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Waveform fitting algorithm for LoLX pulse data

Monday 15 August 2022 11:00 (12 minutes)

The light-only liquid xenon (LoLX) experiment is designed to study light emission, transport, and detection in liquid xenon (LXe) detectors using silicon photomultipliers (SiPMs). LoLX consists of 96 Hamamatsu VUV4 SiPMs arranged in a cylindrical geometry and submerged in liquid xenon. This R&D detector is used to investigate the timing structure of light production processes like scintillation and Cherenkov light in LXe, as well as to provide better understanding of SiPM external cross-talk between neighboring SiPMs and its effect on the overall detector performance. SiPM external cross-talk refers to the emission of secondary photons during the avalanche process resulting from photodetection on a SiPM cell; these can reach other SiPMs and may produce correlated hits on nearby devices. Characterizing the SiPM pulse shape and correlated noise contributions allows for accurate and reliable reconstruction of photons, which is needed to improve the energy and timing resolution of our response model for photon detection. To reconstruct photon signals, we have developed an improved pulse-fitting algorithm that constructs a functional form of the pulse shape. I will present on the functioning of the fitter, its performance, and compare it to other photon-counting algorithms, in particular to a traditional pulse-finding algorithm with respect to improving energy resolution.

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