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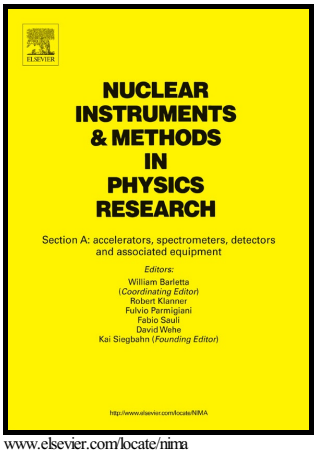

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Novel photon-counting low-dose computed tomography using a multi-pixel photon counter

H. Morita[a,*], T. Oshima[a], J. Kataoka[a], M. Arimoto[a], H.Nitta[b]

[a] *Research Institute for Science and Engineering, Waseda University, 3-4-1 Ohkubo, Shinjuku, Tokyo, Japan*
[b] *Hitachi Metals Ltd, Osaka 618-0013, Japan*

Abstract

X-ray computed tomography (CT) is widely used in diagnostic imaging. Owing to a strong radiation exposure associated with this method, numerous proposals have been made for reducing the radiation dose. In addition, conventional CT does not provide information on the energy associated with each X-ray photon because intensity is rather high, typically amounts to 10^{7-9} cps/mm^2. Here, we propose a novel, low-dose photon-counting CT system based on a multi-pixel photon counter (MPPC) and a high-speed scintillator. To demonstrate high signal-to-noise ratio utilizing the internal gain and the fast time response of the MPPC, we compared CT images acquired under the same conditions among a photodiode (PD), an avalanche photodiode and a MPPC. In particular, the images' contrast-to-noise ratio (CNR) acquired using the MPPC improved 12.6-fold compared with the images acquired in conventional CT using a PD. We also performed energy-resolved imaging by adopting 4 energy thresholds of 20, 40, 60, and 80 keV. We confirmed a substantial improvement of the imaging contrast as well as a reduction in the beam hardening for the CT images. We conclude that the proposed MPPC-based detector is likely to be a promising device for use in future CT scanners.

Keywords: Photon counting CT, MPPC, APD, Low dose

*Corresponding author
Email address: hayato-morita@akane.waseda.jp (H. Morita)