

Correcting Signal Saturation in DEAP-3600

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DEAP-3600 is a tonne-scale, liquid argon (LAr) experiment searching for Weakly Interacting Massive Particles (WIMPs), which are a leading candidate for dark matter. The detector is located at SNOLAB in Sudbury, Ontario, and comprises 3279 kg of LAr as a scintillator, viewed by 255 photomultiplier tubes (PMTs). While DEAP is optimized for detecting WIMPs at recoil energies on the order of 10 keV, vital background analyses probe higher energy regimes—up to a few MeV, where signal saturation in the PMTs and digitizers are important systematic effects. In this presentation, a novel approach to correcting such nonlinear behaviour is discussed, with the goal of decoupling saturation effects in different components. A physics-driven model for PMT saturation has been developed and applied to re-linearize the PMT response. This talk will report on the development of this technique and its validation in data using alpha decays in the LAr bulk of the DEAP-3600 detector.

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