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Cold Electronics R&D

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Operating the wire readout electronics for Liquid Nobel TPCs at cryogenic temperatures has a number of advantages. As demonstrated by the BNL group, the front-end amplifier noise is reduced both by the elimination of extra capacitance due to cables and by the improved transistor noise performance at low temperature. Digitizing and digital multiplexing in the cold is also advantageous in that it reduces the number of cryostat penetrations needed and leads to an overall simpler system. Nonetheless, cryogenic electronics presents a number of challenges including achieving the lifetime and reliability needed for long-term experiments and in some applications, the strict radiopurity requirements. Several groups are pursuing the development a full cryogenic readout chain. Among these, the SLAC ASIC group has recently submitted for the fabrication the mixed-signal "CRYO" ASIC, which combines the three functions of amplification, digitization and multiplexing onto a single ASIC. In this talk, I will describe the status of the global cold electronics R&D effort, including the design, planned testing and application of the CRYO ASIC in the Deep Underground Neutrino Experiment (DUNE) and the next phase of the Enriched Xenon Observatory (nEXO).

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