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Calibration and Performance of the ICARUS Detector at Fermilab

Tuesday 7 October 2025 15:00 (20 minutes)

ICARUS is the largest Liquid Argon Time Projection Chamber (LArTPC) in operation and serves as the Far Detector of the Short Baseline Neutrino (SBN) program at Fermilab. Precise detector calibration is essential for reliable energy reconstruction and for maximizing the physics reach of the experiment. In this talk, I will describe the energy and timing calibration procedures developed at ICARUS. Thanks to the abundant flux of cosmic ray muons at the surface, the TPC response to ionization charge has been equalized across the detector, removing non-uniformities and in-transparency effects. A novel data-driven procedure has been used to tune the simulation of ionization signals and electronics noise yielding close agreement between Monte Carlo and data with minimal residual bias in reconstructed charge. In addition, the light detection system has been calibrated to sub-nanosecond timing resolution. This precision enables efficient cosmic background rejection and accurate synchronization of neutrino interactions with the time structure of both the Booster Neutrino Beam (BNB) and Neutrinos at the Main Injector (NuMI) beam. Together, these efforts demonstrate the robust performance of the detector and provide critical experience for future large LArTPCs, such as DUNE.

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