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Comparative Experimental and Simulation DOI Analysis on Semi-Monolithic Metascintillators

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This study compares the depth of interaction (DOI) performance of semi-monolithic metascintillators (SMMS) of dimensions 25.4x25.4x24 mm^3 and standard semi-monolithic scintillators (SMON) of dimensions 25.4x25.4x20 mm^3. The SMMS comprises LYSO:Ce interleaved with EJ232 organic scintillators, while the SMON contains eight slabs of LYSO:Ce.
The experimental findings demonstrated comparable behaviors regarding centroid positions and Full Width at Half Maximum (FWHM) of the DOI distributions. Indeed, using the logarithmic behavior of the centroid positions and the FWHM values, the average DOI resolution computed revealed values of 2.73 ± 0.51 mm for SMMS and 2.47 ± 0.45 mm for SMON. Additionally, simulation results indicate a close correlation with experimental results, especially in the logarithmic behavior of the DOI distribution centroid positions, while showing a discrepancy in the FWHM. From the timing perspective, simulation results show significant improvement in timing through DOI-time walk correction starting from a raw 136 ps up to 98 ps, thus staging a 28% CTR improvement. These outcomes validate the practical applicability of SMMS in PET imaging, showcasing comparable performance to traditional semi-monolithic structures, thereby reinforcing the potential of SMMS in advancing PET technology.

Field

Detectors and electronics

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