AbstractID: 7565 Title: Marker-less intra-fraction position verification of lung tumors with an EPID in cine mode

Purpose: Patient positioning represents one of the most challenging problems in radiation therapy, especially for some thoracic and abdominal target locations that are under the influence of respiratory motion. To monitor the target during treatment, we have developed an algorithm using a conventional EPID in cine mode and a prior 4DCT scan. A study based on patient data is presented to demonstrate the feasibility of the method.

Materials and Methods: Based on the 4DCT recorded prior to treatment, a digitally reconstructed fluoroscopic (DRF) series is produced for each of the treatment fields. During the treatment, a cine EPID acquisition is performed for each field as it is delivered. Post-treatment, we produce an image mask for the individual EPID and DRF images based on the MLC leaf positions. The masks are spatially registered and the required changes are induced so that the two images have consistent field shape and size. Following the image processing, the two image series are passed through a correlation algorithm that identifies the closest DRF image for each EPID image. This enables us to associate a 4DCT predetermined breathing phase to the EPID series of images, hence allowing us to recover the tumor position during the treatment relative to the planned position.

Results: Depending on the number of acquired EPID images per treatment field (depending on the prescribed treatment dose per field) we were able to recover between 70% (4 images per field) and 91% (6 images) of the 4DCT prerecorded tumor motion.

Conclusion: Based on a prior 4DCT and a cine EPID image sequence taken during the treatment, we have developed a computational algorithm that enabled us to quantify the differences between the tumor motion within the 4DCT that was used to plan the dose distribution on and the actual tumor motion during the treatment.