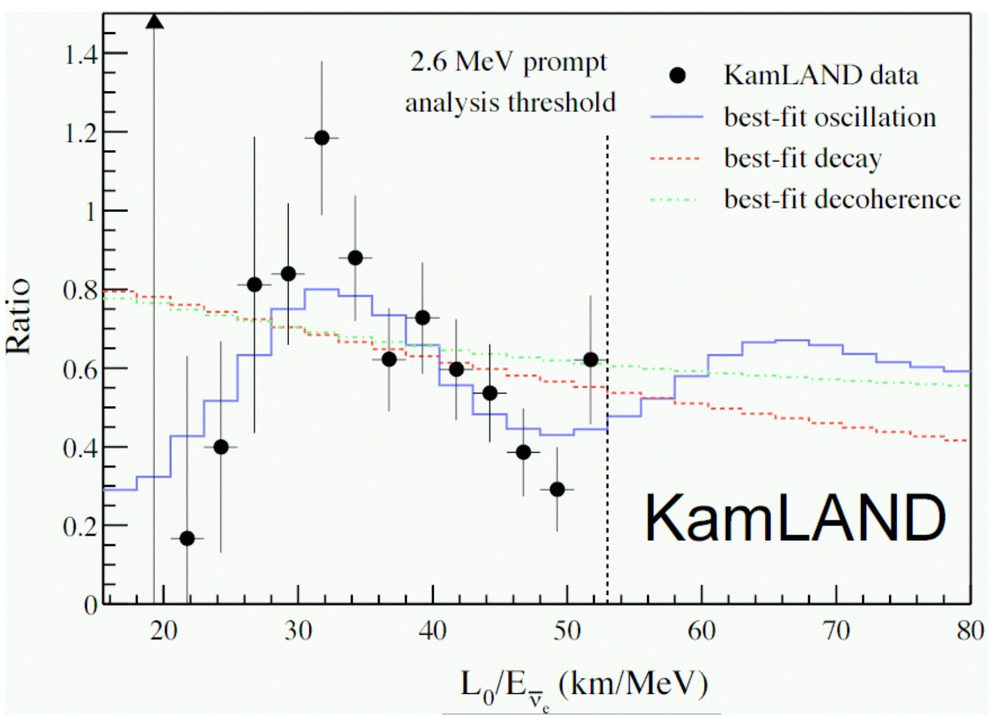
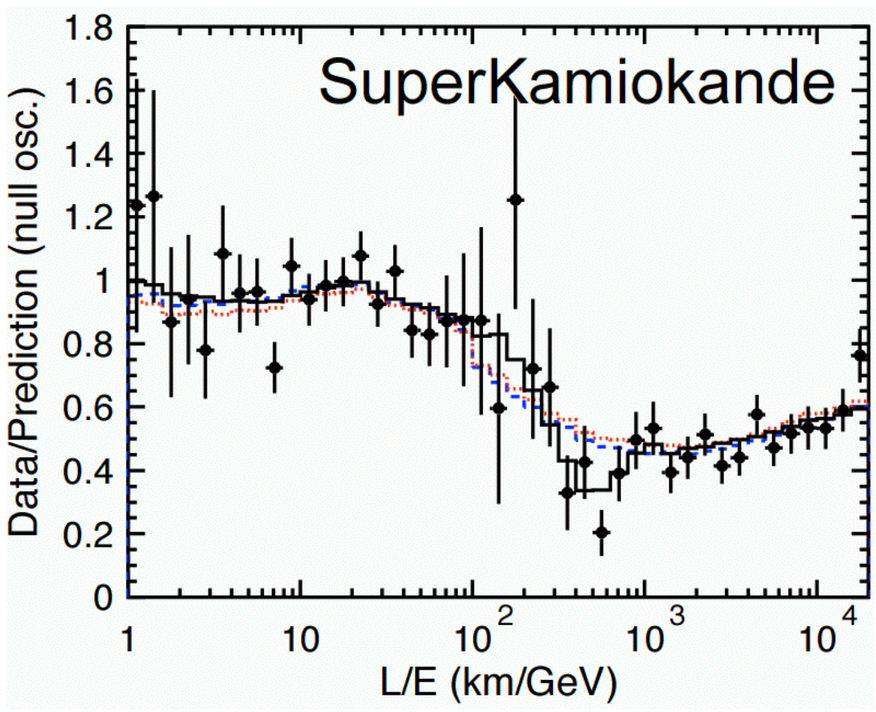
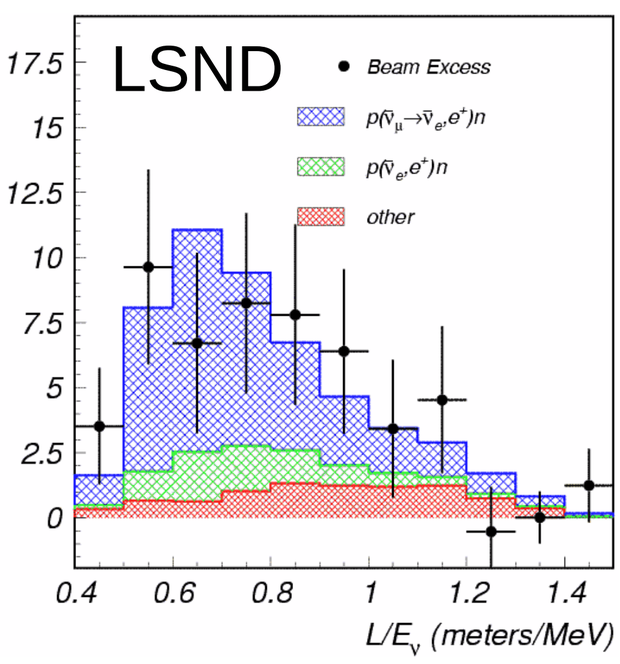
Neutrino Oscillations



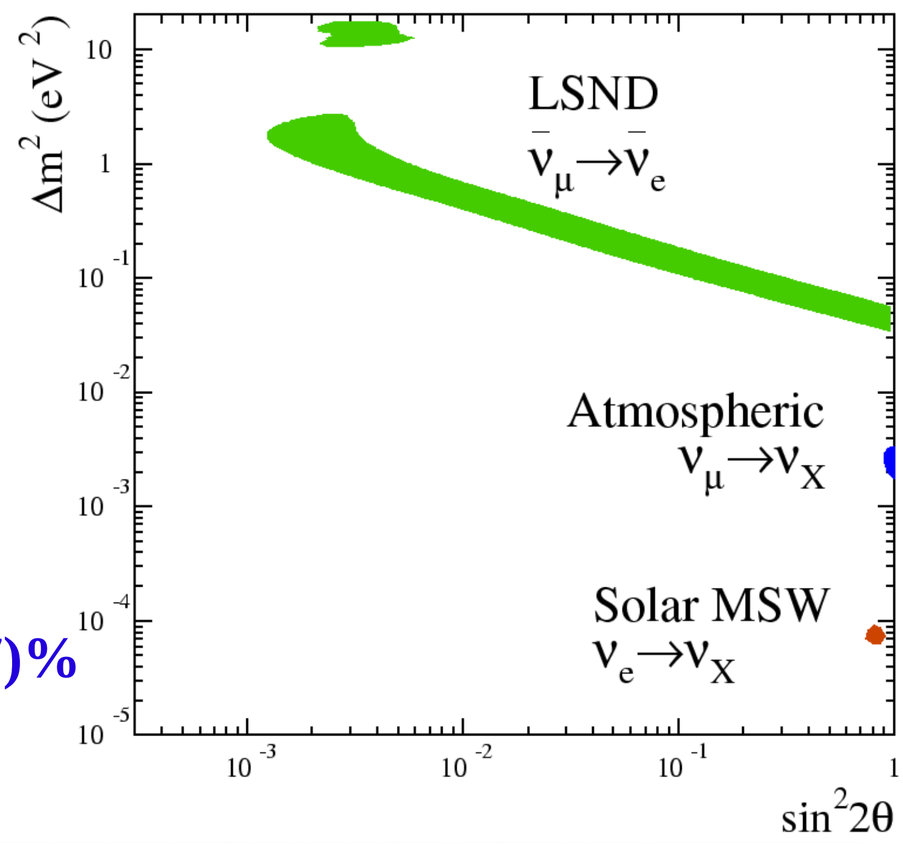




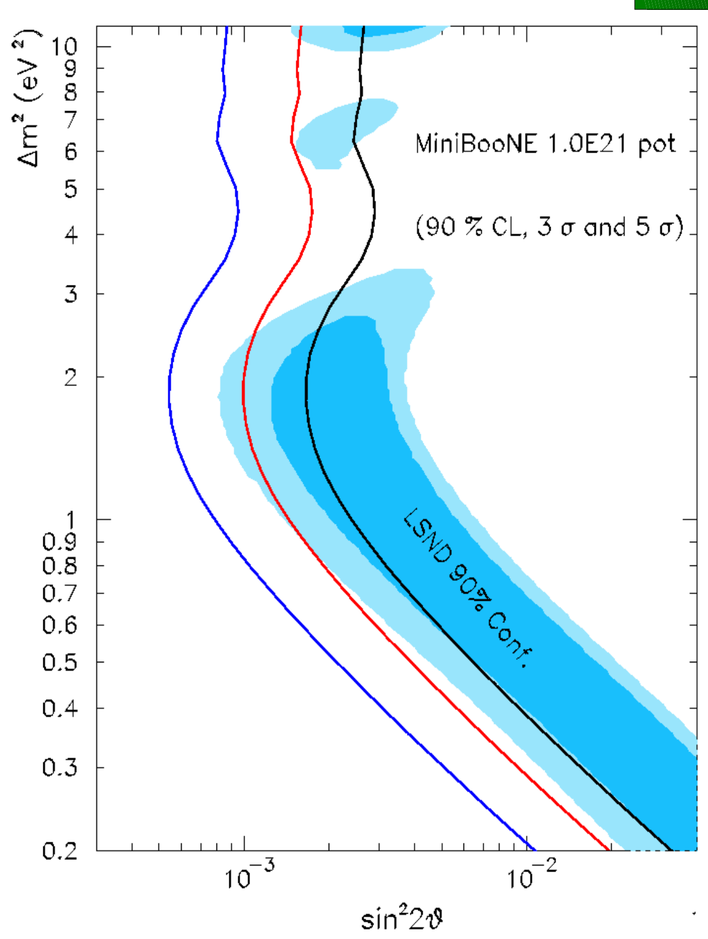
- Through the observation of neutrino oscillations it is now known that neutrinos have mass.
- In a simplified two-neutrino model, the oscillation probability is

$$Prob(\nu_\mu \rightarrow \nu_e) = sin^2 2\theta sin^2\left(\frac{1.27\Delta m^2(eV^2)L(km)}{E(GeV)}\right)$$

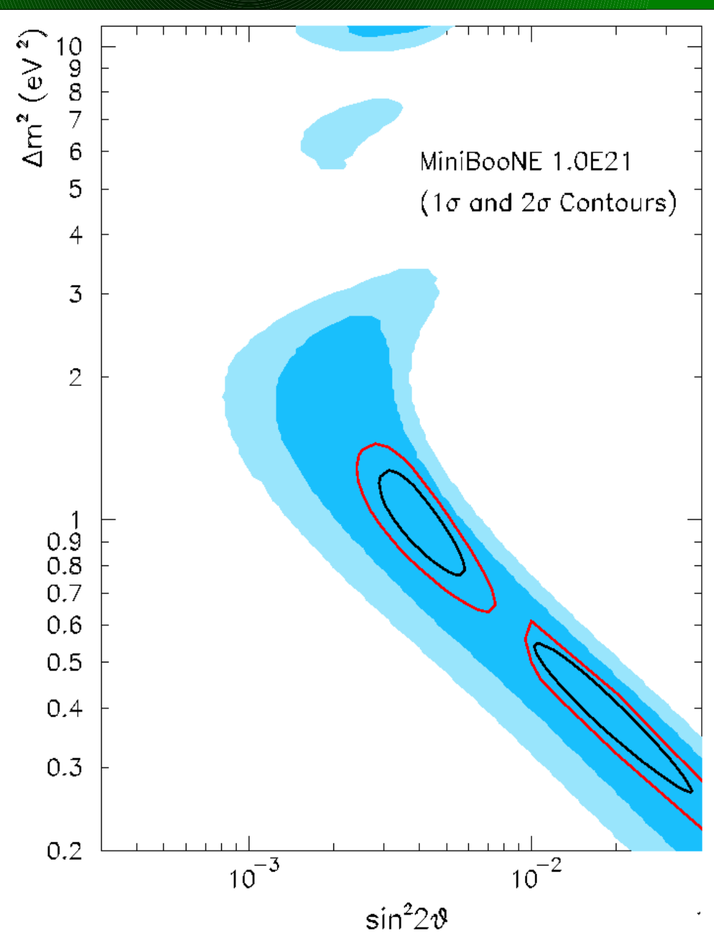
- Oscillations first determined from solar neutrino experiments have been confirmed with reactor neutrinos.
- Oscillations from the atmospheric sector have been confirmed by accelerator-based beams.
- The LSND experiment saw an excess of **89.7 ± 22.4 ± 6.0** events, corresponding to a probability **$P(\bar{\nu}_\mu \rightarrow \bar{\nu}_e)$ = (0.264 ± 0.067 ± 0.017)%**
- The LSND signal is yet to be confirmed...



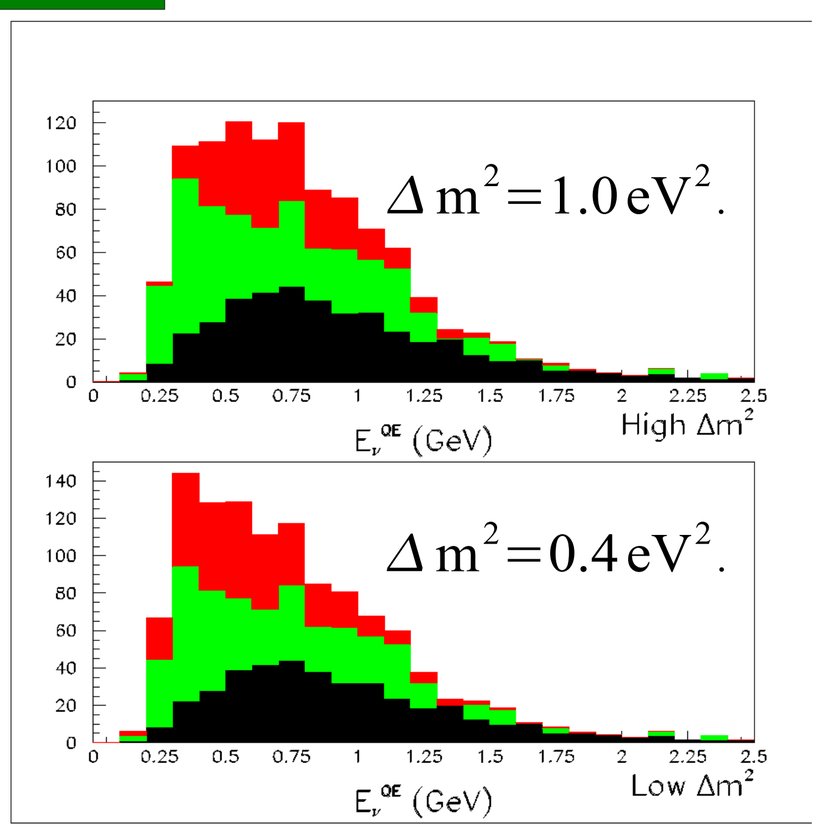
MiniBooNE Oscillation Sensitivity



This figure shows MiniBooNE's sensitivity and ability to cover the LSND allowed regions after collecting 1 x 10^{21} protons on target.



Should MiniBooNE see an oscillation signal, the above plot shows the ability to distinguish between a low and high value for Δm^2.



Reconstructed neutrino energy distribution for the oscillation signal and backgrounds. The black is intrinsic ν_e background, the green is from NC π^0 events, and red is oscillation events. The data in each bin is cumulative.

Summary and Outlook

- The Booster Neutrino Beamline continues reliable delivery of protons on target.
- MiniBooNE continues to make great progress in the analysis, while maintaining a strict adherence to the initially-established blindness criteria.
- Analyses of the expected background signals are developing on many fronts, and an intensive Monte Carlo study to understand systematic errors is underway.
- First results from non-oscillation physics (i.e. charged-current π^+ and neutral-current π^0 cross sections) are expected by the end of the summer.
- Preliminary oscillation results are expected by the end of the year.