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T2K (Tokai to Kamioka) is a long baseline neutrino oscillation experiment

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A high intensity 30 GeV proton beam at J-PARC is directed towards a graphite target. The charged hadrons produced are focussed by magnetic horns to produce a mostly ν_μ beam. The near detectors are set at 280 m from the target to monitor and measure the neutrino flux and intensity. The far detector is located 2.5 degrees off-axis at a distance of 295 km from the neutrino production point. This exposes the far detector to a narrow-band neutrino beam peaked at 0.6 GeV which is optimised to give the maximum neutrino oscillation probability and the minimum background to the ν_e appearance measurement. The current data set analized is 6.57×10^{20} protons on target. The T2K experiment has observed 120 ν_μ events at the far detector although 446 ± 23 events are expected without neutrino oscillation. This result leads to $\sin^2\theta_{23} = 0.514^{+0.055}_{-0.056}(0.511 \pm 0.055)$ and $|\Delta m^2_{32}| = (2.51 \pm 0.10) \times 10^{-3}((2.48 \pm 0.10) \times 10^{-3})$ eV^2 assuming the normal (inverted) mass hierarchy. For the electron neutrino appearance, we have observed 28 ν_e events and measured $\sin^2 2\theta_{13} = 0.140^{+0.038}_{-0.032}(0.170^{+0.045}_{-0.037})$ assuming the normal (inverted) mass hierarchy, $\sin^2\theta_{23} = 0.5, |\Delta m^2_{32}| = 2.4 \times 10^{-3}$ eV^2, and $\delta_{CP} = 0$. This means 7.3 σ significance to $\theta_{13} \neq 0$. In addition to the neutrino oscillation analysis, the neutrino interaction cross section measurements of the inclusive Charged Current, Charged Current quasi-elastic, and neutrino-oxygen neutral-current quasi-elastic channels are reported.