Measurement of Out of Tank (Dirt) Events with MiniBooNE

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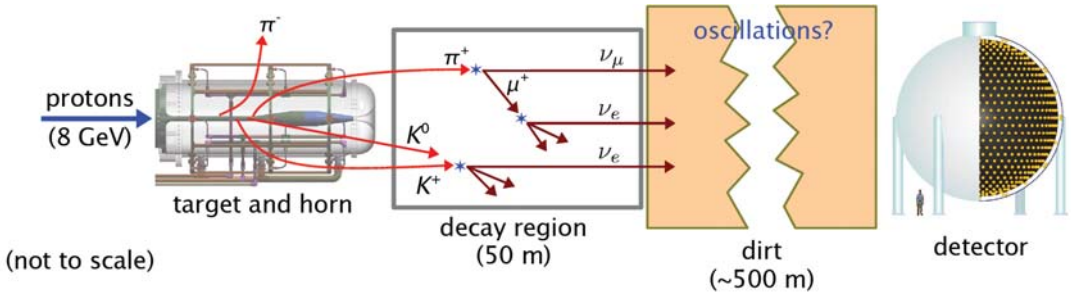
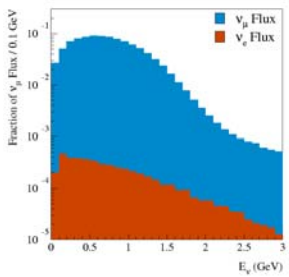
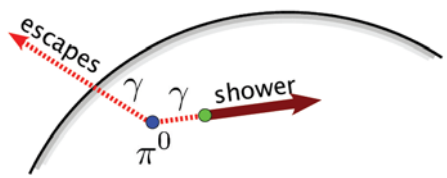
Goal: The MiniBooNE experiment is designed to confirm or refute $\nu_\mu \rightarrow \nu_e$ oscillation signal seen by LSND

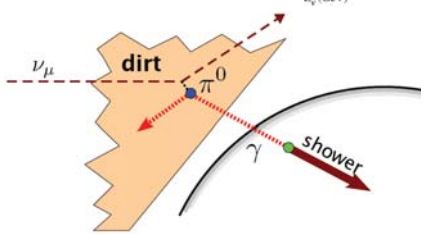


- The FNAL Booster delivers 8 GeV protons to the MiniBooNE beamline.
- The protons hit a 71cm beryllium target producing pions and kaons.
- The magnetic horn focuses the secondary particles towards the detector.
- The mesons decay into neutrinos, and the neutrinos fly to the detector, all other secondary particles are absorbed by absorber and 450 m dirt.
- 5.6E20 POT for neutrino mode since 2002.
- Switch horn polarity to run anti-neutrino mode since January 2006.

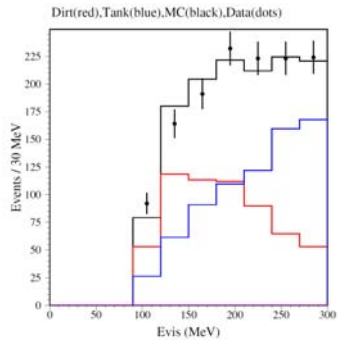
- L/E, MiniBooNE (0.5 km / 0.8 GeV)
- L/E, LSND (0.03km / 0.05 GeV)
- About 0.8 GeV ν_μ beam (~ 0.5% intrinsic ν_e)
- 1.5 M neutrino events collected
- Looking for a few hundred ν_e CCQE
- Major background sources are intrinsic ν_e (~60%), ν_μ mis-ID (~30%) and out of tank events (~10%)

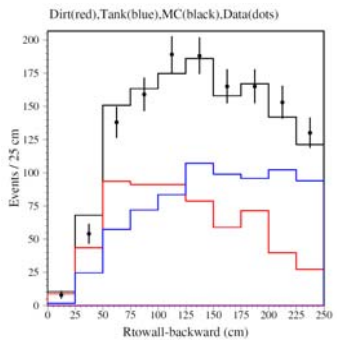




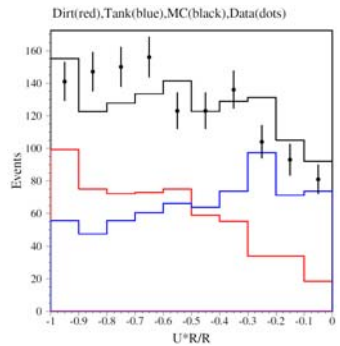


Out of Tank Events in Enhanced Dirt Sample





- Neutrino beam interacts with dirt outside of tank, the high energy γ (100 ~ 300 MeV) sneak into the tank to produce e-like Cerenkov ring.
- N_dirt_expected =621, N_tank_expected=726 , N_data = 1349
- N_dirt_measured / N_dirt_expected = 0.99 $\pm$ 0.15
- Dirt events contribute ~10% of background for oscillation ν_e search.



U – unit vector of reconstructed track direction
R – vector from tank center to track center