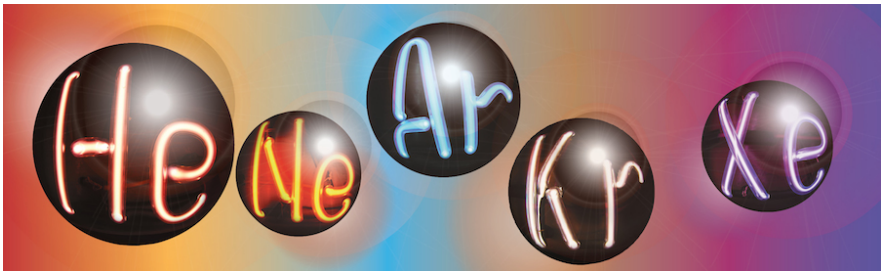

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PoWER: an innovative Photon Detection System for DUNE Phase II

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The Deep Underground Neutrino Experiment (DUNE) is designed to tackle major open questions in neutrino physics, such as CP violation and neutrino mass ordering, by using large-scale liquid argon time projection chambers (LArTPCs). The Phase II of the project, the Far Detector modules will feature vertical-drift, single-phase LArTPCs with an active volume of 13 m × 13 m × 60 m and dual anode planes.

Within this framework, we present PoWER (Polymer Wavelength-shifter and Enhanced Reflection), an innovative photon detection system developed to optimize light collection and improve sensitivity to low-energy events. PoWER employs full field cage coverage with polymer-based wavelength-shifting foils (PEN), paired with enhanced specular reflector (ESR) panels and arrays of Light Detection Units (LDUs) mounted along the cryostat membrane. A key innovation is the integration of both standard and vacuum-ultraviolet (VUV) sensitive silicon photomultipliers (SiPMs) within the LDUs. This configuration increases the photon detection efficiency, provides active veto capabilities by utilizing the surrounding liquid argon buffer volume. As a result, the system can identify and suppress external backgrounds in real time thereby enhancing the experiment sensitivity to detect rare low-energy signals. With an effective photodetector coverage of about 4%, PoWER offers a comprehensive solution for light detection and veto strategy.

This contribution presents the most recent Monte Carlo simulation results, covering photon light map generation and veto performances, and provides an update on ongoing efforts to prototype small-scale demonstrators of this innovative photon detection system concept.

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