

Study of charged current interactions on carbon with a charged pion at the T2K near detector with 4π solid angle acceptance

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The long baseline neutrino experiment Tokai-to-Kamiokande (T2K), located in Japan, measures neutrino oscillation parameters. The J-PARC accelerator complex in Tokai produces a beam of neutrinos; these are detected in the near detector (ND280) and at the far detector (Super-Kamiokande). Muon neutrino charged current interactions in ND280 are used to predict the event rate at the far detector. In particular, these constrain the neutrino flux and neutrino-nucleus interaction cross sections, which are the dominant systematic uncertainties in the oscillation measurements.

We present a study of charged current interactions on carbon with a muon and a single positively charged pion in the final state ($CC1\pi$) at the T2K off-axis near detector with a 4π acceptance. This channel constitutes the main background for the muon neutrino disappearance measurement, when the charged pion is not observed in Super Kamiokande. A precise understanding of it is relevant for all current and planned neutrino oscillation experiments. Single pion production is primarily sensitive to resonant processes but has non-resonant contributions as well as coherent pion production. Additionally, final-state interactions in the nuclear target have to be taken into account.

We further present a characterization of $CC1\pi$ interactions through the measurement of Adler Angles, observables carrying information about the polarization of the Delta resonance and the interference with the non-resonant single pion production. Previously, these were measured with limited statistics in bubble chamber experiments.

Author: VARGAS OLIVA, Danaisis (University of Toronto (CA))

Presenter: VARGAS OLIVA, Danaisis (University of Toronto (CA))

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