

Design of the Single Phase Liquid Argon TPC for ProtoDUNE

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Content

The Deep Underground Neutrino Experiment (DUNE) will use a large liquid argon (LAR) detector to measure the CP violating phase, determine the neutrino mass hierarchy and perform precision tests of the three-flavor paradigm in long-baseline neutrino oscillations. It will also allow sensitive searches for proton decay and the detection and measurement of electron neutrinos from core collapse supernovae. In the DUNE far detector, four modules with fiducial mass of 10kton each are planned. Since each module represents a large leap from the current LArTPCs of 102 ton mass, DUNE is constructing kiloton scale engineering prototypes at CERN to validate the design, fabrication, installation and operation of the full scale detector components. In addition to the engineering studies, charged particle beam tests will also be conducted in these prototypes to provide precision measurements of the detector response to different particle species and energies. ProtoDUNE-SP is the prototype of the single phase liquid argon TPC. It has an active volume of approximately $7.2 \times 7 \times 6 \text{ m}^3$, constructed with components intended for the larger far detector.

Due to the large scale, and underground siting of the far detector, great emphasis was placed on the detector cost, reliability and ease of installation. A modular TPC design is the key to achieve these goals. The DUNE-SP TPC is constructed from hundreds of pre-fabricated and tested TPC modules with unique features:

- ▣ The anode plane assemblies (APAs) can be tiled on 3 sides with virtually no dead space;
- ▣ The cathode plane assemblies (CPAs) use all resistive material to improve high voltage safety;
- ▣ The field cage modules are designed to both mechanically and electrically modular.

Details of the design, fabrication and testing will be presented.

Summary

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