AbstractID: 10507 Title: A simple approach for optimal field abutment in modulated electron radiation therapy

Purpose: Our aim is to address the problem of unacceptably large dose variations at the junction of two adjoined fields in modulated electron radiation therapy (MERT) by optimizing the gap separation at the junction area. Another aim is to provide basic knowledge helping the optimization to get the best MERT plan and understanding the upper limitations for the future MERT treatment design.

Material and method: In this work we used MCBEAM and MCSIM codes for accelerator simulation and phantom/patient dose calculation, respectively. A prototype manually driven eMLC was accurately modeled. Simulation results were compared to measurements. Dose distributions inside a phantom for two adjoined electron fields were investigated for different gaps and different electron energies. Gaps were then evaluated by achieving the best dose distributions and the sharpest target DVH curve fall-off. The gap sizes, which gave the best dose distributions and DVHs for all the energies available, were determined. Gap sizes as a function of energy and SSD to achieve optimal dose profiles at desired depths in the phantom was also studied.

Results: It is shown that as energy increases the gap size need to increase which may be ascribed to the change in penumbra. For a given energy, the gap size shows a linear relationship with the SSD. As is expected, the optimal gap is larger with larger SSD and higher energies. A series of empirical formulas have been developed in obtaining the optimum gap sizes for the adjoined beams with different energies, which can improve the target dose uniformity significantly.

Conclusion:
For each electron beam energy an optimal gap can be chosen to minimize the dose inhomogeneity arising from adjoining two electron fields, which will facilitate the design of the leaf sequences for MERT dose delivery using an eMLC.