Intracranial SRT on Halcyon™ Without a 6DoF Couch: Clinical Evaluation of TruPose™ Head Adjuster and SGRT

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ORLAM

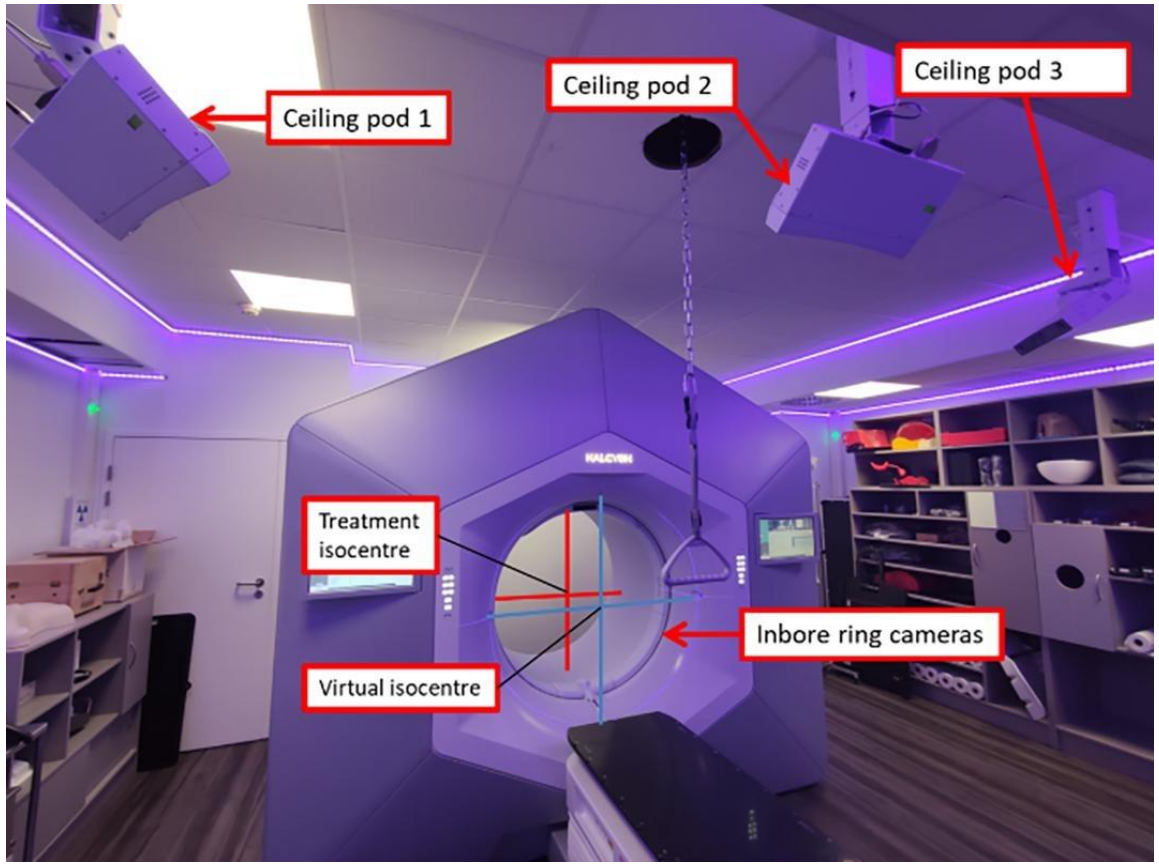
Conflict of Interest Declaration

- The Orlam Group has worked with Vision RT to develop the SGRT solution for the Halcyon.
- The Orlam Group collaborates with Standard Imaging to test the TruPose system on the Halcyon.
- The Orlam Group is a reference center for visits on behalf of Vision RT.
- The opinions expressed in this presentation are my own and do not reflect the official position of Vision RT, Standard Imaging, or ORLAM.

SRT on Halcyon with AlignRT Inbore

Background

- SRT = precise, conformal brain treatments
- Halcyon™: compact, efficient, but no 6DoF couch
- Rotational errors (pitch, roll, yaw) limit accuracy
- Need for 6DoF-like correction without hardware upgrade



Context SRS/SRT Halcyon

Evidence Supporting SRS/SRT on Halcyon™

- ❑ Li et al., Frontiers in Oncology (2019): Halcyon™ coplanar VMAT meets clinical constraints for multiple brain metastases.
- ❑ Good conformity for targets >1 cm and acceptable dose gradients.
- ❑ Efficient coplanar workflow with stable dosimetric performance.

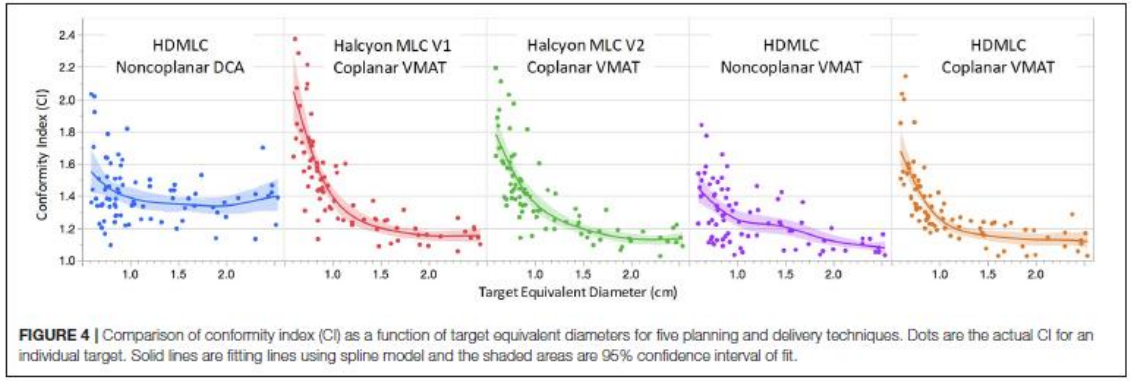


FIGURE 4 | Comparison of conformity index (CI) as a function of target equivalent diameters for five planning and delivery techniques. Dots are the actual CI for an individual target. Solid lines are fitting lines using spline model and the shaded areas are 95% confidence interval of fit.

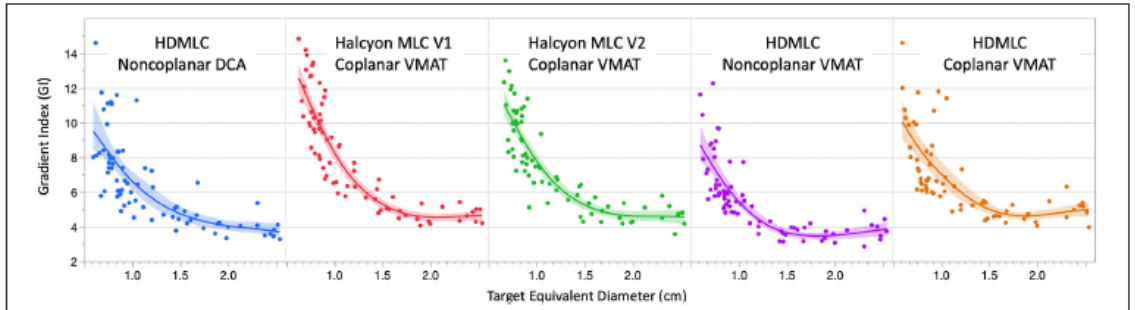
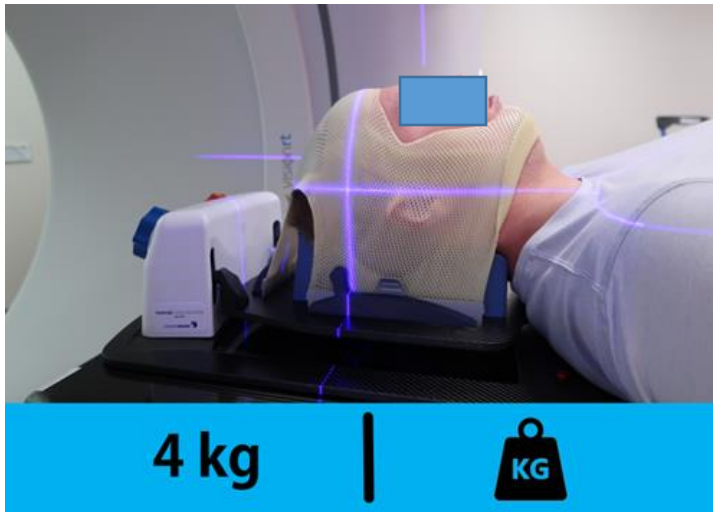


FIGURE 5 | Comparison of gradient index (GI) variation as a function of target equivalent diameters for five planning and delivery techniques. Dots are the actual GI for an individual target. Solid lines are fitting lines using spline model and shaded areas are 95% confidence interval of fit. Only GIs <15 are included in the graph to avoid data skewing due to bridging 50% isodose lines.

Objective

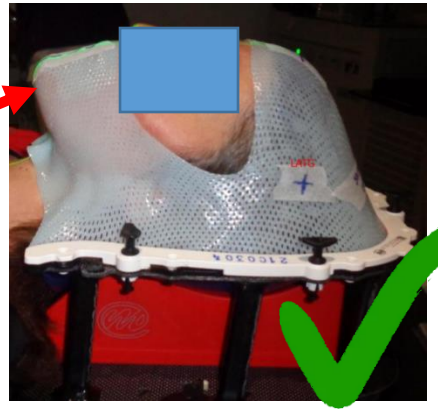
Evaluate if combining **SGRT**, an open-face mask, and the **TruPose™ Head Adjuster**
→ achieves setup accuracy comparable to a TrueBeam™ with 6DoF couch

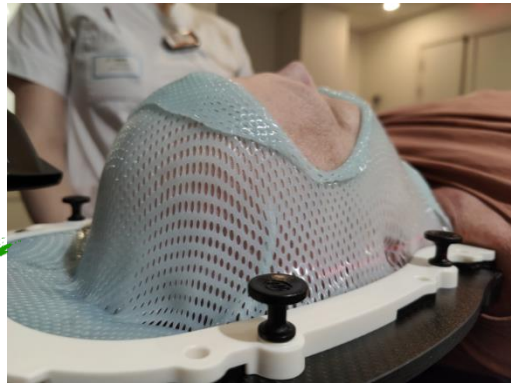


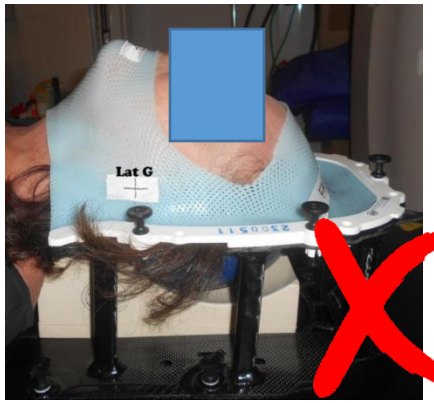
Molding the thermoformed mask on the patient's head

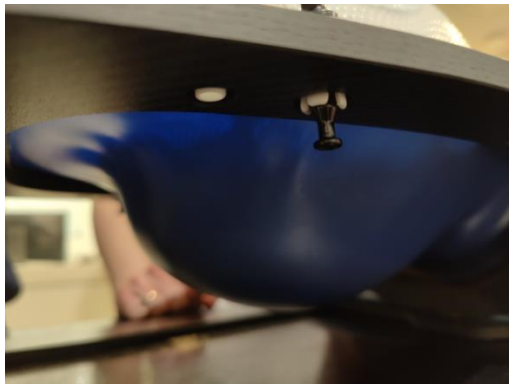
Careful Molding of the Open-Face Thermoplastic Mask:

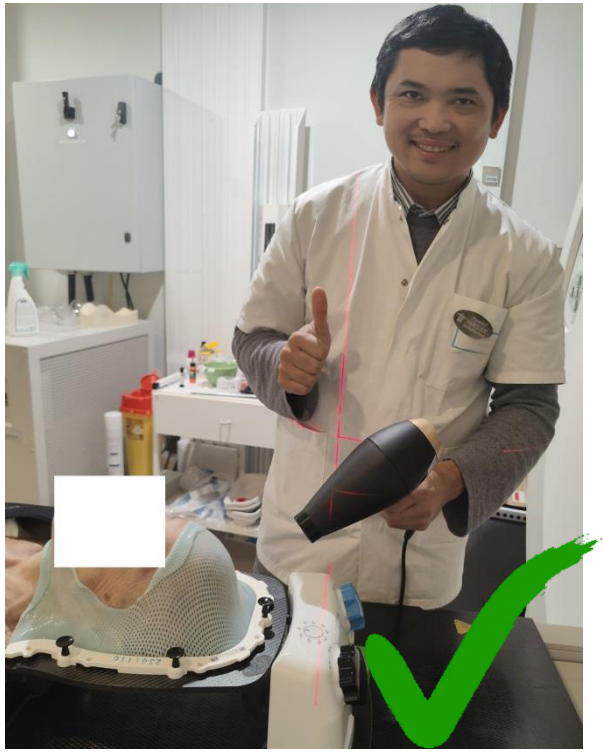
- ❑ For intracranial SRS/SRT: chin must be lowered to expose the face region to the SGRT cameras
- ❑ Elevated chin is only appropriate for head & neck treatments
- ❑ Use a **cold-air hair dryer** to ensure full drying and precise shaping, especially in key areas such as the **chin**, **forehead**, **nape of the neck**, and **skull**. This helps to quickly set the shape and ensure optimal immobilization.
- ❑ Mask must be fully dry before CT simulation







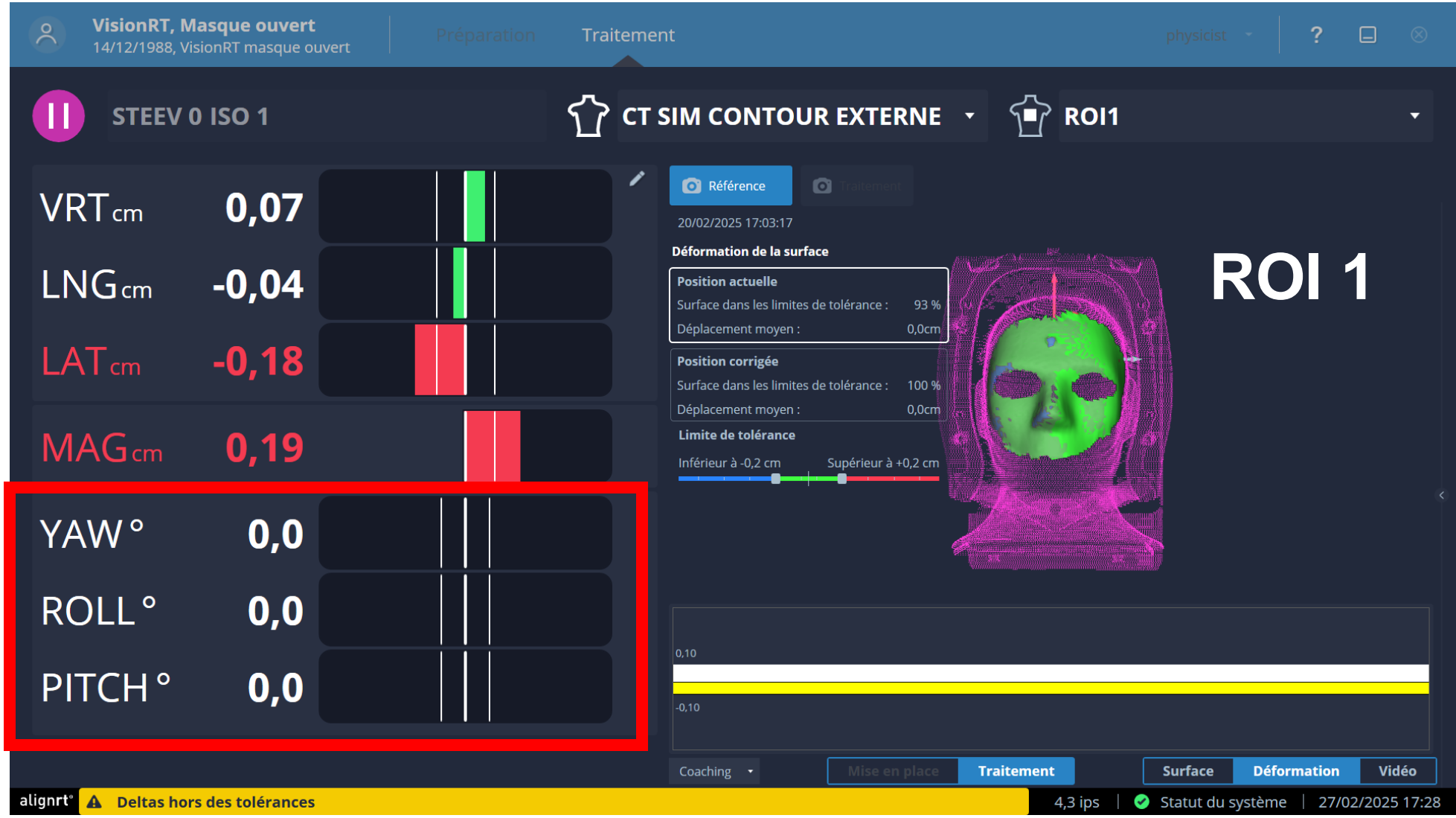




Using a hair dryer with cold air to quickly set the mask

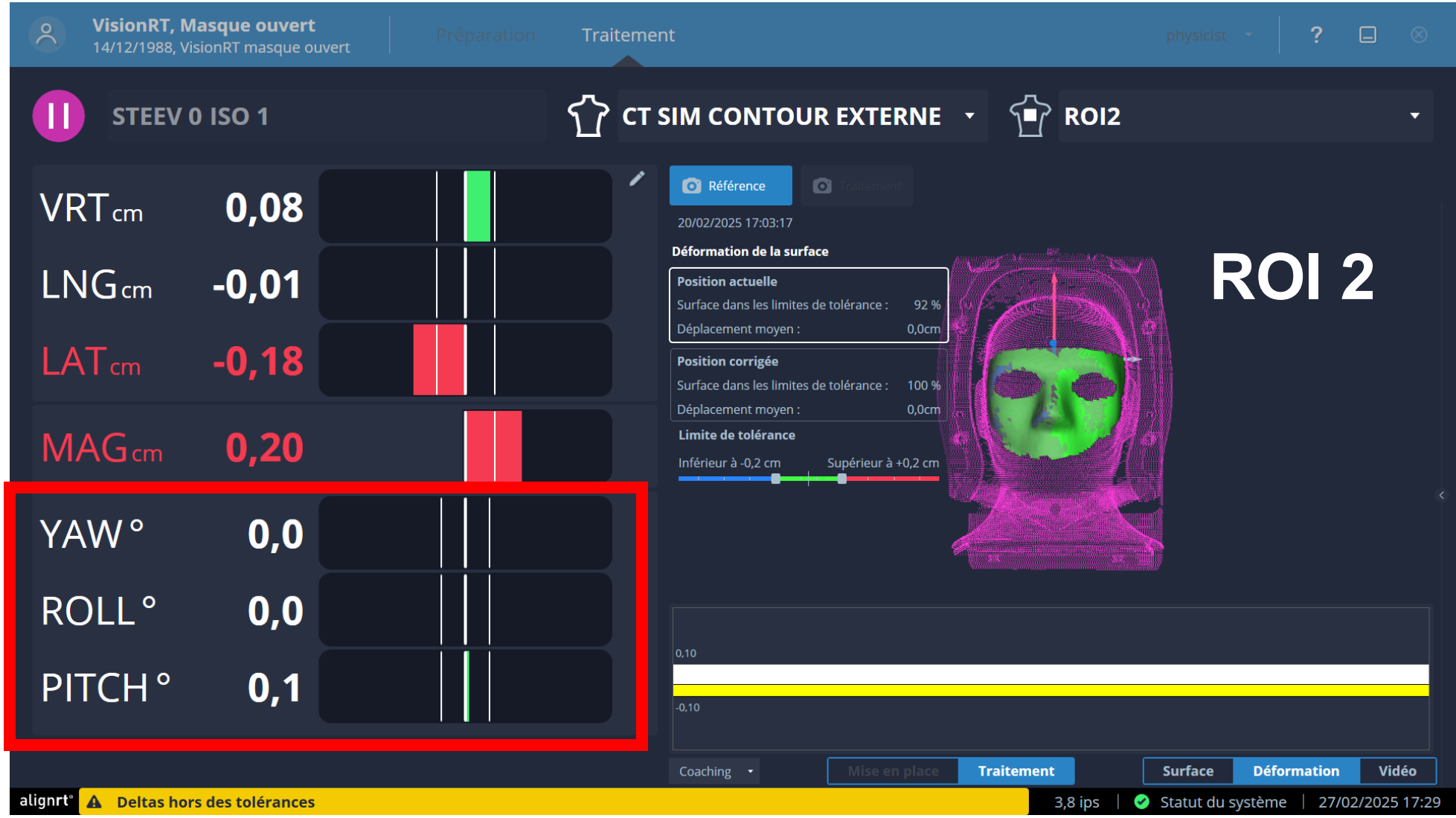
Influence of Three ROIs on Intracranial Stereotactic Treatments

ROI 1



Influence of Three ROIs on Intracranial Stereotactic Treatments

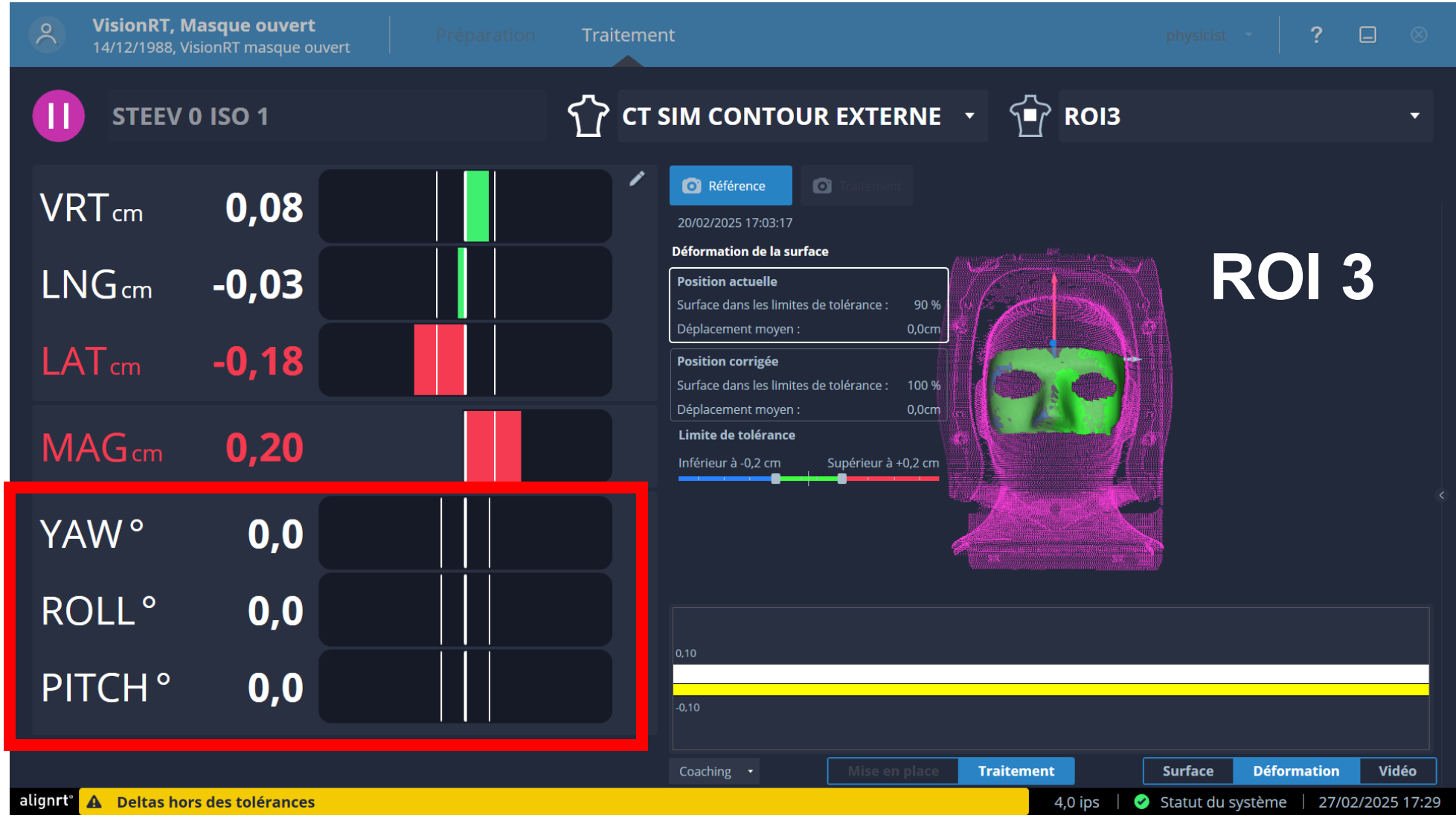
ROI 2



Influence of Three ROIs on Intracranial Stereotactic Treatments

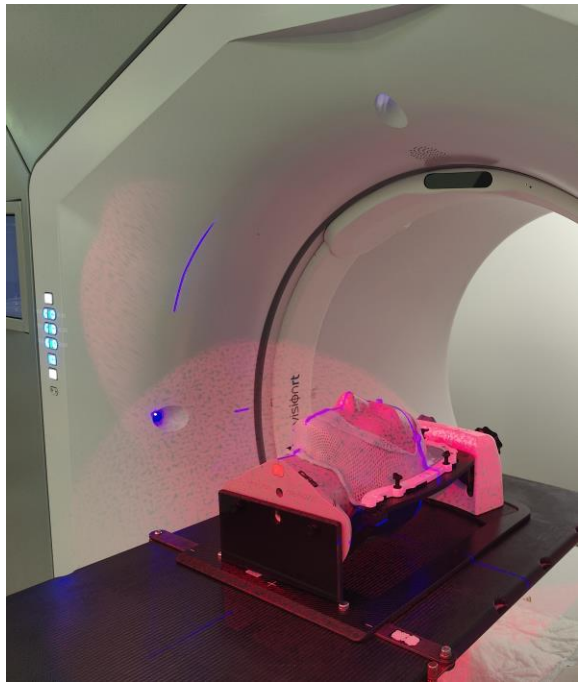
ROI 3

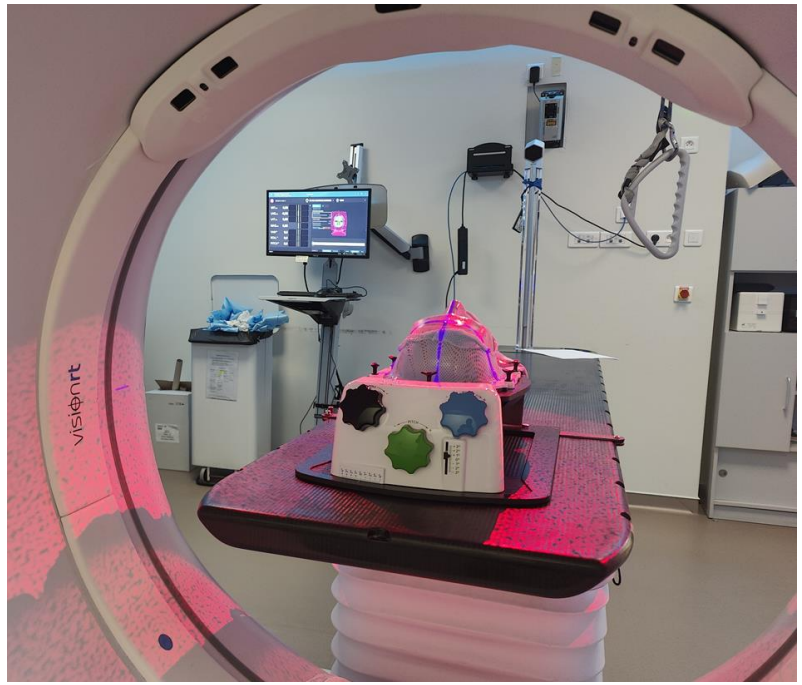
ROI does not affect VRT rotation values
➔ Bore-Linac = no cameras occlusions versus C-arm Linac



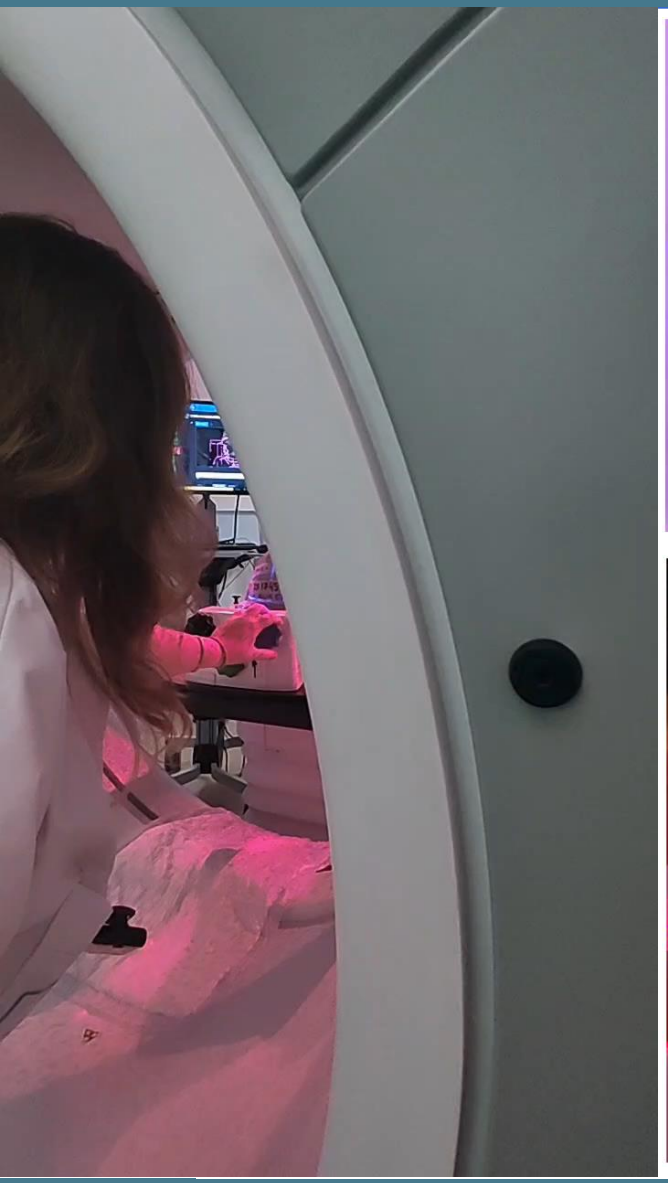
TruPose™ Head Adjuster

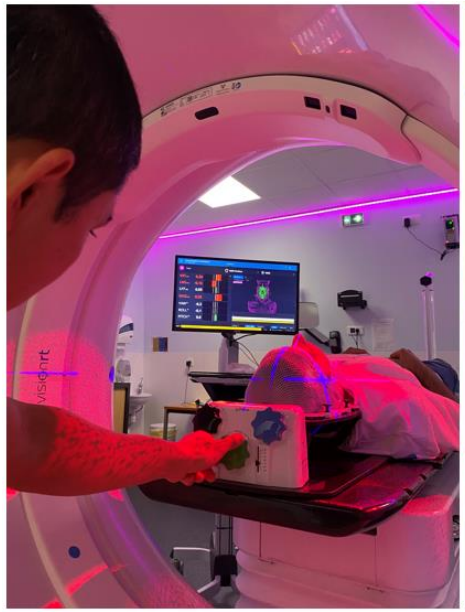
- Mechanical platform for **pitch, roll, yaw** adjustments
- ±4° roll/yaw, ±3° pitch range
- 3 color-coded knobs + safety clutch
- Compatible with Type-S, Orfit, and DSPS mask systems

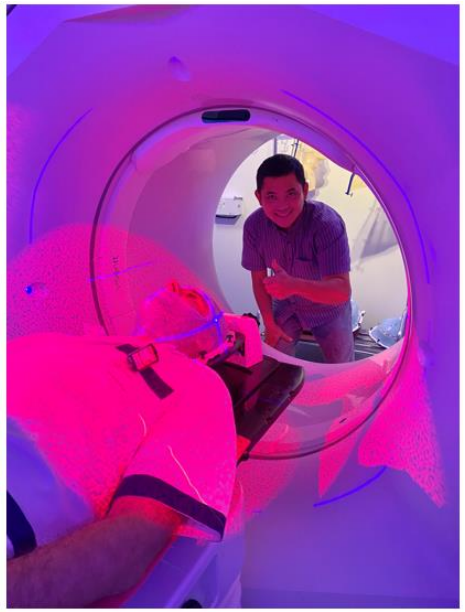




Trupose: Rotation adjustments







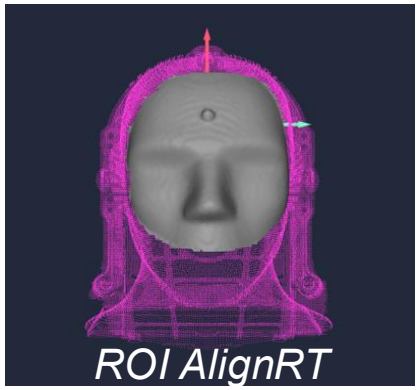
Easy and real-time rotation error corrections with RTD values from AlignRT displayed

Practical Workflow

- CT simulation geometry reproduced using fixed TruPose™ Static base
- SGRT deltas guide incremental rotational adjustments during setup
- Additional micro-adjustments possible after CBCT and during treatment if RTD values exceed tolerances
- Continuous monitoring ensures stability until beam-on
- Total adjustment time typically <1 minute

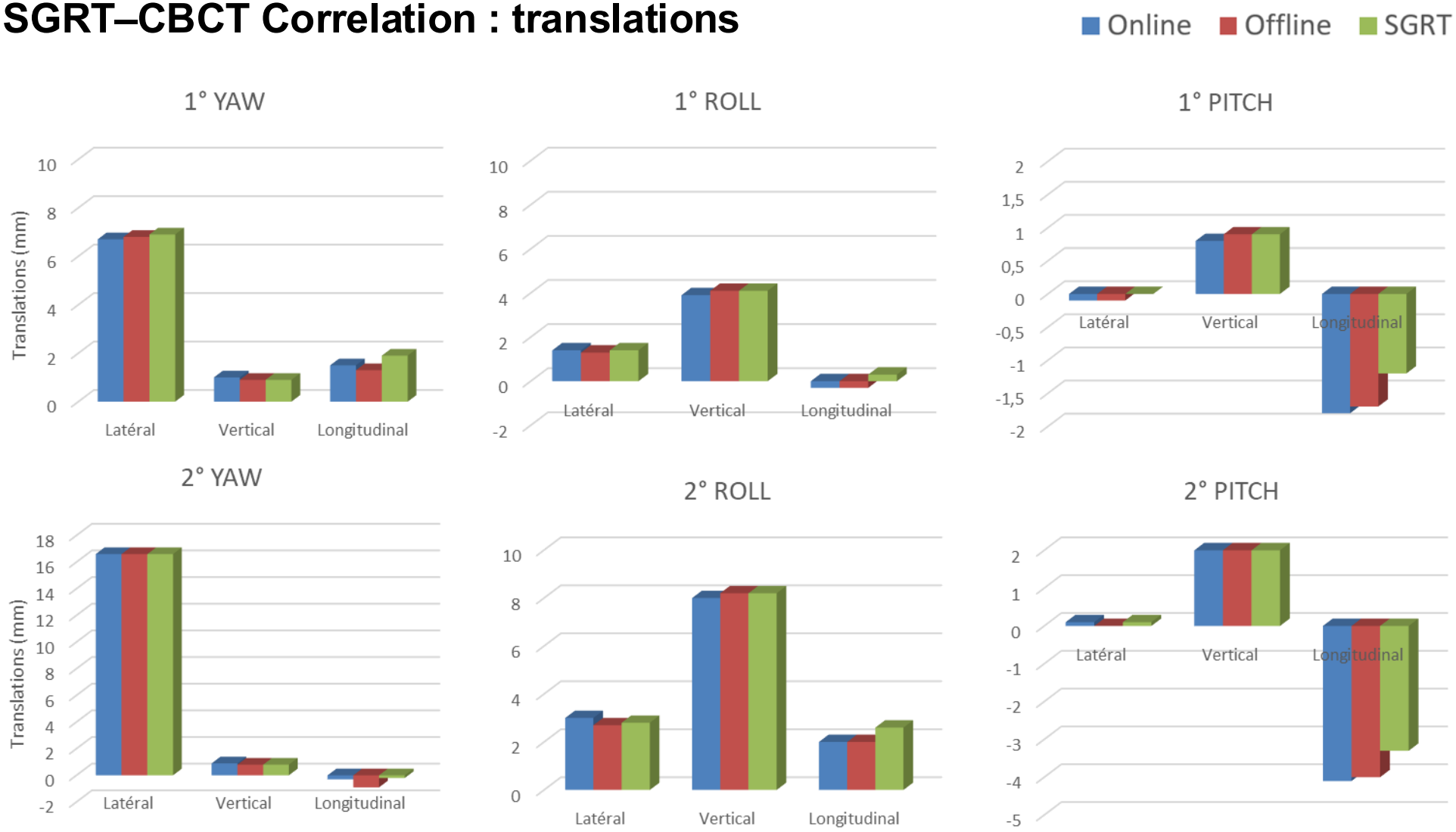
SGRT–CBCT Correlation Study on Phantom

- ❑ STEEV™ cranial phantom (Sun Nuclear) with open 3-point mask (MacroMedics)
- ❑ Controlled rotational offsets generated via AlignRT®
- ❑ Acquisition of CBCT for each induced offset
- ❑ Rotation range tested: **0° to 2°** (Yaw / Roll / Pitch)
- ❑ Comparison between:
  - AlignRT® measured deltas
  - CBCT rigid-registration results (translations + rotations)



STEVE™ Results Overview: translations

SGRT–CBCT Correlation : translations



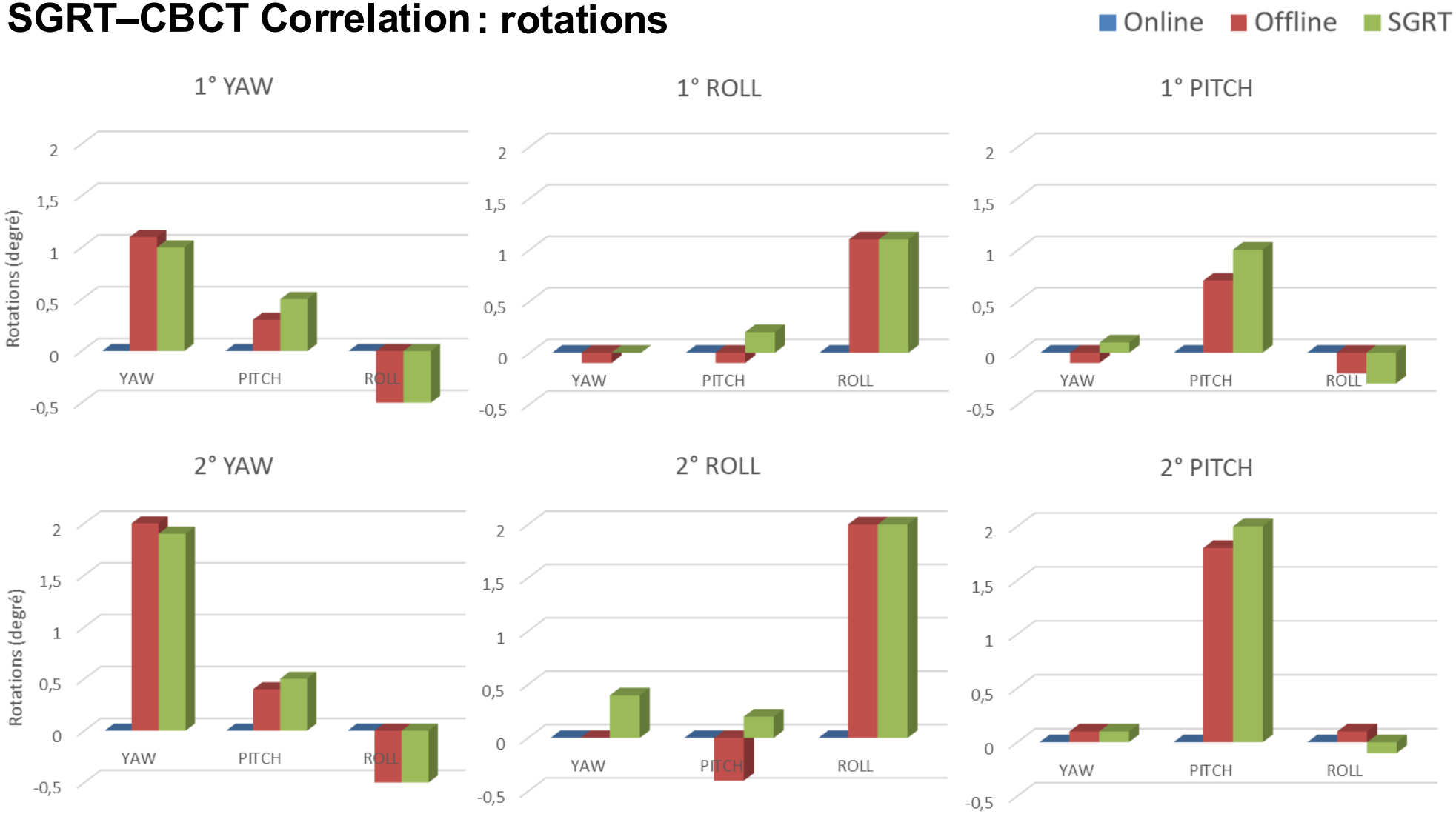
SGRT-CBCT Correlation

LAT	0,1 mm ± 0,0
VRT	0,0 mm ± 0,0
LNG	0,6 mm ± 0,1

No compensation of rotations by translations...

STEVE™ Results Overview: rotations

SGRT–CBCT Correlation : rotations



SGRT–CBCT Correlation

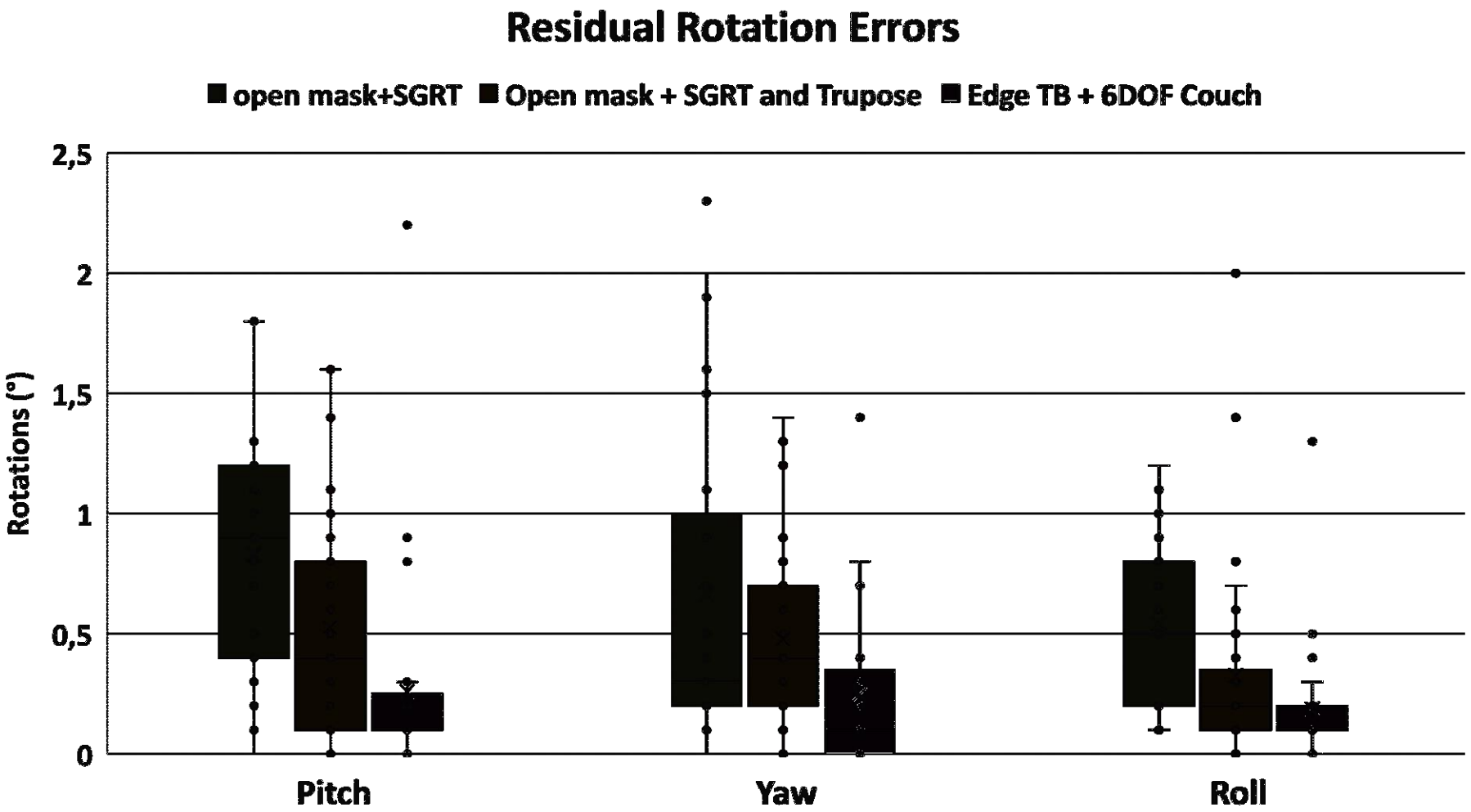
YAW	0,1° ± 0,1
ROLL	0,1° ± 0,1
PITCH	0,3° ± 0,2

SGRT showed sub-degree agreement with CBCT for all rotational axes

Methods

- 75 fractions analyzed → 3 groups
  A: SGRT only (Halcyon™)
  B: SGRT + TruPose™ (Halcyon™)
  C: SGRT + 6DoF couch (TrueBeam™)
- Metrics: residual rotational error

Results: Setup Accuracy

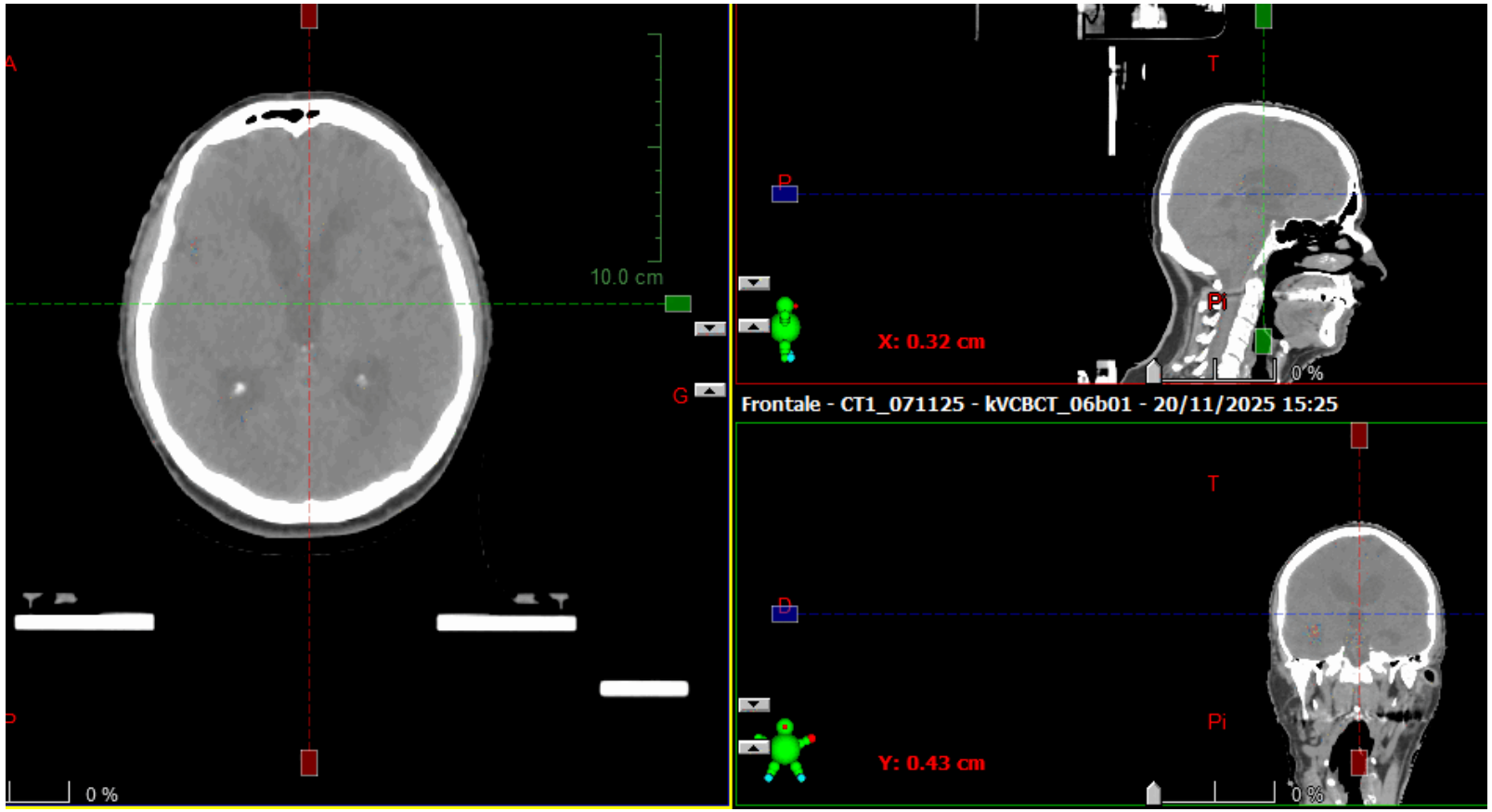


→ Halcyon™ + TruPose™ ≈ 6DoF precision

Statistically significant difference ($p < 0.001$), but both workflows remain within sub-degree rotational accuracy.

Results: CBCT vs. CT Simulation

- Head adjuster position differs due to manual rotation adjustments.
- Despite this, the skull position is nearly identical between CBCT and CT, confirming accurate immobilization.



SGRT + TruPose™ for Intracranial Setup

- Stable and reproducible cranial tracking with SGRT
- Fast, real-time rotational corrections with TruPose™
- Residual rotations usually <1°
- Consistent alignment from CBCT to beam-on
- Provides rotational control on bore-type LINACs without 6DoF
- Still valuable with Halcyon™ 5 + PerfectKinetix™ for rapid <0.5° pre-imaging alignment

Conclusion

- SGRT reliably detects and guides correction of rotational misalignments
- Mechanical rotational adjustment improves setup accuracy on Halcyon™
- Method integrates smoothly into existing SGRT-based brain workflows

Thank you for your attention