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Revisiting T2KK and T2KO physics potential and ν_μ - anti- ν_μ beam ratio

In this presentation, we revisit the sensitivity studies of a Tokai-to-Kamioka-and-Korea (T2KK) and Tokai-to-Kamioka-and-Oki (T2KO) proposals where a 100 kton detector is placed in Korea ($L = 1000$ km) and Oki island ($L = 653$ km) in Japan, respectively, in addition to the Super-Kamiokande (SK) for determination of the neutrino mass hierarchy and leptonic CP phase (δ_{CP}).

We systematically study the ν_μ and anti- ν_μ focusing beam ratio with dedicated estimation of backgrounds for the ν_e appearance and ν_μ disappearance signals, especially improving treatment of the neutral current (NC) π^0 backgrounds.

Using a ν_μ : anti- ν_μ beam ratio between 3 : 2 and 2.5 : 2.5, the mass hierarchy determination with $\Delta\chi^2 = 10-30$ by the T2KK and 3-20 by the T2KO experiment are expected for 5×10^{21} POT when $\sin^2(\theta_{23}) = 0.5$.

The CP phase is measured with the uncertainty of 20 deg. – 50 deg. by the T2KK and T2KO using the ν_μ : anti- ν_μ focusing beam ratio between 3.5 : 1.5 and 1.5 : 3.5.

These findings indicate that the T2KK and T2KO experiments can improve their sensitivity to both the mass hierarchy determination and leptonic CP phase measurement simultaneously, using ν_μ and anti- ν_μ focusing beams with 3 : 2 - 2.5 : 2.5 beam ratio.

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