Responsabilidad Médica

Control de calidad de sistemas computarizados de planificación de tratamiento, sistemas de registro y verificación de datos y equipamiento de simulación

Aceptación de planes de IMRT , IGRT , SRS, SBRT

Lucas CAUSSA

Radioncología

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INSTITUTO DE RADIOTERAPIA
FUNDACION MARIE CURIE

PROGRAMA DE EDUCACION CONTINUA
FUNDACION MARIE CURIE 2016-2017

Curso de Actualización en Protección Radiológica

Córdoba, Argentina
7, 8 y 9 de Abril de 2016

Cuando tratar? 1

Historia Clínica

Intención del tratamiento

Volúmenes de tratamiento

Órganos Sanos a Proteger

Tecnología a usar

Instituto de Radioterapia
Fundación Marie Curie

Cuando tratar? 2

Prescripción de dosis y fraccionamiento

Dosis limitantes en OARs

Inmovilización

Adquisición de imágenes

Dosimetría

Instituto de Radioterapia
Fundación Marie Curie

Cuando tratar? 3

Entrada y salida de haces de irradiación

Cobertura de dosis

Tiempo total estimado

Registro de todos los datos

Aceptación del plan de irradiación

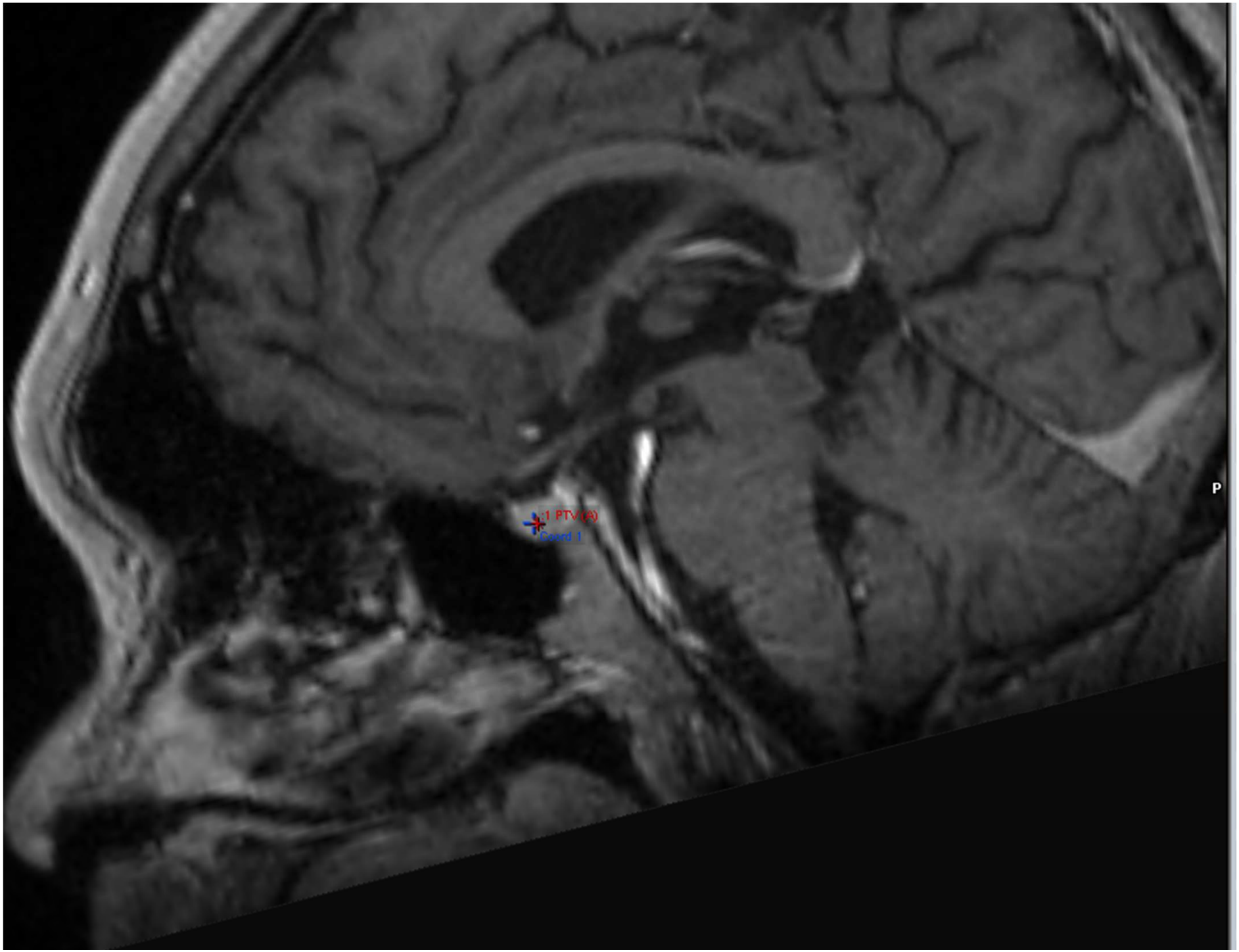
Instituto de Radioterapia
Fundación Marie Curie

Caso 1

Hombre 22 años

2011 enfermedad de cushing causado por un microadenoma de hipófisis operado vía transeptoesfenoidal con remisión parcial de los síntomas.

2015 recaída bioquimica
Obesidad mórbida, insuficiencia cardio-respiratoria, arritmias: NO quirúrgico


1 PTV (A)
Coord 1
P

Que hacer???

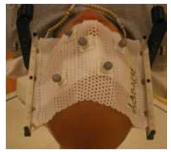
Tratamiento? → **SI** → **Radiocirugía**

✓Inmovilización

FRAME Less

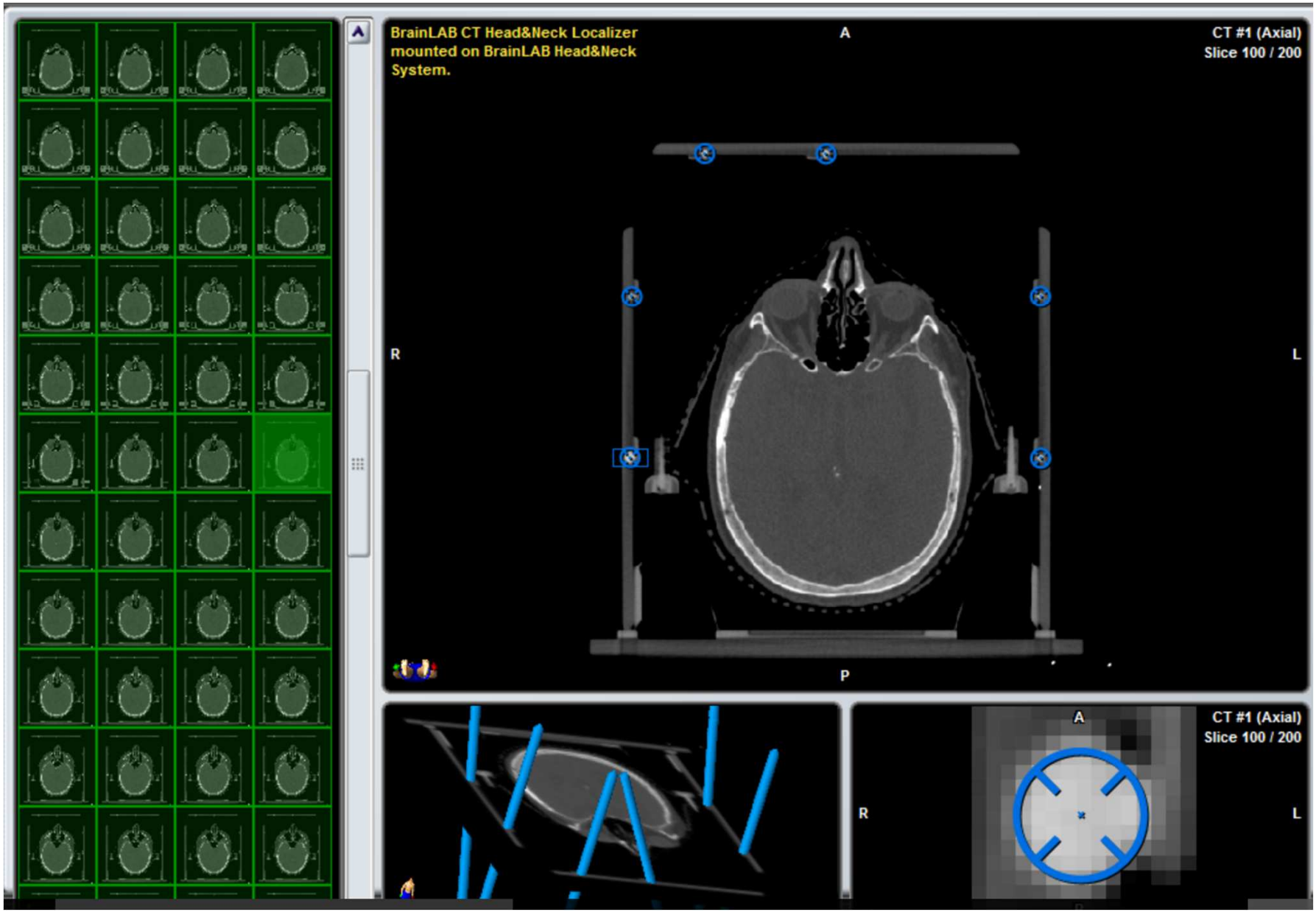









BrainLAB CT Head&Neck Localizer mounted on BrainLAB Head&Neck System.
A
CT #1 (Axial)
Slice 100 / 200
R
L
P
A
CT #1 (Axial)
Slice 100 / 200
R
L
Localization

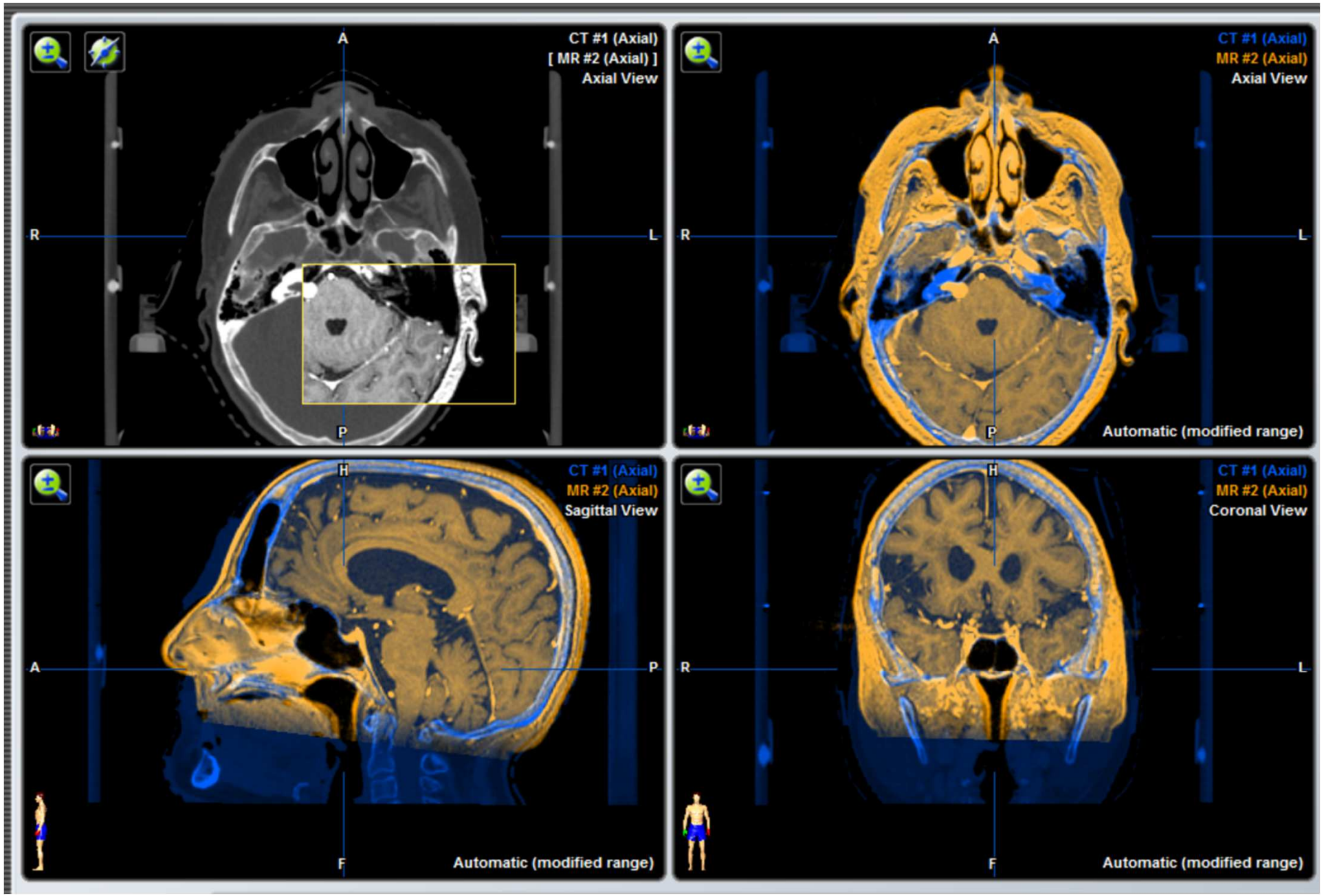
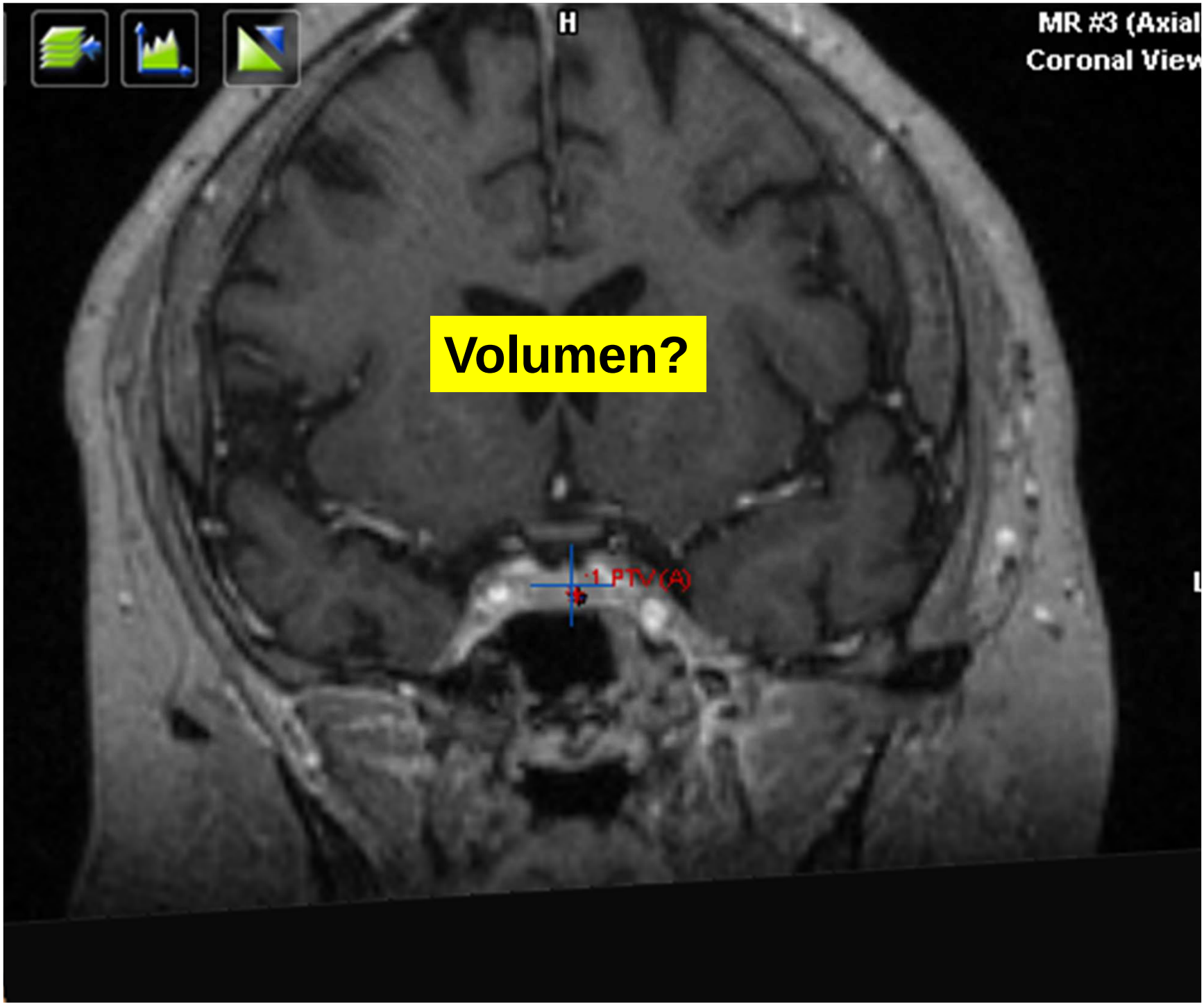
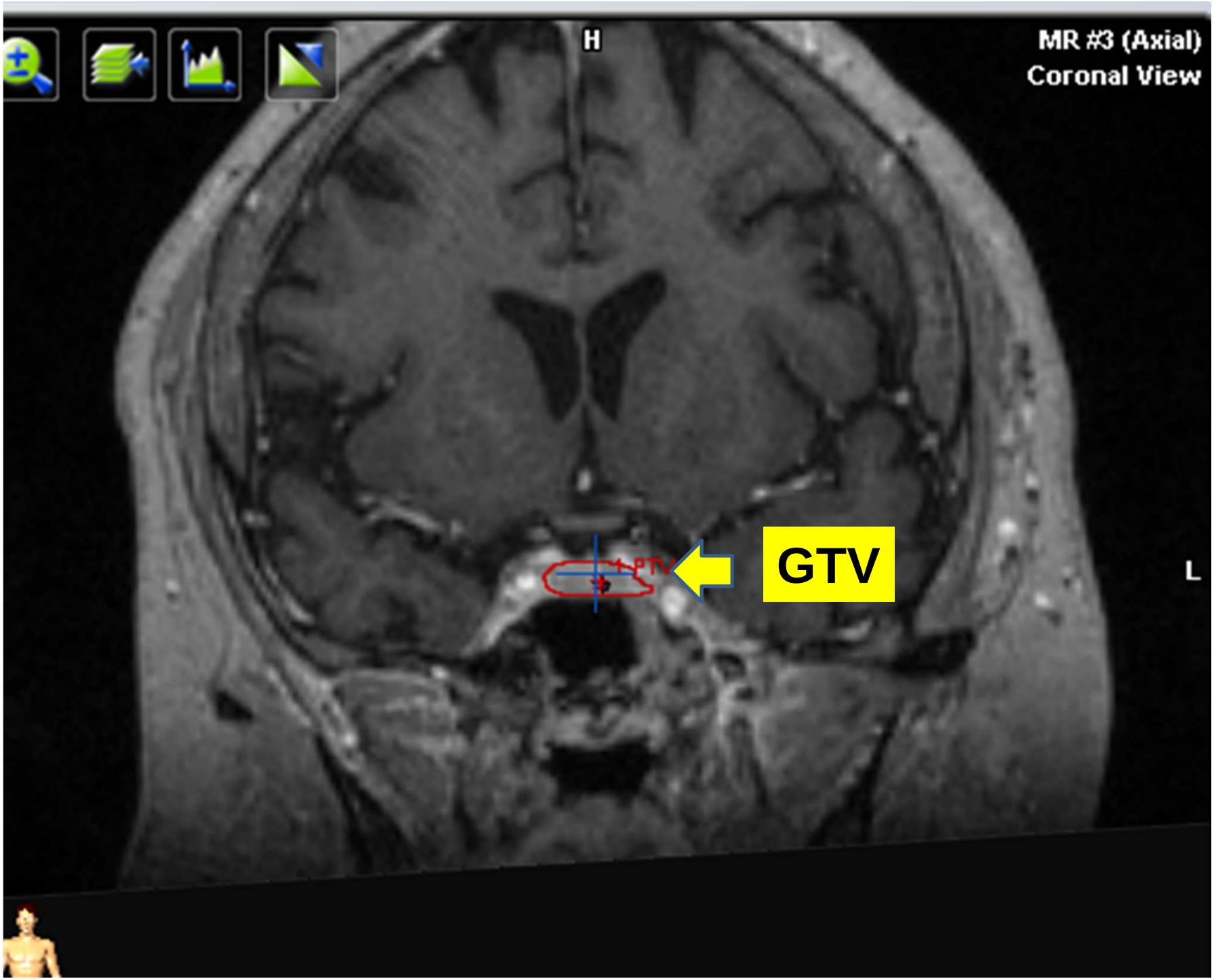
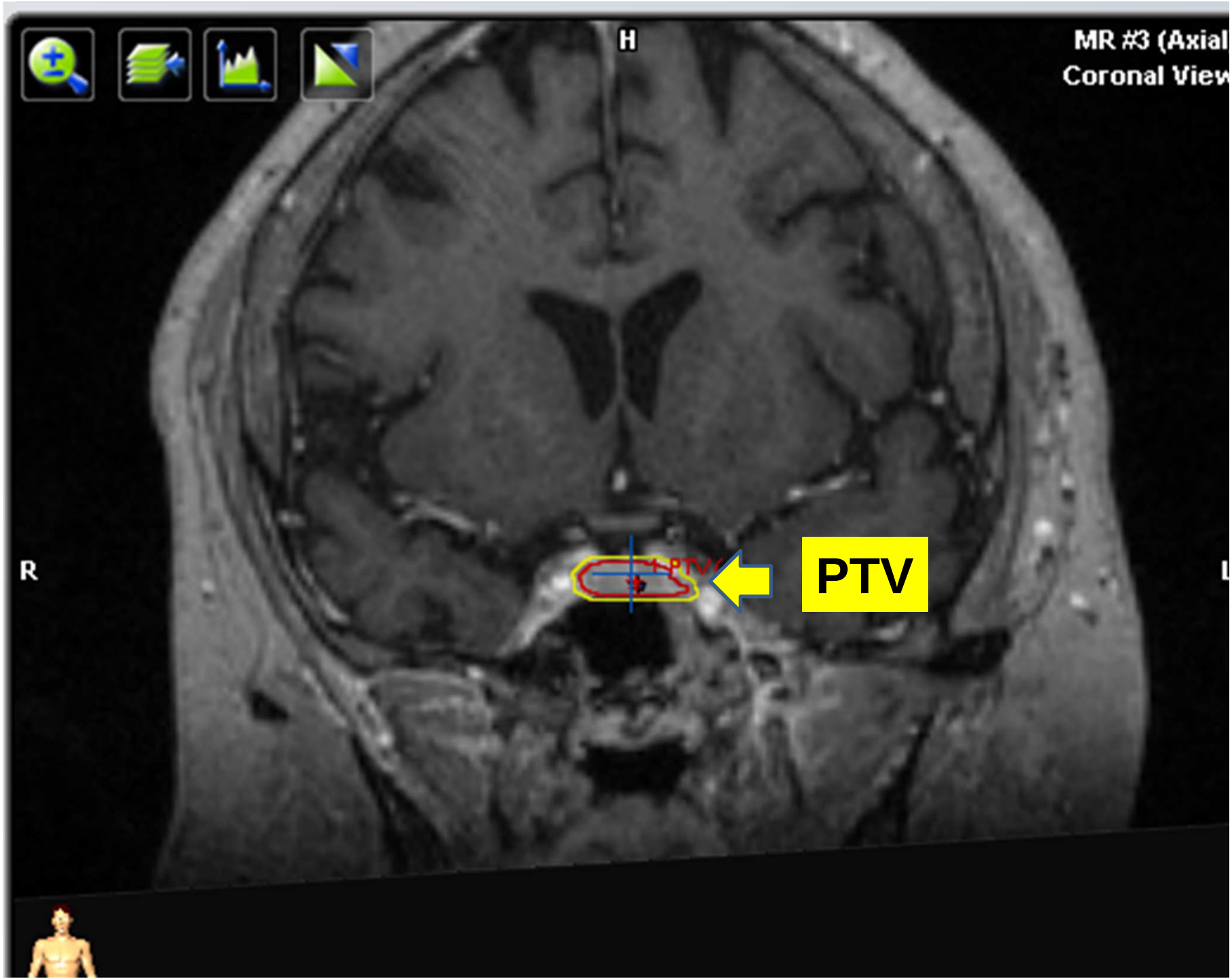
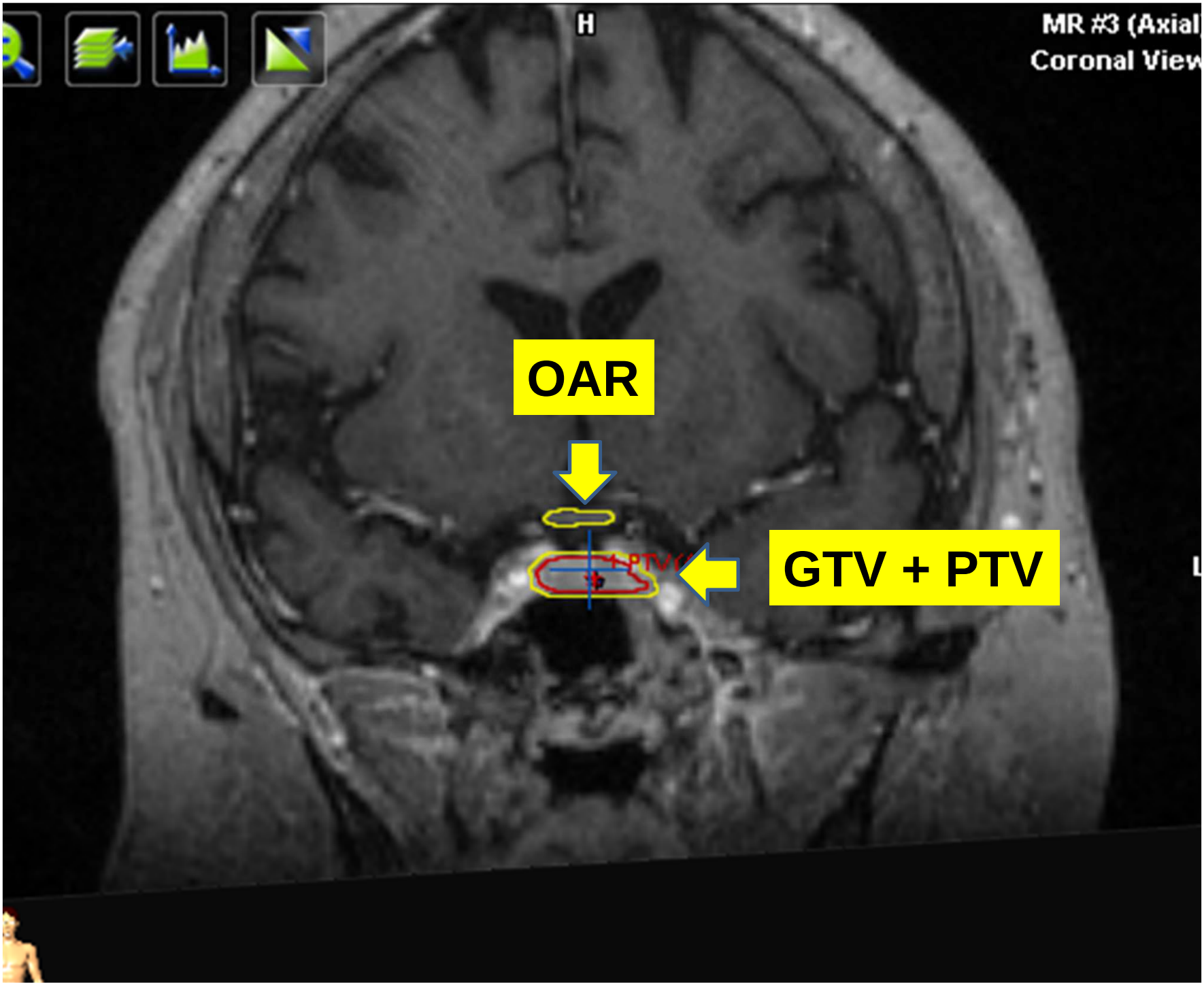


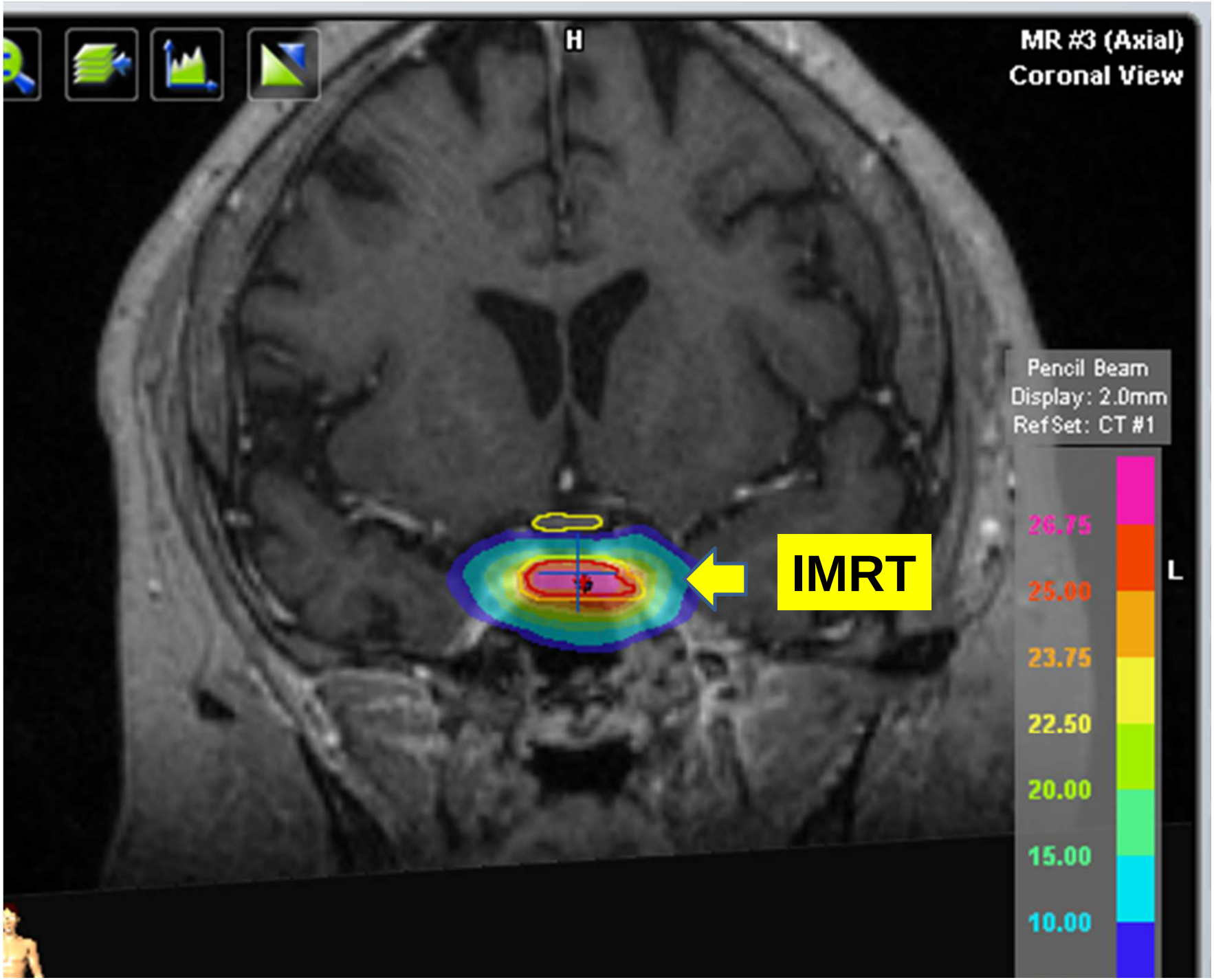
Image Fusion

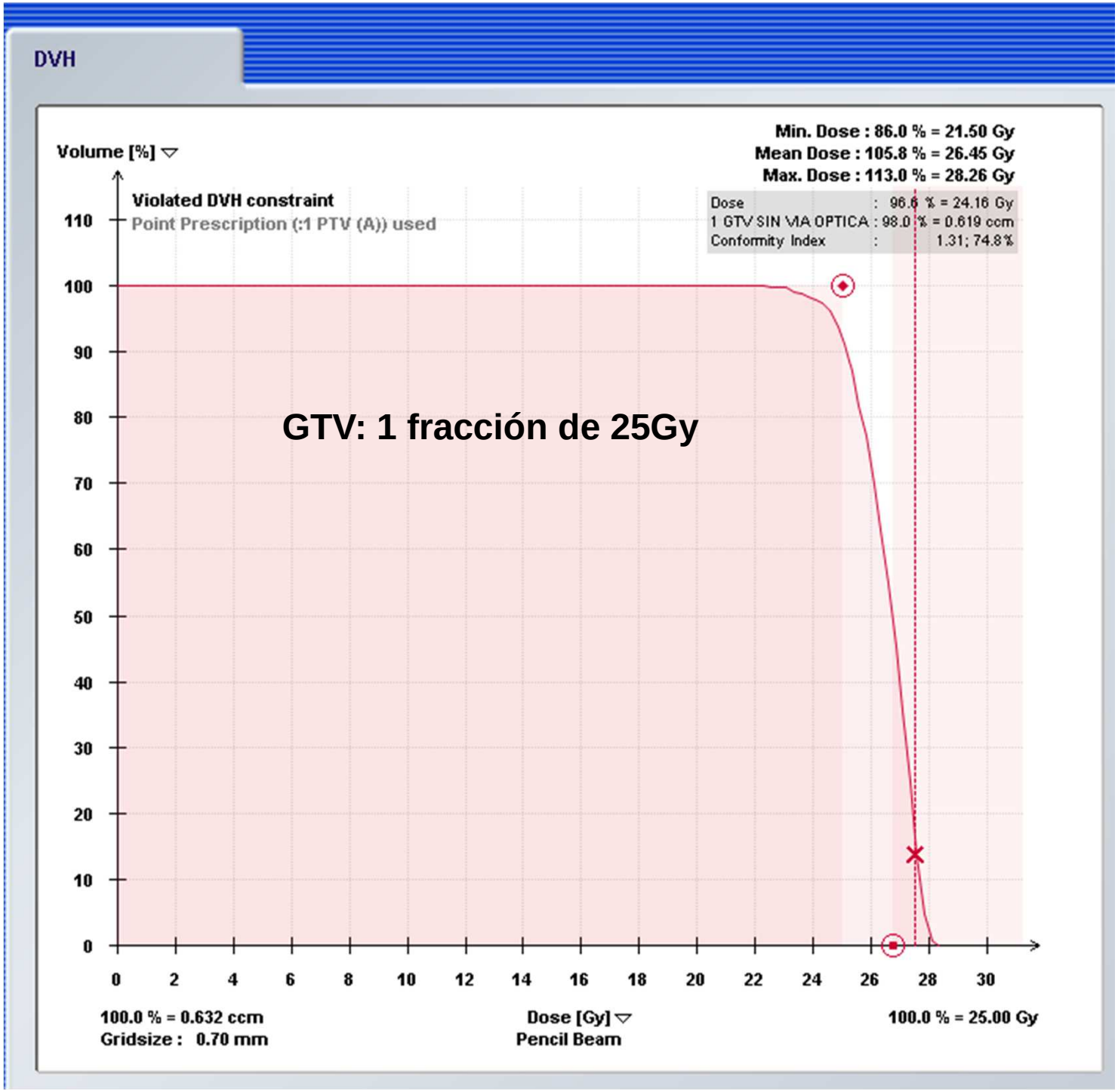

H
MR #3 (Axial
Coronal View
Volumen?
1 PTV (A)

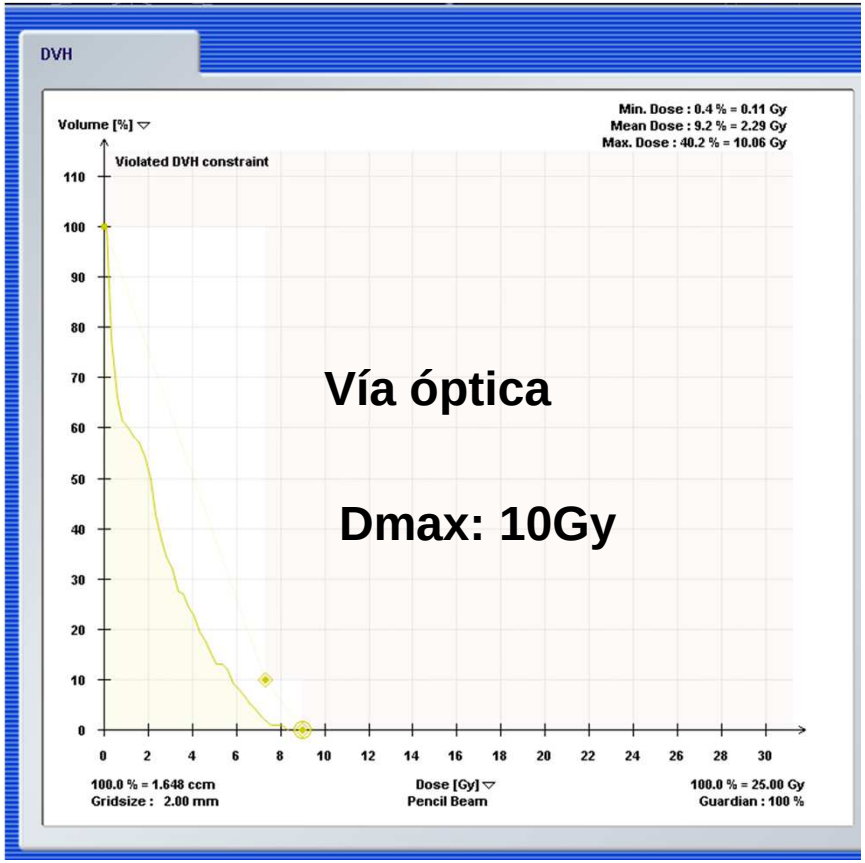

H
MR #3 (Axial)
Coronal View
GTV
PTV
L

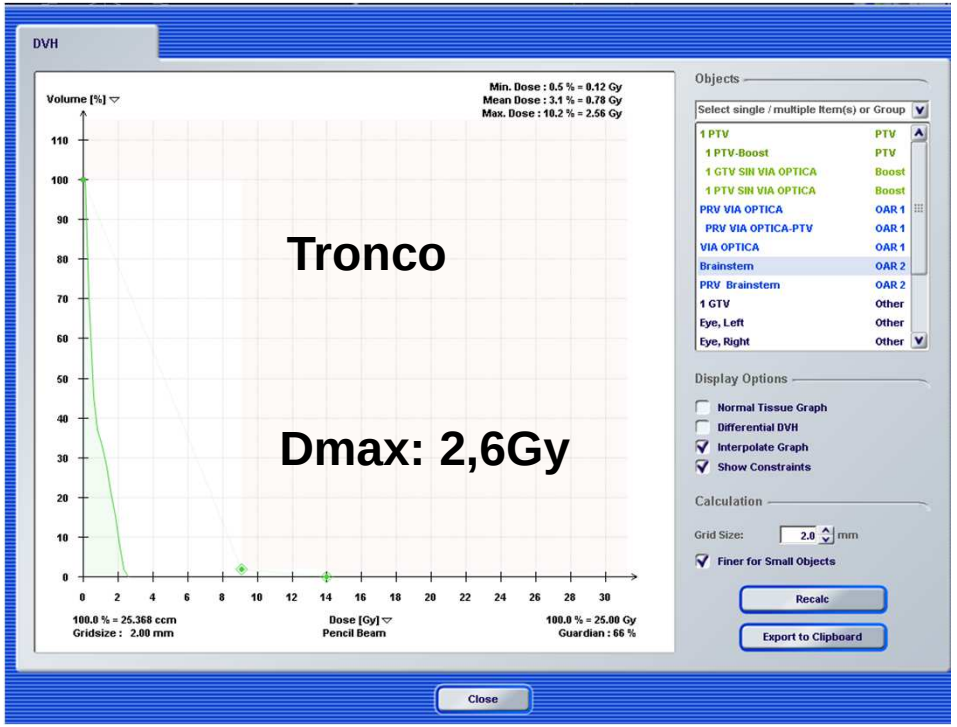

H
MR #3 (Axial
Coronal View
R
PTV
PTV

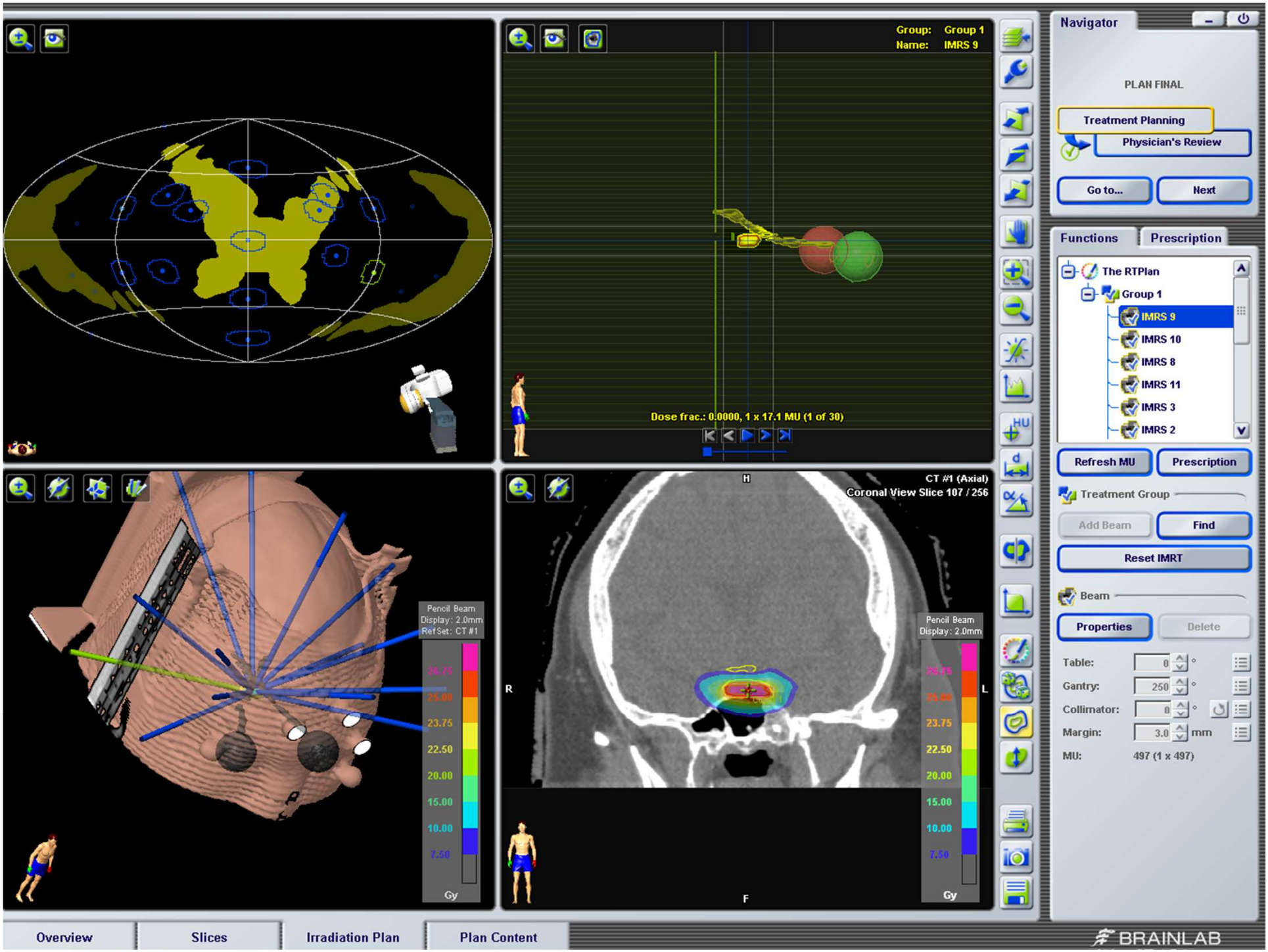

H
MR #3 (Axial
Coronal View
OAR
GTV + PTV

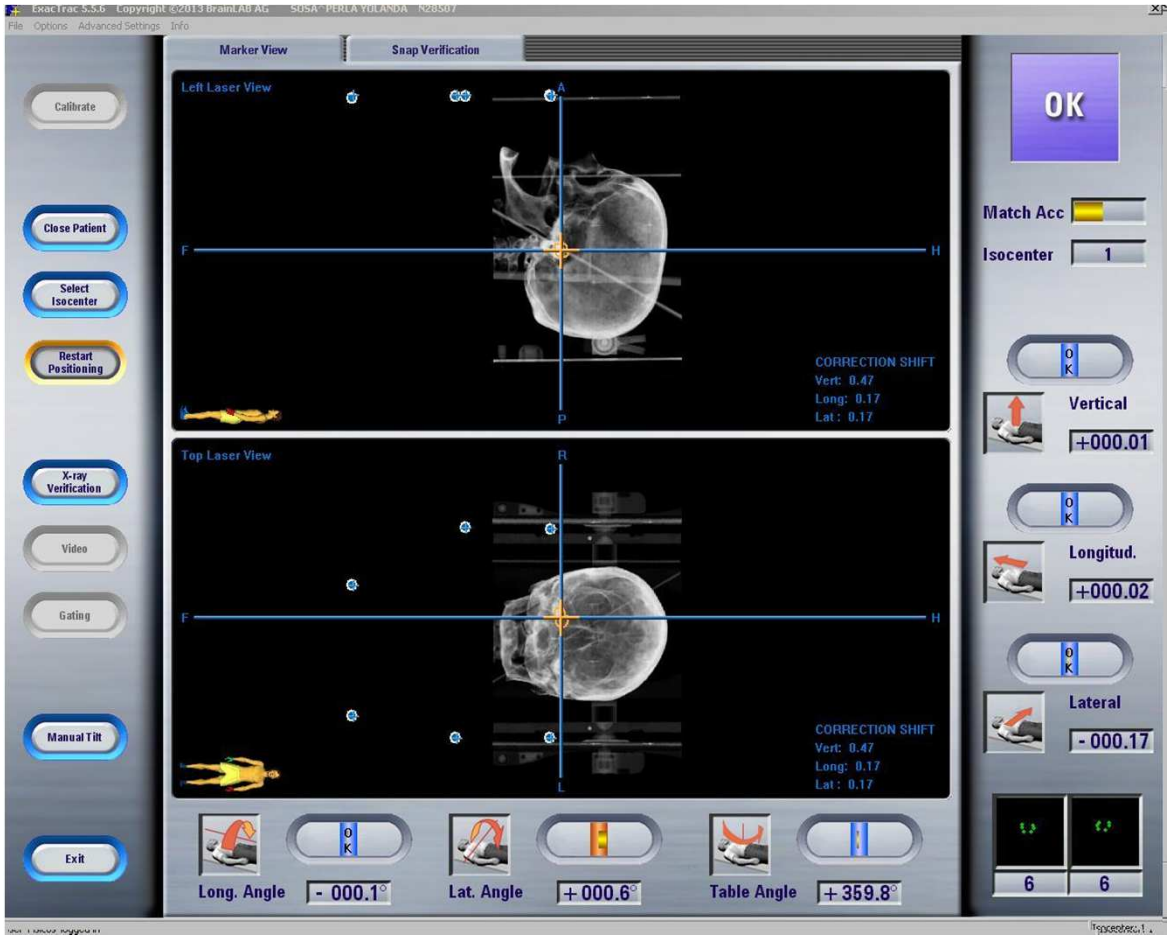

H
MR #3 (Axial)
Coronal View
Pencil Beam
Display: 2.0mm
RefSet: CT #1
26.75
25.00
23.75
22.50
20.00
15.00
10.00
L
IMRT

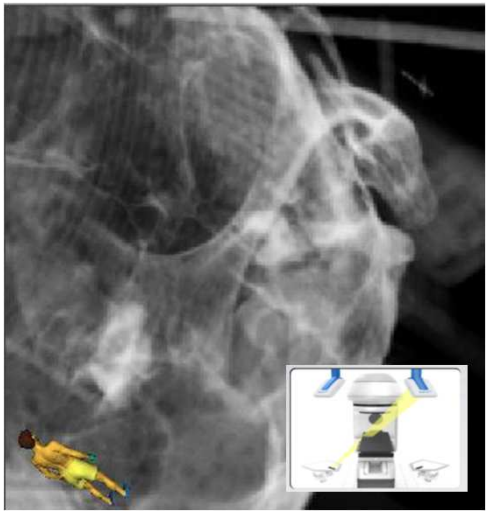

DVH
Min. Dose : 86.0 % = 21.50 Gy
Mean Dose : 105.8 % = 26.45 Gy
Max. Dose : 113.0 % = 28.26 Gy
Volume [%]
Violated DVH constraint
Point Prescription (:1 PTV (A)) used
Dose : 96.6 % = 24.16 Gy
1 GTV SIN VIA OPTICA : 98.0 % = 0.619 ccm
Conformity Index : 1.31; 74.8%
GTV: 1 fracción de 25Gy
110
100
90
80
70
60
50
40
30
20
10
0
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
100.0 % = 0.632 ccm
Gridsize : 0.70 mm
Dose [Gy]
Pencil Beam
100.0 % = 25.00 Gy

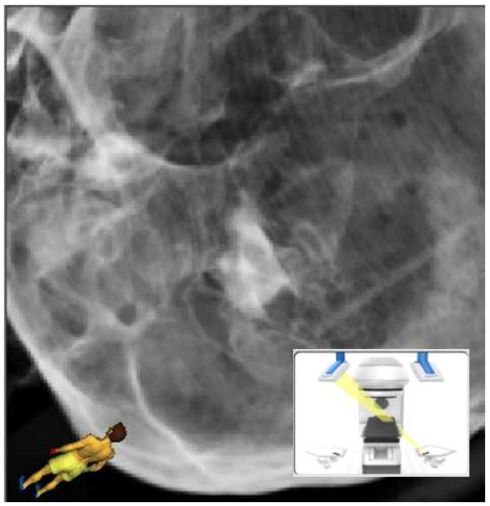

DVH
Volume [%]
Min. Dose : 0.4 % = 0.11 Gy
Mean Dose : 9.2 % = 2.29 Gy
Max. Dose : 40.2 % = 10.06 Gy
Violated DVH constraint
110
100
90
80
70
60
50
40
30
20
10
0
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
100.0 % = 1.648 ccm
Gridsize : 2.00 mm
Dose [Gy]
Pencil Beam
100.0 % = 25.00 Gy
Guardian : 100 %
Vía óptica
Dmax: 10Gy


DVH
Volume [%]
Min. Dose : 0.5 % = 0.12 Gy
Mean Dose : 3.1 % = 0.78 Gy
Max. Dose : 10.2 % = 2.56 Gy
110
100
90
80
70
60
50
40
30
20
10
0
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
100.0 % = 25.368 ccm
Gridsize : 2.00 mm
Dose [Gy]
Pencil Beam
100.0 % = 25.00 Gy
Guardian : 66 %
Tronco
Dmax: 2,6Gy
Objects
Select single / multiple Item(s) or Group
1 PTV PTV
1 PTV-Boost PTV
1 GTV SIN VIA OPTICA Boost
1 PTV SIN VIA OPTICA Boost
PRV VIA OPTICA OAR 1
PRV VIA OPTICA-PTV OAR 1
VIA OPTICA OAR 1
Brainstem OAR 2
PRV Brainstem OAR 2
1 GTV Other
Eye, Left Other
Eye, Right Other
Display Options
Normal Tissue Graph
Differential DVH
Interpolate Graph
Show Constraints
Calculation
Grid Size: 2.0 mm
Finer for Small Objects
Recalc
Export to Clipboard
Close


Group: Group 1
Name: IMRS 9
Dose frac.: 0.0000, 1 x 17.1 MU (1 of 30)
Navigator
PLAN FINAL
Treatment Planning
Physician's Review
Go to...
Next
Functions
Prescription
The RTPlan
Group 1
IMRS 9
IMRS 10
IMRS 8
IMRS 11
IMRS 3
IMRS 2
Refresh MU
Prescription
Treatment Group
Add Beam
Find
Reset IMRT
Beam
Properties
Delete
Table: 0
Gantry: 250
Collimator: 0
Margin: 3.0 mm
MU: 497 (1 x 497)
Pencil Beam
Display: 2.0mm
Ref Set: CT #1
26.75
25.00
23.75
22.50
20.00
15.00
10.00
7.50
Gy
CT #1 (Axial)
Coronal View Slice 107 / 256
H
R
L
F
Overview
Slices
Irradiation Plan
Plan Content
BRAINLAB





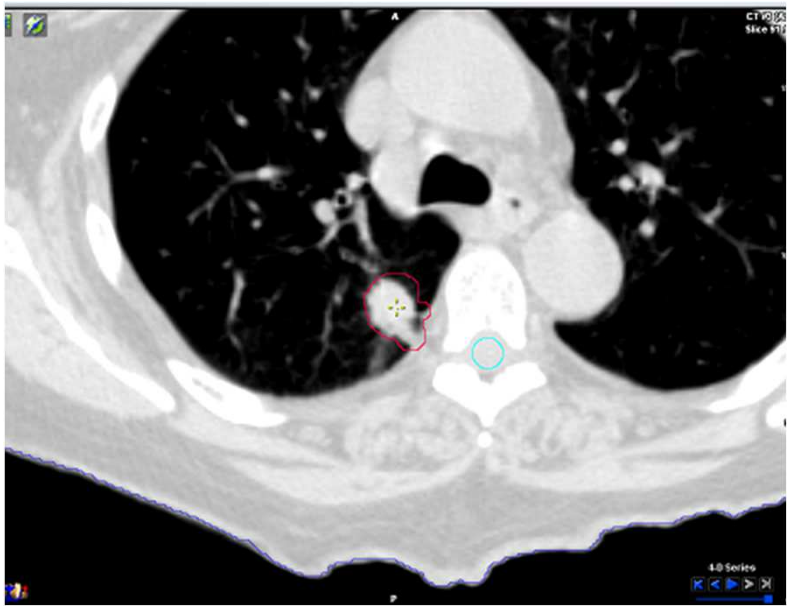


✓ Tratamiento guía por imágenes

Caso 2

Mujer 65 años de edad

Ca pulmón derecho medicamente inoperable



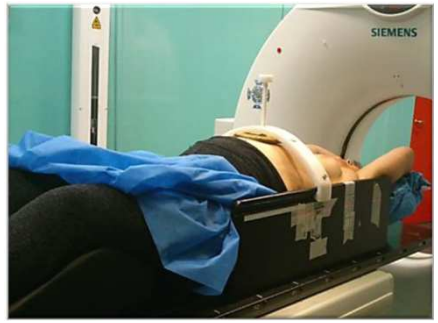
Que hacer???

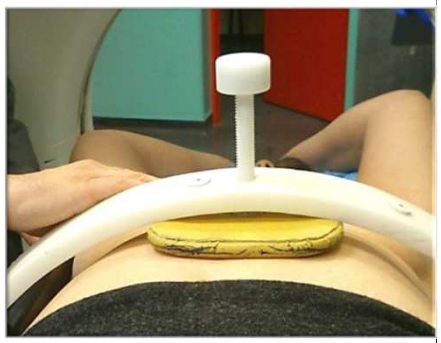
Tratamiento? → **SI** → **SBRT**

SBRT

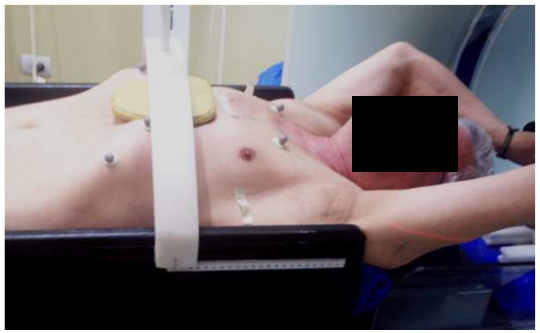
Posicionamiento e inmovilización

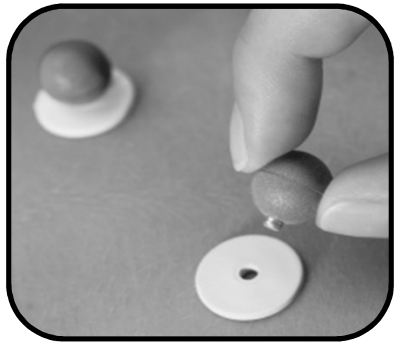
- Bolsa de vacío
- Compresor abdominal
  - Presión sobre abdomen - respiración
- Apoya piernas
- Brazos por encima de la cabeza, debido a múltiples incidencias
- Posición de esferas reflectoras sin interferencia con arco
- Isocentro tratamiento – localización
- Isocentro de tratamiento
  - Verificación de colisiones (ángulos no coplanares)
  - Isocentro definido por esferas NO laser



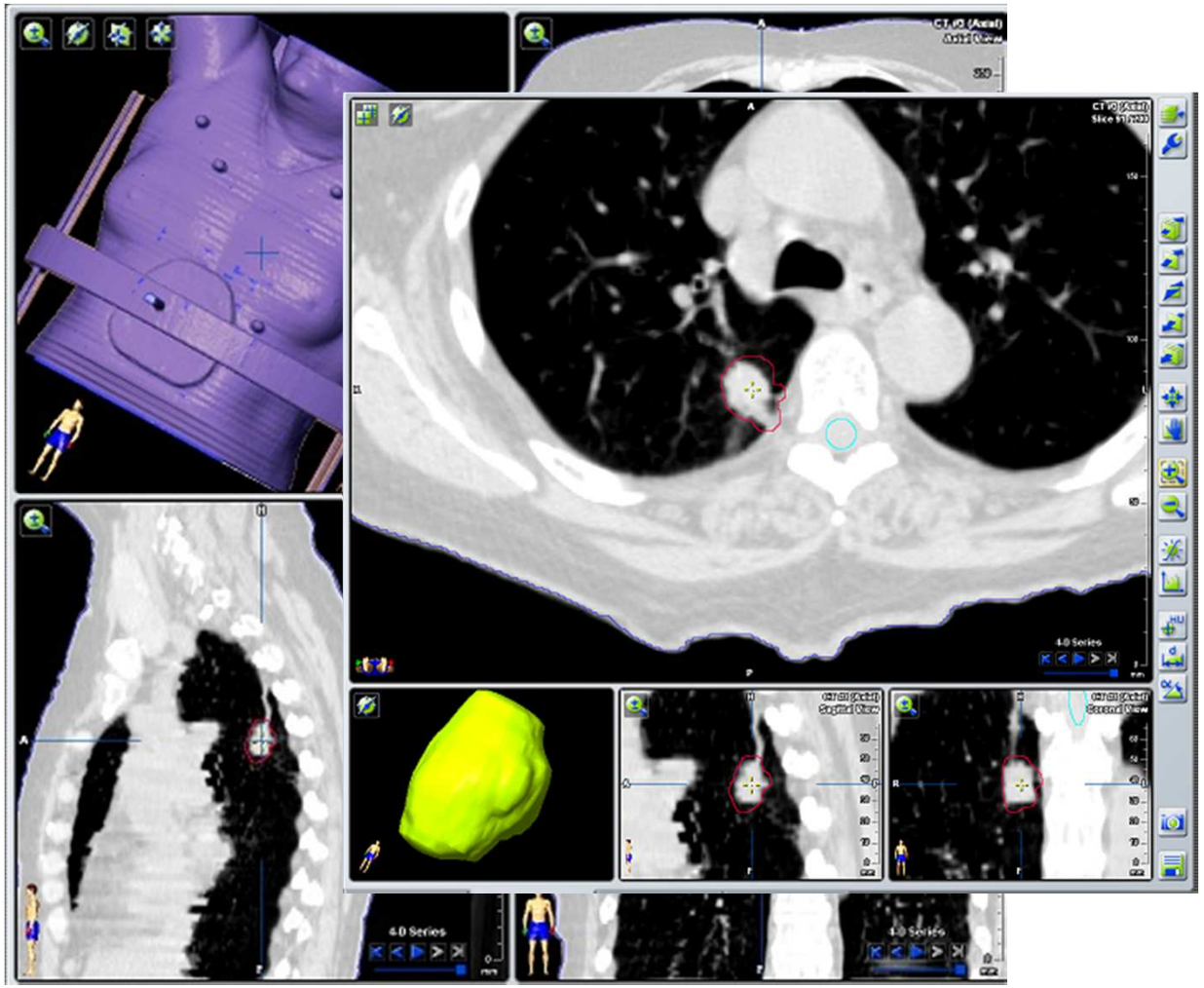


Simulación virtual con esferas reflectoras

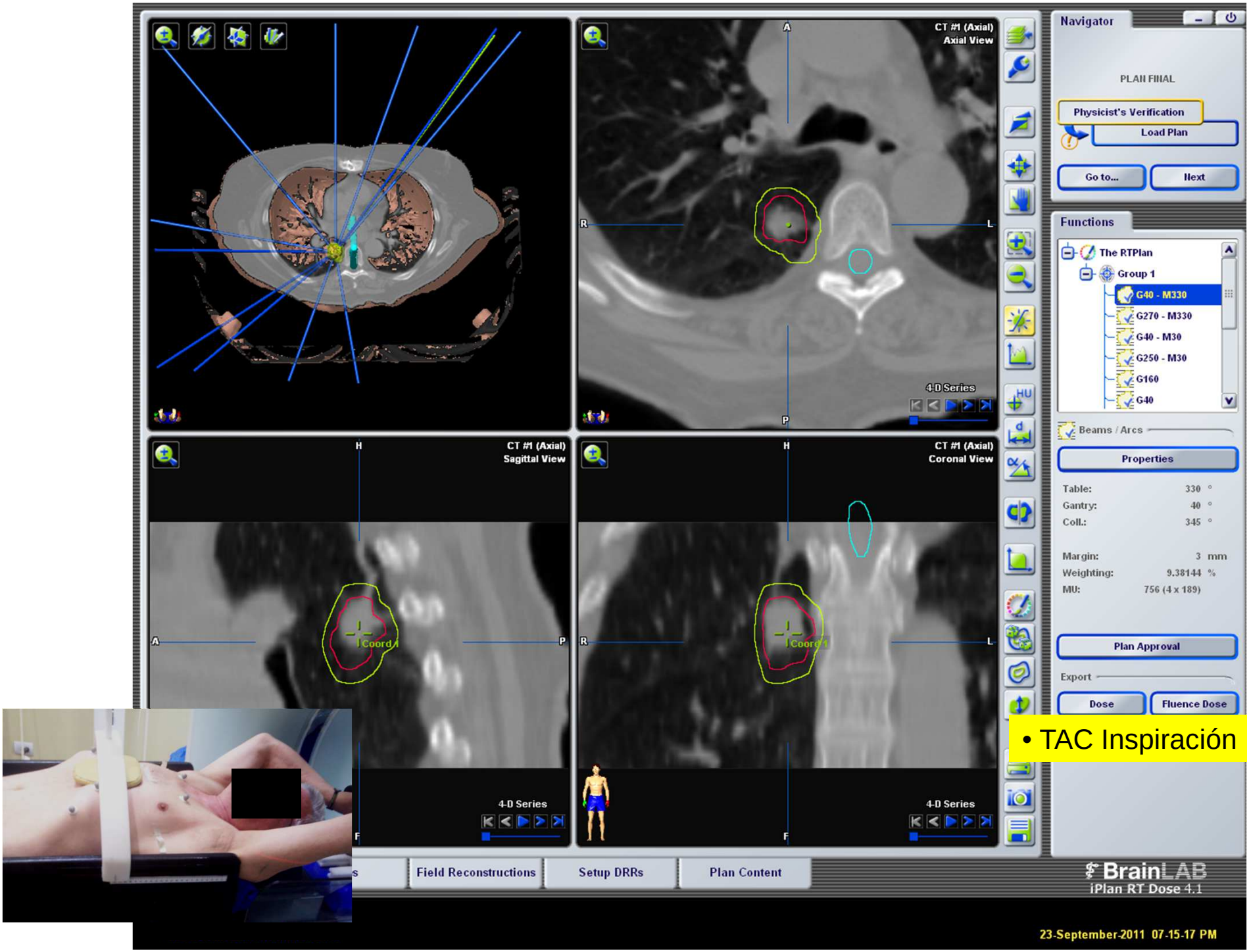




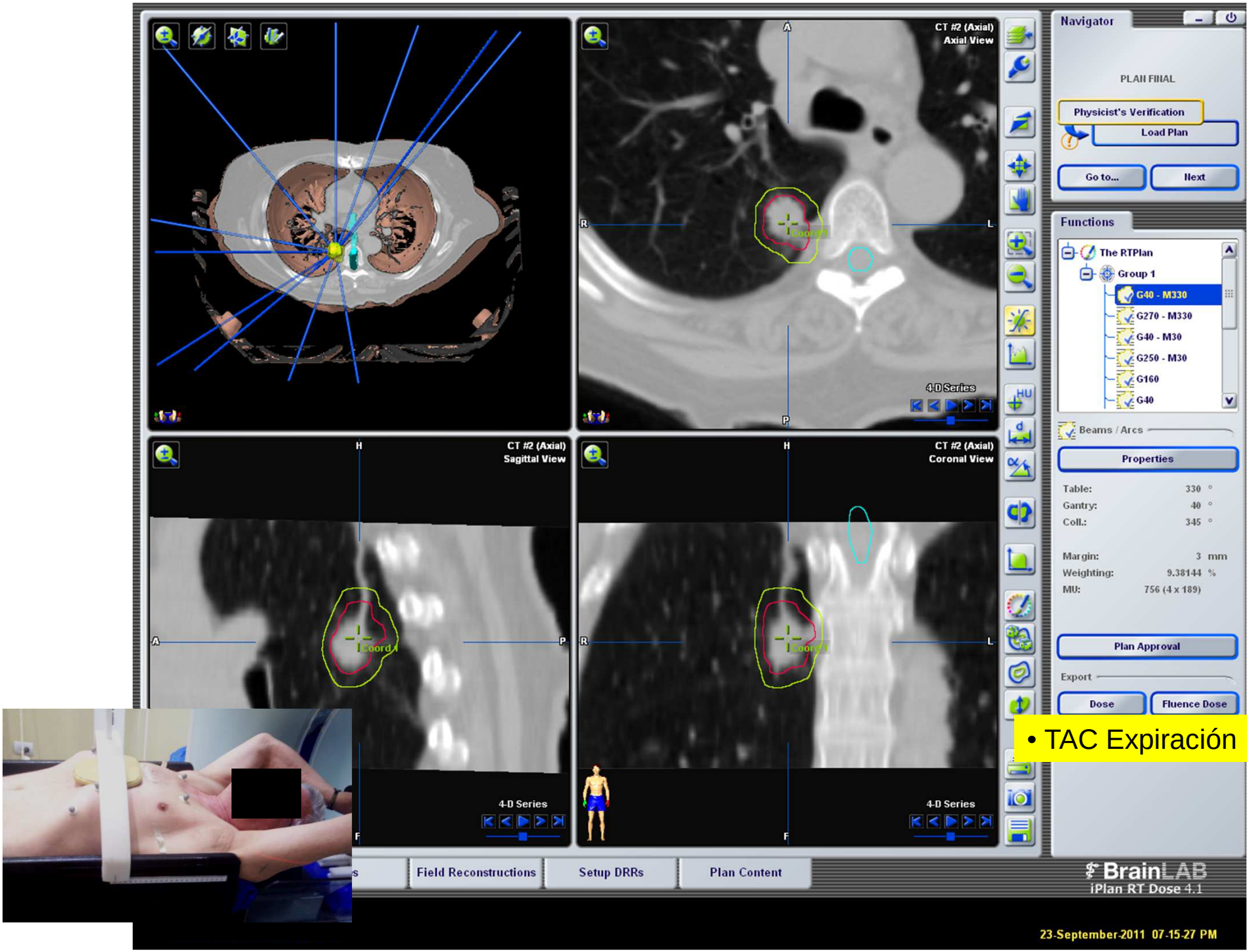
Definición de volúmenes



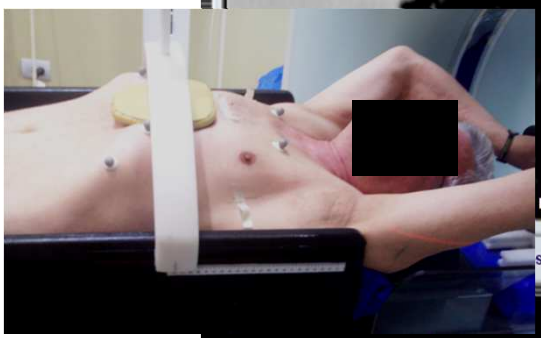
- Posición supina
- Bolsa de vacio
- Bloqueador respiratorio



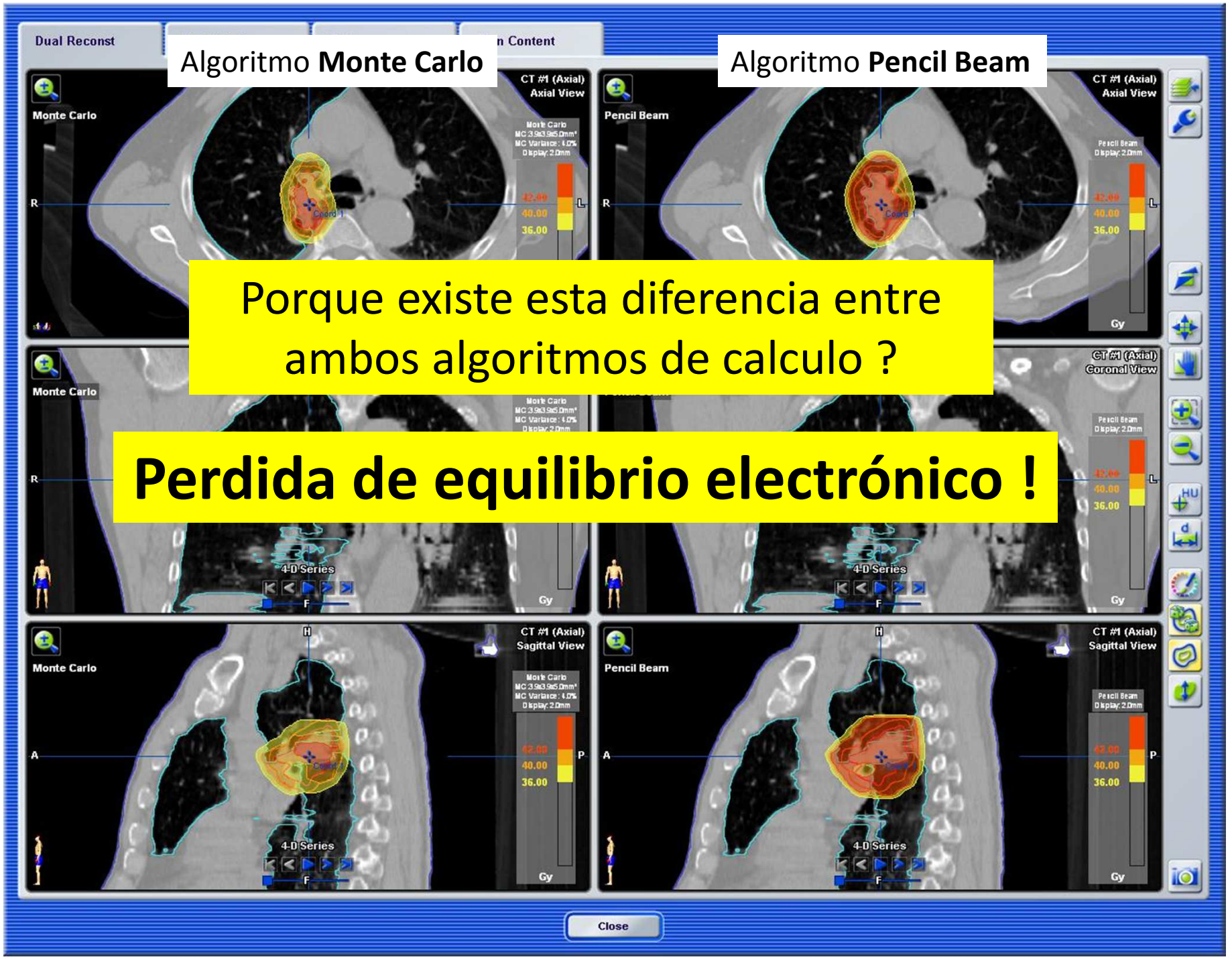
• TAC Inspiración

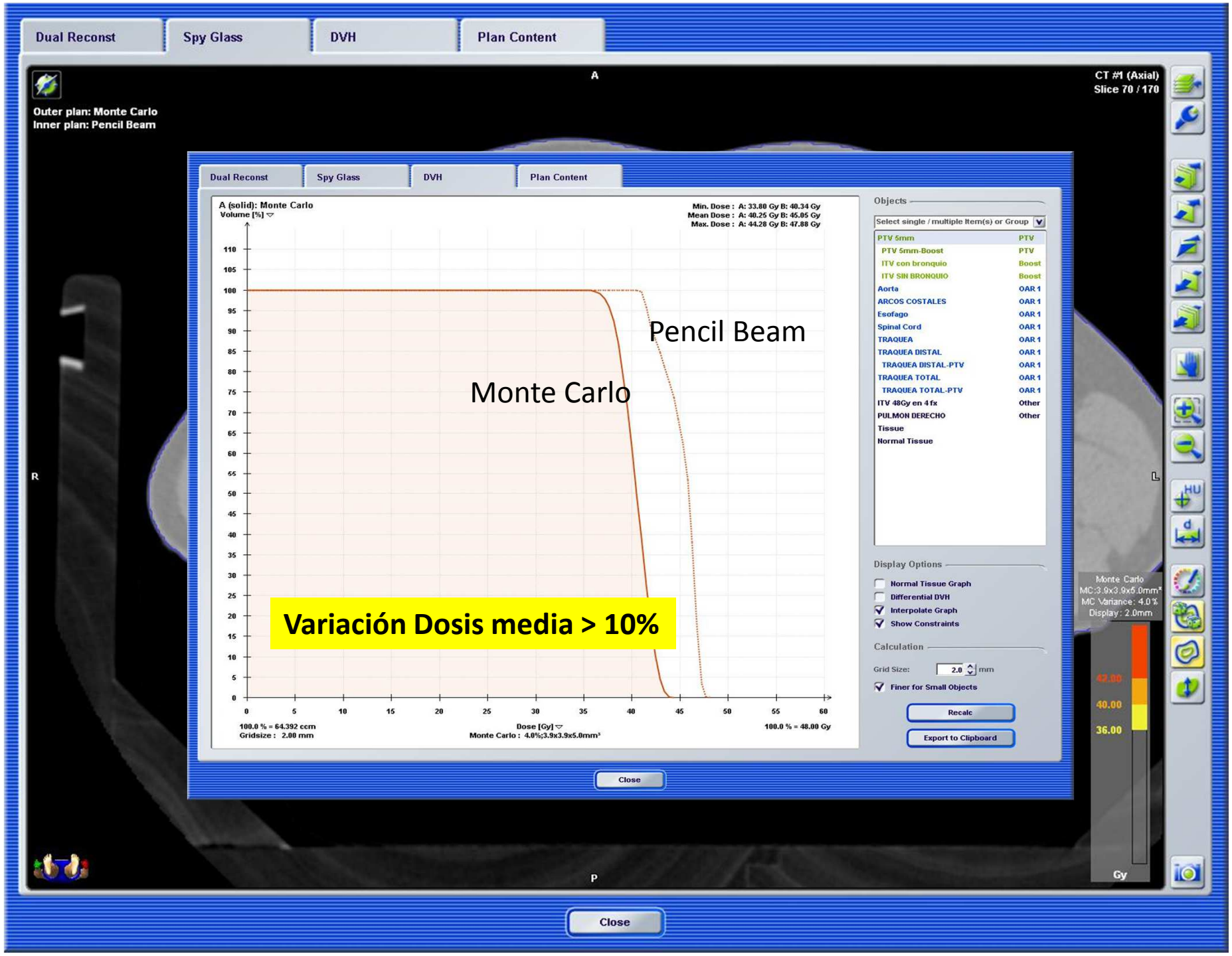


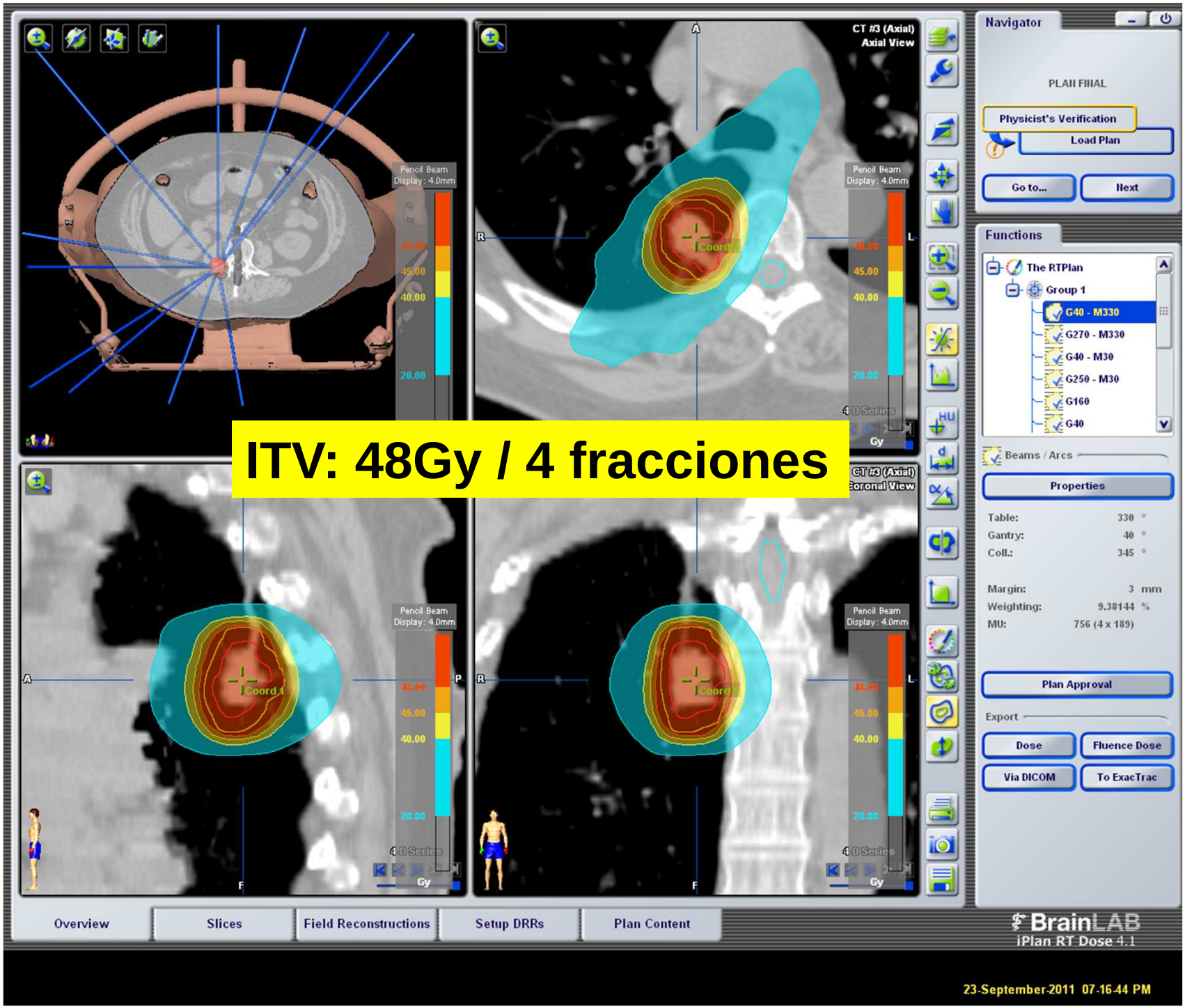
• TAC Expiración



$ITV = CTV_I + CTV_E + CTV_L$


Algoritmo **Monte Carlo**
Algoritmo **Pencil Beam**
Porque existe esta diferencia entre ambos algoritmos de calculo ?
Perdida de equilibrio electrónico !
Dual Reconst
Monte Carlo
Pencil Beam
CT #1 (Axial) Axial View
CT #1 (Axial) Coronal View
CT #1 (Axial) Sagittal View
4-D Series
Gy
Close


Dual Reconst
Spy Glass
DVH
Plan Content
Outer plan: Monte Carlo
Inner plan: Pencil Beam
CT #1 (Axial)
Slice 70 / 170
A (solid): Monte Carlo
Volume [%]
Min. Dose : A: 33.80 Gy B: 40.34 Gy
Mean Dose : A: 40.25 Gy B: 45.05 Gy
Max. Dose : A: 44.28 Gy B: 47.88 Gy
Pencil Beam
Monte Carlo
Variación Dosis media > 10%
100.0 % = 64.392 ccm
Gridsize : 2.00 mm
Dose [Gy]
Monte Carlo : 4.0%;3.9x3.9x5.0mm³
100.0 % = 48.00 Gy
Objects
Select single / multiple Item(s) or Group
PTV 5mm PTV
PTV 5mm-Boost PTV
ITV con bronquio Boost
ITV SIN BRONQUIO Boost
Aorta OAR 1
ARCOS COSTALES OAR 1
Esofago OAR 1
Spinal Cord OAR 1
TRAQUEA OAR 1
TRAQUEA DISTAL OAR 1
TRAQUEA DISTAL-PTV OAR 1
TRAQUEA TOTAL OAR 1
TRAQUEA TOTAL-PTV OAR 1
ITV 48Gy en 4 fx Other
PULMON DERECHO Other
Tissue
Normal Tissue
Display Options
Normal Tissue Graph
Differential DVH
Interpolate Graph
Show Constraints
Calculation
Grid Size: 2.0 mm
Finer for Small Objects
Recalc
Export to Clipboard
Close
Monte Carlo
MC:3.9x3.9x5.0mm³
MC Variance: 4.0 %
Display: 2.0mm
42.00
40.00
36.00
Gy
A
P
R
L
Close


ITV: 48Gy / 4 fracciones
Navigator
PLAN FINAL
Physicist's Verification
Load Plan
Go to...
Next
Functions
The RTPlan
Group 1
G40 - M330
G270 - M330
G40 - M30
G250 - M30
G160
G40
Beams / Arcs
Properties
Table: 330 °
Gantry: 40 °
Coll.: 345 °
Margin: 3 mm
Weighting: 9.38144 %
MU: 756 (4 x 189)
Plan Approval
Export
Dose
Fluence Dose
Via DICOM
To ExacTrac
CT #3 (Axial)
Axial View
CT #3 (Axial)
Coronal View
Pencil Beam
Display: 4.0mm
Overview
Slices
Field Reconstructions
Setup DRRs
Plan Content
BrainLAB
iPlan RT Dose 4.1
23-September-2011 07:16:44 PM

SBRT: personal capacitado

Stereotactic Body Radiation Therapy: The Report of AAPM Task Group 101

….la complejidad de SBRT requiere personal entrenado

SBRT: personal capacitado

Int. J. Radiation Oncology Biol. Phys., Vol. 60, No. 4, pp. 1026–1032, 2004

0360-3016/04/$–see front matter

ASTRO REPORT

AMERICAN SOCIETY FOR THERAPEUTIC RADIOLOGY AND ONCOLOGY*
AND AMERICAN COLLEGE OF RADIOLOGY PRACTICE GUIDELINE FOR
THE PERFORMANCE OF STEREOTACTIC BODY RADIATION THERAPY

Certificación de auditoría
Médico Radioncólogo
Físico Médico
Lic. Bioimágenes

MUCHAS GRACIAS POR SU ATENCION

INSTITUTO DE RADIOTERAPIA
FUNDACIÓN MARIE CURIE