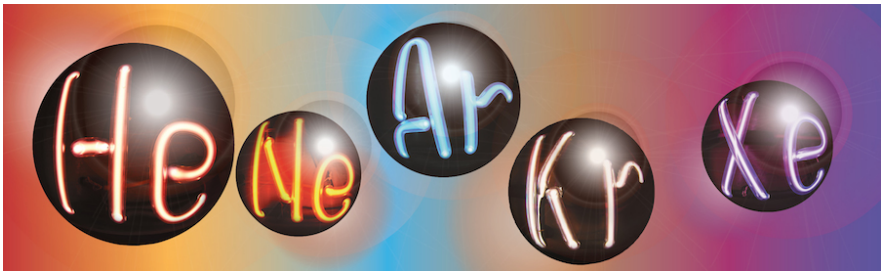

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DUNE Photon Detection System

Tuesday 27 August 2024 15:00 (20 minutes)

The Deep Underground Neutrino Experiment (DUNE) has a broad physics program primarily aiming to probe CP violation in the neutrino sector and to identify the neutrino mass hierarchy. In addition, the search for proton decay, the observation of supernova neutrino bursts, and the investigation of solar neutrinos are also goals of the DUNE, which can be enhanced by the Photon Detection System (PDS).

Using Liquid Argon Time Projection Chamber (LArTPC) detector technology, the experiment plans to observe neutrino interactions inside the detectors located 1300 km away from Fermilab's Long-Baseline Neutrino Facility, where the neutrinos are produced. The experiment consists of two parts: the far and near detectors. The far site will be made of four modules. The first module is a vertical drift single-phase LArTPC, and the second module is a horizontal drift single-phase LArTPC. The configurations of the other modules are still being discussed.

To detect the passage of neutrinos, the LArTPC identifies the charge and light created by the interaction of neutrinos with liquid argon, which are detected by the wire planes on the instrumented anode and the PDS, respectively. This presentation will discuss the current status of the photon detection system of the first two modules, which use a modification of the so-called X-ARAPUCA.

This system consists of dichroic filters and wavelength shifters, creating a trap to detect the scintillation photons of 127 nm in liquid argon. The X-ARAPUCA of the first module is called SUPERCELL, and it consists of a geometry of 488x100 mm^2, whereas the MEGACELL is the second module version, with an active area of 60x60 cm^2. This latter configuration also represents a significant technological advancement. Since half of the modules are placed on the cathode at high voltage, they are powered and read out using innovative power-over-fiber and signal-over-fiber techniques. Meanwhile, the other half will be put in a membrane behind the field cage, with a total transparency of around 70%.

Thanks to an intense R&D campaign conducted in several labs and in ProtoDUNE runs at CERN, the PDS system has been optimized and validated.

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