Advancing Patient Care and Implementing Surface Guided Radiation Therapy (SGRT) – A Clinical Experience

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10 YEARS

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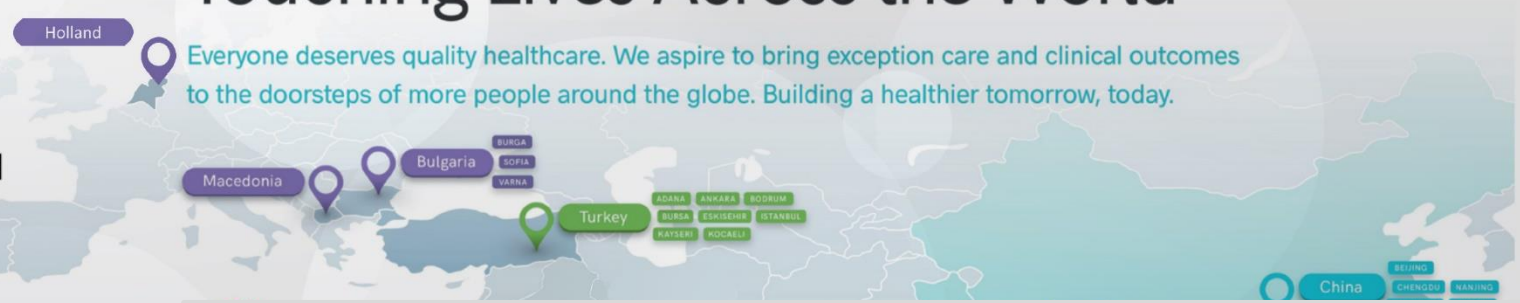

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- 13 general hospital & 12 medical center
  - 10 Rad. Onc. Centers
- 4 hospital
  - 3 Rad. Onc. centers


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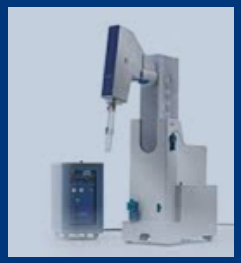
SILIVRI
E80
O-2
O-3
O-1
GALATA
SULTANAHMET
Atakent
SIDE
Altunizade
Sea of Marmara
PRINCES' ISLANDS
GEBZE
10 Kilometers
10 Miles

Acibadem Maslak Hospital - 2018



Future Proton Center

Clinical Program Overview

- Academic Center
- Leading Tech---IMRT, SRS, IORT, MRgRT, SGRT
- Tumor Boards
  - CNS
  - Urology
  - Breast
  - Pediatric
  - Gastrointestinal
  - General (mainly lung)
- Oncological surgery

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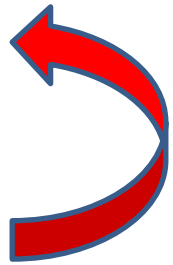
Acıbadem Maslak & SGRT

2022 Renovation Plan

1. Upgrade process of Varian TrueBeam
2. Replacing Varian TrueBeam STX with Ethos



No motion management in Ethos at first installation (06.2022)

Ethos & VisionRT – 3rd center in the World (08.2022)

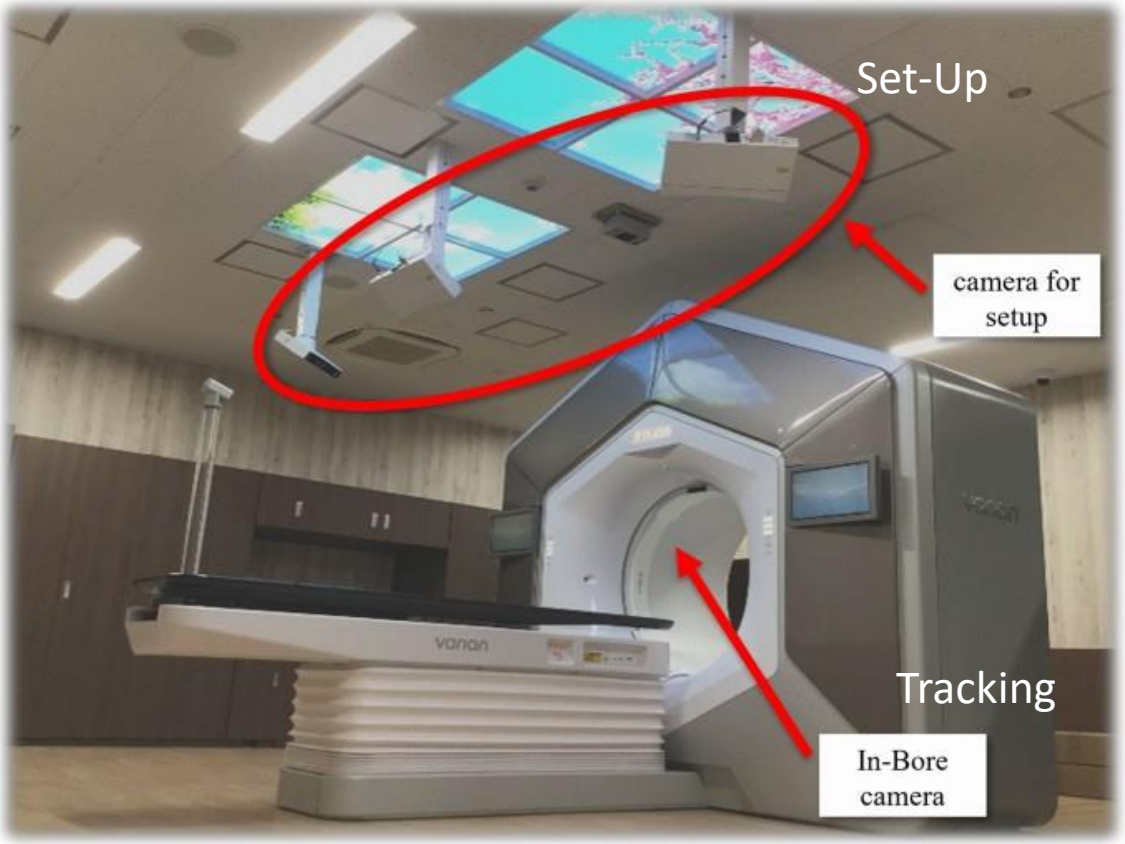
Surface Guided Radiotherapy SGRT

- Utilizes stereo vision technology to track patients' body surface using optical imaging without ionizing radiation.
- Offers markerless setup and treatment,
- Tracks surface motion during treatment and integrates seamlessly with the treatment machine.
- Enables machine positioning and beam control based on detected motion.

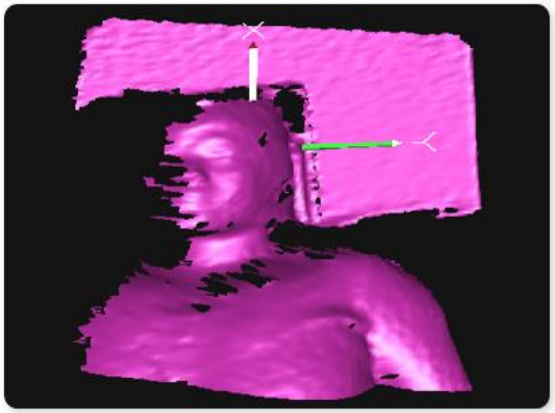
SGRT Cameras

POD: Projector+ Cameras

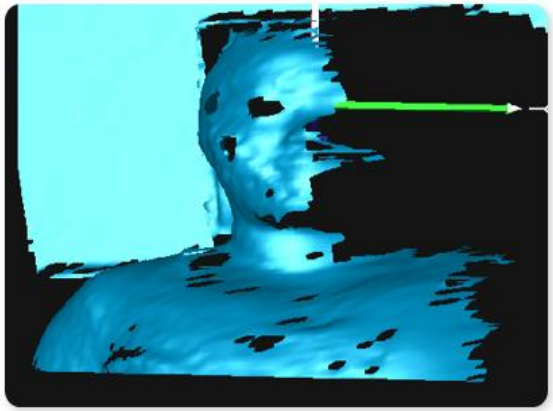
Projector: Invisible light



Surface generating



Pod 1



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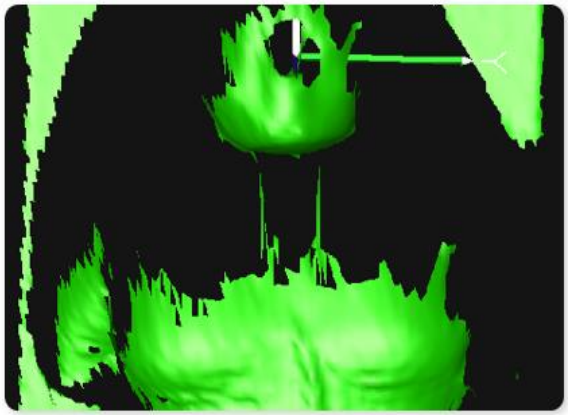
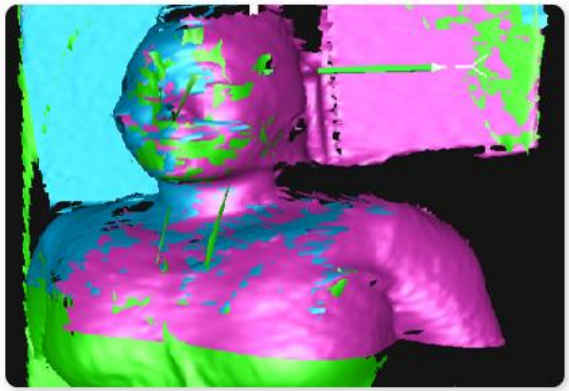
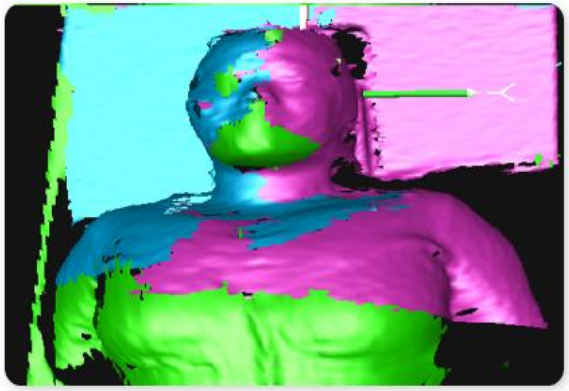


Pod 3





Conventional vs SGRT Setup

- **Conventional Setup:**
  - Lasers, SSD and cross hairs as references
  - Only Vertical, Longitudinal, and Lateral Adjustments
  - Most couches support only Clockwise (CW) and Counterclockwise (CCW) rotations.
  - Challenges in Understanding and Correcting Pitch and Roll Rotations on the Patient's Surface.
  - Possibly increased use of drawings or markers.
  - Utilization of Repeated Image-Guided Radiation Therapy (IGRT).
  - 6D Couch option may be beneficial

Conventional vs SGRT Setup

- **Surface Guided Radiation Therapy (SGRT)**
  - Minimizes corrections with experience
  - Efficiency and Time-Saving Advantages
  - Faster IGRT and reduced imaging dose
  - 6D Couch-less treatment

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SGRT Workflow

Guidelines

ESTRO-ACROP guideline on surface guided radiation therapy

P. Freisleder[a,1,*], V. Batista[b,c], M. Öllers[d], M. Buschmann[e], E. Steiner[f], M. Kügele[g], F. Fracchiolla[h], S. Corradini[a], M. de Smet[i], F. Moura[j], S. Perryck[k], F. Dionisi[l], D. Nguyen[m], C. Bert[n], J. Lehmann[o,p,q]

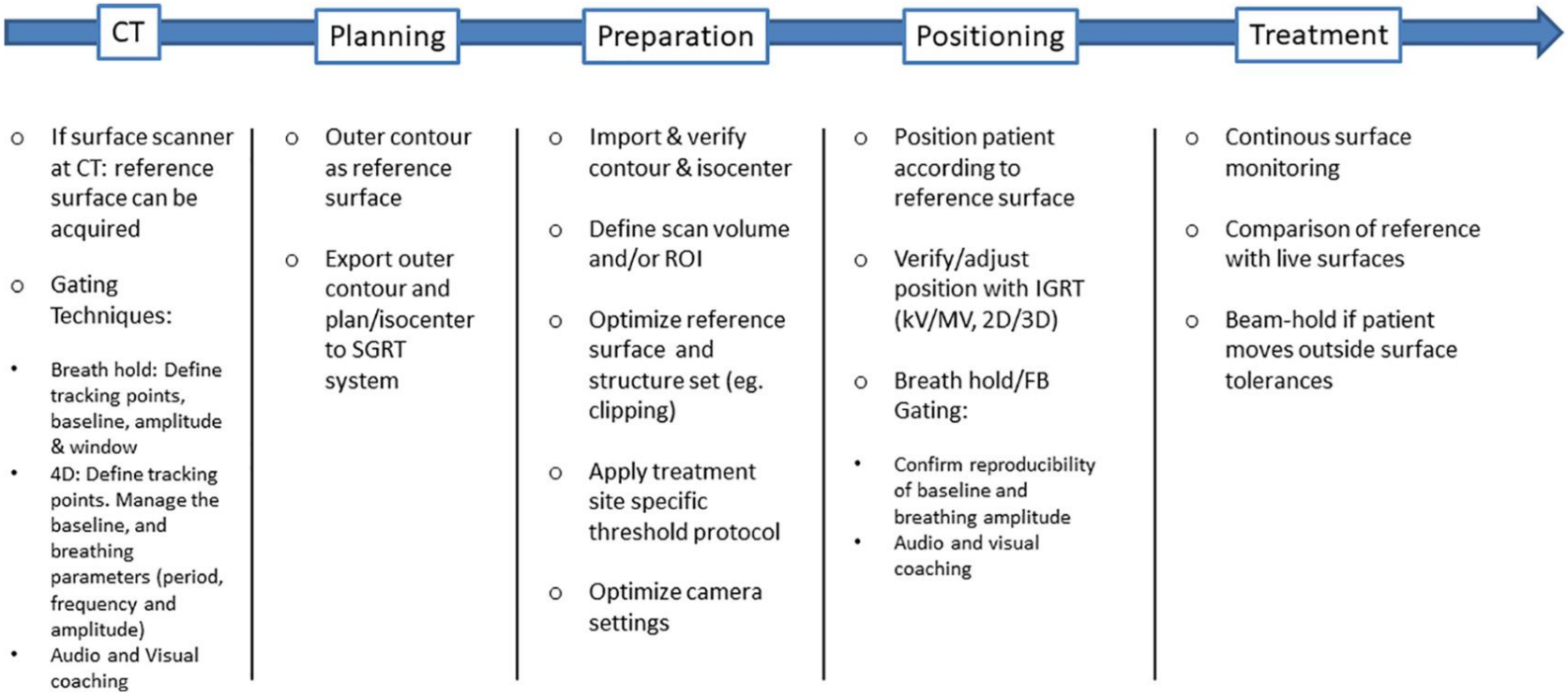
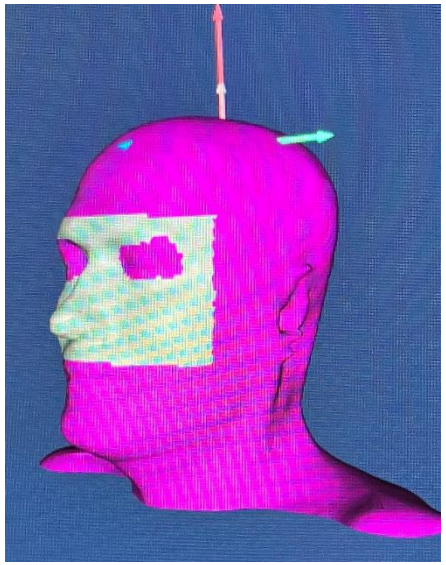


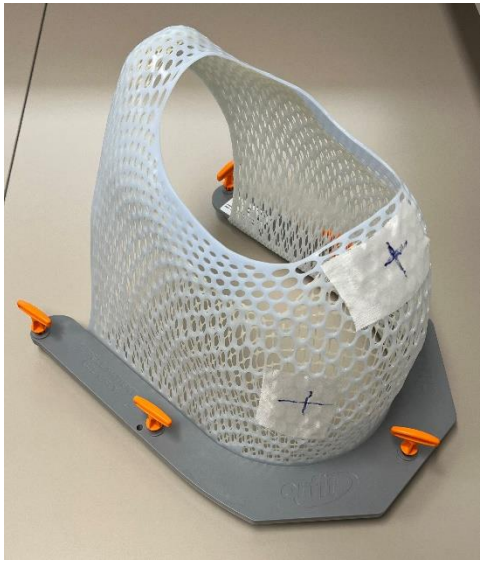
Fig. 1. Diagram of a standard SGRT workflow and the main steps and parameters to be considered.

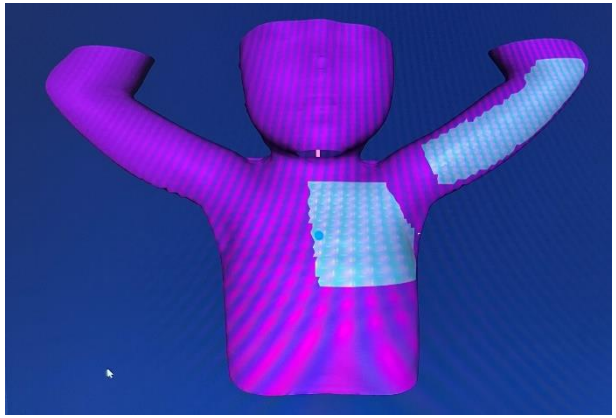
SGRT Setup

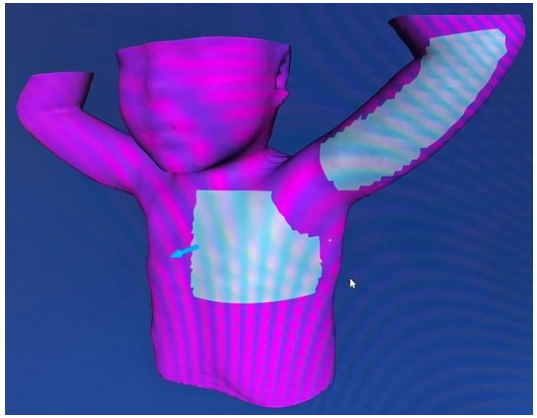
Rigid Areas

- Head&Neck
- Extremity
- Pelvis

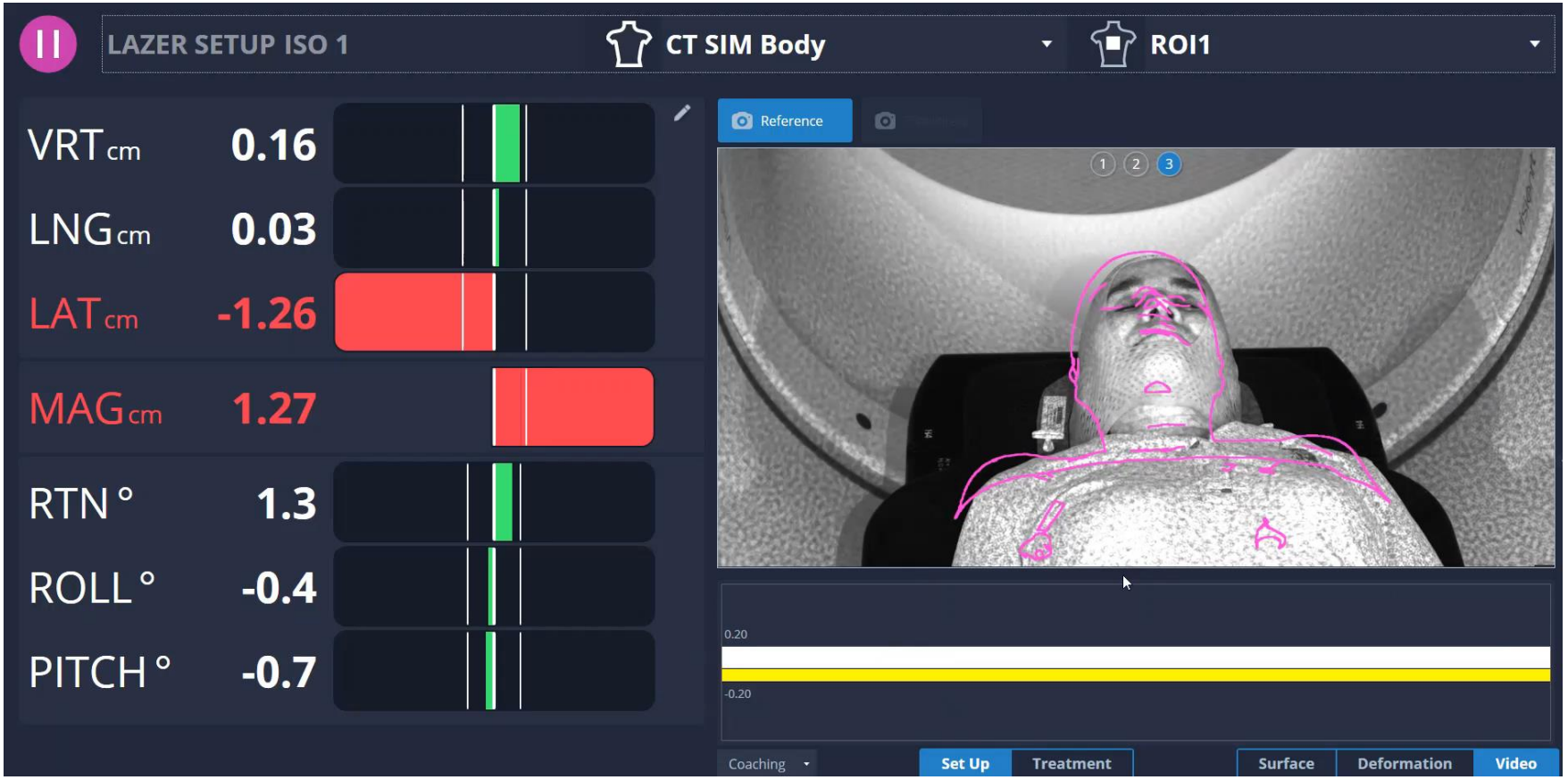






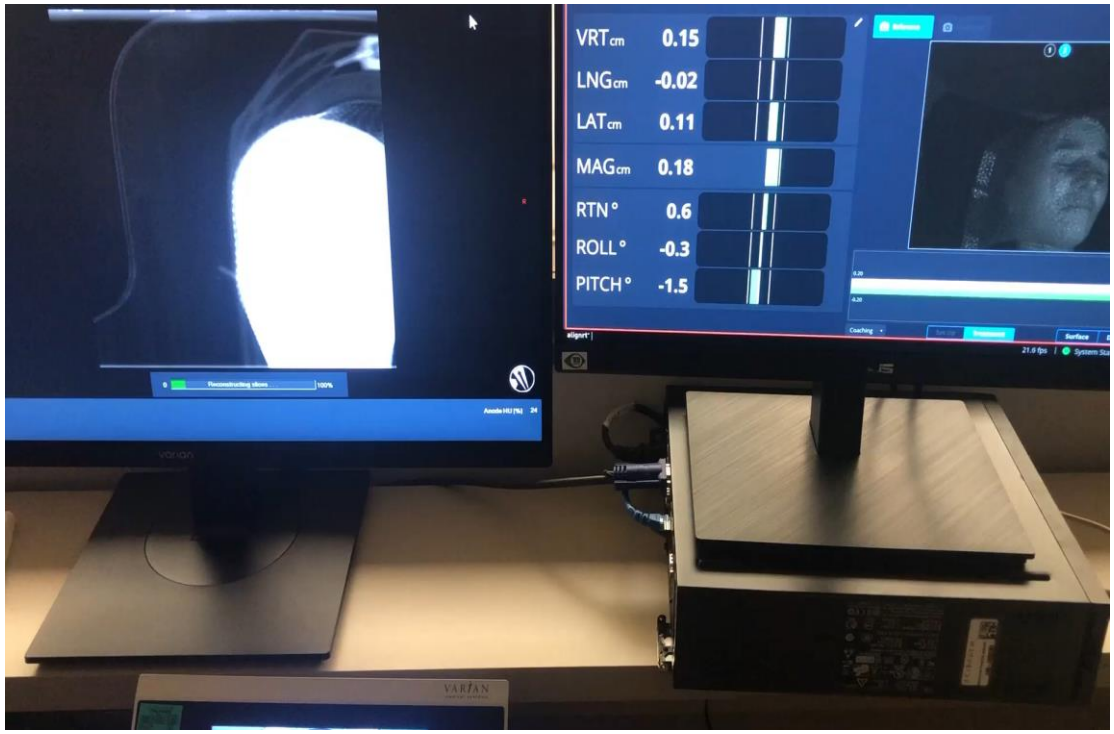


SGRT Setup workflow
(virtual iso and ceiling cameras)



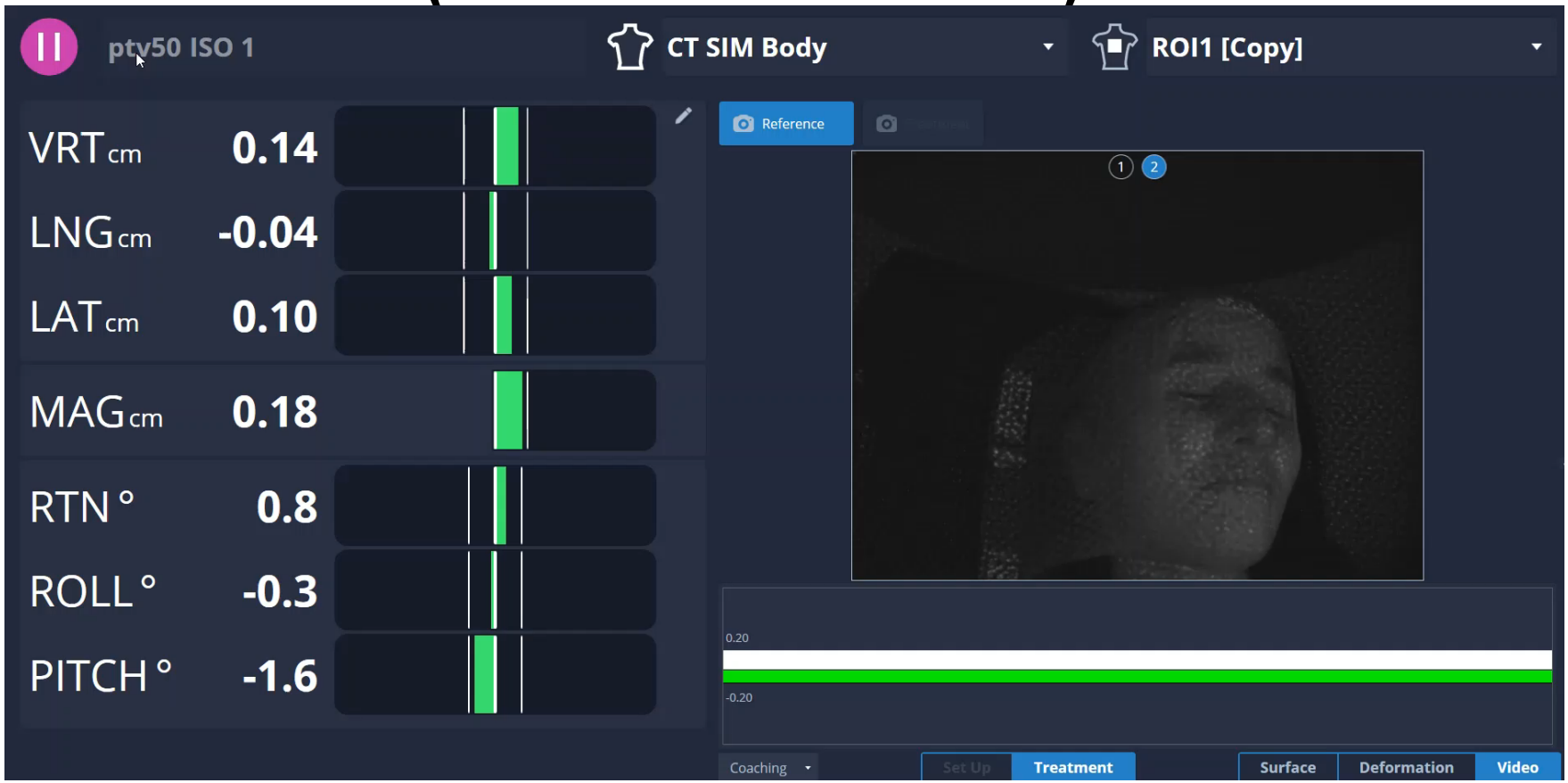
If Couch is entegrated: Autoshift

SGRT vs IGRT Differences



- Due to the 3D couch, there are no rotations in IGRT.
- In SGRT, XYZ differences are also associated with rotation.
- In SGRT, the analyzes is done through ROI on the surface, while radiologic anatomy in IGRT.
- Shift calculation algorithms are different.

Tracking during treatment with SGRT (InBore Cameras)

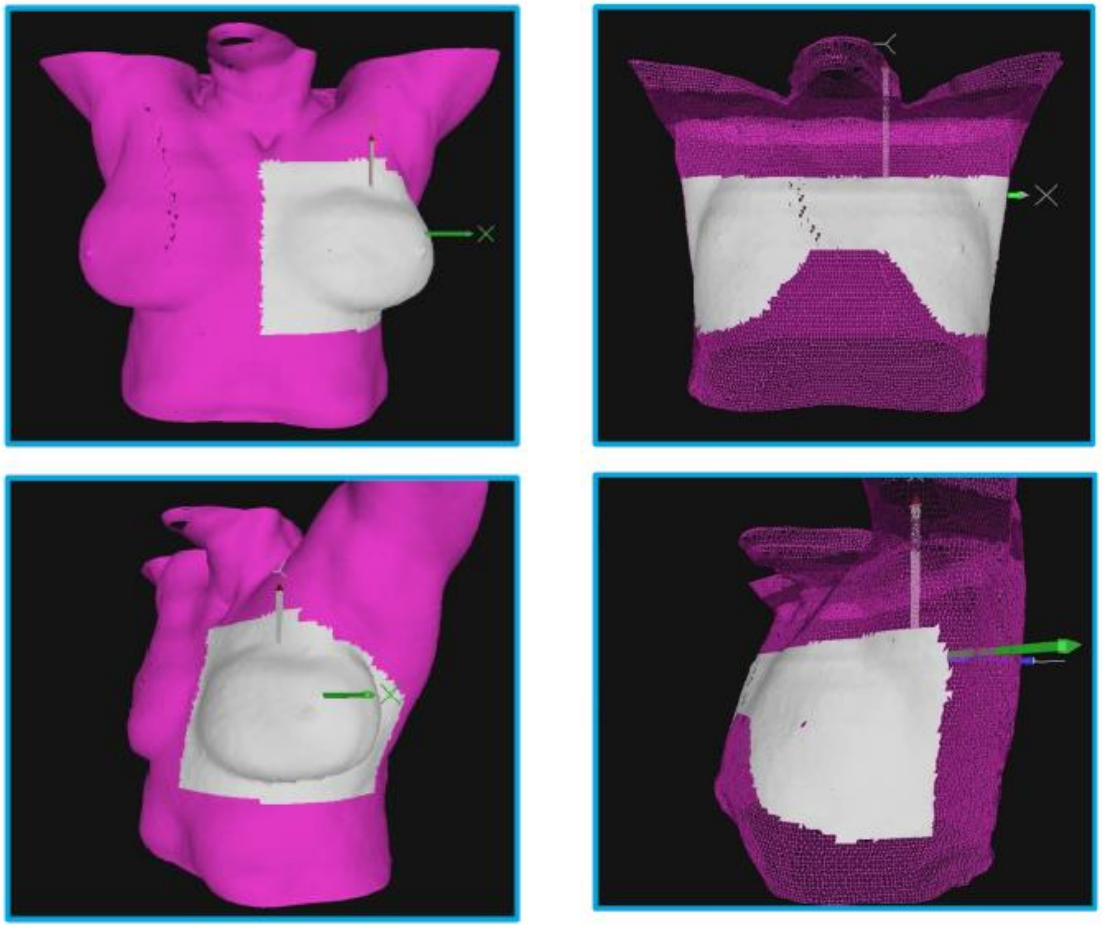


"Anatomical matching is performed with IGRT imaging, the final couch shift is applied, new reference surface is set and the treatment monitoring phase begins."

SGRT in Dynamic Regions

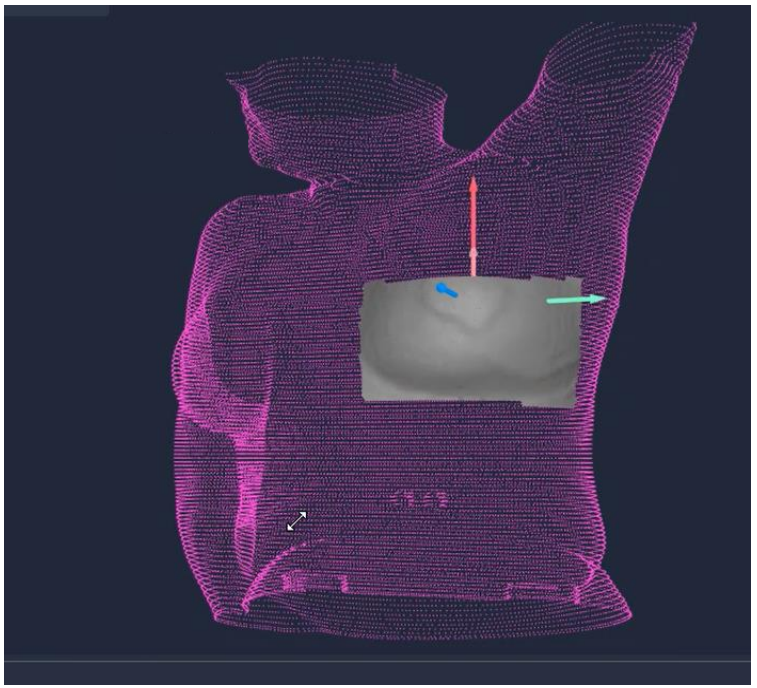
- Breast
- Thorax
- Abdomen

- Breath hold
  - Setup
  - Imaging
  - Treatment
- Free breathing
  - Average breath geometry as reference



Reference Surface / ROI

Ceiling cameras
ROI for positioning

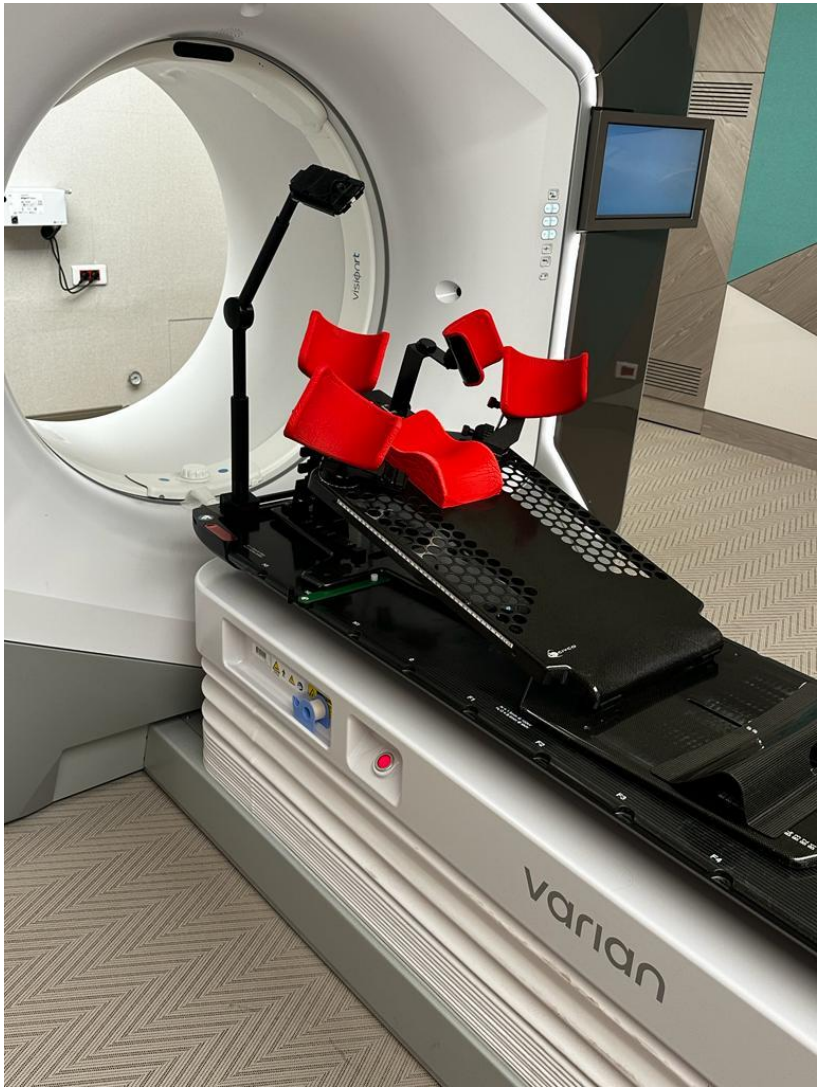


Inbore cameras
ROI for tracking

Requirements for Ideal Breath Hold Treatments

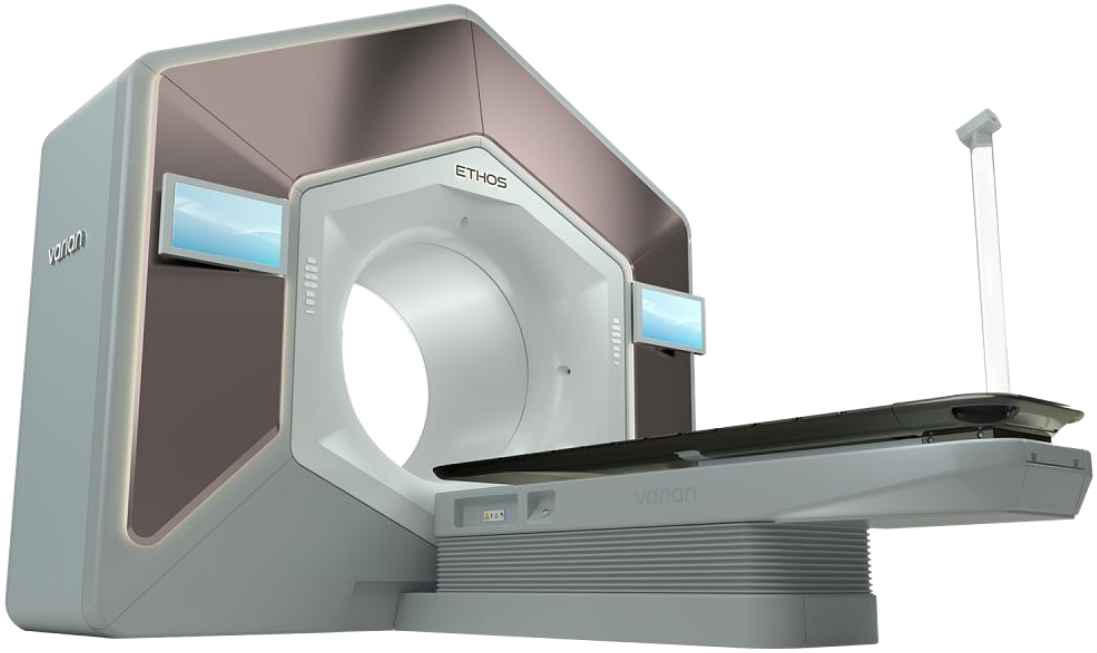
- Patient cooperation is needed
- Patient trainning is needed
  - **Visual assistance** is important both during CT sim and treatment
- At least 15-20 sec breath hold is needed
  - Stable
  - Repeatable

Visual Coaching - Treatment



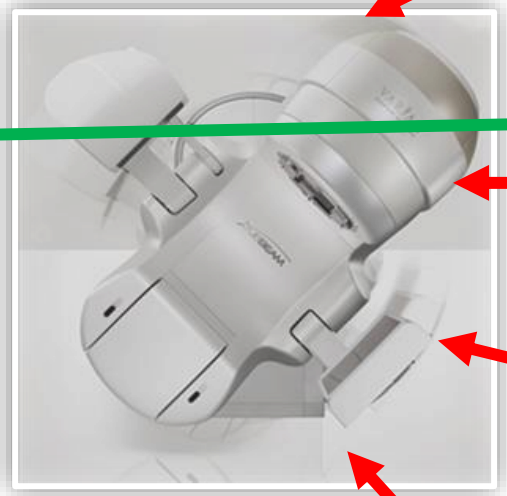
Visual Coaching - Treatment

ETHOS Cases (before SGRT)



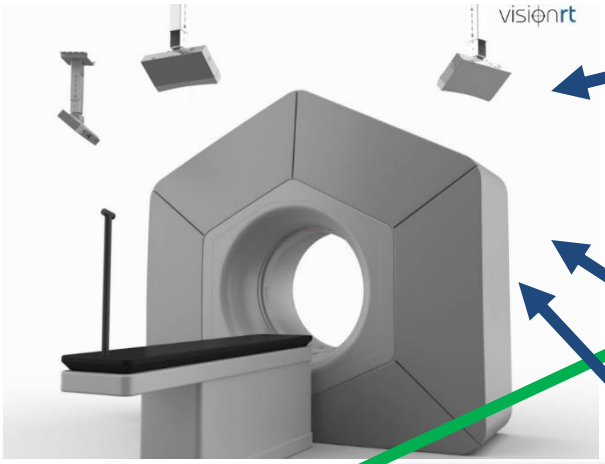
- Pelvis (adaptive)
- Cranial Tumors
- H&N
- Palliative bone mets
- Extremitiy
- Pediatric cases

Acıbadem Maslak – Motion Management



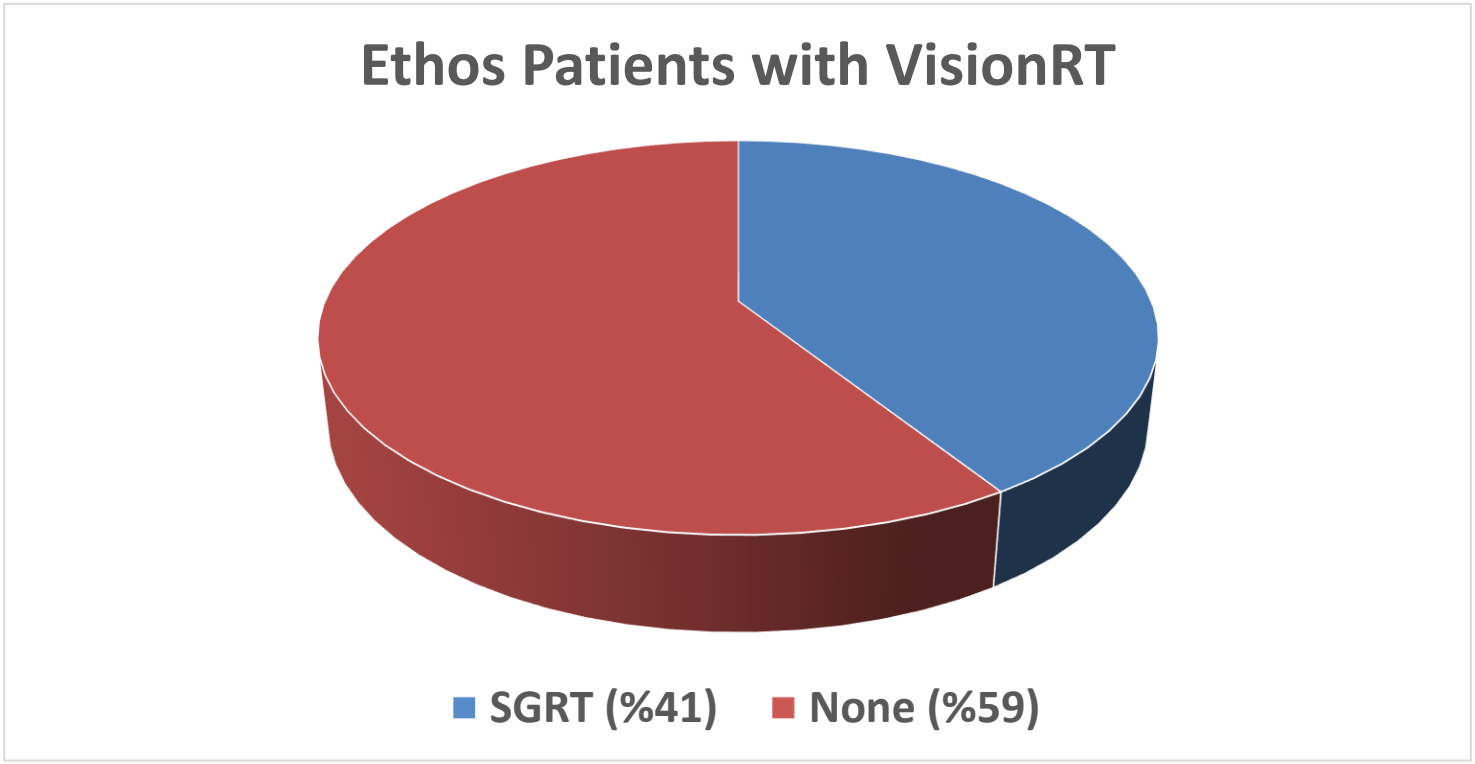
- Deep Breath Hold (breast)
- Breath Hold
- (SBRT thorax / abdomen)
- Breath Hold (locally advanced lung ca)
- 4D CT - ITV approach (locally advanced lung ca)

Acıbadem Maslak – Motion Management after ETHOS with AlignRT

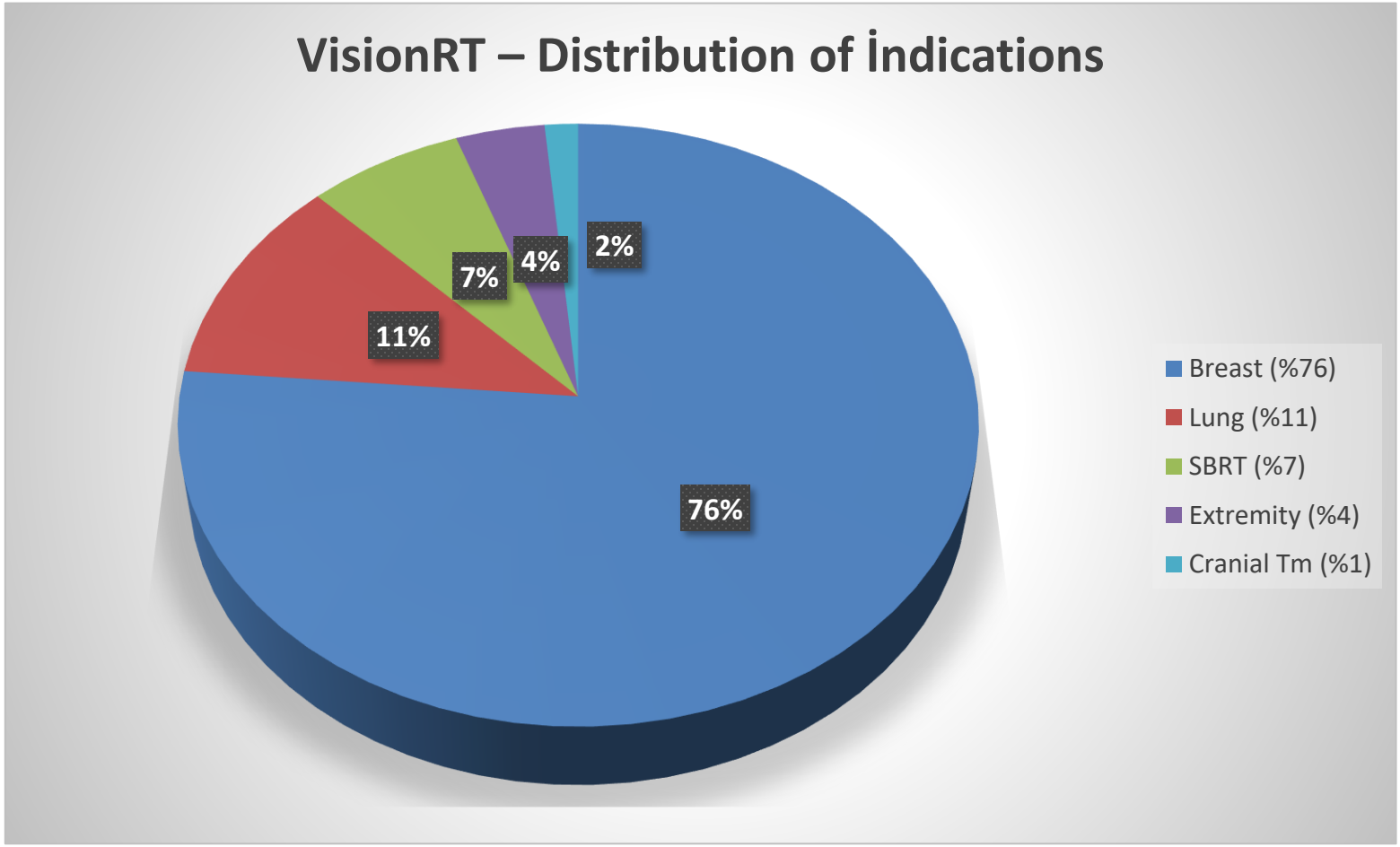


- Deep Breath Hold (breast)
- Breath Hold (SBRT thorax / abdomen) (machine specific reasons)
- Breath Hold (locally advanced lung ca)
- 4D CT - ITV approach (locally advanced lung ca)

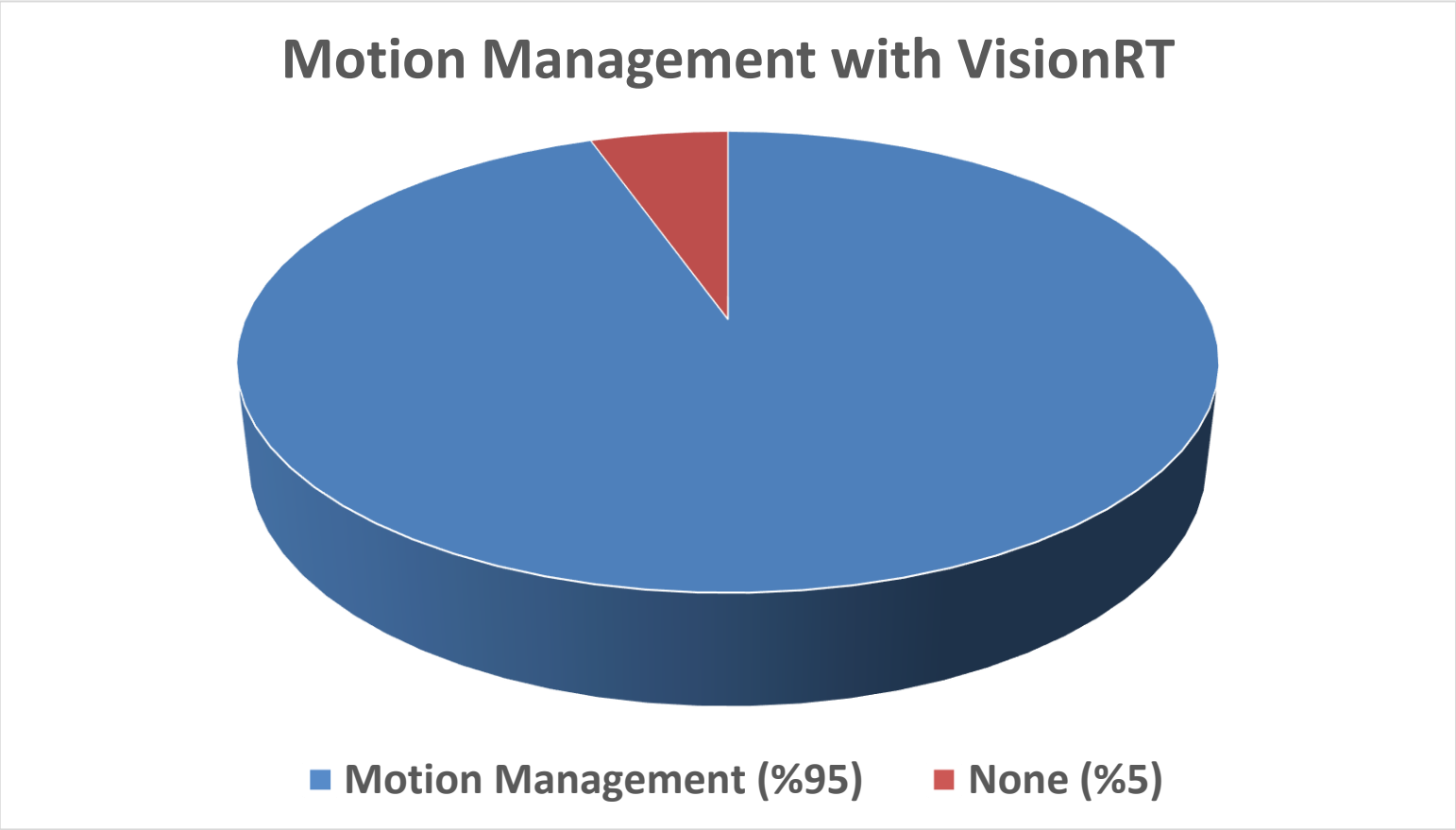
VisionRT & Ethos (Acıbadem Maslak)



VisionRT & Ethos (Acıbadem Maslak)



VisionRT & Ethos (Acıbadem Maslak)



What has changed with SGRT?

- Improved setup with 6D positioning data.
- Breath control/tracking treatment not only vertically but in 6D.
- Significant advantage, particularly for machines lacking 6D capabilities.
- Markerless setup and treatment available (although we still use markers, out of habit)

In Summary…

- What do you gain in your daily routines with SGRT?
  - Practical setup
  - Minimal uncertainities related to rotation
  - Effective IGRT
  - Motion/breath management
  - Treatment tracking
  - Enhanced quality with integrated Beam and Couch control options

- The Bore based linacs setup and treatment are more complex but with VisionRT guidance you can have reliable setup and tracking.

- We have not eliminated CT markers yet (a two-stage workflow). Because we have different machine types and markers are needed for the other machines.