



Contribution ID: 3

Type: **Short talk (15min. + 5 min. Q/A)**

Optimal Transport for e/π^0 Particle Classification in LArTPC Neutrino Experiments

Thursday 30 October 2025 11:10 (15 minutes)

The efficient classification of electromagnetic activity from π^0 and electrons is a notoriously challenging problem in the reconstruction of neutrino interactions in Liquid Argon Time Projection Chamber (LArTPC) detectors. We address this problem using the mathematical framework of Optimal Transport (OT), which has been successfully employed for event classification in other HEP contexts and is ideally suited to the high-resolution calorimetry of LArTPCs. Using a publicly available simulated dataset from the MicroBooNE collaboration, we show that OT methods achieve state-of-the-art reconstruction performance in e/π^0 classification. This performance is further improved when we couple the OT outputs to interpretable machine learning methods, including k-Nearest Neighbors (kNN) and Support Vector Machine (SVM). The success of this first application indicates the broader promise of OT methods for LArTPC-based neutrino experiments such as SBN and DUNE. Since π^0 s are a significant background for both oscillation experiments and BSM searches, integrating OT can lead to sizeable improvements in the selection efficiency for these analyses by introducing a novel method with which to achieve π^0 rejection.

Presenter: FANG, Chuyue “Michaelia”

Session Classification: Innovative PID Approaches