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Results from the first T2K physics run

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T2K is a long-baseline neutrino oscillation experiment searching for oscillation of muon neutrinos into electron neutrinos and measurement of the mixing angle θ_{13} , a key unknown mixing parameter in the lepton sector. The experiment will also make precise measurements of the oscillation parameters Δm^2_{23} and θ_{23} via muon neutrino disappearance.

The major components of T2K include a neutrino beam line, muon monitors, a near detector complex located at 280 m from the proton interaction target, and the far detector Super-Kamiokande, which is 295 km from the neutrino source. The beam uses a 30 GeV primary proton beam, a graphite target, and a three-horn system with a helium decay region. T2K is the first experiment to exploit the narrow-band off-axis flux from a pion decay-in-flight neutrino source. The near detector uses multiple technologies to measure the flux both on the beam axis and at the 2.5 degree off-axis angle that the far detector observes. The unoscillated event rate and spectrum will be predicted using the observed neutrino interactions in the near detectors, measurements of the primary proton beam and tertiary muons, and hadron production data from CERN experiment NA61. The oscillation analysis will compare the rates of observed and predicted muon and electron neutrino candidates in the far detector.

The T2K beam line and the near and far neutrino detectors, including an upgrade of Super-Kamiokande, were successfully commissioned in 2009. The design and performance of the beam and neutrino detectors will be presented, along with some results from the first physics run completed in June 2010.

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