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Cryogenic CsI as a potential PET material

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This study explores the possibility of employing pure cesium iodide (CsI) crystals for a total-body positron emission tomography (TB-PET) device.
When operated at cryogenic temperatures, these crystals exhibit an excellent light yield, up to 110 photons/keV, which is approximately four times larger than LYSO. Although CsI has a slightly lower stopping power and a slower decay time compared with BGO and LYSO, its significantly lower price (3 to 5 times cheaper than its counterparts) could enable the realization of accessible TB-PET devices. The performances in terms of energy and time resolution of a pair of cryogenic CsI crystals have been measured in a dedicated setup and a small-animal PET is currently being assembled.
In this project we also investigate the feasibility of using larger, monolithic crystals read out by an array of solid-state photosensors. This approach significantly simplifies the device's design and assembly, further reducing costs. While monolithic crystals typically face challenges in reconstructing the interaction point of the gamma radiation, recent advancements in machine learning algorithms for image processing could potentially enable the realization of a monolithic PET with performances analogous or better than a pixelated one.

Field

Detectors and electronics

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