Imaging / Knobology / Artifacts

2016 ASCeXAM / ReASCE Review Course

David Adams, ACS, RCS, RDCS, FASE
Duke University Medical Center
April 16, 2016

Disclosures

None

Imaging / Knobology / ~~Artifacts~~

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We Have a Problem

- The ASCeXAM evolves
- More questions on optimizing the images
- Easy if you scan – but if you don’t scan…

DUKE: Adams

DUKE: Adams

The Solution

- You being here
- Me being here
- Us working together

Goals

- When to use what controls
- Optimizing the images
- Knowing what your techs are doing or not doing
- Kind of questions on the exam

Pre Lecture Test

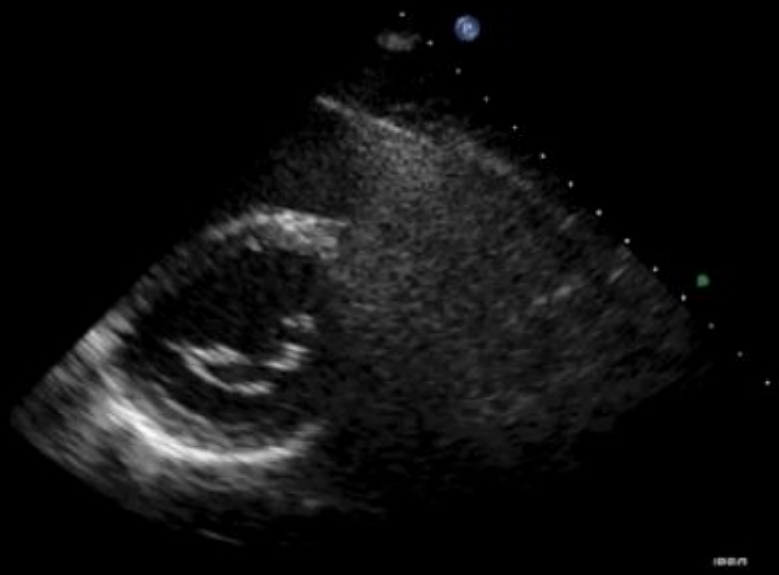
Which standard 2D TTE view typically allows viewing of the LAA?

1. parasternal long axis
2. apical 4 chamber
3. subcostal 4 chamber
4. apical 2 chamber

The problem with this image can be corrected using:

a) overall gain
b) TGC controls
c) LGC controls
d) another view

To correct this view the transducer beam should be angled:



a) laterally
b) medially
c) cranially-up an interspace
d) caudally-down an interspace

10

Where should you position the pulsed wave Doppler sample volume for mitral inflow?

1. at the mitral valve annulus
2. in the middle of the mitral leaflets
3. at the tips of the mitral valve in systole
4. at the tips of the mitral valve in diastole

The best view to measure the RVOT, pulmonic valve and PA flow is:

1. right sternal border
2. subcostal short axis
3. parasternal long axis
4. parasternal short axis

What is an advantage of continuous wave Doppler over pulsed wave Doppler?

a) aliasing
b) range resolution
c) detection of high velocities
d) assessing the severity of regurgitation

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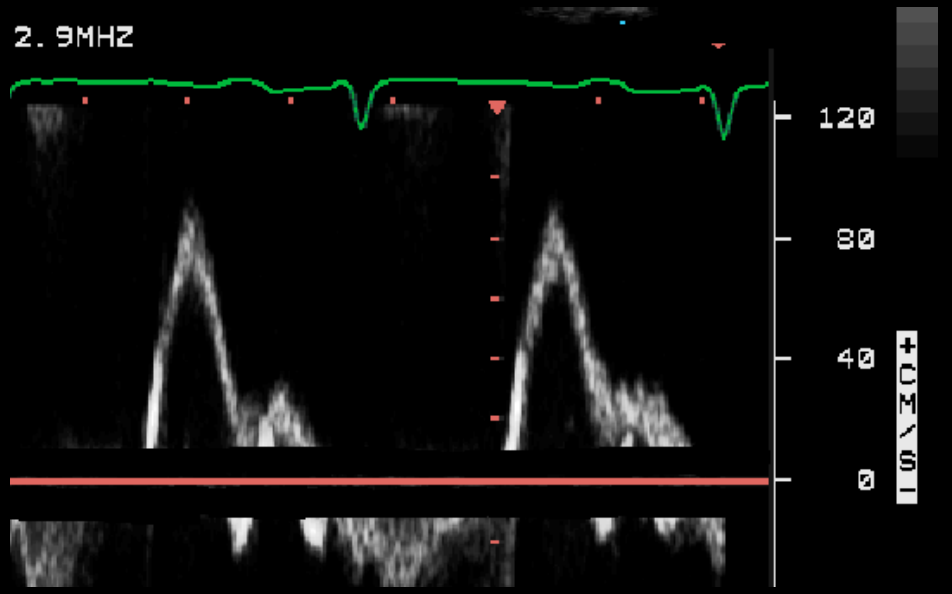
When evaluating which of the following is it best to use a low wall filter?

1. aortic stenosis
2. pulmonary veins
3. mitral regurgitation
4. tricuspid regurgitation

What should be done in order to measure the E wave duration?



1. increase the gain
2. find a better window
3. decrease the wall filter
4. increase the wall filter

Now the Lecture

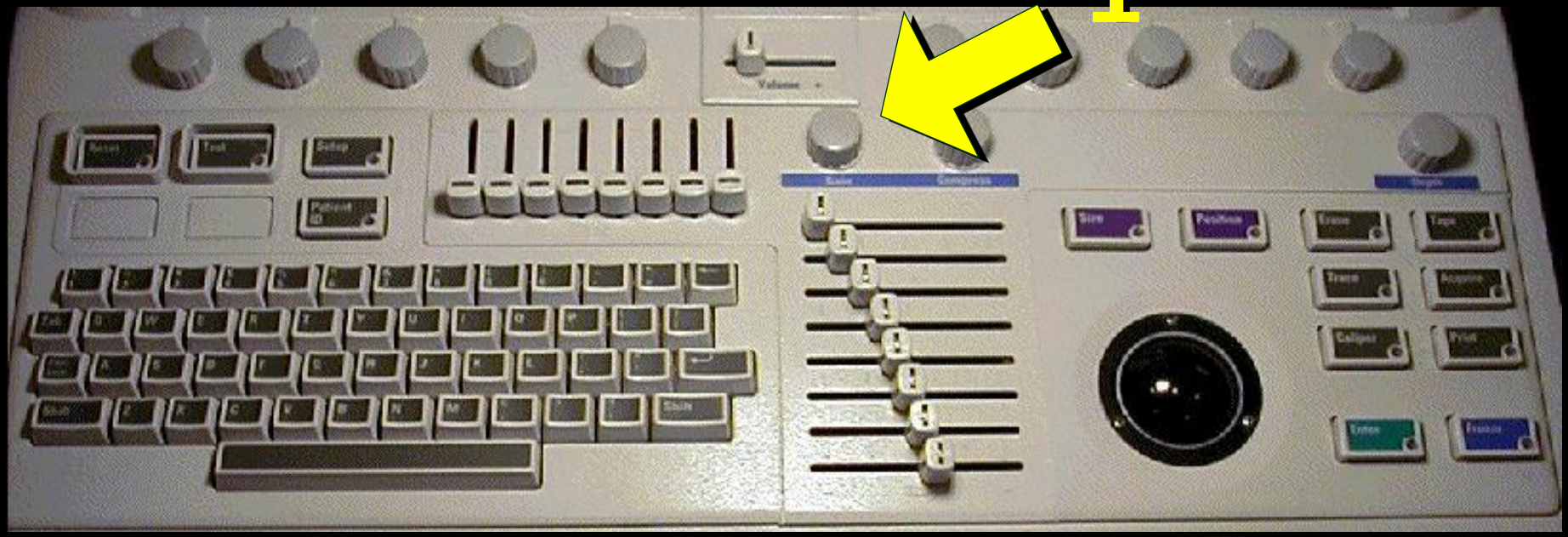
The Challenge

- Get the image
- Optimize the image

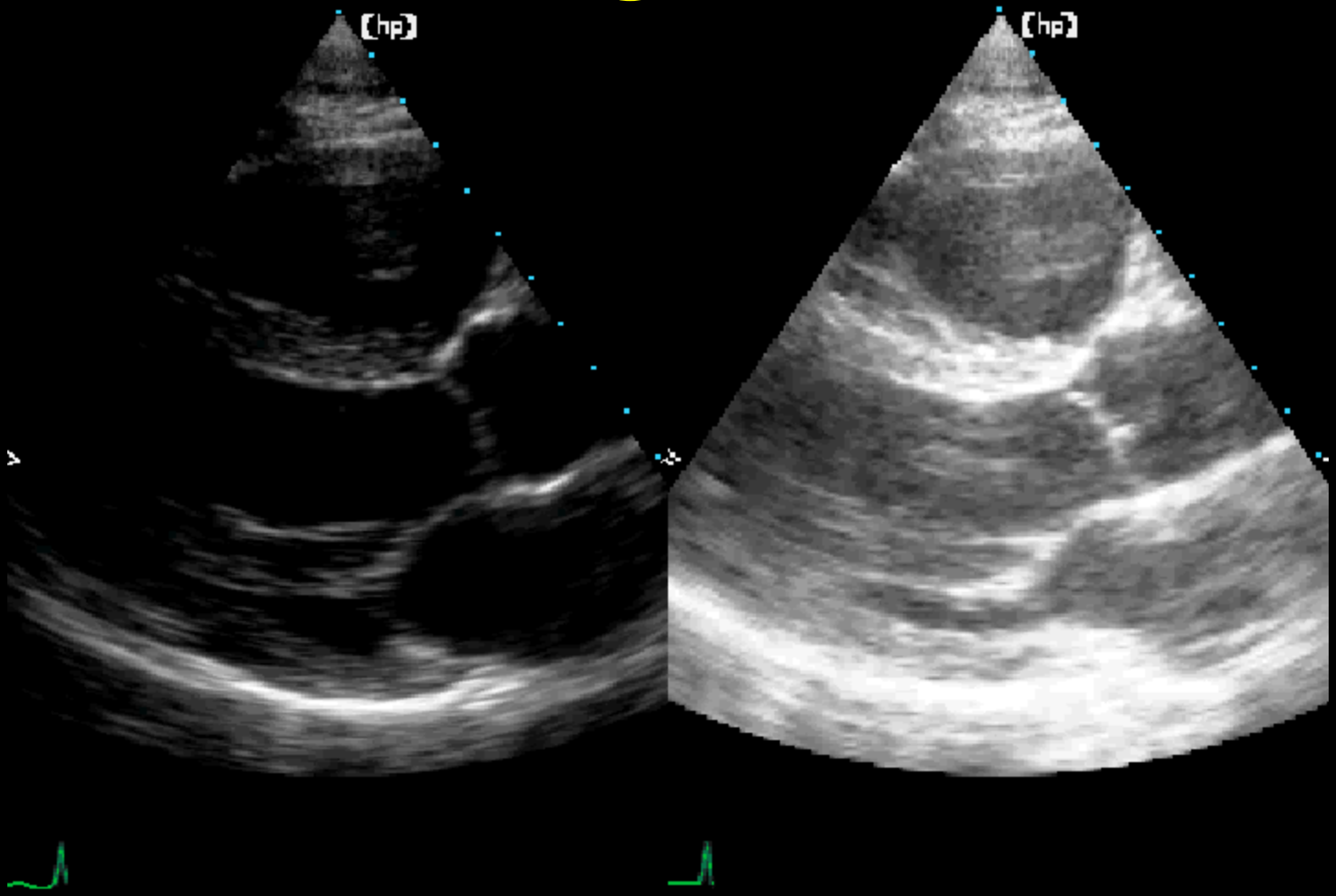
2 Common Mistakes

- Over Gaining
  - destroys resolution

Important controls



2D High Gain



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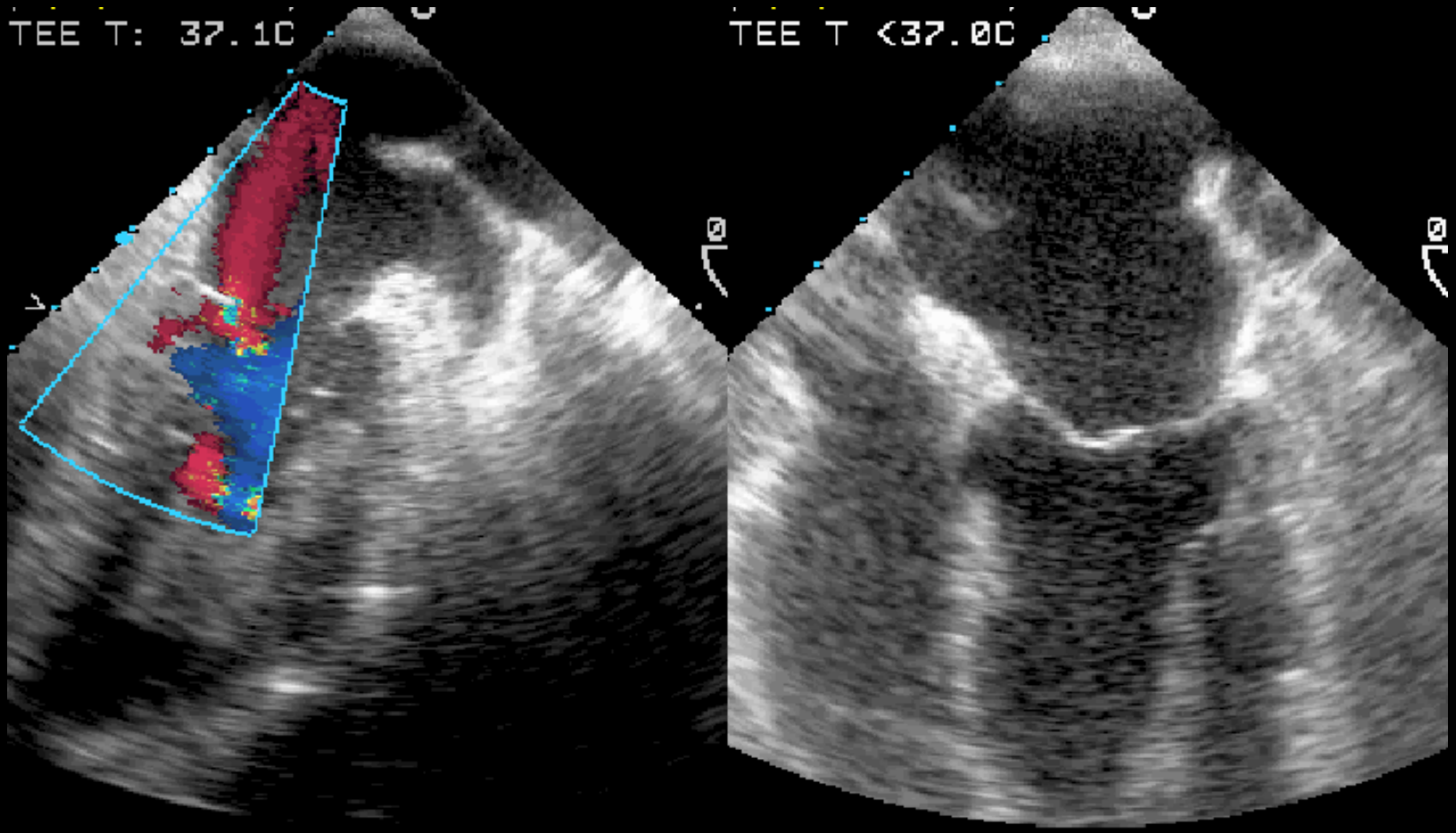
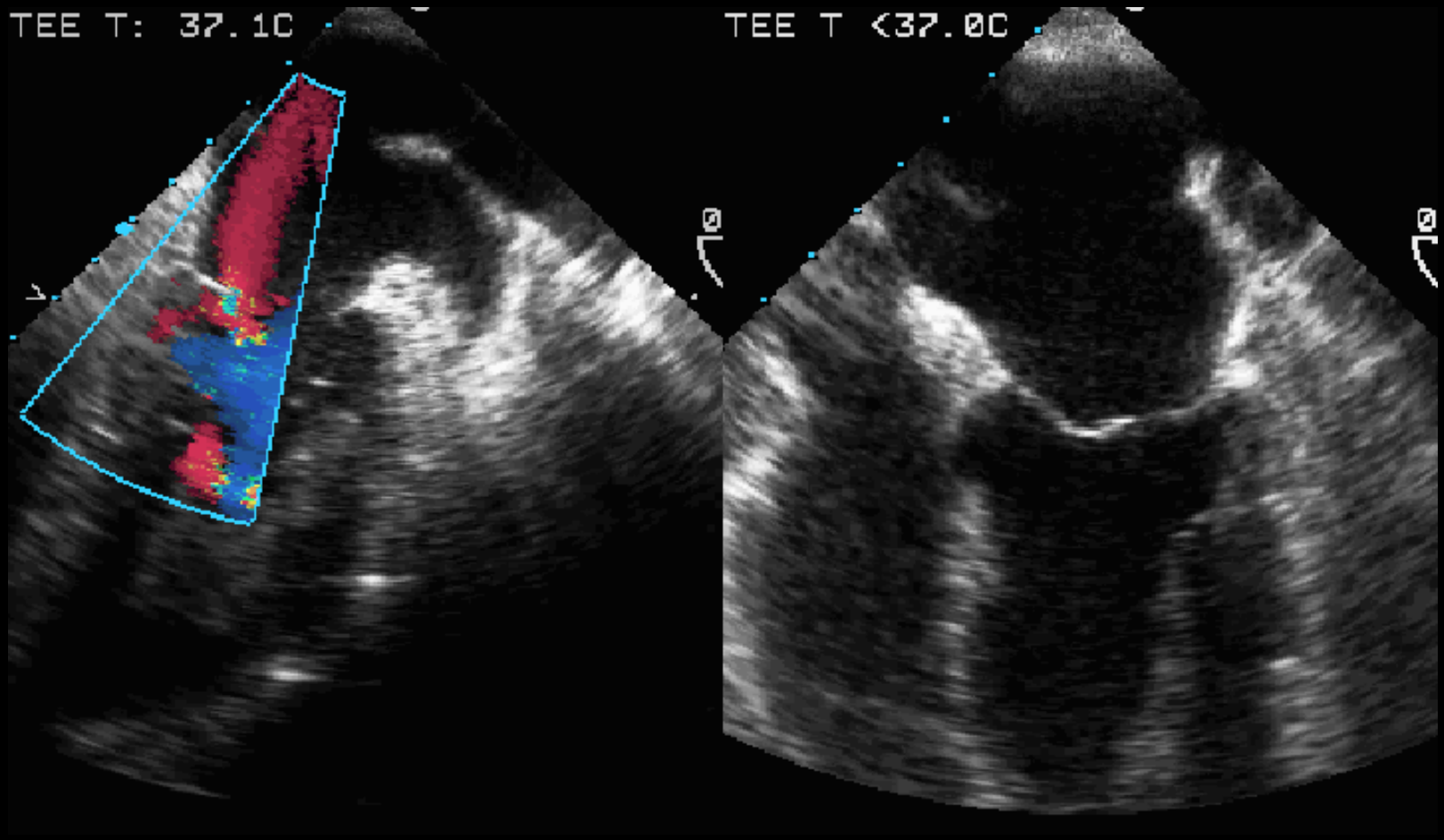
TEE Over Gained



DUKE: Adams

TEE Proper Gain



DUKE: Adams

Sonographer says:

- The images looked fine on the machine!

Monitor Mismatch

- Stay away from deep blacks

Monitor too dark

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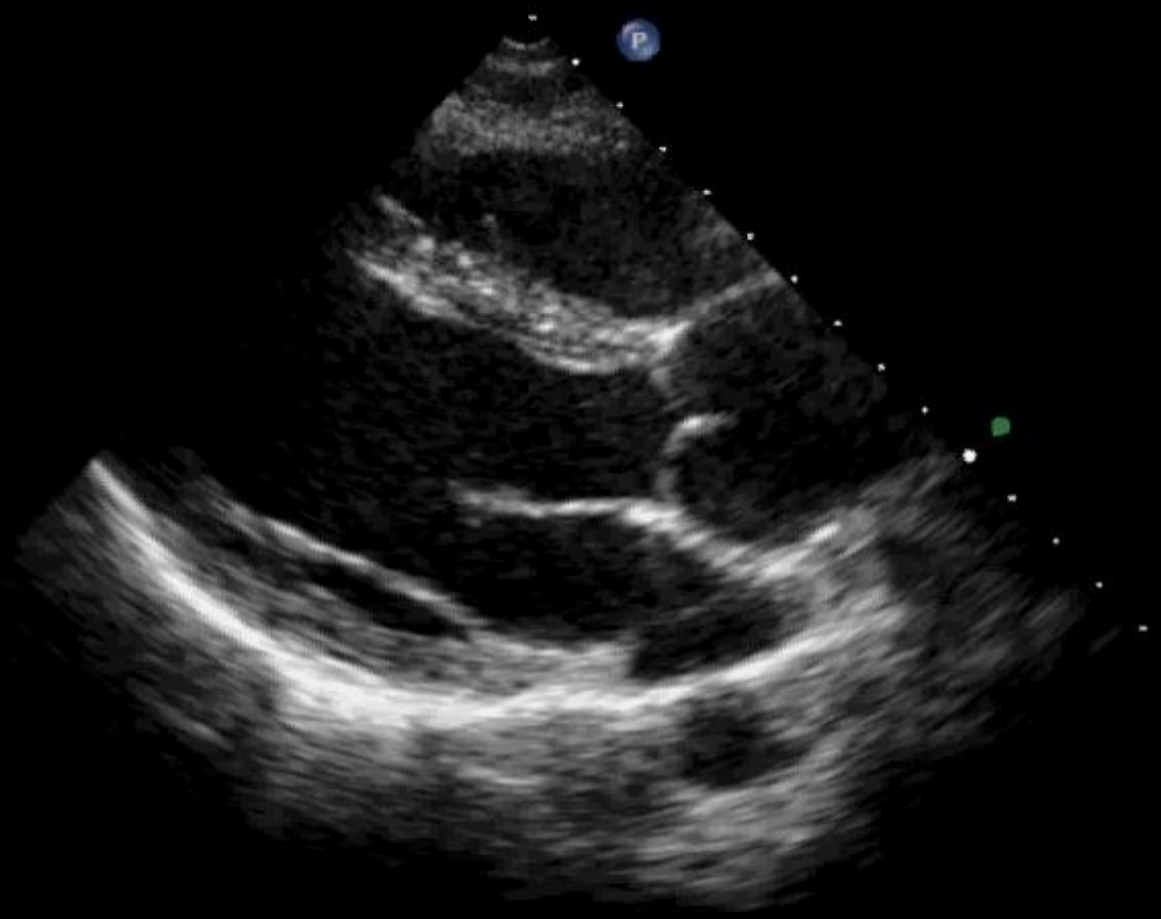
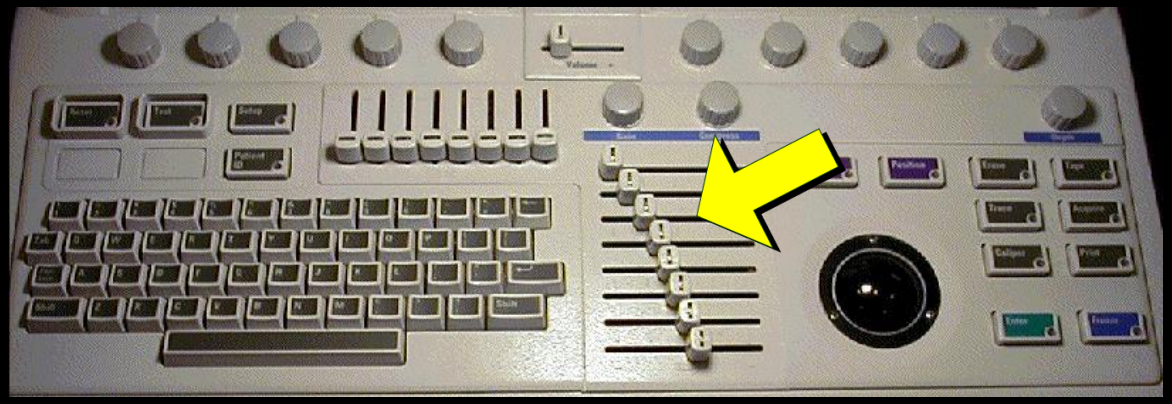
Monitor adjusted



DUKE: Adams

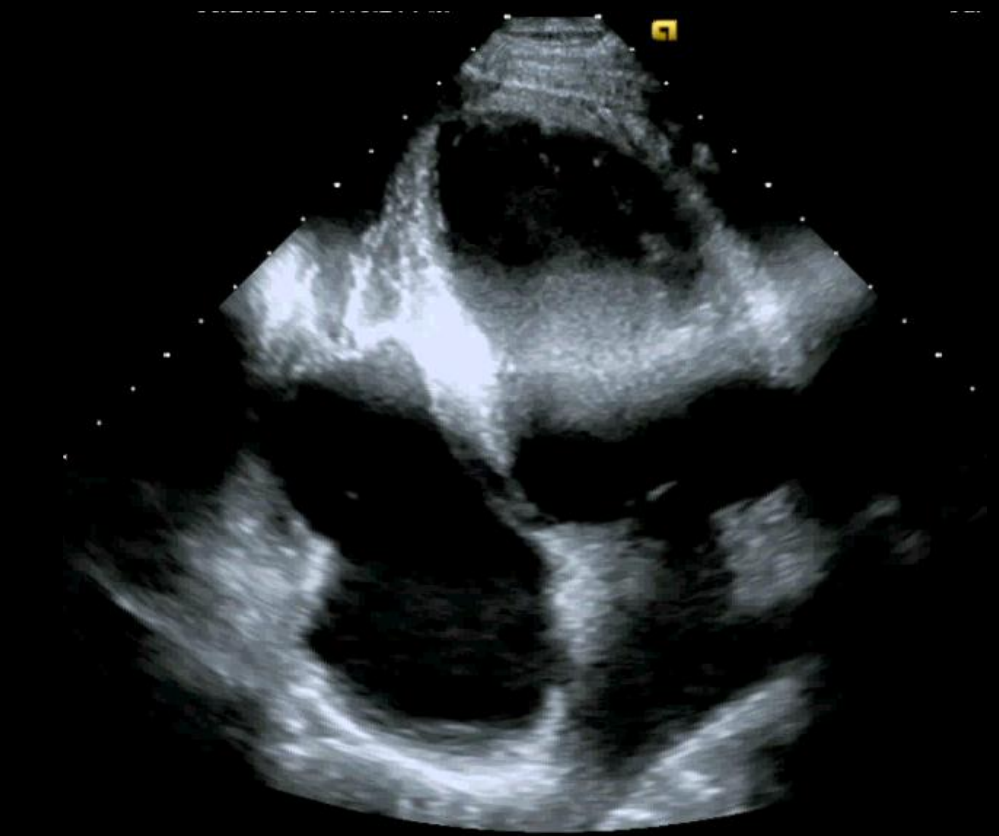
TGC

- Time Gain Compensation
- Evens out the overall image brightness
- Suppresses the strong near field echoes
- Boosts the weaker far field echoes



DUKE: Adams

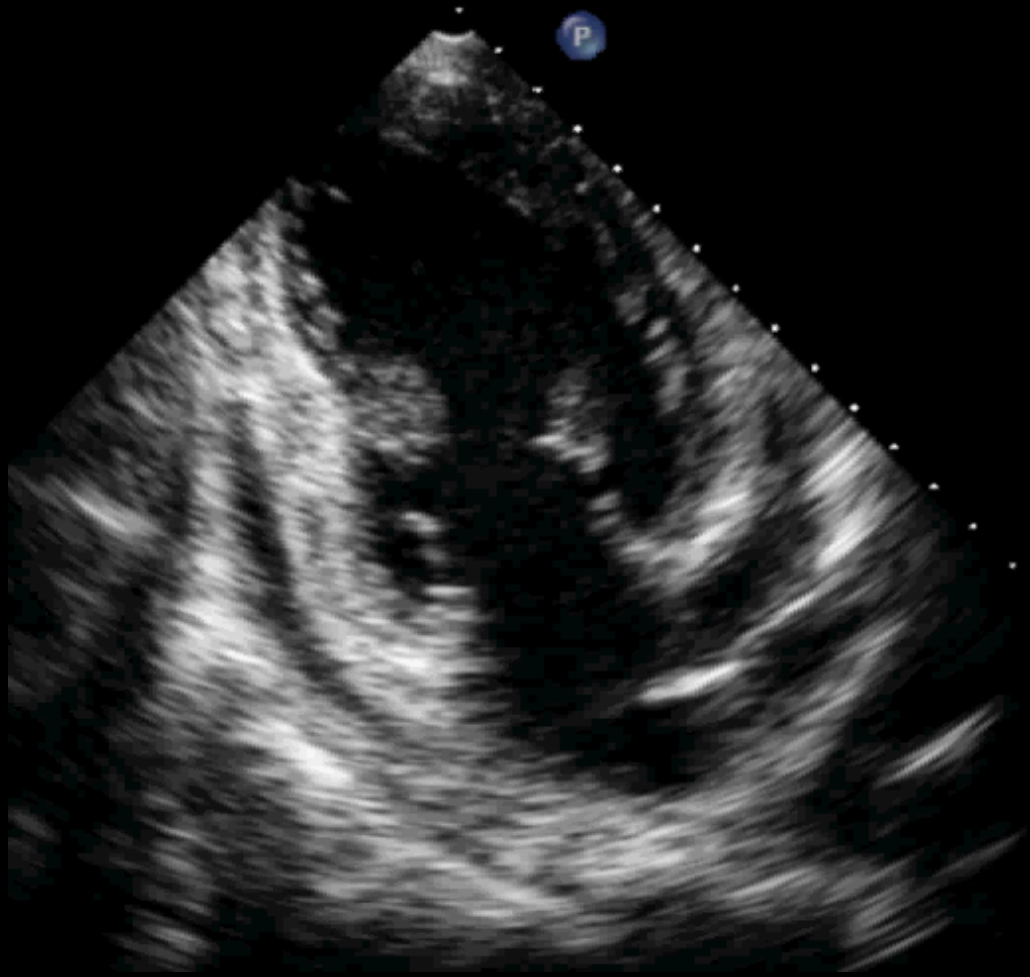
Bad TGC Settings



2 Common Mistakes

- Over gaining
- Foreshortened LV

Foreshortened



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Apical Four - Chamber

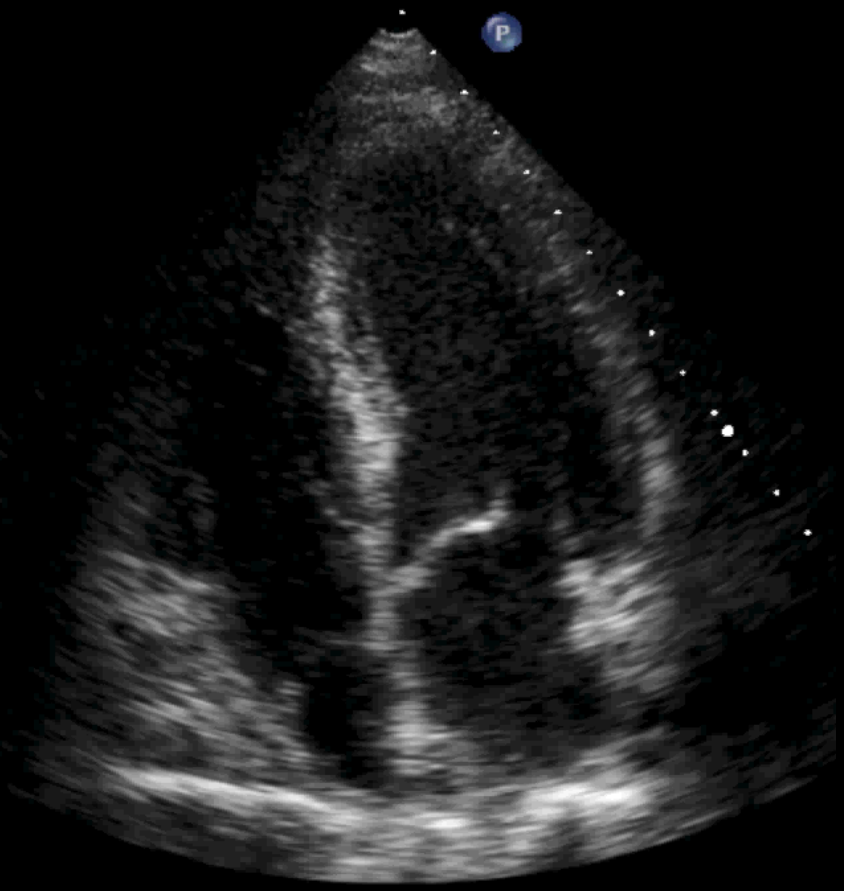

Image true apex

Maximize RV dimension

No aorta

No coronary sinus

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Image Quality

- Resolution
- Target acquisition
- Display (gray scale)

Image Quality

- Resolution
  - dot / detail size
  - the ability to differentiate two points in space

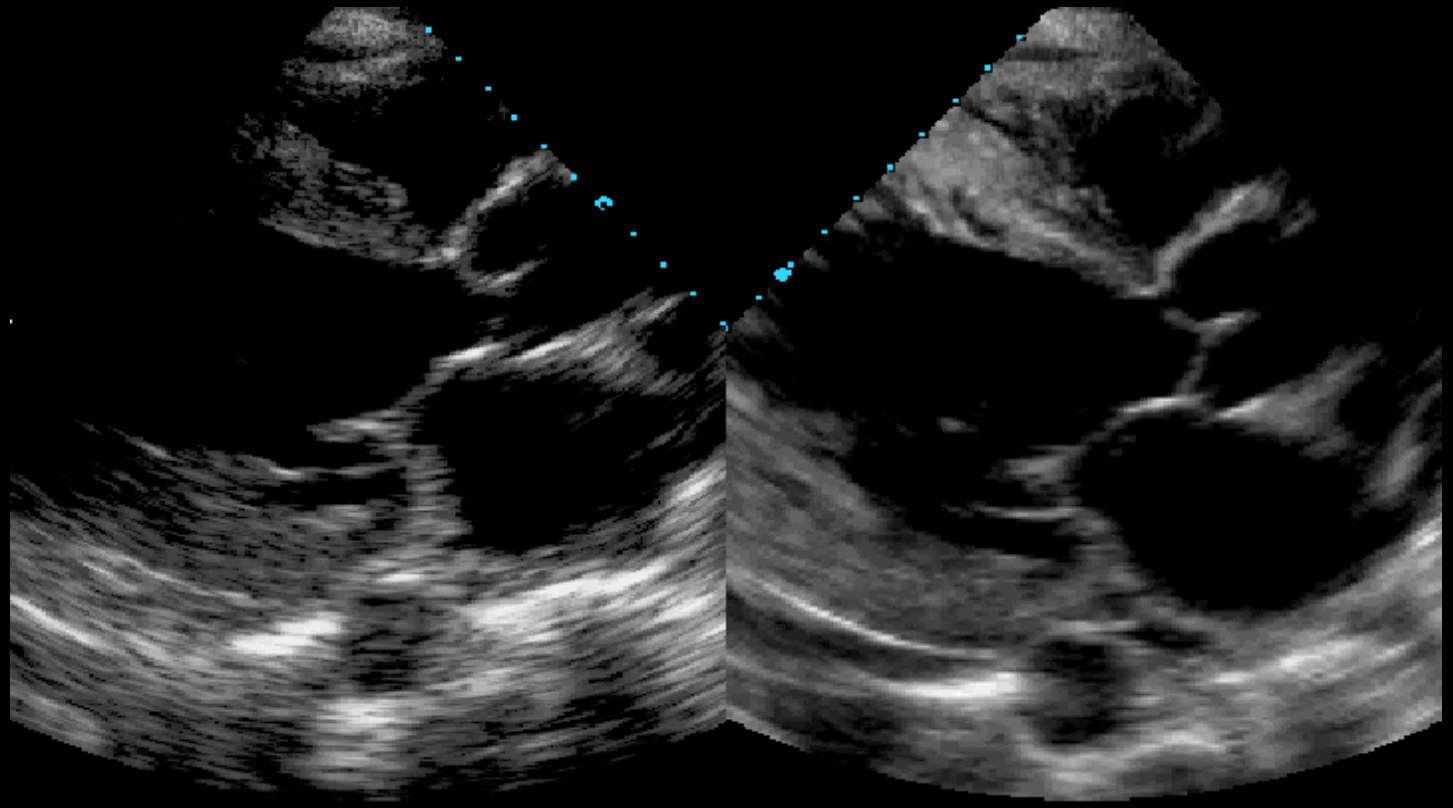
Image Quality

- Resolution
- Depends on frequency
- Varies throughout the image

Transducer frequency

- Lower frequency
  - better penetration (targets)
  - worse resolution
- Higher frequency
  - worse penetration (targets)
  - better resolution

Resolution



2.5 MHz

4.0 MHz

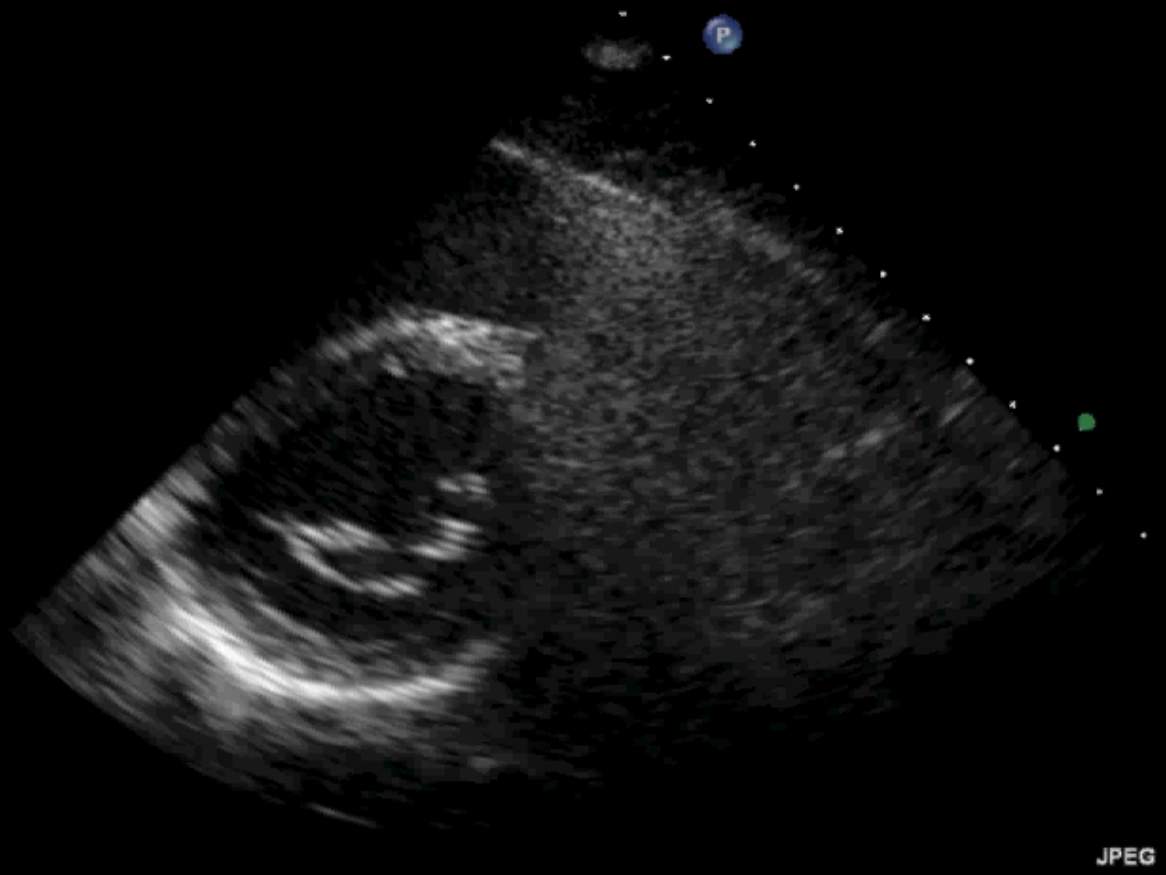
Image Quality

- Resolution
- Target acquisition
  - patient image quality
  - worse with higher frequencies

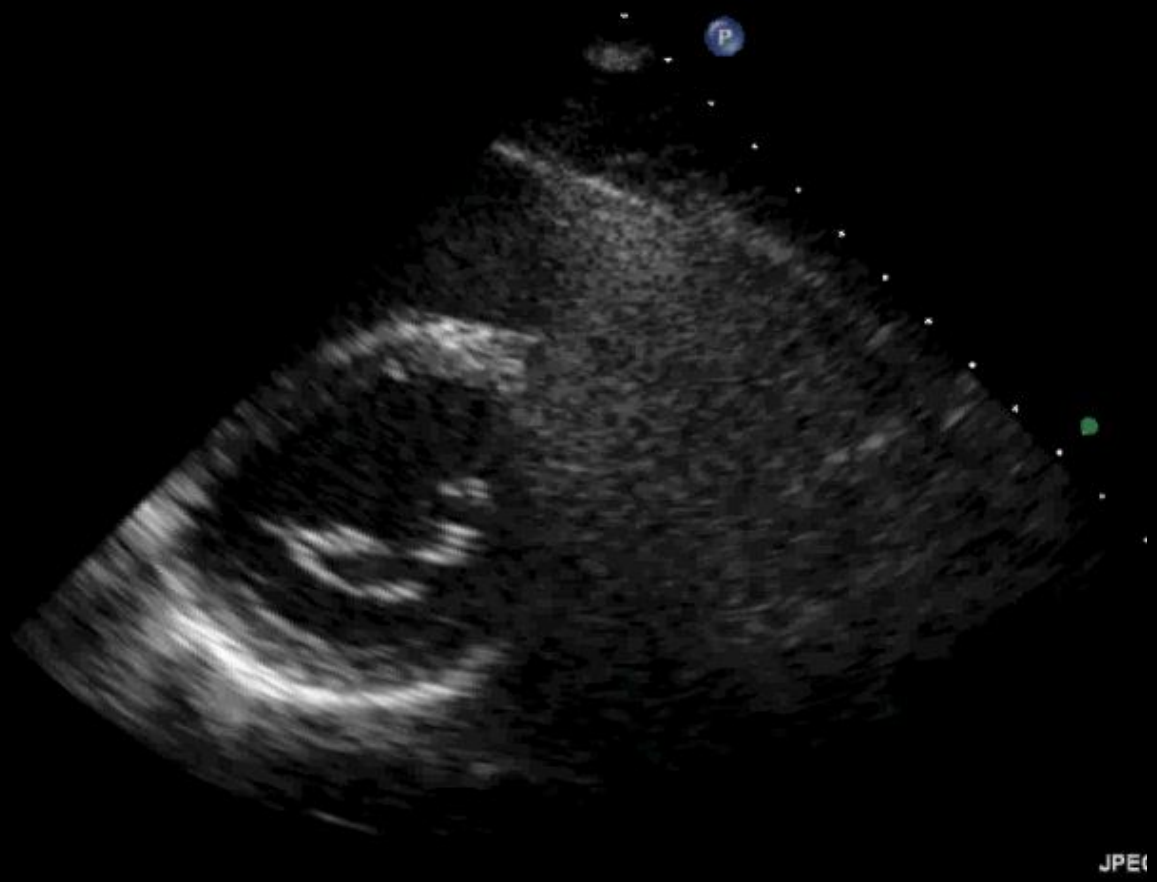
Goals

- Optimizing the images
  - using system controls
  - adjusting the transducer

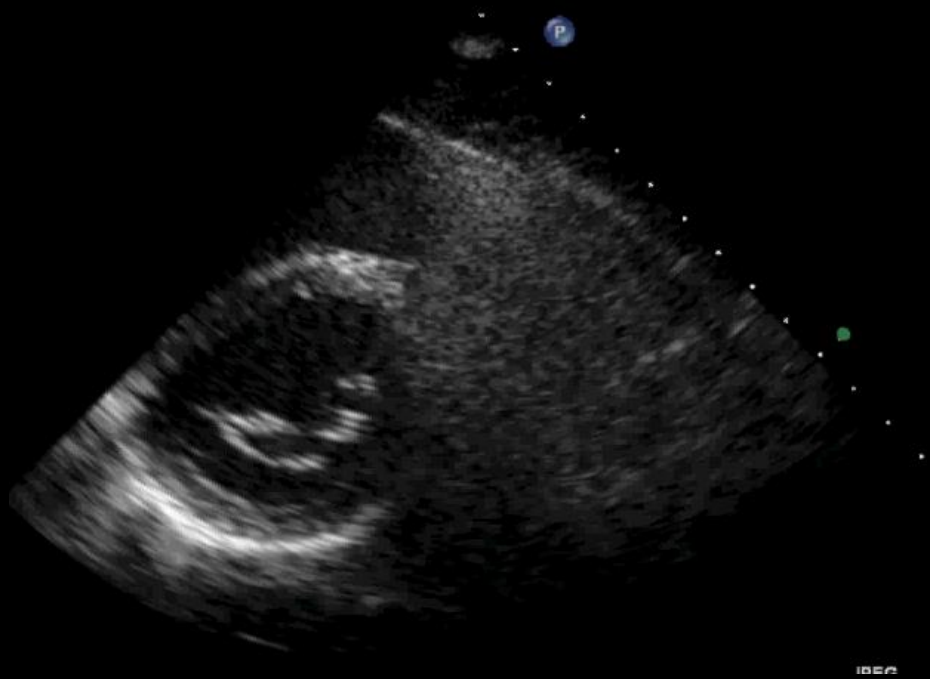
When they show you this.



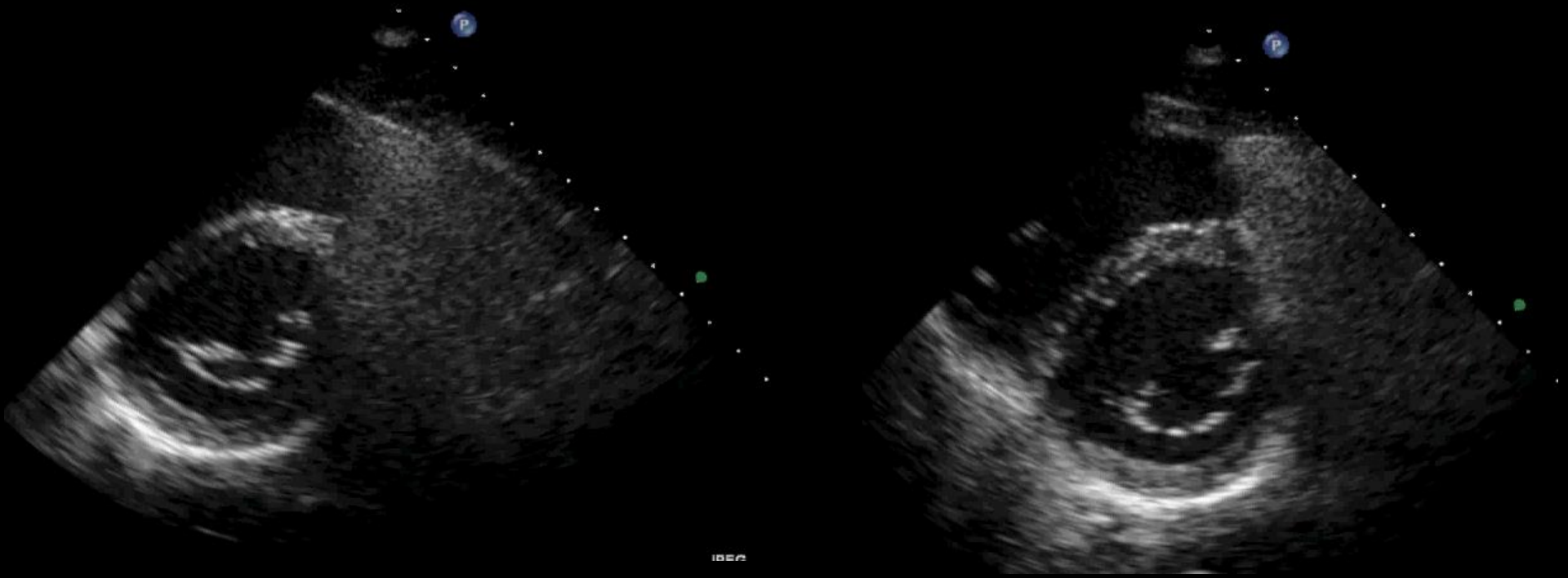
The question might be:



You want to center the SAX.



Sector indicator on pts left



For Doppler

Doppler spectral controls

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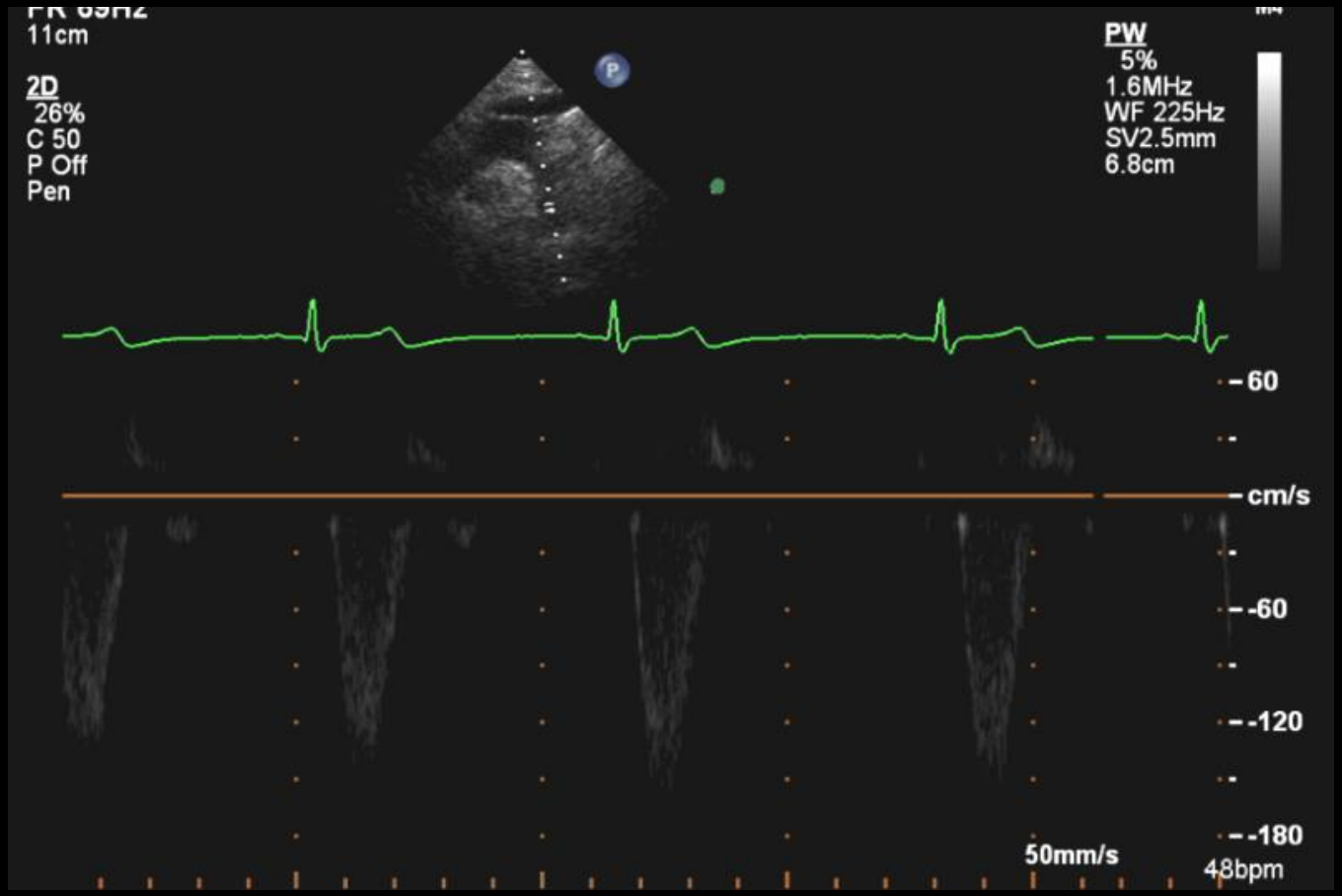
Doppler Spectral

- Gain
- Wall filter
- Baseline shift
- Compression (gray scale)

Low Doppler Gain



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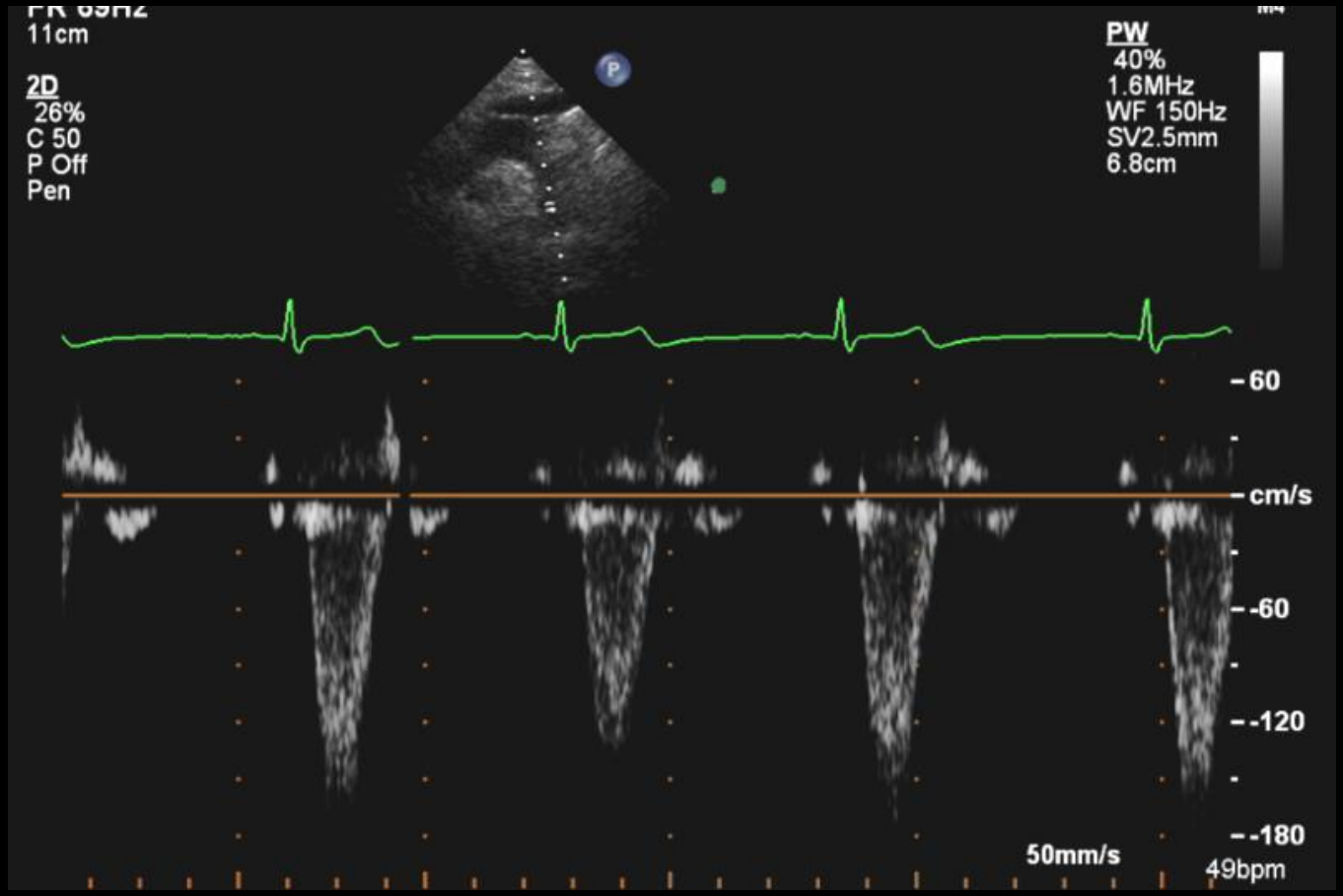
High Doppler Gain

DUKE: Adams

Just Right Doppler Gain

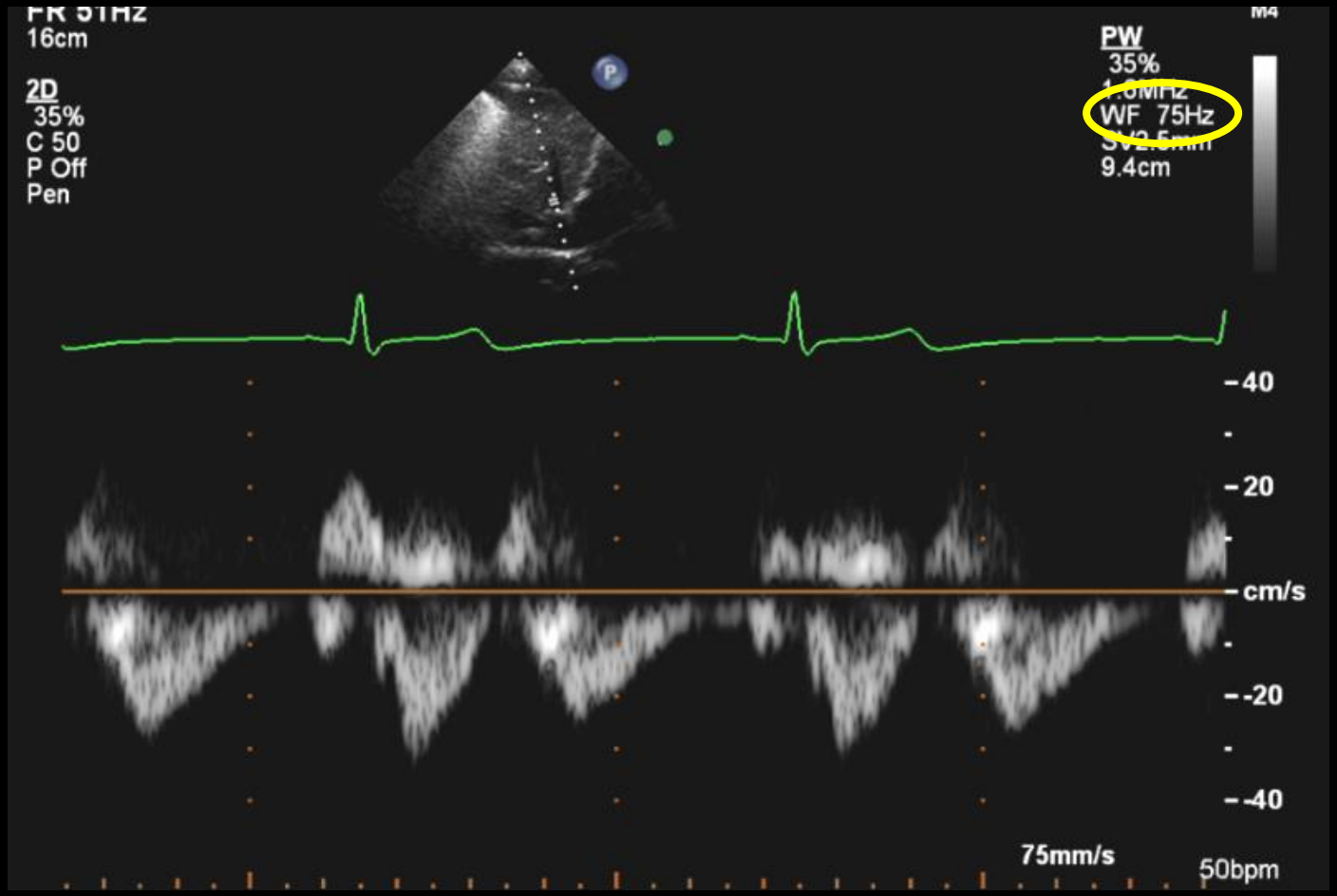


DUKE: Adams

Doppler Spectral

- Gain
- Wall filter
  - used to suppress low velocities around the baseline
  - use less wall filter in order to accurately measure low velocity flows
  - use more filter when looking at high velocity jets (MR, AS, etc…)

Low Wall Filter (75 Hz)



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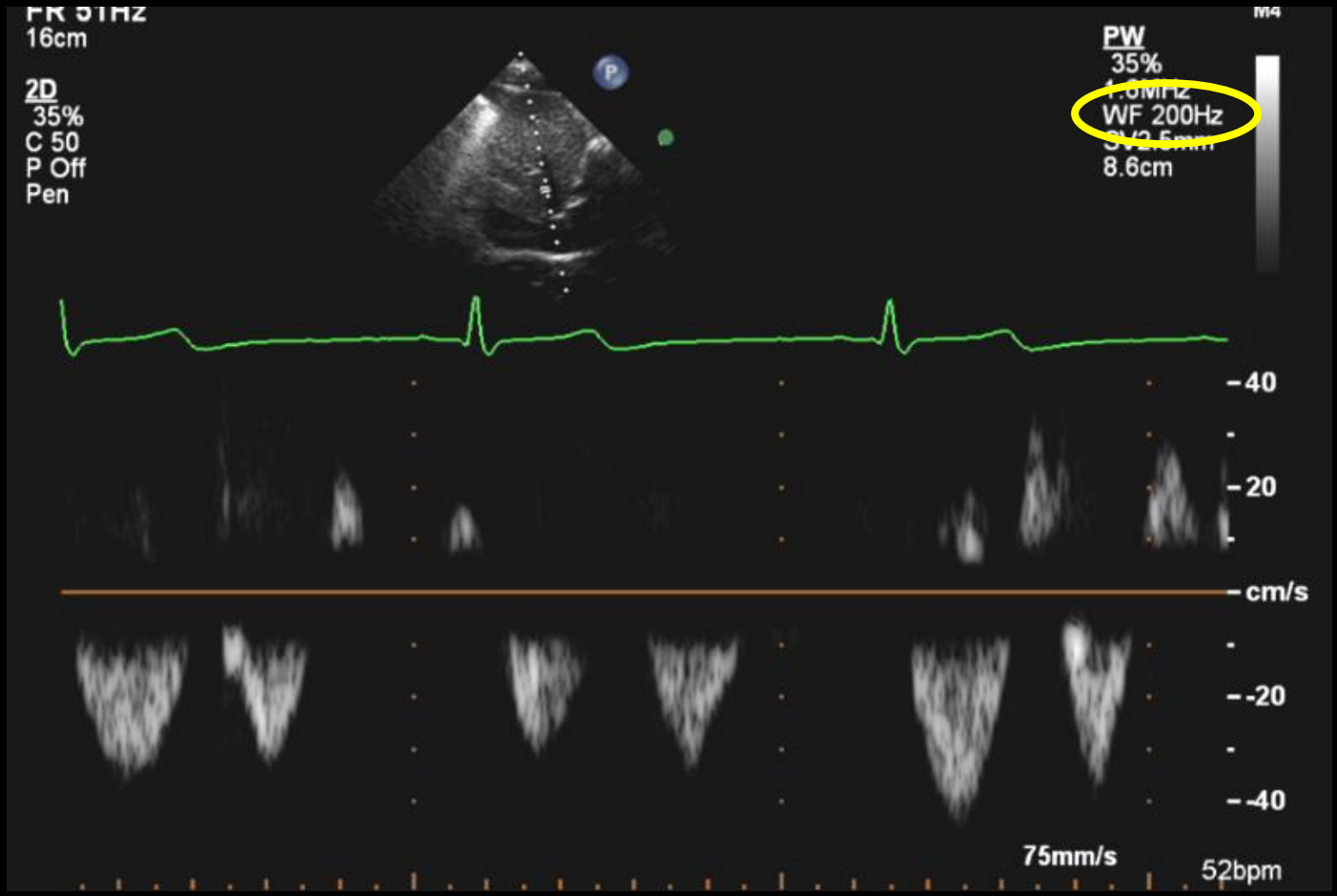
High Wall Filter (200 Hz)



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Doppler Spectral

- Gain
- Wall filter
- Baseline shift

Baseline Shifted too Low

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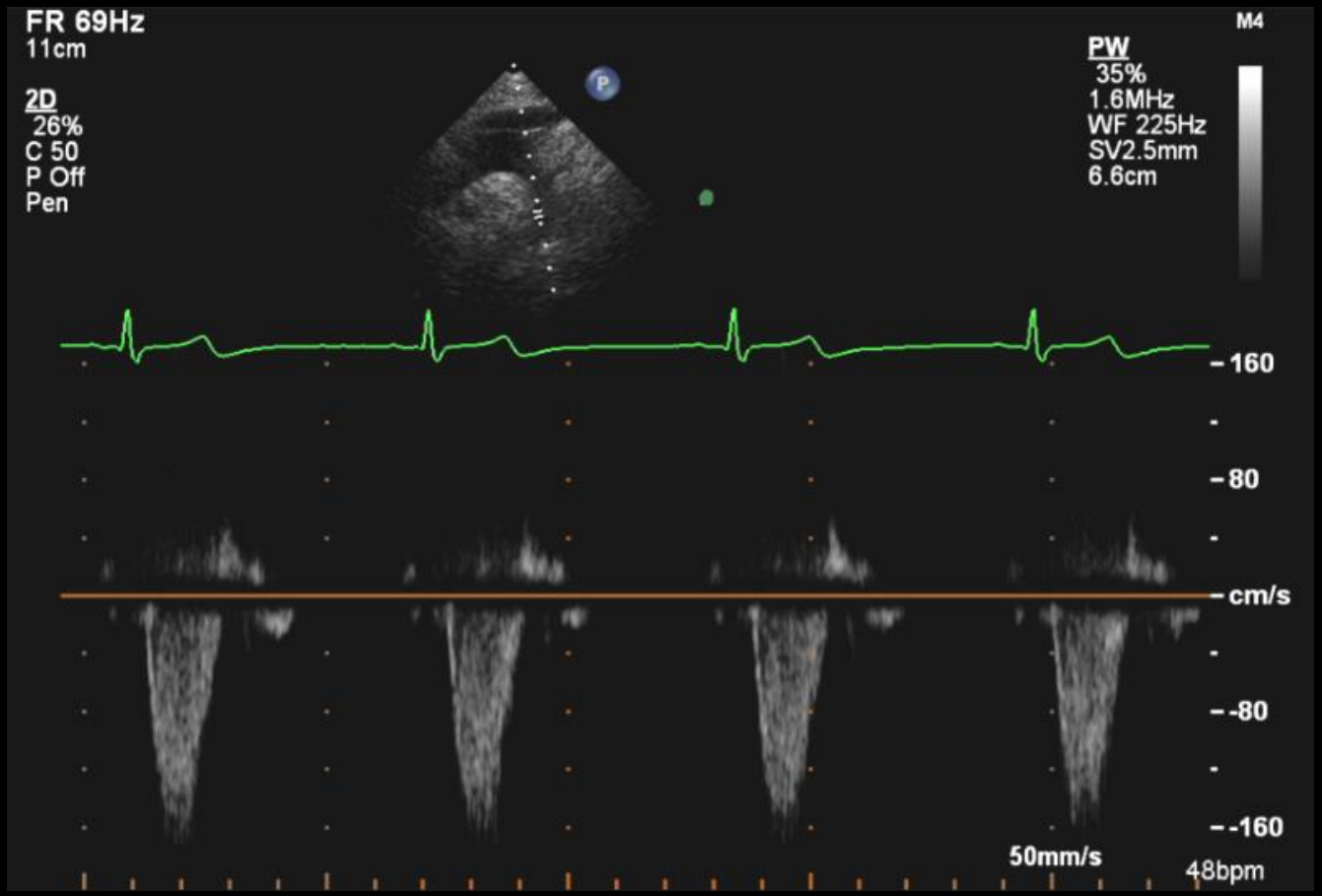
Correct Baseline Shift

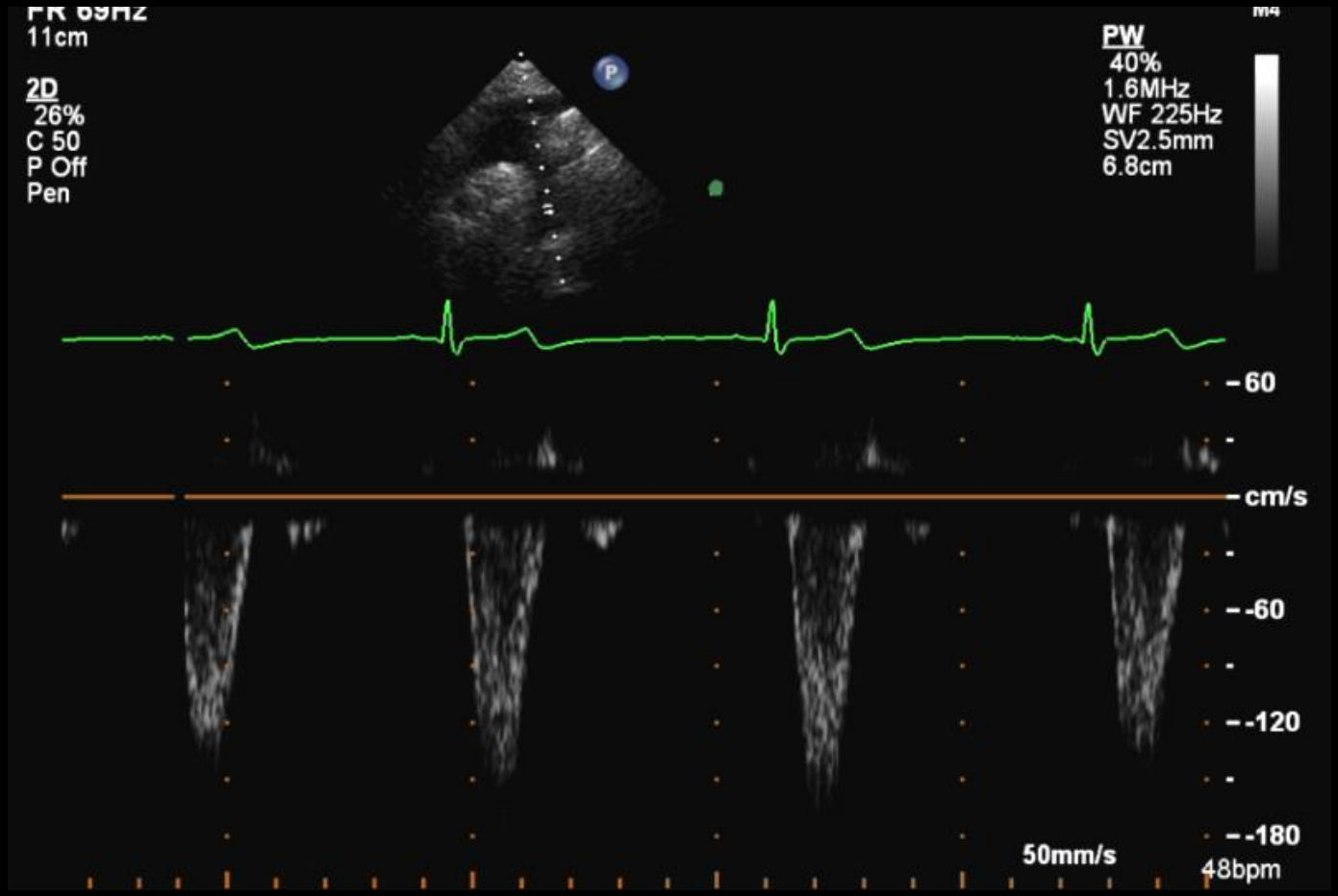


DUKE: Adams

Doppler Spectral

- Gain
- Wall filter
- Baseline shift
- Compression (gray scale)

Less Compression



DUKE: Adams

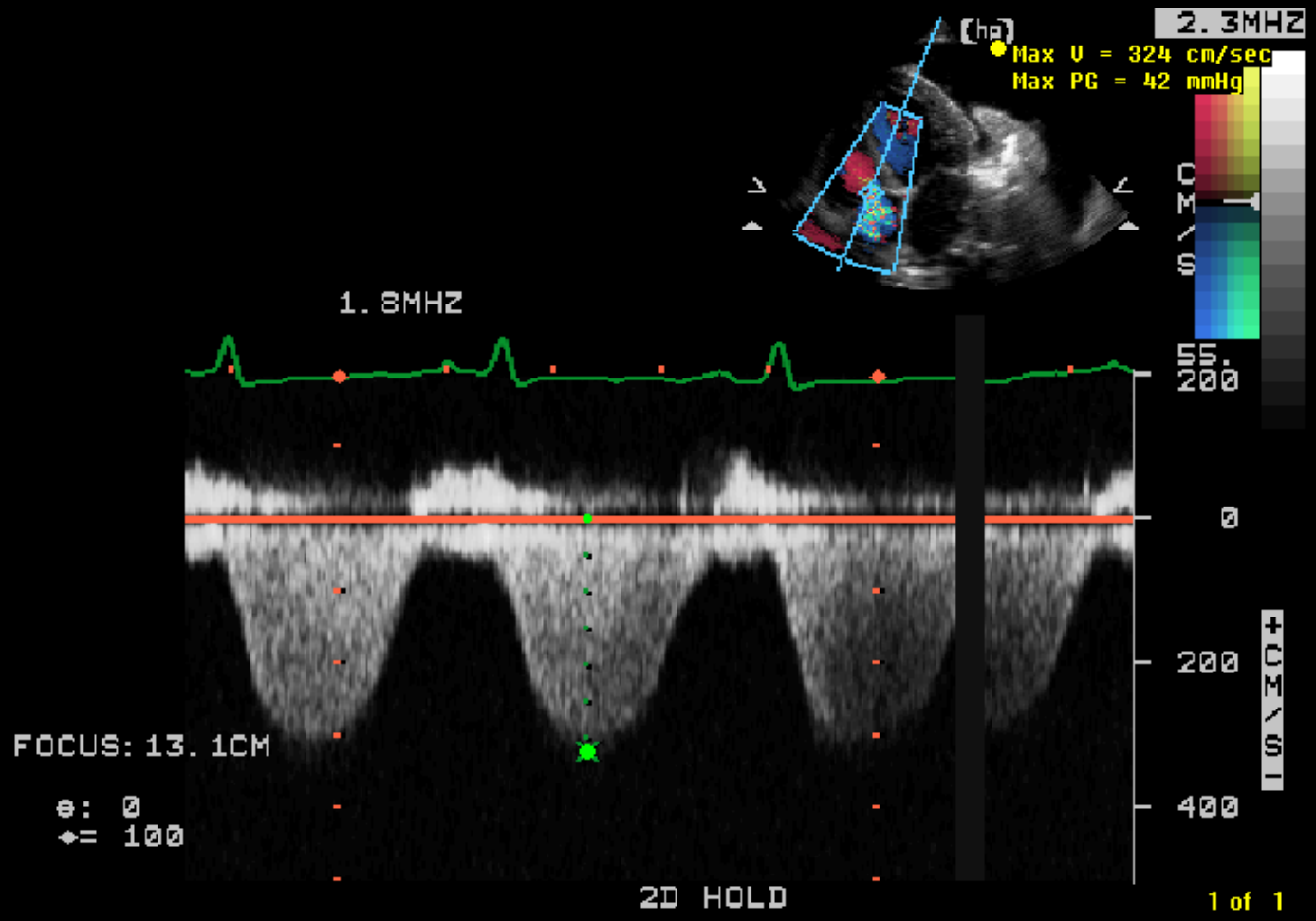
More Compression

DUKE: Adams

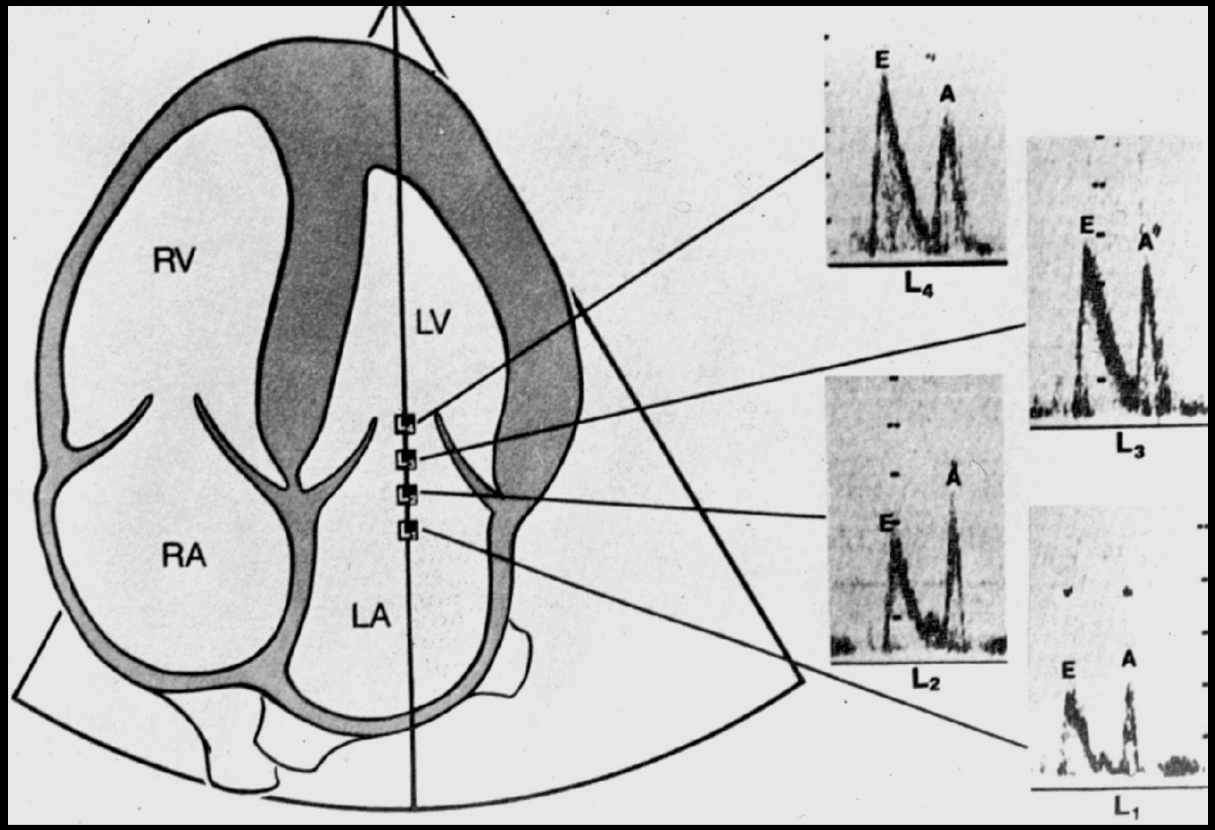
Goals

- Optimizing the valves
- Using system controls or transducer movements

Not a knobology issue



DUKE: Adams



Difference between annulus and tips on Doppler waveform (L2 & L4).

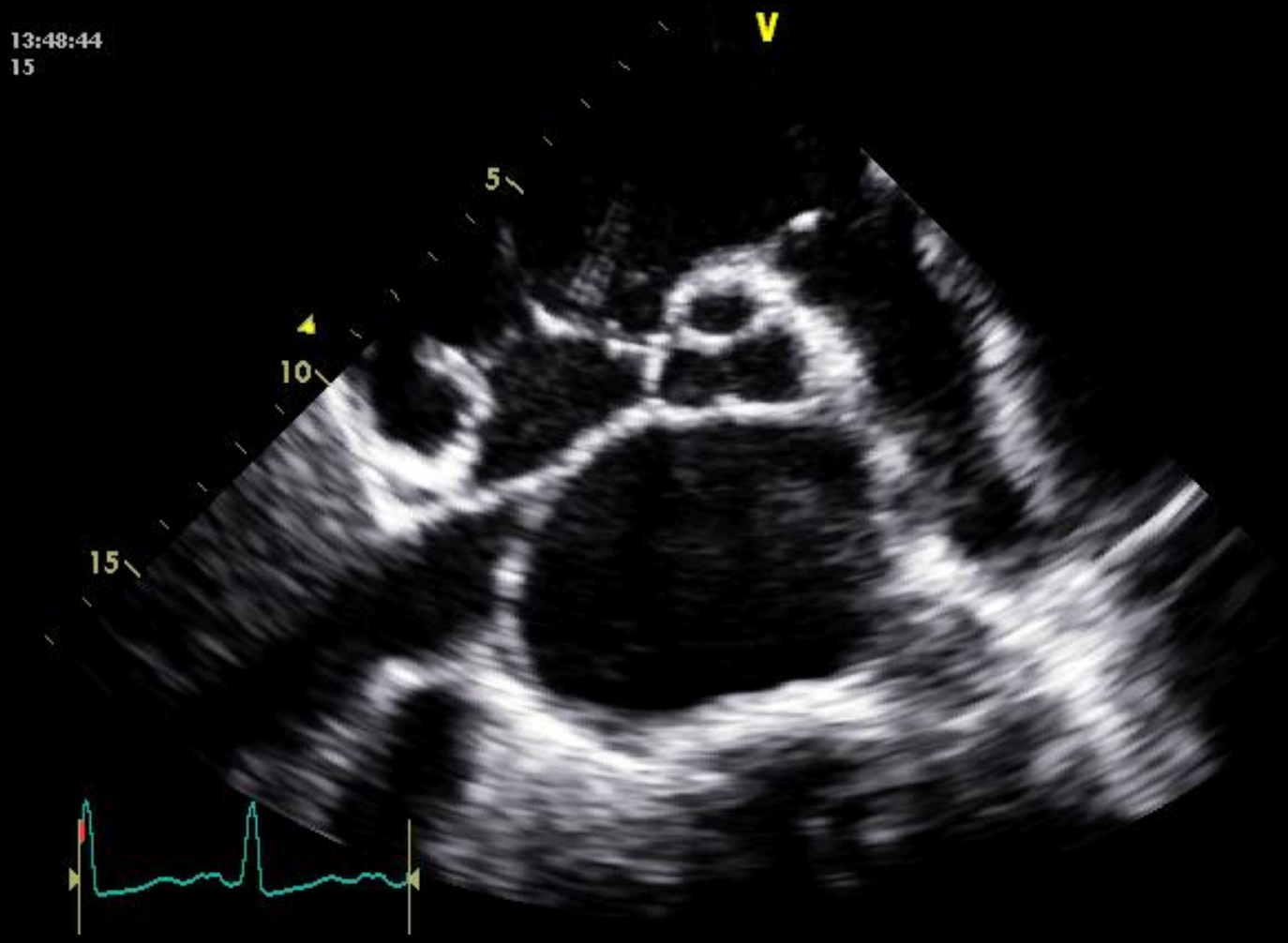
Doppler - Mitral

- Apical 4 chamber
- Pulsed, low freq/gain
- Small sample size
- At leaflet tips

Doppler – Pulm. Veins

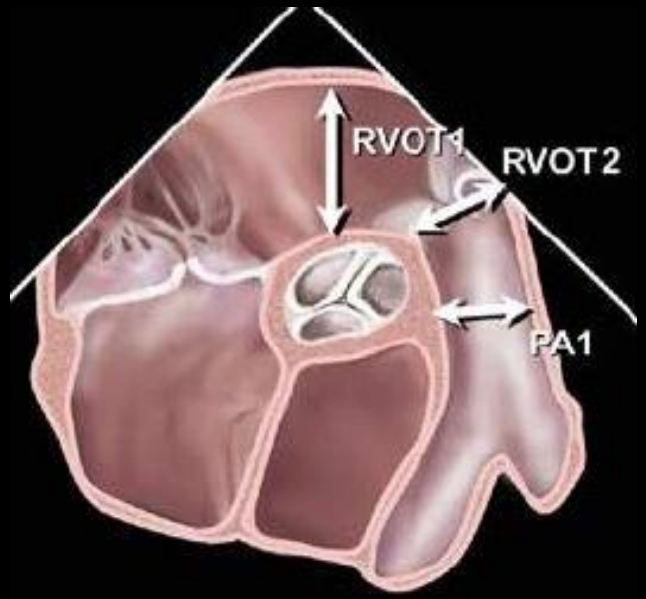
- Apical 4 chamber
- Pulsed, low freq/gain
- Medium sample size
- 1-2 cm into vein

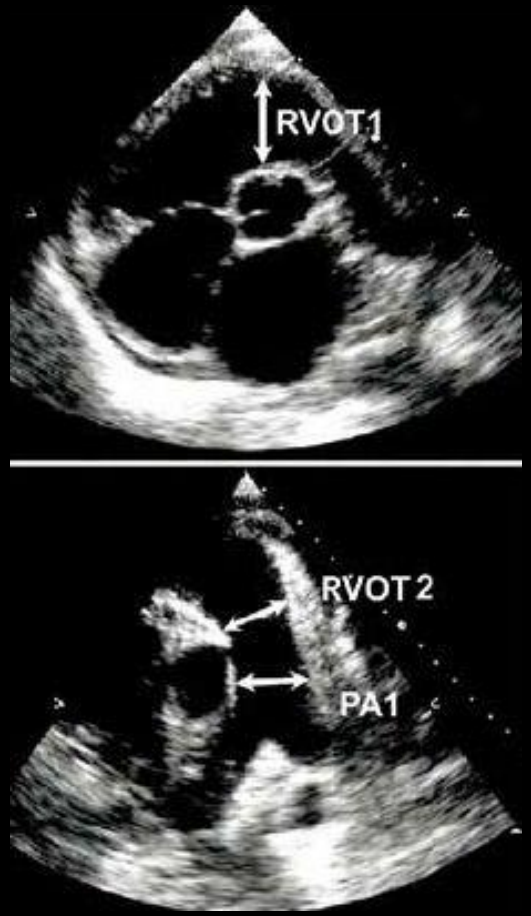
Parasternal SAX Ao



DUKE: Adams

2005 ASE Chamber Quantification Guidelines



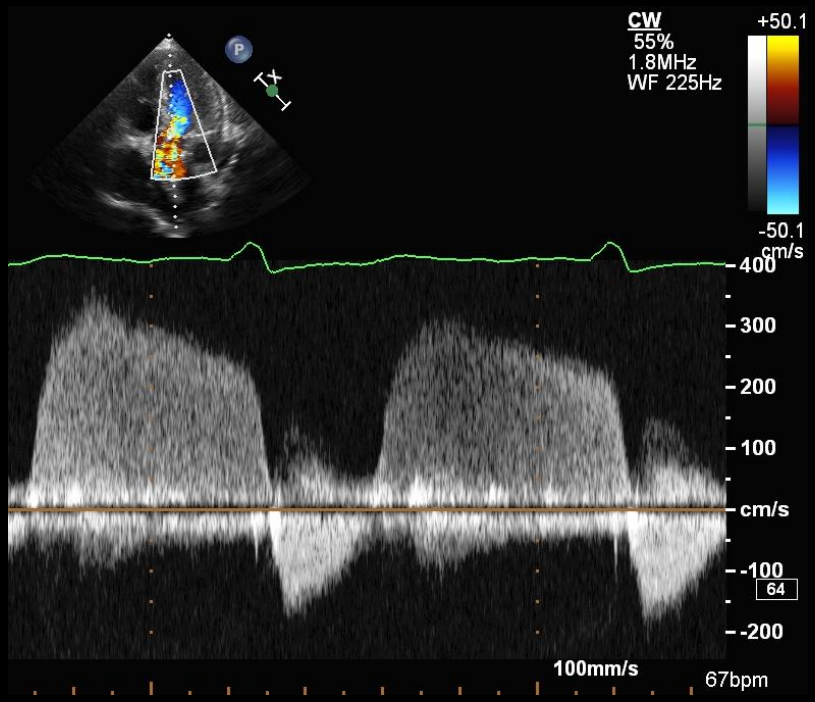


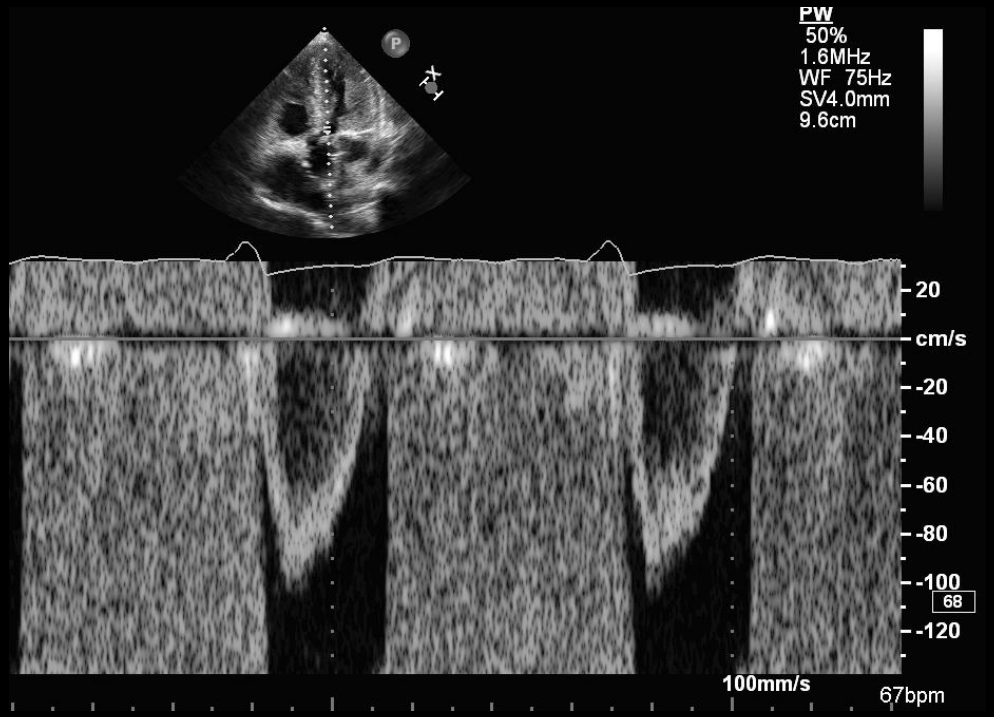
DUKE: Adams

Goals

- Optimizing the valves
  - Imaging - using system controls or transducer movements
  - Doppler – PW or CW

CW vs PW Doppler





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Doppler – Pulm. Veins

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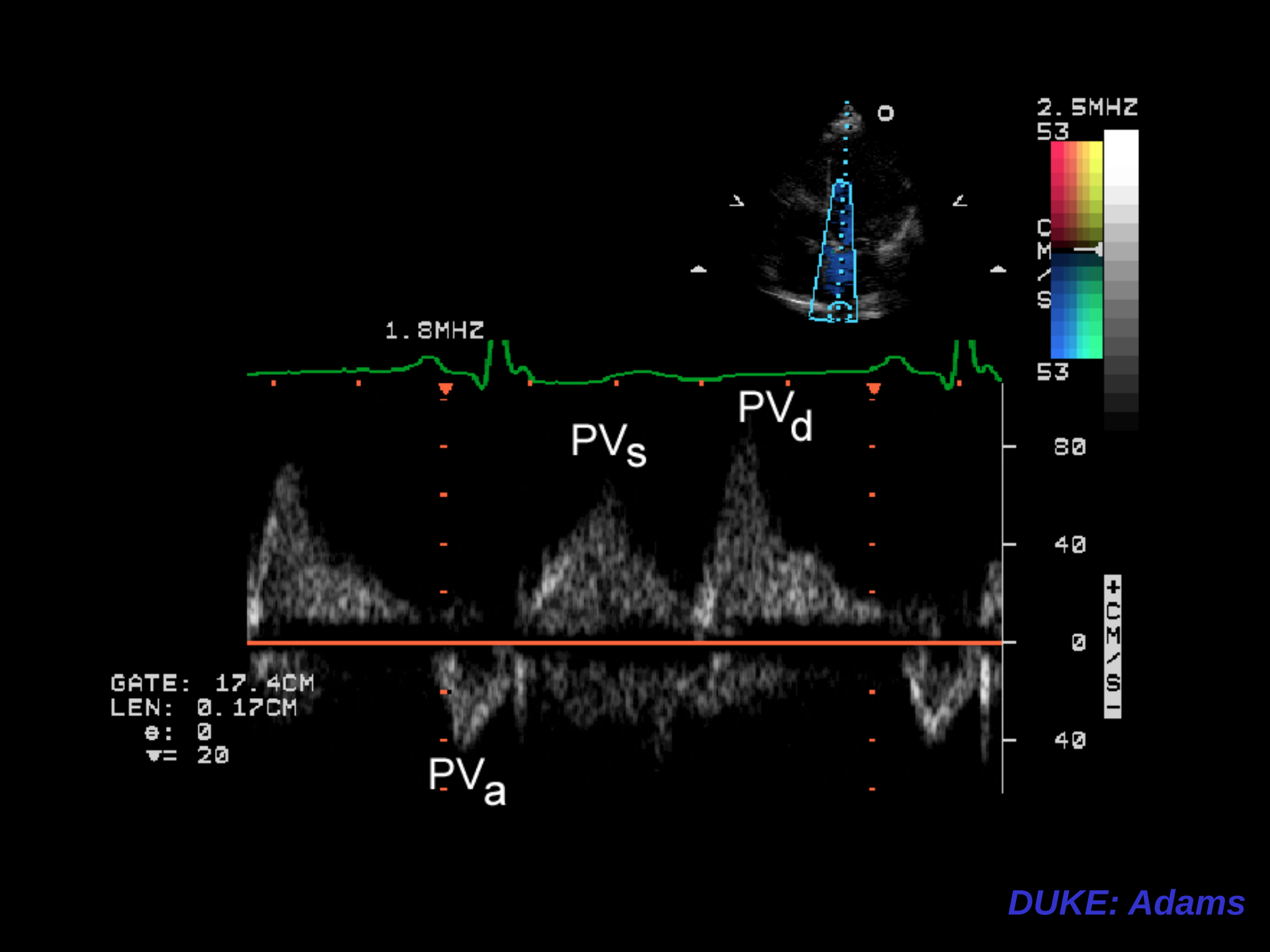
2.5MHZ
53
CM/S
53
1.8MHZ
PVs
PVd
PVa
80
40
0
40
+CM/S-
GATE: 17.4CM
LEN: 0.17CM
θ: 0
▼= 20

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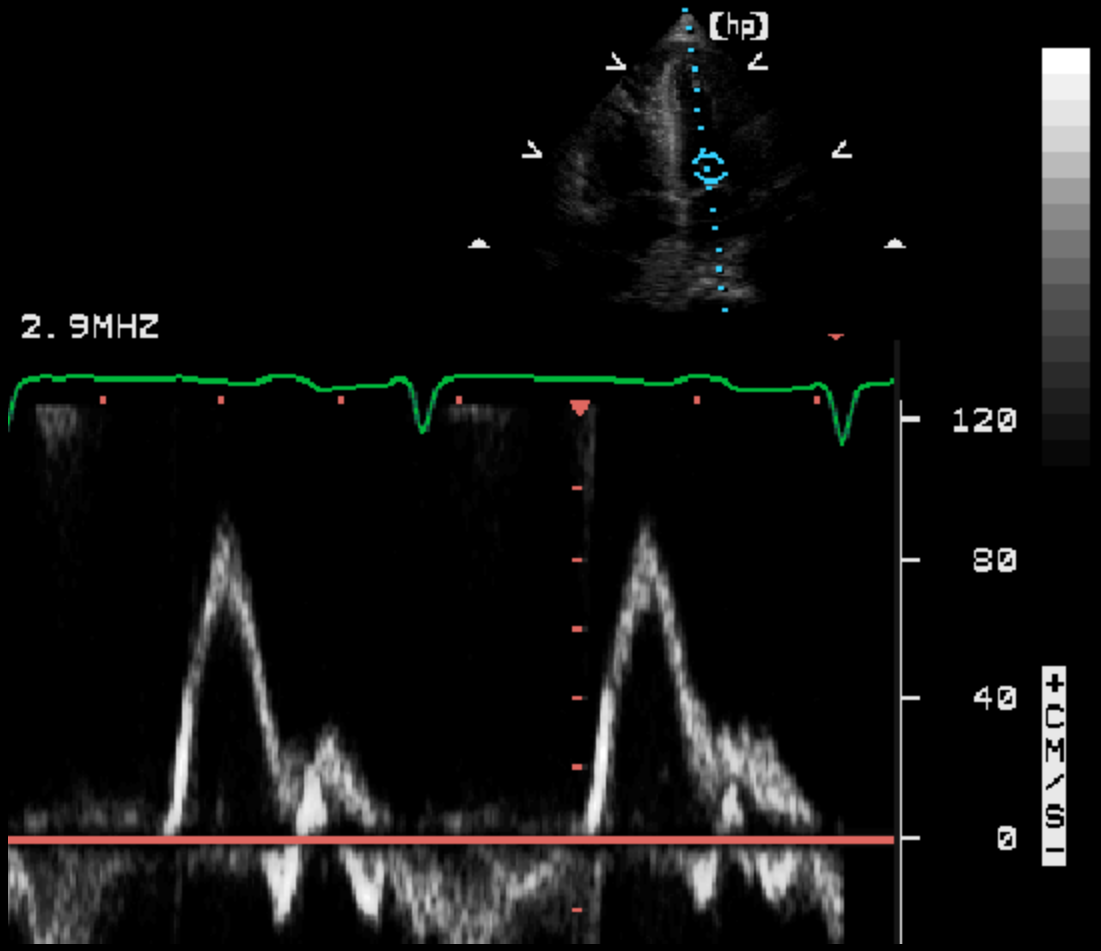
Less Wall Filter



DUKE: Adams

Systematic Approach

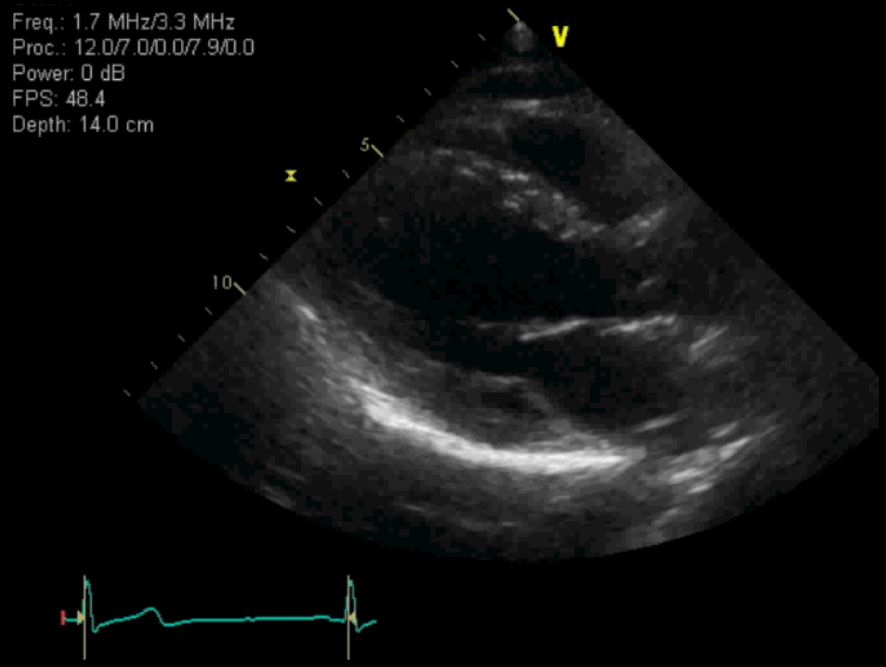
- Optimal gray scale
- Adjust the monitor
- Image in view / depth
- Focus point
- TGC – even gray throughout
- Overall gain – do not over gain!!!
- Compress
- ↑↓ TGC/LGC

DUKE: Adams

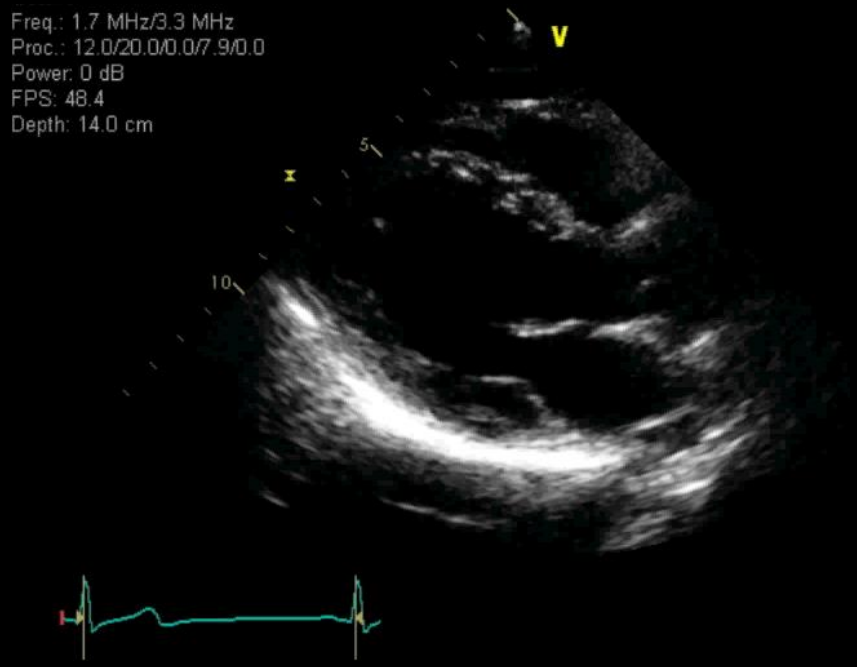
Gray Scale

- Contrast resolution
- Softness / brightness
- Post processing
- Persistence

GRAYSCALE



Wide range of gray



Narrow range of gray

Why is it important?

- Accurate information
- Better diagnosis
- Know limitations
- Pass the exam

Post Lecture Test

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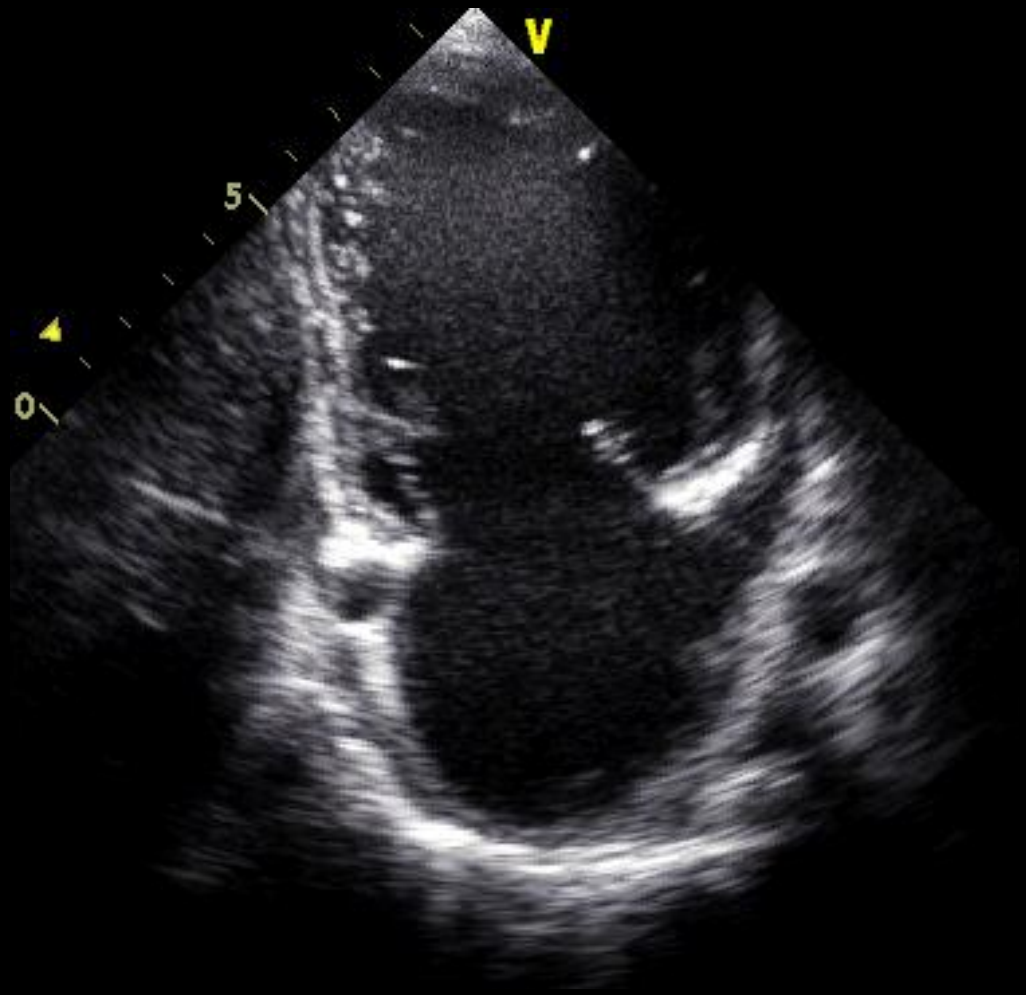
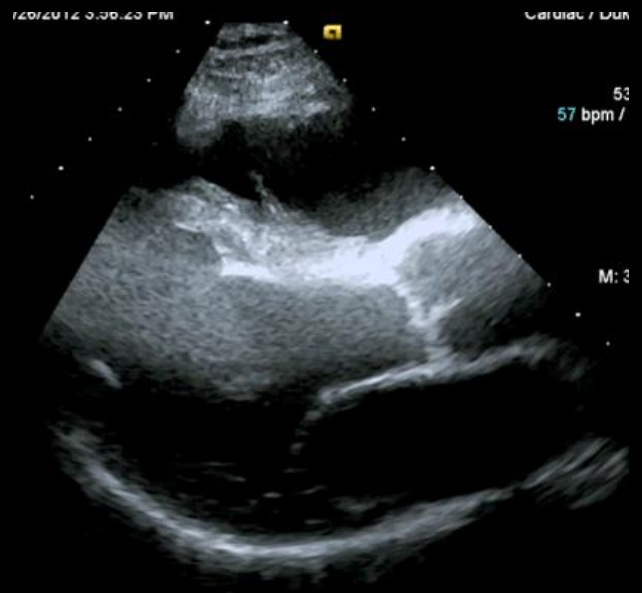
Apical 2 Chamber



DUKE: Adams



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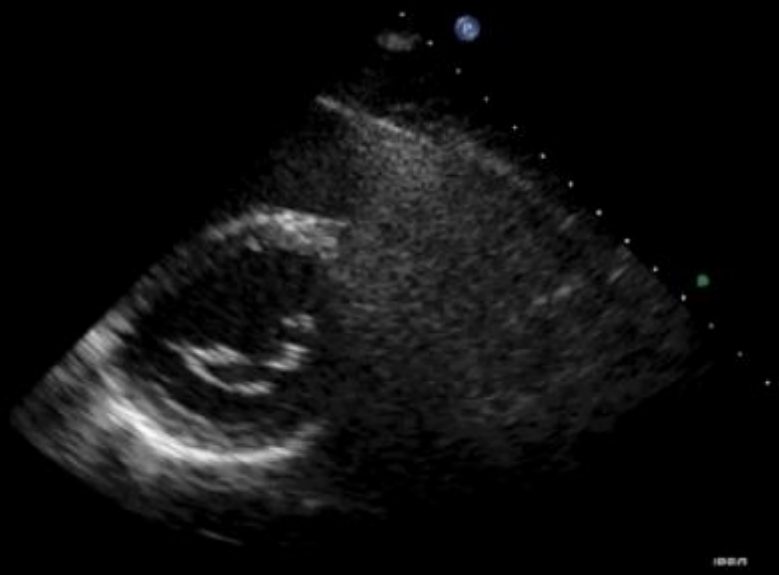

a) laterally

b) medially

c) cranially-up an interspace

d) caudally-down an interspace

10

Where should you position the pulsed wave Doppler sample volume for mitral inflow?

1. at the mitral valve annulus
2. in the middle of the mitral leaflets
3. at the tips of the mitral valve in systole
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The best view to measure the RVOT, pulmonic valve and PA flow is:

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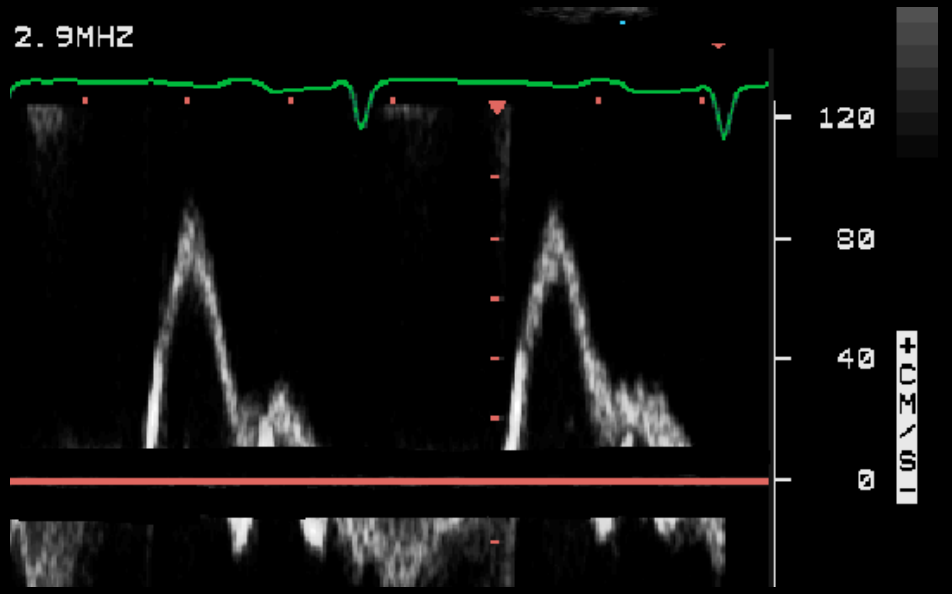

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The End