Preliminary Studies on π^0 Production in the MiniBooNE Antineutrino Data

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π^0 Event Selection

Analysis Pre-Cuts

- Only 1 subevent in the event found by the SplitEvent algorithm
- $N_{VETO}<6$, where N_{VETO} is the no. of veto hits associated with the subevent
- $N_{TANK}>200$, where N_{TANK} is the no. of tank hits associated with the subevent

Analysis Cuts (using the P-fitter reconstruction package)

- $R_e<500$ cm ...cut on the electron-like radius
- $-\log(L_e/L_\mu)>0.05$ ...likelihood cut favoring the electron
- $-\log(L_e/L_\pi)<0$ ...likelihood cut favoring the pion
- $50<M_\pi<500$ MeV...conservative mass cut
- $0<E_{\pi^0}(1.-\cos\theta_{\pi^0})<700$ MeV
- nuance=13,15 ...resonant π^0 production from antineutrinos
- nuance=96 ...coherent π^0 production
- nuance $\neq$13,15,or 96 ...background
- nuance=6,8 ...resonant π^0 production from neutrinos (WS)
- BEAM_ini_pos<2500 cm...no neutrinos > 25 m

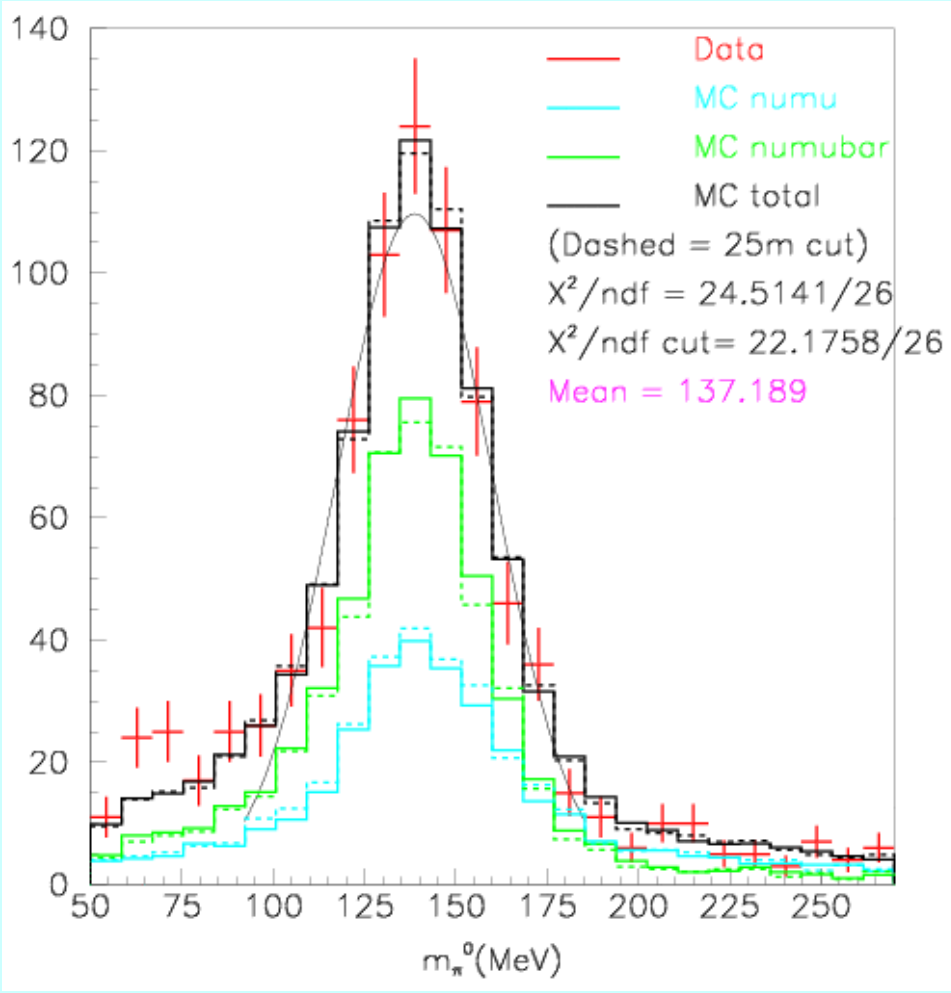
Preliminary Studies

We will see the following:

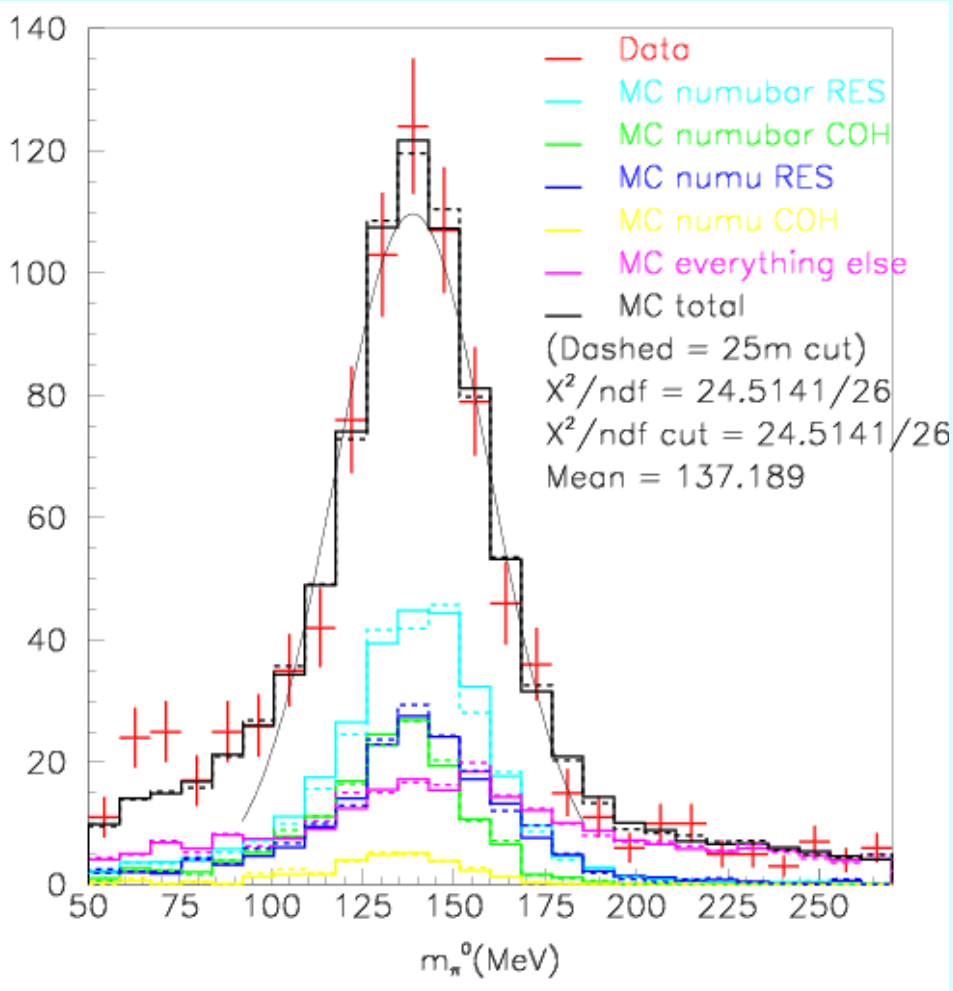
- There are indeed π^0's produced in our antineutrino data
- There is good agreement between data and MC, with and without the 25 m cut
- Kinematic distributions are what we expect
- There is clear evidence for antineutrino NC coherent π^0 production

Note:
The data is from Jan.–Dec. 2006 and the MC is from the May 06 Baseline (no dirt)

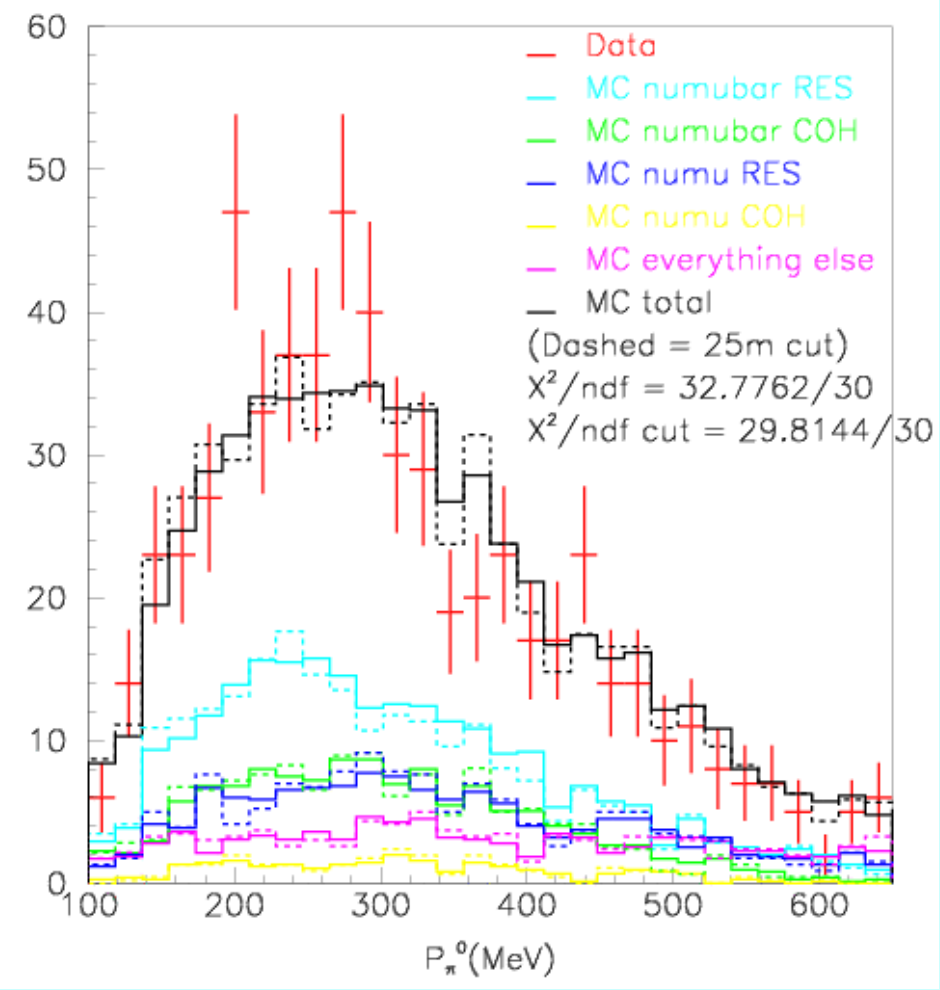
π^0 Mass Peak



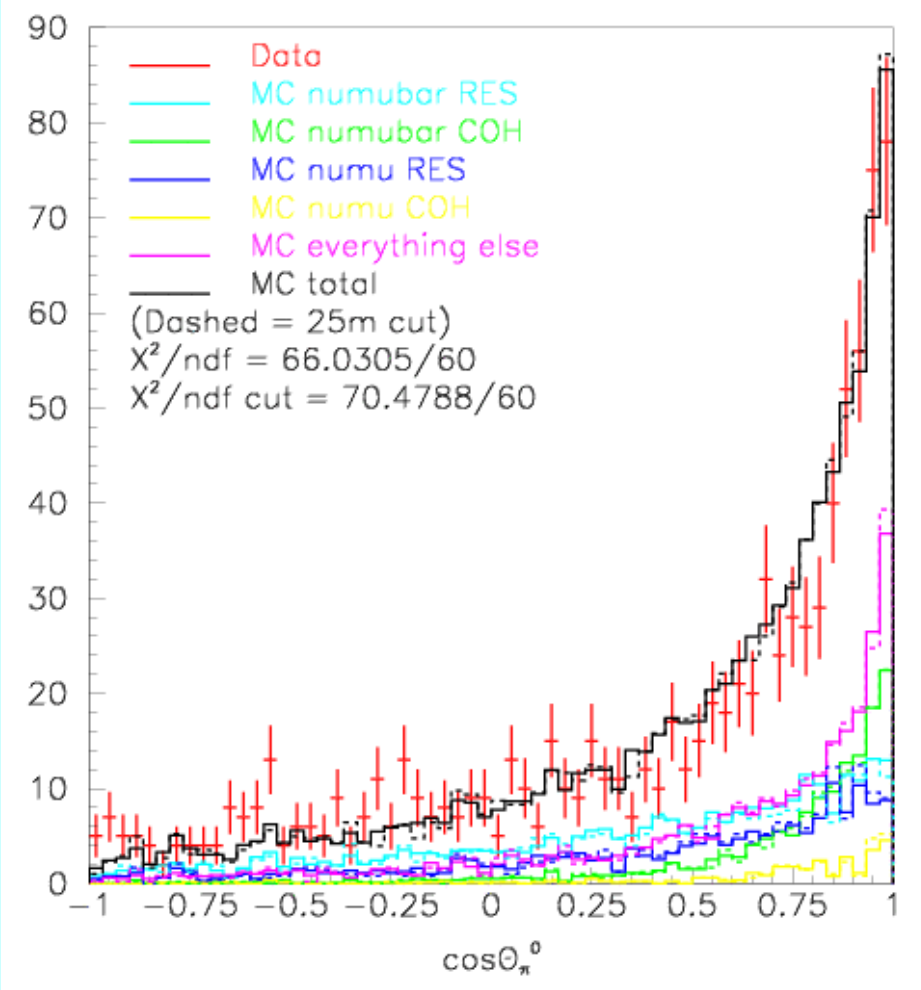
π^0 Mass Peak



π^0 Momentum

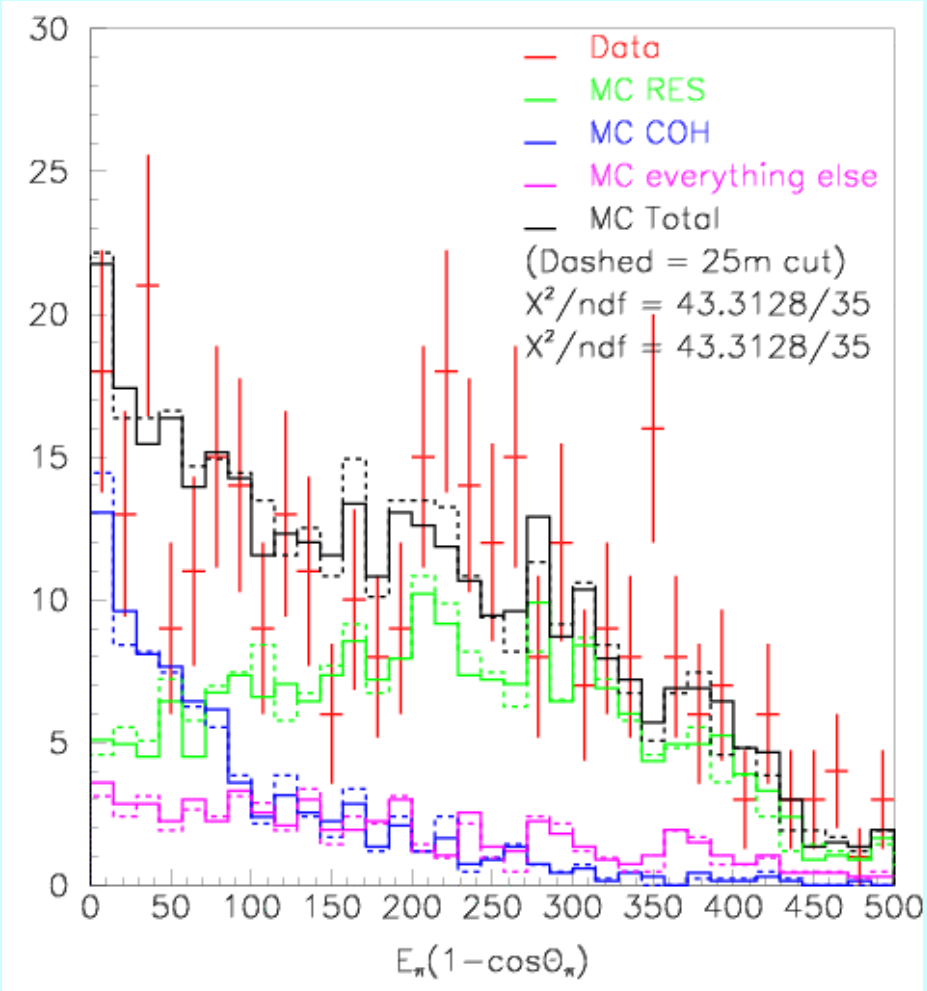


$\cos\theta_{\pi^0}$

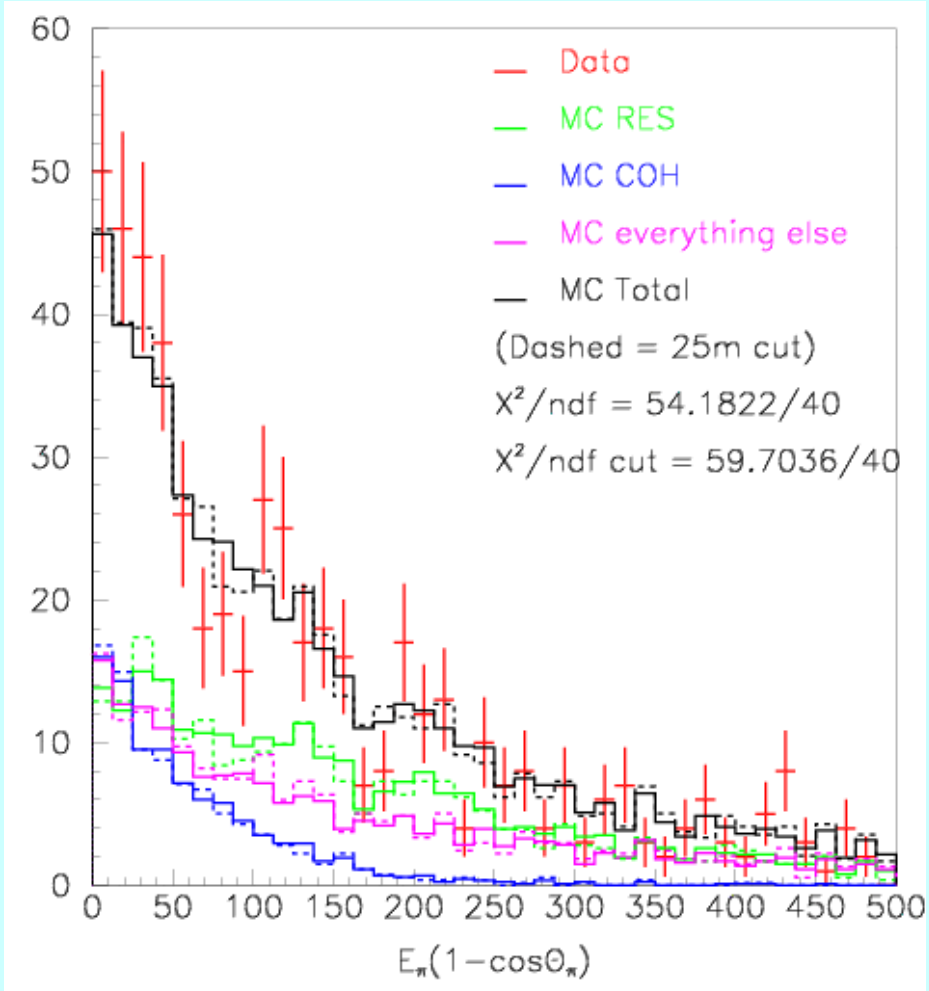


(θ_{π^0} is the angle of the outgoing π^0 in the lab wrt to the $\overline{\nu}$ direction)

Shape Comparison

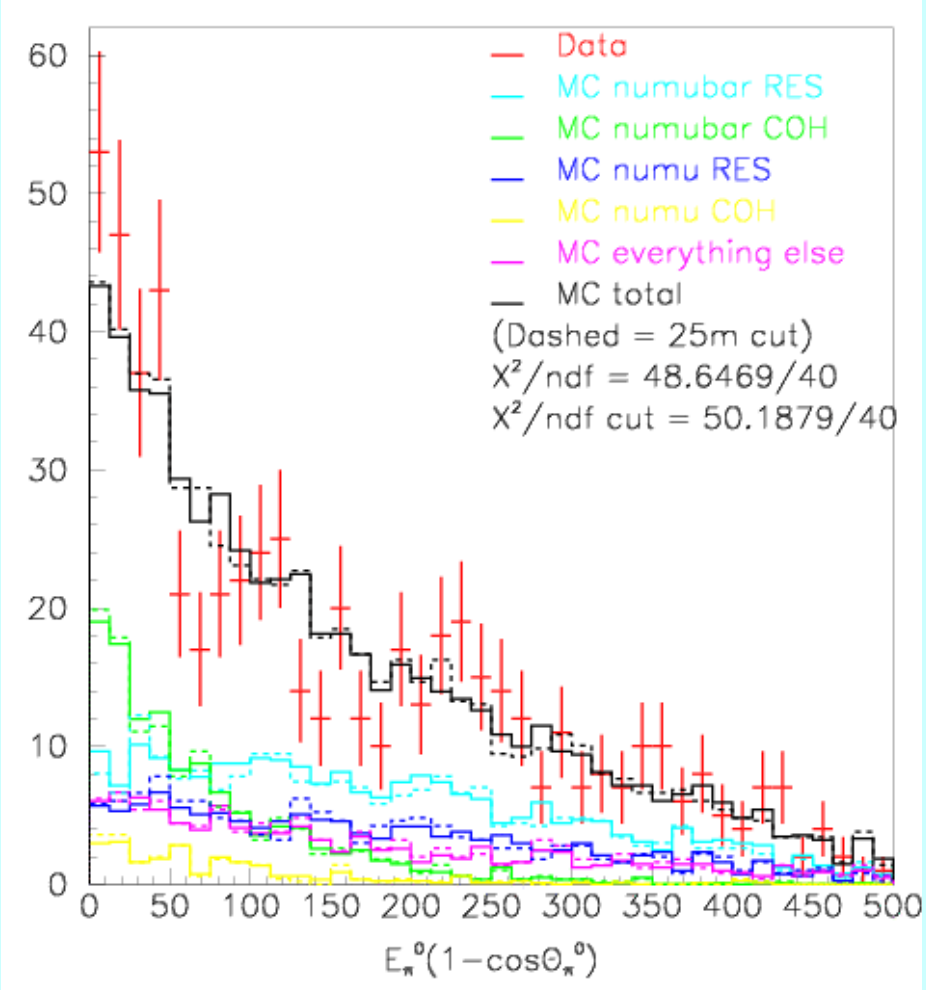


E_π<300 MeV

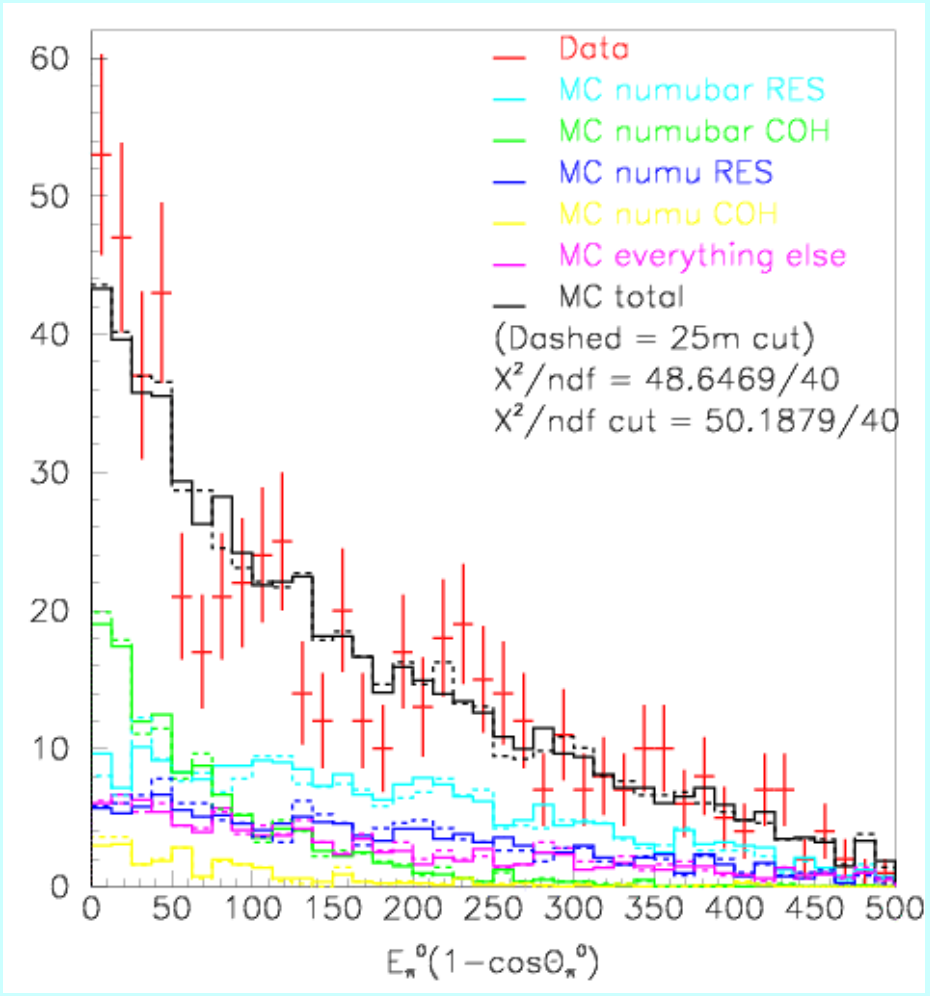


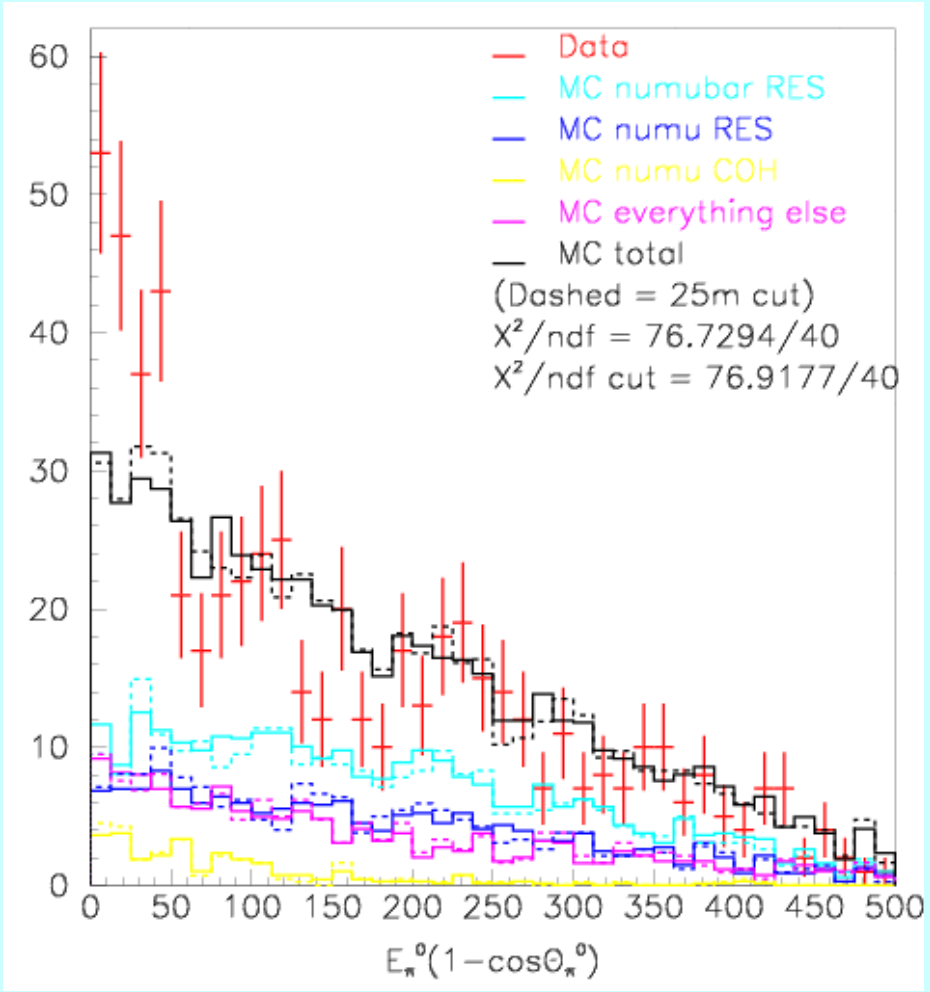
E_π>300 MeV

$E_{\pi^0}(1-\cos_{\pi^0})$



$E_{\pi^0}(1-\cos_{\pi^0})$





No numubar COH contribution

Summary

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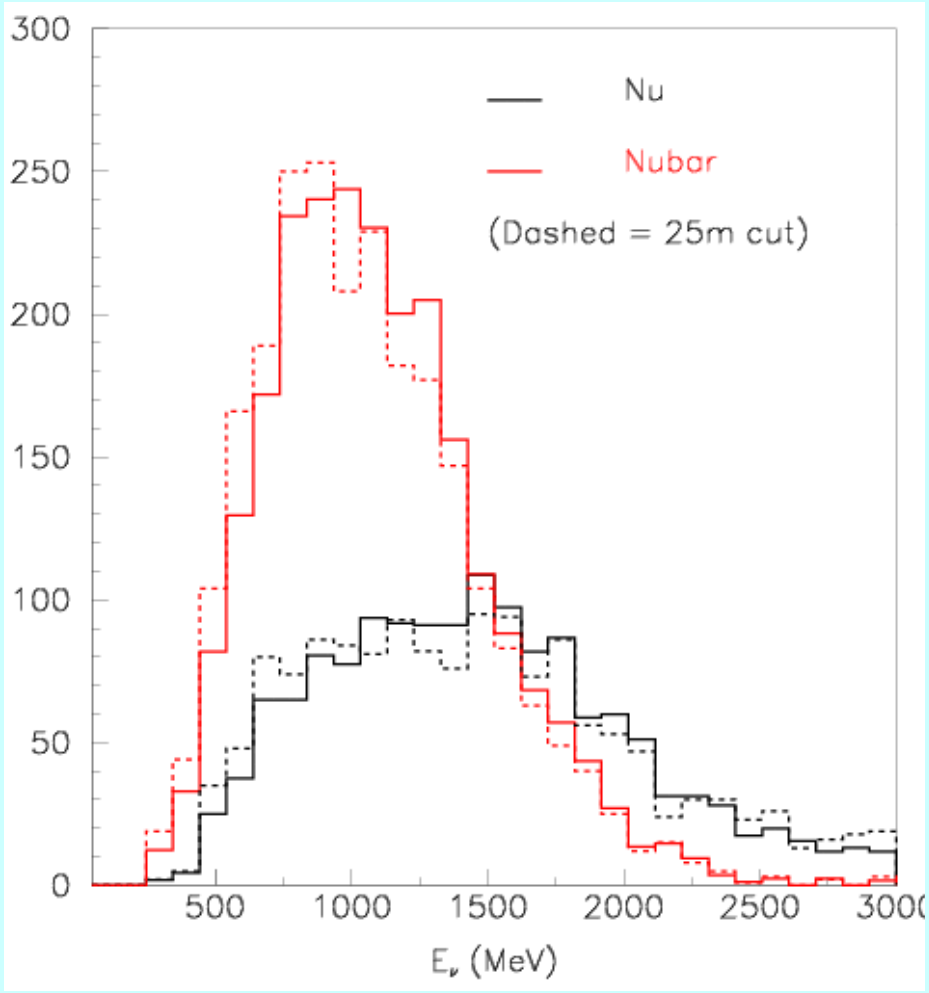
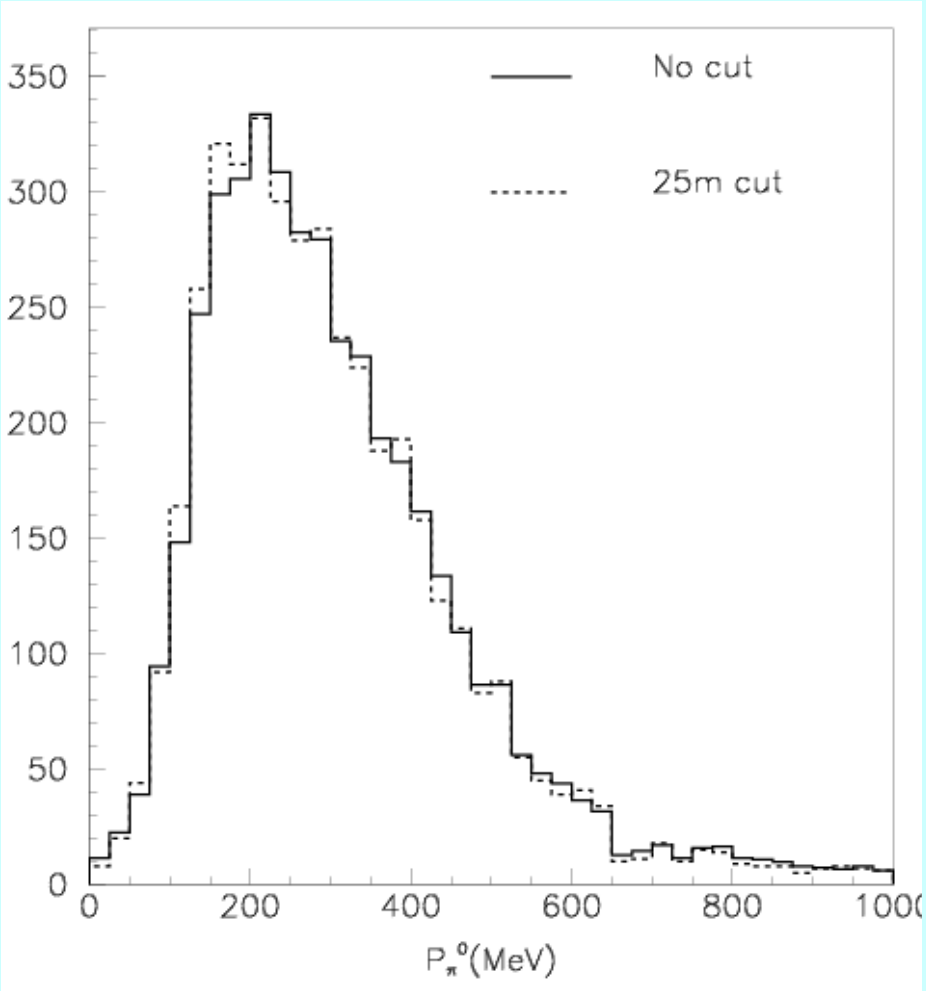
Backup Slides

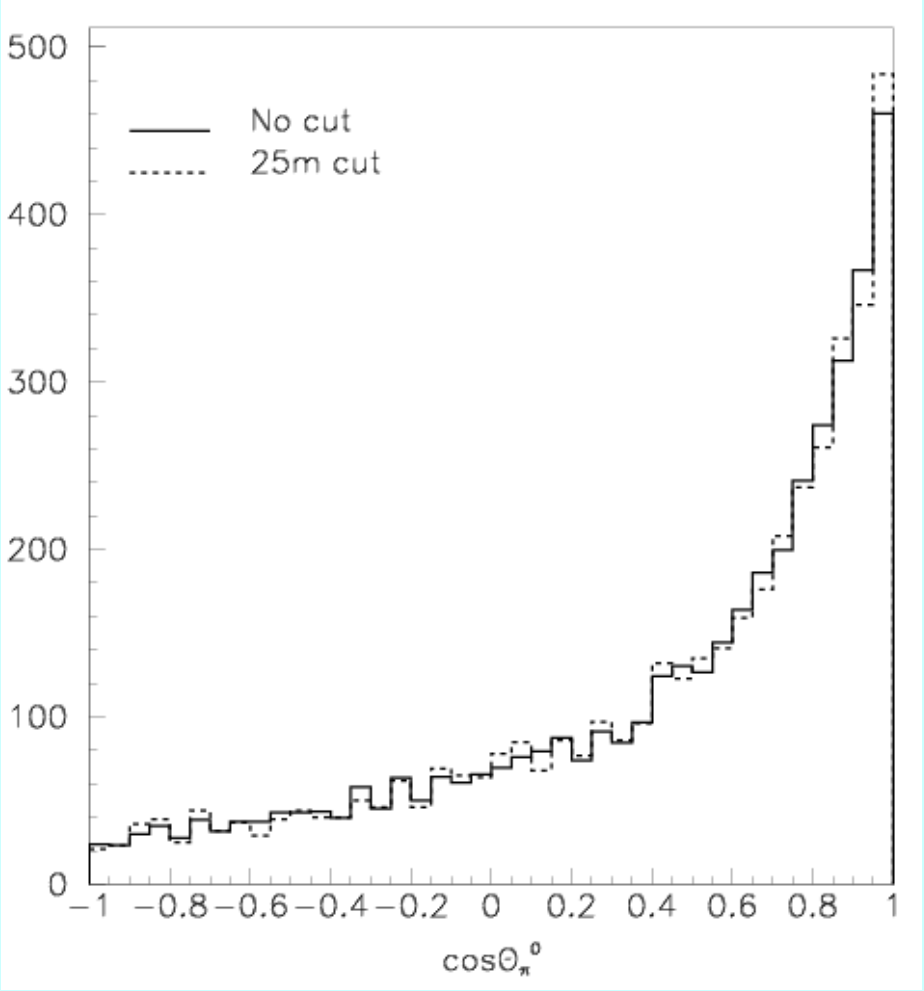
True Generated ν and $\bar{\nu}$ Energies



True Generated π^0 Momentum



True Generated $\cos\theta_{\pi^0}$



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