

## AbstractID: 11843 Title: Mutual Information for beams-eye-view lung tumor tracking without radiopaque markers

**Purpose:** To keep safety margins in lung stereotactic body radiation therapy (SBRT) small and provide retrospective calculation of the delivered dose, the tumor motion should be monitored. We propose a tumor tracking algorithm that can estimate the tumor location from portal images taken during the treatment without the help of fiducial markers. **Method and Materials:** An algorithm based on a normalized mutual information technique was developed for tumor tracking. First a tumor template and a search region are identified on a DRR set reconstructed from a 4DCT acquired prior to the treatment. The set consists of 10 images relating to 10 equally sized breathing phase bins. The template is then used to track the tumor over the sequence of portal images. To estimate the tracking precision a dynamic thorax phantom was employed. **Results:** The phantom study showed a sub millimeter tracking accuracy in the superior- inferior direction for anterior-posterior and lateral fields. In a preliminary retrospective patient study the algorithm was able to track the tumor motion throughout the whole image sequence. Manual verification yielded a tracking magnitude error of  $\Delta xy = (3.4 \pm 0.8)$  mm. Furthermore the algorithm's robustness was tested with portal image sequences from two other patients with different tumor motion amplitude and contrast. The accuracy was estimated by comparison with manual tracking and yielded  $\Delta xy = (1.7 \pm 1.9)$  mm and  $\Delta xy = (1.2 \pm 0.8)$  mm, respectively. **Conclusion:** The algorithm has shown great potential for markerless lung tumor tracking. First test results showed that it can perform tumor tracking on portal images and DRRs even if the tracking template was defined in the other modality respectively.

**Conflict of Interest:** Varian Medical Systems, Inc.