T 98: Search for Dark Matter 4

Time: Thursday 16:00–17:30 Location: Geb. 30.35: HSI

T 98.1 Thu 16:00 Geb. 30.35: HSI

Design and Commissioning of the MainzTPC2 — •Constantin Szyszka, Uwe Oberlack, Alexander Deisting, Christopher Hils, and Jan Lommler — Institut für Physik & Exzellenzcluster PRISMA+, Johannes Gutenberg-Universität Mainz

The MainzTPC is an experimental dual-phase xenon time projection chamber (TPC) dedicated to the study of scintillation and ionization processes of liquid xenon for low-energy electronic and nuclear recoils. It features a signal readout with two PMTs and eight APDs, enabling 3D position reconstruction. The TPC also allows to study the influence of the drift field's strength on the scintillation process. Its design has been optimized for the use as primary target in Compton scattering experiments to measure recoil energies in liquid xenon down to 1 keV.

The MainzTPC is being redesigned to accommodate a SiPM array instead of the top PMT and APDs to improve position resolution in x and y. To address known instabilities in the liquid level of the MainzTPC, we observed the liquid-gas interface using commercially available cameras and aim to improve the level meters and level control based on these observations. We report on the status of this work.

T 98.2 Thu 16:15 Geb. 30.35: HSI

A new test stand for detector tests at Bonn University — •Gerrit Schmieden, Johanna von Oy, Tobias Schiffer, Klaus Desch, and Jochen Kaminski — Universität Bonn, Bonn

The search for the axion particle using helioscopes, like IAXO, requires detectors sensitive to low-energy X-rays ($\sim$1 keV). Due to the low probability of axion-to-X-ray conversion via the inverse Primakoff effect only very few events are expected. This results in the need for ultra-low background detectors. A GridPix detector, constructed from radio-pure materials, is a suitable candidate.

In order to estimate the background behaviour of the detector a dedicated test stand, is essential. This setup consists of two subsystems: a passive lead shielding to block external radiation and an active muon veto based on scintillators. The muon veto is consisting of 14 scintillators and will cover a 4π solid angle. In order to loose as few events as possible fast timing information, synchronised with the detector, is needed. Therefore a new readout system is developed using a Teensy 4.1 microcontroller.

The talk will offer insights into the construction of the test stand, with a special focus on the scintillator readout.

T 98.3 Thu 16:30 Geb. 30.35: HSI

Results of the pure-water phase of the XENONnT neutron veto: The world's first water Cherenkov neutron veto — •Daniel Wenz for the XENON-Collaboration — Institut for Nuclear Physics University of Muenster

Liquid xenon time projection chambers (TPCs) play a key role in the direct search for dark matter such as Weakly Interacting Massive Particles (WIMPs). Neutrons emitted by traces of radioactive isotopes in the detector materials pose a great risk for the search of WIMPs as they can undergo single-scatter nuclear recoils and escape the TPC mimicking WIMP signals. To mitigate this background XENONnT was augmented with a new neutron veto (NV), designed as a Gadolinium water Cherenkov detector, which tags neutrons through their capture on gadolinium and hydrogen. In the first phase of XENONnT the neutron veto was operated using pure water only.

In this talk we will present results of the performance of the NV in this first phase, its calibration using coincident gammas and neutrons from an Americium-Beryllium source, and its impact on the first science search data of XENONnT.

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T 98.4 Thu 16:45 Geb. 30.35: HSI

Muon Shielding Simulations for an Above Ground Cryostat — •Maximilian Hughes for the COSINUS-Collaboration — Max Plank Institute for Physics, Munich, Germany

Cryogenic detectors are highly susceptible to pile-up due to their long signals. Reducing signals from backgrounds, such as muons, can be done by running detectors in underground labs, but space in underground cryostats is limited and in high demand. Detector performance in above ground cryostats can be improved with radiation shielding. Different configurations of shielding for the COSINUS group's above ground cryostat at the Max Plank Institute for Physics (MPP) has been investigated with GEANT4 simulations. The addition of a muon veto made out of plastic scintillator has also been simulated. Using the results of the simulation, the optimal shielding configuration will be designed and built.

T 98.5 Thu 17:00 Geb. 30.35: HSI

Water Cherenkov muon veto for the COSINUS experiment — •Kumrie Shera for the COSINUS-Collaboration — Max-Planck Institue for Physics, Munich, Germany

The Cryogenic Observatory for Signals seen in Next Underground Searches (COSINUS) is a direct dark matter search utilizing sodium iodide (NaI) as a cryogenic calorimeter. The cryogenic facility is located in the hall B at the Laboratori Nazionali del Gran Sasso (LNGS) in Italy. The NaI cryogenic detectors will be housed in a dry dilution refrigerator positioned at the center of a water tank with dimensions of 7 meters in diameter and height. The water serves as passive shielding against ambient radiation. High-energy muons can reach the detector surroundings, generating muon-induced neutrons that can cause nuclear recoils and potentially mimic a dark matter signal. To actively identify and veto against these events, the water tank will be equipped with 28 photo-multiplier tubes (PMTs), enabling the operation of the tank as a Cherenkov detector. This contribution introduces the water Cherenkov muon veto for the COSINUS experiment.

T 98.6 Thu 17:15 Geb. 30.35: HSI

Large scale liquid xenon test platform PANCAKE for future dark matter detectors — •Julia Müller — University of Freiburg

The PANCAKE facility is a large-scale cryogenic platform with a diameter of 2.8m allowing to test detector components such as electrodes for future liquid xenon detectors e.g. DARWIN. As over the past decades these detectors continuously grew in size and sensitivity their technical realization becomes more and more challenging, with the electrodes among the most crucial components. These can be tested in PANCAKE in cryogenic conditions and on full scale. The PANCAKE facility was operated successfully with an entire of 300kg of xenon and preparations for an electrodes testing campaign are currently taken.