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Neutrino Oscillation Measurements Using A Maximum Likelihood Event Reconstruction Algorithm

ANDREW MISSERT[1], University of Colorado Boulder

A new maximum likelihood event reconstruction algorithm is introduced for the Super-Kamiokande (SK) detector. This new algorithm improves the expected particle identification and kinematic resolution for SK neutrino events from the T2K beam. Event selections that exclusively use the new reconstruction methods are then optimized. A particular emphasis is placed on the SK fiducial volume cuts, which must be optimized in the presence of systematic uncertainties. To estimate the SK detector systematic uncertainty, a Markov chain Monte Carlo fit is performed using SK atmospheric data as a control sample. Applying the new reconstruction methods with the optimized fiducial volume cuts increases the statistical size of the T2K event samples by as much as 20%, which improves the sensitivity to the neutrino mixing parameters θ_{23}, θ_{13}, Δm^2_{23}, and the CP-violating phase δ_{CP}.

[1]Harry Lustig Award Session