Very Large Field (*vlf*) IMRT via Solid Compensators

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Introduction

Treatment machines at Ochsner:

- Varian Trilogy 6X/18X with aSi1000 Portal Imaging, OBI, 120 leaf MLC
- Varian 2100C 6X/18X with aSi1000 Portal Imaging, 120 leaf MLC
- Varian 23EX 6X/18X with aSi500 Portal Imaging, 120 Leaf MLC

Treatment Planning:

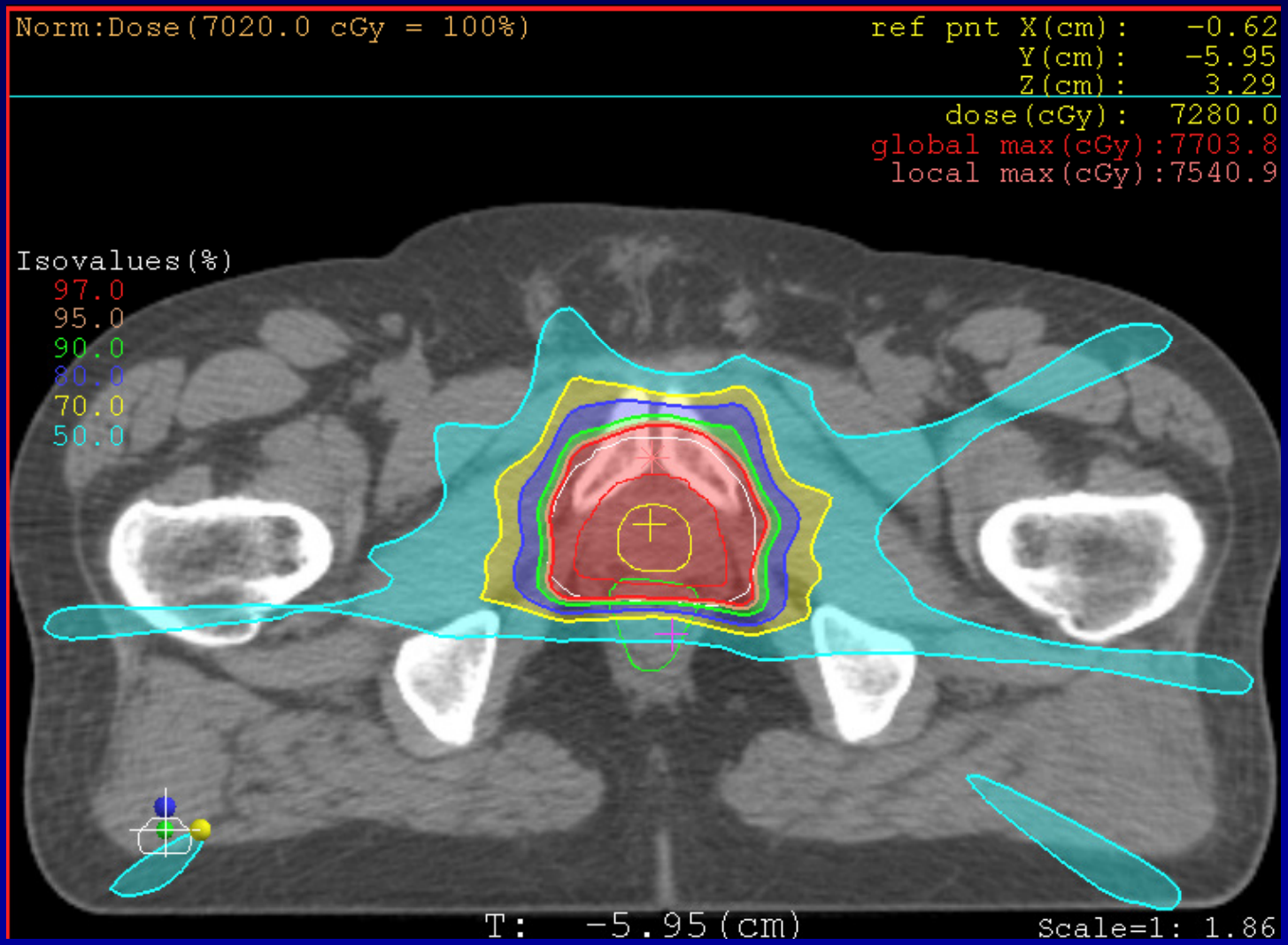
- CMS XiO
- BrainLab BrainScan IMRT
- Varian Eclipse

Dosimetry /QA

- Film / EPID / Mapcheck / MatriXX

Overview of Compensator Based IMRT usage

Prostate Fossa IMRT



Overview of Compensator Based IMRT usage

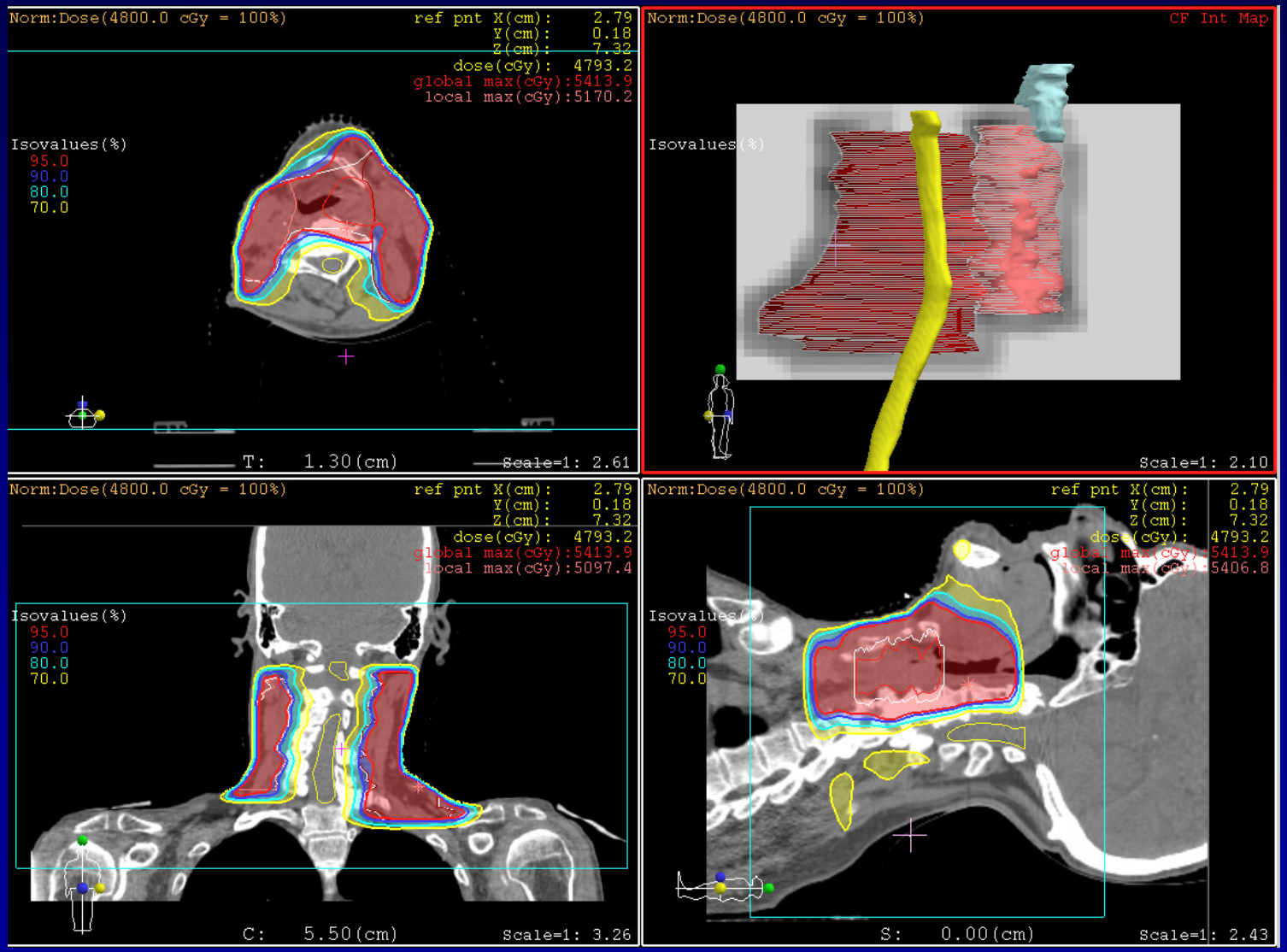
Breast IMRT

Overview of Compensator Based IMRT usage

Head and Neck IMRT

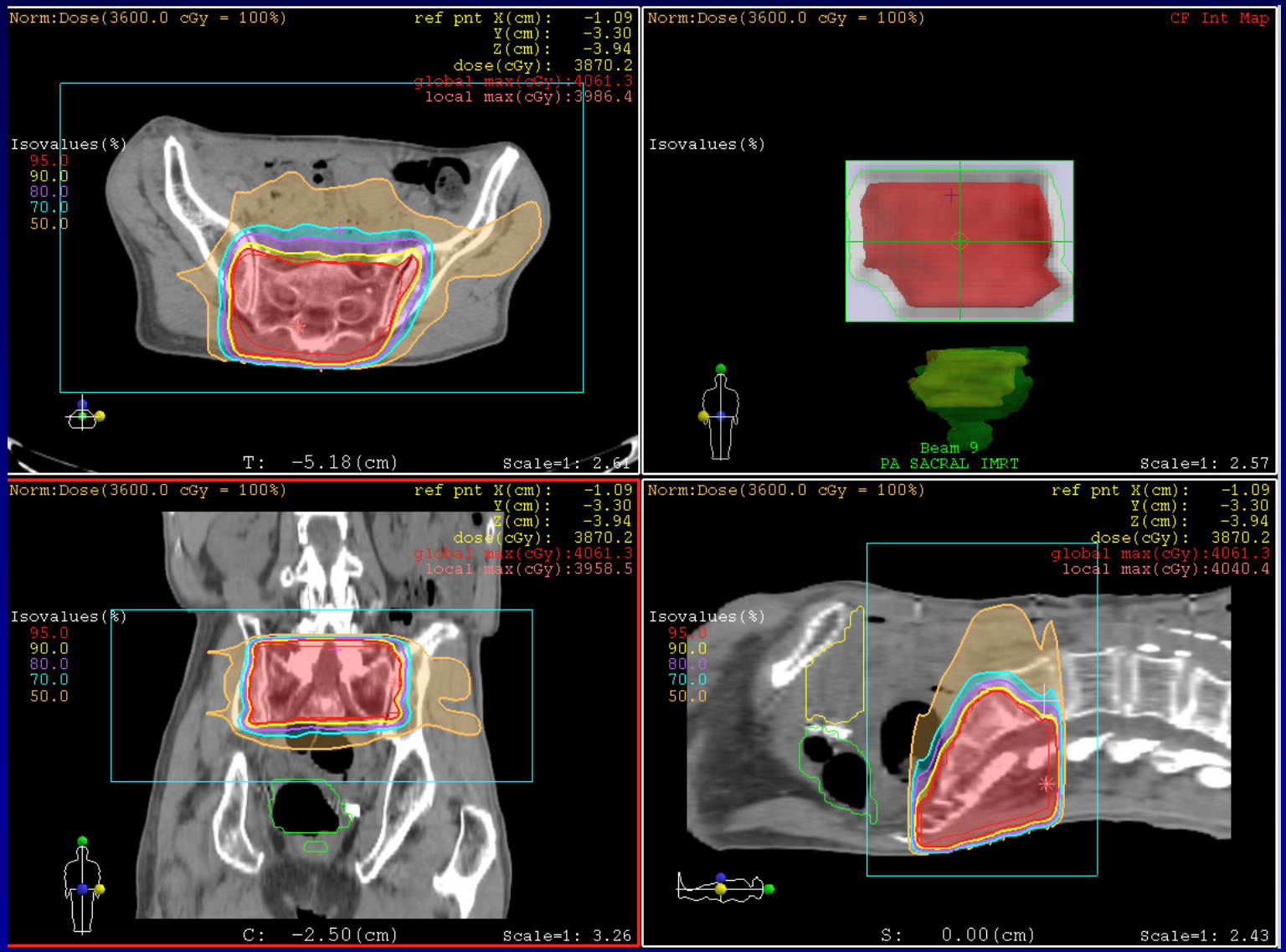
Overview of Compensator Based IMRT usage

Head and Neck IMRT



Overview of Compensator Based IMRT usage

Sacral Mass IMRT

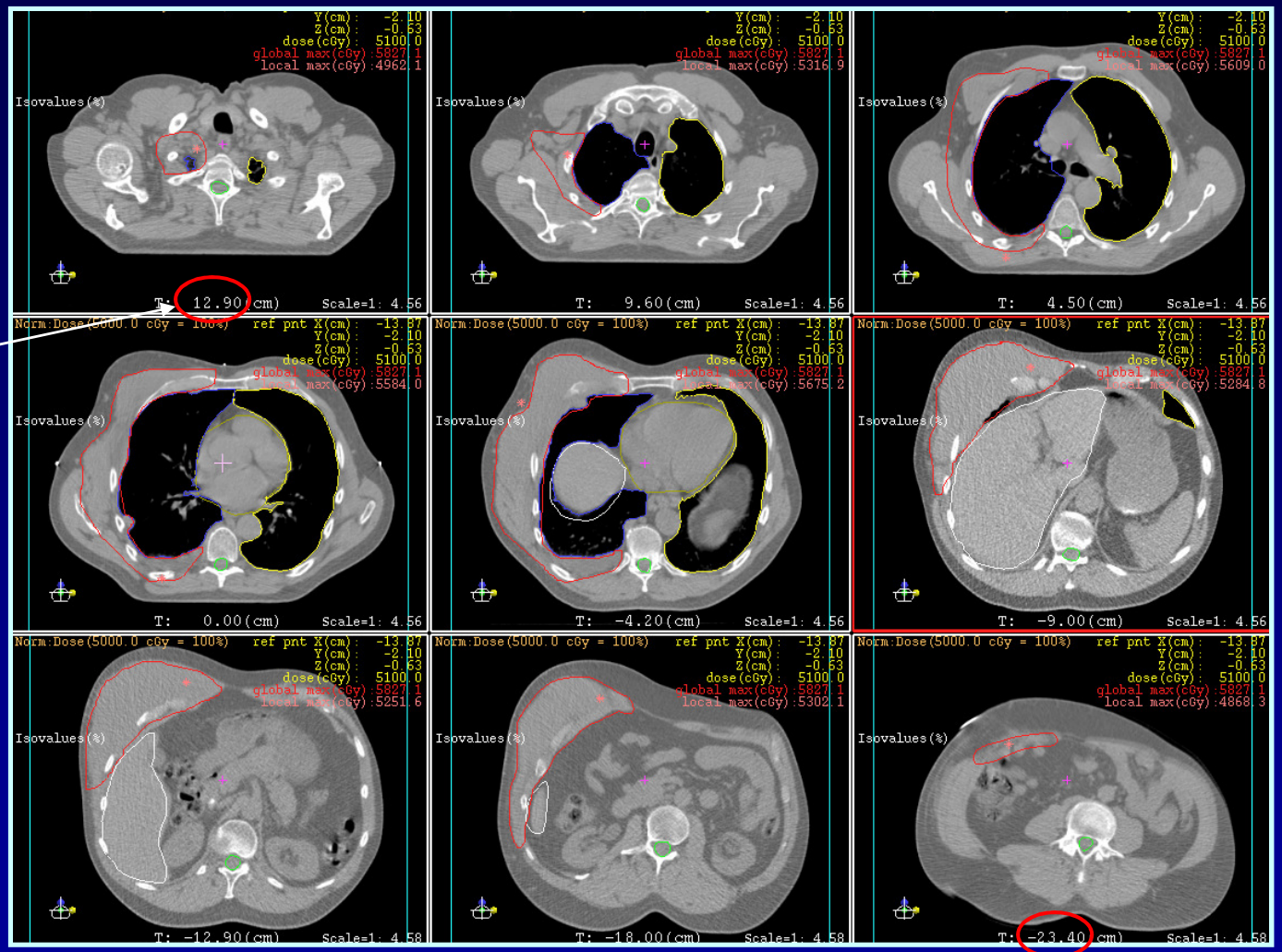


Very Large Field (*vlf*) IMRT via Solid Compensators

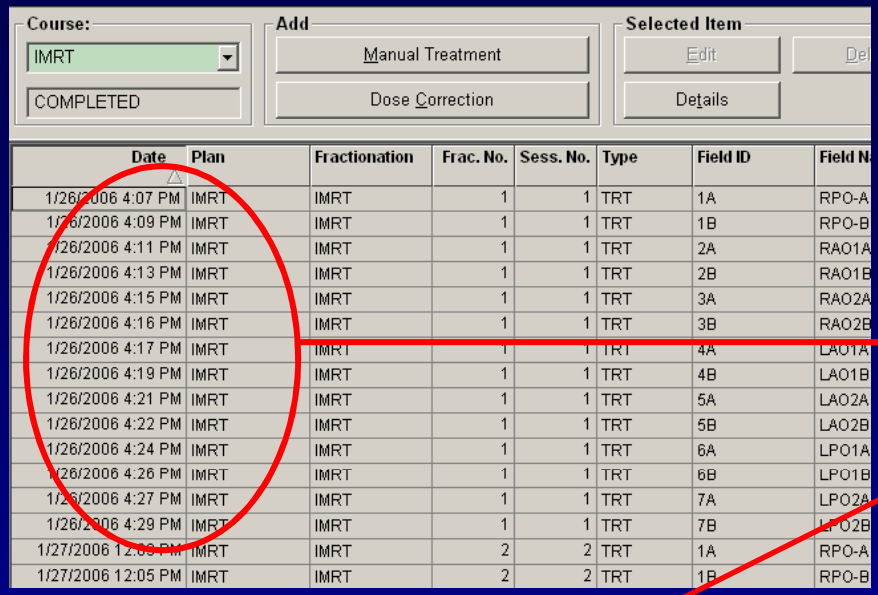
Case Study 1

61 year old patient with history of treatment with chemotherapy for malignant mesothelioma of the right thorax, now with radiographic and symptomatic progression. Stage T4N0M0 malignant mesothelioma with unusually extensive involvement of the right chest wall that has progressed after chemotherapy.

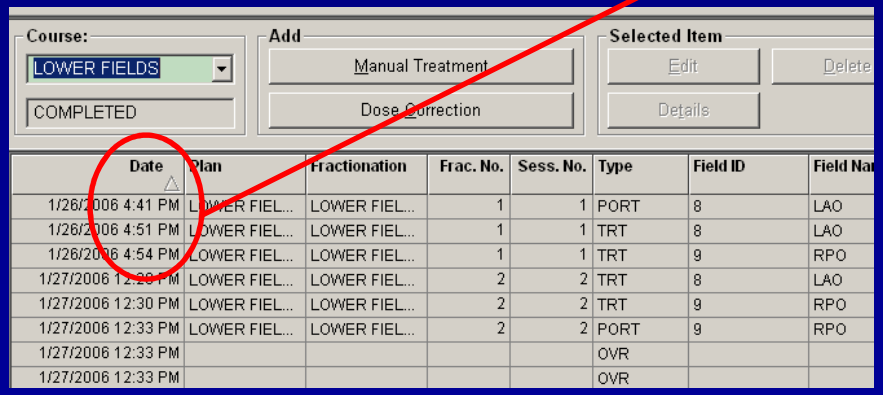
PLAN: Palliative treatment to deliver 70 Gy with IMRT in 2 Gy fractions with concurrent radiosensitizing chemotherapy


+12.9 cm
- 23.4 cm

MLC Based IMRT



Date	Plan	Fractionation	Frac. No.	Sess. No.	Type	Field ID	Field Na
1/26/2006 4:07 PM	IMRT	IMRT	1	1	TRT	1A	RPO-A
1/26/2006 4:09 PM	IMRT	IMRT	1	1	TRT	1B	RPO-B
1/26/2006 4:11 PM	IMRT	IMRT	1	1	TRT	2A	RAO1A
1/26/2006 4:13 PM	IMRT	IMRT	1	1	TRT	2B	RAO1B
1/26/2006 4:15 PM	IMRT	IMRT	1	1	TRT	3A	RAO2A
1/26/2006 4:16 PM	IMRT	IMRT	1	1	TRT	3B	RAO2B
1/26/2006 4:17 PM	IMRT	IMRT	1	1	TRT	4A	LAO1A
1/26/2006 4:19 PM	IMRT	IMRT	1	1	TRT	4B	LAO1B
1/26/2006 4:21 PM	IMRT	IMRT	1	1	TRT	5A	LAO2A
1/26/2006 4:22 PM	IMRT	IMRT	1	1	TRT	5B	LAO2B
1/26/2006 4:24 PM	IMRT	IMRT	1	1	TRT	6A	LPO1A
1/26/2006 4:26 PM	IMRT	IMRT	1	1	TRT	6B	LPO1B
1/26/2006 4:27 PM	IMRT	IMRT	1	1	TRT	7A	LPO2A
1/26/2006 4:29 PM	IMRT	IMRT	1	1	TRT	7B	LPO2B
1/27/2006 12:03 PM	IMRT	IMRT	2	2	TRT	1A	RPO-A
1/27/2006 12:05 PM	IMRT	IMRT	2	2	TRT	1B	RPO-B



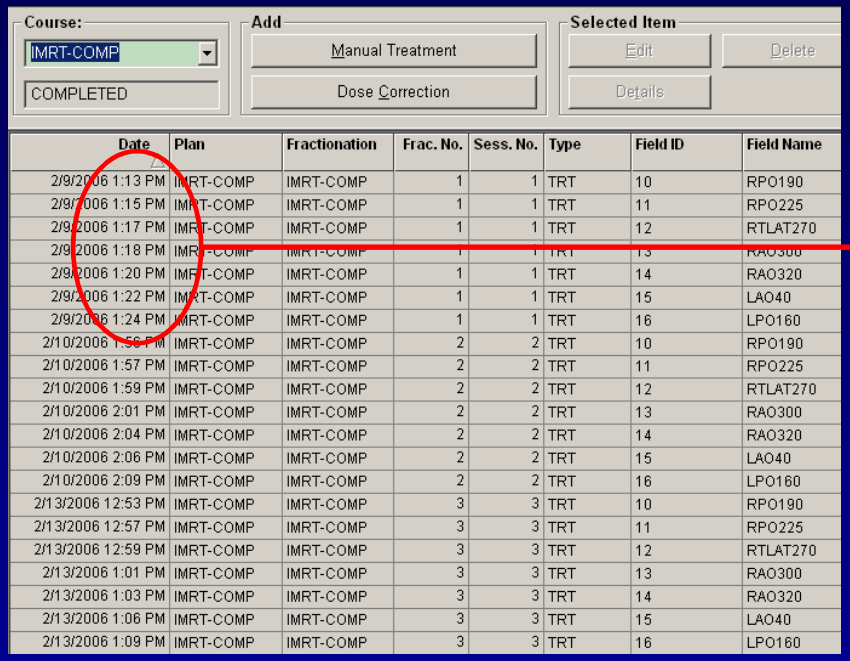
Date	Plan	Fractionation	Frac. No.	Sess. No.	Type	Field ID	Field Na
1/26/2006 4:41 PM	LOWER FIEL...	LOWER FIEL...	1	1	PORT	8	LAO
1/26/2006 4:51 PM	LOWER FIEL...	LOWER FIEL...	1	1	TRT	8	LAO
1/26/2006 4:54 PM	LOWER FIEL...	LOWER FIEL...	1	1	TRT	9	RPO
1/27/2006 12:28 PM	LOWER FIEL...	LOWER FIEL...	2	2	TRT	8	LAO
1/27/2006 12:30 PM	LOWER FIEL...	LOWER FIEL...	2	2	TRT	9	RPO
1/27/2006 12:33 PM	LOWER FIEL...	LOWER FIEL...	2	2	PORT	9	RPO
1/27/2006 12:33 PM					OVR		
1/27/2006 12:33 PM					OVR		

IMRT Upper fields start time: 4:07 p.m

Lower fields finish time: 4:54 p.m

Total Elapsed time ON Treatment Table: 47 min

Compensator Based IMRT

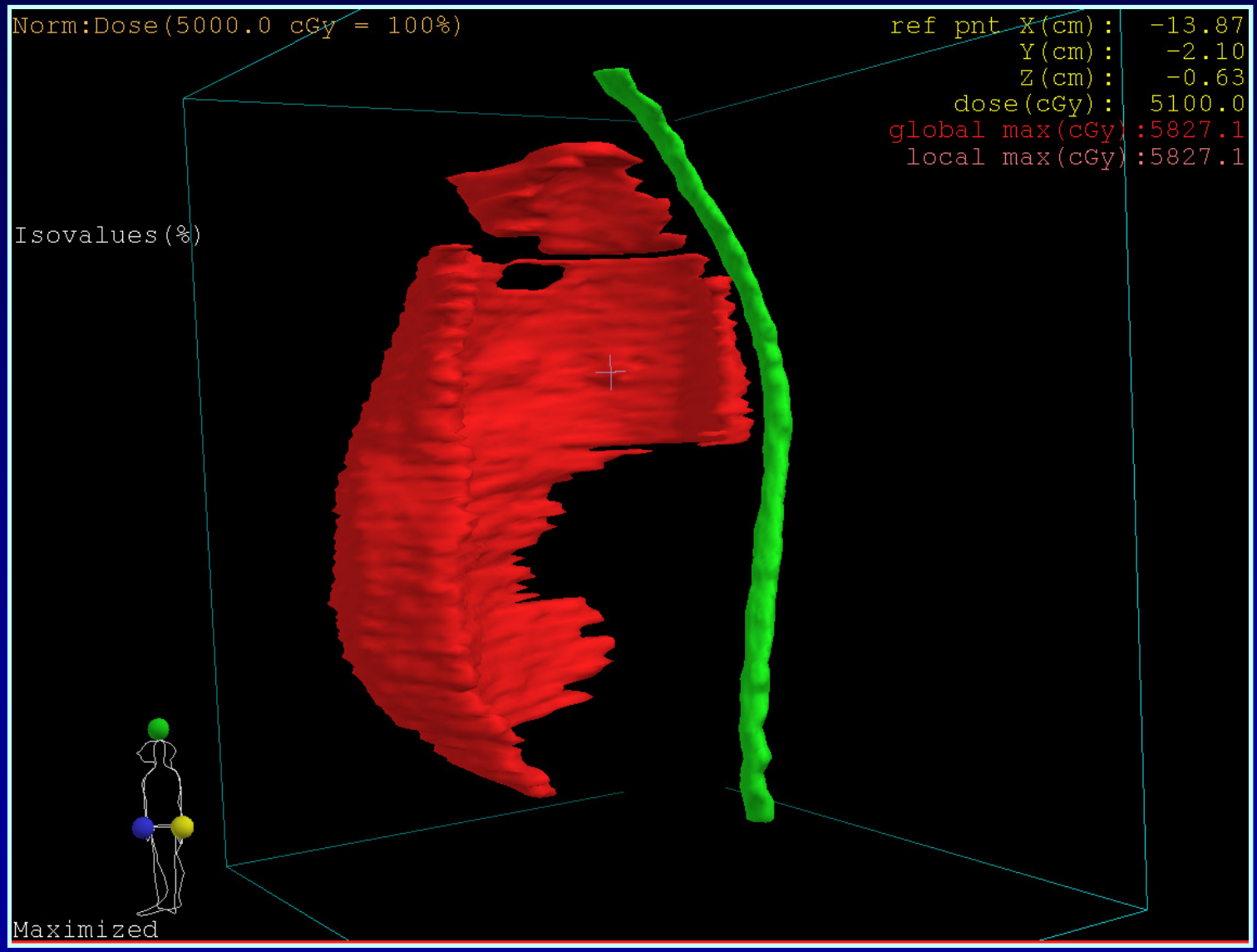


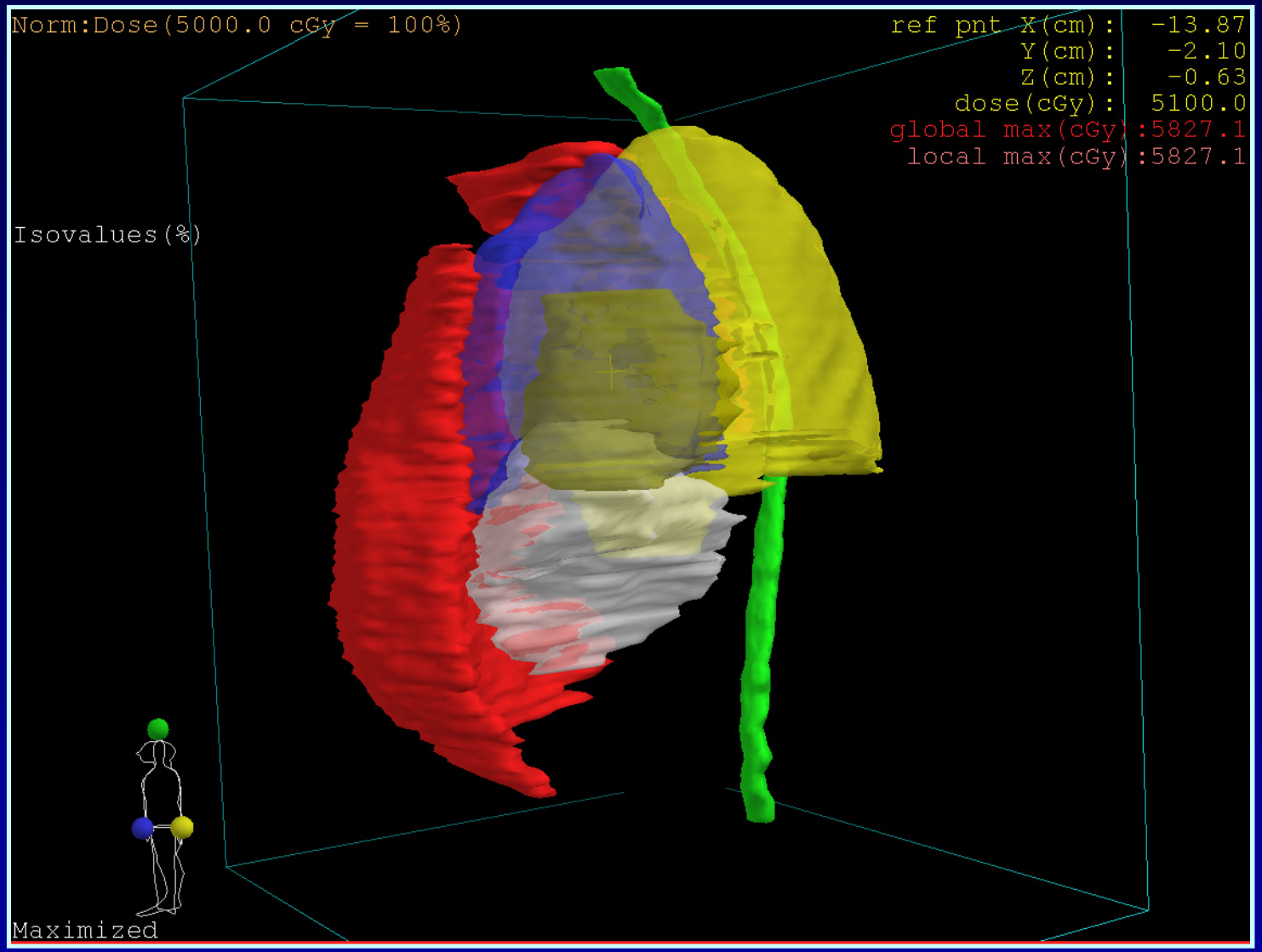
Date	Plan	Fractionation	Frac. No.	Sess. No.	Type	Field ID	Field Name
2/9/2006 1:13 PM	IMRT-COMP	IMRT-COMP	1	1	TRT	10	RPO190
2/9/2006 1:15 PM	IMRT-COMP	IMRT-COMP	1	1	TRT	11	RPO225
2/9/2006 1:17 PM	IMRT-COMP	IMRT-COMP	1	1	TRT	12	RTLAT270
2/9/2006 1:18 PM	IMRT-COMP	IMRT-COMP	1	1	TRT	13	RAO300
2/9/2006 1:20 PM	IMRT-COMP	IMRT-COMP	1	1	TRT	14	RAO320
2/9/2006 1:22 PM	IMRT-COMP	IMRT-COMP	1	1	TRT	15	LAO40
2/9/2006 1:24 PM	IMRT-COMP	IMRT-COMP	1	1	TRT	16	LPO160
2/10/2006 1:56 PM	IMRT-COMP	IMRT-COMP	2	2	TRT	10	RPO190
2/10/2006 1:57 PM	IMRT-COMP	IMRT-COMP	2	2	TRT	11	RPO225
2/10/2006 1:59 PM	IMRT-COMP	IMRT-COMP	2	2	TRT	12	RTLAT270
2/10/2006 2:01 PM	IMRT-COMP	IMRT-COMP	2	2	TRT	13	RAO300
2/10/2006 2:04 PM	IMRT-COMP	IMRT-COMP	2	2	TRT	14	RAO320
2/10/2006 2:06 PM	IMRT-COMP	IMRT-COMP	2	2	TRT	15	LAO40
2/10/2006 2:09 PM	IMRT-COMP	IMRT-COMP	2	2	TRT	16	LPO160
2/13/2006 12:53 PM	IMRT-COMP	IMRT-COMP	3	3	TRT	10	RPO190
2/13/2006 12:57 PM	IMRT-COMP	IMRT-COMP	3	3	TRT	11	RPO225
2/13/2006 12:59 PM	IMRT-COMP	IMRT-COMP	3	3	TRT	12	RTLAT270
2/13/2006 1:01 PM	IMRT-COMP	IMRT-COMP	3	3	TRT	13	RAO300
2/13/2006 1:03 PM	IMRT-COMP	IMRT-COMP	3	3	TRT	14	RAO320
2/13/2006 1:06 PM	IMRT-COMP	IMRT-COMP	3	3	TRT	15	LAO40
2/13/2006 1:09 PM	IMRT-COMP	IMRT-COMP	3	3	TRT	16	LPO160

IMRT start time: 1:13 p.m

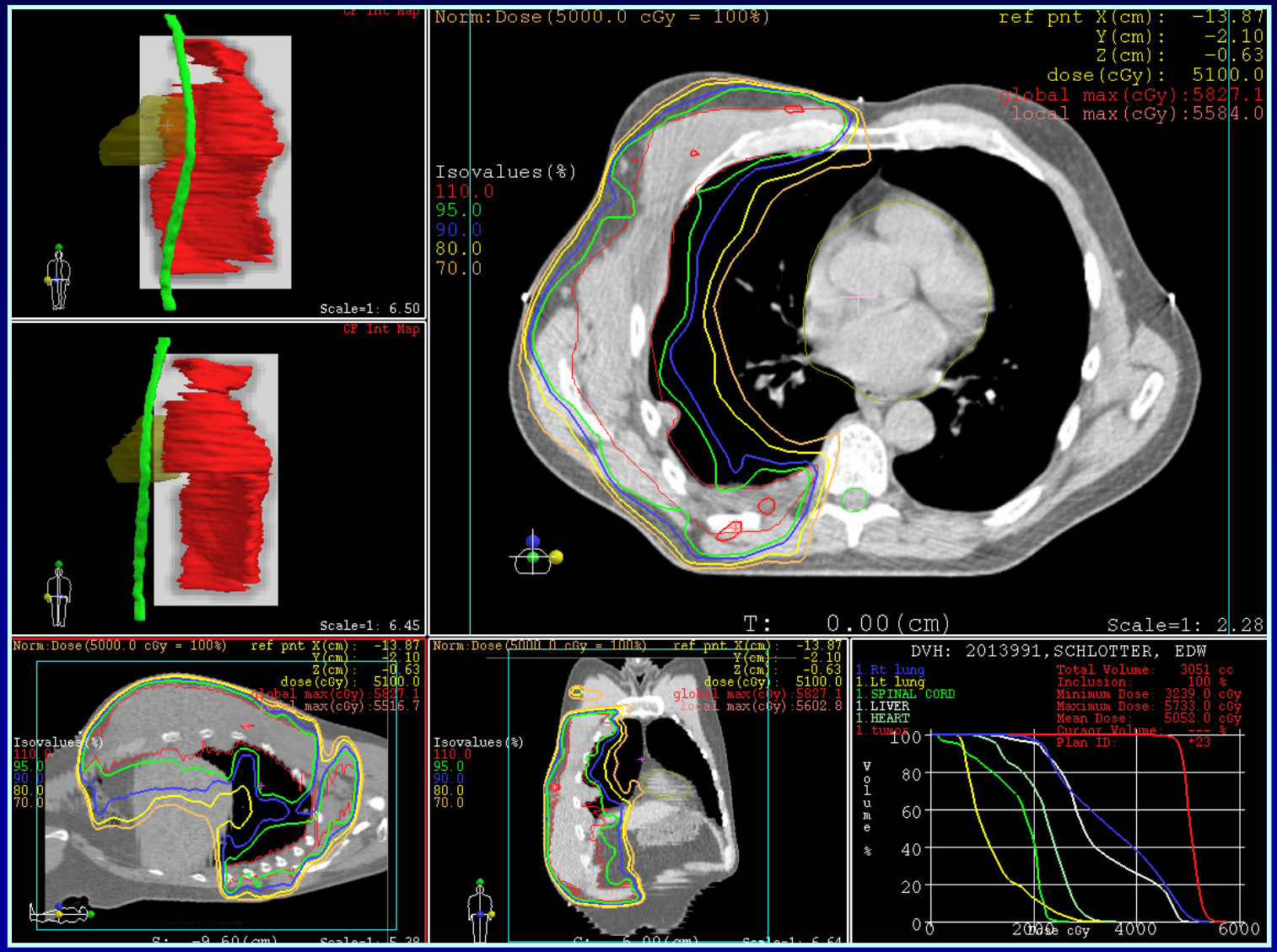
IMRT finish time: 1:24 p.m

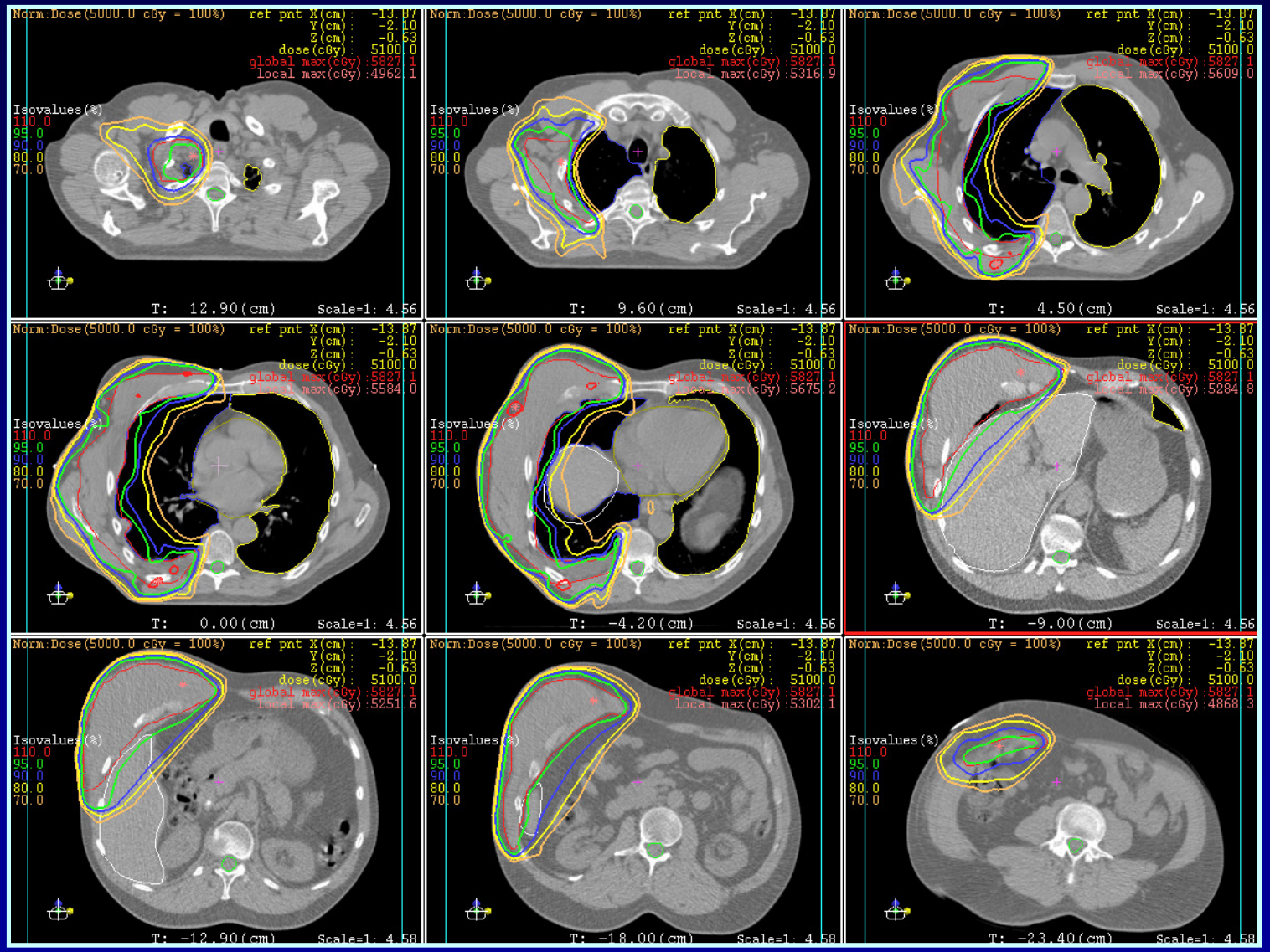
Total Elapsed time ON Treatment Table: 11 min

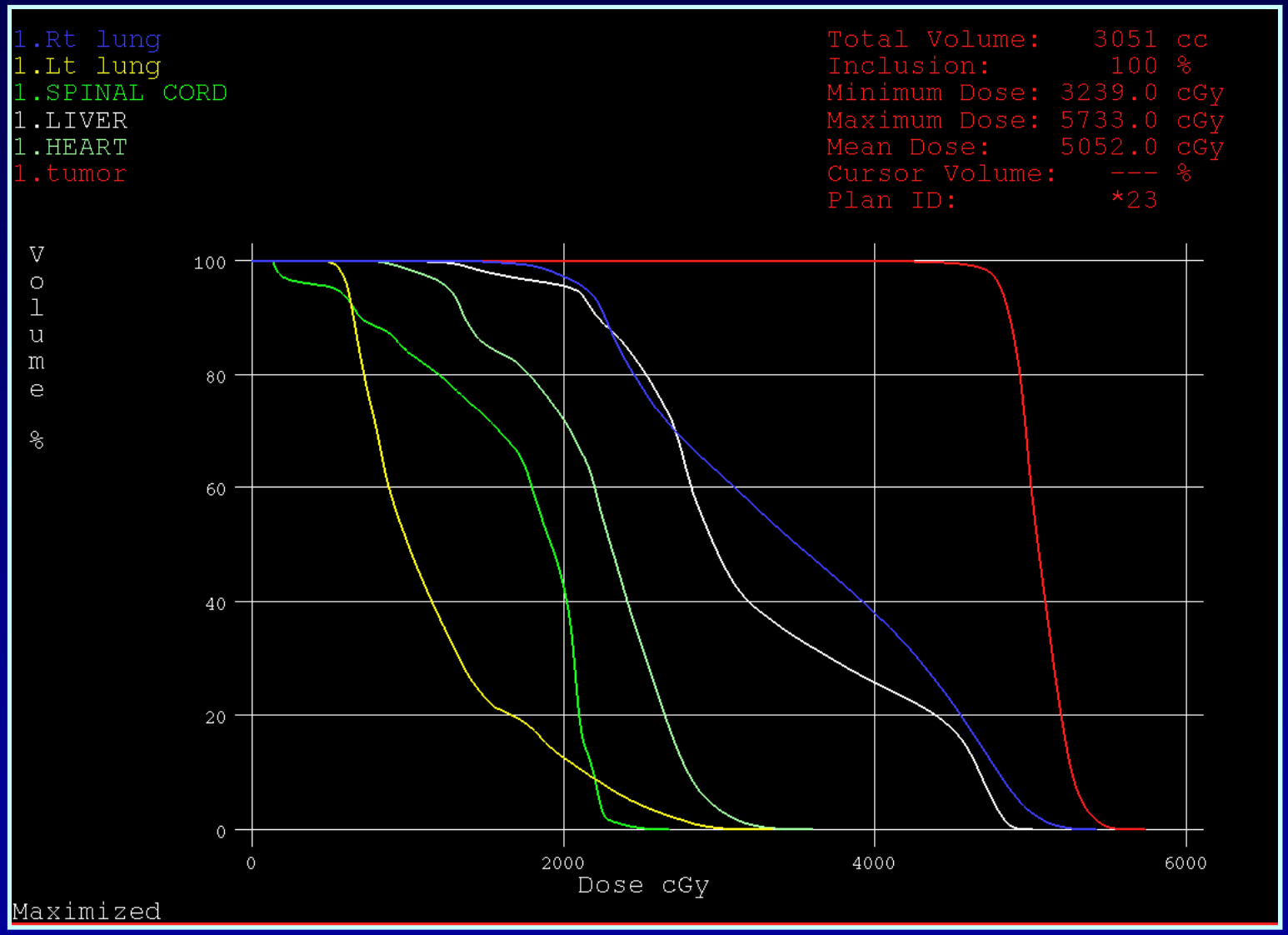

Norm:Dose(5000.0 cGy = 100%)
ref pnt X(cm): -13.87
Y(cm): -2.10
Z(cm): -0.63
dose(cGy): 5100.0
global max(cGy):5827.1
local max(cGy):5827.1
Isovalues(%)
Maximized


Norm:Dose(5000.0 cGy = 100%)
ref pnt X(cm): -13.87
Y(cm): -2.10
Z(cm): -0.63
dose(cGy): 5100.0
global max(cGy):5827.1
local max(cGy):5827.1
Isovalues(%)
Maximized

Ochsner Health System




Norm:Dose(5000.0 cGy = 100%)
ref pnt X(cm): -13.87
Y(cm): -2.10
Z(cm): -0.53
dose(cGy): 5100.0
global max(cGy):5827.1
local max(cGy):4962.1
Isovalues(%)
110.0
95.0
90.0
80.0
70.0
T: 12.90(cm) Scale=1: 4.56
local max(cGy):5316.9
T: 9.60(cm) Scale=1: 4.56
local max(cGy):5609.0
T: 4.50(cm) Scale=1: 4.56
local max(cGy):5584.0
T: 0.00(cm) Scale=1: 4.56
local max(cGy):5675.2
T: -4.20(cm) Scale=1: 4.56
local max(cGy):5284.8
T: -9.00(cm) Scale=1: 4.56
local max(cGy):5251.6
T: -12.90(cm) Scale=1: 4.58
local max(cGy):5302.1
T: -18.00(cm) Scale=1: 4.58
local max(cGy):4868.3
T: -23.40(cm) Scale=1: 4.58


1.Rt lung
1.Lt lung
1.SPINAL CORD
1.LIVER
1.HEART
1.tumor
Total Volume: 3051 cc
Inclusion: 100 %
Minimum Dose: 3239.0 cGy
Maximum Dose: 5733.0 cGy
Mean Dose: 5052.0 cGy
Cursor Volume: --- %
Plan ID: *23
Volume %
100
80
60
40
20
0
0
2000
4000
6000
Dose cGy
Maximized

Case Study 2

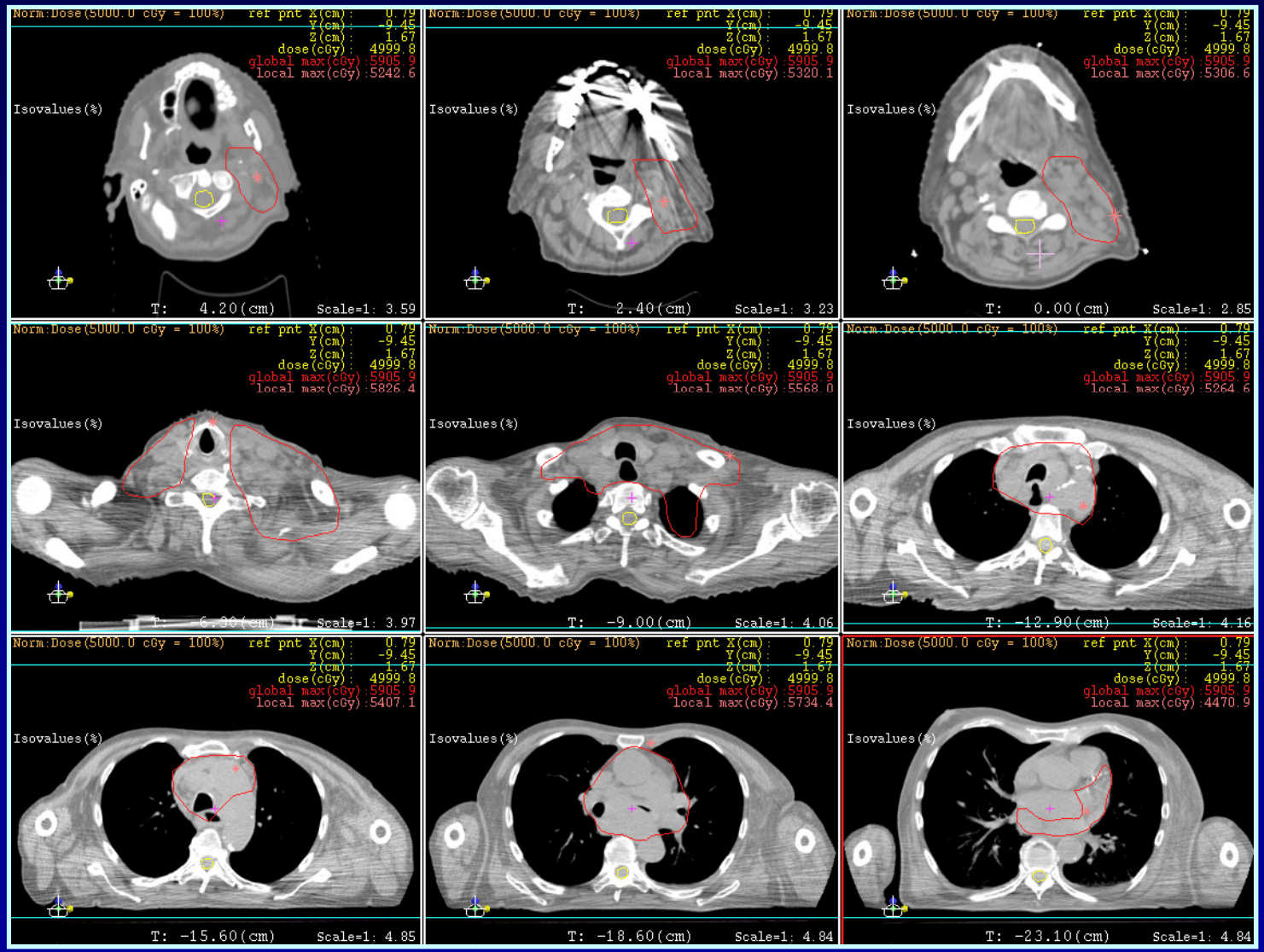
72 year old patient with T1N3M0 adenocarcinoma of the left upper lobe of the lung

Unusually extensive spread to supraclav and lower neck nodes

PLAN: Deliver total 70 Gy in 2 Gy fractions

Start with 7fld compensator based IMRT to entire region (50 Gy)

Followed by 20 Gy boost

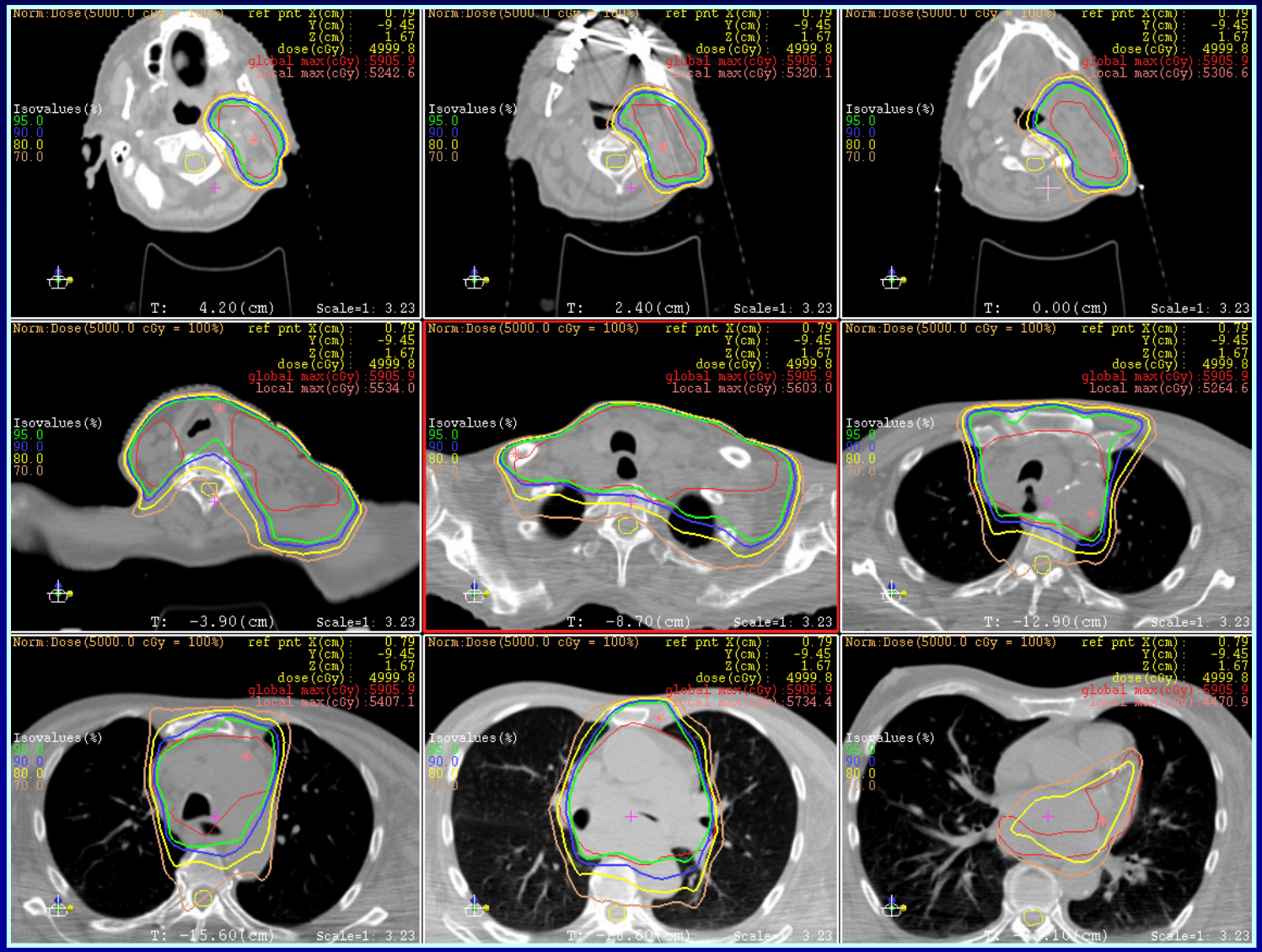

Norm:Dose(5000.0 cGy = 100%)
ref pnt X(cm): 0.79
Y(cm): -9.45
Z(cm): 1.67
dose(cGy): 4999.8
global max(cGy):5905.9
local max(cGy):5242.6
Isovalues(%)
T: 4.20(cm) Scale=1: 3.59
local max(cGy):5320.1
T: 2.40(cm) Scale=1: 3.23
local max(cGy):5306.6
T: 0.00(cm) Scale=1: 2.85
local max(cGy):5826.4
T: -6.30(cm) Scale=1: 3.97
local max(cGy):5568.0
T: -9.00(cm) Scale=1: 4.06
local max(cGy):5264.6
T: -12.90(cm) Scale=1: 4.16
local max(cGy):5407.1
T: -15.60(cm) Scale=1: 4.85
local max(cGy):5734.4
T: -18.60(cm) Scale=1: 4.84
local max(cGy):4470.9
T: -23.10(cm) Scale=1: 4.84

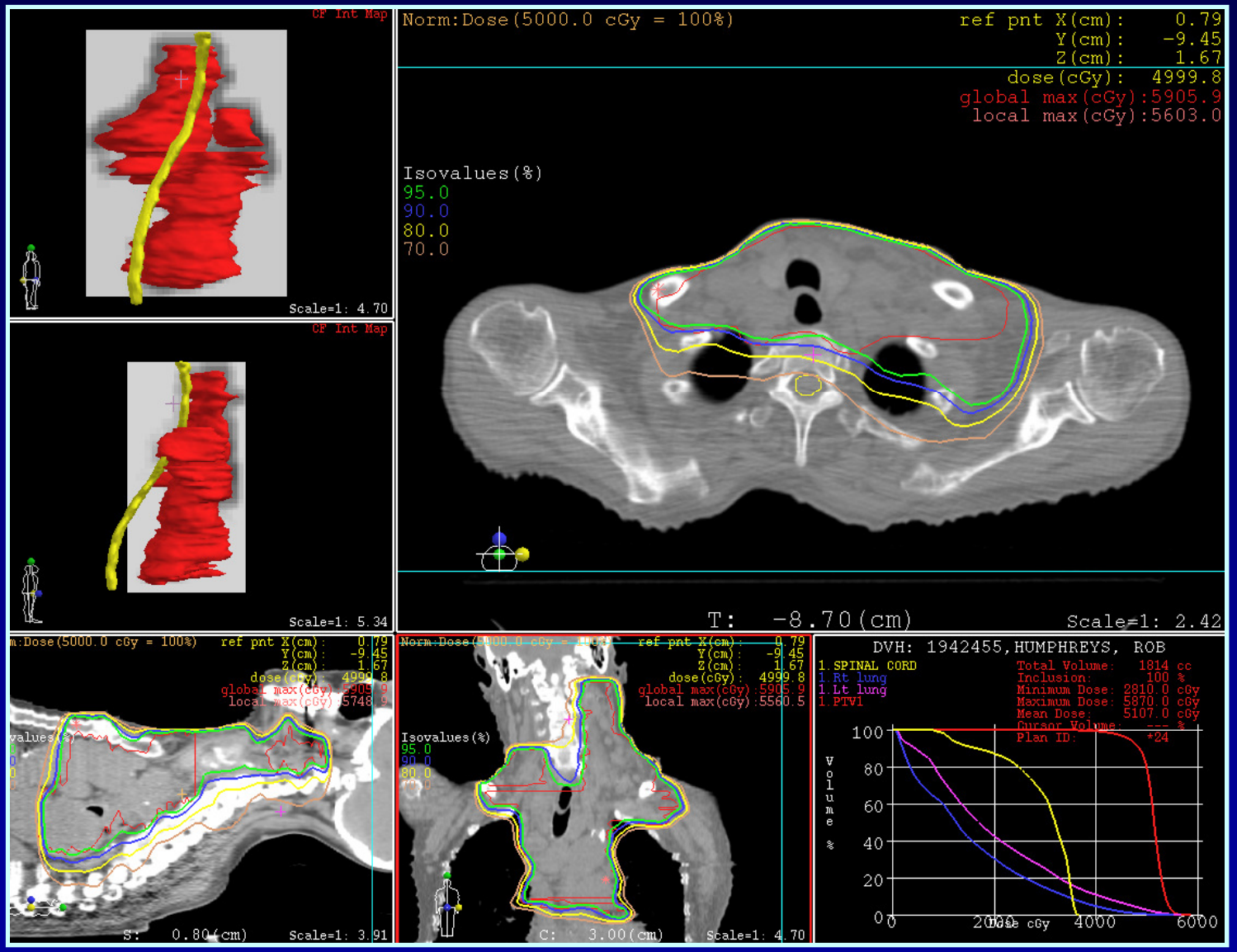
Organs of concern:

Right and Left Lung

Uninvolved Mediastinum / Heart

Spinal Cord


Norm:Dose(5000.0 cGy = 100%)
ref pnt X(cm): 0.79
Y(cm): -9.45
Z(cm): 1.67
dose(cGy): 4999.8
global max(cGy):5905.9
local max(cGy):5242.6
Isovalues(%)
95.0
90.0
80.0
70.0
T: 4.20(cm) Scale=1: 3.23
local max(cGy):5320.1
T: 2.40(cm) Scale=1: 3.23
local max(cGy):5306.6
T: 0.00(cm) Scale=1: 3.23
local max(cGy):5534.0
T: -3.90(cm) Scale=1: 3.23
local max(cGy):5603.0
T: -8.70(cm) Scale=1: 3.23
local max(cGy):5264.6
T: -12.90(cm) Scale=1: 3.23
local max(cGy):5407.1
T: -15.60(cm) Scale=1: 3.23
local max(cGy):5734.4

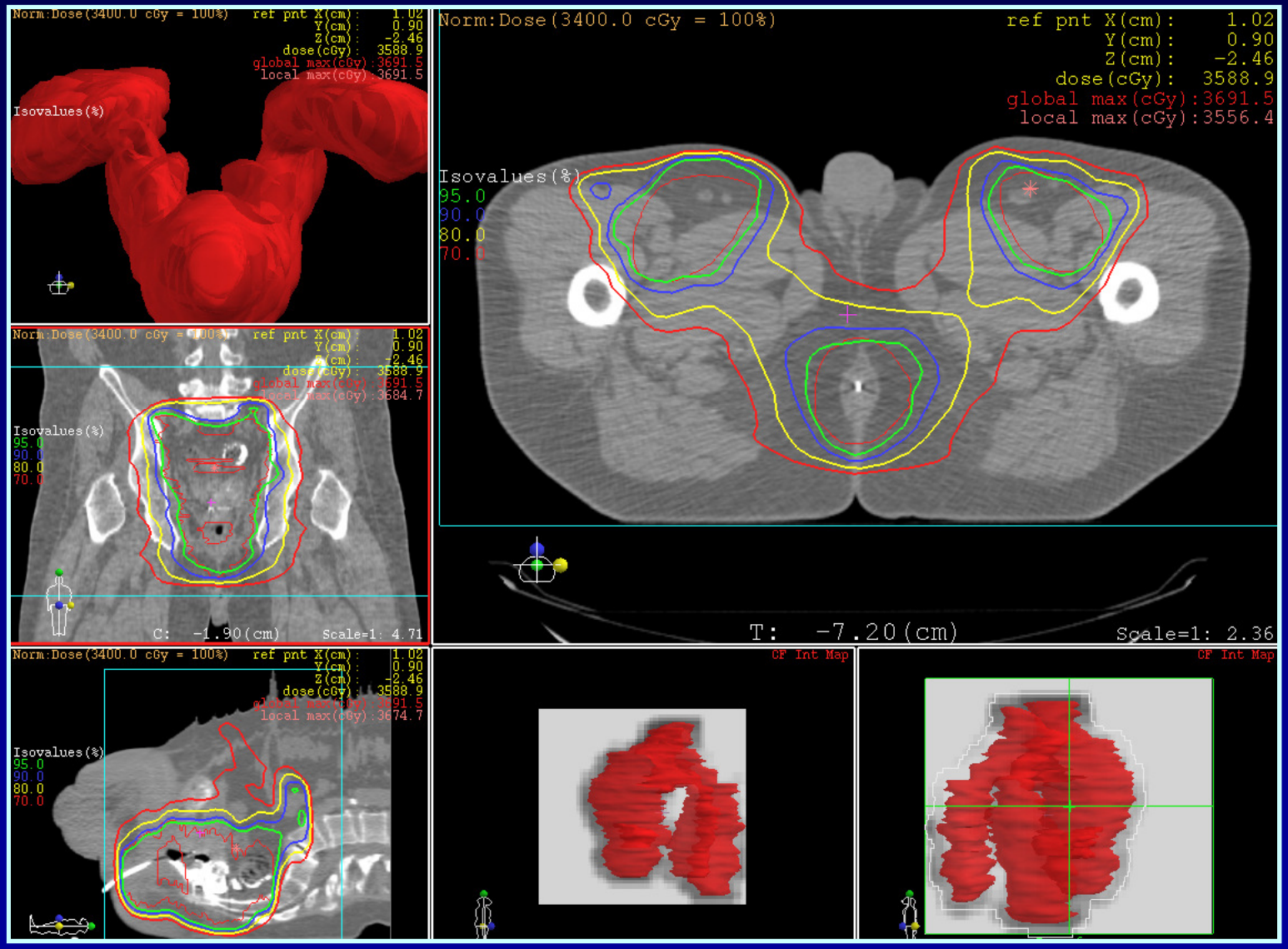

CF Int Map
Scale=1: 4.70
CF Int Map
Scale=1: 5.34
Norm:Dose(5000.0 cGy = 100%)
ref pnt X(cm): 0.79
Y(cm): -9.45
Z(cm): 1.67
dose(cGy): 4999.8
global max(cGy):5905.9
local max(cGy):5603.0
Isovalues(%)
95.0
90.0
80.0
70.0
T: -8.70(cm)
Scale=1: 2.42
S: 0.80(cm)
Scale=1: 3.91
Isovalues(%)
95.0
80.0
C: 3.00(cm)
Scale=1: 4.70
DVH: 1942455,HUMPHREYS, ROB
1.SPINAL CORD
1.Rt lung
1.Lt lung
1.PTV1
Total Volume: 1814 cc
Inclusion: 100 %
Minimum Dose: 2810.0 cGy
Maximum Dose: 5870.0 cGy
Mean Dose: 5107.0 cGy
Plan ID: *24
Volume %
100
80
60
40
20
0
0
2000
4000
6000
Dose cGy

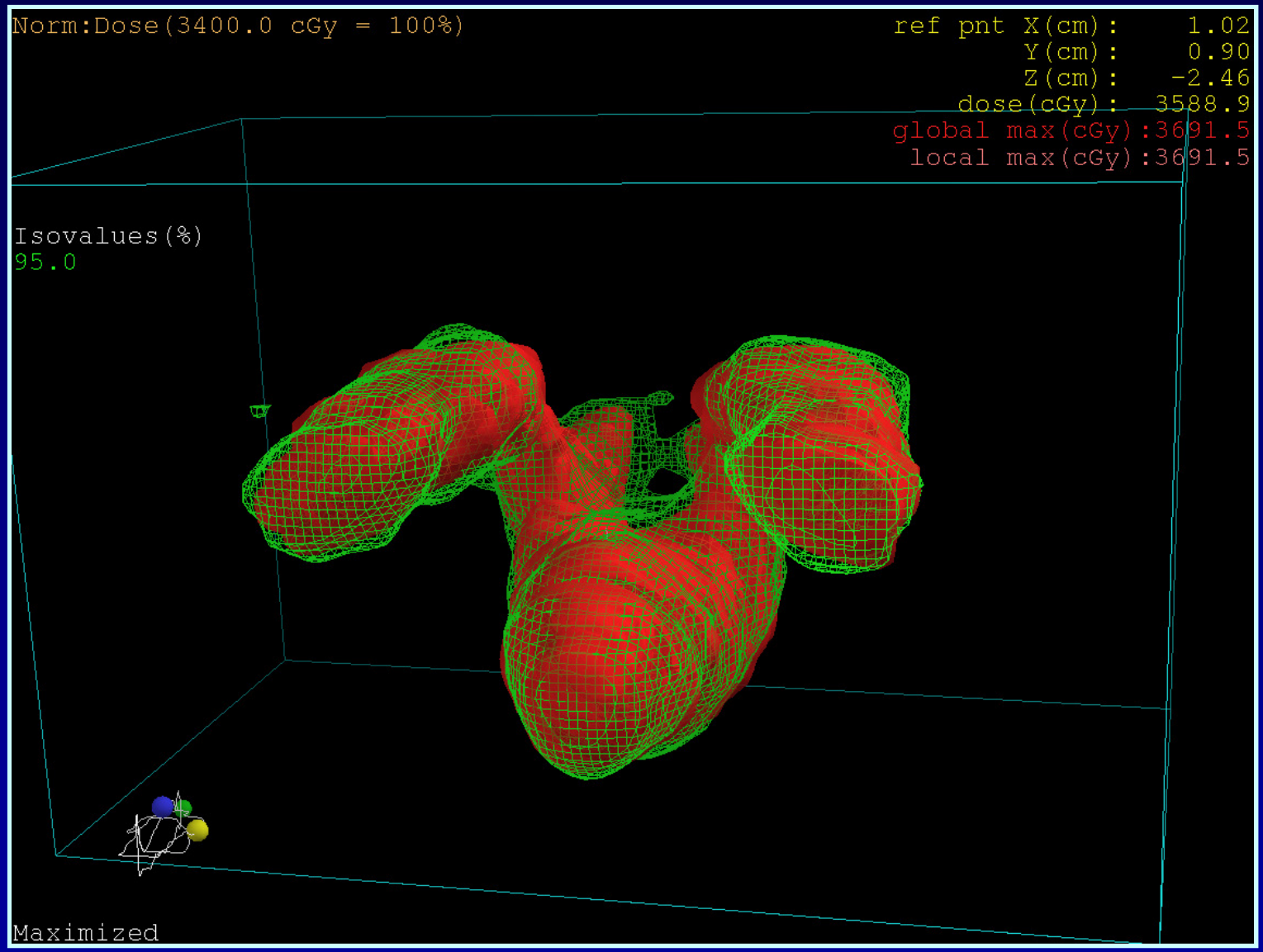
Case Study 3

59 year old patient with T2N0M0(II) basaloid squamous cell carcinoma of the anal canal

PLAN: Radiation and concurrent chemotherapy

56 Gy total dose with IMRT at 2 Gy per fraction

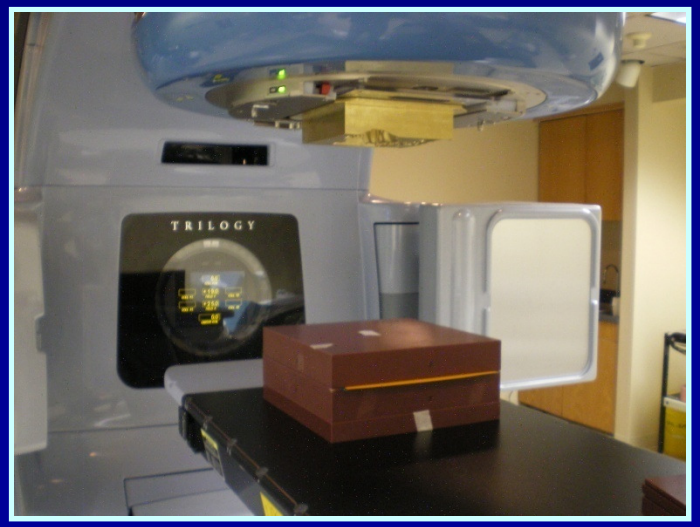

Norm:Dose(3400.0 cGy = 100%)
ref pnt X(cm): 1.02
Y(cm): 0.90
Z(cm): -2.46
dose(cGy): 3588.9
global max(cGy):3691.5
local max(cGy):3556.4
Isovalues(%)
95.0
90.0
80.0
70.0
T: -7.20(cm)
Scale=1: 2.36
C: -1.90(cm)
Scale=1: 4.71
CF Int Map


Norm:Dose(3400.0 cGy = 100%)
ref pnt X(cm): 1.02
Y(cm): 0.90
Z(cm): -2.46
dose(cGy): 3588.9
global max(cGy):3691.5
local max(cGy):3691.5
Isovalues(%)
95.0
Maximized

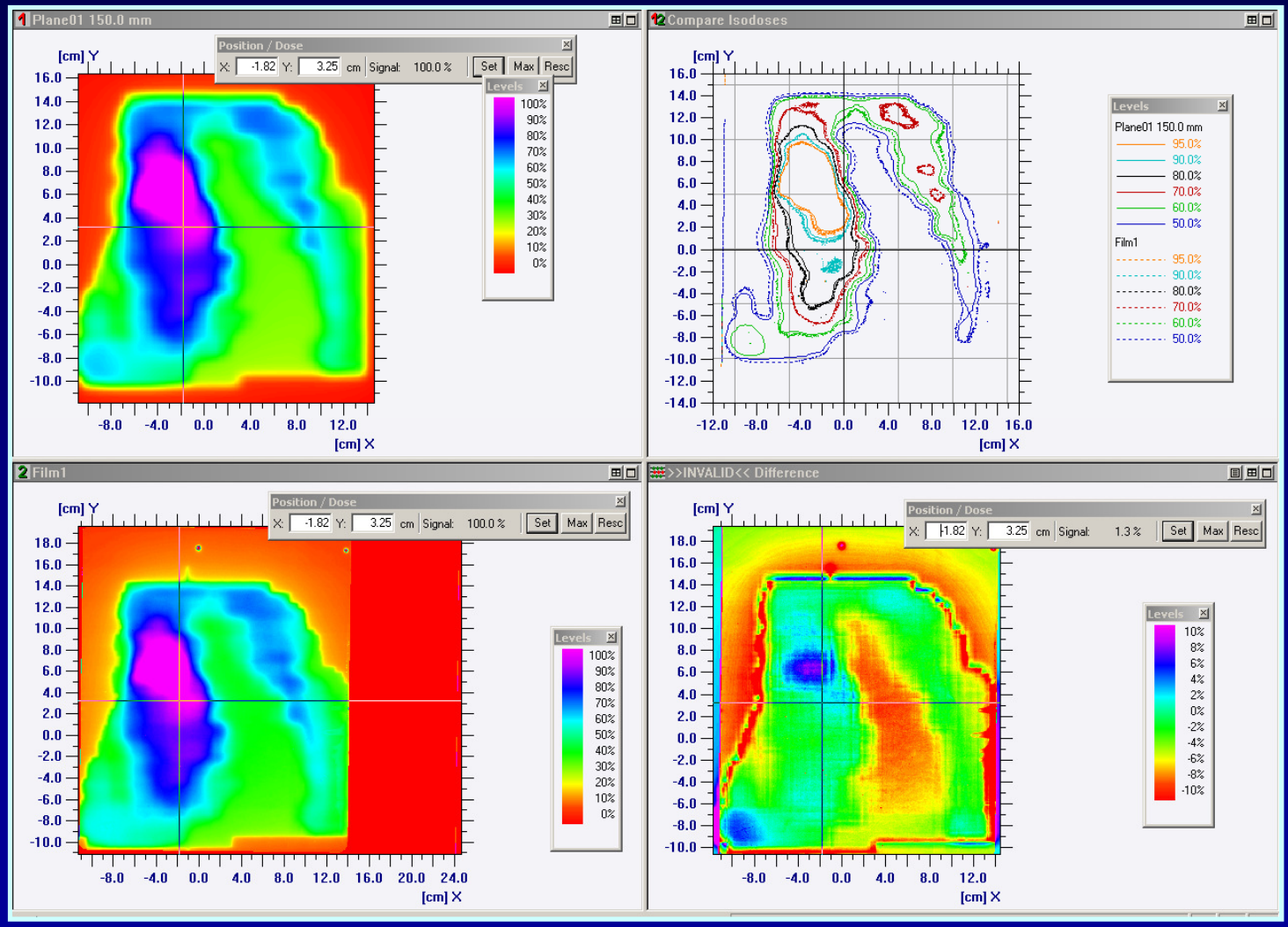
Patient Treatments

- Large field IMRT patients usually treated with 7 or 8 treatment fields
- Treatment time usually fits in a 15 minute time slot
- MLC used for field shaping

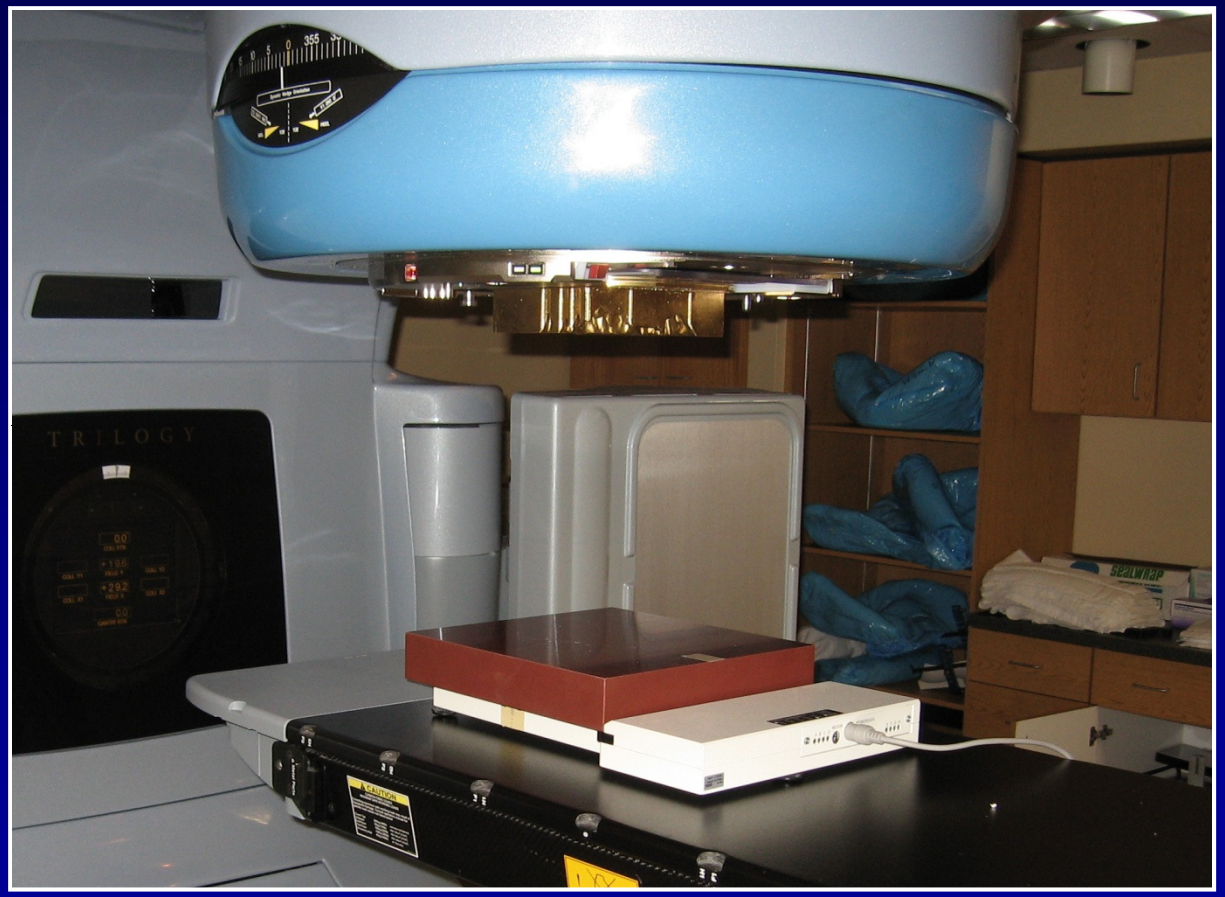
QA and Analysis



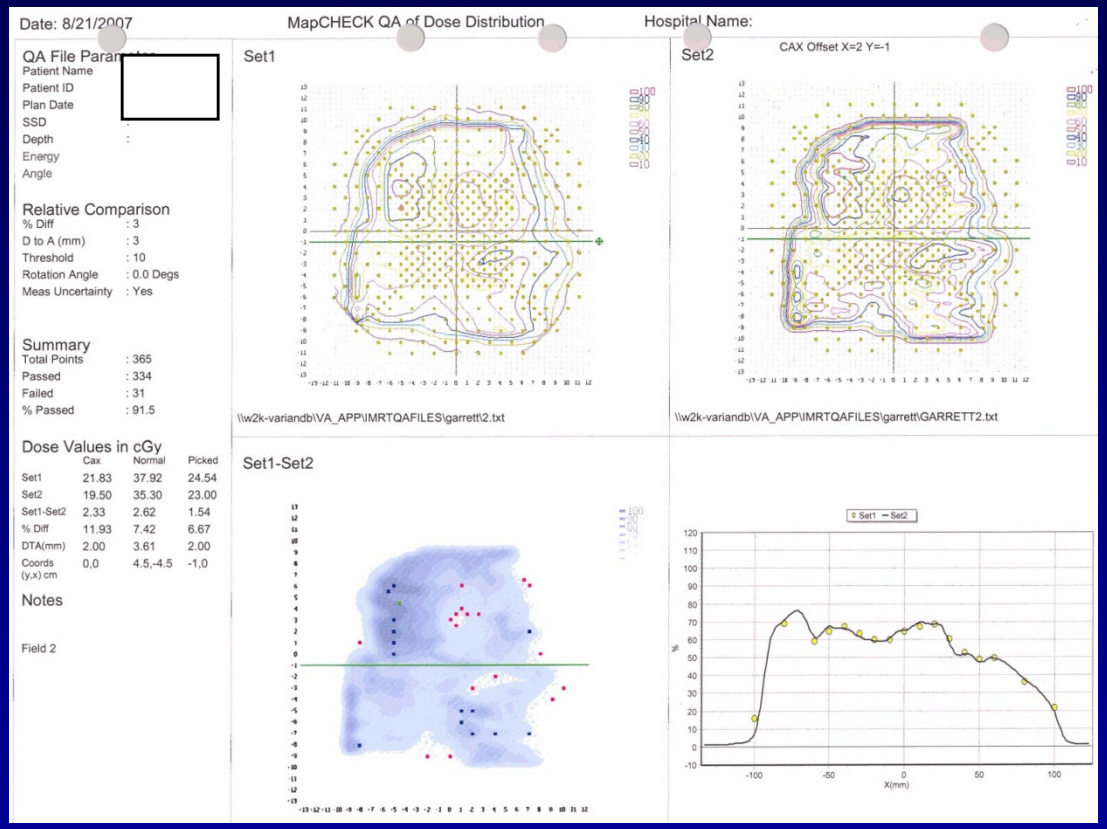
QA with Film Dosimetry (Welhoffer I'mRT Software)



QA with Diode Array SunNuclear MapCheck



QA with Diode Array SunNuclear MapCheck



Clinic#: 253737
Physician: Hawkins

POINT DOSE PHANTOM MEASUREMENT

IMRT Physics Quality Assurance and Verification
Ochsner Clinic Foundation
Department of Radiation Oncology

Procedure:

Patient Plan was mapped to Mapcheck with 5cm buildup. Each field was mapped individually and the coronal plane was exported for MapCheck analysis. All of the fields were treated through VARIS with the gantry at 0 degrees. For calibration dose to the MapCheck, the Monitor Units required to deliver 200 cGy was determind to be 215 MU by the ECLIPSE RTP system and verified using hand calculations, taking into account the appropriate CT-electron density conversion factors.

Dose Delivered to CAX = 200.00 cGy
Dose Measured = 204.05 cGy
Output correction Factor = 0.980
Expected dose at Measurement Point from treatment Plan = **211.46** cGy

Measurement Data:

Field #	Measured Dose	Corrected Dose	Measured % of Dose	Plan Dose to Point	Planned % of Dose	relative % Diff *
	cGy	cGy		cGy		
1	33.64	32.97	15.65	33.88	16.02	-0.4
2	21.47	21.04	9.99	20.73	9.80	0.2
3	33.67	33.00	15.66	34.98	16.54	-0.9
4	22.15	21.71	10.30	18.86	8.92	1.4
5	22.71	22.26	10.57	21.75	10.29	0.3
6	28.68	28.11	13.34	29.73	14.06	-0.7
7	24.56	24.07	11.43	23.00	10.88	0.5
8	28.07	27.51	13.06	28.53	13.49	-0.4
Total		210.68	cGy	211.46	Total	0.00

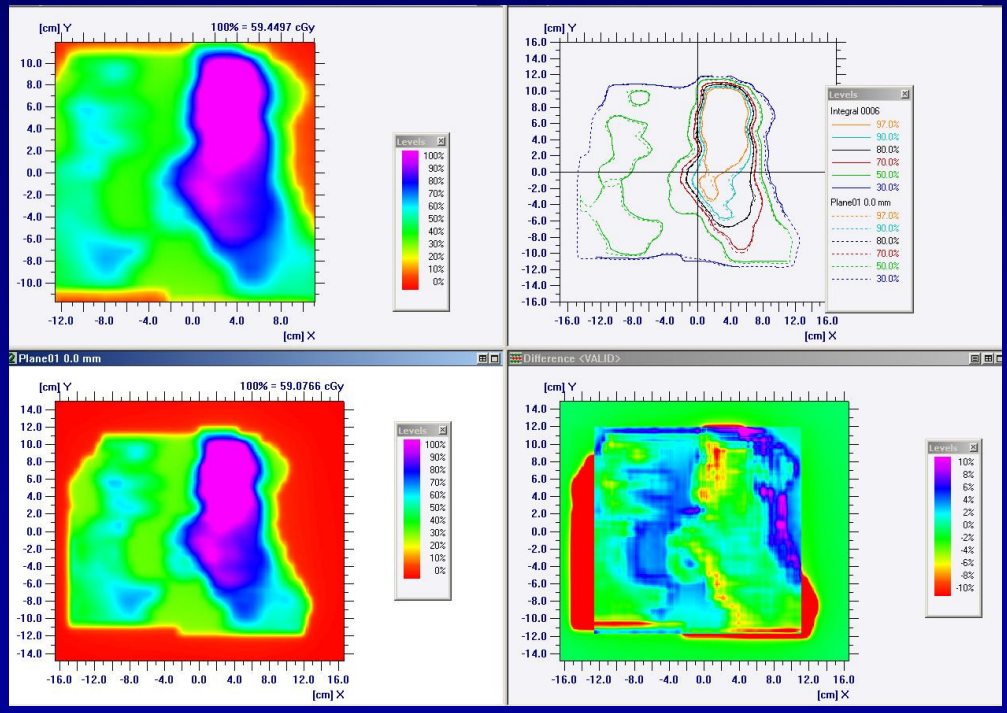
Total Measured Dose: 210.68 cGy

* relative % Diff = (Planned % of Dose - Measured % of Dose)

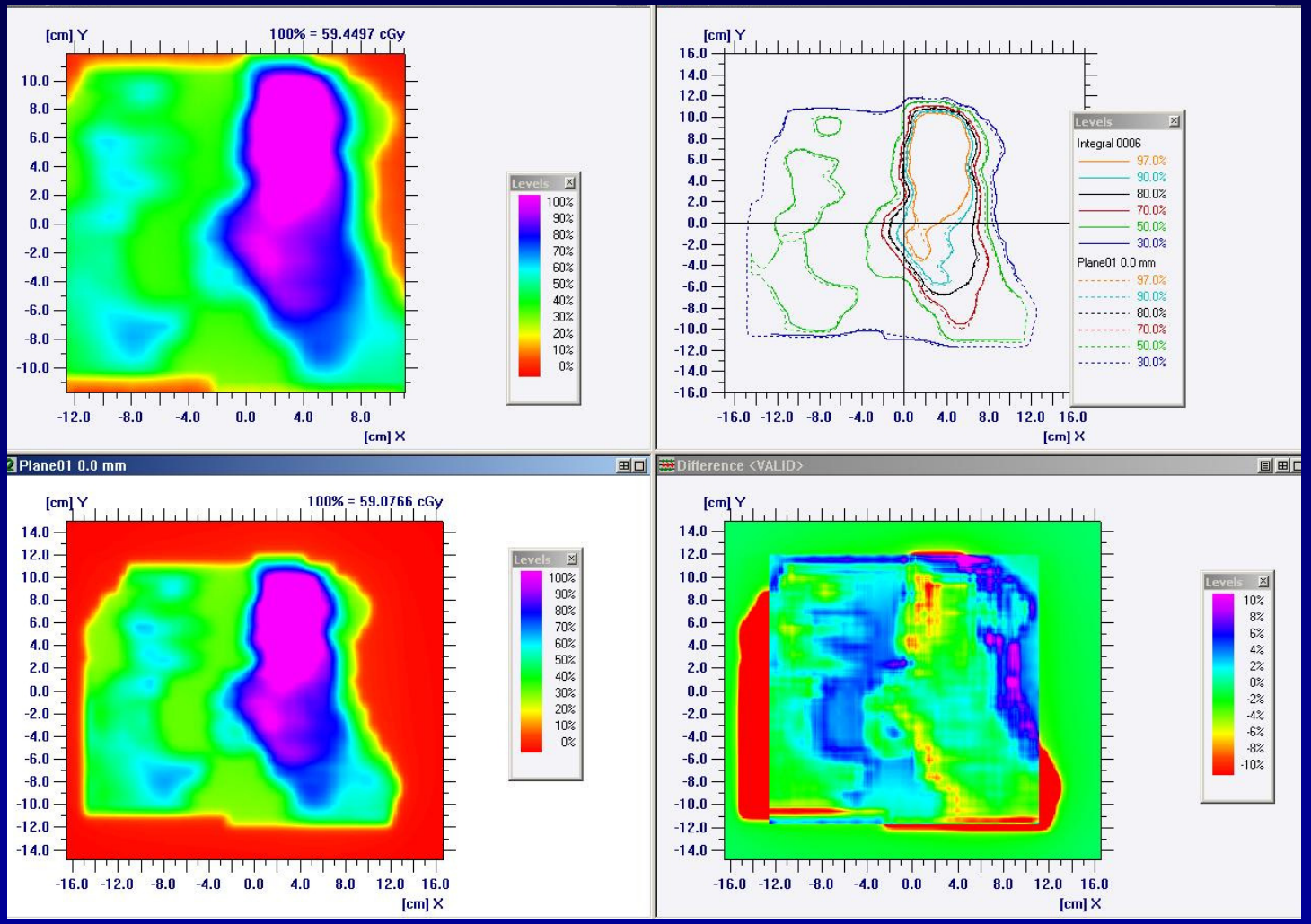
Percent discrepancy between Measured Dose and Expected Dose = **-0.4**

Acceptable for Clinical Use ✓ Y _____ N

QA with Ion Chamber Array (Welhoffer MatriXX)



QA with Ion Chamber Array (Welhoffer MatriXX)



Ochsner Health System

Thank you