Paper

GENERATION OF CALIBRATED TUNGSTEN TARGET X-RAY SPECTRA: MODIFIED TBC MODEL

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Abstract *- In* spite of the recent advances in the experimental detection of x-ray spectra, theoretical or semi-empirical approaches for determining realistic x-ray spectra in the range of diagnostic energies are important tools for planning experiments, estimating radiation doses in patients, and formulating radiation shielding models. The TBC model is one of the most useful approaches since it allows for straightforward computer implementation, and it is able to accurately reproduce the spectra generated by tungsten target x-ray tubes. However, as originally presented, the TBC model fails in situations where the determination of x-ray spectra produced by an arbitrary waveform or the calculation of realistic values of air kerma for a specific x-ray system is desired. In the present work, the authors revisited the assumptions used in the original paper published by Tucker et aI. (1991). They proposed a complementary formulation for taking into account the waveform and the representation of the calculated spectra in a dosimetric quantity. The performance of the proposed model was evaluated by comparing values of air kerma and first and second half value layers from calculated and measured spectra by using different voltages and filtrations. For the output, the difference between experimental and calculated data was better then 5.2 %. First and second half value layers presented differences of 23.8% and 25.5% in the worst case. The performance of the model in accurately calculating these data was better for lower voltage values. Comparisons were also performed with spectral data measured using a CZT detector. Another test was performed by the evaluation of the model when considering a waveform distinct of a constant potential. In all cases the model results can be considered as a good representation of the measured data. The results from the modifications to the TBC model introduced in the present work reinforce the value of the TBC model for application of quantitative evaluations in radiation physics.

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