

JORNADA SARH

“VERIFICACIÓN DOSIMÉTRICA DE
TRATAMIENTOS DE RADIOTERAPIA”

EXPERIENCIA HU VIRGEN DEL ROCIO

COMPASS / VARIAN PORTAL DOSIMETRY

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Sº Radiofísica HU Virgen del Rocío

EQUIPOS

ACELERADOR RAPIDARC DHX (Desde 2012)

- MLC: Millenium 120 láminas.
- PORTAL DOSIMETRY version 10
- Sistema Verificación Pretratamiento:
 - Detector ias2, 1024 x 768 pixeles TC 40 cm * 30 cm,
 - (Resolución espacial 0,4 mm)
 - Detector Matrixx Evolution + Maniquí Multicube + Software Omnipro imrt

ACELERADOR ELEKTA SYNERGY (Desde 2010)

- MLC: MLCi2, 80 Láminas
- Sistema Verificación Pretratamiento:
 - Detector Matrixx Evolution + Compass 4.0.12

ASPECTOS TENER EN CUENTA

- MONTAJE EXPERIMENTAL
- MANIQUÍES
- PRE-TRATAMIENTO VS DOSIMETRÍA IN VIVO
- SOFTWARE DE ANÁLISIS Y GESTIÓN DE BASE DE DATOS
- VERIFICACIÓN GAMMA VS DOSIMETRÍA 3D
- SOLUCIÓN ESCALABLE?

Flujo de trabajo Portal Dosimetry

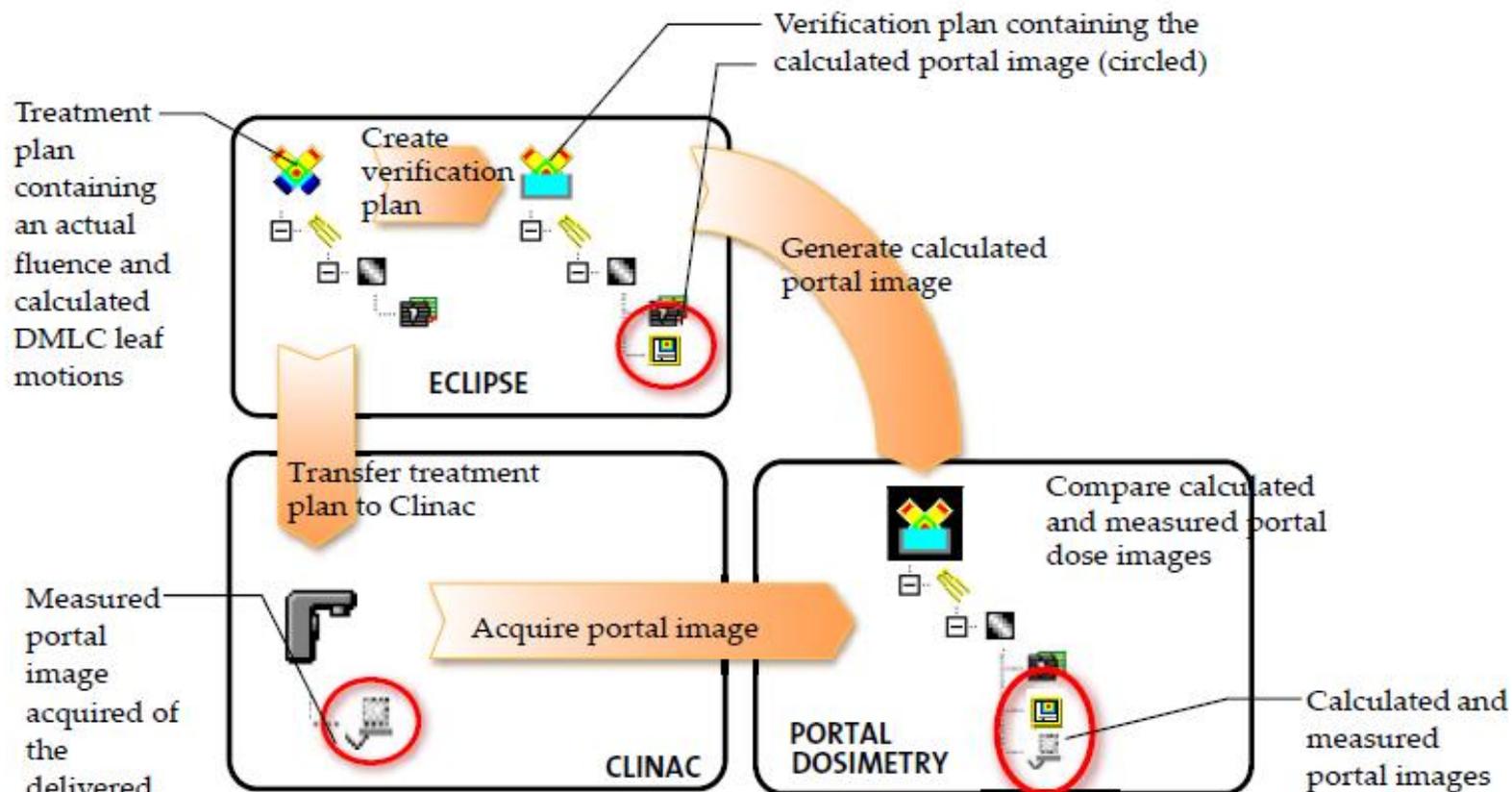


Figure 51 Verification of Plans Using Calculated and Measured Portal Images

Modelado Portal Dosimetry

MEDIDA DE HEMIPERFILES.

MEDIDA DEL LEAF GAP.

CALIBRACIÓN GEOMÉTRICA DEL PORTAL VISION (PV).

CALIBRACIÓN DOSIMÉTRICA DEL PV.

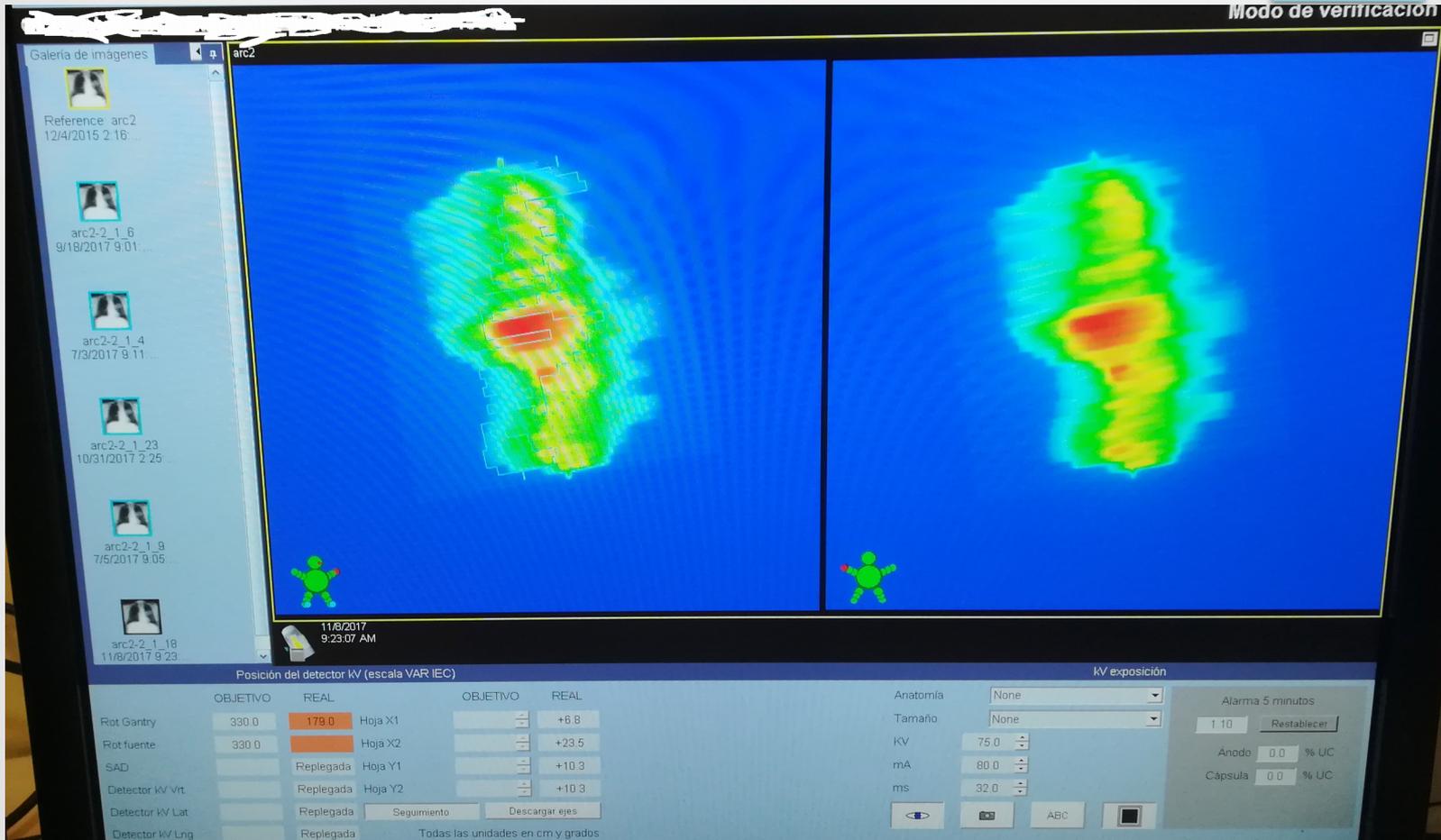
MEDIDA DE LOS OUTPUT FACTOR.

IMPLEMENTACIÓN DEL ALGORITMO PDIP.

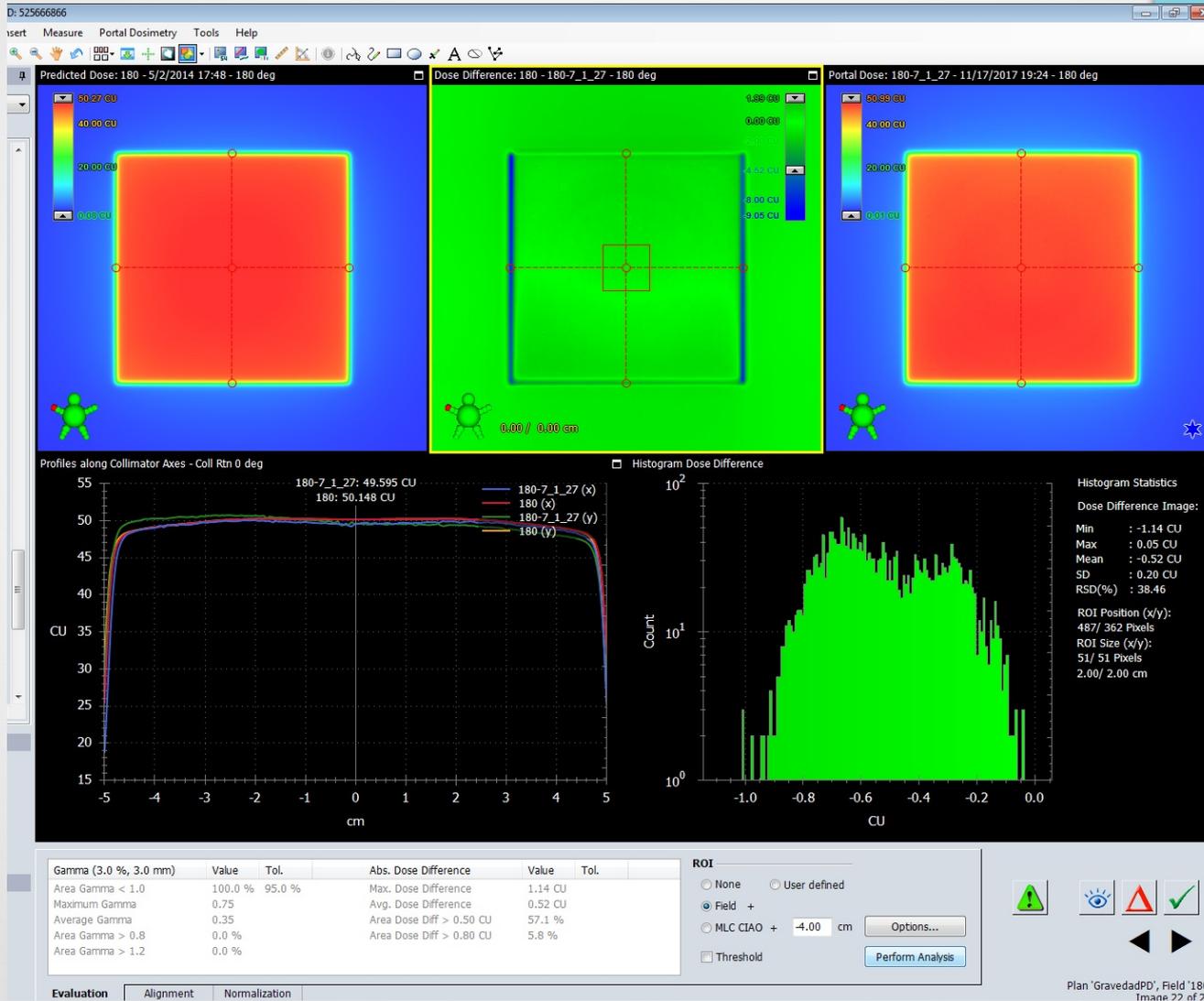
Medida Experimental



Medida Experimental



Medidas de Constancia

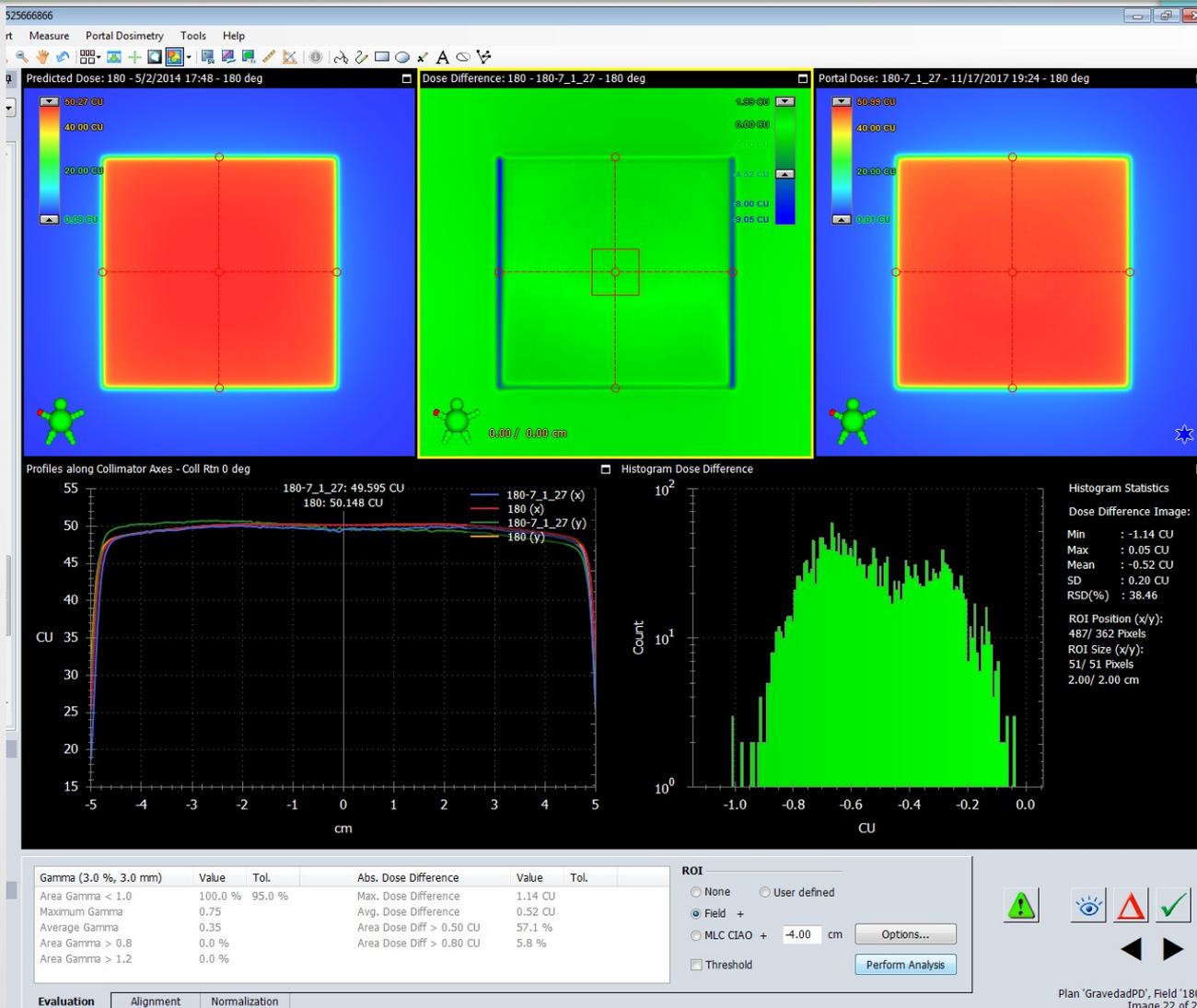


Criterios paso verificación pretratamiento

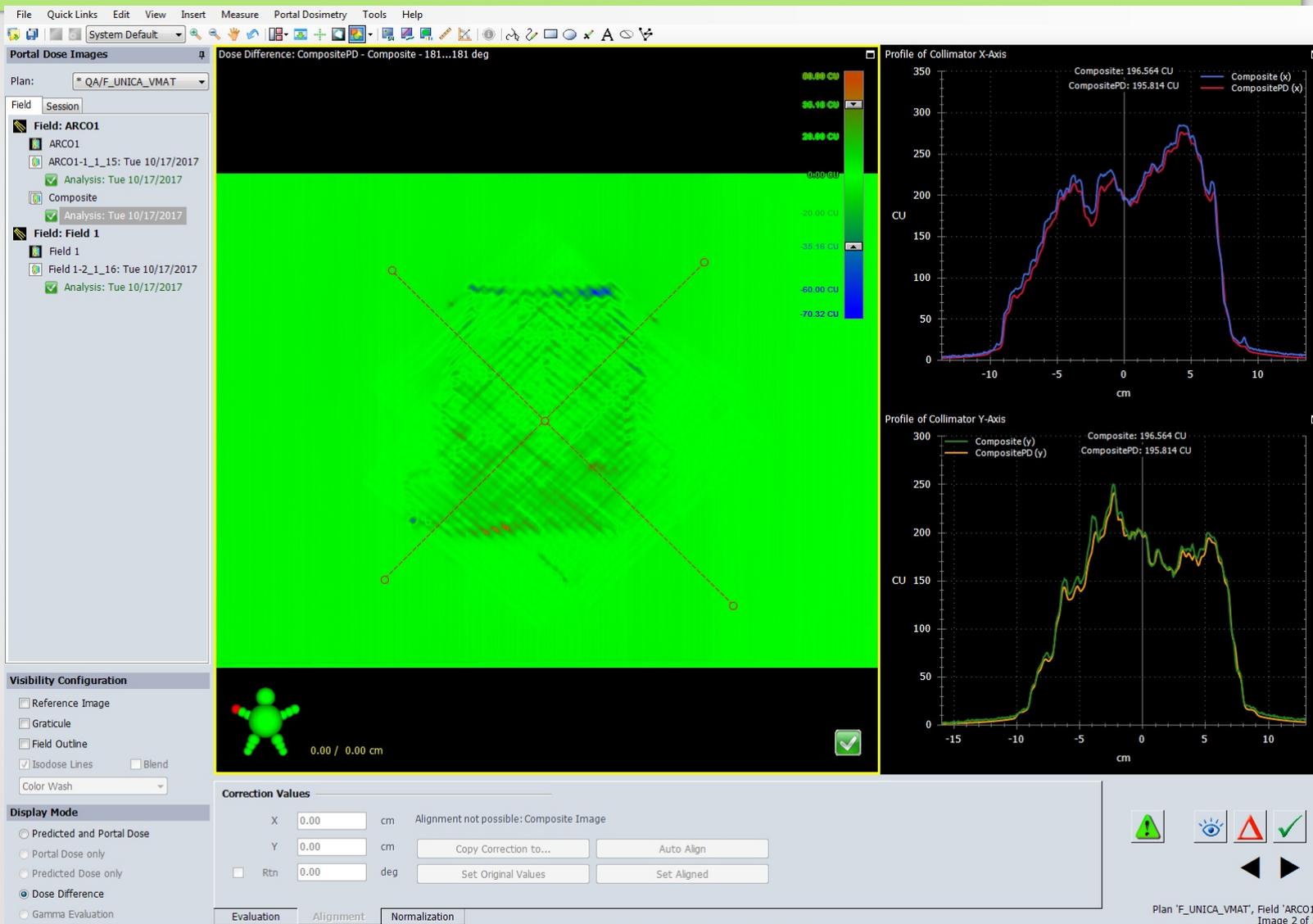
CRITERIOS DE COMPARACIÓN GAMMA

- Gamma global 3% / 3 mm, umbral 10 %
- N arcos o CAMPOS
- NECESARIO:
 - FLUENCIA COMPUESTA PASA CRITERIO GAMMA
- DESEABLE:
 - FLUENCIAS INDIVIDUALES, PASAN GAMMA INDIVIDUALMENTE
 - GAMMA MÁXIMO < 3

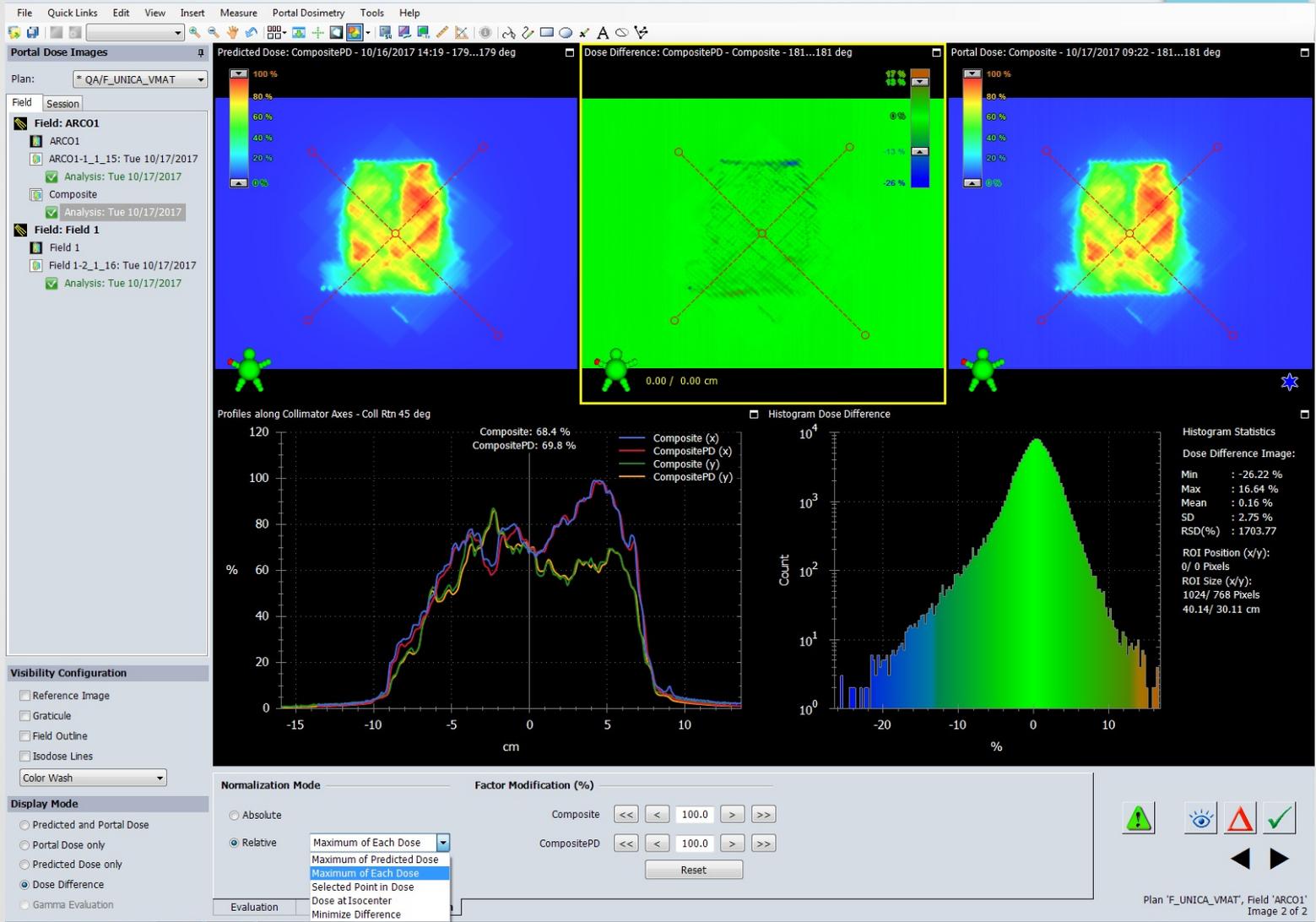
Software de análisis



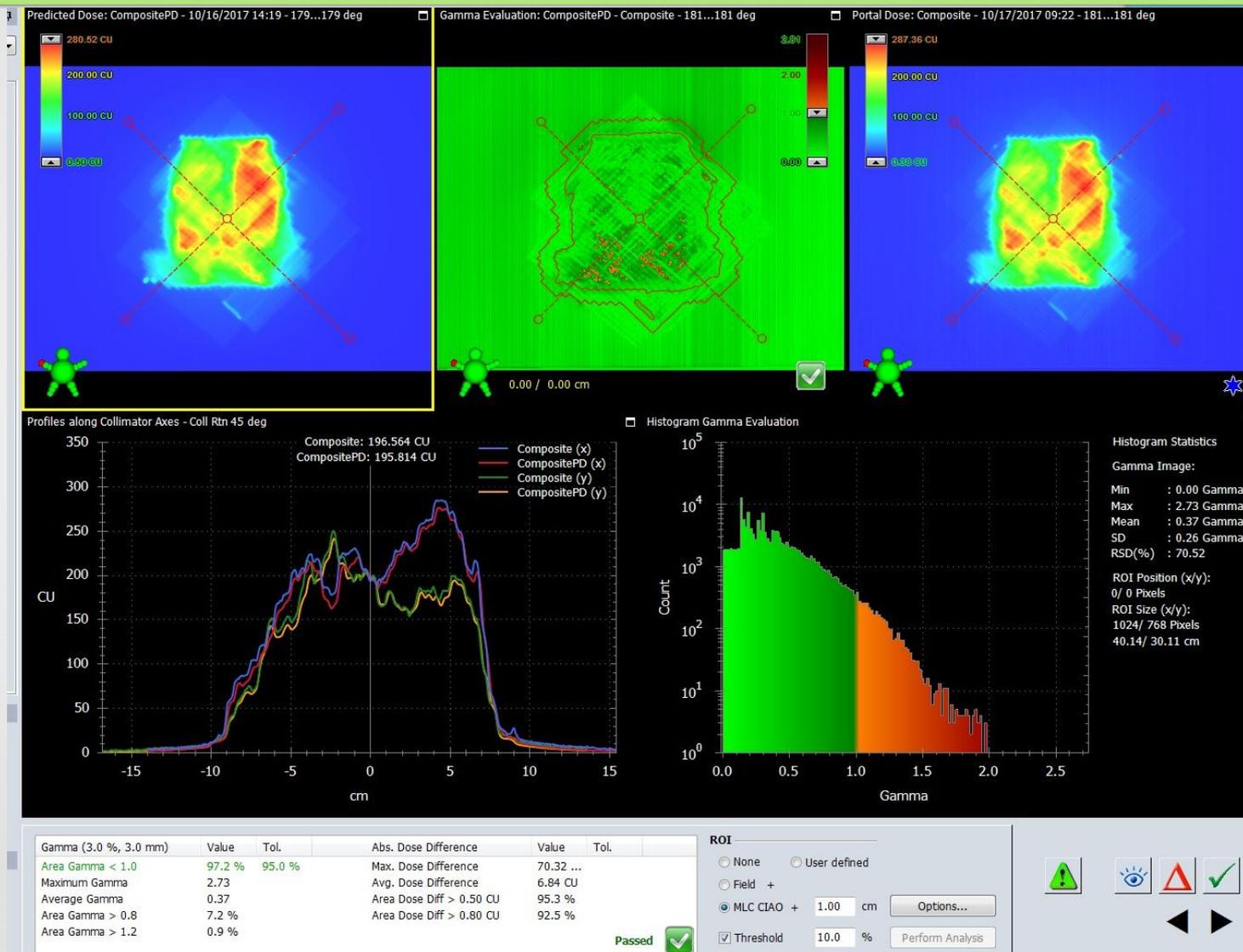
Software de análisis



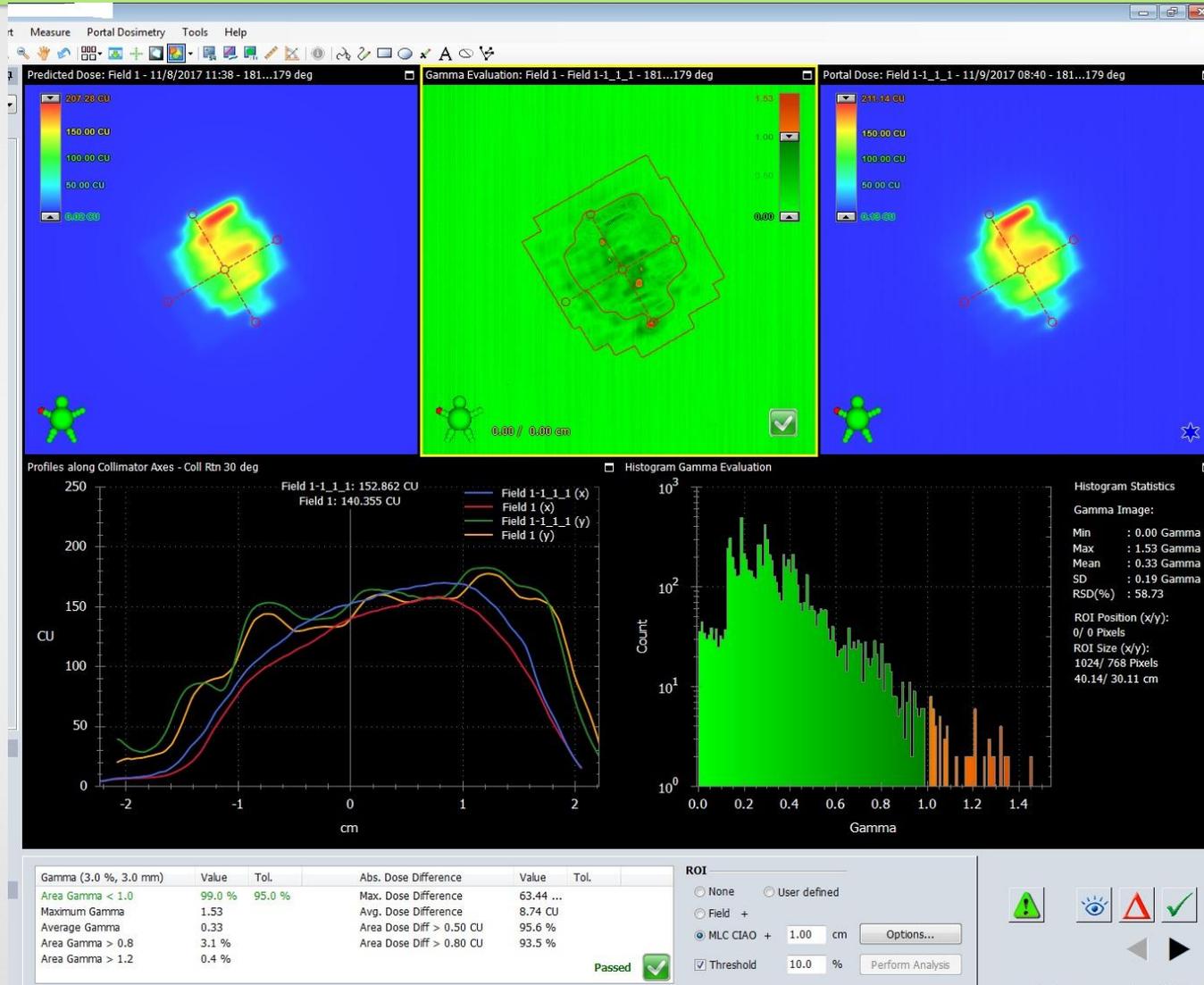
Software de análisis



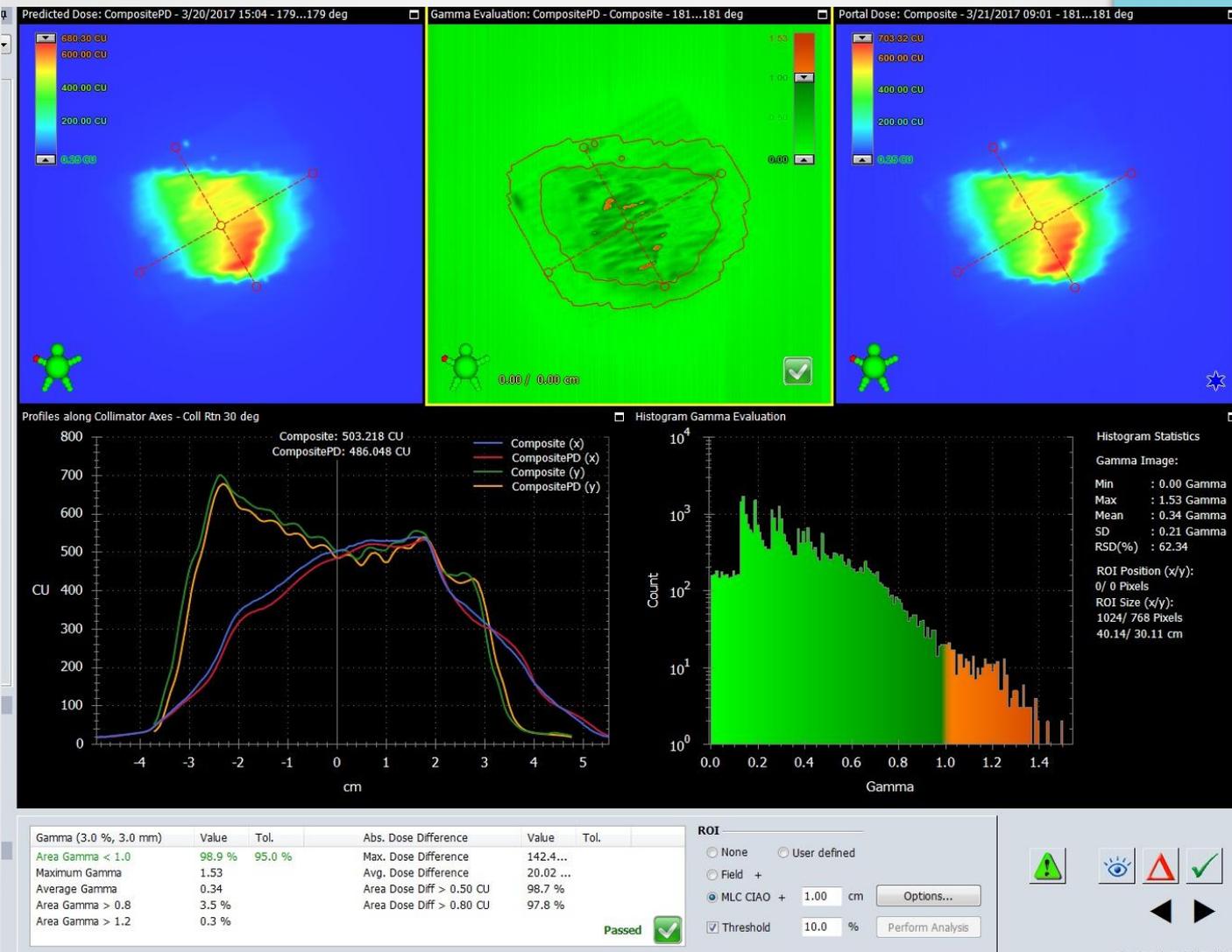
Ejemplo Cabeza y Cuello



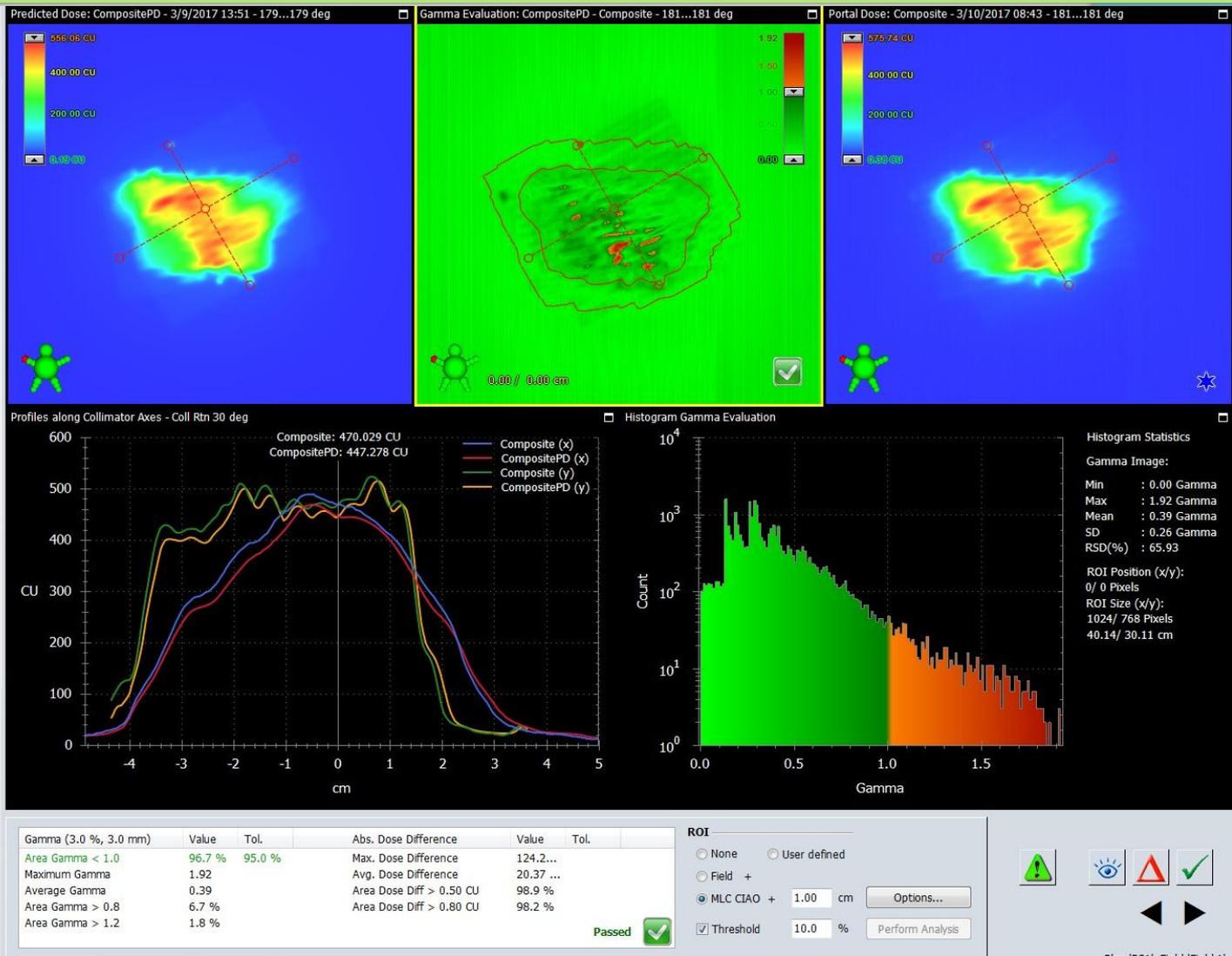
Ejemplo tratamiento cerebral



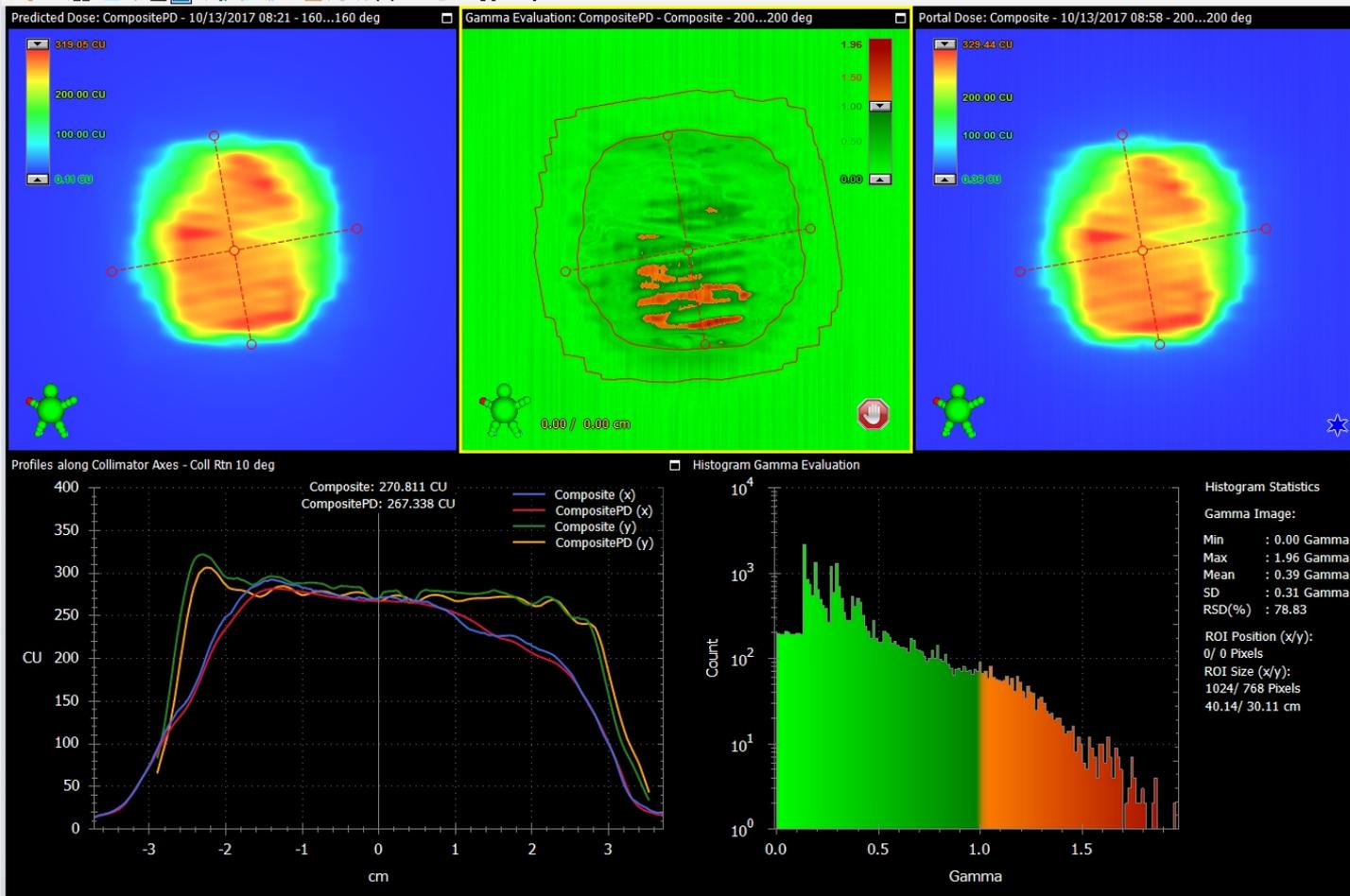
Ejemplo Próstata Estándar



Ejemplo Próstata Sib



Ejemplo Laringe



Gamma (3.0 %, 3.0 mm)	Value	Tol.	Abs. Dose Difference	Value	Tol.
Area Gamma < 1.0	93.3 %	95.0 %	Max. Dose Difference	67.78 ...	
Maximum Gamma	1.96		Avg. Dose Difference	10.44 ...	
Average Gamma	0.39		Area Dose Diff > 0.50 CU	96.5 %	
Area Gamma > 0.8	11.7 %		Area Dose Diff > 0.80 CU	94.4 %	
Area Gamma > 1.2	2.9 %				

ROI

None User defined

Field +

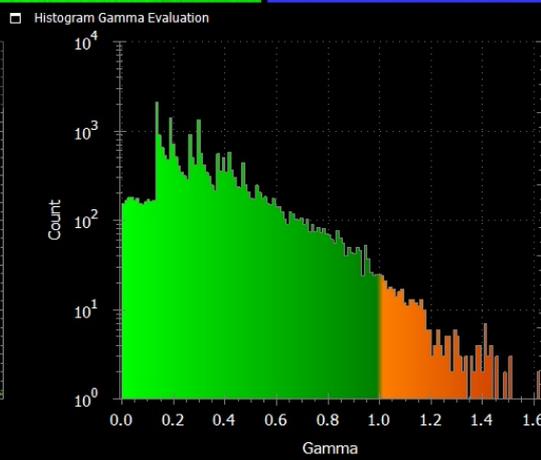
MLC CIAO + 1.00 cm

Threshold 10.0 %



Failed

Ejemplo Laringe



Histogram Statistics

Gamma Image:

- Min : 0.00 Gamma
- Max : 1.62 Gamma
- Mean : 0.34 Gamma
- SD : 0.22 Gamma
- RSD(%) : 66.21

ROI Position (x/y):
0/ 0 Pixels

ROI Size (x/y):
1024/ 768 Pixels
40.14/ 30.11 cm

Gamma (3.0 %, 3.0 mm)	Value	Tol.	Abs. Dose Difference	Value	Tol.
Area Gamma < 1.0	98.5 %	95.0 %	Max. Dose Difference	92.57 ...	
Maximum Gamma	1.62		Avg. Dose Difference	11.83 ...	
Average Gamma	0.34		Area Dose Diff > 0.50 CU	96.7 %	
Area Gamma > 0.8	4.9 %		Area Dose Diff > 0.80 CU	94.7 %	
Area Gamma > 1.2	0.4 %				

Passed

ROI

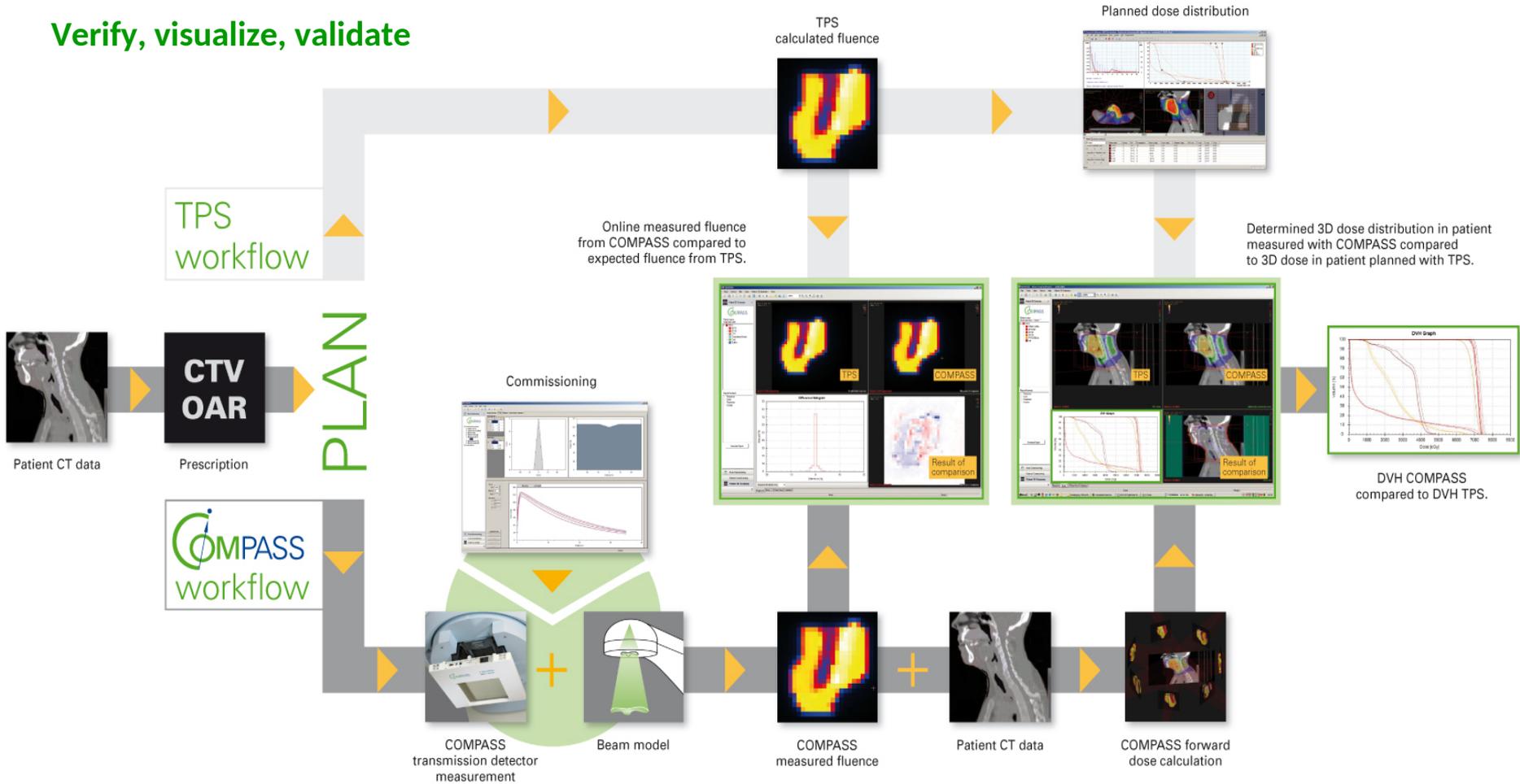
None User defined

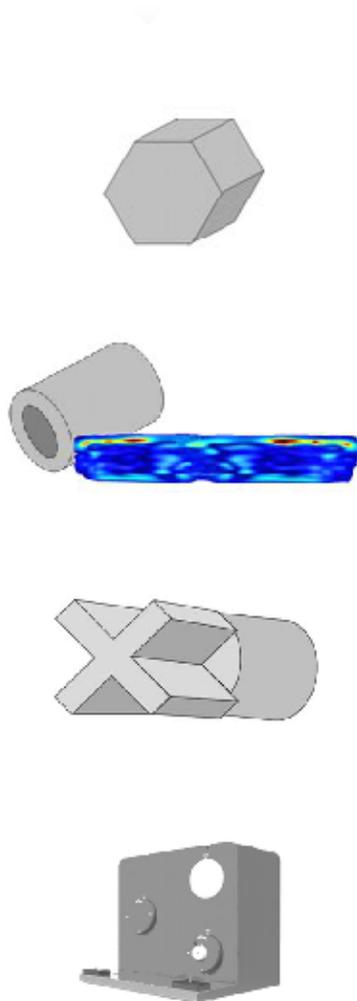
Field +

MLC CIAO + 1.00 cm

Threshold 10.0 %

Verify, visualize, validate

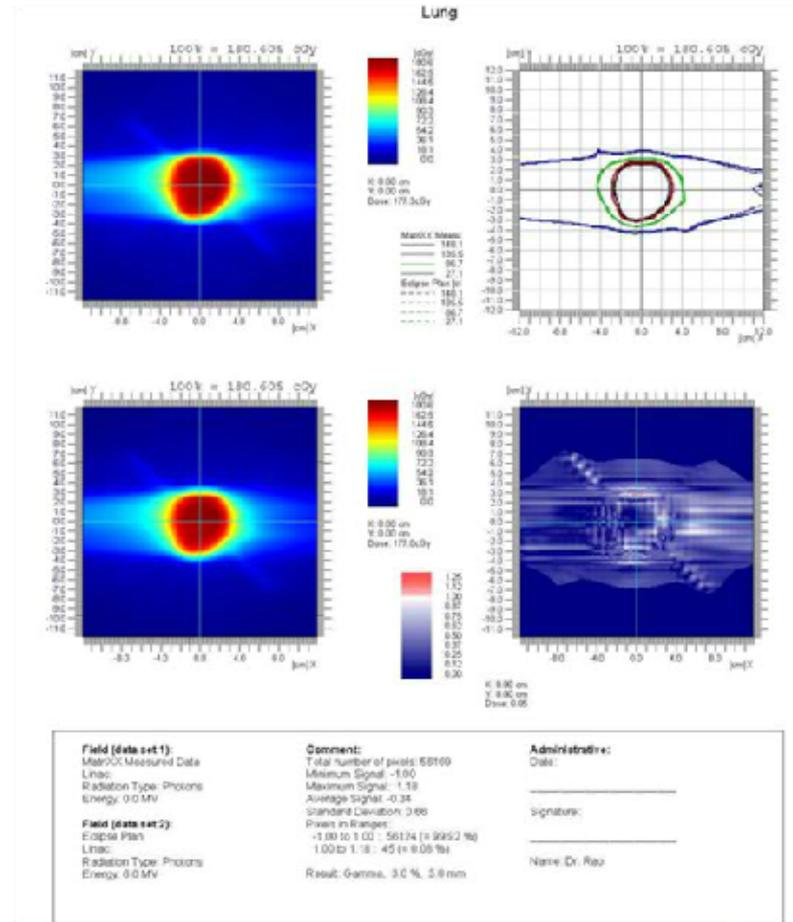




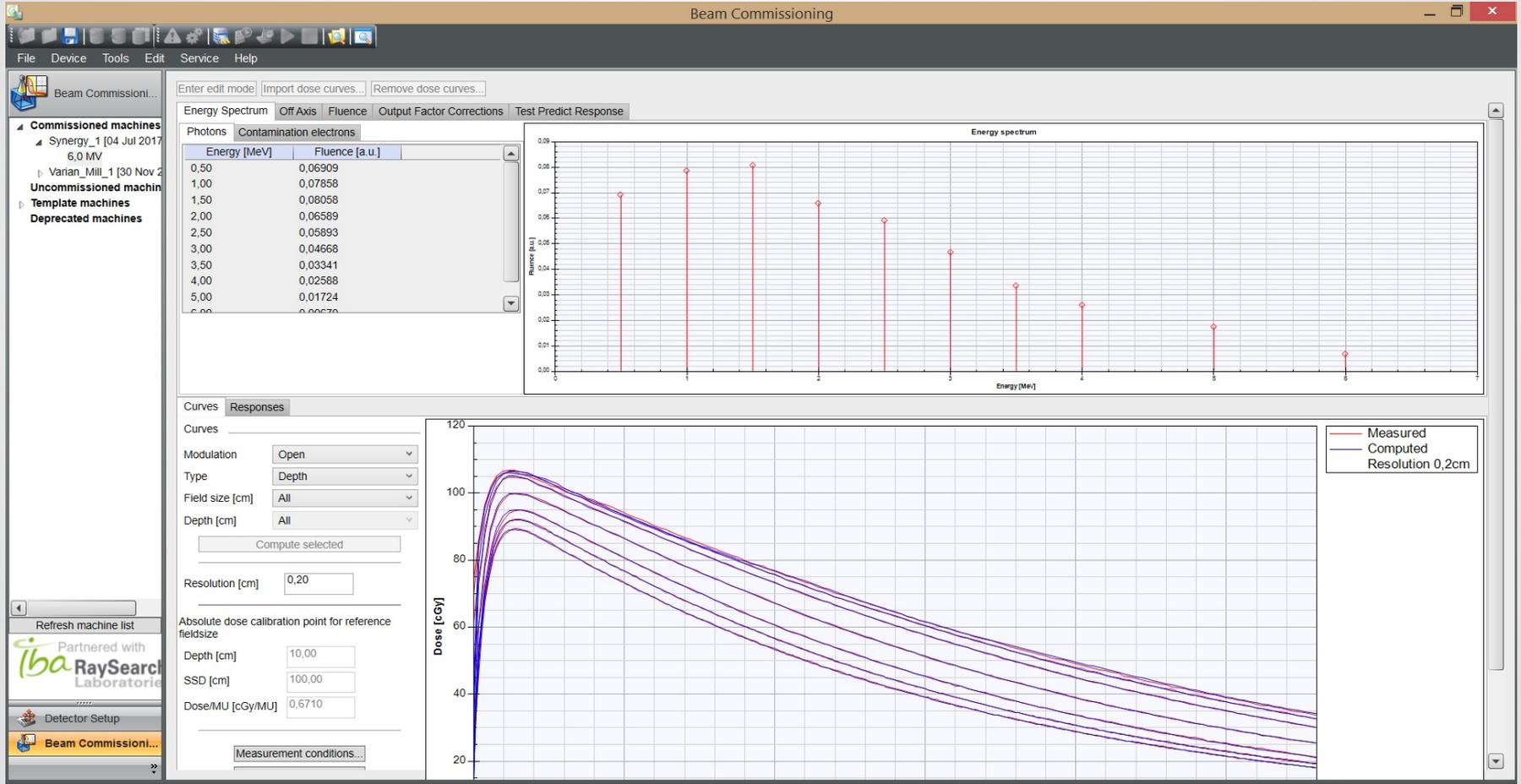
State of the art QA tools

Typical QA report

What about the patient?



Modelado Compass



Modelado Compass

Beam Commissioning

File Device Tools Edit Service Help

Enter edit mode | Import dose curves... | Remove dose curves...

Energy Spectrum | Off Axis | Fluence | Output Factor Corrections | Test Predict Response

Commissioned machines

- Synergy_1 [04 Jul 2017 6,0 MV]
 - Varian_Mill_1 [30 Nov 2017 6,0 MV]
- Uncommissioned machines
- Template machines
- Deprecated machines

Output Factor Corrections

Field size [cm]	Correction factor
2,00	0,97628
3,00	0,98657
5,00	0,99681
10,00	1,00000
20,00	1,00066
30,00	0,99280
40,00	0,97273

Normalization
Dose normalization: 3,90940

Curves Responses

Curves

Modulation: Open
Type: X
Field size [cm]: All
Depth [cm]: All

Compute selected

Resolution [cm]: 0,20

Absolute dose calibration point for reference fieldsize

Depth [cm]: 10,00
SSD [cm]: 100,00
Dose/MU [cGy/MU]: 0,6710

Measurement conditions...

Output Factor Corrections

Curves

Dose [cGy]

Measured
Computed
Resolution 0,2cm

Modelado Compass

Beam Commissioning

File Device Tools Edit Service Help

Enter edit mode | Import dose curves... | Remove dose curves...

Energy Spectrum Off Axis Fluence Output Factor Corrections Test Predict Response

Sources

Source	Eff. dist. to source [cm]	XWidth [cm]	YWidth [cm]	Weight
Primary	-	0,147	0,070	-
Flattening filter	14,00	1,600	-	0,06116
Electrons	-	6,165	-	0,00510

Weight of flattening filter electron source:

Collimator calibration

Collimator	Offset [cm]	Gain	Curvature [1/cm]
YJaws	-0,060	0,0050	0,00000
XJaws	0,010	0,0035	0,00008
MLC x-position	0,000	0,0000	0,00000
MLC y-position	-	0,0030	-

Collimator position

Collimator	Eff. dist. to source [cm]	Transmission
YJaws	50,90	-
XJaws	42,60	0,08000
MLC	32,30	0,01000

Additional MLC parameters

Tongue and groove [cm]

Leaf tip width [cm]

Curves Responses

Curves

Modulation

Type

Field size [cm]

Depth [cm]

Resolution [cm]

Absolute dose calibration point for reference fieldsize

Depth [cm]

SSD [cm]

Dose/MU [cGy/MU]

Refresh machine list

Partnered with **iba** RaySearch Laboratories

Detector Setup

Beam Commissioning

Legend: Measured (red line), Computed (blue line), Resolution 0,2cm

Detector Matrixx Evolution



Technical Specifications

MatriXX^{Evolution}

Number of chambers and type	1020 air-vented ionization chambers
Read-out time	20ms without dead time (parallel read-out)
Active area	24.4 x 24.4 cm ²
Sensor layout	MatriXX in a plane arranged in a 32 x 32 grid
Pixel spacing (center-to-center)	7.6 mm
Chamber size / volume	4.5 (Ø) x 5 (h) mm ² / 0.080 cm ³
Nominal sensitivity	2.0nC/Gy
FFF compatible	Suitable for FFF beams
Charge collection efficiency (at 24Gy/min; 10MV FFF at 100cm SDD)	> 97 % at 1.0 mGy/pulse
Deviation from linearity	≤ 1 % if the dose is ≥ 0.02 Gy
Temperature & pressure sensor	Automated k(t,p) correction of the chambers
Weight	10 kg. Easy to carry
Data communication method	Ethernet connection (via standard RJ45)
Gantry Angle Sensor accuracy	+/- 0.6°



Compass montado Varian



Ajuste del centraje y calibracion

Compass

21,2 °C | 1020 hPa

File Device Tools Help

Detector Setup

- Active Detectors
 - MatrXX (SN 14580)
 - ✓ Varien_Mill_1 [Buildup=2,00cm, SE]
- Detectors in Process
 - MatrXX (SN 14580)
 - ✓ Synergy_1 [Buildup=2,00cm, SDD]
 - ✓ Geometry Calibration
 - ✓ Absolute Calibration

[Disconnect](#)
[Pre-Irradiate](#)
[Measure Background](#)

Nominal Center
 Measured Center

Field [cm]	Offset [cm]	Angle [°]
✓ 9,9 x 9,9	0,04 (0,01; -0,04)	0,3 ccw

Result

Used Tolerance for Offset [cm]: 0,70
Used Tolerance for Angle [°]: 0,7

Total Offset [cm]: 0,04 (0,01; -0,04)
Calculated Origin [cm]: 0,01; -0,04
Total Rotation [°]: 0,3 ccw

Detector: MatrXX
Machine Name: Synergy_1
Detector Type: MatrXX
Serial Number: 14580
SDD: 100 cm

Partnered with
Iba RaySearch
Laboratories

Detector Setup
2D Plan Verification
Patient 3D Dosimetry

Perform measurements.

9,9 x 9,9

Y [cm]

X [cm]

Connected | Background timestamp: 8:25:00 | Administrator, Administrator

Calibracion sensor angular

Compass

Computation Tools Help

21,7 °C | 1020 hPa

1.0x

Dosimetry

Fraction

ExternalAngleSensorFormSerial Number: 30437, Read Period: 70 ms

1. Move Gantry to 0° and press "Check Tilt". If the tilt was set satisfactorily, press "Next".
2. Press "Check tilt". When the tilt has been set satisfactorily, press "Next".
3. Press "Finish" to accept the tilt correction, "Back" to repeat the tilt correction, or "Cancel" to interrupt the tilt correction.

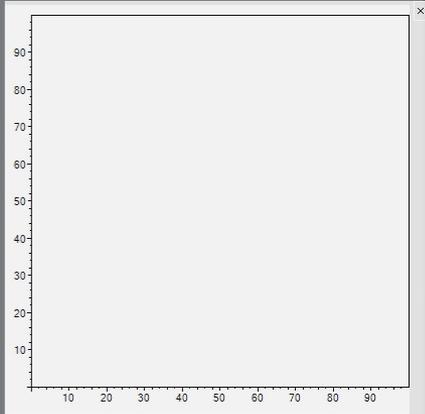
Tilt (Gantry at 0°) Tilt offset: +0,0°

Tilt (Gantry at 90° or Tilt offset: +0,0°

Gantry angle: 90,5°

Tilt tolerance: 5,0°

[new plan.](#)



Connected | Background missing | Administrator Administrator

Reconstruction of high-resolution 3D dose from matrix measurements: error detection capability of the COMPASS correction kernel method

J Godart¹, E W Korevaar¹, R Visser^{1,2}, D J L Wauben¹ and A A van't Veld¹

¹ Department of Radiation Oncology, University Medical Center Groningen/University of Groningen, Groningen, The Netherlands

² Research and Innovation Group in Health Care and Nursing, Hanze University of Applied Sciences, Groningen, The Netherlands

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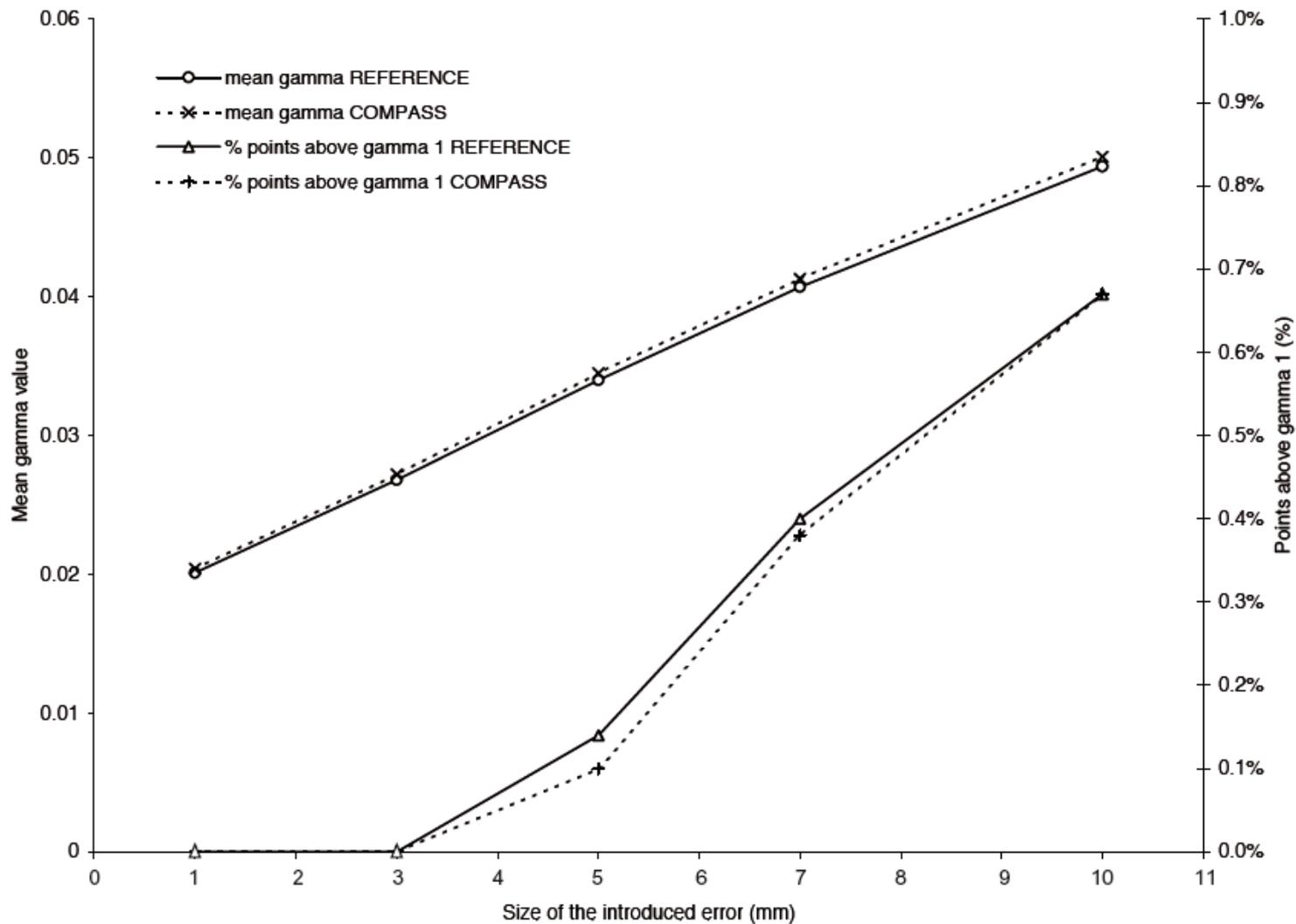


Figure 13: Mean gamma and number of points above gamma 1 (3%/3 mm) of several errors in five leaf pairs of the H&N case. The SDD is 762 mm. [5]

Compass vs otros detectores

JOURNAL OF APPLIED CLINICAL MEDICAL PHYSICS, VOLUME 16, NUMBER 1, 2015

Validation of fluence-based 3D IMRT dose reconstruction on a heterogeneous anthropomorphic phantom using Monte Carlo simulation

Yuji Nakaguchi,^{1a} Takeshi Ono,² Masato Maruyama,¹ Nozomu Nagasue,¹
Yoshinobu Shimohigashi,¹ Yudai Kai¹
Department of Radiological Technology,¹ Kumamoto University Hospital, Kumamoto,

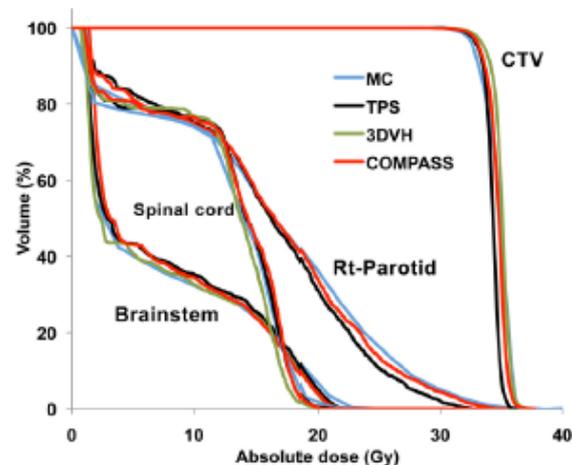
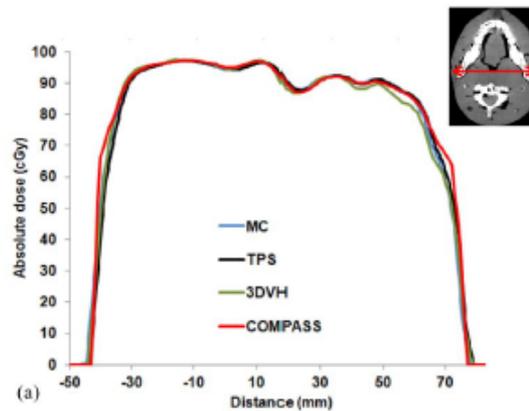
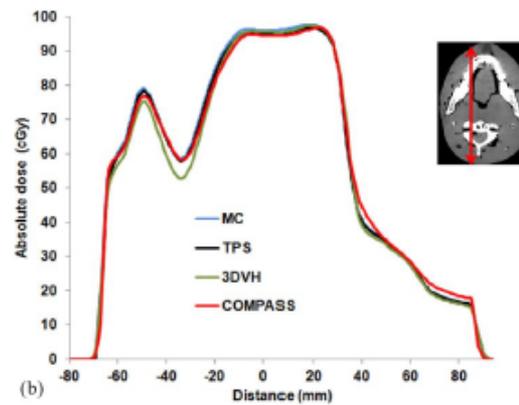


FIG. 6. Comparison of DVHs in anthropomorphic RANDO Alderson phantom between COMPASS, 3DVH, TPS, and MC for neck plan.

Compass vs otros detectores



(a)



(b)

FIG. 5. Comparison of IMRT dose profiles between TPS, 3DVH, COMPASS, and MC calculations at an isocenter: (a) lateral direction on the axial image at the isocenter; (b) vertical direction on the axial image at the isocenter.

Compass detection errores MLC

JOURNAL OF APPLIED CLINICAL MEDICAL PHYSICS, VOLUME 16, NUMBER 5, 2015

Analysis of direct clinical consequences of MLC positional errors in volumetric-modulated arc therapy using 3D dosimetry system

Karthikeyan Nithiyantham,^{1,5} Ganesh K. Mani,^{2a} Vikraman Subramani,^{3,5}

Structure	End Points	MLC Positional Error (mm)											
		-1.0		-0.5		-0.3		0.3		0.5		1.0	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
<i>Brain Cases</i>													
PTV	D ₉₅	-5.15	1.07	-2.67	0.65	-0.98	0.34	0.94	0.26	2.49	0.73	5.57	0.88
PTV	D ₅₀	-4.11	0.92	-2.25	0.77	-0.96	0.21	1.10	0.34	2.19	0.52	4.15	0.53
PTV	D ₂	-4.87	0.24	-2.29	0.27	-0.72	0.29	1.15	0.20	2.43	0.63	5.71	0.82
Brainstem	Max	-5.18	1.33	-2.94	0.62	-0.48	0.20	1.18	0.44	2.59	0.64	5.56	0.70
OC	Max	-6.55	1.85	-3.83	1.77	-1.20	0.72	1.03	0.60	3.55	1.80	7.70	1.88

Compass + Dolphin

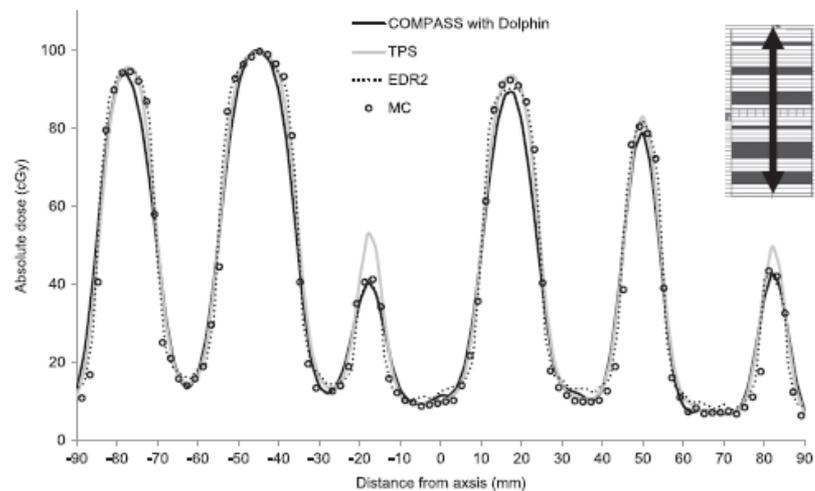
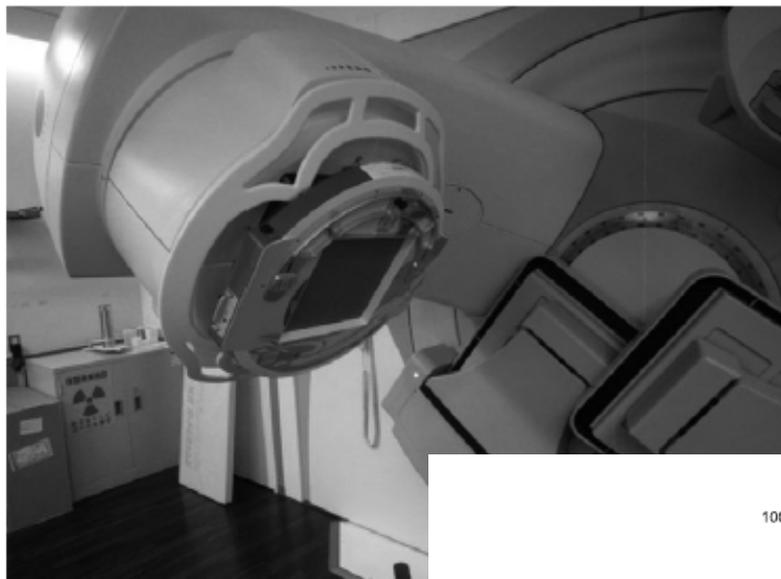


Fig. 5. The comparison of dose profiles in solid water from COMPASS, EDR2, TPS, and MC at a depth of 10 cm for MLC test pattern.

Criterios verificación pre- tratamiento

1) OBJETIVOS NO CLÍNICOS

- GAMMA GLOBAL 3 % / 3 mm
- GAMMA GLOBAL MEDIA máxima en OR paralelo 0,6

2) OBJETIVOS CLÍNICOS

- CÁLCULO RECONSTRUIDO CUMPLA LOS CRITERIOS CLÍNICOS EXIGIDOS AL DISEÑO INICIAL

Software Análisis

Measurement Evaluation Dose Evaluation Side by side 3 plane dose Statistics

Relative all segments in beam maximum Relative image maximum

Plan_0.0: Predicted detector response Select measurement 09/10/2017 8:56:12 response

Weight: 100,00 %
Energy: 6,0 MV
Response: -

Beam: arco1
Gantry: 178,00°
Measurement interval: 180/180
Beam coordinate: -1,48 10,03 cm

Weight: 100,00 %
Energy: 6,0 MV
Response: -
Measurements: 44,78

Beam: arco1
Gantry interval: after 178,00°
Measurement interval: 180/180
Beam coordinate: -1,48 10,03 cm

Statistics Difference

Response difference histogram Diagrams

Total Counts per Degree in Segment Intervals

Counts/Degree

Degree

Total counts per degree in segment intervals

Weight: 100,00 %
Energy: 6,0 MV
Response: -

Beam: arco1
Gantry: 178,00°
Measurement interval: 180/180
Beam coordinate: -1,48 10,03 cm

[Not connected] Administrator Administrator

Software Análisis

File Device Comparison Tools Help

Patient 3D Dosimetry

Available doses

Type Fraction

Treatment plan: Plan_0.0

Current machine: Synergy_1

Current imaging system: Generic CT

Regions of Interest

ROI	Matl	Type
<input checked="" type="checkbox"/> Femoral-Head_R		Organ
<input checked="" type="checkbox"/> Femoral-Head_L		Organ
<input checked="" type="checkbox"/> Bladder1		Organ
<input checked="" type="checkbox"/> Rectum		Organ
<input type="checkbox"/> Prostate1		Organ
<input type="checkbox"/> WVSS		Organ
<input checked="" type="checkbox"/> PTV WVSS		Organ
<input checked="" type="checkbox"/> PTV PROSTATA		Organ
<input type="checkbox"/> RECTO 3 MM		Organ
<input type="checkbox"/> PARED RECTO		Organ
<input type="checkbox"/> VEJIGA 4MM		Organ
<input type="checkbox"/> PARED VEJIGA		Organ
<input type="checkbox"/> External ROI_2		External

Measurement Evaluation Dose Evaluation Side by side 3 plane dose Statistics

Absolute dose Relative reference dose maximum Relative entered value [6522.5] [cGy]

Select reference dose TPS Plan_0.0: TPS dose

Select evaluation dose Plan_0.0: Reconstructed with 10/10/2017 8:46:47, Machine:

Position: -12,90 -163,40 8,66 cm
CT: -1011 HU
Density: -
Dose: 0,0 cGy

Position: -12,90 -163,40 8,66 cm
CT: -1011 HU
Density: -
Dose: 0,0 cGy

Transversal: -163,40 cm
Slice 77/168

Transversal: -163,40 cm
Slice 77/168

Statistics

Dvh Default Statistics Clinical goals Comparative Goals

Plan_0.0: TPS dose Plan_0.0: Reconstructed with 10/10/2017 8:46:47, Machine...

Volume [%]

Dose [cGy]

Distance criteria: 0,3 cm Dose percentage: 3%

Position: -12,90 -163,40 8,66 cm
CT: -1011 HU
Density: -
Dose difference: 0,0 cGy

Gamma: 1,50

Transversal: -163,40 cm
Slice 77/168

Partnered with
Iba RaySearch
Laboratories

Detector Setup

2D Plan Verification

Patient 3D Dosimetry

Software Análisis

Measurement Evaluation | **Dose Evaluation** → Side by side | 3 plane dose | Statistics

Absolute dose Relative reference dose maximum Relative entered value 6522,5 [cGy]

Select reference dose | TPS Plan_0.0: TPS dose | Select evaluation dose | Plan_0.0: Reconstructed with 10/10/2017 8:46:47, Machine:

Reference dose Evaluation dose Dose difference Gamma

3D 2D

Distance criteria: 0,3 cm Dose percentage: 3%
Position: -
Image data: -
Density: -
Dose: -

Gamma: 1,50
1,00
0,99
0,50
0,00

Beam: arco1 (Gantry: 182,00° Collimator: 350,00° Couch: 0,00°)
Transversal: -163,20 cm
Slice 78/168

Distance criteria: 0,3 cm Dose percentage: 3%
Position: -
Image data: -
Dose: -

Gamma: 1,50
1,00
0,99
0,50
0,00

Beam: arco1 (Gantry: 182,00° Collimator: 350,00° Couch: 0,00°)
Sagittal: -0,97 cm

Distance criteria: 0,3 cm Dose percentage: 3%
Position: 4,02 -155,11 -4,08 cm
CT: -7 HU
Density: 1,01 g/cm³
Gamma: 0,4

Gamma: 1,50
1,00
0,99
0,50
0,00

Beam: arco1 (Gantry: 182,00° Collimator: 350,00° Couch: 0,00°)
Coronal: -4,08 cm

[Not connected] Administrator Administrator

Comparación 3D

DOSIMETRÍA IMPORTADA TPS → TPS DOSE

DOSIMETRÍA POR TPS COMPASS → COMPUTED DOSE

DOSIMETRÍA MEDIDA EXPERIMENTAL → RECONSTRUCTED DOSE

TPS DOSE VS COMPUTED DOSE → CALCULO INDEPENDIENTE

COMPUTED VS RECONSTRUCTED → PRECISIÓN ACELERADOR

TPS DOSE VS RECONSTRUCTED → VERIFICACIÓN PRETRATAM.

Dosimetría paciente 3D

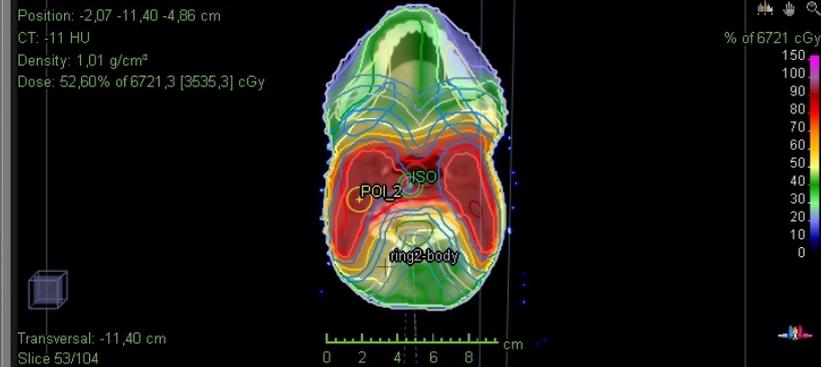
Compass: cabeza y cuello real ZZ_2017 *19/12/1999-cabeza y cuello GRID EXPANDIDA*



Measurement Evaluation **Dose Evaluation** Side by side 3 plane dose Statistics

Absolute dose Relative reference dose maximum Relative entered value 6721,3 [cGy]

Select reference dose **TPS Plan_0.0: TPS dose**



Select evaluation dose **Plan_0.0: Compass Computed Dose, Machine: Synergy_1**

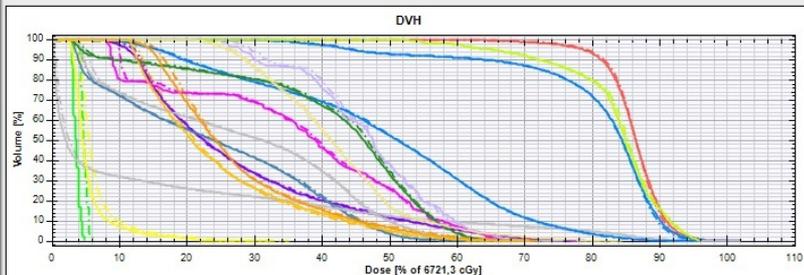


Statistics

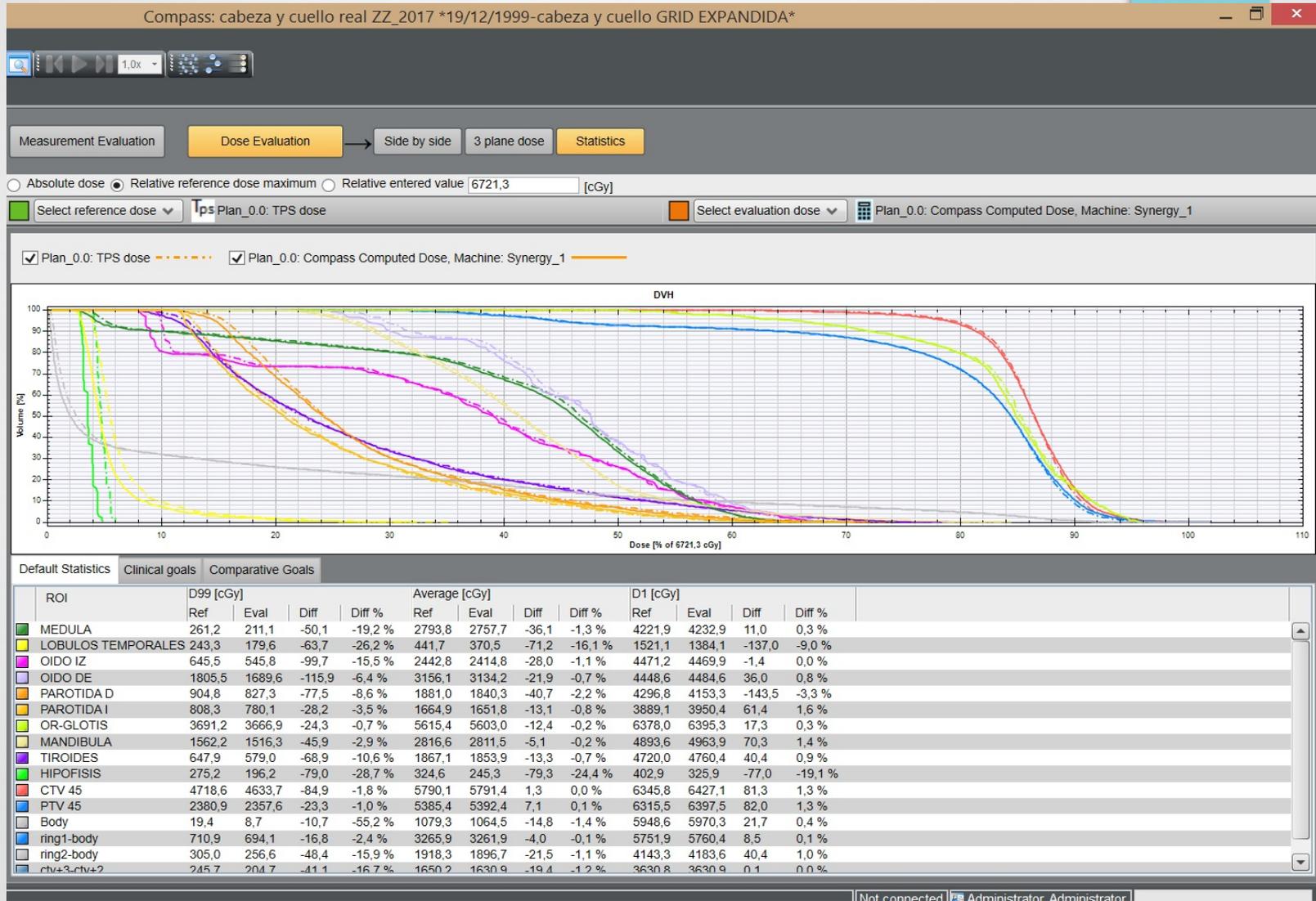
Dose difference Gamma

Dvh Default Statistics Clinical goals Comparative Goals

Plan_0.0: TPS dose Plan_0.0: Compass Computed Dose, Machine: Synergy_1



Dosimetría paciente 3D



Dosimetría paciente 3D

Measurement Evaluation **Dose Evaluation** Side by side 3 plane dose Statistics

Absolute dose Relative reference dose maximum Relative entered value 6522,5 [cGy]

Select reference dose ▼ **Tps Plan_0.0: TPS dose** Select evaluation dose ▼ **Plan_0.0: Reconstructed with 10/10/2017 8:46:47, Machine:**

Position: 3,91 -163,40 0,06 cm
CT: 33 HU
Density: 1,04 g/cm³
Dose: 3744,8 cGy

Transversal: -163,40 cm
Slice 77/168

Position: 3,91 -163,40 0,06 cm
CT: 33 HU
Density: 1,04 g/cm³
Dose: 3510,0 cGy

Transversal: -163,40 cm
Slice 77/168

Statistics

Dose difference Gamma

Dvh Default Statistics Clinical goals Comparative Goals

Plan_0.0: TPS dose Plan_0.0: Reconstructed with 10/10/2017 8:46:47, Machine...

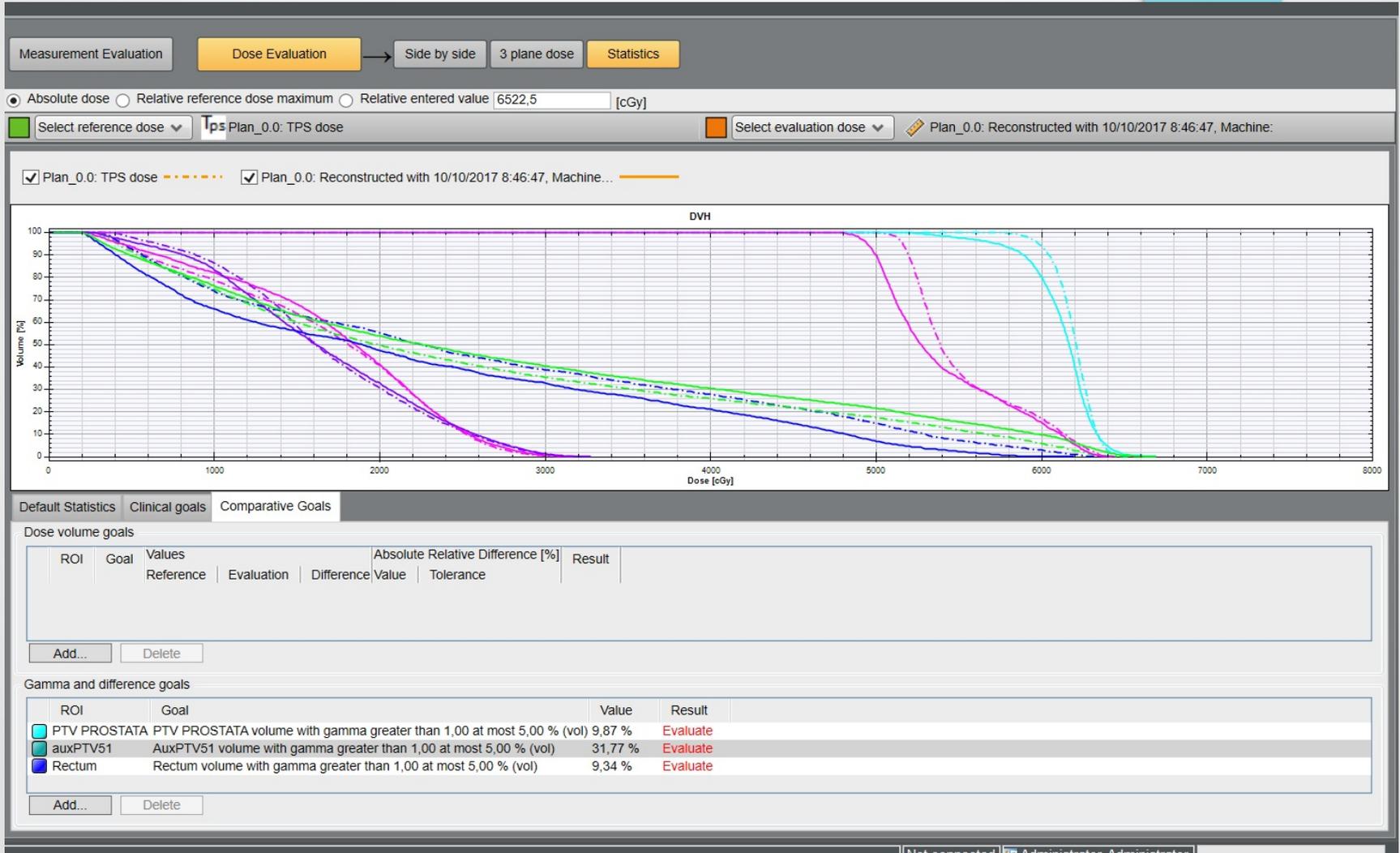
Distance criteria: 0,3 cm Dose percentage: 2%

Position: 3,91 -163,40 0,06 cm
CT: 33 HU
Density: 1,04 g/cm³
Gamma: 0,8

Transversal: -163,40 cm
Slice 77/168

[Not connected] Administrator Administrator

Dosimetría paciente 3D



Dosimetría paciente 3D

Measurement Evaluation

Dose Evaluation

Side by side

3 plane dose

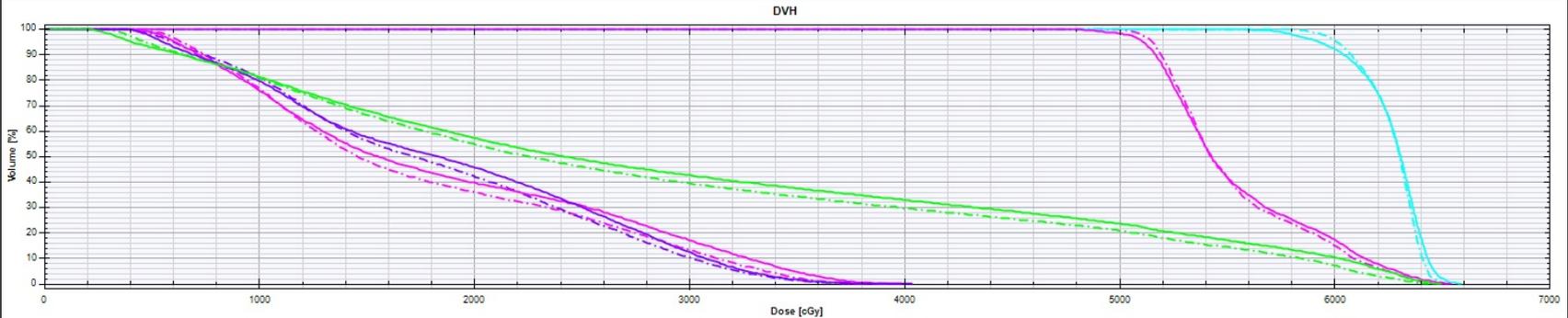
Statistics

Absolute dose Relative reference dose maximum Relative entered value [6520,4] [cGy]

Select reference dose Tps Plan_0.3: TPS dose

Select evaluation dose Plan_0.3: Reconstructed with 11/10/2017 9:17:40, Machine:

Plan_0.3: TPS dose Plan_0.3: Reconstructed with 11/10/2017 9:17:40, Machine...



Default Statistics Clinical goals Comparative Goals

Dose volume goals

ROI	Goal	Values		Absolute Relative Difference [%]		Result
		Reference	Evaluation	Difference Value	Tolerance	
Add... Delete						

Gamma and difference goals

ROI	Goal	Value	Result
PARED VEJIGA	PARED VEJIGA volume with gamma greater than 1,00 at most 5,00 % (vol)	0,08 %	Pass
auxPTV51	AuxPTV51 volume with gamma greater than 1,00 at most 5,00 % (vol)	0,83 %	Pass
PTV VVSS	PTV VVSS volume with gamma greater than 1,00 at most 5,00 % (vol)	0,55 %	Pass
PTV PROSTATA	PTV PROSTATA average gamma at most 0,50	0,31	Pass

Add... Delete

Dosimetría paciente 3D

Measurement Evaluation

Dose Evaluation

Side by side

3 plane dose

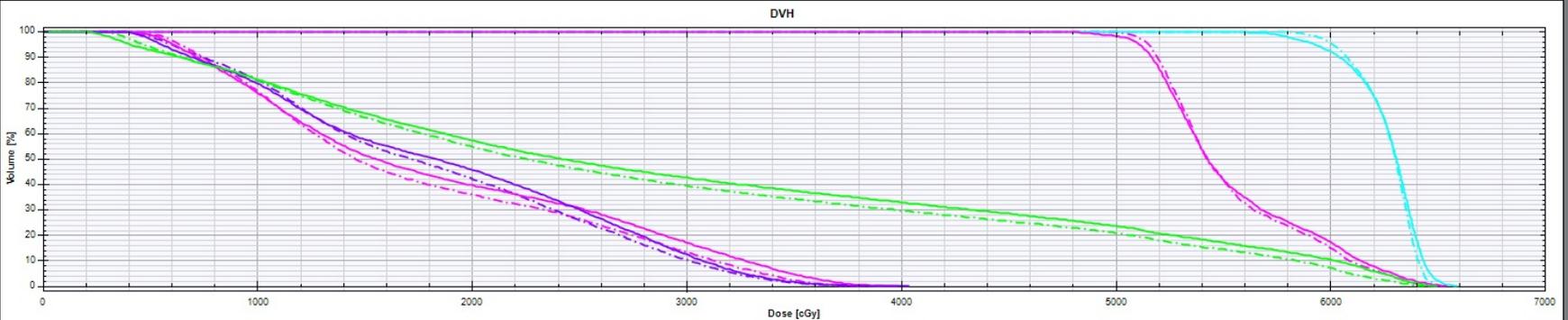
Statistics

Absolute dose Relative reference dose maximum Relative entered value [cGy]

Select reference dose Tps Plan_0.3: TPS dose

Select evaluation dose Plan_0.3: Reconstructed with 11/10/2017 9:17:40, Machine:

Plan_0.3: TPS dose Plan_0.3: Reconstructed with 11/10/2017 9:17:40, Machine...



Default Statistics Clinical goals Comparative Goals

Clinical goals

ROI	Clinical Goal	Reference Dose		Evaluation Dose		Evaluation - Reference	
		Value	Result	Value	Result	Diff	Diff %
Rectum	At most 3.700,0 cGy dose at 40,00 % volume	3.559,6 cGy	Pass	3.064,1 cGy	Pass	-495,5 cGy	-13,9 %
Prostate1	At least 5.900,0 cGy dose at 98,00 % volume	6.187,5 cGy	Pass	6.190,1 cGy	Pass	2,6 cGy	0,0 %
PTV PROSTATA	At least 5.700,0 cGy dose at 95,00 % volume	6.011,0 cGy	Pass	5.928,2 cGy	Pass	-82,9 cGy	-1,4 %
PTV VVSS	At least 4.900,0 cGy dose at 95,00 % volume	5.156,1 cGy	Pass	5.111,4 cGy	Pass	-44,8 cGy	-0,9 %
Bladder1	At most 3.400,0 cGy dose at 65,00 % volume	1.557,2 cGy	Pass	1.627,7 cGy	Pass	70,5 cGy	4,5 %
FemoralHead_R	At most 4.000,0 cGy dose at 5,00 % volume	3.222,2 cGy	Pass	3.261,3 cGy	Pass	39,1 cGy	1,2 %
FemoralHead_L	At most 4.000,0 cGy dose at 5,00 % volume	3.346,5 cGy	Pass	3.481,3 cGy	Pass	134,8 cGy	4,0 %

Add...

Delete

RESUMEN PORTAL DOSIMETRY

ASPECTOS DESTACABLES

- RESOLUCIÓN ESPACIAL
- MONTAJE EXPERIMENTAL SENCILLO Y MEDIDA RÁPIDA
- INTEGRACIÓN DE RESULTADOS EN BASE DATOS DE PACIENTES

ASPECTOS MEJORABLES

- VERIFICACIÓN 2D CON ANÁLISIS POR % PASO CRITERIO GAMMA
- DEPENDENCIA CON TAMAÑO DE CAMPO

RESUMEN COMPASS + MATRIX

ASPECTOS DESTACABLES

- MODELADO PROPIO
- SEGUNDO CALCULO REDUNDANTE (ALGORITMO CC)
- CHEQUEO INDIRECTO COMPORTAMIENTO ACELERADOR
- VERIFICACIÓN VOLUMÉTRICA, INTERPRETACIÓN CLÍNICA

ASPECTOS MEJORABLES

- RESOLUCIÓN ESPACIAL*
- MONTAJE EXPERIMENTAL LABORIOSO QUE AUMENTA EL TIEMPO TOTAL DE MEDIDA
- GESTIÓN PACIENTES EN BASE DATOS