Getting the most of your 3DRA system:

My perspective on Toshiba's capabilities and limitations

The Heart Center

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3D IMAGING I3

3DRA with Toshiba Infinix-I biplane flat planel system

Objectives:

- Provide an overview of 3DRA acquisition
- Highlight features that simplify the process
- Current system limitations
- Future directions

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3DRA Acquisition: How It's Done

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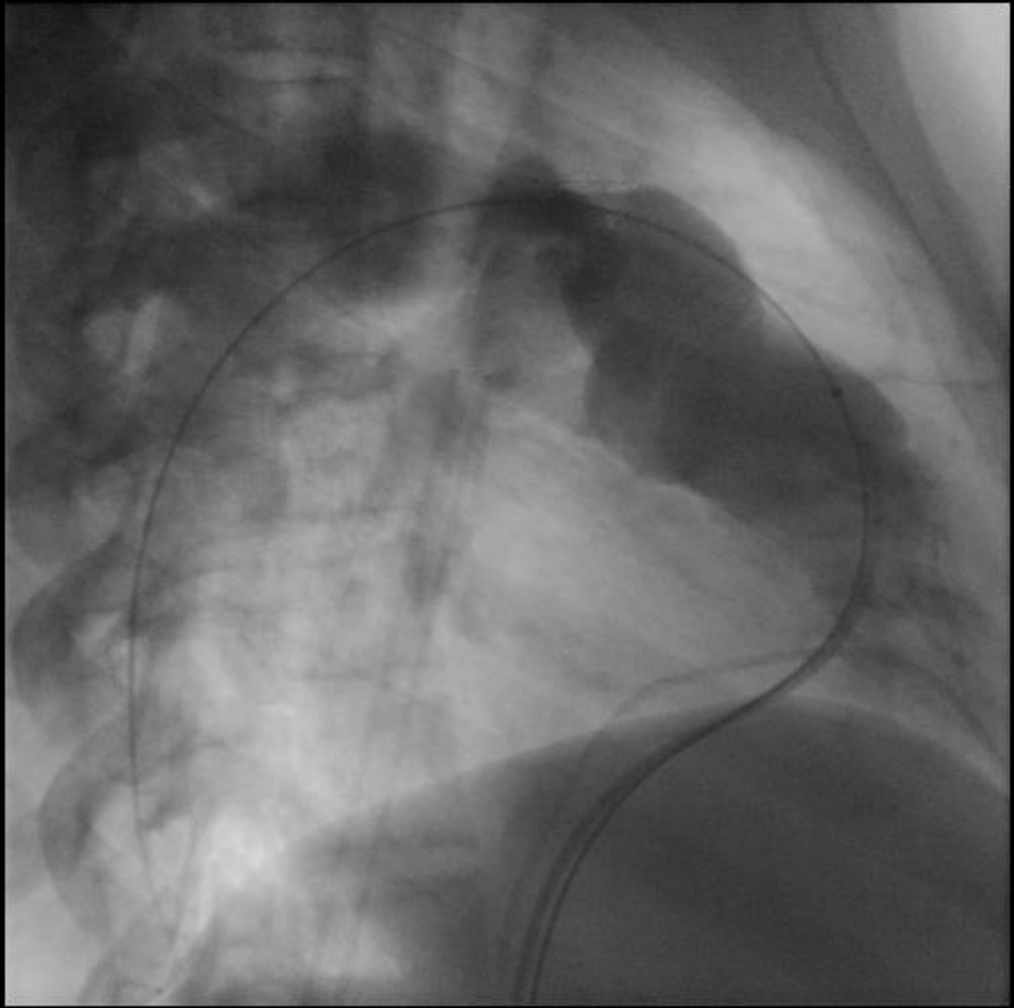


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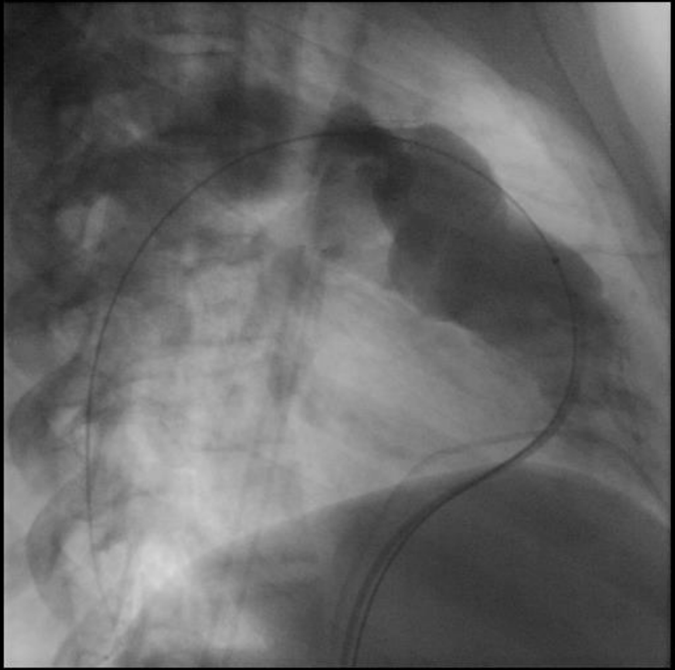

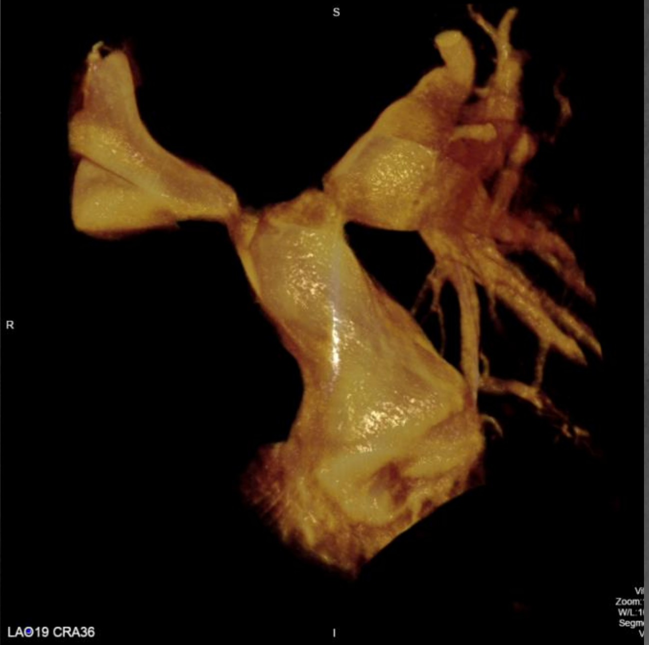
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Goal of any 3DRA

- Minimize rad dose while maximizing image quality
- Simplify the process
  - Image acquisition
  - Post-processing of the data set
- Easy and efficient access to:
  - 3D data set
  - CT data set
  - Fused 3D image overlay on live fluoroscopy (4D)

How does the Toshiba Infinix-i system help accomplish these goals?

Minimize Radiation Dose while preserving image quality

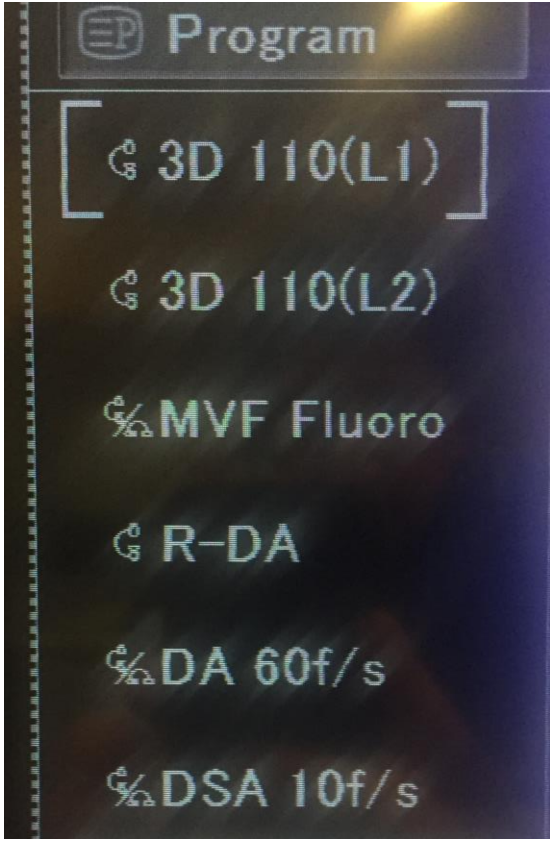
- In 2010
- New system from the factory
- 1 3DRA ≅ 1.5-2X the dose of an equivalent biplane DA at 15fps
- Great image quality
- Giving too much!

Early work on Dose Reduction

- Toshiba engineers visited Miami, FL (2010-2011)
  - Twice over ~9 month period
  - Dose reduction
  - Copper filters
  - 3 different "presets" based on patient weight

- One 3DRA ≅ Comparable biplane DA at 15fps

3DRA "presets"



- 3D 110 L2 < 10kg
- 3D 110 L1 10-30kg
  - pushing towards 40kg
- 3D 110 >30kg
  - ?>40kg

Radiation Protocol for Three-Dimensional Rotational Angiography to Limit Procedural Radiation Exposure in the Pediatric Cardiac Catheterization Lab

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Haddad L, Waller BR, Johnson J, Choudhri A, McGhee V, Zurakowski D, Kuhls-Gilcrist A, Sathanandam S. **Congenit Heart Dis**. 2016 Apr 14

Radiation Parameters	3DRA Group, Median (IQR), $n = 100$	2DDA Group, Median (IQR), $n = 100$	P Value
Duration of single 3DRA/2DDA (seconds)	4.1	4.9 (3.8-6.2)	.12
DAP for a single 3DRA/2DDA (cGy/cm^2)	278 (107–595)	241 (124–760)	.14
Indexed DAP for a single 3DRA/2DDA (cGy/cm^2/m^2)	237 (147–428)	218 (130–732)	.42
Effective dose by Monte-Carlo simulation (mSv)	1.8 (1.2–2.8)	1.67 (1.08–3.7)	.22
Total procedural DAP (cGy/cm^2)	3605 (1679–18 033)	3544 (1186–10 761)	.45
Total procedural indexed DAP (cGy/cm^2/m^2)	3348 (1885–9383)	3176 (1537–7778)	.48
Total procedural Air Kerma (mGy)	250 (146–816)	265 (121–531)	.21
Total procedural indexed Air Kerma (mGy/m^2)	244 (170–578)	249 (174–500)	.79

- **3DRA radiation dose is equivalent to a biplane DA at 15fps**
- **Total procedural rad dose does not appear be greater when utilizing 3DRA**

Simplify the Process:
Image Acquisition

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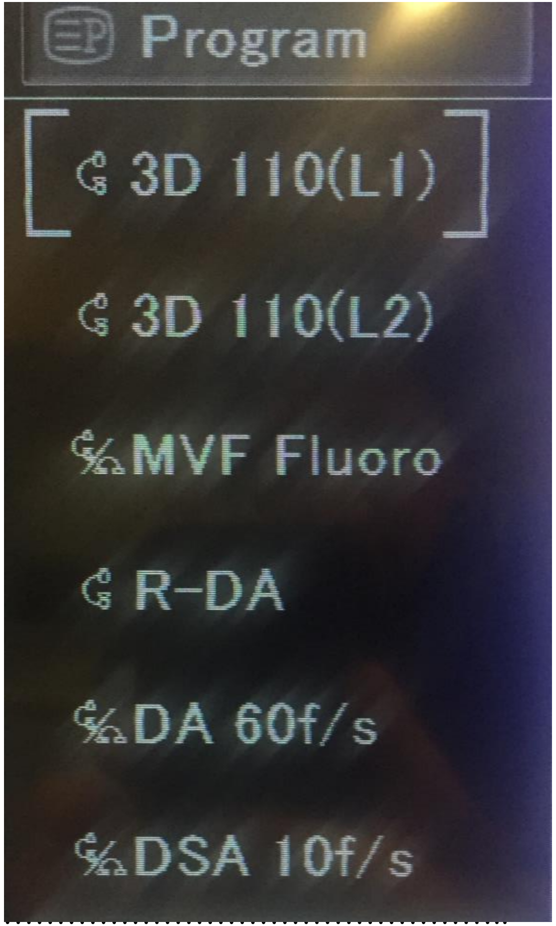
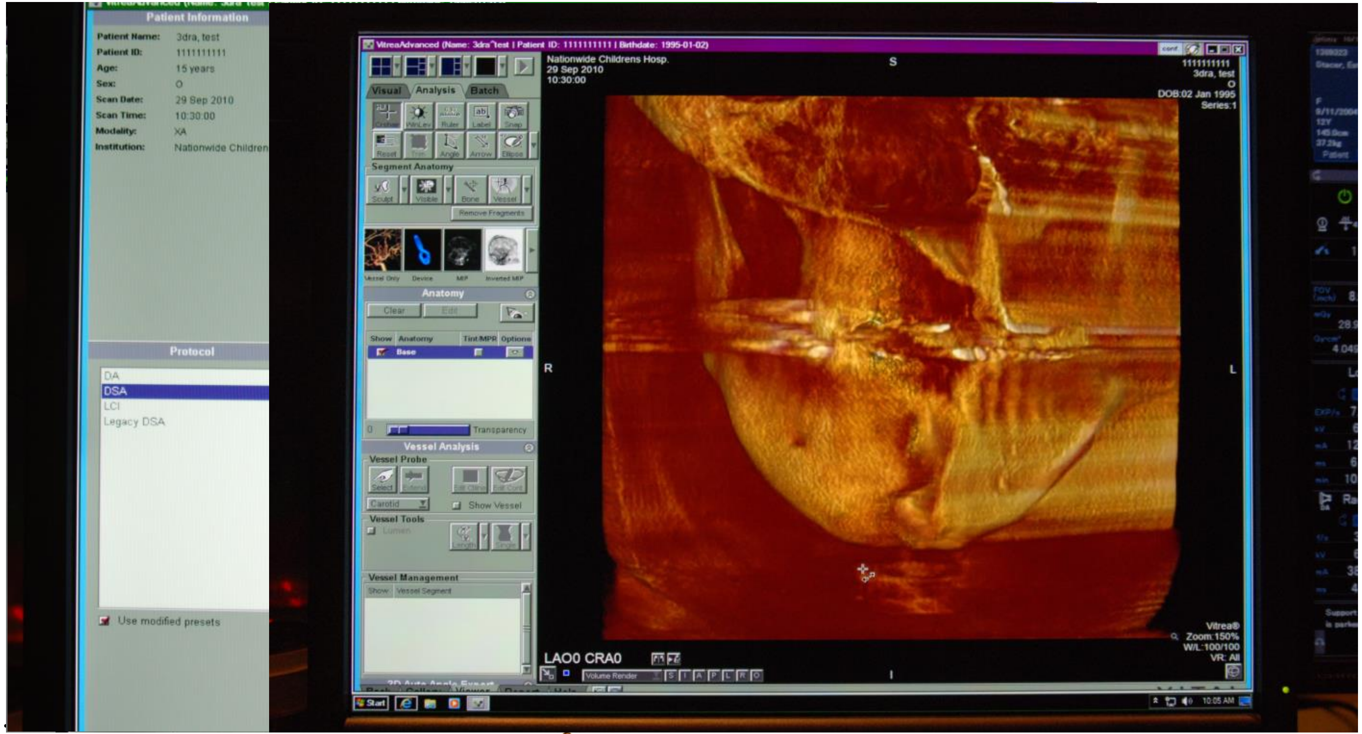
Choose 3DRA setting from drop down



Series of buttons

Simple post-processing of the 3D image



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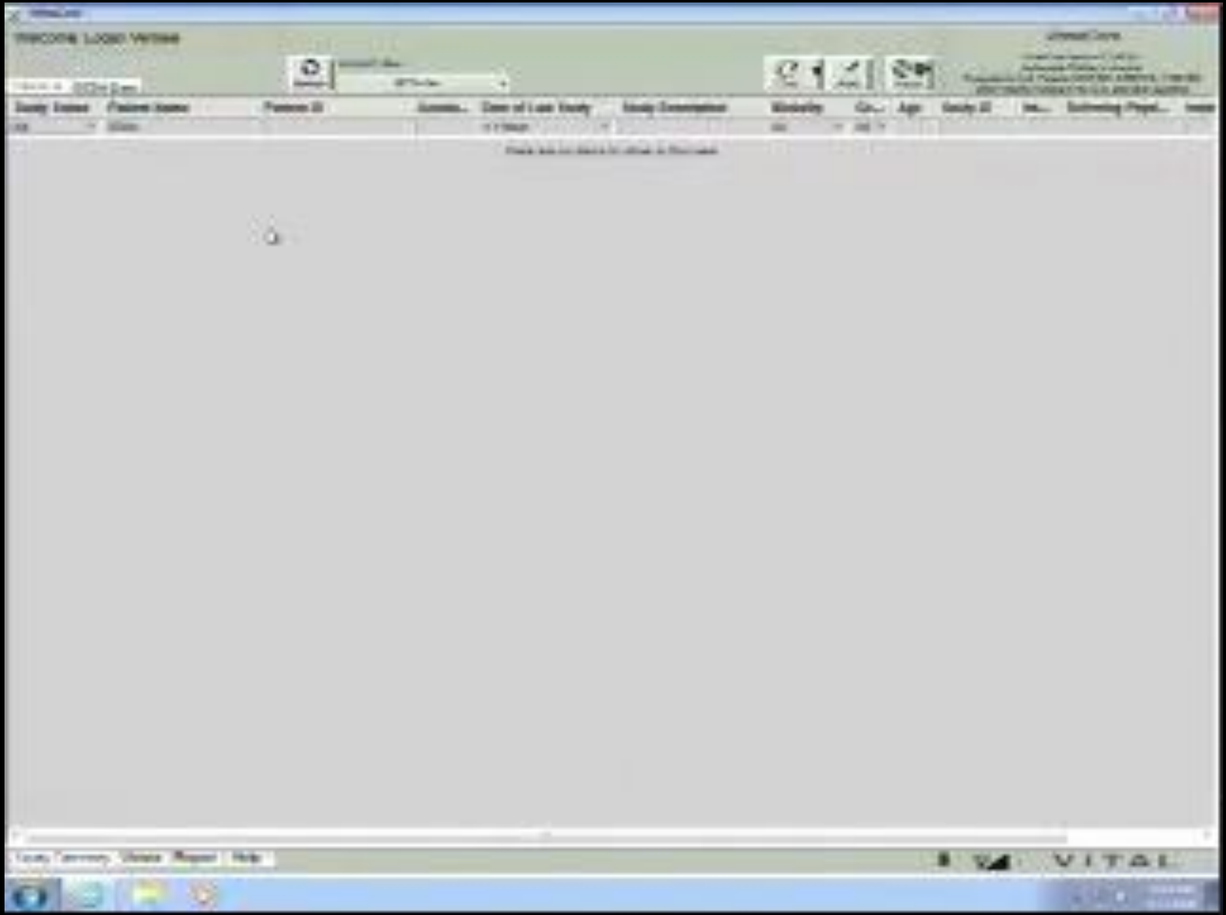

Goal of any 3DRA

- Minimize rad dose while maximizing image quality
- Simplify the process
  - Image acquisition
  - Real time post-processing of 3D image
- Easy and efficient access to
  - 3D data set
  - CT data set
  - Fused 3D image overlay on live fluoroscopy (4D)

4D Fusion Overlay:

Angio Work Station → AWS

- Has always been part of the Toshiba system
- Recently moved to the forefront
- Additional "AP" image with multimodality fusion
  - CT
  - MRI
  - 3DRA

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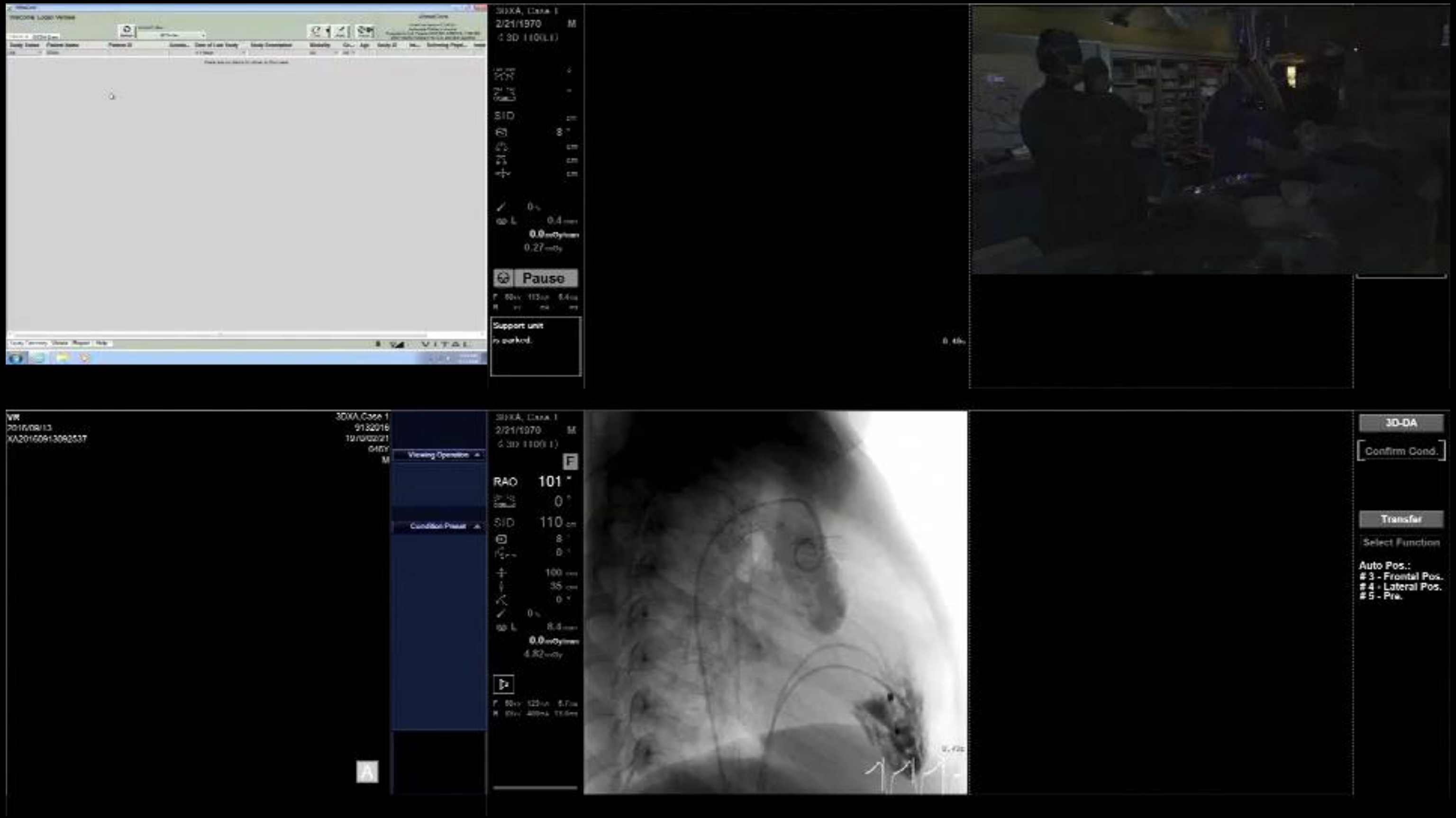
Have easy access to newly acquired data sets



Current Limitations

- Radiation dose ~equal to a biplane DA at 15fps
  - Why stop there?
- Image quality in large (obese) adults
  - Initially poor
  - Getting better

Current limitations:

Can continue to improve efficiency

- Fusion of 3DRA onto live fluoroscopy (4D)
  - Requires post-processing on Vitrea AND AWS separately
  - Redundant process
- Fusion of 3DRA onto fluoroscopy
  - Only visible on the AP camera during live fluoroscopy
  - NOT visible on any digital acquisition

Future of 3DRA and Toshiba

- Newest Vitrea software version (Version 7)
  - New look
  - More direct communication between Vitrea and AWS
    - Post-processed image on Vitrea (XA Dicom dataset)
    - Sent directly to the AWS
    - Eliminates the redundancy of post processing on both

Future of 3DRA and Toshiba

- Low radiation dose 3D acquisition
  - ? Dose similar to fluoro levels
- High definition 3D image acquisition

- 1 rotational angiogram → 3D reconstruction

- 1 rotational angiogram → real time 3D printed model

Future of 3DRA and Toshiba

- AWS/Multimodality fusion
  - Increasing advantages to the AWS
  - Integrate all 3D post-processing into the AWS
  - More efficient process
  - Table side controls
  - ? Incorporate/visualize fused image during DA if desired (on/off button)

3DRA in the OR

THANK YOU
GO DODGERS!