AlignRT Clinical Benefits

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NORTHERN IRELAND
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Dublin
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Kilkenny
Norwich
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Dingle
Killarney
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WALES
ENGLAND
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Oxford
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Bournemouth
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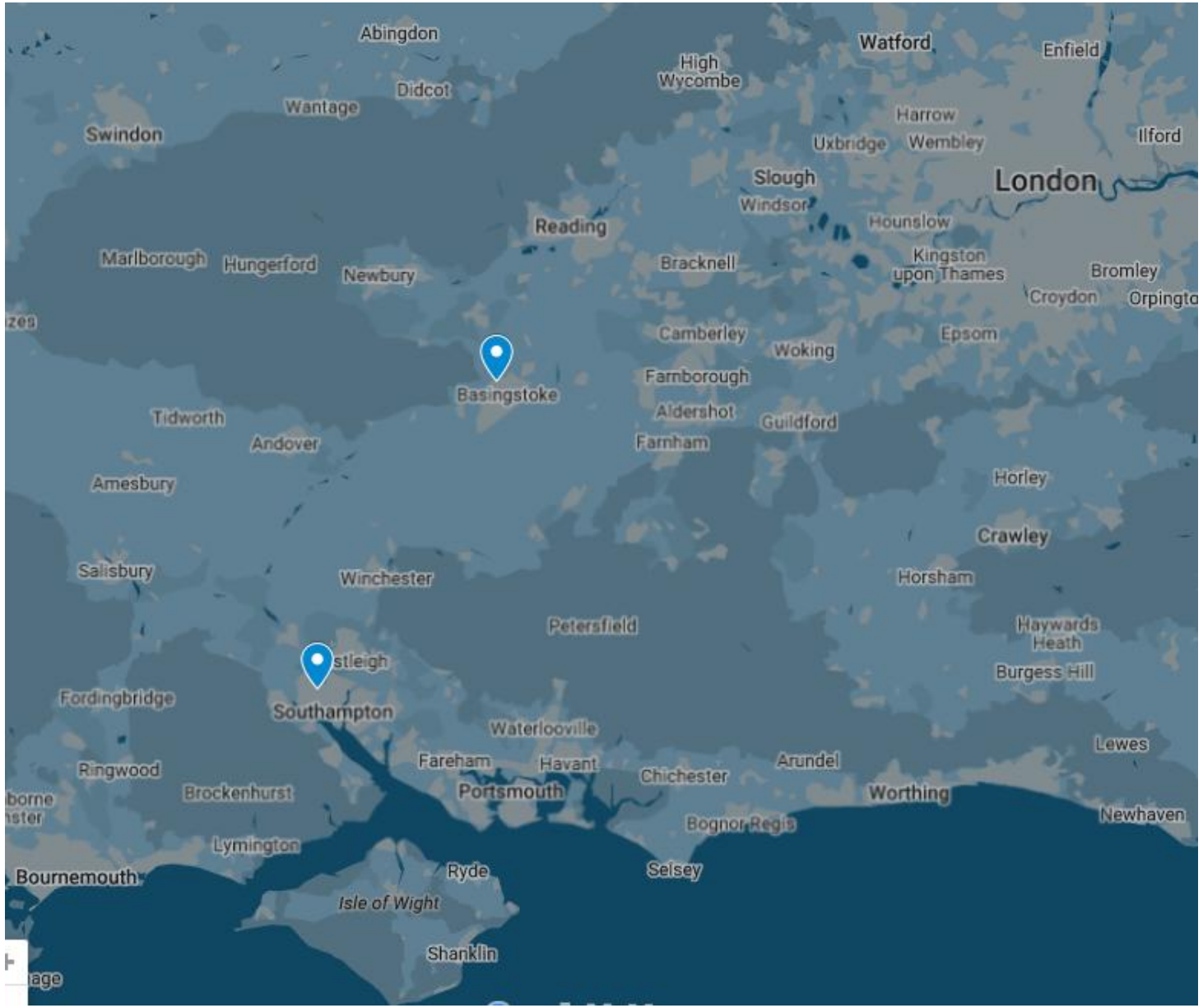
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Horley
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SGRT Systems

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- 6 Versa HD Linacs – UHS
- 1 EVO at satellite site
- All linacs are SGRT enabled:
  - 3 Linacs with ExacTrac Dynamic and Hexapod 6DoF couch
  - 4 Linacs with Align RT
  - Sim RT x 2


Elekta
ProSTEP

Timeline

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- January 2022: first system installed
- February 2022: last system installed
- February 2022: first system commissioned
- June 2022: last system commissioned
- July 2022: Go Live at satellite- breast and prostate

Timeline

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August 2022: Go live at Main Site- breast and prostate

September 2022: Colorectal Tx

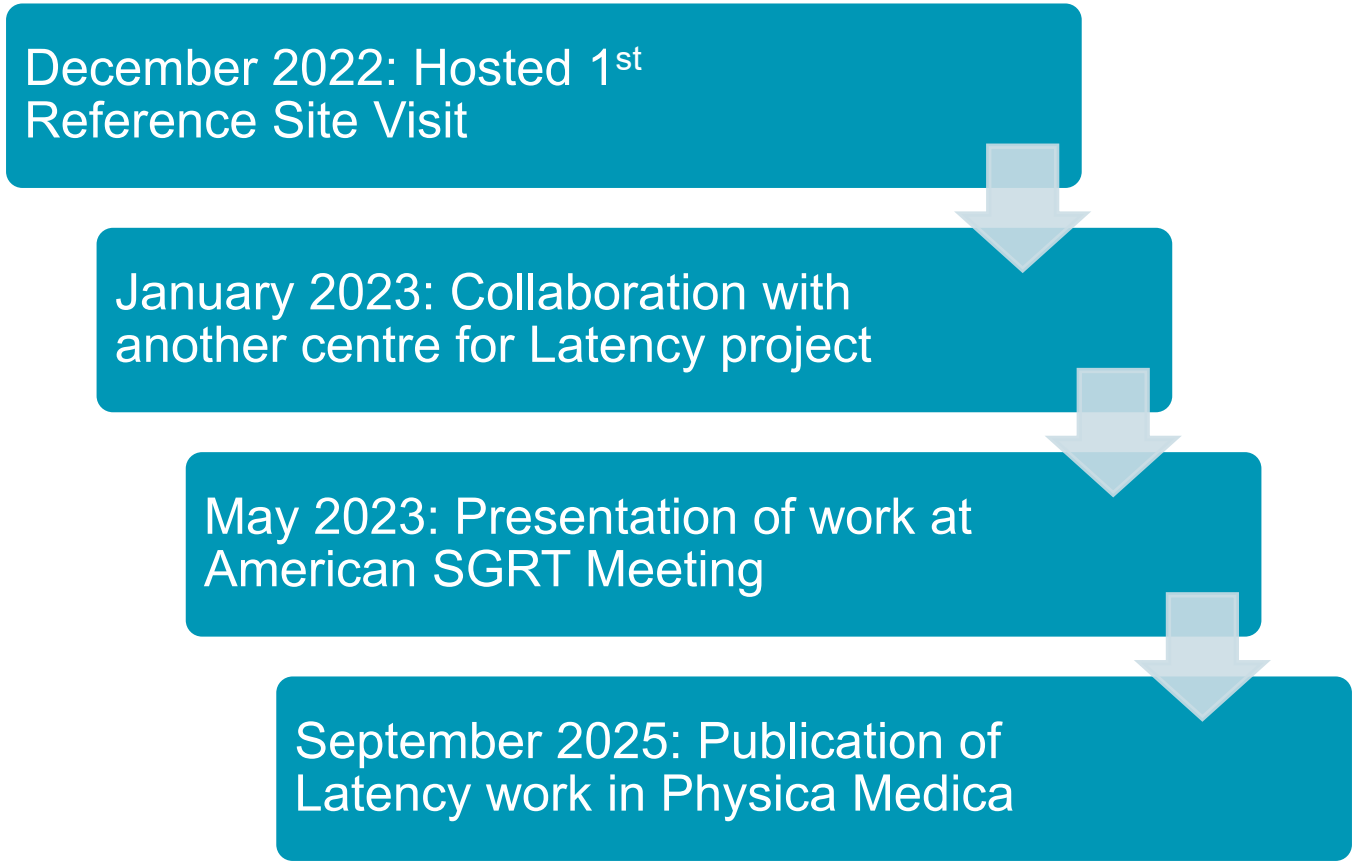
October 2022: tattooless for Align RT sites

October 2022: reduced appointment times

November 2022: DIBH

February 2023: All patients

Timeline


December 2022: Hosted 1st Reference Site Visit
January 2023: Collaboration with another centre for Latency project
May 2023: Presentation of work at American SGRT Meeting
September 2025: Publication of Latency work in Physica Medica

Commissioning Tests

GUIDANCE DOCUMENTS

TG147

TG142

TG302

SGRT Tests

- Effect of ROI size
- Accuracy and Precision - Relative Shifts
- Accuracy and Precision - Absolute Shifts
- Orientation
- Rotational Accuracy
- SSD accuracy
- Deformity Testing
- Gating
- Surface colour, Skin Tone settings
- System drift
- Positional Limitations

Effect of ROI size

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- Frame rate decreases as ROI increases
- ROI should be:
  - Clinically relevant area
  - NOT include moving anatomy (belly breathers) or clothing
  - Extend laterally
  - Large enough for stable delta's but maintain FR > 19 fps

Accuracy and Precision – relative shift

- Shifted couch in three directions in 0.5 mm increments +/- 4 mm
- Compared Delta readout to actual shift

High level of accuracy and precision

– can use system without need for verification imaging

Isocentre Accuracy Testing

- Several plans created on a phantom with different isocentre positions
- Each plan loaded in turn and the relative shift compared to a reference plan was recorded.

ART can be used to shift the patient to within < 0.2 cm of the isocentre

SSD Accuracy

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- Used the plans and compared ART value to Treatment Planning System (Pinnacle) value
- Performed Surface Capture and compared SSD to plan

ART SSD for both the exported contour and the Surface Capture within 0.2 cm of TPS value

Gating Test

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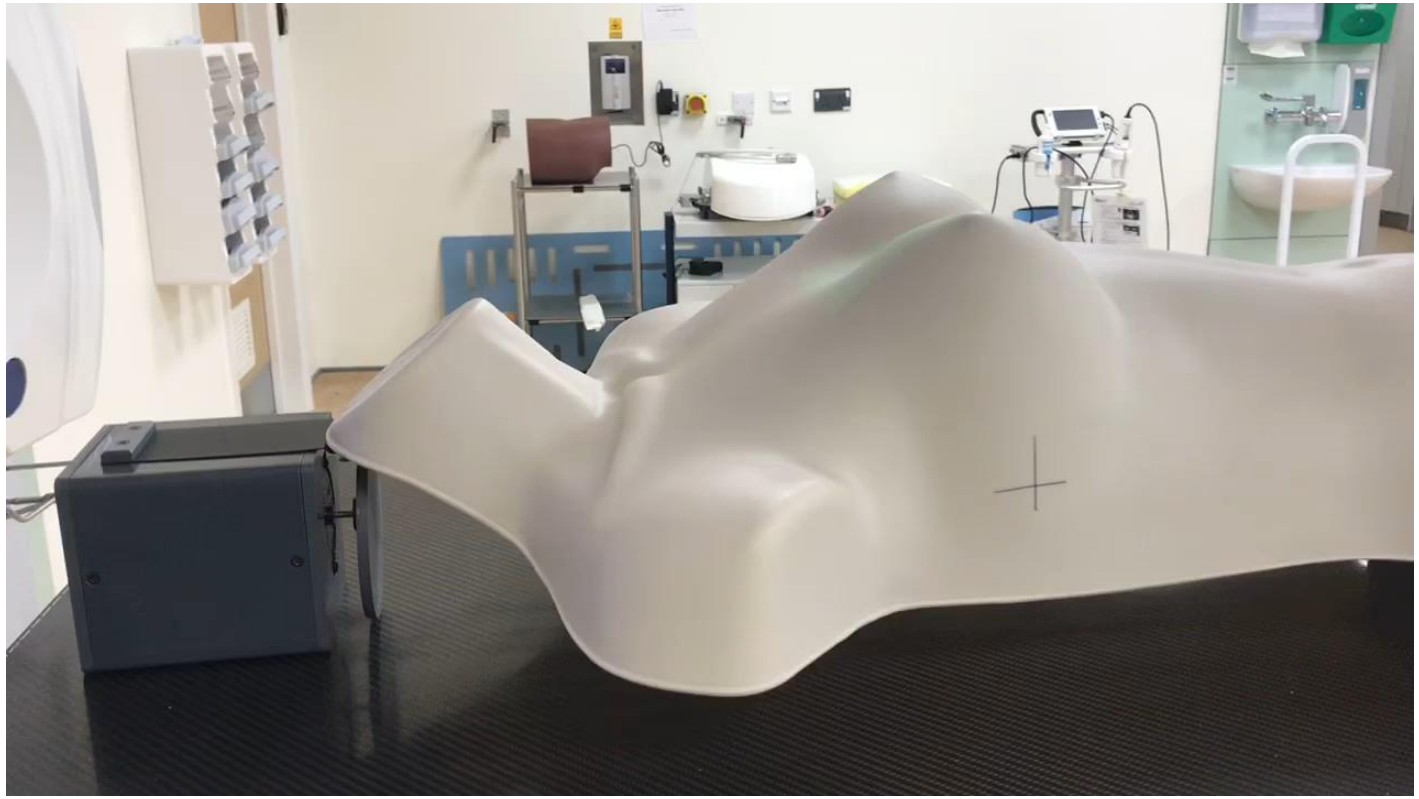

Surface colour, Skin Tone settings

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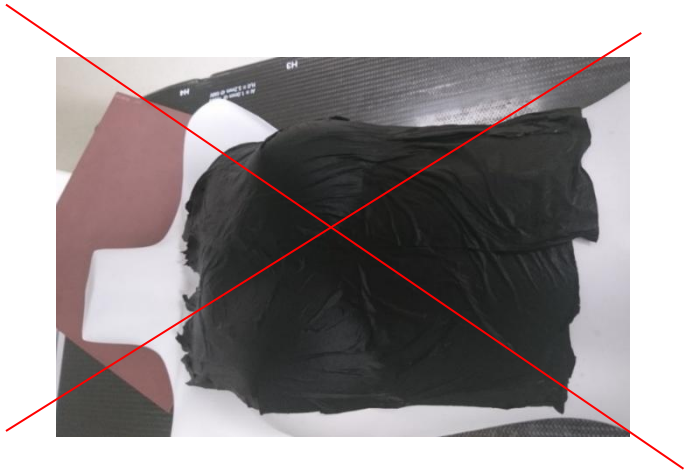

System Drift

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- Monitored every 15 minutes for 75 minutes
- Recorded Delta's

- No drift seen – ART is stable over a time far greater than any treatment time for a patient

Beam-hold Latency

Physica Medica 138 (2025) 105181

Contents lists available at ScienceDirect

Physica Medica

journal homepage: www.elsevier.com/locate/ejmp

Original paper

Quantification of end-to-end beam hold latency using Surface Guided Radiotherapy gating, and cross-vendor linac comparison

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Surface Guided Radiation Therapy
Beam hold
Elekta
Varian
AlignRT

ABSTRACT

Background: Measuring latency of radiation beam-hold is challenging and published guidance on thresholds/tolerances is inconsistent. Two independent Radiotherapy Centres in the South of England collaborated to determine an accurate and simple method applicable to linacs from any vendor.
Purpose: There are an assortment of published methods for measuring SGRT latency, and it is not clear which is optimal (accuracy and efficiency). This project's aim was to develop a simple method that could accurately measure beam-hold latency, that could be shared with other centres for SGRT commissioning and QA without the need for specialist equipment.
Method: A simple phantom was created using a cardboard bowl and a lead marker. This was placed on a moving platform that was programmed with a variety of constant velocities.
A 10 mm vertical tolerance was set on the SGRT software (v6.3, AlignRT), which when exceeded would trigger a beam-hold. Images of the phantom were taken using the megavoltage panel for each velocity.
The displacement of the lead marker from its initial reference position was plotted against the velocity. The gradient of the best-fit line was used to determine the latency.
Results: The average latency measured on four Elekta Versa HD Linacs with Horizon cameras was 149 ms and that measured across four Varian TrueBeams with HD cameras was 131 ms.
Conclusion: The collaboration between the two centres yielded a simple and reproducible method for measuring latency using AlignRT for gating which is accessible to most centres using both Elekta and Varian linacs.

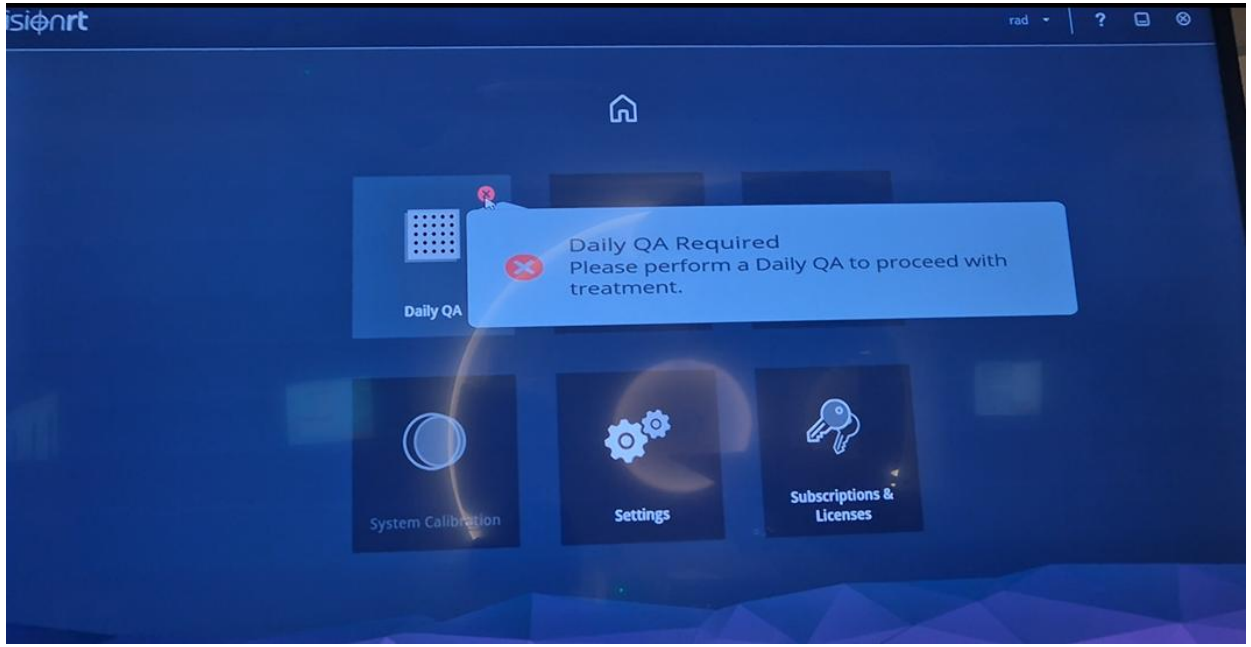
Latency Result

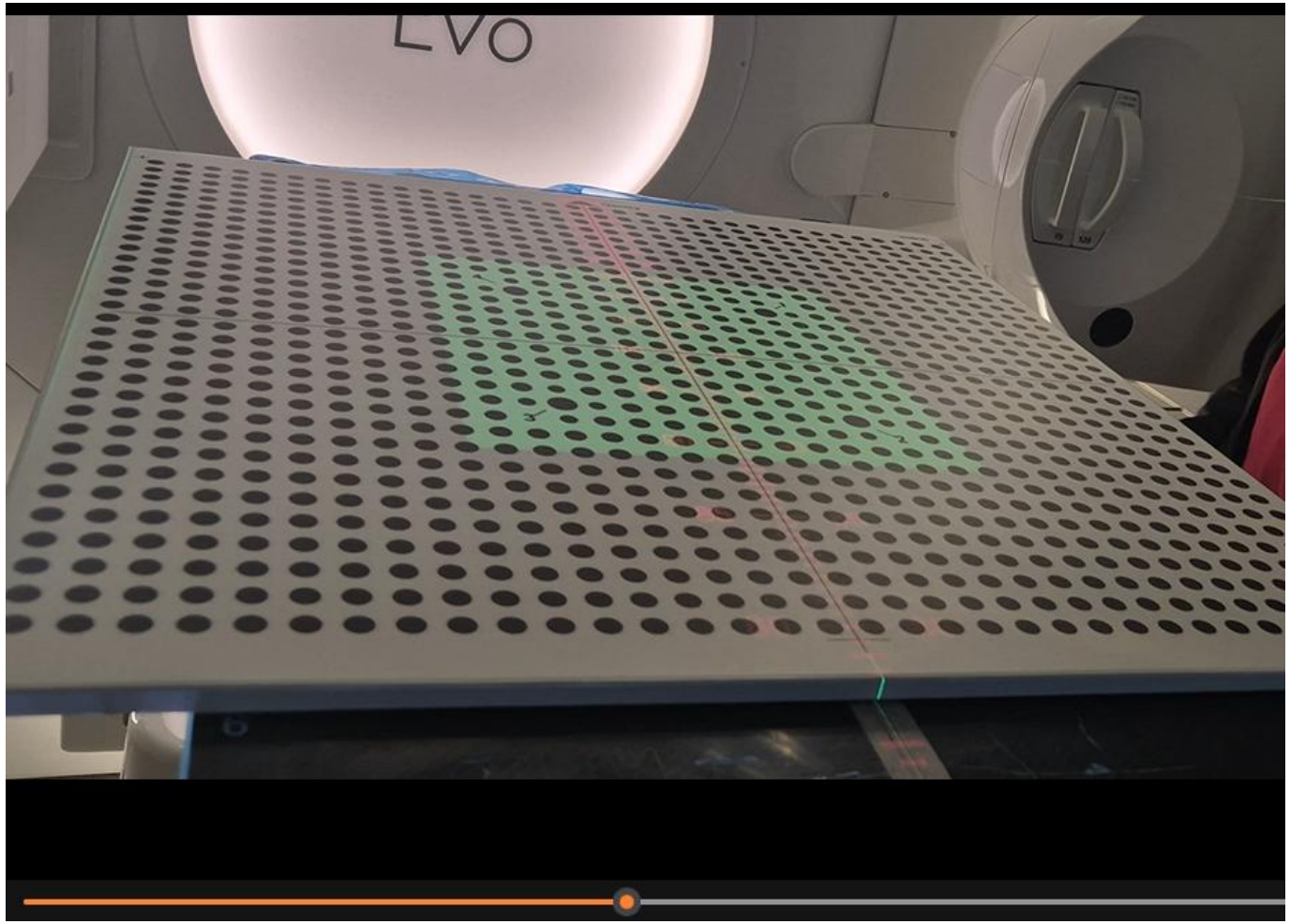
Table 2

Elekta Versa HD beam hold latencies, AlignRT Horizon cam

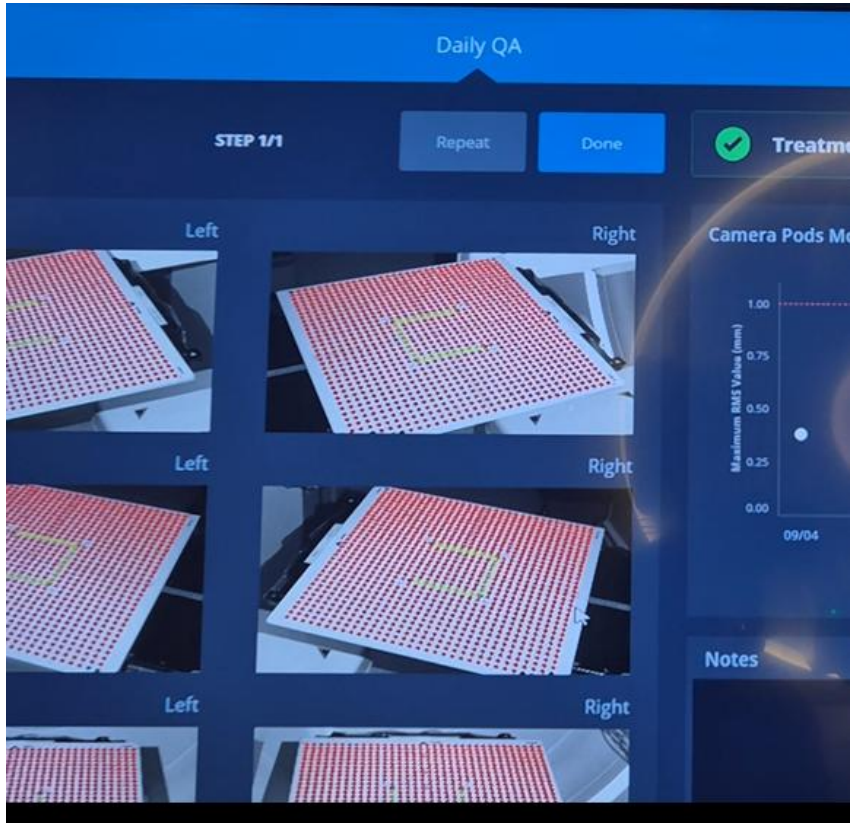
Linac	Beam hold latency [ms]	95 % Confi
VersaHD 1	148	135–161
VersaHD 2	136	124–147
VersaHD 3	147	130–165
VersaHD 4	164	144–184

Daily QA


visionrt
rad
Daily QA
Daily QA Required
Please perform a Daily QA to proceed with treatment.
System Calibration
Settings
Subscriptions & Licenses


LVO

Less than 2 minutes to complete



Clinical sites using Align RT

- Breast- free breathing and DIBH
- Prostate
- Bladder
- Gynae
- Colorectal/ Anus
- Lymphoma
- CNS

Key Benefits

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Increased accuracy of treatment

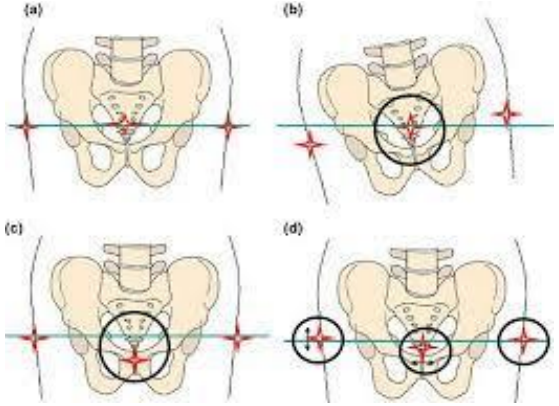
Improved patient experience

Improved efficiency

Workflow Comparison

Previously:

1. Align 3 tattoo dots on patient
2. Image
3. Treat and monitor gross patient movement



Now:

1. Set up using SGRT encompassing 1000s of points on the patient
2. Image
3. Treat and monitor patient position with SGRT to sub millimetric accuracy

Tattoo-less Radiotherapy

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20 OCTOBER 2020 | 4 MINUTES

Radiotherapy tattoos can be a painful reminder of cancer – but 3D imaging could be the solution

By Professor Heidi Probst
Director of the Health Research Institute, Researcher

Breast J. 2020 Feb; 26(2): 316–318.
Published online 2019 Sep 16. doi: 10.1111/tbj.13591
PMCID: PMC7065023
PMID: 31524308

Radiotherapy tattoos: Women's skin as a carrier of personal memory—What do we cause by tattooing our patients?

Torsten Moser, PhD,[✉ 1] Menna Creed, BSc Hons, [1] Robyn Walker, BA, [1] and Gernot Meier, PhD [2]

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Number of Patients receiving tattoo-less treatments per year

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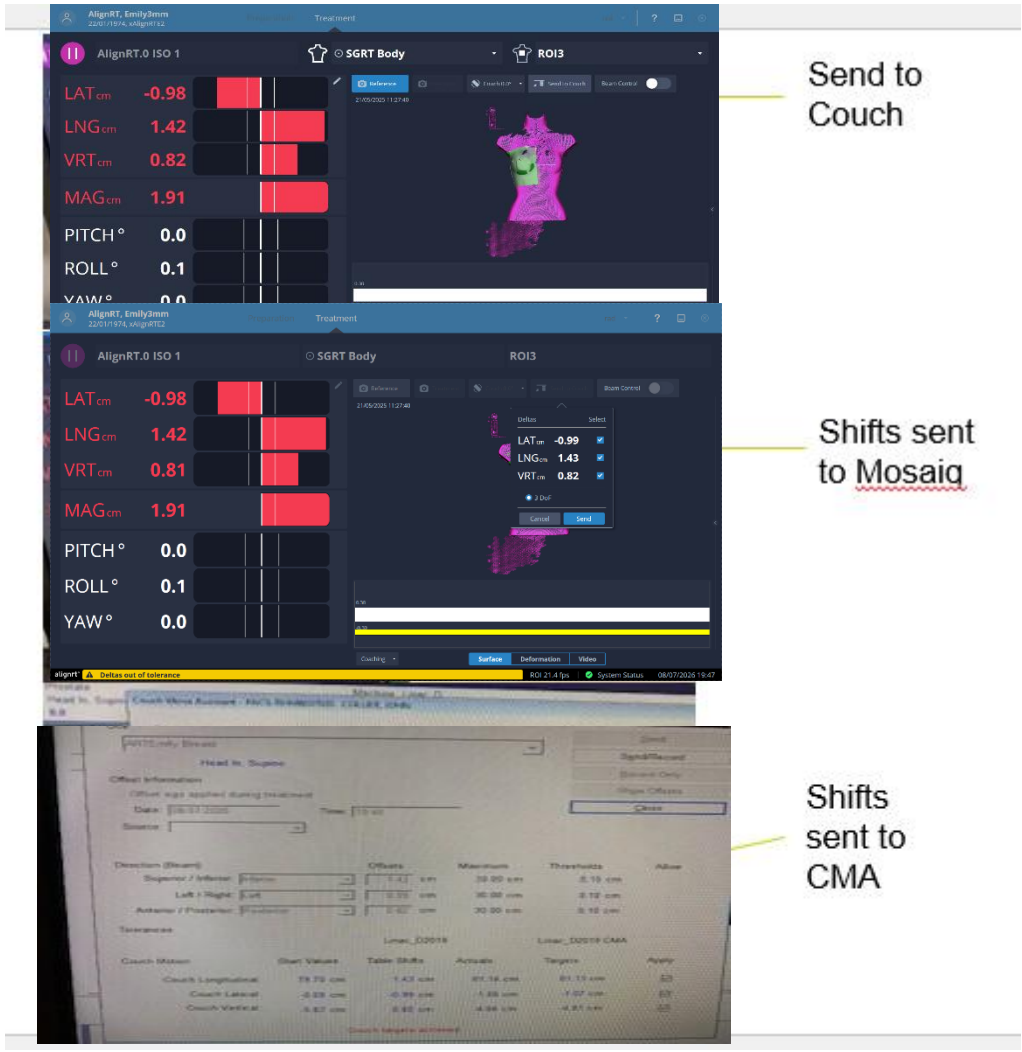
Site	Number of patients
Breast	725
Pelvis- Prostate	468
Pelvis- Rectum	80
Pelvis- Bladder	11
Pelvis- Anus	17
Lymphoma	83
Gynae- Cervix	23
Gynae- Endo	54

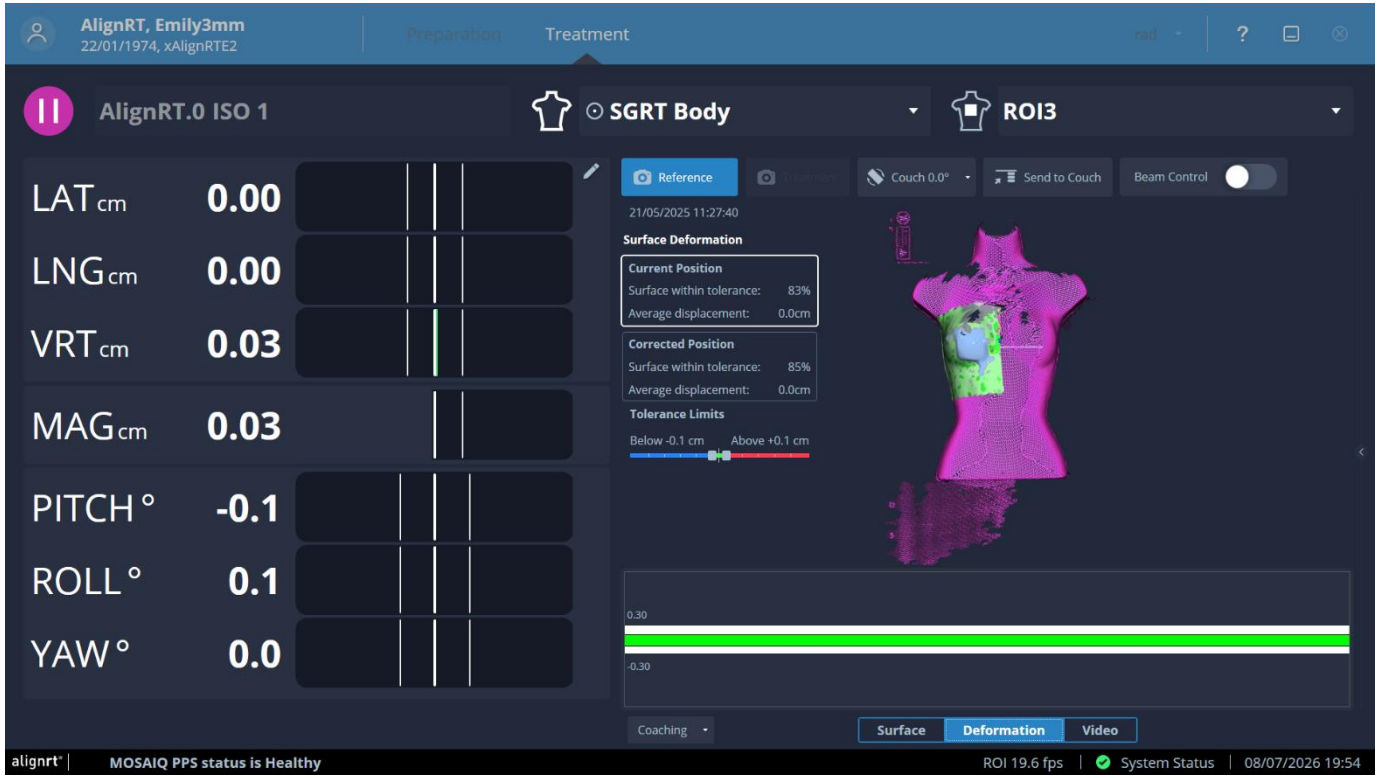
Decreased manual handling

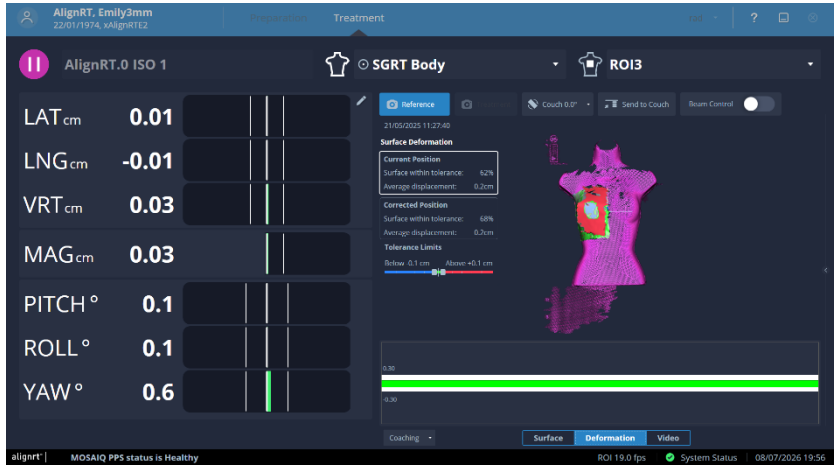
➢Quick, automatic patient alignment with ART

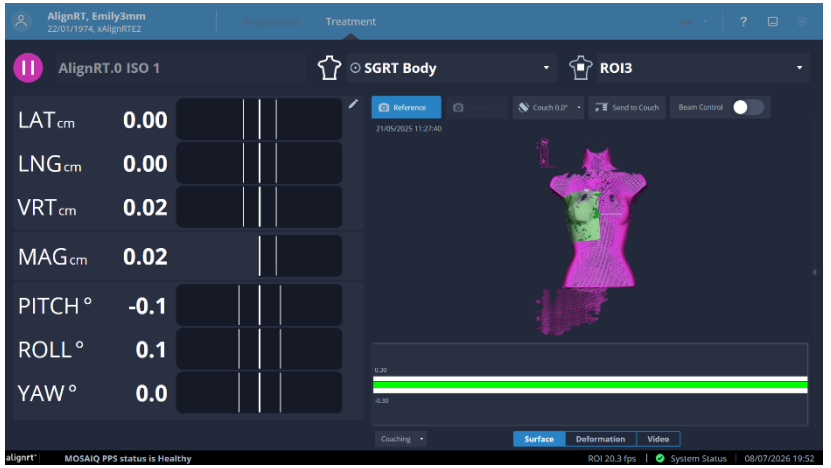
➢Staff manual handling issues/ work related injuries


AlignRT.0 ISO 1
SGRT Body
ROI3
LAT cm -0.98
LNG cm 1.42
VRT cm 0.82
MAG cm 1.91
PITCH ° 0.0
ROLL ° 0.1
YAW ° 0.0
Send to Couch
LAT cm -0.99
LNG cm 1.43
VRT cm 0.82
Shifts sent to Mosaiq
Shifts sent to CMA

Deformation Tool




AlignRT, Emily3mm
22/01/1974, xAlignRTE2
Preparation
Treatment
AlignRT.0 ISO 1
SGRT Body
ROI3
LAT cm 0.01
LNG cm -0.01
VRT cm 0.03
MAG cm 0.03
PITCH ° 0.1
ROLL ° 0.1
YAW ° 0.6
Reference
Couch 0.0°
Send to Couch
Beam Control
21/05/2025 11:27:40
Surface Deformation
Current Position
Surface within tolerance: 62%
Average displacement: 0.2cm
Corrected Position
Surface within tolerance: 68%
Average displacement: 0.2cm
Tolerance Limits
Below -0.1 cm
Above +0.1 cm
Coaching
Surface
Deformation
Video
alignrt
MOSAIQ PPS status is Healthy
ROI 19.0 fps
System Status
08/07/2026 19:56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22/01/1974, xAlignRTE2
Preparation
Treatment
AlignRT.0 ISO 1
SGRT Body
ROI3
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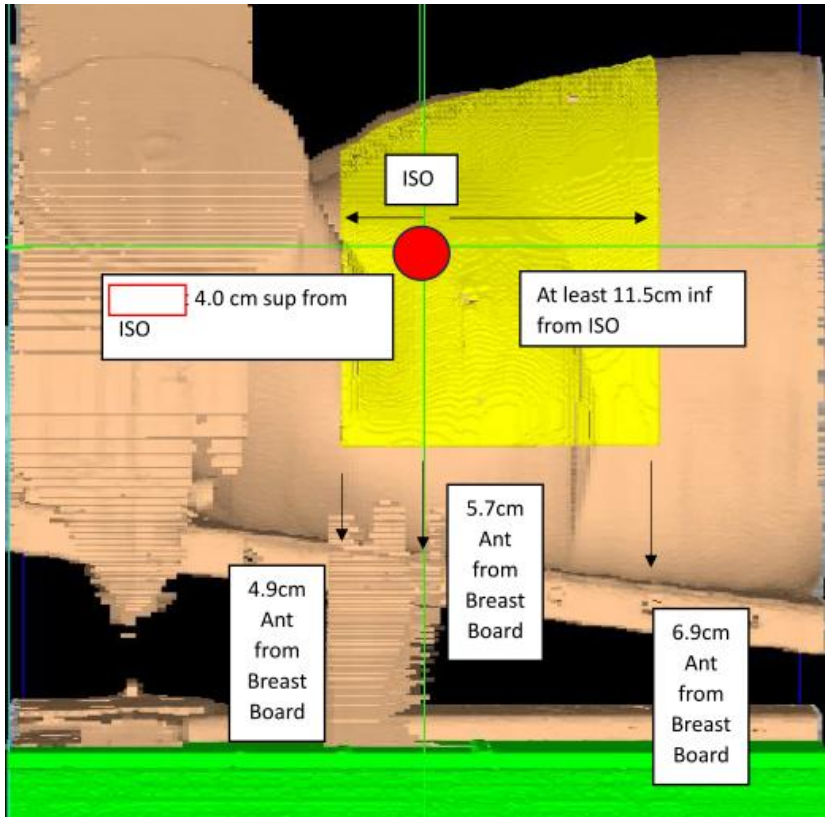
LNG cm 0.00
VRT cm 0.02
MAG cm 0.02
PITCH ° -0.1
ROLL ° 0.1
YAW ° 0.0
Reference
Couch 0.0°
Send to Couch
Beam Control
21/05/2025 11:27:40
Coaching
Surface
Deformation
Video
alignrt
MOSAIQ PPS status is Healthy
ROI 20.3 fps
System Status
08/07/2026 19:52

Postural Video

Reveals issues with immobilisation settings or patient positioning that may have gone un-noticed- e.g arm or shoulder position

Used for Bolus Positioning



Treatment Accuracy

- ART can be used to shift the patient to within < 0.2 cm of the isocentre
- Treatment beam automatically paused with sub millimetric movement

Efficiency audit after SGRT implemented

Electronic Entry in OIS	Time point in clinical workflow	Category
Site Set Up Widget	Patient on bed	Set Up
1st Couch Move Assistant	Move to isocentre	In room checks
1st Verified Treatment	CBCT image acquisition	Image assessment
2nd Couch Move Assistant	CBCT image assessment	
2nd Verified Treatment	Treatment delivery	Treatment Delivery
Code Capture	Feet of bed	

Start of patient setup

End of patient setup

- Tool automatically pulls data from Mosaiq – can analyse hundreds of treatments
- Key time-point ‘captures’ extracted that mark Start and End of Pt setup

Efficiency Data from AlignRT Audit (Prostate Treatments)

Data from 197 prostate treatments in 2024 collected

Average total set up *before* SGRT implemented (minutes)	Average total set up time *after* SGRT implemented (minutes)
3.76	**2.51**

Average total treatment time: 13.17 vs 9.8 minutes

= Total fraction time saving of **26%** for treating prostate patients

Efficiency Data from AlignRT Audit (Free-Breathing Breast Treatments)

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Data from 123 Free Breathing treatments from 2024 collected

Average total set up time in room *before* SGRT implemented (minutes)	Average total set up time in room *after* SGRT implemented (minutes)
4.38	**3.65**

Average total treatment time: 11.8 vs 10.9 minutes

= Total fraction time saving of **8%** at both sites for treating free breathing breast patients

Efficiency Data from AlignRT Audit (DIBH Breast Treatments)

Data from 123 DIBH Breast treatments from 2024 collected

Average total set up time in room *before* SGRT implemented (minutes)	Average total set up time in room *after* SGRT implemented (minutes)
8.66	**6.5**

Average total treatment time: 21.8 vs 17.4 minutes

= Total treatment time saving of **20%** at both sites for DIBH treatments

What was the outcome?

- "A recent efficiency study revealed that implementing SGRT contributed to reducing appointment times by 3 minutes ….This led to a capacity increase of 18 more appointments per week in that radiotherapy centre. As prostate and breast make up over 50% of all radiotherapy patients this technology has huge efficiency saving implications for all radiotherapy centres"

Other Efficiencies

- Tattoo-less tx has saved 2-3 minutes per patient in CT, 20-30 minute slots + cost saving
- Cost of snorkels with previous DIBH equipment= cost saving of £4115.04

Other Clincial Benefits of using AlignRT

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1. Thorax treatment- Faulty vac bag re-inflated between planning CT and day 1 of treatment. Able to re-form the vac bag with Align RT guidance, CBCT revealed CT set up reproduced accurately and could proceed with treatment

2. Use of deformation tool reveals clinical issues such as seromas, changes around scar tissue or axillary swelling, bladder filling

3. Some reduction in repeat imaging seen for breast patients

Benefits Summary

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Multiple benefits to patient and staff

Significant impact on waiting times for treatment

All patients now at UHS now have Surface guided treatment

Whats Next... V8

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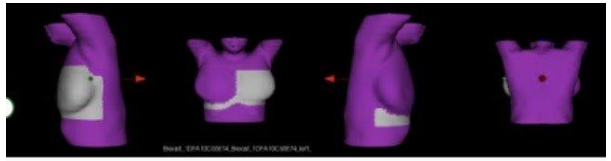
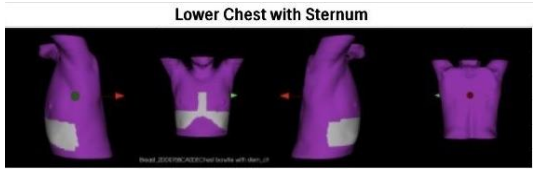
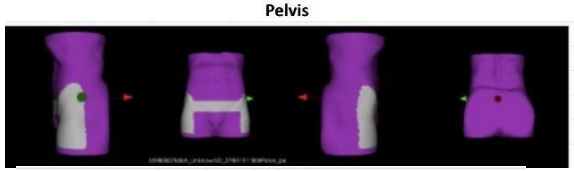
AutoROI: Goal is to look at how it can improve our standardisation and efficiency in patient preparation.

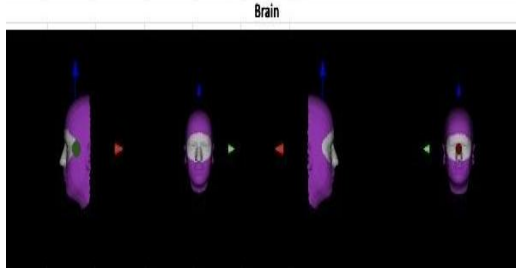
- **Automatically** generate Regions of Interest (ROI) from DICOM RT struct.
- ROI based on a **treatment** site-specific ROI template.
- **Reduce manual steps** and patient preparation time.
- Provides inter-user ROI consistency.

Example ROI









Different ROI templates are available to automate for:

- supine breast
- chest wall
- abdomen
- pelvis
- brain
- intracranial SRS

"For most patients, AutoROI gets it right first time with little or no editing required."

Lisa Laws, Principal Therapeutic Radiographer, Rosemere Cancer Centre, UK, NHS UK.

BeamGuide

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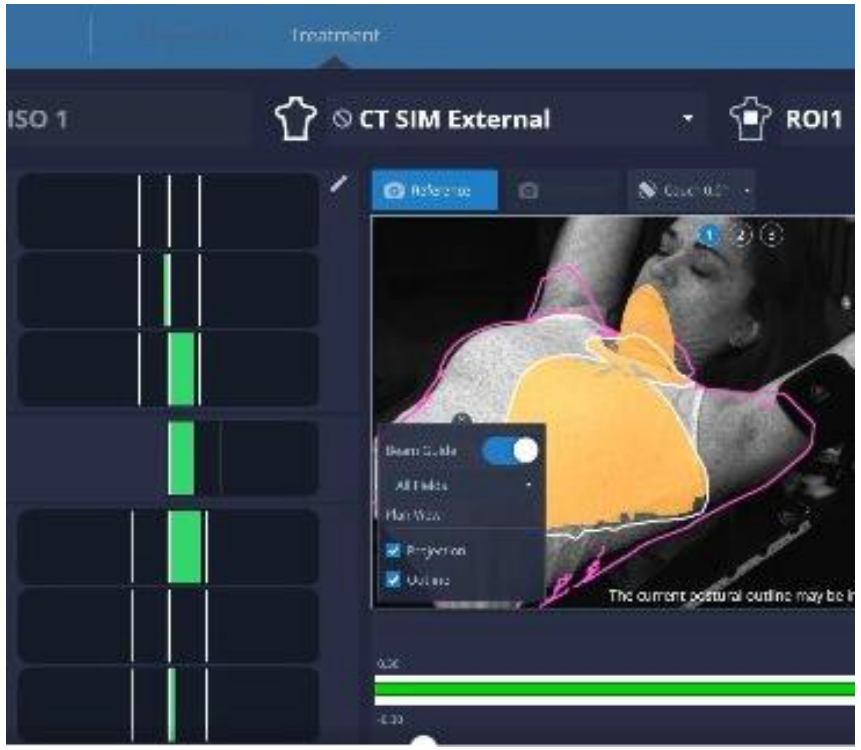
- Traditional workflows assume the beam is correct at setup
- Visual or position-only verification does not equal beam verification
- Many beam-related issues are **invisible until after beam-on**

V8 – BeamGuide

- Project a real-time visualization of planned radiation fields onto the patient during setup and treatment, helping detect and prevent errors before radiation is delivered.
- Live patient surface and the treatment plan and is displayed within Postural Video alongside the planned beam outline. The real-time beam projection and planned beam outline are available during both patient setup and treatment.
- Additional set up tool to aid quicker set up of patients



Examples Beam Guide Clinical Use

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- Unintended dose to chin – remind patient to keep chin lifted
- Dose to contralateral breast – roll and fine tune the patient position.
- Visually confirm the breath hold is at the correct level.
- Unintended dose to areas outside the treatment beam – e.g hands / arms not in the correct position or dose to shoulder in H&N cases.
- Optimise bolus positioning — Using Beam Guide to support accurate placement and real-time checkingof bolus during setup

Ability to correct before any imaging or treatment dose is delivered.

"Being able to visualize the exit dose gives us information we simply wouldn't have from the light field alone." Jodie Bailey, Therapeutic Radiographer Team Manager, Norfolk & Norwich University Hospital, NHS UK

Tips for implementing SGRT

- Commissioning
  - Two staff
  - Prepare spreadsheets in advance for each test
- Clinical Super Users
- Training video of workflow
- Physicist to attend treatments to support initial roll-out
- Review and revise ROI's after initial use

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Thank you! Any Questions?

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Rachel.barlow@uhs.nhs.uk

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Hampshire, SO16 6YD

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