KATRIN - Experiment
Detector System of the Focal Plane Detector of KATRIN

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Tritium source and main tank

Determine mass of electron-antineutrino with an error of 0.2 eV
PIN-diode array as FPD

- Detection of electrons, resolution of approx. 600 eV
- Detector counts the electrons
- Resolution necessary for background suppression

- 9 pF per pixel
- 148 pixel with same area
- Charge at 18.6 keV: approx. 0.8 fC
Mechanics

Specs:

- High vacuum HV (10^{-9} mbar)
- Low temperatures (approx. 210 K)
- Low (α, β, γ) activities within μHz
- High magnetic field strength (6 T)

Stringent environmental and spatial restriction
Feed-through

- Separation of UHV (10^{-11} mbar) and HV (10^{-9} mbar)
- Thermal decoupling of cooled detector and electronics
- Connector: sapphire insulated niobium pins

Electronics side

Detector side

Low activity materials
oxygen free copper-Housing

- Cooling of preamplifiers
- Additional radiation shielding of detector
- Positional fixation of preamplifier-modules
- Electrical shielding
- Low impedance reference potential
Preamplifier modules

- 148 preamps in a carousel
- Modules with 6 ch. (resp. 7 ch.)
- Cooled and fixed with two pins
- Arranged on Al$_2$O$_3$ ceramic
Used materials

- Preamp boards (RUBALIT 710 S, Ceramtec)
  - Less pollution with Uranium, Thorium and Potassium
  - GEANT simulation estimates count-rate of 80 µHz
- Feed through flange (stainless steel, sapphire windows)
- Detector pins (Niobium)
- Front-plate, rods, back-ring, shielding-tube (oxygen free copper)
  - Radiation shielding
- PCB-boards for less radioactive background
  - REXOLITE, Ensinger
  - ULTRALAM, Roger
Preamp modules

Specs for KATRIN:
- Working within vacuum
- Temperature range: 370 K to 210 K
- Influence of magnetic fields
- Low noise: 600 eV
- Power consumption: < 100 mW / channel
- Bandwidth: 5 MHz

Prototype Revision2

Attributes at 300 K
- Sensitivity: 1keV cause approx. 85 µV
- Noise: 100 µV
Resolution

Used input: Testinput
Temp.: 300 K

- Best results at 6 µs (770 eV)
- Domination of current noise changes to voltage noise
Thanks for your attention

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