

Two-dimensional Diced Scintillator Array for Innovative, Fine-resolution Gamma Camera

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We are developing a technique to fabricate fine spatial resolution ($\text{FWHM} < 0.5\text{mm}$) and cost-effective photon counting detectors, by using silicon photomultipliers (SiPMs) coupled with finely pixelated scintillator plate. Unlike traditional X-ray imagers that use a micro-columnar CsI(Tl) plate, we can pixelate various scintillation crystal plates more than 1mm thick, and easily develop large-area, fine-pitch scintillator arrays with high precision. Coupling a fine pitch scintillator array with a SiPM array results in a compact, fast-response detector that is ideal for X-ray, gamma-ray, and charged particle detection as used in autoradiography, gamma cameras, and photon counting CTs. As the first step, we fabricated a two-dimensional, cerium-doped $\text{Gd}_3\text{Al}_2\text{Ga}_3\text{O}_{12}(\text{Ce}:\text{GAGG})$ scintillator array of 0.25mm pitch, by using a dicing saw to cut micro-grooves 50 μm wide into a 1.0mm thick Ce:GAGG plate. The scintillator plate is optically coupled with a 3.0 x 3.0mm pixel 4 x 4 SiPM array and read-out via the resistive charge-division network. Even when using this simple system as a gamma camera, we obtained excellent spatial resolution of 0.45mm(FWHM) for 122-keV gamma-rays. We will present our plans to further improve signal-to-noise in the image, and also discuss a variety of possible applications in the near future.

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