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Advancements in Power-over-Fiber technology for the DUNE Far Detector 3

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The Deep Underground Neutrino Experiment (DUNE) is a next generation long-baseline neutrino experiment that will study neutrino oscillations using a high-intensity neutrino beam produced by the Long-Baseline Neutrino Facility at Fermilab. The beam will pass through two detector complexes: a near detector complex at Fermilab and a far detector complex located ˜1.5 km underground at the Sanford Underground Research Facility in South Dakota.
The DUNE far detector photon detection system (PDS) requires a reliable power supply system capable of operating under cryogenic temperatures and in high-voltage environments. To address these challenges, the power-over-fiber (PoF) technology has emerged as a reliable solution.
PoF is a power-supply technology that generates electrical power by transmitting light from a laser diode through an optical fiber to a photovoltaic power converter. PoF was successfully deployed and operated at CERN for the PDS of the DUNE FD prototype of the vertical drift liquid argon TPC, representing the first successful application in a high-energy physics experiment.
Ongoing efforts aim to further develop this technology to enable power supply delivery to the innovative large-area photon detectors integrated into the TPC field cage, with the goal of increasing the photon detection coverage and improving the energy thresholds, time resolution, and energy resolution of the DUNE Far Detector 3 (FD3). This talk will present the recent advances in PoF and its integration in the proposed PDS for DUNE Phase II FD3.

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