Royal Surrey
NHS Foundation Trust

Use of AlignRT InBore in a Lung SABR Workflow on a Ring Gantry Linac

Gail Anastasi and Hannah Nayee

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Introduction

In 2024, our Satellite Centre received two state-of-the-art installations:

- a Varian Halcyon Linac
- a Varian Ethos Linac

Both equipped with:

- HyperSight imaging capabilities
- AlignRT InBore Surface-Guided Radiotherapy (SGRT) system

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Introduction

Initially the SABR service was moved to the main site and the reintroduction of lung SABR treatments had a profoundly positive impact on our patients.

The implementation working party was made up of an MDT:

- SABR planning study for ring-gantry treatments
- Staff training
- 4D-CBCT workflow amendments
- SGRT monitoring – ROI options
- 10 patient Audit of using AlignRT to monitor Lung SABR on a ring gantry

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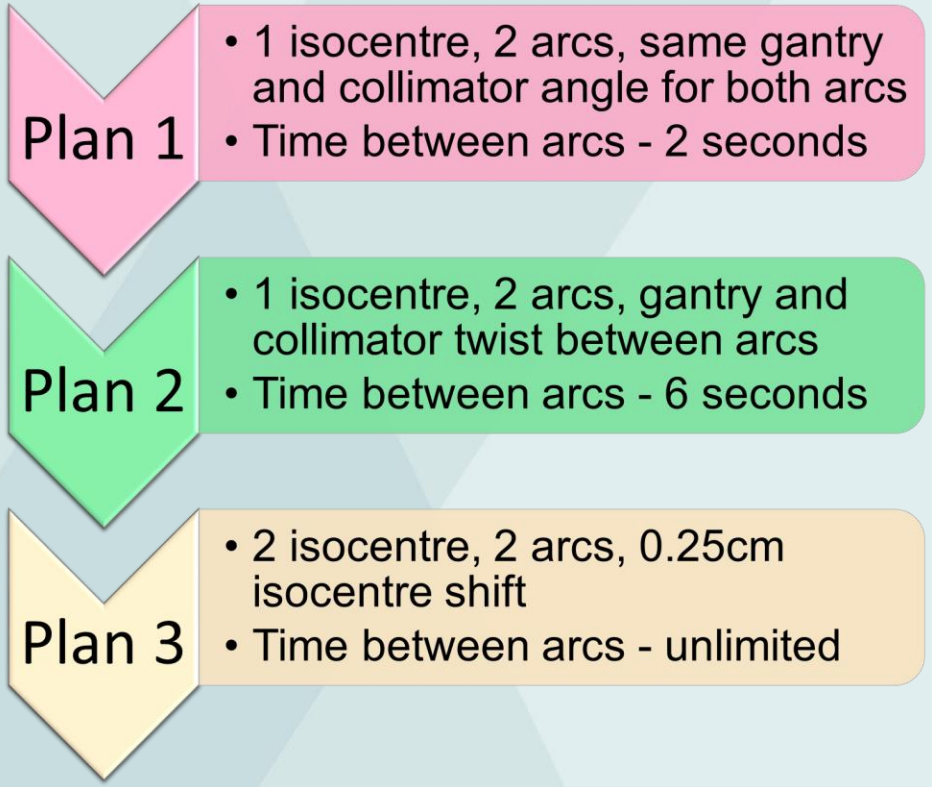
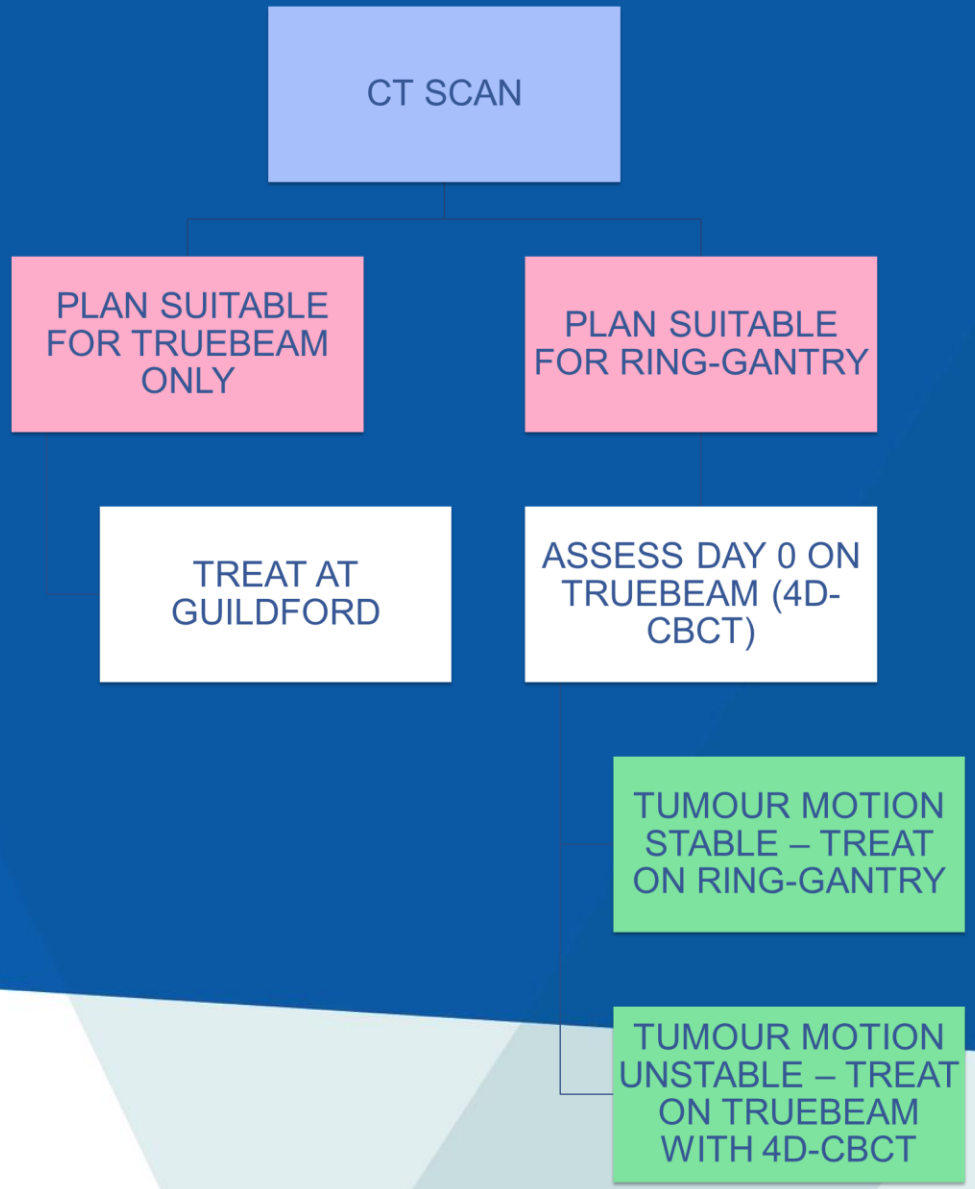
Planning

- SABR plans were required that would allow for a hard pause in treatment between Arcs, where an interim CBCT could be acquired.
- Plan 1 and 2 relied on an operator to stop the automatic start of Arc 2 within a short time of 2 seconds and 6 seconds respectively.
- Plan 3 had 2 isocentres (2.5mm) apart stopping Arc2 from automatically moding up.



Treatment Verification Workflow



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Audit Objectives

To ensure safe delivery we audited our first 10 patients to:

- Evaluate InBore SGRT with ancillary equipment e.g. abdominal belt compression.
- Compare the use of InBore SGRT monitoring to data from CBCTs prior to VMAT delivery.
- Evaluate the reliability of InBore SGRT for continuous motion monitoring.

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Method

- Patients were planned with 2 isocentres (2.5mm apart in SUP/INF direction).
- Immobilisation - arms up on a wing-board with a vacuum bag for arm support.
- Patients with middle to lower lobe tumours were typically treated with an abdominal compression belt.
- An appropriate region of interest (ROI) was created.

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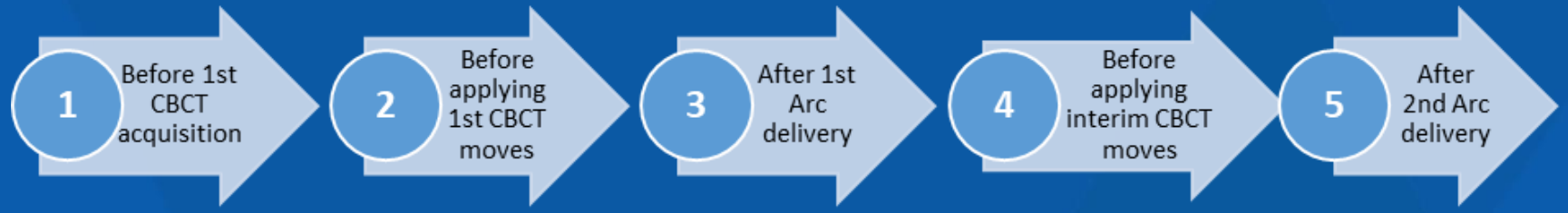
Method

- For each patient real-time delta shifts (Vert, Long, Lat, Yaw, Roll and Pitch) from the InBore SGRT system, were noted at specific time points:



- For consistency/reliability deltas were always recorded at exhale.
- The deltas from the online CBCT match were also obtained.

Results

- 10 patients audited included 8 upper lobes and 2 middle lobes.
- The ROI excluded the abdominal belt.
- A standard thorax ROI was found to not be appropriate for SABR patients

- Delta tolerances were: Vert, Long, Lat - 0.2cm and Yaw, Roll, Pitch - 3^{o}.

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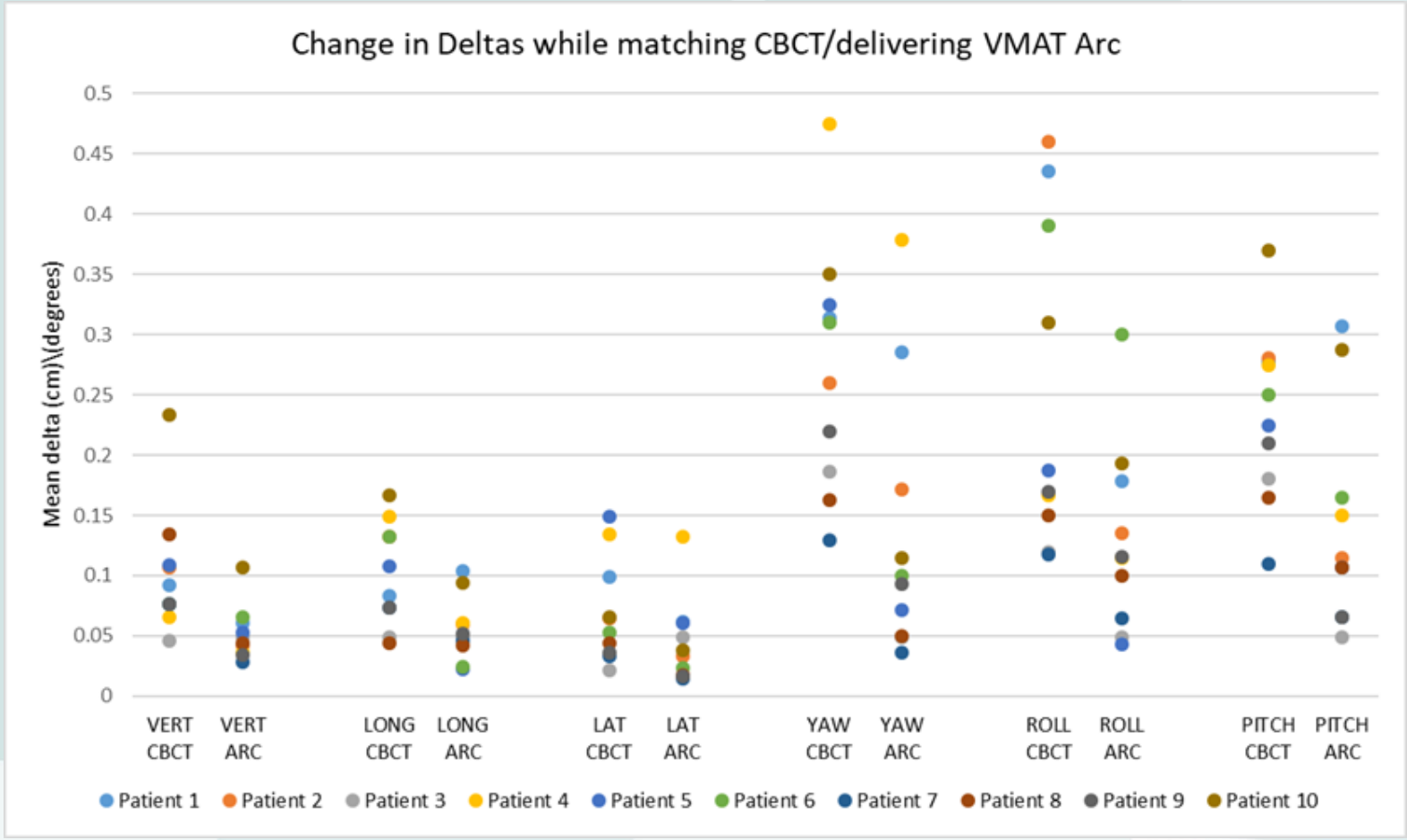
Results

Across all 10 patients mean change in deltas during the time CBCTs were matched and during Arc delivery:

- Vert, Long and Lat was ≤1mm
- Yaw, Roll and Pitch ≤ 0.3º



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Results

- The mean difference between AlignRT deltas and the CBCT match (soft-tissue) was 0.01±0.17cm, -0.02±0.25cm and 0.00±0.21cm for Vert, Long, Lat respectively.

- When AlignRT flagged a move and justified an additional image, a soft tissue positional change was confirmed.

- Patients experienced shorter treatment appointments by an average of 9 mins (average treatment time: 21 mins, range: 17 – 34 mins).

Conclusion

- InBore SGRT for Lung SABR was adopted easily with decreased time on the treatment couch and to date we have treated >30 patients.
- The sub-mm change in deltas during ARC delivery makes us confident that we have a safe treatment approach.
- There was no significant difference between AlignRT deltas immediately prior to CBCT matching and the agreed online match deltas.
- Moving forwards, one could consider omitting the interim CBCT and only acquiring if AlignRT deltas are out of tolerance.

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Acknowledgments

We would like to thank all the staff involved in the working party to enable this project to be successfully established as standard practice within our cancer centre.

Questions?

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