AbstractID: 3830 Title: An Investigation on the Impact of Incident Fluence Prediction on the Computed Doses.

Purpose: For IMRT, most dose calculation algorithms modify the incident energy fluence by a scalar transmission matrix which represents the radiation transmitted through the moving multi-leaf collimator (MLC). These matrices inherently exclude the effects of beam hardening by the MLC and only approximate the radiation scattered from the MLC. The purpose of this study is to determine how such approximations effects patient doses distributions in the limit of a realistic transmission matrix (TM).

Materials and Methods: Monte Carlo (MC) dose calculations were utilized in this study. The reference calculation utilized full MC transport through the moving MLC during the dose computation. The test calculation employed a realistic TM, determined by scoring the ratio of the incident and transmitted energy fluence through the MLC from the reference MC simulation, during the patient dose calculation to include the effects of the MLC on the patient treatment. Ten head-and-neck dynamic IMRT patient treatment plans were computed with each method and dose indices were compared. Dose indices used in the evaluation included the GTV D_{98}, CTV D_{95}, Brainstem D_{02}, Cord D_{02}, and Parotids D_{50}.

Results: For each target index studied, the maximum deviation observed was ≤-1.5% of the treatment dose. The TM dose calculation systematically underestimated the full MC target dose by ~1%. The local differences between the dose indices for the cord and the brainstem were within ±2.4%. Local dose differences of up to 2.9% were observed for the parotid D_{50}.

Conclusions: When a realistic transmission matrix is used, patient local dose results in the targets differ by ≤1.5% of the treatment dose computed with full MC dose simulations, justifying the use of such matrices for both MC and other dose calculation algorithms for the cases studied. This work is supported by NIH-1R01CA98524.