

# Code of practice: Create a verification plan for OCTAVIUS Detector 729 in Philips Pinnacle<sup>3</sup>

There are basically three ways to carry out verification of IMRT fluences.

For all options, it is important that the IMRT plan is calculated as sum total plan or single fraction plan.

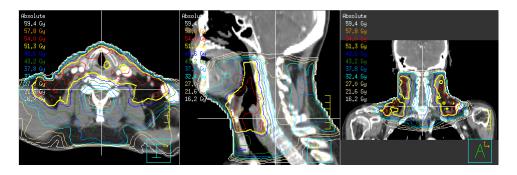


Fig. 1: 3D Isodose image

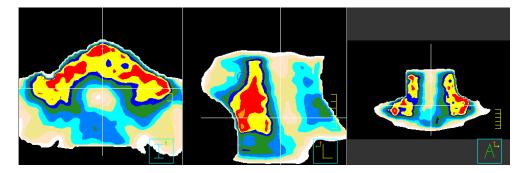


Fig. 2: 3D Isodose image in the calculation matrix

Trial_1	Machine Orientation	Collimation Modifiers	Viewing Window [9]
Current Name	Dose Engine Dose Status	Prescription MU/Fraction	File Options Global 2D Help It
			<u>2</u> D <u>3</u> D
◆ G0	Adaptive Convolve = Computed Cone	PTVad54 💷 [170.4	
	Adaptive Convolve 🖃 Computed Done	PTVad54 💴 🕺 47.5	
	Adaptive Convolve = Computed Done	PTVad54 💷 🛛 66.1	
	Adaptive Convolve = Computed Done	PTVad54	
	Adaptive Convolve = Computed Cone	PTVad54	
↓ G280	Adaptive Convolve = Computed Cone	PTVad54 💷 🗍 95.4	
	Adaptive Convolve - Computed	PTVad54	

Fig. 3: e.g., 7-Field HNO Technique (here: Adaptive Convolve Dose-engine)



## 1. Single field fluence verification.

The planar dose module is selected from the planning window of the current patient:

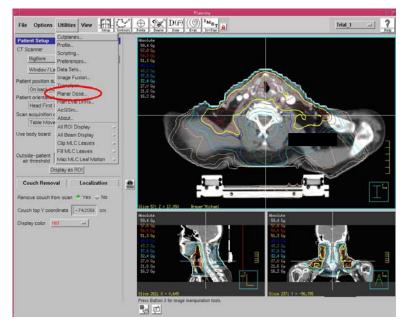


Fig. 4: Planning Window (locating the planar dose module)

-1				Planar I	lose Computatio	n		1
Trial 1	irial_1	-						
		No dose p	ianes exist.			Export Planar Dose Directory: [/home/p3rtp File name: [ Format: ◇ ASCII ◆ Export.Plane.To File Export.Plane.To File Export.All Planes To Fil Print Window Scale [1 Print DICOM Print_	1	Prowse
Pla	nes	Dose			Add Pl	ane Delete Plane	Add Plane Per	Beam Elelete All
urrent	Name	Beam	Couch	Gantry Start Stop	Beam SSD (cm)	SPD (cm)	SSD (cm)	
Dismiss								Help

Fig. 5 Planar Dose Module

When you select "Add Plane per Beam", a 2D calculation plane is created at a distance (SourcePhantomDistance=SPD). This is orthogonal to the gantry angle of the respective field.



- Planar Dose Computation / F					
Trial Trial_1					
	Export Planar Dose     Directory:     i/home/p3rtp     Browse     File name:     i     Format:				
Planes Dose Add P Gantry Beam	Iane Delete Plane Add Plane Per Beam Delete All SPD + SSD				
Current Name Beam Couch Start Stop SSD (cm)	(cm) (cm)				
◆ [DosePlane_1 G0 - ] 0 ] 0 ] 0 93.00	Phantom - 100 100				
↓     DosePlane_2     G40     I     0     I     40     I     40     94.16       ↓     DosePlane_3     G80     I     0     I     80     94.12	Phantom     100     100       Phantom     100     100				
	Phantom - 1100 1100				
Dismiss	Help				

Fig. 6: after "Add Plane per Beam"; practicable: Phantom Data Set and SPD=100 cm

The resolution of the planar dose can be set in the "Dose" tab.

A good value from past experience is half the grid resolution of the patient calculation (e.g., grid size = 4 mm -> resolution selected = 2 mm). The number of calculation points should be considered in this, and it is oriented to the type of further processing.

- Planar Dose Computation / F				
Trial_1				
Export Planar Dose     Directory:     //home/3/tp/PlanarDose     Browse     File name:     (SA-IMBT     Format: ◇ ASCII ◆ Binary     Export Plane To File     Print Window     Scale [1]     Print Using 1:1 Scale     DICOM Print				
Planes Dose Add Plane Delete Plane Add Plane Per Beam Delete All				
Resolution Dimension Current Name (cm) X Y Dose Units Color Dose Status				
DosePlane_1 DosePlane				
◇ [DosePlane_2] [ 0.200 [ 142 [ 135 Gy/MU inverse_grey → Computed Compute File Input]				
DosePlane_3 0200 140 50 Gy/MU Inverse_grey Computed Computes File Input_				
DosePlane_4 D200 I 140 I 145 Gy/MU Inverse_grey Computed Compute File Input_ J				
Dismiss				

Fig. 7: Calculated Planar Dose



Then this can be written in ASCII or binary format in a suitable directory. Use of an FTP server is recommended for a more efficient workflow.

The generation of the plan dose information represents the fastest way to generate absolute dose fluences for a single-field QA. These can be compared relatively using the VeriSoft software after measurement with the 2D-Array in the gantry head bracket (cf. Fig. 8).

The quantitative statement with respect to the absolute dose of the respective single field is rather poor due to the calculation of a virtual water phantom, but sometimes it can be useful.

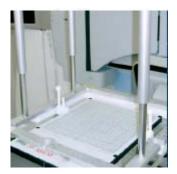


Fig. 8: Gantry head bracket with 2D-Array (aligned on the measurement level = SSD = 100 cm; Approx. 4cm of setup material is missing)

After evaluation of the relative IMRT method using single-field QA, the two other methods "Sum Total Plan Verification" are the means of choice.

### 2. Sum Total Plan Verification

We look at the planar sum-total-plan verification in the CT scanned phantom data set. (2D-ARRAY *seven29* in a slab phantom or in the OCTAVIUS phantom).

In the "Patient Select" tab copy the calculated IMRT plan onto the phantom.

	racier	t Select		
Site: Institution: GP für Strahlentherapie, V8.0k+	-8.0m, Virchowstr.10b, S	ingen:Hohentwie	l, Baden-Wuerttemberg, 782	24, Deutschland
Patients Last Name First Name	Middle	MRN		
Lastivarie Firstivarie	Ivildale		Radiation Oncologist	Last Modified
QA Tools	1	002177	Doku ok	2008-12-18 09:04:48
		003731	Doku OK	2008-12-18 09:04:58
hantom Tools		003732	Doku OK	2008-12-18 09:04:52
		004430	Doku OK	2008-12-18 09:04:56
Copy to Phantom 🚺 Delete Phantom	Save as Phantom	007429	Doku OK	2008-12-18 09:04:58
		003004	Doku OK	2008-12-18 09:04:50
		007577	Daku OK Daku OK	2008-12-18 09:04:58
smiss	Help	005276	Daku OK Daku OK	2008-12-18 09:04:54
L U.S. News		003761	Daku OK Daku OK	2008-12-18 09:04:56 2008-12-18 09:04:52
Hile Name:		003781	Daku OK	2008-12-18 09:04:52
20x20*0A-2D-Array, beader 20x20*0A-D-Array, beader 20x20*0A-PhantomRW3.header 3cm-Siab-2D-Array, beader 3cm-Siab-Bauchlage.header Array*inhomogen.header Car*Blue.header Krieger*Phantom.header Prostate_94.header	Images] Conce	at Images	Sort by Pe The plan was locked with user name p3rt at 2008–02–01 16:19	p
Import	iption.		Fusion   Planning	

Fig. 9: Copy to Phantom ....

The phantom data set should be generated beforehand with the CT scanner (incl. setting the isocenter to the volume middle of the chamber 14/14, (7.5 mm from the surface of the array). When the plan is accessed for the first time, the plan isocenter is synchronized to the phantom data record isocenter.



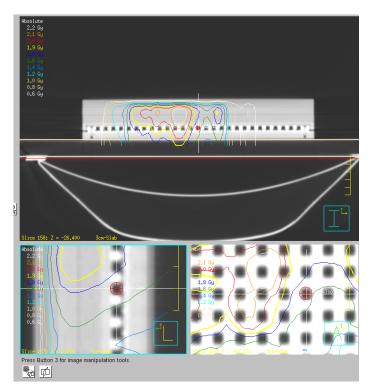


Fig. 10: Iso placement on the desired (meaningful) position

In addition, you should set the calculation grid and couch-removal plane. All the gantry angles are to be set to 0°(not for composite plan). We recommend formulating the prescription in the overall MUs and for only one fraction.

File Options	Localize Windows	Dose Grid Dose Disp Prescrip Blacks		Edit Prescription
Trial_1	-	Machine Orientation	Collimation Modifiers	Prescriptions for trial: Trial_1
Current Name	Dose Engine	Dose Status	Prescription MU/Fraction	
🗢 🔽	Adaptive Convolve	Computed Cione	PTVad54	Monitor Units: 729.5
	Adaptive Convolve	Computed Lione	PTVad54 - 49.9	
	Adaptive Convolve	Computed Lione	PTVad54 = 69.5	
	Adaptive Convolve	Computed Lione	PTVad54 = 169.9	
	Adaptive Convolve	Computed Lione	PTVad54 = 53.4	
🕹 🔂	Adaptive Convolve	Computed Lione	PTVad54 = 100.1	Nuclear differentiance To
🕹 <mark>G320</mark>	Adaptive Convolve	Computed Lione	PTVad54 = 107.8	Number of Fractions:
				Dismiss

Fig. 11: Pay attention to the agreement of the Monitor Units with the R&V system.

The planar dose function is accessed analog to Fig. 4-5. Contrary to Fig. 6, "Add plane" is used this time. Set "Primary Data" and "Sample Trial" in SPD=100 cm.



Planar Dose Computation r					
Trial Trial_1					
	Export Planar Dose Directory: [/home/p3rts/PlanarDose/B Browse File name: [/FHNO.asc Format ASCII & Binary Export Plane To File Export Plane To File Print Window Scale [1 Print Using 1:1 Scale DICOM Print: Preview DICOM Print				
Planes Dose Add Planes Add Planes	ane Delete Plane Add Plane Per Beam Delete All				
Gantry Beam Current Name Beam Couch Start Stop SSD.(cm)	SPD SSD (em) (em)				
◆ [DosePlane_1 G0 - ] 0 [ 0 ] 0 96.30	Primary data NA Sample trial				

Fig. 12: Locating the "Primary data" and "Sample trial" parameters

As a result, a sum total matrix fluence is generated at a distance of 100 cm. Then this can be validated by radiating all IMRT fields on the "head-mounted" 2D-Array using the VeriSoft software. (Instead of the head mounted 2D-Array you can deliver the plan also to the OCTAVIUS phantom)

(Note: If you want fluence for validation with film in an axial direction, the angle of view of the dose matrix is attained using a gantry= table-iso=90° field)

Otherwise, proceed analog to the description above.

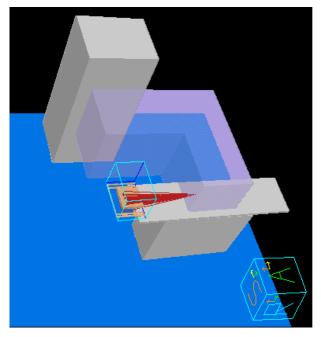


Fig. 13: RoomsEyeView virtual beam



Then this can be written in ASCII or binary format in a suitable directory. Use of an FTP server is recommended for a more efficient workflow.

#### 3. Data Analysis in VeriSoft

Load the ".header" file in VeriSoft. The ".header" file must be in the same directory as the ".image" file. Depending on the Pinnacle version it might be necessary to rotate the file 180°. For absolute dose comparison you have to change the unit from "unknown" into "Gy"

In VeriSoft 4.0 or higher you can program a batch for these two steps.

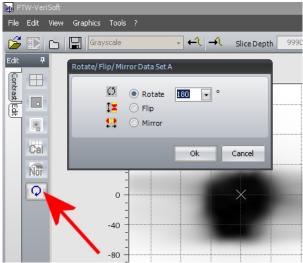


Fig. 14: Rotate in the TPS data



Fig. 15: Calibrate the TPS data Now you can analyze the data in VeriSoft.



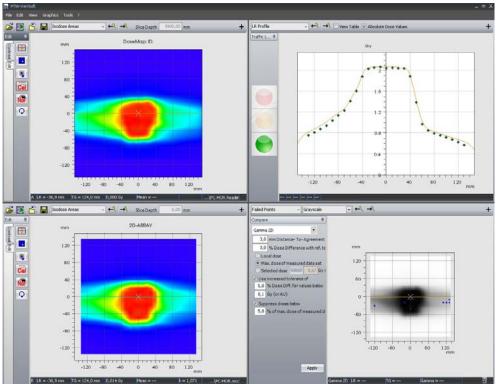


Fig. 16: Analyze the data in VeriSoft

Thank you to Holger Wirtz, STZ Singen, Germany, who provided this information.

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