AbstractID: 11746 Title: Monte-Carlo BEAM modeling of off-axis headscatter for megavoltage photons with MLC

Purpose: The study examines the off-axis headscatter for megavoltage photons with a Multi-Leaf Collimator (MLC). **Methods and Material:** The effect of off-axis headscatter becomes most pronounced in low dose regions IMRT fields. We define the headscatter off-axis ratio (*HOA*) as the ratio of the kerma from headscatter photons at off-axis positions to that from direct primary photons on the central axis. Monte-Carlo (MC) simulations of *HOA* are performed for an accelerator with an MLC replacing the lower jaws. Headscatter contributions from components of the LINAC, e.g. flattening filter, MLC, primary and secondary collimators, are separated for lateral mean energy distribution, *HOA*, energy fluence distribution and spectrum. **Results:** Lateral distribution of the mean energy differs for individual components. Mean energy distribution within the beam collimation is dominated by the primary beam and decreases radially from 1.8~1.6MV. The mean energy distributions of primary collimator and flattening filter remain relatively flat within the treatment field at 1.5MV and 1.2MV, respectively. MC simulation also shows that dose outside of treatment field is dominated by the headscatter from the flattening filter, the primary collimator, and the secondary collimators. Primary collimator and flattening filter's contributions to *HOA* on-axis are estimated to be 1.8% and 3.7%, respectively, for a 20x20 cm^2 field. Total headscatter contribution in this case is ~6.1%, which agrees with experimental results to within 1%. Contributions to *HOA* from the Y-Jaw and the MLC are consistently smaller than 0.3%. The asymmetric nature of *HOA*, due to the vertical displacement of the secondary X & Y collimators, is also examined. **Conclusion:** Contributions from individual components in the treatment head to off-axis headscatter are characterized. It's found that the asymmetric distribution of *HOA* due to contributions from MLC and Y-jaw may need to be incorporated into future IMRT treatment planning systems.