AbstractID: 8358 Title: The use of EPID-measured leaf sequence files and on-treatment cone-beam CT for dose reconstruction of IMRT delivery

Purpose: To develop a methodology for retrospectively reconstructing the IMRT dose delivered to a prostate patient on the basis of on-treatment cone-beam CT (CBCT) and fluence maps derived from the MLC segments captured by an amorphous silicon electronic portal imaging device (aSi-EPID) during the treatment.

Method and Materials: The geometric status of the EPDI, including the sag, tilt, and offsets for various gantry angles were established, and the necessary corrections were incorporated in the later calculation of the leaf end positions. CBCT was performed on a pelvic phantom and a typical IMRT prostate plan was delivered to the phantom; EPID images at 6.7 frames per second were acquired for each field. In-house software was developed to (1) identify the different segmental images captured for each field, (2) calculate from the segmental image the leaf end positions using a maximum gradient algorithm, (3) couple the fractional monitor unit data intercepted from the MLC workstation with each corresponding segment and (4) re-constitute the LS file. The EPID-measured LS files were loaded back to the treatment planning system to derive the delivered fluence maps for CBCT dose reconstruction. The dose distributions from the two dose reconstructions on the CBCT using the delivered and planned fluence maps, respectively, were compared.

Results: A dose reconstruction procedure based on CBCT and EPID-measured LS files has been established. The dose distributions based on the delivered and planned fluence maps were slightly different in the high dose region; the maximum dose from the former distribution was 2.5% lower than that from the latter.

Conclusion: The developed methodology allows us to reconstruct IMRT delivered dose based on (1) the CBCT that depicts the most updated internal anatomy and (2) delivered fluence maps that include the delivery errors. This affords a valuable platform to implement adaptive therapy in the future.