II. Apparatus

Evaluation of Scanning with Semiconductor Detector Ge (Li) (1st-Report)

T. HIGASI and M. KANNO

Department of Radiology, Kanagawa Dental College, Yokohama

H. KURIHARA

Atomic Energy Raboratory, Rikkyo University, Tokyo

E. KASIO and M. KATURADA

Toshiba Co., Ltd., Kawasaki

Recent developments in semiconductor detector technology have caused much interest. We have recently obtained a germanium detector with a capacity of 10cc with a full width at half maximum of 4.5 KeV for the ^{60}Co gamma-ray (1.33 KeV). This semiconductor detector Ge(Li) has a high-resolution for gamma-rays compared with a conventional NaI (Tl) detector. The use of these high resolution detectors should make it possible to map radioactive emission distributions from patients with minimum degradation due to scattered radiation.

Studies were made with a thyroid phantom to determine the relative ability of NaI and Ge(Li) detectors. The phantom was imbedded in water. Scanning time was adjusted so that equal counts were obtained with germanium detector and the NaI using the 37 holes collimator. In this case, the voids in the germanium image were slightly better resolved due to the increase in sharpness of the edges. When the scanning were made equal scantimes, the NaI image were better than germanium image.

From these studies, we have concluded that the imaging ability of semiconductor detector is superior to NaI (Tl) when equal counts are obtained. Small high resolution germanium detectors provide scans of high information content per photon. We feel that the use of germanium detectors for emission scanning in diagnostic Nuclear Medicine will be limited until such time as their sensitivity can be increased to the point when they can compete with NaI detector.

Studies on the Computer Processing of RI Image Using Scintiscanner

T. MUKAI, K. HAMAMOTO, T. MORI, Y. ISHII, T. KOSAKA and K. TORIZUKA

The Central Clinical Radioisotope Division, Kyoto University School of Medicine, Kyoto

The present report deals with the results in digital computer processing of the RI images obtained by scintiscanner (3×2 in. NaI (Tl) crystal×2) with 61 hole honeycomb collimator. Scanning was performed at a speed of 30 cm per minute, and counts in every 1 mm scan were stored into each channel of 1600 channel P.H.A. successively, and data were transferred to the magnetic tape recorder (MT) after one way scanning. The MT was fed into a computer for processing. First, the correction of read data was performed for scalloping, arrangement of data array and half life of nuclides etc. Next, in order to reduce the random fluctuation the raw data was smoothed. Then, to extract the true information from the smoothed data, which were blurred because of the lack of resolution of the detecting system, iterative approximation was performed by the resolving power matrix of the collimator. Finally, the heighest count was determined in the matrix and was divided into 20 levels, each of which was given a typed symbol to be printed in the matrix.

From the experiments for smoothing method, it was found that averaging by 15×9 elements with collimator response was appropriate in the clinical studies for our present system. The computer scintigrams from a scintiscanner with 61 hole collimator were more excellent in their resolution than those from a scinticamera. It seemed that the resolution of processed RI image depended greatly on the detecting system. It may be considered that the digital computer processing has the clinical usefulness with the significant improvement in the details of scan display.

Two Dimensional Analogue Processing of Radioisotope Images

E. Tanaka, N. Nohara and T. Tomitani

National Institute of Radiological Sciences, Chiba

An analogue method of two dimentional processing for radioisotope image is proposed. In this method, an original image is scanned quickly in varying direction with uniform scan line density, and the video signal obtained with the above scanning is processed by a suitable electric filter and displayed on a CRT or storeged on an image storage tube to form an image. The obtained image is the superposition of one dimensionally processed images in varying direction, and the process is equivalent to a two dimensional processing. Thus, one can realize two dimensional image processing with a simple electric filter.

The equivalent point response function of the process is polar symmetry, and its axial spatial response f(r) and the axial frequency response F(ν) are given by

$$f(r) = g(r)/r$$

$$F(\nu) = 2\pi \int_0^\infty g(r) J_0(2\pi\nu r)\,dr$$

respectively, where g(t) is the impulse response of the electric filter, r the axial distance of the space response, ν the axial frequency, and J_0 the first kind, zero order Bessel function.

The advantages of the analogue method proposed here are: (1) capability of handling large information quantity in a short time, (2) continuous, high quality images obtainable, (3) no error associated with quantumization, and (4) easy setting of parameters for optimum processing.