

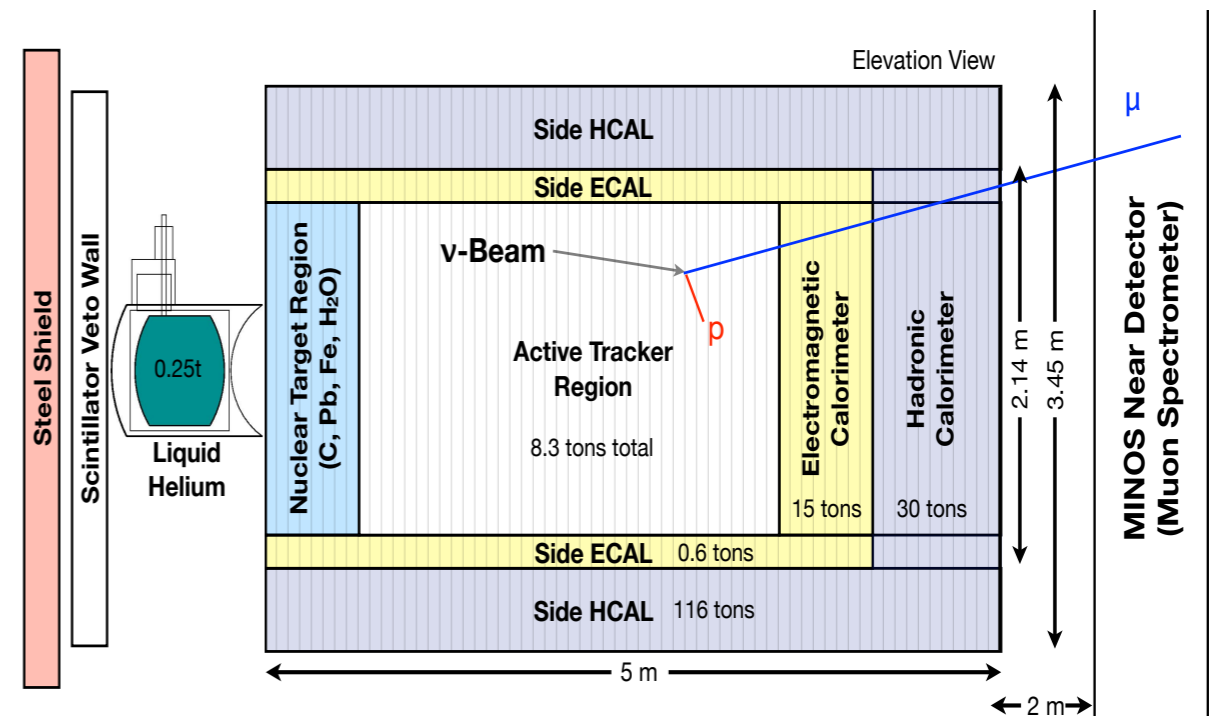


# MINER $\nu$ A

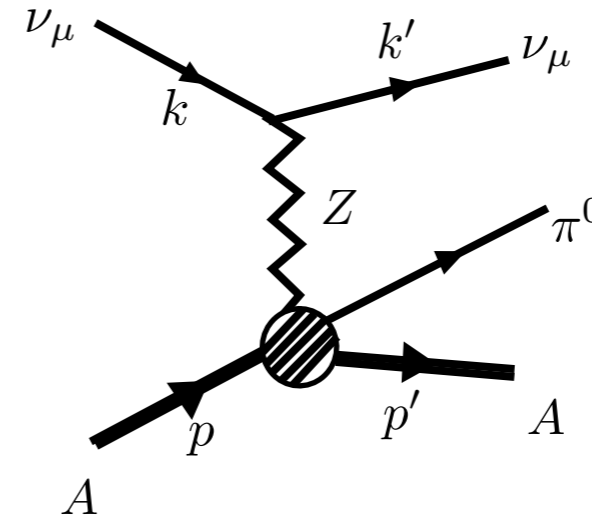
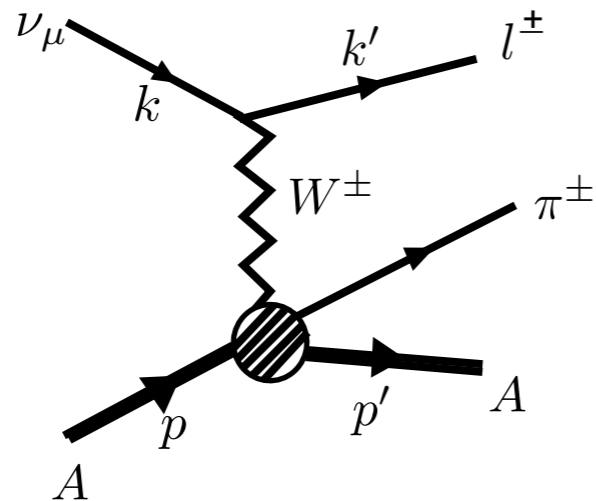
## Coherent Pion Production by Neutrinos

# MINERvA is a dedicated neutrino cross section experiment

- MINERvA makes use of the NuMI beam at Fermilab.
- Single detector with multiple targets (He, C, H<sub>2</sub>O, Fe and Pb) allows study of nuclear effects and A-dependence in neutrino interactions.
- Compact, fully-active detector design provides excellent detail in complex final states.
- MINERvA can provide an important input to future neutrino oscillation experiments.



# Coherent Pion Production by Neutrinos



- Coherent production implies that the nucleus does not break up or alter its quantum numbers during the process.
- Coherent interactions have a great practical application to neutrino experiments because NC coherent pion production provide one of the key background to the  $\nu_e$  appearance measurement.
- Measurements have been made for CC, however the latest measurements could not find evidence at the very lowest energies. NC coherent has only been estimated from the sum of signal plus background.

# Models

## PCAC

(Partially Conserved Axial vector Current)

Rein-Sehgal.

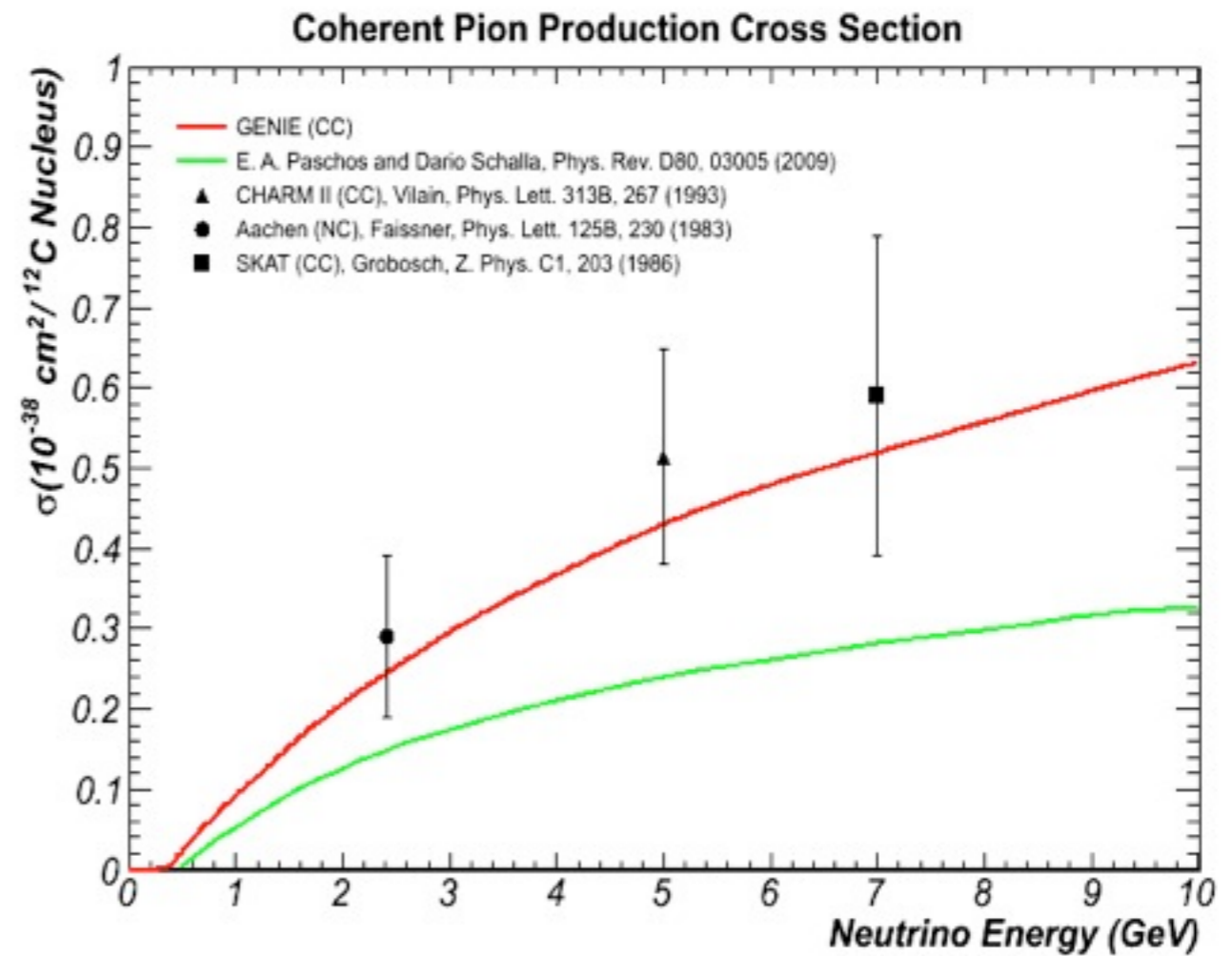
Berger-Sehgal.

Paschos-Schalla.

## Microscopic

Alvares-Ruso et al.

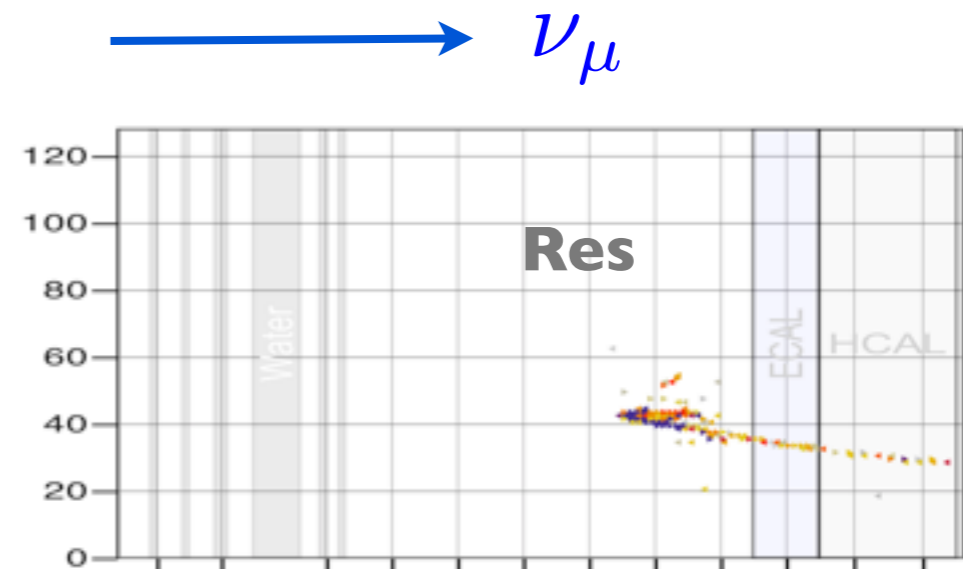
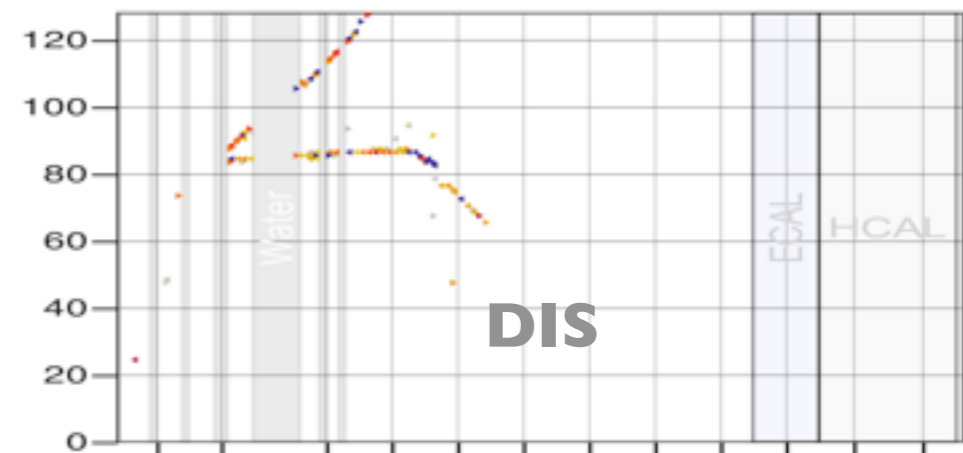
Hernandez et al.



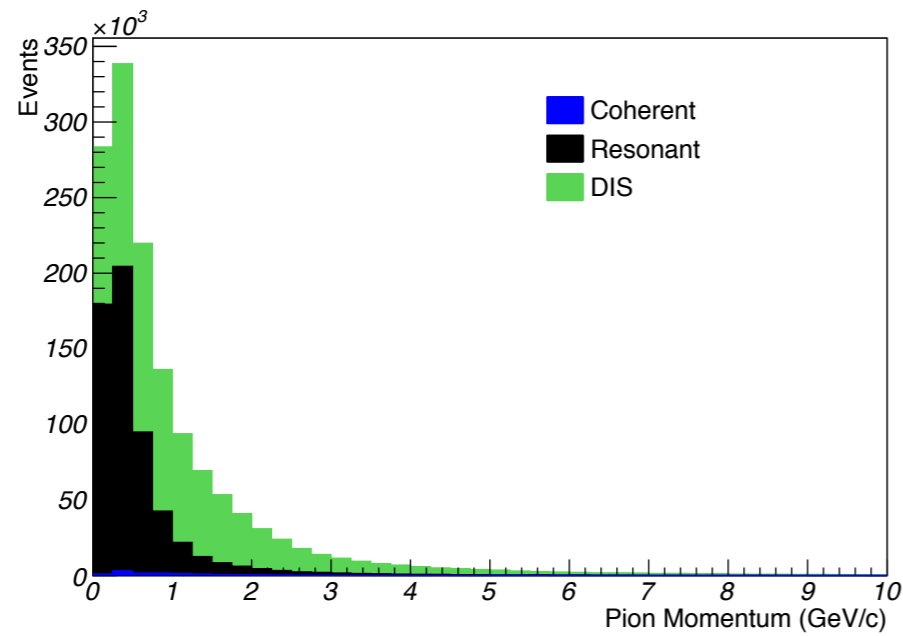
# Hunting Coherent Events

- The cross section is low.
- The backgrounds are large.
  - Pion production, resonances and Deep Inelastic Scattering.
  - Quasi-elastic (QE) due to FSI.
- We can apply topological and kinematics cuts.
  - Two tracks (pion+muon).
  - Pion and muon must go forward.
  - Pion momentum greater than 600 MeV/c.
  - $|t|^2 < 0.2 \text{ (GeV/c)}^2$ .

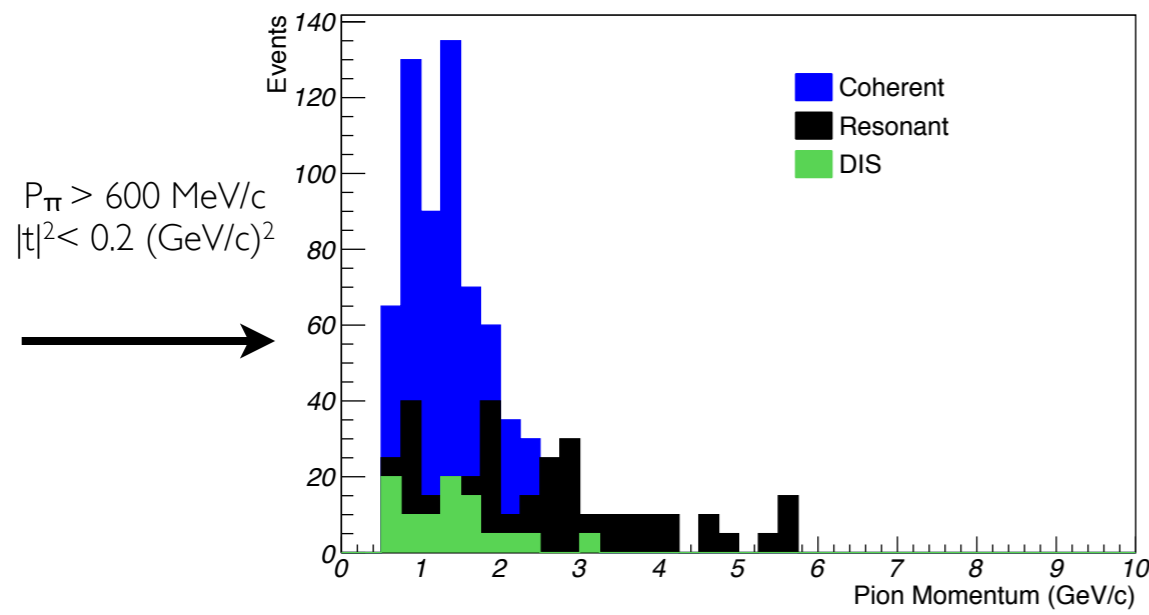
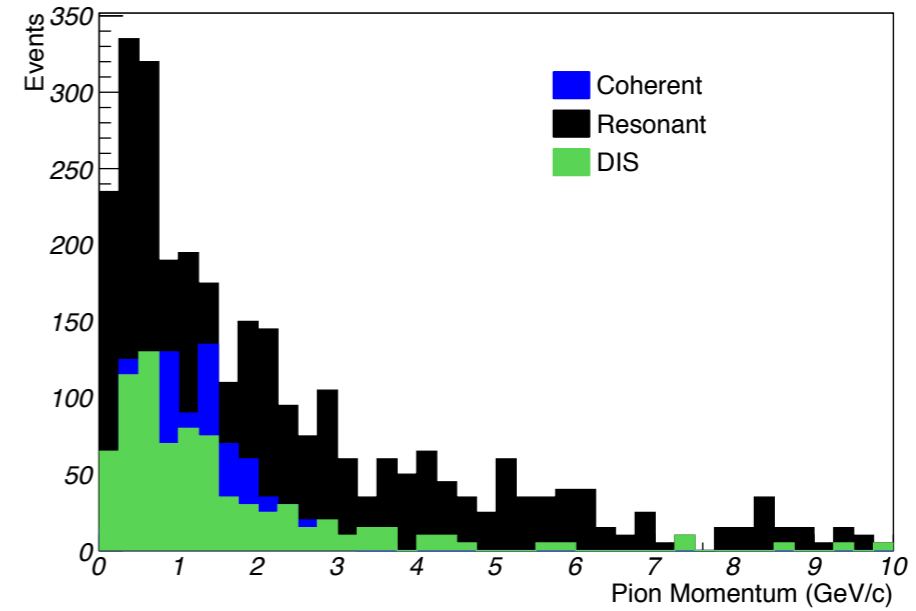
## MC events



# Hunting Coherent Events



$\mu$  and  $\pi$  must go forward  
 $E_\nu < 4$  GeV



	Signal	Background (Res)	Background (DIS)
Generated	13315	597160	1419125
Cut I	810	3080	815
Cut II	650	325	95

\*

\* Expected event rate in LE 1E20 P.O.T

GENIE definition of DIS

Background = any event with at least one pion

# Outlook

- MINERvA's nuclear targets allow the first measurement of the A-dependence of coherent pion cross section across a wide A range in one single detector.
- With better tracking capabilities, angle resolution, PID and high statistics, MINERvA allows a precision measurement of the coherent pion production cross section.

