## TU-A-BRC-11

**Use of Weekly 4DCT-Based Ventilation Maps to Quantify Changes in Lung Function for Patients Undergoing Radiation Therapy**

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PURPOSE: A method has been proposed to calculate ventilation maps from 4DCT images. Weekly 4DCT data were acquired for lung cancer patients undergoing radiation therapy. The purpose of our work was to use ventilation maps calculated from weekly 4DCT data to study how lung function changed throughout radiation therapy METHODS: Spatial registration and a density-changed based model were used to compute weekly ventilation maps for 6 patients. We quantitatively analyzed the data by defining regions of interest (ROIs) according to dose and lung lobe and by tracking the weekly ventilation of each ROI throughout treatment. The slope of the linear fit to the weekly ventilation data was used to evaluate change in lung function throughout treatment. The dose ROI ventilation data were used to study how function changed throughout treatment as a function of dose. The lung lobe ROI ventilation data were used to investigate the impact of tumor reduction on ventilation change throughout treatment. RESULTS: We found that 3 patients had an increase in weekly ventilation as a function of dose and 3 patients had no change or a slight decrease in ventilation as a function of dose. When the tumor volume in a lobe was visibly reduced, ventilation increased, and when the tumor volume was not visibly reduced, the ventilation distribution did not change. The average slope of the group of lobes that contained tumors that shrank was 1.18 (indicating an increase in ventilation), while the average slope of the group that contained tumors that did not shrink was -0.31 ($p = 0.013$). CONCLUSIONS: We did not find a consistent pattern of ventilation change as a function of dose. The weekly lobe ventilation data indicated that when tumor volume shrinks, ventilation increases, and when the thoracic anatomy is not visibly changed, ventilation is likely to remain unchanged.

## Imaging Educational Course Room 214
### *Radionuclides II*

## TU-A-214-01

**Cardiac Dedicated Ultrafast SPECT Cameras: New Designs and Medical Physics Implications**

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Myocardial perfusion imaging using nuclear cardiology techniques has been widely used in clinical practice because of its well documented value in the diagnosis and prognosis of coronary artery disease. Recently, industry has developed innovative designs of dedicated solid-state cardiac SPECT cameras that constrain all detector area to imaging just the heart. New software that recovers image resolution and limits image noise has also been implemented. These SPECT innovations are resulting in shorter study time and/or reduced radiation dose to patients, promoting easier scheduling, higher patient satisfaction and, importantly, higher image quality. Implications to the medical physicist working in laboratories using these new hardware and software technologies deal with novel approaches for: acceptance testing, measuring imaging performance, performing quality control, implementing new protocols, and optimizing efficiency while reducing radiation dose. This presentation discusses these new implications to medical physicists and describes the software and hardware innovations for cardiac-centric SPECT imaging which provide a strong foundation for the continued success of myocardial perfusion SPECT imaging.

Objectives:
1. Teach the principles of solid state SPECT imaging
2. Make audience aware of benefits of new imaging hardware and software
3. Make audience aware of medical physics implications of new technology

## Imaging Educational Course Room 110
### *Radiography II*

## TU-A-110-01

**Resolution in Digital Radiography**

E Samei*, Duke University, E Gingold*, Thomas Jefferson University Hospital

No abstract provided.

## Imaging Educational Course Room 211
### *Image Reconstruction II*

## TU-A-211-01

**Iterative Image Reconstruction for CT**

J Fessler*, University of Michigan, Ann Arbor, MI

After decades of research efforts, statistical methods for image reconstruction have begun to appear in commercial X-ray CT systems, offering substantial improvements in image quality and/or substantial reductions in patient X-ray dose, at the price of increased computation time. This educational talk will give an overview of the principles of statistical/iterative methods for image reconstruction for X-ray CT imaging along with examples from clinical CT.

## Imaging Scientific Session Room 301
### *Breast Imaging*

## TU-A-301-01

**Microcalcifications Visibility in Cone Beam Breast CT with Various Flat Panel Detectors**

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Purpose: To investigate the visibility of microcalcifications (MCs) in cone beam breast CT using various flat panel detectors. Methods: We investigated the visibility of MCs in cone beam CT (CBCT) breast imaging using various flat panel detectors, including PaxScan 4030CB (aSi/CsI) by Varian Medical Systems, FPD14 (aSi/aSe) by Anrad, C4742 (CCD/GdO2S:Tb) and C7921 (CMOS/CsI) detectors by Hamamatsu. A paraffin cylinder with a diameter of 135 mm and a thickness of 40 mm was used to simulate a 100% adipose breast. Calcium carbonate grains, from 125 - 140 µm to 224 - 250 µm in various size groups, were used to simulate the MCs. Groups of 25 same size MCs were arranged into $5 \times 5$ clusters. Each cluster was embedded at the center of a 15 mm diameter cylindrical paraffin phantom, which as inserted into a hole at the center of the breast phantom. The breast phantom with the simulated MCs was scanned on a bench top CBCT system at various exposure levels for each detector. The reconstructed images were reviewed by 6 readers independently. The MC visibility was quantified as the fraction of visible MCs and averaged over all readers for analysis. The visibility was plotted as a function of the estimated dose level and image signal-to-noise ratio (SNR) for various scans and detectors. The relative detector DQEs were compared among the four detectors. Results: It was found the relationship between the visibility and size can be fitted with a Boltzmann function for all the detectors. The Varian detector has the best MC visibility among all the detectors at the same dose level. Conclusions: The visibility of MCs increased with the isocenter dose and image SNR for all detectors. Detector with better DQE could achieve the same MC visibility with lower radiation dose.

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