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A Calibration System for the nEXO Muon Veto

Sunday, 18 February 2024 09:00 (15 minutes)

In the pursuit of unraveling one of the fundamental questions in physics—why the Universe is matter-dominated—one possible approach is to scrutinize the nature of neutrinos through the investigation of neutrinoless double beta ($0\nu\beta\beta$) decay. The detection of $0\nu\beta\beta$ decay would signify lepton number violation in weak processes and confirm the Majorana nature of neutrinos. This signature would demonstrate physics beyond the Standard Model and potentially shed light on the observed matter-antimatter asymmetry in the universe.

The nEXO experiment is a proposed tonne-scale experiment searching for $0\nu\beta\beta$ decay in the isotope ^{136}Xe. nEXO's projected half-life sensitivity exceeds 10^{28} years at the 90\% confidence level. The cryostat and Xe-filled time projection chamber (TPC) of the experiment are housed in a water tank. With a diameter of 12.3 m and a height of 12.8 m, the tank contains 1.5 kilotonnes of ultra-pure deionized water, providing shielding for the cryostat and the Xe-filled TPC against external radiation. In addition, the water tank will be instrumented with 125 8" photomultiplier tubes (PMTs) to detect Cherenkov radiation of passing muons, enabling vetoing of muon induced backgrounds in the TPC.

In this talk, I describe a calibration system that is under development for nEXO's OD to calibrate the timing properties of the PMT's readout system and to monitor the optical properties of the water. The presentation introduces the OD calibration design, leveraging results from GPU-accelerated ray-tracing software (Chroma), and outlines the hardware requirements.

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