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Characterizing the Energy Response of the Daya Bay Antineutrino Detectors

The Daya Bay reactor antineutrino experiment has provided the most precise measurement of the neutrino oscillation amplitude sin^2 2θ_13 = 0.090 +0.008 −0.009 as well as the first direct measurement of the mass-squared difference |Δm^2_{ee}| = (2.59 +0.19 −0.20) × 10^{-3} eV^2 by measuring relative differences in antineutrino interaction rates and spectral shapes between near and far detectors. In addition, the tremendous rate of antineutrinos collected by the four near detectors enables a precision measurement of the reactor ν_e spectra.

These spectral measurements require an accurate understanding of the detector response to e+ , e− and γ, including energy resolution, non-uniformity with vertex position and non-linearity. The scintillator response is non-linear due to Birks' quenching and Cherenkov light absorption and reemission with detectable wavelength. Additional energy non-linearity arises from the interaction of the scintillation light time profile and the charge collection of the readout electronics. This poster presents the analyses to characterize the energy response using various detector calibration data as well as benchtop measurements.

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