T 39: Neutrinos, Dark Matter VI

Time: Tuesday 17:00–18:30 Location: POT/0006

T 39.1 Tue 17:00 POT/0006

Constraining the $^{77(m)}$Ge Production with GERDA Data and Implications for LEGEND-1000 — •Moritz Neuberger[1], Luigi Pertoldi[1], Stefan Schönert[1], and Christoph Wiesinger[2] for the GERDA-Collaboration — [1]Physik-Department E15, Technische Universität München — [2]Physik-Department E47, Technische Universität München

The delayed decay of $^{77(m)}$Ge, produced by neutron capture on ^{76}Ge, is a potential background for the next-generation neutrinoless double-beta decay experiment LEGEND-1000 at the LNGS site. Based on Monte Carlo simulations, various mitigation strategies and suppression techniques have been proposed to identify and suppress this background [1,2,3]. In this talk, we will present the results to search for $^{77(m)}$Ge by exploiting the isomeric state in ^{77}As. Given the very similar configuration - bare germanium detectors in liquid argon - it serves as a benchmark for our LEGEND-1000 predictions. This research was supported by the BMBF through the Verbundforschung 05A20WO2 and by the DFG through the SFB1258 and Excellence Cluster ORIGINS.

[1] C. Wiesinger et al., Eur. Phys. J. C (2018) 78: 597 [2] LEGEND-1000 pCDR, arXiv 2107.11462 [3] M. Neuberger et al., 2021 J. Phys.: Conf. Ser. 2156 012216

T 39.2 Tue 17:15 POT/0006

Plans for the Muon Veto of LEGEND-1000 — •Gina Grünauer for the LEGEND-Collaboration — Physikalisches Institut, Eberhard Karls Universität Tübingen

The **L**arge **E**nriched **G**ermanium **E**xperiment for **N**eutrinoless $\beta\beta$ **D**ecay (LEGEND) is a ton-scale experimental program searching for the neutrinoless $\beta\beta$ ($0\nu\beta\beta$) decay of ^{76}Ge. LEGEND-1000 will have a total active mass of the detector of about 1000 kg, with the goal of a discovery sensitivity at half-life of more than 10^{28} years. To reach such a sensitivity, the background rate must be reduced to less than 10^{-5} cts/(keV·kg·yr). A Cherenkov Muon Veto is currently being developed for this purpose. The new Veto will further optimize the detection efficiency and the noise. The number and positions of the photomultiplier tubes (PMTs) are adapted to the requirements of the LEGEND-1000 Muon Veto.

T 39.3 Tue 17:30 POT/0006

ASIC-based front-end electronics for LEGEND-1000 — •Florian Henkes, Michael Willers, and Susanne Mertens for the LEGEND-Collaboration — Physik-Department, E47, Technische Universität, München, Germany

The **L**arge **E**nriched **G**ermanium **E**xperiment for **N**eutrinoless $\beta\beta$ **D**ecay (LEGEND) is a ton-scale, ^{76}Ge-based, neutrinoless double-beta ($0\nu\beta\beta$) decay experimental program with discovery potential at half-lifes greater than 10^{28} years.

Low-background and low-noise signal readout electronics in close vicinity to the HPGe-detectors are crucial in order to achieve the experiment's sensitivity on $0\nu\beta\beta$-decay. The close proximity to the detectors poses unique challenges to balance electronic performance with radiopurity requirements. In LEGEND-1000, the use of **A**pplication-**S**pecific **I**ntegrated **C**ircuit (ASIC) technology would allow to implement the entire charge sensitive amplifier into a single low-mass chip with ultimate electronic noise performance and signal fidelity while ideally further reducing backgrounds.

In this contribution, the current status of the LEGEND-1000 ASIC based readout development will be presented. It will focus on the design challenges of the CSA implementation and present first results of simulations and measurements of the chip.

T 39.4 Tue 17:45 POT/0006

Double weak decays of ^{124}Xe and ^{136}Xe in XENON1T and XENONnT — •Christian Wittweg for the XENON-Collaboration — Physik-Institut, Universität Zürich

The current generation of xenon-based dark matter direct detection experiments has reached large enough target masses and low enough background levels to probe rare double weak decays. Among these decays are the two-neutrino double electron capture (2νECEC) of ^{124}Xe as well as the neutrinoless double beta decay ($0\nu\beta\beta$) of ^{136}Xe. Observation of the hypothetical neutrinoless decay would provide definite proof of the neutrino's Majorana nature and indicate lepton number violation. The measurement of the Standard Model 2νECEC – first detected by XENON1T in 2018 – provides nuclear structure information that is a crucial input for the nuclear models used to interpret $0\nu\beta\beta$ experiments. This contribution will present the ^{124}Xe 2νECEC results and search for $0\nu\beta\beta$ of ^{136}Xe in XENON1T. Moreover, the sensitivity projection for a ^{136}Xe $0\nu\beta\beta$ search in XENONnT will be outlined.

T 39.5 Tue 18:00 POT/0006

Fast track simulations in XENONnT — •Jaron Grigat for the XENON-Collaboration — Albert-Ludwigs-Universität, Freiburg, Deutschland

We present the work on a fast, effective simulator for the XENONnT dark matter experiment, which bypasses the sophisticated - but resource-intensive - full simulation of waveforms, while remaining as accurate as possible. This talk focuses on the aspect of predicting the multi-scatter resolution in this 'fast track' simulation framework using machine learning techniques.

T 39.6 Tue 18:15 POT/0006

Light signal correction for the XENONnT experiment — •Johanna Jakob for the XENON-Collaboration — Institut für Kernphysik, WWU Münster

XENONnT, the latest stage of the XENON dark matter project, is currently taking science data with the science goals to detect WIMP-nucleus scattering and to search for other rare events. The detector is a dual-phase time projection chamber (TPC) filled with 8.5 tonnes of liquid xenon. The detector side walls reflect the scintillation light caused by energy deposition in the detector, which is registered at the top and bottom by photomultiplier arrays. Free electrons, additionally created by the energy deposition, are drifted to the gaseous phase at the top of the detector where they create a secondary scintillation light pulse by electroluminescence. The combination of light and charge signal allows for a 3-dimensional position reconstruction of the recorded events and a differentiation between electron and nuclear recoil events. This talk focuses on the light signal reconstruction, which requires a correction of the position dependent light collection efficiency. Based on calibration data from internal radioactive sources, light collection efficiency maps are derived and applied to the light signals.

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