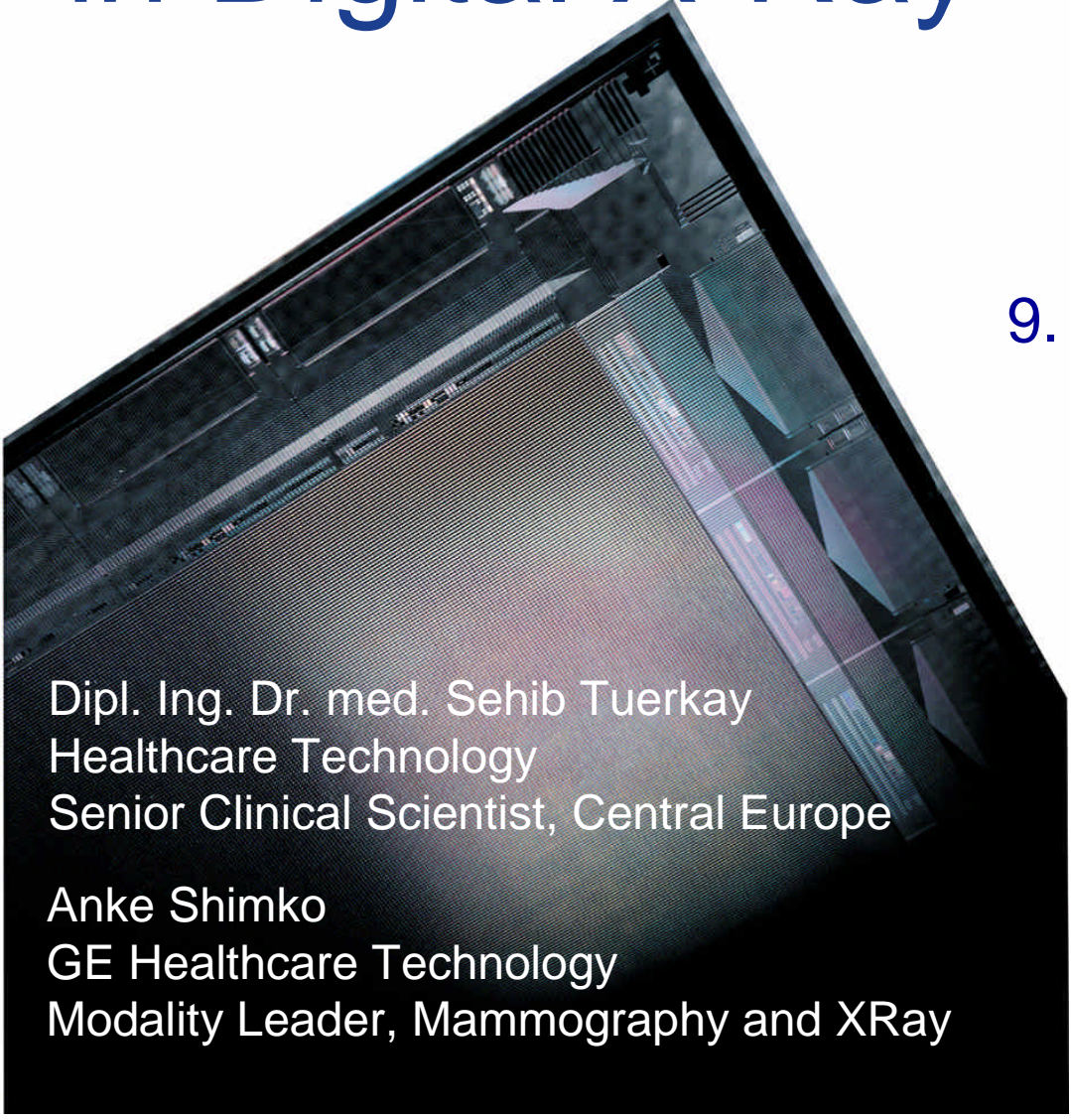


# New Advanced Applications in Digital X-Ray

APT 2005  
9. Fortbildungsseminar  
Göttingen  
June 17, 2005



Dipl. Ing. Dr. med. Sehib Tuerkay  
Healthcare Technology  
Senior Clinical Scientist, Central Europe

Anke Shimko  
GE Healthcare Technology  
Modality Leader, Mammography and XRay

# Advanced Radiography

GE goes beyond  
replacing screen-film with digital...

GE provides new capabilities that  
were not possible with X-Ray  
before...



# Advanced Applications

Dual Energy  
CAD

Auto Pasting  
Volume RAD



# Fully Automatic Large Anatomy Imaging

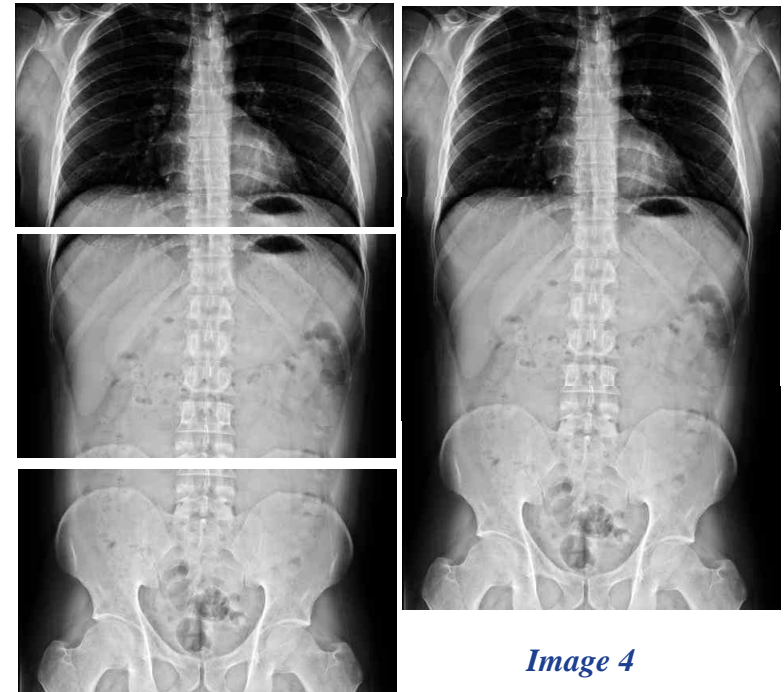
## Auto Pasting



imagination at work

wip (Works in  
Progress)

# Large Anatomy Imaging (fully automatic)



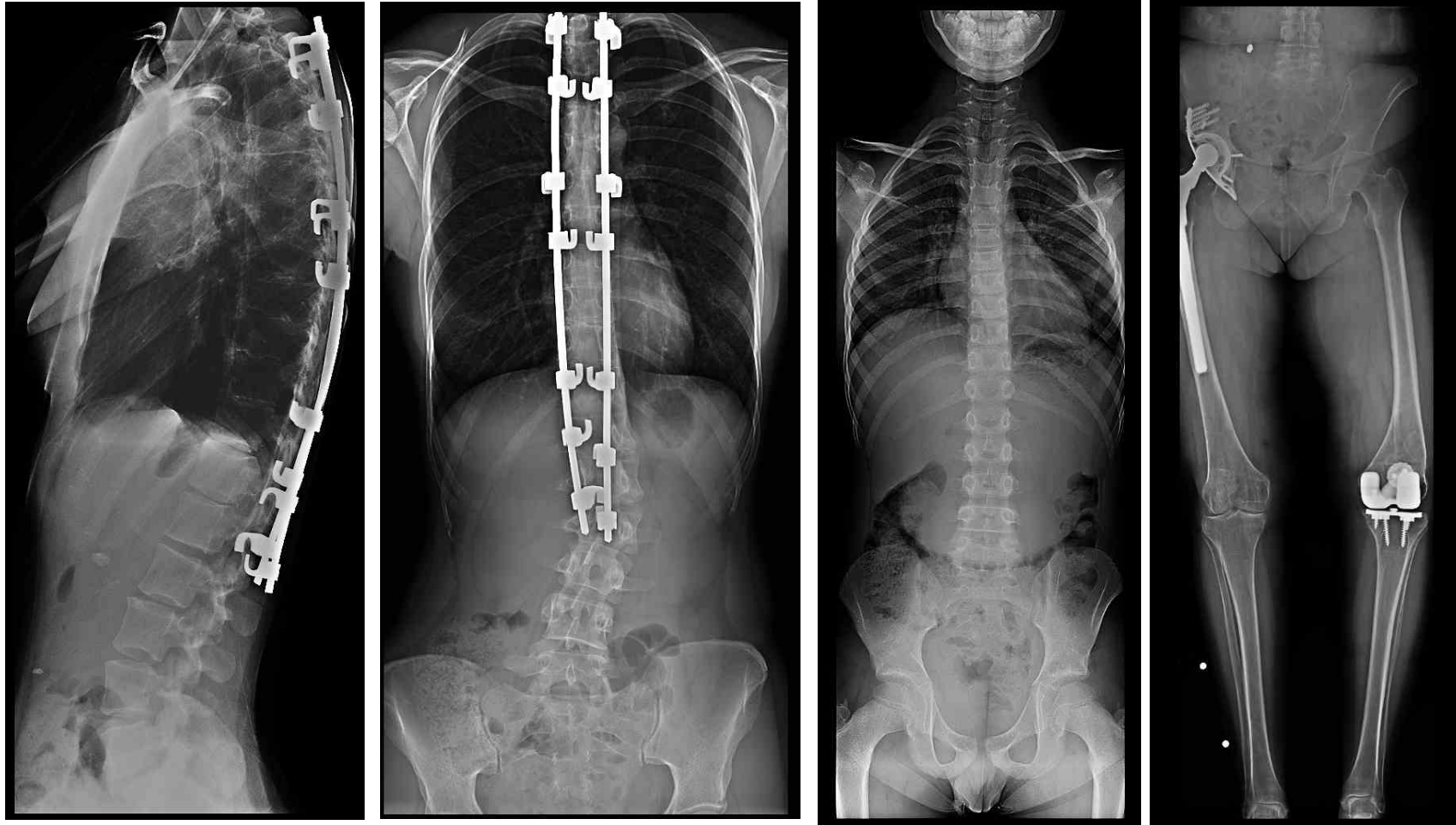
*Images 1,2,3*

*Image 4*





# Large Anatomy Imaging (fully automatic)



# Revolution 3-D Imaging

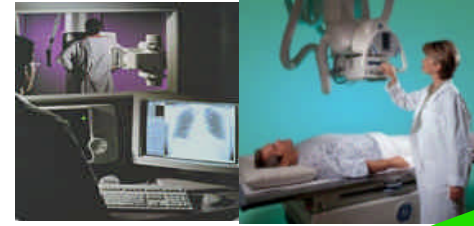
wip

VolumeRAD  
(Tomosynthesis)



imagination at work

# VolumeRAD - Introduction



wip

Multiple exposures taken at multiple angles

Total acquisition time is within a breathhold.

Tube is moving during exposures; detector is stationary

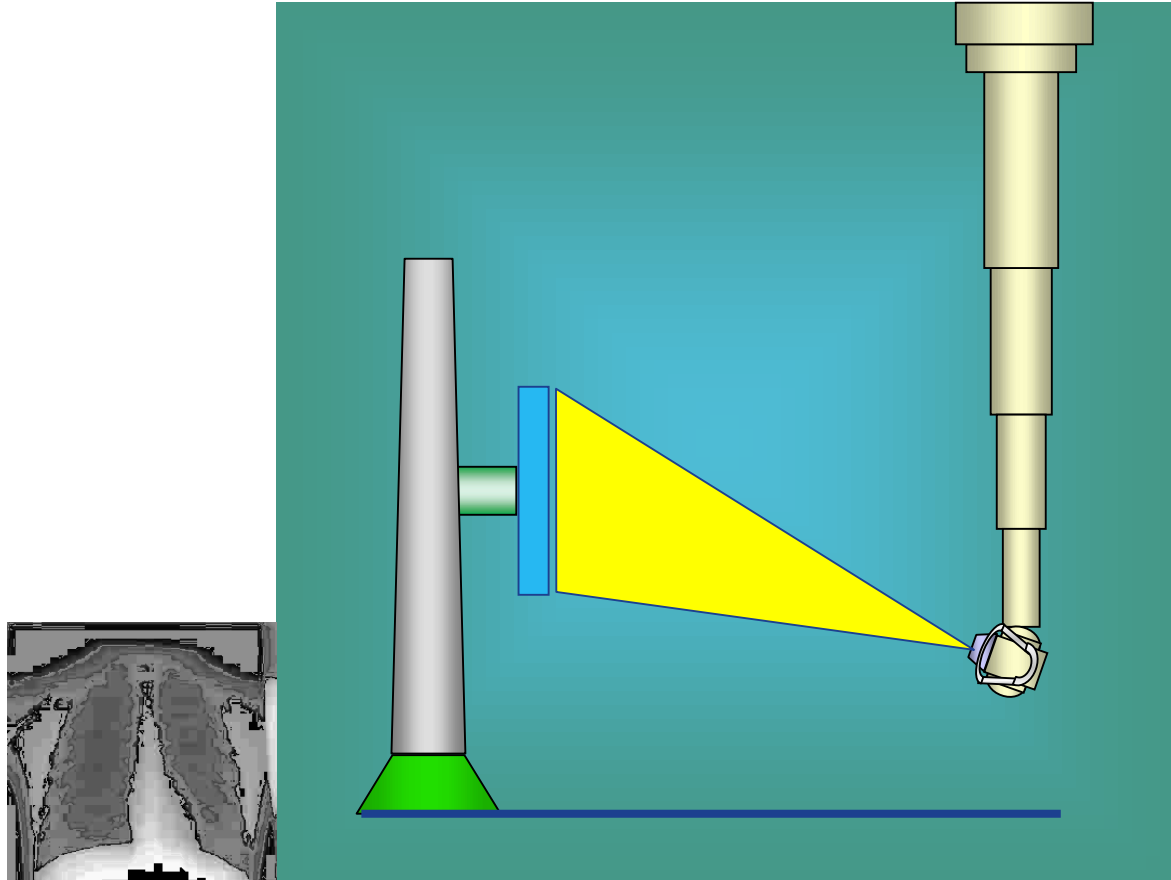
Total dose is comparable to a screen film LAT exam.



# VolumeRAD - Introduction

wip

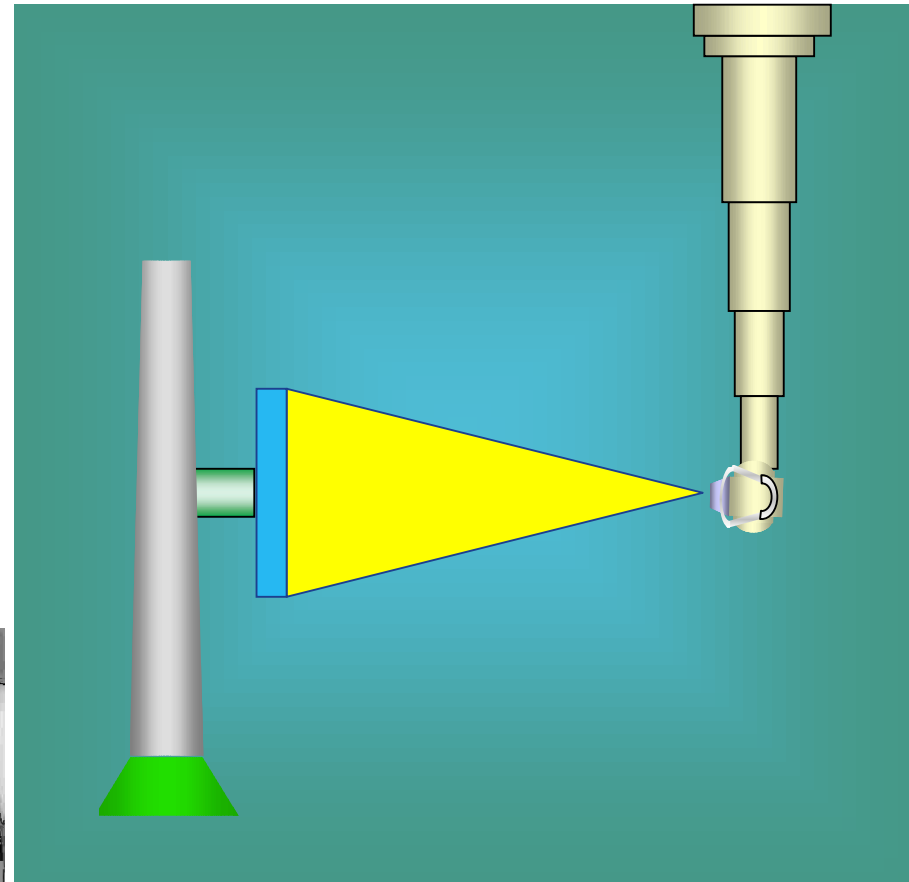
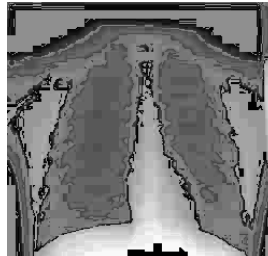
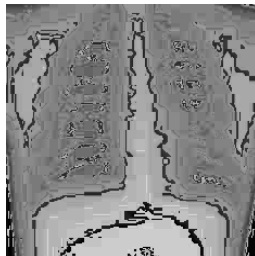
Acquisition...



# VolumeRAD - Introduction

wip

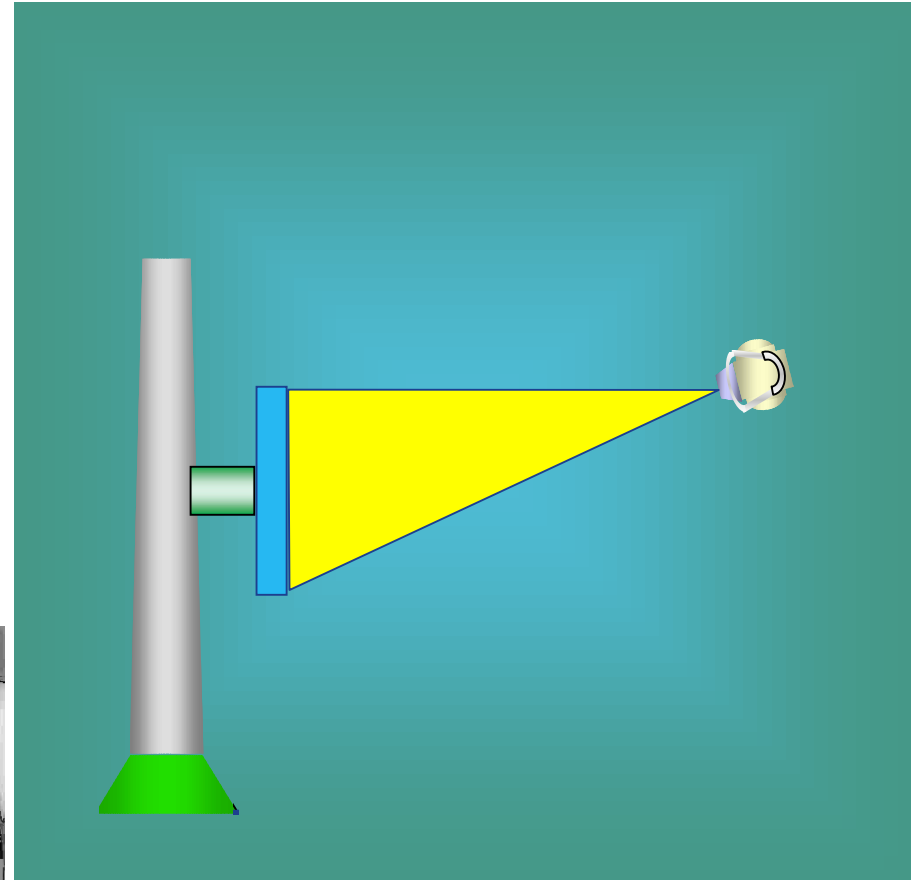
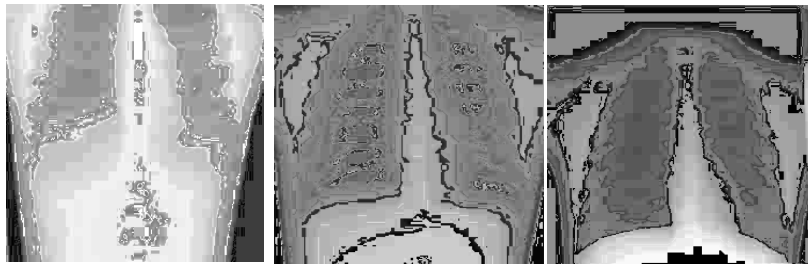
Acquisition...



# VolumeRAD - Introduction

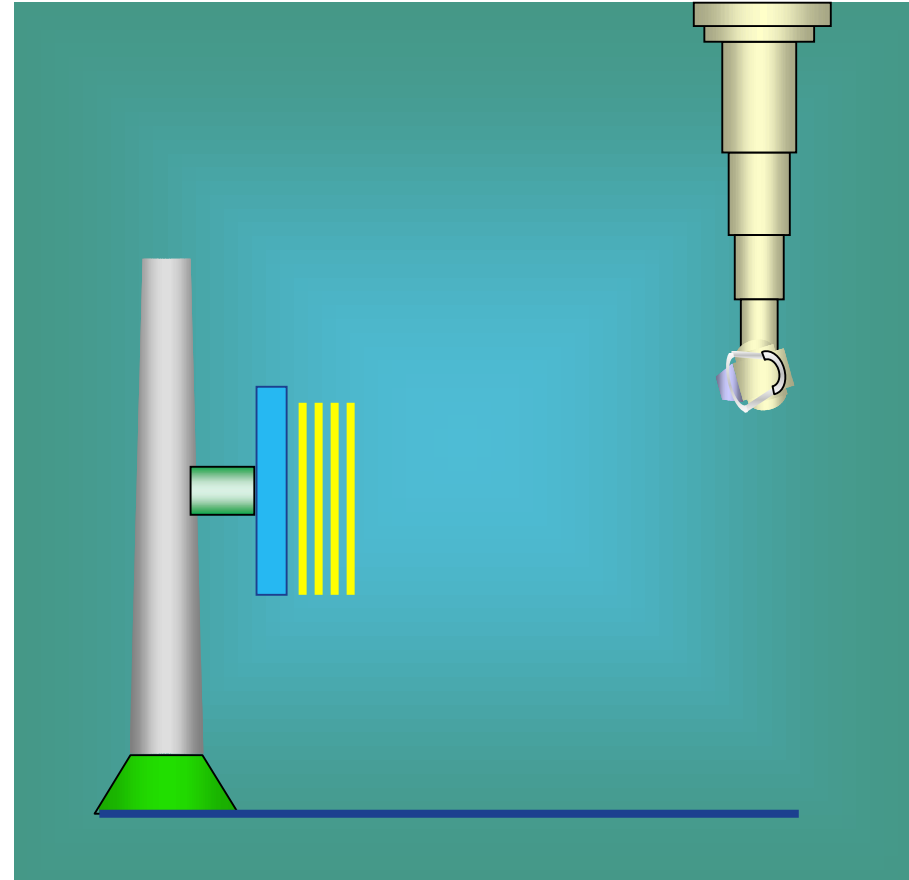
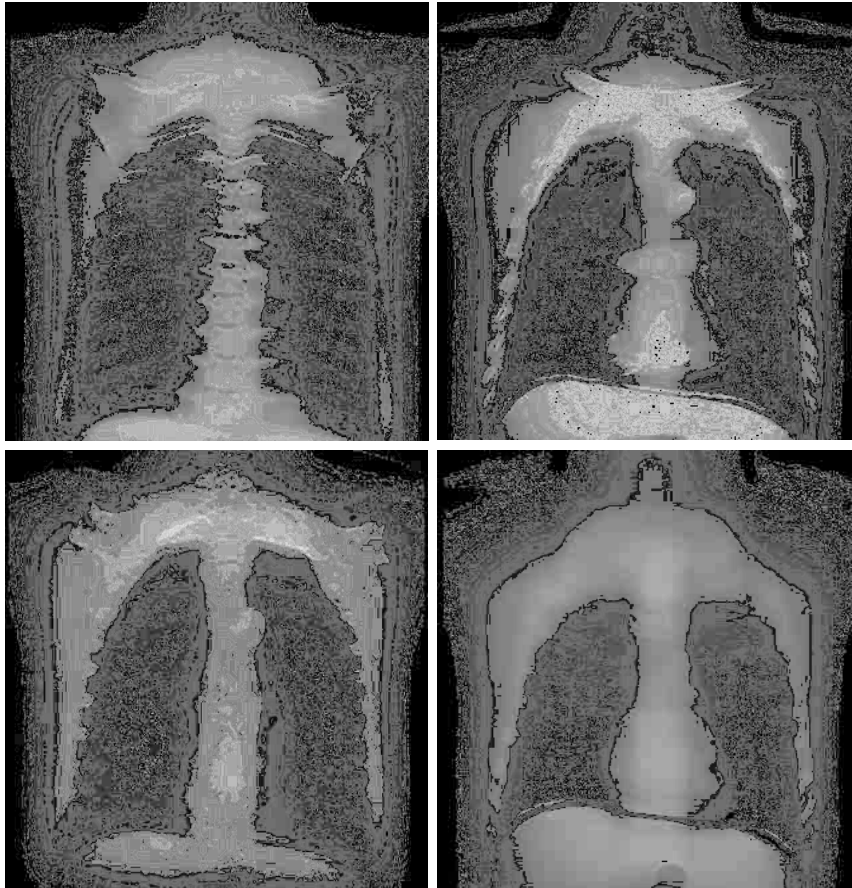
wip

Acquisition...



# VolumeRAD - Introduction

wip



# VolumeRAD 3D Chest RAD

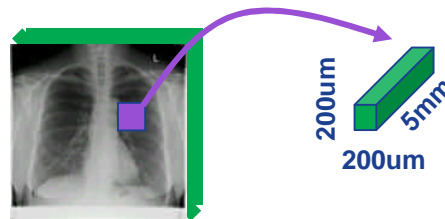
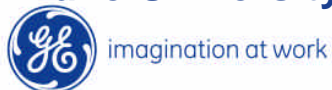
## Goal:

- Limited 3-D reconstruction to remove overlying/underlying structure
- All image planes visualized using a single acquisition

## Acquisition:

- Vertical tube motion
- Number of exposures: max 60
- Exam length: ~10 sec (single breath-hold)
- Slice thickness: ~0.5 to 1 cm
- Number of slices: 20 to 60
- Dose: ~ as a screen-film lateral exam
- Enabled by GE Revolution™ detector:
  - Fast framing
  - Low noise
  - High DQE

Clinical Partner:  
**Duke University**



wip





# Radiographic VolumeRAD - Chest

Opportunities: nodule, vasculature, virtual bronchoscopy, embolism, screening, ...

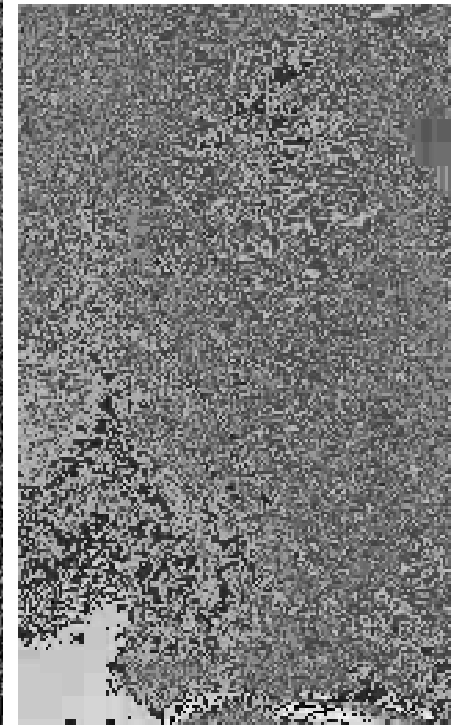
wip



PA view of a lung cancer patient



Tomo slice revealed two unusual nodules (arrows) and more vasculatures and bronchus

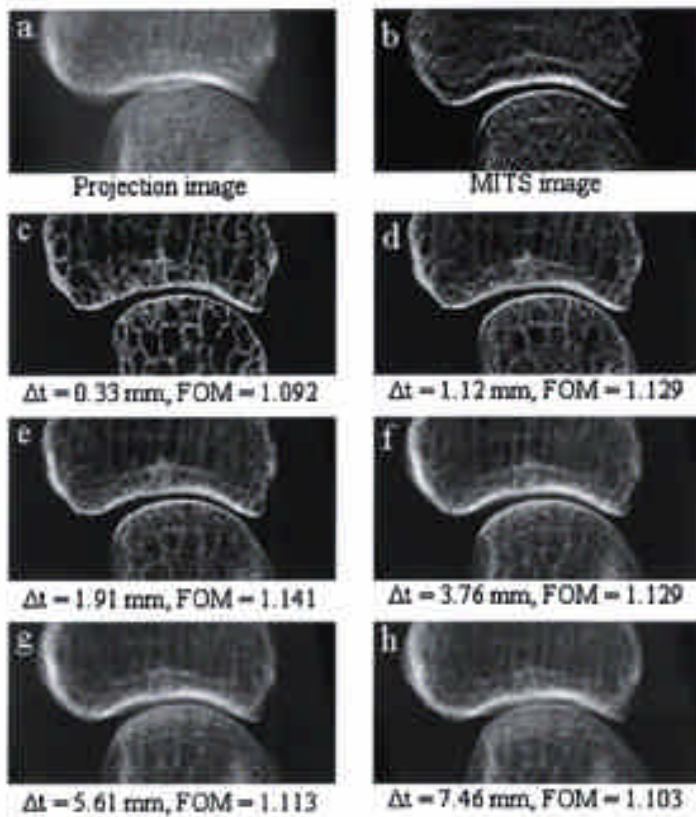




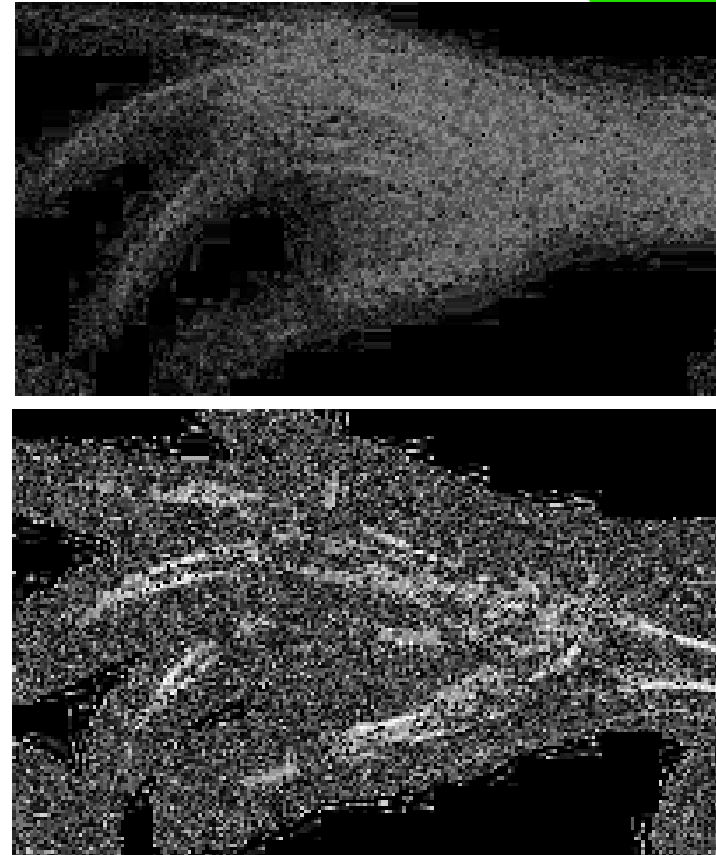
# Radiographic VolumeRAD - Orthopedics

Opportunities: Arthritis evaluation, joint spacing measurement, spine, ...

wip



A sequence of tomo slices through a joint specimen show details\*



(Top) Hand PA view of a wrist phantom.  
(Bottom) A tomo slice displays bone/joint.

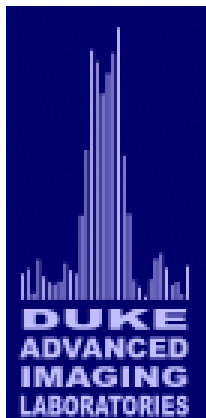
# Digital Tomosynthesis for Improved Lung Nodule Detection: Initial Clinical Experience

HP McAdams, DJ Godfrey, JT Dobbins III

Duke Advanced Imaging Laboratories

Department of Radiology, Duke University Medical Center

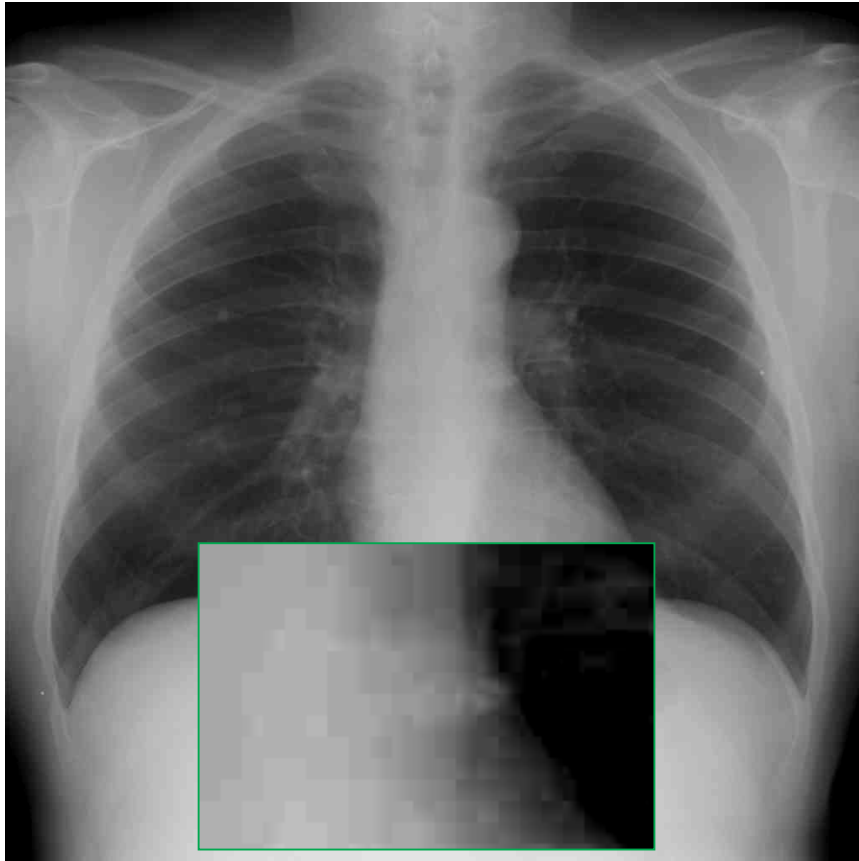
Durham, NC USA



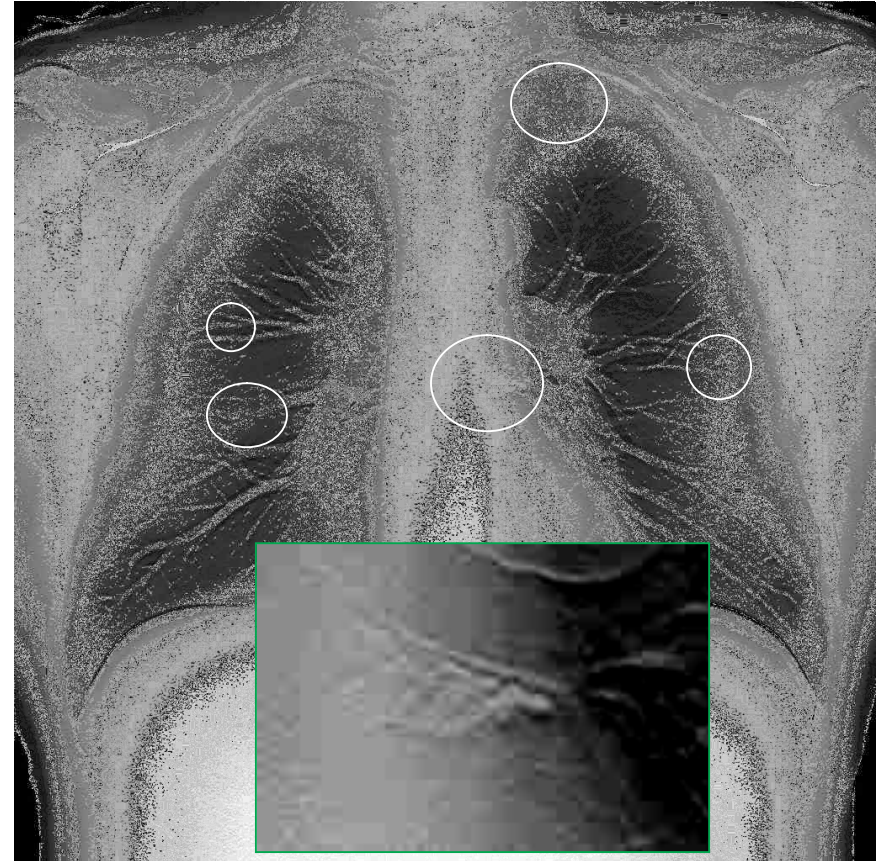
ination at work

# Digital VolumeRAD

---



**Conventional projection image**

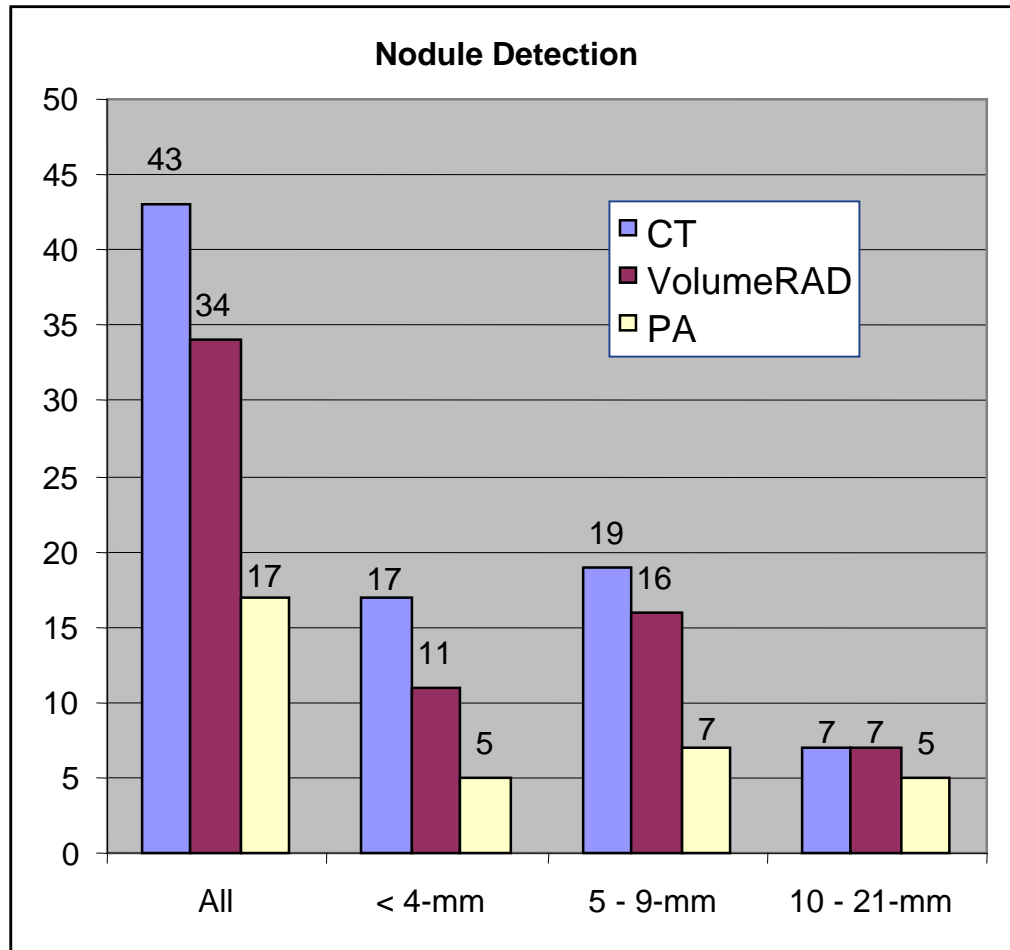


**Reconstructed slice**



Images courtesy of P.McAdams,D. Godfrey, J. Dobbins, Duke University

# VolumeRAD, 3-D RAD Imaging



- 19 patients
- With VolumeRAD  
34 of 43 (79%) nodules were detected
- With VolumeRAD 100% more nodules were detected than standard PA
- Of the nodules  $\leq 10$  mm with VolumeRAD 65% were detected vs. 29% by standard PA

P. McAdams, D. Godfrey, J. Dobbins, Duke University, Durham, USA

Digital VolumeRAD for Improved Lung Nodule Detection: Initial Clinical Experience;  
RSNA 2003



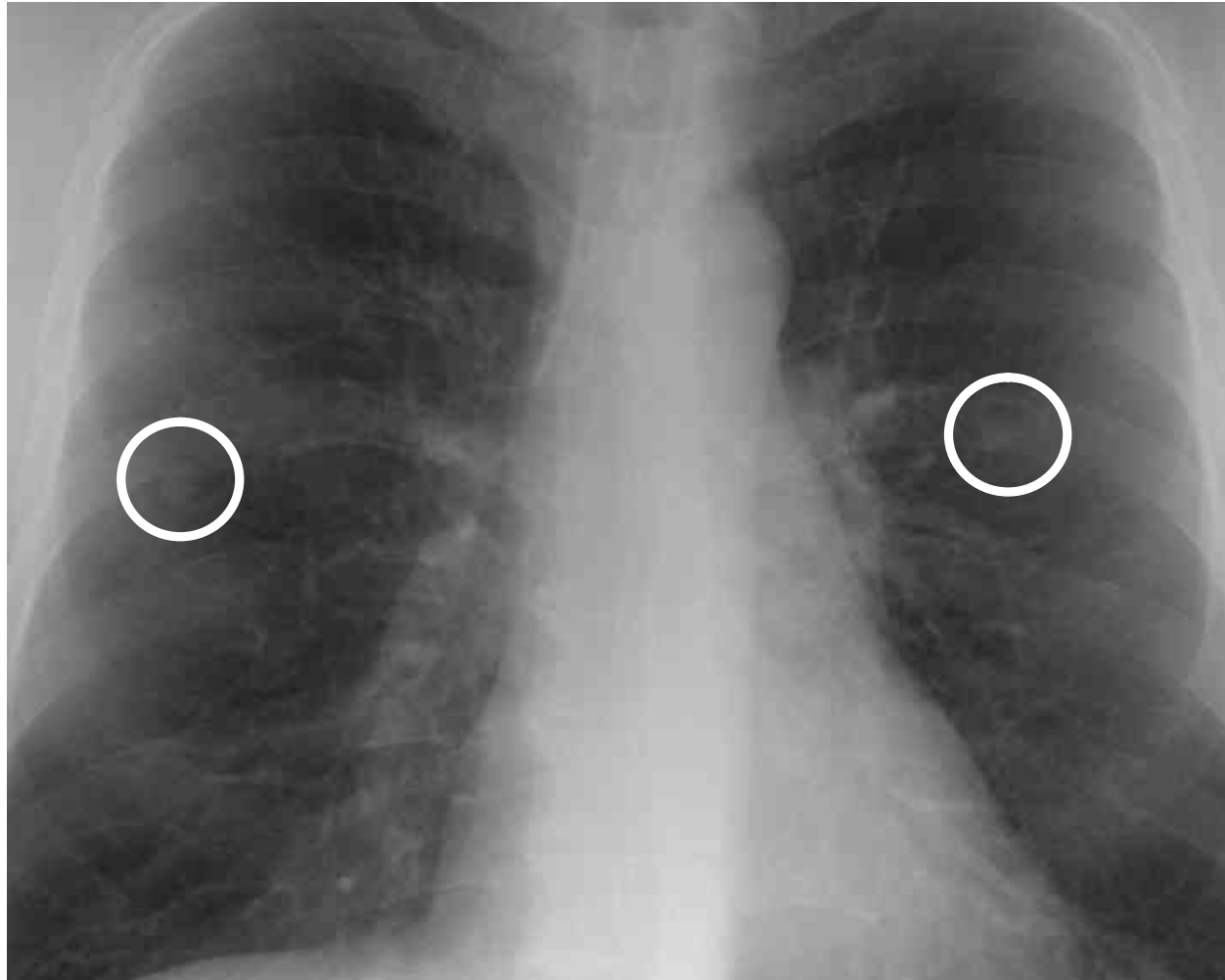
VolumeRAD provides  
**improved detection and improved confidence**  
compared to PA chest radiography

# *Results - Other*

---

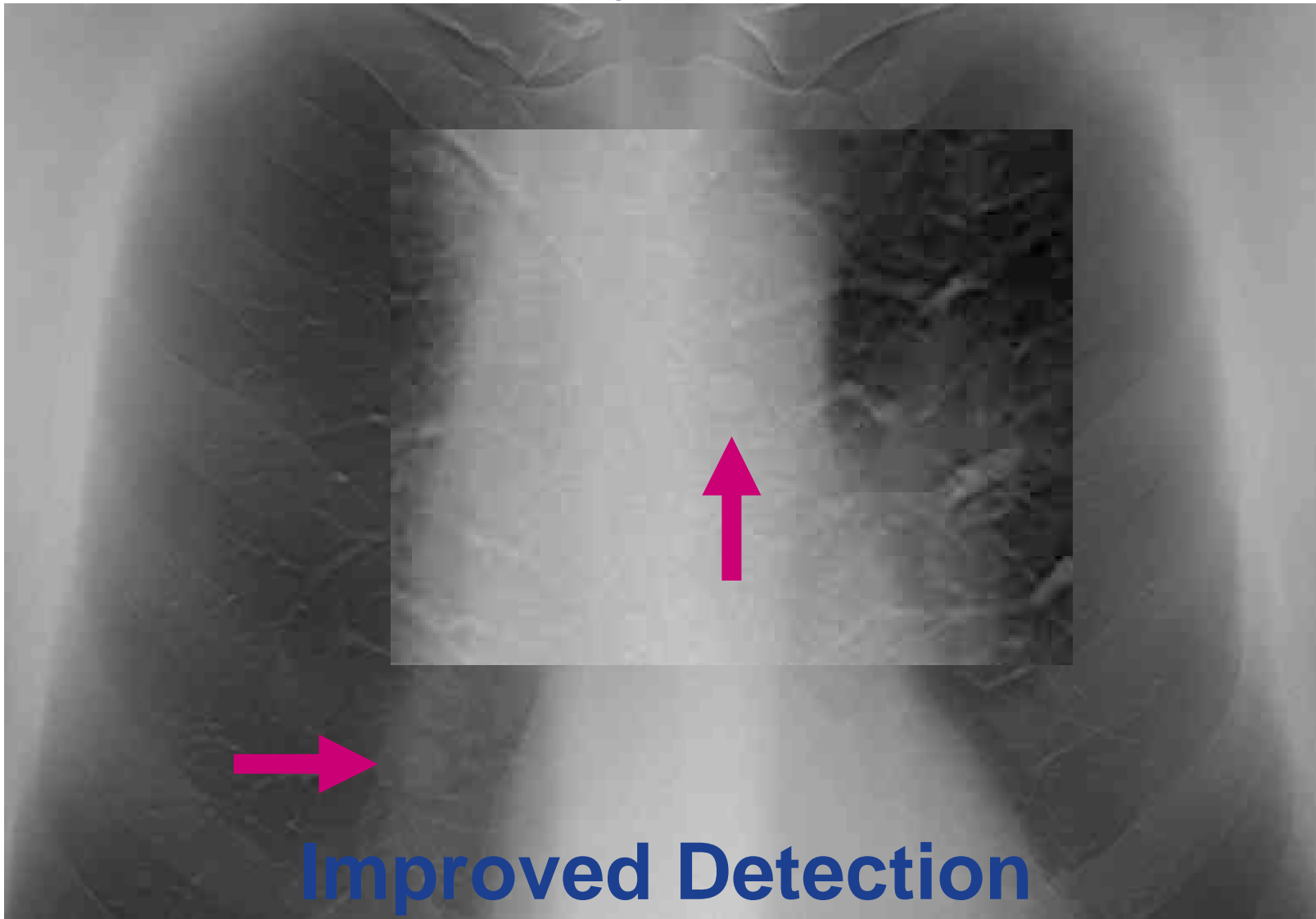
- Tomo improved confidence
  - 3 nodules (6-mm to 8-mm)
- Tomo excluded nodules
  - 2 first rib osteophytes
  - 1 vascular crossing

# Subject 14





# Subject 14



# Subject 14



## Multiple Lung Nodules

# Conclusions

---

- **Chest Tomosynthesis**
  - promising technique
  - improved nodule detection  
c/w PA chest radiography

# *Conclusions*

---

- **Chest Tomosynthesis**
  - must be confirmed
  - 200 subject trial (on-going)

# Conclusions

---

- **Advantages c/w CT**
  - high resolution
  - direct coronal slice imaging
  - high volume setting
  - low cost, low radiation dose

# Conclusions

---

- **Radiation dose**
  - **dose  $\approx$  screen-film lateral radiograph**
  - **dose  $\lll$  CT**