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DEAP-3600 Hardware Upgrades and Study of Effect of Pyrene-Doped Polystyrene Wavelength Shifting

Located 2 km underground at SNOLAB in Sudbury, Canada, the DEAP-3600 experiment uses a 3.3-tonne single-phase liquid argon (LAr) target to detect nuclear recoils from dark matter interactions. Following the conclusion of its second fill run in 2020, the detector underwent major upgrades to mitigate shadowed-alpha and dust-related backgrounds, the two primary noise sources in the WIMP search region. Refilling commenced in early 2025, with subsequent vacuum, gaseous argon, and liquid argon data runs scheduled before full-scale operations resume through 2026. These enhancements, including a slow-time-constant pyrene-based wavelength shifter coating to mitigate shadowed alphas from the detector inlet, are expected to enable background-free sensitivity at the 10^{-46} cm² cross-section level, significantly refining background models and boosting detector performance for next-generation LAr dark matter experiments.

Analysis of the populations of events in the detector data which are affected by pyrene doped polystyrene scintillation and wavelength shifting will be presented, alongside comparisons with the updated Monte Carlo simulation model.

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