User Guide for Varian Medical Systems BrachyVisionTM Algorithm Testing

Breast case

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I Introduction

The American Association of Physicists in Medicine (AAPM) Task Group 186 report [1] provided general guidance for early adopters of model-based dose calculation algorithms (MBDCAs) for brachytherapy (BT) treatment planning. The report's aim was to facilitate uniformity of clinical practice. Among its recommendations was a two-level approach to commissioning MBDCAs embedded in BT treatment planning systems (TPSs) insofar as specific tasks relating to the dose calculation algorithm are concerned. In commissioning level 1, the clinical physicist should assess agreement of MBDCA TPS-derived absolute dose or dose rate with the dose or dose rate obtained in the TPS using AAPM-recommended consensus TG-43 dosimetry parameters for a given BT source model. In commissioning level 2, the physicist should compare 3D dose distributions

calculated with the MBDCA-based TPS for specific virtual phantoms mimicking clinical scenarios against benchmark dose distributions derived independently from the same phantom geometries.

The AAPM Working Group on Dose Calculation Algorithms in Brachytherapy (WG-DCAB) [2] was created to facilitate implementation of the recommendations for MBDCA commissioning made in the TG-186 report. One of its charges is to develop a small number of virtual phantoms and corresponding benchmark dose distributions for use in level 1 and 2 commissioning of high dose rate (HDR) Ir-192 BT sources. These sources can be dealt with collectively by virtue of their similar photon emission properties, and therefore the WG-DCAB has designated a generic HDR Ir-192 virtual source for the purpose of MBDCA commissioning [3]. At present, this source model has been implemented by two MBDCA-based TPS vendors and hence is available to test the commissioning process described in the TG-186 report.

This user manual provides guidelines for level 2 testing of the Varian Medical Systems BrachyVisionTM Algorithm with a test case mimicking a clinical scenario of interstitial HDR breast BT.

The breast test case comprises:

- a computational patient phantom model in Digital Imaging and Communications in Medicine (DICOM) format,
- a treatment plan for the model using the WG generic HDR ¹⁹²Ir source including the corresponding reference TPS dose distribution obtained with BrachyVision,
- a three-dimensional reference dose distribution calculated using Monte Carlo (MC) simulation in the model, using information parsed from the treatment plan exported from the TPS in DICOM radiation therapy (RT) format.

The patient phantom model was prepared based on a representative Accelerated Partial Breast Irradiation (APBI) case [4]. Regions of interest (ROIs) including the external contour, the planning target volume (PTV) mimicking the original left-sided lesion, the lungs, the skin, the heart, and the ribs, were contoured and digitized on the axial patient CT images. A uniform density was assigned to these ROIs using nominal data in the ICRU report No. 46 [5] and the model was written to a series of DICOM CT images. The central axial image of the model is presented in Figure 1. More details on the test case can be found in a corresponding Medical Physics dataset article ("A

test case for commissioning model-based dose calculation in interstitial HDR breast brachytherapy").



Figure 1. Central axial image of the computational patient phantom model

These guidelines follow the recommendations in "Commissioning of Model-Based Dose Calculation Algorithms in Brachytherapy: A Joint AAPM, ESTRO, ABG, and ABS Report" which was at the final stage of review at the time of writing.

In overview, the testing process involves downloading the breast test case treatment plan and the associated reference MC dose distribution and importing them into BrachyVision (Sec. II), locally calculating a dose distribution using the BrachyVision algorithm of the TPS (Sec. III), and then (Sec. IV) comparing the locally calculated and reference TPS dose distributions (TPS validation phase) as well as the locally calculated TPS and reference MC dose distributions (MBDCA validation phase).

II Case Import breast case

A. Accessing the Test Case Repository

Data for the breast test cases will be made available via a web-accessible repository located at: https://doi.org/10.52519/00005 (click on "Link to full text")

Model-Based Dose Calculations

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AAPM Publications	3 rd Party Checks	Disclaimer
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User Guide		
Reference MC		
Reference TPS		
MC input files		
All data as a single file	2	
Elekta ›		

The main page contains links to Reference Data generated using the MC code EGS, and to TPS-specific data for Elekta and Varian users.

B. Downloading Test Case

Select the "Breast test case" then Varian (as highlighted in the figure above) to see the database files. The user can download each file individually or download all data as a single file.

The file "varian.zip" (this is the file name when all data is downloaded as a single file) contains three folders. 1) MC files (MCNP6 and EGS simulation files); 2) Reference MC – 43 DICOM files including a 3D reference radiotherapy dose (RD) matrix calculated using EGS Monte Carlo simulation. 3) Reference TPS - 43 DICOM files including a 3D reference radiotherapy dose (RD) matrix calculated using ACUROS. The DICOM files also include a radiotherapy plan (RP), and a radiotherapy structure set (RS) for both MC and TPS folders.

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Extract all files from the test case .zip folder to a local or network folder accessible to the BrachyVision workstation.

C. Importing Test Case into BrachyVision

The description below might slightly deviate for different versions of BrachyVision.

- Open BrachyVision
- Click on the 'File \rightarrow Import '.

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	Exit	

• The import of the test case will occur in two steps, firstly importing the pre-calculated ACUROS plan & dose and then importing the reference MC dose.



- Click the button and browse to the folder containing the unzipped test case, '...\Reference TPS\'.
- The system will display a list of CT Image data, RT Plan, RT Structure Set and RT Dose.
- Select all files then click on 💿 so the system will read and validate the data ready for import.

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- Confirm the test case information (do not adjust the information to avoid issues while importing the MC dose files) and press
- Then the 'Log Details' window appears with a message: "DVH import is not supported histogram(s) will be skipped". In some cases a message 'Source TG-186 was matched to a source model that is not approved.' can appear. Click Yes to continue.
- Click **o** to finalize the import.
- The plan opens when the import is complete.



• Right-click on the plan name, select properties and confirm the dose per fraction (4.30 Gy) and the number of fractions (1). If it is not correct, adjust the values.

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To import the reference MC dose file follow the next steps:

- Click the 'File → Import' button again and select the folder containing the unzipped test case with the MC data files, '...\Reference MC\'.
- <u>The system will display a list of CT Image data, 'RT Dose' and 'RT Plan' and 'RT Structure</u>
 <u>Set'</u>
- Select the 'RT Dose' and 'RT Plan' and 'RT Structure Set'. Click the 📀 and the system will read and validate the data ready for import and find an exactly matching patient.

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The same 'Log Details' window appears with the message: "DVH import is not supported - histogram(s) will be skipped". In some cases a message 'Source TG-186 was matched to a source model that is not approved.' can appear. Click Yes to continue.

• If an error appears indicating the dose has a reference to an invalid plan, select the Plan ID =>

"EGS_Brachy (C1)" and proceed

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The data for Breast Case has been imported.



A local working copy of the ACUROS plan will now be created for the local user to calculate the dose which will be then used for comparison with the reference EGS_Brachy dose.

• Select the 'ACUROS_Dmm' plan, right-click on it and select the 'Copy Plan' option.

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- Select the 'ACUROS_Dmm' plan, right-click on it and select the 'Paste Plan' option.
- The 'Plan Properties' window opens.
- Enter 'LocalUser' in the ID field, 'LocalUser' in the Name field and Click . Confirm the dose per fraction and number of fractions.

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The import process and local plan creation are complete.

• Click 'Save all' (shortcut "CTRL + S").

III Dose Calculation

A. Confirming the Plan Properties

Note BrachyVision supports standard, IEC-61217 and user-defined coordinate systems. Therefore, the axes might be swapped (see section IV) but it does not require any adjustments or affect the results. The user should not change the configuration of BrachyVision, but be aware of the adopted coordinate system.

- Right-click on 'LocalUser' plan and -> 'Drop to view'.
- Select 'Window -> Brief Report Window'.

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Position [cm] Time [s] Position [cm] Time [s] Position [cm] Time [s] Applicator: Applica Channel Length: 1 Position [cm] Time [s]	30.00 cm, De 130.00 0.0 125.00 0.0 120.00 0.0 ator2, Chann 30.00 cm, De 130.00	129.50 0.0 124.50 0.0 119.50 0.0 el: 2, Sour ad Space 129.50	129.00 0.0 124.00 2.4 119.00 0.0 ce Model Length: - 129.00	0.0 123.50 2.7 118.50 0.0 TG-186 (128.50	128.00 0.0 123.00 3.2 (2015), Tx 128.00	127.50 0.0 122.50 2.5 Strength 127.50	127.00 0.0 122.00 3.1	126.50 0.0 121.50 3.0 0 cGy cm ² 126.50	126.00 0.0 121.00 4.3 / h (nom 126.00	125.50 0.0 120.50 0.0 inal) 125.50		
Position [cm] Time [s] Position [cm] Time [s] Position [cm] Time [s] Applicator: Applicat Channel Length: 1 Position [cm] Time [s] Position [cm]	30.00 cm, De 130.00 0.0 125.00 0.0 120.00 0.0 ator2, Chann 30.00 cm, De 130.00 0.0	129.50 0.0 124.50 0.0 119.50 0.0 el: 2, Sour ad Space 129.50 0.0	129.00 0.0 124.00 2.4 119.00 0.0 ce Model Length: - 129.00 0.0 124.00	0.0 123.50 2.7 118.50 0.0 TG-186 (128.50 0.0	128.00 0.0 123.00 3.2 (2015), Tx 128.00 0.0	127.50 0.0 122.50 2.5 Strength 127.50 0.0	127.00 0.0 122.00 3.1 : 40700.00 127.00 0.0	126.50 0.0 121.50 3.0 0 cGy cm ² 126.50 0.0	126.00 0.0 121.00 4.3 / h (nom 126.00 0.0	125.50 0.0 120.50 0.0 inal) 125.50 2.4		
Position [cm] Time [s] Position [cm] Time [s] Position [cm] Time [s] Applicator: Applica Channel Length: 1 Position [cm] Time [s] Position [cm] Time [s]	30.00 cm, De 130.00 0.0 125.00 0.0 120.00 0.0 ator2, Chann 30.00 cm, De 130.00 0.0 125.00 1.5	129.50 0.0 124.50 0.0 119.50 0.0 el: 2, Sour ad Space 129.50 0.0 124.50 1.1	125.00 0.0 124.00 2.4 119.00 0.0 ce Model Length: - 129.00 0.0 124.00 1.0	0.0 123.50 2.7 118.50 0.0 TG-186 128.50 0.0 123.50 1.5	128.00 0.0 123.00 3.2 (2015), Tx 128.00 0.0 123.00 1.6	127.50 0.0 122.50 2.5 Strength 127.50 0.0 122.50	127.00 0.0 122.00 3.1 40700.00 127.00 0.0 122.00	126.50 0.0 121.50 3.0 0 cGy cm ² 126.50 0.0 121.50	126.00 0.0 121.00 4.3 / h (nom 126.00 0.0 121.00	125.50 0.0 120.50 0.0 inal) 125.50 2.4 120.50	\2*	
Position [cm] Time [s] Position [cm] Time [s] Position [cm] Time [s] Applicator: Applicat Channel Length: 1 Position [cm] Time [s] Position [cm] Position [cm]	30.00 cm, De 130.00 0.0 125.00 0.0 120.00 0.0 ator2, Chann 30.00 cm, De 130.00 0.0 125.00 1.5 120.00	129.50 0.0 124.50 0.0 119.50 0.0 et: 2, Sour ad Space 129.50 0.0 124.50 1.1 119.50	129.00 0.0 124.00 2.4 119.00 0.0 ce Model Length: - 129.00 0.0 124.00 1.0 119.00	0.0 123.50 2.7 118.50 0.0 TG-186 128.50 0.0 123.50 1.5 118.50	128.00 0.0 123.00 3.2 (2015), Tx 128.00 0.0 123.00 1.6 118.00	127.50 0.0 122.50 2.5 Strength 127.50 0.0 122.50	127.00 0.0 122.00 3.1 40700.00 127.00 0.0 122.00	126.50 0.0 121.50 3.0 0 cGy cm ² 126.50 0.0 121.50	126.00 0.0 121.00 4.3 / h (nom 126.00 0.0 121.00	125.50 0.0 120.50 0.0 inal) 125.50 2.4 120.50	_2	
Position [cm] Time [s] Position [cm] Time [s] Position [cm] Time [s] Applicator: Applica Channel Length: 1 Position [cm] Time [s] Position [cm] Time [s]	30.00 cm, De 130.00 0.0 125.00 0.0 120.00 0.0 ator2, Chann 30.00 cm, De 130.00 0.0 125.00 1.5	129.50 0.0 124.50 0.0 119.50 0.0 el: 2, Sour ad Space 129.50 0.0 124.50 1.1	125.00 0.0 124.00 2.4 119.00 0.0 ce Model Length: - 129.00 0.0 124.00 1.0	0.0 123.50 2.7 118.50 0.0 TG-186 128.50 0.0 123.50 1.5	128.00 0.0 123.00 3.2 (2015), Tx 128.00 0.0 123.00 1.6	127.50 0.0 122.50 2.5 Strength 127.50 0.0 122.50	127.00 0.0 122.00 3.1 40700.00 127.00 0.0 122.00	126.50 0.0 121.50 3.0 0 cGy cm ² 126.50 0.0 121.50	126.00 0.0 121.00 4.3 / h (nom 126.00 0.0 121.00	125.50 0.0 120.50 0.0 inal) 125.50 2.4 120.50	_2	
Position [cm] Time [s] Position [cm] Time [s] Applicator: Applicat Channel Length: 1 Position [cm] Time [s] Position [cm] Time [s] Position [cm] Time [s] Applicator: Applicat	30.00 cm, De 130.00 0,0 125.00 0,0 120.00 0,0 ator2, Chann 30.00 cm, De 130.00 1,5 120.00 0,0 1,5 120.00 0,0 1,5 120.00 0,0	129.50 0.0 124.50 0.0 119.50 0.0 et: 2, Sour ad Space 129.50 0.0 124.50 1.1 119.50 0.0 et: 3, Sour	129.00 0.0 124.00 2.4 119.00 0.0 ce Model Length: - 129.00 0.0 124.00 1.0 119.00 0.0 ce Model	0.0 123.50 2.7 118.50 0.0 128.50 0.0 123.50 1.5 118.50 0.0	128.00 0.0 123.00 3.2 (2015), Tx 128.00 0.0 123.00 1.6 118.00 0.0	127.50 0.0 122.50 2.5 Strength 127.50 0.0 122.50 1.1	127.00 0.0 122.00 3.1 40700.00 127.00 0.0 122.00 1.2	126.50 0.0 121.50 3.0 0 eGy cm ² 126.50 0.0 121.50 1.0	126.00 0.0 121.00 4.3 / h (nom 126.00 0.0 121.00 2.8	125.50 0.0 120.50 0.0 inal) 125.50 2.4 120.50 4.6	_2	
Position [cm] Time [s] Position [cm] Time [s] Position [cm] Time [s] Applicator: Applica Channel Length: 1 Position [cm] Time [s] Position [cm] Time [s] Applicator: Applica Channel Length: 1	30.00 cm, De 130.00 0.0 125.00 125.00 120.00 120.00 120.00 130.00 cm, De 130.00 1.5 120.00 0.0 1.5 120.00 1.5 120.00 1.5 120.00 1.5 120.00 1.5 120.00 1.5 120.00 1.5 120.00 1.5 120.00 1.5 120.00 1.5 120.00 1.5 120.00 1.5 120.00 1.5 120.00 1.5 120.00 1.5 120.00 1.5 120.00 1.5 1.5 120.00 1.5 120.00 1.5 1.5 120.00 1.5 1.5 120.00 1.5 120.00 1.5 1.5 120.00 1.5 1.5 120.00 1.5 1.5 120.00 1.5 1.5 120.00 1.5 1.5 120.00 1.5 120.00 1.5 1.5 120.00 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5	129.50 0.0 124.50 0.0 119.50 0.0 et: 2, Sour ad Space 129.50 0.0 124.50 1.1 119.50 0.0 et: 3, Sour ad Space	129.00 0.0 124.00 2.4 119.00 0.0 ce Model Length: - 129.00 0.0 124.00 1.0 119.00 0.0 ce Model Length: -	0.0 123.50 2.7 118.50 0.0 TG-186 128.50 0.0 123.50 1.5 118.50 0.0 TG-186 (.5 .5 .5 .5 .5 .5 .5 .5 .5 .5	128.00 0.0 123.00 3.2 (2015), Tx 128.00 0.0 123.00 1.6 118.00 0.0 (2015), Tx	127.50 0.0 122.50 2.5 Strength 127.50 0.0 122.50 1.1 Strength	127.00 0.0 122.00 3.1 40700.00 127.00 0.0 122.00 1.2	126.50 0.0 121.50 3.0 cGy cm ² 126.50 0.0 121.50 1.0	126.00 0.0 121.00 4.3 / h (nomi 126.00 0.0 121.00 2.8	125.50 0.0 120.50 0.0 inal) 125.50 2.4 120.50 4.6 inal)		
Position [cm] Time [s] Position [cm] Time [s] Position [cm] Time [s] Position [cm] Time [s] Position [cm] Time [s] Applicator: Applica Channel Length: 1 Position [cm] Applicator: Applica Channel Length: 1 Position [cm]	30.00 cm, De 130.00 0.0 125.00 0.0 120.00 0.0 120.00 0.0 120.00 0.0 130.00 0.0 125.00 1.5 120.00 0.0 125.00 1.5 120.00 0.0 125.00 1.5 120.00 0.0 125.00 0.0 125.00 0.0 125.00 0.0 125.00 0.0 125.00 0.0 125.00 0.0 125.00 0.0 125.00 0.0 125.00 0.0 125.00 0.0 120.00 0.0 125.00 1.5 120.00 0.0 125.00 1.5 120.00 0.0 125.00 1.5 120.00 0.0 125.00 1.5 120.00 0.0 125.00 1.5 120.00 0.0 125.00 1.5 120.00 0.0 125.00 1.5 120.00 0.0 125.00 1.5 120.00 0.0 130.00 1.5 120.00 0.0 130.00 1.5 120.00 0.0 130.00 1.5 120.00 0.0 130.00 1.5 120.00 0.0 130.00 130.	129.50 0.0 124.50 0.0 119.50 0.0 129.50 0.0 124.50 1.1 119.50 0.0 124.50 1.1 119.50 0.0 1.2 4.50 1.1 119.50 0.0 1.2 4.50 1.50 1.50 1.50 1.50 1.50 1.50 1.50 1	129.00 0.0 124.00 2.4 119.00 0.0 129.00 0.0 124.00 1.0 119.00 0.0 124.00 1.0 119.00 0.0 1.0 1.0 1.0 0.0 0.0 0.0	0.0 123.50 2.7 118.50 0.0 TG-186 (128.50 0.0 123.50 1.5 118.50 0.0 123.50 1.5 118.50 0.0 123.50 1.5 118.50 0.0 1.5 118.50 0.0 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5	128.00 0.0 123.00 3.2 (2015), Tx 128.00 0.0 123.00 1.6 118.00 0.0 (2015), Tx 128.00	127.50 0.0 122.50 2.5 Strength 127.50 0.0 122.50 1.1 Strength 127.50	127.00 0.0 122.00 3.1 40700.00 127.00 1.2 40700.00 1.2	126.50 0.0 121.50 3.0 0 cGy cm ² 126.50 0.0 121.50 1.0	126.00 0.0 121.00 4.3 / h (nom 126.00 0.0 121.00 2.8 / h (nom 126.00	125.50 0.0 120.50 0.0 inal) 125.50 2.4 120.50 4.6 inal) 125.50		
Position [cm] Time [s] Position [cm] Time [s] Position [cm] Time [s] Applicator: Applica Channel Length: 1 Position [cm] Time [s] Position [cm] Time [s] Applicator: Applica Channel Length: 1	30.00 cm, De 130.00 0.0 125.00 125.00 120.00 120.00 120.00 130.00 cm, De 130.00 1.5 120.00 0.0 1.5 120.00 1.5 120.00 1.5 120.00 1.5 120.00 1.5 120.00 1.5 120.00 1.5 120.00 1.5 120.00 1.5 120.00 1.5 120.00 1.5 120.00 1.5 120.00 1.5 120.00 1.5 120.00 1.5 120.00 1.5 120.00 1.5 1.5 120.00 1.5 120.00 1.5 1.5 120.00 1.5 1.5 120.00 1.5 120.00 1.5 1.5 120.00 1.5 1.5 120.00 1.5 1.5 120.00 1.5 1.5 120.00 1.5 1.5 120.00 1.5 120.00 1.5 1.5 120.00 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5	129.50 0.0 124.50 0.0 119.50 0.0 et: 2, Sour ad Space 129.50 0.0 124.50 1.1 119.50 0.0 et: 3, Sour ad Space	129.00 0.0 124.00 2.4 119.00 0.0 ce Model Length: - 129.00 0.0 124.00 1.0 119.00 0.0 ce Model Length: -	0.0 123.50 2.7 118.50 0.0 TG-186 128.50 0.0 123.50 1.5 118.50 0.0 TG-186 (.5 .5 .5 .5 .5 .5 .5 .5 .5 .5	128.00 0.0 123.00 3.2 (2015), Tx 128.00 0.0 123.00 1.6 118.00 0.0 (2015), Tx	127.50 0.0 122.50 2.5 Strength 127.50 0.0 122.50 1.1 Strength	127.00 0.0 122.00 3.1 40700.00 127.00 0.0 122.00 1.2	126.50 0.0 121.50 3.0 eGy cm ² 126.50 0.0 121.50 1.0	126.00 0.0 121.00 4.3 / h (nomi 126.00 0.0 121.00 2.8	125.50 0.0 120.50 0.0 inal) 125.50 2.4 120.50 4.6 inal)	4	

- Check, if the Total prescription (4.3 Gy in 1 fraction), Source nominal activity (10000 mCi) and Total treatment time (173.60 s) are correct.
- Close the 'Brief Report' Window.
- Select the 'Dose', right-click on it and select 'Properties'. Confirm the 'Dose Matrix Properties' as shown below. Click ______. See section IV for additional information on the DICOM coordinates.

	oment Histor	TY I					
Identification							
1	D Dose						
DICOM U	D 1.2.246.352	.71.7.494841	1863751.427	928.202	206132047	43	
Comme	nt						
					[Series	5
Size		Resoluti	ion		Positio	n	
x	335 pixels	x	0.1000	cm	x	16.7974	cm
	241 pixels	Y	0.1000	cm	Y	-24.8500	cm
Y			0.4000	cm	z	-17.7452	cm
Y Z	120 planes	Z	0.1000 ~] cill			1

B. Performing the ACUROS Dose Calculation

The end-user will now perform a local model based dose calculation using the geometry defined by the selected case, overwriting any previous dose contained in the 'LocalUser' plan.

- To perform an ACUROS dose calculation, click the 🕅 button.
- Select a valid imaging device and press OK. See section V on how to add a specific CT calibration.

e image series is not connected to an imaging device defined	Select the imaging device:		
the system.	TG186Brachy ~		
Driginal imaging device	Selected imaging device		
Manufacturer: V. Peppa	Manufacturer: TG	186	
Model name:	Model name: CT	Scanner	
Device serial number:	Device serial number:		
The selected scanner does not match the original one. You should	create a		

• If an error about the material table appears, select and right-click on the structure set "CT_1" open the Properties menu then the select "Physical Material Table AcurosBV -13.0".

QuickLinks Breast Phantom With Target (6323)	Structure Set Properties —			
	General Summary Equipment History Comment			
ile Edit View Insert Planning Tools Window	ID CT_1			
୫67 ↔ i ⊿ыqq\$® ∰ ≍ 」 ≡ ₂				
Selection Contouring Image Registration External Beam Plan	Name			
- V Image 37 CocalUser - Un Isodose Levels Isodose Levels	Instance Number 1			
- ₩ Image 39 ₩ Image 40 ₩ 4.00 ₩ 4.00 ₩ 4.00	Referenced Image S / Series / CT_1			
- 🖬 C1	UID 1.2.246.352.71.4.494841863751.192949.20220613204739			
GORDS_Dmm GS_Brachy	Physical Material Table			
	Acuros8V-13.0			
	AcurosXB-10.0 AcurosXB-11.0 Referencing Plans AcurosXB-13.5			
✓ ✓ CT_1 Change Structure(s) Status to >	ID Approval Status Calculated DVH Estimates			
- B Delete	C1 / ACUROS_Dmm Unapproved Yes No			
Image: Construction Image: Construction Imag	C1 / LocalUser Unapproved No No			
Image: Second	OK Cancel Apply	Help		

 The ACUROS dose calculation window will appear. Confirm that for the calculation medium the 'CT values' are used and click Start Calculation button to begin the ACUROS calculation.

Calculation Medium	
③ CT values, max mass density:	Start Calculation
2.25 g/cm ⁸	Clear dose inside solid applicator(s)
🔿 Water	
Air	
Reporting Medium	
Medium.	N
O Water	Gr.
Information[Acuros] Origin : triton.lan Information[Acuros] Date : 20:38:06 02 Oct 2012 -04 Information[Acuros]	4:00Z
Information[Acuros] Date : 20:38:06 02 Oct 2012 -04 Information[Acuros] Information[Acuros] Reading point source data file Information[Acuros] Point source data read at 21:02:23	13 Jun 2022 +02:002 anr/RTM(16.1\Brachytherapy\acurosbrachy/data/sources/mbdcawg
information[Acuros] Date : 2038:06 02 Oct 2012 -04 information[Acuros] information[Acuros] Reading point source data file information[Acuros] Point source data read at 21:02:23 information[Acuros] Foit: source data read at 21:02:23 information[Acuros] Foit: molecowg_IHOR_in information[Acuros] Tele : molecowg_IHOR_in information[Acuros] Origin : trona.lan information[Acuros] Origin : trona.lan information[Acuros] Origin : trona.lan information[Acuros] Origin : trona.lan	13 Jun 2022 +02:002 anyRTM(16.1\Brachytherapy\acurosbrachy/data/sources/mbdcawg 002
Information[Acuros] Date : 20.38:06 02 Oct 2012 -04 Information[Acuros] Faeding point source data file Information[Acuros] Point source data read 21:02:23 Information[Acuros] File : 1:Chorgram Files (AB()Vari Information[Acuros] File : InbCarega POR]r Information[Acuros] Format : 1:0.0 Information[Acuros] Corgin : IntonIan Information[Acuros] Date : 20:38:13 19 Jul 2012 -04:	13 Jun 2022 +02:002 anyRTM(16.1\Brachytherapy\acurosbrachy/data/sources/mbdcawg 002
information[Acuros] Date : 2038:06 02 Oct 2012 -04 information[Acuros] information[Acuros] Reading point source data file information[Acuros] Point source data read at 21:02:23 information[Acuros] Foit: source data read at 21:02:23 information[Acuros] Foit: molecowg_IHOR_in information[Acuros] Tele : molecowg_IHOR_in information[Acuros] Origin : trona.lan information[Acuros] Origin : trona.lan information[Acuros] Origin : trona.lan information[Acuros] Origin : trona.lan	13 Jun 2022 +02:002 anyRTM(16.1\Brachytherapy\acurosbrachy/data/sources/mbdcawg 002
Information[Acuros] Date : 2038:06 02 Oct 2012 -04 Information[Acuros] Information[Acuros] Pent Source data File Information[Acuros] Pent Source data read at 21:02:23 Information[Acuros] File : C0;Program Files (x86)[\vari Information[Acuros] File : Indicang_JPOR_I ^{II} Information[Acuros] Format : 1.0.0 Information[Acuros] Date : 20:38:13 19 Jul 2012 -04; Information[Acuros] Date : 20:38:13 19 Jul 2012 -04; Information[Acuros] Date : 20:38:13 19 Jul 2012 -04; Information[Acuros] CT material assignment: ct_data with	13 Jun 2022 +02:202 anyRTM(16.1\Brachytherapy\acurosbrachy/data/sources/mbdcawg 002

• When the calculation is completed, a warning message appears.

Brachythe	erapy Planning	×
	Calculation completed with warnings. Warning[BV] Patient tissue and applicator materials beyond CT image boundary will be omitted from backscatter calculation. Please make sure this is acceptable.	
	С]

• Click or and close the calculation window. The display will be updated with isodoses for the ACUROS calculation. The display will also specify the calculation algorithm 'Transport in



medium. Dose to medium'.

Click 'Planning → Isodose Levels' to change the isodose line values and properly see the dose distribution. Click or Dose values exist inside the dose matrix defined. Click the button to see the dose matrix.

Scale All
Add to All
s as Template

Save the plan by clicking File \rightarrow 'Save All'

F.

The test case is ready for comparison as defined in section IV, Dose Distribution Comparison.

IV Dose Distribution Comparison

The breast test case is evaluated by using DVH parameters.

• To obtain a value from the DVH right-click in the 3D window and click 'Show Dose Volume Histogram View'.



- Increase the size of the 'Dose Volume Histogram' window to have a better view and select a reference contour (e.g. PTV)
- For evaluating DVH indices as described in the manuscript A test case for commissioning model-

based dose calculation in interstitial HDR breast brachytherapy use 'Show Cross-hair'



- In the figure above the D90 of PTV [%] is measured. For this, in the DVH the appropriate organ must be selected. Using the Cross-hair or entering D90% in the Dose Statistics tab gives a D90 of 90.5%.
- Proceed like this for all necessary DVH indices given in table V of the manuscript. Note that small differences (second decimal place) might be observed due to software version and/or settings.

V. BrachyVision coordinates

BrachyVision supports standard, IEC-61217, and user-defined coordinate systems as illustrated below. This user-guide adopted the standard coordinate system. Therefore, systems using the IEC-61217 coordinate system will display swapped Y and Z axes with inverted Z axis, in relation to the standard coordinate system. Note the user should not change the configuration of BrachyVision, but be aware of the adopted coordinate system.

The coordinate system can be checked in Aria/BrachyVision in Administration -> RT Administration. Press

System and Facilities. In the System Properties, the current Planning Coordinate System is shown.



VI. Adding a CT calibration

Please check the regulations and safety requirements of your institution before adding a new CT calibration since an incorrect imaging device selection can affect treatment planning calculations.

It is necessary to create a new "CT Scanner" for which admin rights will be required.

• Open the RT administration



• Select "New" then "New CT Scanner"



• Define the properties using a meaningful name and press OK.

🕎 CT Scanner Properties	—	o x
General CT Scanner Service	e History Description	
ID TG186_Brachy		
Name		
Machine Model	CTScanner	~
Machine Interface		~
Machine Scale		~
Manufacturer Name	TG186	
Serial No.		
Software Version		
Hardware Version		
Operation Status	Ready	~
Conn. Workstation	None	~
Console Character Set	Unicode in UTF-8 (ISO_IR 192)	~
OK Cancel		Help

• To add the CT calibration open "Treatment Planning" then "Beam Configuration"

My	Favorites		
Tasks ar	Categories		
Available	Administration	•	ted Cancelled
iroup By:	DICOM		y: Due Date 🔻 🕋 👤
	EMR		
	Imaging		
	Treatment Manageme	nt 🕨	
	Treatment Planning	F	Beam Configuration
	Quick Reports	•	Brachytherapy 2D Entry
	Customize		Brachytherapy Planning
			Cone Planning
			Contouring
			External Beam Planning
			IRREG Planning
			Model Configuration
			Plan Evaluation
			Selection

- Search Patient Workspace Beam Data Tools Window Match and Assign Add-Ons... × 14 Beam Curve Editor... Calculate Beam Data Calculate All Beam Data Interpolate Missing Values Calibrate Dose Rates... Parameter Values . Approve Data K Unapprove Data CT Calibration... 2 Calculation Defaults... Configure Calculation Models... Update Calculation Models...
- In the "Beam Data" menu select CT calibration

• Select the CT device that was just created then "Mass_Density" and click on Edit.

CT Scanner		Calibration Curve			
D	Default	Туре	Approval	Description	
CT2_Head CT3_Body CT3_Head	^	Electron_Density Mass_Density Stopping_Power_P	roton	Mass_Densit	у
CTConfidence80kV CTMaastro CTPET GE MUMC HANNAH_120kVp HANNAH_79keVPMI MARISKA_1	x				
TG186Brachy TUE_CONFI_FBP120 TUE_CONFID_DD	~			6	
Reset Curves	5	Edit	Reset	Approve	Unapprove



• Include the values shown below and press OK.

• Click on "Approve" and close the "Beam Configuration" software.

This CT calibration can now be used to perform dose calculations with Acuros.

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