

R&D of Power Over Fiber in harsh environments and its novel application for the DUNE FD-VD Photon Detection System

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The Deep Underground Neutrino Experiment (DUNE) is a next generation long-baseline neutrino experiment that will send an intense beam of neutrinos through two detector complexes: a near detector complex located at Fermilab (Chicago), and a far detector complex located ~1.5 km underground at Sanford Underground Research Facility (SURF) in South Dakota.

The DUNE far detector (FD) will consist of four liquid argon time projection chambers (LArTPCs), each holding about 17 kt of liquid argon. One of these modules will employ Horizontal Drift (FD-HD) technology, while another will use Vertical Drift (FD-VD) technology. The FD-VD module will vertically drift the ionized electrons from the cathode plane suspended at the mid-height of the active volume of the cryostat. To increase the photon detector coverage in FD-VD, photon detectors (X-ARAPUCAs) will be installed along the cathode plane. Due to the high voltage (~300 kV) present at the cathode, conventional copper cables cannot be used to power the photon detectors. Therefore, Power-over-Fiber (PoF) technology will be deployed to power the photon detection system based on optical power transmission over optical fibers. This talk presents the R&D on different PoF components under harsh environments and its first-ever application in high energy physics detectors.

Working Group

WG 6: Detectors

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