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First Data with the Upgraded T2K Beam: Validation Using the Near Detector

T2K is a long-baseline experiment measuring neutrino and antineutrino oscillations by observing the disappearance of muon neutrinos, as well as the appearance of electron neutrinos. The ND280 near detector at J-PARC plays a crucial role to minimize the systematic uncertainties related to the neutrino flux and neutrino-nucleus interactions of the un-oscillated neutrino beam. Part of ND280 has recently been upgraded with a new suite of sub-detectors. These new detectors permit analyses with lower tracking thresholds, full angular acceptance and the measurement of kinematics of neutrons produced in neutrino interactions. Alongside this upgrade, the three magnetic horns that select the charge of the decay hadrons produced at the neutrino beamline had their current increased from 250 kA to 320 kA, leading to a purer and more intense (anti-)neutrino flux. This beam upgrade is expected to lead to a $\sim 10\%$ increase in the number of events at the peak of the neutrino flux. Before exploiting data collected with the newly installed detectors, a fundamental step is required: the validation of the upgraded neutrino flux. To this end, the original part tracker is used as a benchmark to compare data collected before and after the beam upgrade, using well-understood detector components. This talk will present evidence for the validation of the upgraded beam, showing for the first time data collected with the 320 kA neutrino flux.

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