T 82: Neutrino Physics VII

Time: Thursday 16:15–18:15 Location: VG 3.104

T 82.1 Thu 16:15 VG 3.104

Cherenkov source for JUNO — •Manuel Böhles[1], Tim Charissé[1], Johann Martyn[1], Oliver Pilarczyk[1], Hans Theodor Josef Steiger[2], and Michael Wurm[1] — [1]Johannes Gutenberg University Mainz, Institute of Physics, Staudingerweg 7, 55128 Mainz, Germany — [2]Technical University of Munich, Physics Department, James-Franck-Str. 1, 85748 Garching, Germany

For the calibration of hybrid analyses of the JUNO experiment, a Cherenkov source has been developed to gain a better understanding of the light yield and propagation of Cherenkov light in JUNO. With this knowledge, the CID method (Correlated and Integrated Directionality) for the detection of solar neutrinos, which has already been successfully applied in Borexino, can be refined. The improved resolution of the ratio of Cherenkov to scintillation light can effectively suppress background events and help in the search for the Diffuse Supernova Background (DSNB).

The fundamental idea is based on the use of a beta source with a few MeV electron energy whose electrons pass through a Cherenkov radiator. In order to improve the triggering of the detector, a coincidence source is to be used (e.g. Bi-Po), the second decay of which triggers a scintillation signal in a plastic scintillator.

The development is funded by the DFG Research Unit "JUNO" (FOR5519).

T 82.2 Thu 16:30 VG 3.104

Source Calibration of the OSIRIS Radiopurity Monitor for JUNO — •Rosmarie Wirth[1], Daniel Bick[1], Caren Hagner[1], Mikhail Smirnov[1], Milo Charavet[1], and Tobias Sterr[2] — [1]Universitaet Hamburg, Hamburg, Deutschland — [2]Eberhard Karls Universität Tübingen, Physikalisches Institut

The Jiangmen Underground Neutrino Observatory (JUNO) features a 20-kiloton liquid scintillator (LS) detector currently under construction in Jiangmen, China. Its primary scientific goal is to determine the neutrino mass ordering with a confidence level of $3\,\sigma$ within the first six years of data taking. This will be achieved by observing the oscillation spectrum of reactor anti-neutrinos at a baseline of ~ 53 km. To effectively distinguish between normal and inverted ordering, the detector requires an energy resolution of 3 % at 1 MeV, high optical coverage, and low background levels, demanding high purity liquid scintillator.

To monitor scintillator quality during the filling of JUNO, the Online Scintillator Internal Radioactivity Investigation System (OSIRIS) has been developed. OSIRIS is a 18-ton cylindrical LS detector that assesses the radio-purity of the provided scintillator through Bismuth-Polonium coincidence signals. For calibration, an Automatic Calibration Unit (ACU) from the Daya Bay experiment is implemented, allowing to submerge different sources in the scintillator, providing calibration points for energy and vertex reconstruction, as well as for the timing and charge calibration of the photomultiplier tubes (PMTs).

This presentation covers the current status of the calibration of OSIRIS using the ACU.

T 82.3 Thu 16:45 VG 3.104

Status of the Laser Calibration of the JUNO pre-detector OSIRIS — •Tobas Sterr[1], Dhanushka Bandara[1], Lukas Bieger[1], Silvia Cengia[1], Jessica Eck[1], Adrian Keiderling[1], Florian Kirsch[1], Tobias Lachenmaier[1], Anurag Sharma[1], and Rosmarie Wirth[2] — [1]Eberhard Karls Universität Tübingen, Physikalisches Institut — [2]Universität Hamburg

The 20 kt liquid scintillator (LS) detector of the Jiangmen Underground Neutrino Observatory (JUNO) experiment, currently under construction in southern China. To achieve its physics goals, stringent radiopurity requirements for the LS must be fulfilled. In order to ensure these limits, the Online Scintillator Internal Radioactivity Investigation System (OSIRIS) was designed as a pre-detector for JUNO. During the months-long filling period of JUNO, OSIRIS will assess the radiopurity of purified LS batches to allow fast countermeasures in case of contaminations. In OSIRIS, an array of 76 Photomultiplier Tubes (PMTs) instruments a water-shielded 18-ton LS target. A pico-second pulsed laser system is used for PMT timing and charge calibration. This presentation will summarize the current status of the laser calibration system, the calibration strategy of this system and first results of the calibration in the commissioning phase of OSIRIS. Furthermore, OSIRIS PMT performance parameters using the laser calibration system are presented and compared to the results of the JUNO PMT testing campaign.

This work is supported by the Deutsche Forschungsgemeinschaft.

T 82.4 Thu 17:00 VG 3.104

Charge Sensitive Amplifier R&D for the LEGEND-1000 Experiment — •Andreas Gieb, Florian Henkes, Susanne Mertens, and Michael Willers for the LEGEND-Collaboration — Technische Universität München, Deutschland

The Large Enriched Germanium Experiment for Neutrinoless Double-Beta Decay (LEGEND) uses ^{76}Ge to search for neutrinoless double-beta ($0\nu\beta\beta$) decay. The LEGEND-200 phase, currently operating at Gran Sasso, serves as a precursor to LEGEND-1000, a 1000-kg experiment designed to achieve discovery sensitivity at half-lives exceeding 10^{28} years, targeting the inverted-ordering neutrino mass scale. Reaching this sensitivity requires ultra-low background levels and exceptional energy resolution in the region of interest.

To meet these requirements, readout electronics near the detectors play a critical role. An application-specific integrated circuit (ASIC)-based front-end system has been developed to achieve low background while maintaining low noise and high energy resolution. This work presents the results of the first ASIC iteration and outlines changes for the second iteration.

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T 82.5 Thu 17:15 VG 3.104

R&D efforts regarding the water tank instrumentation for LEGEND-1000 — •Lorenz Gessler — University Tübingen, Tübingen, Germany

In the pursuit of the stringent background target set by the next phase of the Large Enriched Germanium Experiment for Neutrinoless Double-Beta Decay (LEGEND), the integration and optimization of additional veto systems are essential. Among the most challenging backgrounds are those arising from muon-induced neutron showers, which can produce metastable isotopes such as ^{77m}Ge.

This talk will present ongoing R&D efforts dedicated to enhancing the LEGEND-1000 water tank instrumentation. We are investigating a range of neutron-tagging strategies, such as gadolinium-loaded plastics, alternative Gd-based compounds, and liquid scintillator solutions, using a dedicated 700 L water Cherenkov test detector in Tübingen. By comparing and refining these approaches, we aim to guide the ultimate design of the water-based veto system, thereby improving background suppression and advancing the experiment's sensitivity to the elusive $0\nu\beta\beta$ decay signal.

T 82.6 Thu 17:30 VG 3.104

Detection of Cherenkov and Scintillation light in hybrid scintillators — •Dorina C. Zundel[1], Michael Wurm[1], Manuel Böhles[1], and Hans Steiger[2] — [1]Johannes Gutenberg-Universität Mainz, Institute of Physics and Cluster of Excellence PRISMA+, Staudingerweg 7, 55128 Mainz — [2]Technische Universität München, James-Franck-Straße 1, 85748 Garching

Hybrid scintillator detectors aim at the simultaneous detection of Cherenkov and scintillation light. SCHLYP (**S**cintillation **CH**erenkov **L**ight **Y**ield **P**rism) is a newly developed laboratory setup, used to distinguish Scintillation and Cherenkov light in scintillator samples. The setup uses the geometrical advantages of a hollow prism filled with various scintillator samples as a detector, equipped with three ultra-fast photomultipliers, on each side. Photons from a close-by ^{137}Cs source create a signal by Compton scattering in the scintillator. Using a secondary inorganic scintillator detector, recoil photons are selected to be aligned with the prism geometry, so that two of the PMTs detect both Cherenkov and Scintillation light, while the third PMT is only able to detect scintillation light. The samples being investigated range from slow scintillators to water-based liquid scintillators. In this talk the improved setup and the analysis of the phase II data will be presented.

T 82.7 Thu 17:45 VG 3.104

Development of a High-Pressure Scintillator Test Cell for Double Beta Experiments — •Magdalena Eisenhuth for the NuDoubt-Collaboration — Johannes Gutenberg-Universität Mainz, Institut für Physik, 55128 Mainz, Germany

The investigation of two-neutrino and neutrino-less double beta decay is crucial for understanding the Dirac or Majorana nature of neutrinos.

In this context, the krypton isotope Kr-78 (Q=2.88 MeV) stands out as a promising candidate for a first detection of two-neutrino ECb+ and 2b+ decays.

Detectors like the proposed NuDoubt++ experiment featuring opaque scintillator or an upgrade of the OSIRIS detector with hybrid scintillator can profit from solving the krypton gas in the scintillator at high pressure to increase the loading factor.

This presentation explores the loading process in a small-scale scintillator test cell and the characterization techniques for determining the loading factor.

T 82.8 Thu 18:00 VG 3.104

Electron scattering in cryogenic scintillating calorimeters for rare event searches — •Elisa Gaido for the COSINUS-Collaboration — Max-Planck-Institut für Physik, Munich, Germany

Cryogenic scintillating calorimeters (CSCs) are an established technology for the direct detection of dark matter through nuclear scattering. Current CSC experiments like COSINUS are starting to explore the possibility of using CSCs for the direct detection of dark matter-electron and neutrino-electron scattering, e.g. in the OνDES project. The theoretical framework for these searches is still under development. This contribution explores the possibility of detecting neutrino-electron scattering with CSCs and constraining their properties beyond the standard model of particles. This research is part of the LUCE/OνDES project funded by the Klaus Tschira foundation.