

一种基于沿晶体深度反射层分布不同的单端读出深度测量 PET 探测器

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Depth encoding detectors are preferred for PET scanners with small ring diameter and long axial field of view. In this work, novel depth encoding detectors using different inter-crystal reflector arrangements along the depths of single layer crystal arrays are proposed. As compared to the previous four-layer detector with different reflector arrangements, the detectors proposed in this work are expected to improve the energy resolution and timing resolution and easy to assemble in a PET scanner. 2×2 LYSO arrays using four and two reflector arrangements along the crystal depth are fabricated. The LYSO arrays are single-ended read out by SiPM arrays. The flood histograms and energy resolution of the detector were measured in both singles and coincidence modes. The detector with four reflector arrangements nearly provides four-layer depth encoding capability. Except the top two quarters which cannot be clearly resolved, the bottom three quarters of the detector can be clear resolved from the flood histogram. The detector with two reflector arrangements not only provides two-layer depth encoding capability, but also provides depth encoding capability within each half. The DOI resolution at the top of the detectors is worse than that at the bottom of the detector for both detectors. The DOI resolution of the detector with four reflector arrangements is better than that of the detector with two reflector arrangements. The average energy resolutions of the two detectors are 12.2% and 18.0%. In the next, large LYSO arrays will be made to further prove the feasibility of the detectors.

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