AbstractID: 1560 Title: Derivation of in-air electron and contaminant photon fluence distributions by the deconvolution method

The in-air fluence distributions of the electrons and the contaminant photons in clinical electron beams are needed for the Monte Carlo dose calculations of clinical electron beams for radiotherapy treatment planning. However, the primary electron fluence and the contaminant photon fluence are extremely difficult to determine in a direct measurement. We hypothesize that a dose measurement is a combinatorial convolution of in-air fluence distributions with a Linac collimating system and that a Fast Fourier Transform (FFT) deconvolution algorithm can be used to determine the in-air fluence distributions of the electrons and the contaminant photons from the measured dose distributions in water. As input and gold standard, 2D dose distributions at d_{max} (depth of maximum dose) and d_{brem} (depth at bremsstrahlung tail) of 12 MeV electron beams coming from a Varian 2100CD linear accelerator have been measured using an ionization chamber in water for 100 cm source-to-surface distance (SSD) and 10 cm × 10 cm applicator. By deconvolution, 2D in-air fluence distributions of the electrons and the contaminant photons have been extracted from the modified 2D measured dose distributions. A multiple source model that incorporates the determined fluence distributions of the electrons and the contaminant photons has been employed for Monte Carlo dose calculations in a water phantom. The agreement between measured and Monte Carlo computed dose distributions is within 2% in dose or 2 mm in distance, which has demonstrated the feasibility of the proposed method for the case being investigated.