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Digital Signal Processing in the GRETINA Spectrometer

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Developments in the segmentation of large-volume HPGe crystals has enabled the development of high-efficiency gamma-ray spectrometers which have the ability to track the path of gamma-rays scattering through the detector volume. This technology has been successfully implemented in the GRETINA spectrometer whose high efficiency and ability to perform precise event-by-event Doppler correction has made it an important tool in nuclear spectroscopy. Tracking has required the spectrometer to employ a fully digital signal processing chain. Each of the systems 1120 channels are digitized by 100 Mhz, 14-bit flash ADCs. Filters that provide timing and high-resolution energies are implemented on local FPGAs acting on the ADC data streams while interaction point locations and tracks, derived from the trace on each detector segment, are calculated in real time on a computing cluster. In this presentation we will give a description of GRETINA's digital signal processing system, the impact of design decisions on system performance, and a discussion of possible future directions as we look towards soon developing larger spectrometers such as GRETA with full 4π solid angle coverage. This work was supported by the Office of Science in the Department of Energy under grant DE-AC02-05CH11231.