



ISUOG Basic Training

Transducers, Image Production,
Knobology and Scanning Planes

Learning objectives

At the end of the lecture you will be able to explain:

- How to set up the ultrasound machine
- Which knobs are important to ensure optimal imaging
- The correct orientation of ultrasound images

Key questions

1. Which controls should be used to maximise the quality of the image?
2. What is the correct image orientation when scanning with a TA probe?
3. What is the correct image orientation when scanning with a TV probe?

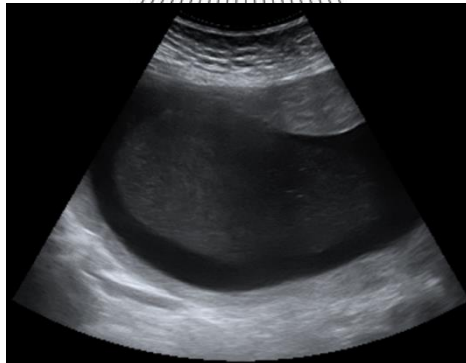
Transducer types



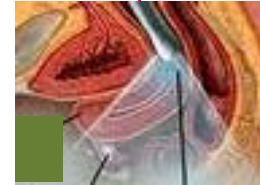
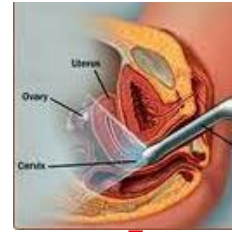
TA



Linear



Curvilinear



TV



Annular / Intracavitary

Hygiene for TV imaging

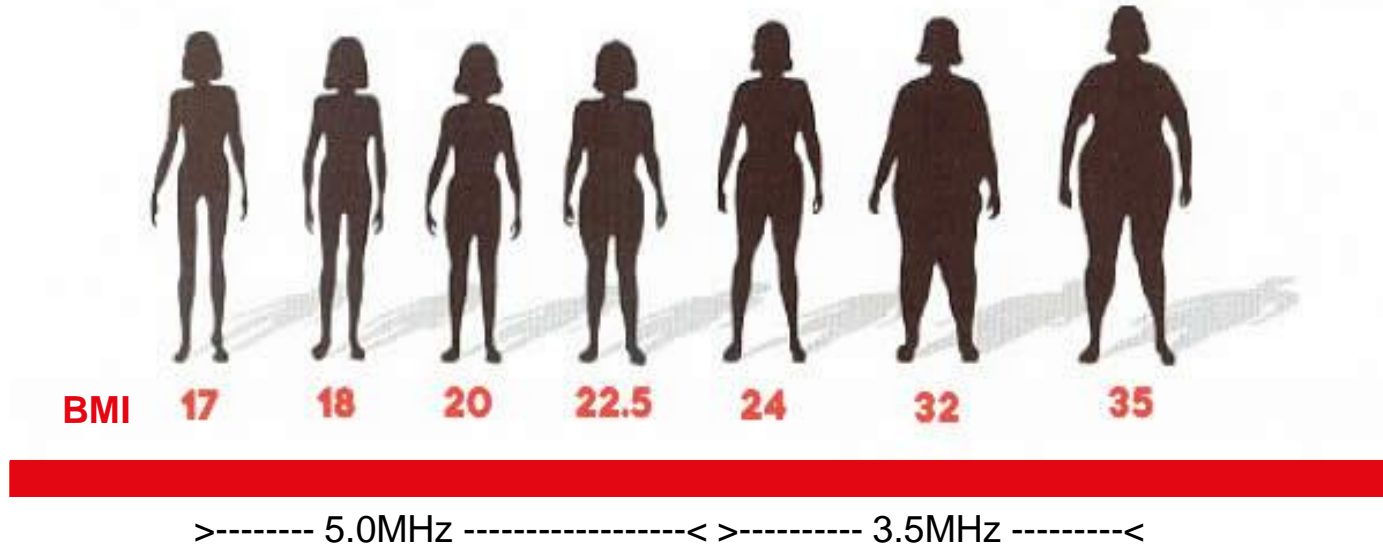


A sheath or cover must **always** be used when performing TV examinations. Prior to every examination ask the patient if they have a latex allergy and ensure latex free covers are available.

Comparison of TA & TV imaging

Probe	Transabdominal (TA)	Transvaginal (TV)
Frequency	3.5 – 5.0 MHz	5.0 - 9.5 MHz
Resolution	Inferior	Superior
Field of view	Larger	Smaller
Structures > 4cm from the probe face	Within field of view	Beyond field of view
Imaging challenges	<ul style="list-style-type: none">• Full bladder in some cases• BMI - distance from probe face to area of interest• Bowel gas	<ul style="list-style-type: none">• Field of view• BMI (to lesser extent)• Bowel gas (to lesser extent)

Transducer selection



Comparison of TA & TV imaging



TA



TV

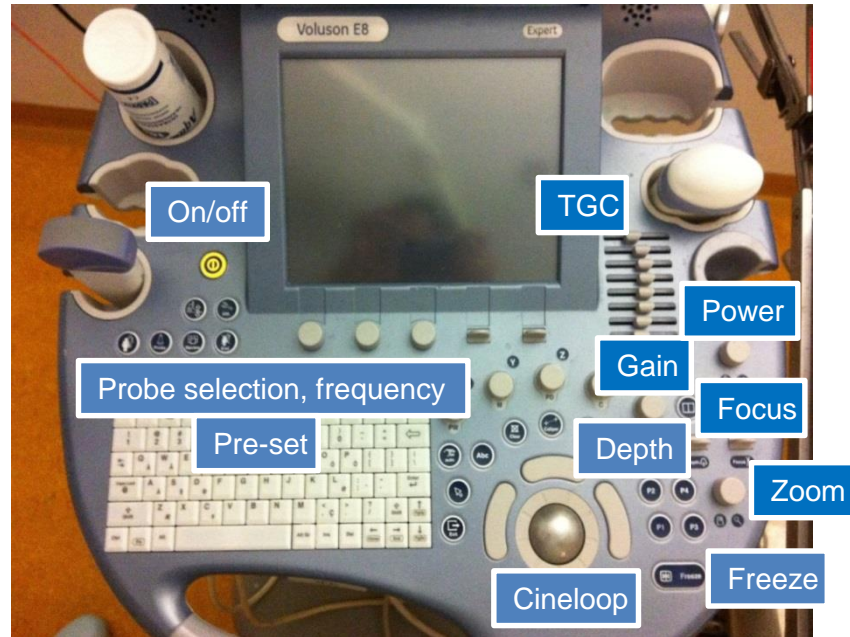


Transducer selection

Examination	Route	Frequency
1st trimester 5-8 wks	TV	5.0 - 9.5 MHz
1st trimester 8-13 wks	TA	5.0MHz (equivalent multi-frequency)
2nd trimester	TA	5.0 MHz (equivalent multi-frequency) <i>If available, also consider 3D probe (heavier than 2D)</i>
3rd trimester	TA	3.5 MHz (equivalent multi-frequency) <i>If available, also consider 3D probe (heavier than 2D)</i>
Accurate assessment of: <ul style="list-style-type: none">• Low placenta• Cervical length	TV	5.0 - 9.5 MHz

Image optimisation / knobology

- Adapt image according to scan plane & object of interest
- Multiple options
 - Probe selection
 - Frequency
 - Preset
 - Power
 - Depth
 - Gain
 - Time Gain Compensation (TGC)
 - Focus
 - Zoom (read/write)
 - Freeze
 - Cineloop



Power



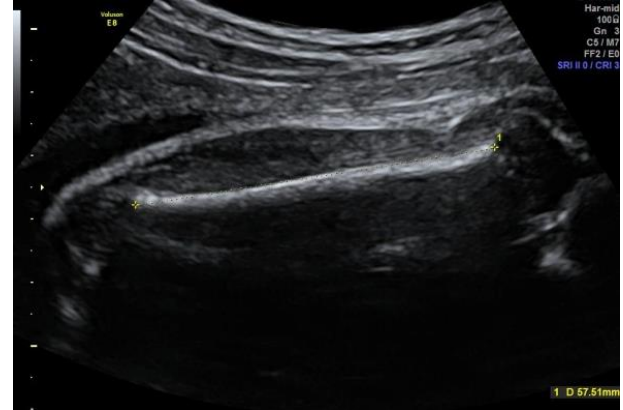
Depth & zoom



X



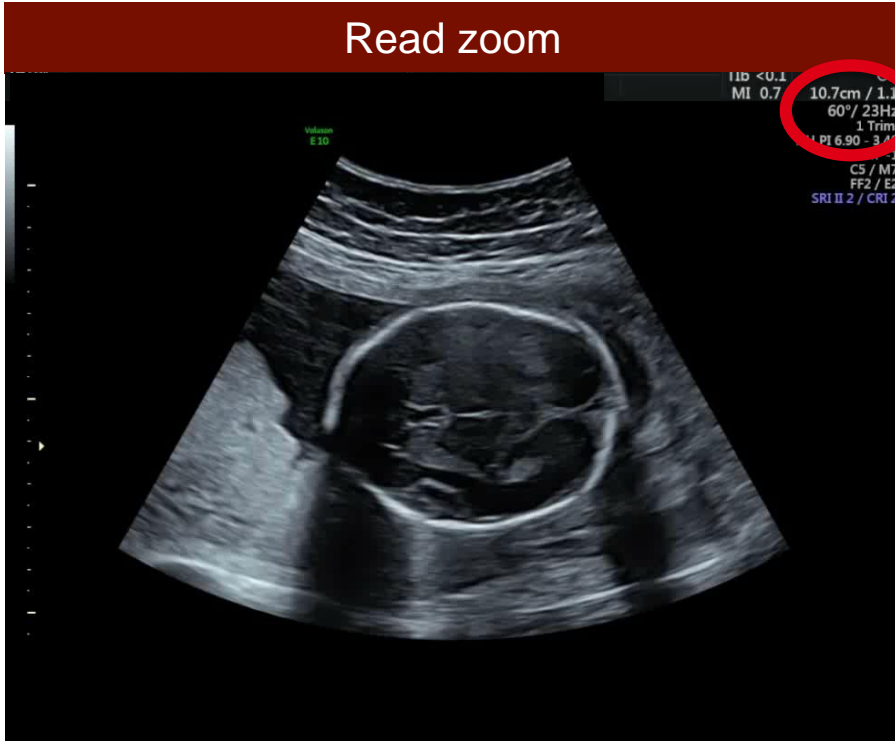
X



✓

Depth & zoom

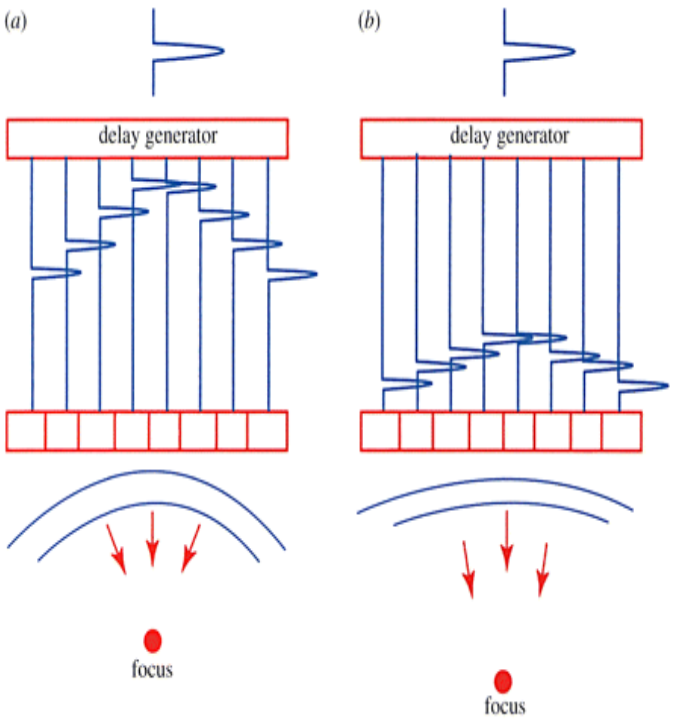
Read zoom



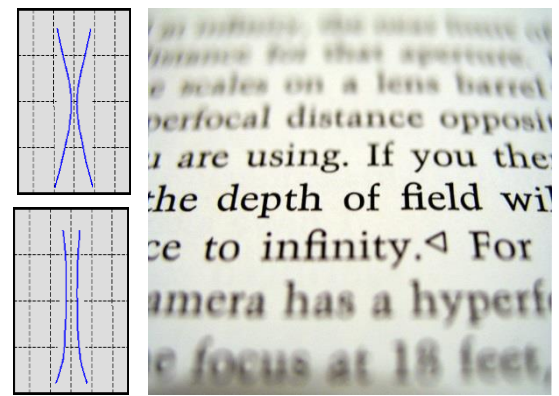
Write zoom



Focus



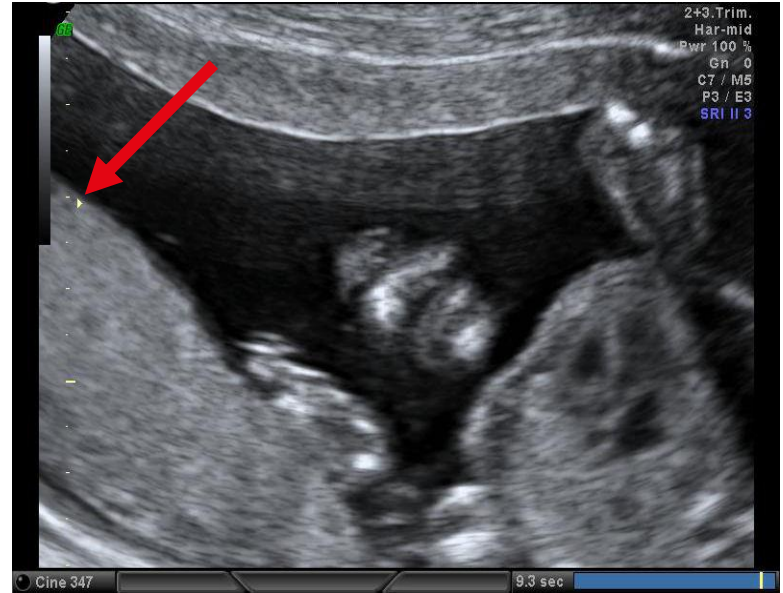
- Compare to a lens
- Extremely important in US guided needling
- Often forgotten!



Focus



X



✓

2D gain



X



✓



- Gain amplifies returning frequencies
- Fluid is black when correct gain settings are applied

Sector width

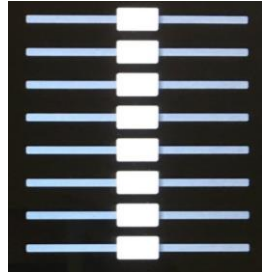
- Sector width related to field of view required
- A narrow sector (right) improves resolution, but reduces field of view



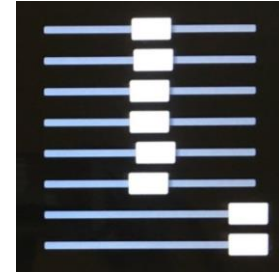
Time gain compensation



Insufficient near gain



Uniform gain



Excessive far gain

Room set up – TV & TA

Typically the scan is performed with:

- The woman lying to the right of and facing the operator
- The operator holding the probe in the right hand & operating the machine controls with the left hand



Ultrasound planes



Coronal



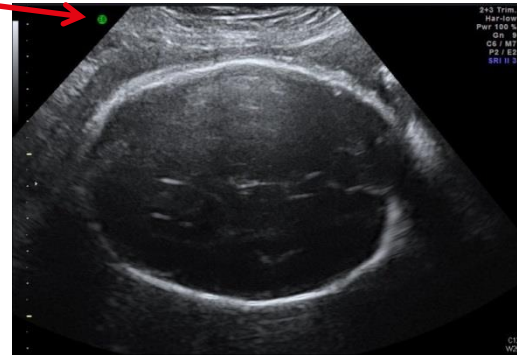
Sagittal



Transverse

Probe orientation

- Every probe has one or more marks which you can feel and see
- The mark on the probe always relates to one side on the monitor
- Check the position of the probe and of the image on the monitor



Correct probe orientation - transverse

Rule:

When you look at the woman and at your monitor:

- The **Right** side of the woman is displayed on the **Left** on the monitor
- Use pressure of your finger to check the correct position
- Fetus with its back to the right of the woman
- **NEVER** rotate the probe $> 100^{\circ}$ but go back to where you started



Incorrect probe orientation - transverse

- The probe has been rotated, incorrectly, through 180° (the mark is now towards the woman's left)
- The fetus therefore seems to be lying with its back to the left side of the woman



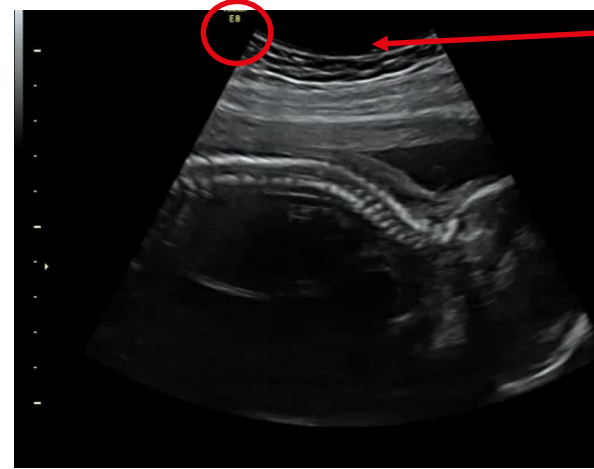
Pressure
from finger

Correct probe orientation - longitudinal

Rule:

When you look at the woman and at your monitor:

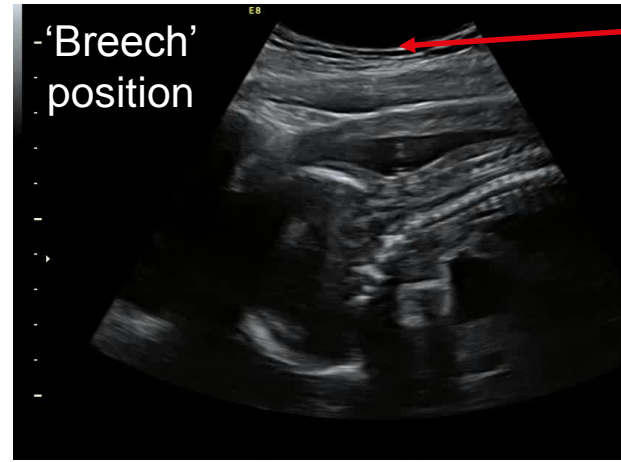
- The **CEPHALAD** /fundus of the woman is displayed on the **Left** on the monitor
- **NEVER** rotate the probe $>100^{\circ}$, but go back to where you started



Pressure
from
finger

Incorrect image orientation - longitudinal

- The probe has been rotated, incorrectly, through 180° (the mark is towards the maternal bladder)
- The fetus is now diagnosed, **incorrectly**, as in a breech position

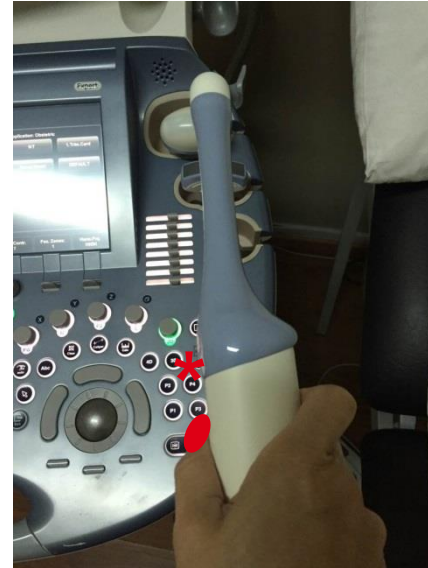


Pressure
from
finger

Transvaginal probe orientation



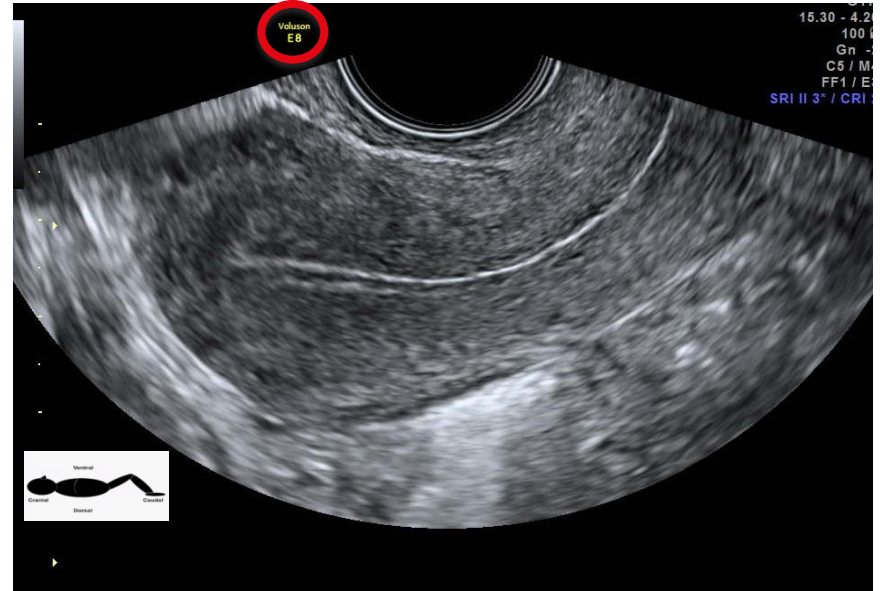
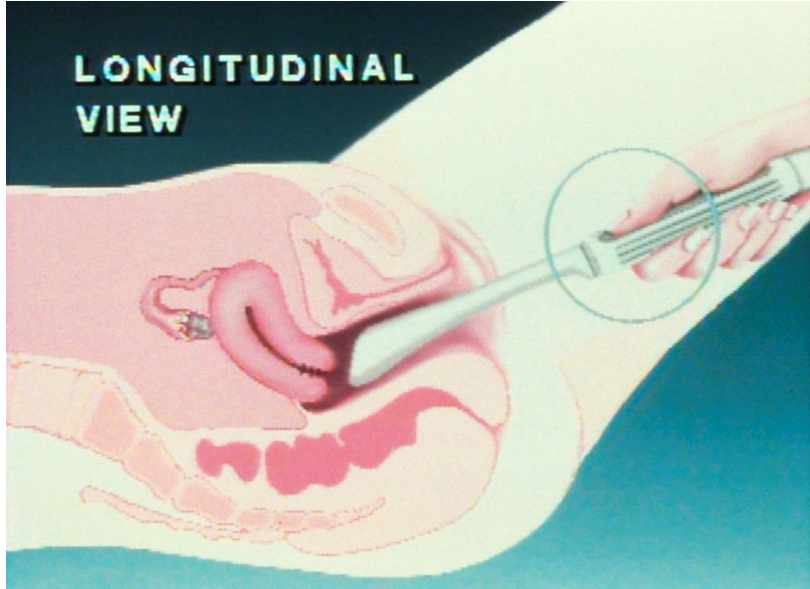
Sagittal



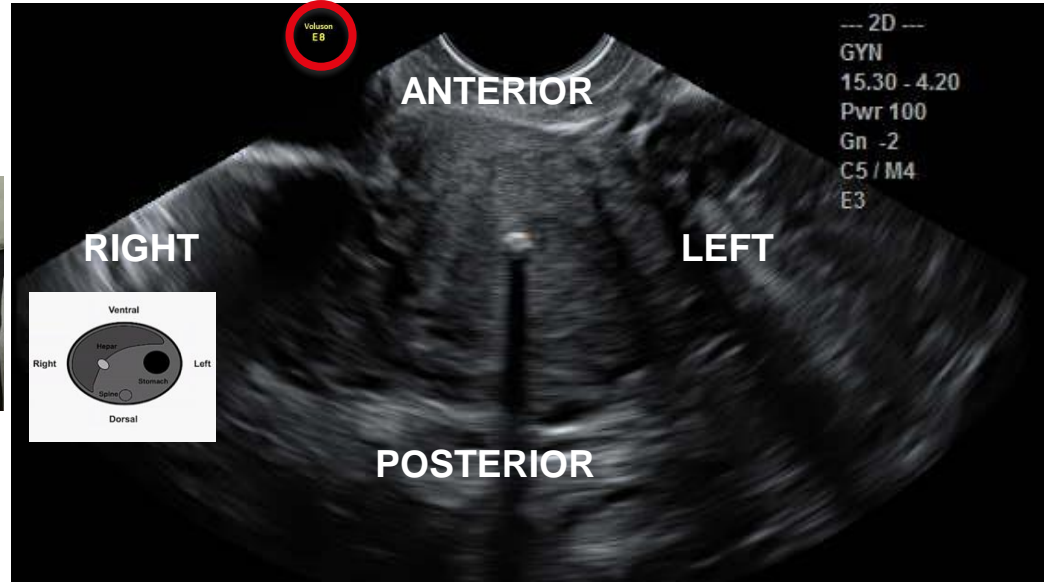
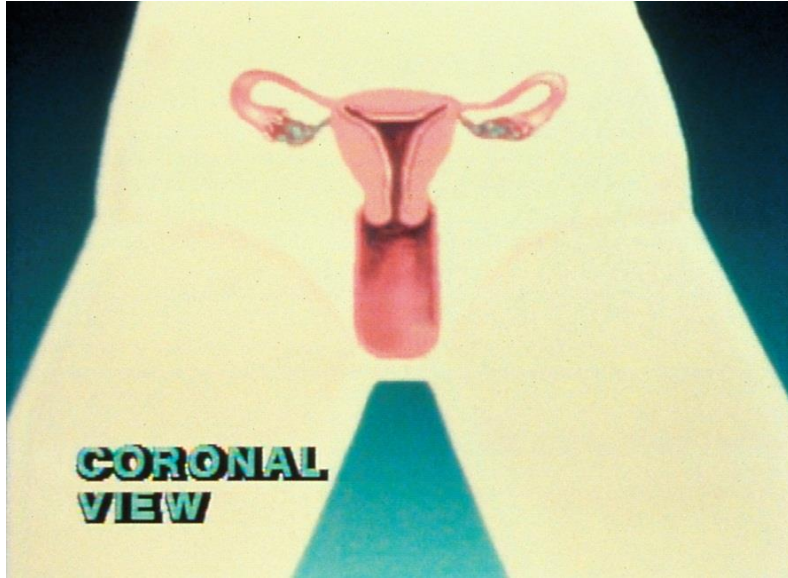
Transverse/ Coronal

(rotate probe anticlockwise)

TV probe orientation sagittal



TV probe orientation transverse / coronal



Key points

1. Select correct probe
2. Adapt the machine settings throughout the examination to obtain & maintain optimal views
3. Probe orientation and image orientation should be consistent
4. Rotate probe anti-clockwise when changing from longitudinal plane to transverse/coronal plane for - TA and TV