Postural Video to Assist with Reproducing Diagnostic CT Position in a Simulation-Free Palliative Workflow

SGRT APAC Meeting 2024 (Naarm/Melbourne)

Alice Oliver, Kenton Thompson, Dr Kathy Pope, Karen McGoldrick, Cara Anticevic, Trevor Ackerly, Derrick Wanigaratne, Dr Katrina Woodford

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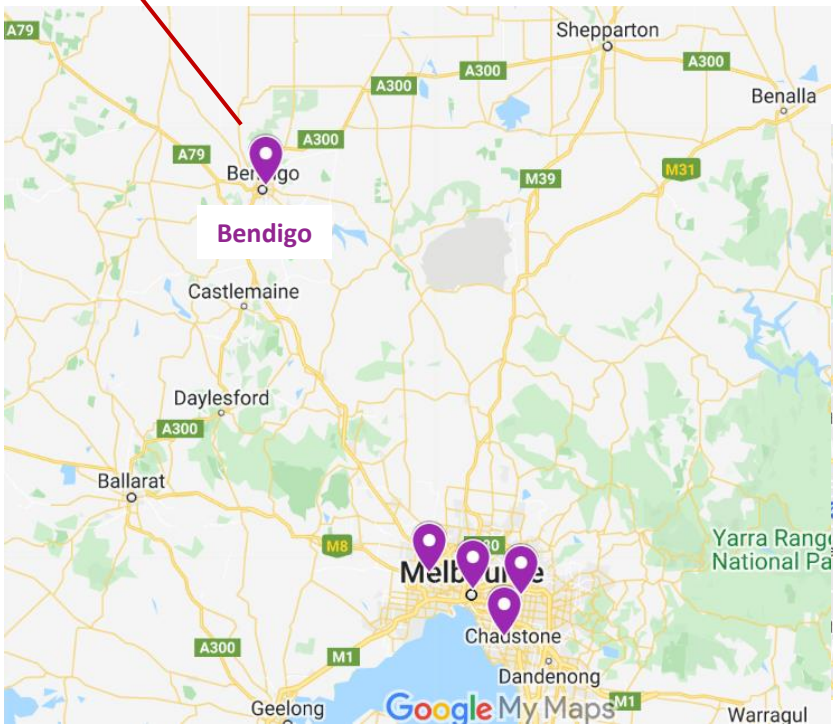
BACKGROUND

Mildura, Victoria 3500

via Calder Hwy/A79 — 4 hr 21 min

Fastest route now due to traffic conditions — 400 km

- **Patient benefits**
  - Reduced no. of visits
  - Reduced time in the department
  - Reduced timeframe from referral to Tx
  - Comparable clinical outcomes
- **Dept. benefit** – pre-planning capacity



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BACKGROUND - DOSIMETRY

Practical Radiation Oncology
Volume 11, Issue 2, March–April 2021, Pages e146-e153

Basic Original Report

Diagnostic Computed Tomography Enabled Planning for Palliative Radiation Therapy: Removing the Need for a Planning Computed Tomography Scan

Shelley Wong MRT [a], Stephanie Roderick MMedPhys [a], Alannah Kejda MSc [a], John Atyeo PhD [a], Kylie Grimberg BAppSc [a], Brian Porter BAppSc [a], Jeremy Booth PhD [a b], George Hruby MBChB, FRANZCR [a c], Thomas Eade MBChB, FRANZCR [a c]

Study	Measurement	Results
Wong, S. et al (2021)	HU comparison between dCT + pCT	Lung and bone: statistically insignificant Liver: *P*=.004 Overall impact on dosimetry: ±2%

Physics and Imaging in Radiation Oncology 27 (2023) 100456

Contents lists available at ScienceDirect

Physics and Imaging in Radiation Oncology

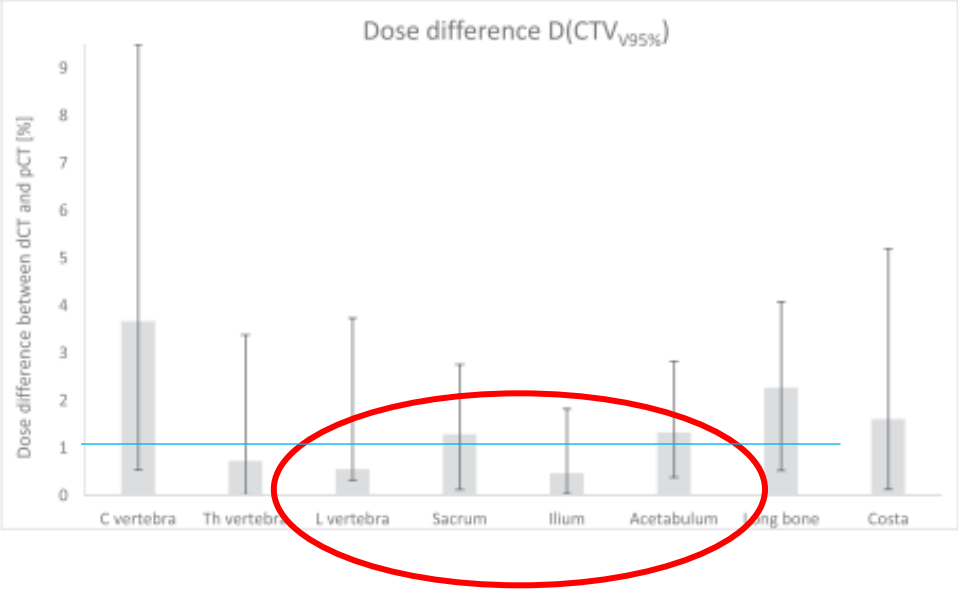
journal homepage: www.sciencedirect.com/journal/physics-and-imaging-in-radiation-oncology

Original Research Article

Palliative intensity modulated radiotherapy of bone metastases based on diagnostic instead of planning computed tomography scans

Suvi Larjavaara *, Satu Strengell, Tiina Seppälä, Mikko Tenhunen, Anu Anttonen

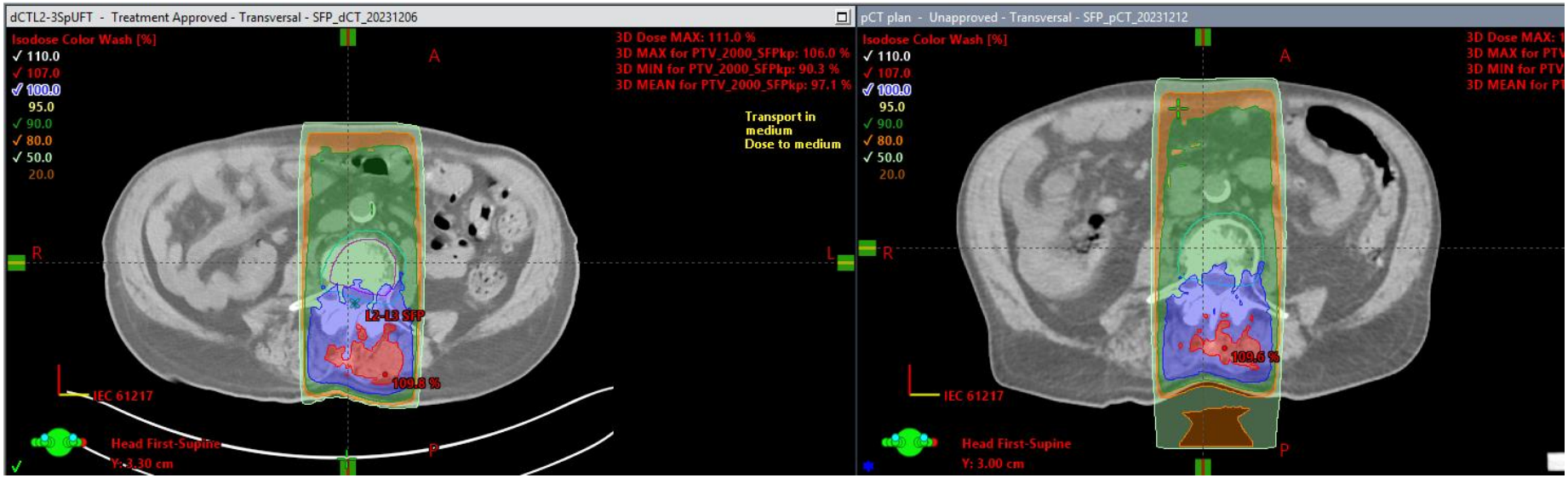
Comprehensive Cancer Center, Helsinki University Central Hospital, PL180, 00029 HUS, Finland



BACKGROUND - DOSIMETRY

Dosimetry on **dCT**

Image fusion and plan copy onto **pCT** (MUs forced)



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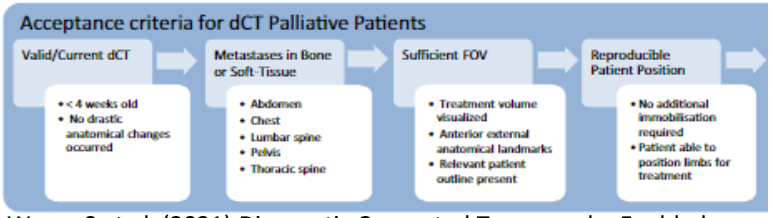
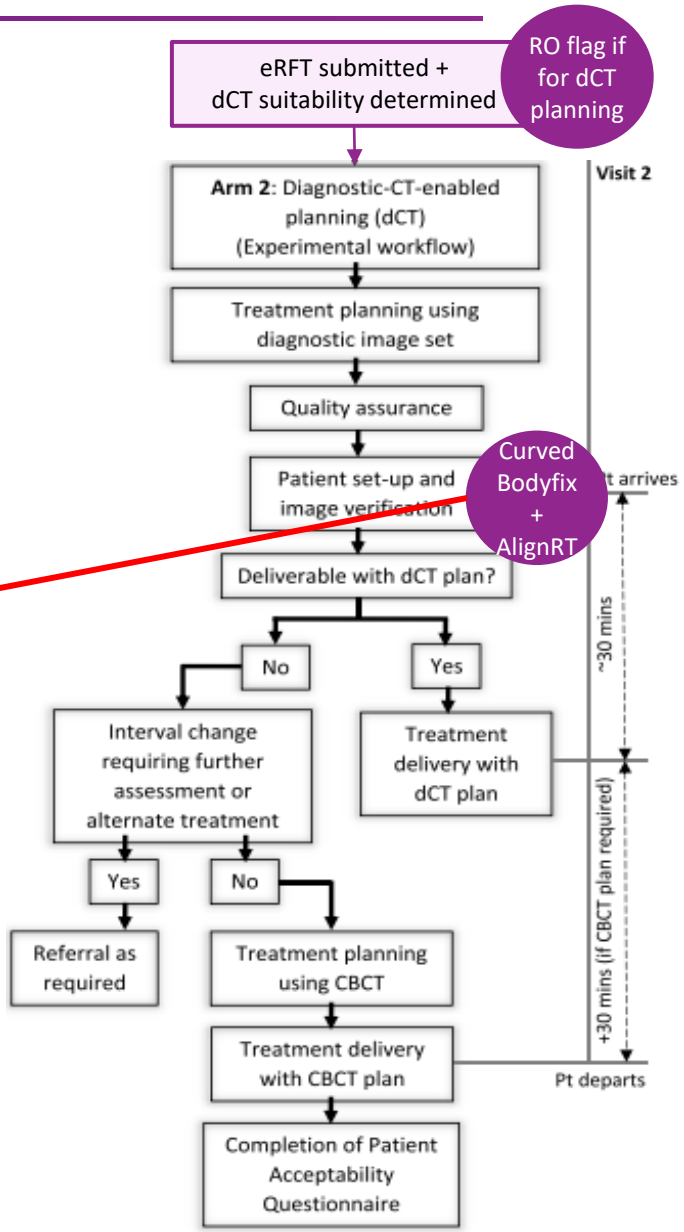
BACKGROUND - WORKFLOW



Wong, S et al. (2021) Diagnostic Computed Tomography Enabled Planning for Palliative Radiotherapy: Removing the Need for a Planning Computed Tomography Scan. **PRO**, *11* e146-153



O'Neil *et al. BMC Palliative Care* (2022) 21:220
https://doi.org/10.1186/s12904-022-01115-y

BMC Palliative Care

STUDY PROTOCOL Open Access

DART: diagnostic-CT-enabled planning: a randomized trial in palliative radiation therapy (study protocol)

Melissa O'Neil, Timothy K. Nguyen, Joanna Laba, Robert Dinniwell, Andrew Warner and David A. Palma*

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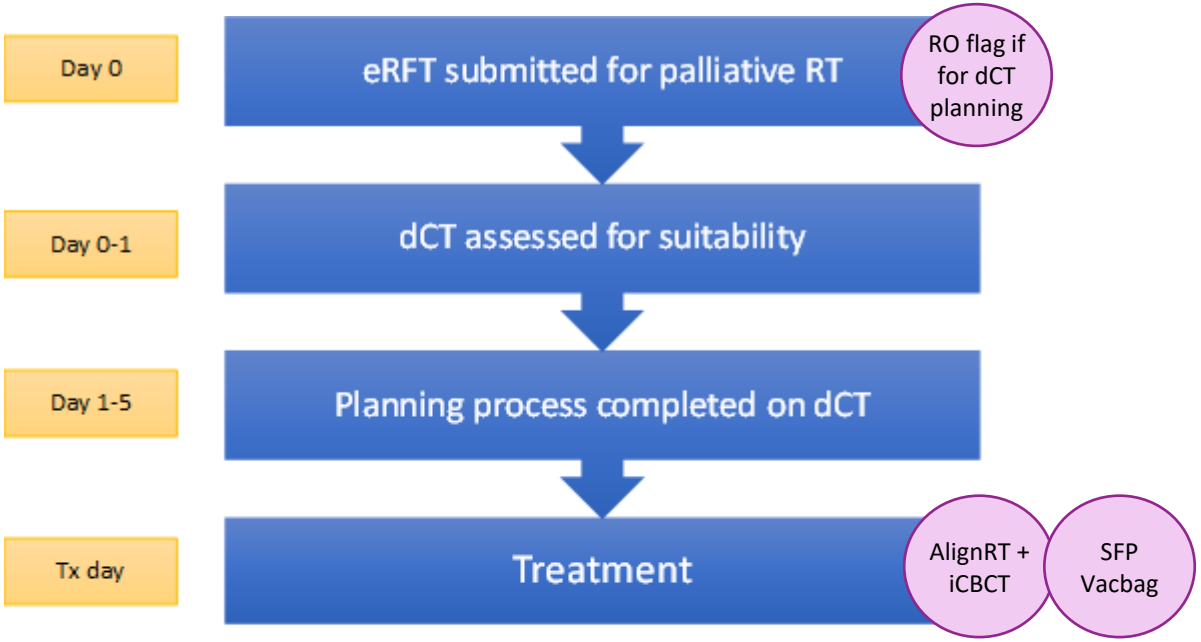
WORKFLOW



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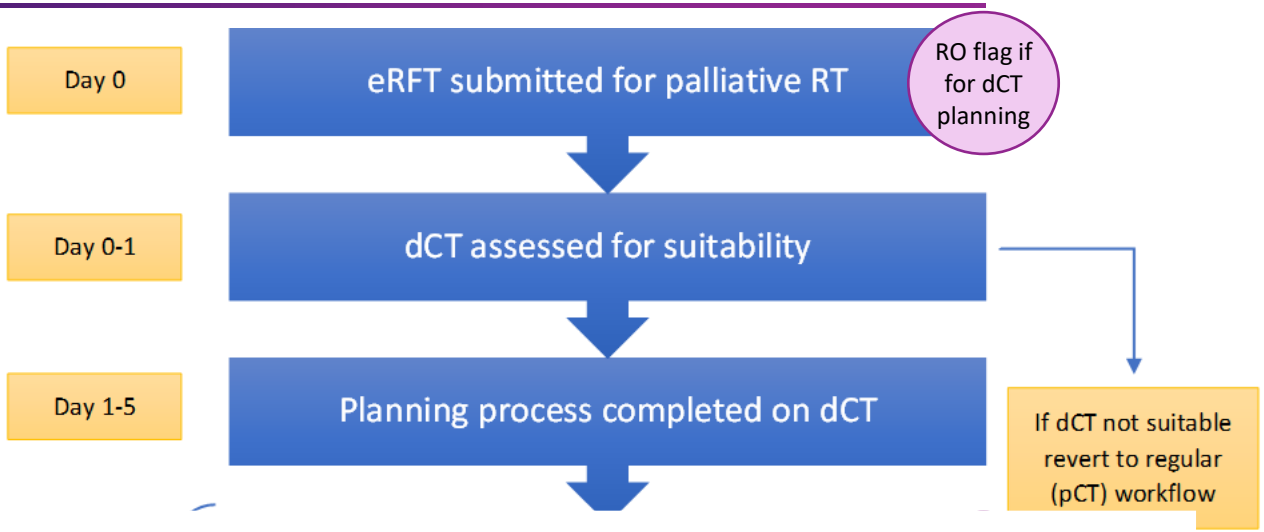
PILOT WORKFLOW



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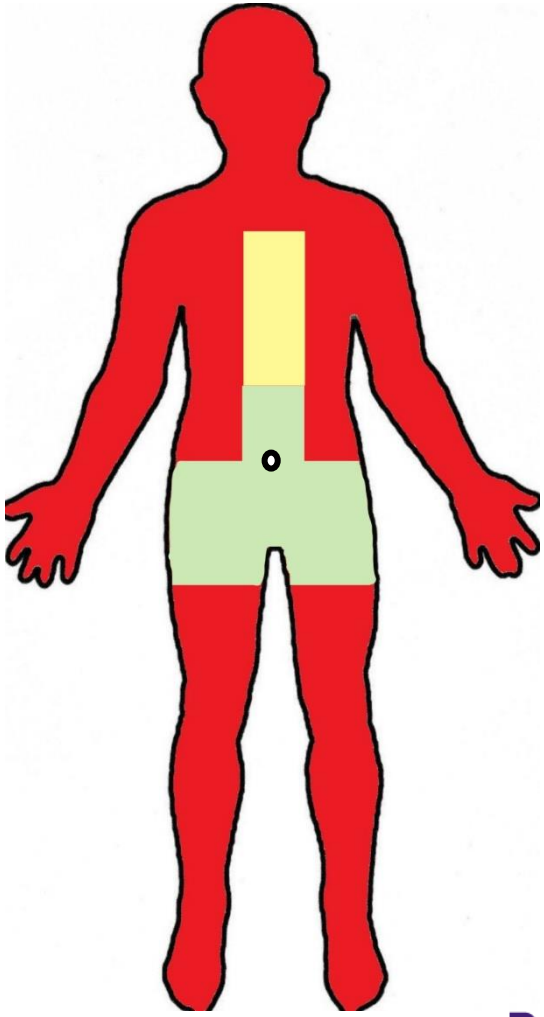
INCLUSION CRITERIA – PILOT PHASE

Keeping it simple

- Non-urgent palliative patients (7-14 days)
- dCT suitability criteria
- Bony lesions – T10 → pelvis

Next up

- Urgent patients eligible
- T4 → T10



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SIM-FREE SET-UP: A CHANGE IN THINKING

	pCT pathway
CT	**Optimise** patient position/scan for Tx
	Document **specific instructions/measurements** – stabilisation equipment, RPs
Patient set-up	Set-up instructions – stabilisation, location RPs – locations, referenced Couch long – starting point
	Follow prescribed instructions (stabilisation equipment/location, RPs, couch long)
	Check against **known** parameters – couch long, isocentre measurements
Imaging	Match to **known** structures Certain degree of **consistency** is expected

ROI SET-UP IN ALIGNRT

ROI1 (Set-up)

- Include as much of the visible surface as possible – beware of indendations/bulges from clothing etc
- Gives as much information as possible in AlignRT deltas

ROI2 (Treatment)

- For monitoring
- Reduce breathing artifact to prevent beam interruption

SIM-FREE SET-UP WORKFLOW

Task	Move…what?	Tools
Find approximate isocentre (Long, Lat, Vert)	The bed/couch	• Postural video • Manual palpation (if required)
Correct rotational position (Pitch, Roll, Rotation)	The patient	• Postural video • Deltas + deformation • Adjust stabilization equipment (if required – eg lift knees higher to correct pitch)

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CASE STUDY

- Patient #6 for pilot phase
- 74 yo female
- Metastatic Breast Ca
- Tx: 20Gy/5Fx to Lt Sacrum
- Course: 6
- dCT → Fx1 = 30 days (recommended: 28 days)
  - 14/2/2024 → 15/3/2024
  - Leap year interference
  - Fx1 delayed by one day due to scheduling constraints
- Beam arrangement: AP-PA, 18MV

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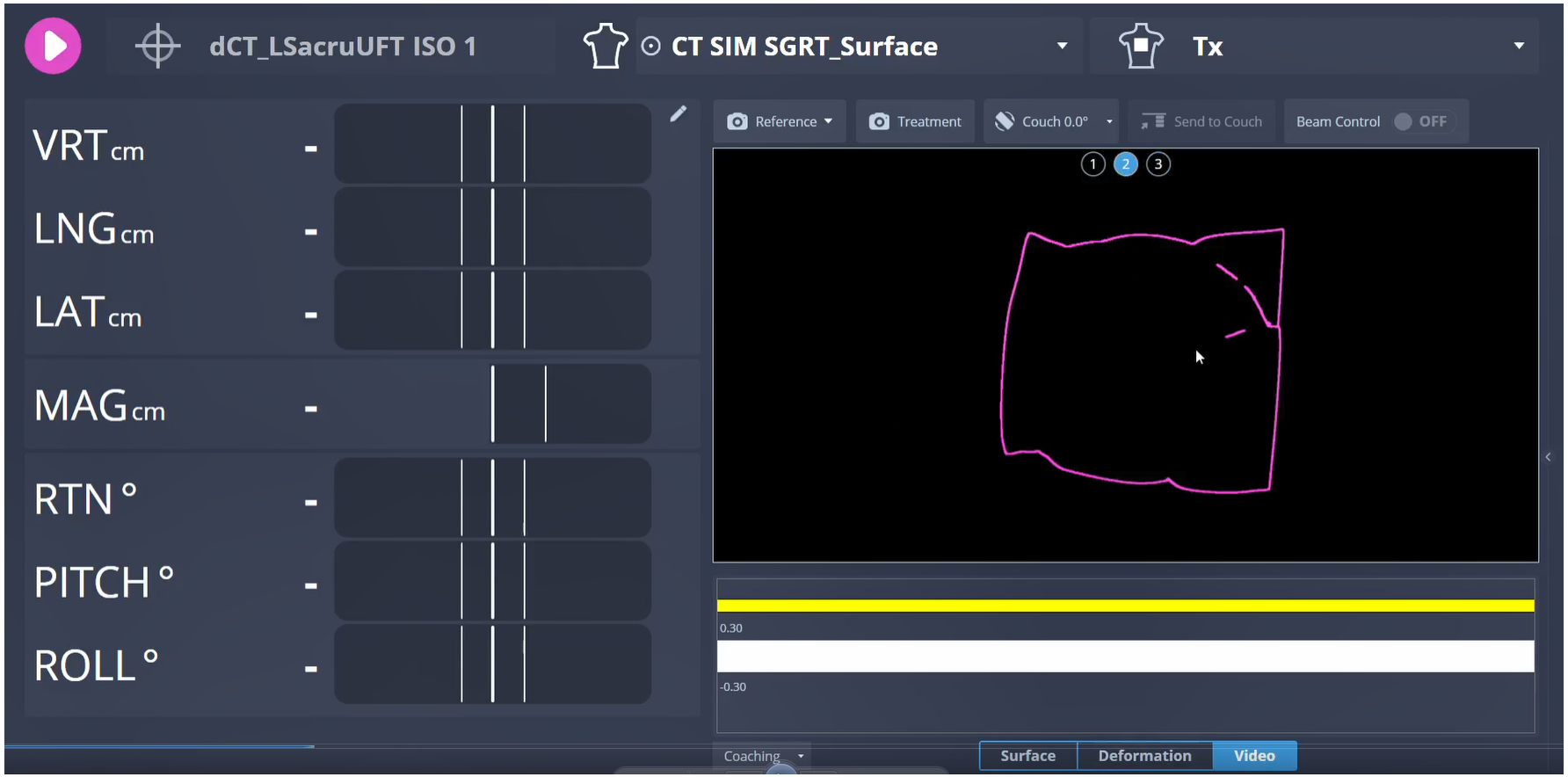
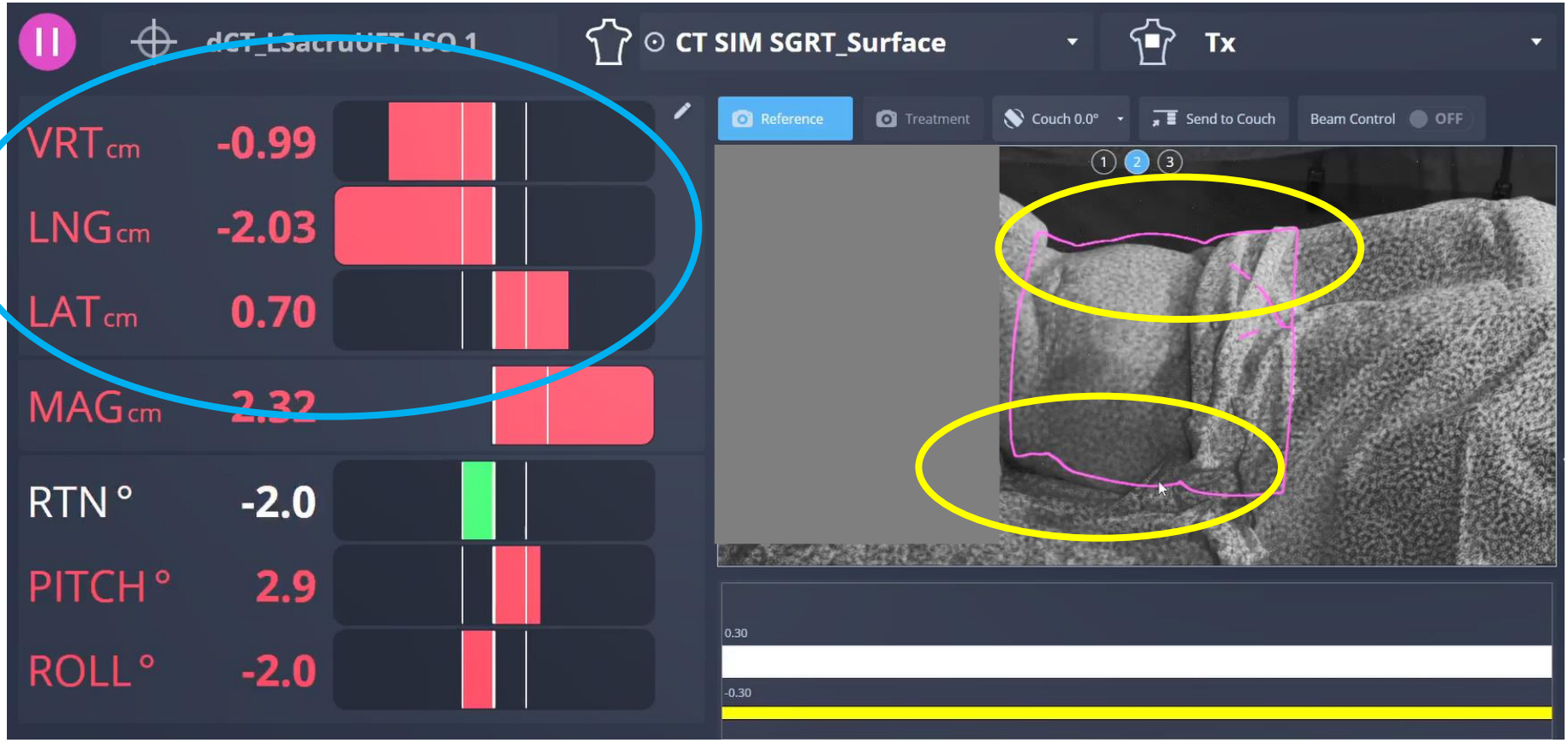
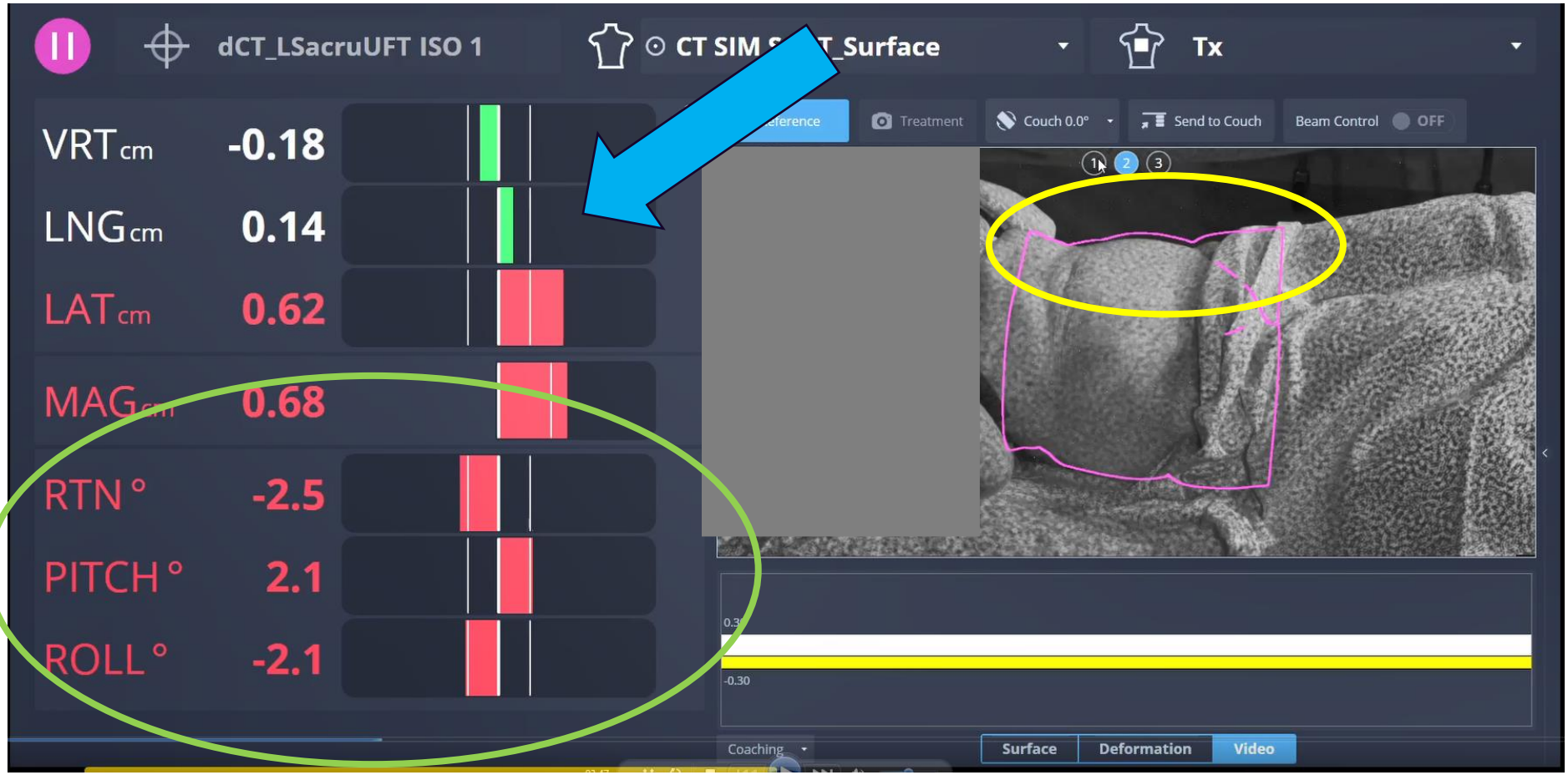
DATASET LENGTH



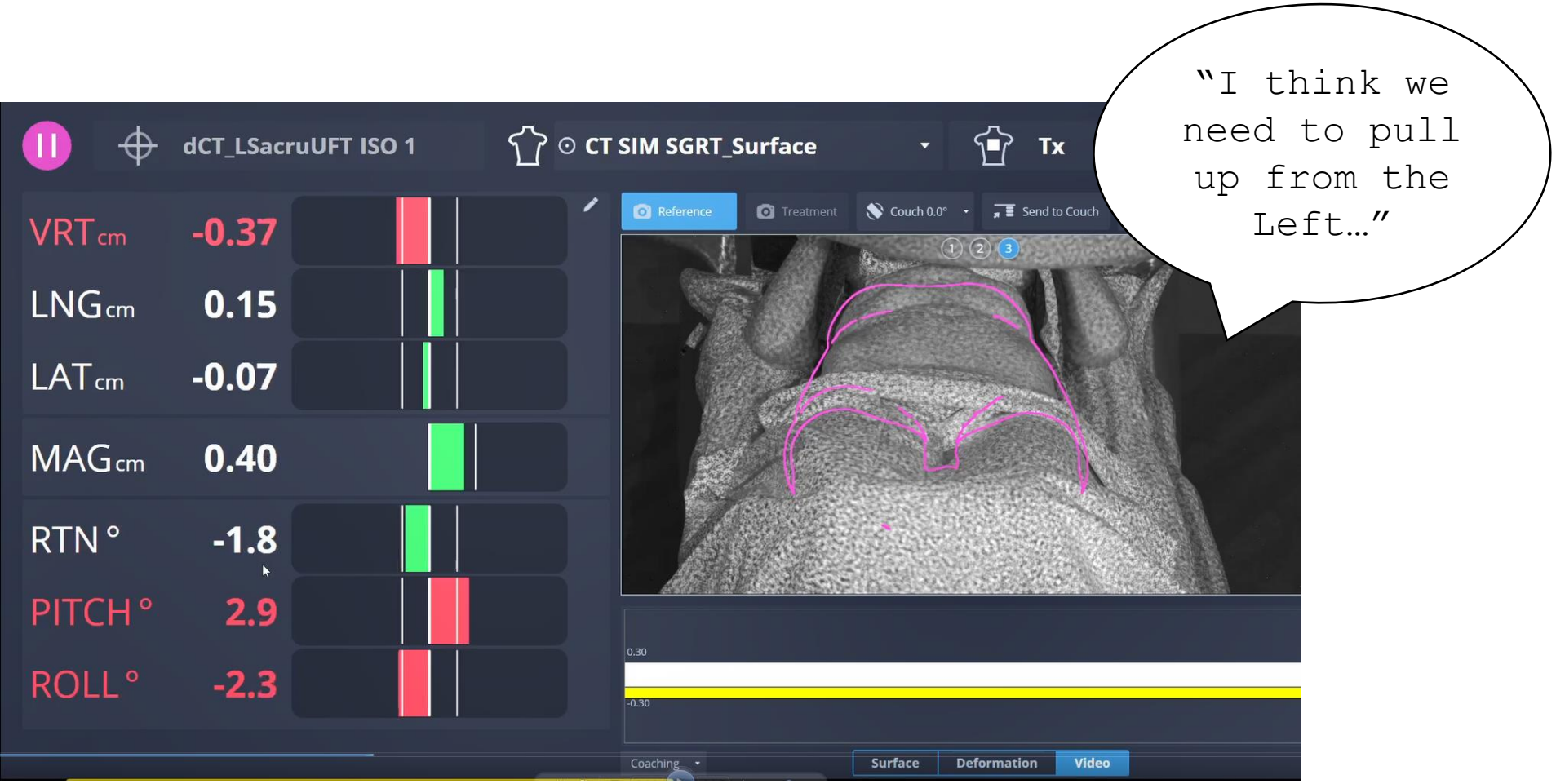
FINDING ISOCENTRE



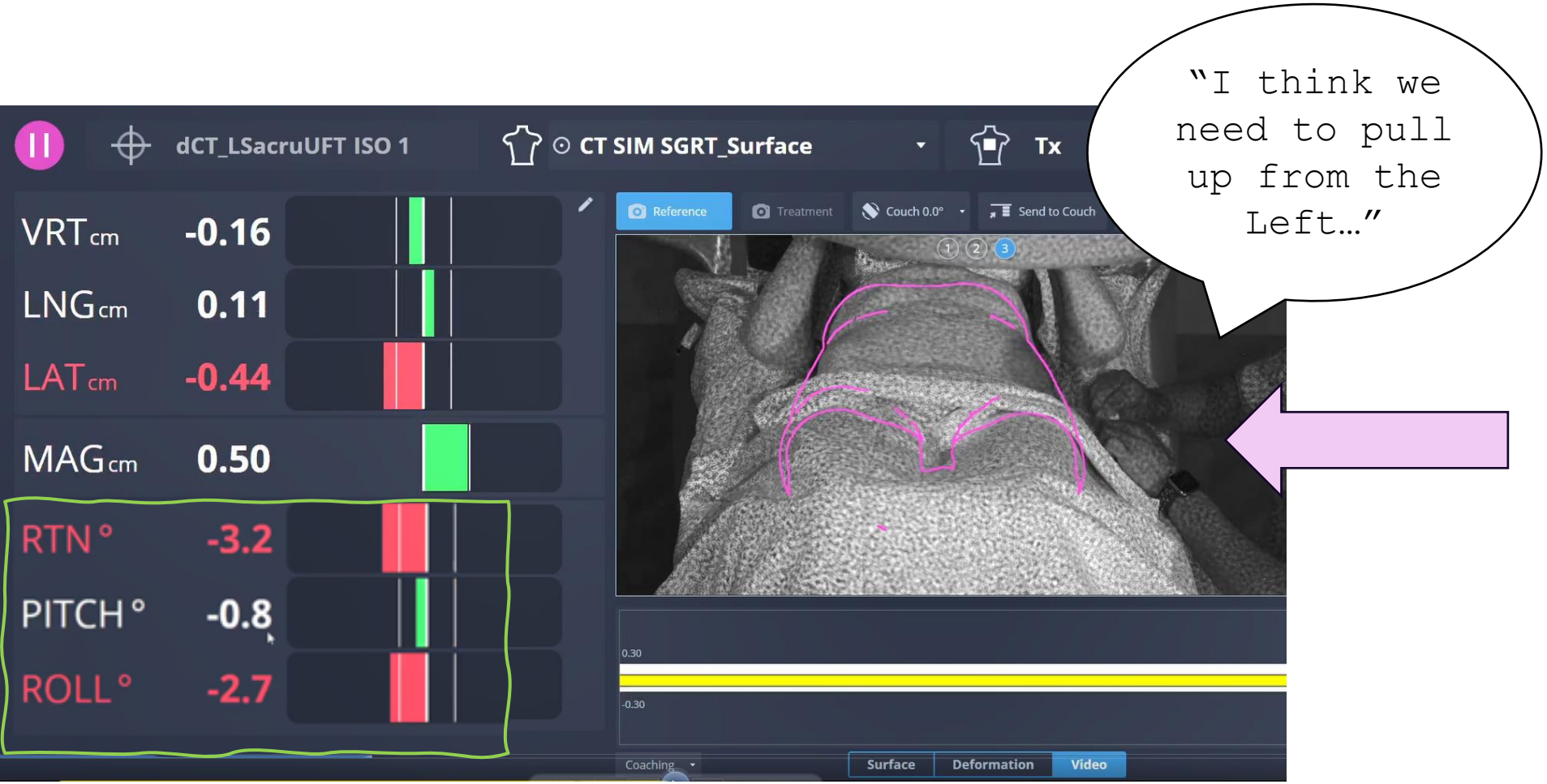
ROTATIONAL CORRECTIONS



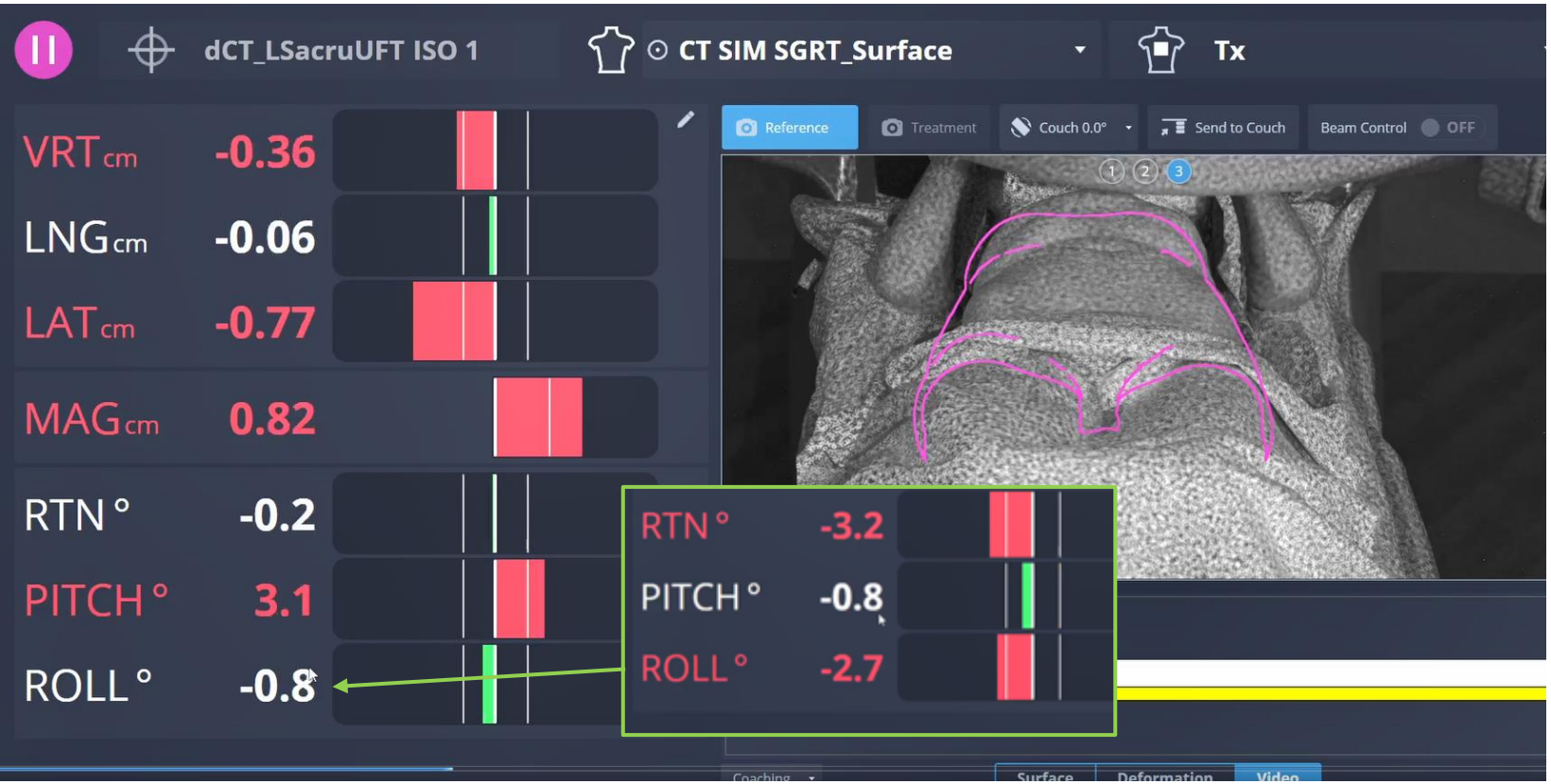
ROTATIONAL CORRECTIONS IN ACTION!



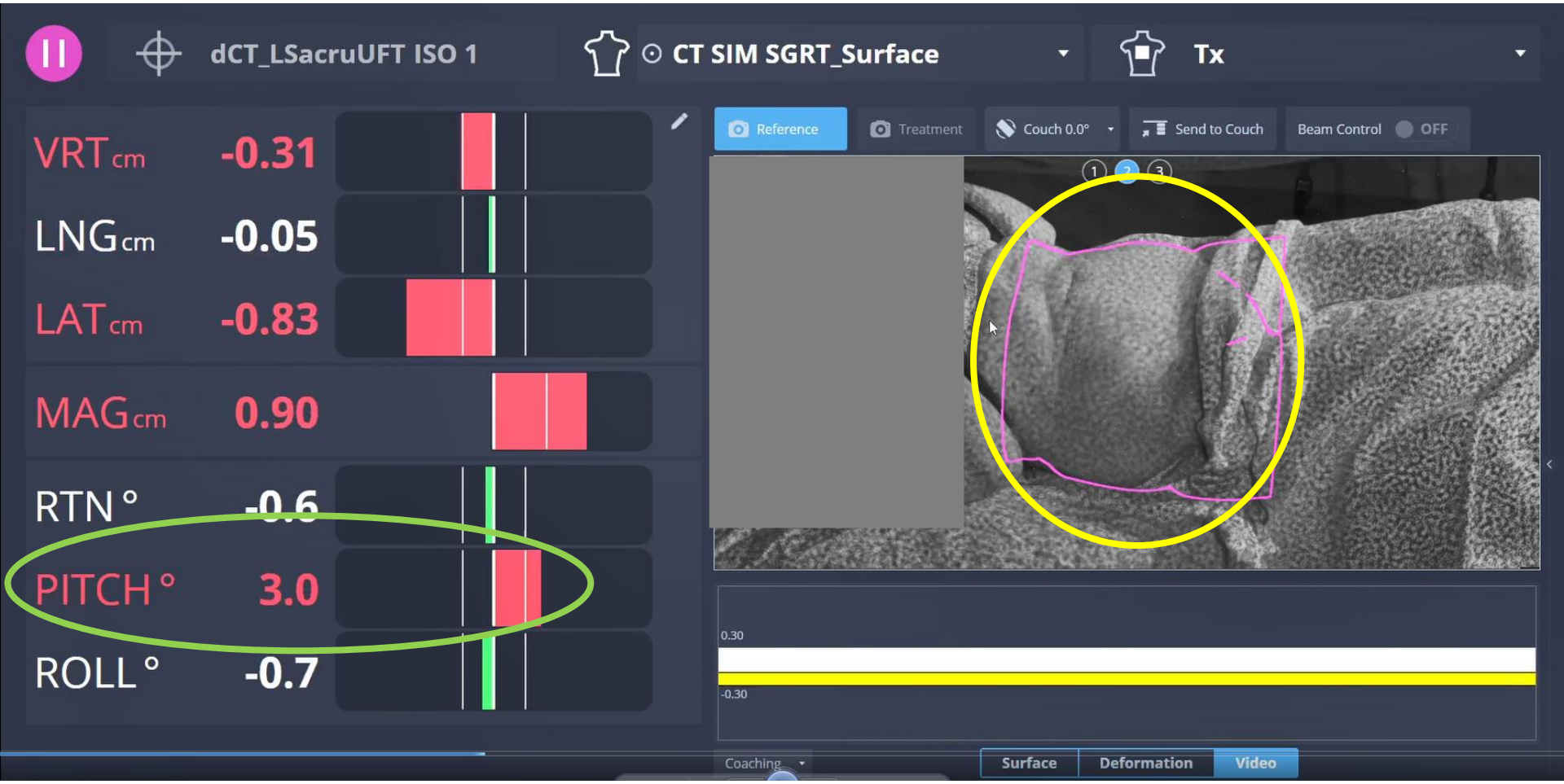
PATIENT REPOSITIONING



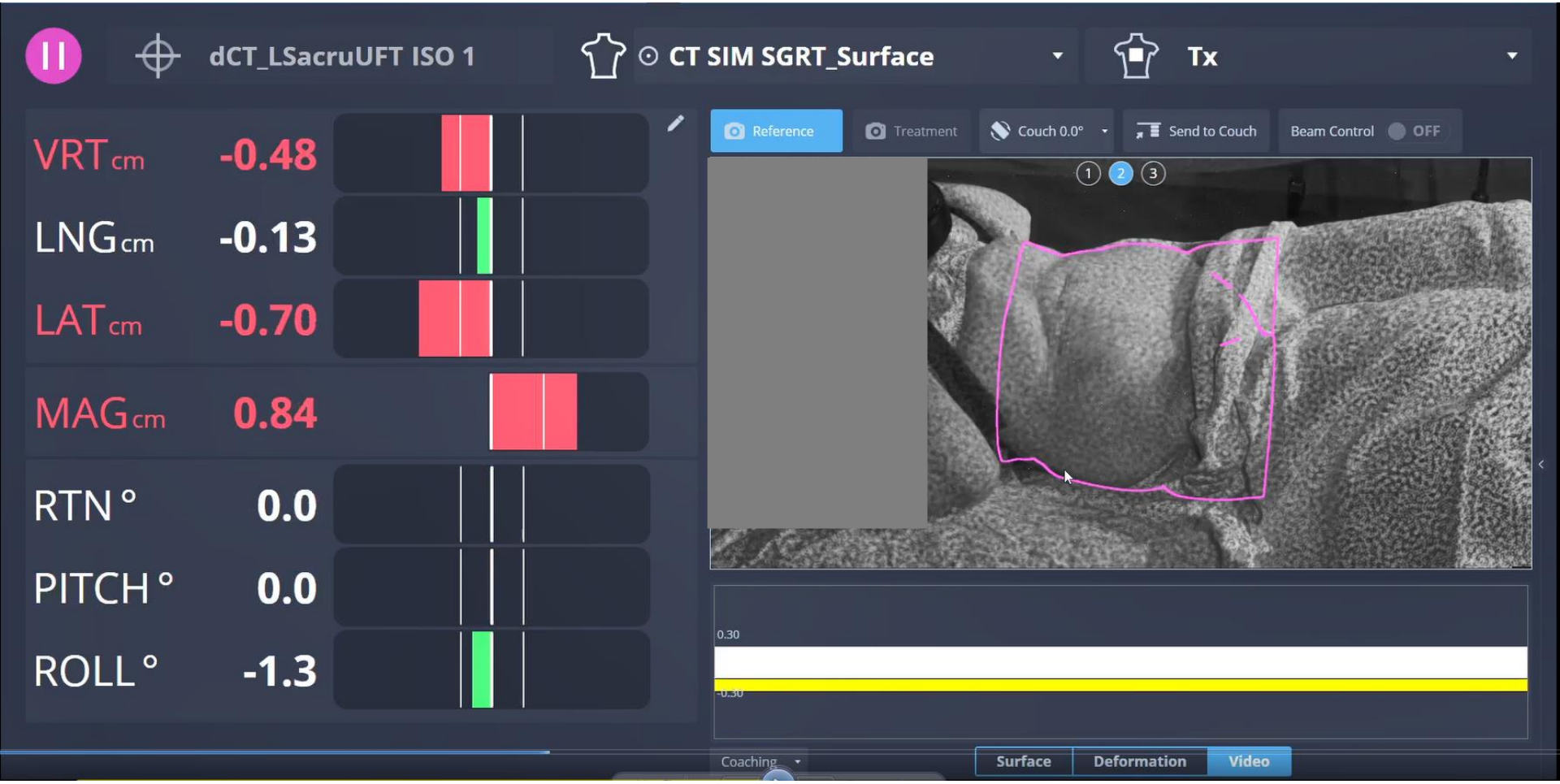
ROLL – CORRECTED



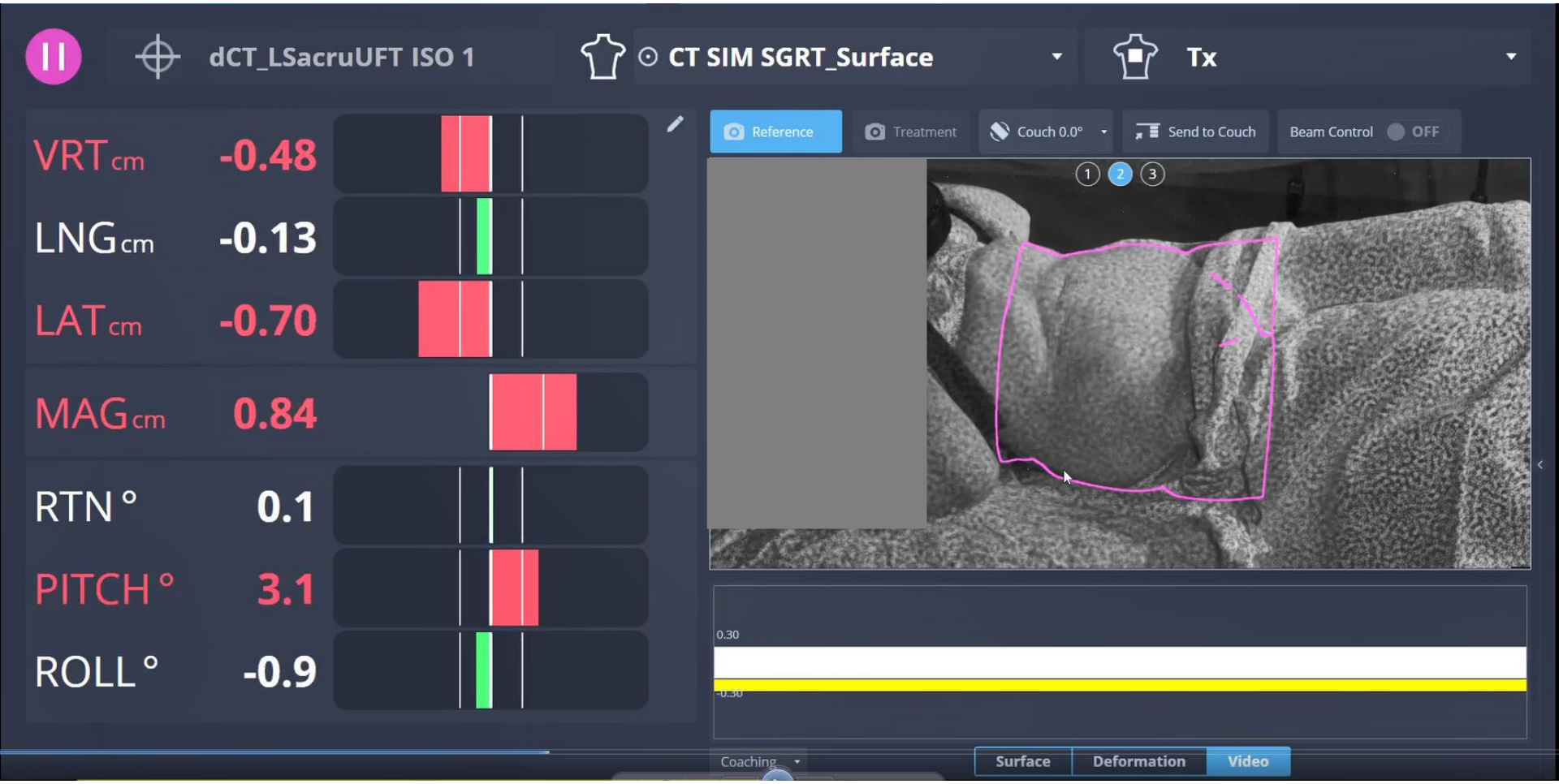
CORRECTING THE PITCH



PITCH – FLICKERING

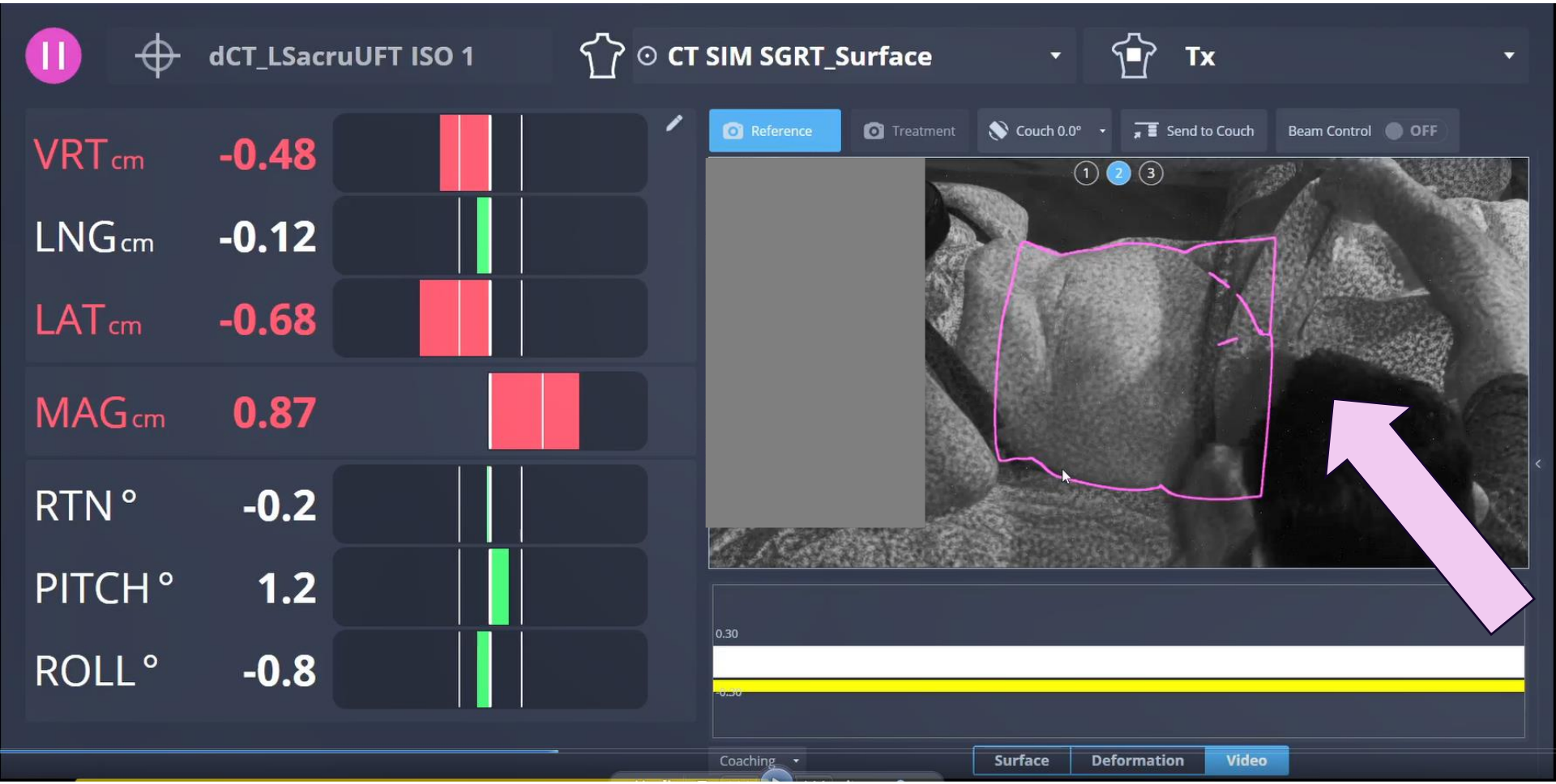


TAKING A PAUSE…

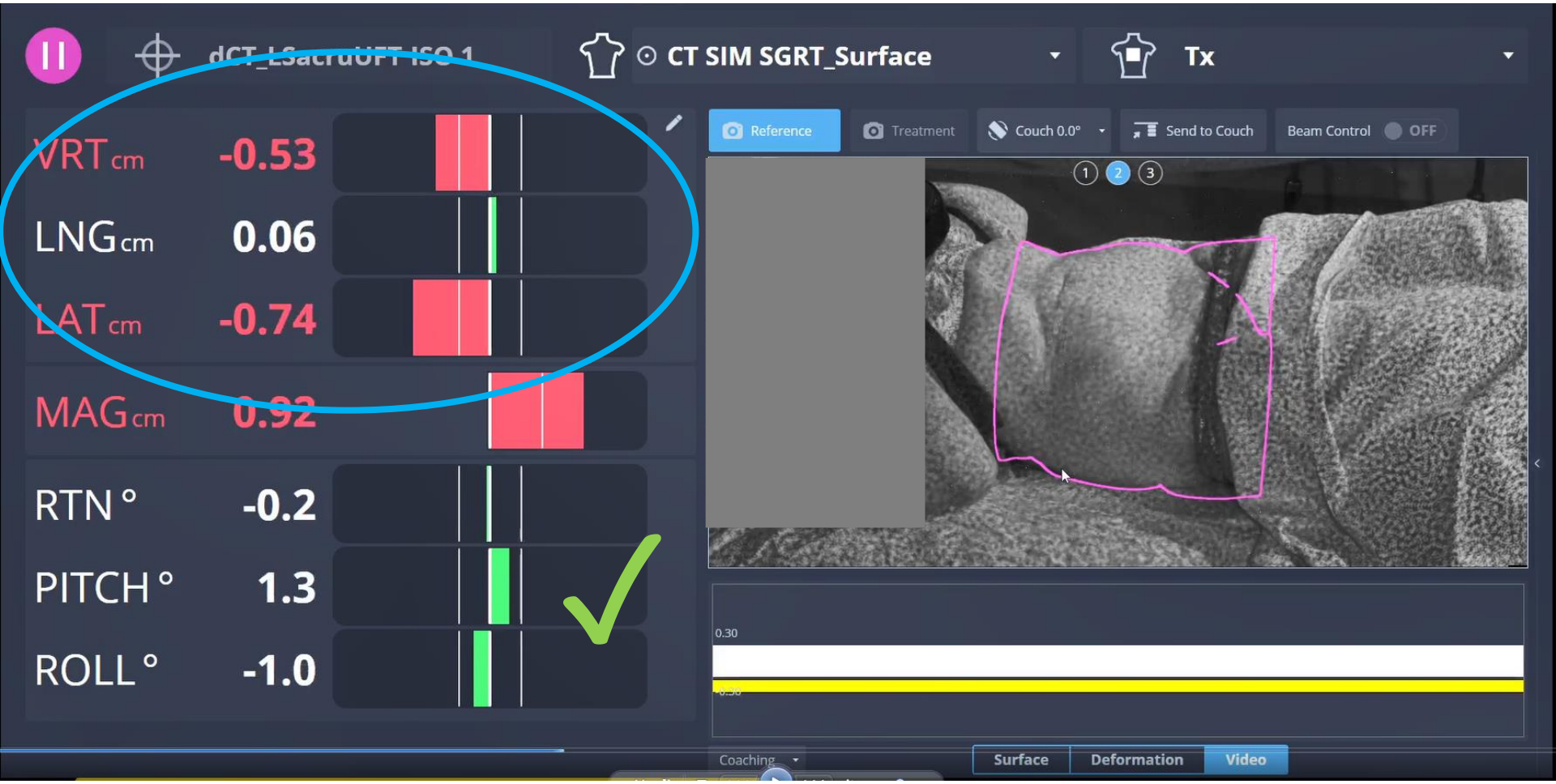


… MAYBE THE SHEET IS IN THE WAY

MOVING THE SHEET AWAY



IT WAS THE SHEET!



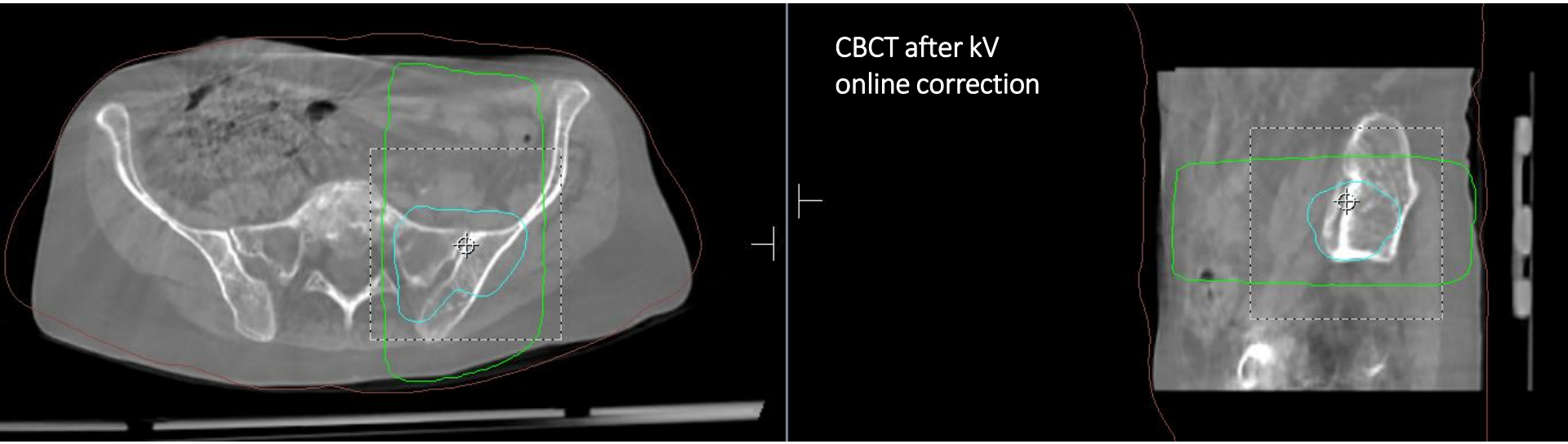
BINGO!


dCT_LSacruUFT ISO 1
CT SIM SGRT_Surface
Tx
VRT cm -0.02
LNG cm -0.02
LAT cm 0.09
MAG cm 0.11
RTN ° 0.0
PITCH ° 0.8
ROLL ° -1.0
Reference
Treatment
Couch 0.0°
Send to Couch
Beam Control OFF
1
2
3
0.30
-0.30
Coaching
Surface
Deformation
Video

REFERENCE CAPTURE

IMAGING

pre-kV pair → 2D/3D match + 6DOF correction → CBCT online review → 6DOF correction (if req'd)



Brown – patient/surface contour from dCT
Cyan – PTV
Green – Dose_90%

Contour looks GREAT!	Contour out of tol (multi Fx)	Contour out of tol (single Fx)
Reference capture for <u>this and future sessions</u> after CBCT for Fx2→	Assess whether it may be due to position and can be corrected. Review for Fx2→	If not positional: MU re-calc or re-plan ☹

SUMMARY

- Successfully treated 7 out of 10 pilot patients. Impatiently waiting for the next 3!
- All imaging has been within tolerance (one r—setup required) and dCT-generated plans 100% deliverable
- Sim-free palliative RT offers significant benefits for both patients and our radiotherapy service
- AlignRT allows RTs to set-up patients from a reference surface generated from the dCT
  - Comparable set-up time vs. traditional set-up workflow
  - Increased accuracy over “free-positioning” or manual palpation
  - May allow more complex sim-free treatment techniques in the future

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ACKNOWLEDGEMENTS

Supervisors

- Dr Katrina Woodford (Research)
- Kenton Thompson (Clinical/Research)

Vacbag Insert Engineer

- Mr Woodford (Katrina's dad)

Moorabbin Team

- ROs: Dr Kathy Pope, Dr Mun Yee Tan, Dr Jennifer Tan, Dr Steven David
- Cara Anticevic & Karen McGoldrick (Education, Training & Supervision)
- RTs: Adrian, Jacinta, Duc, Jess N, Josh, Ngoc, Katherine, Henry, Freshta, Madu, Simone
- Admin/Appts: Be, Vy, Christie
- Physics: Trevor Ackerly, Derrick Wanigaratne

AlignRT Superstars

- Sue McKenna (VisionRT)
- Katie Davidson (Parkville RT)

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