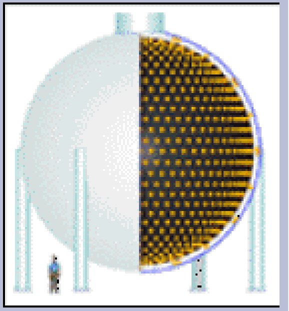
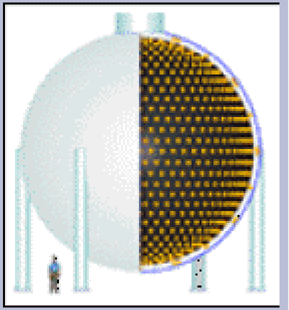


Bari Osmanov
University of Florida

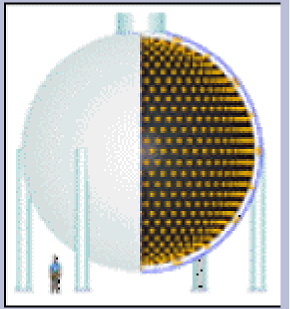
MiniBooNE experiment: recent results and future plans

on behalf of MiniBooNE collaboration

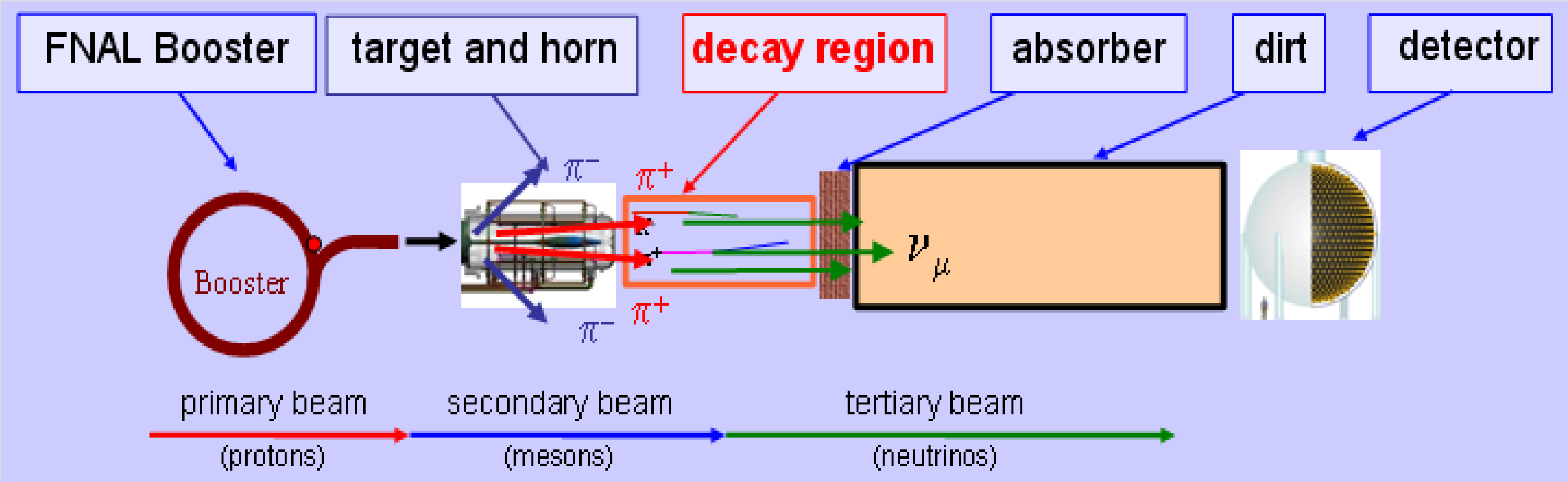
Outline



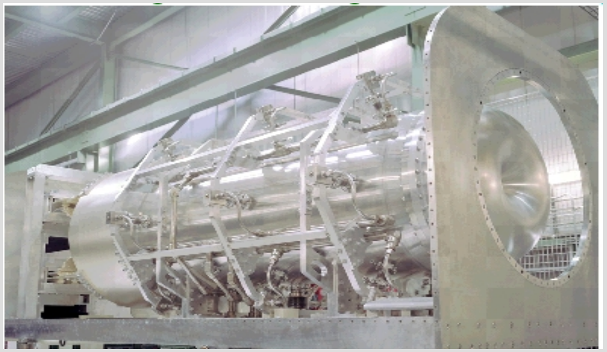
- Booster neutrino beamline
- MiniBooNE detector
- Analysis overview
- Recent results and future plans
- Conclusion

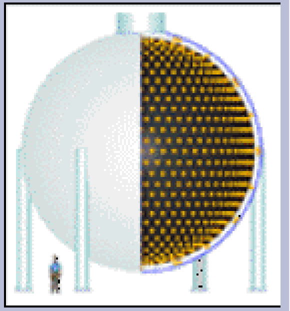


Booster neutrino beamline



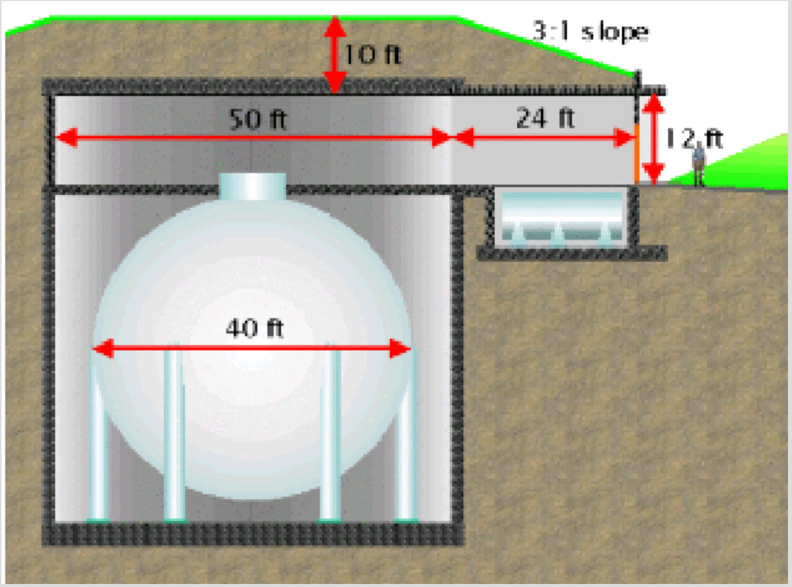
- 8 GeV protons on Be target
- magnetic focusing horn to bend secondary particles towards the detector
- 50-meter decay pipe
- steel absorber to stop undecayed particles
- appr. 500 m of dirt for neutrinos to travel
- mean energy of neutrino beam – 750 MeV

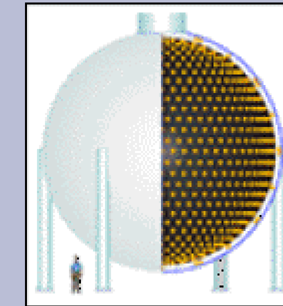




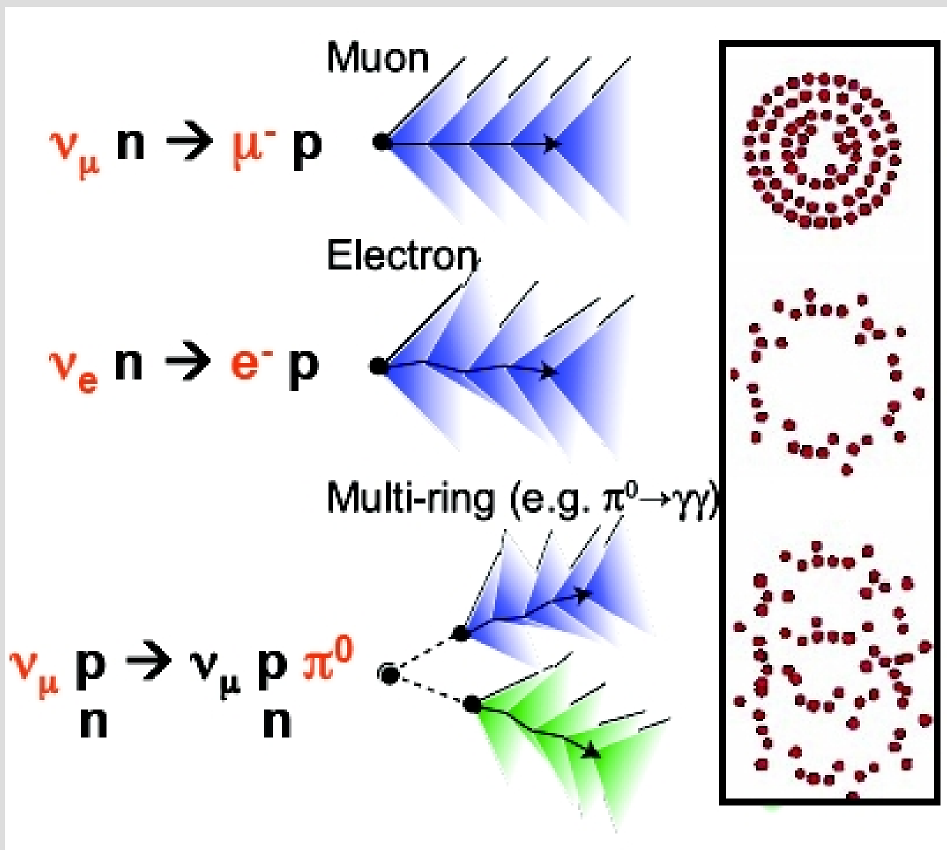
MiniBooNE detector

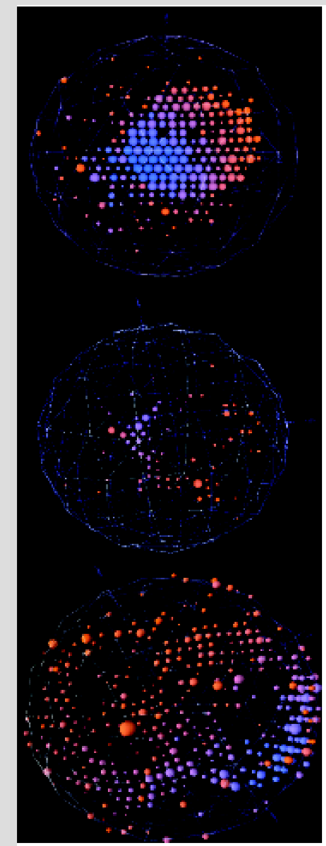
- 541 m from the target
- 3 m of dirt overburden
- 12.2 m diameter sphere
  (10 m diameter “fiducial” region)
- Filled with 800 t of pure mineral oil CH_2 (Fiducial volume: 450 t)
- 1280 8” inner phototubes
  (10% coverage)
- 240 veto phototubes
- Primary detection method – Cherenkov radiation



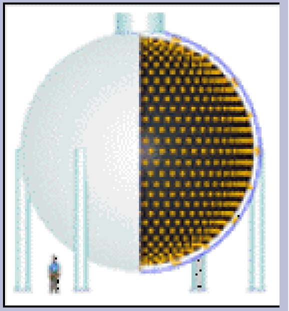


Particle signatures in the detector

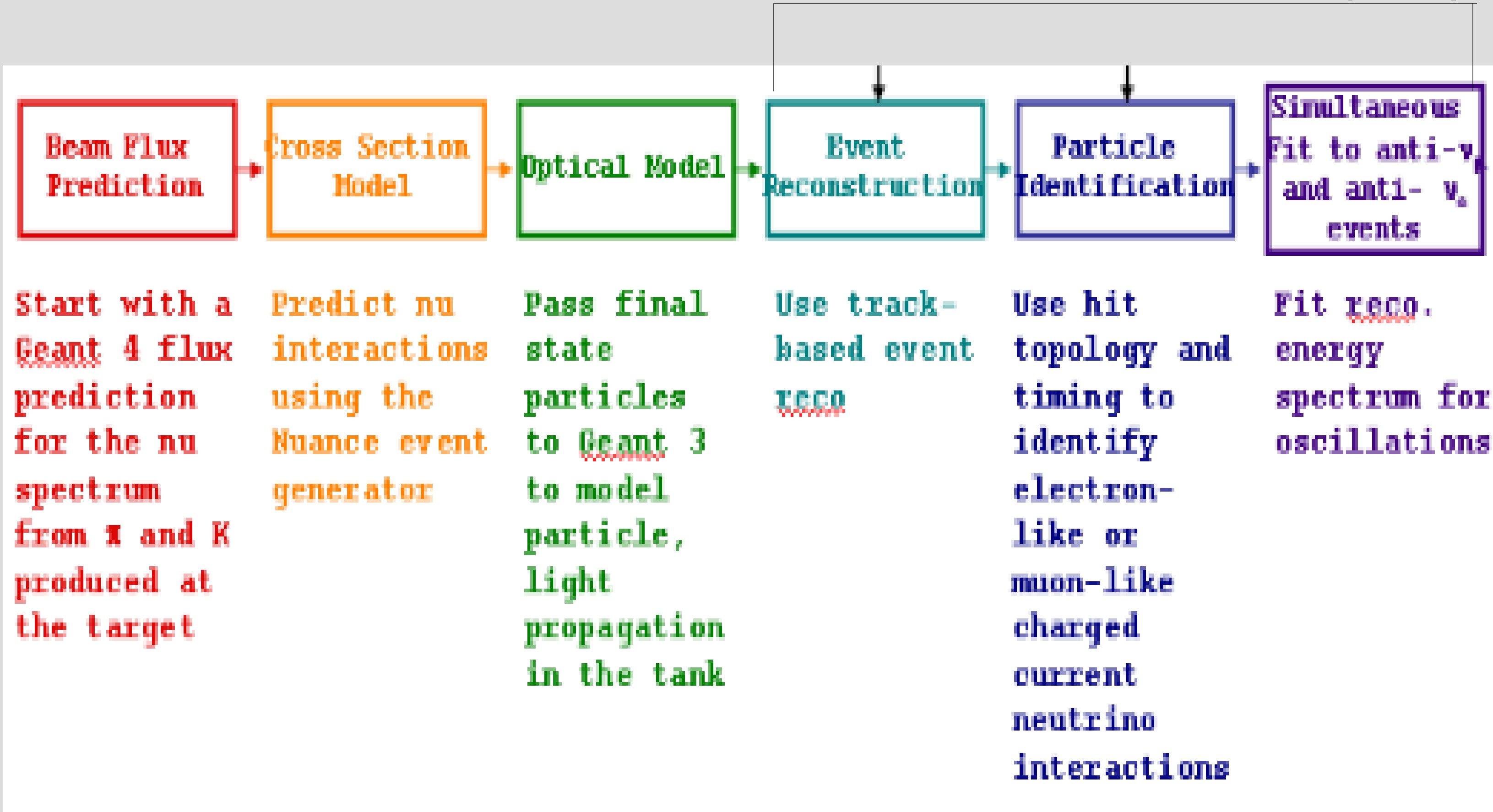




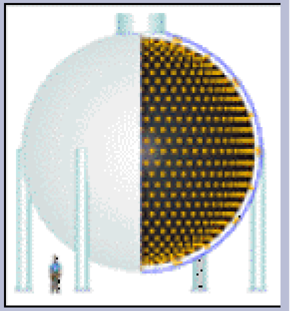
Oscillation analysis overview



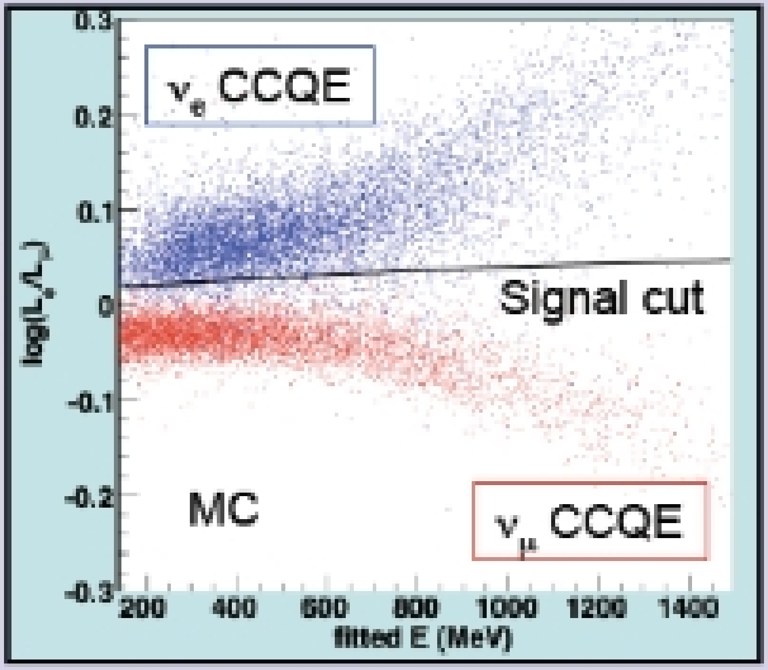
Track-Based Likelihood (TBL)



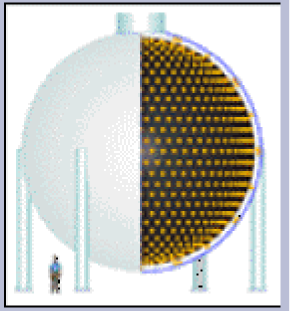
Track-Based Likelihood

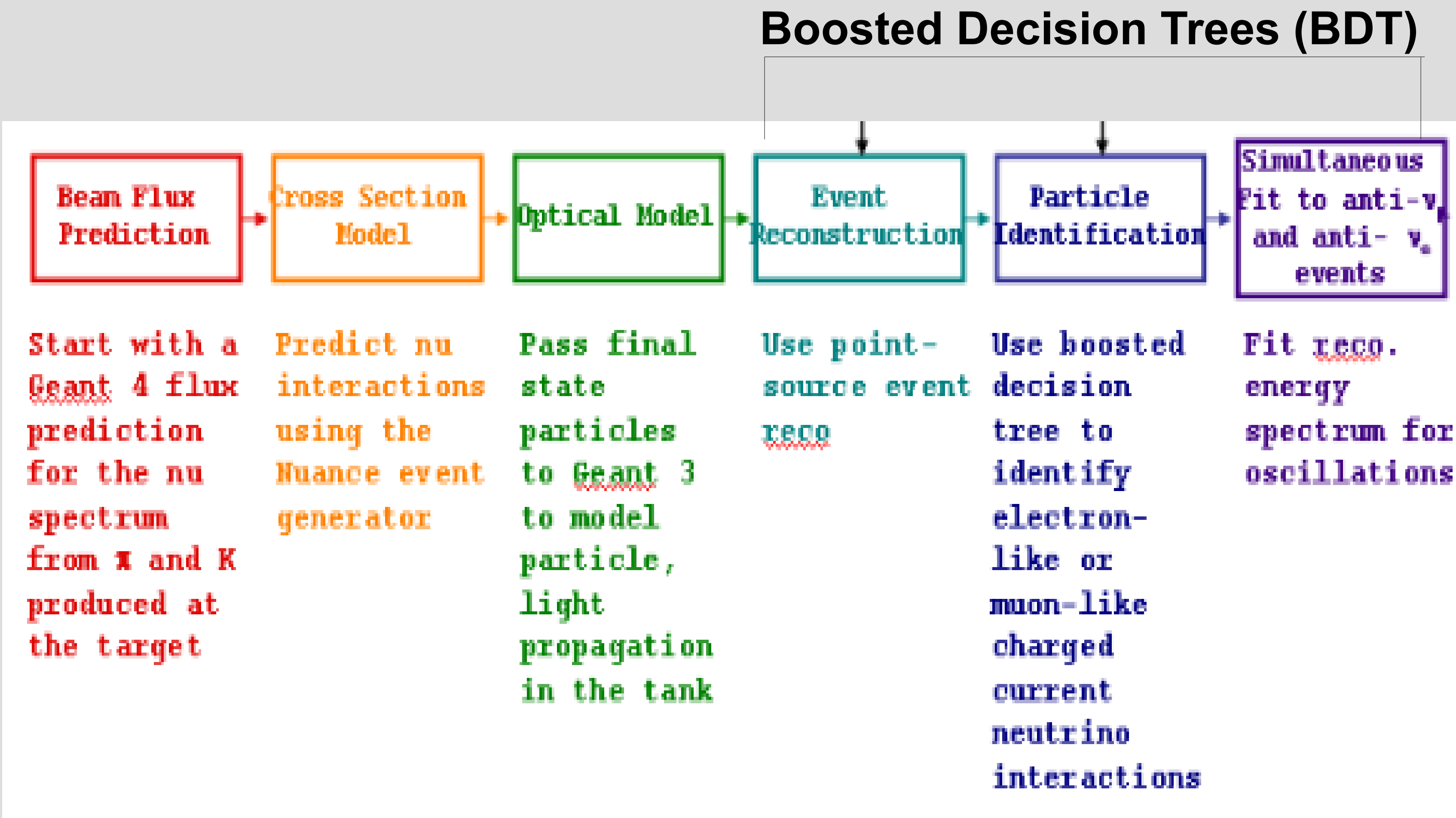


- Fit is done with direct reconstruction of particle tracks
- 7 parameters: t, x, y, z, E, θ, φ
- Event is fit under electron-like and muon-like hypotheses
- Positive (negative) likelihood ratio means electron (muon) track

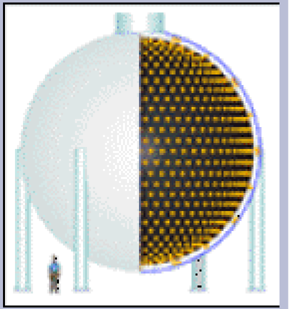


Oscillation analysis overview

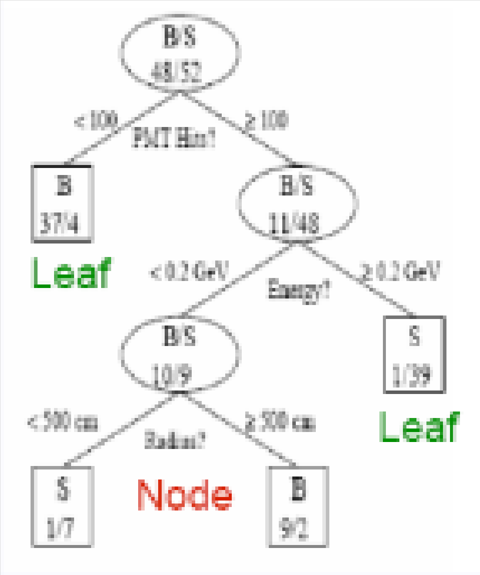




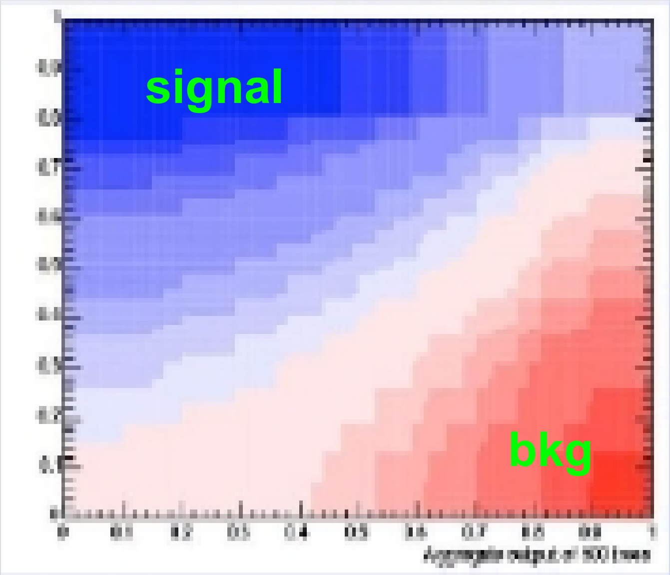
Boosted Decision Trees



- Event reconstruction with point-like model
- Many input variables
- Many weak classifiers (trees) to form strong classifier
- Training sample (MC) is used to teach the algorithm
- The weight of misidentified events is boosted
- For each variable, cuts are made on values with highest “information gain”

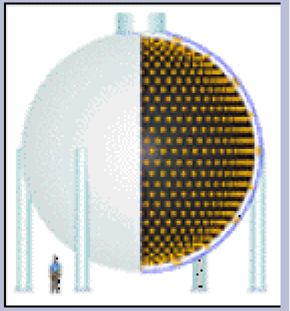


one of many trees

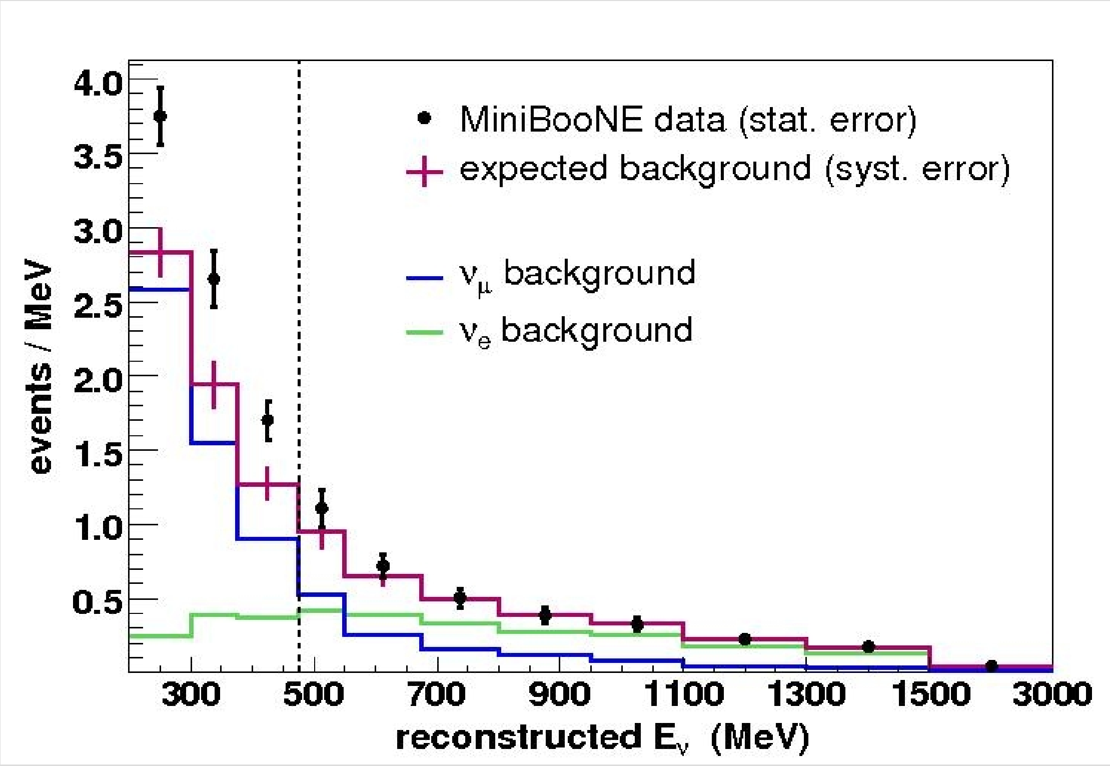


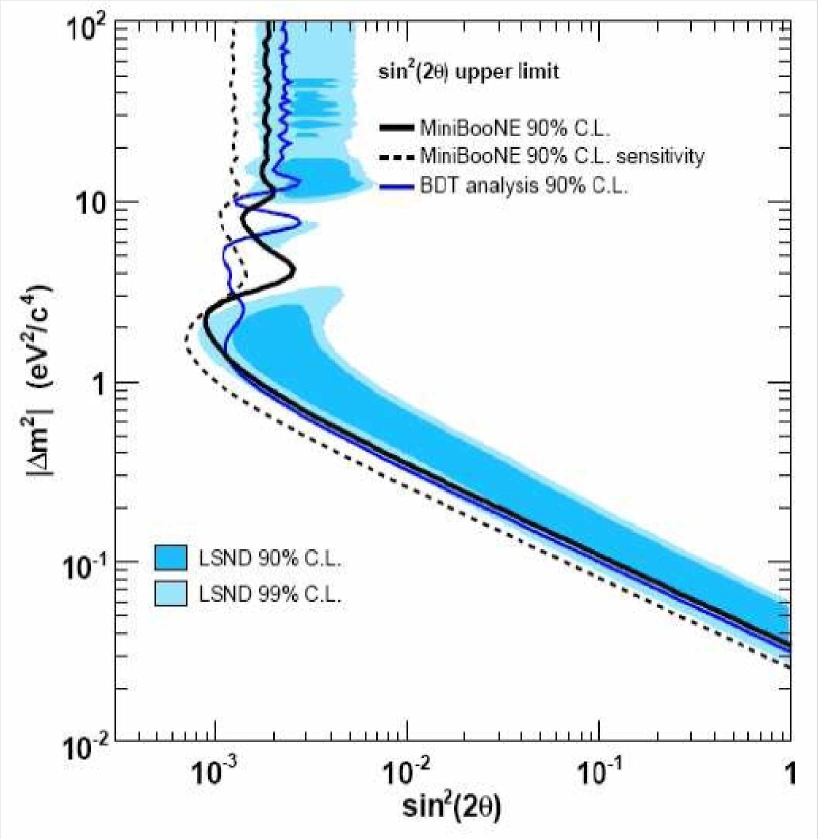
500 trees

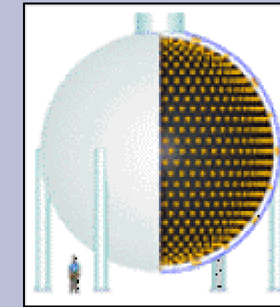
Neutrino mode result (2007)



- Based on 5.58E20 POT
- Ruled out interpretation of LSND signal as oscillations
- Unexplained excess of events in low-energy region



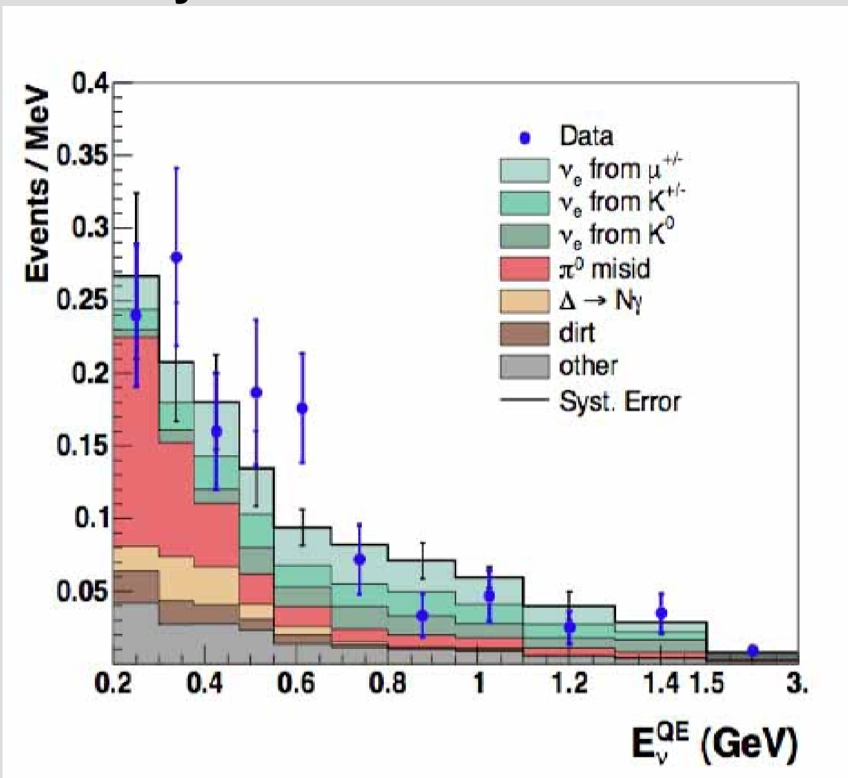


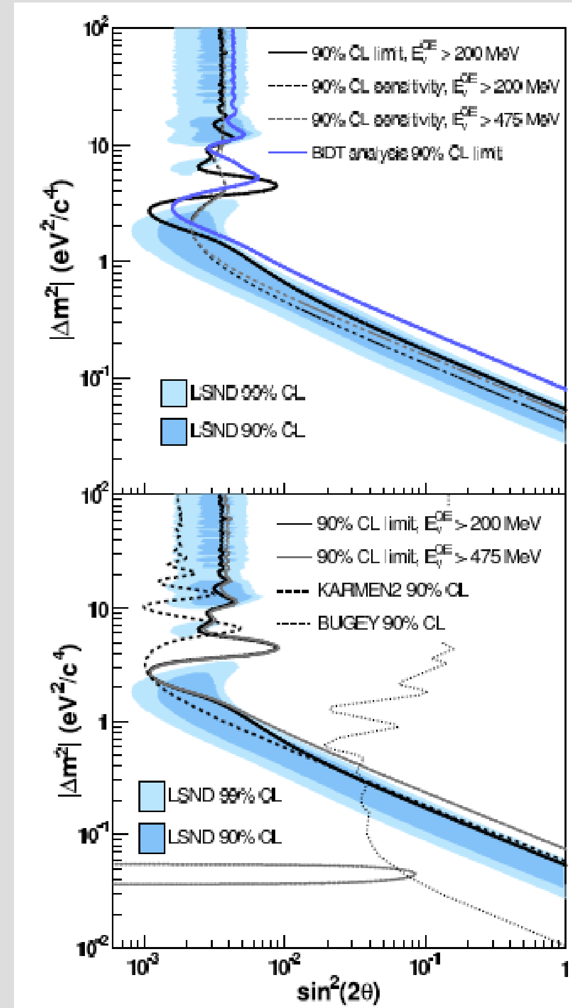


Anti-neutrino mode result (2008/2009)

- Based on 3.386E20 POT (low statistics)
- Similar backgrounds at low energy
- Same analysis chain as in neutrino mode

(G.Karagiorgi)

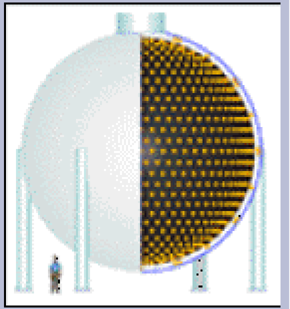




- no low-energy excess
- currently work on combined $\nu - \bar{\nu}$ analysis
- need more stats

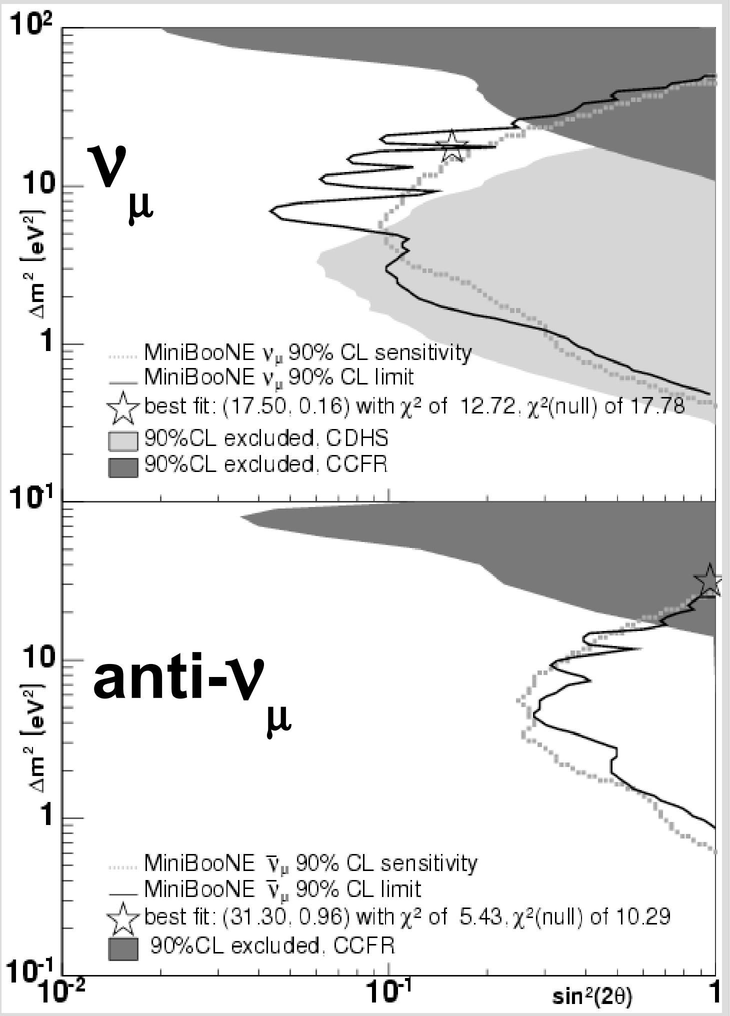
arXiv:0904.1958

Disappearance analysis

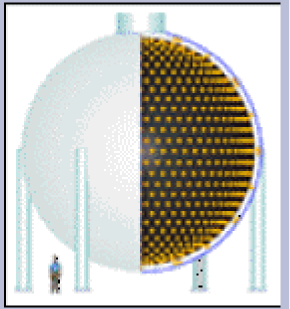


(K.Mahn)

- No antineutrino disappearance at 90%CL
- First antineutrino disappearance measurement between 0.1-10 eV^2



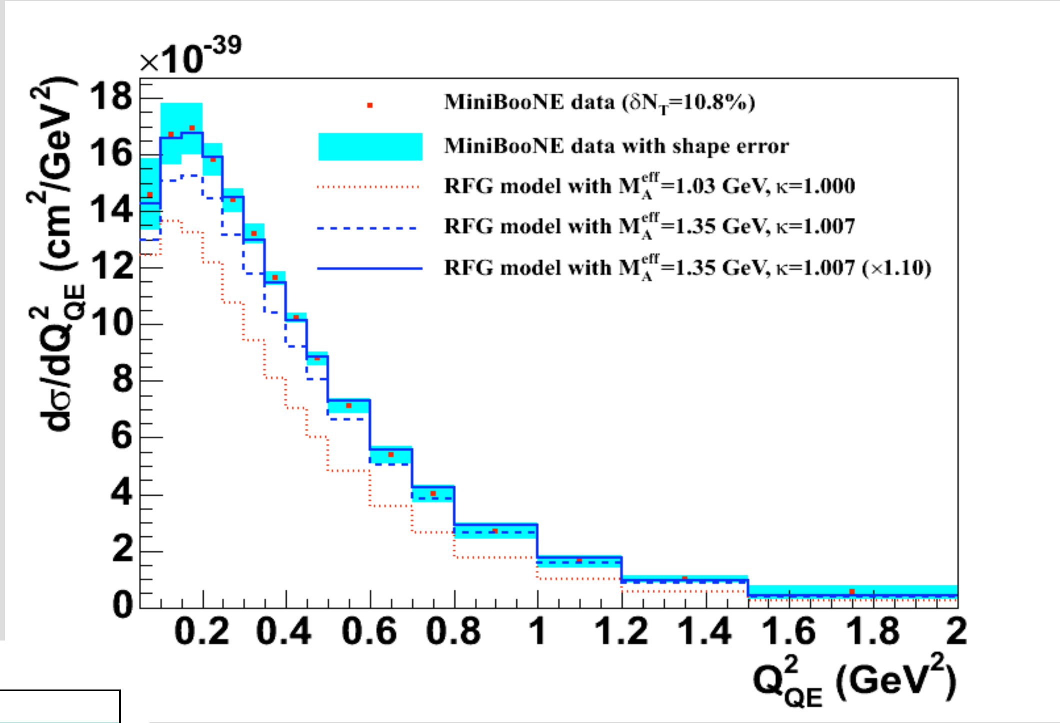
arXiv:0903.2465v1

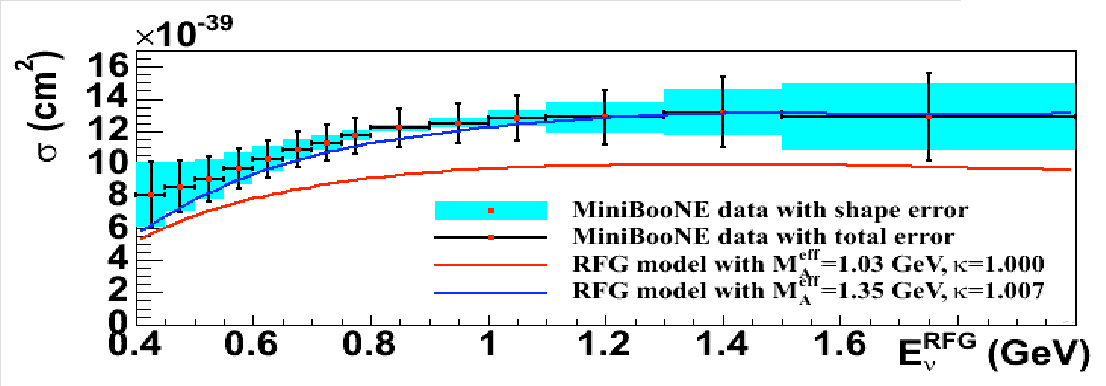


CCQE absolute XS

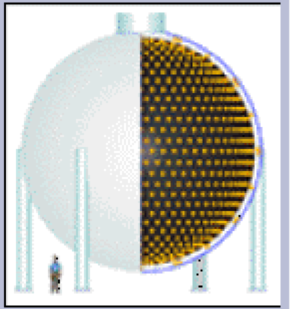
(T.Katori)

- κ – Pauli blocking parameter
- Updated shape fit results in $M_A = 1.35 \pm 0.17$ GeV
- XS is in good agreement with the extracted model



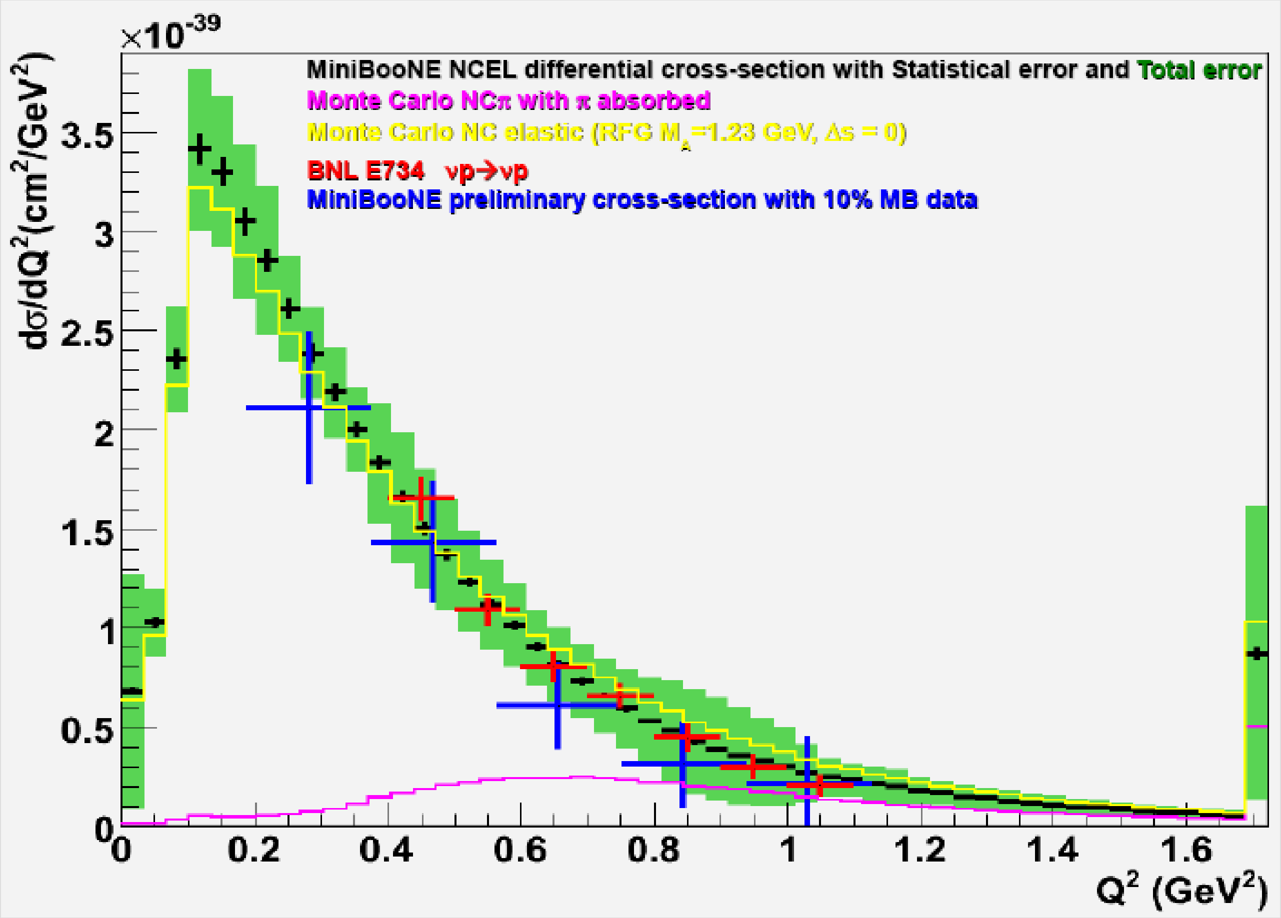


XS: NC Elastic

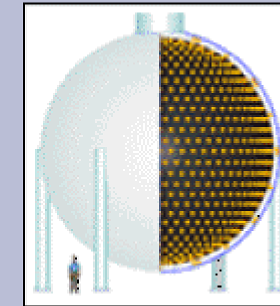


(D.Perevalov)

- Based on 94.5 NC elastic candidates
- First measurement in $Q^2 < 0.4$ GeV^2
- In good agreement with BNL E734 data



XS: NC π^0



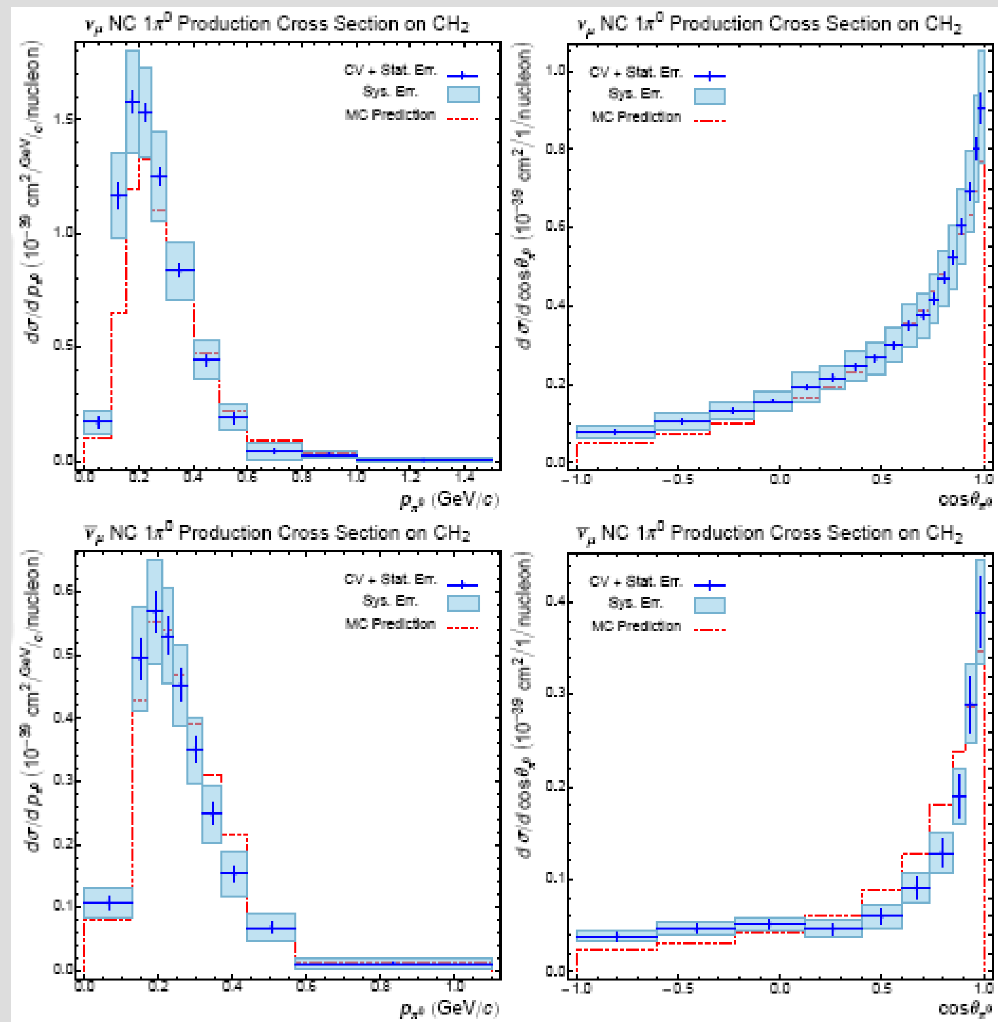
(C.Anderson)

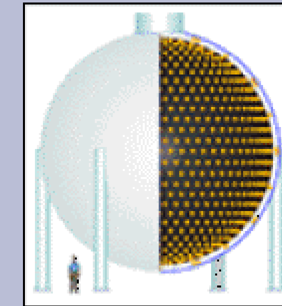
- **First absolute differential XS measurement of NC π^0 production**

- **Total XS:**

$(\nu_\mu)\ \sigma = 4.54 \pm 0.04_{stat} \pm 0.71_{sys} \times 10^{-40}\ \mathrm{cm^2/nucleon}$

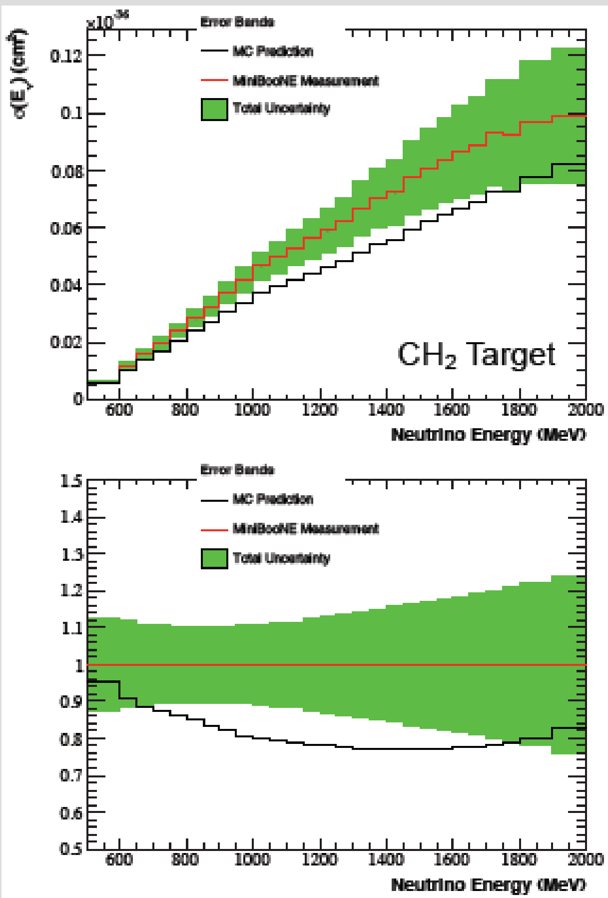
$(\bar{\nu}_\mu)\ \sigma = 1.43 \pm 0.03_{stat} \pm 0.23_{sys} \times 10^{-40}\ \mathrm{cm^2/nucleon}$

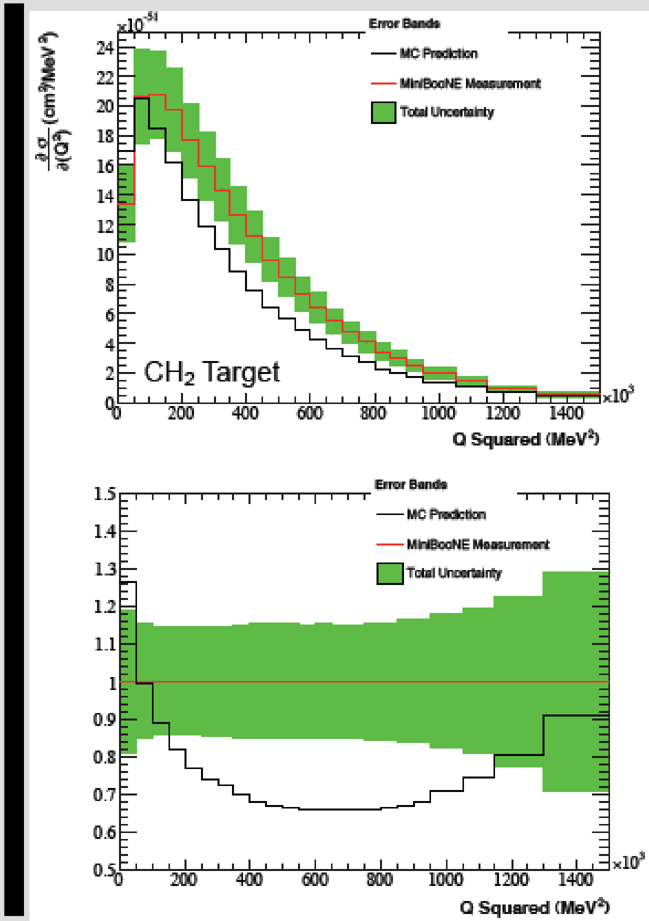


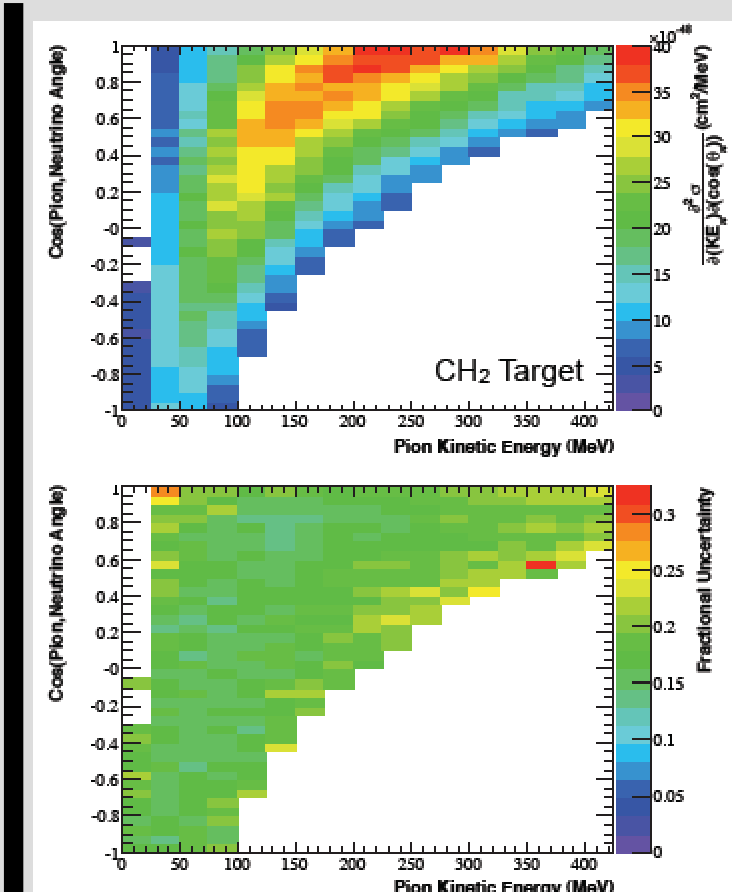


XS: CC π^+

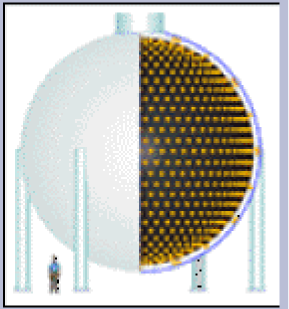
(M.Wilking)







Future plans

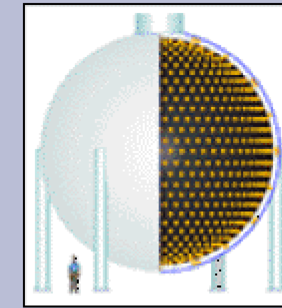


- Collect more anti-neutrino data (approved for a new 5E20 POT run)

- Integration of other data sets (NuMI and SciBooNE)

- MicroBooNE can help to determine the nature of low-energy excess

MiniBooNE collaboration



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Thank you!