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T2K latest oscillation analysis results and methodology

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T2K (Tokai to Kamioka) is a Japan based long-baseline neutrino oscillation experiment designed to measure (anti-)neutrino flavor oscillations. A neutrino beam peaked around 0.6 GeV is produced in Tokai and directed toward the water Cherenkov detector Super-Kamiokande, which is located 295 km away. A complex of near detectors is located at 280 m and is used to constrain the flux and cross-section uncertainties by measuring the neutrinos before oscillations. In 2014, T2K started a campaign to measure the phase δ_{CP} , an unknown element of the Pontecorvo-Maki-Nakagata-Sakata matrix, that can provide a test of the violation or conservation of the CP symmetry in the neutrino sector. To achieve this goal, T2K is taking data with a neutrino and antineutrino enhanced beam investigating asymmetries in the electron neutrino and antineutrino appearance probabilities. The most recent result obtained combining data taken with a neutrino and antineutrino beam showed that the CP-conserving cases are excluded at 90% confidence level. In this presentation the methodology employed to reach this result is outlined with particular emphasis on the measurement of the flux and cross-section uncertainties at the T2K near detector. One of the largest systematic uncertainties in T2K oscillation analysis comes from present limited knowledge of (anti-)neutrino-nucleus cross-sections. Neutrino scattering understanding is crucial for the interpretation of neutrino oscillation and details on how is treated and its impact on T2K oscillation analysis are discussed in this presentation.

Collaboration name

T2K

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