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Cryogenic Charge Readout Electronics for the ProtoDUNE-II Program and DUNE

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The Deep Underground Neutrino Experiment (DUNE) far detectors require readout of several hundred thousand charge-sensing channels immersed in the largest liquid argon time projection chambers ever built, calling for cryogenic front-end electronics in order to be able to adequately instrument the full detector. These electronics must satisfy power constraints of < 50 mW per channel to minimize the thermal load on the cryogenic system, be designed with lifetimes of 20+ years to remain functional throughout the expected lifetime of DUNE, and be able to reliably communicate with warm interface electronics on the other side of cold cables that are up to 30 meters long. The upcoming ProtoDUNE-II program at the CERN neutrino platform will consist of 2 liquid argon time projection chambers, which will serve as demonstrators of the technologies that will be used in the first 2 DUNE far detectors, including the final design of the cryogenic charge readout electronics. This design consists of a chain of 3 different ASICs designed for operation in liquid argon: LArASIC for analog charge amplification, ColdADC for digitization into 14-bit signals, and COLDATA for multiplexing, serialization, and digital control. This talk will discuss the design of these electronics, preliminary performance results from the ProtoDUNE-II assembly experience, and plans for the ProtoDUNE-II runs.

Submitted on behalf of a Collaboration?

Yes

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