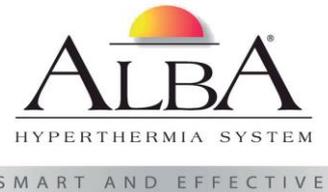


ADAPTIVO: Realidad de la Dosis en Todas las Fases del Tratamiento



Abraham Díaz Mancera
Responsable de Producto
Aplicaciones Tecnológicas S.A.





¿Cómo debe ser la herramienta para el QA del tratamiento?

- ❖ Precisa y fiable
- ❖ Automatizada
- ❖ Rápida y sencilla
- ❖ Ahorro de tiempo
- ❖ Información paciente y dosis



AdaptivoTM

- Software desarrollado por físicos del 21st Century Oncology
- Herramienta para control diario del paciente y la dosis
- Desarrollo inicial para Tomoterapia y posterior para LINACs
- Validación sobre más de 3000 pacientes





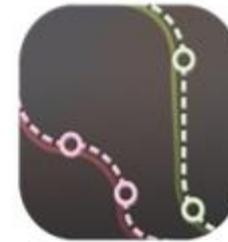
Adaptivo™



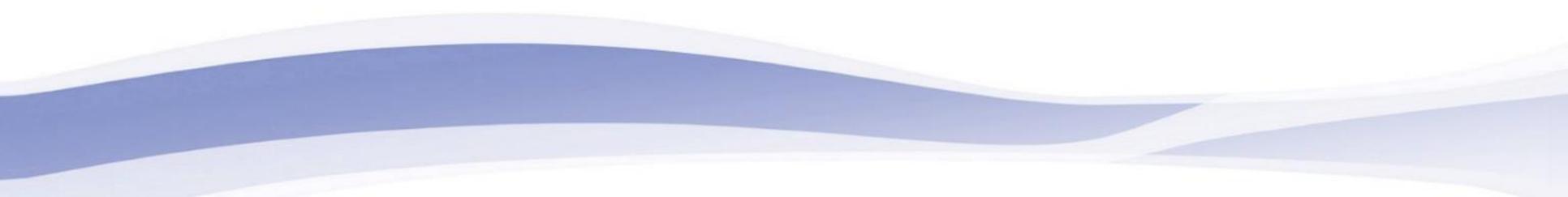
PRETREATMENT



IN VIVO

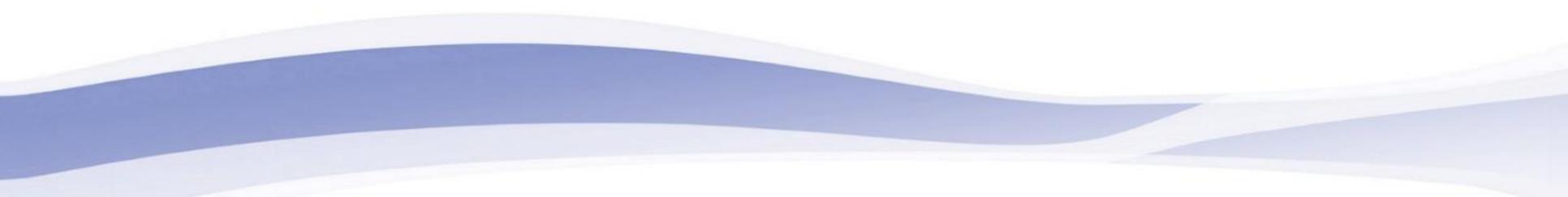


ADAPTIVE





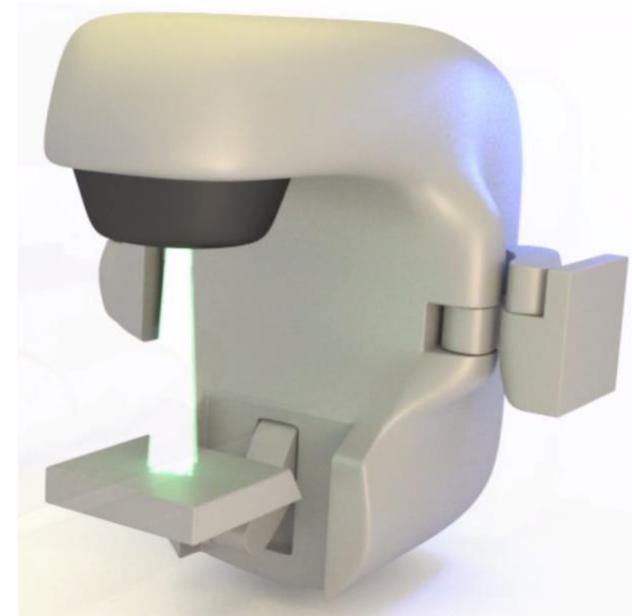
Pre-Treatment





Pre-treatment

- Verificación rápida y sencilla del plan
- Sin necesidad de hardware, fracción en aire
- Comparación automática con imagen calculada
- Notificación de alertas



Adaptivo Clinics - search first/last name, patient id... Help Personal Admin - 1 0 Medical Physicist -

Patient2, Joe (2000002) SI | Standard Imaging | Middleton, WI

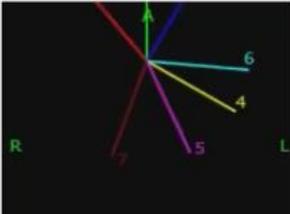
Quality Assurance / Clinics / Patient List / Patient / Plan: LUL_NODESi - Unsubscribe

Plan (LUL_NODESi)

Summary

Patient Name	Patient2, Joe
Plan Label	LUL_NODESi
Plan Intent	Quality Assurance
Last Treatment	2015-04-13 05:53:40
Fraction Count	2
Beam Count	7
Physician Name	Rec Physician

Geometry



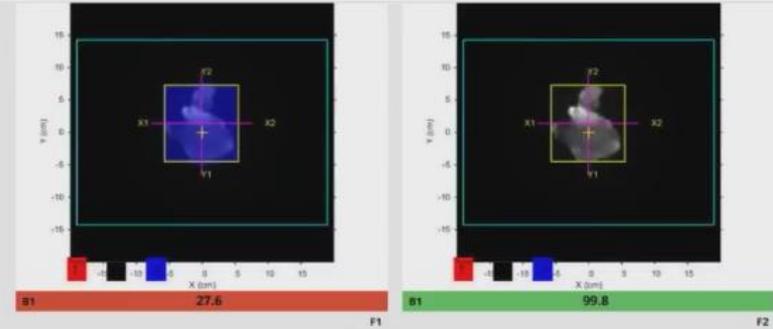
Pretreatment QA Plan Details

Actions - Clear Selection

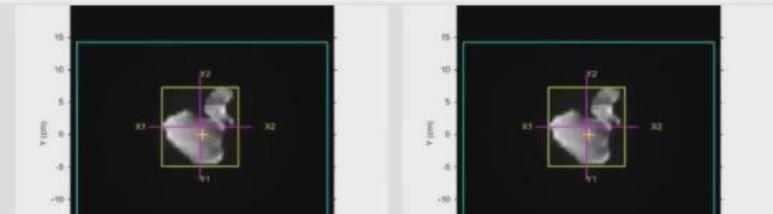
Hot/Cold Gamma over Treat Portal

F 1 F 2

Beam 1 320°
02 G320
Configuration



Beam 2 0°
03 G0
Configuration



Beam 1 (02 G320)

Summary

Result Type Predicted Mode as Planned
Delivered Timestamp 2015-04-13 05:40:15

Gamma Thresholds used for Calculation

Pass / Warn (%)	90
Warn / Fail (%)	80
Dose Difference (%)	3
Dist to Agreement (mm)	3

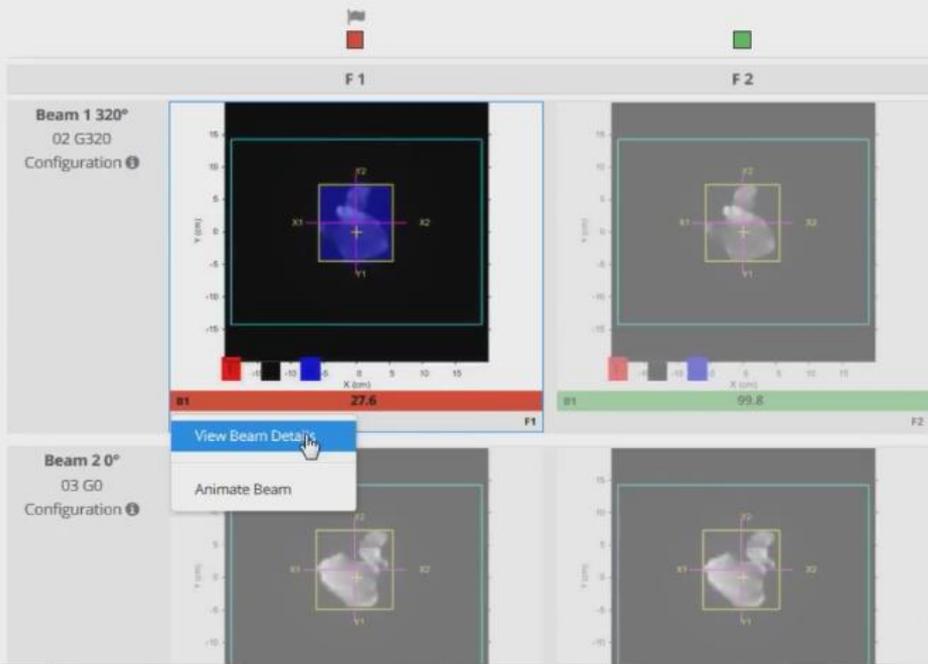
Commissioning

Energy (MV)	6
Wedge (deg)	none
Slab Density	1.04
State	Default Approved

Pretreatment QA Plan Details

Actions - Clear Selection

Hot/Cold Gamma over Treat Portal

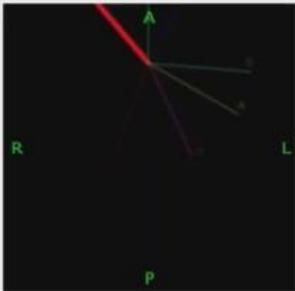


Patient2, Joe (2000002)

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VERIFICATION / Clinics / Patient List / Plan: LUL_NODESI - Fraction: [1] - Beam: [1] 02 G320 -

Beam Geometry



Monitor Units (MU's)		Dose Rate (MU/min)		Meterset Exposure	Number of Frames
DELIVERED	PLANNED	DELIVERED	PLANNED	18.8	37
18	218.44	300	300		

■ Beam [1] 02 G320 - Gamma 27.6%

Hot/Cold Gamma Hot/Cold Gamma and Portal Comparison

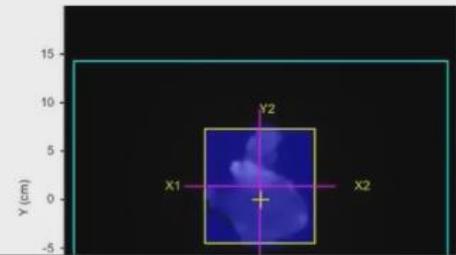
Beam Record Summary

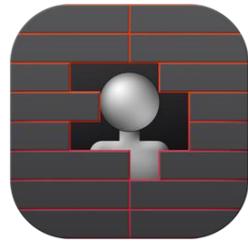
Name	02 G320
Delivered Timestamp	2015-04-13 05:40:15
Number	1
Type	DYNAMIC
Radiation Type	PHOTON
Primary Dosimeter Unit	MV

Gamma over Treatment Portal

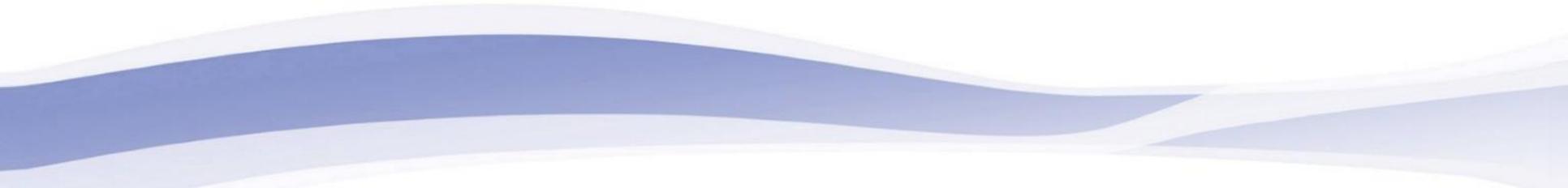


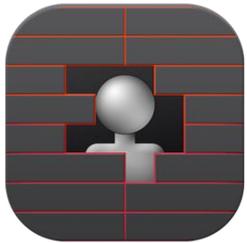
Hot/Cold Gamma over Treatment Portal





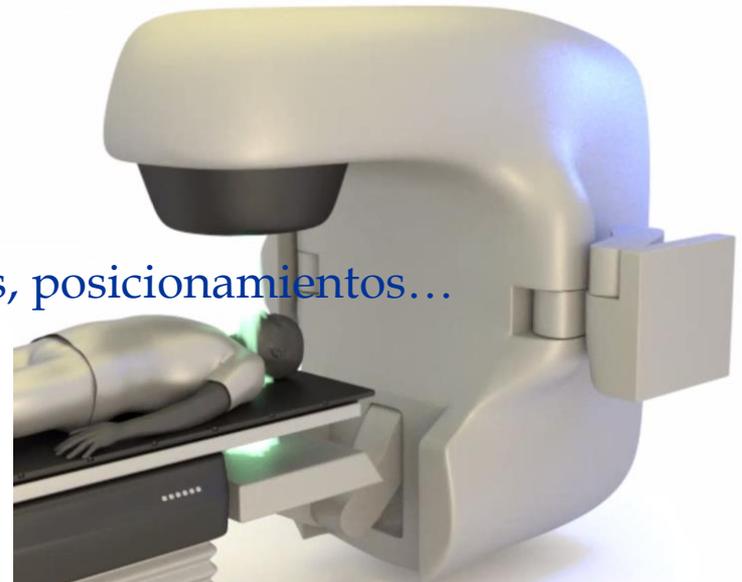
In-Vivo





In-Vivo Verification

- Control de dosis diario
- Modos *Predicted* y *Relative*
- Fácil detección de errores, cambios anatómicos, posicionamientos...
- Notificación de alertas e informes pdf



Patient3, Joe (2000003)

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Clinics / Patient List / Patient / Plan: *RBRST_NORMd

Unsubscribe

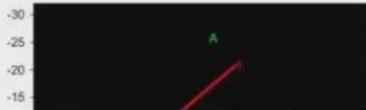
Active Alerts 2

Plan (*RBRST_NORMd)

Summary

InVivo Mode Predicted Mode Rules Based Results
Patient Name Patient3, Joe
Plan Label *RBRST_NORMd
Plan Intent Patient Treatment
Last Treatment 2015-08-12 04:56:20
Fraction Count 28
Beam Count 2
Physician Name Rec Physician

Geometry

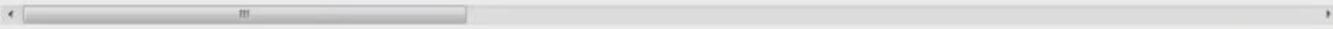


Adaptive In Vivo Treatment Delivery Trends Plan Details

Actions - Clear Selection

Hot/Cold Gamma over Plan DRR

	F 1	F 2	F 3	F 4	F 5	Avg Δ	F 6	F 7	F 8	F 9	F 10	Avg	F 1
Beam 1 150° 01 RMT Configuration ⓘ													
	78.2	94.8	94.8	95.5	94.5	94.6	93.7	95.9	95.4	91.1	95.6	95.2	96
Beam 2 230° 02 RLT Configuration ⓘ													
	84.4	96.8	96.6	97.7	96.5	97.2	96.6	97.6	96.9	94.3	96.8	97.2	97



All Calculations >

Patient3, Joe (2000003)

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Clinics / Patient List / Patient / Plan: *RBRST_NORMd -

Unsubscribe

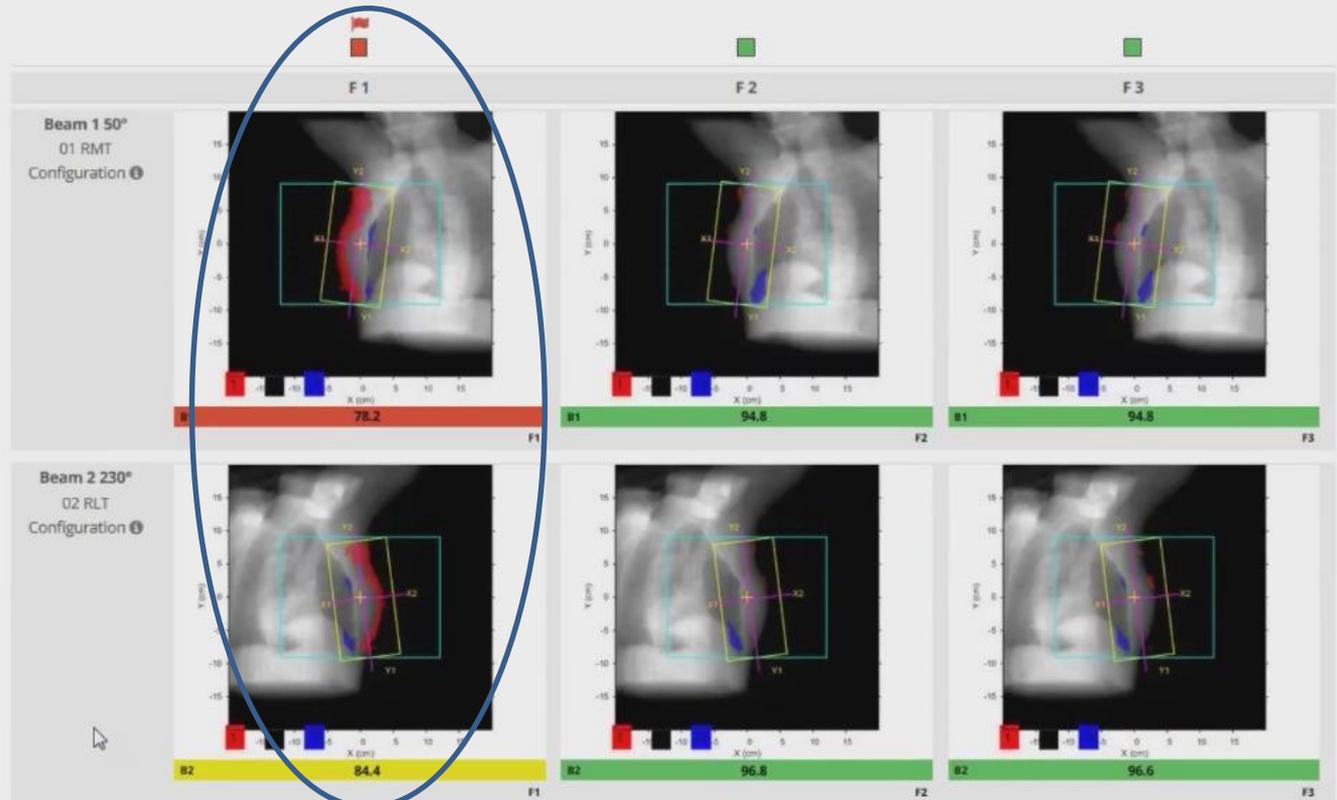
Active Alerts 2

Plan (*RBRST_NORMd)

Summary

InVivo Mode	Predicted Mode Rules Based Results
Patient Name	Patient3, Joe
Plan Label	*RBRST_NORMd
Plan Intent	Patient Treatment
Last Treatment	2015-08-12 04:56:20
Fraction Count	28
Beam Count	2
Physician Name	Rec Physician

Geometry

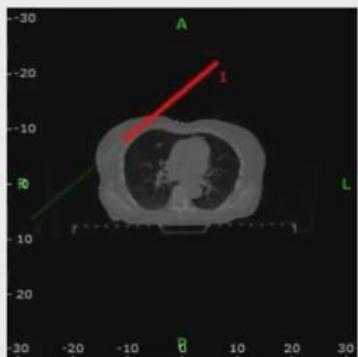


Patient3, Joe (2000003)

SI | Standard Imaging | Middleton, WI

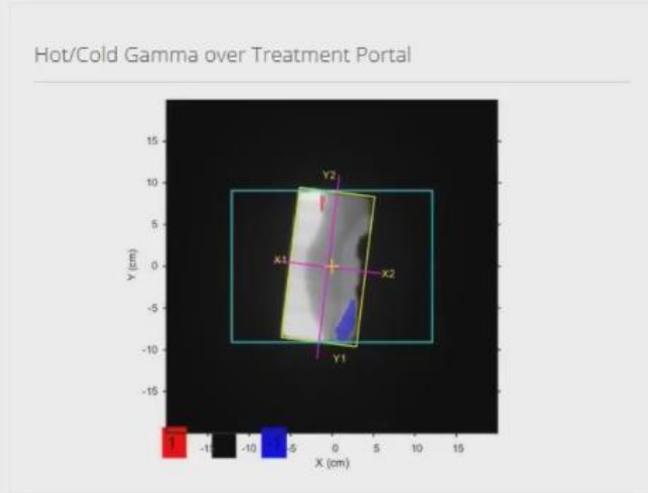
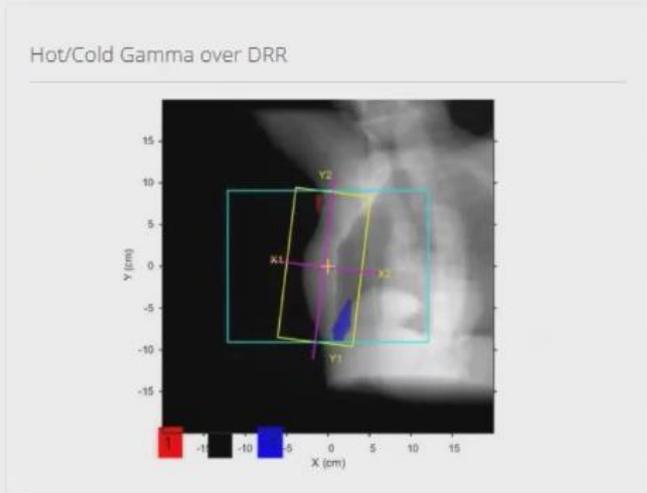
Clinics / Patient List / Plan: *RBRST_NORMd Fraction: [11] Beam: [1] 01 RMT

Beam [1] 01 RMT



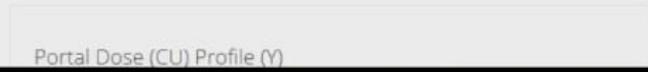
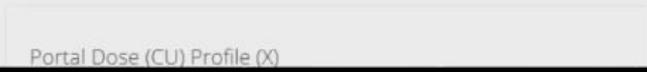
Predicted - 95.99% Predicted with Daily Couch Position - 95.99% Predicted Rules Based Results - 95.99% Relative - 72.29%

Hot/Cold Gamma Hot/Cold Gamma with Portal Registration Hot/Cold Gamma and Portal Comparison Gamma Plan Fluence and Portal Dose



Beam Record Summary

Name	01 RMT
Delivered Timestamp	2015-07-20 03:13:32
Number	1
Type	STATIC

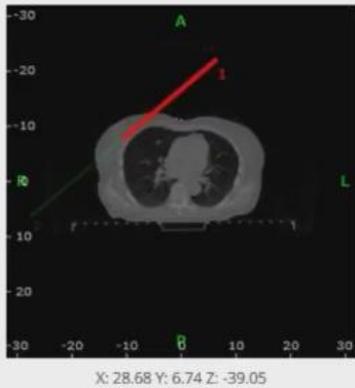


Patient3, Joe (2000003)

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Clinics / Patient List / Plan: *RBRST_NORMd Fraction: [11] Beam: [1] 01 RMT

Beam [1] 01 RMT



Predicted - 95.99% Predicted with Daily Couch Position - 95.99% Predicted Rules Based Results - 95.99% Relative - 72.29%

Hot/Cold Gamma

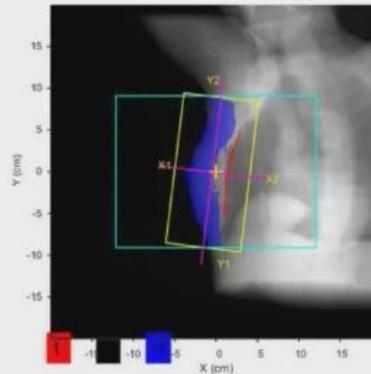
Hot/Cold Gamma with Portal Registration

Hot/Cold Gamma and Portal Comparison

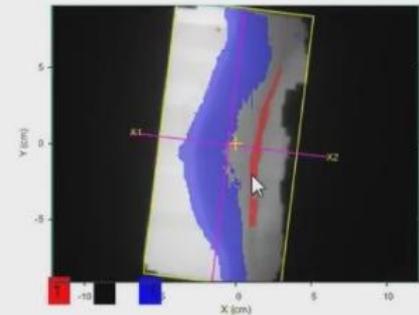
Gamma

Plan Fluence and Portal Dose

Hot/Cold Gamma over DRR



Hot/Cold Gamma over Treatment Portal



Beam Record Summary

Name	01 RMT
Delivered Timestamp	2015-07-20 03:13:32
Number	1
Type	STATIC

Portal Dose (CU) Profile (X)

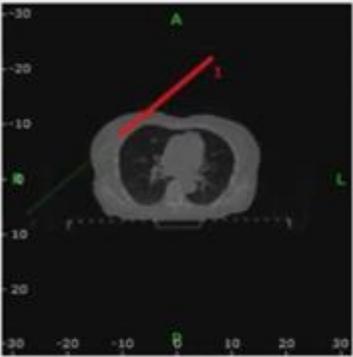
Portal Dose (CU) Profile (Y)

Adaptivo Clinics - search first/last name, patient id... Help Personal Admin - 1 0 Medical Physicist -

Patient3, Joe (2000003) SI | Standard Imaging | Middleton, WI

Clinics / Patient List / Plan: *RBRST_NORMd Fractions: [11] Beam: [1] 01 RMT

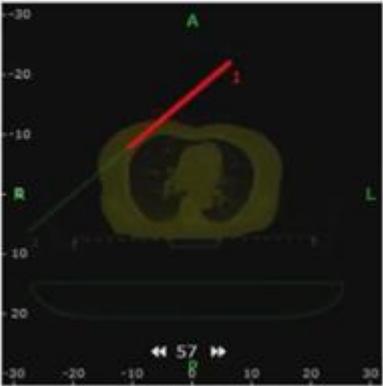
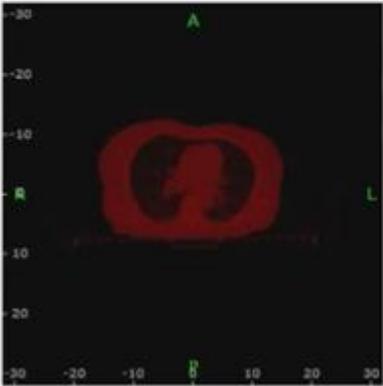
Beam [1] 01 RMT



X: 29.74 Y: -1.59 Z: -39.05

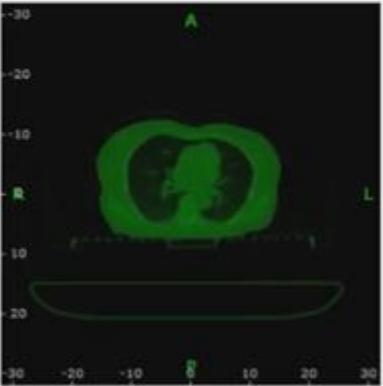
Predicted - 95.99% Predicted with Daily Couch Position - 95.99% Predicted Rules Based Results - 95.99% Relative - 72.29%

Plan Registration Treatment



X: 31.65 Y: -20.82 Z: -39.05

Plan Fraction 57



X: -30.92 Y: -31.27 Z: -39.05

Beam Record Summary

Name	01 RMT
Delivered Timestamp	2015-07-20 03:13:32
Number	1
Time	STATIC

Patient3, Joe (2000003)

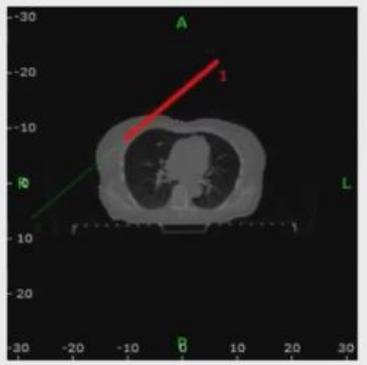
SI | Standard Imaging | Middleton, WI

Clinics / Patient List / Plan: *RBRST_NORMd Fraction: [11] Beam: [1] 01 RMT

Predicted - 95.99% Predicted with Daily Couch Position - 95.99% Predicted Rules Based Results - 95.99% Relative - 72.29%

Hot/Cold Gamma Hot/Cold Gamma with Portal Registration Hot/Cold Gamma and Portal Comparison Gamma Plan Fluence and Portal Dose

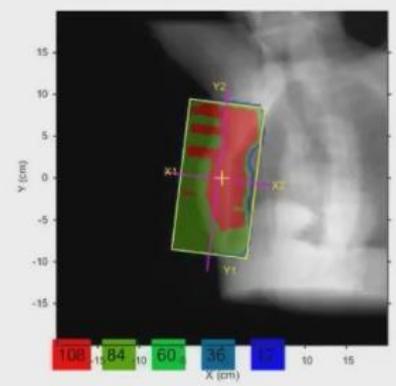
Beam [1] 01 RMT



Beam Record Summary

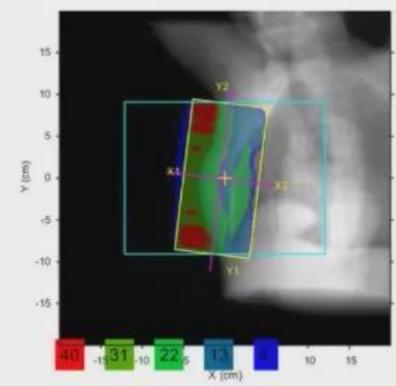
Name	01 RMT
Delivered Timestamp	2015-07-20 03:13:32
Number	1
Type	STATIC

Plan Fluence over DRR



Portal Dose (CU) Profile (X)

Treatment Portal Dose over DRR



Portal Dose (CU) Profile (Y)

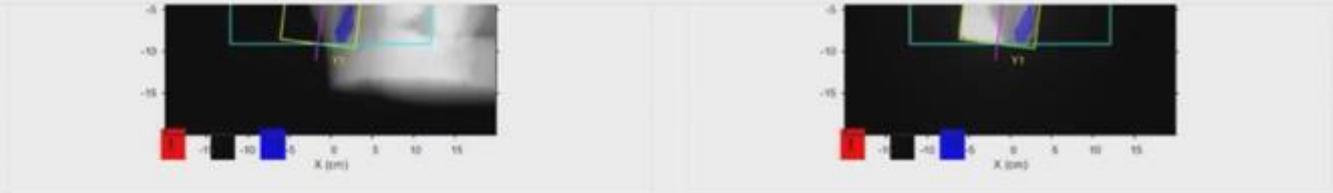
Adaptivo Clinics [search first/last name, patient id...] Help Personal Admin [notification icons] Medical Physicist

Patient3, Joe (2000003) SI | Standard Imaging | Middleton, WI

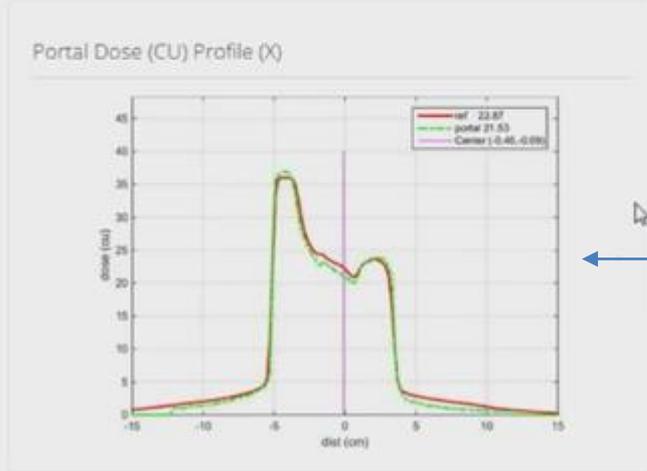
Clinics / Patient List / Plan: *RBRST_NORMd Fraction: [11] Beam: [1] 01 RMT

Beam Record Summary

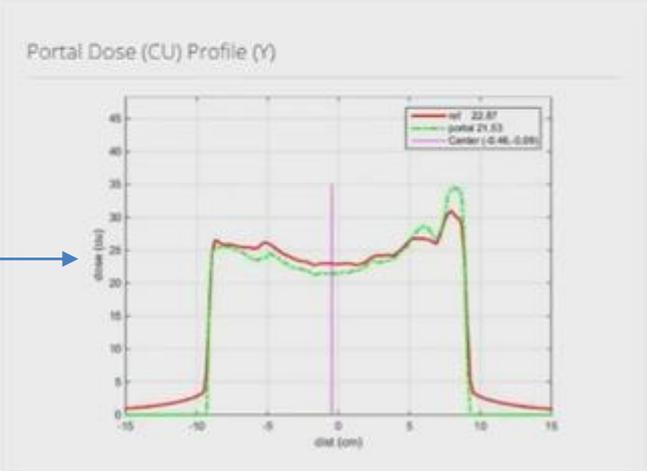
Name	01 RMT
Delivered Timestamp	2015-07-20 03:13:32
Number	1
Type	STATIC
Radiation Type	PHOTON
Primary Dosimeter Unit	MV
Nominal Beam Energy	6
Number Of Control Points	2
Dose Rate Delivered (MU/min)	300
Planned Monitor Units (MU's)	114.25
Delivered Monitor Units (MU's)	114
Meterset Exposure	150.41
Number of Frames	289
Panel Position X (cm)	0
Panel Position Y (cm)	0
Panel Position Z (cm)	-65
Gantry Angle (deg)	50
Gantry Rotation Direction	NONE



Portal Dose (CU) Profile (X)



Portal Dose (CU) Profile (Y)



←→

Patient3, Joe (2000003)

SI | Standard Imaging | Middleton, WI

Clinics / Patient List / Plan: *RBRST_NORMd Fraction: [11] Beam: [1] 01 RMT

- Panel Position X (cm) 0
- Panel Position Y (cm) 0
- Panel Position Z (cm) -65
- Gantry Angle (deg) 50
- Gantry Rotation Direction NONE
- Collimator Angle (deg) 353
- Collimator Rotation Direction NONE
- Jaw X1 (cm) -5
- Jaw X2 (cm) 4.1
- Jaw Y1 (cm) -9.2
- Jaw Y2 (cm) 8.9
- Table Top Vertical Position (cm) -22.2
- Table Top Longitudinal Position (cm) 122.2
- Table Top Lateral Position (cm) 9.8
- Couch Angle (deg) 0
- Wedge ID -
- Wedge Angle (deg) -
- Wedge Orientation -
- Number of Wedges 0
- Number of Compensators 0
- Number of Boll 0
- Number of Blocks 0



Gamma Statistics

	dta_cri = 1mm	dta_cri = 2mm	dta_cri = 3mm	dta_cri = 4mm	dta_cri = 5mm	dta_cri = 7mm	dta_cri = 10mm
dd_cri = 1%	41.65	55.65	66.27	73.49	80.1	89.7	97.52
dd_cri = 2%	60.91	69.68	76.45	81.92	86.67	93.25	98.04
dd_cri = 3%	80.63	85.87	89.54	92.28	94.5	96.73	99.01
dd_cri = 4%	91.23	93.53	95.06	95.91	96.71	97.86	99.21
dd_cri = 5%	93.61	95.16	95.99	96.61	97.32	98.53	99.52
dd_cri = 7%	96.35	97.32	97.7	98.27	98.89	99.72	100
dd_cri = 10%	99.17	99.54	99.74	99.9	100	100	100

Gamma Histogram

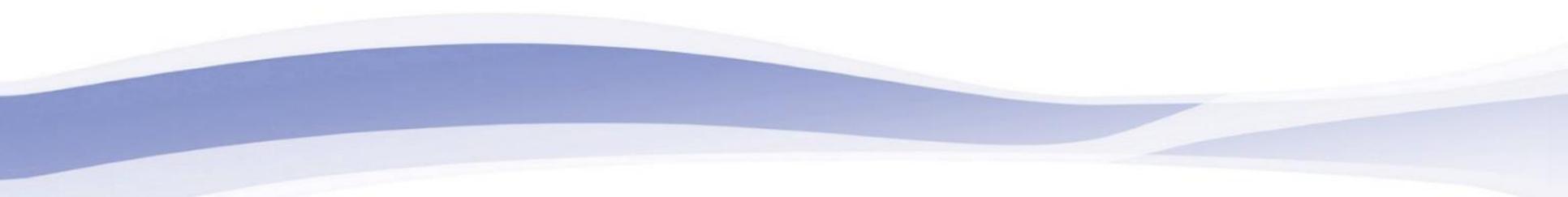


Dose Difference Histogram





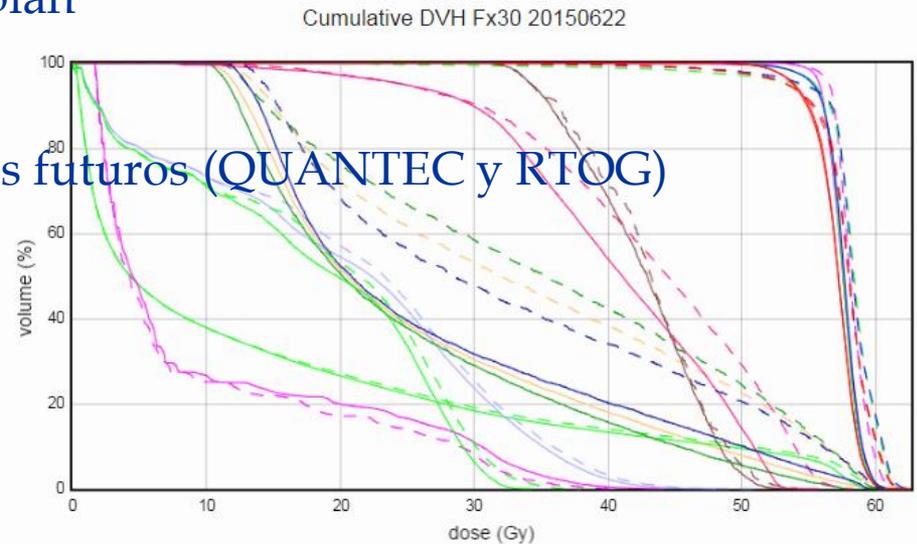
Adaptive





Adaptive Reconstruction

- Cálculo de dosis diaria y acumulada con estructuras deformadas
- Comparación de dosis y DVH con el plan
- Anticipa salidas de tolerancia y errores futuros (QUANTEC y RTOG)
- Notificación de alertas e informes pdf



Patient2, SI-1 (4100003)

SI-1 | Standard Imaging 1 | Middleton, WI

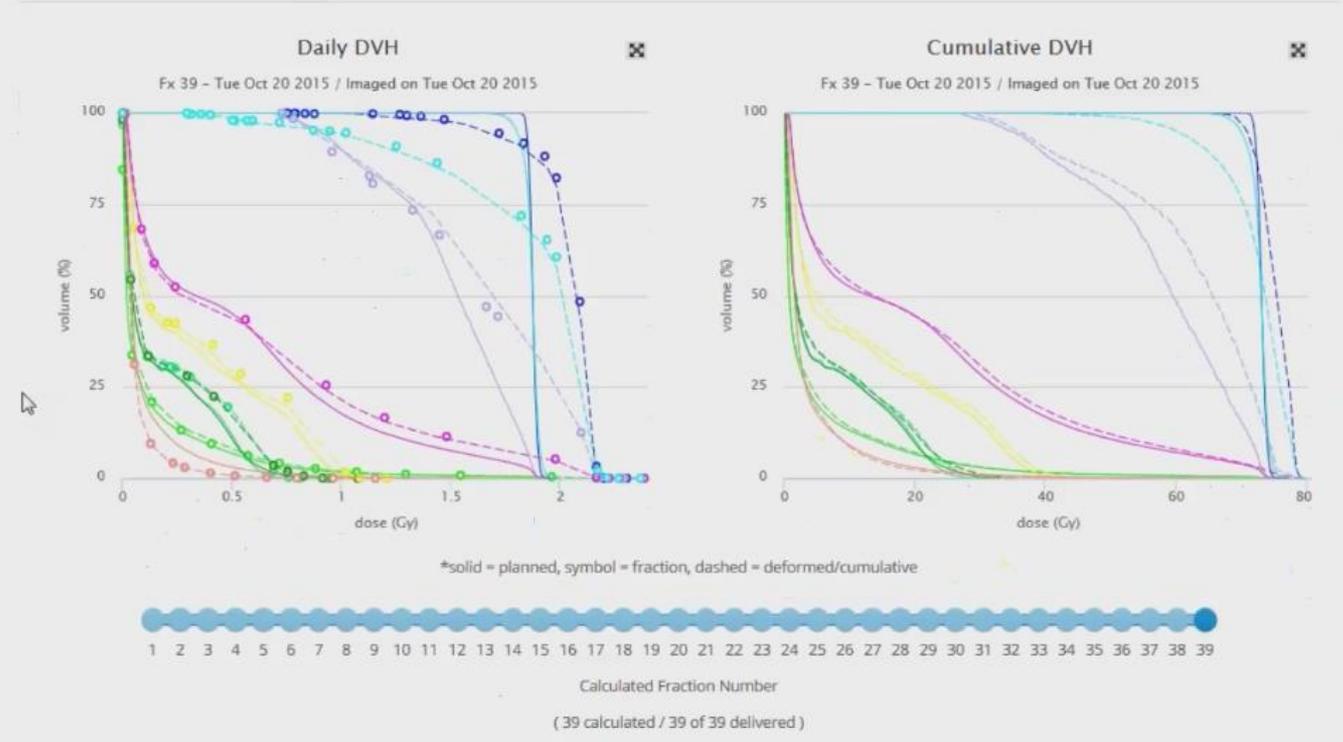
Clinics / Patient List / Patient / Plan: R LUNG_R PTi

Unsubscribe

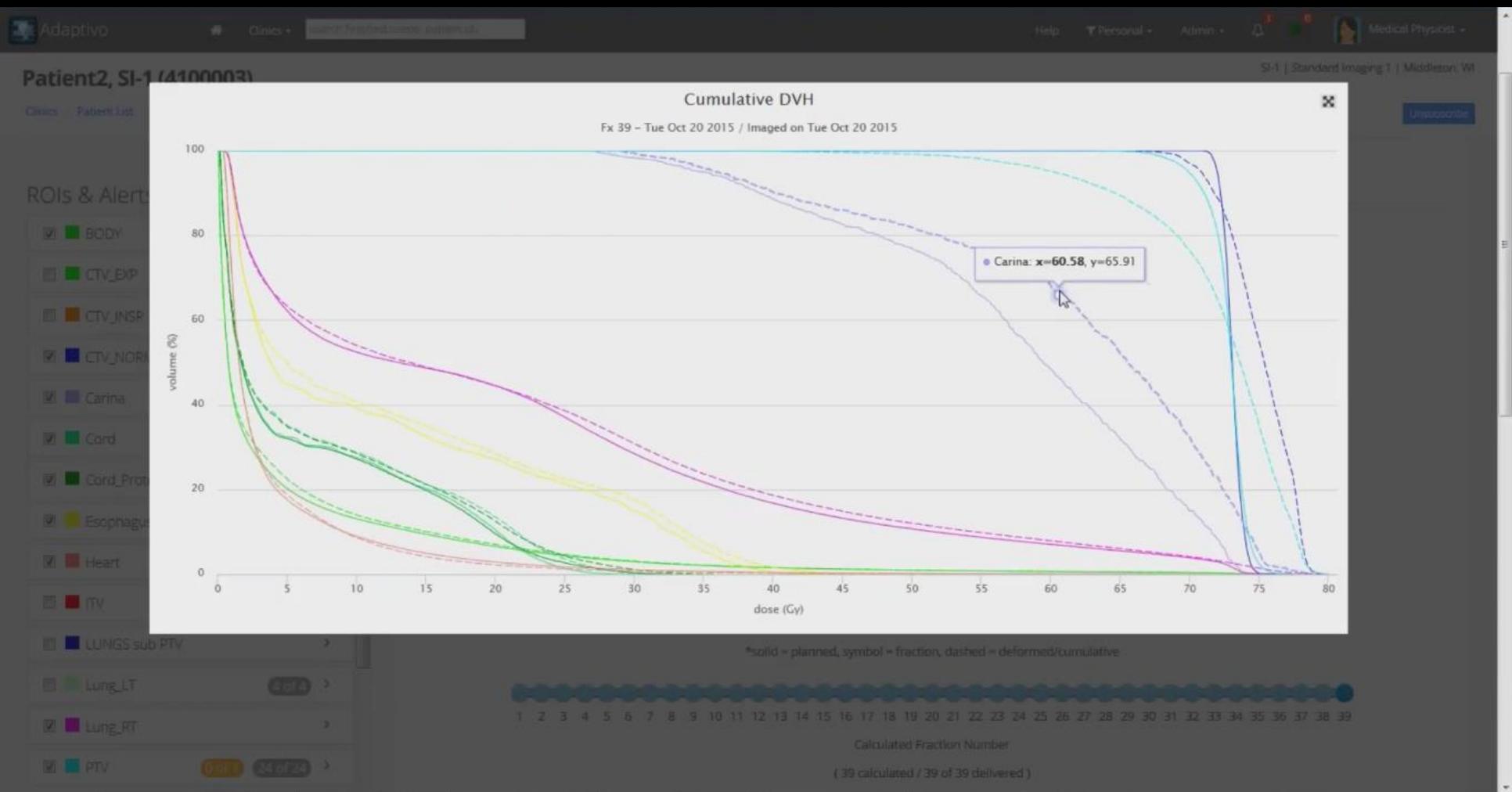
ROIs & Alerts

- BODY
- CTV_EXP
- CTV_INSP
- CTV_NORM
- Carina
- Cord
- Cord_Protect
- Esophagus 7 of 8
- Heart 5 of 5
- ITV
- LUNGS sub PTV
- Lung_LT 4 of 4
- Lung_RT
- PTV 0 of 1 24 of 24

Fraction DVH







Patient2, SI-1 (4100003)

SI-1 | Standard Imaging 1 | Middleton, WI

Clinics / Patient List / Patient / Plan: R LUNG_R PTI

Unsubscribe

- Cord_Protect
- Esophagus 7 of 8
- Heart 5 of 5
- ITV
- LUNGS sub PTV
- Lung_LT 4 of 4
- Lung_RT
- PTV 0 of 1 24 of 24

[view trending](#)

Cumulative

Fx 39: D95% -13.92%, rule: > -10.00% ✓

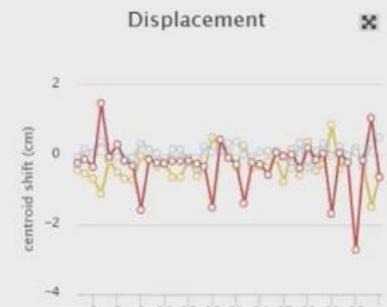
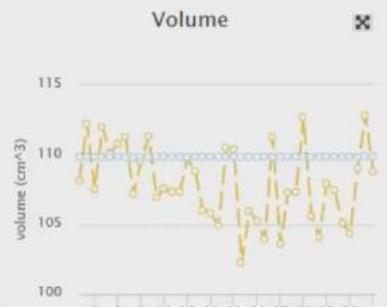
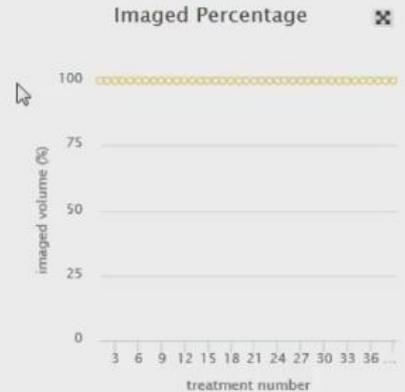
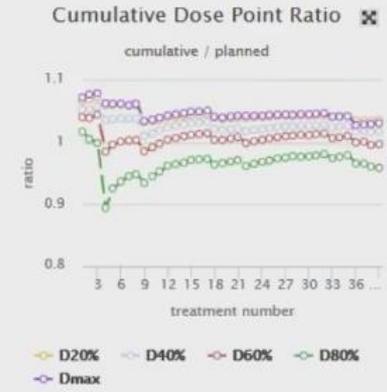
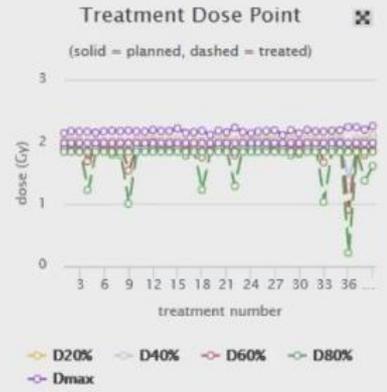
Daily

Fx 2: D95% -15.55%, rule: > -10.00% [acknowledge](#)

Fx 3: D95% -21.50%, rule: > -10.00% [acknowledge](#)

Fx 4: D95% -20.75%, rule: > -10.00%

> PTV



Patient2, SI-1 (4100003)

SI-1 | Standard Imaging 1 | Middleton, WI

Clinics / Patient List / Patient / Plan: R LUNG_R PTi

Unsubscribe

- Cord_Protect
- Esophagus 7 of 8
- Heart 5 of 5
- ITV
- LUNGS sub PTV
- Lung_LT 4 of 4
- Lung_RT
- PTV 0 of 1 24 of 24

view trending

Cumulative

Fx 39: D95% -13.92%, rule: > -10.00%

Daily

Fx 2: D95% -15.55%, rule: > -10.00% [acknowledge](#)

Fx 3: D95% -21.50%, rule: > -10.00% [acknowledge](#)

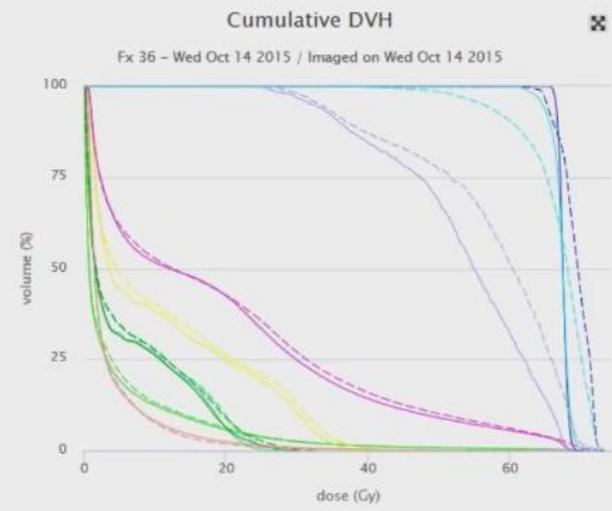
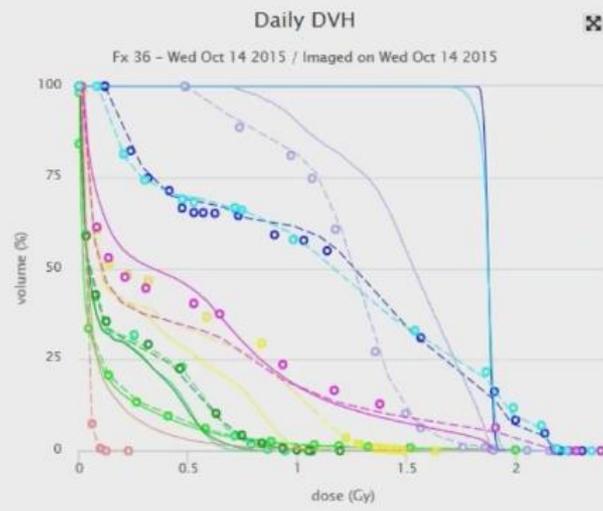
Fx 4: D95% -20.35%, rule: > -10.00%

Adaptive In Vivo Treatment Delivery Trends Plan Details

Actions - **Fractions Viewer** **Cumulative Viewer**

Course Data

Fraction DVH



*solid = planned, symbol = fraction, dashed = deformed/cumulative

Fraction Viewer

4100003 : Patient3, SI-1, Plan: R LUNG_R PTI (39 * 1.8 Gy/fx)

T C S

ROI settings

- BODY
- CTV_EXP
- CTV_INSP
- CTV_NORM
- Carina
- Cord
- Cord_Protect
- CouchGrid
- CouchInterior
- CouchRailLeft
- CouchRailRight
- CouchSurface
- Esophagus
- Heart
- ITV
- LUNGS sub PTV
- Lung_LT
- Lung_RT

Show All Hide All

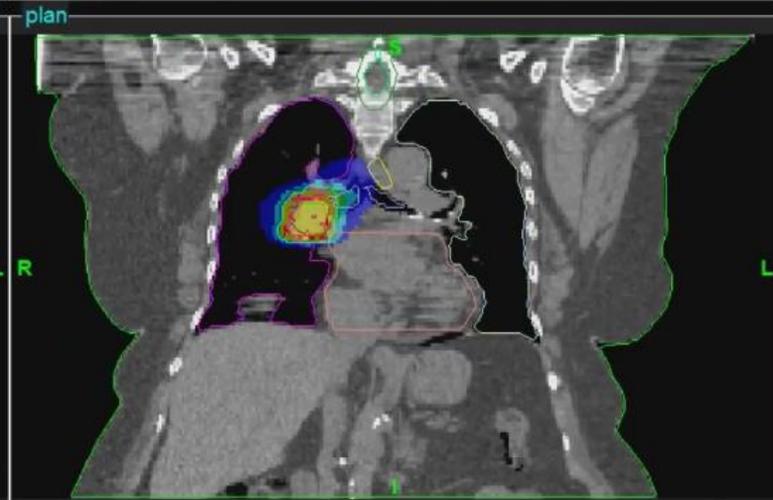
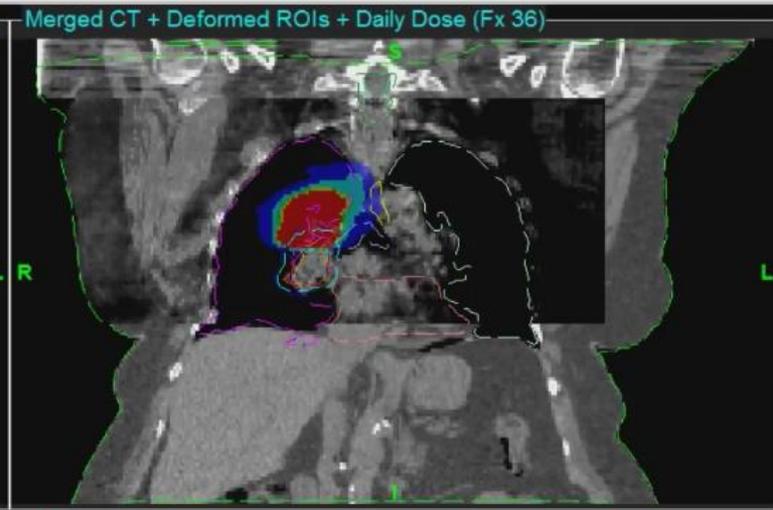
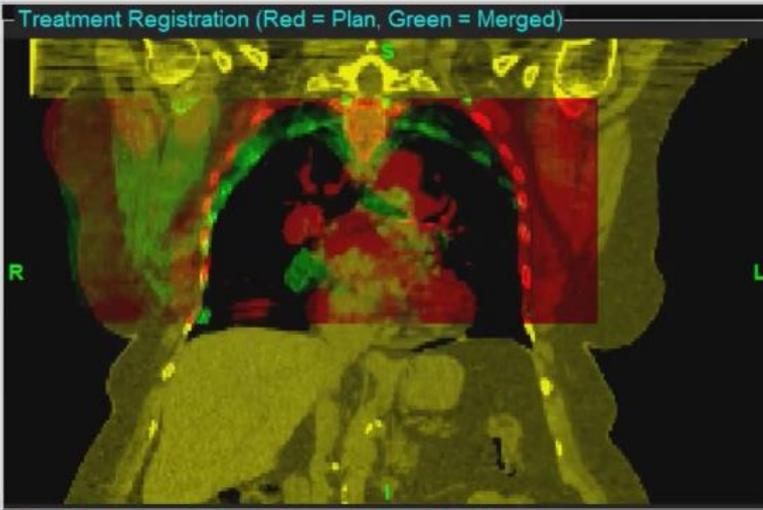
Isodose settings

- 1.89
- 1.8
- 1.71
- 1.44
- 1.08
- 0.72
- 0
- 0
- 0
- 0

Colorwash transparency

← →

window:	600
level:	40



Cumulative Viewer

4100003 : Patient3, SI-1, Plan: R LUNG_R PTI (39 * 1.8 Gy/fx)

T C S

ROI settings

- BODY
- CTV_EXP
- CTV_INSP
- CTV_NORM
- Carina
- Cord
- Cord_Protect
- CouchGrid
- CouchInterior
- CouchRailLeft
- CouchRailRight
- CouchSurface
- Esophagus
- Heart
- ITV
- LUNGS sub PTV
- Lung_LT
- Lung_RT

Show All Hide All

Isodose settings

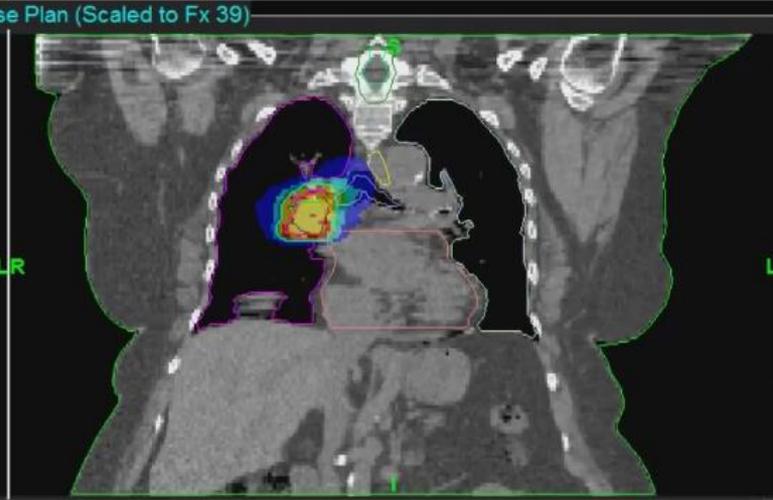
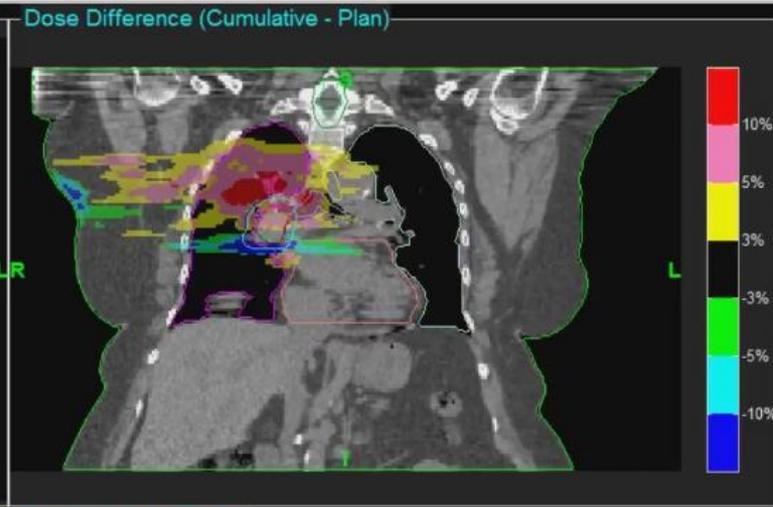
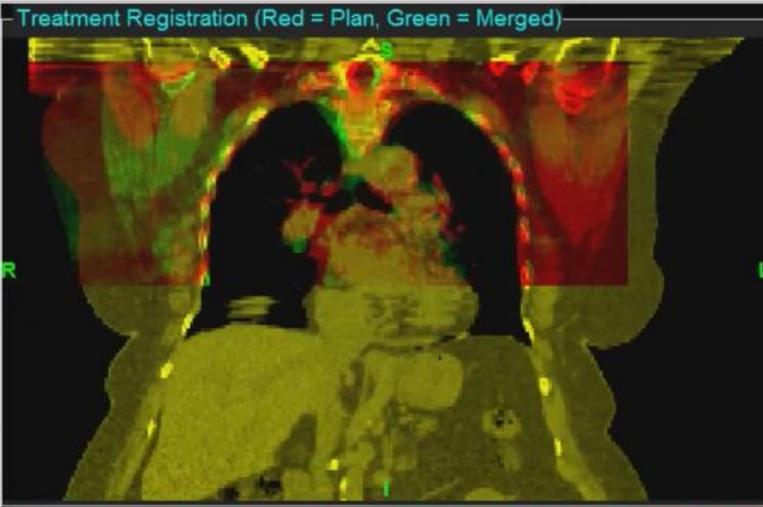
	dose (Gy)	dose (%)
<input checked="" type="checkbox"/>	73.71	105
<input checked="" type="checkbox"/>	70.2	100
<input checked="" type="checkbox"/>	66.69	95
<input checked="" type="checkbox"/>	56.16	80
<input checked="" type="checkbox"/>	42.12	60
<input checked="" type="checkbox"/>	28.08	40
<input type="checkbox"/>	0	0

Reference dose (Gy): 70.2

Colorwash transparency

window: 600

level: 40





AdaptivoTM, en resumen...

- ❖ Preciso y fiable
- ❖ Automatizado
- ❖ Rápido y sencillo
- ❖ Ahorro de tiempo
- ❖ Información paciente y dosis

