Advanced machine settings and artefact recognition

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Lecture aims

- Machine settings
  - Basics→A safe start
  - Advanced→ Tweaking an exam
- Artifacts (and limitations)
  - B-mode
  - Colour Doppler

Disclaimer

- All my images are from GE
- None of my salary is

Overview ultarsound scanner

Probes

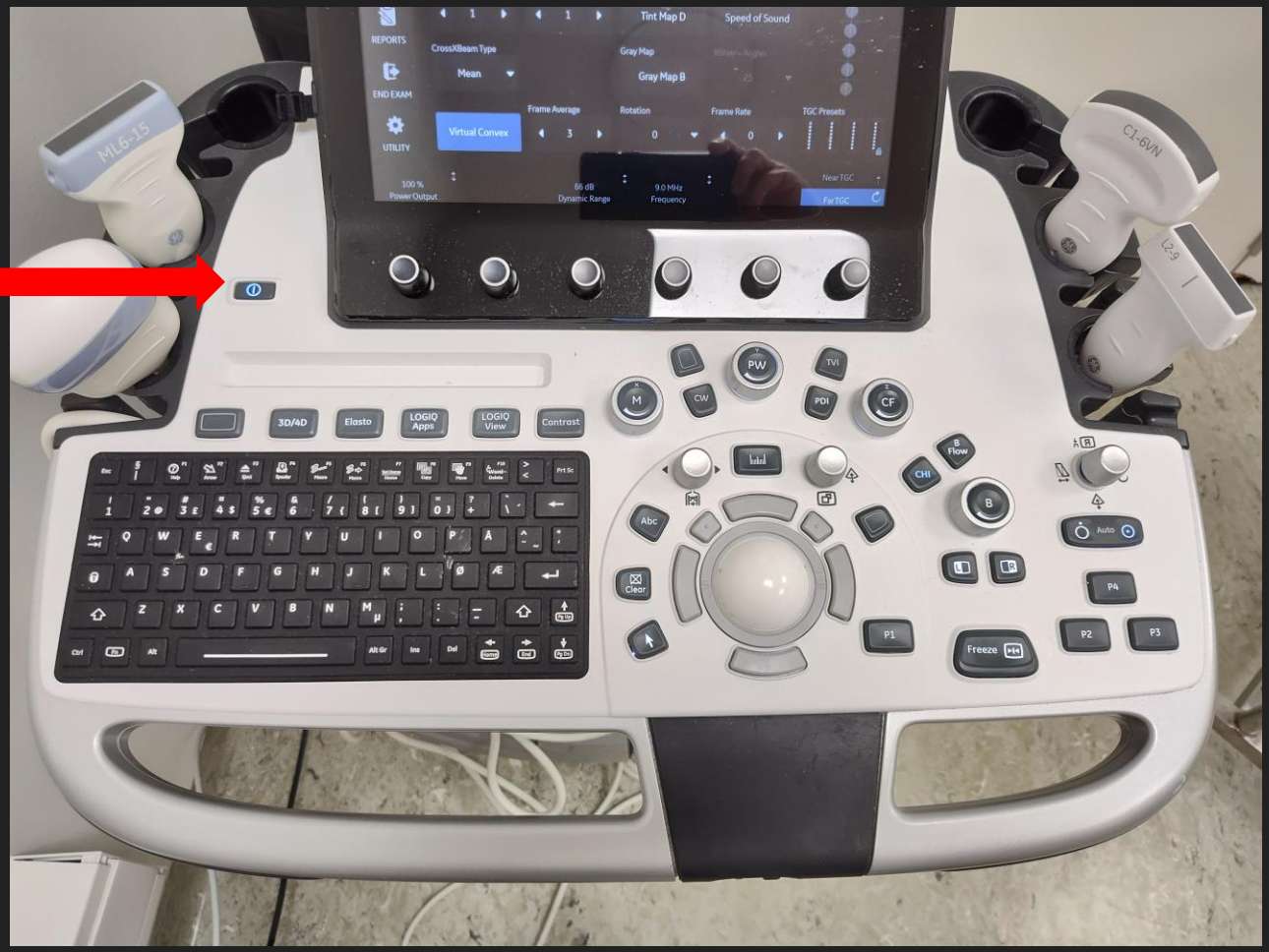
Monitor

Touch display

Manual display
(and keyboard)

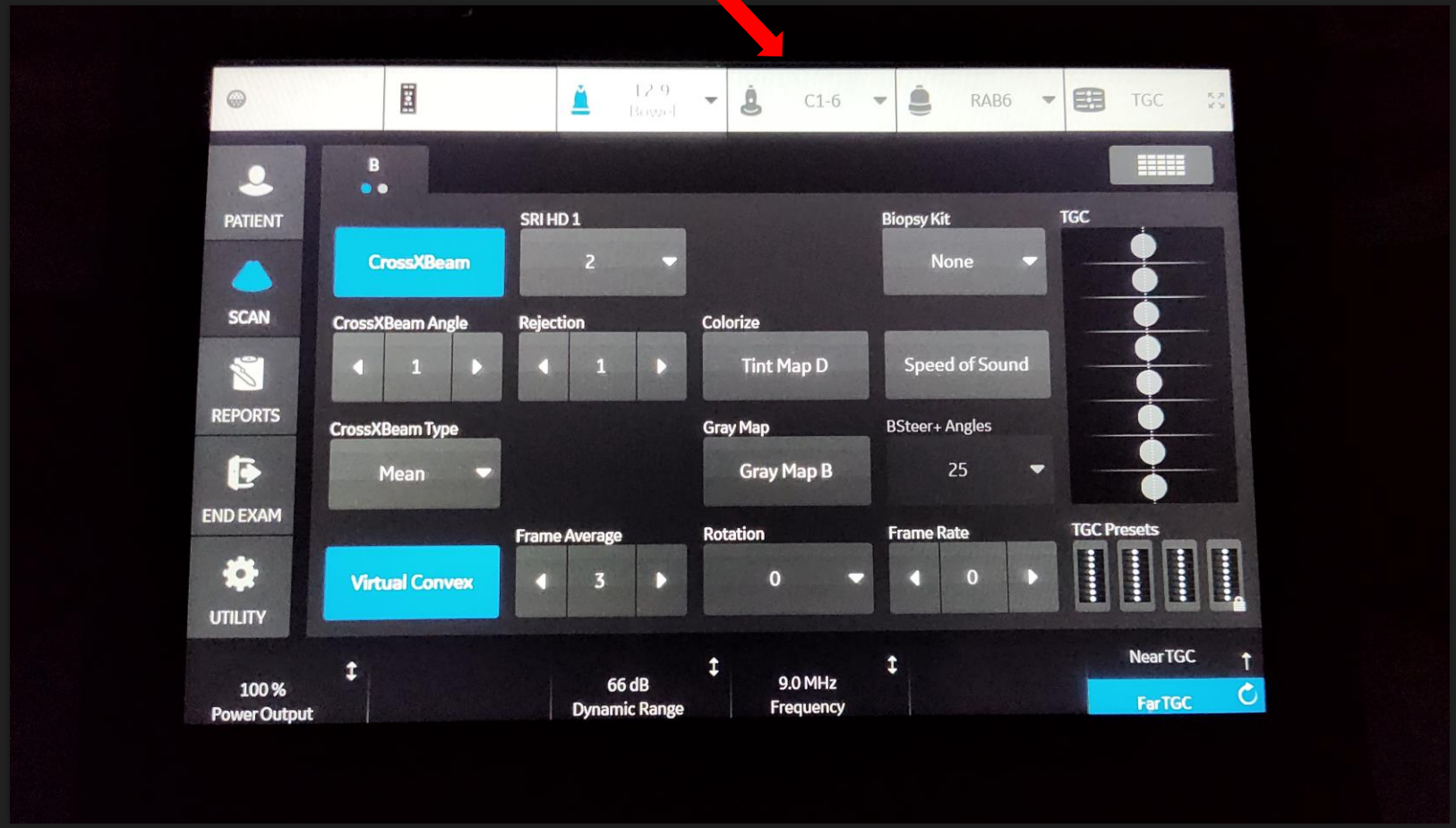
Starting an exam

- On button



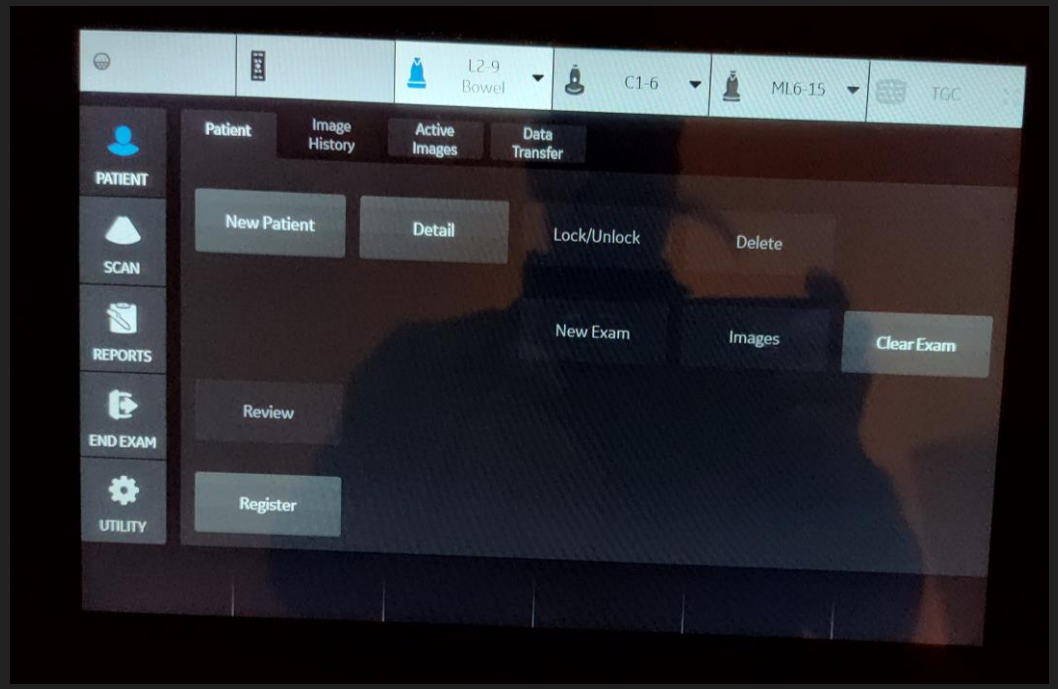
Choose probes and presets

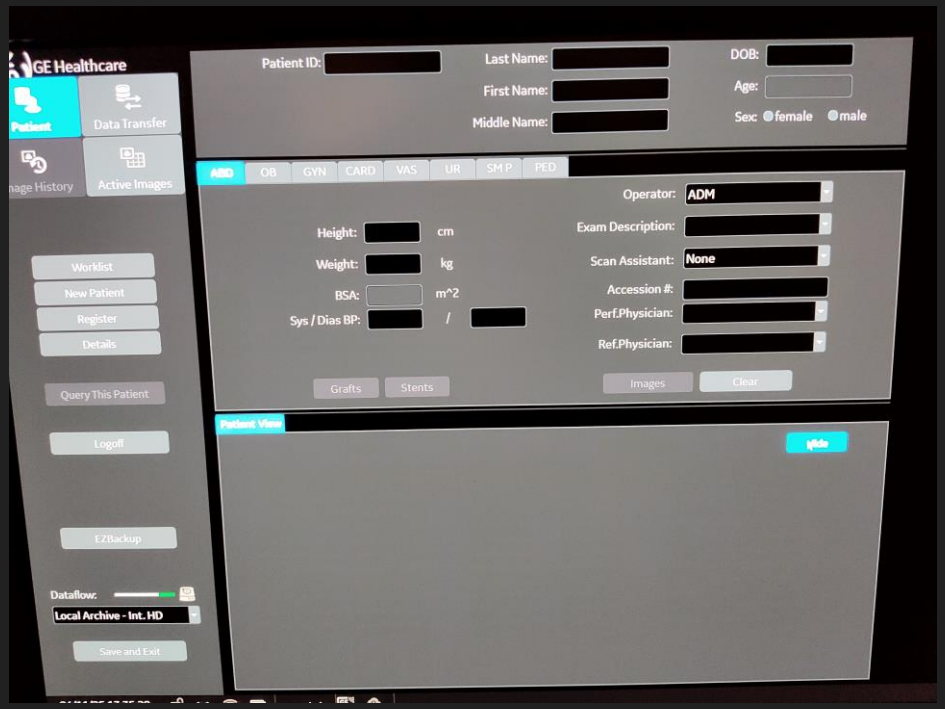
- Choose probe:
  - Available probes
  - Available presets



Choosing a patient

- Manually
- Work-list

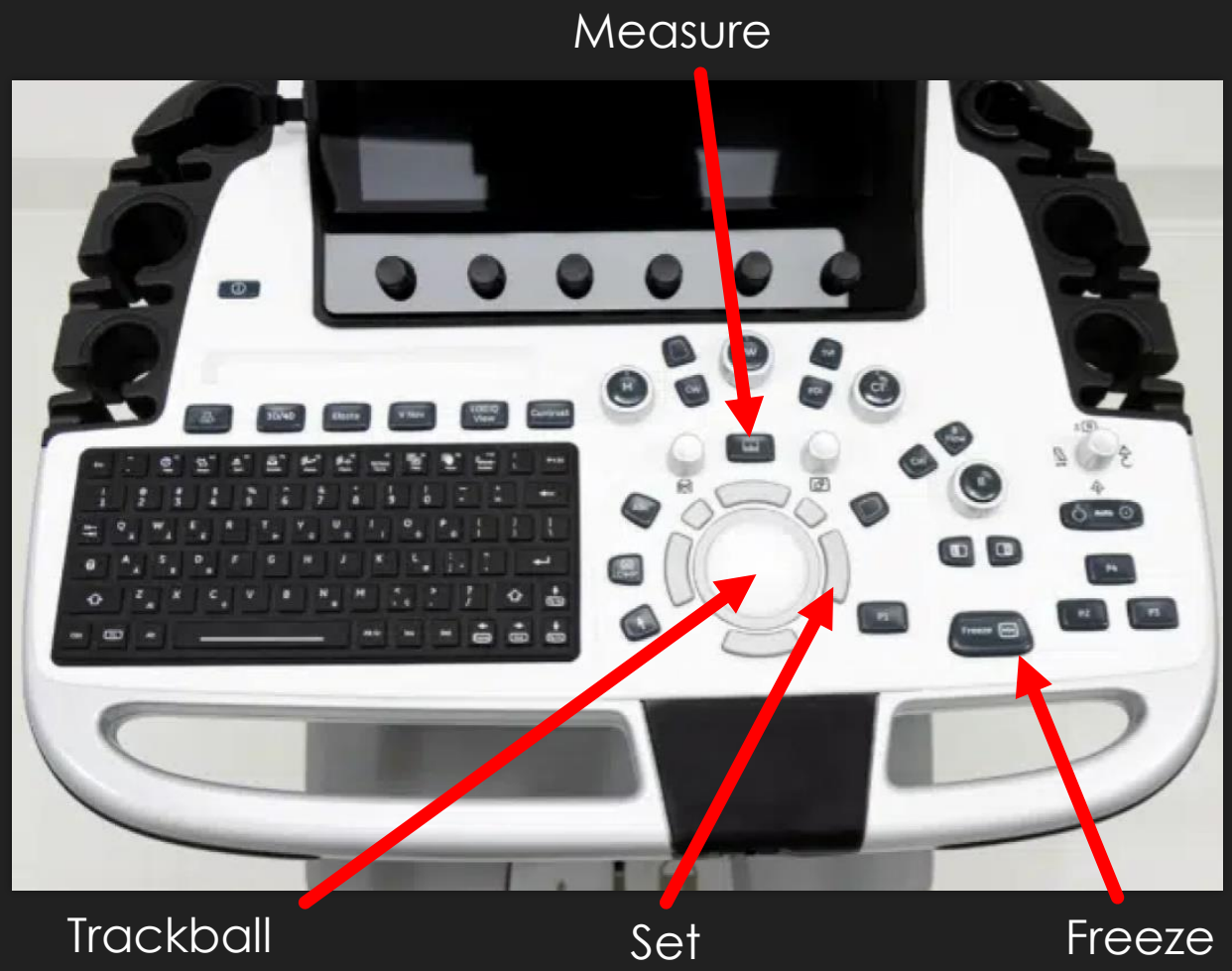




Aquiring data

- Depends on US mode
- Adaptable
  - Specific needs
  - Optimise workflow

- Measuring in B-mode:
- Freeze→«Measure button»→Trackball→Set-button→Trackball→Set-button



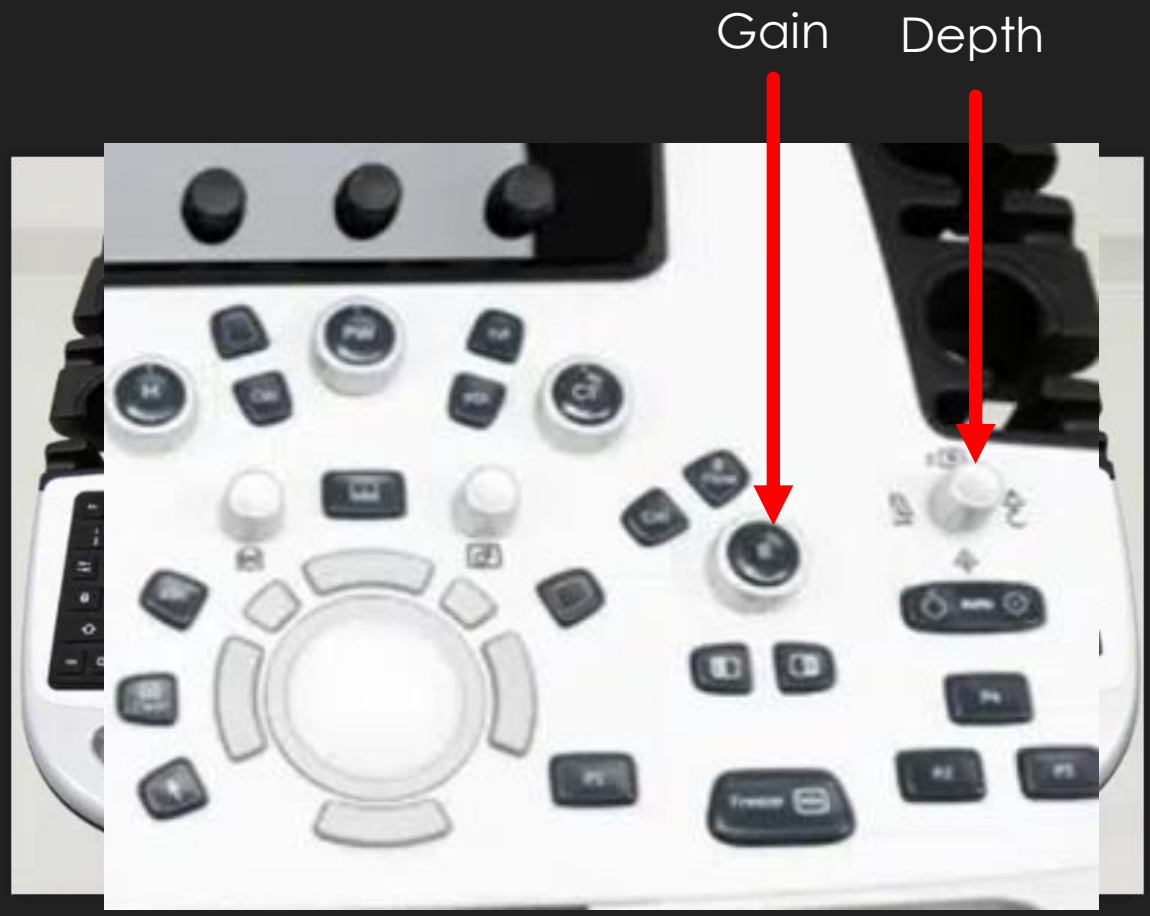
Saving data

- Still image: Freeze+P1
- Still image w/measurement: Freeze→Measure→P1
- Video:
  - Retrospective: P1
  - Prospective: «Record button»→P1
- Print still image: P3

- Format
  - Still image/video (JPG, PNG, wmv)
  - DICOM
    - Open
    - Proprietary

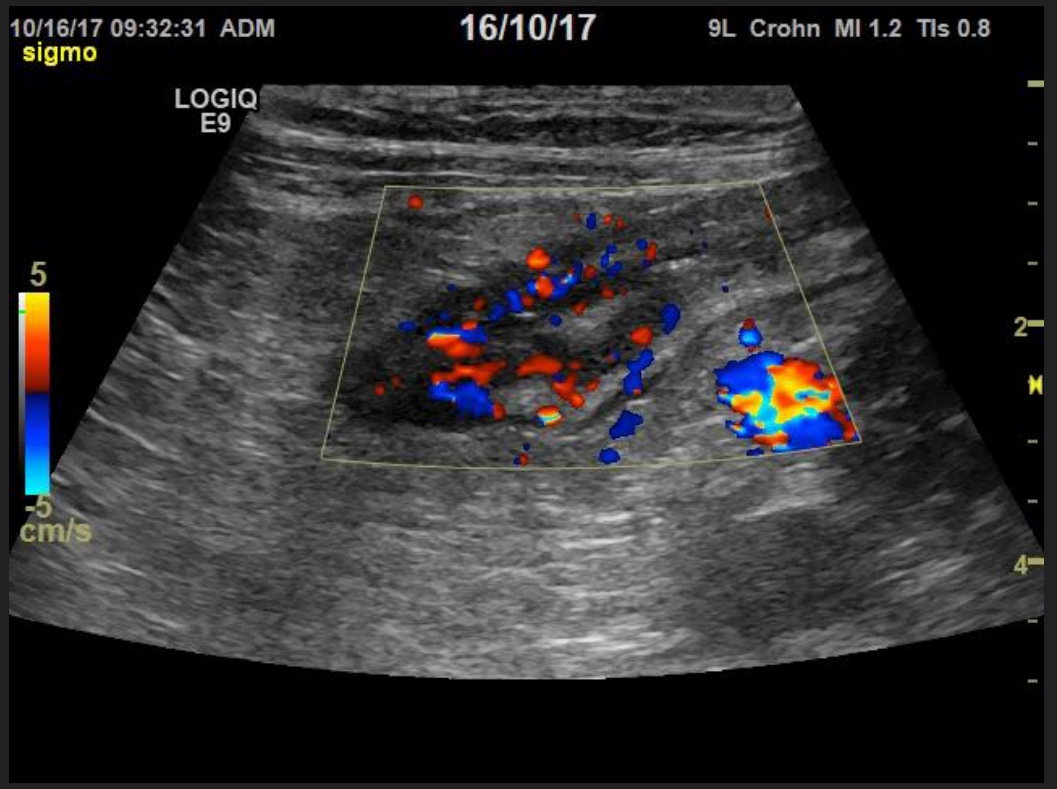
Adjusting settings : B-mode

- How improve image quality?
- Adjust gain
  - Reduce grey scale intensities
  - Increase grey scale intensities
- Adjust depth
  - Increase to include relevant organ
  - Reduce to optimise image in ROI
- Adjust focus point(s)
  - Reduce nearfield noise
  - Improve image sharpness in ROI



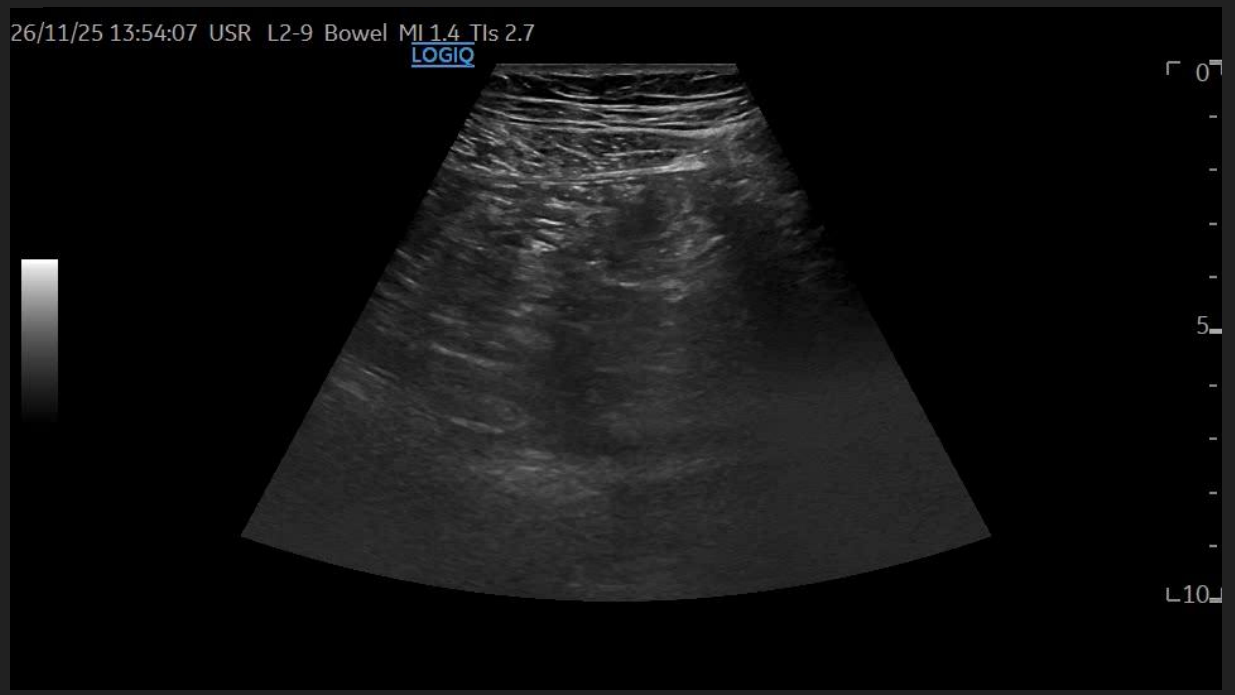
Adjusting settings : Colur doppler

- Adjust sector size to
  - Include region of interest ⬆
  - Increase frame rate and sensitivity ⬇
- Adjust Doppler scale
  - Avoid aliasing in vessels with high velocities ⬆
  - Increase sensitivity for low velocities ⬇
- Adjust gain to
  - Reduce noise form tissue movement ⬇
  - Reduce blooming of Doppler signal ⬇
  - Increase sensitivity for small vessels ⬆

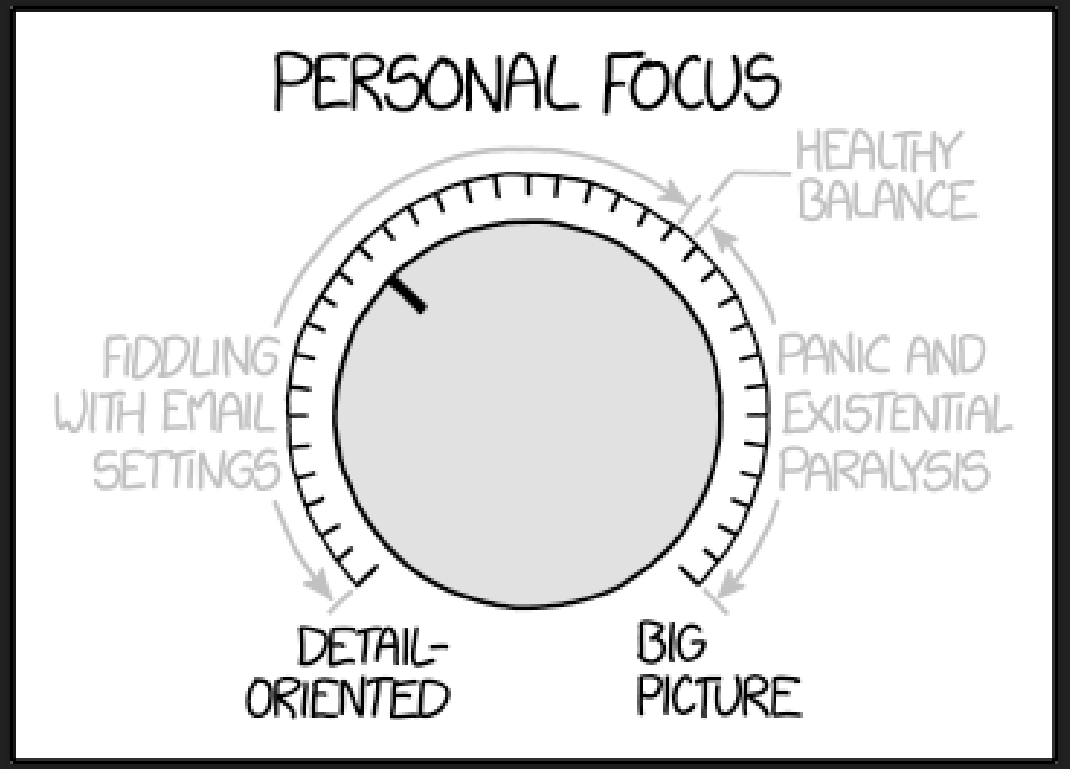


Depth- «The Goldilocks rule»

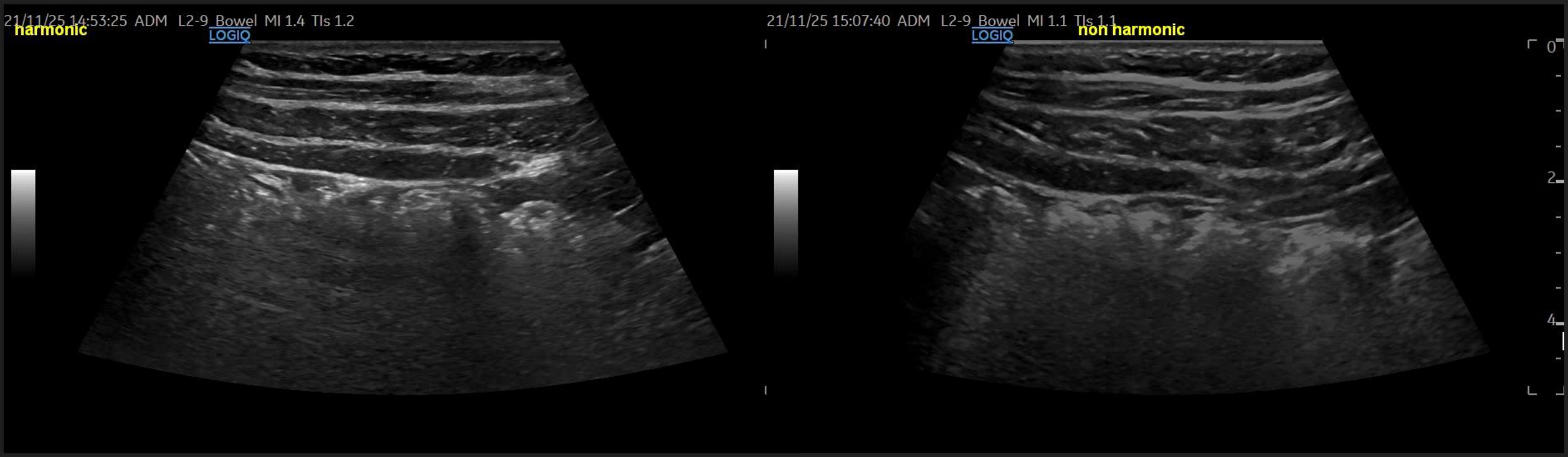
- Too deep
- To shallow
- «Just right»



Focusing

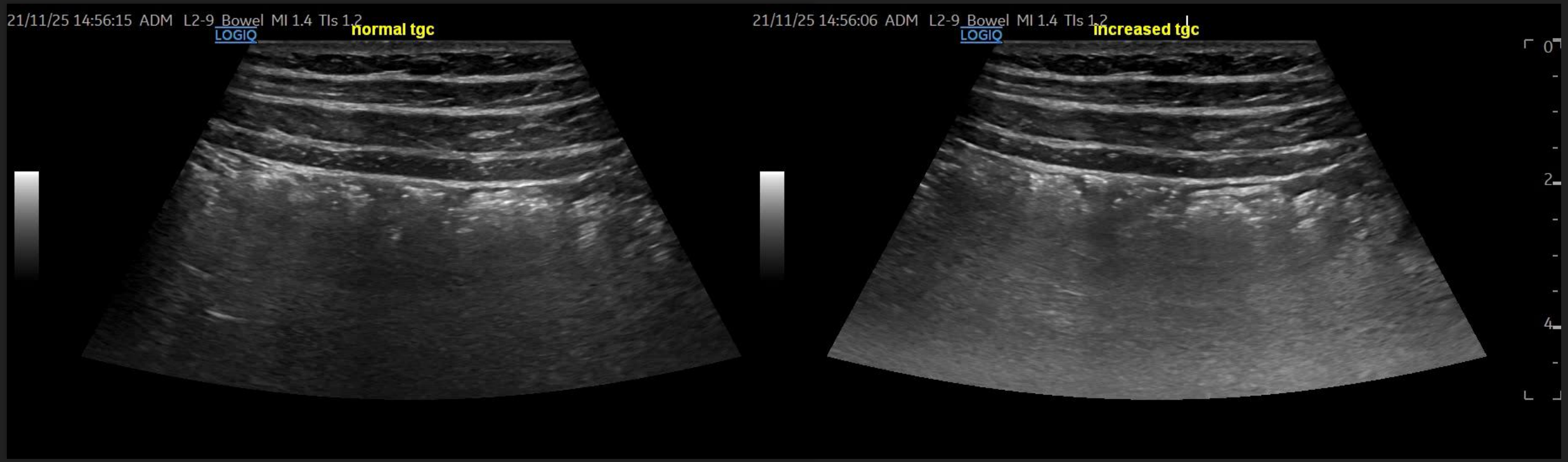

PERSONAL FOCUS
HEALTHY BALANCE
PANIC AND EXISTENTIAL PARALYSIS
BIG PICTURE
DETAIL-ORIENTED
FIDDLING WITH EMAIL SETTINGS

Harmonics



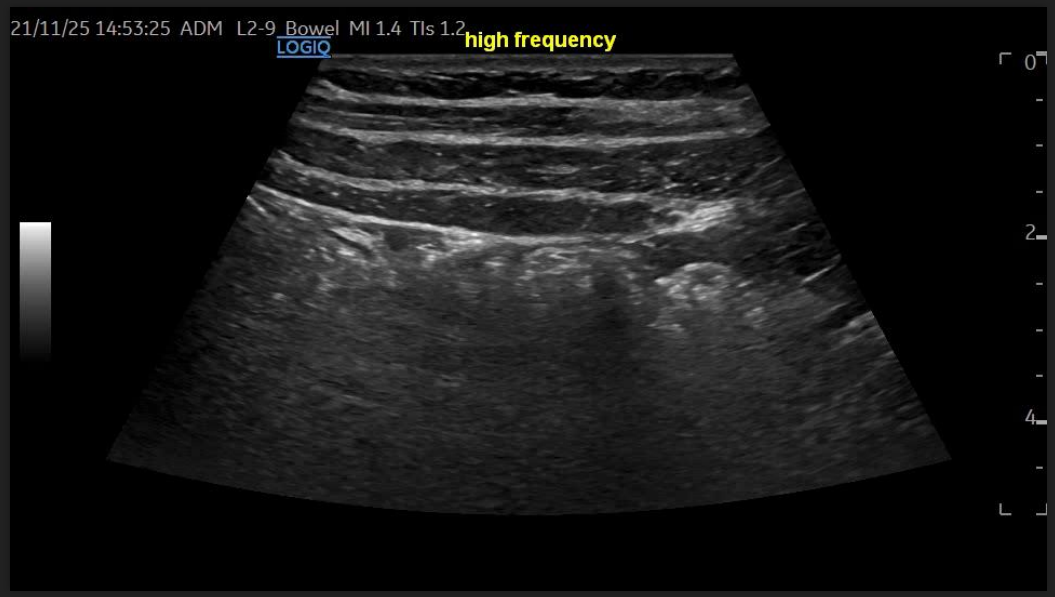
Send at frequency X, recieve at X*2

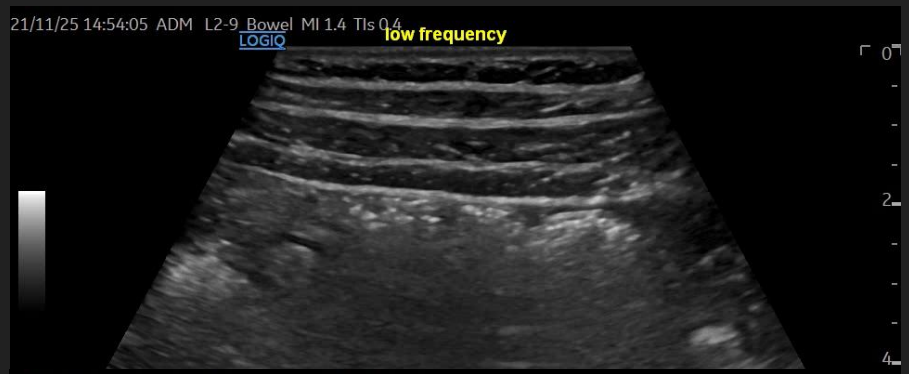
Time gain compensation



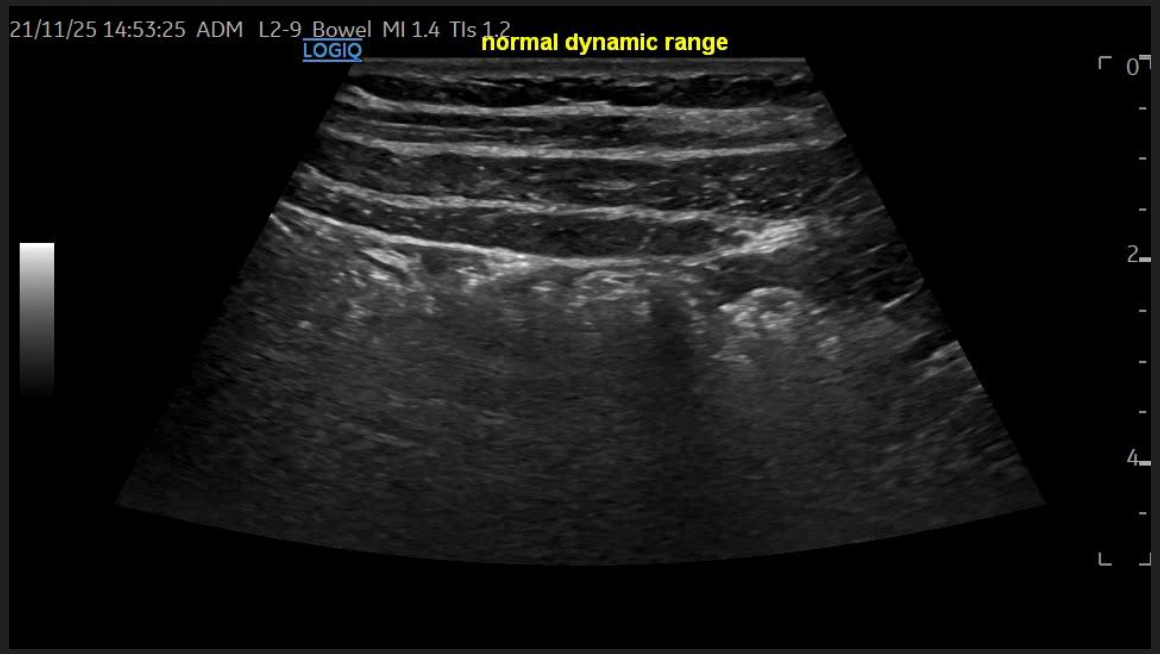
Frequency

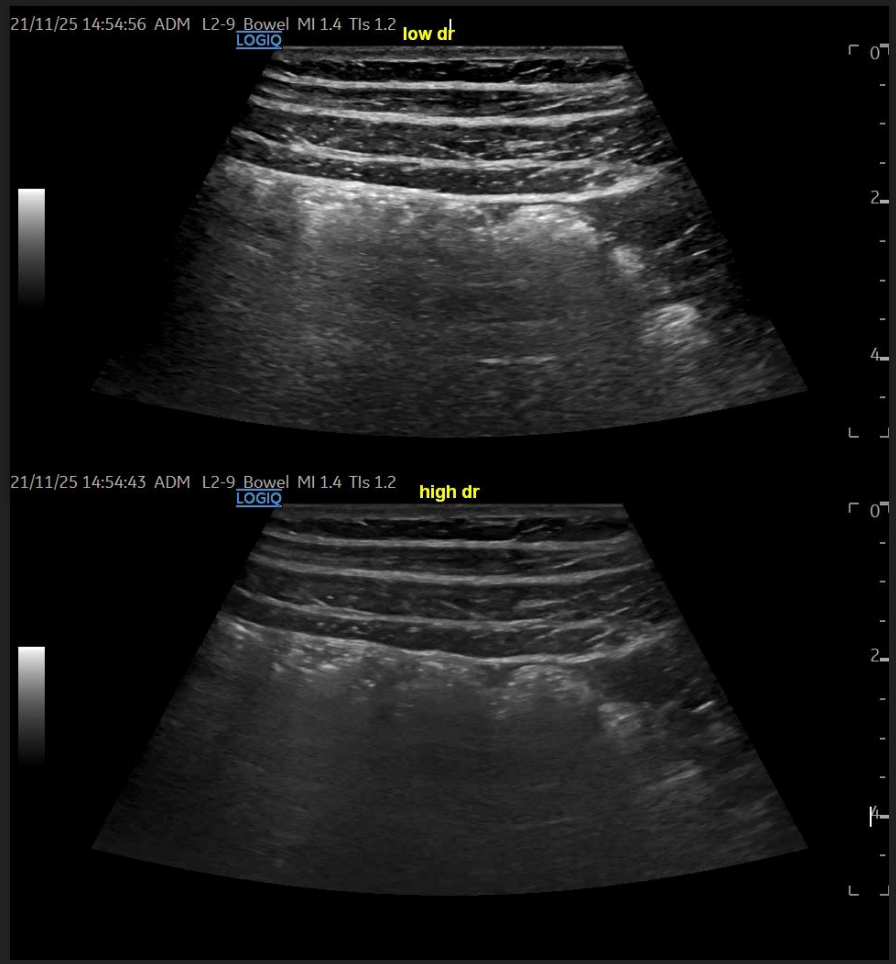
Resolution Penetration



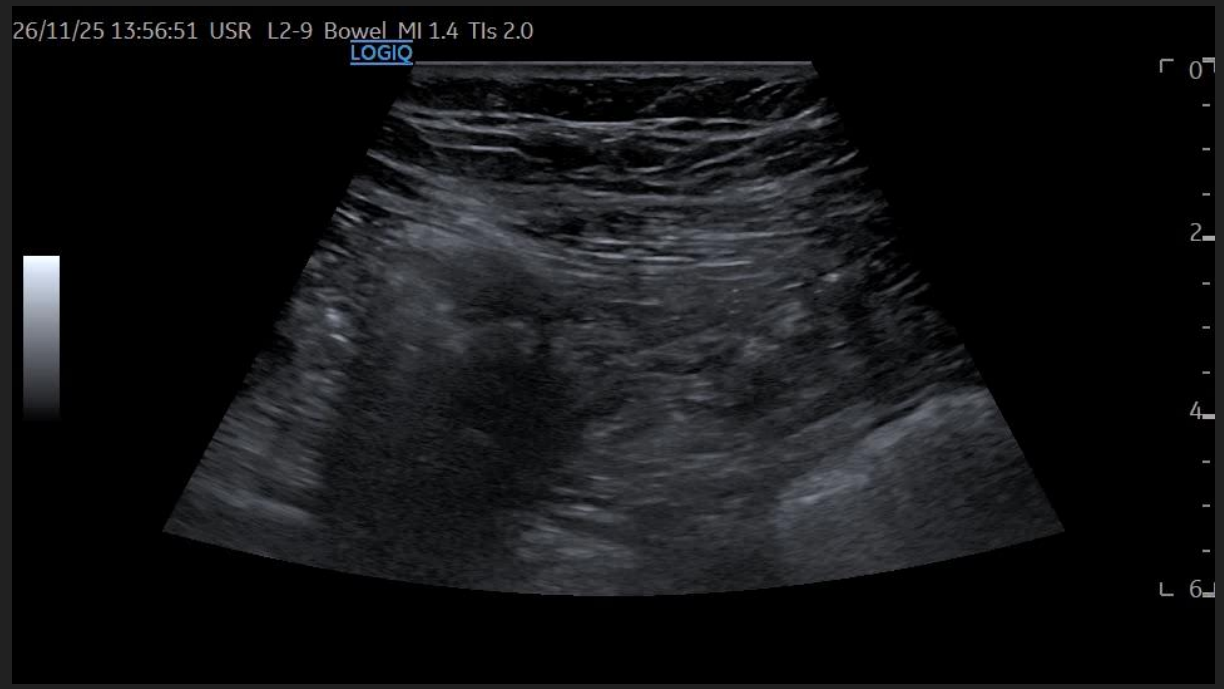


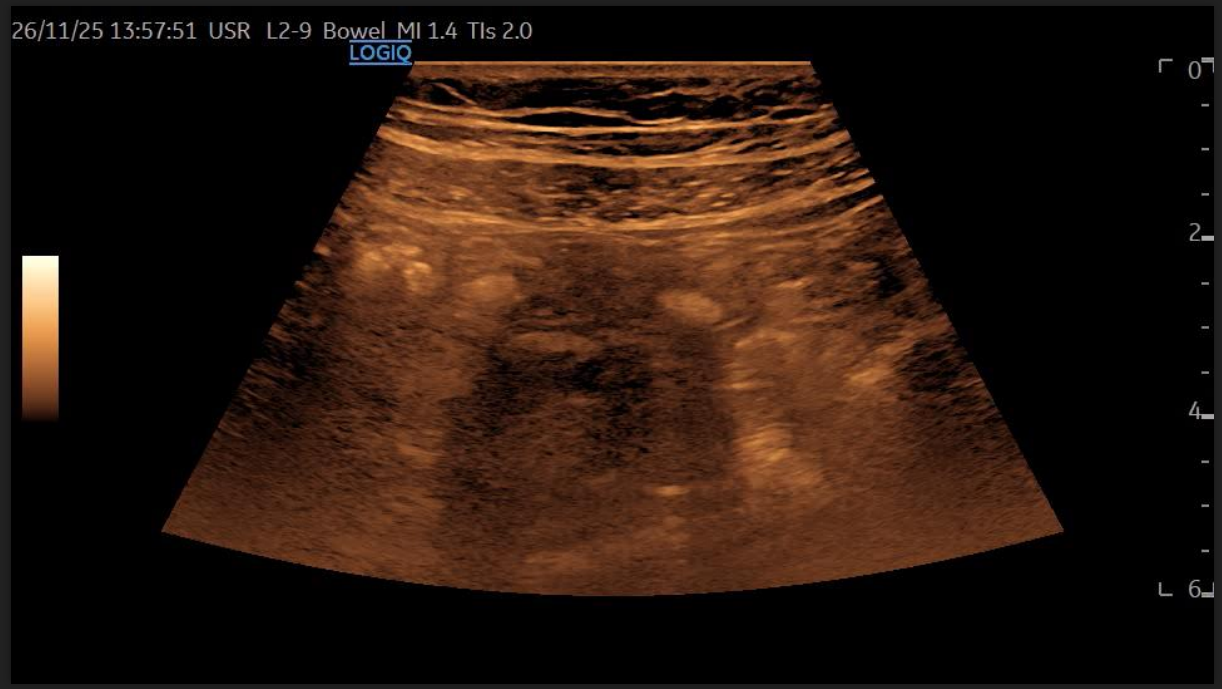
Dynamic range





Tints

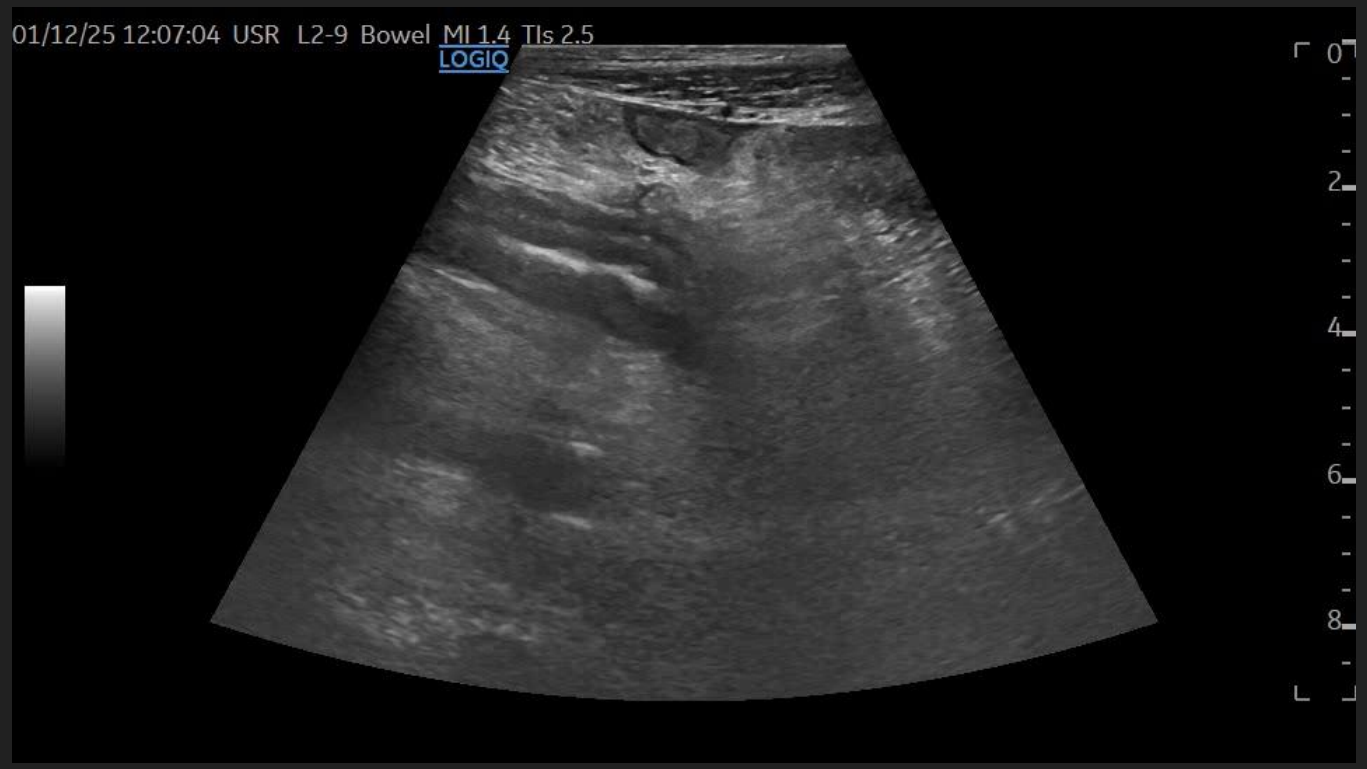




Artefacts

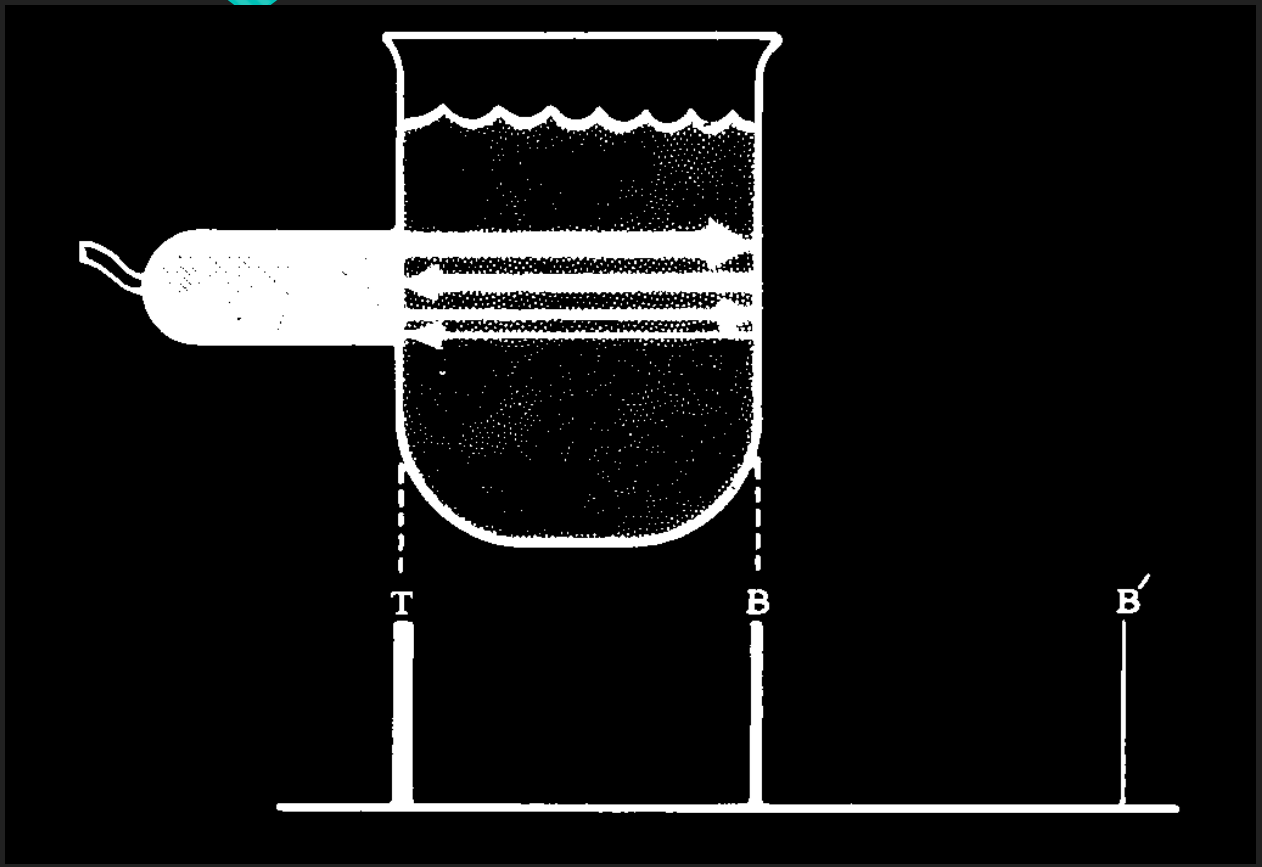
Attenuation

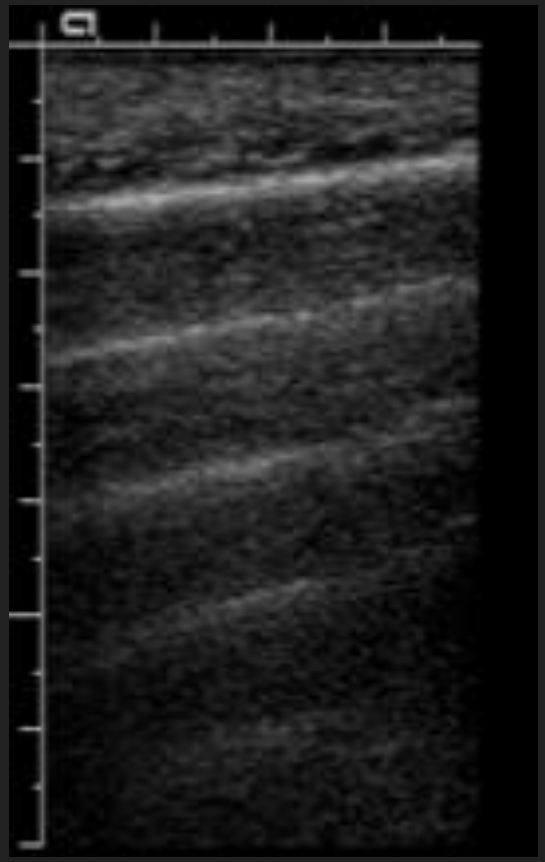
Uncompensated attenuation in fatty liver



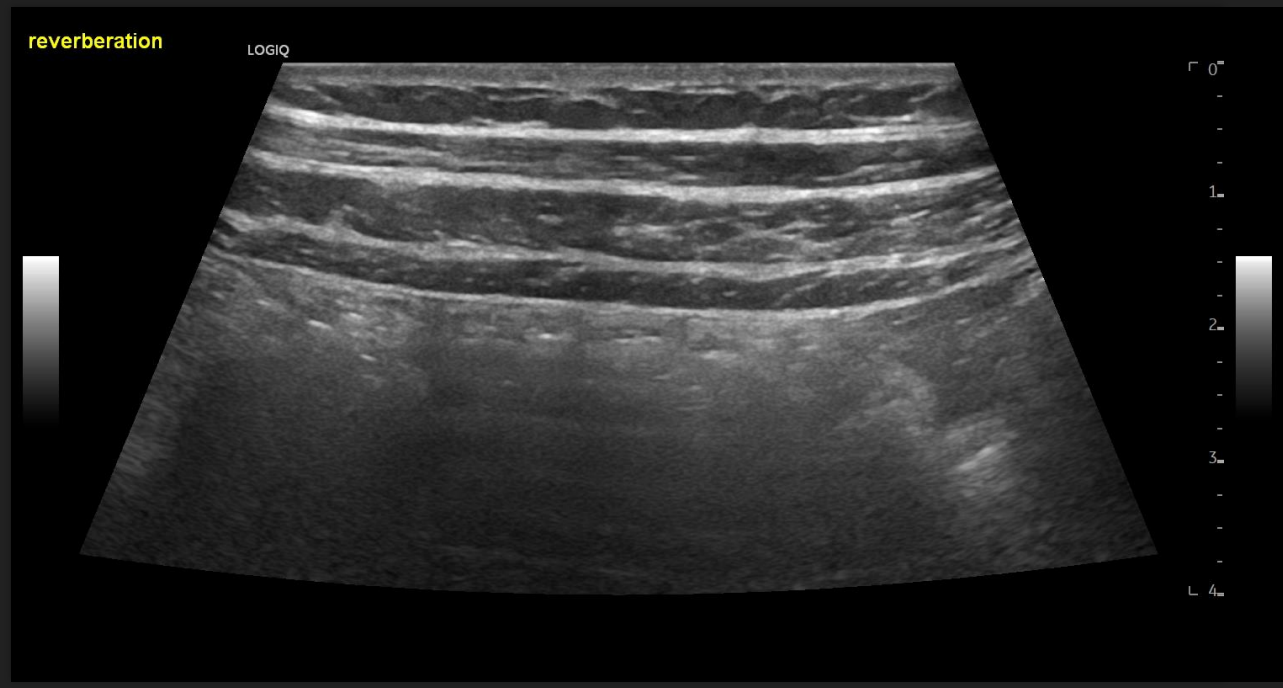
Partially compensated attenuation in bowel

Reverberation

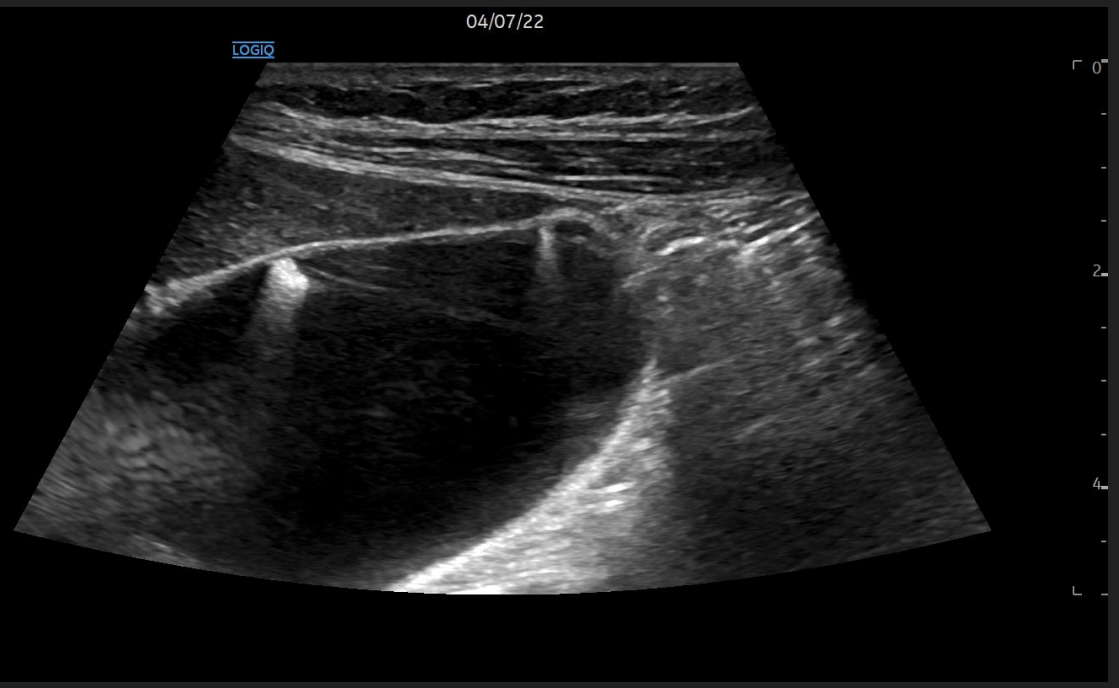




Reverberation

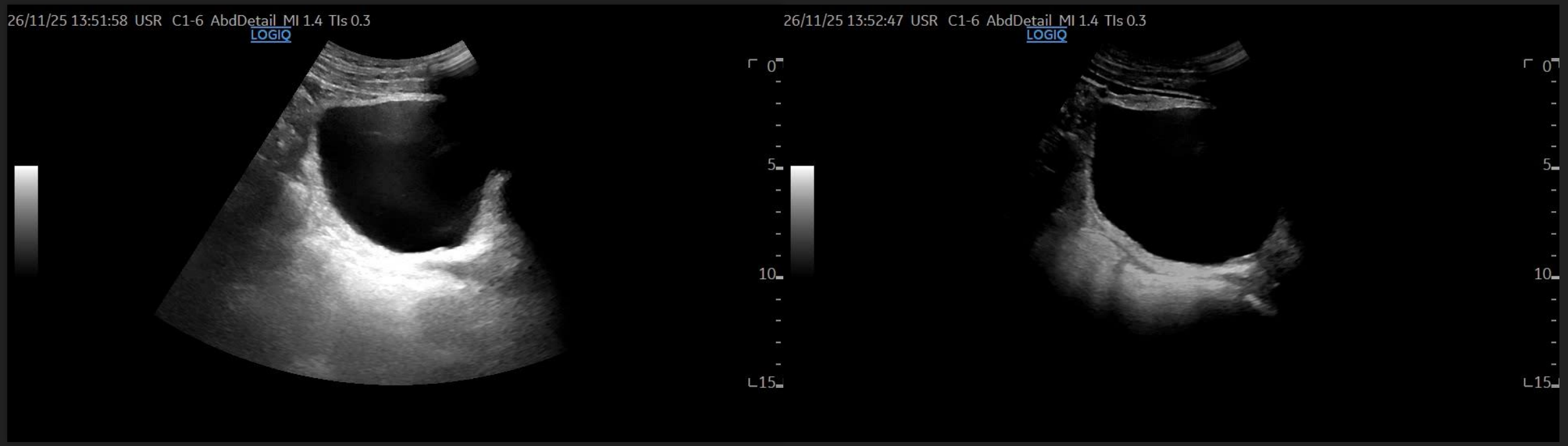


Reverberation due to reflective lines in the abdominal wall (Reduce nearfield gain)



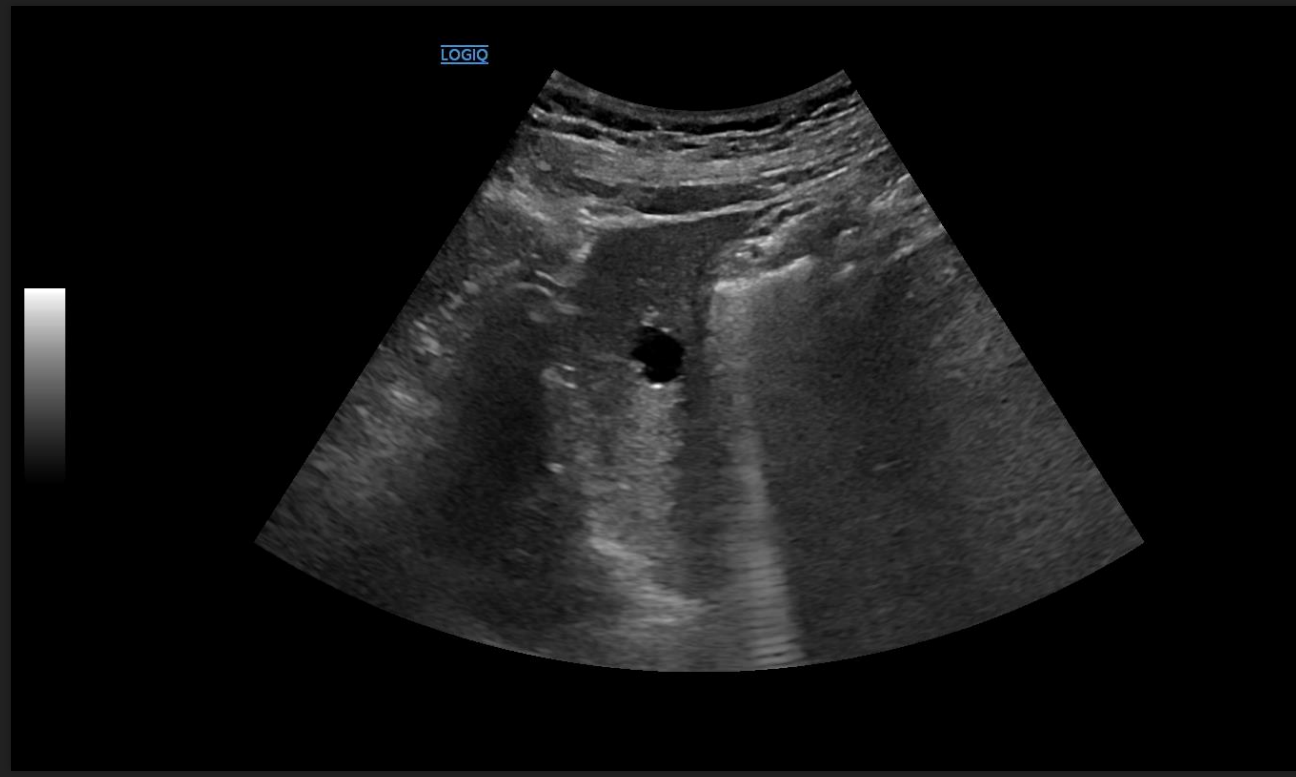
Comet tail artefact in adenomyomatosis of the gall bladder

Acoustic enhancement

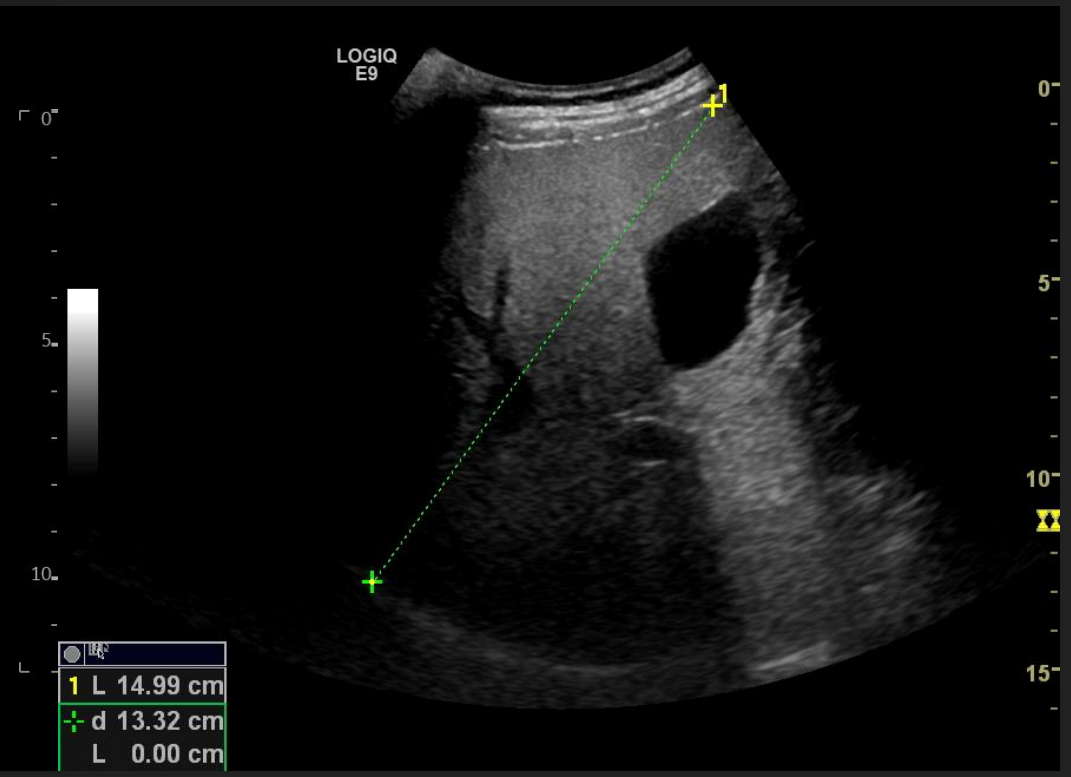


Reduce overall gain

Acoustic enhancement

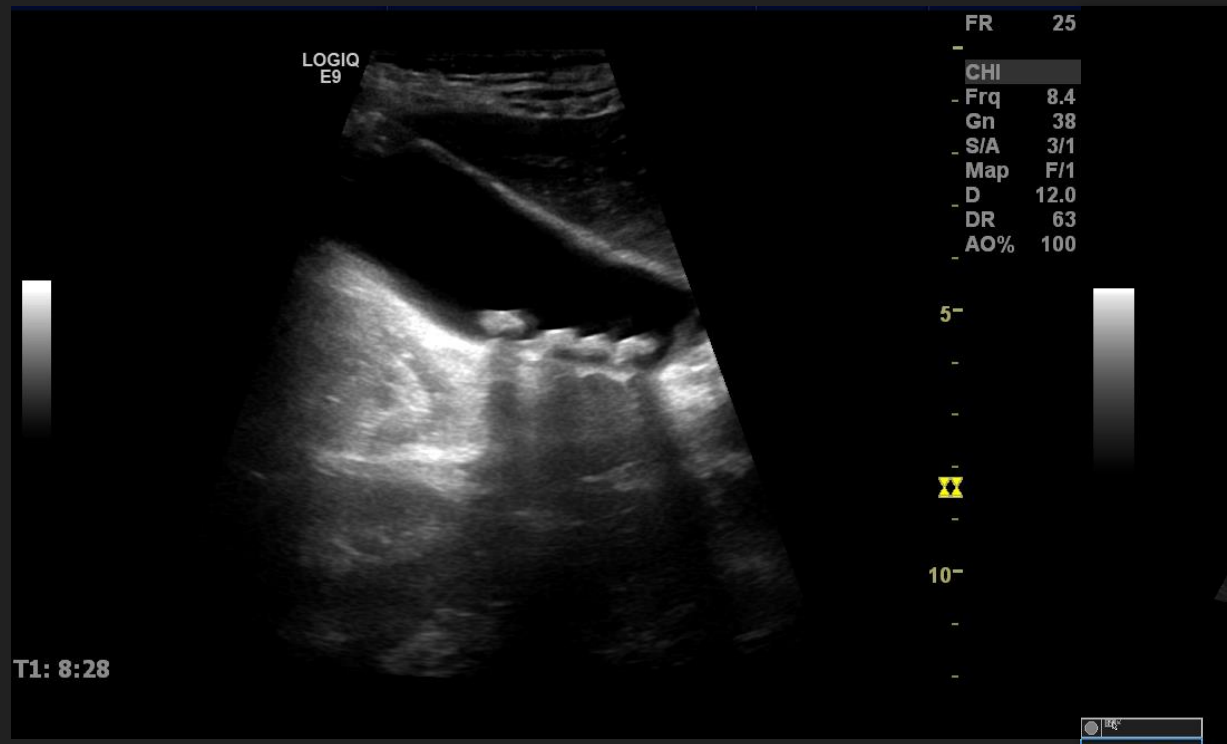


Enhancement as diagnostic criteria

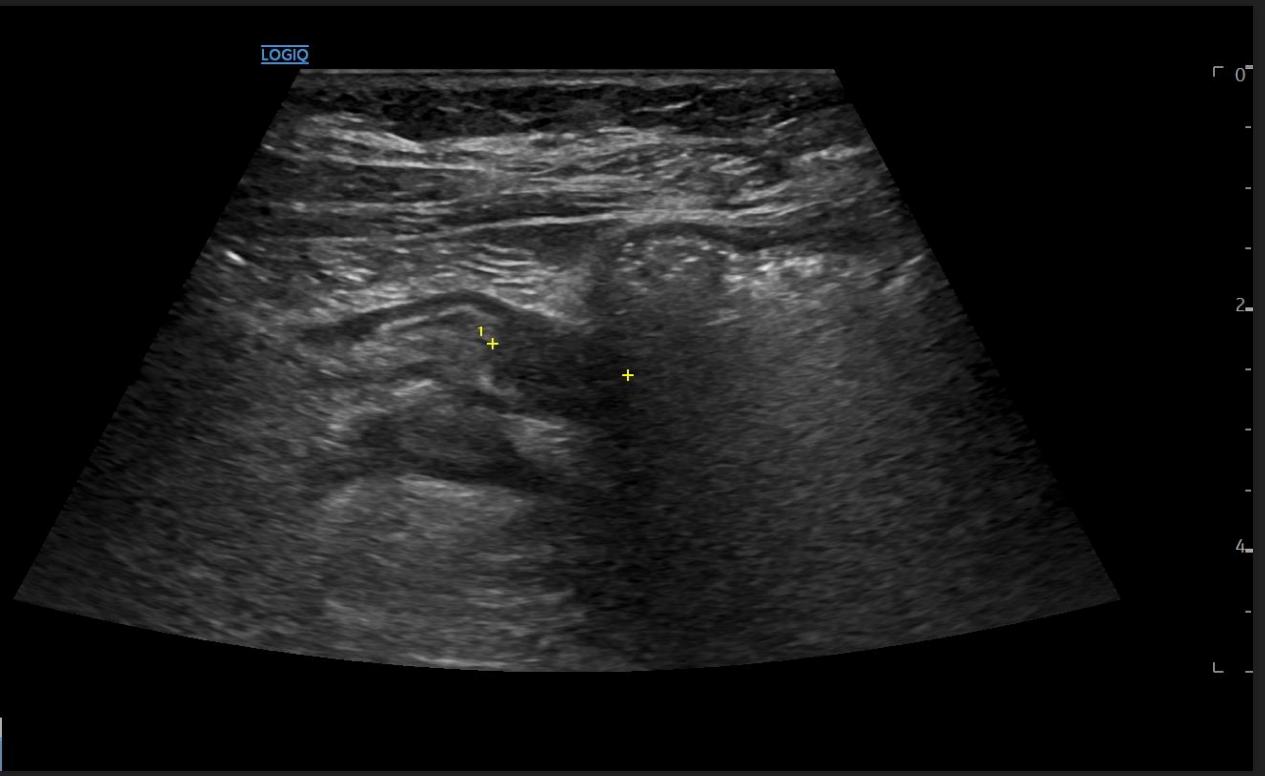


Attentuaion vs enhancement

Shadowing



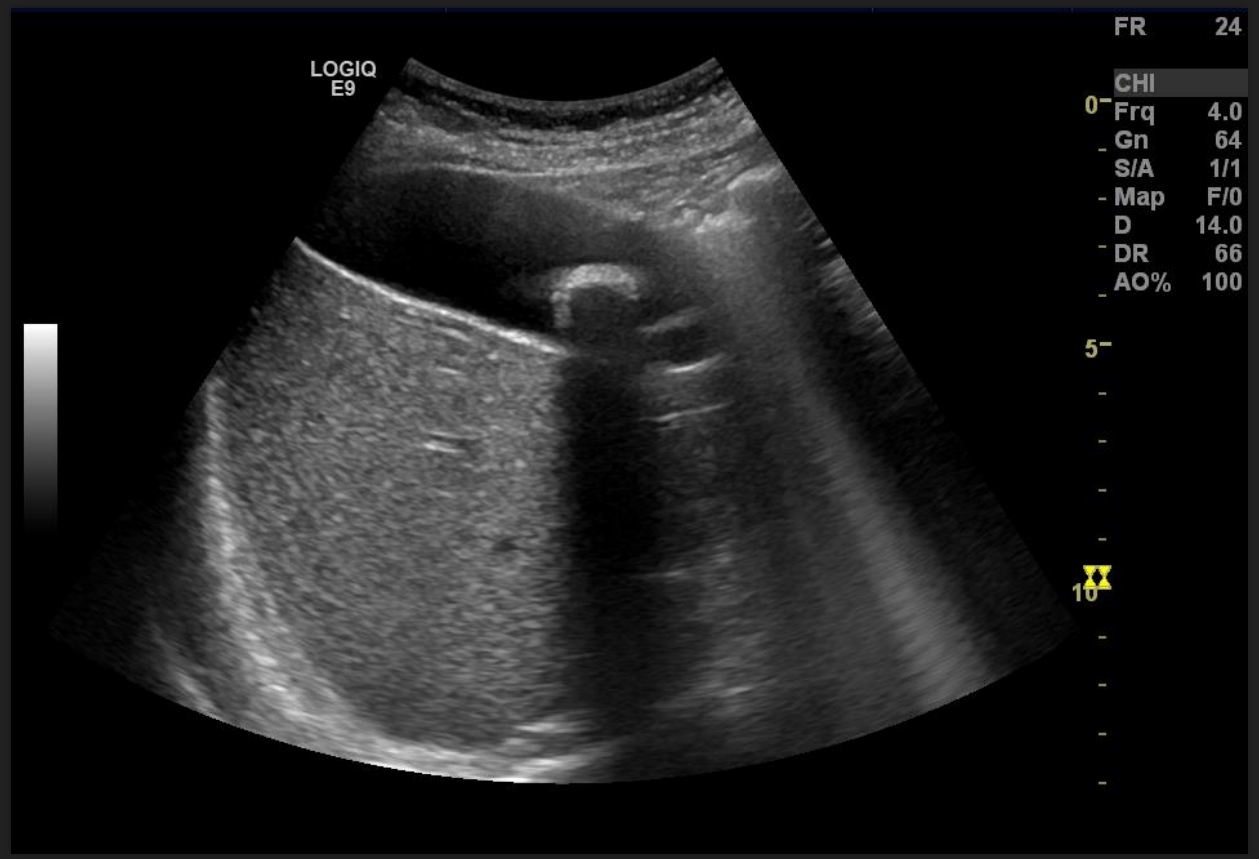
Shadow behind gall stone



«Dirty shadow» behind air in the colon

Shadowing

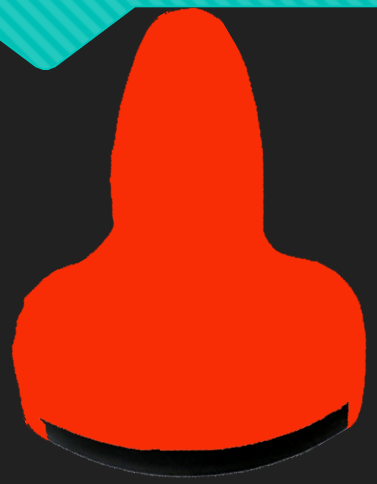
What do you see?

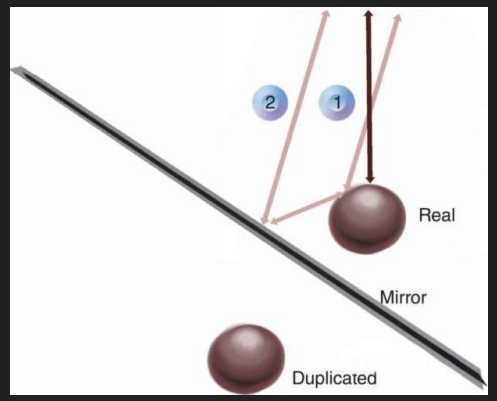


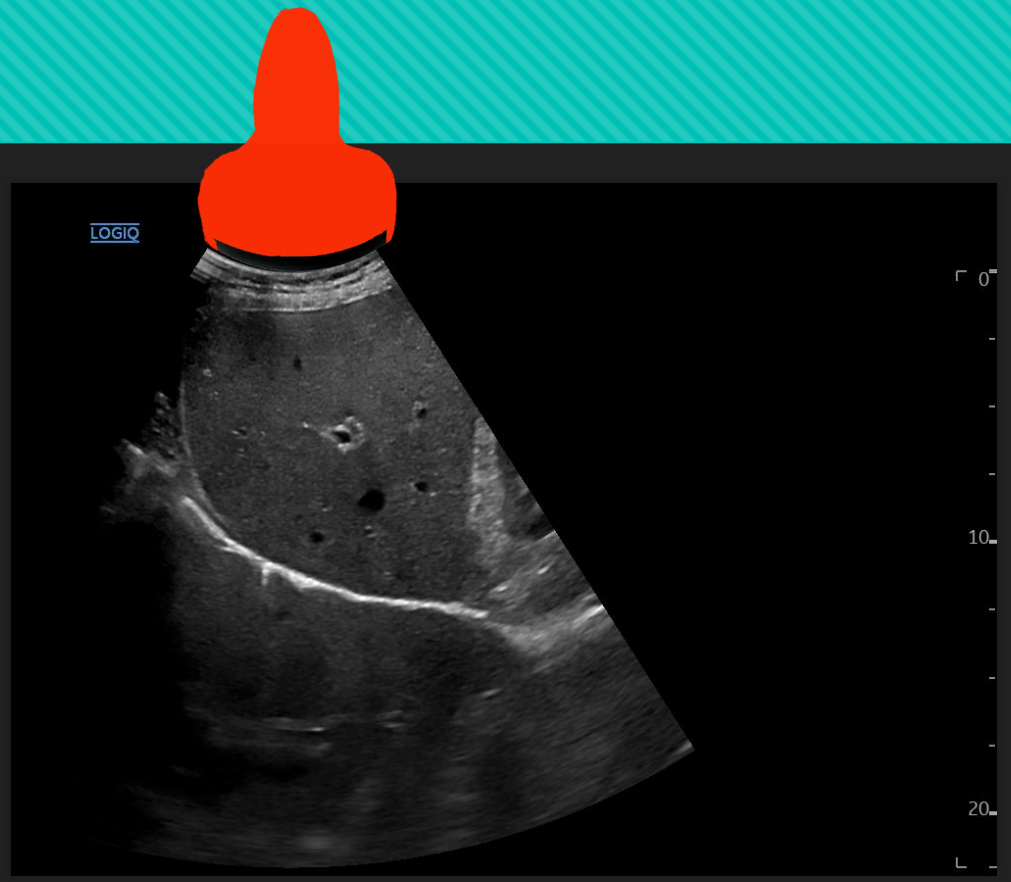
Shadow behind gall stone and comet tail behind duodenal air.

Edge shadowing

Mirror artifacts

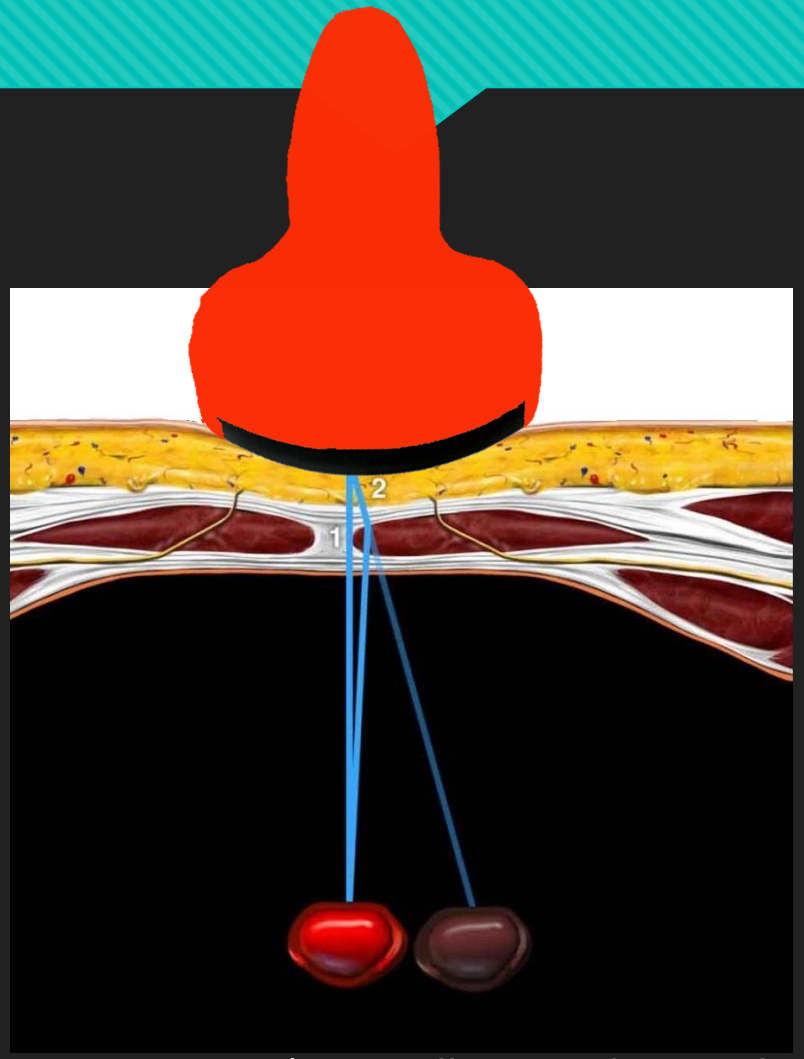






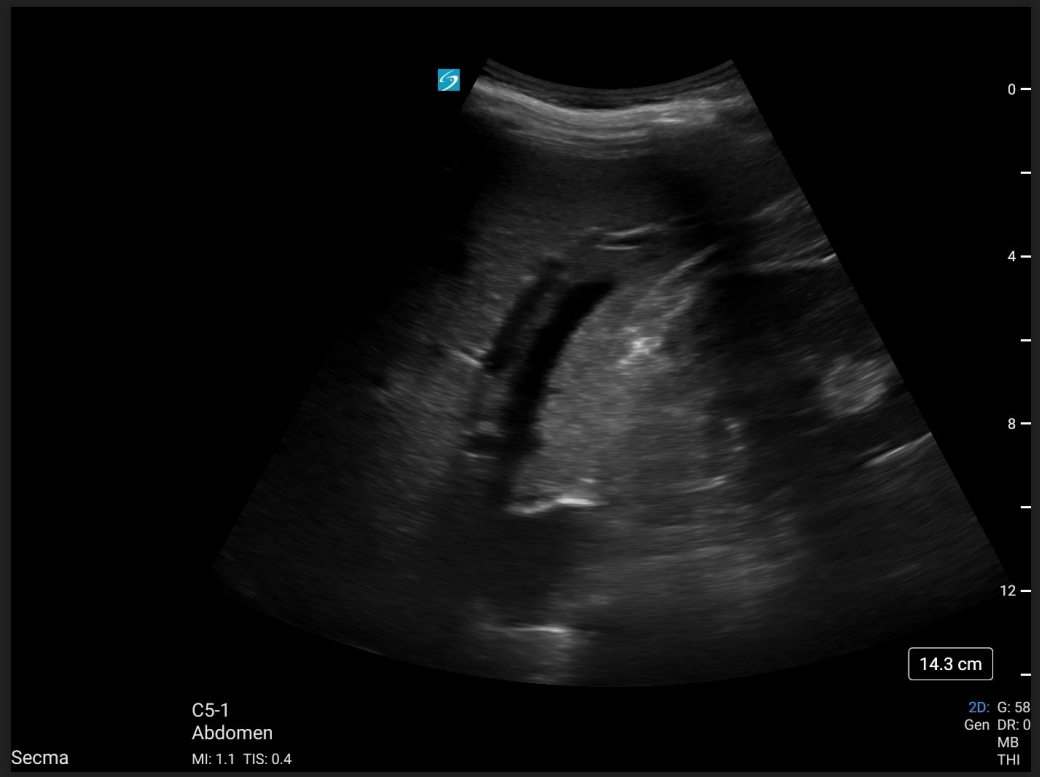
When the ultrasound waves reflect between structures causing multiple reflections and mirroring of the structures

Refraction/Double/image artifact



Linea alba and muscle

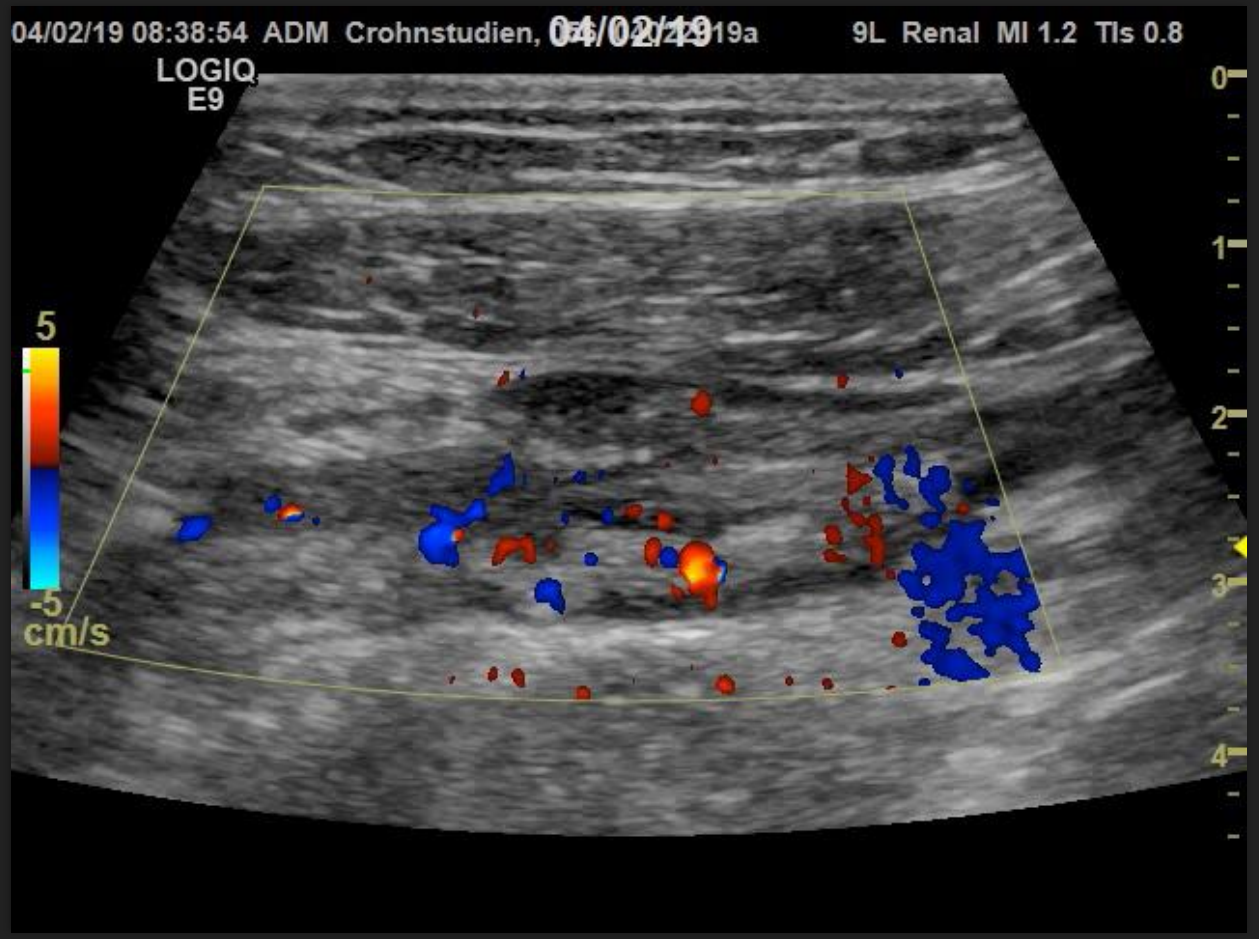
The sound wave is bent when it obliquely crosses an interface with tissues with different propagation speeds



Intercostal muscle and rib

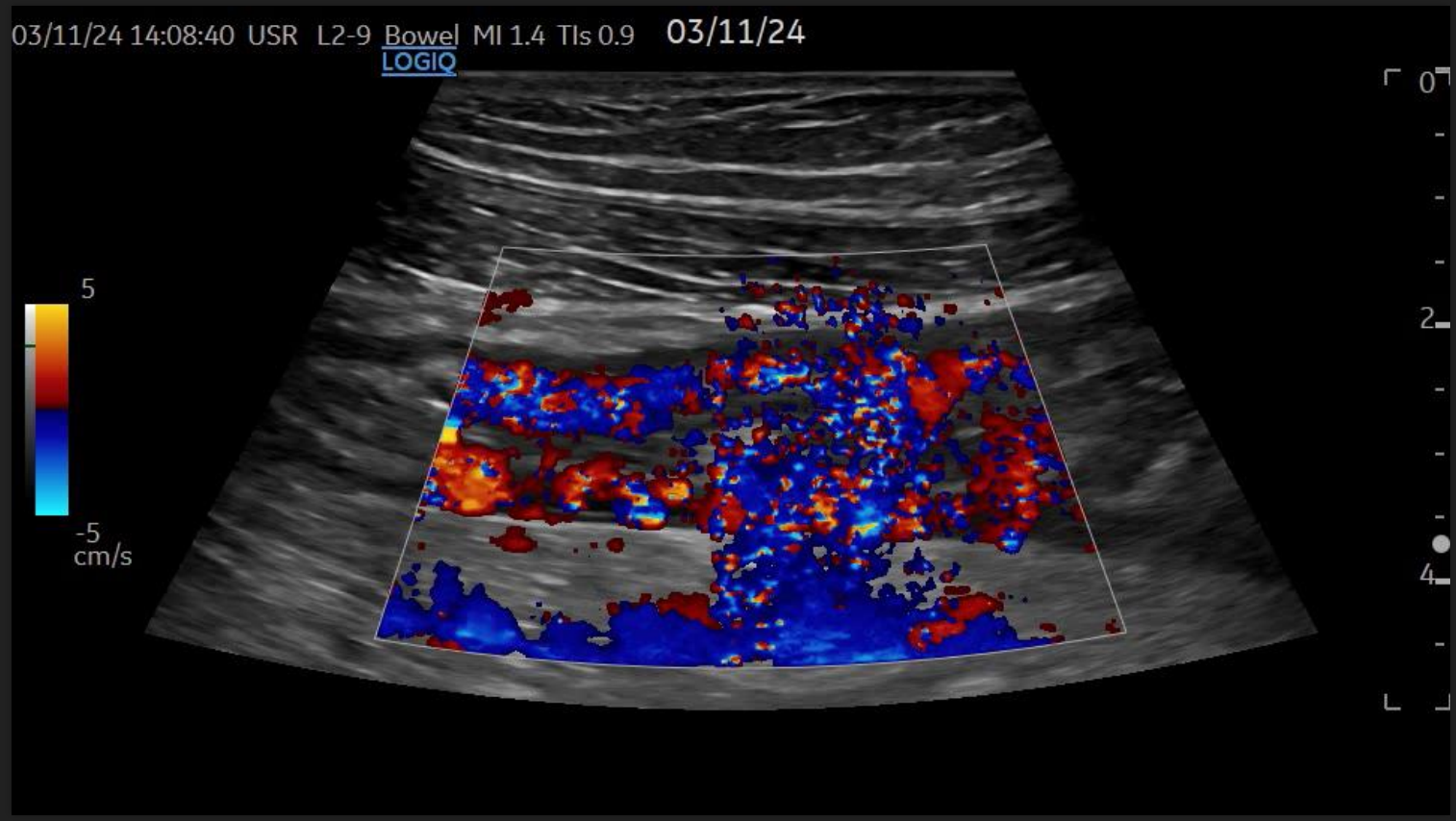
«Flash» artefact

- Flash artefacts using colour Doppler occurs when there is sufficient movment in the tissue to cause a Doppler shift
- Depends on
  - Breathhold
  - Steady hand
  - Your velcocity settings,
  - Gain
  - On the algorithm suppressing tissue movement

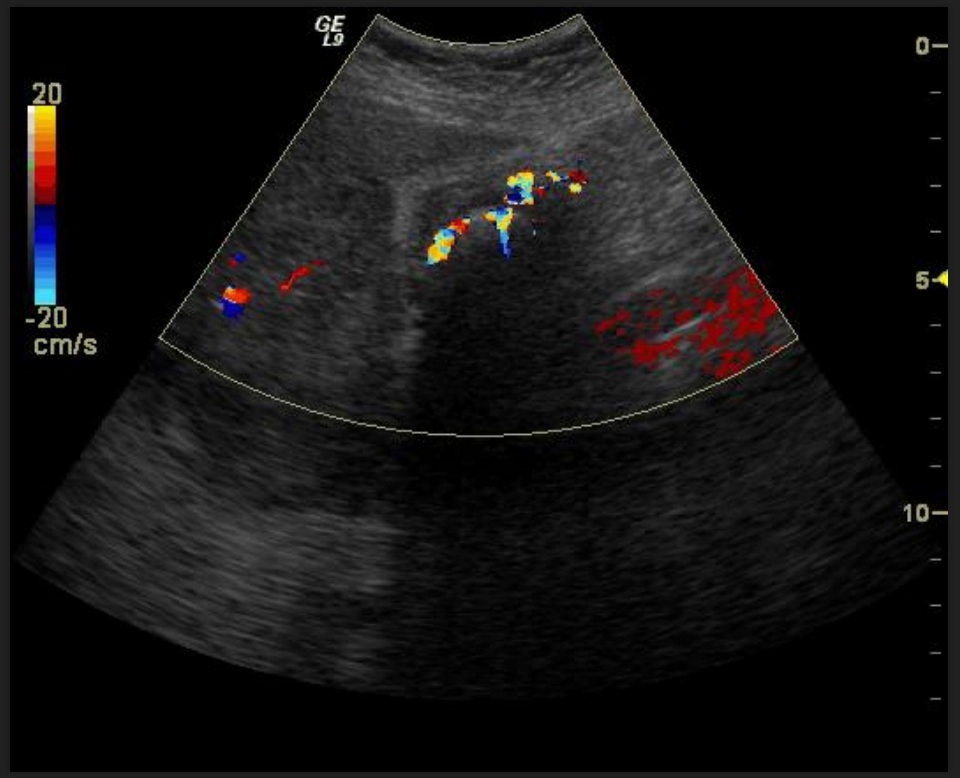


Aliasing

- If the Doppler shift has a frequency higher than the maximum pulse repetition frequency
- In other words: If the blood velocties exceeds the scale
- This is the consequence of a fixed Doppler scale used for standardisaton

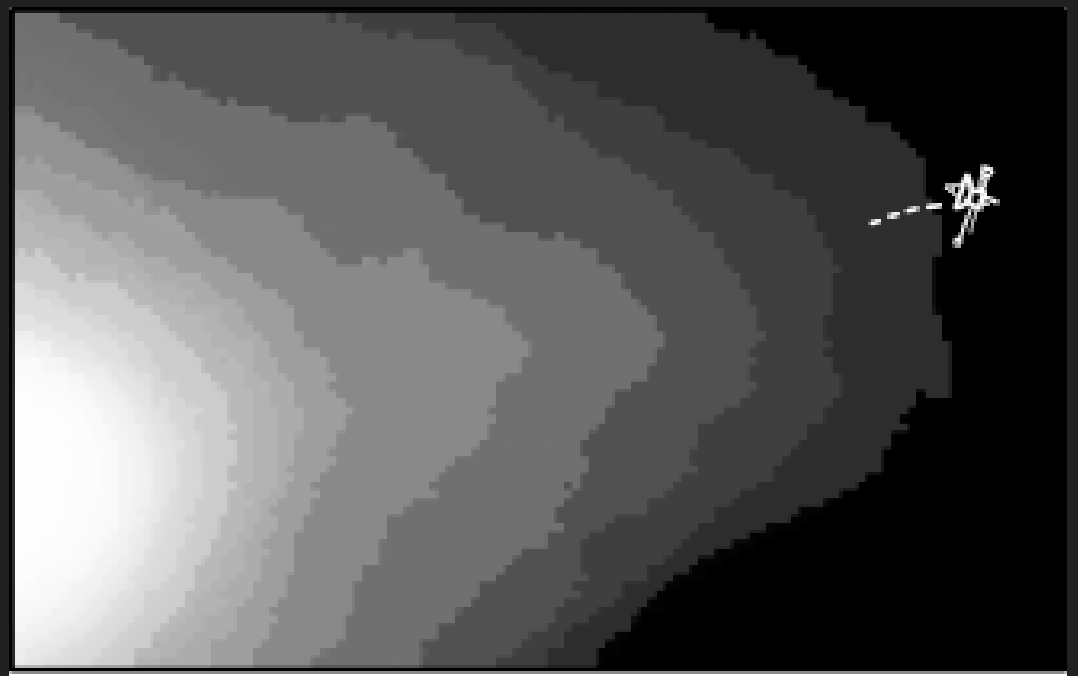


«Twinkling» artefact



Colour Doppler of gall stones causes the stones to «chime»

Video compression



Summary

- There are severel advanced settings on you ultrasound scanner that can improve images
  - You really shouldknow them, but….
  - They are more important on older scanners
  - I would advice you to demand the services of a comptent application specialist from the US vendor
- There are many different ultrasound artefacts, but the most relevant are
  - Shadowing, reverberation, mirror artefact behind the bladder
  - Flash artefacts, aliasing