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Electron Neutrino Flux Measurement at T2K

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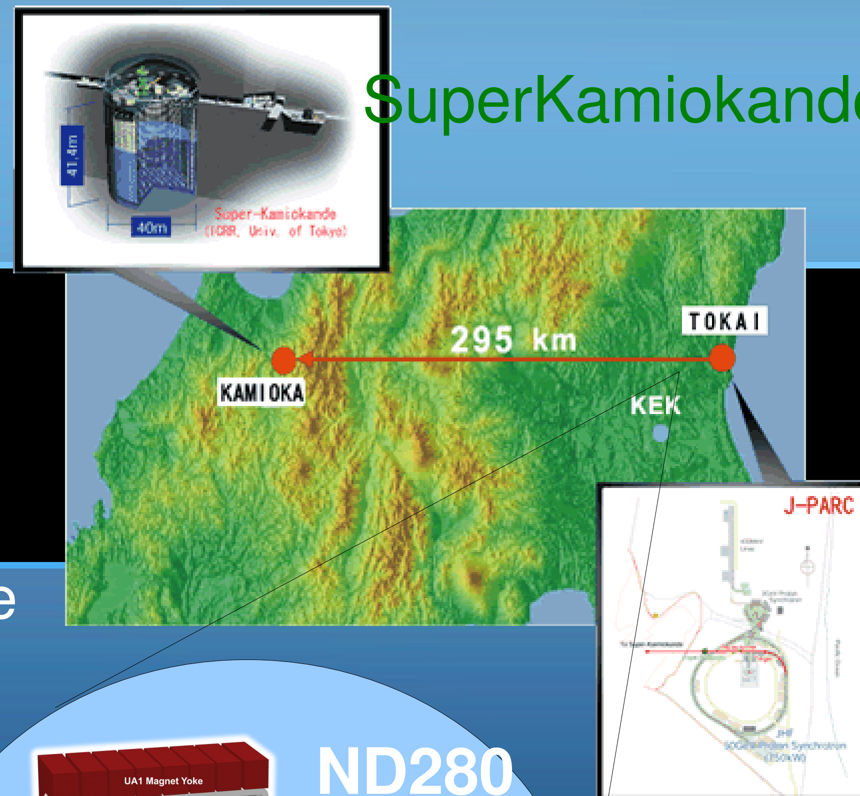
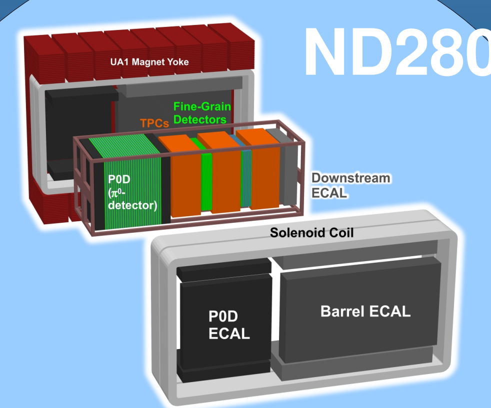
The T2K Experiment

- Long baseline neutrino oscillation experiment in Japan
- Send a ν_μ beam to the Far Detector (SuperKamiokande) 300 km away
- Discovery ν_e appearance → measure θ_{13}
- Precise measurement of ν_μ disappearance

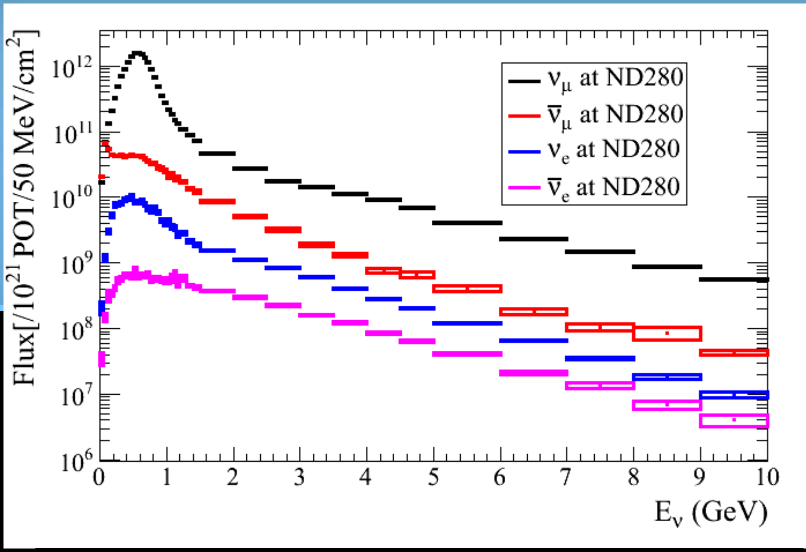


  - ND280 is a detector placed at 280m from the neutrino production point
  - Measure beam properties before the oscillation

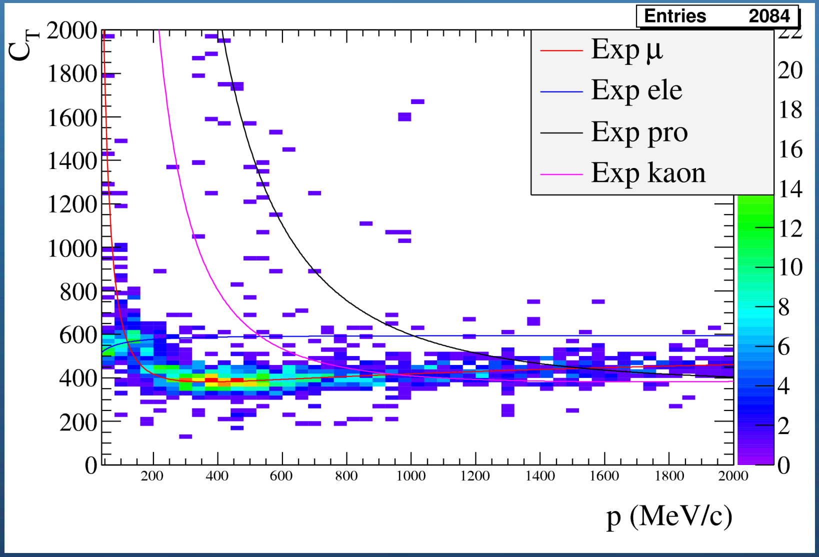


ν_e component

- T2K uses a ν_μ beam
- With the ν_μ also some ν_e are produced coming from μ and K decays
- The ν_e component is the main background to ν_e appearance and has to be measured at ND280



MC prediction: ~ 1.5% ν_e

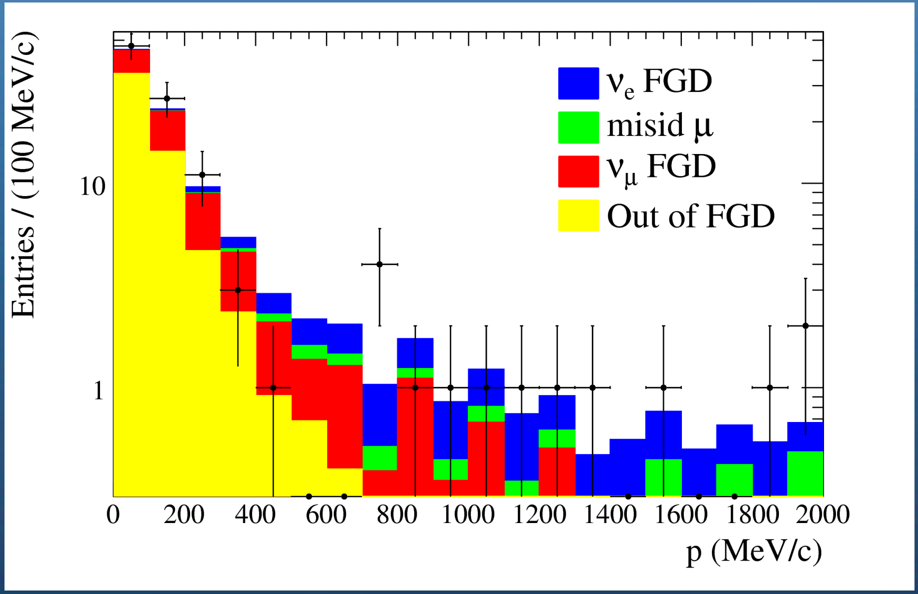


- To measure them we select neutrino interactions in the ND280 Tracker
- Require negative tracks in the TPC and measure their momenta
- Distinguish muons from electrons using the dE/dx in the TPCs

ν_e at ND280

When we select electrons we have three different background together with electrons coming from ν_e

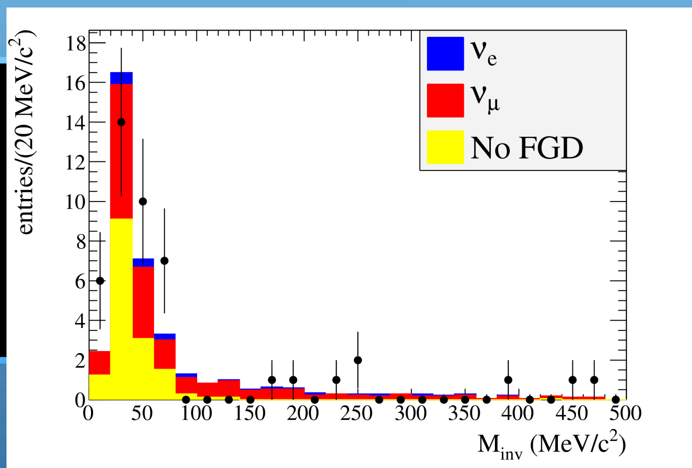
- Gamma conversions producing electrons in TPC:
  - Gammas coming from pi0 decay ($\nu_\mu \rightarrow \mu + p + \pi_0$)
  - Gammas coming from outside the detector
- Misidentified muons

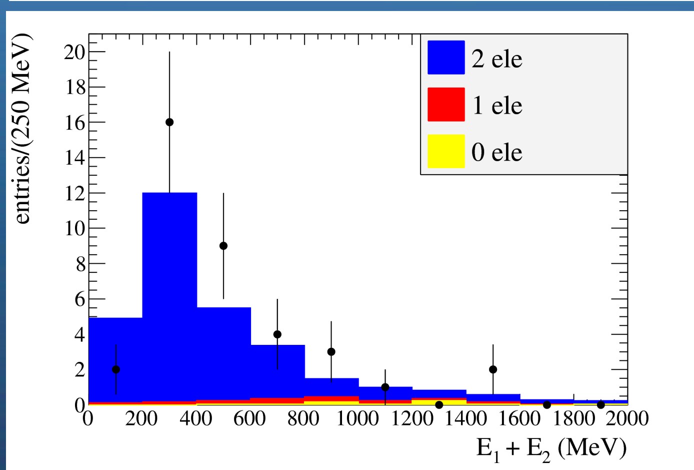


- After the selection of ν_e candidates most of the signal is due to background
- The most important is the EM background
- Likelihood fit to measure the number of events coming from ν_e

EM Background measurement

To control the background coming from γ conversions we select pair e+ e- coming from a photon decay





If the pair comes from a photon, the invariant mass must be zero

According to the MC, we are able to select a very clean sample of e+e- tracks

Conclusion

- The ν_e beam component is an important background to the oscillation and has to be measured in ND280
- We have done a first measurement of this component finding a ratio in good agreement with MC

$$\frac{\nu_e}{\nu_\mu} = 1.0 \pm 0.7(stat) \pm 0.3(syst)\%$$

- To improve this analysis is very important to try to reduce and control the backgrounds
- In particular we can control electromagnetic background by selecting photon conversions giving e+e- tracks in the TPC