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Development of a multi-ring ν_e sample at the T2K far detector

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The T2K experiment is a long-baseline accelerator neutrino experiment that measures ν_e appearance and ν_μ disappearance from the ν_μ beam by observing neutrino events at the near and far detectors. The near detector (ND280) stands 280 metres, and the far detector (Super Kamiokande) stands 295 km away from the beam production target. Super Kamiokande (SK) is a 50 kton water-Cherenkov detector that observes Cherenkov rings from charged particles produced in neutrino interactions with water.

In the present oscillation analyses, T2K uses only single-ring events at SK which are mostly CCQE. Charged-current single π^+ events form the second most dominant signal events in ν_e appearance studies. Thus, the addition of a two-ring CC1π^+ sample which consists of 1e-like ring and 1π^+-like ring can increase the statistics. These events will also help in studying δ_{CP} and the octant of θ_{23}. In my studies, I will explore the properties and selection of 2-ring CC1π^+ events and how they will impact the statistics of ν_e appearance in T2K analysis.

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