AbstractID: 8390 Title: Characterization of head scatter off axis in megavoltage photon beams

Purpose: To investigate the properties of head scatter in an x-ray beam as a function of off-axis position.

Method and Materials: The head-scatter off-axis ratio (HOA) is the ratio of the kerma from head-scatter photons to the kerma from direct primary photons along the central axis. We determined HOA from measurements made with an ionization chamber within a miniphantom for a 6 MV x-ray beam. Measurements of HOA were made for square, rectangular, and half-blocked fields. We developed an empirical model that includes a Gaussian component to account for scatter from the flattening filter and a second component that is a function of the secondary collimator location to account for scatter from the x and y jaws.

Results: Outside of beam collimation, the HOA in the y-jaw direction was larger than in the x-jaw direction, approximately 0.02 compared to 0.006. The shift of the beam edge, defined for the HOA as (measured FWHM) / (square field size), was approximately 1.0 and 1.15 along the x-jaw and y-jaw directions, respectively. The penumbra width of the HOA was approximately equal along the x- and y-jaw directions. Within beam collimation, an additional block was important for the accurate measurement of HOA, however renormalization was also possible using central-axis data. Outside of beam collimation, an additional block was not necessary.

Conclusion: Head scatter off axis is the dominant source of dose outside of beam collimation, and therefore its characterization is important to accurately determine dose for low dose regions, especially when using IMRT fields. The characteristic difference of HOA between Varian and Siemens accelerators with MLCs will be discussed. The model will be used to predict head-scatter dose for a variety of IMRT test cases.