CARL E. RAVIN ADVANCED IMAGING LABORATORIES

April 2009

RAI News

A Newsletter of the Carl E. Ravin Advanced Imaging Laboratories

This Issue

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Editorial: Who are we?

It is a pleasure to see the fourth issue of our newsletter under a new name: RAI News. As we take stock of our accomplishments in the past year, and particularly as we redefine ourselves under a new name, it is useful to briefly revisit who we are as a group.

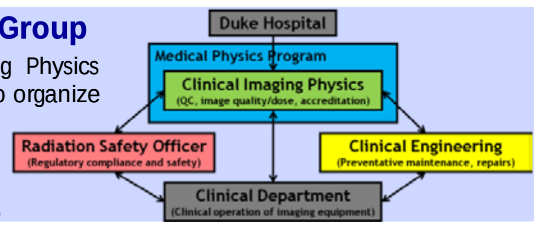
RAI Labs is a coalition of inter-dependent laboratories focused on research in advanced medical imaging with clinical relevance and lasting medical impact. Our integrated identity is one of the unique assets of RAI Labs, enabling us to pursue independent projects while drawing from a close resource infrastructure of expertise and equipment. The research we pursue encompasses diverse projects like patient modeling, clinical trials of new imaging methods, performance metrology, decision support tools, and medical informatics. The rich and broad scope of our research makes our group's research truly comprehensive. However, despite RAI Labs' broad research territory and multiplicity of laboratories, there is one common theme that best captures the group's main research outlook: translational quantitative imaging. I choose this phrase first because every one of our projects includes a rigorous quantitative component. Examples include trying to quantify an elusive imaging concept (e.g. image quality), defining a pertinent image feature (e.g. tumor spiculation), optimizing dose for the best quantitative performance, and combining quantitative information to reach a robust clinical outcome. But secondly, I choose this phrase because our research always serves a clinical end, thus the word translational. We do not do science for the sake of science alone (as valuable as such research is); we do what we do in order to improve clinical practice, and ultimately patient care.

I want to encourage us all to appreciate the unique assets of our group in terms of its integrated and comprehensive identity, take advantage of those assets, and maintain the translational and quantitative outlook that gives our research the relevance and rigor that has brought us thus far.

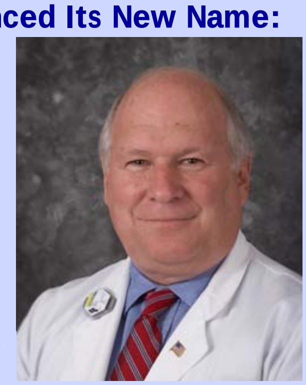
Ehsan Samei, Director

A New Initiative: Clinical Imaging Physics Group

RAI Labs was a catalyst for starting the Clinical Imaging Physics Group (CIPG) at Duke. This endeavor was initiated in order to organize a comprehensive image quality and imaging physics support group for clinical imaging operation at Duke Medical Center. CIPG's priorities include accreditation, acceptance testing, QC, protocol optimization, troubleshooting, and education.



Duke Advanced Imaging Laboratories (DAI Labs) Announced Its New Name: Carl E. Ravin Advanced Imaging Laboratories (RAI Labs)



On January 24, 2009, Duke Advanced Imaging Laboratories (DAI Labs) honored one of its founding members by changing its name to Carl E. Ravin Advanced Imaging Laboratories (RAI Labs). The announcement was made by Chancellor Dzau, Dr. George Bisset, the interim chair of the Radiology Department, and Dr. Ehsan Samei, Director of DAI Labs. Dr. Samei highlighted the importance of the renaming, saying that "*this is in recognition of Carl Ravin's life-long commitment to research in radiological sciences*". The group, established in 1991, has become one of the premier centers for x-ray imaging research. *"[Its success] is no accident but a reflection of Dr. Ravin's caring mentorship, unwavering support, and exemplary leadership. It is therefore most fitting that his legacy be prominently acknowledged in the name of the group."*

This change corresponded with the announcement of Dr. Ravin's appointment as the first president of the Private Diagnostic Clinic (PDC) at Duke as he stepped down from the chairmanship of the Radiology Department.

Both the PDC and RAI Labs will reap the benefits of Dr. Ravin's skills as an administrator and clinician. He is an internationally renowned expert in the field of digital thoracic imaging, where his research has focused on techniques to improve the quality of chest radiography. He started his career at Cornell University where he earned his undergraduate and medical degrees. He completed an internship in surgery at the University of California in San Francisco, his residency in diagnostic radiology at the University of Utah Medical Center, and a fellowship in thoracic radiology at Yale University. He came to Duke in 1978 as chief of diagnostic radiology. He is a member of the prestigious Fleischner Society and served as its president in 1997-1998. He is a founding member of the Society of Thoracic Radiology, has served for 10 years on the editorial board of the journal Chest, and served as Chairman of the PDC Board of Managers from 1999 to 2004.

RAI Labs expects to continue working with Dr. Ravin, and wishes him well in his new role at the PDC.

Research Updates:

Improved CAD for Lung Nodules Developed…

Papers published in *Medical Physics* and *Academic Radiology* describe **Qiang Li, Jiahui Wang** and collaborators' CAD system using multi-detector CT to detect lung nodules with a novel selection filter, a 3D nodule segmentation algorithm, and a rule-based classifier. It shows good performance and minimal overtraining effect.

… and will be applied to PET/CT

Qiang Li and **Jiahui Wang,** in collaboration with Terence Wong and Edward Coleman continue to pursue an NIH RO1 grant to develop a computerized detection and staging system using PET/CT. They submitted an NIH proposal to develop this essential component of accurate clinical staging in March.

Interstitial Lung Disease CT Results

Qiang Li and **Jiahui Wang** with collaborators Dr. Feng Li and Dr. Kunio Doi (University of Chicago) submitted a manuscript to *Academic Radiology* describing the detection and segmentation of lungs with interstitial lung disease, and plan to submit a paper describing the automated segmentation of diseased lungs to *Medical Physics.* They also submitted an NIH RO1 grant proposal last October.

PET Computerized Response Assessment

Qiang Li, Jiahui Wang and collaborators Yonglin Pu and Dan Appelbaum (University of Chicago) plan to detect and segment lesions using PET images, then calculate patients' response index to radiation and chemotherapy. Li is a co-PI on an NIH UO1 grant, which was submitted last October.

Robust Information-Theoretic CAD Developed, Prototype Launched at SPIE, and Extended to 3D Image Volumes

Results from the information-theoretic CAD project, led by **Georgia Tourassi**, confirmed the ability of the system to transfer knowledge across imaging platforms and provide robust performance in screen-film and full field-filed digital mammography, as well as breast tomosynthesis. It gave promising results showing a 5% increase in ROC performance when using a query-independent Gaussian saliency map and a database on mass and normal mammographic regions. The saliency-based IT-CAD system provided 50%-82% improvement in specificity while correctly confirming 98% of the masses when tested on expert mammographers' mass recordings. This led to a launch of an interactive prototype CAD at SPIE in February. **Tourassi** extended the 2D IT-CAD system for application with 3D image volumes and, with **Joseph Lo**, tested it for reduced false positives using breast tomosynthesis.

Improved Decision Making Algorithms

Georgia Tourassi and **Maciej Mazurowski's** research on case base reduction strategies suggests substantial improvement in ROC performance using Random Mutation Hill Climbing, with up to 90% reduction in computational cost. Their paper exploring advanced computation techniques including genetic algorithms, ensembles, and relational representations to improve the information-theoretic CAD's decision making algorithm in *Physics in Medicine and Biology* was chosen as part of the journal's *Highlights of 2008* collection.

Development of 4D Heart Model Underway

Paul Segars and **Greg Sturgeon** are developing a 4D multi-scale finite-element (FE) computational model of the human heart. When combined with a digital phantom of the human body, it will provide predictive multi-modality imaging data from anatomically diverse subjects, and enable quantitative evaluations and comparisons of 4D imaging techniques used to diagnose cardiovascular disease. The RO1 grant submitted for this project received a score of 129 (3.4%) and should be awarded in 2009.

Whole-Body Phantoms to Aid Dose Estimates

Paul Segars and **Ehsan Samei** are creating a library of 4D whole-body computational models representing a wide population, including both genders, varying ages and weights (10^{th} to 90^{th} pct.) from pediatric to adult, to be combined with Monte Carlo dose estimation methods for patient- and population-based CT dose correlation studies. It will assess dose variations across wide populations using highly realistic computational models and provide a database estimating patient-specific CT dose and radiation risk. An NIH RO1 proposal was submitted in November 2008.

CT Breast Phantom Under Development

Paul Segars, James Dobbins, Joseph Lo, Georgia Tourassi, Ehsan Samei and **Christina Li** continue to develop 3D computational breast phantoms using high-resolution CT data from John Boone (UC Davis) to simulate a wide range of anatomical variations and breast compression states for various imaging modalities. The RO1 proposal on this subject received a score of 196 (34.6%) and was resubmitted in March.

Flat Panel Detector Chest Tomosynthesis

James Dobbins, Page McAdams, Christina Li, Devon Godfrey and collaborators report substantial progress on an NIH study of chest tomosynthesis using a flat panel detector. Data from the first 21 of 97 subjects was used to evaluate sensitivity. Preliminary results indicate a 3-fold increase in detectability of subtle pulmonary nodules and potential for substantially improved detection of pulmonary nodules. Results were published in the cover article of the *Journal of Medical Physics*, June 2008 issue. A full clinical observer study is still underway.

Clinical Trial of Chest Tomosynthesis to Start

James Dobbins and Page McAdams are co-PIs of a multi-site chest tomosynthesis clinical trial sponsored by GE Healthcare. The trial is currently in the administrative planning stage and will soon begin collecting clinical data for an FDA submission.

Improved Algorithms for IMRT

Joseph Lo is working with **Shiva Das** (radiation oncology), **Georgia Tourassi**, **Vorakarn Chanyavanich** and **Matthew Freeman** to improve patient safety and treatment planning workflow for prostate cancer IMRT. With data from 200 human subjects, they demonstrated initial feasibility and are now working to optimize the algorithm and explore opportunities for clinical translation. A second year-long grant from Wallace H. Coulter Translational Partners Grant Program was received in March for this project.

Research Updates (continued):

Breast Tomosynthesis Research Continues

Joseph Lo and collaborators completed the selection of acquisition parameters for tomosynthesis and finalized the technique with a clinical comparison study. This work led to the publication of three papers, one in the *International Journal of Functional Informatics and Personalised Medicine* and two in *Medical Physics*. **Lo, Al Baydush, Shawn Mendonca**, and **Erfan Karim** are now applying Bayesian Image Estimation (BIE) to improve the image quality. **Lo** along with **Jay Baker** and **Alexie Riofrio** are working on a clinical trial to assess observer variability of breast tomosynthesis. An NIH R01 funded trial to assess the Siemens' breast tomosynthesis prototype, which has accrued over 300 subjects, is now entering its fourth year. Siemens renewed its research agreement in October for another two years. This marks a total of seven years of collaboration between Duke and Siemens. **Lo, Christy Shafer, Deep Mahtaji** and **Ehsan Samei** are working on breast tomosynthesis quantification to make tomosynthesis images appear more like mammography images (published in *Digital Mammography*), and exploring if breast density can be calculated for cancer risk assessment.

Assessing Cancer Risk Using Multiple Modalities

Joseph Lo, Christy Shafer, and **Victoria Seewaldt** (medicine/oncology) are working to assess breast density and relate it to breast cancer risk using multiple image modalities such as mammography, breast tomosynthesis, and MRI. This project has entered its second year of funding from the Army Synergistic Idea Award.

eDQE for Pediatric and Obese Patients

Ehsan Samei, James Dobbins, Nicole Ranger and collaborators at KCARE, UK are working on an ongoing assessment of system performance by calculating the **Effective DQE (eDQE)** for a range of digital radiographic systems for patients of different sizes such as pediatric or obese patients. The project has been further extended to optimize the systems for kVp, and to develop a metric of SNR per unit effective dose for optimization purposes.

Optimization of Reconstruction Algorithms

Ehsan Samei is working with **John Thompson** and **Jim Bowsher** to develop and optimize iterative reconstruction techniques for breast tomosynthesis and breast CT. Initial results show significantly improved noise performance compared to analytical reconstruction technique. The method is oriented towards quantification of breast density and contrast in breast imaging.

Pediatric CT Dosimetry

Ehsan Samei, Xiang Li, and **Paul Segars** are working on techniques to provide patient-specific dosimetry for pediatric CT examinations. Initial results reported in *Medical Physics* show variability across patients with trends that can be used for retrospective as well as prospective patient dosimetry.

Stereo Chest Radiography Trial Shows Promise

Ehsan Samei, Jin Wooi Tan, Sarah Boyce, and **Nicole Ranger** are comparing monoscopic and stereoscopic chest radiographs. The clinical trial results to date show improved ROC with the stereo application. The results are consistent with earlier trials on stereo mammography.

Modulated Breast CT

Ehsan Samei, **Baiyu Chen**, and **Sam Richard** have been using models to assess the utilities of a modulated CT technique for breast imaging via Monte Carlo and mathematical modeling.

Estimation Metric for Quantitative Imaging

Sam Richard, and Ehsan Samei are developing metrics by which quantitative features of an image can be characterized in terms of an estimation index. Initial applications include breast imaging and CT.

Awards and Honors

The Journal *Physics in Medicine and Biology* selected an article written by **Georgia Tourassi, PhD and Maciej Mazurowski, PhD** (Physics in Medicine and Biology, 53 895-908, 2008) to be included in the *Highlights of 2008* collection as an example of the very best work published in the journal during 2008 based on high praise from referees, the number of online downloads, and the outstanding nature of the research presented.

RSNA and AAPM selected members of RAI Labs to develop three education modules for physics education to radiologists: **Ehsan Samei, PhD** will lead the development of a module focused on X-Ray Quality and Dose, in addition to his prior work on the development of a module focused on CT Dose; **Nicole Ranger, MSc** will develop a module on Radiation Detection/Instrumentation in Nuclear Medicine.

Anuj Kapadia, PhD is one of 55 recipients chosen from among 965 applicants for the Department of Defense Breast Cancer Research Project Idea Award. Also, he was asked to work on the Instrument Development Team at ORNL to develop the Versatile Neutron Imaging System (VENUS) for imaging applications at the Spallation Neutron Source (SNS).

Nicole Ranger, MSc was AAPM's delegate to the AIMBE/WIMBE (American Institute for Medical and Biological Engineering/Women in Biomedical and Biological Engineering) Women's 2008 Leadership Symposium entitled: *It's Your Responsibility: How to Lead and Impact Policy: Enhancing the Role of Women in Medical and Biological Engineering.*

Christina Li and her team, Cerene Biomedics, won the $100K grand prize from the SE Bio/Plan competition to develop an implantable device to prevent focal epileptic seizures by delivering targeted thermoelectric cooling to the brain.

Ehsan Samei, PhD was promoted to Professor of Radiology at Duke University, received the Excellence in Mentorship Award for mentoring Medical Physics Graduate students at Duke University, chaired the SPIE Physics of Medical Imaging Conference and was elected the President-Elect of the Southeast Chapter of the AAPM.

Focus on Research - Testing Whether Breast Compression is Necessary

Breast compression during mammography is used to improve image quality and reduce radiation dose, but discomfort due to compression reduces the impact of screening programs. The need to compress may be lessened with newer technologies such as full-field digital mammography (FFDM), and digital breast tomosynthesis (DBT). **Ehsan Samei, Rob Saunders,** and collaborators assessed the impact of breast compression on inherent diagnostic content in FFDM and DBT.

Both FFDM and DBT systems (prototype) at constant glandular dose showed approximately constant lesion conspicuity (SdNR) with modest decreased compression (Table) when testing simulations of a variable anthropomorphic breast phantom containing masses and microcalcifications (Fig. 1, Fig. 2) using a validated Monte Carlo algorithm based on the Penelope program (Fig. 4). Simulations were performed for two breast thicknesses (4 and 6 cm), two compression levels (standard compression and 12.5% reduced compression), and three photon flux conditions to maintain constant flux, constant detector signal, or constant glandular dose. The DBT simulations used an angular arc of 45 degrees and filtered back-projection reconstruction. The FFDM and DBT images were analyzed for lesion conspicuity (SdNR), which is the ratio of the lesion contrast to the anatomic and quantum noise. (continued)

BREAST SIZE	FFDM SdNR (constant photon flux)		DBT SdNR (constant glandular dose)	
	Standard Compression	12% Reduced Compression	Standard Compression	12% Reduced Compression
4 cm	0.60 0.11	0.62 0.11	1.39 0.15	1.46 0.22
6 cm	0.50 0.11	0.49 0.10	1.26 0.15	1.22 0.20

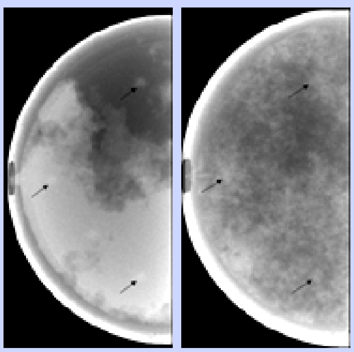


Fig 1: Arrows indicate three masses in projection images for 4 cm (left) and 6 cm (right) breast phantoms using FFDM.

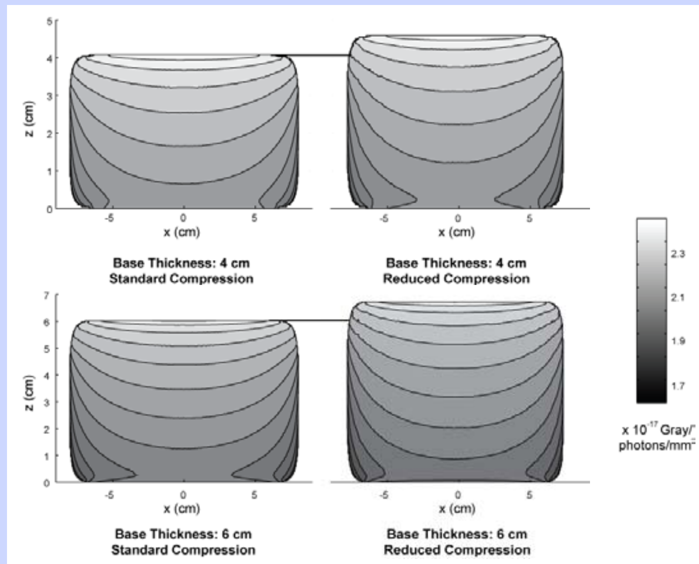
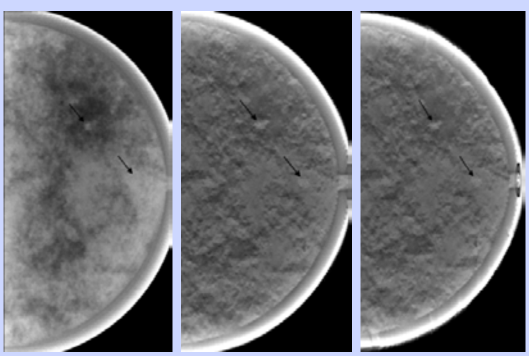


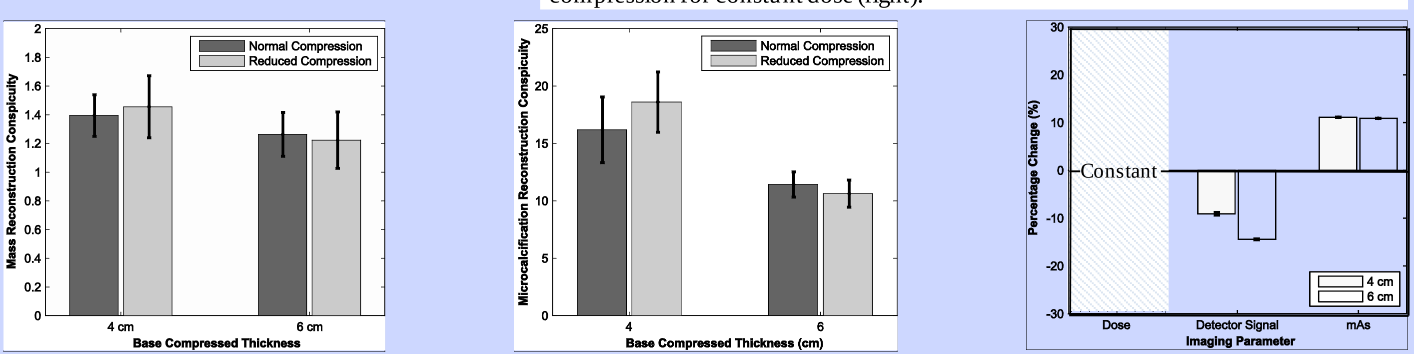
Fig. 3 (above): Absorbed glandular dose distribution integrated along the y-axis from the chest wall to nipple for different compressions of 4 cm (top) and 6 cm (bottom) breast using FFDM. All runs were computed for the same anode photon flux to the breast.

Fig. 2 (below): Arrows indicate one easily visible mass and one mass obscured by anatomy in images of 4 cm breast using FFDM. On the left is a projection image under standard compression Central reconstructed slices under standard (center) and reduced (right) compression show little impact of reduced compression on conspicuity.



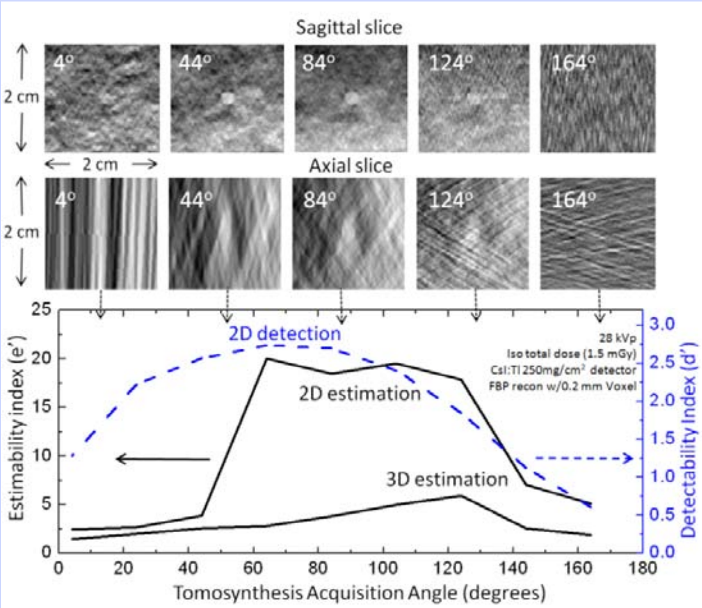
For both FFDM and DBT, keeping photon flux constant with reduced compression lowered glandular dose (Fig. 3). Overall, the results suggested that a 12% reduction in compression is possible with little impact on image quality or dose, provided that the total tube output can be increased by ~10% and the detector signal reduced by ~10%. The findings justify a measured reduction of breast compression, allowing for increased comfort, and possibly better compliance.

Fig. 4: Reduced compression did not significantly change conspicuities in masses (left) and microcalcifications (center) in reconstructed slices for constant glandular dose. The right graph shows how detector signal and mAs changed with compression for constant dose (right).



Focus on Research - Imaging Performance Metrics for Breast Tomosynthesis

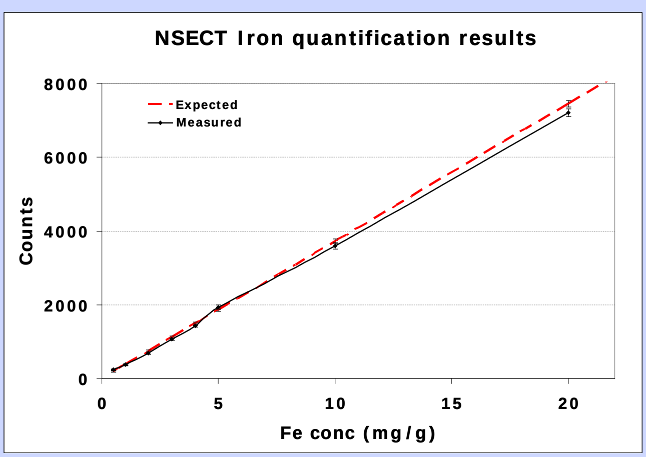
Despite increased interest in improving quantitative features of medical imaging systems, there has been limited effort in developing specific metrics for assessing quantitative imaging performance (or estimation tasks). This is especially so for breast tomosynthesis. **Samuel Richard** and **Ehsan Samei** are developing these types of metrics, as well as the framework to optimize quantitative breast tomosynthesis imaging systems. They simulated tomosynthesis reconstructions of breast phantoms with embedded spherical lesions at various acquisition angles (tomo-angle) with fixed total glandular doses (1.5 mGy). The reconstructed sagittal and axial slices, (shown), illustrate how anatomical clutter is the dominant source of "noise" at small tomo-angles. Conversely, electronic noise (due to photon starvation) dominates at larger tomo-angles. This shows that the tradeoff between anatomical, quantum, and electronic noise in tomosynthesis imaging must be properly addressed to maximize quantitative imaging performance. They used an SNR-type figure of merit called the "estimability index" (e') to quantify imaging performance, which is derived from the mean square error of the maximum-likelihood estimator. Computation of e' for the 2D disk radius estimation task (in sagittal slices) identified maximum performance at 60-120º tomo-angle (see plot). In contrast, peak performance (e') for the 3D sphere radius estimation task occurred at larger tomo-angles. This illustrates that in some cases a larger tomo-angle may be required for 3D estimation tasks as compared to a 2D estimation task. Furthermore, when comparing the estimability index with the conventional metric for detection performance, the detectability index (d') (right axis), results show that size estimation tasks generally require larger tomo-angles than detection tasks.

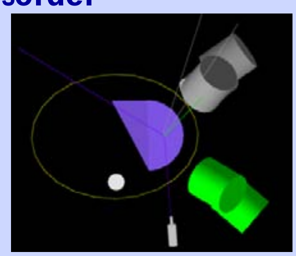


Initial results demonstrate that metrics for quantitative imaging performance can differentiate between estimation and detection tasks for breast tomosynthesis; and can provide a meaningful framework for optimization of volumetric imaging systems for quantitative imaging tasks.

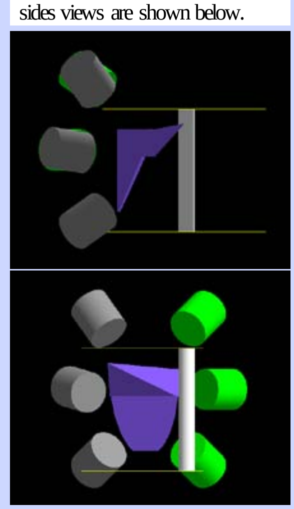
Focus on Research - Developing Portable NSECT for Diagnosis of Liver Disorder

Neutron Stimulated Emission Computed Tomography (NSECT) has shown strong potential for diagnosing disorders in the human body characterized by element concentration differences between diseased and healthy tissue, such as liver disorders which cause iron (hemochromatosis) or copper overload (Wilson's disease). Through a non-invasive scan delivering a few mSv of radiation dose, NSECT can quantify the concentration of iron or copper in the liver – a measurement currently obtained through percutaneous liver biopsy. In earlier experiments performed at the Triangle Universities Nuclear Laboratory (TUNL), **Anuj Kapadia** and Calvin Howell demonstrated sufficient sensitivity to quantify clinical concentrations of iron in the liver. To achieve the next step towards clinical translation, **Kapadia** is developing a portable prototype of the NSECT scanner based on compact portable neutron generators capable of producing monochromatic-energy beams with intense fluxes and sufficient sensitivity and accuracy for quantifying iron overload. **Kapadia** and **Greeshma Agasthya** have investigated this topic using Monte-Carlo simulations developed in GEANT4, and have developed simulated phantoms of the human liver and torso along with a simulated neutron source and gamma detectors (shown). Their results for quantification of iron overload, ranging from mild (2 mg/g) to severe (over 10 mg/g) disease states, indicate that with appropriate calibration and background correction techniques, NSECT can accurately quantify concentrations as low as 2 mg/g with a radiation dose of less than 2 mSv. Dose analysis is performed through a separate dosimetry simulation that takes into account all energy deposited in the body through neutron and gamma interactions. This work is supported by the Department of Defense and the Center for Molecular and Biomolecular Imaging at Duke University.





The neutron source is the gray "gun" (top view only; shown above); phantoms are purple; gamma detectors are green and gray cylinders; The front and sides views are shown below.



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RAI Labs Publications in 2008 (continued #2)

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44. **Samei E.** Acquisition of digital chest images for pneumoconiosis classification: methods, procedures, and hardware. Proc. NIOSH/ILO Scientific Workshop on Pneumoconioses, Washington, DC, March 2008
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Arrivals/Departures

Amarpreet Chawla, PhD, completed his PhD in BME and is working as a Medical Imaging Scientist at GE Global Research in the CT and X-ray Systems Lab.

Ben Pollard, MS completed his masters in May 2008 and is working as a physicist for Harold Leever Regional Cancer Center in Waterbury, Connecticut.

Tuania Wright, staff assistant, and **Karen Wilson**, lab manager, joined RAI Labs in February 2009 to help with administrative and grant-related tasks.

Maciej Mazurowski, PhD joined RAI Labs in January 2009 after completing his PhD at the University of Louisville, KY to continue his collaborations with Georgia Tourassi working on Computer-Aided Detection.

Samuel Richard, PhD joined RAI Labs as a post-doctoral associate in October 2008 after completing his PhD at the University of Toronto. He is working with Ehsan Samei on breast and quantitative imaging.

Swatee Singh defended her PhD in September 2008 and is now working at McKinsey&Company in Chicago and commuting home to Phoenix, AZ.

Robert Saunders, a post-doctoral associate in Ehsan Samei's lab until fall 2008, is now an SPIE-sponsored congressional fellow.

Amy Sharma, graduated with her PhD in December 2008 and has a congressional fellowship sponsored by the National Science Foundation (NSF).

Jason Grimes, a research technician for Paul Segars, is now working as a medical device specialist in Portland, Oregon.

Greeshma Agasthya is working on the NSECT project with Anuj Kapadia, and will stay on to complete a PhD in BME supervised by Kapadia and Lo.

Robert Ike, MS graduated from Duke's Medical Physics Program in 2008 and is now employed with the Clinical Imaging Physics Group (CIPG) at Duke.

The Dobbins lab has expanded to include **Jered Wells** (Med. Phys. PhD student), **Kelly McGrady, Erich Schnell** (Med. Phys. MS students) and **Alex Modestou** (undergraduate physics major). **Wells** is studying noise reduction in tomosynthesis; **McGrady** is completing an observer study of chest tomosynthesis; **Schnell** is working to improve DQE of computed radiography by suppressing fixed-pattern noise in the plates; and **Modestou** is collecting empirical data for a scatter correction algorithm.

There are four new faces in the Lo lab: **Erfan Karim** (BME MS student) is working on Bayesian Image Estimation (BIE) in breast tomosynthesis; **Alexie Riofrio** (3rd year medical student) is studying interobserver variability of radiologists using breast tomosynthesis; **Deep Mehtaji** (Med. Phys. MS student) is working to quantify breast tomosynthesis; and **Matthew Freeman** (Med. Phys. MS student) is optimizing IMRT.

The Samei group welcomed new members: **Baiyu Chen** (Med. Phys. MS student) is working on Monte Carlo simulation; **Lincoln Webb** (Med. Phys. MS student) is focusing on mammography displays including stereoscopy; **John Thompson** (BME MS student) is working on iterative reconstructions; **Jin Wooi Tan** (Med. Phys. PhD students) has been working on chest BCI.

VolumeRad Installed in Duke Clinics

A clinical chest tomosynthesis unit (VolumeRad by GE Healthcare) was installed in Duke clinics in March 2008. Development and introduction of this product for worldwide sale represent the culmination of 10 years of successful collaboration between the Dobbins labs and GE Healthcare.

Society of Directors of Academic Medical Physics Programs, Inc. (SDAMPP) Launched

Officially incorporated and launched, SDAMPP held its first annual meeting in July 2008. SDAMPP aims to help the field of Medical Physics Education. Co-founders, **Ehsan Samei** and **James Dobbins,** both serve on the initial board of directors, and attended AAPM summit meetings addressing board eligibility changes. **Dobbins** is currently serving as interim president.

Alumni News

Devon Godfrey, PhD, recently joined Radiation Oncology at Duke as Assistant Professor.

Jonathan Jesneck was promoted to staff scientist at the Broad Institute in Cambridge, MA.

Other News

Joseph Lo will marry **Cortney Phelon** Saturday April 25th at the Washington Duke Inn (cortneyandjoseph.com)

Sarah and Curt Boyce are pleased to announce their new daughter **Kalyn Elise Boyce** born on September 16, 2008 weighing 6 lbs. 6 oz. and measuring 19 inches.

Jiahui Wang and his wife **Weiyi Zhao** welcomed their new son **Andy Yifei Wang** on December 8, 2008.

Congratulations to **Shawn Mendonca** for his acceptance to medical school.

Tomosynthesis Symposium at Duke

RAI Labs is sponsoring a symposium on Tomosynthesis, April 30 - May 2. Over 50 attendees are expected. The conference will include a White Paper Initiative, which will represent a community voice for the direction of tomosynthesis.

Faces of RAI Labs

From top left corner:

A Kapadia, J Lo, G Tourassi, E Samei, J Dobbins, Q Li, P Segars
M Mazurowski, J Wang, P McAdams, C Ravin, J Baker, N Ranger, S Richard
B Harrawood, A Jarvis, T Wright, K Wilson, B Britt, G Sturgeon, S Mendonca
M Freeman, L Webb, D Mehtaji, E Karim
J Tan, R Ike, C Li, V Chanyavanich, S Boyce, X Li, C Shafer,
K McGrady, J Thompson, B Chen, J Wells, G Agasthya, Y Lin, E Schnell

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