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64-channel photon-counting computed tomography using a new ceramic multi-pixel photon counter

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X-ray computed tomography (CT) is a widely used diagnostic tool. However, the exposure dose of conventional CT in a single scan is large, typically 10 mSv, and therefore, reducing the radiation dose is a problem to be solved. Furthermore, conventional CT does not have the energy information of individual X-ray photon because the read out is an integrated pulse signal. Hence, it causes the misidentification of the material being identified. For this reason, we propose a novel photon counting CT (PC-CT) system consisting of a multi-pixel photon counter (MPPC) coupled with high speed scintillators. This PC-CT can acquire CT images with low radiation dose (1/10-1/100 of that used in conventional CT). Moreover, the advantages of this system are its cost effective than other PC-CT system used cadmium zinc telluride (CZT). We succeeded in procuring color 3-dimensional images of a lighter and estimating absolute concentration of multiple contrast agents with this PC-CT system. In this study, we extended 16-channel PC-CT system to 64-channel. The improvement point from 16-channel PC-CT system is as follows. 1) 64-channel PC-CT system enable to image wider area. 2) The energy information of 64ch PC-CT system increase because the number of thresholds change four to six, and therefore, it enables to simultaneous image of different three contrast agents (e.g. iodine, gadolinium, gold nanoparticle). In addition, we developed a new ceramic MPPC which tolerate high X-ray rate and evaluated it. We conclude that this 64-channel PC-CT system make a giant step toward clinical application.

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