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Power over fiber for fundamental and applied physics at cryogenic temperature: final results of the Cryo-PoF project

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The power over fiber (PoF) technology can power sensors and electrical devices delivering electrical power by sending laser light through an optical fiber to a photovoltaic power converter. The advantages offered by this technology are robustness in a hostile environment, removal of noise induced by power lines, spark free operation when electric and magnetic fields are present and no interference with electromagnetic fields.
R&D for the application of PoF for the DUNE Vertical Drift detector was motivated by the need to operate the Photon Detector System on the high-voltage cathode surface immersed in liquid argon (87 K). In this framework, the Cryo-PoF project developed a cryogenic power over fiber line, based on optoelectronic devices and a single laser input line, to power both the photon detectors (SiPMs) and their electronic amplifier, and control the SiPMs bias.
The Cryo-PoF setup employs a commercial GaAs laser source with 2 W maximum power and a photovoltaic power converter with efficiency of ~ 30% at liquid nitrogen temperature (77 K). Tests for the use of the set up at lower temperature (till 7 K) was also performed.
The results of the project will be presented with emphasis on performance at LAr temperature and potential application in extreme cryogenic physics.

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