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Development and validation of a measurement-driven inter crystal scatter recovery algorithm with in-system calibration

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In PET a high percentage of gamma photons being detected undergo Compton scatter in the scintillator. Depending on the angle of incidence and the scintillator geometry this might lead to inter crystal scatter (ICS) events, where energy is deposited in two or more different crystals in the detector, which common positioning and reconstruction algorithms cannot resolve. Therefore, scattered events worsen the spatial resolution and the signal-to-noise ratio in the reconstruction. We want to address this challenge by recovering crystal interactions of an event and feeding them into a reconstruction framework. In this work, we established an algorithm based on a one-to-one coupled detector, which combines a measurement-driven calibration and a fitting routine to achieve the recovery of crystal interactions. Using Geant4 simulations, we validated this approach by showing that crystals and their energies could be recovered to a satisfactory degree.

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