AbstractID: 7380 Title: Photon Dose Calculation Analysis of a Varian Treatment Planning System Algorithm on a Siemens Linear Accelerator in Inhomogeneous Media

Purpose: To analyze the accuracy of photon dose calculations in inhomogeneous media using the analytical anisotropic algorithm (AAA) and pencil beam convolution (PBC) implemented in Varian Medical Systems' Eclipse treatment planning system with Siemens linear accelerators.

Method and Materials: Using a 0.125 cm^3 ionization chamber in a 3-layer phantom with cork between water-equivalent layers, we measured absolute depth doses (DD) for 6 and 15 MV, and 3, 5, 10, and 20 cm square fields. To assess lateral disequilibrium modeling, we irradiated another phantom in which the middle cork layer extended laterally only 2.5 cm beyond the central axis, the remainder of the layer being plastic with 10 and 20 cm square fields. Dose profiles were measured using EDR2 film placed at three depths and with a diode detector array placed in the bottom layer. Calculations were performed using AAA and PBC with inhomogeneity correction in Eclipse.

Results: For both 6 and 15 MV, the DD calculated by AAA and PBC agreed with measurement within 2% and 3%, respectively proximal to the inhomogeneity beyond the buildup region. Within the inhomogeneity, the agreement was better than 6% for large fields, however, both algorithms overestimated the dose by up to 20% (AAA) or 55% (PBC) for the 3-cm 6MV field. Distal to the inhomogeneity, AAA modeled the shape of the buildup more accurately than PBC. Lateral profiles indicated that the shape of the penumbra in the inhomogeneous region and the perturbation at the vertical interface predicted by AAA agreed with film and diode array measurements better than PBC.

Conclusion: AAA offered an overall improvement over PBC in inhomogeneous media, particularly for small fields and in interface and buildup regions. The overestimate of dose within the inhomogeneity for small fields motivates further investigation, particularly if AAA is used for IMRT calculations in lung.