

Long Bone Imaging Distal Lower Limbs utilizing Tim Technology and the Tim User Interface

James Hancock

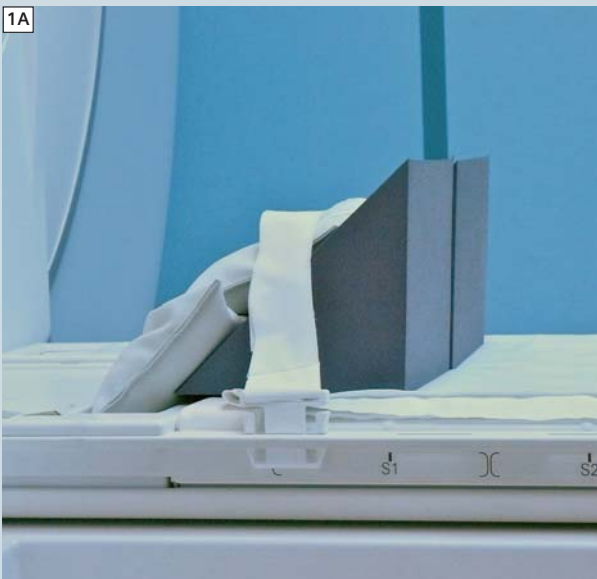
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Distal lower limbs with Tim

Positioning technique

- Head coil and C-spine coil removed from table.
- Spine coil on the table and plugged in.
- Create a bolster for the patient's feet using two triangular pads and sand-bags to support them as shown in figure 1. This support needs to be placed in the region of the first spine element as indicated on the table.
- Position the patient on the examination table feet first with their feet dorsiflexed and placed on the support pads.
- Ensure the patient is in the middle of the table and that their legs are as close together as possible without actually touching.
- Place the two Body Matrix coils over the patient's lower limbs strap down and plug in.
- Use the laser to centre to the patients knee joint.
- Press the isocenter button to move the patient in to the magnet bore.

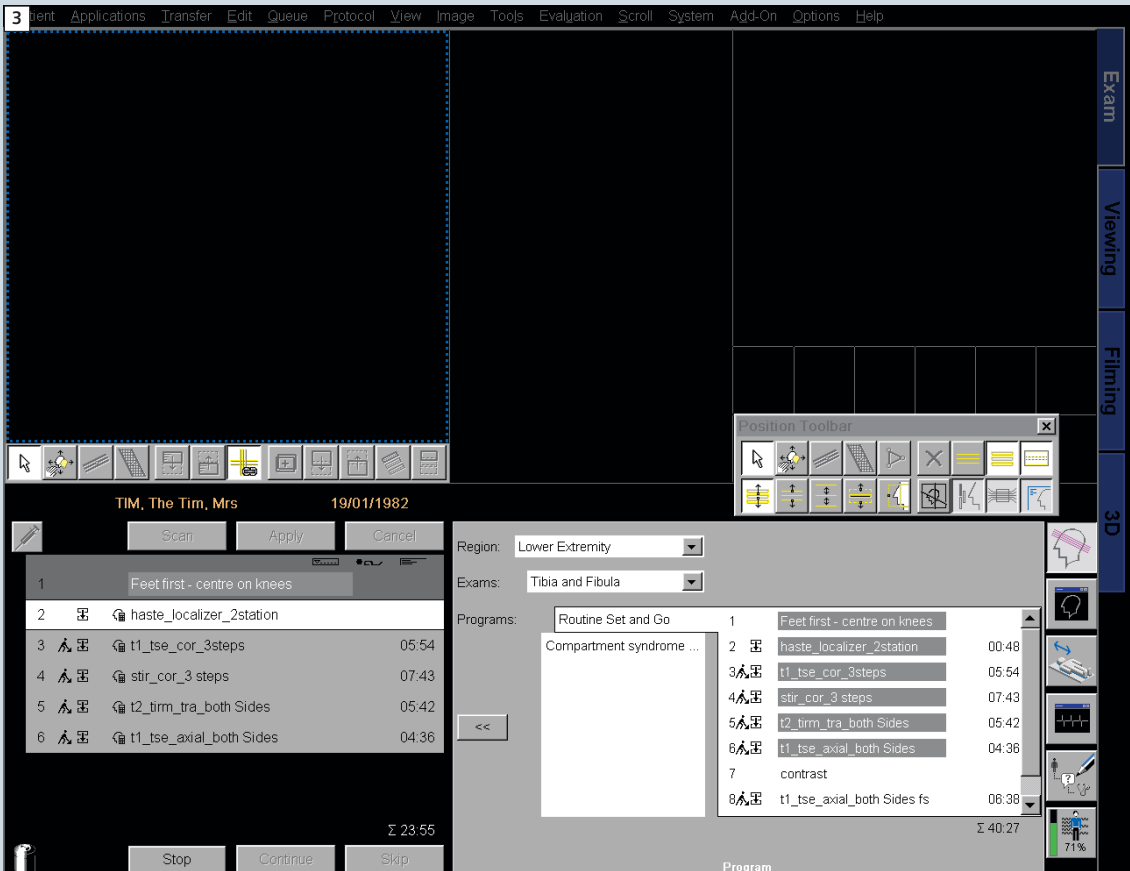
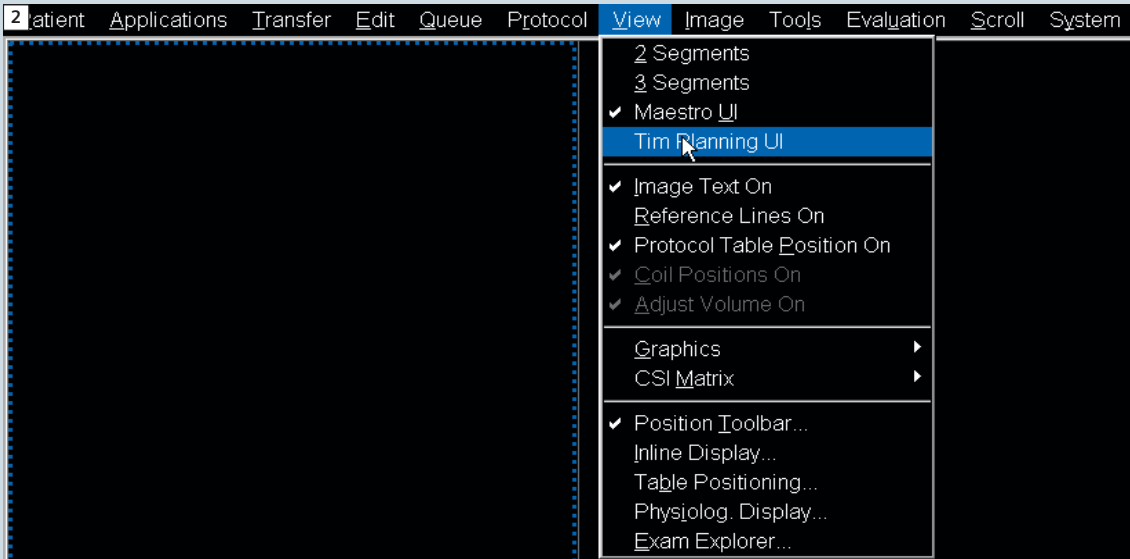
Set up the triangular sponges as shown in these images. Pay attention to the 1st spine element as you want to position them in that region. This allows you to position the patient with their feet dorsiflexed and in the correct anatomical position.





Tim planning

- When running a lower limb protocol it is useful to activate the Tim Planning Suite user interface.
- Figure 3 demonstrates the layout for the Tim User Interface. At our institution the protocol for lower limb MRI is saved under the MSK protocols within the Lower Extremity subsection.



Running the localizers

First step to planning is to run the localizers. Drag the appropriate HASTE localizer into the queue for running. You can bring the other sequences you will run over at the same time. This localizer begins running from the

knee down to mid tibia/fibula then moves the table before running localizers from the mid tibia/fibula down to the ankle. We end up with two localizers in the running queue. Once complete the two stations are auto-

matically composed Inline into one complete image for the entire lower limbs in both sagittal and coronal planes. These images allow us to plan the setup for the rest of the scans.

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TIM, The Tim, Mrs 19/01/1982

Scan Apply Cancel

1		Feet first - centre on knees	
2		haste_localizer_2station	
3		t1_tse_cor_3steps	05:54
4		stir_cor_3 steps	07:43
5		t2_tirm_tra_both Sides	05:42
6		t1_tse_axial_both Sides	04:36

5

TIM, The Tim, Mrs 19/01/1982

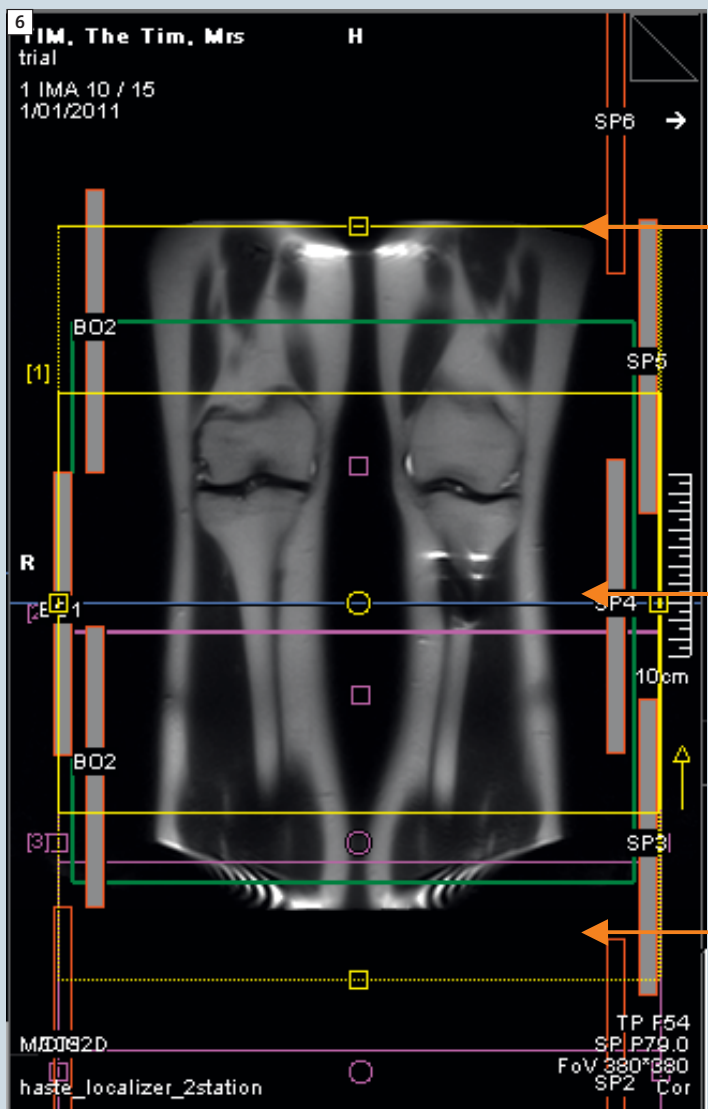
Scan Apply Cancel

1		Feet first - centre on knees	
2.1		haste_localizer_2station	
2.2		haste_localizer_2station	
3		t1_tse_cor_3steps	
4		stir_cor_3 steps	07:43
5		t2_tirm_tra_both Sides	05:42
6		t1_tse_axial_both Sides	04:36

Coronal acquisitions

Setting up the correct fields-of-view

- Drag the T1 coronal sequences across into the queue and open it. This sequence displays three separate sub protocols. This ensures maximum coverage with minimal distortion.
- When setting up for any long bones it is best to take a systematic approach.
- Initially set up your FOV to ensure that you are going to cover the entire region. This involves placing a composed coronal image of the lower limbs into the middle rectangular window.
- When setting up your FOV coverage ensure **coupled graphics is on**. This can be achieved by right clicking in any of the three boxes and selecting the option.
- With coupled graphics on you can then move your FOV and position it appropriately for the correct coverage (Fig. 6).

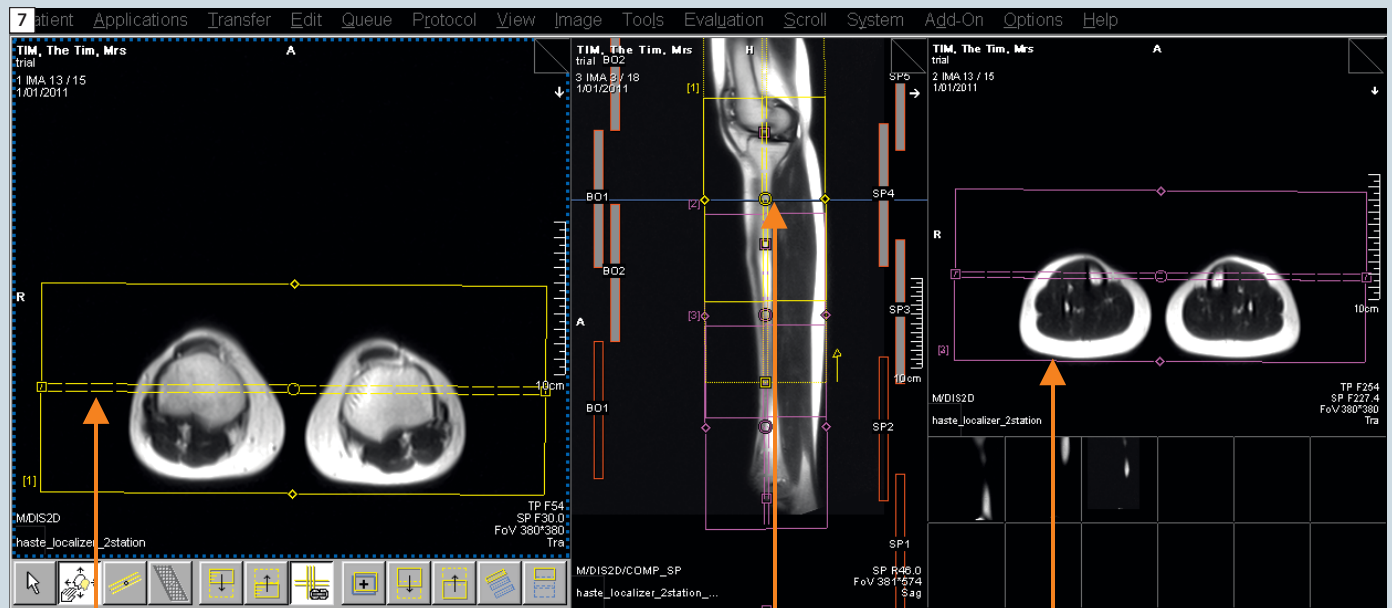


Note the three separate FOV boxes. The upper FOV is yellow and this indicates that it is currently active. By utilizing coupled graphics you can grab and drag all of the three and move them as one. This makes setting up your coverage very easy. Each FOV is also numbered and you can select them by clicking on the little numbers.

Setting up the slice positions

- Once the FOV has been set you need to set the slice group locations for each of the subgroups.
- The best way to do this is to load your individual axial station localizers into the two square windows. This helps you to visualize your coronal slices.
- In the rectangular window place a composed sagittal image. This gives you an indication of the relationship between each subgroup of slices.
- Unlike the spinal cord almost all patients' long bones are relatively straight. This makes setting the slice positions easy. You can leave coupled graphics on and move the slices as one.

positions easy. You can leave coupled graphics on and move the slices as one. Our protocol is set up with plenty of slices to allow easy complete coverage in the coronal plane.



By having an axial localizer of the proximal tibia in this box you can keep an eye on your slice coverage for the proximal portion of the lower legs. Note that there is rotation of this sub-protocol about the H-F axis. This needs to be done with **coupled graphics on** so all sub-protocols match otherwise composition will fail.

A composed sagittal gives you an indication of both the position of your subgroup slice positions and also a good overview of your total FOV.

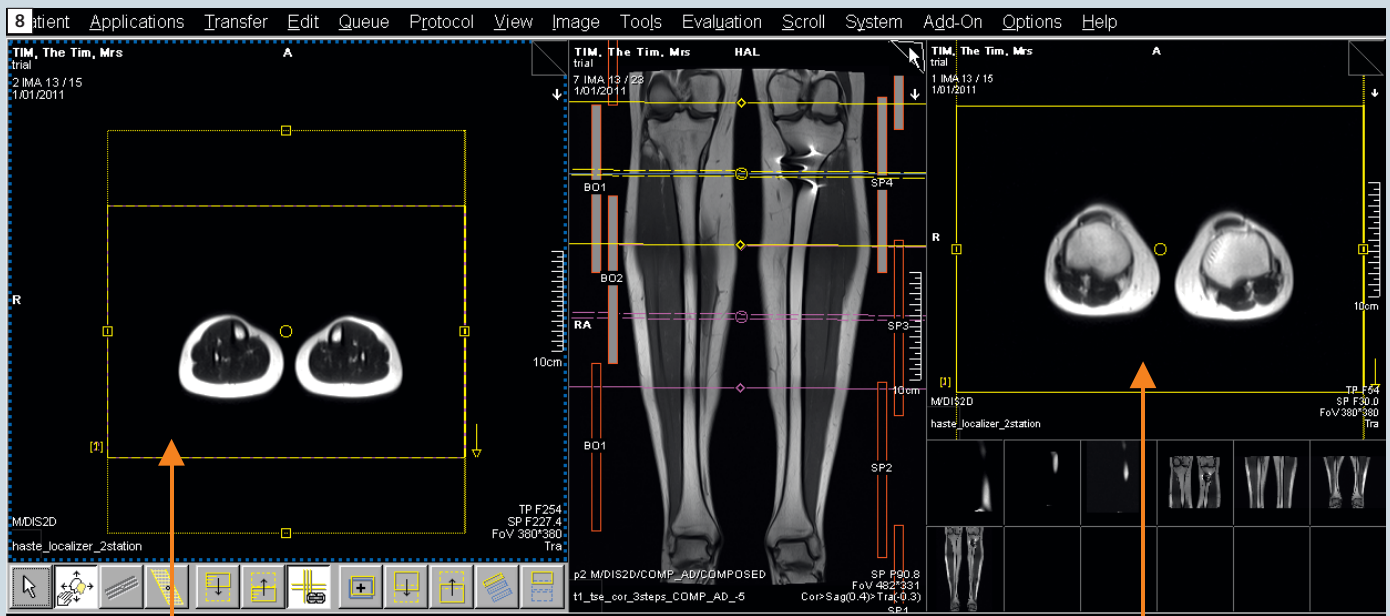
By having an axial localiser of the distal tibia in this box you can keep an eye on your slice coverage for the distal portion of the lower legs. Note that there is rotation of this sub-protocol about the H-F axis. This needs to be done with **coupled graphics on** so all sub-protocols match otherwise composition will fail.

Axial acquisitions

Setting up the correct fields-of-view

- Drag the T1 Axial sequences across into the queue and open it. This sequence displays two separate sub-protocols. This ensures we have maximum coverage with minimal distortion.
- To allow for the correct FOV you should again have a separate proximal and distal axial localizer in each of

your square windows. This makes it easy to ensure your anatomy is in the middle of the FOV and that you will not cut off anatomical regions as your slices progress down the leg. When adjusting leave **coupled graphics on**.

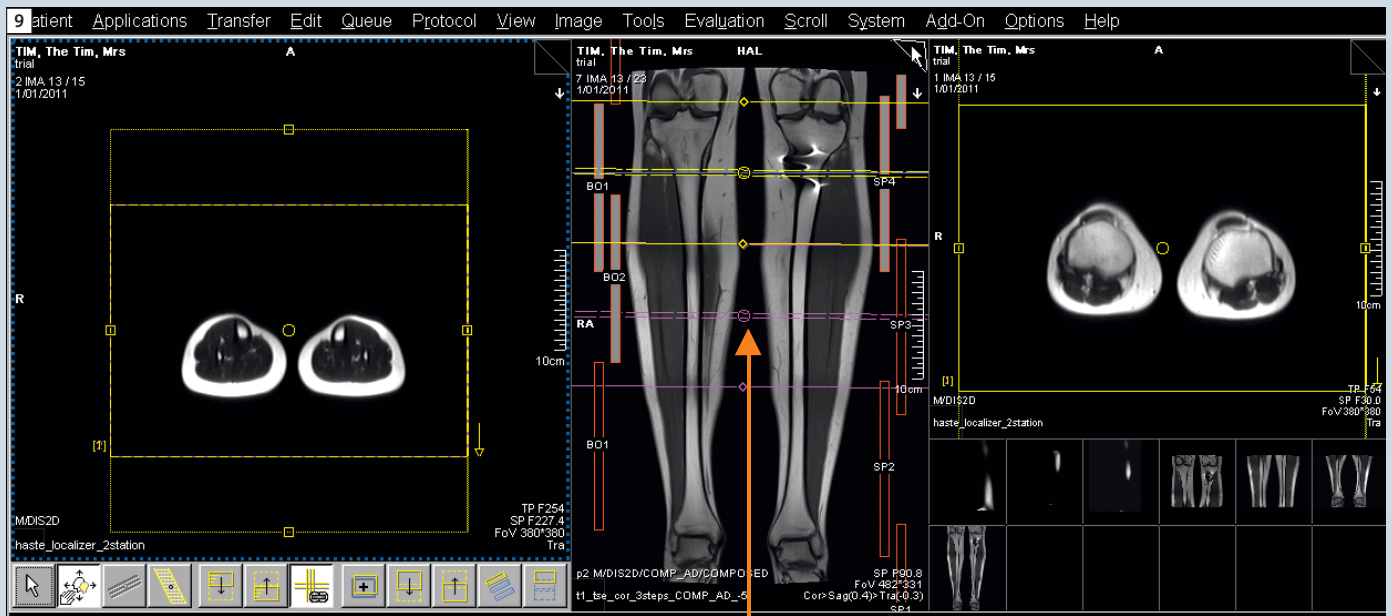


Distal axial localizer. This allows you to position the FOV to ensure you cover the entire distal portion.

Proximal axial localizer. This allows you to position your FOV to ensure you cover the entire proximal portion.

Setting up the slice positions

- Once the FOV has been set you need to set the slice group locations for your axials.
 - In the rectangular window place a composed coronal image which you can use to position your slices. Position your slices to cover the area of interest and within this window
- switch between the coronal and sagittal composed images to ensure your slices are perpendicular and true axials.
- You do this with **coupled graphics** as the two slice groups are linked and this ensures a contiguous run of axial slices.



Switch between the coronal composed and sagittal composed images when setting up your slice groups. Obviously tailor your slice group to cover the region of interest.



You can see how each subgroup for the T1 coronals has its own number 3.1, 3.2, 3.3 etc. Thus if you need to rerun a region simply hold shift and click the one you need to repeat. Drag and drop that region back into the queue. A cross will run through the compose indicator, this shows that it is only going to run that one region again.

Important notes

- Any presets that you position will affect all three subgroups. As such if you use presets you must pay attention to their positioning.
- Changes made to one subgroup will not affect the other groups so never assume!
- Pay attention to the position of the patient on the table, they need to be close to the middle otherwise you are likely to encounter artifacts on your coronal images.
- Overlaps are built into the protocols, be careful when setting up your FOV. Keep these overlaps in place to ensure smooth composing of final images. Thus when setting up your FOV leave coupled graphics on.
- Avoid in-plane rotation when planning your sequences as this will affect the composing of the final images.
- For coronal and sagittal sequences you may angle your sub-protocols in either the A–P (coronal) or R–L (sagittal) planes when using these 2D protocols. However be aware of the previous point. Thus if setting up a coronal sequence you could angle in the sagittal plane to acquire well placed slices but obviously you need to avoid rotation in the coronal plane as this would correspond to in-plane rotation.
- Rotation of sub-protocols in the F–H (axial) plane should be avoided unless absolutely needed. A difference of just 1 degree between sub-protocols will cause composing to fail. If you do rotate in this plane make sure **coupled graphics is on** as this will ensure any changes you make in this plane apply to all sub-protocols.
- At our institution the axial sequences have been optimized to ensure the maximum coverage with minimal distortion. If you need more coverage consider adding a subgroup rather than increasing the number of slices.
- If you need to repeat a subgroup due to patient movement you only need select the region affected by the movement and rerun that particular subgroup. See the example in figure 10.

Contact

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