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Pion and muon identification in charged-current muon-neutrino interaction in the upgraded near detector of the T2K Experiment

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The upgraded near neutrino detector of the T2K experiment is briefly described. The central part is the 3D scintillator fine-grained detector (SuperFGD). The detector comprised of about 2 million $1 \times 1 \times 1$ cm³ plastic scintillator cubes with three orthogonal holes for wavelength shifting fiber readout. It is used as an active neutrino target to detect charged particles and photons. A combination of SuperFGD with the other subdetector systems in the ND280 detector provides a possibility to detect more neutrino events (due to an additional active target), as well as to increase the accuracy of the neutrino events reconstruction.

In charged-current muon-neutrino analysis, the outgoing muon is selected to reconstruct the neutrino energy. In SuperFGD, however, pions can be misidentified as muons, complicating this selection. This work uses a Graph Neural Network (GNN) to identify muons and pions. We present the efficiency and purity of the GNN-based classification of these particles and discuss its impact on event selections. The results are based on Monte Carlo simulations of neutrino interactions in the upgraded ND280 detector.

1. K. Abe et al. (T2K Collaboration), The T2K experiment, Nucl. Instrum. Meth. A 659 (2011) 106-135, DOI: 10.1016/j.nima.2011.06.067
2. Yu. Kudenko et al. (T2K Collaboration), The near neutrino detector of the T2K experiment, Nucl. Instrum. Meth. A 598 (2009) 289-295, DOI: 10.1016/j.nima.2008.08.029
3. Abe S. et al., The super fine-grained detector for the T2K neutrino oscillation experiment. Nucl.Instrum.Meth.A 1092 (2026) 171882
4. Abe K. [et al.]. T2K ND280 Upgrade – Technical Design Report, JINST 6. 2011. P12004 [arXiv:1901.03750] Jan. 11 2019, 196 p.
5. Shlomi, J., Battaglia, P., & Vlimant, J.-R. "Graph neural networks in particle physics." Machine Learning: Science and Technology 2.2 (2021): 021001.

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