Improving initial setup accuracy with the use of SGRT in the treatment of localizations in the upper leg with the use of Bolus.

Colin J. Shelton, RTT, University Hospital Zürich

SASRO 02.09.2022, Baden

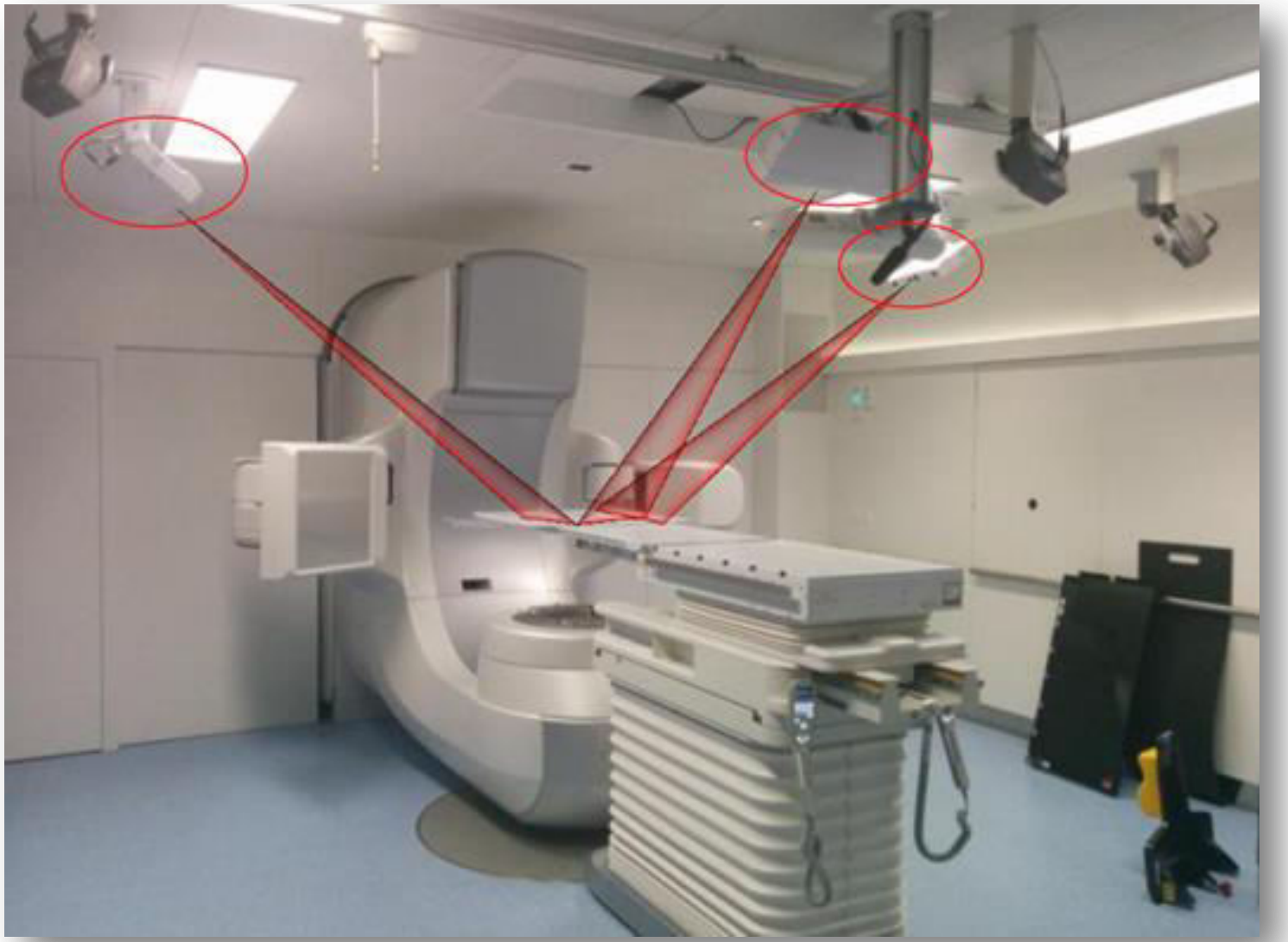
Agenda:

1. **What is Surface Guided Radiation Therapy?**
2. How do we position extremity patients at USZ?
3. Problems with the “Standard Setup”
4. Our Study
5. Conclusions

Surface Guided Radiation Therapy at USZ:

SGRT: Surface Guided Radiation Therapy

At USZ, we use the AlignRT system.



Surface Guided Radiation Therapy at USZ:

The Interface:

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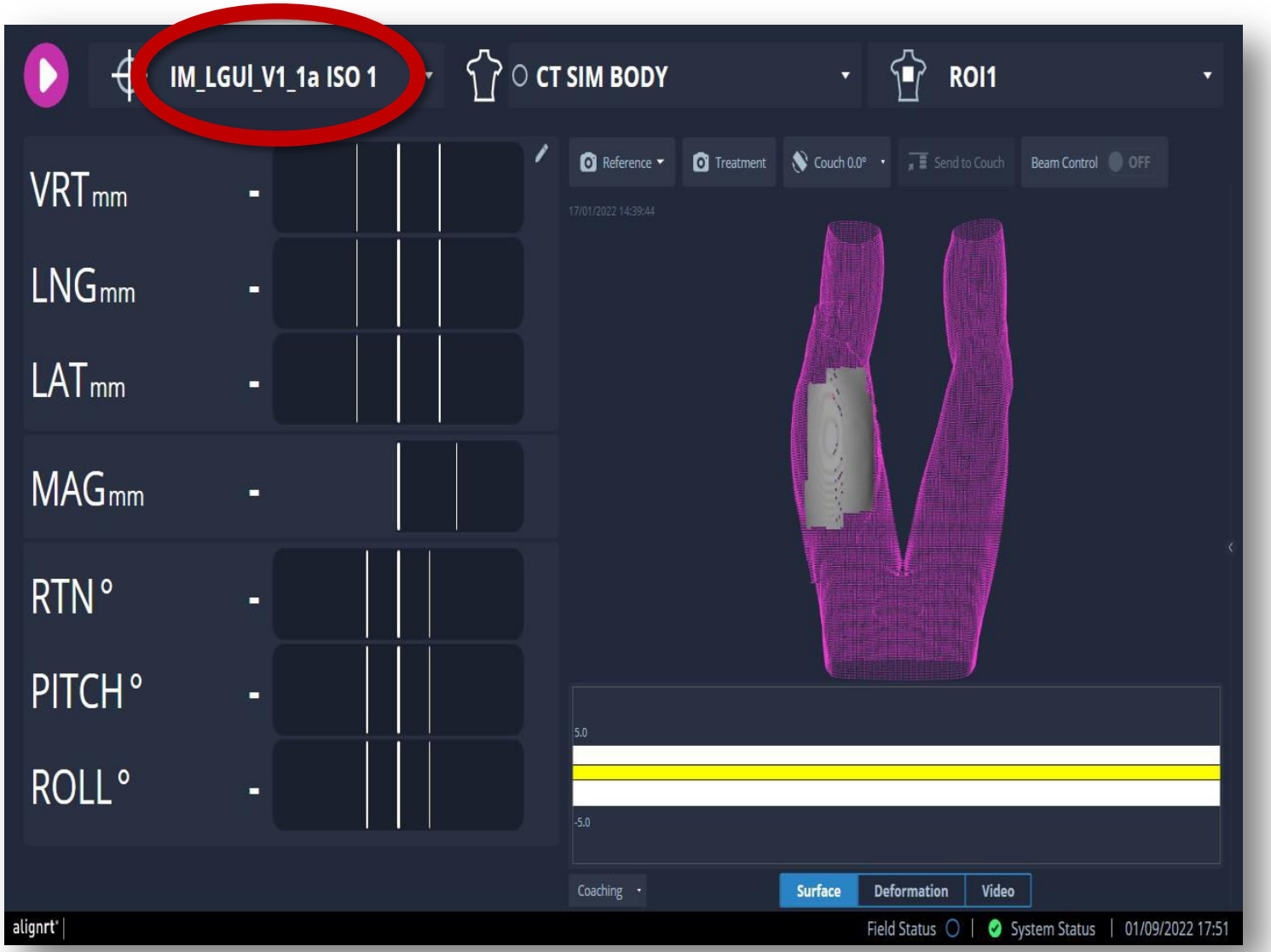
The Interface:

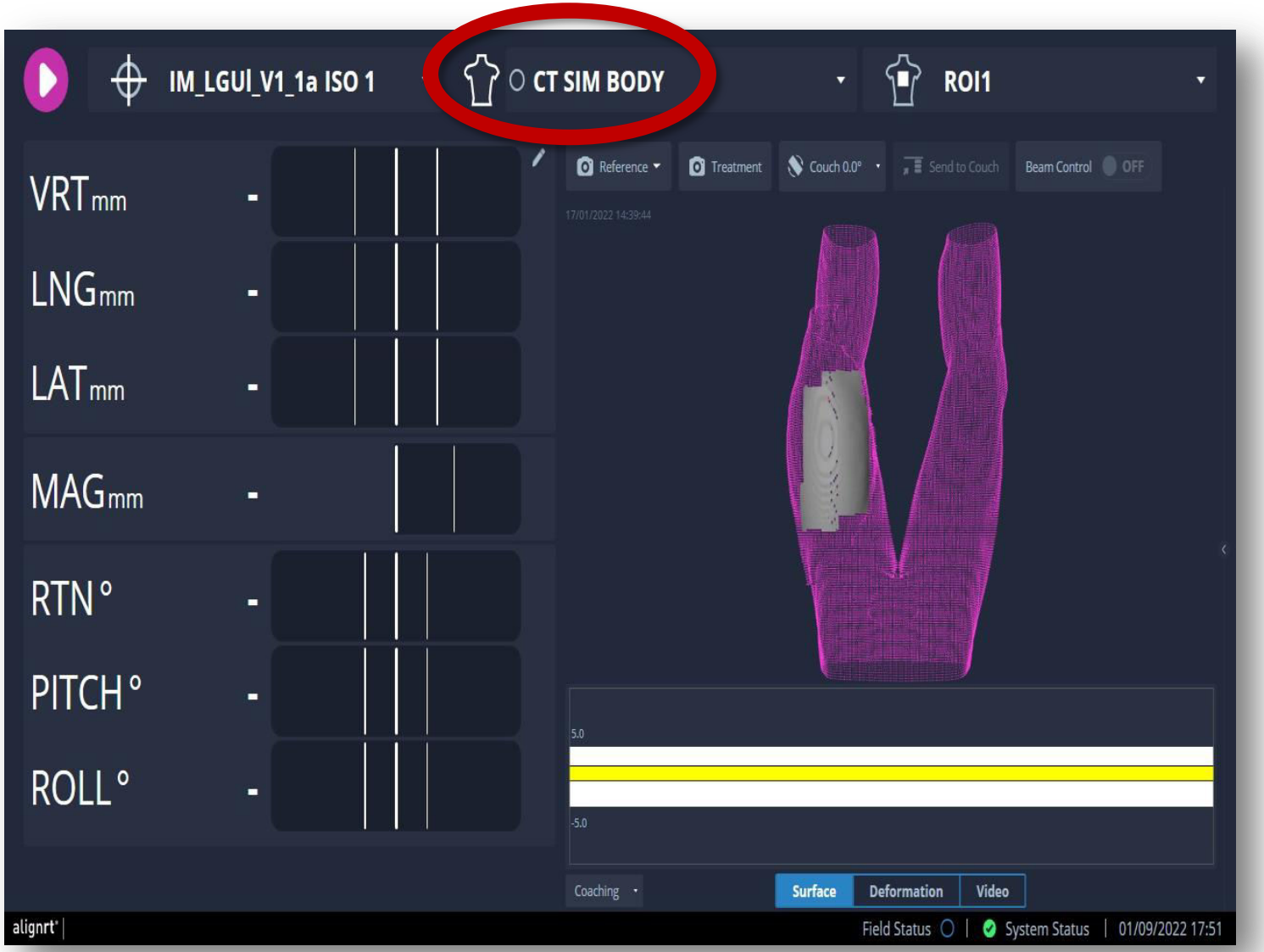
- Plan to be treated



Surface Guided Radiation Therapy at USZ:

The Interface:

- Plan to be treated
- Reference Structure used for initial setup



Surface Guided Radiation Therapy at USZ:

The Interface:

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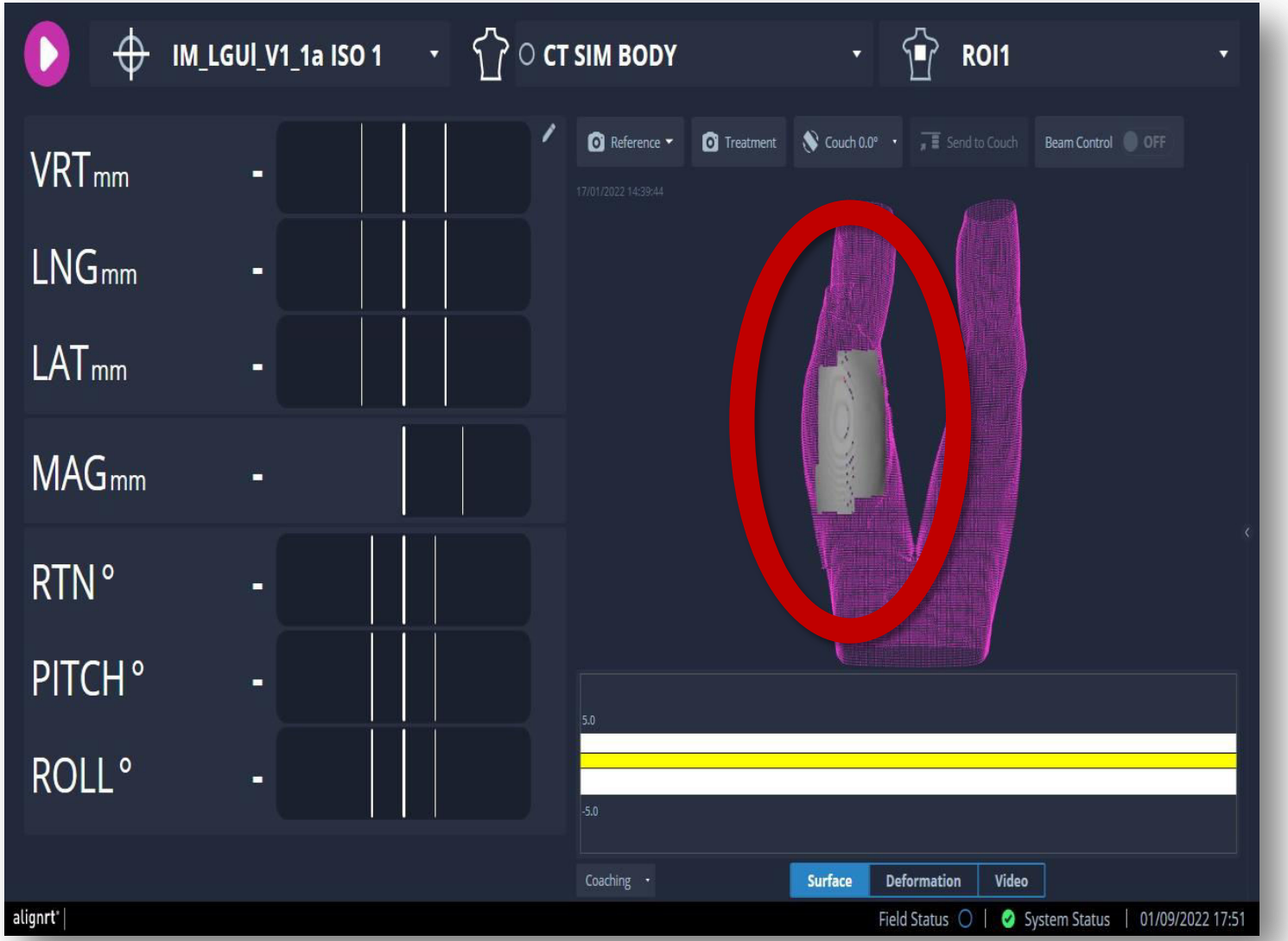
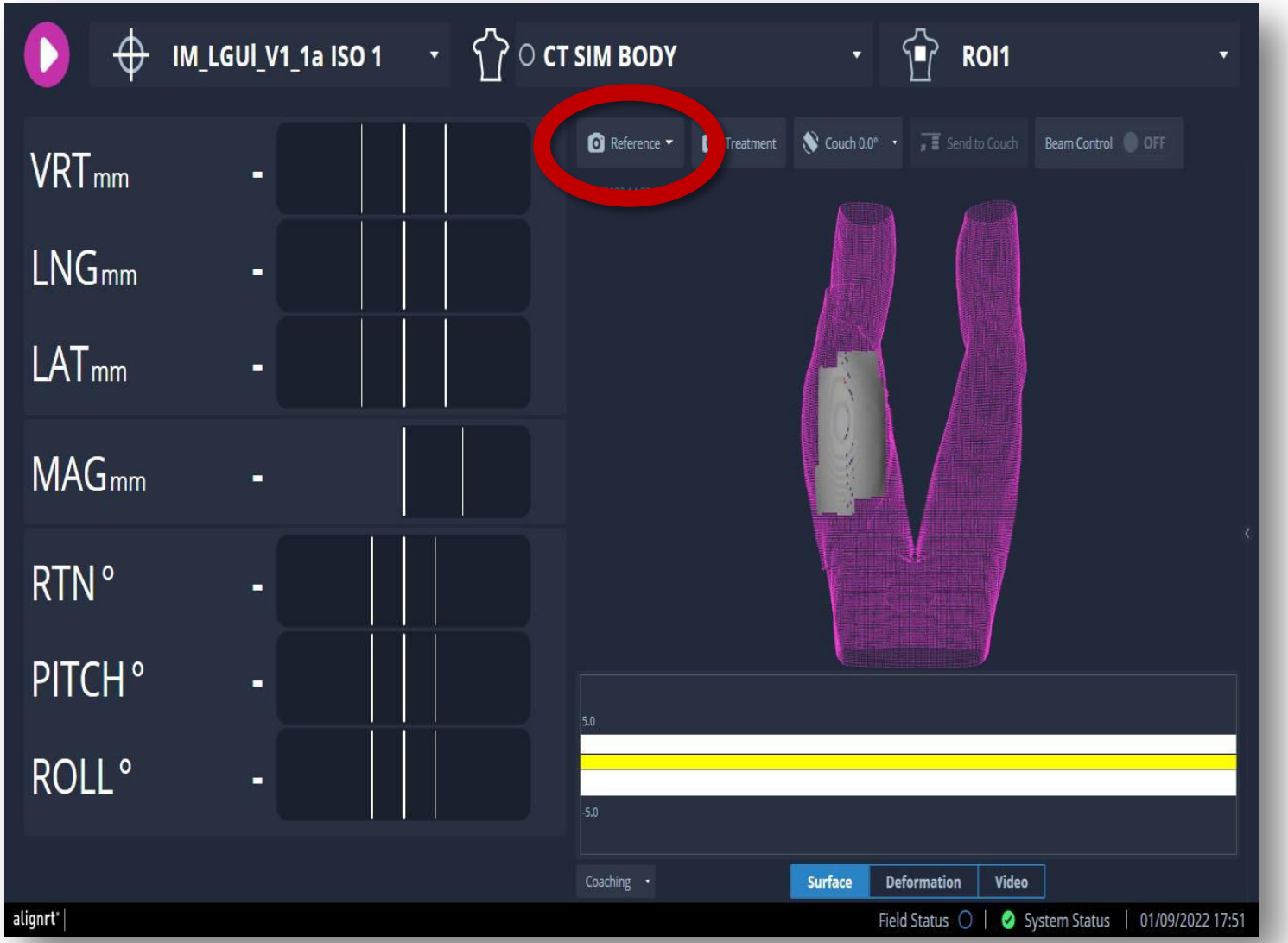
- Reference Structure used for initial setup.
- Region of Interest (ROI) to be used for a setup reference.



Surface Guided Radiation Therapy at USZ:

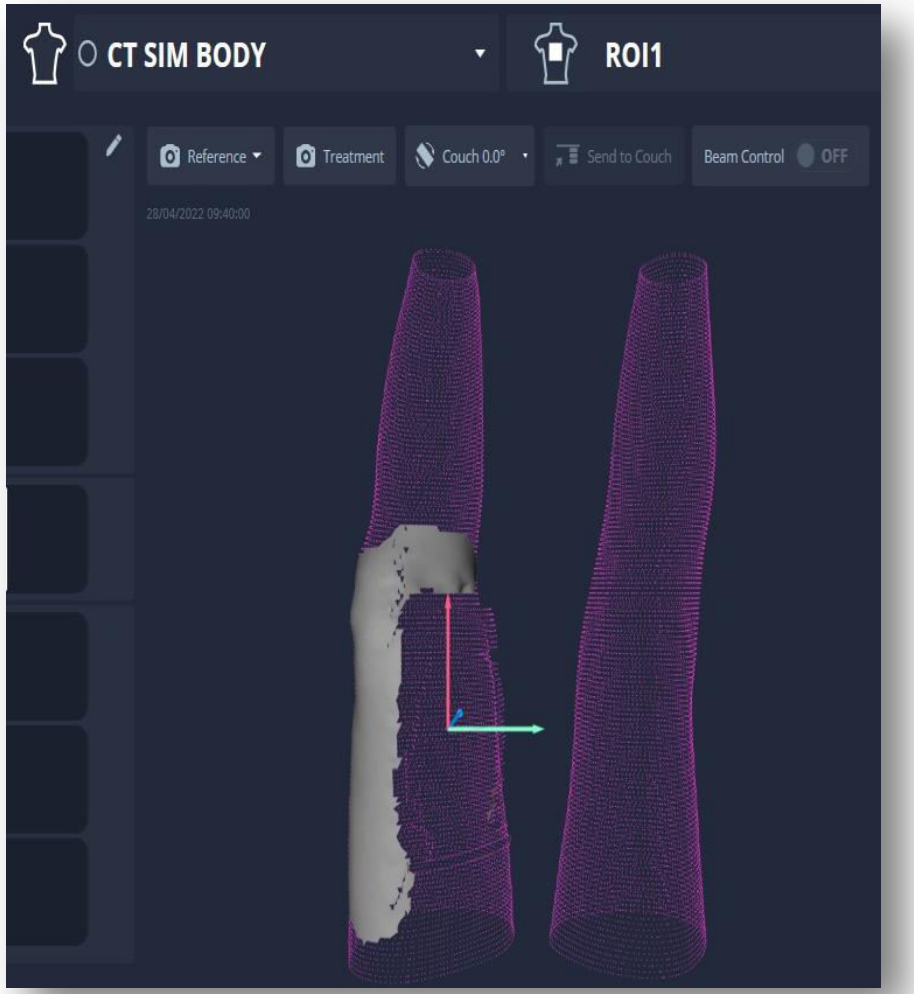
The Interface:

- Plan to be treated.
- Reference Structure used for initial setup.
- Region of Interest (ROI) to be used for a setup reference.
- Reference Capture



Surface Guided Radiation Therapy – Reference Capture:

CT Sim Body Reference



Reference Capture

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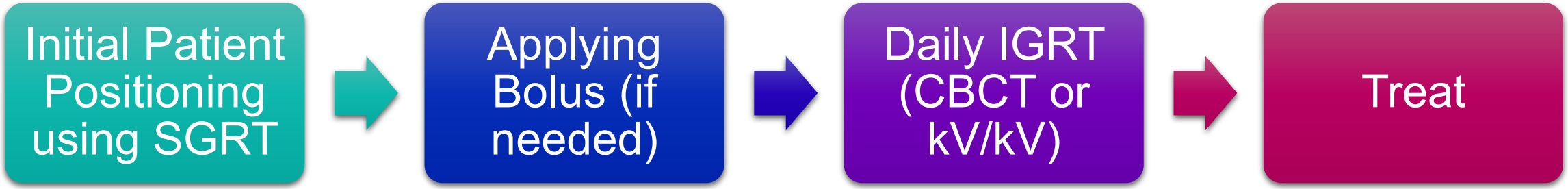
Standard Setup with SGRT:

Using a Vac-Lok bag

Patient in a “Frog Leg” position

The standard setup of upper leg extremity patients at USZ:

The treatment workflow:



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3. **Problems with the “Standard Setup”**
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Problems with the Standard Setup:

After observing the Standard Setup, the following areas of improvement were discovered:

1. Bolus made at CT Simulation → no accurate “Body” Structure for SGRT setup.

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Problems with the Standard Setup:

After observing the Standard Setup, the following areas of improvement were discovered:

1. Bolus made at CT Simulation → no accurate “Body” Structure for SGRT setup.

2. Upper leg extremity tumors can change drastically over the course of treatment.

3. The use of immobilization in the upper leg can often interfere with an optimal ROI to be used with SGRT.

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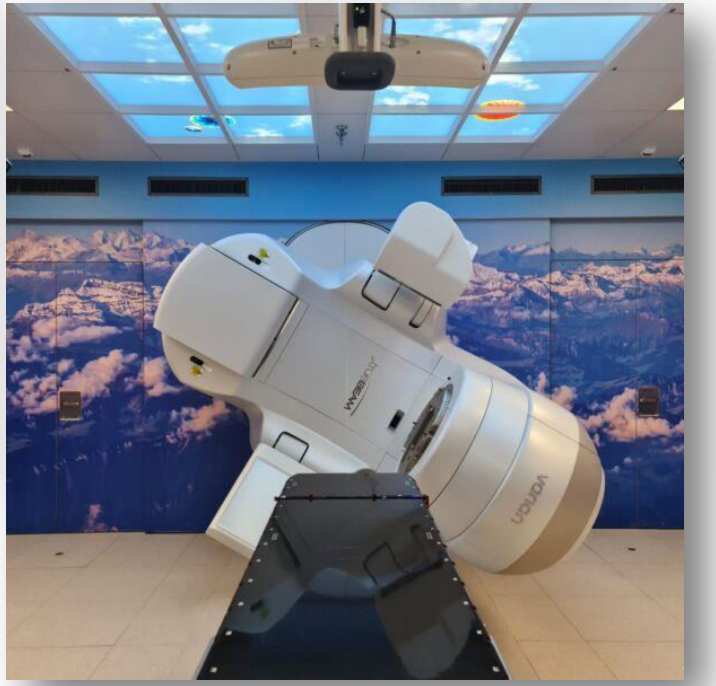
Our new setup technique involving a thorough use of SGRT:

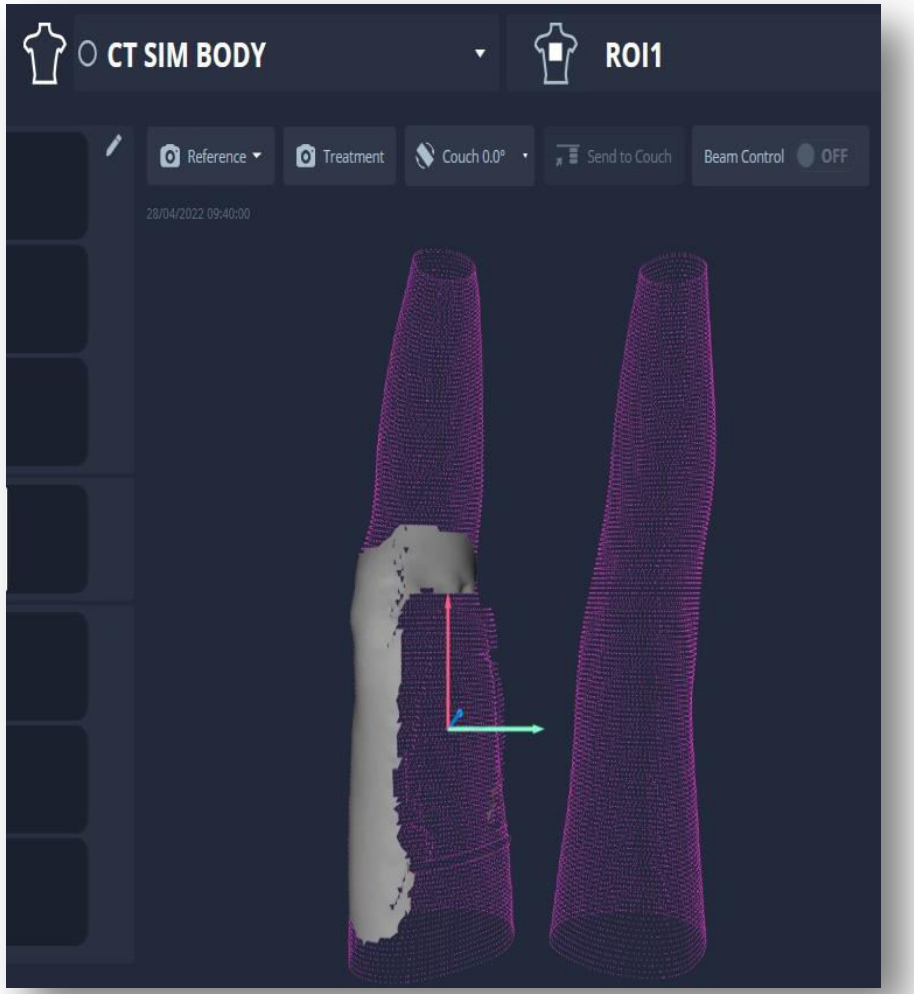


Using an SGRT Reference Capture for Setup:

- 1x a week a new SGRT Reference Capture (after RT without Bolus)
- The Bolus Reference Capture is taken after applying CBCT shifts
- Both Reference Captures are saved for future treatments.

Surface Guided Radiation Therapy – Reference Capture:

CT Sim Body Reference

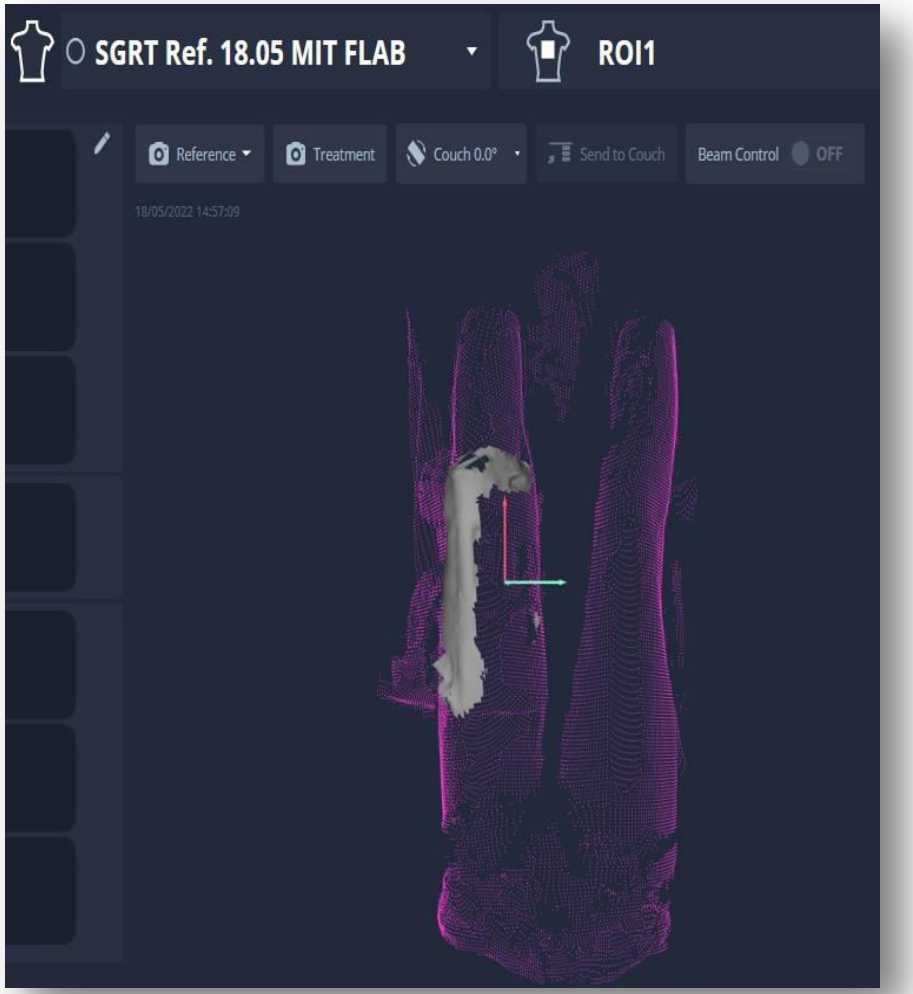


Reference Capture Fr. 6

Surface Guided Radiation Therapy – Reference Capture:

Reference Capture – WITH BOLUS

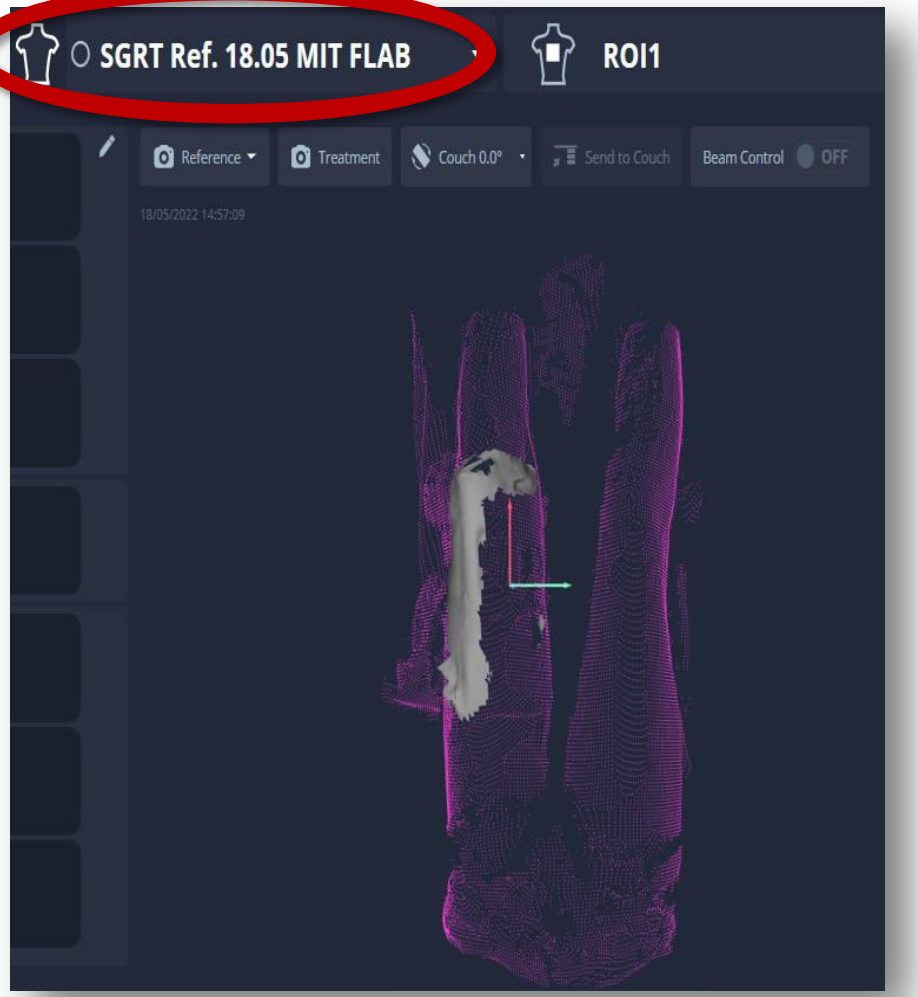
Reference Capture – WITHOUT BOLUS



Surface Guided Radiation Therapy – Reference Capture:

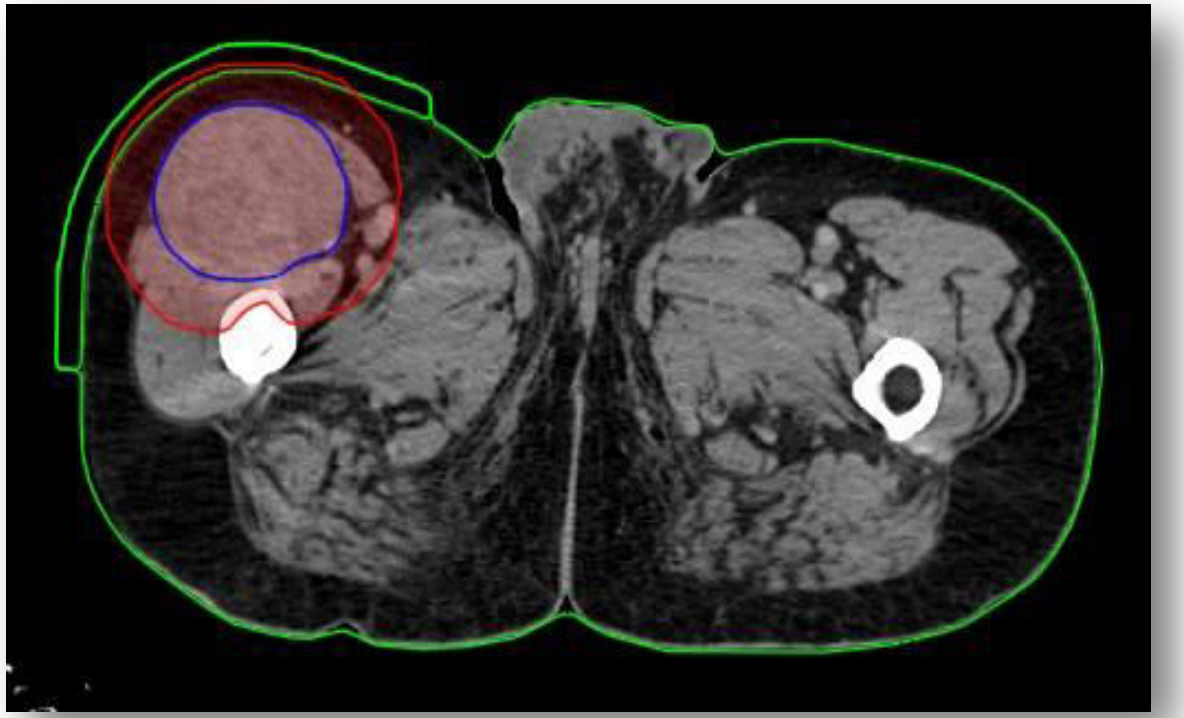
Reference Capture – WITH BOLUS

Reference Capture – WITHOUT BOLUS

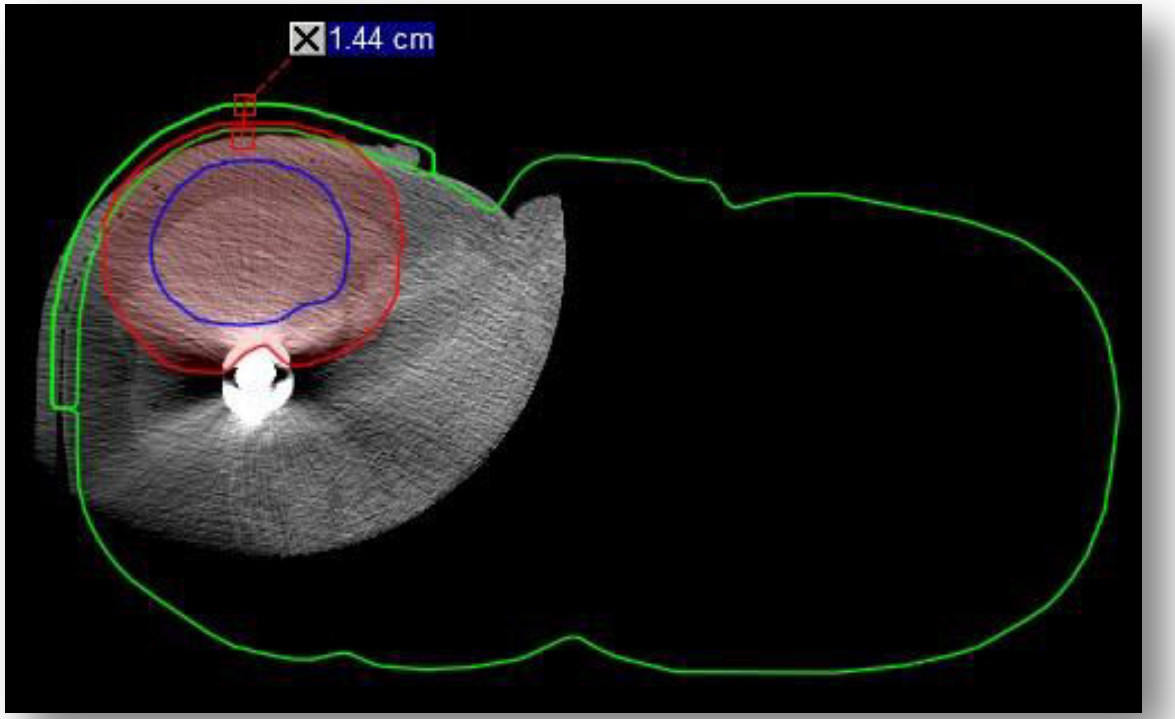


Example:

CT Simulation:



Fraction 15 CBCT:



Example:

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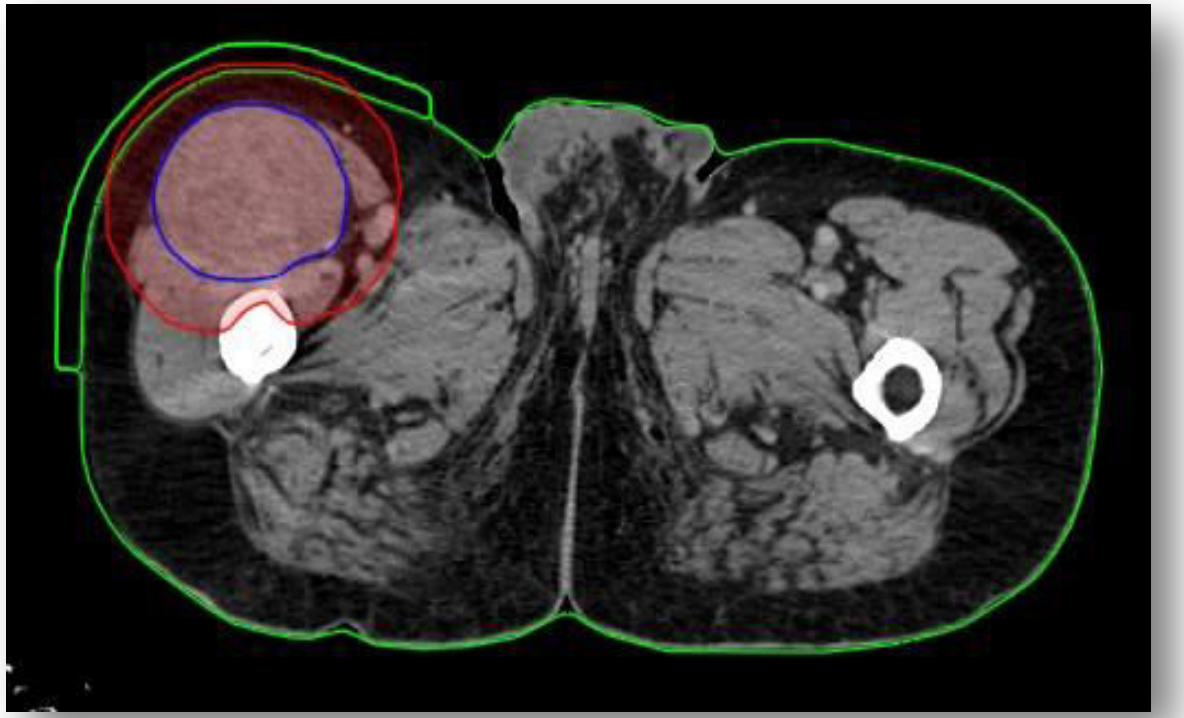

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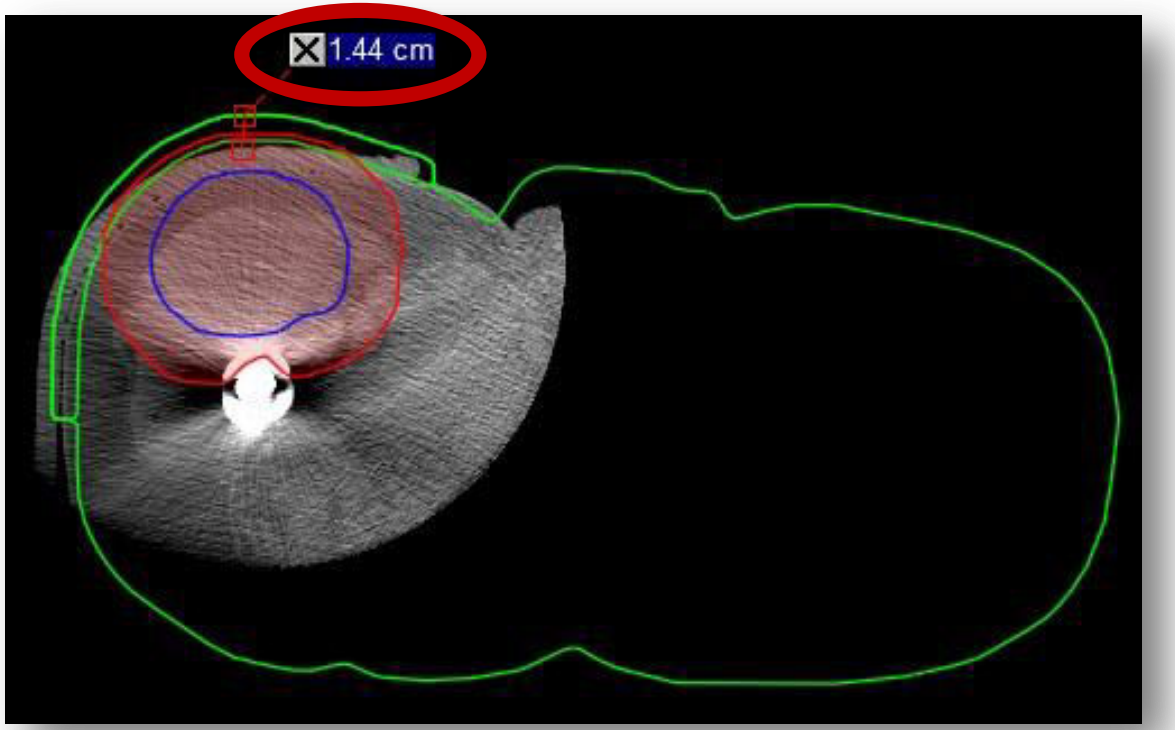


Over 1cm difference

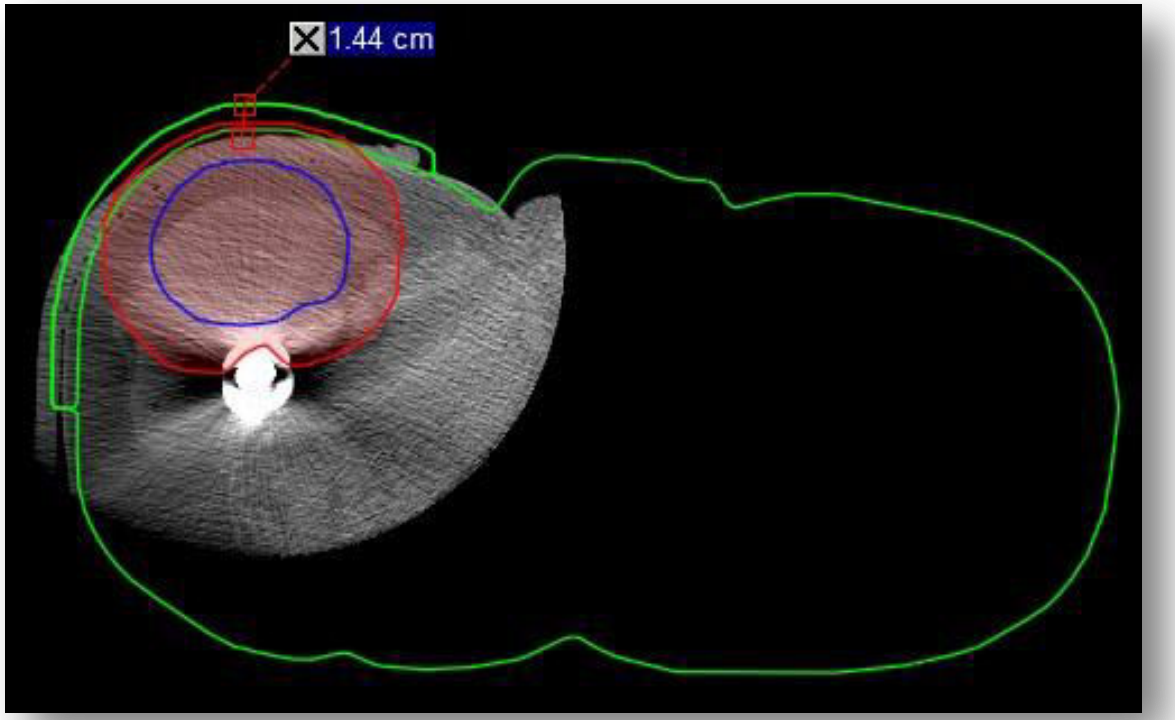
Example:

Shifts applied after IGRT following inital patient positioning:

	VRT (cm):	LNG (cm):	LAT (cm):	PITCH (º):	ROLL (º):	RTN (º):
Fraction 15 CBCT Shifts:	0.15	-0.39	-0.03	1.2	-1.1	1.4

Example:

Even though a large change in patient's surface anatomy was observed, **a SGRT Reference Capture worked well to initially position the patient.**



Method & Materials:

- **12 patients from over 200 fractions**

Standard Setup:	Setup with Reference Capture:
7 patients from 135 fractions	**5 patients from 84 fractions**
(3 setups involved Bolus, 4 without Bolus)	(4 setups involved Bolus, 1 without Bolus)

Method & Materials:

- **12 patients from over 200 fractions**

Standard Setup:	Setup with Reference Capture:
7 patients from 135 fractions (3 setups involved Bolus, 4 without Bolus)	**5 patients from 84 fractions** (4 setups involved Bolus, 1 without Bolus)

Number of images (CBCT or kVkV) taken daily, daily shifts from IGRT and average setup times were recorded.

Results:

Number of repeat images taken due to inaccuracy of initial patient positioning:

Patient Demographic:	Number of Fractions assessed:	Number of Fractions with Repeat Images:
Standard Setup:	135 fractions	**7** (all setups included Bolus)
Setup with a new Reference Capture:	84 fractions	**2** (only 1 setup included Bolus)

Results:

Number of repeat images taken due to inaccuracy of initial patient positioning:

Patient Demographic:	Number of Fractions assessed:	Number of Fractions with Repeat Images:	
Standard Setup:	135 fractions	**7** (all setups included Bolus)	**~5%**
Setup with a new Reference Capture:	84 fractions	**2** (only 1 setup included Bolus)	**~2%**

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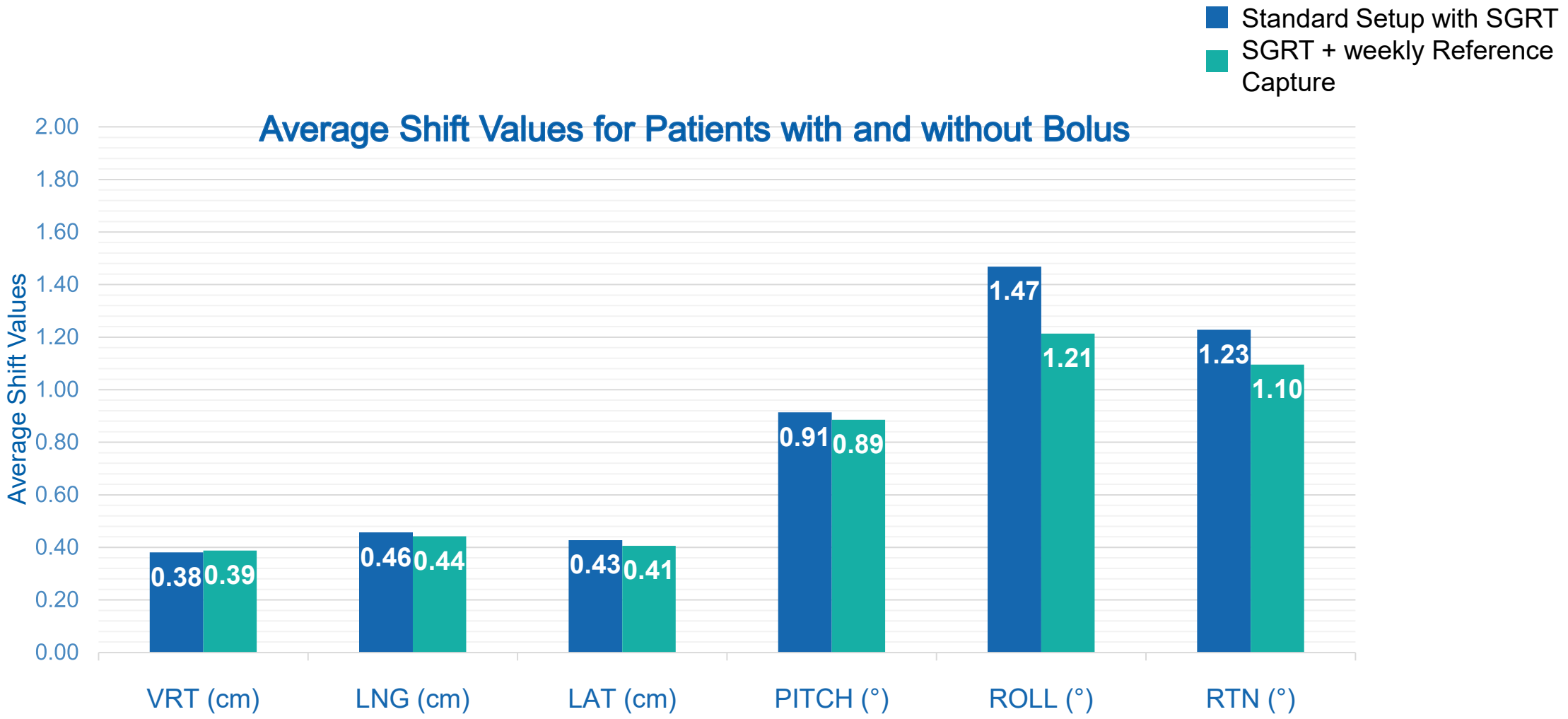
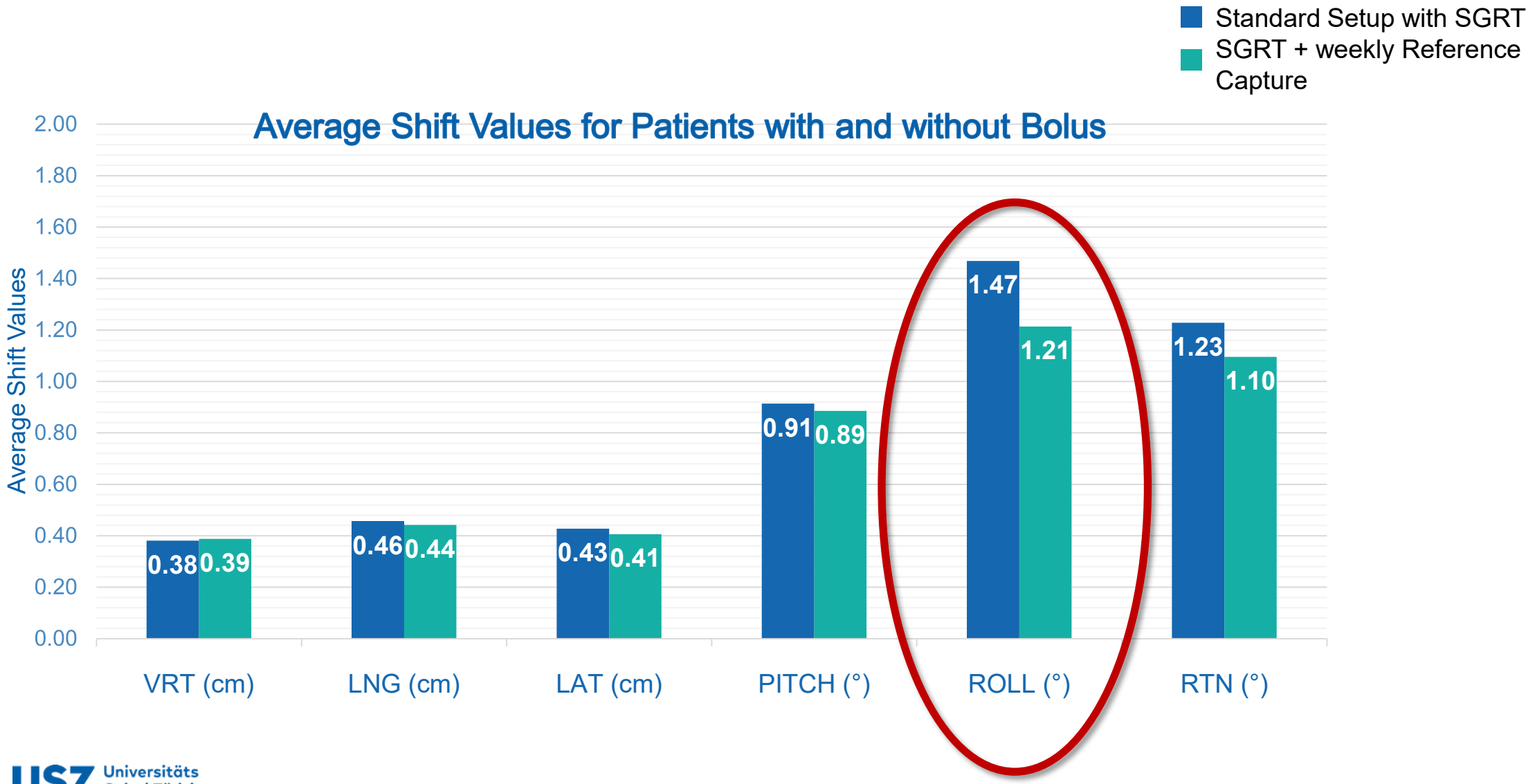
Extra ~6.25mGy from repeat imaging over the course of 25 fractions

Results:


Standard Setup with SGRT
SGRT + weekly Reference Capture
Average Shift Values for Patients with and without Bolus
Average Shift Values
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0.38
0.39
0.46
0.44
0.43
0.41
0.91
0.89
1.47
1.21
1.23
1.10
VRT (cm)
LNG (cm)
LAT (cm)
PITCH (°)
ROLL (°)
RTN (°)

Results: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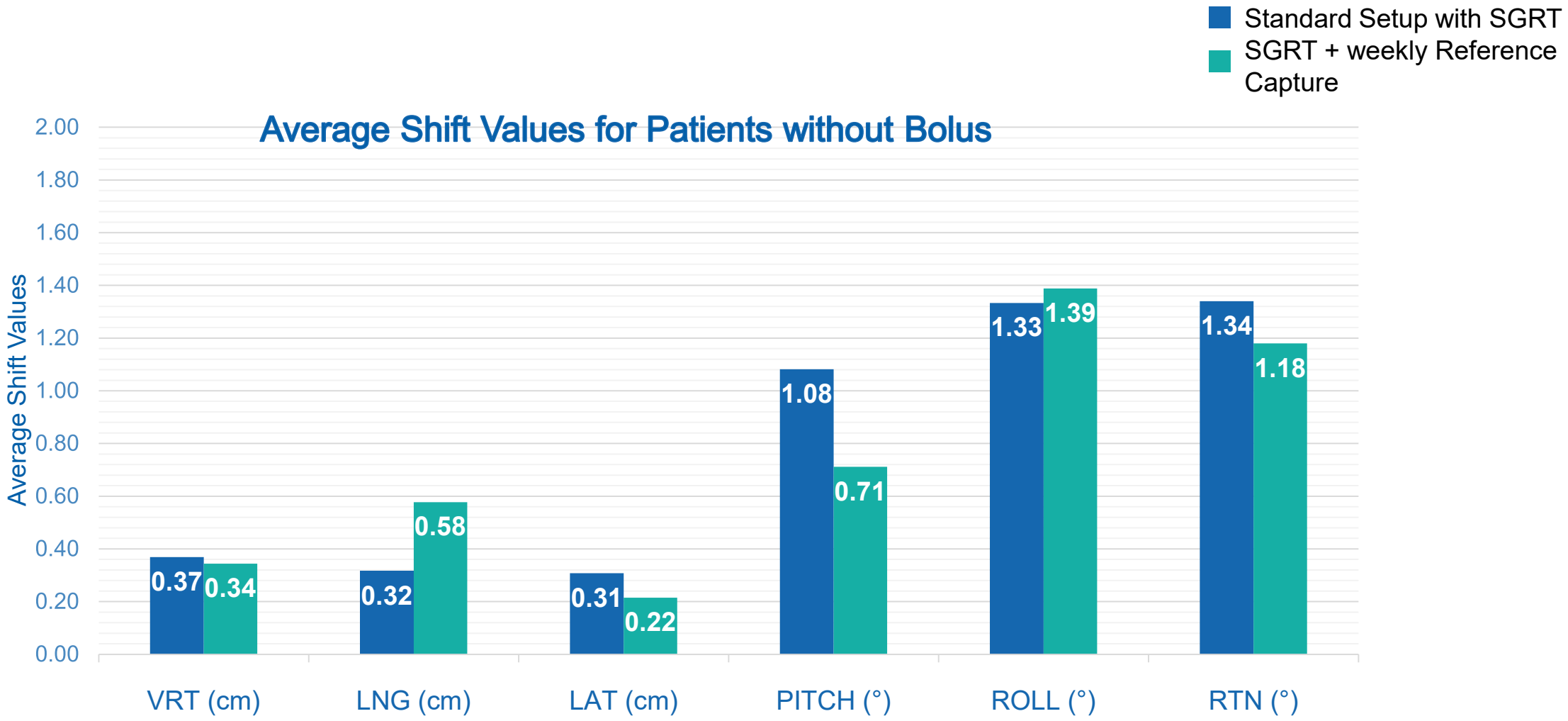
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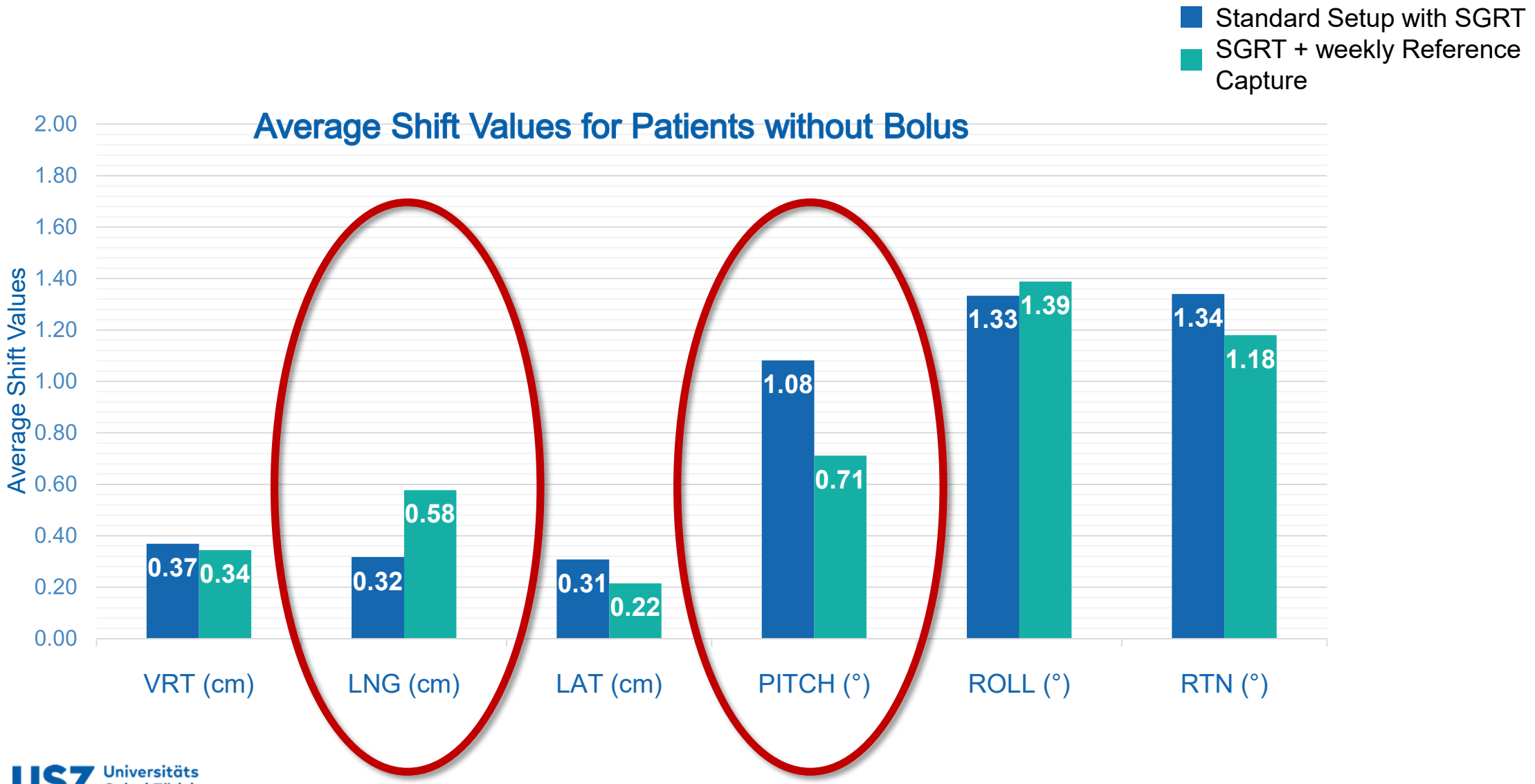
0.60
0.40
0.20
0.00
0.37
0.34
0.32
0.58
0.31
0.22
1.08
0.71
1.33
1.39
1.34
1.18
VRT (cm)
LNG (cm)
LAT (cm)
PITCH (°)
ROLL (°)
RTN (°)

Results: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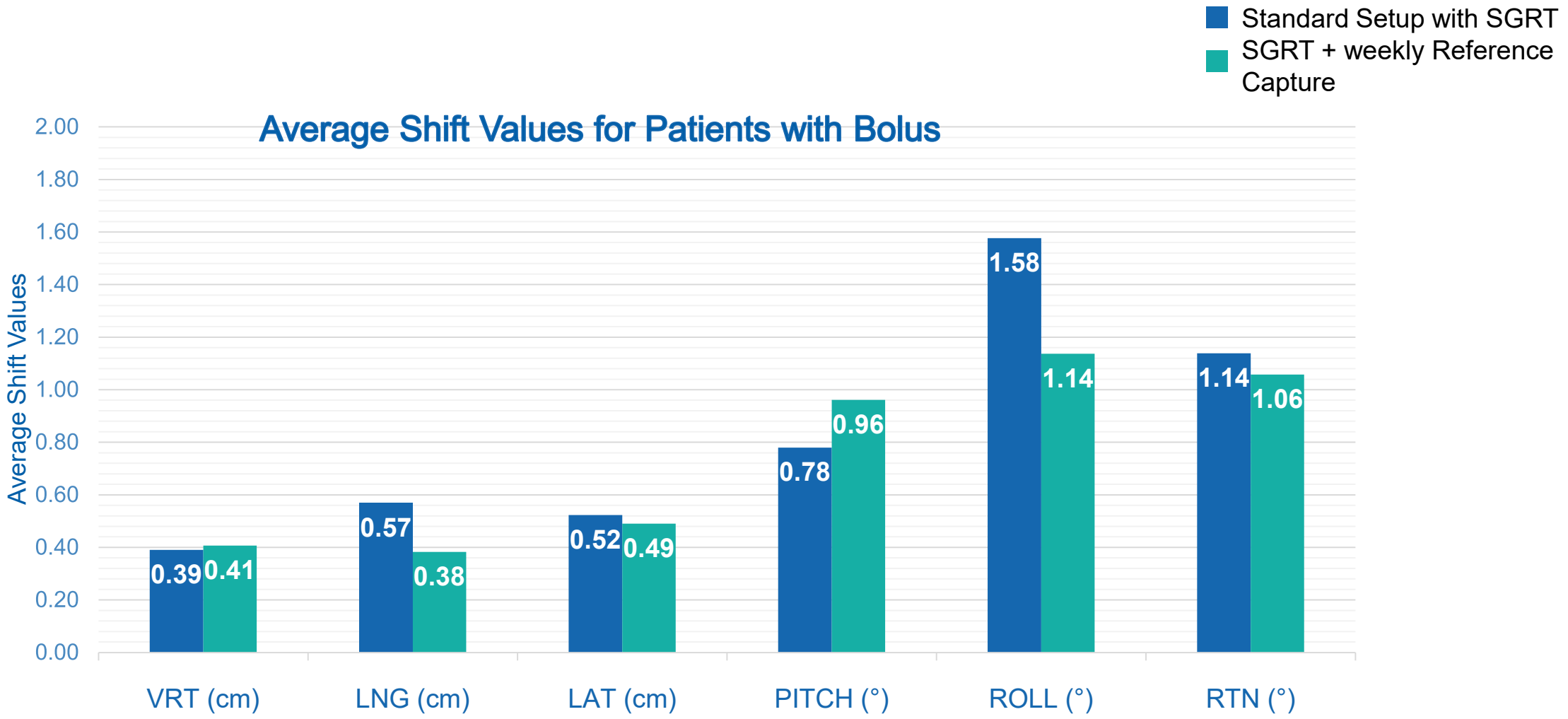
Standard Setup with SGRT
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2.00
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1.40
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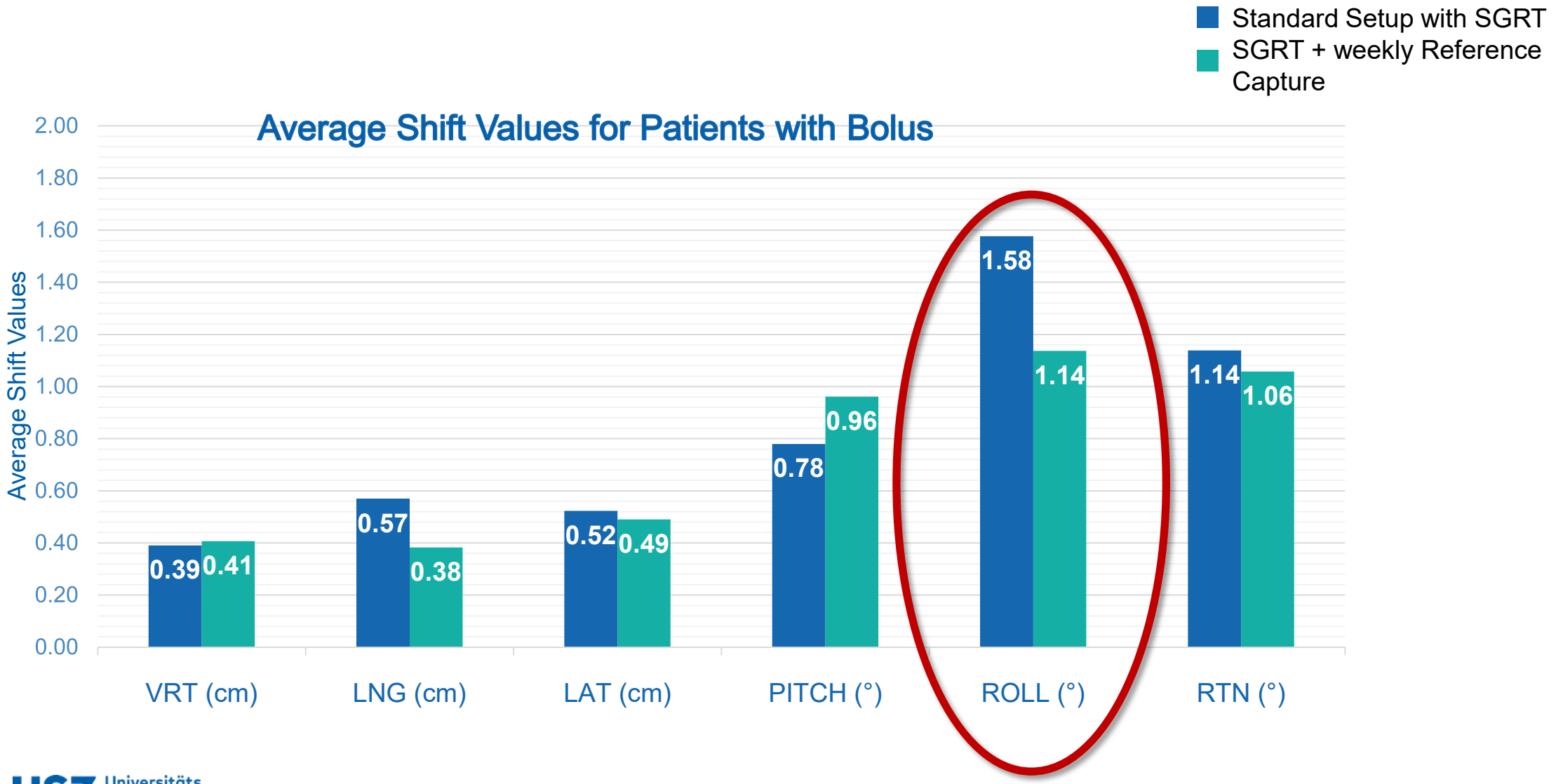
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Results:

Patient Demographic:	Average Initial Setup Time:
All Patients with Bolus:	12 minutes
All Patients without Bolus:	10 minutes
All Patients with the Standard Setup:	12 minutes
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Decrease the number of repeat images needed

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Decrease the amount of time needed for the initial setup.

Early Conclusions:

Using a Reference Capture from AlignRT weekly for initial patient positioning can:

- Decrease the number of repeat images needed
- Help decrease Roll discrepancies
- Decrease the amount of time needed for the initial setup.
- Correct for not having a “Body” Structure without Bolus

Thank you!

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