FP7-269665: Fast Reactor Experiments for hYbrid Applications

Mid-term review meeting

Brussels, 27-28 January 2015

WP2- scope of activity

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WP2: Subcritical configuration for design and licensing of MYRRHA/FASTEF

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WP2 - Objectives

- FREYA-WP2 has a strong interaction with the Central Design Team (CDT) FP7 Project in the domain of design and licensing of the MYRRHA/FASTEF. Following the objectives for MYRRHA/FASTEF to be operated as a subcritical facility, an experimental campaign in support of the design and licensing is needed (to be performed in 2015).
- Another core configuration has to be designed in the VENUS-F facility. Within the constraints of available fuel during the FREYA-project, this core shall be as representative as possible of the MYRRHA/FASTEF core design in terms of fuel/"coolant" features (volume fraction, fuel enrichment), control rods, etc.
- Standard characterization core measurements will be accomplished.
- Different fuel loading patterns according to the different steps in a MYRRHA reloading scheme will be analyzed and characterized.
- Different reactivity effects will be investigated (temperature effects, void effects, water ingress effects and fuel agglomeration effects, in-pile sections).

WP2 - Structure

Participants: KIT (Germany), SCK-CEN (Belgium), ENEA (Italy), CNRS (France), ITN (Portugal), UPM (Spain), KTH (Sweden), INFN (Italy), CIEMAT (Spain), CHALMERS (Sweden), AGH (Poland), BME (Hungary).

- **Task 2.1: MYRRHA Subcritical Mock-up Definition (Task leader: SCK•CEN)**
  → D2.1
- **Task 2.2: MYRRHA Subcritical Mock-up Characterization (Task leader: INFN)**
  → D2.2
- **Task 2.3: MYRRHA Subcritical Mock-up Reactivity Effects (Task leader: UPM)**
  → D2.3
- **Task 2.4: MYRRHA subcriticality monitoring (Task leader: CIEMAT)**
  → D2.4
- **Task 2.5: Transposition to MYRRHA/FASTEF (Task leader: SCK•CEN)**
  → D2.5

WP2 – Schedule

- WP2 was planned to be executed within a **14 months** period (**M18** → **M32**) but unfortunately the project delay is also impacting this planning

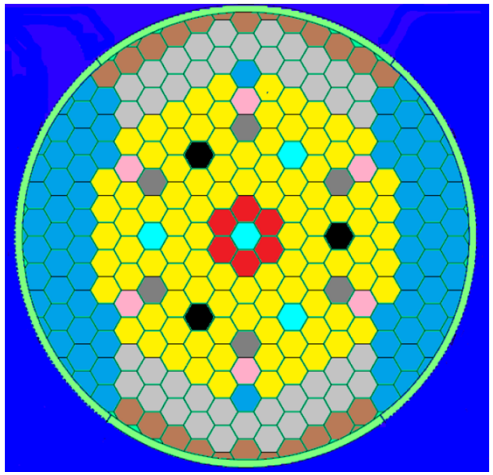
- WP2 activities have started on M33

- WP2 (& WP3) Technical Meetings:
  - 13.11.2013 (Brüssels, M33)
  - 06.05.2014 (Karlsruhe, M39)

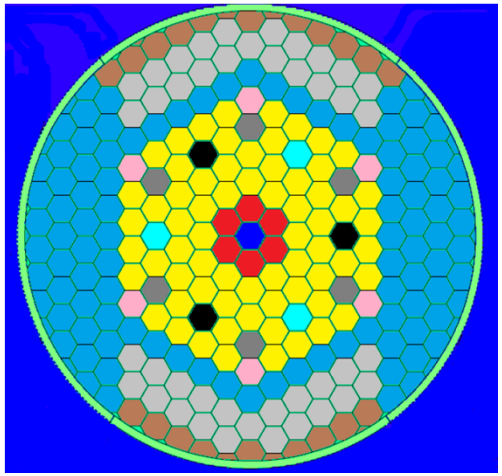
  } **Task 2.1 (& Task 3.1)**

- Due to technical considerations a new optimized chronological sequence of the Tasks within WP2 & WP3 has been agrreed on

WP2 - MYRRHA critical and sub-critical cores

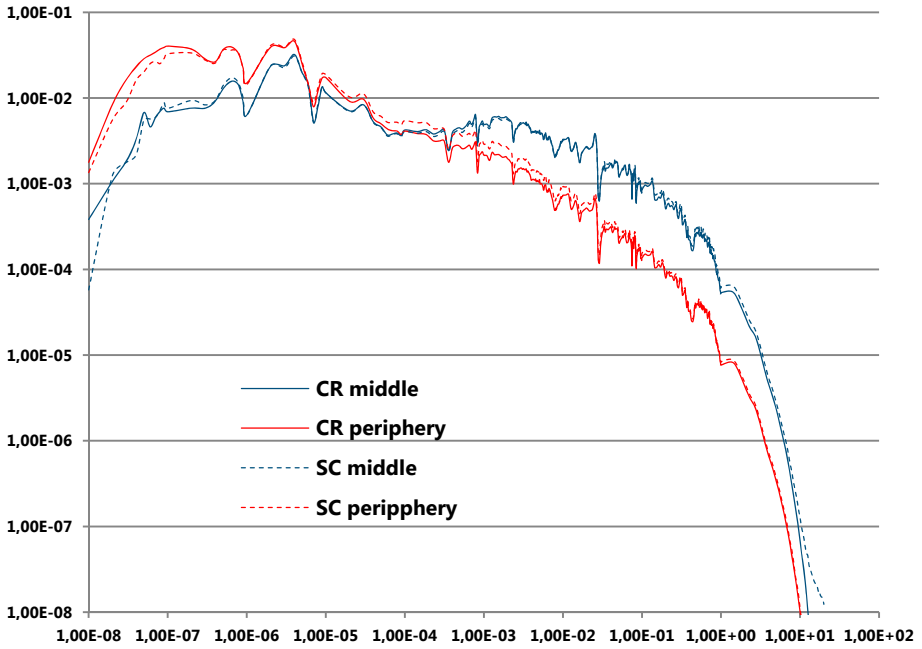


FA (108)
IPS (4)
Control rod (3)
SCRAM FA (6)
BeO Reflector
SS jacket
LBE (dummy)



FA (78)
IPS (3)
Control rod (3)
SCRAM FA (6)
BeO Reflector
SS jacket
LBE (dummy)
LBE (spallation target)

Ratios of spectral indexes (SC/RC)				
	F28/F25	F49/F25	F40/F25	C28/F49
FUEL inner ring	1.14	1.02	1.09	0.95
LBE inner ring	1.17	1.01	1.12	0.96
FUEL outer ring	0.85	0.96	0.85	1.06
LBE outer ring	1.00	0.91	1.01	1.03
IPS	0.92	1.00	0.94	1.07



WP2 & WP3 - Change in the chronological structure (1)

Year	1		2		3		4			
Month	6	12	18	24	30	36	42	48		
WP1										
Task 1.1		MS1							D1.1	M14
Task 1.2			MS2						D1.2	M20
Task 1.3									D1.3	M22
Task 1.4				MS3					D1.4	M24
WP2										
Task 2.1									D2.1	M22
Task 2.2									D2.2	M25
Task 2.3					MS4				D2.3	M29
Task 2.4					MS5				D2.4	M30
Task 2.5									D.2.5	M32

Year	1		2		3		4			
Month	6	12	18	24	30	36	42	48		
WP3										
Task 3.1									D3.1	M30
Task 3.2									D3.2	M32
Task 3.3						MS6			D3.3	M35
WP4										
Task 4.1									D4.1	M38
Task 4.2									D4.2	M43
Task 4.3								MS7	D4.3	M48
WP5										
Task 5.1								MS8	D5.1	M48
Task 5.2										
Task 5.2										
WP6										
									D6.1	M3
									D6.2	M6

Original FREYA WPs/Tasks chronological planning (from DOW)

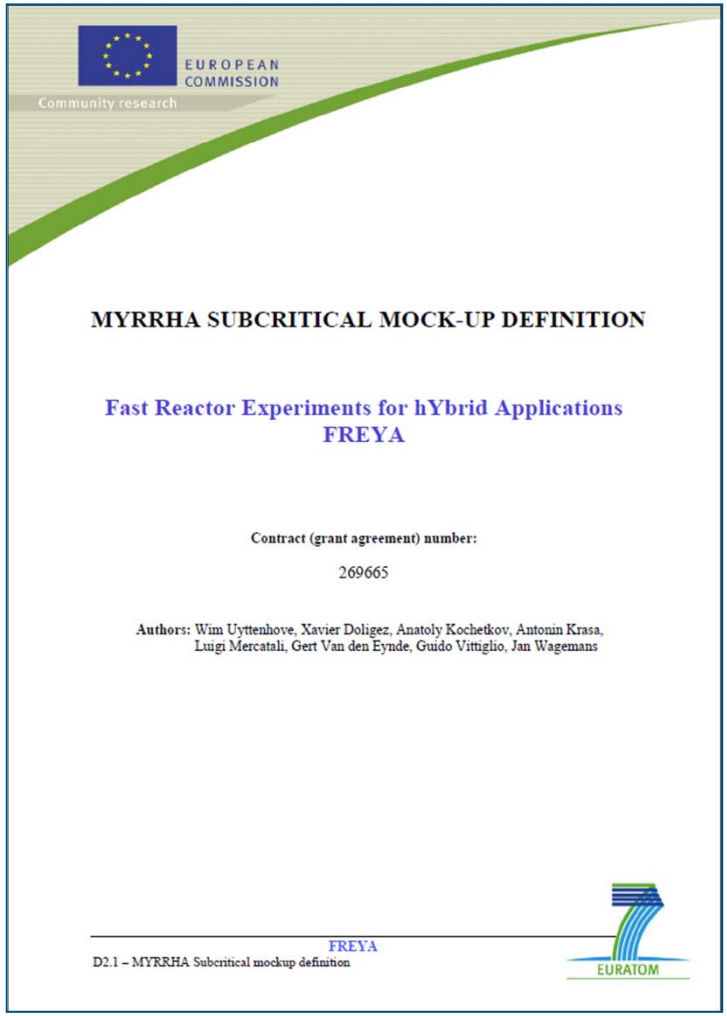
WP2 & WP3 - Change in the chronological structure (2)

- **FAs for VENUS-F in WP2 (sub-critical) and WP3 (critical) will be the same**
- **All the WP2 sub-critical configurations need a reference critical configurations from which to obtain the reference sub-criticality level (e.g. by rod drop)**

- **Task 2.1 (*Sub-critical mock-up definition*) and Task 3.1 (*Critical mock-up definition*) performed in parallel**
- Due to the need of a reference critical even in sub-critical experiments, **the core for Task 2.2 and Task 3.2 will be the same**
- **New sequence:**
  1. Start WP2 experiments fulfilling Task 3.2 and *Task 3.3*
  2. *Task 2.2 (Sub-critical Mock-up Characterization)*
  3. *Task 2.3 (Sub-critical Mock-up Reactivity Effects)*
  4. *Task 2.4 (MYRRHA subcriticality monitoring)*
  5. *Task 2.5 (Transposition to MYRRHA/FASTEF)*

WP2 - Main results

- Task 2.1 completed (D2.1 and D3.1 issued)
  - Design of FAs “representative” of MYRRHA
  - New MYRRHA-type VENUS-F core loadings
- Safety studies for the licensing of the WP3/WP2 core performed by SCK-CEN
- Construction of the new FAs at SCK-CEN (Mol)
- Permission to load the core obtained in December 2014
- First criticality of the MYRRHA mock-up envisioned for March 2015


EUROPEAN COMMISSION
Community research

MYRRHA SUBCRITICAL MOCK-UP DEFINITION

Fast Reactor Experiments for hYbrid Applications
FREYA

Contract (grant agreement) number:

269665

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FREYA
D2.1 – MYRRHA Subcritical mockup definition

EURATOM

WP2 - Next steps

- **Loading of the critical (WP3) configuration (February 2014)**
- **Then before summer 2015:**
  - **Task 3.2: MYRRHA Critical Mock-up Characterization (CIEMAT)**
  - **Task 3.3: MYRRHA Critical Mock-up Reactivity Effects (UPM)**

From September/October 2015 the actual sub-critical experimental campaign is planned

  - **Task 2.2: MYRRHA Subcritical Mock-up Characterization (INFN)**
  - **Task 2.3: MYRRHA Subcritical Mock-up Reactivity Effects (UPM)**
  - **Task 2.4: MYRRHA subcriticality monitoring (CIEMAT)**
  - **Task 2.5: Transposition to MYRRHA/FASTEF (SCK-CEN)**