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Development and evaluation of high-resolution gamma camera for animal imaging

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Recently, α-ray emitting radionuclides, which can treat cancer locally and effectively, have been attracting attention in the in the field of nuclear medicine. Among these, At-211, which is produced in cyclotrons in Japan, is particularly promising. Therefore, it is important to visualize the distribution of At-211 in vivo during targeted radioisotope therapy.
Currently, human SPECT is used for At-211 imaging in animal studies, with a typical resolution of approximately 5 mm. However, the resolution is insufficient for animal imaging experiments because of small sample sizes. Therefore, we developed a high-resolution gamma camera for mouse imaging. We fabricated a device comprising a 5×5 cm^2 multi-pixel photon counter (MPPC) array and 0.5 mm pitch diced GAGG scintillator array. A resistor-split substrate was installed behind the MPPC, and a center-of-gravity calculation was performed using the signal values recorded at the four ends, enabling us to develop a compact detector.
Here, we targeted 79 keV X-rays emitted by At-211. Therefore, we experimented with 81 keV γ-rays from Ba-133, which have a similar energy. By applying a correction method for image distortion and source intensity, a resolution of 0.6 mm was achieved. Additionally, a camera capable of imaging the entire mouse body is necessary to track drug dynamics. Therefore, we developed a large MPPC of 10×10 cm^2 and are working to expand the device while maintaining the resolution. We have succeeded in imaging an 81 keV of the Ba-133 source using this MPPC and planned further imaging and resolution evaluations.

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