The “radiotherapie-dresden” workflow

Patient positioning without skin markers using an optical surface scanner

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Disclosure

The author has no relevant financial or nonfinancial relationships in the products or services described, reviewed, evaluated or compared in this presentation.

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The author accepts no liability for the information given here and any resulting consequential damages.

Think differently…the initial idea.

radiotherapie dresden

ESTRO 2014 - Poster

The workflow and benefits of patient positioning based on absolute table coordinates

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Objectives

To introduce a workflow to position the patient based on absolute table coordinates, because TrueBeam does not support the 'Delta Couch' option.

Methods

The method is only suitable for patient support systems which are fixed on the table and which are exchangeable between CT and LINAC. Our support system for thorax patients (Posirest-2) is used as an example.

(Below X, Y, Z refers to the DICOM coordinate system.)

CT

1 **Define coordinates at the CT-Scan for table position F0:**
Z = 50.0 cm at external green Laser
So: Z = 0.0 cm at internal red laser

2 **Note patient setup point (tattoo) e.g.:**
X = 0.0 cm
Y = 0.0 cm
Z = 17.0 cm
Table top position: -11.5

3 **Absolute table coordinates patient setup point:**

LAT:	0.0 cm	
LNG:	140.0 - 17.0 = 123.0 cm	(F0 at LINAC: LNG = 140.0 cm)
VRT:	-11.5 + 0.5 = -11.0 cm	(Table sag at LINAC: 0.5 cm)

Using an indexed patient support device means:
Absolute table coordinates can be calculated from CT and TPS.

Think differently…the question.

Positioning with absolute table coordinates

The “error “ remaining involves the patient only, especially:

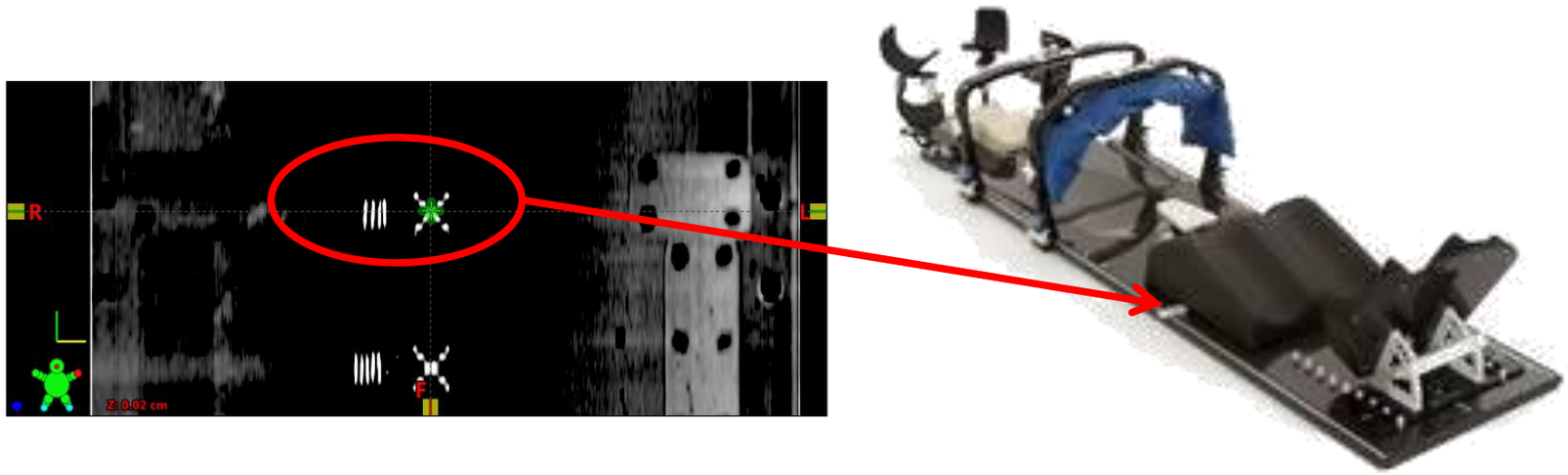
- Rotation
- Pitch
- Roll
- Deformation

under these preconditions -

Can we replace skin markers using an optical surface scanner?

The magic “3”

(1) Indexed support device for <u>every</u> single patient



External reference point
CT DICOM Origin and longitudinal markers

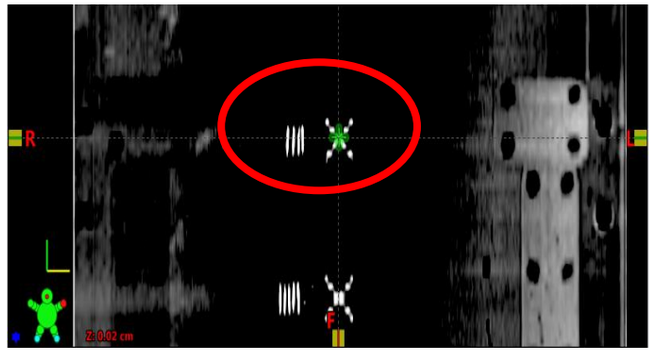
(2) Absolute table coordinates for <u>every</u> treatment plan

(3) Daily IGRT for <u>every</u> fraction of <u>each</u> patient

The pre-treatment workflow

Planning CT

Reset table to zero at marker position
document patient support

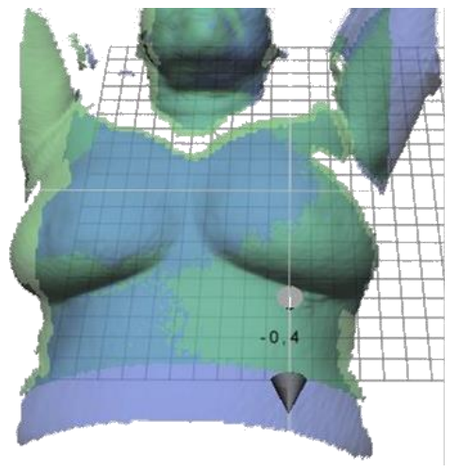


TPS

Set geometrical reference point to couch surface and marker position
Shift isocenter as appropriate, calculate table coordinates

CRAD

Import plan and structure set (body)
apply templates for tolerances etc.



→ no external lasers required at CT

The treatment workflow

“Build” the support device and pre-position patient

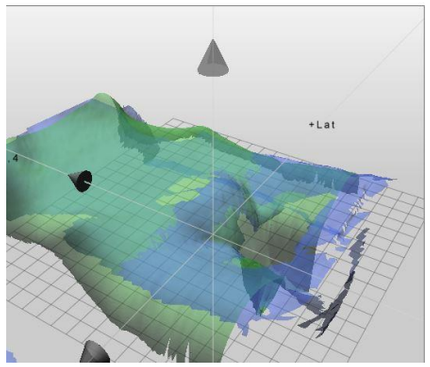
According to documentation from CT

Auto-Go

Bring table to calculated isocenter position

Correct rotation and deformation

Using the scanner information based on CT-Body



Couch

	Absolute	Relative
Lat	-13,8 mm	-0,8 mm
Long	+1390, mm	+0,4 mm
Vert	-152,6 mm	+1,4 mm
Rot	+358,0 °	-2,0 °

Posture

	Relative
Roll	-0.2 °
Pitch	+5.1 °

Shift table using scanner information

Correct remaining displacement (shall be less than 2cm)

Final positioning with IGRT

2D/2D kV Images or Conebeam - CT

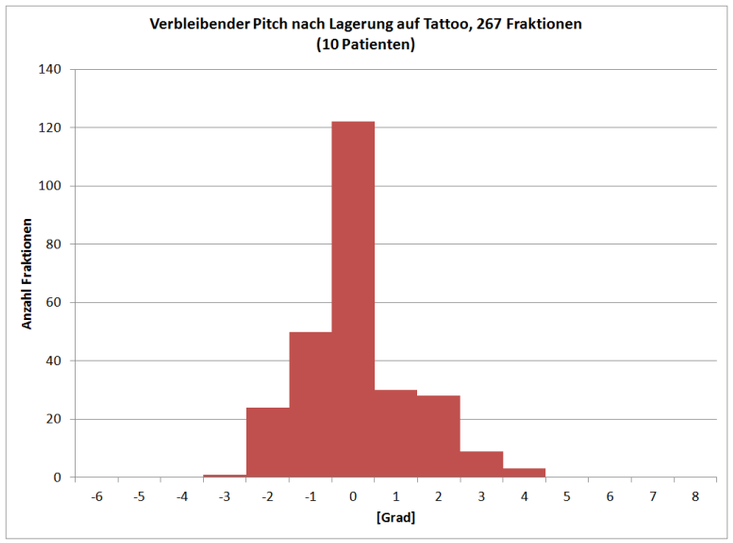
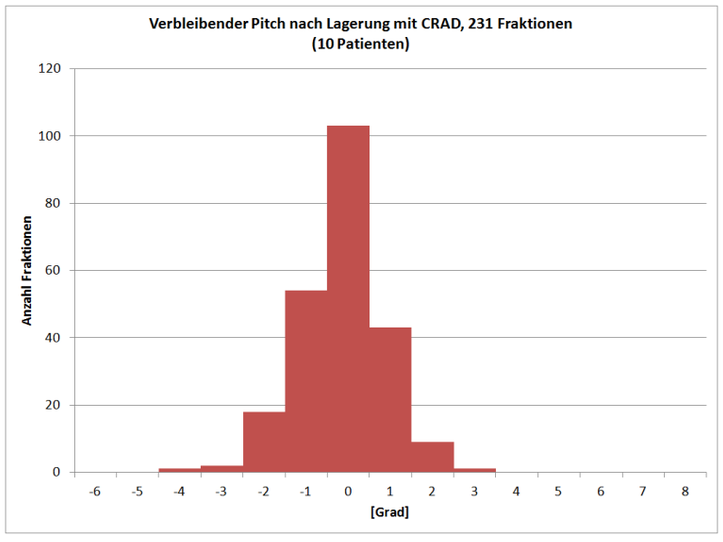
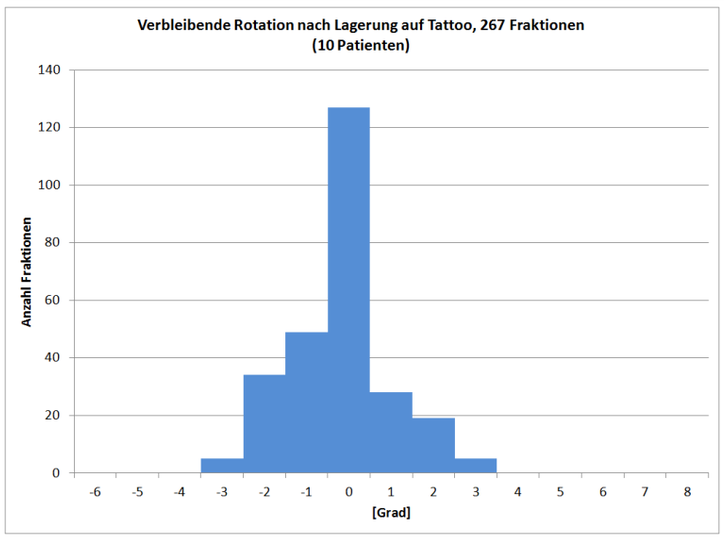
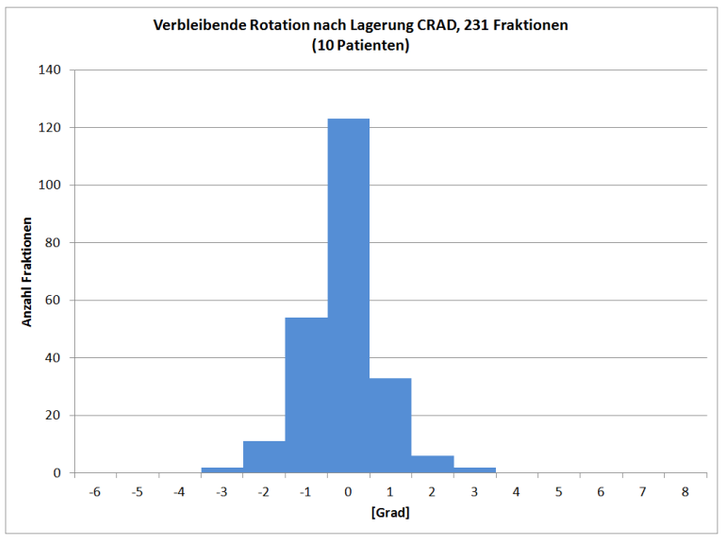
→ no external lasers involved!

Treat!

Evaluation: *Preliminary results…*

IGRT is the gold standard – so the question is:

Can we improve patient positioning regarding rotation and deformation?

	Skin marker	"Dresden"- Workflow
Pitch		
Rotation		

Same accuracy, slight improvement.

(Further evaluation: master theses = work in progress)

Conclusions & final remarks

In clinical routine since 02.01.2016

… with 5 to 6 patients per hour per machine.

… involves the whole team

... to be structured by enthusiastic RTTs and physicists.

… is highly appreciated by our patients

…no markers, washing is possible etc.

…requires some extra effort in certain cases

…interpretation of scanner performance/ results

… three camera system recommended for extremities and higher accuracy

IGRT is a “Must have!”

Scanner positioning alone is not accurate enough!