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Cold readout electronics for liquid argon TPCs in the DUNE far detector

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The DUNE far detector phase I consists of two 10-kt fiducial mass Liquid Argon Time Projection Chambers (LArTPCs), FD-HD (Horizontal Design) and FD-VD (Vertical Design), providing 20-kt of active volume for high-precision neutrino detection and rare event searches. There are 384,000 electrodes over 150 detector units called Anode Plane Arrays (APAs) in FD-HD, and 245,760 electrodes over 80 detector units called Charge Readout Planes (CRPs) in FD-VD, total over 600,000 channels to be read out by cold electronics submerged in liquid argon. Cold readout electronics offer significant advantages: much lower noise through integrated front-end electronics and CMOS technology in liquid argon, and substantially fewer cryostat penetrations by enabling signal processing inside the cryostat, reducing cables and feed-through connections. During the verification phase, ProtoDUNE located in CERN neutrino platform has demonstrated excellent physics performance due to high yield, low noise, and good stability of cold electronics, validating cold electronics as the optimal technology for DUNE LArTPC. This talk will cover the readout solution for the DUNE single phase TPCs and the quality control (QC) strategies towards batch production and detector instrumentation.

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