P0D $\nu_e$ thoughts and questions

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Introduction

- Remaining backgrounds
- $\pi^0$ rejection
- What will we quote and how?
- Systematics thoughts
Are there any rejectable muons left?

After all cuts:

<table>
<thead>
<tr>
<th></th>
<th>Sig</th>
<th>Total BG</th>
<th>Mu</th>
<th>Pi0</th>
<th>MPi</th>
<th>PiC</th>
<th>Prot</th>
<th>Oth</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>64</td>
<td>171</td>
<td>19</td>
<td>70</td>
<td>42</td>
<td>18</td>
<td>5</td>
<td>17</td>
</tr>
</tbody>
</table>

Remaining muons leave little energy in det, have $\pi^{\pm}$

Conclusion: No longer need to think about rejecting muons
Multi-$\pi$ events

- Remaining multi-$\pi$ mostly have $\pi^0$
- Conclusion: Any purity improvements must reject $\pi^0$
Is the background irreducible? MC truth study idea:
- Look at how much PH left by second $\gamma$
- Look at angle between $\gamma$s (vs shower angle?)

Suggestion from Ian: use unassociated PH in event

What is the stopping condition?
- Related: if we can’t reject more background, do we try to improve efficiency?
What will we quote and how?

- What quantity are we quoting as the final result of this analysis?
  - $\nu_e$ flux over $\nu_{\mu}$ flux, $N_{\nu_e}$ data/MC ratio, Cross section on water, 
- And how will we calculate it?
  - eg, fit MC with scale factor, “pen and paper” with efficiency/purity, 
- Affects what systematics are relevant
  - eg, data/MC ratio used to predict $N_{SK}$ needs no beam syst, while cross section does
Related to FV: We are planning to look at magnet MC sample

One way to quantify cut uncertainty:
- Move cut some “1σ” distance in data and MC. Compare $\Delta N_{\text{selected}}$
- Harder for cuts on discrete variables

More complex way to look at effect of “rest of event” (ie, not lepton):
- Take good CC$\mu$ interactions. Replace $\mu$ with $e$. Rereconstruct
- Now have a fake sample of $\nu_e$ events in data and MC
- (Used in MINOS under the names MRCC and MRE)

Who to co-ordinate with in $\pi^0$ group?