

Coherent NC π^0 Production in the MiniBooNE Antineutrino Data

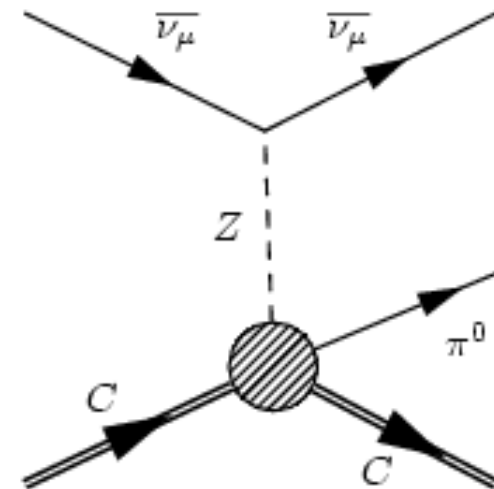
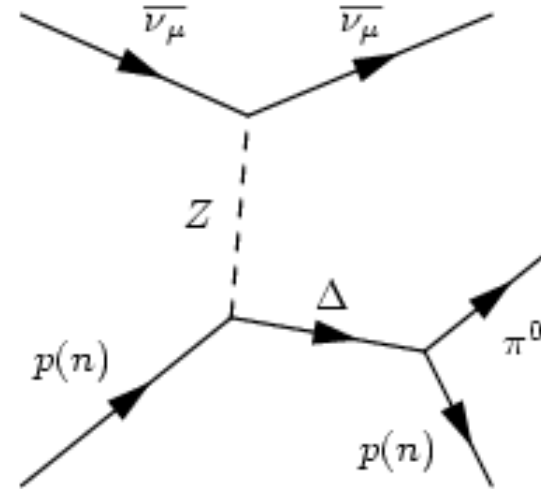
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Moriond EW 2008

NC π^0 Production

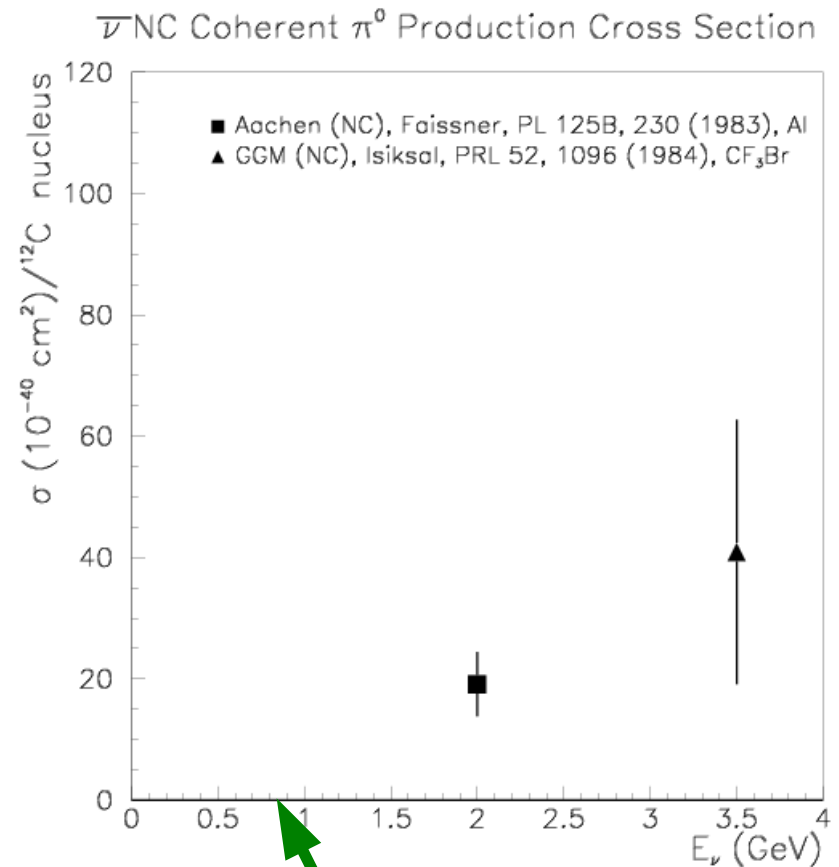
At low energy, NC π^0 's can be created through resonant and coherent production:

- Resonant NC π^0 production:
- **Coherent NC π^0** production:
(Signature: π^0 which is highly forward-going)



Why study coherent NC π^0 production?

- NC π^0 events are the dominant bgd to $\bar{\nu}_\mu \rightarrow \bar{\nu}_e$ ($\nu_\mu \rightarrow \nu_e$) osc searches
- In particular, coherent prod is much more challenging to predict theoretically than resonant processes at these energies (<2 GeV)
- Furthermore, there are few exptl. measurements, with **none** at very low E
- The analysis in this talk represents the **first time** we are probing this region experimentally

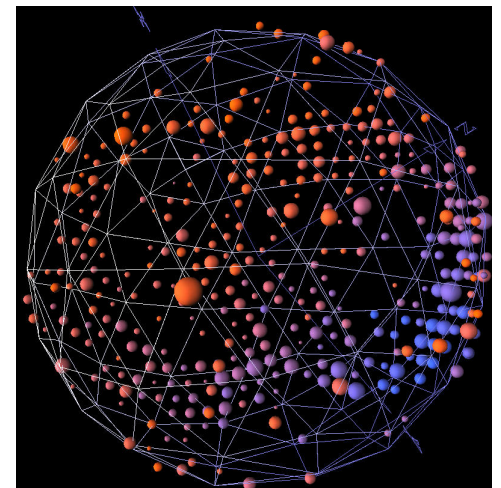
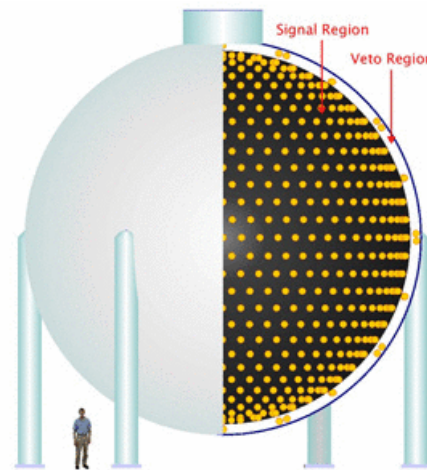


MiniBooNE

NC π^0 's in MiniBooNE

- MiniBooNE, an expt at Fermilab designed to measure ν oscillations, turns out to be very well-suited for π^0 physics
- Large, open-volume Čerenkov detector with full angular coverage is really good at π^0 ID and containment
- MiniBooNE has the world's largest samples of NC π^0 events in interactions with ~ 1 GeV neutrinos (over 23k)* and with ~ 1 GeV antineutrinos (over 1.7k)*

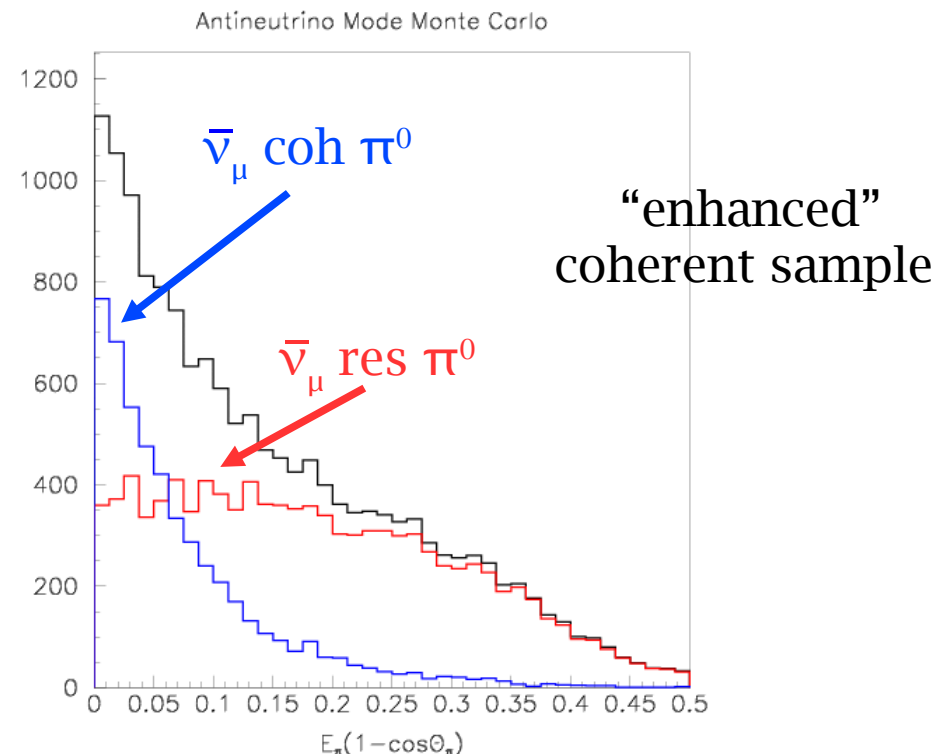
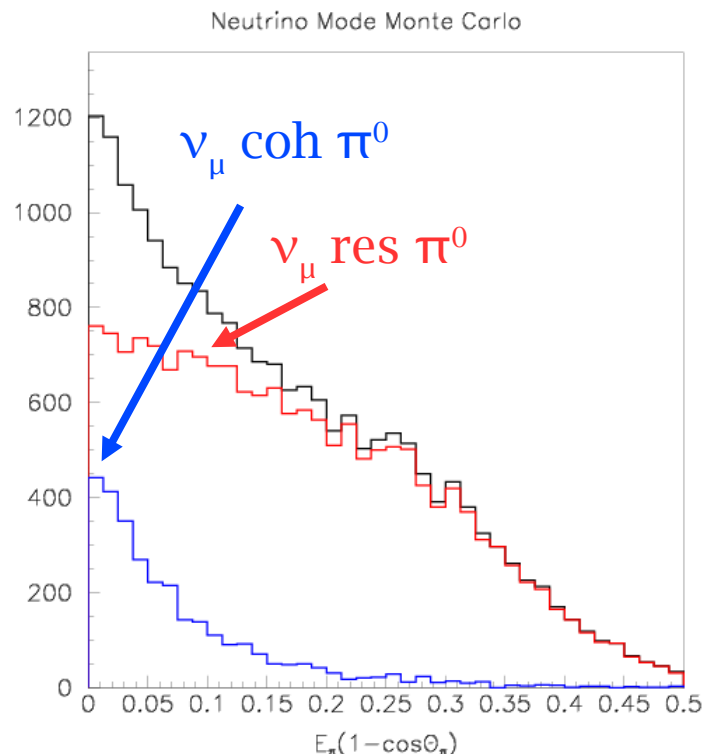
For more info on MiniBooNE,
see C. Polly and T. Katori's talks
Thursday morning



**additional POT being collected in ν mode; collecting more POT in $\bar{\nu}$ mode soon*

Coherent NC π^0 's in ν vs. $\bar{\nu}$ Running

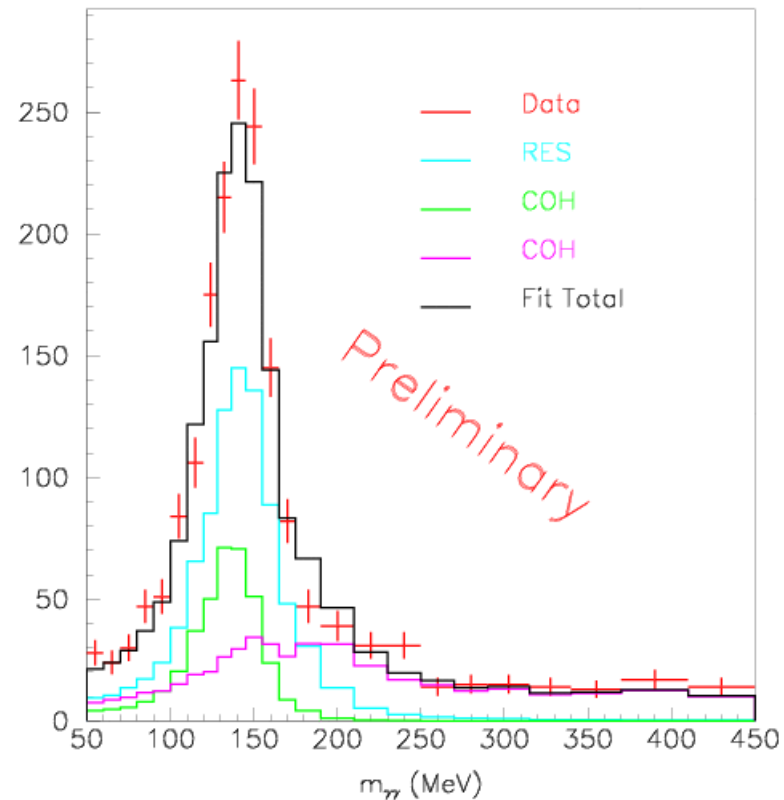
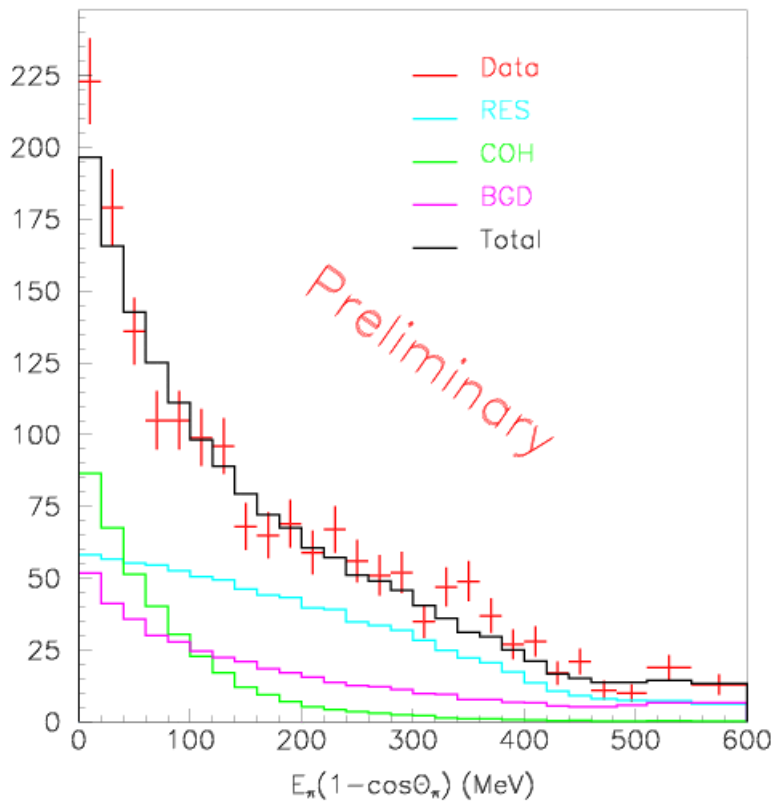
- Useful to study coherent NC π^0 's in terms of the pion mass and energy-weighted angular distribution



Generated π^0 angular distribution for NC ν (left) and $\bar{\nu}$ (right) scattering.

Preliminary Nubar Coherent Fit Results

- MiniBooNE clearly sees evidence for coherent NC π^0 production in both neutrino and antineutrino modes at a rate that is $\sim 1.5\times$ lower than the R-S model prediction, the most widely used model in ν expts
- Preliminary antineutrino mode fit results are shown below



Conclusions

- MiniBooNE has amassed the world's largest samples of NC π^0 events in interactions with ~ 1 GeV (anti)neutrinos and sees strong evidence for coherent production in both modes, where the search in antineutrino mode is the first of its kind at low energy (< 2 GeV)