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## **WA105 experiment at CERN: large demonstrator of Dual Phase Liquid Argon TPC detector for DUNE**

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### **Content**

Deep Underground Neutrino Experiment (DUNE) has chosen liquid argon (LAr) technology for the detection of neutrinos produced with proton beams at Fermilab and transmitted 1300 km through the Earth towards the Sanford Underground Research Facility (SURF) in South Dakota. Two basic configurations for LAr TPC are considered: a single phase and a dual phase. The former has already worked as a 300 ton unit (ICARUS) but more R&D is needed to reach the desired module size of 10 kton. The later has many benefits in terms of signal to noise ratio, imaging capabilities, scalability, and cost reduction but has not yet been proven on a large scale. The task of WA105 is to build ProtoDUNE DP – a large dual phase (DP) demonstrator – and to test it with charged particle beams (0.5-20 GeV/c) at CERN in 2018. The data will provide the necessary calibration of the detector and benchmark reconstruction algorithms. This project is a crucial milestone for DUNE. If successful, DP is likely to become the second 10 kton module to be installed at SURF.

The key advantage of DP TPC is the benefit of charge amplification in the gas phase using Large Electron Multipliers (LEM). Electrons produced by energetic charged particles in the active volume of liquid argon drift along the z-axis towards the top anode and enter the gas layer. Here, a readout plane with LEM tiles provides amplification and charge collection yielding equal charge sharing in the x and y direction. PMTs located on the bottom of the tank provide trigger for non-beam events by registering the scintillation light generated by charged particles in liquid argon.

The active volume of ProtoDUNE DP will be 6 x 6 x 6 m<sup>3</sup> (~300 t of LAr). Both the size and the construction details were chosen to test scalable solutions for the crucial aspects of this detector: ultra-high argon purity in a non-evacuatable tank, long drifts, very high drift voltages, large area Charge Readout Plane, cold preamplifiers, etc. The TPC will be installed inside of a tank based on industrial LNG technology.

### **Summary**

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