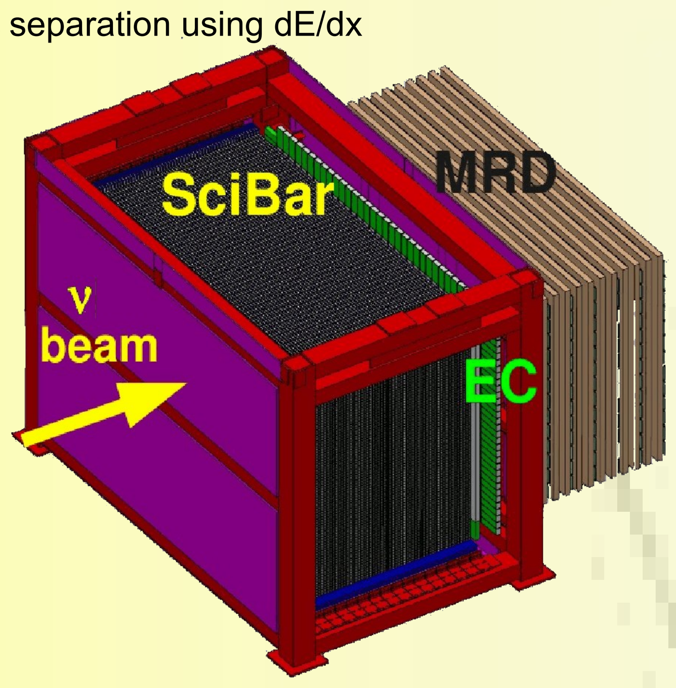
CC-Neutral Pion Production @ SciBooNE

J. Catala Perez (IFIC/U. Valencia)

SciBooNE is a muon neutrino scattering experiment. Its goal is to precisely measure neutrino/anti-neutrino cross sections in the energy region around 1 GeV with high statistics. The current status of the Charged-Current Neutral Pion production analysis is presented in this poster.

Charged Current π^0 is an important contribution to inelastic events at low energies. Its limited knowledge affects the spectrum measurement in ν_μ disappearance searches.

- **SciBar detector:**
  - 14,336 scintillator bars (15 tons)
  - Detect all charged particles
  - p/π separation using dE/dx

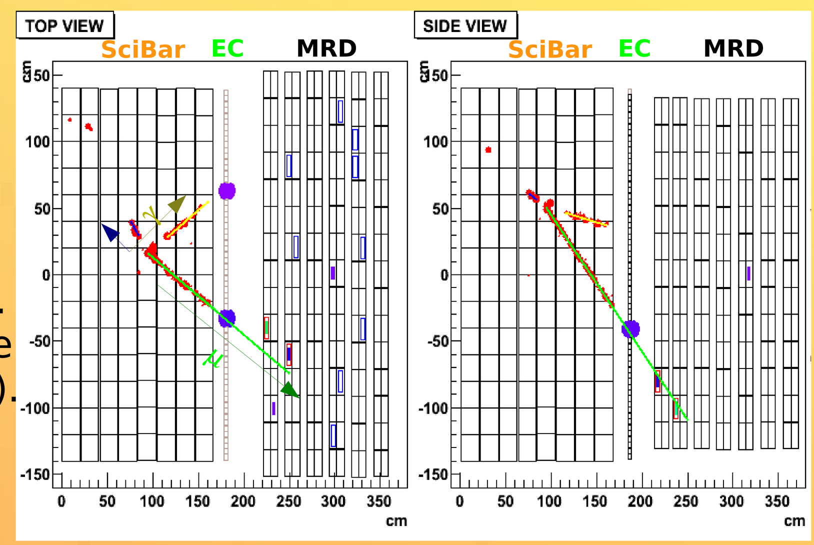


- **Electron Catcher:**
  - Spaghetti calorimeter
  - 2 planes (11 X_0)
  - Identify π^0 and ν_e
- **MRD detector:**
  - 12 steel plates 5 cm thick + scintillator planes.
  - Measure muon momentum with range up to 1.2 GeV/c

Charged Current π^0 (CC-π^0):

Muon neutrino interacting with a neutron producing a muon, a proton and a π^0 which decays to two gammas.

CC-π^0 sample selection:

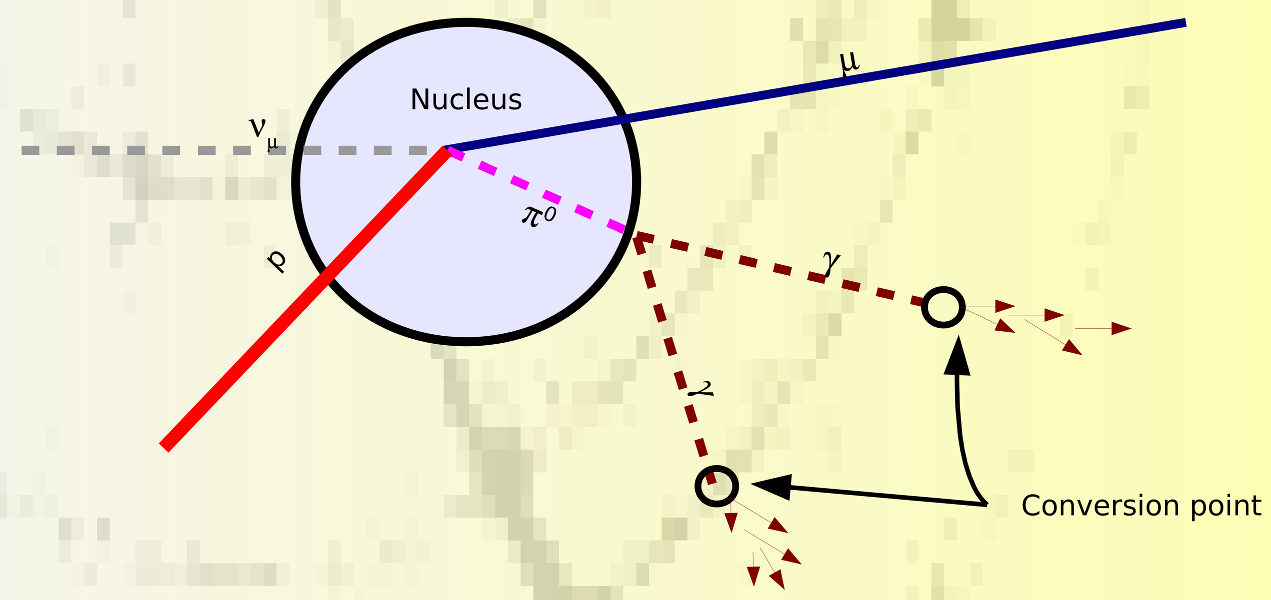


•SciBar-MRD matched track:One SciBar track reaching the MRD (**Charged Current event definition**).
•Only 1 reconstructed muon.
•Veto: removes uncontained SciBar events.
•3 SciBar tracks (1 muon and 2 gamma-like tracks, protons typically not reconstructed).
•Time: removes cosmic rays.
•dE/dx proton rejection from gamma candidates.
•Gamma candidate track minimum distance to vertex set at 9 cm to reject protons and charged pions.

Data reduction summary (NEUT-based MC normalized to CC events)

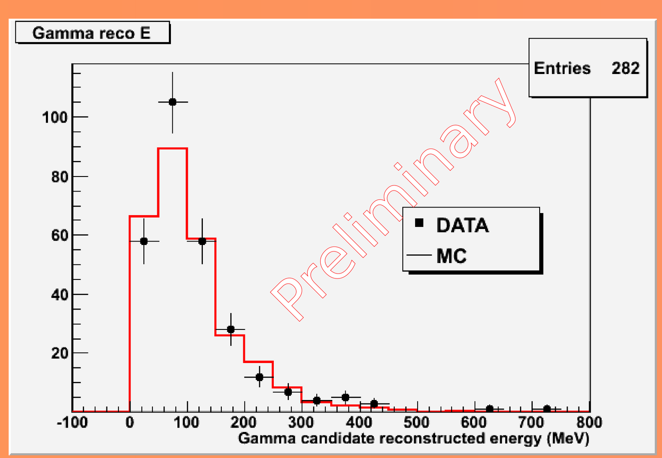
	Data	MC	Purity	Efficiency
MRDMatch sample	30161	30161	6.80%	23.9%
1 muon	28931	27223	6.00%	19.2%
veto	23457	24265	4.00%	11.4%
3 tracks	912	934	23.2%	2.54%
Time cut	846	903	23.8%	2.52%
dE/dx	433	447	27.5%	1.44%
Distance cut	141	137	45.5%	0.73%

Preliminary

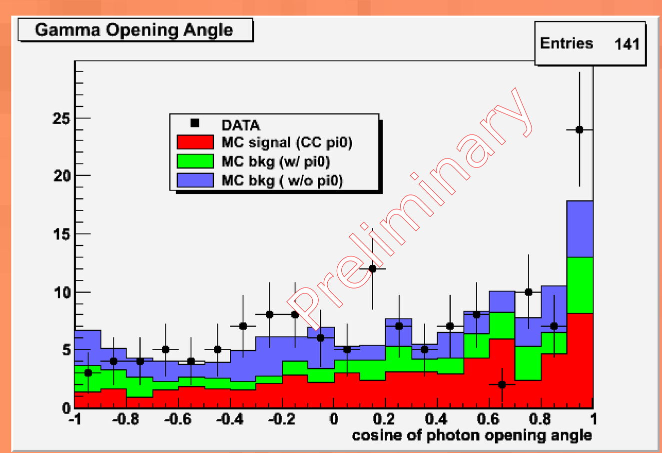


EM shower reconstruction performance:

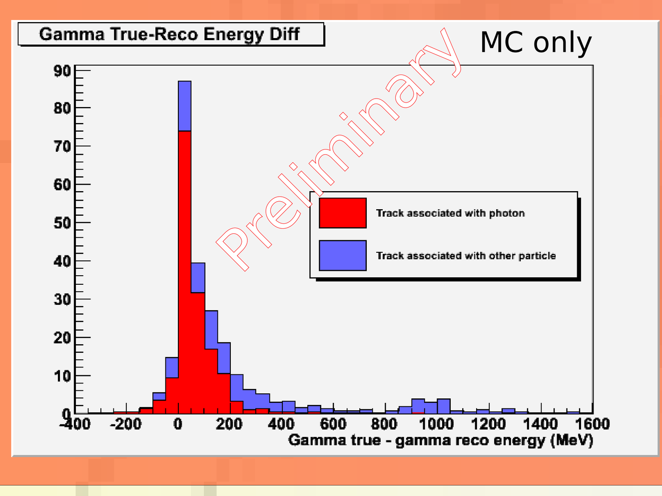
•Tipical gamma energy 50~200 MeV

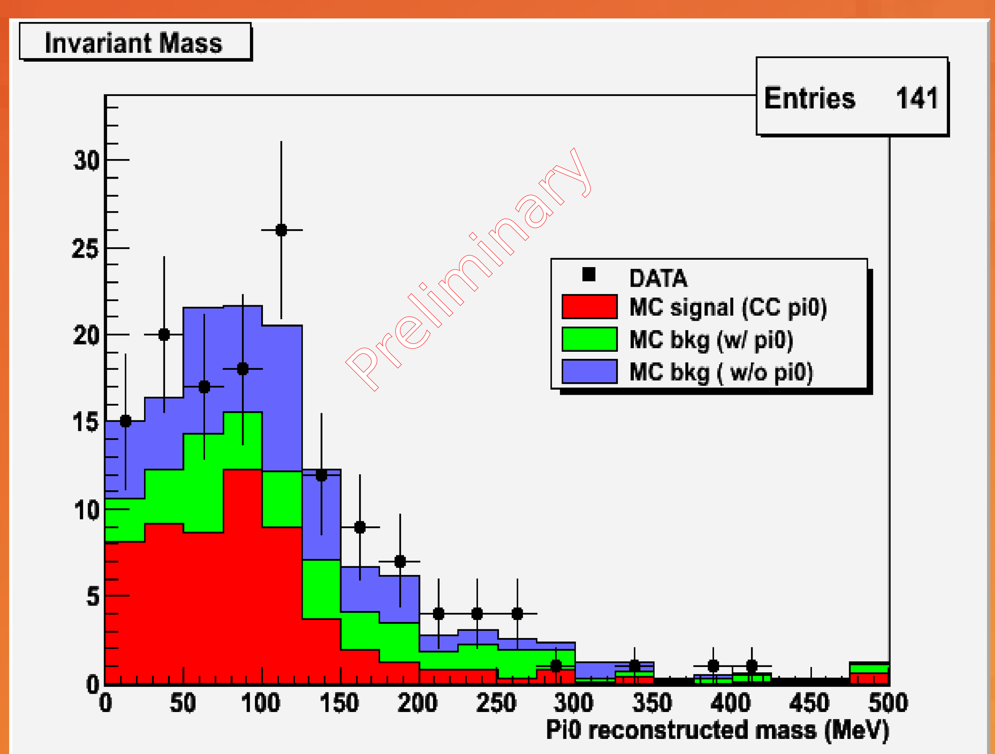


•Gamma candidates produced at all angles.



•For correctly associated gamma candidates, energy reconstructed with 100 MeV resolution and small bias.



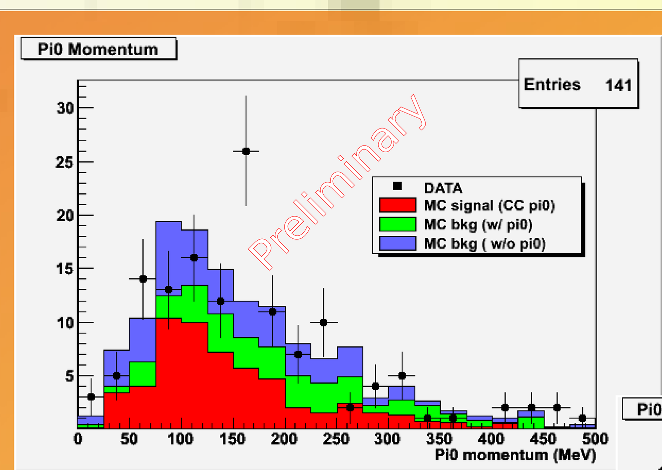


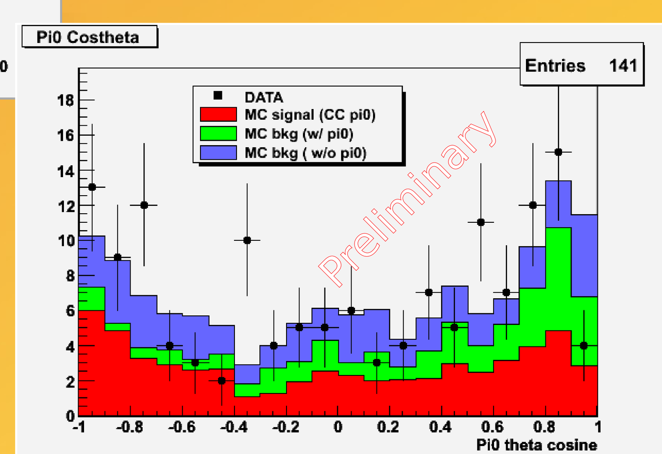
π^0 reconstruction performance:

•Gamma candidate 2 track Invariant Mass:
- Peak close to the π^0 mass visible.

•Able to reconstruct π^0 with momentum in 50~300 MeV/c range, produced at all angles with respect to the beam direction.

•NEUT-based MC simulates π^0 observables well.





Summary

•SciBooNE can reconstruct neutrino-induced π^0 production
•Number of π^0 events, normalized to CC-inclusive, approximately as expected.

Outline

High track multiplicity events are being increased by using a 2 step reconstruction.

First, the default reconstruction is performed using a cellular automaton tracker, defining clusters with hits that have the same Z position, and building tracks by connecting those clusters along the beam direction.

The second step of the reconstruction is to process the unused hits through the same algorithm, but rotated in the transverse direction. This allows us to increase the number of reconstructed tracks, and particularly those that are produced at large angles.

The improvement is about 10% more events with 3 or more reconstructed tracks.

On the other hand, we are working on improving the photon reconstruction performance. EM showers are characterized by disconnected track segments and isolated hits, that can be merged into a single extended track via an energy-flow algorithm.

The electron catcher is not used yet in this analysis. It will increase the number of events by introducing the CC-π^0 events with only one photon converting in SciBar and the other one in the EC.

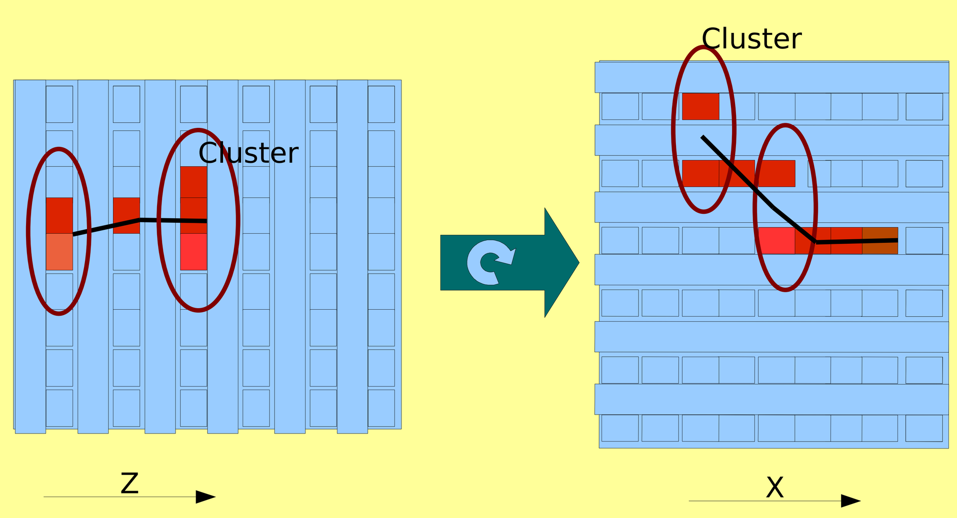


Diagram of high angle track reconstruction algorithm and high angle track display.