A Decade with SGRT: Where We Started, What We've Learned, Where We're Going

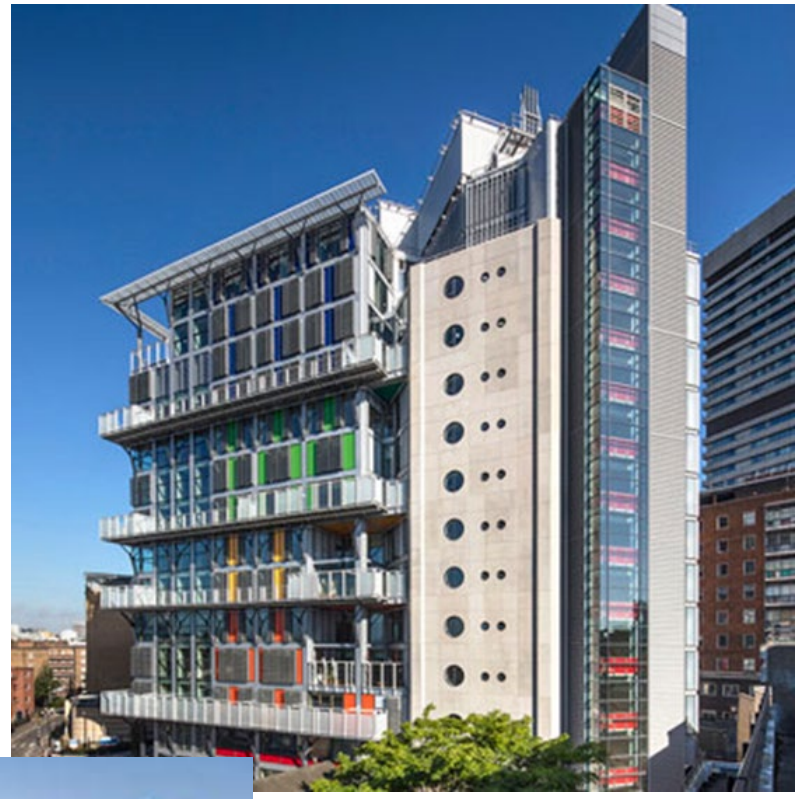
Marina Khan

Research & Development Lead Radiographer

we are **Caring** | **Ambitious** | **Inclusive**

Guy's and St Thomas' Radiotherapy

- **Serving a total population of 2.6 million**
- **2 Hospital sites**
  - Guy's
  - Queen Mary's (satellite)
- **9 Varian TrueBeam linacs**
- **9 AlignRT systems**
- **1 Flexitron HDR**
- **1 Xstrahl**
- **3 GE CT scanners**



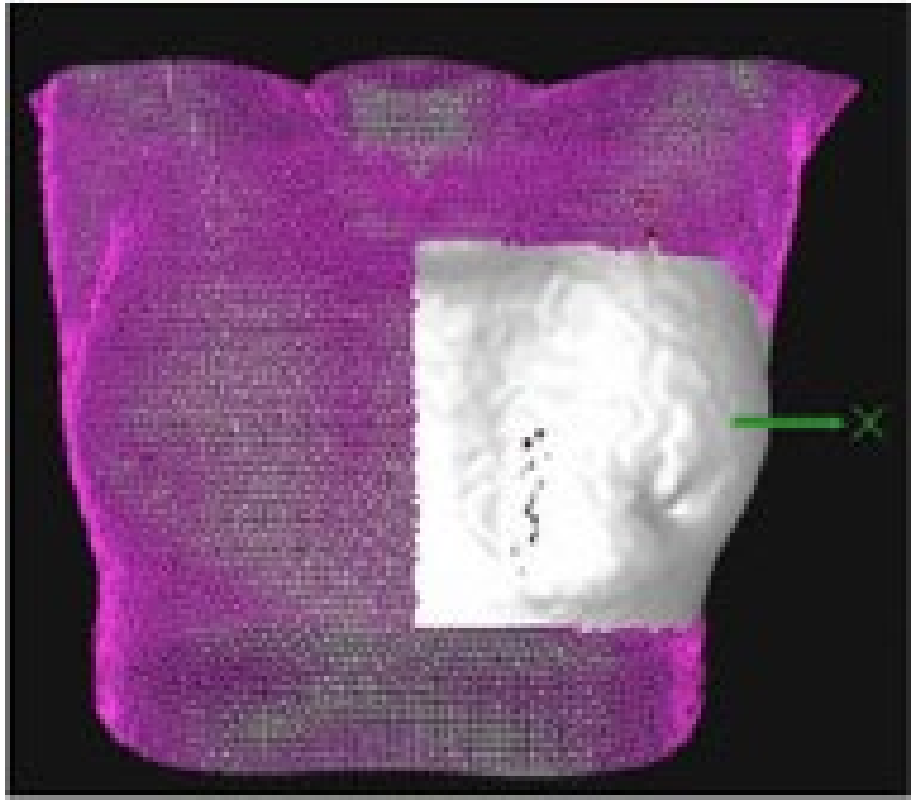


we are **Caring** | **Ambitious** | **Inclusive**

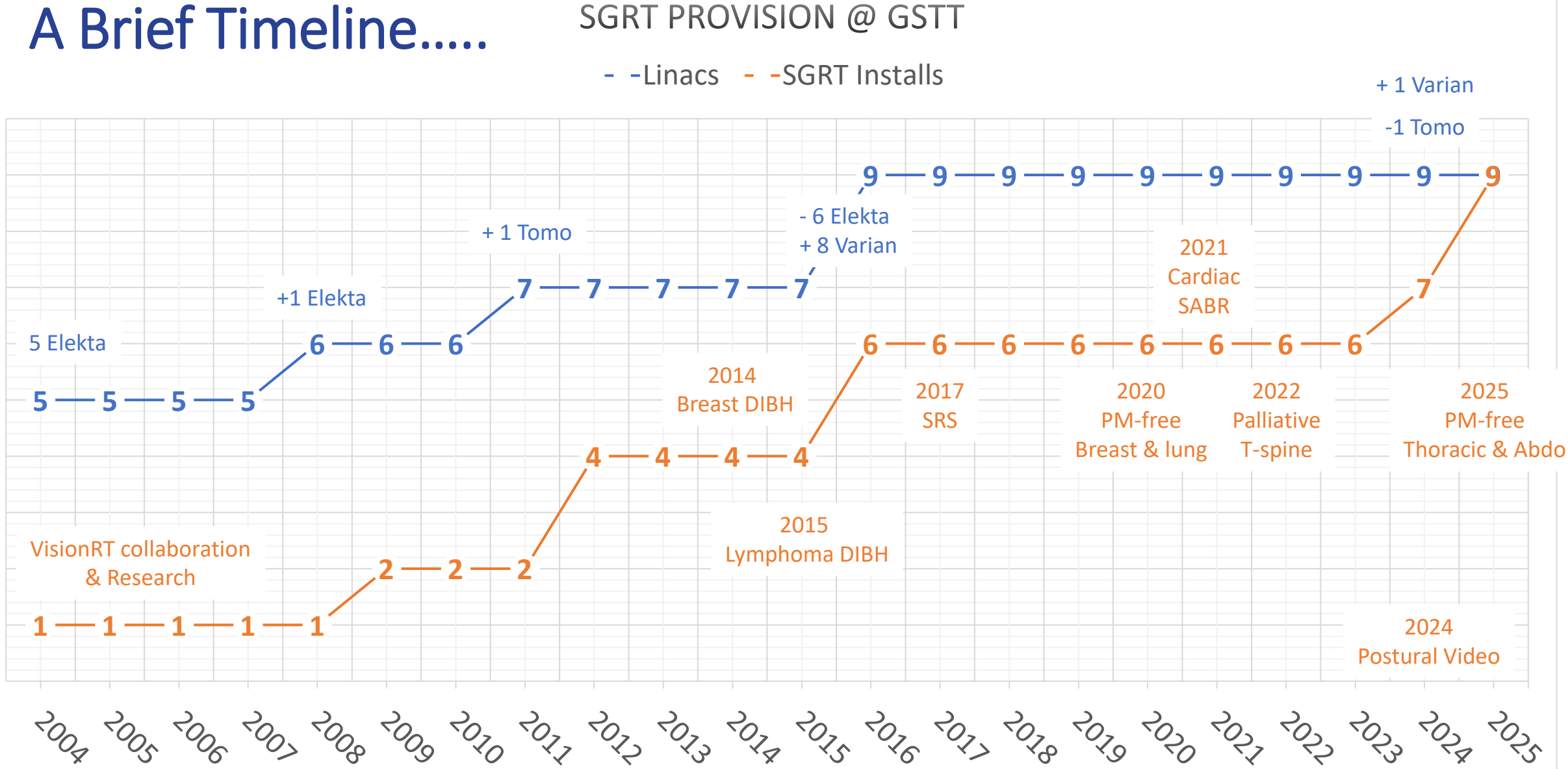
Guy's Cancer

Surface Guided Radiotherapy (SGRT)

- **AlignRT® is a non-invasive Surface Guided Radiation Therapy (SGRT) system designed to enhance precision during radiotherapy. It utilises three 3D stereo cameras and a projected light pattern to continuously monitor and track the patient's position with submillimetre accuracy. The system delivers real-time feedback on patient movement, helping ensure optimal alignment throughout treatment.**



A Brief Timeline.....



we are **Caring** | **Ambitious** | **Inclusive**

Guy's Cancer

Implementation



Governance

Finance

Documentation

Training

Roll out to SoC



Guy's Cancer Charity

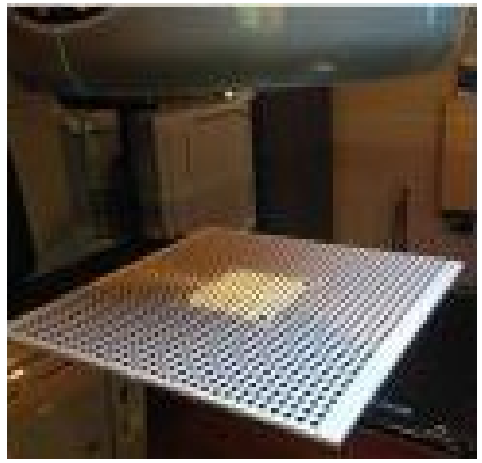


Acceptance, commissioning , QC

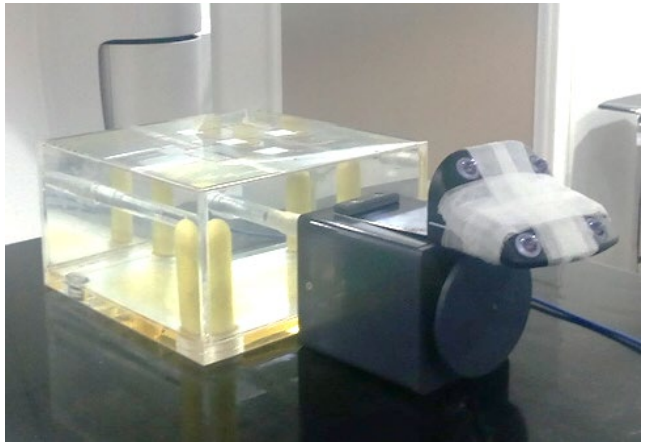
Install	• 3 x cameras, cabling, power • Ancillary equipment, server, user workstation
Connectivity	• Treatment planning system, treatment unit • Server, UPS
User Configuration	• User accounts (clinical, admin, physics ..) • Skin tone settings, lighting, clinical site tolerances
Acceptance	• VisionRT User Acceptance Testing • Connectivity
Commissioning	• Spatial accuracy, temporal accuracy, gating accuracy • full end to end test

Routine QC (@ GSTT)

Daily	• System run-up (camera switch-on) • Calibration check
Fortnightly	• AlignRT to MV isocentre verification (SRS machine)
Quarterly	• Gating and Monitoring • Spatial accuracy and shifts







Breast DIBH



Clinical in 2014 at St Thomas

One of the first centres to treat with DIBH

2 linacs had clinical SGRT

2 sets of data

- At set up position in free-breath.
- At ISO in DIBH.

Changed process with experience and confidence

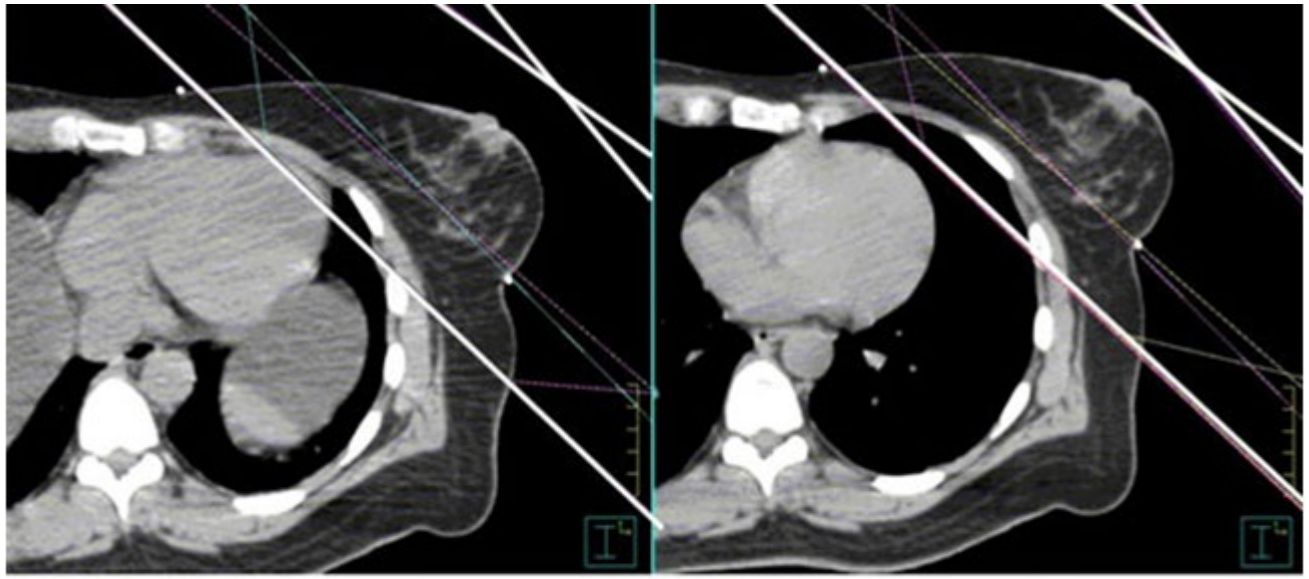
Individual site specific training and competencies

No MMI (no automated beam-hold)

Breast DIBH

Cardiac and Lung Sparing: DIBH physically moves the heart inferiorly, medially, and posteriorly away from the radiation beam, reducing the mean heart dose (MHD) substantially.

Sub-Millimeter Positioning Accuracy: AlignRT tracks the patient's skin surface in real time (3D optical surface imaging), eliminating or reducing the need for daily image guidance while maintaining high setup precision.



Free Breathing Breath-hold

Lymphoma DIBH

Clinical in 2015 at St Thomas'

2 linacs had clinical SGRT

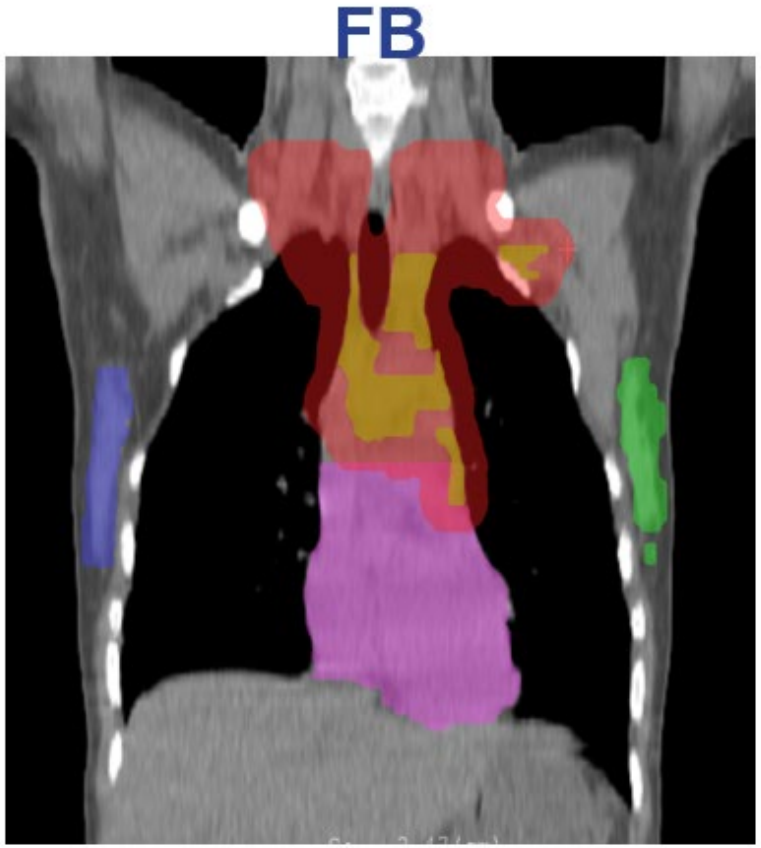
Changed process moving to the cancer centre

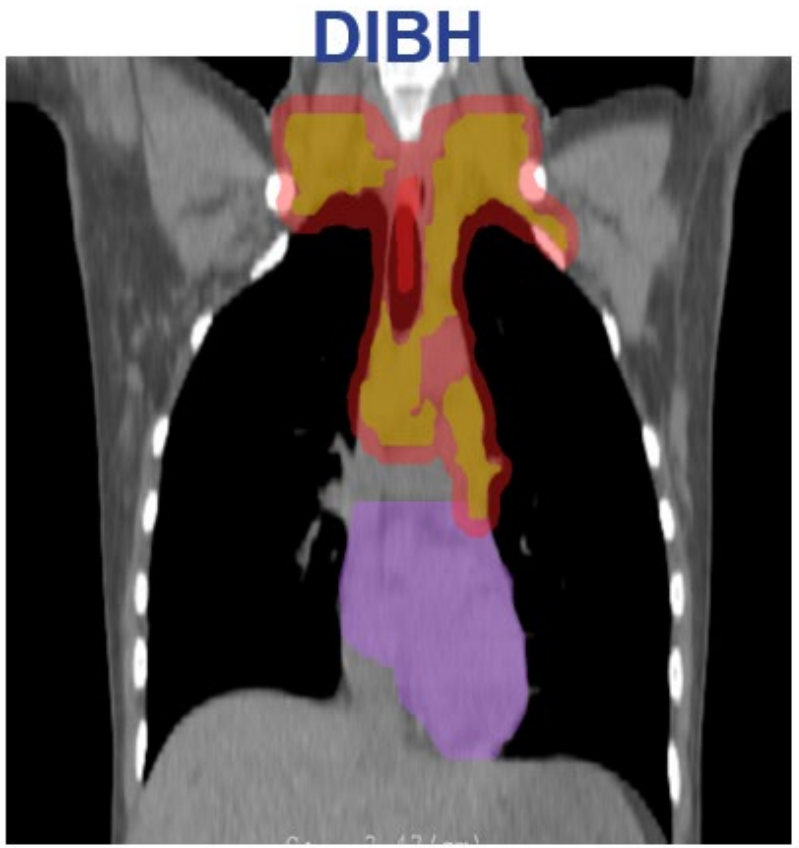
Butterfly Lymphoma technique

Individual site specific training and competencies



Lymphoma DIBH – PTV reduction and OAR position





DIBH

- allows stable anatomy
- allows OARs to move away from target region

SGRT

- Allows accurate DIBH setup due to good correlation between surface and internal anatomy
- Allows confident DIBH monitoring

DIBH and SGRT

- allowed PTV margin reduction from 10mm to 5mm
- gives reduction of OAR doses

Stereotactic Radiosurgery

Motion monitoring

Sub-millimetre accuracy

Challenges

Couch rotation

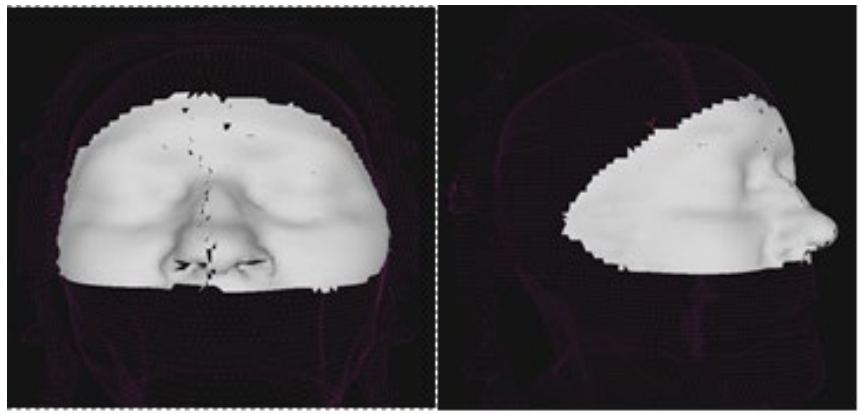
Small ROI

Blocked cameras

Solutions

No MMI on G6

(no auto beam-hold)



Benefits:

Patients

Accurate treatment delivery

Less set up issues=less time on the couch

Staff

Faster set up

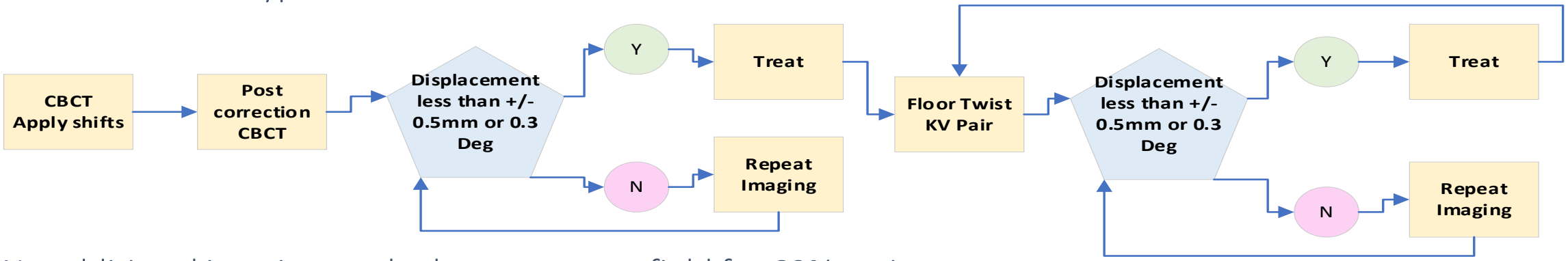
Reassurance of accurate treatment delivery

Stereotactic Radiosurgery

220 SRS patients in past year

13 day pathway

Recent move to Hyperarc treatment



No additional imaging on the last treatment field for 60% patients

Case Study

Patient with Parkinson's disease

Made shell then monitored movement on Align RT prior to any pre-treatment imaging

Patient unsuitable of radiotherapy as moving too much.

Improved workflow, reduced unnecessary workload and improved patient outcome.

From DIBH to PM Free

Opening of the Cancer Centre –> Processes Evaluated

Considerations

- Couch movements for CBCTs
- Interruption of CBCT
- PM free set ups
- Butterfly Lymphoma Technique

Governance processes for implementation

Training process revisited and optimised

Documentation

- Consent
- Patient Information Leaflets
- Work Instructions, Training and Competencies Separated



From DIBH to PM Free – Patient Benefit



No permanent marks as a reminder

Reduced cardiac toxicity

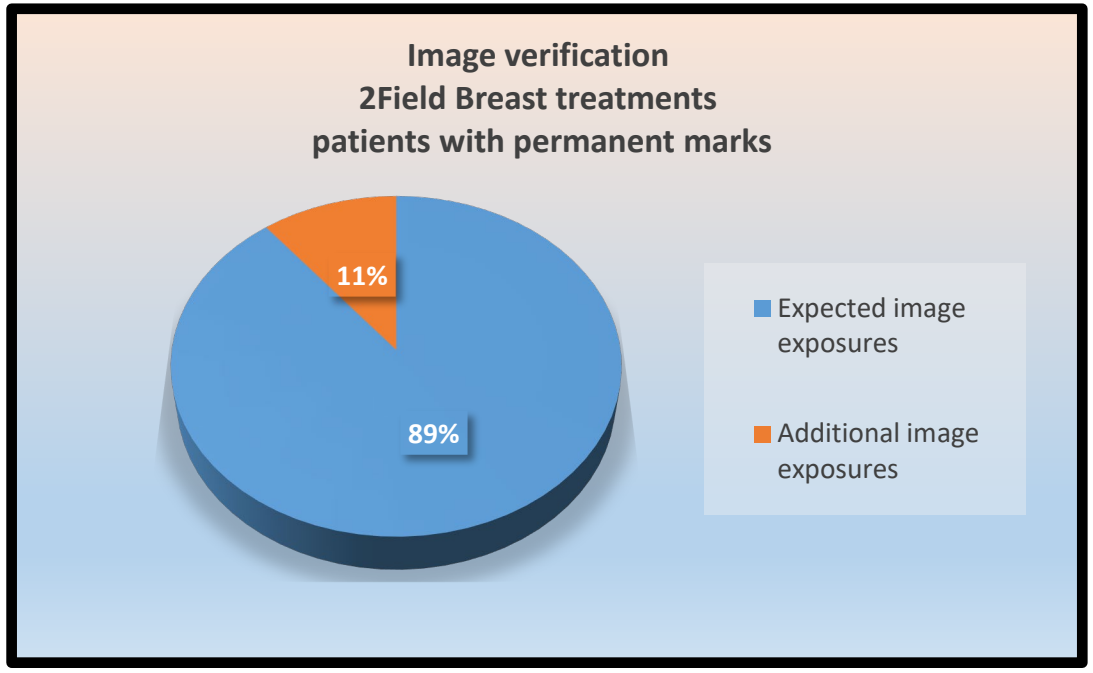
Fewer set up issues = less time on the couch

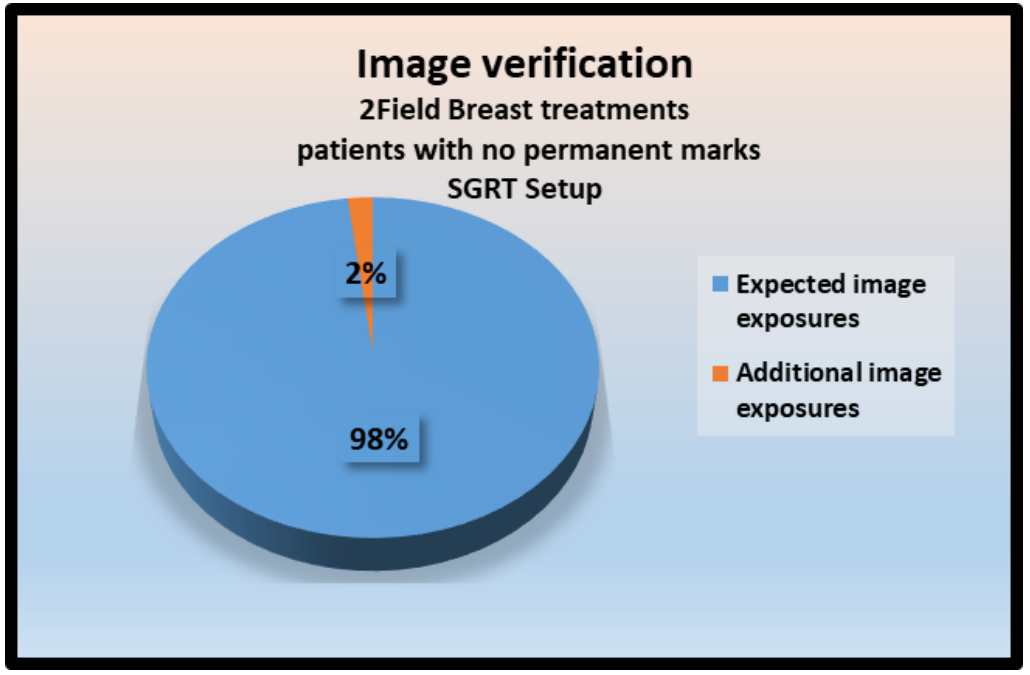
Less dose from imaging

“I was really pleased to find out I wouldn’t be left with tattoo marks as the last thing you want is to be reminded of your cancer all the time. When lots of women have radiotherapy they have already undergone chemotherapy and may be struggling with hair loss and other side effects so this is one less thing to worry about.”

From DIBH to PM Free – Benefits to the Patient

Reduced on-set Imaging





From DIBH to PM Free – Benefits to the Staff

Less manual handling
Reduced paperwork (fewer/no systematic corrections)
Faster set up
Problem solving tool
Contour change

Efficiency Savings at Guys Cancer Centre

Treatment code	Average PM technique (Mins)	Average PM Free technique (mins)	Difference
CT Breast	34.12	25	9.12
CT DIBH Breast	40.5	39.6	0.9
breast Tans	14.77	13.09	1.68
DIBH breast Tans	16.94	16.93	0.01
Breast + SCF & +/- Post axilla	18.17	16.88	1.29
DIBH Breast + SCF & +/- Post axilla	23.26	22.78	0.48
Breast 5# + CBCT	24.37	18.9	5.47
DIBH Breast 5# + CBCT	27.67	20.35	7.32
Photon Boost	20.1	15.58	4.52
DIBH Photon Boost	23.56	27.03	-3.47

From DIBH to PM Free – Benefits cont. – staff survey

	Yes	No	No different / undecided
Do you find setting Patients up using Align RT **easier** than a conventional set up with tattoos?	**22 (84 %)**	**2 (8%)**	**2 (8%)**
Do you find setting Patients up using Align RT **quicker** than a conventional set up with tattoos?	**24 (92%)**	**2 (8%)**	**0**
Do you think setting Patients up using Align RT is more **accurate** than a conventional set up with tattoos?	**20 (77%)**	**3 (11.5%)**	**3 (11.5%)**
Would you be happy to treat DIBH patients without Align RT?	**6 (23%)**	**17 (65%)**	**3 (12%)**

From DIBH to PM Free – Reproducibility Lung Volume

Original Research Article

Reproducibility of surface-based deep inspiration breath-hold technique for lung

ORLAM's group published paper presented in phiRO 2021

Conclusions

Lung SBRT in DIBH with the ring-mounted SGRT system proved reproducible. The surface monitoring provided by SGRT was found to be a reliable surrogate for internal target motion. Moreover, the implementation of DIBH technique helped reduce target volumes and lung doses.

ld

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tumour within 1.5 mm and 1.5°

Limbs

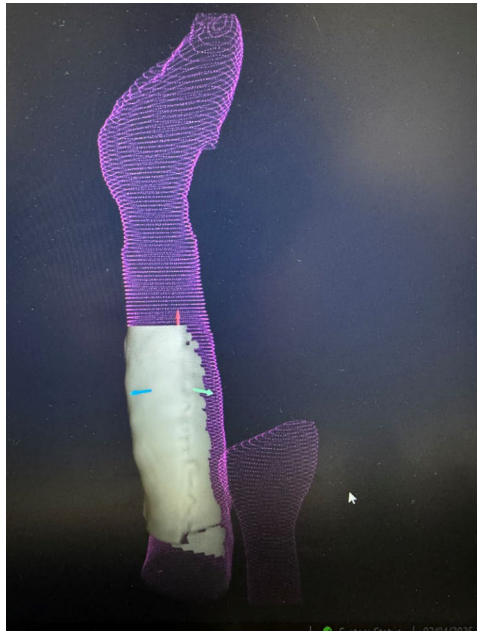
Often challenging to set up

Lengthy PTVs

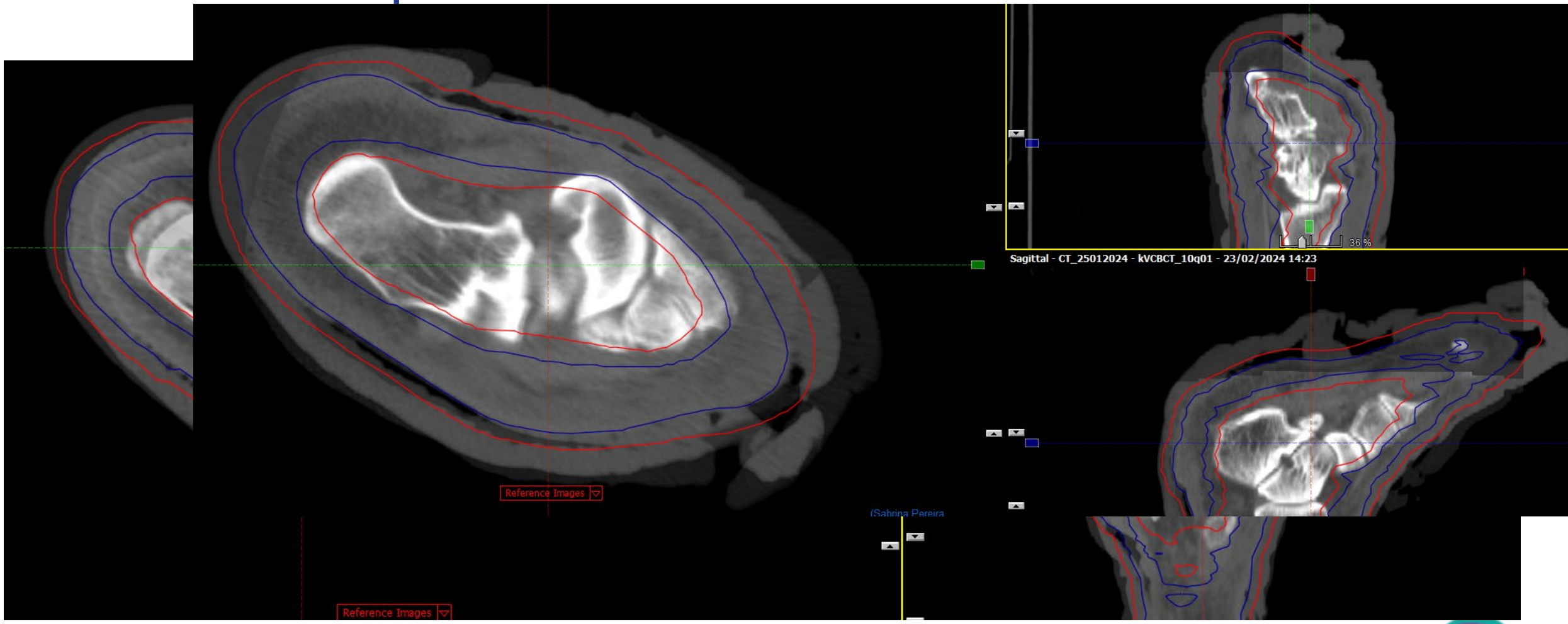
Have been using AlignRT sporadically for limbs since 2016

Always improves set up





Difficult Set Ups - Limbs



Cardiac SABR

Set Up

Motion Monitoring

Re-set up

Used RPM for gating

Initial challenge

- Mosaiq & TrueBeam Interface
- No online 4D-CBCT

Benefits to the patient

- Accurate treatment delivery
- Less time on the couch (patients with limited mobility and high performance status)

Benefits to the staff

- Faster set up
- No need to reset up
- Less manual handling
- Reassurance of accurate treatment delivery

Palliative Spine Set Ups

Started with T-Spine

Aid set up

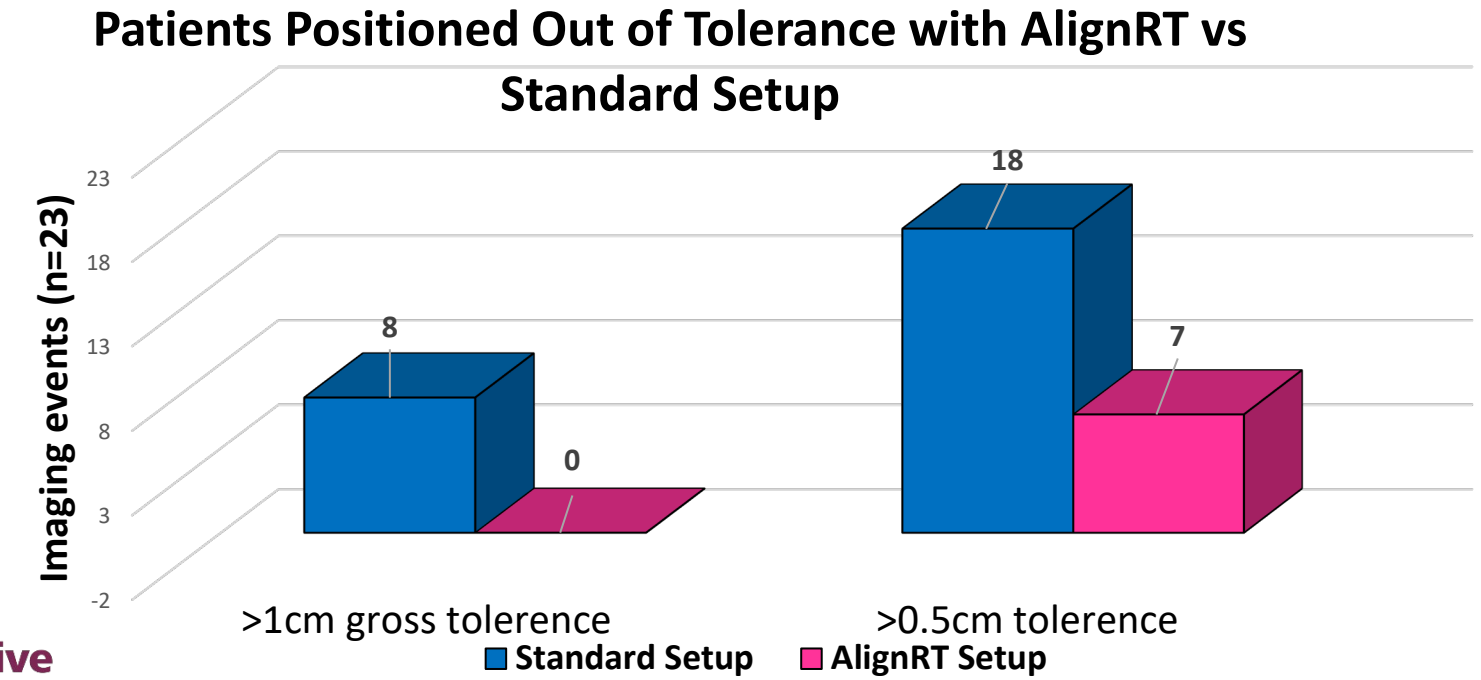
Motion monitoring

Eliminate potential geographical miss

Moving to PM free

Benefits to the patient

- Accurate treatment delivery
- Less set up issues = Less time on the couch
- Improved safety – automatic interruption.



Lung Social Distancing

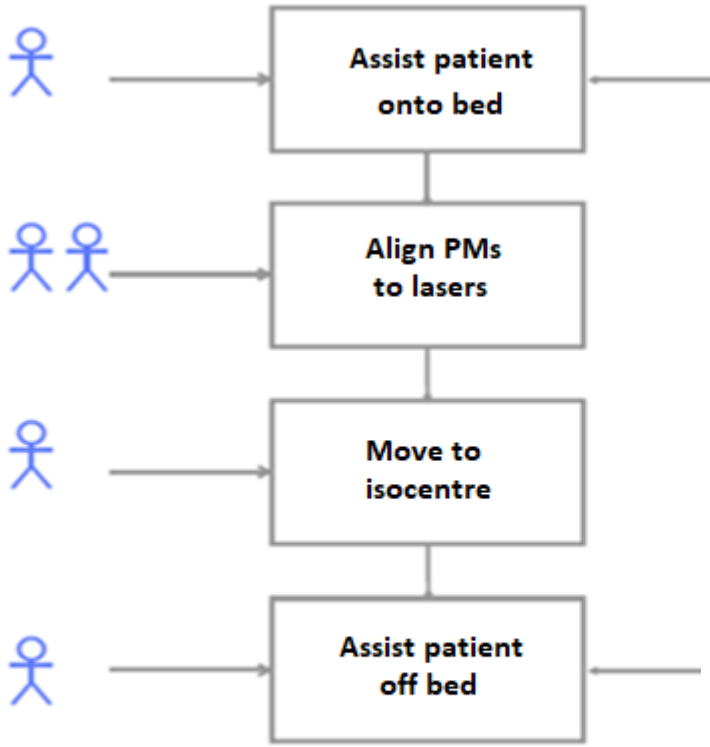


Diagram showing the number of close c
the conventional protocol (left) and the

Used at the beginning of the pandemic to

ent

ely

ELSEVIER
Technical Innovations & Patient Support in Radiation Oncology

tipsRO
Technical Innovations and Patient Support in Radiation Oncology

▸ Tech Innov Patient Support Radiat Oncol. 2021 Dec 16;20:61–63. doi: 10.1016/j.tipsro.2021.11.005

Surface-guided radiotherapy for lung cancer can reduce the number of close patient contacts without compromising initial setup accuracy

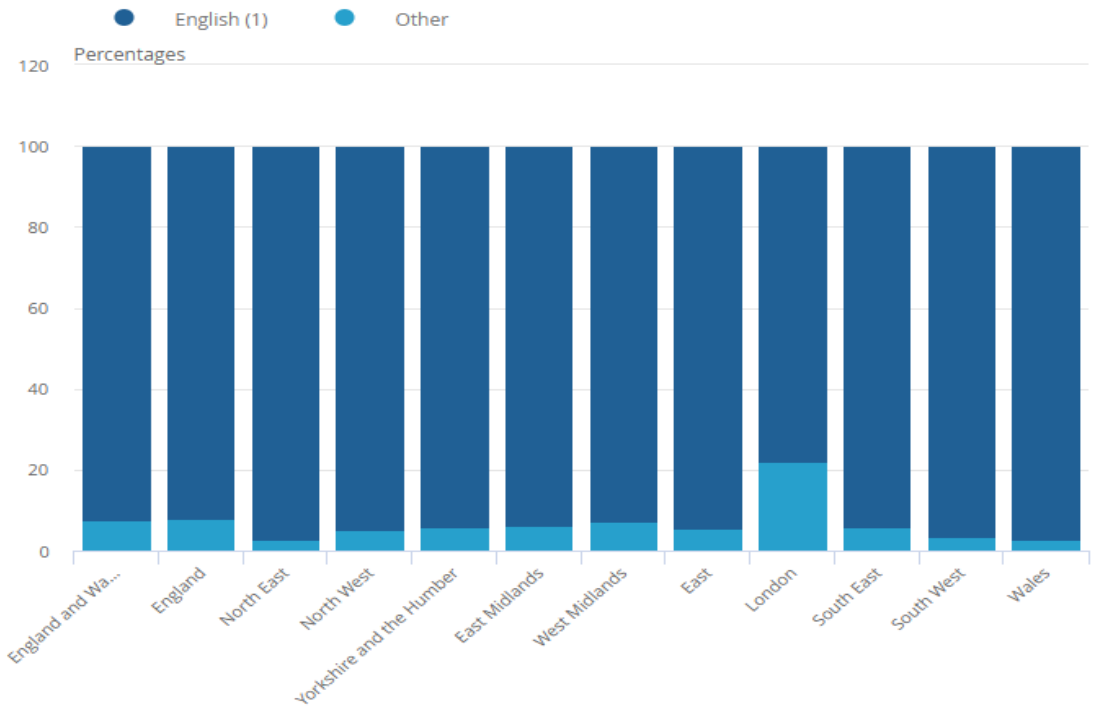
Nicola Blake [a,*], Luciano Pereira [a], David J Eaton [b], Deirdre Dobson [a]

Guy's Cancer

DIBH for non-English speaking patients

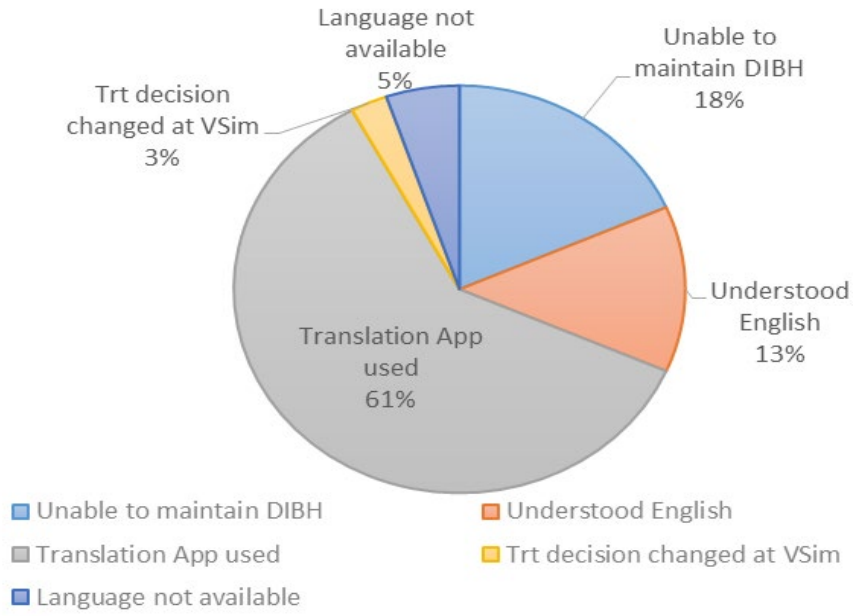
The UK 2021 census (Office for National Statistics) states that London is the most ethnically diverse region in England and Wales. Interpreters are regularly used for communicating with non-English speakers during radiotherapy (RT) consultations.

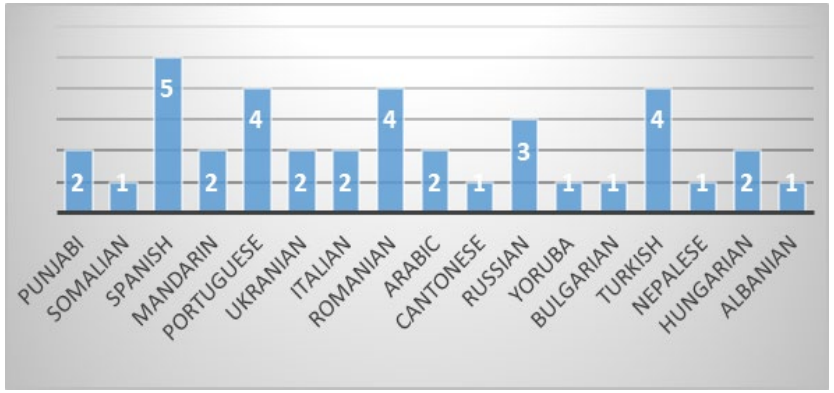
In 2021 our department required interpreters for 16 patients who, but for the language barrier, may have been suitable for DIBH. The use of interpreters in RT clinical areas is problematic due to issues with accessibility, patient dignity, safety and cost.



DIBH for non-English speaking patients

Clinician identified patients that required interpreter.
Inclusion criteria for DIBH is for all patients diagnosed with left breast cancer and left or right breast cancer with internal mammary chain (IMC) or axillary node involvement.
April 2023-April 2025, 38 breast patients have been referred for DIBH who required an interpreter





DIBH for non-English speaking patients

Clinician flags patient after consent

vi

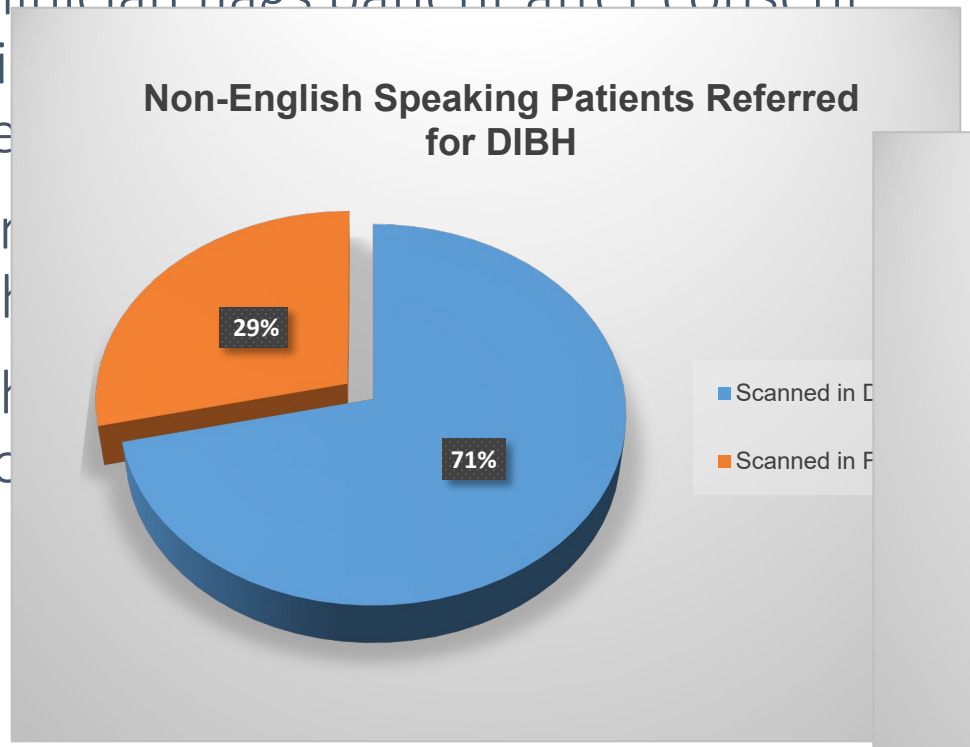
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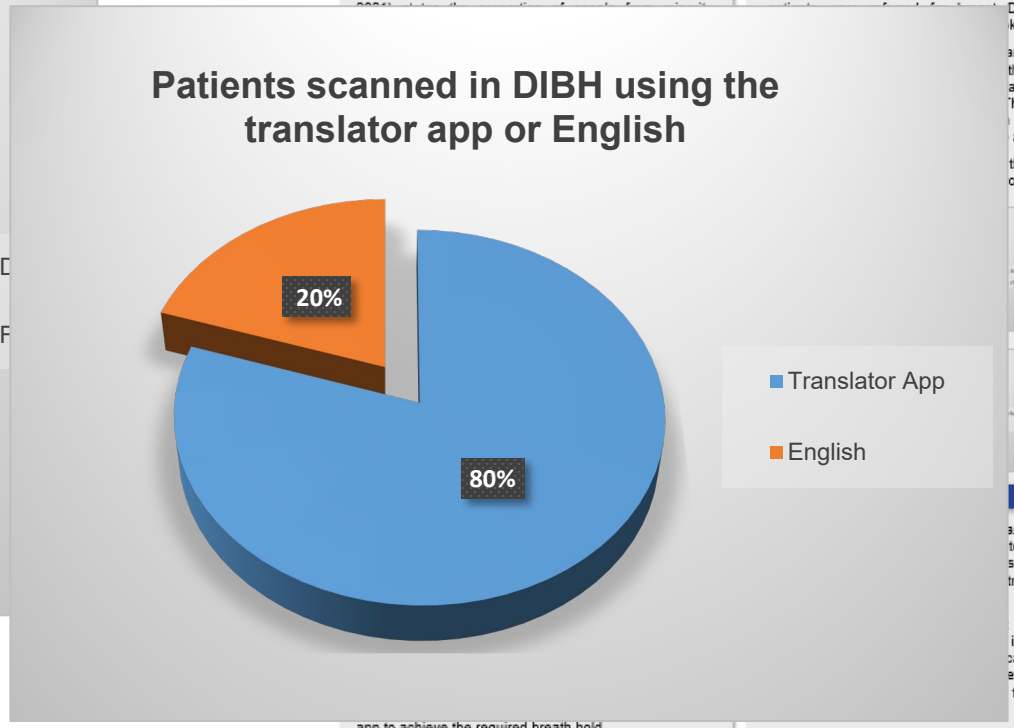
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Delivering Deep Inspiration Breath Hold Radiotherapy to Non-English Speaking Patients

Cornelia Iosub, Jo Strickland, Wendy Goldshaker, Marina Khan, Deirdre Dobson

cornelia.iosub@gstt.nhs.uk

Introduction

The UK 2021 census (Office for National Statistics,

Results

From April 2023 to April 2024, 21 non-English speaking DIBH (*Figure 3*).

anned and treated the translator app and treated using he translator app for a further five achieve DIBH.

the translator app cess this service.

as improved with to the department. s now being used tructions for non-

teams worked instructions were canner and linear etween the teams to be made to the

app to achieve the required breath hold.

If the patient was able to achieve DIBH, the correct language protocol was selected for the CT scan, their treatment was planned in DIBH and the media device was used to translate instructions for treatment delivery.

Patients and their family members have responded well and feedback has been positive. The department is looking to expand the use of the translator app for end-expiration breath hold (EEBH) radiotherapy and DIBH lymphoma patients.

KING'S HEALTH PARTNERS

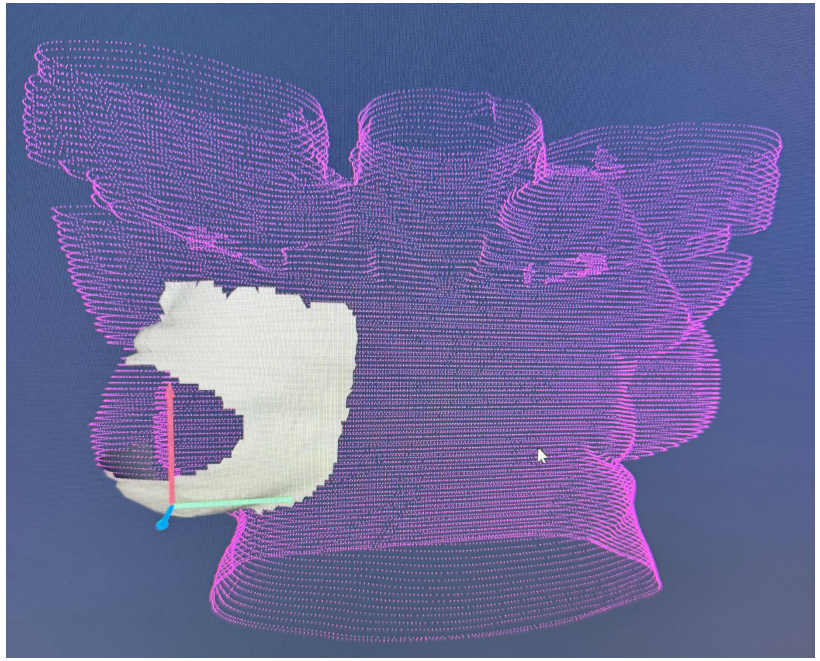
King's College London

NHS Guy's and St Thomas'

we are **Caring** | **Ambitious** | **Inclusive**

Regions of Interest (ROIs)

The system monitors patient position by matching surface contours from the CT scan against the live patient. To allow the system to work accurately you must select a region of interest for the system to match to.
The ROI should include the isocentre, unless the anatomy is especially unstable or its an asymmetric plan

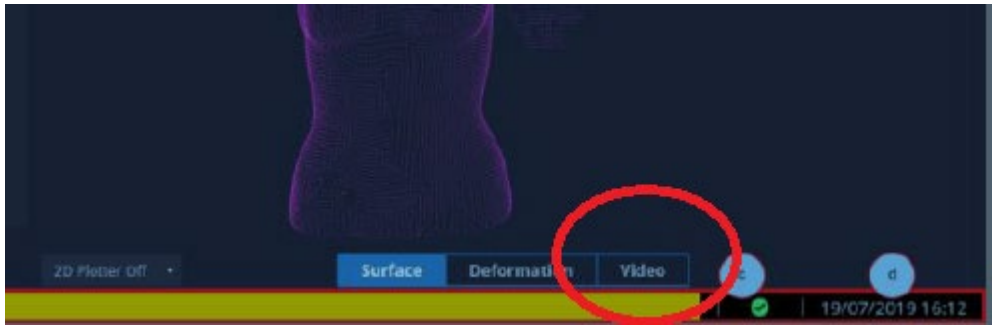


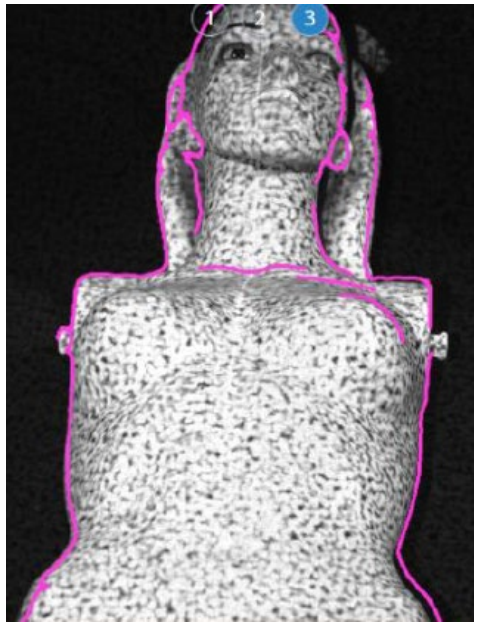


Postural Video

Helps improve set up using real time camera

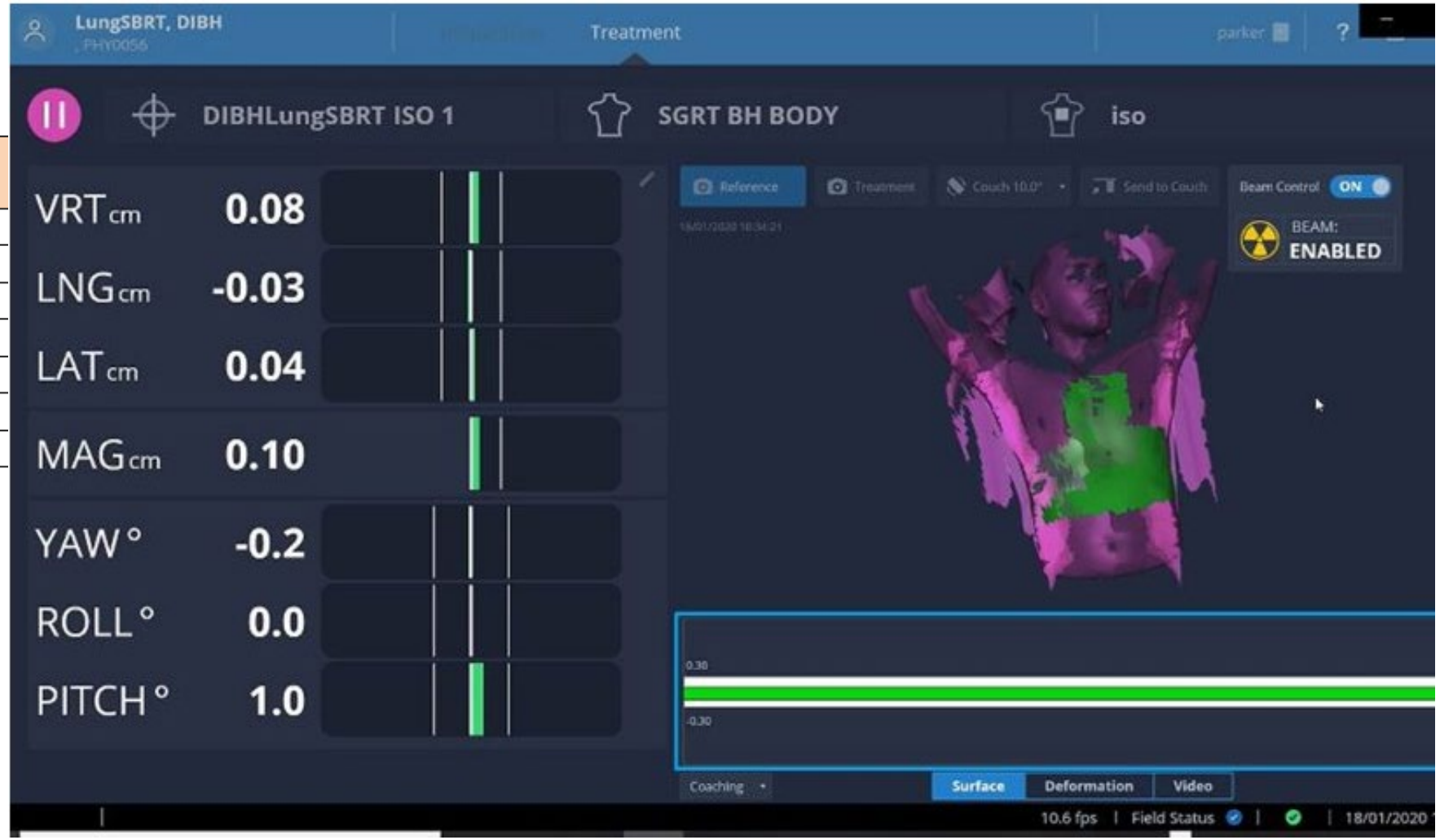
Set up is more efficient as you can see where the patient should be



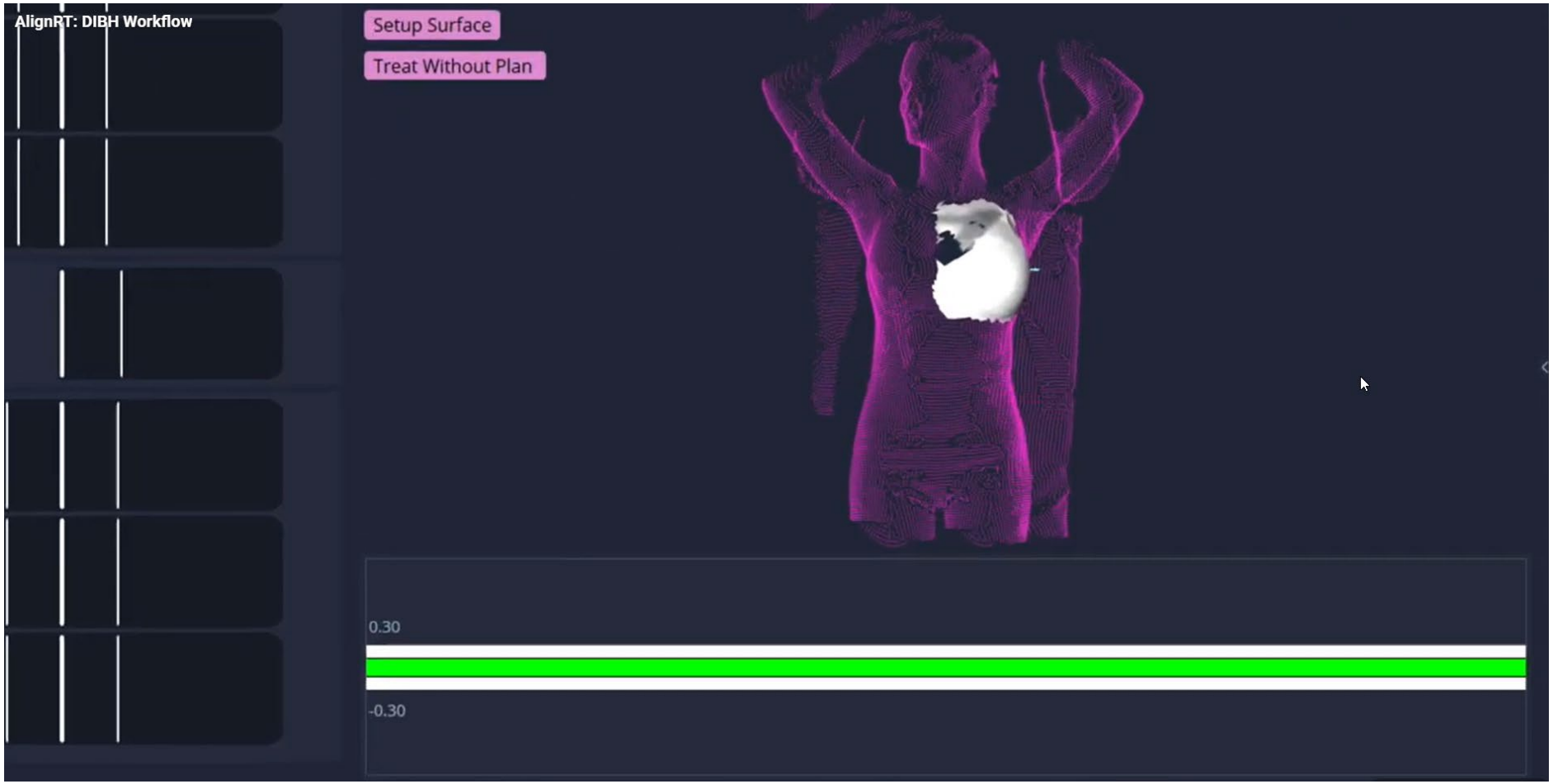


Tolerances

Treatment Site
Breast
Breast DIBH
Lymphoma DIBH
SRS
SABR
Pelvis
Other (Ad-Hoc)



Demo courtesy of VisonRT



Future Development

PM-free for all treatment sites

Respiratory Module

End Exhale Breath hold with the Respiratory Module

Maskless/ open faced masks for H&N and Neuro patients

Summary

Key Functions of SGRT

Patient set-up

Patient monitoring

3D non-invasive imaging

Benefits

Allows sub-millimetre accuracy for setup and monitoring

Facilitates breath-hold treatments

Brings efficiency & time-savings

Assists with difficult setups

Acts as a visual problem-solving tool

Delivers better patient experience (quick set-up, no tattoos, maskless treatment)

References

Nguyen, D. et al (2023) Reproducibility of surface-based deep inspiration breath-hold technique for lung stereotactic body radiotherapy on a closed-bore gantry linac. 2023 May Vol:23 DOI: https://doi.org/10.1016/j.phro.2023.100448

Rong, Y. Walston, S. Welliver, M.X. Chakravarti, A. & Quick, A. M. (2014), Improving Intra-Fractional Target Position Accuracy Using a 3D Surface Surrogate for Left Breast Irradiation Using the Respiratory-Gated Deep-Inspiration Breath-Hold Technique. PLOS ONE. 2014 May 9 (11). DOI: 10.1371/journal.pone.0097933

AlignRT: DIBH Workflow - YouTube

Thank you

Acknowledgements

All at Vision RT for continued work on development and support.

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