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Reactor antineutrino detection in the Double-Chooz experiment: New techniques for background reduction, residual rates and spectra

The Double-Chooz reactor neutrino experiment aims for a precision measurement of the mixing angle θ_{13}. A cornerstone of this analysis is the thorough investigation of the various backgrounds assailing this measurement: neutrino-like coincidence signals are imitated by accidental coincidences of single events as well as correlated events induced by cosmic muons, including stopped muons, fast neutrons and the spallation isotopes Li-9/He-8. In addition, background events resulting from spontaneous light emission by the PMTs have to be considered.

This contribution presents the current state of investigations for these background sources in the Double-Chooz far detector. It lays out several novel techniques devised for identification of the corresponding events. Based on these, efficient veto techniques have been developed that limit the impact of the backgrounds on the result of the oscillation analysis. As a consequence of these efforts, the current uncertainty on the background rate has been reduced by about a factor 2 compared to earlier publications and can be even further constrained by including the spectral information of the final fit. The detailed understanding of the background sources will be crucial for a future near+far detector oscillation analysis in which the correlated background will remain as the main source of systematic uncertainty.

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