REACHING NEW HEIGHTS WITH SGRT

SURFACE GUIDED RADIATION THERAPY
SGRT COMMUNITY

Improving Plan Quality & Safety Using Surface Guided Planning and Dose Visualization

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AdventHealth Celebration

AdventHealth

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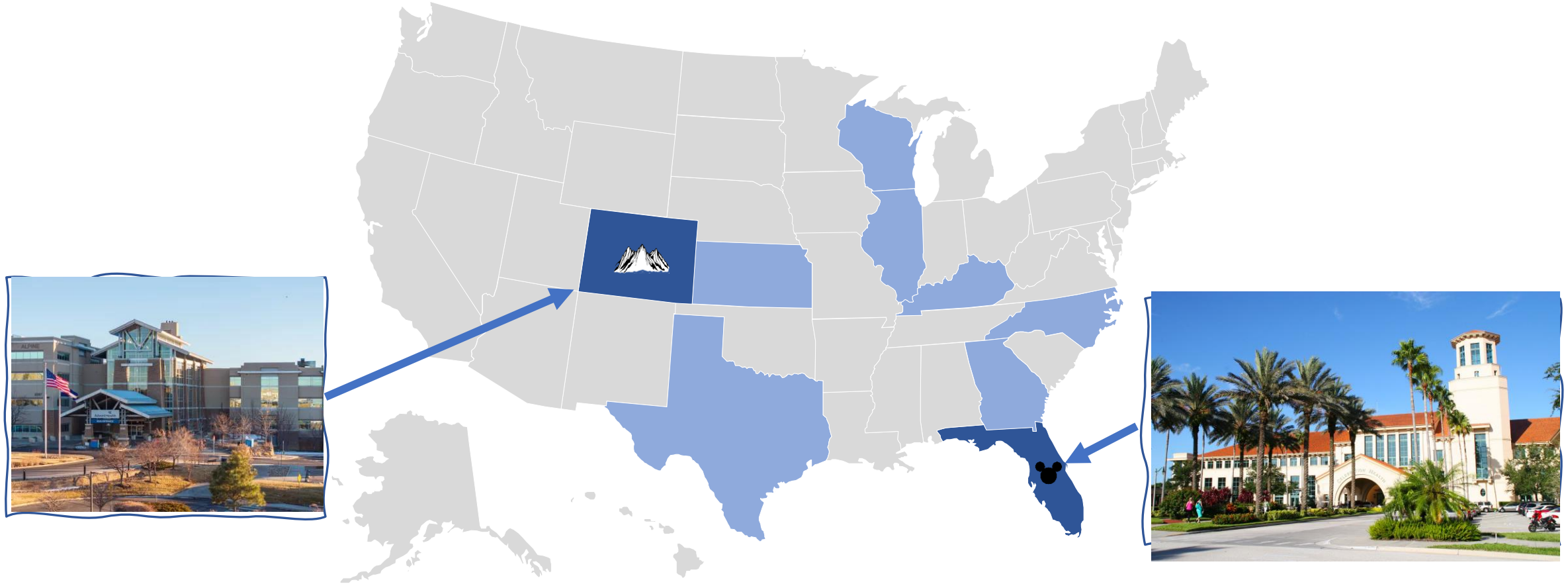
Disclosures

- AdventHealth Celebration has a COE agreement with VisionRT
- AdventHealth Parker has a PSA agreement with VisionRT

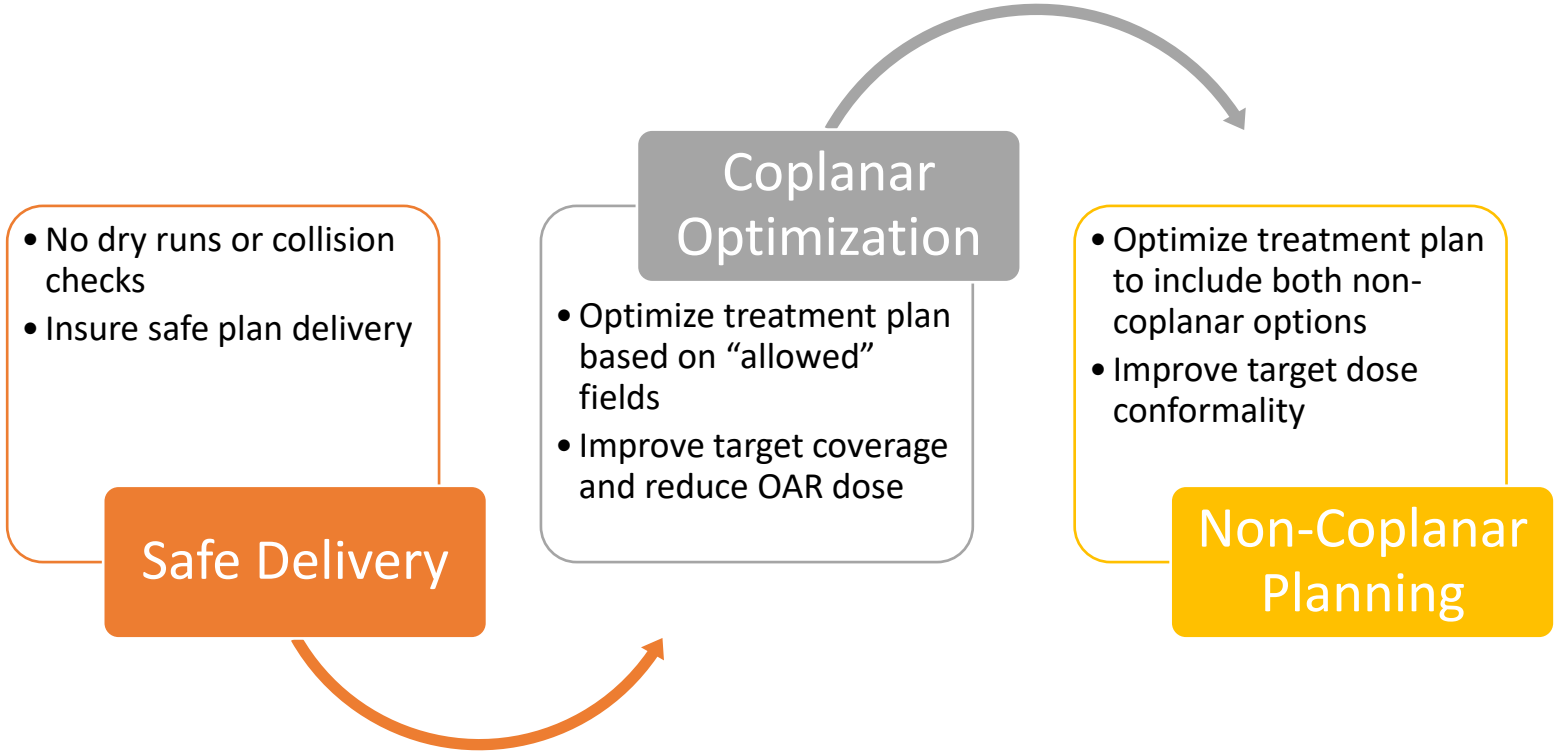
AdventHealth Hospitals



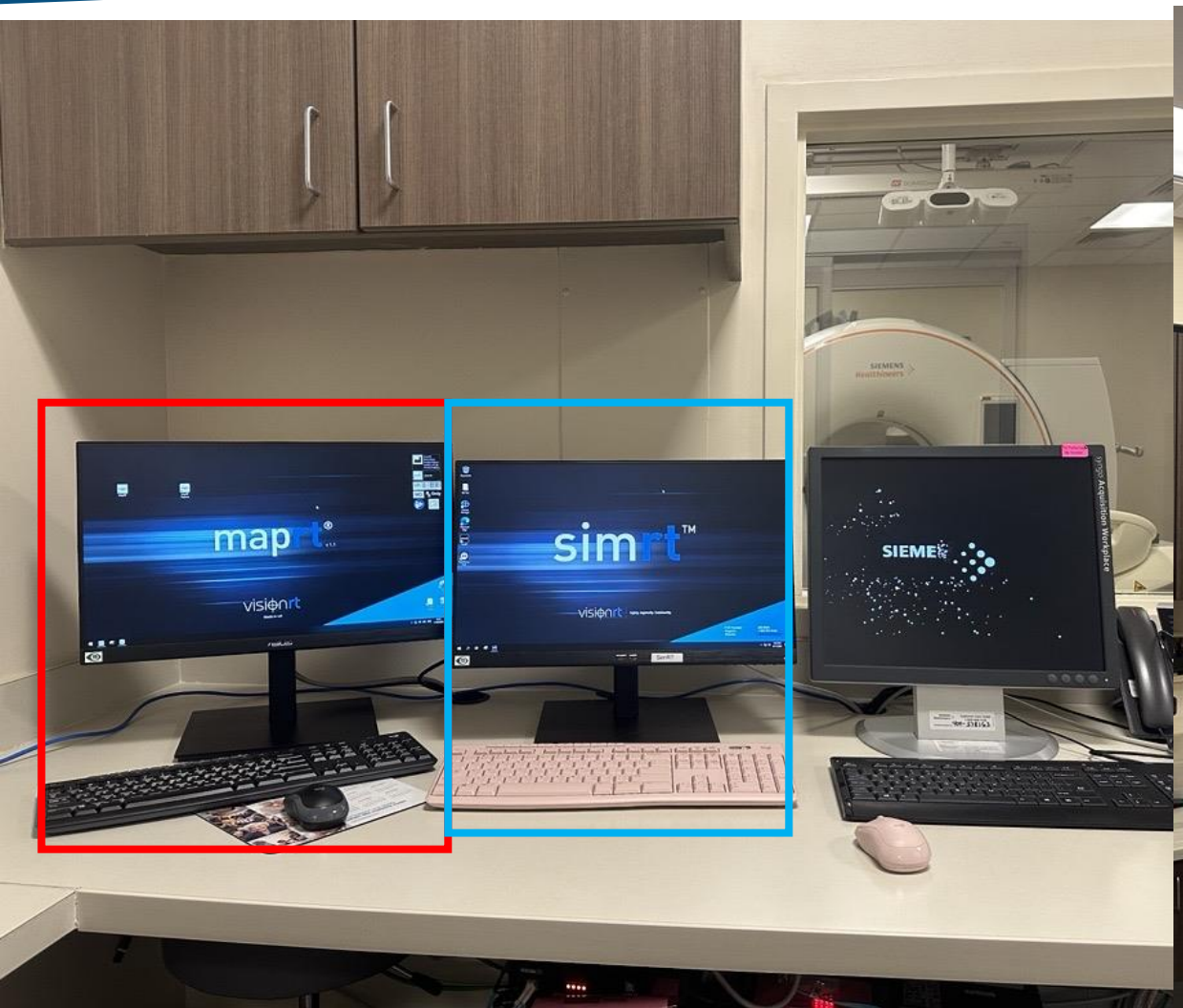
Surface Guided Planning

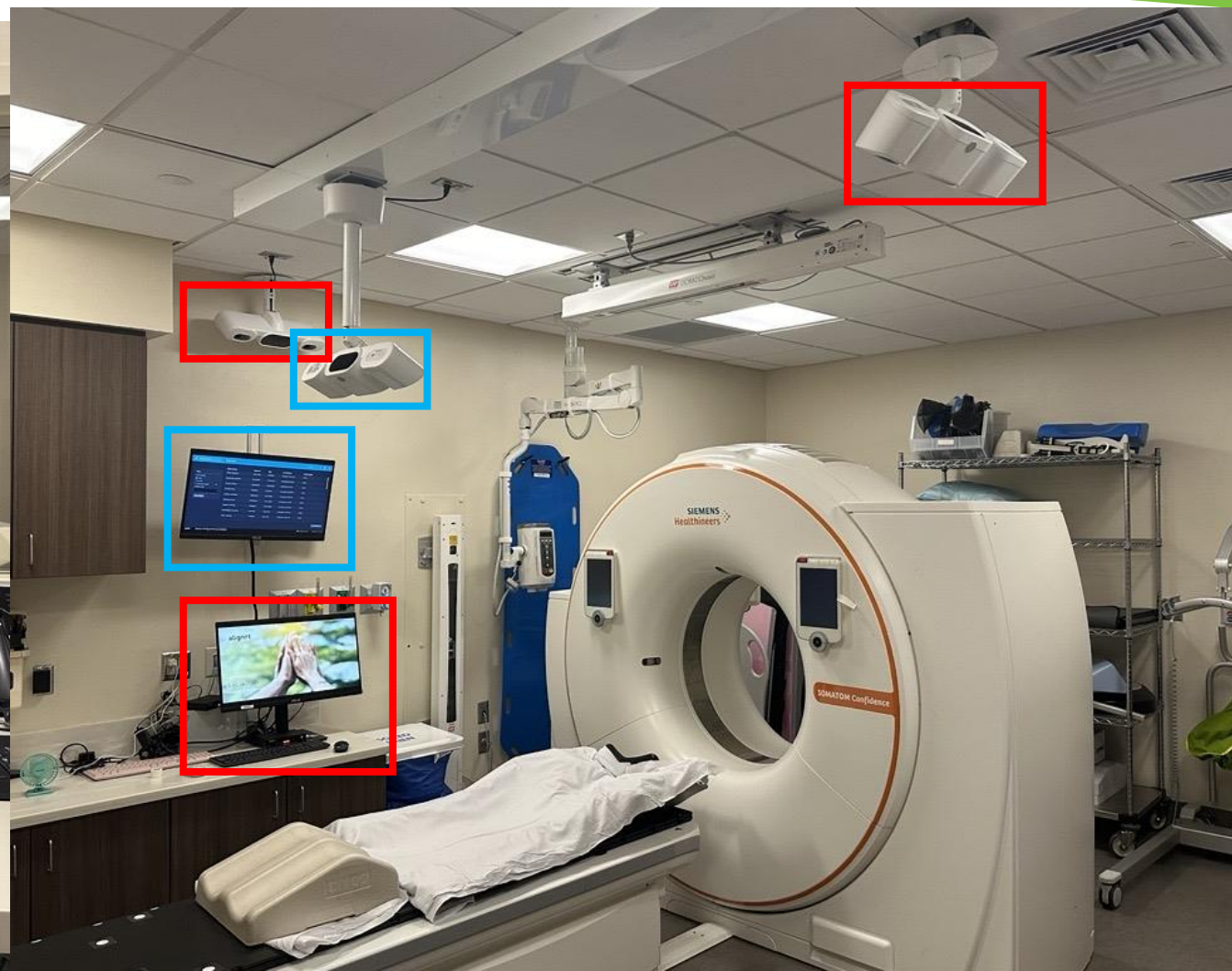
Surface guided Planning with Clearance Mapping

- From day 1, ensure safe plan delivery and reduce physical collision checks
- Introduce plan optimization based on the clearance map
  - Coplanar planning
  - Non-coplanar planning



The Simulation Room





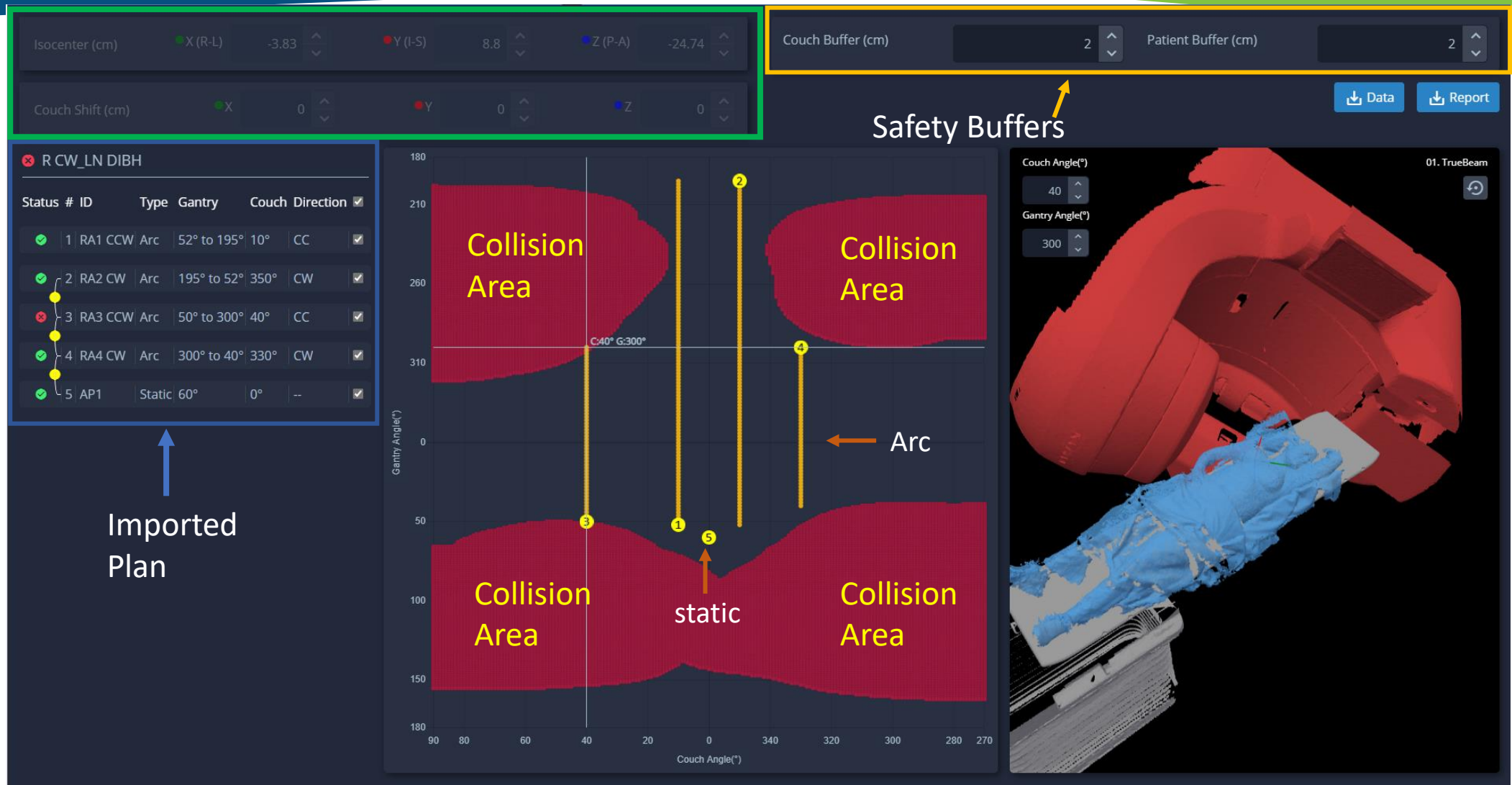
The Clearance Map

Iso location and couch shift

Passing Field

Colliding Field

Potential transition collision

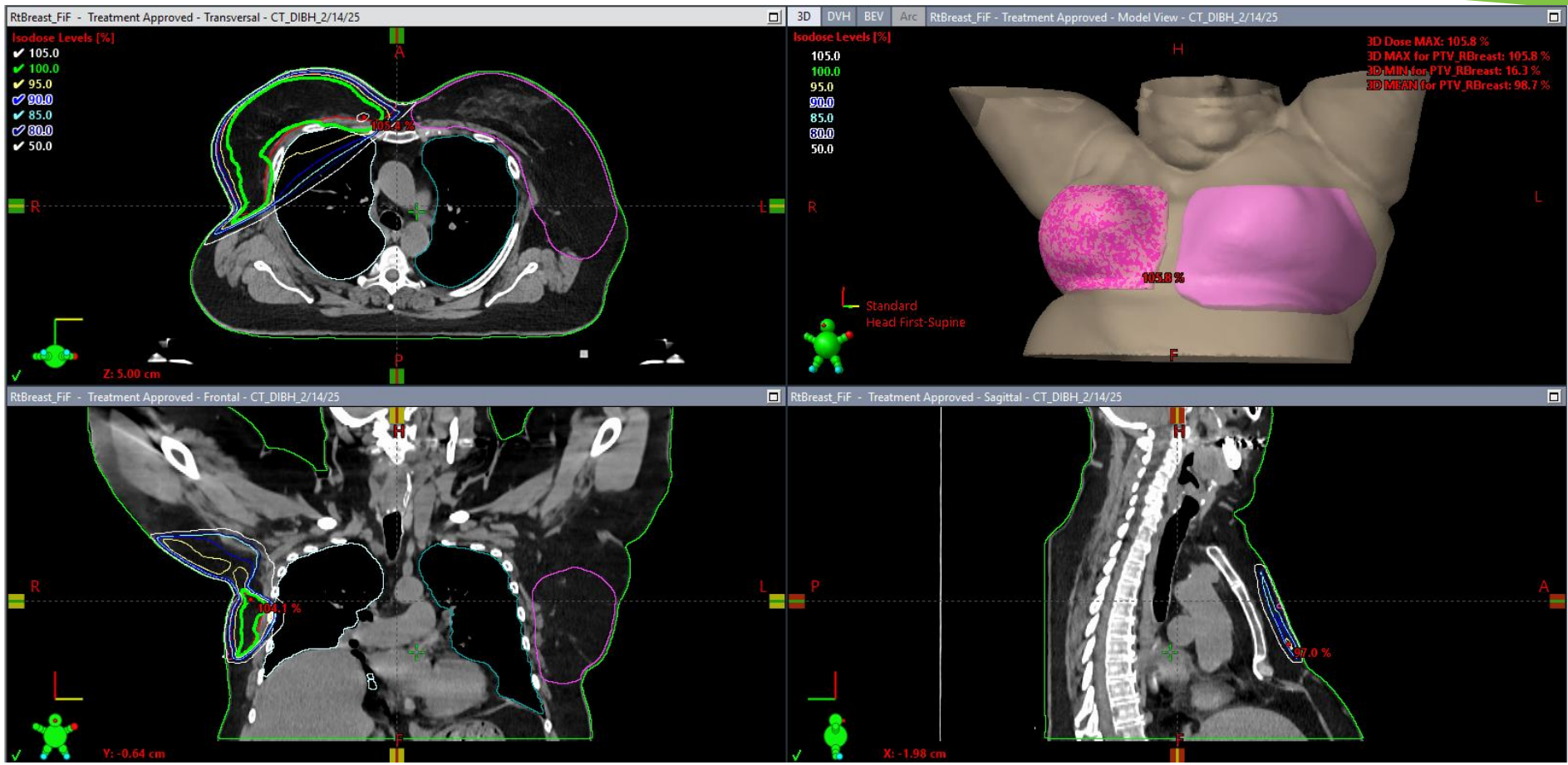


Surface Guided Planning Workflow

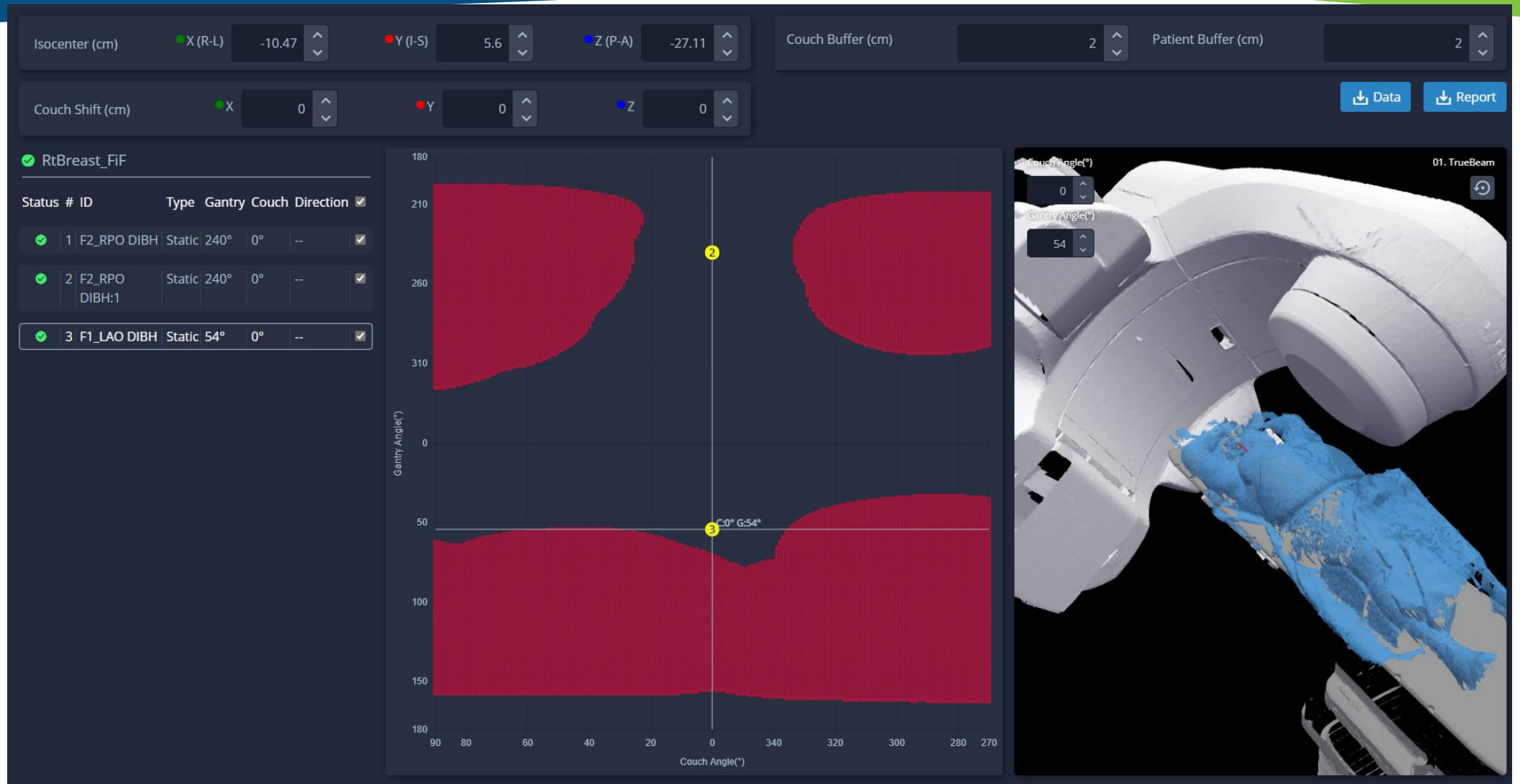
- In the CT sim room
  - Capture surface prior to CT sim
  - Check for collisions
  - Adjust patient position or immobilization device accordingly.
- Treatment Planning
  - Use clearance map to optimize the plan
- Treatment
  - Plan can be safely delivered

Case Study: Rt Breast

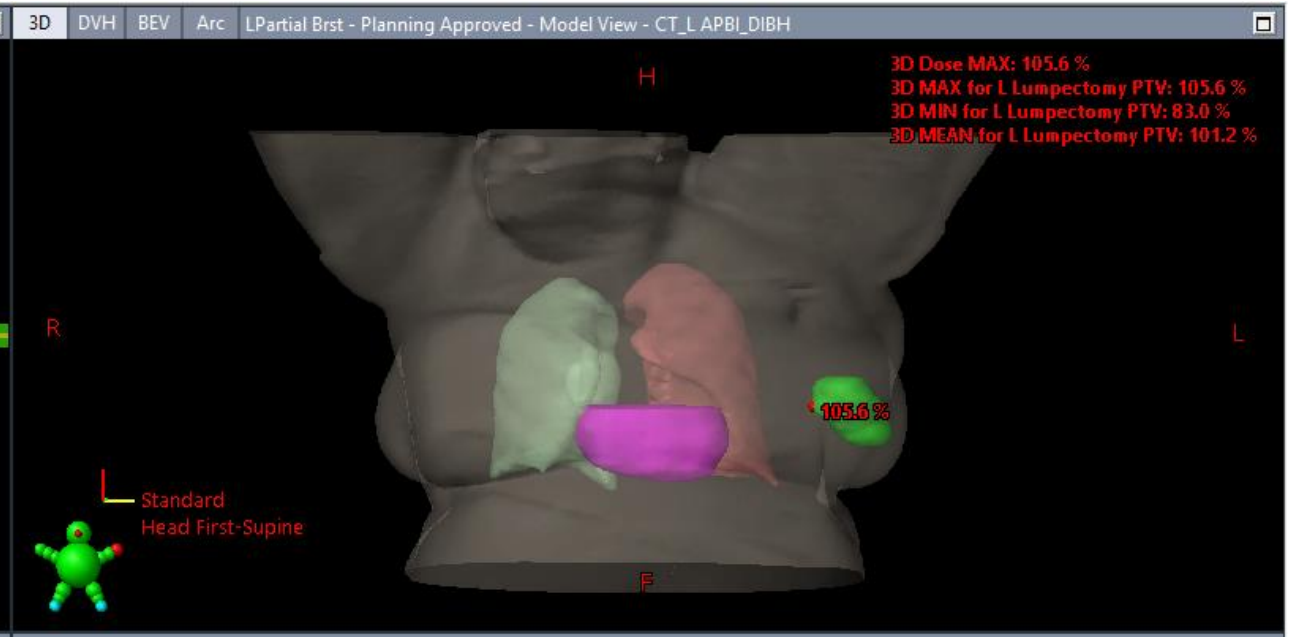
- 69 year old female with malignant neoplasm of the upper-inner quadrant of the right female breast



Rt Breast Clearance Map



Case Study: Lt APBI

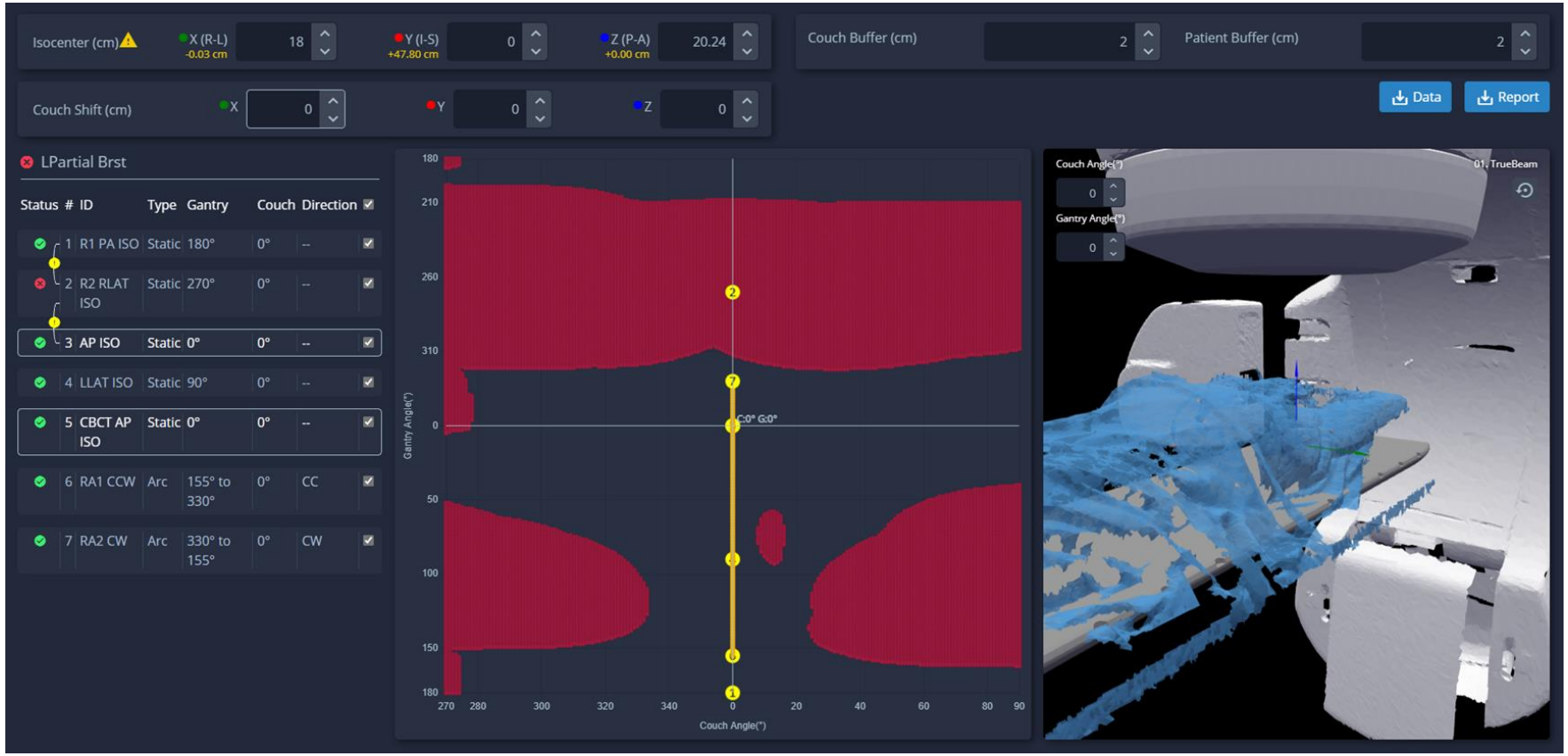


- 75-year-old female with malignant neoplasm of the central portion of the left breast
- VMAT DIBH plan, 267cGy x 15 fractions

Standard Approach to APBI

- 2 Field VMAT DIBH
  - CCW G155-G330
  - CW G330-G155

Structure	Constraint	Lt APBI CP
Lumpectomy_Lt	95% ≥ 95%	99.981%
Lumpectomy_Lt	V100% ≤ 93%	95%
Lumpectomy_Lt	Max ≤ 107%	105.619%
Heart	V1600cGy ≤ 5%	0%
Heart	Mean ≤ 200cGy	112cGy
Lung_L	V1750cGy ≤ 15%	0%
Lung_L	V880cGy ≤ 10%	0%
Lung_L	V144cGy ≤ 50%	11.972%
Breast_R	V144cGy ≤ 10%	0%
Lung_R	V440cGy ≤ 10%	0%



Non-Coplanar Surface Guided Planning

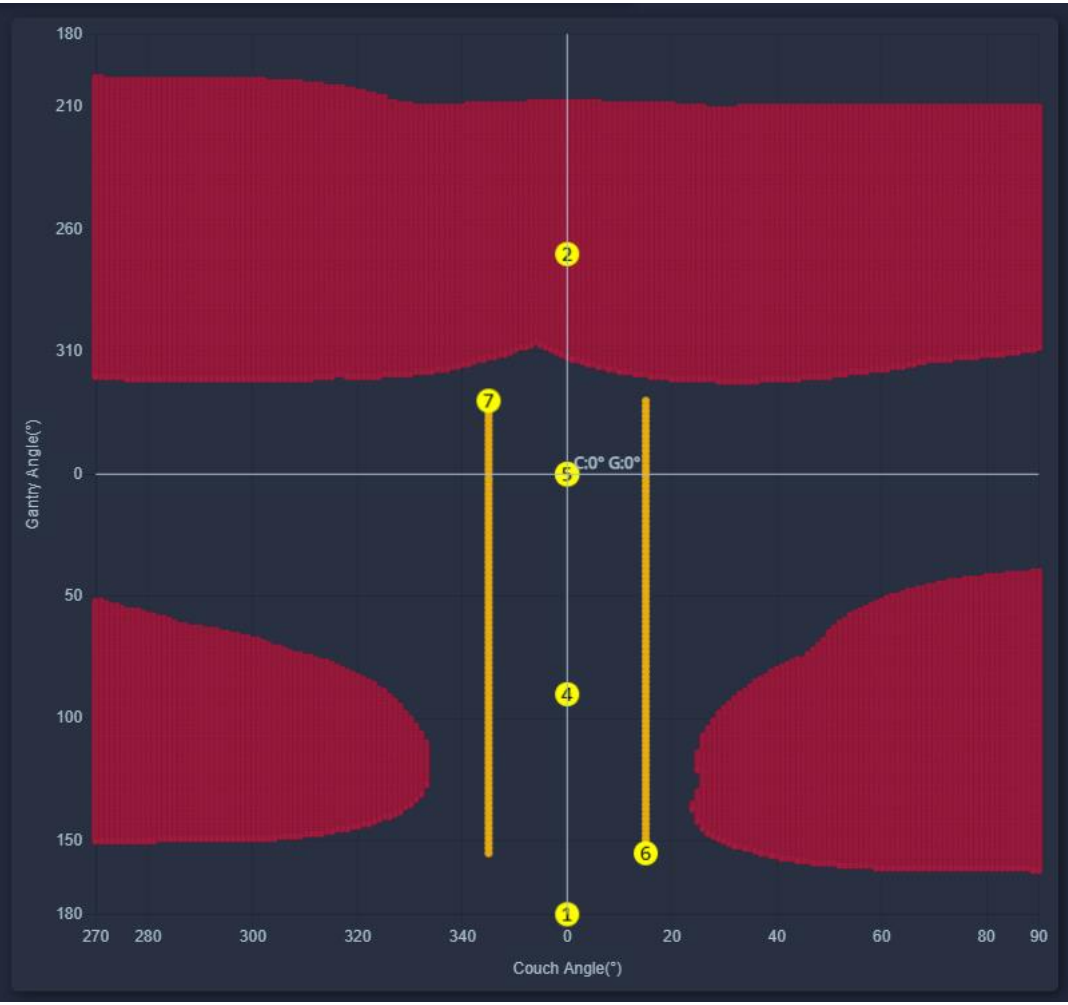
- 2 Field VMAT DIBH with Non-Coplanar Fields
  - CCW G155-G330, **T345**
  - CW G330-G155, **T15**

Structure	Constraint	Lt APBI CP	Lt APBI NCP	Difference
Lumpectomy_Lt	95% ≥ 95%	99.981%	99.952%	0.029
Lumpectomy_Lt	V100% ≤ 93%	95%	95%	0
Lumpectomy_Lt	Max ≤ 107%	105.619%	104.427%	1.192
Heart	V1600cGy ≤ 5%	0%	0%	0
Heart	Mean ≤ 200cGy	112cGy	110cGy	2
Lung_L	V1750cGy ≤ 15%	0%	0%	0
Lung_L	V880cGy ≤ 10%	0%	0%	0
Lung_L	V144cGy ≤ 50%	11.972%	2.66%	9.312
Breast_R	V144cGy ≤ 10%	0%	0%	0
Lung_R	V440cGy ≤ 10%	0%	0%	0

Lt APBI Non-coplanar Clearance Map

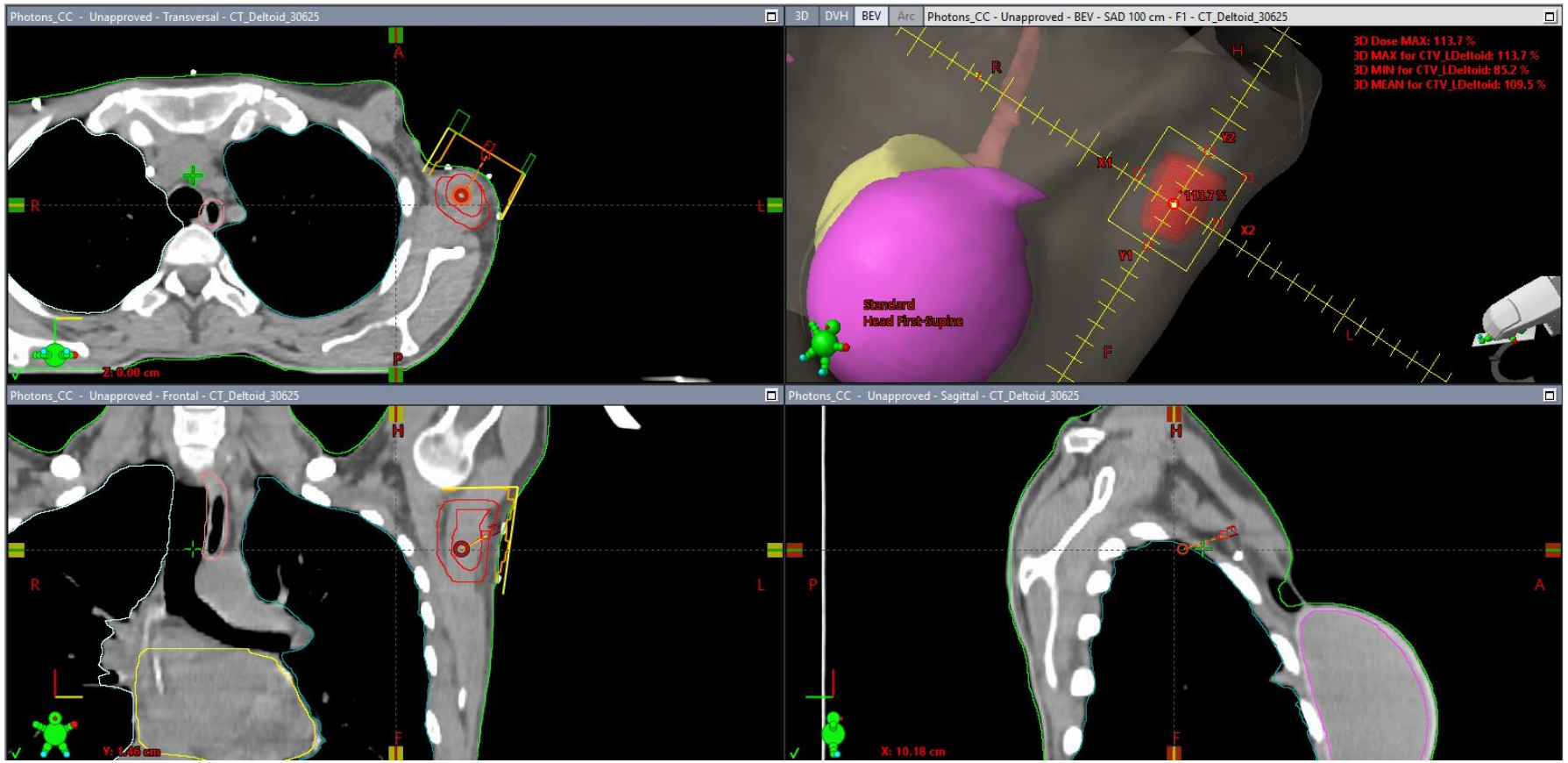
LPartia_ER

Status	#	ID	Type	Gantry	Couch	Direction
✓	1	R1 PA ISO	Static	180°	0°	--
✗	2	R2 RLAT ISO	Static	270°	0°	--
✓	3	AP ISO	Static	0°	0°	--
✓	4	LLAT ISO	Static	90°	0°	--
✓	5	CBCT AP ISO	Static	0°	0°	--
✓	6	RA1 CCW	Arc	155° to 330°	15°	CC
✓	7	RA2 CW	Arc	330° to 155°	345°	CW



Case Study: Lt Deltoid

- 41-year-old female with secondary malignant neoplasm of the left deltoid muscle
- Previous radiation to the left chest wall and lymph nodes

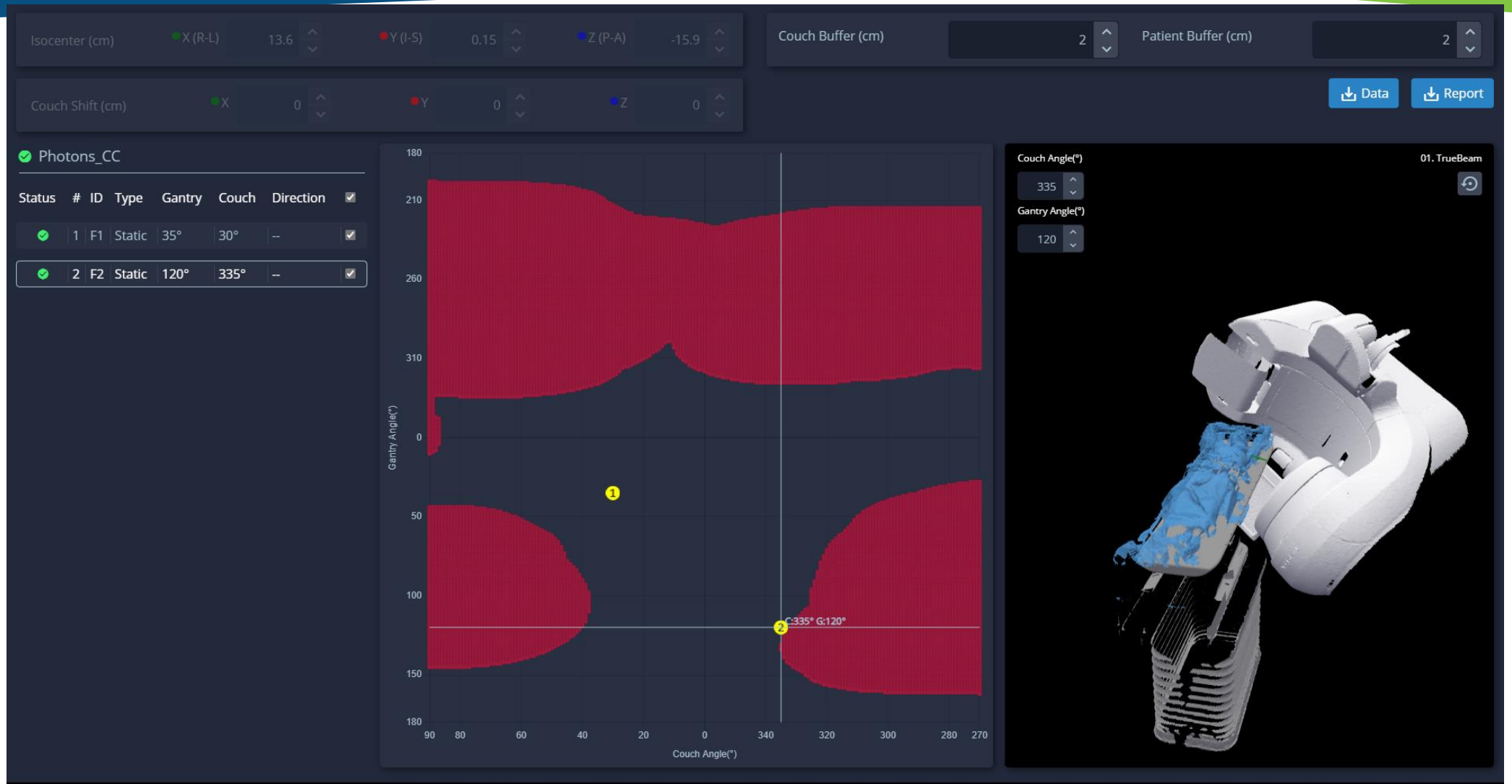


Surface Guided Planning for Lt Deltoid

- Coplanar plan
  - LAO G35
  - LPO G120
- Noncoplanar Plan
  - LAO G35, **T30**
  - LPO G120, **T325**

Structure	Constraint	NCP	CP	Diff
Lt Deltoid	Max ≤ 110%	109.71%	111.56%	-1.85%
Lt Deltoid	V95% ≥ 95%	99.56%	99.31%	0.25%
Breast_L	V300cGy ≤ 10%	0%	0.02%	-0.02%
Breast_L	Max ≤ 300cGy	49.6cGy	655.2cGy	-605.60 cGy
Heart	V2500cGy ≤ 10%	0%	0%	0.00%
Heart	Mean ≤ 300cGy	4cGy	10cGy	-6.00
Lung_L	V2000cGy ≤ 35%	0%	0%	0.00%
Breast_R	V300cGy ≤ 10%	0%	0%	0.00%
Breast_R	Max ≤ 300cGy	1.5cGy	1.8cGy	-0.30 cGy
Lung_R	V500cGy ≤ 10%	0%	0%	0.00%

Lt Deltoid Clearance Map



TPS Integration - Raystation

TPR Integration

- Raystation – full integration with clearance check and map
- Eclipse – integration via API. Mike Tallhamer will do a show and tell.

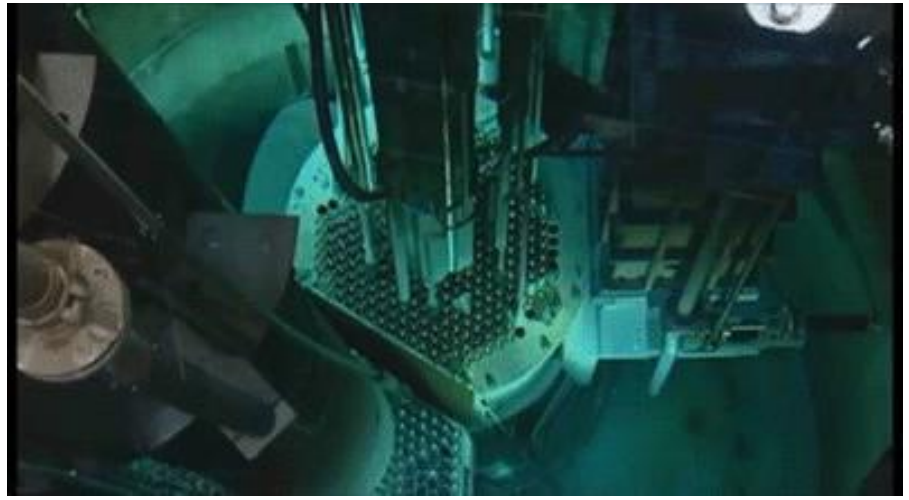
Surface Guided Treatment with Dose Visualization

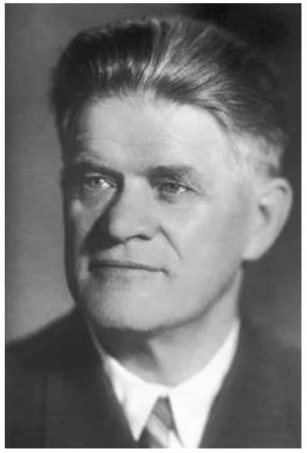
SGRT with Dose Visualization

- Simultaneous real time visualization of dose delivery and patient positioning.
- Can help prevent treatment errors in real time and improve clinical outcome

Cherenkov Radiation

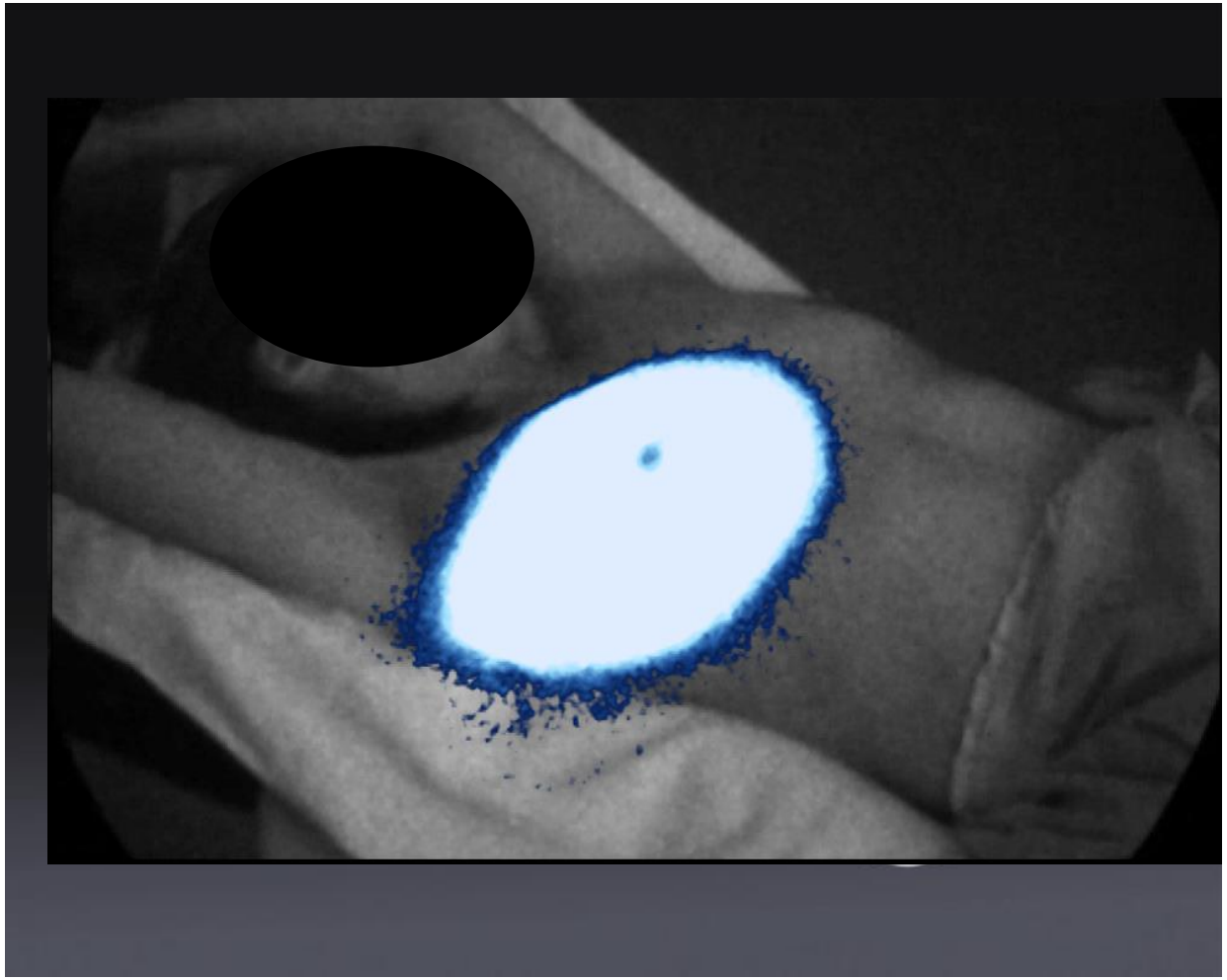
- Cherenkov radiation is emitted when a charged particle moves through a medium faster than the phase velocity of light in that medium.
- First observed in 1934 by Pavel Cherenkov when he saw a bluish light around a radioactive source placed in water. Tamm and Frank developed the theory in 1937 and all 3 share the 1958 Nobel Prize.



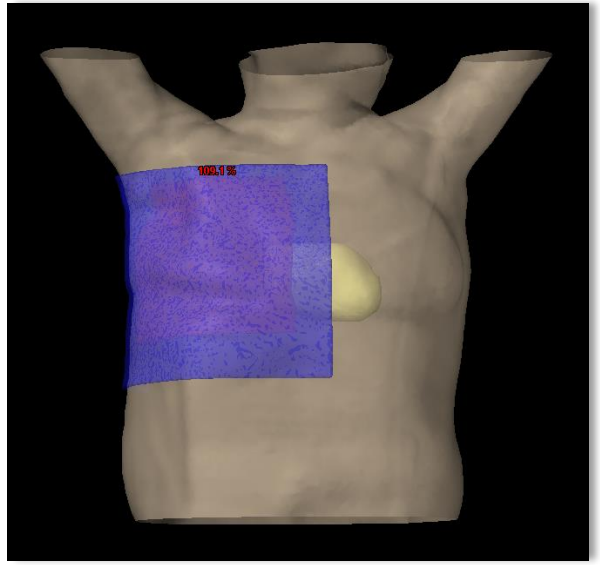


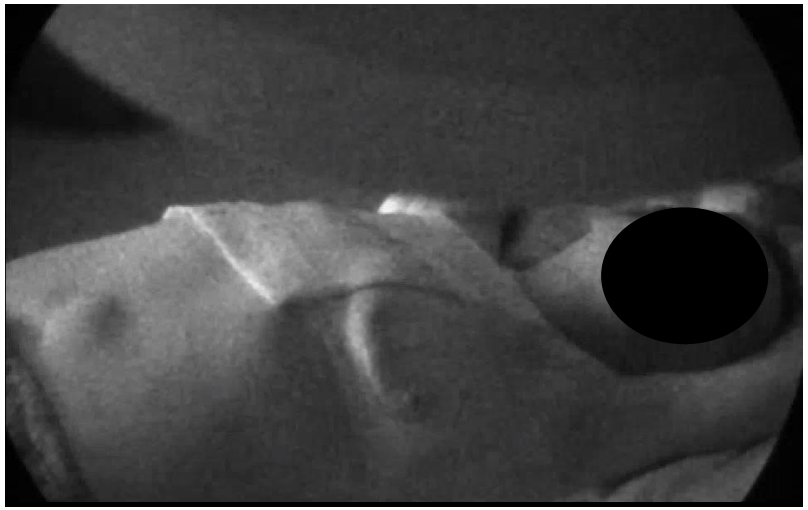
Cherenkov Imaging

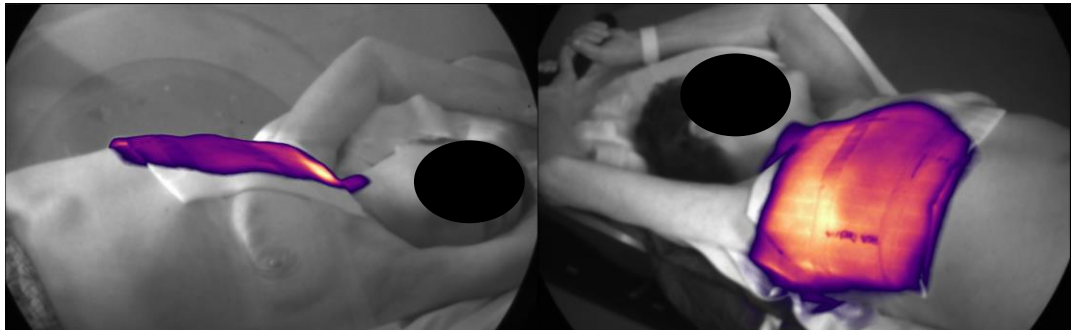
- Cherenkov light can be seen on the patient's skin surface during treatment with special light sensitive cameras.
- The Cherenkov signal is a result of the interaction of the entrance and exit beam during treatment.
- This allows us to visualize the radiation treatment directly on the patient's skin



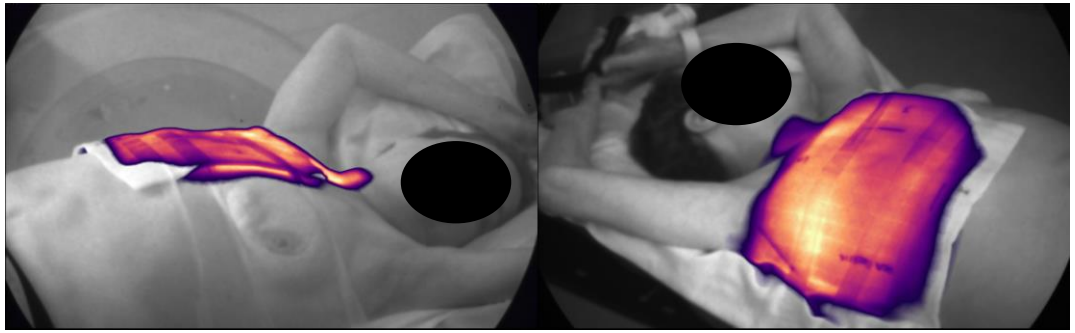
Case Study: Bolus Misplacement



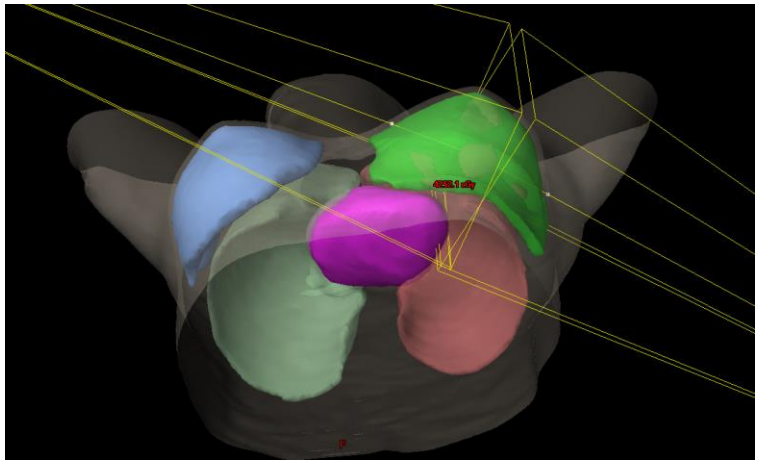


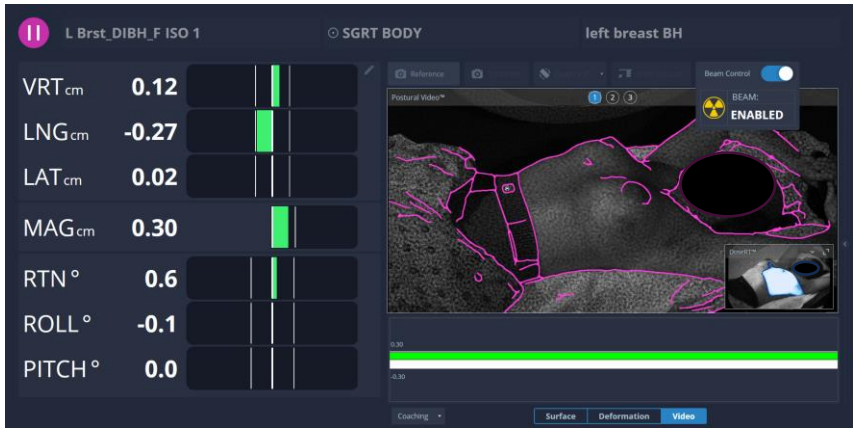


- 62-year-old female, whole right breast treatment.
- 13 with bolus, 12 fractions without.
- On fraction 8 her bolus was misplaced
- Corrected right away and closely monitored after.

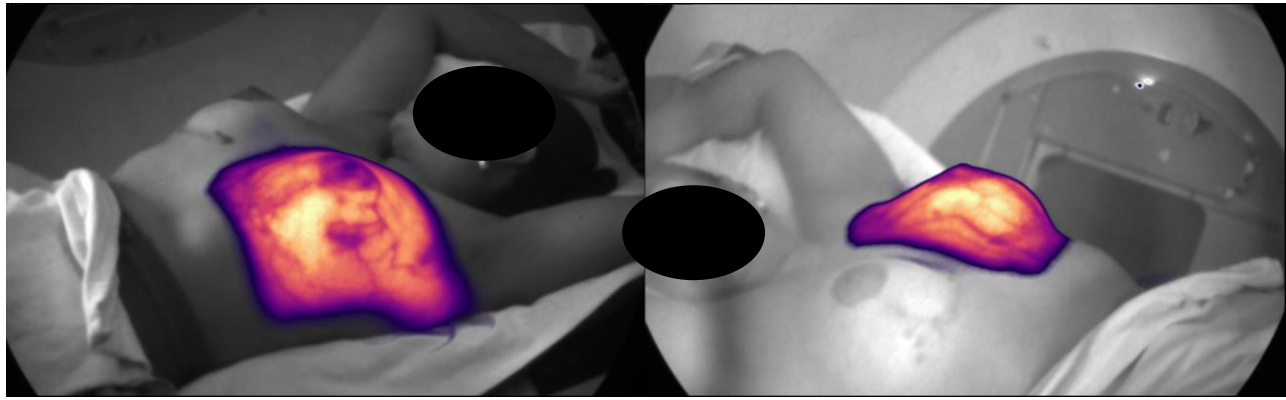


Case Study: Lt Breast with Contralateral Breast Dose

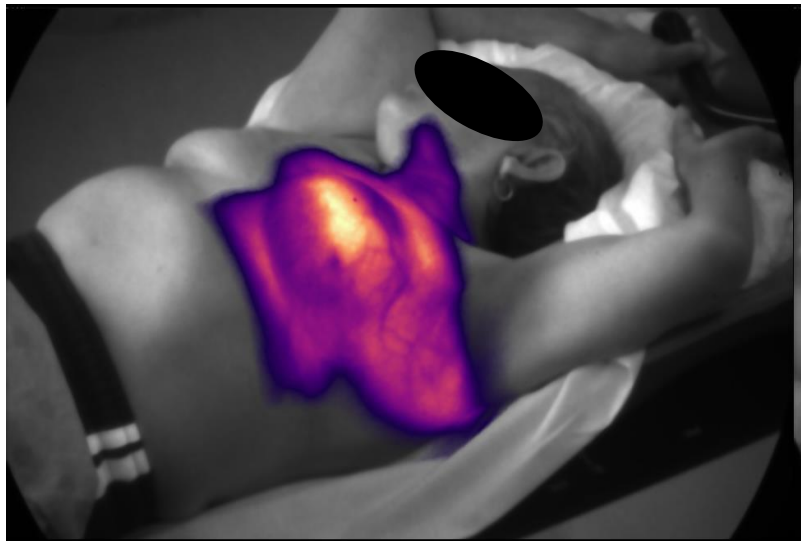


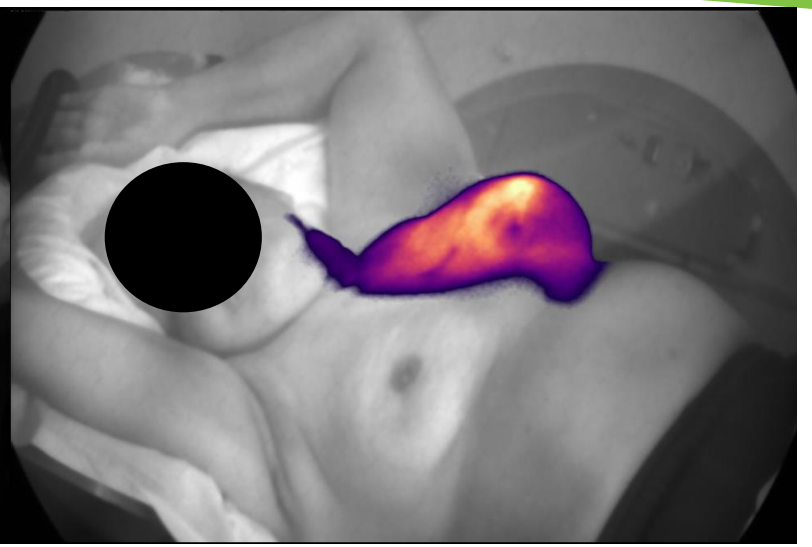


- 51 -year-old female, whole left breast treatment.
- Treated with DIBH
- On the 5th fraction, dose to the right breast was visualized
- AlignRT tolerances and positioning were adjusted
- On fraction 6, no dose to the right breast was seen,

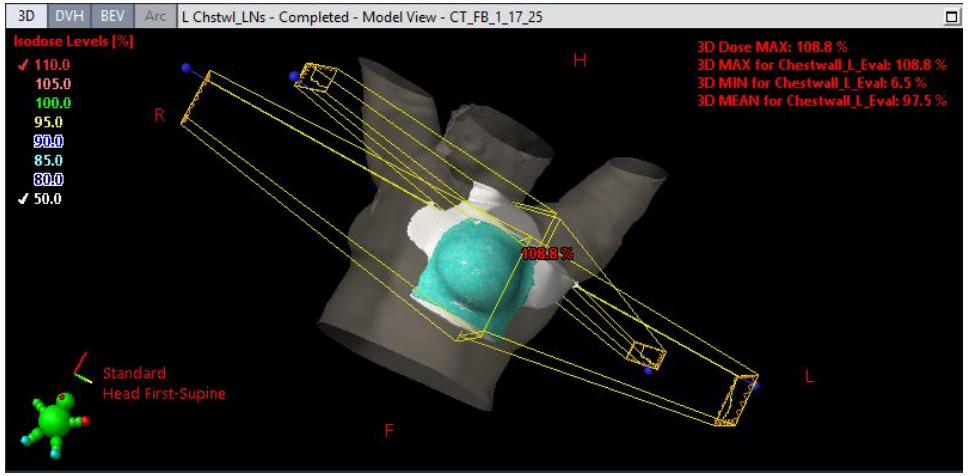


Case Study: Dose to the Chin

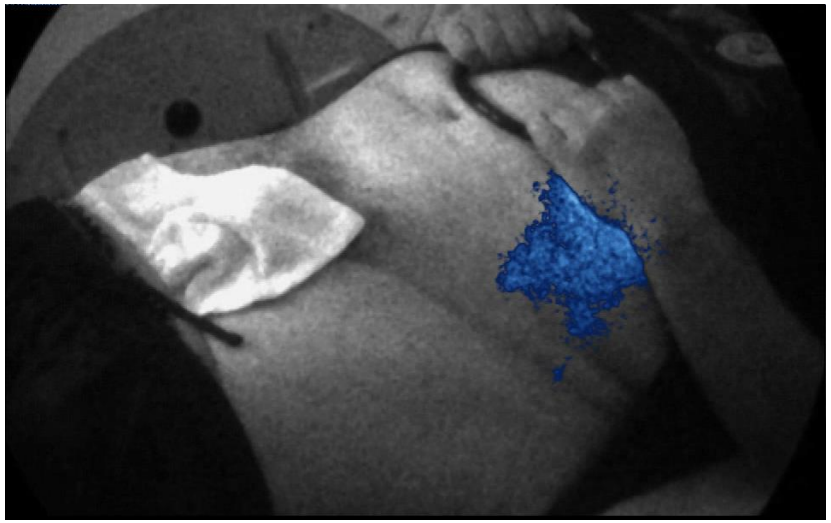




- 61-year-old female with malignant neoplasm of the left breast.
- During the treatment of her SCV lymph node, dose to the chin was visualized.
- Positioning of the patient was corrected for the next fraction

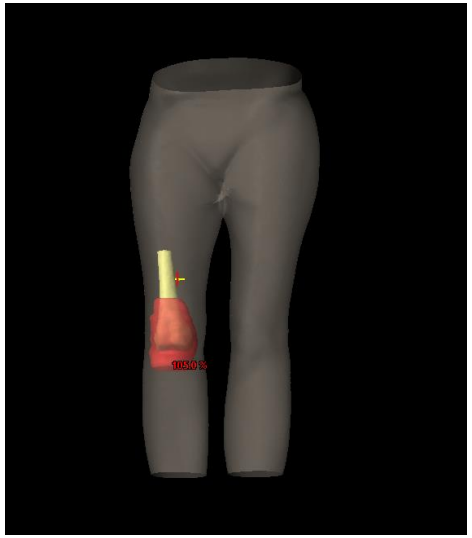


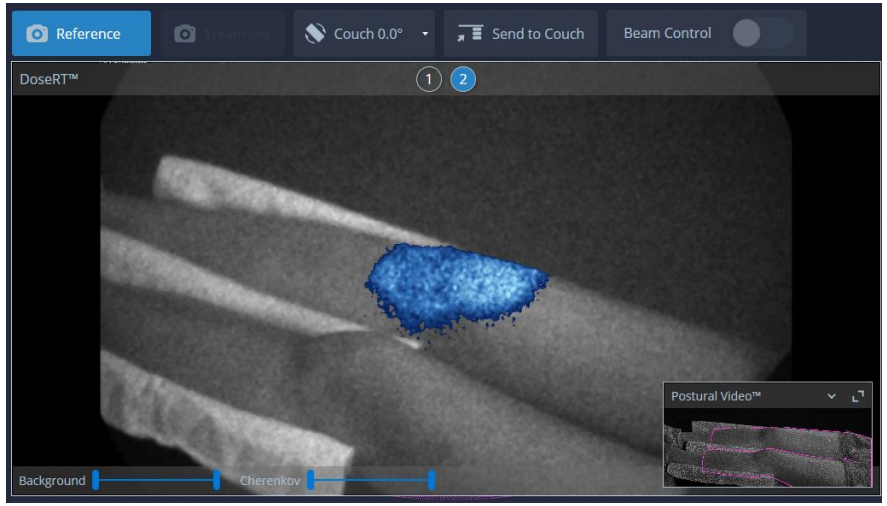
Prostate – Hand in Beam

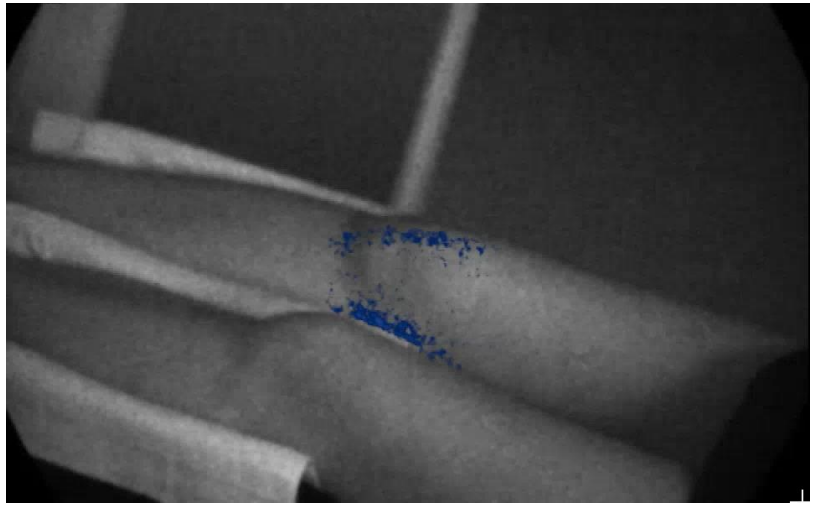


- 75 year old male with malignant neoplasm of the prostate
- 4 field VMAT plan
- On fraction 8, his hands moved into the beam path during the first arc.

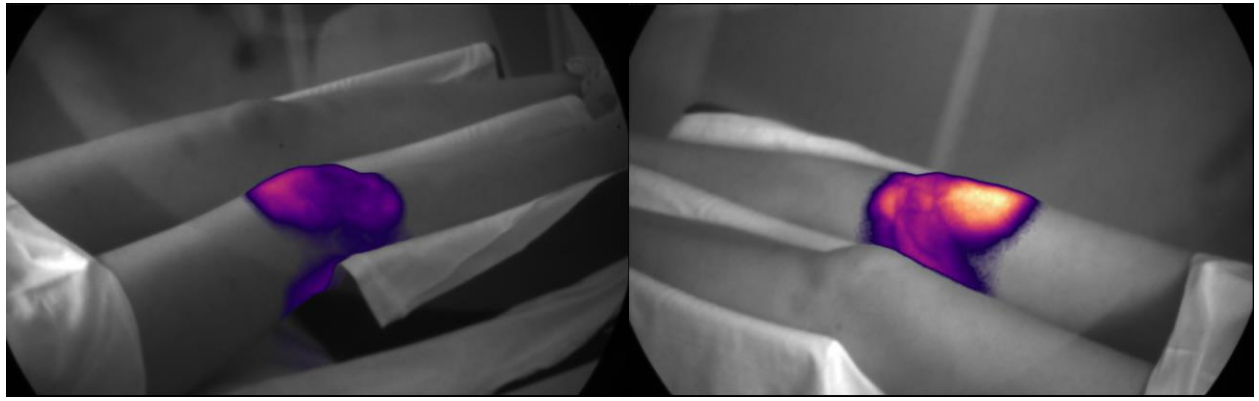
Case Study: Rt Knee



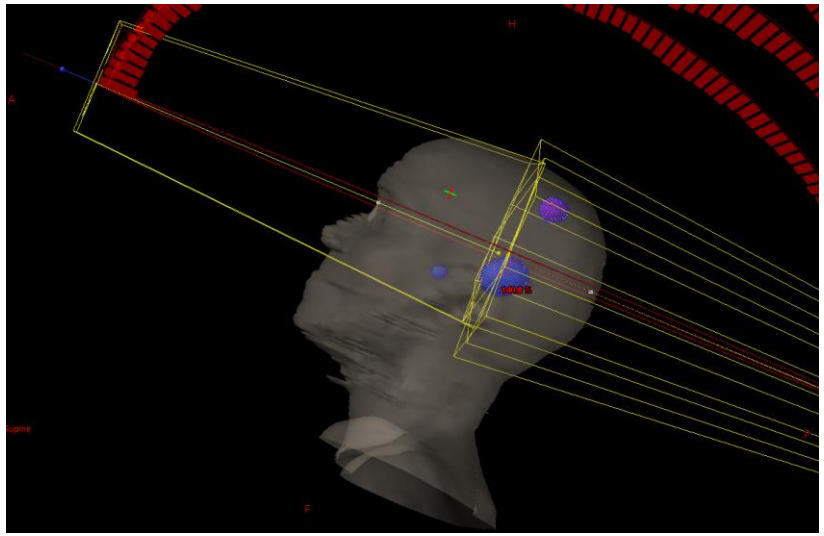


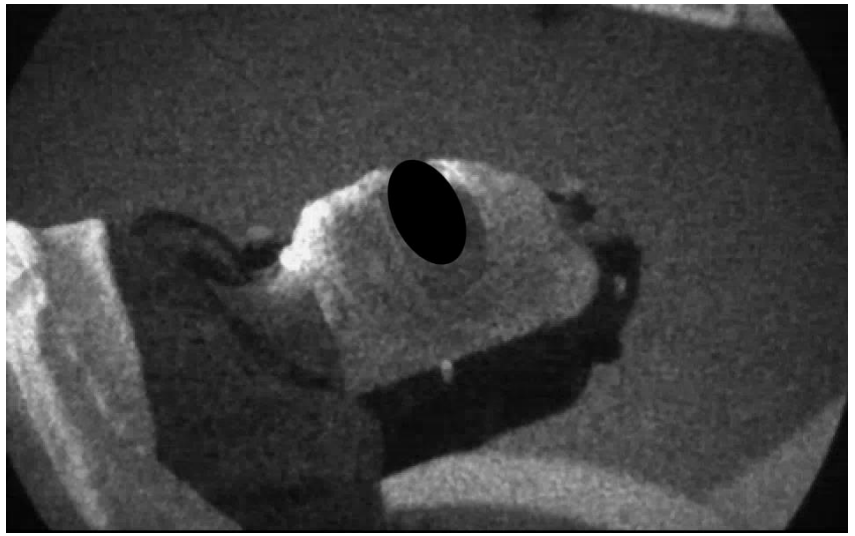


- 21 year old female with Villonodular Synovitis of the right knee (benign)
- 4 field 3D conformal plan

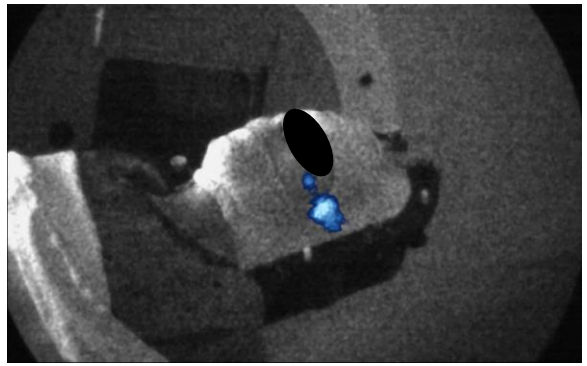


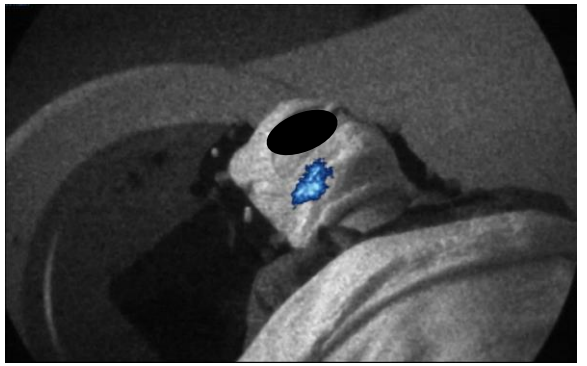
Case Study: SRS Treatment



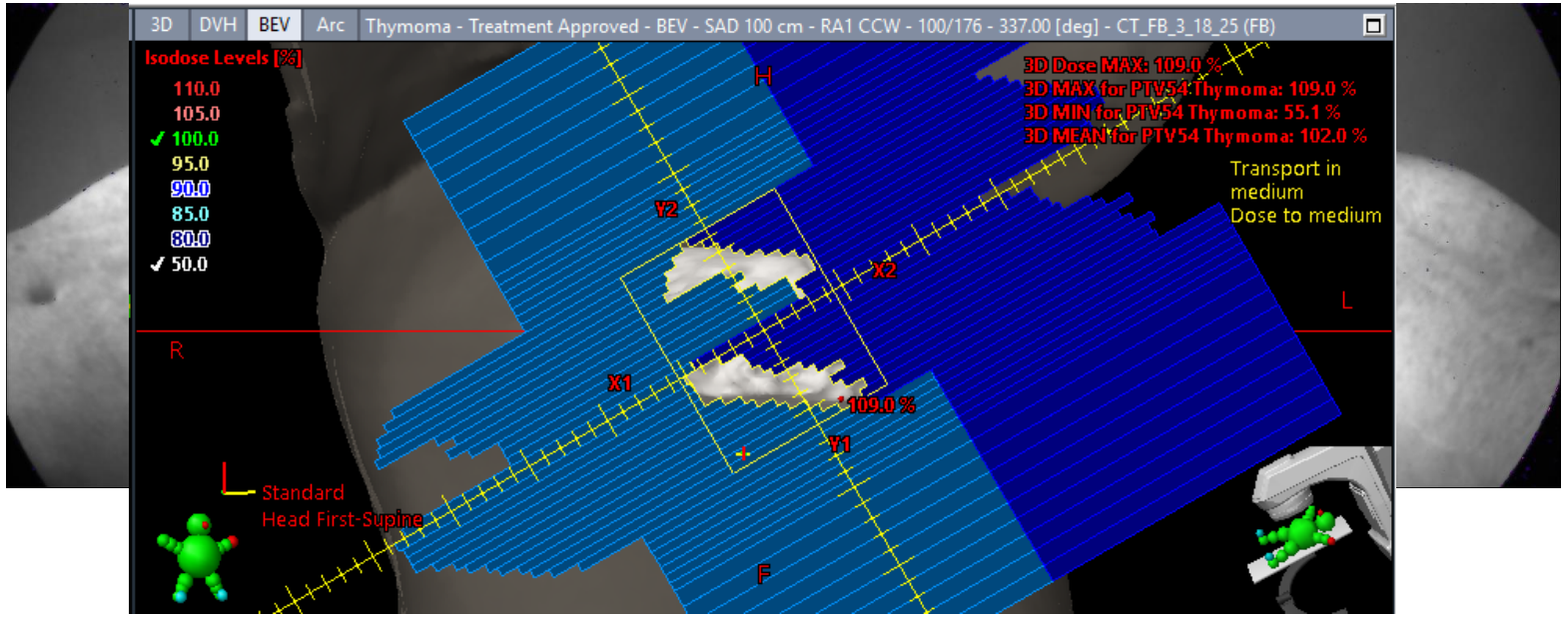


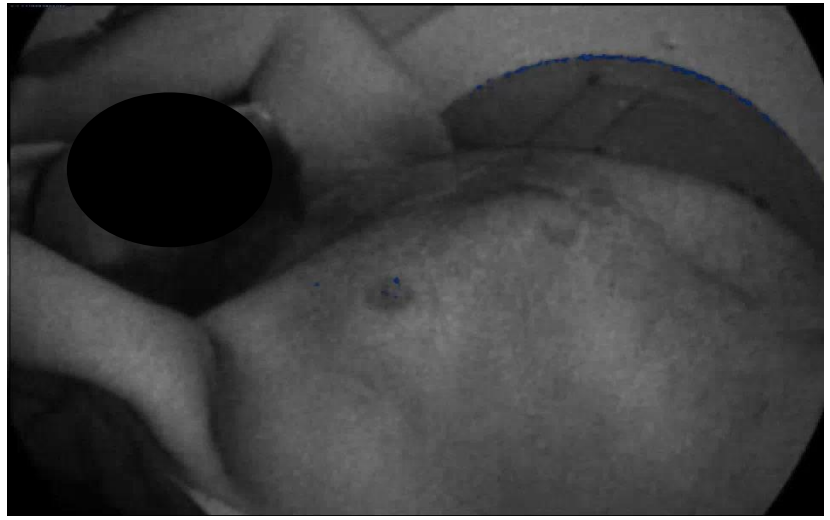
- 53 year old female with malignant neoplasm of brain.
- 9 Gy x 3 to 3 lesions.
- 4 VMAT arcs in a non coplanar treatment.

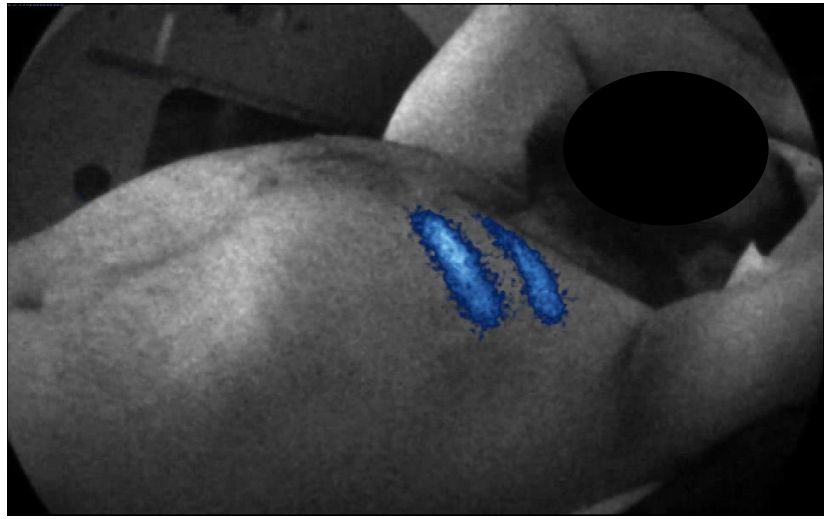




Thymoma

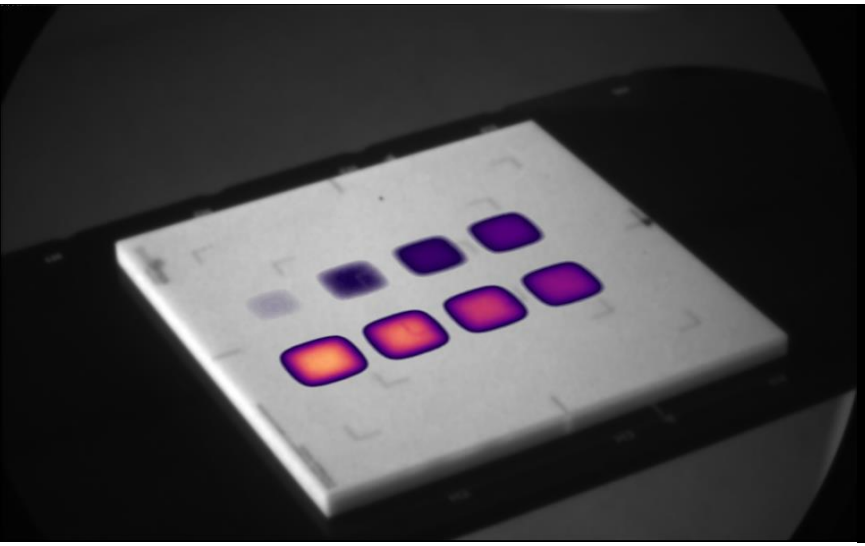


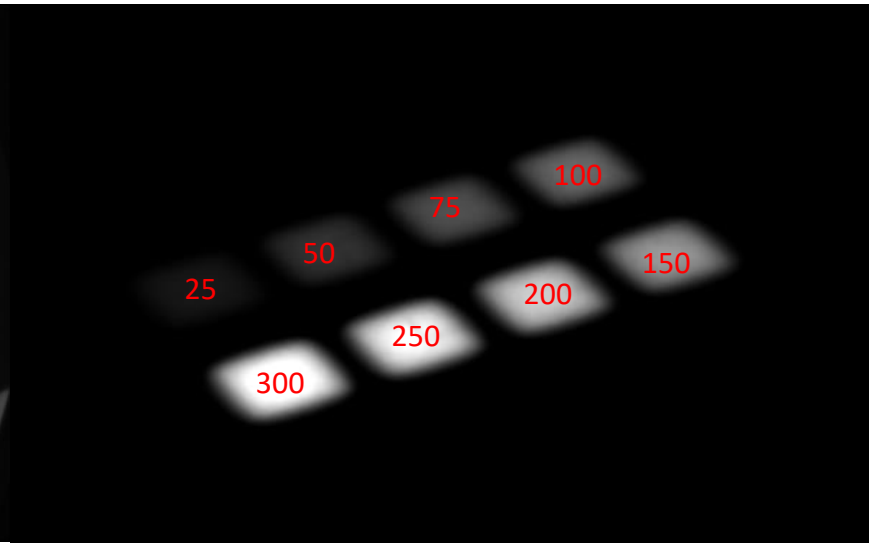


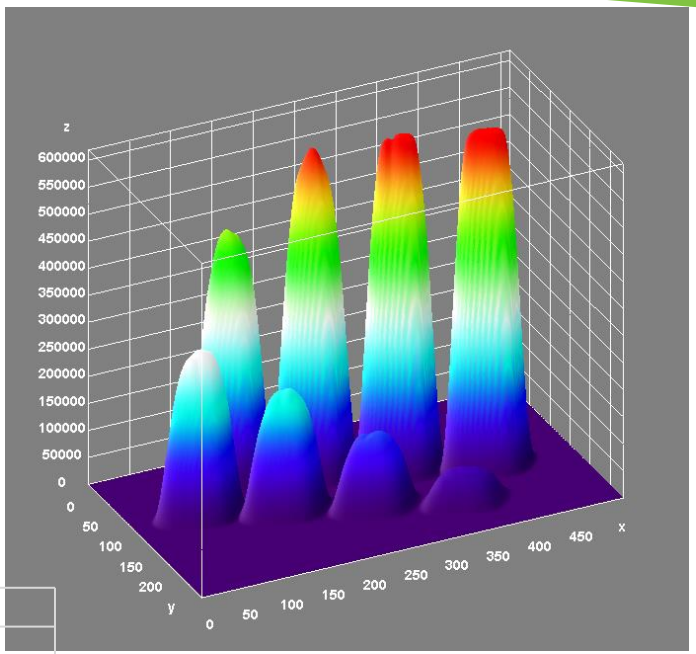


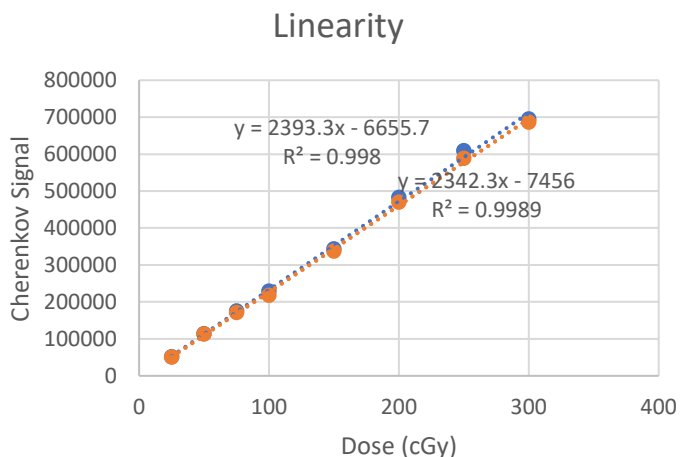
- 50 year old make with malignant neoplasm of the thymus
- 2 field VMAT plan

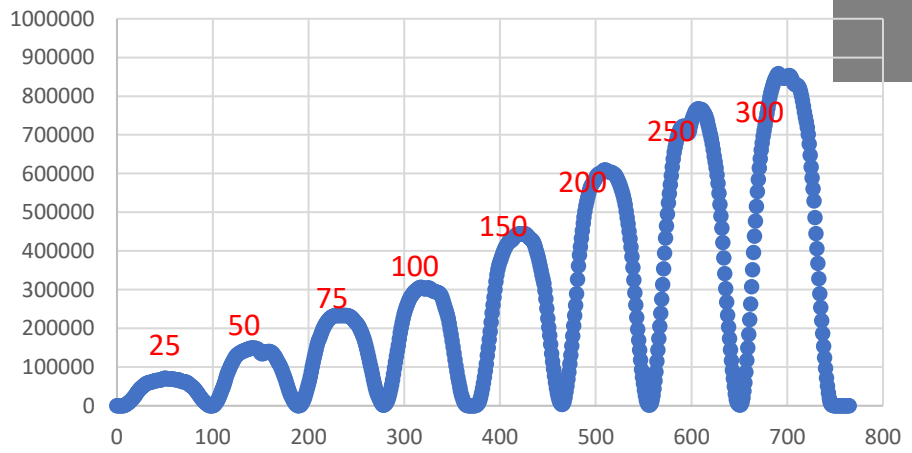
Cherenkov Signal Linearity





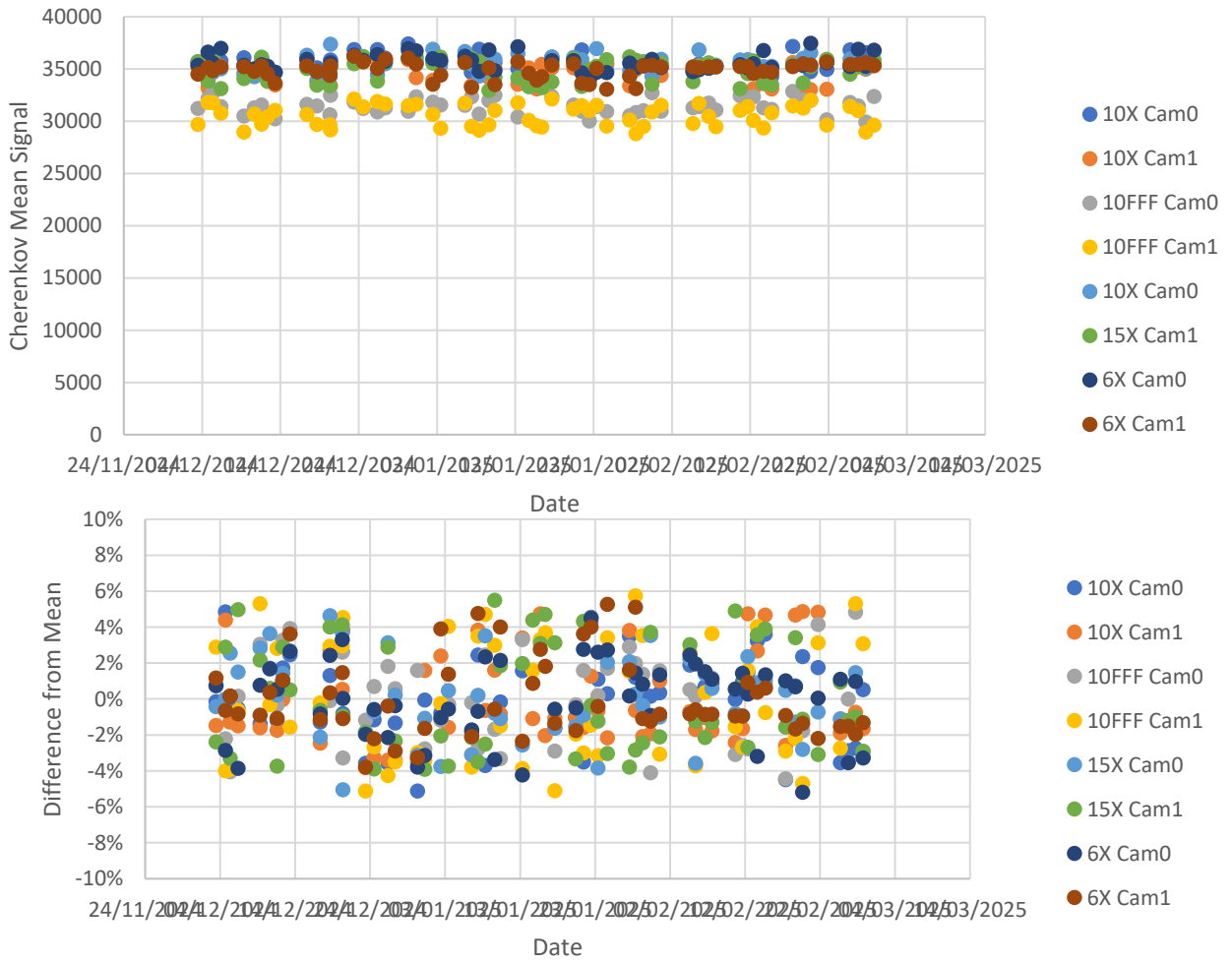




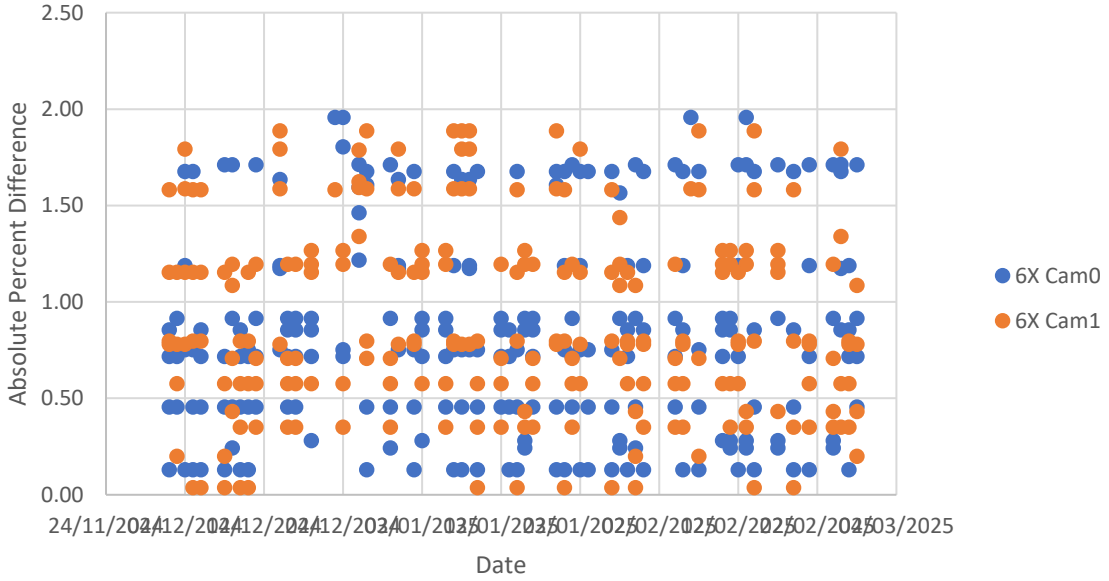


Cherenkov Signal Constancy

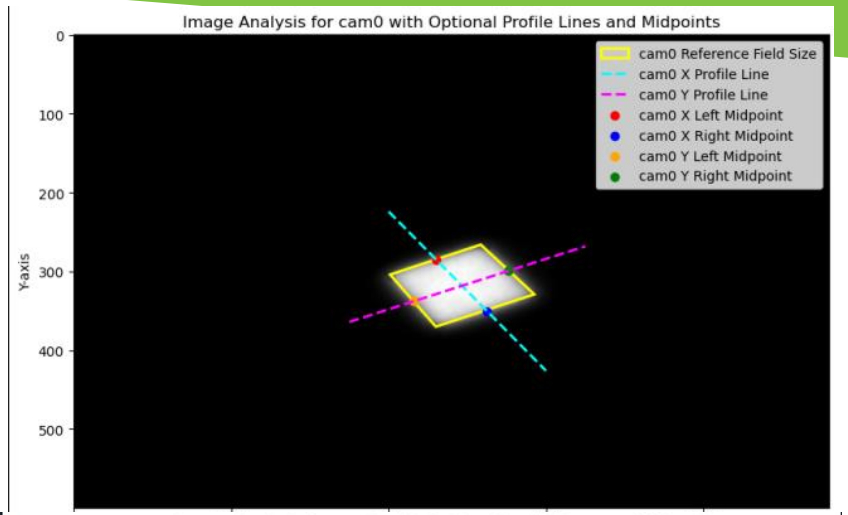
- Singal constancy check daily for 3 months.
- All photon energies (except 6FFF)
- Variation from mean does not exceed +/-6%

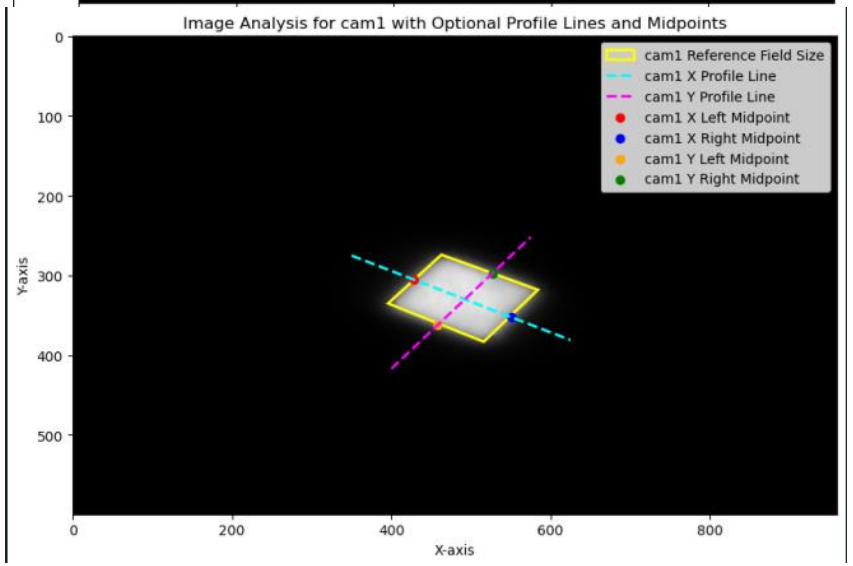


Cherenkov Signal Geometric Constancy

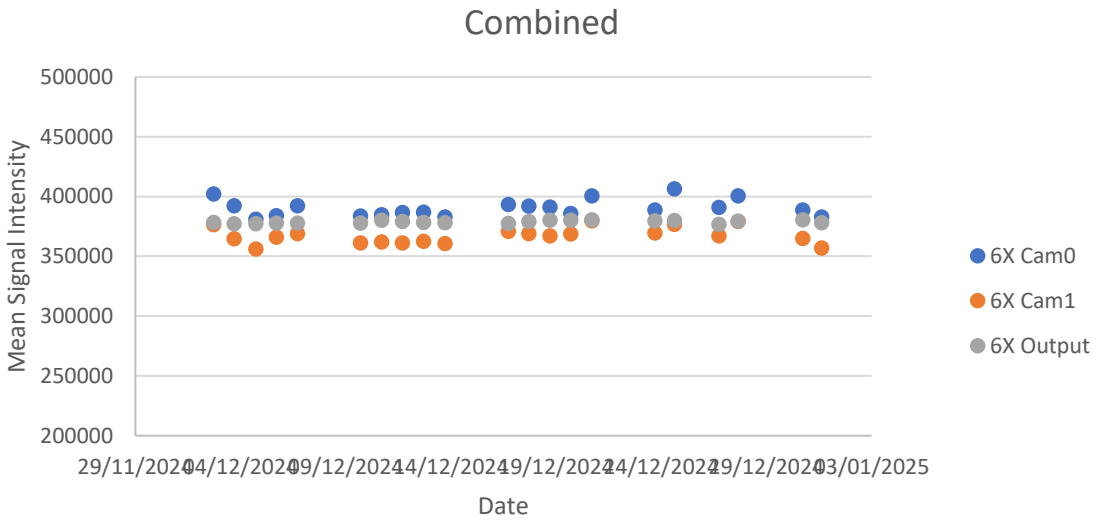


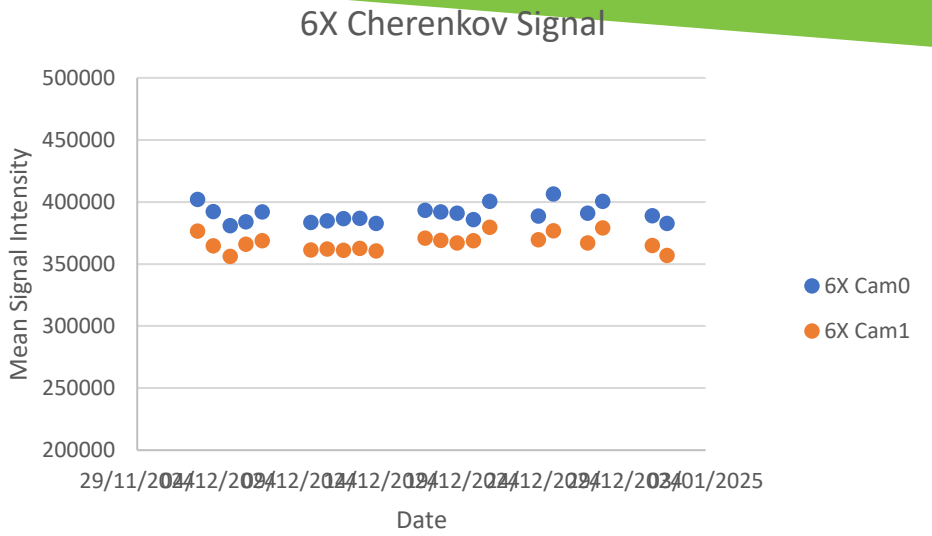
- Field size check for 3 months
- 6MV
- All measurements under 2% following TG-142.

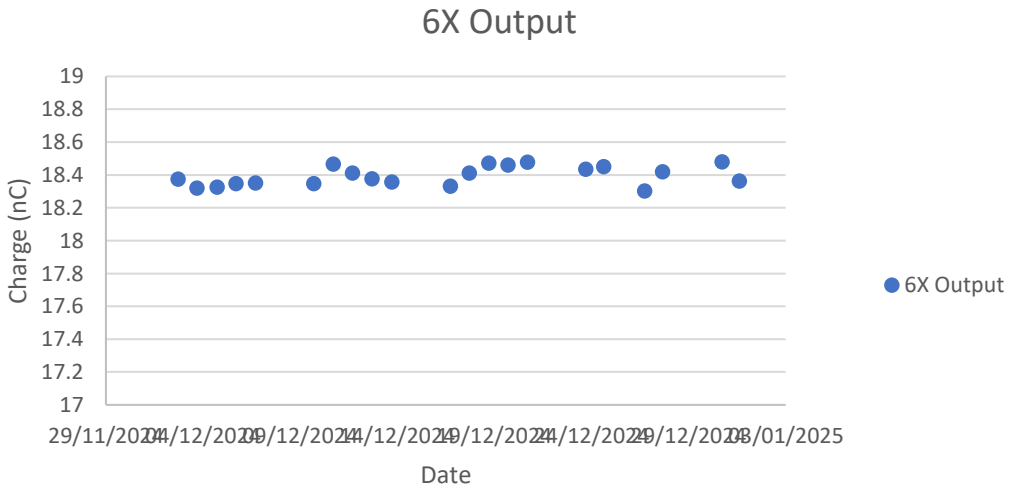




Cherenkov Signal vs Linac Output







- Linac output was measured using ion chamber
- Cherenkov signal was measured at the same time
- Similarity was observed between the two

Conclusion

- MapRT provides a clearance map that eliminates the need for collision checks and dry runs while assisting in improving the quality of the treatment plan
- DoseRT provides dose visualization in real time. assists in improving the quality and safety of treatment delivery.


Thank you!
Questions?
Email: Adi.Robinson@adventhealth.com

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