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Geant4 Monte Carlo study of the relation between image blurring and depth of optical photons produced using kilo-voltage x-rays and micro-columnar scintillators

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Abstract

X-ray detectors, which generally enjoy very good detection efficiency and spatial resolution, have many applications including in radiography and basic research. Many of the existing radiographic methods are extremely inefficient and time-consuming, making them improper for real-time applications. A solution to avoid such a problem has been to develop structured scintillation films such as CsI, which have high density and fast response, and at the same time, have the possibility of being grown as compact micrometer structures – suggesting a way to attain better image qualities. Employing the Geant4 Monte Carlo toolkit, we have used a simple geometry to serve as a radiography system, which includes a polymer layer as a camera, a structured layer of micro-columnar scintillators as x-ray converters, and an aluminum layer as a light reflector. Hence, for pencil-beam x-rays we investigated the dependence of blurring on the production depth of the resulting optical photons.

Keywords: image blurring, kilo-voltage x-ray, micro-columnar scintillator, optical photons, Geant4 Monte Carlo code

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