AbstractID: 8842 Title: On the use of EPID-based Implanted Marker Tracking for 4D Radiotherapy

4D radiotherapy delivery to dynamically moving tumors requires a realtime signal of the tumor position as a function of time so that the radiation beam can continuously track the tumor during the respiration cycle. As electronic portal imaging devices (EPIDs) are present on most modern linear accelerators, and radioopaque markers have been successfully implanted into lung tumors, the aim of this study was to develop and evaluate an EPID-based marker tracking system that could be used for real-time tumor targeting, or 4D radiotherapy.

Three gold cylinders of 3mm length and 1mm diameter were implanted into a dynamic lung phantom. The phantom range of motion was 4cm with a 3second 'breathing' period. EPID image acquisition parameters were modified allowing acquisition in 100ms. Images of the stationary and moving phantom were acquired. Software was developed to automatically segment the marker positions from the EPID images.

Images acquired at 100ms displayed higher noise and poorer contrast than those obtained using regular (>1second) acquisition settings. However, the markers were still clearly visible on the 100ms images. The motion of the phantom blurred the images of the markers, though they could still be successfully segmented from the images.

A method to automatically detect the positions of implanted markers based on EPID images has been developed. The positions of gold markers placed in a lung phantom were detected successfully, even for phantom velocities substantially higher than those observed for typical lung tumors. This method shows the feasibility of EPID-based 4D radiotherapy.