
## A Computational Pipeline for Prompt Gamma-Ray Burst Localization Aboard APT and ADAPT

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The Advanced Particle-astrophysics Telescope (APT) is a mission concept aimed at providing all-sky sensitivity, a very large effective area, and prompt localization of MeV transients such as GRBs. ADAPT (the Antarctic Demonstrator for APT) is under construction and scheduled to fly from Antarctica in late 2025. To this end, we are developing a computational pipeline for GRB localization; to keep latency low, it will execute fully onboard the instrument. Front-end event building stages, including pedestal subtraction, signal integration, and centroiding, are deployed on a set of FPGAs. Back-end CPU-based algorithms perform reconstruction of multiple Compton scattering events and localization of the resulting Compton rings.

This poster describes our recent work in developing a more realistic model for uncertainty in the measured positions and deposited energies of Compton scatters in ADAPT informed by simulations and lab measurements of the detector instrumentation. We present updated models for propagation of optical light in its scintillating CsI:Na tiles, for efficiency of its wavelength shifting fibers, and for electronics noise in its edge detectors. Noise is added in simulation to all readout channels, allowing us to compare zero-suppression algorithms. We also simulate the multiplexing of fibers into readout channels and present initial algorithmic techniques for demultiplexing. We update our model of anisotropic background radiation in the upper atmosphere and consider its effects on event pileup. We additionally consider the implications of communication data rates between the front-end waveform digitizers and FPGAs, model the effect on triggering holdoff, and characterize the tradeoff between longer integration windows and longer holdoff times as it impacts GRB localization. Finally, we look at alternative approaches to our back-end algorithms, including using a neural network to produce an order ranking for multiple Compton reconstruction.