Status of the MiniBooNE $\bar{\nu}_\mu \to \bar{\nu}_e$ oscillation analysis

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Outline

- Motivation

- Anti-neutrino beam

- Oscillation analysis

- Sensitivity

- Conclusion

Motivation

- LSND experiment

  – Excess of electron like events (in $\bar{\nu}_\mu$ beam)

- MiniBooNE designed to investigate the LSND signal

  – First result ruled out $\nu_\mu \to \nu_e$ osc.

- Nuebar appearance provides direct check of LSND

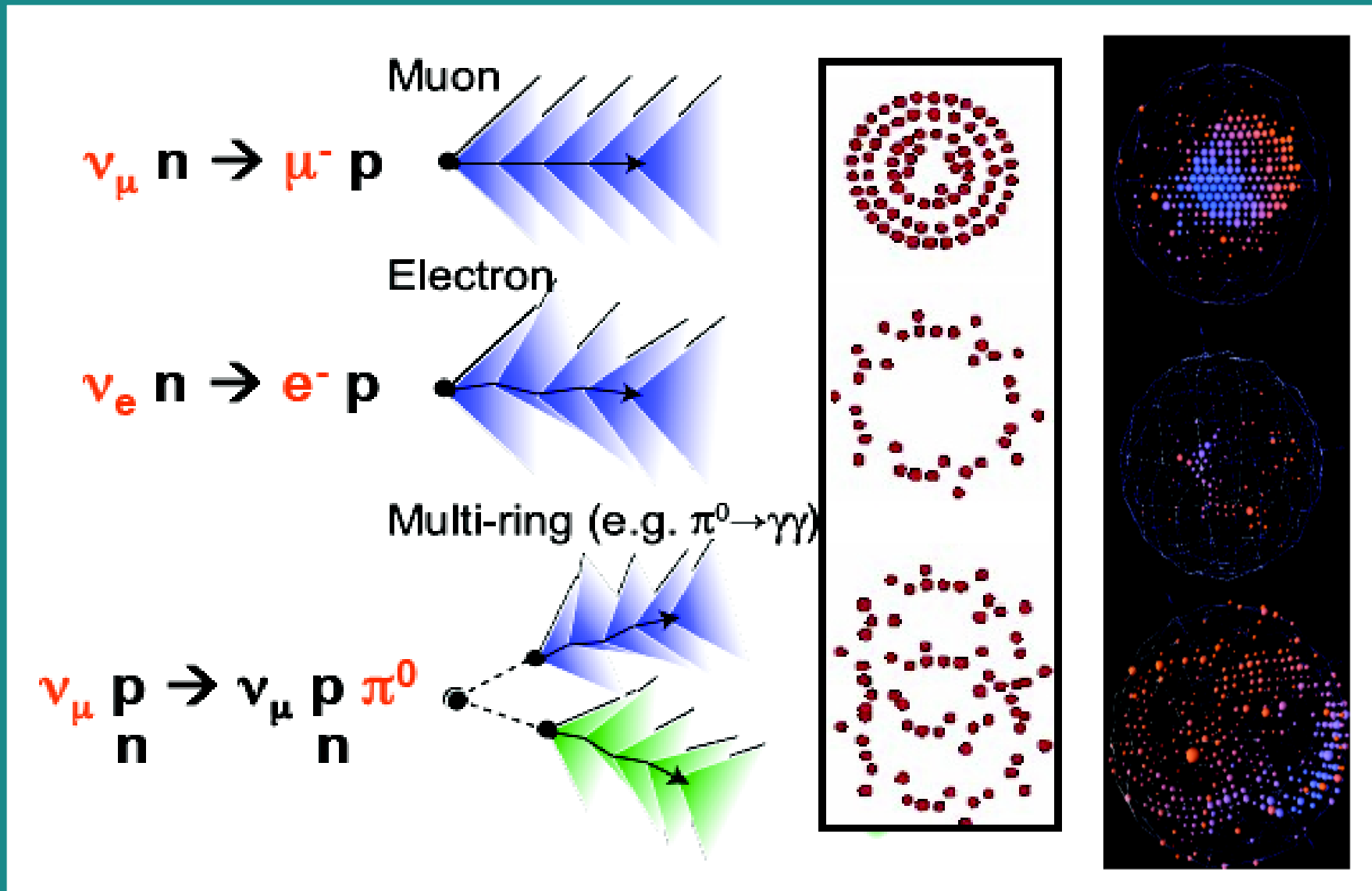- Further insight in low energy excess

LSND data

Antineutrino beam

p

π⁻

μ⁻

ν_μ

π⁺

Decay region
~50m
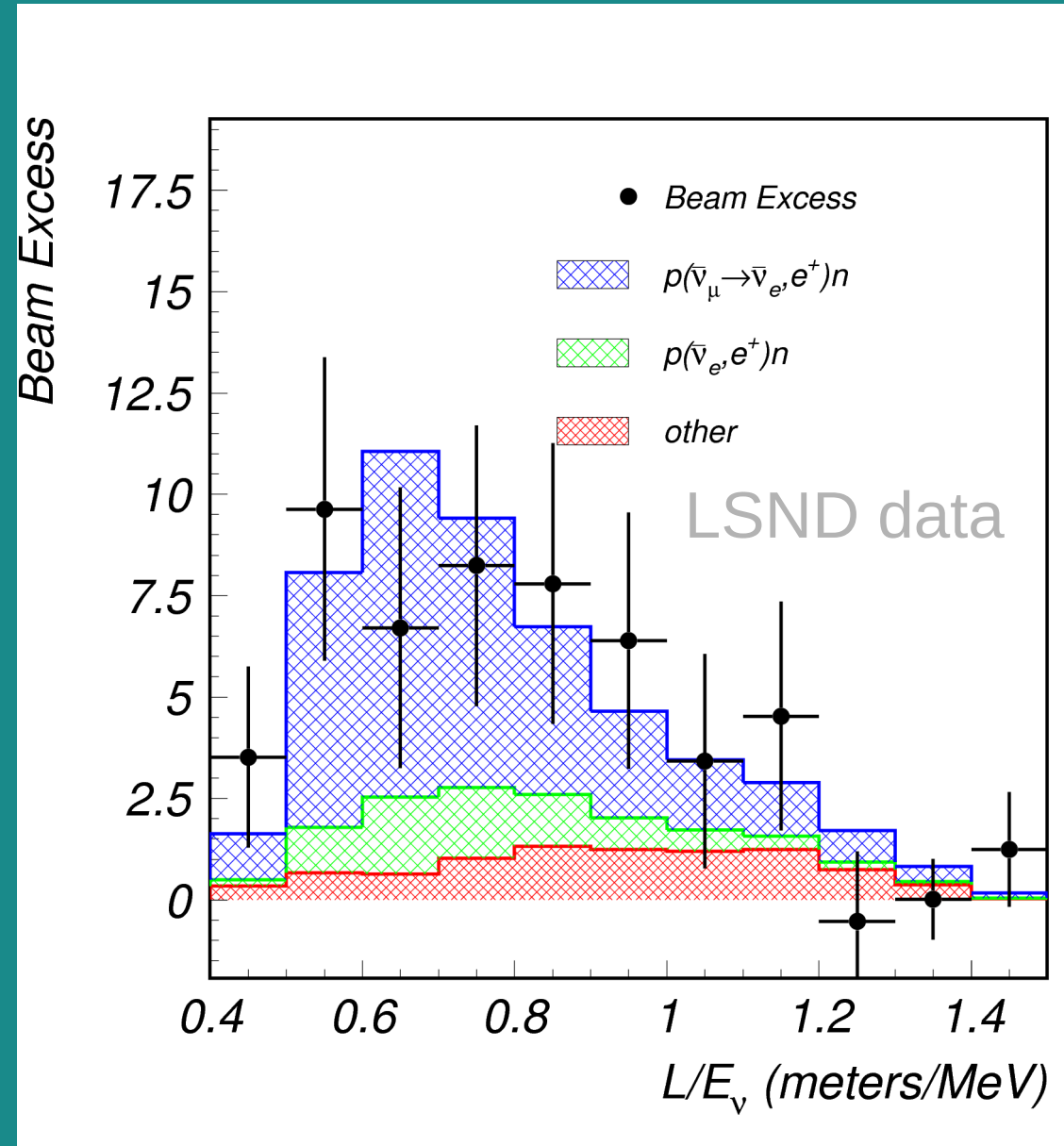
Dirt ~500m
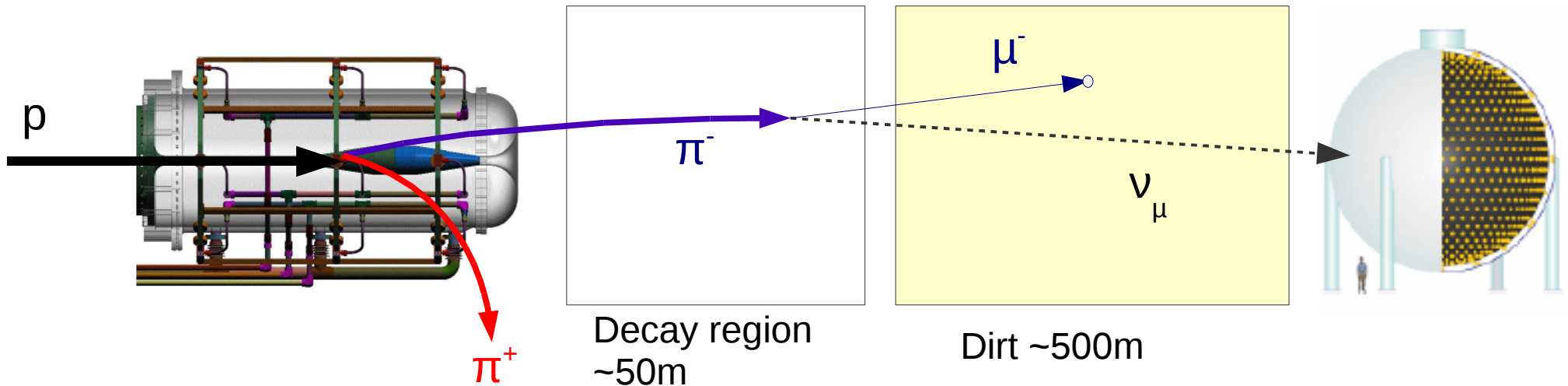
- 8GeV protons
- Reversed horn polarity
  - Focus negative mesons
- Flux: ν_μ(15.7%), $\overline{\nu}_\mu$(83.7), ν_e(0.2%) & $\overline{\nu}_e$(0.4%)
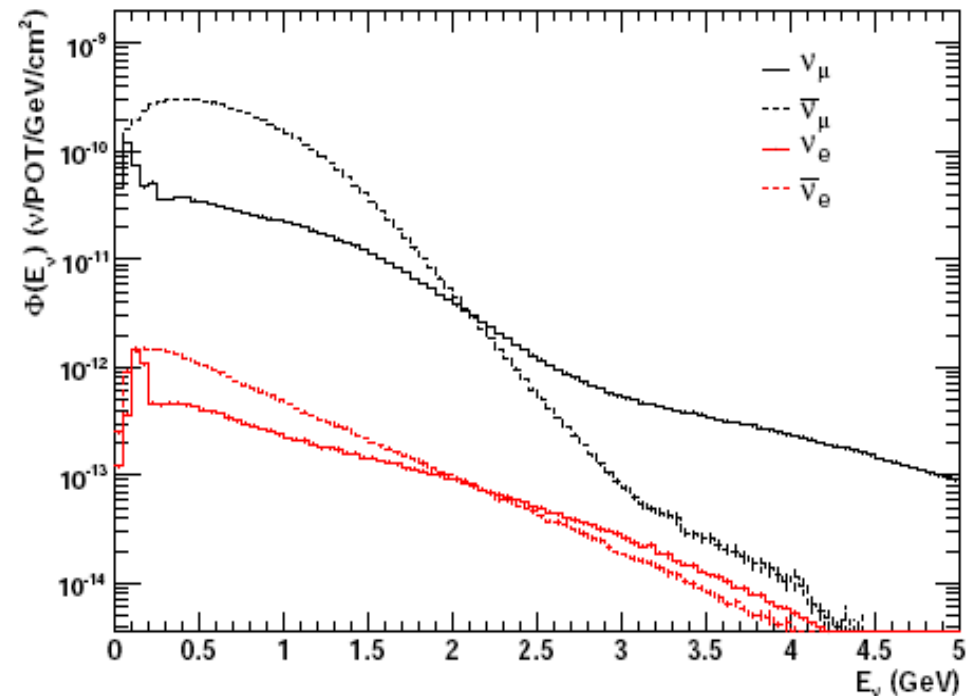
Particle identification

- Use primarily Cherenkov light for particle ID

Event selection

- For first analysis use same particle ID as for neutrino oscillation result

- ID based on ratio of fit likelihoods under different particle hypotheses

- Eliminate dirt events by cutting high radius events that point toward detector center
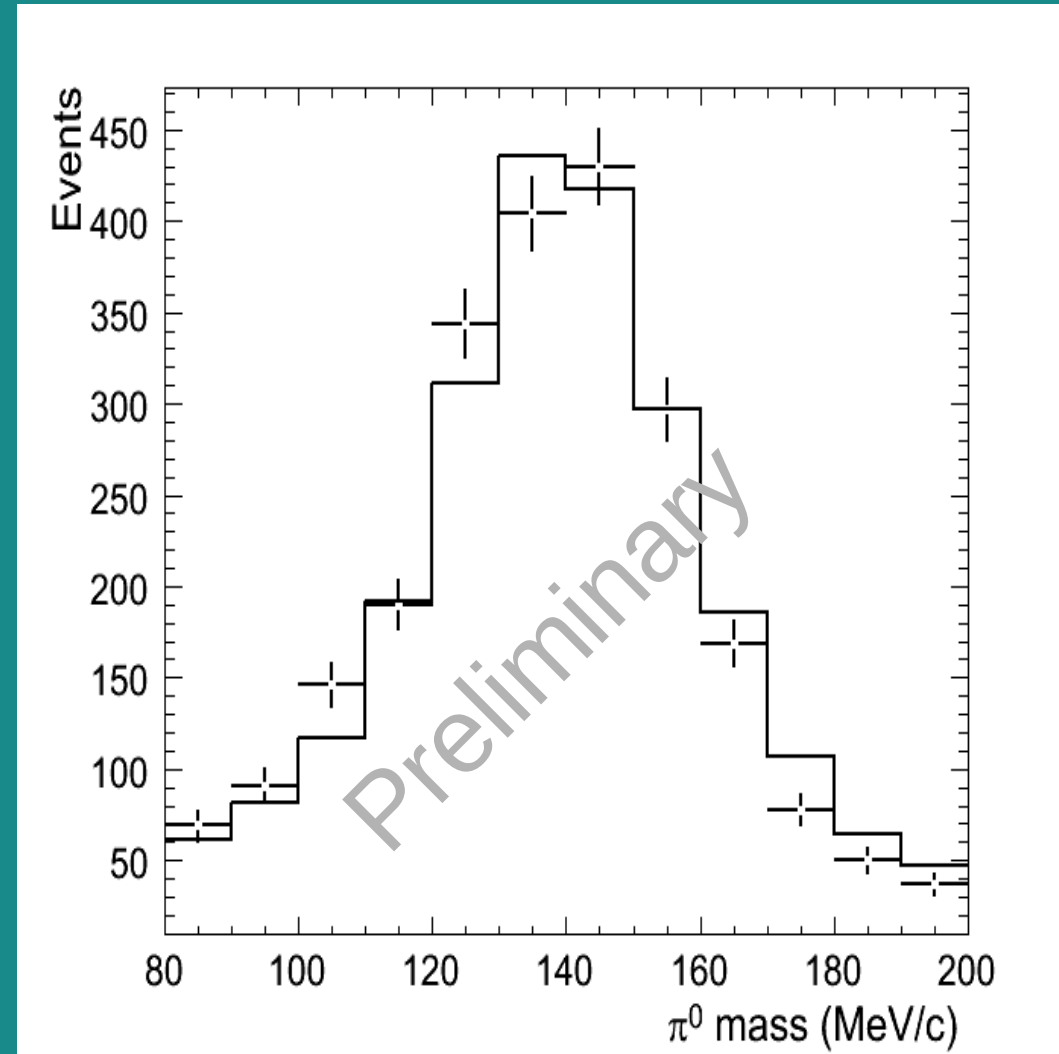
Predicted backgrounds

- Backgrounds similar as in neutrino mod
- Use MB data to constrain backgrounds
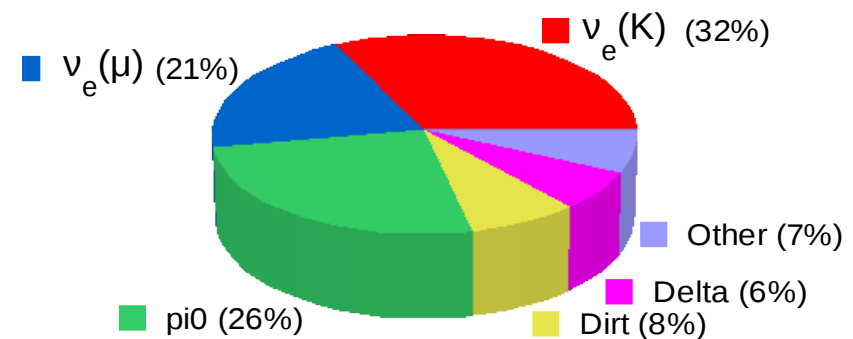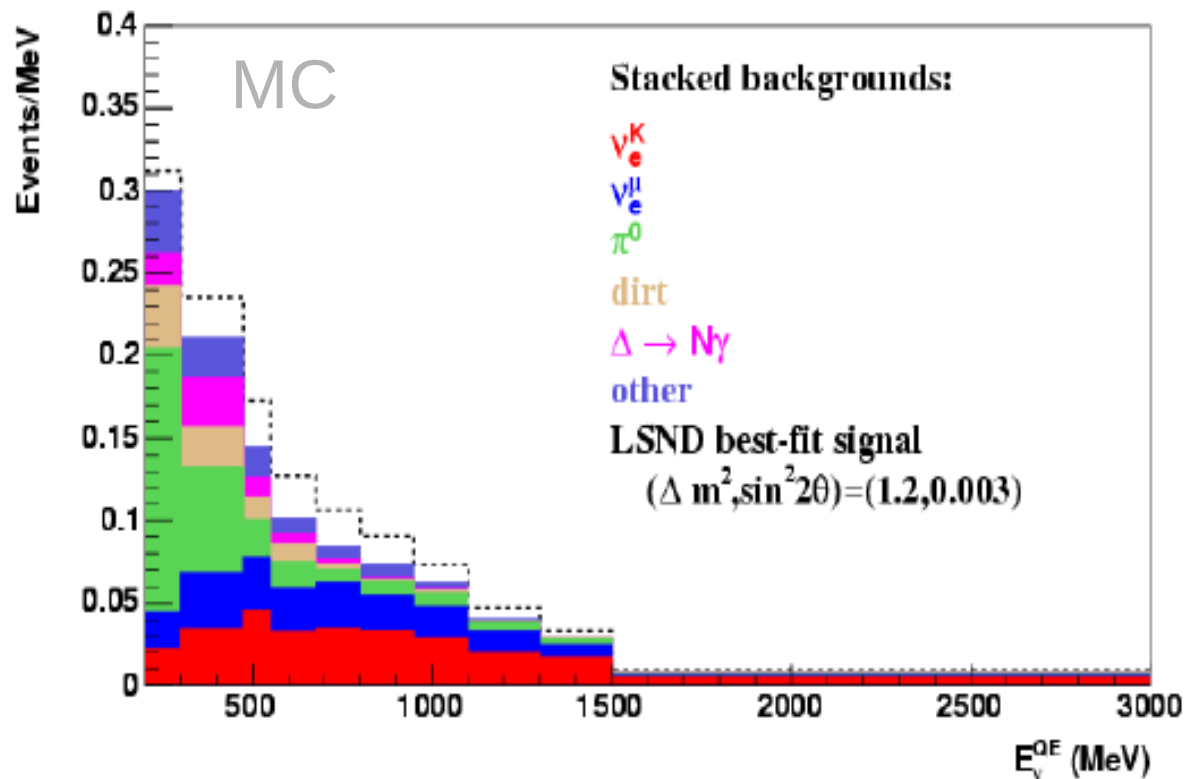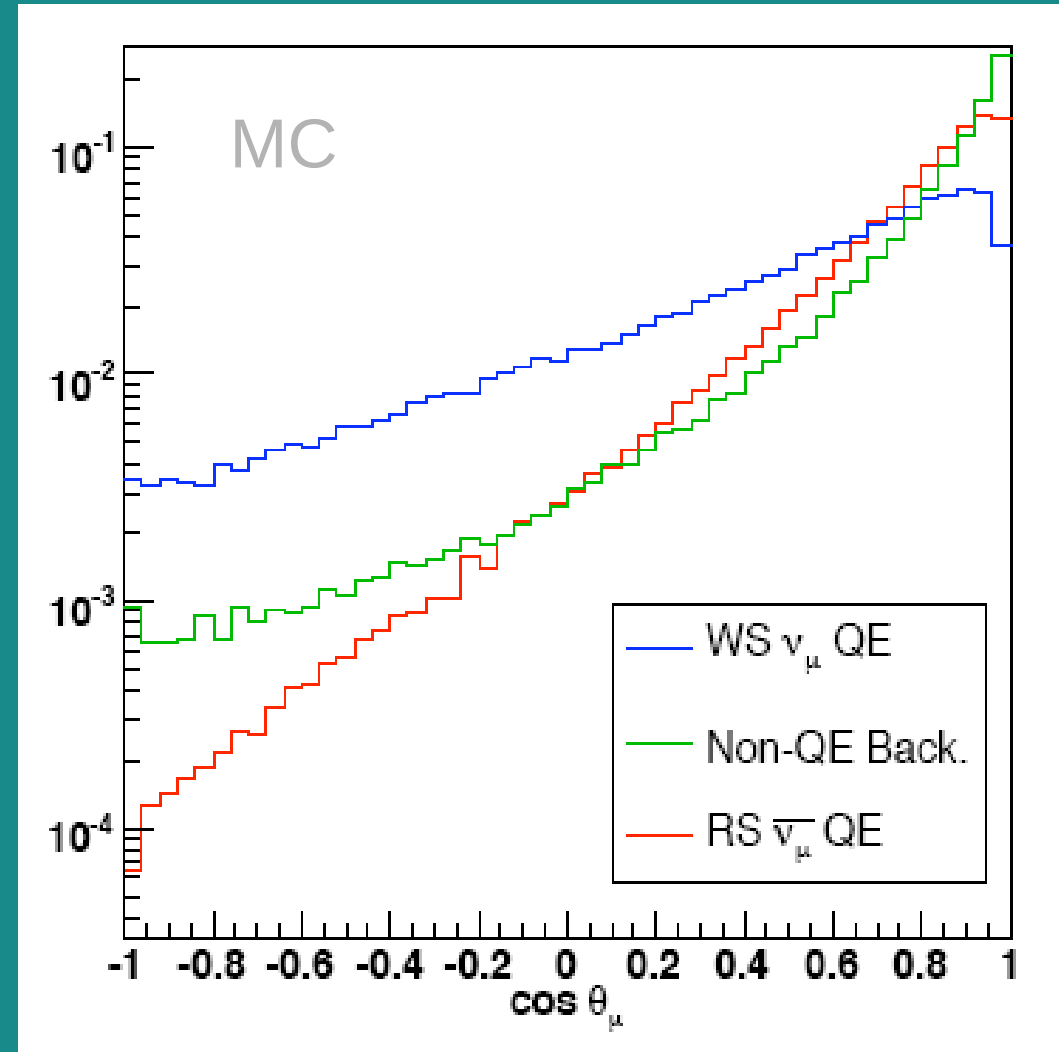
Pi0 background

- Measure NC π^0

- Constrains mis-
  identified ν_e like events

 - π^0 background
  - Radiative delta decay

Wrong sign component

- Bigger fraction of wrong signs in anti-nu running

- Need to determine the fraction of ν_μ (wrong sign component)
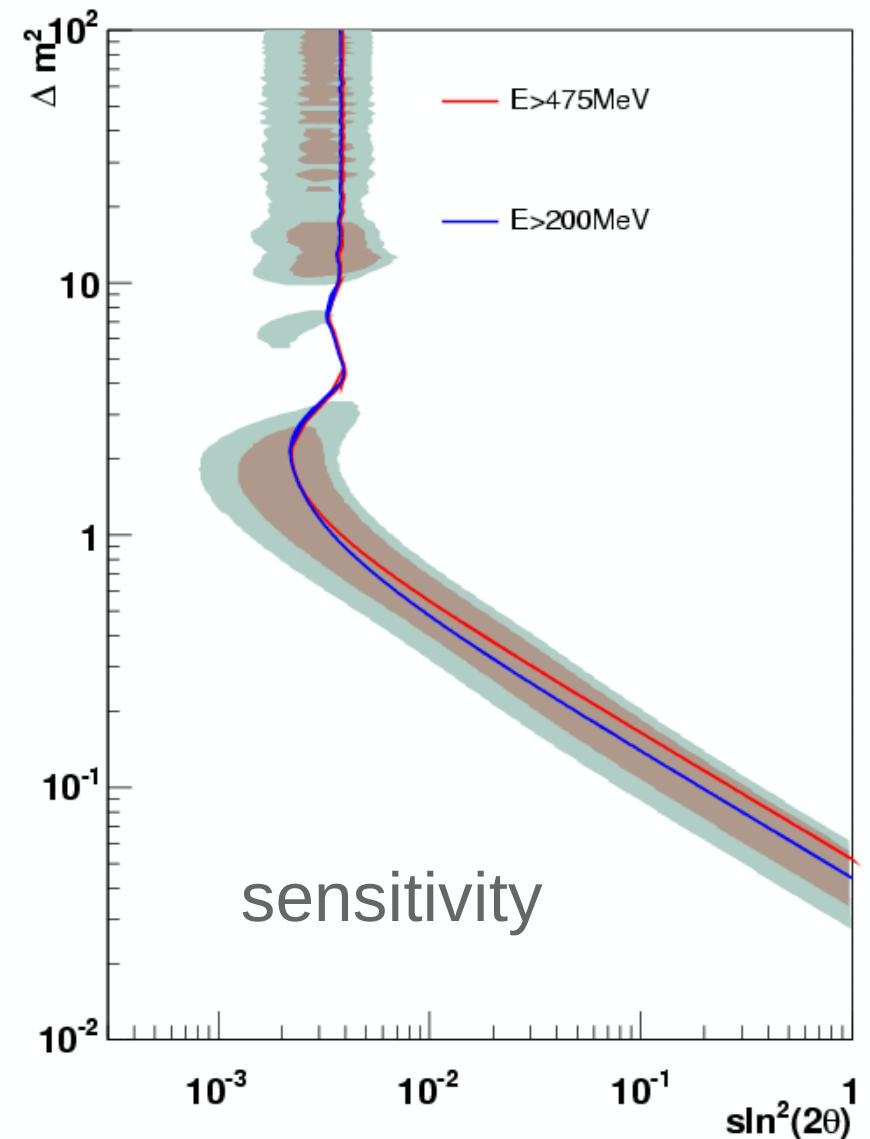
- Use angular distribution of muons

Sensitivity (above 475MeV)

- Currently have data corresponding to 3.386E20 POT

- Statistical and systematic errors included

- Opened the box for this data on 10/22/08
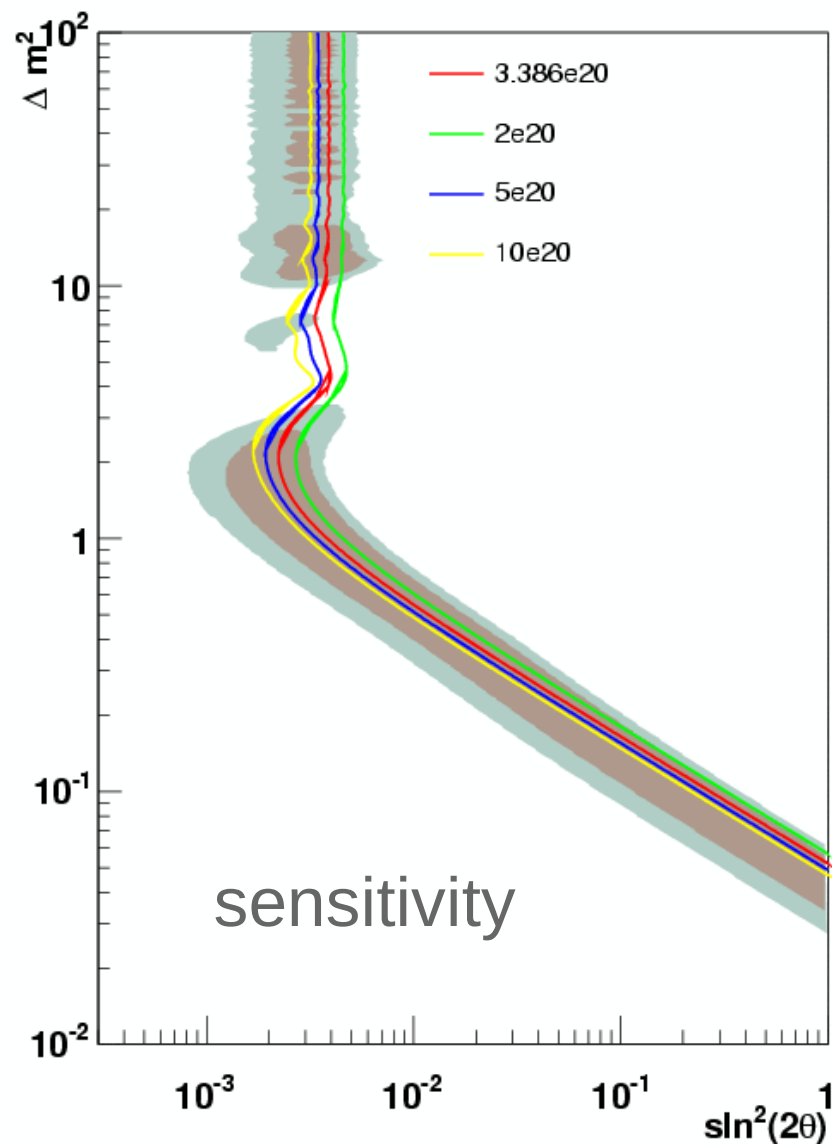
- Results will be presented in December
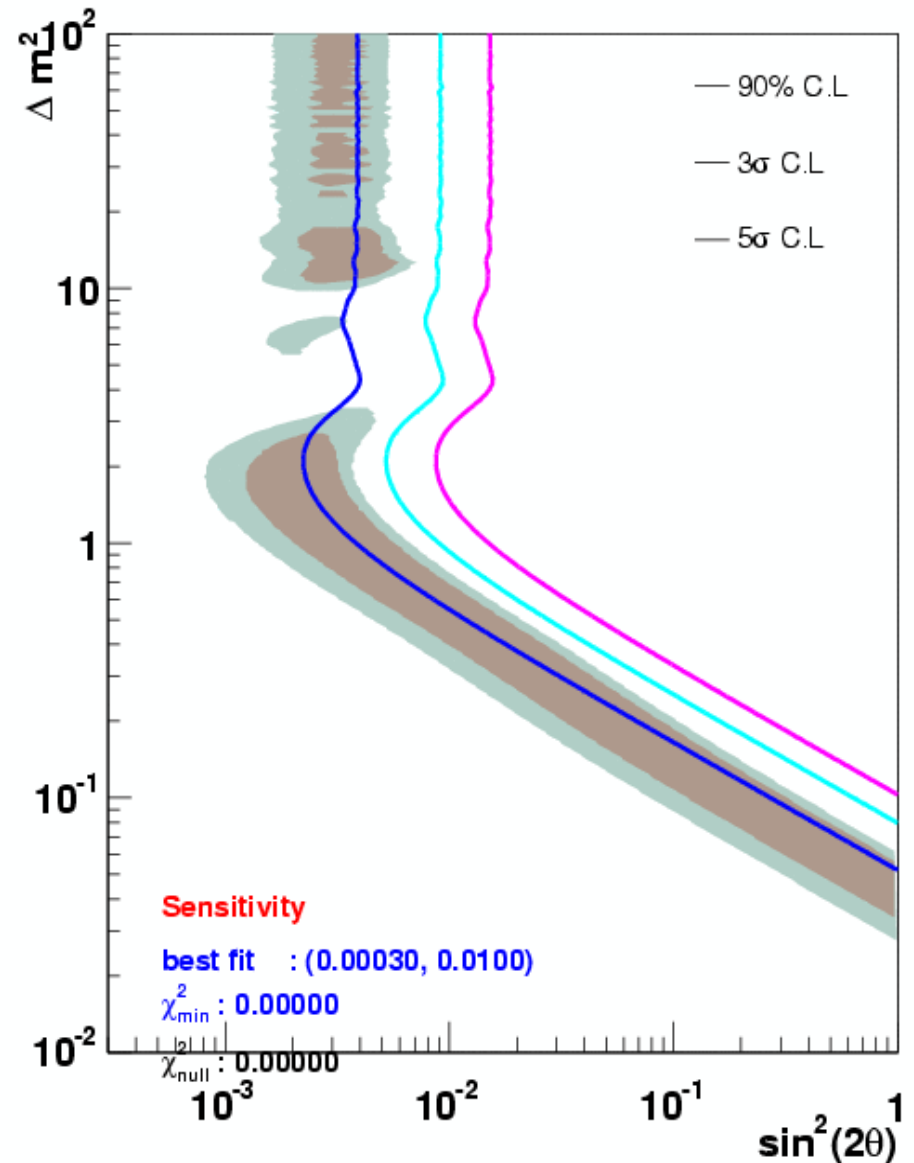
Including low energy nus

- Extend oscillation analysis to use $E_\nu > 200\text{MeV}$

- Improved sensitivity at low Δm^2

Future improvements

- Increase statistics
  - Plan to get 5e20POT

- Future analysis could be optimized for anti-neutrino running

- Combined analysis of neutrino and anti-neutrino mode running

Conclusion

- MiniBooNE currently taking data in anti-neutrino mode

  - $\overline{\nu}_e$ appearance analysis provides direct check of LSND result

  - Further insight in low energy excess observed in neutrino mode

- The box has been opened for data corresponding to 3.386E20POT on 10/22/08 – the results will be presented publicly in December 2008!