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P2.067 Neutrino detection systematics in the two detector phase of the Double Chooz experiment

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Being an intense and pure source of low energy electron antineutrinos, nuclear reactors are one of the most powerful tools to investigate neutrino oscillations. The Double Chooz experiment aims for a precise determination of the neutrino mixing angle θ_{13} using a two detector configuration with a liquid scintillator target volume read by photomultipliers. In order to reach this goal, a high and accurately known detection efficiency of the inverse beta decay (IBD) $\bar{\nu}e + p \rightarrow e + + n$ is required. The $\bar{\nu}e$ event signature consists of the coincidence of a prompt positron signal and a delayed neutron capture on Gd in liquid scintillator.

The neutron detection efficiency estimation is performed using two neutron sources. Firstly, the neutrons produced in the IBD give a homogenously distributed signal in the detector, being especially well-suited for a direct measurement of the globalselection efficiency in the full target volume. Secondly, a 252Cf fission source is deployed along the symmetry axis of the detector. This pointlike isotope emits neutrons at high multiplicity and allows to quantify the neutron capture fraction.

The most dominant uncertainty on neutrino signal detection is introduced by the detection efficiency of the neutron events. The collected data from the near detector since January 2015 will profit from improved detection systematic uncertainties thanks to the cancellation of correlated contributions. New results improving significantly the 0.6% uncertainty obtained in the latest publication will be presented, providing a crucial input for reactor antineutrino oscillation analysis with two detectors.