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Neutrons as probes of nuclear effects in muon neutrino CC0pi at T2K's upgraded near detector

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Detecting neutrons from the interactions of MeV to GeV neutrinos promises to uncover previously hidden details of what is happening at the heart of the interaction and help to reconstruct precise (anti)neutrino kinematics. The newly upgraded near detector, close to the muon (anti)neutrino beam for the T2K experiment, includes a novel super fine-grained detector (Super-FGD), a 3D tracker capable of tagging neutrons from neutrino and antineutrino beam interactions. The primary goal of the near-detector upgrade is to reduce systematic uncertainties associated with neutrino flux and cross-section models for future studies of neutrino oscillations.

A key goal is the measurement of the cross section associated with the pionless charged-current quasielastic interaction of muon antineutrinos, producing a muon and one or more neutrons (CC0pi-n) with the beam operating in antineutrino mode. However, a fraction of the antineutrino beam in fact consists of muon neutrinos, and these can produce a neutron through additional nuclear effects. As such, muon neutrinos are an important background for the muon antineutrino CC0pi-n signal and it is vital to constrain these. The beam is currently being operated to produce muon neutrinos (neutrino mode) and this provides the perfect opportunity to measure the muon neutrino CC0pi-n cross section to place stronger constraints on nuclear effects.

This poster will discuss the detection of neutrons in the Super-FGD for CC0pi-n measurement in the muon neutrino beam, and the significance of the neutron data for the T2K, Super-Kamiokande and Hyper-Kamiokande experiments in discriminating between neutrino interaction generator models.

Poster prize

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