Status Report

Fanny Dufour, June 19th, 2006
Outline

- Reproducing Maxim's results: done!
- Energy plots
- Overall status & plan
  Histograms for each step
Maxim's results

<table>
<thead>
<tr>
<th>Event Category</th>
<th>$\nu_\mu$ CC mis-ID</th>
<th>NC</th>
<th>Beam $\nu_e$</th>
<th>Signal (chooz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FC, FV, Evis $&gt;$ 100 (MeV)</td>
<td>2081.7</td>
<td>801.37</td>
<td>182.9</td>
<td>217.9</td>
</tr>
<tr>
<td>Single ring</td>
<td>983 (47.2%)</td>
<td>214.7 (26.8%)</td>
<td>89 (48.7%)</td>
<td>1843 (84.6%)</td>
</tr>
<tr>
<td>E-like</td>
<td>39.0 (1.9%)</td>
<td>168.3 (21.0%)</td>
<td>86.7 (47.4%)</td>
<td>182.2 (83.6%)</td>
</tr>
<tr>
<td>No decay e-</td>
<td>13.6 (0.65%)</td>
<td>149.9 (18.7%)</td>
<td>72.4 (39.6%)</td>
<td>166.4 (76.2%)</td>
</tr>
<tr>
<td>$0.35 &lt; E &lt; 0.85$ (Gev)</td>
<td>1.37 (0.07%)</td>
<td>50.8 (6.3%)</td>
<td>20.7 (11.3%)</td>
<td>127.2 (58.3%)</td>
</tr>
<tr>
<td>$\cos \theta_{\nu e}$ &lt; 0.9</td>
<td>1.025 (0.05%)</td>
<td>35.8 (4.5%)</td>
<td>17.5 (9.6%)</td>
<td>111.4 (51.1%)</td>
</tr>
<tr>
<td>Polfit $M_{\gamma\gamma} &lt; 100$ MeV/c^2</td>
<td>0.47 (0.02%)</td>
<td>11.8 (1.5%)</td>
<td>13.9 (7.6%)</td>
<td>94.1 (43.2%)</td>
</tr>
<tr>
<td>$\Delta \log \text{Likelihood} &lt; 80$</td>
<td>0.35 (0.017%)</td>
<td>9.8 (1.2%)</td>
<td>13.5 (7.4%)</td>
<td>91.9 (42.2%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Event Category</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>FCFV</td>
<td>2068</td>
<td>821.2</td>
<td>156</td>
<td>214.5</td>
</tr>
<tr>
<td>single ring</td>
<td>971 (46.95%)</td>
<td>222.2 (27.10%)</td>
<td>81.5 (52.20%)</td>
<td>181.1 (84.40%)</td>
</tr>
<tr>
<td>e-like</td>
<td>38.8 (1.88%)</td>
<td>175.1 (21.30%)</td>
<td>80.9 (51.80%)</td>
<td>179.8 (83.80%)</td>
</tr>
<tr>
<td>no decay_e</td>
<td>16.7 (0.81%)</td>
<td>156.9 (19.10%)</td>
<td>68.8 (44.10%)</td>
<td>165 (76.90%)</td>
</tr>
<tr>
<td>$0.35 &lt; E &lt; 0.85$</td>
<td>1.5 (0.07%)</td>
<td>53.1 (6.50%)</td>
<td>18.9 (12.10%)</td>
<td>125.9 (58.70%)</td>
</tr>
<tr>
<td>Likelihood</td>
<td>0.5 (0.023%)</td>
<td>10.9 (1.30%)</td>
<td>15.4 (9.90%)</td>
<td>102.6 (47.80%)</td>
</tr>
</tbody>
</table>

Difference due to the fact that Maxim had NC in $\nu_\nu_e$ sample
\[(E_{\text{rec}} - E_{\text{true}})/E_{\text{true}}\]

Split according to E-true only CC events

- CCQE events
- NUE CC
- NUMU CC
- NC
- E 0.35
- 0.35 E 0.85
- 0.85 E 1.5
- E 1.5
Event by event method

For each event:
- read $E_{\text{true}}$
- assign $E_{\text{rec}}$ according to the matrix of $E_{\text{rec}}$ vs $E_{\text{true}}$

Example: $E_{\text{true}} = 0.85$ GeV
for a CCQE event:
$E_{\text{rec}} = 0.25$ GeV
10% of time

$E_{\text{rec}} = 0.75$ GeV
85% of time

$E_{\text{rec}} = 1.25$ GeV
5% of time
Energy matrices for CCQE $\nu_e$ vs $\bar{\nu}_e$

Had to run on ATM MC since T2K doesn't have $\bar{\nu}_e$
Overall Status & plan

Wrote code to run event by event and do the following:

Done

Okumura-san Done?

Okumura-san & me: Done.

Me, Done

Me, Done
Flux

2.35 degrees off-axis

1 degree off-axis

nu/50 MeV / 1e21pot/cm²

Flux versus Neutrino Energy
I didn't have Okumura's cross-section yet so I used Mine's. 

What is Okumura-san's binning?
Energy Response

For each E-true I associate E-smeared according to the process explained earlier.

Binning of the energy matrices is flexible.
Likelihood Efficiency

bin 1: $E < 0.35$
bin 2: $0.35 < E < 0.85$
bin 3: $0.85 < E < 1.5$
bin 4: $1.5 < E$

Is this binning ok?
Oscillation probability

\[
\begin{align*}
\text{Prob } \nu_\mu \rightarrow \nu_e \\
\text{at Kamioka (L=295 km)}
\end{align*}
\]

\[
\begin{align*}
\text{Prob } \nu_\mu \rightarrow \nu_e \\
\text{in Korea (L=1025km)}
\end{align*}
\]
Next steps

- Polishing the code, start running.
- Do $\chi^2$ analysis
- Prepare MC for SK-2 (for 20% vs 40% coverage study)

NB: all my talks are on:
http://hep.bu.edu/~fdufour/t2kk/

We need:
- all running:
  - Nu-e Flux
- anti-neutrino running:
  - Flux, Likelihood (efficiency)
backups
(E_{\text{rec}} - E_{\text{true}})/E_{\text{rec}}

Split according to E-true only CC events

- CCQE events
- NUE CC events
- NUMU CC events
- NC events

E 0.35
0.35 E 0.85
0.85 E 1.5
E 1.5

NB see backups for plots including all events