KfK 3063
November 1980

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ISSN 0303-4003

Abstract

A FORTRAN IV code for analysis of elastic scattering of spinless particles in the energy region of 100 MeV is described. The code enables a phenomenological scattering phase analysis as well as a potential analysis. In the potential analysis different functional forms for the real and imaginary optical potential can be chosen including so-called "model independent" technique by use of Fourier-Bessel series.
In addition, semimicroscopic descriptions of the real optical potential are provided by density dependent effective projectile-target-nucleon interactions.

The described program system is an extended version of a previous one written by G.W. Schweimer which contained only one parametrization for the optical potential (Saxon-Woods form).

Der Karlsruher Code MODINA zur modellunabhängigen Analyse der elastischen Streuung spinloser Teilchen mit dem optischen Modell.

Zusammenfassung

Ein FORTRAN IV-Programmsystem zur Analyse der elastischen Streuung spinloser Teilchen im Energiebereich von 100 MeV wird beschrieben. Neben der phänomenologischen Streuphasenanalyse ermöglicht das Programm eine Potentialanalyse mit einem komplexen optischen Potential. Hierbei sind verschiedene funktionale Formen des Potentials codiert einschließlich einer sogenannten "modellunabhängigen" Analyse auf der Basis von Fourier-Bessel Serien. Darüberhinaus ist auch eine halbmikroskopische Beschreibung des reellen optischen Potentials mit Hilfe dichteabhängiger effektiver Projektil-Targetnukleon-Wechselwirkungen im Programmsystem eingeschlossen.

Der vorliegende Code ist eine Erweiterung eines früheren Programms von G.W. Schweimer , das lediglich ein Modell für das Optische Potential enthielt (Saxon-Woods-Form).

1. Introduction

The elastic scattering of nuclear projectiles from nuclei provides information about the interaction between the projectile and target nucleus the knowledge of which is important e.g. for the description of inelastic scattering or nuclear transfer reactions. Moreover, in cases where the interaction - at least an effective interaction - is rather well known the elastic scattering analysis enables studies of the form and size of the target nucleus density distribution[2].

In the present paper a program system is described, which serves for the analysis of the angular distribution of elastically scattered spinless particles by use of the Optical Model (Optical Potential) or a phenomenological distribution of scattering amplitudes. The program system is an extended version of a previous one[1] where in particular many different phenomenological and semimicroscopic descriptions of the real optical potential have been added and a flexible handling is provided. Special attention was paid to the ability easily to include additional physical models by a modular technique without changing the existing routines.

2. Calculation of the Theoretical Differential Cross Sections

2.1 General

The scattering amplitude $f(\theta)$ for a spinless charged particle is given by

$$(2.1.1) \qquad f(\theta) = f_c(\theta) + \frac{1}{2ik} \sum_{l=0}^{\infty} (2l+1) \cdot (S_l - 1) \cdot e^{2i\sigma_l} \cdot P_l(\cos\theta)$$

with the following notations

θ	: scattering angle in the center of mass (CM) system
k	: wave number in the CM-system
$f_c(\theta)$	: Coulomb scattering amplitude
σ_l	: Coulomb scattering phases
S_l	: partial scattering amplitudes relative to the Coulomb scattering
$P_l(\cos\theta)$	: Legendre-polynomials

The differential scattering cross section then becomes

$$(2.1.2) \qquad \sigma(\theta) = |f(\theta)|^2$$

The wave number k is

$$(2.1.3) \qquad k = \frac{\sqrt{2mc^2 \cdot E}}{\hbar c} \quad ; \quad \hbar c = 197.315 \text{ MeV fm}$$

where E is the kinetic energy in the CM-system and m is the reduced mass.

The Coulomb scattering phase is given by

$$(2.1.4) \qquad \sigma_l(\eta) = \arg \Gamma(1+1+i\eta)$$

where Γ is the complex Gamma-function. The Coulomb parameter is defined as

$$(2.1.5) \qquad \eta = \frac{\alpha}{\beta} Z_1 Z_2 = \frac{Z_1 Z_2}{137.0373} \sqrt{\frac{mc^2}{2E}}$$

with Z_i being the proton numbers of target and projectile, respectively.

The scattering amplitude for pure Coulomb scattering is given by

$$(2.1.6) \qquad f_c(\theta) = - \frac{\eta \exp\left[2i(\sigma_o - \eta \cdot \ln(\sin \frac{\theta}{2}))\right]}{2k \sin^2 \frac{\theta}{2}}$$

and the partial scattering amplitude is

$$(2.1.7) \qquad S_l = A_l^2 \, e^{2i(\delta_l - \sigma_l)}$$

Hereby δ_l means the scattering phase of the total interaction and A_l the damping of the l-th partial wave.

The main formula (2.1.1) is interpreted as follows: the outgoing spherical waves which are included in the incoming plain waves are changed in amplitude and phase by the projectile-target interaction. The damping A_l is the quotient of the amplitudes of the distorted and undistorted outgoing spherical wave. It can be understood as annihilation or creation of particles in the l-th partial wave depending on whether A_l^2 is smaller or larger than 1, respectively. The scattering phase δ_l is the phase shift between the distorted and undistorted spherical wave.

Because of the infinite range of the Coulomb interaction the Coulomb scattering amplitude is separated and the differences $(S_l - 1)$ are expanded in a complete series.

Any elastic scattering of spinless particles being symmetrical with respect to beam axis can be described by eq. (2.1.1). Two main applications of eq. (2.1.1) are the potential and the resonance scattering. In the potential scattering (optical potential) the distribution of the partial scattering amplitudes S_l with regard to l is rather continuous. In contrast, the resonance scattering is dominated by only one particular partial wave. Interference between potential and resonance scattering leads to a complicated angular distribution of the cross sections. In this case, however, the scattering phase analysis should be able to separate the potential part from the resonance part.

2.2 Scattering Phase Analysis

The phenomenological scattering phase analysis has not been changed compared to the original version of the program[1]. It consists of a parametrization of the partial scattering amplitudes S_l (eq. 2.1.1). Three different options are available for the parametrization (see section 5). After the phenomenological distribution of the amplitudes being determined by one of the parametrization the theoretical cross sections are easily computed by using eqs. (2.1.1 and 2.1.2). The Legendre-polynomial $P_l(\cos\theta_i)$ thereby are calculated via the relations

$$P_o(x) = 1 \qquad x = \cos(\theta_i)$$

$$P_1(x) = x$$

$$P_l(x) = \frac{1}{l}\{(2l-1)\cdot x\cdot P_{l-1}(x) - (l-1)\cdot P_{l-2}(x)\} \quad \text{for } l \geq 2 \tag{2.2.1}$$

2.3 Potential Analysis

In the case of the potential analysis the radial Schrödinger-equation

$$U_l''(\rho) - \left[\frac{l(l+1)}{\rho^2} + \frac{V(r)}{E} - 1\right] U_l(\rho) = 0 \tag{2.3.1}$$

is numerically integrated in NS steps (see section 5). The integration interval $0 \leq r \leq R_\psi$ (R_ψ = matching radius) is devided into NS steps with

$$\Delta r = R_\psi/(NS+MS-1) \tag{2.3.2}$$

and $\quad r_o = 0 \;\; ; \;\; r_1 = MS \cdot \Delta r \;\; ; \;\; r_2 = (MS+1) \cdot \Delta r \;\; ; \;\; \ldots \; r_{NS} = R_\psi$

Between these base points the potential V(r) as approximated by a polynomial of third degree the coefficients of which are calculated such that V(r) and V'(r) are equal to the polynomial and its derivative. The radial wave equation is expanded in a power series of $k(r-r_i)$. The Schrödinger equation then can be solved by comparison of coefficients, where the coefficients of the power series are obtained by a recurrence relation. If the step size Δr is too large rounding errors can occur in the power series. Therefore the Schrödinger-equation cannot be integrated in one step. In detail the iteration procedure works as follows:

With the transformation

$$\rho = \Delta\rho \cdot (x+n) \quad ; \quad 0 \leq x \leq 1 \quad ; \quad \Delta\rho = k \cdot \Delta r \tag{2.3.2}$$

and the expansion

$$U(x,0,1) = x^{l+1} \sum_{i=0}^{\infty} b_i(0,1) \cdot x^i \qquad n = 0 \tag{2.3.3}$$

$$U(x,n,1) = \sum_{i=0}^{\infty} b_i(n,1) \cdot x^i \qquad n \geq 1$$

the Schrödinger-equation (2.3.1) is written

$$(x+n)^2 \cdot U''(x,n,1) = \{l(l+1) + \Delta\rho^2 \cdot (x+n)^2 \cdot \left[\frac{V(r)}{E} - 1 \right] \} \cdot U(x,n,1) \tag{2.3.4}$$

or

$$(x+n)^2 \cdot U''(x,n,1) = f(x,n,1) \cdot U(x,n,1) \quad ; \quad f(x,n,1) = \sum_{i=0}^{m} a_i(n,1) \cdot x^i \tag{2.3.5}$$

For n = 0 the comparison of coefficients yields

$b_o(0,1)$ = normalization coefficient

$b_1(0,1) = 0$ because $a_1(0,1) = 0$

$$b_i(0,1) = \frac{1}{(i+1) \cdot (i+1+1) - l(l+1)} \sum_{j=2}^{\min(m,i)} a_j(0,1) \cdot b_{i-j}(0,1) \quad ; \quad i \geq 2 \tag{2.3.6}$$

and for $n \geq 2$

$$b_o(n,1) = \sum_{i=0}^{\infty} b_i(n-1,1) = U(1,n-1,1)$$

$$b_1(n,1) = \sum_{i=1}^{\infty} i \cdot b_i(n-1,1) = U'(1,n-1,1)$$

$$b_2(n,1) = \frac{a_o(n,1) \cdot b_o(n,1)}{2n^2}$$

$$(2.3.7)\quad b_i(n,1) = \frac{1}{n^2 \cdot i(i-1)} \{-2n(i-1)(i-2)b_{i-1}(n,1) + \left[a_o(n,1)-(i-2)(i-3)\right] \cdot b_{i-2}(n,1) + \sum_{j=1}^{\min(m,i-2)} a_j(n,1) \cdot b_{i-j-2}(n,1)\} \quad ; \quad i \geq 3 \quad ; \quad n \geq MS \geq 2$$

For large i equation (2.3.7) converges against

$$(2.3.8)\quad b_i(n,1) = -\frac{b_{i-1}(n,1)}{n} \qquad \text{for} \quad i \to \infty$$

The logarithmic derivation at the matching radius R_ψ is given by

$$(2.3.9)\quad \frac{U_1'(\rho_{max})}{U_1(\rho_{max})} = \frac{1}{\Delta\rho} \quad \frac{\sum_{i=1}^{\infty} i \cdot b_i(n_{max},1)}{\sum_{i=0}^{\infty} b_i(n_{max},1)}$$

The two series in eq. 2.3.9 are cut off, if 5 sequential terms are smaller than 10^{-8} times the already summed terms or if i = 100.

Since the potential V(r) is complex the coefficients $b_i(n,1)$ are also complex. Since the potential does not depend on l the following relations hold for the coefficients of the polynomials

$$a_o(n,1) = a_o(n,0) + 1(1+1)$$

$$a_i(n,1) = a_i(n,0) \quad ; \quad i = 2,3,\ldots m \quad ; \quad n = 0, MS, MS+1, \ldots NS+MS-1$$

Hence the coefficients $a_i(n,1)$ are only calculated for l = 0. The coefficients $b_i(n,1)$, however, have to be calculated for l = 0, 1, ... LM. The practical application of the method shows that the series (2.3.9) converge after 20 to 50 terms if

MS = 3 or 4

and

NS chosen so that $|\Delta\rho^2 \cdot \frac{V(0)}{E_{cn}}| \approx 1$ and $\Delta r \approx a$ = diffuseness of the potential.

Matching of the outer logarithmic and the inner derivation (eq. 2.3.9) yields the wanted relative partial scattering amplitude S_l:

$$(2.3.10) \qquad \left.\frac{U_l'}{U_l}\right|_{\rho=\rho_{max}} = \left.\frac{F_l' + iG_l' + S_l\cdot(F_l'-iG_l')}{F_l + iG_l + S_l\cdot(F_l-iG_l)}\right|_{\rho=\rho_{max}} \quad ; \quad l = 0, 1, 2, \ldots LM$$

In order to reduce computing time it is possible to calculate S_l for $0 \leq l \leq l_{max}$ only every tenth iteration during the χ^2-fitting procedure. Otherwise S_l is calculated only for $l_1 \leq l \leq l_2$ with

$$|S_l| < 10^{-3} \quad \text{for} \quad l < l_1$$

and

$$|S_l - 1| < 10^{-3} \quad \text{for} \quad l_2 < l$$

(see Section 5.1).

The different models for the potential forms for convenience are explained in the input description (section 5).

3.. Least-Squares-Fit

The program is dominantly suitable for optimizing parameters of a chosen scattering theory (e.g. depth and radius of the optical potential) in order to reproduce given experimental differential cross sections.
For that purpose the deviations

$$f_i = \frac{\frac{d\sigma}{d\Omega}_{exp}(\theta_i) - \frac{d\sigma}{d\Omega}_{theor}(\theta_i) \;/\; P(NP)}{\Delta\frac{d\sigma}{d\Omega}_{exp}(\theta_i)} \tag{3.1}$$

are calculated for each scattering angle θ_i. (P(NP) is a normalization factor (see sect. 5.1)).
The quadratic sum of the deviations

$$\chi^2 = \sum_{i=}^{N} f_i^2 \tag{3.2}$$

are minimized by varying the parameters of the theoretical model in a χ^2-minimizing subroutine[3]. Therefore, the program expects in any case experimental data and calculates the theoretical cross sections only at the given scattering angles*. A parameter fit, however, must not be done.
After convergence of the fit the parameter errors as defined in ref. 3 are printed. From the error correlation matrix the errors of derived quantities are calculated in the cases of "model independent" analyses[4,5].

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* Exception: When preparing a plot of the resulting angular distributions the theoretical cross sections finally are calculated in equidistant steps.

4. Flow Chart and Short Description of Subroutines

A flow chart of the complete code is displayed in fig. 1 a-c showing all subroutine and function subprograms used except of standard IBM scientific subroutines. For different physical models different subroutines of the same name are used alternatively (see section 5).
A short description of what the different modules do is given below:

MAIN : Prints real start and end time of the job and currently used program version

ZEIT : Computes actual CPU-time consumed by the job during execution

DATUM : Computes real time

SCTRLA : Modifies default values of error handling for divide check, over/under flow;
default = 500

SCAMPO : Main driving routine
computes most of the constants, convertes laboratory data to centre of mass system,if necessary

OPTION : Reads and prints selected physical model options

INPUT : Reads, prints and stores all input data in an input array

COULOM : Computes coulomb scattering amplitudes and phases

HORA : Computes and prints real time and actual CPU-time during the job

VA02M : Prepares parameters for the fit and drives print out of the fitting procedure

SV01M : Stores error correlation matrix[4,5]

OUTPUT : Drives output options

GRID : Drives grid calculation

CALFUN : Calculates theoretical differential cross sections as described in section 2

POTE : Provides a simple data check to avoid long computer time with wrong parameters;
computes optical potentials

STRAM : Calculates scattering amplitudes

FITEX : χ^2-minimizing subroutine block[3]

LILESQ
FIT1
INVATA

CSPLOT : Plots experimental and theoretical cross sections on the fast chain printer

XYNPL : Prepares data for XYNETICS-plot

RUTHF : Divides cross sections by the Rutherford cross sections

WQPLOT : Prepares XYNETICS-plot

SYMBL4 : Necessary for full data point symbols on XYNETICS plotter[6)]

POTPR : Prints potentials

DENPR : Prints densities

MOMENT : Computes integral moments of potentials or densities [5)]

ERMOM : Computes errors of integral moments[5)]

FUN : Computes error functions[5)]

SI : Selects Sin-integral Si(x) from IBM scientific subroutine package SICI

FORHAD : Integration subroutine

COULPO : Computes double folded Coulomb potential from realistic charge distributions

DEN1, DEN2 : Charge density functions of projectile (1) and target (2)

FX : Computes Coulomb potential between point charge and projectile charge density

FXV : Calculates real nuclear potential between point nucleon and projectile

DPN : Computes normalization of (given fixed) point proton density of the target

DENS : Matter or neutron density function

DENSP : Proton density function

DEFB : Fourier-Bessel density

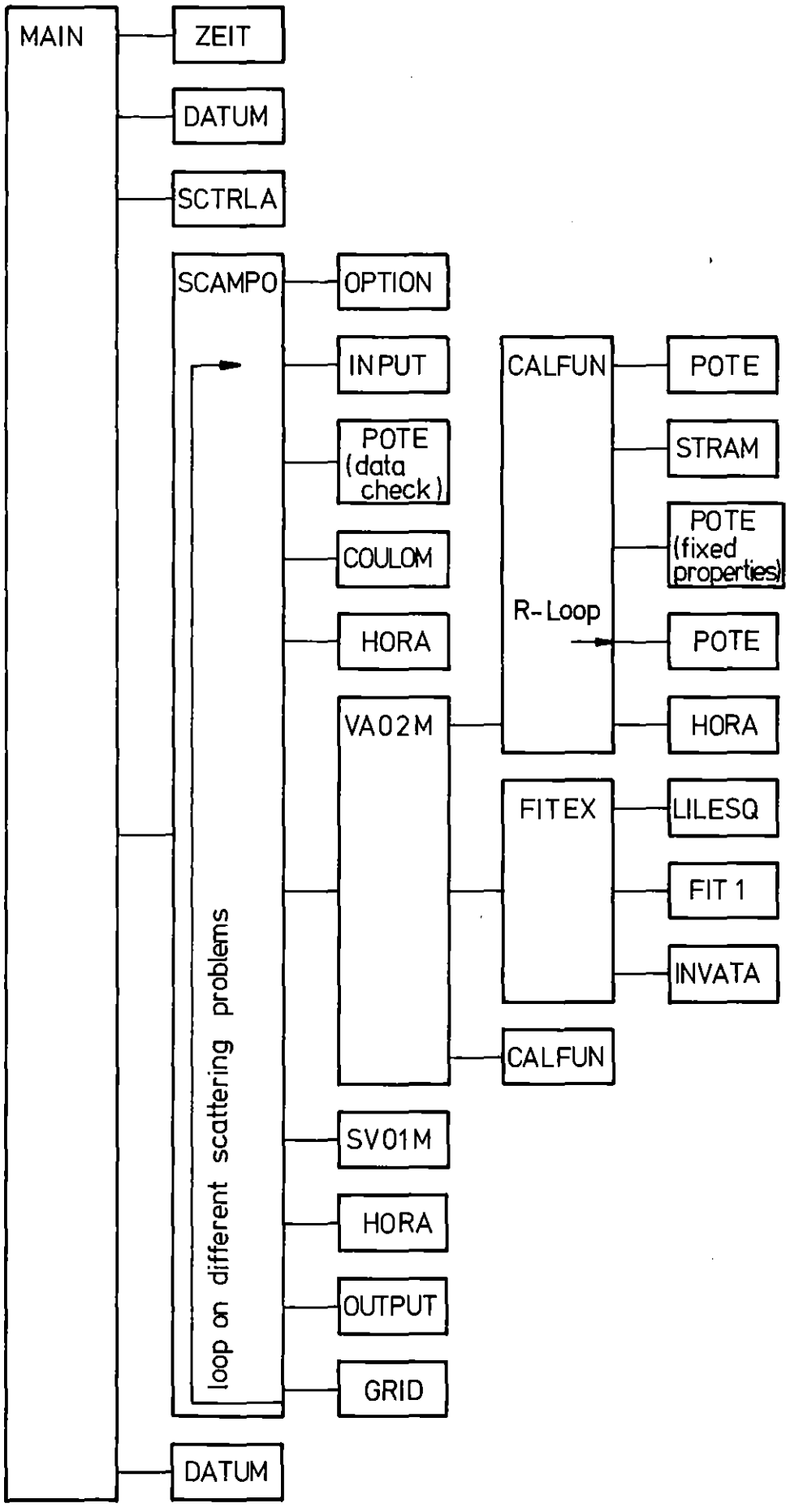


Fig. 1a) Flow chart, only MØDINA

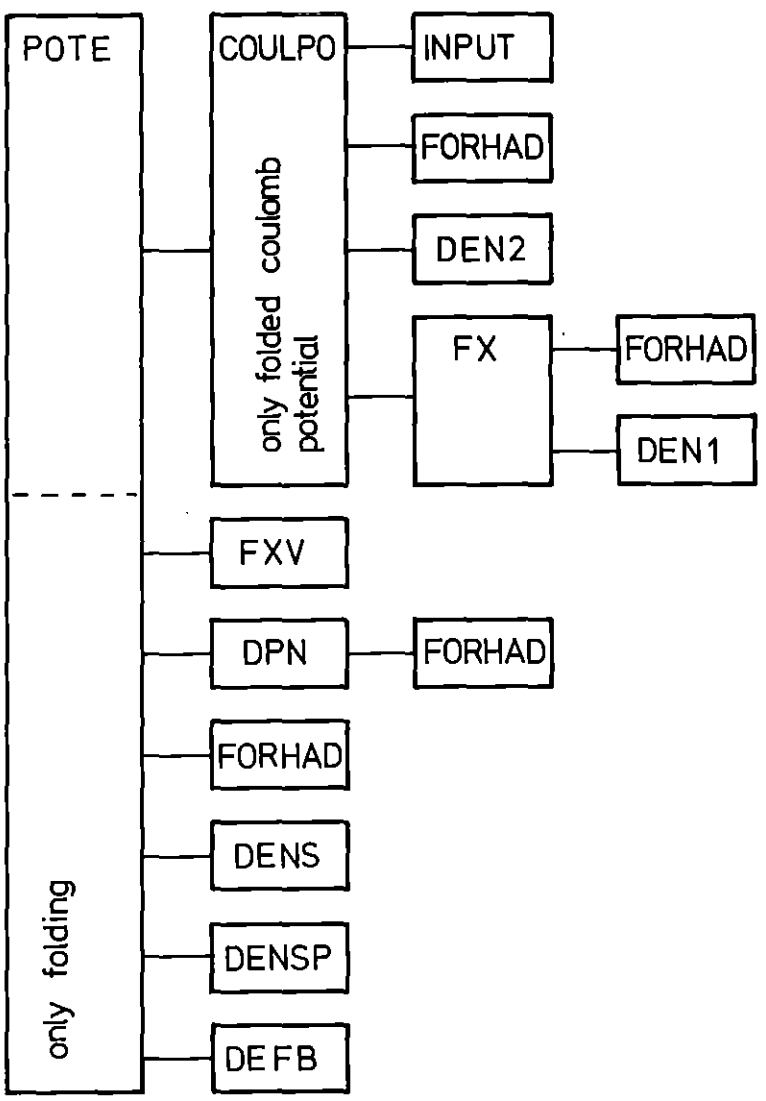


Fig. 1b) Flow chart of PØTE etc. for potential and folding analysis

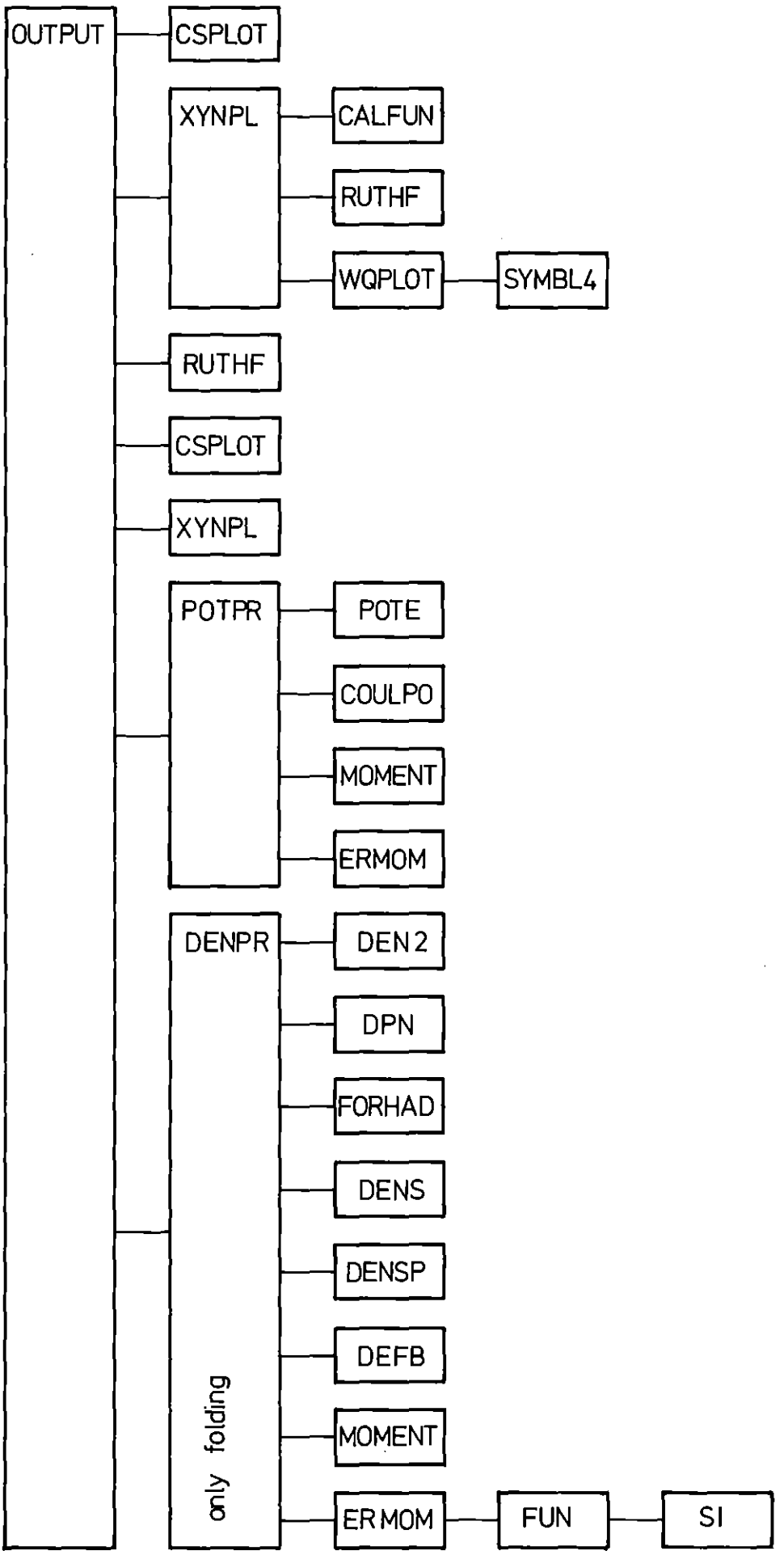


Fig. 1c) Flow chart of output part for potential and folding analysis

5. Input Description

5.1 Standard Input

5.1.1 Job-Control-Cards

The program is available as compiled and linked LØAD-module at the library LIB = ZYK of the IBM 3033-370M68 computer facilities of the HDI (Hauptabteilung Datenverarbeitung und Instrumentierung).
It can be called by the following JOB-control cards*

```
//IAK623MO_JOB_(0623,145,POC1A),GILS,REGION=800K
//_EXEC_FHLG,LIB=ZYK
//L.SYSIN_DD_*
_INCLUDE_LØAD(MØDINA)
_ENTRY_MAIN
//G.SYSIN_DD_*
```

In the LØAD-module MØDINA only the minimum version of the program for scattering phase analysis is contained (see sect. 2.2 and 5.2). For the potential analysis different versions of the subroutine PØTE have to be included in front of MØDINA. The necessary JOB-control cards are explained in the corresponding sections of input description (sect. 5.3). The plot routines and data units necessary for it have also to be selected via additional JOB-control cards (see sect. 5.6).

5.1.2 Standard Data Cards

The first six input cards are standard for all options, the following cards depend on the model used.

5.1.2.1 Options

The first three cards select the options of the program corresponding to the following list. In general "0" means "no" and "1" means "yes". These three cards occur only once in a run of the program, even if several scattering problems are treated in one run (NUMBER OF INDEPENDENT CALCULATIONS > 1).

CARD 1 (FORMAT 14I5)

		further comments on page
NUMBER OF INDEPENDENT CALCULATIONS	1	10
CM-DATA	1	-

---

* _ means necessary blank column

		further comments on page
GRID CALCULATIONS	0	28
PRINT INPUT	1	30
PRINT CPU-TIME	0	15
PRINT CROSS SECTIONS	0	
PRINT CROSS SECTIONS/RUTHERFORD	0	
PRINT SCATTERING AMPLITUDES	1	
PRINT POTENTIALS	1	
PRINT POTENTIAL MOMENTS	2	
PRINT DENSITIES	0	
PRINT DENSITY MOMENTS	0	
PUNCH POTENTIALS OR DENSITIES	0	14
PUNCH MOMENTS	0	14

For the option PRINT POTENTIAL MOMENTS the meaning is

0 no

1 only moments of real potential

2 moments of real and imaginary potential

For the PUNCH options the numbers in the last four decimal digits select yes = 1 or no = 0 in the following way

decimal digit 10^0 : Real potential

10^1 : Imaginary potential

10^2 : Matter density

10^3 : Neutron density

The output unit for PUNCH POTENTIALS OR DENSITIES is FT07. It has be initialisated by the JOB-control card

//G.FT07F001_DD_UNIT = ... (see JCL in IBM handbook).

This card has to be placed just in front of the card

//G.SYSIN_DD_* .

The output unit for PUNCH MOMENTS is

//G.FT08F001_DD_UNIT = ...

which has also to be placed in front of the GO-step card.

CARD 2 (FORMAT 5I5)

		further comments on page
FOLDED COULOMB POTENTIAL	1	22
REAL POTENTIAL	4	19
TARGET DENSITY (FOLDING)	0	26
IMAGINARY POTENTIAL	1	19
CONSERVE VOLUME-INTEGRAL	0	21
RELATIVISTIC KINEMATICS	0	

Except of the Coulomb potential more than one possibilities are avialable for these options which are explained in section 5.3.

CARD 3 (FORMAT 3I5)

further comments on page

PLOTTER TYPE	1
PLOT CROSS SECTIONS	0
PLOT CS/RUTHERFORD	1

PLOTTER TYPE 1 = fast chain printer
2 = XYNETICS plotter (see sect. 5.5)

CARD 4 (FORMAT 70A1)

title card

CARD 5 (FORMAT 5F10.6)

projectile mass (amu)
target mass (amu)
projectile proton number
target proton number
projectile laboratory energy (MeV)

CARD 6 (FORMAT 5I5)

CPU (SEC)
LMAX
NS
MS
IT
ITP

CPU The cpu-time chosen should be 20 sec less than the time on the JOB-card. Then the program stops early enough during a fitting calculation to provide the full output.

LMAX Maximum l-value of the scattering amplitudes

NS,MS The meaning of NS and MS is double-fold due to historical reasons of the original program version[1)]

NS ≦ 0 : Scattering phase analysis

MS < 0 : Parametrization of real and imaginary part of S_1 (see sect. 5.2a)

MS > 0 : Parametrization of absolute value and phase of S_1 (see sect. 5.2b)

NS > 0 : Potential analysis NS = number of radial integration base points (see eq. 2.3.2)

MS ≧ 2 : First radial step (see eq. 2.3.2)

IT Maximum number of iterations during the fit

ITP Print out of current parameter values only each |ITP|-th iteration
If ITP is negative the print out of the functions f(i) (see eq. 3.1) is suppressed in general and the print out of the error correlation matrix is suppressed at the end of the fit.

The following input is read in certain "blocks" corresponding to their meaning. Each block is preceeded by one card (FORMAT 2I5, 20A1) giving the type of the input block (1 = Integer 2 = Real), the number and read-FORMAT of the input data values.

Example: _ _ _ _ 2 _ _ _ 13 (7F10.3)
means that 13 real numbers written in the FORMAT (7F10.3) are following.

DATA BLOCK 1: Parameter field P(I) (REAL)
The number of parameters NP and the meaning of the parameters depend on the physical model chosen. Only the meaning of the last parameter is fixed.

P(NP) = Normalization factor (eq. 3.1)

DATA BLOCK 2: Fit input: first step and accuracy (REAL)
The length of the first searching step and the required fit accuracies for each parameter to be fitted are read (Ref. 3).

DATA BLOCK 3: Varied Parameters (INTEGER)
The numbers I of the parameters P(I) to be varied are read.

DATA BLOCK 4: Experimental cross sections (REAL)
The experimental differential cross sections (either in the laboratory or in the CM system) must be read as data triple for each scattering angle

$$\theta_i(\text{degr}),\ \frac{d\sigma}{d\Omega}(\theta_i),\ \Delta\frac{d\sigma}{d\Omega}(\theta_i) = \text{absolute experimental errors (not \%)}$$

The units of $\frac{d\sigma}{d\Omega}$ and $\Delta\frac{d\sigma}{d\Omega}$ must be equal (e.g. barn/sr) but can be chosen by the user. The theoretical cross sections are calculated in units of |barn/sr| so that the correct normalization factor P(NP) (eq. 3.1) has to be chosen if the experimental cross sections are given in other units. The number of data to be given on the preceding data block card must be the total number (i.e. 3* number of experimental points).

5.2 Scattering phase analysis

In the scattering phase analysis the number of parameters (first data block) is NP=11. The meaning of the parameters P(I) depends on the options chosen by the driving numbers NS,MS (CARD 6). These are:

a) Parametrization of the real and imaginary part of S_1 (NS ≦ 0, MS < 0)

(2.2.1) $$\mathrm{Re}\,[S_1 - 1] = (P(7) - 1)\cdot A_i(x)$$

(2.2.2) $$\mathrm{Im}\,|S_1| = P(6)\cdot B_j(x') + P(8)\cdot A_i(x)$$

(2.2.3) $$x = \frac{1 - |P(2)|}{|P(3)|} \quad ; \quad x' = \frac{1 - |P(4)|}{|P(5)|}$$

$i = |NS|$; $j = |MS|$ (see input description)

$A_i(x)$: step function with

$$A_i(-\infty) = 1; \quad A_i(0) = 0{,}5; \quad A_i(\infty) = 0; \quad \left.\frac{d\cdot A_i(x)}{d\cdot x}\right|_{x=0} = -1$$

$B_j(x)$: bell-shaped function with

$$B_j(x) = B_j(-x); \quad B_j(0) = 1; \quad B_j(0{,}5) = 0{,}5; \quad B_j(\infty) = 0$$

The indices i and j give the type of the step or bell-shaped function, respectively:

(2.2.4) $$A_1(x) = 0{,}5 - \frac{1}{\pi}\left[\mathrm{arctg}\,(y) + \frac{y}{1+y^2}\right] \quad ; \quad y = \frac{\pi}{2}\cdot x$$

(2.2.5) $$A_2(x) = \frac{1}{1+e^{4x}}$$

(2.2.6) $$A_3(x) = \frac{1-\mathrm{erf}(y)}{2} \quad ; \quad y = \sqrt{\pi}\cdot x$$

(2.2.7) $$B_1(x) = \frac{1}{(1+y^2)^2} \quad ; \quad y = 2\sqrt{\sqrt{2}-1}\cdot x$$

(2.2.8) $$B_2(x) = \frac{4e^{-y}}{(1+e^{-y})^2} \quad ; \quad y = \left[2\,\ln(3+\sqrt{8})\right]\cdot x$$

(2.2.9) $$B_3(x) = e^{-y^2} \quad ; \quad y = 2\sqrt{\ln 2}\cdot x$$

b) Parametrization of the absolute value and phase of S_1 from which the real and imaginary part is calculated (NS ≦ 0, MS > 0)

$$|S_1| = P(4) + |1 - |P(4)|| \cdot A_i(-x') \tag{2.2.10}$$

$$\arg|S_1| = |P(6) + P(7)\cdot x + P(8)\cdot x^2 + P(9)\cdot x^3 + P(10)\cdot x^4| \cdot A_j(x) \tag{2.2.11}$$

$$x'' = \frac{1 - |P(2)|}{|P(3)|}\ ;\quad x' = \frac{1 - |P(2)|}{|P(5)|}\ ;\quad x = 1 - |P(2)| \tag{2.2.12}$$

$i = |NS|$; $j = |MS|$

A : step function as in case a)

c) If $|P(3)| < 10^{-10}$ or $|P(5)| < 10^{-10}$ S_1 is evaluated by using the sharp cut-off model:

$S_1 = 0$ for $1 < |P(2)|$

$S_1 = 1$ for $1 \geq |P(2)|$

In all cases the parameters P(2) to P(10) are input data.

```
//IAK623Z1 JOB (0623,145,POC1A),GILS,REGION=800K
// EXEC FHLG,LIB=ZYK
//L.SYSIN DD *
 INCLUDE LOAD(MODINA)
 ENTRY MAIN
//G.SYSIN DD *
    1     1     0     1     1     0     0     1     1     2
    0     0     0     0     0
    1     0     1
  104 MEV ALPHAS ON 90-ZR                  40.         104.
4.0026     89.9047    2.
   20    70    -2    -2  100    20
    2    11 (7(F8.3,2X))          30.28      1.565      .0842      -.00192
+15.        31.01       6.68              .00101
+.0345      0.          0.
    2     8 (7(F8.3,2X))          .01        .05        .005       .005
+10.        .01         .01
+.005
    1     7 (20I3)
  2  3  4  5  6  7  8
    2  285      ((2(0PF10.3,1P2E10.3)))
     8.939 7.563E+03 3.277E+02     10.403 4.322E+03 4.022E+02
    10.925 2.637E+03 3.702E+02     11.970 7.724E+02 1.750E+02
    12.492 4.678E+02 4.390E+01     13.119 5.377E+02 8.577E+00
                     1.530E+01     14.059 6.433E+02 2.618E+01
                                           2.283E+01
//
```

Table 1: Input example for scattering phase analysis

5.3 Potential Analysis

5.3.1 Real and Imaginary Potential

5.3.1.1 Functional forms

For the potential analysis there are 6 different subroutines POTE available covering 12 different models for the real, 4 for the imaginary and 2 for the Coulomb potential which can arbitrarily be combined. The subroutine POTE and some additionally necessary routines are available from different LOAD-modules which have to be included in the LINK-step in front of MØDINA (see below). In the different models different numbers of parameters NP are used. The first three parameters, however, have the same meaning in all models

DATA BLOCK 1 : Parameter field P(1) - P(3)

P(1) = Matching radius R_ψ (eg. 2.3.2)

P(2) = Coulombradius / $A^{1/3}$ $\sim$ 1.34 (fm)

P(3) = Target mass number

5.3.1 Real and Imaginary Potential

The most frequently used form for the optical potential is the Saxon-Woods form (SW) which is defined as

$$U(r) = -V_o \cdot f_r - i \cdot W_o \cdot f_i - W_s \cdot f_s \qquad (5.3.1.1)$$

with the volume from factors

$$f^{SW}_{r,i}(r) = \left[1 + \exp \frac{r-R_{r,i}}{a_{r,i}} \right]^{-1} \qquad (5.3.1.2)$$

and the surface from factor

$$f^{SW}_s(r) = -4\, a_s\, W_s \frac{d}{dr} \left(1 + \exp \frac{r-R_s}{a_s} \right)^{-1} \qquad (5.3.1.3)$$

This model is contained in the LOAD module PØSW which has NP = 13 parameters with the following meaning

P(4) = V_o

P(5) = R_r / $A^{1/3}$

P(6) = a_r

P(7) = W_o

P(8) = R_i / $A^{1/3}$

P(9) = a_i

P(10) = W_s

P(11) = R_s / $A^{1/3}$

P(12) = a_s

P(13) = Normalization (eq. 3.1)

The option numbers (CARD 2) for this model are

REAL POTENTIAL 1

IMAGINARY POTENTIAL 1

Recently, the SW-form squared had been found to be more suitable for elastic α-particle scattering[6]. The corresponding form factors are

$$(5.3.1.4\ a)\quad f^{SW^2}_{r,i}(r) = \left[1 + \exp\frac{r-R_{r,i}}{a_{r,i}}\right]^{-2}$$

$$(5.3.1.4\ b)\quad f^{SW^2}_{s}(r) = -4\, a_s\, W_s \frac{d}{dr}\left(1 + \exp\frac{r-R_s}{a_s}\right)^{-2}$$

This model is also contained in the module PØSW and can be selected by the options

REAL POTENTIAL 2

IMAGINARY POTENTIAL 2

The meaning of the parameters P(4) - P(12) is the same as for the SW form factor. A complete input data set for the SW or SW^2 optical potential is given in table 2.

```
//IAK623C1 JOB (0623,145,POC1A),GILS,REGION=800K,TIME=10
// EXEC FHLG,LIB=ZYK
//L.SYSIN DD *
 INCLUDE LOAD(POSW)
 INCLUDE LOAD(MODINA)
 ENTRY MAIN
//G.SYSIN DD *                                        2
    1    1    1    1    0    0    0    0    0
    1    2    0    1
    0    0    0
   104 MEV ALPHA-PARTICLES ON 40-CA             104.
 4.0026    39.96259   2.         20.
  580    55    42      2  100   -10
    2    13   (7(F9.4,1X))       152.6      1.404     1.253     20.0
14.       1.34        40.        1.         1.        .001
1.603     .678        0.
   2       6   (7(F9.4,1X))                           .005
10.        .5        .005       .005       .005
   1       5   (10I3)
  4  5  6  8  9
   2   384     ((2(0PF10.3,1P2E10.3)))     3.738 1.243E+05 1.893E+04
    3.187 2.335E+05 2.627E+04           4.859 4.960E+04 5.133E+03
    [illegible] 7.599E+04 8.889E+03     [illegible] 1.916E+04 2.392E+03
-------------------------------------------------------------------------
    108.530 [illegible]
    2      2 (7(F9.4,1X))
4.          1.3227
    2      4 (7(F9.4,1X))
9.          3.766      .586        -.161
    1      2 (2I3)
  7  5
    2      1 (7(F9.4,1X))
5.
//
```

Table 2: Input example for SW-potential analysis

5.3.1.2 Fourier-Bessel-Method

In the functional forms a strong coupling between the inner and outermore parts of the optical potential is contained, which frequently leads to an unsufficient reproduction of the experimental cross sections. This can be avoided by using a less model dependent parametrization[4]. In electron scattering analyses the model independent Fourier-Bessel (FB) method[7] has been applied with great success. For scattering of nuclear particles it has been modified in the following way[4]: Series of zeroth spherical Bessel functions $j_o(r,R,n)$ are added either to the real U_R or the imaginary U_I best fit SW or SW^2-optical potentials (or added to both U_R and U_I)

$$U_R(r) = U_R + \sum_{n=1}^{N} b_n \, j_o \left(\frac{n\pi r}{R_{cR}}\right)$$

$$U_I(r) = U_I + \sum_{m=1}^{M} c_m \, j_o \left(\frac{n\pi r}{R_{cI}}\right) \qquad (5.3.1.5)$$

R_{cR} and R_{cI} are suitable chosen cut-off radii beyond which the Fourier-Bessel series vanishes. The coefficients b_n and c_m are the free parameters to be fitted to the experimental data.

The FB-potential model is contained in the LØAD-module PØFB. The number of parameters for this model is NP = 42. The meaning of the parameters P(1) - P(12) is the same as in PØSW defining U_R and U_I. Furthermore

P(13) = R_{cR}
P(14) - P(28) = b_n, n=1,15
P(29) = R_{cI}
P(30) - P(41) = c_m, m=1,12
P(NP) = Normalization (eq. 3.1)

The options chosing this model are (option card 2)

REAL POTENTIAL = 3 = SW+FB
= 4 = SW^2+FB
IMAGINARY POTENTIAL = 3 = SW+FB
= 4 = SW^2+FB

Each combination is possible. An input example for the FB-model is shown in table 3.

The volume integral of the potentials may be conserved by chosing this option on CARD 2. In this case the first FB-coefficient (P(14)) should not be varied.

```
//IAK623C2 JOB (0623,145,POC1A),GILS,REGION=800K,TIME=3
// EXEC FHLG,LIB=ZYK
//L.SYSIN DD *
 INCLUDE LOAD(POFB)
 INCLUDE LOAD(MODINA)
 ENTRY MAIN
//G.SYSIN DD *
    1     1     0     1     0     0     0     0     1     2
    1     4     0     1
    1     0     1
   104 MEV ALPHA-PARTICLES ON 40-CA
 4.0026    39.96259  2.          20.         104.
  160    55    42    2  200    20
    2    42  (7(F9.4,1X))
 14.        1.34        40.         152.6       1.404       1.253       20.0
 1.603       .678        0.          1.          1.          10.
                                                                          .001
    2    14  (7(F9.4,1X))
 10.         .2          .005        .005        .1          .1          .1
 .1          .1          .1          .1          .1          .1          .1
    1    13  (23I3)
  7  8  9 14 15 16 17 18 19 20 21 22 23
    2   384     ((2(OPF10.3,1P2E10.3)))
      3.187 2.335E+05 2.627E+04      3.738 1.243E+05 1.893E+04
      [illegible]
    101.648 [illegible]                5.054 1.916E+04 2.392E+03
    108.530 2.655E-04 5.769E-05    [illegible]
    2     2 (7(F9.4,1X))
 4.          1.3227
    2     4 (7(F9.4,1X))
 9.          3.766       .586        -.161
//
```

Table 3: Input example for model-independent potential analysis

5.3.2 Coulomb Potential

Two options are possible for the Coulomb potential. The simpler way is to describe it as the potential between a point charged projectile and a homogenously charged target sphere of radius $R_{Coul} = P(2) \cdot A^{1/3}$. This option is chosen by (option card 2)

FOLDED COULOMB POTENTIAL = 0

For studies of tiny potential effects (e.g. isotopic differences determined by the FB-method) it seems reasonable to use a realistic Coulomb potential derived from experimental charge distributions of projectile ρ_p and target ρ_t by double folding

$$U_c(r_p) = k \cdot \int_0^{R_t} dr_t \rho_t(r_t) f(|\vec{r}_t - \vec{r}_p|)$$

(5.3.2.1)

$$\text{with} \quad f(x) = 4\pi \left[\frac{1}{x} \int_0^x \rho_p(r_p) r_p^2 dr_p + \int_x^{R_p} \rho_p(r_p) r_p^2 dr_p \right]$$

This option is chosen by (option card 2)
FOLDED COULOMB POTENTIAL = 1

Selecting the folded Coulomb potential the projectile and target density distributions must be known. They are read as

DATA BLOCK 5: Parameters of charge distribution (REAL) of the projectile
CP(1) = Integration radius R_T (eq. 5.3.3.1)
CP(2) = parameters
⋮
$CP_{max}(25)$

DATA BLOCK 6: Parameters of charge distribution of the target (REAL)
CT(1) = Integration radius R_P (eq. 5.3.3.1)
CT(2) = Parameters
⋮
$CT_{max}(25)$

In the standard version of MØDINA the functional forms of the densities are Gaussian (G) for the projectile

5.3.2.2 $$\rho_p(r) = \rho_p^o \cdot \exp\left(\frac{r^2}{CP(2)^2}\right)$$

and 3-parameter Fermi form (F-3) for the target

5.3.2.3 $$\rho_t(r) = \rho_t^o \cdot \left[1 + CT(4)\,\frac{r^2}{CT(2)^2}\right]\left[1 + \exp\frac{r-CT(2)}{CT(3)}\right]^{-1}$$

There are also other functional forms available which have to be included in front of the MØDINA module in order to replace the standard functions. These are

_INCLUDE_LØAD(DCF3) for F-3 forms of target and projectile with the parameters of the projectile CP(I) having corresponding meaning as in eq. 5.3. 2.3.

_INCLUDE_LØAD(DCGG) for a Gaussian distribution of the projectile (eq. 5.3.2.2) and a modified Gaussian distribution for the target

5.3.2.4 $$\rho_t(r) = \rho_t^o \left[1 + CT(4)\,\frac{r^2}{CT(2)^2}\right]\left[1 + \exp\frac{r^2-CT(2)^2}{CT(3)^2}\right]^{-1}$$

An example for folded Coulomb potential input is at the bottom of table 3.

5.4 Folding Models

In cases where a phenomenologically or microscopically determined effective interaction between the projectile and a free or bound target nucleon V_{PN} is known the elastic scattering cross sections can be interpreted by a folding model approach. For that purpose the real part of the optical potential U_R is generated by folding the effective interaction V_{PN} over the point nucleon density distribution of the target ρ_m

$$(5.4.1) \qquad U_R(r) = \int V_{PN}(|\vec{r}'-\vec{r}|)\rho_m(\vec{r}')d\vec{r}'$$

In order to account for saturation effects[4] (density dependence of the interaction) $V_{PN}(r)$ may be written as[8]

$$(5.4.2) \qquad V_{PN}(r) = -V_o \cdot f(|\vec{r}'-\vec{r}|)\ \{1-\gamma\rho_m^{2/3}(r')\}$$

where f(r,r') is the form factor of the free interaction and the last term accounts for the saturation.
This kind of folding model is also coded in the program and can be called for by using corresponding subroutines PØTE plus some additional necessary subroutines (see flow chart) which are included in the LØAD-modules.

5.4.1 Effective interaction

The integration of eq. 5.4.1 is performed analytically, when assuming a Gaussian form factor $f(|\vec{r}'-\vec{r}|)$ of the effective interaction

$$(5.4.3) \qquad f(x) = \exp\ (-x^2/a^2)$$

The corresponding subroutine is contained in the module PØGA which has to be included in front of MØDINA. The options for this folding models are

_INCLUDE_LØAD(PØGA):

REAL POTENTIAL	= 5			
TARGET DENSITY (FOLDING)	= 1	OR	2	(see 5.4.2)
IMAGINARY POTENTIAL	= 1	OR	2	(see 5.3.1)

The number of parameters for PØGA is NP = 21.

The parameters of the Gaussian interaction are

P(4) = V_o = 64.37

P(5) = a = 1.798

P(6) = γ = 1.8954

The given values are suitable for elastic α-particle scattering from medium weight nuclei at E_α = 104 MeV[8),9)].
The meaning of the parameters P(1)-P(3) and P(7)-P(12) is the same as for the other potential models, the meaning of the parameters P(13)-P(20) is given in sect. 5.4.2.1.

When other form factors $f(|r'-r|)$ of the effective interaction than a Gaussian one are wanted to be used the folding integral (5.4.1) is evaluated numerically using the Gauss-Legendre method for the angular integration and the Simpson method for the radial integral (number of steps = NS, see section 5.3). This version of the folding model is contained in the module PØAR and should be called with the options

_INCLUDE_LØAD(PØAR)

REAL POTENTIAL = 7

others as for POGA

The form factor for this folding model is calculated in a small subroutine FXV. In the standard modules of PØAR and PØARFB a microscopically determined effective interaction[10)] for scattering of 104 MeV α particles is numerically contained. The necessary parameters are

P(4) = V_o = 0.791

P(5) = R_∞ = radial integration limit = 7.2

P(6) = γ = 0.969

The given values are suitable for medium weight target nuclei.
The meaning of the other parameters (NP=21) is the same as for PØGA.

Another interaction is available for elastic scattering of 156 MeV ^{6}Li projectiles[10)]. This can be calles for in the LINK-step with the card

_INCLUDE_LØAD(FXVLI)

to be placed in front of PØAR or PØARFB. Any other interaction may be added by the user by including another subroutine FXV having the general form as given in the source listing (sect. 6).

5.4.2 Proton, Neutron, and Matter Densities

The point nucleon matter density distribution $\rho_m(r)$ occuring in eq. (5.4.1) can be parametrized in different ways. It may either be a general distribution function $\rho_m(r)$ where no distinction between protons and neutrons is possible. Alternatively, the distribution functions for protons $\rho_p(r)$ and neutrons $\rho_n(r)$ may be different with

$$(5.4.4) \qquad \rho_m(r) = \frac{Z}{A}\,\rho_p(r) + \frac{N}{A}\,\rho_n(r)$$

Z = proton number
N = neutron number
A = mass number

These two possibilities are selected by the option

TARGET DENSITY (FOLDING) = 1: $\rho_m \equiv \frac{A}{Z}\,\rho_p \equiv \frac{A}{N}\,\rho_n$

= 2: $\rho_m = \rho_p + \rho_n$

which is valid for all folding models.

5.4.2.1 Functional forms

The form factors f(r) of the density distributions

$$(5.4.5) \qquad \rho_{m,p,n}(r) = \rho^{o}_{m,p,n} \cdot f(r)$$

can either be analytic expressions or can be parametrized by the "model independent" Fourier-Bessel method (see below). The standard functional form being included in PØGA and PØAR is the 3-parameter Fermi distribution (F-3)

$$(5.4.6) \qquad \rho_m(r) = \rho^{o}_{m}\left[1 + w\,\frac{r^2}{c^2}\right]\left[1 + \exp\frac{r-c}{a}\right]^{-1}$$

The parameters w, c, a are stored in the parameter field at the following positions

P(13) = R_c
P(14) = $c/A^{1/3}$ [fm]
P(15) = a
P(16) = w

Hereby R_c is the integration radius for the normalization of the density

$$(5.4.7) \qquad A = \int_0^{R_c} \rho_m(r) d^3r$$

If the density distributions for protons and neutrons are assumed to be different, the parameters compiled above hold for the neutron distribution whereas the corresponding parameters for the proton distributions are

$$P(17) = c_p/A^{1/3}$$
$$P(18) = a_p$$
$$P(19) = w_p$$

The integration Radius R_c is the same for protons and neutrons.

Instead of the 3-parameter Fermi form the so-called modified Gaussian function (G-3) can also be used for the nucleon densities. It is defined as

$$(5.4.8) \qquad \rho_{m,n,p}(r) = \rho^0_{m,n,p} \left[1 + w \frac{r^2}{c^2}\right] \left[1 + \exp \frac{r^2 - c^2}{a^2}\right]^{-1}$$

These density functions are stored in the load module DGG which should be included in front of PØGA or PØAR.

5.4.2.2 Fourier-Bessel series

In the folding models the density distributions ρ_m or ρ_n may also be parametrized in a less model dependent way by use of a Fourier-Bessel-series added to one of the functional forms defined above

$$(5.4.8) \qquad \rho_{m,n}(r) = (F\text{-}3; G\text{-}3) + \sum_{\nu=1}^{N'} \beta_\nu \, j_o\left(\frac{\nu \pi r}{R_{CTF}}\right)$$

This model independent description (including also the FB options for the imaginary potential; see sect. 5.3.1.2) is coded in the LØAD-modules PØGAFB and PØARFB which are called with the options

_INCLUDE LØAD (PØGAFB) or PØARFB

REAL POTENTIAL = 6 for PØGAFB

= 7 for PØARFB.

The total number of parameters for these models is NP = 49. The meaning of the parameters (P1) to P(12) is the same as for PØGA and PØAR. The FB-density cut-off radius and coefficients are stored at the same places as the corresponding real FB-potential values,

P(13) = R_{CTF}

P(14) to P(28) = β_ν, ν = 1,15)

P(29) = R_{cI} (Imaginary Potential), see sect. 5.3.1.2

P(30) to P(41) = c_m, m = 1,12 see sect. 5.3.1.2

P(42) = R_c (eq. 5.4.7)

P(43) = $c_{m,n}/A^{1/3}$ (eq. 5.4.6, 5.4.8)

P(44) = $a_{m,n}$ " " "

P(45) = $w_{m,n}$ " " "

P(46) = $c_p/A^{1/3}$ " " "

P(47) = a_p " " "

P(48) = w_p " " "

In the standard PØGAFB and PØARFB modules the functional form to which the FB-series is added is a 3-parameter Fermi form (eqs. 5.4.6 and 5.4.8). When wishing to select a G-3 distribution in eq. 5.4.8 an additional LØAD-module named DEG3FB has to be included in front of PØGAFB or PØARFB.

Input examples for four typical folding model cases are given in table 4 a - c.

```
//IAK623C3 JOB (0623,145,POC1A),GILS,REGION=8C0K,TIME=3
// EXEC FHLG,LIB=ZYK
//L.SYSIN DD *
 INCLUDE LOAD(POGA)
 INCLUDE LOAD(MODINA)
 ENTRY MAIN
//G.SYSIN DD *
    1    1    0    1    0    0    0    0    0    1    1    1
    1    5    2    1
    0    0    0
   104 MEV ALPHA-PARTICLES ON 40-CA        20.          104.
 4.0026   39.96259  2.
  160   55   42   2  200  -10
    2   21  (7(F9.4,1X))          64.37       1.798       1.8954      20.
 14.        1.34      40.                                 9.          1.09624
 1.603     .678       0.          1.          1.          0.          .001
 .512188   -.166      1.1134      .512188     -.166
    2    6  (7(F9.4,1X))          .005        .005        .005
 10.        .2        .005
   1    5  (10I3)
  7  8  9 14 15
   2  384     ((2(0PF10.3,1P2E10.3)))    3.738 1.243E+05 1.893E+04
    3.187 2.335E+05 2.627E+04            4.859 4.960E+04 5.133E+03
    4.289 7.599E+04 8.889E+03            5.954 1.916E+04 2.392E+03
    [illegible] 3.677E+03                [illegible] 1.068E+03
--------------------------------------------------------------------
    101.648 [illegible]                  116.291 [illegible]
    108.530 2.655E-04 5.769E-05
    2     2 (7(F9.4,1X))
  4.        1.3227
    2     4 (7(F9.4,1X))
            3.766       .586         -.161
  1.
 //
```

Table 4 a) Gauss-interaction, F-3 model density,

$$\rho_m = \rho_p + \rho_n ; \; \rho_n \neq \frac{N}{Z} \rho_p$$

```
//IAK62322 JOB (0623,145,POCIA),GILS,REGION=80CK,TIME=3
//*FORMAT PR,DDNAME=FT06F001,FORMS=REPRO
// EXEC FHLG,LIB=ZYK
//L.SYSIN DD *
 INCLUDE LOAD(DCGG)
 INCLUDE LOAD(DGG)
 INCLUDE LOAD(POAR)
 INCLUDE LOAD(MODINA)
 ENTRY MAIN
//G.SYSIN DD *                                          1      1      2      1      1
    1     1     0     1     0     0     0
    1     7     2     1
    1     0     1
  104 MEV ALPHAS ON 90-ZR          40.         104.
4.0026      89.9047    2.
  160    70    50     3  200   -10
    2    21 (7(F8.3,2X))                                    .969       18.03
+14.      1.34       90.        .791       7.2        10.        1.0604
+1.711    .70        0.         1.         1.         0.         .00101
+2.3244   .1648      1.0604     2.3244     .1648
    2     6 (7(F8.3,2X))                                         .005
+10.      .2         .005       .005       .005
     1    5 (20I3)
   7  8  9 14 15
   2  285        ((2(0PF10.3,1P2E10.3)))   10.403 4.322E+03 4.022E+02
    8.939 7.563E+03 3.277E+02         11.970 7.724E+02 1.750E+02
   10.925 2.637E+03 3.702E+02         13.119 5.377E+02 8.577E+00
              .......  4.390E+01          .......    2.618E+01
---------------------------------------------------------------------
   72.409 ......
   75.453 4.902E-02 2.775E-03
    2     2 (7(F8.3,2X))
+4.       1.3227
    2     4 (7(F8.3,2X))
+10.      4.5217     2.5245     .2455
//
```

Table 4 b) Microscopic interaction [10]; G-3 model density,

$$\rho_m \equiv \frac{A}{Z}\rho_p \equiv \frac{A}{N}\rho_n$$

```
//IAK623C4 JOB (0623,145,POCIA),GILS,REGION=800K,TIME=10
// EXEC FHLG,LIB=ZYK
//L.SYSIN DD *
 INCLUDE LOAD(POGAFB)
 INCLUDE LOAD(MODINA)
 ENTRY MAIN
//G.SYSIN DD *
    1    1    0    1    0    0    0    0    0    0    1    1
    1    6    2    1    0    0
    0    0    0
      48-CA ( 4-HE,4-HE ) 48-CA  ELASTIC SCATTERING
 4.0026    47.9525    2.           20.          104.
   570    55    42    2  200   -10
     2    49 (7(F9.4,1X))          66.736       1.7980       1.8954      19.4342
 +14.       1.34      48.          1.           .5           7.0
 +1.60949  .643129   0.
                                                                         9.
                                   1.06724      .4409        -.03        .001
 1.02146   .607071    -.03
     2    10 (7(F9.4,1X))                                    .01          .01
                          .005      .005         .01          .01          .01
 50.        .2        .01       .01          .01
 .01        .01
      1       9 (2013)
   7   3   9 15  16  17  18  19  20  21  22
     2  384   ((2(0PF10.3,1P2E10.3)))     3.680 1.407E+05 1.632E+04
    3.137 2.643E+05 2.482E+04             5.331 3.678E+04 3.880E+03
    4.790 6.125E+04 6.366E+03             6.513 1.114E+04 1.702E+03
    ... 2.415E+03                         ... 3.302E+02
   89.883 8.559E-03 ...                 100.130 2.409E-03 ...
   95.151 7.674E-03 2.329E-03
     2     2 (7(F9.4,1X))
 +4.        1.3227
     2     4 (7(F9.4,1X))
 +8.        3.7369      .5245       -.03
 //
```

Table 4 c) Gauss-interaction, F3-FB density,

$$\rho_m = \rho_p + \rho_n, \ \rho_n \neq \frac{N}{Z} \rho_p$$

5.5 Grid-Calculations

If one may wish to study the systematic dependence of theoretical cross sections, scattering amplitudes etc. on certain parameters, it is useful to vary these parameters automatically step by step in a grid calculation. For that purpose the grid option (CARD 1) has to be switched on and two additional data blocks have to be given

DATA BLOCK 7 (INTEGER)

numbers of parameters to be in grid
step number for each parameter to be in grid

DATA BLOCK 8 (REAL)

step size for each parameter to be in grid

The total number of parameters to be in grid should be lower than 6, parameters in grid should not be in search at the same time.

An input example for a grid calculation is given in table 2.

5.6 Special Input for XYNETICS-Plot

Special plot software can be used to prepare plots of the experimental and theoretical angular distributions ready for publication (XYNETICS-plots).
The corresponding option is (option card 3)

PLOTTER TYPE = 2

In this case only one scattering problem can be treated in one job. Hence, on option card 1 it must read

NUMBER OF INDEPENDENT CALCULATIONS = 1

The following job-control card has to be induced in front of the GØ-step card:

The input cards necessary for the plot described in ref. 6 leave to be placed at the very end of the data cards.

The output examples correspond to the input examples given in tables 1 - 4.


```
START OF THE JOB : 23.07.80  17.41.45 H.MIN.SEC
```

```
NUMBER OF INDEPENDENT CALCULATIONS  1
CM-DATA                             1
GRID CALCULATIONS                   0
PRINT INPUT                         1
PRINT CPU-TIME                      1
PRINT CROSS SECTIONS                0
PRINT CROSS SECTIONS/RUTHERFORD     0
PRINT SCATTERING AMPLITUDES         1
PRINT POTENTIALS                    1
PRINT POTENTIAL MOMENTS             2
PRINT DENSITIES                     0
PRINT DENSITY MOMENTS               0
PUNCH POTENTIALS OR DENSITIES       0
PUNCH MOMENTS                       0

FOLDED COULOMB POTENTIAL            0
REAL POTENTIAL                      0
TARGET DENSITY (FOLDING)            0
IMAGINARY POTENTIAL                 0
CONSERVE VOLUME-INTEGRAL            0
RELATIVISTIC KINEMATICS             0

KE(21-28) : FREE

PLOTTER TYPE                        1
PLOT CROSS SECTIONS                 0
PLOT CS/RUTHERFORD                  1
KE(32-42) : FREE
```

```
 104 MEV ALPHAS ON 90-ZR


PROJECTILE-MASS    =    4.  TARGET-MASS    =  90.
PROJECTILE-CHARGE  =    2.  TARGET-CHARGE  =  40.
PROJECTILE-ENERGY (MEV) =   104.00

CM-ENERGY = 99.5672D+00   K = 4.272790+00   ETA = 2.471590+00


SCATTERING PHASE ANALYSIS


CPU-TIME (SEC)     =     20
LMAX               =     70
ITERATIONS         =    100
PRINT-OUT AT EACH       20 ITERATION

PARAMETRIZATION OF REAL AND IMAGINARY PART
```

PARAMETERS

```
 15.000     31.010      6.680     30.280      1.565      0.084     -0.002
  0.034      0.0         0.0       0.001
```

REQUIRED FIRST STEP AND FIT ACCURACIES

```
 10.000      0.010      0.010      0.010      0.050      0.005      0.005
  0.005
```

VARIED PARAMETERS

```
 2  3  4  5  6  7  8
```

EXPERIMENTAL CROSS SECTIONS

```
    8.939 7.563E+03 3.277E+02    10.403 4.322E+03 4.022E+02
   10.925 2.637E+03 3.702E+02    11.970 7.724E+02 1.750E+02
   12.492 4.678E+02 4.390E+01    13.119 5.377E+02 8.577E+00
   66.302 8.781E-02 1.530E+01    14.059 6.433E+02 2.618E+01
   69.359 8.187E-02 3.193E-03    70.885 6.823E+02 2.283E+01
   72.409 6.584E-02 3.215E-03    73.932 5.682E-02 3.233E-03
   75.453 4.902E-02 2.775E-03
DATE 23.07.80          TIME 17.41.45          DURATION     0.0003          DIFFERENCE     0.0003
DATE 23.07.80          TIME 17.41.46          DURATION     0.0846          DIFFERENCE     0.0843

   1 ITERATIONS   TOTAL CHISQUARE = 1.740610+04   IW(4) =   0   W(3) =  0.0
VARIABLES
  3.10100D+01  6.68000D+00  3.02800D+01  1.56500D+00  8.42000D-02 -1.92000D-03  3.45000D-02
FUNCTIONS
 -6.94212D+00 -2.45665D+00 -3.35129D+00 -5.63462D+00 -1.61095D+01 -3.42953D+01 -1.40801D+01 -3.38535D+00 -7.99875D-01 -1.98562D+00
 -1.46782D+00 -3.37753D+00 -5.39748D+00 -6.80786D+00 -1.44486D+01 -2.78361D+01 -8.25131D+00 -5.34779D+00 -5.43028D+00 -2.08653D+01
 -1.09244D+01 -6.93639D+00 -7.38992D+00 -9.01326D+00 -1.37508D+01 -3.65432D+01 -3.90046D+01 -1.12650D+01 -7.36498D+00 -9.97420D+00
 -3.10605D+01 -1.73523D+01 -1.23626D+01 -1.16635D+01 -1.24094D+01 -1.50056D+01 -2.68534D+01 -2.32434D+01 -3.12579D+00  8.57904D-01
  3.38085D+00  5.07386D+00  2.34320D+00 -9.19562D-01 -1.43580D+00 -6.52084D-01 -2.27201D-01  1.59403D+00  1.58534D+01  8.46668D+00
  4.88057D+00  3.43384D+00 -5.99510D-01 -1.29760D+01 -9.06389D+00 -2.36630D+00 -3.29074D-01  1.37333D+00  3.78694D+00  5.36781D+00
  1.36907D+01  2.43967D+01  1.41556D+01  9.41293D+00  1.18719D+01  8.82497D+00  9.36483D+00  9.49769D+00  9.13650D+00  1.08611D+01
  1.51383D+01  2.16148D+01  1.01946D+01  3.56874D+00 -2.69361D+00 -2.27094D+00  3.72398D-01  1.13548D+01  1.48514D+01  1.92135D+01
  6.55887D-01 -2.07203D+01  8.95336D+00  1.90154D+01  4.31686D+00  1.24342D+01  2.96268D+01  7.26732D+00 -1.57535D+01  6.71317D+00
  2.34826D+01  1.12868D+01  6.32603D+00  1.57416D+01  5.58393D+00
DATE 23.07.80          TIME 17.41.48          DURATION     2.1544          DIFFERENCE     2.0698
```

```
  20 ITERATIONS    TOTAL CHISQUARE = 1.68087D+04   IW(4) =   2   W(3) =  0.0
VARIABLES
  3.11945D+01  6.71742D+00  3.01525D+01  2.63303D+00  1.02397D-01  6.16698D-03  2.89579D-02
FUNCTIONS
 -6.92786D+00 -2.46257D+00 -3.28384D+00 -5.33518D+00 -1.50100D+01 -3.02997D+01 -1.25263D+01 -2.88073D+00 -2.68603D-01 -1.67495D+00
 -1.23927D+00 -3.08528D+00 -4.84372D+00 -5.95904D+00 -1.25118D+01 -2.29769D+01 -6.21369D+00 -3.69894D+00 -3.37351D+00 -1.40451D+01
 -7.71571D+00 -5.33681D+00 -5.85110D+00 -7.18006D+00 -1.08502D+01 -2.80304D+01 -2.88364D+01 -8.09097D+00 -5.19295D+00 -7.36799D+00
 -2.46777D+01 -1.43761D+01 -1.04781D+01 -9.75341D+00 -1.01594D+01 -1.17078D+01 -1.96576D+01 -1.45564D+01 -8.31735D-01  2.07987D+00
  4.45891D+00  6.92176D+00  4.26441D+00  4.20085D-01  1.61986D-01  1.12442D+00  1.83855D+00  5.49671D+00  2.62348D+01  1.17991D+01
  6.38170D+00  5.05597D+00  4.19275D+00 -1.59377D+00  3.66759D-01  3.92796D+00  3.99347D+00  5.83731D+00  7.95572D+00  9.18998D+00
  1.91795D+01  2.80312D+01  1.38745D+01  8.57954D+00  1.25619D+01  1.23381D+01  1.40007D+01  1.34529D+01  1.20404D+01  1.29858D+01
  1.59503D+01  1.90940D+01  8.85763D-01 -1.36146D+01 -1.72196D+01 -9.41197D+00 -6.44032D-01  1.47374D+01  1.82709D+01  1.72799D+01
 -1.29776D+01 -3.25288D+01  1.79573D+01  2.07518D+01 -1.09269D+01  2.54345D+00  2.56900D+01 -2.80181D+00 -3.10639D+01  1.98161D-01
  2.52322D+01  1.20415D+01  3.00349D+00  1.30907D+01  7.72732D+00
DATE 23.07.80          TIME 17.41.51          DURATION     4.9857          DIFFERENCE     2.8312

  40 ITERATIONS    TOTAL CHISQUARE = 7.27517D+03   IW(4) =   1   W(3) =  0.0
VARIABLES
  3.14598D+01  6.80350D+00  2.91910D+01  6.37820D+00  1.84836D-01  7.61573D-03  6.63346D-03
FUNCTIONS
 -4.66330D+00 -1.82306D+00 -2.71484D+00 -4.26668D+00 -1.09536D+01 -1.16270D+01 -3.04841D+00  1.90557D+00  7.23057D+00  2.33277D+00
  5.01905D-01 -1.77713D+00 -3.19035D+00 -4.03385D+00 -8.72812D+00 -1.36532D+01 -1.84779D+00  6.08214D-01  3.21187D+00  1.07244D+01
  4.08666D+00  8.32468D-02 -1.32043D+00 -2.62925D+00 -4.83255D+00 -1.30321D+01 -1.25988D+01 -2.77638D+00 -5.53779D-01  5.96389D-01
  1.71220D+00 -3.34153D-01 -1.89833D+00 -2.25707D+00 -3.10749D+00 -4.08307D+00 -9.07421D+00 -9.62079D+00 -1.87923D+00  1.06748D-01
  1.88337D+00  4.98742D+00  6.61876D+00  2.84196D+00  2.49596D+00  2.58517D+00  1.92824D+00  2.02569D+00  5.09781D+00  6.67180D-01
  3.66015D-01  1.10990D+00  3.74042D+00  9.10278D+00  1.04163D+01  9.10056D+00  5.78055D+00  5.31311D+00  4.52928D+00  1.97258D+00
 -2.56742D+00 -1.17732D+01 -9.74688D+00 -7.33851D+00 -2.81217D+00  3.62428D+00  7.99002D+00  8.07680D+00  6.44674D+00  5.78043D+00
  5.22627D+00  4.79591D+00 -6.12651D+00 -1.72950D+01 -1.62344D+01 -9.93935D+00 -7.99135D+00 -1.23383D+00  4.39825D-01 -2.12432D+00
 -1.13679D+01 -1.85817D+01  8.17741D-01  8.34415D+00  1.18276D+01  1.41122D+01  2.09770D+01  2.04702D+01  1.76908D+01  1.89543D+01
  1.86492D+01  1.98879D+01  1.81804D+01  1.63825D+01  1.66140D+01

  43 ITERATIONS    TOTAL CHISQUARE = 7.23755D+03   IW(4) =  87   W(3) =  8.96036D+00
VARIABLES
  3.13892D+01  6.82270D+00  2.91547D+01  6.50172D+00  1.90718D-01  6.01903D-03  6.63969D-03
FUNCTIONS
 -4.39192D+00 -1.78680D+00 -2.71665D+00 -4.27876D+00 -1.08415D+01 -1.00985D+01 -1.97642D+00  2.56404D+00  8.27040D+00  2.79145D+00
  6.27361D-01 -1.74436D+00 -3.20993D+00 -4.08553D+00 -8.78128D+00 -1.34534D+01 -1.58166D+00  9.68082D-01  3.75785D+00  1.23671D+01
  4.59931D+00  1.96040D-01 -1.31105D+00 -2.67500D+00 -4.90376D+00 -1.29931D+01 -1.19673D+01 -2.30589D+00  7.53868D-04  1.50847D+00
  4.08096D+00  5.47948D-01 -1.55163D+00 -2.07595D+00 -3.00281D+00 -3.96270D+00 -8.63175D+00 -8.52555D+00 -1.31174D+00  6.68277D-01
  2.69847D+00  6.46425D+00  7.36394D+00  2.95297D+00  2.43599D+00  2.46399D+00  1.81612D+00  1.99694D+00  5.91344D+00  1.39582D+00
  9.45287D-01  1.75958D+00  4.84566D+00  1.01263D+01  1.06290D+01  9.09811D+00  5.79053D+00  5.42188D+00  4.81774D+00  2.56728D+00
 -6.25813D-01 -7.76288D+00 -6.97720D+00 -5.10827D+00 -2.61241D-01  5.08025D+00  8.65279D+00  8.37027D+00  6.63390D+00  6.00029D+00
  5.60240D+00  5.42917D+00 -5.46842D+00 -1.64349D+01 -1.57051D+01 -9.71665D+00 -7.81933D+00 -9.06210D-01  9.40807D-01 -9.70544D-01
 -9.62214D+00 -1.59132D+01  2.78266D+00  9.80811D+00  1.24843D+01  1.43307D+01  2.13142D+01  2.09317D+01  1.83811D+01  1.98489D+01
  1.94421D+01  2.04166D+01  1.83489D+01  1.64475D+01  1.66342D+01
```

STANDARD ERRORS
1.85452D-01 1.77574D-01 2.24726D-01 3.99775D-01 1.84877D-02 3.07986D-03 4.29421D-03

ERROR ENHANCEMENTS
3.00069D+00 2.61647D+00 2.63228D+00 1.96103D+00 1.64387D+00 1.14082D+00 1.07455D+00

ERROR CORRELATION MATRIX
1.00000D+00
6.46416D-01 1.00000D+00
6.68635D-01 3.77485D-02 1.00000D+00
-5.95658D-01 -4.38701D-01 -4.56004D-01 1.00000D+00
-1.21126D-02 1.44522D-01 1.05254D-01 4.02618D-01 1.00000D+00
2.41898D-01 1.77778D-01 1.71571D-01 -4.57336D-01 -1.28649D-01 1.00000D+00
-1.07697D-01 1.22800D-02 -4.41281D-02 1.03836D-02 -1.17884D-01 -3.99171D-02 1.00000D+00

CONVERGENCE WITH ERROR CODE 0
DATE 23.07.80 TIME 17.41.51 DURATION 5.6381 DIFFERENCE 0.6524

FINAL PARAMETERS AT END OF SEARCH

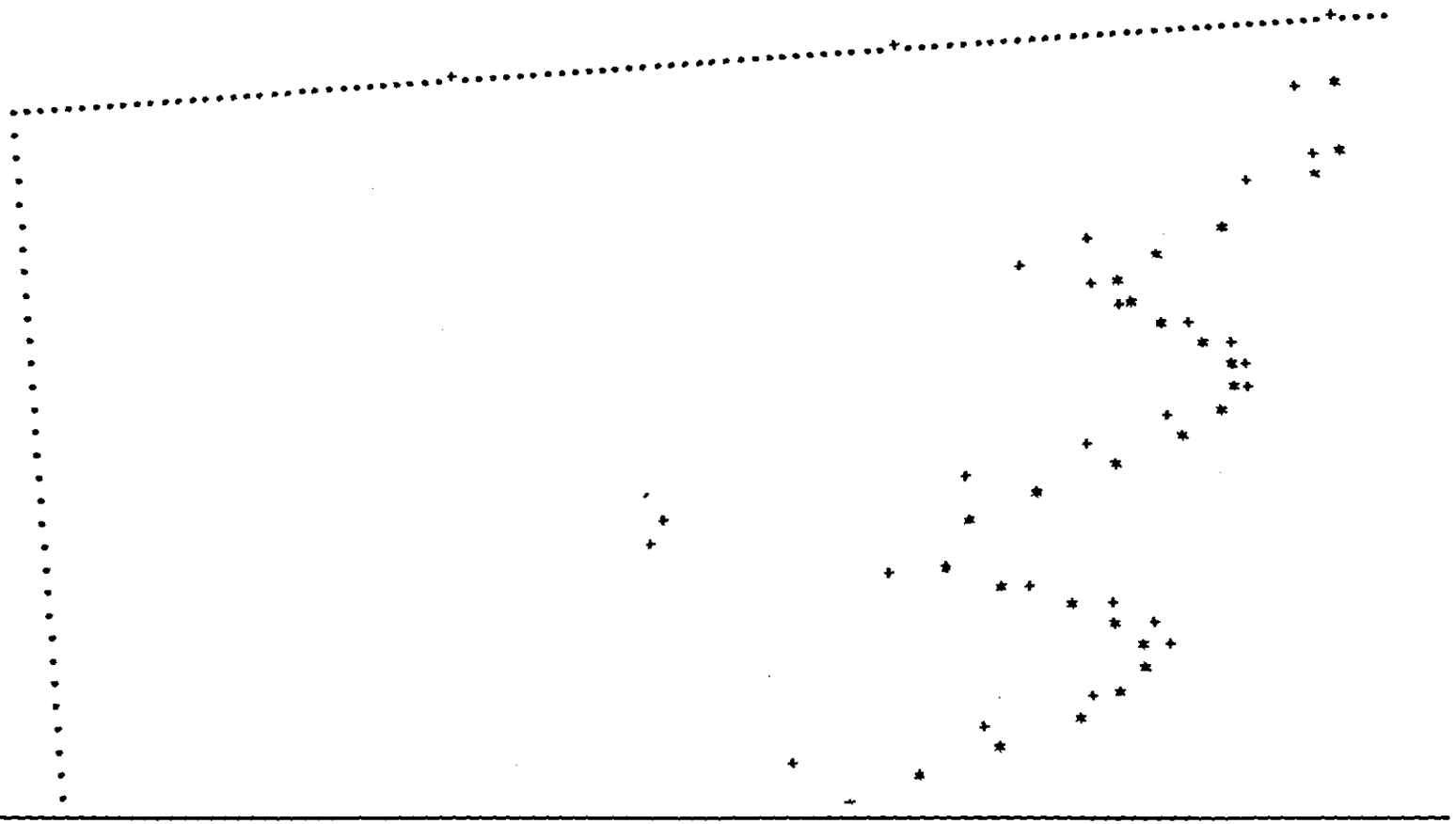
NUMBER	VALUE	ERROR
2	3.13892D+01	2.06970D-02
3	6.82270D+00	1.98177D-02
4	2.91547D+01	2.50800D-02
5	6.50172D+00	4.46159D-02
6	1.90718D-01	2.06328D-03
7	6.01903D-03	3.43721D-04
8	6.63969D-03	4.79246D-04

CHI-SQUARE PER DEGREE OF FREEDOM = 8.319D+01

SCATTERING AMPLITUDES

L	RE(SL-1)	IM(SL)	COS(2SIGL)	SIN(2SIGL)
0	-9.9398D-01	6.6398D-03	5.1251D-01	8.5868D-01
1	-9.9398D-01	6.6399D-03	-9.6541D-01	-2.6072D-01
2	-9.9398D-01	6.6400D-03	4.5638D-01	-8.8979D-01
		6.6402D-03	9.6068D-01	2.7767D-01
66				9.8340D-01
67	-8.5163D-10	9.3935D-10		
68	-4.7384D-10	5.4604D-10	-4.5715D-01	
69	-2.6364D-10	3.1741D-10	-5.1961D-01	8.5440D-01
70	-1.4669D-10	1.8451D-10	-5.7858D-01	8.1563D-01

THETA	SIGMAEXP	SIGMATHE
8.0	0.0	0.0
8.5	0.0	0.0
9.0	3.37D-01	4.01D-01
9.5	0.0	0.0
10.0	0.0	0.0
10.5	3.53D-01	4.11D-01
11.0	2.61D-01	3.61D-01
11.5	0.0	0.0
12.0	1.10D-01	2.17D-01
12.5	7.91D-02	1.60D-01
13.0	1.11D-01	1.28D-01
13.5	1.25D-01	1.32D-01
14.0	1.74D-01	1.56D-01
14.5	2.26D-01	1.89D-01
15.0	2.37D-01	2.14D-01
15.5	2.31D-01	2.19D-01
16.0	1.59D-01	2.01D-01
16.5	1.05D-01	1.64D-01
17.0	5.61D-02	1.19D-01
17.5	1.13D-02	7.79D-02
18.0	1.08D-02	5.26D-02
18.5	0.0	0.0
19.0	3.65D-02	4.78D-02
19.5	6.97D-02	6.17D-02
20.0	1.10D-01	8.63D-02
20.5	1.36D-01	1.11D-01
21.0	1.49D-01	1.27D-01
21.5	1.29D-01	1.27D-01
22.0	9.45D-02	1.12D-01
		9.62D-02
72.5	9.68D-03	0.0
73.0	0.0	0.0
73.5	0.0	5.76D-04
74.0	8.97D-03	0.0
74.5	0.0	0.0
75.0	0.0	4.84D-04
75.5	8.30D-03	0.0
76.0	0.0	



END OF THE JOB : 23.07.80 17.41.52 H.MIN.SEC

MODINA, VERSION JULY 1980

```
START OF THE JOB : 23.07.80  20.01.13 H.MIN.SEC
```

```
NUMBER OF INDEPENDENT CALCULATIONS  1
CM-DATA                             1
GRID CALCULATIONS                   1
PRINT INPUT                         1
PRINT CPU-TIME                      0
PRINT CROSS SECTIONS                0
PRINT CROSS SECTIONS/RUTHERFORD     0
PRINT SCATTERING AMPLITUDES         0
PRINT POTENTIALS                    0
PRINT POTENTIAL MOMENTS             2
PRINT DENSITIES                     0
PRINT DENSITY MOMENTS               0
PUNCH POTENTIALS OR DENSITIES       0
PUNCH MOMENTS                       0

FOLDED COULOMB POTENTIAL            1
REAL POTENTIAL                      2
TARGET DENSITY (FOLDING)            0
IMAGINARY POTENTIAL                 1
CONSERVE VOLUME-INTEGRAL            0
RELATIVISTIC KINEMATICS             0

KE(21-28) : FREE

PLOTTER TYPE                        0
PLOT CROSS SECTIONS                 0
PLOT CS/RUTHERFORD                  0
KE(32-42) : FREE
```

```
  104 MEV ALPHA-PARTICLES ON 40-CA


PROJECTILE-MASS    =   4.  TARGET-MASS    =  40.
PROJECTILE-CHARGE  =   2.  TARGET-CHARGE  =  20.
PROJECTILE-ENERGY (MEV) =   104.00

CM-ENERGY = 94.5318D+00   K = 4.05671D+00   ETA = 1.23580D+00


POTENTIAL ANALYSIS


CPU-TIME (SEC)     =   580
LMAX               =    55
INTEGRATION STEPS  =    43
FIRST STEP         =     2
ITERATIONS         =   100
PRINT-OUT AT EACH      -10 ITERATION
```

```
PARAMETERS

 14.0000    1.3400   40.0000  152.6000    1.4040    1.2530   20.0000
  1.6030    0.6780    0.0       1.0000    1.0000    0.0010

REQUIRED FIRST STEP AND FIT ACCURACIES

 10.0000    0.5000    0.0050    0.0050    0.0050    0.0050

VARIED PARAMETERS

 4  5  6  8  9

MATCHING RADIUS (FM) = 14.00D+00   STEP SIZE = 0.325581D+00

EXPERIMENTAL CROSS SECTIONS

    3.187 2.335E+05 2.627E+04     3.738 1.243E+05 1.893E+04
   94.177 2.811E-03 8.889E+03     4.859 4.960E+04 5.133E+03
  101.648 9.332E-04 2.808E-04   106.573 4.917E-04 2.392E+03
  108.530 2.655E-04 5.769E-05   116.291 9.449E-05 3.150E-05

PARAMETERS OF CHARGE DISTRIBUTIONS

  4.0000    1.3227
  9.0000    3.7660    0.5860   -0.1610

   1 ITERATIONS   TOTAL CHISQUARE = 8.41802D+02   IW(4) =   0   W(3) =  0.0
VARIABLES
  1.52600D+02  1.40400D+00  1.25300D+00  1.60300D+00  6.78000D-01

  10 ITERATIONS   TOTAL CHISQUARE = 4.59046D+02   IW(4) =   0   W(3) =  0.0
VARIABLES
  1.53308D+02  1.40242D+00  1.25622D+00  1.61138D+00  6.70326D-01

  10 ITERATIONS   TOTAL CHISQUARE = 4.59046D+02   IW(4) = 122   W(3) =  1.92482D+00
VARIABLES
  1.53308D+02  1.40242D+00  1.25622D+00  1.61138D+00  6.70326D-01

CONVERGENCE WITH ERROR CODE 0
```

```
FINAL PARAMETERS AT END OF SEARCH
 NUMBER        VALUE            ERROR
    4      1.53303D+02     8.12620D-01
    5      1.40242D+00     3.11933D-03
    6      1.25622D+00     4.78160D-03
    8      1.61138D+00     1.80201D-03
    9      6.70326D-01     3.95148D-03


CHI-SQUARE PER DEGREE OF FREEDOM =  3.763D+00


REAL POTENTIAL

K-TH MOMENT FOR K = -2, -1, ...,+5, +6
    2.71176        3.30233        3.70866        4.03458        4.31583        4.56941        4.80486        5.02811        5.24311

VOLUME =  5.09202D+04   PER NUCLEON PAIR =  3.18251D+02


IMAGINARY POTENTIAL

K-TH MOMENT FOR K = -2, -1, ...,+5, +6
    3.40601        4.01497        4.40091        4.69558        4.94256        5.16195        5.36482        5.55801        5.74603

VOLUME =  1.60681D+04   PER NUCLEON PAIR =  1.00425D+02


GRID-PARAMETERS AND STEPS

 7  5
  5.0000


**********************************************************************************************************************************

GRID-PARAMETER NUMBER   7  NEW VALUE =  2.50000D+01

   1 ITERATIONS   TOTAL CHISQUARE = 3.34508D+04   IW(4) =   0   W(3) =  0.0
VARIABLES
  1.53308D+02  1.40242D+00  1.25622D+00  1.61138D+00  6.70326D-01
```

```
**********************************************************************************************************************

GRID-PARAMETER NUMBER   7  NEW VALUE =  4.50000D+01

   1 ITERATIONS   TOTAL CHISQUARE = 2.11734D+04   IW(4) =   0   W(3) =  0.0
VARIABLES
  1.69082D+02  1.32245D+00  1.37794D+00  1.12508D+00  1.14315D+00

  10 ITERATIONS   TOTAL CHISQUARE = 2.84309D+04   IW(4) =   1   W(3) =  0.0
VARIABLES
  1.89069D+02  1.32279D+00  1.34596D+00  1.09076D+00  1.15624D+00

  20 ITERATIONS   TOTAL CHISQUARE = 5.64214D+03   IW(4) =   1   W(3) =  0.0
VARIABLES
  1.89082D+02  1.25968D+00  1.45903D+00  1.01801D+00  1.22080D+00

CPU-TIME EXCEEDED AFTER  30 CALLS OF CALFUN


  30 ITERATIONS   TOTAL CHISQUARE = 7.16843D+03   IW(4) =   1   W(3) =  0.0
VARIABLES
  1.69082D+02  1.30258D+00  1.41940D+00  1.04023D+00  1.19492D+00

  30 ITERATIONS   TOTAL CHISQUARE = 5.60634D+03   IW(4) = 122   W(3) =  6.62339D+00
VARIABLES
  1.79082D+02  1.29235D+00  1.43207D+00  1.02820D+00  1.22349D+00

CONVERGENCE WITH ERROR CODE 3



FINAL PARAMETERS AT END OF SEARCH
 NUMBER        VALUE            ERROR
    4     1.79082D+02     2.08572D+00
    5     1.29235D+00     6.69244D-03
    6     1.43207D+00     6.66635D-03
    8     1.02820D+00     4.36884D-03
    9     1.22349D+00     6.36497D-03


CHI-SQUARE PER DEGREE OF FREEDOM =  4.595D+01
```

```
REAL POTENTIAL

K-TH MOMENT FOR K = -2, -1, ...,+5, +6
    2.62716        3.24342        3.68104        4.04008        4.35551        4.64407        4.91520        5.17466        5.42613

VOLUME =  4.83703D+04   PER NUCLEON PAIR =  3.02315D+02


IMAGINARY POTENTIAL

K-TH MOMENT FOR K = -2, -1, ...,+5, +6
    2.98660        3.73484        4.30361        4.80096        5.26163        5.69882        6.11657        6.51478        6.89181

VOLUME =  1.80746D+04   PER NUCLEON PAIR =  1.12966D+02


END OF THE JOB : 23.07.80  20.24.57 H.MIN.SEC


MODINA, VERSION JULY 1980
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START OF THE JOB : 23.07.80 18.10.18 H.MIN.SEC

NUMBER OF INDEPENDENT CALCULATIONS	1
CM-DATA	1
GRID CALCULATIONS	0
PRINT INPUT	1
PRINT CPU-TIME	0
PRINT CROSS SECTIONS	0
PRINT CROSS SECTIONS/RUTHERFORD	0
PRINT SCATTERING AMPLITUDES	0
PRINT POTENTIALS	1
PRINT POTENTIAL MOMENTS	2
PRINT DENSITIES	0
PRINT DENSITY MOMENTS	0
PUNCH POTENTIALS OR DENSITIES	0
PUNCH MOMENTS	0
FOLDED COULOMB POTENTIAL	1
REAL POTENTIAL	4
TARGET DENSITY (FOLDING)	0
IMAGINARY POTENTIAL	1
CONSERVE VOLUME-INTEGRAL	0
RELATIVISTIC KINEMATICS	0

KE(21-28) : FREE

PLOTTER TYPE	1
PLOT CROSS SECTIONS	0
PLOT CS/RUTHERFORD	1

KE(32-42) : FREE

104 MEV ALPHA-PARTICLES ON 40-CA

PROJECTILE-MASS = 4. TARGET-MASS = 40.
PROJECTILE-CHARGE = 2. TARGET-CHARGE = 20.
PROJECTILE-ENERGY (MEV) = 104.00

CM-ENERGY = 94.5318D+00 K = 4.0567ID+00 ETA = 1.2358OD+00

POTENTIAL ANALYSIS

CPU-TIME (SEC)	=	160
LMAX	=	55
INTEGRATION STEPS	=	43
FIRST STEP	=	2
ITERATIONS	=	200
PRINT-OUT AT EACH		20 ITERATION

PARAMETERS

14.0000	1.3400	40.0000	152.6000	1.4040	1.2530	20.0000
1.6030	0.6780	0.0	1.0000	1.0000	10.0000	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0010

REQUIRED FIRST STEP AND FIT ACCURACIES

10.0000	0.2000	0.0050	0.0050	0.1000	0.1000	0.1000
0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000

VARIED PARAMETERS

7 8 9 14 15 16 17 18 19 20 21 22 23

MATCHING RADIUS (FM) = 14.000+00 STEP SIZE = 0.325581D+00

EXPERIMENTAL CROSS SECTIONS

3.187	2.335E+05	2.627E+04	3.738	1.243E+05	1.893E+04
[illegible]	[illegible]	8.889E+03	4.859	4.960E+04	5.133E+03
94.177	2.811E-03	[illegible]	[illegible]	[illegible]	2.392E+03
101.648	9.332E-04	2.808E-04	106.573	[illegible]	
108.530	2.655E-04	5.769E-05	116.291	9.449E-05	3.150E-05

PARAMETERS OF CHARGE DISTRIBUTIONS

4.0000	1.3227		
9.0000	3.7660	0.5860	-0.1610

1 ITERATIONS TOTAL CHISQUARE = 8.418020+02 IW(4) = 0 W(3) = 0.0

VARIABLES

2.00000D+01	1.603000+00	6.78000C-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0							

```
FUNCTIONS
 -1.41586D-01 -2.08446D-01 -5.75901D-01 -6.89447D-01 -5.69707D-01 -8.99496D-01  6.32139D-01  6.52442D-01  8.62811D-01  1.40699D+00
  1.51601D+00  2.70983D+00 -1.40727D+00  3.71751D-01 -8.03770D-02 -2.34530D+00 -2.22075D+00 -1.70126D+00 -3.99926D-01 -1.75235D-01
  3.44879D-01  6.82631D-01  3.09032D+00  2.15987D+00  2.94638D-02  8.84425D-01 -4.62690D-01  5.37580D-01 -3.82246D-01 -6.41258D-01
 -3.08807D-01 -2.09194D+00 -2.72829D+00 -2.86317D+00 -7.14717D-01 -2.86907D-01 -7.08292D-01 -1.50394D+00 -3.82030D-01  2.42984D+00
  8.85654D-01 -5.73681D-01  3.65939D-01  2.79397D+00  3.83562D-01 -1.79319D+00 -1.84540D+00 -1.62424D+00 -1.90484D+00 -1.03887D+00
 -2.44929D+00 -2.93959D+00 -4.25590D+00 -2.97260D+00  1.71535D+00  1.03997D+00  1.83121D+00 -2.24717D+00 -7.84499D-01 -1.20267D+00
  8.61935D-01  8.60957D-01  3.05231D-01 -7.16579D-01 -1.79839D-02 -1.84026D-01 -3.53692D+00 -3.59350D+00 -3.74977D+00 -3.09004D+00
 -2.60019D+00 -4.03902D+00  7.41004D-01 -2.71021D+00 -1.37601D+00  3.02725D+00  1.40868D+00  1.28943D+00  8.08425D-01  5.15368D-01
  5.10253D-01 -4.11672D+00 -6.80965D+00 -4.19479D+00 -6.70762D+00 -6.54089D+00 -4.67073D+00 -5.34123D+00 -3.25163D+00 -8.47871D-01
 -3.97225D+00 -2.89182D+00 -3.32904D+00 -2.80375D+00 -4.77674D-01 -2.23005D+00 -3.02774D+00 -1.47531D+00 -1.63028D+00 -9.74546D-01
 -1.43433D+00 -2.22518D+00 -2.34057D+00 -2.67783D+00 -3.13253D+00 -3.18428D+00 -2.43468D+00 -2.42403D+00 -3.22763D+00 -3.80666D+00
 -2.84910D+00 -3.09304D+00 -6.47320D+00 -5.62996D+00 -4.94414D+00 -5.82927D+00 -1.88312D+00 -2.04621D+00 -8.90224D-01  3.84716D+00
  1.99699D+00  2.72093D+00  1.53095D+00  3.36551D+00  1.38027D+00  3.00563D+00  2.12173D+00  2.04264D+00

  20 ITERATIONS    TOTAL CHISQUARE = 4.03348D+02    IW(4) =    0    W(3) =  0.0
VARIABLES
  2.08104D+01  1.61860D+00  6.44154D-01  1.39555D+00 -1.21973D-01 -3.60067D+00 -3.44543D-01  5.45556D+00  3.22083D+00 -5.77718D+00
 -8.35833D+00 -3.86813D+00 -6.54067D-01
FUNCTIONS
 -1.48611D-01 -2.24414D-01 -6.05419D-01 -7.20220D-01 -5.84468D-01 -8.92439D-01  6.72495D-01  7.09583D-01  9.40607D-01  1.48172D+00
  1.43674D+00  2.21518D+00 -1.91126D+00 -1.31407D-01 -7.22101D-01 -2.69794D+00 -2.40103D+00 -1.72952D+00 -3.12358D-01 -3.32873D-02
  5.28662D-01  8.73220D-01  2.75516D+00  1.60559D+00 -3.72130D-01  4.60735D-01 -9.09453D-01  1.33564D-01 -1.01132D+00 -1.15919D+00
 -4.80574D-01 -2.30199D+00 -2.45435D+00 -2.35877D+00 -9.92779D-02  2.37562D-01 -1.86241D-01 -8.18829D-01  6.71026D-01  2.63755D+00
  8.33916D-01 -4.90022D-01  6.82403D-01  3.77975D+00  3.44050D+00  2.94254D-01 -2.30204D-01 -3.59278D-01 -7.90120D-01 -2.29678D-01
 -1.85252D+00 -2.41593D+00 -4.05007D+00 -2.97189D+00  1.93578D+00  1.84256D+00  2.94323D+00  8.70662D-01  1.10437D+00 -4.45769D-01
  7.42724D-01  3.89267D-01 -3.67679D-01 -1.68654D+00 -1.24622D+00 -9.07799D-01 -3.20208D+00 -6.48704D-01  1.15227D+00  1.29861D+00
  1.70488D+00 -1.44061D+00  1.94328D+00 -1.60528D+00 -1.02697D+00  2.87182D+00  1.46976D+00  2.02796D+00  2.46115D+00  3.93816D+00
  4.35375D+00  4.53857D-01  4.48066D-01  1.11456D+00 -2.73193D+00 -2.22989D+00 -1.25851D+00 -2.80970D+00 -1.14027D+00  4.45453D-01
 -2.71440D+00 -7.73702D-01 -7.19421D-01  1.23855D+00  4.27028D+00  9.20373D-01  2.53081D-02  3.18233D-01 -1.38867D-01  1.25960D+00
  9.91221D-01  4.31700D-01  1.06183D+00  1.09468D+00 -9.40850D-02 -2.75422D-01  3.21246D-01  2.44309D-01 -1.15749D-01 -5.46334D-01
  1.72619D-01  1.56850D-01 -3.27743D+00 -3.05793D+00 -3.33198D+00 -4.55066D+00 -1.27526D+00 -2.62182D+00 -3.19071D+00  9.64130D-01
 -1.88103D+00 -5.87002D-01 -3.26100D+00 -1.45874D+00 -1.98808D+00 -1.09694D+00 -3.95068D+00 -1.45476D+00

  35 ITERATIONS    TOTAL CHISQUARE = 2.95183D+02    IW(4) = 114    W(3) =  1.60855D+00
VARIABLES
  2.01468D+01  1.63089D+00  6.44429D-01  1.33400D+00 -1.88788D-01 -2.94689D+00 -2.19583D-01  3.94843D+00  9.50955D-01 -6.48177D+00
 -7.42630D+00 -2.37159D+00  9.08696D-02
FUNCTIONS
 -1.31048D-01 -2.28349D-01 -6.21779D-01 -7.29096D-01 -5.66106D-01 -8.37183D-01  7.71752D-01  8.18868D-01  1.07076D+00  1.60996D+00
  1.43239D+00  1.90817D+00 -2.16823D+00 -2.79319D-01 -6.98862D-01 -2.53822D+00 -2.10508D+00 -1.39101D+00  2.06329D-02  2.68911D-01
  8.08725D-01  1.09635D+00  2.43204D+00  1.18838D+00 -6.36037D-01  2.23326D-01 -1.11318D+00 -1.48739D-03 -1.11984D+00 -1.11329D+00
 -3.59586D-01 -1.92279D+00 -2.01204D+00 -1.92044D+00  2.76121D-01  4.98222D-01  3.30484D-02 -5.69472D-01  9.97217D-01  2.63873D+00
  7.12314D-01 -6.16692D-01  5.60916D-01  3.55687D+00  3.01223D+00  1.08949D-01 -2.78344D-01 -3.16165D-01 -6.44231D-01  8.39312D-03
 -1.48662D+00 -1.67333D+00 -2.94918D+00 -2.20425D+00  2.04453D+00  1.44290D+00  2.35562D+00 -5.30421D-01  6.37269D-01 -2.12190D-01
  1.47194D+00  1.14769D+00  4.24272D-01 -7.08822D-01 -1.02453D-01 -1.95488D-01 -3.07917D+00 -1.79743D+00 -7.06563D-01 -9.47983D-02
  9.24284D-01 -1.41081D+00  2.26086D+00 -5.25963D-01  6.59535D-01  3.76023D+00  1.78228D+00  1.77684D+00  1.65773D+00  2.41833D+00
  2.93377D+00 -8.57262D-01 -1.01642D+00  4.92415D-01 -2.94580D+00 -2.15166D+00 -1.03992D+00 -2.72170D+00 -1.39338D+00 -5.49837D-02
 -3.47388D+00 -2.01526D+00 -1.54321D+00  8.83662D-01  4.49057D+00  1.14391D+00 -7.36716D-02 -6.19280D-02 -5.39936D-01  9.45900D-01
  9.98177D-01  6.24864D-01  1.32872D+00  1.29211D+00 -5.37149D-03 -1.58799D-01  5.65218D-01  6.11571D-01  3.97375D-01  7.08590D-02
  8.95082D-01  1.24524D+00 -1.70853D+00 -1.22398D+00 -1.74072D+00 -2.89510D+00  7.78596D-01  9.16023D-02 -4.60746D-01  3.64199D+00
  1.29219D+00  1.44977D+00 -5.58393D-01  9.46272D-01  1.39079D-02  1.95629D-01 -1.20797D+00 -4.53674D-01
```

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STANDARD ERRORS
  3.62960D-01  1.14558D-02  1.53852D-02  2.81107D-01  4.31488D-01  1.23670D+00  1.76509D+00  1.85868D+00  1.78167D+00  2.05102D+00
  2.20036D+00  1.78803D+00  7.93380D-01

ERROR ENHANCEMENTS
  1.84670D+01  2.93111D+01  1.00919D+01  5.15303D+00  4.96504D+00  1.63409D+01  2.10697D+01  2.21291D+01  3.15935D+01  3.61418D+01
  3.14853D+01  2.05027D+01  8.25574D+00

ERROR CORRELATION MATRIX
  1.00000D+00
 -9.37443D-01  1.00000D+00
  8.33378D-01 -9.24361D-01  1.00000D+00
 -2.46156D-01  4.94887D-01 -4.20935D-01  1.00000D+00
  5.74692D-01 -5.34606D-01  4.80398D-01  1.76110D-01  1.00000D+00
  7.00193D-01 -7.91311D-01  7.63392D-01 -2.05508D-01  8.66518D-01  1.00000D+00
  7.56619D-01 -7.50797D-01  7.59119D-01 -3.21930D-03  8.92048D-01  9.35435D-01  1.00000D+00
  6.37618D-01 -5.30718D-01  5.04606D-01  2.60722D-01  8.68867D-01  7.67535D-01  9.17583D-01  1.00000D+00
  4.34738D-01 -3.74839D-01  2.67100D-01  1.71577D-01  7.76366D-01  6.78366D-01  7.29981D-01  8.61616D-01  1.00000D+00
  3.88913D-01 -4.33959D-01  3.58177D-01 -1.06716D-01  6.76463D-01  6.99149D-01  6.30136D-01  6.25830D-01  8.61659D-01  1.00000D+00
  5.01669D-01 -5.15186D-01  5.44055D-01 -5.20301D-02  6.76164D-01  7.00329D-01  6.85134D-01  5.88891D-01  6.17827D-01  8.41801D-01
  1.00000D+00
  4.26895D-01 -3.64010D-01  4.69457D-01  1.71816D-01  5.76521D-01  5.09524D-01  5.88338D-01  5.10245D-01  3.53539D-01  5.15908D-01
  8.80649D-01  1.00000D+00
  2.94913D-01 -1.67763D-01  2.76461D-01  3.47376D-01  4.53216D-01  2.84922D-01  4.13942D-01  3.87525D-01  1.59335D-01  2.40545D-01
  6.67392D-01  9.29200D-01  1.00000D+00

CONVERGENCE WITH ERROR CODE 0



FINAL PARAMETERS AT END OF SEARCH
 NUMBER        VALUE            ERROR
    7      2.01468D+01     2.25644D-01
    8      1.63089D+00     7.12181D-02
    9      6.44429D-01     9.56466D-02
   14      1.33400D+00     1.74758D-01
   15     -1.88788D-01     2.68246D-01
   16     -2.94689D+00     7.68830D-01
   17     -2.19583D-01     1.09731D+00
   18      3.94843D+00     1.15550D+00
   19      9.50955D-01     1.10763D+00
   20     -6.48177D+00     1.27507D+00
   21     -7.42630D+00     1.36791D+00
   22     -2.37199D+00     1.11158D+00
   23      9.08696D-02     4.93227D-01
```
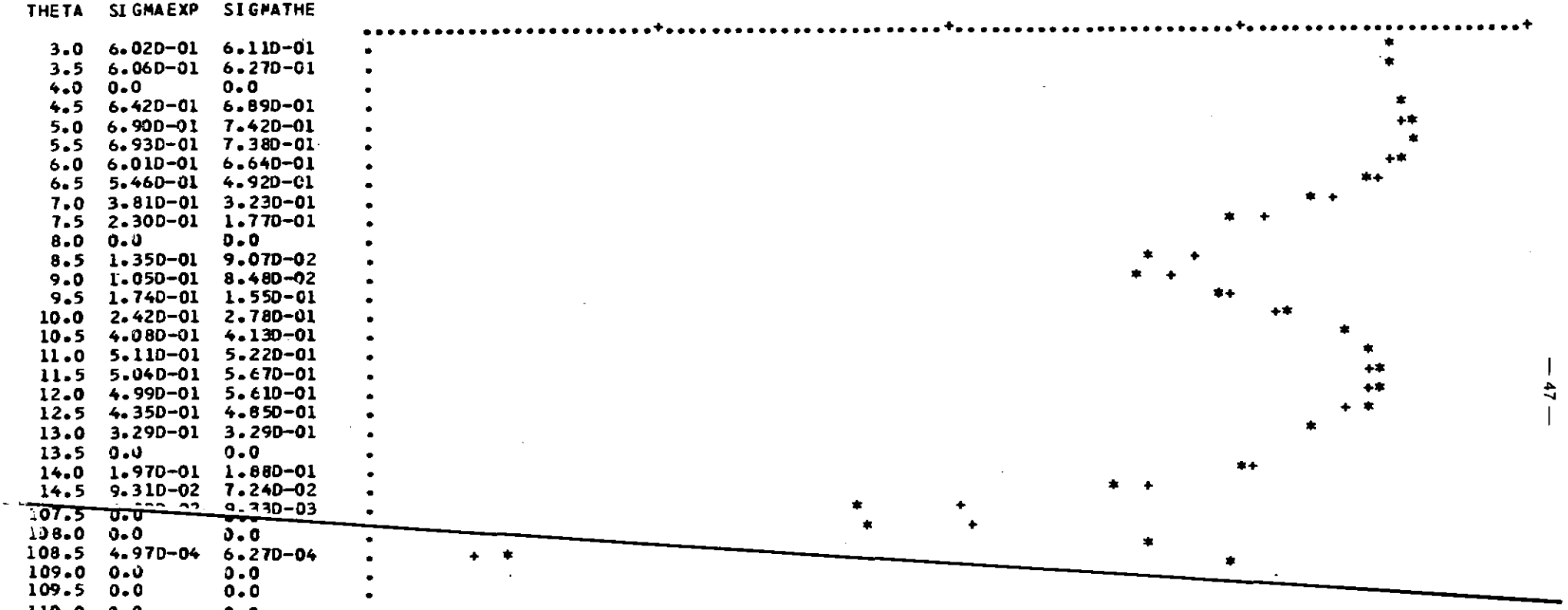

CHI-SQUARE PER DEGREE OF FREEDOM = 2.589D+00

THETA	SIGMAEXP	SIGMATHE
3.0	6.02D-01	6.11D-01
3.5	6.06D-01	6.27D-01
4.0	0.0	0.0
4.5	6.42D-01	6.89D-01
5.0	6.90D-01	7.42D-01
5.5	6.93D-01	7.38D-01
6.0	6.01D-01	6.64D-01
6.5	5.46D-01	4.92D-01
7.0	3.81D-01	3.23D-01
7.5	2.30D-01	1.77D-01
8.0	0.0	0.0
8.5	1.35D-01	9.07D-02
9.0	1.05D-01	8.48D-02
9.5	1.74D-01	1.55D-01
10.0	2.42D-01	2.78D-01
10.5	4.08D-01	4.13D-01
11.0	5.11D-01	5.22D-01
11.5	5.04D-01	5.67D-01
12.0	4.99D-01	5.61D-01
12.5	4.35D-01	4.85D-01
13.0	3.29D-01	3.29D-01
13.5	0.0	0.0
14.0	1.97D-01	1.88D-01
14.5	9.31D-02	7.24D-02
107.5	0.0	[illegible]
108.0	0.0	0.0
108.5	4.97D-04	6.27D-04
109.0	0.0	0.0
109.5	0.0	0.0
110.0	0.0	0.0
110.5	0.0	0.0
111.0	0.0	0.0
111.5	0.0	0.0
112.0	0.0	0.0
112.5	0.0	0.0
113.0	0.0	0.0
113.5	0.0	0.0
114.0	0.0	0.0
114.5	0.0	0.0
115.0	0.0	0.0
115.5	0.0	0.0
116.0	0.0	0.0
116.5	2.12D-04	2.44D-04
117.0	0.0	0.0



R	REAL	ERROR REAL	ERROR PERC	REAL+COULOMB	IMAGINARY	ERROR IMAG	ERROR PERC	COULOMB
0.0	-1.3289D+02	1.6579D+01	1.2476D+01	-1.1329D+02	-2.0143D+01	0.0	0.0	1.9597D+01
0.100	-1.3252D+02	1.6462D+01	1.2423D+01	-1.1293D+02	-2.0143D+01	0.0	0.0	1.9583D+01
0.200	-1.3239D+02	1.6118D+01	1.2175D+01	-1.1282D+02	-2.0142D+01	0.0	0.0	1.9569D+01
0.300	-1.3248D+02	1.5559D+01	1.1745D+01	-1.1293D+02	-2.0141D+01	0.0	0.0	1.9544D+01
0.400	-1.3276D+02	1.4805D+01	1.1152D+01	-1.1325D+02	-2.0140D+01	0.0	0.0	1.9511D+01
0.500	-1.3320D+02	1.3884D+01	1.0424D+01	-1.1373D+02	-2.0139D+01	0.0	0.0	1.9468D+01
0.600	-1.3375D+02	1.2830D+01	9.5924D+00	-1.1433D+02	-2.0138D+01	0.0	0.0	1.9416D+01
[illegible]	[illegible]	1.1677D+01	8.6917D+00	-1.1500D+02	-2.0136D+01	0.0	0.0	1.9353D+01
13.400	[illegible]	[illegible]	[illegible]	-1.1568D+02	-2.0135D+01	0.0	0.0	1.9283D+01
13.500	-1.4221D-04	0.0	0.0	[illegible]	[illegible]	0.0	0.0	1.9202D+01
13.600	-1.2125D-04	0.0	0.0	4.2347D+00	[illegible]	0.0	0.0	1.9113D+01
13.700	-1.0337D-04	0.0	0.0	4.2038D+00	-6.7669D-05	0.0	[illegible]	[illegible]
13.800	-8.8135D-05	0.0	0.0	4.1734D+00	-5.7935D-05	0.0	0.0	4.1735D+00
13.900	-7.5141D-05	0.0	0.0	4.1434D+00	-4.9608D-05	0.0	0.0	4.1435D+00
14.000	-6.4062D-05	0.0	0.0	4.1138D+00	-4.2477D-05	0.0	0.0	4.1139D+00

REAL POTENTIAL

K-TH MOMENT FOR K = -2, -1, ...,+5, +6

2.76133	3.34290	3.74754	4.07313	4.35372	4.60619	4.84034	5.06222	5.27575

VOLUME = 5.23065D+04 PER NUCLEON PAIR = 3.26916D+02

ERRORS OF K-TH MOMENT FOR K = -2, -1, ... ,+5, +6

1.19244D-02	3.11164D-02	4.68823D-02	8.35349D-02	5.29110D-02	4.43474D-02	4.17304D-02	4.15721D-02	4.24388D-02

ERROR VOLUME = 4.47481D+02 PER NUCLEON PAIR = 2.79675D+00

IMAGINARY POTENTIAL

K-TH MOMENT FOR K = -2, -1, ...,+5, +6

3.42575	4.03126	4.41178	4.70006	4.93994	5.15159	5.34608	5.53026	5.70870

VOLUME = 1.65723D+04 PER NUCLEON PAIR = 1.03577D+02

END OF THE JOB : 23.07.80 18.17.53 H.MIN.SEC

MODINA, VERSION JULY 1980

START OF THE JOB : 24.07.80 11.07.18 H.MIN.SEC

```
NUMBER OF INDEPENDENT CALCULATIONS  1
CM-DATA                             1
GRID CALCULATIONS                   0
PRINT INPUT                         1
PRINT CPU-TIME                      0
PRINT CROSS SECTIONS                0
PRINT CROSS SECTIONS/RUTHERFORD     0
PRINT SCATTERING AMPLITUDES         0
PRINT POTENTIALS                    0
PRINT POTENTIAL MOMENTS             1
PRINT DENSITIES                     1
PRINT DENSITY MOMENTS               1
PUNCH POTENTIALS OR DENSITIES       0
PUNCH MOMENTS                       0

FOLDED COULOMB POTENTIAL            1
REAL POTENTIAL                      5
TARGET DENSITY (FOLDING)            2
IMAGINARY POTENTIAL                 1
CONSERVE VOLUME-INTEGRAL            0
RELATIVISTIC KINEMATICS             0

KE(21-28) : FREE

PLOTTER TYPE                        0
PLOT CROSS SECTIONS                 0
PLOT CS/RUTHERFORD                  0
KE(32-42) : FREE
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  104 MEV ALPHA-PARTICLES ON 40-CA


PROJECTILE-MASS    =   4.  TARGET-MASS    =  40.
PROJECTILE-CHARGE  =   2.  TARGET-CHARGE  =  20.
PROJECTILE-ENERGY (MEV) =    104.00

CM-ENERGY = 94.5318D+00   K = 4.0567ID+00   ETA = 1.2358OD+00


POTENTIAL ANALYSIS


CPU-TIME (SEC)     =   160
LMAX               =    55
INTEGRATION STEPS  =    43
FIRST STEP         =     2
ITERATIONS         =   200
PRINT-OUT AT EACH     -10 ITERATION
```

PARAMETERS

14.0000	1.3400	40.0000	64.3700	1.7980	1.8954	20.0000
1.6030	0.6780	0.0	1.0000	1.0000	9.0000	1.0962
0.5122	-0.1660	1.1134	0.5122	-0.1660	0.0	0.0010

REQUIRED FIRST STEP AND FIT ACCURACIES

10.0000	0.2000	0.0050	0.0050	0.0050	0.0050

VARIED PARAMETERS

7 8 9 14 15

MATCHING RADIUS (FM) = 14.00D+00 STEP SIZE = 0.325581D+00

EXPERIMENTAL CROSS SECTIONS

3.187	2.335E+05	2.627E+04	3.738	1.243E+05	1.893E+04
[illegible]	[illegible]	8.889E+03	4.859	4.960E+04	5.133E+03
94.177	2.811E-03	[illegible]	[illegible]	[illegible]	2.392E+03
101.648	9.332E-04	2.808E-04	106.573	4.917E-04	[illegible]
108.530	2.655E-04	5.769E-05	116.291	9.449E-05	3.150E-05

PARAMETERS OF CHARGE DISTRIBUTIONS

4.0000	1.3227		
9.0000	3.7660	0.5860	-0.1610

1 ITERATIONS TOTAL CHISQUARE = 6.86177D+02 IW(4) = 0 W(3) = 0.0
VARIABLES
2.00000D+01 1.60300D+00 6.78000D-01 1.09624D+00 5.12188D-01

10 ITERATIONS TOTAL CHISQUARE = 6.10269D+02 IW(4) = 0 W(3) = 0.0
VARIABLES
2.03244D+01 1.58461D+00 7.17579D-01 1.07732D+00 5.50133D-01

13 ITERATIONS TOTAL CHISQUARE = 5.90671D+02 IW(4) = 122 W(3) = 2.18217D+00
VARIABLES
2.06462D+01 1.57833D+00 7.15121D-01 1.08212D+00 5.35907D-01

CONVERGENCE WITH ERROR CODE 0

FINAL PARAMETERS AT END OF SEARCH

NUMBER	VALUE	ERROR
7	2.06462D+01	1.19669D-01
8	1.57833D+00	3.87176D-03
9	7.15121D-01	5.03626D-03
14	1.08212D+00	6.67935D-03
15	5.35907D-01	6.88908D-03

CHI-SQUARE PER DEGREE OF FREEDOM = 4.842D+00

REAL POTENTIAL

K-TH MOMENT FOR K = -2, -1, ...,+5, +6

2.68936 3.26756 3.66529 3.98243 4.25289 4.49261 4.71040 4.91171 5.10012

VOLUME = 4.95156D+04 PER NUCLEON PAIR = 3.09472D+02

DENSITY CHARGE = 8.49247D-02

DENSITIES MATTER/NEUTRONS AND PROTONS 9.15712D-02 8.54324D-02

R	MATTER	NEUTRONS	PROTONS	CHARGE
0.0	1.7686D-01	9.1480D-02	8.5382D-02	8.4788D-02
0.100	1.7681D-01	9.1450D-02	8.5361D-02	8.4752D-02
0.200	1.7671D-01	9.1394D-02	8.5319D-02	8.4693D-02
0.300	1.7657D-01	9.1311D-02	8.5254D-02	8.4610D-02
0.400	1.7637D-01	9.1201D-02	8.5166D-02	8.4500D-02
0.500	1.7612D-01	9.1062D-02	8.5055D-02	8.4363D-02
8.100	[illegible]	9.0893D-02	8.4918D-02	8.4198D-02
8.200	7.5357D-06	[illegible]	8.4757D-02	8.4004D-02
8.300	5.6330D-06	2.8316D-06	2.8014D-06	[illegible]
8.400	4.1575D-06	2.0615D-06	2.0960D-06	6.2148D-06
8.500	3.0193D-06	1.4686D-06	1.5507D-06	4.7350D-06
8.600	2.1466D-06	1.0154D-06	1.1312D-06	3.5614D-06
8.700	1.4823D-06	6.7199D-07	8.1027D-07	2.6352D-06
8.800	9.8089D-07	4.1442D-07	5.6647D-07	1.9083D-06
8.900	6.0643D-07	2.2370D-07	3.8273D-07	1.3416D-06
9.000	3.3034D-07	8.4776D-08	2.4556D-07	9.0320D-07

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MATTER DENSITY

K-TH MOMENT FOR K = -2, -1, ... ,+5, +6
2.26507D+00   2.69446D+00   2.97277D+00   3.18771D+00   3.36870D+00   3.52932D+00   3.67699D+00   3.81610D+00   3.94943D+00

VOLUME =  4.00000D+01


NEUTRON DENSITY

K-TH MOMENT FOR K = -2, -1, ... ,+5, +6
2.24316D+00   2.67184D+00   2.95120D+00   3.16795D+00   3.35115D+00   3.51425D+00   3.66452D+00   3.80629D+00   3.94222D+00

VOLUME =  2.00000D+01


PROTON DENSITY

K-TH MOMENT FOR K = -2, -1, ... ,+5, +6
2.28765D+00   2.71747D+00   2.99449D+00   3.20747D+00   3.38615D+00   3.54427D+00   3.68933D+00   3.82581D+00   3.95657D+00

VOLUME =  2.00000D+01


CHARGE DENSITY

K-TH MOMENT FOR K = -2, -1, ... ,+5, +6
2.30853D+00   2.75727D+00   3.05296D+00   3.28446D+00   3.48158D+00   3.65807D+00   3.82134D+00   3.97571D+00   4.12376D+00

VOLUME =  2.00000D+01


END OF THE JOB : 24.07.80  11.12.55 H.MIN.SEC


MODINA, VERSION JULY 1980
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START OF THE JOB : 30.07.80 12.25.01 H.MIN.SEC

NUMBER OF INDEPENDENT CALCULATIONS	1
CM-DATA	1
GRID CALCULATIONS	0
PRINT INPUT	1
PRINT CPU-TIME	0
PRINT CROSS SECTIONS	0
PRINT CROSS SECTIONS/RUTHERFORD	0
PRINT SCATTERING AMPLITUDES	1
PRINT POTENTIALS	1
PRINT POTENTIAL MOMENTS	2
PRINT DENSITIES	1
PRINT DENSITY MOMENTS	1
PUNCH POTENTIALS OR DENSITIES	0
PUNCH MOMENTS	0
FOLDED COULOMB POTENTIAL	1
REAL POTENTIAL	7
TARGET DENSITY (FOLDING)	2
IMAGINARY POTENTIAL	1
CONSERVE VOLUME-INTEGRAL	0
RELATIVISTIC KINEMATICS	0

KE(21-28) : FREE

PLOTTER TYPE	1
PLOT CROSS SECTIONS	0
PLOT CS/RUTHERFORD	1

KE(32-42) : FREE

104 MEV ALPHAS ON 90-ZR

PROJECTILE-MASS = 4. TARGET-MASS = 90.
PROJECTILE-CHARGE = 2. TARGET-CHARGE = 40.
PROJECTILE-ENERGY (MEV) = 104.00

CM-ENERGY = 99.5672D+00 K = 4.272790+00 ETA = 2.47159D+00

POTENTIAL ANALYSIS

CPU-TIME (SEC)	=	160
LMAX	=	70
INTEGRATION STEPS	=	52
FIRST STEP	=	3
ITERATIONS	=	200
PRINT-OUT AT EACH		-10 ITERATION

PARAMETERS

14.000	1.340	90.000	0.791	7.200	0.969	18.030
1.711	0.700	0.0	1.000	1.000	10.000	1.060
2.324	0.165	1.060	2.324	0.165	0.0	0.001

REQUIRED FIRST STEP AND FIT ACCURACIES

10.000	0.200	0.005	0.005	0.005	0.005

VARIED PARAMETERS

7 8 9 14 15

MATCHING RADIUS (FM) = 14.000+00 STEP SIZE = 0.269231D+00

EXPERIMENTAL CROSS SECTIONS

8.939	7.563E+03	3.277E+02	10.403	4.322E+03	4.022E+02
[illegible]	[illegible]	[illegible]	11.570	7.724E+02	1.750E+02
69.359	8.137E-02	[illegible]	[illegible]	[illegible]	8.577E+00
72.409	6.584E-02	3.215E-03	73.932	[illegible]	[illegible]
75.453	4.902E-02	2.775E-03			

PARAMETERS OF CHARGE DISTRIBUTIONS

4.000	1.323		
10.000	4.522	2.524	0.246

1 ITERATIONS TOTAL CHISQUARE = 4.52456D+04 IW(4) = 0 W(3) = 0.0
VARIABLES
1.80300D+01 1.71100D+00 7.00000D-01 1.06040D+00 2.32440D+00

10 ITERATIONS TOTAL CHISQUARE = 3.97374D+04 IW(4) = 1 W(3) = 0.0
VARIABLES
1.70141D+01 1.71431D+00 7.05799D-01 1.19163D+00 1.92449D+00

20 ITERATIONS TOTAL CHISQUARE = 1.72915D+04 IW(4) = 1 W(3) = 0.0
VARIABLES
1.58018D+01 1.66739D+00 6.77895D-01 1.12315D+00 2.32439D+00

```
  30 ITERATIONS    TOTAL CHISQUARE = 4.86511D+02    IW(4) =    0    W(3) =  0.0
VARIABLES
  2.02376D+01  1.54503D+00  6.55653D-01  1.13808D+00  2.32750D+00

  34 ITERATIONS    TOTAL CHISQUARE = 4.09358D+02    IW(4) =   89    W(3) =  2.14301D+00
VARIABLES
  2.02288D+01  1.53816D+00  6.71486D-01  1.10827D+00  2.44222D+00

CONVERGENCE WITH ERROR CODE 0
```

FINAL PARAMETERS AT END OF SEARCH

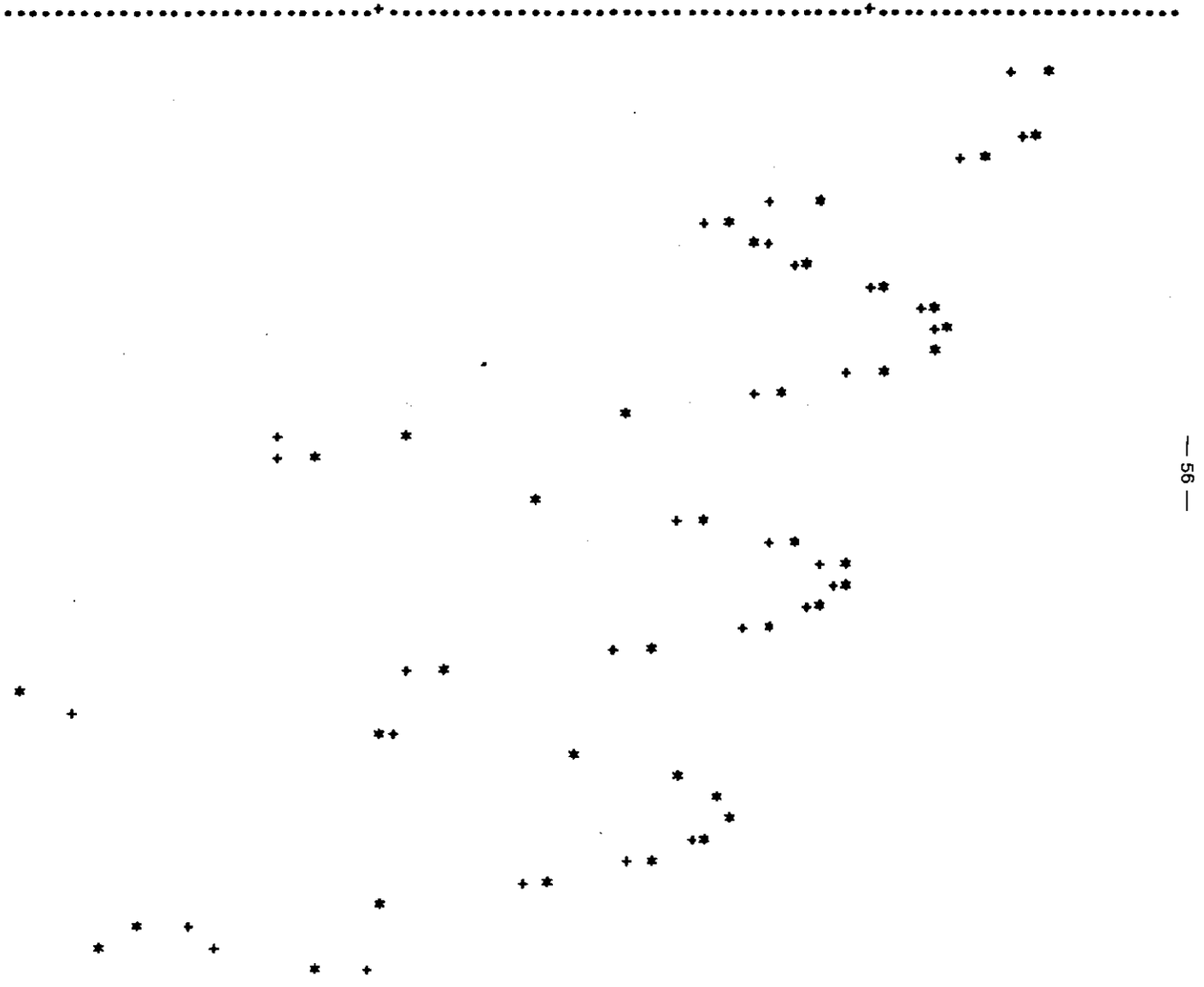
NUMBER	VALUE	ERROR
7	2.02288D+01	9.32150D-02
8	1.53816D+00	2.04259D-03
9	6.71486D-01	5.14100D-03
14	1.10827D+00	1.00895D-02
15	2.44222D+00	3.94056D-02

CHI-SQUARE PER DEGREE OF FREEDOM = 4.600D+00

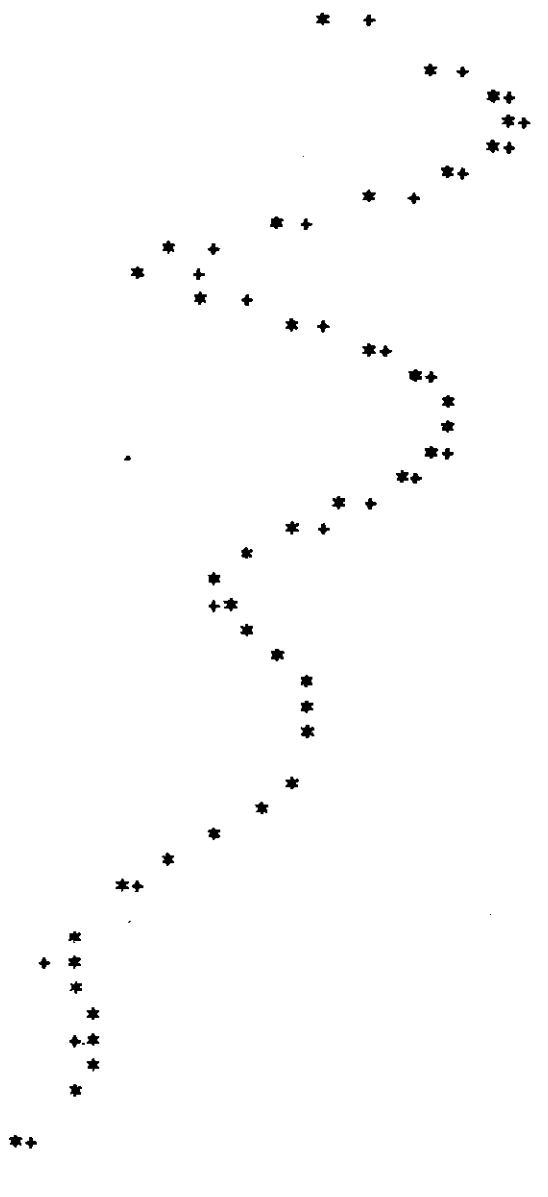
SCATTERING AMPLITUDES

L	RE(SL-1)	IM(SL)	COS(2SIGL)	SIN(2SIGL)
0	-1.0109D+00	-2.1403D-03	5.1251D-01	8.5868D-01
1	-9.9351D-01	8.7318D-03	-9.6541D-01	-2.6072D-01
2	-9.9344D-01	-8.5321D-03	4.5638D-01	-8.8979D-01
[illegible]	-1.0082D+00	-7.1475D-03	9.6068D-01	2.7767D-01
58	[illegible]	[illegible]	1.8146D-01	9.8340D-01
59	-7.4174D-06	1.5263D-07	[illegible]	[illegible]
60	-3.2001D-06	2.5773D-08	1.3835D-01	9.9038D-01
61	-1.3010D-06	-2.3651D-09	5.7771D-02	9.9833D-01
62	-4.9554D-07	-6.3781D-09	-2.1881D-02	9.9976D-01
63	-1.8152D-07	-4.2716D-09	-1.0014D-01	9.9497D-01
64	-6.2555D-08	-2.1332D-09	-1.7657D-01	9.8429D-01
65	-2.0483D-08	-9.1084D-10	-2.5081D-01	9.6804D-01
66	-6.3844D-09	-3.4878D-10	-3.2251D-01	9.4657D-01
67	-1.8974D-09	-1.2255D-10	-3.9137D-01	9.2023D-01
68	-5.3853D-10	-4.0036D-11	-4.5715D-01	8.8939D-01
69	-1.4619D-10	-1.2264D-11	-5.1961D-01	8.5440D-01
70	-3.8005D-11	-3.5440D-12	-5.7858D-01	8.1563D-01

THETA	SIGMAEXP	SIGMATHE
8.0	0.0	0.0
8.5	0.0	0.0
9.0	3.37D-01	4.13D-01
9.5	0.0	0.0
10.0	0.0	0.0
10.5	3.53D-01	3.91D-01
11.0	2.61D-01	3.08D-01
11.5	0.0	0.0
12.0	1.10D-01	1.33D-01
12.5	7.91D-02	9.17D-02
13.0	1.11D-01	1.00D-01
13.5	1.25D-01	1.33D-01
14.0	1.74D-01	1.87D-01
14.5	2.26D-01	2.33D-01
15.0	2.37D-01	2.50D-01
15.5	2.31D-01	2.31D-01
16.0	1.59D-01	1.81D-01
16.5	1.05D-01	1.17D-01
17.0	5.61D-02	5.70D-02
17.5	1.13D-02	1.96D-02
18.0	1.08D-02	1.35D-02
18.5	0.0	0.0
19.0	3.65D-02	3.68D-02
19.5	6.97D-02	7.83D-02
20.0	1.10D-01	1.22D-01
20.5	1.36D-01	1.52D-01
21.0	1.49D-01	1.59D-01
21.5	1.29D-01	1.41D-01
22.0	9.45D-02	1.05D-01
22.5	5.38D-02	6.19D-02
23.0	1.98D-02	2.47D-02
23.5	3.40D-03	3.37D-03
24.0	4.12D-03	1.79D-03
24.5	1.89D-02	1.76D-02
25.0	4.50D-02	4.33D-02
25.5	6.96D-02	6.94D-02
26.0	8.52D-02	8.70D-02
26.5	8.80D-02	9.12D-02
27.0	7.35D-02	8.14D-02
27.5	5.63D-02	6.15D-02
28.0	3.39D-02	3.79D-02
28.5	1.83D-02	1.77D-02
29.0	7.44D-03	5.89D-03
29.5	7.97D-03	4.71D-03
30.0	1.72D-02	1.30D-02



30.5	3.27D-02	2.69D-02	.
31.0	0.0	0.0	.
31.5	4.73D-02	4.16D-02	.
32.0	5.56D-02	5.24D-02	.
32.5	6.08D-02	5.65D-02	.
33.0	5.60D-02	5.34D-02	.
33.5	4.74D-02	4.45D-02	.
34.0	3.79D-02	3.30D-02	.
34.5	2.58D-02	2.22D-02	.
35.0	1.77D-02	1.52D-02	.
35.5	1.71D-02	1.33D-02	.
36.0	2.00D-02	1.65D-02	.
36.5	2.70D-02	2.34D-02	.
37.0	3.52D-02	3.17D-02	.
37.5	4.09D-02	3.90D-02	.
38.0	4.35D-02	4.35D-02	.
38.5	4.50D-02	4.42D-02	.
39.0	4.50D-02	4.13D-02	.
39.5	3.93D-02	3.60D-02	.
40.0	3.24D-02	2.57D-02	.
40.5	2.68D-02	2.39D-02	.
41.0	2.04D-02	1.99D-02	.
41.5	1.75D-02	1.82D-02	.
42.0	1.82D-02	1.87D-02	.
42.5	2.05D-02	2.06D-02	.
43.0	2.31D-02	2.32D-02	.
43.5	2.58D-02	2.53D-02	.
44.0	2.63D-02	2.64D-02	.
44.5	2.62D-02	2.60D-02	.
45.0	0.0	0.0	.
45.5	2.47D-02	2.42D-02	.
46.0	2.16D-02	2.14D-02	.
46.5	1.80D-02	1.82D-02	.
47.0	1.46D-02	1.51D-02	.
47.5	1.33D-02	1.26D-02	.
48.0	0.0	0.0	.
48.5	1.01D-02	1.02D-02	.
49.0	9.51D-03	1.02D-02	.
49.5	1.04D-02	1.05D-02	.
50.0	1.11D-02	1.10D-02	.
50.5	1.06D-02	1.12D-02	.
51.0	1.11D-02	1.10D-02	.
51.5	1.05D-02	1.04D-02	.
52.0	0.0	0.0	.
52.5	8.71D-03	8.44D-03	.
53.0	0.0	0.0	.
53.5	0.0	0.0	.



54.0	6.79D-03	6.20D-03	* +
54.5	0.0	0.0	
55.0	0.0	0.0	
55.5	6.70D-03	6.84D-03	*
56.0	0.0	0.0	
56.5	0.0	0.0	
57.0	7.96D-03	8.25D-03	*
57.5	0.0	0.0	
58.0	0.0	0.0	
58.5	7.29D-03	8.38D-03	+ *
59.0	0.0	0.0	
59.5	0.0	0.0	
60.0	7.27D-03	8.11D-03	+ *
60.5	0.0	0.0	
61.0	0.0	0.0	
61.5	7.74D-03	8.90D-03	+ *
62.0	0.0	0.0	
62.5	0.0	0.0	
63.0	9.28D-03	1.02D-02	+ *
63.5	0.0	0.0	
64.0	0.0	0.0	
64.5	0.0	0.0	
65.0	1.02D-02	1.07D-02	*
65.5	0.0	0.0	
66.0	0.0	0.0	
66.5	9.48D-03	1.02D-02	+ *
67.0	0.0	0.0	
67.5	0.0	0.0	
68.0	1.03D-02	9.93D-03	*+
68.5	0.0	0.0	
69.0	0.0	0.0	
69.5	1.04D-02	1.01D-02	*+
70.0	0.0	0.0	
70.5	0.0	0.0	
71.0	9.32D-03	1.00D-02	+*
71.5	0.0	0.0	
72.0	0.0	0.0	
72.5	9.68D-03	9.30D-03	*+
73.0	0.0	0.0	
73.5	0.0	0.0	
74.0	8.97D-03	8.31D-03	* +
74.5	0.0	0.0	
75.0	0.0	0.0	
75.5	8.30D-03	7.54D-03	*+
76.0	0.0	0.0	

R	REAL	REAL+COULOMB	IMAGINARY	COULOMB
0.0	-1.6566685D+02	-1.3388993D+02	-2.0228101D+01	3.1776914D+01
0.100	-1.6562558D+02	-1.3386186D+02	-2.0227988D+01	3.1763720D+01
0.200	-1.6558431D+02	-1.3383378D+02	-2.0227857D+01	3.1750525D+01
0.300	-1.6554304D+02	-1.3378114D+02	-2.0227705D+01	3.1728191D+01
0.400	-1.6547954D+02	-1.3372046D+02	-2.0227528D+01	3.1697481D+01
0.500	-1.6527922D+02	-1.3362190D+02	-2.0227323D+01	3.1657315D+01
	-1.6511556D+02	-1.3350684D+02	-2.0227085D+01	3.1608720D+01
			-2.0226808D+01	3.1550684D+01
				3.1485045D+01
13.800	-3.71125040-06	8.2277116D+00	-5.1223230D-04	
13.900	-1.86218590-06			
14.000				

REAL POTENTIAL

K-TH MOMENT FOR K = -2, -1, ...,+5, +6

3.25633 3.92137 4.36738 4.71616 5.00863 5.26394 5.48268 5.70144 5.89460

VOLUME = 1.062710+05 PER NUCLEON PAIR = 2.951580+02

IMAGINARY POTENTIAL

K-TH MOMENT FOR K = -2, -1, ...,+5, +6

4.16188 4.87356 5.30941 5.63165 5.89354 6.11935 6.32222 6.51012 6.68828

VOLUME = 3.03511D+04 PER NUCLEON PAIR = 8.430870+01

DENSITY CHARGE = 7.584470-02

DENSITIES MATTER/NEUTRONS AND PROTONS 8.050030-02 7.366600-02

R	MATTER	NEUTRONS	PROTONS	CHARGE
0.0	1.5179D-01	7.9233D-02	7.2556D-02	7.2897D-02
0.100	1.5180D-01	7.9236D-02	7.2559D-02	7.2902D-02
0.200	1.5181D-01	7.9246D-02	7.2569D-02	7.2915D-02
		7.9262D-02	7.2585D-02	7.2936D-02
			7.2607D-02	7.2965D-02
9.800	7.1762D-07	6.0835D-07	7.6245D-08	
9.900	5.1551D-07	4.3927D-07		
10.000				

MATTER DENSITY

K-TH MOMENT FOR K = -2, -1, ... ,+5, +6
3.04518D+00 3.56285D+00 3.87989D+00 4.11357D+00 4.30209D+00 4.46267D+00 4.60456D+00 4.73329D+00 4.85239D+00

VOLUME = 9.000000+01

NEUTRON DENSITY

K-TH MOMENT FOR K = -2, -1, ... ,+5, +6
3.10882D+00 3.63680D+00 3.95977D+00 4.19751D+00 4.38904D+00 4.55196D+00 4.69573D+00 4.82598D+00 4.94636D+00

VOLUME = 5.00000D+01

PROTON DENSITY

K-TH MOMENT FOR K = -2, -1, ... ,+5, +6
2.97087D+00 3.47454D+00 3.78230D+00 4.00865D+00 4.19087D+00 4.34578D+00 4.48240D+00 4.60613D+00 4.72045D+00

VOLUME = 3.99999D+01

CHARGE DENSITY

K-TH MOMENT FOR K = -2, -1, ... ,+5, +6
2.97899D+00 3.49876D+00 3.82386D+00 4.06799D+00 4.26814D+00 4.44106D+00 4.55571D+00 4.73745D+00 4.86971D+00

VOLUME = 4.00003D+01

END OF THE JOB : 30.07.80 12.30.43 H.MIN.SEC

MODINA, VERSION JULY 1980

START OF THE JOB : 15.08.80 08.17.17 H.MIN.SEC

```
NUMBER OF INDEPENDENT CALCULATIONS  1
CM-DATA                             1
GRID CALCULATIONS                   0
PRINT INPUT                         1
PRINT CPU-TIME                      0
PRINT CROSS SECTIONS                0
PRINT CROSS SECTIONS/RUTHERFORD     0
PRINT SCATTERING AMPLITUDES         0
PRINT POTENTIALS                    0
PRINT POTENTIAL MOMENTS             0
PRINT DENSITIES                     1
PRINT DENSITY MOMENTS               1
PUNCH POTENTIALS OR DENSITIES       0
PUNCH MOMENTS                       0

FOLDED COULOMB POTENTIAL            1
REAL POTENTIAL                      6
TARGET DENSITY (FOLDING)            2
IMAGINARY POTENTIAL                 1
CONSERVE VOLUME-INTEGRAL            0
RELATIVISTIC KINEMATICS             0

KE(21-28) : FREE

PLOTTER TYPE                        0
PLOT CROSS SECTIONS                 0
PLOT CS/RUTHERFORD                  0
KE(32-42) : FREE
```

48-CA (4-HE,4-HE) 48-CA ELASTIC SCATTERING

```
PROJECTILE-MASS    =   4.  TARGET-MASS    =  48.
PROJECTILE-CHARGE  =   2.  TARGET-CHARGE  =  20.
PROJECTILE-ENERGY (MEV) =    104.00

CM-ENERGY = 95.9879D+00   K = 4.11919D+00   ETA = 1.23580D+00
```

POTENTIAL ANALYSIS

```
CPU-TIME (SEC)     =   570
LMAX               =    55
INTEGRATION STEPS  =    43
FIRST STEP         =     2
ITERATIONS         =   200
PRINT-OUT AT EACH     -10 ITERATION
```

PARAMETERS

14.0000	1.3400	48.0000	66.7360	1.7980	1.8954	19.4342
1.6095	0.6431	0.0	1.0000	0.5000	7.0000	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	9.0000
1.0215	0.6071	-0.0300	1.0672	0.4409	-0.0300	0.0010

REQUIRED FIRST STEP AND FIT ACCURACIES

50.0000	0.2000	0.0050	0.0050	0.0100	0.0100	0.0100
0.0100	0.0100	0.0100				

VARIED PARAMETERS

7 8 9 15 16 17 18 19 20

MATCHING RADIUS (FM) = 14.00D+00 STEP SIZE = 0.325581D+00

EXPERIMENTAL CROSS SECTIONS

3.137	2.643E+05	2.482E+04	3.680	1.407E+05	1.632E+04
4.790	6.125E+04	6.366E+03	5.331	3.678E+04	3.880E+03
86.743	9.181E-03	2.416E+03	6.513	1.114E+04	1.702E+03
89.883	8.559E-03	2.591E-03	91.393	8.978E-03	3.302E+02
95.151	7.674E-03	2.329E-03	100.130	2.409E-03	1.763E-03

PARAMETERS OF CHARGE DISTRIBUTIONS

4.0000	1.3227		
8.0000	3.7369	0.5245	-0.0300

1 ITERATIONS TOTAL CHISQUARE = 4.81583D+02 IW(4) = 0 W(3) = 0.0
VARIABLES

1.94342D+01	1.60949D+00	6.43129D-01	0.0	0.0	0.0	0.0	0.0	0.0

115 ITERATIONS TOTAL CHISQUARE = 4.02980D+02 IW(4) = 0 W(3) = 0.0
VARIABLES

1.85479D+01	1.63116D+00	6.07567D-01	-5.25812D-04	2.63196D-03	2.53912D-02	4.48827D-02	0.0	5.00000D-01

CONVERGENCE WITH ERROR CODE 0

FINAL PARAMETERS AT END OF SEARCH

NUMBER	VALUE	ERROR
7	1.85479D+01	7.16407D-02
8	1.63116D+00	3.22296D-03
9	6.07567D-01	5.22996D-03
15	-5.25812D-04	3.72299D-04
16	2.63196D-03	7.85271D-04
17	2.53912D-02	8.38207D-03
18	4.48827D-02	1.92358D-02
19	-1.23840D-02	2.95778D-02
20	-3.96391D-02	3.21038D-02

CHI-SQUARE PER DEGREE OF FREEDOM = 3.415D+00

DENSITY CHARGE = 7.86975D-02

DENSITIES MATTER/NEUTRONS AND PROTONS 1.06508D-01 7.43111D-02

R	MATTER	NEUTRONS	ERROR	ERROR PERC	PROTONS	CHARGE
0.0	2.0076D-01	1.2646D-01	1.6471D-01	1.3024D+02	7.4300D-02	7.8634D-02
0.100	2.0099D-01	1.2670D-01	1.6256D-01	1.2831D+02	7.4295D-02	7.8619D-02
0.200	2.0173D-01	1.2745D-01	1.5625D-01	1.2260D+02	7.4287D-02	7.8598D-02
8.700	[illegible]	1.2862D-01	1.4610D-01	1.1359D+02	7.4276D-02	7.8570D-02
8.800	2.1185D-05	[illegible]	1.3269D-01	1.0201D+02	7.4260D-02	7.8535D-02
8.900	1.7840D-05	1.7132D-05	0.0	[illegible]	7.4239D-02	7.8491D-02
9.000	1.5024D-05	1.4462D-05	0.0	0.0	[illegible]	7.8438D-02

MATTER DENSITY

K-TH MOMENT FOR K = -2, -1, ... ,+5, +6

2.32988D+00 2.79985D+00 3.10666D+00 3.34187D+00 3.54022D+00 3.71903D+00 3.88771D+00 4.05135D+00 4.21239D+00

VOLUME = 4.80001D+01

NEUTRON DENSITY

K-TH MOMENT FOR K = -2, -1, ... ,+5, +6

2.30691D+00	2.81286D+00	3.15192D+00	3.41271D+00	3.63231D+00	3.82998D+00	4.01583D+00	4.19477D+00	4.36869D+00

VOLUME = 2.80000D+01

ERRORS OF K-TH MOMENT FOR K = -2, -1, ... ,+5, +6

5.28346D-03	2.26617D-02	2.84770D-02	4.76628D-02	3.46214D-02	3.42614D-02	3.71390D-02	4.08154D-02	4.41793D-02

ERROR VOLUME = 1.20229D-01

PROTON DENSITY

K-TH MOMENT FOR K = -2, -1, ... ,+5, +6

2.36322D+00	2.78183D+00	3.04438D+00	3.24269D+00	3.40711D+00	3.55159D+00	3.68379D+00	3.80840D+00	3.92849D+00

VOLUME = 2.00000D+01

CHARGE DENSITY

K-TH MOMENT FOR K = -2, -1, ... ,+5, +6

2.34030D+00	2.77571D+00	3.05834D+00	3.27824D+00	3.46524D+00	3.63295D+00	3.78859D+00	3.93628D+00	4.07834D+00

VOLUME = 2.00006D+01

END OF THE JOB : 15.08.80 08.33.26 H.MIN.SEC

MODINA, VERSION JULY 1980

```
                C-----HAUPTPROGRAMM ZUR ANALYSE VON ELASTISCHER STREUUNG                00000100
                C-----DIE GENERELLE ARBEITSROUTINE HEISST "SCAMPO"                      00000200
ISN 0002              REAL*8 TAG,UHR                                                   00000300
ISN 0003              COMMON /CZE/TID                                                  00000400
ISN 0004              TID=ZEIT(0.)                                                     00000500
ISN 0005              CALL DATUM (TAG,UHR)                                             00000600
ISN 0006              WRITE (6,6000) TAG,UHR                                           00000700
ISN 0007           6000 FORMAT (' START OF THE JOB : ',A8,2X,A8,' H.MIN.SEC')          00000800
ISN 0008              CALL SCTRLA                                                      00000900
ISN 0009              CALL SCAMPO                                                      00001000
ISN 0010              CALL DATUM (TAG,UHR)                                             00001100
ISN 0011              WRITE (6,6001) TAG,UHR                                           00001200
ISN 0012           6001 FORMAT (///' END OF THE JOB : ',A8,2X,A8,' H.MIN.SEC')         00001300
ISN 0013              WRITE (6,6002)                                                   00001400
ISN 0014           6002 FORMAT (///' MODINA, VERSION JULY 1980')                       00001500
ISN 0015              STOP                                                             00001600
ISN 0016              END                                                              00001700
```



```
                C-----MODIFICATION OF ERROR HANDLING FOR UNDERFLOW, OVERFLOW AND DIVIDE 00001800
                C-------------------------------------------------------------------- 00001900
ISN 0002              SUBROUTINE SCTRLA                                                00002000
ISN 0003              CALL FSPIE                                                       00002100
ISN 0004              CALL ERRSET(207,500,1,0)                                         00002200
ISN 0005              CALL ERRSET(208,500,1,0)                                         00002300
ISN 0006              CALL ERRSET(209,500,1,0)                                         00002400
ISN 0007              CALL ERRSET(245,500,1,0)                                         00002500
ISN 0008              CALL ERRSET(261,500,1,0)                                         00002600
ISN 0009              CALL ERRSET(262,500,1,0)                                         00002700
ISN 0010              CALL ERRSET(263,500,1,0)                                         00002800
ISN 0011              CALL ERRSET(264,500,1,0)                                         00002900
ISN 0012              CALL ERRSET(265,500,1,0)                                         00003000
ISN 0013              CALL ERRSET(266,500,1,0)                                         00003100
ISN 0014              CALL ERRSET(267,500,1,0)                                         00003200
ISN 0015              CALL ERRSET(268,500,1,0)                                         00003300
ISN 0016              CALL ERRSET(269,500,1,0)                                         00003400
ISN 0017              RETURN                                                           00003500
ISN 0018              END                                                              00003600
```

```
ISN 0002            SUBROUTINE HORA                                                  00003700
ISN 0003            REAL*8 DDAT,DZEIT                                                00003800
ISN 0004            DATA KT/0/,A/0./,DEP/0./                                         00003900
ISN 0005            IF (KT.GT.0) GO TO 1                                             00004000
ISN 0007            DEP=ZEIT(DEP)                                                    00004100
ISN 0008            KT=1                                                             00004200
ISN 0009          1 DUR=ZEIT(DEP)                                                    00004300
ISN 0010            CALL DATUM (DDAT,DZEIT)                                          00004400
ISN 0011            D=DUR-A                                                          00004500
ISN 0012            A=DUR                                                            00004600
ISN 0013            WRITE (6,1000) DDAT,DZEIT,DUR,D                                  00004700
ISN 0014       1000 FORMAT (' DATE ',A8,10X,' TIME ',A8,10X,' DURATION ',F10.4,10X,' 00004800
                    1IFFERENCE ',F10.4)                                             00004900
ISN 0015            RETURN                                                           00005000
ISN 0016            END                                                              00005100
```

```
ISN 0002            SUBROUTINE OPTION                                                00005200
                  C-----LESEN DER OPTIONEN ZUR STEUERUNG VON POTFIT                  00005300
                  C     KE(42) : MEHRFACH-OPTIONEN                                   00005400
ISN 0003            COMMON /INPT/KE(42),WI(1000),IN(100)                             00005500
ISN 0004            READ (5,5001) KE                                                 00005600
ISN 0005       5001 FORMAT (1415)                                                    00005700
                  C-----AUSDRUCK DER OPTIONEN                                        00005800
ISN 0006            WRITE (6,6001) (KE(I),I=1,10)                                    00005900
ISN 0007       6001 FORMAT (////////' NUMBER OF INDEPENDENT CALCULATIONS ',I2/       00006000
                    1 ' CM-DATA                          ',I2/                      00006100
                    2 ' GRID CALCULATIONS                ',I2/                      00006200
                    3 ' PRINT INPUT                      ',I2/                      00006300
                    4 ' PRINT CPU-TIME                   ',I2/                      00006400
                    5 ' PRINT CROSS SECTIONS             ',I2/                      00006500
                    6 ' PRINT CROSS SECTIONS/RUTHERFORD  ',I2/                      00006600
                    7 ' PRINT SCATTERING AMPLITUDES      ',I2/                      00006700
                    8 ' PRINT POTENTIALS                 ',I2/                      00006800
                    9 ' PRINT POTENTIAL MOMENTS          ',I2)                      00006900
ISN 0008             WRITE (6,6002) (KE(I),I=11,19)                                 00007000
ISN 0009       6002 FORMAT(                                                         00007100
                    1 ' PRINT DENSITIES                  ',I2/                      00007200
                    2 ' PRINT DENSITY MOMENTS            ',I2/                      00007300
                    3 ' PUNCH POTENTIALS OR DENSITIES    '  ,I4/                    00007400
                    4 ' PUNCH MOMENTS                    '  ,I4//                   00007500
```

```
          5 ' FOLDED COULOMB POTENTIAL        ',I2/
          6 ' REAL POTENTIAL                  ',I2/
          7 ' TARGET DENSITY (FOLDING)        ',I2/
          8 ' IMAGINARY POTENTIAL             ',I2/
          9 ' CONSERVE VOLUME-INTEGRAL        ',I2)
ISN 0010      WRITE (6,6004) KE(20)
ISN 0011 6004 FORMAT (
          1 ' RELATIVISTIC KINEMATICS         ',I2/
          2  /' KE(21-28) : FREE'/)
ISN 0012      WRITE (6,6003) (KE(I),I=29,31)
ISN 0013 6003 FORMAT ( ' PLOTTER TYPE                         ',I2/
          1 ' PLOT CROSS SECTIONS             ',I2/
          2 ' PLOT CS/RUTHERFORD              ',I2/
          6 ' KE(32-42) : FREE ' )
ISN 0014 1000 RETURN
ISN 0015      END


ISN 0002      SUBROUTINE INPUT(IO,I1,IWO,IW1)
         C-----LESEN DES INPUTS FUER POTFIT
ISN 0003      DIMENSION FORM(10)
ISN 0004      COMMON /INPT/KE(42),WI(1000),IN(100)
ISN 0005      IO=IN(1)
ISN 0006      IWO=WI(1)+.1
ISN 0007      READ (5,5001) ITYP,INUM,FORM
ISN 0008      GO TO (100,200,300), ITYP
ISN 0009  100 IO=IO+1
ISN 0010      IN(IO)=INUM
ISN 0011      I1=IO+IN(IO)
ISN 0012      IOO=IO+1
ISN 0013 5001 FORMAT (2I5,10A4)
ISN 0014      READ (5,FORM) (IN(I),I=IOO,I1)
ISN 0015      IF (KE(4).EQ.1) WRITE (6,FORM) (IN(I),I=IOO,I1)
ISN 0017      IN(1)=I1
ISN 0018      RETURN
ISN 0019  200 IWO=IWO+1
ISN 0020      WI(IWO)=INUM
ISN 0021      IW1= IWO+INUM
ISN 0022      IOO=IWO+1
ISN 0023      READ (5,FORM) (WI(I),I=IOO,IW1)
ISN 0024      IF (KE(4).EQ.1) WRITE (6,FORM) (WI(I),I=IOO,IW1)
```

```
ISN 0026            WI(1)=IW1                                                    00011500
ISN 0027          300 RETURN                                                     00011600
ISN 0028              END                                                        00011700



ISN 0002            SUBROUTINE SCAMPO                                            00011800
                C   POTENTIALSTREUUNG, POTENTIAL ODER STREUAMPLITUDENANPASSUNG   00011900
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                    00012000
ISN 0004            REAL*4 TID,WI(1000),TITLE(15),ZEIT                           00012100
ISN 0005            DIMENSION F(300),G(30),IA(30),P(4000),W(21000),X(30),PERR(30) 00012200
ISN 0006            DIMENSION VARM(30,30)                                        00012300
ISN 0007            COMMON /INPT/KO(42),WI,IN(100)                               00012400
ISN 0008            COMMON /IFIT/IA,NC,ID                                        00012500
ISN 0009            COMMON /CZE/TID                                              00012600
ISN 0010            PPI=3.141592653589793                                        00012700
ISN 0011            CALL OPTION                                                  00012800
ISN 0012            KB=KO(1)                                                     00012900
ISN 0013            DO 26 KA=1,KB                                                00013000
ISN 0014            READ (5,5001) TITLE                                          00013100
ISN 0015         5001 FORMAT (15A4)                                              00013200
ISN 0016            READ (5,5002) (WI(I),I=2,6)                                  00013300
ISN 0017            WI(1)=6                                                      00013400
ISN 0018            IN(1)=7                                                      00013500
ISN 0019         5002 FORMAT (5F10.6)                                            00013600
ISN 0020            READ (5,5003) (IN(I),I=2,7)                                  00013700
ISN 0021         5003 FORMAT (6I5)                                               00013800
ISN 0022            A1=WI(2)                                                     00013900
ISN 0023            A2=WI(3)                                                     00014000
ISN 0024            Z1=WI(4)                                                     00014100
ISN 0025            Z2=WI(5)                                                     00014200
ISN 0026            Z=Z1*Z2                                                      00014300
ISN 0027            EL=WI(6)                                                     00014400
ISN 0028            ID=IN(2)                                                     00014500
ISN 0029            LM=IN(3)                                                     00014600
ISN 0030            NS=IN(4)                                                     00014700
ISN 0031            MS=IN(5)                                                     00014800
ISN 0032            MC=IN(6)                                                     00014900
ISN 0033            IP=IN(7)                                                     00015000
ISN 0034            WRITE (6,6000)                                               00015100
ISN 0035         6000 FORMAT (////////////)                                      00015200
ISN 0036            WRITE (6,5001) TITLE                                         00015300
```

```
ISN 0037            WRITE (6,6001) (WI(I),I=2,6)                                                00015400
ISN 0038          6001 FORMAT (///' PROJECTILE-MASS    = ',F4.0,'  TARGET-MASS    = ',F4.0/00015500
                     1            ' PROJECTILE-CHARGE = ',F4.0,'  TARGET-CHARGE = ',F4.0/00015600
                     2            ' PROJECTILE-ENERGY (MEV) = ',F8.2)                         00015700
ISN 0039             A1=931.478*A1                                                             00015800
ISN 0040             A2=931.478*A2                                                             00015900
ISN 0041             C=A1*A2/(A1+A2)                                                           00016000
ISN 0042             IF (KO(20).EQ.0) GO TO 404                                                00016100
ISN 0044             REL=A1+EL                                                                 00016200
ISN 0045             RKL=(.01D0/1.97315D0)*(REL**2-A1**2)**.5D0                                00016300
ISN 0046             FK=RKL*A2/(2.D0*A2*REL+A2**2+A1**2)**.5D0                                 00016400
ISN 0047             DER=(A2*REL+A1**2)*(A2*REL+A2**2)/(2.D0*A2*REL+A2**2+A1**2)**1.5D000016500
ISN 0048             EC=197.315D0**2*FK**2/(2.D0*DER)                                          00016600
ISN 0049             RF2=1.D0+(A2*REL-A2*A1**2/REL)/(A2**2+A1**2+A2*REL+A2*A1**2/REL)          00016700
ISN 0050             ETA=Z*1.44*REL/(197.315D0**2*RF2*RKL)                                     00016800
ISN 0051             XK=FK                                                                     00016900
ISN 0052             GO TO 405                                                                 00017000
ISN 0053           404 EC=C*EL/A1                                                              00017100
ISN 0054             XK=DSQRT((C+C)*EC)/197.315                                                00017200
ISN 0055             ETA=.71993173*XK*Z/EC                                                     00017300
ISN 0056           405 WRITE (6,6002) EC,XK,ETA                                                00017400
ISN 0057          6002 FORMAT (/' CM-ENERGY = ',2PD11.4,'   K = ',1PD11.5,'   ETA = ',1PD00017500
                     111.5)                                                                    00017600
ISN 0058             IF (NS.GE.2) GO TO 401                                                    00017700
ISN 0060             WRITE (6,6100)                                                            00017800
ISN 0061          6100 FORMAT (///' SCATTERING PHASE ANALYSIS')                                00017900
ISN 0062             WRITE (6,6008) ID,LM,MC,IP                                                00018000
ISN 0063          6008 FORMAT (///' CPU-TIME (SEC)     = ',I5/                                 00018100
                     1            ' LMAX                = ',I5/                                 00018200
                     4            ' ITERATIONS          = ',I5/                                 00018300
                     5            ' PRINT-OUT AT EACH   ',I5,' ITERATION')                      00018400
ISN 0064             IF (MS.LT.0) WRITE (6,6501)                                               00018500
ISN 0066          6501 FORMAT (/' PARAMETRIZATION OF REAL AND IMAGINARY PART')                 00018600
ISN 0067             IF (MS.GT.0) WRITE (6,6502)                                               00018700
ISN 0069          6502 FORMAT (/' PARAMETRIZATION OF ABSOLUTE VALUE AND PHASE')                00018800
ISN 0070             GO TO 221                                                                 00018900
ISN 0071           401 NMSUM=NS+MS-1                                                           00019000
ISN 0072             WRITE (6,6101)                                                            00019100
ISN 0073          6101 FORMAT (///' POTENTIAL ANALYSIS')                                       00019200
ISN 0074             WRITE (6,6003) ID,LM,NMSUM,MS,MC,IP                                       00019300
ISN 0075          6003 FORMAT (///' CPU-TIME (SEC)     = ',I5/                                 00019400
                     1            ' LMAX                = ',I5/                                 00019500
                     2            ' INTEGRATION STEPS = ',I5/                                  00019600
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                  3            ' FIRST STEP          = ',I5/
                  4            ' ITERATIONS          = ',I5/
                  5            ' PRINT-OUT AT EACH    ',I5,' ITERATION')
ISN 0076        221 IF (KO(4).EQ.1) WRITE (6,6010)
ISN 0078       6010 FORMAT (/////' PARAMETERS'/)
ISN 0079            CALL INPUT(IN0,IN1,IW0,IW1)
ISN 0080            NP=WI(IW0)+.1
ISN 0081            DO 200 I=1,NP
ISN 0082            P(I)=WI(IW0+I)
ISN 0083        200 CONTINUE
ISN 0084            IF (KO(4).EQ.1) WRITE (6,6011)
ISN 0086       6011 FORMAT (///' REQUIRED FIRST STEP AND FIT ACCURACIES'/)
ISN 0087            CALL INPUT(IN0,IN1,IW0,IW1)
ISN 0088            N=WI(IW0)+.1-1
ISN 0089            DO 201 I=1,N
ISN 0090            G(I)=WI(IW0+I+1)
ISN 0091        201 CONTINUE
ISN 0092            ES=WI(IW0+1)
ISN 0093            WI(1)=IW1
ISN 0094            IF (KO(4).EQ.1) WRITE (6,6012)
ISN 0096       6012 FORMAT (///' VARIED PARAMETERS'/)
ISN 0097            CALL INPUT(IN0,IN1,IW0,IW1)
ISN 0098            NIN=IN(IN0)
ISN 0099            IF (NIN.NE.N) GO TO 4
ISN 0101            DO 40 I=1,N
ISN 0102            IA(I)=IN(IN0+I)
ISN 0103         40 CONTINUE
ISN 0104            NC=0
ISN 0105            IF(LM)34,35,35
ISN 0106         34 LM=-LM
ISN 0107            NC=-1
ISN 0108         35 IF(NS)31,31,32
ISN 0109         32 C=NS+MS-1
ISN 0110            A=P(1)/C
ISN 0111            P(1)=A*C
ISN 0112         31 P(NP+1)=EC
ISN 0113            P(NP+2)=XK
ISN 0114            P(NP+3)=A
ISN 0115            P(NP+4)=Z
ISN 0116            P(NP+6)=NS
ISN 0117            P(NP+7)=MS
ISN 0118            IF (NS.GE.2) GO TO 402
ISN 0120            IF ((P(3).LT.1.D-10).OR.(P(5).LT.1.D-10)) WRITE (6,6503)
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ISN 0122      6503 FORMAT (///' SHARP CUT-OFF'/)                                        00024000
ISN 0123           GO TO 403                                                          00024100
ISN 0124       402 WRITE (6,6004) P(1),A                                              00024200
ISN 0125      6004 FORMAT (/' MATCHING RADIUS (FM) = ',2PD9.2,'    STEP SIZE = ',     00024300
                  1 0PD12.6)                                                         00024400
ISN 0126       403 KE=0                                                              00024500
ISN 0127           CALL POTE(P,F,W,KE)                                               00024600
ISN 0128           IF(NP-IABS (KE))4,6,4                                             00024700
ISN 0129         4 WRITE(6,5)                                                        00024800
ISN 0130         5 FORMAT (54H ERROR IN INPUT-DATA OR WRONG SUBROUTINE POTE INCLUDED)00024900
ISN 0131           GO TO 27                                                          00025000
ISN 0132         6 R=XK*P(1)                                                         00025100
ISN 0133           CALL COULOM (LM,ETA,R,F,W,C,D,S)                                  00025200
ISN 0134           LA=LM+1                                                           00025300
ISN 0135           P(NP+5)=LA                                                        00025400
ISN 0136           P(NP+8)=S                                                         00025500
ISN 0137           A=DCOS(S)                                                         00025600
ISN 0138           B=DSIN(S)                                                         00025700
ISN 0139           J=NP+8*LA+9                                                       00025800
ISN 0140           IF (KO(4).EQ.1) WRITE (6,6013)                                    00025900
ISN 0142      6013 FORMAT (///' EXPERIMENTAL CROSS SECTIONS'/)                       00026000
ISN 0143           CALL INPUT(IN0,IN1,IW0,IW1)                                       00026100
ISN 0144           M=WI(IW0)/3+.1                                                    00026200
ISN 0145           K=J-1+3*M                                                         00026300
ISN 0146           IF (P(NP).GT.1.D-2) GO TO 203                                     00026400
ISN 0148           P(NP)=1.D3*P(NP)                                                  00026500
ISN 0149           DO 204 I=1,M                                                      00026600
ISN 0150           I1=3*I-1+IW0                                                      00026700
ISN 0151           WI(I1)=.001*WI(I1)                                                00026800
ISN 0152       204 WI(I1+1)=.001*WI(I1+1)                                            00026900
ISN 0153       203 I1=0                                                              00027000
ISN 0154           DO 202 I=J,K                                                      00027100
ISN 0155           I1=I1+1                                                           00027200
ISN 0156           P(I)=WI(I1+IW0)                                                   00027300
ISN 0157       202 CONTINUE                                                          00027400
ISN 0158           S=0.                                                              00027500
ISN 0159           I1=NP+9                                                           00027600
ISN 0160           I2=I1+LA                                                          00027700
ISN 0161           I3=I2+LA                                                          00027800
ISN 0162           I4=I3+LA                                                          00027900
ISN 0163           I5=I4+LA                                                          00028000
ISN 0164           I6=I5+LA                                                          00028100
ISN 0165           P(I1)=F(1)                                                        00028200
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ISN 0166            P(I2)=W(1)                                                00028300
ISN 0167            P(I3)=C                                                   00028400
ISN 0168            P(I4)=D                                                   00028500
ISN 0169            P(I5)=A*A-B*B                                             00028600
ISN 0170            P(I6)=2.*A*B                                              00028700
ISN 0171            DO 10 I=2,LA                                              00028800
ISN 0172            I1=I1+1                                                   00028900
ISN 0173            I2=I2+1                                                   00029000
ISN 0174            I3=I3+1                                                   00029100
ISN 0175            I4=I4+1                                                   00029200
ISN 0176            I5=I5+1                                                   00029300
ISN 0177            I6=I6+1                                                   00029400
ISN 0178            S=S+1.                                                    00029500
ISN 0179            E=ETA/S                                                   00029600
ISN 0180            D=E+S/R                                                   00029700
ISN 0181            C=DSQRT(1.+E*E)                                           00029800
ISN 0182            P(I1)=F(I)                                                00029900
ISN 0183            P(I2)=W(I)                                                00030000
ISN 0184            P(I3)=C*F(I-1)-D*F(I)                                     00030100
ISN 0185            P(I4)=C*W(I-1)-D*W(I)                                     00030200
ISN 0186            D=(A-B*E)/C                                               00030300
ISN 0187            B=(B+A*E)/C                                               00030400
ISN 0188            A=D                                                       00030500
ISN 0189            P(I5)=A*A-B*B                                             00030600
ISN 0190         10 P(I6)=2.*A*B                                              00030700
ISN 0191            E=A1+A2+EL                                                00030800
ISN 0192            D=EL*(A1+A1+EL)                                           00030900
ISN 0193            C=A1*A1                                                   00031000
ISN 0194            A=A2*A2*D/(C+A2*(E+E-A2))                                 00031100
ISN 0195            D=D/(E*E)                                                 00031200
ISN 0196            UA=DSQRT(D*(A+C)/A)                                       00031300
ISN 0197            VA=1./(1.-D)                                              00031400
ISN 0198            IF (KO(2).EQ.1) GO TO 37                                  00031500
ISN 0200            I1=NP+8*LA+6                                              00031600
ISN 0201            DO 19 I=1,M                                               00031700
ISN 0202            I1=I1+3                                                   00031800
ISN 0203            I2=I1+1                                                   00031900
ISN 0204            I3=I2+1                                                   00032000
ISN 0205            D=PPI/180.*P(I1)                                          00032100
ISN 0206            IF(P(I1)-90.)11,13,11                                     00032200
ISN 0207         11 C=DSIN(D)                                                 00032300
ISN 0208            C=C*C                                                     00032400
ISN 0209            C=VA*C/(1.-C)                                             00032500
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ISN 0210          H=1./(1.+C)                                                    00032600
ISN 0211          A=-UA*C*H                                                      00032700
ISN 0212          H=H*DSQRT(1.+C*(1.-UA*UA))                                     00032800
ISN 0213          IF(P(I1)-90.)12,13,14                                          00032900
ISN 0214       14 C=A-H                                                          00033000
ISN 0215          GO TO 15                                                       00033100
ISN 0216       13 C=-UA                                                          00033200
ISN 0217          GO TO 15                                                       00033300
ISN 0218       12 C=A+H                                                          00033400
ISN 0219       15 IF((C-1.)*(C+1.))16,17,17                                      00033500
ISN 0220       17 P(I1)=PPI/2.*(1.D0-DSIGN(1.D0,C))                              00033600
ISN 0221          GO TO 18                                                       00033700
ISN 0222       16 P(I1)=PPI/2.   -DARSIN(C)                                      00033800
ISN 0223       18 D=C+UA                                                         00033900
ISN 0224          D=VA*D*D+1.-C*C                                                00034000
ISN 0225          B=DSQRT(VA/D)*(1.+C*UA)/D                                      00034100
ISN 0226          P(I2)=P(I2)*B                                                  00034200
ISN 0227       19 P(I3)=P(I3)*B                                                  00034300
ISN 0228          GO TO 39                                                       00034400
ISN 0229       37 I1=NP+8*LA+6                                                   00034500
ISN 0230          DO 38 I=1,M                                                    00034600
ISN 0231          I1=I1+3                                                        00034700
ISN 0232       38 P(I1)=PPI/180.*P(I1)                                           00034800
ISN 0233       39 DO 20 I=1,N                                                    00034900
ISN 0234          J=IA(I)                                                        00035000
ISN 0235          X(I)=P(J)                                                      00035100
ISN 0236          IF(NP-J)4,29,20                                                00035200
ISN 0237       29 X(I)=DARSIN(2.*P(NP)-2.)                                       00035300
ISN 0238       20 CONTINUE                                                       00035400
ISN 0239          IF (KO(5).EQ.1) CALL HORA                                      00035500
ISN 0241          CALL VA02M(M,N,F,X,G,ES,IP,MC,W,P)                             00035600
ISN 0242          IF(M.LT.0) M=-M                                                00035700
ISN 0244          IF (IABS(MC).LE.1) GO TO 334                                   00035800
ISN 0246          CALL SVC1M(M,N,VARM,25,2,W)                                    00035900
ISN 0247          IF (KO(5).EQ.1) CALL HORA                                      00036000
ISN 0249          WRITE (6,6005)                                                 00036100
ISN 0250     6005 FORMAT (/////' FINAL PARAMETERS AT END OF SEARCH'/             00036200
                 1 '  NUMBER       VALUE            ERROR')                     00036300
ISN 0251          DO 30 I=1,N                                                    00036400
ISN 0252          J=IA(I)                                                        00036500
ISN 0253          P(J)=X(I)                                                      00036600
ISN 0254          PERR(I)=DSQRT(VARM(I,I))                                       00036700
ISN 0255          IF(NP-J)4,33,333                                               00036800
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ISN 0256        33 P(NP)=1.+.5*DSIN(X(I))                                        00036900
ISN 0257       333 WRITE (6,6006) J,P(J),PERR(I)                                 00037000
ISN 0258        30 CONTINUE                                                      00037100
ISN 0259      6006 FORMAT (2X,I4,4X,2(1PD12.5,3X))                               00037200
ISN 0260       334 J=NP+8*LA+6                                                   00037300
ISN 0261           CHI2=0.D0                                                    00037400
ISN 0262           DO 23 I=1,M                                                  00037500
ISN 0263           CHI2=CHI2+F(I)*F(I)                                          00037600
ISN 0264           J=J+3                                                        00037700
ISN 0265           P(J)=P(J)*180./PPI                                           00037800
ISN 0266           P(J+2)=P(NP)*P(J+2)                                          00037900
ISN 0267        23 P(J+1)=P(NP)*P(J+1)                                          00038000
ISN 0268           CHI2=CHI2/(M-N-1)                                            00038100
ISN 0269           WRITE (6,6007) CHI2                                          00038200
ISN 0270      6007 FORMAT (///' CHI-SQUARE PER DEGREE OF FREEDOM = ',1PD10.3)   00038300
ISN 0271         3 CALL OUTPUT(P,W,F,X,NP,N,M,LA,VARM,CHI2)                     00038400
ISN 0272           I=ZEIT(TID)                                                  00038500
ISN 0273           IF(ID-I)   27,27,25                                          00038600
ISN 0274        25 IF (KO(3).EQ.0) GO TO 26                                     00038700
ISN 0276           CALL GRID(P,W,F,NP,M,N,LA,KG)                                00038800
ISN 0277           IF (KG.EQ.0) GO TO 37                                        00038900
ISN 0279        26 CONTINUE                                                     00039000
ISN 0280        27 RETURN                                                       00039100
ISN 0281           END                                                          00039200


ISN 0002           SUBROUTINE GRID(P,W,F,NP,M,N,LA,KG)                          00039300
ISN 0003           IMPLICIT REAL*8 (A-H,O-Z)                                    00039400
ISN 0004           DIMENSION P(2),W(2),F(2),IA(30),IG(5),ST(5),NST(5),JST(5)    00039500
ISN 0005           REAL*4 WI(1000)                                              00039600
ISN 0006           COMMON /INPT/KE(42),WI,IN(100)                               00039700
ISN 0007           COMMON /IFIT/IA,NC,ID                                        00039800
ISN 0008           DATA NC1/0/                                                  00039900
ISN 0009           KG=0                                                         00040000
ISN 0010           NC2=P(3)+.1                                                  00040100
ISN 0011           IF (NC1.EQ.NC2) GO TO 100                                    00040200
ISN 0013           IF (KE(4).EQ.1) WRITE (6,6001)                               00040300
ISN 0015      6001 FORMAT (///' GRID-PARAMETERS AND STEPS'/)                    00040400
ISN 0016           CALL INPUT(IN0,IN1,IW0,IW1)                                  00040500
ISN 0017           NG=IN(IN0)/2.+.1                                             00040600
ISN 0018           IF (NG.GT.5) GO TO 500                                       00040700
ISN 0020           DO 1 I=1,NG                                                  00040800
ISN 0021           IG(I)=IN(IN0+I)                                              00040900
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ISN 0022            NST(I)=IN(INO+NG+I)                                                00041000
ISN 0023            JST(I)=0                                                           00041100
ISN 0024          1 CONTINUE                                                           00041200
ISN 0025            CALL INPUT (INO,IN1,IWO,IW1)                                       00041300
ISN 0026            DO 10 I=1,NG                                                       00041400
ISN 0027            ST(I)=WI(IWO+I)                                                    00041500
ISN 0028            DO 10 J=1,N                                                        00041600
ISN 0029            IF (IG(I).EQ.IA(J)) GO TO 600                                      00041700
ISN 0031           10 CONTINUE                                                         00041800
ISN 0032            NC1=NC2                                                            00041900
ISN 0033          100 J=NP+8*LA+6                                                      00042000
ISN 0034            DO 200 I=1,NG                                                      00042100
ISN 0035            JS=IG(I)                                                           00042200
ISN 0036            IF (NST(I)-JST(I)) 201,201,300                                     00042300
ISN 0037          300 P(JS)=P(JS)+ST(I)                                                00042400
ISN 0038            JST(I)=JST(I)+1                                                    00042500
ISN 0039            WRITE (6,6004) JS,P(JS)                                            00042600
ISN 0040         6004 FORMAT (///' ************************************************** 00042700
                    1************************************************************** 00042800
                    2********'//' GRID-PARAMETER NUMBER ',I3,'  NEW VALUE = ',1PD12.5) 00042900
ISN 0041            RETURN                                                             00043000
ISN 0042          201 JST(I)=0                                                         00043100
ISN 0043            P(JS)=P(JS)-NST(I)*ST(I)                                           00043200
ISN 0044            WRITE (6,6004) JS,P(JS)                                            00043300
ISN 0045          200 CONTINUE                                                         00043400
ISN 0046            KG=1                                                               00043500
ISN 0047            RETURN                                                             00043600
ISN 0048          500 WRITE (6,6002)                                                   00043700
ISN 0049         6002 FORMAT (//' NUMBER OF GRID-PARAMETERS GREATER THAN 5 ')         00043800
ISN 0050            KG=1                                                               00043900
ISN 0051            RETURN                                                             00044000
ISN 0052          600 WRITE (6,6003)                                                   00044100
ISN 0053         6003 FORMAT (//' ONE OF THE GRID-PARAMETERS IS ALSO IN SEARCH')      00044200
ISN 0054            KG=1                                                               00044300
ISN 0055            RETURN                                                             00044400
ISN 0056            END                                                                00044500
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ISN 0002            SUBROUTINE VA02M(M,N,F,X,E,ES,IPP,MC,W,P)                        00044600
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                        00044700
ISN 0004            REAL*4 F4(300),X4(30),E4(30),W4(21000),WI(1000)                  00044800
ISN 0005            DIMENSION W(2),X(30),F(300),IW(30),P(2),E(30)                    00044900
ISN 0006            COMMON /INPT/KO(42),WI,IN(100)                                   00045000
ISN 0007            DO 100 I=1,N                                                     00045100
ISN 0008            X4(I)=X(I)                                                       00045200
ISN 0009            E4(I)=E(I)                                                       00045300
ISN 0010        100 CONTINUE                                                         00045400
ISN 0011            KE=0                                                             00045500
ISN 0012            IP=IABS(IPP)                                                     00045600
ISN 0013            W4(1)=ES                                                         00045700
ISN 0014            W4(2)=0.                                                         00045800
ISN 0015            W4(3)=0.                                                         00045900
ISN 0016            W(3)=0.                                                          00046000
ISN 0017            IW(1)=N+1                                                        00046100
ISN 0018            IW(2)=MC                                                         00046200
ISN 0019            IW(3)=1                                                          00046300
ISN 0020            IW(4)=0                                                          00046400
ISN 0021            NP=0                                                             00046500
ISN 0022          2 W4(4)=0.                                                         00046600
ISN 0023            CALL CALFUN(M,N,F,X,P)                                           00046700
ISN 0024            IF (M) 22,22,21                                                  00046800
ISN 0025         22 IW(2)=IW(3)                                                      00046900
ISN 0026            WRITE (6,600) IW(3)                                              00047000
ISN 0027            M=-M                                                             00047100
ISN 0028        600 FORMAT (/' CPU-TIME EXCEEDED AFTER ',I3,' CALLS OF CALFUN'/)     00047200
ISN 0029         21 DO 3 I=1,M                                                       00047300
ISN 0030            F4(I)=F(I)                                                       00047400
ISN 0031          3 W4(4)=W4(4)+F(I)*F(I)                                            00047500
ISN 0032            W(4)=W4(4)                                                       00047600
ISN 0033            IF(IW(3).NE.NP.AND.IW(3).NE.1.AND.IP.NE.1) GO TO 4               00047700
ISN 0035            IF (KO(5).EQ.1) CALL HORA                                        00047800
ISN 0037            WRITE(6,60) IW(3),W(4),IW(4),W(3)                                00047900
ISN 0038            WRITE(6,61) (X(I),I=1,N)                                         00048000
ISN 0039            NP=NP+IP                                                         00048100
ISN 0040            IF(IPP.LE.0) GO TO 4                                             00048200
ISN 0042            WRITE(6,66)                                                      00048300
ISN 0043            WRITE(6,61) (F(I),I=1,M)                                         00048400
ISN 0044          4 CALL FITEX(KE,M,N,F4,X4,E4,W4,IW)                                00048500
ISN 0045            DO 101 I=1,N                                                     00048600
ISN 0046            X(I)=X4(I)                                                       00048700
ISN 0047        101 CONTINUE                                                         00048800
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ISN 0048            IF(KE.EQ.1) GO TO 2                                                    00048900
ISN 0050            DO 103 I=1,M                                                           00049000
ISN 0051            F(I)=F4(I)                                                             00049100
ISN 0052          103 CONTINUE                                                             00049200
ISN 0053            IF (MC.EQ.1) GO TO 9                                                   00049300
ISN 0055            CALL CALFUN(M,N,F,X,P)                                                 00049400
ISN 0056            IF (M.LE.0) M=-M                                                       00049500
ISN 0058            6 KW=4+N+N+N*N                                                         00049600
ISN 0059            DO 104 I=1,KW                                                          00049700
ISN 0060            W(I)=W4(I)                                                             00049800
ISN 0061          104 CONTINUE                                                             00049900
ISN 0062            WRITE(6,60) IW(3),W(4),IW(4),W(3)                                      00050000
ISN 0063            WRITE(6,61) (X(I),I=1,N)                                               00050100
ISN 0064            IF(IPP.LE.0) GO TO 9                                                   00050200
ISN 0066            WRITE(6,66)                                                            00050300
ISN 0067            WRITE(6,61) (F(I),I=1,M)                                               00050400
ISN 0068            IF(KE*(KE-3).NE.0.OR.W(5).LE.0.) GO TO 9                               00050500
ISN 0070            WRITE(6,62)                                                            00050600
ISN 0071            WRITE(6,61) (W(4+I),I=1,N)                                             00050700
ISN 0072            WRITE(6,63)                                                            00050800
ISN 0073            WRITE(6,61) (W(4+N+I),I=1,N)                                           00050900
ISN 0074            WRITE(6,64)                                                            00051000
ISN 0075            L=4+N+N                                                                00051100
ISN 0076            DO 7 I=1,N                                                             00051200
ISN 0077            K=L+1                                                                  00051300
ISN 0078            L=L+I                                                                  00051400
ISN 0079            7 WRITE(6,61) (W(J),J=K,L)                                             00051500
ISN 0080            9 WRITE(6,65) KE                                                       00051600
ISN 0081           60 FORMAT('0',I4,' ITERATIONS   TOTAL CHISQUARE =',1PE12.5,'   IW(4)  00051700
                     1=',I4,'   W(3) =',1PE13.5/' VARIABLES')                             00051800
ISN 0082           61 FORMAT(' ',1P10E13.5)                                               00051900
ISN 0083           62 FORMAT('0STANDARD ERRORS')                                          00052000
ISN 0084           63 FORMAT('0ERROR ENHANCEMENTS')                                       00052100
ISN 0085           64 FORMAT('0ERROR CORRELATION MATRIX')                                 00052200
ISN 0086           65 FORMAT('0CONVERGENCE WITH ERROR CODE',I2)                           00052300
ISN 0087           66 FORMAT(' FUNCTIONS')                                                00052400
ISN 0088            RETURN                                                                00052500
ISN 0089            END                                                                   00052600
```

```
ISN 0002            SUBROUTINE SVD1M(M,N,VARM,IVDIM,IVDIM2,W)                    00052700
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                    00052800
ISN 0004            DIMENSION W(2),VARM(30,30)                                   00052900
ISN 0005            L=4+N+N                                                      00053000
ISN 0006            DO 1 I=1,N                                                   00053100
ISN 0007            K=L+1                                                        00053200
ISN 0008            L=L+I                                                        00053300
ISN 0009            JJ=0                                                         00053400
ISN 0010            DO 2 J=K,L                                                   00053500
ISN 0011            JJ=JJ+1                                                      00053600
ISN 0012            VARM(JJ,I)=W(J)*W(4+I)*W(4+JJ)/W(3)**2                       00053700
ISN 0013            VARM(I,JJ)=VARM(JJ,I)                                        00053800
ISN 0014          2 CONTINUE                                                     00053900
ISN 0015          1 CONTINUE                                                     00054000
ISN 0016            DO 3 I=1,N                                                   00054100
ISN 0017            VARM(I,I)=(W(4+I)/W(3))**2                                   00054200
ISN 0018          3 CONTINUE                                                     00054300
ISN 0019            RETURN                                                       00054400
ISN 0020            END                                                          00054500
```



```
                C     POTENTIALSTREUUNG, POTENTIAL ODER STREUAMPLITUDENANPASSUNG    00054600
ISN 0002            SUBROUTINE CALFUN(M,N,F,X,P)                                 00054700
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                    00054800
ISN 0004            DIMENSION F(2),X(2),P(2),BR(100),BI(100),PR(6),PI(6),UR(121),  00054900
                   1 VR(121),UI(121),VI(121),YR(2),YI(2),IA(30)                  00055000
ISN 0005            REAL*4 ZEIT,TID                                              00055100
ISN 0006            COMMON /IFIT/IA,NC,ID                                        00055200
ISN 0007            COMMON /CZE/TID                                              00055300
ISN 0008            NP=0                                                         00055400
ISN 0009            CALL POTE(P,PR,PI,NP)                                        00055500
ISN 0010            NP= IABS(NP)                                                 00055600
ISN 0011            LA=P(NP+5)                                                   00055700
ISN 0012            NS=P(NP+6)                                                   00055800
ISN 0013            DO 1 I=1,N                                                   00055900
ISN 0014            J=IA(I)                                                      00056000
ISN 0015            IF(J-NP)30,29,30                                             00056100
ISN 0016         29 P(NP)=1.+.5*DSIN (X(I))                                      00056200
ISN 0017            GO TO 1                                                      00056300
ISN 0018         30 P(J)=X(I)                                                    00056400
ISN 0019          1 CONTINUE                                                     00056500
```

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                C      BERECHNUNG DER STREUAMPLITUDEN                                    00056600
ISN 0020              IF(NS)31,31,32                                                     00056700
ISN 0021           31 CALL STRAM(P,NP)                                                   00056800
ISN 0022              GO TO 41                                                           00056900
                C-----POTENTIAL-ANPASSUNG                                               00057000
ISN 0023           32 CALL POTE(P,PR,PI,1)                                              00057100
ISN 0024              P(1)=0.                                                            00057200
ISN 0025              CALL POTE(P,YR,YI,2)                                               00057300
ISN 0026              NC=NC+1                                                            00057400
ISN 0027              IF(NC)34,33,33                                                     00057500
ISN 0028           33 L1=1                                                             00057600
ISN 0029              L2=LA                                                              00057700
ISN 0030           34 SN=P(NP+7)-2.                                                    00057800
ISN 0031              DO 22 I1=1,NS                                                      00057900
ISN 0032              SN=SN+1.                                                           00058000
ISN 0033              C=SN+SN                                                            00058100
ISN 0034              SNQ=SN*SN                                                          00058200
ISN 0035              DR=P(NP+3)                                                         00058300
ISN 0036              IF(2-I1)3,3,2                                                      00058400
ISN 0037            2 C=0.                                                             00058500
ISN 0038              SNQ=0.                                                             00058600
ISN 0039              DR=DR*P(NP+7)                                                      00058700
ISN 0040            3 P(1)=P(1)+DR                                                       00058800
ISN 0041              CALL POTE(P,PR,PI,2)                                               00058900
ISN 0042              A=DR*P(NP+2)                                                       00059000
ISN 0043              A=A*A/P(NP+1)                                                      00059100
ISN 0044              BR(1)=A*(YR(1)-P(NP+1))                                            00059200
ISN 0045              BI(1)=A*YI(1)                                                      00059300
ISN 0046              BR(2)=A*DR*YR(2)                                                   00059400
ISN 0047              BI(2)=A*DR*YI(2)                                                   00059500
ISN 0048              BR(3)=A*(3.*(PR(1)-YR(1))-DR*(YR(2)+YR(2)+PR(2)))                  00059600
ISN 0049              BI(3)=A*(3.*(PI(1)-YI(1))-DR*(YI(2)+YI(2)+PI(2)))                  00059700
ISN 0050              PR(6)=A*(2.*(YR(1)-PR(1))+DR*(YR(2)+PR(2)))                        00059800
ISN 0051              PI(6)=A*(2.*(YI(1)-PI(1))+DR*(YI(2)+PI(2)))                        00059900
ISN 0052              YR(1)=PR(1)                                                        00060000
ISN 0053              YI(1)=PI(1)                                                        00060100
ISN 0054              YR(2)=PR(2)                                                        00060200
ISN 0055              YI(2)=PI(2)                                                        00060300
ISN 0056              AC=SNQ*BR(1)                                                       00060400
ISN 0057              PI(1)=SNQ*BI(1)                                                    00060500
ISN 0058              PR(2)=C*BR(1)+SNQ*BR(2)                                            00060600
ISN 0059              PI(2)=C*BI(1)+SNQ*BI(2)                                            00060700
ISN 0060              PR(3)=BR(1)+C*BR(2)+SNQ*BR(3)                                      00060800
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ISN 0061          PI(3)=BI(1)+C*BI(2)+SNQ*BI(3)                                  00060900
ISN 0062          PR(4)=BR(2)+C*BR(3)+SNQ*PR(6)                                  00061000
ISN 0063          PI(4)=BI(2)+C*BI(3)+SNQ*PI(6)                                  00061100
ISN 0064          PR(5)=BR(3)+C*PR(6)                                            00061200
ISN 0065          PI(5)=BI(3)+C*PI(6)                                            00061300
ISN 0066          S=L1-2                                                         00061400
ISN 0067          DO 22 L=L1,L2                                                  00061500
ISN 0068          IC=0                                                           00061600
ISN 0069          S=S+1.                                                         00061700
ISN 0070          SLQ=S*(S+1.)                                                   00061800
ISN 0071          PR(1)=AQ+SLQ                                                   00061900
ISN 0072          IF(2-I1)5,5,4                                                  00062000
ISN 0073        4 BR(1)=1.                                                       00062100
ISN 0074          BI(1)=0.                                                       00062200
ISN 0075          BR(2)=0.                                                       00062300
ISN 0076          BI(2)=0.                                                       00062400
ISN 0077          B=4.*S+6.                                                      00062500
ISN 0078          BR(3)=PR(3)/B                                                  00062600
ISN 0079          BI(3)=PI(3)/B                                                  00062700
ISN 0080          SI=S+3.                                                        00062800
ISN 0081          VR(L)=1.+S+SI*BR(3)                                            00062900
ISN 0082          VI(L)=SI*BI(3)                                                 00063000
ISN 0083          GO TO 8                                                        00063100
ISN 0084        5 BR(1)=UR(L)                                                    00063200
ISN 0085          BI(1)=UI(L)                                                    00063300
ISN 0086          BR(2)=VR(L)                                                    00063400
ISN 0087          BI(2)=VI(L)                                                    00063500
ISN 0088          IF(2-I1)7,6,6                                                  00063600
ISN 0089        6 BR(2)=BR(2)/P(NP+7)                                            00063700
ISN 0090          BI(2)=BI(2)/P(NP+7)                                            00063800
ISN 0091        7 BR(3)=(PR(1)*BR(1)-PI(1)*BI(1))/(SNQ+SNQ)                      00063900
ISN 0092          BI(3)=(PR(1)*BI(1)+PI(1)*BR(1))/(SNQ+SNQ)                      00064000
ISN 0093          SI=2.                                                          00064100
ISN 0094          VR(L)=BR(2)+2.*BR(3)                                           00064200
ISN 0095          VI(L)=BI(2)+2.*BI(3)                                           00064300
ISN 0096        8 UR(L)=BR(1)+BR(2)+BR(3)                                        00064400
ISN 0097          UI(L)=BI(1)+BI(2)+BI(3)                                        00064500
ISN 0098          DO 21 I=4,100                                                  00064600
ISN 0099          SI=SI+1.                                                       00064700
ISN 0100          IF(2-I1)10,10,9                                                00064800
ISN 0101        9 C=SI*(SI-1.)-SLQ                                               00064900
ISN 0102          BR(I)=0.                                                       00065000
ISN 0103          BI(I)=0.                                                       00065100
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ISN 0104            IMJ=I                                                                00065200
ISN 0105            GO TO 11                                                             00065300
ISN 0106         10 C=SNQ*SI*(SI-1.)                                                     00065400
ISN 0107            D=-(SN+SN)*(SI-1.)*(SI-2.)                                           00065500
ISN 0108            E=PR(1)-(SI-2.)*(SI-3.)                                              00065600
ISN 0109            BR(I)=D*BR(I-1)+E*BR(I-2)-PI(1)*BI(I-2)                              00065700
ISN 0110            BI(I)=D*BI(I-1)+E*BI(I-2)+PI(1)*BR(I-2)                              00065800
ISN 0111            IMJ=I-2                                                              00065900
ISN 0112         11 K= MINO (6,IMJ)                                                      00066000
ISN 0113            DO 12 J=2,K                                                          00066100
ISN 0114            IMJ=IMJ-1                                                            00066200
ISN 0115            BR(I)=BR(I)+PR(J)*BR(IMJ)-PI(J)*BI(IMJ)                              00066300
ISN 0116         12 BI(I)=BI(I)+PR(J)*BI(IMJ)+PI(J)*BR(IMJ)                              00066400
ISN 0117            BR(I)=BR(I)/C                                                        00066500
ISN 0118            BI(I)=BI(I)/C                                                        00066600
ISN 0119            IF(DABS(BR(I))+DABS(BI(I))-1.D15)15,13,13                            00066700
ISN 0120         13 DO 14 K=1,I                                                          00066800
ISN 0121            BR(K)=1.D-30*BR(K)                                                   00066900
ISN 0122         14 BI(K)=1.D-30*BI(K)                                                   00067000
ISN 0123            UR(L)=1.D-30*UR(L)                                                   00067100
ISN 0124            UI(L)=1.D-30*UI(L)                                                   00067200
ISN 0125            VR(L)=1.D-30*VR(L)                                                   00067300
ISN 0126            VI(L)=1.D-30*VI(L)                                                   00067400
ISN 0127         15 UR(L)=UR(L)+BR(I)                                                    00067500
ISN 0128            UI(L)=UI(L)+BI(I)                                                    00067600
ISN 0129            C=SI*BR(I)                                                           00067700
ISN 0130            D=SI*BI(I)                                                           00067800
ISN 0131            VR(L)=VR(L)+C                                                        00067900
ISN 0132            VI(L)=VI(L)+D                                                        00068000
ISN 0133            IF(1.D-8*DABS(UR(L))-DABS(BR(I)))20,16,16                            00068100
ISN 0134         16 A=DABS(C/VR(L))                                                      00068200
ISN 0135            IF(UI(L)*VI(L))17,18,17                                              00068300
ISN 0136         17 A=A+DABS(BI(I)/UI(L))+DABS(D/VI(L))                                  00068400
ISN 0137         18 IF(1.E-7-A)20,19,19                                                  00068500
ISN 0138         19 IC=IC+1                                                              00068600
ISN 0139            IF(IC-5)21,21,22                                                     00068700
ISN 0140         20 IC=0                                                                 00068800
ISN 0141         21 CONTINUE                                                            00068900
ISN 0142         22 CONTINUE                                                            00069000
ISN 0143            DR=DR*P(NP+2)                                                        00069100
ISN 0144            I1=7+NP+L1                                                           00069200
ISN 0145            DO 26 L=L1,L2                                                        00069300
ISN 0146            I1=I1+1                                                              00069400
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ISN 0147            I2=I1+LA                                                    00069500
ISN 0148            I3=I2+LA                                                    00069600
ISN 0149            I4=I3+LA                                                    00069700
ISN 0150            I7=I4+3*LA                                                  00069800
ISN 0151            I8=I7+LA                                                    00069900
ISN 0152            VR(L)=VR(L)/DR                                              00070000
ISN 0153            VI(L)=VI(L)/DR                                              00070100
ISN 0154            A=2.*(P(I3)*UR(L)-P(I1)*VR(L))                              00070200
ISN 0155            B=2.*(P(I3)*UI(L)-P(I1)*VI(L))                              00070300
ISN 0156            C=P(I2)*VI(L)-P(I4)*UI(L)-.5*A                              00070400
ISN 0157            D=P(I4)*UR(L)-P(I2)*VR(L)-.5*B                              00070500
ISN 0158            H=C*C+D*D                                                   00070600
                  C-----CALL OVERFL(I)                                          00070700
                  C-----CALL SUBH3(I)                                           00070800
                  C-----GO TO (24,25),I                                         00070900
                  C--24 P(I7)=0.                                                00071000
                  C-----P(I8)=0.                                                00071100
                  C-----GO TO 26                                                00071200
ISN 0159          25  P(I7)=(A*C+B*D)/H                                         00071300
ISN 0160              P(I8)=(B*C-A*D)/H                                         00071400
ISN 0161          26  CONTINUE                                                 00071500
ISN 0162              IF(NC)41,35,41                                            00071600
ISN 0163          35  NC=-10                                                   00071700
ISN 0164              I7=8+NP+6*LA                                              00071800
ISN 0165              L1=0                                                      00071900
ISN 0166              DO 40 L=1,LA                                              00072000
ISN 0167              I7=I7+1                                                   00072100
ISN 0168              I8=I7+LA                                                  00072200
ISN 0169              A=P(I8)*P(I8)-1.E-6                                       00072300
ISN 0170              IF(L1)36,36,38                                            00072400
ISN 0171          36  IF((P(I7)+1.)*(P(I7)+1.)+A)38,38,37                     00072500
ISN 0172          37  L1=L                                                     00072600
ISN 0173          38  IF(P(I7)*P(I7)+A)39,39,40                               00072700
ISN 0174          40  CONTINUE                                                 00072800
ISN 0175          39  L2=L                                                     00072900
                  C       BERECHNUNG VON SIGMA AUS DEN STREUAMPLITUDEN        00073000
ISN 0176          41  I4=8+NP+4*LA                                             00073100
ISN 0177              K=6+NP+8*LA                                               00073200
ISN 0178              R=.5/P(NP+2)                                              00073300
ISN 0179              ETA=.71993173*P(NP+2)*P(NP+4)/P(NP+1)                     00073400
ISN 0180              DO 28 I=1,M                                               00073500
ISN 0181              K=K+3                                                     00073600
ISN 0182              I5=I4+1                                                   00073700
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ISN 0183            I6=I5+LA                                                                00073800
ISN 0184            I7=I6+LA                                                                00073900
ISN 0185            I8=I7+LA                                                                00074000
ISN 0186            A=DSIN(.5*P(K))                                                         00074100
ISN 0187            C=-ETA/(A*A)                                                            00074200
ISN 0188            S=2.*(P(NP+8)-ETA*DLOG(DABS(A)))                                        00074300
ISN 0189            T=1.-2.*A*A                                                             00074400
ISN 0190            A1=R*(C*DCOS(S)+P(I7)*P(I6)+P(I8)*P(I5)+3.*T*(P(I7+1)*P(I6+1)+P(I800074500
                   1+1)*P(I5+1)))                                                           00074600
ISN 0191            A2=R*(C*DSIN(S)-P(I7)*P(I5)+P(I8)*P(I6)-3.*T*(P(I7+1)*P(I5+1)-P(I800074700
                   1+1)*P(I6+1)))                                                           00074800
ISN 0192            A=1.                                                                    00074900
ISN 0193            C=T                                                                     00075000
ISN 0194            S=1.                                                                    00075100
ISN 0195            D=3.                                                                    00075200
ISN 0196            DO 27 L=3,LA                                                            00075300
ISN 0197            I5=I4+L                                                                 00075400
ISN 0198            I6=I5+LA                                                                00075500
ISN 0199            I7=I6+LA                                                                00075600
ISN 0200            I8=I7+LA                                                                00075700
ISN 0201            H=C*D*T-A*S                                                             00075800
ISN 0202            S=S+1.                                                                  00075900
ISN 0203            D=D+2.                                                                  00076000
ISN 0204            A=C                                                                     00076100
ISN 0205            C=H/S                                                                   00076200
ISN 0206            H=C*D*R                                                                 00076300
ISN 0207            A1=A1+H*(P(I7)*P(I6)+P(I8)*P(I5))                                       00076400
ISN 0208         27 A2=A2+H*(P(I8)*P(I6)-P(I7)*P(I5))                                       00076500
ISN 0209         28 F(I)=(P(K+1)-1.D-2*(A1*A1+A2*A2)/P(NP))/P(K+2)                          00076600
ISN 0210            I=ZEIT(TID)                                                             00076700
ISN 0211            IF(ID-I) 43,44,44                                                       00076800
ISN 0212         43 M=-M                                                                    00076900
ISN 0213         44 RETURN                                                                  00077000
ISN 0214            END                                                                     00077100
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ISN 0002            SUBROUTINE COULOM(L,ETA,X,F,G,FP,GP,SI)                    00077200
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                  00077300
ISN 0004            DIMENSION A(6),B(6),C(6),E(6),F(1),G(1)                    00077400
                C   COULOMB-FUNCTIONEN  F(L,ETA,X) UND G(L,ETA,X)              00077500
ISN 0005            IF(L)47,42,42                                              00077600
ISN 0006         42 IF(ETA)47,47,43                                            00077700
ISN 0007         43 IF(X)47,47,44                                              00077800
ISN 0008         44 ES=ETA*ETA                                                 00077900
ISN 0009            E2=2.*ETA                                                  00078000
ISN 0010            IF(ETA-1.)3,1,1                                            00078100
ISN 0011          1 RX=E2                                                      00078200
ISN 0012            IF(ETA-2.)4,4,2                                            00078300
ISN 0013          2 E6=ETA**.1666666666666667                                  00078400
ISN 0014            T=E6**4                                                    00078500
ISN 0015            A1=(.04959570165+(.002455199181+.0002534684115/ES)/ES)/(T*T)00078600
ISN 0016            B1=1.-(.0088888888888889+.0009108958061/ES)/ES             00078700
ISN 0017            F(1)=.7063326373*E6*(B1-A1)                                00078800
ISN 0018            G(1)=1.223404061*E6*(B1+A1)                                00078900
ISN 0019            A1=(.17282604+(.0035812148+.00090739664/ES)/ES)/T          00079000
ISN 0020            B1=1.+(.00031746032+.00031178247/ES)/ES                    00079100
ISN 0021            FP=.40869573*(A1+B1)/E6                                    00079200
ISN 0022            GP=.70788177*(A1-B1)/E6                                    00079300
ISN 0023            GO TO 17                                                   00079400
ISN 0024          3 RX=2.                                                      00079500
ISN 0025          4 SM=(22.+E2)/RX                                             00079600
ISN 0026            H=1.D-2*SM                                                 00079700
ISN 0027            B(1)=.32986D0                                              00079800
ISN 0028            B(2)=1.302083333333333                                     00079900
ISN 0029            B(3)=.8680555555555555                                     00080000
ISN 0030            B(4)=B(3)                                                  00080100
ISN 0031            B(5)=B(2)                                                  00080200
ISN 0032            B(6)=B(1)                                                  00080300
ISN 0033            DO 5 N=1,6                                                 00080400
ISN 0034          5 E(N)=0.                                                    00080500
ISN 0035            S=H                                                        00080600
ISN 0036          6 A(5)=0.                                                    00080700
ISN 0037            A(6)=0.                                                    00080800
ISN 0038            S=S-H                                                      00080900
ISN 0039            DO 9 N=1,6                                                 00081000
ISN 0040            C(5)=-RX*S+E2*DATAN(S)                                     00081100
ISN 0041            IF(50.-DABS(C(5)))7,58,58                                  00081200
ISN 0042         58 C(5)=DEXP(C(5))                                            00081300
ISN 0043            GO TO 8                                                    00081400
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ISN 0044          7 C(5)=0.                                                    00081500
ISN 0045          8 C(6)=-S*C(5)                                               00081600
ISN 0046            S=S+H                                                      00081700
ISN 0047            DO 9 M=5,6                                                 00081800
ISN 0048          9 A(M)=A(M)+B(N)*C(M)                                        00081900
ISN 0049            DO 10 M=5,6                                                00082000
ISN 0050         10 E(M)=E(M)+H*A(M)                                           00082100
ISN 0051            IF(SM-S)11,6,6                                             00082200
ISN 0052         11 T=.05D0                                                    00082300
ISN 0053            S=T                                                        00082400
ISN 0054         12 DO 13 N=1,4                                                00082500
ISN 0055         13 A(N)=0.                                                    00082600
ISN 0056            S=S-T                                                      00082700
ISN 0057            DO 14 N=1,6                                                00082800
ISN 0058            H=DTANH(S)                                                 00082900
ISN 0059            A1=H*RX-S*E2                                               00083000
ISN 0060            B1=DSIN(A1)                                                00083100
ISN 0061            A1=DCOS(A1)                                                00083200
ISN 0062            P=1.-H*H                                                   00083300
ISN 0063            C(1)=P*A1                                                  00083400
ISN 0064            C(3)=-P*B1                                                 00083500
ISN 0065            C(2)=H*C(3)                                                00083600
ISN 0066            C(4)=-H*C(1)                                               00083700
ISN 0067            S=S+T                                                      00083800
ISN 0068            DO 14 M=1,4                                                00083900
ISN 0069         14 A(M)=A(M)+B(N)*C(M)                                        00084000
ISN 0070            DO 15 M=1,4                                                00084100
ISN 0071         15 E(M)=E(M)+T*A(M)                                           00084200
ISN 0072            IF(S-10.)12,12,16                                          00084300
ISN 0073         16 P=3.1415927*E2                                             00084400
ISN 0074            P=RX*DSQRT((1.-DEXP(-P))/P)                                00084500
ISN 0075            F(1)=P*E(1)                                                00084600
ISN 0076            G(1)=P*(E(3)+E(5))                                         00084700
                 C-----POTENTIAL-ANPASSUNG                                     00084800
ISN 0077            FP=P*E(2)+F(1)/RX                                          00084900
ISN 0078            GP=P*(E(4)+E(6))+G(1)/RX                                   00085000
ISN 0079         17 P=X-RX                                                     00085100
ISN 0080            N=DABS(P)                                                  00085200
ISN 0081            H=MINO (N,1)                                               00085300
ISN 0082            IF(P)18,32,19                                              00085400
ISN 0083         18 H=-H                                                       00085500
ISN 0084            P=.5                                                       00085600
ISN 0085            GO TO 20                                                   00085700
```

```
      19 P=1.
      20 IF(N)28,28,21
      21 IN=0
         I=0
      40 I=I+1
         IF(2.-RX)23,22,22
      22 H=P*H
         P=1.
      23 S1=G(1)
         S2=H*GP
         S3=H*H*(E2-RX)*S1/(2.*RX)
         G(1)=S1+S2+S3
         GP=S2+2.*S3
         T=1.
         DO 25 J=1,50
         T=T+1.
         S4=-(H*(T*(T-1.)*S3+H*((RX-E2)*S2+H*S1)))/(RX*T*(T+1.))
         G(1)=G(1)+S4
         GP=GP+(T+1.)*S4
         IF(1.D45-DABS(GP))47,47,46
      46 S1=S2
         S2=S3
         S3=S4
         IF(1.D-8-DABS(S4/G(1)))25,24,24
      24 IF(DABS(S4*T/GP)-1.D-8)26,26,25
      25 CONTINUE
      26 GP=GP/H
         RX=RX+H
         IF(IN)28,27,32
      27 IF(I-N)40,28,28
      28 IN=1
         IF(DABS((RX-X)/X)-1.D-6)32,32,29
      29 H=X-RX
         IF(H)30,32,23
      30 IF(2.-RX)23,31,31
      31 IN=-1
         H=DMAX1(-.5D0,H)
         GO TO 23
      32 G(2)=((1./X+ETA)*G(1)-GP)/DSQRT(1.+ES)
         KE=2
         IF(1-L)33,53,55
      55 L=1
         KE=1
```

```
ISN 0129        53 J=1                                                                  00090100
ISN 0130           GO TO 54                                                             00090200
ISN 0131        33 S=0.                                                                 00090300
ISN 0132           DO 34 J=2,L                                                          00090400
ISN 0133           S=S+1.                                                               00090500
ISN 0134           T=S+1.                                                               00090600
ISN 0135           P=(S+T)*(ETA+S*T/X)*G(J)-T*DSQRT(S*S+ES)*G(J-1)                      00090700
ISN 0136           IF(1.D40-DABS(P)) 41,34,34                                           00090800
ISN 0137        34 G(J+1)=P/(S*DSQRT(T*T+ES))                                           00090900
ISN 0138           J=L                                                                  00091000
ISN 0139        54 LX=J+1                                                               00091100
ISN 0140           S1=G(J)                                                              00091200
ISN 0141           S2=G(LX)                                                             00091300
ISN 0142           DO 49 J=LX,1000                                                      00091400
ISN 0143           S=S+1.                                                               00091500
ISN 0144           T=S+1.                                                               00091600
ISN 0145           P=(S+T)*(ETA+S*T/X)*S2-T*DSQRT(S*S+ES)*S1                            00091700
ISN 0146           S1=S2                                                                00091800
ISN 0147           IF(1.D40-DABS(P)) 35,49,49                                           00091900
ISN 0148        49 S2=P/(S*DSQRT(T*T+ES))                                               00092000
ISN 0149           J=1000                                                               00092100
ISN 0150           GO TO 35                                                             00092200
ISN 0151        41 L=J-1                                                                00092300
ISN 0152        35 LX=MAXO (L+10,J)                                                     00092400
ISN 0153           S3=0.                                                                00092500
ISN 0154           S2=1.D-20                                                            00092600
ISN 0155           S=LX+1                                                               00092700
ISN 0156           DO 52 I=L,LX                                                         00092800
ISN 0157           T=S                                                                  00092900
ISN 0158           S=S-1.                                                               00093000
ISN 0159           S1=((S+T)*(ETA+S*T/X)*S2-S*DSQRT(T*T+ES)*S3)/(T*DSQRT(S*S+ES))       00093100
ISN 0160           IF(DABS(S1)-1.D20)51,50,50                                           00093200
ISN 0161        50 S1=1.D-40*S1                                                         00093300
ISN 0162           S2=1.D-40*S2                                                         00093400
ISN 0163        51 S3=S2                                                                00093500
ISN 0164        52 S2=S1                                                                00093600
ISN 0165           F(L+1)=S3                                                            00093700
ISN 0166           F(L)=S2                                                              00093800
ISN 0167           LX=L+1                                                               00093900
ISN 0168           IF(L-1)57,57,56                                                      00094000
ISN 0169        56 N=L-1                                                                00094100
ISN 0170           DO 38 I=1,N                                                          00094200
ISN 0171           J=N-I                                                                00094300
```

```
ISN 0172            S=J+1                                                                 00094400
ISN 0173            T=S+1.                                                                00094500
ISN 0174            F(J+1)=((S+T)*(ETA+S*T/X)*F(J+2)-S*DSQRT(T*T+ES)*F(J+3))/(T*DSQRT(    00094600
                   1S*S+ES))                                                              00094700
ISN 0175            IF(DABS(F(J+1))-1.D20)38,36,36                                        00094800
ISN 0176          36 M=J+1                                                                00094900
ISN 0177            DO 37 K=M,LX                                                          00095000
ISN 0178          37 F(K)=1.D-40*F(K)                                                     00095100
ISN 0179          38 CONTINUE                                                             00095200
ISN 0180          57 P=1./(DSQRT(1.+ES)*(F(1)*G(2)-F(2)*G(1)))                            00095300
ISN 0181            DO 39 J=1,LX                                                          00095400
ISN 0182          39 F(J)=P*F(J)                                                          00095500
ISN 0183            FP=(1.+F(1)*GP)/G(1)                                                  00095600
ISN 0184            GO TO (47,48),KE                                                      00095700
ISN 0185          48 P=ES+16.                                                             00095800
ISN 0186            SI=ETA*(DLOG(P)/2.-1.)+3.5*DATAN(ETA/4.)-DATAN(ETA)-DATAN(ETA/2.)     00095900
                   1-DATAN(ETA/3.)-(1.+(ES-48.+(ES*(ES-160.)+1280.)/(3.5*P*P))/(30.*P*    00096000
                   2P))*ETA/(12.*P)                                                       00096100
                                                                                          00096200
ISN 0187          45 RETURN                                                               00096300
ISN 0188          47 L=0                                                                  00096400
ISN 0189            GO TO 48                                                              00096500
ISN 0190            END
```

```
                C     STREUAMPLITUDEN                                                     00096600
ISN 0002            SUBROUTINE STRAM(P,NP)                                              00096700
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                           00096800
ISN 0004            DIMENSION P(2)                                                      00096900
ISN 0005            D=DABS(P(2))                                                        00097000
ISN 0006            E=DABS(P(3))                                                        00097100
ISN 0007            F=DABS(P(4))                                                        00097200
ISN 0008            G=DABS(P(5))                                                        00097300
ISN 0009            LA=P(NP+5)                                                          00097400
ISN 0010            N1=DABS(P(NP+6))                                                    00097500
ISN 0011            N2=DABS(P(NP+7))                                                    00097600
ISN 0012            N3=1                                                                00097700
ISN 0013            IF(P(NP+7))13,13,14                                                 00097800
ISN 0014          13 N3=2                                                               00097900
ISN 0015          14 IF(1.D-10-E)15,15,16                                               00098000
ISN 0016          15 IF(1.D-10-G)17,17,16                                               00098100
ISN 0017          16 N3=3                                                               00098200
```

```
ISN 0018        17 J=8+NP+6*LA                                                  00098300
ISN 0019           S=-1.                                                        00098400
ISN 0020           DO 12 I=1,LA                                                 00098500
ISN 0021           S=S+1.                                                       00098600
ISN 0022           J=J+1                                                        00098700
ISN 0023           K=J+LA                                                       00098800
ISN 0024           GO TO (18,23,26),N3                                          00098900
ISN 0025        18 X=DABS(S-D)/E                                                00099000
ISN 0026           M=1                                                          00099100
ISN 0027           GO TO 2                                                      00099200
ISN 0028        19 B=(1.-F)*A                                                   00099300
ISN 0029        31 X=(S-D)/G                                                    00099400
ISN 0030           M=2                                                          00099500
ISN 0031           GO TO 2                                                      00099600
ISN 0032        20 Y=S-D                                                        00099700
ISN 0033           C=A*(P(6)+Y*(P(7)+Y*(P(8)+Y*(P(9)+Y*P(10)))))                00099800
ISN 0034        32 IF(Y)21,21,22                                                00099900
ISN 0035        21 P(J)=(F+B)*DCOS(C)-1.                                        00100000
ISN 0036           P(K)=(F+B)*DSIN(C)                                           00100100
ISN 0037           GO TO 12                                                     00100200
ISN 0038        22 A=DSIN(.5*C)                                                 00100300
ISN 0039           P(J)=-2.*A*A-B*DCOS(C)                                       00100400
ISN 0040           P(K)=(1.-B)*DSIN(C)                                          00100500
ISN 0041           GO TO 12                                                     00100600
ISN 0042        23 X=(S-D)/E                                                    00100700
ISN 0043           M=3                                                          00100800
ISN 0044           GO TO 2                                                      00100900
ISN 0045        24 B=A                                                          00101000
ISN 0046           X=(S-F)/G                                                    00101100
ISN 0047           M=4                                                          00101200
ISN 0048           GO TO 9                                                      00101300
ISN 0049        25 P(J)=(P(7)-1.)*B                                             00101400
ISN 0050           P(K)=P(6)*A+P(8)*B                                           00101500
ISN 0051           GO TO 12                                                     00101600
ISN 0052        26 P(J)=0                                                       00101700
ISN 0053           P(K)=0                                                       00101800
ISN 0054           IF(S-D)27,28,28                                              00101900
ISN 0055        27 P(J)=-1.                                                     00102000
ISN 0056        28 GO TO 12                                                     00102100
ISN 0057         2 Y=4.*X                                                       00102200
ISN 0058           IF(Y+20.) 3,3,4                                              00102300
ISN 0059         3 A=1.                                                         00102400
ISN 0060           GO TO 11                                                     00102500
```

```
ISN 0061          4 IF(Y.LE.50.) GO TO 5                                        00102600
ISN 0063          1 A=0.                                                        00102700
ISN 0064            GO TO 11                                                    00102800
ISN 0065          5 A=DEXP(-Y)                                                  00102900
ISN 0066            A=A/(1.+A)                                                  00103000
ISN 0067            GO TO 11                                                    00103100
ISN 0068          9 Y=3.5254942*DABS(X)                                         00103200
ISN 0069            IF(50.-Y)1,6,6                                              00103300
ISN 0070          6 A=DEXP(-Y)                                                  00103400
ISN 0071            A=4.*A/((1.+A)*(1.+A))                                      00103500
ISN 0072         11 GO TO (19,20,24,25),M                                       00103600
ISN 0073         12 CONTINUE                                                    00103700
ISN 0074            RETURN                                                      00103800
ISN 0075            END                                                         00103900
```

```
ISN 0002            SUBROUTINE POTE(P,PR,PI,N)                                  00104000
                  C-----POTE FUER STRAM                                         00104100
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                   00104200
ISN 0004            DIMENSION P(2),PR(2),PI(2)                                  00104300
ISN 0005            REAL*4 WI(1000)                                             00104400
ISN 0006            COMMON /INPT/KE(42),WI,IN(100)                              00104500
ISN 0007            N=11                                                        00104600
ISN 0008            IF (IN(4).GT.0) N=1                                         00104700
ISN 0010            RETURN                                                      00104800
ISN 0011            END                                                         00104900
```

```
ISN 0002            SUBROUTINE COULPO(KE,P,R,VCC,VDD)                           00105000
                  C-----COULOMBPOTENTIAL ZWISCHEN ZWEI AUSGEDEHNTEN KUGELSYMMETRISCHEN  00105100
                  C     LADUNGSVERTEILUNGEN                                     00105200
                  C                                                             00105300
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                   00105400
ISN 0004            DIMENSION P(1),S(25),VC(400),PP(2,20) ,D(801)               00105500
ISN 0005            REAL*8 PGN(10)/Z40271AD8921466DF,Z402630336A58B322,         00105600
                   *                Z402460691E694A69,Z4021B658BB64DBFB,        00105700
                   *                Z401E41FF31573848,Z401A1817A317A820,        00105800
                   *                Z4015519FE196E249,Z4C100B467DF7E474,        00105900
                   *                Z3FA64DAF529DB3FA,Z3F4825A009D3A2BA/        00106000
```

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ISN 0006            REAL*8 XGN(10)/Z4013973DF98B86AF,Z403A502C6D25177F,                00106100
                   *               Z405FAB33C5594B0F,Z4082C82E09F8FFB4,                00106200
                   *               Z40A2D469FD3886D7,Z40BF0F9B9A352A6F,                00106300
                   *               Z40D6D05EAF7EB739,Z40E988320B9FEC8C,                00106400
                   *               Z40F6C6DD3DEBB4F5,Z40FE3DAD0638E701/                00106500
ISN 0007            REAL*8 PI/3.14159265358979D0/                                      00106600
ISN 0008            REAL*4 WI(1000)                                                    00106700
ISN 0009            COMMON /INPT/KO(42),WI,IN(100)                                     00106800
ISN 0010            DATA NC1/0/,ISMT/0/                                                00106900
ISN 0011            IF(KE.EQ.2) GO TO 10                                               00107000
ISN 0013            NC2=P(3)+.1                                                        00107100
ISN 0014            NP=WI(7)+.1                                                        00107200
ISN 0015            H=P(NP+3)                                                          00107300
ISN 0016            Z1=WI(4)                                                           00107400
ISN 0017            Z2=WI(5)                                                           00107500
ISN 0018            ISM=P(NP+6)+P(NP+7)-1                                              00107600
ISN 0019            IF(NC1.EQ.NC2) GO TO 31                                            00107700
ISN 0021            IF (KO(4).EQ.1) WRITE (6,6001)                                     00107800
ISN 0023         6001 FORMAT (///' PARAMETERS OF CHARGE DISTRIBUTIONS'/)               00107900
ISN 0024            DO 30 I=1,2                                                        00108000
ISN 0025            CALL INPUT(INC,IN1,IW0,IW1)                                        00108100
ISN 0026            NC1=NC2                                                            00108200
ISN 0027            NC=WI(IW0)+.1                                                      00108300
ISN 0028            DO 20 J=1,NC                                                       00108400
ISN 0029            PP(I,J)=WI(IW0+J)                                                  00108500
ISN 0030         20 CONTINUE                                                           00108600
ISN 0031         30 CONTINUE                                                           00108700
ISN 0032         31 IF (ISM.EQ.ISMT) GO TO 10                                          00108800
ISN 0034            IF(ISM.GT.400) ISM=400                                             00108900
ISN 0036            ISMT=ISM                                                           00109000
ISN 0037            ISM1=PP(2,1)/H                                                     00109100
ISN 0038            ISM2=PP(1,1)/H                                                     00109200
ISN 0039            ISM12=ISM1+ISM2                                                    00109300
ISN 0040            IF(ISM12.GT.ISM) ISM12=ISM                                         00109400
                  C-----NORMIERUNG DER LADUNGSVERTEILUNG DES TARGETKERNS               00109500
ISN 0042            S(1)=0.                                                            00109600
ISN 0043            S(2)=PP(2,1)                                                       00109700
ISN 0044            S(5)=.000001D0                                                     00109800
ISN 0045            K=0                                                                00109900
ISN 0046            NF=0                                                               00110000
ISN 0047          1 CALL FORHAD(K,S)                                                   00110100
ISN 0048            GO TO  (2,2,3,3),K                                                 00110200
ISN 0049          2 S(4)=S(3)*S(3)*DEN2(PP,S)                                          00110300
```

```
ISN 0050            NF=NF+1                                                    00110400
ISN 0051            GO TO 1                                                    00110500
ISN 0052          3 IF(NF.LE.5) GO TO 2                                        00110600
ISN 0054            RHOT=Z2/(4.D0*PI*S(4))                                     00110700
                  C-----BERECHNUNG VON FX                                      00110800
ISN 0055            ISM22=2*ISM12+1                                            00110900
ISN 0056            CALL FX(H,ISM22,PP,D,Z1)                                   00111000
ISN 0057            DO 4 IS12=1,ISM12                                          00111100
ISN 0058          4 VC(IS12)=0.D0                                              00111200
                  C-----R-ALPHA PUNKTE                                         00111300
ISN 0059            R1=0.D0                                                    00111400
ISN 0060            DO 7 IS1=1,ISM1                                            00111500
ISN 0061            R1=R1+H                                                    00111600
ISN 0062            S(3)=R1                                                    00111700
ISN 0063            SIM=(1+MOD(IS1,2))*R1*R1*DEN2(PP,S)*RHOT                   00111800
                  C-----FO VON R, R-ALPHA                                      00111900
ISN 0064            DO 6 IS12=1,ISM12                                          00112000
ISN 0065            A=(IS1*IS1+IS12*IS12)*H*H                                  00112100
ISN 0066            B=2.D0*IS1*IS12*H*H                                        00112200
ISN 0067            FO=0.D0                                                    00112300
                  C-----WINKELINTEGRATION                                      00112400
ISN 0068            DO 5 I=1,10                                                00112500
ISN 0069            C=A-B*XGN(I)                                               00112600
ISN 0070            C=DSQRT(C)                                                 00112700
ISN 0071            J=C/H                                                      00112800
ISN 0072            X=C/H-J                                                    00112900
ISN 0073            F=.5D0*(D(J)+X*(D(J+1)-D(J)))                              00113000
ISN 0074            C=A+B*XGN(I)                                               00113100
ISN 0075            C=DSQRT(C)                                                 00113200
ISN 0076            J=C/H                                                      00113300
ISN 0077            X=C/H-J                                                    00113400
ISN 0078            F=F+.5D0*(D(J)+X*(D(J+1)-D(J)))                            00113500
ISN 0079          5 FO=FO+F*PGN(I)                                             00113600
ISN 0080          6 VC(IS12)=VC(IS12)+SIM*FO                                   00113700
ISN 0081          7 CONTINUE                                                   00113800
                  C-----NORMIERUNG                                             00113900
ISN 0082            A=1.43985*P(NP+4)/(H*ISM12*VC(ISM12))                      00114000
ISN 0083            DO 8 IS12=1,ISM12                                          00114100
ISN 0084          8 VC(IS12)=A*VC(IS12)                                        00114200
ISN 0085            IF (ISM12.GE.ISM) RETURN                                   00114300
ISN 0087            DO 9 IS=ISM12,ISM                                          00114400
ISN 0088            A=DFLOAT(ISM12)/DFLOAT(IS)                                 00114500
ISN 0089          9 VC(IS)=VC(ISM12)*A                                         00114600
```

```
ISN 0090            RETURN                                                    00114700
                  C-----INTERPOLATION                                         00114800
ISN 0091             10 J=R/H                                                 00114900
ISN 0092                X=R/H-J                                               00115000
ISN 0093                IF(J.EQ.ISM) GO TO 11                                 00115100
ISN 0095                IF(J.EQ.0) GO TO 13                                   00115200
ISN 0097                VCC=VC(J)+X*(VC(J+1)-VC(J))                           00115300
ISN 0098                IF(J.EQ.1) GO TO 12                                   00115400
ISN 0100                VDD=(VC(J+1)-VC(J-1))/(2.D0*H)                        00115500
ISN 0101                RETURN                                                00115600
ISN 0102             11 VCC=VC(J)+X*(VC(J)-VC(J-1))                           00115700
ISN 0103                VDD=(VC(J)-VC(J-1))/H                                 00115800
ISN 0104                RETURN                                                00115900
ISN 0105             12 VDD=(VC(J+1)-VC(J))/H                                 00116000
ISN 0106                RETURN                                                00116100
ISN 0107             13 VCC=2.*VC(1)-VC(2)                                    00116200
ISN 0108                VDD=(VC(2)-VC(1))/H                                   00116300
ISN 0109                RETURN                                                00116400
ISN 0110                END                                                   00116500
```



```
ISN 0002            SUBROUTINE FX(H,ISM12,PP,D,Z1)                            00116600
                  C-----COULOMBPOTENTIAL EINER KUGELSYMMETRISCHEN LADUNGSVERTEILUNG IM    00116700
                  C     ABSTAND X=I*H, I=1,ISM12                              00116800
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                 00116900
ISN 0004            DIMENSION PP(2,20),S(25),D(500)                           00117000
ISN 0005            REAL*8 PI/3.1415926535897930/                             00117100
                  C-----NORMIERUNG                                            00117200
ISN 0006            S(1)=0.D0                                                 00117300
ISN 0007            S(2)=PP(1,1)                                              00117400
ISN 0008            S(5)=.000001D0                                            00117500
ISN 0009            K=0                                                       00117600
ISN 0010            NF=0                                                      00117700
ISN 0011             1 CALL FORHAD (K,S)                                      00117800
ISN 0012               GO TO (2,2,3,3),K                                      00117900
ISN 0013             2 S(4)=S(3)*S(3)*DEN1(PP,S)                              00118000
ISN 0014               NF=NF+1                                                00118100
ISN 0015               GO TO 1                                                00118200
ISN 0016             3 IF(NF.LE.5) GO TO 2                                    00118300
ISN 0018               RHO=Z1/(4.D0*PI*S(4))                                  00118400
```

```
C-----RADIAL-INTEGRATION                                              00118500
ISN 0019        R=0.D0                                                00118600
ISN 0020        DO 10 I=1,ISM12                                       00118700
ISN 0021        F2=0.D0                                               00118800
ISN 0022        R=R+H                                                 00118900
ISN 0023        IF(R.GT.PP(1,1)) GO TO 10                             00119000
ISN 0025        S(1)=0.D0                                             00119100
ISN 0026        S(2)=R                                                00119200
ISN 0027        S(5)=.000005D0                                        00119300
ISN 0028        K=0                                                   00119400
ISN 0029        NF=0                                                  00119500
ISN 0030      4 CALL FORHAD(K,S)                                      00119600
ISN 0031        GO TO (5,5,6,6),K                                     00119700
ISN 0032      5 S(4)=S(3)*S(3)*DEN1(PP,S)*RHO                         00119800
ISN 0033        NF=NF+1                                               00119900
ISN 0034        GO TO 4                                               00120000
ISN 0035      6 IF (NF.LE.5) GO TO 5                                  00120100
ISN 0037        F1=S(4)                                               00120200
ISN 0038        S(1)=R                                                00120300
ISN 0039        S(2)=PP(1,1)                                          00120400
ISN 0040        S(5)=.000005D0                                        00120500
ISN 0041        K=0                                                   00120600
ISN 0042        NF=0                                                  00120700
ISN 0043      7 CALL FORHAD (K,S)                                     00120800
ISN 0044        GO TO (8,8,9,9),K                                     00120900
ISN 0045      8 S(4)=S(3)*DEN1(PP,S)*RHO                              00121000
ISN 0046        NF=NF+1                                               00121100
ISN 0047        GO TO 7                                               00121200
ISN 0048      9 IF(NF.LE.5) GO TO 8                                   00121300
ISN 0050        F2=S(4)                                               00121400
ISN 0051     10 D(I)=4.D0*PI*(F1/R+F2)                                00121500
ISN 0052        RETURN                                                00121600
ISN 0053        END                                                   00121700
```

```
ISN 0002            FUNCTION DEN1(PP,S)                                          00121800
                  C-----GAUSS-LADUNGSVERTEILUNG DES ALPHA-TEILCHENS               00121900
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                    00122000
ISN 0004            DIMENSION PP(2,20),S(2)                                      00122100
ISN 0005            DEN1=0.D0                                                    00122200
ISN 0006            C=PP(1,2)                                                    00122300
ISN 0007            R=S(3)                                                       00122400
ISN 0008            IF (R.GT.PP(1,1)) RETURN                                     00122500
ISN 0010            DEN1=DEXP(-(R*R/(C*C)))                                      00122600
ISN 0011            RETURN                                                       00122700
ISN 0012            END                                                          00122800
```

```
ISN 0002            FUNCTION DEN2(PP,S)                                          00122900
                  C-----3-PARAMETER FERMI-VERTEILUNG DES TARGETS                  00123000
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                    00123100
ISN 0004            DIMENSION PP(2,20),S(2)                                      00123200
ISN 0005            DEN2=0.D0                                                    00123300
ISN 0006            C=PP(2,2)                                                    00123400
ISN 0007            A=PP(2,3)                                                    00123500
ISN 0008            W=PP(2,4)                                                    00123600
ISN 0009            R=S(3)                                                       00123700
ISN 0010            IF (R.GT.PP(2,1)) RETURN                                     00123800
ISN 0012            DEN2=(1.D0+R*R*W/(C*C))/(1.D0+DEXP((R-C)/A))                 00123900
ISN 0013            RETURN                                                       00124000
ISN 0014            END                                                          00124100
```

```
ISN 0002            SUBROUTINE OUTPUT(P,W,F,X,NP,N,M,LA,VARM,CHI2)               00124200
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                    00124300
ISN 0004            DIMENSION P(2),W(2),F(2),T(300),S(300),ST(300),DS(300),VARM(30,30)00124400
                   *,X(2)                                                        00124500
ISN 0005            REAL*4 WI(1000)                                              00124600
ISN 0006            COMMON /INPT/KE(42),WI,IN(100)                               00124700
ISN 0007            TS=5.                                                        00124800
ISN 0008            T2=5.                                                        00124900
ISN 0009            I0=NP+8*LA+6                                                 00125000
ISN 0010            I1=I0+1                                                      00125100
ISN 0011            I2=I1+1                                                      00125200
```

```
ISN 0012            DO 100 I=1,M                                                                00125300
ISN 0013            I0=I0+3                                                                     00125400
ISN 0014            I1=I1+3                                                                     00125500
ISN 0015            I2=I2+3                                                                     00125600
ISN 0016            T(I)=P(I0)                                                                  00125700
ISN 0017            IF (I.GT.1) T2=T(I)-T(I-1)                                                  00125800
ISN 0019            TS=DMIN1(TS,T2)                                                             00125900
ISN 0020            S(I)=P(I1)                                                                  00126000
ISN 0021            ST(I)=P(I1)-F(I)*P(I2)                                                      00126100
ISN 0022            DS(I)=P(I2)                                                                 00126200
ISN 0023          100 CONTINUE                                                                  00126300
ISN 0024            NTS=TS*10.                                                                  00126400
ISN 0025            TS=NTS*.1                                                                   00126500
ISN 0026            IF (TS.LT..5D0) TS=.5D0                                                     00126600
ISN 0028            IF (KE(6).EQ.1) WRITE (6,6001) (T(I),ST(I),S(I),DS(I),F(I),I=1,M)           00126700
ISN 0030         6001 FORMAT (/////' DIFFERENTIAL CROSS SECTIONS (BARN/SR)'/'      THETA00126800
                    1    THEORETICAL   EXPERIMENTAL      ERROR         FUNCTIONS'//      00126900
                    2 (0PF10.2,5X,4(1PD10.3,5X)))                                           00127000
ISN 0031            IF (KE(8).NE.1) GO TO 120                                                   00127100
ISN 0033            J1=NP+8+6*LA                                                                00127200
ISN 0034            J2=J1+LA                                                                    00127300
ISN 0035            J3=NP+8+4*LA                                                                00127400
ISN 0036            J4=J3+LA                                                                    00127500
ISN 0037            WRITE (6,6003)                                                              00127600
ISN 0038         6003 FORMAT (///' SCATTERING AMPLITUDES'/                                      00127700
                    1 '      L             RE(SL-1)          IM(SL)         COS(2SIGL)     00127800
                    2  SIN(2SIGL)')                                                          00127900
ISN 0039            DO 110 I=1,LA                                                               00128000
ISN 0040            I1=I-1                                                                      00128100
ISN 0041            J1=J1+1                                                                     00128200
ISN 0042            J2=J2+1                                                                     00128300
ISN 0043            J3=J3+1                                                                     00128400
ISN 0044            J4=J4+1                                                                     00128500
ISN 0045            WRITE (6,6004) I1,P(J1),P(J2),P(J3),P(J4)                                   00128600
ISN 0046          110 CONTINUE                                                                  00128700
ISN 0047          120 CONTINUE                                                                  00128800
ISN 0048         6004 FORMAT ((5X,I3,9X,4(1PD11.4,5X)))                                         00128900
ISN 0049            KE29=KE(29)                                                                 00129000
ISN 0050            IF (KE(30).EQ.0) GO TO 130                                                  00129100
ISN 0052            GO TO (140,150), KE29                                                       00129200
ISN 0053          140 CALL CSPLOT(M,T,S,ST,DS,TS)                                               00129300
ISN 0054            GO TO 130                                                                   00129400
ISN 0055          150 CALL XYNPL(P,W,F,X,NP,N,M,T,S,ST,DS)                                      00129500
```

```
ISN 0056        130 IF ((KE(7).EQ.0).AND.(KE(31).EQ.0)) GO TO 160                    00129600
ISN 0058            CALL RUTHF(M,NP,P,T,S,ST,DS)                                     00129700
ISN 0059            IF (KE(7).EQ.1) WRITE (6,6002) (T(I),ST(I),S(I),DS(I),I=1,M)     00129800
ISN 0061       6002 FORMAT (///' DIFFERENTIAL CROSS SECTIONS DIVIDED BY THE RUTHERFORD00129900
                   1 CROSS SECTIONS'/'     THETA    THEORETICAL EXPERIMENTAL     ERROR00130000
                   2'/(0PF10.2,4X,3(1PD10.3,3X)))                                   00130100
ISN 0062            IF (KE(31).EQ.0) GO TO 160                                      00130200
ISN 0064            GO TO (170,180), KE29                                           00130300
ISN 0065        170 CALL CSPLOT(M,T,S,ST,DS,TS)                                     00130400
ISN 0066            GO TO 160                                                       00130500
ISN 0067        180 CALL XYNPL(P,W,F,X,NP,N,M,T,S,ST,DS)                            00130600
ISN 0068        160 IF ((KE(9).NE.0).OR.(KE(10).NE.0).OR.(KE(13).NE.0).OR.(KE(14).NE.000130700
                   1)) CALL POTPR(P,W,NP,M,N,VARM,CHI2)                             00130800
ISN 0070            IF (((KE(11).NE.0).OR.(KE(12).NE.0).OR.(KE(13).NE.0).OR.(KE(14).  00130900
                   1NE.0)).AND.(KE(17).NE.0)) CALL DENPR (P,W,NP,M,N,VARM,CHI2)     00131000
ISN 0072            RETURN                                                          00131100
ISN 0073            END                                                             00131200


ISN 0002            SUBROUTINE MOMENT (NUM,W,H,NS,RMS)                              00131300
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                       00131400
ISN 0004            DIMENSION W(2),RMS(10)                                          00131500
ISN 0005            REAL*8 PI/3.1415926535897930/                                   00131600
ISN 0006            DO 1 I=1,10                                                     00131700
ISN 0007            RMS(I)=0.D0                                                     00131800
ISN 0008          1 CONTINUE                                                        00131900
ISN 0009            SIM=.5D0                                                        00132000
ISN 0010            R=-H                                                            00132100
ISN 0011            DO 100 I=1,NS                                                   00132200
ISN 0012            J=I+NUM*NS                                                      00132300
ISN 0013            R=R+H                                                           00132400
ISN 0014            R2=R *R                                                         00132500
ISN 0015            R3=R2*R                                                         00132600
ISN 0016            R4=R3*R                                                         00132700
ISN 0017            R5=R4*R                                                         00132800
ISN 0018            R6=R5*R                                                         00132900
ISN 0019            R7=R6*R                                                         00133000
ISN 0020            R8=R7*R                                                         00133100
ISN 0021            RMS(1)=RMS(1)+SIM*W(J)                                          00133200
ISN 0022            RMS(2)=RMS(2)+SIM*R*W(J)                                        00133300
ISN 0023            IF (R) 20,20,10                                                 00133400
ISN 0024         10 RMS(3)=RMS(3)+SIM*R2*DLOG(R)*W(J)                               00133500
```

```
ISN 0025        20 RMS(4)=RMS(4)+SIM*R2*W(J)                                    00133600
ISN 0026           RMS(5)=RMS(5)+SIM*R3*W(J)                                    00133700
ISN 0027           RMS(6)=RMS(6)+SIM*R4*W(J)                                    00133800
ISN 0028           RMS(7)=RMS(7)+SIM*R5*W(J)                                    00133900
ISN 0029           RMS(8)=RMS(8)+SIM*R6*W(J)                                    00134000
ISN 0030           RMS(9)=RMS(9)+SIM*R7*W(J)                                    00134100
ISN 0031           RMS(10)=RMS(10)+SIM*R8*W(J)                                  00134200
ISN 0032           SIM=1+MOD(I,2)                                               00134300
ISN 0033       100 CONTINUE                                                     00134400
ISN 0034           RMS(1)=(RMS(1)/RMS(4))**(-.5D0)                              00134500
ISN 0035           RMS(2)=(RMS(2)/RMS(4))**(-1.D0)                              00134600
ISN 0036           RMS(6)=(RMS(6)/RMS(4))**(.5D0)                               00134700
ISN 0037           RMS(7)=(RMS(7)/RMS(4))**(1.D0/3.D0)                          00134800
ISN 0038           RMS(8)=(RMS(8)/RMS(4))**(.25D0)                              00134900
ISN 0039           RMS(9)=(RMS(9)/RMS(4))**(.20D0)                              00135000
ISN 0040           RMS(10)=(RMS(10)/RMS(4))**(1.D0/6.D0)                        00135100
ISN 0041           RMS(3)=DEXP(RMS(3)/RMS(4))                                   00135200
ISN 0042           RMS(5)=RMS(5)/RMS(4)                                         00135300
ISN 0043           RMS(4)=RMS(4)*H*8.D0/3.D0*PI                                 00135400
ISN 0044           RMS(4)=DABS(RMS(4))                                          00135500
ISN 0045           RETURN                                                       00135600
ISN 0046           END                                                          00135700
```



```
ISN 0002           SUBROUTINE ERMOM(II,IU,ID,IU1,IU2,VARM,RCTF,CHI2,RMS)        00135800
ISN 0003           IMPLICIT REAL*8 (A-H,O-Z)                                    00135900
ISN 0004           REAL*8 PI/3.14159265358979D0/                                00136000
ISN 0005           DIMENSION VARM(30,30),RMS(10),DRS(9)                         00136100
ISN 0006           FAK=4.D0*RCTF/PI                                             00136200
ISN 0007           DS=0.D0                                                      00136300
ISN 0008           DO 20 K=IU,ID                                                00136400
ISN 0009           I1=K-IU1                                                     00136500
ISN 0010           I2=I1+IU2                                                    00136600
ISN 0011           DO 10 J=IU,ID                                                00136700
ISN 0012           J1=J-IU1                                                     00136800
ISN 0013           J2=J1+IU2                                                    00136900
ISN 0014           DS=DS+VARM(II+I1,II+J1)*(-1.)**(I2+J2)/(I2*J2*PI**2)**2      00137000
ISN 0015        10 CONTINUE                                                     00137100
ISN 0016        20 CONTINUE                                                     00137200
ISN 0017           DS=DS*16.D0*PI**2*RCTF**6*CHI2                               00137300
ISN 0018           DS=DSQRT(DS*2.D0)                                            00137400
```

```
ISN 0019          DO 100 L=1,9                                                                00137500
ISN 0020          LR=L                                                                        00137600
ISN 0021          IF (L.GE.4) LR=L+1                                                          00137700
ISN 0023          DS2=0.D0                                                                    00137800
ISN 0024          DRS(L)=0.D0                                                                 00137900
ISN 0025          F=FAK*(RCTF)**(L-1)                                                         00138000
ISN 0026          DO 50 K=IU,IO                                                               00138100
ISN 0027          I1=K-IU1                                                                    00138200
ISN 0028          I2=I1+IU2                                                                   00138300
ISN 0029          DO 40 J=IU,IO                                                               00138400
ISN 0030          J1=J-IU1                                                                    00138500
ISN 0031          J2=J1+IU2                                                                   00138600
ISN 0032          DS2=DS2+VARM(II+I1,II+J1)*(-1.D0)**(I2+J2)*FUN(L,I2,J2,RCTF)                00138700
                 1 /(I2*J2)**2                                                                00138800
ISN 0033       40 CONTINUE                                                                    00138900
ISN 0034       50 CONTINUE                                                                    00139000
ISN 0035          DS2=DSQRT(DS2*2.D0*CHI2)*F/RMS(4)                                           00139100
ISN 0036          IF (L.EQ.3) GO TO 51                                                        00139200
ISN 0038          LI=IABS(L-3)                                                                00139300
ISN 0039          DRS(L)=1.D0/LI*(DABS(DS2/(RMS(LR)**LI))+DABS(DS/RMS(4)))*RMS(LR)            00139400
ISN 0040          GO TO 100                                                                   00139500
ISN 0041       51 DRS(3)=(DABS(DS2/RMS(3))+DABS(DS/RMS(4)))*RMS(3)                            00139600
ISN 0042      100 CONTINUE                                                                    00139700
ISN 0043          DO 200 I=1,3                                                                00139800
ISN 0044          RMS(I)=DRS(I)                                                               00139900
ISN 0045      200 CONTINUE                                                                    00140000
ISN 0046          RMS(4)=DS                                                                   00140100
ISN 0047          DO 300 I=5,10                                                               00140200
ISN 0048          RMS(I)=DRS(I-1)                                                             00140300
ISN 0049      300 CONTINUE                                                                    00140400
ISN 0050          RETURN                                                                      00140500
ISN 0051          END                                                                         00140600
```

```
ISN 0002          FUNCTION FUN(L,I1,J1,RCTF)                                                  00140700
ISN 0003          IMPLICIT REAL*8 (A-H,O-Z)                                                   00140800
ISN 0004          REAL*8 PI/3.1415926535897930/                                               00140900
ISN 0005          IZ=1                                                                        00141000
ISN 0006          N=I1                                                                        00141100
ISN 0007          XNP=N*PI                                                                    00141200
```

```
ISN 0008          GO TO (1,2,3,4,5,6,7,8,9),L                                    00141300
ISN 0009        1 F=(-1.D0)**(N+1)*PI/N*SI(XNP)                                  00141400
ISN 0010          GO TO (90,100),IZ                                              00141500
ISN 0011        2 F=(-1.D0)**(N+1)+1.D0                                          00141600
ISN 0012          GO TO (90,100),IZ                                              00141700
ISN 0013        3 F=(-1.D0)**N/(N*PI)*SI(XNP)+DLOG(RCTF)                         00141800
ISN 0014          GO TO (90,100),IZ                                              00141900
ISN 0015        4 F=(-1.D0)**(N+1)+1.D0                                          00142000
ISN 0016          F=-F*2.D0/((PI*N)**2)+1.D0                                     00142100
ISN 0017          GO TO (90,100),IZ                                              00142200
ISN 0018        5 F=(PI*N)**2                                                    00142300
ISN 0019          F=1.D0-6.D0/F                                                  00142400
ISN 0020          GO TO (90,100),IZ                                              00142500
ISN 0021        6 F=(-1.D0)**(N+1)+1.D0                                          00142600
ISN 0022          F=-F*2.D0/((PI*N)**2)+1.D0                                     00142700
ISN 0023          F=-F*12.D0/((PI*N)**2)+1.D0                                    00142800
ISN 0024          GO TO (90,100),IZ                                              00142900
ISN 0025        7 F=(PI*N)**2                                                    00143000
ISN 0026          F=1.D0-6.D0/F                                                  00143100
ISN 0027          F=-F*20.D0/((PI*N)**2)+1.D0                                    00143200
ISN 0028          GO TO (90,100),IZ                                              00143300
ISN 0029        8 F=(-1.D0)**(N+1)+1.D0                                          00143400
ISN 0030          F=-F*2.D0/((PI*N)**2)+1.D0                                     00143500
ISN 0031          F=-F*12.D0/((PI*N)**2)+1.D0                                    00143600
ISN 0032          F=-F*30.D0/((PI*N)**2)+1.D0                                    00143700
ISN 0033          GO TO (90,100),IZ                                              00143800
ISN 0034        9 F=(PI*N)**2                                                    00143900
ISN 0035          F=1.D0-6.D0/F                                                  00144000
ISN 0036          F=-F*20.D0/((PI*N)**2)+1.D0                                    00144100
ISN 0037          F=-F*42.D0/((PI*N)**2)+1.D0                                    00144200
ISN 0038          GO TO (90,100),IZ                                              00144300
ISN 0039       90 IZ=2                                                           00144400
ISN 0040          N=JI                                                           00144500
ISN 0041          XNP=N*PI                                                       00144600
ISN 0042          FUN=F                                                          00144700
ISN 0043          GO TO (1,2,3,4,5,6,7,8,9),L                                    00144800
ISN 0044      100 FUN=FUN*F                                                      00144900
ISN 0045          RETURN                                                         00145000
ISN 0046          END                                                            00145100
```

```
ISN 0002            FUNCTION SI(X)                                                  00145200
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                       00145300
ISN 0004            REAL*4 S4,C4,X4                                                 00145400
ISN 0005            REAL*8 PI/3.14159265358979D0/                                   00145500
ISN 0006            X4=X                                                            00145600
ISN 0007            CALL SICI(S4,C4,X4)                                             00145700
ISN 0008            SI=S4+PI/2.D0                                                   00145800
ISN 0009            RETURN                                                          00145900
ISN 0010            END                                                             00146000


                  C-----SCHNELLDRUCKER-PLOT                                         00146100
ISN 0002            SUBROUTINE CSPLOT(M,T,S,ST,DS,TS)                               00146200
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                       00146300
ISN 0004            DIMENSION S(300),ST(300),T(300),DS(300),WMP(500),WTP(500)       00146400
ISN 0005            LOGICAL*1 LINE(101),CROS/'+'/,STAR/'*'/,BLANK/' '/,POINT/'.'/   00146500
ISN 0006            THETA1=IDINT(T(1))                                              00146600
ISN 0007            THETA2=IDINT(T(M)+1.)                                           00146700
ISN 0008            JJ=(THETA2-THETA1)/TS+1.                                        00146800
ISN 0009            THETA=THETA1-TS                                                 00146900
ISN 0010            DO 100 I=1,JJ                                                   00147000
ISN 0011            THETA=THETA+TS                                                  00147100
ISN 0012            A=0.                                                            00147200
ISN 0013            WMP(I)=0.                                                       00147300
ISN 0014            WTP(I)=0.                                                       00147400
ISN 0015            DO 90 II=1,M                                                    00147500
ISN 0016            IF(DABS(THETA-T(II)).GT.0.5*TS) GO TO 90                        00147600
ISN 0018            A=A+1.                                                          00147700
ISN 0019            WMP(I)=WMP(I)+S(II)                                             00147800
ISN 0020            WTP(I)=WTP(I)+ST(II)                                            00147900
ISN 0021         90 CONTINUE                                                        00148000
ISN 0022            IF(A.GT.0.) GO TO 80                                            00148100
ISN 0024            GO TO 100                                                       00148200
ISN 0025         80 WMP(I)=WMP(I)/A                                                 00148300
ISN 0026            WTP(I)=WTP(I)/A                                                 00148400
ISN 0027        100 CONTINUE                                                        00148500
ISN 0028            SMA=0.                                                          00148600
ISN 0029            SMI=1.E50                                                       00148700
ISN 0030            DO 1000 II=1,JJ                                                 00148800
ISN 0031            IF(WTP(II).EQ.0.) GO TO 1000                                    00148900
ISN 0033            IF(WTP(II).GT.SMA) SMA=WTP(II)                                  00149000
```

```
ISN 0035            IF(WTP(II).LT.SMI) SMI=WTP(II)                                  00149100
ISN 0037            IF(WMP(II).EQ.0.) GO TO 1000                                    00149200
ISN 0039            IF(WMP(II).GT.SMA) SMA=WMP(II)                                  00149300
ISN 0041            IF(WMP(II).LT.SMI) SMI=WMP(II)                                  00149400
ISN 0043         1000 CONTINUE                                                      00149500
ISN 0044            IF(SMI.LE.0..OR.SMI.GE.SMA) GO TO 3                             00149600
ISN 0046            NDEC=IDINT(DLOG(SMA/SMI))+1                                     00149700
ISN 0047            SMA=100./NDEC                                                   00149800
ISN 0048            DEC=SMA*(DLOG(10.D0/SMI)-DLOG(1.D0/SMI))                        00149900
ISN 0049            IS=DEC+1.1                                                      00150000
ISN 0050            DO 115 I=1,101                                                  00150100
ISN 0051            LINE(I)=POINT                                                   00150200
ISN 0052            IF (IS.NE.I) GO TO 115                                          00150300
ISN 0054            LINE(I)=CROS                                                    00150400
ISN 0055            IS=IS+DEC                                                       00150500
ISN 0056          115 CONTINUE                                                      00150600
ISN 0057            WRITE (6,1008)                                                  00150700
ISN 0058            WRITE(6,6001) LINE                                              00150800
ISN 0059         6001 FORMAT (30X,101A1)                                            00150900
ISN 0060            DO 110 II=1,101                                                 00151000
ISN 0061          110 LINE(II)=BLANK                                                00151100
ISN 0062         1008 FORMAT('0THETA  SIGMAEXP  SIGMATHE')                          00151200
ISN 0063            THETA=THETA1                                                    00151300
ISN 0064            DO 120 II=1,JJ                                                  00151400
ISN 0065            SK=WTP(II)                                                      00151500
ISN 0066            IF(SK.LE.0.0) SK=SMI                                            00151600
ISN 0068            JS=SMA*DLOG(SK/SMI)+1.1                                         00151700
ISN 0069            IF(WMP(II).GT.0.) SK=WMP(II)                                    00151800
ISN 0071            JC=SMA*DLOG(SK/SMI)+1.1                                         00151900
ISN 0072            SK=SMI                                                          00152000
ISN 0073            JP=SMA*DLOG(SK/SMI)+1.1                                         00152100
ISN 0074            LINE(JC)=CROS                                                   00152200
ISN 0075            LINE(JS)=STAR                                                   00152300
ISN 0076            LINE(JP)=POINT                                                  00152400
ISN 0077            WRITE(6,1009) THETA,WMP(II),WTP(II),LINE                        00152500
ISN 0078         1009 FORMAT(0PF6.1,1P2E10.2,4X,101A1)                              00152600
ISN 0079            THETA=THETA+TS                                                  00152700
ISN 0080            LINE(JP)=BLANK                                                  00152800
ISN 0081            LINE(JS)=BLANK                                                  00152900
ISN 0082          120 LINE(JC)=BLANK                                                00153000
ISN 0083            RETURN                                                          00153100
ISN 0084            3 WRITE (6,6002)                                                00153200
```

```
ISN 0085      6002 FORMAT (//' ERROR IN FAST-PLOT')                                    00153300
ISN 0086           RETURN                                                              00153400
ISN 0087           END                                                                 00153500


ISN 0002           SUBROUTINE RUTHF (M,NP,P,T,S,ST,DS)                                 00153600
ISN 0003           IMPLICIT REAL*8 (A-H,O-Z)                                           00153700
ISN 0004           REAL*4 WI(1000)                                                     00153800
ISN 0005           DIMENSION P(2),S(300),T(300),ST(300),DS(300)                        00153900
ISN 0006           COMMON /INPT/KE(42),WI,IN(100)                                      00154000
ISN 0007           XK=P(NP+2)                                                          00154100
ISN 0008           ETA=.71993173*XK*P(NP+4)/P(NP+1)                                    00154200
ISN 0009           DO 100 I=1,M                                                        00154300
ISN 0010           SR=(ETA/(2.*XK*(DSIN(T(I)/(2.*57.29578)))**2))**2/100.              00154400
ISN 0011           S(I)=S(I)/SR                                                        00154500
ISN 0012           ST(I)=ST(I)/SR                                                      00154600
ISN 0013           DS(I)=DS(I)/SR                                                      00154700
ISN 0014       100 CONTINUE                                                            00154800
ISN 0015           RETURN                                                              00154900
ISN 0016           END                                                                 00155000


ISN 0002           SUBROUTINE XYNPL(P,W,F,X,NP,N,M,T,S,ST,DS)                          00155100
ISN 0003           IMPLICIT REAL*8 (A-H,O-Z)                                           00155200
ISN 0004           DIMENSION P(2),W(2),F(2),T(300),S(300),ST(300),DS(300),X(2)         00155300
ISN 0005           RETURN                                                              00155400
ISN 0006           END                                                                 00155500


ISN 0002           SUBROUTINE DENPR(P,W,NP,M,N,VARM,CHI2)                              00155600
ISN 0003           IMPLICIT REAL*8 (A-H,O-Z)                                           00155700
ISN 0004           DIMENSION P(2),W(2),VARM(30,30)                                     00155800
ISN 0005           RETURN                                                              00155900
ISN 0006           END                                                                 00156000


ISN 0002           SUBROUTINE POTPR(P,W,NP,M,N,VARM,CHI2)                              00156100
ISN 0003           IMPLICIT REAL*8 (A-H,O-Z)                                           00156200
ISN 0004           REAL*4 WI(1000)                                                     00156300
ISN 0005           DIMENSION P(2),PR(2),PI(2),W(2),VARM(30,30),RMS(10)                 00156400
ISN 0006           RETURN                                                              00156500
ISN 0007           END                                                                 00156600
```

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ISN 0002            SUBROUTINE POTE (P,PR,PI,N)                                   00000010
                C                                                                 00000020
                C   WOODS-SAXON POTENTIAL MIT OBERFLAECHENABSORPTION               00000030
                C   UND WOODS-SAXON-QUADRAT                                      00000040
                C   REALTEIL---P(4),P(5),P(6)                                     00000050
                C   IMAGINAERTEIL---P(7),P(8),P(9)                               00000060
                C   OBERFLAECHE  P(10),P(11),P(12)                               00000070
                C   COULOMBRADIUS P(2)                                           00000080
                C   Z*Z P(NP+4)                                                   00000090
ISN 0003            IMPLICIT REAL*8(A-H,O-Z)                                      00000100
ISN 0004            DIMENSION P(2) ,PR(2),PI(2)                                   00000110
ISN 0005            REAL*4 WI(1000)                                               00000120
ISN 0006            COMMON /INPT/KE(42),WI,IN(100)                                00000130
ISN 0007            IF(N)2,1,2                                                    00000140
ISN 0008          1 N= 13                                                         00000150
ISN 0009            IF ((KE(16).NE.1).AND.(KE(16).NE.2)) N=1                      00000160
ISN 0011            NP=N                                                          00000170
ISN 0012            RETURN                                                        00000180
                C   COULOMB INNEN                                                 00000190
ISN 0013          2 IF(N-2)3,4,4                                                  00000200
ISN 0014          3 AH13=P(3)**(1.D0/3.D0)                                        00000210
ISN 0015            IF (KE(15).EQ.0) GO TO 6                                      00000220
ISN 0017            CALL COULPO(1,P,R,VC,VD)                                      00000230
ISN 0018            RETURN                                                        00000240
ISN 0019          6 R=P(2)*AH13                                                   00000250
ISN 0020            A=1.43985*P(NP+4)/R                                           00000260
ISN 0021            V2=-.5* A/(R*R)                                               00000270
ISN 0022            VD=A-R*R* V2                                                  00000280
ISN 0023            PCR=R                                                         00000290
ISN 0024            RETURN                                                        00000300
ISN 0025          4 R=P(1)                                                        00000310
ISN 0026            IF (KE(15).EQ.0) GO TO 7                                      00000320
ISN 0028            CALL COULPO(2,P,R,VC,VD)                                      00000330
ISN 0029            GO TO 19                                                      00000340
ISN 0030          7 IF(R-PCR)5,18,18                                              00000350
ISN 0031          5 VC=VD+R*R* V2                                                 00000360
ISN 0032            VD=R* 2.*V2                                                   00000370
ISN 0033            GO TO 19                                                      00000380
                C   COULOMB AUSSEN                                                00000390
ISN 0034         18 VC=1.43985*P(NP+4)/R                                          00000400
ISN 0035            VD=-VC/R                                                      00000410
                C   REALTEIL                                                     00000420
ISN 0036         19 S=R-P(5)*AH13                                                 00000430
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ISN 0037            A=P(6)                                                00000440
ISN 0038            IF (KE(16).EQ.2) GO TO 519                            00000450
ISN 0040            Y=1.D0/(1.D0+DEXP(S/A))                               00000460
ISN 0041            Z=-DEXP(S/A)/ A*Y*Y                                   00000470
ISN 0042            PR(1)=VC-P(4)*Y                                       00000480
ISN 0043            PR(2)=VD-P(4)*Z                                       00000490
ISN 0044            GO TO 520                                             00000500
ISN 0045          519 Y=1.D0/(1.D0+DEXP(S/A))                             00000510
ISN 0046            Z=Y*Y*Y*DEXP(S/A)*(-2.D0/A)                           00000520
ISN 0047            Y=Y*Y                                                 00000530
ISN 0048            PR(1)=VC-P(4)*Y                                       00000540
ISN 0049            PR(2)=VD-P(4)*Z                                       00000550
ISN 0050          520 KEW=KE(18)                                          00000560
                  C     VOLUMENABSORPTION                                 00000570
ISN 0051            GO TO (170,180),KEW                                   00000580
ISN 0052          170 SS=R-P(8)*AH13                                      00000590
ISN 0053            A=P(9)                                                00000600
ISN 0054            Y=1.D0/(1.D0+DEXP(SS/A))                              00000610
ISN 0055            Z=-DEXP(SS/A)/A*Y*Y                                   00000620
ISN 0056            PI(1)=-P(7)*Y                                         00000630
ISN 0057            PI(2)=-P(7)*Z                                         00000640
                  C     OBERFLAECHENABSORPTION                            00000650
ISN 0058            WD=P(10)                                              00000660
ISN 0059            IF(WD) 30,31,30                                       00000670
ISN 0060           30 SS=R-P(11)*AH13                                     00000680
ISN 0061            A=P(12)                                               00000690
ISN 0062            Z=DEXP(SS/A)                                          00000700
ISN 0063            VV=1.D0+Z                                             00000710
ISN 0064            Y=Z/(VV*VV)                                           00000720
ISN 0065            Z=Y*(1.D0-2.D0*Z/VV)/A                                00000730
ISN 0066            PI(1)=PI(1)-4.D0*WD*Y                                 00000740
ISN 0067            PI(2)=PI(2)-4.D0*WD*Z                                 00000750
ISN 0068           31 RETURN                                              00000760
                  C    IMAGINAERTEIL VOLUMEN                            00000770
ISN 0069          180 SS=R-P(8)*AH13                                      00000780
ISN 0070            A=P(9)                                                00000790
ISN 0071            Y=1.D0/(1.D0+DEXP(SS/A))                              00000800
ISN 0072            Z=Y*Y*Y*DEXP(SS/A)*(-2.D0/A)                          00000810
ISN 0073            Y=Y*Y                                                 00000820
ISN 0074            PI(1)=-P(7)*Y                                         00000830
ISN 0075            PI(2)=-P(7)*Z                                         00000840
                  C     OBERFLAECHENABSORPTION                            00000850
ISN 0076            WD=P(10)                                              00000860
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ISN 0077            IF(WD) 230,231,230                                                  00000870
ISN 0078          230 SS=R-P(11)*AH13                                                   00000880
ISN 0079            A=P(12)                                                             00000890
ISN 0080            Y1=1.D0/(1.D0+DEXP(SS/A))                                           00000900
ISN 0081            Y2=DEXP(SS/A)                                                       00000910
ISN 0082            Y=Y1**3*Y2*(-2.D0/A)                                                00000920
ISN 0083            Z=Y1**4*Y2*Y2*6.D0/(A**2)-Y1**3*Y2*2.D0/(A**2)                      00000930
ISN 0084            PI(1)=PI(1)+4.D0*WD*Y*A                                             00000940
ISN 0085            PI(2)=PI(2)+4.D0*WD*Z*A                                             00000950
ISN 0086          231 RETURN                                                            00000960
ISN 0087            END                                                                 00000970


                  C-----POTENTIAL PRINT                                                 00000980
ISN 0002            SUBROUTINE POTPR(P,W,NP,M,N,VARM,CHI2)                              00000990
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                           00001000
ISN 0004            REAL*4 WI(1000)                                                     00001010
ISN 0005            DIMENSION P(2),PR(2),PI(2),W(2),VARM(30,30),RMS(10)                 00001020
ISN 0006            COMMON /INPT/KE(42),WI,IN(100)                                      00001030
ISN 0007            COMMON /IFIT/IA(30),NC,ID                                           00001040
ISN 0008            NRC=P(NP+3)*(P(NP+6)+P(NP+7)-1.)+1.                                 00001050
ISN 0009            RC=NRC                                                              00001060
ISN 0010            H=.1D0                                                              00001070
ISN 0011            AH13=P(3)**(1.D0/3.D0)                                              00001080
ISN 0012            NA2=WI(2)+.2                                                        00001090
ISN 0013            HA=P(NP+3)                                                          00001100
ISN 0014            NSA=P(NP+6)                                                         00001110
ISN 0015            MSA=P(NP+7)                                                         00001120
ISN 0016            P(NP+3)=H                                                           00001130
ISN 0017            NS=RC/H+2                                                           00001140
ISN 0018            MS=0                                                                00001150
ISN 0019            P(NP+6)=NS                                                          00001160
ISN 0020            P(NP+7)=MS                                                          00001170
ISN 0021            NN=1                                                                00001180
ISN 0022            CALL POTE(P,PR,PI,NN)                                               00001190
ISN 0023            IF (KE(15).EQ.1) GO TO 6                                            00001200
ISN 0025            R=P(2)*AH13                                                         00001210
ISN 0026            A=1.43985*P(NP+4)/R                                                 00001220
ISN 0027            V2=-.5*A/(R*R)                                                      00001230
ISN 0028            V0=A-R*R*V2                                                         00001240
ISN 0029          6 IF (KE(9).EQ.1) WRITE(6,6000)                                       00001250
ISN 0031       6000 FORMAT (///' ',10X,'R',15X,'REAL',13X,'REAL+COULOMB',8X,          00001260
                   1 'IMAGINARY',11X,'COULOMB')                                       00001270
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ISN 0032          9 R=-H                                                                00001280
ISN 0033            DO 2 I=1,NS                                                         00001290
ISN 0034            R=R+H                                                               00001300
ISN 0035            P(1)=R                                                              00001310
ISN 0036            W(I)=0.D0                                                           00001320
ISN 0037            W(I+NS)=0.D0                                                        00001330
ISN 0038            W(I+2*NS)=0.D0                                                      00001340
ISN 0039            CALL POTE(P,PR,PI,NP)                                               00001350
ISN 0040            IF(KE(15).EQ.0) GO TO 3                                             00001360
ISN 0042            CALL COULPO(2,P,R,VC,VD)                                            00001370
ISN 0043            GO TO 1                                                             00001380
ISN 0044          3 IF (R-P(2)*AH13) 4,5,5                                              00001390
ISN 0045          4 VC=V0+R*R*V2                                                        00001400
ISN 0046            GO TO 1                                                             00001410
ISN 0047          5 VC=1.43985*P(NP+4)/R                                                00001420
ISN 0048          1 PR(2)=PR(1)                                                         00001430
ISN 0049            PR(1)=PR(1)-VC                                                      00001440
ISN 0050            W(I)=PR(1)                                                          00001450
ISN 0051            W(I+NS)=PI(1)                                                       00001460
ISN 0052            IF (KE(9).EQ.1) WRITE(6,6100) R,PR(1),PR(2),PI(1),VC                00001470
ISN 0054          2 CONTINUE                                                            00001480
ISN 0055       6100 FORMAT(' ',0PF15.3,5X,4(1PD15.7,5X))                                00001490
ISN 0056       6300 FORMAT (///' REAL POTENTIAL')                                       00001500
ISN 0057         31 KMR=MOD(KE(14),10)                                                  00001510
ISN 0058            IF ((KE(10).EQ.0).AND.(KMR.EQ.0)) GO TO 30                          00001520
ISN 0060            NV=0                                                                00001530
ISN 0061            WRITE (6,6300)                                                      00001540
ISN 0062            CALL MOMENT(NV,W,H,NS,RMS)                                          00001550
ISN 0063            WRITE (6,6001) (RMS(I),I=1,3),(RMS(I),I=5,10)                       00001560
ISN 0064       6001 FORMAT (//' K-TH MOMENT FOR K = -2, -1, ...,+5, +6'/9(F12.5,2X))    00001570
ISN 0065            VOL=RMS(4)/(P(3)*NA2)                                               00001580
ISN 0066            WRITE (6,6002) RMS(4),VOL                                           00001590
ISN 0067       6002 FORMAT (/' VOLUME = ',1PD12.5,'   PER NUCLEON PAIR = ',1PD12.5)     00001600
ISN 0068            IF (KMR.GT.0) WRITE (8,7001) RMS                                    00001610
ISN 0070       6400 FORMAT (///' IMAGINARY POTENTIAL')                                  00001620
ISN 0071         32 KMI=MOD(KE(14),100)/10                                              00001630
ISN 0072            IF ((KE(10).LT.2).AND.(KMI.EQ.0)) GO TO 30                          00001640
ISN 0074            NV=1                                                                00001650
ISN 0075            WRITE (6,6400)                                                      00001660
ISN 0076            CALL MOMENT(NV,W,H,NS,RMS)                                          00001670
ISN 0077            VOL=RMS(4)/(P(3)*NA2)                                               00001680
ISN 0078            WRITE (6,6001) (RMS(I),I=1,3),(RMS(I),I=5,10)                       00001690
ISN 0079            WRITE (6,6002) RMS(4),VOL                                           00001700
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ISN 0080          IF (KMI.GT.0) WRITE (8,7001) RMS                          00001710
ISN 0082       30 P(NP+3)=HA                                                00001720
ISN 0083          P(NP+6)=NSA                                               00001730
ISN 0084          P(NP+7)=MSA                                               00001740
ISN 0085          IWP=NS                                                    00001750
ISN 0086          IWS=1                                                     00001760
ISN 0087          KPR=MOD(KE(13),10)                                        00001770
ISN 0088          IF (KPR.GT.0) WRITE (7,7001) (W(I),I=IWS,IWP)             00001780
ISN 0090          IWP=IWP+NS                                                00001790
ISN 0091          IWS=IWS+NS                                                00001800
ISN 0092          KPI=MOD(KE(13),100)/10                                    00001810
ISN 0093          IF (KPI.GT.0) WRITE (7,7001) (W(I),I=IWS,IWP)             00001820
ISN 0095     7001 FORMAT ((5X,'*',6(1PD10.3,',')))                          00001830
ISN 0096          RETURN                                                    00001840
ISN 0097          END                                                       00001850
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ISN 0002              SUBROUTINE POTE(P,PR,PI,N)                                        00000010
                C                                                                       00000020
                C     FOURIER-BESSEL REIHE PLUS                                         00000030
                C     WOODS-SAXON POTENTIAL MIT OBERFLAECHENABSORPTION                   00000040
                C     ODER WOODS-SAXON QUADRAT                                          00000050
                C     REALTEIL---P(4),P(5),P(6)                                         00000060
                C     IMAGINAERTEIL---P(7),P(8),P(9)                                    00000070
                C     OBERFLAECHE  P(10),P(11),P(12)                                    00000080
                C     COULOMBRADIUS P(2)                                                00000090
                C     Z*Z P(NP+4)                                                       00000100
                C                                                                       00000110
                C     CUT-OFF RADIEN :REAL=P(13); IMAG=P(29)                            00000120
                C     FB-KOEFFIZIENTEN: REAL=P(14)-P(28); IMAG=P(30)-P(41)              00000130
ISN 0003              IMPLICIT REAL*8(A-H,O-Z)                                          00000140
ISN 0004              DIMENSION P(2) ,PR(2),PI(2)                                       00000150
ISN 0005              REAL*4 WI(1000)                                                   00000160
ISN 0006              REAL*8 PII/3.141592653589793/                                     00000170
ISN 0007              COMMON /INPT/KE(42),WI,IN(100)                                    00000180
ISN 0008              COMMON /IFIT/IA(30),NC,ID                                         00000190
ISN 0009              IF(N)2,1,2                                                        00000200
ISN 0010            1 N= 42                                                           00000210
ISN 0011              IF (((KE(16).NE.3).AND.(KE(16).NE.4)).AND.((KE(18).NE.3).AND.(KE(100000220
                     1 8).NE.4))) N=1                                                 00000230
ISN 0013              NP=N                                                              00000240
ISN 0014              RETURN                                                            00000250
                C     COULOMB INNEN                                                     00000260
ISN 0015            2 IF(N-2)3,4,4                                                    00000270
ISN 0016            3 AH13=P(3)**(1.D0/3.D0)                                          00000280
ISN 0017              RCTF=P(13)                                                        00000290
ISN 0018              NF=IN(8)                                                          00000300
ISN 0019              IU=14                                                             00000310
ISN 0020              IO=IA(NF)                                                         00000320
ISN 0021              IF (IO.EQ.NP) IO=IA(NF-1)                                         00000330
ISN 0023              IF (KE(18).LT.3) GO TO 13                                         00000340
ISN 0025              IOW=IO                                                            00000350
ISN 0026              RCTFW=P(29)                                                       00000360
ISN 0027              DO 11 I=1,NF                                                      00000370
ISN 0028              IF (IA(I).GT.28) GO TO 12                                         00000380
ISN 0030           11 CONTINUE                                                        00000390
ISN 0031           12 IO=IA(I-1)                                                      00000400
ISN 0032              IUW=30                                                            00000410
ISN 0033           13 IF (KE(15).EQ.0) GO TO 6                                       00000420
ISN 0035              CALL COULPO(1,P,R,VC,VD)                                          00000430
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ISN 0036          RETURN                                                        00000440
ISN 0037        6 R=P(2)*AH13                                                   00000450
ISN 0038          A=1.43985*P(NP+4)/R                                           00000460
ISN 0039          V2=-.5* A/(R*R)                                               00000470
ISN 0040          V0=A-R*R* V2                                                  00000480
ISN 0041          PCR=R                                                         00000490
ISN 0042          RETURN                                                        00000500
ISN 0043        4 R=P(1)                                                        00000510
ISN 0044          IF (KE(15).EQ.0) GO TO 7                                      00000520
ISN 0046          CALL COULPO(2,P,R,VC,VD)                                      00000530
ISN 0047          GO TO 19                                                      00000540
ISN 0048        7 IF(R-PCR)5,18,18                                              00000550
ISN 0049        5 VC=V0+R*R* V2                                                 00000560
ISN 0050          VD=R* 2.*V2                                                   00000570
ISN 0051          GO TO 19                                                      00000580
                C     COULOMB AUSSEN                                          00000590
ISN 0052       18 VC=1.43985*P(NP+4)/R                                          00000600
ISN 0053          VD=-VC/R                                                      00000610
                C     REALTEIL                                                00000620
ISN 0054       19 S=R-P(5)*AH13                                                 00000630
ISN 0055          A=P(6)                                                        00000640
ISN 0056          KEV=KE(16)                                                    00000650
ISN 0057          GO TO (518,519,518,519), KEV                                  00000660
ISN 0058      518 Y=1.D0/(1.D0+DEXP(S/A))                                       00000670
ISN 0059          Z=-DEXP(S/A)/ A*Y*Y                                           00000680
ISN 0060          GO TO 520                                                     00000690
ISN 0061      519 Y=1.D0/(1.D0+DEXP(S/A))                                       00000700
ISN 0062          Z=Y*Y*Y*DEXP(S/A)*(-2.D0/A)                                  00000710
ISN 0063          Y=Y*Y                                                         00000720
ISN 0064      520 SYFB=0.D0                                                     00000730
ISN 0065          SZFB=0.D0                                                     00000740
ISN 0066          IF ((R.GE.RCTF).OR.(KE(16).LT.3)) GO TO 191                   00000750
ISN 0068          IF ((KE(19).NE.1).AND.(KE(19).NE.3)) GO TO 521                00000760
ISN 0070          IU1=15                                                        00000770
ISN 0071          P(14)=0.D0                                                    00000780
ISN 0072          DO 522 I=IU1,IO                                               00000790
ISN 0073          II=I-13                                                       00000800
ISN 0074          P(14)=P(14)+P(I)*(-1.D0)**II/II**2                            00000810
ISN 0075      522 CONTINUE                                                      00000820
ISN 0076      521 DO 190 I=IU,IO                                                00000830
ISN 0077          IX=I-13                                                       00000840
ISN 0078          IF (R) 180,180,181                                            00000850
ISN 0079      180 SYFB=SYFB+P(I)                                                00000860
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ISN 0080            GO TO 190                                                   00000870
ISN 0081          181 YFB=PII*R*IX/RCTF                                         00000880
ISN 0082            SYFB=SYFB+P(I)*DSIN(YFB)/YFB                                00000890
ISN 0083            SZFB=SZFB+P(I)*(DCOS(YFB)*PII*IX*YFB/RCTF-                  00000900
                   1 DSIN(YFB)*PII*IX/RCTF)/YFB**2                              00000910
ISN 0084          190 CONTINUE                                                  00000920
ISN 0085          191 CONTINUE                                                  00000930
ISN 0086            PR(1)=VC-P(4)*Y-SYFB                                        00000940
ISN 0087            PR(2)=VD-P(4)*Z-SZFB                                        00000950
                C     IMAGINAERTEIL VOLUMEN                                     00000960
ISN 0088            KEW=KE(18)                                                  00000970
ISN 0089            GO TO (170,220,170,220),KEW                                 00000980
ISN 0090          170 SS=R-P(8)*AH13                                            00000990
ISN 0091            A=P(9)                                                      00001000
ISN 0092            Y=1.D0/(1.D0+DEXP(SS/A))                                    00001010
ISN 0093            Z=-DEXP(SS/A)/A*Y*Y                                         00001020
ISN 0094            PI(1)=-P(7)*Y                                               00001030
ISN 0095            PI(2)=-P(7)*Z                                               00001040
                C     OBERFLAECHENABSORPTION                                    00001050
ISN 0096            WD=P(10)                                                    00001060
ISN 0097            IF(WD) 30,31,30                                             00001070
ISN 0098           30 SS=R-P(11)*AH13                                           00001080
ISN 0099            A=P(12)                                                     00001090
ISN 0100            Z=DEXP(SS/A)                                                00001100
ISN 0101            VV=1.D0+Z                                                   00001110
ISN 0102            Y=Z/(VV*VV)                                                 00001120
ISN 0103            Z=Y*(1.D0-2.D0*Z/VV)/A                                      00001130
ISN 0104            PI(1)=PI(1)-4.D0*WD*Y                                       00001140
ISN 0105            PI(2)=PI(2)-4.D0*WD*Z                                       00001150
ISN 0106           31 IF (KE(18).GT.2) GO TO 500                                00001160
ISN 0108            RETURN                                                      00001170
                C     IMAGINAERTEIL VOLUMEN                                     00001180
ISN 0109          220 SS=R-P(8)*AH13                                            00001190
ISN 0110            A=P(9)                                                      00001200
ISN 0111            Y=1.D0/(1.D0+DEXP(SS/A))                                    00001210
ISN 0112            Z=Y*Y*Y*DEXP(SS/A)*(-2.D0/A)                                00001220
ISN 0113            Y=Y*Y                                                       00001230
ISN 0114            PI(1)=-P(7)*Y                                               00001240
ISN 0115            PI(2)=-P(7)*Z                                               00001250
                C     OBERFLAECHENABSORPTION                                    00001260
ISN 0116            WD=P(10)                                                    00001270
ISN 0117            IF(WD) 230,231,230                                          00001280
ISN 0118          230 SS=R-P(11)*AH13                                           00001290
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ISN 0119            A=P(12)                                                    00001300
ISN 0120            Y1=1.D0/(1.D0+DEXP(SS/A))                                  00001310
ISN 0121            Y2=DEXP(SS/A)                                              00001320
ISN 0122            Y=Y1**3*Y2*(-2.D0/A)                                       00001330
ISN 0123            Z=Y1**4*Y2*Y2*6.D0/(A**2)-Y1**3*Y2*2.D0/(A**2)             00001340
ISN 0124            PI(1)=PI(1)+4.D0*WD*Y*A                                    00001350
ISN 0125            PI(2)=PI(2)+4.D0*WD*Z*A                                    00001360
ISN 0126        231 IF (KE(18).GT.2)GO TO 500                                  00001370
ISN 0128            RETURN                                                     00001380
ISN 0129        500 SYFB=0.D0                                                  00001390
ISN 0130            SZFB=0.D0                                                  00001400
ISN 0131            IF (R.GE.RCTFW) GO TO 391                                  00001410
ISN 0133            IF ((KE(19).NE.2).AND.(KE(19).NE.3)) GO TO 321             00001420
ISN 0135            IU1=31                                                     00001430
ISN 0136            P(30)=0.D0                                                 00001440
ISN 0137            DO 322 I=IU1,IOW                                           00001450
ISN 0138            II=I-29                                                    00001460
ISN 0139            P(30)=P(30)+P(I)*(-1.D0)**II/II**2                         00001470
ISN 0140        322 CONTINUE                                                   00001480
ISN 0141        321 DO 390 I=IUW,IOW                                           00001490
ISN 0142            IX=I-29                                                    00001500
ISN 0143            IF (R) 380,380,381                                         00001510
ISN 0144        380 SYFB=SYFB+P(I)                                             00001520
ISN 0145            GO TO 390                                                  00001530
ISN 0146        381 YFB=PII*R*IX/RCTFW                                         00001540
ISN 0147            SYFB=SYFB+P(I)*DSIN(YFB)/YFB                               00001550
ISN 0148            SZFB=SZFB+P(I)*(DCOS(YFB)*PII*IX*YFB/RCTFW-                00001560
                   1 DSIN(YFB)*PII*IX/RCTFW)/YFB**2                            00001570
ISN 0149        390 CONTINUE                                                   00001580
ISN 0150        391 PI(1)=PI(1)-SYFB                                           00001590
ISN 0151            PI(2)=PI(2)-SZFB                                           00001600
ISN 0152            RETURN                                                     00001610
ISN 0153            END                                                        00001620
```

```
                C-----POTENTIAL PRINT                                                   00001630
ISN 0002              SUBROUTINE POTPR(P,W,NP,M,N,VARM,CHI2)                            00001640
ISN 0003              IMPLICIT REAL*8 (A-H,O-Z)                                         00001650
ISN 0004              REAL*4 WI(1000)                                                   00001660
ISN 0005              DIMENSION P(2),PR(2),PI(2),W(2),VARM(30,30),RMS(10)               00001670
ISN 0006              REAL*8 PJ/3.141592653589793D0/                                    00001680
ISN 0007              COMMON /INPT/KE(42),WI,IN(100)                                    00001690
ISN 0008              COMMON /IFIT/IA(30),NC,ID                                         00001700
ISN 0009              NRC=P(NP+3)*(P(NP+6)+P(NP+7)-1.)+1.                               00001710
ISN 0010              RC=NRC                                                            00001720
ISN 0011              H=.1D0                                                            00001730
ISN 0012              AH13=P(3)**(1.D0/3.D0)                                            00001740
ISN 0013              NA2=WI(2)+.2                                                      00001750
ISN 0014              HA=P(NP+3)                                                        00001760
ISN 0015              NSA=P(NP+6)                                                       00001770
ISN 0016              MSA=P(NP+7)                                                       00001780
ISN 0017              P(NP+3)=H                                                         00001790
ISN 0018              NS=RC/H+2                                                         00001800
ISN 0019              MS=0                                                              00001810
ISN 0020              P(NP+6)=NS                                                        00001820
ISN 0021              P(NP+7)=MS                                                        00001830
ISN 0022              NN=1                                                              00001840
ISN 0023              CALL POTE(P,PR,PI,NN)                                             00001850
ISN 0024              IF (KE(15).EQ.1) GO TO 6                                          00001860
ISN 0026              R=P(2)*AH13                                                       00001870
ISN 0027              A=1.43985*P(NP+4)/R                                               00001880
ISN 0028              V2=-.5*A/(R*R)                                                    00001890
ISN 0029              V0=A-R*R*V2                                                       00001900
ISN 0030            6 RCTF=P(13)                                                        00001910
ISN 0031              RCT2=RCTF-.01                                                     00001920
ISN 0032              NF=IN(8)                                                          00001930
ISN 0033              IF (KE(16).LT.3) GO TO 10                                         00001940
ISN 0035              DO 8 I=1,NF                                                       00001950
ISN 0036              IF (IA(I).GT.13) GO TO 9                                          00001960
ISN 0038            8 CONTINUE                                                          00001970
ISN 0039            9 IU=IA(I)                                                          00001980
ISN 0040              IU1=IU-1                                                          00001990
ISN 0041              IU2=IU-14                                                         00002000
ISN 0042              II=I-1                                                            00002010
ISN 0043           10 IO=IA(NF)                                                         00002020
ISN 0044              IF (IO.EQ.NP) IO=IA(NF-1)                                         00002030
ISN 0046              IF (KE(18).LT.3) GO TO 13                                         00002040
ISN 0048              IOW=IO                                                            00002050
```

```
ISN 0049            RCTFW=P(29)                                                          00002060
ISN 0050            RCTFW2=RCTFW-.01                                                     00002070
ISN 0051            DO 11 I=1,NF                                                         00002080
ISN 0052            IF (IA(I).GT.29) GO TO 12                                            00002090
ISN 0054         11 CONTINUE                                                             00002100
ISN 0055         12 IO=IA(I-1)                                                           00002110
ISN 0056            IUW=IA(I)                                                            00002120
ISN 0057            IU1W=IUW-1                                                           00002130
ISN 0058            IU2W=IUW-30                                                          00002140
ISN 0059            IIW=I-1                                                              00002150
ISN 0060         13 IF (KE(9).EQ.1) WRITE (6,6010)                                       00002160
ISN 0062       6010 FORMAT(///' ',7X,'R',8X,'REAL',8X,'ERROR REAL',4X,'ERROR PERC',      00002170
                   1 2X,'REAL+COULOMB',4X,'IMAGINARY',5X,'ERROR IMAG',4X,'ERROR PERC',00002180
                   2 4X,'COULOMB')                                                      00002190
ISN 0063            R=-H                                                                 00002200
ISN 0064            DO 2 I=1,NS                                                          00002210
ISN 0065            R=R+H                                                                00002220
ISN 0066            P(1)=R                                                               00002230
ISN 0067            W(I)=0.D0                                                            00002240
ISN 0068            W(I+NS)=0.D0                                                         00002250
ISN 0069            W(I+2*NS)=0.D0                                                       00002260
ISN 0070            W(I+3*NS)=0.D0                                                       00002270
ISN 0071            DV=0.D0                                                              00002280
ISN 0072            DVW=0.D0                                                             00002290
ISN 0073            CALL POTE(P,PR,PI,NP)                                                00002300
ISN 0074            IF(KE(15).EQ.0) GO TO 3                                              00002310
ISN 0076            CALL COULPO(2,P,R,VC,VD)                                             00002320
ISN 0077            GO TO 1                                                              00002330
ISN 0078         3  IF (R-P(2)*AH13) 4,5,5                                               00002340
ISN 0079         4  VC=V0+R*R*V2                                                         00002350
ISN 0080            GO TO 1                                                              00002360
ISN 0081         5  VC=1.43985*P(NP+4)/R                                                 00002370
ISN 0082         1  PR(2)=PR(1)                                                         00002380
ISN 0083            PR(1)=PR(1)-VC                                                       00002390
ISN 0084            W(I)=PR(1)                                                           00002400
ISN 0085            W(I+2*NS)=PI(1)                                                      00002410
ISN 0086            IF ((KE(17).NE.0).OR.(KE(16).LT.3)) GO TO 90                         00002420
ISN 0088            IF (R.GE.RCT2) GO TO 90                                              00002430
ISN 0090            DO 50 K=IU,IO                                                        00002440
ISN 0091            I1=K-IU1                                                             00002450
ISN 0092            I2=I1+IU2                                                            00002460
ISN 0093            Y=I2*PJ*R/RCTF                                                       00002470
ISN 0094            DO 60 J=IU,IO                                                        00002480
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ISN 0095            J1=J-IU1                                                        00002490
ISN 0096            J2=J1+IU2                                                       00002500
ISN 0097            Z=J2*PJ*R/RCTF                                                  00002510
ISN 0098            IF (R) 70,70,80                                                 00002520
ISN 0099         70 DV=DV+VARM(II+I1,II+J1)                                         00002530
ISN 0100            GO TO 60                                                        00002540
ISN 0101         80 DV=DV+(DSIN(Y)*DSIN(Z)/(Y*Z))*VARM(II+I1,II+J1)                 00002550
ISN 0102         60 CONTINUE                                                        00002560
ISN 0103         50 CONTINUE                                                        00002570
ISN 0104            W(I+NS)=DSQRT(DV*CHI2*2.D0)                                     00002580
ISN 0105            DV=-W(I+NS)/PR(1)*100.                                          00002590
ISN 0106         90 IF (KE(18).LT.3) GO TO 81                                       00002600
ISN 0108            IF (R.GE.RCTFW2) GO TO 81                                       00002610
ISN 0110            DO 150 K=IUW,IOW                                                00002620
ISN 0111            I1=K-IU1W                                                       00002630
ISN 0112            I2=I1+IU2W                                                      00002640
ISN 0113            Y=I2*PJ*R/RCTFW                                                 00002650
ISN 0114            DO 160 J=IUW,IOW                                                00002660
ISN 0115            J1=J-IU1W                                                       00002670
ISN 0116            J2=J1+IU2W                                                      00002680
ISN 0117            Z=J2*PJ*R/RCTFW                                                 00002690
ISN 0118            IF (R) 170,170,180                                              00002700
ISN 0119        170 DV=DV+VARM(IIW+I1,IIW+J1)                                       00002710
ISN 0120            GO TO 160                                                       00002720
ISN 0121        180 DV=DV+(DSIN(Y)*DSIN(Z)/(Y*Z))*VARM(IIW+I1,IIW+J1)               00002730
ISN 0122        160 CONTINUE                                                        00002740
ISN 0123        150 CONTINUE                                                        00002750
ISN 0124            W(I+3*NS)=DSQRT(DV*CHI2*2.D0)                                   00002760
ISN 0125            DV=-W(I+NS)/PR(1)*100.                                          00002770
ISN 0126            DVW=-W(I+3*NS)/PI(1)*100.                                       00002780
ISN 0127         81 IF (KE(9).EQ.1) WRITE (6,6110)R,PR(1),W(I+NS),DV,PR(2),PI(1)    00002790
                   1 ,W(I+3*NS),DVW,VC                                              00002800
ISN 0129            2 CONTINUE                                                      00002810
ISN 0130       6110 FORMAT (' ',0PF10.3,2X,8(1PD12.4,2X))                           00002820
ISN 0131       6300 FORMAT (///' REAL POTENTIAL')                                   00002830
ISN 0132         31 KMR=MOD(KE(14),10)                                              00002840
ISN 0133            IF ((KE(10).EQ.0).AND.(KMR.EQ.0)) GO TO 30                      00002850
ISN 0135            NV=0                                                            00002860
ISN 0136            WRITE (6,6300)                                                  00002870
ISN 0137            CALL MOMENT(NV,W,H,NS,RMS)                                      00002880
ISN 0138            WRITE (6,6001) (RMS(I),I=1,3),(RMS(I),I=5,10)                   00002890
ISN 0139       6001 FORMAT (//' K-TH MOMENT FOR K = -2, -1, ...,+5, +6'/9(F12.5,2X)) 00002900
ISN 0140            VOL=RMS(4)/(P(3)*NA2)                                           00002910
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ISN 0141            WRITE (6,6002) RMS(4),VOL                                          00002920
ISN 0142        6002 FORMAT (/' VOLUME = ',1PD12.5,'   PER NUCLEON PAIR = ',1PD12.5)   00002930
ISN 0143            IF (KMR.GT.0) WRITE (8,7001) RMS                                   00002940
ISN 0145            IF ((KE(17).NE.0).OR.(KE(16).LT.3)) GO TO 32                       00002950
ISN 0147            CALL ERMOM(II,IU,IO,IU1,IU2,VARM,RCTF,CHI2,RMS)                    00002960
ISN 0148            VOL=RMS(4)/(P(3)*NA2)                                              00002970
ISN 0149            WRITE (6,6501) (RMS(I),I=1,3),(RMS(I),I=5,10)                      00002980
ISN 0150        6501 FORMAT ((//' ERRORS OF K-TH MOMENT FOR K = -2, -1, ... ,+5, +6'   00002990
                    1 /9(1PD12.5,2X)))                                                 00003000
ISN 0151            WRITE (6,6502) RMS(4),VOL                                          00003010
ISN 0152        6502 FORMAT (/' ERROR VOLUME = ' ,1PD12.5,'   PER NUCLEON PAIR = ',    00003020
                    1 1PD12.5)                                                         00003030
ISN 0153            IF (KMR.GT.0) WRITE (8,7001) RMS                                   00003040
ISN 0155        6400 FORMAT (///' IMAGINARY POTENTIAL')                                00003050
ISN 0156          32 KMI=MOD(KE(14),100)/10                                            00003060
ISN 0157            IF ((KE(10).LT.2).AND.(KMI.EQ.0)) GO TO 30                         00003070
ISN 0159            NV=2                                                               00003080
ISN 0160            WRITE (6,6400)                                                     00003090
ISN 0161            CALL MOMENT(NV,W,H,NS,RMS)                                         00003100
ISN 0162            VOL=RMS(4)/(P(3)*NA2)                                              00003110
ISN 0163            WRITE (6,6001) (RMS(I),I=1,3),(RMS(I),I=5,10)                      00003120
ISN 0164            WRITE (6,6002) RMS(4),VOL                                          00003130
ISN 0165            IF(KE(18).LT.3) GO TO 30                                           00003140
ISN 0167            CALL ERMOM(IIW,IUW,IOW,IU1W,IU2W,VARM,RCTFW,CHI2,RMS)              00003150
ISN 0168            VOL=RMS(4)/(P(3)*NA2)                                              00003160
ISN 0169            WRITE (6,6501) (RMS(I),I=1,3),(RMS(I),I=5,10)                      00003170
ISN 0170            WRITE (6,6502) RMS(4),VOL                                          00003180
ISN 0171          30 P(NP+3)=HA                                                        00003190
ISN 0172            P(NP+6)=NSA                                                        00003200
ISN 0173            P(NP+7)=MSA                                                        00003210
ISN 0174            IWP=NS                                                             00003220
ISN 0175            IF ((KE(16).GT.2).AND.(KE(16).LT.5)) IWP=IWP+NS                    00003230
ISN 0177            IWS=1                                                              00003240
ISN 0178            KPR=MOD(KE(13),10)                                                 00003250
ISN 0179            KPI=MOD(KE(13),100)/10                                             00003260
ISN 0180            IF (KPR.GT.0) WRITE (6,7001) (W(I),I=IWS,IWP)                      00003270
ISN 0182            IWS=IWP+1                                                          00003280
ISN 0183            IWP=IWP+NS                                                         00003290
ISN 0184            IF (KE(18).GT.2) IWP=IWP+NS                                        00003300
ISN 0186            IF (KPI.GT.0) WRITE (6,7001) (W(I),I=IWS,IWP)                      00003310
ISN 0188        7001 FORMAT ((5X,'*',6(1PD10.3,',')))                                  00003320
ISN 0189            RETURN                                                             00003330
ISN 0190            END                                                                00003340
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ISN 0002            SUBROUTINE POTE (P,PR,PI,N)                                   00000100
                   C-----MIKROSKOPISCHES OPTISCHES POTENTIAL                      00000200
                   C-----GAUSS-INTERACTION MIT DICHTEABHAENGIGKEIT                00000300
                   C-----NEUTRONEN- UND PROTONENVERTEILUNG VERSCHIEDEN            00000400
                   C-----NUKLEONENVERTEILUNG IN FUNCTION DENS BERECHNET           00000500
                   C-----COULOMBRADIUS P(2)                                      00000600
                   C-----MASSENZAHL P(3)                                         00000700
                   C-----Z*Z P(N+4)                                              00000800
                   C-----REALTEIL : NORMIERUNG = P(4)                            00000900
                   C                MUE = P(5)                                   00001000
                   C                GAMMA = P(6)                                 00001100
                   C-----IMAGINAERTEIL : P(7), P(8), P(9)                        00001200
                   C     OBERFLAECHE   : P(10), P(11), P(12)                     00001300
                   C-----DICHTE-CUT-OFF : P(13)                                  00001400
                   C-----COULOMB VC UND VD                                       00001500
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                     00001600
ISN 0004            DIMENSION P(2),PR(2),PI(2),S(25),D(2)                         00001700
ISN 0005            REAL*8 ROO(2)/0.D0,0.D0/                                      00001800
ISN 0006            REAL*4 WI(1000)                                               00001900
ISN 0007            REAL*8 PJ/3.14159265358979D0/                                 00002000
ISN 0008            COMMON /INPT/KE(42),WI,IN(100)                                00002100
ISN 0009            IF(N) 2,1,2                                                   00002200
ISN 0010          1 N=21                                                          00002300
ISN 0011            IF ((KE(16).NE.5).OR.(KE(17).EQ.0)) N=1                       00002400
ISN 0013            NP=N                                                          00002500
ISN 0014            RETURN                                                        00002600
ISN 0015          2 IF(N-2) 3,4,4                                                 00002700
ISN 0016          3 AH13=P(3)**(1.D0/3.D0)                                        00002800
ISN 0017            G=P(5)*P(5)                                                   00002900
ISN 0018            IF (KE(15).EQ.0) GO TO 6                                      00003000
ISN 0020            CALL COULPO(1,P,R,VC,VD)                                      00003100
ISN 0021            GO TO 33                                                      00003200
ISN 0022          6 R=P(2)*AH13                                                   00003300
ISN 0023            A=1.43985*P(NP+4)/R                                           00003400
ISN 0024            V2=-.5*A/(R*R)                                                00003500
ISN 0025            VO=A-R*R*V2                                                   00003600
ISN 0026            PCR=R                                                         00003700
ISN 0027         33 IF (KE(17).EQ.1) GO TO 20                                     00003800
ISN 0029            CALL DPN(ROO,P)                                               00003900
ISN 0030            D(1)=P(3)-P(NP+4)/WI(4)                                       00004000
ISN 0031            D(2)=P(NP+4)/WI(4)                                            00004100
ISN 0032            ROO(2)=ROO(2)*D(2)                                            00004200
ISN 0033            GO TO 21                                                      00004300
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ISN 0034          20 D(1)=P(3)                                                  00004400
ISN 0035          21 S(1)=0.                                                    00004500
ISN 0036             S(2)=P(13)                                                 00004600
ISN 0037             S(5)=.000005D0                                             00004700
ISN 0038             K=0                                                        00004800
ISN 0039             NF=0                                                       00004900
ISN 0040          10 CALL FORHAD(K,S)                                           00005000
ISN 0041             GO TO (11,11,12,12),K                                      00005100
ISN 0042          11 S(4)=S(3)*S(3)*DENS(P,S)                                   00005200
ISN 0043             NF=NF+1                                                    00005300
ISN 0044             GO TO 10                                                   00005400
ISN 0045          12 IF(NF.LE.5) GO TO 11                                       00005500
ISN 0047             ROO(1)=D(1)/(4.D0*PJ*S(4))                                 00005600
ISN 0048             RETURN                                                     00005700
ISN 0049           4 R=P(1)                                                     00005800
ISN 0050             IF (KE(15).EQ.0) GO TO 7                                   00005900
ISN 0052             CALL COULPO(2,P,R,VC,VD)                                   00006000
ISN 0053             GO TO 19                                                   00006100
ISN 0054           7 IF (R-PCR) 5,18,18                                         00006200
ISN 0055           5 VC=V0+R*R*V2                                               00006300
ISN 0056             VD=R*2.*V2                                                 00006400
ISN 0057             GO TO 19                                                   00006500
ISN 0058          18 VC=1.43985*P(NP+4)/R                                       00006600
ISN 0059             VD=-VC/R                                                   00006700
                  C-----INTEGRATION                                            00006800
ISN 0060          19 GR=.1                                                     00006900
ISN 0061             S(1)=0.                                                    00007000
ISN 0062             S(2)=P(13)+3.*P(5)                                         00007100
ISN 0063             S(5)=0.00005D0                                             00007200
ISN 0064             IF(R-GR) 40,80,80                                          00007300
ISN 0065          40 K=0                                                        00007400
ISN 0066             NF=0                                                       00007500
ISN 0067          50 CALL FORHAD(K,S)                                           00007600
ISN 0068             GO TO (60,60,70,70),K                                      00007700
ISN 0069          60 SUM4=ROO(1)*DENS(P,S)                                      00007800
ISN 0070             IF (KE(17).EQ.2) SUM4=SUM4+ROO(2)*DENSP(P,S)               00007900
ISN 0072             SH23=DMAX1(0.D0,SUM4)                                      00008000
ISN 0073             SH23=SH23**(2.D0/3.D0)                                     00008100
ISN 0074             S(4)=SUM4*(1.D0-P(6)*SH23)                                 00008200
ISN 0075             NF=NF+1                                                    00008300
ISN 0076             S(4)=S(4)*DEXP(-S(3)*S(3)/G)*2.*S(3)*S(3)/G                00008400
ISN 0077             GO TO 50                                                   00008500
ISN 0078          70 IF(NF.LE.5) GO TO 60                                       00008600
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ISN 0080          TO=S(4)                                                    00008700
ISN 0081          PR(1)=DEXP(-R*R/G)*TO                                      00008800
ISN 0082          PR(2)=-2.*PR(1)*R/G                                        00008900
ISN 0083          GO TO 150                                                  00009000
ISN 0084       80 K=0                                                        00009100
ISN 0085          NF=0                                                       00009200
ISN 0086       90 CALL FORHAD(K,S)                                           00009300
ISN 0087          GO TO (100,100,110,110),K                                  00009400
ISN 0088      100 SUM4=ROO(1)*DENS(P,S)                                      00009500
ISN 0089          IF (KE(17).EQ.2) SUM4=SUM4+ROO(2)*DENSP(P,S)               00009600
ISN 0091          SH23=DMAX1(0.DO,SUM4)                                      00009700
ISN 0092          SH23=SH23**(2.DO/3.DO)                                     00009800
ISN 0093          S(4)=SUM4*(1.DO-P(6)*SH23)                                 00009900
ISN 0094          NF=NF+1                                                    00010000
ISN 0095          X1=( 2.DO*S(3)*R-R*R-S(3)*S(3))/G                          00010100
ISN 0096          X2=(-2.DO*S(3)*R-R*R-S(3)*S(3))/G                          00010200
ISN 0097          IF (X2+1.D2) 101,102,102                                   00010300
ISN 0098      101 S(4)=S(4)*DEXP(X1)*S(3)                                    00010400
ISN 0099          GO TO 90                                                   00010500
ISN 0100      102 S(4)=S(4)*(DEXP(X1)-DEXP(X2))*S(3)                         00010600
ISN 0101          GO TO 90                                                   00010700
ISN 0102      110 IF(NF.LE.5) GO TO 100                                      00010800
ISN 0104          T=S(4)                                                     00010900
ISN 0105          PR(1)=T/(R*2.DO)                                           00011000
ISN 0106          K=0                                                        00011100
ISN 0107          NF=0                                                       00011200
ISN 0108      120 CALL FORHAD(K,S)                                           00011300
ISN 0109          GO TO (130,130,140,140),K                                  00011400
ISN 0110      130 SUM4=ROO(1)*DENS(P,S)                                      00011500
ISN 0111          IF (KE(17).EQ.2) SUM4=SUM4+ROO(2)*DENSP(P,S)               00011600
ISN 0113          SH23=DMAX1(0.DO,SUM4)                                      00011700
ISN 0114          SH23=SH23**(2.DO/3.DO)                                     00011800
ISN 0115          S(4)=SUM4*(1.DO-P(6)*SH23)                                 00011900
ISN 0116          NF=NF+1                                                    00012000
ISN 0117          S(4)=S(4)*DEXP(-S(3)*S(3)/G)*2*S(3)*S(3)/G                 00012100
ISN 0118          S(4)=S(4)*DCOSH(2.*S(3)*R/G)                               00012200
ISN 0119          GO TO 120                                                  00012300
ISN 0120      140 IF(NF.LE.5) GO TO 130                                      00012400
ISN 0122          TD=S(4)                                                    00012500
ISN 0123          PR(2)=DEXP(-R*R/G)/R*TD-PR(1)*(2.*R/G+1./R)                00012600
ISN 0124      150 F1=2.*PJ*G*P(4)                                            00012700
ISN 0125          PR(1)=VC-F1*PR(1)                                          00012800
ISN 0126          PR(2)=VD-F1*PR(2)                                          00012900
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ISN 0127            KEW=KE(18)                                                    00013000
ISN 0128            GO TO (170,180),KEW                                           00013100
ISN 0129          170 SS=R-P(8)*AH13                                              00013200
ISN 0130            A=P(9)                                                        00013300
ISN 0131            Y=1.D0/(1.D0+DEXP(SS/A))                                      00013400
ISN 0132            Z=-DEXP(SS/A)/A*Y*Y                                           00013500
ISN 0133            PI(1)=-P(7)*Y                                                 00013600
ISN 0134            PI(2)=-P(7)*Z                                                 00013700
                  C     OBERFLAECHENABSORPTION                                    00013800
ISN 0135            WD=P(10)                                                      00013900
ISN 0136            IF(WD) 30,31,30                                               00014000
ISN 0137           30 SS=R-P(11)*AH13                                             00014100
ISN 0138            A=P(12)                                                       00014200
ISN 0139            Z=DEXP(SS/A)                                                  00014300
ISN 0140            VV=1.D0+Z                                                     00014400
ISN 0141            Y=Z/(VV*VV)                                                   00014500
ISN 0142            Z=Y*(1.D0-2.D0*Z/VV)/A                                        00014600
ISN 0143            PI(1)=PI(1)-4.D0*WD*Y                                         00014700
ISN 0144            PI(2)=PI(2)-4.D0*WD*Z                                         00014800
ISN 0145           31 RETURN                                                      00014900
                  C   IMAGINAERTEIL VOLUMEN                                     00015000
ISN 0146          180 SS=R-P(8)*AH13                                              00015100
ISN 0147            A=P(9)                                                        00015200
ISN 0148            Y=1.D0/(1.D0+DEXP(SS/A))                                      00015300
ISN 0149            Z=Y*Y*Y*DEXP(SS/A)*(-2.D0/A)                                  00015400
ISN 0150            Y=Y*Y                                                         00015500
ISN 0151            PI(1)=-P(7)*Y                                                 00015600
ISN 0152            PI(2)=-P(7)*Z                                                 00015700
                  C     OBERFLAECHENABSORPTION                                    00015800
ISN 0153            WD=P(10)                                                      00015900
ISN 0154            IF(WD) 230,231,230                                            00016000
ISN 0155          230 SS=R-P(11)*AH13                                             00016100
ISN 0156            A=P(12)                                                       00016200
ISN 0157            Y1=1.D0/(1.D0+DEXP(SS/A))                                     00016300
ISN 0158            Y2=DEXP(SS/A)                                                 00016400
ISN 0159            Y=Y1**3*Y2*(-2.D0/A)                                          00016500
ISN 0160            Z=Y1**4*Y2*Y2*6.D0/(A**2)-Y1**3*Y2*2.D0/(A**2)                00016600
ISN 0161            PI(1)=PI(1)+4.D0*WD*Y*A                                       00016700
ISN 0162            PI(2)=PI(2)+4.D0*WD*Z*A                                       00016800
ISN 0163          231 RETURN                                                      00016900
ISN 0164            END                                                           00017000
```

```
ISN 0002            SUBROUTINE DPN(ROO,P)                                    00017100
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                00017200
ISN 0004            REAL*4 WI(1000)                                          00017300
ISN 0005            DIMENSION ROO(2),F(25),P(2)                              00017400
ISN 0006            REAL*8 PI/3.141592653589793DO/                           00017500
ISN 0007            DATA NC1/0/                                              00017600
ISN 0008            COMMON /INPT/ KE(42),WI,IN(100)                          00017700
ISN 0009            NC2=WI(3)+.2                                             00017800
ISN 0010            IF (NC1.EQ.NC2) GO TO 10                                 00017900
ISN 0012            NC1=NC2                                                  00018000
                  C-----NORMIERUNG DER PROTONEN-VERTEILUNG                   00018100
ISN 0013            F(1)=0.                                                  00018200
ISN 0014            F(2)=P(13)                                               00018300
ISN 0015            F(5)=.00000100                                           00018400
ISN 0016            K=0                                                      00018500
ISN 0017            NF=0                                                     00018600
ISN 0018          100 CALL FORHAD(K,F)                                       00018700
ISN 0019            GO TO (110,110,120,120), K                               00018800
ISN 0020          110 F(4)=F(3)*F(3)*DENSP(P,F)                              00018900
ISN 0021            NF=NF+1                                                  00019000
ISN 0022            GO TO 100                                                00019100
ISN 0023          120 IF(NF.LE.5) GO TO 110                                  00019200
ISN 0025            ROO(2)=1.DO/(4.DO*PI*F(4))                               00019300
ISN 0026            RHO2=ROO(2)                                              00019400
ISN 0027            RETURN                                                   00019500
ISN 0028           10 ROO(2)=RHO2                                            00019600
ISN 0029            RETURN                                                   00019700
ISN 0030            END                                                      00019800


ISN 0002            FUNCTION DENS(P,S)                                       00019900
                  C-----3-PARAMETER FERMI-VERTEILUNG DER NEUTRONEN ODER MASSE 00020000
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                00020100
ISN 0004            DIMENSION P(2),S(2)                                      00020200
ISN 0005            DENS=0.DO                                                00020300
ISN 0006            C=P(14)*P(3)**(1.DO/3.DO)                                00020400
ISN 0007            A=P(15)                                                  00020500
ISN 0008            W=P(16)                                                  00020600
ISN 0009            R=S(3)                                                   00020700
ISN 0010            IF (R.GT.P(13)) RETURN                                   00020800
ISN 0012            DENS=(1.DO+R*R*W/(C*C))/(1.DO+DEXP((R-C)/A))             00020900
ISN 0013            RETURN                                                   00021000
ISN 0014            END                                                      00021100
```

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ISN 0002            FUNCTION DENSP(P,S)                                          00021200
                  C-----3-PARAMETER FERMI-VERTEILUNG DER PROTONEN                00021300
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                    00021400
ISN 0004            DIMENSION P(2),S(2)                                          00021500
ISN 0005            DENSP=0.D0                                                   00021600
ISN 0006            C=P(17)*P(3)**(1.D0/3.D0)                                    00021700
ISN 0007            A=P(18)                                                      00021800
ISN 0008            W=P(19)                                                      00021900
ISN 0009            R=S(3)                                                       00022000
ISN 0010            IF (R.GT.P(13)) RETURN                                       00022100
ISN 0012            DENSP=(1.D0+R*R*W/(C*C))/(1.D0+DEXP((R-C)/A))                00022200
ISN 0013            RETURN                                                       00022300
ISN 0014            END                                                          00022400
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```
ISN 0002            SUBROUTINE DENPR(P,W,NP,M,N,VARM,CHI2)                       00022500
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                    00022600
ISN 0004            REAL*4 WI(1000)                                              00022700
ISN 0005            DIMENSION P(2),W(2),VARM(30,30),S(25),D(2),CP(2,20),ROO(2)   00022800
ISN 0006            DIMENSION RMS(10)                                            00022900
ISN 0007            REAL*8 PJ/3.14159265358979300/                               00023000
ISN 0008            COMMON /INPT/KE(42),WI,IN(100)                               00023100
ISN 0009            COMMON /IFIT/IA(30),NC,ID                                    00023200
ISN 0010            RC=P(13)                                                     00023300
ISN 0011            AH13=P(3)**(1.D0/3.D0)                                       00023400
ISN 0012            Z2=WI(5)                                                     00023500
ISN 0013            H=.1D0                                                       00023600
ISN 0014            NS=RC/H+2.                                                   00023700
ISN 0015            DRSM=0.D0                                                    00023800
ISN 0016            DRSN=0.D0                                                    00023900
                  C-----LADUNGSVERTEILUNG                                        00024000
ISN 0017            IF (KE(15).EQ.0) GO TO 10                                    00024100
ISN 0019            NW=7                                                         00024200
ISN 0020            DO 1 I=1,4                                                   00024300
ISN 0021            NW=NW+WI(NW)+1.1                                             00024400
ISN 0022          1 CONTINUE                                                     00024500
ISN 0023            NC=WI(NW)+.1                                                 00024600
ISN 0024            DO 2 I=1,NC                                                  00024700
ISN 0025            CP(2,I)=WI(NW+I)                                             00024800
ISN 0026          2 CONTINUE                                                     00024900
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ISN 0027            NW=NW+WI(NW)+1.1                                                00025000
ISN 0028            S(1)=0.                                                         00025100
ISN 0029            S(2)=CP(2,1)                                                    00025200
ISN 0030            S(5)=.000001D0                                                  00025300
ISN 0031            K=0                                                             00025400
ISN 0032            NF=0                                                            00025500
ISN 0033          3 CALL FORHAD(K,S)                                                00025600
ISN 0034            GO TO (4,4,5,5), K                                              00025700
ISN 0035          4 S(4)=S(3)*S(3)*DEN2(CP,S)                                       00025800
ISN 0036            NF=NF+1                                                         00025900
ISN 0037            GO TO 3                                                         00026000
ISN 0038          5 IF (NF.LE.5) GO TO 4                                            00026100
ISN 0040            RHOC=Z2/(4.D0*PJ*S(4))                                          00026200
ISN 0041            WRITE (6,6002) RHOC                                             00026300
ISN 0042       6002 FORMAT (//' DENSITY CHARGE = ',1PD15.5)                         00026400
               C-----PROTONENVERTEILUNG                                             00026500
ISN 0043         10 IF (KE(17).EQ.1) GO TO 20                                       00026600
ISN 0045            CALL DPN(ROO,P)                                                 00026700
ISN 0046            D(1)=P(3)-P(NP+4)/WI(4)                                         00026800
ISN 0047            D(2)=P(NP+4)/WI(4)                                              00026900
ISN 0048            ROO(2)=ROO(2)*D(2)                                              00027000
ISN 0049            GO TO 21                                                        00027100
ISN 0050         20 D(1)=P(3)                                                       00027200
ISN 0051         21 IF (KE(17).LT.1) GO TO 1000                                     00027300
ISN 0053            S(1)=0.                                                         00027400
ISN 0054            S(2)=P(13)                                                      00027500
ISN 0055            S(5)=.000001D0                                                  00027600
ISN 0056            K=0                                                             00027700
ISN 0057            NF=0                                                            00027800
ISN 0058         22 CALL FORHAD(K,S)                                                00027900
ISN 0059            GO TO (23,23,24,24), K                                          00028000
ISN 0060         23 S(4)=S(3)*S(3)*DENS(P,S)                                        00028100
ISN 0061            NF=NF+1                                                         00028200
ISN 0062            GO TO 22                                                        00028300
ISN 0063         24 IF (NF.LE.5) GO TO 23                                           00028400
ISN 0065            ROO(1)=D(1)/(4.D0*PJ*S(4))                                      00028500
ISN 0066            WRITE (6,6004) ROO                                              00028600
ISN 0067       6004 FORMAT (//' DENSITIES MATTER/NEUTRONS AND PROTONS',1P2D15.5)    00028700
ISN 0068            VK=4.D0*PJ*(P(2)*AH13)**3/3.D0                                  00028800
ISN 0069            DCK=P(NP+4)/(WI(4)*VK)                                          00028900
ISN 0070            PHC=P(2)*AH13                                                   00029000
ISN 0071         31 IF (KE(11).EQ.1) WRITE(6,6003)                                  00029100
ISN 0073       6003 FORMAT (///' ',7X,'R',11X,'MATTER',10X,'NEUTRONS',10X,         00029200
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                      1 'PROTONS',10X,'CHARGE')                                                        00029300
ISN 0074           33 R=-H                                                                             00029400
ISN 0075              DO 100 I=1,NS                                                                    00029500
ISN 0076              R=R+H                                                                            00029600
ISN 0077              DM=0.                                                                            00029700
ISN 0078              DN=0.                                                                            00029800
ISN 0079              DP=0.                                                                            00029900
ISN 0080              DC=0.                                                                            00030000
ISN 0081              IF (R.LT.PHC) DC=DCK                                                             00030100
ISN 0083              W(I+NS)=0.D0                                                                     00030200
ISN 0084              W(I+2*NS)=0.D0                                                                   00030300
ISN 0085              W(I+3*NS)=0.D0                                                                   00030400
ISN 0086              S(3)=R                                                                           00030500
ISN 0087              IF (KE(17).EQ.1) GO TO 32                                                        00030600
ISN 0089              DN=DENS(P,S)*ROO(1)                                                              00030700
ISN 0090              DP=DENSP(P,S)*ROO(2)                                                             00030800
ISN 0091              DM=DN+DP                                                                         00030900
ISN 0092              GO TO 35                                                                         00031000
ISN 0093           32 DM=DENS(P,S)*ROO(1)                                                              00031100
ISN 0094           35 IF (KE(15).EQ.1) DC=DEN2(CP,S)*RHOC                                              00031200
ISN 0096              W(I)=DM                                                                          00031300
ISN 0097              W(I+NS)=DN                                                                       00031400
ISN 0098              W(I+2*NS)=DP                                                                     00031500
ISN 0099              W(I+3*NS)=DC                                                                     00031600
ISN 0100           91 IF (KE(11).EQ.1) WRITE (6,6011) R,DM,DN,DP,DC                                    00031700
ISN 0102          100 CONTINUE                                                                         00031800
ISN 0103         6011 FORMAT (' ',0PF10.3,5X,4(1PD12.4,5X))                                            00031900
ISN 0104              IF ((KE(12).EQ.0).AND.(KE(14).EQ.0)) GO TO 203                                   00032000
ISN 0106              KMM=MOD(KE(14),1000)/100                                                         00032100
ISN 0107              KMN=KE(14)/1000                                                                  00032200
ISN 0108              IF (KE(17).NE.2) KMN=0                                                           00032300
ISN 0110              DO 110 I=1,4                                                                     00032400
ISN 0111              ND=I-1                                                                           00032500
ISN 0112              IF (((KE(17).EQ.1).AND.(I.GT.1)).AND.(.NOT.((KE(15).EQ.1).AND.(I.E00032600
                      1 Q.4)))) GO TO 110                                                              00032700
ISN 0114              CALL MOMENT(ND,W,H,NS,RMS)                                                       00032800
ISN 0115              IF (I.EQ.1) WRITE (6,6300)                                                       00032900
ISN 0117         6300 FORMAT (///' MATTER DENSITY')                                                    00033000
ISN 0118              IF (I.EQ.2) WRITE (6,6301)                                                       00033100
ISN 0120         6301 FORMAT (///' NEUTRON DENSITY')                                                   00033200
ISN 0121              IF (I.EQ.3) WRITE (6,6302)                                                       00033300
ISN 0123         6302 FORMAT (///' PROTON DENSITY')                                                    00033400
ISN 0124              IF (I.EQ.4) WRITE (6,6303)                                                       00033500
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ISN 0126      6303 FORMAT (///' CHARGE DENSITY')                                00033600
ISN 0127           WRITE (6,6501) (RMS(J),J=1,3),(RMS(J),J=5,10)              00033700
ISN 0128      6501 FORMAT ((/' K-TH MOMENT FOR K = -2, -1, ... ,+5, +6'       00033800
                  1 /9(1PD12.5,2X)))                                          00033900
ISN 0129           WRITE (6,6502) RMS(4)                                      00034000
ISN 0130      6502 FORMAT (/' VOLUME = ',1PD12.5)                             00034100
ISN 0131           IF ((KMM.GT.0).AND.(I.EQ.1)) WRITE (8,7001) RMS            00034200
ISN 0133           IF ((KMN.GT.0).AND.(I.EQ.2)) WRITE (8,7001) RMS            00034300
ISN 0135       110 CONTINUE                                                   00034400
ISN 0136       203 IWP=NS                                                     00034500
ISN 0137           IWS=1                                                      00034600
ISN 0138           KDM=MOD(KE(13),1000)/100                                   00034700
ISN 0139           KDN=KE(13)/1000                                            00034800
ISN 0140           IF (KE(17).NE.2) KDN=0                                     00034900
ISN 0142           IF (KDM.GT.0) WRITE(7,7001) (W(I),I=IWS,IWP)               00035000
ISN 0144           IWS=IWP+1                                                  00035100
ISN 0145           IWP=IWP+NS                                                 00035200
ISN 0146           IF (KDN.GT.0) WRITE (7,7001) (W(I),I=IWS,IWP)              00035300
ISN 0148      7001 FORMAT((5X,'*',6(1PD10.3,',')))                            00035400
ISN 0149      1000 RETURN                                                     00035500
ISN 0150           END                                                        00035600

                C-----POTENTIAL PRINT                                         00035700
ISN 0002           SUBROUTINE POTPR(P,W,NP,M,N,VARM,CHI2)                     00035800
ISN 0003           IMPLICIT REAL*8 (A-H,O-Z)                                  00035900
ISN 0004           REAL*4 WI(1000)                                            00036000
ISN 0005           DIMENSION P(2),PR(2),PI(2),W(2),VARM(30,30),RMS(10)        00036100
ISN 0006           COMMON /INPT/KE(42),WI,IN(100)                             00036200
ISN 0007           COMMON /IFIT/IA(30),NC,ID                                  00036300
ISN 0008           NRC=P(NP+3)*(P(NP+6)+P(NP+7)-1.)+1.                        00036400
ISN 0009           RC=NRC                                                     00036500
ISN 0010           H=.100                                                     00036600
ISN 0011           AH13=P(3)**(1.D0/3.D0)                                     00036700
ISN 0012           NA2=WI(2)+.2                                               00036800
ISN 0013           HA=P(NP+3)                                                 00036900
ISN 0014           NSA=P(NP+6)                                                00037000
ISN 0015           MSA=P(NP+7)                                                00037100
ISN 0016           P(NP+3)=H                                                  00037200
ISN 0017           NS=RC/H+2                                                  00037300
ISN 0018           MS=0                                                       00037400
ISN 0019           P(NP+6)=NS                                                 00037500
ISN 0020           P(NP+7)=MS                                                 00037600
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ISN 0021            NN=1                                                                00037700
ISN 0022            CALL POTE(P,PR,PI,NN)                                               00037800
ISN 0023            IF (KE(15).EQ.1) GO TO 6                                            00037900
ISN 0025            R=P(2)*AH13                                                         00038000
ISN 0026            A=1.43985*P(NP+4)/R                                                 00038100
ISN 0027            V2=-.5*A/(R*R)                                                      00038200
ISN 0028            V0=A-R*R*V2                                                         00038300
ISN 0029          6 IF (KE(9).EQ.1) WRITE(6,6000)                                       00038400
ISN 0031       6000 FORMAT (///' ',10X,'R',15X,'REAL',13X,'REAL+COULOMB',8X,            00038500
                   1 'IMAGINARY',11X,'COULOMB')                                        00038600
ISN 0032          9 R=-H                                                             00038700
ISN 0033            DO 2 I=1,NS                                                       00038800
ISN 0034            R=R+H                                                             00038900
ISN 0035            P(1)=R                                                            00039000
ISN 0036            W(I)=0.D0                                                         00039100
ISN 0037            W(I+NS)=0.D0                                                      00039200
ISN 0038            W(I+2*NS)=0.D0                                                    00039300
ISN 0039            CALL POTE(P,PR,PI,NP)                                             00039400
ISN 0040            IF(KE(15).EQ.0) GO TO 3                                           00039500
ISN 0042            CALL COULPO(2,P,R,VC,VD)                                          00039600
ISN 0043            GO TO 1                                                           00039700
ISN 0044          3 IF (R-P(2)*AH13) 4,5,5                                            00039800
ISN 0045          4 VC=V0+R*R*V2                                                      00039900
ISN 0046            GO TO 1                                                           00040000
ISN 0047          5 VC=1.43985*P(NP+4)/R                                              00040100
ISN 0048          1 PR(2)=PR(1)                                                       00040200
ISN 0049            PR(1)=PR(1)-VC                                                    00040300
ISN 0050            W(I)=PR(1)                                                        00040400
ISN 0051            W(I+NS)=PI(1)                                                     00040500
ISN 0052            IF (KE(9).EQ.1) WRITE(6,6100) R,PR(1),PR(2),PI(1),VC              00040600
ISN 0054          2 CONTINUE                                                        00040700
ISN 0055       6100 FORMAT(' ',0PF15.3,5X,4(1PD15.7,5X))                            00040800
ISN 0056       6300 FORMAT (///' REAL POTENTIAL')                                   00040900
ISN 0057         31 KMR=MOD(KE(14),10)                                              00041000
ISN 0058            IF ((KE(10).EQ.0).AND.(KMR.EQ.0)) GO TO 30                      00041100
ISN 0060            NV=0                                                            00041200
ISN 0061            WRITE (6,6300)                                                  00041300
ISN 0062            CALL MOMENT(NV,W,H,NS,RMS)                                      00041400
ISN 0063            WRITE (6,6001) (RMS(I),I=1,3),(RMS(I),I=5,10)                   00041500
ISN 0064       6001 FORMAT (//' K-TH MOMENT FOR K = -2, -1, ...,+5, +6'/9(F12.5,2X)) 00041600
ISN 0065            VOL=RMS(4)/(P(3)*NA2)                                           00041700
ISN 0066            WRITE (6,6002) RMS(4),VOL                                       00041800
ISN 0067       6002 FORMAT (/' VOLUME = ',1PD12.5,'   PER NUCLEON PAIR = ',1PD12.5) 00041900
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ISN 0068            IF (KMR.GT.0) WRITE (8,7001) RMS                          00042000
ISN 0070         6400 FORMAT (///' IMAGINARY POTENTIAL')                      00042100
ISN 0071           32 KMI=MOD(KE(14),100)/10                                  00042200
ISN 0072              IF ((KE(10).LT.2).AND.(KMI.EQ.0)) GO TO 30              00042300
ISN 0074              NV=1                                                    00042400
ISN 0075              WRITE (6,6400)                                          00042500
ISN 0076              CALL MOMENT(NV,W,H,NS,RMS)                              00042600
ISN 0077              VOL=RMS(4)/(P(3)*NA2)                                   00042700
ISN 0078              WRITE (6,6001) (RMS(I),I=1,3),(RMS(I),I=5,10)           00042800
ISN 0079              WRITE (6,6002) RMS(4),VOL                               00042900
ISN 0080              IF (KMI.GT.0) WRITE (8,7001) RMS                        00043000
ISN 0082           30 P(NP+3)=HA                                              00043100
ISN 0083              P(NP+6)=NSA                                             00043200
ISN 0084              P(NP+7)=MSA                                             00043300
ISN 0085              IWP=NS                                                  00043400
ISN 0086              IWS=1                                                   00043500
ISN 0087              KPR=MOD(KE(13),10)                                      00043600
ISN 0088              IF (KPR.GT.0) WRITE (7,7001) (W(I),I=IWS,IWP)           00043700
ISN 0090              IWP=IWP+NS                                              00043800
ISN 0091              IWS=IWS+NS                                              00043900
ISN 0092              KPI=MOD(KE(13),100)/10                                  00044000
ISN 0093              IF (KPI.GT.0) WRITE (7,7001) (W(I),I=IWS,IWP)           00044100
ISN 0095         7001 FORMAT ((5X,'*',6(1PD10.3,',')))                        00044200
ISN 0096              RETURN                                                  00044300
ISN 0097              END                                                     00044400
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ISN 0002            SUBROUTINE POTE (P,PR,PI,N)                                   00000100
                   C-----MIKROSKOPISCHES OPTISCHES POTENTIAL                      00000200
                   C-----GAUSS-INTERACTION MIT DICHTEABHAENGIGKEIT                00000300
                   C-----NEUTRONEN- UND PROTONENVERTEILUNG VERSCHIEDEN            00000400
                   C-----NUKLEONENVERTEILUNG IN FUNCTION DENS BERECHNET           00000500
                   C-----COULOMBRADIUS P(2)                                       00000600
                   C-----MASSENZAHL P(3)                                          00000700
                   C-----Z*Z P(N+4)                                               00000800
                   C-----REALTEIL : NORMIERUNG = P(4)                             00000900
                   C                MUE = P(5)                                    00001000
                   C                GAMMA = P(6)                                  00001100
                   C-----IMAGINAERTEIL : P(7), P(8), P(9)                         00001200
                   C     OBERFLAECHE   : P(10), P(11), P(12)                      00001300
                   C-----DICHTE-CUT-OFF : P(42)                                   00001400
                   C-----COULOMB VC UND VD                                        00001500
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                     00001600
ISN 0004            DIMENSION P(2),PR(2),PI(2),S(25),D(2)                         00001700
ISN 0005            REAL*8 ROO(2)/0.D0,0.D0/                                      00001800
ISN 0006            REAL*4 WI(1000)                                               00001900
ISN 0007            REAL*8 PJ/3.14159265358979D0/                                 00002000
ISN 0008            COMMON /INPT/KE(42),WI,IN(100)                                00002100
ISN 0009            COMMON /IFIT/IA(30),NC,ID                                     00002200
ISN 0010            DATA NC1/0/                                                   00002300
ISN 0011            IF(N) 2,1,2                                                   00002400
ISN 0012          1 N=49                                                          00002500
ISN 0013            IF ((KE(16).NE.5).OR.(KE(17).EQ.0)) N=1                       00002600
ISN 0015            NP=N                                                          00002700
ISN 0016            RETURN                                                        00002800
ISN 0017          2 IF(N-2) 3,4,4                                                 00002900
ISN 0018          3 NC2=P(3)                                                      00003000
ISN 0019            AH13=P(3)**(1.D0/3.D0)                                        00003100
ISN 0020            G=P(5)*P(5)                                                   00003200
ISN 0021            NF=IN(8)                                                      00003300
ISN 0022            IO=IA(NF)                                                     00003400
ISN 0023            IF (IO.EQ.NP) IO=IA(NF-1)                                     00003500
ISN 0025            IF (KE(18).LT.3) GO TO 113                                    00003600
ISN 0027            IOW=IO                                                        00003700
ISN 0028            RCTFW=P(29)                                                   00003800
ISN 0029            DO 111 I=1,NF                                                 00003900
ISN 0030            IF (IA(I).GT.28) GO TO 112                                    00004000
ISN 0032        111 CONTINUE                                                      00004100
ISN 0033        112 IO=IA(I-1)                                                    00004200
ISN 0034            IUW=30                                                        00004300
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ISN 0035          IF (IO.LT.14) IO=28                                    00004400
ISN 0037        113 IF (KE(15).EQ.0) GO TO 6                             00004500
ISN 0039          CALL COULPO(1,P,R,VC,VD)                               00004600
ISN 0040          GO TO 33                                               00004700
ISN 0041          6 R=P(2)*AH13                                          00004800
ISN 0042          A=1.43985*P(NP+4)/R                                    00004900
ISN 0043          V2=-.5*A/(R*R)                                         00005000
ISN 0044          VO=A-R*R*V2                                            00005100
ISN 0045          PCR=R                                                  00005200
ISN 0046         33 IF (KE(17).EQ.1) GO TO 20                            00005300
ISN 0048          CALL DPN(ROO,P)                                        00005400
ISN 0049          D(1)=P(3)-P(NP+4)/WI(4)                                00005500
ISN 0050          D(2)=P(NP+4)/WI(4)                                     00005600
ISN 0051          ROO(2)=ROO(2)*D(2)                                     00005700
ISN 0052          GO TO 21                                               00005800
ISN 0053         20 D(1)=P(3)                                            00005900
ISN 0054         21 IF (NC1.EQ.NC2) RETURN                               00006000
ISN 0056          S(1)=0.                                                00006100
ISN 0057          S(2)=P(42)                                             00006200
ISN 0058          S(5)=.00000100                                         00006300
ISN 0059          K=0                                                    00006400
ISN 0060          NF=0                                                   00006500
ISN 0061         10 CALL FORHAD(K,S)                                     00006600
ISN 0062          GO TO (11,11,12,12),K                                  00006700
ISN 0063         11 S(4)=S(3)*S(3)*DENS(P,S)                             00006800
ISN 0064          NF=NF+1                                                00006900
ISN 0065          GO TO 10                                               00007000
ISN 0066         12 IF(NF.LE.5) GO TO 11                                 00007100
ISN 0068          ROO(1)=D(1)/(4.D0*PJ*S(4))                             00007200
ISN 0069          NC1=NC2                                                00007300
ISN 0070          RETURN                                                 00007400
ISN 0071          4 R=P(1)                                               00007500
ISN 0072          IF (KE(15).EQ.0) GO TO 7                               00007600
ISN 0074          CALL COULPO(2,P,R,VC,VD)                               00007700
ISN 0075          GO TO 19                                               00007800
ISN 0076          7 IF (R-PCR) 5,18,18                                   00007900
ISN 0077          5 VC=VO+R*R*V2                                         00008000
ISN 0078          VD=R*2.*V2                                             00008100
ISN 0079          GO TO 19                                               00008200
ISN 0080         18 VC=1.43985*P(NP+4)/R                                 00008300
ISN 0081          VD=-VC/R                                               00008400
                C-----INTEGRATION                                        00008500
ISN 0082         19 GR=.1                                                00008600
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ISN 0083          S(1)=0.                                                    00008700
ISN 0084          S(2)=P(42)+3.*P(5)                                         00008800
ISN 0085          S(5)=0.00005D0                                             00008900
ISN 0086          IF(R-GR) 40,80,80                                          00009000
ISN 0087       40 K=0                                                        00009100
ISN 0088          NF=0                                                       00009200
ISN 0089       50 CALL FORHAD(K,S)                                           00009300
ISN 0090          GO TO (60,60,70,70),K                                      00009400
ISN 0091       60 SUM4=ROO(1)*DENS(P,S)                                      00009500
ISN 0092          IF (KE(17).EQ.2) SUM4=SUM4+ROO(2)*DENSP(P,S)               00009600
ISN 0094          SUM4=SUM4+DEFB(P,S,IO)                                     00009700
ISN 0095          SH23=DMAX1(0.D0,SUM4)                                      00009800
ISN 0096          SH23=SH23**(2.D0/3.D0)                                     00009900
ISN 0097          S(4)=SUM4*(1.D0-P(6)*SH23)                                 00010000
ISN 0098          NF=NF+1                                                    00010100
ISN 0099          S(4)=S(4)*DEXP(-S(3)*S(3)/G)*2.*S(3)*S(3)/G                00010200
ISN 0100          GO TO 50                                                   00010300
ISN 0101       70 IF(NF.LE.5) GO TO 60                                       00010400
ISN 0103          TO=S(4)                                                    00010500
ISN 0104          PR(1)=DEXP(-R*R/G)*TO                                      00010600
ISN 0105          PR(2)=-2.*PR(1)*R/G                                        00010700
ISN 0106          GO TO 150                                                  00010800
ISN 0107       80 K=0                                                        00010900
ISN 0108          NF=0                                                       00011000
ISN 0109       90 CALL FORHAD(K,S)                                           00011100
ISN 0110          GO TO (100,100,110,110),K                                  00011200
ISN 0111      100 SUM4=ROO(1)*DENS(P,S)                                      00011300
ISN 0112          IF (KE(17).EQ.2) SUM4=SUM4+ROO(2)*DENSP(P,S)               00011400
ISN 0114          SUM4=SUM4+DEFB(P,S,IO)                                     00011500
ISN 0115          SH23=DMAX1(0.D0,SUM4)                                      00011600
ISN 0116          SH23=SH23**(2.D0/3.D0)                                     00011700
ISN 0117          S(4)=SUM4*(1.D0-P(6)*SH23)                                 00011800
ISN 0118          NF=NF+1                                                    00011900
ISN 0119          X1=( 2.D0*S(3)*R-R*R-S(3)*S(3))/G                          00012000
ISN 0120          X2=(-2.D0*S(3)*R-R*R-S(3)*S(3))/G                          00012100
ISN 0121          IF (X2+1.D2) 101,102,102                                   00012200
ISN 0122      101 S(4)=S(4)*DEXP(X1)*S(3)                                    00012300
ISN 0123          GO TO 90                                                   00012400
ISN 0124      102 S(4)=S(4)*(DEXP(X1)-DEXP(X2))*S(3)                         00012500
ISN 0125          GO TO 90                                                   00012600
ISN 0126      110 IF(NF.LE.5) GO TO 100                                      00012700
ISN 0128          T=S(4)                                                     00012800
ISN 0129          PR(1)=T/(R*2.D0)                                           00012900
```

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ISN 0130            K=0                                                                 00013000
ISN 0131            NF=0                                                                00013100
ISN 0132          120 CALL FORHAD(K,S)                                                  00013200
ISN 0133            GO TO (130,130,140,140),K                                           00013300
ISN 0134          130 SUM4=ROO(1)*DENS(P,S)                                             00013400
ISN 0135            IF (KE(17).EQ.2) SUM4=SUM4+ROO(2)*DENSP(P,S)                        00013500
ISN 0137            SUM4=SUM4+DEFB(P,S,IO)                                              00013600
ISN 0138            SH23=DMAX1(0.DO,SUM4)                                               00013700
ISN 0139            SH23=SH23**(2.DO/3.DO)                                              00013800
ISN 0140            S(4)=SUM4*(1.DO-P(6)*SH23)                                          00013900
ISN 0141            NF=NF+1                                                             00014000
ISN 0142            S(4)=S(4)*DEXP(-S(3)*S(3)/G)*2*S(3)*S(3)/G                          00014100
ISN 0143            S(4)=S(4)*DCOSH(2.*S(3)*R/G)                                        00014200
ISN 0144            GO TO 120                                                           00014300
ISN 0145          140 IF(NF.LE.5) GO TO 130                                             00014400
ISN 0147            TD=S(4)                                                             00014500
ISN 0148            PR(2)=DEXP(-R*R/G)/R*TD-PR(1)*(2.*R/G+1./R)                         00014600
ISN 0149          150 F1=2.*PJ*G*P(4)                                                   00014700
ISN 0150            PR(1)=VC-F1*PR(1)                                                   00014800
ISN 0151            PR(2)=VD-F1*PR(2)                                                   00014900
ISN 0152            KEW=KE(18)                                                          00015000
ISN 0153            GO TO (170,220,170,220),KEW                                         00015100
ISN 0154          170 SS=R-P(8)*AH13                                                    00015200
ISN 0155            A=P(9)                                                              00015300
ISN 0156            Y=1.DO/(1.DO+DEXP(SS/A))                                            00015400
ISN 0157            Z=-DEXP(SS/A)/A*Y*Y                                                 00015500
ISN 0158            PI(1)=-P(7)*Y                                                       00015600
ISN 0159            PI(2)=-P(7)*Z                                                       00015700
                  C     OBERFLAECHENABSORPTION                                        00015800
ISN 0160            WD=P(10)                                                            00015900
ISN 0161            IF(WD) 30,31,30                                                     00016000
ISN 0162           30 SS=R-P(11)*AH13                                                   00016100
ISN 0163            A=P(12)                                                             00016200
ISN 0164            Z=DEXP(SS/A)                                                        00016300
ISN 0165            VV=1.DO+Z                                                           00016400
ISN 0166            Y=Z/(VV*VV)                                                         00016500
ISN 0167            Z=Y*(1.DO-2.DO*Z/VV)/A                                              00016600
ISN 0168            PI(1)=PI(1)-4.DO*WD*Y                                               00016700
ISN 0169            PI(2)=PI(2)-4.DO*WD*Z                                               00016800
ISN 0170           31 IF (KE(18).GT.2) GO TO 500                                        00016900
ISN 0172            RETURN                                                              00017000
                  C   IMAGINAERTEIL VOLUMEN                                           00017100
ISN 0173          220 SS=R-P(8)*AH13                                                    00017200
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ISN 0174            A=P(9)                                                    00017300
ISN 0175            Y=1.D0/(1.D0+DEXP(SS/A))                                  00017400
ISN 0176            Z=Y*Y*Y*DEXP(SS/A)*(-2.D0/A)                              00017500
ISN 0177            Y=Y*Y                                                     00017600
ISN 0178            PI(1)=-P(7)*Y                                             00017700
ISN 0179            PI(2)=-P(7)*Z                                             00017800
                C   OBERFLAECHENABSORPTION                                    00017900
ISN 0180            WD=P(10)                                                  00018000
ISN 0181            IF(WD) 230,231,230                                        00018100
ISN 0182          230 SS=R-P(11)*AH13                                         00018200
ISN 0183            A=P(12)                                                   00018300
ISN 0184            Y1=1.D0/(1.D0+DEXP(SS/A))                                 00018400
ISN 0185            Y2=DEXP(SS/A)                                             00018500
ISN 0186            Y=Y1**3*Y2*(-2.D0/A)                                      00018600
ISN 0187            Z=Y1**4*Y2*Y2*6.D0/(A**2)-Y1**3*Y2*2.D0/(A**2)            00018700
ISN 0188            PI(1)=PI(1)+4.D0*WD*Y*A                                   00018800
ISN 0189            PI(2)=PI(2)+4.D0*WD*Z*A                                   00018900
ISN 0190          231 IF (KE(18).GT.2)GO TO 500                               00019000
ISN 0192            RETURN                                                    00019100
ISN 0193          500 SYFB=0.D0                                               00019200
ISN 0194            SZFB=0.D0                                                 00019300
ISN 0195            IF (R.GE.RCTFW) GO TO 391                                 00019400
ISN 0197            IF ((KE(19).NE.2).AND.(KE(19).NE.3)) GO TO 321            00019500
ISN 0199            IU1=31                                                    00019600
ISN 0200            P(30)=0.D0                                                00019700
ISN 0201            DO 322 I=IU1,IOW                                          00019800
ISN 0202            II=I-29                                                   00019900
ISN 0203            P(30)=P(30)+P(I)*(-1.D0)**II/II**2                        00020000
ISN 0204          322 CONTINUE                                                00020100
ISN 0205          321 DO 390 I=IUW,IOW                                        00020200
ISN 0206            IX=I-29                                                   00020300
ISN 0207            IF (R) 380,380,381                                        00020400
ISN 0208          380 SYFB=SYFB+P(I)                                          00020500
ISN 0209            GO TO 390                                                 00020600
ISN 0210          381 YFB=PJ*R*IX/RCTFW                                       00020700
ISN 0211            SYFB=SYFB+P(I)*DSIN(YFB)/YFB                              00020800
ISN 0212            SZFB=SZFB+P(I)*(DCOS(YFB)*PJ*IX*YFB/RCTFW-                00020900
                   1 DSIN(YFB)*PJ*IX/RCTFW)/YFB**2                            00021000
ISN 0213          390 CONTINUE                                                00021100
ISN 0214          391 PI(1)=PI(1)-SYFB                                        00021200
ISN 0215            PI(2)=PI(2)-SZFB                                          00021300
ISN 0216            RETURN                                                    00021400
ISN 0217            END                                                       00021500
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ISN 0002            SUBROUTINE DPN(ROO,P)                                    00021600
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                00021700
ISN 0004            REAL*4 WI(1000)                                          00021800
ISN 0005            DIMENSION ROO(2),F(25),P(2)                              00021900
ISN 0006            REAL*8 PI/3.14159265358979300/                           00022000
ISN 0007            DATA NC1/0/                                              00022100
ISN 0008            COMMON /INPT/ KE(42),WI,IN(100)                          00022200
ISN 0009            NC2=WI(3)+.2                                             00022300
ISN 0010            IF (NC1.EQ.NC2) GO TO 10                                 00022400
ISN 0012            NC1=NC2                                                  00022500
                  C-----NORMIERUNG DER PROTONEN-VERTEILUNG                   00022600
ISN 0013            F(1)=0.                                                  00022700
ISN 0014            F(2)=P(42)                                               00022800
ISN 0015            F(5)=.000001D0                                           00022900
ISN 0016            K=0                                                      00023000
ISN 0017            NF=0                                                     00023100
ISN 0018          100 CALL FORHAD(K,F)                                       00023200
ISN 0019            GO TO (110,110,120,120), K                               00023300
ISN 0020          110 F(4)=F(3)*F(3)*DENSP(P,F)                              00023400
ISN 0021            NF=NF+1                                                  00023500
ISN 0022            GO TO 100                                                00023600
ISN 0023          120 IF(NF.LE.5) GO TO 110                                  00023700
ISN 0025            ROO(2)=1.D0/(4.D0*PI*F(4))                               00023800
ISN 0026            RHO2=ROO(2)                                              00023900
ISN 0027            RETURN                                                   00024000
ISN 0028           10 ROO(2)=RHO2                                            00024100
ISN 0029            RETURN                                                   00024200
ISN 0030            END                                                      00024300


ISN 0002            FUNCTION DENS(P,S)                                       00024400
                  C-----3-PARAMETER FERMI-VERTEILUNG DER NEUTRONEN ODER MASSE 00024500
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                00024600
ISN 0004            DIMENSION P(2),S(2)                                      00024700
ISN 0005            DENS=0.D0                                                00024800
ISN 0006            C=P(43)*P(3)**(1.D0/3.D0)                                00024900
ISN 0007            A=P(44)                                                  00025000
ISN 0008            W=P(45)                                                  00025100
ISN 0009            R=S(3)                                                   00025200
ISN 0010            IF (R.GT.P(42)) RETURN                                   00025300
ISN 0012            DENS=(1.D0+R*R*W/(C*C))/(1.D0+DEXP((R-C)/A))             00025400
ISN 0013            RETURN                                                   00025500
ISN 0014            END                                                      00025600
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ISN 0002            FUNCTION DENSP(P,S)                                          00025700
                  C-----3-PARAMETER FERMI-VERTEILUNG DER PROTONEN                00025800
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                    00025900
ISN 0004            DIMENSION P(2),S(2)                                          00026000
ISN 0005            DENSP=0.D0                                                   00026100
ISN 0006            C=P(46)*P(3)**(1.D0/3.D0)                                    00026200
ISN 0007            A=P(47)                                                      00026300
ISN 0008            W=P(48)                                                      00026400
ISN 0009            R=S(3)                                                       00026500
ISN 0010            IF (R.GT.P(42)) RETURN                                       00026600
ISN 0012            DENSP=(1.D0+R*R*W/(C*C))/(1.D0+DEXP((R-C)/A))                00026700
ISN 0013            RETURN                                                       00026800
ISN 0014            END                                                          00026900


                  C-----FOURIER-BESSEL DENS                                      00027000
ISN 0002            FUNCTION DEFB(P,S,IO)                                        00027100
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                    00027200
ISN 0004            REAL*4 WI(1000)                                              00027300
ISN 0005            REAL*8 PI/3.14159265358979300/                               00027400
ISN 0006            DIMENSION P(2),S(2)                                          00027500
ISN 0007            COMMON /INPT/KE(42),WI,IN(100)                               00027600
ISN 0008            DEFB=0.D0                                                    00027700
ISN 0009            R=S(3)                                                       00027800
ISN 0010            IF (R.GT.P(13)) RETURN                                       00027900
ISN 0012            NF=IN(8)                                                     00028000
ISN 0013            RCTF=P(13)                                                   00028100
ISN 0014            IU=14                                                        00028200
ISN 0015            IU1=15                                                       00028300
ISN 0016            P(14)=0.                                                     00028400
ISN 0017            DO 50 I=IU1,IO                                               00028500
ISN 0018            II=I-13                                                      00028600
ISN 0019            P(14)=P(14)+P(I)*(-1.)**II/II**2                             00028700
ISN 0020         50 CONTINUE                                                     00028800
ISN 0021            SYFB=0.D0                                                    00028900
ISN 0022            DO 100 I=IU,IO                                               00029000
ISN 0023            IX=I-13                                                      00029100
ISN 0024            IF (R) 10,10,20                                              00029200
ISN 0025         10 SYFB=SYFB+P(I)                                               00029300
ISN 0026            GO TO 100                                                    00029400
ISN 0027         20 YFB=PI*R*IX/RCTF                                             00029500
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ISN 0028            SYFB=SYFB+P(I)*DSIN(YFB)/YFB                                    00029600
ISN 0029          100 CONTINUE                                                      00029700
ISN 0030            DEFB=DEFB+SYFB                                                  00029800
ISN 0031            RETURN                                                          00029900
ISN 0032            END                                                             00030000


ISN 0002            SUBROUTINE DENPR(P,W,NP,M,N,VARM,CHI2)                          00030100
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                       00030200
ISN 0004            REAL*4 WI(1000)                                                 00030300
ISN 0005            DIMENSION P(2),W(2),VARM(30,30),S(30),D(2),CP(2,20),ROO(2)      00030400
ISN 0006            DIMENSION RMS(10)                                               00030500
ISN 0007            REAL*8 PJ/3.14159265358979300/                                  00030600
ISN 0008            COMMON /INPT/KE(42),WI,IN(100)                                  00030700
ISN 0009            COMMON /IFIT/IA(30),NC,ID                                       00030800
ISN 0010            RC=P(42)                                                        00030900
ISN 0011            AH13=P(3)**(1.D0/3.D0)                                          00031000
ISN 0012            Z2=WI(5)                                                        00031100
ISN 0013            H=.1D0                                                          00031200
ISN 0014            NS=RC/H+2.                                                      00031300
ISN 0015            DRSM=0.D0                                                       00031400
ISN 0016            DRSN=0.D0                                                       00031500
                  C-----LADUNGSVERTEILUNG                                           00031600
ISN 0017            IF (KE(15).EQ.0) GO TO 10                                       00031700
ISN 0019            NW=7                                                            00031800
ISN 0020            DO 1 I=1,4                                                      00031900
ISN 0021            NW=NW+WI(NW)+1.1                                                00032000
ISN 0022          1 CONTINUE                                                        00032100
ISN 0023            NC=WI(NW)+.1                                                    00032200
ISN 0024            DO 2 I=1,NC                                                     00032300
ISN 0025            CP(2,I)=WI(NW+I)                                                00032400
ISN 0026          2 CONTINUE                                                        00032500
ISN 0027            NW=NW+WI(NW)+1.1                                                00032600
ISN 0028            S(1)=0.                                                         00032700
ISN 0029            S(2)=CP(2,1)                                                    00032800
ISN 0030            S(5)=.00000100                                                  00032900
ISN 0031            K=0                                                             00033000
ISN 0032            NF=0                                                            00033100
ISN 0033          3 CALL FORHAD(K,S)                                                00033200
ISN 0034            GO TO (4,4,5,5), K                                              00033300
ISN 0035          4 S(4)=S(3)*S(3)*DEN2(CP,S)                                       00033400
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ISN 0036            NF=NF+1                                                          00033500
ISN 0037            GO TO 3                                                          00033600
ISN 0038          5 IF (NF.LE.5) GO TO 4                                             00033700
ISN 0040            RHOC=Z2/(4.D0*PJ*S(4))                                           00033800
ISN 0041            WRITE (6,6002) RHOC                                              00033900
ISN 0042       6002 FORMAT (//' DENSITY CHARGE = ',1PD15.5)                          00034000
                   C-----PROTONENVERTEILUNG                                         00034100
ISN 0043         10 IF (KE(17).EQ.1) GO TO 20                                       00034200
ISN 0045            CALL DPN(ROO,P)                                                  00034300
ISN 0046            D(1)=P(3)-P(NP+4)/WI(4)                                          00034400
ISN 0047            D(2)=P(NP+4)/WI(4)                                               00034500
ISN 0048            ROO(2)=ROO(2)*D(2)                                               00034600
ISN 0049            GO TO 21                                                         00034700
ISN 0050         20 D(1)=P(3)                                                       00034800
ISN 0051         21 IF (KE(17).LT.1) GO TO 1000                                     00034900
ISN 0053            S(1)=0.                                                          00035000
ISN 0054            S(2)=P(42)                                                       00035100
ISN 0055            S(5)=.000001D0                                                   00035200
ISN 0056            K=0                                                              00035300
ISN 0057            NF=0                                                             00035400
ISN 0058         22 CALL FORHAD(K,S)                                                 00035500
ISN 0059            GO TO (23,23,24,24), K                                           00035600
ISN 0060         23 S(4)=S(3)*S(3)*DENS(P,S)                                        00035700
ISN 0061            NF=NF+1                                                          00035800
ISN 0062            GO TO 22                                                         00035900
ISN 0063         24 IF (NF.LE.5) GO TO 23                                           00036000
ISN 0065            ROO(1)=D(1)/(4.D0*PJ*S(4))                                       00036100
ISN 0066            WRITE (6,6004) ROO                                               00036200
ISN 0067       6004 FORMAT (//' DENSITIES MATTER/NEUTRONS AND PROTONS',1P2D15.5)     00036300
ISN 0068            VK=4.D0*PJ*(P(2)*AH13)**3/3.D0                                   00036400
ISN 0069            DCK=P(NP+4)/(WI(4)*VK)                                           00036500
ISN 0070            PHC=P(2)*AH13                                                    00036600
ISN 0071            RCTF=P(13)                                                       00036700
ISN 0072            RCT2=RCTF-.01                                                    00036800
ISN 0073            NF=IN(8)                                                         00036900
ISN 0074            IO=IA(NF)                                                        00037000
ISN 0075            IF (IO.EQ.NP) IO=IA(NF-1)                                        00037100
ISN 0077            DO 25 I=1,NF                                                     00037200
ISN 0078            IF (IA(I).GT.13) GO TO 26                                        00037300
ISN 0080         25 CONTINUE                                                        00037400
ISN 0081         26 IU=IA(I)                                                        00037500
ISN 0082            II=I-1                                                           00037600
ISN 0083            IU1=IU-1                                                         00037700
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ISN 0084            IU2=IU-14                                                          00037800
ISN 0085            IF (KE(18).LT.3) GO TO 30                                          00037900
ISN 0087            DO 8 I=1,NF                                                        00038000
ISN 0088            IF (IA(I).GT.28) GO TO 9                                           00038100
ISN 0090          8 CONTINUE                                                           00038200
ISN 0091          9 IO=IA(I-1)                                                         00038300
ISN 0092         30 IF (KE(11).EQ.1) WRITE (6,6001)                                    00038400
ISN 0094       6001 FORMAT (///' ',7X,'R',11X,'MATTER',10X,'NEUTRONS',11X,'ERROR',   00038500
                   1 9X,'ERROR PERC',8X,'PROTONS',10X,'CHARGE')                       00038600
ISN 0095         33 R=-H                                                             00038700
ISN 0096            DO 100 I=1,NS                                                    00038800
ISN 0097            R=R+H                                                            00038900
ISN 0098            DM=0.                                                            00039000
ISN 0099            DN=0.                                                            00039100
ISN 0100            DP=0.                                                            00039200
ISN 0101            DC=0.                                                            00039300
ISN 0102            ERR=0.                                                           00039400
ISN 0103            W(I+NS)=0.D0                                                     00039500
ISN 0104            W(I+2*NS)=0.D0                                                   00039600
ISN 0105            W(I+3*NS)=0.D0                                                   00039700
ISN 0106            W(I+4*NS)=0.D0                                                   00039800
ISN 0107            S(3)=R                                                           00039900
ISN 0108            IF (R.LT.PHC) DC=DCK                                             00040000
ISN 0110            KE17=KE(17)                                                      00040100
ISN 0111            GO TO (34,35), KE17                                              00040200
ISN 0112         34 DM=DENS(P,S)*ROO(1)+DEFB(P,S,IO)                                 00040300
ISN 0113            GO TO 36                                                         00040400
ISN 0114         35 DN=DENS(P,S)*ROO(1)+DEFB(P,S,IO)                                 00040500
ISN 0115            DP=DENSP(P,S)*ROO(2)                                             00040600
ISN 0116            DM=DN+DP                                                         00040700
ISN 0117         36 IF (KE(15).EQ.1) DC=DEN2(CP,S)*RHOC                              00040800
ISN 0119            W(I)=DM                                                          00040900
ISN 0120            W(I+2*NS)=DN                                                     00041000
ISN 0121            W(I+3*NS)=DP                                                     00041100
ISN 0122            W(I+4*NS)=DC                                                     00041200
ISN 0123            IF (R.GE.RCT2) GO TO 90                                          00041300
ISN 0125            DO 50 K=IU,IO                                                    00041400
ISN 0126            I1=K-IU1                                                         00041500
ISN 0127            I2=I1+IU2                                                        00041600
ISN 0128            Y=I2*PJ*R/RCTF                                                   00041700
ISN 0129         59 DO 60 J=IU,IO                                                    00041800
ISN 0130            J1=J-IU1                                                         00041900
ISN 0131            J2=J1+IU2                                                        00042000
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ISN 0132            Z=J2*PJ*R/RCTF                                                  00042100
ISN 0133            IF (R) 70,70,80                                                 00042200
ISN 0134          70 ERR=ERR+VARM(II+I1,II+J1)                                      00042300
ISN 0135            GO TO 60                                                        00042400
ISN 0136          80 ERR=ERR+(DSIN(Y)*DSIN(Z)/(Y*Z))*VARM(II+I1,II+J1)              00042500
ISN 0137          60 CONTINUE                                                       00042600
ISN 0138          50 CONTINUE                                                       00042700
ISN 0139            W(I+NS)=DSQRT(ERR*CHI2*2.D0)                                    00042800
ISN 0140            IF (KE(17).EQ.1) GO TO 85                                       00042900
ISN 0142            ERR=W(I+NS)/DN*100.                                             00043000
ISN 0143            GO TO 90                                                        00043100
ISN 0144          85 ERR=W(I+NS)/DM*100.                                            00043200
ISN 0145          90 IF (KE(11).EQ.1) WRITE (6,6010) R,DM,DN,W(I+NS),ERR,DP,DC    00043300
ISN 0147         100 CONTINUE                                                       00043400
ISN 0148        6010 FORMAT (' ',0PF10.3,5X,6(1PD12.4,5X))                         00043500
ISN 0149            IF ((KE(12).EQ.0).AND.(KE(14).EQ.0)) GO TO 203                  00043600
ISN 0151            KMM=MOD(KE(14),1000)/100                                        00043700
ISN 0152            KMN=KE(14)/1000                                                 00043800
ISN 0153            IF (KE(17).NE.2) KMN=0                                          00043900
ISN 0155            DO 110 I=1,4                                                    00044000
ISN 0156            ND=I                                                            00044100
ISN 0157            IF (I.EQ.1) ND=I-1                                              00044200
ISN 0159            IF (((KE(17).EQ.1).AND.(I.GT.1)).AND.(.NOT.((KE(15).EQ.1).AND.(I.E00044300
                   1 Q.4)))) GO TO 110                                              00044400
ISN 0161            CALL MOMENT(ND,W,H,NS,RMS)                                      00044500
ISN 0162            IF (I.EQ.1) WRITE (6,6300)                                      00044600
ISN 0164        6300 FORMAT (///' MATTER DENSITY')                                  00044700
ISN 0165            IF (I.EQ.2) WRITE (6,6301)                                      00044800
ISN 0167        6301 FORMAT (///' NEUTRON DENSITY')                                 00044900
ISN 0168            IF (I.EQ.3) WRITE (6,6302)                                      00045000
ISN 0170        6302 FORMAT (///' PROTON DENSITY')                                  00045100
ISN 0171            IF (I.EQ.4) WRITE (6,6303)                                      00045200
ISN 0173        6303 FORMAT (///' CHARGE DENSITY')                                  00045300
ISN 0174            WRITE (6,6501) (RMS(J),J=1,3),(RMS(J),J=5,10)                   00045400
ISN 0175        6501 FORMAT ((/' K-TH MOMENT FOR K = -2, -1, ... ,+5, +6'           00045500
                   1 /9(1PD12.5,2X)))                                               00045600
ISN 0176            WRITE (6,6502) RMS(4)                                           00045700
ISN 0177        6502 FORMAT (/' VOLUME = ',1PD12.5)                                 00045800
ISN 0178            IF ((KMM.GT.0).AND.(I.EQ.1)) WRITE (8,7001) RMS                 00045900
ISN 0180            IF ((KMN.GT.0).AND.(I.EQ.2)) WRITE (8,7001) RMS                 00046000
ISN 0182            IF ((I.GT.2).OR.((I.EQ.1).AND.(KE(17).EQ.2))) GO TO 109         00046100
ISN 0184            CALL ERMOM (II,IU,IO,IU1,IU2,VARM,RCTF,CHI2,RMS)                00046200
ISN 0185            WRITE (6,6503) (RMS(J),J=1,3),(RMS(J),J=5,10)                   00046300
```

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ISN 0186          WRITE (6,6504) RMS(4)                                          00046400
ISN 0187       6503 FORMAT ((/' ERRORS OF K-TH MOMENT FOR K = -2, -1, ... ,+5, +6'  00046500
                   1 /9(1PD12.5,2X)))                                            00046600
ISN 0188       6504 FORMAT (/' ERROR VOLUME = ',1PD12.5)                         00046700
ISN 0189        109 IF ((KMM.GT.0).AND.(I.EQ.1)) WRITE (8,7001) RMS              00046800
ISN 0191            IF ((KMN.GT.0).AND.(I.EQ.2)) WRITE (8,7001) RMS              00046900
ISN 0193        110 CONTINUE                                                     00047000
ISN 0194        203 IWP=NS*2                                                     00047100
ISN 0195            IWS=1                                                        00047200
ISN 0196            KDM=MOD(KE(13),1000)/100                                     00047300
ISN 0197            KDN=KE(13)/1000                                              00047400
ISN 0198            IF (KE(17).NE.2) KDN=0                                       00047500
ISN 0200            IF (KDM.GT.0) WRITE(7,7001) (W(I),I=IWS,IWP)                 00047600
ISN 0202            IWS=IWP+1                                                    00047700
ISN 0203            IWP=IWP+NS                                                   00047800
ISN 0204            IF (KDN.GT.0) WRITE (7,7001) (W(I),I=IWS,IWP)                00047900
ISN 0206       7001 FORMAT((5X,'*',6(1PD10.3,',')))                              00048000
ISN 0207       1000 RETURN                                                      00048100
ISN 0208            END                                                          00048200
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                C-----POTENTIAL PRINT                                          00048300
ISN 0002            SUBROUTINE POTPR(P,W,NP,M,N,VARM,CHI2)                     00048400
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                  00048500
ISN 0004            REAL*4 WI(1000)                                            00048600
ISN 0005            DIMENSION P(2),PR(2),PI(2),W(2),VARM(30,30),RMS(10)        00048700
ISN 0006            REAL*8 PJ/3.141592653589793D0/                             00048800
ISN 0007            COMMON /INPT/KE(42),WI,IN(100)                             00048900
ISN 0008            COMMON /IFIT/IA(30),NC,ID                                  00049000
ISN 0009            NRC=P(NP+3)*(P(NP+6)+P(NP+7)-1.)+1.                        00049100
ISN 0010            RC=NRC                                                     00049200
ISN 0011            H=.1D0                                                     00049300
ISN 0012            AH13=P(3)**(1.D0/3.D0)                                     00049400
ISN 0013            NA2=WI(2)+.2                                               00049500
ISN 0014            HA=P(NP+3)                                                 00049600
ISN 0015            NSA=P(NP+6)                                                00049700
ISN 0016            MSA=P(NP+7)                                                00049800
ISN 0017            P(NP+3)=H                                                  00049900
ISN 0018            NS=RC/H+2                                                  00050000
ISN 0019            MS=0                                                       00050100
ISN 0020            P(NP+6)=NS                                                 00050200
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ISN 0021            P(NP+7)=MS                                                          00050300
ISN 0022            NN=1                                                                00050400
ISN 0023            CALL POTE(P,PR,PI,NN)                                               00050500
ISN 0024            IF (KE(15).EQ.1) GO TO 6                                            00050600
ISN 0026            R=P(2)*AH13                                                         00050700
ISN 0027            A=1.43985*P(NP+4)/R                                                 00050800
ISN 0028            V2=-.5*A/(R*R)                                                      00050900
ISN 0029            VO=A-R*R*V2                                                         00051000
ISN 0030          6 NF=IN(8)                                                            00051100
ISN 0031            IO=IA(NF)                                                           00051200
ISN 0032            IF (IO.EQ.NP) IO=IA(NF-1)                                           00051300
ISN 0034            IF (KE(18).LT.3) GO TO 13                                           00051400
ISN 0036            IOW=IO                                                              00051500
ISN 0037            RCTFW=P(29)                                                         00051600
ISN 0038            RCTFW2=RCTFW-.01                                                    00051700
ISN 0039            DO 11 I=1,NF                                                        00051800
ISN 0040            IF (IA(I).GT.29) GO TO 12                                           00051900
ISN 0042         11 CONTINUE                                                            00052000
ISN 0043         12 IUW=IA(I)                                                           00052100
ISN 0044            IU1W=IUW-1                                                          00052200
ISN 0045            IU2W=IUW-30                                                         00052300
ISN 0046            IIW=I-1                                                             00052400
ISN 0047         13 IF (KE(9).EQ.1) WRITE (6,6010)                                      00052500
ISN 0049       6010 FORMAT(///' ',7X,'R',8X,'REAL',7X,                                  00052600
                   1 'REAL+COULOMB',3X,'IMAGINARY',5X,'ERROR IMAG',4X,'ERROR PERC',    00052700
                   2 4X,'COULOMB')                                                     00052800
ISN 0050            R=-H                                                                00052900
ISN 0051            DO 2 I=1,NS                                                         00053000
ISN 0052            R=R+H                                                               00053100
ISN 0053            P(1)=R                                                              00053200
ISN 0054            W(I)=0.D0                                                           00053300
ISN 0055            W(I+NS)=0.D0                                                        00053400
ISN 0056            W(I+2*NS)=0.D0                                                      00053500
ISN 0057            W(I+3*NS)=0.D0                                                      00053600
ISN 0058            DV=0.D0                                                             00053700
ISN 0059            DVW=0.D0                                                            00053800
ISN 0060            CALL POTE(P,PR,PI,NP)                                               00053900
ISN 0061            IF(KE(15).EQ.0) GO TO 3                                             00054000
ISN 0063            CALL COULPO(2,P,R,VC,VD)                                            00054100
ISN 0064            GO TO 1                                                             00054200
ISN 0065          3 IF (R-P(2)*AH13) 4,5,5                                              00054300
ISN 0066          4 VC=VO+R*R*V2                                                        00054400
ISN 0067            GO TO 1                                                           00054500
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ISN 0068          5 VC=1.43985*P(NP+4)/R                                                00054600
ISN 0069          1 PR(2)=PR(1)                                                         00054700
ISN 0070            PR(1)=PR(1)-VC                                                      00054800
ISN 0071            W(I)=PR(1)                                                          00054900
ISN 0072            W(I+NS)=PI(1)                                                       00055000
ISN 0073            IF (KE(18).LT.3) GO TO 81                                           00055100
ISN 0075            IF (R.GE.RCTFW2) GO TO 81                                           00055200
ISN 0077            DO 150 K=IUW,IOW                                                    00055300
ISN 0078            I1=K-IU1W                                                           00055400
ISN 0079            I2=I1+IU2W                                                          00055500
ISN 0080            Y=I2*PJ*R/RCTFW                                                     00055600
ISN 0081            DO 160 J=IUW,IOW                                                    00055700
ISN 0082            J1=J-IU1W                                                           00055800
ISN 0083            J2=J1+IU2W                                                          00055900
ISN 0084            Z=J2*PJ*R/RCTFW                                                     00056000
ISN 0085            IF (R) 170,170,180                                                  00056100
ISN 0086        170 DV=DV+VARM(IIW+I1,IIW+J1)                                           00056200
ISN 0087            GO TO 160                                                           00056300
ISN 0088        180 DV=DV+(DSIN(Y)*DSIN(Z)/(Y*Z))*VARM(IIW+I1,IIW+J1)                   00056400
ISN 0089        160 CONTINUE                                                            00056500
ISN 0090        150 CONTINUE                                                            00056600
ISN 0091            W(I+2*NS)=DSQRT(DV*CHI2*2.D0)                                       00056700
ISN 0092            DVW=-W(I+2*NS)/PI(1)*100.                                           00056800
ISN 0093         81 IF (KE(9).EQ.1) WRITE (6,6110)R,PR(1),PR(2),PI(1)                   00056900
                   1 ,W(I+2*NS),DVW,VC                                                  00057000
ISN 0095           2 CONTINUE                                                          00057100
ISN 0096       6110 FORMAT (' ',0PF10.3,2X,6(1PD12.4,2X))                              00057200
ISN 0097       6300 FORMAT ('//' REAL POTENTIAL')                                      00057300
ISN 0098         31 KMR=MOD(KE(14),10)                                                 00057400
ISN 0099            IF ((KE(10).EQ.0).AND.(KMR.EQ.0)) GO TO 30                          00057500
ISN 0101            NV=0                                                                00057600
ISN 0102            WRITE (6,6300)                                                      00057700
ISN 0103            CALL MOMENT(NV,W,H,NS,RMS)                                          00057800
ISN 0104            WRITE (6,6001) (RMS(I),I=1,3),(RMS(I),I=5,10)                       00057900
ISN 0105       6001 FORMAT ('//' K-TH MOMENT FOR K = -2, -1, ...,+5, +6'/9(F12.5,2X))  00058000
ISN 0106            VOL=RMS(4)/(P(3)*NA2)                                               00058100
ISN 0107            WRITE (6,6002) RMS(4),VOL                                           00058200
ISN 0108       6002 FORMAT ('/' VOLUME = ',1PD12.5,'   PER NUCLEON PAIR = ',1PD12.5)   00058300
ISN 0109            IF (KMR.GT.0) WRITE (8,7001) RMS                                    00058400
ISN 0111            IF ((KE(17).NE.0).OR.(KE(16).LT.3)) GO TO 32                        00058500
ISN 0113            CALL ERMOM(II,IU,IO,IU1,IU2,VARM,RCTF,CHI2,RMS)                     00058600
ISN 0114            VOL=RMS(4)/(P(3)*NA2)                                               00058700
ISN 0115            WRITE (6,6501) (RMS(I),I=1,3),(RMS(I),I=5,10)                       00058800
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ISN 0116      6501 FORMAT ((//' ERRORS OF K-TH MOMENT FOR K = -2, -1, ... ,+5, +6'    00058900
                  1 /9(1PD12.5,2X)))                                                  00059000
ISN 0117           WRITE (6,6502) RMS(4),VOL                                          00059100
ISN 0118      6502 FORMAT (/' ERROR VOLUME = ' ,1PD12.5,'   PER NUCLEON PAIR = ',     00059200
                  1 1PD12.5)                                                          00059300
ISN 0119           IF (KMR.GT.0) WRITE (8,7001) RMS                                   00059400
ISN 0121      6400 FORMAT (///' IMAGINARY POTENTIAL')                                 00059500
ISN 0122        32 KMI=MOD(KE(14),100)/10                                             00059600
ISN 0123           IF ((KE(10).LT.2).AND.(KMI.EQ.0)) GO TO 30                         00059700
ISN 0125           NV=1                                                               00059800
ISN 0126           WRITE (6,6400)                                                     00059900
ISN 0127           CALL MOMENT(NV,W,H,NS,RMS)                                         00060000
ISN 0128           VOL=RMS(4)/(P(3)*NA2)                                              00060100
ISN 0129           WRITE (6,6001) (RMS(I),I=1,3),(RMS(I),I=5,10)                      00060200
ISN 0130           WRITE (6,6002) RMS(4),VOL                                          00060300
ISN 0131           IF(KE(18).LT.3) GO TO 30                                           00060400
ISN 0133           CALL ERMOM(IIW,IUW,IOW,IU1W,IU2W,VARM,RCTFW,CHI2,RMS)              00060500
ISN 0134           VOL=RMS(4)/(P(3)*NA2)                                              00060600
ISN 0135           WRITE (6,6501) (RMS(I),I=1,3),(RMS(I),I=5,10)                      00060700
ISN 0136           WRITE (6,6502) RMS(4),VOL                                          00060800
ISN 0137        30 P(NP+3)=HA                                                         00060900
ISN 0138           P(NP+6)=NSA                                                        00061000
ISN 0139           P(NP+7)=MSA                                                        00061100
ISN 0140           IWP=NS                                                             00061200
ISN 0141           IF ((KE(16).GT.2).AND.(KE(16).LT.5)) IWP=IWP+NS                    00061300
ISN 0143           IWS=1                                                              00061400
ISN 0144           KPR=MOD(KE(13),10)                                                 00061500
ISN 0145           KPI=MOD(KE(13),100)/10                                             00061600
ISN 0146           IF (KPR.GT.0) WRITE (7,7001) (W(I),I=IWS,IWP)                      00061700
ISN 0148           IWS=IWP+1                                                          00061800
ISN 0149           IWP=IWP+NS                                                         00061900
ISN 0150           IF (KE(18).GT.2) IWP=IWP+NS                                        00062000
ISN 0152           IF (KPI.GT.0) WRITE (7,7001) (W(I),I=IWS,IWP)                      00062100
ISN 0154      7001 FORMAT ((5X,'*',6(1PD10.3,',')))                                   00062200
ISN 0155      1000 RETURN                                                             00062300
ISN 0156           END                                                                00062400
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ISN 0002            SUBROUTINE PCTE (P,PR,PI,N)                                   00000010
                   C-----MIKROSKOPISCHES OPTISCHES POTENTIAL                      00000020
                   C-----BELIEBIGE WECHSELWIRKUNG IN FXV BERECHNET                00000030
                   C-----MIT DICHTE-ABHAENGIGKEIT                                 00000040
                   C-----NEUTRONEN- UND PROTONENVERTEILUNG VERSCHIEDEN            00000050
                   C-----NUKLEONENVERTEILUNG IN FUNCTION DENS BERECHNET           00000060
                   C-----COULOMBRADIUS P(2)                                       00000070
                   C-----MASSENZAHL P(3)                                          00000080
                   C-----Z*Z P(N+4)                                               00000090
                   C-----REALTEIL : NORMIERUNG = P(4)                             00000100
                   C                CUT-OFF = P(5)                                00000110
                   C                GAMMA = P(6)                                  00000120
                   C-----IMAGINAERTEIL P(7), P(8), P(9)                           00000130
                   C     OBERFLAECHE   P(10), P(11), P(12)                        00000140
                   C-----COULOMB VC UND VD                                        00000150
                   C-----COULOMB AUS GEGEBENER LADUNGSVERTEILUNG EXAKT BERECHNET  00000160
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                     00000170
ISN 0004            DIMENSION P(2),PR(2),PI(2),F(25),S(25),D(2)                   00000180
ISN 0005            REAL*8 ROO(2)/0.D0,0.D0/                                      00000190
ISN 0006            DIMENSION V(401),UC(200)                                      00000200
ISN 0007            REAL*4 WI(1000)                                               00000210
ISN 0008            REAL*8 PGN(10)/Z40271AD8921466DF,Z402630336A58B322,           00000220
                   *               Z402460691E694A69,Z4021B658BB64DBFB,           00000230
                   *               Z401E41FF31573B48,Z401A1817A317A820,           00000240
                   *               Z4015519FE196E249,Z401C0B467DF7E474,           00000250
                   *               Z3FA64DAF529DB3FA,Z3F4825A009D3A2BA/           00000260
ISN 0009            REAL*8 XGN(10)/Z4013973DF98B86AF,Z403A502C6D25177F,           00000270
                   *               Z405FAB33C5594B0F,Z4082C82E09FBFFB4,           00000280
                   *               Z40A2D469FD3886D7,Z40BF0F9B9A352A6F,           00000290
                   *               Z40D6D05EAF7EB739,Z40E988320B9FEC8C,           00000300
                   *               Z40F6C6DD3DEBB4F5,Z40FE3DAD0638E701/           00000310
ISN 0010            REAL*8 PJ/3.14159265358979D0/                                 00000320
ISN 0011            COMMON /INPT/ KE(42),WI,IN(100)                               00000330
ISN 0012            DATA NC1/0/                                                   00000340
ISN 0013            IF(N) 2,1,2                                                   00000350
ISN 0014          1 N=21                                                          00000360
ISN 0015            NP=N                                                          00000370
ISN 0016            IF ((KE(16).NE.7).OR.(KE(17).EQ.0)) N=1                       00000380
ISN 0018            RETURN                                                        00000390
ISN 0019          2 IF(N-2) 3,4,4                                                 00000400
ISN 0020          3 AH13=P(3)**(1.D0/3.D0)                                        00000410
ISN 0021            IF (KE(15).EQ.0) GO TO 66                                     00000420
ISN 0023            CALL COULPO(1,P,R,VC,VD)                                      00000430
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ISN 0024            GO TO 9                                                    00000440
ISN 0025         66 R=P(2)*AH13                                                00000450
ISN 0026            A=1.43985*P(NP+4)/R                                        00000460
ISN 0027            V2=-.5*A/(R*R)                                             00000470
ISN 0028            V0=A-R*R*V2                                                00000480
ISN 0029            PCR=R                                                      00000490
ISN 0030          9 H=P(NP+3)                                                  00000500
ISN 0031            R=P(1)                                                     00000510
ISN 0032            NC2=H*10.                                                  00000520
ISN 0033            IF (NC1.EQ.NC2) GO TO 21                                   00000530
ISN 0035            ISM=P(NP+6)+P(NP+7)                                        00000540
ISN 0036            IF(ISM.GT.200) ISM=200                                     00000550
ISN 0038            ISM1=P(5)/H                                                00000560
ISN 0039            ISM2=P(13)/H                                               00000570
ISN 0040            ISM12=ISM1+ISM2                                            00000580
ISN 0041            IF(ISM12.GT.ISM) ISM12=ISM                                 00000590
                 C-----BERECHNUNG VON FXV                                      00000600
ISN 0043            ISM22=2*ISM12+1                                            00000610
ISN 0044            CALL FXV(H,ISM22,V)                                        00000620
ISN 0045            NC1=NC2                                                    00000630
                 C-----NORMIERUNG DER NEUTRONEN- UND PROTONENVERTEILUNG        00000640
ISN 0046            IF (KE(17).EQ.1) GO TO 20                                  00000650
ISN 0048            CALL DPN(ROO,P)                                            00000660
ISN 0049            D(1)=P(3)-P(NP+4)/WI(4)                                    00000670
ISN 0050            D(2)=P(NP+4)/WI(4)                                         00000680
ISN 0051            ROO(2)=ROO(2)*D(2)                                         00000690
ISN 0052            GO TO 21                                                   00000700
ISN 0053         20 D(1)=P(3)                                                  00000710
ISN 0054         21 S(1)=0.                                                    00000720
ISN 0055            S(2)=P(13)                                                 00000730
ISN 0056            S(5)=.00000500                                             00000740
ISN 0057            K=0                                                        00000750
ISN 0058            NF=0                                                       00000760
ISN 0059         10 CALL FORHAD(K,S)                                           00000770
ISN 0060            GO TO (11,11,12,12),K                                      00000780
ISN 0061         11 S(4)=S(3)*S(3)*DENS(P,S)                                   00000790
ISN 0062            NF=NF+1                                                    00000800
ISN 0063            GO TO 10                                                   00000810
ISN 0064         12 IF(NF.LE.5) GO TO 11                                       00000820
ISN 0066            ROO(1)=D(1)/(4.D0*PJ*S(4))                                 00000830
                 C-----INTEGRATION                                             00000840
ISN 0067         43 DO 44 IS12=1,ISM12                                         00000850
ISN 0068         44 UC(IS12)=0.D0                                              00000860
```

```
                C-----R-ALPHA PUNKTE                                                    00000870
ISN 0069        R1=0.D0                                                                 00000880
ISN 0070        DO 7 IS1=1,ISM1                                                         00000890
ISN 0071        R1=R1+H                                                                 00000900
ISN 0072        S(3)=R1                                                                 00000910
ISN 0073        RODS=RO0(1)*DENS(P,S)                                                   00000920
ISN 0074        IF (KE(17).EQ.2) RODS=RODS+RO0(2)*DENSP(P,S)                            00000930
ISN 0076        RODS23=DMAX1(0.D0,RODS)                                                 00000940
ISN 0077        RODS23=RODS23**(2.D0/3.D0)                                              00000950
ISN 0078        RODS=RODS*(1.D0-P(6)*RODS23)                                            00000960
ISN 0079        SIM=(1+MOD(IS1,2))*R1*R1*RODS                                           00000970
                C-----F0 VON R, R-ALPHA                                                 00000980
ISN 0080        DO 6 IS12=1,ISM12                                                       00000990
ISN 0081        A=(IS1*IS1+IS12*IS12)*H*H                                               00001000
ISN 0082        B=2.DC*IS1*IS12*H*H                                                     00001010
ISN 0083        F0=0.D0                                                                 00001020
                C-----WINKELINTEGRATION                                                 00001030
ISN 0084        DO 5 I=1,10                                                             00001040
ISN 0085        C=A-B*XGN(I)                                                            00001050
ISN 0086        C=DSQRT(C)                                                              00001060
ISN 0087        J=C/H                                                                   00001070
ISN 0088        X=C/H-J                                                                 00001080
ISN 0089        FF=.5D0*(V(J)+X*(V(J+1)-V(J)))                                          00001090
ISN 0090        C=A+B*XGN(I)                                                            00001100
ISN 0091        C=DSQRT(C)                                                              00001110
ISN 0092        J=C/H                                                                   00001120
ISN 0093        X=C/H-J                                                                 00001130
ISN 0094        FF=FF+.5D0*(V(J)+X*(V(J+1)-V(J)))                                       00001140
ISN 0095      5 F0=F0+FF*PGN(I)                                                         00001150
ISN 0096      6 UC(IS12)=UC(IS12)+SIM*F0                                                00001160
ISN 0097      7 CONTINUE                                                                00001170
ISN 0098        RETURN                                                                  00001180
                C-----INTERPOLATION                                                     00001190
ISN 0099      4 R=P(1)                                                                  00001200
ISN 0100        IF (KE(15).EQ.0) GO TO 77                                               00001210
ISN 0102        CALL COULPO(2,P,R,VC,VD)                                                00001220
ISN 0103        GO TO 79                                                                00001230
ISN 0104     77 IF (R-PCR) 75,18,18                                                     00001240
ISN 0105     75 VC=V0+R*R*V2                                                            00001250
ISN 0106        VD=R*2.*V2                                                              00001260
ISN 0107        GO TO 79                                                                00001270
ISN 0108     18 VC=1.43985*P(NP+4)/R                                                    00001280
ISN 0109        VD=-VC/R                                                                00001290
```

```
ISN 0110         79 J=R/H                                                    00001300
ISN 0111            X=R/H-J                                                  00001310
ISN 0112            IF(J.EQ.ISM) GO TO 211                                   00001320
ISN 0114            IF(J.EQ.0) GO TO 213                                     00001330
ISN 0116            VCC=UC(J)+X*(UC(J+1)-UC(J))                              00001340
ISN 0117            IF(J.EQ.1) GO TO 212                                     00001350
ISN 0119            VDD=(UC(J+1)-UC(J-1))/(2.D0*H)                           00001360
ISN 0120            GO TO 150                                                00001370
ISN 0121       211 VCC=UC(J)+X*(UC(J)-UC(J-1))                              00001380
ISN 0122            VDD=(UC(J)-UC(J-1))/H                                    00001390
ISN 0123            GO TO 150                                                00001400
ISN 0124       212 VDD=(UC(J+1)-UC(J))/H                                    00001410
ISN 0125            GO TO 150                                                00001420
ISN 0126       213 VCC=2.*UC(1)-UC(2)                                       00001430
ISN 0127            VDD=(UC(2)-UC(1))/H                                      00001440
ISN 0128       150 F1=2.*4.*PJ*H/3.*P(4)                                    00001450
ISN 0129            PR(1)=VC-F1*VCC                                          00001460
ISN 0130            PR(2)=VD-F1*VDD                                          00001470
ISN 0131            KEW=KE(18)                                               00001480
ISN 0132            GO TO (170,180),KEW                                      00001490
ISN 0133       170 SS=R-P(8)*AH13                                           00001500
ISN 0134            A=P(9)                                                   00001510
ISN 0135            Y=1.D0/(1.D0+DEXP(SS/A))                                 00001520
ISN 0136            Z=-DEXP(SS/A)/A*Y*Y                                      00001530
ISN 0137            PI(1)=-P(7)*Y                                            00001540
ISN 0138            PI(2)=-P(7)*Z                                            00001550
                C   OBERFLAECHENABSORPTION                                   00001560
ISN 0139            WD=P(10)                                                 00001570
ISN 0140            IF(WD) 310,311,310                                       00001580
ISN 0141       310 SS=R-P(11)*AH13                                          00001590
ISN 0142            A=P(12)                                                  00001600
ISN 0143            Z=DEXP(SS/A)                                             00001610
ISN 0144            VV=1.D0+Z                                                00001620
ISN 0145            Y=Z/(VV*VV)                                              00001630
ISN C146            Z=Y*(1.D0-2.D0*Z/VV)/A                                   00001640
ISN 0147            PI(1)=PI(1)-4.D0*WD*Y                                    00001650
ISN 0148            PI(2)=PI(2)-4.D0*WD*Z                                    00001660
ISN 0149       311 RETURN                                                   00001670
                C   IMAGINAERTEIL VOLUMEN                                    00001680
ISN 0150       180 SS=R-P(8)*AH13                                           00001690
ISN 0151            A=P(9)                                                   00001700
ISN 0152            Y=1.DC/(1.DC+DEXP(SS/A))                                 00001710
ISN 0153            Z=Y*Y*Y*DEXP(SS/A)*(-2.DC/A)                            00001720
```

```
ISN 0154            Y=Y*Y                                                                  00001730
ISN 0155            PI(1)=-P(7)*Y                                                          00001740
ISN 0156            PI(2)=-P(7)*Z                                                          00001750
                C   OBERFLAECHENABSORPTION                                                 00001760
ISN 0157            WD=P(10)                                                               00001770
ISN 0158            IF(WD) 110,111,110                                                     00001780
ISN 0159          110 SS=R-P(11)*AH13                                                      00001790
ISN 0160            A=P(12)                                                                00001800
ISN 0161            Y1=1.D0/(1.D0+DEXP(SS/A))                                              00001810
ISN 0162            Y2=DEXP(SS/A)                                                          00001820
ISN 0163            Y=Y1**3*Y2*(-2.D0/A)                                                   00001830
ISN 0164            Z=Y1**4*Y2*Y2*6.D0/(A**2)-Y1**3*Y2*2.D0/(A**2)                         00001840
ISN 0165            PI(1)=PI(1)+4.D0*WD*Y*A                                                00001850
ISN 0166            PI(2)=PI(2)+4.D0*WD*Z*A                                                00001860
ISN 0167          111 RETURN                                                               00001870
ISN 0168            END                                                                    00001880
```

```
                C   MAJKA-INTERACTION NUMERICALLY                                         00001890
ISN 0002            SUBROUTINE FXV(H,ISM12,DV)                                             00001900
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                              00001910
ISN 0004            DIMENSION DV(401)                                                      00001920
ISN 0005            REAL*8 DVN(72)/                                                        00001930
                   * 0.32655598D+02, 0.32818804D+02, 0.32688257D+02, 0.32723604D+02,      00001940
                   * 0.32168960D+02, 0.32198909D+02, 0.31829261D+02, 0.31356074D+02,      00001950
                   * 0.30909814D+02, 0.30617404D+02, 0.29515920D+02, 0.28450010D+02,      00001960
                   * 0.27300033D+02, 0.26230426D+02, 0.24902445D+02, 0.23538169D+02,      00001970
                   * 0.22027391D+02, 0.20460865D+02, 0.18892759D+02, 0.17223171D+02,      00001980
                   * 0.15566984D+02, 0.14046482D+02, 0.12476956D+02, 0.10975707D+02,      00001990
                   * 0.96716745D+01, 0.83365711D+01, 0.71814886D+01, 0.62168890D+01,      00002000
                   * 0.53542093D+01, 0.44514222D+01, 0.37565651D+01, 0.31529389D+01,      00002010
                   * 0.26126167D+01, 0.21962766D+01, 0.18207003D+01, 0.15049992D+01,      00002020
                   * 0.12389898D+01, 0.10193921D+01, 0.83641474D+00, 0.68325897D+00,      00002030
                   * 0.56343686D+00, 0.46001230D+00, 0.37258873D+00, 0.30326228D+00,      00002040
                   * 0.24278179D+00, 0.19695899D+00, 0.16071306D+00, 0.12965536D+00,      00002050
                   * 0.10558739D+00, 0.85178007D-01, 0.68000002D-01, 0.55061227D-01,      00002060
                   * 0.44403788D-01, 0.36031468D-01, 0.29025146D-01, 0.23121597D-01,      00002070
                   * 0.18424027D-01, 0.14836518D-01, 0.11981919D-01, 0.96334101D-02,      00002080
                   * 0.76927038D-02, 0.61213995D-02, 0.49233453D-02, 0.39453534D-02,      00002090
                   * 0.31329012D-02, 0.25093473D-02, 0.20045213D-02, 0.15997472D-02,      00002100
```

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                * 0.12769238D-02, 0.10150427D-02, 0.81179935D-03, 0.64787354D-03/  00002110
ISN 0006          DO 100 I=1,ISM12                                                  00002120
ISN 0007          DV(I)=0.D0                                                        00002130
ISN 0008        100 CONTINUE                                                        00002140
ISN 0009          R=0.D0                                                            00002150
ISN 0010          DO 200 I=1,ISM12                                                  00002160
ISN 0011          R=R+H                                                             00002170
ISN 0012          IF (R.GT.7.2) GO TO 300                                           00002180
ISN 0014          J=R/.1                                                            00002190
ISN 0015          X=R/.1-J                                                          00002200
ISN 0016          IF (J.EQ.ISM12) GO TO 211                                         00002210
ISN 0018          IF (J.EQ.0) GO TO 213                                             00002220
ISN 0020          DV(I)=DVN(J)+X*(DVN(J+1)-DVN(J))                                  00002230
ISN 0021          GO TO 200                                                         00002240
ISN 0022        211 DV(I)=DVN(J)+X*(DVN(J)-DVN(J-1))                                00002250
ISN 0023          GO TO 200                                                         00002260
ISN 0024        213 DV(I)=2.D0*DVN(1)-DVN(2)                                        00002270
ISN 0025        200 CONTINUE                                                        00002280
ISN 0026        300 RETURN                                                          00002290
ISN 0027          END                                                               00002300
```



```
ISN 0002          SUBROUTINE DPN(ROO,P)                                             00002310
ISN 0003          IMPLICIT REAL*8 (A-H,O-Z)                                         00002320
ISN 0004          REAL*4 WI(1000)                                                   00002330
ISN 0005          DIMENSION ROO(2),F(25),P(2)                                       00002340
ISN 0006          REAL*8 PI/3.1415926535897930/                                     00002350
ISN 0007          DATA NC1/0/                                                       00002360
ISN 0008          COMMON /INPT/ KE(42),WI,IN(100)                                   00002370
ISN 0009          NC2=WI(3)+.2                                                      00002380
ISN 0010          IF (NC1.EQ.NC2) GO TO 10                                          00002390
ISN 0012          NC1=NC2                                                           00002400
                C-----NORMIERUNG DER PROTONEN-VERTEILUNG                          00002410
ISN 0013          F(1)=0.                                                           00002420
ISN 0014          F(2)=P(13)                                                        00002430
ISN 0015          F(5)=.000001D0                                                    00002440
ISN 0016          K=0                                                               00002450
ISN 0017          NF=0                                                              00002460
ISN 0018        100 CALL FORHAD(K,F)                                                00002470
ISN 0019          GO TO (110,110,120,120), K                                        00002480
```

```
ISN 0020        110 F(4)=F(3)*F(3)*DENSP(P,F)                                   00002490
ISN 0021            NF=NF+1                                                     00002500
ISN 0022            GO TO 100                                                   00002510
ISN 0023        120 IF(NF.LE.5) GO TO 110                                       00002520
ISN 0025            ROO(2)=1.DO/(4.DO*PI*F(4))                                  00002530
ISN 0026            RHO2=ROO(2)                                                 00002540
ISN 0027            RETURN                                                      00002550
ISN 0028         10 ROO(2)=RHO2                                                 00002560
ISN 0029            RETURN                                                      00002570
ISN 0030            END                                                         00002580


ISN 0002            FUNCTION DENS(P,S)                                          00002590
                C-----3-PARAMETER FERMI-VERTEILUNG DER NEUTRONEN ODER MASSE     00002600
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                   00002610
ISN 0004            DIMENSION P(2),S(2)                                         00002620
ISN 0005            DENS=0.DO                                                   00002630
ISN 0006            C=P(14)*P(3)**(1.DO/3.DO)                                   00002640
ISN 0007            A=P(15)                                                     00002650
ISN 0008            W=P(16)                                                     00002660
ISN 0009            R=S(3)                                                      00002670
ISN 0010            IF (R.GT.P(13)) RETURN                                      00002680
ISN 0012            DENS=(1.DO+R*R*W/(C*C))/(1.DO+DEXP((R-C)/A))                00002690
ISN 0013            RETURN                                                      00002700
ISN 0014            END                                                         00002710


ISN 0002            FUNCTION DENSP(P,S)                                         00002720
                C-----3-PARAMETER FERMI-VERTEILUNG DER PROTONEN                 00002730
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                   00002740
ISN 0004            DIMENSION P(2),S(2)                                         00002750
ISN 0005            DENSP=0.DO                                                  00002760
ISN 0006            C=P(17)*P(3)**(1.DO/3.DO)                                   00002770
ISN 0007            A=P(18)                                                     00002780
ISN 0008            W=P(19)                                                     00002790
ISN 0009            R=S(3)                                                      00002800
ISN 0010            IF (R.GT.P(13)) RETURN                                      00002810
ISN 0012            DENSP=(1.DO+R*R*W/(C*C))/(1.DO+DEXP((R-C)/A))               00002820
ISN 0013            RETURN                                                      00002830
ISN 0014            END                                                         00002840
```

```
ISN 0002            SUBROUTINE DENPR(P,W,NP,M,N,VARM,CHI2)                          00002850
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                       00002860
ISN 0004            REAL*4 WI(1000)                                                 00002870
ISN 0005            DIMENSION P(2),W(2),VARM(30,30),S(25),D(2),CP(2,20),ROO(2)      00002880
ISN 0006            DIMENSION RMS(10)                                               00002890
ISN 0007            REAL*8 PJ/3.14159265358979300/                                  00002900
ISN 0008            COMMON /INPT/KE(42),WI,IN(100)                                  00002910
ISN 0009            COMMON /IFIT/IA(30),NC,ID                                       00002920
ISN 0010            RC=P(13)                                                        00002930
ISN 0011            AH13=P(3)**(1.DO/3.DO)                                          00002940
ISN 0012            Z2=WI(5)                                                        00002950
ISN 0013            H=.1DO                                                          00002960
ISN 0014            NS=RC/H+2.                                                      00002970
ISN 0015            DRSM=0.DO                                                       00002980
ISN 0016            DRSN=0.DO                                                       00002990
                  C-----LADUNGSVERTEILUNG                                           00003000
ISN 0017            IF (KE(15).EQ.0) GO TO 10                                       00003010
ISN 0019            NW=7                                                            00003020
ISN 0020            DO 1 I=1,4                                                      00003030
ISN 0021            NW=NW+WI(NW)+1.1                                                00003040
ISN 0022          1 CONTINUE                                                        00003050
ISN 0023            NC=WI(NW)+.1                                                    00003060
ISN 0024            DO 2 I=1,NC                                                     00003070
ISN 0025            CP(2,I)=WI(NW+I)                                                00003080
ISN 0026          2 CONTINUE                                                        00003090
ISN 0027            NW=NW+WI(NW)+1.1                                                00003100
ISN 0028            S(1)=0.                                                         00003110
ISN 0029            S(2)=CP(2,1)                                                    00003120
ISN 0030            S(5)=.00000100                                                  00003130
ISN 0031            K=0                                                             00003140
ISN 0032            NF=0                                                            00003150
ISN 0033          3 CALL FORHAD(K,S)                                                00003160
ISN 0034            GO TO (4,4,5,5), K                                              00003170
ISN 0035          4 S(4)=S(3)*S(3)*DEN2(CP,S)                                       00003180
ISN 0036            NF=NF+1                                                         00003190
ISN 0037            GO TO 3                                                         00003200
ISN 0038          5 IF (NF.LE.5) GO TO 4                                            00003210
ISN 0040            RHOC=Z2/(4.DO*PJ*S(4))                                          00003220
ISN 0041            WRITE (6,6002) RHOC                                             00003230
ISN 0042     6002 FORMAT (//' DENSITY CHARGE = ',1PD15.5)                           00003240
                  C-----PROTONENVERTEILUNG                                          00003250
ISN 0043         10 IF (KE(17).EQ.1) GO TO 20                                       00003260
ISN 0045            CALL DPN(ROO,P)                                                 00003270
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ISN 0046            D(1)=P(3)-P(NP+4)/WI(4)                                    00003280
ISN 0047            D(2)=P(NP+4)/WI(4)                                         00003290
ISN 0048            ROO(2)=ROO(2)*D(2)                                         00003300
ISN 0049            GO TO 21                                                   00003310
ISN 0050          20 D(1)=P(3)                                                 00003320
ISN 0051          21 IF (KE(17).LT.1) GO TO 1000                               00003330
ISN 0053            S(1)=0.                                                    00003340
ISN 0054            S(2)=P(13)                                                 00003350
ISN 0055            S(5)=.000001D0                                             00003360
ISN 0056            K=0                                                        00003370
ISN 0057            NF=0                                                       00003380
ISN 0058          22 CALL FORHAD(K,S)                                          00003390
ISN 0059             GO TO (23,23,24,24), K                                    00003400
ISN 0060          23 S(4)=S(3)*S(3)*DENS(P,S)                                  00003410
ISN 0061             NF=NF+1                                                   00003420
ISN 0062             GO TO 22                                                  00003430
ISN 0063          24 IF (NF.LE.5) GO TO 23                                     00003440
ISN 0065             ROO(1)=D(1)/(4.D0*PJ*S(4))                                00003450
ISN 0066             WRITE (6,6004) ROO                                        00003460
ISN 0067       6004 FORMAT (//' DENSITIES MATTER/NEUTRONS AND PROTONS',1P2D15.5) 00003470
ISN 0068             VK=4.D0*PJ*(P(2)*AH13)**3/3.D0                            00003480
ISN 0069             DCK=P(NP+4)/(WI(4)*VK)                                    00003490
ISN 0070             PHC=P(2)*AH13                                             00003500
ISN 0071          31 IF (KE(11).EQ.1) WRITE(6,6003)                            00003510
ISN 0073       6003 FORMAT (///' ',7X,'R',11X,'MATTER',10X,'NEUTRONS',10X,     00003520
                    1 'PROTONS',10X,'CHARGE')                                  00003530
ISN 0074          33 R=-H                                                      00003540
ISN 0075             DO 100 I=1,NS                                             00003550
ISN 0076             R=R+H                                                     00003560
ISN 0077             DM=0.                                                     00003570
ISN 0078             DN=0.                                                     00003580
ISN 0079             DP=0.                                                     00003590
ISN 0080             DC=0.                                                     00003600
ISN 0081             IF (R.LT.PHC) DC=DCK                                      00003610
ISN 0083             W(I+NS)=0.D0                                              00003620
ISN 0084             W(I+2*NS)=0.D0                                            00003630
ISN 0085             W(I+3*NS)=0.D0                                            00003640
ISN 0086             S(3)=R                                                    00003650
ISN 0087             IF (KE(17).EQ.1) GO TO 32                                 00003660
ISN 0089             DN=DENS(P,S)*ROO(1)                                       00003670
ISN 0090             DP=DENSP(P,S)*ROO(2)                                      00003680
ISN 0091             DM=DN+DP                                                  00003690
ISN 0092             GO TO 35                                                  00003700
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```
ISN 0093        32 DM=DENS(P,S)*ROO(1)                                                  00003710
ISN 0094        35 IF (KE(15).EQ.1) DC=DEN2(CP,S)*RHOC                                  00003720
ISN 0096           W(I)=DM                                                              00003730
ISN 0097           W(I+NS)=DN                                                           00003740
ISN 0098           W(I+2*NS)=DP                                                         00003750
ISN 0099           W(I+3*NS)=DC                                                         00003760
ISN 0100        91 IF (KE(11).EQ.1) WRITE (6,6011) R,DM,DN,DP,DC                        00003770
ISN 0102       100 CONTINUE                                                          00003780
ISN 0103      6011 FORMAT (' ',0PF10.3,5X,4(1PD12.4,5X))                             00003790
ISN 0104           IF ((KE(12).EQ.0).AND.(KE(14).EQ.0)) GO TO 203                       00003800
ISN 0106           KMM=MOD(KE(14),1000)/100                                             00003810
ISN 0107           KMN=KE(14)/1000                                                      00003820
ISN 0108           IF (KE(17).NE.2) KMN=0                                               00003830
ISN 0110           DO 110 I=1,4                                                         00003840
ISN 0111           ND=I-1                                                               00003850
ISN 0112           IF (((KE(17).EQ.1).AND.(I.GT.1)).AND.(.NOT.((KE(15).EQ.1).AND.(I.EQ00003860
                  1 Q.4)))) GO TO 110                                                   00003870
ISN 0114           CALL MOMENT(ND,W,H,NS,RMS)                                           00003880
ISN 0115           IF (I.EQ.1) WRITE (6,6300)                                           00003890
ISN 0117      6300 FORMAT (///' MATTER DENSITY')                                        00003900
ISN 0118           IF (I.EQ.2) WRITE (6,6301)                                           00003910
ISN 0120      6301 FORMAT (///' NEUTRON DENSITY')                                       00003920
ISN 0121           IF (I.EQ.3) WRITE (6,6302)                                           00003930
ISN 0123      6302 FORMAT (///' PROTON DENSITY')                                        00003940
ISN 0124           IF (I.EQ.4) WRITE (6,6303)                                           00003950
ISN 0126      6303 FORMAT (///' CHARGE DENSITY')                                        00003960
ISN 0127           WRITE (6,6501) (RMS(J),J=1,3),(RMS(J),J=5,10)                        00003970
ISN 0128      6501 FORMAT ((/' K-TH MOMENT FOR K = -2, -1, ... ,+5, +6'                 00003980
                  1 /9(1PD12.5,2X)))                                                    00003990
ISN 0129           WRITE (6,6502) RMS(4)                                                00004000
ISN 0130      6502 FORMAT (/' VOLUME = ',1PD12.5)                                       00004010
ISN 0131           IF ((KMM.GT.0).AND.(I.EQ.1)) WRITE (8,7001) RMS                      00004020
ISN 0133           IF ((KMN.GT.0).AND.(I.EQ.2)) WRITE (8,7001) RMS                      00004030
ISN 0135       110 CONTINUE                                                          00004040
ISN 0136       203 IWP=NS                                                            00004050
ISN 0137           IWS=1                                                                00004060
ISN 0138           KDM=MOD(KE(13),1000)/100                                             00004070
ISN 0139           KDN=KE(13)/1000                                                      00004080
ISN 0140           IF (KE(17).NE.2) KDN=0                                               00004090
ISN 0142           IF (KDM.GT.0) WRITE(7,7001) (W(I),I=IWS,IWP)                         00004100
ISN 0144           IWS=IWP+1                                                            00004110
ISN 0145           IWP=IWP+NS                                                           00004120
ISN 0146           IF (KDN.GT.0) WRITE (7,7001) (W(I),I=IWS,IWP)                        00004130
```

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ISN 0148       7001 FORMAT((5X,'*',6(1PD10.3,',')))                                    00004140
ISN 0149       1000 RETURN                                                             00004150
ISN 0150            END                                                                00004160



               C-----POTENTIAL PRINT                                                   00004170
ISN 0002            SUBROUTINE POTPR(P,W,NP,M,N,VARM,CHI2)                             00004180
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                          00004190
ISN 0004            REAL*4 WI(1000)                                                    00004200
ISN 0005            DIMENSION P(2),PR(2),PI(2),W(2),VARM(30,30),RMS(10)                00004210
ISN 0006            COMMON /INPT/KE(42),WI,IN(100)                                     00004220
ISN 0007            COMMON /IFIT/IA(30),NC,ID                                          00004230
ISN 0008            NRC=P(NP+3)*(P(NP+6)+P(NP+7)-1.)+1.                                00004240
ISN 0009            RC=NRC                                                             00004250
ISN 0010            H=.1DC                                                             00004260
ISN 0011            AH13=P(3)**(1.DO/3.DO)                                             00004270
ISN 0012            NA2=WI(2)+.2                                                       00004280
ISN 0013            HA=P(NP+3)                                                         00004290
ISN 0014            NSA=P(NP+6)                                                        00004300
ISN 0015            MSA=P(NP+7)                                                        00004310
ISN 0016            P(NP+3)=H                                                          00004320
ISN 0017            NS=RC/H+2                                                          00004330
ISN 0018            MS=0                                                               00004340
ISN 0019            P(NP+6)=NS                                                         00004350
ISN 0020            P(NP+7)=MS                                                         00004360
ISN 0021            NN=1                                                               00004370
ISN 0022            CALL POTE(P,PR,PI,NN)                                              00004380
ISN 0023            IF (KE(15).EQ.1) GO TO 6                                           00004390
ISN 0025            R=P(2)*AH13                                                        00004400
ISN 0026            A=1.43985*P(NP+4)/R                                                00004410
ISN 0027            V2=-.5*A/(R*R)                                                     00004420
ISN 0028            VO=A-R*R*V2                                                        00004430
ISN 0029          6 IF (KE(9).EQ.1) WRITE(6,6000)                                      00004440
ISN 0031       6000 FORMAT (///' ',10X,'R',15X,'REAL',13X,'REAL+COULOMB',8X,           00004450
                   1 'IMAGINARY',11X,'COULOMB')                                       00004460
ISN 0032          9 R=-H                                                             00004470
ISN 0033            DO 2 I=1,NS                                                      00004480
ISN 0034            R=R+H                                                            00004490
ISN 0035            P(1)=R                                                           00004500
ISN 0036            W(I)=0.DO                                                        00004510
ISN 0037            W(I+NS)=0.DO                                                     00004520
```

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ISN 0038            W(I+2*NS)=0.D0                                                  00004530
ISN 0039            CALL POTE(P,PR,PI,NP)                                           00004540
ISN 0040            IF(KE(15).EQ.0) GO TO 3                                         00004550
ISN 0042            CALL COULPO(2,P,R,VC,VD)                                        00004560
ISN 0043            GO TO 1                                                         00004570
ISN 0044          3 IF (R-P(2)*AH13) 4,5,5                                          00004580
ISN 0045          4 VC=V0+R*R*V2                                                    00004590
ISN 0046            GO TO 1                                                         00004600
ISN 0047          5 VC=1.43985*P(NP+4)/R                                            00004610
ISN 0048          1 PR(2)=PR(1)                                                     00004620
ISN 0049            PR(1)=PR(1)-VC                                                  00004630
ISN 0050            W(I)=PR(1)                                                      00004640
ISN 0051            W(I+NS)=PI(1)                                                   00004650
ISN 0052            IF (KE(9).EQ.1) WRITE(6,6100) R,PR(1),PR(2),PI(1),VC            00004660
ISN 0054          2 CONTINUE                                                        00004670
ISN 0055       6100 FORMAT(' ',0PF15.3,5X,4(1PD15.7,5X))                            00004680
ISN 0056       6300 FORMAT (///' REAL POTENTIAL')                                   00004690
ISN 0057         31 KMR=MOD(KE(14),10)                                              00004700
ISN 0058            IF ((KE(10).EQ.0).AND.(KMR.EQ.0)) GO TO 30                      00004710
ISN 0060            NV=0                                                            00004720
ISN 0061            WRITE (6,6300)                                                  00004730
ISN 0062            CALL MOMENT(NV,W,H,NS,RMS)                                      00004740
ISN 0063            WRITE (6,6001) (RMS(I),I=1,3),(RMS(I),I=5,10)                   00004750
ISN 0064       6001 FORMAT (//' K-TH MOMENT FOR K = -2, -1, ...,+5, +6'/9(F12.5,2X)) 00004760
ISN 0065            VOL=RMS(4)/(P(3)*NA2)                                           00004770
ISN 0066            WRITE (6,6002) RMS(4),VOL                                       00004780
ISN 0067       6002 FORMAT (/' VOLUME = ',1PD12.5,'   PER NUCLEON PAIR = ',1PD12.5) 00004790
ISN 0068            IF (KMR.GT.0) WRITE (8,7001) RMS                                00004800
ISN 0070       6400 FORMAT (///' IMAGINARY POTENTIAL')                              00004810
ISN 0071         32 KMI=MOD(KE(14),100)/10                                          00004820
ISN 0072            IF ((KE(10).LT.2).AND.(KMI.EQ.0)) GO TO 30                      00004830
ISN 0074            NV=1                                                            00004840
ISN 0075            WRITE (6,6400)                                                  00004850
ISN 0076            CALL MOMENT(NV,W,H,NS,RMS)                                      00004860
ISN 0077            VOL=RMS(4)/(P(3)*NA2)                                           00004870
ISN 0078            WRITE (6,6001) (RMS(I),I=1,3),(RMS(I),I=5,10)                   00004880
ISN 0079            WRITE (6,6002) RMS(4),VOL                                       00004890
ISN 0080            IF (KMI.GT.0) WRITE (8,7001) RMS                                00004900
ISN 0082         30 P(NP+3)=HA                                                      00004910
ISN 0083            P(NP+6)=NSA                                                     00004920
ISN 0084            P(NP+7)=MSA                                                     00004930
ISN 0085            IWP=NS                                                          00004940
ISN 0086            IWS=1                                                           00004950
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ISN 0087            KPR=MOD(KE(13),10)                                          00004960
ISN 0088            IF (KPR.GT.0) WRITE (7,7001) (W(I),I=IWS,IWP)               00004970
ISN 0090            IWP=IWP+NS                                                  00004980
ISN 0091            IWS=IWS+NS                                                  00004990
ISN 0092            KPI=MOD(KE(13),100)/10                                      00005000
ISN 0093            IF (KPI.GT.0) WRITE (7,7001) (W(I),I=IWS,IWP)               00005010
ISN 0095       7001 FORMAT ((5X,'*',6(1PD10.3,',')))                            00005020
ISN 0096            RETURN                                                      00005030
ISN 0097            END                                                         00005040
```

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ISN 0002            SUBROUTINE POTE (P,PR,PI,N)                                   00000010
                   C-----MIKROSKOPISCHES OPTISCHES POTENTIAL                      00000020
                   C-----BELIEBIGE WECHSELWIRKUNG IN FXV BERECHNET                00000030
                   C-----MIT DICHTE-ABHAENGIGKEIT                                 00000040
                   C-----NEUTRONEN- UND PROTONENVERTEILUNG VERSCHIEDEN            00000050
                   C-----NUKLEONENVERTEILUNG IN FUNCTION DENS BERECHNET           00000060
                   C-----COULOMBRADIUS P(2)                                       00000070
                   C-----MASSENZAHL P(3)                                          00000080
                   C-----Z*Z P(N+4)                                               00000090
                   C-----REALTEIL : NORMIERUNG = P(4)                             00000100
                   C                CUT-OFF = P(5)                                00000110
                   C                GAMMA = P(6)                                  00000120
                   C-----IMAGINAERTEIL P(7), P(8), P(9)                           00000130
                   C     OBERFLAECHE   P(10), P(11), P(12)                        00000140
                   C-----COULOMB VC UND VD                                        00000150
                   C-----COULOMB AUS GEGEBENER LADUNGSVERTEILUNG EXAKT BERECHNET  00000160
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                     00000170
ISN 0004            DIMENSION P(2),PR(2),PI(2),F(25),S(25),D(2)                   00000180
ISN 0005            REAL*8 RCO(2)/0.D0,0.D0/                                      00000190
ISN 0006            DIMENSION V(401),UC(200)                                      00000200
ISN 0007            REAL*4 WI(1000)                                               00000210
ISN 0008            REAL*8 PGN(10)/Z40271AD8921466DF,Z402630336A58B322,           00000220
                   *               Z402460691E694A69,Z4021B658BB64DBF8,           00000230
                   *               Z401E41FF31573B48,Z401A1817A317A820,           00000240
                   *               Z4015519FE196E249,Z40100B467DF7E474,           00000250
                   *               Z3FA64DAF529D83FA,Z3F4825A009D3A2BA/           00000260
ISN 0009            REAL*8 XGN(10)/Z4013973DF98B86AF,Z403A502C6D25177F,           00000270
                   *               Z405FAB33C55948OF,Z4082C82E09FBFFB4,           00000280
                   *               Z40A2D469FD3886D7,Z40BF0F9B9A352A6F,           00000290
                   *               Z4006D05EAF7EB739,Z40E988320B9FEC8C,           00000300
                   *               Z40F6C6DD3DE8B4F5,Z40FE3DAD0638E701/           00000310
ISN 0010            REAL*8 PJ/3.14159265358979300/                                00000320
ISN 0011            COMMON /INPT/ KE(42),WI,IN(100)                               00000330
ISN 0012            COMMON /IFIT/ IA(30),NC,ID                                    00000340
ISN 0013            DATA NC1/0/,NC3/0/                                            00000350
ISN 0014            IF(N) 2,1,2                                                   00000360
ISN 0015          1 N=49                                                          00000370
ISN 0016            NP=N                                                          00000380
ISN 0017            IF ((KE(16).NE.8).OR.(KE(17).EQ.0)) N=1                       00000390
ISN 0019            RETURN                                                        00000400
ISN 0020          2 IF(N-2) 3,4,4                                                 00000410
ISN 0021          3 AH13=P(3)**(1.00/3.00)                                        00000420
ISN 0022            NC4=P(3)                                                      00000430
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ISN 0023            NF=IN(8)                                                    00000440
ISN 0024            IO=IA(NF)                                                   00000450
ISN 0025            IF (IO.EQ.NP) IO=IA(NF-1)                                   00000460
ISN 0027            IF (KE(18).LT.3) GO TO 113                                  00000470
ISN 0029            ICW=IO                                                      00000480
ISN 0030            RCTFW=P(29)                                                 00000490
ISN 0031            DO 111 I=1,NF                                               00000500
ISN 0032            IF (IA(I).GT.28) GO TO 112                                  00000510
ISN 0034          111 CONTINUE                                                  00000520
ISN 0035          112 IC=IA(I-1)                                                00000530
ISN 0036            IUW=30                                                      00000540
ISN 0037            IF (IO.LT.14) IO=28                                         00000550
ISN 0039          113 IF (KE(15).EQ.0) GO TO 66                                 00000560
ISN 0041            CALL COULPO(1,P,R,VC,VD)                                    00000570
ISN 0042            GO TO 9                                                     00000580
ISN 0043           66 R=P(2)*AH13                                               00000590
ISN 0044            A=1.43985*P(NP+4)/R                                         00000600
ISN 0045            V2=-.5*A/(R*R)                                              00000610
ISN 0046            V0=A-R*R*V2                                                 00000620
ISN 0047            PCR=R                                                       00000630
ISN 0048            9 H=P(NP+3)                                                 00000640
ISN 0049            R=P(1)                                                      00000650
ISN 0050            NC2=H*10.                                                   00000660
ISN 0051            IF (NC1.EQ.NC2) GO TO 21                                    00000670
ISN 0053            ISM=P(NP+6)+P(NP+7)                                         00000680
ISN 0054            IF(ISM.GT.200) ISM=200                                      00000690
ISN 0056            ISM1=P(5)/H                                                 00000700
ISN 0057            ISM2=P(42)/H                                                00000710
ISN 0058            ISM12=ISM1+ISM2                                             00000720
ISN 0059            IF(ISM12.GT.ISM) ISM12=ISM                                  00000730
                  C-----BERECHNUNG VON FXV                                      00000740
ISN 0061            ISM22=2*ISM12+1                                             00000750
ISN 0062            CALL FXV(H,ISM22,V)                                         00000760
ISN 0063            NC1=NC2                                                     00000770
                  C-----NORMIERUNG DER NEUTRONEN- UND PROTONENVERTEILUNG        00000780
ISN 0064            IF (KE(17).EQ.1) GO TO 20                                   00000790
ISN 0066            CALL DPN(ROO,P)                                             00000800
ISN 0067            D(1)=P(3)-P(NP+4)/WI(4)                                     00000810
ISN 0068            D(2)=P(NP+4)/WI(4)                                          00000820
ISN 0069            ROO(2)=ROO(2)*D(2)                                          00000830
ISN 0070            GO TO 21                                                    00000840
ISN 0071           20 D(1)=P(3)                                                 00000850
ISN 0072           21 IF (NC3.EQ.NC4) GO TO 43                                  00000860
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ISN 0074            S(1)=0.                                                    00000870
ISN 0075            S(2)=P(42)                                                 00000880
ISN 0076            S(5)=.000001D0                                             00000890
ISN 0077            K=0                                                        00000900
ISN 0078            NF=0                                                       00000910
ISN 0079         10 CALL FORHAD(K,S)                                           00000920
ISN 0080            GO TO (11,11,12,12),K                                      00000930
ISN 0081         11 S(4)=S(3)*S(3)*DENS(P,S)                                   00000940
ISN 0082            NF=NF+1                                                    00000950
ISN 0083            GO TO 10                                                   00000960
ISN 0084         12 IF(NF.LE.5) GO TO 11                                       00000970
ISN 0086            ROO(1)=D(1)/(4.D0*PJ*S(4))                                 00000980
ISN 0087            NC3=NC4                                                    00000990
                 C-----INTEGRATION                                             00001000
ISN 0088         43 DO 44 IS12=1,ISM12                                         00001010
ISN 0089         44 UC(IS12)=0.D0                                              00001020
                 C-----R-ALPHA PUNKTE                                          00001030
ISN 0090            R1=0.D0                                                    00001040
ISN 0091            DO 7 IS1=1,ISM1                                            00001050
ISN 0092            R1=R1+H                                                    00001060
ISN 0093            S(3)=R1                                                    00001070
ISN 0094            RODS=ROO(1)*DENS(P,S)+DEFB(P,S,IO)                         00001080
ISN 0095            IF (KE(17).EQ.2) RODS=RODS+DENSP(P,S)*ROO(2)               00001090
ISN 0097            RODS23=DMAX1(0.D0,RODS)                                    00001100
ISN 0098            RODS23=RODS23**(2.D0/3.D0)                                 00001110
ISN 0099            RODS=RODS*(1.D0-P(6)*RODS23)                               00001120
ISN 0100            SIM=(1+MOD(IS1,2))*R1*R1*RODS                              00001130
                 C-----FO VON R, R-ALPHA                                       00001140
ISN 0101            DO 6 IS12=1,ISM12                                          00001150
ISN 0102            A=(IS1*IS1+IS12*IS12)*H*H                                  00001160
ISN 0103            B=2.D0*IS1*IS12*H*H                                        00001170
ISN 0104            FO=0.D0                                                    00001180
                 C-----WINKELINTEGRATION                                       00001190
ISN 0105            DO 5 I=1,10                                                00001200
ISN 0106            C=A-B*XGN(I)                                               00001210
ISN 0107            C=DSQRT(C)                                                 00001220
ISN 0108            J=C/H                                                      00001230
ISN 0109            X=C/H-J                                                    00001240
ISN 0110            FF=.5D0*(V(J)+X*(V(J+1)-V(J)))                             00001250
ISN 0111            C=A+B*XGN(I)                                               00001260
ISN 0112            C=DSQRT(C)                                                 00001270
ISN 0113            J=C/H                                                      00001280
ISN 0114            X=C/H-J                                                    00001290
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ISN 0115            FF=FF+.5D0*(V(J)+X*(V(J+1)-V(J)))                    00001300
ISN 0116          5 FO=FO+FF*PGN(I)                                      00001310
ISN 0117          6 UC(IS12)=UC(IS12)+SIM*FO                             00001320
ISN 0118          7 CONTINUE                                             00001330
ISN 0119            RETURN                                               00001340
                C-----INTERPOLATION                                      00001350
ISN 0120          4 R=P(1)                                               00001360
ISN 0121            IF (KE(15).EQ.0) GO TO 77                            00001370
ISN 0123            CALL COULPO(2,P,R,VC,VD)                             00001380
ISN 0124            GO TO 79                                             00001390
ISN 0125         77 IF (R-PCR) 75,18,18                                  00001400
ISN 0126         75 VC=V0+R*R*V2                                         00001410
ISN 0127            VD=R*2.*V2                                           00001420
ISN 0128            GO TO 79                                             00001430
ISN 0129         18 VC=1.43985*P(NP+4)/R                                 00001440
ISN 0130            VD=-VC/R                                             00001450
ISN 0131         79 J=R/H                                                00001460
ISN 0132            X=R/H-J                                              00001470
ISN 0133            IF(J.EQ.ISM) GO TO 211                               00001480
ISN 0135            IF(J.EQ.0) GO TO 213                                 00001490
ISN 0137            VCC=UC(J)+X*(UC(J+1)-UC(J))                          00001500
ISN 0138            IF(J.EQ.1) GO TO 212                                 00001510
ISN 0140            VDD=(UC(J+1)-UC(J-1))/(2.D0*H)                       00001520
ISN 0141            GO TO 150                                            00001530
ISN 0142        211 VCC=UC(J)+X*(UC(J)-UC(J-1))                          00001540
ISN 0143            VDD=(UC(J)-UC(J-1))/H                                00001550
ISN 0144            GO TO 150                                            00001560
ISN 0145        212 VDD=(UC(J+1)-UC(J))/H                                00001570
ISN 0146            GO TO 150                                            00001580
ISN 0147        213 VCC=2.*UC(1)-UC(2)                                   00001590
ISN 0148            VDD=(UC(2)-UC(1))/H                                  00001600
ISN 0149        150 F1=2.*4.*PJ*H/3.*P(4)                                00001610
ISN 0150            PR(1)=VC-F1*VCC                                      00001620
ISN 0151            PR(2)=VD-F1*VDD                                      00001630
ISN 0152            KEW=KE(18)                                           00001640
ISN 0153            GO TO (170,220,170,220),KEW                          00001650
ISN 0154        170 SS=R-P(8)*AH13                                       00001660
ISN 0155            A=P(9)                                               00001670
ISN 0156            Y=1.D0/(1.D0+DEXP(SS/A))                             00001680
ISN 0157            Z=-DEXP(SS/A)/A*Y*Y                                  00001690
ISN 0158            PI(1)=-P(7)*Y                                        00001700
ISN 0159            PI(2)=-P(7)*Z                                        00001710
                C     OBERFLAECHENABSORPTION                             00001720
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ISN 0160          WD=P(10)                                                    00001730
ISN 0161          IF(WD) 30,31,30                                             00001740
ISN 0162       30 SS=R-P(11)*AH13                                             00001750
ISN 0163          A=P(12)                                                     00001760
ISN 0164          Z=DEXP(SS/A)                                                00001770
ISN 0165          VV=1.D0+Z                                                   00001780
ISN 0166          Y=Z/(VV*VV)                                                 00001790
ISN 0167          Z=Y*(1.D0-2.D0*Z/VV)/A                                      00001800
ISN 0168          PI(1)=PI(1)-4.D0*WD*Y                                       00001810
ISN 0169          PI(2)=PI(2)-4.D0*WD*Z                                       00001820
ISN 0170       31 IF (KE(18).GT.2) GO TO 500                                  00001830
ISN 0172          RETURN                                                      00001840
                C     IMAGINAERTEIL VOLUMEN                                 00001850
ISN 0173     220  SS=R-P(8)*AH13                                             00001860
ISN 0174          A=P(9)                                                      00001870
ISN 0175          Y=1.DC/(1.D0+DEXP(SS/A))                                    00001880
ISN 0176          Z=Y*Y*Y*DEXP(SS/A)*(-2.DC/A)                               00001890
ISN 0177          Y=Y*Y                                                       00001900
ISN 0178          PI(1)=-P(7)*Y                                               00001910
ISN 0179          PI(2)=-P(7)*Z                                               00001920
                C     OBERFLAECHENABSORPTION                                00001930
ISN 0180          WD=P(10)                                                    00001940
ISN 0181          IF(WD) 230,231,230                                          00001950
ISN 0182     230  SS=R-P(11)*AH13                                            00001960
ISN 0183          A=P(12)                                                     00001970
ISN 0184          Y1=1.D0/(1.D0+DEXP(SS/A))                                   00001980
ISN 0185          Y2=DEXP(SS/A)                                               00001990
ISN 0186          Y=Y1**3*Y2*(-2.DC/A)                                        00002000
ISN 0187          Z=Y1**4*Y2*Y2*6.D0/(A**2)-Y1**3*Y2*2.D0/(A**2)              00002010
ISN 0188          PI(1)=PI(1)+4.DC*WD*Y*A                                     00002020
ISN 0189          PI(2)=PI(2)+4.D0*WD*Z*A                                     00002030
ISN 0190     231  IF (KE(18).GT.2)GO TO 500                                   00002040
ISN 0192          RETURN                                                      00002050
ISN 0193     500  SYFB=0.D0                                                  00002060
ISN 0194          SZFB=0.D0                                                   00002070
ISN 0195          IF (R.GE.RCTFW) GO TO 391                                   00002080
ISN 0197          IF ((KE(19).NE.2).AND.(KE(19).NE.3)) GO TO 321              00002090
ISN 0199          IU1=31                                                      00002100
ISN 0200          P(30)=0.D0                                                  00002110
ISN 0201          DO 322 I=IU1,IOW                                            00002120
ISN 0202          II=I-29                                                     00002130
ISN 0203          P(30)=P(30)+P(I)*(-1.D0)**II/II**2                          00002140
ISN 0204     322  CONTINUE                                                   00002150
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ISN 0205        321 DO 390 I=IOW,IOw                                                    00002160
ISN 0206            IX=I-29                                                             00002170
ISN 0207            IF (R) 380,380,381                                                  00002180
ISN 0208        380 SYFB=SYFB+P(I)                                                      00002190
ISN 0209            GO TO 390                                                           00002200
ISN 0210        381 YFB=PJ*R*IX/RCTFW                                                   00002210
ISN 0211            SYFB=SYFB+P(I)*DSIN(YFB)/YFB                                        00002220
ISN 0212            SZFB=SZFB+P(I)*(DCOS(YFB)*PJ*IX*YFB/RCTFW-                          00002230
                   1 DSIN(YFB)*PJ*IX/RCTFW)/YFB**2                                      00002240
ISN 0213        390 CONTINUE                                                            00002250
ISN 0214        391 PI(1)=PI(1)-SYFB                                                    00002260
ISN 0215            PI(2)=PI(2)-SZFB                                                    00002270
ISN 0216            RETURN                                                              00002280
ISN 0217            END                                                                 00002290


            C       MAJKA-INTERACTION NUMERICALLY                                       00002300
ISN 0002            SUBROUTINE FXV(H,ISM12,DV)                                          00002310
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                           00002320
ISN 0004            DIMENSION DV(401)                                                   00002330
ISN 0005            REAL*8 DVN(72)/                                                     00002340
                   * 0.32655598D+02, 0.32818804D+02, 0.32688257D+02, 0.32723604D+02,    00002350
                   * 0.32168960D+02, 0.32198909D+02, 0.31829261D+02, 0.31356074D+02,    00002360
                   * 0.30909814D+02, 0.30617404D+02, 0.29515920D+02, 0.28450010D+02,    00002370
                   * 0.27300033D+02, 0.26230426D+02, 0.24902445D+02, 0.23538169D+02,    00002380
                   * 0.22027391D+02, 0.20460865D+02, 0.18892759D+02, 0.17223171D+02,    00002390
                   * 0.15566984D+02, 0.14046482D+02, 0.12476956D+02, 0.10975707D+02,    00002400
                   * 0.96716745D+01, 0.83365711D+01, 0.71814886D+01, 0.62168890D+01,    00002410
                   * 0.53542093D+01, 0.44514222D+01, 0.37565651D+01, 0.31529389D+01,    00002420
                   * 0.26126167D+01, 0.21962766D+01, 0.18207003D+01, 0.15049992D+01,    00002430
                   * 0.12389898D+01, 0.10193921D+01, 0.83641474D+00, 0.68325897D+00,    00002440
                   * 0.56343686D+00, 0.46001230D+00, 0.37258873D+00, 0.30326228D+00,    00002450
                   * 0.24278179D+00, 0.19695899D+00, 0.16071306D+00, 0.12965536D+00,    00002460
                   * 0.10558739D+00, 0.85178007D-01, 0.68000002D-01, 0.55061227D-01,    00002470
                   * 0.44403788D-01, 0.36031468D-01, 0.29025146D-01, 0.23121597D-01,    00002480
                   * 0.18424027D-01, 0.14836518D-01, 0.11981919D-01, 0.96334101D-02,    00002490
                   * 0.76927038D-02, 0.61213995D-02, 0.49233453D-02, 0.39453534D-02,    00002500
                   * 0.31329012D-02, 0.25093473D-02, 0.20045213D-02, 0.15997472D-02,    00002510
                   * 0.12769238D-02, 0.10150427D-02, 0.81179935D-03, 0.64787354D-03/    00002520
ISN 0006            DO 100 I=1,ISM12                                                    00002530
ISN 0007            DV(I)=0.00                                                          00002540
ISN 0008        100 CONTINUE                                                            00002550
```

```
ISN 0009            R=0.D0                                                    00002560
ISN 0010            DO 200 I=1,ISM12                                          00002570
ISN 0011            R=R+H                                                     00002580
ISN 0012            IF (R.GT.7.2) GO TO 300                                   00002590
ISN 0014            J=R/.1                                                    00002600
ISN 0015            X=R/.1-J                                                  00002610
ISN 0016            IF (J.EQ.ISM12) GO TO 211                                 00002620
ISN 0018            IF (J.EQ.0) GO TO 213                                     00002630
ISN 0020            DV(I)=DVN(J)+X*(DVN(J+1)-DVN(J))                          00002640
ISN 0021            GO TO 200                                                 00002650
ISN 0022        211 DV(I)=DVN(J)+X*(DVN(J)-DVN(J-1))                          00002660
ISN 0023            GO TO 200                                                 00002670
ISN 0024        213 DV(I)=2.D0*DVN(1)-DVN(2)                                  00002680
ISN 0025        200 CONTINUE                                                  00002690
ISN 0026        300 RETURN                                                    00002700
ISN 0027            END                                                       00002710


ISN 0002            SUBROUTINE DPN(ROO,P)                                     00002720
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                 00002730
ISN 0004            REAL*4 WI(1000)                                           00002740
ISN 0005            DIMENSION ROO(2),F(25),P(2)                               00002750
ISN 0006            REAL*8 PI/3.1415926535897930/                             00002760
ISN 0007            DATA NC1/0/                                               00002770
ISN 0008            COMMON /INPT/ KE(42),WI,IN(100)                           00002780
ISN 0009            NC2=WI(3)+.2                                              00002790
ISN 0010            IF (NC1.EQ.NC2) GO TO 10                                  00002800
ISN 0012            NC1=NC2                                                   00002810
                C-----NORMIERUNG DER PROTONEN-VERTEILUNG                      00002820
ISN 0013            F(1)=0.                                                   00002830
ISN 0014            F(2)=P(42)                                                00002840
ISN 0015            F(5)=.000001D0                                            00002850
ISN 0016            K=0                                                       00002860
ISN 0017            NF=0                                                      00002870
ISN 0018        100 CALL FORHAD(K,F)                                          00002880
ISN 0019            GO TO (110,110,120,120), K                                00002890
ISN 0020        110 F(4)=F(3)*F(3)*DENSP(P,F)                                 00002900
ISN 0021            NF=NF+1                                                   00002910
ISN 0022            GO TO 100                                                 00002920
ISN 0023        120 IF(NF.LE.5) GO TO 110                                     00002930
ISN 0025            ROO(2)=1.D0/(4.D0*PI*F(4))                                00002940
ISN 0026            RHO2=ROO(2)                                               00002950
ISN 0027            RETURN                                                    00002960
```

```
ISN 0028          10 ROO(2)=RHO2                                                00002970
ISN 0029             RETURN                                                     00002980
ISN 0030             END                                                        00002990


ISN 0002             FUNCTION DENS(P,S)                                         00003000
                  C-----3-PARAMETER FERMI-VERTEILUNG DER NEUTRONEN ODER MASSE   00003010
ISN 0003             IMPLICIT REAL*8 (A-H,O-Z)                                  00003020
ISN 0004             DIMENSION P(2),S(2)                                        00003030
ISN 0005             DENS=0.DO                                                  00003040
ISN 0006             C=P(43)*P(3)**(1.DO/3.DO)                                  00003050
ISN 0007             A=P(44)                                                    00003060
ISN 0008             W=P(45)                                                    00003070
ISN 0009             R=S(3)                                                     00003080
ISN 0010             IF (R.GT.P(42)) RETURN                                     00003090
ISN 0012             DENS=(1.DO+R*R*W/(C*C))/(1.DO+DEXP((R-C)/A))               00003100
ISN 0013             RETURN                                                     00003110
ISN 0014             END                                                        00003120


ISN 0002             FUNCTION DENSP(P,S)                                        00003130
                  C-----3-PARAMETER FERMI-VERTEILUNG DER PROTONEN               00003140
ISN 0003             IMPLICIT REAL*8 (A-H,O-Z)                                  00003150
ISN 0004             DIMENSION P(2),S(2)                                        00003160
ISN 0005             DENSP=0.DO                                                 00003170
ISN 0006             C=P(46)*P(3)**(1.DO/3.DO)                                  00003180
ISN 0007             A=P(47)                                                    00003190
ISN 0008             W=P(48)                                                    00003200
ISN 0009             R=S(3)                                                     00003210
ISN 0010             IF (R.GT.P(42)) RETURN                                     00003220
ISN 0012             DENSP=(1.DO+R*R*W/(C*C))/(1.DO+DEXP((R-C)/A))              00003230
ISN 0013             RETURN                                                     00003240
ISN 0014             END                                                        00003250
```

```
C-----FOURIER-BESSEL DENS                                                00003260
ISN 0002        FUNCTION DEFB(P,S,IO)                                    00003270
ISN 0003        IMPLICIT REAL*8 (A-H,O-Z)                                00003280
ISN 0004        REAL*4 WI(1000)                                          00003290
ISN 0005        REAL*8 PI/3.1415926535897930/                            00003300
ISN 0006        DIMENSION P(2),S(2)                                      00003310
ISN 0007        COMMON /INPT/KE(42),WI,IN(100)                           00003320
ISN 0008        DEFB=0.D0                                                00003330
ISN 0009        R=S(3)                                                   00003340
ISN 0010        IF (R.GT.P(13)) RETURN                                   00003350
ISN 0012        NF=IN(8)                                                 00003360
ISN 0013        RCTF=P(13)                                               00003370
ISN 0014        IU=14                                                    00003380
ISN 0015        IU1=15                                                   00003390
ISN 0016        P(14)=0.                                                 00003400
ISN 0017        DO 50 I=IU1,IO                                           00003410
ISN 0018        II=I-13                                                  00003420
ISN 0019        P(14)=P(14)+P(I)*(-1.)**II/II**2                         00003430
ISN 0020     50 CONTINUE                                                 00003440
ISN 0021        SYFB=0.D0                                                00003450
ISN 0022        DO 100 I=IU,IO                                           00003460
ISN 0023        IX=I-13                                                  00003470
ISN 0024        IF (R) 10,10,20                                          00003480
ISN 0025     10 SYFB=SYFB+P(I)                                           00003490
ISN 0026        GO TO 100                                                00003500
ISN 0027     20 YFB=PI*R*IX/RCTF                                         00003510
ISN 0028        SYFB=SYFB+P(I)*DSIN(YFB)/YFB                             00003520
ISN 0029    100 CONTINUE                                                 00003530
ISN 0030        DEFB=DEFB+SYFB                                           00003540
ISN 0031        RETURN                                                   00003550
ISN 0032        END                                                      00003560


ISN 0002        SUBROUTINE DENPR(P,W,NP,M,N,VARM,CHI2)                   00003570
ISN 0003        IMPLICIT REAL*8 (A-H,O-Z)                                00003580
ISN 0004        REAL*4 WI(1000)                                          00003590
ISN 0005        DIMENSION P(2),W(2),VARM(30,30),S(30),D(2),CP(2,20),RCO(2)  00003600
ISN 0006        DIMENSION RMS(10)                                        00003610
ISN 0007        REAL*8 PJ/3.1415926535897930/                            00003620
ISN 0008        COMMON /INPT/KE(42),WI,IN(100)                           00003630
ISN 0009        COMMON /IFIT/IA(30),NC,ID                                00003640
ISN 0010        RC=P(42)                                                 00003650
```

```
ISN 0011            AH13=P(3)**(1.D0/3.D0)                                  00003660
ISN 0012            Z2=WI(5)                                                00003670
ISN 0013            H=.1D0                                                  00003680
ISN 0014            NS=RC/H+2.                                              00003690
ISN 0015            DRSM=0.D0                                               00003700
ISN 0016            DRSN=0.D0                                               00003710
                   C-----LADUNGSVERTEILUNG                                  00003720
ISN 0017            IF (KE(15).EQ.0) GO TO 10                               00003730
ISN 0019            NW=7                                                    00003740
ISN 0020            DO 1 I=1,4                                              00003750
ISN 0021            NW=NW+WI(NW)+1.1                                        00003760
ISN 0022          1 CONTINUE                                                00003770
ISN 0023            NC=WI(NW)+.1                                            00003780
ISN 0024            DO 2 I=1,NC                                             00003790
ISN 0025            CP(2,I)=WI(NW+I)                                        00003800
ISN 0026          2 CONTINUE                                                00003810
ISN 0027            NW=NW+WI(NW)+1.1                                        00003820
ISN 0028            S(1)=0.                                                 00003830
ISN 0029            S(2)=CP(2,1)                                            00003840
ISN 0030            S(5)=.00000100                                          00003850
ISN 0031            K=0                                                     00003860
ISN 0032            NF=0                                                    00003870
ISN 0033          3 CALL FORHAD(K,S)                                        00003880
ISN 0034            GO TO (4,4,5,5), K                                      00003890
ISN 0035          4 S(4)=S(3)*S(3)*DEN2(CP,S)                               00003900
ISN 0036            NF=NF+1                                                 00003910
ISN 0037            GO TO 3                                                 00003920
ISN 0038          5 IF (NF.LE.5) GO TO 4                                    00003930
ISN 0040            RHOC=Z2/(4.D0*PJ*S(4))                                  00003940
ISN 0041            WRITE (6,6002) RHOC                                     00003950
ISN 0042         6002 FORMAT (//' DENSITY CHARGE = ',1PD15.5)               00003960
                   C-----PROTONENVERTEILUNG                                 00003970
ISN 0043         10 IF (KE(17).EQ.1) GO TO 20                               00003980
ISN 0045            CALL DPN(ROO,P)                                         00003990
ISN 0046            D(1)=P(3)-P(NP+4)/WI(4)                                 00004000
ISN 0047            D(2)=P(NP+4)/WI(4)                                      00004010
ISN 0048            ROO(2)=ROO(2)*D(2)                                      00004020
ISN 0049            GO TO 21                                                00004030
ISN 0050         20 D(1)=P(3)                                               00004040
ISN 0051         21 IF (KE(17).LT.1) GO TO 1000                             00004050
ISN 0053            S(1)=0.                                                 00004060
ISN 0054            S(2)=P(42)                                              00004070
ISN 0055            S(5)=.00000100                                          00004080
```

```
ISN 0056            K=0                                                                 00004090
ISN 0057            NF=0                                                                00004100
ISN 0058          22 CALL FORHAD(K,S)                                                   00004110
ISN 0059            GO TO (23,23,24,24), K                                              00004120
ISN 0060          23 S(4)=S(3)*S(3)*DENS(P,S)                                           00004130
ISN 0061            NF=NF+1                                                             00004140
ISN 0062            GO TO 22                                                            00004150
ISN 0063          24 IF (NF.LE.5) GO TO 23                                              00004160
ISN 0065            ROO(1)=D(1)/(4.DO*PJ*S(4))                                          00004170
ISN 0066            WRITE (6,6004) ROO                                                  00004180
ISN 0067        6004 FORMAT (///' DENSITIES MATTER/NEUTRONS AND PROTONS',1P2D15.5)      00004190
ISN 0068            VK=4.DO*PJ*(P(2)*AH13)**3/3.DO                                      00004200
ISN 0069            DCK=P(NP+4)/(WI(4)*VK)                                              00004210
ISN 0070            PHC=P(2)*AH13                                                       00004220
ISN 0071            RCTF=P(13)                                                          00004230
ISN 0072            RCT2=RCTF-.01                                                       00004240
ISN 0073            NF=IN(8)                                                            00004250
ISN 0074            IO=IA(NF)                                                           00004260
ISN 0075            IF (IO.EQ.NP) IO=IA(NF-1)                                           00004270
ISN 0077            DO 25 I=1,NF                                                        00004280
ISN 0078            IF (IA(I).GT.13) GO TO 26                                           00004290
ISN 0080          25 CONTINUE                                                           00004300
ISN 0081          26 IU=IA(I)                                                           00004310
ISN 0082            II=I-1                                                              00004320
ISN 0083            IU1=IU-1                                                            00004330
ISN 0084            IU2=IU-14                                                           00004340
ISN 0085            IF (KE(18).LT.3) GO TO 30                                           00004350
ISN 0087            DO 8 I=1,NF                                                         00004360
ISN 0088            IF (IA(I).GT.28) GO TO 9                                            00004370
ISN 0090            8 CONTINUE                                                          00004380
ISN 0091            9 IO=IA(I-1)                                                        00004390
ISN 0092          30 IF (KE(11).EQ.1) WRITE (6,6001)                                    00004400
ISN 0094        6001 FORMAT (///' ',7X,'R',11X,'MATTER',10X,'NEUTRONS',11X,'ERROR',     00004410
                   1 9X,'ERROR PERC',8X,'PROTONS',10X,'CHARGE')                         00004420
ISN 0095          33 R=-H                                                               00004430
ISN 0096            DO 100 I=1,NS                                                       00004440
ISN 0097            R=R+H                                                               00004450
ISN 0098            DM=0.                                                               00004460
ISN 0099            DN=0.                                                               00004470
ISN 0100            DP=0.                                                               00004480
ISN 0101            DC=0.                                                               00004490
ISN 0102            ERR=0.                                                              00004500
ISN 0103            W(I+NS)=0.DO                                                        00004510
```

```
ISN 0104            W(I+2*NS)=0.D0                                                  00004520
ISN 0105            W(I+3*NS)=0.D0                                                  00004530
ISN 0106            W(I+4*NS)=0.D0                                                  00004540
ISN 0107            S(3)=R                                                          00004550
ISN 0108            IF (R.LT.PHC) DC=DCK                                            00004560
ISN 0110            KE17=KE(17)                                                     00004570
ISN 0111            GO TO (34,35), KE17                                             00004580
ISN 0112          34 DM=DENS(P,S)*RCO(1)+DEFB(P,S,IO)                               00004590
ISN 0113            GO TO 36                                                        00004600
ISN 0114          35 DN=DENS(P,S)*RCO(1)+DEFB(P,S,IO)                               00004610
ISN 0115            DP=DENSP(P,S)*RCO(2)                                            00004620
ISN 0116            DM=DN+DP                                                        00004630
ISN 0117          36 IF (KE(15).EQ.1) DC=DEN2(CP,S)*RHOC                            00004640
ISN 0119            W(I)=DM                                                         00004650
ISN 0120            W(I+2*NS)=DN                                                    00004660
ISN 0121            W(I+3*NS)=DP                                                    00004670
ISN 0122            W(I+4*NS)=DC                                                    00004680
ISN 0123            IF (R.GE.RCT2) GO TO 90                                         00004690
ISN 0125            DO 50 K=IU,IC                                                   00004700
ISN 0126            I1=K-IU1                                                        00004710
ISN 0127            I2=I1+IU2                                                       00004720
ISN 0128            Y=I2*PJ*R/RCTF                                                  00004730
ISN 0129          59 DO 60 J=IU,IC                                                  00004740
ISN 0130            J1=J-IU1                                                        00004750
ISN 0131            J2=J1+IU2                                                       00004760
ISN 0132            Z=J2*PJ*R/RCTF                                                  00004770
ISN 0133            IF (R) 70,70,80                                                 00004780
ISN 0134          70 ERR=ERR+VARM(II+I1,II+J1)                                      00004790
ISN 0135            GO TO 60                                                        00004800
ISN 0136          80 ERR=ERR+(DSIN(Y)*DSIN(Z)/(Y*Z))*VARM(II+I1,II+J1)              00004810
ISN 0137          60 CONTINUE                                                       00004820
ISN 0138          50 CONTINUE                                                       00004830
ISN 0139            W(I+NS)=DSQRT(ERR*CHI2*2.D0)                                    00004840
ISN 0140            IF (KE(17).EQ.1) GO TO 85                                       00004850
ISN 0142            ERR=W(I+NS)/DN*100.                                             00004860
ISN 0143            GO TO 90                                                        00004870
ISN 0144          85 ERR=W(I+NS)/DM*100.                                            00004880
ISN 0145          90 IF (KE(11).EQ.1) WRITE (6,6010) R,DM,DN,W(I+NS),ERR,DP,DC      00004890
ISN 0147         100 CONTINUE                                                       00004900
ISN 0148        6010 FORMAT (' ',0PF10.3,5X,6(1PD12.4,5X))                          00004910
ISN 0149            IF ((KE(12).EQ.0).AND.(KE(14).EQ.0)) GO TO 203                  00004920
ISN 0151            KMM=MOD(KE(14),1000)/100                                        00004930
ISN 0152            KMN=KE(14)/1000                                                 00004940
```

```
ISN 0153            IF (KE(17).NE.2) KMN=0                                                  00004950
ISN 0155            DO 110 I=1,4                                                            00004960
ISN 0156            ND=I                                                                    00004970
ISN 0157            IF (I.EQ.1) ND=I-1                                                      00004980
ISN 0159            IF (((KE(17).EQ.1).AND.(I.GT.1)).AND.(.NOT.((KE(15).EQ.1).AND.(I.E00004990
                   1 Q.4)))) GO TO 110                                                      00005000
ISN 0161            CALL MOMENT(ND,W,H,NS,RMS)                                              00005010
ISN 0162            IF (I.EQ.1) WRITE (6,6300)                                              00005020
ISN 0164      6300  FORMAT (///' MATTER DENSITY')                                           00005030
ISN 0165            IF (I.EQ.2) WRITE (6,6301)                                              00005040
ISN 0167      6301  FORMAT (///' NEUTRON DENSITY')                                         00005050
ISN 0168            IF (I.EQ.3) WRITE (6,6302)                                              00005060
ISN 0170      6302  FORMAT (///' PROTON DENSITY')                                          00005070
ISN 0171            IF (I.EQ.4) WRITE (6,6303)                                              00005080
ISN 0173      6303  FORMAT (///' CHARGE DENSITY')                                          00005090
ISN 0174            WRITE (6,6501) (RMS(J),J=1,3),(RMS(J),J=5,10)                           00005100
ISN 0175      6501  FORMAT ((/' K-TH MOMENT FOR K = -2, -1, ... ,+5, +6'                    00005110
                   1 /9(1PD12.5,2X)))                                                       00005120
ISN 0176            WRITE (6,6502) RMS(4)                                                   00005130
ISN 0177      6502  FORMAT (/' VOLUME = ',1PD12.5)                                         00005140
ISN 0178            IF ((KMM.GT.0).AND.(I.EQ.1)) WRITE (8,7001) RMS                         00005150
ISN 0180            IF ((KMN.GT.0).AND.(I.EQ.2)) WRITE (8,7001) RMS                         00005160
ISN 0182            IF ((I.GT.2).OR.((I.EQ.1).AND.(KE(17).EQ.2))) GO TO 109                 00005170
ISN 0184            CALL ERMOM (II,IU,IO,IU1,IU2,VARM,RCTF,CHI2,RMS)                        00005180
ISN 0185            WRITE (6,6503) (RMS(J),J=1,3),(RMS(J),J=5,10)                           00005190
ISN 0186            WRITE (6,6504) RMS(4)                                                   00005200
ISN 0187      6503  FORMAT ((/' ERRORS OF K-TH MOMENT FOR K = -2, -1, ... ,+5, +6'         00005210
                   1 /9(1PD12.5,2X)))                                                       00005220
ISN 0188      6504  FORMAT (/' ERROR VOLUME = ',1PD12.5)                                   00005230
ISN 0189       109  IF ((KMM.GT.0).AND.(I.EQ.1)) WRITE (8,7001) RMS                         00005240
ISN 0191            IF ((KMN.GT.0).AND.(I.EQ.2)) WRITE (8,7001) RMS                         00005250
ISN 0193       110  CONTINUE                                                                00005260
ISN 0194       200  IWP=NS*2                                                                00005270
ISN 0195            IwS=1                                                                   00005280
ISN 0196            KDM=MOD(KE(13),1000)/100                                                00005290
ISN 0197            KDN=KE(13)/1000                                                         00005300
ISN 0198            IF (KE(17).NE.2) KDN=0                                                  00005310
ISN 0200            IF (KDM.GT.0) WRITE(7,7001) (W(I),I=IWS,IWP)                            00005320
ISN 0202            IWS=IWP+1                                                               00005330
ISN 0203            IWP=IWP+NS                                                              00005340
ISN 0204            IF (KDN.GT.0) WRITE (7,7001) (W(I),I=IWS,IWP)                           00005350
ISN 0206      7001  FORMAT((5X,'*',6(1PD10.3,',')))                                        00005360
ISN 0207      1000  RETURN                                                                  00005370
ISN 0208            END                                                                     00005380
```

```
                C-----POTENTIAL PRINT                                                   00005390
ISN 0002              SUBROUTINE POTPR(P,W,NP,M,N,VARM,CHI2)                            00005400
ISN 0003              IMPLICIT REAL*8 (A-H,O-Z)                                         00005410
ISN 0004              REAL*4 WI(1000)                                                   00005420
ISN 0005              DIMENSION P(2),PR(2),PI(2),W(2),VARM(30,30),RMS(10)               00005430
ISN 0006              REAL*8 PJ/3.14159265358979300/                                    00005440
ISN 0007              COMMON /INPT/KE(42),WI,IN(100)                                    00005450
ISN 0008              COMMON /IFIT/IA(30),NC,ID                                         00005460
ISN 0009              NRC=P(NP+3)*(P(NP+6)+P(NP+7)-1.)+1.                               00005470
ISN 0010              RC=NRC                                                            00005480
ISN 0011              H=.100                                                            00005490
ISN 0012              AH13=P(3)**(1.00/3.00)                                            00005500
ISN 0013              NA2=WI(2)+.2                                                      00005510
ISN 0014              HA=P(NP+3)                                                        00005520
ISN 0015              NSA=P(NP+6)                                                       00005530
ISN 0016              MSA=P(NP+7)                                                       00005540
ISN 0017              P(NP+3)=H                                                         00005550
ISN 0018              NS=RC/H+2                                                         00005560
ISN 0019              MS=0                                                              00005570
ISN 0020              P(NP+6)=NS                                                        00005580
ISN 0021              P(NP+7)=MS                                                        00005590
ISN 0022              NN=1                                                              00005600
ISN 0023              CALL POTE(P,PR,PI,NN)                                             00005610
ISN 0024              IF (KE(15).EQ.1) GO TO 6                                          00005620
ISN 0026              R=P(2)*AH13                                                       00005630
ISN 0027              A=1.43985*P(NP+4)/R                                               00005640
ISN 0028              V2=-.5*A/(R*R)                                                    00005650
ISN 0029              V0=A-R*R*V2                                                       00005660
ISN 0030            6 NF=IN(8)                                                          00005670
ISN 0031              IO=IA(NF)                                                         00005680
ISN 0032              IF (IO.EQ.NP) IO=IA(NF-1)                                         00005690
ISN 0034              IF (KE(18).LT.3) GO TO 13                                         00005700
ISN 0036              IOW=IO                                                            00005710
ISN 0037              RCTFW=P(29)                                                       00005720
ISN 0038              RCTFW2=RCTFW-.01                                                  00005730
ISN 0039              DO 11 I=1,NF                                                      00005740
ISN 0040              IF (IA(I).GT.29) GO TO 12                                         00005750
ISN 0042           11 CONTINUE                                                        00005760
ISN 0043           12 IUW=IA(I)                                                       00005770
ISN 0044              IU1W=IUW-1                                                        00005780
ISN 0045              IU2W=IUW-30                                                       00005790
ISN 0046              IIW=I-1                                                           00005800
ISN 0047           13 IF (KE(9).EQ.1) WRITE (6,6010)                                  00005810
```

```
ISN 0049      6010 FORMAT(///' ',7X,'R',3X,'REAL',7X,                                    00005820
                  1 'REAL+COULOMB',3X,'IMAGINARY',5X,'ERROR IMAG',4X,'ERROR PERC',     00005830
                  2 4X,'COULOMB')                                                      00005840
ISN 0050           R=-H                                                                00005850
ISN 0051           DO 2 I=1,NS                                                         00005860
ISN 0052           R=R+H                                                               00005870
ISN 0053           P(1)=R                                                              00005880
ISN 0054           W(I)=0.DO                                                           00005890
ISN 0055           W(I+NS)=0.DO                                                        00005900
ISN 0056           W(I+2*NS)=0.DO                                                      00005910
ISN 0057           W(I+3*NS)=0.DO                                                      00005920
ISN 0058           DV=0.DO                                                             00005930
ISN 0059           DVW=0.DO                                                            00005940
ISN 0060           CALL POTE(P,PR,PI,NP)                                               00005950
ISN 0061           IF(KE(15).EQ.0) GO TO 3                                             00005960
ISN 0063           CALL COULPO(2,P,R,VC,VD)                                            00005970
ISN 0064           GO TO 1                                                             00005980
ISN 0065         3 IF (R-P(2)*AH13) 4,5,5                                              00005990
ISN 0066         4 VC=V0+R*R*V2                                                        00006000
ISN 0067           GO TO 1                                                             00006010
ISN 0068         5 VC=1.43985*P(NP+4)/R                                                00006020
ISN 0069         1 PR(2)=PR(1)                                                         00006030
ISN 0070           PR(1)=PR(1)-VC                                                      00006040
ISN 0071           W(I)=PR(1)                                                          00006050
ISN 0072           W(I+NS)=PI(1)                                                       00006060
ISN 0073           IF (KE(18).LT.3) GO TO 81                                           00006070
ISN 0075           IF (R.GE.RCTFW2) GO TO 81                                           00006080
ISN 0077           DO 150 K=IUW,IOW                                                    00006090
ISN 0078           I1=K-IU1W                                                           00006100
ISN 0079           I2=I1+IU2W                                                          00006110
ISN 0080           Y=I2*PJ*R/RCTFW                                                     00006120
ISN 0081           DO 160 J=IUW,IOW                                                    00006130
ISN 0082           J1=J-IU1W                                                           00006140
ISN 0083           J2=J1+IU2W                                                          00006150
ISN 0084           Z=J2*PJ*R/RCTFW                                                     00006160
ISN 0085           IF (R) 170,170,180                                                  00006170
ISN 0086       170 DV=DV+VARM(IIW+I1,IIW+J1)                                           00006180
ISN 0087           GO TO 160                                                           00006190
ISN 0088       180 DV=DV+(DSIN(Y)*DSIN(Z)/(Y*Z))*VARM(IIW+I1,IIW+J1)                   00006200
ISN 0089       160 CONTINUE                                                            00006210
ISN 0090       150 CONTINUE                                                            00006220
ISN 0091           W(I+2*NS)=DSQRT(DV*CHI2*2.DO)                                       00006230
ISN 0092           DVW=-W(I+2*NS)/PI(1)*100.                                           00006240
```

```
ISN 0093        81 IF (KE(9).EQ.1) WRITE (6,6110)R,PR(1),PR(2),PI(1)                    00006250
                  1 ,W(I+2*NS),DVW,VC                                                    00006260
ISN 0095         2 CONTINUE                                                            00006270
ISN 0096      6110 FORMAT (' ',0PF10.3,2X,6(1PD12.4,2X))                               00006280
ISN 0097      6300 FORMAT (///' REAL POTENTIAL')                                       00006290
ISN 0098        31 KMR=MOD(KE(14),10)                                                  00006300
ISN 0099           IF ((KE(10).EQ.0).AND.(KMR.EQ.0)) GO TO 30                          00006310
ISN 0101           NV=0                                                                00006320
ISN 0102           WRITE (6,6300)                                                      00006330
ISN 0103           CALL MOMENT(NV,W,H,NS,RMS)                                          00006340
ISN 0104           WRITE (6,6001) (RMS(I),I=1,3),(RMS(I),I=5,10)                       00006350
ISN 0105      6001 FORMAT (//' K-TH MOMENT FOR K = -2, -1, ...,+5, +6'/9(F12.5,2X))    00006360
ISN 0106           VOL=RMS(4)/(P(3)*NA2)                                               00006370
ISN 0107           WRITE (6,6002) RMS(4),VOL                                           00006380
ISN 0108      6002 FORMAT (/' VOLUME = ',1PD12.5,'   PER NUCLEON PAIR = ',1PD12.5)     00006390
ISN 0109           IF (KMR.GT.0) WRITE (8,7001) RMS                                    00006400
ISN 0111           IF ((KE(17).NE.0).OR.(KE(16).LT.3)) GO TO 32                        00006410
ISN 0113           CALL ERMOM(II,IU,IO,IU1,IU2,VARM,RCTF,CHI2,RMS)                     00006420
ISN 0114           VOL=RMS(4)/(P(3)*NA2)                                               00006430
ISN 0115           WRITE (6,6501) (RMS(I),I=1,3),(RMS(I),I=5,10)                       00006440
ISN 0116      6501 FORMAT ((//' ERRORS OF K-TH MOMENT FOR K = -2, -1, ... ,+5, +6'    00006450
                  1 /9(1PD12.5,2X)))                                                  00006460
ISN 0117           WRITE (6,6502) RMS(4),VOL                                           00006470
ISN 0118      6502 FORMAT (/' ERROR VOLUME = ' ,1PD12.5,'   PER NUCLEON PAIR = ',     00006480
                  1 1PD12.5)                                                          00006490
ISN 0119           IF (KMR.GT.0) WRITE (8,7001) RMS                                    00006500
ISN 0121      6400 FORMAT (///' IMAGINARY POTENTIAL')                                  00006510
ISN 0122        32 KMI=MOD(KE(14),100)/10                                             00006520
ISN 0123           IF ((KE(10).LT.2).AND.(KMI.EQ.0)) GO TO 30                          00006530
ISN 0125           NV=1                                                                00006540
ISN 0126           WRITE (6,6400)                                                      00006550
ISN 0127           CALL MOMENT(NV,W,H,NS,RMS)                                          00006560
ISN 0128           VOL=RMS(4)/(P(3)*NA2)                                               00006570
ISN 0129           WRITE (6,6001) (RMS(I),I=1,3),(RMS(I),I=5,10)                       00006580
ISN 0130           WRITE (6,6002) RMS(4),VOL                                           00006590
ISN 0131           IF(KE(18).LT.3) GO TO 30                                            00006600
ISN 0133           CALL ERMOM(IIW,IUW,IOW,IU1W,IU2W,VARM,RCTFW,CHI2,RMS)               00006610
ISN 0134           VOL=RMS(4)/(P(3)*NA2)                                               00006620
ISN 0135           WRITE (6,6501) (RMS(I),I=1,3),(RMS(I),I=5,10)                       00006630
ISN 0136           WRITE (6,6502) RMS(4),VOL                                           00006640
ISN 0137        30 P(NP+3)=HA                                                          00006650
ISN 0138           P(NP+6)=NSA                                                         00006660
ISN 0139           P(NP+7)=MSA                                                         00006670
```

```
ISN 0140            IWP=NS                                                    00006680
ISN 0141            IF (((KE(16).GT.2).AND.(KE(16).LT.5)) IWP=IWP+NS          00006690
ISN 0143            IWS=1                                                     00006700
ISN 0144            KPR=MOD(KE(13),10)                                        00006710
ISN 0145            KPI=MOD(KE(13),100)/10                                    00006720
ISN 0146            IF (KPR.GT.0) WRITE (6,7001) (W(I),I=IWS,IWP)             00006730
ISN 0148            IWS=IWP+1                                                 00006740
ISN 0149            IWP=IWP+NS                                                00006750
ISN 0150            IF (KE(18).GT.2) IWP=IWP+NS                               00006760
ISN 0152            IF (KPI.GT.0) WRITE (6,7001) (W(I),I=IWS,IWP)             00006770
ISN 0154      7001  FORMAT ((5X,'*',6(1PD10.3,',')))                          00006780
ISN 0155      1000  RETURN                                                    00006790
ISN 0156            END                                                       00006800
```

```
                C-----SUBROUTINE ZUM PLOTTEN VON EXPERIMENTELLEN UND THEORETISCHEN      00000010
                C     RELATIVEN WIRKUNGSQUERSCHNITTEN (SIGMA/SIGMA-RUTHERFORD) IM      00000020
                C     BEREICH 0 BIS 60 GRAD; XYNETICS-PLOTTER                          00000030
ISN 0002              SUBROUTINE WQPLOT(N1,T1,S1,DS1,N2,T2,S2)                         00000040
ISN 0003              REAL*4 T1(1),S1(1),DS1(1),T2(1),S2(1),T(600),S(600),DS(600),     00000050
                     1    XV(3)/0.0,-0.009,0.009/,YV(3)/0.007,-0.007,-0.007/,ST(2)    00000060
ISN 0004              INTEGER*4 IBUF(5000),IFMT(5)                                     00000070
ISN 0005              LOGICAL*1 ITEXT(20)                                              00000080
                C-----INITIALISIEREN                                                   00000090
ISN 0006              READ(5,5000)LOGMAX,LOGMIN,DT,KINEMA,IDYDX,LABCMS,IPLTYP,INETZ,   00000100
                     1    IPRINT,FAK                                                  00000110
ISN 0007               5000 FORMAT(2I5,F10.3,6I5,F10.3)                                00000120
ISN 0008              NDEK=LOGMAX-LOGMIN                                               00000130
ISN 0009              IF(NDEK.GT.1.AND.NDEK.LE.9)GOTO 090                              00000140
ISN 0011              WRITE(6,6010)                                                    00000150
ISN 0012               6010 FORMAT('0ABBRUCH DA LOGMAX UND LOGMIN < 1 ODER > 9 DEKADEN DEFINIE00000160
                     1REN')                                                           00000170
ISN 0013              STOP                                                             00000180
ISN 0014               090 NDEKM2=NDEK*2                                               00000190
ISN 0015              GOTO(092,094),IPLTYP                                             00000200
ISN 0016               092 WRITE(6,6020)                                               00000210
ISN 0017               6020 FORMAT('0STATCS-PLOTTER')                                  00000220
ISN 0018              CALL PLOTS(IBUF,5000,3)                                          00000230
ISN 0019              GOTO 096                                                         00000240
ISN 0020               094 WRITE(6,6030)                                               00000250
ISN 0021               6030 FORMAT('0XYNETICS-PLOTTER')                                00000260
ISN 0022              CALL PLOTS(18.0,21.0,11)                                         00000270
ISN 0023              GOTO 097                                                         00000280
ISN 0024               096 CALL PLOT(2.0,1.0,3)                                        00000290
ISN 0025              CALL PLOT(2.0,20.0,2)                                            00000300
ISN 0026              CALL PLOT(4.5,20.0-NDEKM2,-3)                                    00000310
ISN 0027               097 CALL FACTOR(FAK)                                            00000320
                C-----X-ACHSEN PLOTTEN                                                 00000330
ISN 0028              DO 105 K=1,2                                                     00000340
ISN 0029              Y0=(2*K-3)*0.1                                                   00000350
ISN 0030              X=2.0                                                            00000360
ISN 0031              Y=2.0+NDEKM2*(K-1)                                               00000370
ISN 0032              CALL PLOT(X,Y,3)                                                 00000380
ISN 0033              Y=Y+1.5*Y0                                                       00000390
ISN 0034              CALL PLOT(X,Y,2)                                                 00000400
ISN 0035              Y=Y-1.5*Y0                                                       00000410
ISN 0036              CALL PLOT(X,Y,2)                                                 00000420
ISN 0037              DO 100 J=1,6                                                     00000430
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ISN 0038            DO 100 I=1,10                                                  00000440
ISN 0039            X=X+0.2                                                        00000450
ISN 0040            CALL PLOT(X,Y,2)                                               00000460
ISN 0041            Y1=0.5*Y0                                                      00000470
ISN 0042            IF(I.EQ.5)Y1=Y0                                                00000480
ISN 0044            IF(I.EQ.10)Y1=1.5*Y0                                           00000490
ISN 0046            Y=Y+Y1                                                         00000500
ISN 0047            CALL PLOT(X,Y,2)                                               00000510
ISN 0048            Y=Y-Y1                                                         00000520
ISN 0049        100 CALL PLOT(X,Y,2)                                               00000530
ISN 0050            Y=Y+(2*K-3)*0.01                                               00000540
ISN 0051            CALL PLOT(14.01,Y,3)                                           00000550
ISN 0052        105 CALL PLOT(1.99,Y,2)                                            00000560
ISN 0053            DO 115 N=1,3                                                   00000570
ISN 0054            CALL NUMBER(1.9+XV(N),1.5+YV(N),0.28,0.0,0.0,-1)               00000580
ISN 0055            DO 110 I=2,12,2                                                00000590
ISN 0056        110 CALL NUMBER(I+1.78+XV(N),1.5+YV(N),0.28,5.*I,0.0,-1)           00000600
ISN 0057            X= 6.90+XV(N)                                                  00000610
ISN 0058            Y=0.8+YV(N)                                                    00000620
ISN 0059            CALL SYMBL2(X,Y,0.35,'2',0.0,1)                                00000630
ISN 0060            X=X+0.37                                                       00000640
ISN 0061            GOTO(111,112),LABCMS                                           00000650
ISN 0062        111 CALL SYMBOL(X,Y,0.14,'L',0.0,1)                                00000660
ISN 0063            X=X+0.12                                                       00000670
ISN 0064            IF (IPLTYP.EQ.2) X=X-.018                                      00000680
ISN 0066            CALL SYMBL1(X,Y,0.14,'AB',0.0,2)                               00000690
ISN 0067            X=X+0.42                                                       00000700
ISN 0068            GOTO 113                                                       00000710
ISN 0069        112 CALL SYMBOL(X,Y,0.14,'CM',0.0,2)                               00000720
ISN 0070            X=X+3*0.14                                                     00000730
ISN 0071        113 CALL SYMBL1(X,Y,0.28,'(',0.0,1)                                00000740
ISN 0072            X=X+0.28                                                       00000750
ISN 0073            CALL SYMBL1(X,Y,0.28,'DEG',0.0,3)                              00000760
ISN 0074            X=X+0.84                                                       00000770
ISN 0075        115 CALL SYMBL1(X,Y,0.28,')',0.0,1)                                00000780
                C-----Y-ACHSEN PLOTTEN                                             00000790
ISN 0076            DO 125 K=1,2                                                   00000800
ISN 0077            X0=(2*K-3)*0.1                                                 00000810
ISN 0078            X=2.0+12.0*(K-1)                                               00000820
ISN 0079            Y=2.0                                                          00000830
ISN 0080            CALL PLOT(X,Y,3)                                               00000840
ISN 0081            X=X+1.5*X0                                                     00000850
ISN 0082            CALL PLOT(X,Y,2)                                               00000860
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ISN 0083            X=X-1.5*XO                                                    00000870
ISN 0084            CALL PLOT(X,Y,2)                                              00000880
ISN 0085            DO 120 J=1,NDEK                                               00000890
ISN 0086            DO 120 I=2,10                                                 00000900
ISN 0087            X1=0.5*XO                                                     00000910
ISN 0088            IF(I.EQ.5)X1=XO                                               00000920
ISN 0090            IF(I.EQ.10)X1=1.5*XO                                          00000930
ISN 0092            Y=2.0+2.0*ALOG10(I*10.0**(J-1))                               00000940
ISN 0093            CALL PLOT(X,Y,2)                                              00000950
ISN 0094            X=X+X1                                                        00000960
ISN 0095            CALL PLOT(X,Y,2)                                              00000970
ISN 0096            X=X-X1                                                        00000980
ISN 0097        120 CALL PLOT(X,Y,2)                                              00000990
ISN 0098            X=X+(2*K-3)*0.01                                              00001000
ISN 0099            CALL PLOT(X,2.0+NDEKM2+0.01,3)                                00001010
ISN 0100        125 CALL PLOT(X,1.99,2)                                           00001020
ISN 0101            DO 135 N=1,3                                                  00001030
ISN 0102            NDP1=NDEK+1                                                   00001040
ISN 0103            DO 130 I=1,NDP1                                               00001050
ISN 0104            CALL SYMBOL(1.0+XV(N),1.85+2.0*(I-1)+YV(N),0.28,'10',0.0,2)   00001060
ISN 0105            X=1.55                                                        00001070
ISN 0106            IEXP=LOGMIN+I-1                                               00001080
ISN 0107            IF(IEXP.LT.0)X=1.5                                            00001090
ISN 0109        130 CALL NUMBER(X+XV(N),2.0+2.0*(I-1)+YV(N),0.21,1.0*IEXP,0.0,-1) 00001100
ISN 0110            X=0.5+XV(N)                                                   00001110
ISN 0111            Y=1.5+0.5*NDEKM2+YV(N)                                        00001120
ISN 0112            CALL SYMBL3(X,Y,0.35,'S S',90.0,3)                            00001130
ISN 0113            CALL SYMBOL(X,Y+.1,0.35,' /',90.0,2)                          00001140
ISN 0114        135 CALL SYMBOL(X+0.1,Y+1.0,0.21,'R',90.0,1)                      00001150
ISN 0115            IF(INETZ.EQ.0)GOTO 171                                        00001160
                C-----VERTIKALE GITTERLINIEN PLOTTEN                              00001170
ISN 0117            YMAX=2.0+NDEKM2                                               00001180
ISN 0118            DO 150 I=1,11                                                 00001190
ISN 0119            IF(I.GT.6 )YMAX=2.0+NDEKM2-4                                  00001200
ISN 0121            X=2.0+I                                                       00001210
ISN 0122            Y=2.01                                                        00001220
ISN 0123            CALL PLOT(X,Y,3)                                              00001230
ISN 0124        140 Y=Y+0.01                                                      00001240
ISN 0125            CALL PLOT(X,Y,2)                                              00001250
ISN 0126            Y=Y+0.03                                                      00001260
ISN 0127            CALL PLOT(X,Y,3)                                              00001270
ISN 0128            IF(Y.LT.YMAX)GOTO 140                                         00001280
ISN 0130        150 CONTINUE                                                      00001290
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                C-----HORIZONTALE GITTERLINIEN PLOTTEN                                  00001300
ISN 0131            XMAX=14.0                                                           00001310
ISN 0132            IMAX=10                                                             00001320
ISN 0133            DO 170 J=1,NDEK                                                     00001330
ISN 0134            IF(J.GT.NDEK-2)XMAX=6.0                                             00001340
ISN 0136            IF(J.EQ.NDEK)IMAX=9                                                 00001350
ISN 0138            DO 170 I=2,IMAX                                                     00001360
ISN 0139            X=2.01                                                              00001370
ISN 0140            Y=2.0+2.0*ALOG10(I*10.0**(J-1))                                     00001380
ISN 0141            CALL PLOT(X,Y,3)                                                    00001390
ISN 0142          160 X=X+0.01                                                          00001400
ISN 0143            CALL PLOT(X,Y,2)                                                    00001410
ISN 0144            X=X+0.03                                                            00001420
ISN 0145            CALL PLOT(X,Y,3)                                                    00001430
ISN 0146            IF(X.LT.XMAX)GOTO 160                                               00001440
ISN 0148          170 CONTINUE                                                          00001450
                C-----TEXT PLOTTEN                                                      00001460
ISN 0149          171 READ(5,5100)ITEXT,ITYP,IG,X0,Y0,IW                                00001470
ISN 0150         5100 FORMAT(20A1,2I5,2F10.3,I5)                                        00001480
ISN 0151            IF(IG.EQ.0)GOTO 189                                                 00001490
ISN 0153            GPS=.07                                                             00001500
ISN 0154            IF (IPLTYP.EQ.2) GPS=.06                                            00001510
ISN 0156            DO 188 N=1,3                                                        00001520
ISN 0157            XA=2.0+X0+XV(N)                                                     00001530
ISN 0158            YA=2.0+NDEKM2-Y0+YV(N)                                              00001540
ISN 0159            IF(ITYP.EQ.0)CALL SYMBOL(XA,YA,IG*0.07,ITEXT,1.0*IW,20)             00001550
ISN 0161            IF(ITYP.EQ.1)CALL SYMBL1(XA,YA,IG*GPS ,ITEXT,1.0*IW,20)             00001560
ISN 0163            IF(ITYP.EQ.2)CALL SYMBL2(XA,YA,IG*GPS ,ITEXT,1.0*IW,20)             00001570
ISN 0165            IF(ITYP.EQ.3)CALL SYMBL3(XA,YA,IG*GPS ,ITEXT,1.0*IW,20)             00001580
ISN 0167          188 CONTINUE                                                          00001590
ISN 0168            GOTO 171                                                            00001600
                C-----EINZELZEICHEN PLOTTEN                                             00001610
ISN 0169          189 READ(5,5200)IZ,IG,X0,Y0,IW                                        00001620
ISN 0170         5200 FORMAT(2I5,2F10.3,I5)                                             00001630
ISN 0171            IF(IG.EQ.0)GOTO 200                                                 00001640
ISN 0173            DO 190 N=1,3                                                        00001650
ISN 0174          190 CALL SYMBOL(2.0+X0+XV(N),2.0+NDEKM2-Y0+YV(N),IG*0.07,IZ,1.0*IW,-1)00001660
ISN 0175            GOTO 189                                                            00001670
                C-----KOORDINATEN UMBENENNEN                                            00001680
ISN 0176          200 DO 320 NF=1,2                                                     00001690
ISN 0177            READ(5,5300)LOGF,IPTYP,IG,IRA,ST(1),ST(2),EPROJ,MPROJ,MTARG         00001700
ISN 0178         5300 FORMAT(4I10,3F10.3,2I5)                                           00001710
ISN 0179            GOTO(204,210),NF                                                    00001720
```

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ISN 0180        204 NP=MIN0(N1,600)                                                 00001730
ISN 0181            IF(NP.GE.2)GOTO 206                                             00001740
ISN 0183            WRITE(6,6080)                                                   00001750
ISN 0184       6080 FORMAT('0KEIN PLOT DER EXPERIMENTELLEN PUNKTE DA DEREN ANZAHL < 2'00001760
                   1)                                                               00001770
ISN 0185            GOTO 320                                                        00001780
ISN 0186        206 DO 208 I=1,NP                                                   00001790
ISN 0187            T(I)=T1(I)                                                      00001800
ISN 0188            S(I)=S1(I)                                                      00001810
ISN 0189        208 DS(I)=DS1(I)                                                    00001820
ISN 0190            GOTO 216                                                        00001830
ISN 0191        210 NP=MIN0(N2,600)                                                 00001840
ISN 0192            IF(NP.GE.2)GOTO 212                                             00001850
ISN 0194            WRITE(6,6085)                                                   00001860
ISN 0195       6085 FORMAT('0KEIN PLOT DER THEORETISCHEN PUNKTE DA DEREN ANZAHL < 2') 00001870
ISN 0196            GOTO 320                                                        00001880
ISN 0197        212 DO 214 I=1,NP                                                   00001890
ISN 0198            T(I)=T2(I)                                                      00001900
ISN 0199        214 S(I)=S2(I)                                                      00001910
ISN 0200        216 DO 220 I=1,NP                                                   00001920
                C-----STREUWINKEL UM LINKS-/RECHTS-KORREKTUR BERICHTIGEN            00001930
ISN 0201            T(I)=T(I)+DT                                                    00001940
                C-----UMRECHNUNG DER STREUWINKEL VON LABOR- IN SCHWERPUNKTSYSTEM    00001950
ISN 0202            IF(KINEMA.EQ.0)GOTO 217                                         00001960
ISN 0204            IF(I.EQ.1)WRITE(6,6095)                                         00001970
ISN 0206       6095 FORMAT('0UMRECHNUNG DER STREUWINKEL VON LABOR- IN SCHWERPUNKTSYSTE00001980
                   1M NOCH NICHT INSTALLIERT')                                      00001990
                C-----KOORDINATEN AUF BILDRAHMEN BESCHRAENKEN                       00002000
ISN 0207        217 IF(T(I).GT.60.0)T(I)=60.0                                       00002010
ISN 0209            S(I)=S(I)*10.0**LOGF                                            00002020
ISN 0210            IF(S(I).GT.10.0**LOGMAX)S(I)=10.0**LOGMAX                       00002030
ISN 0212            IF(S(I).LT.10.0**LOGMIN)S(I)=10.0**LOGMIN                       00002040
ISN 0214            IF(IRA.EQ.1)DS(I)=DS(I)*S(I)                                    00002050
ISN 0216            IF(IRA.EQ.2)DS(I)=DS(I)*10.0**LOGF                              00002060
ISN 0218            IF(IDXDY.EQ.0)GOTO 220                                          00002070
                C-----WINKELFEHLER IN WIRKUNGSQUERSCHNITT-FEHLER UMRECHNEN          00002080
ISN 0220            IF(I.EQ.1)D2=(S(2)-S(1))/(T(2)-T(1))*0.1                        00002090
ISN 0222            IF(I.EQ.NP)D2=(S(NP)-S(NP-1))/(T(NP)-T(NP-1))*0.1               00002100
ISN 0224            IF(S(I-1).GT.S(I).AND.S(I+1).GT.S(I))D2=AMAX1((S(I-1)-S(I))/(T(I)-00002110
                   1    T(I-1)),(S(I+1)-S(I))/(T(I+1)-T(I)))*0.1                    00002120
ISN 0226            D2=(S(I+1)-S(I-1))/(T(I+1)-T(I-1))*0.1                          00002130
ISN 0227            DS(I)=SQRT(DS(I)*DS(I)+D2*D2)                                   00002140
ISN 0228        220 CONTINUE                                                        00002150
```

```
ISN 0229            GOTO(230,250),NF                                                    00002160
                  C-----MESSPUNKTE UND FEHLERBALKEN PLOTTEN                             00002170
ISN 0230            230 IF(IPRINT.EQ.1)WRITE(6,6100)(I,T(I),S(I),DS(I),I=1,NP)          00002180
ISN 0232            6100 FORMAT('0GEGEBENE EXPERIMENTELLE PUNKTE:'/                     00002190
                         1        '0    I     THETA          SIGMA          DSIGMA'/   00002200
                         2        ' ------------------------------------------'/      00002210
                         3       (' ',I5,F10.3,F15.3,F15.3))                          00002220
ISN 0233            DO 240 I=1,NP                                                       00002230
ISN 0234            X=2.0+0.2*T(I)                                                      00002240
ISN 0235            CALL SYMBL4(X,2.0+2.0*(ALOG10(S(I))-LOGMIN),IG*0.07,IPTYP,0.0,-1)   00002250
ISN 0236            Y=2.0+AMIN1(2.0*NDEK,2.0*(ALOG10(S(I)+DS(I))-LOGMIN))               00002260
ISN 0237            CALL PLOT(X,Y,3)                                                    00002270
ISN 0238            Y=2.0+AMAX1(0.0,2.0*(ALOG10(S(I)-DS(I))-LOGMIN))                    00002280
ISN 0239            240 CALL PLOT(X,Y,2)                                                00002290
ISN 0240            GOTO 320                                                            00002300
                  C-----THEORETISCHE PUNKTE DURCH POLYGONZUG VERBINDEN                  00002310
ISN 0241            250 IF(IPRINT.EQ.0)GOTO 274                                         00002320
ISN 0243            WRITE(6,6150)                                                       00002330
ISN 0244            6150 FORMAT(/'0GEGEBENE THEORETISCHE KOORDINATEN'/                  00002340
                         1        '0    I     THETA   SIGMA(MB/SR)'/                   00002350
                         2        ' ------------------------------')                   00002360
ISN 0245            WRITE(6,6300)(I,T(I),S(I),I=1,NP)                                   00002370
ISN 0246            6300 FORMAT(' ',I5,F10.2,F15.3)                                     00002380
ISN 0247            274 DO 279 N=1,3                                                    00002390
ISN 0248            CALL PLOT(2.0+0.2*T(1)+XV(N),2.+2.0*(ALOG10(S(1))-LOGMIN)+YV(N),3)00002400
ISN 0249            DO 279 I=2,NP                                                       00002410
ISN 0250            279 CALL PLOT(2.0+0.2*T(I)+XV(N),2.+2.0*(ALOG10(S(I))-LOGMIN)+YV(N),2)00002420
ISN 0251            320 CONTINUE                                                        00002430
                  C-----ABSCHLUSS                                                       00002440
ISN 0252            CALL PLOT(0.,0.,999)                                                00002450
ISN 0253            WRITE(6,6600)                                                       00002460
ISN 0254            6600 FORMAT('0PLOT MIT SUBROUTINE WQPLOT')                          00002470
ISN 0255            RETURN                                                              00002480
ISN 0256            END                                                                 00002490
```

```
      C-----SUBROUTINE ZUM PLOTTEN EINES GEFUELLTEN ZENTRIERTEN PUNKTSYMBOLS  00002500
ISN 0002      SUBROUTINE SYMBL4(XO,YO,G,IZ,W,IPEN)                           00002510
ISN 0003      IG=100.0*G                                                     00002520
ISN 0004      IG=MAXO(IG,4)/2*2                                              00002530
ISN 0005      G2=IG*0.005                                                    00002540
ISN 0006      ITYP=IABS(IZ)                                                  00002550
ISN 0007      IF(IPEN.LE.-1)GOTO 090                                         00002560
ISN 0009      WRITE(6,6000)                                                  00002570
ISN 0010   6000 FORMAT('0ABBRUCH DA BETRAG DES 6. ARGUMENTS VON SYMBL4 NICHT NEGAT00002580
          1IV')                                                             00002590
ISN 0011      STOP                                                           00002600
ISN 0012    090 IF(IPEN.LE.-2)CALL PLOT(XO,YO,2)                             00002610
ISN 0014      GOTO(100,200,300,400,500),ITYP                                 00002620
ISN 0015      WRITE(6,6100)                                                  00002630
ISN 0016   6100 FORMAT('0ABBRUCH DA 4. ARGUMENT VON SYMBL4 < 1 ODER > 5')    00002640
ISN 0017      STOP                                                           00002650
ISN 0018    100 IG=70.7*G                                                    00002660
ISN 0019      IG=MAXO(IG,4)/2*2                                              00002670
ISN 0020      G2=IG*0.005                                                    00002680
ISN 0021      X1=XO-G2                                                       00002690
ISN 0022      X2=XO+G2                                                       00002700
ISN 0023      Y =YO+G2                                                       00002710
ISN 0024      Y2=YO-G2                                                       00002720
ISN 0025      CALL PLOT(X1,Y,3)                                              00002730
ISN 0026      CALL PLOT(X2,Y,2)                                              00002740
ISN 0027    110 Y=Y-0.00999                                                  00002750
ISN 0028      IF(Y.LT.Y2)RETURN                                              00002760
ISN 0030      CALL PLOT(X2,Y,2)                                              00002770
ISN 0031      CALL PLOT(X1,Y,2)                                              00002780
ISN 0032      Y=Y-0.00999                                                    00002790
ISN 0033      IF(Y.LT.Y2)RETURN                                              00002800
ISN 0035      CALL PLOT(X1,Y,2)                                              00002810
ISN 0036      CALL PLOT(X2,Y,2)                                              00002820
ISN 0037      GOTO 110                                                       00002830
      C-----8-ECK-SYMBOL                                                     00002840
ISN 0038    200 IG=75.6*G                                                    00002850
ISN 0039      IG=MAXO(IG,4)/2*2                                              00002860
ISN 0040      IG=(IG-2)/4*4+2                                                00002870
ISN 0041      G2=IG*0.005                                                    00002880
ISN 0042      E=(IG-2)/4*0.01                                                00002890
ISN 0043      DX=0.01                                                        00002900
ISN 0044      X1=XO-E                                                        00002910
ISN 0045      X2=XO+E                                                        00002920
```

```
ISN 0046            Y =Y0+G2                                          00002930
ISN 0047            Y2=Y0-G2                                          00002940
ISN 0048            Y3=Y0+E                                           00002950
ISN 0049            Y4=Y0-E                                           00002960
ISN 0050            CALL PLOT(X1,Y,3)                                 00002970
ISN 0051            CALL PLOT(X2,Y,2)                                 00002980
ISN 0052          210 Y=Y-0.00999                                     00002990
ISN 0053            IF(Y.LT.Y3)DX=0.0                                 00003000
ISN 0055            IF(Y.LT.Y4)DX=-0.01                               00003010
ISN 0057            IF(Y.LT.Y2)RETURN                                 00003020
ISN 0059            X2=X2+DX                                          00003030
ISN 0060            CALL PLOT(X2,Y,2)                                 00003040
ISN 0061            X1=X1-DX                                          00003050
ISN 0062            CALL PLOT(X1,Y,2)                                 00003060
ISN 0063            Y=Y-0.00999                                       00003070
ISN 0064            IF(Y.LT.Y3)DX=0.0                                 00003080
ISN 0066            IF(Y.LT.Y4)DX=-0.01                               00003090
ISN 0068            IF(Y.LT.Y2)RETURN                                 00003100
ISN 0070            X1=X1-DX                                          00003110
ISN 0071            CALL PLOT(X1,Y,2)                                 00003120
ISN 0072            X2=X2+DX                                          00003130
ISN 0073            CALL PLOT(X2,Y,2)                                 00003140
ISN 0074            GOTO 210                                          00003150
                  C-----DREIECK-SYMBOL                                00003160
ISN 0075          300 X1=X0                                           00003170
ISN 0076            X2=X0                                             00003180
ISN 0077            Y =Y0+1.4*G2                                      00003190
ISN 0078            Y2=Y0-0.6*G2                                      00003200
ISN 0079            CALL PLOT(X0,Y,3)                                 00003210
ISN 0080            Y=Y-0.00999                                       00003220
ISN 0081            CALL PLOT(X0,Y,2)                                 00003230
ISN 0082          310 Y=Y-0.00999                                     00003240
ISN 0083            IF(Y.LT.Y2)RETURN                                 00003250
ISN 0085            X1=X1-0.01                                        00003260
ISN 0086            CALL PLOT(X1,Y,2)                                 00003270
ISN 0087            X2=X2+0.01                                        00003280
ISN 0088            CALL PLOT(X2,Y,2)                                 00003290
ISN 0089            Y=Y-0.00999                                       00003300
ISN 0090            IF(Y.LT.Y2)RETURN                                 00003310
ISN 0092            CALL PLOT(X2,Y,2)                                 00003320
ISN 0093            CALL PLOT(X1,Y,2)                                 00003330
ISN 0094            GOTO 310                                          00003340
                  C-----RHOMBUS-SYMBOL                                00003350
```

```
ISN 0095        400 X1=X0                                                   00003360
ISN 0096            X2=X0                                                   00003370
ISN 0097            DX=0.01                                                 00003380
ISN 0098            Y =Y0+G2                                                00003390
ISN 0099            Y2=Y0-G2                                                00003400
ISN 0100            CALL PLOT(X0,Y,3)                                       00003410
ISN 0101        410 Y=Y-0.00999                                             00003420
ISN 0102            IF(Y.LT.Y2)RETURN                                       00003430
ISN 0104            IF(Y.LT.Y0)DX=-0.01                                     00003440
ISN 0106            X1=X1-DX                                                00003450
ISN 0107            CALL PLOT(X1,Y,2)                                       00003460
ISN 0108            X2=X2+DX                                                00003470
ISN 0109            CALL PLOT(X2,Y,2)                                       00003480
ISN 0110            Y=Y-0.00999                                             00003490
ISN 0111            IF(Y.LT.Y2)RETURN                                       00003500
ISN 0113            IF(Y.LT.Y0)DX=-0.01                                     00003510
ISN 0115            X2=X2+DX                                                00003520
ISN 0116            CALL PLOT(X2,Y,2)                                       00003530
ISN 0117            X1=X1-DX                                                00003540
ISN 0118            CALL PLOT(X1,Y,2)                                       00003550
ISN 0119            GOTO 410                                                00003560
                C-----DOPPELPFEIL-SYMBOL                                    00003570
ISN 0120        500 X1=X0-G2                                                00003580
ISN 0121            X2=X0+G2                                                00003590
ISN 0122            DX=0.01                                                 00003600
ISN 0123            Y =Y0+G2                                                00003610
ISN 0124            Y2=Y0-G2                                                00003620
ISN 0125            CALL PLOT(X1,Y,3)                                       00003630
ISN 0126            CALL PLOT(X2,Y,2)                                       00003640
ISN 0127        510 Y=Y-0.00999                                             00003650
ISN 0128            IF(Y.LT.Y0)DX=-0.01                                     00003660
ISN 0130            IF(Y.LT.Y2)RETURN                                       00003670
ISN 0132            X2=X2-DX                                                00003680
ISN 0133            CALL PLOT(X2,Y,2)                                       00003690
ISN 0134            X1=X1+DX                                                00003700
ISN 0135            CALL PLOT(X1,Y,2)                                       00003710
ISN 0136            Y=Y-0.00999                                             00003720
ISN 0137            IF(Y.LT.Y0)DX=-0.01                                     00003730
ISN 0139            IF(Y.LT.Y2)RETURN                                       00003740
ISN 0141            X1=X1+DX                                                00003750
ISN 0142            CALL PLOT(X1,Y,2)                                       00003760
ISN 0143            X2=X2-DX                                                00003770
ISN 0144            CALL PLOT(X2,Y,2)                                       00003780
ISN 0145            GOTO 510                                                00003790
ISN 0146            END                                                     00003800
```

```
ISN 0002            SUBROUTINE XYNPL(P,W,F,X,NP,N,M,T,S,ST,DS)                        00003810
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                        00003820
ISN 0004            DIMENSION P(2),W(2),F(2),T(300),S(300),ST(300),DS(300),TT(300)   00003830
ISN 0005            DIMENSION X(2),DUMM(300)                                         00003840
ISN 0006            REAL*4 T4(300),S4(300),ST4(300),DS4(300),TT4(300)                00003850
ISN 0007            REAL*4 WI(1000)                                                  00003860
ISN 0008            REAL*8 PI/3.14159265358979D0/                                    00003870
ISN 0009            COMMON /INPT/KE(42),WI,IN(100)                                   00003880
ISN 0010            IF (KE(4).EQ.1) WRITE (6,6001)                                   00003890
ISN 0012     6001 FORMAT (///' EQUIDISTANT CROSS SECTIONS FROM T1 TO T2, STEP :')    00003900
ISN 0013            CALL INPUT(IN0,IN1,IW0,IW1)                                      00003910
ISN 0014            T1=WI(IW0+1)                                                     00003920
ISN 0015            T2=WI(IW0+2)                                                     00003930
ISN 0016            TS=WI(IW0+3)                                                     00003940
ISN 0017            MT=(T2-T1)/TS+1                                                  00003950
ISN 0018            LA=P(NP+5)+.1                                                    00003960
ISN 0019            JA=NP+8*LA+6                                                     00003970
ISN 0020            J=JA                                                             00003980
ISN 0021            DO 1 I=1,M                                                       00003990
ISN 0022            T4(I)=T(I)                                                       00004000
ISN 0023            S4(I)=S(I)                                                       00004010
ISN 0024            DS4(I)=DS(I)                                                     00004020
ISN 0025          1 CONTINUE                                                         00004030
ISN 0026            T1=T1-TS                                                         00004040
                    C                                                              00004050
ISN 0027            DO 10 I=1,MT                                                     00004060
ISN 0028            J=J+3                                                            00004070
ISN 0029            TT4(I)=T1+I*TS                                                   00004080
ISN 0030            TT(I)=TT4(I)                                                     00004090
ISN 0031            P(J)=TT(I)*PI/180.                                               00004100
ISN 0032            P(J+1)=100.                                                      00004110
ISN 0033            P(J+2)=1.                                                        00004120
ISN 0034         10 CONTINUE                                                         00004130
ISN 0035            CALL CALFUN(MT,N,F,X,P)                                          00004140
                    C                                                              00004150
ISN 0036            J=JA                                                             00004160
ISN 0037            DO 20 I=1,MT                                                     00004170
ISN 0038            J=J+3                                                            00004180
ISN 0039            ST(I)=(P(J+1)-F(I)*P(J+2))*P(NP)                                 00004190
ISN 0040            ST4(I)=ST(I)                                                     00004200
ISN 0041         20 CONTINUE                                                         00004210
ISN 0042            IF (KE(31).EQ.1) CALL RUTHF(MT,NP,P,TT,DUMM,ST,DUMM)            00004220
ISN 0044            DO 21 I=1,MT                                                     00004230
```

```
ISN 0045        21 ST4(I)=ST(I)                                                  00004240
ISN 0046           CALL WQPLOT(M,T4,S4,DS4,MT,TT4,ST4)                           00004250
ISN 0047           J=JA                                                          00004260
ISN 0048           DO 30 I=1,M                                                   00004270
ISN 0049           J=J+3                                                         00004280
ISN 0050           P(J)=T(I)                                                     00004290
ISN 0051           P(J+1)=S(I)                                                   00004300
ISN 0052           P(J+2)=DS(I)                                                  00004310
ISN 0053        30 CONTINUE                                                      00004320
ISN 0054           RETURN                                                        00004330
```

```
ISN 0002            FUNCTION DEN1(PP,S)                                          00013910
                  C-----GAUSS-LADUNGSVERTEILUNG DES ALPHA-TEILCHENS
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                    00013930
ISN 0004            DIMENSION PP(2,20),S(2)                                      00013940
ISN 0005            DEN1=0.DO                                                    00013950
ISN 0006            C=PP(1,2)                                                    00013960
ISN 0007            R=S(3)                                                       00013990
ISN 0008            IF (R.GT.PP(1,1)) RETURN                                     00014000
ISN 0010            DEN1=DEXP(-(R*R/(C*C)))
ISN 0011            RETURN                                                       00014020
ISN 0012            END                                                          00014030
```

```
ISN 0002            FUNCTION DEN2(PP,S)                                          00014040
                  C-----3-PARAMETER MODIFIZIERTE GAUSS-VERTEILUNG DES TARGETS    00014050
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                    00014060
ISN 0004            DIMENSION PP(2,20),S(2)                                      00014070
ISN 0005            DEN2=0.DO                                                    00014080
ISN 0006            C=PP(2,2)                                                    00014090
ISN 0007            A=PP(2,3)                                                    00014100
ISN 0008            W=PP(2,4)                                                    00014110
ISN 0009            R=S(3)                                                       00014120
ISN 0010            IF (R.GT.PP(2,1)) RETURN                                     00014130
ISN 0012            DEN2=(1.DO+R*R*W/(C*C))/(1.DO+DEXP((R*R-C*C)/(A*A)))         00014140
ISN 0013            RETURN                                                       00014150
ISN 0014            END                                                          00014160
```

```
ISN 0002            FUNCTION DEN1(PP,S)                                          00005940
                  C-----3-PARAMETER FERMI-VERTEILUNG DES ALPHA-TEILCHENS         00005950
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                    00005960
ISN 0004            DIMENSION PP(2,20),S(2)                                      00005970
ISN 0005            DEN1=0.DO                                                    00005980
ISN 0006            C=PP(1,2)                                                    00005990
ISN 0007            A=PP(1,3)                                                    00006000
ISN 0008            W=PP(1,4)                                                    00006010
ISN 0009            R=S(3)                                                       00006020
ISN 0010            IF (R.GT.PP(1,1)) RETURN                                     00006030
ISN 0012            DEN1=(1.DO+R*R*W/(C*C))/(1.DO+DEXP((R-C)/A))                 00006040
ISN 0013            RETURN                                                       00006050
ISN 0014            END                                                          00006060
```

```
ISN 0002            FUNCTION DEN2(PP,S)                                          00006070
                  C-----3-PARAMETER FERMI-VERTEILUNG DES TARGETS                 00006080
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                    00006090
ISN 0004            DIMENSION PP(2,20),S(2)                                      00006100
ISN 0005            DEN2=0.DO                                                    00006110
ISN 0006            C=PP(2,2)                                                    00006120
ISN 0007            A=PP(2,3)                                                    00006130
ISN 0008            W=PP(2,4)                                                    00006140
ISN 0009            R=S(3)                                                       00006150
ISN 0010            IF (R.GT.PP(2,1)) RETURN                                     00006160
ISN 0012            DEN2=(1.DO+R*R*W/(C*C))/(1.DO+DEXP((R-C)/A))                 00006170
ISN 0013            RETURN                                                       00006180
ISN 0014            END                                                          00006190
```

```
ISN 0002            FUNCTION DENS(P,S)                                          00007400
                  C-----GAUSS-3 DENSITY                                         00007410
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                   00007420
ISN 0004            DIMENSION P(2),S(2)                                         00007430
ISN 0005            DENS=0.DO                                                   00007440
ISN 0006            C=P(14)*P(3)**(1.DO/3.DO)                                   00007450
ISN 0007            A=P(15)                                                     00007460
ISN 0008            W=P(16)                                                     00007470
ISN 0009            R=S(3)                                                      00007480
ISN 0010            IF (R.GT.P(13)) RETURN                                      00007490
ISN 0012            DENS=(1.DO+R*R*W/(C*C))/(1.DO+DEXP((R*R-C*C)/(A*A)))        00007500
ISN 0013            RETURN                                                      00007510
ISN 0014            END                                                         00007520
```

```
ISN 0002            FUNCTION DENSP(PP,S)                                        00007530
                  C-----3-PARAMETER GAUSS-VERTEILUNG DER PROTONEN               00007540
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                   00007550
ISN 0004            DIMENSION PP(2),S(2)                                        00007560
ISN 0005            DENSP=0.DO                                                  00007570
ISN 0006            C=PP(17)                                                    00007580
ISN 0007            A=PP(18)                                                    00007590
ISN 0008            W=PP(19)                                                    00007600
ISN 0009            R=S(3)                                                      00007610
ISN 0010            IF (R.GT.PP(13)) RETURN                                     00007620
ISN 0012            DENSP=(1.DO+R*R*W/(C*C))/(1.DO+DEXP((R*R-C*C)/(A*A)))       00007630
ISN 0013            RETURN                                                      00007640
ISN 0014            END                                                         00007650
```

```
ISN 0002            FUNCTION DENS(P,S)                                                  00006880
                  C-----GAUSS-3 DENSITY FOR FB ASYMPTOTIC                               00006890
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                           00006900
ISN 0004            DIMENSION P(2),S(2)                                                 00006910
ISN 0005            DENS=0.DO                                                           00006920
ISN 0006            C=P(43)*P(3)**(1.DO/3.DO)                                           00006930
ISN 0007            A=P(44)                                                             00006940
ISN 0008            W=P(45)                                                             00006950
ISN 0009            R=S(3)                                                              00006960
ISN 0010            IF (R.GT.P(42)) RETURN                                              00006970
ISN 0012            DENS=(1.DO+R*R*W/(C*C))/(1.DO+DEXP((R*R-C*C)/(A*A)))                00006980
ISN 0013            RETURN                                                              00006990
ISN 0014            END                                                                 00007000


ISN 0002            FUNCTION DENSP(PP,S)                                                00007010
                  C-----3-PARAMETER GAUSS-VERTEILUNG DER PROTONEN                       00007020
ISN 0003            IMPLICIT REAL*8 (A-H,O-Z)                                           00007030
ISN 0004            DIMENSION PP(2),S(2)                                                00007040
ISN 0005            DENSP=0.DO                                                          00007050
ISN 0006            C=PP(46)                                                            00007060
ISN 0007            A=PP(47)                                                            00007070
ISN 0008            W=PP(48)                                                            00007080
ISN 0009            R=S(3)                                                              00007090
ISN 0010            IF (R.GT.PP(42)) RETURN                                             00007100
ISN 0012            DENSP=(1.DO+R*R*W/(C*C))/(1.DO+DEXP((R*R-C*C)/(A*A)))               00007110
ISN 0013            RETURN                                                              00007120
ISN 0014            END                                                                 00007130
```

```
                C-----SUBROUTINE ZUM PLOTTEN VON EXPERIMENTELLEN UND THEORETISCHEN      00004390
                C     RELATIVEN WIRKUNGSQUERSCHNITTEN (SIGMA/SIGMA-RUTHERFORD) IM       00004400
                C     BEREICH 0 BIS 120 GRAD                                           00004410
ISN 0002              SUBROUTINE WQPLOT(N1,T1,S1,DS1,N2,T2,S2)                         00004420
ISN 0003              REAL*4 T1(1),S1(1),DS1(1),T2(1),S2(1),T(600),S(600),DS(600),     00004430
                     1    XV(3)/0.0,-0.009,0.009/,YV(3)/0.007,-0.007,-0.007/,ST(2)    00004440
ISN 0004              INTEGER*4 IBUF(5000),IFMT(5)                                     00004450
ISN 0005              LOGICAL*1 ITEXT(20)                                              00004460
                C-----INITIALISIEREN                                                   00004470
ISN 0006              READ(5,5000)LOGMAX,LOGMIN,DT,KINEMA,IDYDX,LABCMS,IPLTYP,INETZ,   00004480
                     1    IPRINT,FAK                                                  00004490
ISN 0007               5000 FORMAT(2I5,F10.3,6I5,F10.3)                               00004500
ISN 0008              NDEK=LOGMAX-LOGMIN                                               00004510
ISN 0009              IF(NDEK.GT.1.AND.NDEK.LE.9)GOTO 090                              00004520
ISN 0011              WRITE(6,6010)                                                    00004530
ISN 0012               6010 FORMAT('0ABBRUCH DA LOGMAX UND LOGMIN < 1 ODER > 9 DEKADEN DEFINIE00004540
                     1REN')                                                           00004550
ISN 0013              STOP                                                             00004560
ISN 0014                090 NDEKM2=NDEK*2                                              00004570
ISN 0015              GOTO(092,094),IPLTYP                                             00004580
ISN 0016                092 WRITE(6,6020)                                              00004590
ISN 0017               6020 FORMAT('0STATOS-PLOTTER')                                 00004600
ISN 0018              CALL PLOTS(IBUF,5000,0)                                          00004610
ISN 0019              GOTO 096                                                         00004620
ISN 0020                094 WRITE(6,6030)                                              00004630
ISN 0021               6030 FORMAT('0XYNETICS-PLOTTER')                               00004640
ISN 0022              CALL PLOTS(18.0,22.0,11)                                         00004650
ISN 0023              GOTO 097                                                         00004660
ISN 0024                096 CALL PLOT(2.0,1.0,3)                                       00004670
ISN 0025              CALL PLOT(2.0,20.0,2)                                            00004680
ISN 0026              CALL PLOT(4.5,20.0-NDEKM2,-3)                                    00004690
ISN 0027                097 CALL FACTOR(FAK)                                           00004700
                C-----X-ACHSEN PLOTTEN                                                 00004710
ISN 0028              DO 105 K=1,2                                                     00004720
ISN 0029              Y0=(2*K-3)*0.1                                                   00004730
ISN 0030              X=2.0                                                            00004740
ISN 0031              Y=2.0+NDEKM2*(K-1)                                               00004750
ISN 0032              CALL PLOT(X,Y,3)                                                 00004760
ISN 0033              Y=Y+1.5*Y0                                                       00004770
ISN 0034              CALL PLOT(X,Y,2)                                                 00004780
ISN 0035              Y=Y-1.5*Y0                                                       00004790
ISN 0036              CALL PLOT(X,Y,2)                                                 00004800
ISN 0037              DO 100 J=1,6                                                     00004810
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ISN 0038            DO 100 I=1,10                                                    00004820
ISN 0039            X=X+0.2                                                          00004830
ISN 0040            CALL PLOT(X,Y,2)                                                 00004840
ISN 0041            Y1=0.5*Y0                                                        00004850
ISN 0042            IF(I.EQ.5)Y1=Y0                                                  00004860
ISN 0044            IF(I.EQ.10)Y1=1.5*Y0                                             00004870
ISN 0046            Y=Y+Y1                                                           00004880
ISN 0047            CALL PLOT(X,Y,2)                                                 00004890
ISN 0048            Y=Y-Y1                                                           00004900
ISN 0049        100 CALL PLOT(X,Y,2)                                                 00004910
ISN 0050            Y=Y+(2*K-3)*0.01                                                 00004920
ISN 0051            CALL PLOT(14.01,Y,3)                                             00004930
ISN 0052        105 CALL PLOT(1.99,Y,2)                                              00004940
ISN 0053            DO 115 N=1,3                                                     00004950
ISN 0054            CALL NUMBER(1.9+XV(N),1.5+YV(N),0.28,0.0,0.0,-1)                 00004960
ISN 0055            DO 110 I=2,12,2                                                  00004970
ISN 0056        110 CALL NUMBER(I+1.78+XV(N),1.5+YV(N),0.28,10.*I,0.0,-1)            00004980
ISN 0057            X= 6.90+XV(N)                                                    00004990
ISN 0058            Y=0.8+YV(N)                                                      00005000
ISN 0059            CALL SYMBL2(X,Y,0.35,'2',0.0,1)                                  00005010
ISN 0060            X=X+0.37                                                         00005020
ISN 0061            GOTO(111,112),LABCMS                                             00005030
ISN 0062        111 CALL SYMBOL(X,Y,0.14,'L',0.0,1)                                  00005040
ISN 0063            X=X+0.12                                                         00005050
ISN 0064            IF (IPLTYP.EQ.2) X=X-.018                                        00005060
ISN 0066            CALL SYMBL1(X,Y,0.14,'AB',0.0,2)                                 00005070
ISN 0067            X=X+0.42                                                         00005080
ISN 0068            GOTO 113                                                         00005090
ISN 0069        112 CALL SYMBOL(X,Y,0.14,'CM',0.0,2)                                 00005100
ISN 0070            X=X+3*0.14                                                       00005110
ISN 0071        113 CALL SYMBL1(X,Y,0.28,'(',0.0,1)                                  00005120
ISN 0072            X=X+0.28                                                         00005130
ISN 0073            CALL SYMBL1(X,Y,0.28,'DEG',0.0,3)                                00005140
ISN 0074            X=X+0.84                                                         00005150
ISN 0075        115 CALL SYMBL1(X,Y,0.28,')',0.0,1)                                  00005160
                C-----Y-ACHSEN PLOTTEN                                               00005170
ISN 0076            DO 125 K=1,2                                                     00005180
ISN 0077            X0=(2*K-3)*0.1                                                   00005190
ISN 0078            X=2.0+12.0*(K-1)                                                 00005200
ISN 0079            Y=2.0                                                            00005210
ISN 0080            CALL PLOT(X,Y,3)                                                 00005220
ISN 0081            X=X+1.5*X0                                                       00005230
ISN 0082            CALL PLOT(X,Y,2)                                                 00005240
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ISN 0083            X=X-1.5*X0                                                    00005250
ISN 0084            CALL PLOT(X,Y,2)                                              00005260
ISN 0085            DO 120 J=1,NDEK                                               00005270
ISN 0086            DO 120 I=2,10                                                 00005280
ISN 0087            X1=0.5*X0                                                     00005290
ISN 0088            IF(I.EQ.5)X1=X0                                               00005300
ISN 0090            IF(I.EQ.10)X1=1.5*X0                                          00005310
ISN 0092            Y=2.0+2.0*ALOG10(I*10.0**(J-1))                               00005320
ISN 0093            CALL PLOT(X,Y,2)                                              00005330
ISN 0094            X=X+X1                                                        00005340
ISN 0095            CALL PLOT(X,Y,2)                                              00005350
ISN 0096            X=X-X1                                                        00005360
ISN 0097        120 CALL PLOT(X,Y,2)                                              00005370
ISN 0098            X=X+(2*K-3)*0.01                                              00005380
ISN 0099            CALL PLOT(X,2.0+NDEKM2+0.01,3)                                00005390
ISN 0100        125 CALL PLOT(X,1.99,2)                                           00005400
ISN 0101            DO 135 N=1,3                                                  00005410
ISN 0102            NDP1=NDEK+1                                                   00005420
ISN 0103            DO 130 I=1,NDP1                                               00005430
ISN 0104            CALL SYMBOL(1.0+XV(N),1.85+2.0*(I-1)+YV(N),0.28,'10',0.0,2)   00005440
ISN 0105            X=1.55                                                        00005450
ISN 0106            IEXP=LOGMIN+I-1                                               00005460
ISN 0107            IF(IEXP.LT.0)X=1.5                                            00005470
ISN 0109        130 CALL NUMBER(X+XV(N),2.0+2.0*(I-1)+YV(N),0.21,1.0*IEXP,0.0,-1) 00005480
ISN 0110            X=0.5+XV(N)                                                   00005490
ISN 0111            Y=1.5+0.5*NDEKM2+YV(N)                                        00005500
ISN 0112            CALL SYMBL3(X,Y,0.35,'S S',90.0,3)                            00005510
ISN 0113            CALL SYMBOL(X,Y+.1,0.35,' /',90.0,2)                          00005520
ISN 0114        135 CALL SYMBOL(X+0.1,Y+1.0,0.21,'R',90.0,1)                      00005530
ISN 0115            IF(INETZ.EQ.0)GOTO 171                                        00005540
                C-----VERTIKALE GITTERLINIEN PLOTTEN                              00005550
ISN 0117            YMAX=2.0+NDEKM2                                               00005560
ISN 0118            DO 150 I=1,11                                                 00005570
ISN 0119            IF(I.GT.6 )YMAX=2.0+NDEKM2-4                                  00005580
ISN 0121            X=2.0+I                                                       00005590
ISN 0122            Y=2.01                                                        00005600
ISN 0123            CALL PLOT(X,Y,3)                                              00005610
ISN 0124        140 Y=Y+0.01                                                      00005620
ISN 0125            CALL PLOT(X,Y,2)                                              00005630
ISN 0126            Y=Y+0.03                                                      00005640
ISN 0127            CALL PLOT(X,Y,3)                                              00005650
ISN 0128            IF(Y.LT.YMAX)GOTO 140                                         00005660
ISN 0130        150 CONTINUE                                                      00005670
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                C-----HORIZONTALE GITTERLINIEN PLOTTEN                                  00005680
ISN 0131            XMAX=14.0                                                           00005690
ISN 0132            IMAX=10                                                             00005700
ISN 0133            DO 170 J=1,NDEK                                                     00005710
ISN 0134            IF(J.GT.NDEK-2)XMAX=6.0                                             00005720
ISN 0136            IF(J.EQ.NDEK)IMAX=9                                                 00005730
ISN 0138            DO 170 I=2,IMAX                                                     00005740
ISN 0139            X=2.01                                                              00005750
ISN 0140            Y=2.0+2.0*ALOG10(I*10.0**(J-1))                                     00005760
ISN 0141            CALL PLOT(X,Y,3)                                                    00005770
ISN 0142          160 X=X+0.01                                                          00005780
ISN 0143            CALL PLOT(X,Y,2)                                                    00005790
ISN 0144            X=X+0.03                                                            00005800
ISN 0145            CALL PLOT(X,Y,3)                                                    00005810
ISN 0146            IF(X.LT.XMAX)GOTO 160                                               00005820
ISN 0148          170 CONTINUE                                                          00005830
                C-----TEXT PLOTTEN                                                      00005840
ISN 0149          171 READ(5,5100)ITEXT,ITYP,IG,X0,Y0,IW                                00005850
ISN 0150         5100 FORMAT(20A1,2I5,2F10.3,I5)                                        00005860
ISN 0151            IF(IG.EQ.0)GOTO 189                                                 00005870
ISN 0153            GPS=.07                                                             00005880
ISN 0154            IF (IPLTYP.EQ.2) GPS=.06                                            00005890
ISN 0156            DO 188 N=1,3                                                        00005900
ISN 0157            XA=2.0+X0+XV(N)                                                     00005910
ISN 0158            YA=2.0+NDEKM2-Y0+YV(N)                                              00005920
ISN 0159            IF(ITYP.EQ.0)CALL SYMBOL(XA,YA,IG*0.07,ITEXT,1.0*IW,20)             00005930
ISN 0161            IF(ITYP.EQ.1)CALL SYMBL1(XA,YA,IG*GPS ,ITEXT,1.0*IW,20)             00005940
ISN 0163            IF(ITYP.EQ.2)CALL SYMBL2(XA,YA,IG*GPS ,ITEXT,1.0*IW,20)             00005950
ISN 0165            IF(ITYP.EQ.3)CALL SYMBL3(XA,YA,IG*GPS ,ITEXT,1.0*IW,20)             00005960
ISN 0167          188 CONTINUE                                                          00005970
ISN 0168            GOTO 171                                                            00005980
                C-----EINZELZEICHEN PLOTTEN                                             00005990
ISN 0169          189 READ(5,5200)IZ,IG,X0,Y0,IW                                        00006000
ISN 0170         5200 FORMAT(2I5,2F10.3,I5)                                             00006010
ISN 0171            IF(IG.EQ.0)GOTO 200                                                 00006020
ISN 0173            DO 190 N=1,3                                                        00006030
ISN 0174          190 CALL SYMBOL(2.0+X0+XV(N),2.0+NDEKM2-Y0+YV(N),IG*0.07,IZ,1.0*IW,-1)00006040
ISN 0175            GOTO 189                                                            00006050
                C-----KOORDINATEN UMBENENNEN                                            00006060
ISN 0176          200 DO 320 NF=1,2                                                     00006070
ISN 0177            READ(5,5300)LOGF,IPTYP,IG,IRA,ST(1),ST(2),EPROJ,MPROJ,MTARG         00006080
ISN 0178         5300 FORMAT(4I10,3F10.3,2I5)                                           00006090
ISN 0179            GOTO(204,210),NF                                                    00006100
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ISN 0180        204 NP=MINO(N1,600)                                                 00006110
ISN 0181            IF(NP.GE.2)GOTO 206                                             00006120
ISN 0183            WRITE(6,6080)                                                   00006130
ISN 0184       6080 FORMAT('0KEIN PLOT DER EXPERIMENTELLEN PUNKTE DA DEREN ANZAHL < 2'00006140
                   1)                                                               00006150
ISN 0185            GOTO 320                                                        00006160
ISN 0186        206 DO 208 I=1,NP                                                   00006170
ISN 0187            T(I)=T1(I)                                                      00006180
ISN 0188            S(I)=S1(I)                                                      00006190
ISN 0189        208 DS(I)=DS1(I)                                                    00006200
ISN 0190            GOTO 216                                                        00006210
ISN 0191        210 NP=MINO(N2,600)                                                 00006220
ISN 0192            IF(NP.GE.2)GOTO 212                                             00006230
ISN 0194            WRITE(6,6085)                                                   00006240
ISN 0195       6085 FORMAT('0KEIN PLOT DER THEORETISCHEN PUNKTE DA DEREN ANZAHL < 2') 00006250
ISN 0196            GOTO 320                                                        00006260
ISN 0197        212 DO 214 I=1,NP                                                   00006270
ISN 0198            T(I)=T2(I)                                                      00006280
ISN 0199        214 S(I)=S2(I)                                                      00006290
ISN 0200        216 DO 220 I=1,NP                                                   00006300
                C-----STREUWINKEL UM LINKS-/RECHTS-KORREKTUR BERICHTIGEN            00006310
ISN 0201            T(I)=T(I)+DT                                                    00006320
                C-----UMRECHNUNG DER STREUWINKEL VON LABOR- IN SCHWERPUNKTSYSTEM    00006330
ISN 0202            IF(KINEMA.EQ.0)GOTO 217                                         00006340
ISN 0204            IF(I.EQ.1)WRITE(6,6095)                                         00006350
ISN 0206       6095 FORMAT('0UMRECHNUNG DER STREUWINKEL VON LABOR- IN SCHWERPUNKTSYSTE00006360
                   1M NOCH NICHT INSTALLIERT')                                      00006370
                C-----KOORDINATEN AUF BILDRAHMEN BESCHRAENKEN                       00006380
ISN 0207        217 IF(T(I).GT.120.0)T(I)=120.0                                     00006390
ISN 0209            S(I)=S(I)*10.0**LOGF                                            00006400
ISN 0210            IF(S(I).GT.10.0**LOGMAX)S(I)=10.0**LOGMAX                       00006410
ISN 0212            IF(S(I).LT.10.0**LOGMIN)S(I)=10.0**LOGMIN                       00006420
ISN 0214            IF(IRA.EQ.1)DS(I)=DS(I)*S(I)                                    00006430
ISN 0216            IF(IRA.EQ.2)DS(I)=DS(I)*10.0**LOGF                              00006440
ISN 0218            IF(IDXDY.EQ.0)GOTO 220                                          00006450
                C-----WINKELFEHLER IN WIRKUNGSQUERSCHNITT-FEHLER UMRECHNEN          00006460
ISN 0220            IF(I.EQ.1)D2=(S(2)-S(1))/(T(2)-T(1))*0.1                        00006470
ISN 0222            IF(I.EQ.NP)D2=(S(NP)-S(NP-1))/(T(NP)-T(NP-1))*0.1               00006480
ISN 0224            IF(S(I-1).GT.S(I).AND.S(I+1).GT.S(I))D2=AMAX1((S(I-1)-S(I))/(T(I)-00006490
                   1    T(I-1)),(S(I+1)-S(I))/(T(I+1)-T(I)))*0.1                    00006500
ISN 0226            D2=(S(I+1)-S(I-1))/(T(I+1)-T(I-1))*0.1                          00006510
ISN 0227            DS(I)=SQRT(DS(I)*DS(I)+D2*D2)                                   00006520
ISN 0228        220 CONTINUE                                                        00006530
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ISN 0229            GOTO(230,250),NF                                                    00006540
                  C-----MESSPUNKTE UND FEHLERBALKEN PLOTTEN                             00006550
ISN 0230            230 IF(IPRINT.EQ.1)WRITE(6,6100)(I,T(I),S(I),DS(I),I=1,NP)          00006560
ISN 0232           6100 FORMAT('OGEGEBENE EXPERIMENTELLE PUNKTE:'/                      00006570
                       1         '0    I     THETA          SIGMA          DSIGMA'/    00006580
                       2         ' ------------------------------------------'/       00006590
                       3        (' ',I5,F10.3,F15.3,F15.3))                           00006600
ISN 0233            DO 240 I=1,NP                                                       00006610
ISN 0234            X=2.0+0.1*T(I)                                                      00006620
ISN 0235            CALL SYMBL4(X,2.0+2.0*(ALOG10(S(I))-LOGMIN),IG*0.07,IPTYP,0.0,-1)   00006630
ISN 0236            Y=2.0+AMIN1(2.0*NDEK,2.0*(ALOG10(S(I)+DS(I))-LOGMIN))               00006640
ISN 0237            CALL PLOT(X,Y,3)                                                    00006650
ISN 0238            Y=2.0+AMAX1(0.0,2.0*(ALOG10(S(I)-DS(I))-LOGMIN))                    00006660
ISN 0239            240 CALL PLOT(X,Y,2)                                                00006670
ISN 0240            GOTO 320                                                            00006680
                  C-----THEORETISCHE PUNKTE DURCH POLYGONZUG VERBINDEN                  00006690
ISN 0241            250 IF(IPRINT.EQ.0)GOTO 274                                         00006700
ISN 0243            WRITE(6,6150)                                                       00006710
ISN 0244           6150 FORMAT(/'OGEGEBENE THEORETISCHE KOORDINATEN'/                   00006720
                       1         '0    I     THETA   SIGMA(MB/SR)'/                    00006730
                       2         ' ----------------------------')                      00006740
ISN 0245            WRITE(6,6300)(I,T(I),S(I),I=1,NP)                                   00006750
ISN 0246           6300 FORMAT(' ',I5,F10.2,F15.3)                                      00006760
ISN 0247            274 DO 279 N=1,3                                                    00006770
ISN 0248            CALL PLOT(2.0+0.1*T(1)+XV(N),2.+2.0*(ALOG10(S(1))-LOGMIN)+YV(N),3)00006780
ISN 0249            DO 279 I=2,NP                                                       00006790
ISN 0250            279 CALL PLOT(2.0+0.1*T(I)+XV(N),2.+2.0*(ALOG10(S(I))-LOGMIN)+YV(N),2)00006800
ISN 0251            320 CONTINUE                                                        00006810
                  C-----ABSCHLUSS                                                       00006820
ISN 0252            CALL PLOT(0.,0.,999)                                                00006830
ISN 0253            WRITE(6,6600)                                                       00006840
ISN 0254           6600 FORMAT('0PLOT MIT SUBROUTINE WQPLOT')                           00006850
ISN 0255            RETURN                                                              00006860
ISN 0256            END                                                                 00006870
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8. Index of Modules and Subroutines

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