Contribution ID: **46** Type: **Talk**

Measurement of numu, numu-bar CC interactions on iron using a nuclear emulsion detector in the NINJA experiment

Monday 24 October 2022 17:15 (20 minutes)

The NINJA experiment aims to study neutrino-nucleus interactions in the 1 GeV energy region with a nuclear emulsion-based detector. The nuclear emulsion is suitable for measuring the positions and angles of charged particles from neutrino interactions since it has a sub-μm spatial resolution. The sub-micron spatial resolution of the emulsion detector allows us to detect short tracks of low-momentum charged particles such as protons. (The momentum threshold for protons is down to 200 MeV/c).
Data in this presentation was taken from the exposure of a 65 kg iron target in 2016 to the neutrino and anti-neutrino beam corresponding to 4.0 x 10ˆ19 and 3.5 × 10ˆ20 protons on target. Based on 183 and 770 candidate events of neutrino and anti-neutrino charged-current interactions in the target, the multiplicities and kinematics of muons, charged pions, and protons emitted from the events were measured. The data were compared to Monte Carlo predictions, and some significant differences were observed in the anti-neutrino measurement.

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Session Classification: Shallow Inelastic, Deep Inelastic and Inclusive Scattering 2