

Scintillator pixel detectors for measurements of gamma ray Compton scattering

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The Compton scattering of gamma rays has lately received a growing interest in developing medical physics applications such as Positron Emission Tomography and Compton camera based Single-photon Emission Computed Tomography, as well as in research involving tests of fundamental quantum mechanical laws, such as entanglement. A common method of detection and reconstruction of gamma Compton scattering is to use two detector layers, the first for detection of the scattered electron and the second for the scattered gamma. We have assembled modules of scintillation pixels, which are able to detect and reconstruct the Compton scattering with only one readout layer, thus minimizing the number of electronic channels. A module consists of a 4x4 matrix of Lutetium Fine Silicate scintillators with dimensions 3 mm x 3 mm x 20 mm. It is read out by a matching Silicon photomultiplier array, the signals are amplified and finally acquired by fast pulse digitizers. Two such modules have been tested with a ^{22}Na source and the performance in the detection of 511 keV gamma rays has been evaluated. We have also successfully reconstructed Compton scattering of the 511 keV gammas and we will present the results obtained at the corresponding lower energy depositions approaching the X-ray region.

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