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Searching for CP and CPT Violation in a Short Baseline Experiment The BooNE Proposal at Fermilab

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Abstract

The proposal to move the MiniBooNE experiment to a near location at 200 meters is discussed. The resulting data would resolve whether the MiniBooNE low energy anomaly in neutrino mode was an oscillation effect. It would also provide a first measurement of $\bar{\nu}_\mu$ disappearance in the 1 eV^2 range of Δm^2 .

Keywords:

Neutrinos, Oscillations, MiniBooNE, Fermilab, Short Baseline

1. Introduction

The MiniBooNE experiment has run since September 1, 2002 and accumulated a substantial amount of data in both neutrino-mode and antineutrino-mode. The ν_e appearance measurement is now dominated by systematic errors on the neutrino flux, cross section, and detector response. Prior to decommissioning the experiment it is proposed that the detector be moved to a location much nearer its production target than its current 541 meter distance.

At 200 meters, for example, the data rates would be more than 7 times larger, and statistically equivalent samples in both neutrino and antineutrino modes could be taken with a one year run. When analysed in conjunction with the 541 meter data, the 200 meter data would virtually eliminate the systematic error now hindering the MiniBooNE analysis. It would resolve whether or not the MiniBooNE low energy excess was an oscillatory effect. This is an important result for long baseline programs seeking to measure θ_{13} and δ_{CP} . It would also measure both ν_μ and $\bar{\nu}_\mu$ disappearance in the Δm^2 1 eV^2 range. Figures 1 and 2 show the sensitivities of the BooNE experiment after one year of running.

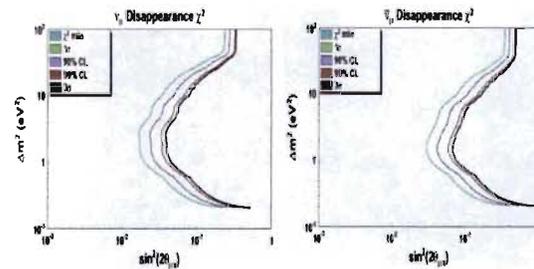


Figure 1: the sensitivities of the BooNE experiment for ν_μ and $\bar{\nu}_\mu$ disappearance

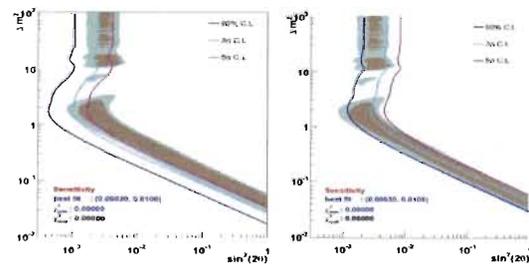


Figure 2: the sensitivities of the BooNE experiment for ν_e and $\bar{\nu}_e$ appearance