

A LArTPC with Vertical Drift for the DUNE Far Detector

Thursday 9 September 2021 13:50 (18 minutes)

This talk presents the conceptual design of an alternative Liquid Argon Time Projection Chamber (LArTPC) for the Deep Underground Neutrino Experiment (DUNE).

The DUNE experiment will be a large LAr detector located at a baseline of 1300 kilometers, 1.5 km deep underground. It is planned to be made up of four modules, each with a total mass of 17 kt of LAr, at least the first two of which will consist in LArTPCs. Although this technology was proposed 40 years ago and has been implemented before, it was never done at such a large scale. To prove the feasibility of the LArTPC technology at the kiloton scale, the ProtoDUNE SP and DP detectors were constructed and operated at the CERN Neutrino facility.

The Vertical Drift concept proposes to instrument a DUNE module with a TPC where the electrons drift vertically, from a cathode suspended at mid-height, towards anodes placed at the bottom and top of the detector. The anodes would be made out of printed PCBs instead of wires, and the new disposition would allow the top readout electronics to be accessible during the lifetime of the experiment. The layout of the photo-detection system, that provides the timestamp of the event and the depth coordinate, would need to be modified with respect to the horizontal drift detector scheme. Since the PCB anodes are opaque, the photo-sensors would need to be placed on surfaces at a high voltage, such as the cathode or the field cage, posing a challenge in terms of power and signal transmission. Studies are ongoing both to overcome the technical challenges of this new design and to finalize the concept.

Working group

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Primary author: SACERDOTI, Sabrina (APC-Paris,France)

Co-author: DUNE COLLABORATION

Presenter: SACERDOTI, Sabrina (APC-Paris,France)

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