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DUNE FD3 APEX Physics Prospects and Prototyping Status

Friday, 20 September 2024 14:05 (20 minutes)

In this talk, I present a light detection system called APEX (Aluminum Profiles with Embedded X-arapucas) targeted for next generation long-baseline neutrino experiment DUNE phase II FD3 where large-area light trap photodetectors will be instrumented on the entire field cage of a 17-kt LArTPC module. The photodetectors will cover four vertical walls of a DUNE vertical drift (VD) like LArTPC volume excluding the two anode planes, with a covered area up to 2500 m^2. The PoF (power over fiber) and SoF (signal over fiber) technologies developed and successfully demonstrated in DUNE VD make such a design possible and attractive. I will present the mechanical and electronic readout challenges during the scaling up of the photodetector coverage as well as integrating with the field cage structure. Its prototyping status at the CERN 2-ton cryostat and future plans will be introduced. The FD3 module is essential to DUNE which requires 40 kt of LAr fiducial mass to achieve its main physics goal specified in the 2014 P5 report and reaffirmed in the 2023 P5 report. To complete the fiducial mass, the DUNE phase II program requires two more far detector modules. The baseline design of FD3 is a copy of the DUNE VD module. The proposed APEX solution for FD3 further increases detector optical coverage area up to 60% and enables DUNE with improved event reconstruction, energy resolution, background rejection, and expansion of its physics reach to the tens-of-MeV energy region. The solution can also be combined with most of the proposed Phase II VD LArTPC charge readout technologies. Preliminary light simulation performance, improved reconstruction and physics sensitivity will be presented.

Working Group

WG 6: Detectors

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