EScale

T2KSK @ SB Meeting

José Palomino, Joshua Hignight
06/27/2013
From Last Week

- Mine-san accepted the median value will be the best choice for this analysis, but we still need to take care of the Cherenkov angle.

- The shape of the histograms are due to the (mis)reconstruction of Cherenkov angle.

- Mine-san suggested to calculate the Cherenkov angle shift between Data and MC per energy region (200, 280, 360, 440) and then “correct” the Cherenkov angle in MC and repeat the previous study.
**Filling out Histograms**

\( v_e \) When we fill out the histograms \( P_{pe} / P_\Theta \), we run over two loops (1 for Data and 1 for MC). It means Data entries are not equal MC entries.

( Default way )

\( v_e \) MC sample is generated according to Data

( True MC is Data ).

\( v_e \) We need to have same statistics between Data and MC. If data event pass all cuts also MC must pass all cuts.
Only Data passes selections

We call the related MC, Ptheta is used to split the sample
Only Data passes selections

We call the related MC, Ppe is used to split the sample
Information

Ptheta is not good variable to isolate block of sample (momentum range) when we just select by Data.

Incoming Plots Data and MC both pass the selections.
Data and MC pass selections

Data Reco $\theta, P_{[200,280]}$

- Mean = 34.56
- RMS = 1.26
- Entries = 2826

Data Reco $\theta, P_{[280,360]}$

- Mean = 37.54
- RMS = 0.54
- Entries = 1217

Data Reco $\theta, P_{[360,440]}$

- Mean = 38.90
- RMS = 0.28
- Entries = 789

MC Reco $\theta, P_{[200,280]}$

- Mean = 34.46
- RMS = 1.29
- Entries = 2826

MC Reco $\theta, P_{[280,360]}$

- Mean = 37.51
- RMS = 0.54
- Entries = 1217

MC Reco $\theta, P_{[360,440]}$

- Mean = 38.92
- RMS = 0.27
- Entries = 789

Thursday, June 27, 13
Correct MC reconstructed theta with these shifts and repeat study.

\[ P_\theta = \frac{m_\mu}{\sqrt{n^2 \cdot \cos^2 \theta - 1}} \]

Table 1: Mean(Median) \( \theta_{Data} \) - Mean(Median) \( \theta_{MC} \) (degrees)

<table>
<thead>
<tr>
<th>Range (MeV)</th>
<th>Mean Method</th>
<th>Median Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 - 280</td>
<td>0.099</td>
<td>0.115</td>
</tr>
<tr>
<td>280 - 360</td>
<td>0.033</td>
<td>0.066</td>
</tr>
<tr>
<td>360 - 440</td>
<td>-0.017</td>
<td>-0.018</td>
</tr>
</tbody>
</table>

Data and MC pass selections
Table 1: \(100 \times (MC - Data) / Data\)

<table>
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<tr>
<th>Range (MeV)</th>
<th>Mean Method</th>
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<tbody>
<tr>
<td>200 - 280</td>
<td>-0.48</td>
<td>-0.89</td>
</tr>
<tr>
<td>280 - 360</td>
<td>-0.14</td>
<td>0.65</td>
</tr>
<tr>
<td>360 - 440</td>
<td>-0.11</td>
<td>0.95</td>
</tr>
</tbody>
</table>

Table 1: \(MC / Data\)

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<tr>
<th>Range (MeV)</th>
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</thead>
<tbody>
<tr>
<td>200 - 280</td>
<td>0.995</td>
<td>0.991</td>
</tr>
<tr>
<td>280 - 360</td>
<td>0.999</td>
<td>1.007</td>
</tr>
<tr>
<td>360 - 440</td>
<td>0.999</td>
<td>1.009</td>
</tr>
</tbody>
</table>

Data and MC pass selections
**Theta Corrected by Mean**

### Table 1: $100 \times (\text{MC} - \text{Data}) / \text{Data}$

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<th>Range (MeV)</th>
<th>Mean Method</th>
<th>Median Method</th>
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<tbody>
<tr>
<td>200 - 280</td>
<td>-0.84</td>
<td>-1.19</td>
</tr>
<tr>
<td>280 - 360</td>
<td>-0.29</td>
<td>0.59</td>
</tr>
<tr>
<td>360 - 440</td>
<td>0.03</td>
<td>1.10</td>
</tr>
</tbody>
</table>

### Table 1: MC / Data

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</tr>
</thead>
<tbody>
<tr>
<td>200 - 280</td>
<td>0.992</td>
<td>0.988</td>
</tr>
<tr>
<td>280 - 360</td>
<td>0.997</td>
<td>1.006</td>
</tr>
<tr>
<td>360 - 440</td>
<td>1.000</td>
<td>1.011</td>
</tr>
</tbody>
</table>
Theta Corrected by Median

### Table 1: MC / Data

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### Table 1: 100*(MC - Data) / Data

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<th>Range (MeV)</th>
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<td>200 - 280</td>
<td>-0.91</td>
<td>-1.25</td>
</tr>
<tr>
<td>280 - 360</td>
<td>-0.29</td>
<td>0.63</td>
</tr>
<tr>
<td>360 - 440</td>
<td>0.04</td>
<td>1.09</td>
</tr>
</tbody>
</table>

Data and MC pass selections
Comments

Having same statistics Data and MC reduce the relative difference to 1% ( before was 2% ).

This criteria reduces between 50 - 80% our number of entries.

The Theta correction ( Data - MC ) didn't affect too much the final result. ( 1% error means Data and MC are quite similar ), but still Theta variable is not the right one.
Backup
Data and MC pass selections

**Data Reco $P_{e}/P_{\theta}$ [200,280]**
- Mean = 1.21
- RMS = 0.15
- Entries = 2826

**Data Reco $P_{e}/P_{\theta}$ [280,360]**
- Mean = 1.10
- RMS = 0.14
- Entries = 1217

**Data Reco $P_{e}/P_{\theta}$ [360,440]**
- Mean = 1.04
- RMS = 0.12
- Entries = 789

**MC Reco $P_{e}/P_{\theta}$ [200,280]**
- Mean = 1.20
- RMS = 0.15
- Entries = 2826

**MC Reco $P_{e}/P_{\theta}$ [280,360]**
- Mean = 1.10
- RMS = 0.14
- Entries = 1217

**MC Reco $P_{e}/P_{\theta}$ [360,440]**
- Mean = 1.04
- RMS = 0.13
- Entries = 789