Intrinsic XRF corrections in Timepix3 CdTe spectral detectors

One of the limitations of Hybrid Pixel Detectors (HPD) is the intrinsic X-ray fluorescence emission from the detector semiconductor sensor. These fluorescence photons cause artifacts and false peaks in the photon energy spectrum measured by the HPD. ADVAPIX-Timepix3 is an energy dispersive HPD based on a semiconductor sensor (Si/CdTe/CZT/GaAs) and readout by a Timepix3 ASIC. Timepix3 is capable of measuring simultaneous Time-Over-Threshold (Energy) and Time-of-Arrival as well as sparse readout. This allows unambiguous one-by-one photon detection where each photon measurement is assigned a time stamp. In this work, we use the time and energy information of every single photon to identify intrinsic XRF events in a $^{57}$Co radioactive source spectrum as measured by a CdTe based detector. We compute the minimum time (ns) and space (pixels) coincidence window, between the XRF and escape photons, that is required to suppress the XRF effect. These parameters were found to be $\pm 15$ ns and 10 pixels (pixel size = 55 $\mu$m) for 1 mm CdTe at 3000 V/cm, 24 $\pm$ 1°C, and a flux of $1.666 \times 10^3$ photons/s before correction.

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