AbstractID: 13662 Title: Effective tracking of intrafractional organ motion due to breathing using a Siemens 160 MLC

Purpose: In this work we demonstrate effective tracking of highly irregular breathing motion using a dynamic Siemens 160 MLC™ and a neural network predictor to compensate for the relatively large end-to-end system latency of 500 ms. **Method and Materials:** One-dimensional breathing patterns were recorded from several radiotherapy patients using the ANZAI pressure belt system. The pressure belt signal was reproduced by a programmable phantom, which has embedded electromagnetic transponders for target localization and tracking (Calypso® Medical Technologies, Inc.). The aperture of a Siemens 160 MLC™ was adapted in real-time to the target position provided by the Calypso system. Due to the highly irregular nature of breathing motion, advanced prediction methods are required to accurately compensate the system latency. We therefore implemented a feedforward neural network predictor. The network was trained on a 120 second sample of breathing data which preceded the data that was used for the subsequent tracking experiments. The geometric tracking accuracy was determined through an analysis of portal images acquired during radiation delivery. A metal ball attached to the phantom allowed the reconstruction of the phantom trajectory from the portal images. Tracking errors were quantified as the difference between the phantom trajectory and the geometric centroid of the radiation field on the portal images. **Results:** In an offline cross-validation study, we could identify a common set of model parameters of the neural network, which yielded good prediction performance for all the breathing patterns under consideration. The analysis of the images acquired during the tracking experiments yielded root mean squared tracking errors of 1.21 mm, 1.29 mm and 1.58 mm for the three investigated motion patterns. **Conclusion:** In spite of the relatively large system latency, we achieved highly accurate MLC tracking for irregular breathing patterns. **Conflict of Interest:** Supported by Siemens Healthcare OCS and Calypso Medical Technologies, Inc.