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Current status of the Double Chooz experiment

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The Double Chooz reactor antineutrino experiment aims for a precision measurement of the neutrino mixing angle θ_{13}. Located at the Chooz nuclear power plant in France, it observes an energy dependent deficit in the neutrino spectrum, currently with one detector filled with gadolinium-loaded liquid scintillator at a baseline of 1.05\,km. The past Double Chooz publications featured different analysis approaches: The θ_{13} result was not only provided via rate-only analysis of the deficit in neutrino flux; a combined rate and spectral shape fit as well as a background model independent analysis based on reactor power variations were performed, giving consistent results. Besides that, Double Chooz has been the first experiment to determine θ_{13} using the neutrino detection channel via neutron captures on hydrogen nuclei. Among the recent reactor-based oscillation experiments with comparable baseline it was the only one to observe scheduled reactor shutdown phases. These enabled to measure the background spectrum solely, allowing to crosscheck the background models used in the oscillation analysis.
At present an improved analysis is in progress with twice as much data statistics collected compared to the last publication. Revised selection criteria and background studies enhance the signal to background ratio while a reduction in the corresponding uncertainties is achieved. Along with an improved energy calibration the overall systematic uncertainty on θ_{13} is decreased preparing for a two detector analysis.
In the near future the second identically constructed detector will commence operation at 400 meters distance to the reactor cores, leading to a cancellation of correlated systematic uncertainties, which allows for a high precision θ_{13} measurement.

Summary

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