Theoretical Validation of Experimentally Determined Beam Quality Correction Factors For the 6 MeV and 6 MV Linear Accelerator Radiotherapy Beams At University of Nigeria Teaching Hospital, Ituku-Ozalla, Enugu State In South Eastern Nigeria

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Abstract

Experimental Beam quality correction factors, kQ, for three ion chambers (ICs) have been validated for linear accelerator (LINAC) beams used for a calibration process at the University of Nigeria Teaching Hospital (UNTH) facility in Nigeria. The beam transport processes within the LINAC treatment head were simulated with the BEAMnrc Monte Carlo (M.C.) package of EGSnrc suite, while the beam transport processes within the Phantom-IC geometries were simulated with the DOSXYZnrc Monte Carlo (M.C.) package of EGSnrc suite. The computation of the kQ values were obtained from depth-dose distributions generated from DOSXYZnrc. The kQ calculated for the three ion chambers (ICs) –Farmer IC, Semi-Flex IC and Advanced Markus IC – are in good agreement with the experimentally determined kQ values. The values of calculated kQ for the Farmer IC deviated from the experimental kQ by 0.1%, while the Semi-Flex IC deviated by 0.9%. Calculated kQ value for the Advanced-Markus IC also deviated from experiment by 0.7%. The study concluded that MC.-determined beam quality correction factors, kQ, obtained using BEAMnrc and DOSXYZnrc packages can be used to validate experimental beam quality correction factor values for medical LINAC beams once geometric specifications and dimensions of calibration systems, alongside recommended dosimetry protocols have been incorporated.

Keywords: Monte Carlo, Beam quality correction factor, Phase space, depth ionization

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