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Measurement of the detection systematic uncertainty in the Double Chooz experiment

Double Chooz is a 2-detector reactor antineutrino oscillation experiment designed to make a precision measurement of the neutrino mixing angle θ_{13}. The electron antineutrinos from the Chooz (France) nuclear power plant are detected through the inverse beta decay process $\bar{\nu}_e + p \rightarrow e^+ + n$ in a gadolinium-loaded liquid scintillator target. In the 1-detector run, started in April 2011, Double Chooz relies on a Monte Carlo simulation to predict the antineutrino flux and measure the oscillation-induced deficit in the Far Detector (located at ~ 1050 m from the reactors). Therefore, the accuracy of the simulation in reproducing the antineutrino generation and detection is essential.

In this poster, the new methods developed for measuring the dominant components of the detection systematic uncertainty using several neutron sources, as well as the Monte Carlo simulations to study the neutron transport boundary effects on the target are described. Benefiting from a revised signal selection criteria and increased statistics, the 0.5% precision level achieved on the detection systematic uncertainty represents a factor 2 improvement with respect to the previous result and leads to a more precise θ_{13} measurement. In addition, in the 2-detector run starting this summer with the operation of the Near Detector (at ~ 400 m from the reactors), the subsequent cancellation of correlated uncertainties is expected to grant the experiment an even better detection systematic uncertainty and a high precision θ_{13} result.

Summary

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