

Title: Calculation of the Water Equivalent Dose in the Human Head for Proton Therapy Using Three Different Calibration Procedures of CT scanner

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The present study was aimed at calculating the proton dose distribution in a typical human head (obtained from CT scans) by simulation in the Geant4 code. The geometry and the materials employed were established by converting the data from CT images to electron density and tissue stoichiometry. The stoichiometric method applied by Schneider et al., the BEAMnrc, and the water equivalent methods were utilized to convert CT numbers to tissue materials. Subsequently, the water equivalent dose and the water equivalent thickness of the head phantom were assessed according to the dose obtained via the three calibration methods of the conversion of CT numbers to electron density. The water equivalent dose and thickness obtained were compared with the results of direct simulation of water phantom with Geant4. The findings of this research revealed that Bragg peak depth error values were approximately 0.69 mm (1%), 1.23 mm (1.91%), and 1.6 mm (2.3%) for the stoichiometric method employed by Schneider et al, the BEAMnrc, and the water equivalent methods, respectively. The water equivalent dose, which was achieved through stoichiometric method by Schneider et al., matched the dose distribution of water phantom well in comparison with the other two methods.

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