

Fig. 5. (a) Acceptance of the detector, in which horizontal axis is an arbitrary unit. (b, c) are the images of the phantom of the human thyroid gland filled with ^{131}I (364 keV) before and after applying the acceptance correction, respectively. The phantom was set on the 20 cm front from the center of the ETCC.

we have obtained the image in the energy region used in nuclear medicine. From this figure, we infer that an image of gamma rays at 511 keV would be separated from that of ^{131}I or ^{67}Ga . For medical imaging, the recognition of the extended distribution of isotopes in the body is quite inevitable. Using this mobile ETCC, we tried to get the image of the phantom of human thyroid gland for 364 keV gamma rays of ^{131}I . Before measuring the images, the acceptance of ETCC was measured by moving the ^{131}I point source on the plane at the 20 cm front from the center of the ETCC, and obtained its acceptance plotted in Fig. 5a. One should note the ETCC covers about four times the size of the $\mu\text{-TPC}$ (the region having a better acceptance than a half of the maximum acceptance). Using this acceptance, the images of a $\text{Ø } 1 \times 30 \text{ cm}^2$ line source filled with ^{131}I were measured by changing its position on vertical and horizontal as shown in Fig. 7. Also, the image of two line sources filled with ^{131}I is presented in Fig. 6 after applying the acceptance correction. Obviously, two lines are distinguished although its shape is distorted. In both Figs. 6 and 7, the acceptance of the detector was crucial for getting the shape of the images. The distortion of the line sources in the under part may indicate the necessity of the more accurate measurement for the acceptance. Based on such a study, the image of the phantom of the human thyroid gland filled with ^{131}I was measured. The phantom was set on the 20 cm front from the center of the ETCC. Fig. 5b and c shows the images before and after applying the acceptance corrections, where you recognize the shape of the phantom although the image is still blurred.

3. Perspective and discussion

As mentioned in Section 1, Compton camera, if its imaging ability were similar to that of PET, would have excellent features for nuclear medicine and molecular imaging, which are not realized by SPECT and PET. We have developed the ETCC and obtained several images

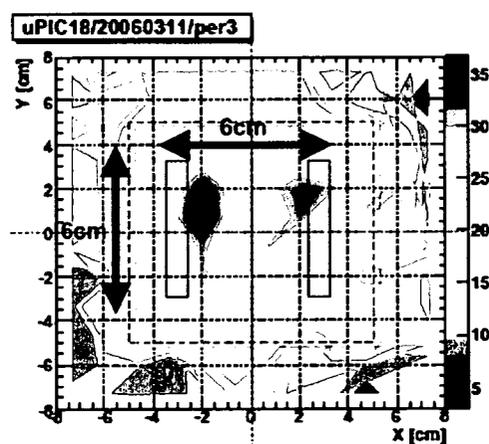


Fig. 6. Image of two line sources filled with ^{131}I (364 keV), where red lines indicate the positions of two line sources. Two line sources are set on the 20 cm front of the ETCC.

for the extended sources. For reconstructing the extended images, an acceptance correction is found quite significant. While any type of Compton camera is expected to have a wide field of view, our results show that half of the target size is at least necessary as a detection area to reconstruct the image of the extended target. In the observation for the human organs, more $10 \times 10 \text{ cm}^2$ detection area seems to be needed. A Compton camera based on the gas detector easily provides such a large detection area and a flat acceptance. At present, obtained angular resolution is not enough for the imaging of the human organs; however, simulation shows that the angular resolution of the 5° would provide a similar quality of the image to that of PET. In general, a Compton camera provides better images as energy increasing. A simple extrapolation from the angular resolution at 364 keV says that the ETCC will have an angular resolution of $\sim 5^\circ$ at 511 keV. In July 2006, we have observed phantom images using ^{18}F (511 keV)-ion and $^{18}\text{F}\text{-FGD}$ for a rat, of which results will appear soon. In addition a large $\mu\text{-TPC}$ ($30 \times 30 \times 15 \text{ cm}^3$) for the ETCC imaging a human body is now being tuned.

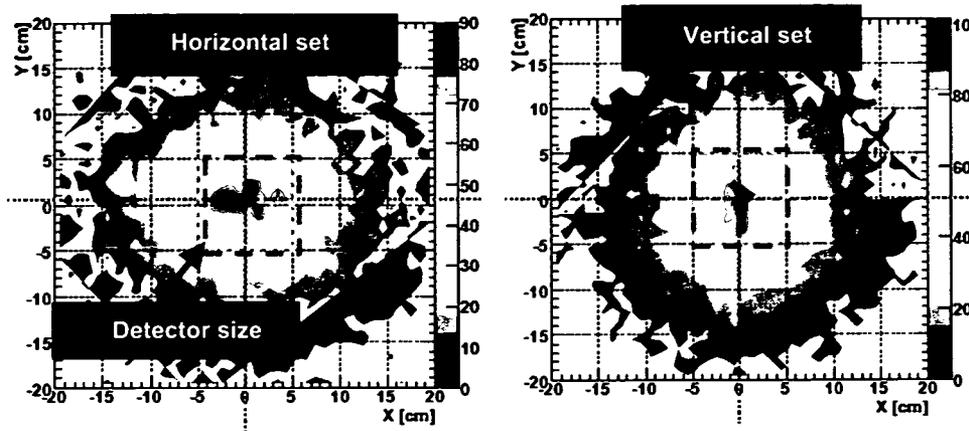


Fig. 7. Images of a long line source ($\varnothing 1 \times 30 \text{ cm}^2$) filled with ^{131}I (364 keV) setting on vertical and horizontal, respectively (both are set on the 20 cm front of the ETCC).

Acknowledgments

This work was supported by a Grant-in-Aid in Scientific Research of the Japan Ministry of Education, Culture, Science, Sports and Technology, Health Labor Sciences Research Grant (Research on Advanced Medical Technology), SENTAN of Japan Science and Technology Agency, and a Grant-in-Aid for the 21st Century COE “Center for Diversity and Universality in Physics”.

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発行日 : 平成20年3月31日

発行所 : 福井大学高エネルギー医学研究センター

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事務局 : 福井大学高エネルギー医学研究センター

〒910-1193 福井県吉田郡永平寺町松岡下合月23-3

印刷所 : 創文堂印刷株式会社