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Machine Learning Applications to Reactor Antineutrino Detection with PROSPECT

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The Precision Reactor Oscillation and Spectrum Experiment (PROSPECT) is an above-ground antineutrino experiment at short baselines located at the High Flux Isotope Reactor (HFIR) at Oak Ridge National Laboratory (ORNL). This experiment's physics goals include searching for the existence of sterile neutrinos and precisely measuring the antineutrino energy spectrum. At PROSPECT, antineutrinos are detected via the inverse beta decay (IBD) interaction. This process provides a near-unique space-time correlated signal pair consisting of a positron energy deposition and a delayed neutron capture in the liquid scintillator (LS). The correlation between prompt and delayed pulses/signals is an excellent handle for background suppression. The ORNL group is currently exploring several applications of machine learning techniques for the reconstruction and analysis of antineutrino events. In this presentation, I will focus on one of these efforts which attempts to improve the current positron identification capability by identifying a subset of positrons through orthopositronium formation.

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