AbstractID: 11493 Title: Dosimetric evaluation of the setup and breathing motion effect for modulated electron radiation therapy of breast cancer

Purpose: In conventional photon breast therapy, the effect of setup and breathing motion is accounted for by adding a margin to the clinical target volume (CTV). In modulated electron radiation therapy (MERT), since the electron beams can be arranged nearly along the direction of the organ motion, the effect of breathing motion is greatly reduced. This work is aimed to estimate the dosimetric changes caused by setup and breathing motion for MERT of breast cancer.

Method and Materials: Monte Carlo (MC) based inverse treatment planning was used based on the CT data of a breast phantom. The dosimetric accuracy of the MERT delivery using the Siemens photon MLC (pMLC) was verified previously. In this work, five Monte Carlo calculated plans were compared with different static displacements (along the beam direction) of the phantom from its normal position, i.e. ± 1 cm, ± 0.5 cm and 0cm. Comparisons were performed in terms of 2D isodose distributions, dose-volume histograms (DVHs), minimum dose (D_{min}), mean dose (D_{mean}) and maximum dose (D_{max}).

Results: For ± 1 cm target displacements, dose differences from the nominal plan (without target motion) are relatively large in both 2D dose distributions and DVHs. For example, the difference in D_{mean} for this case is about 3.4%, indicating a visible target dose reduction. For ± 0.5 cm target displacements, a minor difference is seen for the 90% isodose lines, and the difference in D_{mean} is less than 2%. The integrated dose distributions remain unchanged, indicating the effect of breathing motion on the dose coverage of the target is ignorable.

Conclusions: Due to the relatively small SSDs used for pMLC-based MERT the effect of patient setup may become significant (displacement >0.5cm). Breathing motion has little effect for en-face electron irradiation. The magnitude of the setup effect can be estimated with the inverse-square relationship with an accurately determined "effective" SSD.