T 29: Detectors III (Scintillators)

Time: Tuesday 16:15–17:30 Location: VG 1.102

T 29.1 Tue 16:15 VG 1.102

Status of cosmogenic studies in the JUNO pre-detector OSIRIS — •Marcel Büchner[1,2], Arshak Jafar[1,2], George Parker[1,2], Michael Wurm[1,2], Oliver Pilarczyk[1,2], Tim Charisse[1,2], and Manuel Böhles[1,2] — [1]Johannes Gutenberg-University, Mainz, Germany — [2]EC PRISMA+

OSIRIS as the pre-detector of the JUNO reactor neutrino measurement, is meant to monitor the radio-purity of the scintillator used. The monitoring of the scintillators radio-purity relies on an in situ measurement of radioactive decays in the 20-ton scintillator volume. Therefore, the scintillator volume is surrounded by 500 tons of water for external shielding and all detector materials have been carefully selected for radiopurity. To ensure that the background is as low as possible, OSIRIS is located approximately 700m under ground. Even at that depth, a relevant level of background events originates from cosmic muons, which not only cause a signal themselves but they can interact with the detector material and cause the creation of radioactive isotopes. This talk presents the ongoing work of the implementation of a muon tracking for OSIRIS. Utilizing the charge information of 64 PMTs inside OSIRIS, an estimate of the muon path will be calculated. This estimate will later be used as an input of a chi-squared-minimazation, to further improve the accuracy of the muon tracking. Based on the tracking of these muons and using spatial and tem poral correlations, cosmogenic neutrons and radioactive isotopes (e.g. C-11) can be identified. This Project is funded by the DFG Research Unit FOR 5519.

T 29.2 Tue 16:30 VG 1.102

Large Area MMC-based Photon detector - LAMP — •Christian Ritter, Christian Enss, Andreas Fleishmann, Daniel Hengstler, Ashish Jadhav, Cagla Mahanoglu, Ioana-Alexandra Nitu, Andreas Reifenberger, Daniel Unger, and Loredana Gastaldo — Kirchhoff Institute for Physics, Heidelberg University

Using scintillating crystals coupled to temperature sensors and a photon sensor to detect the scintillation light emitted upon a particle interaction plays a very important role in experiments for rare event searches. Comparing the amplitude of the signal from the temperature sensor and the one of the photon sensor allows for discriminating light particles from heavy particles. We present the development and first characterization of a large area (metallic magnetic calorimeters) MMC-based photon detector (LAMP). This detector features an MMC sensor with stripline geometry fabricated onto a silicon substrate that is used as a photon absorber. The LAMP detector has been conceived to be used as a photon detector in the AMoRE experiment for the search of neutrinoless double beta decay in Mo-100 using calcium molybdate scintillating crystals. We discuss the achieved performance in relation to the requirement of the AMoRE experiment and the suitability of the LAMP detector design to be part of a combined photon and phonon detector sharing the same Si substrate.

T 29.3 Tue 16:45 VG 1.102

Construction and operation of a scintillation detector with full waveform analysis for spatial resolution enhancement. — •Erik Ehlert, Dmitry Eliseev, Markus Merschmeyer, Thomas Hebbeker, and Alexander Schmidt — III. Physikalisches Institut A, RWTH Aachen University

Increasing the resolution in large area scintillation detectors usually demands a higher number of readout channels. In order to study ways of increasing spatial resolution for fewer readout channels, a setup of two detectors, a reference and large scintillaton tile, was developed. In addition, to demonstrate the plausibility of the concept, a Geant4 simulation of the entire detector setup was performed.

The reference detector consists of two layers of arrays of scintillator strips coupled to pairs of silicon photomultipliers (SiPMs). This detector is used to provide reference measurements for the single scintillator tile. The tile is read out by only four SiPMs. The signals from the reference and tile detector are digitized by an FPGA-based setup developed in-house. With the information about the exact hit position and the full SiPM-waveform data, an analysis for enhancing the spatial resolution was set up.

The talk provides an overview of the entire detector setup, simulation, analysis, and will showcase the achieved enhancement in spatial resolution.

T 29.4 Tue 17:00 VG 1.102

Osiris DAQ and Single Event Analysis — •Arshak Jafar, Michael Wurm, Oliver Pilarczyk, Tim Charisse, Marcel Buchner, and George Parker — JGU Mainz, Institute of Physics and EC PRISMA+

The Jiangmen Underground Neutrino Observatory (JUNO), under construction in southern China, will determine the neutrino mass hierarchy (MH) by observing neutrinos from nuclear reactors at a distance of 53 km. To reach the desired sensitivity ($> 3\sigma$) for MH, the radiopurity of the different detector components plays a crucial role. To ensure the purity of the 20 kt liquid scintillator (LS) target of JUNO, the Online Scintillator Internal Radioactivity Investigation System (OSIRIS) is being constructed. The 20-ton pre-detector will monitor the radiopurity of the LS during its production and the filling phase of the central detector of JUNO. This talk will focus on the design principles and working of the data acquisition system (DAQ) of the OSIRIS pre-detector as well as the single event analysis of the data to estimate the rate of radioactive contaminants in the liquid scintillator.

This work is supported by DFG, Research Unit FOR 5519.

T 29.5 Tue 17:15 VG 1.102

Quenching Studies to Increase JUNO's Sensitivity to Proton Decay — •Ulrike Fahrendholz, Lothar Oberauer, Matthias Raphael Stock, Selina Rudolph, and Hans Steiger — TUM School of Natural Sciences, Physics Department, James-Franck-Str. 1, 85748 Garching

The hypothetical proton decay $p \to K^+ + \bar{\nu}$ generates a distinctive threefold coincidence signal in the Jiangmen Underground Neutrino Observatory (JUNO). JUNO features 20 kton of liquid scintillator, which requires precise characterization of its scintillation response to achieve the high sensitivity necessary for proton decay searches.

This talk presents the results of quenching studies on protons at kinetic energies of the order of 100 MeV. Additionally, measurements of ^{12}C will be discussed, offering insights also relevant for the interpretation of supernova neutrino events.

From the proton quenching, the light emission behavior of kaons is extrapolated. These results can be used to increase the event selection efficiency for $p \to K^+\bar{\nu}$ in JUNO.

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