how low energy gamma ray contributes to the scintigram.

For measurements of the scatter radiation eight nuclides of energy range 30 to 412 KeV, and thyroid- and liver phantoms, each having a small chamber in the center, were prepared. Spectra including primary- and scatter radiations were obtained by filling uniformly the phantom with various isotopes, scatter spectra being obtained by filling the small chamber with water and the rest of the phantom with various isotopes. The fraction of scatter radiation in a photo peak was determined by the ratio between the area of the scatter regions and that of the photo peak, which lies inside the window set of ±10%.

When low energy nuclides, ^{197}Hg, ^{99m}Tc, and ^{188}Re were used in a liver phantom, the scatter fraction in a photo peak was high (30—15%). With Se-75 and Hg-203 it was low (7 and With ^{75}Se ^{203}Hg it was low (7 and 5%). It was, however, a little higher (9 and 7%) with ^{131}I and ^{198}Au which is due to a little increase of the septal penetration of the primary gamma ray.

While the thyroid is a small organ compared to the liver, the fraction is little. For a low energy radionuclide the fraction of the scatter radiation comes 3 to 6 times as large as that of ^{75}Se and ^{203}Hg. As for the gamma ray of ^{198}Au, we found the shielding of collimator was a little insufficient, that is the shielding becomes more important for getting a good quality of scintigram. The counts of scatter radiation measured in a photopeak can not be entirely removed from those of the primary radiation, but it can decrease by means of moving the window set to upper level or reducing the window width.

This study suggests that the best energy of the gamma ray used in scanning is about 250 KeV from the view point of the shield effectiveness and the contribution of the scatter radiation.

Spark Chamber for the Use of Gamma Camera

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A spark chamber, which is known as an economic radiation detector because of simplicity in structure and in field size, has been investigated for use as a gamma camera. The main features of the spark chamber made in our laboratory for preliminary experiments are summerized as follows: (1) Two electroconductive glasses are arranged as parallel plate electrodes, of which conductive layers face each other. This arrangement gives the detection efficiency higher than that in any other type of spark chambers for a gamma camera. (2) Pure helium gas is employed at atmospheric pressure, because it has low starting potential or sparking and high electron multiplication factor. (3) The D. C. potential is applied to the electrodes through a quenching resister and semi-automatic on-off control is performed using a preset counter. (4) Although there is essentially and technically no limitation in the size, the field size of the spark chamber is chosen 21 cm in the diameter for the preliminary study of the spark chamber as a medical tool. (5) Spark images are recorded by a specially modefied Polaroid Land camera and ASA 3000 films at f:8 or 11. (6) In order to obtain excellent images, new multichannel collimators are employed. The design concept considering the thickness of the source is different from that of Anger's.

For the purpose of investigations on the characteristics of the above spark chamber, a Picker Nuclear phantom was used and gamma-ray emitting R. I., such as ^{99m}Tc, ^{131}I, ^{137}Cs and ^{198}Au, were prepared.

The experimental results are shown in the followings: (1) The detection efficiency is monotonously increasing with the energy of gamma-rays from R. I. under the same experimental condition. This result world be explained by an idea that sparks are predominantly triggered by the forward emitting secondary electrons from the cathode material. (2) The detection efficiency is not always in linear relationship with the intensity of incident gamma-rays, but saturates in high energy region, owing to the dead time of the spark chamber. (3) spatial resolution does not highly depend upon that of the spark chamber itself, but on the resolution of the adopted collimator.

It would be concluded that the spark chamber can be expected as a useful gamma camera for its energy dependence and the high resolution, in addition to the advantages of low cost and no essential limitation in field size.

Studies on 11″ϕ Scintillation Camera

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A number of methods have been used to convert γ-ray images to visible images. Some of them were in routine use in hospitals and laboratories. Recently, one of radioisotope camera was constructed, which employ 11-inch diameter crystal viewed by an array of 19 photomultiplier tubes, so called the Scintillation Camera.

The image detector has an 11½-inch diameter by 1/2-inch thick sodium iodide crystal, ninteen 3-inch photomultiplier tubes, four channels matrix circuit board and 300 kg lead shielding. Collimators are changed by six bolts on detector head. High energy collimator has 2100 parallel holes and 75mm thick. Low energy one has 7000 parallel holes and 30mm thick. Pin-hole collimator has 5mm diam. platinum edge.

The four signals (+X, X, +Y, and −Y) are obtained from the detector. These signals are sent to the nuclide selection circuits. At the output of the nuclide selection circuit, the Z signal is obained by adding the same four signals. The signal is sent to the input of the pulse-height selector. The output of the pulse-height selector is sent to the grid of the cathode-ray tube in the oscilloscope, for unblanking the cathode-ray beam.

In other words, the four output signals (+X, −X, +Y, and −Y) of nuclide selection circuits take the ratio to Z signal. The output of the ratio circuits are sent to the four deflection plate of the cathode-ray tube. Then, the location of each flash of light on the cathode-ray tube screen corresponds quite accurately with that of the original scintillation.

The viewing area of the image detector is divided into semicircle or quartered circle. The numbers of light flashes in any two of semicircle or four areas are counted by two six decade scalers. Also, analogue signals of the two scaler's readings are prepared.

The scintillation camera are tested by several ways and some performances are made clear. The usable diameter of the crystal is about 25cm. When high energy collimator is used, the resolution for ^{203}Hg 1mm diam. parallel line source is found 1.25cm.

Scintillation Camera Using Delay Line as Position Computer

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The scintillation cameras are being increasingly used in the field of diagnosis, but they still have many problems to be improved, that is, linearity, resolution, etc. A new method of