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DUNE's Tau neutrino event reconstruction and selection strategies using graph neural networks

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The Deep Underground Neutrino Experiment (DUNE), a pioneering project underway in the US, involves the construction of a next-generation neutrino experiment. This experiment features a broadband neutrino beam spanning from Fermilab to the Sanford Underground Research Facility (SURF) in Lead, South Dakota, incorporating a high-precision near detector and a substantial liquid argon time-projection chamber (LArTPC) far detector, represented by two prototypes –Proto-DUNE single-phase horizontal-drift (ProtoDUNE-HD) and ProtoDUNE single-phase vertical-drift (ProtoDUNE-VD). This study focuses on the DUNE's ability to reconstruct tau neutrino events in the far detector using the NUML graph neural network, essential for differentiating charged current muon, tau, and electron events and classifying hits by particle type.

The findings indicate that leveraging the simultaneous readout of an entire far detector module improves the Positive Prediction Value (PPV) and the True Negative Rate (TNR) compared to utilising individual readout modules in isolation, which would only sample portions of a neutrino interaction's image

Poster prize

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