AbstractID: 7628 Title: Treatment Planning Modeling and Dose Delivery Advantages of Standard Linac Without Flattening Filter

Purpose: The objective of this study is to determine the accuracy with which treatment planning systems can model dose distributions generated by conventional linear accelerators without the flattening filter, and the potential benefits.

Method and Materials: Data was collected on a Siemens Oncor linear accelerator, where the flattening filter has been removed and energy tuned to match a standard 6 MV x-ray beam but with dose rates of 1000 MU/min. Data was acquired to model and commission four treatment planning systems (Philips Pinnacle, CMS Xio, Nomos Corvus, and Siemens Konrad). Comparisons included: TPS model parameters w/ and w/o flattening filter, measured and computed %dd and profiles, conventional and IMRT dose distributions both via planning and delivery measurements in phantom.

Results: Beam energy spectrum characteristics show only a modest softening in the beam since beam tuning matched the filtered 6 MV. Differences are seen in the off-axis fluence and off-axis energy softening: the fluence is reduced linearly away from the central axis and the energy spectrum is only slightly reduced by comparison. Dose profiles and %dd were accurately modeled to within 2% and 2mm for all field sizes 2- 40 cm. When applied to IMRT treatment plans, the model produced equivalent dose distributions for head-and-neck, CNS, and prostate plans; the number of monitor units was slightly increased (~15%) but the number of segments was identical. Delivery times at 1000 MU/min were shorter (20% reduction), and the IMRT plans delivered had a 30-50% reduction in the number of pixels showing dose-differences beyond 5%.

Conclusion: Treatment planning systems are not only capable of modeling the dose distributions produced without flattening filters, they perform superior than with the filter present, and can reduce common dosimetric errors observed in IMRT phantom studies.

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