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Spatial resolution improvement of gamma camera with diverging collimator using tapered crystal array

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Diverging collimators are used to obtain reduced images of an object, or to detect a wide field-of-view (FOV) using a small gamma camera. In the gamma camera using the diverging collimators, the block scintillator, and the pixel scintillator array, gamma rays are obliquely incident on the scintillator surface when the source is located the periphery of the FOV. Therefore, the spatial resolution is reduced because it is obliquely detected in the depth direction [1]. In this study, we designed a novel system to improve the spatial resolution in the periphery of the FOV. Using a tapered crystal array to configure the scintillation pixels to coincide with the angle of the collimator's hole allows imaging to one scintillation pixel location, even if events occur at different depths. That is, even if is detected at various points in the diagonal direction, the gamma rays interact with one crystal pixel, so resolution does not degrade. The resolution of the block scintillator and the tapered crystal array were compared and evaluated through Geant4 Application for Tomographic Emission (GATE) simulation. Figure 1 shows the scintillator and collimator designed for the simulation and shows the acquired image and profile when the source is generated at the periphery of the FOV. The spatial resolution of the obtained image was 4.05 mm in the block scintillator and 2.97 mm in the tapered crystal array. There was a 26.67% spatial resolution improvement in the tapered crystal array compared to the block scintillation.

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