Purity Monitor

13.01.2009

Satoshi MIHARA

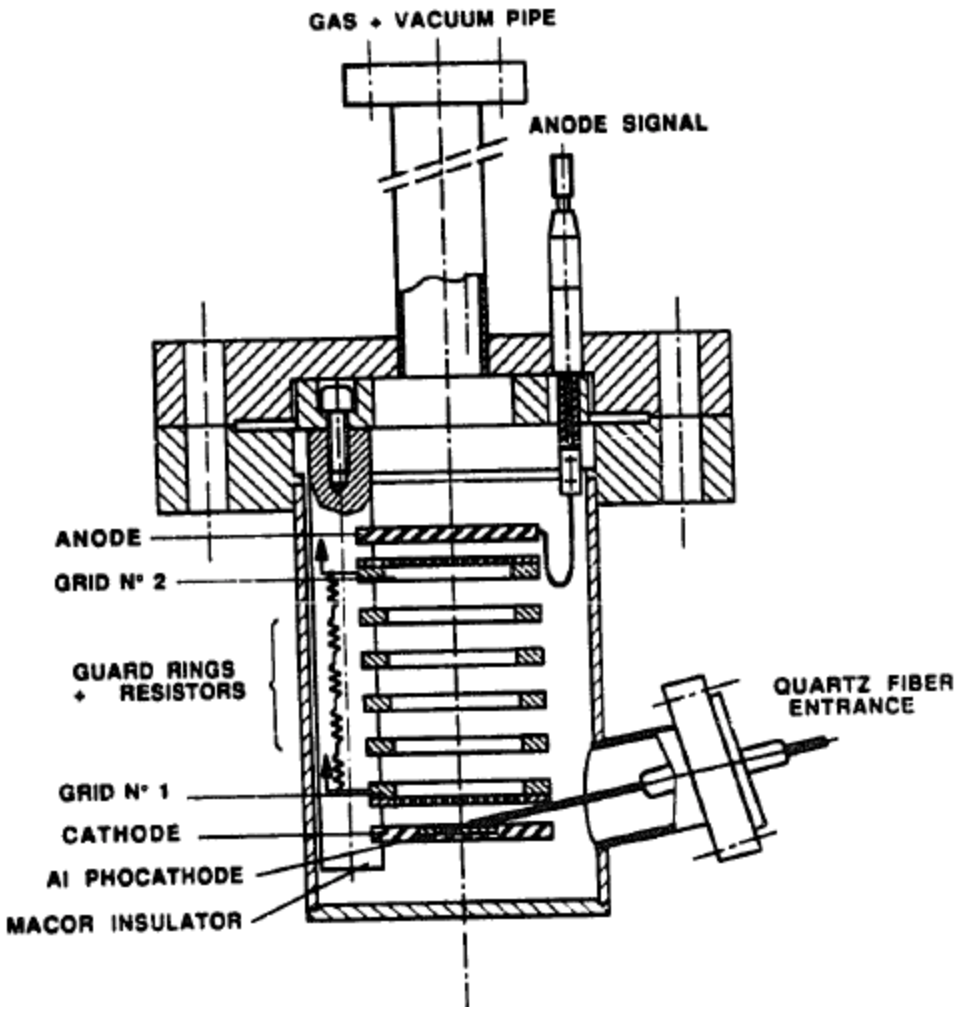
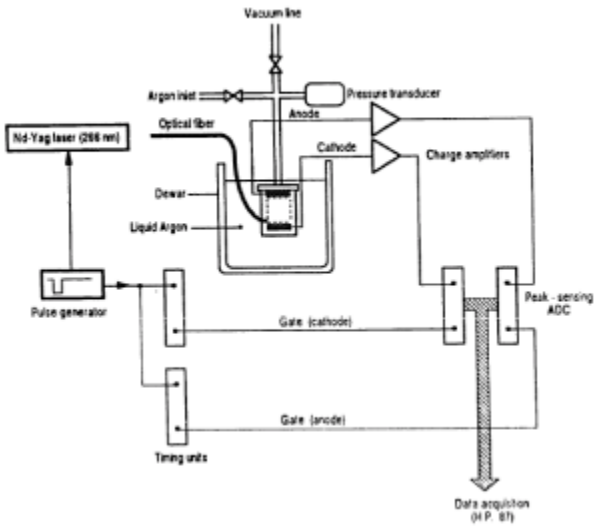
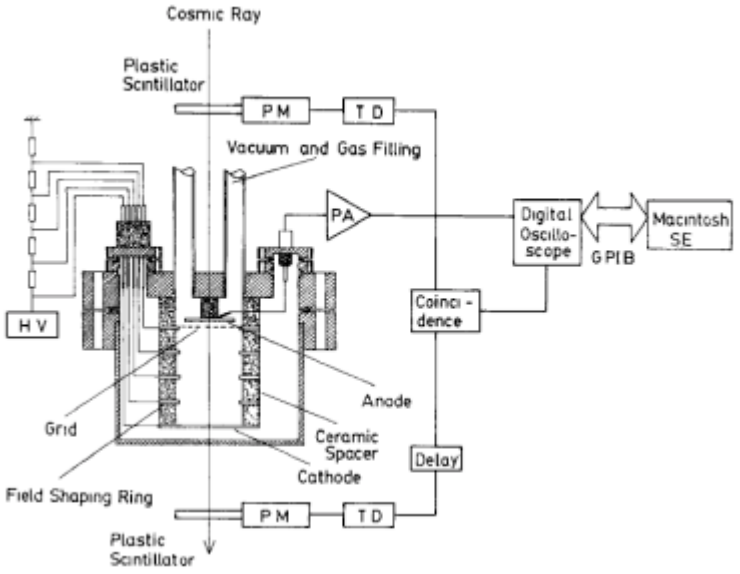


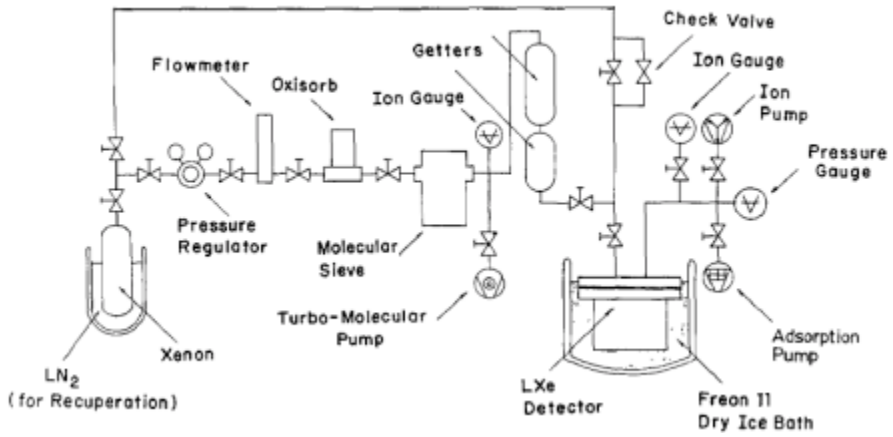
Table 1
Parameters of the detector

Volume of the cell	180 cm^3
Anode to cathode distance	60 mm
Cathode to first grid distance	5 mm
Second grid to anode distance	5 mm
Maximum electric field	1000 V/cm
Angle between anode and fiber	11°
Quartz fiber diameter	1 mm
Fiber length	1.5 m
Laser wavelength	266 nm
Laser repetition rate (max)	30 Hz
Energy at the input of the fiber (average)	1.5 mJ
Laser pulse width (FWHM)	8 ns

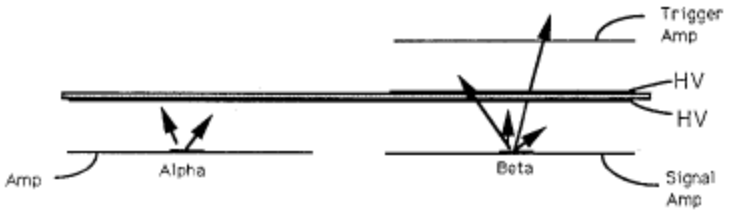


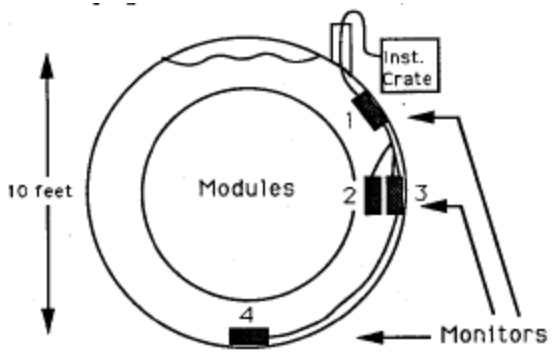
G. Carugno et al NIM A292 (1990) 580





E. Aprile et al. NIM A300 (1991) 343-350

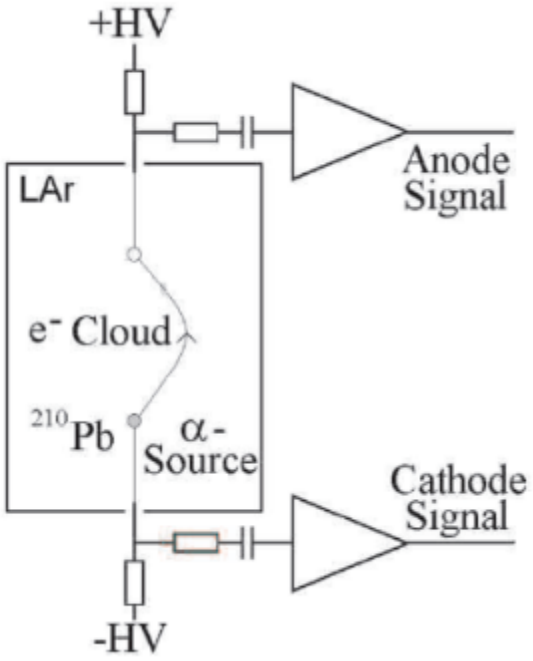




Each monitor contains two sensing channels. Figure 3 displays the basic attributes of a pair. The α sensor consists of a single high voltage gap (2.3 mm) with an α source (Am-241) electro-deposited on the sensing plane. Because α particles are heavily ionizing, any particle emitted into the gap deposits all its kinetic energy by ionizing the LAr very near the source plane. A positive voltage across the gap causes the free electrons to drift, and the induced current can subsequently be detected and amplified. Because each electron drifts across the entire gap, there is great sensitivity of the induced current to attenuation through electron-contaminant recombination. Typically, there are about 30,000 free electrons per α particle.

The β channel has a second high voltage gap located adjacent to the first gap. Energetic, minimum ionizing particles (>2 MeV) from the electro-deposited β source (Ru-106) easily reach the second gap. Since minimum ionizing particles produce only 5-10 thousand electrons in the gap, the second gap is needed to provide a clean trigger to minimize effects from noise.

G. C. Blazey D0 UR-1203 ER-13065-656



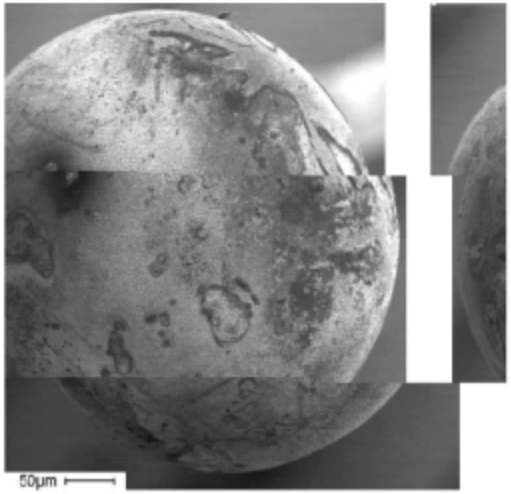
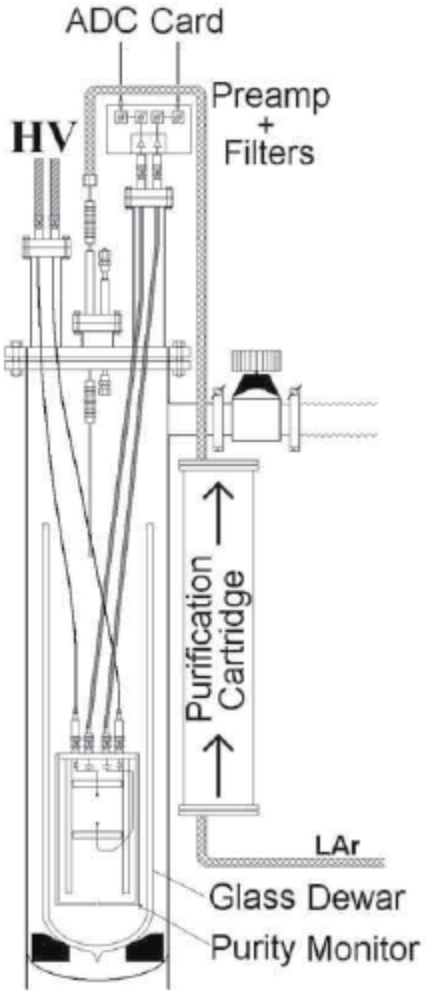
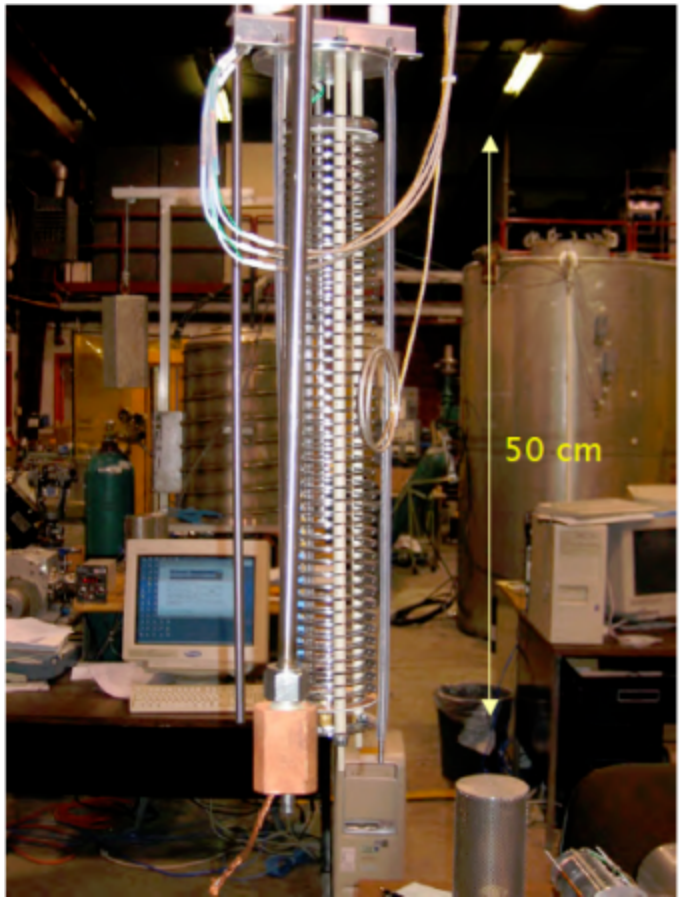
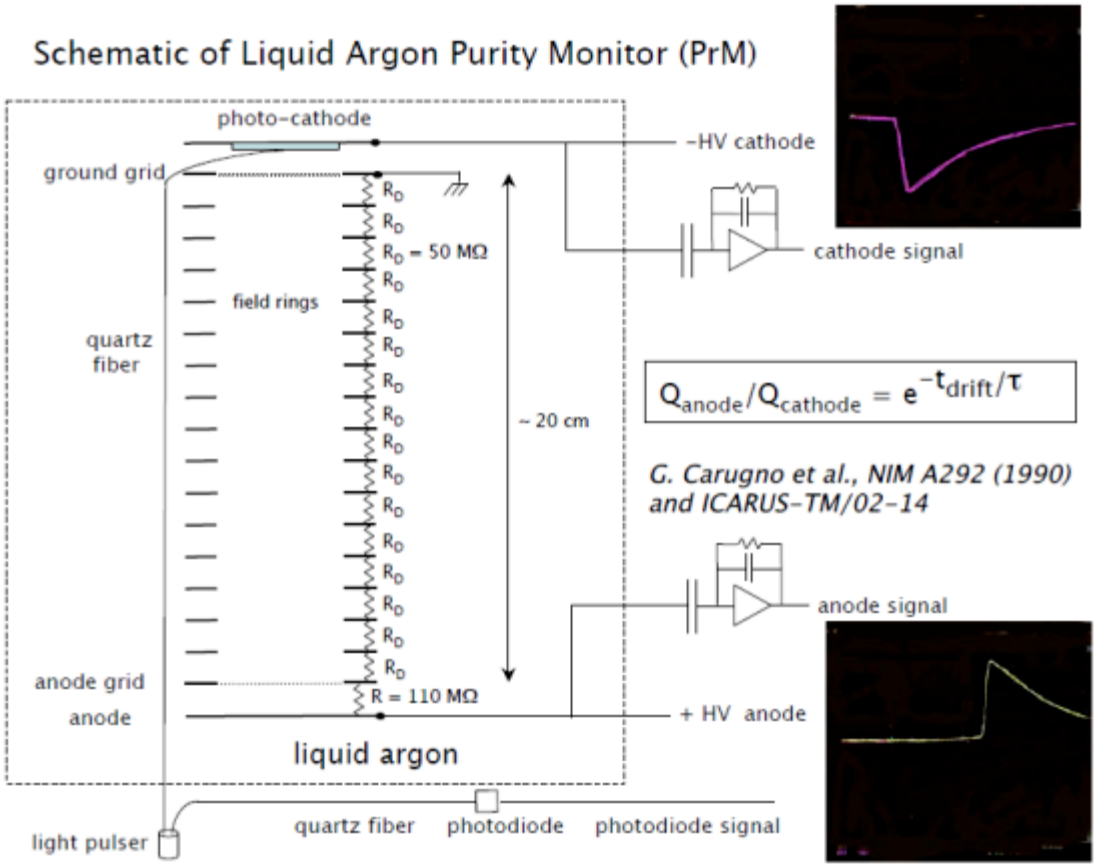


Fig. 2. Electronic microscope picture of the spherical platinum cathode with the ^{210}Pb deposited on the surface. The scale is shown in the lower-bottom corner.

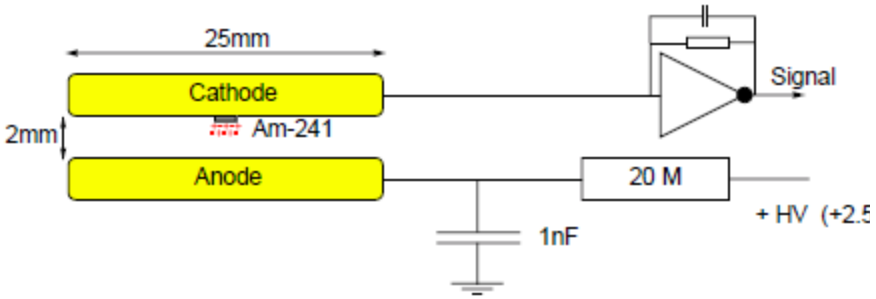


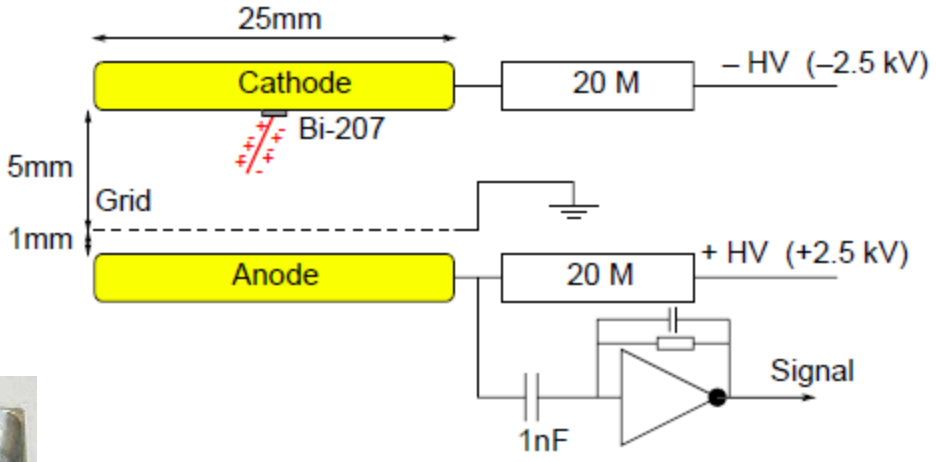
A. Badertscher et al. arXiv physics/0412166v1

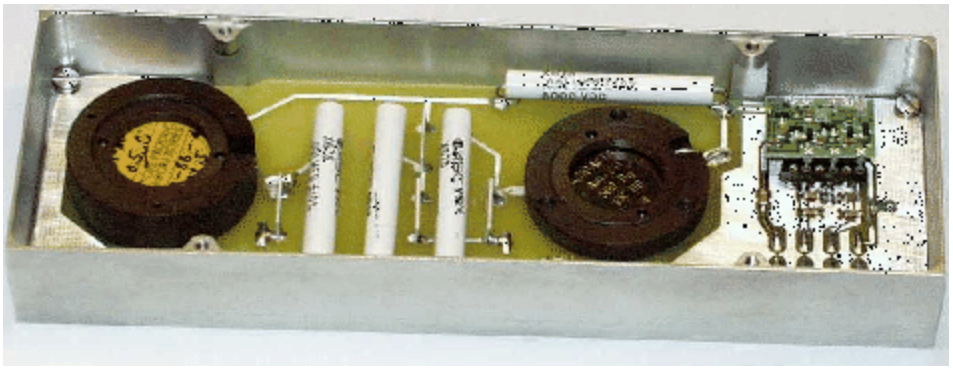


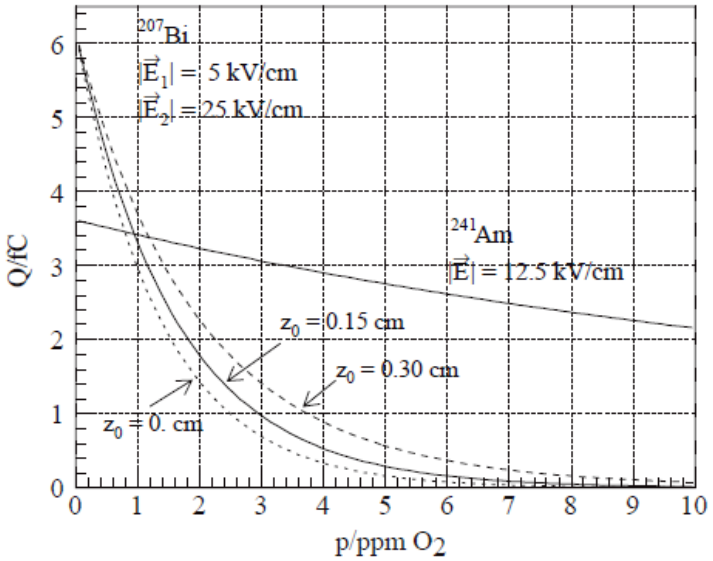


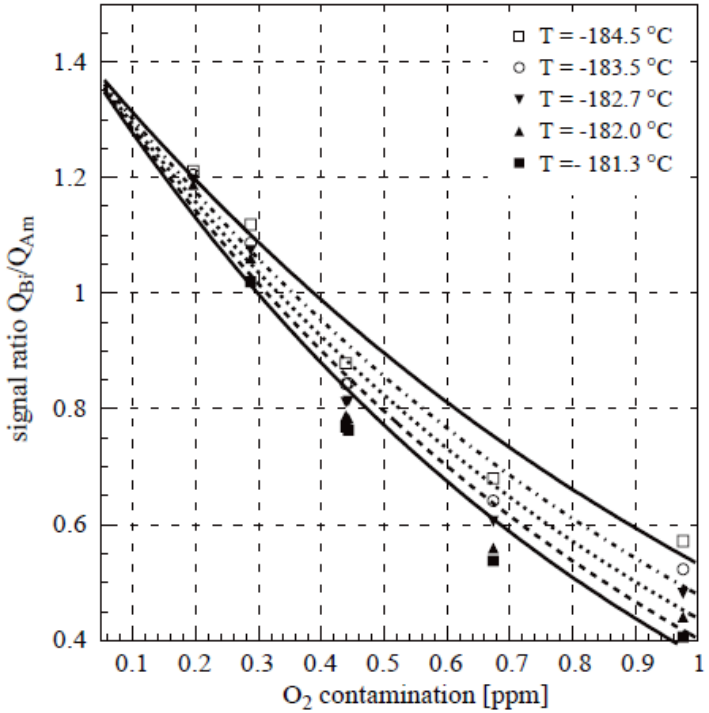
S. Pordes FNAL May 13th 2006











M. Adams et al NIM A545 (2006) 613

issues

- Dynamic range
  - 100ppb
  - 10ppb
  - 1ppb
- Electron source
  - Radioactive source
    - Combination of alpha and beta sources
  - Cosmic ray
  - Light source (laser or Xe light) + photocathode
    - GaAs
    - Gold
    - Aluminium
- Cryostat
  - Separate cryostat
  - Monitor in the detector cryostat