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Guiding VMAT Total Body Irradiation with AlignRT

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Austin
HEALTH

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TBI Overview

Total Body Irradiation (TBI)

- To prepare for blood stem cell or bone marrow transplant (BMT)¹

Low-dose TBI – Non-Myeloablative regimen²:

- 2Gy in 1# (SD)
- 4Gy in 2# (BID)

High-dose TBI – Myeloablative regimen²:

- 12Gy in 6-8# (BID)
- 13.2Gy in 11# (TID)



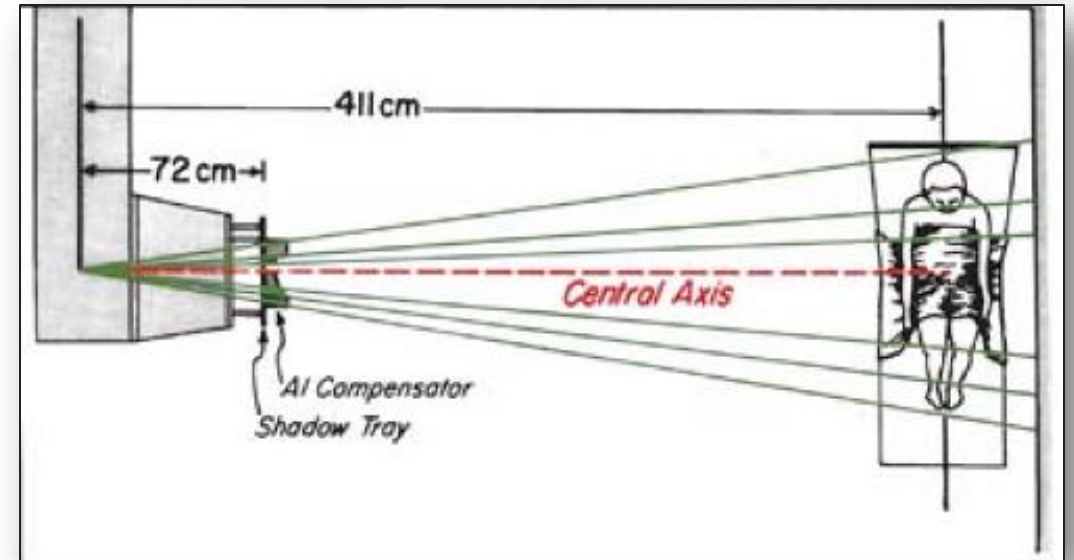
TBI VMAT at ONJ

TBI Clinical Implementation at ONJ:

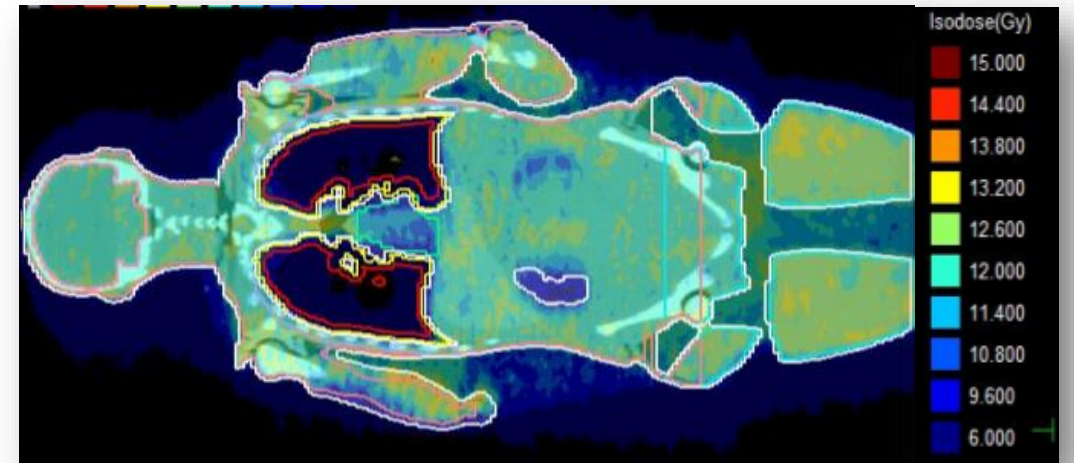
- Project started 2024, First patient mid-2025
- 8 Patients treated

VMAT Vs Traditional Bilateral Fields:

- ONJ Bunkers too small
- CSI VMAT Experience
- Improved dose homogeneity & OAR sparing^{3,4,5}
- Patient comfort enhanced^{4,5}



Source: Khan FM, Williamson JF, Sewchand W, et al. Basic data for dosage calculation and compensation. *Int J Radiat Oncol Biol Phys.* 1980;6:745-751



Benefits of SGRT for TBI VMAT



**Tattoo-Free
Workflow⁶**



**Enhanced
Verification^{6,7}**



**Improved Setup
Accuracy and
Speed^{6,8}**



**Continuous Intra-
fraction
Monitoring^{6,7}**



CT Simulation

CT Simulation

Setup and Equipment:

- **TBI STEP**
- Supine, arms by side, legs flat
- Full Length BodyFIX
- Thermoplastic 3-point mask
- No clothes, excl. underwear

Workflow:

- Approx. Isocenter
- Immobilisation
- Landmark and record
- Perform a HFS scan, Rotate, then FFS scan

CT Scan:

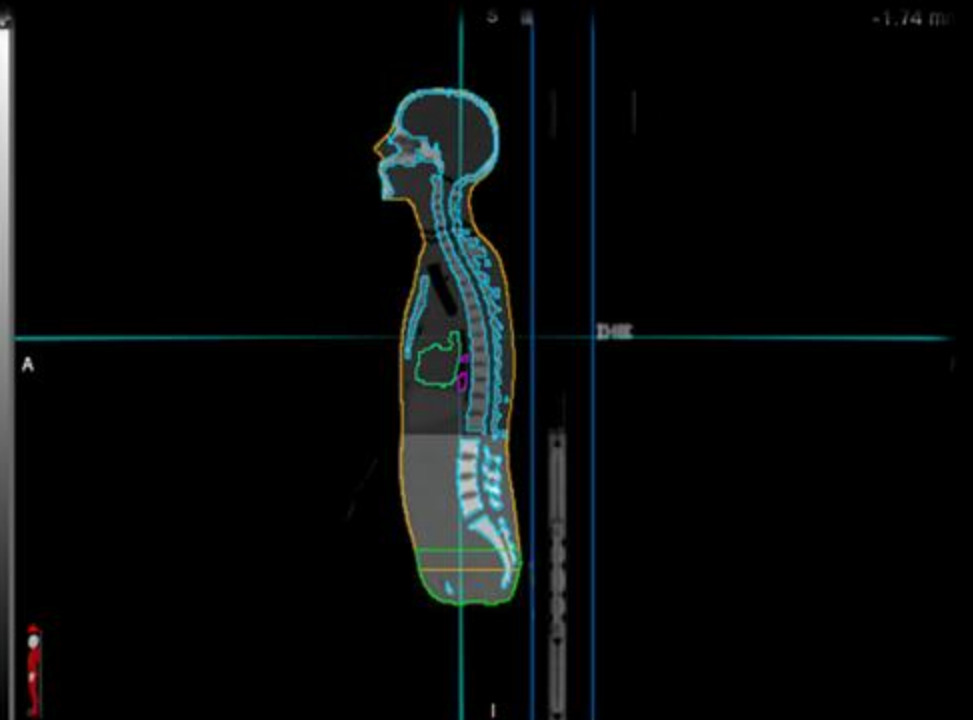
- 5mm slice thickness
- Extended FOV



Planning

CT/CT Fusion #1
Cyto 2
0231023TBITK
40124TBICUpper
024-01-24 17:00:53
40124TBICLower
024-01-24 17:05:58

270.25 mm
CT (P): 117
CT (S): 233
WW 1440 HU
WL 394 HU
CT (S): -1024 HU



OARs
Mandatory
Lung_L/R
Lung_Bilat
Lung_Bilat-10mm
Lung_Bilat-3mm
Kidney_L/R
Kidney_Bilat
Lens_L/R
Reporting
Brain
Thyroid
Heart
Thecal sac
Testes
OralCavity



Monaco Plan Preparation



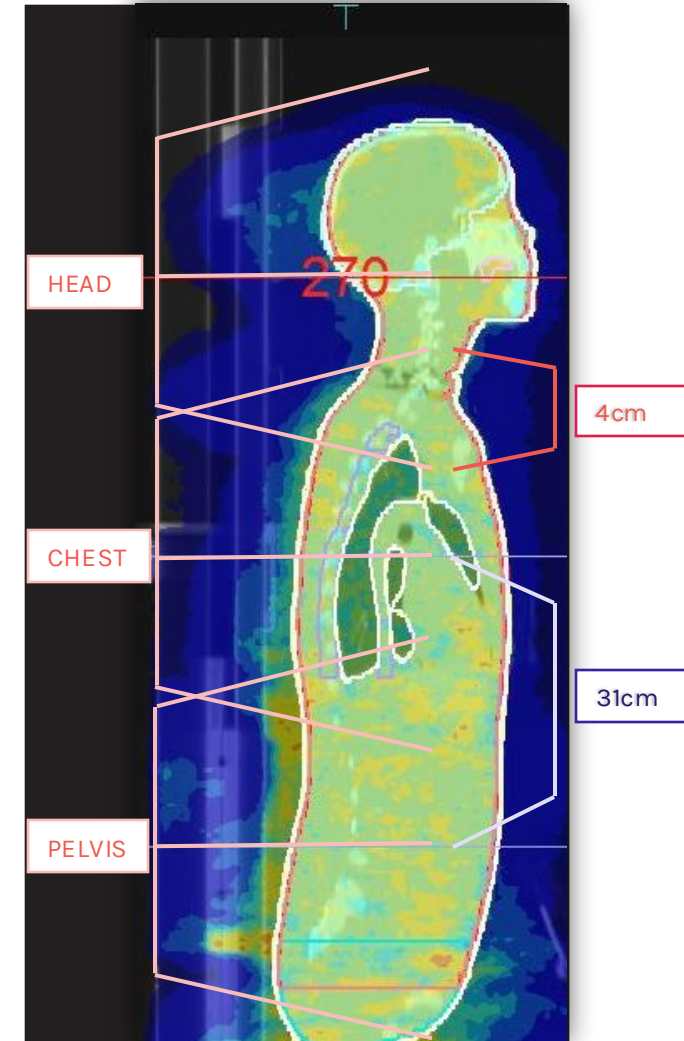
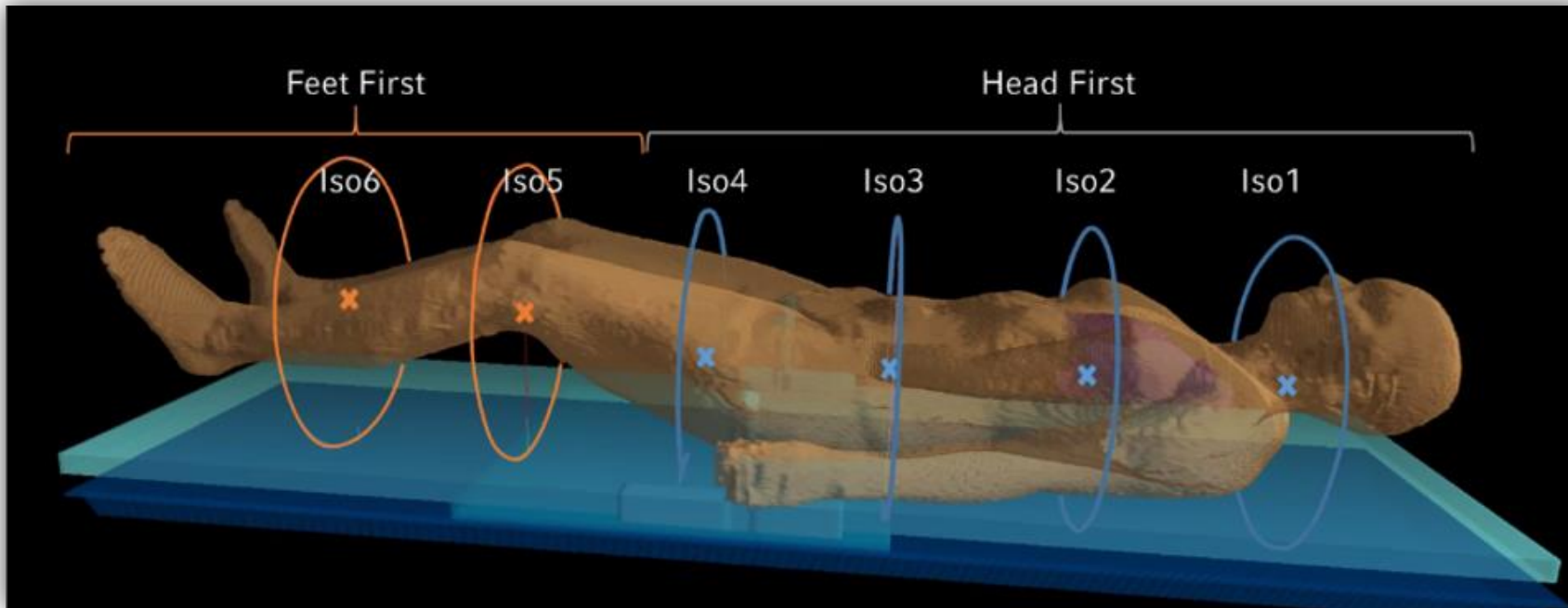
Isocentres:

- 5-8 total overlapping 360° arcs



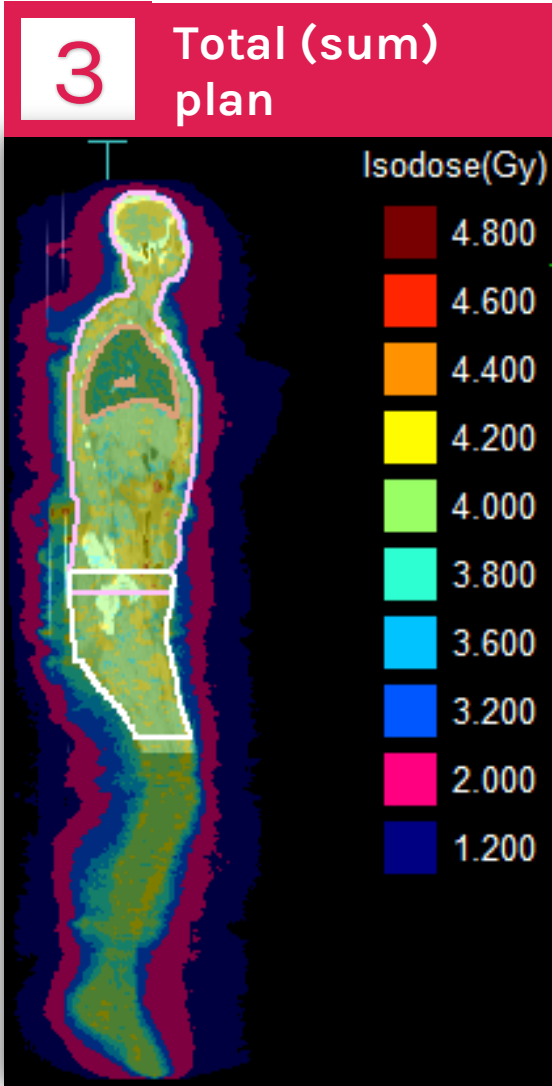
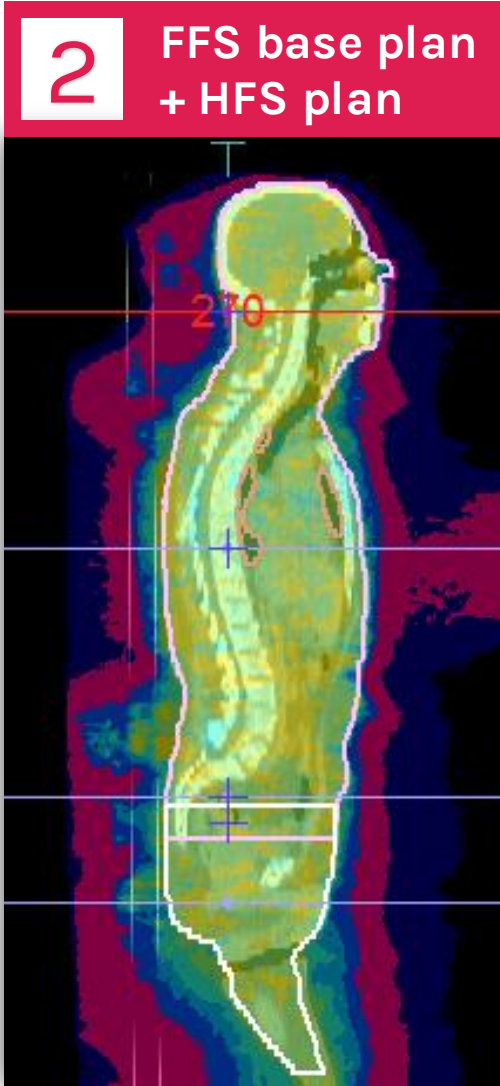
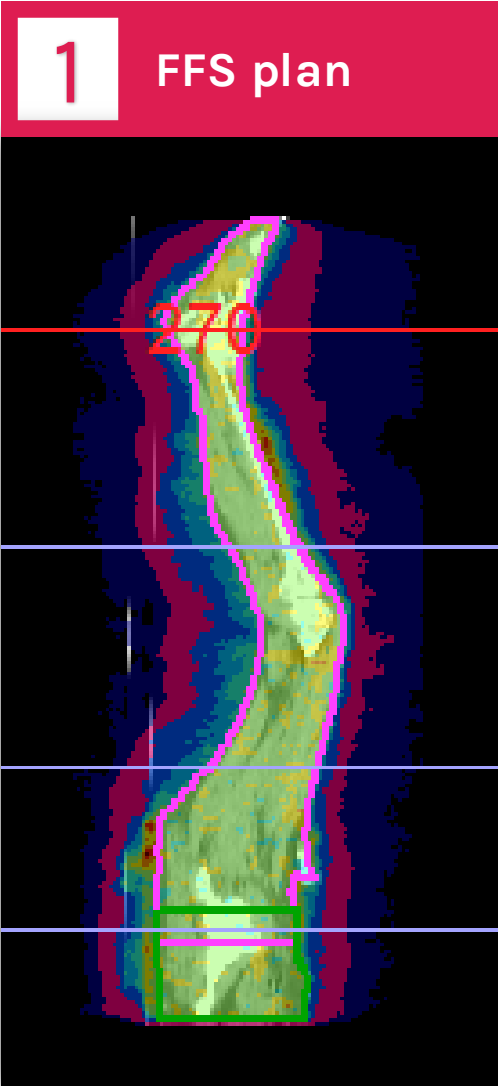
Plan Objectives:

- Minimise dose to Kidneys and Lungs



Source: Losert, C., Shpani, R., Kießling, R. *et al.* Novel rotatable tabletop for total-body irradiation using a linac-based VMAT technique. *Radiat Oncol* 14, 244 (2019). <https://doi.org/10.1186/s13014-019-1445-3>

Planning workflow



AlignRT

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TBI SGRT Setup Testing

ZZTEST, VMATTB14
13/03/1963, RVMATTB14

Treatment

RTT ? ment

RTT ? ?

01_A1DEFTBIFFSB4 ISO 1

SGRT Skin Lower

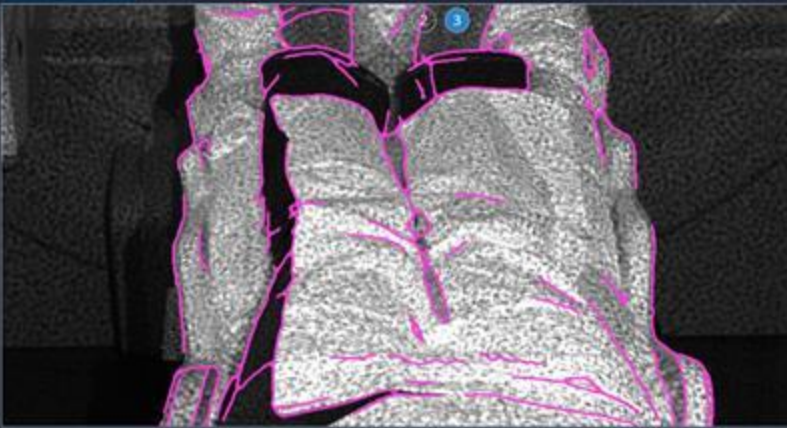
ROI2

SGRT Skin Upper

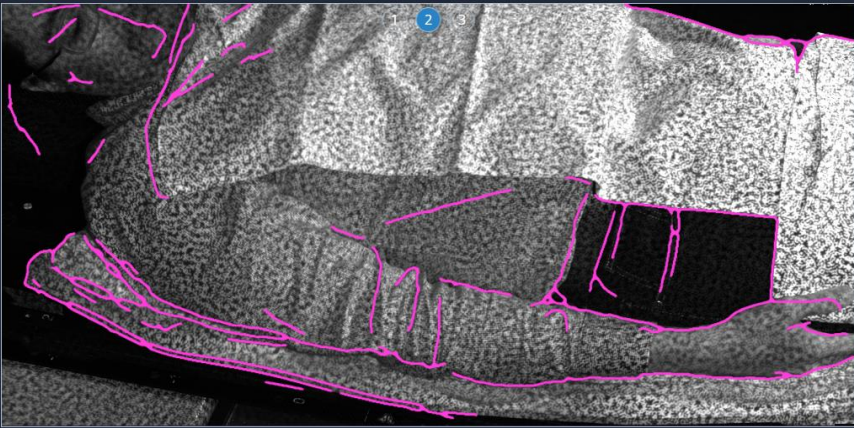
cHESTisO1

LAT _{cm}	0.02			
LNG _{cm}	-0.01			
VRT _{cm}	0.01			
MAG _{cm}	0.02			
PITCH [°]	0.0			
ROLL [°]	0.0			
RTN [°]	0.0			

Reference Treatment Couch 0.0° Send to Couch Beam Control OFF



Reference Treatment Couch 0.0° Send to Couch Beam Control OFF



Coaching

Surface Deformation Video

Coaching

Surface Deformation Video



AlignRT: Preparation

HFS:

- **Skin structure:** Head-> Mid-thigh
- 2x ISOs: Chest and Pelvis
 - ROIs: Chest and Pelvis

FFS:

- **Skin structure:** Abdo-> Toes
- 2x ISOs: Mid-thigh and Knee
 - ROIs: Pelvis, Lt leg & Rt Leg

The screenshot displays the 'Treatment Course' interface in a dark theme. At the top, it says 'Treatment Course'. Below this is a table with two columns: 'Plan Name' and 'Active'. The table contains several rows, each representing a different treatment plan or ROI. The first row is 'TBI HFS [Spine]' with a dropdown arrow. Below it are three rows: 'ISO 1 [2.0, -260.0, 640.0]', '1B. CHEST [2.0, -260.0, 430.0]', and 'ISO 3 [2.0, -260.0, 215.0]'. The next row is '1D. PELVIS [2.0, -260.0, 0.0]'. Below that is a row with a shirt icon and the text 'CT SIM Skin Upper 11/08/2025 16:25:...'.

Plan Name	Active
▼ TBI HFS [Spine]	
▶ ⊕ ISO 1 [2.0, -260.0, 640.0] ⓘ	<input type="checkbox"/>
▶ ⊕ 1B. CHEST [2.0, -260.0, 430.0] ⓘ	<input checked="" type="checkbox"/>
▶ ⊕ ISO 3 [2.0, -260.0, 215.0] ⓘ	<input type="checkbox"/>
▼ ⊕ 1D. PELVIS [2.0, -260.0, 0.0] ⓘ	<input checked="" type="checkbox"/>
▼ 👕 CT SIM Skin Upper 11/08/2025 16:25:...	<input checked="" type="checkbox"/>

Below the table, there is a dropdown menu currently showing 'Treat Without Beam Control'. Below that is a button with a shirt icon and the text 'PELVIS ROI [Isocentric]'. Below that is a blue button with a plus icon and the text 'Add ROI'. At the bottom of the interface, there is a 'Done' button.



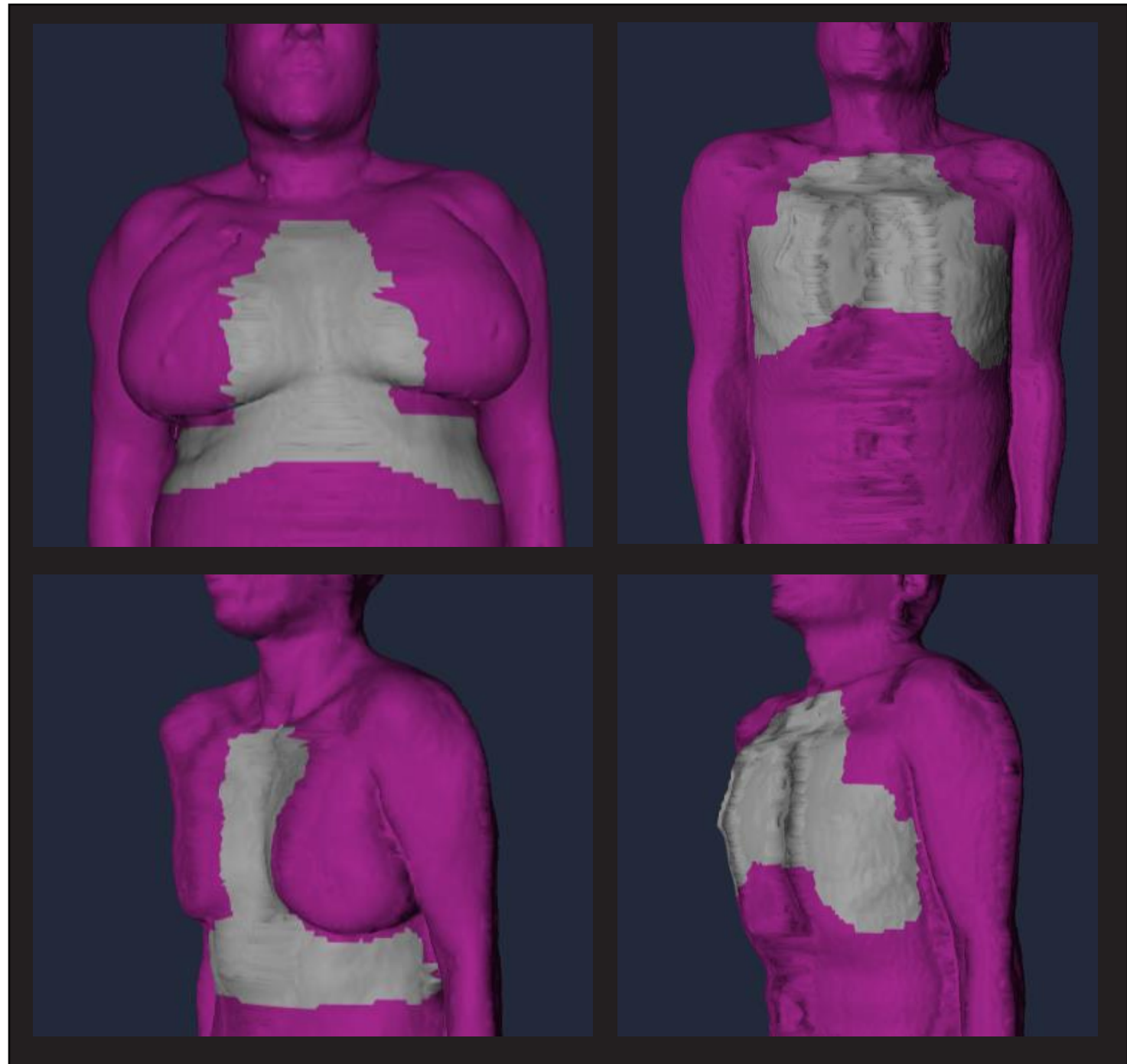
Chest ISO & ROI

Include:

- Sternum
- Edge of ribs
- Lateral

Do not include:

- Unstable areas
- Breathing motion
- Immobilisation



Pelvis ISO & ROI

Include:

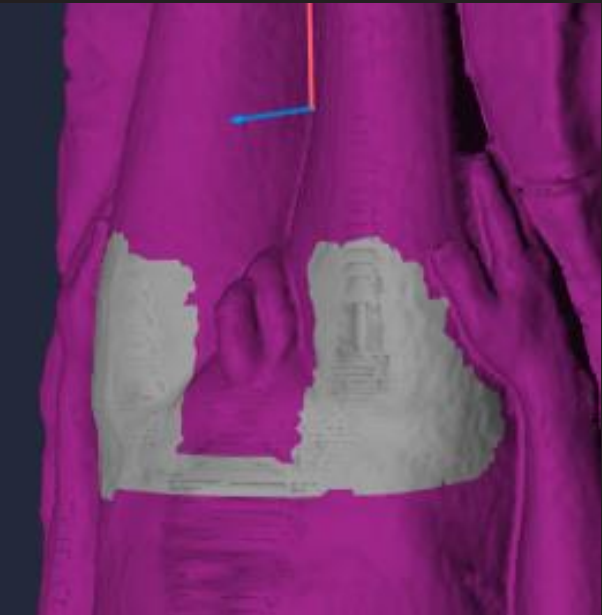
- Anterior hips
- Lateral hips

Do not include:

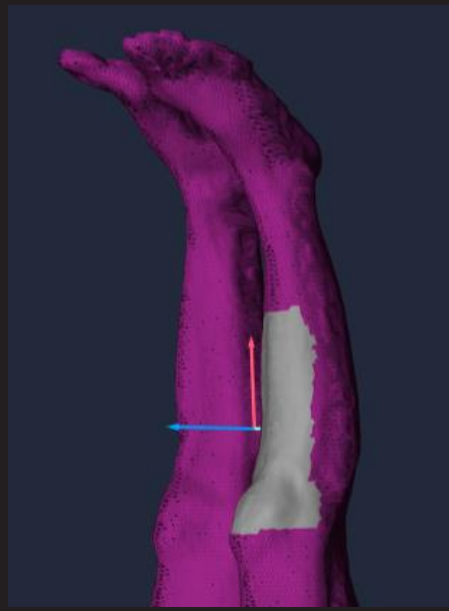
- Modesty area
- Hands on side
- Areas of motion



Mid Thigh ISO & ROI



Knee ISO & Rt Knee ROI



Knee ISO & Lt Knee ROI



Treatment

Treatment Workflow: HFS

II TBI HFS 1B. CHEST CT SIM Skin Upper CHEST ROI

LAT _{cm}	-0.02	
LNG _{cm}	0.22	
VRT _{cm}	0.43	
MAG _{cm}	0.49	
PITCH [°]	-0.8	
ROLL [°]	-0.1	
RTN [°]	0.4	

Reference Treatment Couch 0.0° Send to Couch Beam Control OFF

0.30
-0.30

Coaching Surface Deformation Video

alignrt ⚠ Deltas out of tolerance 20.9 fps | Field Status ○ | System Status ✖ | 10/09/2025

Reference Treatment Couch 0.0° Send to Couch Beam Control OFF

0.30
-0.30

Coaching Surface Deformation Video



Treatment Workflow: FFS

II TBI FFS 1F. KNEES CT SIM DVH Skin Lower LT LEG ROI

LAT _{cm}	0.02	
LNG _{cm}	-0.31	
VRT _{cm}	-1.38	
MAG _{cm}	1.42	
PITCH [°]	-2.6	
ROLL [°]	3.2	
RTN [°]	-0.6	

Reference Treatment Couch 0.0° Send to Couch Beam Control OFF

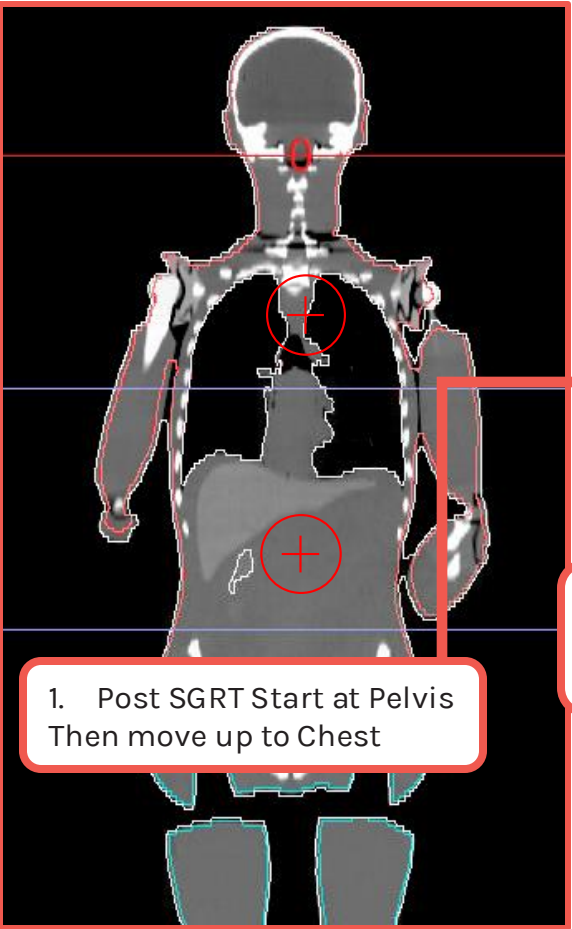
0.30
 -0.30

Coaching Surface Deformation Video

alignrt® Deltas out of tolerance 33.1 fps | Field Status | System Status | 10/09/2025 13:13



Treatment Workflow post SGRT



3. Shift to Head Iso
Orthogonal 2DkV image,
Apply Lat + Vert shifts only.
Treat

2. CBCT, Apply shifts. Treat

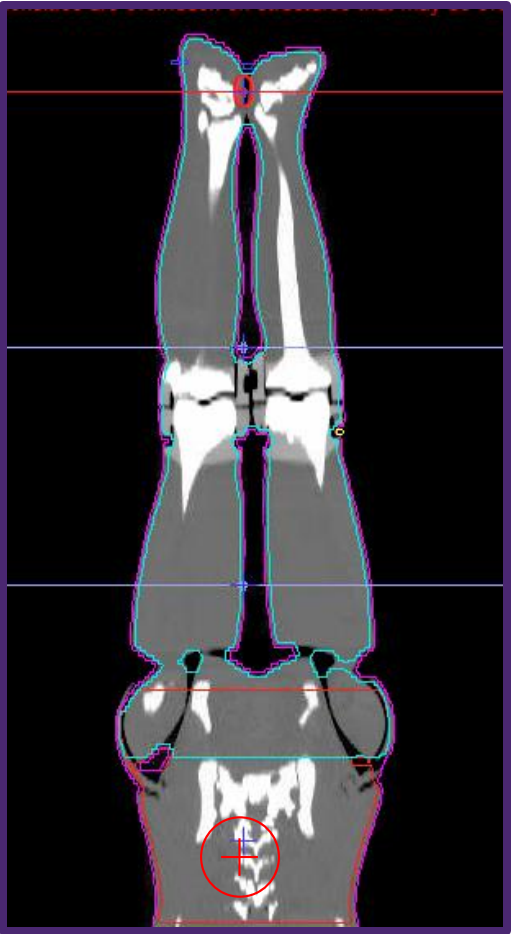
4. Shift to Pelvis Iso,
Orthogonal image, Apply
Lat + Vert shifts only. Treat

5. Rotate TBI STEP
to FFS

8. Long shift to Feet
Iso, AP 2DkV, shift Lat.
Treat

7. Long shift to Knee
iso, AP 2DkV, shift Lat.
Treat

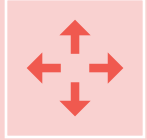
6. Set to Thigh Iso using couch
long value. CBCT.
Apply Lat + Vert Shifts only.
Treat



EXPERIENCE



Patient Experience



Contour changes



Reduced imaging

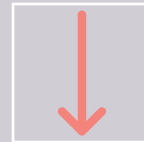
FUTURE



Beam hold



Faceless Masks



Further reduce imaging



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All patient images shown in this presentation have been included with documented informed consent



**Thank you
Any Questions?**

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