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PERFORMANCE OF HEADTOME-III AS A WHOLE BODY POSITRON EMISSION TOMOGRAPH.

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HEADTOME-III was primarily designed as a brain imaging positron emission tomograph (PET). However, a large diameter of patient tunnel to improve uniformity and quantitation, enable a whole body imaging. In this study fundamental performances of HEADTOME-III as a whole body PET were examined and resulted in as follows.

Spatial resolution (r=150 mm)	Radial	11 mm FWHM
	Tangential	11 mm FWHM
	Axial	15 mm FWHM
Spatial non-linearity		2 %
Non-uniformity of efficiency		2 %
Sensitivity for 30 cm pool		
Direct plane		50.42 kcps/μCi/ml
Cross plane		80.60 kcps/μCi/ml

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SCATTERED COINCIDENCE ON HEADTOME-III AND THE EFFECT OF THE SEPTA.

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The septa-length dependence of scatter components in image was measured by using a 18 cm diam. cylindrical pool which has a 5 cm diam. and 3.5 cm long cold spot. As shown in Fig. 1. the scatter components were decreased by extending the septa length.

The effect of "off-area subtraction" technique being employed in HEADTOME-III was also investigated by using the same phantom. The result is shown in Fig. 2.

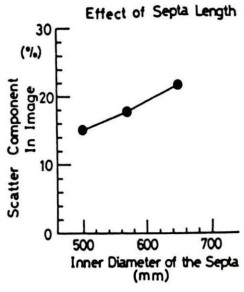

Fig.1

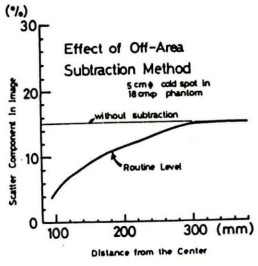

Fig.2

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DIRECT MEASUREMENT OF SCATTERED COINCIDENCE AND ITS CORRECTION METHOD IN POSITRON EMISSION TOMOGRAPHY.

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New method to directly measure the scattered coincidence was proposed. The method is based on shadow obtained by gamma-ray opaque material placed outside the field of view. The opaque shades true-coincidences but not scattered coincidences. The scattered coincidence measured by this method were a triangle-shaped distribution in the sinogram for the small and medium size cylindrical pool less than 20 cm diameter and flat distribution for that of 30 cm diameter. These well agreed with analytical method by Tanaka et al. The measurement of scatter in a transmission scan showed flat distribution more than 30 % of true events, which suggests that attenuation correction method using the transmission scan will result in a significant underestimation at center in the reconstructed image. The new method is applicable in the existing PET scanner as a real-time method for measurement and correction of scatter coincidence. Problems in applying the method such as a size of the opaque material, a diameter of orbit of the opaque and handling significantly low S/N of the shadow were discussed.

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QUANTITATIVITY AND STABILITY OF HEADTOME III IN ROUTINE POSITRON EMISSION TOMOGRAPHIC STUDY.

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Quantitativity and stability of positron emission tomograph (PET) is one of the most important points in quantitative PET study. We examined factors in routine procedures affecting on quantitation of PET data. Detector non-uniformity was calibrated using a plate source of Ge-68 every morning. In order to obtain a sensitivity relationship between PET and well detector for tissue count and arterial blood count, respectively, a cross calibration was carried out weekly using a same concentrated radioactive solution for the two equipments. Stability of sensitivity was evaluated by Ge-68 plate source, and showed gradual decrease in this second year of HEADTOME III. However, the effect of this slow deterioration can be corrected by the cross calibration process. System troubles due to hardware and software bugs during this second year were considerably decreased when compared with those in the first year. Experiment using a cold spot phantom showed a significant scatter level in the reconstructed image. Thus, it is suggested that a complete correction method should be developed to avoid a misinterpretation of PET Image due to such scattered coincidence.

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