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Understanding the effects of pile up in the DEAP-3600 detector

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DEAP-3600 is a single phase direct dark matter detector located at SNOLAB in Ontario, Canada. 255 photo-multiplier tubes surround a spherical acrylic vessel to detect scintillation light from ~3300 kg of liquid argon. DEAP-3600 was designed to search for spin independent weakly interacting massive particles (WIMPs) and holds the leading WIMP exclusion using liquid argon.

Identifying background events is vital in WIMP searches. To precisely model backgrounds, pile up—multiple interactions happening in a single triggered event—must be understood. Pile up can be studied using our periodic trigger—a 40 Hz, threshold-less trigger—which provides snapshots of what is occurring in the detector at random moments.

A data-driven method to study pile up in DEAP-3600 is by mixing the raw waveforms of periodic trigger events with physics events. Using this technique, we investigate the ability of pile up to mimic a WIMP signal.

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