T 121: Search for Dark Matter 6

Time: Friday 9:00–10:30 Location: Geb. 30.35: HSI

T 121.1 Fri 9:00 Geb. 30.35: HSI

Position Dependent Corrections for the Electroluminescence Signal of the XENONnT Time Projection Chamber — •Peter Gyorgy — JGU Mainz

The XENONnT experiment is a dual-phase liquid xenon time projection chamber (TPC) for the direct search of Dark Matter. The electroluminescence signal (S2) is created when electrons emitted from energy deposits are extracted from the liquid into the gas phase of the TPC. Various physical effects result in a position-dependent S2 distribution, which must be corrected using calibrations. Krypton 83m provides a uniform distribution of S2 signals, which allow for the creation of a 2D correction map. This presentation discusses the S2 correction map for Science Run 1 (SR1) of XENONnT, and compares them to those of Science Run 0.

T 121.2 Fri 9:15 Geb. 30.35: HSI

Nuclear recoil response calibration for the XENONnT experiment — •Johanna Jakob for the XENON-Collaboration — Institut für Kernphysik, Universität Münster, Germany

XENONnT is currently taking science data with the science goals to detect weakly interacting massive particles (WIMPs) and other rare event signals. The detector is a dual-phase time projection chamber filled with 8.5 tons of liquid xenon surrounded by an active water Cherenkov neutron and muon veto. Just like WIMPs, neutrons scatter off xenon nuclei elastically, producing a nuclear recoil (NR), and tend to leave the TPC cryostat after a single backscatter. As these signals are indistinguishable from WIMPs, they provide an excellent calibration source. This talk discusses a background-free NR response calibration of the XENONnT TPC, using neutrons from an americium beryllium source which are tagged by coincidentally emitted γs detected in the neutron veto. This work is supported by BMBF under contract 05A23PM1 und by DFG within the Research Training Group GRK-2149.

T 121.3 Fri 9:30 Geb. 30.35: HSI

Power Calibration of a Dielectric Haloscope — •Bernardo Ary dos Santos for the MADMAX-Collaboration — RWTH, Aachen, Germany

The MADMAX collaboration intends to build a dielectric haloscope targeted to detect galactic axion dark matter, in the mass range from 40 to 400 μeV . This experiment consists of a series of dielectric discs and a mirror placed inside a strong homogeneous magnetic field that would produce the emission of coherent electromagnetic radiation with a frequency related to the mass of the axion. A prototype has recently been tested at CERN inside a 1.6T dipole magnet. In this talk I will explain the Power calibration procedure used during the data taking that allows us to estimate the sensitivity of the experiment.

T 121.4 Fri 9:45 Geb. 30.35: HSI

Vibration decoupling in the COSINUS dry dilution refrigerator — •Moritz Kellermann for the COSINUS-Collaboration — Max-Planck-Institut für Physik, 85748 Garching

Cryogenic detectors are a valuable class of detectors for rare event searches. Currently, energy resolutions and thresholds on the order of O(eV) are reached using Transition Edge Sensors (TES). However, besides detector effects, one of the dominating backgrounds limiting the sensitivity and operation stability of cryogenic detectors are microphonics which originate from vibrations produced by the refrigerator itself.

The COSINUS experiment will use a custom-made dry dilution refrigerator with a pulse tube cooler (PT) to cool down particle detectors with TES for dark matter research. To mitigate vibrations, a spring-based passive decoupling system inside of the refrigerator is currently under development in a test facility at the Max-Planck Institute for Physics (MPP) in Munich. This contribution shows the current status of the vibration system and presents first measurements of the vibration level at the lowest temperature stages.

T 121.5 Fri 10:00 Geb. 30.35: HSI

Antenna alignment of the MADMAX booster system using Machine Learning techniques — •Nabil Salama for the MADMAX-Collaboration — Institut für Experimentalphysik, Universität Hamburg, Luruper Chaussee149, 22761 Hamburg

The axion is a promising hypothetical dark matter candidate that would also solve the strong CP problem. The MADMAX experiment aims at detecting the axion in a large mass range corresponding to a frequency between 10 and 100 GHz using an array of dielectric disks in a high magnetic field of 9 T which are individually moveable to tune the resonance frequency. I present a method to spatially align the antenna that picks up a potential axion signal as well as the disks in order to compensate for a possible antenna misalignment. This is necessary to maximize the signal power of the system. The possibility of electric field measurements using the so-called bead-pull method for an objective function is investigated. The alignment procedure of antenna and disks involves many degrees of freedom which makes the problem complex, therefore it is approached using Machine Learning techniques. Results yielded by the algorithm are compared to a non-learning algorithm and theoretical expectations from Gaussian beam optics.

T 121.6 Fri 10:15 Geb. 30.35: HSI

Coating based radon barriers for future liquid xenon detectors — •Florian Jörg, Giovanni Volta, and Hardy Simgen — Max-Planck-Institut für Kernphysik Heidelberg, Germany

Dual-phase liquid xenon time projection chambers have become a leading technology in the search for dark matter. These detectors must be operated under extremely low radioactive background conditions. Especially, the radioactive noble gas ^{222}Rn, that is constantly released from material surfaces, must be suppressed to the level of only a few atoms.

We have been investigating techniques to suppress its release by sealing surfaces with thin coating layers. A thousandfold reduction of the radon release has been demonstrated on a 2×2 cm^2-small stainless steel sample, that has been implanted with ^{226}Ra at the ISOLDE facility at CERN. Following on the successful small-scale tests, the setup underwent an upgrade which allows coating of larger vessel-like samples. Besides the radon tightness of the coating layers, also their intrinsic radiopurity is now being assessed and first results will be shown.