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Calibration and Timing Performance of the Light Detection System in the ICARUS Detector

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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. It aims to investigate the possible existence of sterile neutrinos with $\Delta m^2 \approx 1 \text{ eV}^2$ using the Booster Neutrino Beam (BNB) and explore physics beyond the Standard Model with the Neutrinos at the Main Injector (NuMI) beam. The ICARUS light detection system, comprising 360 TPB-coated large-area Photo-Multiplier Tubes (PMTs), is crucial for triggering and event reconstruction. Due to its shallow installation, the detector is exposed to a high flux of cosmic rays, necessitating precise timing to reject background events and align neutrino interactions with the beam time profile. This talk will detail the timing inter-calibration procedures for the ICARUS light detection system, which achieve sub-nanosecond resolution. Additionally, the performance of the system in reconstructing the timing of neutrino interactions from the BNB and NuMI beams will be discussed. The results highlight the effectiveness of the ICARUS light detection system in enhancing the detector's capability for precise and reliable neutrino selection.

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