Contribution ID: **366** Type: **POSTER**

Development of gamma-ray detector consisting of 1 mm pixelated halide scintillator arrays and MPPC arrays

Saturday 14 December 2019 14:03 (1 minute)

Scintillator and scintillator array detectors have been applied as gamma-ray imaging sensors in many fields, including high-energy physics, medical imaging, astrophysics, and homeland security. One of the most recent trends in gamma-ray imaging is the Compton camera. The Compton camera is based on active-matrix pixels composed of either (1) semiconductor detectors or (2) scintillators. Although the scintillator is advantageous for use in practical commercial systems because of its cost effectiveness, there is still room for improvement in the scintillation performance in terms of the energy resolution, light yield, and decay time.
Because of their excellent energy resolution and high light yield, increasing focus has been placed on halide scintillator crystals over the last decade. The SrI2:Eu scintillator is one of the most promising candidates for use in gamma-ray imaging detectors such as Compton cameras because of its high energy resolution and fast decay time [1]. In a previous study, we reported the development of 3×3×3 mm3/pixel 8×8 matrix SrI2:Eu halide scintillator arrays and obtained average energy resolution of 6.7% (FWHM) for 662 keV gamma-rays [2]. However, the assembly of 1.0 mm or smaller pixels in the halide scintillator matrix is both technically challenging and time consuming because these pixels are highly hygroscopic and are difficult to process.
In this study, we develop a radiation detector with 1.0 mm pixel-sized SrI2:Eu arrays using a dicing technique that is cost-effective, widely applicable, and provides good energy resolution. In this conference, we will present the energy and position performance of developed SrI2:Eu arrays coupled with MPPC arrays. The study of depth-of-interaction (DOI) capability of these arrays will also be shown.
REFERENCES
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Submission declaration

Original and unpublished

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Session Classification: POSTER

Track Classification: Technologies