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A time-of-flight based neutron background reduction for imaging of proton-induced secondary-electron-bremsstrahlung x-rays: A Monte Carlo study

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Therapeutic proton beams generate secondary-electron-bremsstrahlung (SEB) x-rays along the beam passing through the patient body. Yamaguchi et al. have successfully imaged beam trajectories in water during proton beam irradiation by measuring the SEB x-rays using a low-energy dedicated x-ray camera. Unfortunately, the measured x-ray images contain neutron background as well as the SEB x-rays signal. To reduce the neutron background in the measured x-rays images, we proposed to apply a time-of-flight (TOF) method to the SEB x-rays imaging. The purpose of this study is to investigate the optimal time window for SEB x-rays imaging without the neutron background from the difference in time spectra between photons and neutrons. In the presentation, we will show the simulated results of SEB x-rays images without the neutron background by applying the TOF method with the optimal time window.

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