# AbstractID: 3355 Title: High Resolution Film Based Finite Pencil Beam Model for MLC Defined Beamlets

**Purpose:** We studied the detailed behavior of leaf-side and leaf-end multileaf collimator (MLC) defined beamlets with high spatial resolution film dosimetry. It is demonstrated that a simple analytic finite sized pencil beam model can be developed to accurately describe jaw-defined and MLC-defined small beamlet dose to water as a function of off-axis distance. Such a model has great utility in rapid IMRT delivery validation and fluence map optimization dose computations.

**Method and Materials:** Kodak EDR2 was used to measure central and off-axis 1x1 cm2 beamlets from a Varian 2100 C/D linear accelerator using a 120-leaf Millennium MLC. Scanned images were imported into Matlab v7.0 for analysis. Horizontal profiles in both the leaf end and leaf side directions were normalized to fractional depth dose (FDD), corrected to remove beam divergence, and fitted with a sum of difference of error functions. Fit parameters were used in a FSPB model to calculate doses in 3D.

**Results:** We found that leaf end and leaf side profiles remain approximately constant with depth when normalized to FDD and beam divergence. Off-axis profiles could be approximated by linearly scaling central axis profiles. The 20-80% lateral profile penumbral distances were found to be 0.21, 0.24, and 0.25 for leaf side MLC, jaw aperture, and leaf end MLC beamlets, respectively.

**Conclusion:** A single FSPB dose calculation model agrees well with measured dose to water values in the leaf end and leaf side directions for both central and off-axis beamlets. The 20-80% lateral profile penumbral distances measured in this study are significantly smaller than those determined with micro-ionization chambers.