Segmented BEGe detector: Characterization



Outline:

- [Segmented] BEGe detector
- Characterizations on Segmented BEGe detector
- Summary & outlook

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Broad Energy Germanium Detector



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- P-type point contact detector
- Widely used for many experiments: GERDA/MAJORANA, TEXONO, CDEX, CoGeNT,...

Broad Energy Germanium Detector

- Advantages for BEGe detector:
- ✓ smaller p⁺ contact ⇒ less noise
- ✓ Well pronounced weighting field:
 - Powerful PSD using A/E method

p+(readout contact)

Disadvantages for BEGes:
 <u>Degeneracy in φ</u>



Segmented Broad Energy Germanium Detector





- Designed by the GEDET group, made by Canberra France
- n-type BEGe detector
 Electrons are collected in contact
- Point contact with 4-fold segmentation
 - **3D event reconstruction:** ✓ Break degeneracy in ♦
 - Segmentation design:
 - Minimize number of contacts
 - Maximize information
- Configuration: Dimensions: φ 75 mm x 40 mm Mass: 940 g HV: +4500 Volt (on n⁺ contact)

Test Facility



- K1 test stand:
- Conventional vacuum cryostat
- Single detector:

cooling finger submerged in LN2

- 2 copper ears to house electronics
 Cold FET for core
 - L warm preamps for segments
- Capable to scan in (r, ϕ, z)

Characterization using ¹³³Barium source



Hit Positions Along Z Direction From Simulation



Mirror Pulse: sensitive to event topologies



Mirror Pulse: sensitive to event topologies



Mirror Pulse: sensitive to event topologies



Segment Boundary Determination



Detector Position In The Cryostat



Detector position: Not located in the center
 Decentralization confirmed by CANBERRA

Crystal Axes Orientation



Summary & Outlook

- BEGe detector with extra segmentation useful to disentangle different event topologies
- The segmented BEGe detector was designed by GEDET group and built by Canberra France
- Characterization using ¹³³Ba source
- Basic characterization accomplished: energy resolution, rise times, orientation of crystal axes and location of segment boundaries
- Study event position reconstruction
- Detector response near n⁺ contact