AbstractID: 3934 Title: Implementation and initial testing of a Monte Carlo based algorithm for IMRT inverse treatment planning

Purpose: To report on the implementation of a Monte Carlo (MC) based algorithm and to compare this system with a convolution/superposition-based algorithm (CS) for IMRT inverse planning.

Methods: The DPM MC code was modified using a fluence matrix approach to perform beamlet calculations for IMRT planning. The code was integrated within our in-house inverse treatment planning system and compared with the TPS (CS) algorithm. Initial testing involved the computation of 6 MV beamlet depth doses for 1x1, 2x2 and 10x10 (100, 1 cm beamlets) in a water phantom. MC and CS calculations were then performed for an example lung treatment plan to examine dosimetric differences between these algorithms. MC statistical uncertainties were on average less than 2% (in the depth doses) for all beamlet calculations. Optimization of beamlet doses is carried out using simulated annealing with quadratic cost functions derived from our clinical protocols.

Results: Beamlet depth doses calculated with MC and CS are in good absolute agreement for field sizes larger than 2x2 cm^2. Significant differences exist for 1x1 beamlets because CS is unable to accurately model lateral electron transport. For the example lung plan, much smaller differences were found. This is likely due to the fact that with larger field sizes (~10x10 cm in the example), effects of lateral electron scattering are much less pronounced.

Conclusions: We have implemented a fluence matrix method to perform MC-based beamlet calculations for IMRT planning. Initial testing for an example lung plan and field sizes larger than 2x2, revealed good agreement between MC and CS. However, larger differences were found for 1x1 beamlets due to lateral electron transport issues. Testing is currently being performed for a variety of treatment plans, spanning a range of field sizes to thoroughly investigate dosimetric differences between MC and CS in IMRT planning.

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