Evolution of SGRT from Positioning to Motion management and beyond

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Visakhapatnam

Omega Hospitals

A Unit of Vizag Speciality Hospitals

- Radiotherapy as a cornerstone in cancer treatment
- Importance of precision and accuracy
- Historical reliance on bony anatomy and skin markings

- Limitations of traditional positioning methods
- Importance of minimizing margins and sparing healthy tissue
- Non invasive
- Real time monitoring

SGRT

- 3D surface imaging for real time patient tracking
- Employs structured light or stereovision system
- Contact less
- Tattoo free

- Early systems : limited resolution , basic set up assistance
- Modern systems : sub – mm accuracy, respiratory gating , AI enhancements
- Integration with TPS and Linac

VisionRT installed along with Versa HD phase one installation in October 2019

Clinical Workflow

Immobilization

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CT/MRI Imaging

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Tumour and OAR Delineation

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Treatment Planning

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Plan Evaluation

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Patient Specific QA

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Treatment Execution

Clinical Workflow

Setup

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Imaging

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Treatment delivery

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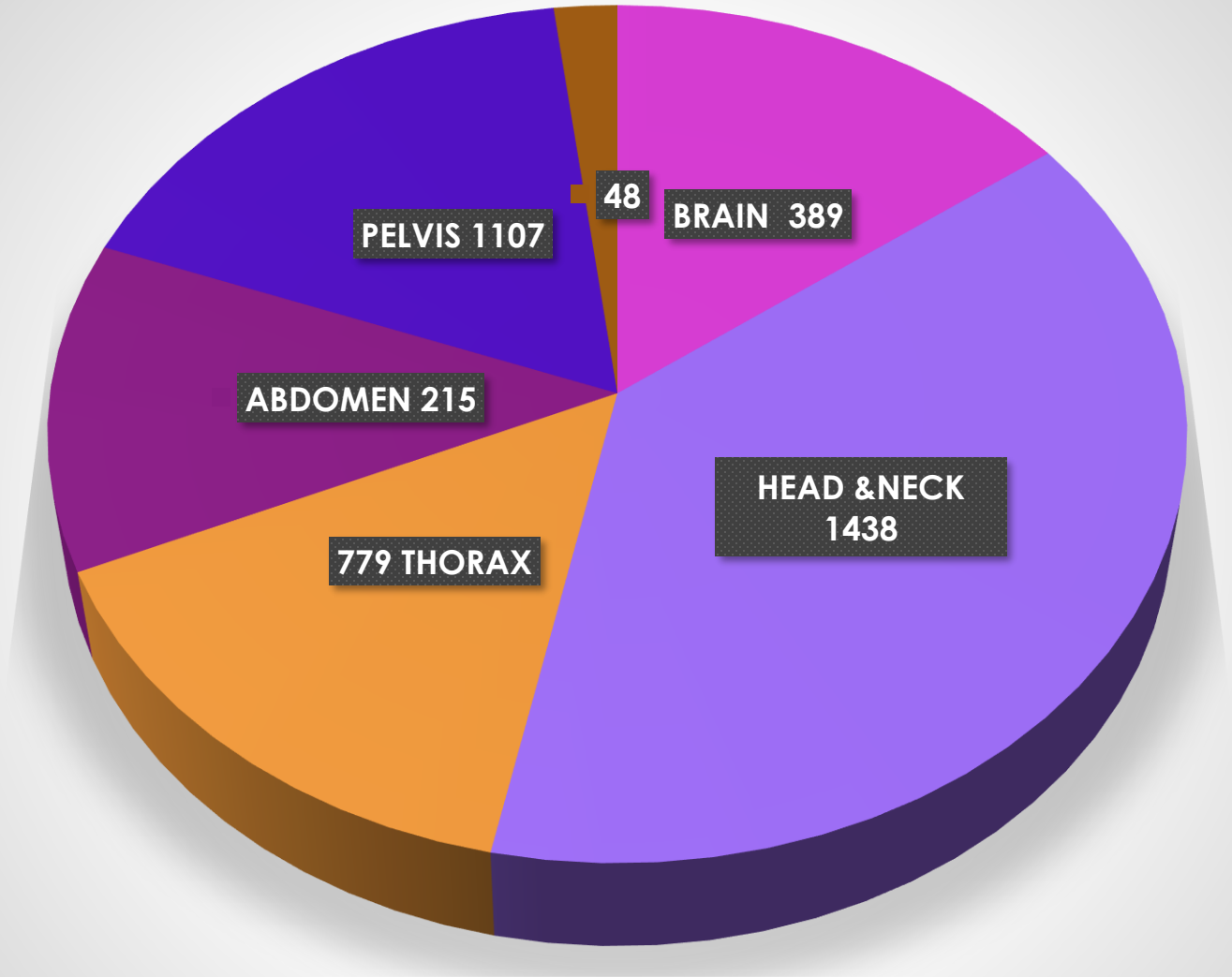
Monitoring

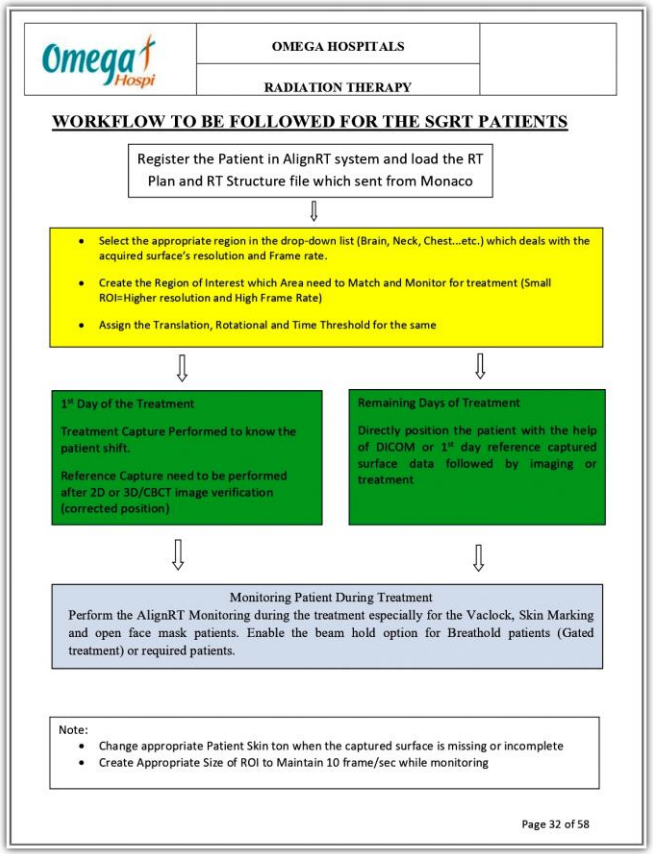
Centre Of Excellence

Our Experience

Total no of patients Treated by SGRT



SGRT SOP



OMEGA HOSPITALS

RADIATION THERAPY

WORKFLOW TO BE FOLLOWED FOR THE SGRT PATIENTS

Register the Patient in AlignRT system and load the RT Plan and RT Structure file which sent from Monaco

- Select the appropriate region in the drop-down list (Brain, Neck, Chest...etc.) which deals with the acquired surface's resolution and Frame rate.
- Create the Region of Interest which Area need to Match and Monitor for treatment (Small ROI=Higher resolution and High Frame Rate)
- Assign the Translation, Rotational and Time Threshold for the same

1st Day of the Treatment

Treatment Capture Performed to know the patient shift.

Reference Capture need to be performed after 2D or 3D/CBCT image verification (corrected position)

Remaining Days of Treatment

Directly position the patient with the help of DICOM or 1st day reference captured surface data followed by imaging or treatment

Monitoring Patient During Treatment

Perform the AlignRT Monitoring during the treatment especially for the Vaclock, Skin Marking and open face mask patients. Enable the beam hold option for Breathold patients (Gated treatment) or required patients.

Note:

- Change appropriate Patient Skin ton when the captured surface is missing or incomplete
- Create Appropriate Size of ROI to Maintain 10 frame/sec while monitoring

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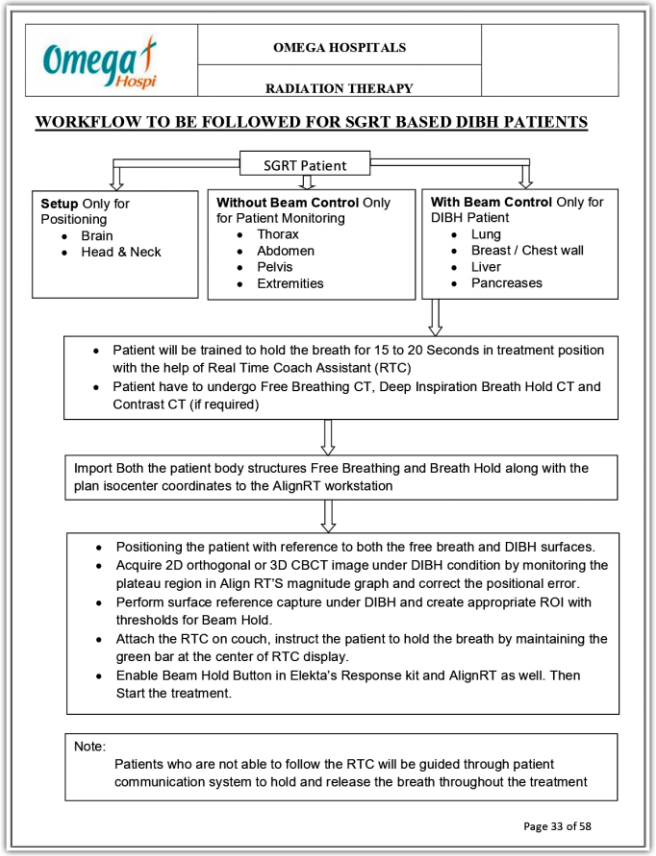

OMEGA HOSPITALS

RADIATION THERAPY

WORKFLOW TO BE FOLLOWED FOR SGRT BASED DIBH PATIENTS

SGRT Patient

Setup Only for Positioning
- Brain
- Head & Neck

Without Beam Control Only for Patient Monitoring
- Thorax
- Abdomen
- Pelvis
- Extremities

With Beam Control Only for DIBH Patient
- Lung
- Breast / Chest wall
- Liver
- Pancreases

- Patient will be trained to hold the breath for 15 to 20 Seconds in treatment position with the help of Real Time Coach Assistant (RTC)
- Patient have to undergo Free Breathing CT, Deep Inspiration Breath Hold CT and Contrast CT (if required)

Import Both the patient body structures Free Breathing and Breath Hold along with the plan isocenter coordinates to the AlignRT workstation

- Positioning the patient with reference to both the free breath and DIBH surfaces.
- Acquire 2D orthogonal or 3D CBCT image under DIBH condition by monitoring the plateau region in Align RT'S magnitude graph and correct the positional error.
- Perform surface reference capture under DIBH and create appropriate ROI with thresholds for Beam Hold.
- Attach the RTC on couch, instruct the patient to hold the breath by maintaining the green bar at the center of RTC display.
- Enable Beam Hold Button in Elekta's Response kit and AlignRT as well. Then Start the treatment.

Note:

Patients who are not able to follow the RTC will be guided through patient communication system to hold and release the breath throughout the treatment

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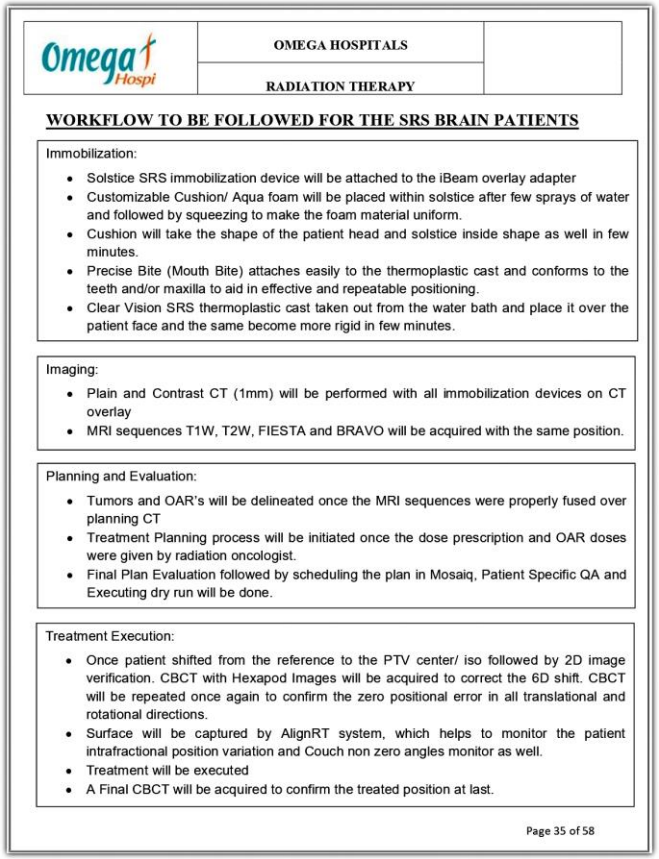

OMEGA HOSPITALS

RADIATION THERAPY

WORKFLOW TO BE FOLLOWED FOR THE SRS BRAIN PATIENTS

Immobilization:

- Solstice SRS immobilization device will be attached to the iBeam overlay adapter
- Customizable Cushion/ Aqua foam will be placed within solstice after few sprays of water and followed by squeezing to make the foam material uniform.
- Cushion will take the shape of the patient head and solstice inside shape as well in few minutes.
- Precise Bite (Mouth Bite) attaches easily to the thermoplastic cast and conforms to the teeth and/or maxilla to aid in effective and repeatable positioning.
- Clear Vision SRS thermoplastic cast taken out from the water bath and place it over the patient face and the same become more rigid in few minutes.

Imaging:

- Plain and Contrast CT (1mm) will be performed with all immobilization devices on CT overlay
- MRI sequences T1W, T2W, FIESTA and BRAVO will be acquired with the same position.

Planning and Evaluation:

- Tumors and OAR's will be delineated once the MRI sequences were properly fused over planning CT
- Treatment Planning process will be initiated once the dose prescription and OAR doses were given by radiation oncologist.
- Final Plan Evaluation followed by scheduling the plan in Mosaiq, Patient Specific QA and Executing dry run will be done.

Treatment Execution:

- Once patient shifted from the reference to the PTV center/ iso followed by 2D image verification. CBCT with Hexapod Images will be acquired to correct the 6D shift. CBCT will be repeated once again to confirm the zero positional error in all translational and rotational directions.
- Surface will be captured by AlignRT system, which helps to monitor the patient intrafractional position variation and Couch non zero angles monitor as well.
- Treatment will be executed
- A Final CBCT will be acquired to confirm the treated position at last.

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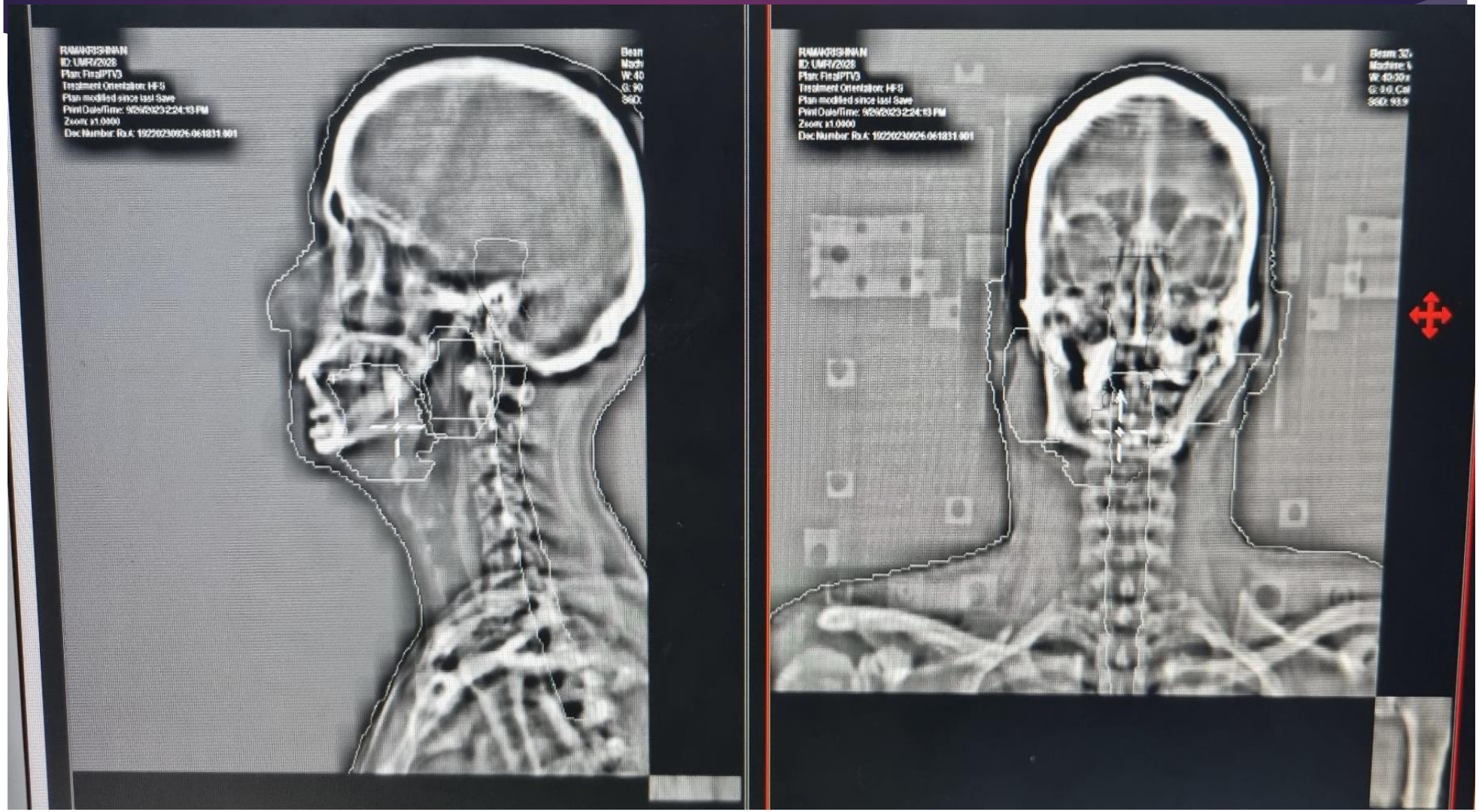
SET UP

- Fast, accurate
- Replace tattoo
- Automated couch corrections
- Reduce set up time and variability

Immobilization


SIM patient
ROI
Reference
Treatment
Couch 0.0°
Send to Couch
Beam Control
OFF
3
0.30
-0.30


RAMAKRISHNAN
ID: UMRV2028
Plan: FinalPTV3
Treatment Orientation: HFS
Plan modified since last Save
Print Date/Time: 9/26/2023 2:24:13 PM
Zoom: x1.0000
Doc Number: Rx A: 1922023092606183 1.001
RAMAKRISHNAN
ID: UMRV2028
Plan: FinalPTV3
Treatment Orientation: HFS
Plan modified since last Save
Print Date/Time: 9/26/2023 2:24:13 PM
Zoom: x1.0000
Doc Number: Rx A: 1922023092606183 1.001

Cone Beam CT (CBCT)


physicist
01_ABFinalPTV1 ISO 1
SGRT patient
ROI1
VRT cm 0.06
LNG cm 0.06
LAT cm -0.05
MAG cm 0.10
YAW° 0.0
ROLL° -0.0
PITCH° -0.1
Reference
Treatment
Couch 0.0°
Send to Couch
Beam Control OFF
Skin Tone
SSD
Report Screenshot
ROI Tools
Surface Display
Reset Surface
0.30
-0.30


LALITHA KUMARI KUCHIMANC, K
20/10/1952, UMRV7012
Treatment
physicist
01_ABFinalPTV1 ISO 1
CT SIM patient
BreastRt
VRT cm -0.13
LNG cm -0.05
LAT cm -0.35
MAG cm 0.38
YAW° 0.2
ROLL° 2.7
PITCH° -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
17.0 fps
Field Status


Selected
Zoom: 62%
ID: UMRV5917
Plan: FinalPTV1
Treatment Orientation: HF-S
Plan Save Date/Time: 10/5/2022 1:14:12 PM
Print Date/Time: 10/6/2022 1:20:59 PM
Zoom: x1.0000
Doc Number: RxA: 19220221006.130742.000
Not Selected
Zoom: 62%
ID: UMRV5917
Plan: FinalPTV1
Treatment Orientation: HF-S
Plan Save Date/Time: 10/5/2022 1:14:12 PM
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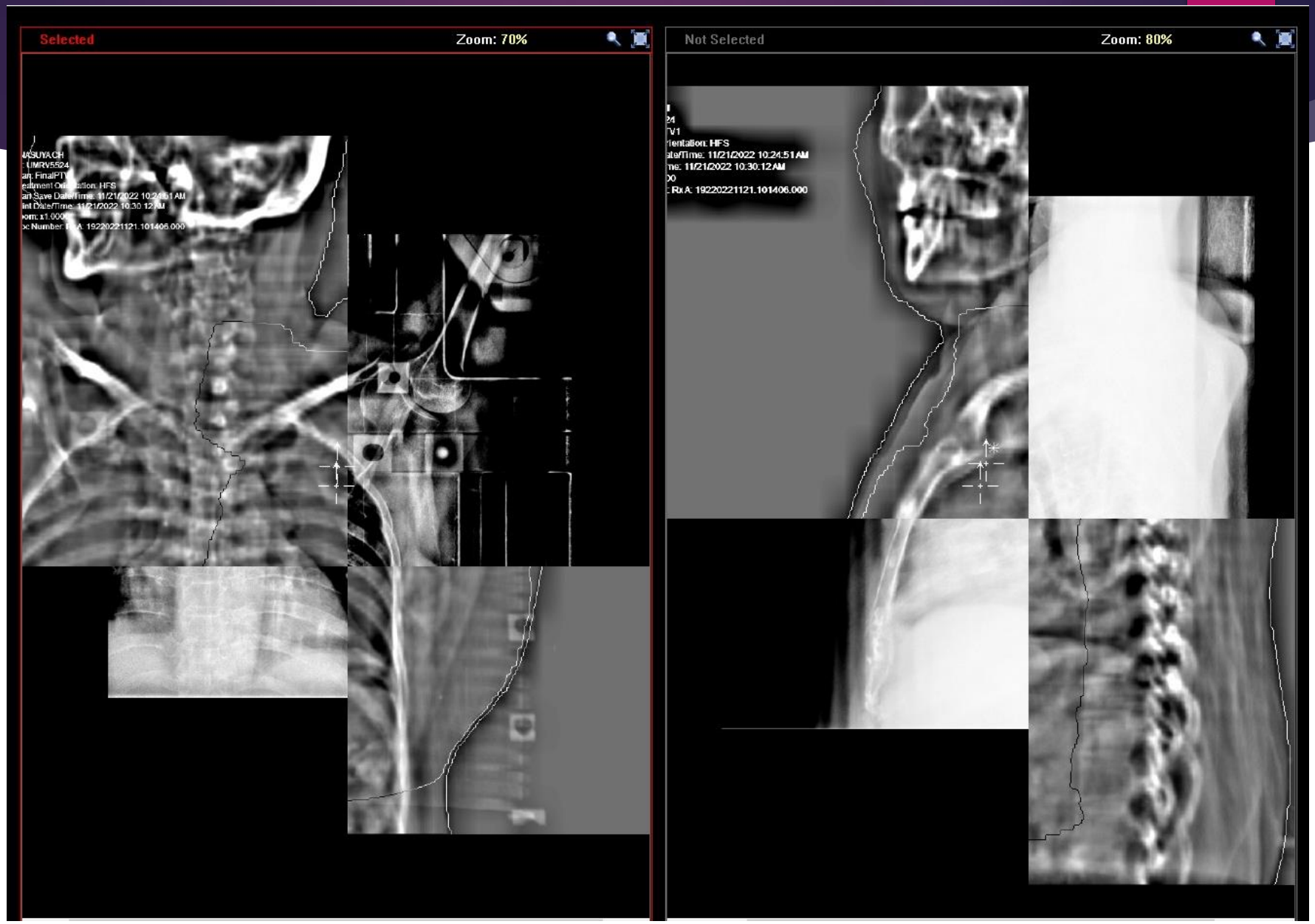
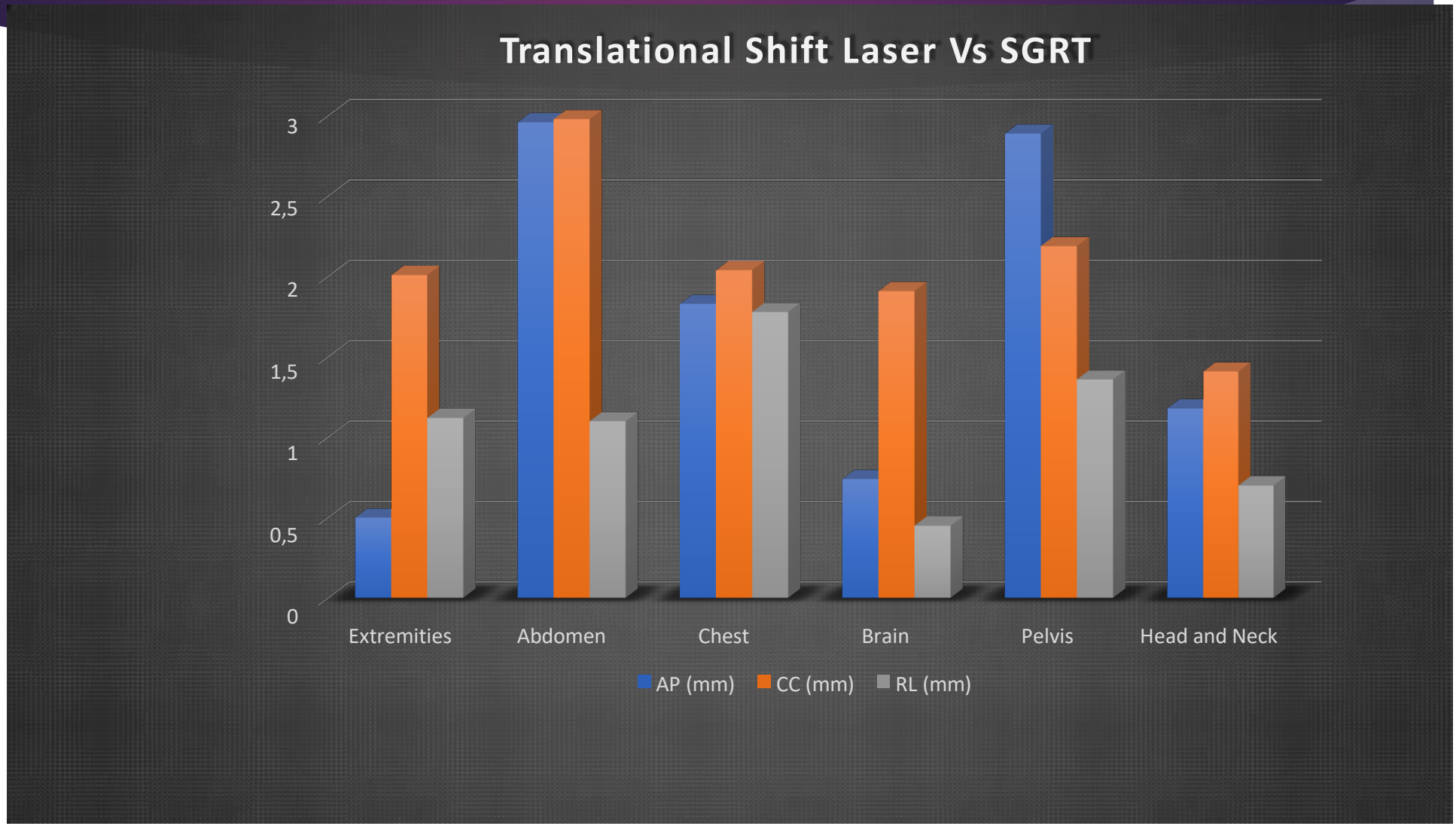
Zoom: x1.0000
Doc Number: RxA: 19220221006.130742.000

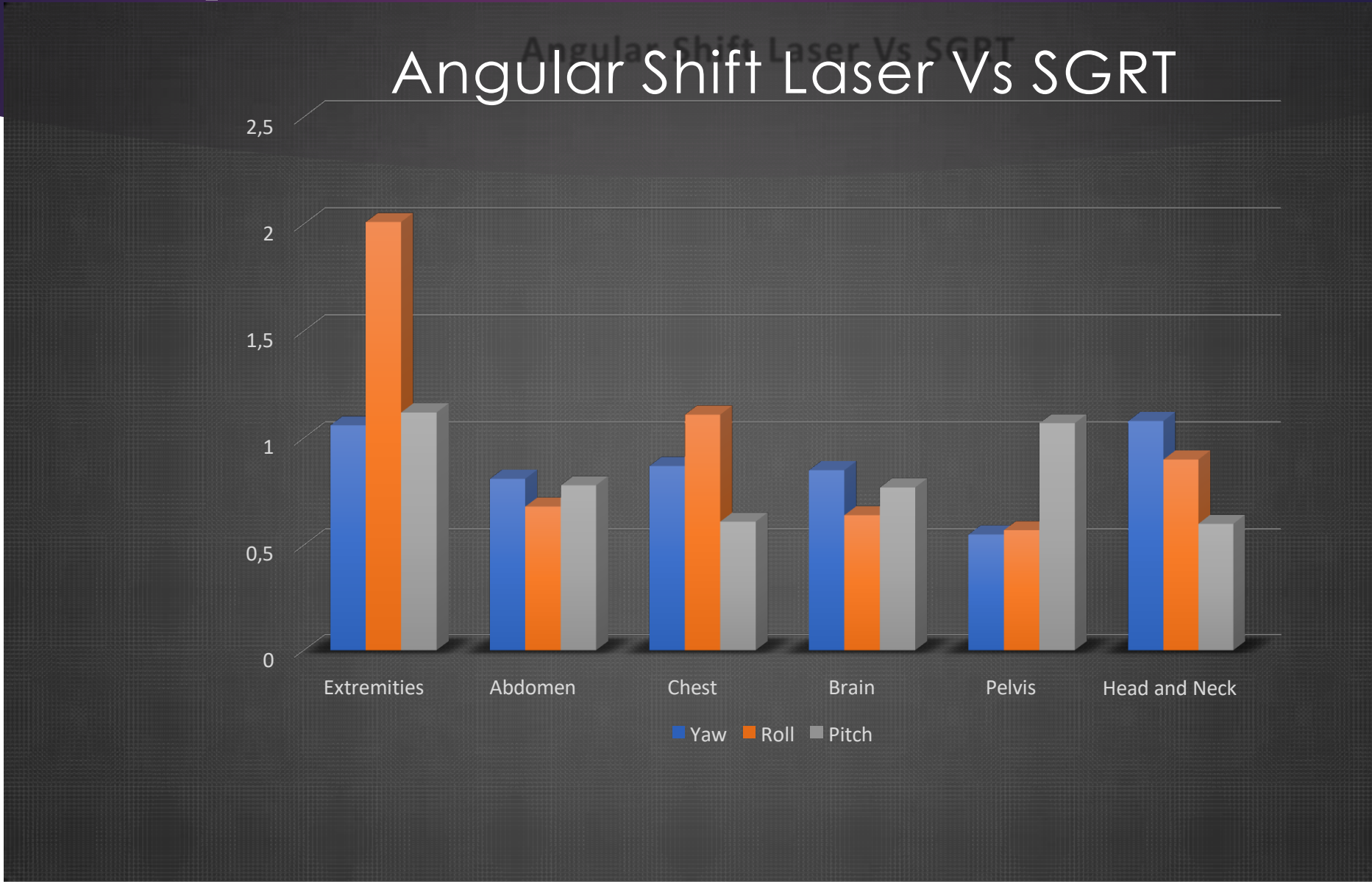

Selected
Zoom: 70%
Not Selected
Zoom: 80%

- SGRT can reduce set up time
- SGRT can reduce number of images

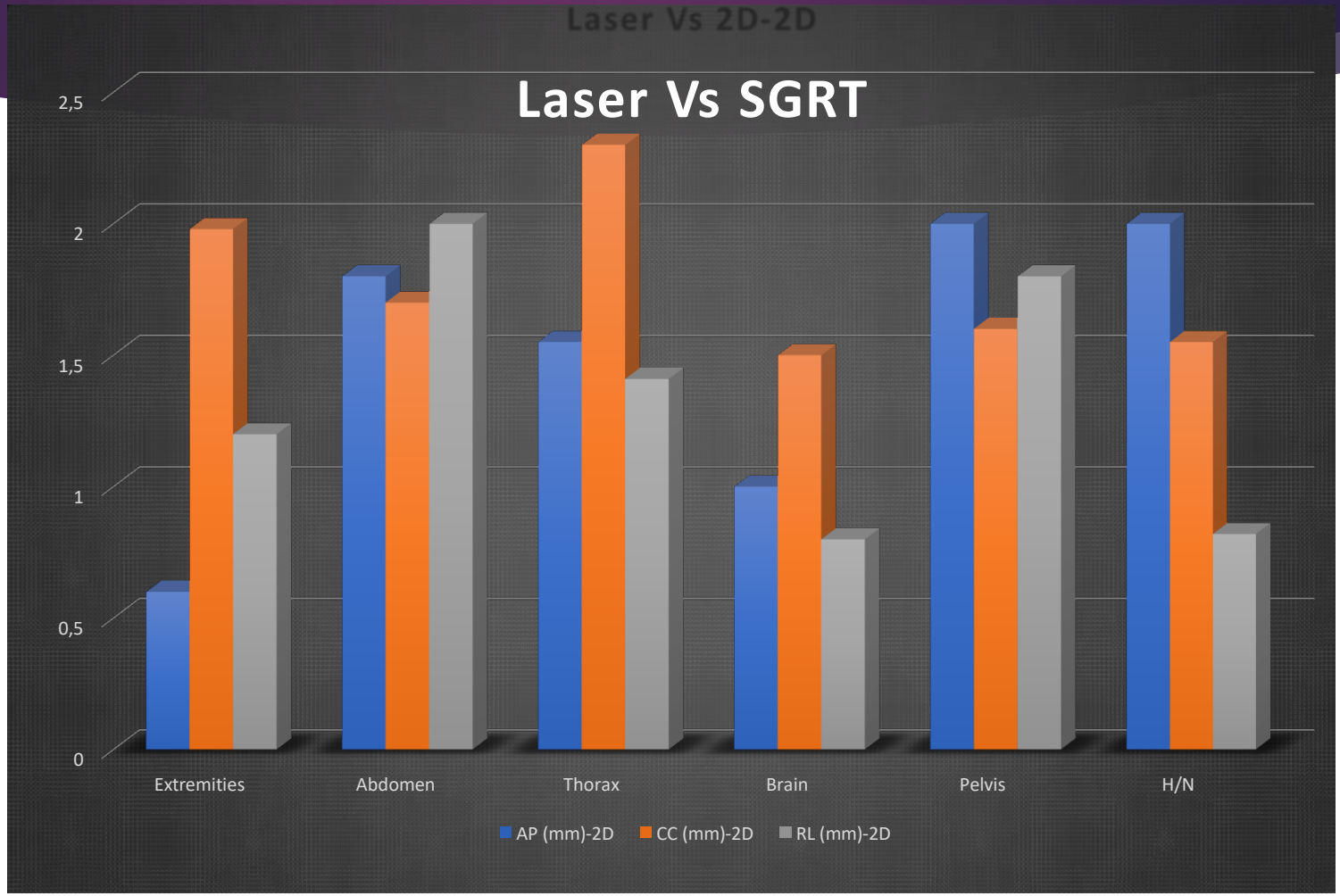
Bar Chart of Site Specific Translational positional errors



Bar Chart of Site Specific Angular positional errors



Bar Chart of Site-Specific Laser Vs 2D-2D Imaging positional errors



Motion Management

- Real –time monitoring of patient movement
- Intrafractional motion detection (breast, lung)
- Respiratory gating like DIBH

- **Respiratory motion affects all tumor sites in the thorax, abdomen.**

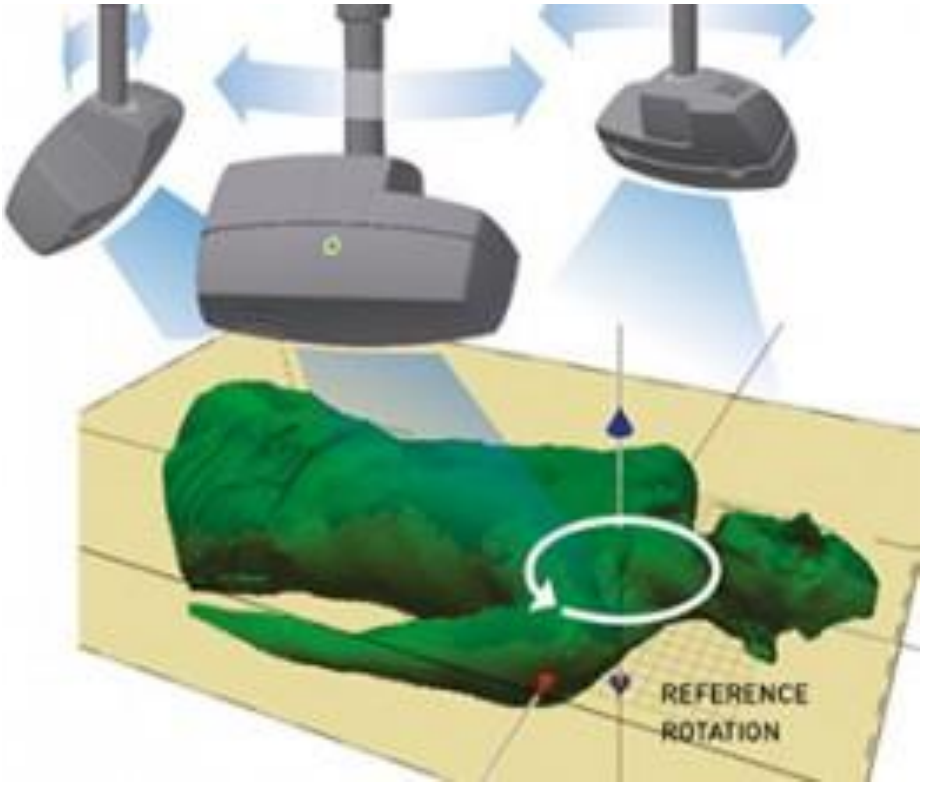
- **Tumors in the lung, liver, pancreas, breast, and other neighboring sites are known to move due to respiration.**

- **Lung tumors can move several centimeters in any direction during irradiation.**

- **Lung tumor motion is independent of tumor size, tumor location, and pulmonary function .**

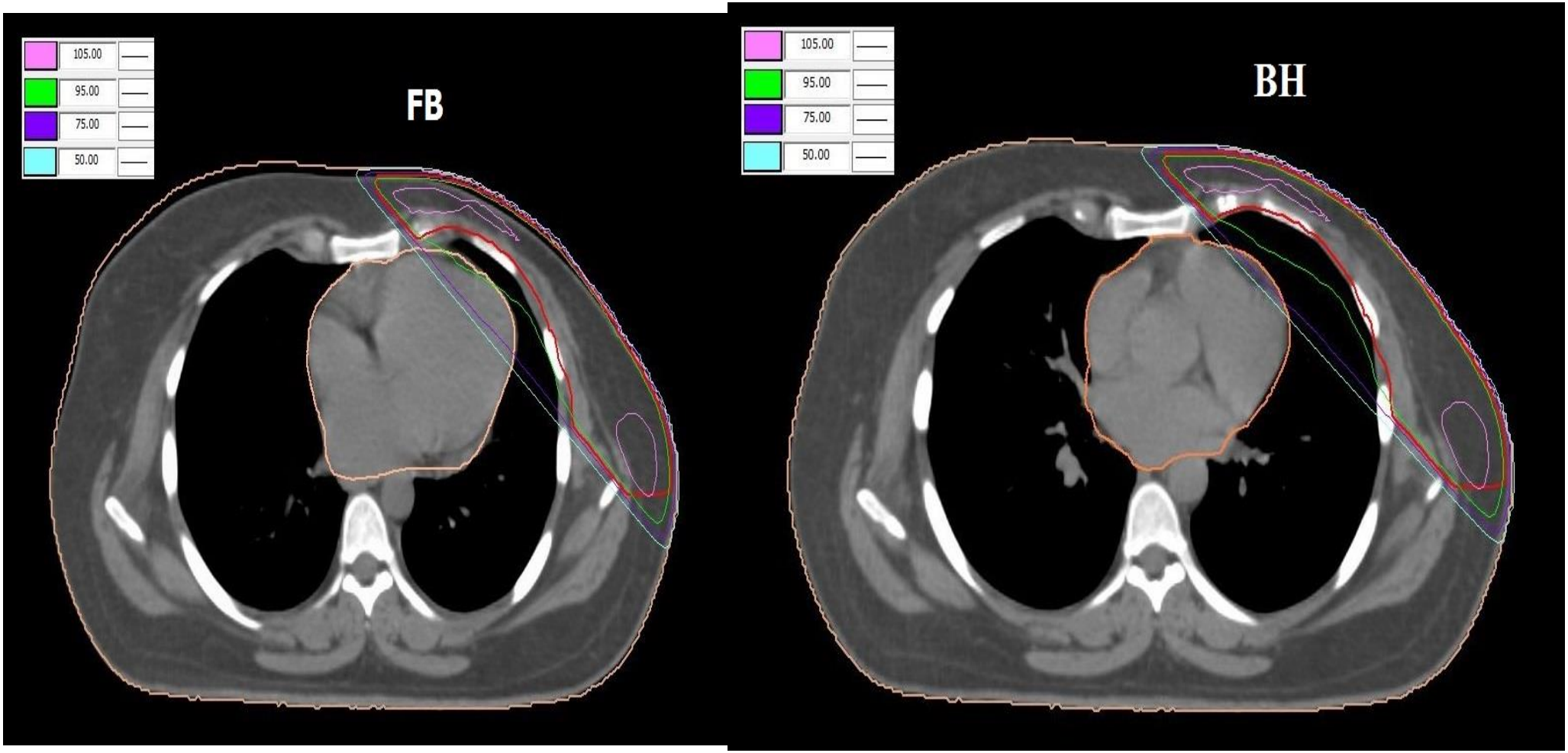
- There are several types of breath-hold techniques available for reducing motion for lung or breast tumors.

- Breath-hold techniques often result in creating a larger separation between the chest wall and the heart
- which can be advantageous in treatments of the breast or chest wall.


REFERENCE
ROTATION

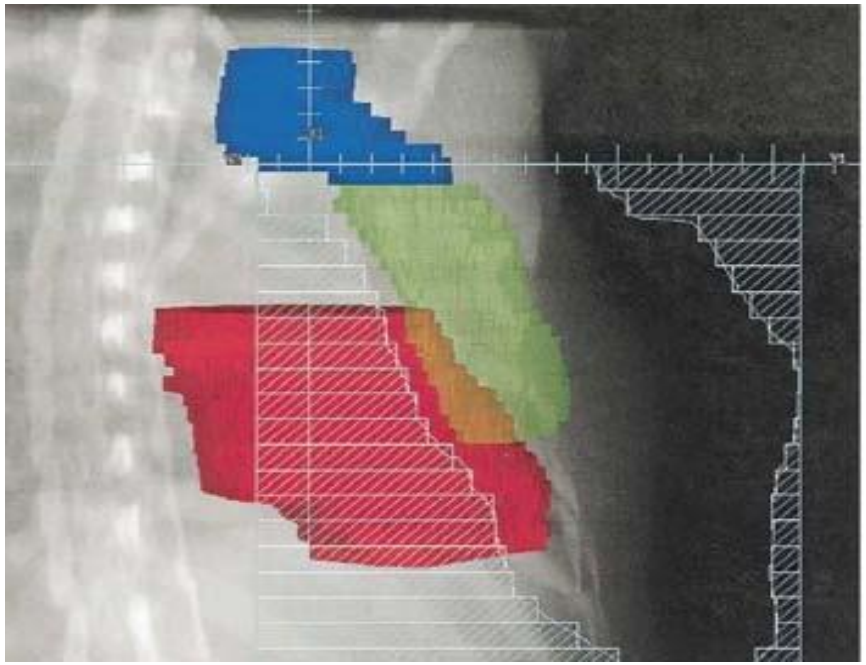
DIBH

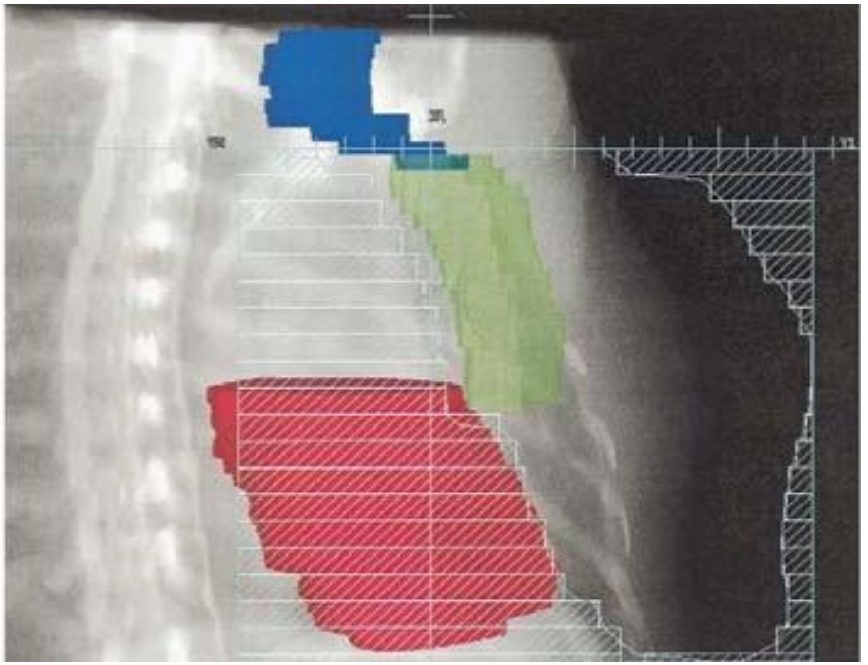
- For DIBH planning patient need to undergo both Free Breathing(FB) and Breath Hold(BH) CT.
- FB CT's body structure will be used for patient positioning purpose
- BH CT's body structure will be used for treatment purpose with proper well defined ROI and threshold


105.00
95.00
75.00
50.00
FB
105.00
95.00
75.00
50.00
BH

ADVANTAGES OF DIBH

- Freeze organ/ tumor motion
- Separate heart from target (breast, IMN)
- Increase total lung volume



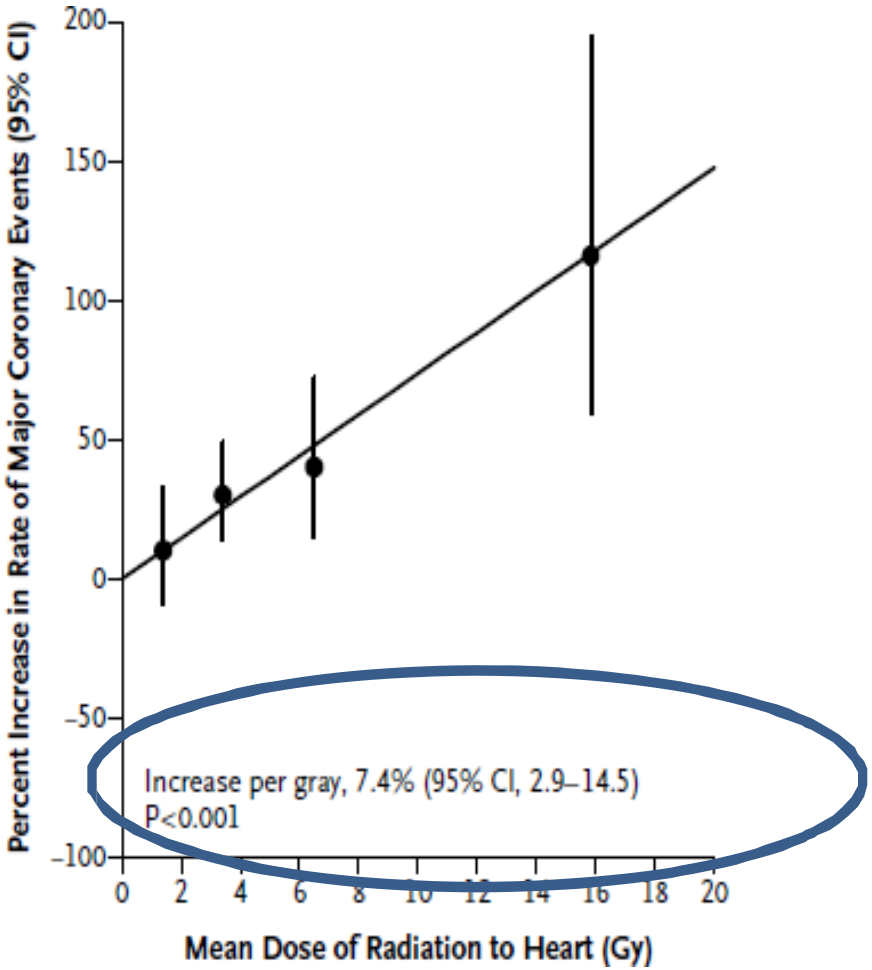


The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 MARCH 14, 2013 VOL. 368 NO. 11

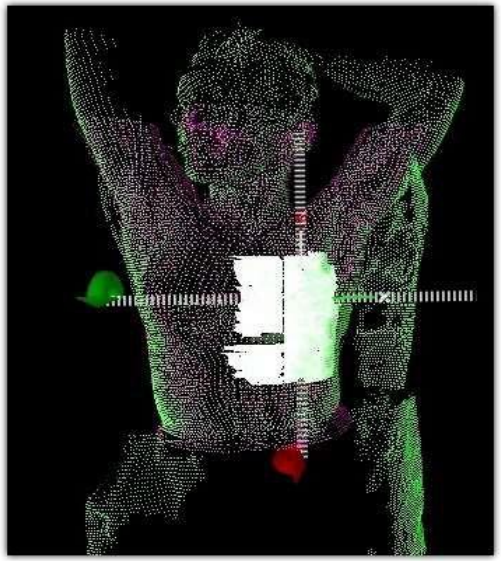
Risk of Ischemic Heart Disease in Women after Radiotherapy for Breast Cancer

- Population-based study in Sweden & Denmark
- Breast RT from 1958-2001:
  - 963 major coronary events
  - 1205 controls
- Heart dose estimated:
  - " CT scan of a woman with typical anatomy"




Versa HD

Treatment Capture for adjusting patient position in Free Breath



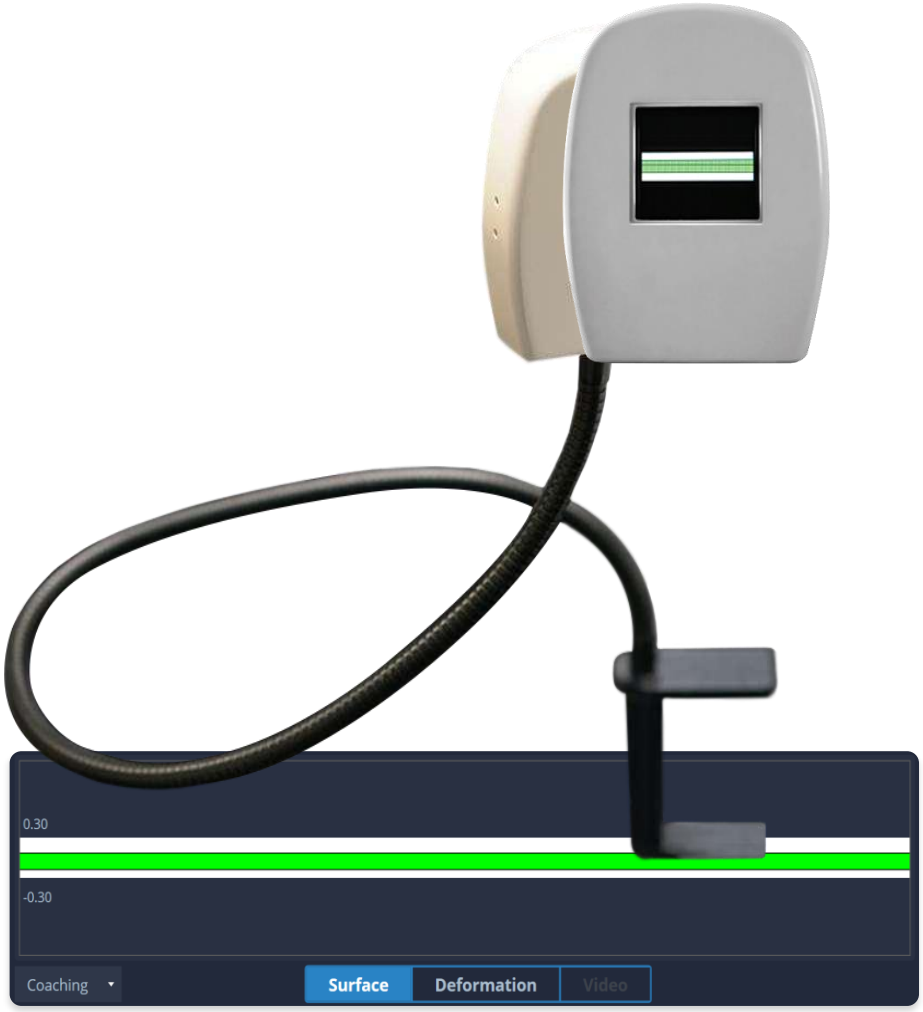
Monitoring Patient

- Real time patient 6D delta shift can be viewed through this monitoring option.

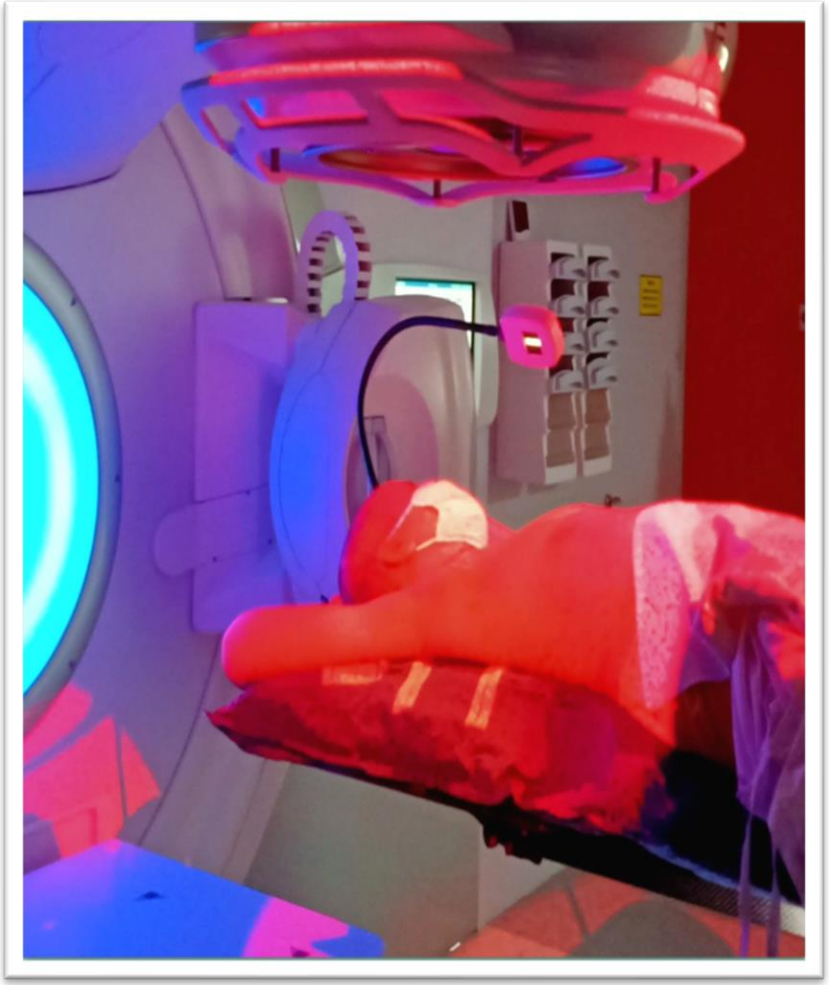
- We can enable the Beam Hold option during patient monitoring with appropriate thresholds which really helps for the non cooperative and pediatric patients.

- Even for Non Co planner Beams we can monitor the patient in a very precise way **(0.1mm & 0.1 Degree).**

Real Time Coach (RTC)



Real Time Coach




alignrt®
JHANSILAKSHMI, P (Female) DOB: 1-Jan-1968
UMRV1317
User: physicist (Physicist)
Version 5.1.2
Patient
Chest wall
APlan15 (4.03 ,-7.56 ,0.58
Site/Isocentre
CHEST BH
VRT
Field/Reference
Settings
Reference Capture
Threshold Edit Mode
Initial Setup
Mid
Skintone
Monitoring
0.0
Couch Rotation
Default ROI
ROI Selection
Move Couch
Edit ROI
Surface Tools
ON
Gate Beam
VRTcm -0.11
LNGcm -0.10
LATcm 0.20
MAGcm 0.26
YAW° -0.4
Roll° 0.5
Pitch° -0.4
Beam ENABLED
Continuous Real-Time Deltas (3D manipulation locked)
Magnitude (cm)
Magnitude
Frame Rate: 4.4
Time (s)
Monitoring patient movement...
MOSAIQ
IEC 61217
visionrt
ASUS


alignrt®
JHANSILAKSHMI, P (Female) DOB: 1-Jan-1968
UMRV1317
User: physicist (Physicist)
Version 5.1.2
Chest wall
APlan15 (4.03 ,-7.56 ,0.58
Site/Isocentre
CHEST BH
VRT
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Settings
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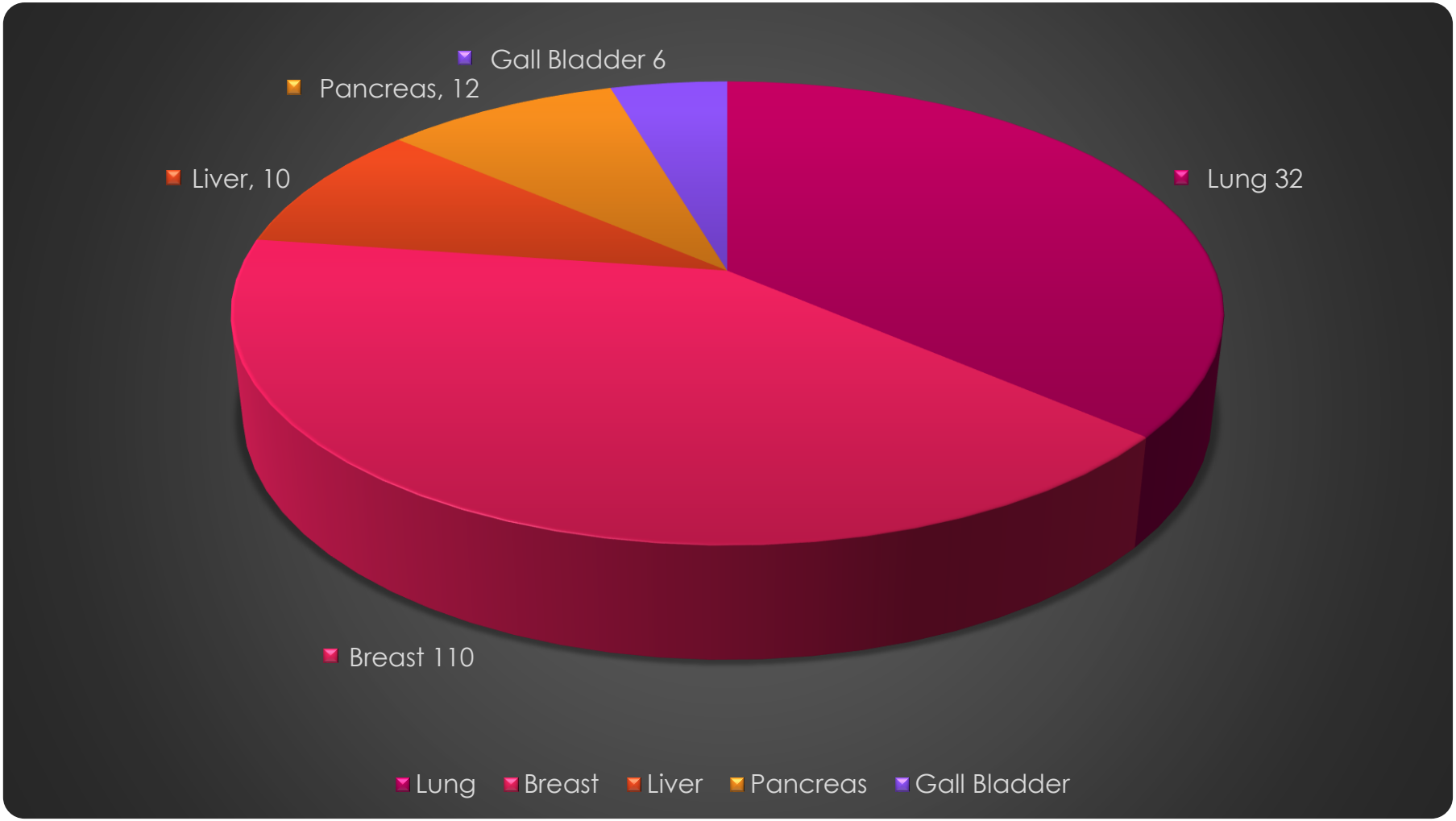
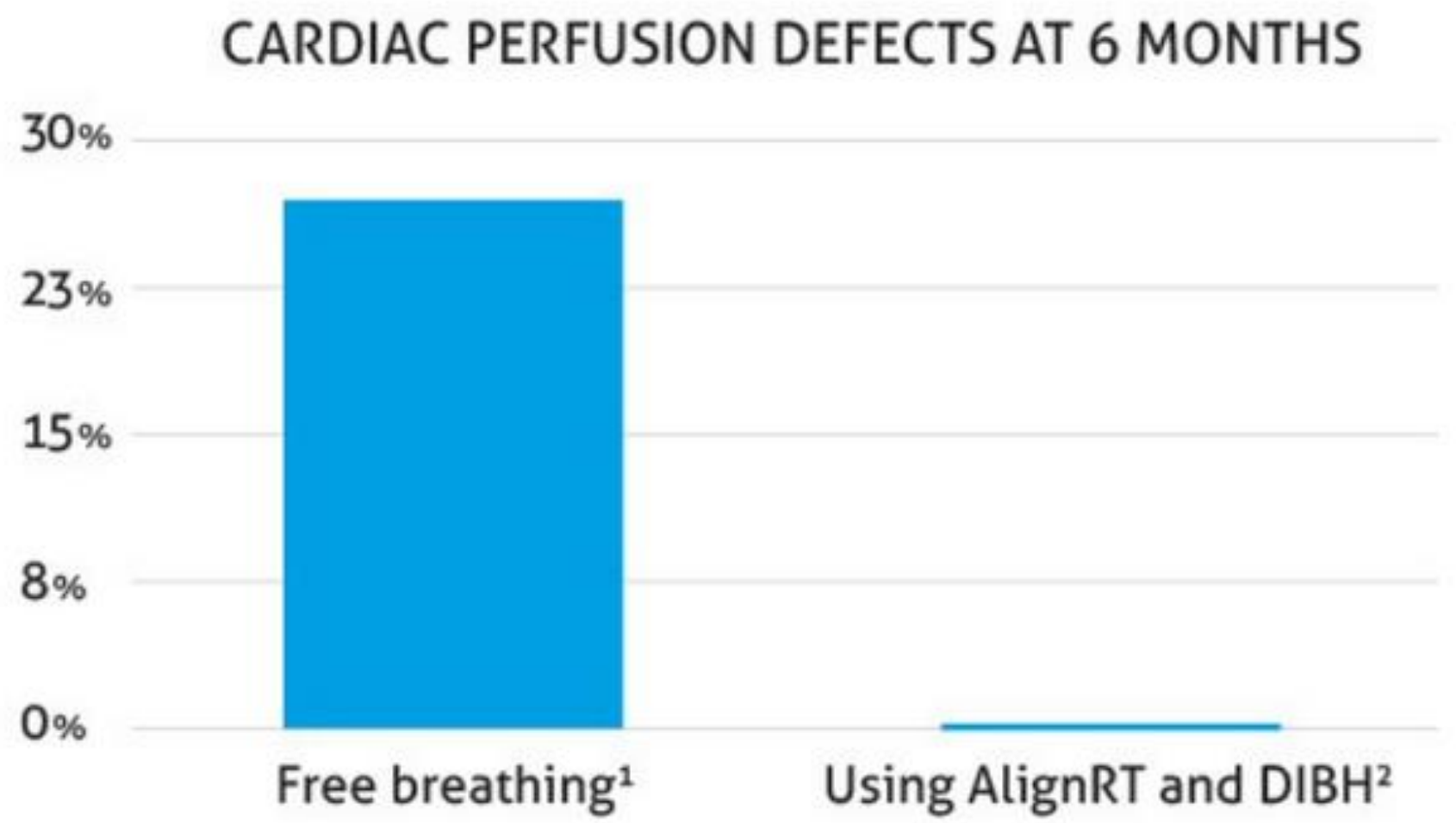
Threshold Edit Mode
Initial Setup
Mid
Skintone
Patient
Monitoring
0.0
Couch Rotation
Default ROI
ROI Selection
Move Couch
Edit ROI
Surface Tools
ON
Gate Beam
Beam ENABLED
VRTcm -0.01
LNGcm 0.00
LATcm 0.23
MAGcm 0.23
YAW° -0.6
Roll° 0.8
Pitch° -1.2
Continuous Real-Time Deltas (3D manipulation locked)
Coaching
Monitoring patient movement...
Frame Rate: 4.0
MOSAIQ
IEC 61217
ASUS

DIBH Patients




CARDIAC PERFUSION DEFECTS AT 6 MONTHS
30%
23%
15%
8%
0%
Free breathing[1]
Using AlignRT and DIBH[2]

Cardiac and lung sparing Radiotherapy in Breast and chest wall irradiation with SGRT DIBH technique

1.Bellala Ravi Shankar, 2. Tulika Tyagi, 3.Ananda Krishnan Kuppusamy, 4. Venkata Madhavi Bellala,
5. Kasipeta Sowjanya, 6. Surendhiran Manoharam, 7. Prithviraj Bellala,8. Rishik Bellala, 9. Trilochan sha.

Head of clinical Oncology, Omega hospital, Health City, Arilova, Visakhapatnam-530040, Andhra Pradesh, India

ABSTRACT

Breast cancer is the commonest cancer among women requires multimodality treatment including adjuvant radiotherapy for better loco regional control. Long term toxicity to heart following chemotherapy especially anthracyclines and Trastuzumab is inescapable.The adjuvant radiotherapy escalates the morbidity and damage caused by chemotherapy. It is necessary to reduce long term toxicity for better survival with reduced morbidity. Deep inspiratory breath-hold technique is a state of art technique for reducing heart doses without compromising target coverage. The technique permits less dose to the heart and ipsilateral lung.Our study explores the benefit of using DIBH with SGRT in left sided breast cancer radiotherapy

OBJECTIVES

To evaluate dosimetric advantage, feasibility, and improvement in patient positioning by using SGRT with deep inspirational breath-hold (DIBH) technique over free breathing (FB) technique for reducing cardiac and ipsilateral lung dose in breast irradiation

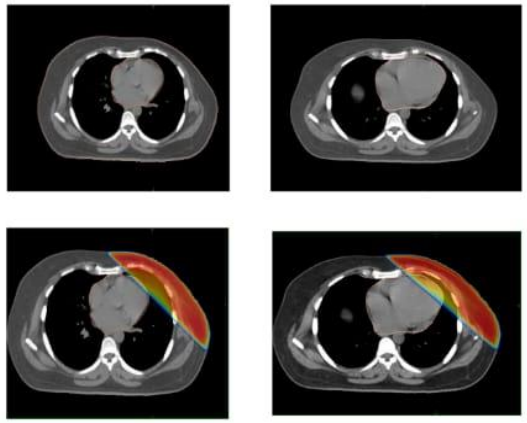
MATERIALS AND METHODS

Ninety-Eight patients with left breast cancer including chest wall and whole intact breast received adjuvant radiotherapy were studied in this study. The target volumes (chest wall, axilla and supraclavicular region), including organs at risk (OARs, ipsilateral and contra lateral lung, heart and contra lateral breast) were delineated as per the RTOG (Radiation Therapy Oncology Group) contouring guidelines. The mono isocentric Forward IMRT (fields in the field) treatment plans were generated with the Monaco Treatment Planning System (ELEKTA Medical Systems) for both FB and DIBH images, doses to the target volume, OARs and patient's positional shifts with three point laser and Align RT (VisionRT) surface guided RT were compared.

RESULTS

Among Ninety-Eight enrolled patients, average Dmean, V5%, V10%, V30% to heart with DIBH is 6.27 Gy, 33.04 Gy, 19.49 Gy, 3.85Gy respectively. Average Dmean, V5%, V10%, V30% to heart with free breathing is 8.87Gy, 42.2 Gy, 29.9 Gy, 4.9Gy. which shows a statistically significant reduction in dose delivered to heart by using DIBH technique. Average dose to lung in terms of V30 Gy, V20Gy, V12Gy, V5Gy with DIBH is observed to be 24.38%, 28.9%, 36.51%, 48.98% respectively. While using FB technique lung doses in terms of V30 Gy, V20Gy, V12Gy, V5Gy with DIBH is observed to be 27.86%, 32.74, 37.58, 49.45 respectively. With DIBH dose received by lung was significantly lower than in FB.

DIBH **FB**



DISCUSSION

Techniques of radiotherapy have improved over the years in an attempt to decrease doses to OARs and thereby reduce the probability of complications. The respiratory, cardiac, and gastrointestinal systems affect the movement of the target during radiotherapy, among which respiratory motion has a significant effect on intra- and interfractional treatment delivery. DIBH technique is one of the most effective and reproducible methods.DIBH with SGRT results in improving patient positioning accuracy, monitoring and correcting intrafraction motion, detecting anatomic changes which leads to more accurate treatment delivery to Target volume and less dose to OARS.

CONCLUSIONS

Surface guided radiotherapy helps in precise positioning and patient monitoring which aims at more accurate treatment delivery. DIBH with SGRT is an excellent heart sparing technique in breast radiotherapy. It results in significant reduction in doses to lungs and heart.

REFERENCES

1. Lee HY, Chang JS, Lee IJ, Park K, Kim YB, Suh CO, Kim JW, Keum KC: The deep inspiration breath hold technique using Abches reduces cardiac dose in patients undergoing left-sided breast irradiation. Radiat Oncol J 2013;31:239–246
2. Rochet N, Drake J-I, Harrington K et al. Deep inspiration breathhold technique in left-sided breast cancer radiation therapy: evaluating cardiac contact distance as a predictor of cardiac exposure for patient selection. Pract Radiat Oncol 2015;5:e127–34.
3. Dell'Oro M, Giles E, Sharkey A et al. A retrospective dosimetric study of radiotherapy patients with left-sided breast cancer; patient selection criteria for deep inspiration breath hold technique. Cancers (Basel) 2019;11:259.
4. Latty D, Stuart K-E, Wang W et al. Review of deep inspiration breath-hold techniques for the treatment of breast cancer. J Med Radiat Sci 2015;62:74–81.
5. Tanguturi S-K, Lyatskaya Y, Chen Y et al. Prospective assessment of deep inspiration breath-hold using 3-dimensional surface tracking for irradiation of left-sided breast cancer. Pract Radiat Oncol 2015;5:358–65

SGRT-SRS-Delivery

Position Patient using AlignRT to Reduce Rotations and Translations

↓

Acquire CBCT to Assess Patient Position

↓

Adjust Patient Position with Hexapod based on CBCT Registration

↓

Acquire 2nd CBCT to verify the applied 6D shift

↓

Acquire a New AlignRT Reference in the Current Treatment Position

↓

Monitor Patient Motion with AlignRT for all the beams

↓

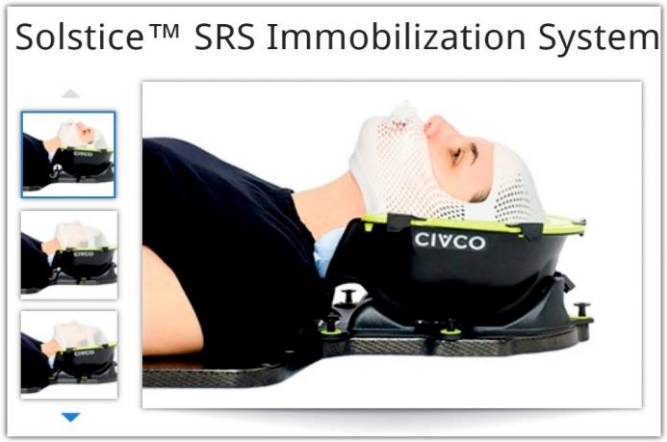
Acquire 3rd CBCT to verify the patients remains in the same position

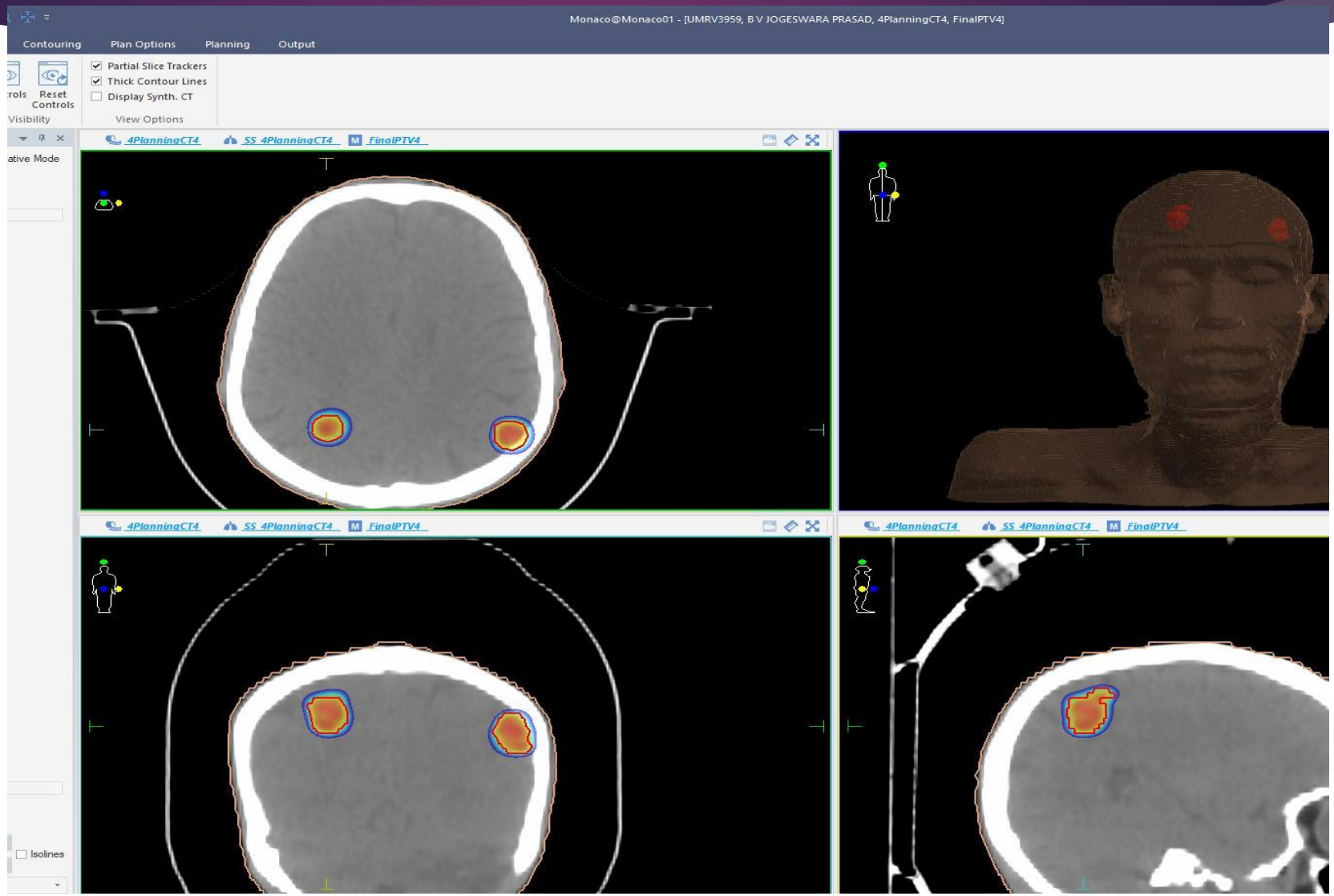
Immobilization for SRS/SRT

- **Solstice SRS immobilization device will be attached to the iBeam overlay adapter**
- **Customizable Cushion/ Aqua foam will be placed within solstice after few sprays of water and followed by squeezing to make the foam material uniform.**
- **Cushion will take the shape of the patient head and solstice inside shape as well in few minutes.**

Immobilization for SRS/SRT

- **Precise Bite (Mouth Bite) attaches easily to the thermoplastic cast and conforms to the teeth and/or maxilla to aid in effective and repeatable positioning.**
- **Clear Vision SRS thermoplastic cast taken out from the water bath and place it over the patient face by leaving proper opening space on the forehead for creating ROI.**

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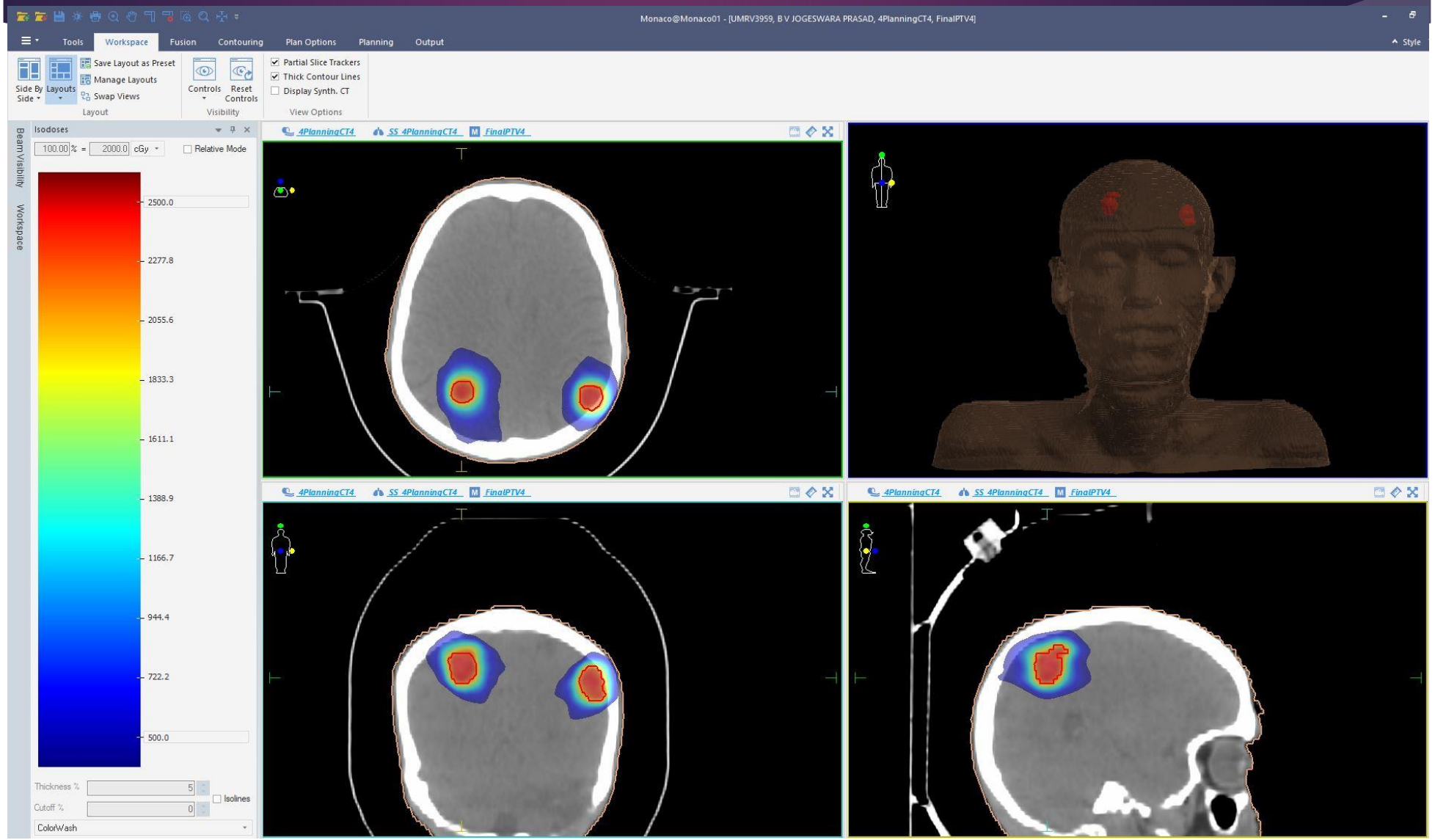
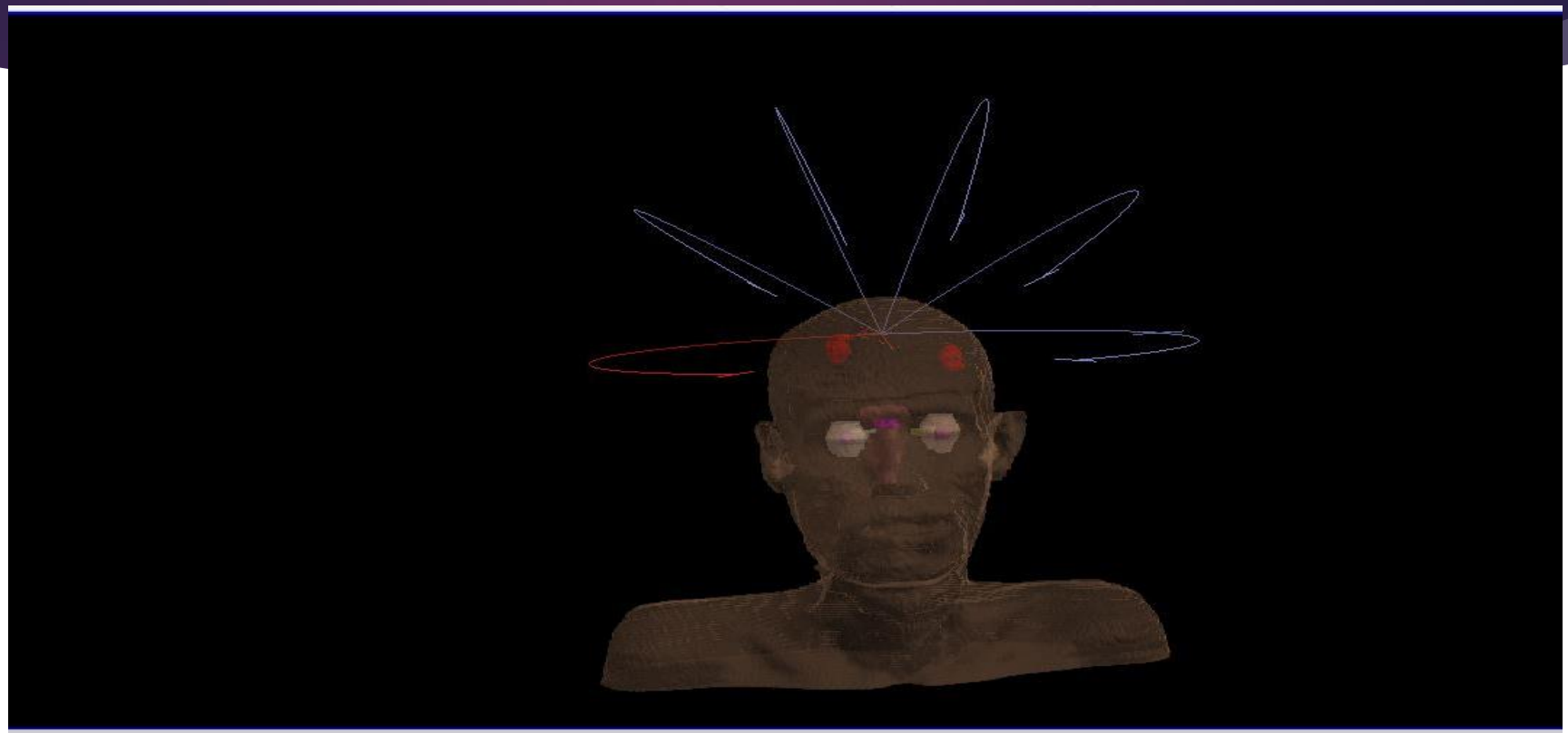
Contouring
Plan Options
Planning
Output
Partial Slice Trackers
Thick Contour Lines
Display Synth. CT
Reset Controls
View Options
4PlanningCT4
SS 4PlanningCT4
FinalPTV4
Isolines


Monaco@Monaco01 - [UMRV3959, B V JOGESWARA PRASAD, 4PlanningCT4, FinalPTV4]
Tools
Workspace
Fusion
Contouring
Plan Options
Planning
Output
Style
Side By Side
Layouts
Save Layout as Preset
Manage Layouts
Swap Views
Layout
Controls
Reset Controls
Visibility
Partial Slice Trackers
Thick Contour Lines
Display Synth. CT
View Options
Beam Visibility
Workspace
Isodoses
100.00 % = 2000.0 cGy
Relative Mode
2500.0
2277.8
2055.6
1833.3
1611.1
1388.9
1166.7
944.4
722.2
500.0
Thickness %
Cutoff %
Isolines
ColorWash
4PlanningCT4
SS 4PlanningCT4
FinalPTV4



lete Parent Beams

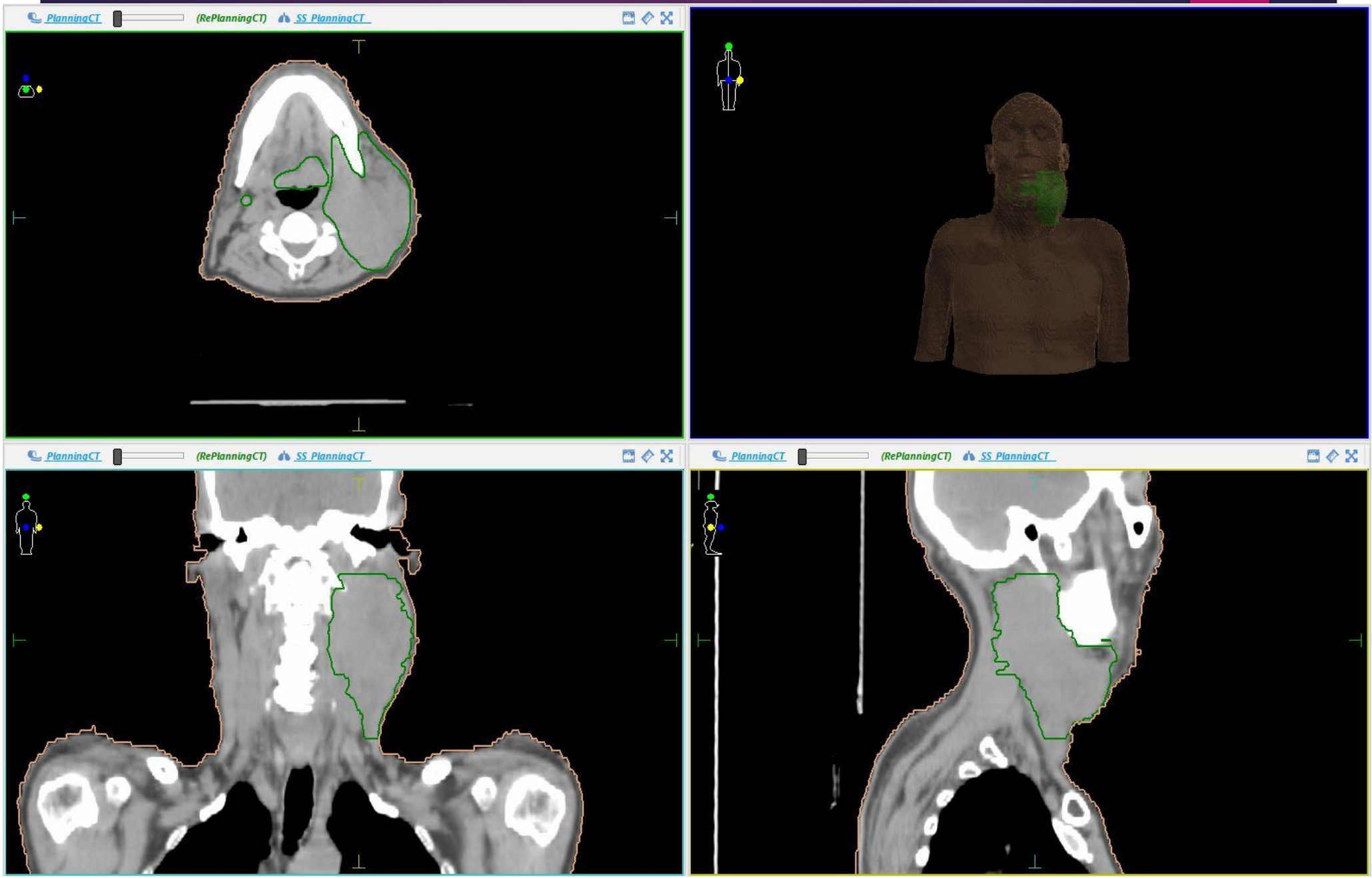
Field ID	Visible	Delivery	Treatment Unit	Modality	Algorithm	Energy	MU / Fx	SSD (cm)	Isocenter Location	X (cm)	Y (cm
ARC41	☑	VMAT	VersaHD	Photon	Monte Carlo	6.0 FFF	1119.17	95.89	Setup Reference Point	0.07	0.10
ARC42	☑	VMAT	VersaHD	Photon	Monte Carlo	6.0 FFF	969.99	90.65	Setup Reference Point	0.07	0.10
ARC43	☑	VMAT	VersaHD	Photon	Monte Carlo	6.0 FFF	1393.56	95.89	Setup Reference Point	0.07	0.10
ARC44	☑	VMAT	VersaHD	Photon	Monte Carlo	6.0 FFF	631.09	95.89	Setup Reference Point	0.07	0.10
ARC51	☑	VMAT	VersaHD	Photon	Monte Carlo	6.0 FFF	1025.25	95.89	Setup Reference Point	0.07	0.10
ARC52	☑	VMAT	VersaHD	Photon	Monte Carlo	6.0 FFF	1028.99	95.89	Setup Reference Point	0.07	0.10
ARC53	☑	VMAT	VersaHD	Photon	Monte Carlo	6.0 FFF	1324.13	95.89	Setup Reference Point	0.07	0.10
ARC54	☐	VMAT	VersaHD	Photon	Monte Carlo	6.0 FFF	528.56	93.29	Setup Reference Point	0.07	0.10

<click to add a new beam>

SRS CBCT Vs AlignRT Shifts

	Lat	Long	Ver	Pitch	Yaw	Roll
CBCT-1	0.1	0.14	0.13	0.34	0.71	0.51
Dicom Vs VRT	0.04	0.07	0.1	0.31	0.6	0.61
CBCT-2	0	0	0	0	0	0
CBCT-3	0	0	0	0	0	0

Adaptive Radiotherapy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SS PlanningCT
PlanningCT
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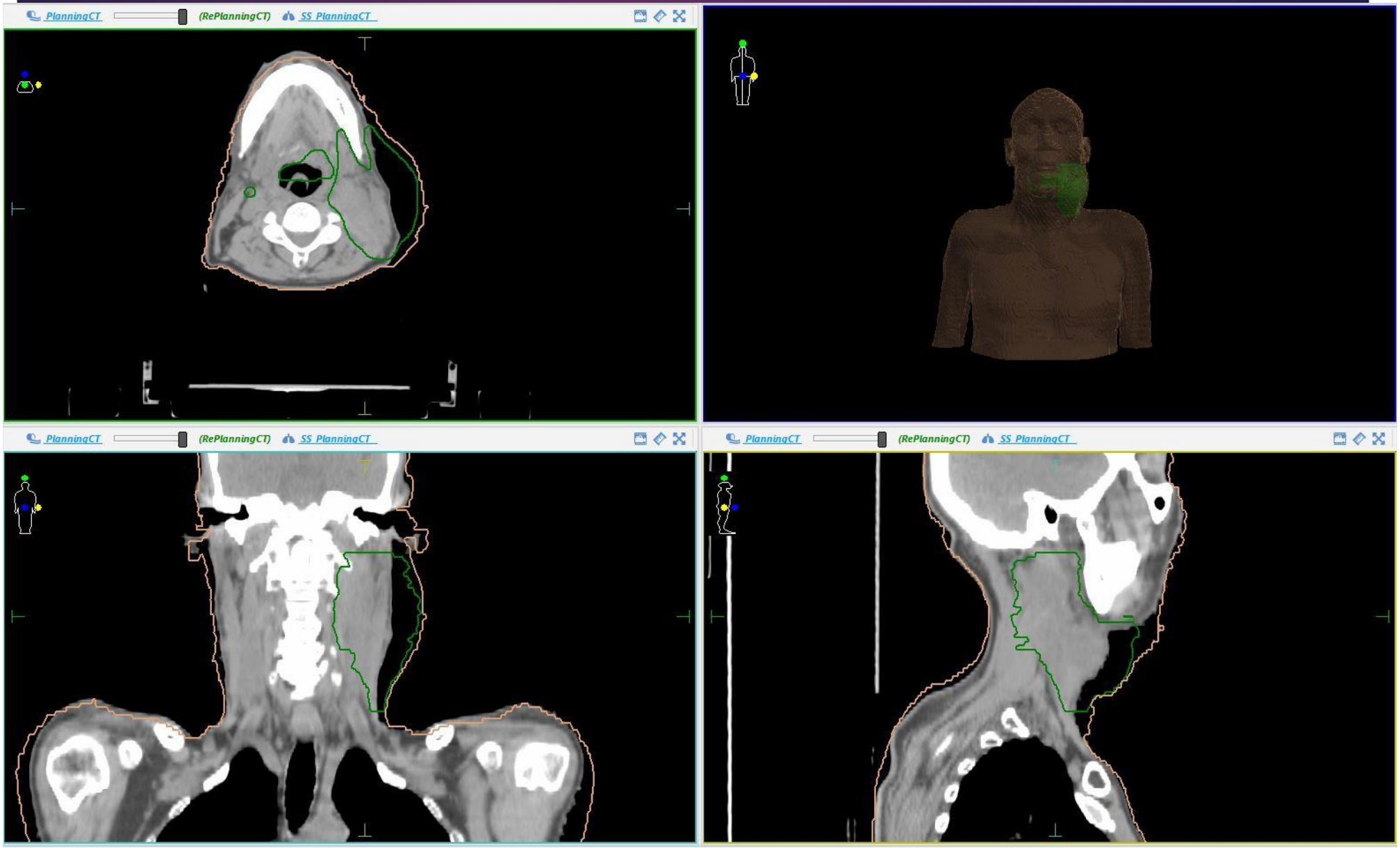
SS PlanningCT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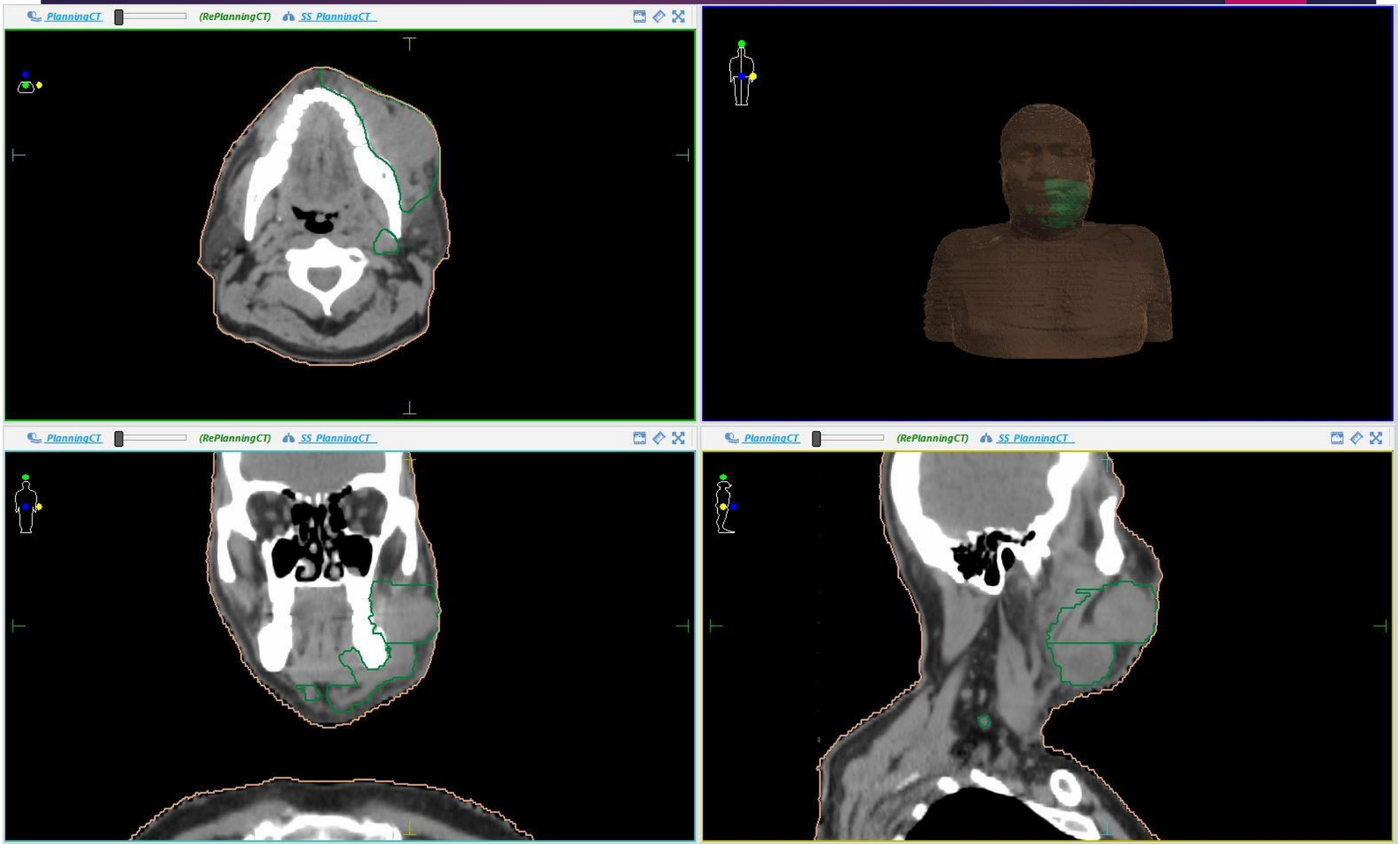
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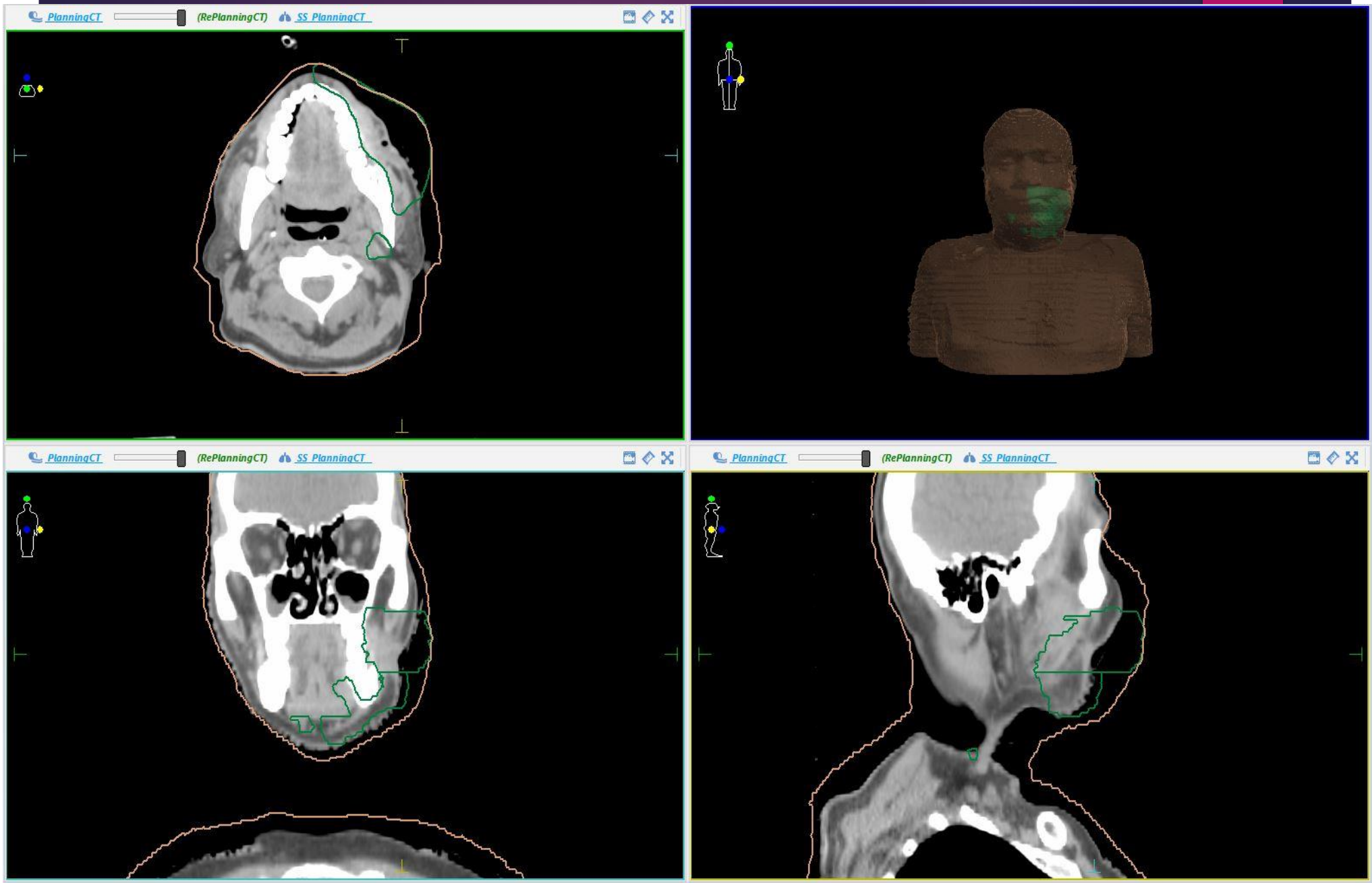
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PlanningCT
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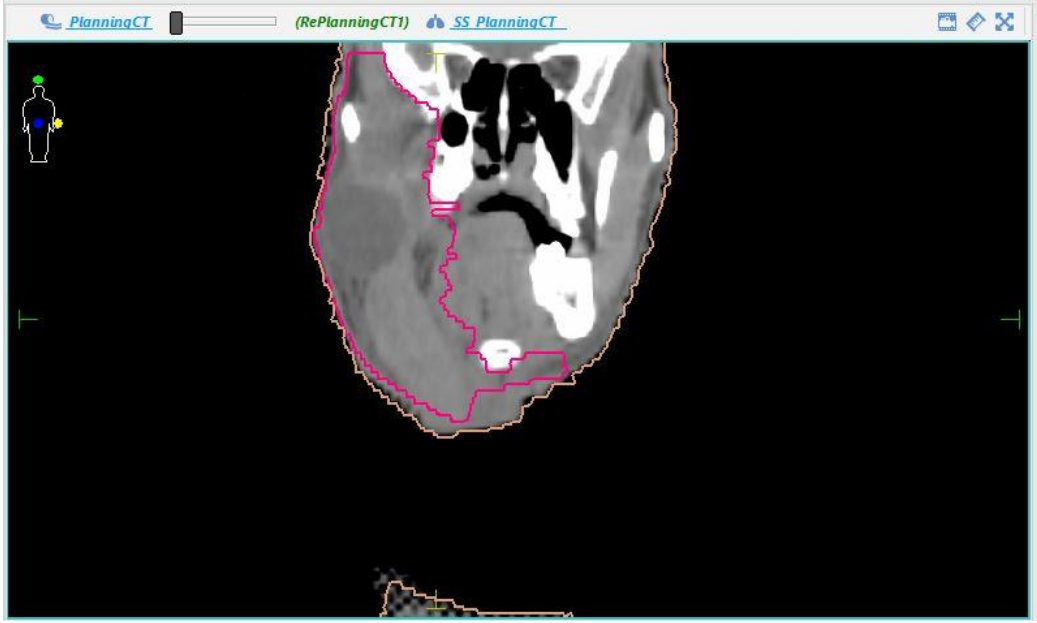
SS PlanningCT


PlanningCT
(RePlanningCT1)
SS PlanningCT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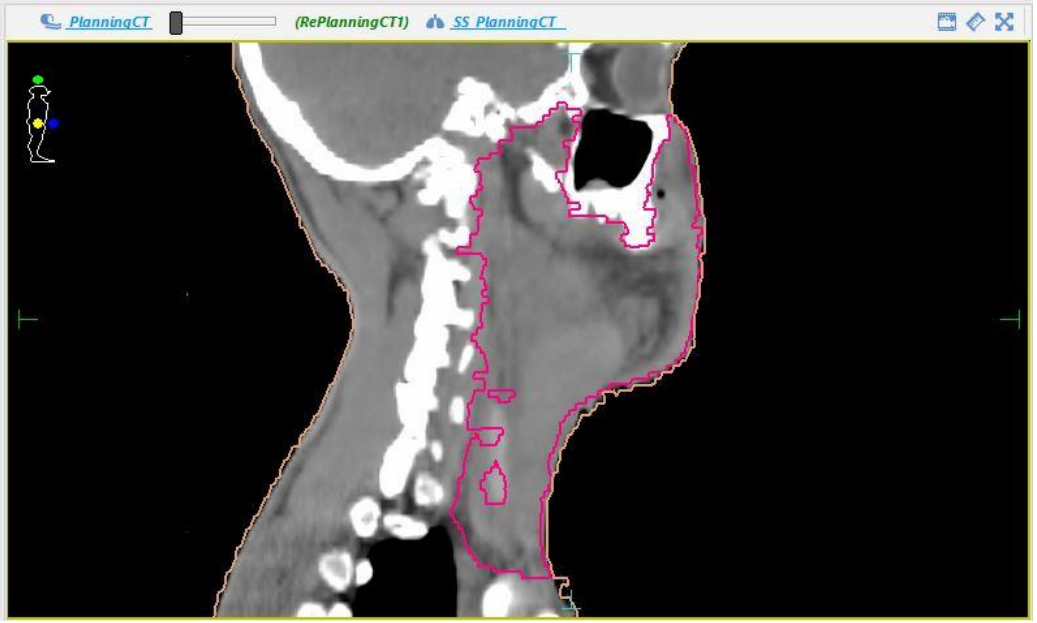
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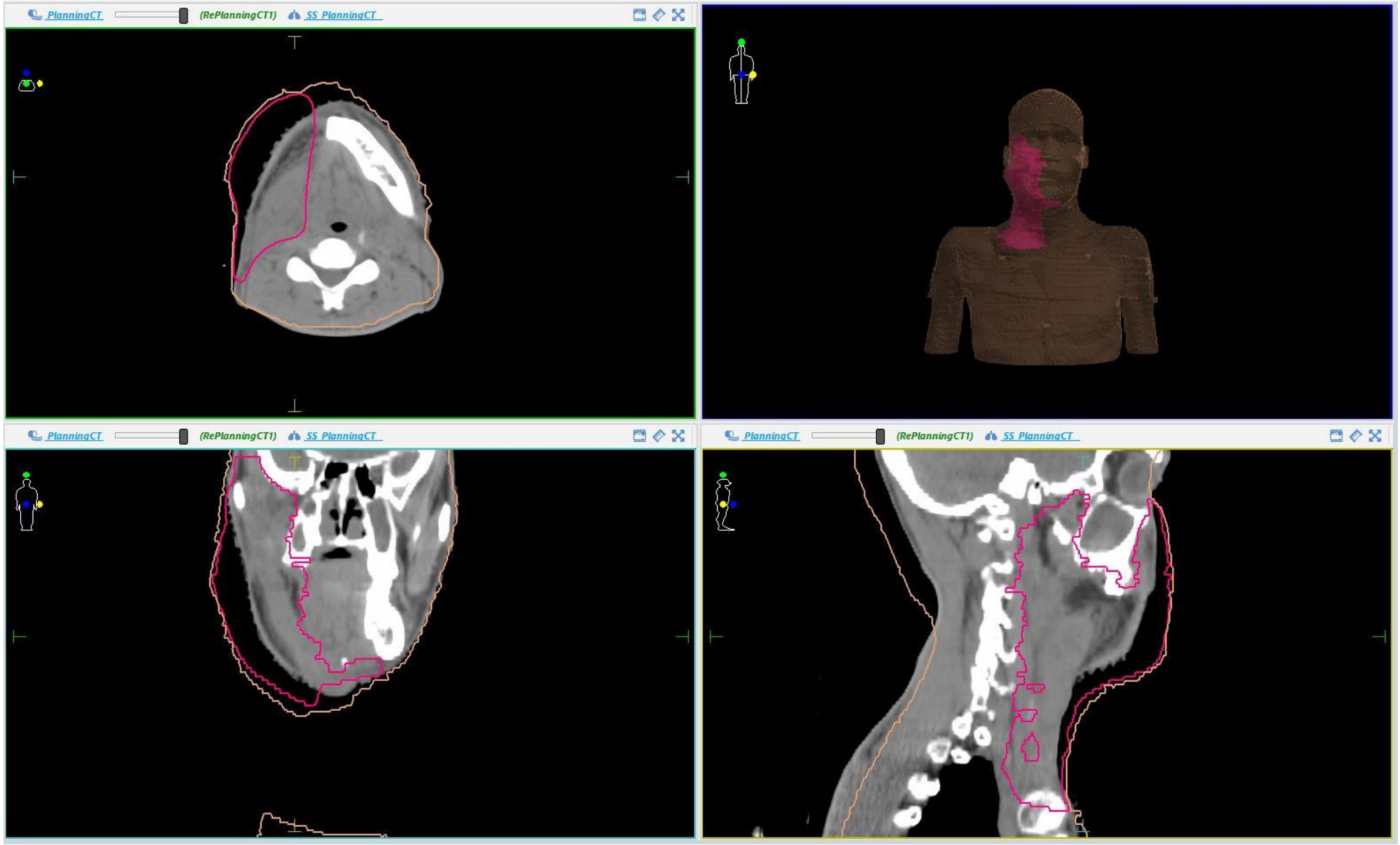
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(RePlanningCT1)
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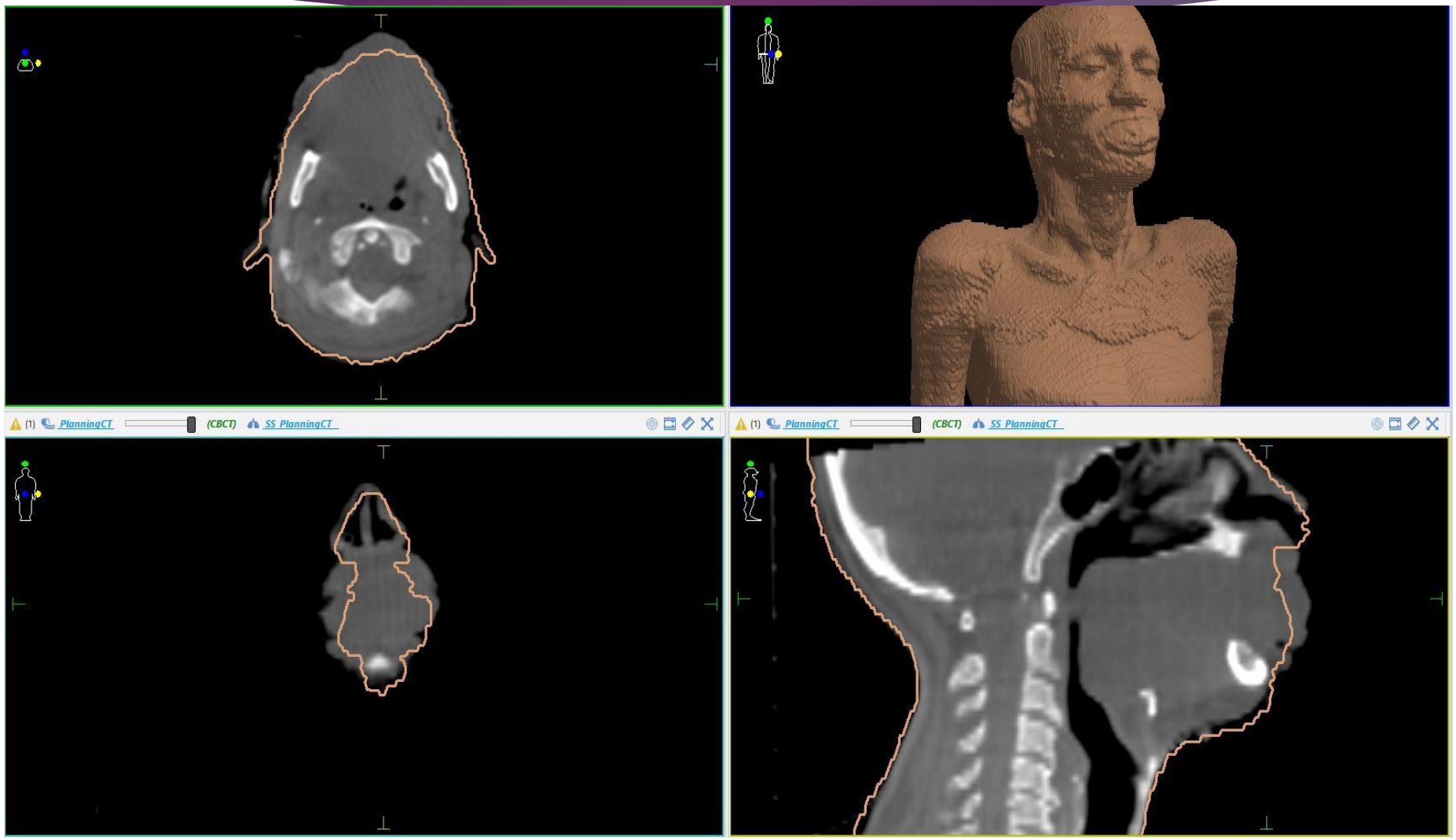
PlanningCT
(RePlanningCT1)
SS PlanningCT
PlanningCT
(RePlanningCT1)
SS PlanningCT

Sometimes there could be increase in volume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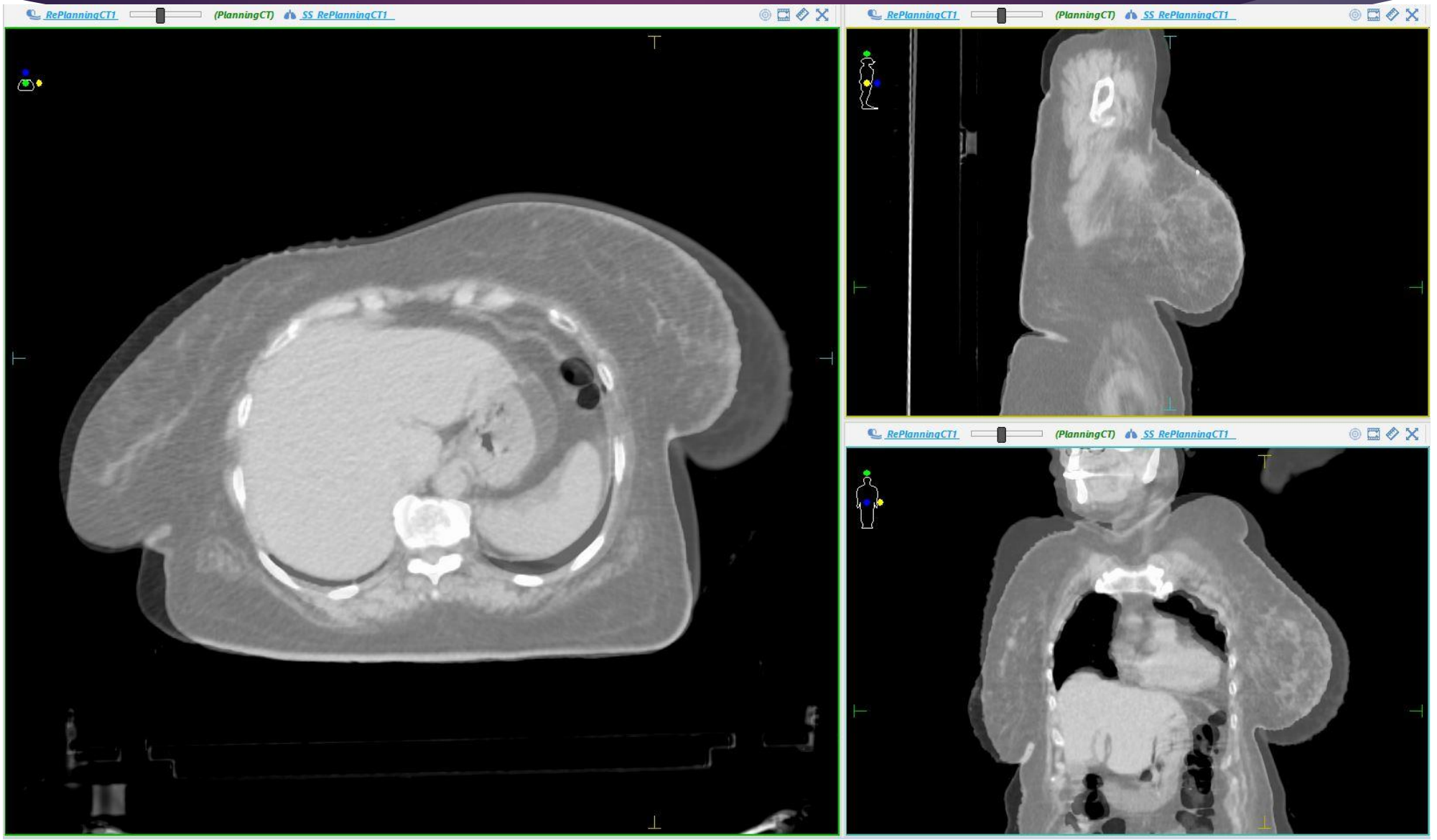
(1) PlanningCT (CBCT) SS PlanningCT


RePlanningCT1
(PlanningCT)
SS_RePlanningCT1
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RePlanningCT1
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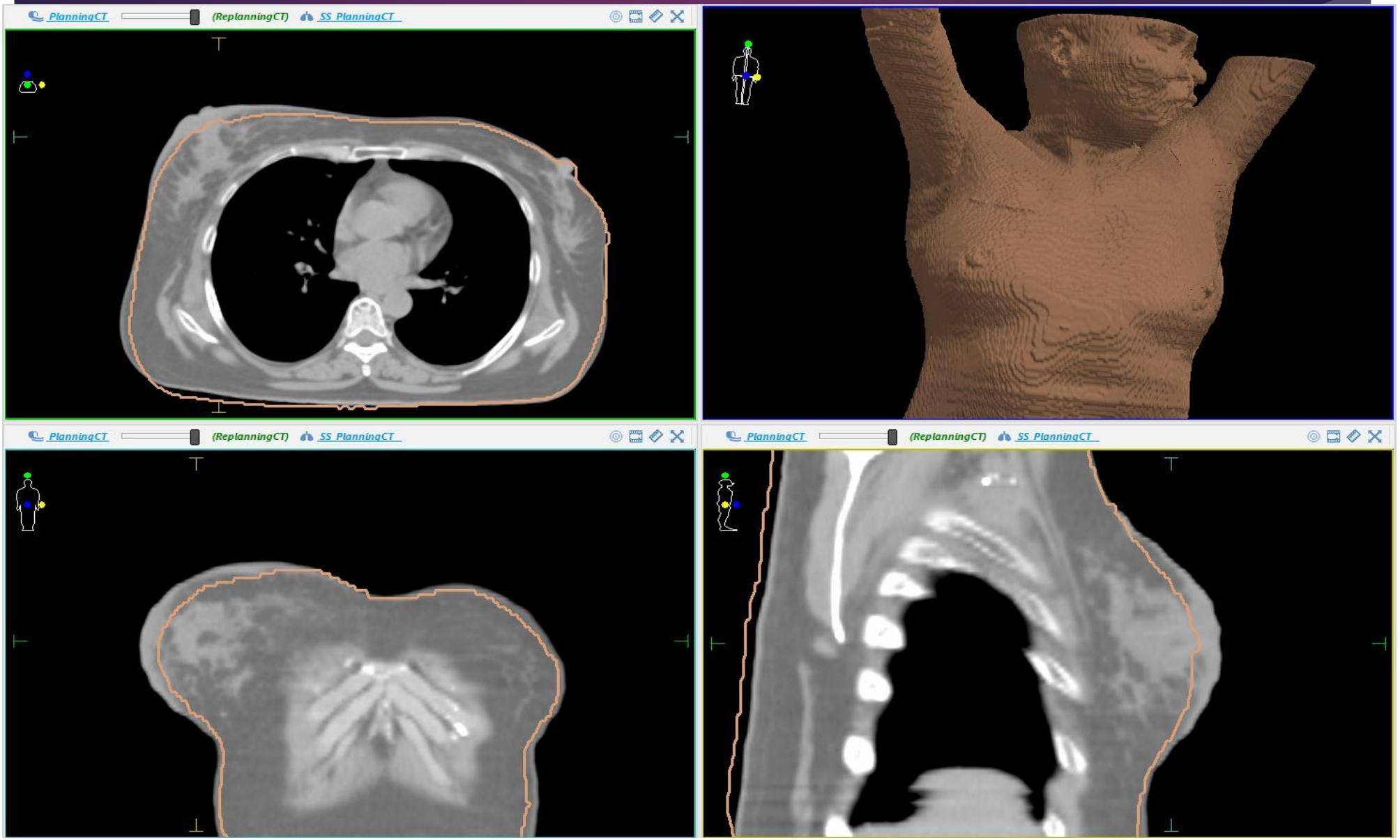
SS_RePlanningCT1


PlanningCT
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SS PlanningCT
PlanningCT
(ReplanningCT)
SS PlanningCT
PlanningCT
(ReplanningCT)
SS PlanningCT

Pediatric Patients

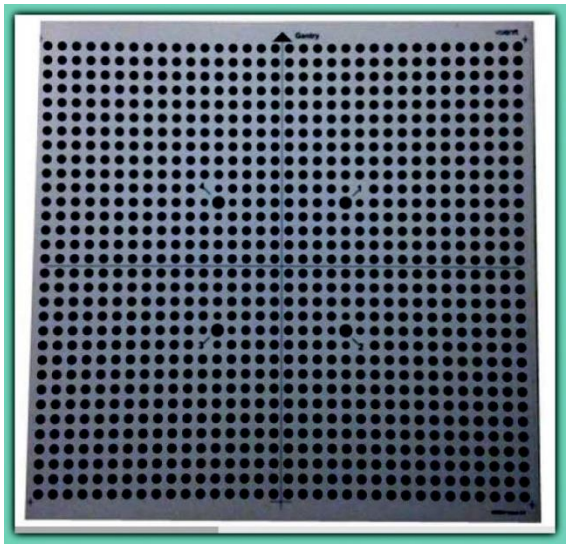

Elekta
Versa HD


TEJESWAR DUMPALA, D
04/08/2016, UMRV9333
Treatment
physicist
01_AFinalPTV1 ISO 1
SGRT patient
ROI2
Reference
Treatment
Couch 0.0°
Send to Couch
Beam Control
OFF
26/09/2023 17:02:47
VRT cm 0.21
LNG cm -0.10
LAT cm 0.05
MAG cm 0.24
YAW ° -0.4
ROLL ° -0.2
PITCH ° 1.3
0.30
-0.30
Coaching
Surface
Deformation
Video
21.2 fps
Field Status
System Status
26/09/2023 17:02

AlignRT Calibration

Alignment and Calibration of the AlignRT Isocentre to a surrogate for the Radiation Isocentre

Performed Monthly or As Required



Original Article

Review of clinical applications and challenges with surface-guided radiation therapy

ABSTRACT

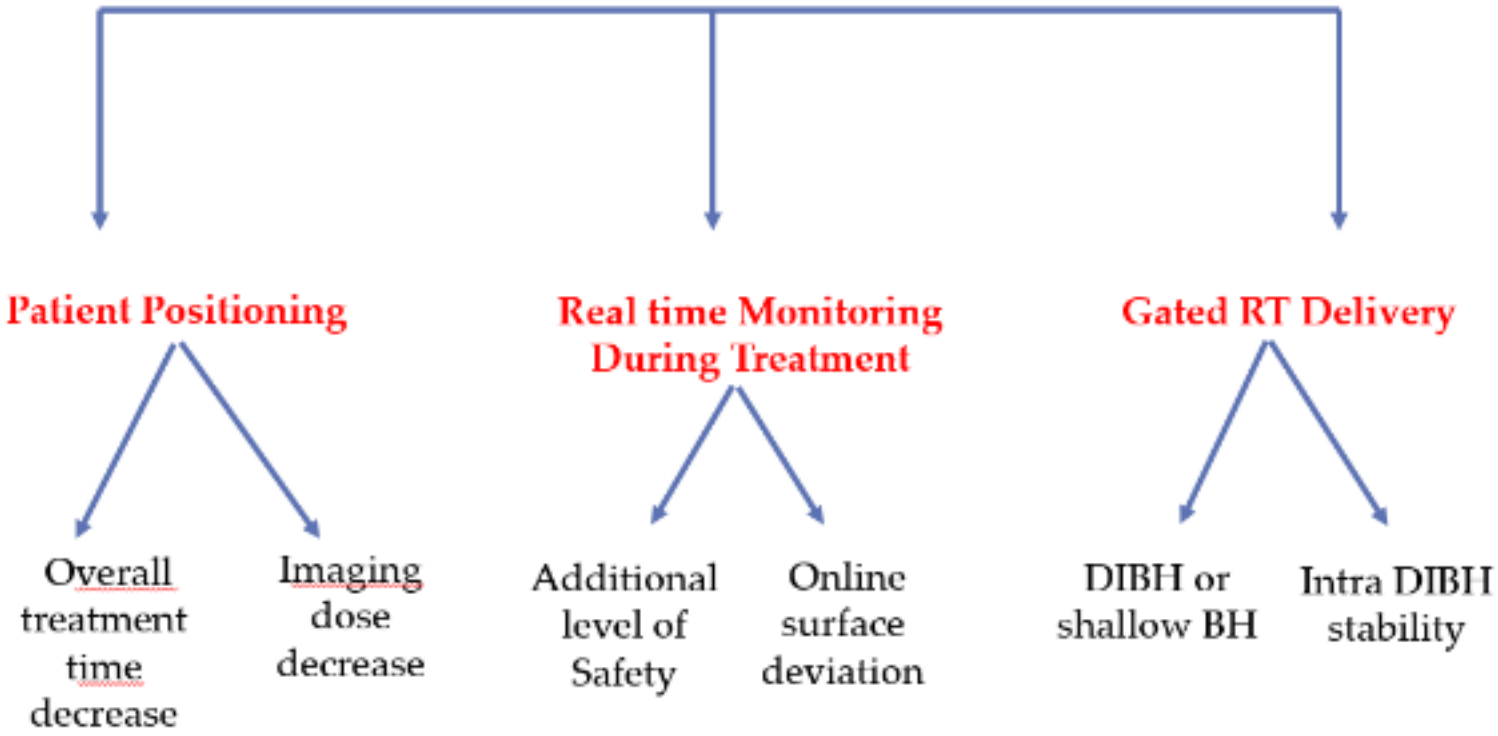
Aim: To evaluate the use of this new technique, surface-guided radiotherapy (SGRT), for patient setup and motion management in various cancers.

Materials and Methods: Data was collected from 533 patients, who received treatment in our hospital for various malignancies using SGRT from October 2019 to April 2021. We studied patient setup, interfraction position, and patient position during the breath-hold (BH) technique. The main advantage of SGRT is that, it is completely non-invasive and uses visible light to compare the patient's skin surface in the treatment room and planned treatment position. In this analysis, Monaco 5.51.10 (Elekta) treatment planning system, Versa HD Linear Accelerator, and AlignRT 6.2 (Vision RT) SGRT system were used.

Results: With SGRT, treatment setup time can be reduced with more precision and techniques like Deep inspiration breathhold (DIBH) can be done with very good compliance.

Ravishankar Bellala, Anandakrishnan Kuppusamy, Venkata Madhavi Bellala, Tulika Tyagi, Surendhiran Manoharan, Gunasekhar Gangarapu,

Why SGRT?


Patient Positioning
Overall treatment time decrease
Imaging dose decrease
Real time Monitoring During Treatment
Additional level of Safety
Online surface deviation
Gated RT Delivery
DIBH or shallow BH
Intra DIBH stability

Key Advantages

- Improved Accuracy and Precision
- Real time Motion Monitoring
- Non – Invasive and Comfortable
- Reduced Imaging Dose
- Supports Advanced Techniques
- Workflow Efficiency