AbstractID: 3863 Title: Modeling the Headscatter Off-Axis in Megavoltage Photon Beams

**Purpose:** To accurately model off-axis headscatter from a linear accelerator at off-axis positions using a parameterized, two-component model.  An improved model is now proposed to model headscatter outside beam collimation.

**Method and Materials:**
 We define the head-scatter off-axis ratio, HOA, as the ratio of the kerma due to head-scatter photons at the off-axis position x to the kerma from direct primary photons on the central axis. "Direct primary" are those photons that come from the source without interactions in the intervening structures. We measured HOA along the X jaw direction from the central axis to a distance of 25 cm from the field edge for various collimator settings.  We fit the measured HOA using an improved two-component model.  The first component is a Gaussian source projected on a plane below the x-ray source, representing the headscatter from the flattening filter and the primary collimator. Compared to an earlier model [1], this model models the second component for photons scattered in the secondary (variable) collimators using a linear edge kernel integrated over the four collimator jaws.  Headscatter off-axis outside beam collimation is examined more extensively with this study.

**Results:** The two-component model can be fit to data obtained from a variety of fields with a mean (maximum) local relative error of 10% (35)%.  The region outside the penumbra region is modeled primarily by the collimator component.

**Conclusion:**
A two-component model in which the headscatter from the flattening filter and the collimators are modeled separately can accurately predict HOA values for arbitrary collimator settings.

[1] Zhu, T.C. and Bjärngard, B.E., Med. Phys. **30** 533-543, 2003