AbstractID: 11548 Title: Volumetric visualization of clinical contours, dose, high-definition patient anatomy for four-dimensional adaptive radiotherapy treatment planning

Purpose: Volume rendered analysis of organ motion throughout the course of radiotherapy, investigating organ interplay during inter- and intra-fraction motion and patient variation. **Method and Materials:** We used a two-step process to volumetrically visualize clinical contours and dose alongside patient anatomy. First, deformable image registration methods were applied to warp physician-drawn contours from a single phase (either end-of-exhale or mid-exhale) to all other respiratory phases of a four-dimensional treatment dataset. For this process, a b-spline, intensity-matching algorithm was used to deform the original physician-drawn contours. The resultant contours were then fused onto their respective phases. Next, a High Definition® Volume Rendering engine by Fovia Inc. was used to render and display structure contours alongside dose distributions and high-detail anatomy. The four-dimensional display allowed for dynamic, interactive, and intuitive visualization and qualitative assessment of treatment accuracy. A set of sample thoracic, GI, and head and neck cases were reviewed following this methodology. In addition to dose-delivery verification, anatomical regions with reported treatment complications were scrutinized for any unusual dose patterns or organ movements/deformations. **Results:** Our results show agreement between the centers of mass and targets identified automatically by our deformable image registration and manually by the radiation oncologist. Both qualitative and quantitative analyses provided useful insights into the potential and limitations of four-dimensional radiotherapy treatment planning. **Conclusion:** Time variation of patient physiology during radiotherapy warrants continued reassessment of the delivered treatment plan. Volume rendering allows for improved visualization of the interplay between planned treatment ports and patient anatomy, illustrating in an interactive way changes as they occur over the course of treatment.