AbstractID: 4635 Title: Quantification of Patient Specific Target Motion in the presence of Limited Data through Population Models

Purpose: Integrate 2D cine imaging into 3D patient population models of physiological motion for patient specific quantification of deformation.

Method and Materials: Inhale and exhale CT images of the liver were obtained for 5 patients under an REB approved protocol. A finite element model was constructed from the exhale contours of one patients liver and deformed into the exhale then inhale position of each patient, providing a common model of the 3D deformation of each patient's respiration, using Morfeus, a finite element-based deformable registration algorithm. Average deformation maps were computed for all combinations of 4 patients. Simulated 2D coronal cine images were generated from the exhale and inhale data of each patient. Narrow 2D channels were used to obtain image intensity data at the dome of the liver and the inferior tip of the liver on the exhale image and at the same location on the inhale image. A least squares fit was performed to align the image intensities in the superior-inferior direction, providing an estimate of the coronal motion of the liver. The motion from the channel was applied to the population deformation model, providing patient specific refinement by scaling the motion of the population model by the ratio of the motion at the navigator for the specific patient to the motion at the navigator for the population model.

Results: The average superior-inferior displacement difference over the liver volume between the 3D deformation model via Morfeus and the patient-refined population model was –0.12 cm (SD 0.15 cm). The average standard deviation across the five patients was 0.38 cm.

Conclusion: Population models of volumetric organ deformation due to physiological motion can be used to predict patient specific motion when limited data is available, such as with 2D cine data.

Conflict of Interest: Research supported in part by Varian Medical Systems