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Neutron scintillation in liquid Argon for reducing uncertainties in neutrino oscillation experiments

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For current and upcoming accelerator-based neutrino oscillation experiments, a precise understanding of neutrino-nucleus interactions is crucial to attaining the desired sensitivity. Insufficient knowledge of the energy carried by undetected particles, particularly neutrons, produced in neutrino-nucleus interactions can distort the reconstructed neutrino energy spectrum and introduces bias in the determination of oscillation parameters, and in searches for new physics. The characteristics of the scintillation produced by neutrons resulting from these interactions with the leading detector material in neutrino oscillation experiments remains poorly understood, especially in the tens-of-MeV energy range where experimental data are limited. We present a new local setup, SArIT, to measure scintillation in LAr induced by neutrons up to 40 MeV in kinetic energy. We aim to measure the scintillation light temporal pulse shape induced by neutrons and utilise pulse shape discrimination (PSD), with and without the presence of an electric field, to improve the light modelling in neutrino interactions, enhanced neutron detection, thereby improving the neutrino energy reconstruction methods.

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