XV. Apparatus

Double Hole Honeycomb Collimator

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For the providing the honeycomb collimator with a higher sensitivity and higher resolving power than those of the usual ones, we have developed a new concept of honeycomb collimator. It is a double hole honeycomb collimator, because the modification consists of inserting a lead tube in each hole of the usual collimator, the diameter of which being 1/3 of the hole containing it.

By this device the penumbra gamma rays are absorbed by these lead tubes. The on-focus gamma rays will effect the reduction of the effective area to the extent of the thickness of the tube.

By increasing the diameter of the holes, it is presumed to be possible to make a collimator which has a better resolving power, and a similar degree of sensitivity, to those of the usual 37-holes honeycomb collimator. This time a 19-double holes honeycomb collimator was prepared, and its sensitivity and resolving power were compared to usual 37-holes one by means of MTF. The cristal diameter was 3 inches.

Results:

Using ^{99m}Tc, the value of MTF of 37-holes one and 19-double holes one at 0.6 lines/cm were 1.4 and 2.9. But on sensitivity, the sensitivity of 19-double holes one was reduced by 30% than that of usual 37-holes one.

Variable Focus Collimator for ^{99m}Tc

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A variable focus collimator planned for ^{131}I was reported previously by Saito.

This is to report the variable focus collimator produced for ^{99m}Tc gamma rays. The focus is shifted by changing the gaps between five lead plates, which are supported by three pantagraphs and extended vertically by screwed cover surrounding the collimator body. Each lead plate keeps the same space at the same time by the pantagraph. The lead plate is 0.5 cm thick having 91 holes in the central area. Focus was changed from 10.5 to 20.0 cm continuously and the change of sensitivity was small as expected. The resolution was 2.0–2.5 cm for ^{99m}Tc line source, and the sensitivity was 42–121 cps/μCi.

A Model of Shadow-shield-type Whole-body Counter

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In this paper, the shadow-shield type whole-body counter which was recently built in Osaka University Hospital is outlined.

The counter was designed as a middle-level apparatus aiming the clinical applications in which tracer studies were main usages.

It consists of two fixed detectors with 5-in. diam. by 4-in. thick NaI (Tl) crystals. One detector is above and the other is below the patient, who lies on a moving bed passing between the two detectors. The distance between crystal faces is 78 cm. The detectors have a pair of flat-field type and slit type collimetors. The shielding is done with 5 cm thick lead around the detectors and the both side of the bed to cut out any direct pathway for external radiation to the crystals. The moving speed of the bed is variable in 5–15 cm/min.

The chief performance are as follows;

Background in ^{131}I range (255–473 KeV) is 721 cpm in ^{137}Cs range (530–794 KeV) is 335 cpm and in ^{60}Co range (1170–1325 KeV) is 116 cpm.

Counting linearity to the amount of radioisotope was fairly good in 0.1–50 μCi ^{131}I point source.

The minimum measurable amount for fixed ^{131}I point source to achieve $\pm 5\%$ accuracy is 0.012 μCi in 10 min, 0.0065 μCi in 30 min and 0.0045 μCi in 60 min counting time.

When the isotope is diluted in a body size plastic phantom and counted with bed running, the minimum measurable amount in the same accuracy was 0.043 μCi in 15 cm/min, 0.034 μCi in 10 cm/min and 0.023 μCi in 5 cm/min bed speed.

The counting efficiency to the point source fixed in the midst of the two detectors is 0.88%, and it is about 65% of the geometric value.