In attendance:

Philip Judy, PhD (Moderator)
Eric Hoffman, PhD   RSNA
Zachary Levine, PhD   Susan Anderson, MLS
Joshua Levy   Joe Koudelik
John D. Newell, Jr, MD

Reference standard phantom
- Is there a need for a reference standard phantom?
- There is a phantom for COPDGene (which could be modified and improved). Phantom is modular with removable/changeable rings
    - it has not been established as reference standard phantom; Dr Levine and Mr Levy are familiar with the phantom
- COPDGene phantom gaining use to approve a scanner and prove its stability over time
- Need to compare other existing phantoms used in clinical trials, e.g., Dr Coxson's phantom from the Eclipse trial and Dr Stoel's phantom
- Reference phantom will be more complex
- Need further discussion on what really is needed:
- What materials could be utilized; materials (other foams) which could be used; scanning the foam materials with micro/CT—useful to consider in a more systematic way; how to use info on a reference system

Phantom foam density and bubble size
- Foam bubbles known to produce undesirable resolution affects
    - Lower density = larger bubbles
    - Algorithm or recon filter effects may not be observed if foam bubble size is small as compared to size of air "bubbles" in lung. If bubbles are too small, the phantom will not mimic lung.
- Comparisons of existing foams is needed across phantom types
- COPDGene phantom is modular, allowing for foam placement in various positions
- Dr Levine wrote *Medical Physics* article in past year on the need for fill material uniformity
- Density also depends on slice thickness
- Attenuation coefficients for various materials needed; for water and bone simulation combinations
- COPD/Asthma Committee to determine relative contribution of biology to scanner variation
- Will the 'biology signal' overwhelm the physics variability?
    - Need to better understand the physics
- Short term goal: Resolution sampling effects in bulk density measures in foam; need to characterize materials and make them useful
- Long term goal: Material with small enough bubbles to characterize materials as being uniform

- Ideal content bulk density material would contain various bubble sizes
- Best approach for mobile phantom testing needed
  - CTPhan phantom inserts could be sent between imaging sites
- COPDGene phantom needs fill material mimicking lung tissue; more varied, i.e. non-uniform
- Two issues to be addressed
  - Uniform, small bubbles, below 'resolution-of-intent'
  - Consistent devise to make measurements independent of all variables
- Match distribution of bubbles in foam to air cavities in tissue
- Scanner slice thickness produces variations in lung density measures
- Bubble size in foam not designed to bi-pass slice thickness and kernel recon affects
- Current fill materials were agreed upon by users, thus incorporated by manufacturers
- Reproducible material is required by manufacturers
- Dr Judy to distribute paper(s) from the mid-90s by Gerrit J. Kemerink on dependence of CT slice thickness on various foam densities

Immediate operations issue
- Scanning materials with microCT; could be compared with Dr Levine's materials data
- Microphotonics outcomes may be needed for tomography sets
- Should material be sent to Dr Levine's lab for microCT…

Scanning the foam with microCT
- Systematic process needed to apply the microCT technique to additional materials
- Can use this data as a reference to help characterize material via attenuation characteristics
  - What material is best?
  - What tests or internal phantom structures are best?
- Need an unbiased sampling methodology
- Need to assess alveolar geometry; resolution at this level would be helpful
- Need to know bubble size in various materials
- Gradation of hole size needed; wide enough to identify where hole size no longer matters; vCT slice thickness and kernel used will have affects
- Averaging over large areas will reduce bubble noise; introducing statistical inaccuracy possible

Metrics
- The metrics need to be well-stated in efforts to assess phantoms

Two COPD Profiles in Parallel Development
- Density - tissue
- Morphology – airway geometry and dimensions

Next steps:
  - Explore microCT of lung literature
  - Dr Judy to distribute paper(s) on dependence of CT slice thickness on various foam densities
  - Dr Hoffman will send Dr Levine abstract data
  - Mr Levy will send sample of COPDGene foam material to Dr Levine
  - Dr Levine and Mr Levy (Phantom Labs, Phone# 800-525-1190) to discuss off-line phantom fill materials and exchange information