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Analysis of muon and electron neutrino charged current interactions in the T2K near detectors

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We present the updated measurement of the muon neutrino interaction rates and spectrum at the T2K near detector complex, ND280, located at the JPARC accelerator facility in Tokai, Japan, 280 meters downstream from the target. The measurements are obtained using all the data collected until 2014. The spectrum measured at ND280 off-axis detector constrains the flux and cross section uncertainties in the T2K oscillation analysis. The great reduction of these uncertainties was achieved thanks to the selection method of the charged-current events in the tracker, in which the selected events are divided into three subsamples based on the charged pion multiplicity in the final state, and fitting the muon spectrum separately for each subsample. The subsamples will be also used to determine the inclusive and exclusive cross section for the T2K flux. The prospects for the future measurements will be presented, including running with anti-neutrino mode beam. The on-axis detector (INGRID) at 280 m was used to select charged current events in the 2014 data as well, and results will be presented on the measurement of the cross sections for the inclusive, quasi elastic and coherent pion production.

The main and irreducible background to the observation of ν_e appearance in T2K comes from the presence of a small intrinsic ν_e component in the beam originating from muon and kaon decays. This component is expected to represent 1.2% of the total neutrino flux and it has been measured using the Near Detector (ND280) Tracker. A 65% pure sample of ν_e charged current (CC) interactions is selected by combining the particle identification capabilities of the time projection chambers and of the electromagnetic calorimeters of ND280. The measured ratio between the observed beam ν_e component and the prediction is 1.01 ± 0.10 providing a direct confirmation of the neutrino fluxes and neutrino cross section modeling used for all the T2K neutrino oscillation analyses. Also the differential ν_e CC cross section in electron momentum, angle, and Q^2 is measured, along with the total flux-averaged cross section.

Summary

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