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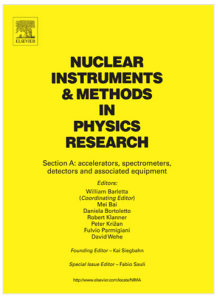

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Optical imaging of water during X-ray beam irradiations from linear accelerator

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Abstract

Measurements of dose distribution are important for high energy X-ray beam from linear accelerators (LINAC) for quality assessment (QA) of the system. Although ionization chambers are commonly used for this purpose, measurements need relatively long time to obtain the data especially for the two- or three-dimensional dose distributions. To solve the problem, we conducted optical imaging of water during irradiations of high energy X-ray beam from a LINAC. We placed a water phantom set on a table with a LINAC system, and optical images of water were measured with a high-sensitivity cooled charge coupled device (CCD) camera during X-ray beam irradiations to the water phantom from the upper side. Measurements were made for different energies and doses of X-ray beams. We also measured dynamic images while moving the multi-leaf collimators of the LINAC system to evaluate the performance for more practical condition. Then we measured the light spectra of the optical images of water for X-ray beam by changing the optical filters. In all irradiations of different energies and doses of X-ray beam, we could obtain clear optical images in water. The lateral profiles of the images were almost identical to those calculated by planning system. However the depth profiles were slightly smaller at the deeper area. We obtained dynamic images while moving the multi-leaf collimators. The light spectrum of the image during X-ray beam irradiation was similar to that of the Cerenkov-light. There was not a significant difference in the depth profiles between different wave lengths of light. Optical imaging of water during irradiations of X-ray beam has a potential to be used for the lateral profile of the beams. Also it might be useful to estimate the depth profiles with slight under estimations at deeper areas. Dynamic optical imaging while moving the multi-leaf collimators during irradiation of X-ray were possible.

Key words: optical imaging; water; X-ray beam; linear accelerator; Cerenkov-light