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P1.036 Anti-neutrino beam direction and intensity measurement with the T2K on-axis near detector

T Hayashino

Kyoto University, Japan

on behalf of T2K collaboration

In the T2K experiment, neutrino oscillations are measured by using an intense and highly pure beam of muon (anti) neutrinos generated at J-PARC. The beam characteristics are measured by a near detector complex, situated 280 m downstream of the neutrino production target and a far detector, Super-Kamiokande, located 295 km away from the target at 2.5° angular offset from the average beam direction. In 2013, T2K made the first observation of electron neutrino appearance in a muon neutrino beam and constrained CP violating phase δ_{CP} . T2K started data-taking with an anti-neutrino beam to enhance the sensitivity to CP violation measurements in 2014.

In the neutrino oscillation analysis, the events in Super-Kamiokande are predicted based on measurements of the near detectors. When neutrino beam direction is shifted by 1 mrad, the peak of neutrino energy is shifted by 3% and the number of events is changed by 5%. Therefore, the beam direction, profile, intensity and their stability need to be measured for the precise prediction of the events in Super-Kamiokande. In the T2K experiment, they are measured using an on-axis near detector, INGRID (Interactive Neutrino GRID), consisting of 14 modules arranged in horizontal and vertical arrays around the beam center. The neutrino beam direction and profile are measured from the number of observed neutrino events in each module.

We will report anti-neutrino beam measurements using the INGRID based on the anti-neutrino run until June 2015. We measured the beam direction with 0.15 mrad accuracy and the event rate with 1.7% accuracy.