

DIBH with AlignRT on Halcyon

The UZ Leuven experience

Laurence Delombaerde

laurence.delombaerde@uzleuven.be

UZ Leuven Radiation Oncology department

Varian
Truebeam



Varian
Halcyon



Varian
Truebeam



Varian
Halcyon



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IBA
ProteusONE

History of SGRT in UZ Leuven

AlignRT use (July 2019- August 2020)

Jan 2018: 1st install on TrueBeam

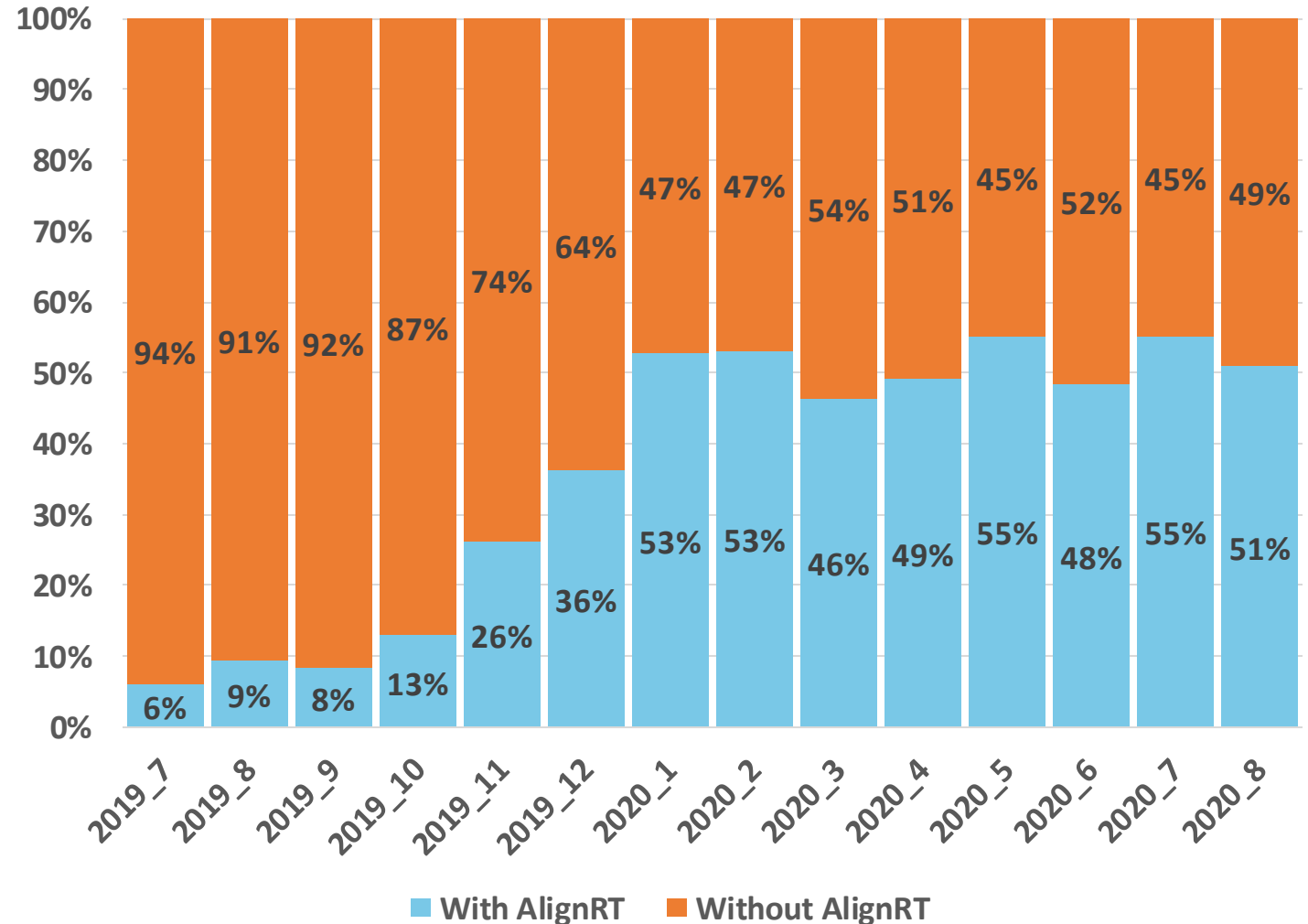
Feb 2018: Setup of 1st patient (free breathing breast cancer patient)

Feb 2018: 1st DIBH left-sided breast

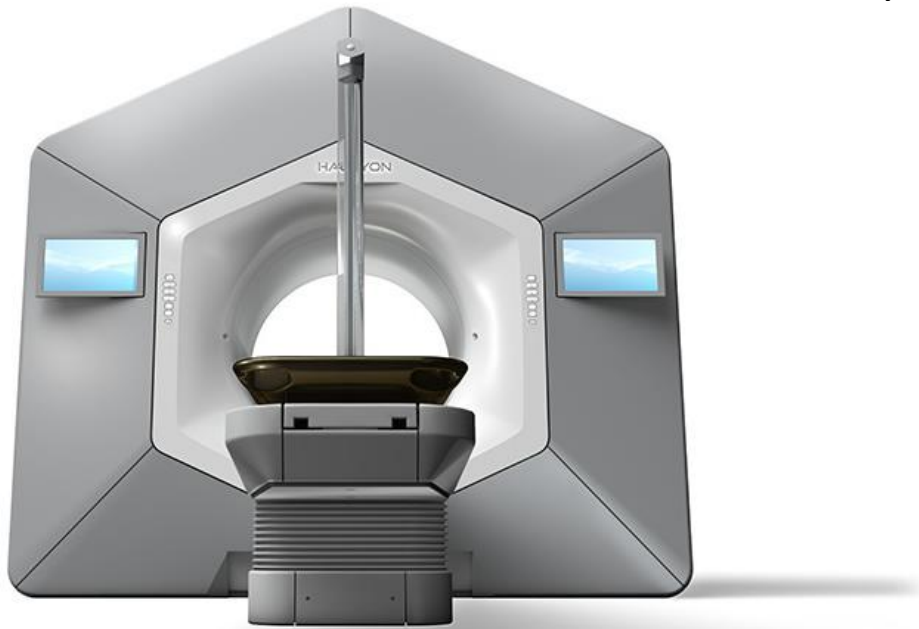
Aug 2019: Increase of setup indications

Sept 2020: > 50% patients with SGRT
(= 1400 patients of the 2800 pat/year)

Oct 2020: upgrade AlignRT v6.2



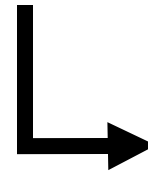
Fast-delivery O-ring gantry



Gantry rotation speed 2 RPM



TrueBeam (C-arm) 1 RPM



Fast-delivery VMAT with DIBH

intrafraction errors can be decreased by limiting the number DIBH

Correlation between S-I errors and the number of breath holds per fraction¹



Motion management?

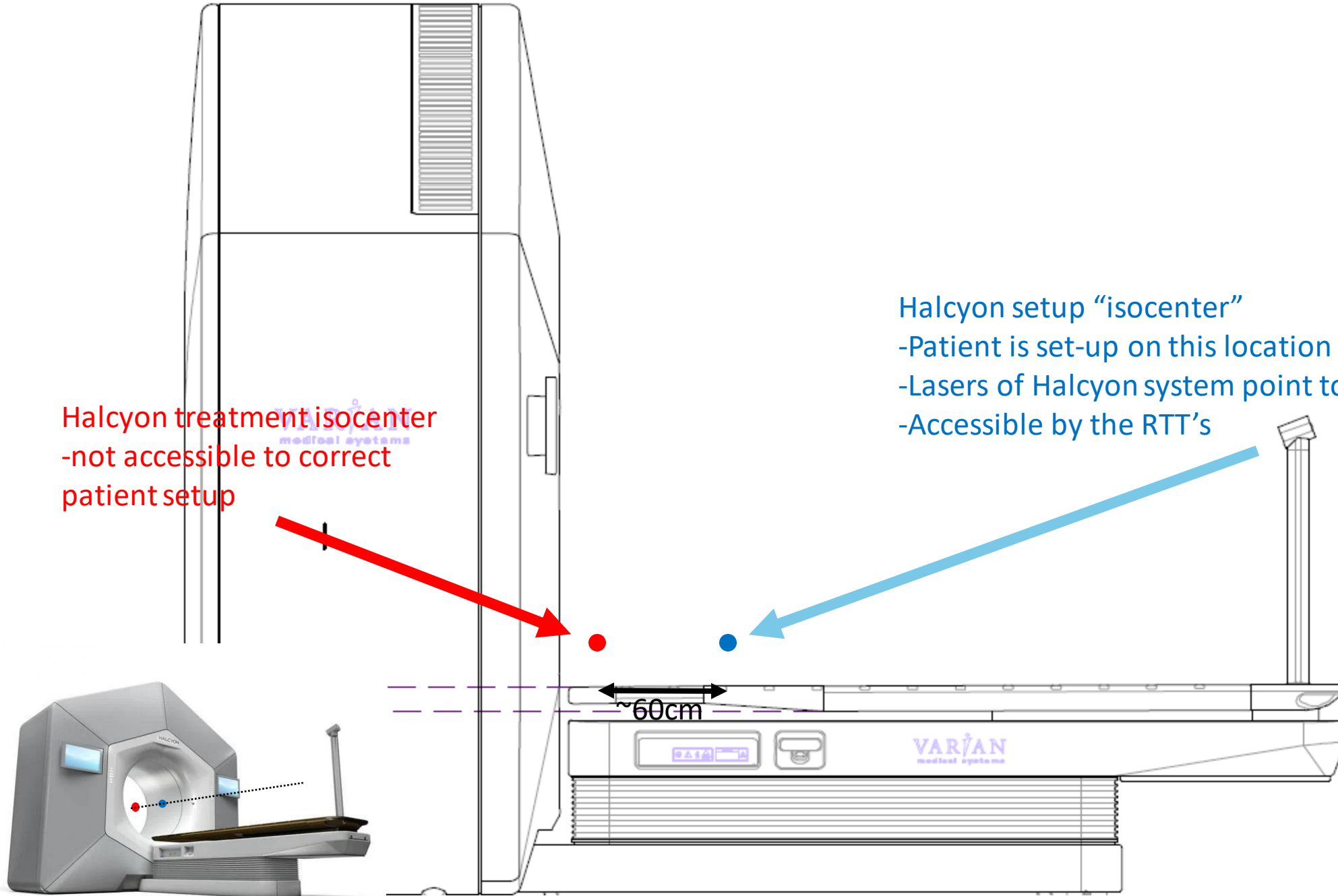
Halcyon

ted

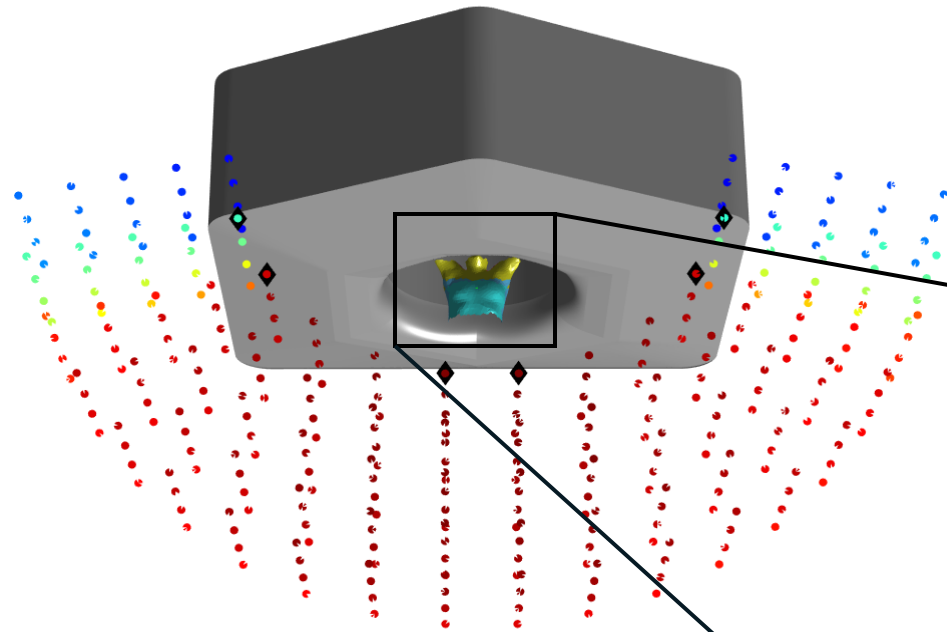
Halcyon setup "isocenter"

- Patient is set-up on this location
- Lasers of Halcyon system point to this iso
- Accessible by the RTT's

Halcyon treatment isocenter
-not accessible to correct
patient setup



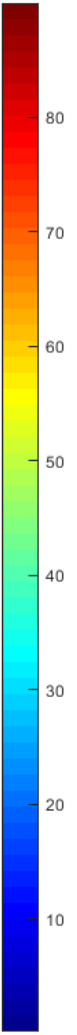
Setup "isocenter"



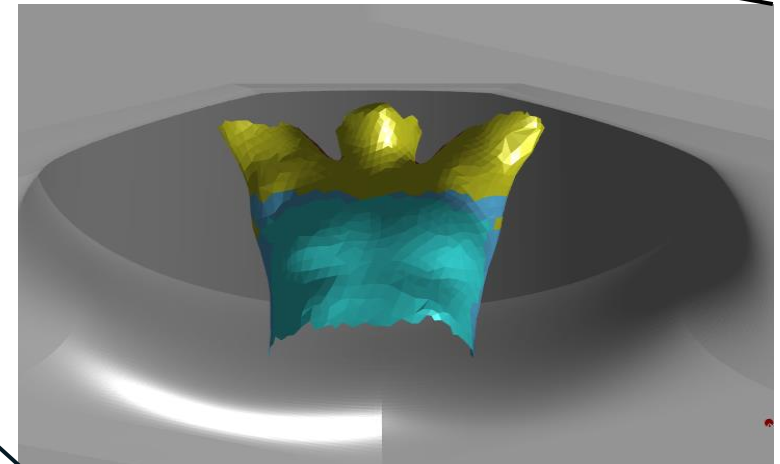
Seen by

- all 3 pods
- 2 pods
- pod 1
- pod 2
- pod 3
- none

% visible surface area



"Raytracing simulation visibility surface using ceiling mounted camera system"



Halcyon

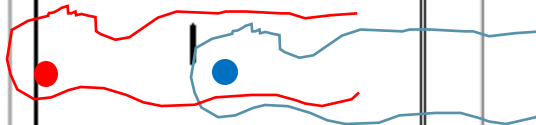
with AlignRT

3-camera setup



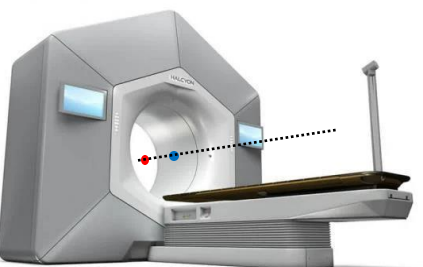
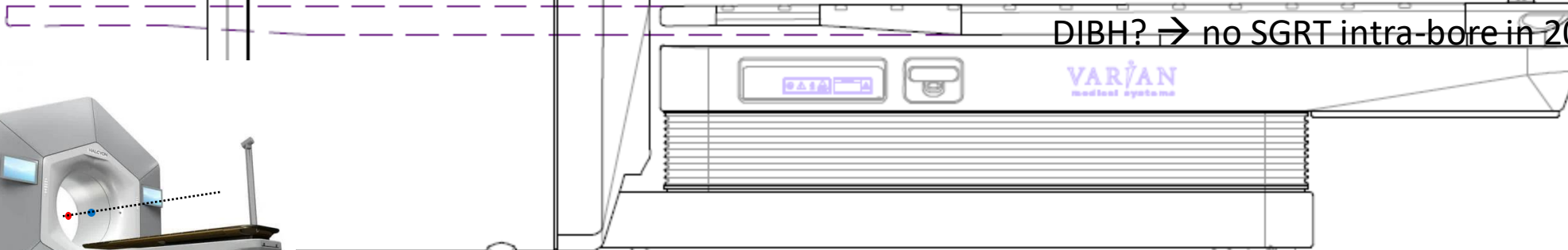
VARIAN
medical systems

Move into bore



Step 2: Shift into the bore with/without Delta Couch (shift between setup point and isocenter)

DIBH? → no SGRT intra-bore in 2018...

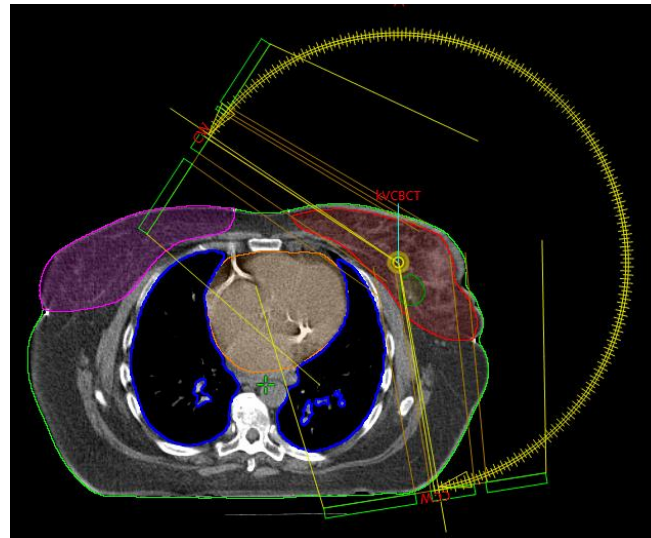


DIBH on Halcyon? → spirometer

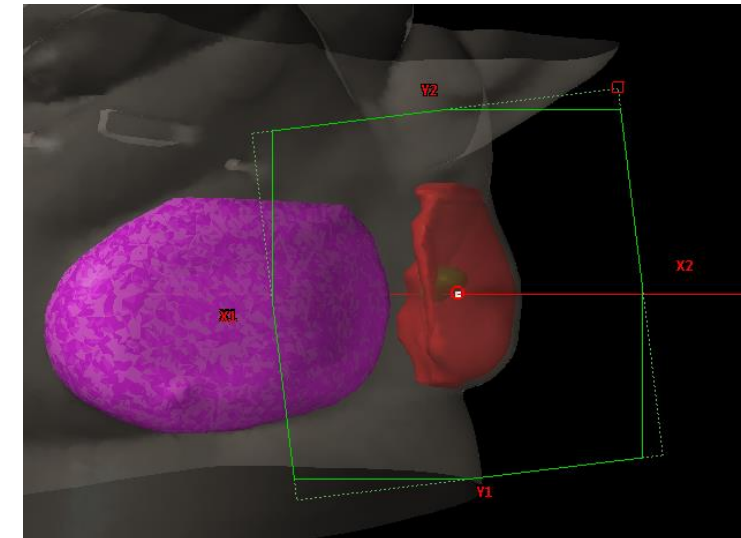
- Only spirometer device available to trigger intra-bore (Dyn'R SDX)
- 2 partial arcs ($300^\circ \rightarrow 170^\circ$, $171^\circ \rightarrow 301^\circ$)

CAVEAT: manual gating!
40s/arc: too long for 1 breath-hold

- 3 partial arcs: ~ 20/25 sec per arc
- Collimator (10° , 280°)



CW: $303^\circ \rightarrow 170^\circ$, CCW: $171^\circ \rightarrow 304^\circ$

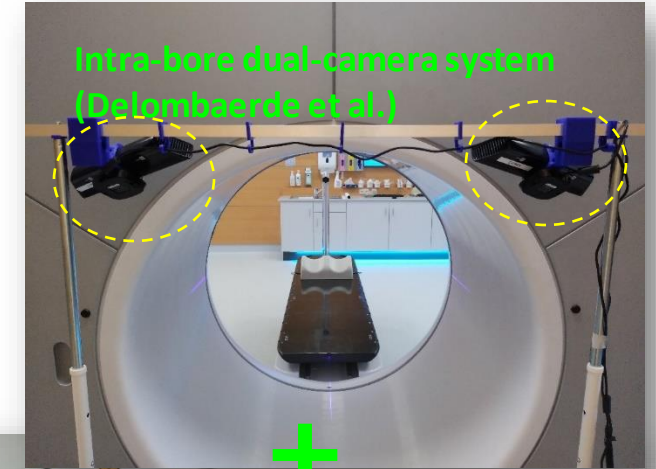
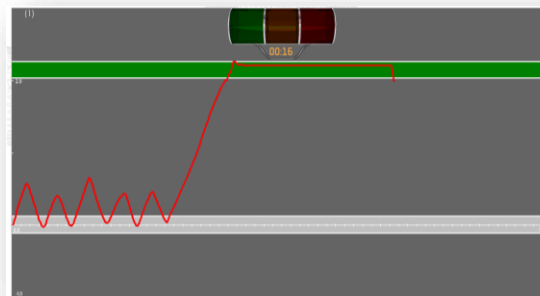


Collimator 7°

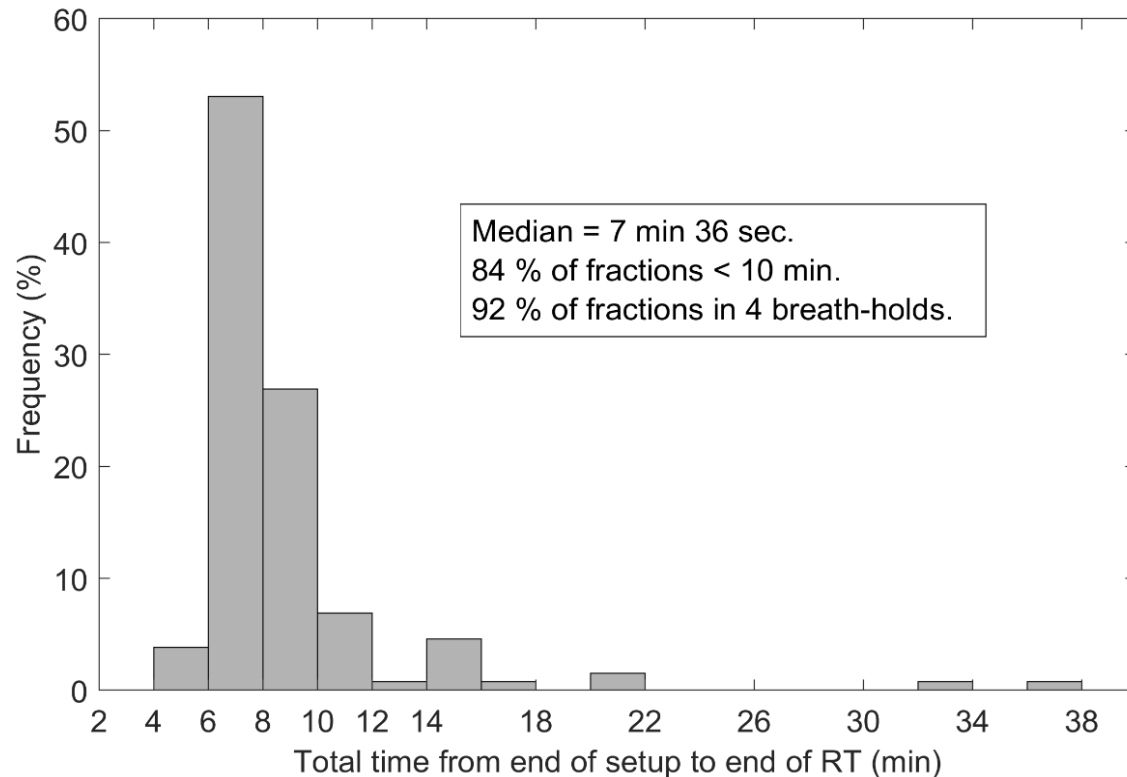
DIBH on Halcyon? → spirometer

- Monitoring with in-house surface scanning

1. Connect spirometer (with patient)
2. Setup with AlignRT
3. Load to isocenter
4. CBCT in breath-hold (16s)
5. Irradiate in breath-hold (manual)



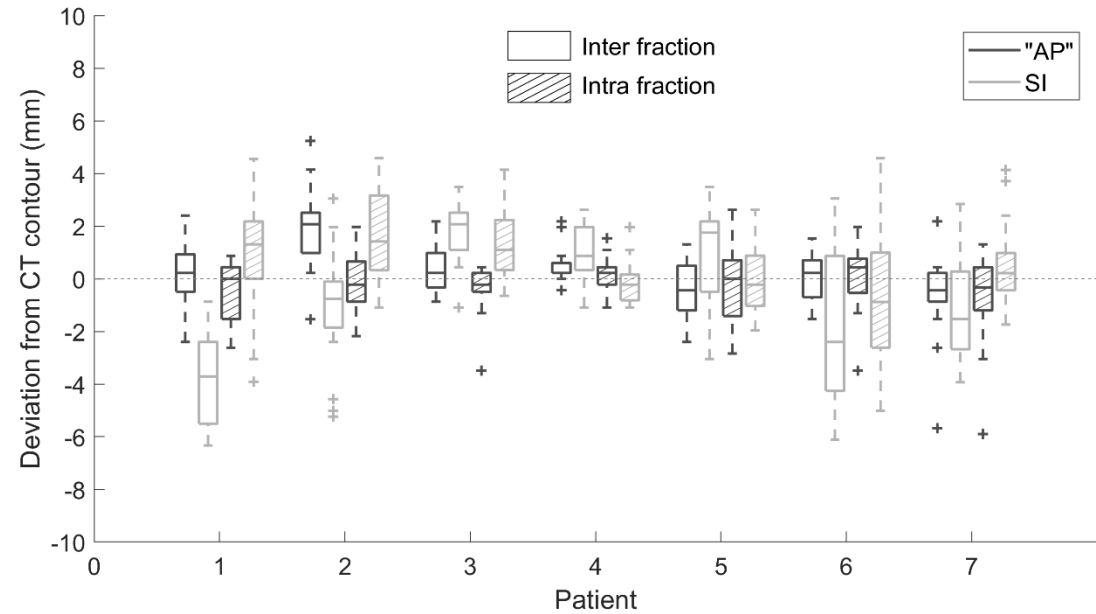
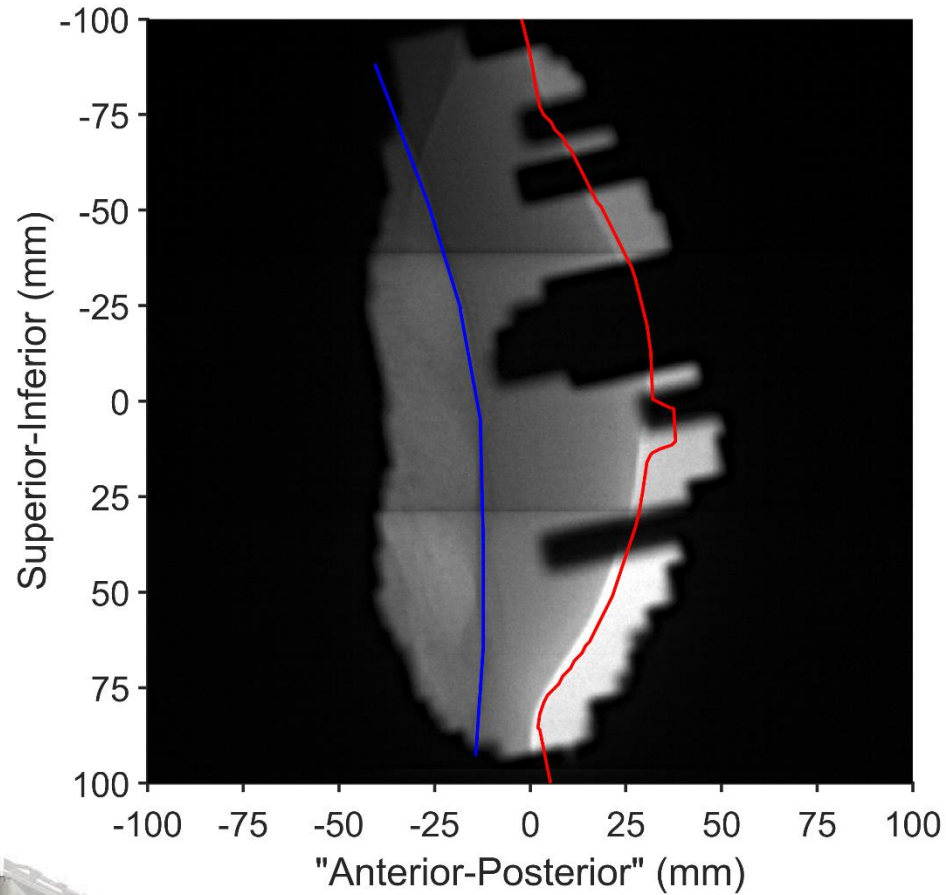
VMAT-SIB DIBH on Halcyon = highly efficient DIBH delivery



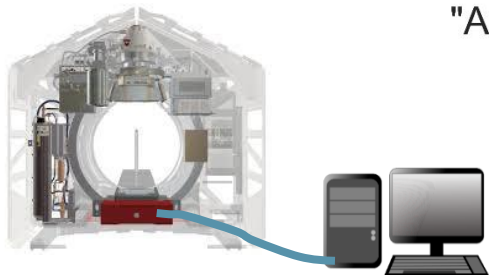
Results:

- Median treatment time = **7 min 36 sec** (including CBCT + 3 VMAT arc)
- 92% of fractions in **4 breath holds**
- Measured in population **age > 70y**

DIBH on Halcyon - spirometer

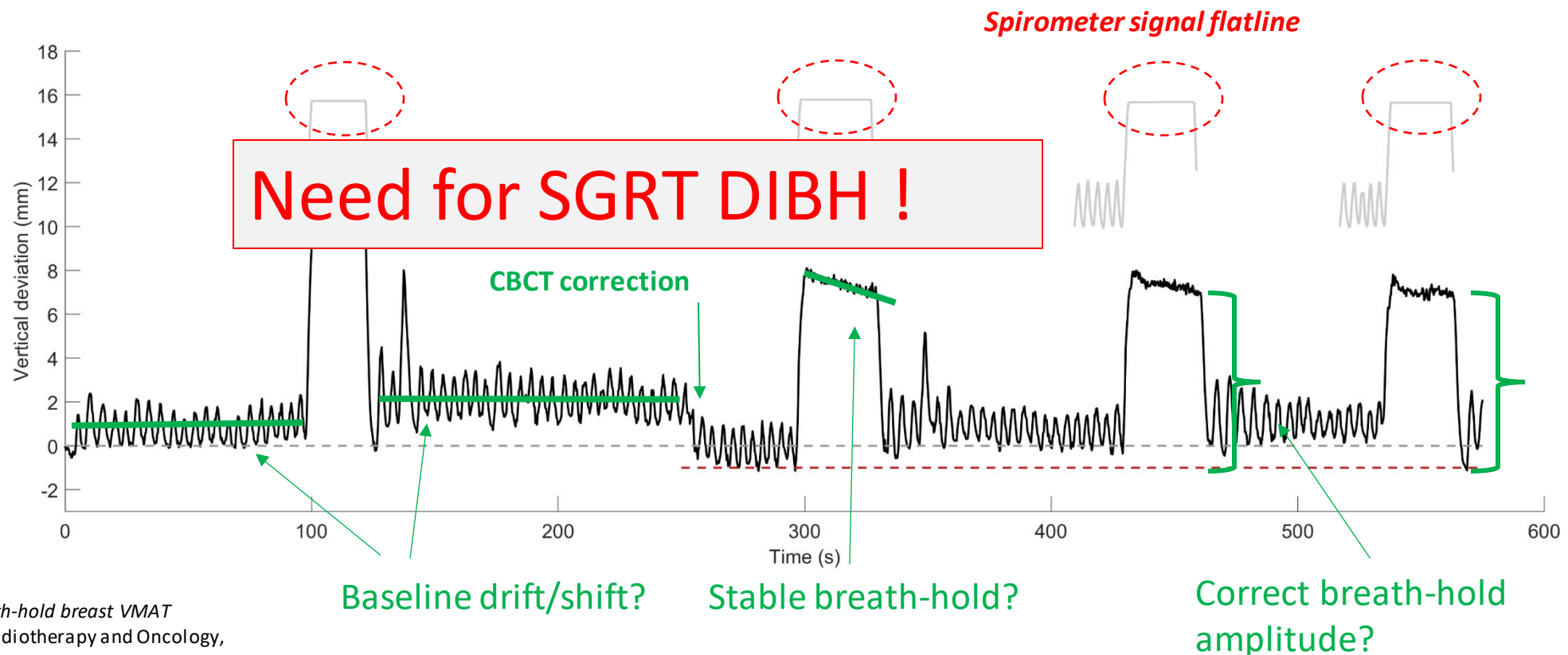
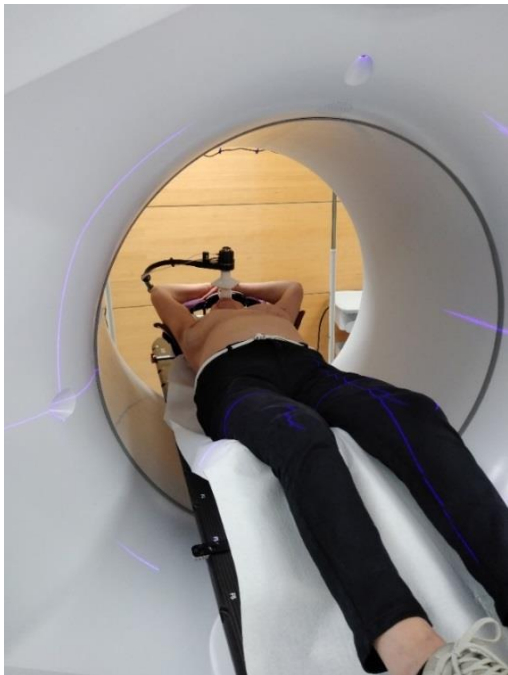


Spirometer does not provide information on position!

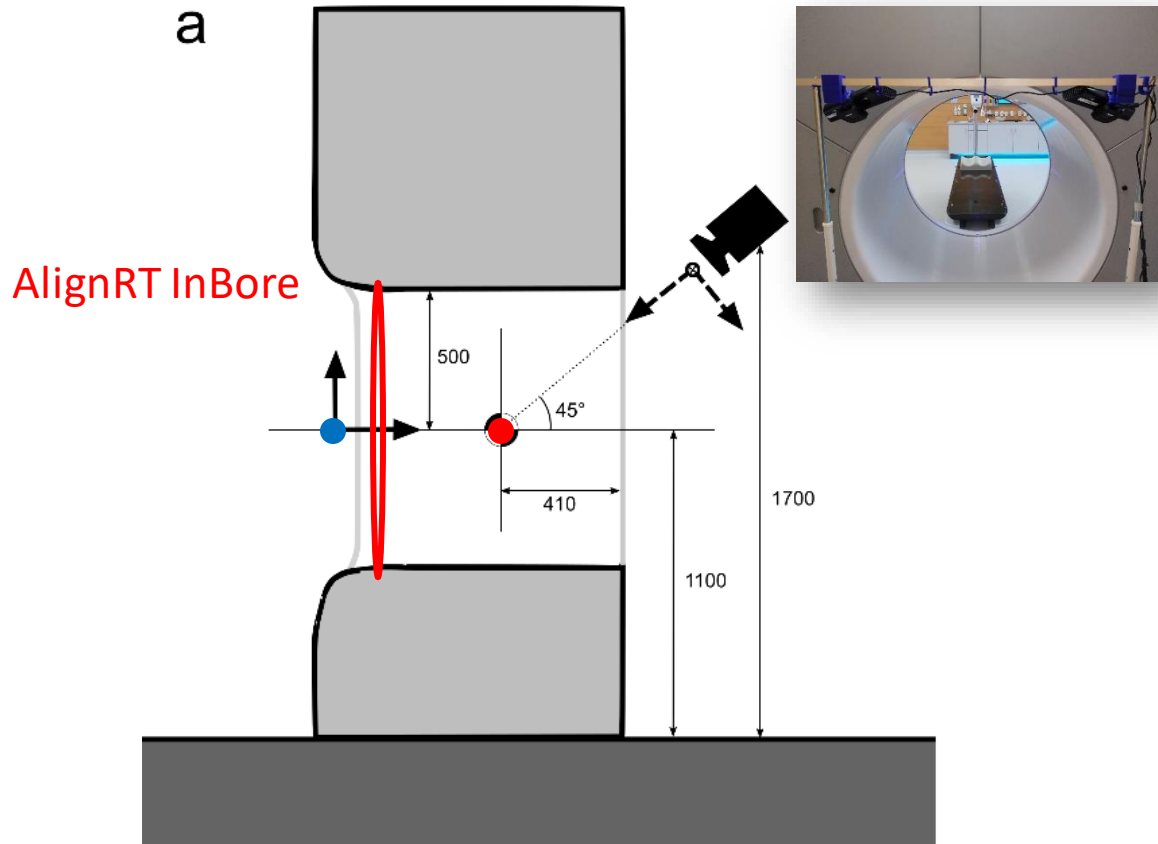


DIBH on Halcyon (spirometer)

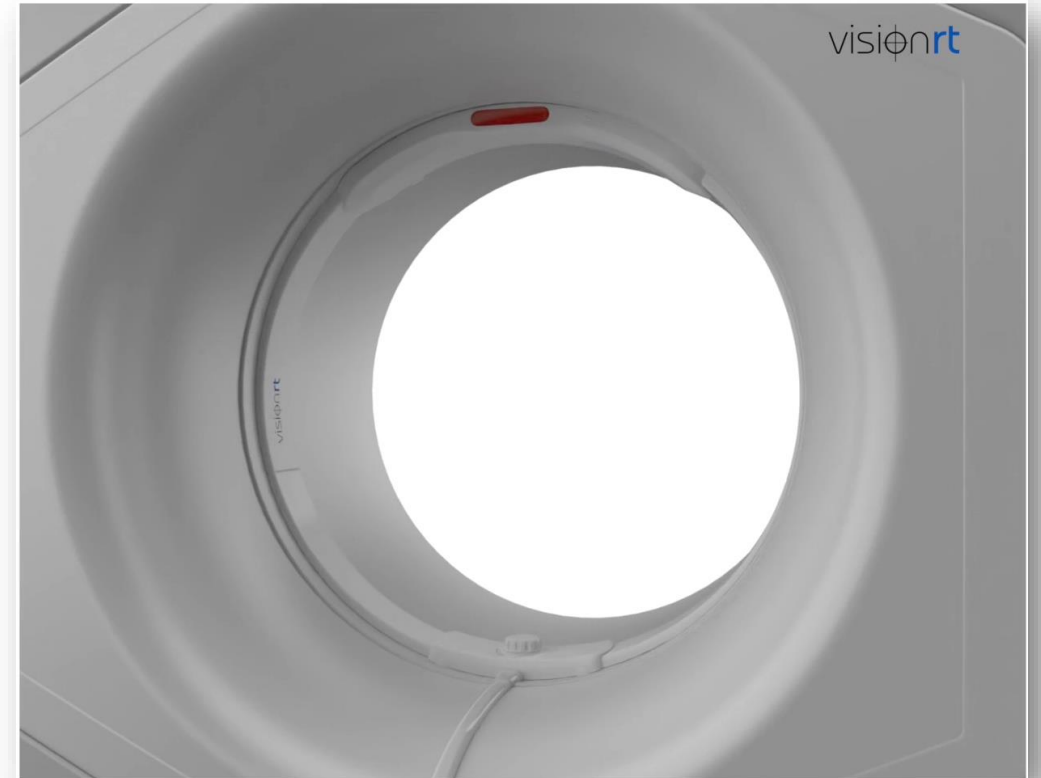
- SGRT monitoring of breath-holds → much more info than spirometer signal!



AlignRT InBore™



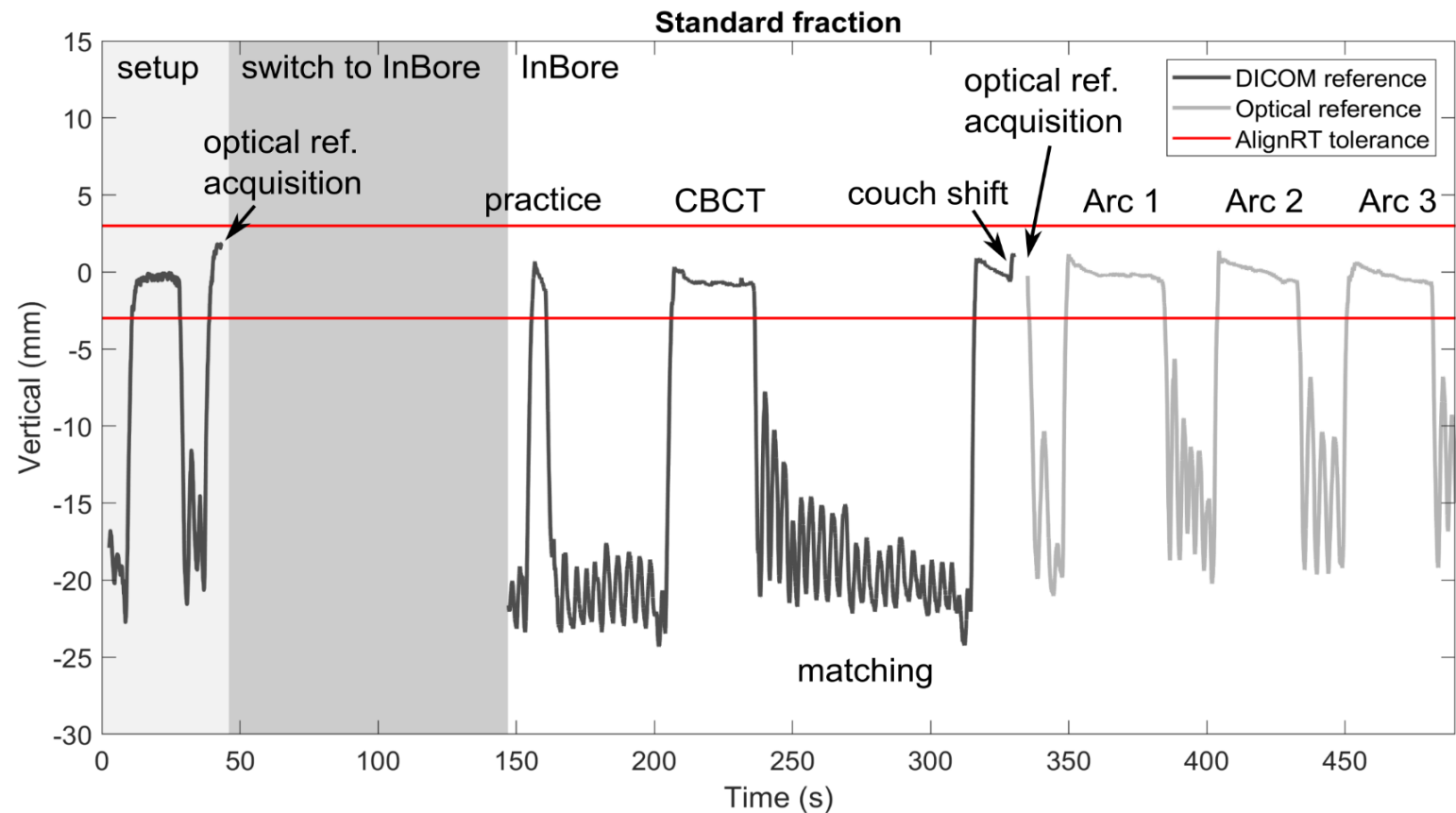
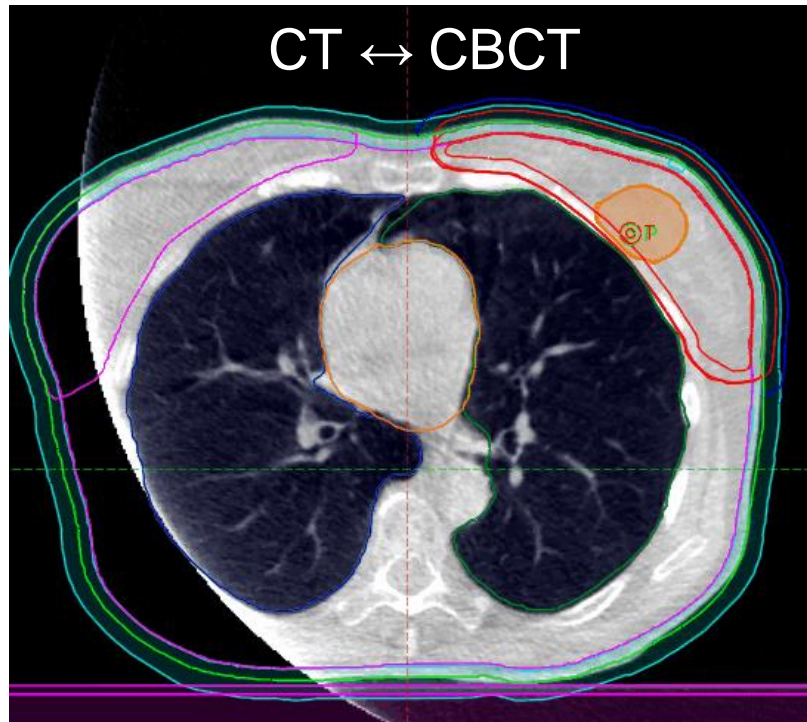
Placed behind bore
Self-shadowing for heavier breasted patients
Adapted system uses 2 cameras



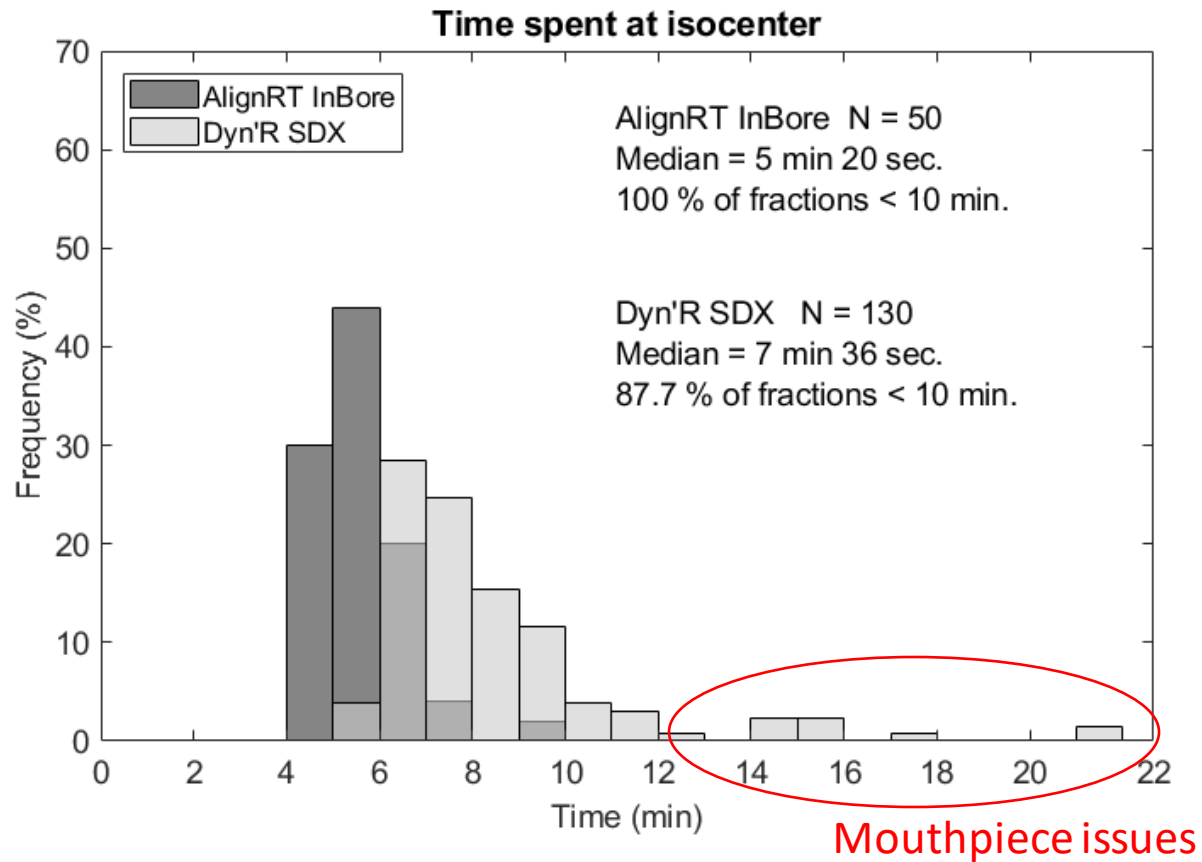
Placed inside bore
Higher incident angle to the surface
Integration with 'out-of-bore' system

DIBH with InBore AlignRT

- InBore installed in May 2021 (two pc system → *switching between setup and InBore*)
- “Fully” surface guided DIBH (identical to spirometer study: 1 CBCT + 3 arc)



DIBH with InBore AlignRT



Total fraction time: median 10 min 18 sec
well within DIBH time slot of 18 min

includes idle time during switching between setup and InBore system

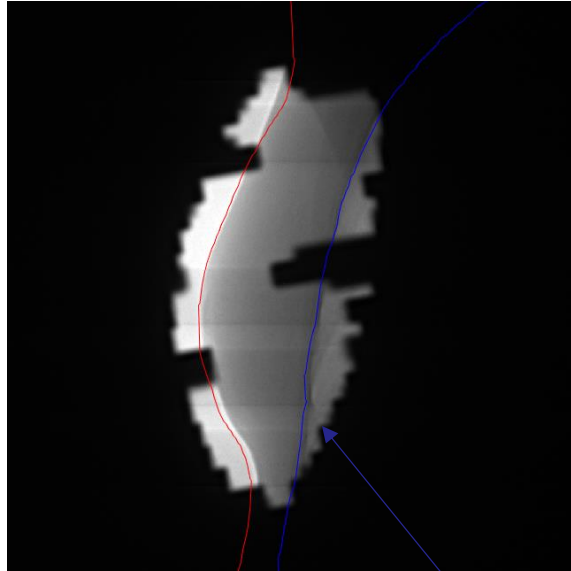
→ mean 2 min 2 sec (removed in v.7)

Avoid 'fiddling' with spirometer consumables

Non-contact!

DIBH with InBore AlignRT

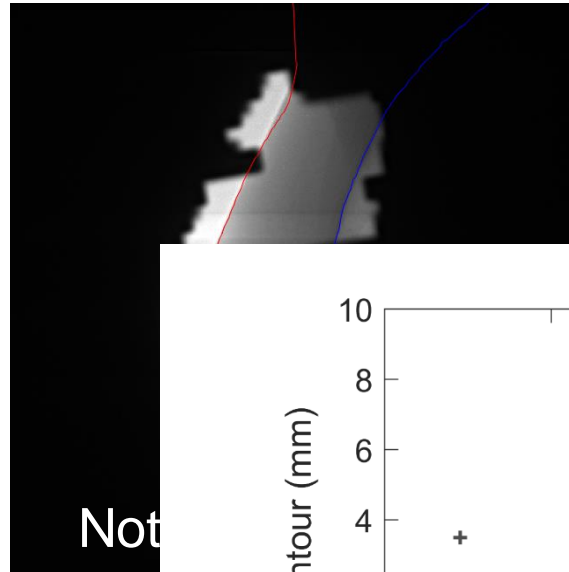
Fx 1



Body contour CT

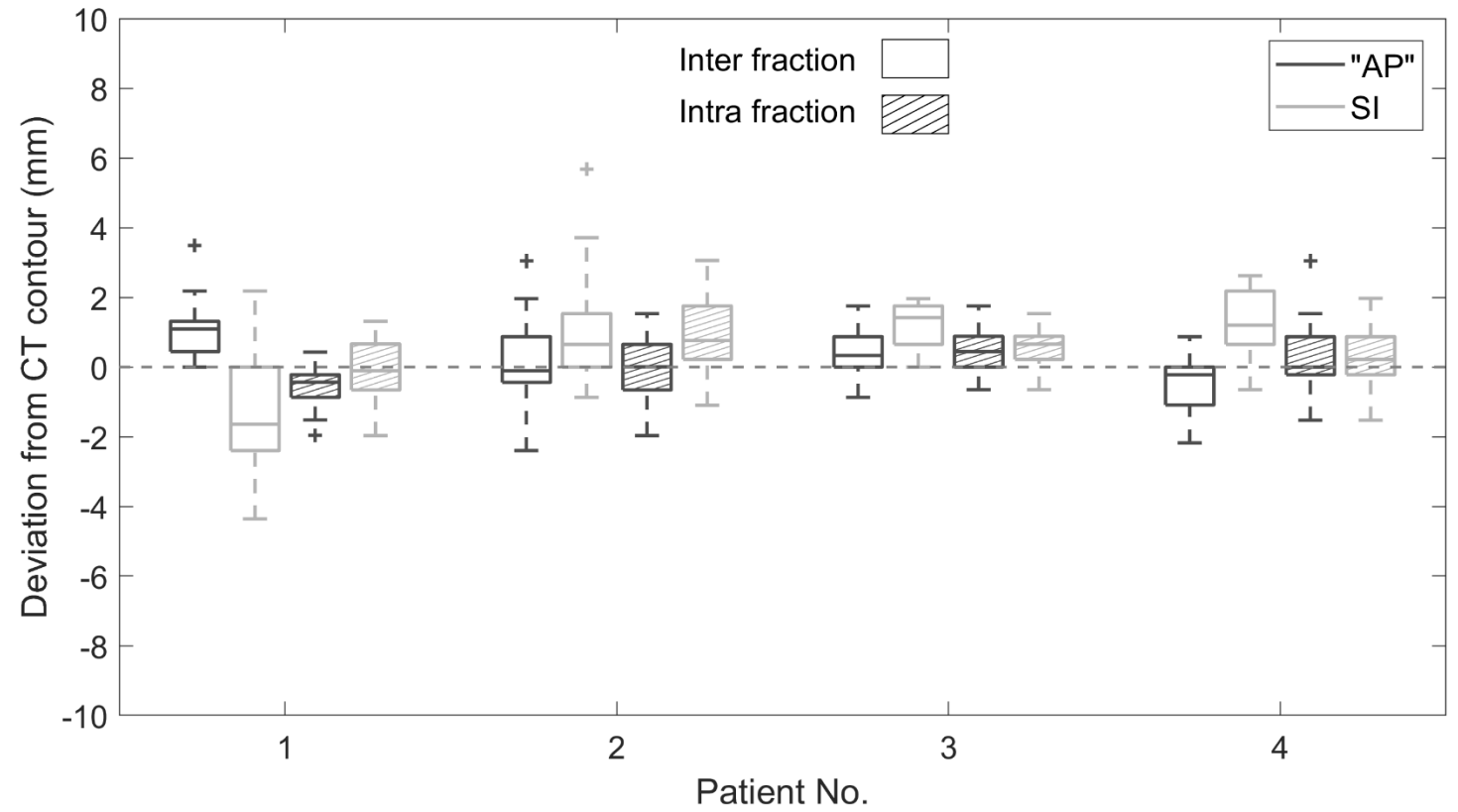
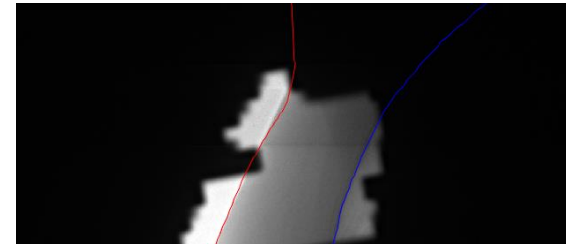
Lung contour

Fx 2



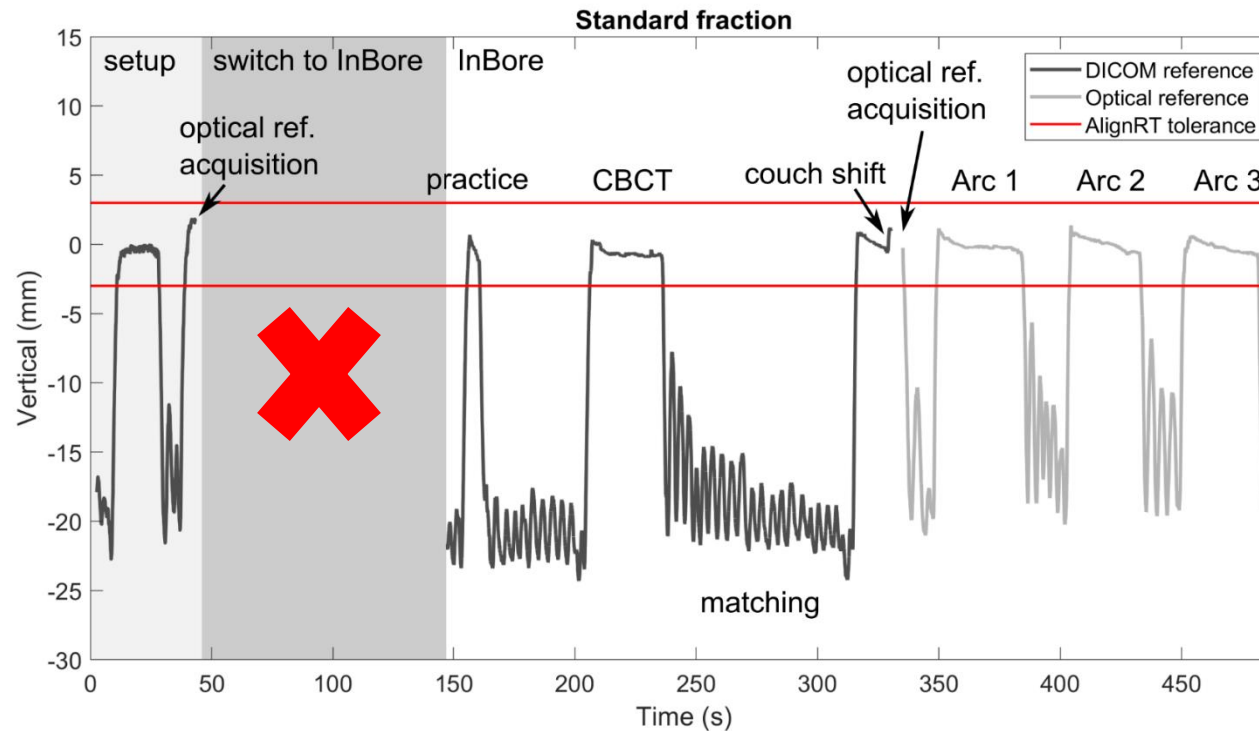
Not

Fx 3

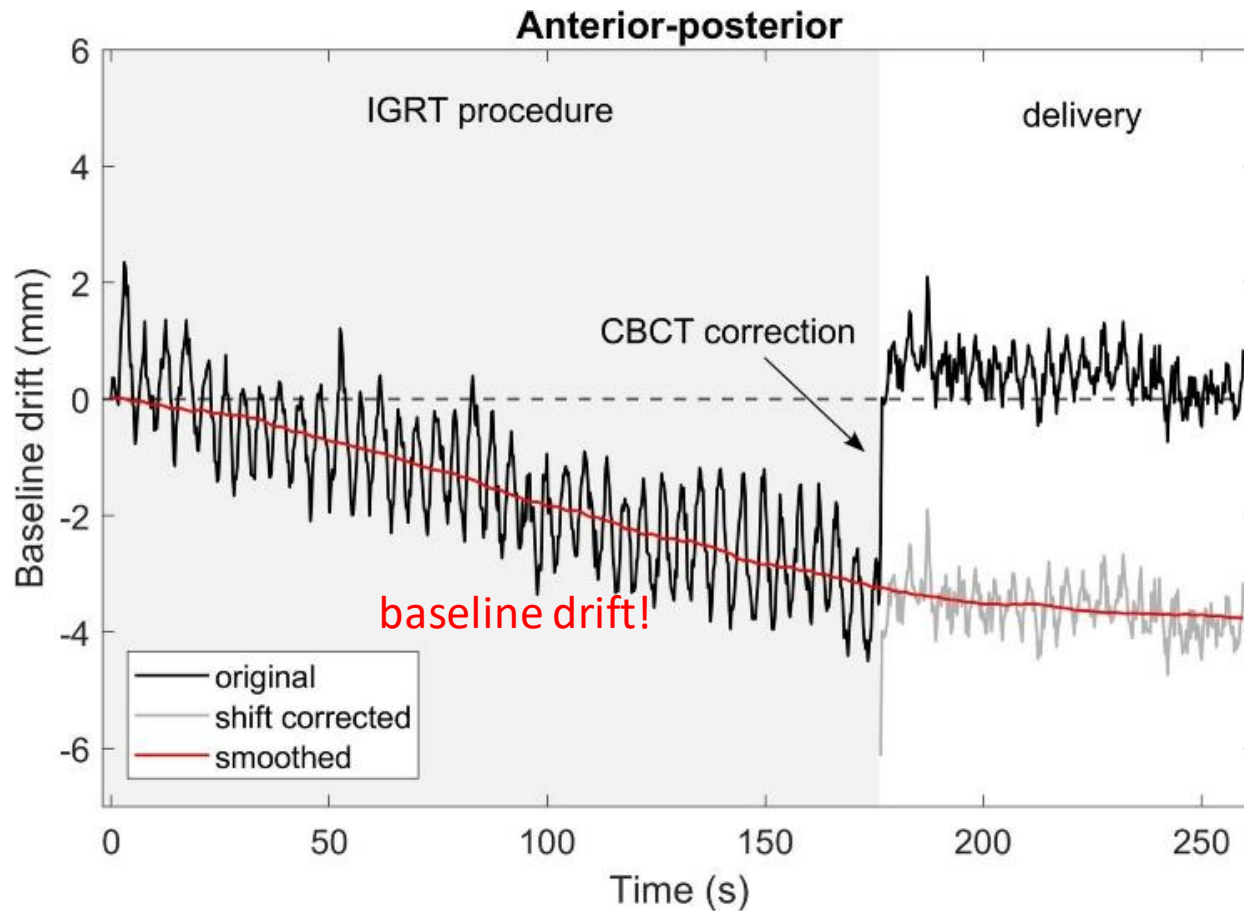


DIBH with InBore AlignRT – future?

- Expand application of DIBH: Breast with nodes, oligometastatic, mediastinal lymphoma
 → *To all sites benefitting from a fast DIBH delivery!*
- AlignRT v7



SGRT is not only useful for DIBH...



Even during short fractions patients move!

Motion during *imaging* becomes more important.