Phantom Study on RI Tomoscan (PHO/CON)

Kenji KAWAKAMI, Naofumi KATSUYAMA, Makoto TAKAYAMA, Izumi ANNO,
Junta HARADA, Hironobu HASHIMOTO, Sadayoshi SHIGIHARA, Makoto FUJIOKA
Department of Radiology, Jikei University School of Medicine, Minato-ku, Tokyo

A comparative study was performed between a tomoscan (PHO/CON) and a conventional camera, using various phantoms. On a line source with various separations from 15 mm to 6 mm, the tomoscan distinguished a 10 mm separation of lines at a 5.2 cm below the surface of collimator, whilst, the camera distinguished lines separated 12 mm. The detectability was inversely proportional to the distance from collimator. On the tomoscan, the decrease rate of detectability was less than on the camera.

When the line source was covered with a flood source phantom as background activity, 11 mm distance was separated on the tomoscan at a 5.2 cm below the collimator, Separation by the camera, on the ohter hand, was 14 mm. In the phantom with the background activity, the difference of the detectability between the tomoscan and the camera was larger than in that without background activity.

On a liver slice phantom study, the result was almost same as the line source phantom study. Especially, in the case with background activity, the tomoscan was superior to the camera, because of the tomographic effect.

Some balls were situated in planes of various depth in a pool source containing ^{99m}Tc. The tomoscan clearly identified these balls as focal defects at each plane. The camera imaged these balls on one plane. And a deeply situated ball was not identified. The tomoscan was superior to the camera on the detectability of focal defects at deep depth. Further more, the position of balls was three-dimentionally demonstrated.

Elimination of Off-focus Images in Longitudinal Tomography by Means of Iterative Approximation

Takehiro TOMITANI and Eiichi TANAKA
Physics Division, National Institute of Radiological Sciences

Longitudinal tomographic devices suffer from such a disadvantage that the off-focus images are superimposed on the in-focus images. These off-focus images seriously degrade quality of the in-focus images.

In an effort to eliminate these off-focus images from the observed sectional images, here is presented an iterative approximation method similar to the iterative approximation method known as Gauss-Seidel method in linear equation theory. Coefficient matrix and vectors in linear equation should be replaced by a set of blurring operators and sets of image matrices, respectively. Also simple products of scalar numbers should be replaced by convolutions. The merit of this method lies in the fact that it does not require any precalculation, therefore the same algorism can be applicable to different conditions with known response functions.

The condition of convergence of the method was analyzed, which revealed that the iterative process converges with a suitable damping factor except D.C. component.

The method was tested with digital phantoms which simulated liver and pancreas. The test revealed that slow frequency components converges only slowly. D.C. components were kept constant throughout iteration process, since there is no way to determine them from the measured images. This fact arises from the fact that longitudinal tomography can be regarded as imperfect projections, so that D.C. component is indefinite and informations on the slow frequency components are lacking in the measured images. As iteration process are recurred, noise in the images increases, so that number of iteration is restricted to 2–4 times, depending on the statistical noise in the images. Nevertheless, major features in the images could be restored i.g. overlaying organs can be separated and defects can be discernible.

This method can be applicable to longitudinal tomographic devices such as positron camera, tomographic scanning camera, scintillation camera with rotating inclined hole collimator and coded aperture imaging.