

Echo Artifacts: The Cause and Solution

NCUS

3/14/15

David Adams, RCS, RDCS, FASE

Duke University Medical Center

Disclosures

None

My Happy / Sad ratio

- 20% Sad
 - 1st talk on Sunday (post party)
 - Talk about Artifacts

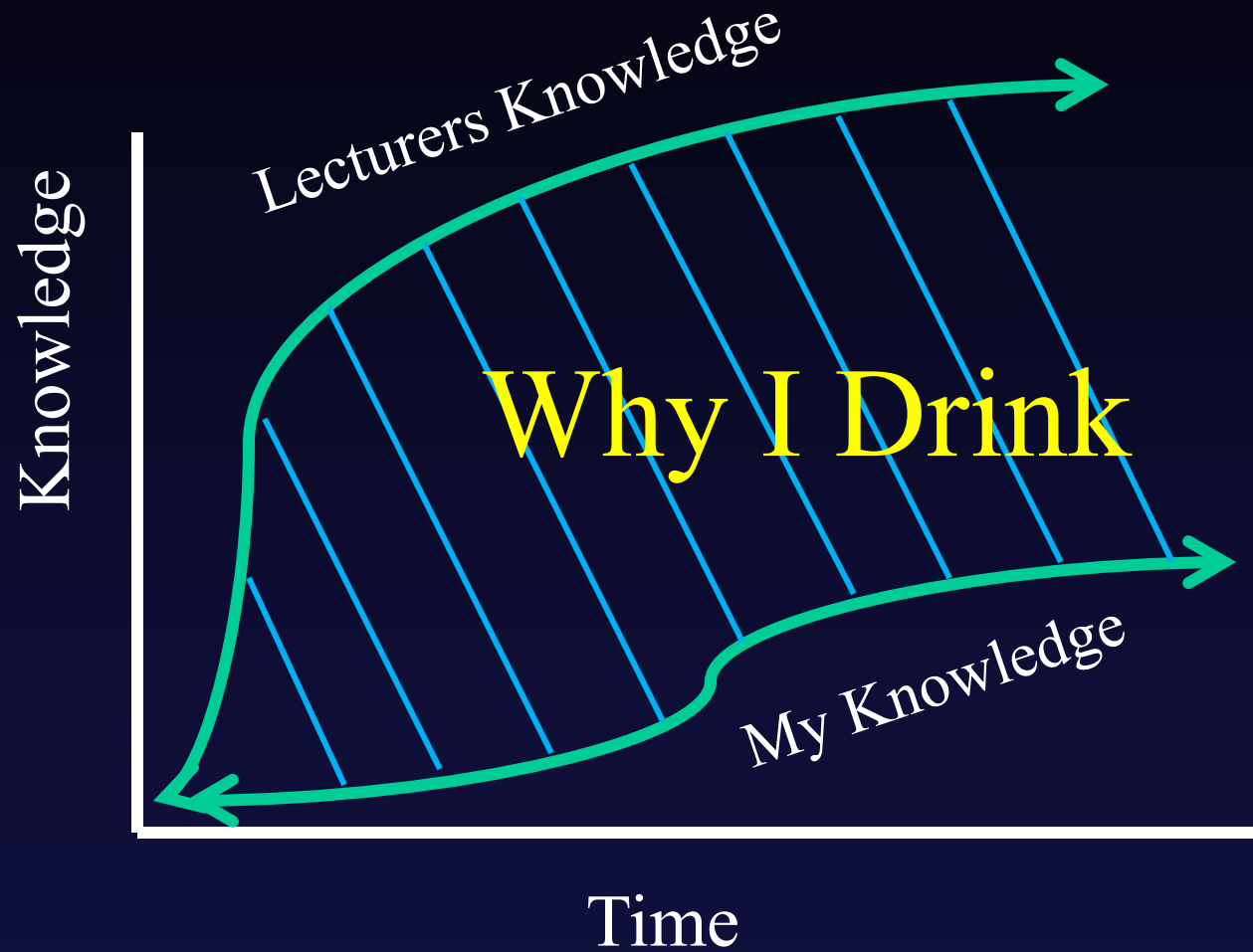
Artifacts - definition

- From 2 Latin words:
 - *arte* = “by skill”
 - *factum* = “to make”
- OLD!!!!

Happy / Sad ratio

- 20% Sad
 - 1st talk on Sunday (post party)
 - Talk about Artifacts
- 80% Happy
 - Being here
 - Finished the talk Saturday
 - No snow or tornadoes

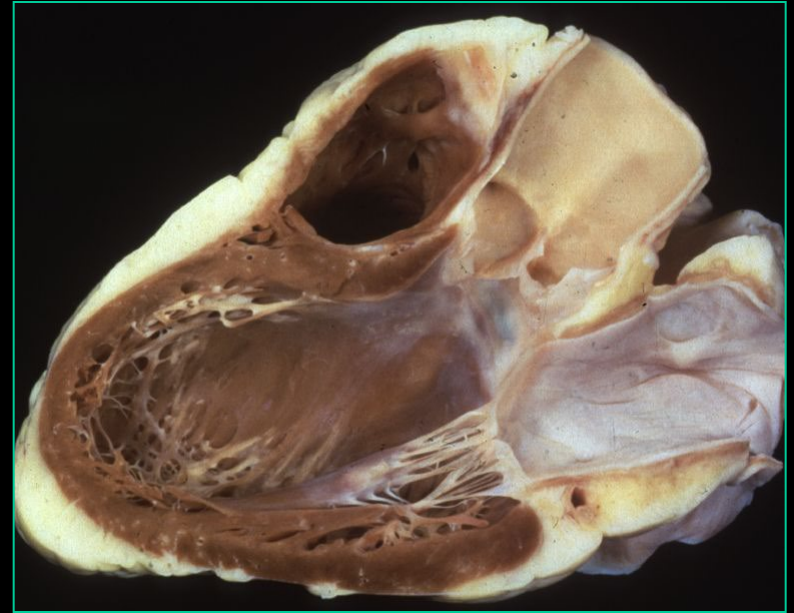
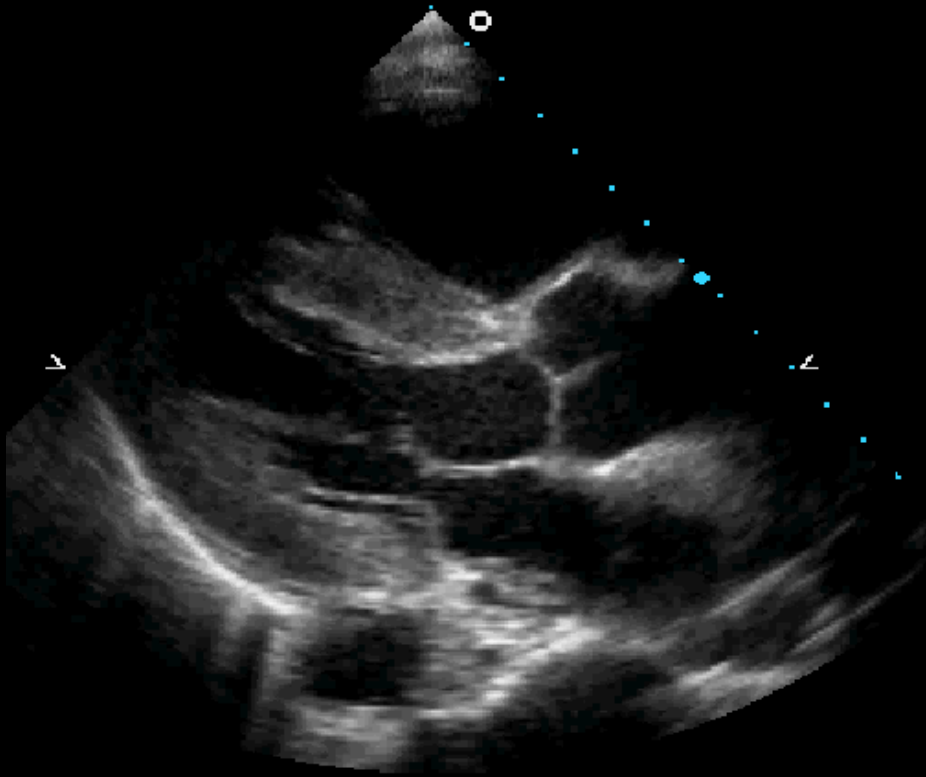
Artifact Talks I've Heard



The Kisslo Rules

1. If you don't point at it you can't see it.
2. If you don't see it you can't diagnosis it.
3. It's not the heart stupid!

It's Not the Heart Stupid!



Kissloisms

- Artifacts

- Not enough just to know that something is an artifact.
- What is the physics behind it

ARTIFACTS

That's our
goal today.

ARTIFACTS – My Classification

- Easy
- Difficult
- Impossible

DATING – My Classification

- Easy
- Difficult
- Impossible

ARTIFACTS

- Causes:
 - violation of assumptions
 - equipment malfunction or design
 - physics of US
 - operator error

ARTIFACTS

- Error in imaging:
 - not real
 - missing reflectors
 - improper size, shape, brightness, position
- ALL ultrasound images contain artifacts!



BASIC ASSUMPTIONS

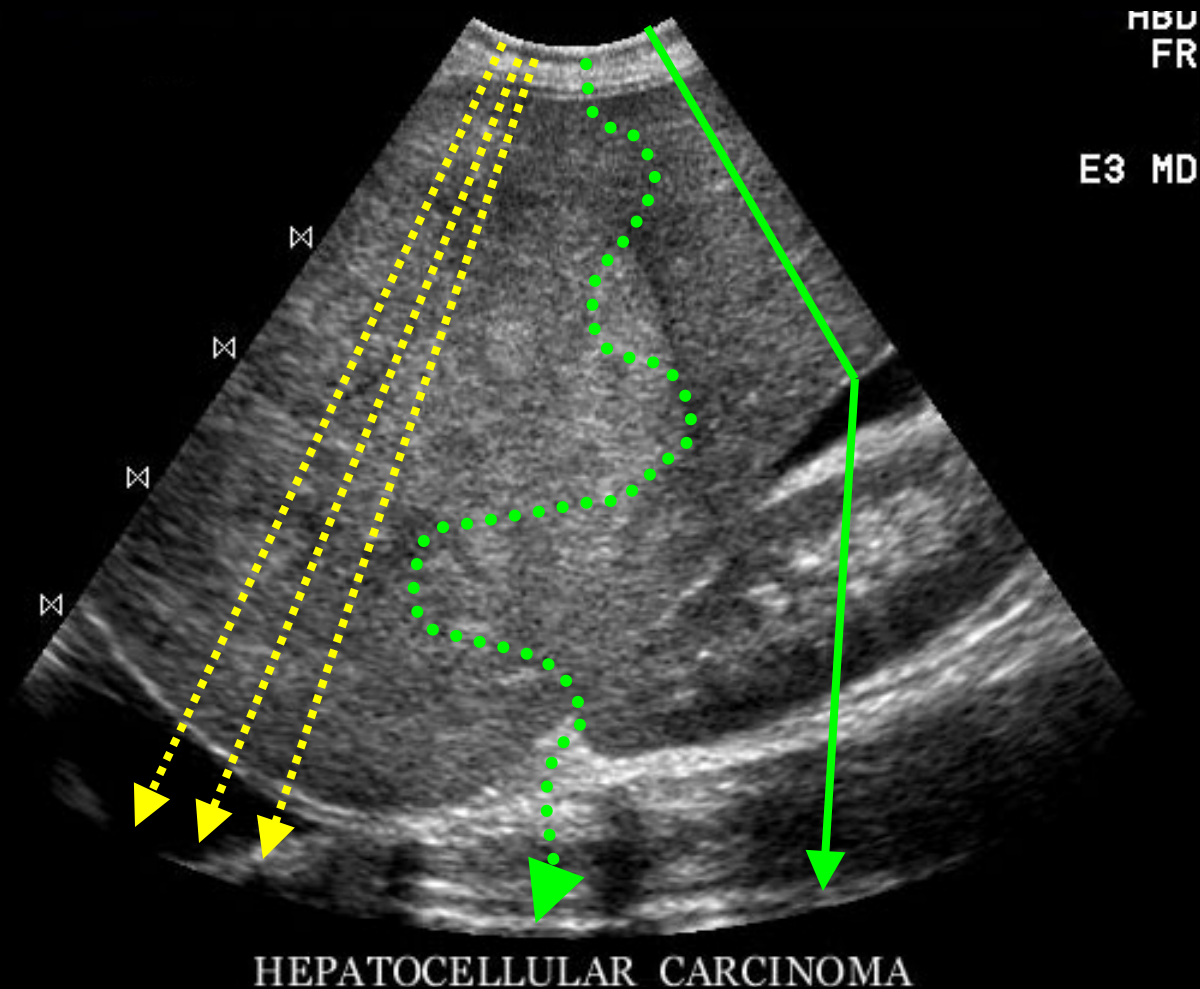
- ASSUME
- ASS U ME

BASIC ASSUMPTIONS

- sound travels in a straight line
- reflections only arise from structures along the beam's main axis
- sound travels exactly 1540 meters/second
- imaging plane is extremely thin
- sound travels directly to a reflector and back

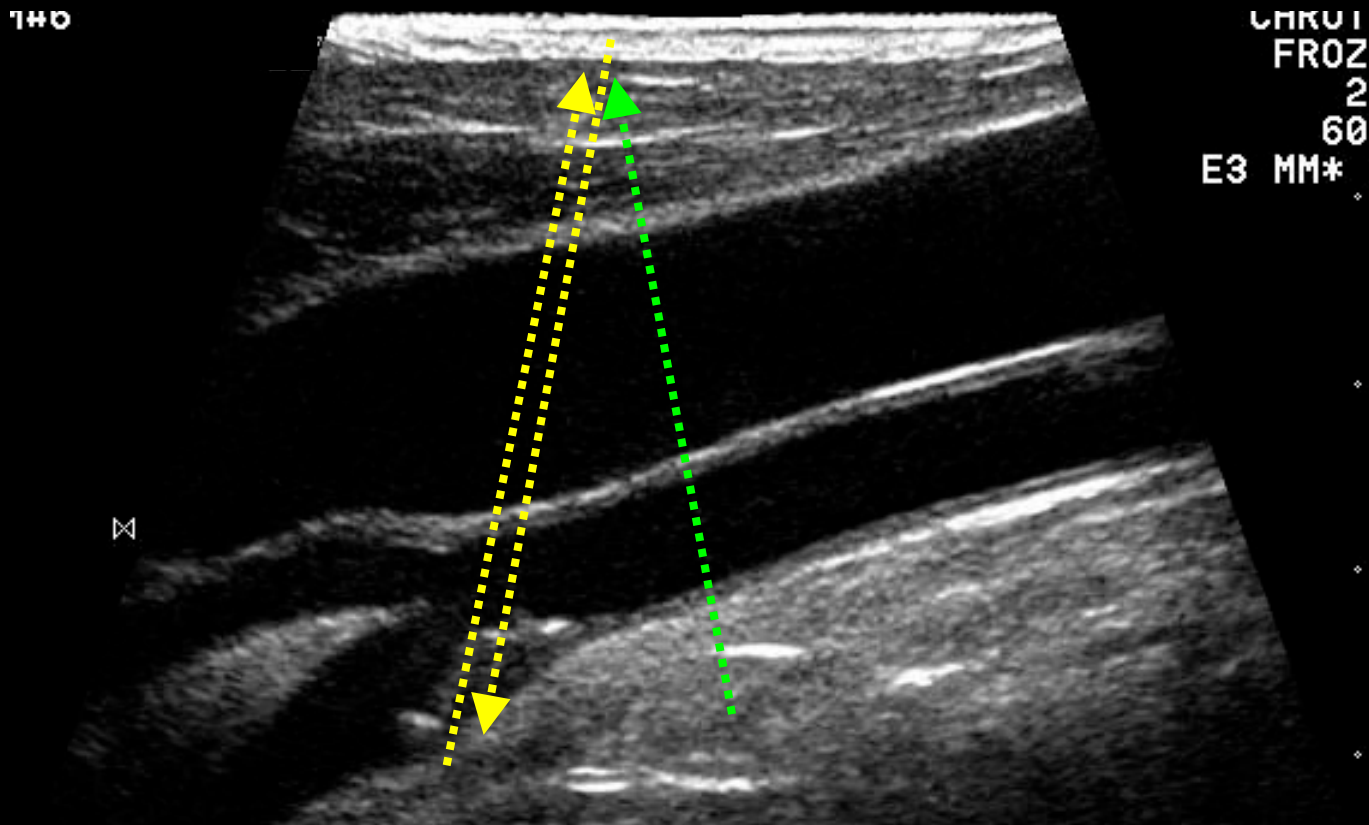
BASIC ASSUMPTIONS

- sound travels in a straight line



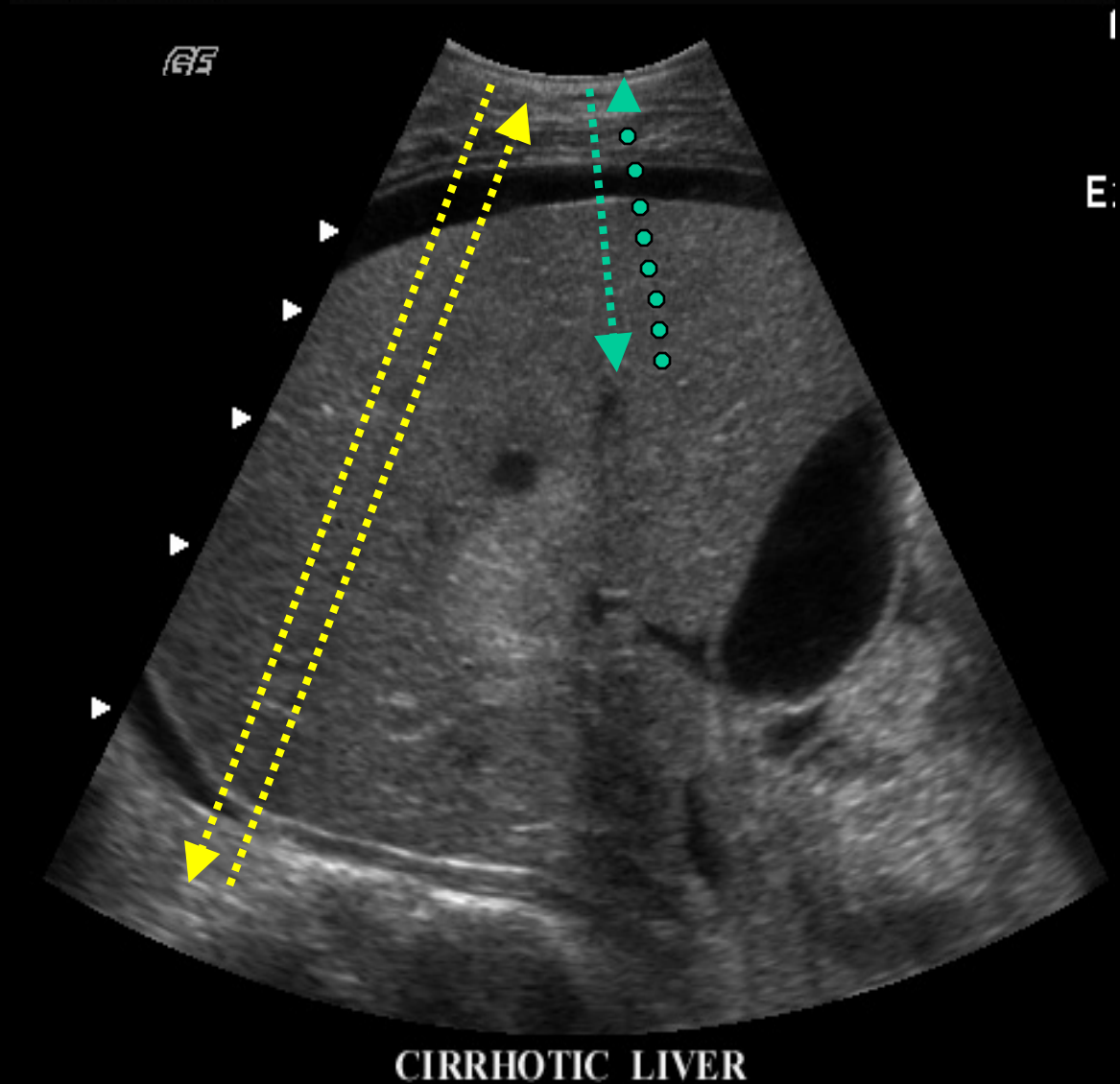
BASIC ASSUMPTIONS

- reflections only arise from structures along the beam's main axis



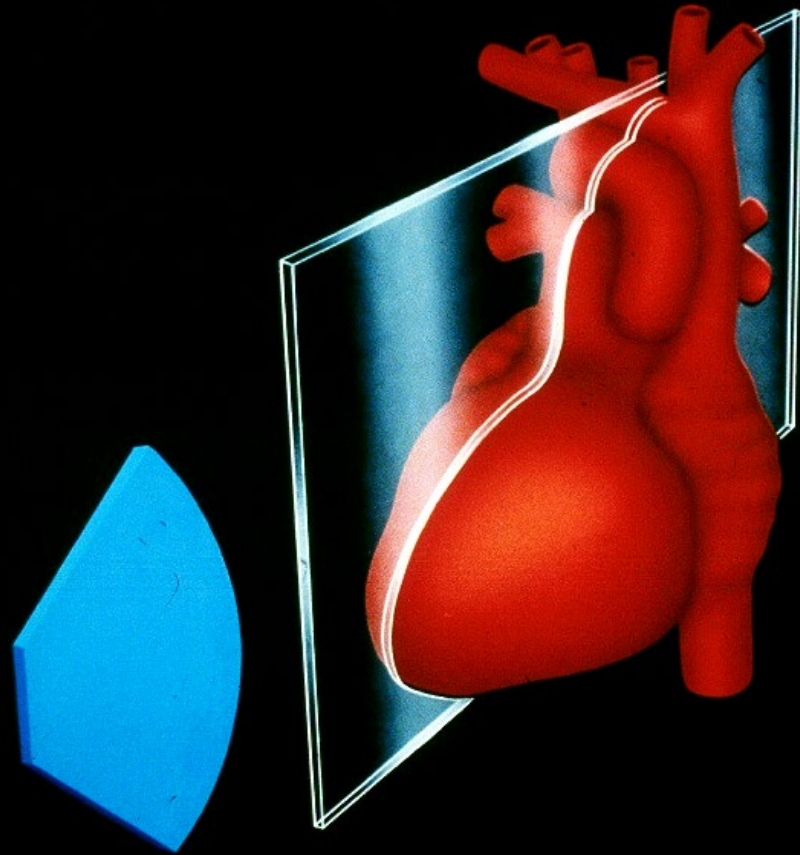
BASIC ASSUMPTIONS

- sound travels exactly 1540 meters/sec



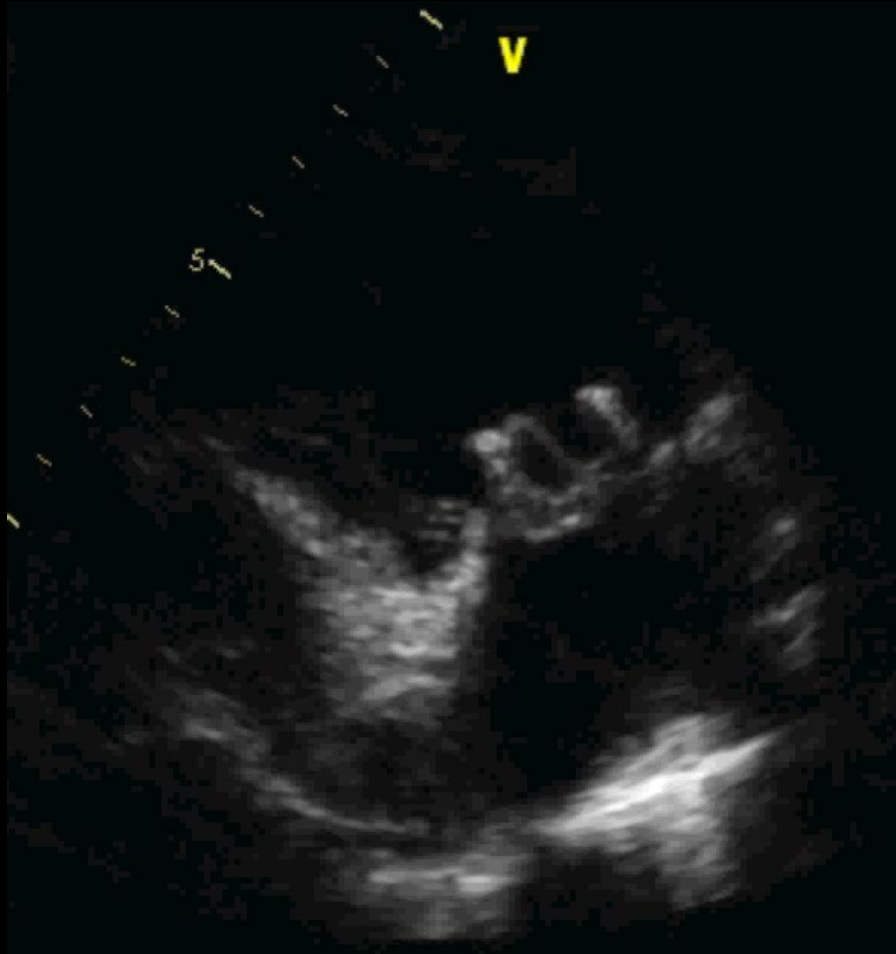
BASIC ASSUMPTIONS

- imaging plane is extremely thin



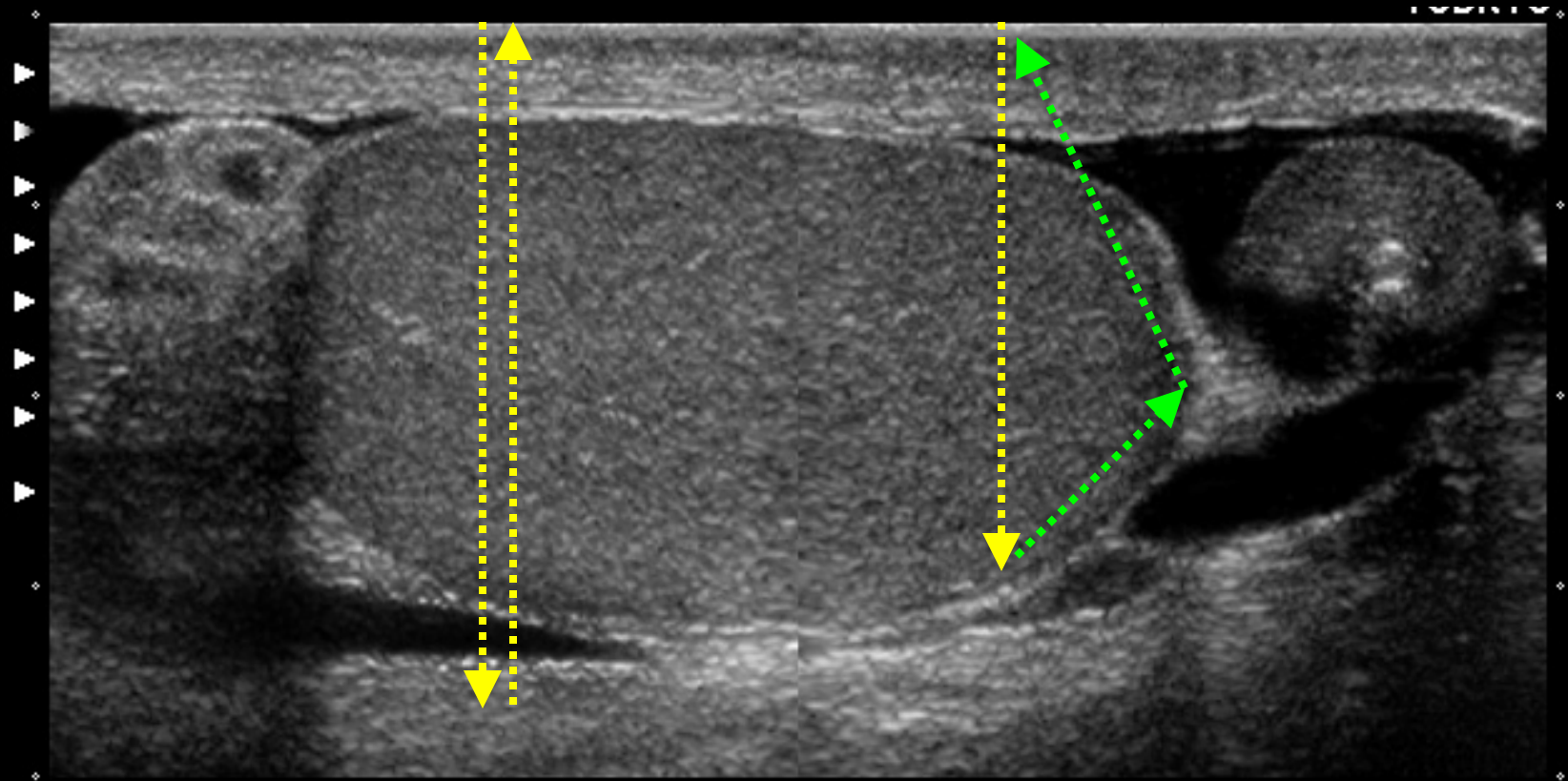
BASIC ASSUMPTIONS

- imaging plane is extremely thin



BASIC ASSUMPTIONS

- sound travels directly to a reflector & back



NORMAL TESTICLE
SMALL HYDROCELE

ARTIFACTS

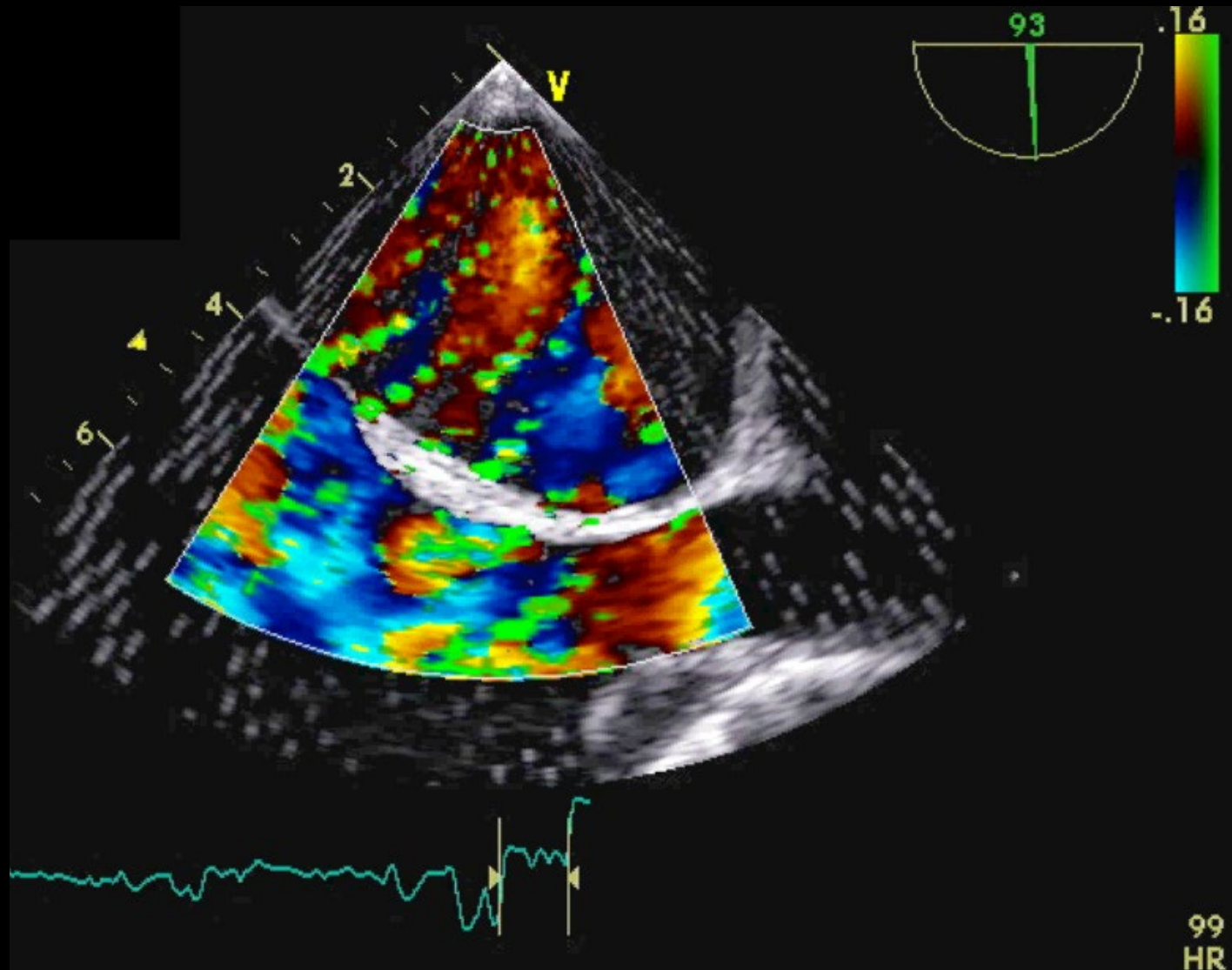
- appear & disappear depending on the view
- disappear when corrective measures are taken
- actual anatomy remains visible
- if obvious artifact remains, call a service person



ARTIFACTS – My Classification

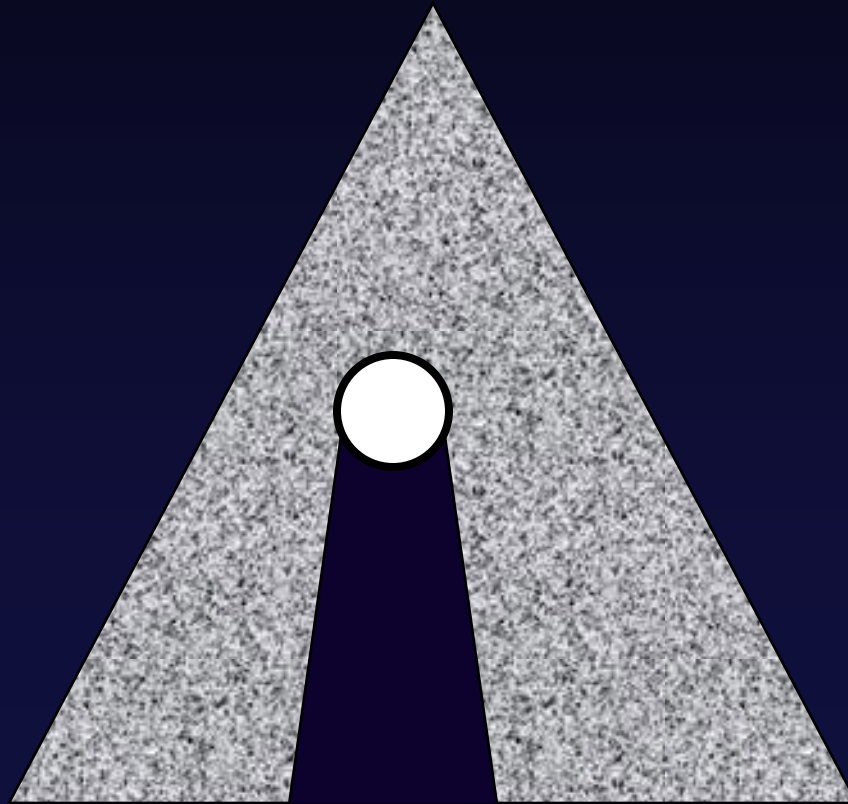
- Easy
 - common
 - identify
 - explain

Bovie Cautery Interference

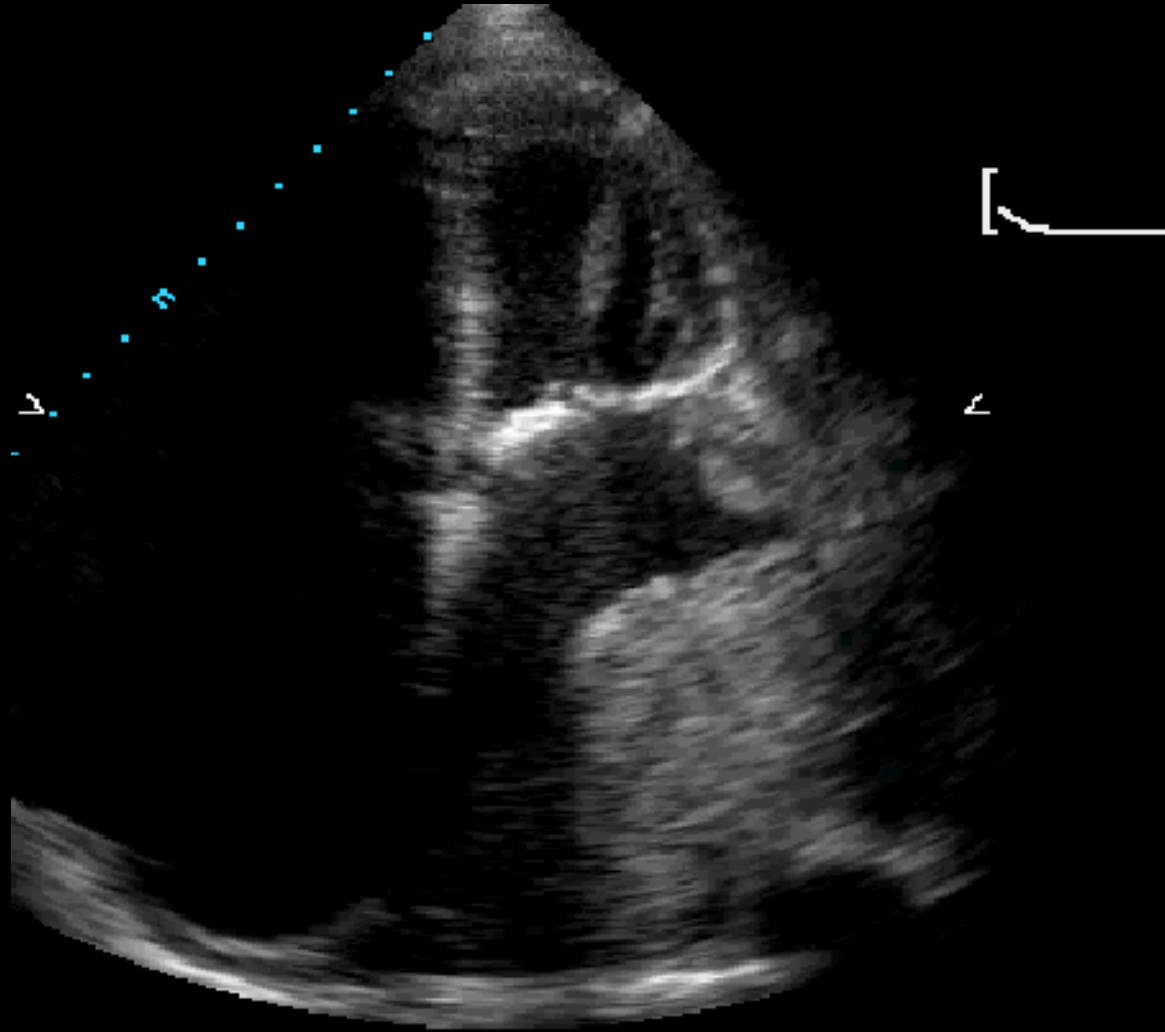


SHADOWING

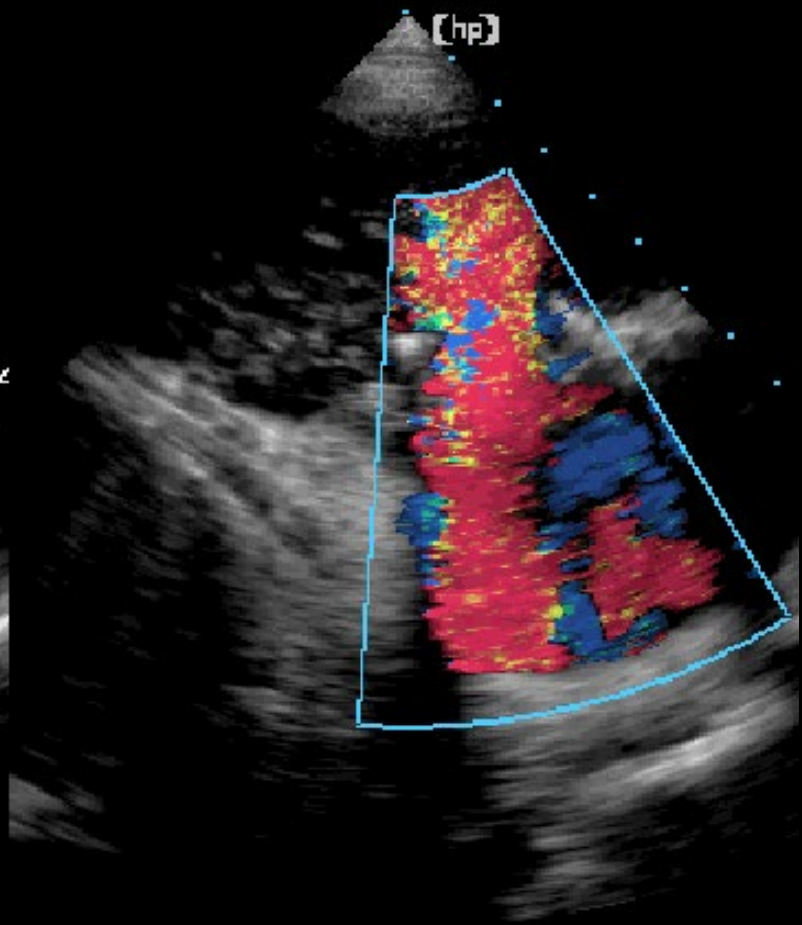
- a hypoechoic region appearing beneath a structure with abnormally high attenuation



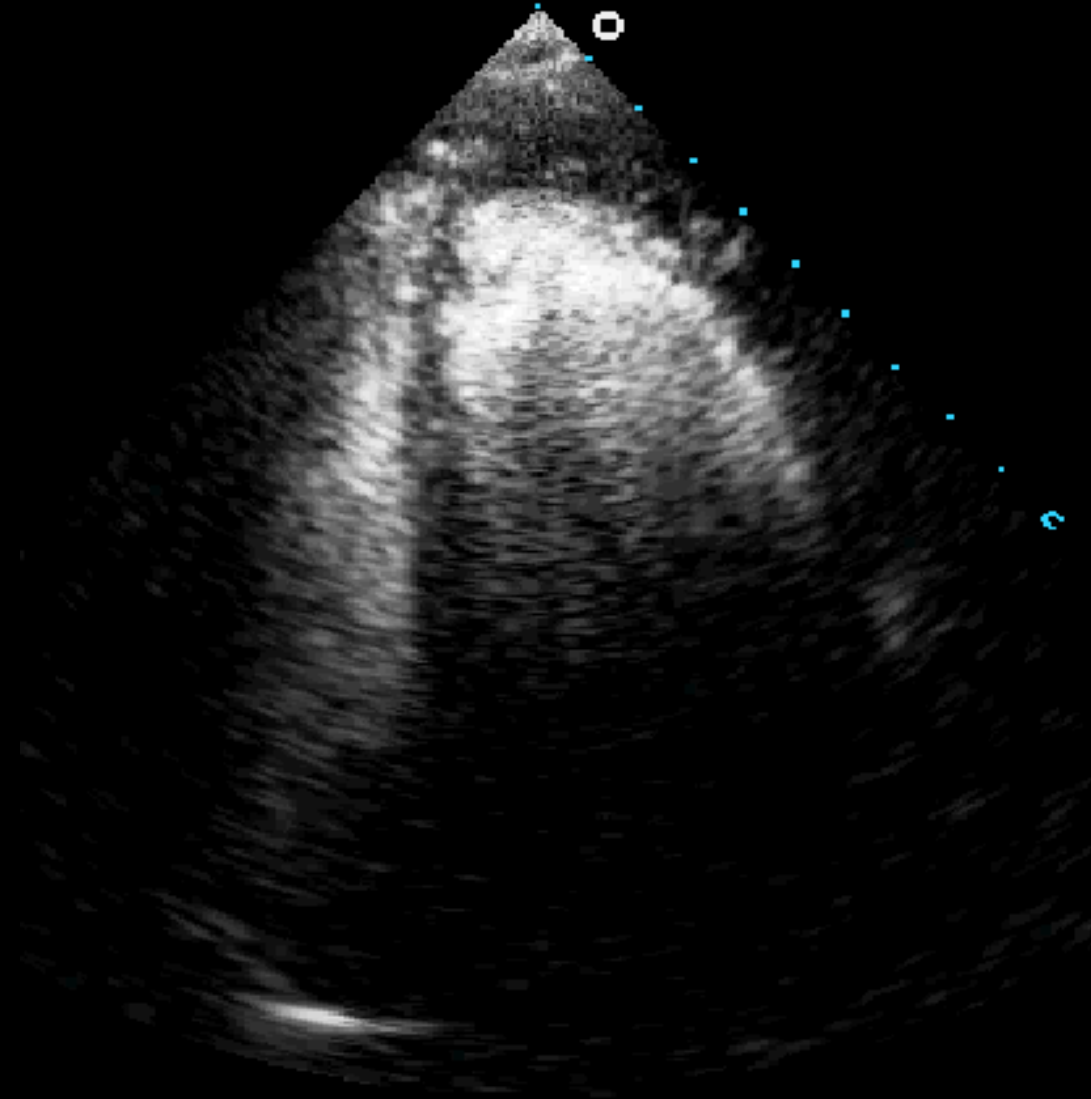
SHADOWING - MS



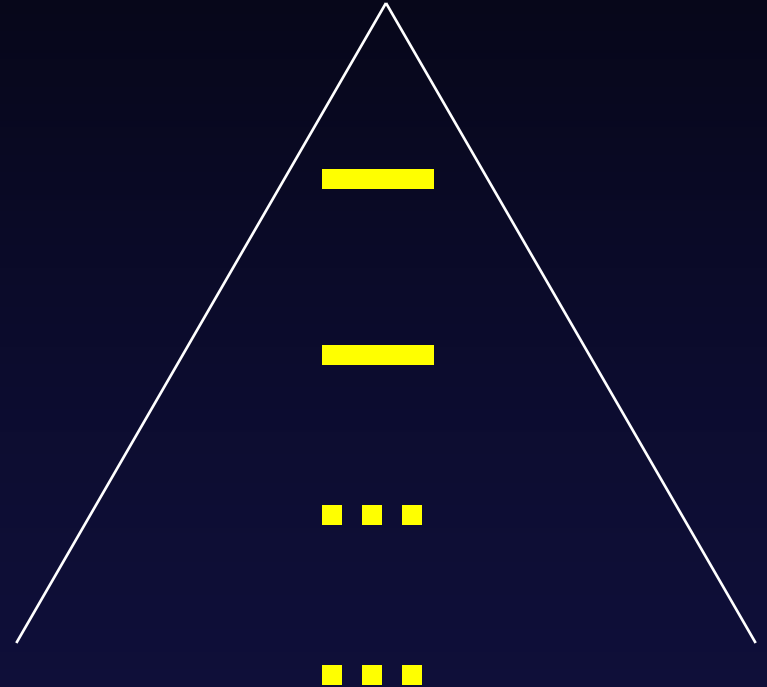
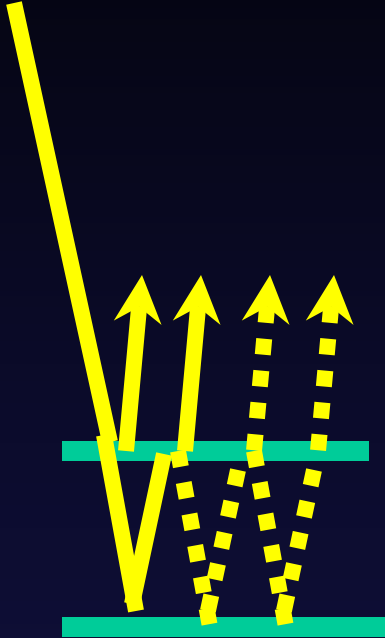
SHADOWING - TVR



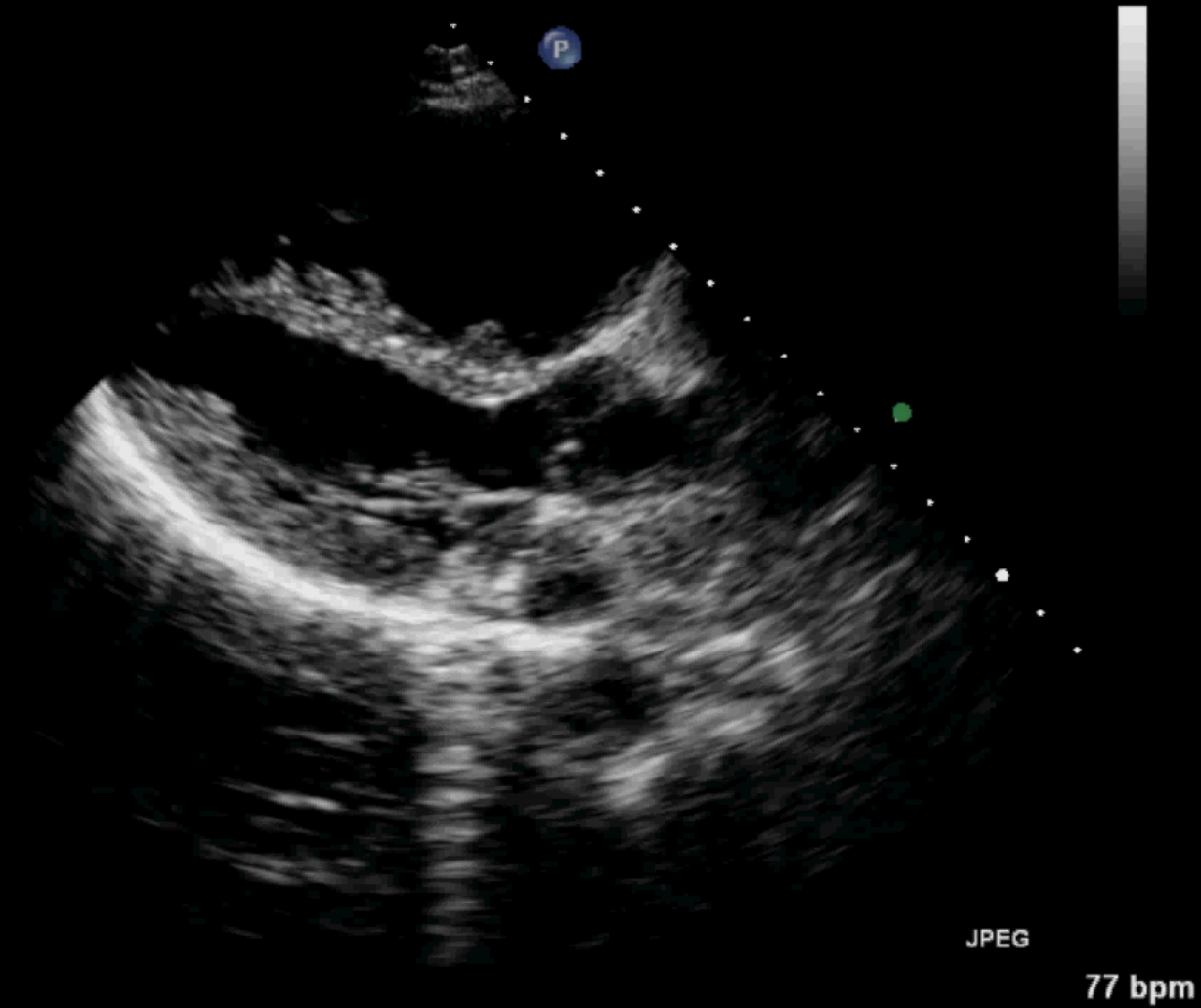
WHAT CAUSES THIS ARTIFACT?



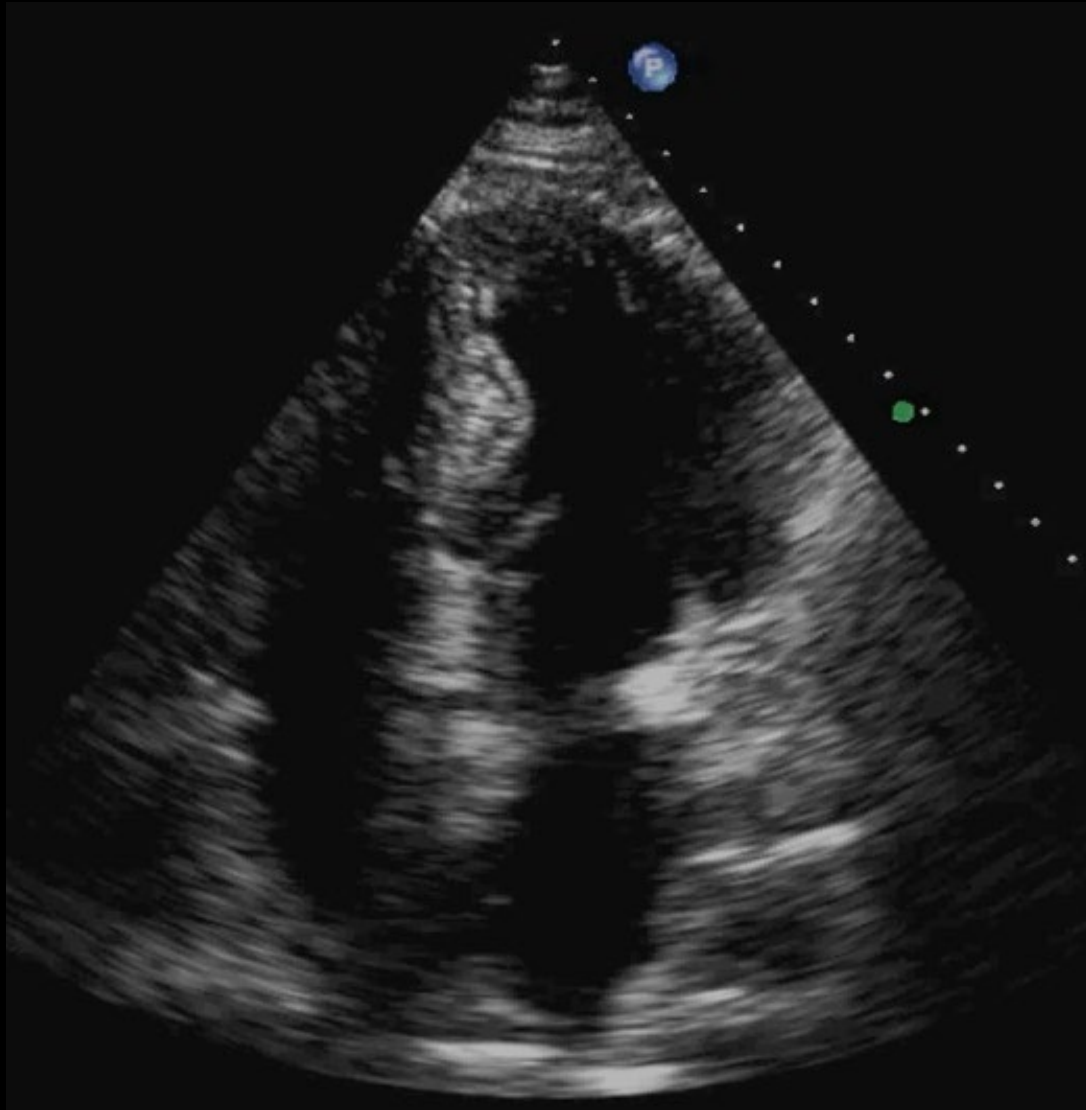
REVERBERATION



REVERBERATION



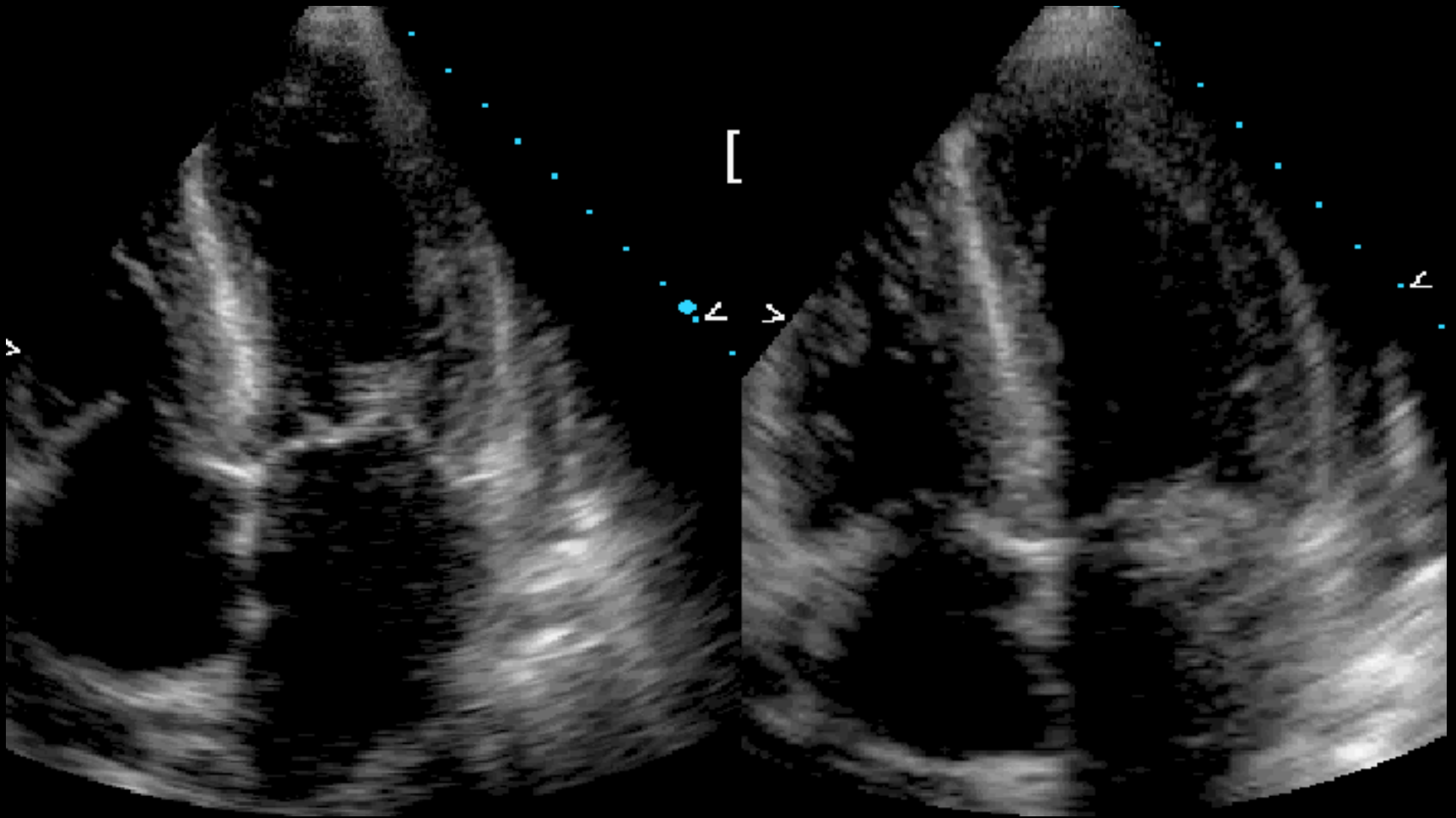
Main Bang Artifact - Herbie



ARTIFACTS?

- Change depth

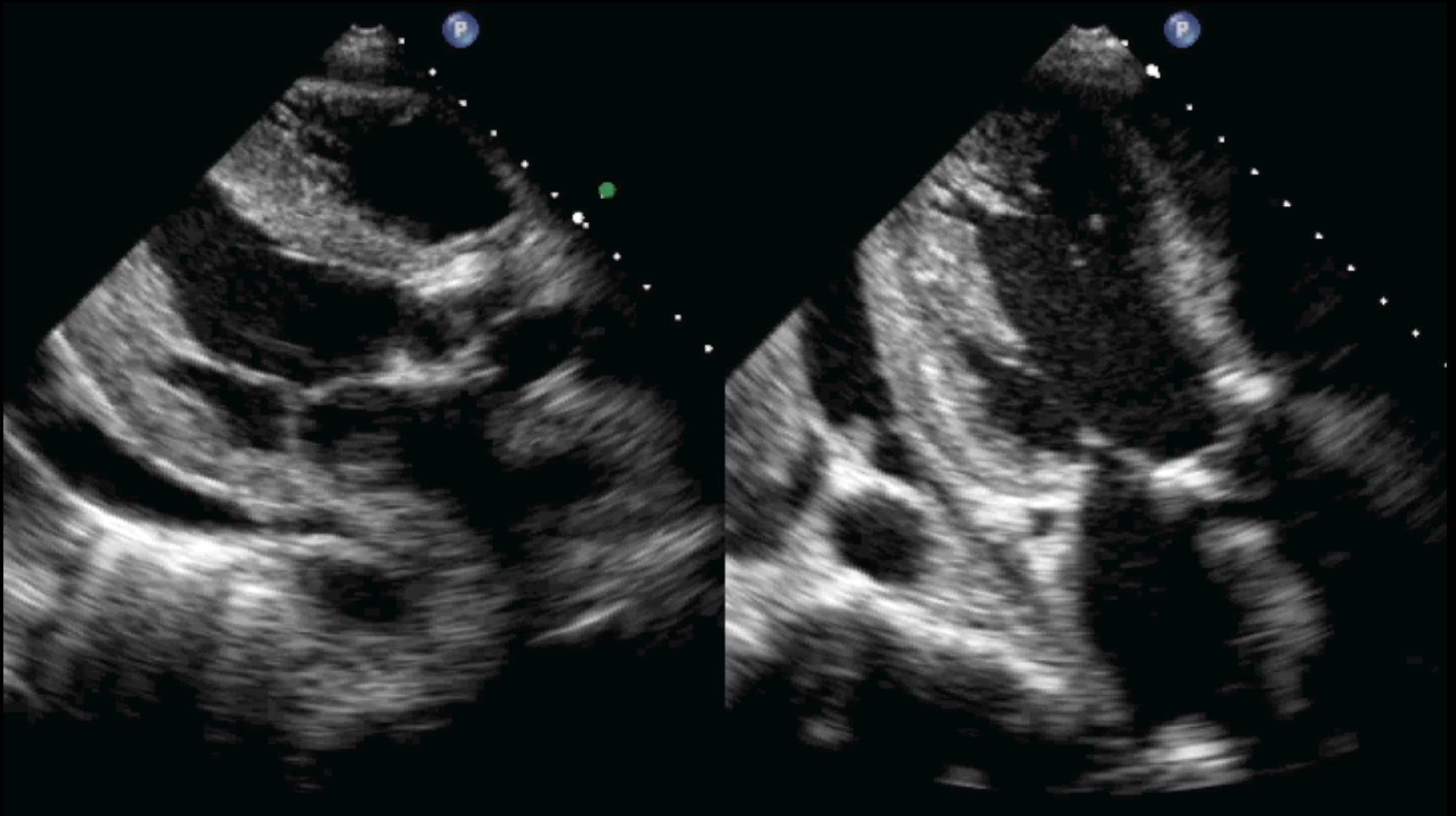
ARTIFACTS?



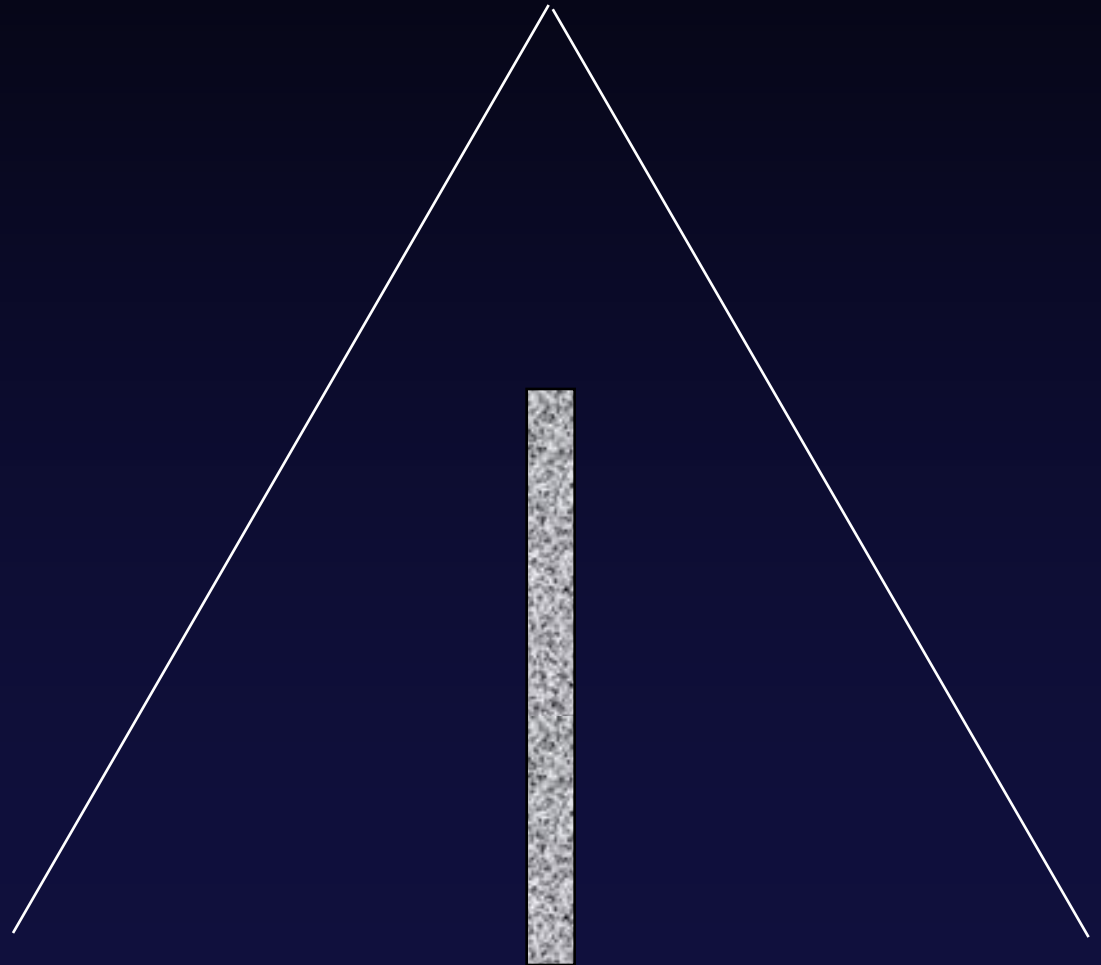
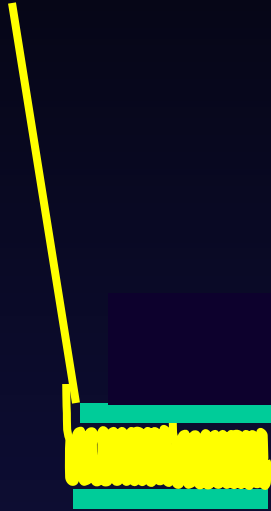
ARTIFACTS?

- Change depth
- Change transducer frequency
- See in more than one view

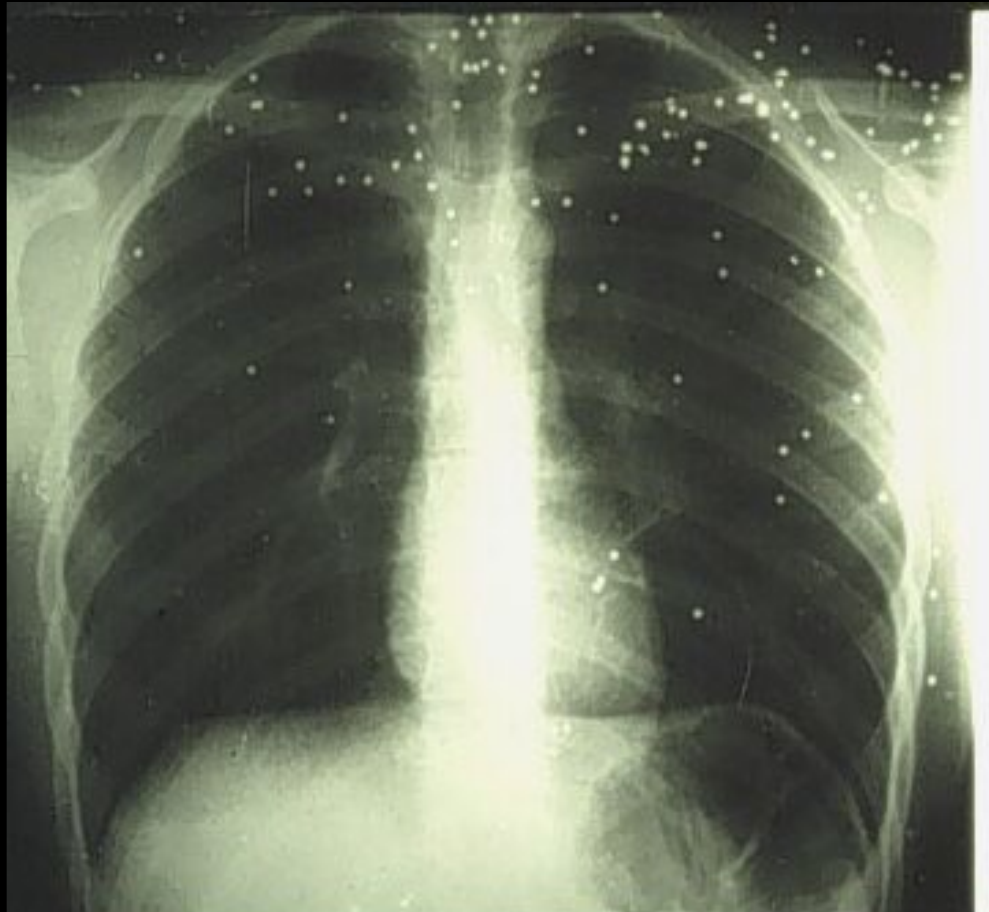
ARTIFACTS?



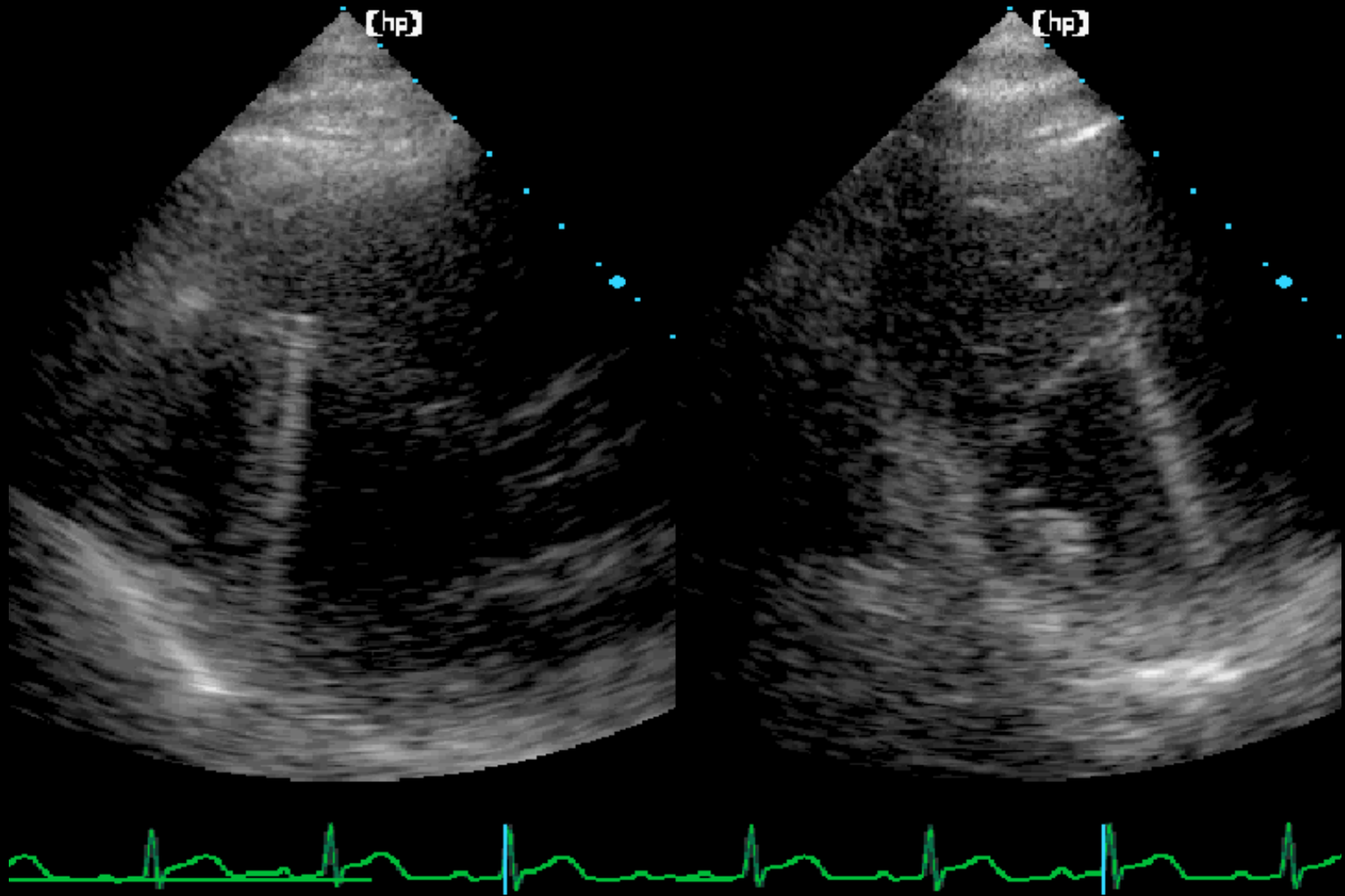
COMET TAIL



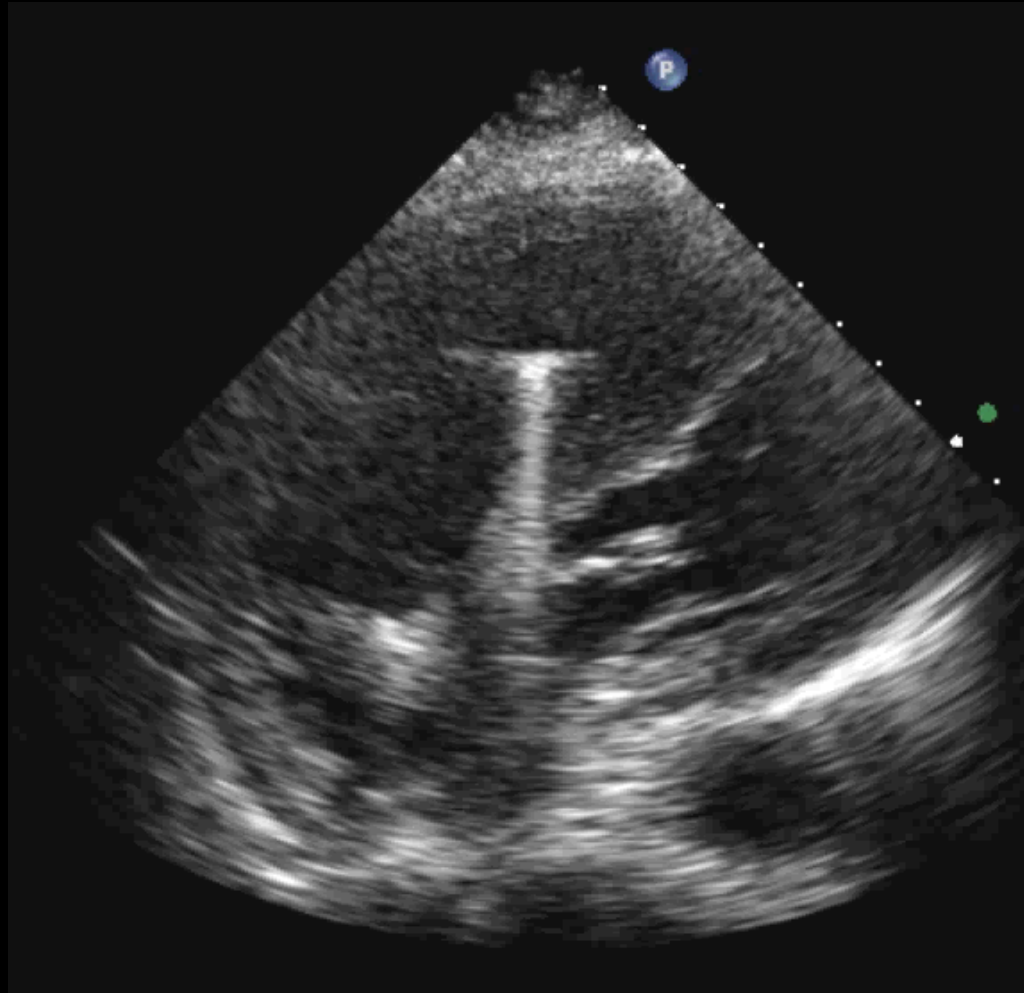
GSW Upper Chest



Comet Tail Artifact



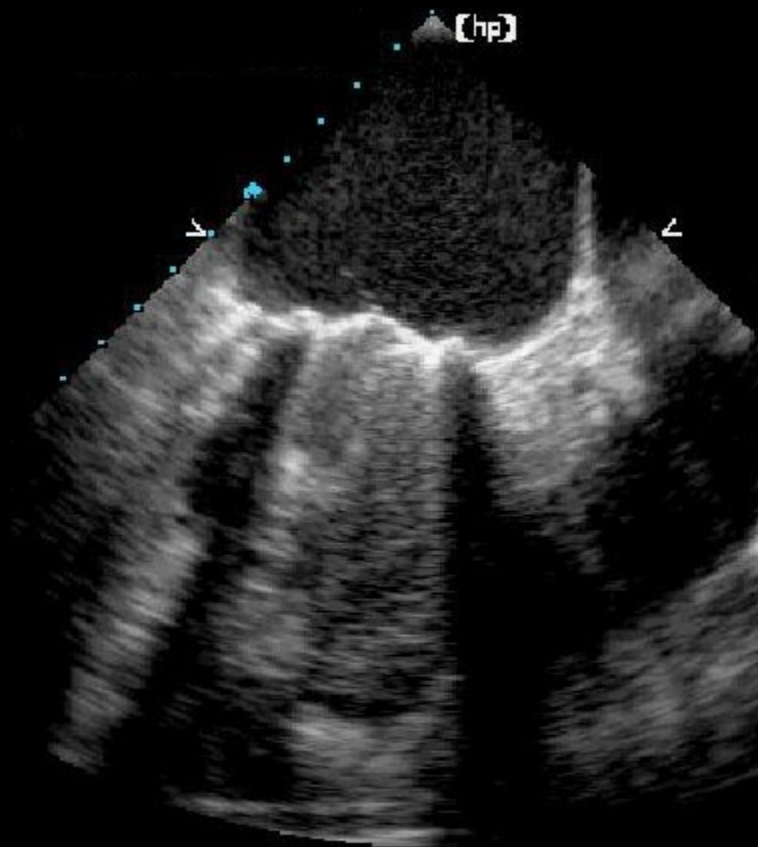
Bioptome – Comet Tail



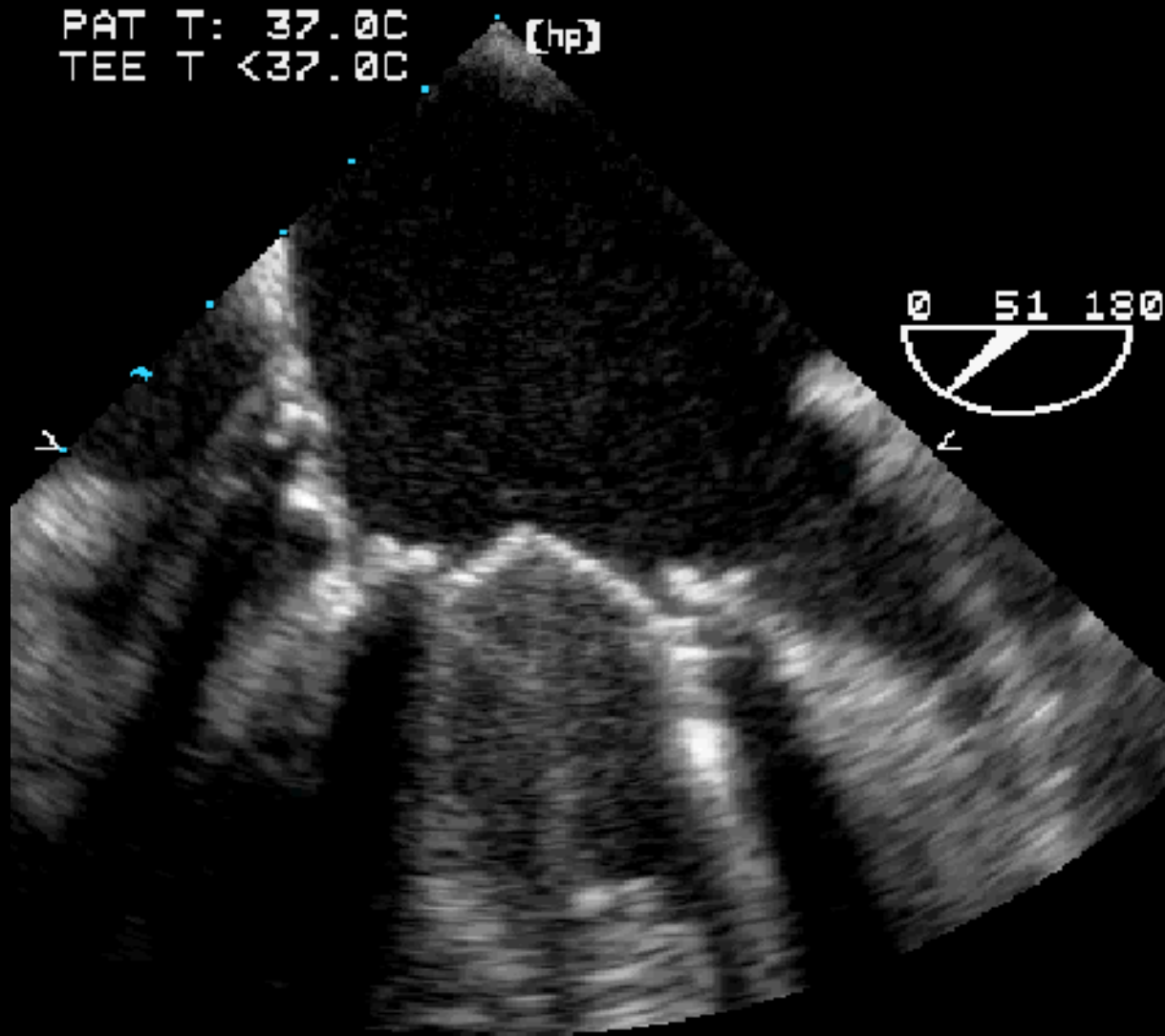
St. Jude Valve



Shadowing & Comet Tail



Shadowing & Comet Tail



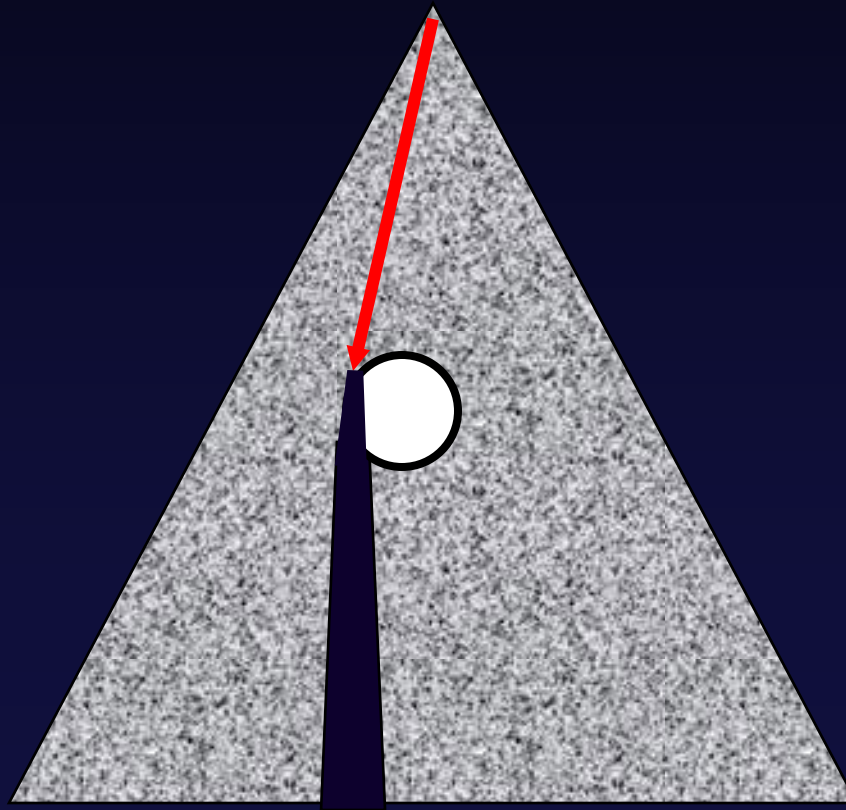
ARTIFACTS – My Classification

- Difficult

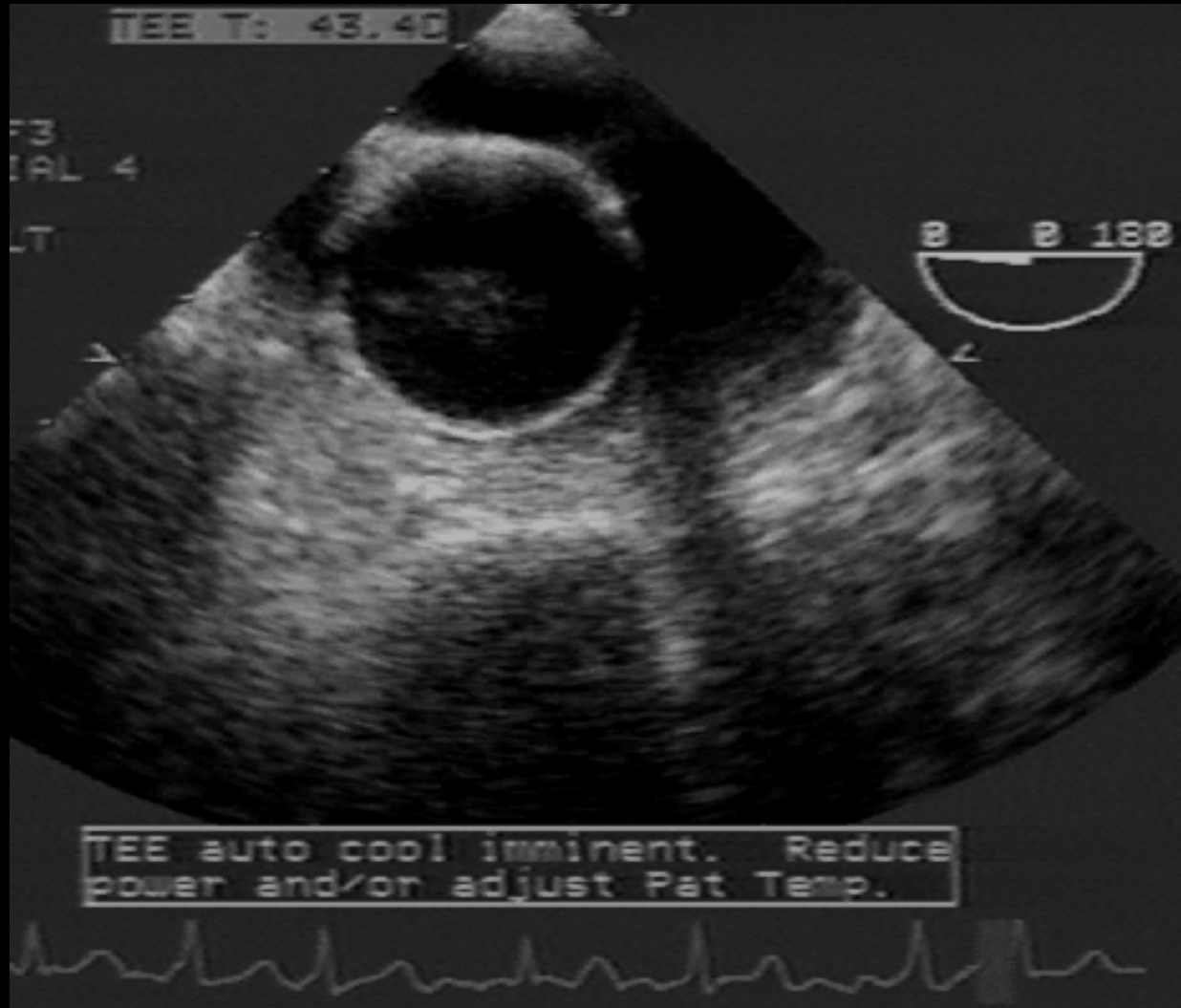
- easy identify
- but explaining??
- I'm sorry
- Can be applied to dating

Edge Shadow Artifact

- a hypoechoic region appearing beneath the edge of a curved structure

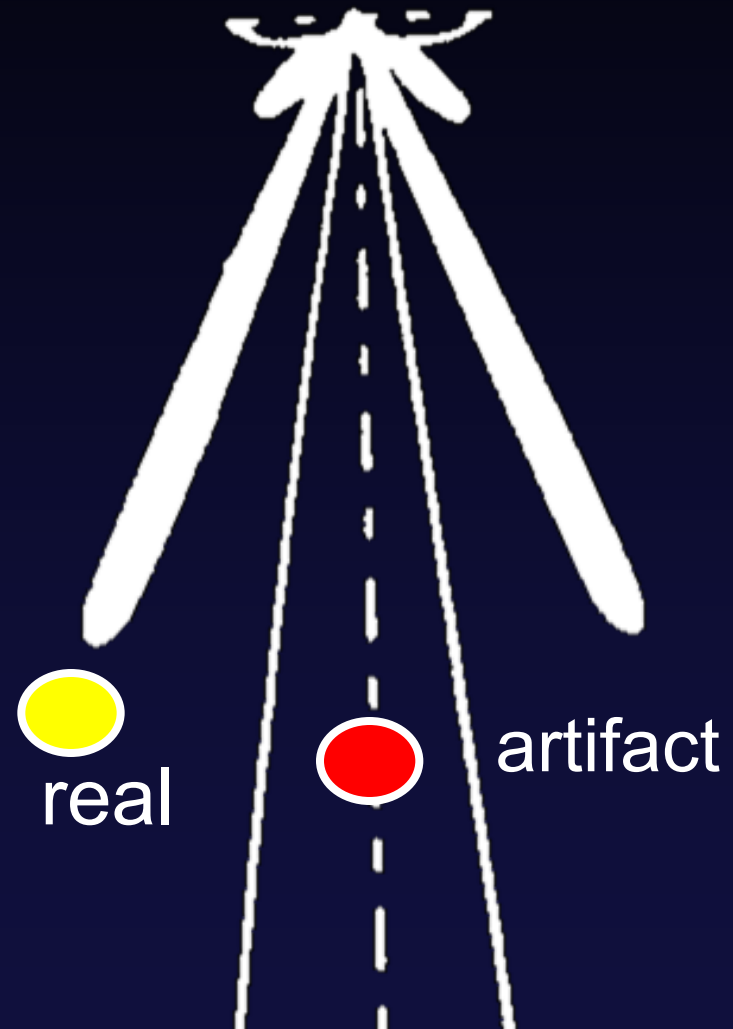


Edge Shadow Artifact

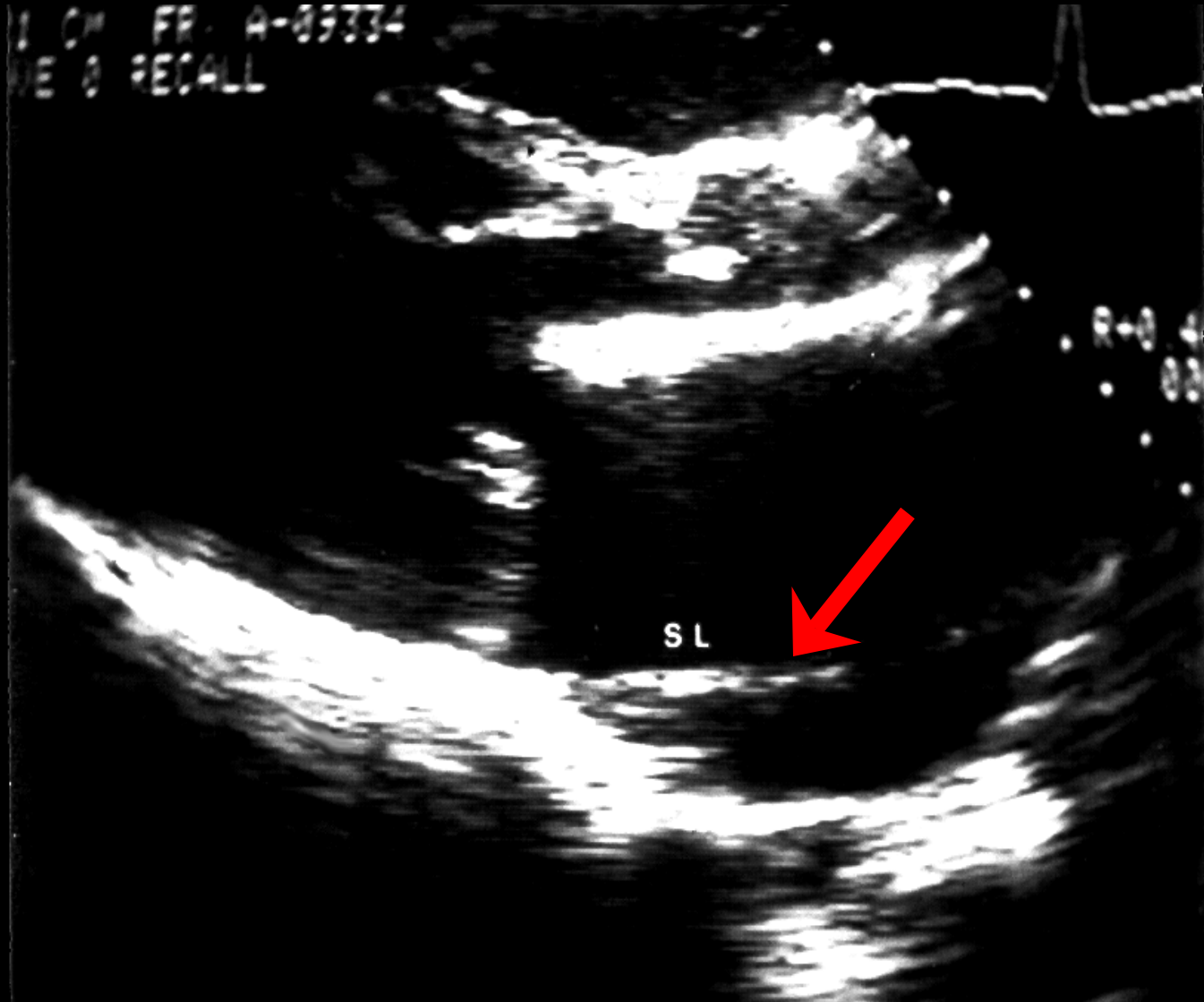


Side Lobes – Grating Lobes

- sound directed off-axis
- 2nd copy of reflector along side of true anatomy



Side Lobes – Grating Lobes



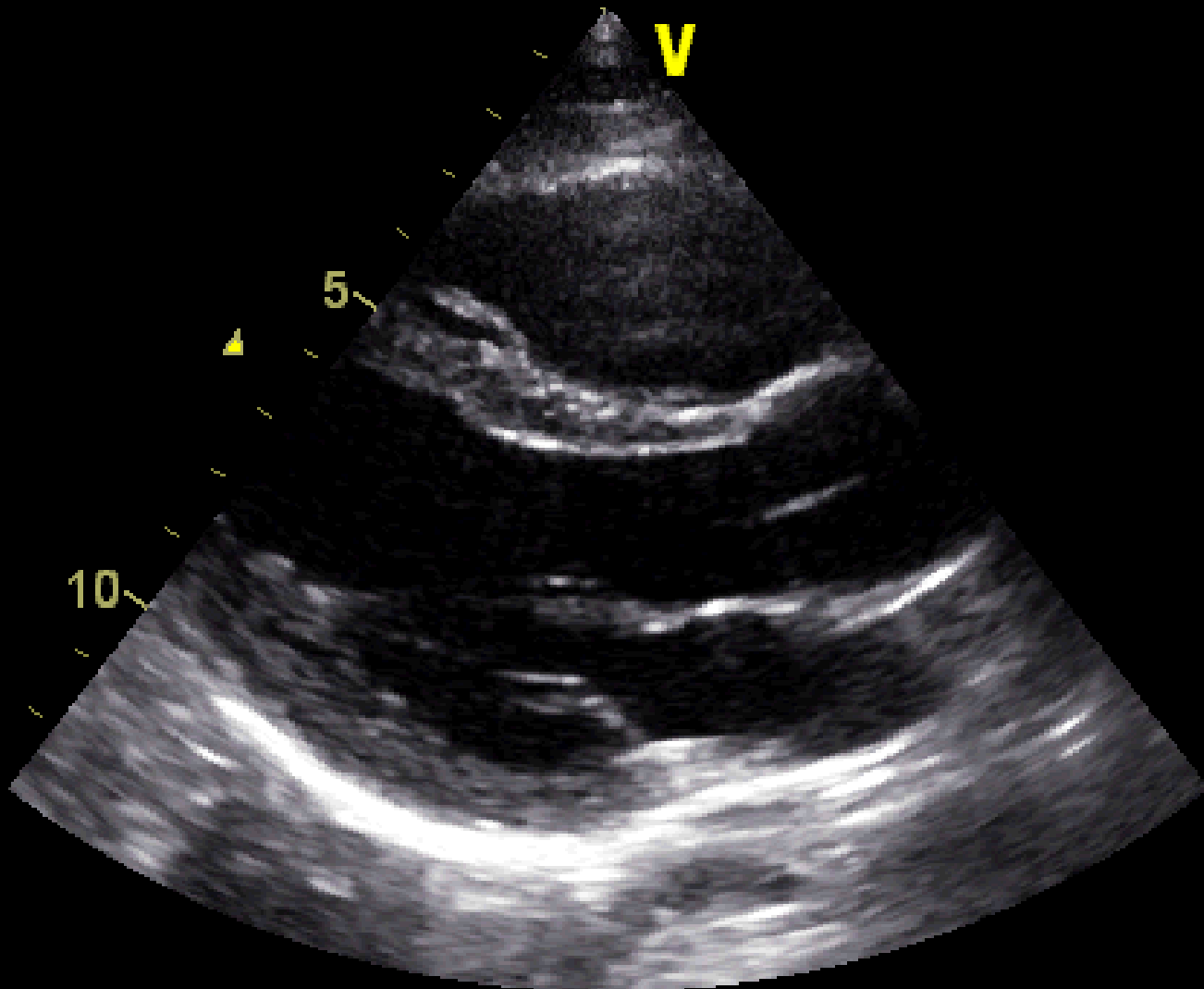
1 CM FR. A-09334
VE 0 RECALL

R-0 4
00

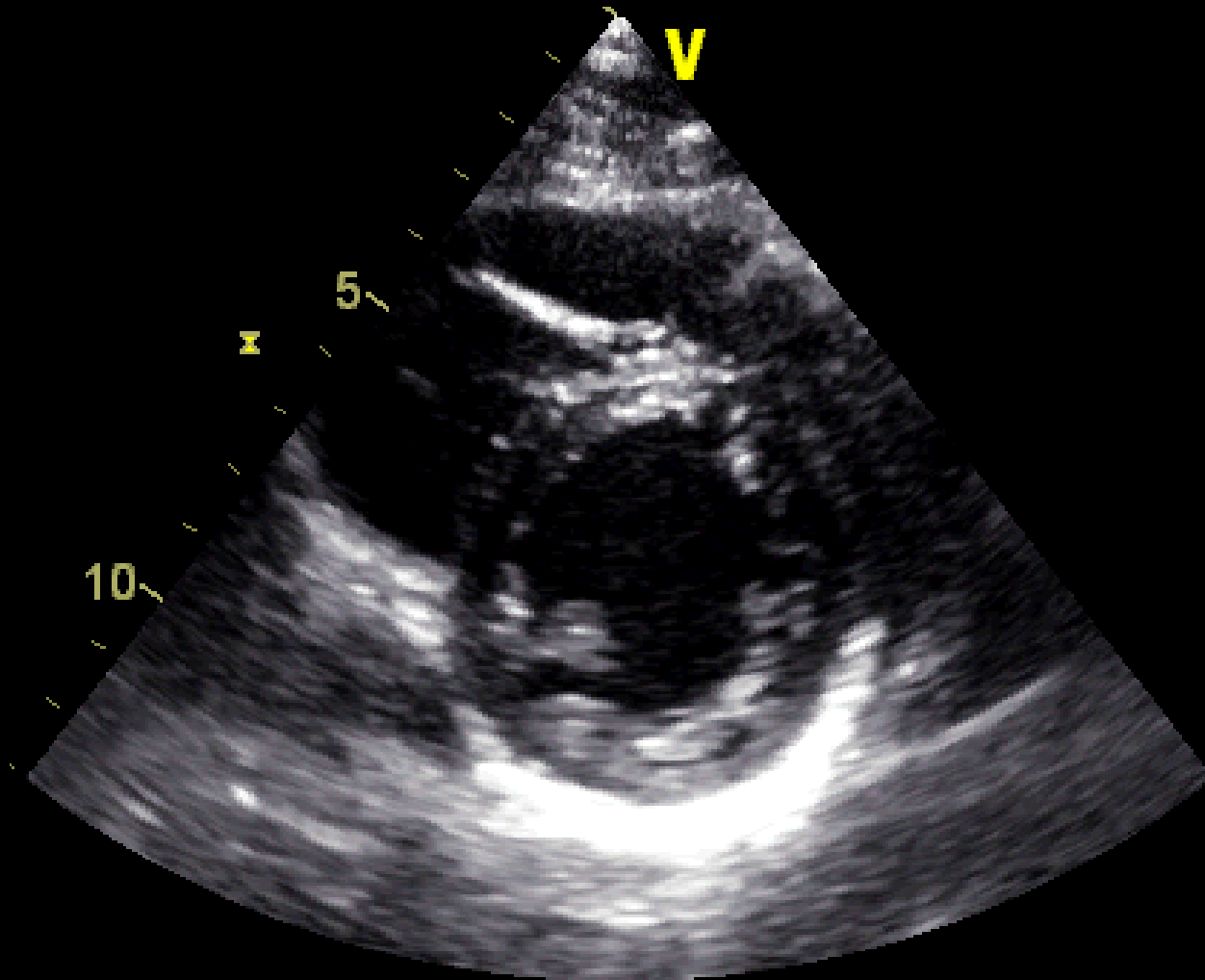
SL



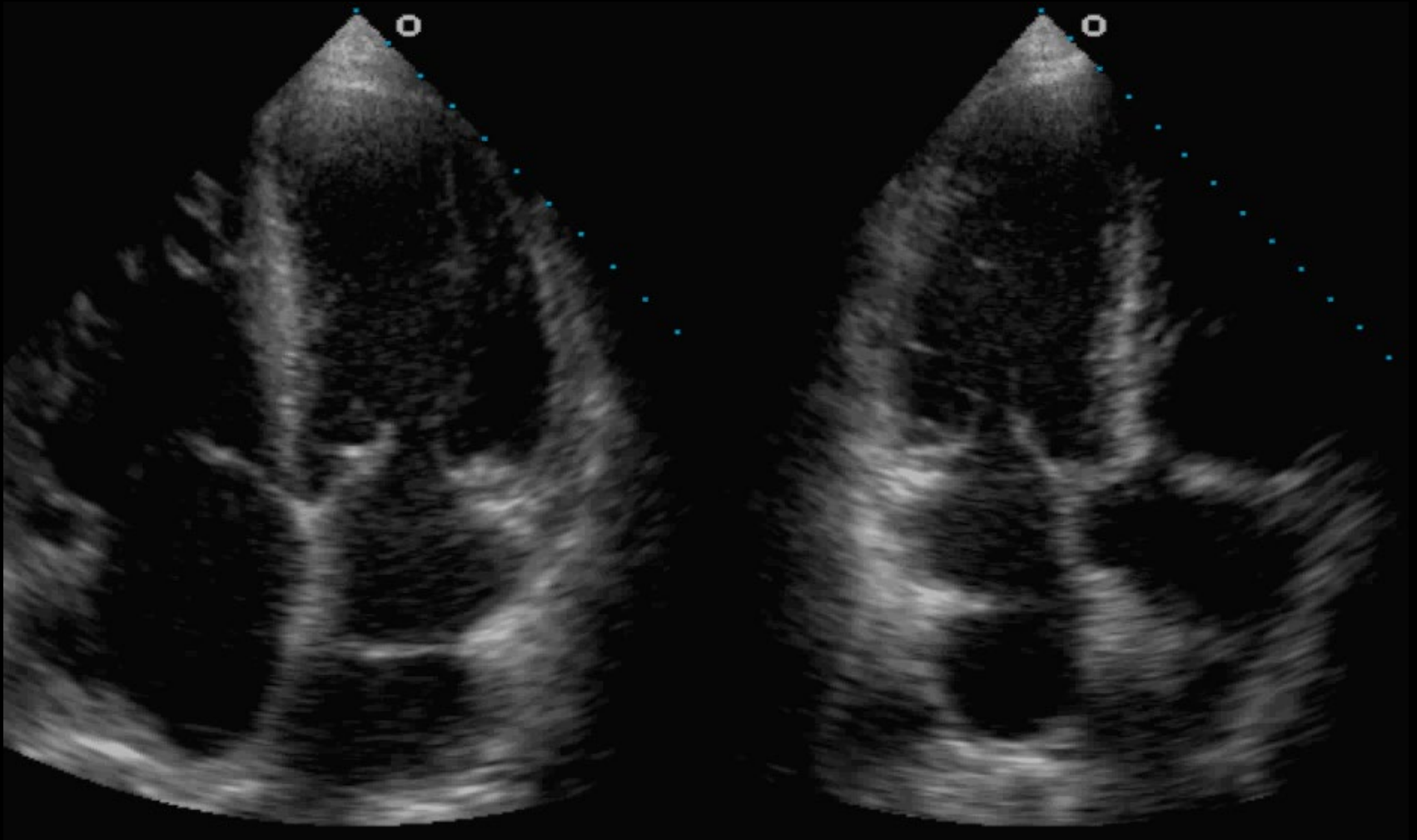
Grating Lobe



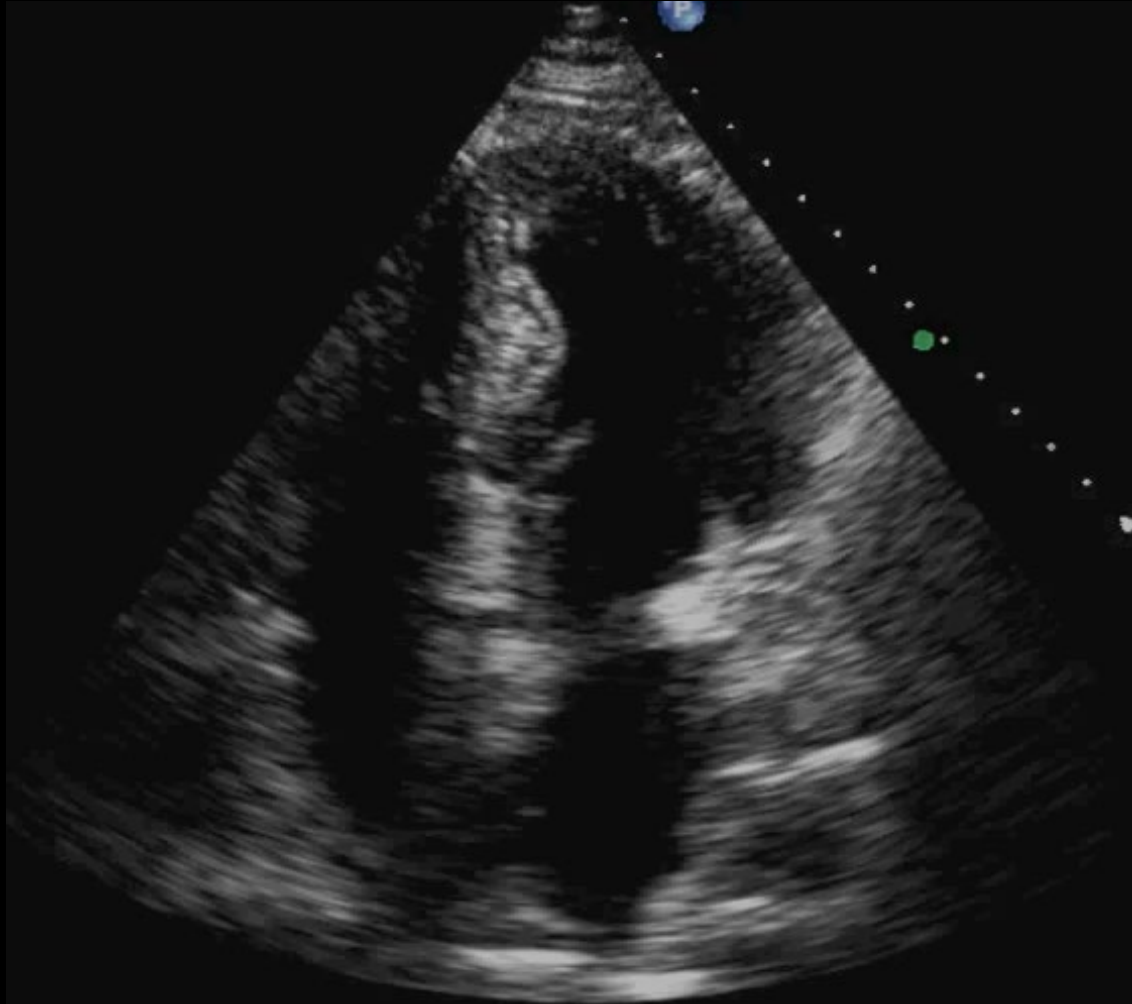
Grating Lobe



Cor Triatriatum



Cor Triatriatum???

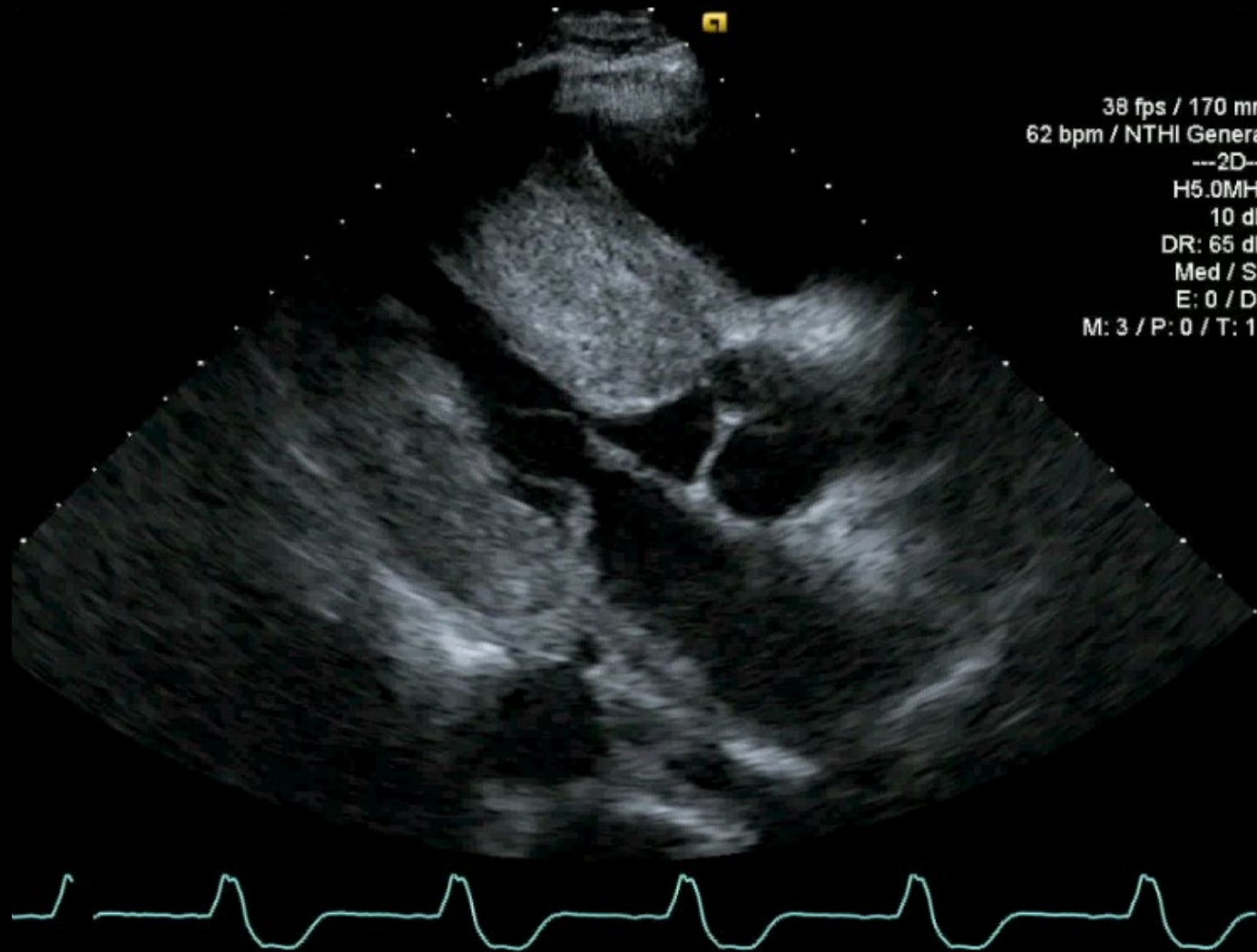


SPEED ERRORS

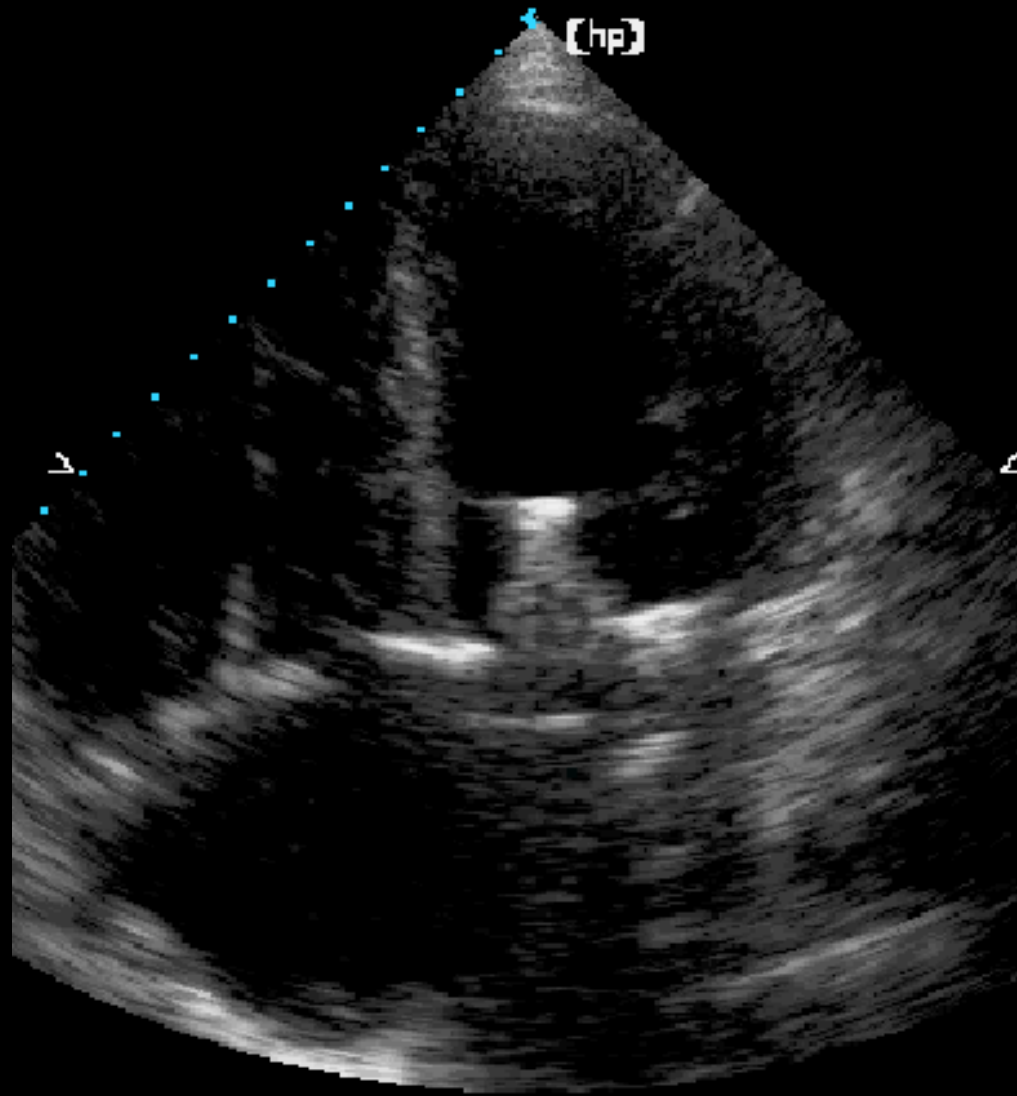
- when sound travels at speeds other than 1,540 m/s, reflectors are placed at incorrect depths
- when speed is greater than 1,540 reflectors appear too shallow on the image
- when speed is less than 1,540 reflectors appear too deep on the image



Rib or Lung Interference



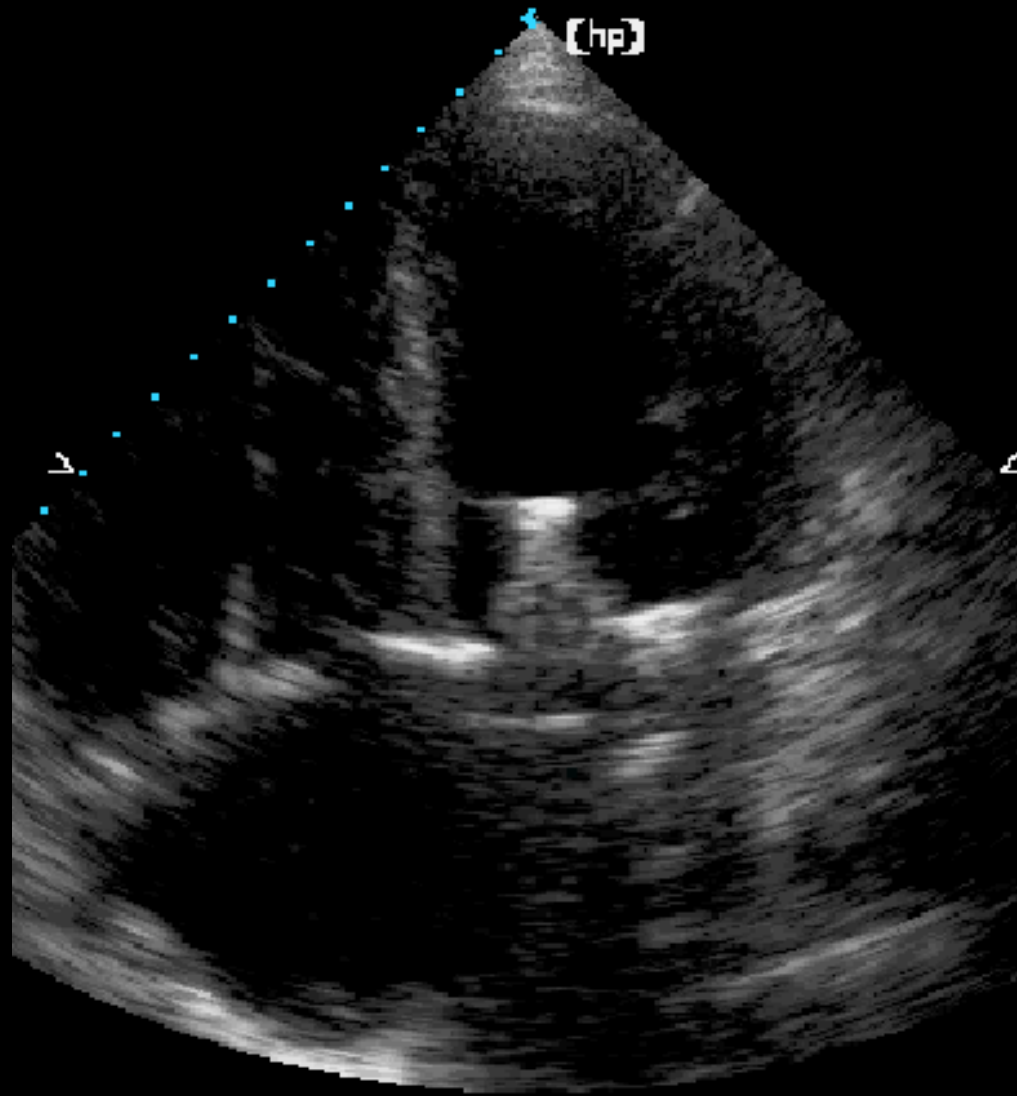
Starr-Edwards MVR



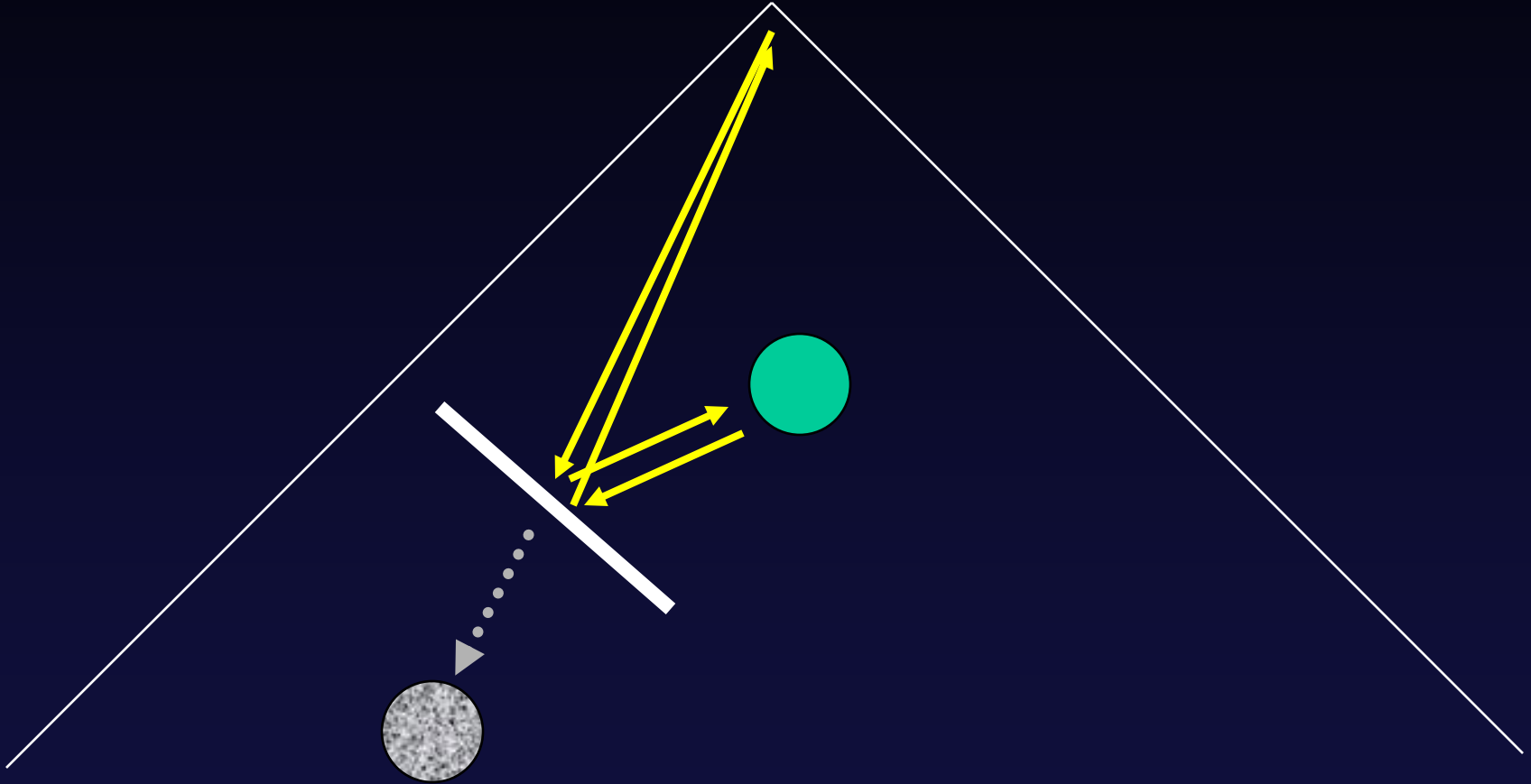
Starr-Edwards Valve



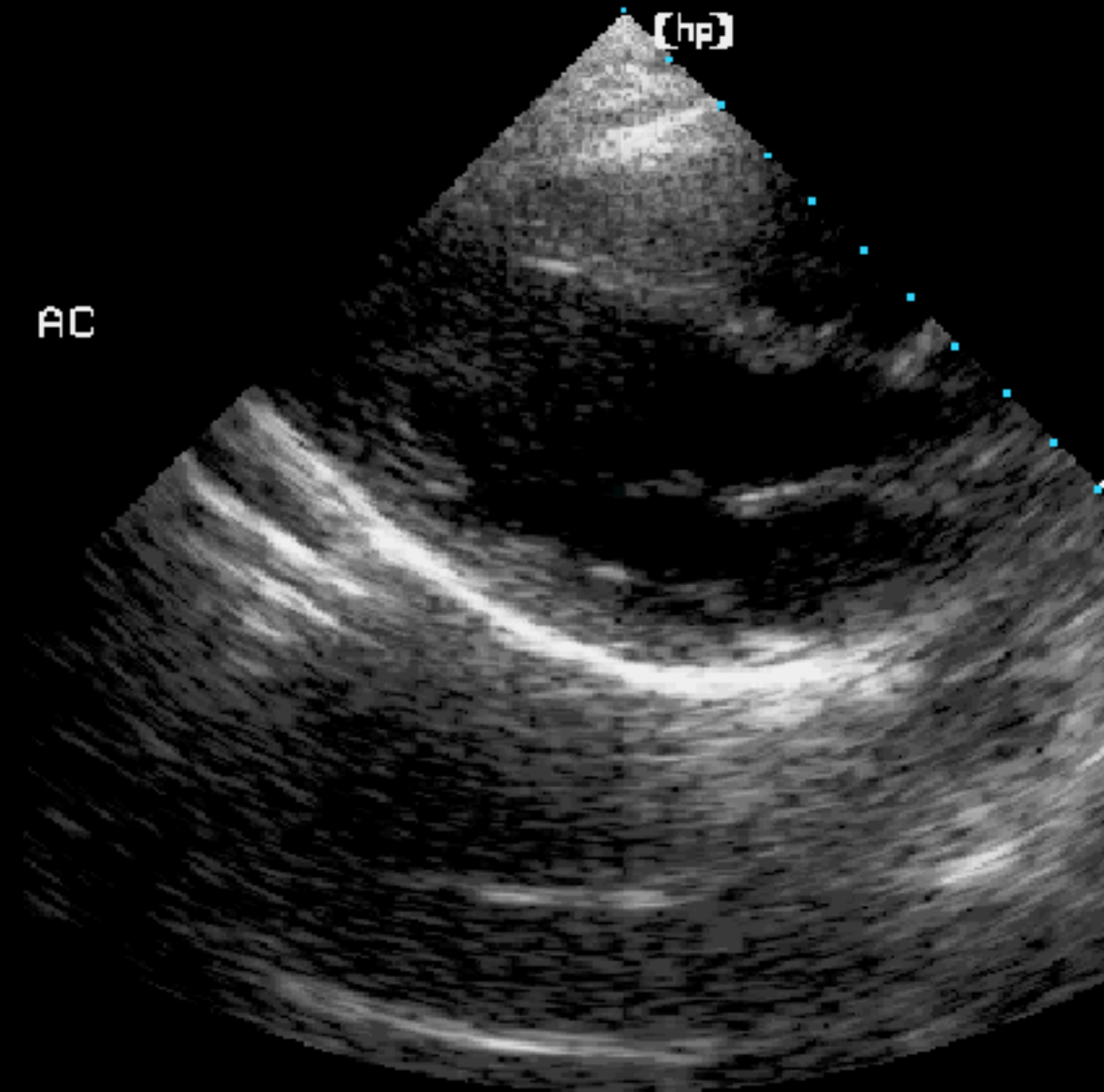
Starr-Edwards MVR



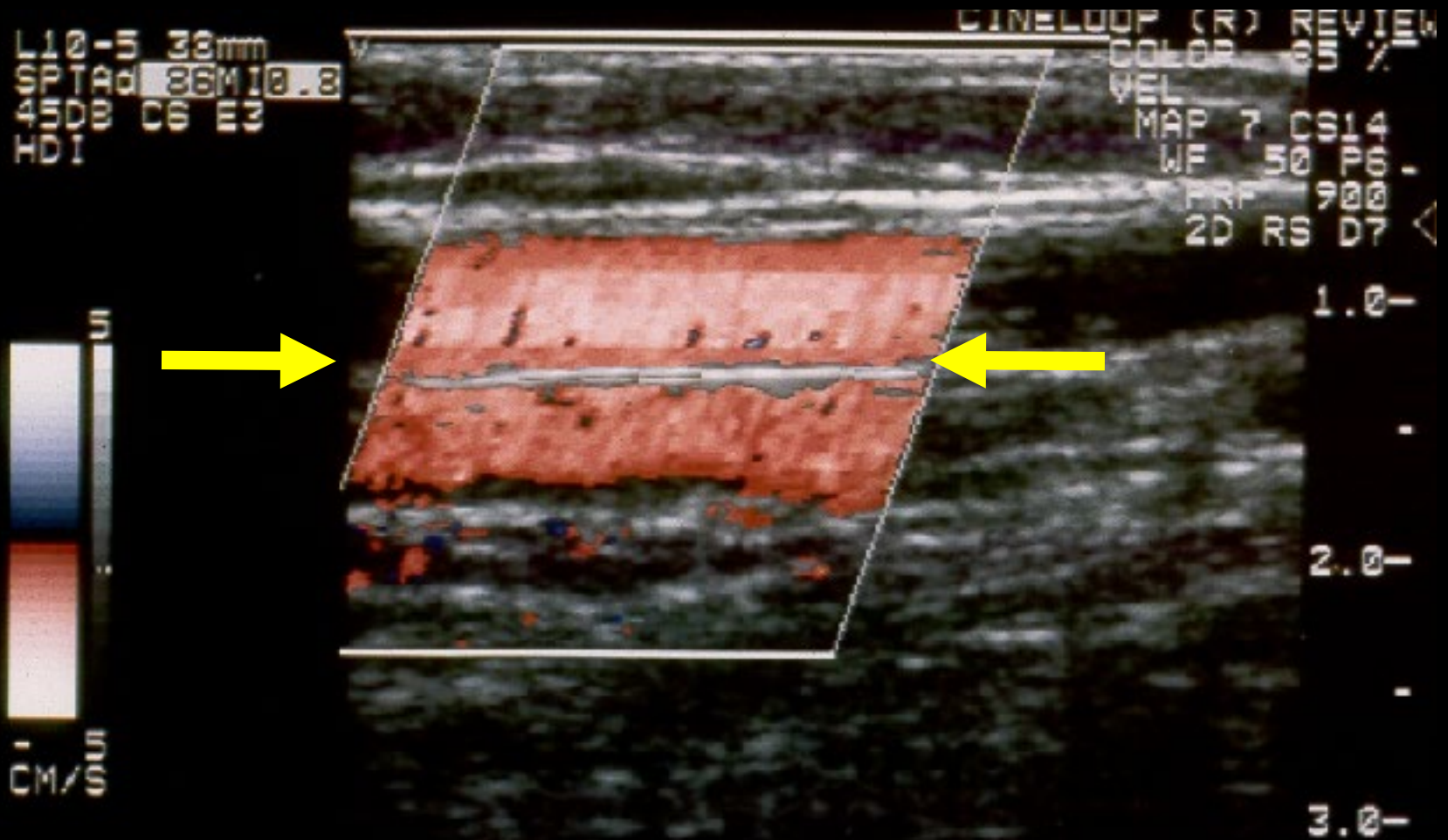
MIRROR IMAGE



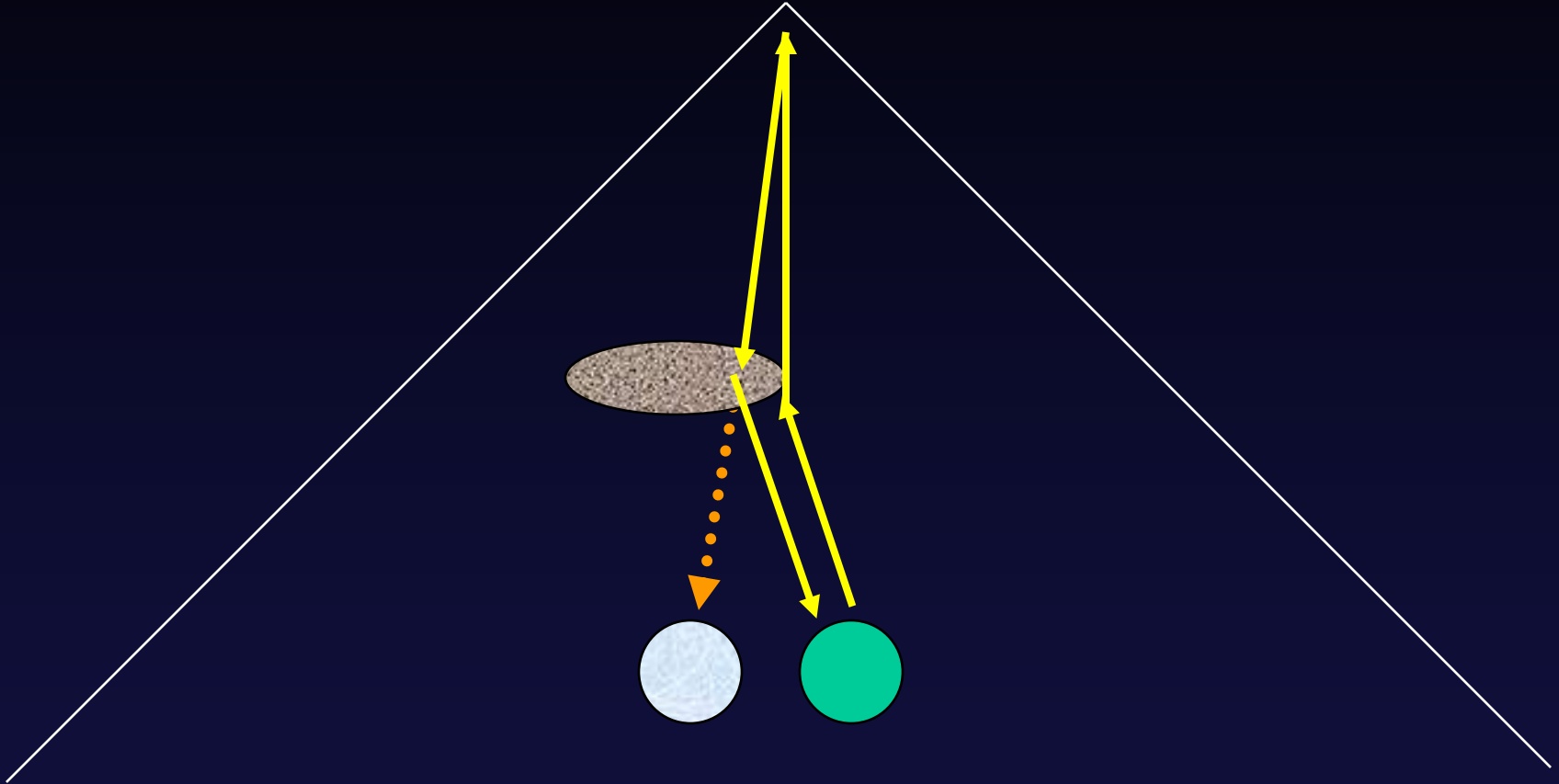
MIRROR IMAGE



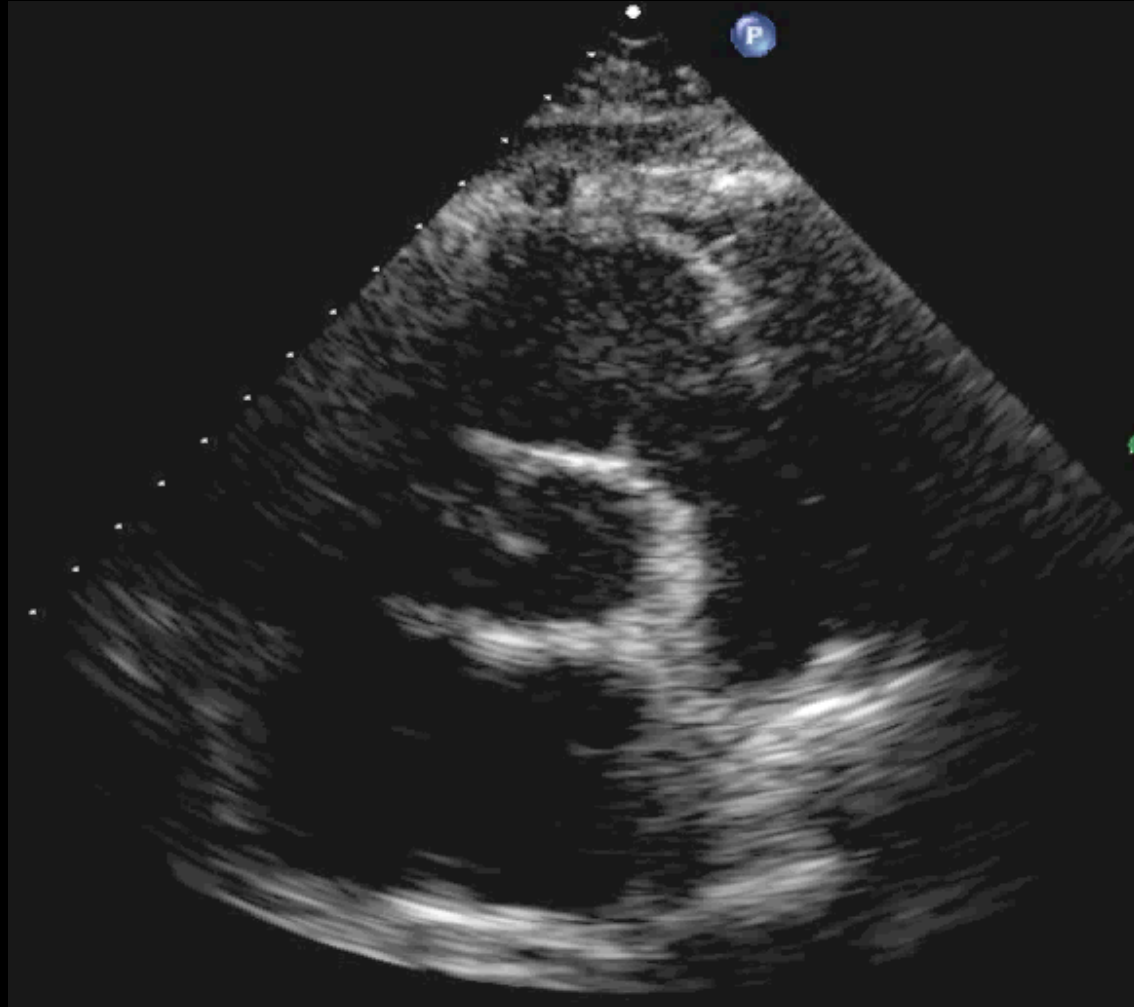
MIRROR IMAGE



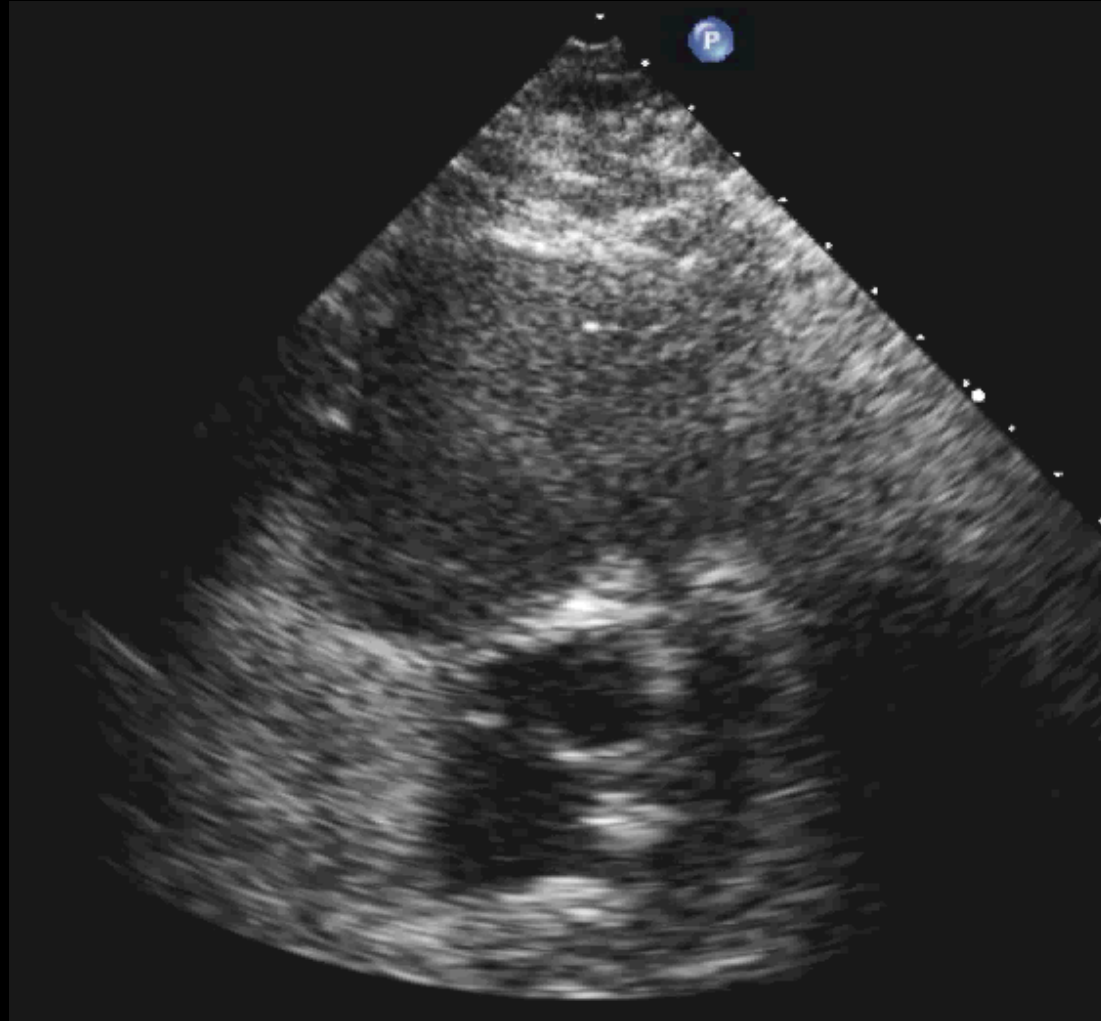
REFRACTION



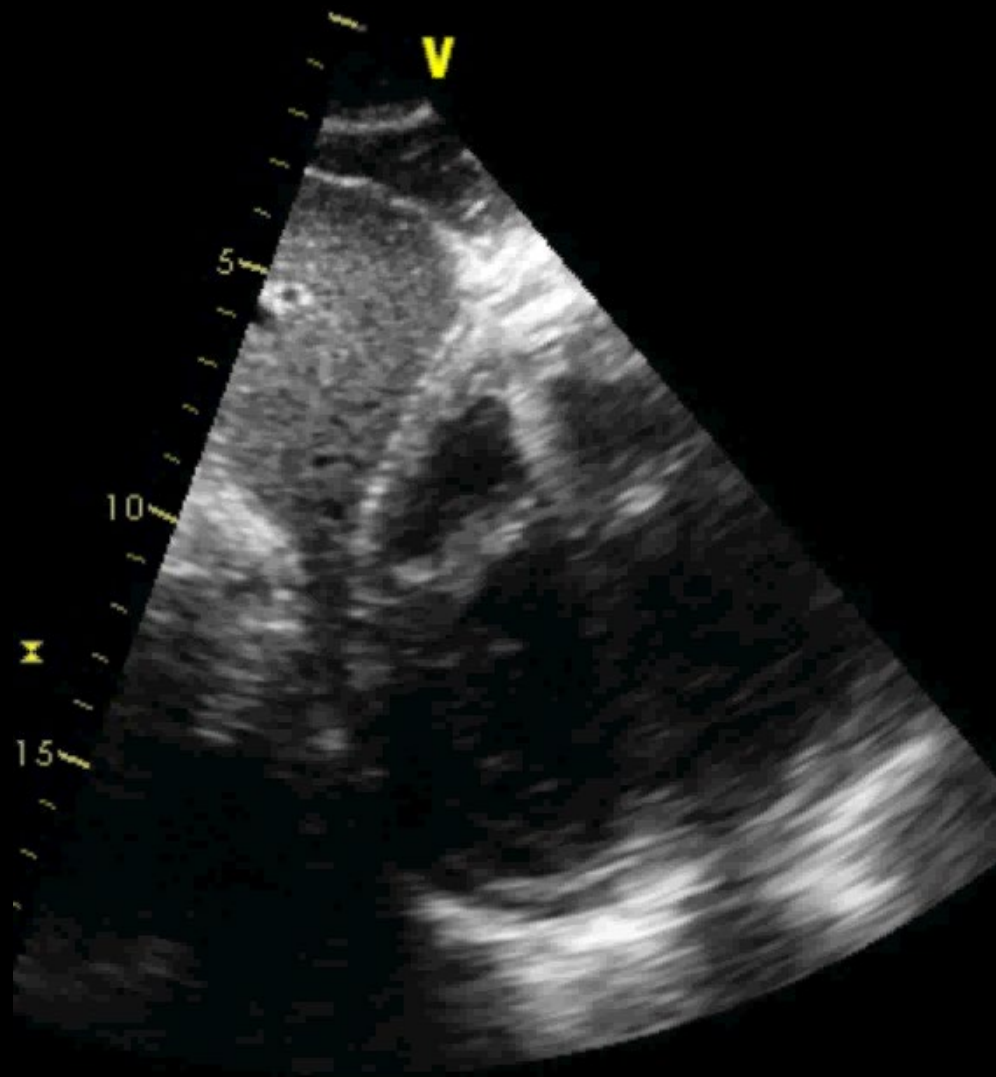
Double Ao - Refraction



Double Ao - Refraction

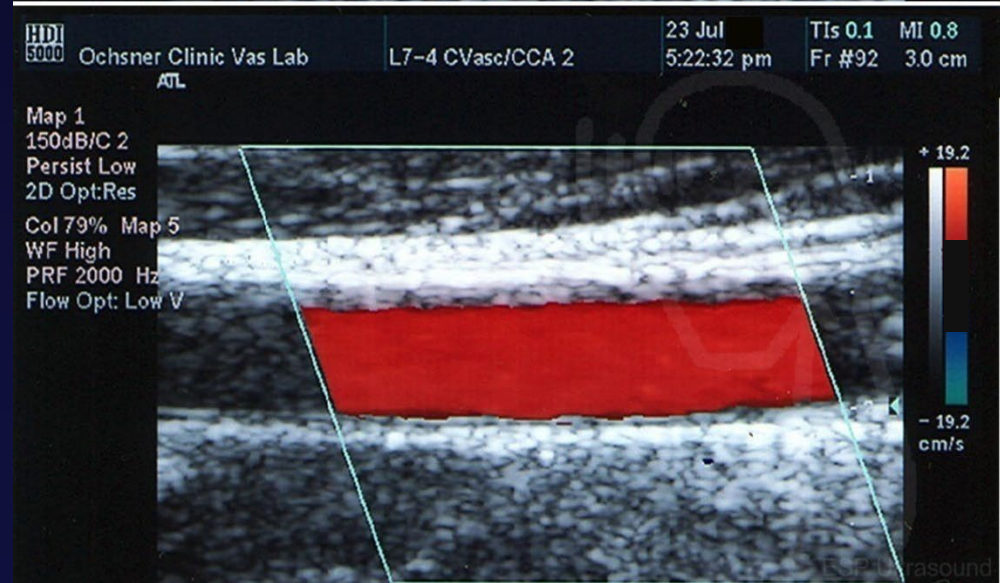
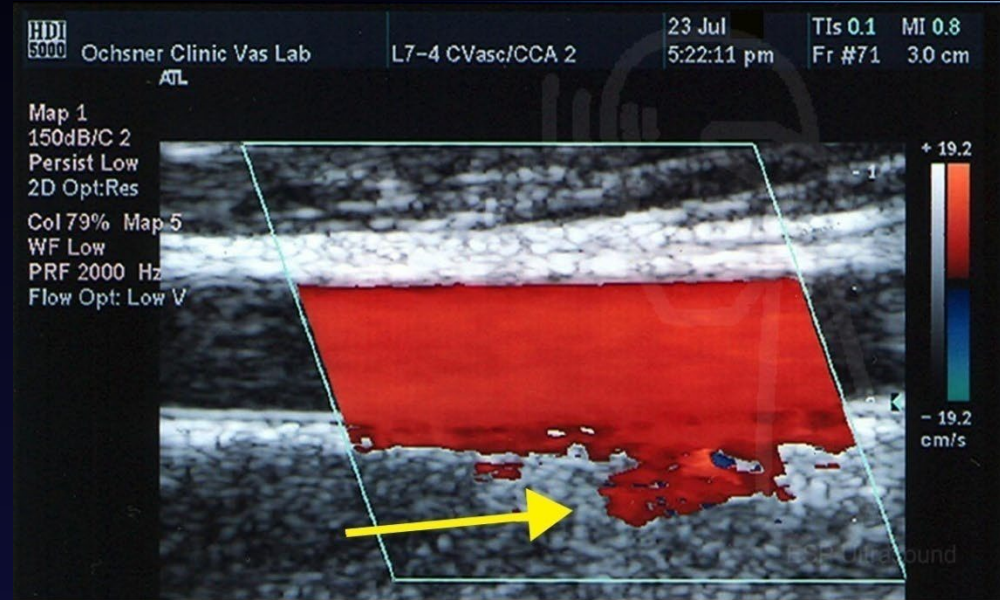


Double LV - Refraction

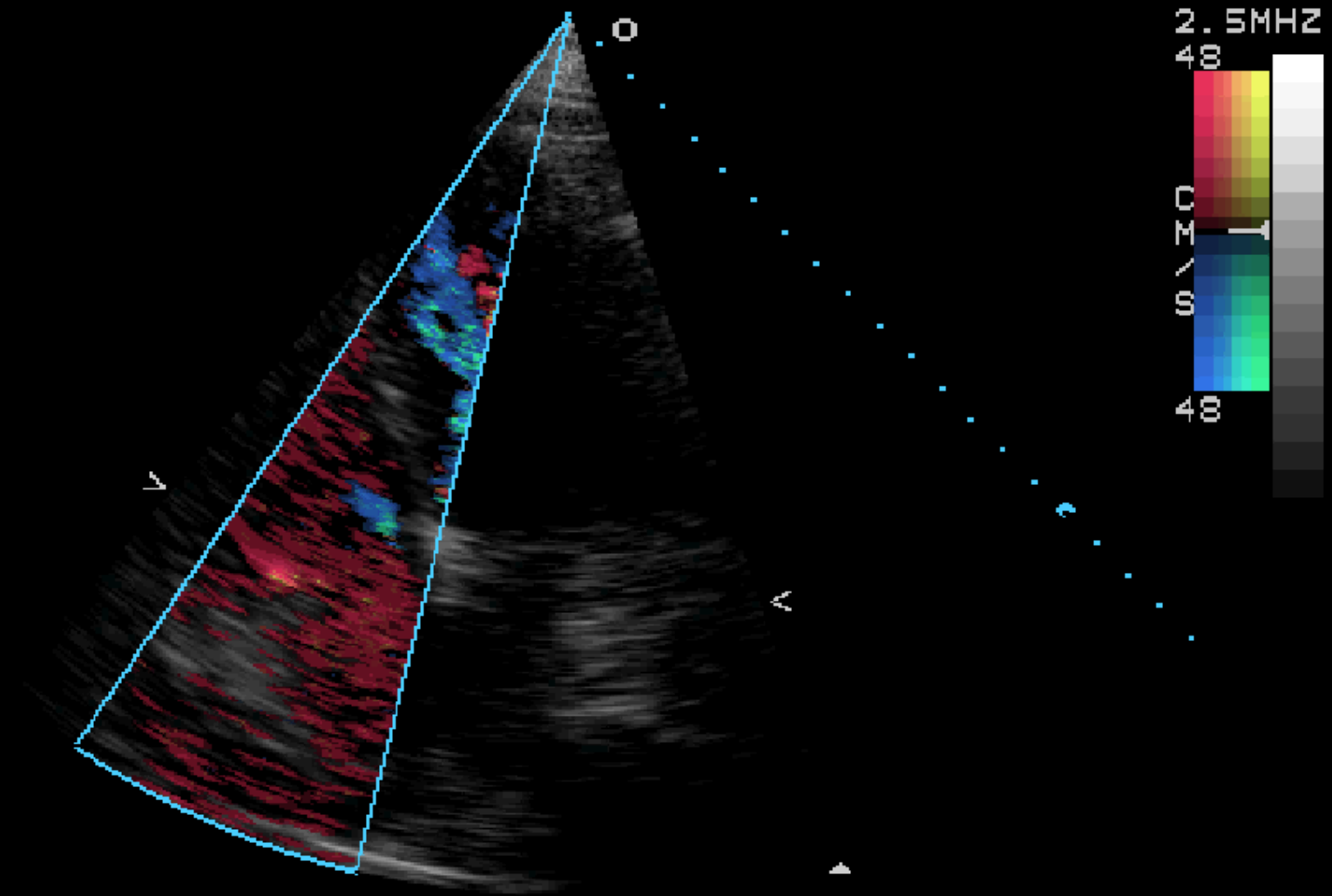


DOPPLER ARTIFACTS

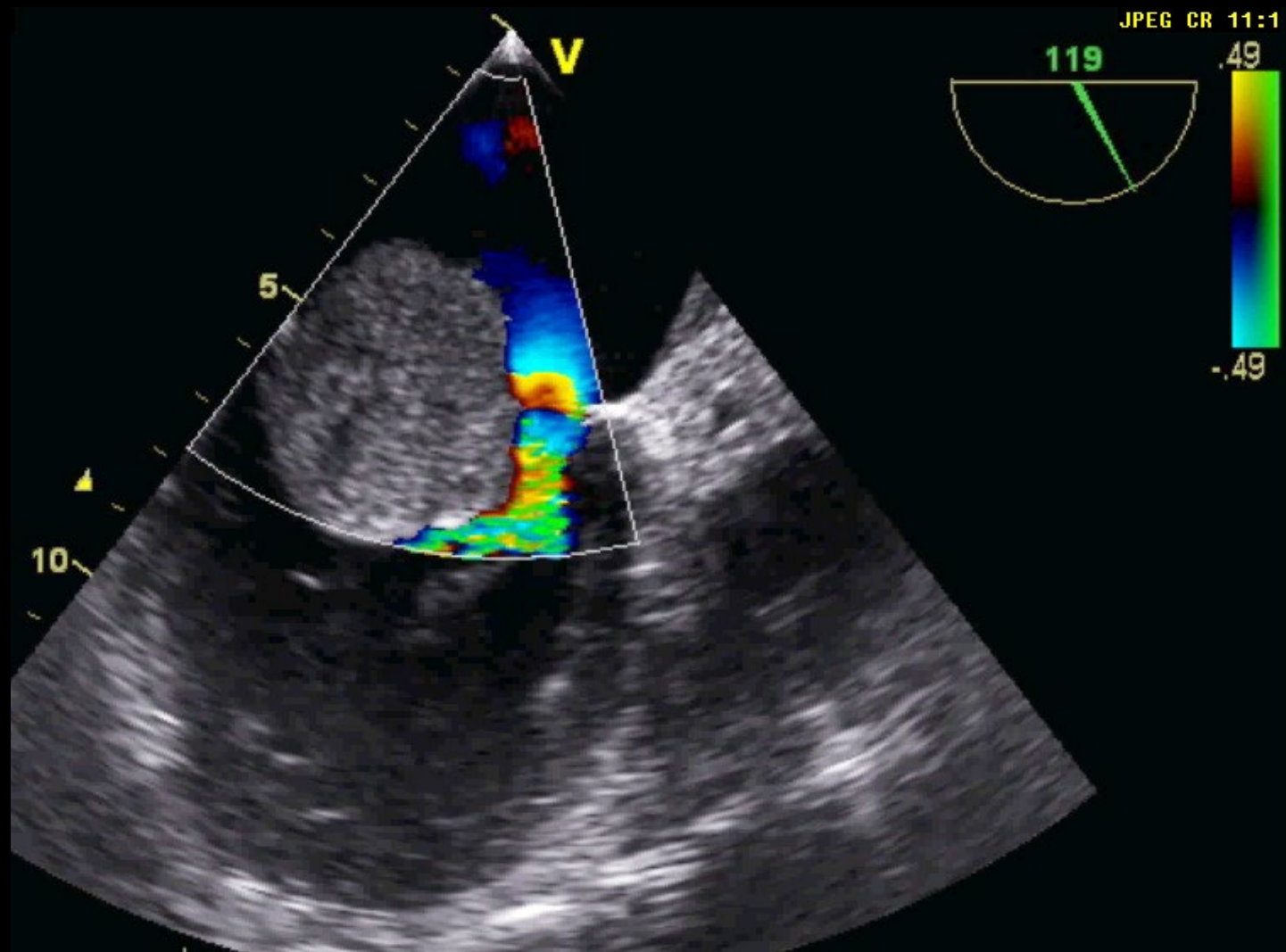
- pulsating vessel walls and moving structures (heart) can create small Doppler shifts – clutter
- color flash or ghosting appears in early systole due to heart motion
- wall filters eliminate color from small Doppler shifts that arise from structure motion



Ghosting Artifact



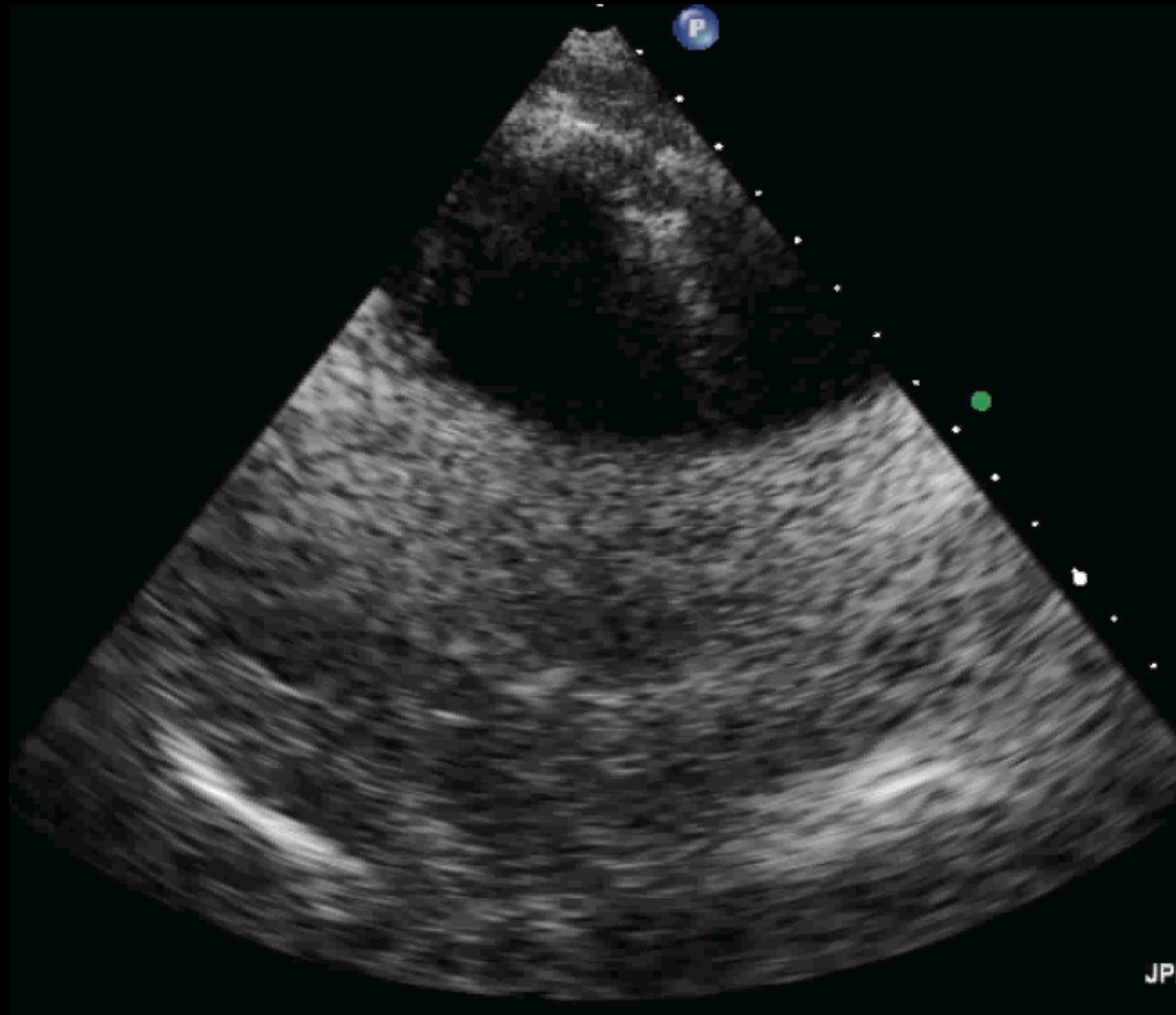
Ghosting Artifact



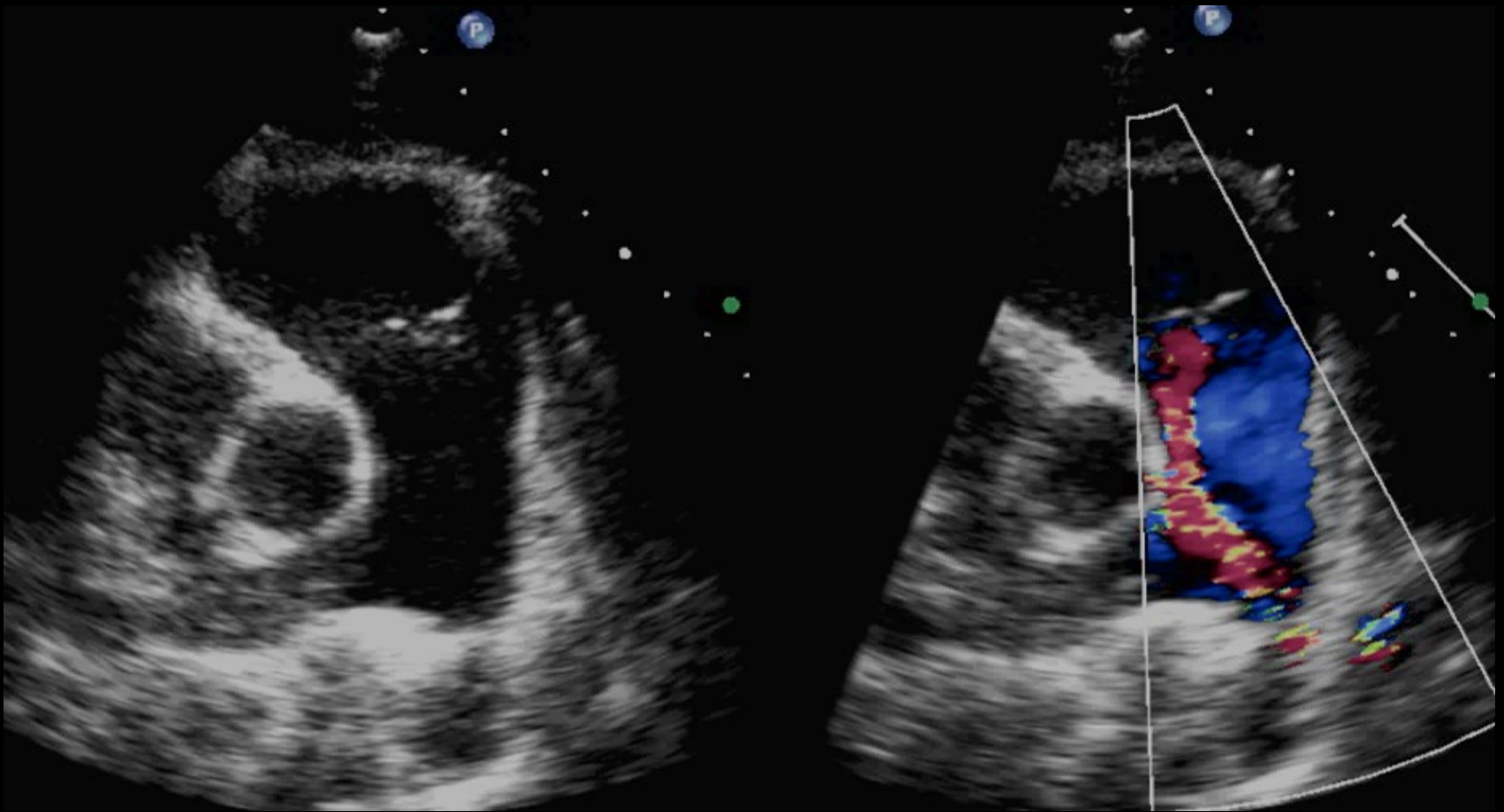
ARTIFACTS – My Classification

- Easy
- Difficult
- Impossible
 - Weird things not explained by physics
 - (Don't mention dating / women)

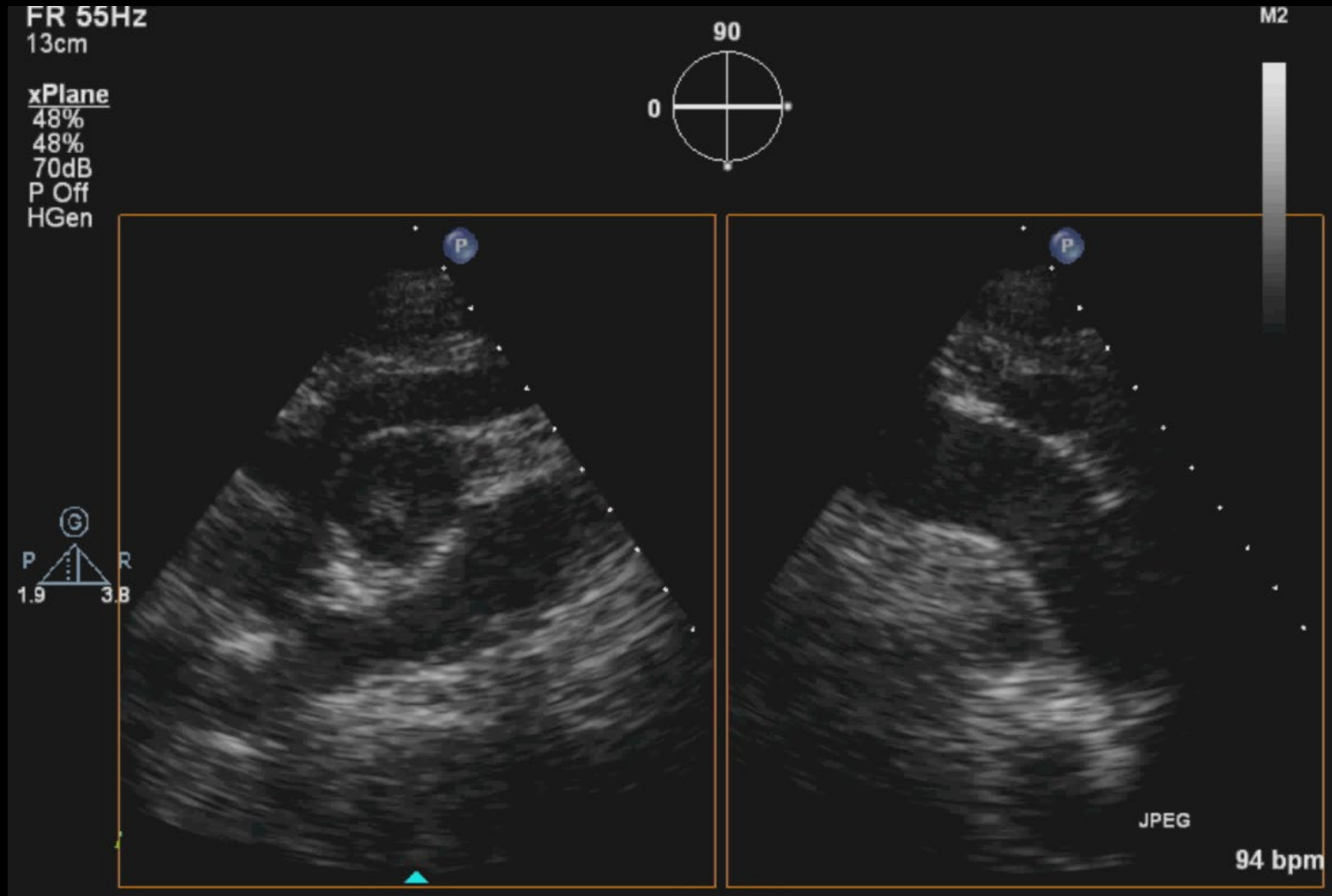
Breast Implant



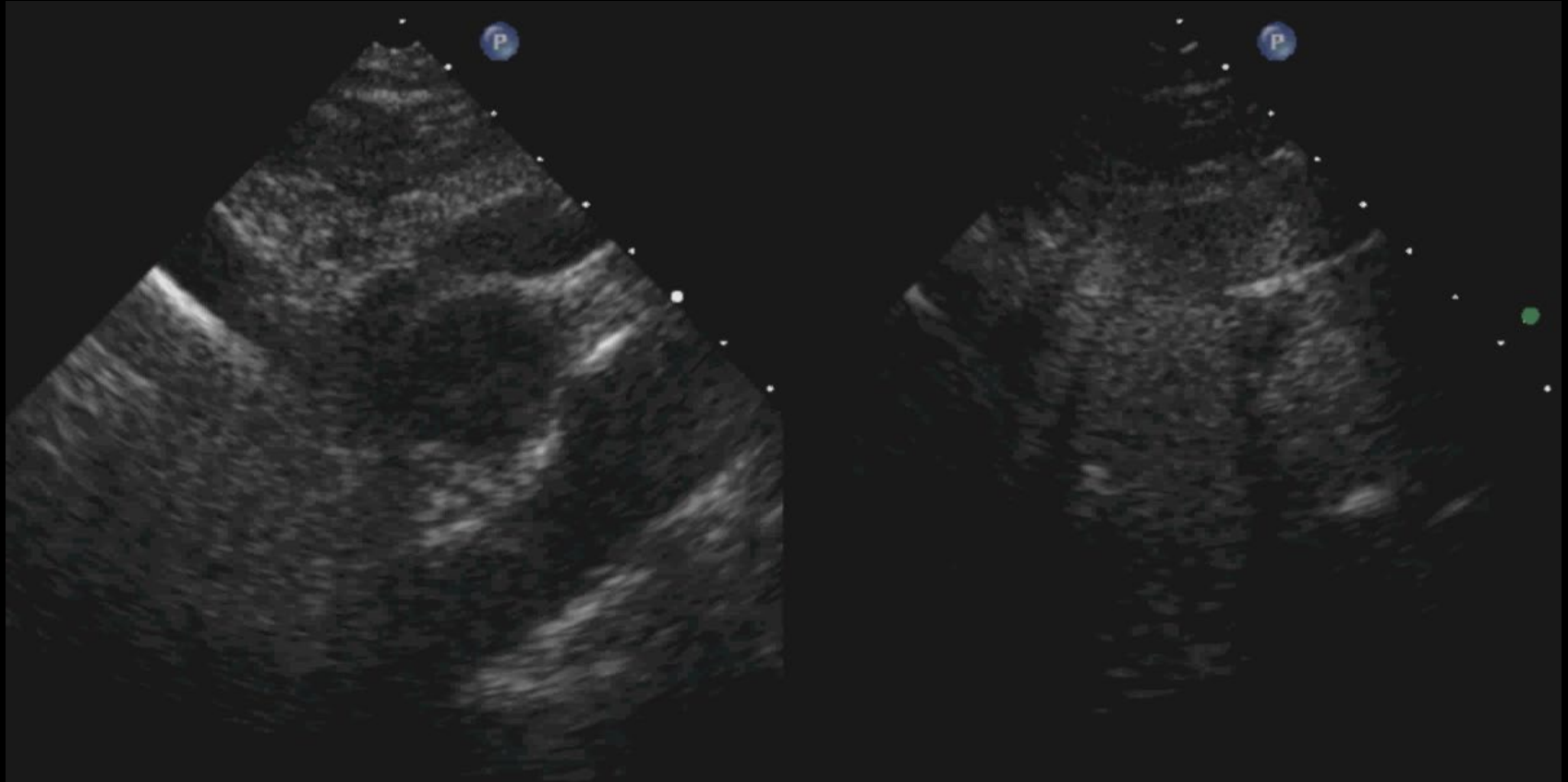
PDA Doppler Artifact



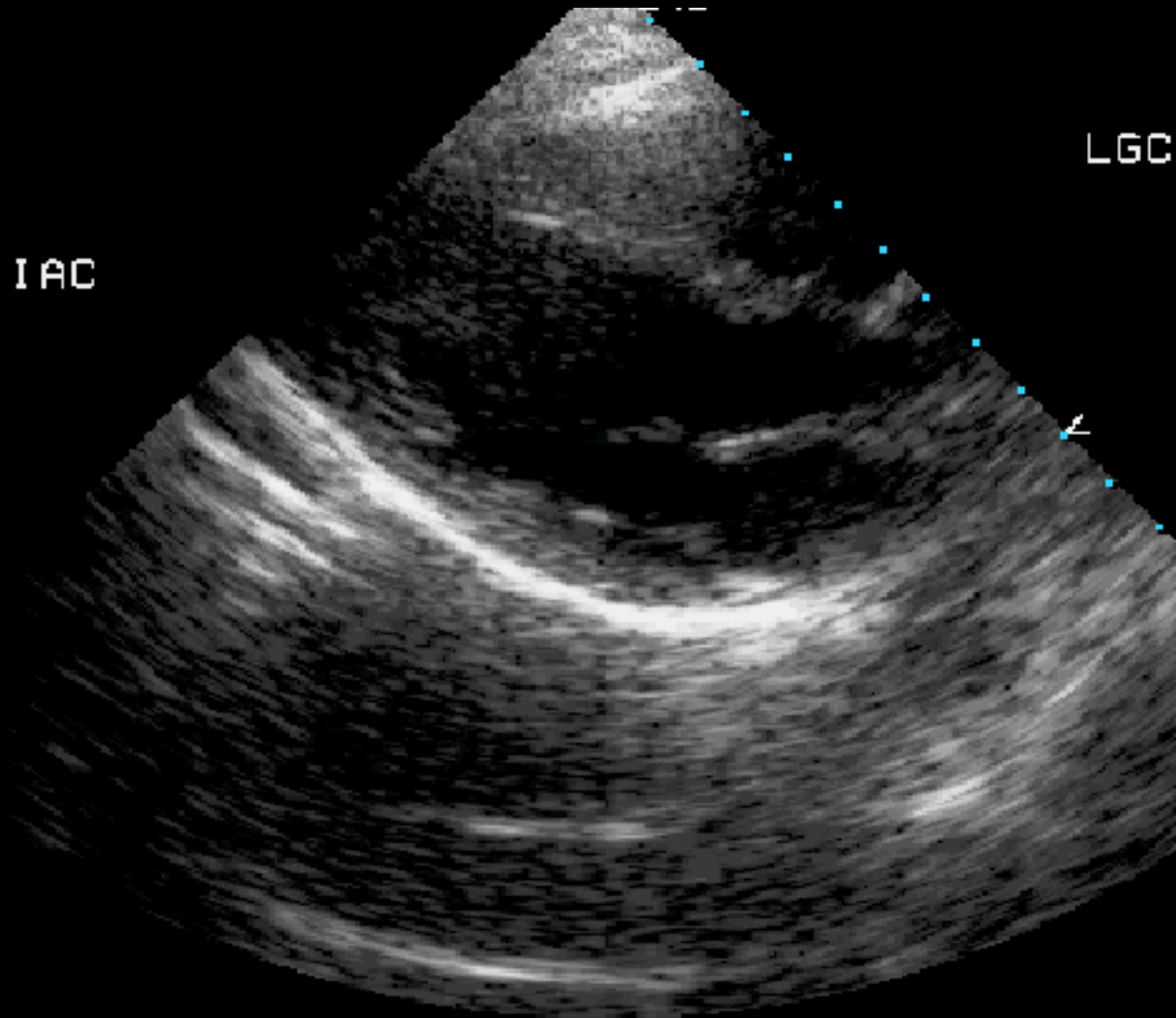
? Artifact in the Ao



? Artifact disproved by contrast

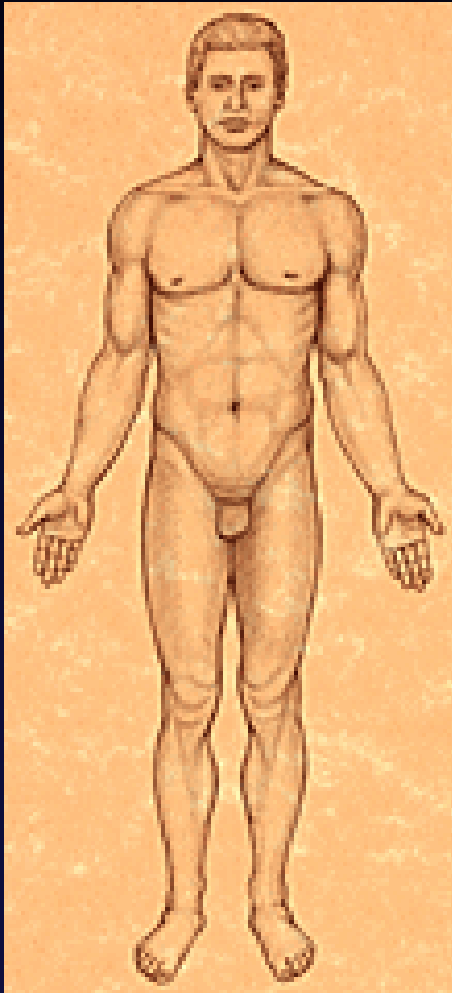


Multiple Artifacts (4)



ARTIFACTS

- In all Images
- Most can be explained
- If you think its real – change depth or xducer & document in more than one view.



Duke ER

The End

DUKE: Adams