Updated Event Selection for the PROSPECT Experiment

PROSPECT aims to measure highly enriched $^{235}\text{U}$ reactor anti-neutrino energy spectrum with high precision and to model-independently search for $\text{eV}^2$ sterile neutrino oscillations. PROSPECT is an optical segmented detector filled with $\sim 4 \text{ ton} \ ^6\text{Li}$-loaded liquid scintillator and deployed at $\sim 7\text{ m}$ from compact reactor core in HFIR (High Flux Isotope Reactor).

In order to detect reactor anti-neutrinos via IBD (Inverse Beta Decay) processes, we developed an analysis framework based on the liquid scintillator PSD (Pulse Shape Discrimination) particle-identification and the temporal-spatial correlations in the IBD processes. Additional cosmogenic veto cuts mitigate high on-surface cosmogenic backgrounds.

Previously we reported $^{235}\text{U}$ anti-neutrino spectrum and sterile neutrino oscillation result based on $\sim 30$ days’ reactor on data-taking. Here we describe improvements to the IBD event selection applied to a larger data set with approximately twice the IBD statistics.

Mini-abstract

Improved PROSPECT inverse beta decay event selection applied to 95 days reactor on data.

Experiment/Collaboration

PROSPECT collaboration

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