obtaining the position signal is proposed, and some results of preliminary experiments are reported. The method is based on the position-to-time conversion by using two tapped delay lines for X and Y axes. Output pulse from each photomultiplier tube is fed to the suitable tap on the delay line so that the signal delay time is proportional to the position coordinate of the photomultiplier tube. Providing an appropriate pulse shaping, the information about the position of scintillation may be obtained from the waveforms appeared at the end of the delay line.

To study the possibility of this method a small detector assembly and electronic apparatus for signal processing have been constructed. The detector consists of a 6″ϕ × 6mm NaI (T1), a Lucite light guide and nineteen photomultiplier tubes of 1.5″ϕ. The outputs of the photomultiplier tubes are shaped so that the signal at the end of the delay line is bipolar and its zero-crossing time corresponds to the position of scintillation. The position signal for a cathode ray tube is generated by means of a time-to-pulse height converter which is started by the leading edge of the signal and is stopped by zero-crossing point.

Although conclusive results have not been obtained, as compaired with ordinary system, better spatial resolution is expected with this system since weighting factors of position computation for all tubes can be made, for instance, nearly equal.

Studies on the Principal Characteristics of the Scintillation Camera and 1600 Channel Analyzer

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The principal characteristics of the Nuclear-Chicago "Pho-Gamma" scintillation camera and 1600 channel memory apparatus attached to it were investigated.

By use of 1600 memory analyzer, the scintiphoto obtained with the scintillation camera was divided into 40 × 40 matrix and the pulses in each compartment were transfered into digital amounts by A-D converter, then memorized and displayed as both map and profile views, and furthermore the digital amounts in 40 × 40 matrix were printed out.

Isoresponse curve was determined by using digital readout method of 1600 analyzer, with a point-source phantom on the mid line of the detector, placed at various distances from the surface of the multiholes or pin hole collimator.

Collimation of the camera was excellent, showing narrow isoresponse curve which was obtained with a preset time per exposure using ^{131}I point source and 1000 holes collimator.

For the ^{99m}Tc point-source phantom and 4000 holes collimator, similar isoresponse curve was obtained, while the sensitivity was higher than that of former.

For the pin hole collimator, isoresponse curve was funnel shaped, indicating the enhanced distortions for thick organs closed to the pin hole collimator.

Spatial resolution of the scintillation camera was investigated by using the 1600 analyzer, employing the ^{131}I paper phantom with 1cm width contained 1μCi of ^{131}I per cm^2. For the 1000 holes collimator, paper phantoms at intervals of 3mm were distinctly separated from each other, while for the pin hole collimator they could still be recognized as separate source at 1mm in space.

Wepth response and resolution of camera and the effect of absorbing medium were investigated by using 1600 analyzer, employing the ^{198}Au agar-phantom with 0.1μCi of ^{198}Au per cm^3 in 6cm depth.

Balls of 3.8cm diameter filled with water could be detected as the RI defects at any depth in agar phantom for the 1000 holes collimator.

When the balls of 1.5cm diameter were placed at various depth in the agar phantom, they could be detected only at a depth of 1cm for the 1000 holes collimator, and to a depth of 2cm for the pin hole collimator while no longer over 2cm depth. For the 1000 holes collimator, RI activities were increased proportionally to increase in agar phantom thickness, except for 1 inch wide outer edge of whole vision field.

High Level Whole Body Counting by a Conventional Profile-Scanner

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In order to study the metabolism of ^{85}Sr and ^{47}Ca in osteoporotic patients, the utility of a profile-scanner for the high level whole body counting was tested. The scanner has 2 detectors $3''\phi \times 2''$ NaI (T1) crystal over and below the moving bed. Pulses from the both detectors are mixed and recorded by a 100-channel pulse height analyzer. The sensitivity and the spatial response of the scanner in the measurement of the whole body retention of selected isotopes were compard with the NIRS whole body counter in a steel-shield room, having a same scanning geometry.

1) Counter Sensitivity: The isotopes investigated were ^{85}Sr, ^{47}Ca, and ^{131}I most commonly used for medical diagnosis. The count rate per microcurie and the minimal measurable activity (MMA) with the accuracy of 3% standard deviation in photopeak count of the both counters were estimated with the patients administered the isotopes intra-venously. The mesuring time for the calculation of MMA was 40 minutes for the patients and 60 minutes for background. The MMA of the scanner was 0.033μCi of ^{85}Sr, 0.24μCi of ^{47}Ca and 0.18μCi of ^{131}I, which is higher than that of the NIRS-counter by the factor of 21, 37 and 22, respectively. The net count rate of these 3 isotopes, expressed as cpm per microcurie, was 1/15, 1/14 of that of the NIRS-counter, respectively.

2) Spatial Response: The iso-response curve obtained by the 2 counters with a ^{85}Sr point source in air and in water (20cm thick) was almost similar. The energy spectra of each isotope distributed in patients were distorted, because of absorption and scatter. In order to yield the optimal spatial response, 3 energy bands, (i.e. 1) photopeak, 2) Compton scatter, 3) photopeak including Compton scatter) were compared for calculations. The optimal spatial response was obtained by the count of energy band of the photopeak including Compton scatter, in different source distributions.

But in the case of radioisotopes which show geometrically a fixed distribution soon after the administration, such as ^{85}Sr given intravenously, the response was not different in each energy band, and the counting efficiency was best in the photopeak band.

The retention curves of ^{85}Sr in a patient, obtained by both counters, showed good agreement up to 135 days following intra-venous administration of 10μCi of the isotope.

From the above experiments, the high level whole body counter for clinical use was found to satisfy the following specification.

1) The efficiency of detection system matches that of an *in vitro* sample counter for the required observation period for the selected isotopes of interest.

2) The spatial response of the counter for various distribution of sources falls in an error within $\pm 3\%$.