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GERDA Phase II detectors: behind the production and characterisation at low background conditions

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The low background GERmanium Detector Array (GERDA) at Laboratori Nazionali del Gran Sasso is designed to search for the rare neutrino-less double beta decay (0vbb) in 76Ge. Bare germanium diodes are operated in liquid argon that is used as coolant, as passive and soon active as well shield against external radiation. Currently, Phase I of the experiment is running using ~15 kg of co-axial Germanium diodes. In order to increase the sensitivity of the experiment ~30 Broad Energy Germanium (BEGe) diodes will be added within 2013. The additional target mass of ~20 kg, the better energy resolution and the enhanced pulse shape discrimination of background events through these novel detectors will drastically improve the sensitivity of the experiment.
This presentation reviews the production chain of the new BEGe detectors from isotopic enrichment to diode production and testing. As demonstrated all steps were carefully planned in order to minimize the exposure of the enriched germanium to cosmic radiation. Cosmogenically-induced radioisotopes in germanium such as 68Ge, 60Co or 58Co are namely a serious hazard that mimics rare events of interest like 0vbb decays. Following this premise, acceptance and characterisation measurement of the newly produced diodes have been performed within the HEROICA project in the Belgian underground laboratory HADES close to the diode manufacturer. The full test program, including advanced investigations of diode properties, is discussed. It includes the determination of parameters essential for GERDA such as energy resolution, depletion voltage, charge collection efficiency, dead layer, active volume fraction and pulse shape performance. Results from a subset of the recently terminated GERDA Phase II BEGe survey will be presented.

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