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Position Reconstruction Using Photon Timing for the DEAP-3600 Liquid Argon Dark Matter Experiment

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DEAP-3600 is a single-phase liquid argon (LAr) dark matter detector being operated 2 km underground at SNOLAB. The ultra-pure LAr target is contained in a spherical acrylic vessel of 3600 kg capacity, viewed by an array of 255 photomultiplier tubes (PMTs). The expected sensitivity to the spin-independent WIMP-nucleon cross-section is 10^{-46} cm^2 at 100 GeV WIMP mass. Natural radioactive contamination can cause alpha decays originating in the acrylic vessel or TPB wavelength shifter, or gamma rays, mostly from PMT materials, that may induce Cerenkov light. These are potential surface backgrounds. Reconstruction of the position of the interactions taking place in the detector utilizes both charge and timing. Including this information in our suite of cuts allows us to identify and remove almost all surface background events. An overview and the results of the initial filling phase is presented. A method of event position reconstruction emphasizing photon timing will be discussed.

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