

DISSERTATION

MEASUREMENT OF ν_μ INDUCED CHARGED CURRENT
INCLUSIVE CROSS SECTION ON WATER USING THE
NEAR DETECTOR OF THE T2K EXPERIMENT

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ABSTRACT

MEASUREMENT OF ν_μ INDUCED CHARGED CURRENT INCLUSIVE CROSS SECTION ON WATER USING THE NEAR DETECTOR OF THE T2K EXPERIMENT

The Tokai to Kamioka (T2K) Experiment is a long-baseline neutrino oscillation experiment located in Japan with the primary goal to precisely measure multiple neutrino flavor oscillation parameters. An off-axis muon neutrino beam peaking at 600 MeV is generated at the JPARC facility and directed towards the 50 kiloton Super-Kamiokande (SK) water Cherenkov detector located 295 km away. Measurements from a Near Detector that is 280 m downstream of the neutrino beam target are used to constrain uncertainties in the beam flux prediction and neutrino interaction rates. We present a selection of inclusive charged current neutrino interactions on water. We used several sub-detectors in the ND280 complex, including a Pi-Zero detector (P0D) that has alternating planes of plastic scintillator and water bag layers, a time projection chamber (TPC) and fine-grained detector (FGD) to detect and reconstruct muons from neutrino charged current events. We use a statistical subtraction method with the water-in and water-out inclusive selection to extract a flux-averaged, ν_μ induced, charged current inclusive cross section. We also outline the evaluation of systematic uncertainties. We find an absolute cross section of $\langle\sigma\rangle_\Phi = (6.37 \pm 0.157(stat.)_{-0.919}^{+0.811}(sys.)) \times 10^{-39} \frac{cm^2}{H_2O \text{ nucleon}}$. This is the first ν_μ charged current inclusive cross section measurement on water.