



P R E S E N T E D   A T

# RSNA<sup>®</sup> 2010

PERSONALIZED MEDICINE:  
In Pursuit of Excellence


The Metal Deletion Technique (MDT), a new method for  
reducing metal streak artifacts in CT scans

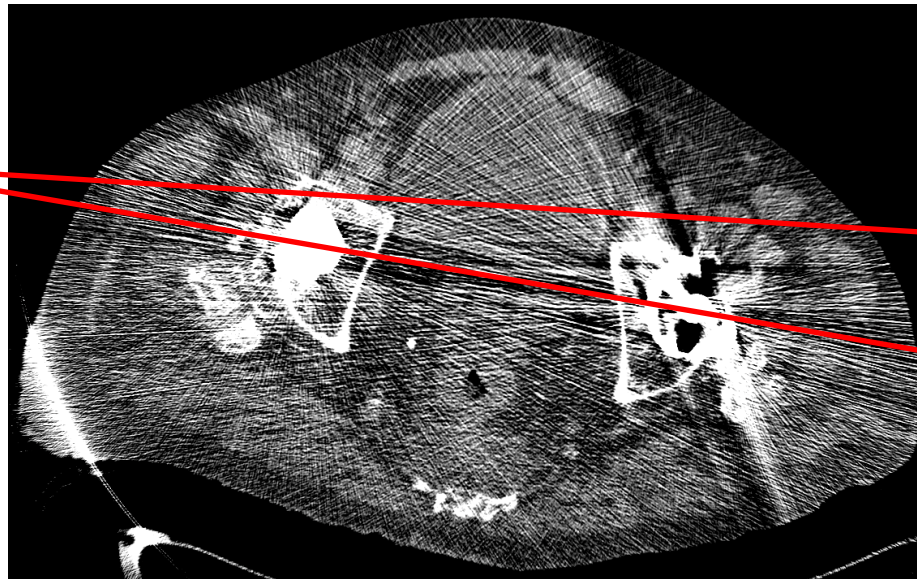
*F. Edward Boas and Dominik Fleischmann, Stanford Hospital*

# CT metal artifacts



# CT metal artifacts

  
**X-ray source**



**Low error**

**High error, due to:**

- Poisson noise
- Beam hardening
- Scatter
- Motion

# Metal Deletion Technique (MDT)

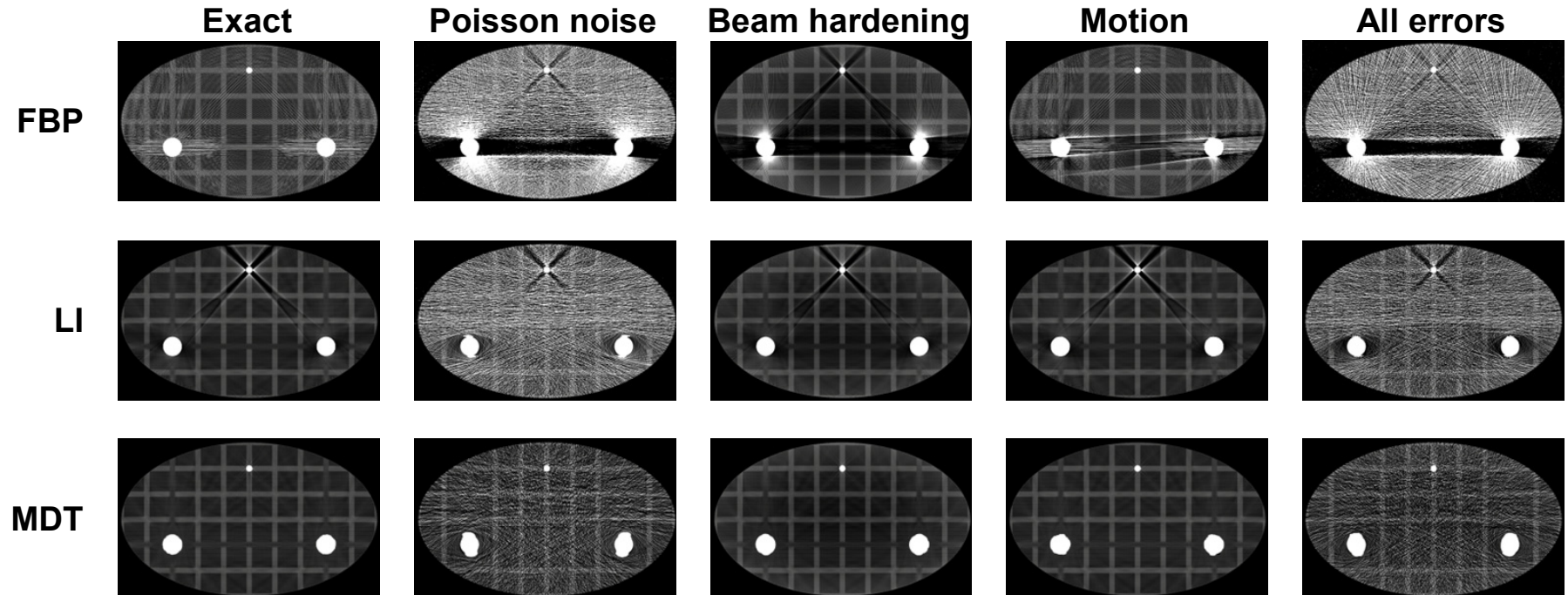
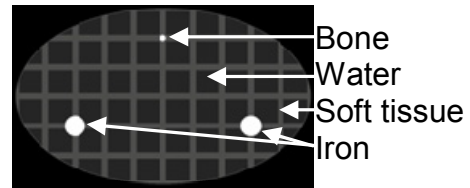
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Use forward projection to replace detector measurements that involve metal.

# Simulated scans

Simulated scans of a phantom:



# Coils: FBP





# Coils: LI

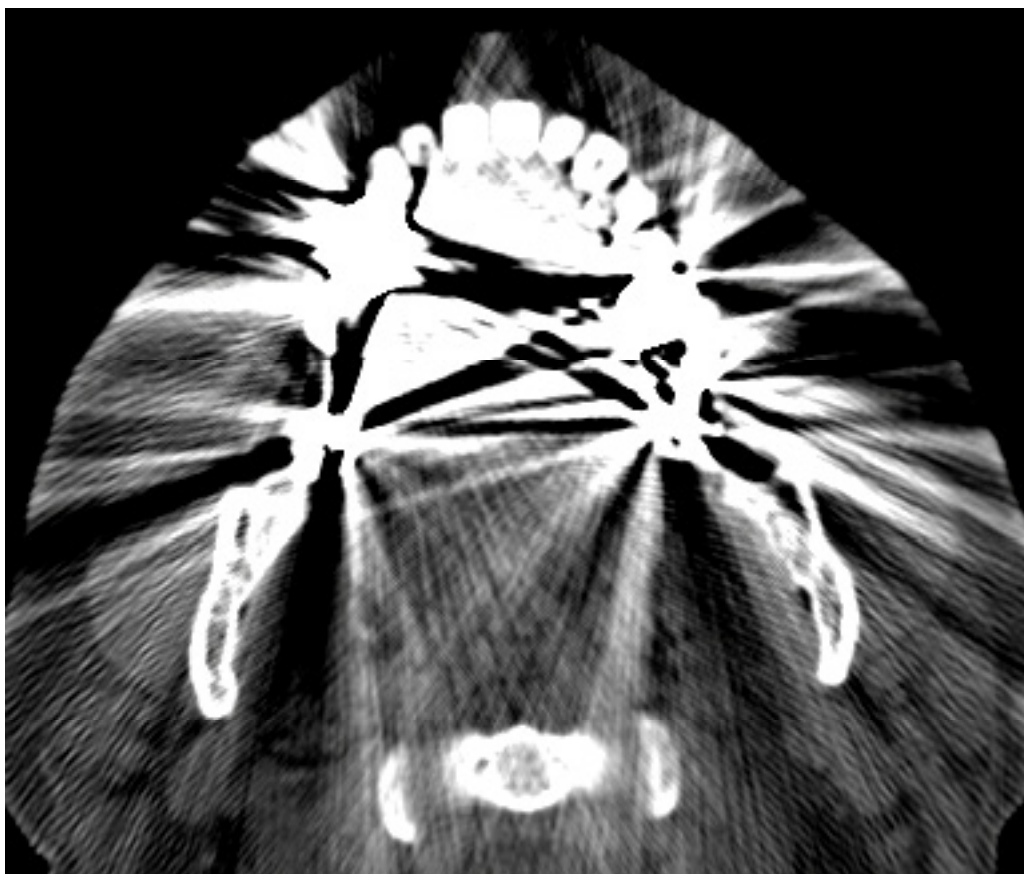


# Coils: MDT

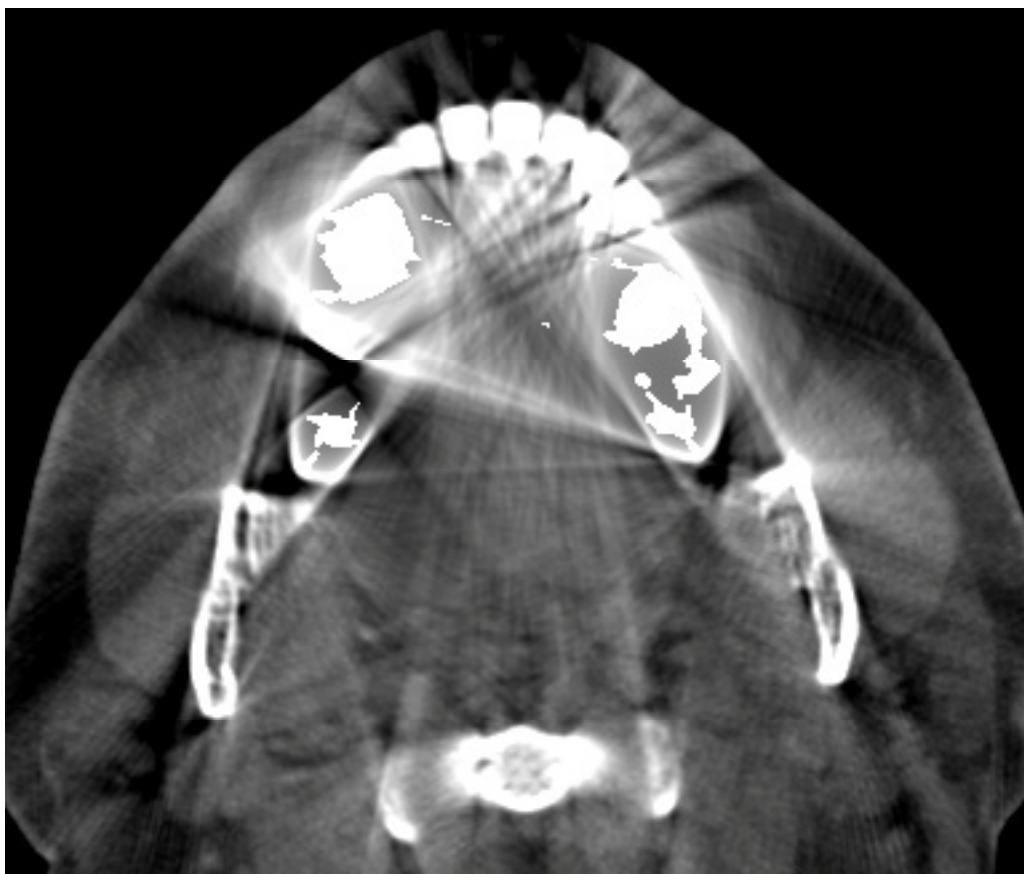




# Dental fillings: FBP



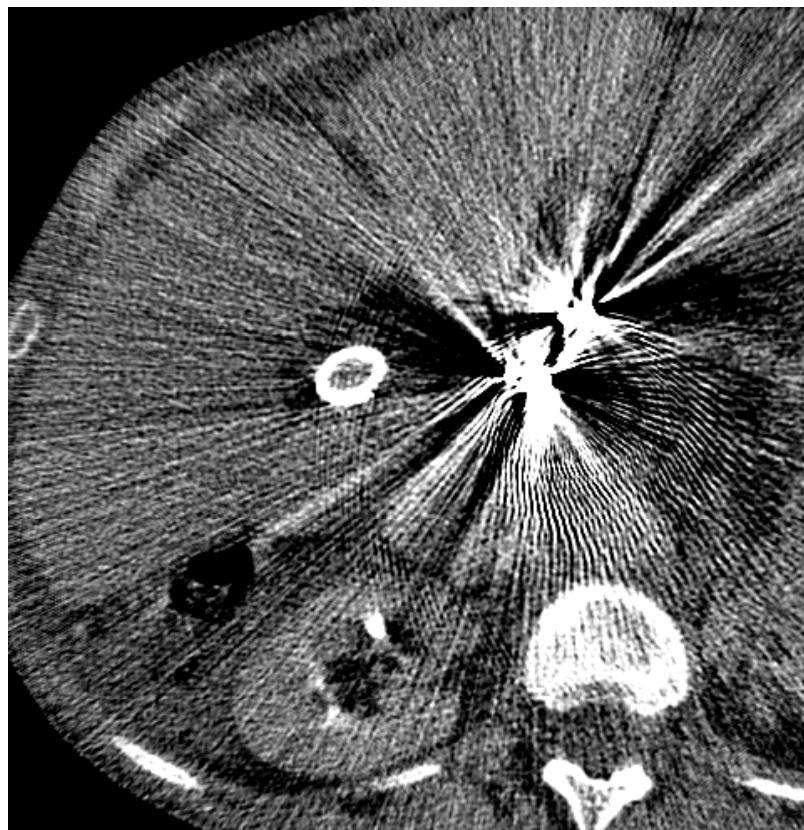
# Dental fillings: LI



# Dental fillings: MDT



# Coils: FBP



# Coils: LI





# Coils: MDT





# Cholecystectomy clips: FBP



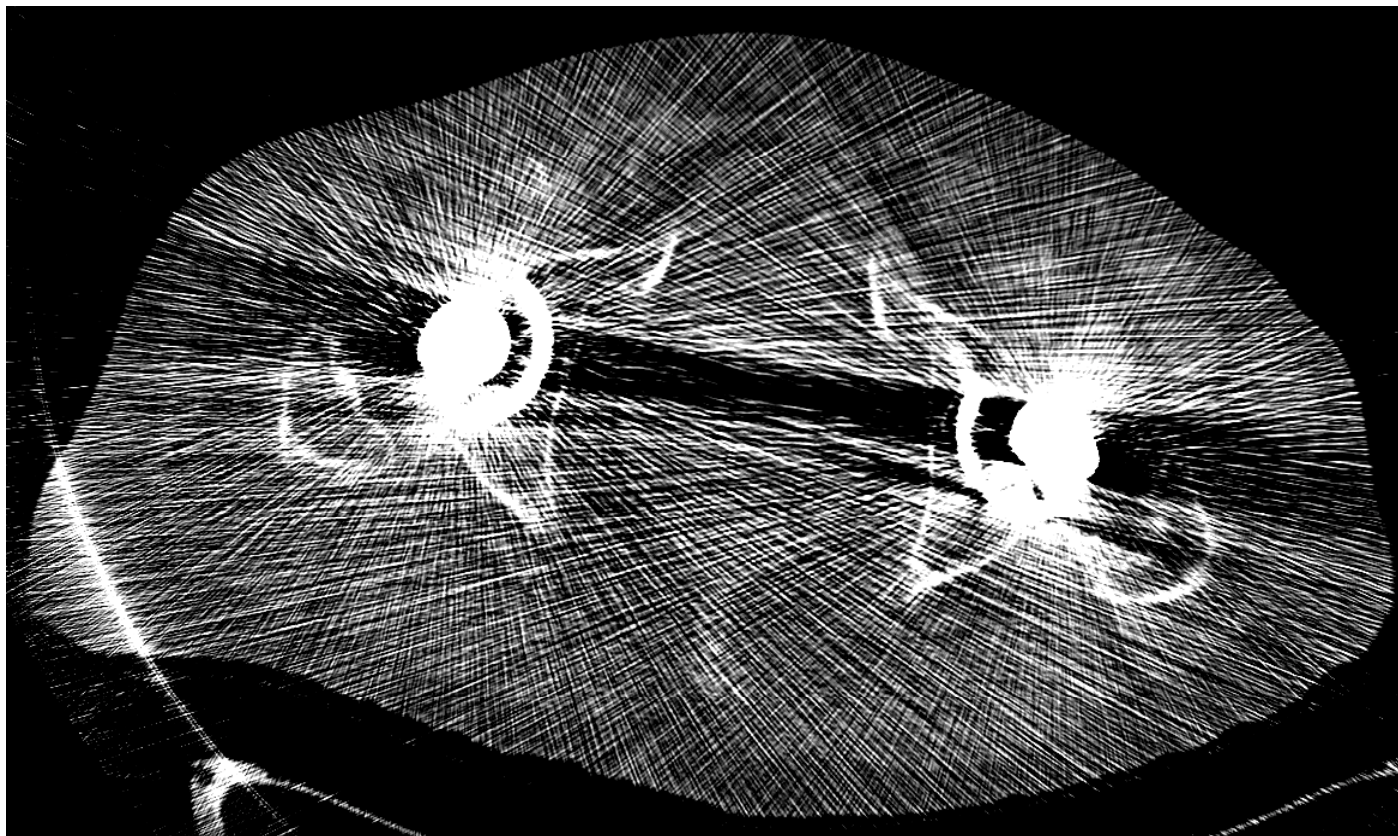
# Cholecystectomy clips: LI



# Cholecystectomy clips: MDT

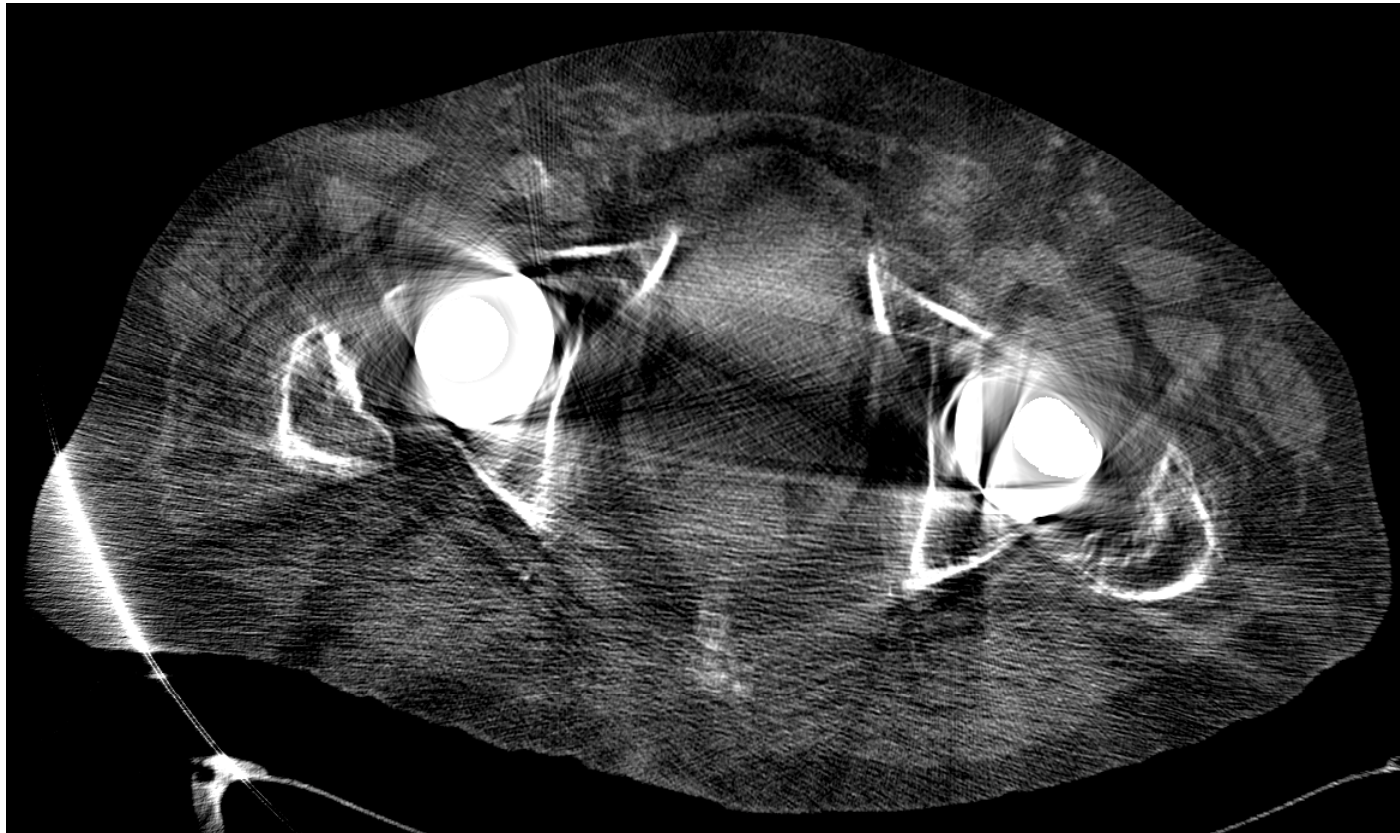


# Hip replacements: FBP

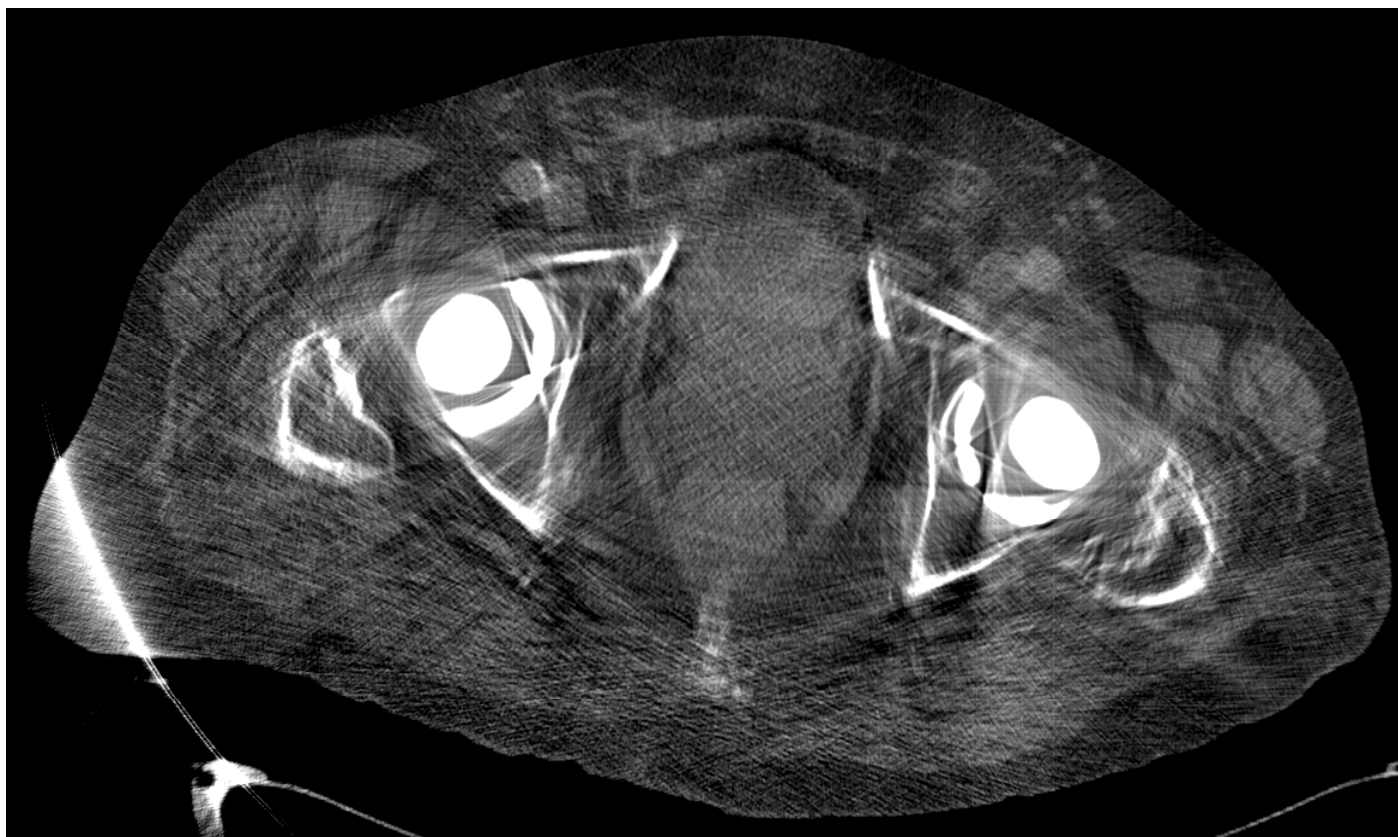




# Hip replacements: LI



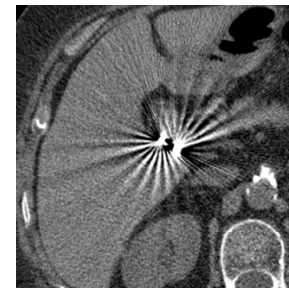
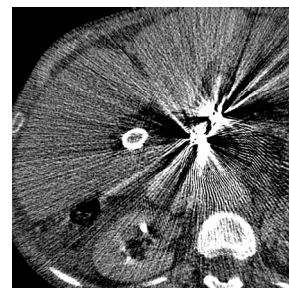
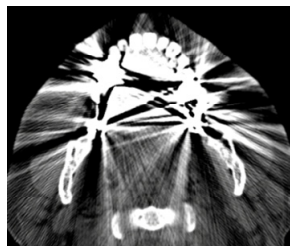
# Hip replacements: MDT



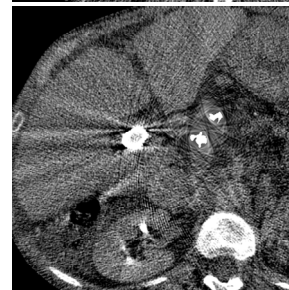


# Clinical scans

**FBP**



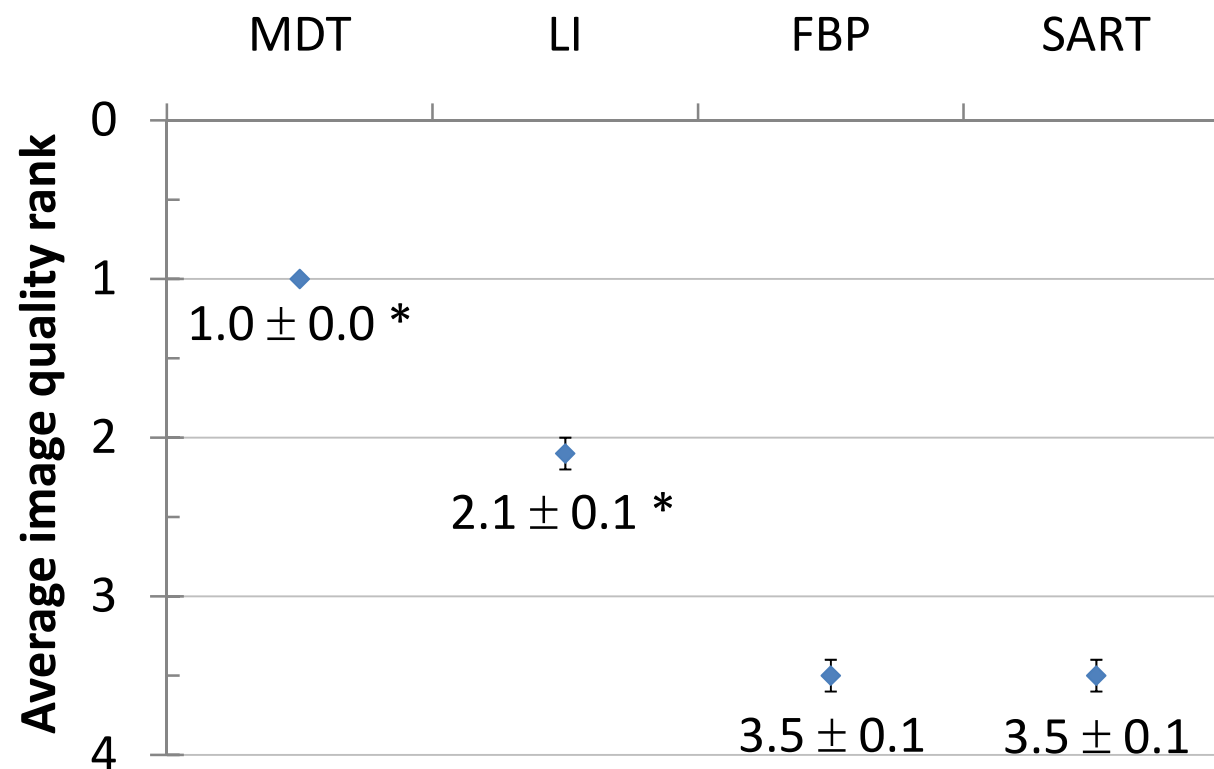
**LI**



**MDT**



# Image quality rank



11 scans  
178 slices

Average ± S.E.M.

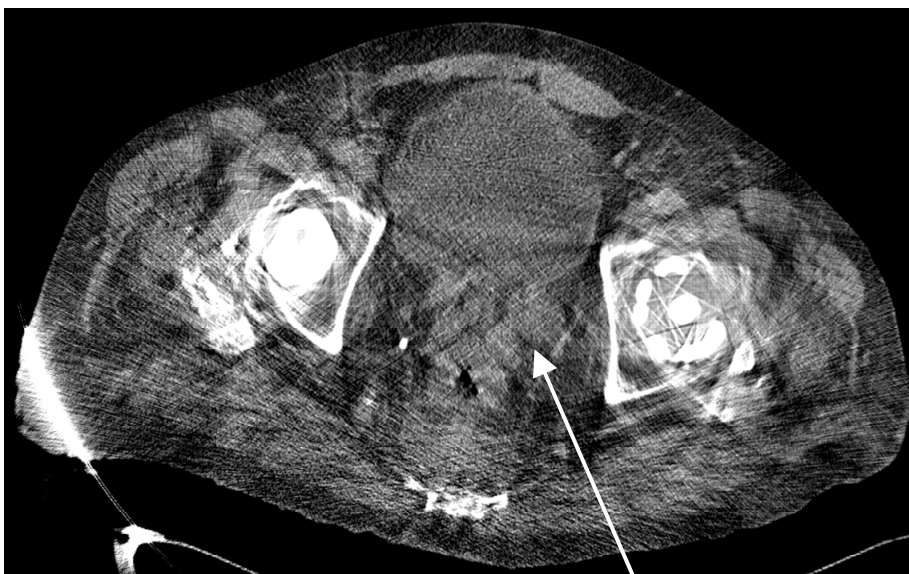
\* statistically significant  
difference

# Improved diagnosis

**FBP**



**MDT**

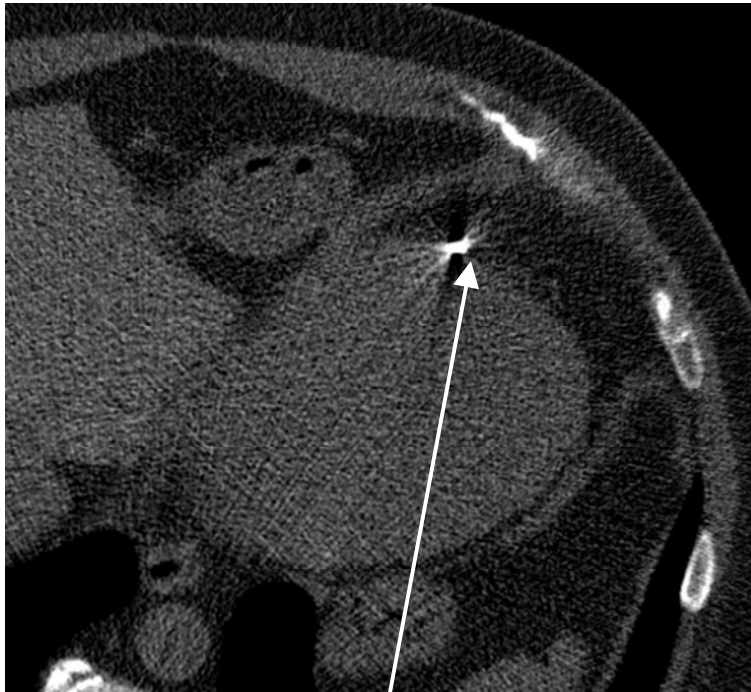


Peri-rectal nodes



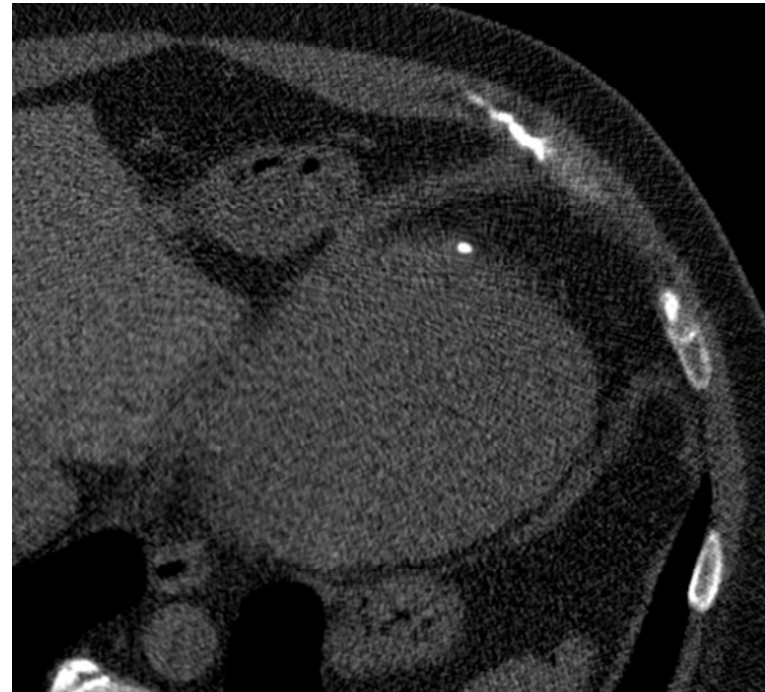
# Improved diagnosis

**FBP**

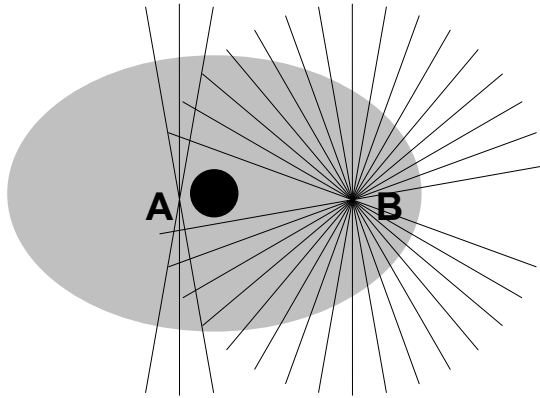


Apparent tip of the pacer wire

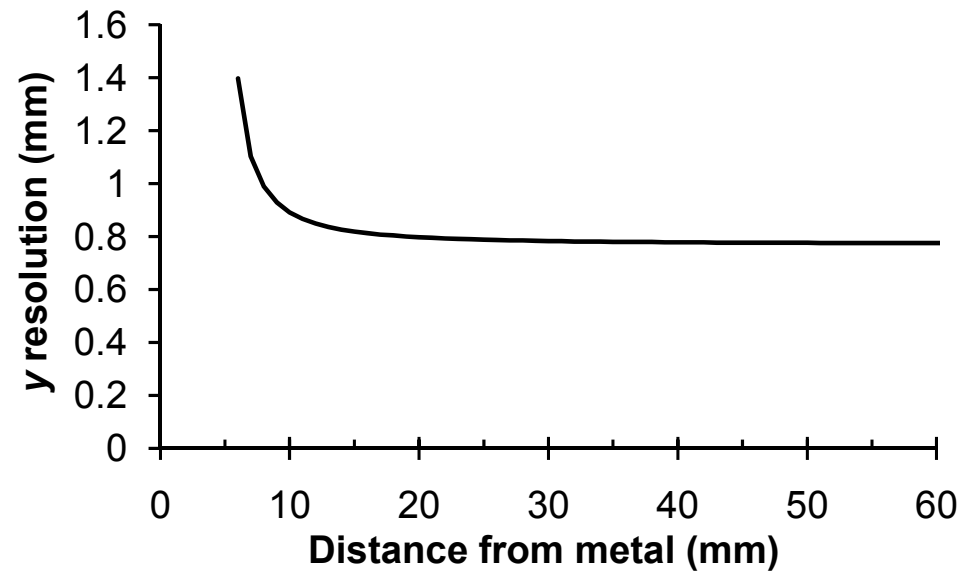
**MDT**



# Decreased resolution near metal



Resolution near a 10 mm metal implant



# Conclusions

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1. MDT reduces metal artifacts due to Poisson noise, beam hardening, and motion.
2. MDT has better image quality than other techniques ( $p=0.0005$ ), and may change the diagnosis.
3. MDT works on a variety of scans, from hip replacements to moving pacer wires.



# Acknowledgements

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# Thank you!

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[www.revisionrads.com](http://www.revisionrads.com)

Login: rsna2010

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Ed Boas (ed.boas@gmail.com)

# End



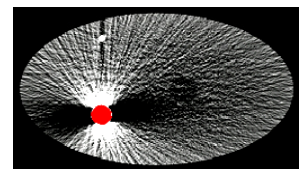
# Metal Deletion Technique (MDT)

- ❶ Original projection data from the scanner.

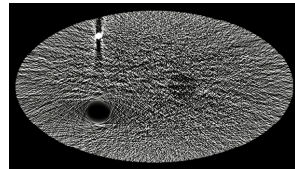
Corrupted metal data causes streaks

- ❺ Forward project ❷

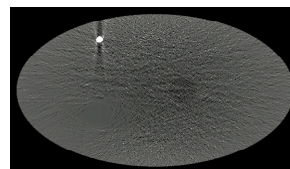
- ❻ Replace metal data from ❶ with values from ❺.



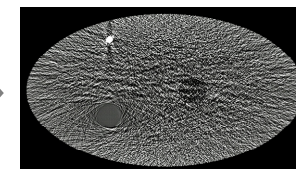
❷ Filtered backprojection



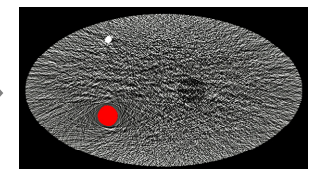
❸ Linear interpolation



❹ Edge-preserving blur filter

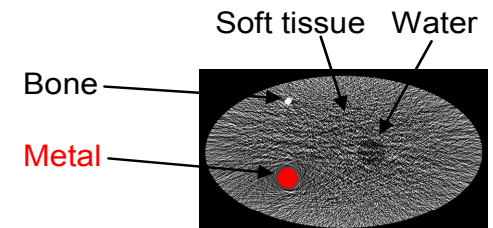


❺ Filtered backprojection



Add back metal pixels from ❷

Iterate 4 times



# Adaptive detector element size

