AbstractID: 7918 Title: Dependence of Convolution/Superposition Algorithm Dose Calculations for Photons on Energy Spectrum

The convolution/superposition calculation algorithm can be performed in the polyenergetic approximation (one single convolution), or with multiple energy components. With multiple components, the energy dependence is more accurately modeled, but the calculation time increases with the number of components. Fewer energy components have been used with the sole intent to calculate photon dose as accurately as possible in a reasonable amount of time, but the selection of proper energies and weights is a difficult task. In principle, there should be only one spectrum solution. While a few spectral arrangements could suit a dose distribution in homogeneous water, it is unclear how this choice will affect the results in different situations, e.g. inhomogeneities. We have studied the sensitivity of the dose distribution to the energy components using a hypothetical 15 MV beam for 3x3 cm^2 and 10x10 cm^2 fields at various depths in water and water-lung media. Six spectra were generated by alternatively assigning weights of 0.1, 0.3, and 0.6 to fixed energy bins of 0.5, 2 and 10 MeV. Lung calculation results are used to study the importance of the various spectral components: with up to 8% peak-to-peak differences for the 3x3 cm^2 and at most 2% for the 10x10 cm^2 field. First and second moments and skewness of the spectral distribution were not adequate to illustrate the underlying physical processes. This study shows that designated electronic disequilibrium test cases will be important in unambiguously determining the correct energy spectrum to be used.

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