AbstractID: 11504 Title: Volume Rendered Cardiac Segmentation and Analysis for Breast Radiotherapy

Purpose: Development of a non-rigid deformable template algorithm for the segmentation of cardiac anatomy allowing for quantification of dose delivered to the heart during breast irradiation. **Method and Materials:** A high resolution, contrast enhanced, cardiac CT scan was used for manual delineation of cardiac? anatomy. This reference scan consisted of 163 slices, 0.75 mm thick. In-plane reconstruction voxel dimension of the scan was 0.373x0.373x0.75mm. Manual contours were generated to delineate cardiac anatomy, describing in detail position of relevant anatomy such as the left anterior descending coronary artery (LAD). This set of segmented structures, along with the corresponding cardiac CT image, define a reference set of cardiac data, to be used to match corresponding structures in our patient population. Plastimatch, a b-spline, non-rigid registration algorithm, was employed to determine the vector fields necessary to deform the reference CT image to match the designated patient volume. Using this vector field, the segmented model may then be deformed and registered to the new patient anatomy. Using the Fovia High Definition® Volume Rendering platform, the segmented volume may be analyzed volumetrically, visualizing anatomy, segmented volumes and delivered dose in near real-time. **Results:** Retrospective application of this algorithm upon a selection of previously irradiated free breathing and breath hold left breast patients shows good agreement with expected geometry. However, alignment issues persist where significant thoracic and pulmonary motion obscures the registration image of the patients heart, resulting in poor registration of the treated anatomy with the cardiac template. **Conclusion:** Risk of late cardiopulmonary toxicity from left breast irradiation has motivated new treatment techniques to reduce cardiac exposure during radiotherapy. Implementation of a deformable segmentation model imaged volumetrically allows for careful analysis of delivered cardiac dose.