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PHYSICAL PERFORMANCE OF A WHOLE-BODY,MULTI-SLICE POSITRON EMISSION COMPUTED TOMOGRAPH, POSITOLOGICA-II.
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Performance of a whole-body, multi-slice positron emission computed tomograph, POSITOLOGICA-II, was experimentally evaluated. The device has three 85 cm diameter detector rings, each consisting of 160 BGO crystals ($15x24x24\ mm^3$), and produces simultaneously five tomographic images separated 18 mm from each other. Spatial resolution was 9.5 mm FWHM in central region and 12 mm FWHM in peripheral region in the 45 cm diameter field of view. Sensitivity was also evaluated with 10 to 40 cm diameter cylindrical uniform phantoms. For a 20 cm diameter phantom filled with water and with preliminary setting of detectors, the sensitivity was 26 kcps/μCi/ml for intra-ring slice and 33 kcps/μCi/ml for inter-ring slice. Effect of scattered coincidence on uniform disc images was also evaluated. Scatter fraction at center of reconstructed image was less than 10% with correction in which constant background was subtracted from projections.

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IMAGE QUALITY IMPROVEMENTS BY TIME-OF-FLIGHT ON A POSITRON EMISSION COMPUTED TOMOGRAPH.
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We clarify image qualify improvements by the time-of-flight information (TOF) of positron annhilation gamma-rays between a pair of detectors in positron CT. A 35 cm cylidrical uniform phantom and patients were scanned with SUPER PETT I which is the first practical positron CT with TOF developed by our group. Gain of TOF is defined by the ratio of variances in images reconstructed without TOF (conventional mode) to with TOF. The gain increases as the activity level in the phantom because of the random coincidence reduction effect with TOF. The gain on the phantom images is 3 at the lowest activity level, and 5 to 8 in the practically interested range of the level. We can expect further gain using TOF on the transmission data for gamma-ray attenuation corrections by body.

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CONVERSION OF OUR 2ND CYCLOTRON.
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Conversion of the AVF type cyclotron, which accelerates negative ions, into our 2nd cyclotron for RI production was started in April 1981. Process of the conversion and the machine's specifications are reported here.

In the conversion, consideration was given to the following points. 1) modification from negative to positive accelerator for RI production, 2) installation of target systems, 3) adding improvements from our experiences with the 1st cyclotron, 4) using domestic parts as much as possible for easier maintenance.

The conversion which started in April '81 was finished clearing above points, and internal beam was accelerated in July. Trial production of RI was started in December, and now the cyclotron is fully employed for production using both internal and external targets.

It was confirmed that there was practically no difference between the 1st and the 2nd cyclotrons in the obtainable proton energy, as well as in the yield of the produced RIs.

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ACTIVATION BY CYCLOTRON (1) NEUTRON DISTRIBUTION IN THE CYCLOTRON VAULT.
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We measured the energy distribution of neutron emitted by the proton bombardment in order to estimate the neutron activation level in the cyclotron vault. Using samples such as Al, Fe, Cu, the neutron spectrum was obtained by activation spectrometry. A copper plate was bombarded by proton beam (26 MeV) accelerated by TCC's CS-30 cyclotron. The activities of samples were measured by the Ge(Li) detector.

The neutron flux density for 26 MeV protons was 1.7×10^{-4} neutron/sr·proton at an angle of 80 degrees from the direction of the proton beams. The neutron energy distribution well corresponded with Maxwell's distribution with the nuclear temperature of 2.5 MeV. For 16 MeV protons, the flux densities were 0.4×10^{-4} and 1.1×10^{-4} n/sr·p at 80 and 30 degrees respectively. The nuclear temperature of Maxwell distribution was about 1.3 MeV both at 80 and 30 degrees.

We also measured the neutron intensity distribution in the cyclotron vault. Cyclotron yokes made a dark shadow (1/40-1/100) for high energy neutrons, but it was not the case for thermal neutrons.