A New Method for Obtaining Scintillation Camera Images with Serial Flow Camera

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Nowadays, there are increasingly many cases in which the images of such large organs as the whole lungs and the liver (including the spleen) are obtained from the scintillation camera. However, the effective field of the usual scintillation camera with the parallel hole collimator is so small that it is difficult to obtain the whole image of such a large organ within the field of the camera. In comparison with this, the camera with a diverging collimator and a pin hole collimator is able to obtain the image within a single field, but these images obtained are mostly distorted. So, we worked out a system to obtain the image of the large organ within the field of the camera without any distortion, by using the usual scintillation camera with a parallel hole collimator.

In principle, by scanning the object in the given direction, using the detector with the slit type of collimator, a large rectangular effective field which is the diameter of the collimator by the moving distance of the detector in dimensions can gained, and it becomes possible to obtain the image of the large organ within it.

In practice, the detector is fixed and the linear bed which the object is lying on is placed under the detector and moved in the given direction at the given rate. Then, the image of the object as well as the bed is obtained, moving in the given direction, on the CRT, and recoded continusouly on the film of 35 mm wide through the slit, setting the serial flow camera.

The above mentioned devices enable us to obtain the image of the large organ as the lung and liver without any distortion within the field. In the same way, the scintillation camera image of the whole body also can be obtained by moving the bed lengthways.

Study On Longitudinal Simultaneous Multiplane Tomographic Radioisotopic Imaging With A Scintillation Camera

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A new system is proposed for gamma ray logitudinal simultaneous multiplane tomography using a scintillation camera and a new type of collimator "The Tomocollimator" which was originally designed by authors.

This new type of "The Tomocollimator" is a multichannel collimator with 1400 parallel holes made of tungusten. The detector containing 11.5 in-dia crystal is fitted with "The Tomocollimator".

Principles of New Method of Tomography

As the detector head moves back and forth in a linear motion, the angle of inclination of the channels, which at all time are parallel to each other, should change accordingly so that one channel is always focused on the same point in the plane of interest, during this back and forth linear motion of the detector head. For example, the channel at the center of the detector head should always be focused on the center point of the plane of interest. As the detector moves and collects information about the plane of interest, that plane's image will appear clearly on the CRT.

Although in one back and forth motion of the detector head, only one plane's image clearly appears on the CRT, the information about the points on all the other planes is stored in the VTR in that one motion of the detector head.

It is only a matter of simple computer processing to focus on other planes.

Result

3 cylinders 6 mm in diameter and 6 cm in length, containing 100 μCi of --Se-Selenomethionine, were placed at 5 cm, 10 cm and 15 cm from the surface of the collimator. The cylinder which was focused on appeared clearly in the same position and with the same features on the CRT, while the other cylinders appeared on the CRT but moved as the detector head moved and were thus blurred. A clinical application of this method was performed on a patient with meningioma.

Tomographic imaging with a scintillation camera having a large field of view

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An apparatus for tomographic imaging of radioisotope distribution in human has been constructed. Its principle is the same as one devised by groupes of Chiba University and Nuclear Chicago Co. A 30° slanted parallel hole collimator which is attached to a scintillation camera with delay line arithmetic rotates about its central axis at a constant speed of one revolution per minute, while a top of a table is moved in a circular motion. The camera consists of a NaI(Tl) crystal of 38.7 cm in diameter viewed by thirty photomultiplier tubes. It provides a field of view having a diameter of 34 cm. The intrinsic spatial resolution of the camera in X and Y directions are 8.4 and 8.0 cm (FWHM) for a ^{57}Co source, respectively.

In tomographic imaging the longitudinal resolution as well as the transverse resolution is required to be better. Response function of the system to a point source was theoretically derived and given by a Gaussian function modified by a modified Bessel's function of zero order. Tomographic effect can be evaluated by calculating the response function. An index of the longitudinal resolution was defined here to be a distance from the focal plane, where the FWHM value of the response to a point source becomes twice that of the response to a point source in the focal plane.

According to this definition, the present system had the longitudinal resolution of 1.8 cm with the transverse resolution of 1.6 cm (FWHM) for a ^{57}Co point source located 10 cm from the collimator surface.