

Ultra Low-background HPGe Detectors



APPLICATION

Ultra low-background HPGe detectors are widely used in underground laboratories for determination of radionuclides activities in environmental or industrial samples at $\mu\text{Bq/kg}$ levels and in scientific experiments such as investigation of magnetic moment of neutrino, dark matter search, etc.



Design

- Task related design (U-type, vertical, down-looking or portable cryostat)
- Remote not cooled part of preamplifier
- Zeolite is placed near not cooled part of preamplifier in order to be outside measuring chamber

Cryostat materials

- Certified materials with low radiation impurities
- Ultrapure aluminium–silicon alloy with U + Th content $< 1, 0.5$ or 0.2 ppb for detector holder and endcap
- Freshly produced electrolytic copper for coldfinger and pedestal
- Tested on radiopurity selected stainless steel screws and sapphire insulators

Technology

- Transportation of HPGe crystal and cryostat materials by surface freight
- Minimization of fabrication time (location of materials above ground)
- Assembly in a cleanroom
- Cleaning and passivation of copper surfaces
- Storage of crystal and cryostat materials in a container made from materials effectively slowing down and absorbing neutrons (water and Cd)

Design features

- Fabrication of large volume HPGe detectors without bulletization
- Front end electronics made on low-background Teflon substrate
- Passive screen between front end electronics and HPGe crystal made from Pb with Bi-210 radioactivity < 0.1 Bq/kg
- Double-crystal HPGe detector design
- Multi-crystal HPGe detector design

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Gamma-rays