AbstractID: 5444 Title: A Biological Lung Phantom for IGRT Studies

Purpose: We are evaluating the feasibility of a dynamic biological lung phantom for IGRT studies, with the initial goal of developing a reliable phantom suitable for use in validation of deformable registration and volume rendering studies of the lung. The properties of an ideal lung phantom would include complex geometry, anisotropic inflation, and composition, lobar structure and internal airway architecture similar to that of human lung.

Method and Materials: Preserved swine lung was obtained and compared to human lung. The prepared lung was statically inflated to different volumes using a regulated nitrogen supply, and can also be dynamically inflated using a medical ventilator. The inflated phantom was imaged on a GE Lightspeed CT scanner. Volume rendering of the CT image data was performed to visualize and determine coordinates of airway bifurcations.

Results: Preserved swine lung was determined to be comparable to human lung in terms of tissue radiological and physical properties, lobar structure, airway architecture, volume and mass. Rendered airway vs. physiologic airway dimensions are undergoing verification by dissection. Analysis of CT images and volume rendering data demonstrates that the airway architecture may be followed to at least the 5^{th} airway bifurcation, yielding a conservative minimum of 31 reproducible anatomic landmarks evenly distributed throughout the lung. By visual inspection, it is possible to follow the displacement vector of these landmarks in sequential images.

Conclusion: Initial analysis shows that a swine lung phantom meets a number of the requirements of a reliable and functional phantom for validation of deformable registration and volume rendering methods. Reference points generated using the CT/volume rendering technique may be useful as a validation tool for both feature- and intensity-based deformable registration techniques. Ongoing study will evaluate the potential of the lung phantom for use in planning, delivering, and validating 4D IGRT.