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

> AAPM Annual Meeting 2017

TU-B-201-1 Artifacts: DR

What will be covered:

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



 Detector support electronics are visible due to excessive backscatter

Resolution:

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









- 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



- 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

- 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
- 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)





- 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





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- Detector was dropped
- Shift in layers in the GOS detector construction causing misregistration due to impact
- Resolution:
 - Repeat gain calibration
 - Replace GOS with Csl detector



- Detector rotated and artifact remained unchanged – localizes artifact to the detector itself
- Detector delamination bubbles between TFT and phosphor
- Resolution:
 - Repeat gain calibration

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)

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:

- AAPM Report No. 151 Ongoing Quality Control in DR, 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.