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Search for heavy neutrinos with the T2K near-detector

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Neutrinos are the only matter particles in the Standard Model of particle physics that have only been observed with left handed chirality. If right handed neutrinos exist, they could be responsible for several phenomena that have no explanation within the Standard Model, including neutrino masses, the baryon asymmetry of the universe and dark matter.

The Neutrino Minimal Standard Model predicts the existence of three heavy neutrino, including two at GeV-scale. A particularly interesting mass domain is between 140 and 500 MeV, accessible to T2K, experiment initially built to study standard neutrino oscillations. The analysis aims at the study of heavy neutrino (N) produced in kaon decay along with the standard T2K neutrino beam, that decay in the near detector (ND280). The most promising channels are $N \rightarrow e \pi$, or $N \rightarrow \mu \pi$. The excellent TPC performance will help in reconstructing these decays.

This study requires a good understanding of the reconstruction algorithms which would allow to identify a heavy neutrino signal (peak in electron-pion or muon-pion invariant mass distribution). An important step is to understand background coming from standard neutrino interactions. The final goal is to place limits on unknown heavy mixing parameters and compare them with other bounds.

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