AbstractID: 5437 Title: Determination of the MLC scatter, MLC transmission and dosimetric gap in dynamic IMRT as a function of field size, depth and beam energy

Purpose: To develop a dynamic MLC test for the determination of the MLC scatter, transmission and dosimetric gap for large field size and complex geometry IMRT.

Materials and Methods: A series of dynamic MLC tests was designed and performed with ionization chamber in a solid water phantom as a function of field size, depth, MLC gap size for 6,10MV 2100Ex: open beam (OB), closed MLC (cMLC), and dynamic sweeping gap (dMLCgap). Based on a generalized fluence model, MLC scatter, direct MLC transmission (no scatter) and dosimetric gap (due to rounded leaves) were determined. IMRT planning system predictions and measurement doses were compared at the central axis and outside of the field edges. Dose errors were corrected using the generalized fluence model.

Results: MLC scatter is responsible for field size dependence of cMLC-to-OB dose ratio (1.45% for size=5cmx5cm, 1.8% for size=14cmx30cm, 6MV). MLC scatter is rather uniform within and outside of the field edges, and decreases only slightly with depth. Direct MLC transmission (no MLC scatter) changes with depth up to 10% (6MV), 5% (10MV) due to beam hardening. In dynamic MLC delivery, MLC scatter is significant for large field sizes (14cmx30cm) and low average fluence $\langle\ _{dMLC}\rangle$: MLC scatter=1%-5% for clinically realistic $\langle\ _{dMLC}\rangle$ =30%-10%, ($\langle\ _{OB}\rangle$=100%, $\langle\ _{cMLC}\rangle$ 1.5% by definition). Dose errors of 1%-8% for large sizes and sweeping gaps 1.0cm-0.1cm were corrected when the modified fluence model (including MLC scatter) was used instead of the Eclipse fluence.

Conclusions: Many commercial IMRT planning systems do not account for the MLC scatter. It is suggested that the OB-cMLC-dMLCgap test be used for commissioning of the IMRT when field sizes are large and average fluence $\langle\ _{dMLC}\rangle$ is low. MLC parameters in IMRT planning system may need to be adjusted separately for each IMRT class depending on field size and fluence complexity (or $\langle\ _{dMLC}\rangle$).