

ProtoDUNE-HD Photon Detection System: IV curve and Vbd determination

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The ProtoDUNE-HD detector is a horizontal drift (HD) liquid argon time projection chamber (LArTPC) that was constructed and operated in the CERN North Area during summer 2024. It is a prototype for the first far detector (FD) module of the Deep Underground Neutrino Experiment (DUNE), a next-generation long-baseline experiment for neutrino physics under construction in US. The successful operation of ProtoDUNE-HD should demonstrate the effectiveness of the horizontal drift far detector design.

In particular, the FD Photon Detection System (PDS) is critical for the DUNE physics program. The topology of a neutrino interaction is reconstructed by looking at the tracks of secondary charged particles, which produce scintillation light and free charge carriers by ionization during their propagation in LAr. The reference time of the event is given by the scintillation light, collected by the PDS equipped with Silicon PhotoMultipliers (SiPMs).

For this reason, it is important to monitor and check the performance of the PDS during ProtoDUNE-HD operation. One of the most important parameters to check is the SiPM breakdown voltage (Vbd), which can be measured by acquiring IV curves thanks to DAPHNE boards. Thanks to this work, an optimization of the required performances of the FD can be performed, in order to achieve DUNE scientific goals.

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