

Beth Schueler, Ph.D.  
Mayo Clinic Rochester

IDENTIFYING IMAGE  
ARTIFACTS, THEIR CAUSES,  
AND HOW TO FIX THEM:  
DIGITAL RADIOGRAPHY

AAPM Annual  
Meeting 2016

# What will be covered:

- Flat panel detectors used for projection radiography
  - Cassette and fixed panel detectors
  - Examples from multiple manufacturers and models





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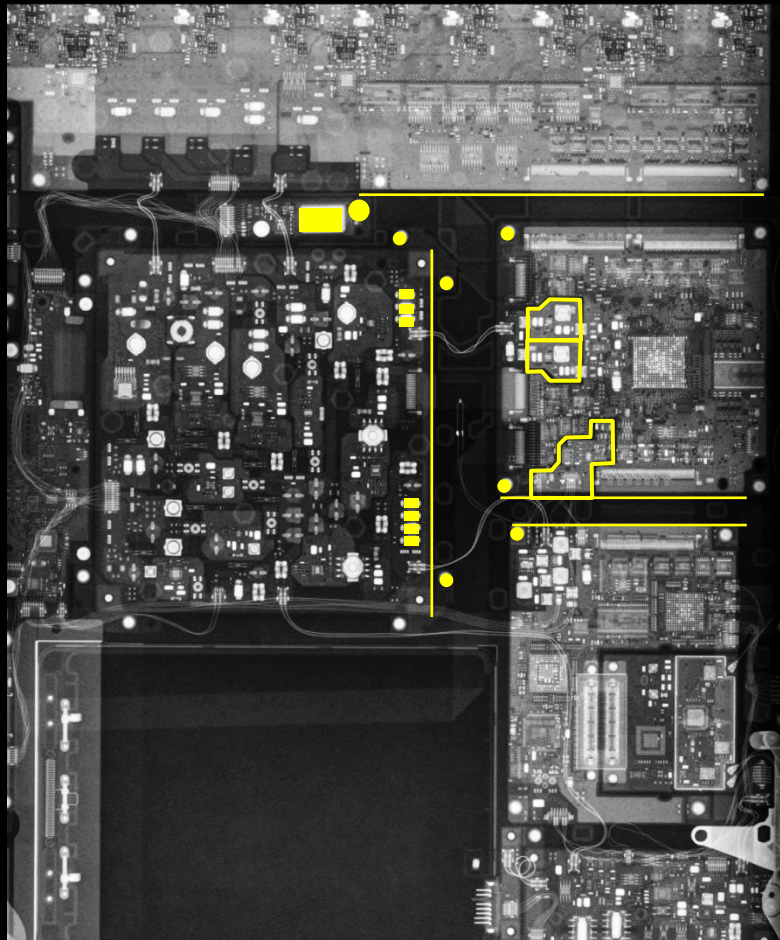
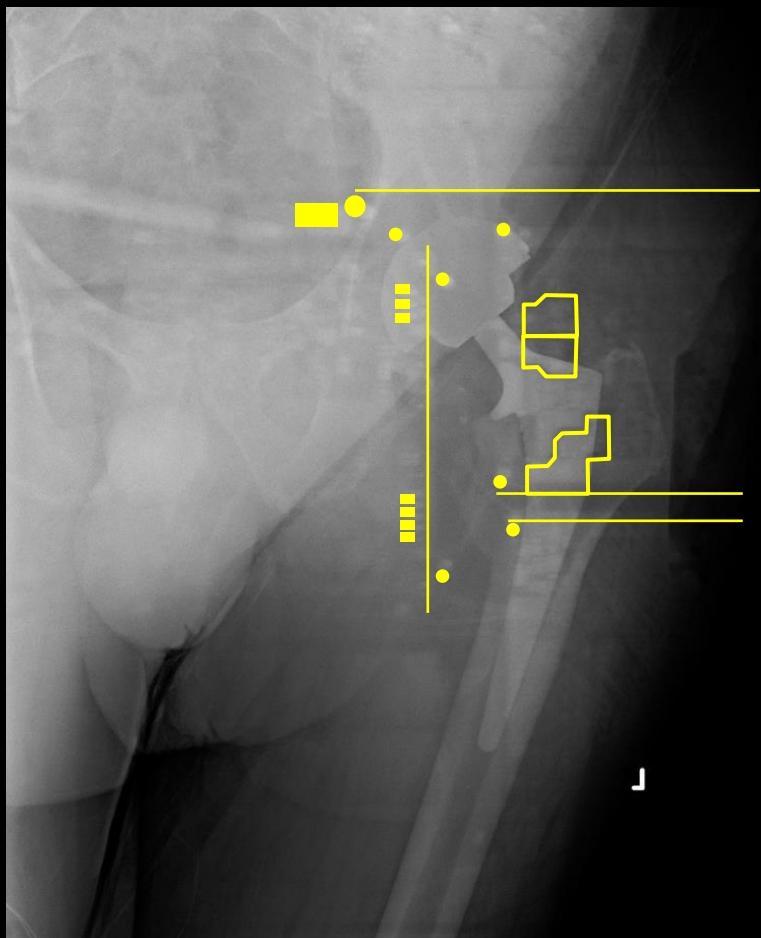
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(R)

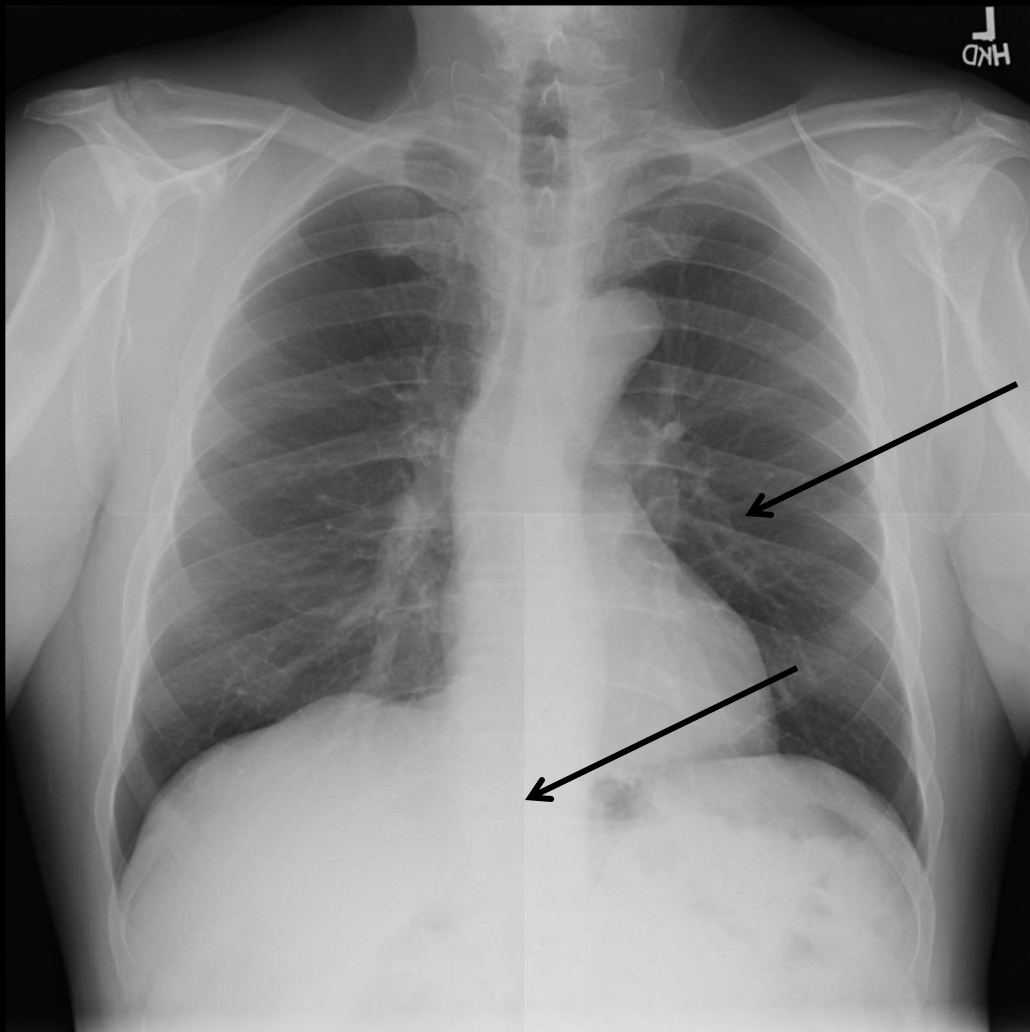
## ⦿ Cause:

- Detector support electronics are visible due to excessive backscatter

## ⦿ Resolution:

- Reduce backscattered radiation by
  - Collimating to no more than the detector edges
  - Avoiding overexposure
  - Placing lead behind the detector





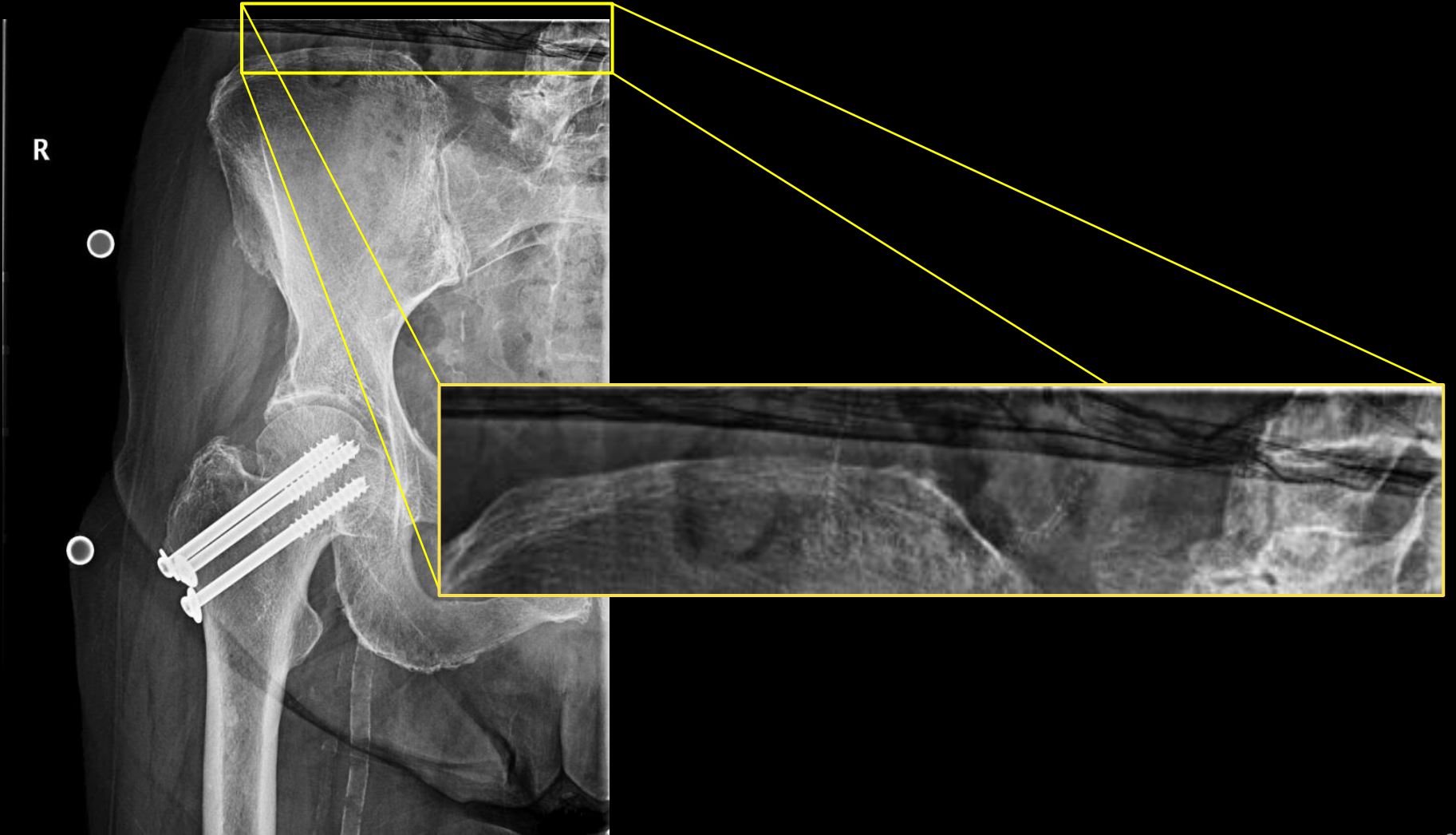
## ◎ Cause:

- Detector is constructed of 4 butted sections. Interface between sections is visible due to variation in acquisition signal as compared to gain calibration.
- Signal variation may be caused by temperature fluctuations

## ◎ Resolution:

- Repeat gain calibration
- Stabilize exam room and detector temperature
- Use detectors produced from monolithic panels







## ⦿ Cause:

- Extra material (pillow edge) in exposure field during gain calibration

## ⦿ Resolution:

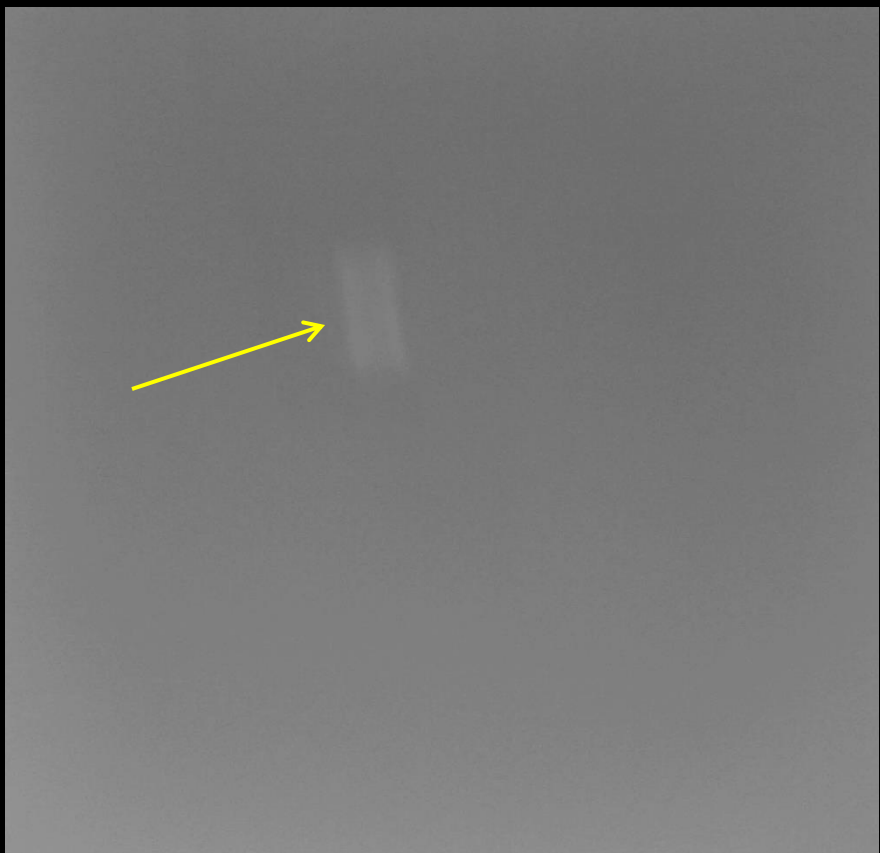
- Repeat gain calibration with a clear exposure field

# Clinical Image Artifacts

- ◎ Technologists should be trained how to:
  - Recognize common artifacts
  - Resolve the problem themselves when possible or
  - When to contact a physicist or service engineer for assistance

# Flat Field Artifact Check

- ④ A flat field image should be acquired
  - After gain calibration to detect calibration errors
  - After a wireless detector drop to look for damage
  - As part of routine QC
- ④ Acquire image of full detector using gain calibration technique and a uniform phantom
  - Apply minimal image processing
  - Use level = mean pixel value, width = 10% of the level
    - Reference: AAPM Report No. 151 (2015)



## ⦿ Cause:

- Fine metal flecks near tube port
- Artifact is an image of the focal spot – fleck acts as a reverse pinhole camera
- Shift in fleck position between gain calibration and image can cause a dark-light artifact

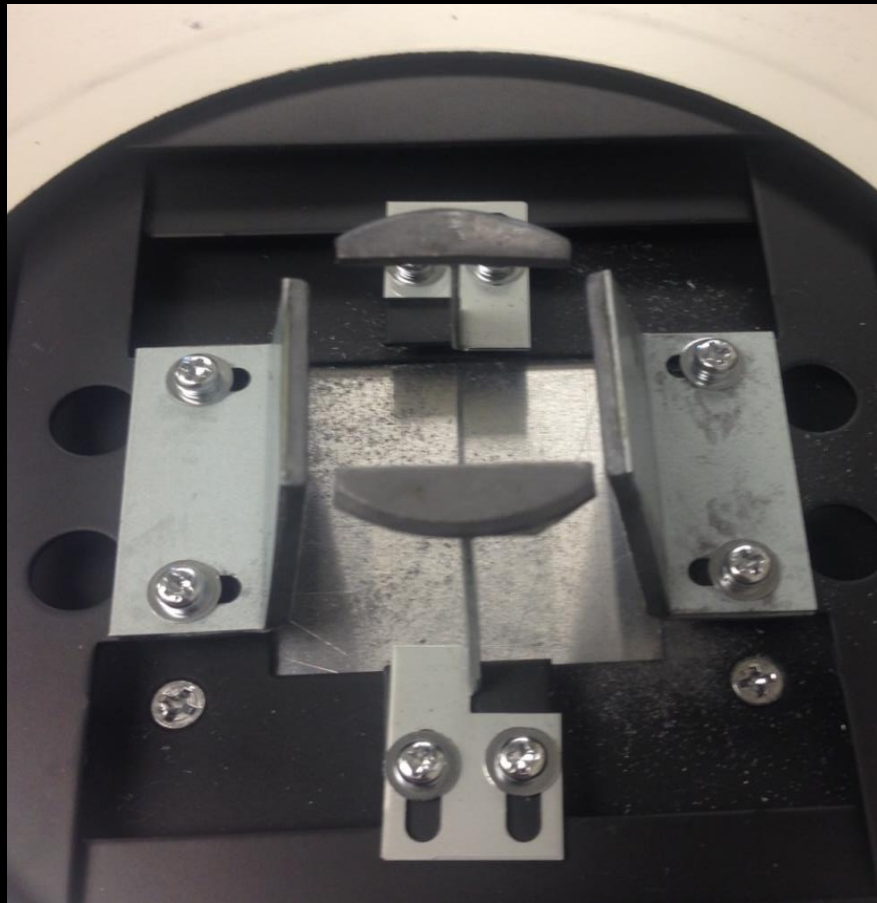


## ⦿ Resolution:

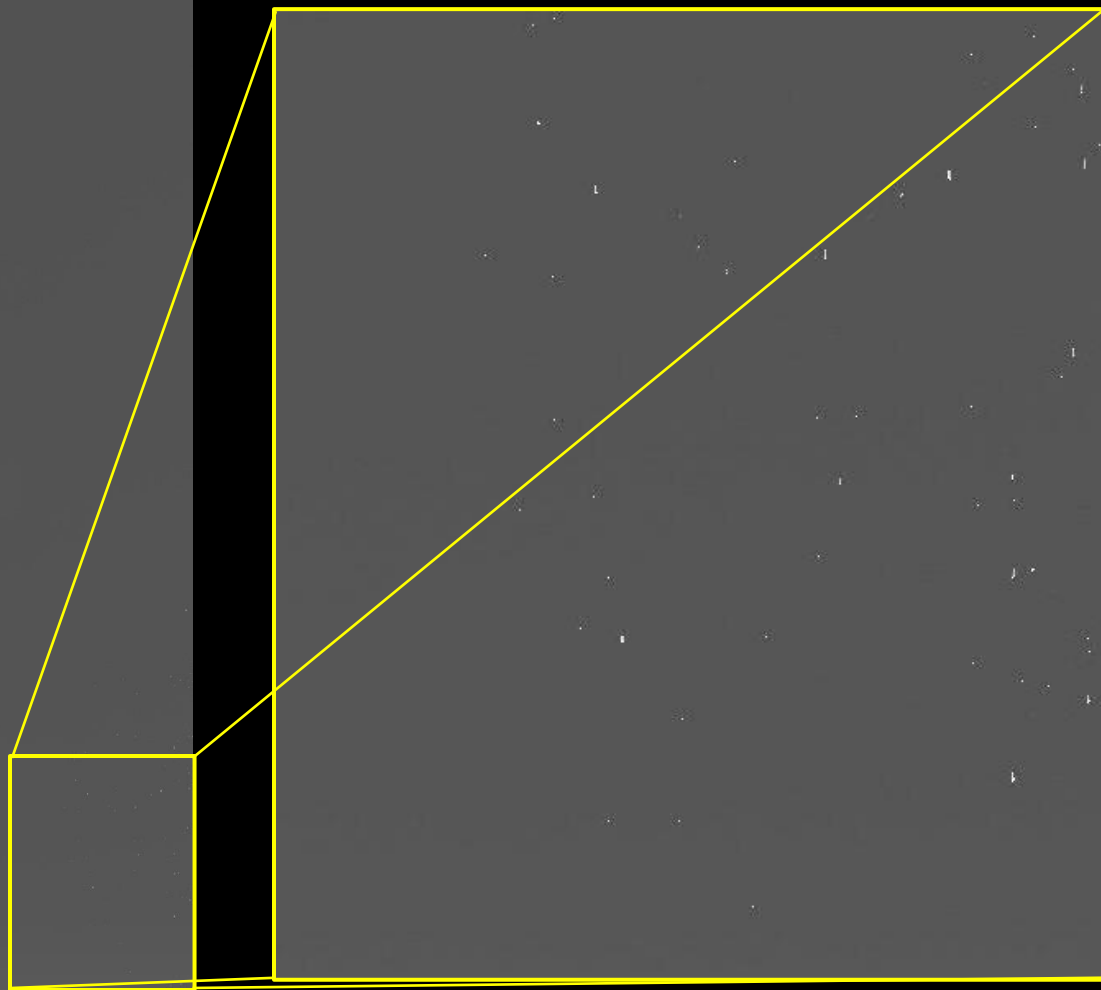
- Remove debris and repeat gain calibration











## ⦿ Cause:

- Detector was dropped
- Shift in layers in the GOS detector construction causing misregistration due to impact

## ⦿ Resolution:

- Repeat gain calibration
- Replace GOS with CsI detector



# Flat Field Artifact Check

- ◎ To determine location of artifact cause within the imaging chain, repeat exposure with
  - Detector rotated or shifted (wireless detector)
  - Collimator rotated
  - Different filter
  - Different SID
  - Detector outside of bucky or table (evaluates grid)

## ◎ Cause:

- Detector rotated and artifact remained unchanged  
– localizes artifact to the detector itself
- Detector delamination – bubbles between TFT and phosphor

## ◎ Resolution:

- Repeat gain calibration

# Clinical Evaluation of Artifacts

- ◎ Some artifacts visible in a flat field image are not visible in clinical images
  - Eliminate the artifacts that can practically be removed
  - Review clinical or anthropomorphic phantom images to determine if artifact is visible and clinically important

# References:

- TG151 Ongoing Quality Control in Digital Radiography, 2015
  - Includes large library of artifact examples
- Honey, MacKenzie. “Artifacts found during quality assurance testing of computed radiography and digital radiography detectors.” J Digit Imaging 2009; 22:383–392.
- Marshall et al. “Quality control measurements for digital x-ray detectors.” Phys Med Biol 2011; 56:979–999.
- Walz-Flannigan et al. “Artifacts in Digital Radiography.” AJR 198:156–161, 2012.
- Willis et al. “Artifacts and Misadventures in Digital Radiography.” Appl. Radiol. 33:11–20, 2004.