Patient Identification and Reproducibility

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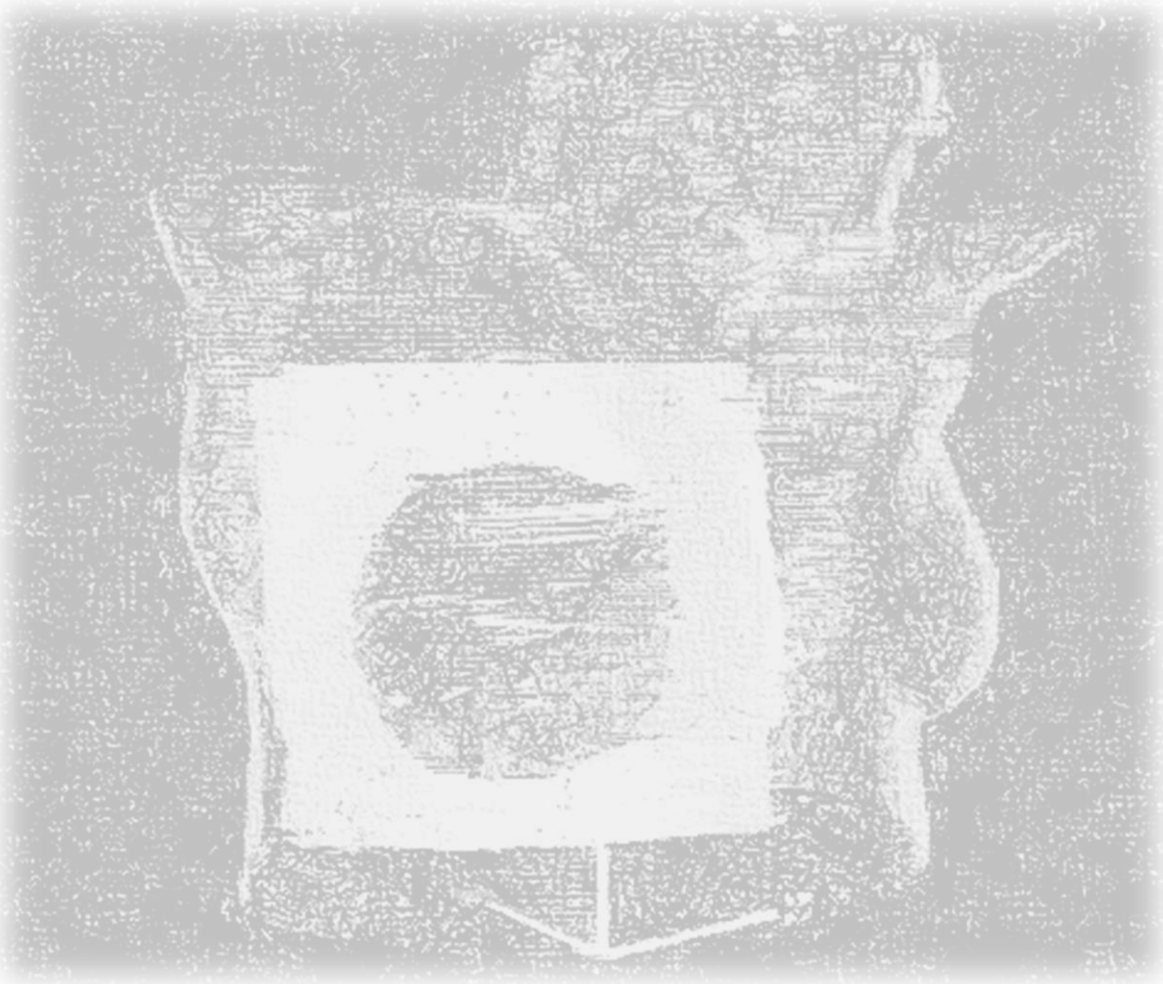


Disclosures: Materials and technical support from Vision RT

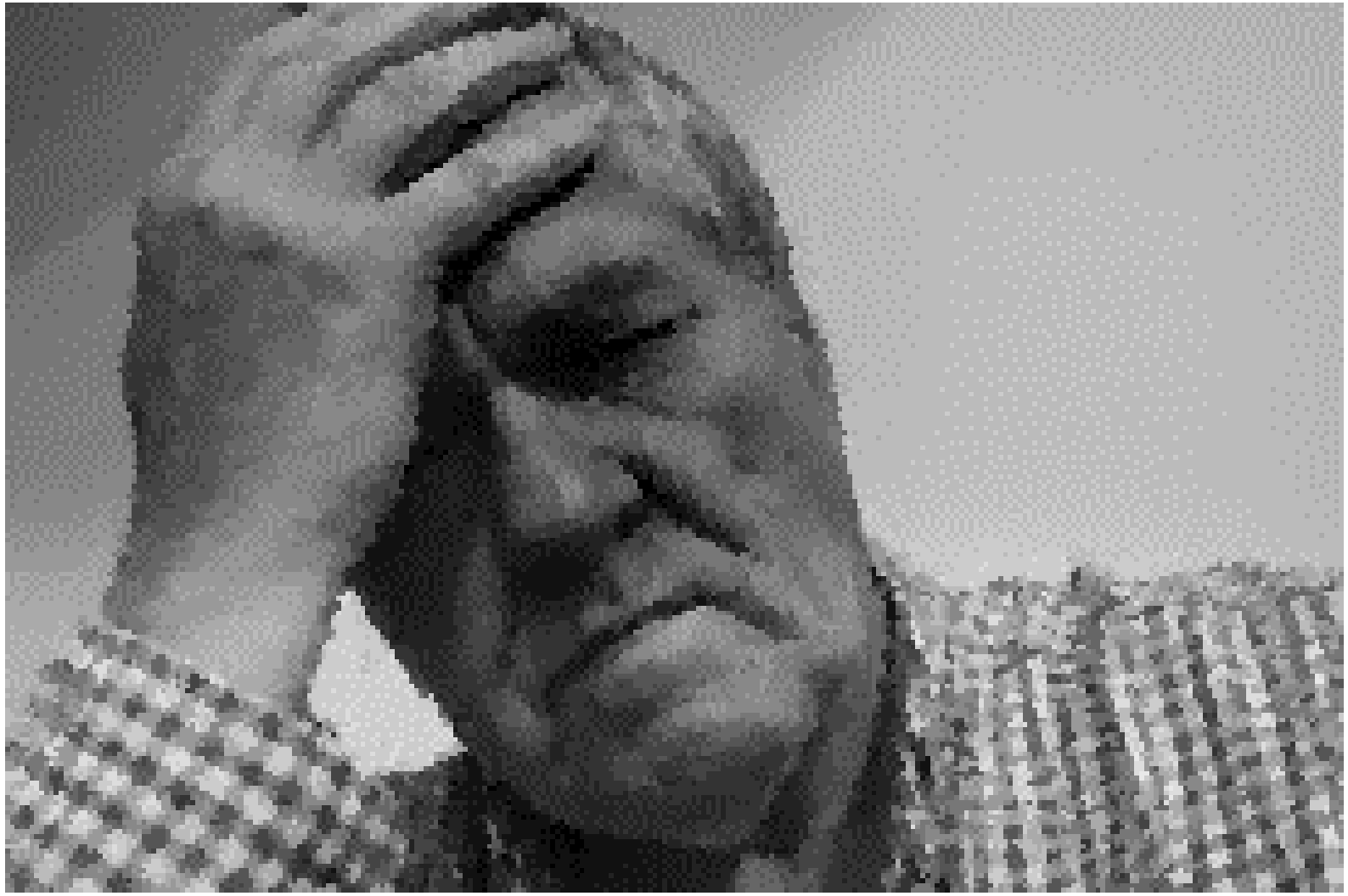
VALUE =

Patient & Staff

👍Quality👎 + ☺EXPERIENCE☹

$↓ COST $↑

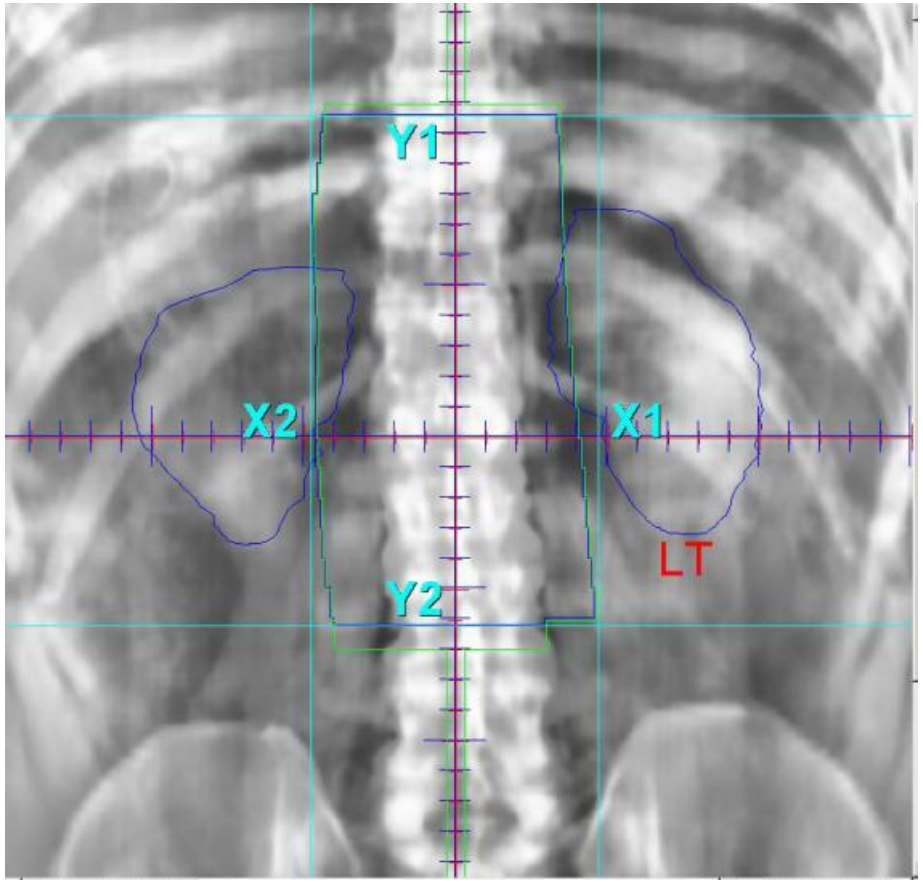
Patient in Pain…



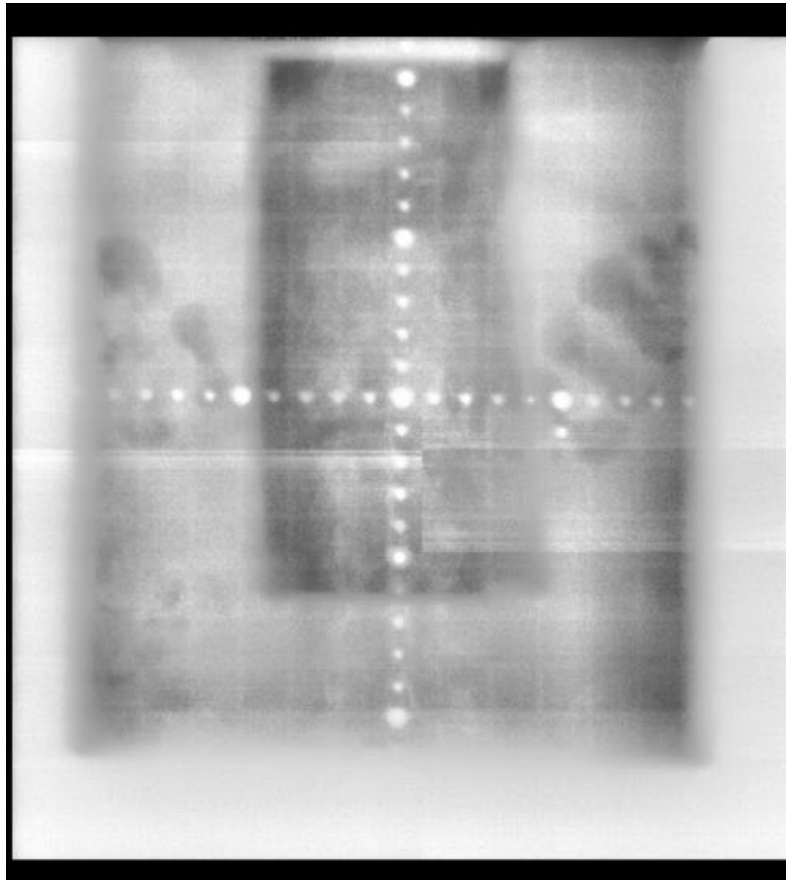
Prevents Gross Errors

A real life example from 2011

1.

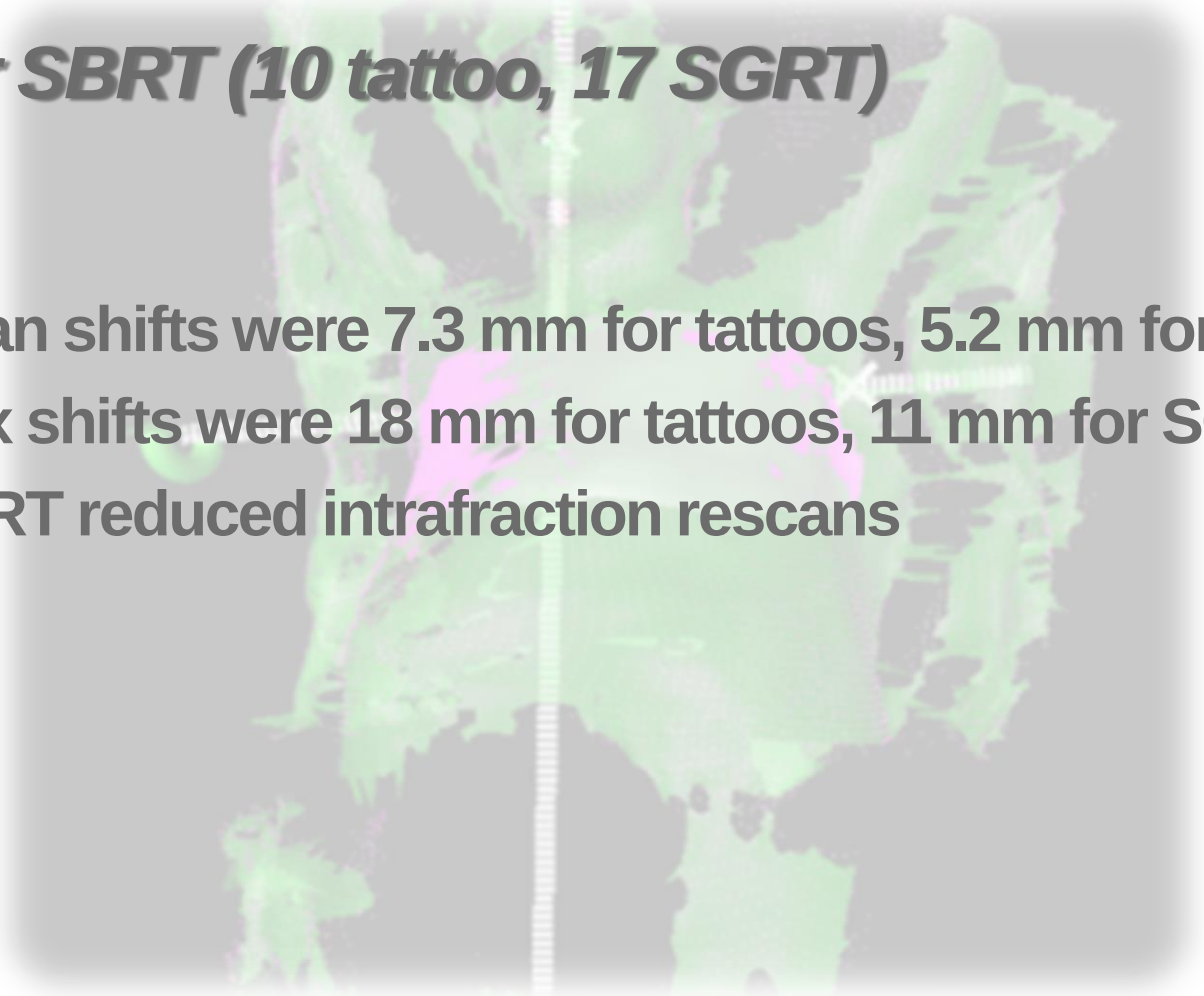


2.



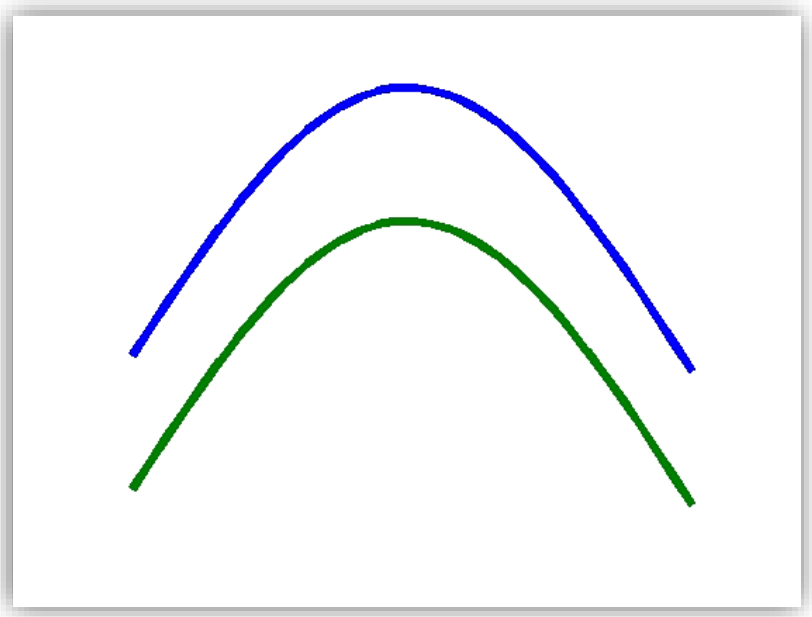
Surface imaging with SBRT

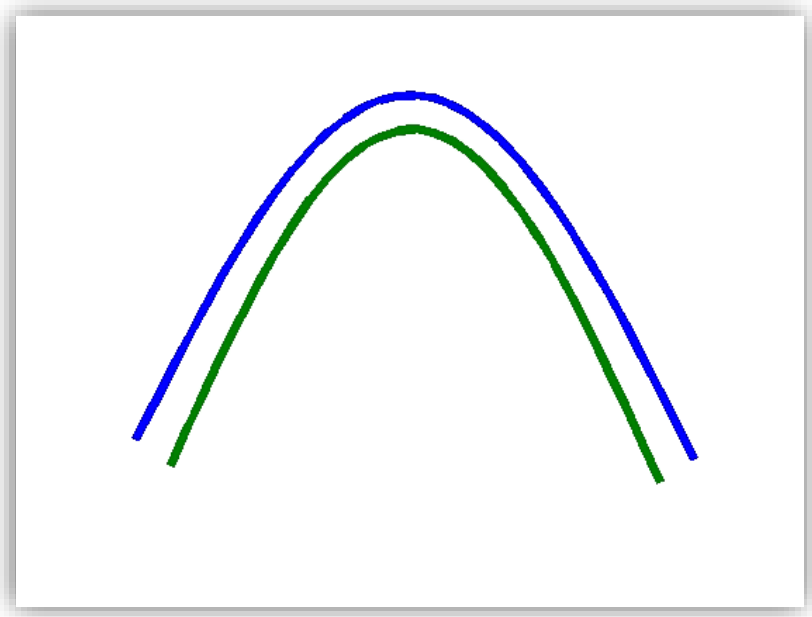
Lung, Liver SBRT (10 tattoo, 17 SGRT)



- **Mean shifts were 7.3 mm for tattoos, 5.2 mm for SGRT**
- **Max shifts were 18 mm for tattoos, 11 mm for SGRT**
- **SGRT reduced intrafraction rescans**

Off topic….But hopefully valuable



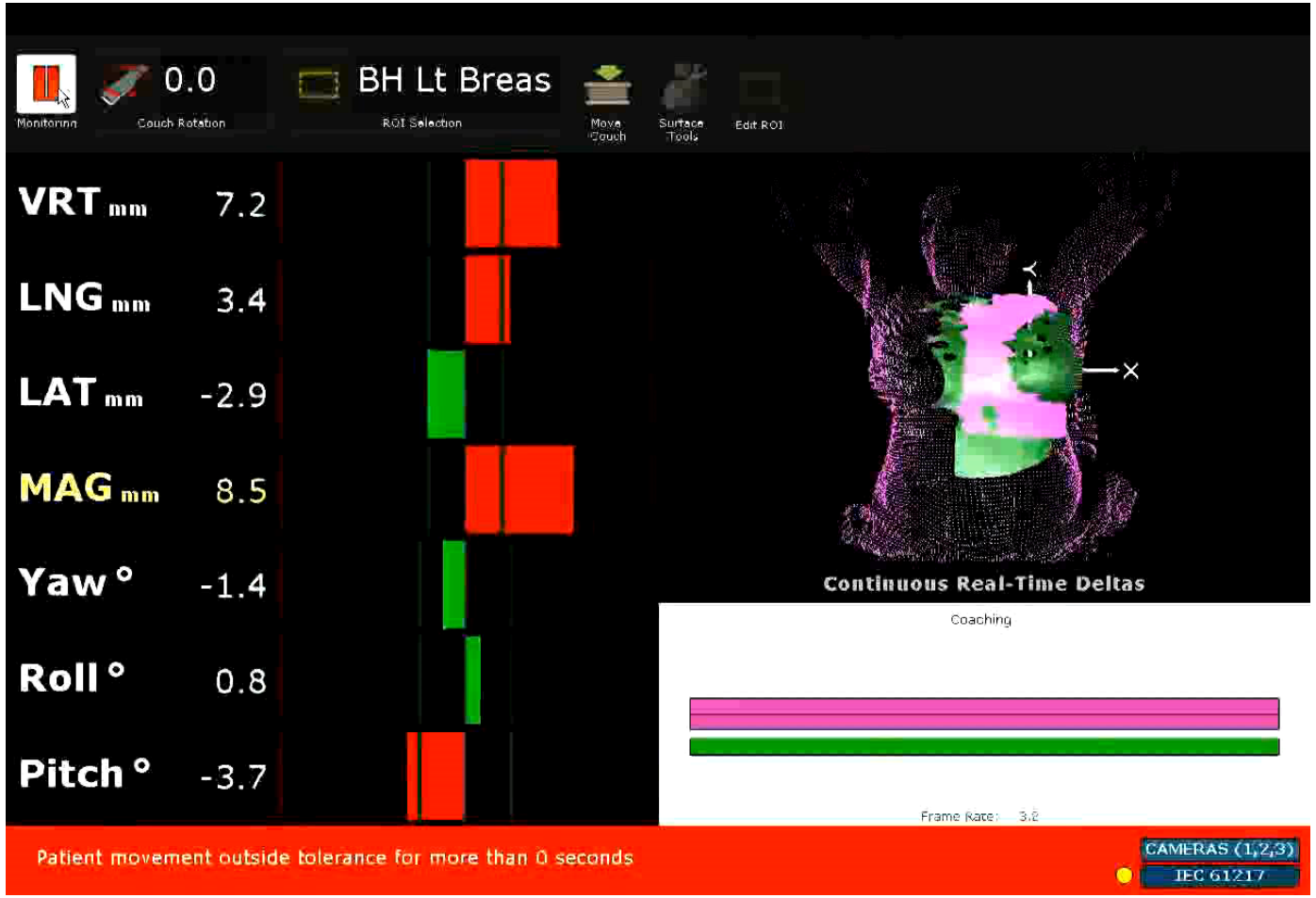


Surface imaging results depend on the input values

Outline

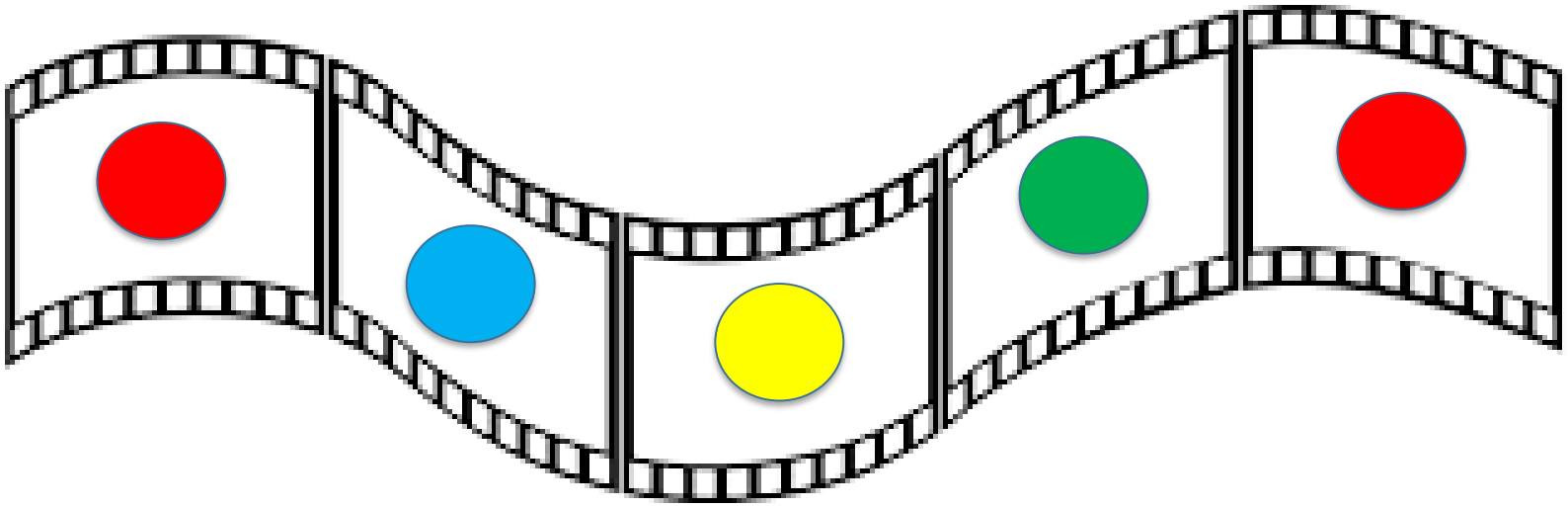
i. Introduction to intrafraction monitoring
ii. Intrafraction motion – Breast
iii. Intrafraction motion – Pelvis
iv. Patient Identification

Intrafraction monitoring

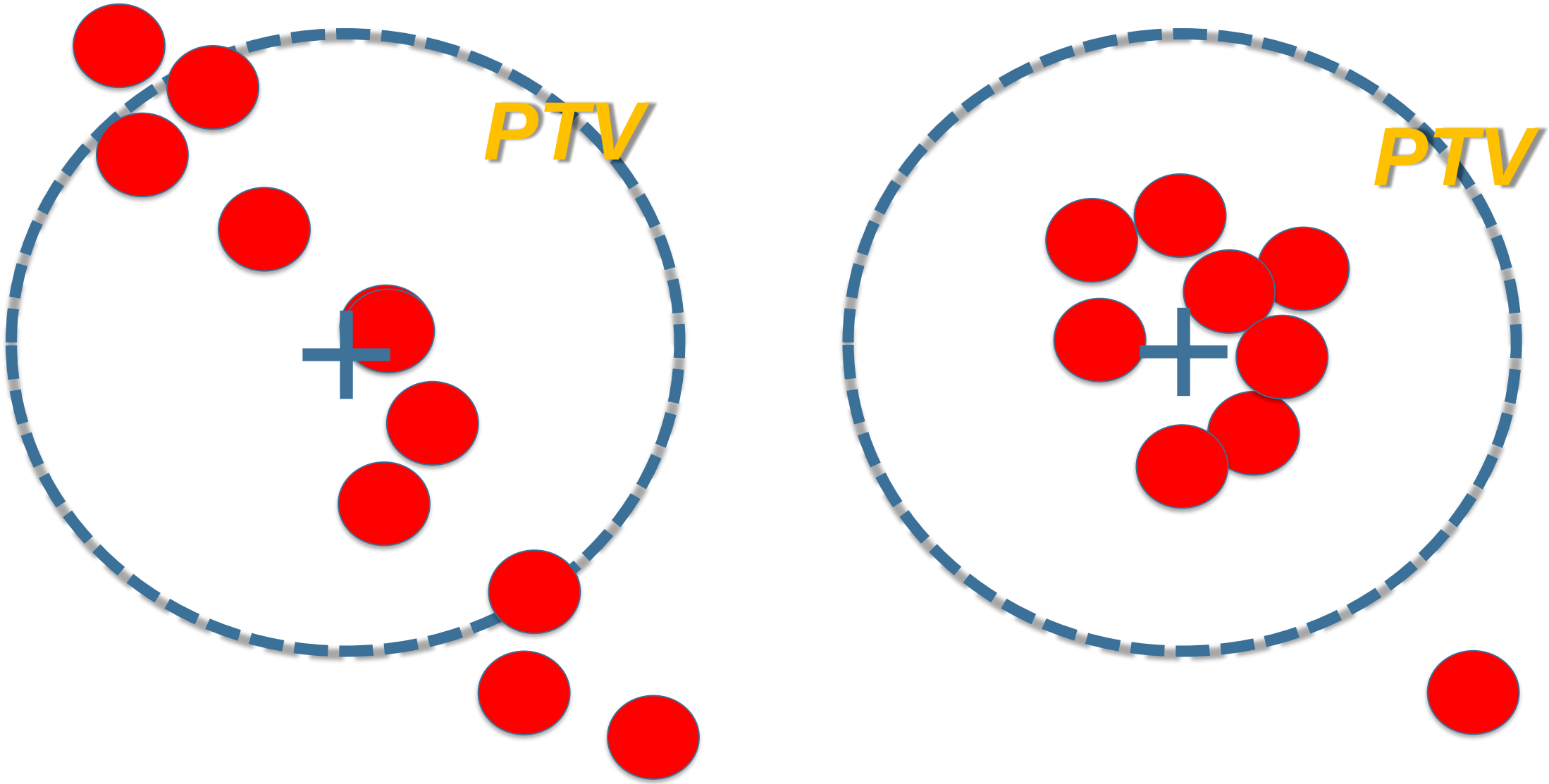


Intrafraction monitoring

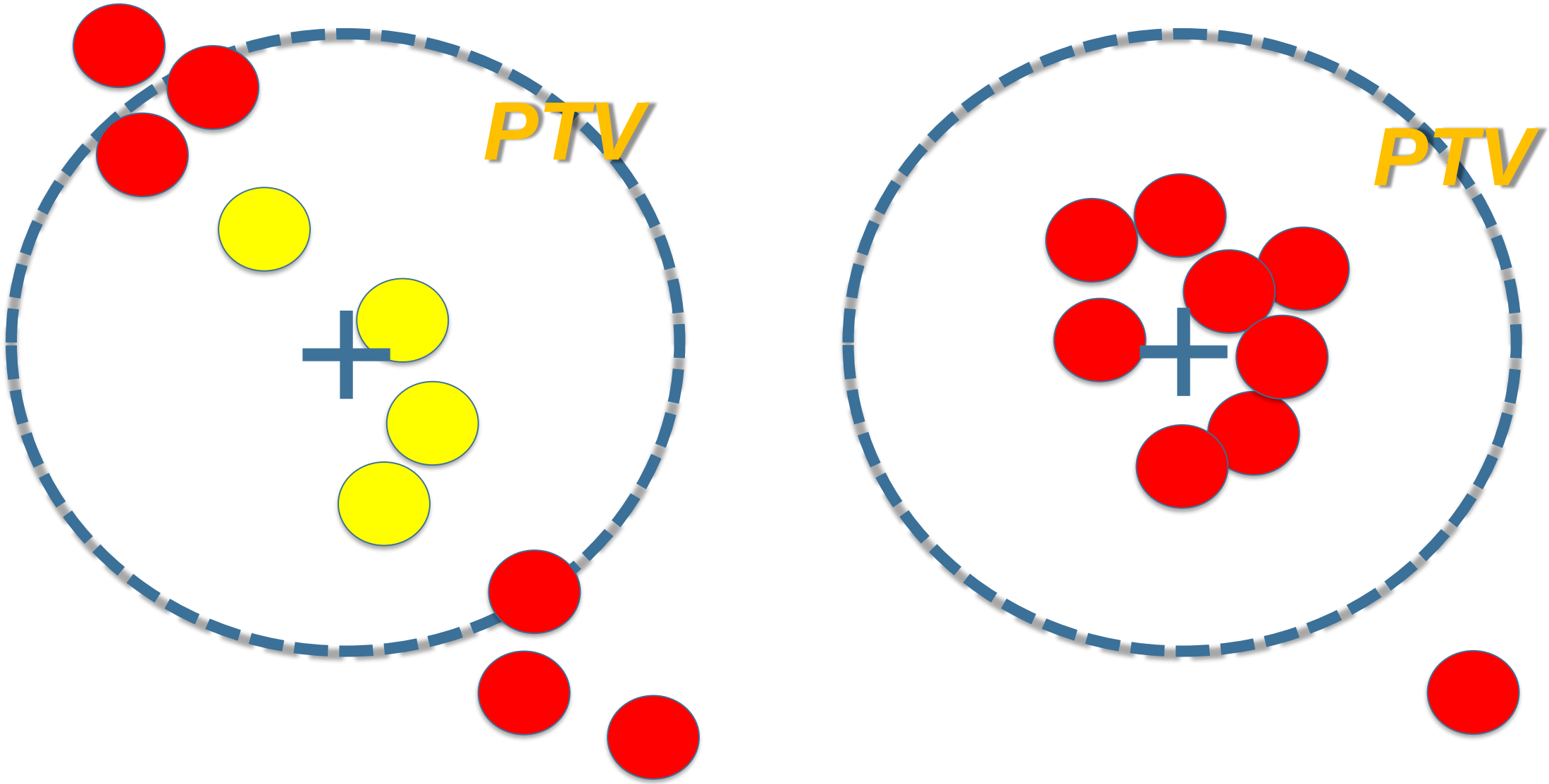
Radiographic images → SGRT



Intrafraction monitoring

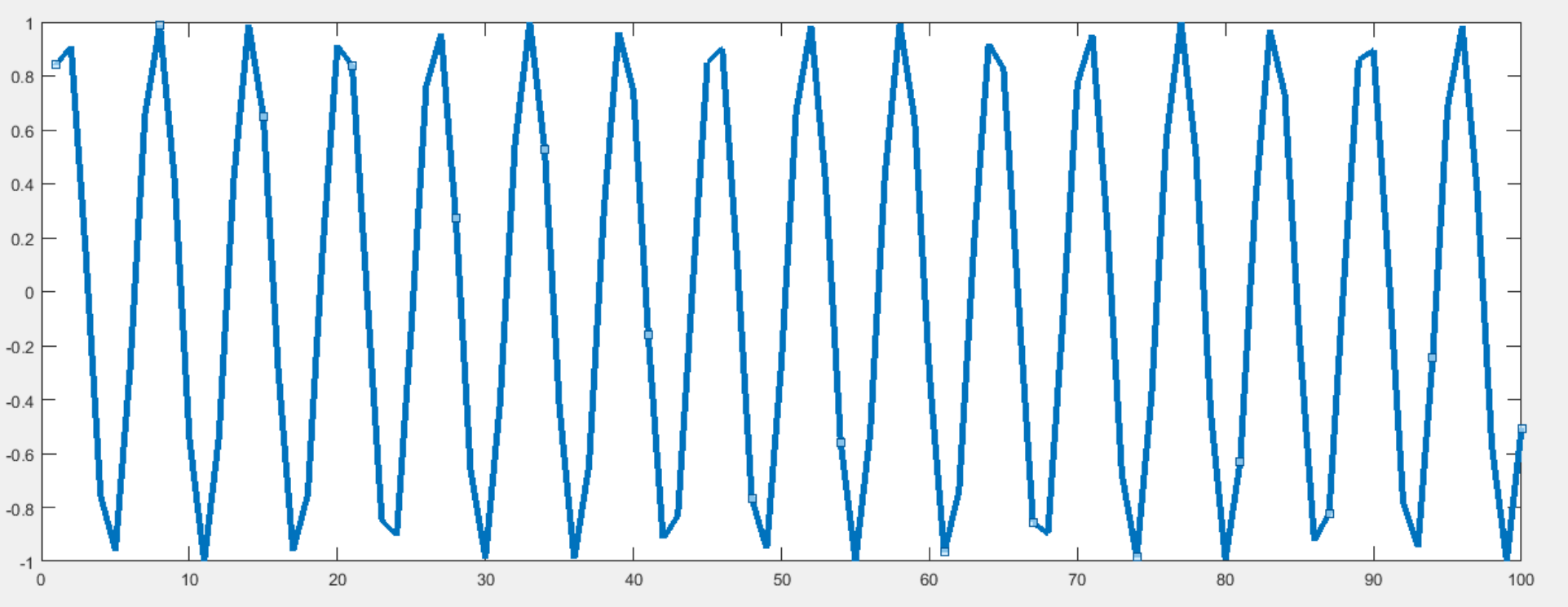


Intrafraction monitoring



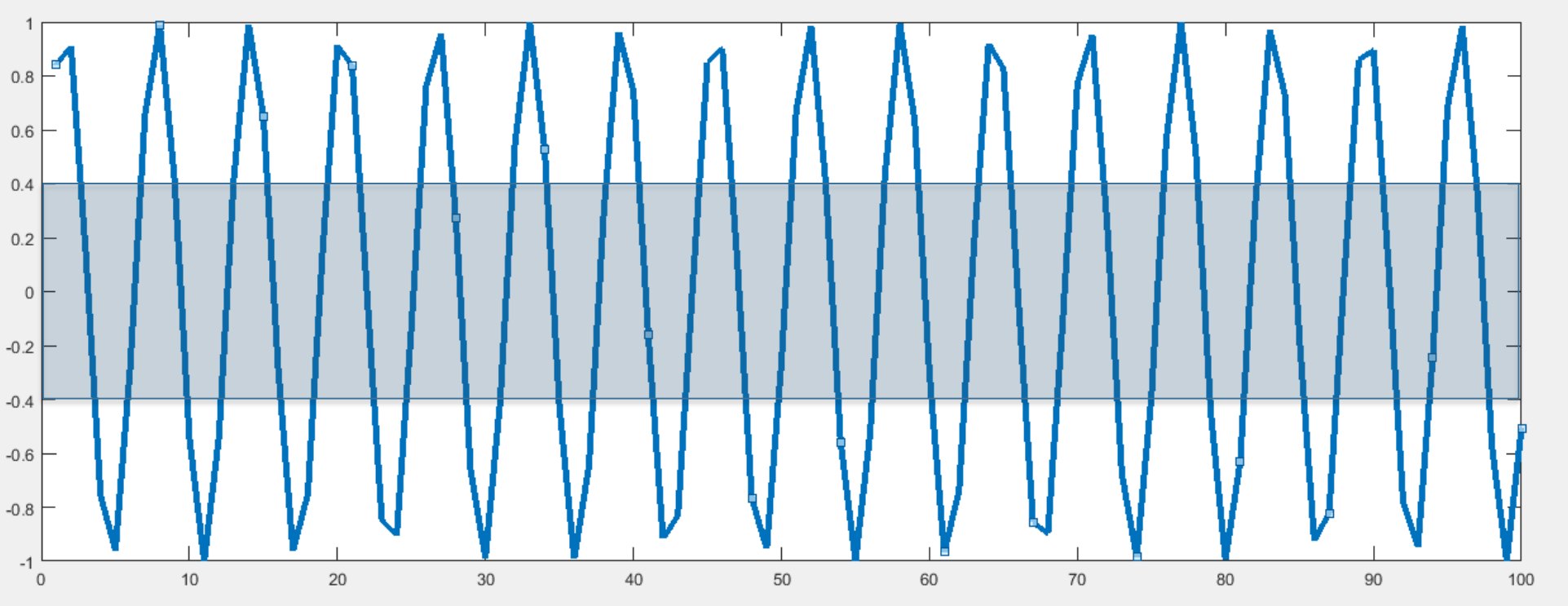
Intrafraction monitoring

- ***Means, max, and STD don't show the whole picture. Time is important now.***



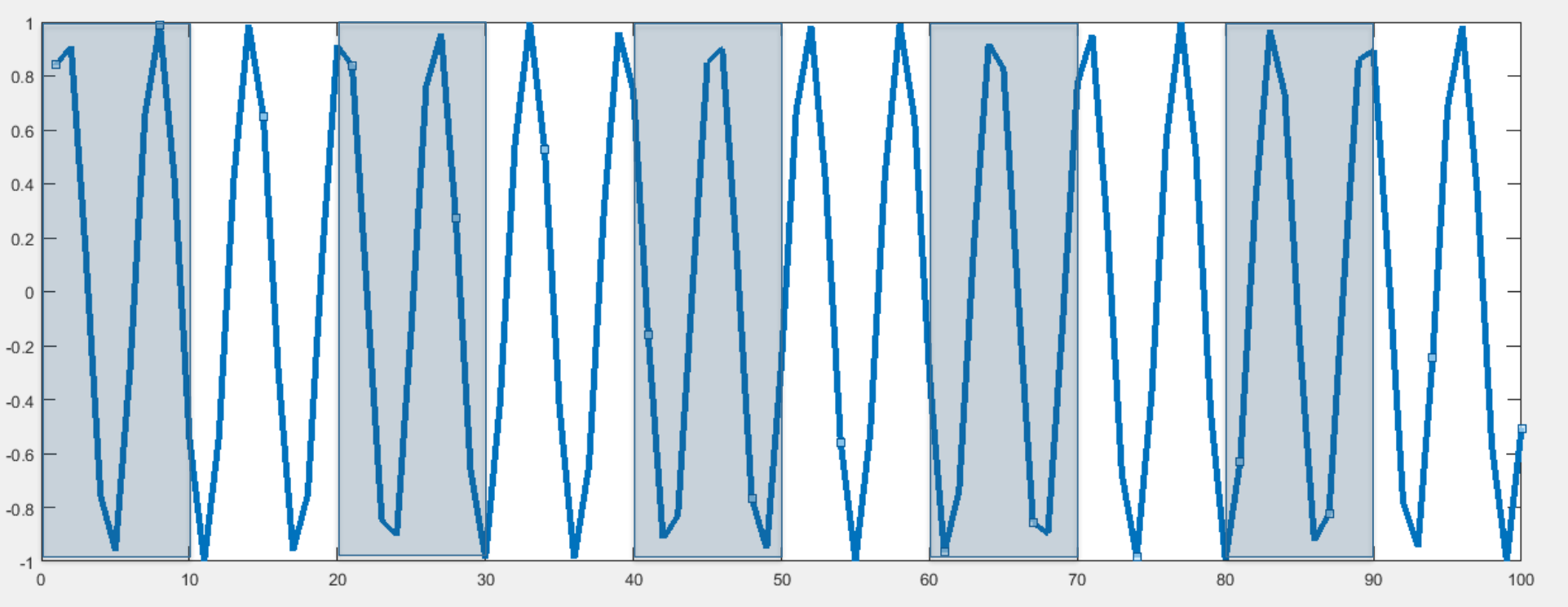
Intrafraction monitoring

- ***Interval? Amount of time inside a certain threshold?***

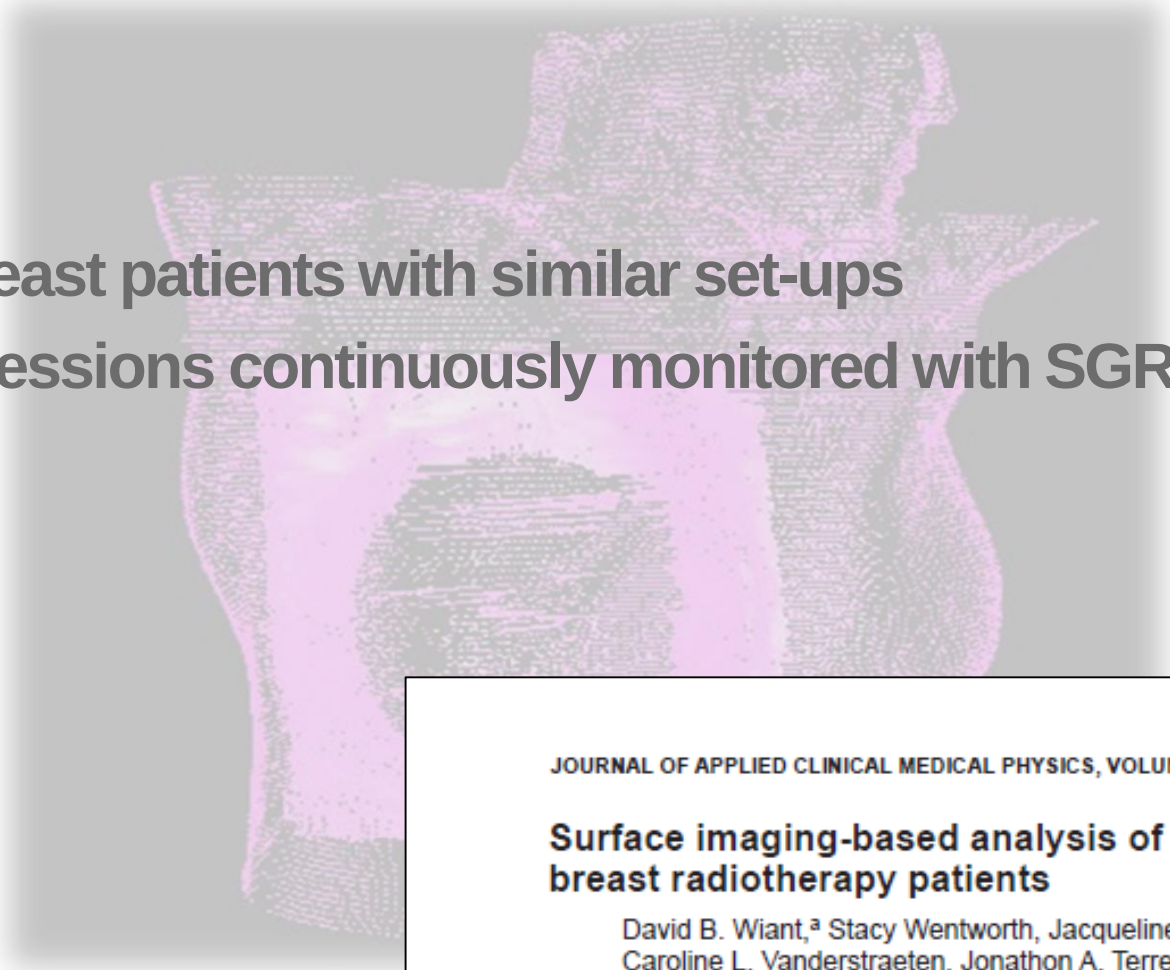


Intrafraction monitoring

- ***Interval? Minute by minute means?***



Intrafraction monitoring - Breast



- 30 breast patients with similar set-ups
- 831 sessions continuously monitored with SGRT

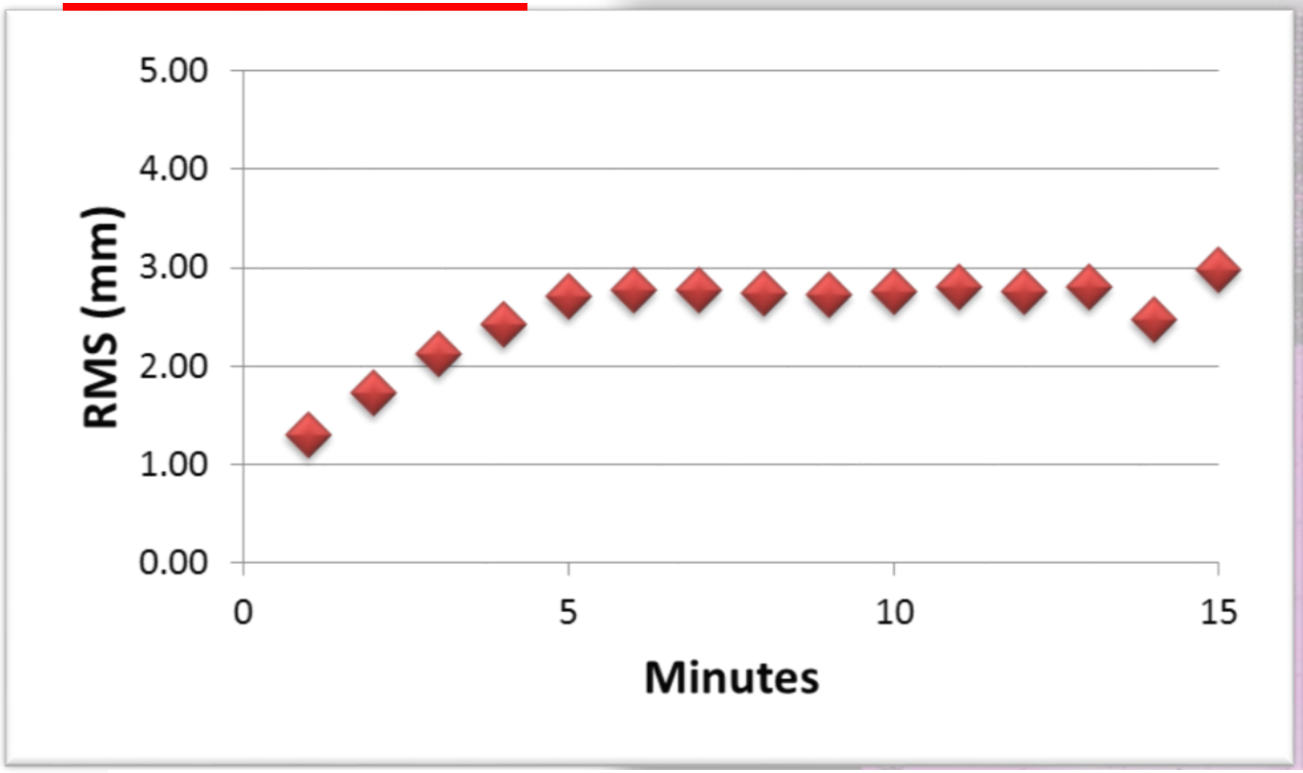
JOURNAL OF APPLIED CLINICAL MEDICAL PHYSICS, VOLUME 15, NUMBER 6, 2014

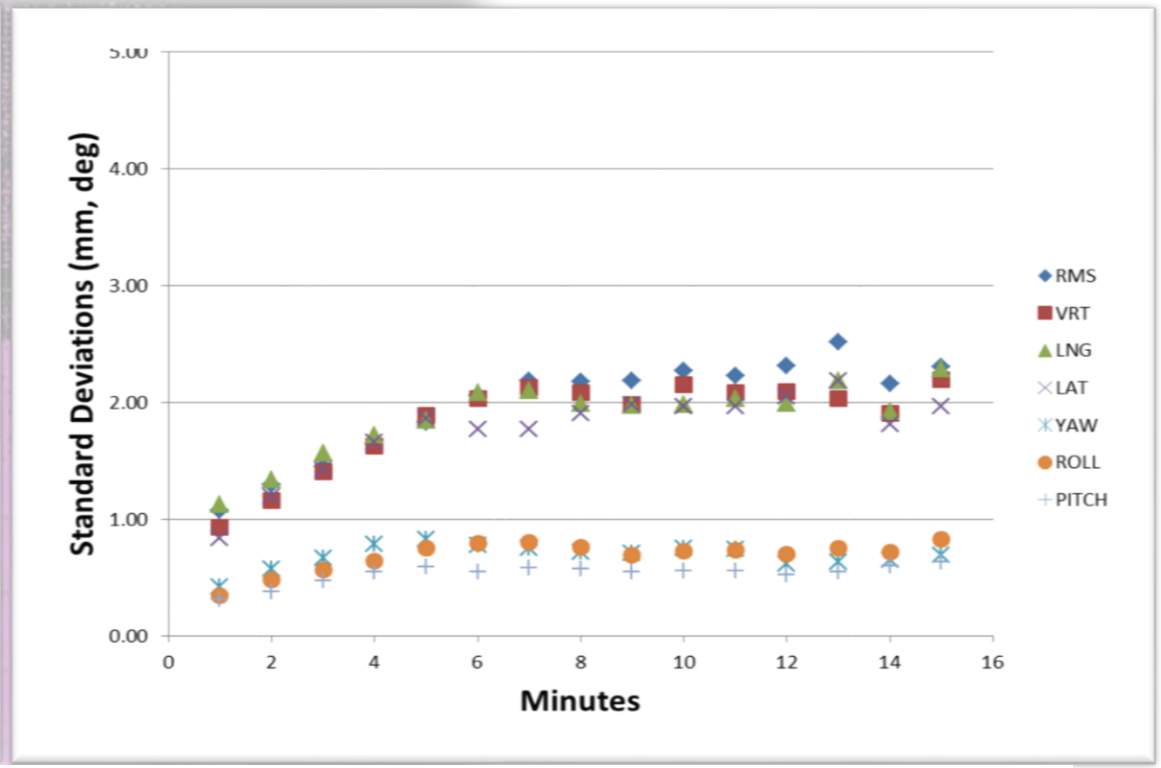
Surface imaging-based analysis of intrafraction motion for breast radiotherapy patients

David B. Wiant,[a] Stacy Wentworth, Jacqueline M. Maurer,
Caroline L. Vanderstraeten, Jonathon A. Terrell, Benjamin J. Sintay
Department of Radiation Oncology, Cone Health Cancer Center, Greensboro, NC, USA
david.wiant@conehealth.com

Intrafraction monitoring - Breast

Time Intervals



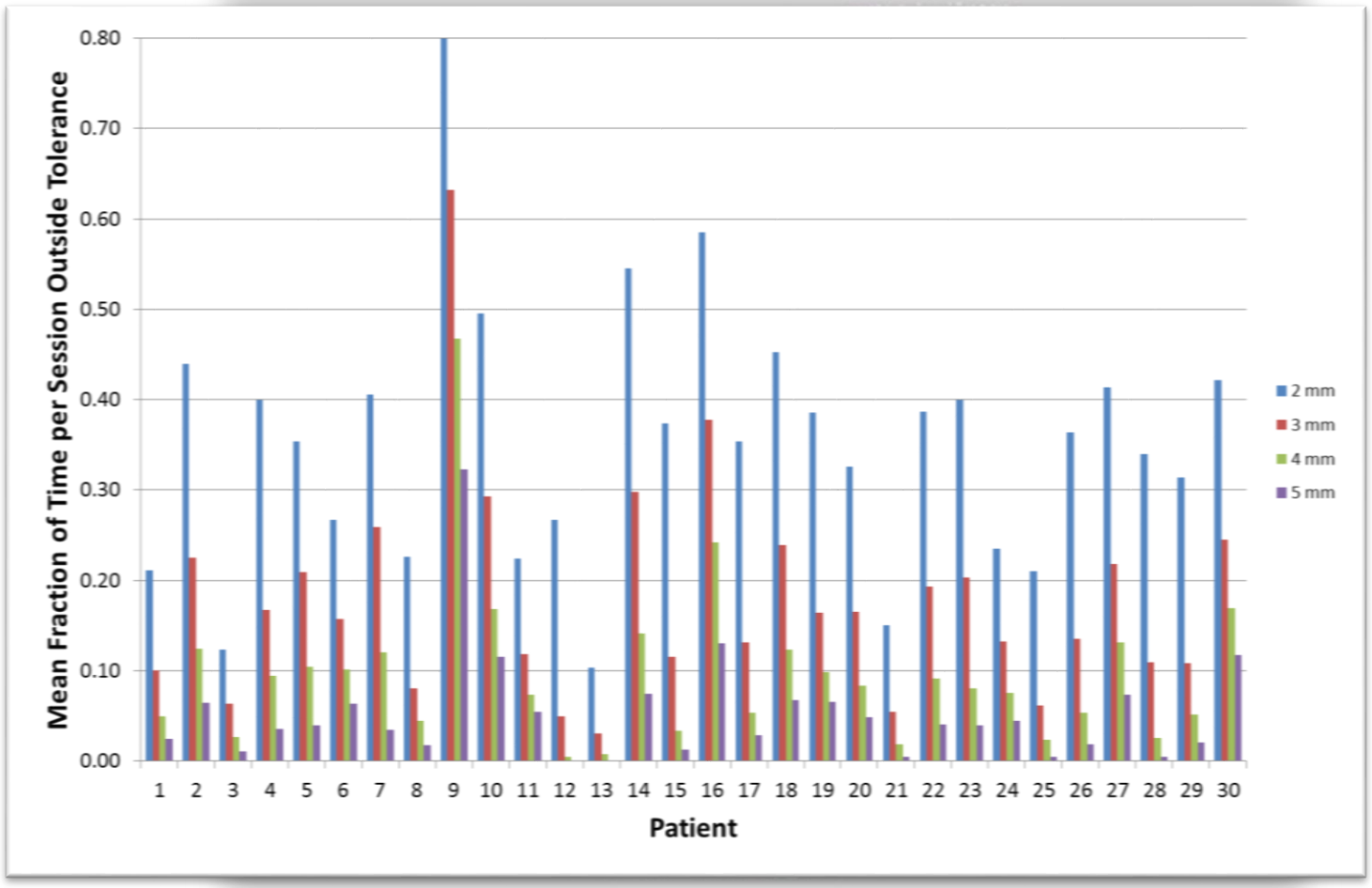


- **Intrafraction motion increases than levels off around 6-7 min into treatment**

Wiant D. *et al*, Surface imaging-based analysis of intrafraction motion for breast radiotherapy patients, JACMP. **15**(6), 4957 (2014).

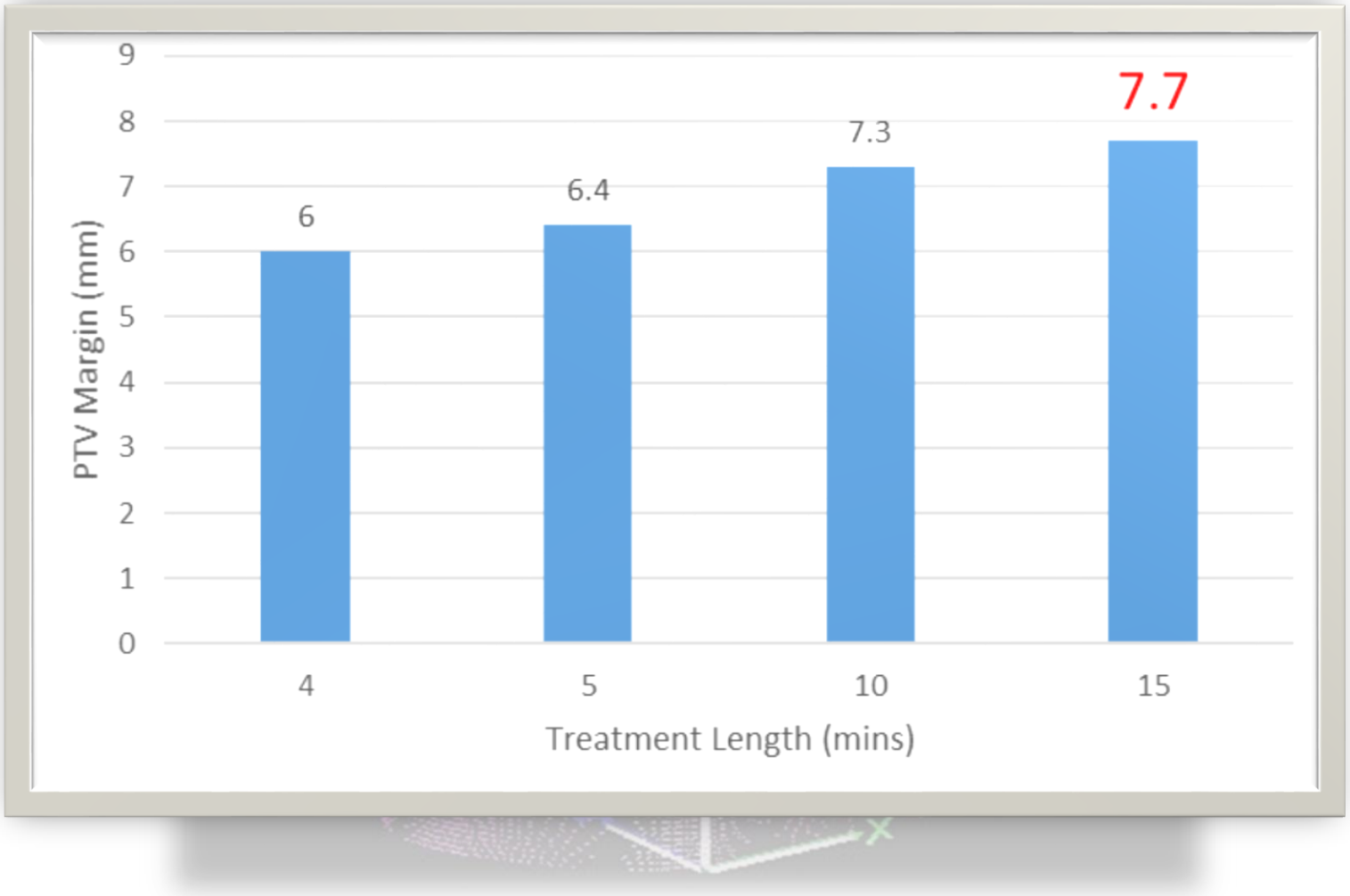
Intrafraction monitoring - Breast

Length Intervals



Wiant D. *et al*, Surface imaging-based analysis of intrafraction motion for breast radiotherapy patients, JACMP. **15**(6), 4957 (2014).

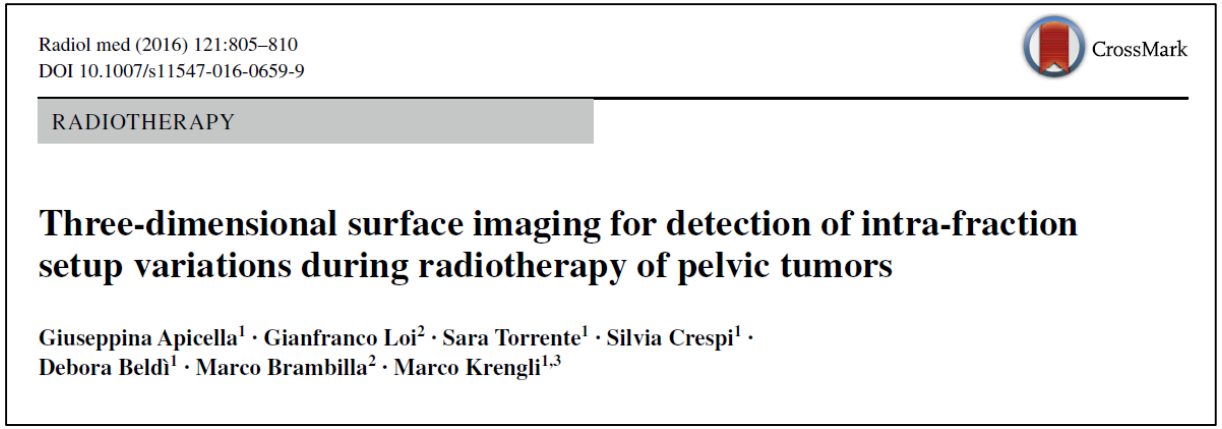
Intrafraction monitoring - Breast



Wiant D. *et al*, Surface imaging-based analysis of intrafraction motion for breast radiotherapy patients, JACMP. **15**(6), 4957 (2014).

Intrafraction monitoring - Pelvis

- 29 pelvis patients
- All treated supine with leg immobilization. Bladder and rectal protocol used
- 792 sessions with a surface image acquired before, during, and after treatment



Radiol med (2016) 121:805–810
DOI 10.1007/s11547-016-0659-9

CrossMark

RADIOTHERAPY

Three-dimensional surface imaging for detection of intra-fraction setup variations during radiotherapy of pelvic tumors

Giuseppina Apicella[1] · Gianfranco Loi[2] · Sara Torrente[1] · Silvia Crespi[1] · Debora Beldì[1] · Marco Brambilla[2] · Marco Krengli[1,3]

Intrafraction monitoring - Pelvis

Table 2 The intra-fraction setup variations detected at mean (MT) and at final (F) times

	Z (vertical axes, A-P direction)			*Y* (longitudinal axes, C–C direction)			*X* (horizontal axes, L–L direction)		
	Mean (range)	CI −95 %	CI +95 %	Mean (range)	CI −95 %	CI +95 %	Mean (range)	CI −95 %	CI +95 %
I-MT	−1.20 (−4.6, +5.8)	−1.3	−1.07	−0.95 (−14.2, +4.3)	−1.2	−0.7	0.07 (−5.1, +4.3)	−0.1	0.2
I-F	−1.55 (−5.5, +6.7)	−1.7	−1.4	−1.00 (−15.2, +5.2)	−1.2	−0.8	0.26 (−6.2, +11.4)	0.1	0.4

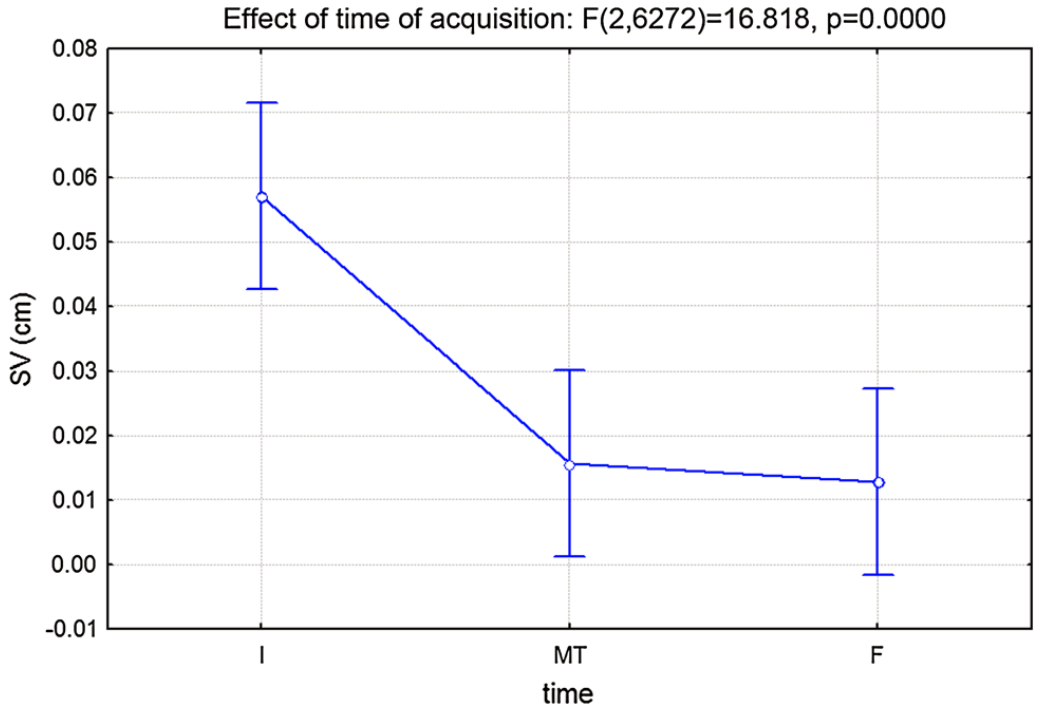
All values are expressed in millimeters (mm)

CI confidence interval, *I* initial treatment time acquisition, *MT* mid-treatment time acquisition, *F* final-treatment time acquisition

- **4 - 15 mm random motion**

Apicella G *et al.*, 3D surface imaging for detection of intra-fraction setup variations during radiotherapy of pelvic tumors, Radiol. Med. **121**(10), 805 (2016).

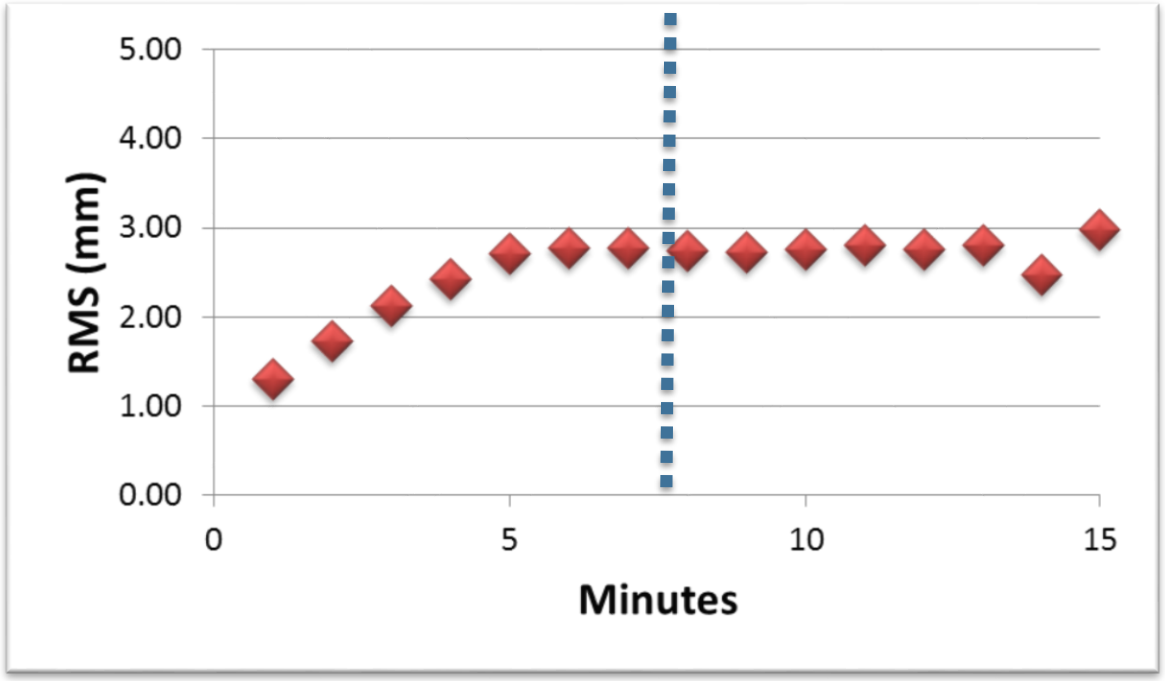
Intrafraction monitoring - Pelvis

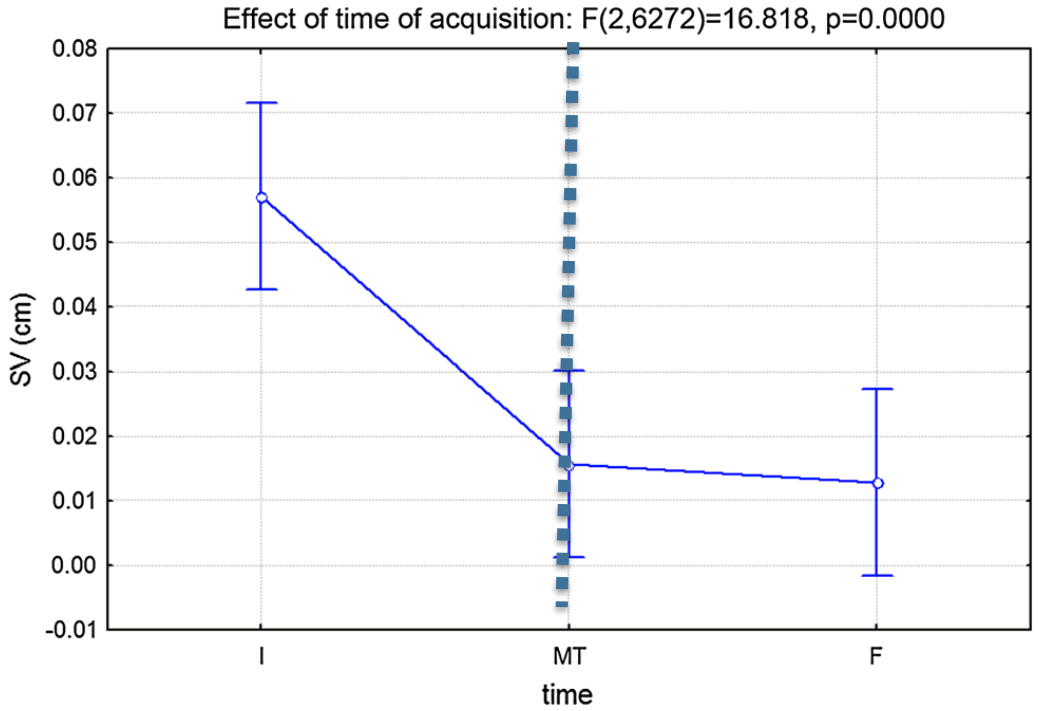


- **Significant difference between Initial and Mid-Treatment**
- **Mean time from Initial to Mid-Treatment was about 8 mins**

Apicella G *et al.*, 3D surface imaging for detection of intra-fraction setup variations during radiotherapy of pelvic tumors, Radiol. Med. **121**(10), 805 (2016).

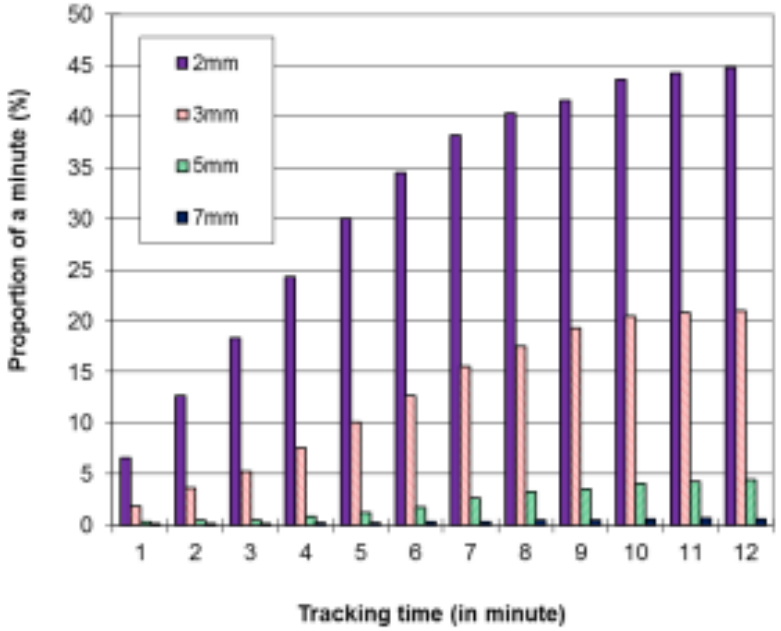
Intrafraction monitoring

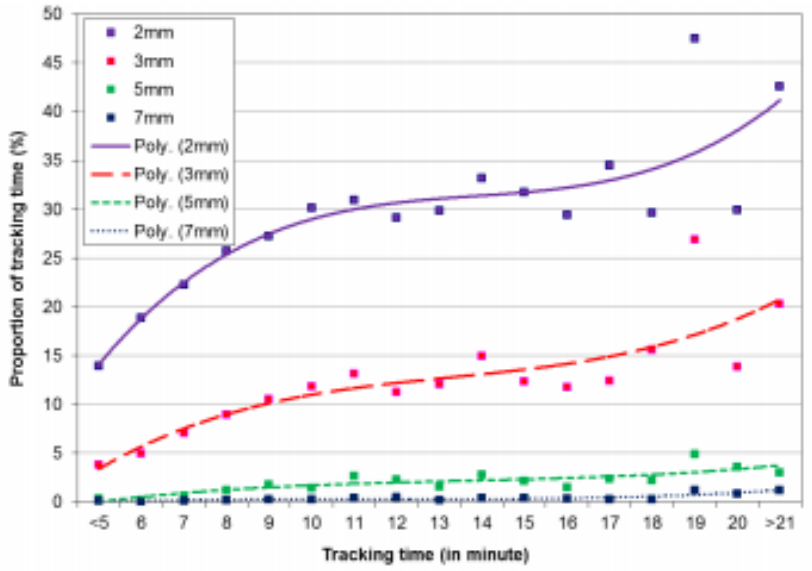




- **What is happening around 7 mins into a treatment?**

Intrafraction monitoring





JOURNAL OF APPLIED CLINICAL MEDICAL PHYSICS, VOLUME 16, NUMBER 2, 2015

Intrafractional prostate motion during external beam radiotherapy monitored by a real-time target localization system

Xu Tong,[1] Xiaoming Chen,[2] Jinsheng Li,[2] Qianqian Xu,[1] Mu-han Lin,[2] Lili Chen,[2] Robert A. Price,[2] and Chang-Ming Ma[2a]

Radiation Oncology Department,[1] Third-Affiliated Hospital of Qiqihar Medical University, Qiqihar, China; Radiation Oncology Department,[2] Fox Chase Cancer Center, Philadelphia, USA

Charlie.ma@fccc.edu

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2016 Hospital National Patient Safety Goals

The purpose of the National Patient Safety Goals is to improve patient safety. The goals focus on problems in health care safety and how to solve them.

Identify patients correctly	
NPSG.01.01.01	Use at least two ways to identify patients. For example, use the patient's name *and* date of birth. This is done to make sure that each patient gets the correct medicine and treatment.
NPSG.01.03.01	Make sure that the correct patient gets the correct blood when they get a blood transfusion.
Improve staff communication	
NPSG.02.03.01	Get important test results to the right staff person on time.

Patient Identification

- 16 left sided breast patients with similar set-ups
- 10 same patient comparisons, 10 different patient comparisons
- 3 mm / 5 mm overlap between surfaces

JOURNAL OF APPLIED CLINICAL MEDICAL PHYSICS, VOLUME 17, NUMBER 2, 2016

A novel method for radiotherapy patient identification using surface imaging

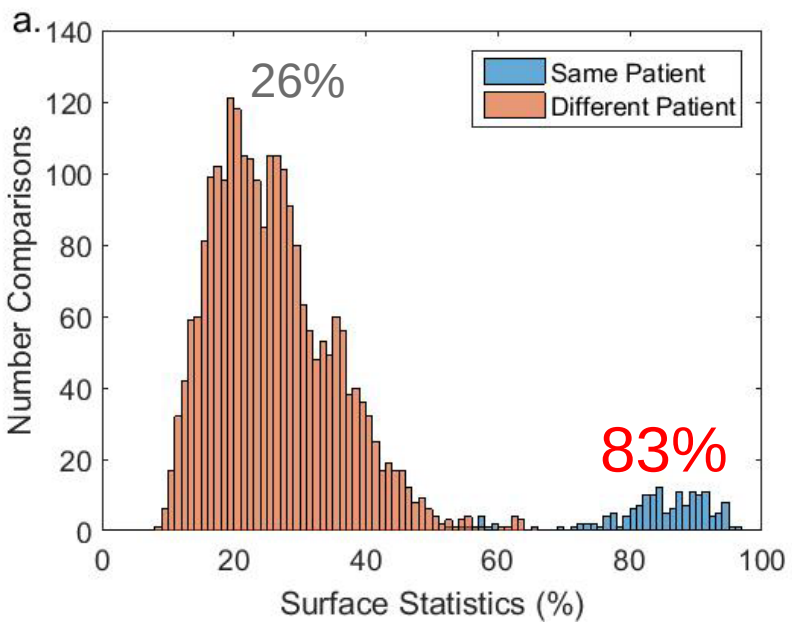
David B. Wiant,[1a] Quinton Verchick,[2] Percy Gates,[3] Caroline L. Vanderstraeten,[1] Jacqueline M. Maurer,[1] T. Lane Hayes,[1] Han Liu,[1] and Benjamin J. Sintay[1]

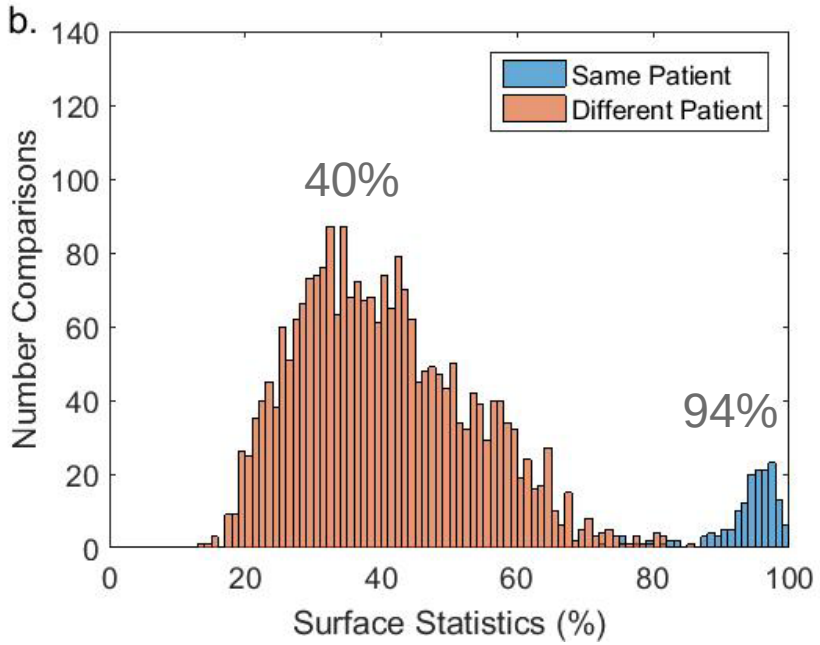
Department of Radiation Oncology,[1] Cone Health Cancer Center, Greensboro, NC, USA; Department of Health Policy and Management,[2] University of North Carolina, Chapel Hill, NC, USA; Department of Physics,[3] Kenyon College, Gambier, OH, USA
david.wiant@conehealth.com

Patient Identification

Wiant D *et al.*, A novel method for radiotherapy patient identification using surface imaging, JACMP. **17**(2), 271–278 (2016).

Patient Identification





- No overlap on any 1 patient
- 55% threshold for 3 mm would give 1% false-positives and 1% false-negatives

Wiant D *et al.*, A novel method for radiotherapy patient identification using surface imaging, JACMP. **17**(2), 271–278 (2016).

Thank You’s

- BJ Sintay, Cone Health
- Caroline Vanderstraeten, Cone Health
- Jeff Wilson, Cone Health
- Todd Atwood, UC San Diego
- Grace Kim, UC San Diego
- Nels Knutson, Washington University
- Jean Peng, MUSC