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DESIGN OF HIGH RESOLUTION POSITRON CT FOR ANIMAL STUDIES--POSITOLOGICA IV. T.Tomitani, N.Nohara, H.Murayama, M.Yamamoto, E.Tanaka and T.Hayashi\* National Institute of Radiological Sciences and Hamamatsu Photonics K.K.\* Chiba and Hamamatsu.\*

At present, resolution of positron CT is limited by the photomultiplier(PMT) diameter. The diameter of the smallest PMT available is 13.5mm. Recently we had a prospect to overcome this limitation by use of a new type of PMT, which was reported separately in this meeting. Here the system design was reported. 128 bismuth germanate crystals of 4 mm wide, 10 mm high and 20 mm long are arranged on the ring of 265 mm diameter. The crystal arrangement was determined by POSITOLGY, which, along with the gantry rotation, enables us fine and uniform sampling. Two crystals are coupled to one PMT, one bank consists of 8 such units and each bank has 5 coincidence circuits corresponding to 5 opposing banks. The signals are transmitted from the rotor to the stator via 128 coaxial cables. Separate delayed coincidence circuits are provided to record random coincidence events. Binning width is 1 mm and number of angular smapling is 128 for 180°. Data are stored into PDP 11/23 minicomputer with DMA add-one unit developed by us.

Detector pair resolution at center is 2 mm. System sensitivity is estimated to be 1.2 kcps/ $\mu$ Ci/ml with 10 cm dia. phantom filled with water solution.

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PRELIMINARY PERFORMANCES OF HEADTOME III. I.Kanno, S.Miura, M.Murakami, K.Takahashi, F.Shishido and K.Uemura. Research Institute of Brain & Blood Vessels-AKITA, Akita.

Preliminary performances of a high quality brain positron camera (HEADTOME III) were reported. The HEADTOME III employs 480 BGO detectors arrayed on 75 cm diameter three circular rings and facilitates a narrow and a wide collimators, a high resolution collimators, and high quality collimator. The performances of system was measured with the energy window of 350 to 650 KeV and with the time window of 20 ns.

Spatial resolutions without shadow mask (normal resolution scan) were 8.5 mm and 9.0 mm FWHM at the center and at 10 cm off-center, respectively, and the resolutions with shadow mask (high resolution scan) 6.5 mm FWHM at the center. Slice thicknesses without septa (standard quality scan) were 15 mm FWHM over the FOV of the direct slice and 12 mm and 18 mm FWHM at the center and at 10 cm off-center, respectively, in the cross slice. The slice thickness with septa (high quality scan) was decreased from 9 to 10 mm FWHM over the FOV. The sensitivity was about 30 and 60 kcps/ $\mu$ Ci/ml for 20 cm water pool at the direct slice and the cross slice, respectively, with the standard quality scan, and 18 kcps/ $\mu$ Ci/ml at the direct slice with the high quality scan.

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DEVELOPMENT OF POSITRON EMISSION COMPUTED TOMOGRAPH FOR WHOLE BODY STUDY. S.Inoue, K.Ishimatsu, A.Ohgushi, K.Hirata and M.Kumamoto. Hitachi Medical Corporation, Kashiwa, Chiba. K.Takami. Central Research Lab., Hitachi Ltd. Kokubunji, Tokyo T.Hayashi. Hamamatsu Photonics K.K. Hamamatsu, Shizuoka. K.Torizuka. Dept. Nuclear Med., Faculty of Med., Kyoto Univ. Kyoto. R.Morita. Dept. Central Radiology Faculty of Med., Kyoto Univ. Kyoto.

A new positron emission computed tomograph for whole body study has been developed in succession to the development of POSITOLOGICA-II. This device has 4 rotary detector rings and is capable of providing 7 slice images simultaneously. Each detector ring has 192 BGO scintillators (12 x 12 x 24mm<sup>3</sup>) and 96 dual rectangular photomultipliers. The BGO scintillators are arranged on a circular ring with irregular spacings respectively. Images of Derenzo phantom obtained by the device indicate that all patterns of holes are resolved. This development has been performed under contract with the Agency of Industrial Science and Technology, MITI, Japan.

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A BGO DETECTOR UNIT FOR HIGH RESOLUTION POSITRON CT. H.Murayama, E.Tanaka, N.Nohara, T.Tomitani, M.Yamamoto and T.Hayashi\*. National Institute of Radiological Sciences and Hamamatsu Photonics K.K.\*. Chiba and Hamamatsu\*.

As a new detector unit for high resolution positron CT, a twin BGO detector is proposed which consists of two BGO crystals and one single photomultiplier tube. The BGO crystals are 4 mm wide, 10 mm high and 20 mm long. Each crystal is sandwiched with lead septa (1 mm wide, 10 mm high and 15 mm long). The stacked BGO crystals with lead septa are optically coupled to a rectangular photomultiplier tube having a 13 mm x 13 mm cross section. Inside the tube, a small and thin mesh is added as the grid behind half of the photocathode window on which side one of the crystals is located.

The amplitude of the detector signals for the scintillation events in the grid side crystal is modulated by supplying the negative pulses of about -10 volts to the grid. The crystal identification is performed with pulse shape discrimination for the detector signals.

The detector has the energy resolution of about 30 % FWHM and the time resolution of 5.8 ns FWHM for annihilation photon pairs. The reasonable positioning responses for the individual crystals were obtained by moving a 1 mm collimated beam of annihilation photons impinging to the crystal face. The responses suggest that the detector pair resolution may be about 2 mm in positron CT.