GERDA Phase II Detectors and Acceptance Tests

Victoria Wagner

for the Acceptance Tests WG Max-Planck-Institut für Kernphysik

01.03.2012



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Phase II ^{enr} BEGe Production Overview Status

Acceptance Tests

Motivation Preparation HADES Location Infrastructure Measurements

First Results

Conlcusion and Outlook

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The GERDA Experiment

- Phase I started Nov. 1st
 2011
- Currently running with 9 coaxial germanium detectors
- Total mass: 15.57kg (enriched) + 7.59kg (natural) Germanium



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Phase II

- ▶ Goal 1: Increase sensitivity: T_{1/2} ∝ a × √M
 a: enrichment fraction
 M: mass of active material
 - additional total mass approx. 20kg
 - use of enriched material that contains about 87% of ⁷⁶Ge (nat. abundance 7.6%)
- Goal 2: Active background rejection with pulse shape analysis
 - Broad Energy Germanium detectors



 Phase II planned to start end of 2012 with approximately 25 enriched BEGe detectors GERDA Acceptance Test

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Overview



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Current Status of Diode Production

Delivery of first 7 enriched BEGes by Canberra February 14-17 for acceptance tests in underground laboratory HADES



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Acceptance Tests

► A full characterization of the enriched detectors → Possibility of close study of enriched detectors before deployment into GERDA

- Do the ^{enr}BEGe detectors have the required characteristics for Phase II?
 - \rightarrow acceptance or rejection of ^{enr}BEGe detectors
- in case of rejection: send back diodes to Canberra for refurbishing/ regrowing

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Preparation of Acceptance Tests at MPIK

- Characterization of 5 depleted BEGe during the last 2 years
- Optimization of DAQ and measurement procedure as well as analysis tools at Max-Planck-Institut für Kernphysik
- Special interest in pulse shape analysis:
 - Scan with ²²⁸Th in different DAQ modes
 ⁶⁰Co measurements for PSA
 - Co measurements for PSA



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Preparation of Acceptance Test at MPIK

Th228 measurement with depleted BEGe for pulse shape discrimination



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Location



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- Location of acceptance test in HADES = High Activity Disposal Experimental Site at SCK, the Belgian Nuclear Research Center
- Approx. 20km to Canberra Olen

Infrastructure in HADES

Data acquisition with two parallel systems:

- FADC: pulses and energy spectrum
- MCA: only energy spectrum





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Measurements at HADES

Standard test protocol for ^{enr}BEGe:

- HV Scan
- Energy resolution
- Leakage current monitoring with USB loggers
- Active volume measurement with ⁶⁰Co
- ▶ Dead layer measurement with ¹³³Ba and ²⁴¹Am
- Pulse shape discrimination with ²²⁸Th and ⁹⁰Sr
- Short term measurement to test stability
- Charge collection study with collimated ²⁴¹Am source

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First results from acceptance tests in HADES

- In the last 2 weeks measurements of the first 4 detectors have begun
- Energy resolution of ARGO (FWHM):

1173.2keV: (1.60±0.01)keV 1332.5keV: (1.69±0.01)keV

\rightarrow both enriched BEGe detectors have a very good energy resolution!

evaluated by Sabine Hemmer

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Conclusion

- Preparation of test: successful
- Start of acceptance test with 7 enriched detectors: successful
- GERDA requirements:
 - ▶ 2 detectors/week : possible
 - Installation of several setups: possible, partly implemented

Outlook:

- Finish test of first seven detectors
- Green light for production of second batch of detectors
- Bonding, holder production AND finally deployment of detectors in GERDA

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Thank you for your attention!

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