The Daya Bay Measurement of Δm_{ee}^2

January 31, 2013

The Daya Bay Collaboration

Daya Bay has accumulated 210 days of data with 6 Antineutrino Detectors (ADs) and commenced 8-AD data-taking in October 2012. Our discovery of a large value for θ_{13} (PRL **108**:171803) will allow a measurement of the effective mass splitting Δm_{ee}^2 with a precision comparable to the MINOS measurement of $\Delta m^2_{\mu\mu}$. The disappearance of electron antineutrinos (Δm_{ee}^2) over km-long baselines observed at Daya Bay is a combination of antineutrino oscillations with mass splittings Δm^2_{31} and Δm^2_{32} orthogonal to that measured by MINOS.

In addition to the neutrino mixing angles and the Dirac CP-violating phase, the mass-squared differences are crucial for understanding the nature of neutrinos. Daya Bay will provide a precise measurement of Δm^2_{ee}, better than 5% as shown in Fig. 1: complementary to $\Delta m^2_{\mu\mu}$ determined by accelerator-based experiments. Independent determination of the three mass-squared differences will validate the sum rule of neutrino mixing, $\Delta m^2_{12} + \Delta m^2_{23} + \Delta m^2_{31} = 0$. Any deviation from this sum rule could signal the existence of neutrinos beyond three generations.

With the 8-AD configuration, Daya Bay is expected to achieve a precision better than $1{\times}10^{-4}$ eV^2 after 3 years of data collection.

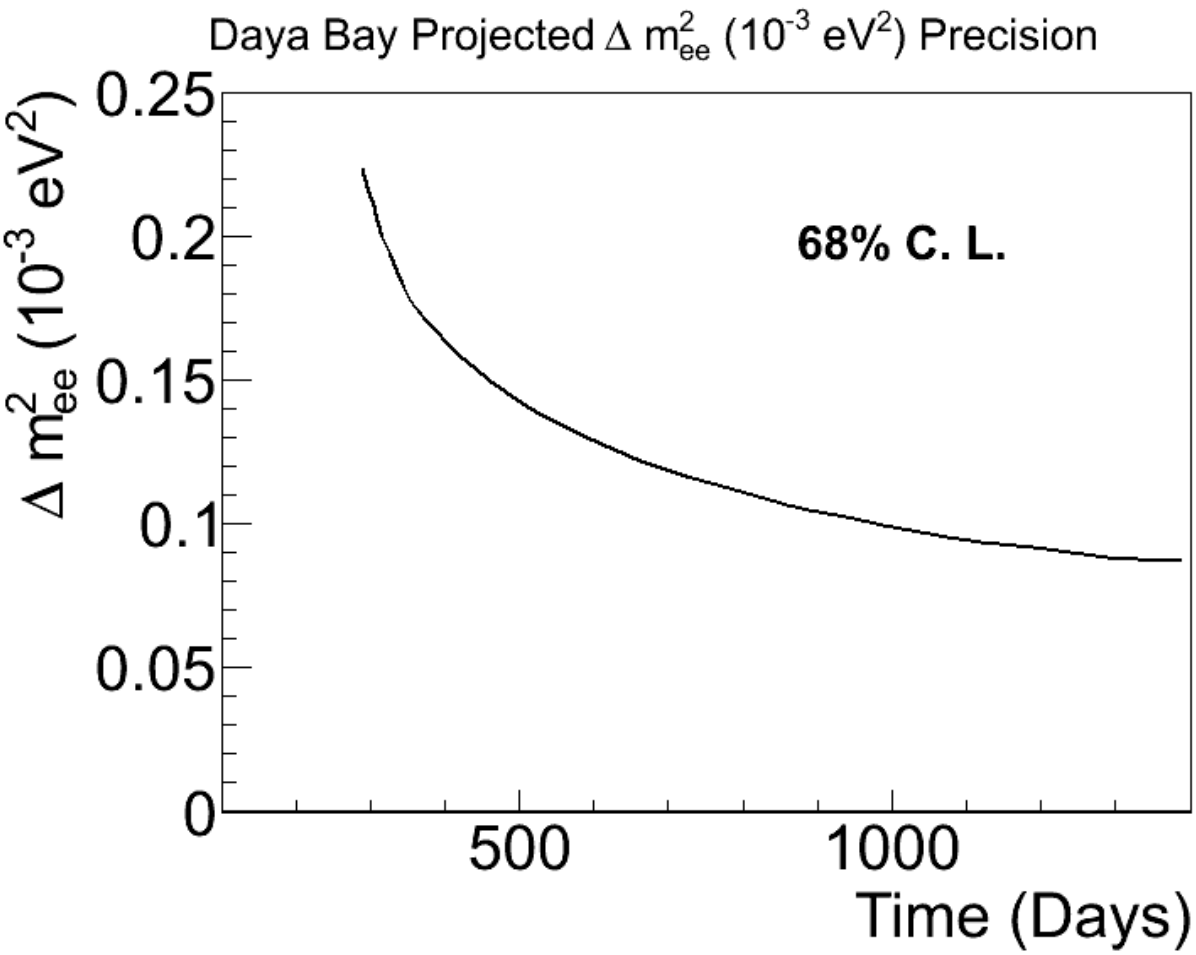

Figure 4: Expected Daya Bay uncertainty on Δm^2_{ee} as a function of running time with 8 ADs.