

A scenic view of a city from a high vantage point, featuring a cable car and people climbing a rocky mountain trail. The image shows a cable car suspended in the air, overlooking a city with a large body of water. In the foreground, two people are climbing a rocky mountain trail with metal railings. The overall scene is bright and clear, suggesting a sunny day.

Clinical Experience with AlignRT on ProBeam360

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Haukeland University Hospital Cancer Clinic

- 6 linacs
- 2 Halcyon
- 1 Ethos
- 3 TrueBeam

- 2 ProBeam 360 Varian

AlignRt in every room

Starting in 2015



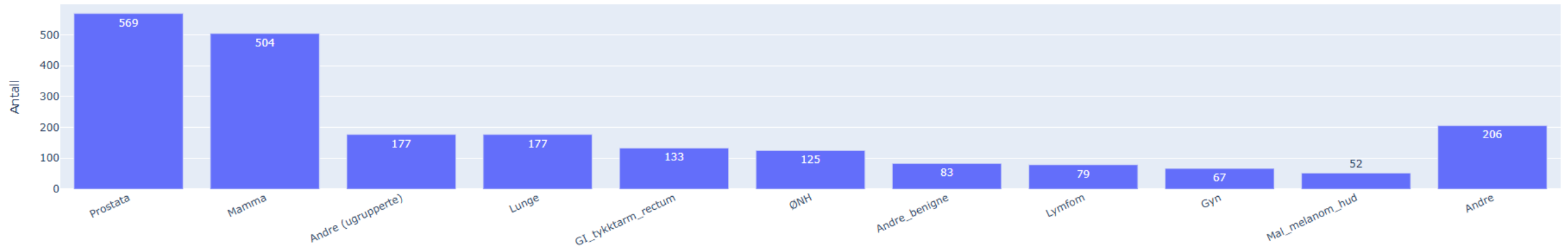
Statistics radiotherapy treatments Haukeland University Hospital

2025

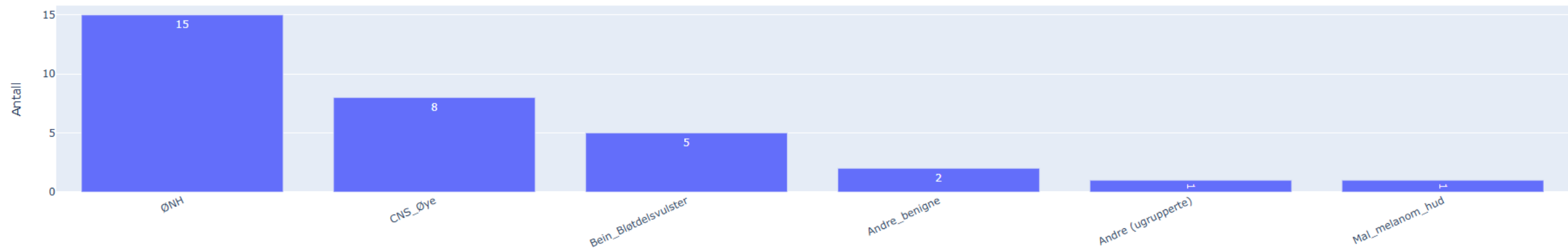
2172 radiotherapy patients in total

32 proton patients (23th March 2026: 46 patients in total)

Pasienter per diagnosegrupper



Protonpasienter per diagnosegrupper



Proton Clinic Bergen

Two ProBeam 360 by Varian Siemens Medical.

6 Dof Couch. Leoni Robot

9 RTTS trained in protons

Room 1: Science

Room 2: treatments

Both rooms approved for patient treatments

Couch angles 90-270 degrees (Couch Kick) Typically CNS

H&N 6-7 fields (Uni lateral 4 fields)

CNS 3-4. Total CNS 5 ISO: Spine 4 fields. Brain 3 fields.

Rangeshifter modulating beam in target depth. 2-3-5 cm. Snout- as close as possible to body surface.

AlignRT in both rooms.

- First patients in May 2025
- Today around 5-6 patients per day



Why are we using SGRT in proton therapy?

Protons are more sensitive to **geometric inaccuracies**, density variations, and patient motion **than photons**.

SGRT provides **continuous, non-ionizing positional control**.

Unlike photons, protons stop at a specific depth (the **Bragg peak**). Small setup errors can lead to:

- Underdosage of the tumor
- Overdosage of organs at risk
- Misplacement of the Bragg peak

Proton therapy requires:

- Accurate patient setup
- Stable patient positioning throughout the entire fraction

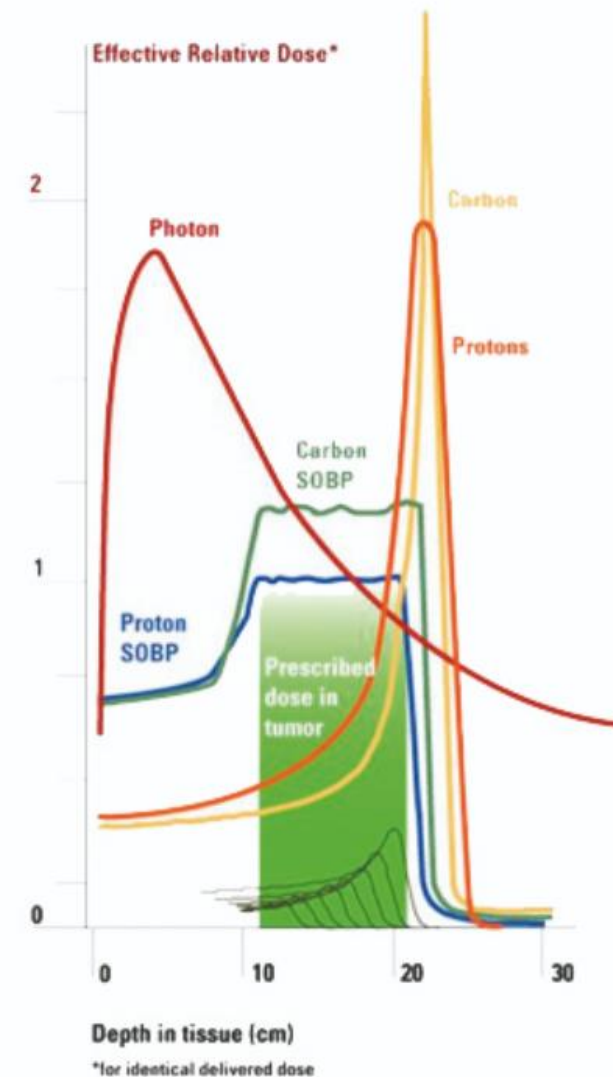


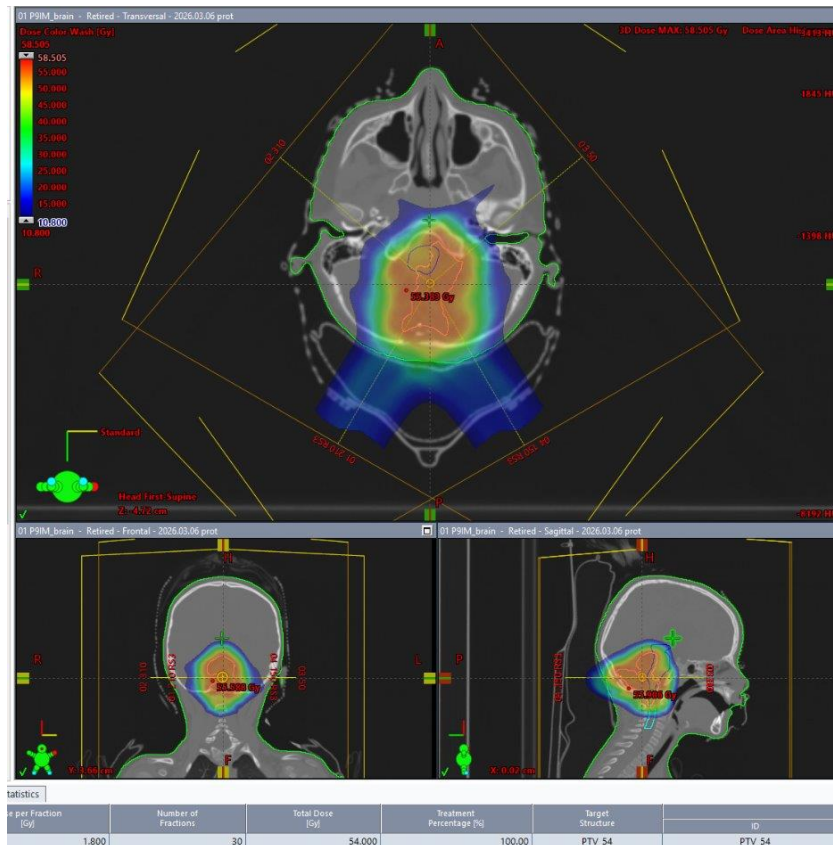
Figure 3. Examples of various different relative doses with respect to depth for a variety of photon energies, protons and carbon ions

Tolerances in proton therapy

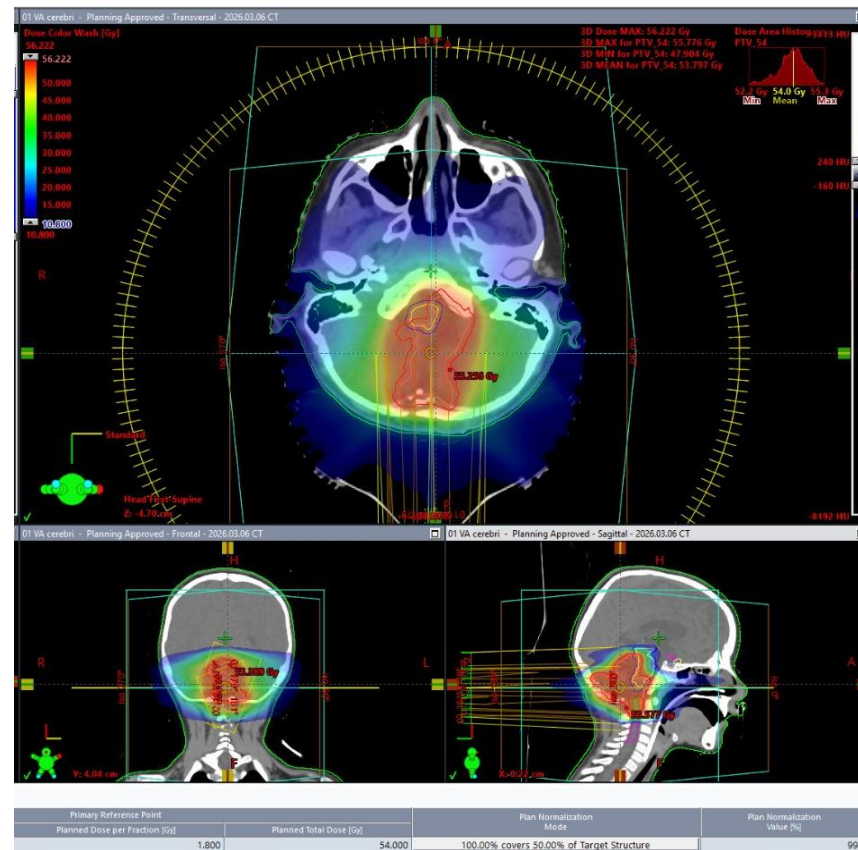
Tolerances are often **stricter** than in photon therapy:

Rotational: $\pm 1,5$. To avoid shift of patient anatomy

A 2-3 mm shift can **misplace the Bragg peak** for protons

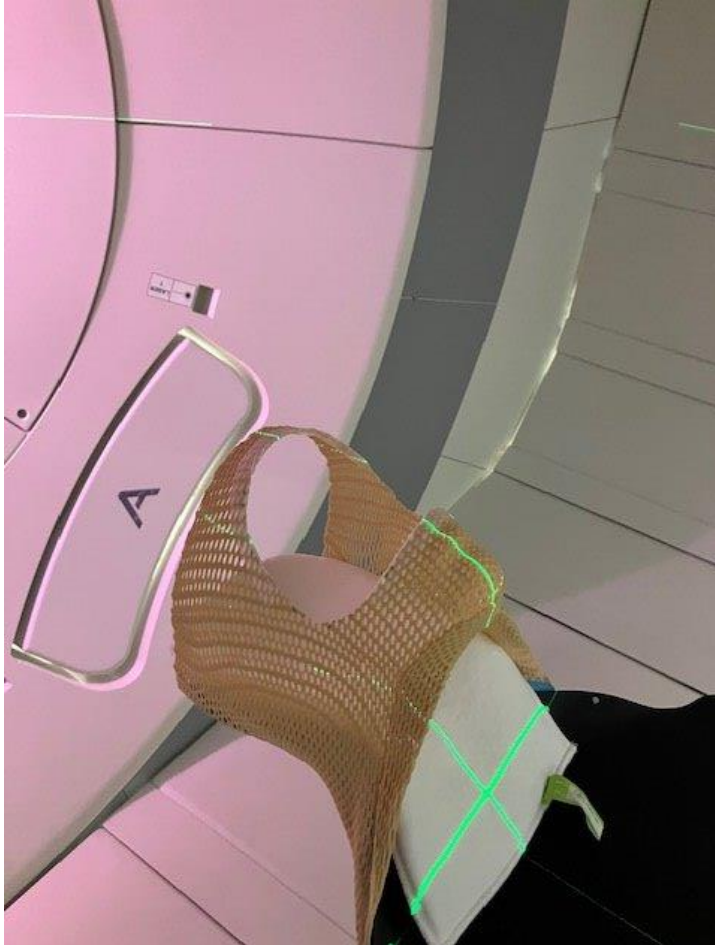


Proton



Photon

Workflow with AlignRT



Proton SGRT must account for: camera blocking

- Gantry rotation
- Nozzle
- Snout

Proton dose plan often requires:

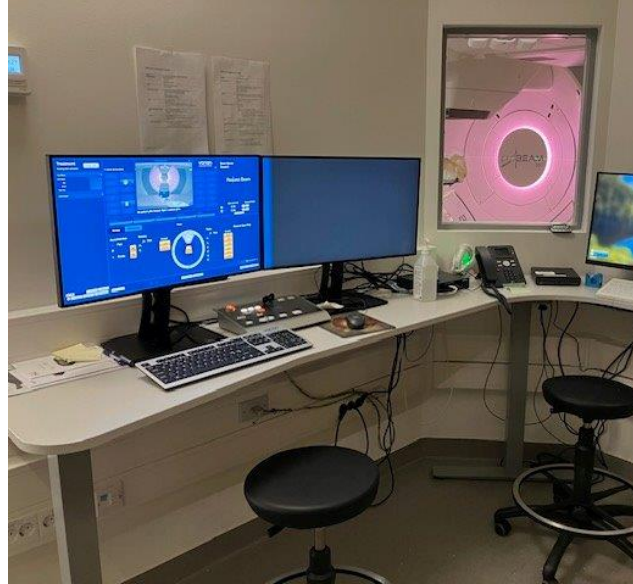
- Field-specific verification (PSQA)
- Camera configuration optimization

- ROI: Isocentric vs Setup

Isocentric based if the ROI correlate well to the treatment isocenter

Setup based for regions that are independent of the treatment isocenter.

Nb! When choosing setup based ROI we can not monitor the patient during treatment.



Proton AlignRT

Benefits:

Reducing Time & Dose

Tattooless

Imaging constraints: Rotations 1.5° No merge in longitudinal

Challenges:

No screen in the alcove.

No "send to couch" function

License Postural limited until end of May 2026.

(Finance)

Limitations – important to remember

- SGRT monitors **only the surface**
- Internal organ motion must still be assessed using:
 - IGRT
 - Robust treatment planning

AlignRT is always used as a **complement**, not a replacement, for imaging verification.



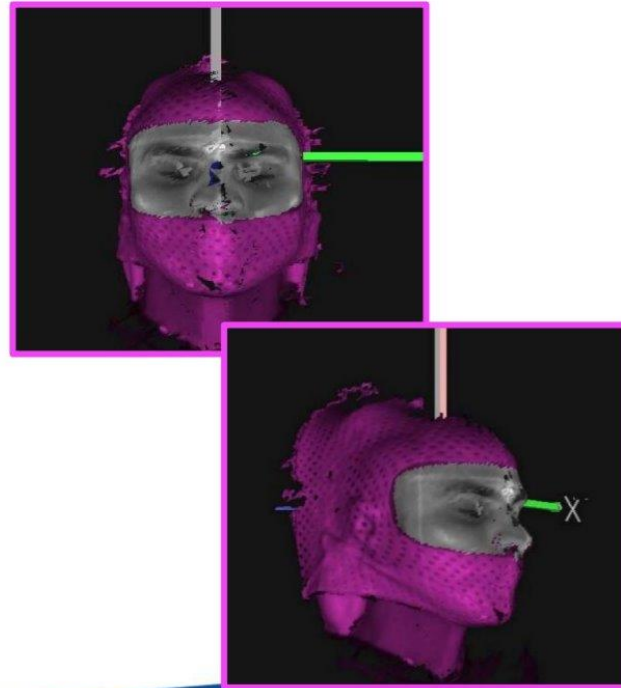
Our tools with AlignRT

- Postural Video
- Deformation
- Treatment Capture
- Beam Control

We include the isocenter when possible, and surrounding area. Skin surface only. The most stable surface is included.

Consider treatment technique and potential camera occlusions during treatment delivery. E.g snout and gantry.

SRS / BRAIN - EXAMPLE



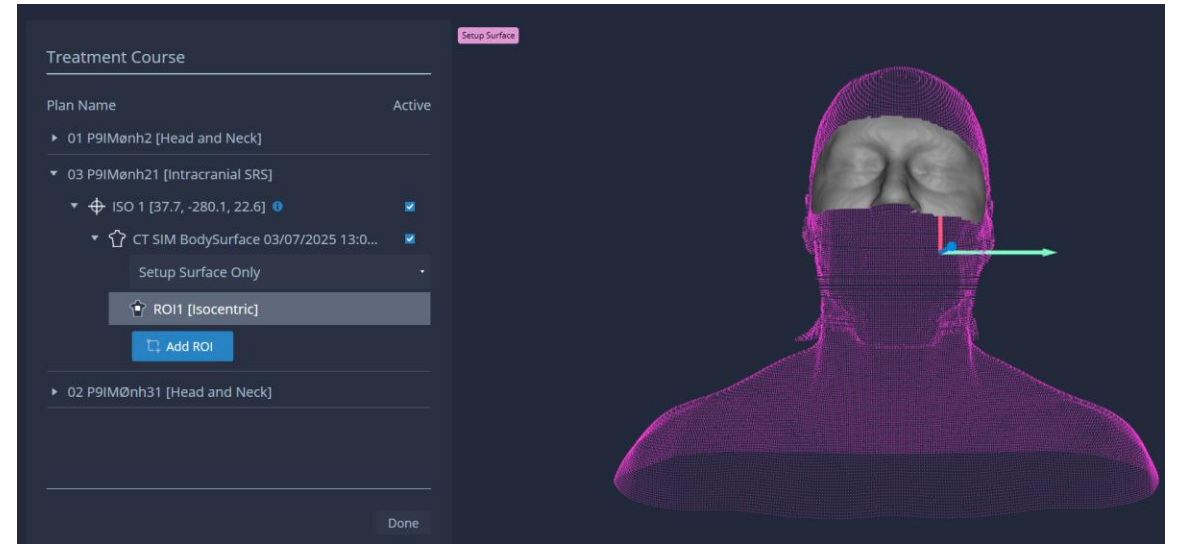
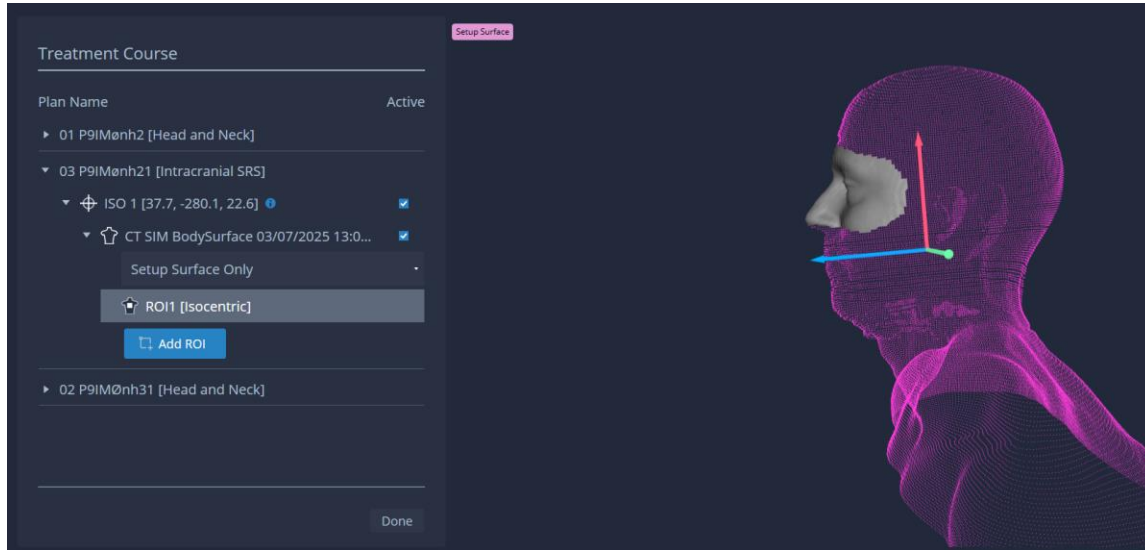
Include:

- Eyebrows, nose, forehead, cheeks
- Laterally: outer canthus to the anterior of the tragus
- Ensure there is a small gap between the edge of the mask and the edge of the ROI

NOTE: USER MAY CHOOSE TO EXCLUDE EYELIDS AND/OR NOSTRILS FROM ROI IF MOVEMENT IS DETECTED FROM THESE AREAS

Recommend User Guide. Nb! Not proton specific





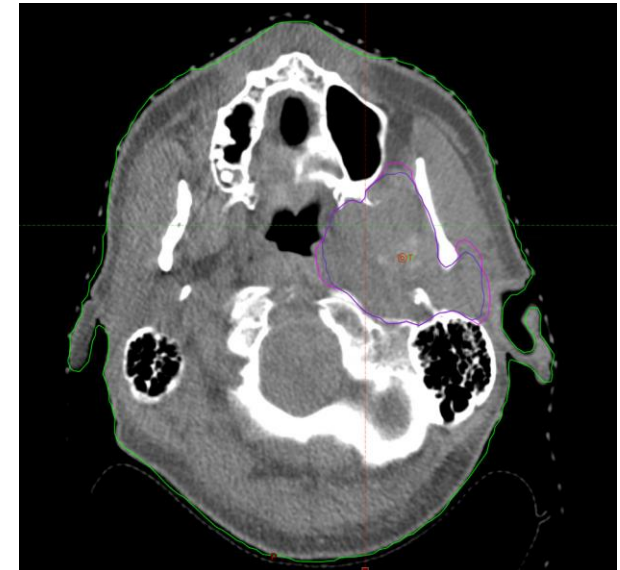
Case 1

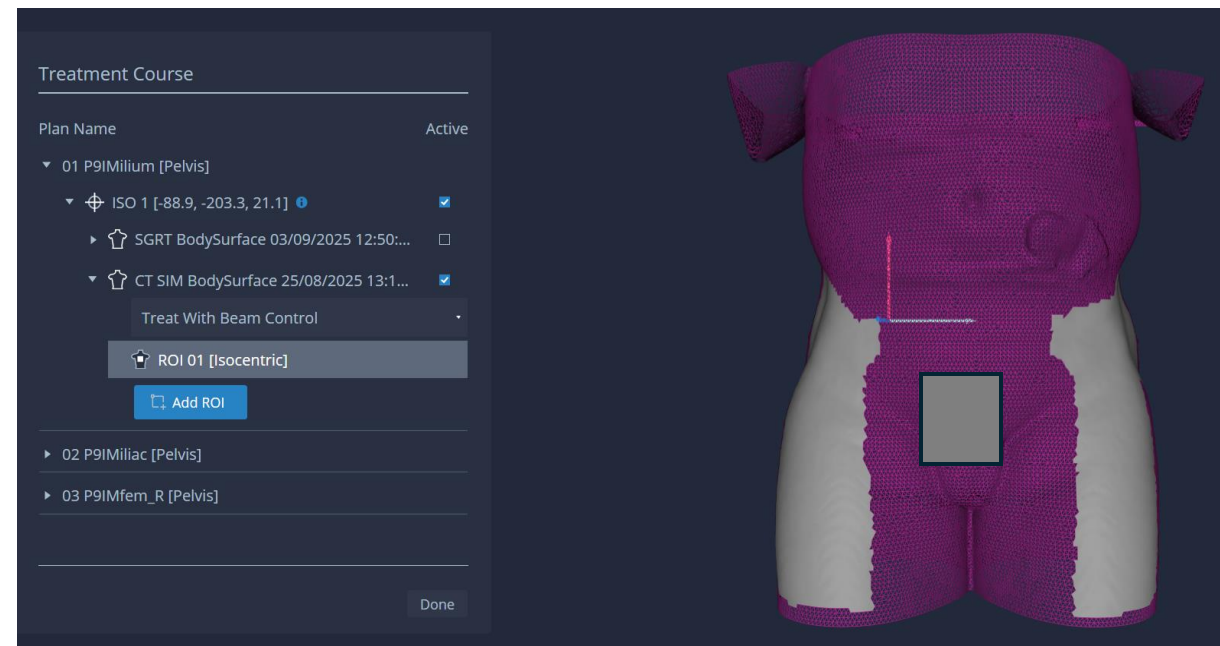
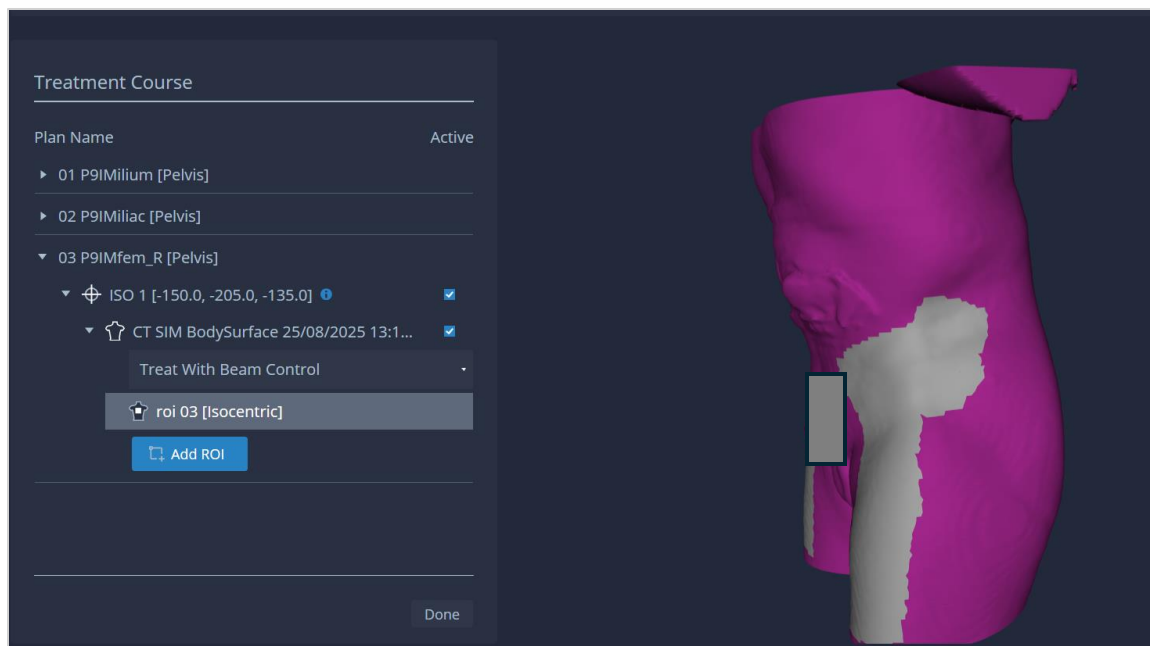
Open mask.

Head and neck



- Challenges: Rotations

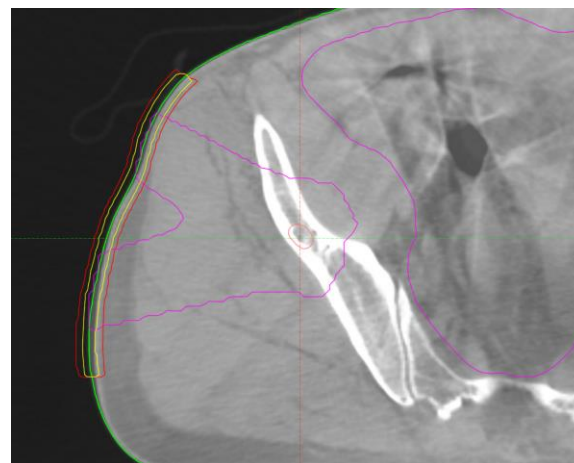




Case 2 Pelvic. Beam Control

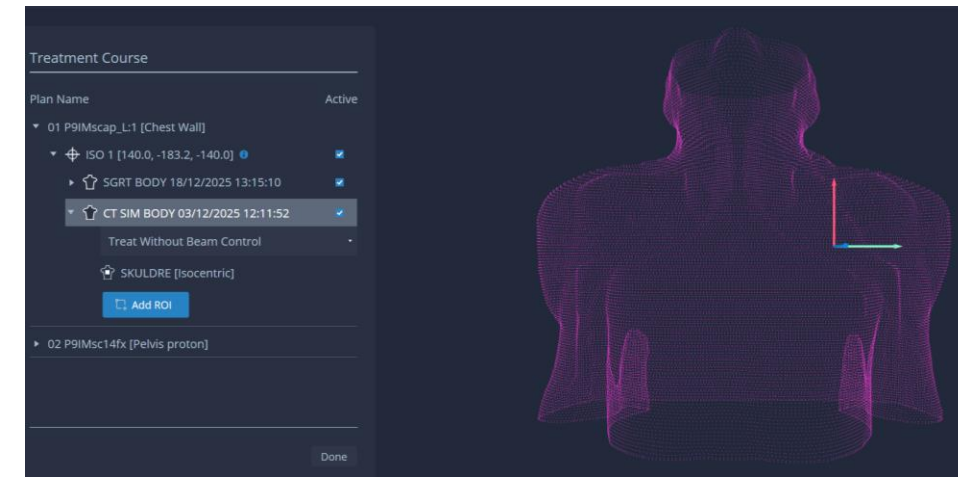
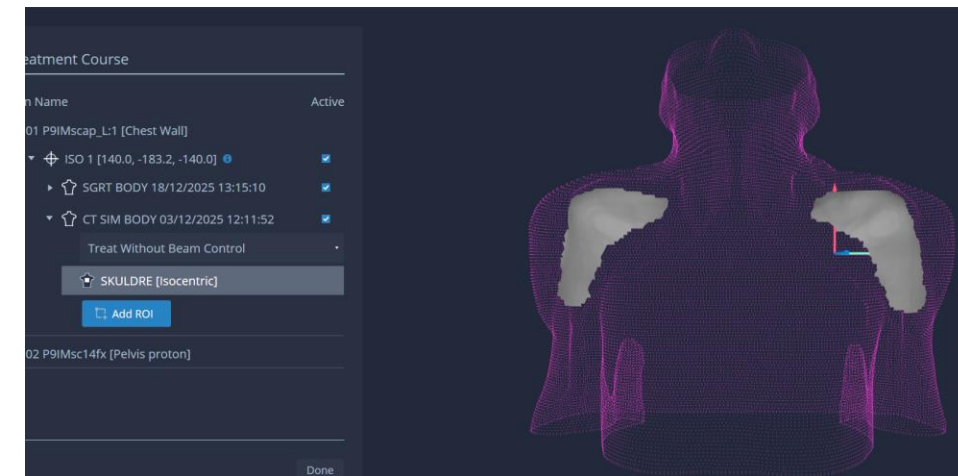
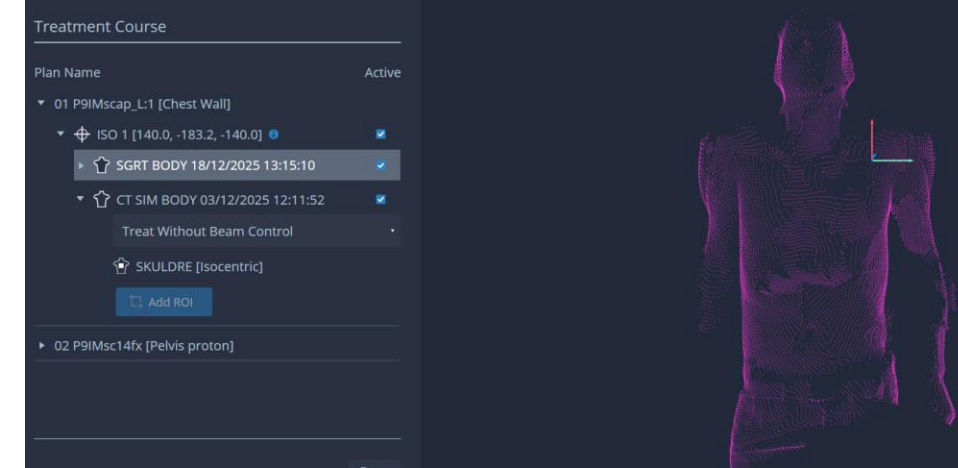
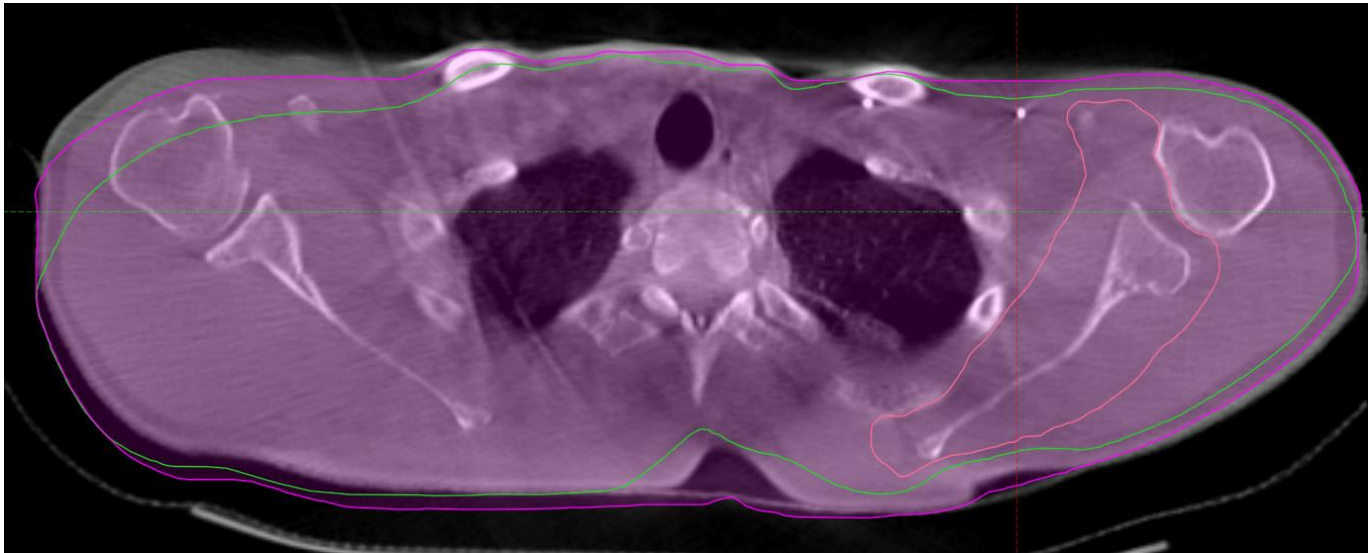


- Challenges: Three isocenters with small size CTV. The patient laying loose.

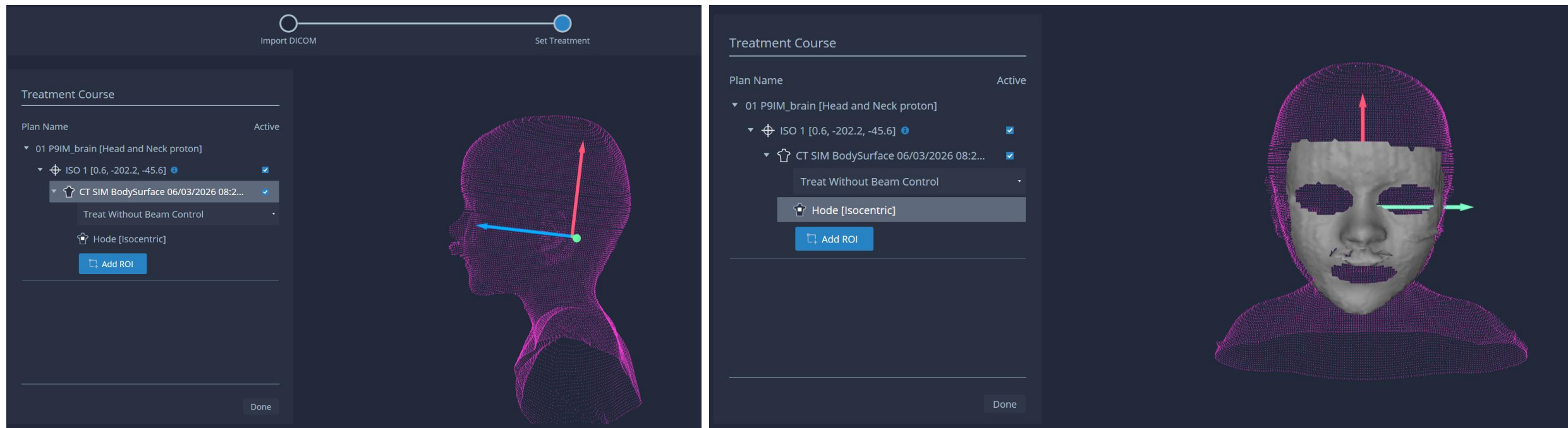


Case 3 Scapula

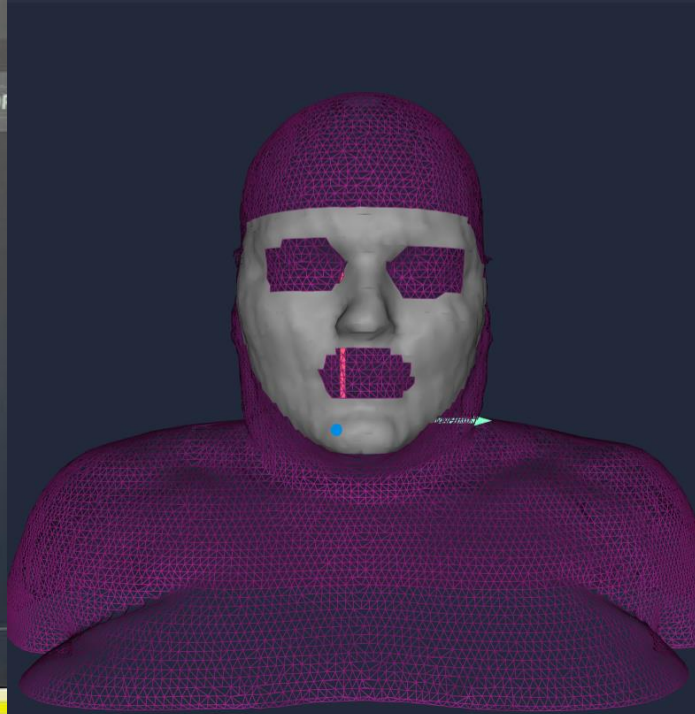
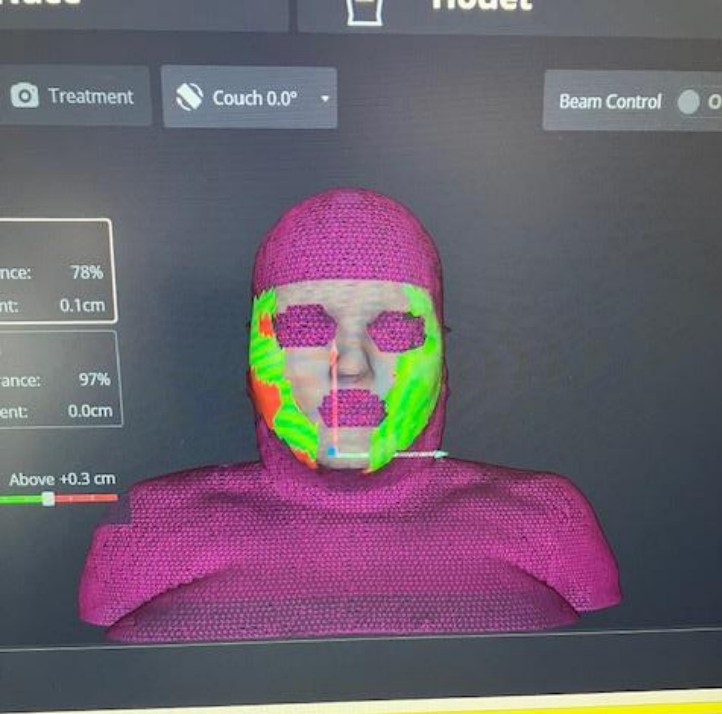
- More accurate positioning of arm and shoulder
- Choosing stable and firm surface close to the isocenter
- Postural video



Case 4 Child Closed mask. Anastaetic

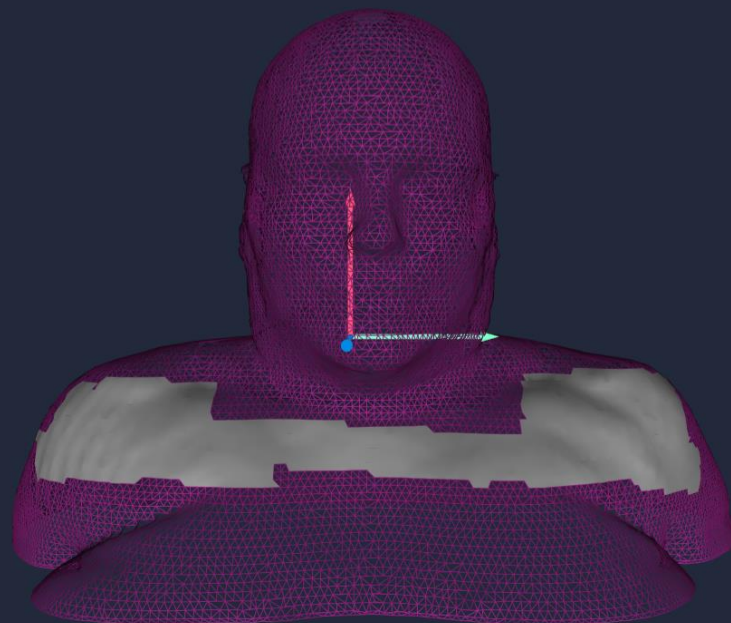
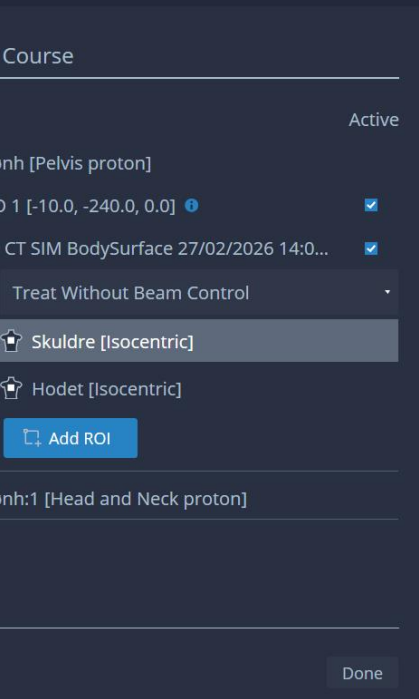


Challenges: Keeping the head in the same rotational position while maintaining free breathing.



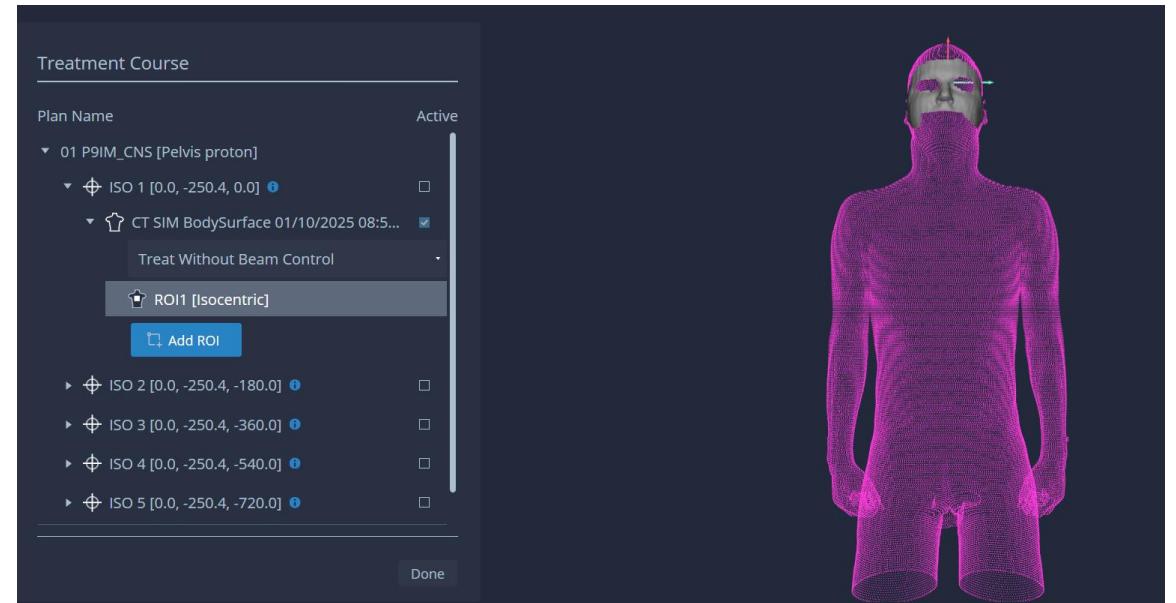
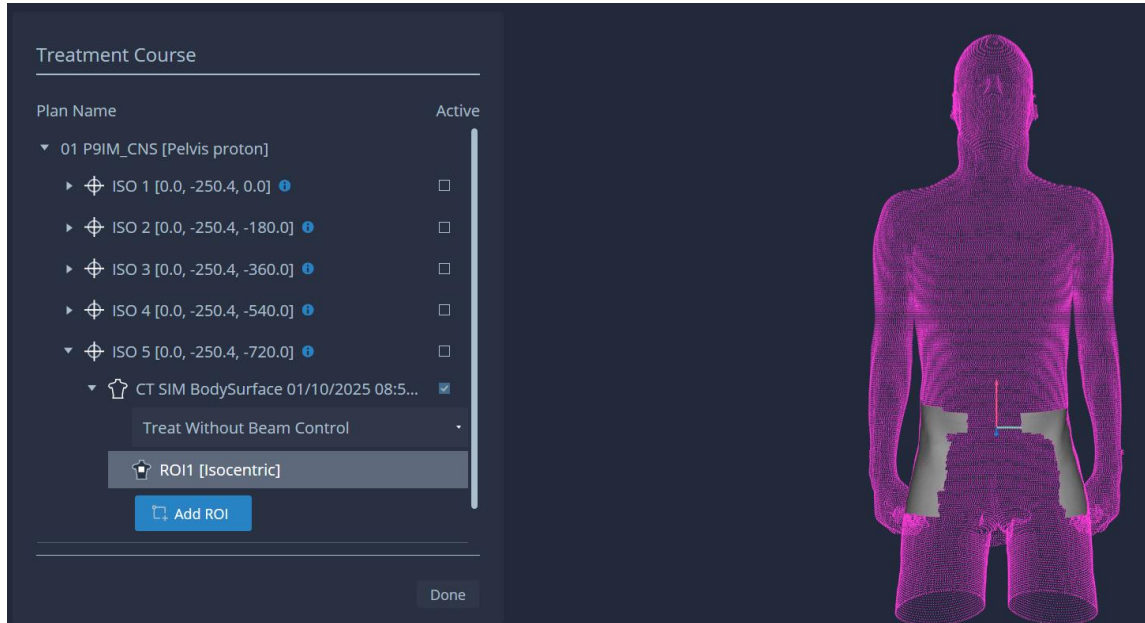
Case 5 Closed long mask

Challenges: Shoulder and chin



Case 6 Total CNS

- Challenges: Aligning the whole body with in the strict tolerances. Patient must be still for 1-1,5 hours



To summarize currently usage Proton AlignRT

- Every Patient
- AlignRT most of all as a tool for set up
- Monitor the patient during treatment
- Body Surface : CT body minus the face mask
- Postural video, first choice
- Shadow from Gantry still no big worry
- ROI covering unilateral surface
- Belly is throwing shadow
- High knee fixation awareness

Future plans SGRT Proton

ENLUCA

National Clinical Study. Phase 1.

- Dose escalation Non small cell lung cancer. Protons. Safe?

DIBH Align

Thank you :)

