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Characterization of Charged Pions with the NOvA Detectors

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Recent results from neutrino experiments such as MINERvA, T2K, and NOvA have revealed notable disparities between simulated predictions and observed data in neutrino-matter interactions. These inconsistencies underscore the inadequacies of the leading theoretical models coded in the simulations, hence shadowing the full complexity of the interactions. A comprehensive understanding of the theoretical frameworks is imperative to address the disparities and to develop effective models that better represent neutrino-matter interactions. We focus on elucidating the challenges inherent in the identification of charged pions in the NOvA detectors, a crucial aspect of neutrino-matter interactions. By analyzing discrepancies and difficulties encountered in the reconstruction and identification stages in NOvA's charged pion characterization, we aim to shed light on potential shortcomings in current simulation methodologies. In addition, we present a comparison between two types of Deep Learning techniques for their performance on charged pion identification in NOvA. One was developed outside the collaboration and the other is a custom algorithm for instance segmentation. This analysis main objective is to highlight the discrepancies between data and Monte Carlo samples in areas such as the multiplicity and the energy of the charged pions. Moreover, the analysis is developing strategies to identify and address failure modes in simulation algorithms and in further data analysis.

Poster prize

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