Purpose: While real time imaging of treatment through an electronic portal imaging device (EPID) is a powerful tool to monitor treatment, limited field of view and lower contrast from an MV beam can make assessment difficult for physicians. This work will develop a method to register and project contour outlines for the internal target volume (ITV) and planning target volume (PTV) of lung tumor cases onto cine mode EPID images to help physicians in interpretation during treatment.

Methods: A sequence of EPID images, acquired during treatment, was registered to treatment planning computed tomography (CT) by machine geometry and patient setup with cone-beam computed tomography (CBCT). The planning CT was converted from Hounsfield scale to electron density by calibration curves of our CT simulator and digitally reconstructed radiographs (DRRs) were produced to match the EPID geometry, pixel for pixel. ITV and PTV structures as defined on the planning CT were then projected onto the DRRs. The DRRs were registered to the EPID images using cross correlation of a single template defined within the treatment aperture of each image. Once registered, the contours from the DRR were transferred to the EPID.

Results: We were able to successfully register MV DRRs to EPID images and display the projected target volumes. Without introduced motion, geometric registration and CBCT guided patient setup were sufficient to register the contours within a single pixel, as normalized cross correlations produced no additional shift. We expect the DRR/EPID registration to be an important step when looking at cases with substantial tumor movement.

Conclusions: The visualization of target volumes provides a tool for physicians to interpret EPID images and assess treatment, especially in cases with tumor movement. The methods developed will serve as the basis for a clinical tool providing real time contours.