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# Kaon Reconstruction Improvement with Pandora Reconstruction for Proton Decay Searches at the Deep Underground Neutrino Experiment

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The existence of Grand Unified Theories describing the unification of the electromagnetic, weak, and strong forces is still an open question. One of the notable features of these theories is the prediction of protons decaying into lighter particles with long lifetimes of order $10^{30}$-$10^{40}$ years. Although many studies have been conducted assuming various decay channels so far, such decays have yet to be observed. In particular, the sensitivity to decay modes involving kaons in Cherenkov detectors is hampered by the fact that kaons produced in proton decay are under detection thresholds due to their heavy mass. The Deep Underground Neutrino Experiment (DUNE) is a state-of-the-art international experiment aiming to reveal the nature of neutrinos and proton decay amongst other BSM topics. DUNE's far detector will utilise a liquid argon time projection chamber (LArTPC) with an active volume of 40kt. The LArTPC technology will allow direct observation of the track of $K^+$ with high accuracy of particle identification and detection efficiency. For the further improvement on the detection, a novel event reconstruction algorithm for $K^+$ has been developed to distinguish the track-like hits of signals from shower-like hits from the background. In this presentation, the performance of the reconstruction algorithm and the event selection method using machine learning techniques for $K^+$ detection on simulated proton decay events via $p \rightarrow \nu K^+$ will be described.

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