AbstractID: 10755 Title: A Novel Dynamic MLC Leaf Sequencing Algorithm for 4D Treatment with Deformable Target Motion Correction

Purpose: To investigate a dynamic MLC (DMLC) leaf sequencing method for the 4D IMRT delivery. **Materials and methods:** A 4D CT was obtained and n phase CT data sets were created respectively. Individual IMRT plan was generated for each phase on Pinnacle treatment planning station, and a 4D plan was created using a deformable image registration technique. Based on the DMLC leaf sequences generated from the plan of each phase, the non-rigid motion corrected 4D leaf sequence was created by matching the time indexes of the leaf sequences and the breathing cycles of each phase. The 4D leaf sequence wasiteratively adjusted for the maximum leaf speed to avoid any beam hold-offs. At the same time, a rigid motion corrected 4D leaf sequence was calculated by adjusting the leaf center corresponding to the center of mass position of the target in each phase. The opening density map (ODM) of the 4D plan was used to create a traditional no-motion corrected leaf sequence. All three leaf sequences were delivered by Varian 2100 C/D with Millennium 120 leaf DMLC. The MatriXX (IBA Dosimetry) was used to measure the delivered fluence map every 40 ms. The delivered fluence maps were registered back to the patient's coordinate system. **Results:** Using the 4D plan ODM as reference, the fluence map from the non-rigid motion corrected 4D leaf sequence showed a maximum dosimetric difference of 3%. However, the fluence maps from the rigid motion corrected 4D leaf sequence and the nomotion corrected leaf sequence showed maximum dosimetric differences of 30%. **Conclusion:** For 4D plan DMLC delivery, the non-rigid motion corrected leaf sequencing, the rigid motion corrected 4D leaf sequencing and the no-motion corrected leaf sequencing were investigated. Results showed that the non-rigid motion corrected leaf sequencing is the one that closest deliverers the 4D plan.