

# JORNADA SARH

## ANTEQUERA 25/11/17

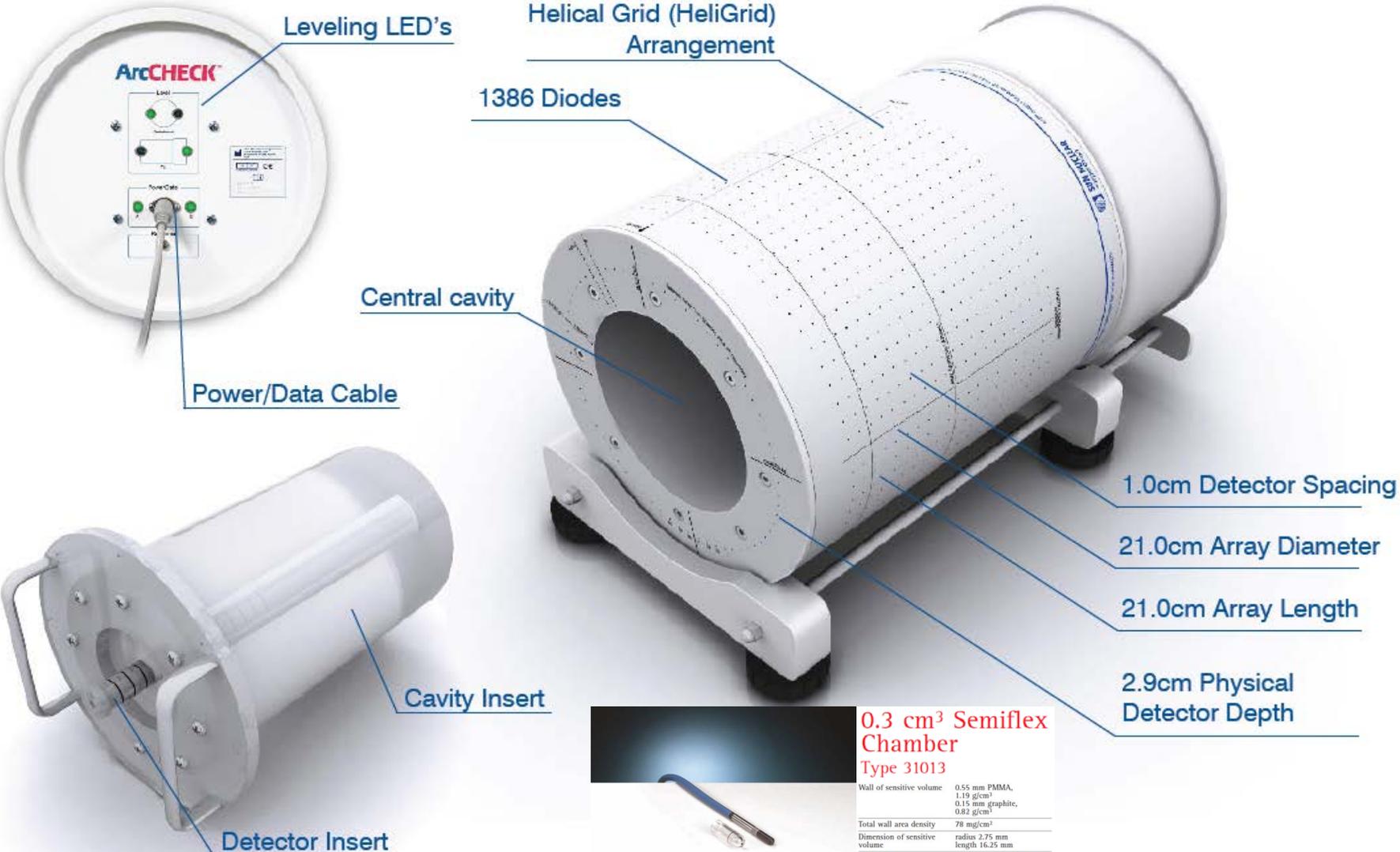
“VERIFICACIÓN DOSIMÉTRICA DE LOS  
TRATAMIENTOS DE RADIOTERAPIA”

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UGC de Radiofísica  
Hospital U. Reina Sofía (Córdoba)

ArcCheck y  
3DVH  
(Sun Nuclear)

**ARCCHECK**

# HARDWARE



Leveling LED's

Helical Grid (HeliGrid)  
Arrangement

1386 Diodes

Central cavity

Power/Data Cable

Cavity Insert

Detector Insert

1.0cm Detector Spacing

21.0cm Array Diameter

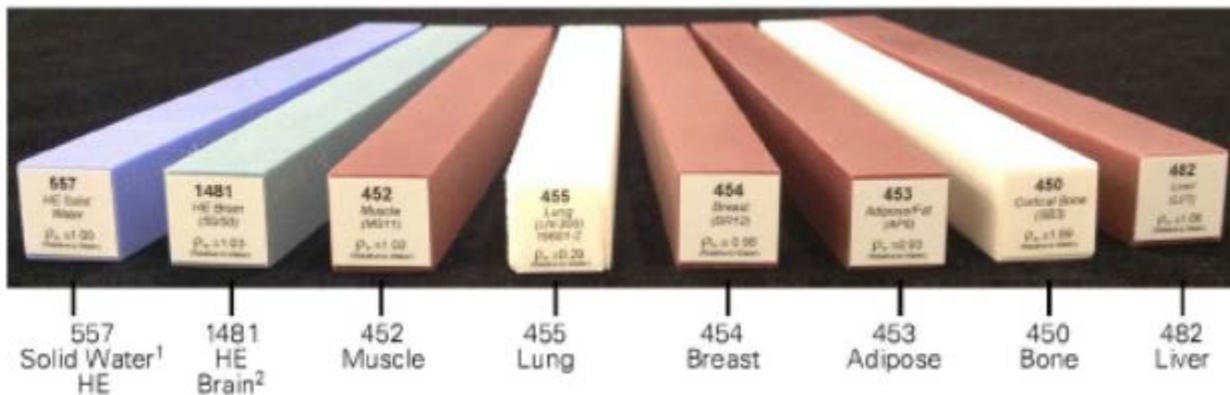
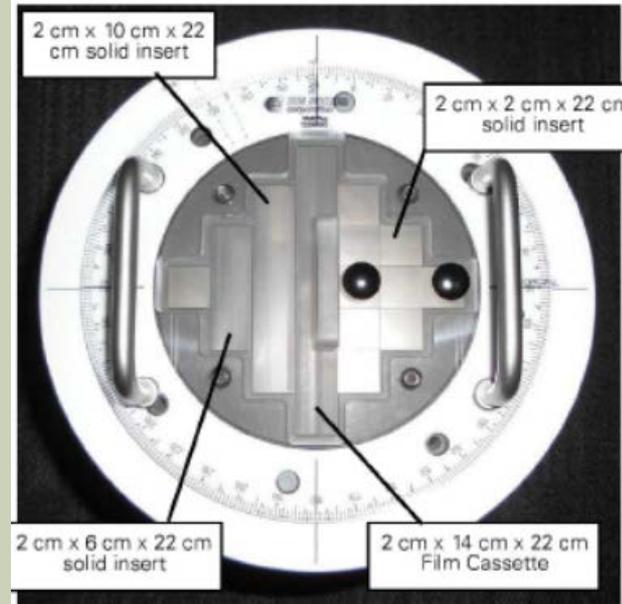
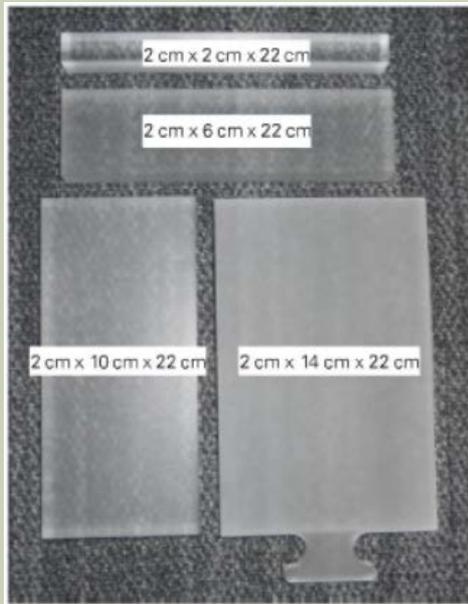
21.0cm Array Length

2.9cm Physical  
Detector Depth

**0.3 cm<sup>3</sup> Semiflex Chamber  
Type 31013**

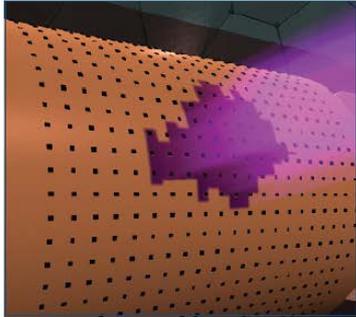
Wall of sensitive volume	0.55 mm PMMA, 1.19 g/cm <sup>3</sup> 0.15 mm graphite, 0.82 g/cm <sup>3</sup>
Total wall area density	78 mg/cm <sup>2</sup>
Dimension of sensitive volume	radius 2.75 mm length 16.25 mm
Central electrode	Al 99.98, diameter 0.9 mm

# MULTIPLUG

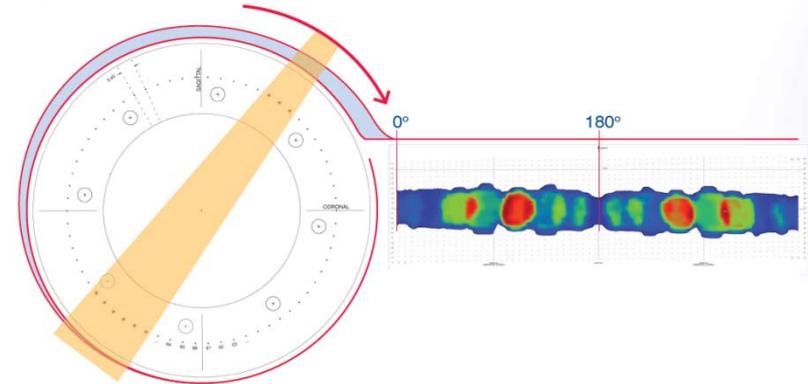
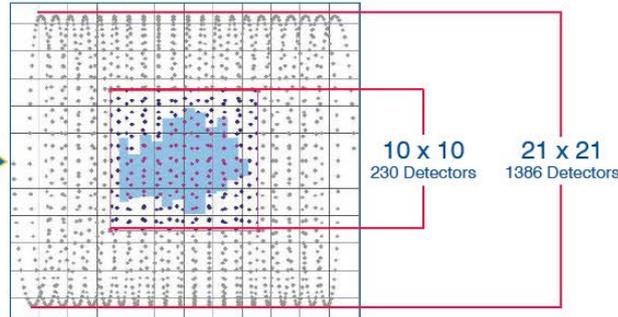


# HARDWARE

Beam Simulation



ArcCHECK Detector BEV



**Detector type:** SunPoint Diode Detectors

**Detector quantity:** 1386

**Detector spacing (cm):** 1.0

**Array diameter (cm):** 21.0

**Array length (cm):** 21.0

**Cavity diameter (cm):** 15.0

**Inherent buildup (g/cm<sup>2</sup>):** 3.2

**Inherent backscatter (g/cm<sup>2</sup>):** 3.2

**Detector physical depth (cm):** 2.9

**Array geometry (cm):** Helical Grid (HeliGrid) 1cm offset

**Phantom Material:** PMMA (Acrylic)

**Active detector area (mm<sup>2</sup>):** 0.64

**Detector volume (cm<sup>3</sup>):** 0.000019

**Detector stability:** 0.5%/kGy at 6MV

**Dose rate dependence:** ± 1%, 75 - 250cm SSD

**Update frequency (ms):** 50

**Radiation measured:**

- Electrons, 6 MeV to 25 MeV
- Photons, Co-60 to 25 MV

**PC Hardware:**

- 2 CPU Core, 1.6 GHz CPU Speed,
- 2 GB RAM

**Number of connection cables:** Single power/data cable

**Dimensions (cm<sup>2</sup>) / Weight (kg):** 27.0 x 43.0 / 16.0

**Operating system:** Windows 2000, XP 32-bit, or Vista 32-bit

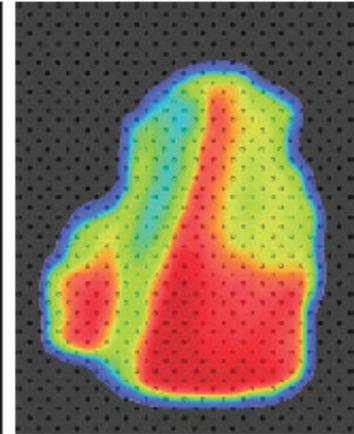
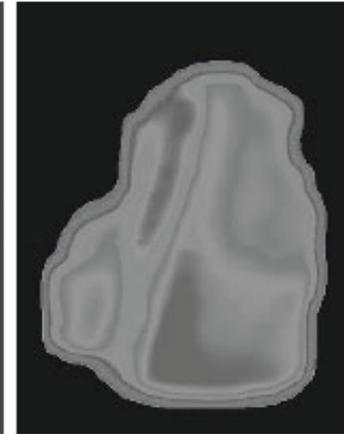
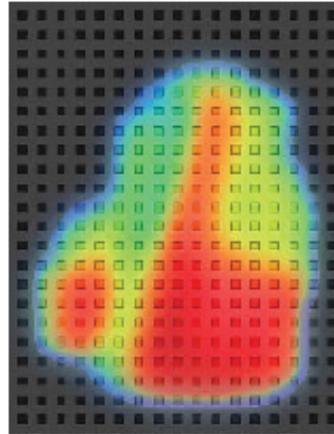
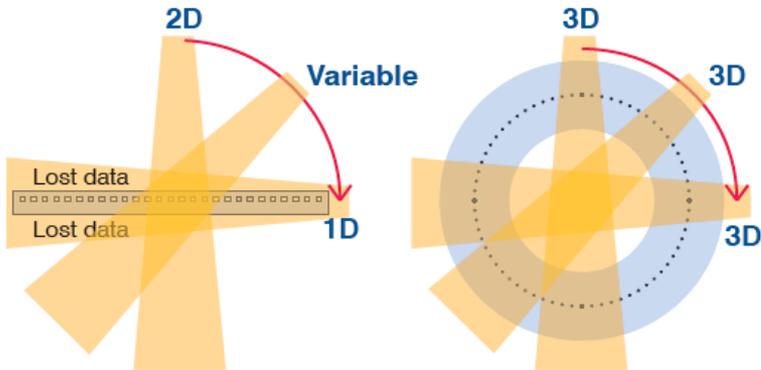
**Minimum Requirements:**

- 2 GB RAM, 1 available USB port, Dual-core processor, 50 MB hard disk space, 4 MB VGA video card (1024 x 768), 16-bit color depth

**Recommended Requirements:**

- 16 MB video RAM, OpenGL hardware accelerated video card

# DISTRIBUCIÓN DE LOS DETECTORES



## Chambers ▶

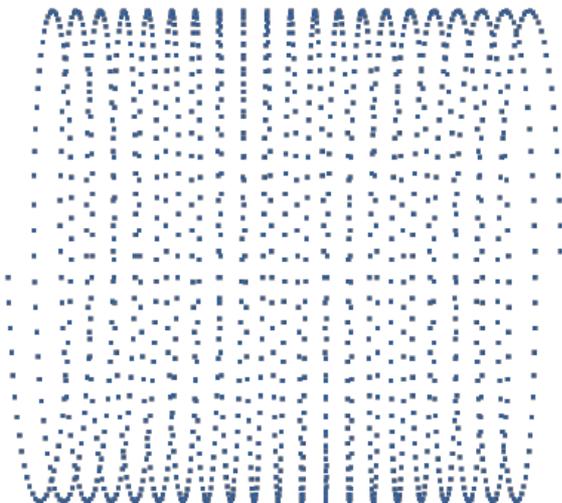
Ion chamber measurements lack high-resolution, resulting in a blurred measurement

## EPID/Film ▶

Superior density and resolution, however absolute dose, accuracy, uniformity and reproducibility need to be verified

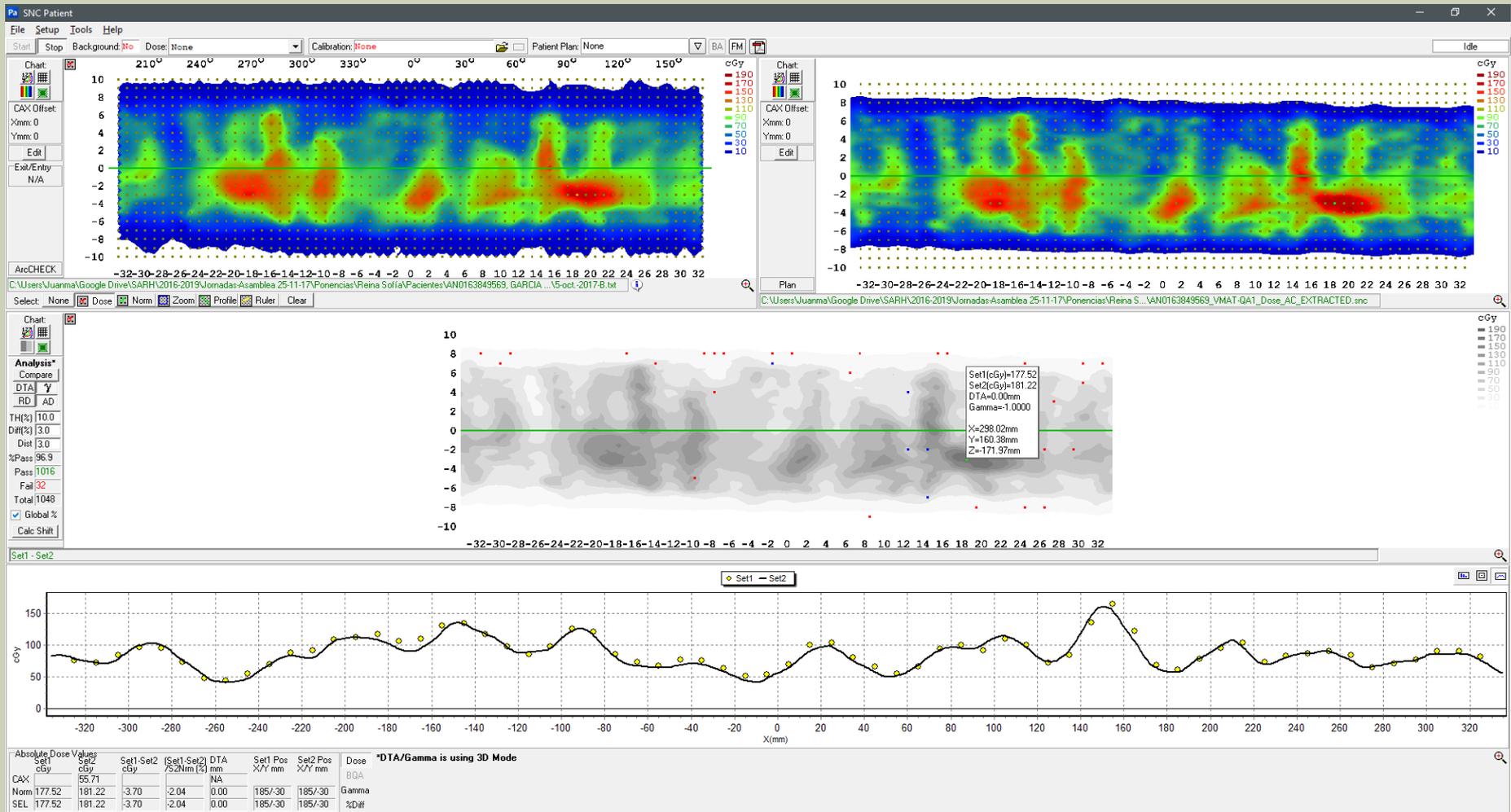
## Diodes ▶

Diodes, with proper spacing are capable of accurate, reproducible high-resolution measurements



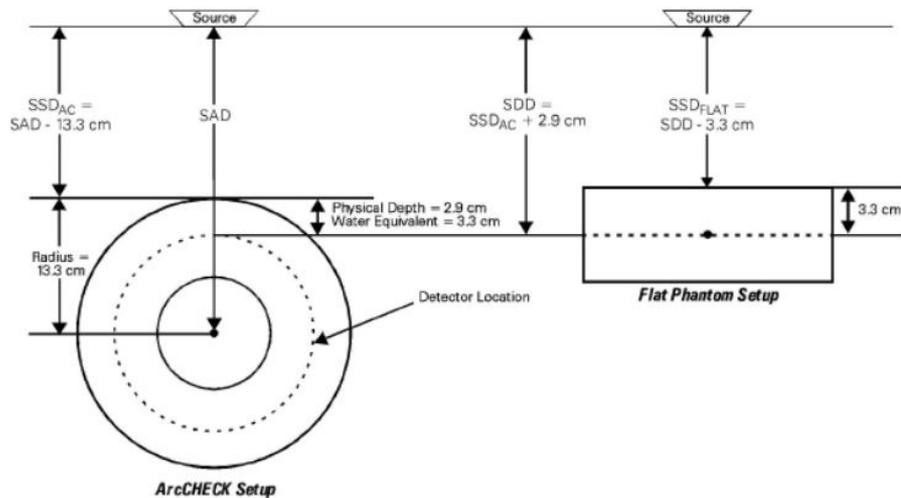
- Incidencia del haz principalmente perpendicular a los detectores. (Corrección adicional por ángulo de incidencia)
- Medida de dosis de entrada y salida.
- Permite medida simultanea de dosis con cámara de ionización (con inserto de PMMA).
- Procedimiento sencillo de calibración absoluta y relativa de los detectores.

# ANÁLISIS DE RESULTADOS SOFTWARE SNCPATIENT



# CALIBRACIÓN

## Absoluta



ArcCHECK and Flat Phantom Setup for Dose Calibration

## Relativa (Array)

The screenshot shows the **Array Calibration** software interface. The top section displays a 3D model of the ArcCHECK device with a red field size of  $20 \text{ cm}$  by  $27 \text{ cm}$  and a rotation of  $180^\circ$ . The bottom section shows a top-down view of the device with a  $286 \text{ IEC}$  field size. The right panel shows the **Device Status: Waiting For Beam...** and **Beam** buttons. Below this, the **Exposures:** section lists steps G through L. The **Instructions:** section provides a list of steps: 1) Rotate ArcCHECK Cylinder 180 degrees where the Sagittal line is now facing the couch; 2) Center the device; 3) Set the field size to  $x=20 \text{ cm}$   $y=27 \text{ cm}$ ; 4) Rotate gantry to  $-74$  degrees (286 IEC); 5) Press the Start button; 6) Deliver 200 MU; 7) Press the Stop button; 8) Press Next to move to the next step. The **Beam Control** section includes **Start** and **Stop** buttons. The **Finish** button is also present. The **Set Default** button is located at the bottom right.

# FUNCIONES ADICIONALES

## ■ Análisis/punto de control:

- Dosis
- QA MLC

## ■ Inclinómetro virtual

## ■ Unión de 2 medidas:

- Campos grandes.
- Aumento de resolución.

## ■ Concatenación de medidas.

## ■ Composición de medidas.

## ■ Split

## QA máquina

## ■ Reproducibilidad máquina.

## ■ Gantry QA

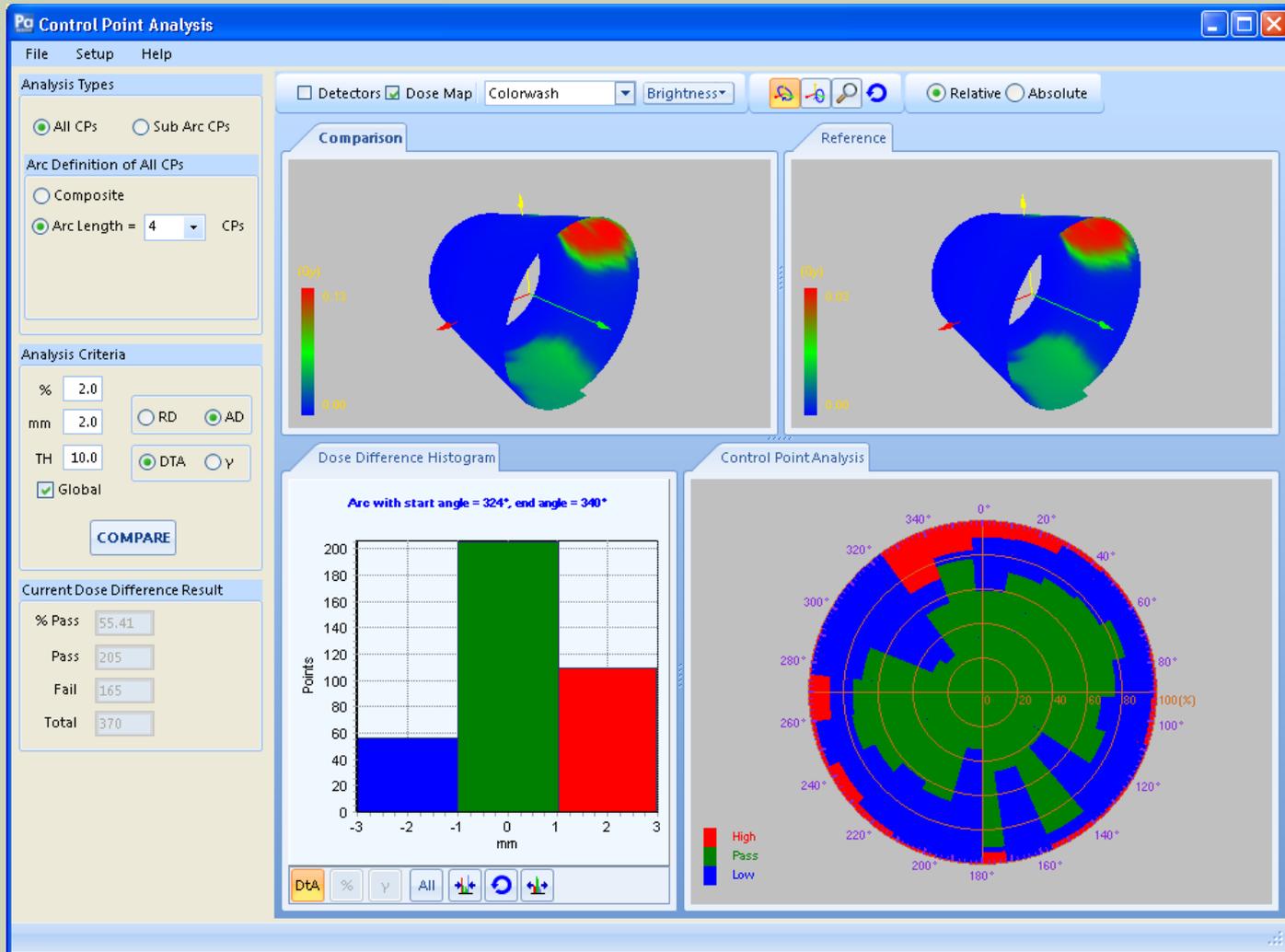
- Ángulo
- Rotación
- Velocidad
- Rotación 3D

## ■ MLC/Collimator

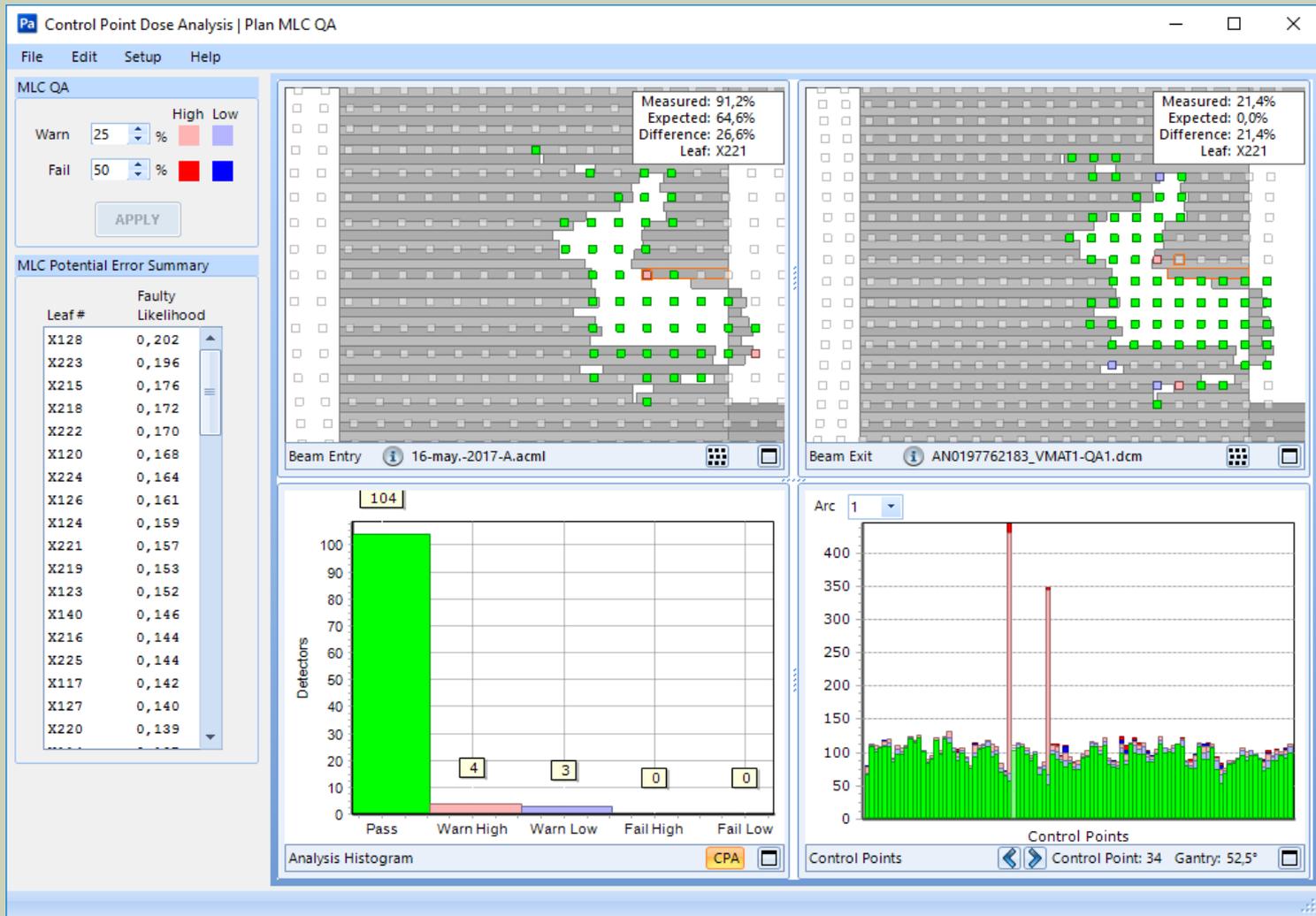
## ■ Flatness/Simetry



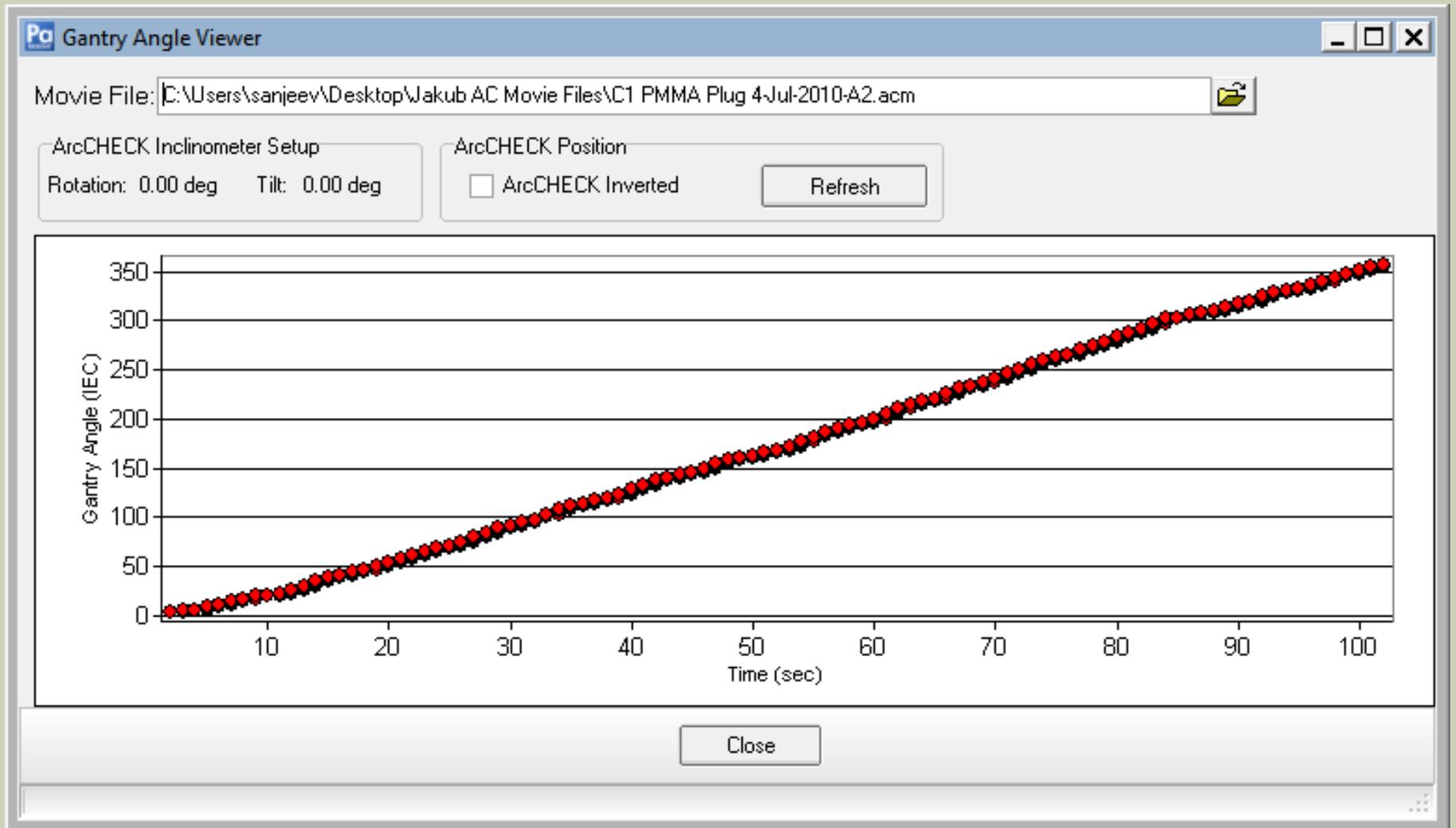
# ANALISIS DE PUNTOS DE CONTROL



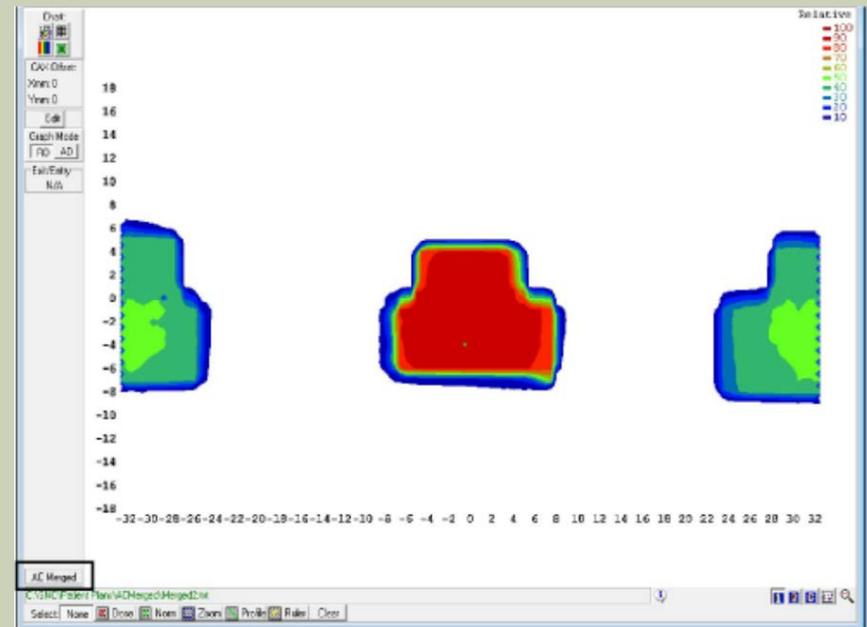
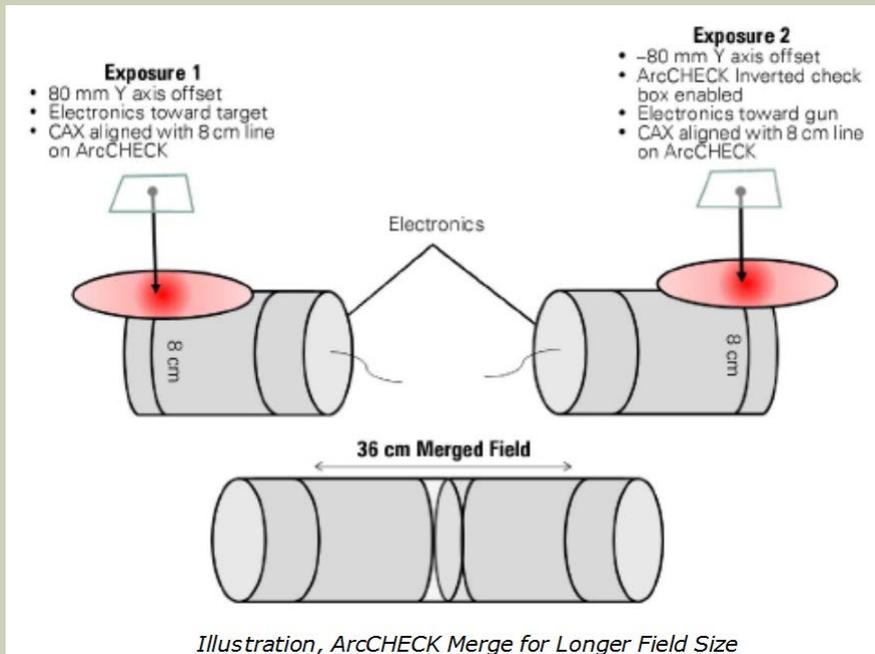
# QA MLC POR PUNTO CONTROL



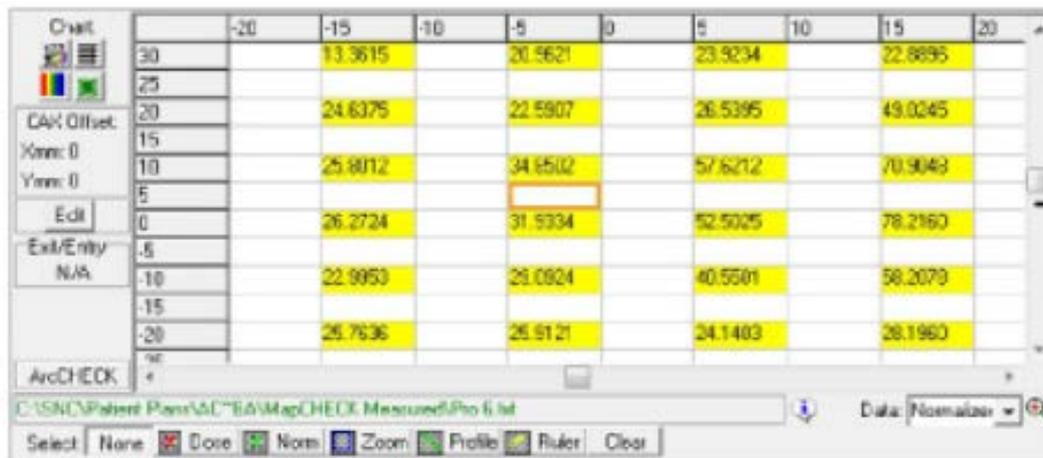
# INCLINÓMETRO VIRTUAL



# UNIÓN DE DOS EXPOSICIONES PARA CAMPOS GRANDES.



# UNIÓN DE EXPOSICIONES PARA AUMENTAR LA RESOLUCIÓN



Non-shifted measurement



Merged (high density) measurement

*The Higher Density Measurement has Dose Values Between the Previous Points*

# BEAM SPLIT/SUSPENSION

Split Composite Into Single Beams ✕

ArcCHECK/MapCHECK 2 Movie File:  

Minimum Time Between Beams:  sec(s)

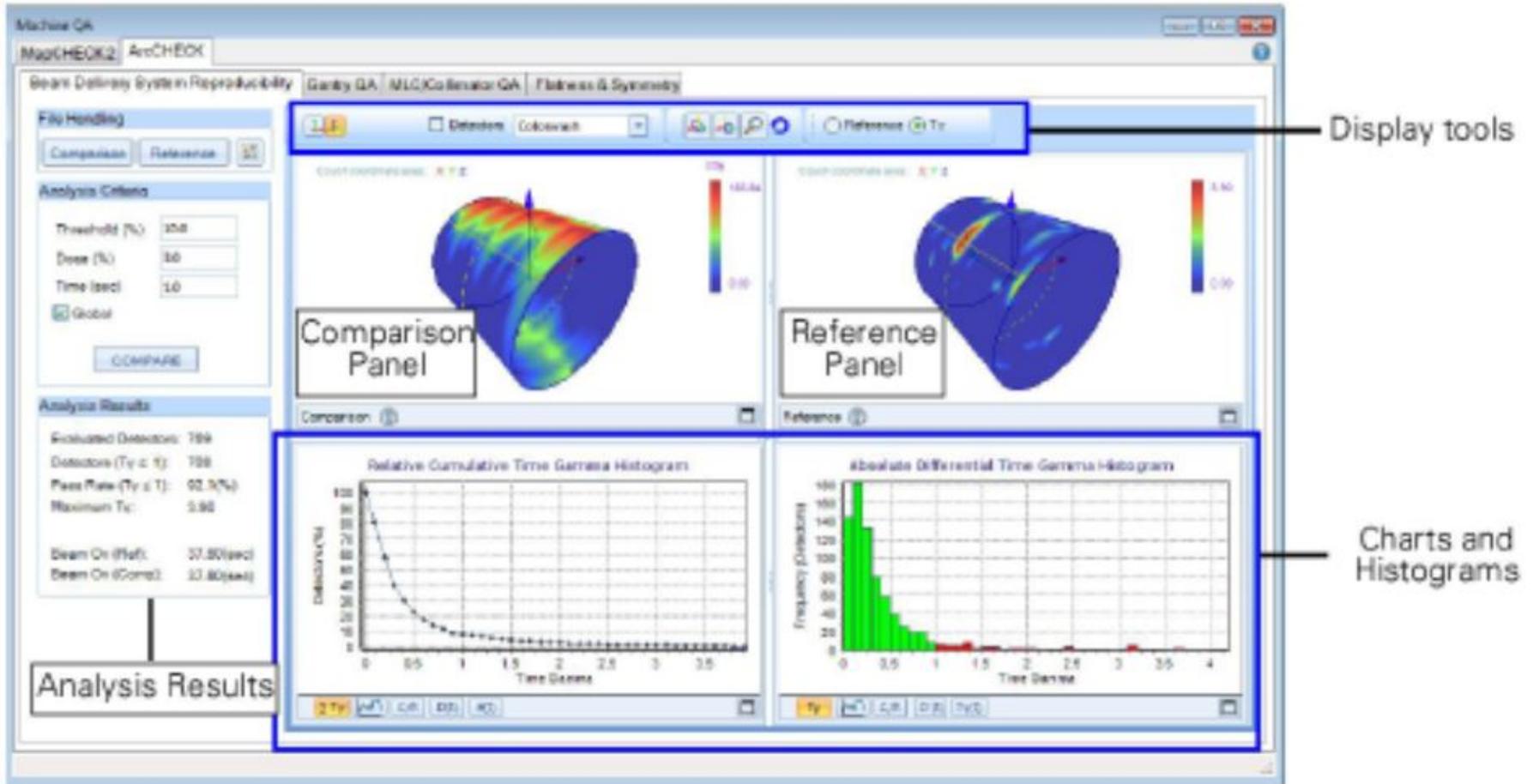
Integrate Beams At The Same Angle:

Beam #	Beam Time (Secs)	Time Between Beams (Secs)	Gantry Angle (IEC) (ArcCHECK Only)	Max Dose (cGy)
1	23.1	0.0	214.7	372.4
2	4.0	0.8	180.0	49.9
3	3.1	1.2	244.7	40.4
4	8.2	14.5	180.0	202.1
5	2.6	0.3	94.2	17.1
6	4.8	1.4	167.3	78.4
7	76.4	14.2	230.6	691.9

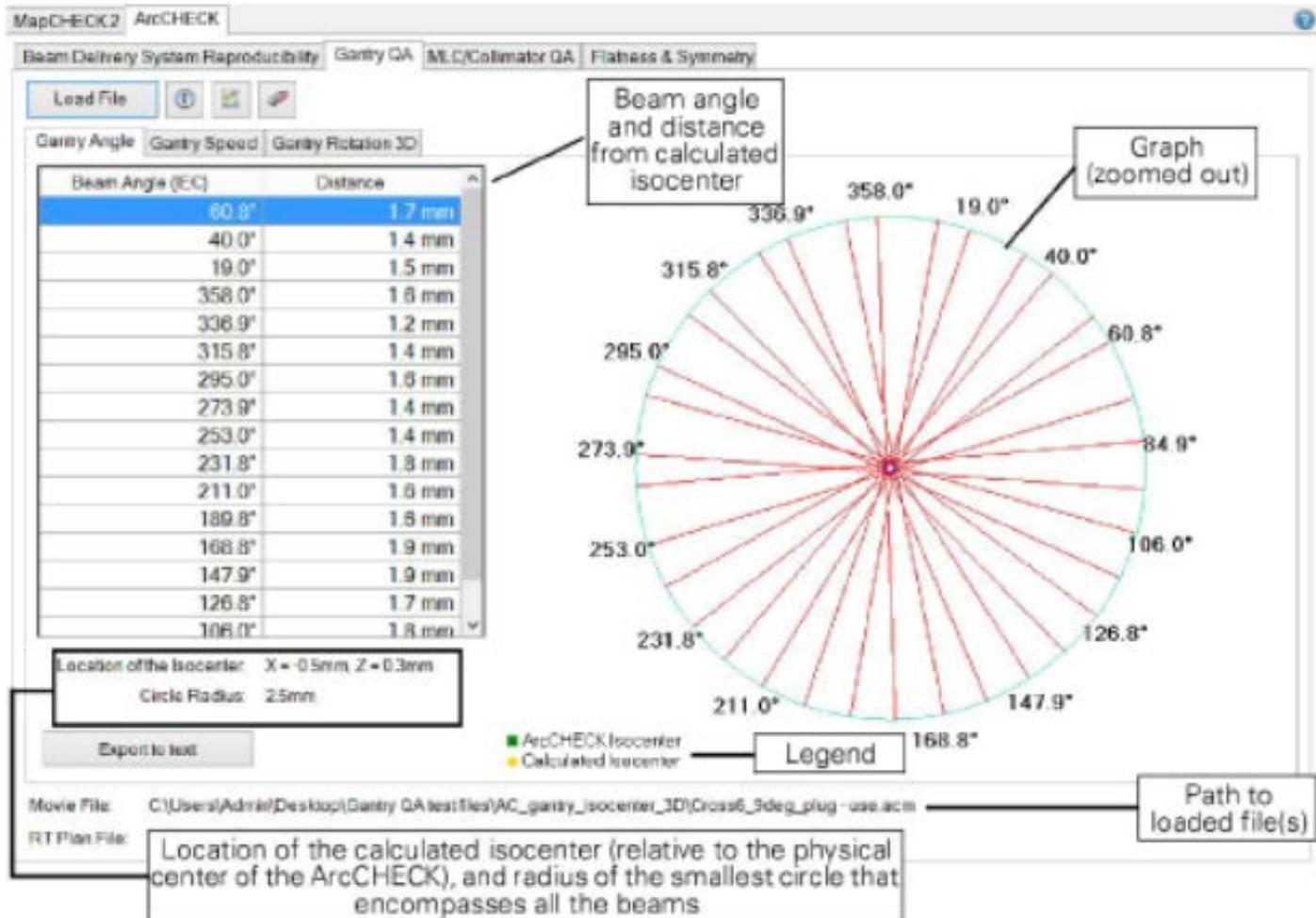
Total Beams: 15



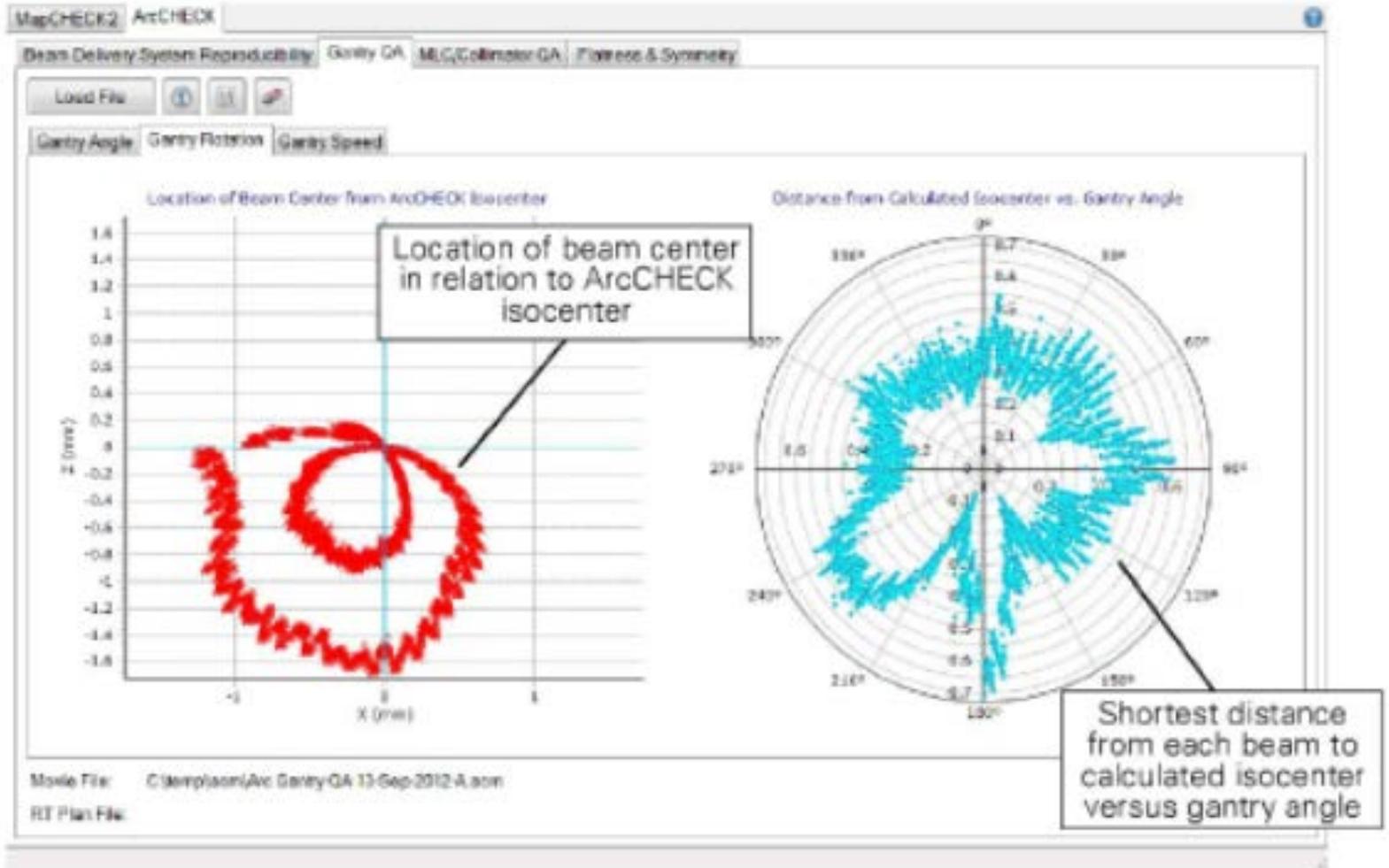
# REPRODUCIBILIDAD



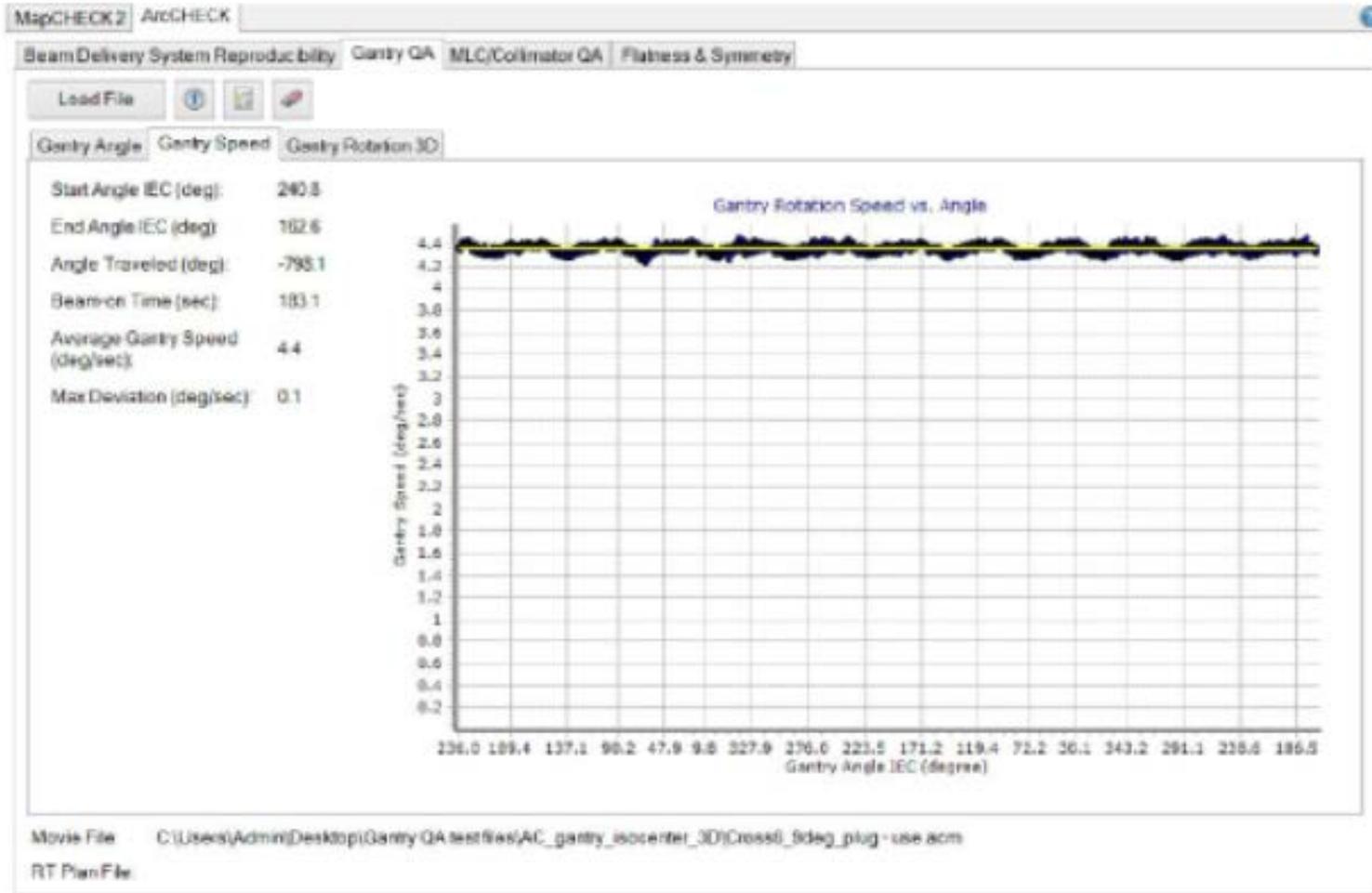
# GANTRY ANGLE



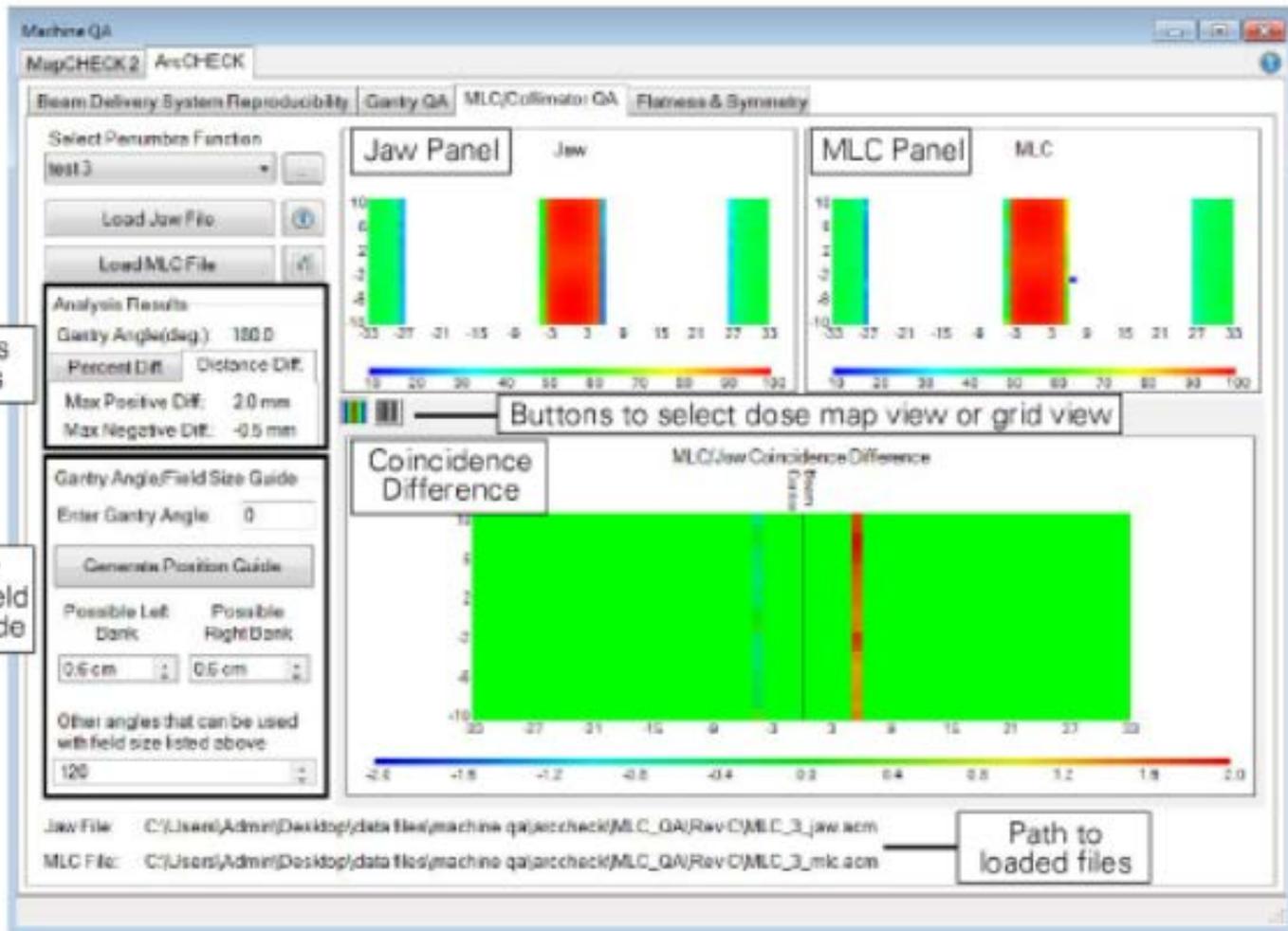
# GANTRY ROTATION



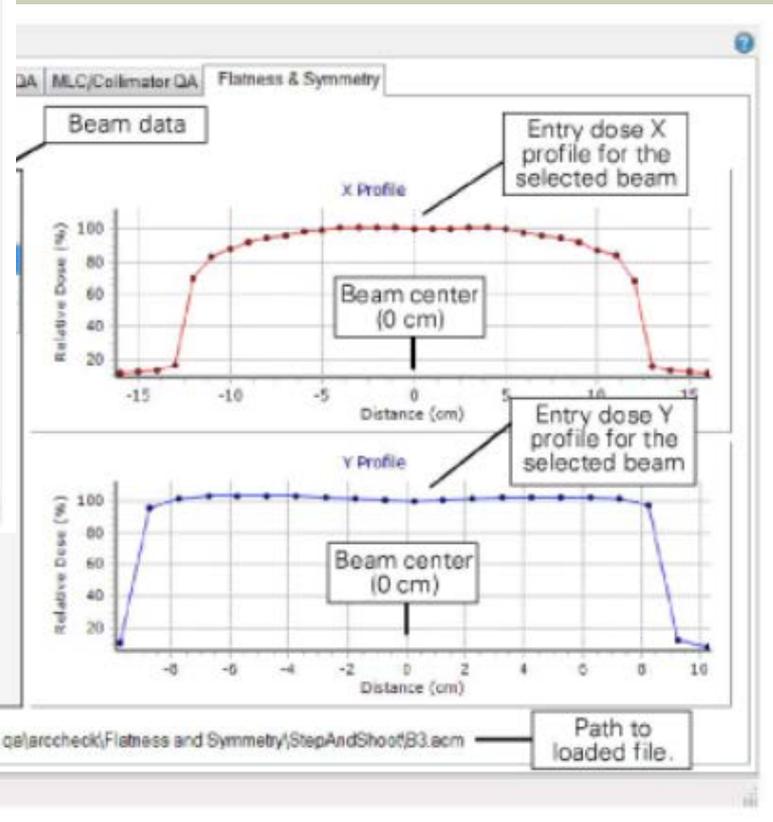
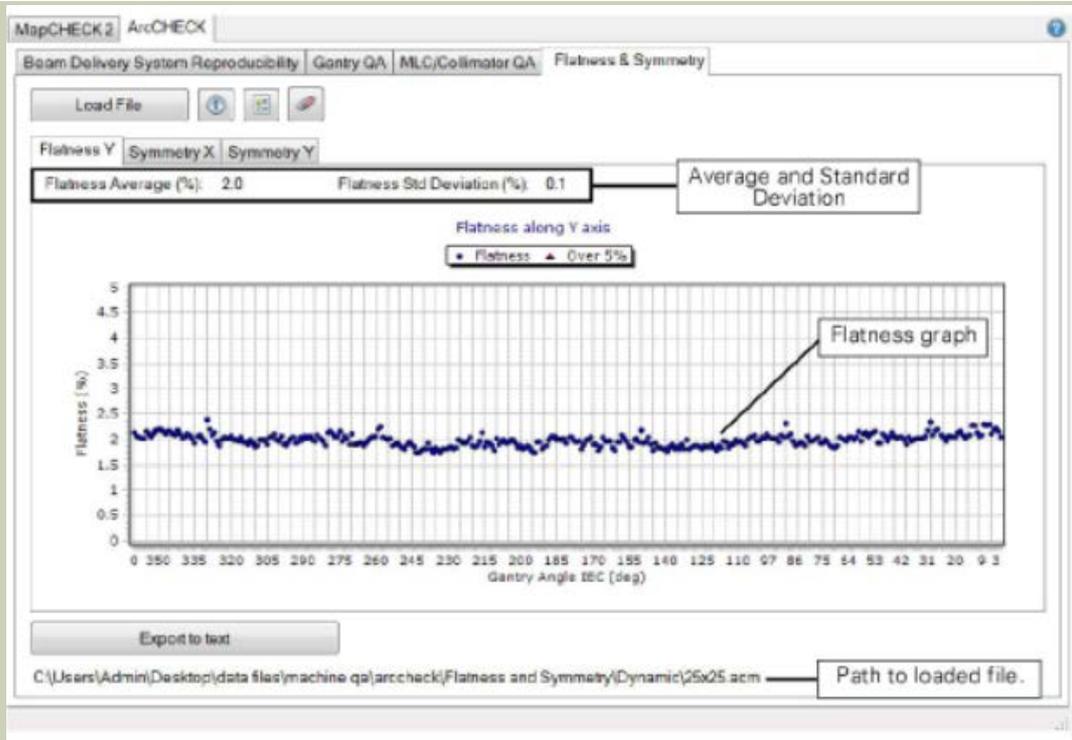
# GANTRY SPEED



# MLC / COLLIMATOR QA



# FLATNESS / SIMETRY



# CONTROL DE CALIDAD DIARIO CON ARCCHECK

Hoja de  
cálculo  
propia del  
hospital

# CONTROL DE CALIDAD DIARIO

## Hoja de registro de control de calidad diario con ArcCheck

Cargar Nuevo QA: 149

Equipo de medida de dosis absoluta (Electrómetro/Cámara): PTWdosimetro D14-DL4339-337 / PTW-31003-516		Equipo de medida de dosis relativa: ArcCheck n/s. 6156004	
Factor de calibración global para la calidad del haz (cGy/div): 102.72		Prof. C.I.(g/cm <sup>2</sup> ): 15.1	
Fecha:	23-Nov-2012	Técnico:	M va
Acelerador:		Físico responsable:	Ju án
		P (hPa):	1013.0
		T(°C):	23.2

### Medida de la constancia del factor de calibración con la cámara de ionización en el isocentro y de la estabilidad del haz, con arco de calentamiento de 360°

Plantilla de medida del acelerador:	Arco Calentamiento ArcCheck		Estudio de referencia para la comparación:	13-Jun-2011-A.Nueva calibración tras actualización a SNC Patient 6.0.txt									
Archivo AC	23-Nov-2012-A.txt	Energía:	X06	Tasa (um/min):	600	u.m.:	800	Campo (cm <sup>2</sup> ):	21*16	Gantry:	180°/360°	Colimador:	90°
Lectura Electrómetro (div):	5.5921	Diso c.i. (cGy):	580.8	Diso Ref.(cGy):	586.4	Error F.C.:	-1.0%	D <sub>Diodos</sub> AC:	373.4	D <sub>Diodos</sub> AC <sub>ref</sub> :	377.9	% paso AC:	96.5%

### Medida de la constancia del factor de calibración con la cámara de ionización en el isocentro, con campo de referencia

Plantilla de medida del acelerador:	Constancia FC y Energía con ArcCheck		Estudio de referencia para la comparación:	16-Jun-2011-A.txt									
Archivo AC	23-Nov-2012-A.txt	Energía:	X06	Tasa (um/min):	300	u.m.:	200	Campo (cm <sup>2</sup> ):	10.4*10.4	Gantry:	0°	Colimador:	0°
Lectura Electrómetro (div):	1.2825	Diso c.i. (cGy):	133.2	Diso Ref.(cGy):	135.5	Error F.C.:	-1.7%	D <sub>Diodos</sub> AC:	238.6	D <sub>Diodos</sub> AC <sub>ref</sub> :	237.7	% paso AC:	99.9%

### Medida de la constancia del factor de calibración con la cámara de ionización en el isocentro, con campo de referencia

Prof. diodos centrales superiores ArcCheck (g/cm <sup>2</sup> ):	3.3	Ddiodo Sup. AC (cGy):	238.6	BQF (Ds/Di):	0.290	BQF <sub>ref</sub> :	0.292	Error BQF:	0.6%	<a href="#">Registrar conjunto medidas</a>
Prof. diodos centrales inferiores ArcCheck (g/cm <sup>2</sup> ):	18.4	Ddiodo Inf. AC (cGy):	69.3							

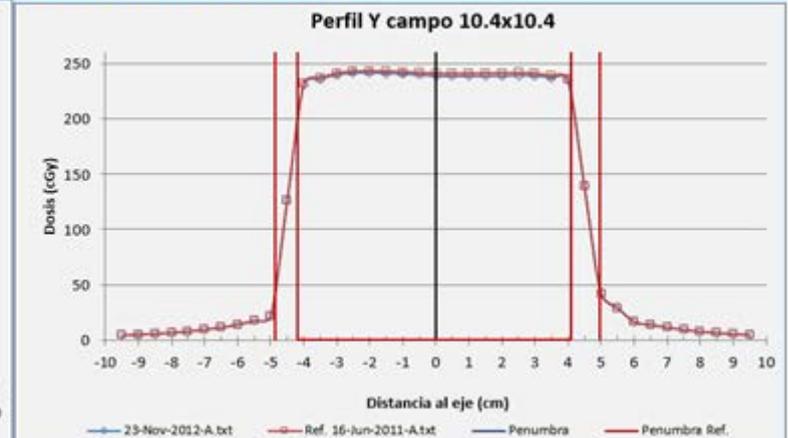
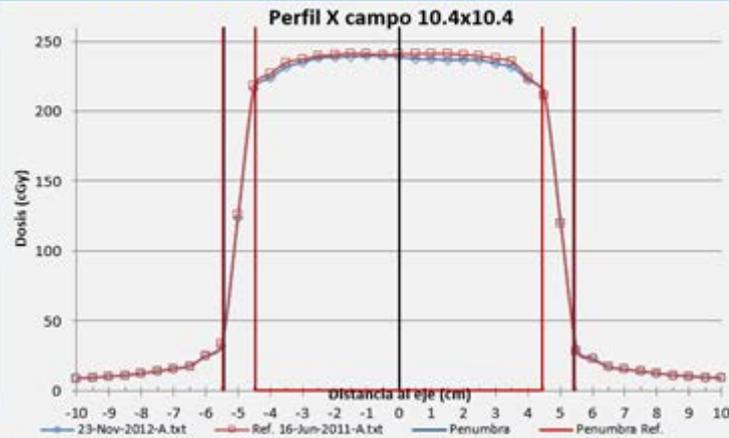
### Medida de la Uniformidad, simetría y penumbra con los diodos superiores, con campo de referencia

Perfil Crossplane (X)			
	Medida	Ref.	Error
Uniformidad	7.5%	7.5%	0.0%
Simetría	0.7%	0.1%	0.6%
Penumbra -	1.0 cm	1.0 cm	0.0 cm
Penumbra +	1.0 cm	1.0 cm	0.0 cm
Eje Rad. (cm)	-0.01	-0.02	0.01

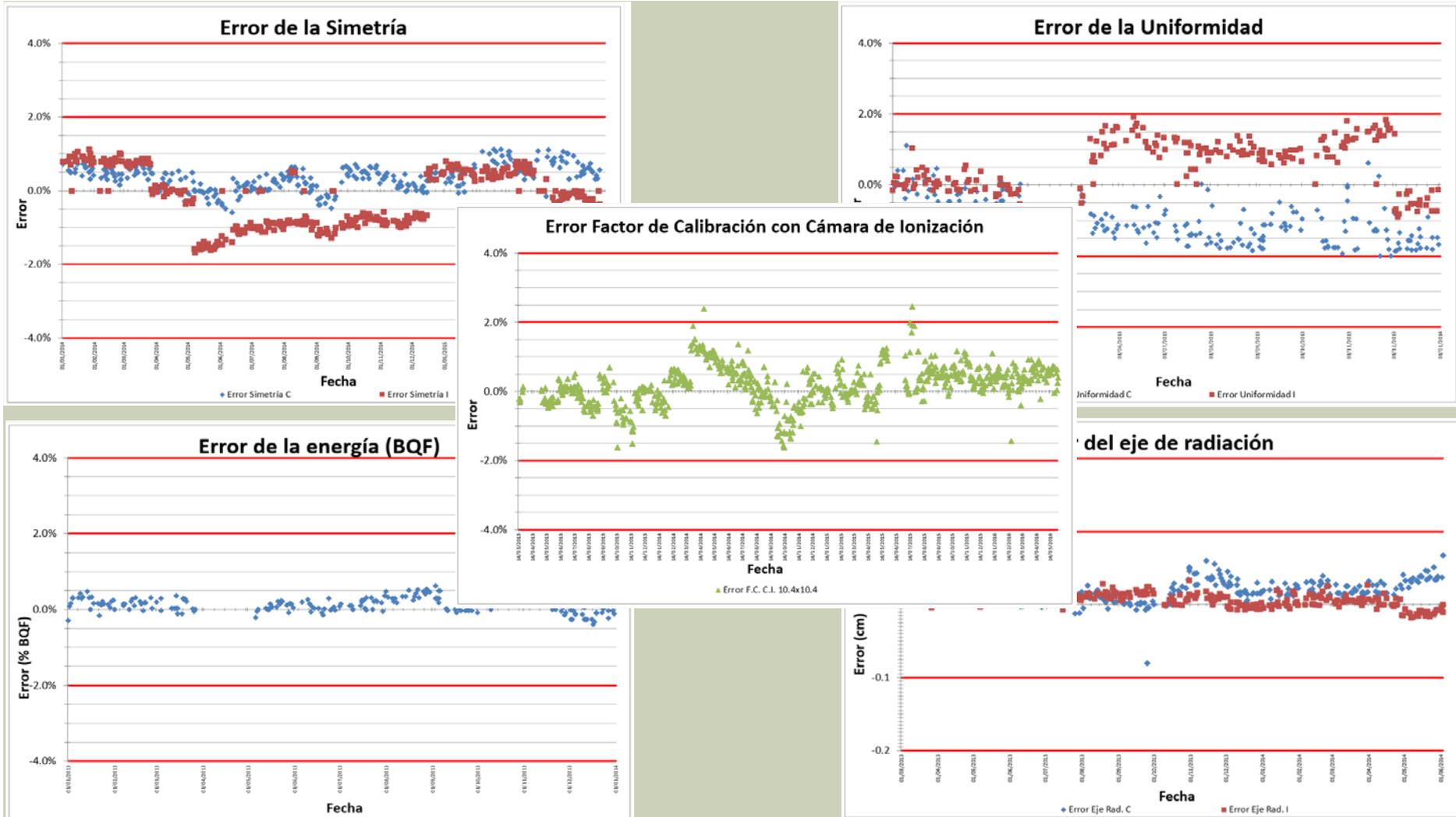
  

Perfil Inplane (Y)			
	Medida	Ref.	Error
Uniformidad	4.4%	4.5%	-0.1%
Simetría	-0.4%	-0.1%	-0.3%
Penumbra -	-0.9 cm	-0.9 cm	0.0 cm
Penumbra +	-0.7 cm	-0.7 cm	0.0 cm
Eje Rad. (cm)	0.03	0.03	0.00

Nota: Rellenar sólo las casillas de color amarillo



# CONTROL DE CALIDAD DIARIO

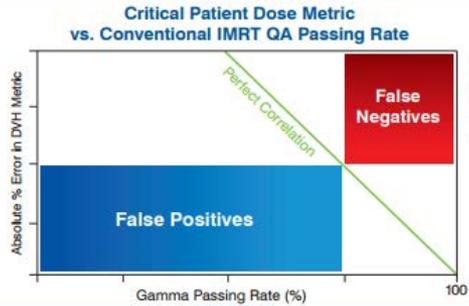


**SOFTWARE 3DVH**

# PROBLEMA DE FALSOS POSITIVOS / NEGATIVOS

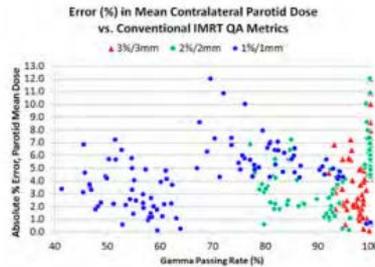
## The Problem<sup>1</sup>

**False positives:** where beam-by-beam QA results fail to meet criteria, yet clinical impact is negligible.



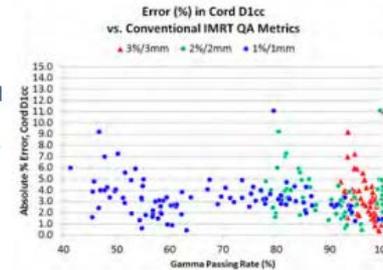
**False negatives:** where beam-by-beam QA meets criteria, yet patient dose errors still occur.

## Examples<sup>1</sup>

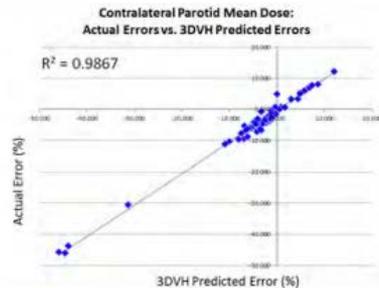


Lack of correlation of Actual and Predicted Error

Clinically Relevant?

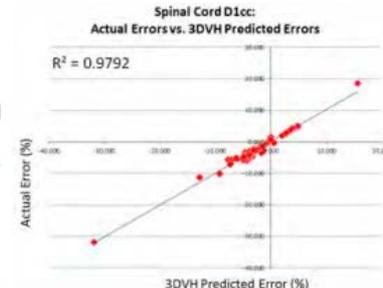


## 3DVH Correlation<sup>2,3</sup>



High correlation of Actual and Predicted Error

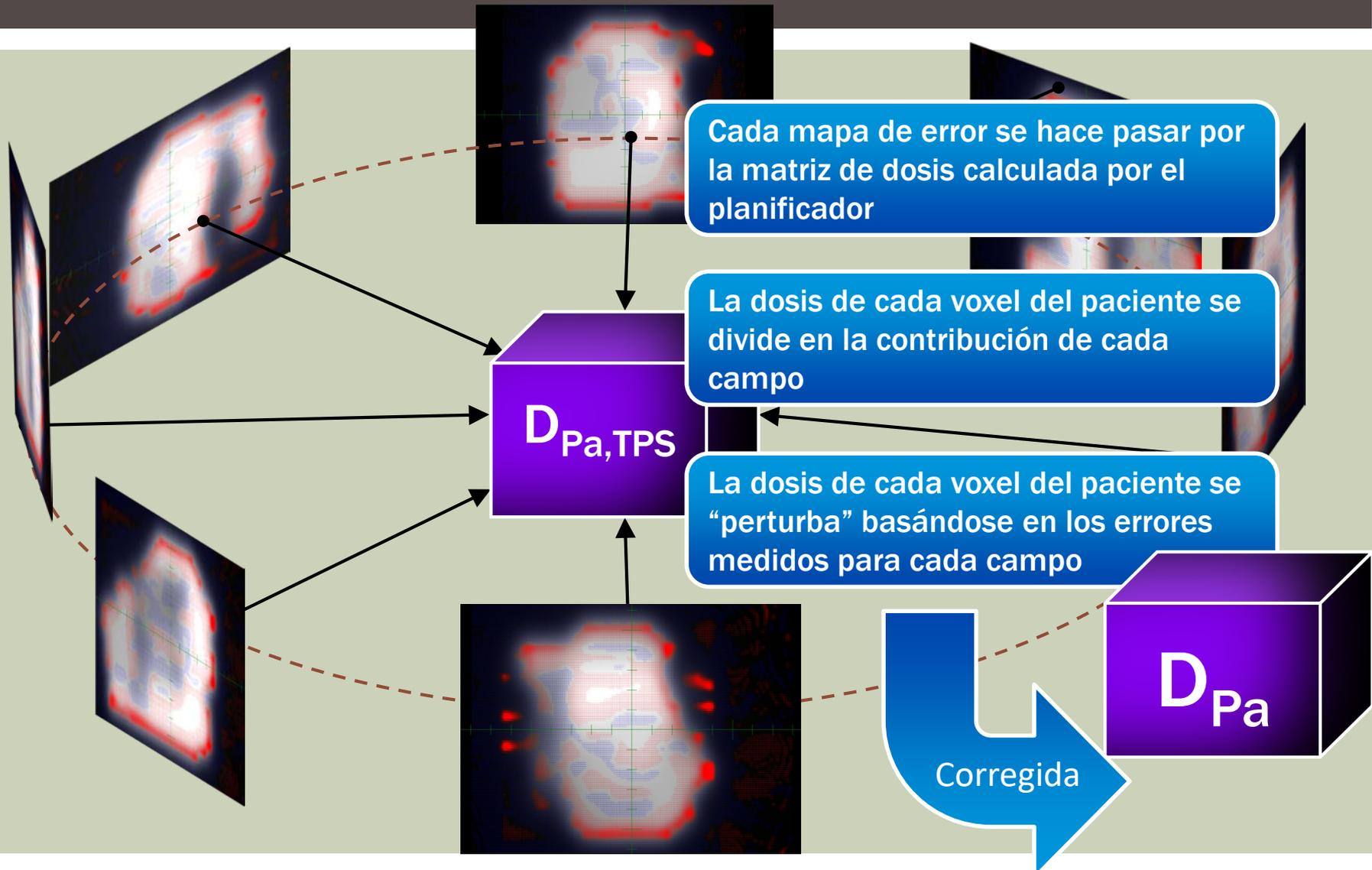
Clinically Relevant!



# 3DVH

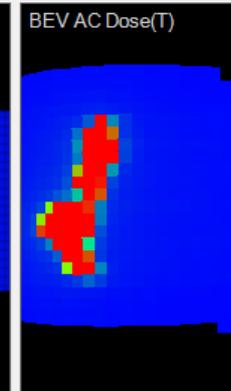
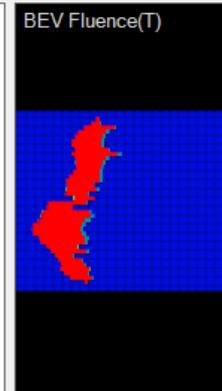
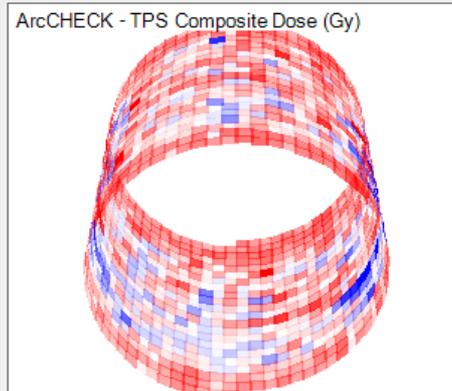
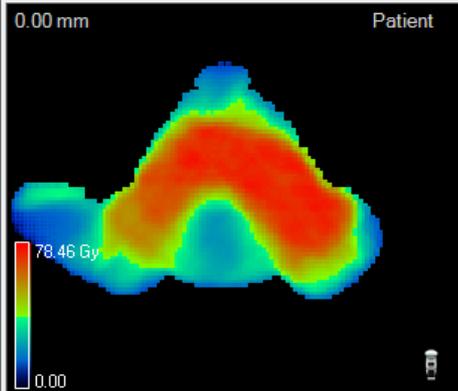
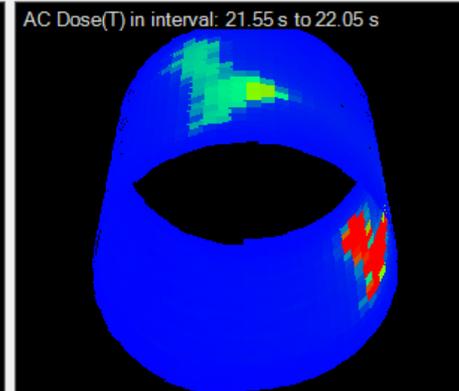
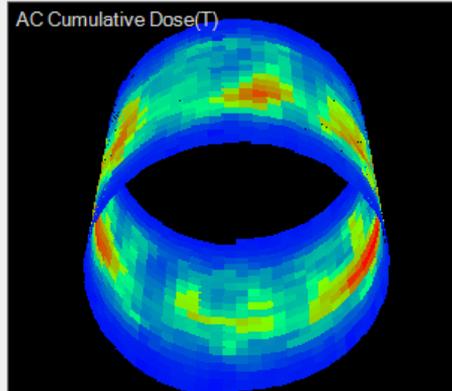
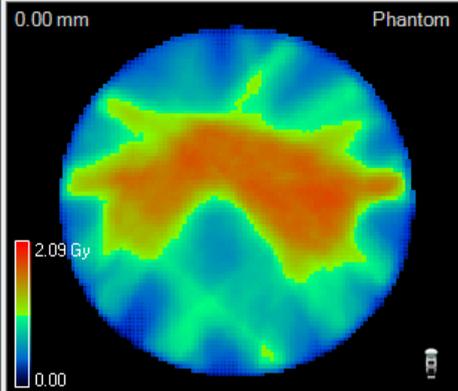
- Usa las medidas ya realizadas:
  - MapCheck.
  - ArcCheck.
- Algoritmo PDP (Planned Dose Perturbation).
  - Calcula distribución de dosis sobre la anatomía del paciente a partir de los errores en la dosis medida por el ArcCheck/MapCheck.
  - Válido para presencia de heterogeneidades.
  - No realiza un cálculo redundante mediante “pencil beam”.
  - Corrige sólo donde se necesita.
- No hay modelar el ALE/MLC – PDP tiene almacenados modelos para cada modelo ALE/MLC.

# ALGORITMO PDP



# CÁLCULO PDP

AC-PDP Calculator : Updating 1 of 2 (sub-beam 44 of 346)



Updating 1 of 2 (sub-beam 44 of 346)



Load



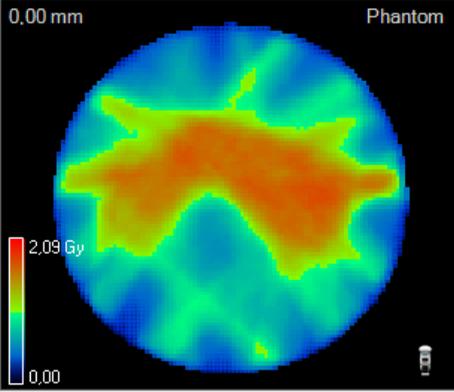
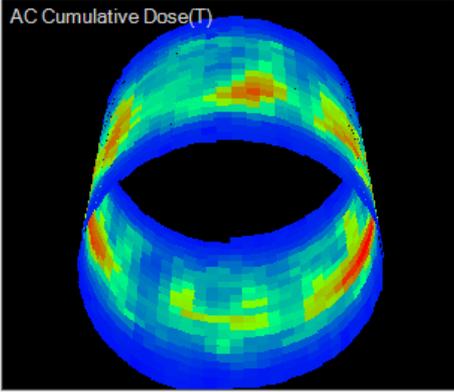
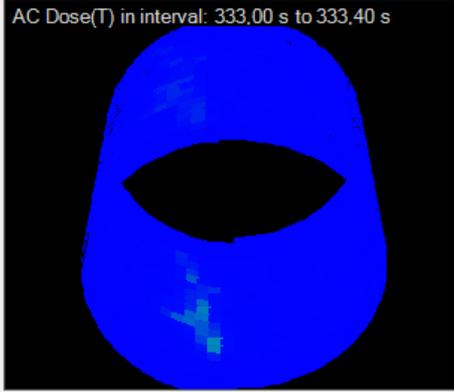
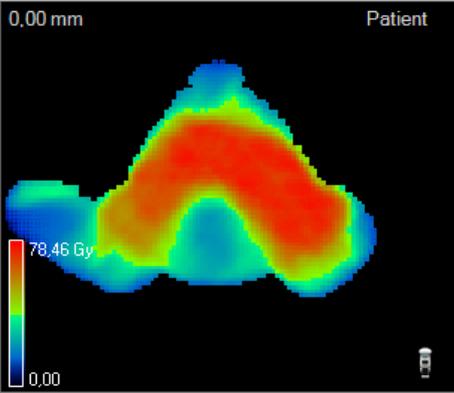
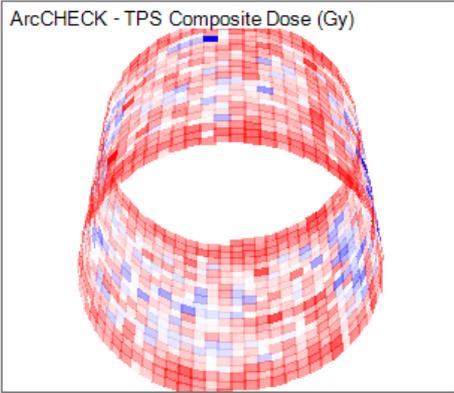
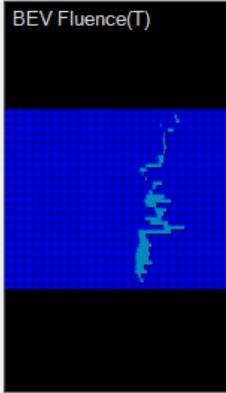
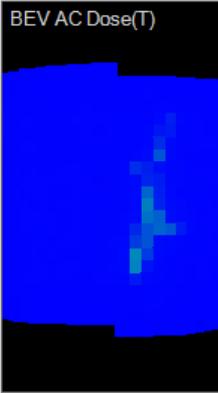
Hide



Cancel

# CÁLCULO PDP

AC-PDP Calculator : Calculation complete.

<p>0,00 mm Phantom</p>  <p>2,09 Gy 0,00</p>	<p>AC Cumulative Dose(T)</p> 	<p>AC Dose(T) in interval: 333,00 s to 333,40 s</p> 	
<p>0,00 mm Patient</p>  <p>78,46 Gy 0,00</p>	<p>ArcCHECK - TPS Composite Dose (Gy)</p> 	<p>BEV Fluence(T)</p> 	<p>BEV AC Dose(T)</p> 

Global Correction (393 Diodes):

TPS AC Isocenter Dose (Gy): 1,2006      Isocenter ~1cc Dose Range (Gy): [0,85, 1,60]

AC-PDP Isocenter Dose (Gy): 1,2135

Perform Ion Chamber Dose Perturbation

**Calculation complete.**

# REFERENCIA

3DVH 3.3 (Hospital Reina Sofia (Cordoba))

FILE SETUP TOOLS DOSE PROFILES HELP

Loaded Data

Ref: AN A  
Comp: AN A

Structures

<input checked="" type="checkbox"/>	Color	ROI Name
<input checked="" type="checkbox"/>	External	External
<input checked="" type="checkbox"/>	OR-MEDULA	OR-MEDULA
<input checked="" type="checkbox"/>	OR-PAROTIDA DRC	OR-PAROTIDA DRC
<input checked="" type="checkbox"/>	OR-PAROTIDA IZQ	OR-PAROTIDA IZQ
<input checked="" type="checkbox"/>	OR-PRV medula	OR-PRV medula
<input checked="" type="checkbox"/>	OR-mandibula	OR-mandibula
<input checked="" type="checkbox"/>	OR-ATM derecha	OR-ATM derecha
<input checked="" type="checkbox"/>	OR-ATM izquierda	OR-ATM izquierda
<input checked="" type="checkbox"/>	OR-SNC	OR-SNC
<input checked="" type="checkbox"/>	OR-Tronco encefalo	OR-Tronco encefalo
<input checked="" type="checkbox"/>	GTV-N	GTV-N
<input checked="" type="checkbox"/>	CTV-N	CTV-N
<input checked="" type="checkbox"/>	GTV-2	GTV-2
<input checked="" type="checkbox"/>	OR-esofago	OR-esofago

Stats:

Dose Display

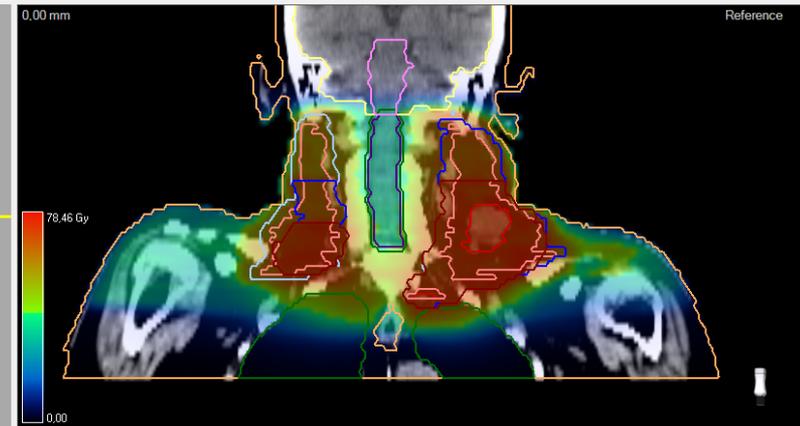
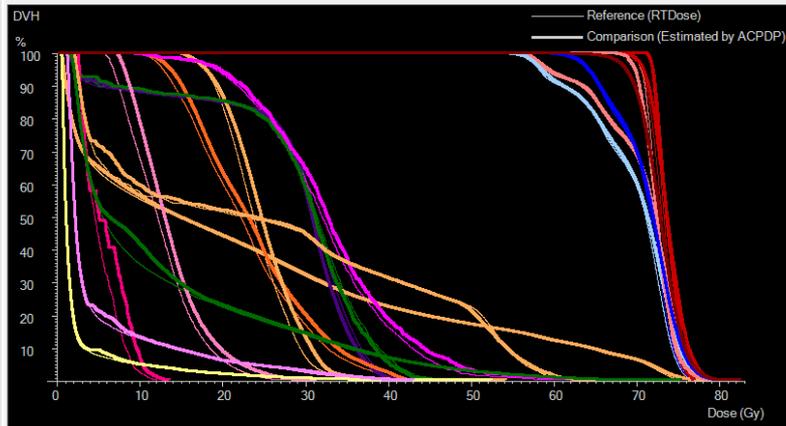
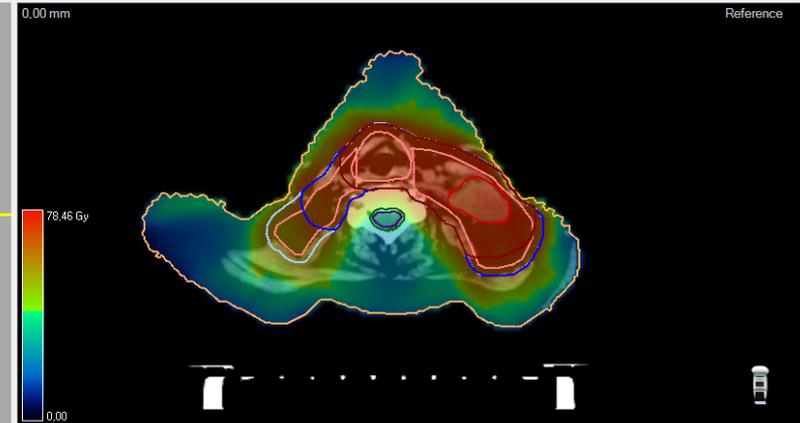
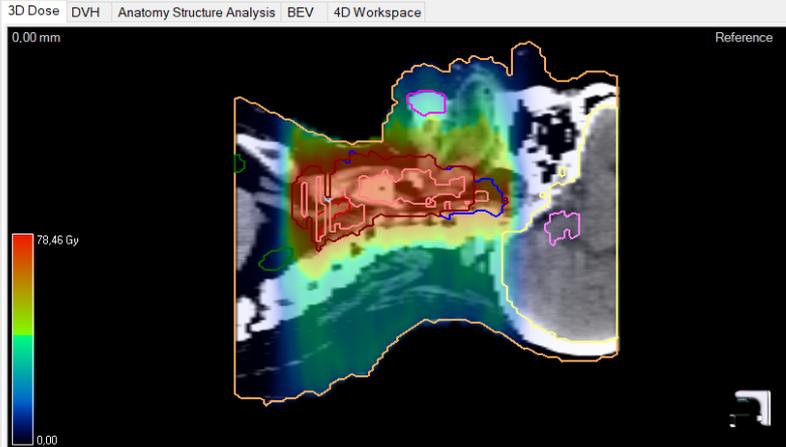
Show: Reference  
LUT: Color  
 Smooth 50 % Opacity

Parameters

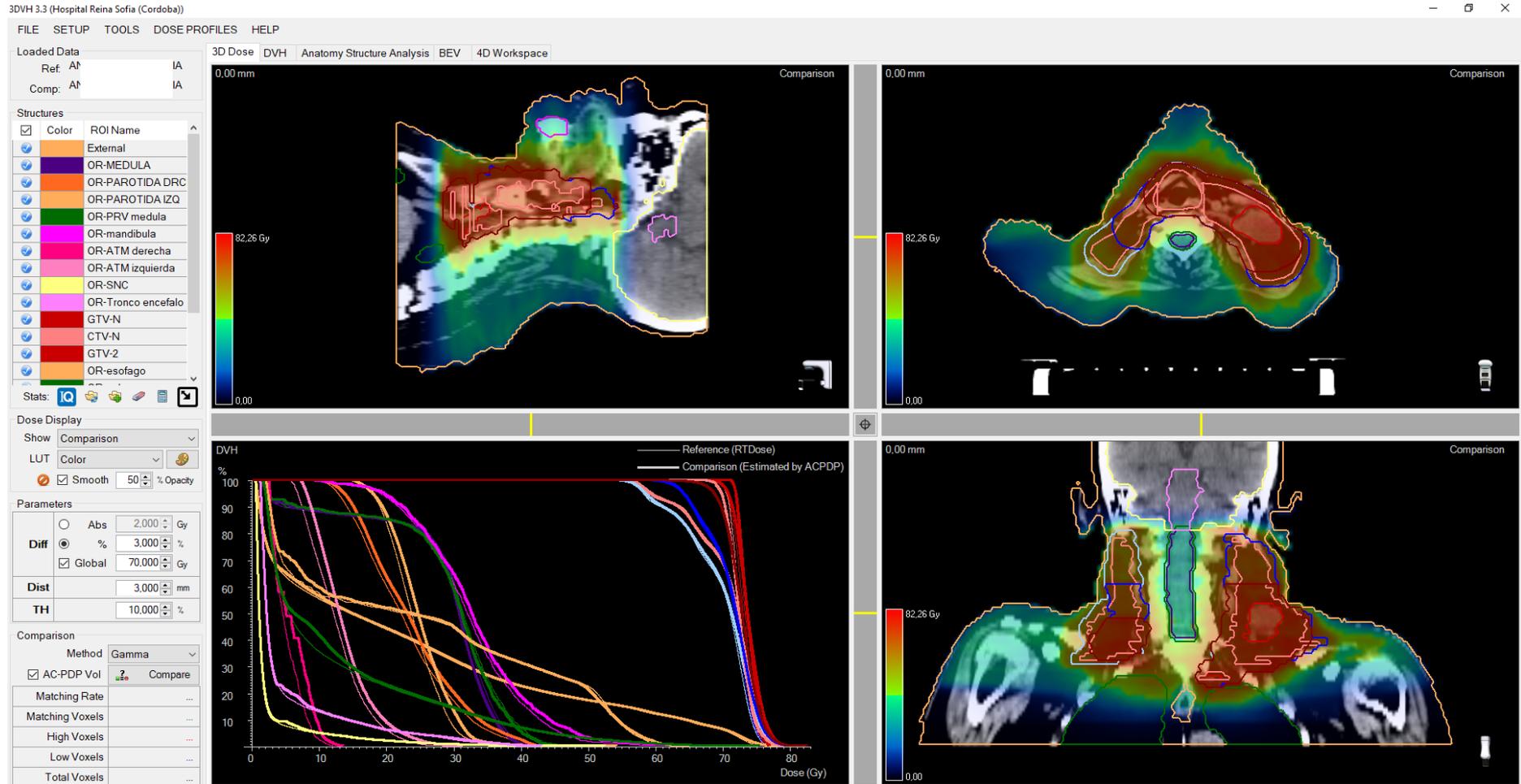
Diff:  Abs 2.000 Gy  
 % 3.000 %  
 Global 70.000 Gy  
Dist: 3.000 mm  
TH: 10.000 %

Comparison

Method: Gamma  
 AC-PDP Vol Compare  
Matching Rate: ...  
Matching Voxels: ...  
High Voxels: ...  
Low Voxels: ...  
Total Voxels: ...



# CÁLCULO PDP



# 3DVH: COMPARACIÓN (ABSOLUTA)

3DVH 3.3 (Hospital Reina Sofia (Cordoba))

FILE SETUP TOOLS DOSE PROFILES HELP

Loaded Data

Ref: AN A  
Comp: AN A

Structures

- | Color                               | ROI Name           |
|-------------------------------------|--------------------|
| <input checked="" type="checkbox"/> | External           |
| <input checked="" type="checkbox"/> | OR-MEDULA          |
| <input checked="" type="checkbox"/> | OR-PAROTIDA DRC    |
| <input checked="" type="checkbox"/> | OR-PAROTIDA IZQ    |
| <input checked="" type="checkbox"/> | OR-PRV medula      |
| <input checked="" type="checkbox"/> | OR-mandibula       |
| <input checked="" type="checkbox"/> | OR-ATM derecha     |
| <input checked="" type="checkbox"/> | OR-ATM izquierda   |
| <input checked="" type="checkbox"/> | OR-SNC             |
| <input checked="" type="checkbox"/> | OR-Tronco encefalo |
| <input checked="" type="checkbox"/> | GTV-N              |
| <input checked="" type="checkbox"/> | CTV-N              |
| <input checked="" type="checkbox"/> | GTV-2              |
| <input checked="" type="checkbox"/> | OR-esofago         |

Stats: IQ

Dose Display

Show: Difference

LUT: Color

Smooth 50 % Opacity

Parameters

Diff:  Abs 2.100 Gy  
 % 3.000 %  
 Global 70.000 Gy

Dist: 3.000 mm

TH: 7.000 Gy

Comparison

Method: Gamma

AC-PDP Vol Compare

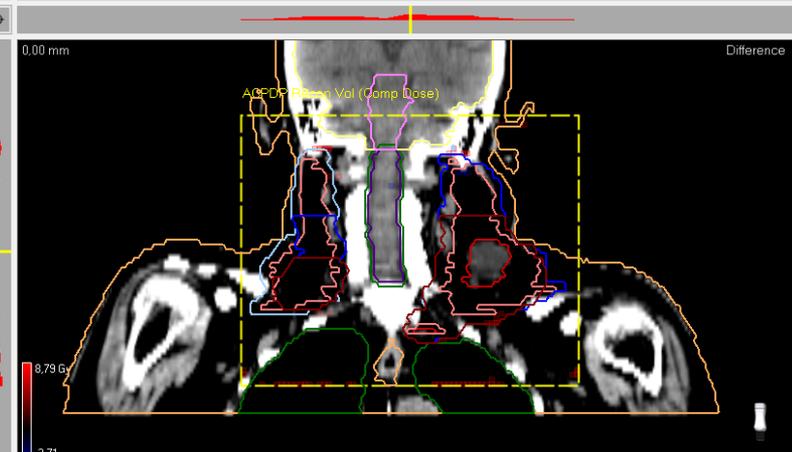
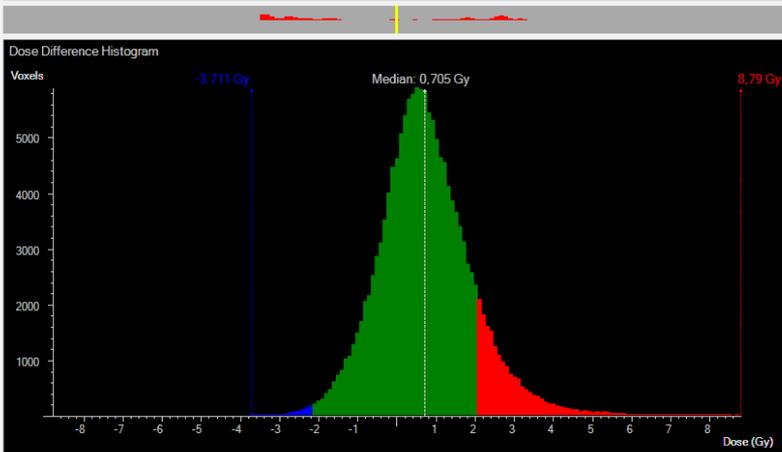
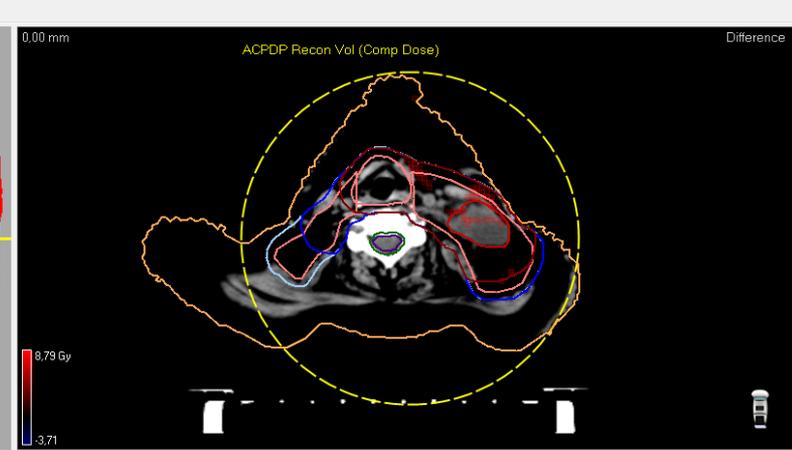
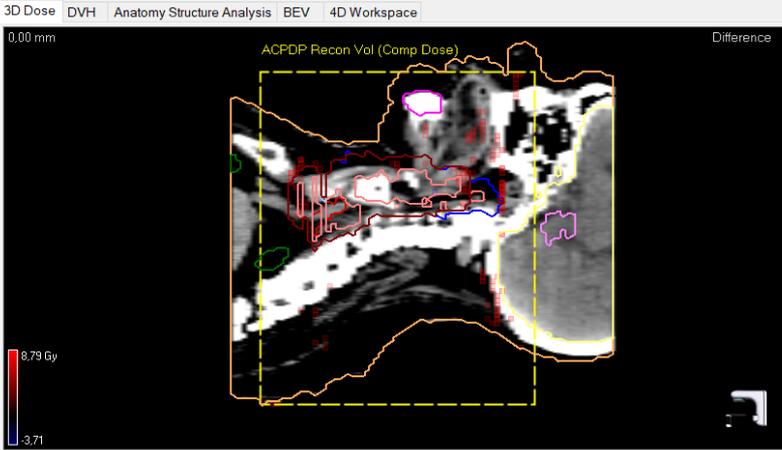
Matching Rate: 97.0%

Matching Voxels: 143 783

High Voxels: 4 310

Low Voxels: 190

Total Voxels: 148 283



# 3DVH: COMPARACIÓN (RELATIVA)

3DVH 3.3 (Hospital Reina Sofia (Cordoba))

FILE SETUP TOOLS DOSE PROFILES HELP

Loaded Data

Ref: AN A  
Comp: AN A

Structures

Color	ROI Name
<input checked="" type="checkbox"/>	External
<input checked="" type="checkbox"/>	OR-MEDULA
<input checked="" type="checkbox"/>	OR-PAROTIDA DRC
<input checked="" type="checkbox"/>	OR-PAROTIDA IZQ
<input checked="" type="checkbox"/>	OR-PRV medula
<input checked="" type="checkbox"/>	OR-mandibula
<input checked="" type="checkbox"/>	OR-ATM derecha
<input checked="" type="checkbox"/>	OR-ATM izquierda
<input checked="" type="checkbox"/>	OR-SNC
<input checked="" type="checkbox"/>	OR-Tronco encefalo
<input checked="" type="checkbox"/>	GTV-N
<input checked="" type="checkbox"/>	CTV-N
<input checked="" type="checkbox"/>	GTV-2
<input checked="" type="checkbox"/>	OR-esofago

Stats: IQ

Dose Display

Show: Difference

LUT: Color

Smooth 50 % Opacity

Parameters

Diff	<input type="radio"/> Abs	2.000 Gy
	<input checked="" type="radio"/> %	3.000 %
	<input type="radio"/> Global	70.000 Gy
Dist		3.000 mm
TH		10.000 %

Comparison

Method: Gamma

AC-PDP Vol Compare

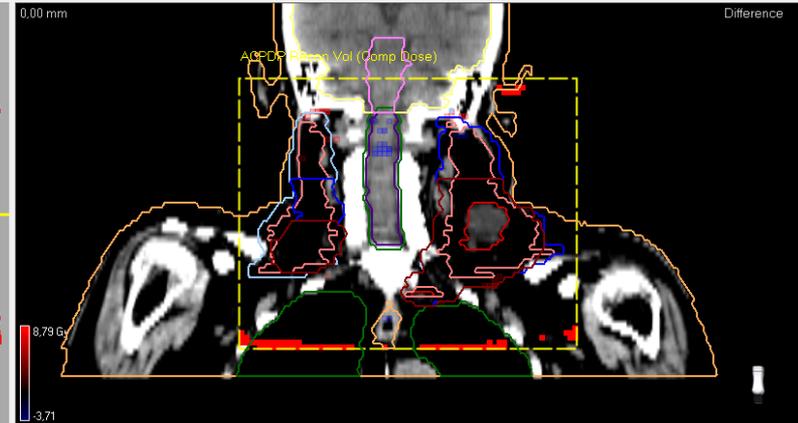
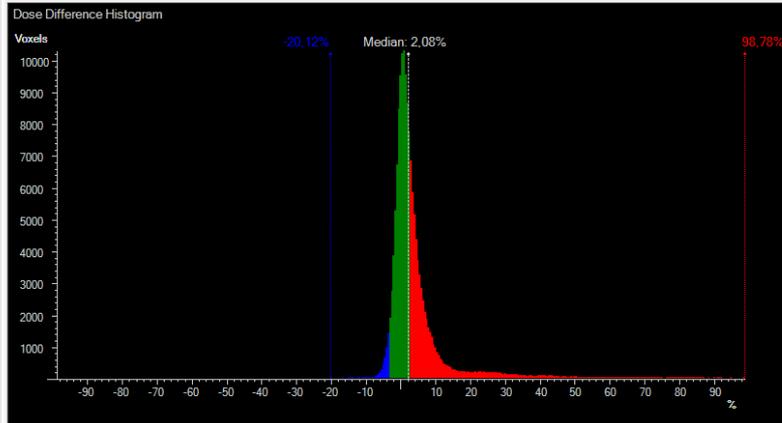
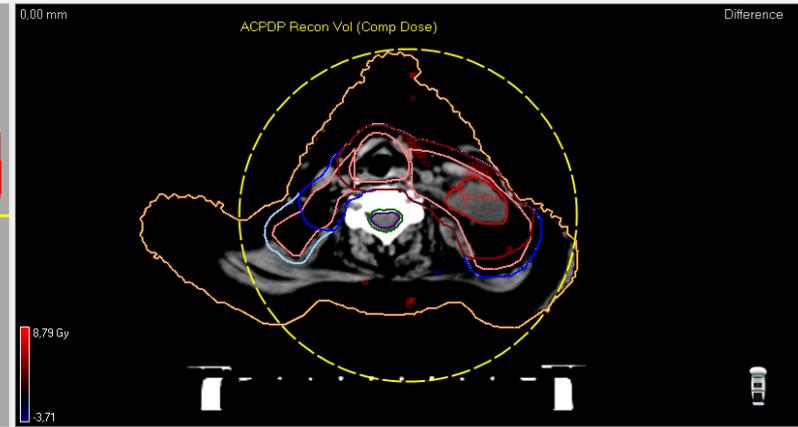
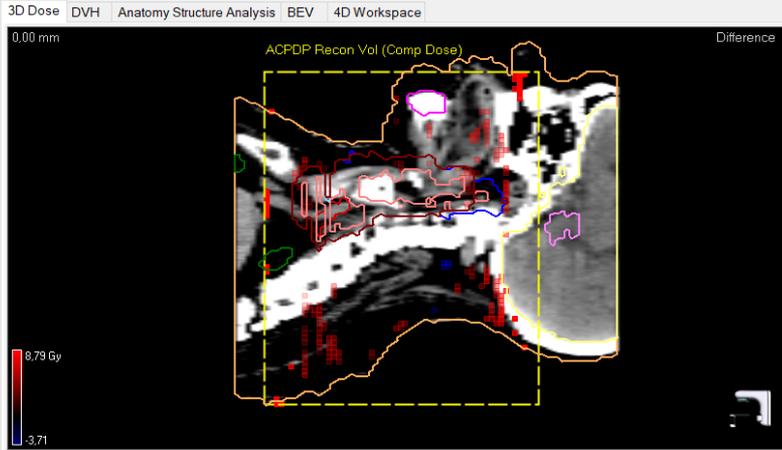
Matching Rate: 94.8%

Matching Voxels: 140 580

High Voxels: 7 232

Low Voxels: 4 71

Total Voxels: 148 283



# 3DVH: COMPARACIÓN (GLOBAL)

3DVH 3.3 (Hospital Reina Sofia (Cordoba))

FILE SETUP TOOLS DOSE PROFILES HELP

Loaded Data  
Ref: ANI  
Comp: ANI

Structures

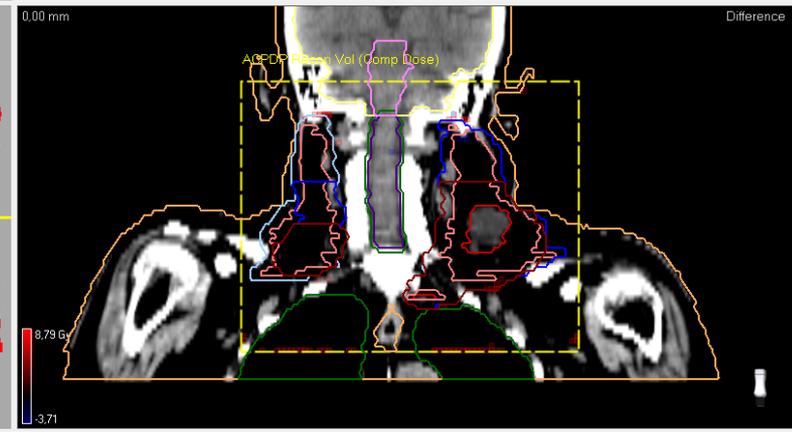
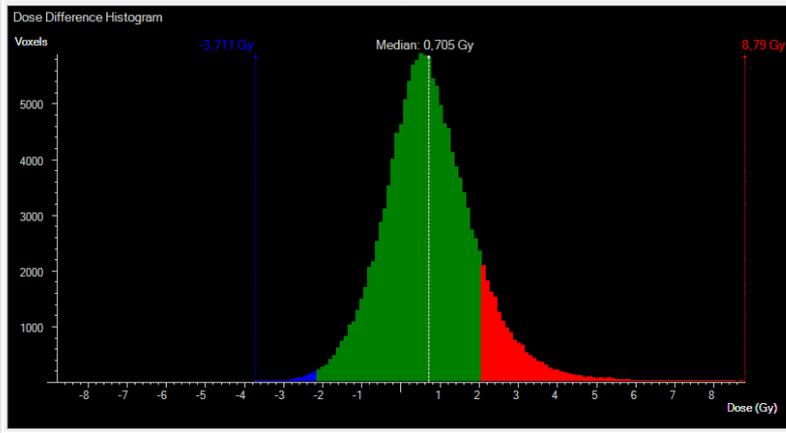
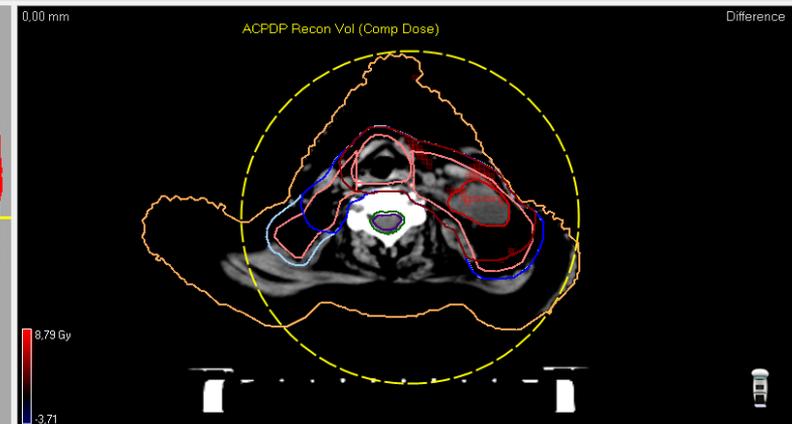
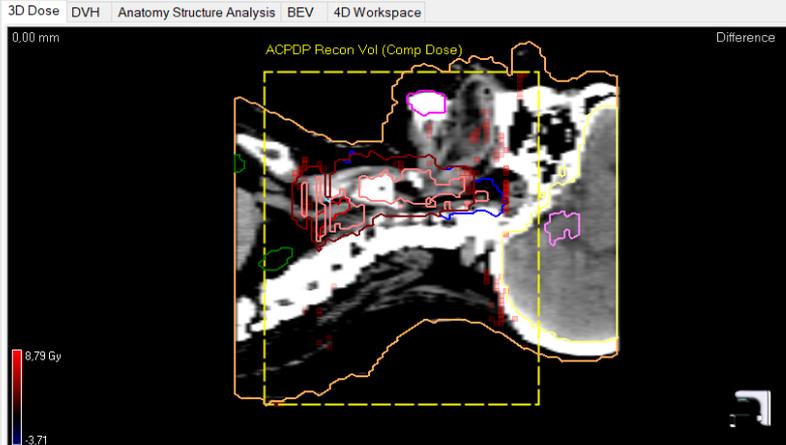
Color	ROI Name
<input checked="" type="checkbox"/>	External
<input checked="" type="checkbox"/>	OR-MEDULA
<input checked="" type="checkbox"/>	OR-PAROTIDA DRC
<input checked="" type="checkbox"/>	OR-PAROTIDA IZQ
<input checked="" type="checkbox"/>	OR-PRV medula
<input checked="" type="checkbox"/>	OR-mandibula
<input checked="" type="checkbox"/>	OR-ATM derecha
<input checked="" type="checkbox"/>	OR-ATM izquierda
<input checked="" type="checkbox"/>	OR-SNC
<input checked="" type="checkbox"/>	OR-Tronco encefalo
<input checked="" type="checkbox"/>	GTV-N
<input checked="" type="checkbox"/>	CTV-N
<input checked="" type="checkbox"/>	GTV-2
<input checked="" type="checkbox"/>	OR-esofago

Dose Display  
Show: Difference  
LUT: Color  
 Smooth 50 % Opacity

Parameters  
Diff:  Abs 2.100 Gy  
 % 3.000 %  
 Global 70.000 Gy  
Dist: 3.000 mm  
TH: 10.000 %

Comparison

Method	Gamma
<input checked="" type="checkbox"/> AC-PDP Vol	Compare
Matching Rate	97.0%
Matching Voxels	143 783
High Voxels	4 310
Low Voxels	190
Total Voxels	148 283



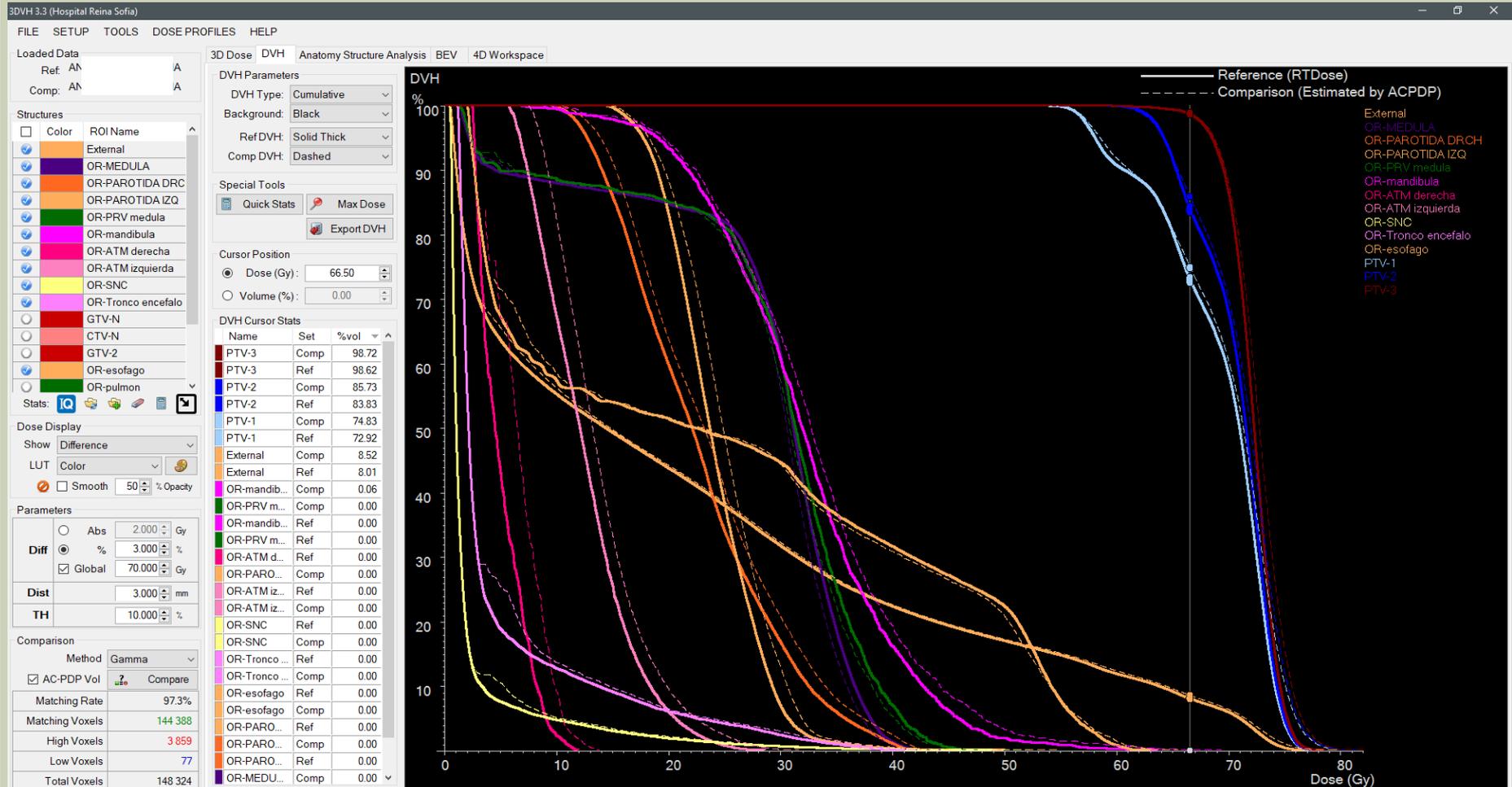
# ESTADÍSTICAS

3D Dose DVH Anatomy Structure Analysis BEV 4D Workspace

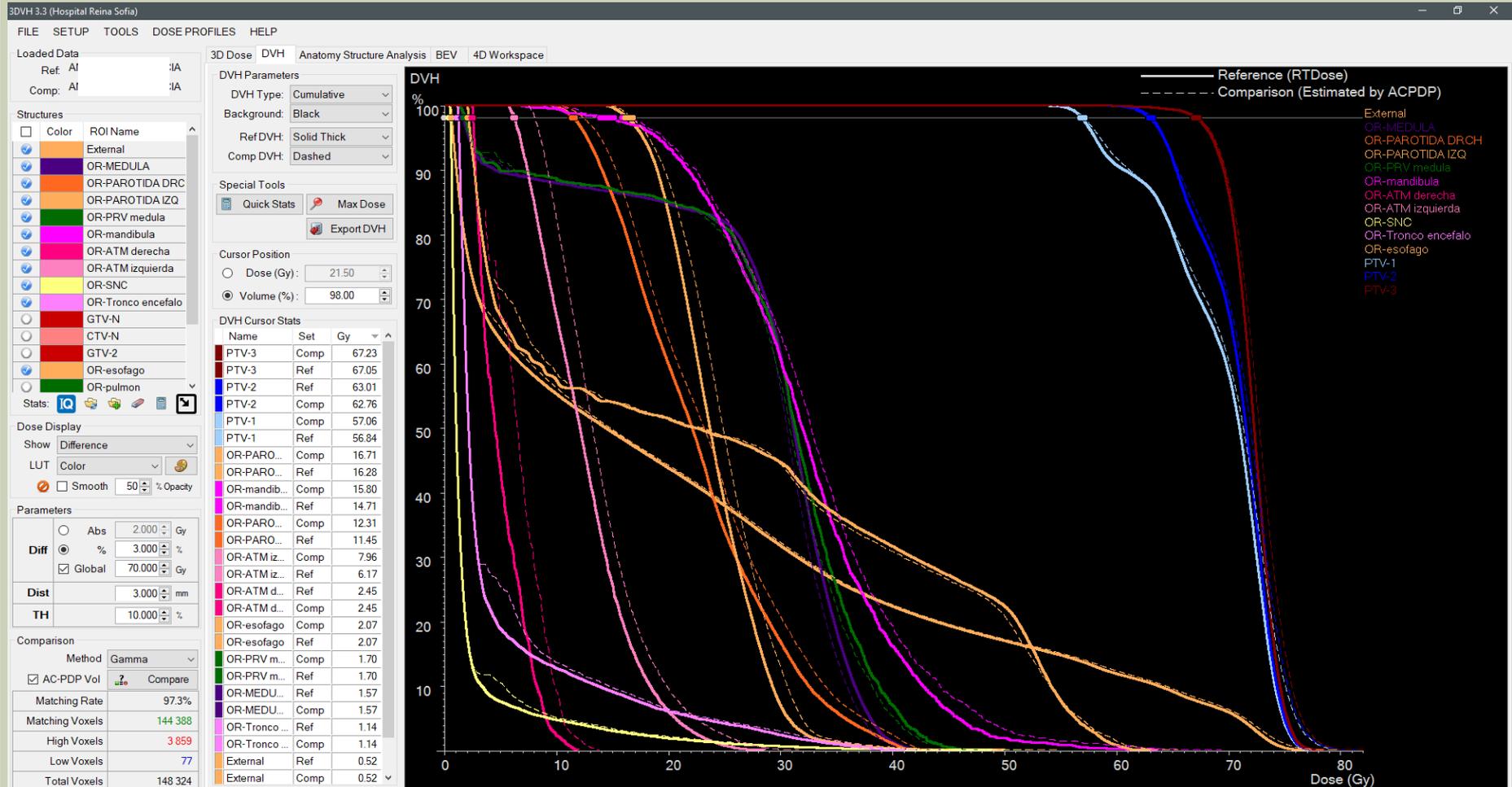
 Calculate Currently Displayed Structures
  Calculate All Structures
  Clear All Current Results

	ROI Name	Matching Rate (%)	Matching	High	Low	Total
<input checked="" type="checkbox"/>	External	97.7	138684	3178	110	141972
<input checked="" type="checkbox"/>	OR-MEDULA	99.4	830	1	4	835
<input checked="" type="checkbox"/>	OR-PAROTIDA DRCH	98.7	532	7	0	539
<input checked="" type="checkbox"/>	OR-PAROTIDA IZQ	97.8	571	13	0	584
<input checked="" type="checkbox"/>	OR-PRV medula	99.5	1458	1	6	1465
<input checked="" type="checkbox"/>	OR-mandibula	99.8	1558	3	0	1561
<input checked="" type="checkbox"/>	OR-ATM derecha	100.0	10	0	0	10
<input checked="" type="checkbox"/>	OR-ATM izquierda	100.0	34	0	0	34
<input checked="" type="checkbox"/>	OR-SNC	99.4	1519	9	0	1528
<input checked="" type="checkbox"/>	OR-Tronco encefalo	100.0	112	0	0	112
<input checked="" type="checkbox"/>	GTV-N	95.6	2841	131	1	2973
<input checked="" type="checkbox"/>	CTV-N	95.9	14383	557	60	15000
<input checked="" type="checkbox"/>	GTV-2	100.0	17	0	0	17
<input checked="" type="checkbox"/>	OR-esofago	99.5	212	0	1	213
<input checked="" type="checkbox"/>	OR-pulmon	97.8	8008	184	0	8192
<input checked="" type="checkbox"/>	PTV-1	95.1	28423	1368	81	29872
<input checked="" type="checkbox"/>	CTV-t	99.0	1875	16	2	1893
<input checked="" type="checkbox"/>	PTV-2	94.7	24253	1285	79	25617
<input checked="" type="checkbox"/>	PTV-3	94.3	18423	1083	27	19533

# HISTOGRAMAS DOSIS VOLUMEN



# HISTOGRAMAS DOSIS VOLUMEN



# ESTADÍSTICAS

## Structures

<input type="checkbox"/>	Color	ROI Name	Min	Mean	Max	Quick Stat DVH Point(s)
<input checked="" type="checkbox"/>		External	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>		OR-MEDULA	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	D0.25cc
<input checked="" type="checkbox"/>		OR-PAROTIDA DRCH	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	V30;V32
<input checked="" type="checkbox"/>		OR-PAROTIDA IZQ	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	V30;V32
<input checked="" type="checkbox"/>		OR-PRV medula	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	D0.25cc
<input checked="" type="checkbox"/>		OR-mandibula	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>		OR-ATM derecha	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	V60;V65
<input checked="" type="checkbox"/>		OR-ATM izquierda	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	V60;V65
<input checked="" type="checkbox"/>		OR-SNC	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	V12
<input checked="" type="checkbox"/>		OR-Tronco encefalo	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	D1cc
<input type="checkbox"/>		GTV-N	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>		CTV-N	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>		GTV-2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>		OR-esofago	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	V35;V50
<input type="checkbox"/>		OR-pulmon	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>		PTV-1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	D98%;D2%;D50%
<input type="checkbox"/>		CTV-t	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>		PTV-2	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	D98%;D2%;D50%
<input checked="" type="checkbox"/>		PTV-3	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	D98%;D2%;D50%

# ESTADÍSTICAS

3d 3DVH: Customized 'Quick Stats' per ROI

Color	ROI Name	Volume (cc)	Quick Stat	Unit	Reference	Comparison	Diff (Abs / %)
	OR-MEDULA	25.071	Mean	Gy	27.930	27.435	-0.494 Gy / -1.770%
	OR-MEDULA	25.071	D0.25cc	Gy	40.230	39.610	-0.620 Gy / -1.541%
	OR-PAROTIDA DRCH	14.502	Mean	Gy	22.592	23.727	1.135 Gy / 5.024%
	OR-PAROTIDA DRCH	14.502	V30Gy	%vol	16.543	20.480	3.937 %vol / 23.802%
	OR-PAROTIDA DRCH	14.502	V32Gy	%vol	10.998	14.688	3.689 %vol / 33.542%
	OR-PAROTIDA IZQ	16.065	V30Gy	%vol	6.679	12.543	5.864 %vol / 87.791%
	OR-PAROTIDA IZQ	16.065	V32Gy	%vol	2.708	4.426	1.718 %vol / 63.448%
	OR-PRV medula	44.145	D0.25cc	Gy	44.510	44.540	0.030 Gy / 0.067%
	OR-mandibula	42.147	Max	Gy	63.605	69.239	5.635 Gy / 8.859%
	OR-ATM derecha	1.332	V60Gy	%vol	0.000	0.000	0.000 %vol / 0.000%
	OR-ATM derecha	1.332	V65Gy	%vol	0.000	0.000	0.000 %vol / 0.000%
	OR-ATM izquierda	0.9450001	V60Gy	%vol	0.000	0.000	0.000 %vol / 0.000%
	OR-ATM izquierda	0.9450001	V65Gy	%vol	0.000	0.000	0.000 %vol / 0.000%
	OR-SNC	664.335	Max	Gy	48.755	52.146	3.391 Gy / 6.955%
	OR-SNC	664.335	V12Gy	%vol	4.036	4.357	0.321 %vol / 7.956%
	OR-Tronco encefalo	19.677	Max	Gy	41.018	42.440	1.422 Gy / 3.468%
	OR-Tronco encefalo	19.677	D1cc	Gy	22.210	23.300	1.090 Gy / 4.908%
	OR-esofago	9.054	Mean	Gy	25.012	25.082	0.071 Gy / 0.283%
	OR-esofago	9.054	V35Gy	%vol	36.448	35.542	-0.906 %vol / -2.485%
	OR-esofago	9.054	V50Gy	%vol	22.222	20.665	-1.557 %vol / -7.008%
	PTV-1	807.408	Mean	Gy	69.096	69.614	0.517 Gy / 0.749%
	PTV-1	807.408	D98%	Gy	56.840	57.060	0.220 Gy / 0.387%
	PTV-1	807.408	D2%	Gy	75.530	77.040	1.510 Gy / 1.999%
	PTV-1	807.408	D50%	Gy	70.880	71.220	0.340 Gy / 0.480%
	PTV-2	692.442	Mean	Gy	70.619	71.133	0.514 Gy / 0.728%
	PTV-2	692.442	D98%	Gy	63.010	62.760	-0.250 Gy / -0.397%
	PTV-2	692.442	D2%	Gy	75.640	77.230	1.590 Gy / 2.102%
	PTV-2	692.442	D50%	Gy	71.460	71.870	0.410 Gy / 0.574%
	PTV-3	527.391	Mean	Gy	72.032	72.601	0.570 Gy / 0.791%
	PTV-3	527.391	D98%	Gy	67.050	67.230	0.180 Gy / 0.268%
	PTV-3	527.391	D2%	Gy	75.800	77.510	1.710 Gy / 2.256%
	PTV-3	527.391	D50%	Gy	72.190	72.650	0.460 Gy / 0.637%

OK

# 3DVH: ANÁLISIS PLANAR DESDE EL BEV

General  
Ref: ANC REZ  
Comp: ANC REZ

Structures

<input type="checkbox"/>	Color	ROI Name
<input checked="" type="checkbox"/>	Orange	Cuerpo Externo
<input checked="" type="checkbox"/>	Green	OR pulmones
<input checked="" type="checkbox"/>	Red	OR higado
<input checked="" type="checkbox"/>	Olive	OR riñon derec
<input checked="" type="checkbox"/>	Pink	OR riñon izqui
<input checked="" type="checkbox"/>	Blue	OR bazo
<input checked="" type="checkbox"/>	Purple	cabeza_p
<input checked="" type="checkbox"/>	Yellow	cuerno gastric

Dose Display  
Show: Difference  
Color LUT: Color  
Fader: [Slider]

Parameters

<input type="radio"/>	Abs	2.000	Gy
<input checked="" type="radio"/>	Diff	2.000	%
<input checked="" type="checkbox"/>	Global	50.400	Gy
DTA		2.000	mm
TH		0.000	%

Comparison  
Method: Gamma  
Compare

Matching Rate	98.9%
Matching Voxels	937 620
High Voxels	9 499
Low Voxels	1 264
Total Voxels	948 383

3D Dose DVH Anatomy Structure Analysis BEV

Beam Thumbnails

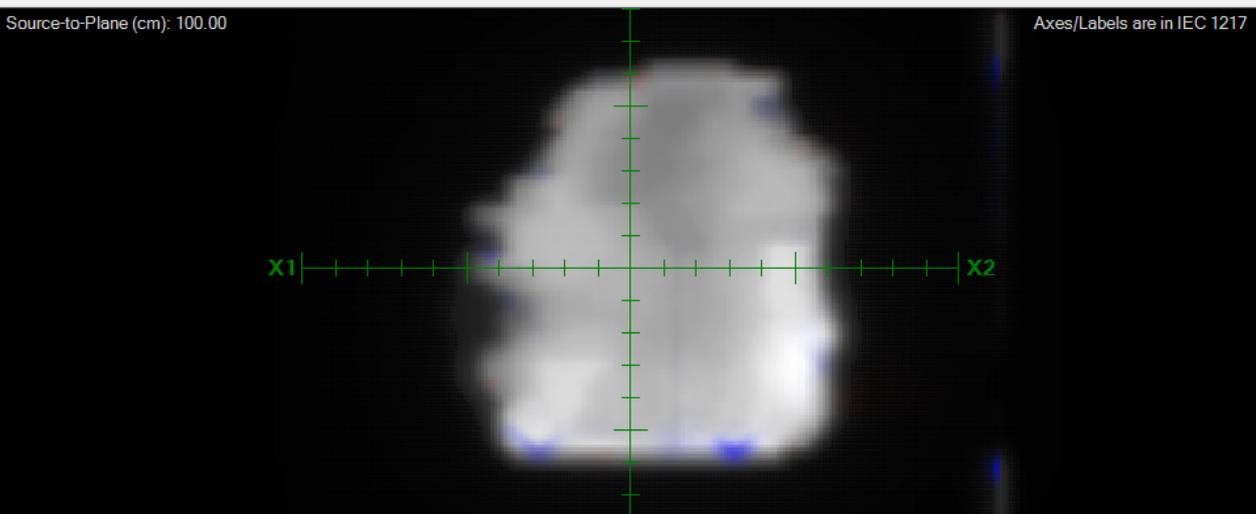


Beam #/Name: 1 G0

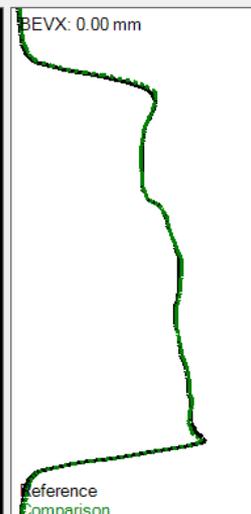
Intensity Map Planar QA Data Diff Overlay

Source-to-Plane (cm): 100.00

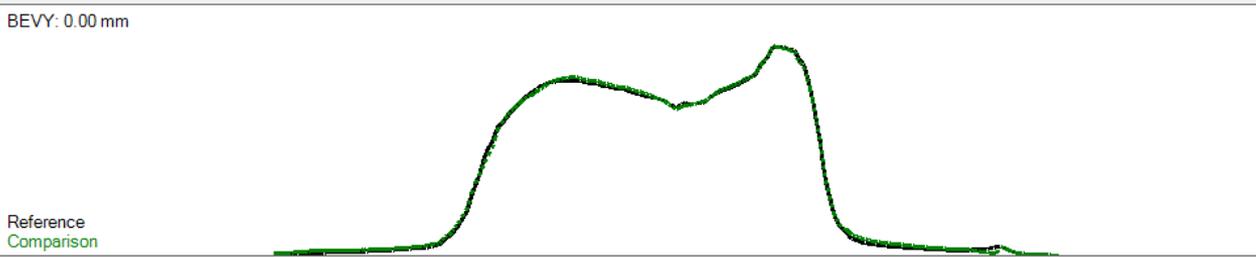
Axes/Labels are in IEC 1217 BEVX: 0.00 mm



Reference Comparison



BEVY: 0.00 mm



Reference Comparison

# FUNCIONES ADICIONALES

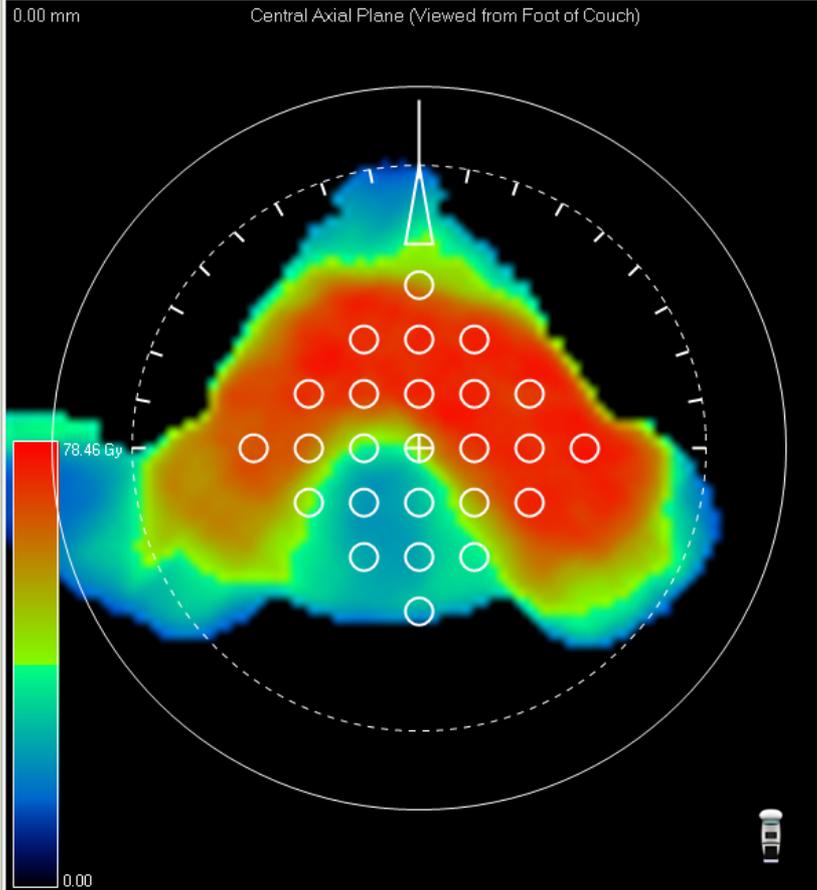
- Dosis y localización del punto de máxima dosis.
- Volumen cubierto por una dosis.
- Estadísticas de dosis en un punto.
- Muestreo de dosis en alojamiento cámara ionización.
- Minimización de diferencias
  - Posicionamiento del maniquí.
  - Escalado de dosis.
- Perfiles de dosis.
- 4D Workspace.
  - Dynalogs



# MUESTREO DE DOSIS EN ALOJAMIENTOS CÁMARA IONIZACIÓN

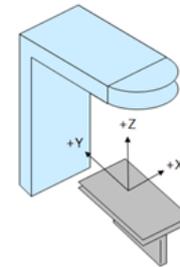
Sample Dose at Potential Ion Chamber Locations

DOSE AND CHAMBER POSITIONS (VIEWED FROM FOOT OF COUCH)



PARAMETERS

Couch Coordinate System



Selected Location X, Y, Z (mm)

0.0 0.0 0.0

ArcCHECK MultiPlug Rotation

0 Degrees

Find Low Gradient/High Dose

Current Angle

Over All Angles

Ion Chamber Volume

0.3000 cc

Active 3D Grid's Dose at XYZ

46.30581 Gy

Ion Chamber Dose at XYZ

46.30581 Gy [1.00000]

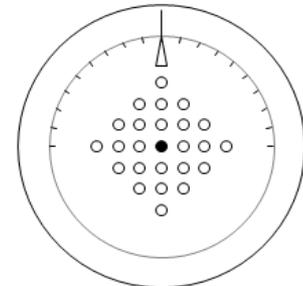
Dose Gradient / Level

Dose Gradient: 67.35% over 1 cc

Dose Level: 59.02% of global max

GUIDE / TIPS

Plug View (Opposite Electronics)



MultiPlug Locator

[Col, Row]: [0, 0], Angle: 0 deg

Create Report

Print to PDF



OK



Close

# DOSIS MÁXIMA

Max Dose Value(s) and Location(s) ✕

 Max Dose Information:

Reference Dose:  
Max Dose = 63.278 Gy  
Location (couch XYZ) = (6.00mm, 63.00mm, -30.00mm)

Comparison Dose:  
Max Dose = 66.242 Gy  
Location (couch XYZ) = (6.00mm, 63.00mm, -30.00mm)

# VOLUMEN CUBIERTO POR UNA ISODOSIS

ArcCHECK Dose Scaling

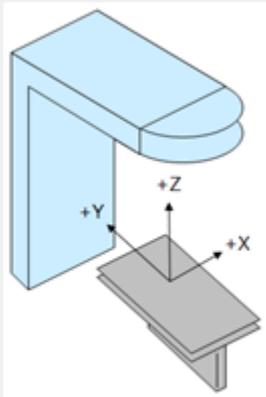
**Sum all dose voxel volumes at or above the specified threshold dose (Gy).**

Threshold Dose (Gy):	<input type="text" value="60.000"/>
Reference Dose Volume (cc):	98.31
Comparison Dose Volume (cc):	131.65

OK

# XYZ SHIFTS

## XYZ Shift Results



XYZ Shifts (i.e. shifts in comparison dose grid relative to reference grid) that minimize the sum of |dose differences|:

X shift (mm): 0.00

Y shift (mm): 0.00

Z shift (mm): 0.00

Shifts Sampled: 729

Initial Sum over all |Dose Diff| (Gy): 71941.40

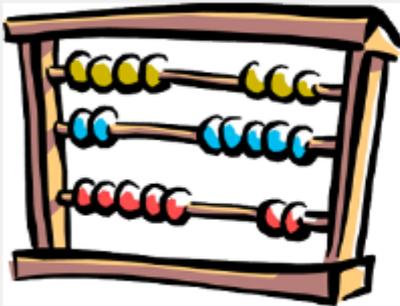
Shifted Sum over all |Dose Diff| (Gy): 71941.40

NOTE: All shifts are in the intuitive 3DVH 'Couch Coordinate System' as shown in the image on the left.

OK

# SCALE FACTOR

## Scale Factor Results



Dose Scaling (applied to comparison dose grid) that minimizes the sum of |dose differences|:

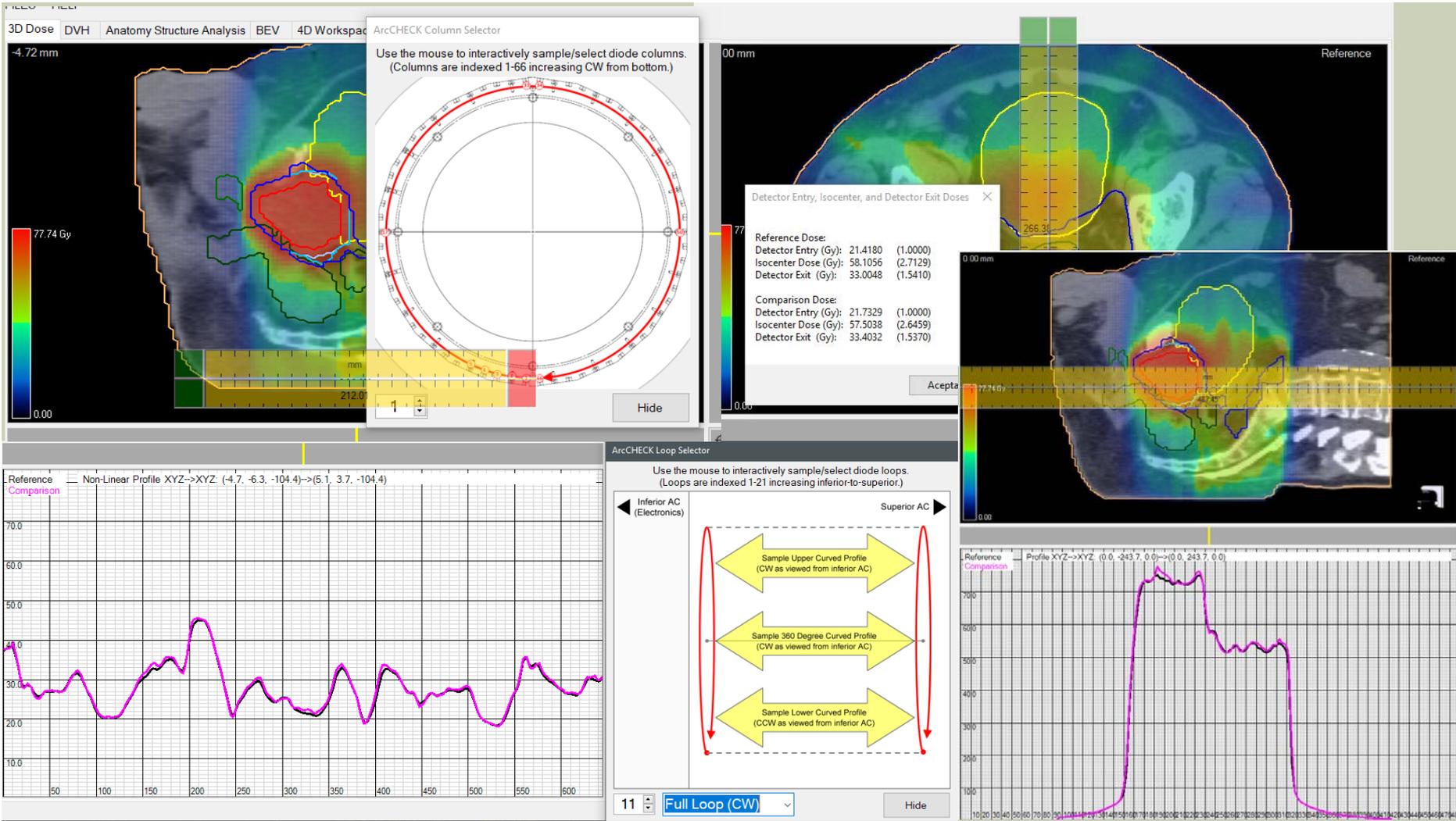
Scale Factor: 0.996

Initial Sum of |Dose Diff| (Gy) for all dose points > lower threshold: 71941.400

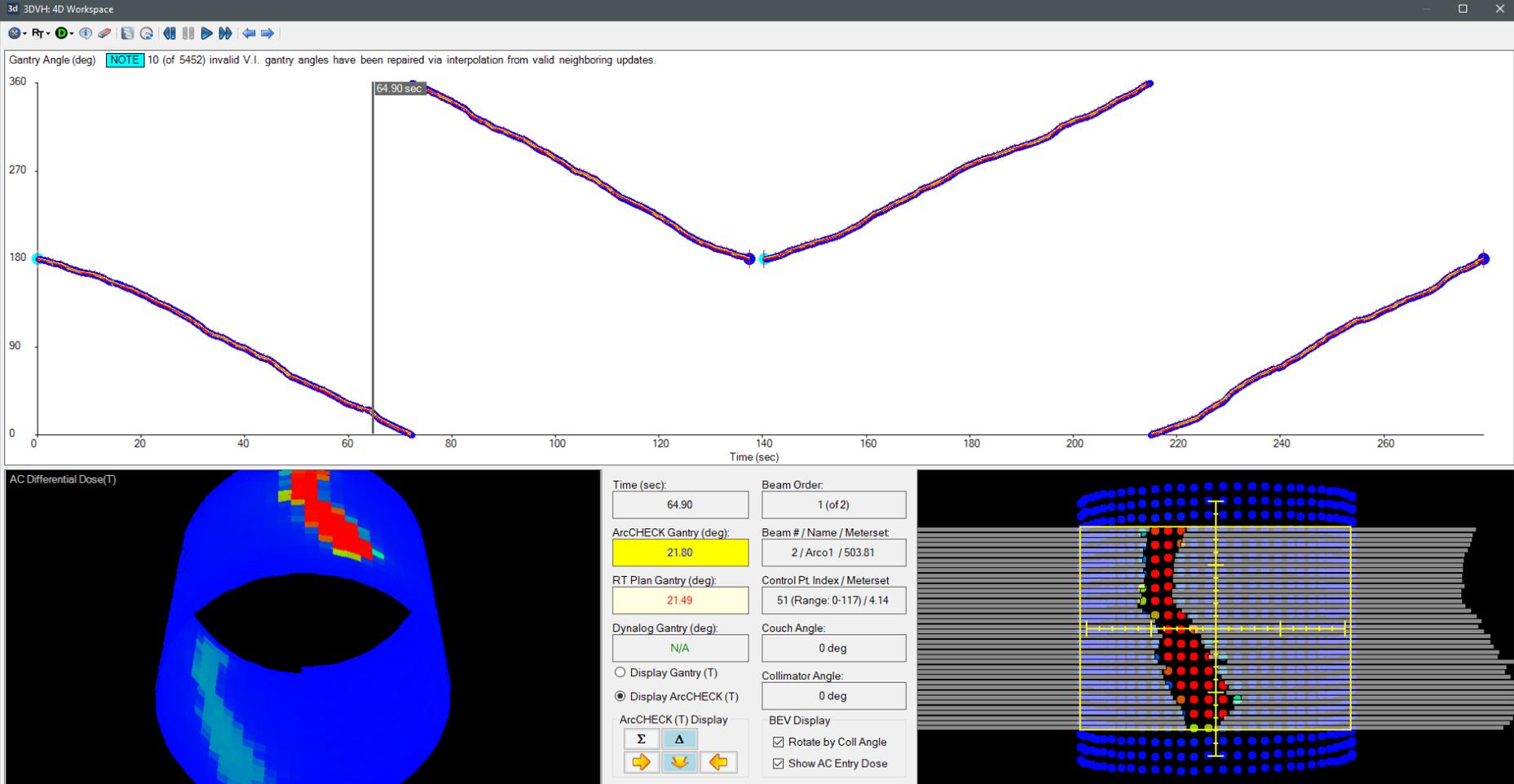
Scaled Sum of |Dose Diff| (Gy) for all dose points > lower threshold: 70593.380

OK

# PERFILES DE DOSIS



# 4D WORKSPACE



# FLUJO DE TRABAJO

# LISTAS DE CONTROL DE CALIDAD MOSAIQ

**RF\_QA\_IMRT**

Fecha requerida	Descripción	Solicitante	Responsable	Comentarios
0	Cálculo Plan QA		TERT Física	Cálculo plan de QA en MONACO
1	Medida QA	TERT Física	TERT Física	Medida del plan de tto sobre maniquí de CC.
1	Registro QA en BD	TERT Física	TERT Física	Registro de los resultados del QA en base de datos.
1	Añadir sig. Lista	TERT Física	TERT Física	RF_FISICO_validación_QA

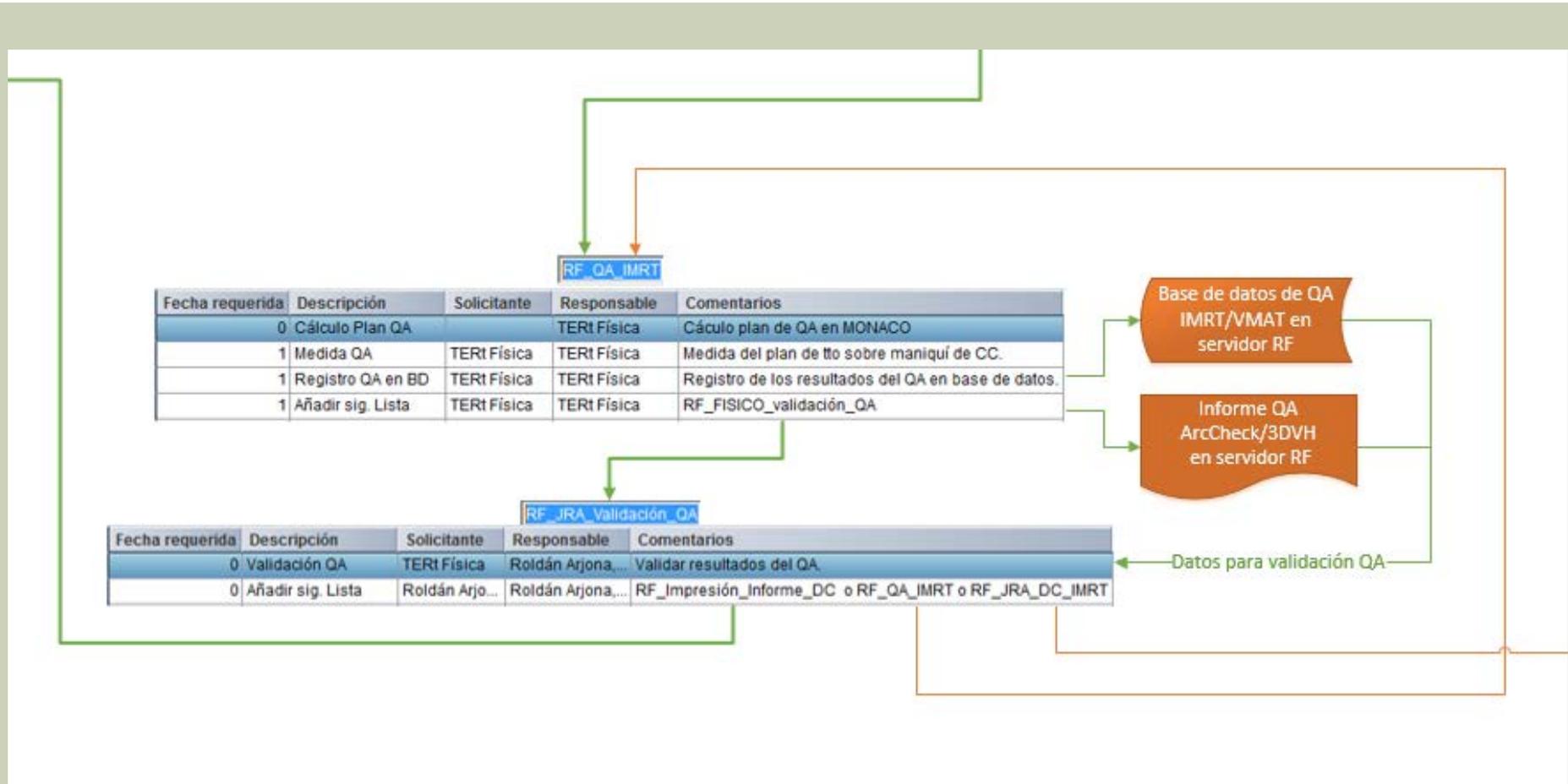
Base de datos de QA  
IMRT/VMAT en  
servidor RF

Informe QA  
ArcCheck/3DVH  
en servidor RF

Datos para validación QA

**RF\_JRA Validación\_QA**

Fecha requerida	Descripción	Solicitante	Responsable	Comentarios
0	Validación QA	TERT Física	Roldán Arjona,...	Validar resultados del QA.
0	Añadir sig. Lista	Roldán Arjo...	Roldán Arjona,...	RF Impresión_Informe_DC o RF_QA_IMRT o RF_JRA_DC_IMRT



# LCC MOSAIQ

## Lista control calidad de sitio - TERT Física

Añadir Cambiar Eliminar Completado Ignorar Nota

Filtros

Vista:  Ubicación:   ⓘ

Intervalo fechas:

Mostrar incompletos fuera de plazo  Mostrar solo elem. solicitados por usuario

Estado

- Completar
- Incompleto
- Todos

Tarea	Fecha limite	Responsable	Prioridad	Medico responsable	Solicitante	Comentarios	Nota
Paciente:							
Registro QA en BD	21/11/2017	TERT Física		Espin	TERT Física	Registro de los resultados del QA en base de datos.	<input type="checkbox"/>
Medida QA	21/11/2017	TERT Física		Espin	TERT Física	Medida del plan de tto sobre maniquí de CC.	<input type="checkbox"/>
Paciente:							
Registro QA en BD	16/11/2017	TERT Física		B	TERT Física	Registro de los resultados del QA en base de datos.	<input type="checkbox"/>
Medida QA	16/11/2017	TERT Física		E	TERT Física	Medida del plan de tto sobre maniquí de CC.	<input type="checkbox"/>
Cálculo Plan QA	15/11/2017	TERT Física		Bé	Bé	Cáculo plan de QA en MONACO	<input type="checkbox"/>

## Lista de trabajo - Roldán Arjona, Juan Manuel F

Lista control calidad X

Fecha limite	Tarea	Comentarios	Prioridad	Medico responsable	Solicitante
Responsable: Física					
Responsable: Rc					
Paciente: Ct					
24/11/2017	Validación QA	Validar resultados del QA.			TERT Física
24/11/2017	Añadir sig. Lista	RF_Impresión_Informe_DC o RF_QA_IMRT o RF_JRA_DC_IMRT			F a...
Responsable: TERT Física					

# BASE DE DATOS

**Controles de calidad de IMRT/VMAT con ArcCheck**

NUHSA  Apellidos  Nombre

Plan de QA:  Patología  Monaco Vers.

Descripción  150

**Medidas de Control de Calidad**

Fecha  Físico

Informes   Técnico

Observaciones  Error Ionización (%)

SNCPatient versión  3DVH Versión

**Gamma Absoluta** **Gamma Relativa** **Estadística Gamma** **HDV PTV** **HDV OAR**

% Dif.	DTA	Umbral	Sin Van Dyk	Con Van Dyk	% Dif.	DTA	Umbral	Sin Van Dyk	Con Van Dyk
3 %	3 mm	0 %	63.3	93.7	3 %	3 mm	0 %	95.9	97.2
3 %	3 mm	5 %	63.5	93.8	3 %	3 mm	5 %	93.8	95.8
3 %	3 mm	10 %	67.3	93.2	3 %	3 mm	10 %	92.5	95
2 %	2 mm	0 %	43.3	70.1	2 %	2 mm	0 %	89.9	92.2
2 %	2 mm	5 %	43.4	70.1	2 %	2 mm	5 %	84.7	88.2
2 %	2 mm	10 %	46.4	70.3	2 %	2 mm	10 %	81.6	85.8

# BASE DE DATOS

**Controles de calidad de IMRT/VMAT con ArcCheck**

NUHSA  Apellidos   Nombre

Plan de QA:  Patología  Monaco Vers.

Descripción  150

**Medidas de Control de Calidad**

Fecha  Físico

Informes  Técnico

Observaciones  Error Ionización (%)

SNCPatient versión  3DVH Versión

Gamma Absoluta
Gamma Relativa

Estadística Gamma
HDV PTV
HDV OAR

% Dif.	DTA	Umbral	% paso criterio gamma
3 %	3 mm	0 %	<input type="text" value="99.9"/>
3 %	3 mm	5 %	<input type="text" value="99.8"/>
3 %	3 mm	10 %	<input type="text" value="99.8"/>
2 %	2 mm	0 %	<input type="text" value="95.7"/>
2 %	2 mm	5 %	<input type="text" value="95.7"/>
2 %	2 mm	10 %	<input type="text" value="95.4"/>

	Exp	Calc	Error
D98%	<input type="text" value="53.937"/>	<input type="text" value="52.938"/>	<input type="text" value="1.9%"/>
D2%	<input type="text" value="75.697"/>	<input type="text" value="73.592"/>	<input type="text" value="2.9%"/>
V95%	<input type="text" value="99.212"/>	<input type="text" value="97.336"/>	<input type="text" value="1.9%"/>
V107%	<input type="text" value="77.125"/>	<input type="text" value="69.027"/>	<input type="text" value="11.7%"/>
Dmedia	<input type="text" value="65.05"/>	<input type="text" value="63.207"/>	<input type="text" value="2.9%"/>
Dmax	<input type="text" value="79.573"/>	<input type="text" value="77.299"/>	<input type="text" value="2.9%"/>

Registro:

# INFORMES ADJUNTOS EN BASE DATOS

**Controles de calidad de IMRT/VMAT con ArcCheck**

NUHSA AN Apellidos N Nombre LUIS

Plan de QA: dIMRT2-QA1 Patología ORL Monaco Vers. 3.10.02

Descripción Hipofaringe boost Integrado. PTV1 70Gy, PTV2 63 Gy, PTV3, 56Gy en 35 fr. 150

**Datos adjuntos**

Datos adjuntos (haga doble clic para abrir)

- Informe QA 3DVH.pdf
- Informe QA ArcCheck.PDF

Agregar...  
Quitar  
Abrir  
Guardar como...  
Guardar todo...

Acceptar Cancelar

%				
3 %	3 mm	0 %		99.9
3 %	3 mm	5 %		99.8
3 %	3 mm	10 %		99.8
2 %	2 mm	0 %		95.7
2 %	2 mm	5 %		95.7
2 %	2 mm	10 %		95.4

Parótida Izquierda

Dosis (Gy) 30

	Exp	Calc	Error
Volumen	39.477	40.184	-1.8%
Dmedia	28.785	28.689	0.3%
D50%	23.11	23.88	-3.2%
Dmax	72.057	69.943	3.02%

Registro: 1 de 4 Sin filtro Buscar

# INFORME CC ARCCHECK PDF

Date: 05/09/2012

ArcCHECK QA of Dose Distribution

Hospital Name: Hospital Universitario Reina Sofia

## QA File Parameter

Patient Name : I...E, LUS  
 Patient ID :  
 Plan Date : 4/9/2012  
 SSD : 868.4  
 Depth : 131.6  
 Energy : X06  
 Angle : dIMRT

## Relative Comparison

% Diff : 2  
 Distance (mm) : 2  
 Threshold : 0  
 Rotation Angle : 0.0 Degs  
 Meas Uncertainty : Yes  
 Cavity Dose : 122.1

## Summary (Gamma Analysis)

Total Points : 1383  
 Passed : 1323  
 Failed : 60  
 % Passed : 95.7  
 \*DTA/Gamma is using 3D Mode

## Dose Values in cGy

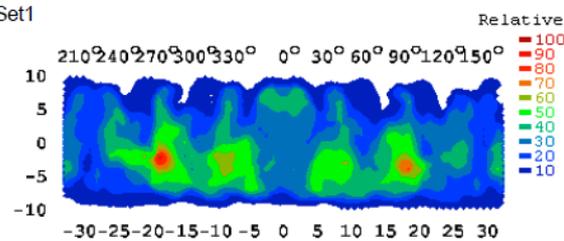
	Cax	Normal	Picked
Set1		172.39	
Set2	50.06	159.83	83.38
Set1-Set2		12.56	
% Diff		7.86	
DTA(mm)	NA	0.00	>10
Coords (y,x) cm	0,0	-2,-18.5	NA

## Notes

2%, 2mm, Sin umbral, Relativa Ionización: 1.6%

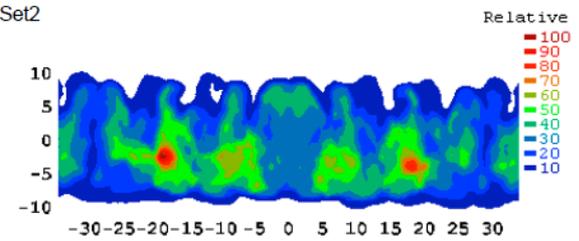
Reviewed By :

Set1



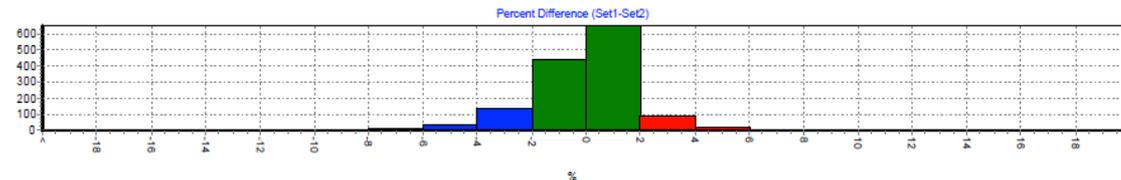
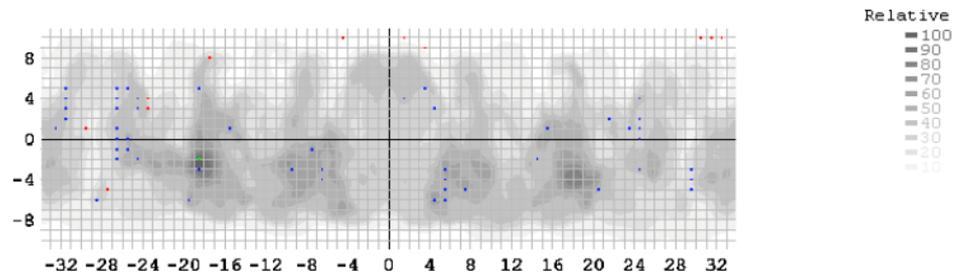
\\Wfprhp13\radiofisical\radioterapia\MONACO\QA\IM...14-Sep-2012-A.txt

Set2



\\Wfprh...IAN0198330645\_dIMRT2-QA1\_Dose.DCM\_AC\_EXTRACTED.snc

Set1-Set2



# INFORME CC 3DVH



Hospital Reina Sofia

Plan: MAI 3330645  
 Structure Set: MAI 3330645  
 Dose (Reference): MAI 3330645/RTDose  
 Dose (Comparison): MAI 3330645/ACPPD  
 Report Generated: 05/09/2012 12:42:47  
 Reviewed by:



ROI Name	Volume (cc)	Quick Stat	Unit	Reference	Comparison	Diff (Abs / %)
OR Med Espinal	7.425	Mean	Gy	24.927	24.360	-0.567 Gy / -2.273%
OR Med Espinal	7.425	Max	Gy	36.305	37.206	0.901 Gy / 2.482%
OR Med Espinal	7.425	D50%	Gy	28.105	27.255	-0.850 Gy / -3.024%
OR Med Espinal	7.425	V45Gy	%vol	0.000	0.000	0.000 %vol / 0.000%
PRV medula	25.083	Mean	Gy	25.418	24.941	-0.477 Gy / -1.878%
PRV medula	25.083	Max	Gy	43.792	44.244	0.452 Gy / 1.032%
PRV medula	25.083	D50%	Gy	28.625	28.085	-0.560 Gy / -1.956%
PRV medula	25.083	V45Gy	%vol	0.000	0.000	0.000 %vol / 0.000%
OR Parotida D	28.620	Mean	Gy	27.785	29.093	1.308 Gy / 4.708%
OR Parotida D	28.620	Max	Gy	64.624	67.962	2.939 Gy / 4.547%
OR Parotida D	28.620	D50%	Gy	22.250	23.120	0.870 Gy / 3.910%
OR Parotida D	28.620	V30Gy	%vol	37.736	39.151	1.415 %vol / 3.750%
OR Parotida I	38.232	Mean	Gy	28.689	28.785	0.096 Gy / 0.334%
OR Parotida I	38.232	Max	Gy	68.843	72.057	3.114 Gy / 4.517%
OR Parotida I	38.232	D50%	Gy	23.880	23.110	-0.770 Gy / -3.224%
OR Parotida I	38.232	V30Gy	%vol	40.184	39.477	-0.706 %vol / -1.757%
PTV1	531.144	Mean	Gy	63.207	65.050	1.843 Gy / 2.916%
PTV1	531.144	Max	Gy	77.299	79.573	2.275 Gy / 2.943%
PTV1	531.144	D98%	Gy	52.938	53.937	0.999 Gy / 1.888%
PTV1	531.144	D2%	Gy	73.592	75.697	2.105 Gy / 2.861%
PTV1	531.144	V53.2Gy	%vol	97.336	99.212	1.876 %vol / 1.927%
PTV1	531.144	V59.92Gy	%vol	89.027	77.125	-8.098 %vol / -11.731%
PTV2	365.364	Mean	Gy	66.119	68.053	1.944 Gy / 2.940%
PTV2	365.364	Max	Gy	77.299	79.573	2.275 Gy / 2.943%
PTV2	365.364	D98%	Gy	58.839	60.384	1.545 Gy / 2.625%
PTV2	365.364	D2%	Gy	73.915	76.203	2.289 Gy / 3.097%
PTV2	365.364	V59.85Gy	%vol	94.687	98.936	4.249 %vol / 4.488%
PTV2	365.364	V67.41Gy	%vol	39.876	53.392	13.516 %vol / 33.895%
PTV3	135.783	Mean	Gy	69.966	71.981	2.014 Gy / 2.879%
PTV3	135.783	Max	Gy	77.299	79.573	2.275 Gy / 2.943%
PTV3	135.783	D98%	Gy	65.626	67.323	1.697 Gy / 2.586%
PTV3	135.783	D2%	Gy	74.621	77.001	2.380 Gy / 3.190%
PTV3	135.783	V68.03Gy	%vol	93.577	99.443	5.866 %vol / 6.268%
PTV3	135.783	V74.9Gy	%vol	1.332	12.567	11.235 %vol / 843.282%



Hospital Reina Sofia

Plan: M LUIS /AN 5  
 Structure Set: M LUIS /AN 5  
 Dose (Reference): M LUIS /AN 5/RTDose  
 Dose (Comparison): M LUIS /AN 5/ACPPD  
 Report Generated: 05/09/2012 12:42:49  
 Reviewed by:

