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Neutrino mass hierarchy and neutrino oscillation parameters with 100,000 reactor events

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This work is being performed in collaboration with E. Lisi (INFN, Bari, Italy) and F. Capozzi (U. of Bari, Italy), and will appear soon on arxiv. Proposed high-statistics, medium-baseline reactor experiments such as Daya Bay II will allow to probe the neutrino mass hierarchy, and will significantly reduce the uncertainty on oscillation parameters related to electron neutrino disappearance. These goals generally require a control of the energy spectrum with sub-percent accuracy. In this context, we revisit several ingredients of prospective data analyses, including: nucleon recoil in inverse beta decay and its impact on energy reconstruction and resolution, hierarchy and matter effects in the oscillation probability, spread of reactor distances, (un)binned event spectra, irreducible backgrounds from geoneutrinos and from far reactors, and degeneracies between energy scale and spectrum shape uncertainties. We also introduce a continuous parameter \alpha, which interpolates smoothly between normal hierarchy (\alpha=+1) and inverted hierarchy (\alpha=-1), allowing intermediate cases (\alpha ~ 0) where the hierarchy may be "undecidable". On the basis of numerical simulations, we discuss quantitatively the sensitivity to the hierarchy and to the other mass-mixing parameters.

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