

# Calibrating the DUNE LArTPC Detectors for Precision Physics

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The Deep Underground Neutrino Experiment (DUNE) is an international collaboration focused on studying neutrino oscillation over a long baseline (1300 km). DUNE will make use of a near detector and O(GeV) neutrino beam originating at Fermilab in Batavia, IL, and a far detector operating 1.5 km underground at the Sanford Underground Research Facility in Lead, South Dakota. The near and far detectors will use the LArTPC (Liquid Argon Time Projection Chamber) technology to image neutrino interactions. In order to make precise physics measurements at DUNE, such as the amount of CP violation in the neutrino sector, it is essential to be able to accurately reconstruct particle energies and other kinematic quantities; this in turn necessitates an extensive calibration program for DUNE's LArTPC detectors. In this presentation, we describe the requirements for calibrating the DUNE detectors, emphasizing the challenges of massive multi-kiloton LArTPC detectors which are to operate for multiple years deep underground. A preliminary DUNE detector calibration program, including use of both dedicated calibration hardware and cosmogenic/beam-induced calibration sources, is presented. First results on detector calibration at the ProtoDUNE-SP prototype detector located at CERN, and associated impact on calibrations at the DUNE far detector, are also emphasized.

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