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Double Chooz: optimizing the sensitivity to theta13 with a multi-detector setup.

One of the fundamental open issues in neutrino oscillation physics is the measurement of the mixing angle theta13, whose best upper limit to date is provided by the Chooz experiment. The eventual measurement of theta13 in reactor neutrino experiments relies on a reduction of the Chooz systematics of about 1 order of magnitude, along with a major increase of the luminosity. Provided that enough statistics are achieved with long data taking runs (˜ 3 years), fighting the systematics becomes the key towards theta13. The Double Chooz experiment aims at improving the Chooz experience by means of a long-term stability multi-detector setup. The comparison between un-oscillated reactor neutrino flux at a near site (˜400 m) and the oscillated flux at a far site (˜1km) allows for the cancellation of the reactor-related correlated errors. The detector-related systematics are kept under control by constructing two identical detectors providing accurate energy reconstruction and high signal-to-noise ratios. Phase I of Double Chooz, starting in summer 2010 with only one detector, will be able to improve the current theta13 limit with only a few months of operation, thanks to the reduction of the experimental uncertainties with respect to Chooz. Ultimate systematics reduction will be achieved in Phase II (2012) when the second detector (near site) starts taking data.

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