Clinical benefits of the use of Surface Guided Radiotherapy for Palliative Treatments

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Thank you to Lisa Telford, Treatment Delivery Team leader who can't be here today but has been integral to data gathering, analysis and co author of this presentation.

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Department overview

- Centre is in Preston in the North-West of England
- Treats patients from Cumbria, most of Lancashire and Fylde Coast
- Treats up to 250 patients per day
- One XStrahl superficial machine
- 2 Phillips wide bore CT scanners
- 8 Elekta linacs, 1 harmony with 1 being installed currently, 6 Versa HD
- Went live with SGRT Jan 2023, 72% staff competent
- Treat all breast, all thorax, SABR thorax and all palliatives with SGRT
- All systems funded by our charity Rosemere Cancer Foundation
- All CT scanners and linacs have SimRT or AlignRT installed

Aims of moving to Palliative SGRT

Some set ups are complex- simplify treatment set up and delivery

Set ups are more difficult due to patient condition, position, multiple immobilisation aids-more accurate set up with reduced imaging displacements

Increased imaging due to difficult in setting up patient and patient condition-less images therefore reduced imaging dose

Longer treatment times-reduce treatment times to reduce patient pain

Steps to go live

- Palliative protocol for SGRT put in place with tolerances 5mm on translations/rotations and mag 0.7.
- Existing imaging workflow reviewed and simplified to reflect SGRT capture procedure and simplify workflow.
- Apps training with VisionRT with a focus specifically on palliative SGRT with existing and new users.
- Go live next day with small patient cohort.
- Due to confidence with SGRT although tattoos still present went straight to set up and monitoring ignoring tattoos.
- Used for single fields, pop and extended FSD V-Sim planned straight away then moved on to high dose planned palliative patients.
- Reviewed new WI against patients treated and amended workflow and steps to reflect best streamlined practice.
- Reviewed imaging data to validate improved displacements, reduced repeats to move forward with all palliative patients across department.

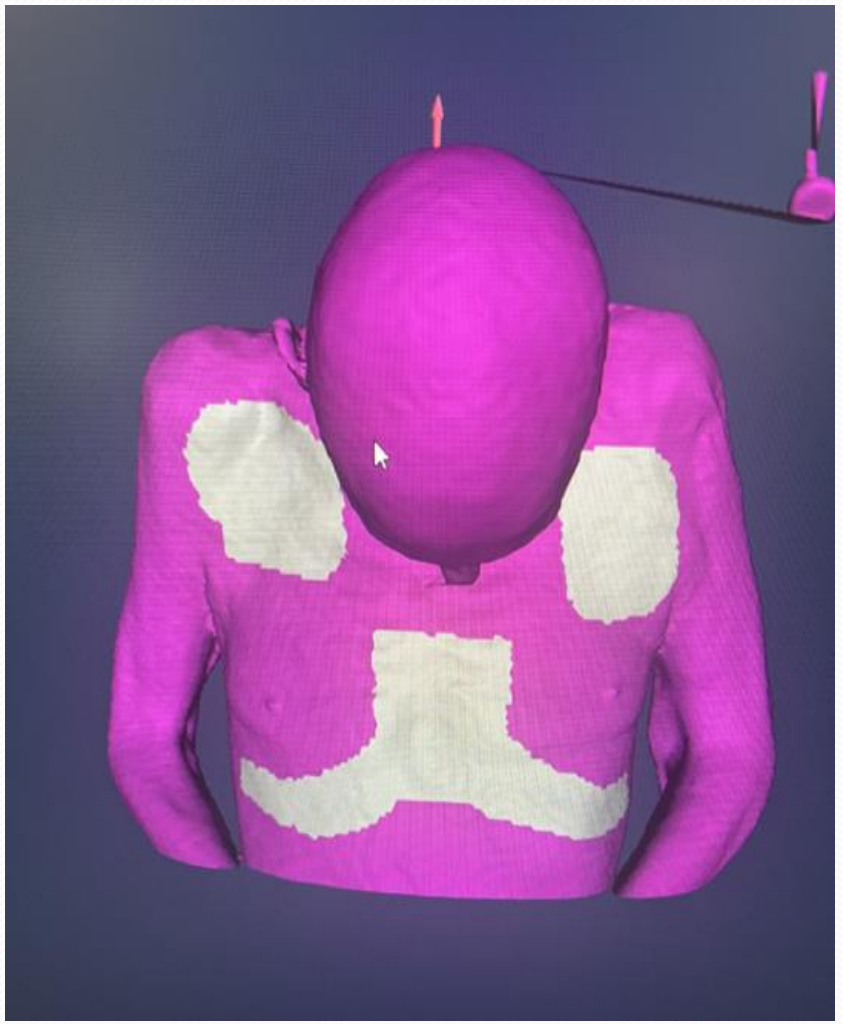
Learning from initial go live

- Learned to adjust ROI from recommended ROI quite quickly for patients that they did not work for ie moving to pelvis ROI for upper L/T spine for rotund patients.
- Confidence of the existing trained staff having a good understanding of what the cameras can see and what would be included for difficult set ups added in this
- Utilisation of gated capture for some patients even those that weren't thorax
- FSD function used more for this cohort to speed up set up.
- After first few patients utilised postural video for initial set up as discovered forcing patient into flat and straight position ROI did not match. Used postural video to get into natural position.
- Single post field treatments on mattress caused issue with ROI matching at 100 FSD. Testing on phantom showed mattress squash but gave confidence on ROI match representing 100cm to skin accurately.

ROI deviation from recommendations

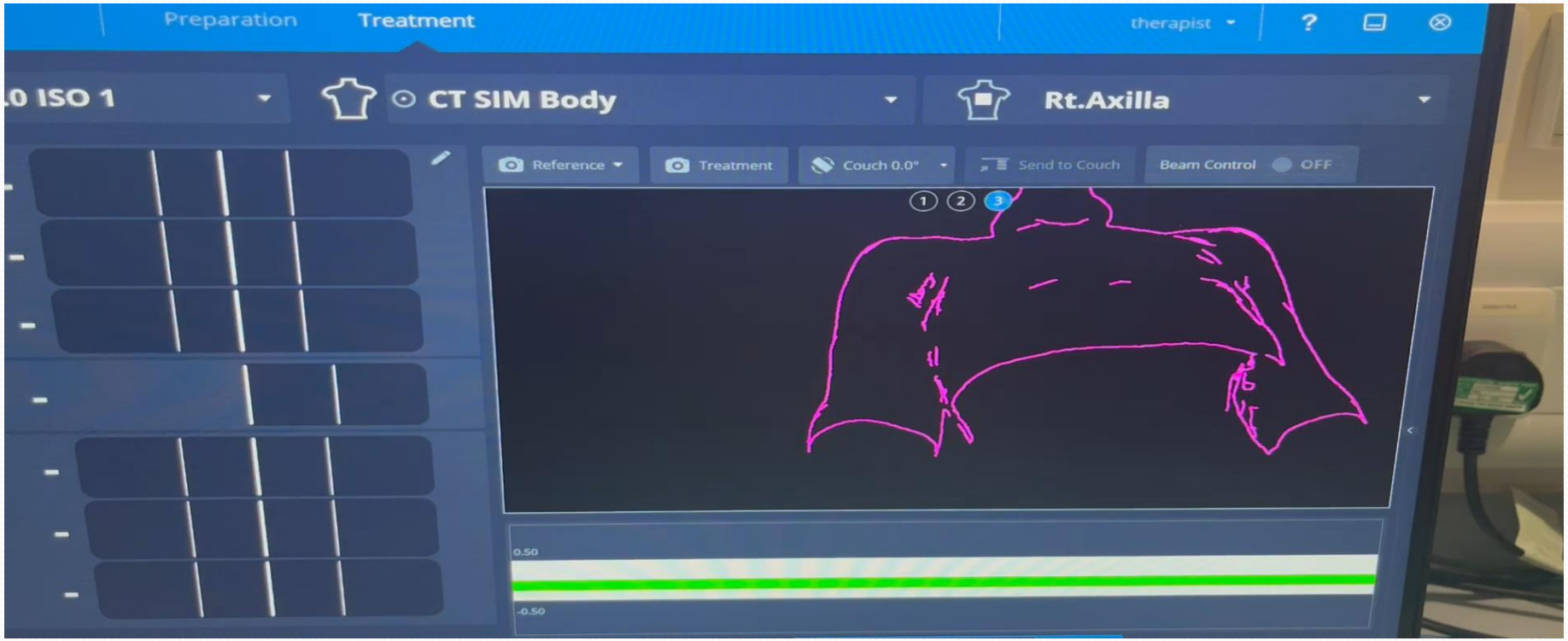
ROI strip on upper thorax omitted as not visible due to slope of chest.

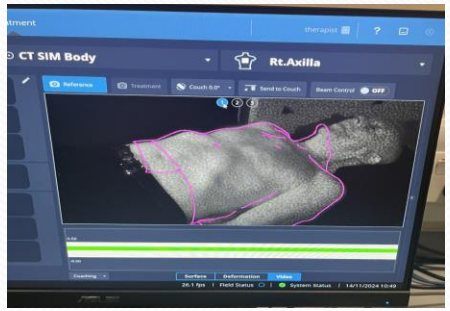
Extremity feet to gantry, amend to pelvis ROI as more visible to cameras



Patient partially upright in VAC bag, ROI placed on gave best visualisation, will be discussed later.

Postural video for Palliative Radiotherapy





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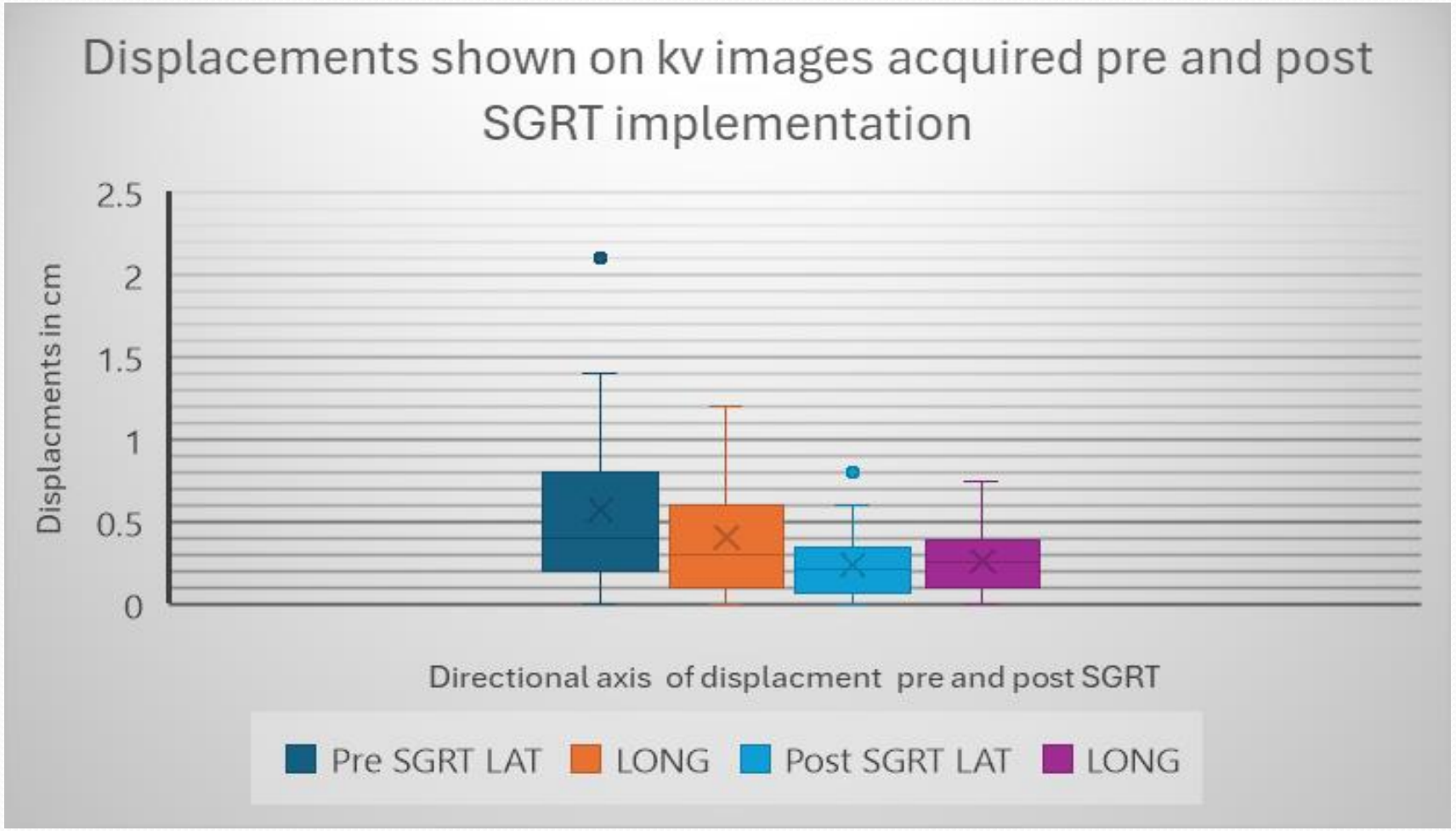
Reduction in imaging displacement-kv images

Pre SGRT		Post SGRT	
LAT	LONG	LAT	LONG
0.2	0.1	0.4	0.2
0.8	0.6	0.3	0.1
0.2	0.3	0.07	0.26
0.2	0.6	0.27	0.14
0.7	0.1	0.07	0.75
0.9	0.1	0.26	0.26
1	0.2	0.22	0.54
0.4	0.2	0.1	0.1
1.1	0.1	0.45	0.32
0.2	0.1	0.19	0.32
0.3	0.1	0.14	0.2
0.8	0.3	0.6	0.26
0.8	0	0.8	0.3
0.2	0.5	0	0
0.3	0.1	0.04	0.4
1.3	0.1	0.21	0.53
2.1	0.3	0.06	0.48
0.7	0.1	0	0
0	0.4	0.33	0.39
0.7	0.3	0.27	0.21
0.7	0.4	0.5	0.06
0.8	0.6	0	0
0.1	0		
0.1	1		
0.4	1.1		
0.1	0.9		
1.4	0.6		
0.1	1.2		
0.4	0.2		
0.4	0		
1.1	0.7		
0.3	0.9		
1.2	0.9		
0.5	0.5		
0.1	0.9		
0.7	0.7		
0.2	0.6		
0.2	0.3		
0.3	0.1		
0.9	0		

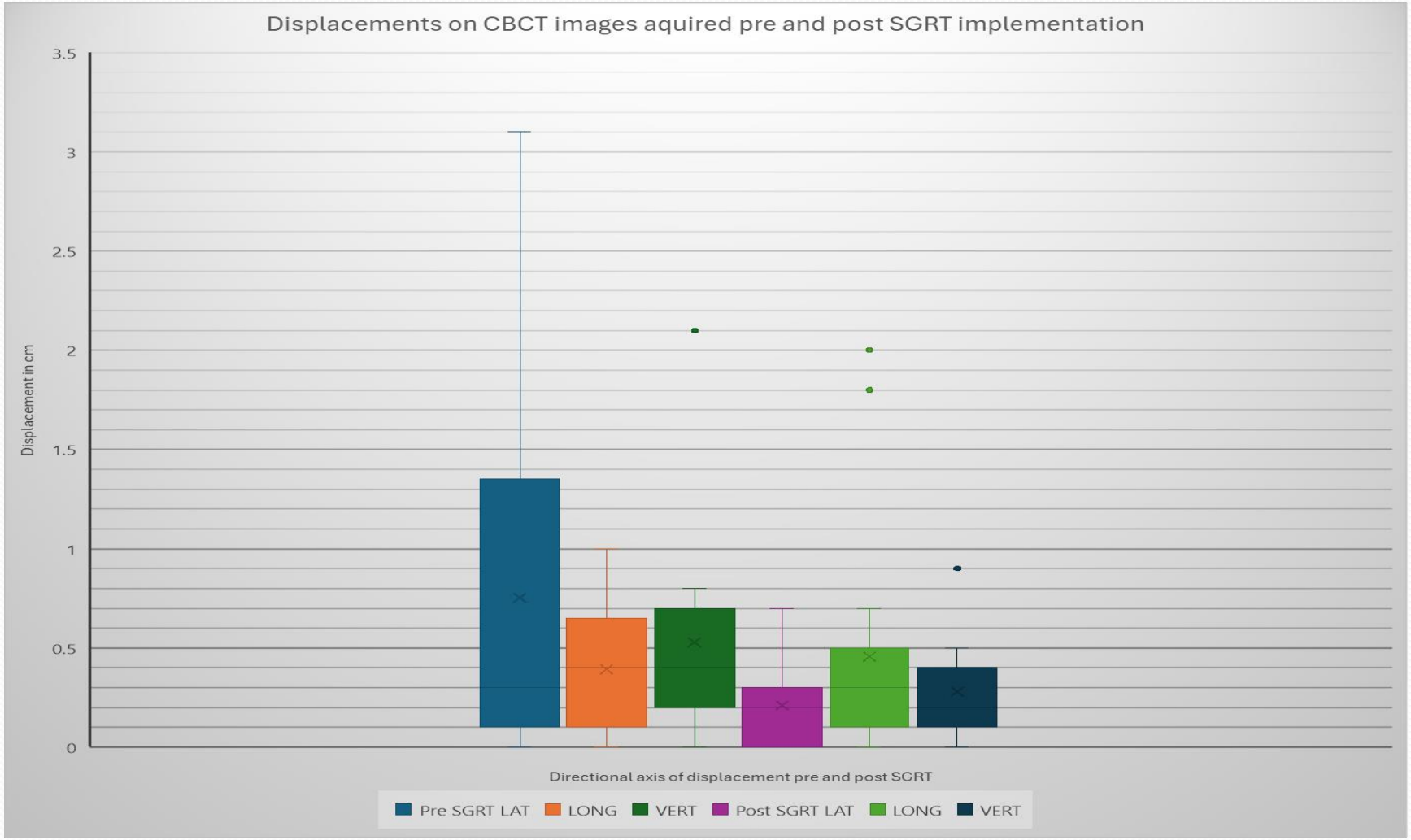
22.5% of images acquired pre SGRT were out of 1cm imaging tolerance, none out of tolerance post SGRT



Reduction in imaging displacement-CBCT

Pre SGRT			Post SGRT		
LAT	LONG	VERT	LAT	LONG	VERT
1	0.7	0.7	0.7	0.3	0.5
0.5	0.1	0.7	0.4	0.07	0.3
0	0.1	0.2	0.2	0.1	0
3.1	0.4	0.2	0.1	0.5	0.1
0	0	0	0.3	0.3	0.1
2	0.2	0.2	0.3	0.5	0.2
1.7	0.3	0.3	0.1	0.7	0.3
2	0.5	0.7	0	0.3	0.4
0.1	0.4	0.7	0.2	0.4	0.5
0.1	1	0.8	0.2	0.4	0.1
0.6	0.6	0.4	0.5	0.1	0.2
0	0.5	0.5	0.2	1.8	0.5
0.9	0	2.1	0	2	0.9
0.1	0.3	0.2	0.3	0.7	0.1
0.3	0.7	0.4	0.3	0.1	0
0.19	0.08	0.08	0	0.1	0.4
0.2	0.8	0.8	0	0.1	0.4
			0	0.2	0.1
			0.2	0	0.2

21.1% of CBCT acquired pre SGRT were out of 1cm imaging tolerance, 5% out of tolerance post SGRT



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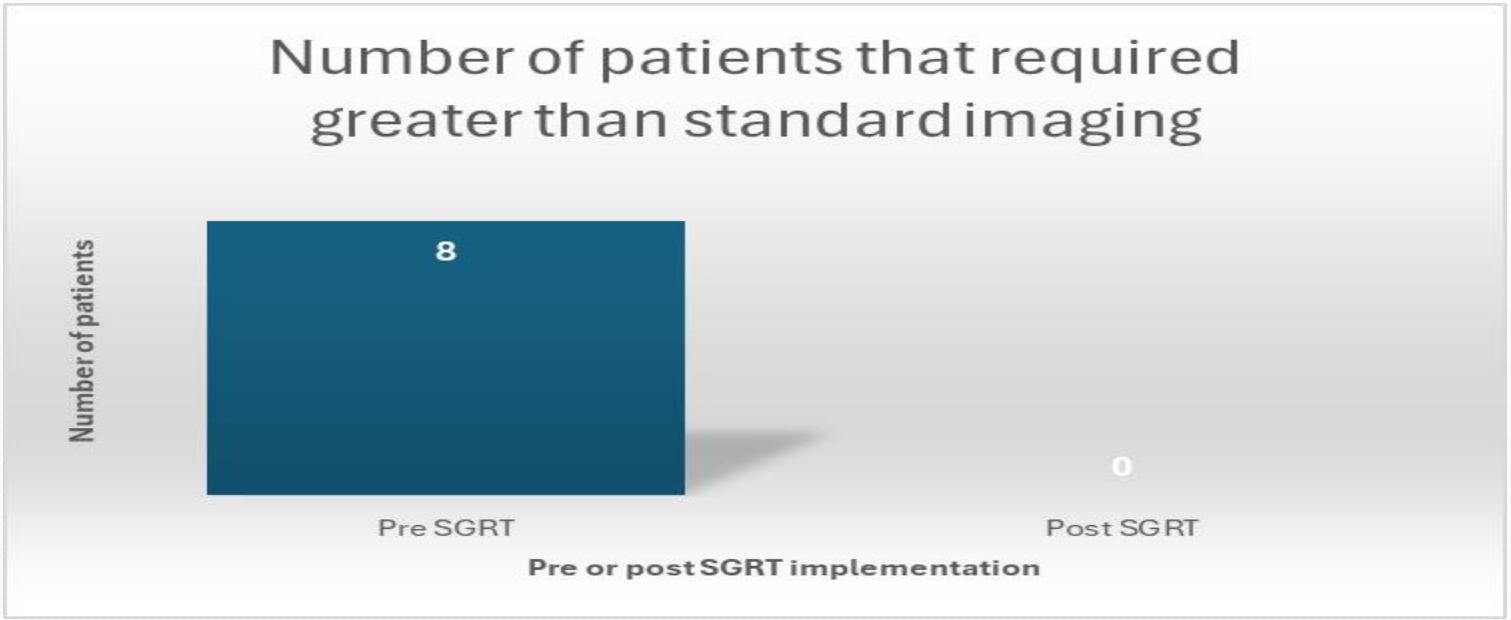
Reduction in images and repeat images

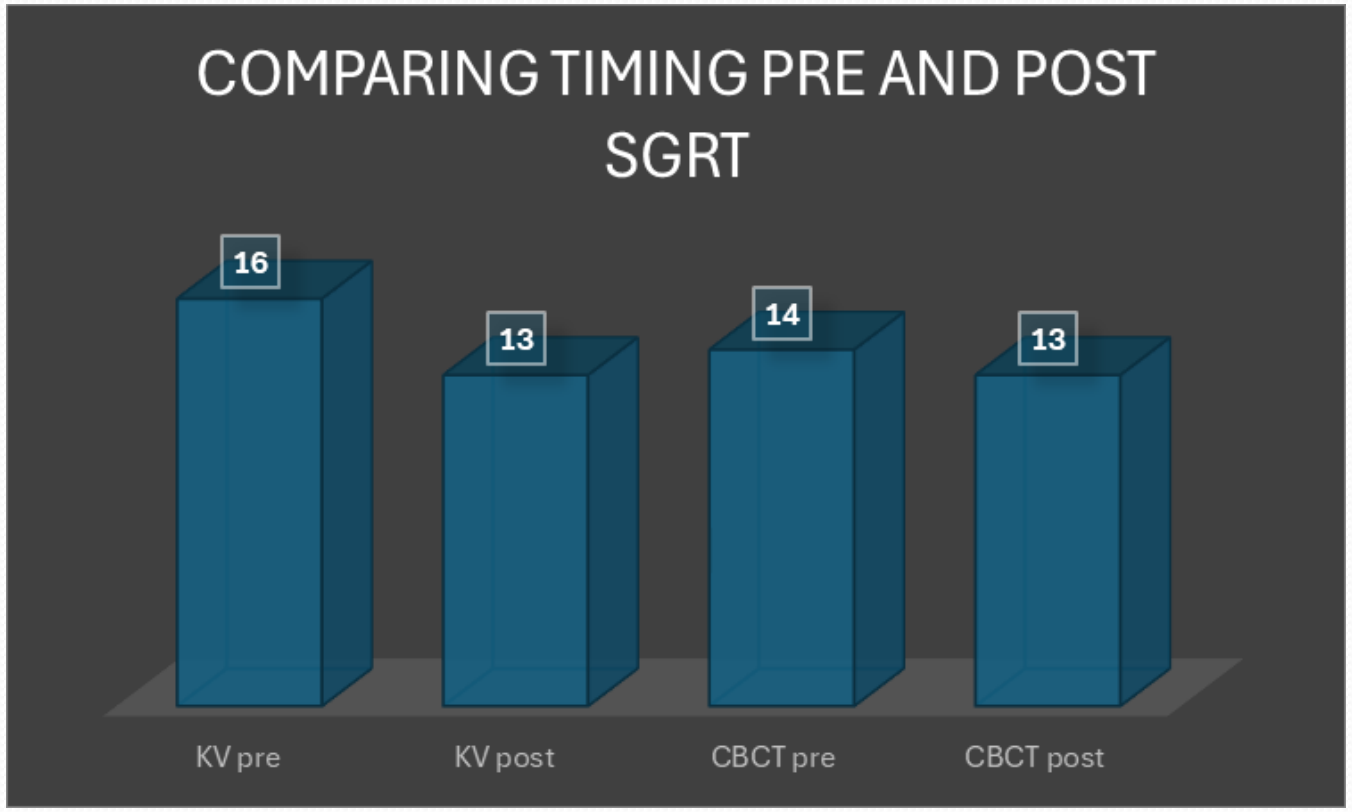
For kv imaging 8/15 patients treated required systematic analysis or required daily imaging during treatment due to being out of tolerance on day 1 and 2 imaging or due to set up issues (53%)

After SGRT all patients only required standard day 1/2 images if fractionated as all images were within tolerance, no systematic analysis or daily images were required.



Treatment times pre and post SGRT

Average time for treatment (mins)



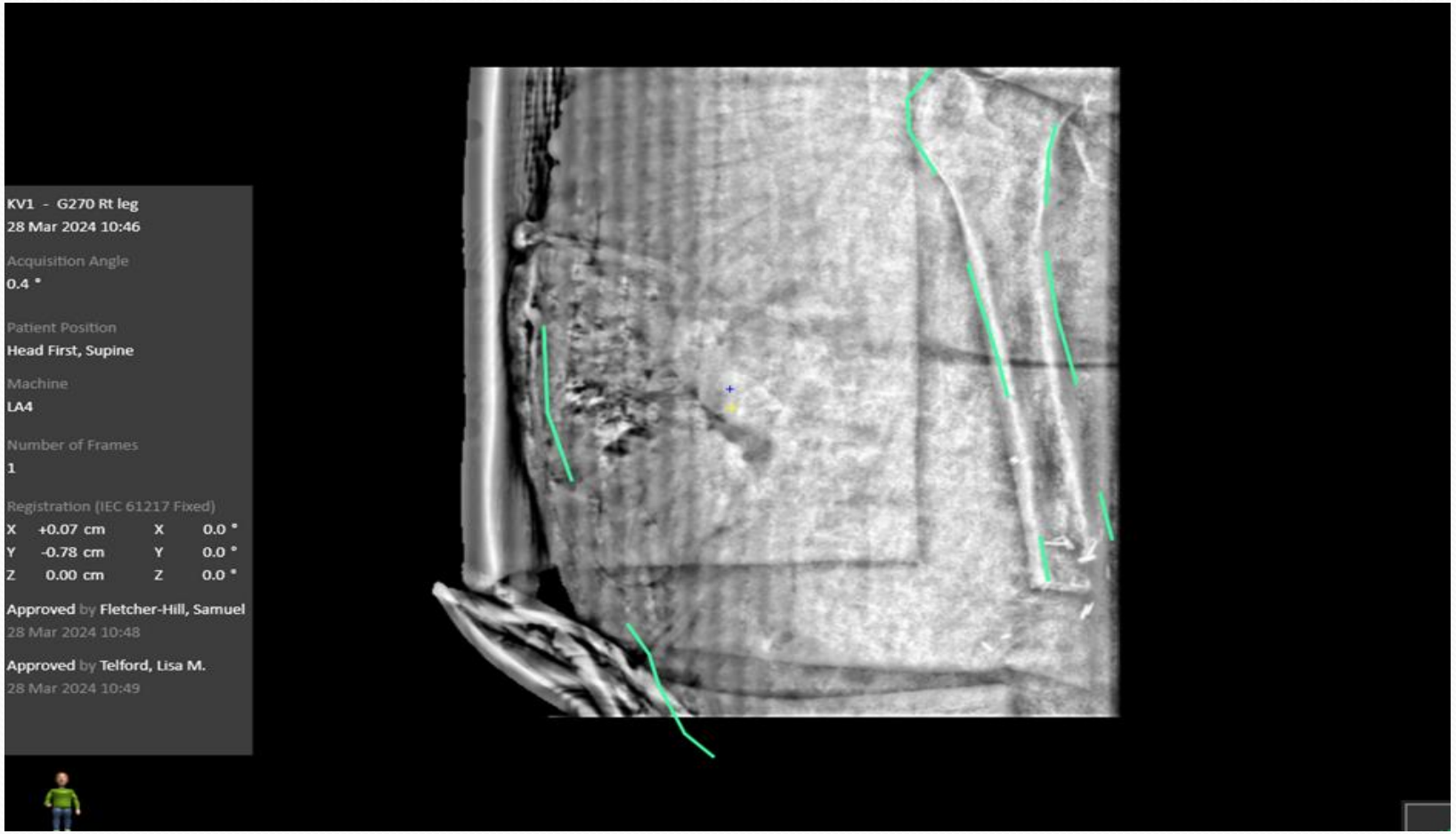
Type of image acquired pre or post SGRT

Some patient case studies of difficult set ups improved by SGRT

Patient example 1

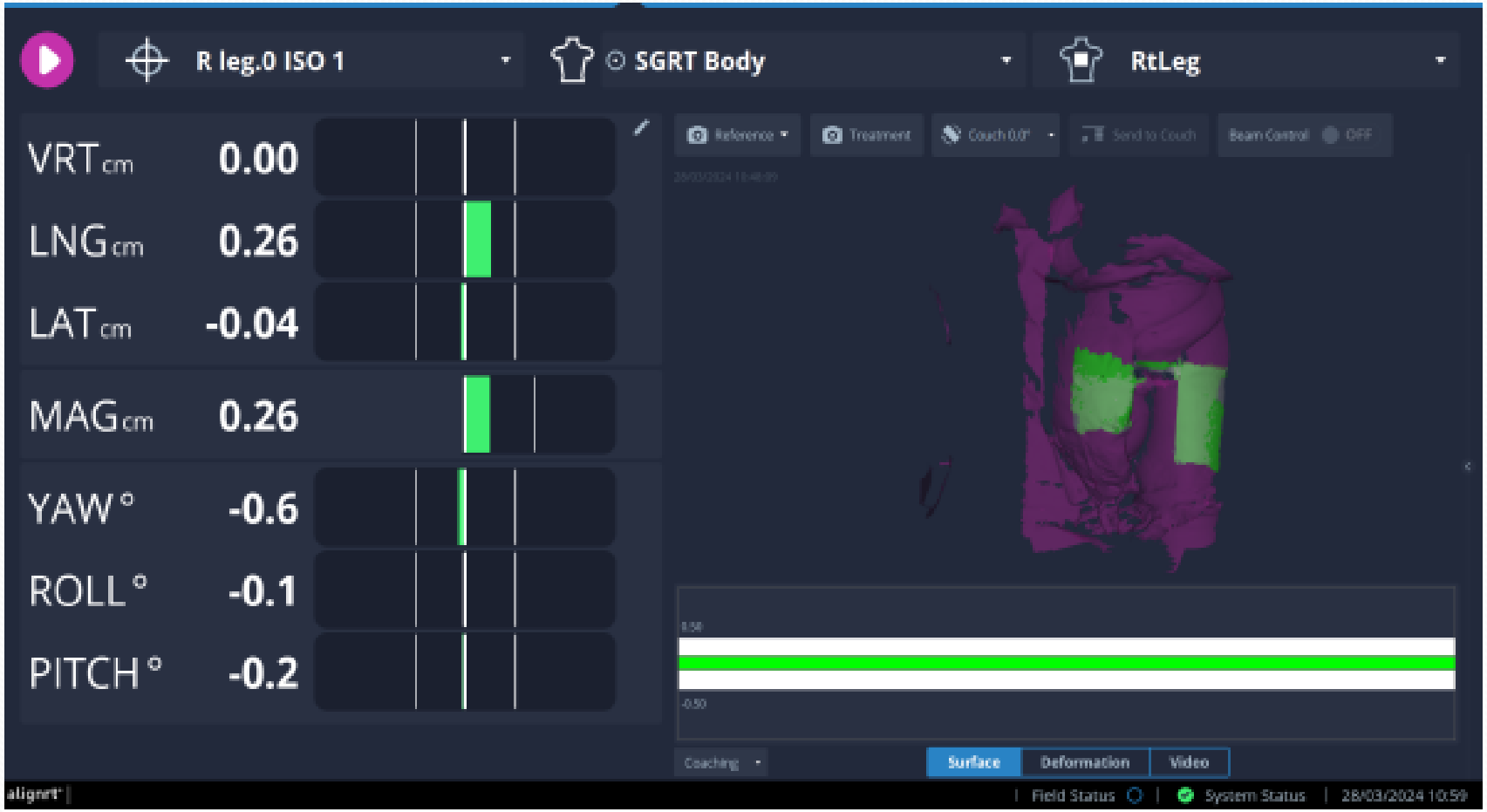
- 78 yo female with, extensive sarcoma of the right thigh. 8GY/1# palliative intent
- Right leg amputee, wheelchair bound, limited movement
- Lymphoedema in the right thigh
- Multiple cushions for comfort
- Treated with dressings on and 1cm wrapped around thigh
- Significant pain
- Pre SGRT would be time consuming to get in correct position leading to longer time on bed, increased pain, possible larger displacement and repeat imaging

Patient example 1



After acquiring kv verification image displacements were within palliative tolerance. However, department protocol is to apply absolute correction for single # so move downloaded.

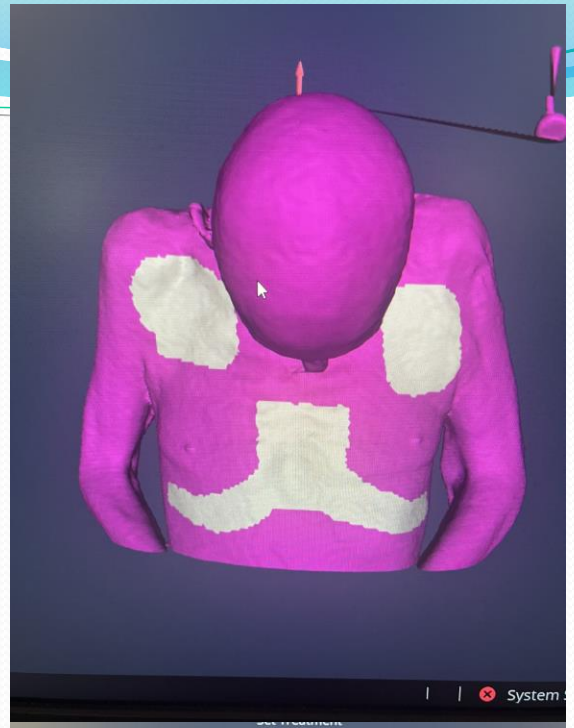
Patient example 1

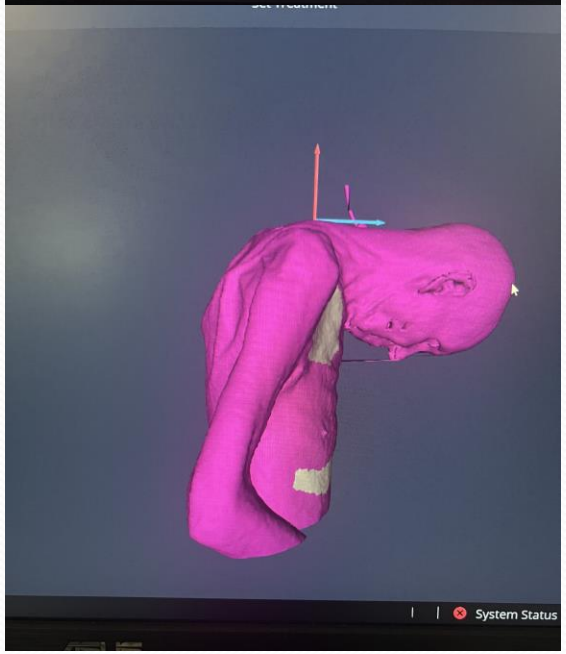


Set up quickly and easily with SGRT using postural video for initial positioning. Deltas were stable before and after imaging and well within the 5mm tolerance throughout treatment.

Patient example 2

- 76 yo male with bony mets C/T spine 8GY/1# palliative intent
- Not able to lay flat, shoulders and head supported upright with a vac bag
- Treated with floor at 270 and gantry at 90
- Significant pain
- Pre SGRT would be time consuming to get in correct position leading to longer time on bed, increased pain, possible larger displacement and repeat imaging





Patient example 2

After acquiring CBCT verification image displacements were within palliative tolerance. However, department protocol is to apply absolute correction for single # so move downloaded.

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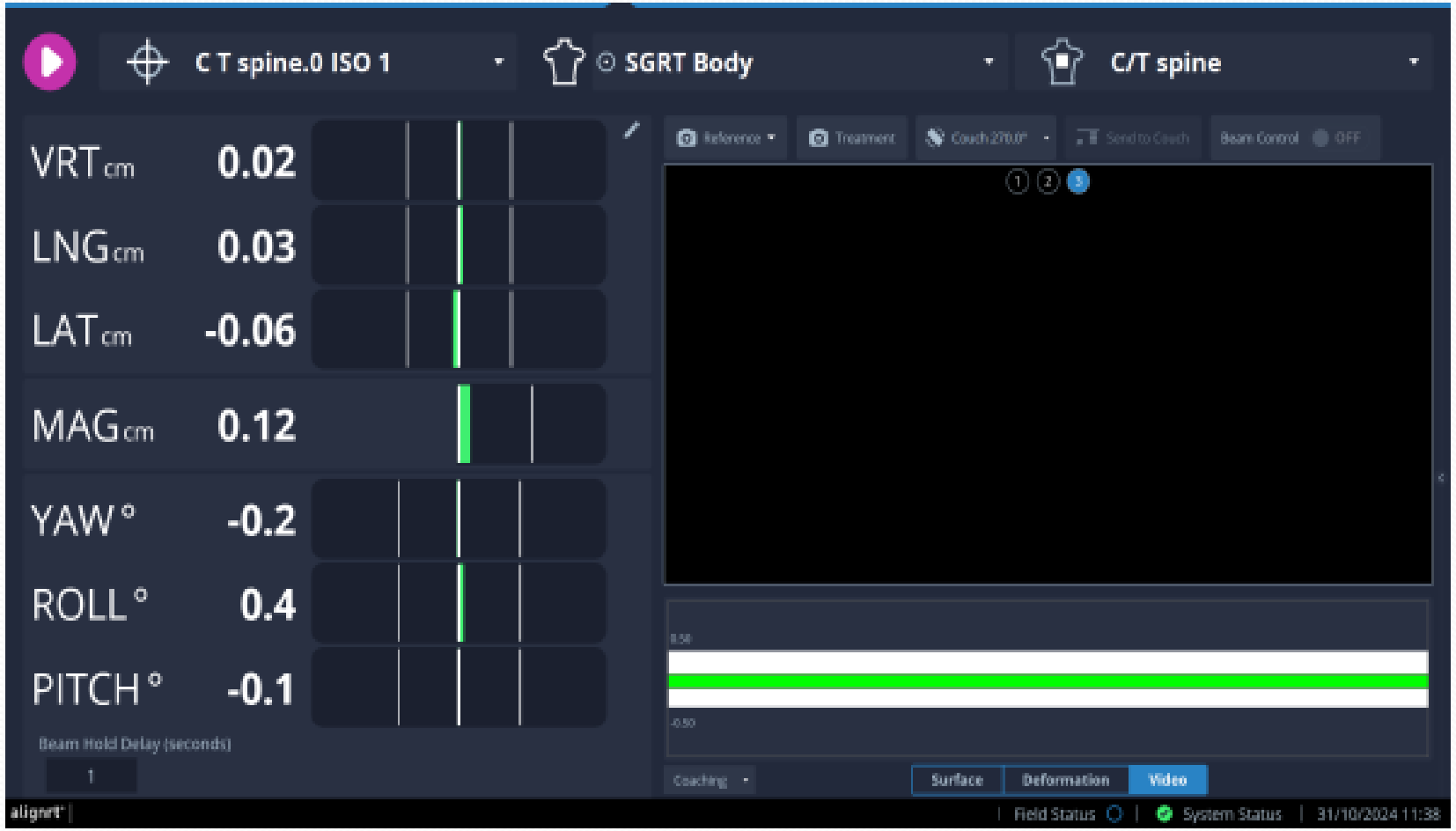
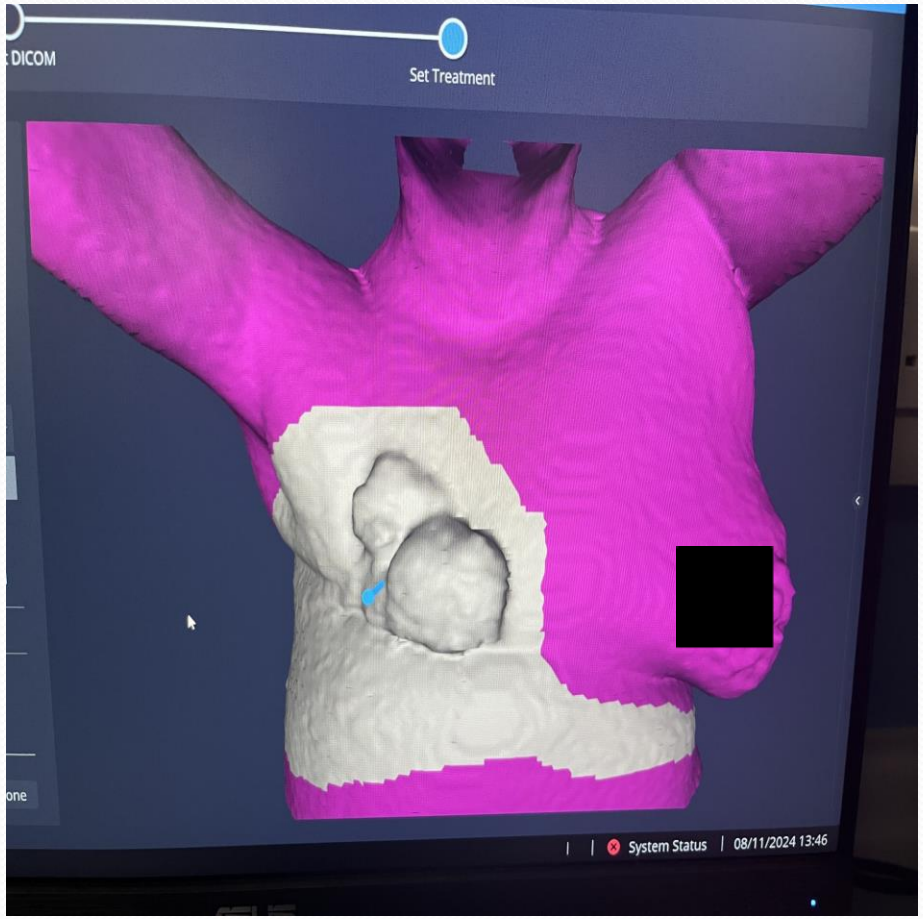
Patient example 2



Set up quickly and easily with SGRT using postural video for initial positioning. Deltas were stable before and after imaging and well within the 5mm tolerance throughout treatment.

Patient example 3

- 52yo female previous Rt Breast treatment, receiving bilateral breast treatment.36GY/5# to lt breast and retreatment to Rt chest wall 8GY/1# palliative intent
- Uncomfortable due to fungating lesion in rt chest wall and rotated due to large breast on lt pulling her over slightly
- 1cm bolus
- Pre SGRT would be time consuming to get in correct position leading to longer time on bed, increased discomfort, possible larger displacements and repeat imaging

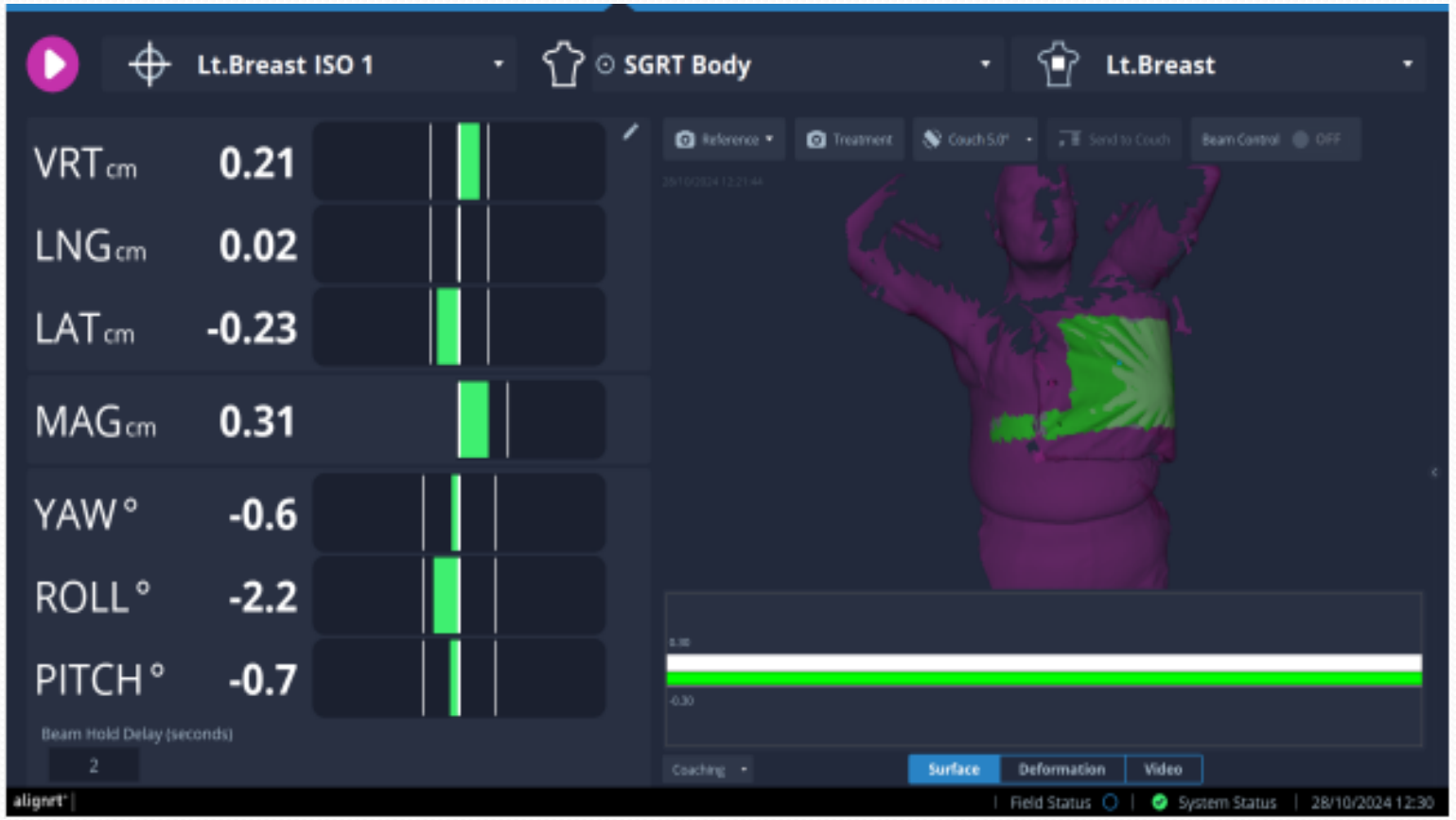


Patient example 3

coverage good lmt	173					X: 0.0 | Y: 0.0 | Z: 0.0 cm	X: 0.0 | Y: 0.0 | Z: 0.0 deg.
lmt	173					X: 0.0 | Y: +0.1 | Z: -0.5 cm	X: 0.0 | Y: 0.0 | Z: 0.0 deg.
5cm lat shift for clearance coverage good RMM	173					X: -5.0 | Y: +0.1 | Z: +0.7 cm	X: 0.0 | Y: 0.0 | Z: 0.0 deg.
Chestwall good, bolus position good CMY	88					X: -5.3 | Y: +0.2 | Z: +0.3 cm	X: 0.0 | Y: 0.0 | Z: 0.0 deg.
Coverage comp bolus on 5cm shift for clearance ...	88					X: -4.9 | Y: +0.3 | Z: +0.3 cm	X: 0.0 | Y: 0.0 | Z: 0.0 deg.

After acquiring CBCT verification image displacements were within radical tolerance. Set up was excellent, before SGRT this may have been a patient case that may have been rescanned.

Patient example 3



Set up quickly and easily with SGRT using postural video for initial positioning. Deltas were stable before and after imaging and well within the 3mm tolerance throughout treatment. Although palliative used breast protocol with tighter tolerances

In conclusion

Palliative treatment sites can benefit greatly from SGRT, patients can receive quicker set up times and allowed more comfort in their positioning.

Complex set ups become easier with less written instruction to follow, focusing more on the patient and what is being treated.

Radiographers can be confident with a large range of different anatomical sites, will aid with confidence for future roll out to other sites.

Palliative set up benefits greatly for

from postural video use.

Imaging displacements are reduced therefore leading to decrease in repeat imaging and imaging dose received.

Works well with both KV and CBCT imaging

Thank you for listening!
Any questions?

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