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Experimental study of PET with polarimetric capability

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We have developed, assembled and tested a novel device for Positron Emission Tomography (PET) capable of measuring polarization correlations of annihilation quanta. PET is know as an important medical imaging modality with applications in oncology, neurology and cardiology diagnostics. PET relies on detection of a pair of gamma rays created after positron annihilation in tissue. These annihilation quanta have opposite momenta, energies of 511 keV and orthogonal polarizations. The conventional PET systems have not been utilizing this last property so far, mostly due to lack of cost-efficient polarimeters compatible with PET technology. We developed and tested single-layer Compton polarimeters comprising scintillator matrices read out on one end by the matching silicon photomultipliers and we demonstrated that the polarization correlation can be measured with such devices. In this work we present the experimental study of the PET system based on such polarimeters and its performance with sources of clinically relevant activities.

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