AdventHealth

Dosimetric Planning Advantages of Surface Guided Planning

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Disclosures

- None

Outline

- What is Surface Guided Planning?
  - MapRT
  - Clearance Mapping
- Non-Coplanar treatments
  - Advantages
  - Examples
- MapRT in Action
  - Breast
  - Brain
- Conclusions

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AdventHealth Florida

- 15 Radiation Oncology Centers
- 19 Linacs (10 TrueBeam, 9 C-Series)
- 1 GammaKnife
- 3 HDRs (1 Flexitron, 2 Nucletron)
- 2 IORT (Xoft)
- 6 SGRT systems (4 AlignRT, 2 IDENTIFY)
- Single server Aria and Eclipse system

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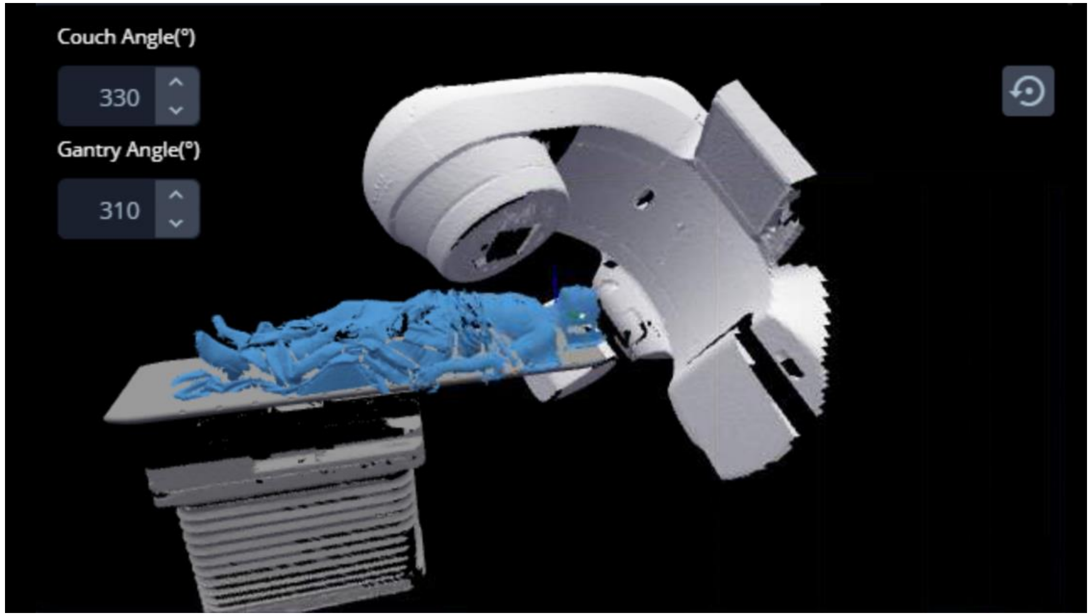
Issues with Treatment Planning

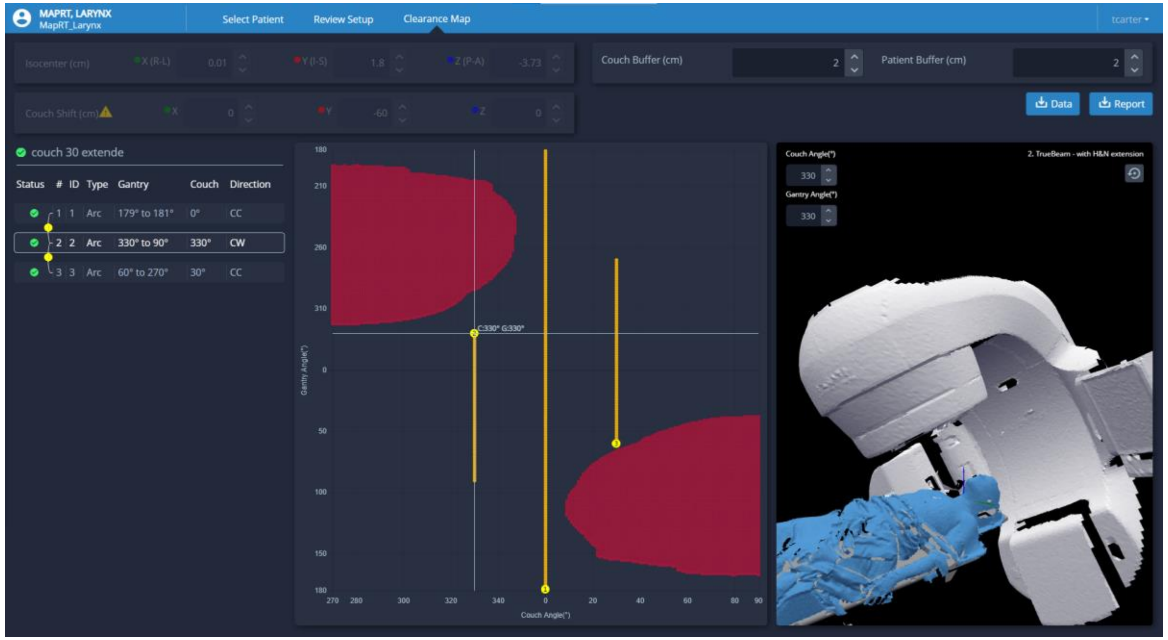
- Traditional treatment planning relays on CT/MR images. Images are taken in a sim room with little correlation to the treatment environment.
- Some treatment plans will require dry runs to ensure patient and/or accessories will clear the linac or imagers.
- Failing a dry run will result in re-planning which leads to delays in treatment

MapRT and Clearance Mapping

- Using two lateral wide field cameras, MapRT images the entire surface of the patient and their accessories.
- The resulting 3D model is used to calculate a clearance map for every couch and gantry angles.
- A treatment plan can be imported to MapRT to verify that there are no imaging, treatment or transitional collisions.


PHILIPS


Couch Angle(°)
330
Gantry Angle(°)
310


MAPRT, LARYNX
MapRT_Larynx
Select Patient
Review Setup
Clearance Map
tcarter
Isocenter (cm)
X (R-L)
0.01
Y (I-S)
1.8
Z (P-A)
-3.73
Couch Buffer (cm)
2
Patient Buffer (cm)
2
Couch Shift (cm)
X
0
Y
-60
Z
0
Data
Report
couch 30 extende
Status # ID Type Gantry Couch Direction
1 1 Arc 179° to 181° 0° CC
2 2 Arc 330° to 90° 330° CW
3 3 Arc 60° to 270° 30° CC
C:330° G:330°
Gantry Angle(°)
Couch Angle(°)
Couch Angle(°)
330
Gantry Angle(°)
330
2. TrueBeam - with H&N extension

Non-Coplanar Treatments

- Non-Coplanar radiotherapy involves treatment fields at a non-zero couch angle.
- Non-coplanar beam arrangement can help improve tumor coverage and/or lower dose to OARs
- However, it introduces the risk of collisions and requires clearance verification prior to delivery.

Non-Coplanar Treatments - Examples

REVIEW ARTICLE

Recent developments in non-coplanar radiotherapy

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ABSTRACT

This paper gives an overview of recent developments in non-coplanar intensity modulated radiotherapy (IMRT) and volumetric modulated arc therapy (VMAT). Modern linear accelerators are capable of automating motion around multiple axes, allowing efficient delivery of highly non-coplanar radiotherapy techniques. Novel techniques developed for C-arm and non-standard linac geometries, methods of optimization, and clinical applications are reviewed. The additional degrees of freedom are shown to increase the therapeutic ratio, either through dose escalation to the target or dose reduction to functionally important organs at risk, by multiple research groups. Although significant work is still needed to translate these new non-coplanar radiotherapy techniques into the clinic, clinical implementation should be prioritized. Recent developments in non-coplanar radiotherapy demonstrate that it continues to have a place in modern cancer treatment.

Dosimetric Comparision of Coplanar versus Noncoplanar Volumetric Modulated Arc Therapy for Treatment of Bilateral Breast Cancers

Avinav Bharati, Satyajeet Rath,[1] Rohini Khurana,[2] Madhup Rastogi,[2] Susama R. Mandal,[3] Ajeet Kumar Gandhi,[2] Rahat Hadi,[2] Anoop K. Srivastava,[2] and Surendra Prasad Mishra[2]

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Abstract Go to: ▸

Introduction:

The purpose of this study was to compare the dosimetric parameters of volumetric modulated arc therapy (VMAT) treatment plans using coplanar and noncoplanar beams in patients with bilateral breast cancer/s (BBCs) in terms of organ at risk sparing and target volume coverage. The hypothesis was to test whether VMAT with noncoplanar beams can result in lesser dose delivery to critical organs such as heart and lung, which will result in lesser overall toxicity.

Non-coplanar volumetric modulated arc therapy for locoregional radiotherapy of left-sided breast cancer including internal mammary nodes

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Disclosure: No potential conflicts of interest were disclosed

Background. Non-coplanar volumetric modulated arc therapy (ncVMAT) is proposed to reduce toxicity in heart and lungs for locoregional radiotherapy of left-sided breast cancer, including internal mammary nodes (IMN).
Patients and methods. This retrospective study included 10 patients with left-sided breast cancer who underwent locoregional radiotherapy after breast-conserving surgery. For each patient, the ncVMAT plan was designed with four partial arcs comprising two coplanar arcs and two non-coplanar arcs, with a couch rotating to 90°. The prescribed dose was normalized to cover 95% of planning target volume (PTV), with 50 Gy delivered in 25 fractions. For each ncVMAT plan, dosimetric parameters were compared with the coplanar volumetric modulated arc therapy (coVMAT) plan.
Results. There were improvements in conformity index, homogeneity index and V_{55} of total target volume (PTVall) comparing ncVMAT to coVMAT ($p < 0.001$). Among the organs at risk, the average V_{30}, V_{20}, V_{10}, V_5, and mean dose (D_{mean}) of the heart decreased significantly ($p < 0.001$). Furthermore, ncVMAT significantly reduced the mean V_{20}, V_{10}, V_5, and D_{mean} of left lung and the mean V_{10} and V_5 and D_{mean} of contralateral lung ($p < 0.001$). An improved sparing of the left anterior descending coronary artery and right breast were also observed with ncVMAT ($p < 0.001$).
Conclusions. Compared to coVMAT, ncVMAT provides improved conformity and homogeneity of whole PTV, better dose sparing of the heart, bilateral lungs, left anterior descending coronary artery (LAD), and right breast for locoregional radiotherapy of left-sided breast cancer with IMN, potentially reducing the risk of normal tissue damage.

Key words: non-coplanar; volumetric modulated arc therapy; left-sided breast cancer; internal mammary nodes

Locoregional breast radiotherapy including IMN: optimizing the dose distribution using an automated non-coplanar VMAT-technique

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Affiliations + expand

PMID: 37812070 DOI: 10.1080/0284186X.2023.2264488

Abstract

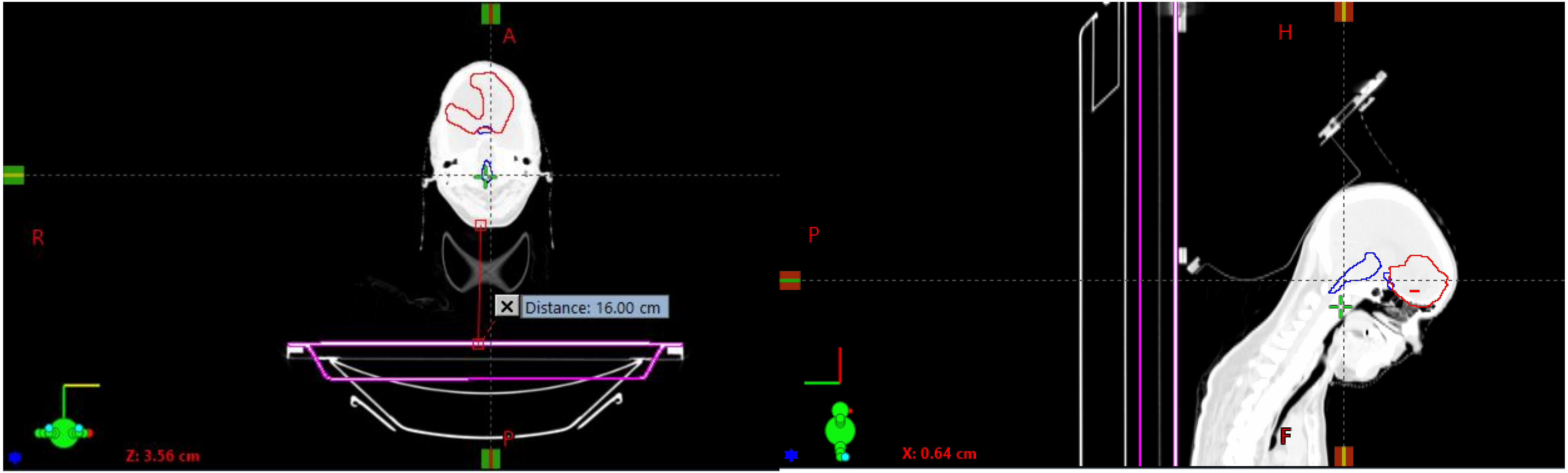
Background: Volumetric Modulated Arc Therapy (VMAT) offers better conformity, homogeneity and sparing of the heart and ipsilateral lung for locoregional radiotherapy in left-sided breast cancer compared to three-dimensional conformal radiotherapy (3D-CRT). However, conventional coplanar VMAT (cVMAT) can result in higher doses to the normal tissue on the contralateral side. This study investigates a non-coplanar VMAT-technique (ncVMAT) to mitigate this issue.

Material and methods: CT series of 20 left sided breast cancer patients were included for planning of locoregional breast radiotherapy including internal mammary nodes (IMN). Three treatment plans; 3D-CRT, cVMAT and ncVMAT, were generated for each patient with a prescription dose of 40.05 Gy in 15 fractions. Both VMAT-techniques consisted of a single arc in the axial plane, while ncVMAT included an additional arc in the sagittal plane. All plans were optimized to cover the clinical target volume (CTV) by 38.05 Gy for the breast and 36.05 Gy for lymph nodes, with as low as possible dose to organs at risk.

Results: Full CTV coverage was achieved for all plans. Both cVMAT and ncVMAT delivered more conformal and homogeneous target doses than 3D-CRT. Doses to the heart and ipsilateral lung were significantly lower with ncVMAT compared to both cVMAT and 3D-CRT. ncVMAT reduced doses to both the contralateral breast and lung compared to cVMAT and achieved levels similar to 3D-CRT for the contralateral breast and moderately higher doses for the contralateral lung. Delivery of high doses (>30 Gy) to the contralateral side was completely avoided with ncVMAT, contrary to the results for cVMAT and 3D-CRT.

Conclusion: ncVMAT reduced doses to the heart and ipsilateral lung as compared to both cVMAT and 3D-CRT. All contralateral dose metrics were reduced with the novel ncVMAT technique compared to cVMAT. and the mean contralateral breast doses were similar to 3D-CRT.

Planning with a Clearance Map - Brain



Planning with a Clearance Map - Brain

- 2 Field VMAT plan
  - CW G250-G70
  - CCW G70-G250

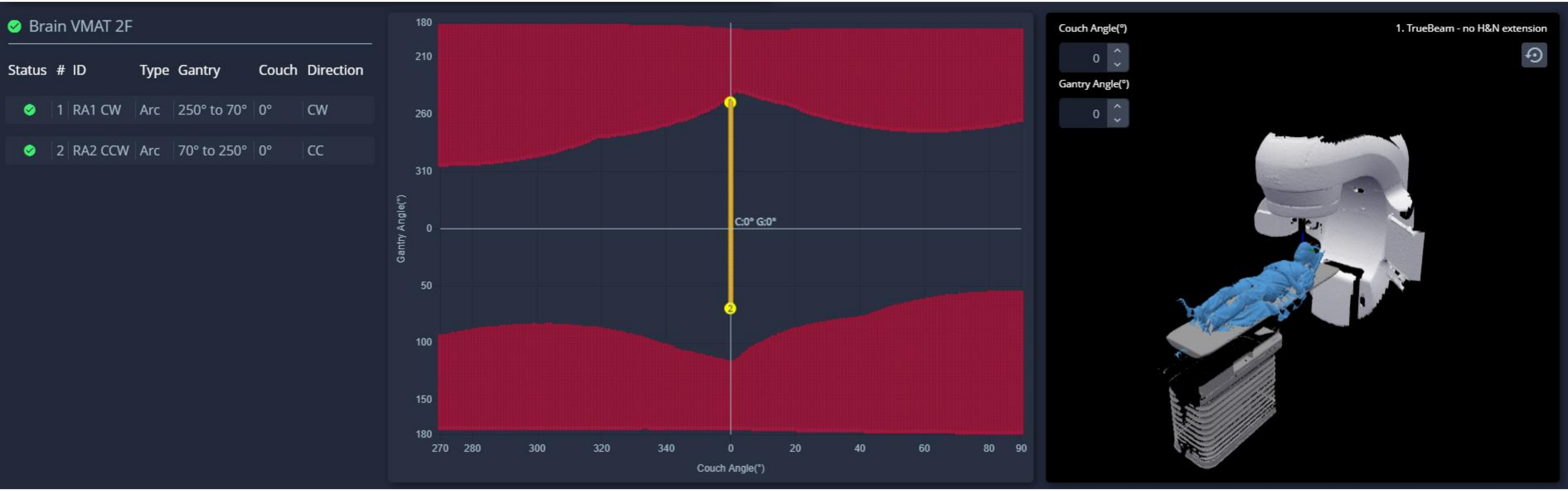
Priority	Structure Template	Structure Plan	Type	Prescription	Constraint	Goal	Brain VMAT 2F	Pass/Fail
1	**PTV57**	PTVFrontal_5700_30	Target	**PTV57: 5700cGy**	Max ≤	110%	119.081%	✗
2	**PTV 57**	PTVFrontal_5700_30	Target	**PTV57: 5700cGy**	V100% ≥	95%	98.257%	✓
3	Lens_R	Lens_R	OAR		Max ≤	700cGy	701.8cGy	✗
4	Lens_L	Lens_L	OAR		Max ≤	700cGy	666.7cGy	✓
7	Eye_L	Eye_L	OAR		Mean ≤	3000cGy	1139.7cGy	✓
8	Eye_R	Eye_R	OAR		Mean ≤	3000cGy	1151.6cGy	✓
12	Brainstem	Brainstem	OAR		Max ≤	5400cGy	3492.9cGy	✓
13	Cochlea_L	Cochlea_L	OAR		Max ≤	4500cGy	2634.8cGy	✓
14	Cochlea_L	Cochlea_L	OAR		Mean ≤	3500cGy	2414.1cGy	✓
15	Cochlea_R	Cochlea_R	OAR		Max ≤	4500cGy	1608.1cGy	✓
16	Cochlea_R	Cochlea_R	OAR		Mean ≤	3500cGy	1388.7cGy	✓

Planning with a Clearance Map - Brain

- 3 Field VMAT plan
  - CW G250-G100
  - CCW G100-G250
  - CW G300-G50

Priority	Structure Template	Structure Plan	Type	Prescription	Constraint	Goal	Brain VMAT 3F	Pass/Fail
1	**PTV57**	PTVFrontal_5700_30	Target	**PTV57: 5700cGy**	Max ≤	110%	118.796%	✗
2	**PTV 57**	PTVFrontal_5700_30	Target	**PTV57: 5700cGy**	V100% ≥	95%	98.337%	✓
3	Lens_R	Lens_R	OAR		Max ≤	700cGy	767.4cGy	✗
4	Lens_L	Lens_L	OAR		Max ≤	700cGy	574.1cGy	✓
7	Eye_L	Eye_L	OAR		Mean ≤	3000cGy	1086.2cGy	✓
8	Eye_R	Eye_R	OAR		Mean ≤	3000cGy	1152.3cGy	✓
12	Brainstem	Brainstem	OAR		Max ≤	5400cGy	3650.9cGy	✓
13	Cochlea_L	Cochlea_L	OAR		Max ≤	4500cGy	2294.3cGy	✓
14	Cochlea_L	Cochlea_L	OAR		Mean ≤	3500cGy	2085.8cGy	✓
15	Cochlea_R	Cochlea_R	OAR		Max ≤	4500cGy	1649.2cGy	✓
16	Cochlea_R	Cochlea_R	OAR		Mean ≤	3500cGy	1412.2cGy	✓

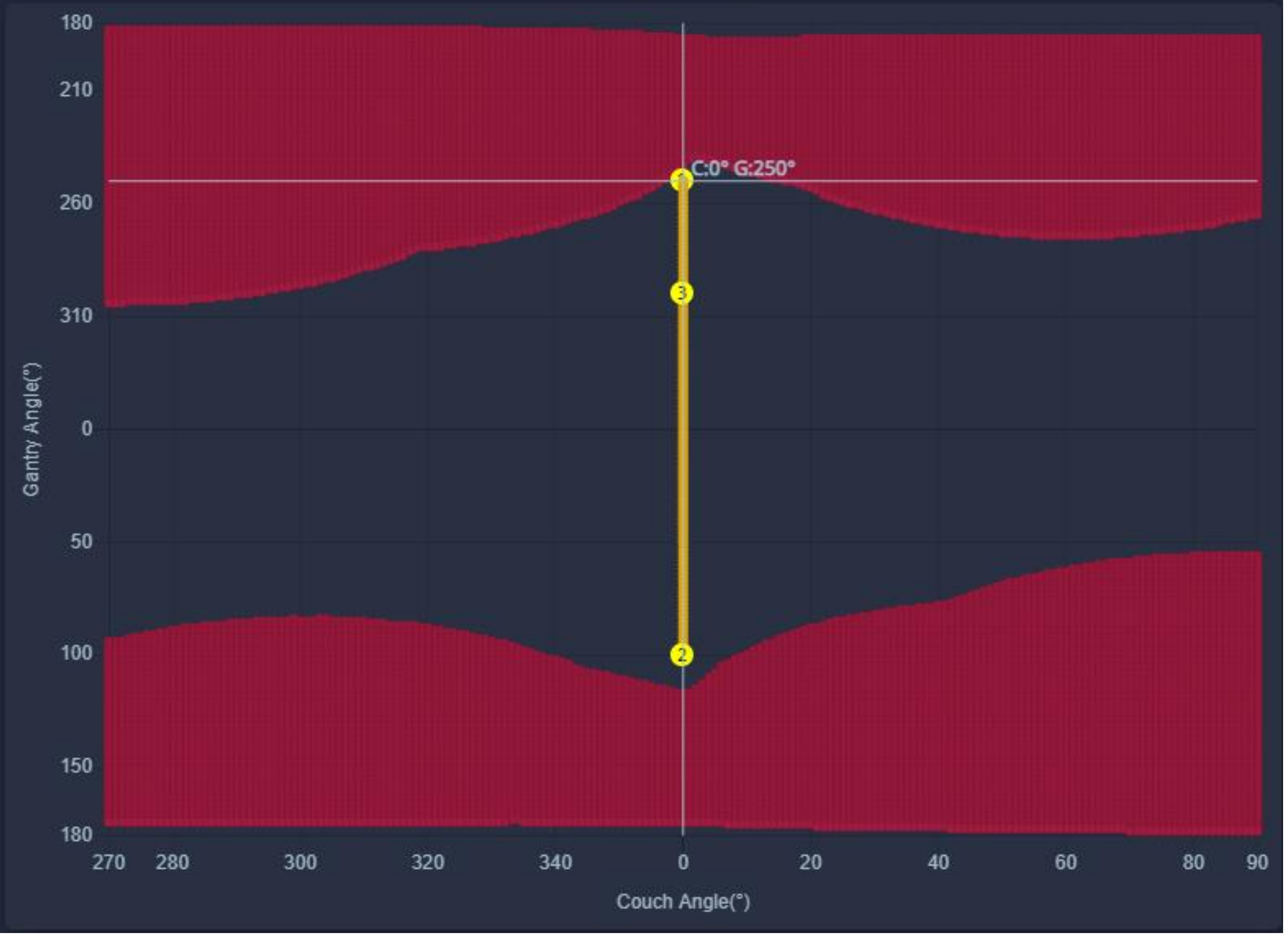
Planning with a Clearance Map - Brain



Planning with a Clearance Map - Brain

Brain VMAT 3F

Status	#	ID	Type	Gantry	Couch	Direction
✓	1	RA1 CW	Arc	250° to 100°	0°	CW
✓	2	RA2 CCW	Arc	100° to 250°	0°	CC
✓	3	RA3 CW	Arc	300° to 50°	0°	CW

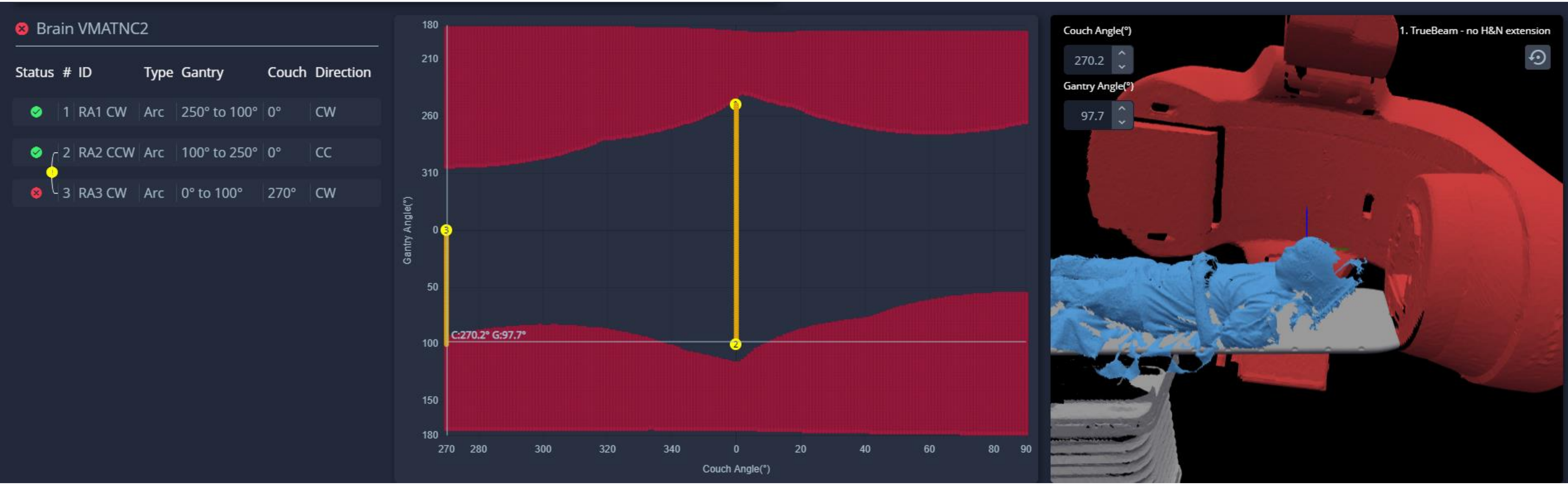


Planning with a Clearance Map - Brain

- 3 Field VMAT non-coplanar plan
  - CW G250-G100
  - CCW G100-G250
  - CW G0-G100, couch at 90

Priority	Structure Template	Structure Plan	Type	Prescription	Constraint	Goal	Brain VMATNC2	Pass/Fail
1	**PTV57**	PTVFrontal_5700_30	Target	**PTV57: 5700cGy**	Max ≤	110%	115.253%	✗
2	**PTV 57**	PTVFrontal_5700_30	Target	**PTV57: 5700cGy**	V100% ≥	95%	98.46%	✓
3	Lens_R	Lens_R	OAR		Max ≤	700cGy	538.2cGy	✓
4	Lens_L	Lens_L	OAR		Max ≤	700cGy	525.2cGy	✓
7	Eye_L	Eye_L	OAR		Mean ≤	3000cGy	1285cGy	✓
8	Eye_R	Eye_R	OAR		Mean ≤	3000cGy	1179.7cGy	✓
12	Brainstem	Brainstem	OAR		Max ≤	5400cGy	2961.9cGy	✓
13	Cochlea_L	Cochlea_L	OAR		Max ≤	4500cGy	1553.8cGy	✓
14	Cochlea_L	Cochlea_L	OAR		Mean ≤	3500cGy	1395.3cGy	✓
15	Cochlea_R	Cochlea_R	OAR		Max ≤	4500cGy	1591.5cGy	✓
16	Cochlea_R	Cochlea_R	OAR		Mean ≤	3500cGy	1345.4cGy	✓

Planning with a Clearance Map - Brain

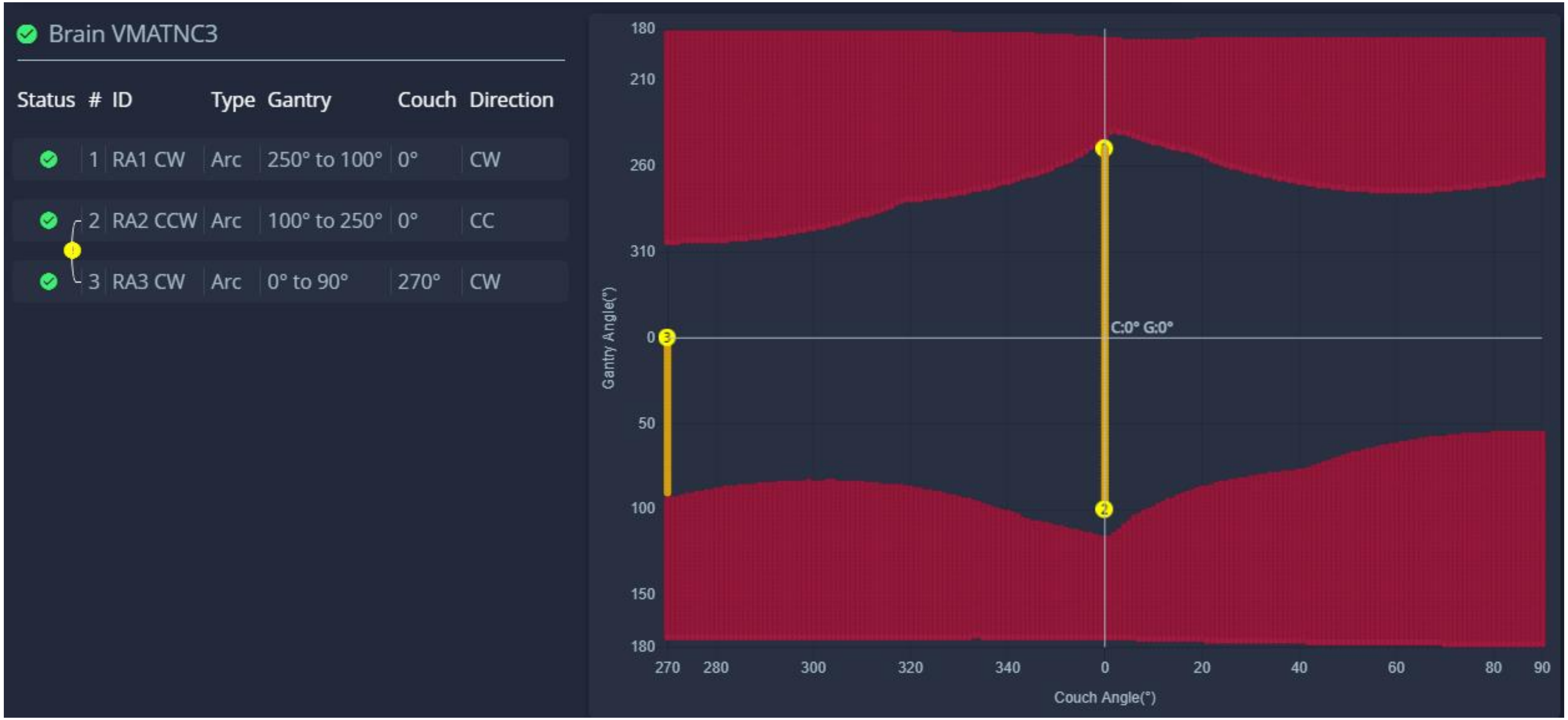


Planning with a Clearance Map - Brain

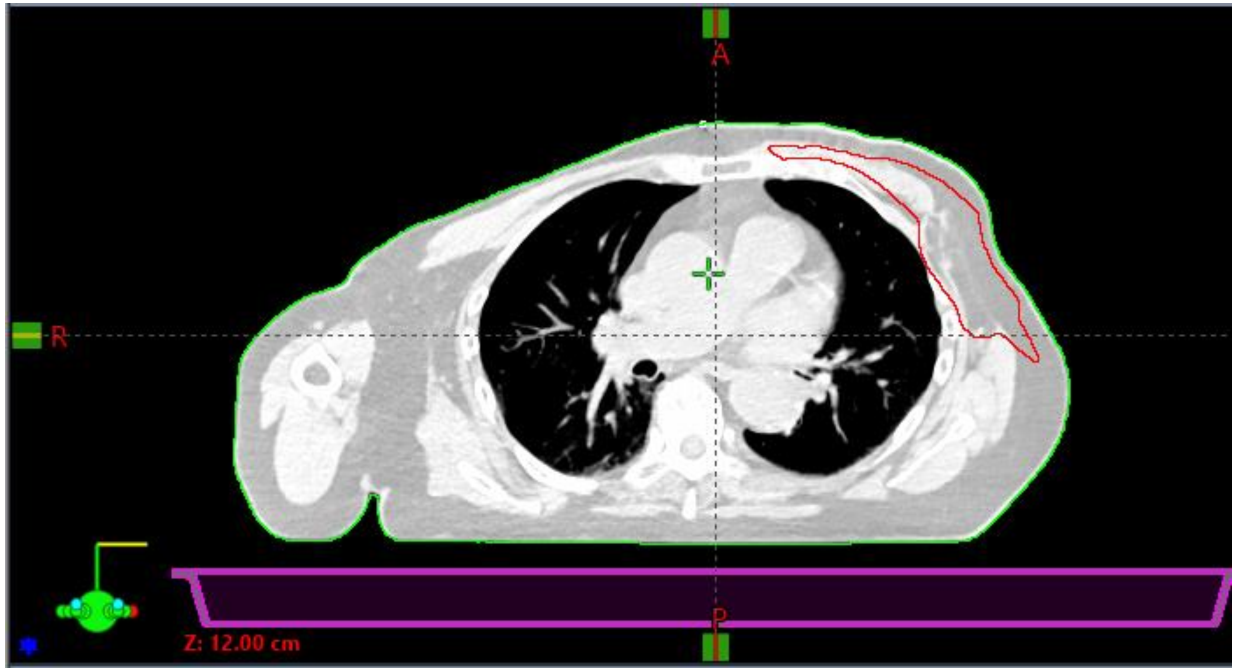
- 3 Field VMAT non-coplanar plan
  - CW G250-G100
  - CCW G100-G250
  - CW G0-G90, couch at 90

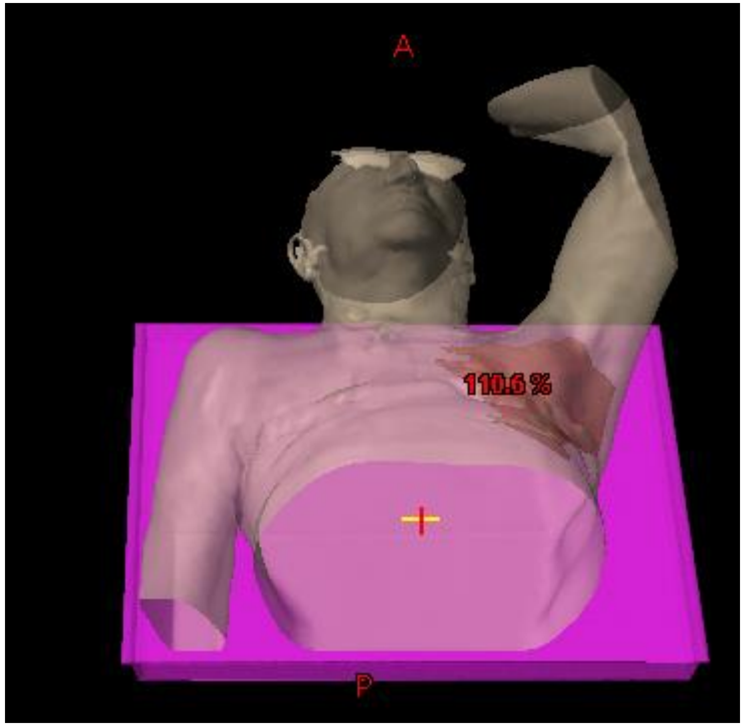
Priority	Structure Template	Structure Plan	Type	Prescription	Constraint	Goal	Brain VMATNC3	Brain VMAT 3F
1	**PTV57**	PTVFrontal_5700_30	Target	**PTV57: 5700cGy**	Max ≤	110%	115.149%	118.796%
2	**PTV 57**	PTVFrontal_5700_30	Target	**PTV57: 5700cGy**	V100% ≥	95%	98.763%	98.337%
3	Lens_R	Lens_R	OAR		Max ≤	700cGy	526.3cGy	767.4cGy
4	Lens_L	Lens_L	OAR		Max ≤	700cGy	521.6cGy	574.1cGy
7	Eye_L	Eye_L	OAR		Mean ≤	3000cGy	1193.8cGy	1086.2cGy
8	Eye_R	Eye_R	OAR		Mean ≤	3000cGy	1173cGy	1152.3cGy
12	Brainstem	Brainstem	OAR		Max ≤	5400cGy	3253.9cGy	3650.9cGy
13	Cochlea_L	Cochlea_L	OAR		Max ≤	4500cGy	1550.9cGy	2294.3cGy
14	Cochlea_L	Cochlea_L	OAR		Mean ≤	3500cGy	1398.8cGy	2085.8cGy
15	Cochlea_R	Cochlea_R	OAR		Max ≤	4500cGy	1384cGy	1649.2cGy
16	Cochlea_R	Cochlea_R	OAR		Mean ≤	3500cGy	1143.8cGy	1412.2cGy

Planning with a Clearance Map - Brain



Planning with a Clearance Map - Breast



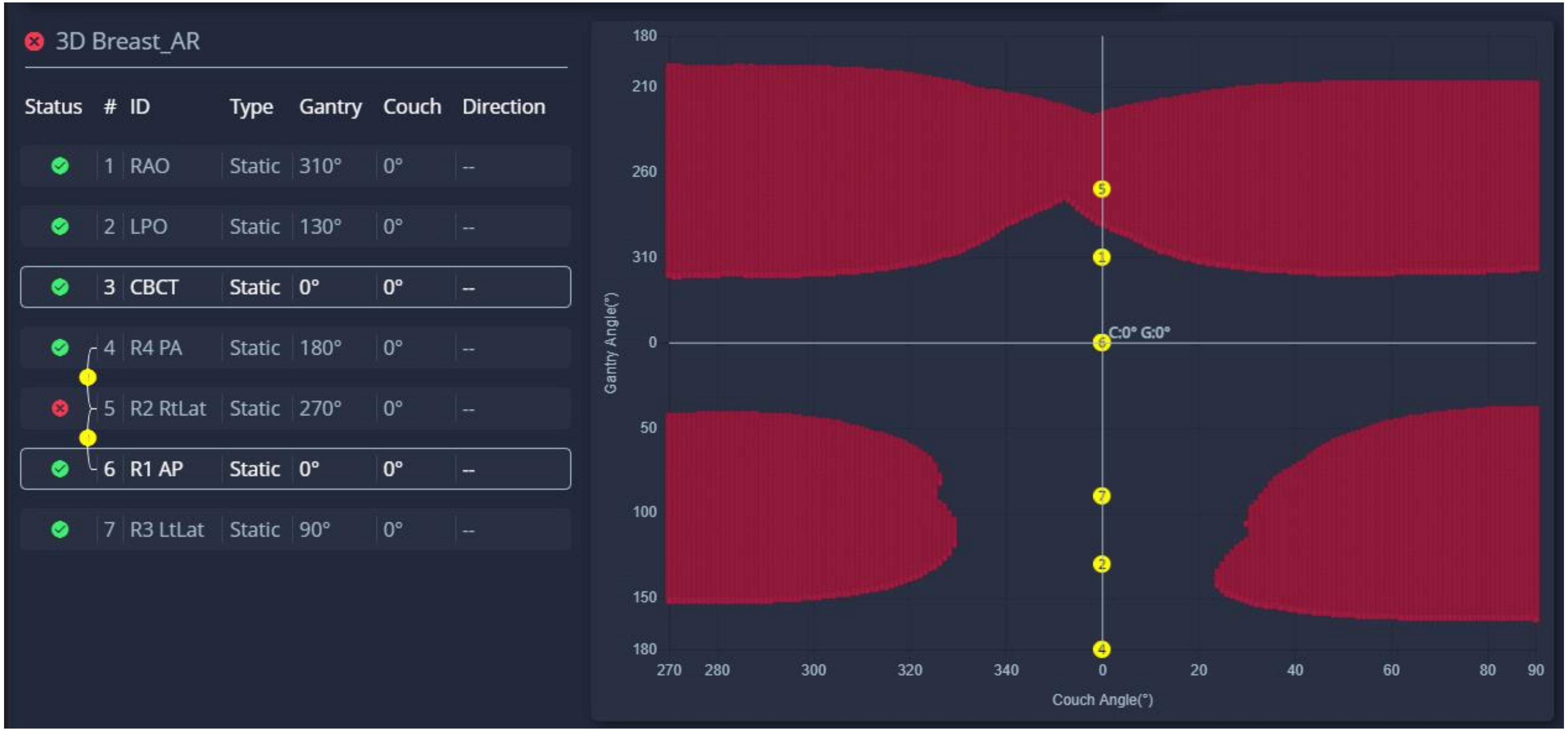


Planning with a Clearance Map - Breast

- 2 Field 3D Conformal plan
  - RAO G310
  - LPO G130

Priority	Structure Template	Structure Plan	Type	Prescription	Constraint	Goal	3D Breast	Pass/Fail
1	Lt Breast/CW eval	zptv_total	Target	Lt Breast/CW eval: 4005cGy	V95% ≥	95%	98.901%	✓
2	Lt Breast/CW eval	zptv_total	Target	Lt Breast/CW eval: 4005cGy	V107% ≤	10cc	31.327cc	✗
3	Lt Breast/CW eval	zptv_total	Target	Lt Breast/CW eval: 4005cGy	Max ≤	110%	110.034%	✗
4	Lt Breast/CW eval	zptv_total	Target	Lt Breast/CW eval: 4005cGy	D10% ≤	105%	106.655%	✗
5	Heart (Lt Breast)	Heart	OAR		V2250cGy ≤	10%	0.021%	✓
6	Heart	Heart	OAR		Mean ≤	300cGy	127cGy	✓
7	Lung_L	Lung L	OAR		V1800cGy ≤ (ipsilateral)	10%	19.497%	✗
8	Breast_R	Breast_R	OAR		V300cGy ≤ (contralateral)	1%	0%	✓
9	Lung_R	Lung_R	OAR		V480cGy ≤ (contralateral)	5%	0%	✓

Planning with a Clearance Map - Breast

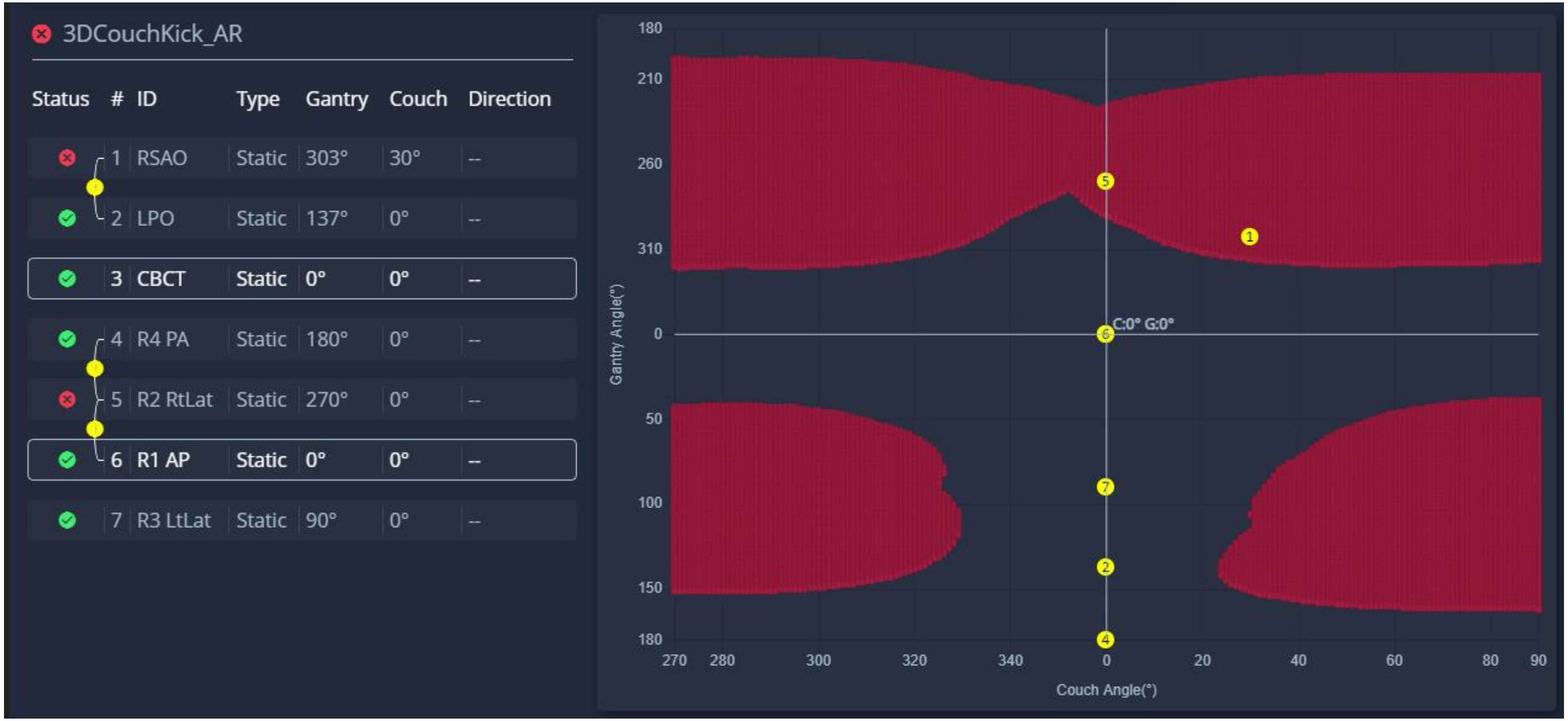


Planning with a Clearance Map - Breast

- 2 Field 3D Conformal non-coplanar plan
  - RAO G303, C30, T330
  - LPO G137, C340, T0

Priority	Structure Template	Structure Plan	Type	Prescription	Constraint	Goal	3DCouchKick	3D Breast
1	Lt Breast/CW eval	zptv_total	Target	Lt Breast/CW eval: 4005cGy	V95% ≥	95%	95.991%	98.901%
2	Lt Breast/CW eval	zptv_total	Target	Lt Breast/CW eval: 4005cGy	V107% ≤	10cc	0cc	31.327cc
3	Lt Breast/CW eval	zptv_total	Target	Lt Breast/CW eval: 4005cGy	Max ≤	110%	106.654%	110.034%
4	Lt Breast/CW eval	zptv_total	Target	Lt Breast/CW eval: 4005cGy	D10% ≤	105%	102.553%	106.655%
5	Heart (Lt Breast)	Heart	OAR		V2250cGy ≤	10%	0.852%	0.021%
6	Heart	Heart	OAR		Mean ≤	300cGy	145.8cGy	127cGy
7	Lung_L	Lung L	OAR		V1800cGy ≤ (ipsilateral)	10%	16.982%	19.497%
8	Breast_R	Breast_R	OAR		V300cGy ≤ (contralateral)	1%	0%	0%
9	Lung_R	Lung_R	OAR		V480cGy ≤ (contralateral)	5%	0%	0%

Planning with a Clearance Map - Breast



Planning with a Clearance Map - Breast

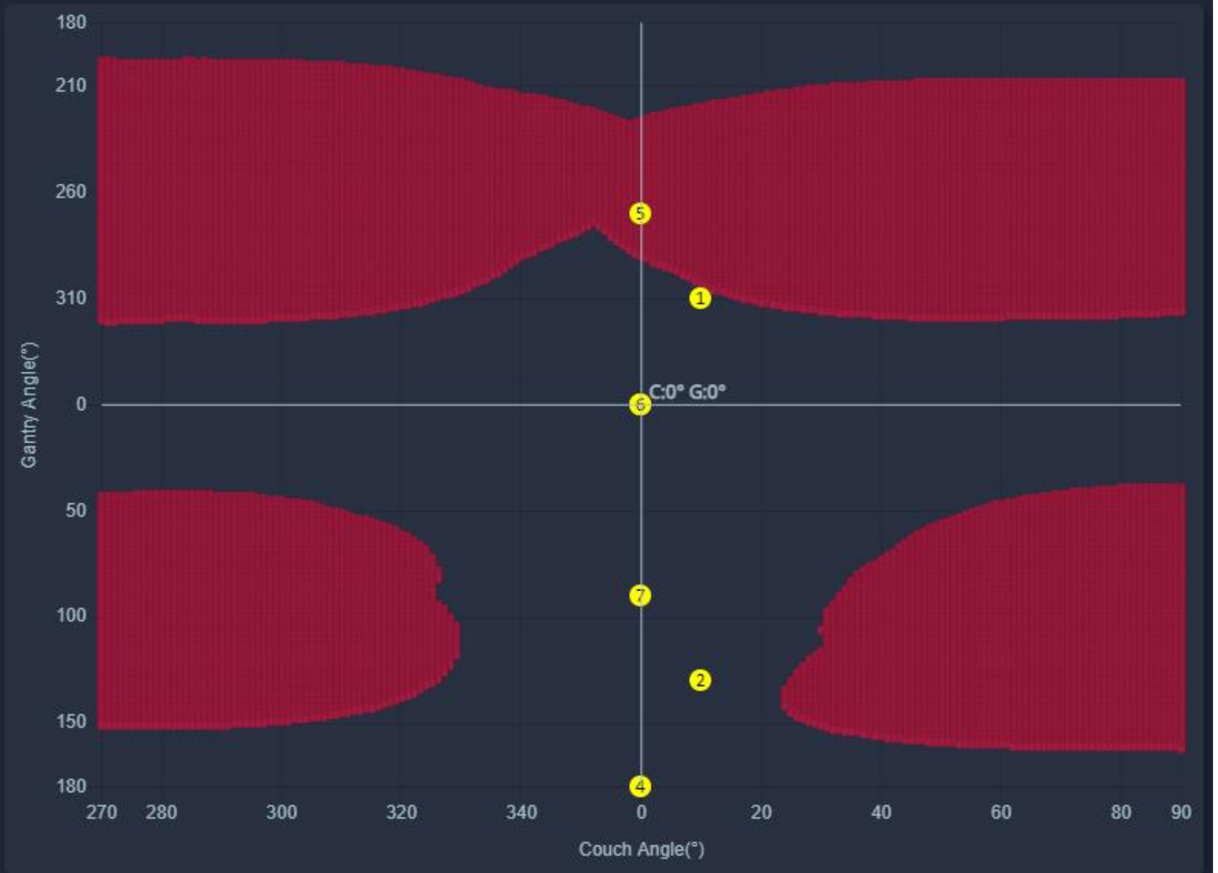
- 2 Field 3D Conformal non-coplanar plan
  - RAO G310, C10, T350
  - LPO G130, C350, T350

Priority	Structure Template	Structure Plan	Type	Prescription	Constraint	Goal	3D breast CC	3D Breast
1	Lt Breast/CW eval	zptv_total	Target	Lt Breast/CW eval: 4005cGy	V95% ≥	95%	96.916%	98.901%
2	Lt Breast/CW eval	zptv_total	Target	Lt Breast/CW eval: 4005cGy	V107% ≤	10cc	0cc	31.327cc
3	Lt Breast/CW eval	zptv_total	Target	Lt Breast/CW eval: 4005cGy	Max ≤	110%	106.357%	110.034%
4	Lt Breast/CW eval	zptv_total	Target	Lt Breast/CW eval: 4005cGy	D10% ≤	105%	103.616%	106.655%
5	Heart (Lt Breast)	Heart	OAR		V2250cGy ≤	10%	0.002%	0.021%
6	Heart	Heart	OAR		Mean ≤	300cGy	105.7cGy	127cGy
7	Lung_L	Lung L	OAR		V1800cGy ≤ (ipsilateral)	10%	16.036%	19.497%
8	Breast_R	Breast_R	OAR		V300cGy ≤ (contralateral)	1%	0%	0%
9	Lung_R	Lung_R	OAR		V480cGy ≤ (contralateral)	5%	0%	0%

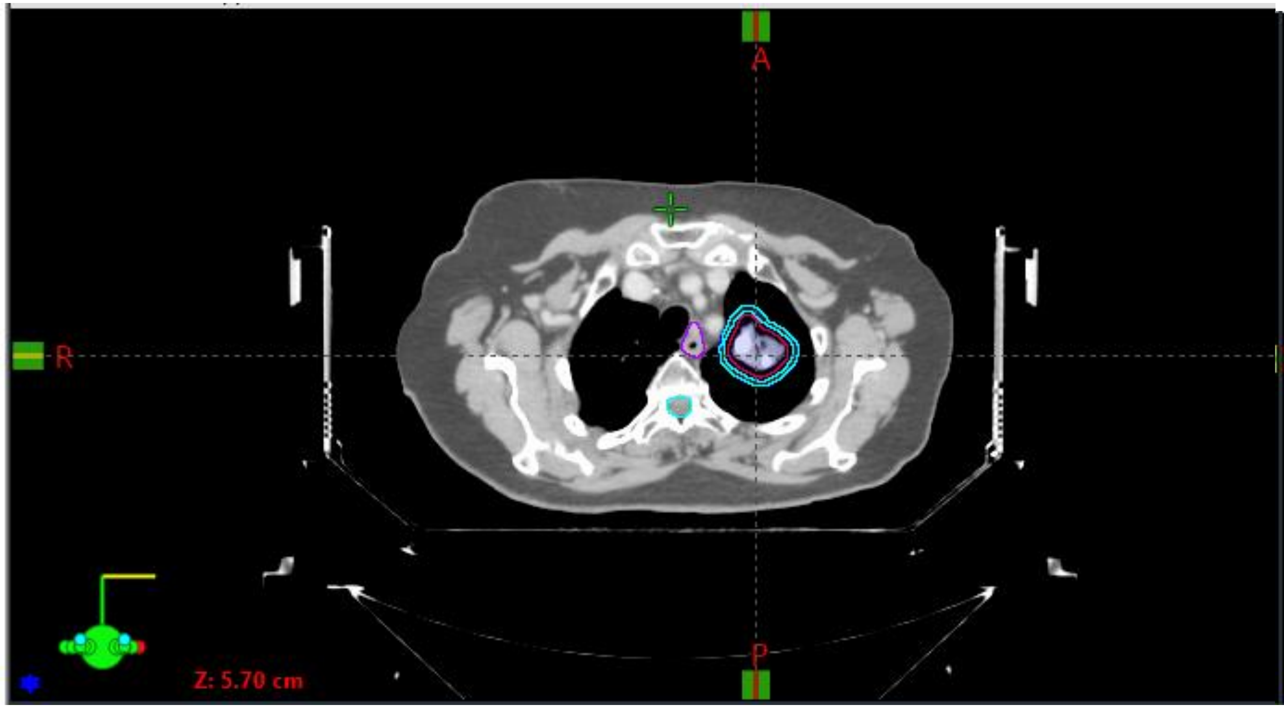
Planning with a Clearance Map - Breast

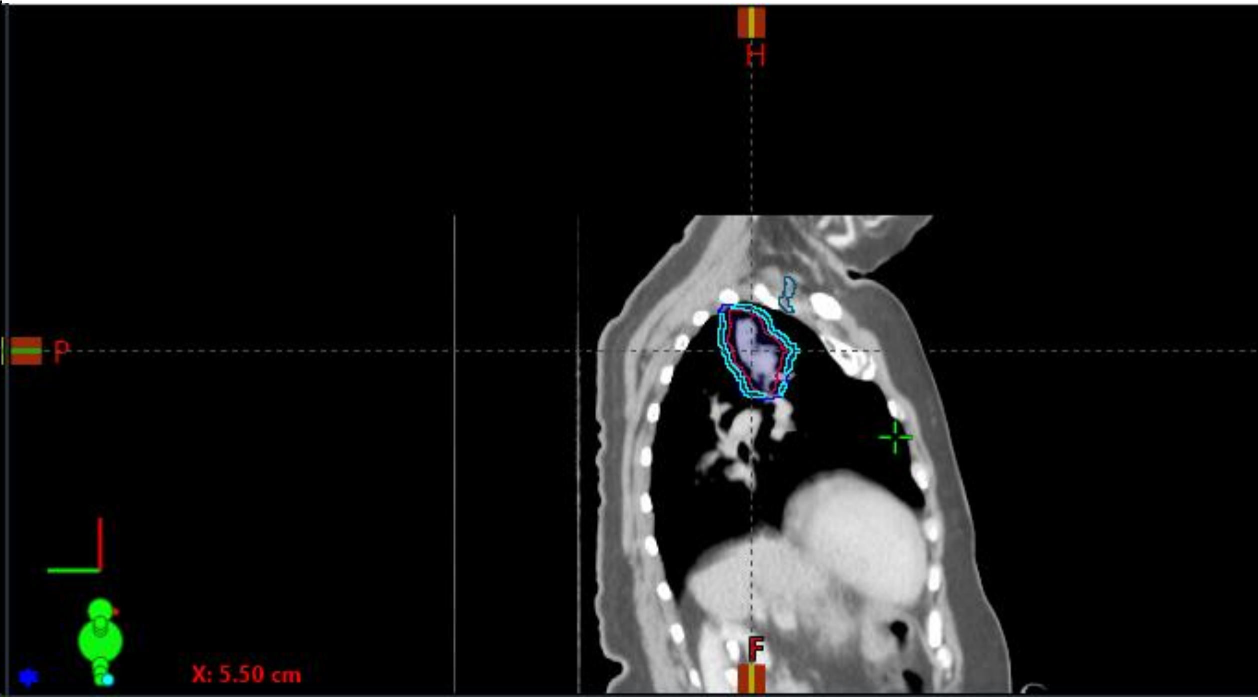
3DCouchKicks_AR

Status	#	ID	Type	Gantry	Couch	Direction
✔	1	RAO	Static	310°	10°	--
✔	2	LPO	Static	130°	10°	--
✔	3	CBCT	Static	0°	0°	--
✔	4	R4 PA	Static	180°	0°	--
✖	5	R2 RtLat	Static	270°	0°	--
✔	6	R1 AP	Static	0°	0°	--
✔	7	R3 LtLat	Static	90°	0°	--



Planning with a Clearance Map - Lung





Planning with a Clearance Map - Lung

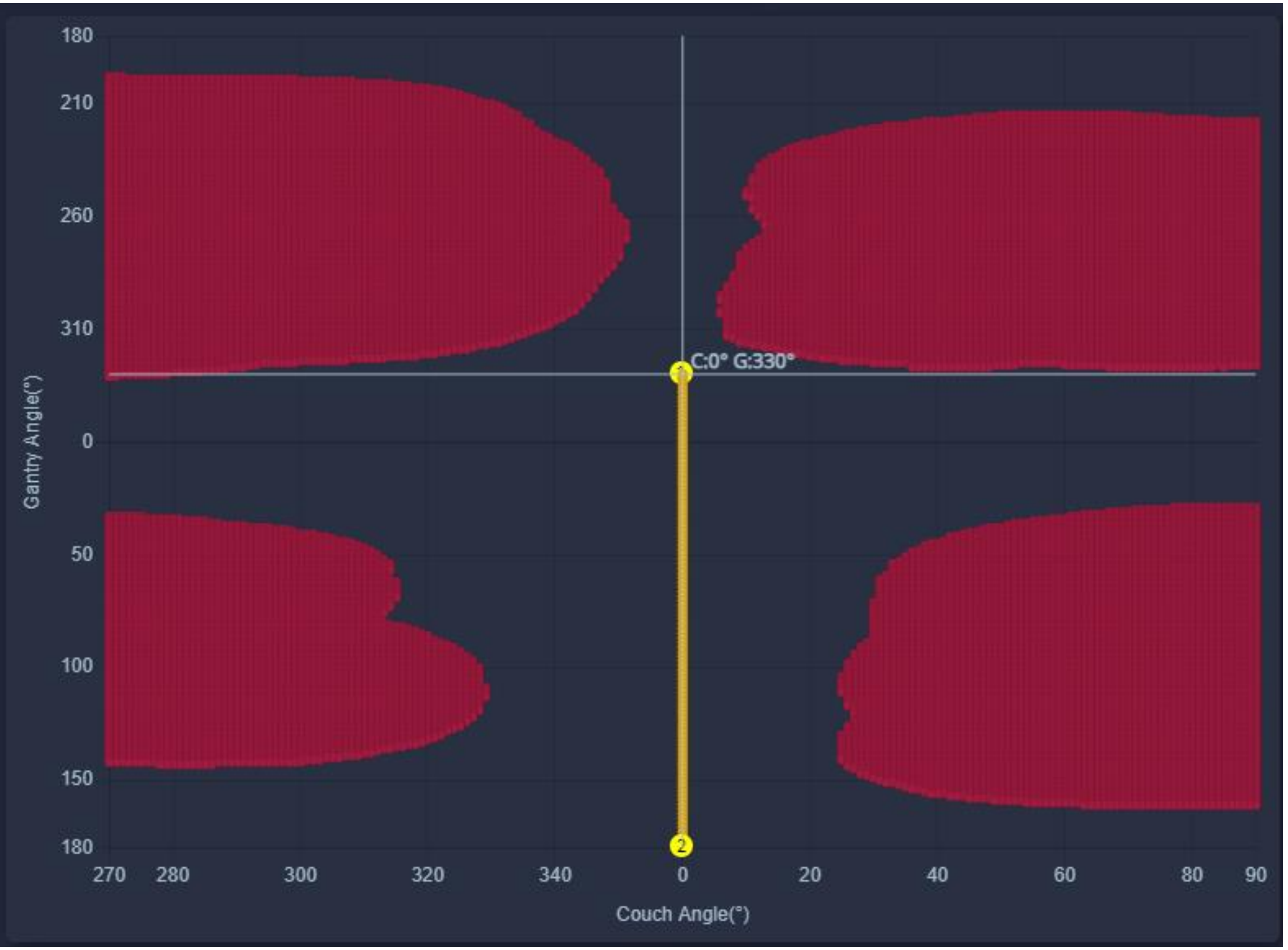
- 2 Field VMAT plan
  - CW G330-G179
  - CCW G179-G330

Priority	Structure Template	Structure Plan	Type	Prescription	Constraint	Goal	VMAT NoKick	Pass/Fail
1	PTV	PTV_LUL_4000_5	Target	**PTV: 4000cGy**	Max ≤	120%	130.52%	✗
2	PTV	PTV_LUL_4000_5	Target	**PTV: 4000cGy**	V100% ≥	95%	99.992%	✓
3	PTV	PTV_LUL_4000_5	Target	**PTV: 4000cGy**	CI 100% ≤ (ratio: PTV vs 100% iso)	1.2-1.5	1.224	△
4	PTV	PTV_LUL_4000_5	Target	**PTV: 4000cGy**	CI 50% ≤ (ratio: PTV vs 50% iso)	3.47-4.74	4.452	△
5	2cm from PTV	y_Ext-PTV+2cm	OAR	**PTV: 4000cGy**	MaxDT using PTV_LUL_4000_5 vol	66.597-86.448%	59.713%	✓
6	SpinalCord	SpinalCanal	OAR		V1700cGy ≤	0.03cc	0cc	✓
7	SpinalCord	SpinalCanal	OAR		V1500cGy ≤	1cc	0cc	✓
9	Heart	Heart	OAR		Max ≤	5250cGy	93.5cGy	✓
10	Heart	Heart	OAR		V3800cGy ≤	0.03cc	0cc	✓
11	Heart	Heart	OAR		V3200cGy ≤	15cc	0cc	✓
12	Skin	Skin	OAR		Max ≤	3200cGy	1770.7cGy	✓
13	Skin	Skin	OAR		V3000cGy ≤	10cc	0cc	✓
14	Trachea	Trachea	OAR		V1800cGy ≤	4cc	0cc	✓
15	Bronchus	Bronchus	OAR		V1800cGy ≤ (Ipsi)	4cc	0cc	✓
19	Esophagus	Esophagus	OAR		Max ≤	5250cGy	2280.7cGy	✓
20	Esophagus	Esophagus	OAR		Mean ≤	1800cGy	444.7cGy	✓
21	Esophagus	Esophagus	OAR		V2750cGy ≤	5cc	0cc	✓

Planning with a Clearance Map - Lung

VMAT NoKick

Status	#	ID	Type	Gantry	Couch	Direction
✔	1	Field 1	Arc	330° to 179°	0°	CW
✔	2	Field 2	Arc	179° to 330°	0°	CC

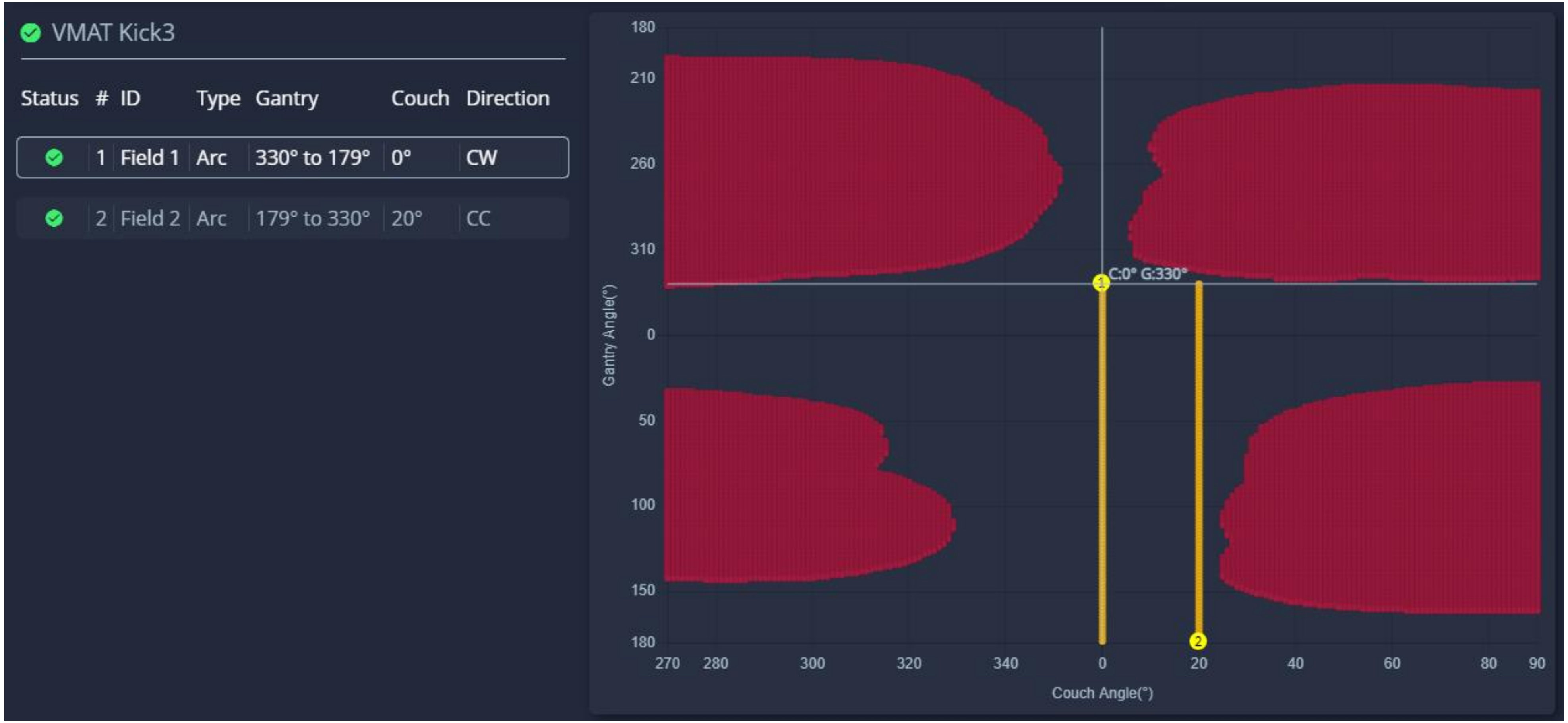


Planning with a Clearance Map - Lung

- 2 Field VMAT non-coplanar plan
  - CW G330-G179, T0
  - CCW G179-G330, T340

Priority	Structure Template	Structure Plan	Type	Prescription	Constraint	Goal	VMAT Kick3	VMAT NoKick
1	PTV	PTV_LUL_4000_5	Target	**PTV: 4000cGy**	Max ≤	120%	123.959%	130.52%
2	PTV	PTV_LUL_4000_5	Target	**PTV: 4000cGy**	V100% ≥	95%	99.967%	99.992%
3	PTV	PTV_LUL_4000_5	Target	**PTV: 4000cGy**	CI 100% ≤ (ratio: PTV vs 100% iso)	1.2-1.5	1.219	1.224
4	PTV	PTV_LUL_4000_5	Target	**PTV: 4000cGy**	CI 50% ≤ (ratio: PTV vs 50% iso)	3.47-4.74	4.141	4.452
5	2cm from PTV	y_Ext-PTV+2cm	OAR	**PTV: 4000cGy**	MaxDT using PTV_LUL_4000_5 '	66.597-86.448%	54.556%	59.713%
6	SpinalCord	SpinalCanal	OAR		V1700cGy ≤	0.03cc	0cc	0cc
7	SpinalCord	SpinalCanal	OAR		V1500cGy ≤	1cc	0.006cc	0cc
9	Heart	Heart	OAR		Max ≤	5250cGy	91.7cGy	93.5cGy
10	Heart	Heart	OAR		V3800cGy ≤	0.03cc	0cc	0cc
11	Heart	Heart	OAR		V3200cGy ≤	15cc	0cc	0cc
12	Skin	Skin	OAR		Max ≤	3200cGy	1562.7cGy	1770.7cGy
13	Skin	Skin	OAR		V3000cGy ≤	10cc	0cc	0cc
14	Trachea	Trachea	OAR		V1800cGy ≤	4cc	0.041cc	0cc
15	Bronchus	Bronchus	OAR		V1800cGy ≤ (Ipsi)	4cc	0cc	0cc
19	Esophagus	Esophagus	OAR		Max ≤	5250cGy	2216.5cGy	2280.7cGy
20	Esophagus	Esophagus	OAR		Mean ≤	1800cGy	434.2cGy	444.7cGy
21	Esophagus	Esophagus	OAR		V2750cGy ≤	5cc	0cc	0cc

Planning with a Clearance Map - Lung



Conclusion

- Non-Coplanar treatments can have a clinically significant impact on treatment plans.
  - Can improve target coverage and hot spots
  - Can provide lower OAR doses
  - Reduce the total amount of MUs
- MapRT provides a clearance map that can prevent replans due to collisions and stop the need of a dry-run for complicated setups.
- Planning with a clearance map can improve the quality of a treatment plan and its delivery

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- Thank you!