

AbstractID: 3551 Title: Monte Carlo dosimetric verification for IMRT QA using MLC log files and EPID

Purpose: EPID is a useful tool for pre-treatment patient setup and target localization and post-treatment dosimetry verification. However, EPID images are significantly affected by photon attenuation and scattering in the patient and the detector and therefore cannot be used directly for dose reconstruction. This work investigates a Monte Carlo dosimetric verification method based on MLC log files and the electronic portal imaging device (EPID) for IMRT quality assurance (QA).

Method and Materials: We have developed Monte Carlo based software to derive accurate intensity-modulated fluence maps behind the patient using MLC log files, which take into account the accelerator head geometry, the MLC leaf movement accuracy and the patient attenuation and scatter. Patient initial simulation and pre-treatment CT data were used to simulate the patient anatomy for interfraction dose comparison. The phase space data behind the patient were used in the EPID response simulation and compared with measured EPID images to investigate patient setup accuracy and dose reconstruction uncertainty.

Results: Ten previously treated prostate IMRT plans and patient CT data are included in this study. The MLC leaf position accuracy of the dynalog files from a Varian 21Ex accelerator is verified to within 1mm. The dose distributions based on the leaf sequences from the treatment planning system and the fluence maps rebuilt from the dynalog files are consistent to within 2%, validating our software implementation. The primary photons and scatters are recorded separately behind the patient for different applications as described above. Energy spectrum, fluence distribution and angular distribution are derived to facilitate dose calculation in the EPID.

Conclusion: We have developed a log file based Monte Carlo method to generate phase space and fluence maps for pre-treatment patient setup and post-treatment dose verification with EPID. This work is implemented as part of our IMRT QA procedure.