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TOTAL BODY EMISSION SCANNOGRAM WITH POSITOLOGICA-II

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When taking positron CT, it may be convenient and sometimes necessary to get a distribution of administered radionuclide within total body, because it is useful for positioning slices and it gives a rough idea about internal behaviour of tracer. We have developed a computer program, with which one can take emission scannograms from all directions using the scanning mechanism of POSITOLOGICA-II and linear translation of bed. With the program, one can take emission scannograms 504x1392 mm in the maximum size from 128 directions. Standard scan time is 5-10 minutes for images of the maximum size, and pixel size is 6x6 mm. Time decay of activity and attenuation of radiation in the body can be corrected. An outline of the program, physical characteristics of scannogram and examples of patient study will be presented.

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A HIGH PERFORMANCE BGO DETECTOR FOR POSITRON EMISSION TOMOGRAPH.

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The basic characteristics of a new high performance and low cost detector for positron emission tomograph (PET) were measured. The detector consists of eight 3mm wide BGO crystals coupled to a dual rectangular photomultiplier tube (PMT) through a pair of light guides.

Position, timing and energy resolution were measured. In-plane resolution (line spread function) was 3.6mm (FWHM). Timing resolution between two detector was 6nsec (FWHM) and 12nsec (FWTM). Energy resolution was 24% (FWHM).

Image quality of a PET system using this detector was also discussed.

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EXPERIMENTAL EVALUATIONS OF IMAGE QUANTITATIVITY IN DETECTION OF A SMALL DEFFECTED REGION USING HEADTOME III.

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Quantitativity in imaging a small defected region was experimentally evaluated using various acrylic disks (AD) in a cylindrical pool filled with uniform radioactivity. For evaluation of image plane direction, the AD of various diameters from 1 to 4 cm with 4 cm thickness were measured as shifting axially in 3 mm step. For evaluation of axial direction, the AD of various thickness from 0.5 to 4 cm with 4 cm diameter were measured at the center of direct and cross planes. Attenuation was corrected using the transmission scan. Image defect was evaluated by a relative value of region of interest (ROI) on the AD area to a mean value of the surrounding hot area. In the image plane direction, the value of the defect was increased as increasing a ROI size more than 1/2 of the AD diameter. Thus, ROI size was fixed to 1/2 of the AD diameter. The value of the defect were increased with decreasing the AD diameter, and a critical minimum of the defect for quantitative evaluation seemed to be approx. 2 cm. Similarly in the axial direction, minimum thickness of the defect resulted in 2.5 cm. In these images 10 ∿ 15 % scatter level was remained.

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EVALUATION ON SPATIAL RESOLUTION OF A POSITRON EMISSION COMPUTED TOMOGRAPH.

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We have developed a positron emission computed tomograph (PCT) with high spatial resolution of 5-6mm (FWHM) for whole body use. In designing the PCT, we evaluated an optimum crystal width to achieve uniform resolution in the field of view (FOV). The resolution uniformity deteriorates in peripheral areas where the angle of incident gamma rays is relatively large. In order to reduce this resolution nonuniformity, it is suggested to use inter-crystal septa, but this results in a degradation of sensitivity. Then, we evaluated the optimum crystal width with a minimum degradation in sensitivity, in the case of that no inter-crystal septa are used, under the following conditions.
(1) detector ring diameter, 800-850mm.
(2) packing ratio, 0.85-0.9. (3) BGO depth, 24mm. (4) BGO width, 5-9mm.
Results of our evaluation show that, for the crystal width less than 8mm, radial resolution at the distance of 200mm from the center of the FOV becomes worse than that at the center of the FOV by a factor of 1.5-2.5. Consequently, the optimum crystal width, which makes radial resolution coincide with tangential resolution in the FOV is 8mm in the above evaluation.