(様式4)

学 位 論 文 の 内 容 の 要 旨

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(学位論文のタイトル)

A carbon CT system: how to obtain accurate stopping power ratio using a Bragg peak reduction technique

(炭素線CTシステム：ブラッグピーク低減技術を用いた正確な阻止能比の求め方)

(学位論文の要旨)

In this study, we investigate the performance of the Gunma University Heavy Ion Medical Center's ion computed tomography (CT) system, which measures the residual range of a carbon-ion beam using a fluoroscopy screen, a charge-coupled-device camera (CCD), and a moving wedge absorber and collects CT reconstruction images from each projection angle. Each 2D image was obtained by changing the polymethyl methacrylate (PMMA) thickness, such that all images for one projection could be expressed as the depth distribution in PMMA. The residual range as a function of PMMA depth was related to the range in water through a calibration factor, which was determined by comparing the PMMA-equivalent thickness (PET) measured by the ion CT system to the water-equivalent thickness (WET) measured by a water column. Aluminium, graphite, PMMA, and five biological phantoms were placed in a sample holder, and the residual range for each was quantified simultaneously. A novel method of CT reconstruction to correct for the angular deflection of incident carbon ions in the heterogeneous region utilising the Bragg peak reduction (BPR) is also introduced in this paper, and its performance is compared with other methods present in the literature such as the decomposition and differential methods. Stopping power ratio (SPR) values derived with the BPR method from carbon-ion CT images matched closely with the true WEL values obtained from the validation slab experiment.