Enhancing Radiation Therapy Precision and Workflow with Vision RT Surface Guided Radiation Therapy: A One-Year Institutional Experience

Roxana Zaharia[1,2], Cornel Rusnacu[1], Marius Maxin[1], Daniela Martin[1]

[1]The Oncology Institute “Prof Dr Ion Chiricuță” Cluj-Napoca
[2] The “Babes-Bolyai” University, Cluj-Napoca

SGRT Annual European Meeting , 27-28 November 2025, London

Agenda

01 Overview of IOCN Radiotherapy Department

02 SGRT Implementation & Clinical Workflow

03 Study objectives
Quantitative Evaluation Metrics

04 Setup Accuracy Improvement

05 Workflow Efficiency

06 Qualitative Observations

07 Challenges & Practical Considerations

08 Clinical Impact

09 Conclusions

10 Future Directions

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Membru al Organizației Institutelor Europene de Cancer "OECI"

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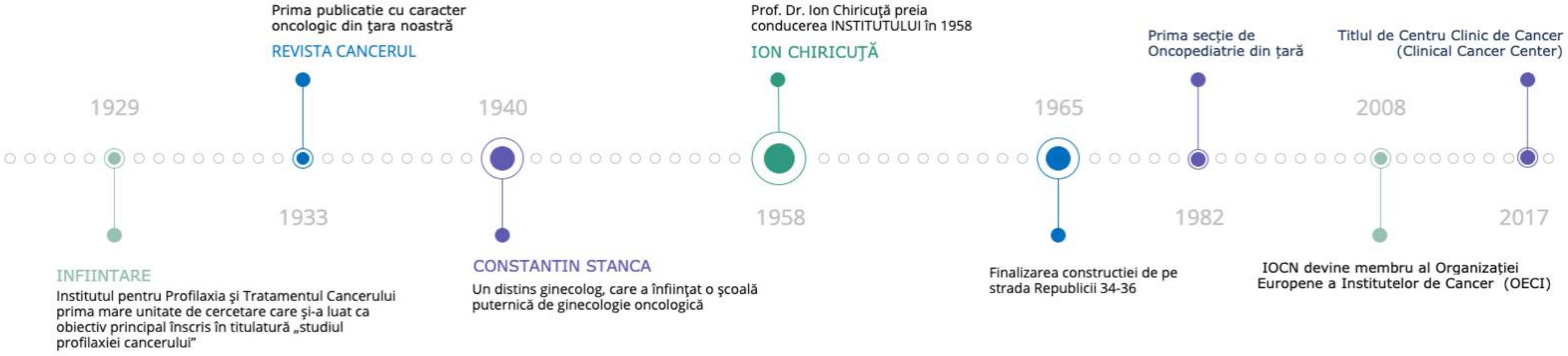
CERTIFICARI
ACT
ASCO Certified
Patient-Centered Cancer Care Standards
AFILIERI
European Reference Network
Endo-ERN



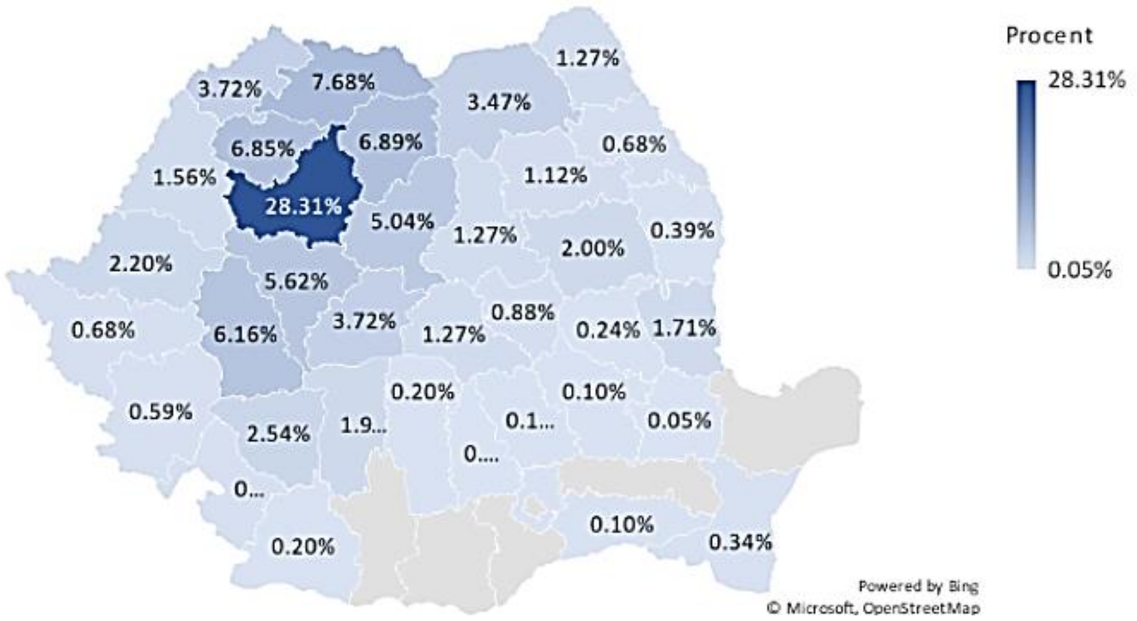
2024 →					
113	90022	522	53	20971	99365
PHYSICIANS	AMBULATORY CONSULTATIONS	BEDS	DAY HOSPITAL BEDS	HOSPITALIZED PATIENTS	MEDICAL PROCEDURES

https://iocn.ro/

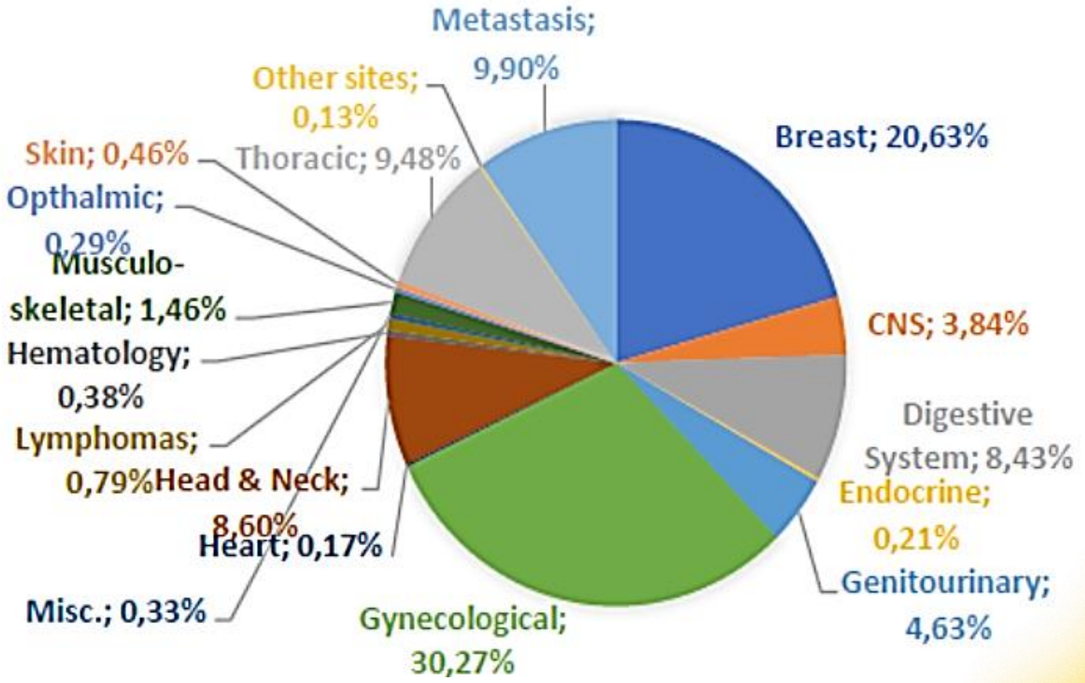
IOCN Radiotherapy Department: 2024 statistics at glance

- ✓ 15600 consultations, **2395** patients with RT, 37281 fractions, full spectrum of tumor sites

County-Level Patient Distribution



Patients by treatment site

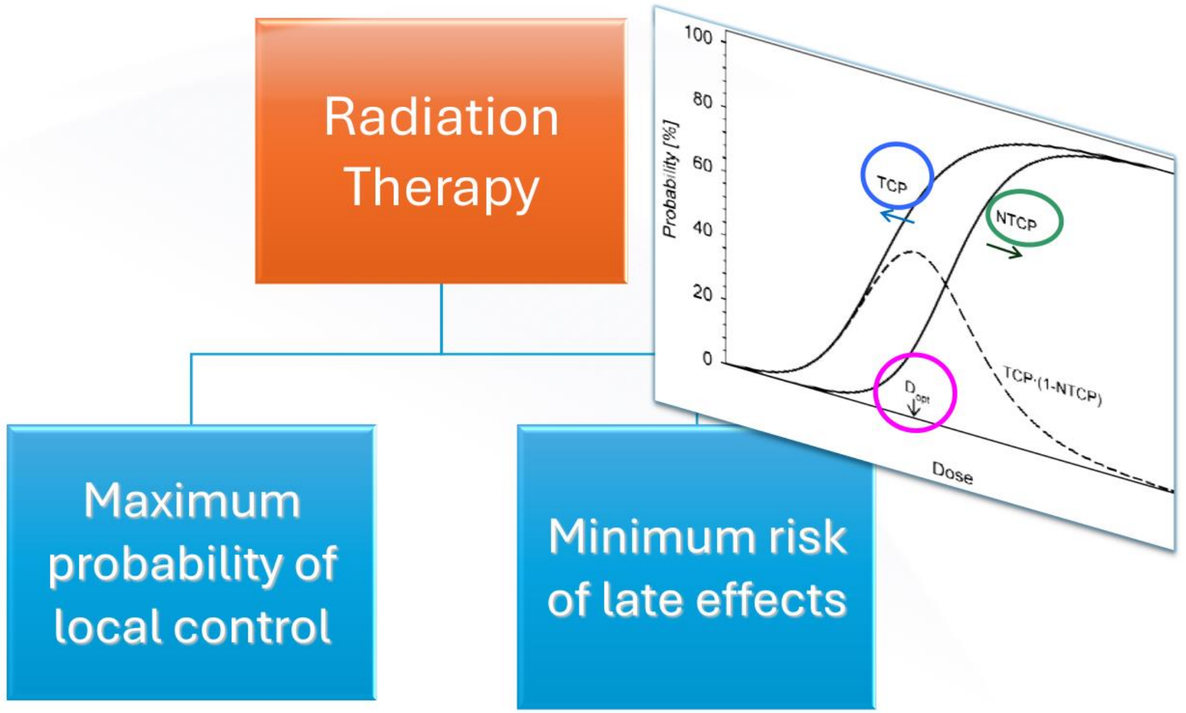


Our goal: to improve RT Quality

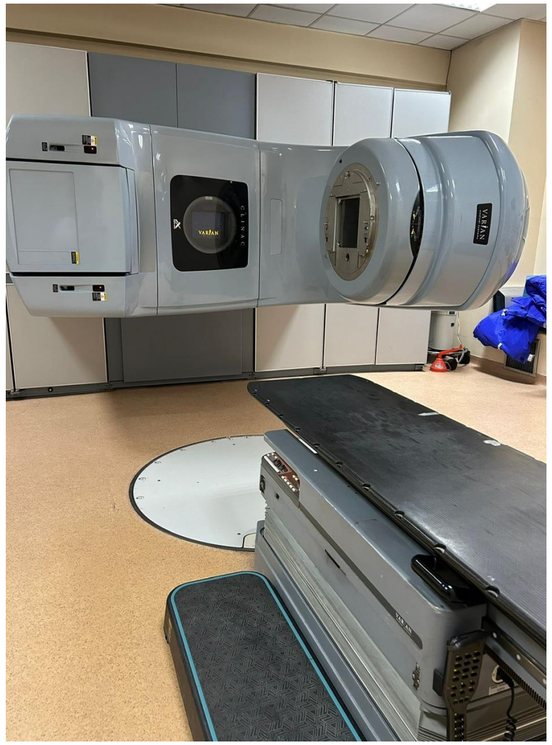
- ✓ **Strengthening QA Programs:**
  - from diagnosis to treatment and follow-up → 5–15% increase in OS
- ✓ **Raising Standards in Dose Prescription and Delivery:**
  - greater precision, consistency, and safety
- ✓ **Optimizing Radiation Dose Distribution and treatment accuracy:**
  - advanced techniques such as **IMRT, SaBR, IGRT, SGRT**
- ✓ **Leveraging Advances in Radiobiology:**
  - Integrating biological insights to refine treatment planning and personalize therapy

Why SGRT?

- Enhances patient positioning accuracy
- Improves treatment reproducibility
- Supports DIBH
- Enhances safety and reduces errors
- Improves workflow efficiency
- Facilitates complex techniques
- Supports transition toward tattoo-free, markerless workflows



IOCN Radiotherapy Department: Equipments



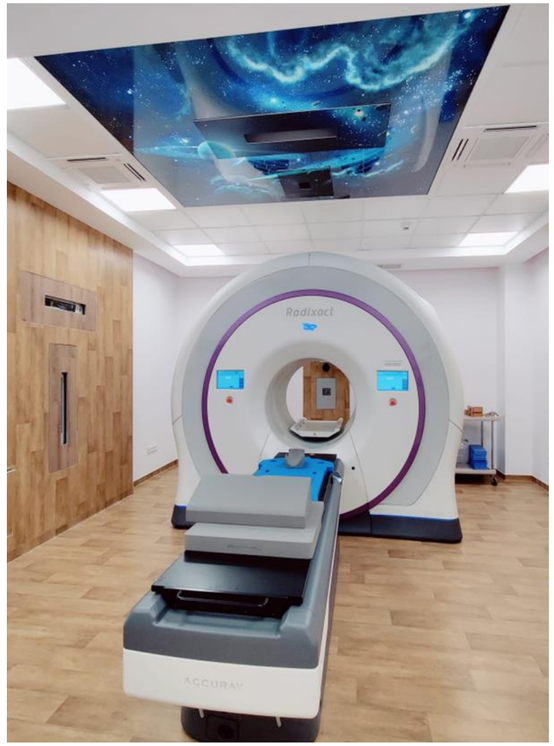
Varian CLINAC iX, SILHOUETTE, 2009
photons 6 MV, 16 MV
electrons 4 ÷ 18 MeV

3D-CRT, IMRT, IGRT

Varian CLINAC iX, 2019

photons 6 MV, 10 MV
electrons 6 ÷ 16 MeV

VMAT, IMRT, 3D-CRT, IGRT



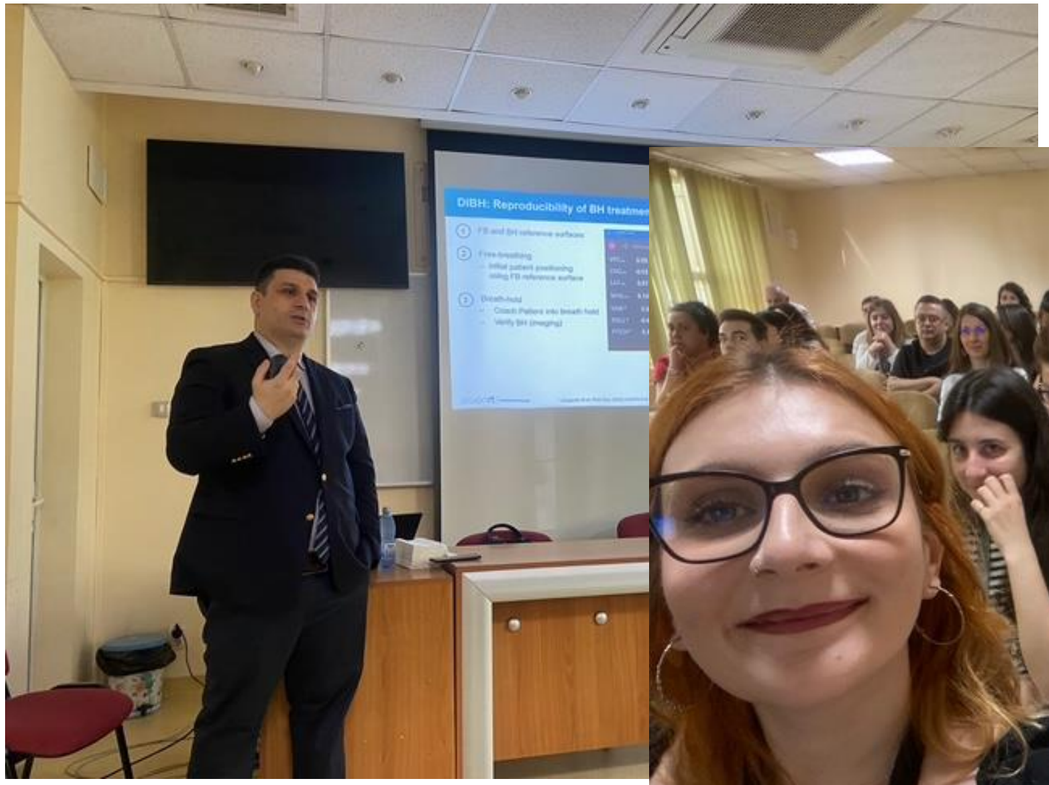
Accuray RADIXACT X7, 2021
photons 6FFF,
Helical Tomotherapy

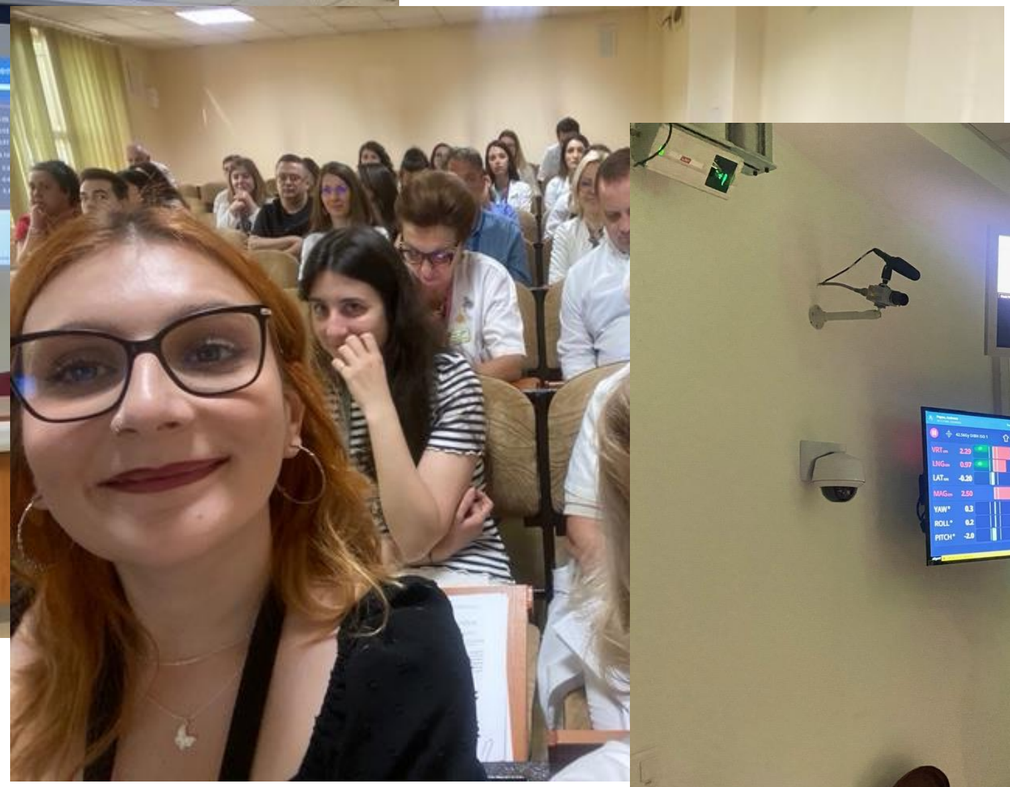
IMRT, fSRT, IG/IMRT

Varian TRUE BEAM 4.0, 2022
photons 6MV, 6FFF

IMRT, VMAT, SaBR, IGRT, SGRT

AlignRT & Training





Implementation: first SGRT/ DIBH steps

Surface Guidance Integration

- SimRT on Siemens CT Simulator
  - SGRT-supported simulation & reproducibility

Implementation: first SGRT/ DIBH steps

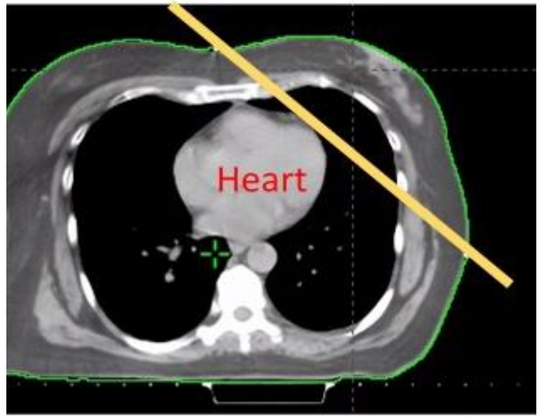
- SimRT on Siemens CT Simulator
  - SGRT-supported simulation & reproducibility

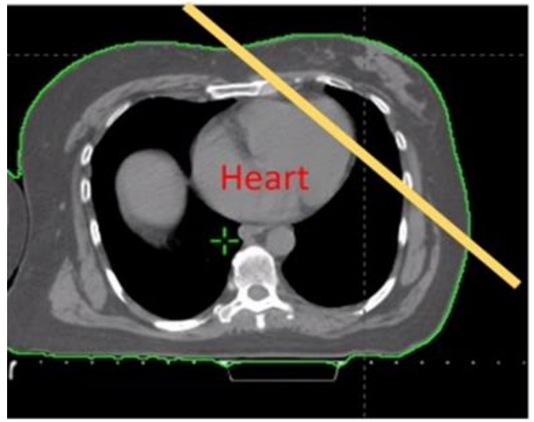
Surface Guidance Integration

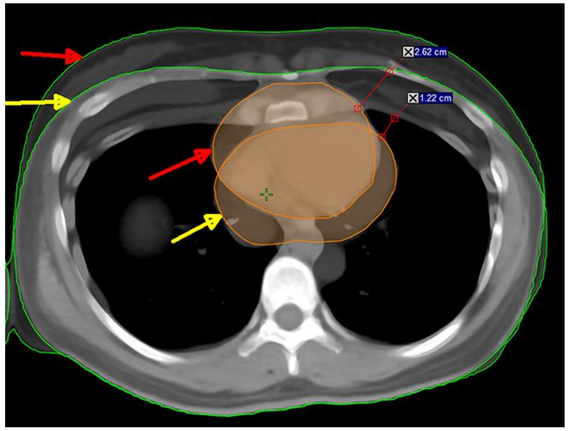
- AlignRT on Varian TrueBeam
  - Real-time surface monitoring during treatment

Cardiac dose- "as low as possible“

with SGRT and DIBH

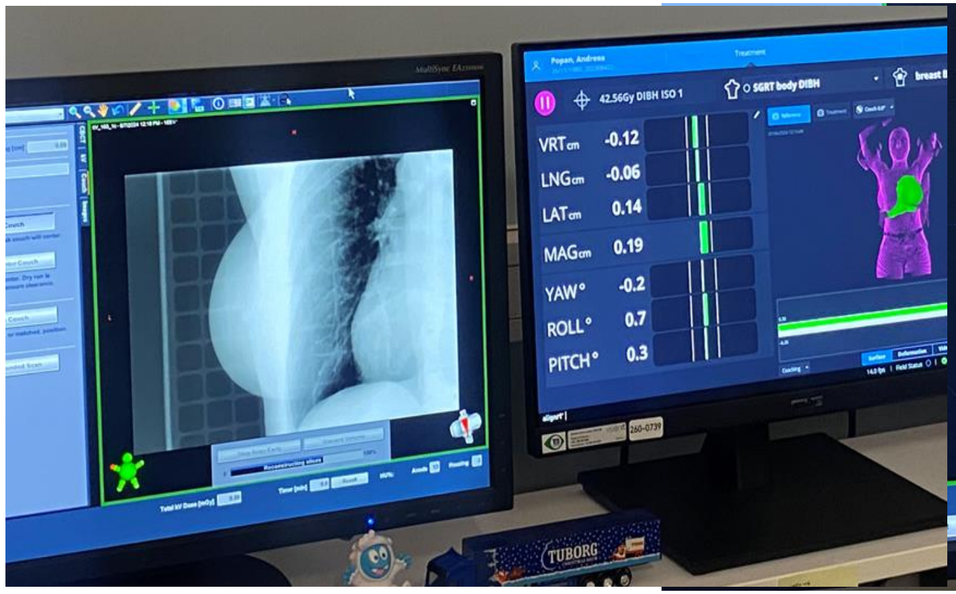


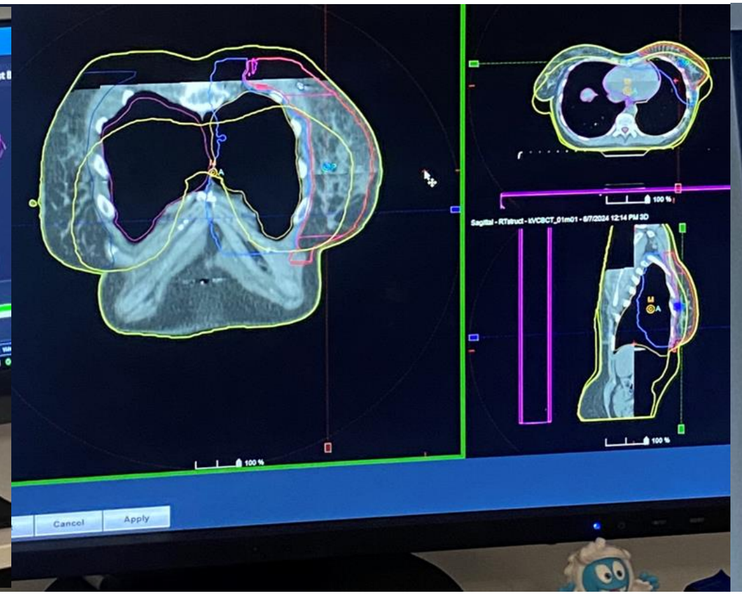




DIBH

Free-Breathing





7.06.2024 – first patient treated with AlignRT - DIBH

Cardiac dose-

"as low as possible“

with SGRT and DIBH

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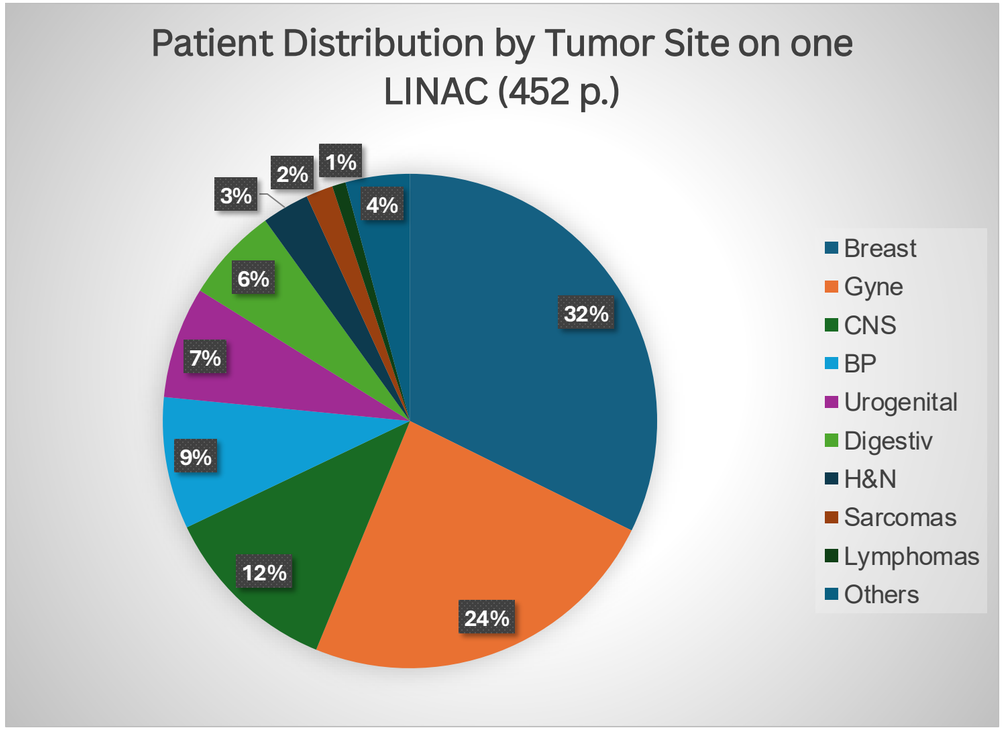
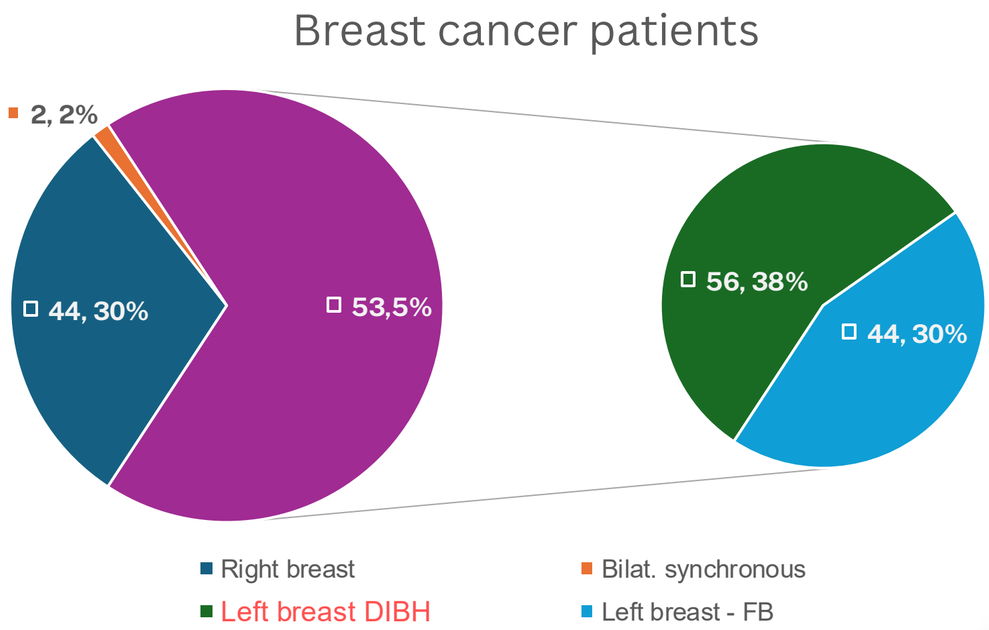
SGRT. DIBH. 1 year experience

- 452 patients treated with SGRT since 7th of June 2024
  - ✓ Breast DIBH positioning & stability
  - ✓ Selected paediatric cases — faster positioning
  - ✓ SaBR with sub-millimeter precision





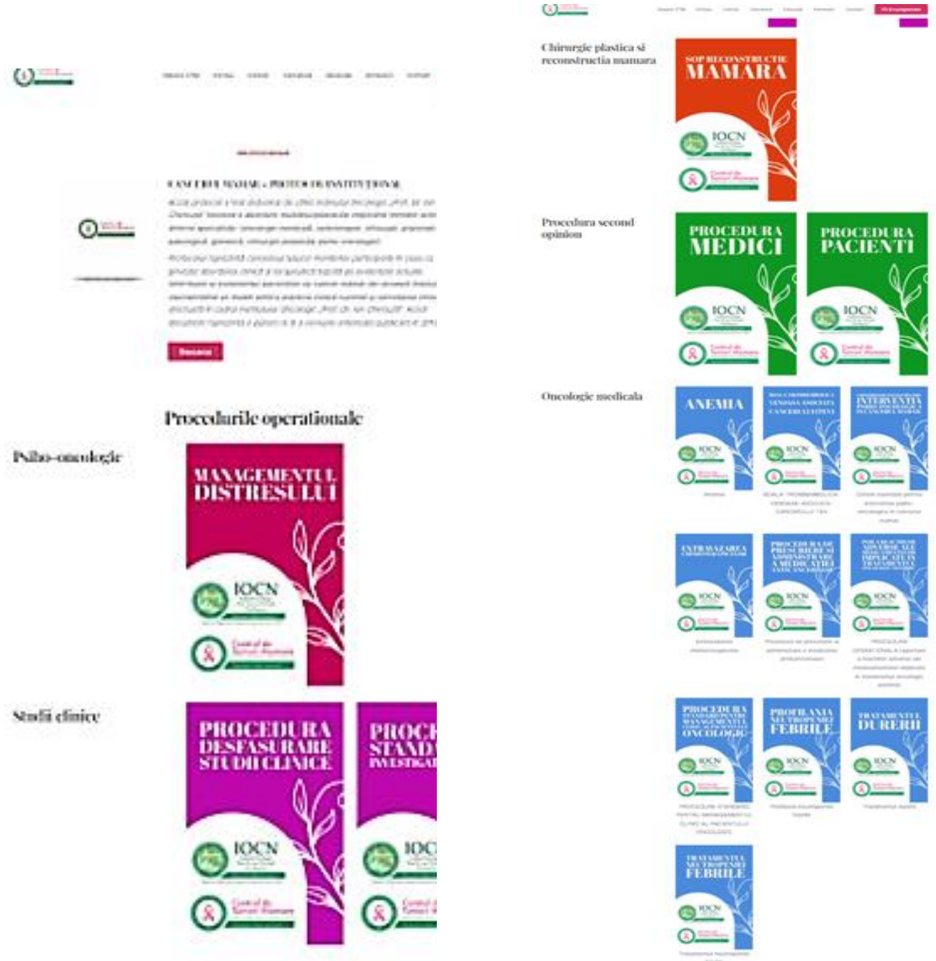
Radiotherapy Department Database, 2024-2025

How to Improve Patient Compliance?
Counseling, education, training, coaching, communication

- Pre-treatment patient preparation
  - useful informations: brochures, educational videos
  - 15-30 minutes training session with kynesiotherapist/ nurse, to practice the DIBH before the CT simulation
  - "mock-up" CT-Sim run
  - consistent practice

- In-treatment guidance and feedback
  - real-time visual feedback: to help patients see their breath hold level and improve accuracy
  - consistent coaching throughout the treatment session by trained RTTs

- Fostering a positive patient experience
  - build trust and empathy
  - track and address patient anxiety
  - use a structured approach to patient education and training

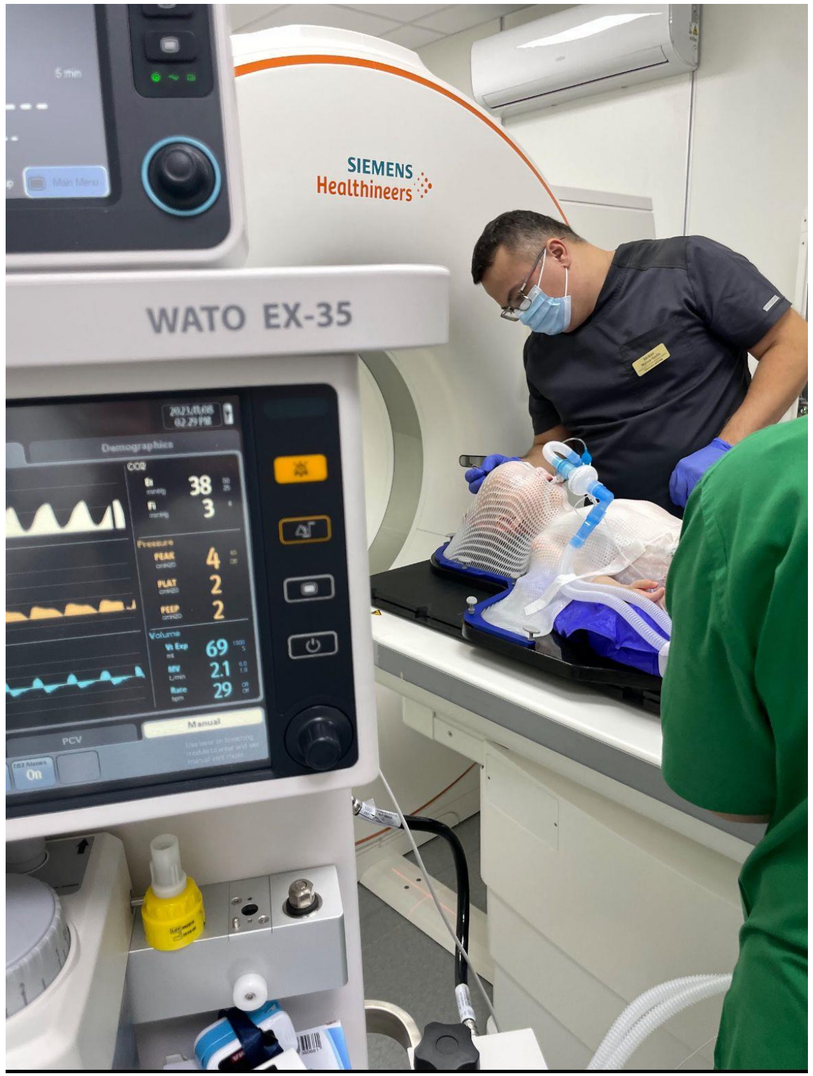


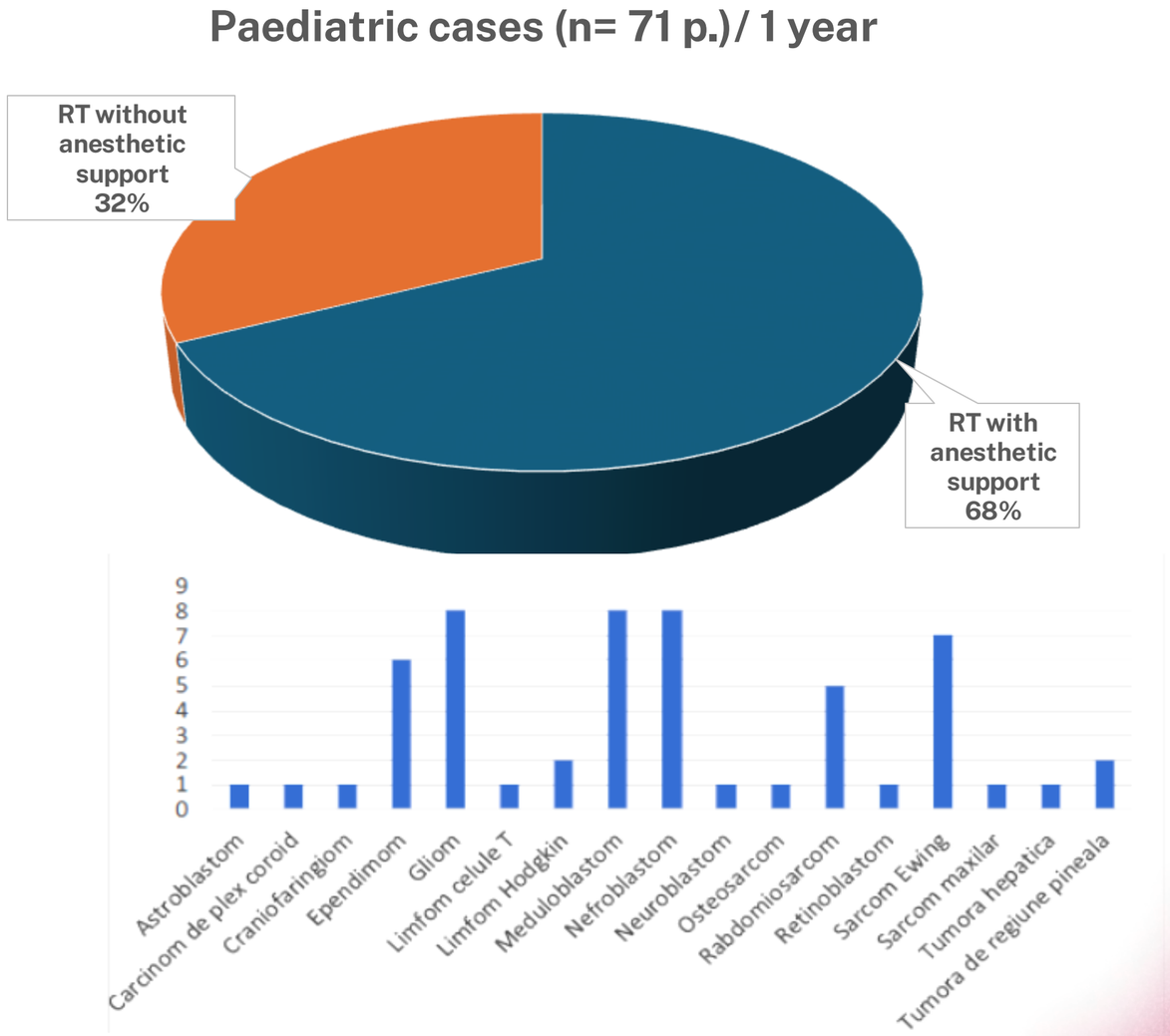
https://ctm.iocn.ro/despre-ctm/

DIBH vs FB & IOCN experience

	MHD		Max Heart Dose		Mean LADCA Dose		Max LADCA Dose		V5 Lung		V20 Lung	
Average	FB	DIBH	FB	DIBH	FB	DIBH	FB	DIBH	FB	DIBH	FB	DIBH
	2.71	1.48	44.9	28.74	13.44	5.95	30.91	15.48	27.09	26.33	12.41	11.73
Average dose reduction (Gy)	1.23		16.16		7.5		15.4		0.76		0.68	
Average % dose reduction	45.4%		36%		55.7%		50%		2.8%		5.5%	

Paediatric cases in IOCN (1982-2025, 1000+ p.)





C.N., 5 years old – First patient treated with the anesthesiology team:
8 March 2023

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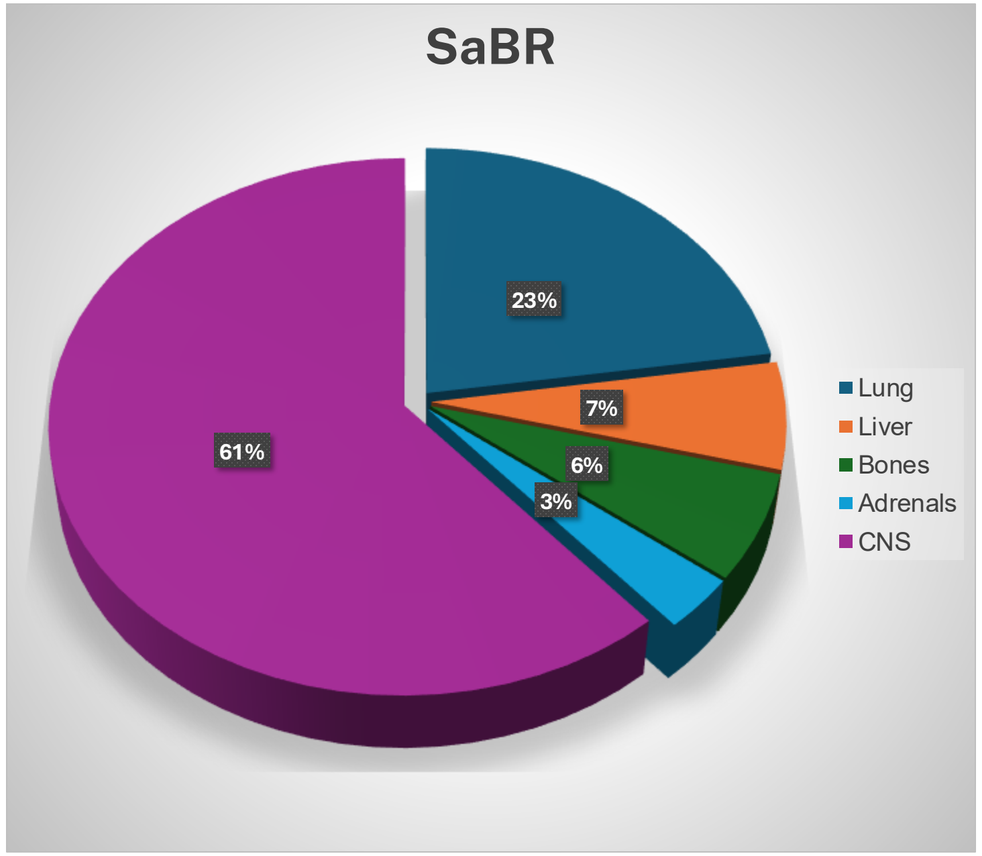
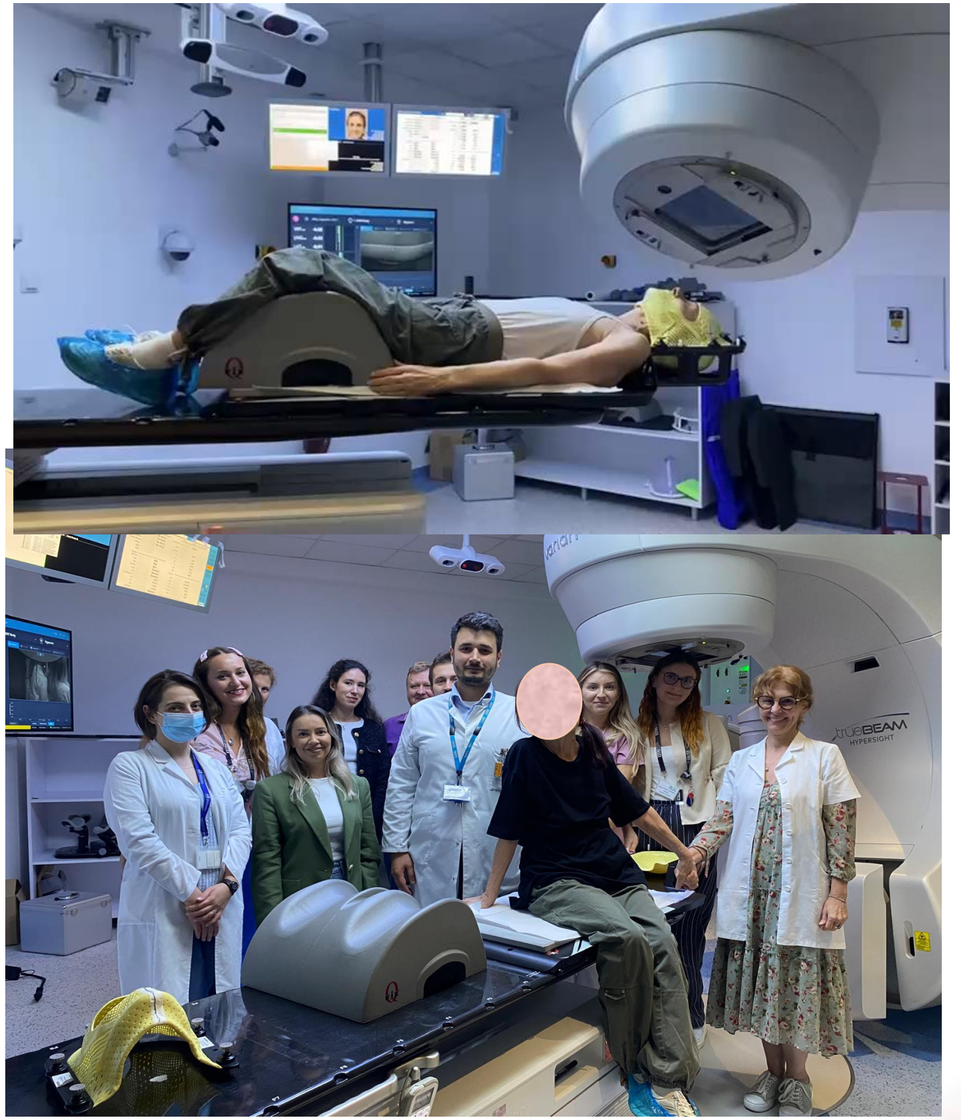
SaBR – 31 p. (2025)





First intracranial SaBR with HyperARC technology – 12.09.2025

IOCN Radiotherapy Department: The Team

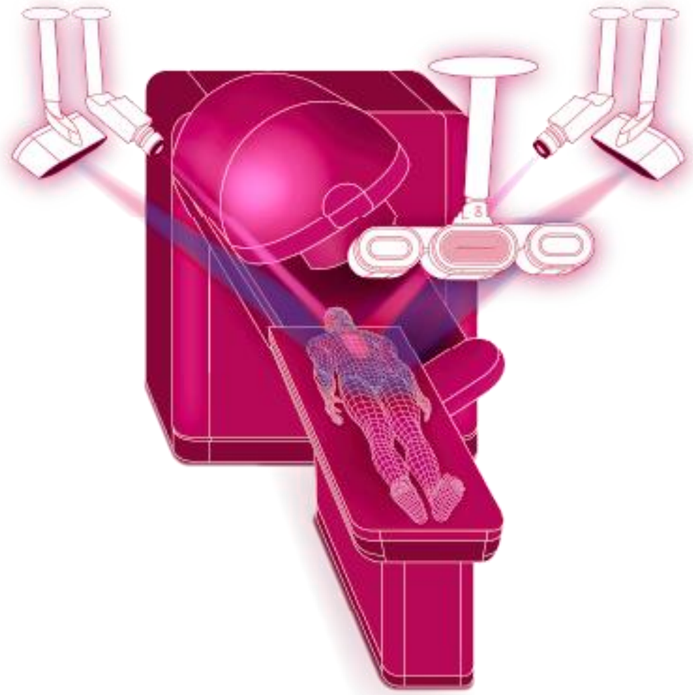
- 17 radiation oncologists
- 36 radiation oncology residents
- 3 expert physicists, 8 medical physicists
- 25 RTTs
- 2 engineers
- 3 registrars
- 6 nurses
- 8 care assistants

Study Overview and Objectives

Aim: Assess the impact of SGRT on positioning accuracy, workflow efficiency, and patient reproducibility

Focus Areas:

- Breast DIBH → motion management and cardiac sparing
- Head SRS → sub-millimeter positioning precision
- Pediatric treatments → faster, comfortable positioning



Key Measurements:

- Couch shifts applied after surface-guided setup
- Setup workflow efficiency & Patient compliance and stability
- Clinical Impact

Goal of the Study: Understand how SGRT contributes to safe, efficient, and reproducible treatments across multiple clinical sites

SGRT WORKFLOWS OVERVIEW

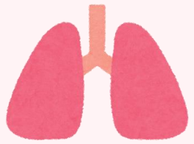
Breast DIBH

Preparation → ROI delimitation → FB positioning → DIBH positioning → Imaging

Head SRS

Preparation → ROI delimitation → Open-face alignment (no mask) → Verify after mask placement → CBCT maging

Quantitative Analysis

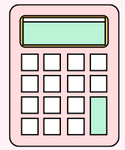


DIBH Group

N=20 Patients
80 fractions
Protocol: SGRT Setup + CBCT Verification

SaBR Group

N=10 Patients
40 fractions
Protocol: SGRT Setup + CBCT Verification (Masked)



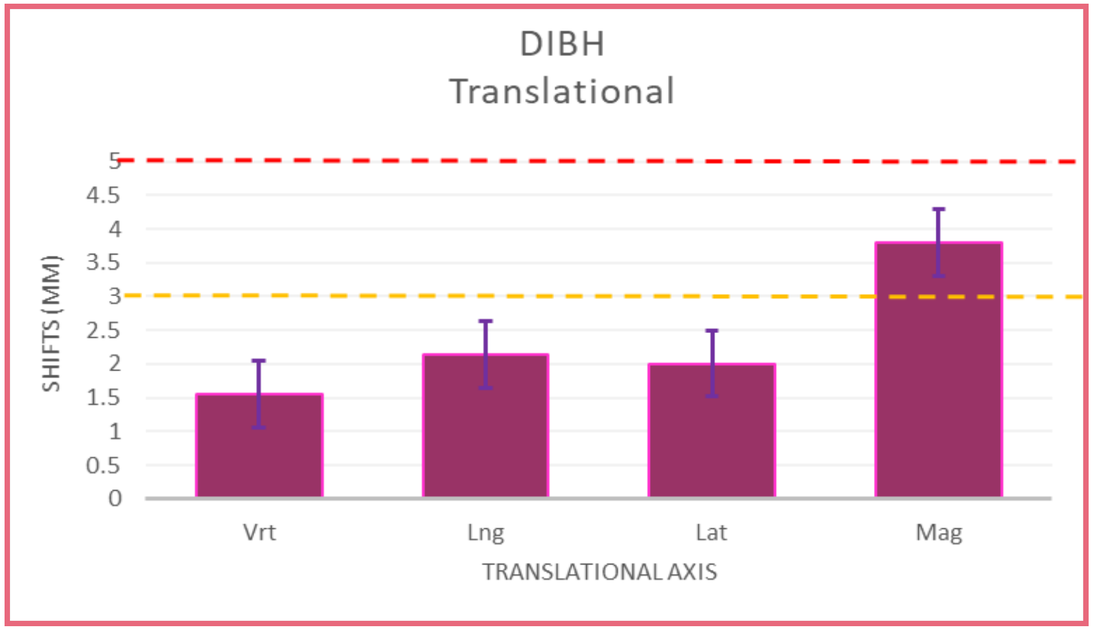
Metrics

Mean and **standard deviation** (per direction and rotation)
50th, 90th, and 95th percentiles
3D vector magnitude (total displacement)

Results

I. DIBH -Translational Setup Accuracy (mm)

	Vrt	Lng	Lat	Mag
Mean	1.55	2.14	2.01	3.8
std	1.14	1.54	1.49	1.55
Median	1.25	1.8	1.95	3.78
90th	3.22	4.2	4.5	5.43
95th	3.5	4.43	4.8	5.62



- Mean shifts: 1.55–2.14 mm across axes
- Highest variability: longitudinal direction (2.14 ± 1.54 mm)

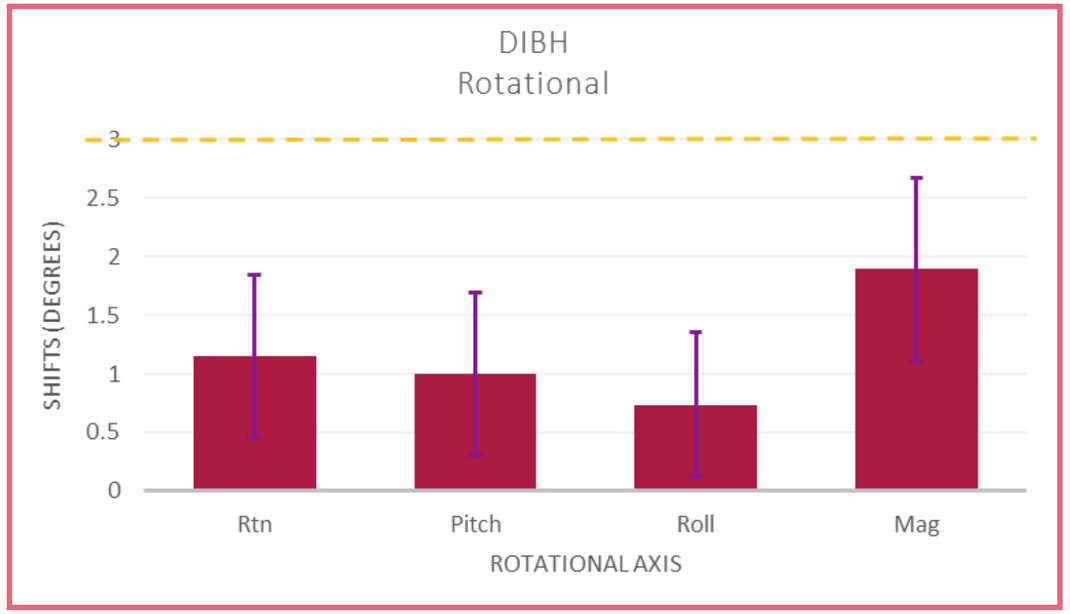
- 95th percentile magnitude: 5.62 mm
- >90% of fractions within 5 mm tolerance
- Indicates good overall translational reproducibility

Slightly higher longitudinal deviations likely reflect natural differences in breath-hold depth.

Results

I. DIBH - Rotational Setup Accuracy (°)

	Rtn	Pitch	Roll	Mag
Mean	1.15	1	0.74	1.89
std	0.69	0.7	0.62	0.78
Median	1	0.95	0.6	1.88
90th	1.91	2	1.6	3.02
95th	2.22	2.41	1.72	3.47



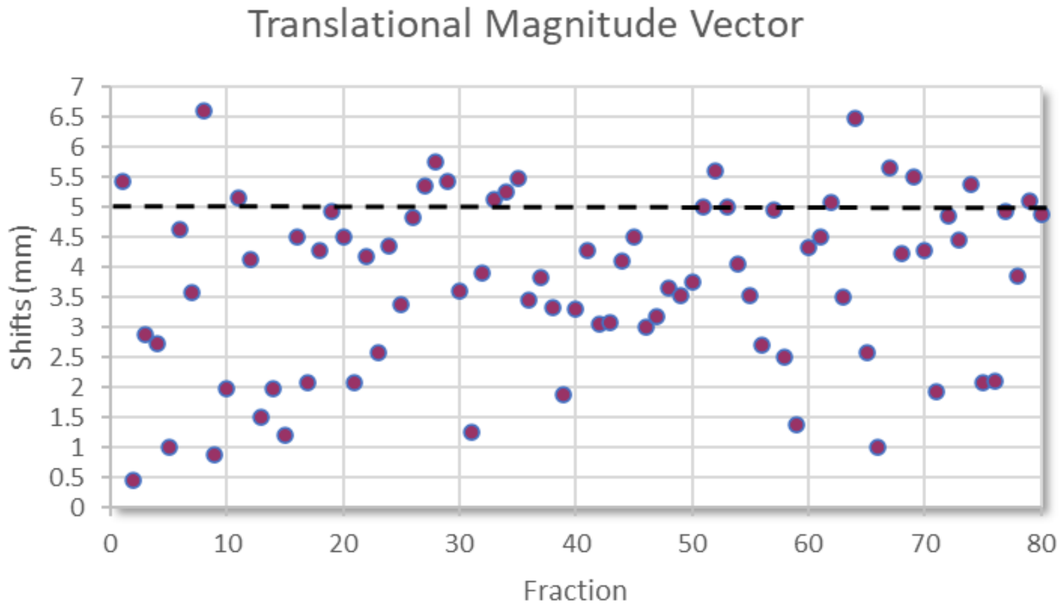
- Mean rotations: 0.7–1.1°
- Standard deviation: <0.8°

- 95th percentile values: ≤2.4°
- Excellent rotational stability across all fractions

Rotational deviations were minimal and well within clinical tolerances.

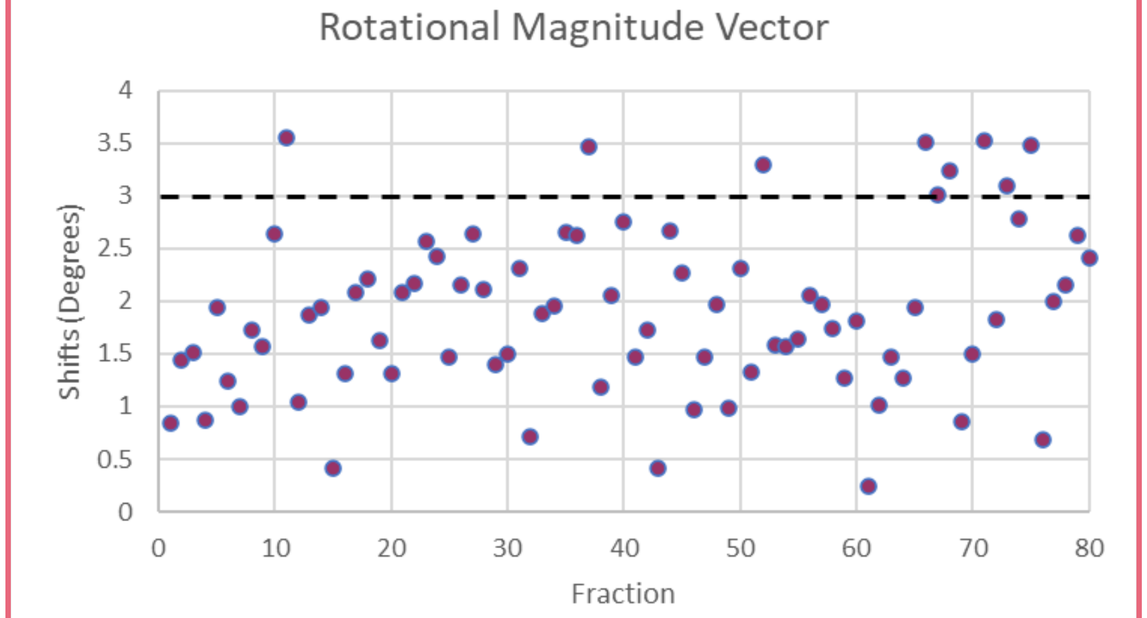
Results

I. DIBH - Fractional Magnitude Distribution



- Majority of fractions below 5 mm
- Few fractions slightly above tolerance (≤5.6 mm)
- Overall high consistency of DIBH positioning

Minor outliers likely due to variable breath-hold depth or patient comfort.

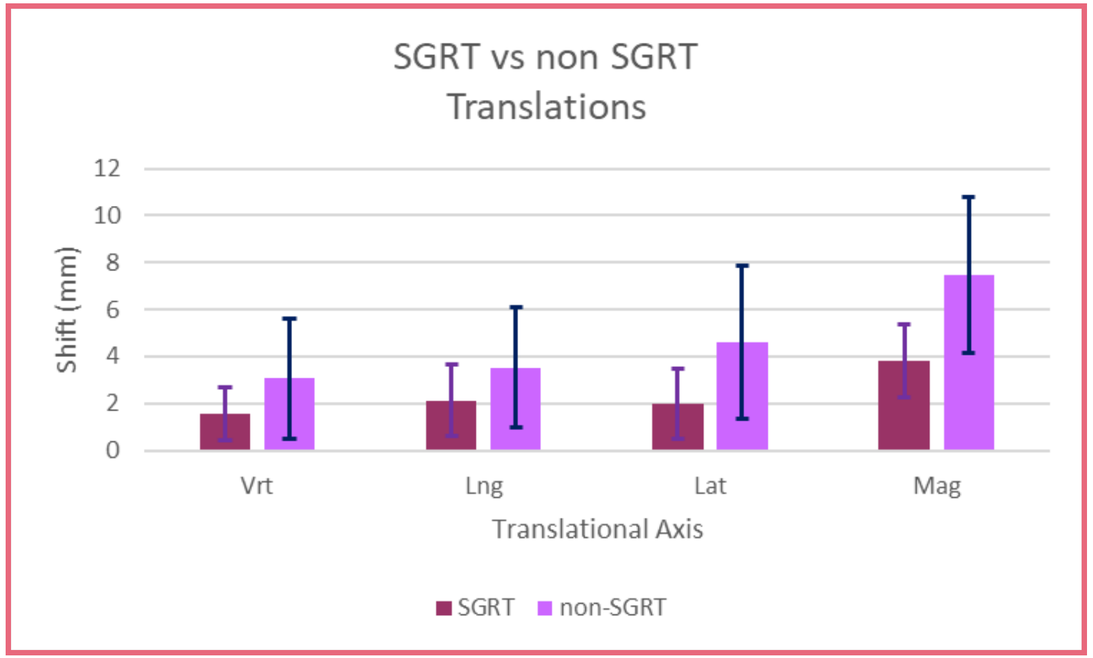


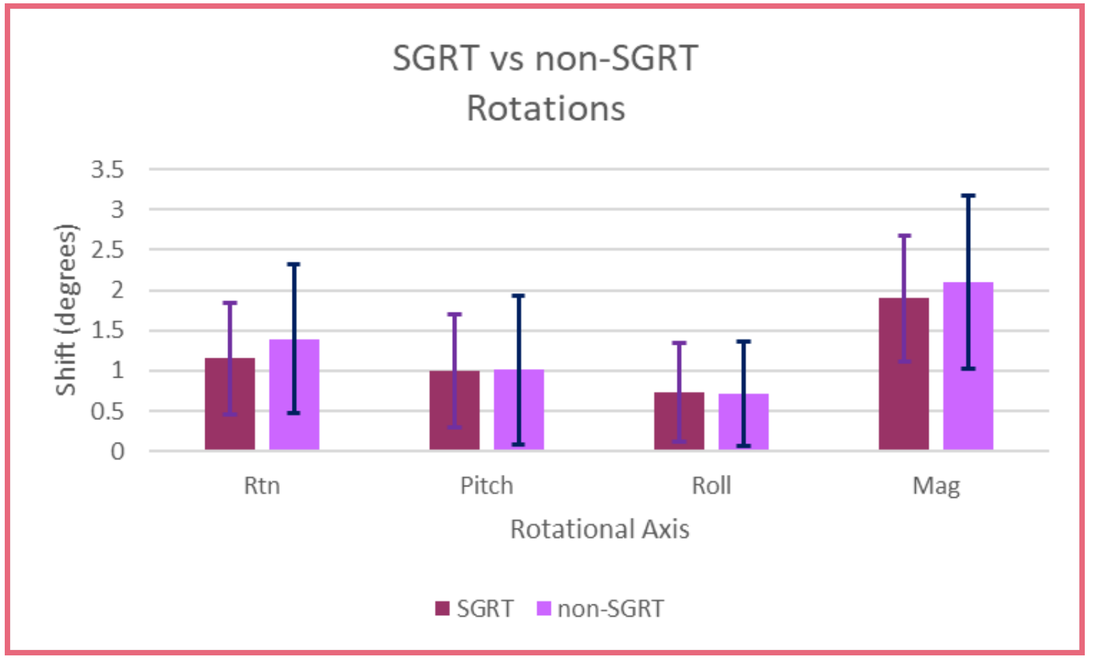
- Majority of fractions within 3° tolerance
- Small number of outliers, no systematic trend
- Confirms stable angular reproducibility across sessions

Most fractions show rotational magnitudes well below 3°, indicating consistent patient setup and minimal angular drift during DIBH.

Results

I. DIBH - Positioning Accuracy: SGRT vs Non-SGRT





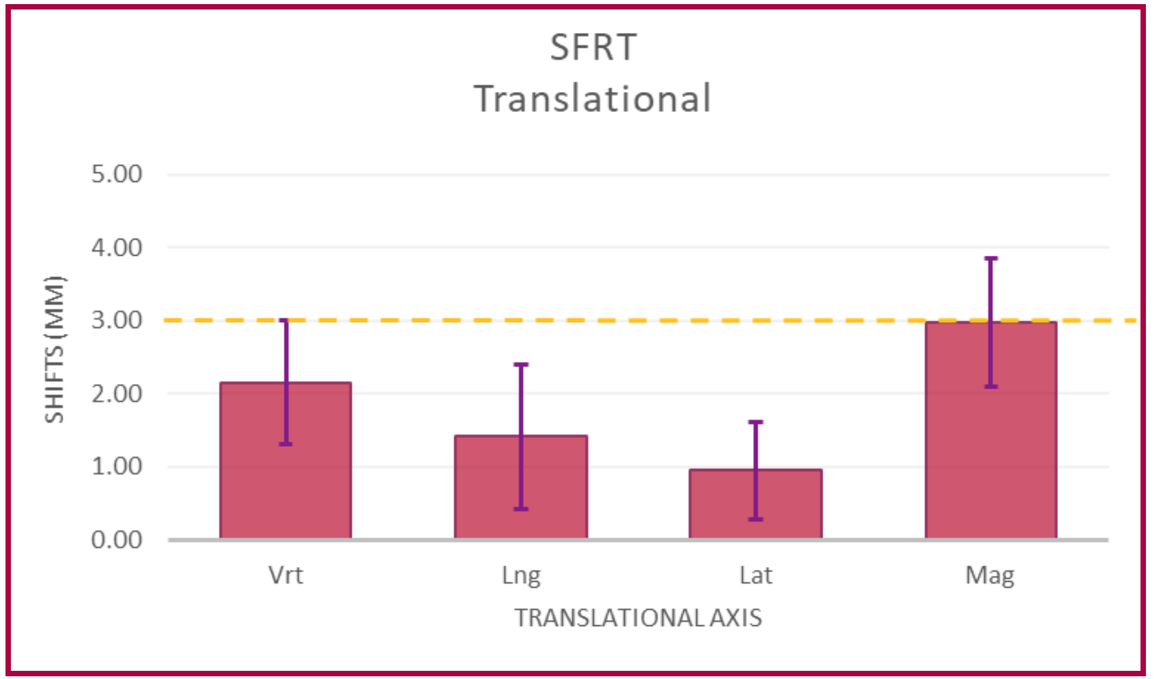
- Non-SGRT mean magnitude ≈ 7.4 mm vs 3.8 mm with SGRT
- SGRT reduces translational errors by ~50%
- 90th percentile magnitude: 12.2 mm (non-SGRT) vs 5.4 mm (SGRT)
- Similar variability (SD), but consistently smaller mean values
- Demonstrates systematic improvement in reproducibility

- Mean rotational shifts: ~1° for both methods
- SGRT and non-SGRT show comparable angular reproducibility
- 95th percentile magnitudes: 3.7° (non-SGRT) vs 3.5° (SGRT)
- Confirms strong baseline rotational stability in DIBH setup

Results

II. FSRT - Translational Setup Accuracy (mm)

	Vrt	Lng	Lat	Mag
Mean	2.15	1.41	0.94	2.97
std	0.85	0.99	0.67	0.89
Median	2.2	1.5	0.8	2.9
90th	3.12	2.51	1.81	4.1
95th	3.51	2.65	1.91	4.28



- Small residual shifts observed after CBCT verification.
- Mean corrections were below 3 mm, confirming accurate SGRT setup.
- Low variability (SD < 1 mm) across all directions.

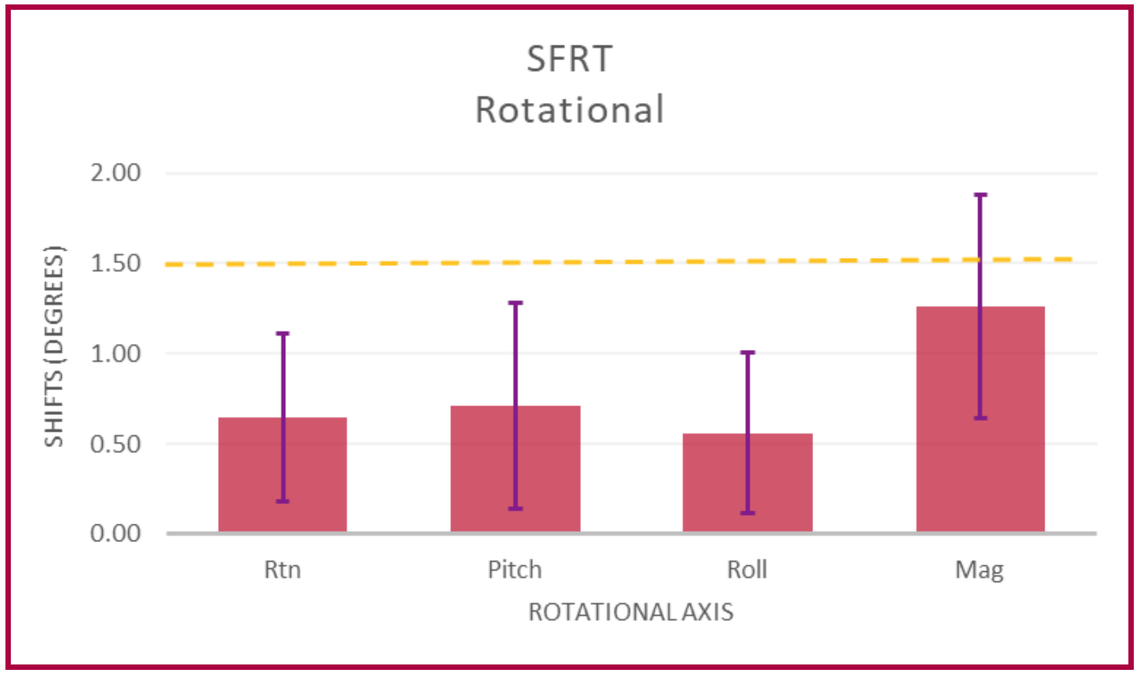
- 95th percentile < 5 mm, within clinical tolerance.
- SGRT provided reliable pre-imaging alignment, reducing large corrections.

SGRT positioning achieved accurate and consistent alignment prior to CBCT.

Results

II. FSRT - Rotational Setup Accuracy (°)

	Rtn	Pitch	Roll	Mag
Mean	0.65	0.71	0.56	1.26
std	0.47	0.57	0.44	0.62
Median	0.6	0.6	0.5	1.16
90th	1.4	1.6	1.2	2.11
95th	1.41	1.71	1.31	2.26

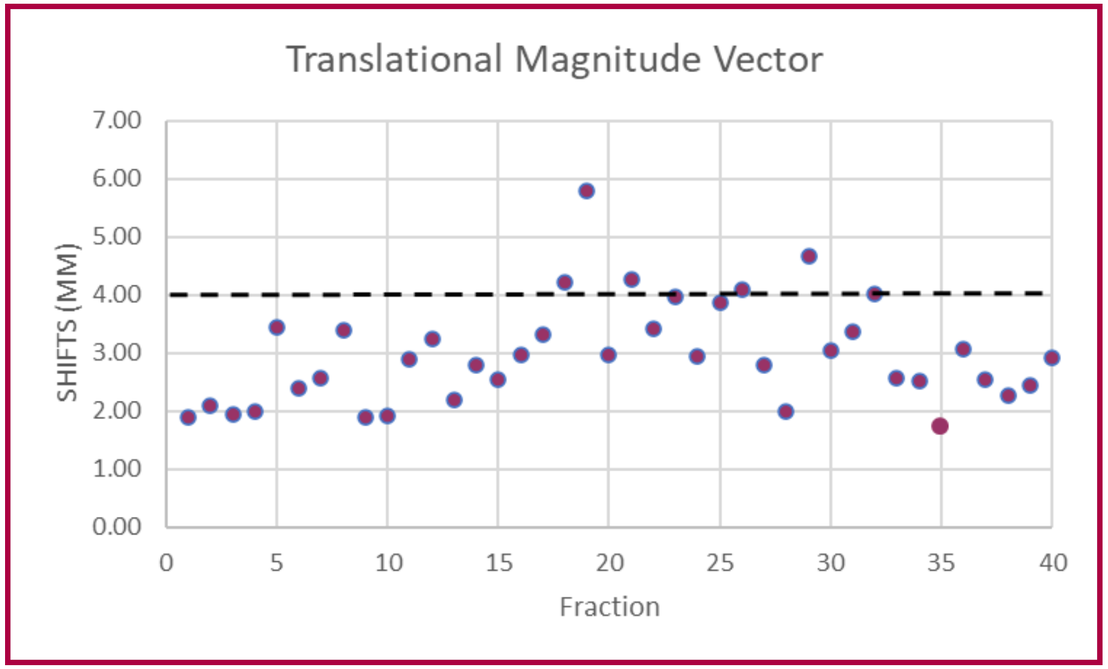


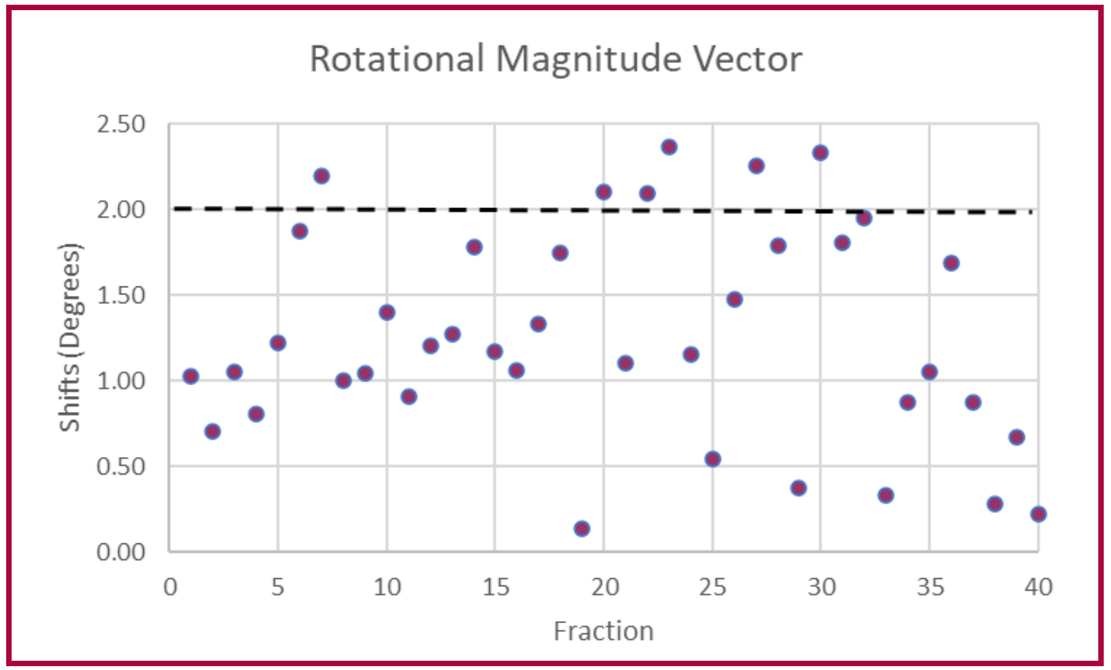
- Small residual rotations after CBCT verification — all axes well within tolerance.
- Mean < 1° for all rotational directions.
- 95th percentile < 2.3°, confirming excellent rotational reproducibility.
- Low variability (SD < 0.6°) indicates stable daily positioning.
- SGRT ensures precise angular alignment before imaging.

Rotational corrections after SGRT setup were minimal, confirming stable angular positioning across fractions.

Results

II. FSRT- Fractional Magnitude Distribution





- Translational magnitudes: mostly below 4 mm, within stereotactic tolerance.
- Rotational magnitudes: consistently under 2°, confirming excellent angular accuracy.
- Stable performance across all fractions — no trend toward increased deviation.
- Confirms that SGRT provides highly accurate and reproducible positioning suitable for stereotactic delivery.

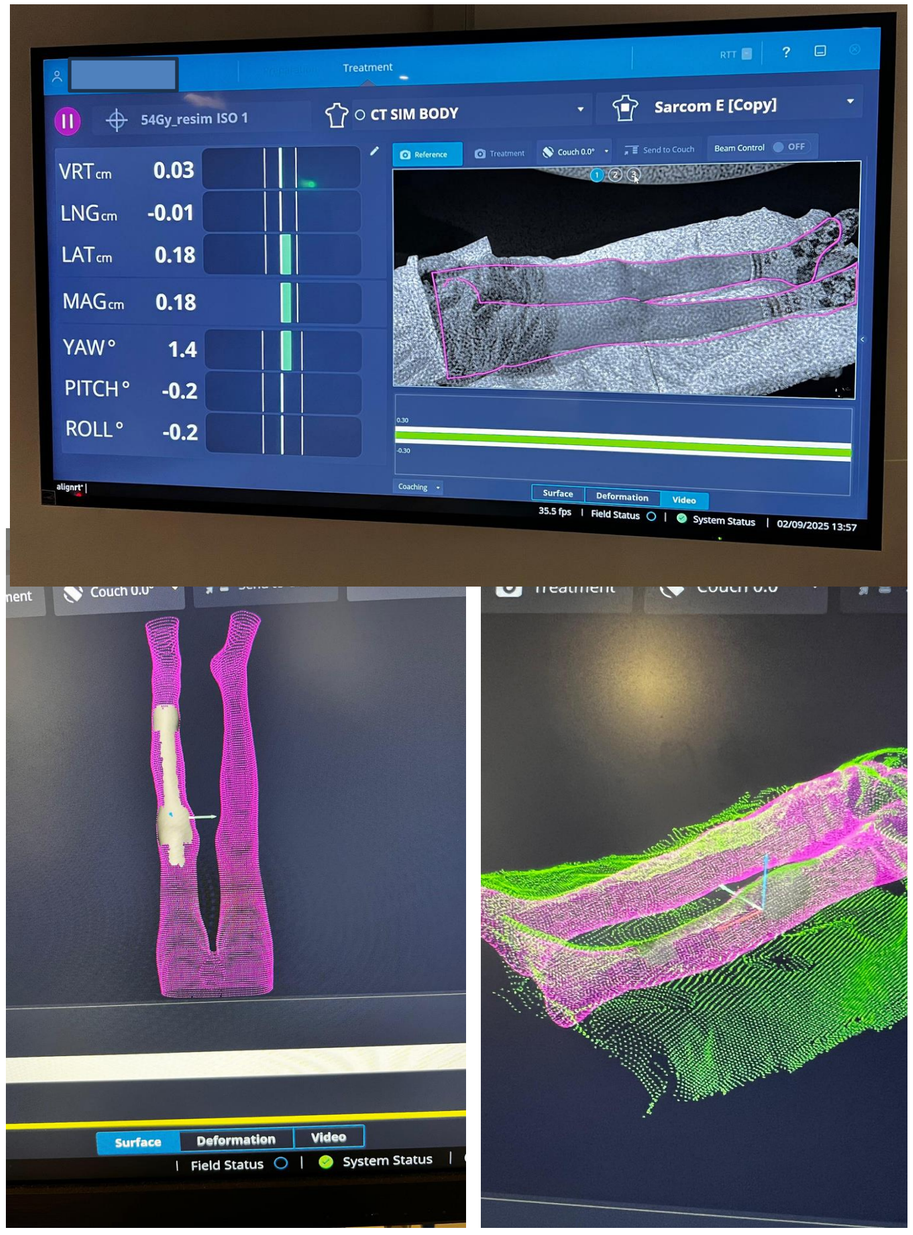
Use of SGRT in Pediatric Radiotherapy

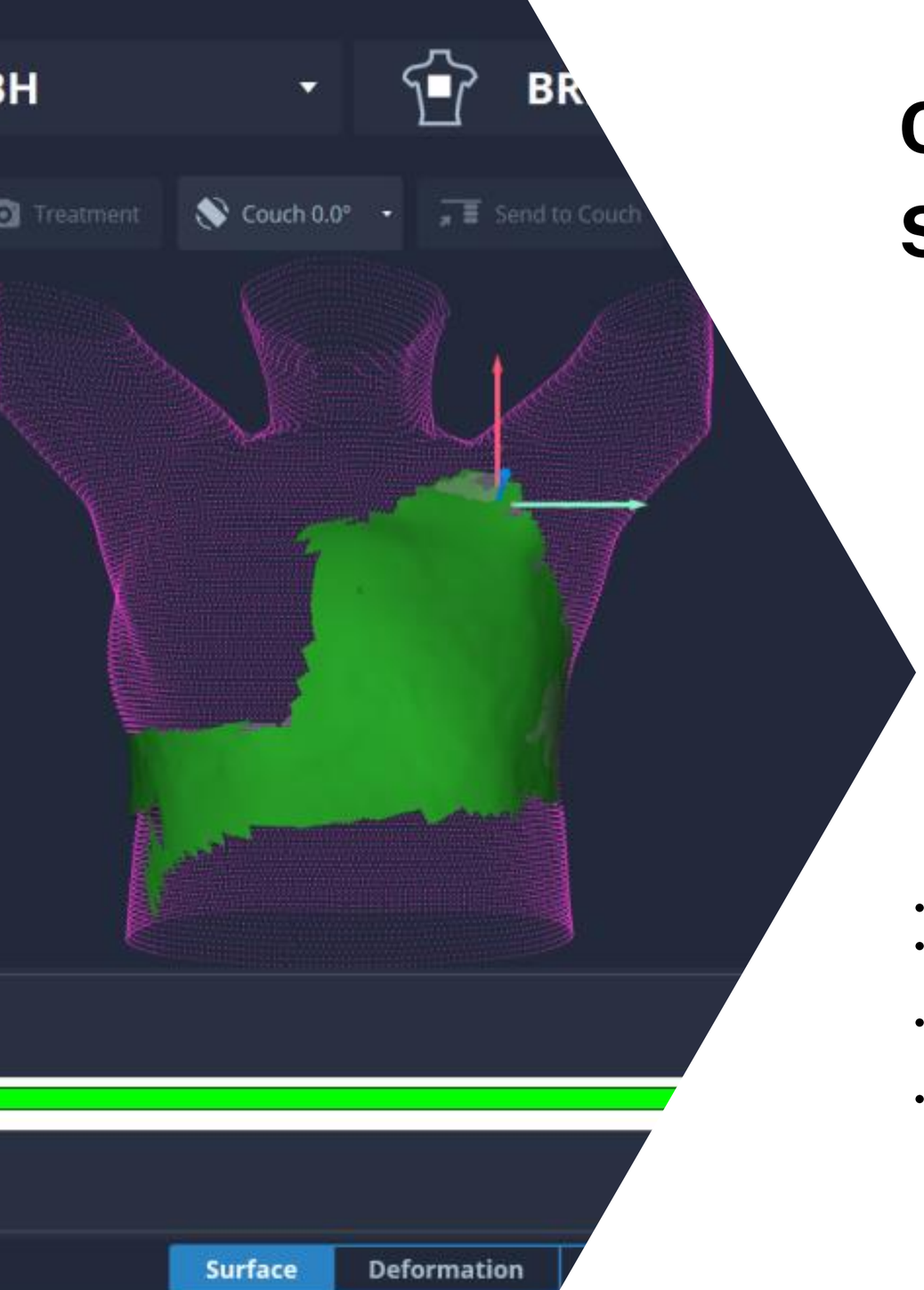
Clinical Experience:

- SGRT has been implemented for selected pediatric cases in our department.
- Mainly applied in extremity treatments and craniospinal irradiations .
- For craniospinal cases, use is limited due to the usage of a closed-face thermoplastic mask, which restricts optical surface visibility.
- In extremity setups, SGRT is used effectively for real-time monitoring and setup verification, providing improved alignment confidence.

Limitations and Potential:

- Current pediatric sample size too small for statistical analysis.
- However, preliminary experience shows promising workflow integration and potential for motion management in unmasked or partially visible areas.
- Future plans include expanding use in non-cranial pediatric sites where visibility is adequate.





Qualitative Observations on SGRT Implementation

- SGRT integrated successfully into daily clinical workflow.
- Setup faster and more consistent than laser/tattoo-based positioning
- Visual feedback improves patient understanding and DIBH reproducibility.
- High confidence in real-time monitoring and treatment accuracy.

Observed benefits

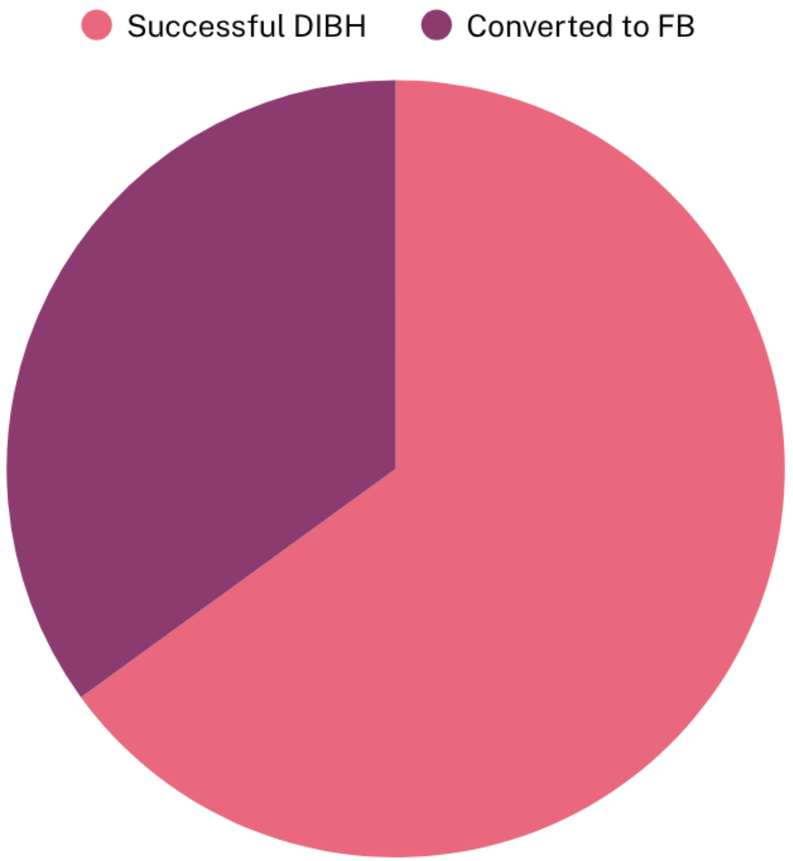
- Reduced need for repeat CBCTs
- Smoother daily setup and verification
- Patient position monitoring during treatment
- Ability to quickly restore patient position after intrafraction motion

Challenges

- Camera occlusion at certain gantry angles
- No automatic beam control during CBCT
- Tracking difficulties when using bolus
- ROI propagation errors — sometimes the region must be manually redrawn by RTTs

Patient Compliance with DIBH

- Approximately **60–70%** of patients are **able to perform and maintain** a **stable breath-hold** throughout treatment.
- Patient coaching and visual feedback improve compliance and reproducibility.
- Some patients are unable to tolerate DIBH due to:
  - Anxiety or discomfort while holding breath.
  - Difficulty maintaining consistent breath-hold depth.
  - Fatigue or shortness of breath during longer sessions
- In such cases, if maintaining DIBH becomes visibly difficult, RTTs communicate with the physician, and the patient is transitioned to a free-breathing (FB) treatment plan.
- The decision prioritizes patient comfort and safety while maintaining treatment quality.



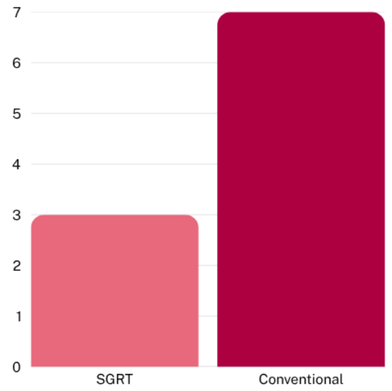
Overall Positioning and Treatment Time

Workflow observations:

- SGRT setup (AlignRT) is faster and more reliable than traditional 3-tattoo alignment.
- Initial alignment reached with minimal couch adjustments.
- Surface feedback improves first-attempt accuracy before CBCT.
- Repeat CBCTs rarely required — first scan usually within tolerance.

Tattoo Setup → multiple steps, more imaging.
6-8 min.

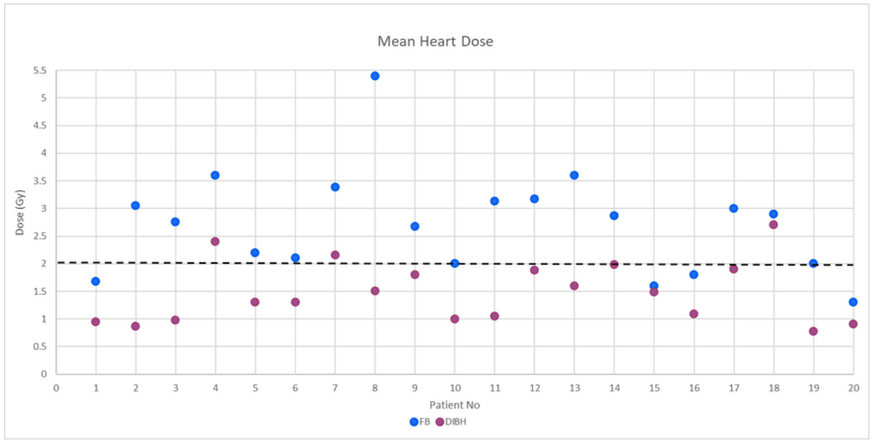
SGRT Setup → direct surface alignment, one CBCT.
2-4 min.

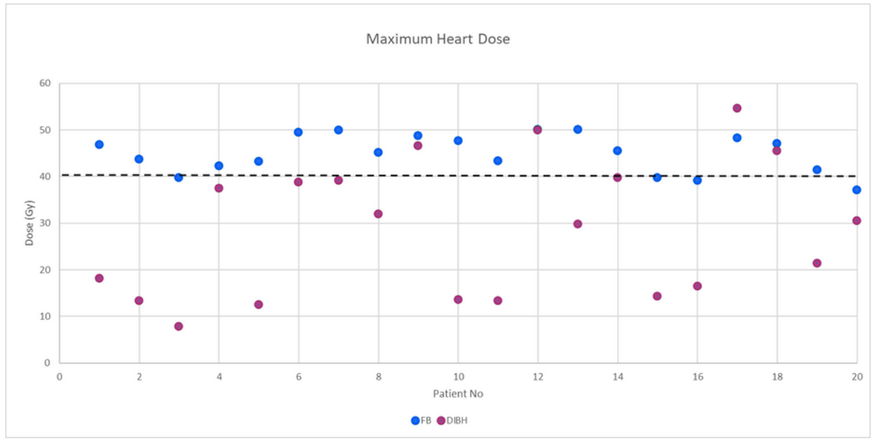


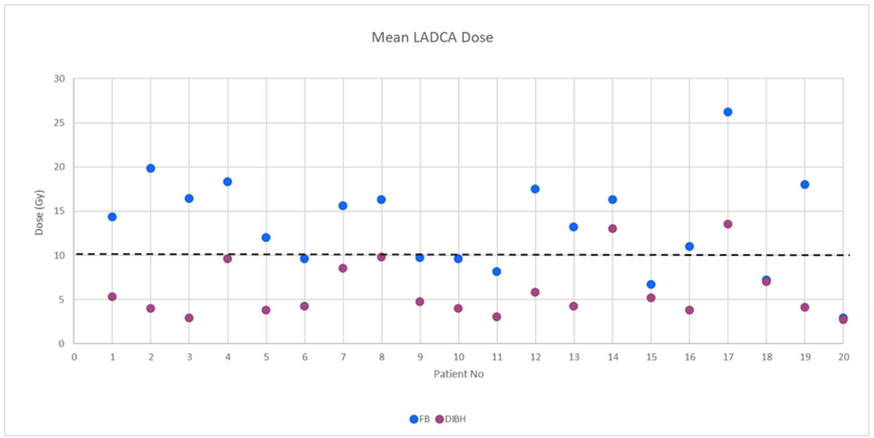
- **Average SGRT positioning time: 2–4 minutes** (depending on case complexity and patient cooperation)
- *First session may take longer due to initial setup and preparation*
- **Conventional workflow: ~6–8 minutes** (tattoos, skin marks, manual alignment, initial portal/CBCT verification)

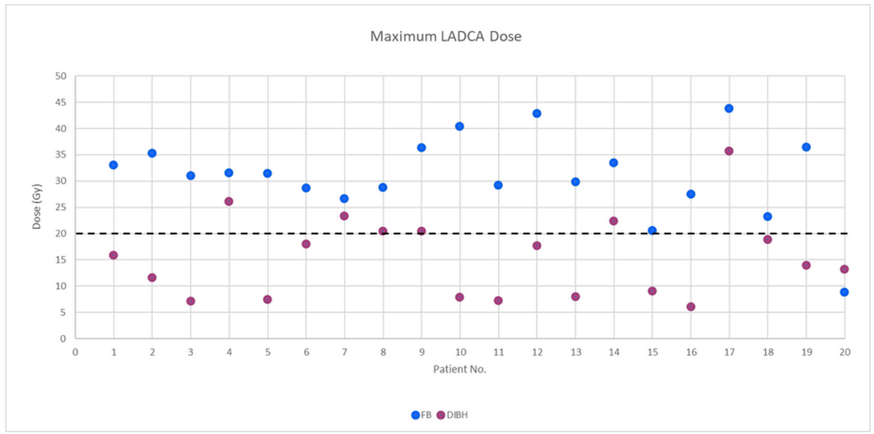
Clinical Impact of AlignRT Implementation

Left Breast









- **Mean heart dose ↓ 45.4 %**
- **Maximum heart dose ↓ 35.9 %**
- **Mean LADCA dose ↓ 55.7 %**
- **Maximum LADCA dose ↓ 50.0 %**

Confirms substantial cardiac sparing achievable with DIBH when guided by AlignRT.
DIBH now standard practice for left-sided breast treatments in our department.

Conclusions

Quantitative findings

- Accurate and reproducible positioning with SGRT
- CBCT confirmed minimal residual errors
- 95% of fractions within tolerance
- SGRT reduced translational deviations vs non-SGRT

Qualitative feedback

- Faster and smoother daily setup
- Higher positioning confidence
- Good patient compliance (≈60–70%)
- Fewer repeat CBCTs

Clinical Outcomes

- Enabled reliable DIBH delivery
- Improved cardiac sparing and patient safety
- Enhanced comfort through non-contact setup
- SGRT now an integral part of clinical practice

Future Perspectives for SGRT in Our Department

1. **Focus on pediatric cases:**
   Collect and analyze data for craniospinal and extremity treatments.
   Aim to present clinical experience and findings at upcoming conferences.

2. **Expand patient sample:**
   Include a larger cohort to strengthen statistical reliability.
   Broaden analysis to additional treatment sites and techniques (with focus to more SaBR cases).

3. **System validation:**
   Compare AlignRT-reported shifts with CBCT-derived corrections.
   Assess correlation and consistency between surface and imaging data.

Ongoing goal: refine workflow and protocols for even greater precision and reproducibility.

Thank You

IOCN Radiation Oncology Team

VisionRT Clinical and Technical Support Team

Patients and Caregivers

Our patients - the WINNERS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