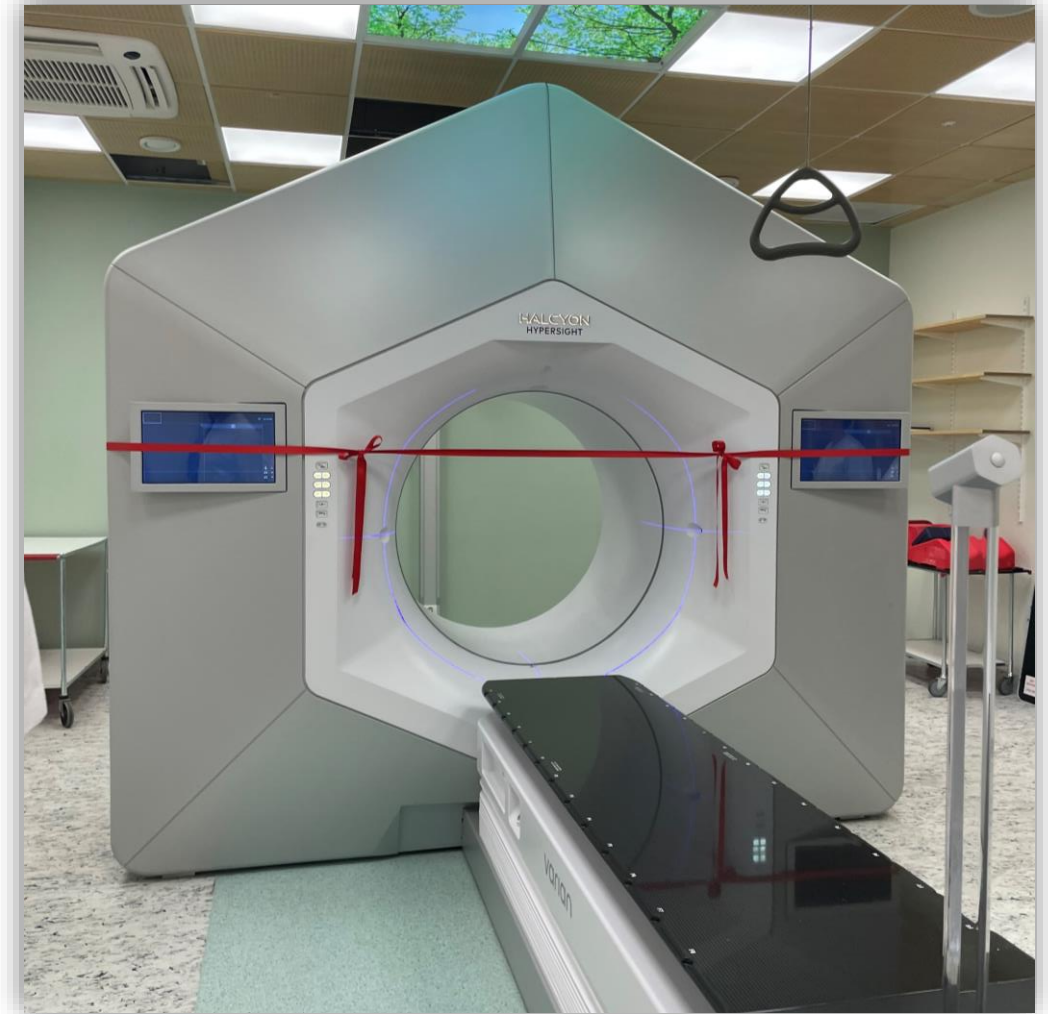# Breast treatments on Halcyon linac

SGRT Nordics 23.05.25
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Haukeland University Hospital

Background

- Haukeland University Hospital has 6 linacs from Varian.
- 4 TrueBeam.
- In February 2024 we installed a Halcyon linac.
  - Our second O-ring linac, the first one is an Ethos.
- With HyperSight imaging.
- With AlignRT InBore.
- Wanted to see what diagnosis could be treated except pelvis.

Breast treatment plans

- We treat breast with hybrid-IMRT on TrueBeam
  - 90% static fields and 10% IMRT.
  - Tangential fields
  - 4-6 fields
- For Halcyon we decided on tangential fields IMRT
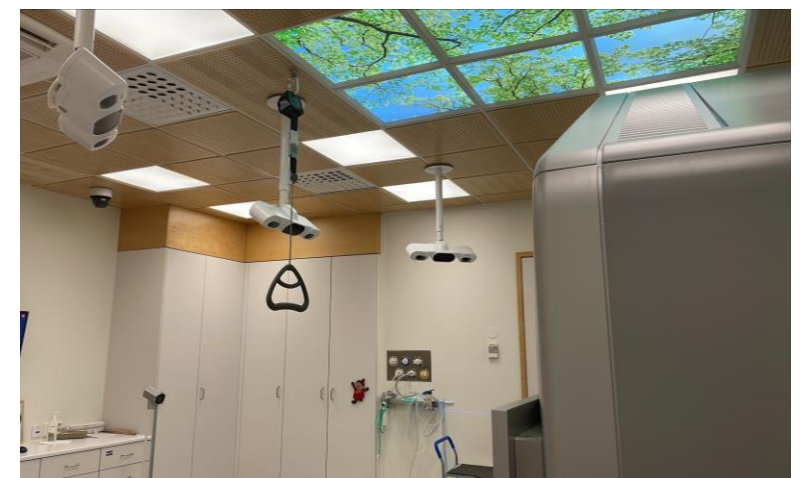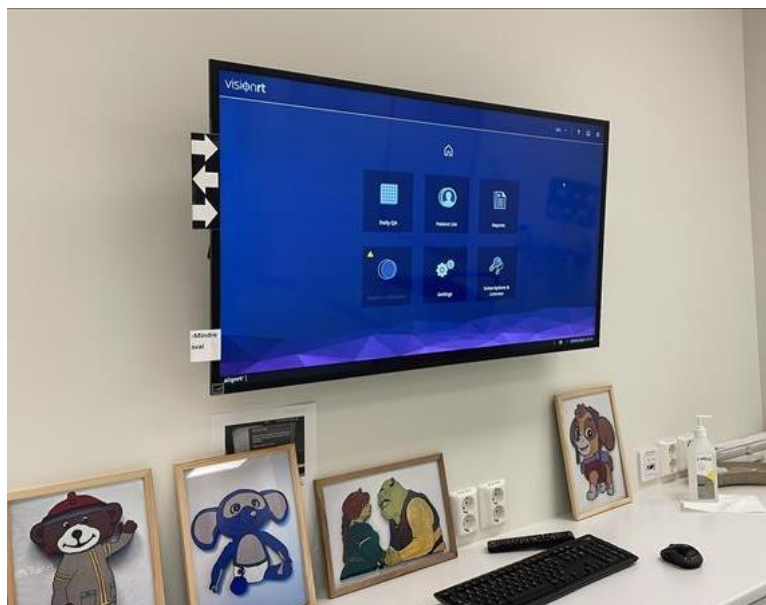 - 4-6 fields
  - Skin Flash Tool
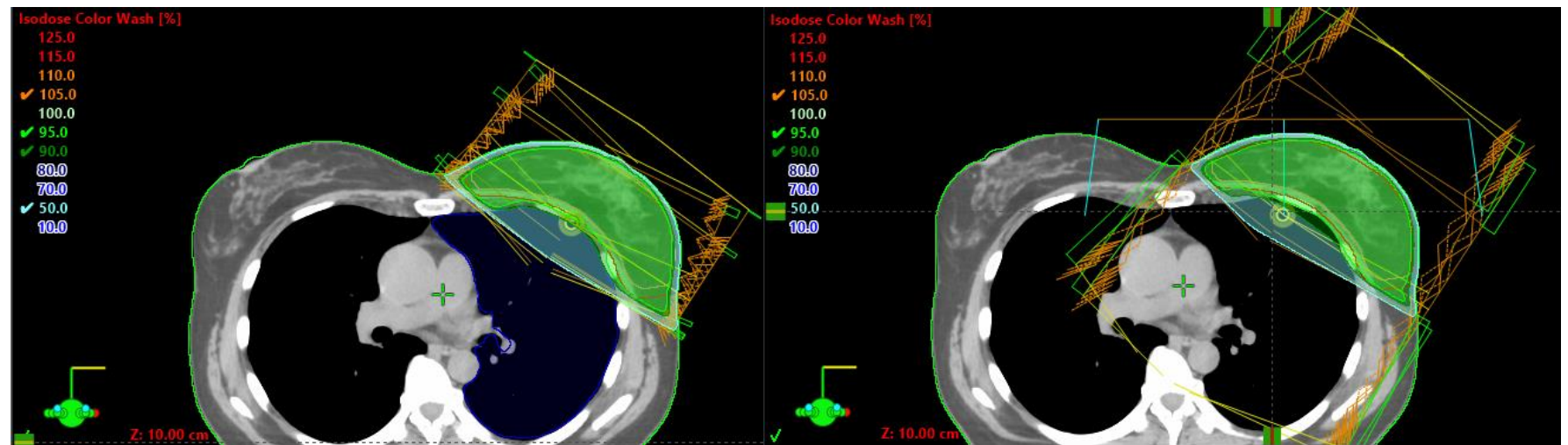
Breast on Halcyon

- October 2024
  - 8 fractions right sided breast: 1 patient
- December 2024
  - 2 fractions DIBH left sided breast:
    3 patients with VisionRT clinical specialist
- January 2025
  - 15 fractions right sided breast: 3 patients
- March-April 2025
  - 15 fractions (almost) DIBH left sided breast:
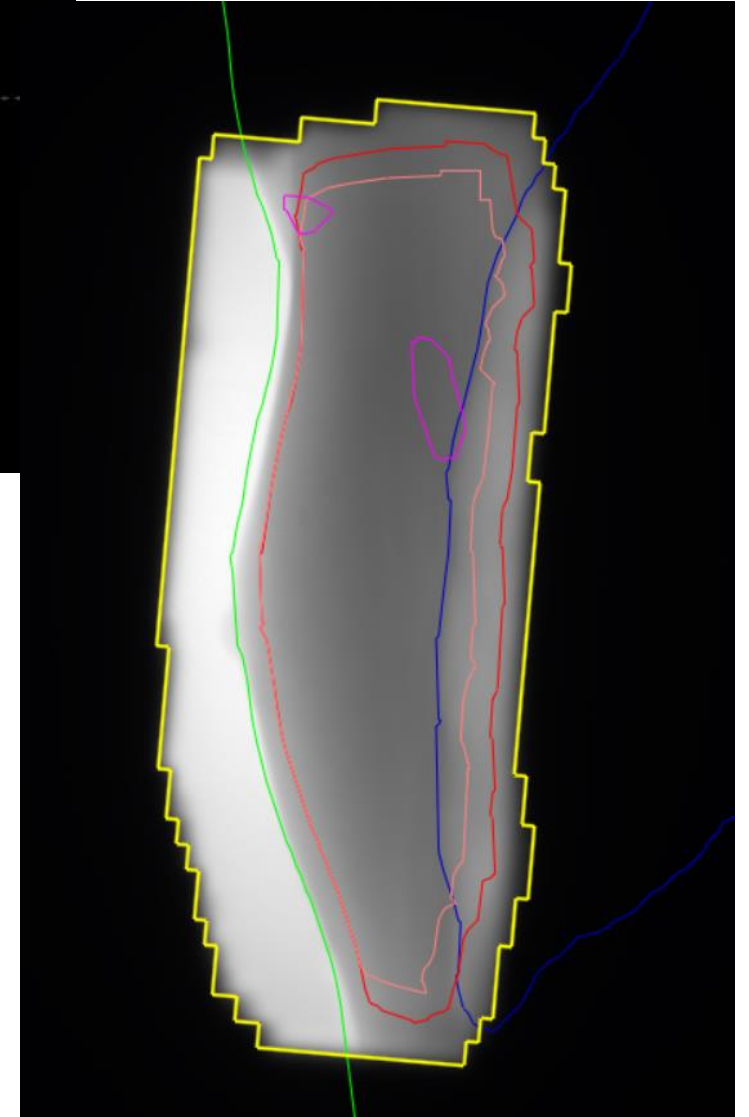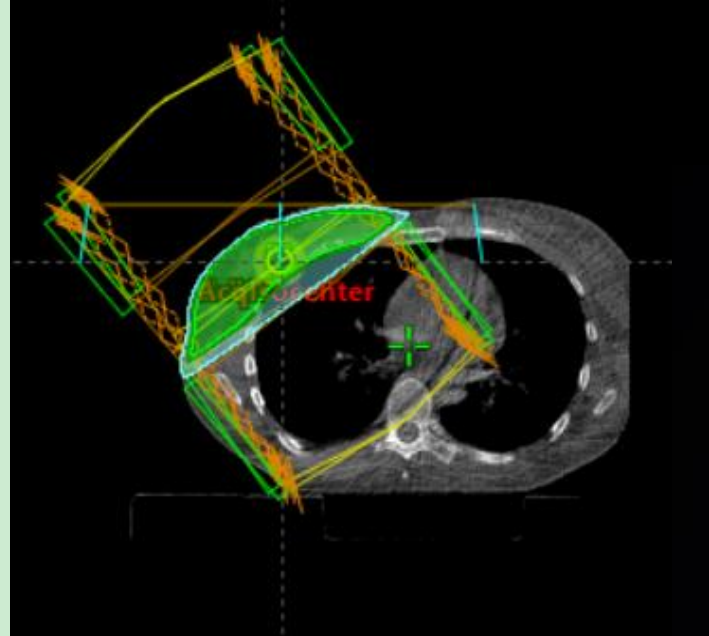   3 patients

AlignRT InBore Set Up

Right sided breast/Free Breathing

- Set up with AlignRT.

- CBCT Breast or CBCT Breast Low Dose.

- New reference on AlignRT for monitoring during radiation.

- Possible to see MV-images online while treating and offline to verify that the breast contour is within the field borders.

Treatment time

- Defined here as time from imaging begins to last treatment field is given.
- From ARIA/RT Summery.
- Average and standard deviation in table.
- 3-7 minutes – 4 minutes 30 seconds.
- Comparable with treatment times for TrueBeam.

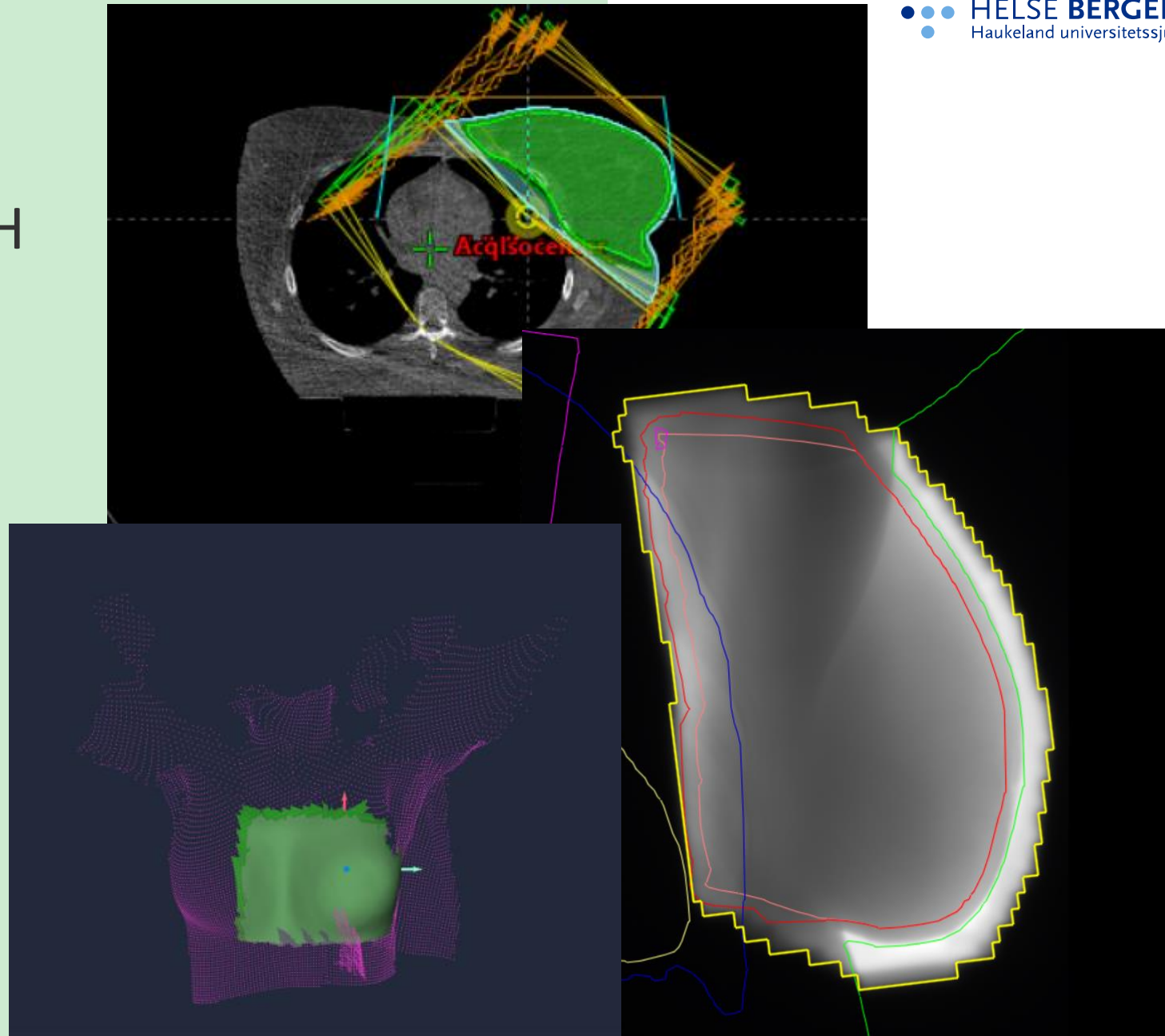|	Halcyon (s)	TrueBeam (s)
Patient 1	281 ± 63	254 ± 58
Patient 2	276 ± 48	288 ± 64
Patient 3	260 ± 49	246 ± 54

Average online matched values CBCT

- Values from Offline Review.
- Average and standard deviation.
- Couch shift from starting point to online matched.
- 3 mm in VRT – indication of patients "sinking" between positioning and imaging.
- No "Send to couch" to correct for this from treatment console.
  - If you wanted to correct you would need to drive patient to set up isocenter, correct and then move back to treatment isocenter.

	VRT (mm)	LNG (mm)	LAT (mm)
Average	3 ± 1,5	-1 ± 1,8	-0,5 ± 2
Max	6	2	3
Min	-1	-6	-5

Left sided breast/DIBH

- Set up with AlignRT and test breath hold with set up camera.

- Drive patient to treatment isocenter and verify similar VRT-value for treatment camera.

- CBCT Breast before treatment.

- New reference after match and only turn on beam when deltas are within tolerance.

- If during beam delivery deltas turn red, pause beam and tell patient to breath out. Coach patient back to breath hold and resume beam delivery.

- Possible to see MV-images online while treating and offline to verify that the breast contour is within the field borders.

- Post-CBCT for 5 fractions.

Treatment time

- Defined here as time from CBCT begins to last treatment field is given.
- From ARIA/RT Summery.
- Average and standard deviation in table.
- 4-9 minutes – 6 minutes
- TrueBeam only 1-2 fractions for each patient.
  - Patient 3 took multiple kV-images for one fraction.

	Halcyon (s)	TrueBeam (s)
Patient 1	307 ± 34	305 ± 1
Patient 2	362 ± 54	455 ± 0
Patient 3	400 ± 60	666 ± 319

Average online matched values CBCT

- Values from Offline Review.
- Average and standard deviation.
- Couch shift from starting point to online matched.
- No "Send to couch" to correct for "sinking" from treatment console.
  - If you wanted to correct you would need to drive patient to set up isocenter, correct and then move back to treatment isocenter.

|	VRT (mm)	LNG (mm)	LAT (mm)
Average	2,3 ± 1,2	-3,3 ± 1,2	0,3 ± 1,6
Max	5	4	4
Min	0	-9	-3

Average online matched values post-CBCT

- Suggested couch shift after treatment.
- Average and standard deviation in table.
- Translation values from Offline Review.
- Rotational values noted down by RTT from match on Halcyon.

|	VRT (mm)	LNG (mm)	LAT (mm)	ROT (°)	PITCH (°)	ROLL (°)
Average	0 ± 1,5	0,6 ± 1,7	1,2 ± 0,9	0,1 ± 1,1	0,1 ± 0,7	0,1 ± 0,8
Max	3	3	3	2,2	1,1	2,0
Min	-3	-3	0	-2,0	-1,2	-1,0

Distance from spine to sternum

- Deviation from pre-CBCT to post-CBCT
- Patient 1 tended to have larger spine to sternum distance at post-CBCT – indicating she took a deeper breath hold.
- Patient 2 and 3 tended to have smaller spine to sternum distance at post-CBCT – indicating a shallower breath hold than at pre-CBCT.
- Small deviation all over and well within tolerance.

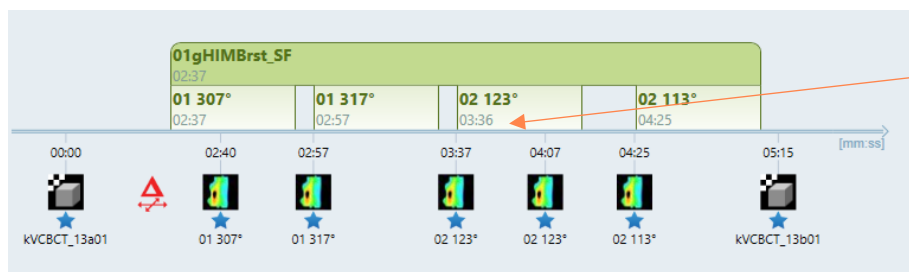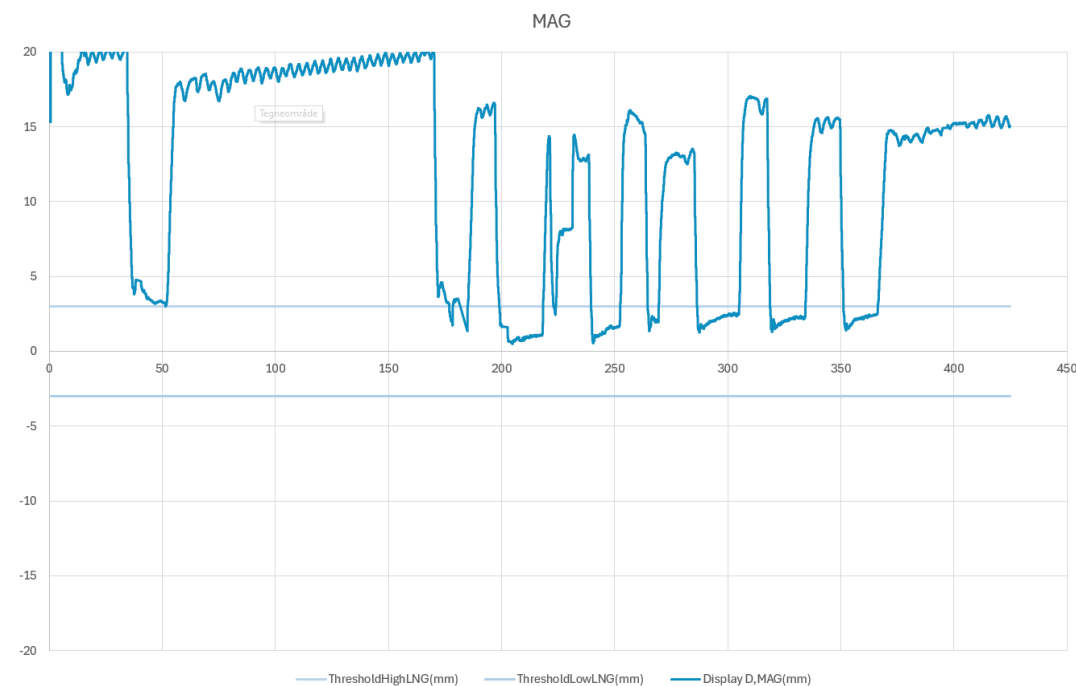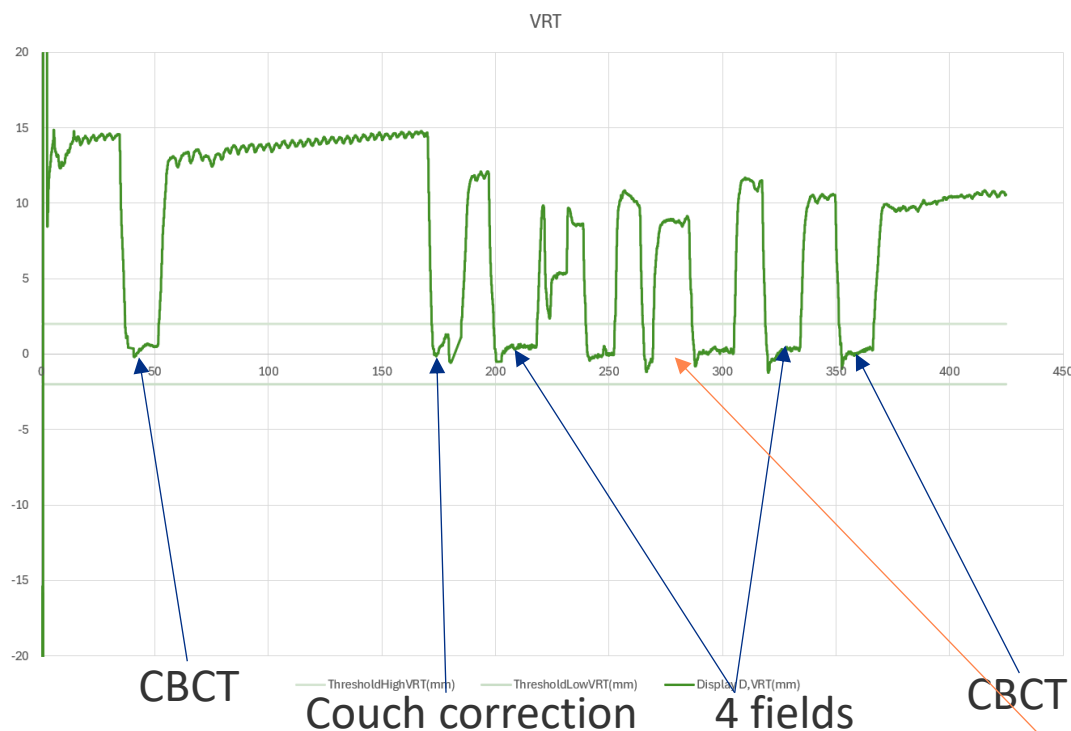|	Average difference (mm)
Patient 1	-0,5 ± 0,3
Patient 2	0,8 ± 0,8
Patient 3	1,5 ± 1,0
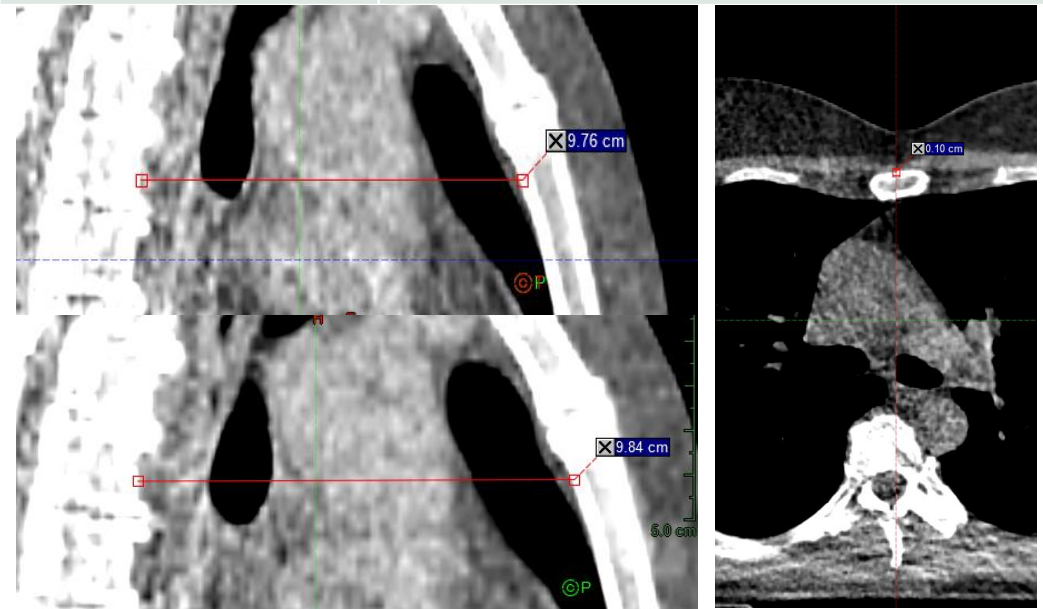
Data from AlignRT InBore, patient 2 fx. 15
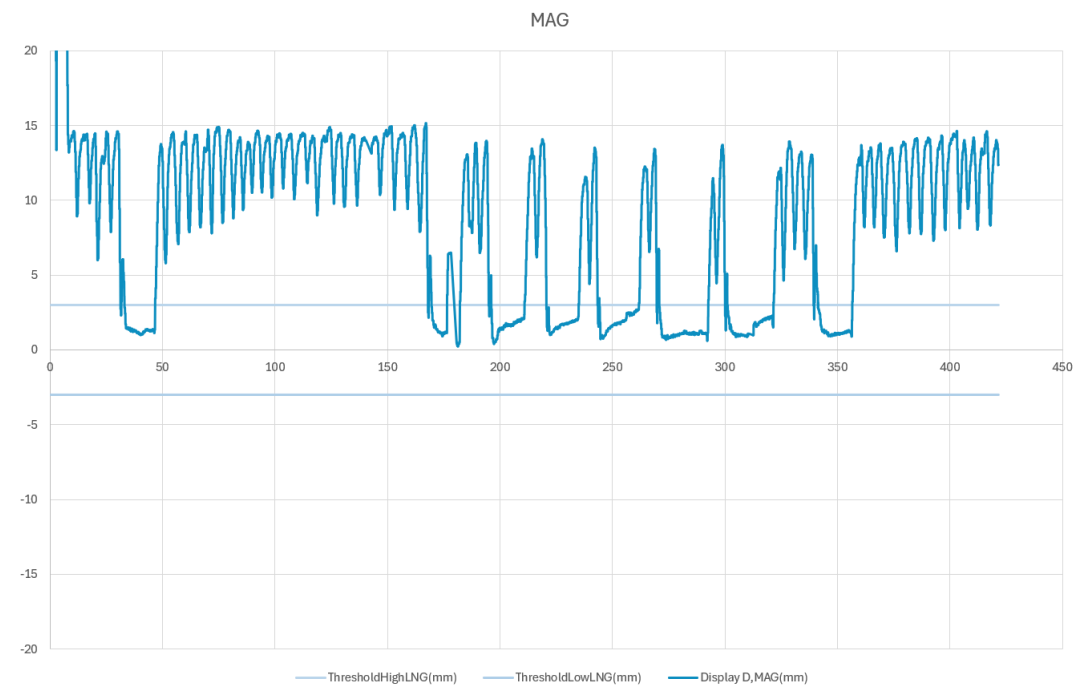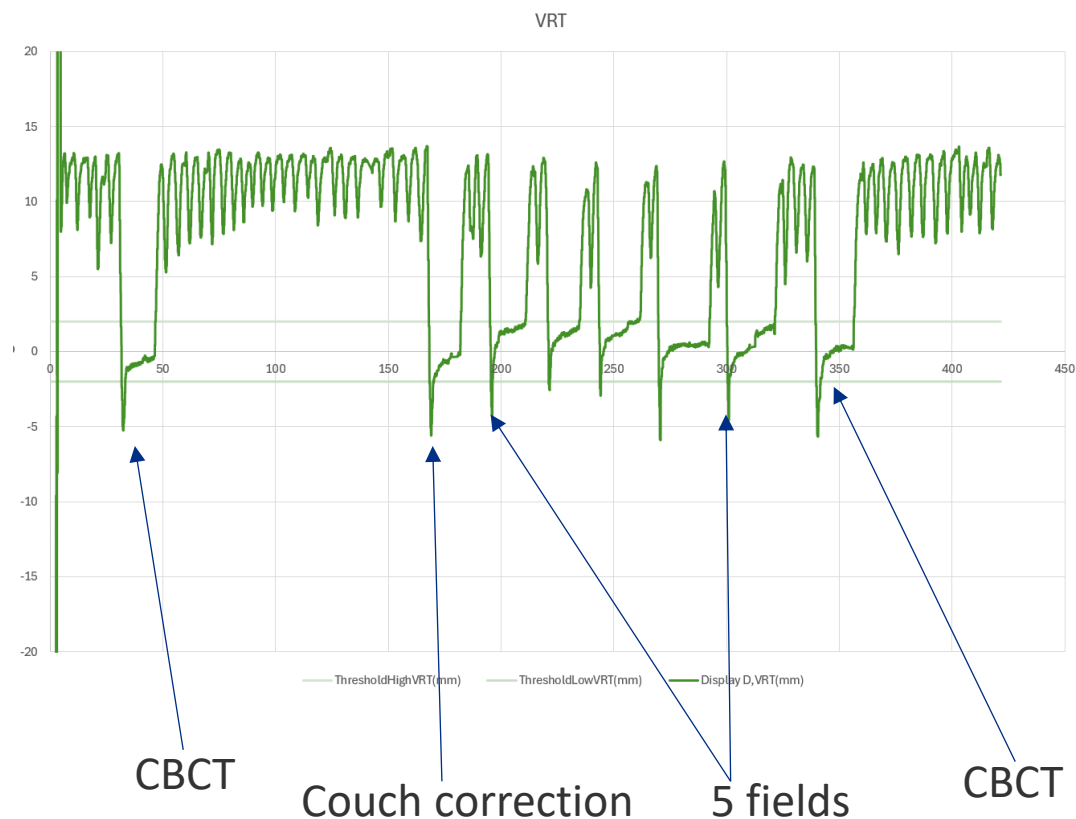
Patient who overshoots but stabilizes at correct VRT-value after less then a second. Does the same for imaging and treatment.

Data from AlignRT InBore, patient 1, fx. 14

VRT

MAG

CBCT

Couch correction

4 fields

CBCT

01gHIMBrst_SF

2 MV-pictures for field 02 indicates the RTT stopped the beam and resumed after ~30 seconds. Correlates well with data from AlignRT.

Personnel perspective

- If AlignRT InBore or Halcyon is down/can't treat we currently need to use a TrueBeam.
- No Beam Hold makes it a bit more of a challenge.
  - Not every RTT is comfortable with the workflow yet.
- Because you need to go back to set up isocenter it can be time consuming if you need to correct for "sinking", arm position etc.
- No problem that the couch is 3DoF, used to only doing correction in 4DoF historically.
- No issues with blocking or poor signal for the cameras as sometimes is the case on TrueBeam.
- Similar time slot needed.
- CBCT is easier without the risk of collisions.

Patient perspective

- A couple of patient has mentioned that they prefer the treatment on Halcyon.
  - Most do not have an opinion either way.
  - One patient wanted to continue on Halcyon after she was scheduled to go back to TrueBeam.

Thank you for listening!

- Thanks to
  - Aurora and Anna
  - RTTs on Halcyon
  - Dose planners
  - Katja and VisionRT