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The detector system of the Daya Bay reactor neutrino experiment

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ABSTRACT

The Daya Bay experiment was the first to report simultaneous measurements of reactor antineutrinos at multiple baselines leading to the discovery of $\bar{\nu}_e$ oscillations over km-baselines. Subsequent data has provided the world's most precise measurement of $\sin^2 2\theta_{13}$ and the effective mass splitting Δm^2_{ee}. The experiment is located in Daya Bay, China where the cluster of six nuclear reactors is among the world's most prolific sources of electron antineutrinos. Multiple antineutrino detectors are deployed in three underground water pools at different distances from the reactor cores to search for deviations in the antineutrino rate and energy spectrum due to neutrino mixing. Instrumented with photomultiplier tubes, the water pools serve as shielding against natural radioactivity from the surrounding rock and provide efficient muon tagging. Arrays of resistive plate chambers over the top of each pool provide additional muon detection. The antineutrino detectors were specifically designed for measurements of the antineutrino flux with minimal systematic uncertainty. Relative detector efficiencies between the near and far detectors are known to better than 0.2%. With the unblinding of the final two detectors'

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