AbstractID: 1878 Title: X-Ray Energy Spectrum Condensation: A New Approach for Fast Dose Calculation

Bremsstrahlung x-rays, emitted following the interactions of accelerated electrons in a target, are characterized by an energy spectrum distribution. The energy spectrum of therapeutic x-ray is one of the essential data for accurate dose calculation and other calculations in radiation therapy. Monte Carlo methods, rather than direct measurements, have been used to supply the energy spectrum accurately. For computational purpose, the continuous energy spectrum is divided into finite energy segments with an assumption that photon physics is invariable within each energy segment. Accuracy of dose calculation is explicitly dependent on the resolution of energy segments. As the number of energy segments increases, dose computation time increases. Conversely, as the number decreases, dose calculation is accelerated, but with decreased accuracy. This paper proposes a new method of *energy spectrum condensation* (ESC) which condenses the spectrum of megavoltage x-ray into a few spectrum-equivalent energies (SEEs) for fast and accurate dose calculation. To test this method, three SEEs were condensed from the NRC 18MV x-ray spectrum (0.25MeV energy resolution). Depth dose calculations were performed using Monte Carlo simulations with MCNP4c in a homogeneous water phantom and in an inhomogeneous phantom made of water, aluminum, ICRU lung, and water. Depth dose profiles using the SEEs agree well with that using the NRC spectrum. As the feasibility of the ESC method has been successfully tested by this study, extensive follow-up studies are warranted. Offering fast and accurate dose calculation, this method promises significant contribution to both the current and future trend of radiation therapy.