

Proton Decay Identification in DUNE with Multimodal Machine Learning Fusion Techniques

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The quest for proton decay is a pivotal endeavor in particle physics, offering potential validation of Grand Unification Theories. In this pursuit, DUNE employs LArTPC technology and ML to boost detection sensitivity and minimize background events. This poster presents a new multimodal ML framework to distinguish proton decay into charged kaons and muons from DUNE's atmospheric neutrino interactions. Using data processed by the CFF Algorithm, the framework integrates modified ResNet and EfficientNet models using late fusion and a gating mechanism for each LArTPC plane. The late fusion model shows promising signal discrimination compared with methods combining preselection cuts with BDT and CNN features. The key advantage of this ML framework is its ability to analyze raw detector data, avoiding track reconstruction. This method effectively addresses the incomplete kaon association from proton decay and the misidentification of protons as signal events.

Alternate track

1. Beyond the Standard Model

I read the instructions above

Yes

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