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The T2K Near Detector upgrade

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Neutrino oscillation physics has now entered the precision era. In parallel with needing larger detectors to collect more data, future experiments further require a significant reduction of systematic uncertainties with respect to what is currently available. In the neutrino oscillation measurements from the T2K experiment, the systematic uncertainties related to neutrino interaction cross sections are currently dominant. To reduce this uncertainty, a significantly improved understanding of neutrino-nucleus interactions is required. In particular, it is crucial to better characterise the nuclear effects which can alter the final state topology and kinematics of neutrino interactions in such a way which can bias neutrino energy reconstruction and therefore bias measurements of neutrino oscillations.

The upgraded ND280 detector will consist of a totally active Super-Fine-Grained-Detector (Super-FGD) composed of 2 million 1 cm^3 scintillator cubes with three 2D readouts, two High Angle TPC (HA-TPC) instrumented with resistive MicroMegas modules, and six TOF planes. It will directly confront our knowledge of neutrino interactions thanks to its full polar angle acceptance and a much lower proton tracking threshold. Furthermore, neutron tagging capabilities, in addition to precision timing information, will allow the upgraded detector to estimate neutron kinematics from neutrino interactions. Such improvements permit access to a much larger kinematic phase space which correspondingly allows techniques such as the analysis of transverse kinematic imbalances, to offer remarkable constraints of the pertinent nuclear physics for T2K analyses.

New reconstruction algorithms are being developed to fully benefit from the improved capabilities of the Super-FGD and of the HA-TPC and will be described in this talk together with the expected performances of the ND280 upgrade.

Attendance type

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