NE5A/2010G055

PRELIMINARY EXPERIMENTAL RESULTS WITH TRANSMISSION CT IMAGING SYSTEM FOR FLUORESCENT X-RAY CT

Tohoru TAKEDA[1], Hideaki KUROSAWA[2], Takafumi SATO[2], THET THET LWIN[1], Ryota SHIRAI[1], Takuya KUNII[1], Tetsuya YUASA [2], Kazuyuki HYODO[3]
[1]Kitasato University, Sagamihara, Kanagawa, Japan
[2]Yamagata University, Yonezawa, Yamagata, Japan
[3]High Energy Acceleration Research Organization, Tsukuba, Japan

1 Introduction

The fluorescent X-ray computed tomography (FXCT) has been developed to depict the cross sectional distribution of very low concentration of non-radioactive specific elements such as iodine, gadolinium, or aurum inside the biomedical objects for novel molecular imaging technique [1-5].

To image small animal, definition of imaging position is very important at in-vivo study because the pharmacological distribution of drug is changes rapidly. So the slice positioning of transmission CT images (TCT) can depict detailed morphological information which could not obtain from FXCT. In addition, to obtain the quantitative information with respect to specific element from FXCT image, TCT image are also applied. Attenuation correction of FXCT image is based on the distributions of linear attenuation coefficients which obtained from TCT images.

Here, we develop the TCT imaging system and to perform the reconstructed image of phantom to prove the efficiency of this imaging system.

2 Method and Material

We constructed the imaging system at the BL-NE 7A bending-magnet beam line (6.5GeV), KEK in Japan. The whit X-ray beam was monochromatized using monochromator Si (220) from 32 to 51 keV. The phantom flux rate in front of the object was approximately 9.3×10^{7}photons/s for a beam current of 40 mA. FXCT system consists of a Si double crystal monochromator, an X-ray slit system, a scanning table, fluorescent X-ray detector and CCD camera for TCT.

To confirm the efficiency, we performed an imaging experiment using physical phantom by using newly developed X-ray CCD camera (2 dimensional type). The projections are collected by rotating the object over 180 degree.

The phantom was a 10 mm in diameter acrylic cylinder containing 3mm paraxial channel filled with iodine (2.5 mg/ml, 5 mg/ml) and Gadolinium (5mg/ml, 10mg/ml). Exposure time for each data point was 150 msec. To examine the detection efficiency, monochromatic X-ray energy was changed from 32 to 51 keV. The K-edge energy of iodine and gadolinium are 33.2 keV and 50.2 keV, respectively.

3 Results and Discussion

Fig 1 showed the reconstructed image of the phantom obtained by this X-ray CCD camera. Four circles corresponding to the regions including the iodine and Gadolinium solution are successfully delineated at 37 keV X-ray energy. These CT image was obtained three dimensionally, and energy subtraction of each elements is also possible. These CT image was obtained within 1 min, so the positioning of object is also suitable.

Thus the new TCT imaging system will be useful for two-dimensional FSCT experiment.

Acknowledgement

This research was supported by a Special Coordination Funds from the Ministry of Education, Culture, Sports, Science and Technology, and was performed under proposal number (B) 21390339 approved by the High Energy Accelerator Research Organization.

References

[1]. Takeda T *et al*., Proc.SPIE **2708** (1996) 685.
[2]. Yuasa T *et al*., IEEE Trans.Nucl.Sci. **44 (**1997) 54.
[3]. Takeda T *et al*., Nucl.Instr.Meth. **467 (**2001) 1318.
[4]. Yu Q *et al*., J. Synchrotron Rad. **8** (2001) 1030.
[5]. Takeda T *et al.*, Nucl. Instr. Meth. **A548 (**2005) 38.

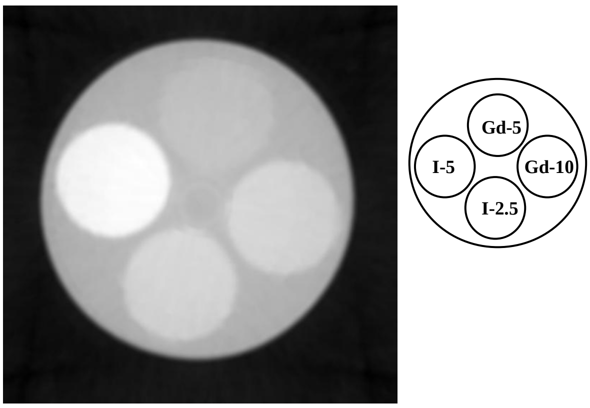

Fig 1. FXCT image of a 10 mm in diameter phantom with 4 holes. The 5 mg/ml iodine solution, 2.5 mg/ml iodine solution, 10 mg/Gd solution, 5 mg/Gd solution, projection time 150 msec, I= iodine, Gd= Gadolinium