

3D Imaging: How to make beautiful images

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Acknowledgments

All cases are courtesy of RUSH University Hospital (D. Lopes, M. Chen) unless explicitly stated.

The rotating C-Arm: What a strange Animal



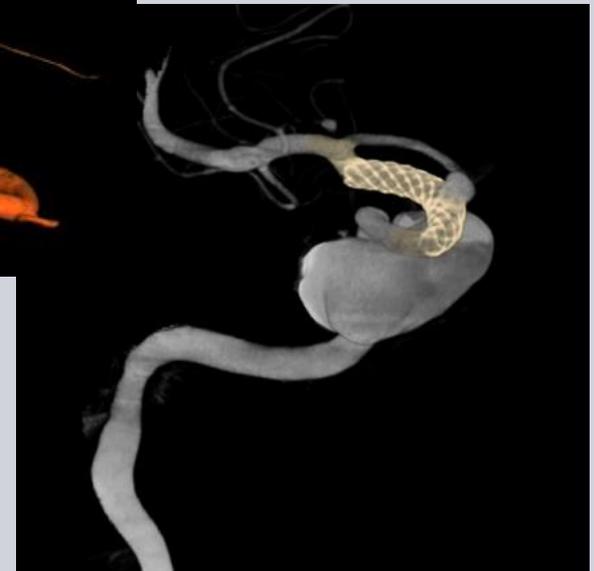
The rotating C-Arm: Proper Setup



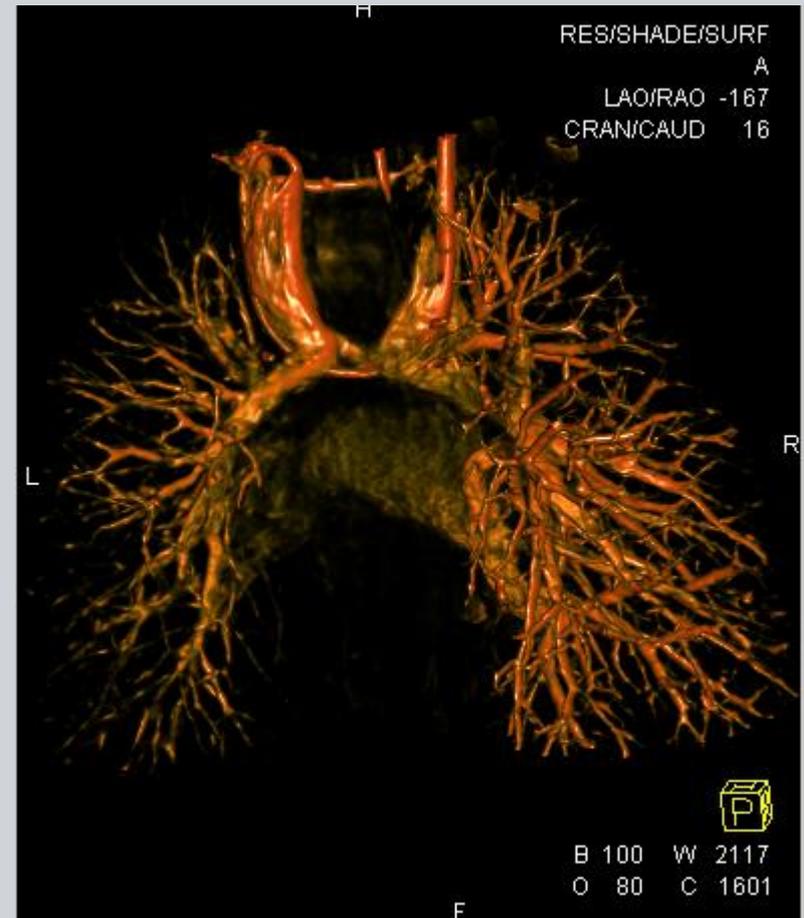
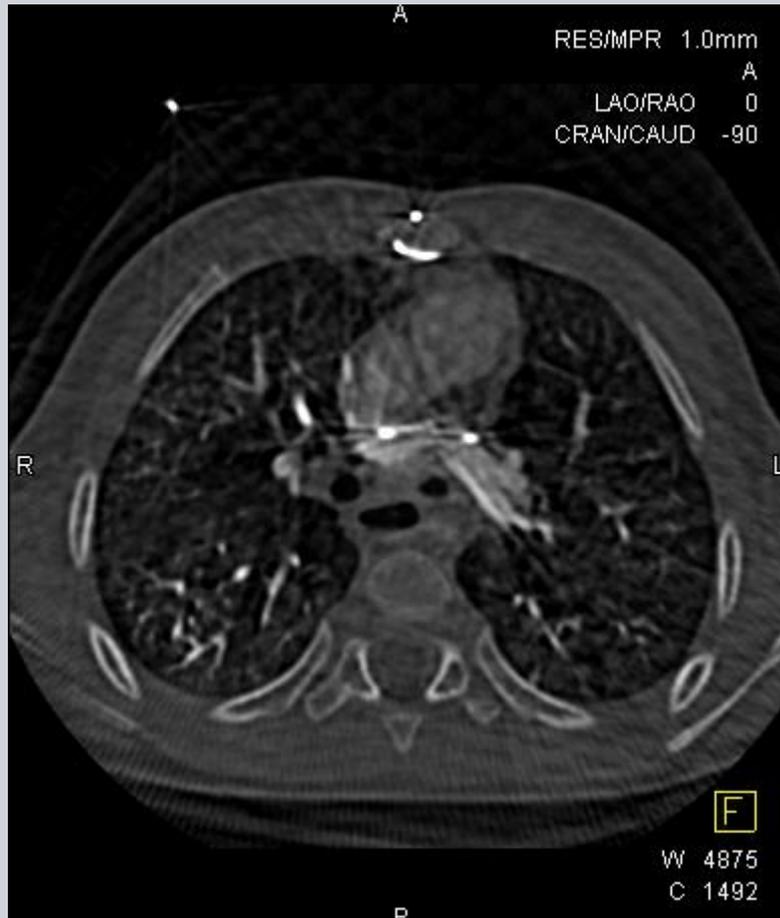
Important Considerations:

- Anesthesia Setup
- Vital Monitoring
- Lead Shielding

Applications in Neuroendovascular Imaging

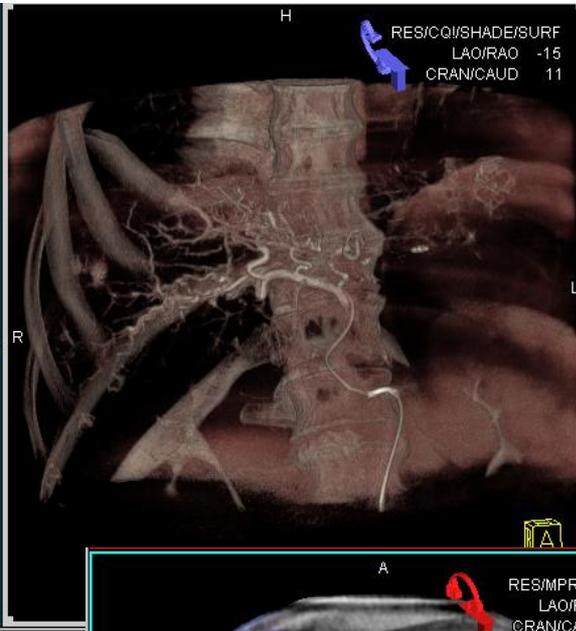
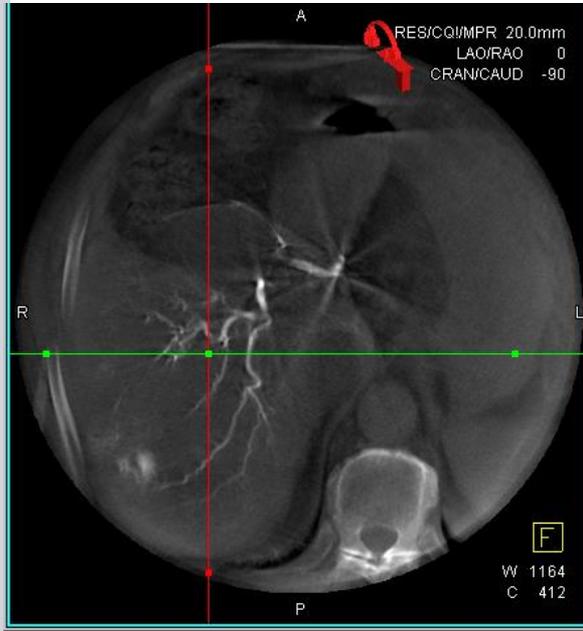


Applications in Cardiac Imaging



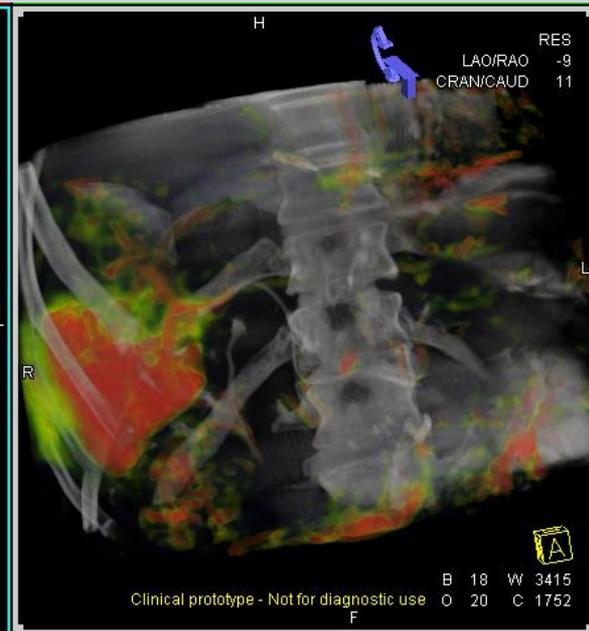
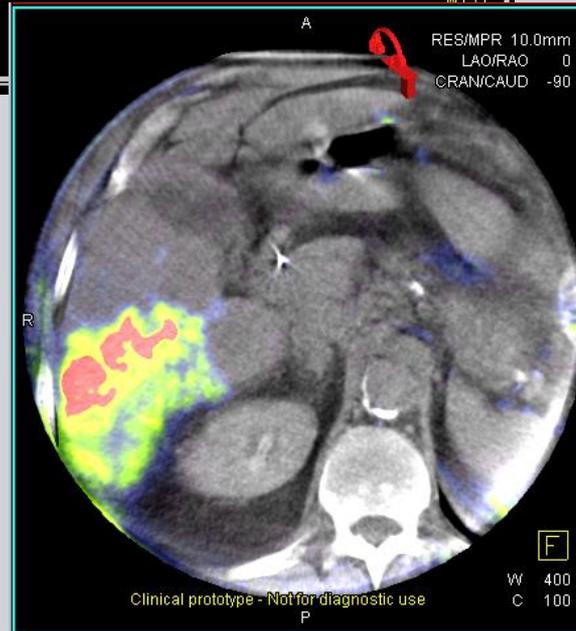
Pulmonary Artery Imaging

Applications in Body Imaging



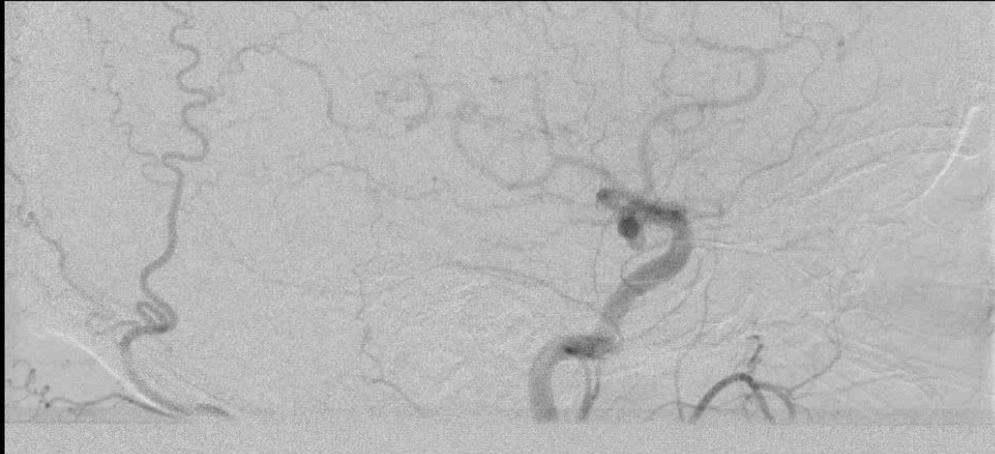
← Liver CTA

Liver Blood Volume →

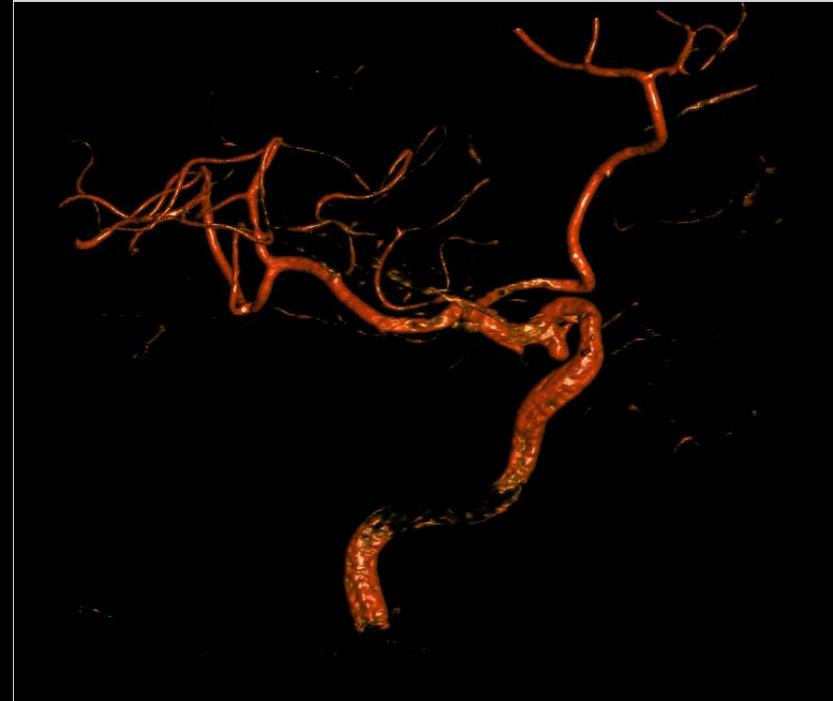


**Wait a second here, when
my images come up, they
often look like @\$!&@#\$\$%**

Patchy Vessel Syndrome



**Incomplete/Intermittent/Low
Contrast Opacification**

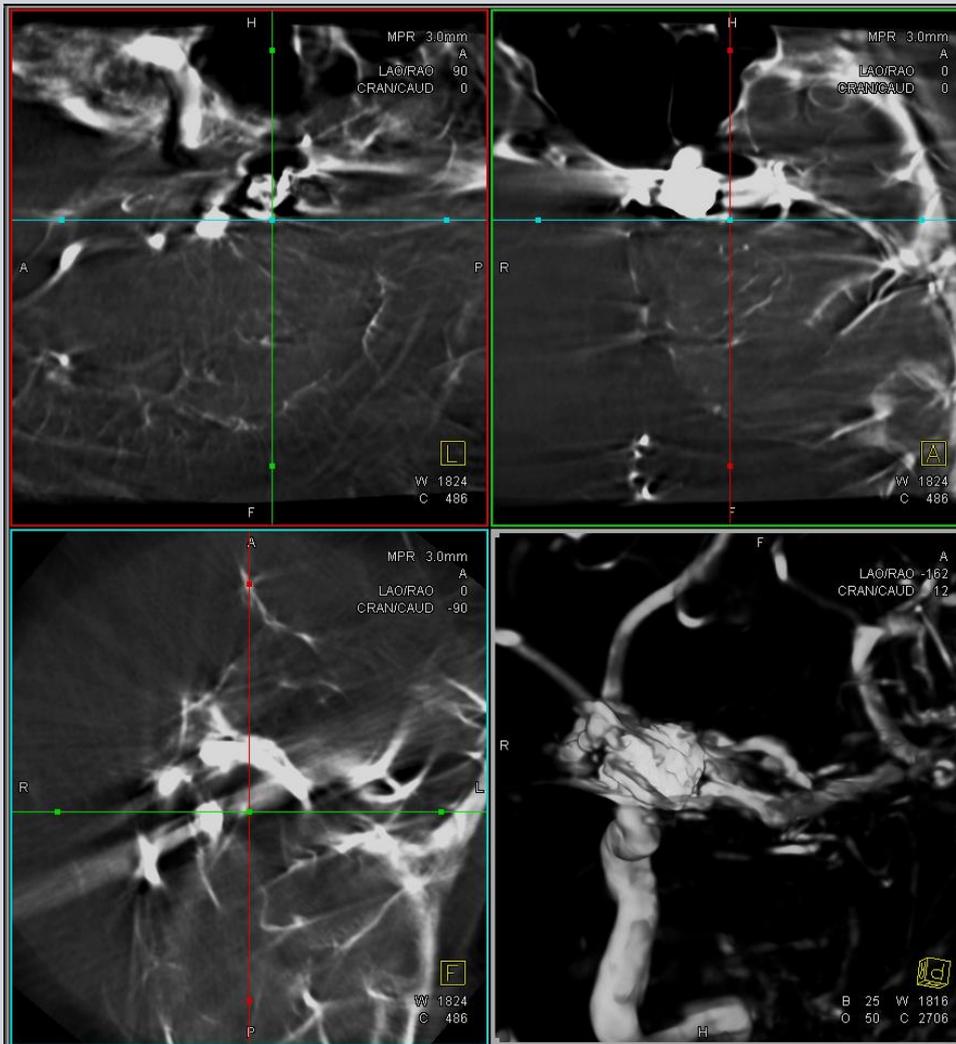


Patchy Vessel Syndrome



Repeat Reconstruction of Image and select a smooth Image Representation/Kernel

Sickle Shaped Vessels



Two Sources:

- Patient Motion
- System out of Calibration
- Call Service

Blurred Slice Views



Two Sources:

- **Patient Motion**
- System out of Calibration
 - Call Service

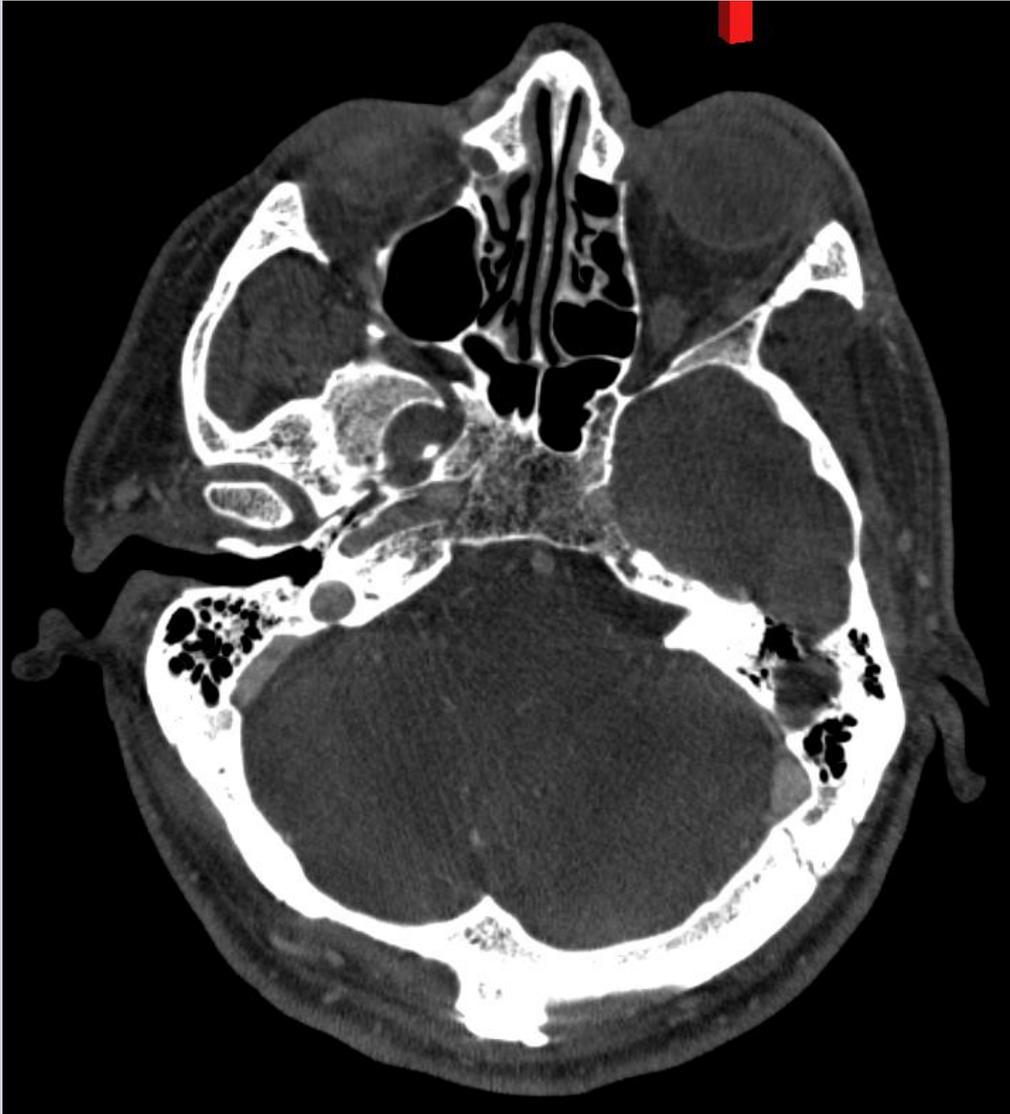
Noisy Slice Views



Bad Image Appearance:

1. Window and Level Image

Noisy Slice Views



Bad Image Appearance:

1. Window and Level Image
2. Change Slice Thickness

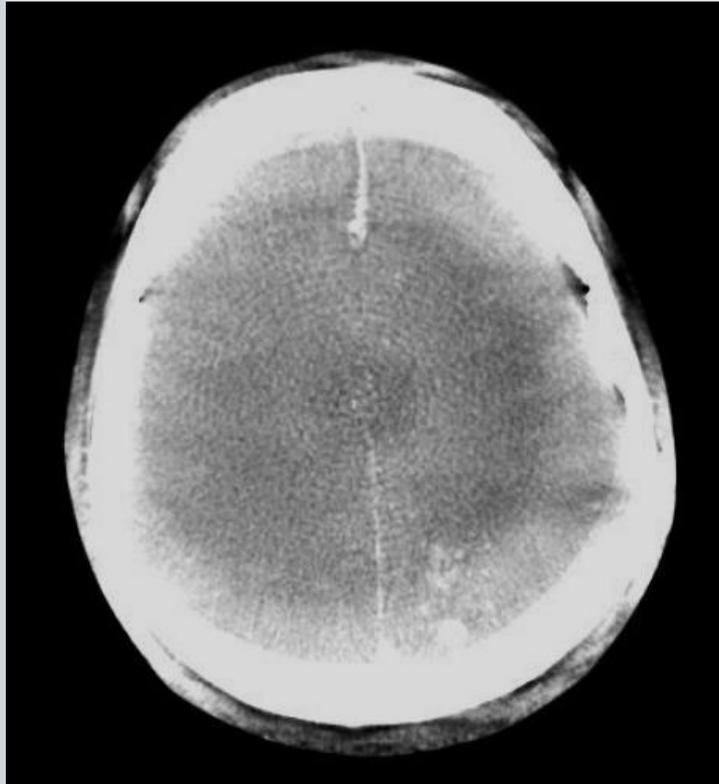
Noisy Slice Views



Bad Image Appearance:

1. Window and Level Image
2. Change Slice Thickness
 1. 0.5mm to 5mm

Ring Artifacts



**Ring Artifacts are caused by faulty/broken detector pixel.
Cannot be removed by post-processing.**

**But 3D-DSA, that's
yesterday's Spaghetti!**

3D-DSA Dual Volume



Acquisition:

- Conventional 3D-DSA
- Example for 5s long fill run acquisition:
 - 3ml for 7sec
 - 2 sec x-ray delay to achieve constant filling
 - 100% Contrast Concentration

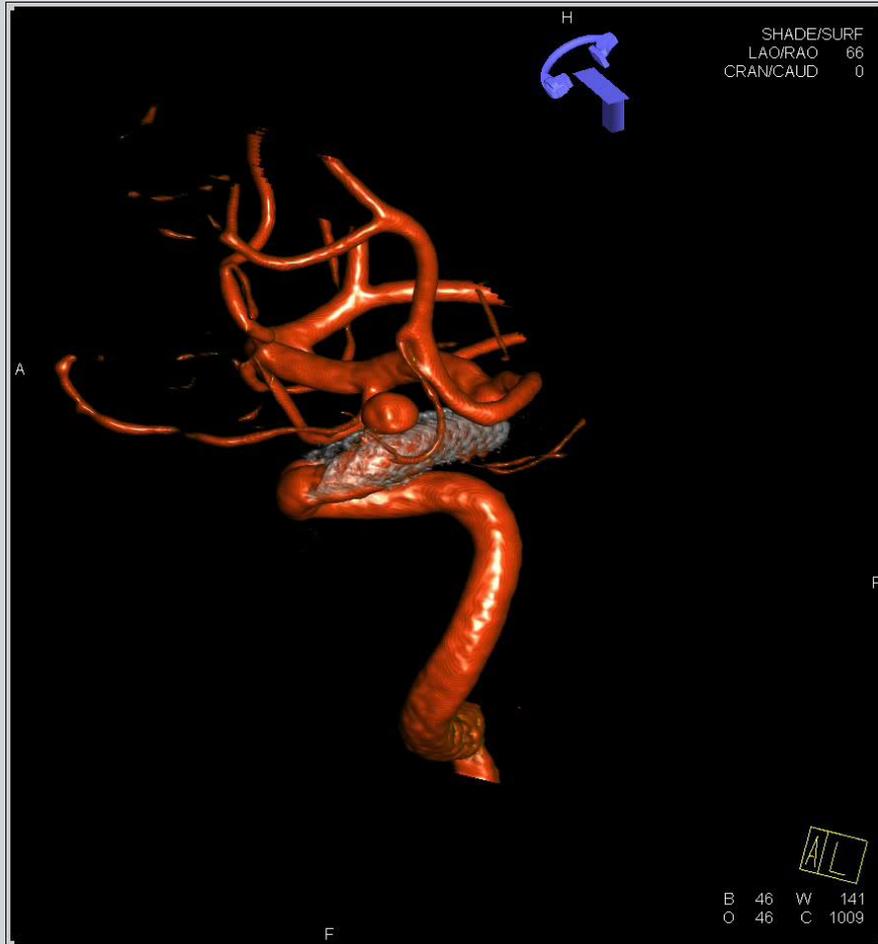
Reconstruction:

- Subtracted Reconstruction to create 3D-DSA
- Reconstruction of Mask Run

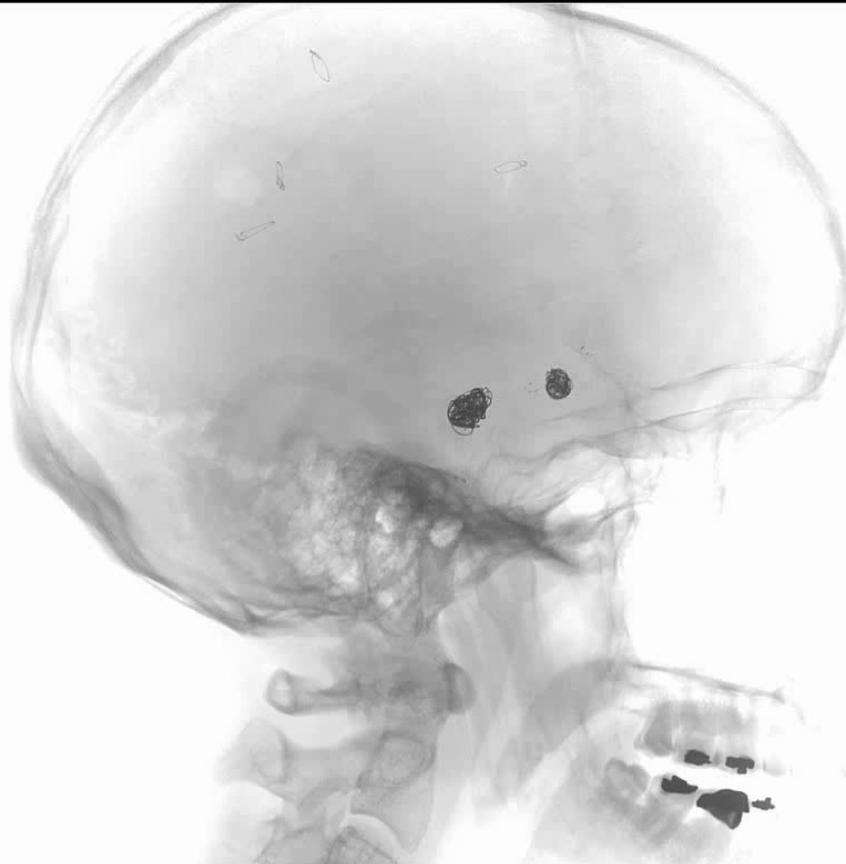
Display:

- Open both files as merged
- Crop/Remove/W+L unwanted areas

3D-DSA Dual Volume



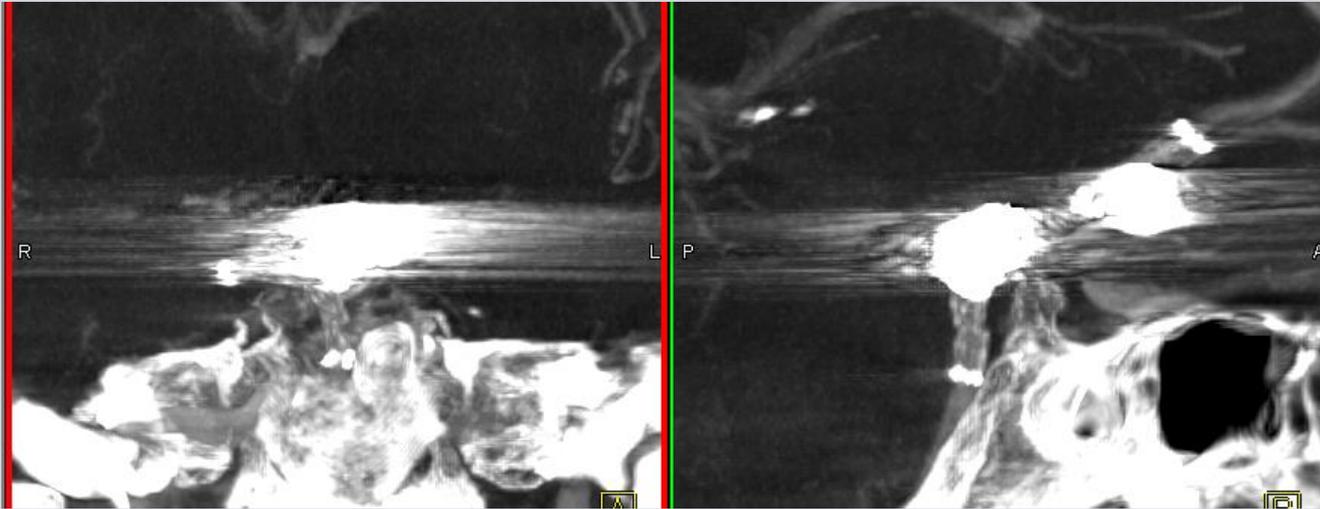
IV-DynaCTA for Implant F/U



Scan Setup – INTRA-VEINOUS INJECTION:

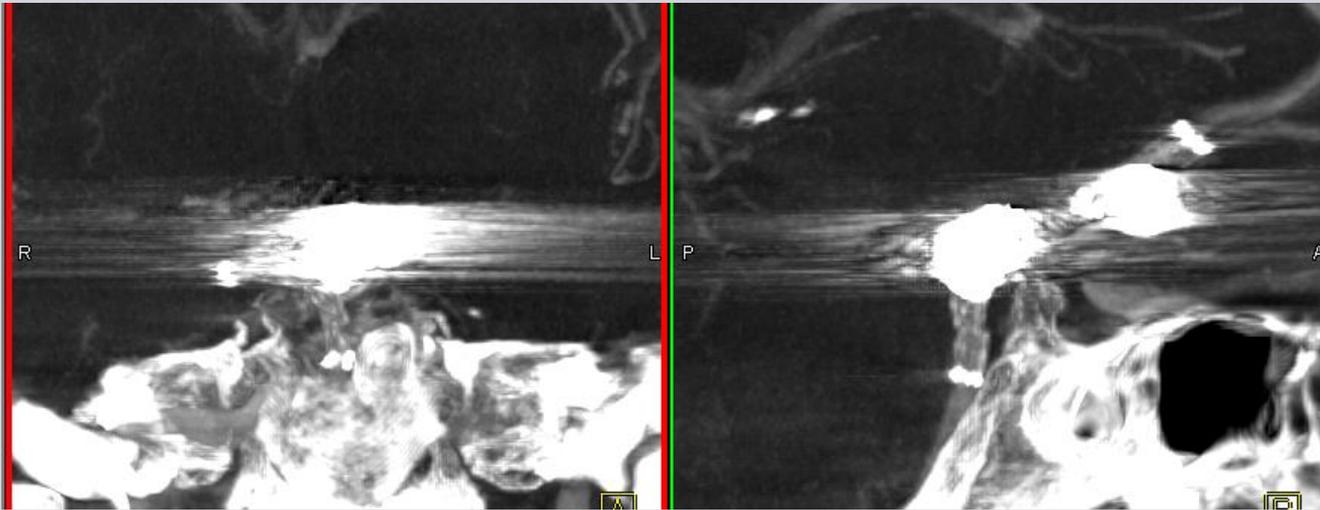
- I. Place 16-18 F IV catheter (The larger the diameter the better)
- II. Select exam protocol
- III. Follow prompts on screen to setup C-Arm
 - A. Make sure that target is visible in all test positions
- IV. Arm Injector
 - A. 80ml at 100% contrast (350mg/L)
 - B. Flow rate: 4 ml/sec
 - C. X-Ray delay: 11-16sec
- V. Start Acquisition, press and hold until completed
- VI. Image Reconstructed Automatically

DynaCTA + MAR

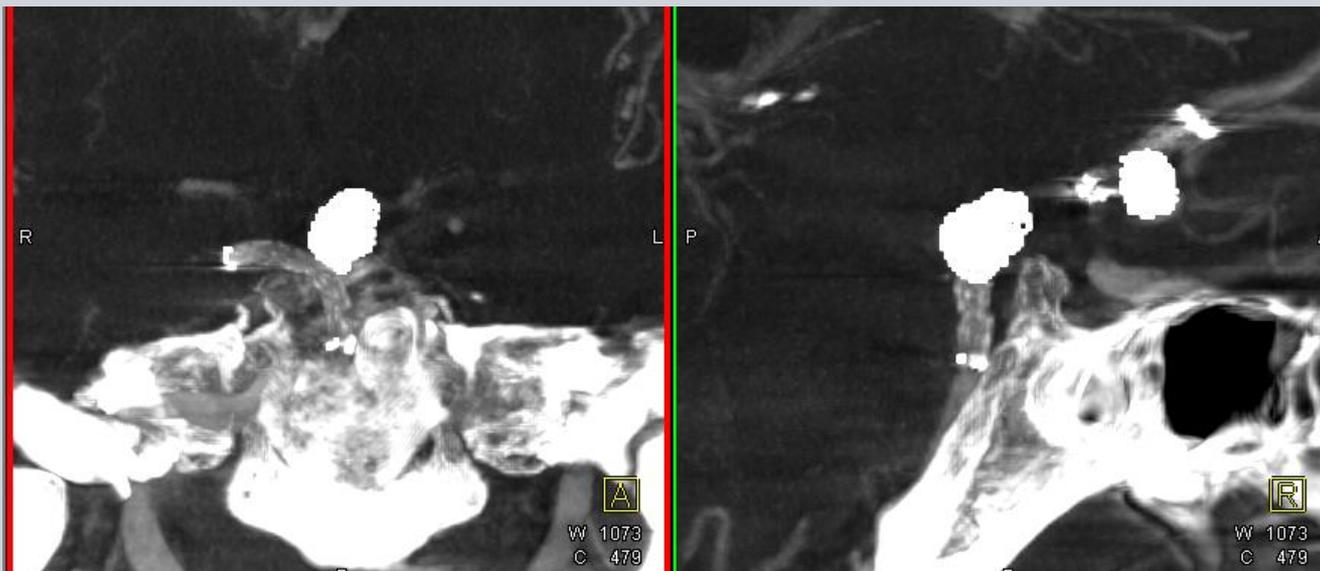


**No Metal Artifact
Reduction**

DynaCTA + MAR

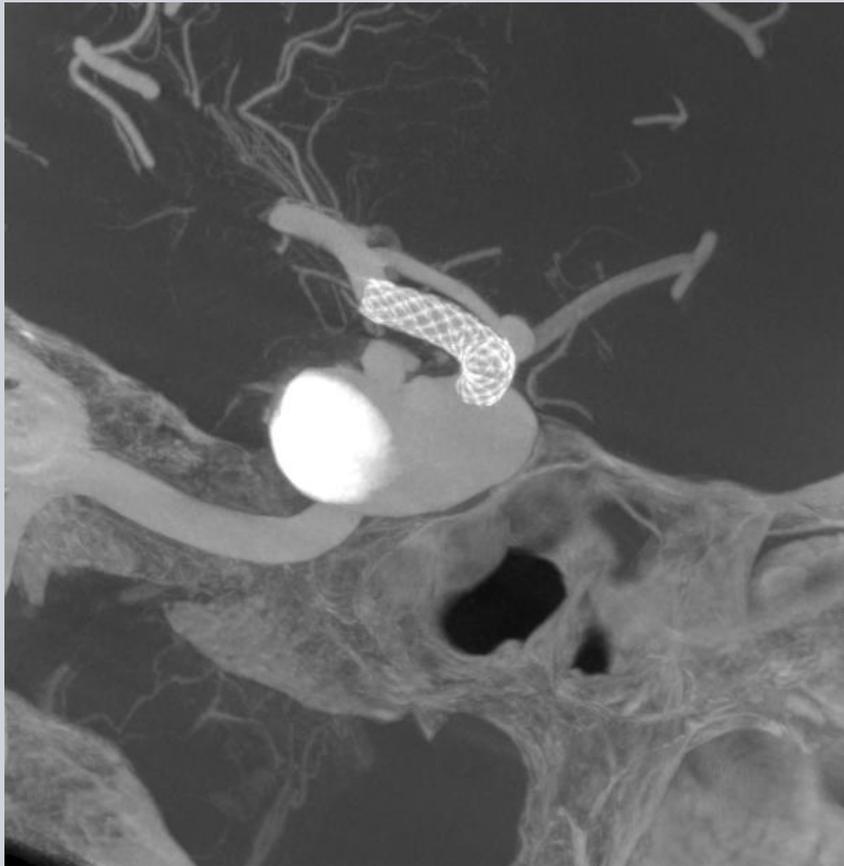


**No Metal Artifact
Reduction**



**With Metal Artifact
Reduction**

DynaCT Micro



1x1 Binning (Micro)

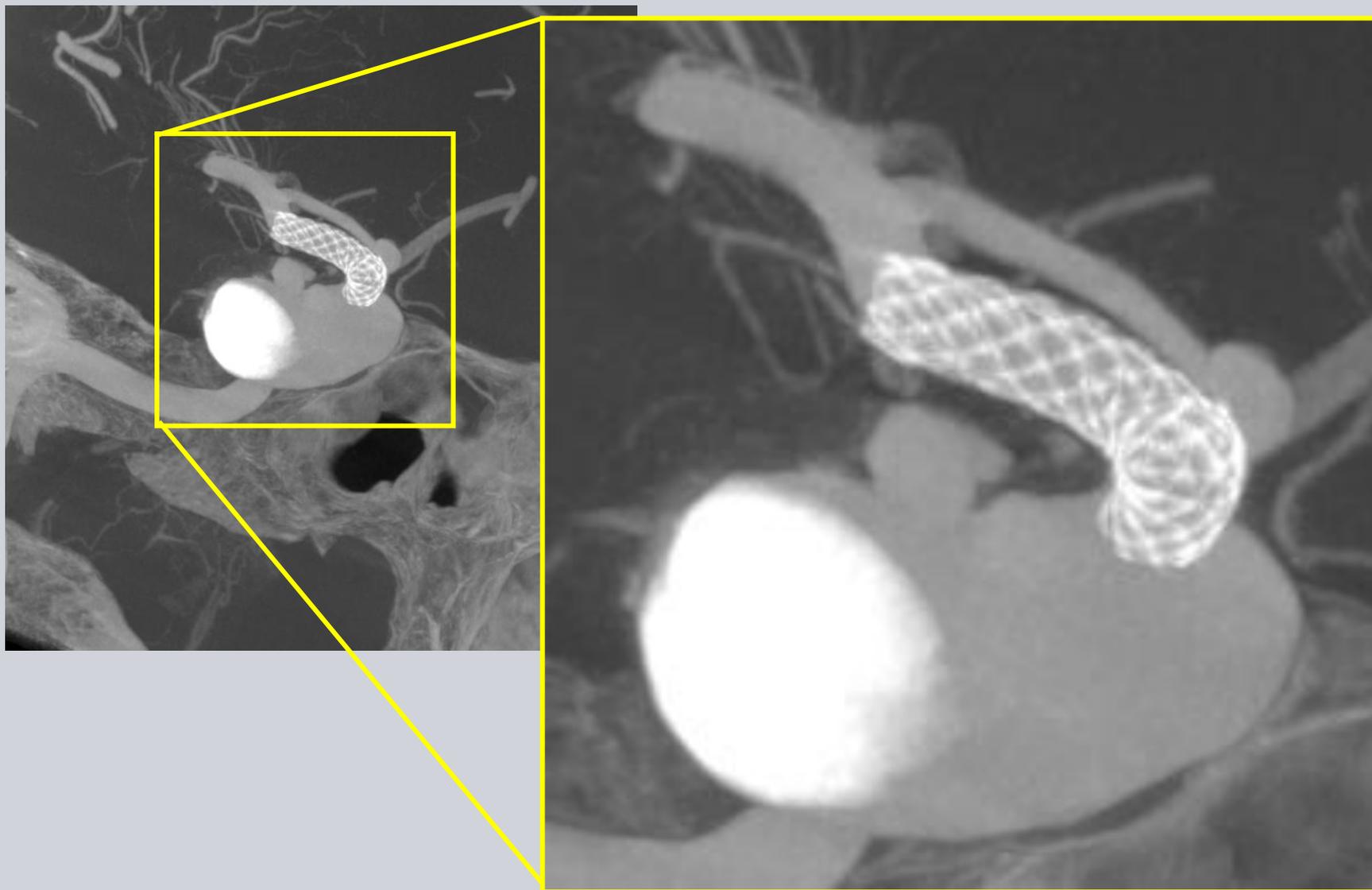
2x2 Binning (Standard)

DynaCT Micro

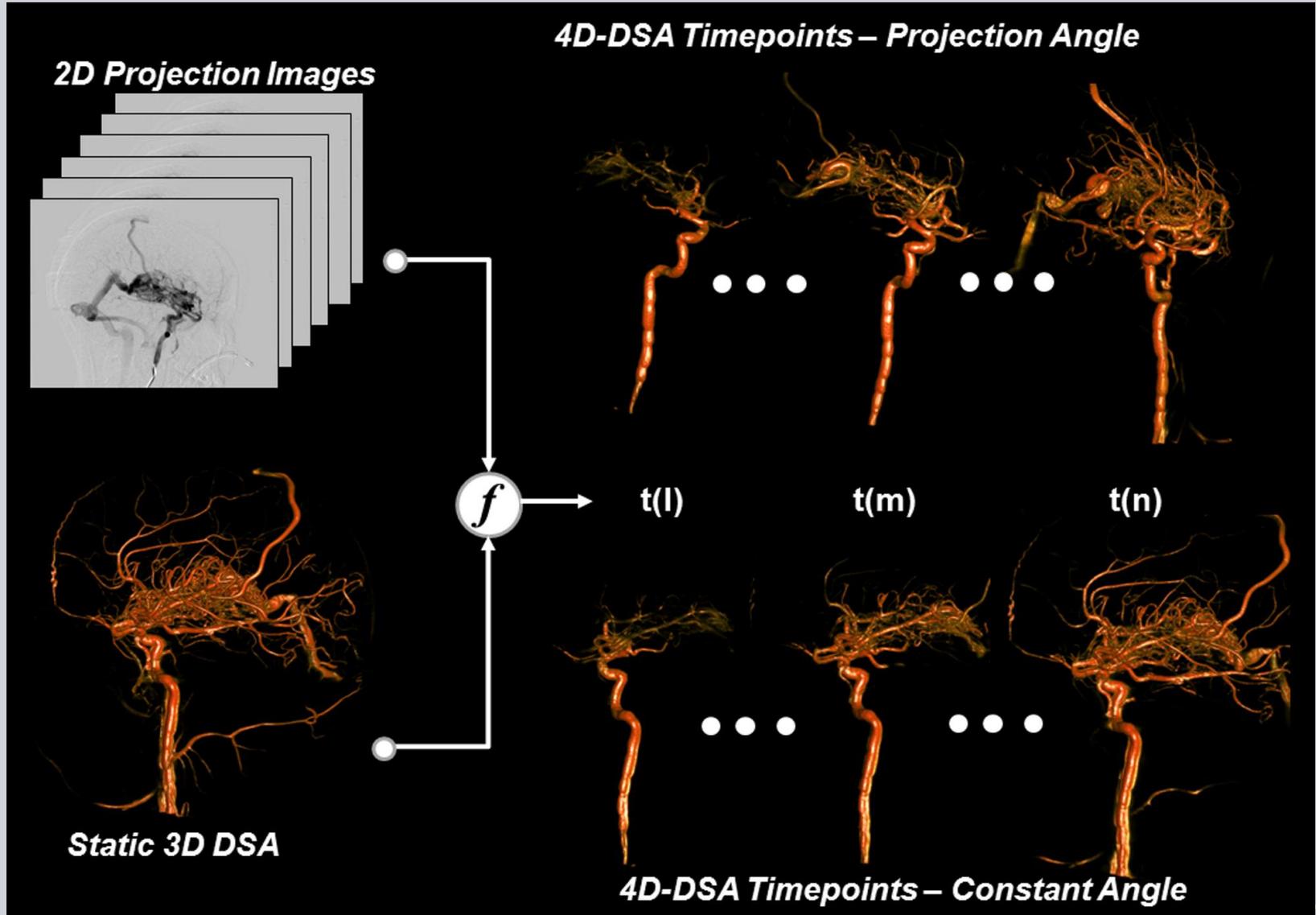
SIEMENS



RUSH UNIVERSITY
MEDICAL CENTER



4D-DSA – Overview



4D-DSA – Acquisition



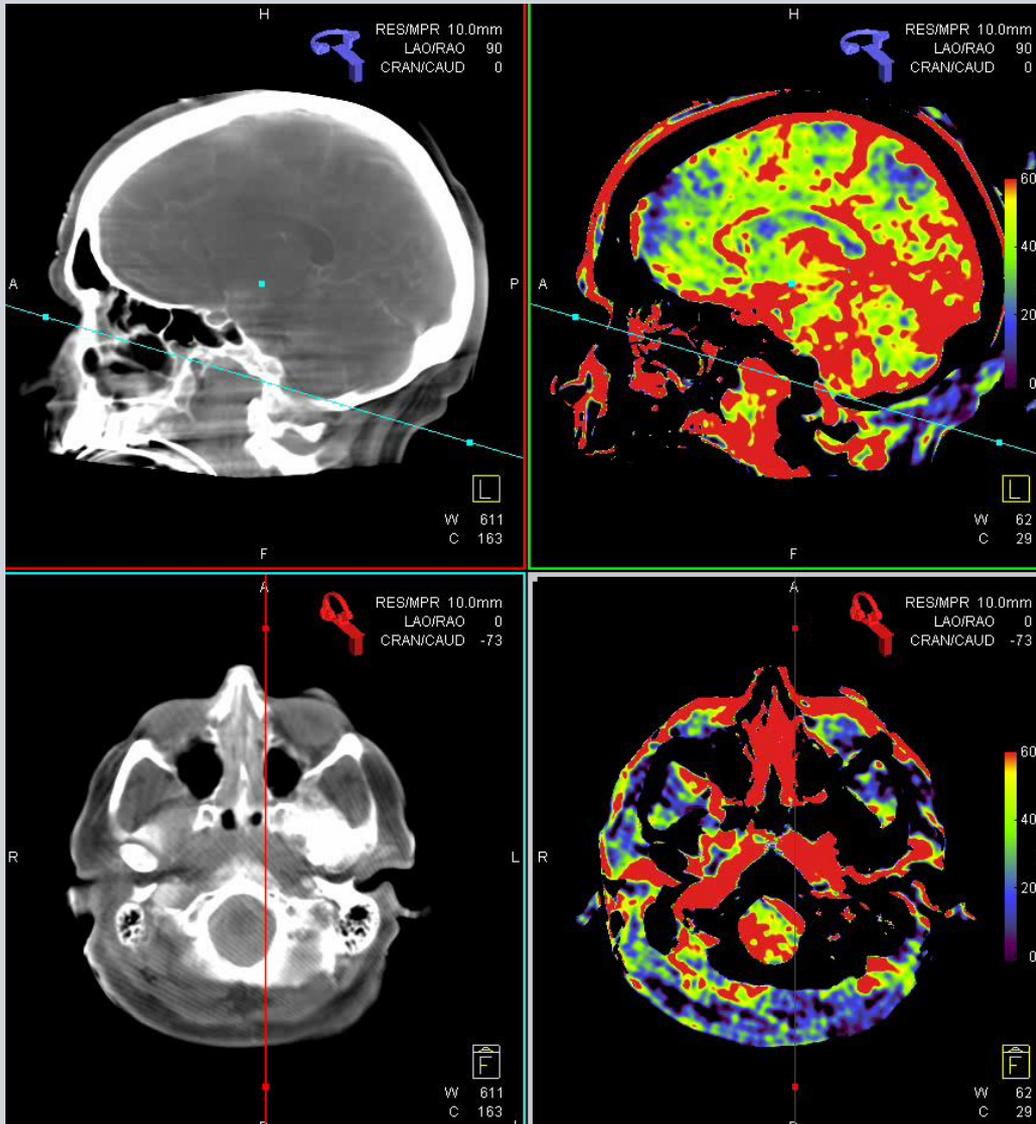
Scan Setup:

- I. Position catheter in appropriate vessel
- II. Select desired exam protocol
- III. Follow prompts on screen to setup C-Arm
 - A. Make sure that target is visible in all test positions
- IV. Arm Injector (Similar for both 6s and 12s acquisitions)
 - A. Contrast
 - a) 24 ml at 100% contrast [300mg/L]
 - B. Flow rate: 3 ml/sec
 - C. Injection delay: 0.5sec
 - D. Injection Duration: 8s
 - E. Pressure: 600 PSI
 - F. Rise Rate: 0.3cc
- V. Acquire

4D-DSA – Examples



Neuro-PBV



Scan Setup – INTRA-VENOUS INJECTION:

- I. Place 16-18 F IV catheter (The larger the diameter the better)
- II. Select exam protocol
- III. Follow prompts on screen to setup C-Arm
 - A. Make sure that target is visible in all test positions
- IV. Arm Injector
 - A. 80ml at 100% contrast (350mg/L)
 - B. Flow rate: 4 ml/sec
 - C. X-Ray delay: 0sec
- V. Start Acquisition
 - A. **Press and hold** top trigger (Do not let go until end of complete acquisition indicated by bell)
 - B. Press blue front trigger once
- VI. Mask run will complete and C-Arm will return to start position
- VII. Automatic projection acquisition at 1 F/s starts
 - A. Monitor to see **filling of Sinus Sagittalis Superior / Jugular Vein**
 - B. **WAIT FIVE SECONDS**
 - C. Press blue side trigger to start Fill acquisition
- VIII. Done

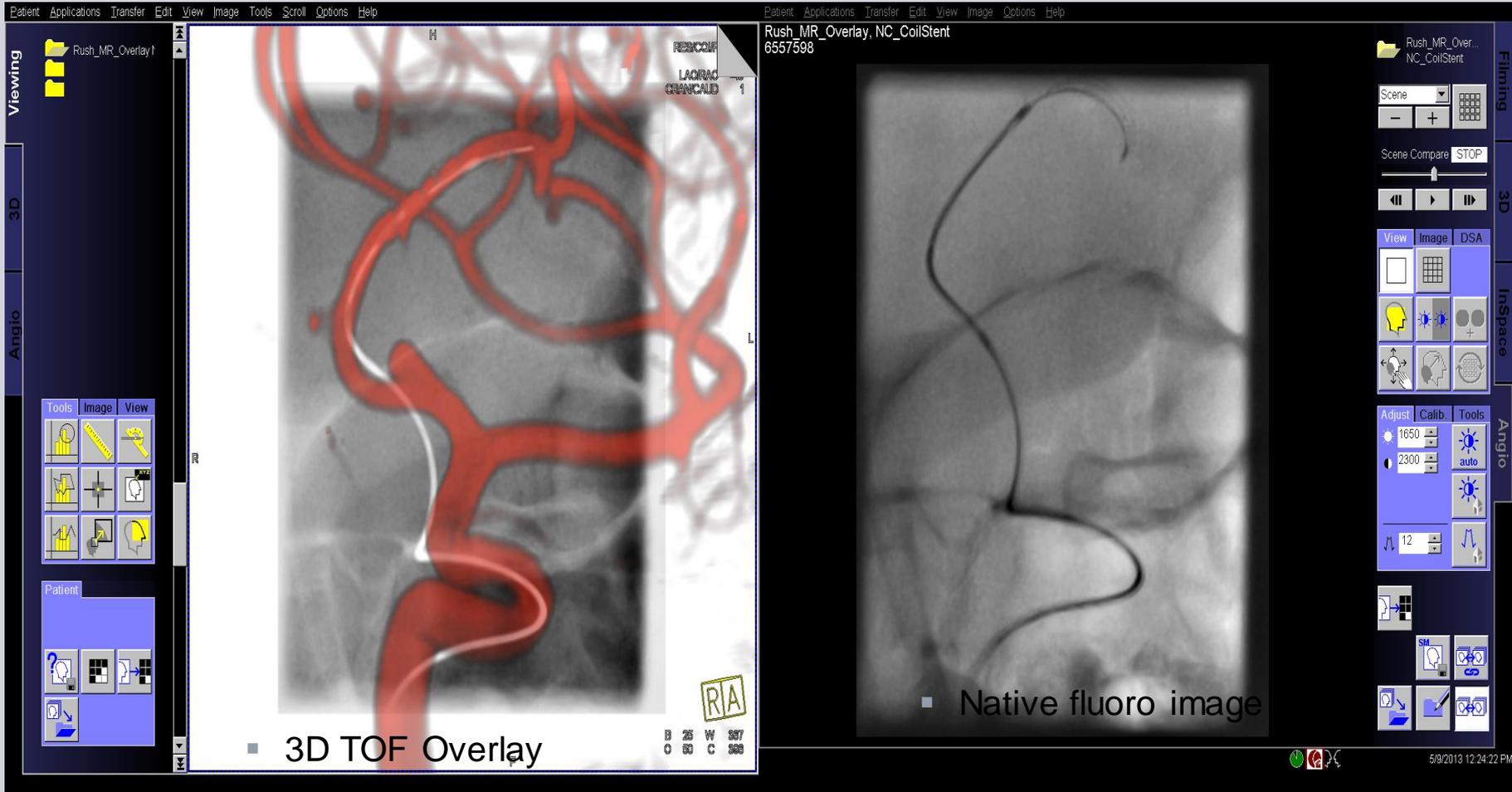
**Pretty Images, but can they be
used for anything else than
staring at them?**

Tools – 3D Roadmap

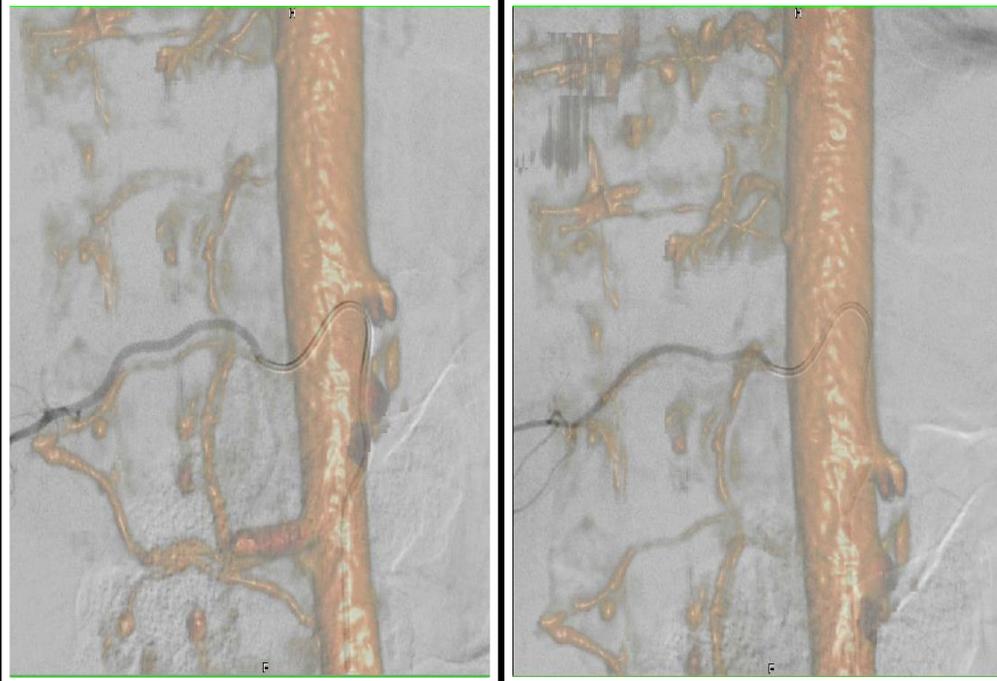
- 3D overlay with live fluoro for better guidance during endovascular treatment
- Automatic adjustments to current image geometry
- Choose 3D visualization according to your preference



Tools – 3D Roadmap



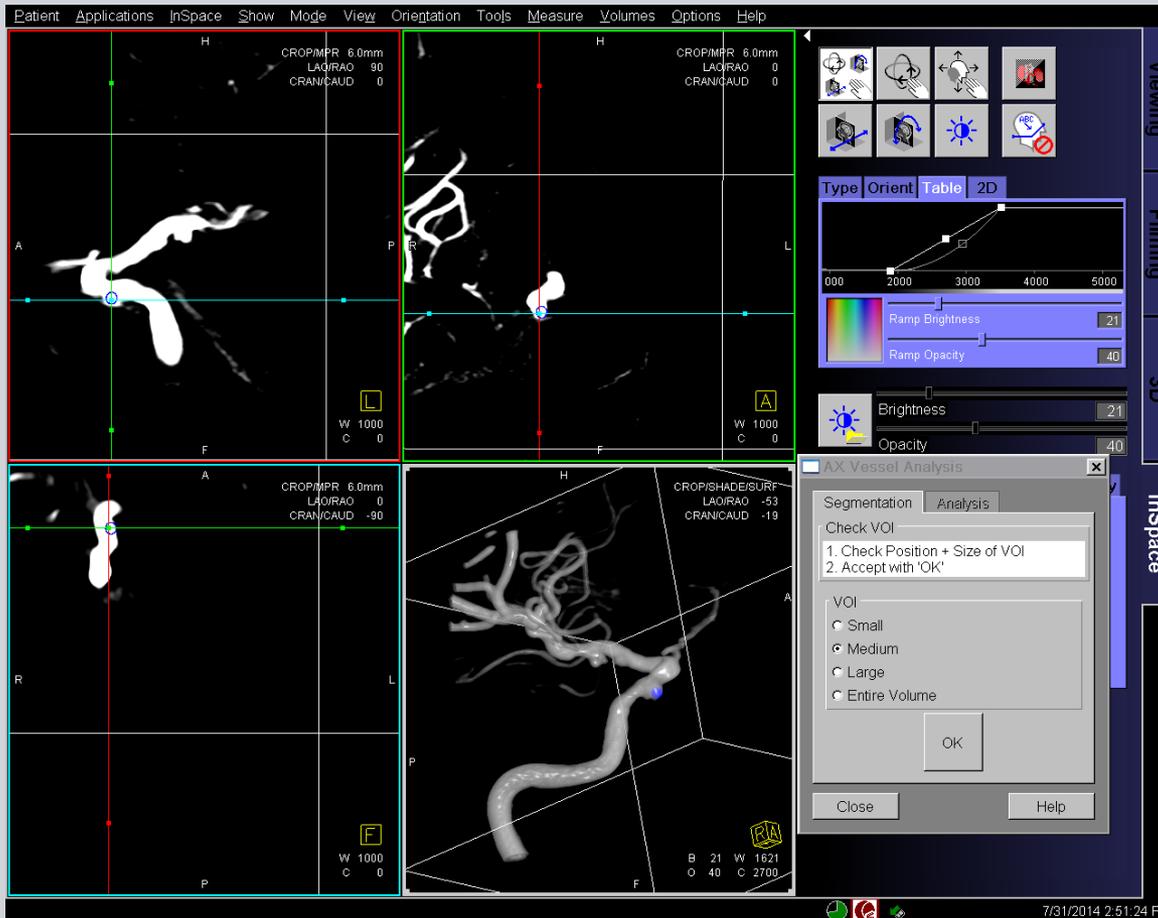
Tools – 3D Roadmap



- Goal:
- Guidance to find origin of spinal arteries fast and reliable

- Approach:
- TWIST multiphase MR acquisition
- 5sDynaCT acquisition
- Registration of both datasets and registration matrix stored
- Overlay of TWIST images to live fluoro for guidance during procedure

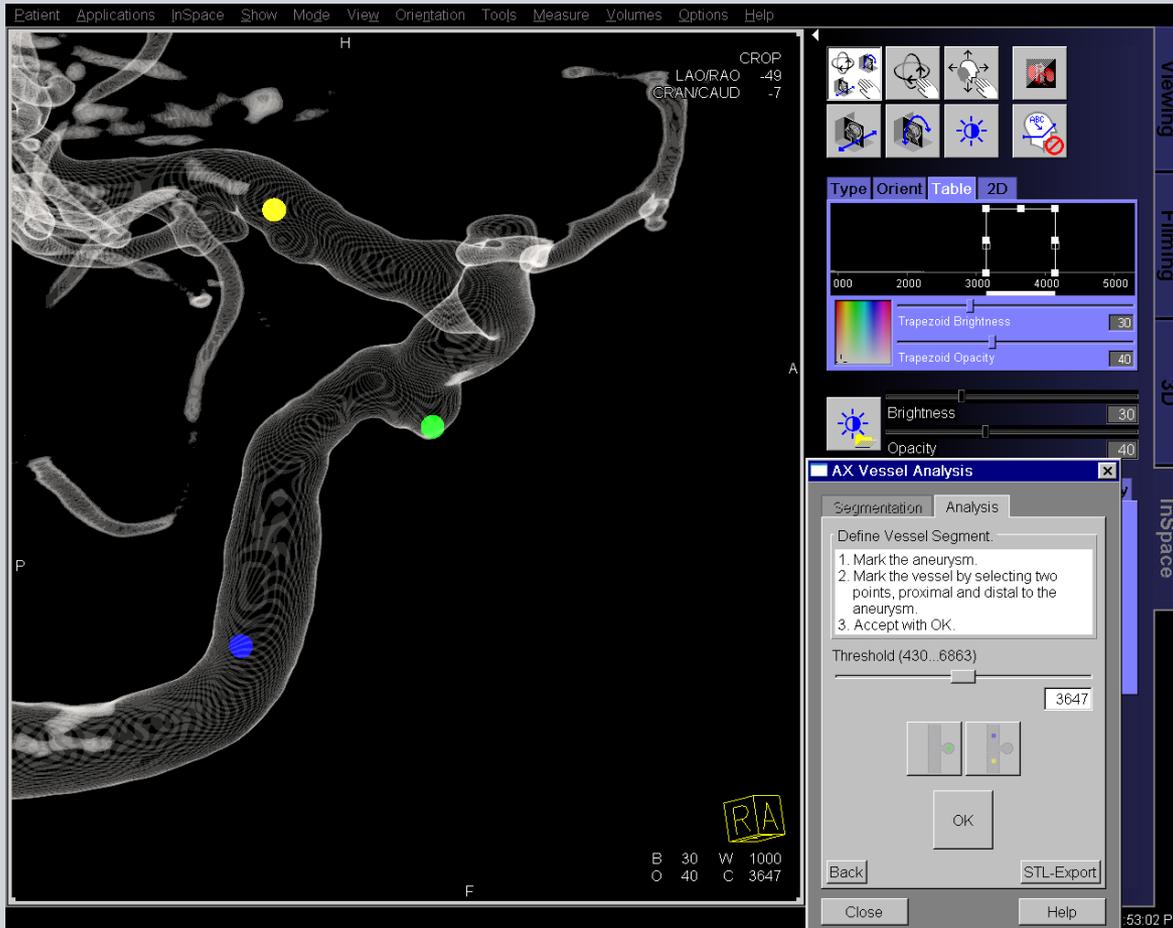
Tools – Vessel Evaluation/Virtual Stent



Workflow:

1. Select ROI

Tools – Vessel Evaluation/Virtual Stent



Workflow:

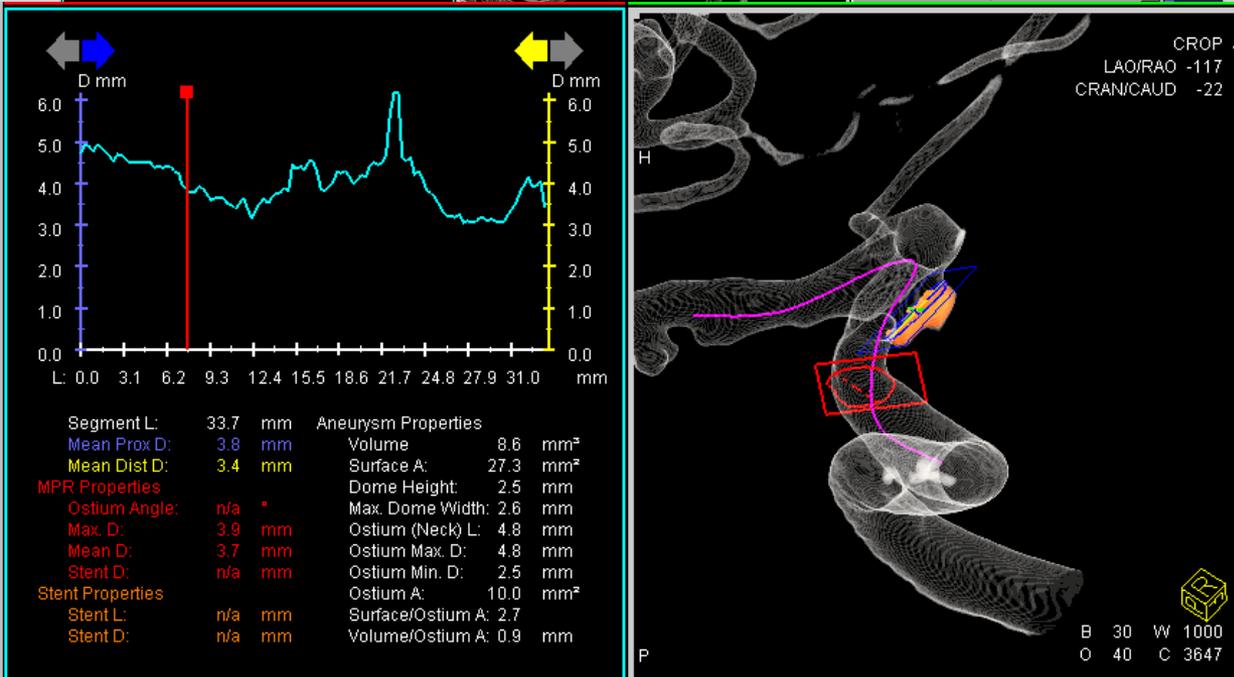
1. Select ROI
2. Select Aneurysm Dome and Parent Vessel

Tools – Vessel Evaluation/Virtual Stent



Workflow:

1. Select ROI
2. Select Aneurysm Dome and Parent Vessel
3. Aneurysm dome and vessel centerline extracted automatically

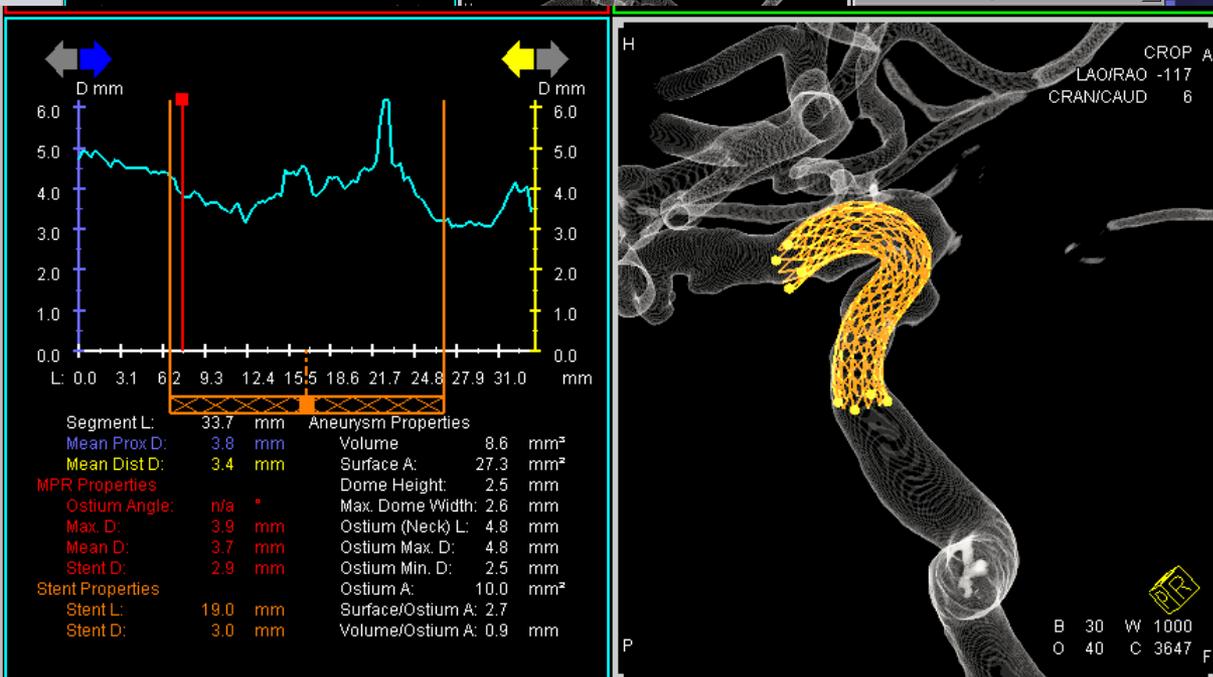


Tools – Vessel Evaluation/Virtual Stent

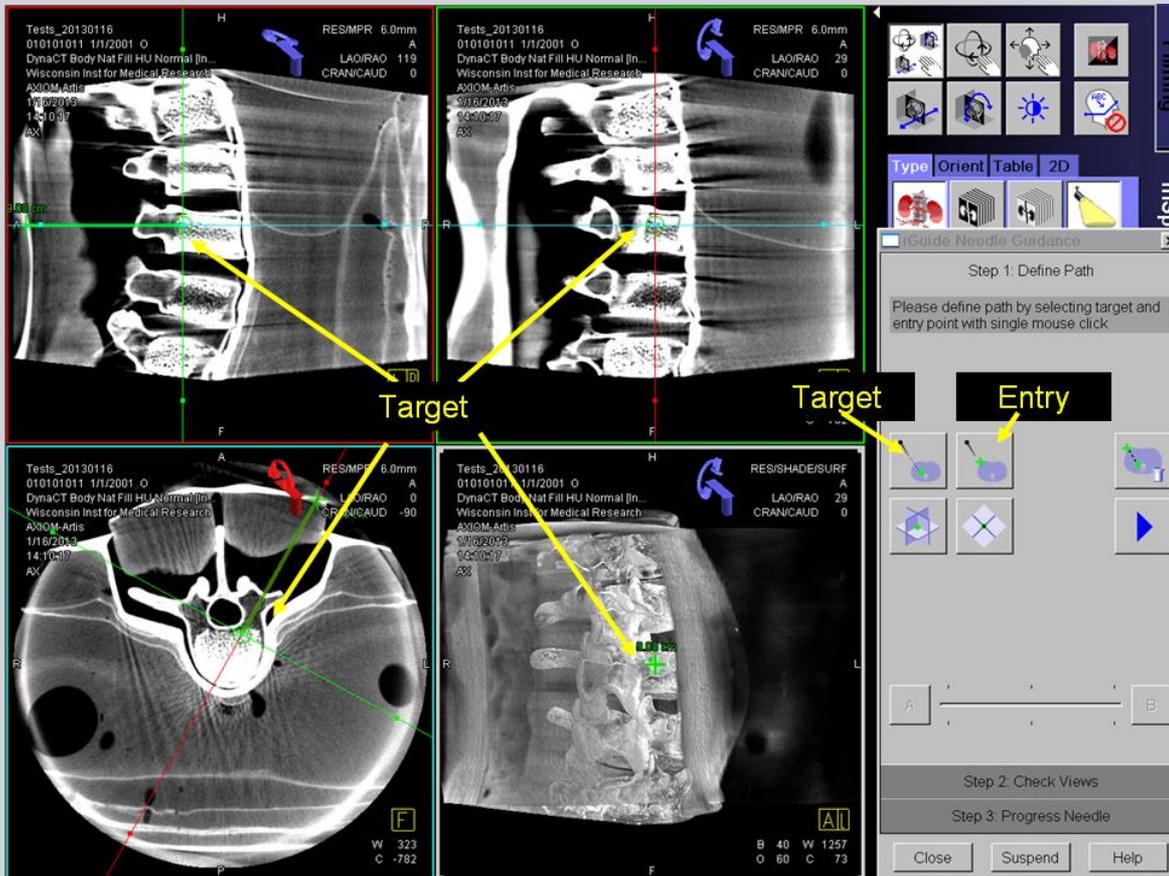


Workflow:

1. Select ROI
2. Select Aneurysm Dome and Parent Vessel
3. Aneurysm dome and vessel centerline extracted automatically



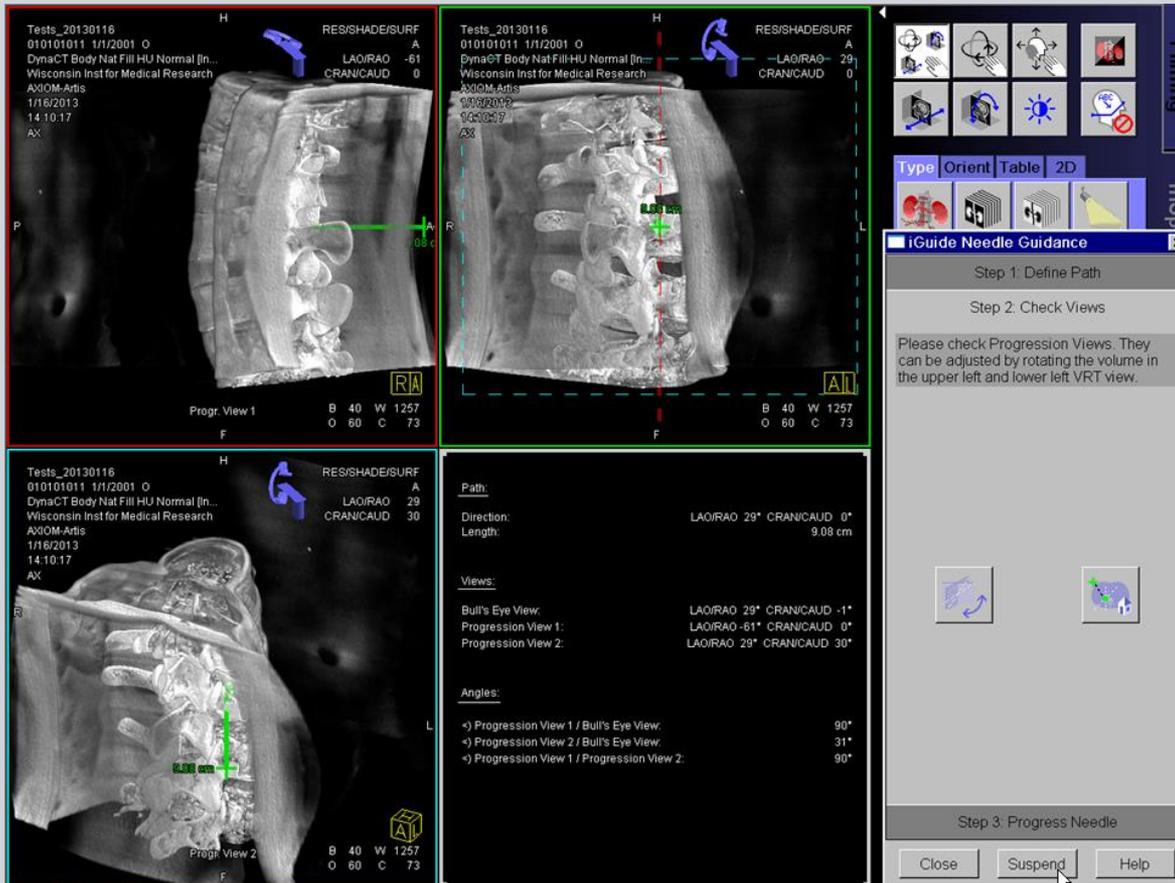
Tools – Needle Guidance



Workflow:

1. Acquire 3D of target area
2. Select Target and Entry

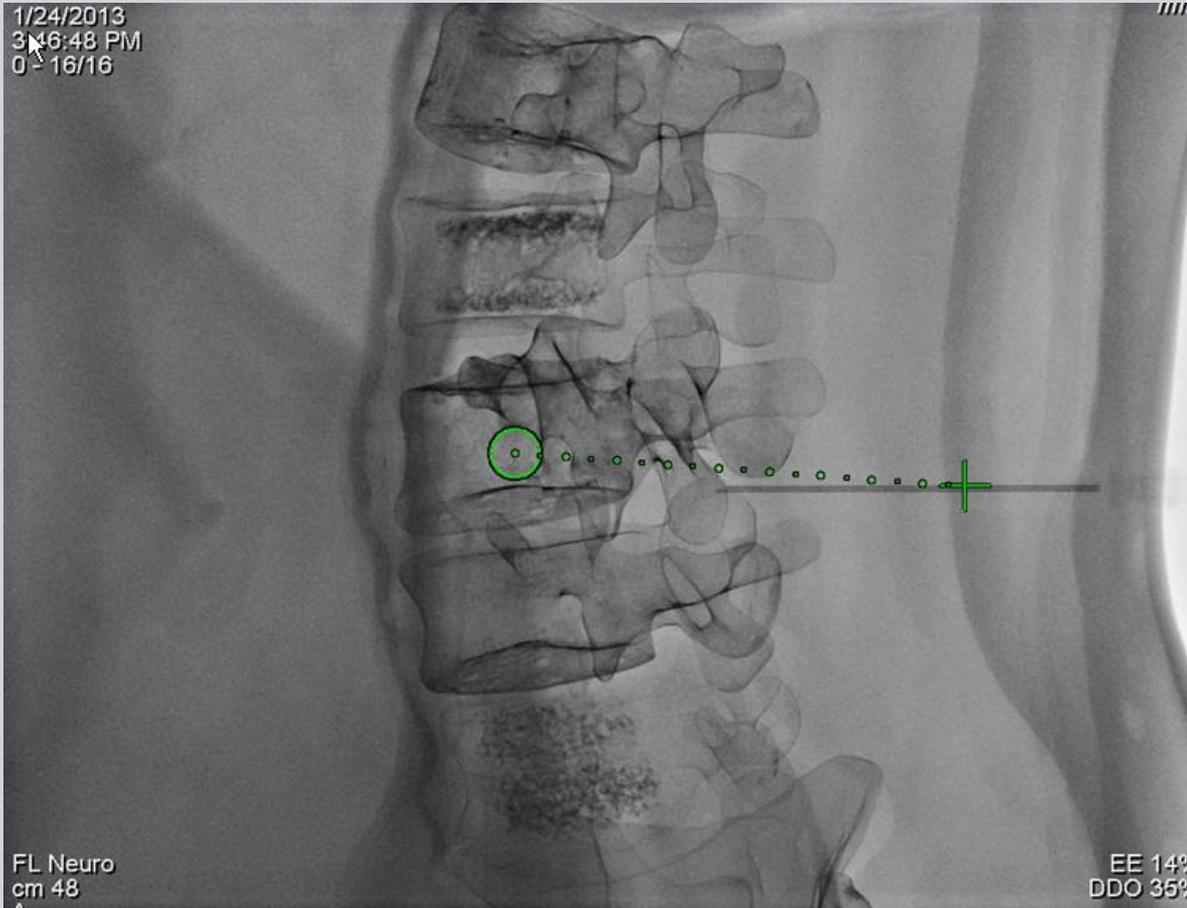
Tools – Needle Guidance



Workflow:

1. Acquire 3D of target area
2. Select Target and Entry
3. Check auto-views on usability

Tools – Needle Guidance



Workflow:

1. Acquire 3D of target area
2. Select Target and Entry
3. Check auto-views on usability
4. Follow prompts on live screen
5. Place Needle

The End?
For the presentation,
yes.

For 3D, probably not!

**Thank you for your
attention!**