

ULTRASOUND NAVIGATION PROTOCOL

BILLING CODE: UABDL or UABLAT - there is no additional charge for fusion

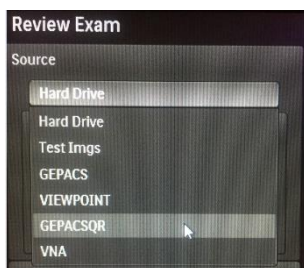
PATIENT PREP: none

(*TIP*- you can use pause PercuNav tab at any time to go back and forth) you can start the PercuNav and link the CT/MR before you bring in the patient.

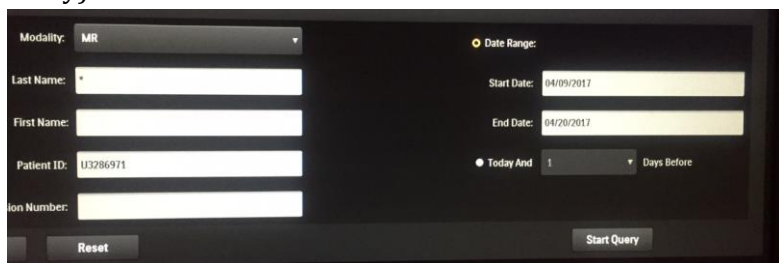
PRIOR TO IMAGING PATIENT

DOWNLOADING CT/MR IMAGES - **Do this prior to appointment time, it can take a while*

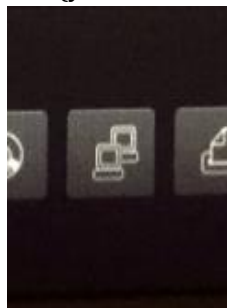
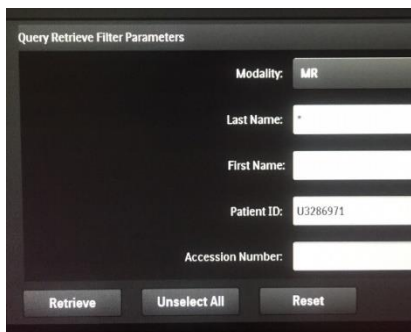
- 1) Review CT/MR images with Radiologist to see the area(s) you are targeting. Write down the modality we will be fusing, the date of the exam, and what series of images you will choose from the folder. You also need the total # of images in that series.
- 2) Go to **Review** on the ultrasound machine.
- 3) Go to **hard drive** and select **VISAGEQR** (Query retrieve)



- 4) Type in U# with capital "U", and select date range of CT/MR (give 7 days on either side of actual study).



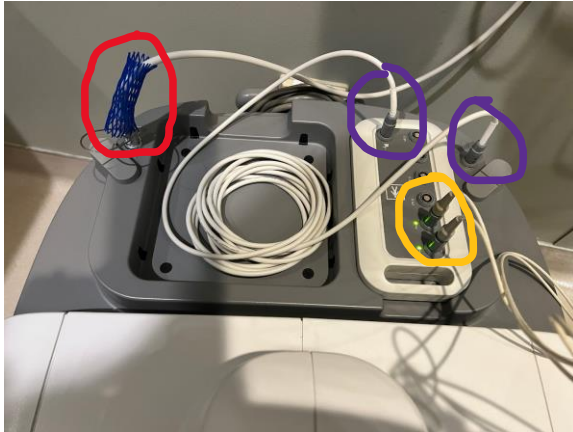
- 5) Click on **Start Query** (lower left icon will say Query in Progress).
- 6) Hit the + to the left of the patient's name to see the image numbers and the series, select the corresponding series and then select **Retrieve** (you can look at the network status to see status).



Network status icon

GETTING PATIENT SET UP

- 1) Make sure that the **navigation system** (red circle), the **probe tracker** (yellow circle), **patient tracker** cords (yellow circle) and the **TCU cord** (purple circles) are plugged into the navigation device on the back of machine. The lights to the left of the probe and patient trackers should be yellow when registering and then they will turn green when they are appropriately set up.



- 2) Use foam tape to secure the tracker on patient's sternum (smooth side down).
- 3) Place generator over patient's abdomen.
- 4) Put the guide on the C5-1 probe. Attach the probe tracker cord to the guide (only certain guides have the slot to attach the navigation device and the c5-1 and c9-2 have different guides). All the probes with the icon below have built in trackers (**some of the eL-18s and the other newer probes have this - the mc7-2 is the probe recommended by Phillips - these probes are kept in the bottom drawer of Shaun's office**)



NAVIGATION SET UP

- 1) Select patient information from the worklist and select the correct probe and preset.
- 2) Select **PercuNav** on the touch screen. Note: (if you have already scanned the patient and taken some images, make sure you are not using zoom. This will hide the PercuNav icon)
- 3) Choose **Select PET/CT/MR** from the hard drive.



- 4) This will take you back to **Review**, type in patient name or U#. (Two exams will come up if you already have images taken, the US and the downloaded MR/CT. If you have taken images it will auto highlight the US, unselect the US exam and select the CT/MR)

- 5) Choose the CT/MR exam by highlighting it on the list.
- 6) Hopefully you only have one set of images to choose from but if there are more, select the cross sectional image folder that you decided on with Radiologist (look at image count and series number that correspond with what you decided with the Rad.)
OR: Open up CT/MR scan the Radiologist wants. When the scan is open, you can click on the small box associated with the thumbnail series (click it once, don't double click) and then click fusion.



- 7) Select **Fusion**. System will beep twice if done correctly. If it does not beep – click field generator setup and then initialize and this should wake up the system – if it does not, make sure everything is properly plugged in.
- 8) There may be a few pop up messages that say the info (A#) doesn't match up --> say ok.
- 9) If a pop up comes up that says “select plan” just click select and this will activate the fusion

TARGET PLANNING

(*TIP*- you can use pause PercuNav tab at any time to go back and forth) you can do this step before you bring in the patient. Target planning can be done before fusion or after fusion, up to you.

- 1) Click “**Target Planning**” tab on touch screen.
- 2) Find the target on the CT/MR (scroll through frames with trackball or the scroll knob) and mark with select button next to track ball. You can move the + and select with the select button on the Left of the track ball and the image will zoom in. (The Right select button changes the darkness of the image).
- 3) If you want to keep this target, push the **Select Target** button on the touch screen. If you push the update button above trackball you can use the trackball to slice image by image. Or you can use the scroll knob to change your CT/MR slice.
- 4) Once you find the lesion on the CT/MR, set a target in the center of the lesion (Shaun likes to set multiple targets surrounding the lesion, (lateral, medial, anterior, posterior, middle, superior, and inferior) by moving caliper with tracker ball, then press left select button, then **Set Target** button on touch screen.) Do this for each new target you want to set. Phillips says this is unnecessary and that one target set in the middle of the lesion is enough. The machine only shows one active target at a time. So they recommend only placing multiple targets if there are multiple lesions being targeted.
- 5) The areas of interest marked will be labeled T1, T2, T3, etc. You can toggle between the different targets with the bottom Lt Knob labeled **Target**.
Tip There is a bar next to the right of the image and will light up if you're scanning too high (yellow) or too inferior (blue) from the target you have selected.



FUSION

There are a few methods for fusion! If you set up your PercuNav before grabbing the patient, click resume PercuNav on the right side of the touch screen (if it is not there, make sure you are not zoomed in, this hides the PercuNav button) If you have not started the PercuNav yet, follow the navigation setup steps on page 2.

Follow these steps for AUTO REGISTRATION using vessel match or surface match (there are three methods for auto reg, but don't use the one click method – that one is still being fine-tuned)

***DO NOT do auto reg methods if the patient has had a liver resection – jump to the instructions for internal landmark if they have. Also do not do surface based match if there is ascites present.**

VESSEL match: If you cannot see the vessels (MPV and branches) well on ultrasound this method is not optimal, jump to surface based or internal landmark.

1. Select **vessel based** method
2. Scan **intercostal** in the rib space that you can see the MPV and its branching best
3. Have the patient **pause their breathing** (have them do whatever breathing you can see the lesion best in as that is how the fusion will line up)
4. Click **start sweep** on the touchscreen or the **update** button above the trackball and obtain a smooth, well controlled fanning sweep within that one rib space
5. Click **freeze or stop**
6. If you are happy with the sweep **click register** and this should bring you to your fusion image page (If it doesn't register it will have a pop up that asks if you want to try the surface based match, but try vessel based match again.)
7. **Click next** and then you can play with the layout (left /right) and blend overlay
8. If you have not done so already, after you are properly matched go to target planning and match the lesion

SURFACE BASED match: If the patient has ascites this method will not work.

1. Select **surface based** match
2. Move the probe over the sternum and select **mark sternum**
3. Move the probe over the navel and select **mark navel**
4. Then the **sweep** option should be available. A **subcostal sweep** is best, but intercostal should work too.
5. Click **next** and then you can play with the layout and blend
6. If it does not seem to line up well, try again and end your sweep before you sweep out of the liver.
7. If you have not done so already, after you are properly matched go to target planning and match the lesion

Notes:

If you don't like how it matched up, you can click back on the touch screen and try again.

Do not do surface sweep if there is ascites

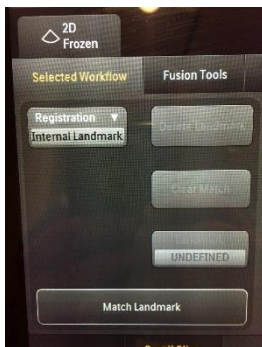
For the auto reg method do not do a midline sweep, always intercostal or subcostal depending on the method

If you are doing a renal ablation the patient is ALWAYS PRONE! - when doing fusion go to fusion tools and flip the CT/MR top to bottom AND left to right so that the orientations match up

If you are practicing this method on the phantom, just move the probe to the top plastic edge of the phantom for the sternum and to the bottom plastic edge for the navel. This is just to lock in the location to the tracker, no image is required of these areas. Also, for the surface based method on the phantom, do not sweep all the way through the liver. The machine thinks that there is ascites inferior to the liver in the phantom, so stop your sweep before you hit this part. (ADD IMAGE?)

Follow these steps for the INTERNAL LANDMARK method

1. Click Selected Workflow Tab



2. Click **Registration** and then select **internal landmark (this should be the default method selected)**. It is easiest to do this with the left lobe/subcostal as then you won't have to rotate the CT/MR and then once you have matched up the modalities the CT/MR will rotate with you if you come from the side.
3. Use the **scroll knob** to find the same landmark on the CT/MR and US. Freeze your image and **place a cursor** in the same spot on the CT/MR and the US and then select **match landmark**. Repeat this step multiple times for multiple (at least three) landmarks in areas that are fairly spread out. (vessel bifurcations or cysts/lesions are a great landmark to use) On the left side of the screen it will show you your Reg Fit. This number tells you how well the US and CT/MR are matched. Under 0.8 is good (the lower the better though). If it is higher than that you should exclude the cursor with the highest number and find another spot. To exclude a cursor: scroll through your landmarks and click exclude match on the one with the highest number.
4. Once you have matched multiple landmarks and have a reg fit number that is less than 0.8 **click next** on the touch screen. Then you can adjust the layout and **blend overlay** and use the **trackball** to adjust (confirm/adjust in multiple planes)
5. If you have not done so already, after you are properly matched go to target planning and match the lesion

Notes:

If you don't like how it matched up, you can click **back** on the touch screen and toggle between the landmarks delete landmark with the highest fit reg and then match new landmarks.

If you want to cine back on your US, make sure that the frame that corresponds to the US is selected on the touchscreen and then you can click the update button and "scroll" through the ultrasound.

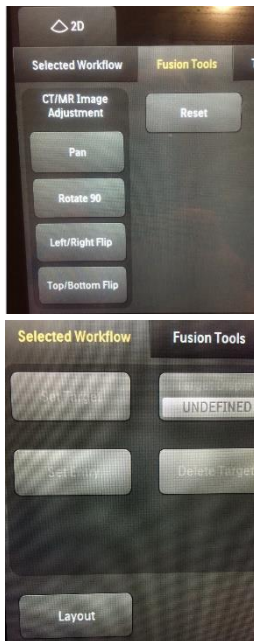
In a pinch you can use the superior pole of the right kidney as an area to match, just try to be as specific in the area you match on the CT/MR and US.

NEVER use the gallbladder as a landmark as this is a dynamic structure and will not match well.

If you are doing a renal ablation the patient is ALWAYS PRONE! - when doing fusion go to fusion tools and flip the CT/MR top to bottom AND left to right so that the orientations match up

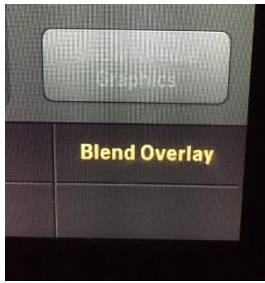
Follow these steps for the PLANE MATCH method

- 1) If you don't have a subcostal window, and are looking at the **Right** lobe and scanning intercostal, under **Fusion Tool tab** choose **Rotate 90**. This will turn your CT/MR so that it will match your US. (You do not need to do this if you are looking at **Left** lobe). *Tip* If CT image is too bright or dark, Right click the select button next to the track ball and then use the track ball to change the brightness.

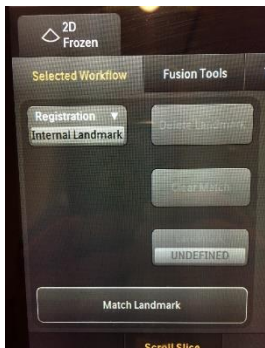


- 2) Scanning in the same plane as the CT/MR, Transverse and **perfectly perpendicular** to the bed (not oblique), find a landmark on the ultrasound image that you can easily spot on the MR or CT. Keep ultrasound image live.
- 3) Using Selected Workflow Tab, select "trackball" on touch screen. From there, you can scroll, rotate or move entire image to match up US with CT/MR. Start in transverse and try to match up a landmark. Adjust overlay to match, then turn to sagittal plane and try to match up right kidney. Go back and forth until your landmarks match up.

- 4) Moving the trackball, a cursor will show up: Place cursor on MR/CT then left click. Move trackball over US image and place cursor in the same spot, then left click mark the same spot. You can scan through the CT/MR using **Scroll Slice** knob, to find a good spot.
- 5) You can use the **Blend** to make the US and CT/MR blend over each other.

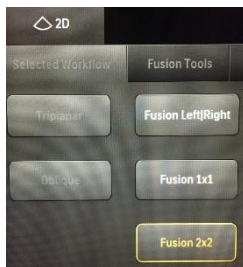


- 6) When you have found approximately the same spot on the US and CT/MR, choose Match Plane Landmark under **Selected Workflow Tab**.



Match Landmark button on the left part of the touchscreen

- 7) Also under **Selected Workflow/layout Tab**, choose Layout Left/Right. Shaun thinks this is a better layout.



- 8) With breath hold assistance from patient, better match your fusion using the **Trackball** function under **Selected Workflow** tab. You will need to match the fused images in both the sagittal and transverse planes. Hint: try using right kidney as your landmark and then fine tune with vasculature landmarks.
- 9) See if you see the target area on the US.
- 10) At this time you can further correct the overlay of the image to make sure they are matching up. Go to the **Selected Workflow Tab** and use **Trackball**. This allows you to scroll, rotate or move entire CT/MR image to line them up.
- 11) Find the target on the blended image and make sure your landmarks match up in 2 planes.
- 12) You can turn on the color; this will help you see if you need to match up better.

Ultrasound Navigation Protocol History

	Date	Changes made	By whom
Updated	10/10/21		
Updated	9/23/2024	Updated to match new software version	Annie Sauvage, Shaun Bornemeier, Renee Betit Fitzgerald