

QIBA COPD/Asthma Phantom Design Committee

December 17, 2009

1 PM CST

Call Summary

In attendance

Philip Judy, PhD (co-chair)
Andrew Buckler, MS
Zachary Levine, PhD
Joshua Levy
Daniel Sullivan, MD

RSNA Staff

Susan Anderson, MLS
Joe Koudelik

General Discussion

Phantom Fill Material

- Need consistent material for phantom use
- Ideal foam would have 1mm or larger symmetrical hole sizes throughout
- Specific density preferred is 0.1-0.15
- Foam available in a variety of densities (i.e. hole sizes) but 1mm or larger is difficult to acquire since foam suppliers base their manufacturing technique on different parameters; not based on CT imaging
- Mr Levy (Phantom Laboratory) attempting to get grasp on foam uniformity
- Paper presented at RSNA 2009 dealing with evaluating imaging quality of pediatric Chest CT described natural sponges with added iodine to assist with visually evaluating image quality
- Mr Buckler and Draper Laboratories (Cambridge) discussion over artificial tissue use in phantoms; Consider whether foam should be replaced with other technologies. Whatever material best benefits the study should be used

Dr Judy performing micro-CT on various foam samples sent by Dr Levine

- Means and standard deviation calculated
- Pair correlation function fell to 0.07mm-0.08mm with a .034 pixel size (2-3 voxels down to ½ correlation length seen)
- Lower foam density doesn't show longer correlation length though
- Dr Judy still recovering images from phantom; will send to Dr Levine on DVD

COPDGene phantom

- Attempts needed to make the COPDGene phantom more useful
- More attenuation needed to reduce noise in air hole to mimic observed issues seen with the trachea
- A single hole to perform air measurements needed
- Drilling a consistent 15mm hole through an inner ring possible, but location will vary between phantoms
- Hole in ring may produce pixel SD of 8-10 HU, where as SD for trachea reconstructions are typically 20-30 HU; this might cause issues with CT reconstructions?

Beam hardening/scatter

- Need to reproduce high-density material around the air hole to determine which factors are most important and how to best measure
- Increasing material around the lung generates scatter (local and small angle scatter)
- Adaptive filtering may impact CT at lower end of scale
- Varying anti-scatter grids proposed
- Experimental plan proposed:

- Placing 30mm plexiglass annulus around air hole, surrounded by fill foam proposed for COPDGene phantom - for research use only
- Vary air hole sizes as a function of ring size
- Use rings of various size to determine where scatter may originate
- COPDGene phantom without inserted rings to be scanned for reference
- Air hole to be filled with hater to better mimic the air trachea

Characterizing vs. Optimizing

- COPD/Asthma Committee to define experimental groundwork activity to both characterize and optimize phantom performance
- Unlike the Q-CT 1A, 1B and 1C studies, COPD/Asthma not possible to pursue with volunteer effort
- Need to segment ancillary study (pivotal study) requiring funding support vs. preliminary activity of defining the study
- COPDGene has minimal resources to further develop the COPDGene phantom
- Desire for simple modification of the existing COPDGene phantom helpful, but will not solve the problems being pursued by this group
- Mr Levy of Phantom Laboratory graciously offered assistance with minor phantom modification in efforts to advance this scientific study
- Goal is to characterize lung performance with presumption of design changes for scanner manufactures

Next Steps:

- Dr Judy still recovering images from phantom; will send images to Dr Levine on DVD
- Dr Judy to send annulus dimensions to Mr Levy; Mr Levy to examine modification possibilities
- Dr Judy and Mr Buckler to follow up off-line with ancillary study layout
- Next call scheduled for January 7th, 2010 at 2 pm CST (3 PM EST)