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Electromagnetic shower reconstruction in the ICARUS liquid argon time projection chamber detector

The ICARUS-T600 liquid argon time projection chamber (LArTPC) detector is taking data at shallow depth as the far detector of the Short Baseline Neutrino (SBN) program at Fermilab, to search for a possible sterile neutrino signal at $\Delta m^2 \approx 1$ eV^2 with the Booster (BNB) and Main Injector (NuMI) neutrino beams at ~ 0.8 GeV and ~ 2 GeV average energies respectively.

The LArTPC technology, developed by the ICARUS collaboration and now a standard in neutrino physics, offers impressive charged-particle imaging capabilities with ~ 1 mm spatial resolution, enabling efficient discrimination between track-like signatures (e.g., from muons, pions, and protons) and electromagnetic showers (from electrons and photons). Moreover, electron and photon signatures can be distinguished both with the calorimetric measurement of local energy depositions at the shower start and with the cm-scale conversion gap signature of photons.

This contribution discusses event reconstruction at ICARUS focusing on Pandora, a multi-algorithm pattern recognition software widely used in LArTPC experiments.
Over a hundred Pandora algorithms and tools are used to reconstruct cosmic rays and neutrino interactions in the ICARUS detector. Recent developments have focused on the reconstruction of electromagnetic shower signatures, crucial to ensure a robust and efficient reconstruction of charged-current ν_e interactions, which serve as a key signature of sterile neutrino oscillations at SBN.
In this contribution, recent improvements to the reconstruction are discussed, focusing on the discrimination between tracks and electromagnetic showers using neutrino simulations and data.

Secondary track

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