**MEASURING THE $\nu_e$ CC INCLUSIVE CROSS-SECTION AT THE GEV-Scale USING ND280, THE T2K NEAR DETECTOR**

**$\nu_e$ CROSS-SECTIONS ARE IMPORTANT**

Long baseline oscillation experiments are searching for CP violation. $\nu_\mu \rightarrow \nu_e$ oscillation is a golden channel for this. We need to understand differences between $\nu_e$ and $\nu_\mu$ cross-sections!

**EVENT SELECTION**

1. Start with highest momentum negative track in active plastic scintillator target, FGD1.
2. Select electrons using TPCs (p/E0) and ECals (shape and charge). Reject 99.9% of $\nu_\mu$.
3. Veto $e^+e^-$ conversions to achieve 65% CC $\nu_e$ purity.

**UNFOLDING**

Use Bayesian unfolding to estimate true distribution.

$$F(x) = \frac{\sum_i P_i(x) P_i(y)}{\sum_i P_i(y)}$$

Shearing matrices relate true and reconstructed information. Bremsstrahlung affects momentum reconstruction.

Constrain background using sample of $\gamma \rightarrow e^+e^-$ conversions. Constrain background from out of fiducial volume in full bin.

**SYSTEMATICS**

**Summary**

Use covariance matrix method with 10,000 throws. Dominant uncertainties on total cross-section are:
- Flux (12.9%)
- Data statistics (8.7%)
- Detector systematics (8.4%)

**Flux**

Constrain 5 sources of uncertainty using beam measurements and NA61 hadron production data.

**Detector**

All ND280 uncertainties are constrained by data. Separate systematics cover:
- FGDs
- TPCs
- ECals
- External interactions

Uncertainty on number of target nucleons is 0.67%.

**RESULTS**

Selection is not sensitive to low momentum and high angle tracks. Unfolding into these regions depends on the MC model (NEUT). Present two results – with and without unfolding into unseen region. These are the first GEV-scale $\nu_e$ cross-section results since Gargamelle!

**FUTURE PROSPECTS**

Many exciting analyses planned:
- CCQE-enhanced selection to give $\nu_e$ CCQE cross-section as a function of $E_T$
- Running T2K in anti-neutrino mode will give anti-$\nu_e$ cross-sections
- $\nu_e\nu_e$ cross-section ratio measurement will benefit from cancelling of many systematic uncertainties.