



Tips and tricks of 3D/4D scanning on Voluson S8.

Welcome to 3D/4D scans!!

It can be very daunting at first as you are so used to producing good 2D ultrasound pictures of babies and you are very good at what you do but now you don't know what you are doing!! And the client is paying for it!! And they and all their family have very high expectations of you!!

Your role here is to produce high quality pictures of babies to enhance the customer's experience. Your aim is to give them a truly memorable visit with images to treasure and share with friends and family. All 4D scans should be performed after you have completed the wellbeing checks as documented in our protocols. The findings of a serious fetal anomaly at any gestation require you to suspend any "bonding" scan until you have explained the findings and the need for a referral to the NHS for ongoing care and support. If the client then requests to continue with gender determination or 4D imaging the scan may be continued for that purpose.

The best pictures will be obtained at 24 to 30 weeks. Close up shots of the face are best at 28 to 32 weeks. After 32 weeks there is less fluid around to work with which can lead to suboptimal results. Also after 32 weeks the baby may have already descended into the pelvis, making any views of baby impossible. Twins are best at 22 to 28 weeks.

Mum should be comfortable – she should not need an over full bladder. This is her time to be comfortable and relaxed so that she can enjoy watching her baby. However, if the baby is in an awkward position or location it may be helpful to fill the bladder.

It should not be necessary to press on the abdomen too hard and you should not get too carried away with prodding and pressing too hard, indeed good 3/4D images are often obtained by less pressure on mum's abdomen!! (see more information later, Page 10)

The main conditions causing suboptimal imaging are:

- a lack of fluid between the probe and object,
- increased distance from probe of object,
- head too deep in the pelvis,
- baby facing the floor,

- arms and legs in front of the face.

Common concerns of clients during scan are:

- a shadow on the forehead of the baby,
- a shadow on the tip of the nose,
- black holes of the eye sockets – all of these occur when you have a frontal view of the face. I will explain later how to overcome these problems. See pages 14 & 17.
- Umbilical cord around neck or close to the face. Re assurance required here that it is normal and very common, indeed it is the normal place for the cord in the pool of liquor in front of face and neck.

Ultrasound is a camera – you are shining a light on the baby. Successful 3/4D will only result if you have amniotic fluid in the available space between the lens of the camera and the subject. The area you wish to see must be close to and facing the lens (transducer).

When you have a profile view of the face in 2D the resulting 3/4D image will be a frontal one. A frontal view in 2D will result in a profile view in 3/4D. If the baby is facing the floor you will only obtain a 3/4D view of the back of the head and neck.

The simultaneous display of 2D and volume mode images side by side is a good way to appreciate the importance of the initial positioning of the green rendering line and the need for speedy access to the X axis manipulation of the image when into 4D mode. However I advise only using it when you are first in training as it will not be popular with the clients. See page 16.

This guide cannot replace “hands on” training but will help you on your way to learning this difficult task.

IMAGE ORIENTATION

The ultrasound machine should be set up so that a cephalic presentation will show the head to the right of the screen and the baby's bottom to the left. When 3/4D is selected you will need to invert the image as it will appear upside down.

If baby is breech the head should be to the left of the screen and when 3/4D is selected the image will be the correct way up.

It can be very confusing to work out which way up the 3/4D image is displayed especially if it is a sub optimal image. It is therefore good practice to reset the Preset on the touch screen before each new scan.

The "up side down" button is located here:



MACHINE SETTINGS

The 2D image settings should all be set by the Applications Specialist when the machine is delivered and installed:

- Gain
- Depth of view
- Focal point
- Angle of view
- Frequency of transducer
- SRI level (Speckle reduction imaging)
- HI on (Harmonic imaging)
- Image labelling presets

The 3/4D settings should be pre set:

- “Surface Big” is optimised.
- Volume angle
- ROI box set to its widest (region of interest – green box)
- High quality level
- Screen goes straight to single image when 4D is activated (not split into two)
- HD Live (Smooth) is optimised

Note: You will often need to decrease the overall gain when you change from 2D to 4D scanning in normal surface rendering mode. In HD Live you need to increase the gain to “fill in” eye sockets and mouth.

If any of this not set up correctly contact your Applications Specialist or me to set your preset up correctly.

Remember that the 3/4D image you acquire is totally dependent on a good 2D image (both machine settings and good composition). If you cannot obtain a good image you will not get in 3/4D.

The 3D effect of any image will always be better at the edges of the picture. See page 18.

TECHNIQUE

Do not underestimate the value of 2D scanning. 2D scanning is just as important and enjoyable to everyone. Remember that parents only usually get fleeting views during their NHS clinical scan. They get little time to appreciate it during their clinical scan especially if they have an overfull bladder!

TIP: Make sure you linger over areas long enough especially the heartbeat, and breathing movements of the chest.

Show them the face profile and point out the mouth opening and closing. Take still 2D images of this and review with a cine loop. Many people will miss it first time round!!! Use the pointer. Label images of gender and take time to point this out. Always use the pointer but do not leave it on the screen when you are not using it.

TIP: Do not freeze the image too soon if you see baby do something interesting like yawn, move hands in front of face or put its’ tongue out. It will be on the cine loop.

Review this and you can then take several still 3D images from one cine loop (with mouth open, fully open and then closed). It is also good to show this if it was not appreciated by everyone in the room – even 2 or 3 times over!!

The added benefit here is that you are not scanning but still giving a good experience and images whilst reducing the effect on your RSI, reducing the scanning time and therefore overall dose of ultrasound to the baby. (ALARA principal). The baby’s eyes are the most sensitive to any effects of ultrasound.

TIP: Most times you will need to turn Mum almost onto her side to move the baby's face away from an anterior placenta or the anterior uterine wall and allow some fluid in between them. This also often requires less pressure on the abdomen to increase the amount of fluid in the space. The less fluid there is, the more shadowing artefacts you will have on the forehead, nose and eye sockets on 4D images which are not appreciated by clients.

TIP: take an extra second or two to set up your 2D image before moving into 4D. This requires positioning the green (render) line in the fluid and not in the placenta or anterior uterine wall and reduce the amount of pressure on the abdomen with your probe, is lift slightly off the abdomen which allow a slightly deeper amount of fluid in between the placenta/uterine wall and the baby's face.

TIP: use the Swept Gain controls (TGC) to remove reverberation lines from the fluid in between the face and the uterine wall or anterior placenta. (make the fluid blacker).

TIP: Rest your elbow on Mum's hips and / or use your little finger on Mum's abdomen to steady your hand and probe which needs to remain still.



It is rare to obtain face views with Mum flat even if you scan from the side.



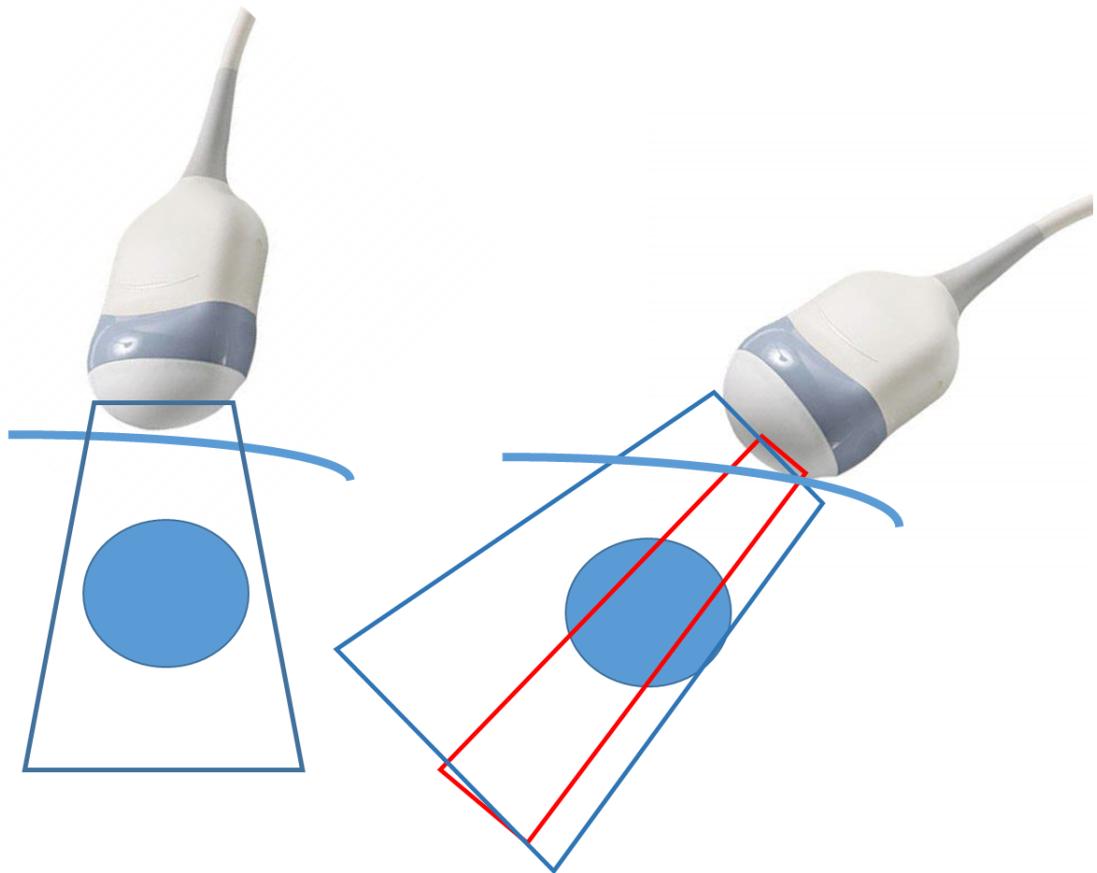
Turn Mum to show baby's face. Rest your arm on Mum's hip.

Mum's with a high BMI always require turning and scanning in from the side, or asking mum to hold her tummy up so that you can reduce the amount of tissue in between the probe and baby's face. You may be pleasantly surprised by the image quality, although it may well be quite hazy in 4D.

If the hands are covering the face, this is not necessarily a "bad" picture. It may showcase the baby's personality and be a more true to life image.

Breech presentation often results in limbs in front of the face – usually extended breech with feet over the head although you may be pleasantly surprised by the image of the face. An anterior placenta is also a problem in breech presentations.

Beware of using too steep an angle of the probe in respect to the skin surface.

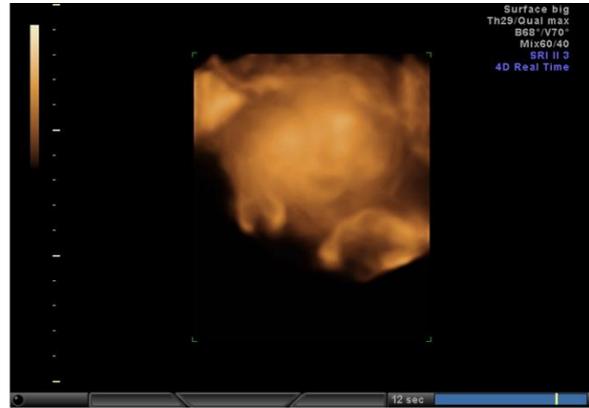


If too steep an angle is used the image will only consist of the red box as a steep angle results in the whole of the 70 degree sector sweep not being used because it is not contacting with the skin and the image will not be complete.

TIP: When the baby is cephalic but facing the floor, send them out for 15 to 20 minutes as you will be wasting time. However it is a good idea to show Mum the resulting 4D image to help them appreciate that it is circumstances beyond your control to obtain a face picture. (they will also be less likely to complain!!).



30 weeks face down



Resulting 3d image

For good 4D, in 2D the baby's face needs to be facing the probe. This will result in a frontal view in 4D.

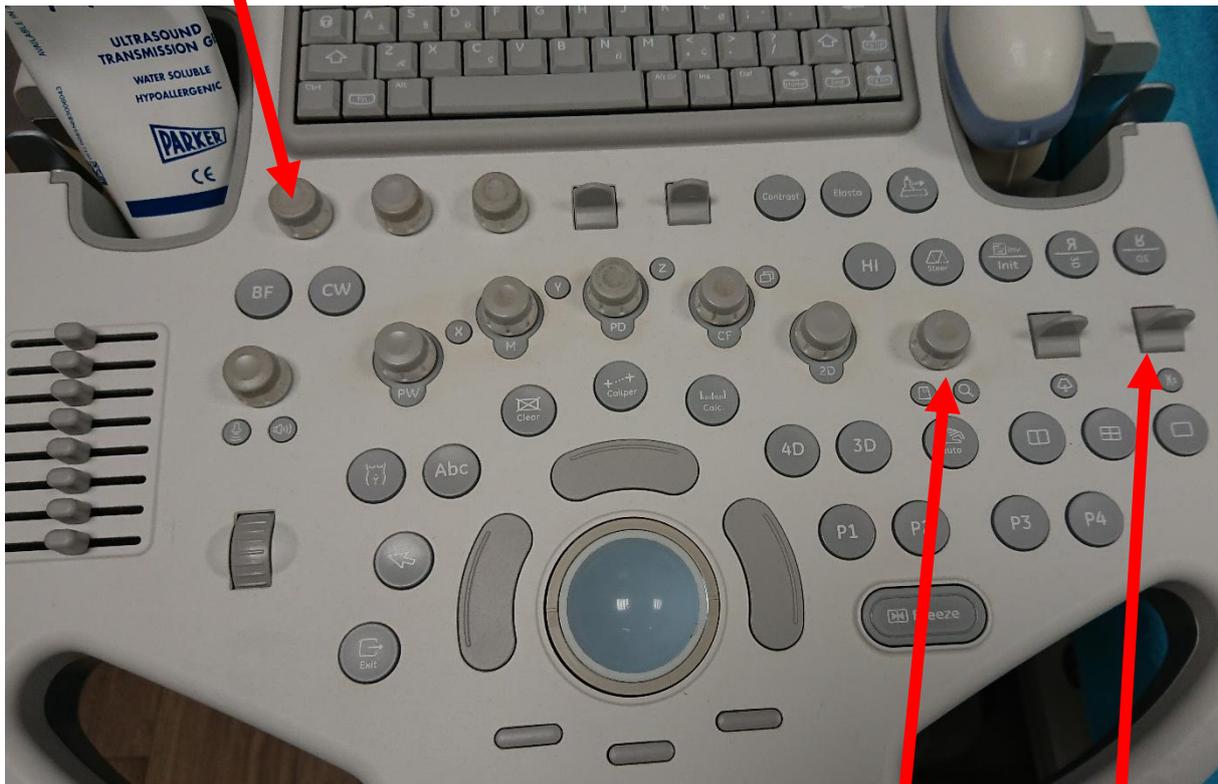
A frontal view in 2D as below will result in a profile view in 4D.



Sexing can be very challenging at 16 weeks especially on Mum's with a high BMI. Try to get the best out of your machine settings which includes:-

- Using a narrow field of view to increase the frame rate
- Try higher or lower HI settings
- Zoom and focus
- Try Pan zoom/HD zoom box

FOV – rotate to change, narrow or wider. Press to re set to maximum.



PAN ZOOM BOX

FOCUS

My advice is that by using the narrow FOV and then magnifying gives a better resolution image than when using the Pan Zoom box. Narrowing down the FOV gives an image created of increased line density resulting in increased resolution.

OPTIMISATION OF 4D IMAGE

Before attempting 4D imaging show Mum the position of the baby, where the face is, the length of the body, legs, arms and the hands and feet. This will all help to explain any problems you may have in obtaining good 3/4D images and go some way to overcome the huge disappointment they will experience if you cannot give them what they are expecting.

If the baby is extended breech especially when arms and legs are straight up over the head, head deep in the pelvis and/or facing the floor, face buried in an anterior placenta with no amniotic fluid there, **GIVE UP** for now and send them outside for 15 to 20 minutes and then try again.



Manipulation of the probe scanning angle to bring the profile more horizontal will help you get a better 4D image straight away.



Too much pressure

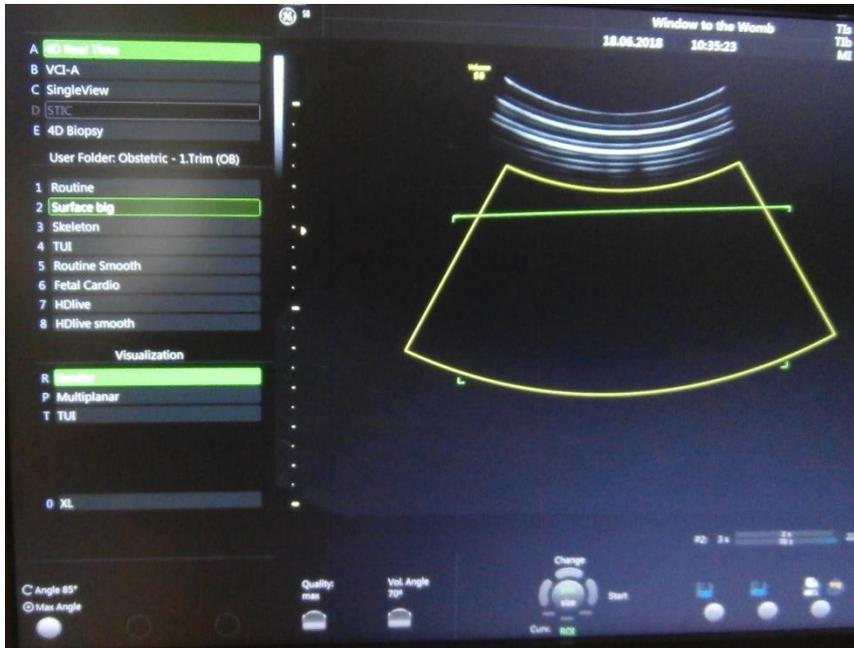


Less pressure allows fluid in front of face

TIP: the swept gain controls (TGC) should be used to decrease the amount of reverberation echoes in between the anterior uterine wall and the baby's face.

Select 4D and the green render line with the render box (Region of Interest box, ROI.) – yellow, will appear on the screen. This box tells the machine what you want to see in 4D. Everything inside the box will appear in 4D, and everything outside the box will not.

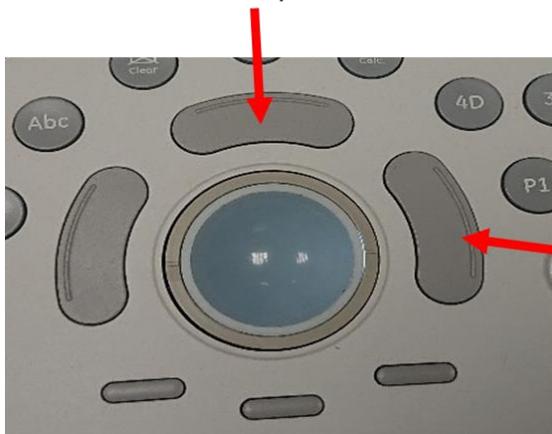
TIP: Optimum setting is Surface Big.



The render line should be placed in fluid just in front of the baby's face.

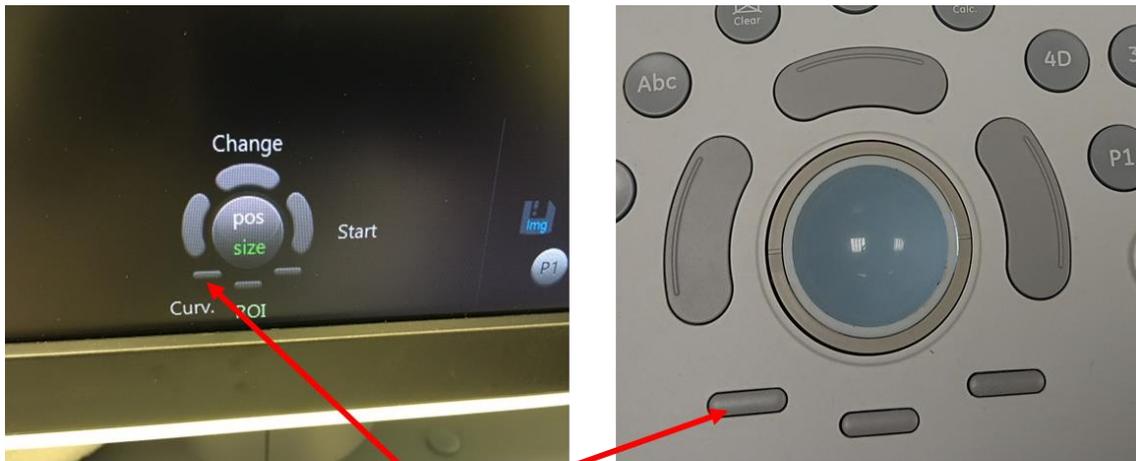
When the render box has a dashed line appearance it will appear on the single 4D image and looks better off.

Use this button to toggle between changing the size of the box or it's position

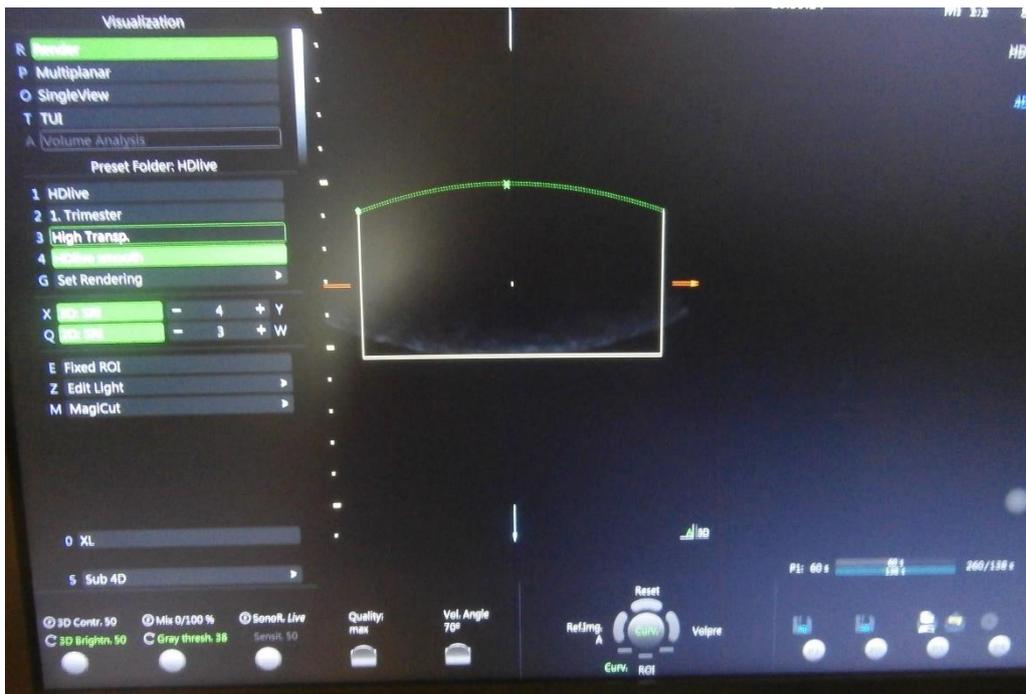


To start 4d run press this button

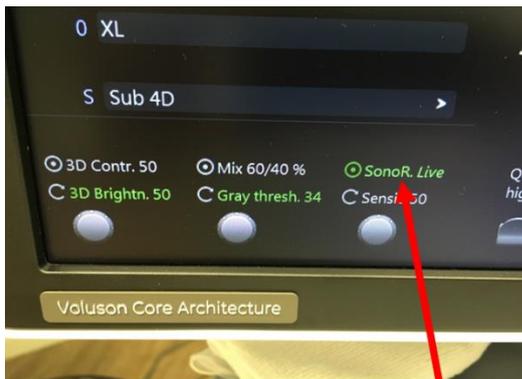
TIP: try using the button below the Tracker ball to curve the green line around the face when close to the placenta. It can remove the placenta from the 4D image.



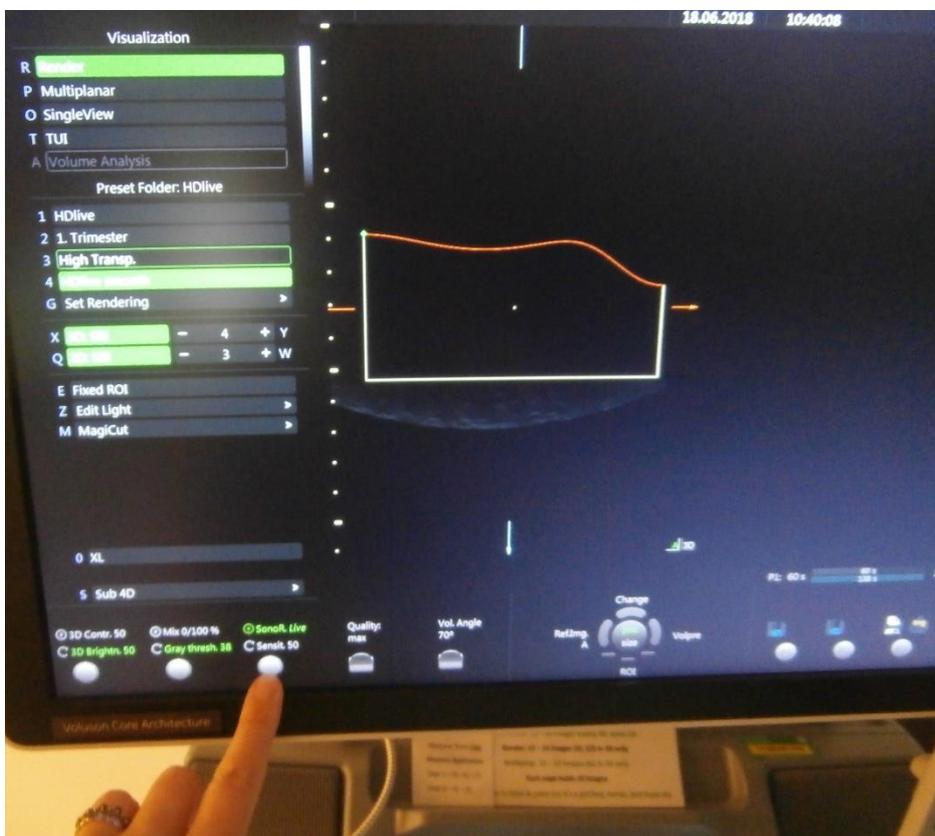
Curving the render line around the face.



TIP: Automated adjustment, automatically fits around the face.



Select SonoR Live by pressing this button.



To view the effect of curved or automated render line you will need to be in split screen into two, for side by side display (as shown on page 15). Take care as this can result in complaints from customers if the setup of this takes time, perceived as too long and uninteresting.

The series of images below show how a profile in 2D will result in a frontal view in 3/4D. The first 3D picture shows how the image will most likely have a shadow on the forehead because the render line is situated within the forehead on 2D image (this will be more exaggerated if you do not bring the face as horizontal as possible as in images on page 10).



The third and fourth images are obtained by moving the Par Shift button. All of above images are obtained from the same cine loop review.

X, Y & Z AXIS for rotation of 3 & 4D image

PAR SHIFT – moves the render line closer to or further away from the baby's face, in effect it re focuses the image after magnifying.

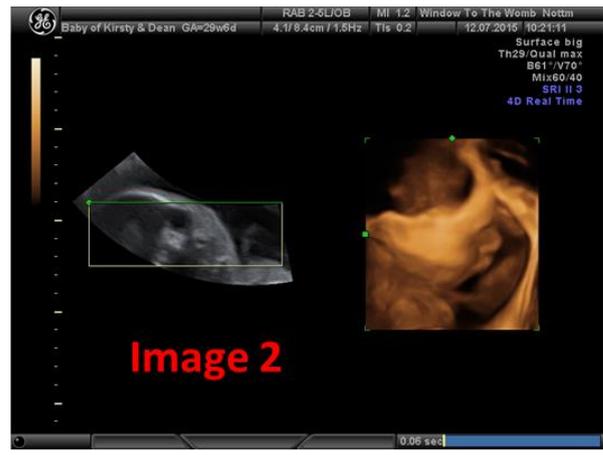
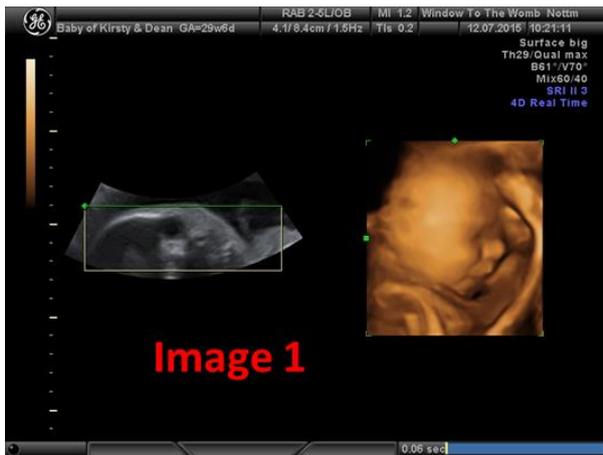


Up side down button

Split screen into 2 display,
Goes green when active.

Select 4D render box

4D live run button



This series of images are shown on the simultaneous display of 2D and 3D for illustration only. Image one is correct positioning of render line, often not possible to achieve and you will probably be scanning as in 2D image on Image 2 where the render line is within the baby's head which will produce the shadowing on the forehead. **You must be ready when you switch to 4D scanning (set up on single screen) to manipulate the X axis button on the control panel.** The Y axis button will straighten the image up vertically and the Z axis button will rotate the head and bring it more into frontal view (but it has a limited effect).

TIP: Do not forget to increase or decrease the overall gain settings when changing from 2D to 4D.

TIP: If you have a good 3D image of the face use zoom. Make sure that it is straight (Z axis) and maybe try rotate a little (Y axis). You will then need to use the PAR SHIFT to refocus the image (you are actually moving the rendering line out of the face and thereby removing the shadowing).



The three images above show the effect of magnifying an image (first to second) with the second image showing shadows on the forehead and tip of the nose. The third image shows the effect of refocussing with the Par Shift button.



All three images obtained from same cine loop review. Reducing actual real time scanning time.



The simultaneous display shows that if you position the render line in fluid in front of the chest with the face at the extreme right of the 2D image you will obtain a good 3D picture of the face.

Note the cord (it is not around the baby's neck!!).

TIP: Take an extra few seconds to obtain an image parallel to the probe face as much as possible by dipping the probe which will result in requiring less manipulation of the X, Y & Z axis as overuse of manipulation will degrade image quality.

Dipping the probe describes gently pressing one end of the probe into the abdomen so that the midline (sagittal) plane of the face is brought from an acute angle to more horizontal.

HD LIVE

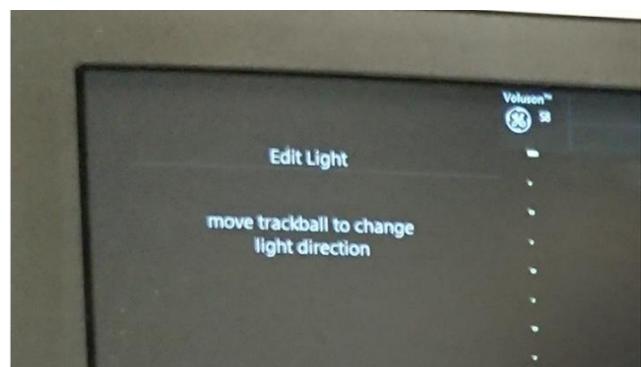
During scanning in normal 4D render mode you can change to HD Live.

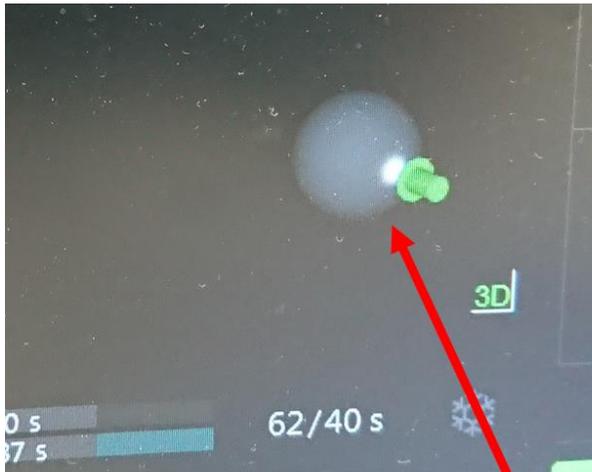
Select HD Live smooth with Navigation wheel, pointer or Number 8 on keyboard.



Manipulation of the image by X, Y & Z rotation and the Par Shift buttons is the same as in normal render mode and can be performed in real time or on a frozen 3D image.

There is an added feature of using the Edit Light button (a moveable light source/"torch") to give differing light and shadows on the face. Press Z on the keyboard.



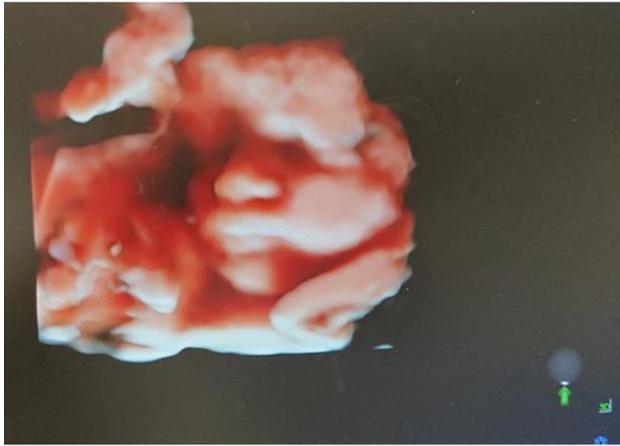


When you move the tracker ball it will rotate the “torch” around the sphere to give different light and shadows on the face.

TIP: You cannot use cine review or the pointer when Edit Light is activated. Similarly, you cannot select Edit Light when the pointer or the text button are active on the screen.

TIP: Change back to normal render mode before exiting 4D when completed the current scan as it will default to HD Live on the following scan which may not be appropriate/requested.





SUMMARY OF 3/4D PRINCIPALS.

1. Fluid is essential in between the object and the probe, **no fluid = no image.**
2. The object is required to be as close to the probe as possible.
3. The best images are produced when the probe is as close to 90degrees to the skin surface.
4. Very steep angles between probe and skin surface will result in an incomplete image.
5. Less pressure of the probe on the abdomen is required.

FINAL TIPS

Your scan assistant is your best friend!!!

They take most of the pressure off you, establishing a rapport with everyone in the room allowing your full attention to be given to produce the best images you can.

Take your time and make it the best experience ever for all the clients in the room. It is very important to balance performing the wellbeing checks speedily, which to some customers will be boring (all they want to know is the sex!!) with making the whole scan **an interesting experience** for everyone in the room. You have to make the wellbeing checks interesting to the customer and all relatives.

The main trick is to recognise when it is not your fault and when it is a waste of time continuing as it is due to circumstances beyond your control such as a sleepy baby, a lack of fluid in the correct place or all limbs in front of the face.

Try again 20 minutes later. If no luck, they should be offered a free rescan but remember that none of this will improve after 34 weeks and obtaining face pictures beyond 34 weeks are purely down to luck (although they will be quite stunning if you do get them) !!!

Finally, good luck and I hope that you enjoy the experience of working for Window to the Womb. We value your expertise.

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Window to the Womb Franchise Ltd.

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