A. Instrumentation

Performance Improvement of the Standard-size Scintillation Camera

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A new standard-size scintillation camera based on delay line time conversion has been constructed. This camera has a higher resolving power and a higher count rate performance.

The intrinsic spatial resolution of gamma camera originates from the statistical fluctuation of photo multiplier output. Formerly we used Na I (T*l*) crystal having 311 mm diameter and 12.7 mm thick viewed by a hexagonal array of nineteen 3-inch photomultipliers. By adapting a hexagonal array of thirty-seven 2-inch photomultipliers, it is expected that the statistical fluctuation does not change and the spatial resolution becomes 2/3 of the conventional value.

<Intrinsic spatial resolution>

The average intrinsic resolution values (FWHM) measured at three points within 50 mm from the center of the crystal are 5.6 mm along X-axis and 5.3 mm along Y-axis for ^{57}Co γ-ray. The detector can resolve the 3.2 mm lead bar phantom for ^{57}Co γ-ray.

<Total spatial resolution>

The total spatial resolution (FWHM) of the detector attached the collimator is 8.3 mm for Co γ-ray at the distance of 100 mm from the collimator surface, and the detection efficiency becomes 150 cpm/μCi.

<High count rate performance>

For ^{99m}Tc γ-ray 2 mm ϕ lead apertures placed at intervals of 8 mm of the Anger phantom can be resolved at 60 K cps.

The highest count rate reaches about 100 K cps.

High Resolution Large Field of View Gammacamera with Two Inch Dia. Photomultipliers

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A new high resolution scintillation camera having large field of view has been constructed.

The detector is NaI (Tl) crystal having 406 mm diameter and 12.7 mm thick viewed by a hexagonal array of sixty-one 2-inch photomultipliers. For the positioning circuit the delay line time conversion method is used.

—Intrinsic spatial resolution— The intrinsic spatial resolution (FWHM) measured at several points within 100 mm from the center of the crystal is 5.3 mm along X-axis and 5.0 mm along Y-axis for ^{57}Co γ-ray.

The detector has 3.2mm lead bar phantom resolution for ^{57}Co γ-ray and clearly resolves the finest pattern of the Anger phamtom(1).

—Field uniformity— Digital data of uniformity of response taken with a pulse-height analyser shows non-uniformity of $\pm 9\%$ within 80% field of view.

—Energy resolution— The energy resolution for ^{57}Co is 16.4% (FWHM) when the entire crystal is uniformly irradiated. The values for ^{203}Hg and ^{131}I are 12.0% and 11.9% respectively.

—Collimator— A new collimator for ^{99m}Tc is constructed. Its geometrical resolution (FWHM) is 6.0 mm at the distance of 100 mm from the collimator surface.

Combining this collimator with the new detector, 6.3 mm lead bar phantom can be resolved even at the distance of 150 mm in the air.

(1) H. O. Anger: Testing the performance of scintillation cameras. Prepared for the US AEC, May 1973.

The Effect of Collimator Movement on Scientillation Camera Image

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It has been known that the distortion of image occurs in taking the scintiphoto of a point and line gamma ray source, and a star test chart by the septal effect of multichannel collimator. Therefore, the effect of horizontal movement of multichannel parallel hole collimators produced for 280 KeV and 140 KeV was examined.

The scintillation images obtained by moving the collimators showed high resolution without image distortion.

For obtaining high fidelity scintillation camera image, the adoption of moving collimator system is recommended.