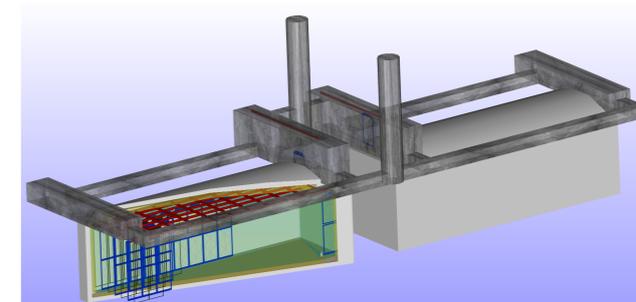
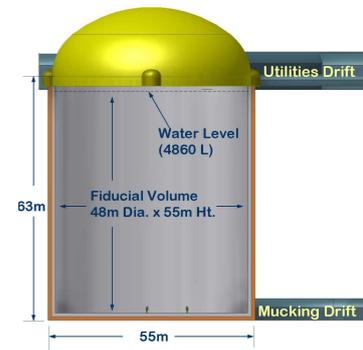


# Analysis model

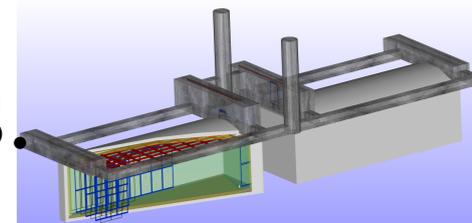
Milind Diwan 6/1/2011



# Analysis model



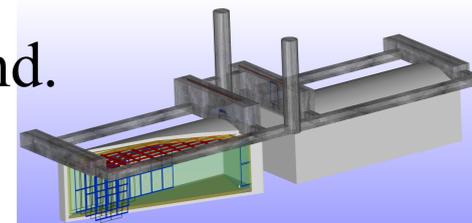
- There is a need for an analysis model for determining the background for the far detector.
- The model need not have all details. Only the key ideas.
- The model is only for demonstrating possible performance. There is no intention that this model will be followed exactly.
- Since it is only a model: it needs to be simple with emphasis on important items.



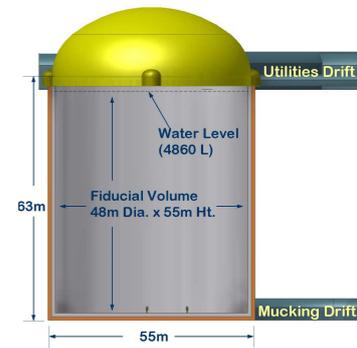
# Key ideas



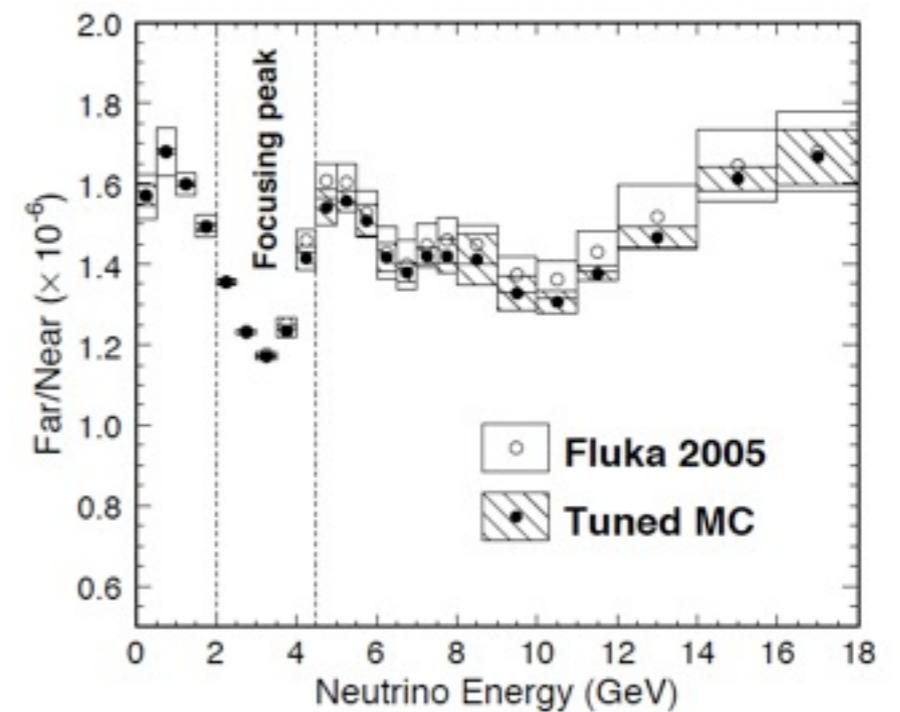
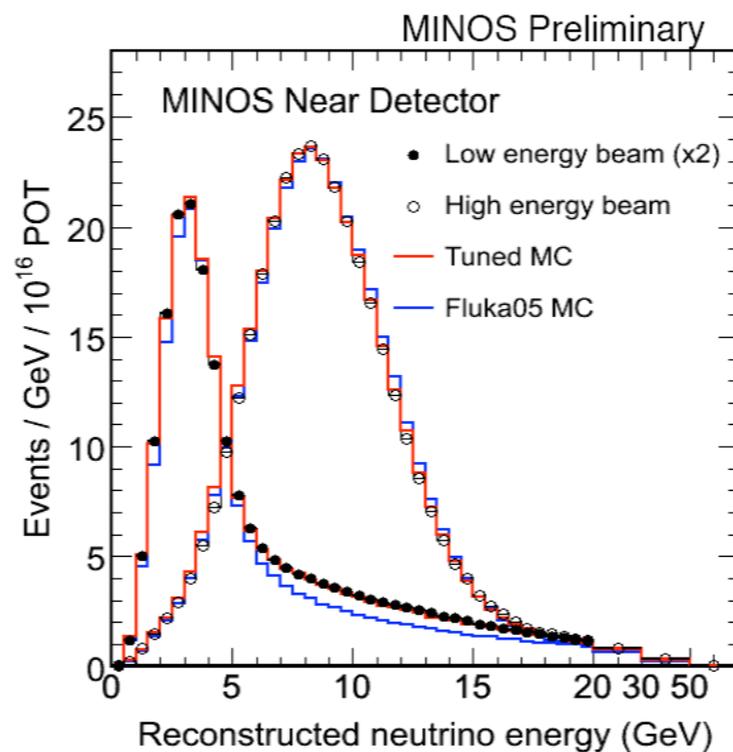
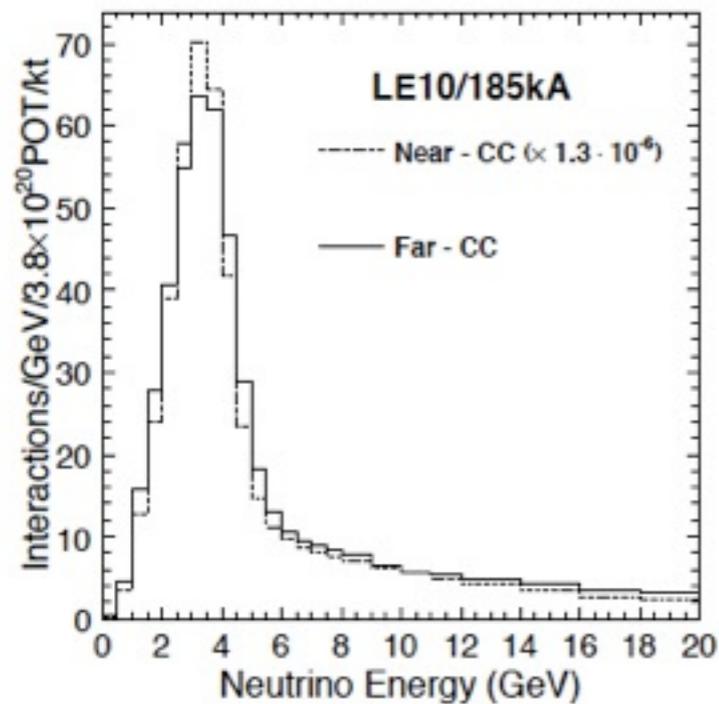
- The near detector is used for
  - Complete Characterization of the beam line in combination with knowledge of beamline geometry using Numu flux. Output should be a numu/anti-numu flux at the far site. (This can use MINOS technology)
  - Measure electron neutrino background contamination in the beamline.
  - Measure cross section of background reactions in the same nuclear target.
  - Separate the background reactions detected in near detector into several pieces:
    - Pieces that could be clearly identified in the far detector.
    - Pieces that are contributing background in far detector.
    - MINOS does this by turning off the horns to enrich background.



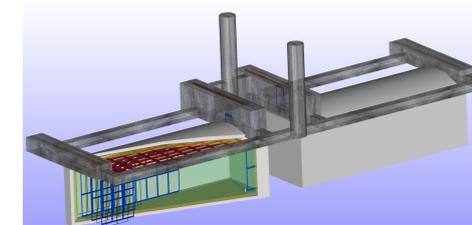
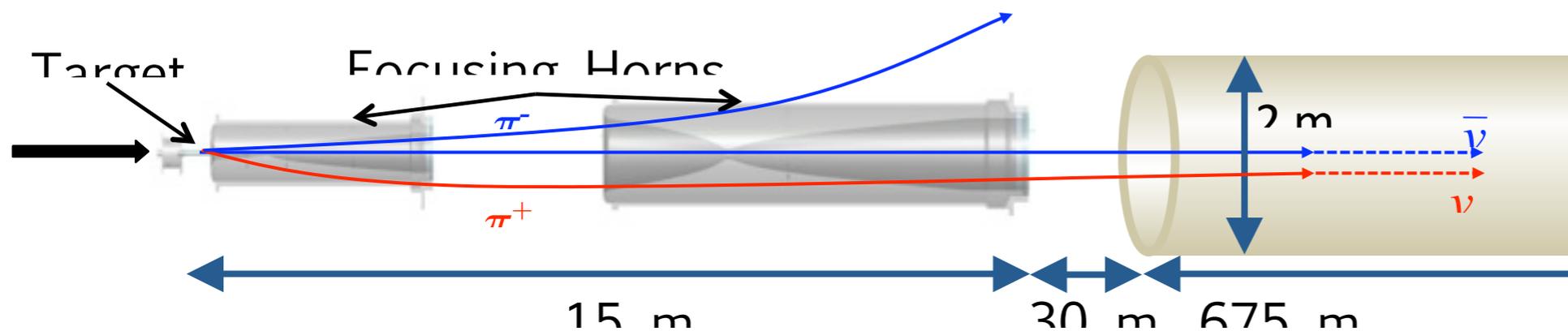
# Some plots



- MINOS technology



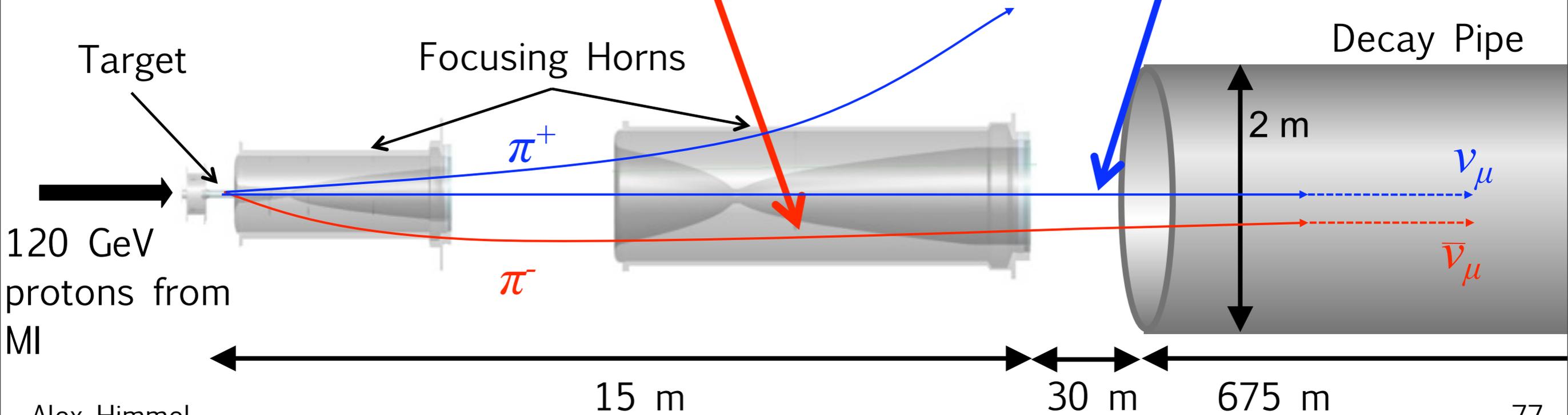
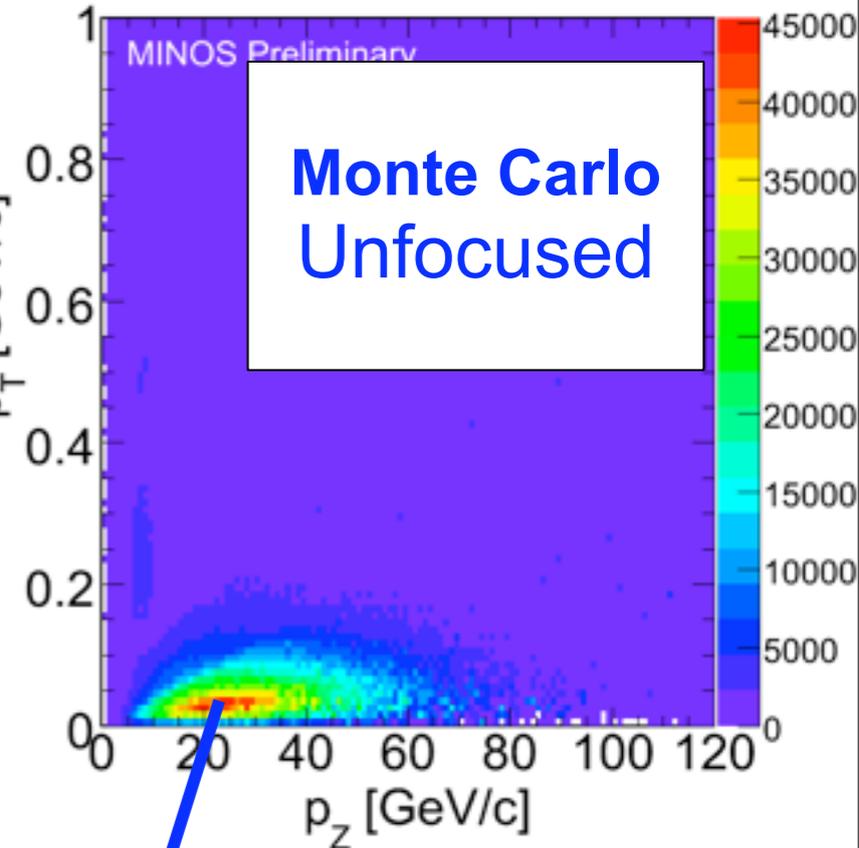
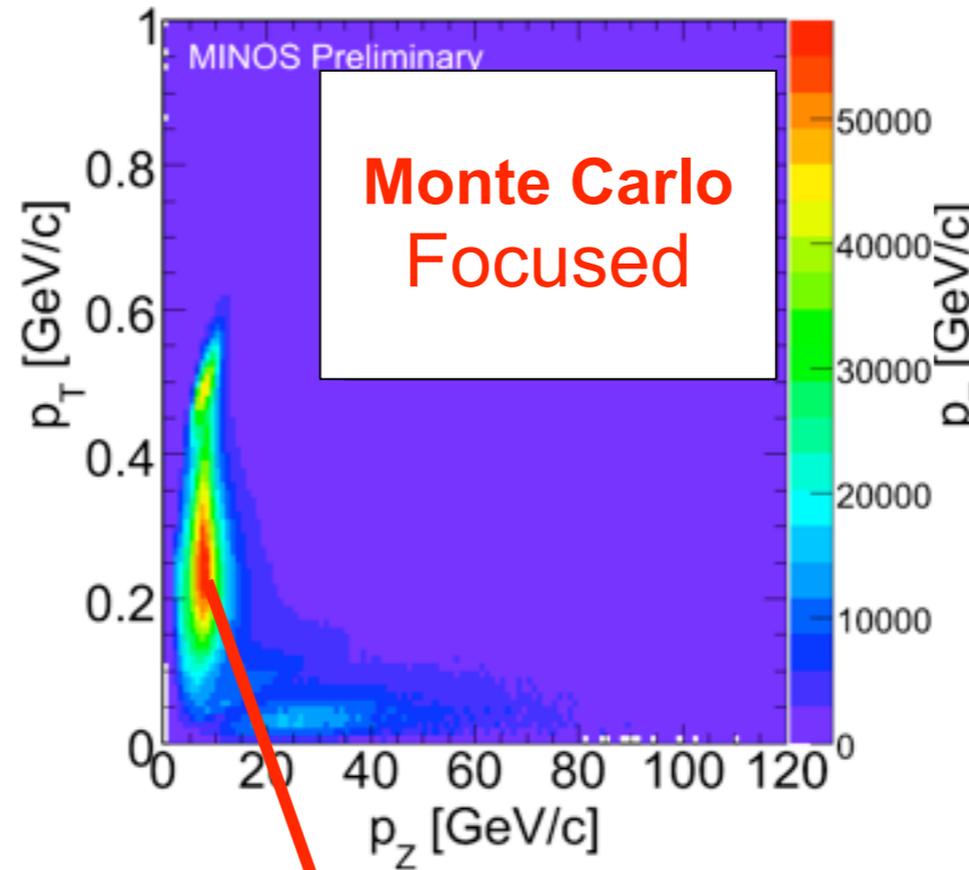
Source size makes near and far different



# Peak vs. Tail



- $\bar{\nu}_\mu$ 's from **high- $p_t$   $\pi^-$ 's**
  - Focused by horns
- $\nu_\mu$ 's from **low- $p_t$   $\pi^+$ 's**
  - Pass through horn center

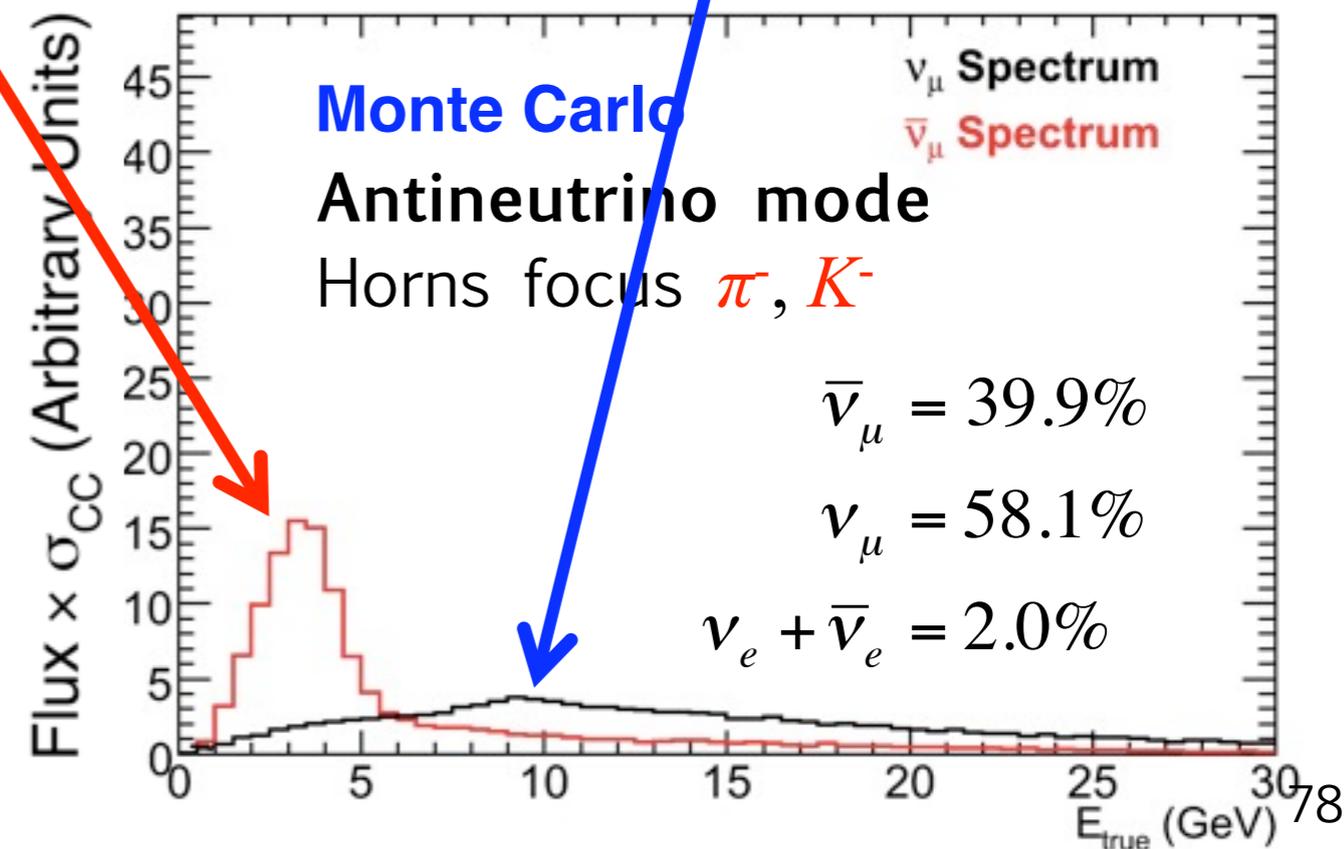
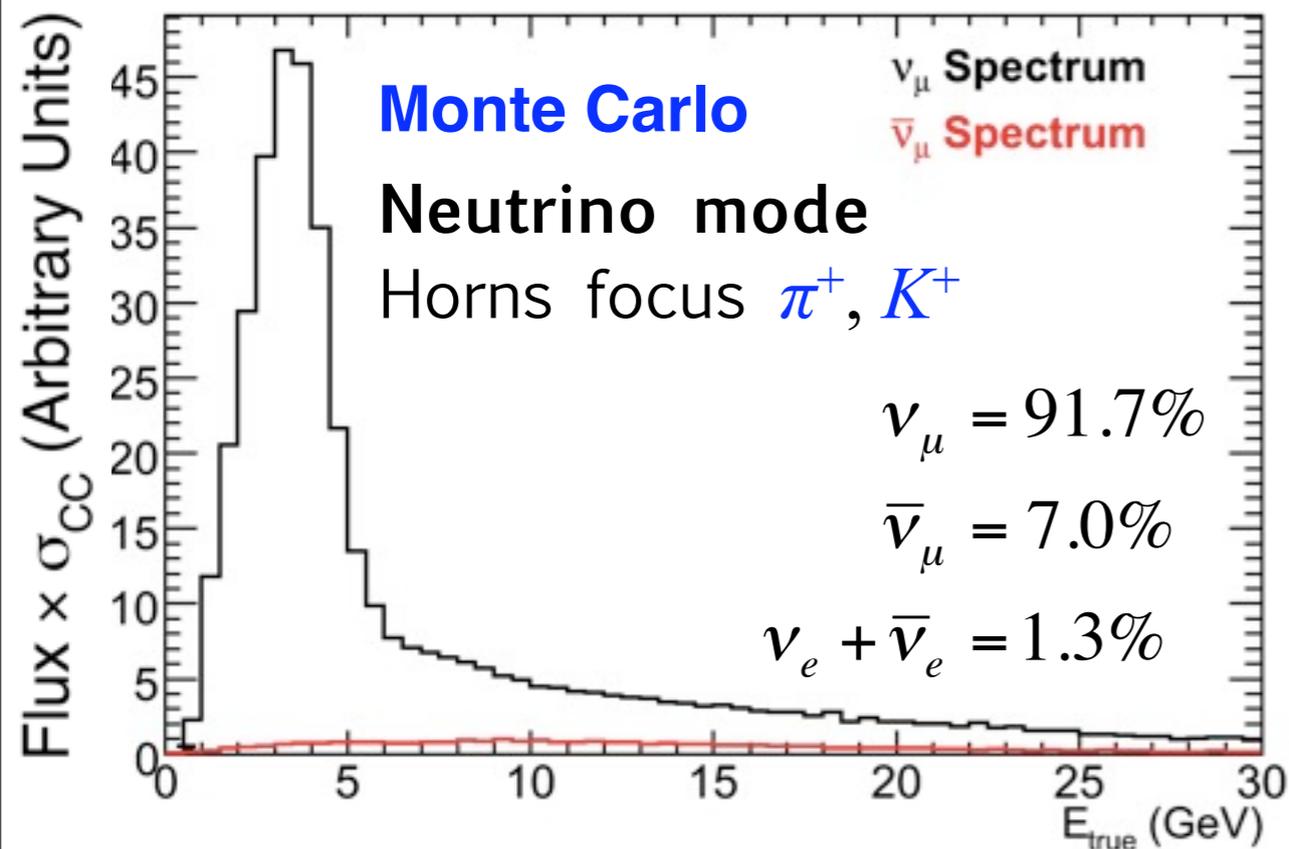
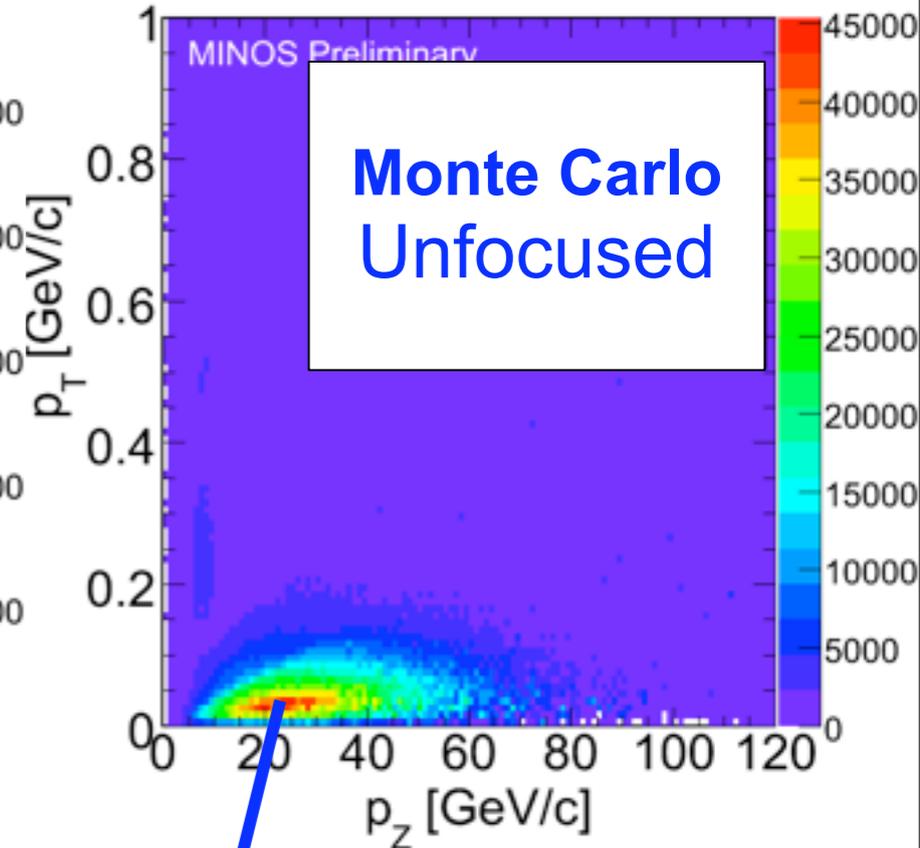
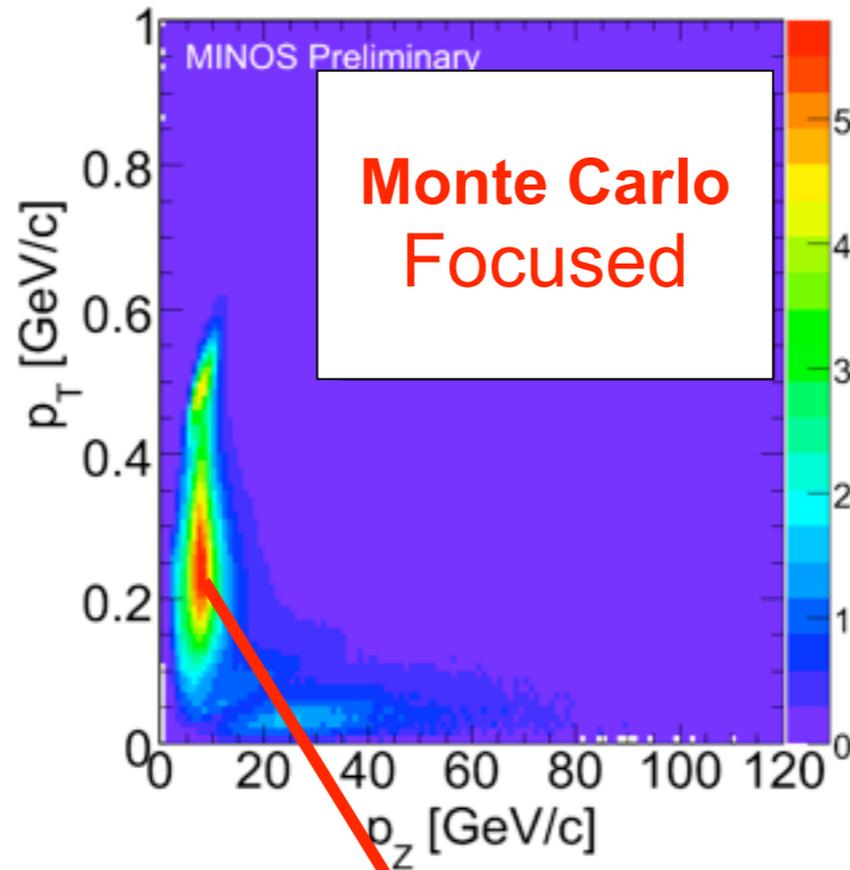




# Peak vs. Tail

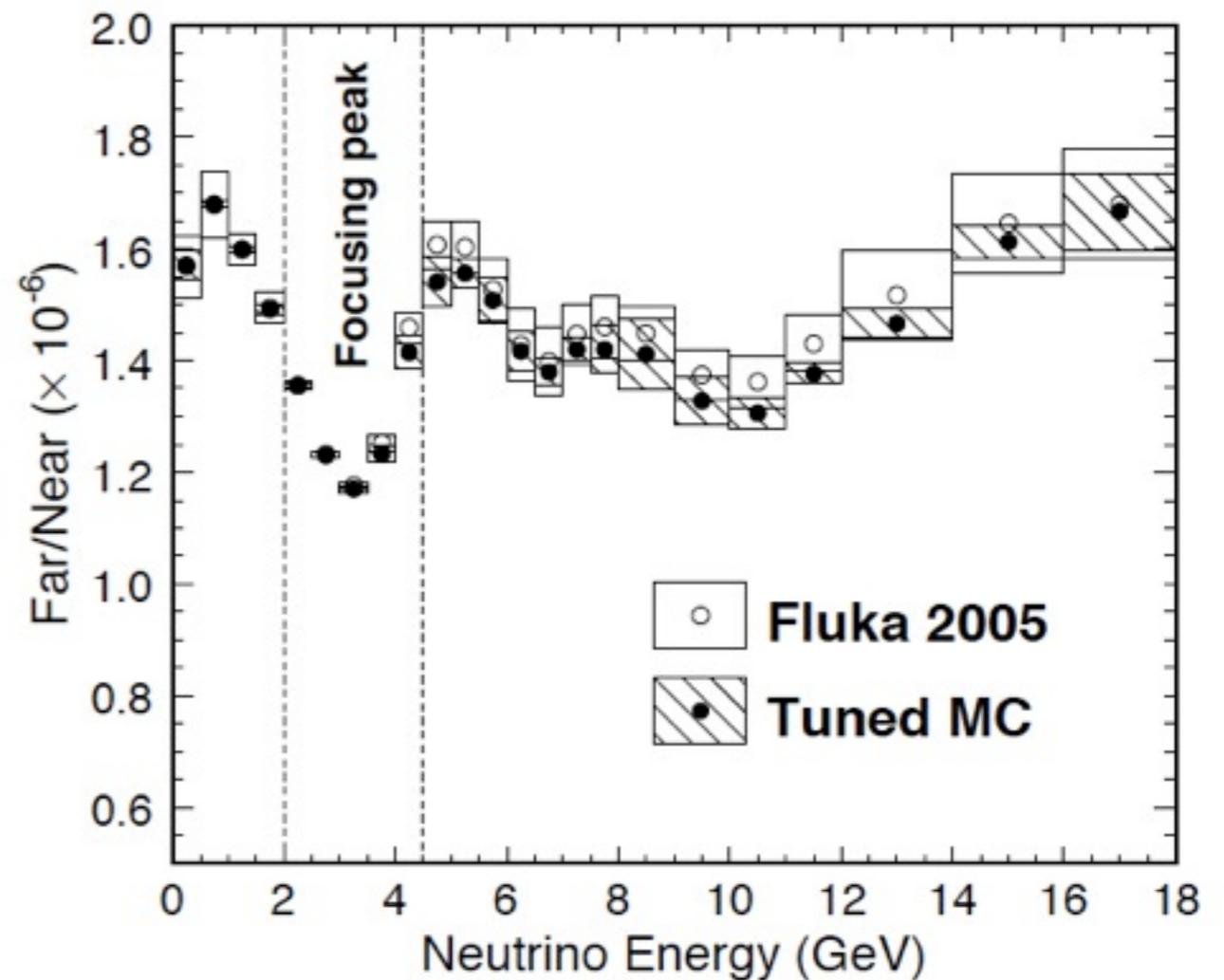
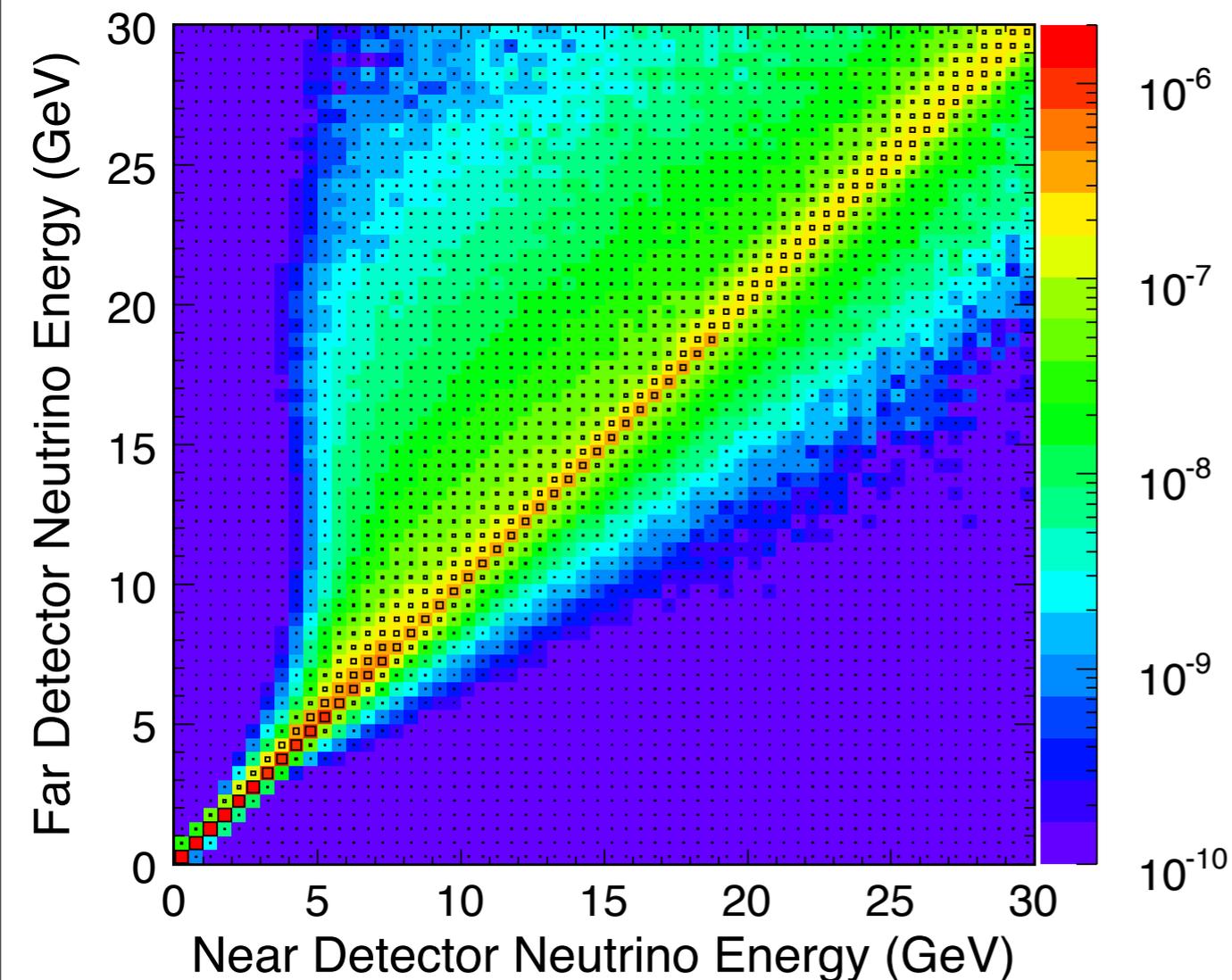


- $\bar{\nu}_\mu$ 's from **high- $p_t$   $\pi^-$ 's**
  - Focused by horns
- $\nu_\mu$ 's from **low- $p_t$   $\pi^+$ 's**
  - Pass through horn center



# Extrapolation

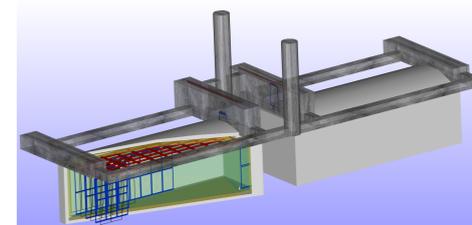
- Muon-neutrino and anti-neutrino analyses: beam matrix for FD prediction of track events
- NC and electron-neutrino analyses: Far to Near spectrum ratio for FD prediction of shower events



# Far detector analysis



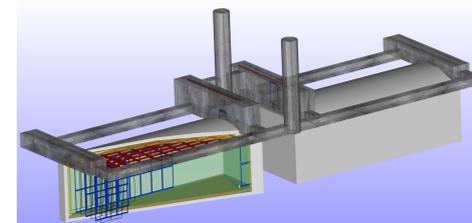
- Produce several samples of events
  - One sample is obviously the signal sample
  - Other samples will be clearly identified background samples.



# Background calculation



- The previous assembled data can now be used to calculate the background using various ratios.
- There can be many independent background estimates.
- Most important: the normalization of the background is data-based. the MC is used for ratios only.



# Example.



- $N_{\text{FBG}} = (N_{\text{NBG}}) * (\text{Far/Near})_{\text{MC}}$
- $N_{\text{NBG}}$  is the background measured in near detector. This estimate would have the heaviest reliance on MC.

