A. B. C. Instrumentation

Measurement I (Information Processing) and Measurement II (Invivo)

Ohio-Nuclear Sigma 410 Radioisotope Camera, its Characteristics and Clinical Evaluation

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Recently we have equipped Ohio-Nuclear Sigma 410 radioisotope camera Ultimat imager, ON75 data storage and retrieval system.

The camera has a hexagonal field of 36.8 cm in diameter. Uniformity of the camera could be corrected automatically around 3% (C.V.) by Dynamic Uniform Field Correction (DUFC) panel. At least 2.5 mm of lead bar phantom could be differentiated without collimator, and on the surface of a low energy high resolution collimator (HR), 3.4 mm could be clearly differentiated. $^{99m}TcO_4^-$ point sources with window setting of 40 keV$\pm$20% was used for the countihg ability up to approximately 25Kcps which was achieved by 12mCi source with HR collimator and 3mCi with high sensitivity (HS) collimator, respectively.

As to the isotope selection, an 128 multichannel PHA is equipped together with a spectrometer and makes the selection quite accurate. Addition to these, an autopeak tracking device maintins the isotopepeak automatically.

Largefield camera has a disadvantage for examining a small organ, but the camera has a magnified field control (MAG) which enables to choose 9 round areas of 25.4 cm in diameter at random.

On the whole body survey, the camera head moves along with the bed longitudinally instead of sliding the bed. This saves the room space greatly.

On 75 dose not only store data but also display and smooth dynamic curves in 128 channel histogram fashion. Ultimat imager builds images on 20 $\times$ 25 cm X-ray film, and one frame per 0.1 sec. and at most 42 frames could inputted.

Dual intensity device is useful for whole body imaging. In cases of dynamic study, simultaneous data sampling on ON 75 serves to provide suitable images by retrieval in 1/8 of storage time.

Evaluation of the System Performance of Mobile Gamma Camera (SEARLE PHO/GAMMA L.E.M.) and the Clinical Studies

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SEARLE PHO/GAMMA L.E.M. is a mobile gamma camera with high utility. Crystal size (diameter 31.12 cm, thickness 1.27 cm), field of view (25.7 cm with parallel holl colimators) and photomultiplier tubes (37) are similar to those of stand type SEARLE PHO/GAMMA IV. The system performance and the scintigrams by L.E.M. were compared with those of IV. The methods are as follows:

1) Sensitivity was examined without colimator.
2) Uniformity was examined with window of PHA on three portion of photo peak (lower, center, and upper portion) which shows in normal and in an exaggrated field uniformity.
3) Specific resolution was investigated by using lead bar phantom.
4) Resolution distance were measured at using two thin tubes containing radio nuclides of gamma ray energy from 92 keV to 247 keV.
5) Resolution distance were also measured at various distance from ditector surface to source using above mentioned line source.
6) Counting loss of maximum counting rate was examined by decaying source method.
7) Scintigrams of myocardium, kidney and celebral cisterna were obtained using by Tl-201 (Hg X-ray 65 keV to 82 keV), Tc-99mDTPA (140 keV), In-111DTPA (172 keV), Two scintigrams obtained by L.E.M. and IV. The same patient were comapred critically.

The results showed that system performance and scintigrams were proved better in L.E.M. than in IV. Sensitivity of L.E.M. system was higher than that of IV system by the factor of about two hold in the Tc-99m source. Uniformity with window of PHA on lower and upper portions of photo peak were worse compared with centered photo peak.

Specific resolution by lead bar phantom were 3 mm in L.E.M. and 3.5 mm in IV. Resolution distance at various distance from 2.5 to 20 cm were always better in L.E.M. than in IV. Resolution distance were 5 mm by L.E.M. and 7 mm by IV in source to ditector distance 2.5 cm. Counting loss started to appear at 200Kcps by L.E.M. and at 12Kcps by IV. Scintigrams of the organs showed that L.E.M. provide us with good images in short time compared with IV. However, it is limited in low energy region.

The most effective utility of L.E.M. is to be mobile and even collimator can be changeable easily. L.E.M. could be used not only in CCU, ICU and operation room for an emergency examination but also would be used as standard gamma camera for extensive examination by connecting with mini computer and micro dot imager system.

Rhombic Coordinate Systems for Scintillation Cameras

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New position computation methods for scintillation cameras are investigated both theoretically and experimentally. To date, scintillation point coordinates have been calculated along two axes, x axis and y axis, which cross at 90°. However there are several coordinate systems for scintillation camera position arithmetics, where two axes cross obliquely. Two of these coordinate systems are investigated. One of them consists of the Cartesian x axis and an axis which crosses the x axis at 60°. The other system uses the y axis and an axis crossing the y axis at 60°. These coordinate systems are called the "X rhombic" and "Y rhombic" systems, respectively. These systems are more symmetrical than the ordinary Cartesian coordinate system for a hexagonal array of photomultiplier tubes (PMTs).

A comparative evaluation is made for these three systems. The scintillation camera detector used in the experiments consists of a 12 inch NaI scintillation crystal and nineteen 2 inch PMTs. Signals from these 19 PMTs are converted to nine line-signals for "X rhombic," and five line-signals for "Y rhombic". Positioning signals are calculated by conventional Delay-line method. Measurement of spatial resolution and uniformity are made with ^{57}Co (122 keV) gamma-rays.

Results of these experiments are as follows: No difference in spatial resolution is found among the three systems. However, the uniformity of the Y rhombic system is inferior to the other two systems. A certain amount of distortion which cannot be corrected remained in the Y rhombic system.

After investigation of the experimental results,