AbstractID: 9281 Title: Dosimetric Verification of Modulated Electron Radiotherapy Delivery Using Photon Multileaf Collimator

Purpose: To investigate the dose accuracy of modulated electron radiotherapy (MERT) delivered using the photon multileaf collimator (pMLC) on a Siemens Primus accelerator.

Method and Materials: A Monte Carlo based inverse treatment planning system was developed for the 3D treatment planning process. Phase space data of 6, 9, 12 and 15 MeV electron beams were accurately commissioned and used as the input source for Monte Carlo dose calculations. Treatment planning was performed based on a 3D CT data of a "breast phantom" which mimics a breast cancer patient. SSD was chosen 60 cm in the planning based on the previous investigation. Rigorous film and ion chamber dosimetry was carefully established for the MERT plan verification using the breast phantom and a solid water phantom. The MERT plan verification was done by comparing isodose distributions, dose profiles and point doses with those obtained from the Monte Carlo plan calculations.

Results: The plan was delivered with 22 segments with both energy and intensity modulated. The relative isodose distributions and dose profiles between film measurements and calculations agreed each other within 1%/1mm. Absolute doses given by the ion chamber measurements in the solid water phantom showed differences from the Monte Carlo dose calculations by 1.7%, 0.5%, 1.6% and 1.5% for 6, 9, 12 and 15 MeV energy component of the plan, respectively while overall measured absolute dose accuracy is 1.37%. In addition, the dose alteration caused by the film in the lung region was identified and confirmed by recalculating the treatment plan with detailed geometry that includes both the film (thickness and density) and the breast phantom.

Conclusions: Our in-house developed Monte Carlo treatment planning system is capable of performing accurate dose calculation and treatment optimization for MERT, and the pMLC has a great potential to deliver MERT treatment plans accurately and efficiently.