

# Power over Fiber technology for Photon Detector in LArTPC

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## Subject

Using **power over fiber technology** (POF) to power SiPM and other electronics positioned on high voltage surfaces immersed in a liquid Argon volume and develop POF for transmitters of SiPM signal off the high voltage surface to the outside of the detector

The current PhotoDetector System (PDS) implemented in the DUNE-SinglePhase FarDetector design is made by an array of optical modules inserted in the APA frames (Anode plane of the TPC - at ground) and looking for scintillation light signals in the drift volume in front. A major limitation of this solution is the very large non-uniformity of the response as a function of cathode-anode distance.

To make the response uniform across the detector the ideal solution would be to promote the cathode plane into a photo-sensitive cathode plane, so to read the light signal from both the opposite sides (anode AND cathode) of the TPC volume, thus enhancing the light yield and the pointing capability/position resolution of the PDS and restoring an acceptable level of uniformity of the response.

Instrumenting with photo-sensors a surface at very large HV is the challenge that requires dedicated R&D. Arrays of VUV sensitive SiPMs passively ganged in parallel to form single channels provide an easy solution for large photo-sensitive area, the challenge is to supply bias voltage (in the range of 50 V or less) and to read-out the signal out of the cathode plane at (nominal) 180 kV. **Power over fiber technology** (POF) to power SiPMs and transmit signal off the cathode surface of the TPC immersed in a liquid Argon volume to the outside of the detector represents an ideal solution. The implementation requires development that includes a first phase of POF testing at cryo-temperature in liquid Argon, SiPM connection to POF system and POF for transmitters, and a second phase with POF and SiPM on HV surface (in LAr).

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