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Beam Event Light Yield Measurement with the Photon Detection System in the ProtoDUNE-VD Detector at CERN

ProtoDUNE-VD is the first large-scale prototype for the Vertical Drift configuration of the Deep Underground Neutrino Experiment (DUNE) far detector, installed at CERN's Neutrino Platform. During the summer of 2025, both calibration and test beam data were collected. The H2 Very Low Energy (H2-VLE) beamline at the CERN Neutrino Platform can deliver particles (electrons, protons, pions, muons, and kaons) with momenta ranging from sub-GeV/c to a few GeV/c. A series of beamline instruments provides particle identification via Cherenkov response and time-of-flight measurements.

Precise particle identification and background rejection are crucial for a light yield measurement with the PDS system. In this work, we focus primarily on beam electrons delivered by the H2-VLE beamline in the momentum range of 1.0-8.0 GeV/c. By applying a spectral method to isolate beam electrons, we are able to discriminate them from background contamination and improve event selection in cases where beam instrumentation is insufficient. Finally, by applying geometrical corrections to the photon count from selected beam electrons, we provide a preliminary light yield measurement using beam electrons.

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