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(G*) Alpha background rejection in DEAP-3600 using slow wavelength shifters

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The DEAP-3600 experiment (Dark matter Experiment using Argon Pulseshape discrimination) at SNOLAB in Sudbury, Ontario is searching for dark matter by recording their interactions with a liquid argon target. It is designed to detect nuclear recoils induced by the elastic scattering of weakly interacting massive particles (WIMPs) - a leading candidate for dark matter.

Minimizing backgrounds is important for acquiring high sensitivity to dark matter. An example of a background source is an alpha decay which can produce a signal mimicking a dark matter signal. DEAP-3600 uses pulse shape discrimination (PSD) to distinguish between signal events and backgrounds. Prompt light (light coming early to the PMTs) versus total light in the pulse - called fprompt - is used as a discrimination parameter.

The detector setup includes a neck region that has flowguides made of acrylic. Alpha decays are produced in the flowguides from naturally occurring radioactive isotopes in the acrylic. These decays scintillate in the liquid argon (which is in the form of mist or condensate layer around the flowguides) and form a major background component in DEAP. In the upcoming hardware upgrades to DEAP-3600, the flowguides will be coated with a wavelength shifter having a slow time constant which could help move these neck alphas out of the WIMP ROI (region of interest) and increase our WIMP sensitivity. Monte Carlo simulations are used to model the ROI acceptance of the neck alphas with the slow wavelength shifter in place and in this talk, I will present the status of this work which includes measurements of the optical properties relevant for the simulations.

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