scan-converter. These positive and negative images in two scan-converter are superimposed with up and down shift of half size, respectively. Then nega and posi image made from its superimposed image was divided in four and each one fourth image was erased every one fourth in turn, then with up and down shift one fourth without image in the mid of rest three fourth. Next, eight division was done as same as four dividion. The superimposition was horizontally as same as vertically. As a result a kind of checker-board like superimposition was done, in which manner HT was executed instantly and able to observe. HT has no phase term. Wave form of HT is rectangular other than sinusoid form in Fourier transformation. HT with matric of 32 × 32 of the liver scintigram was obtained. Concept of sequency in HT has other physical meanings than FT. Detailed meanings must be moreover studied.

A Preliminary Experiment on Compton Scatter Tomography (CST) (2nd report)—Study by ^{192}Ir source

Masahiro ENDO, Toru MATSUMOTO, Takeshi A. IINUMA and Yukio TATENO
Division of Clinical Research, National Institute of Radiological Sciences

CST is hopeful imaging method aquiring tomographic distribution of electron density. We have studied this method by phantom experiments. An object is irradiated by a rotating fan-shaped gamma ray and orthogonally scattered irradiations are detected by a conventional scintillation camera, which thereby images the irradiated section of the object.

^{192}Ir was selected as the gamma ray source since high disintegration rate (1-5Ci) necessary for clinical use can be easily obtained and it has moderate half-life (74 days) and peak energy (300 keV). We used 0.5–2.5Ci source in this study and objects were irradiated from four directions whose angular spacing is 90°. A Toshiba GCA-202 camera was used as a detector and a Toshiba TOSBAC-3400 computer was used for image processings, which in this study consisted of (1) superimposing of four images obtained by different dirrections, (2) correction of the non-uniformity of the camera, and (3) correction of the attenuation of the primary ray (if necessary).

Some quantitative characteristics were measured by the phantom study. Counting rate (efficiency) was agreed with calculations. There was a few percent variations for imaging of a uniform object (water phantom). Resolution was 16 mm FWHM and was limited by camera's overall resolution. Measurement values of electron density were some what degraded by self-absorption.

In conclusion the performance of CST is limited by both the characteristics of the scintillation camera (including collimators) and absorption of scattered ray. Development of a new camera system (including collimators) and image processing methods will be necessary for wide clinical applications of CST.

Proton Radiography

Ei-ichi TAKENAKA*, Atsuo AKANUMA*, Takeo HASEGAWA and Isao SUGAI**
**Department of Radiology and Institute of Nuclear Science **The University of Tokyo*

High LET radiation therapy brings out proton radiography or heavy ion particle radiography as a new diagnostic technique. Proton radiography is taken with three techniques such as one to use a great energy loss near the end of proton range, the second to use a kind of edge effect by multiple scattering of incident proton, the enhancement of the proton inetensity distribution of the added scattered proton at the boundary in the object as same as xero-radiographs taken with X-rays, and the third to measure porosity. These proton radiography will be clinically useful for monitoring of proton therapy or proton computed tomography.

FM cyclotron of Institute of Nuclear Science, The University of Tokyo, was used as the following conditions; proton energy of 52 MeV, beam size of $3 \times 7\,cm^2$ or diameter of 15 cm, max. range of 23 mm in paraffin, primary proton beam or scattered beam by a bloc of iron or aluminum, several kinds of non-screen film with seven layers sandwich of Al foil (1 or 2 mm) and film.

Proton radiographs to use marginal range showed sharp edges which were similar to relief photographs with low contrast at the inner part, but it was unsufficient to image the bone. Proton radiographs with continuous energy spectra scattered by a bloc of iron showed high contrast of the air way such as the trachea, the pharynx, the air in bowels and the meatus in the temporal bones. Several films were obtained from sandwich technique of film and Al foil; the first one showed proton radiographs by multiple scattering, the second or third one showed the area over Bragg's peak of the transmitted weakend proton, and the next one showed greater area without proton reaching. The superimposed four proton radiographs were similar to an isodensity curve photograph in proportion to the thickness or atomic composition of an object.

In Vivo X-ray Fluorescent Analysis of Iodine Concentration in the Thyroid

K. IMAMURA*, Y. SASAKI**, K. SOMEYA** and M. FIJII
*Department of Radiology, **Department of the Third Internal Medicine,
St. Marianna University School of Medicine

A simple apparatus was made for the in vivo X-ray fluorescent analysis of stable iodine in the thyroid. The apparatus consists of disc type ^{241}Am source of 300 mCi and pure Ge detector of $50\,mm^2 \times 5\,mm$. Diverging collimators were designed both for the source and the detector to achieve a full view of the thyroid lobe. The detectable concentration was 0.2 mg iodine/g tissue assuming the coefficient of variance of 30% and the counting time of 5 minutes. It allows to determine the iodine concentration within a suitable time unless the concentration is extremely low.

Measurement was performed for autopsied normal 10 thyroids and the results were consistent with those by neutron activation analysis. Iodine concentration ranged 0.3–1.2 mg/g (mean 0.6 mg/g) and compared well with the data in literatures. Comparing with other techniques which enable to know the bulk iodine concentration, like in vivo neutron activation analysis and X-ray fluorescent scanning, this technique is simple and does not need reactor or strong exciting sources.

Diagnostic Significance of Combined Use of Radionuclide Scintigraphy and Ultrasonography

B. KADO*, T. NAKAJIMA*, M. SAKURA*, Y. SASAKI** and T. NAGAI***
*Department of Radiology, Saitama Cancer Center
**The 3rd Department of Internal Medicine, St. Marianna University of School Medicine
***Department of Radiology, Gunma University School of Medicine

Diagnostic usefulness of combined use of two non-invasive imaging, i.e. radionuclide scintigraphy and ultrasonography were investigated. LFOV gamma camera (Searl) and multi-purpose ultrasonic device (Aloka SSD-60B) were the instruments used. Radionuclide scan was performed first. Using persistentscope and anatomical marker, contour of a organ and the site of space occupying lesion, if any, were marked on the patient body surface and a poraloid image. Following radionuclide