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Study of Xenon-Doped Liquid Argon Scintillation Light Properties in ProtoDUNE Vertical Drift Using Cosmic Ray Tagger Data

Doping liquid argon (LAr) with a few parts per million (ppm) mass of xenon (Xe) is a known technique to modify the scintillation light properties. The energy deposited by charged particles crossing the detector is transferred from argon excimers to xenon excimers, through the process $\text{Ar}_2 \rightarrow \text{ArXe} \rightarrow \text{Xe}_2^*$, which emits photons with a longer wavelength. These effects are expected to affect the light yield, the light transport, and timing performance in large-scale detectors such as the Deep Underground Neutrino Experiment (DUNE). In this work, we use ProtoDUNE Vertical Drift (VD) cosmic-ray-tagger (CRT) data to study the properties and spatial dependence of photon detector responses in Xe-doped liquid argon, and to investigate their impact on photon detection performance.

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