Prostate Plan Walkthrough

Launching Planning

1. Open the Astroid Launcher and login



- 2. Select your realm
- 3. A list of available apps will be listed on the left, select Planning from this list
- 4. If you see an Install button click it and wait for the version to install. You will know it is installed when you see a LAUNCH button
- 5. Click the LAUNCH button. The version of planning that is installed in your realm will now open

Creating a Patient

- 1. From within the Planning App click on the Imports block
- 2. Select the CT image set (SBRT Prostate) from the list of available files for import
- 3. Ensure that the MRN is correct
- 4. Click the Create Patient button to start the import process

Matching No matching pa Create Patient	Patient atient found. A new patient must be created.
DICOM In	formation
Patient Name:	SBRT PROSTATE
MRN:	111111k5 Edit
Modality:	CT Image Set
Acquired Date:	2016-06-09
CT Slices:	429
Upload Date:	2017-05-05 12:11:15
Upload By:	Kevin Erhart
Archived:	No Archive

- 5. In the control pane on the left hand side, the patient model will be automatically selected based on the structure set DICOM UID information
- 6. Fill in the Patient Data and select the appropriate treatment site and HU to RSP curve (as shown below)

▼ Patient Data		
Intent Data		
Treatment Site *:	MGH_Prostate_Protocol	٠
Narrative:		
Protocol:	•	
RSP Data		
HU to RSP Curve*:	ctedproton; 120 kVp; FOV [0, 1000]	
Import Structure	Set	
Structure Set:	Date: 2016-06-09 (archived)	٠

7. You will see a list of the imported structures. Here you may choose whether or not to import each structure by checking or unchecking the box beside each structure name.

Import Structures	
Treatment Site: MGH_Prostate_Protocol Patient Structure: skin	
Variant Label: variant_1_2018-08-16	
 Matched / Assigned (4) 	
► 🗶 skin	Importing new structure
► 🗙 Bladder	Importing new structure
► 💌 Prostate	Importing new structure
► 🗙 Rectum	Importing new structure
 Not Matched (custom) (11) 	
► 🗙 2cm	Importing new structure
Bladder neck	Importing new structure
• 🗙 Bowel	Importing new structure
► 💌 Left Fernoral Hea	Importing new structure
► 💌 Neurovascular Bu	Importing new structure
► 🕱 penile bulb	Importing new structure
PTV (course)	Importing new structure
Right Femoral He	Importing new structure
 Seminal Vesicles (course) 	Importing new structure
► × Testes	Importing new structure
► × Urethra	Importing new structure
	Import Cancel
and the second	1.1. 1. 1.1.1.

- 1. For this case, we will import all available structures and there is nothing to change on this page
- 2. You also have the ability to assign or edit any structures that are shown as *custom*, which indicates the name did not exactly match a site structure from the treatment site template list you specified during patient creation
- 3. Matched, Assigned, and Custom structures are designated with corresponding tags at the end of the structure name in the structure list.
- 4. Assigning a custom structure to a defined site structure will result in the imported structure inheriting all the predefined structure properties (e.g. name, type, color)
- 5. For all custom structures the type is by default set to "Other" unless it contains the letters "TV" (as in PTV or CTV), in which case it is assigned the type of "Target"; this may be changed here if needed
- 8. Click the Import button to create the patient and import the CT Images and Structures into it
- 9. The patient is now created and all available data has been imported, so it is time to proceed with entering the prescription information

10. Click on the *Open Patient* button



Course Prescription

Prescription information is stored in the *Course* and must be added prior to making a treatment plan for a new patient.

- 1. The patient opens directly after importing
- 2. Next proceed to Prescriptions
 - 1. Select Create New Prescription

■ Prescriptions	
	Create New Prescription

- 2. Select PTV from the Prescription drop down menu
- 3. For this example the dose will be 79.2Gy in 44 fractions to the PTV (as shown below)

≣ Prescrip	otions			
			Create New Prescrip	ption
Label:	PRO			
Prescription:	79.2 Gy(RBE) to	PTV	▼ X	
	Add			
Fractions:	44			
Description:				
Color:			• •	
			Add	Cancel

- 4. Label and Description are free text fields that allow you to "name" each Prescription and provide any description or notes necessary to distinguish between each in the case of multiple prescriptions. You must enter a "name" in the Label in order to proceed. You are free to enter your own values in these fields for this walkthrough. Click Add when completed
- 3. Fill in the *Clinical Goals*
 - 1. Choose the structure from the dropdown to add your goal
 - 2. In this example we will set a minimum dose to the PTV at 79.2Gy and the maximum dose at 85.5Gy as shown below

Clinical Goal	s				
PTV					×
min:	79.2	Gy(RBE)	×		
max:	85.5	Gy(RBE)	×		
min mean:	Add Statement				
max mean:	Add Statement				
min DVH:	Add Statement				
max DVH:	Add Statement				
Add Structu	re 🔻				
Course Struc Edit Course	tures Structures				
				D	one Cancel

4. Click Done to complete the Course editing

Plan Creation

The required *Course* and *Patient Model* information was selected during import, so now we can move to creation of a treatment *Plan*

1. From the Patient Overview tree, click Add Plan under the Patient Model entry



1. Name the plan and click OK (the description is optional)

New Plan		
Name:	prostate	
Description:	First trial plan	
		OK Cancel

- 2. This creates an empty plan with its prescription set to fulfill all portions of the Course Prescription
- 2. Now open the new plan by clicking the *Open* button under the new plan entry in the Patient Overview tree

Plan Prescription Implementations

- 1. Click the *General / History* heading to expand this block
 - 1. Notice here that our empty plan starts out with its prescription set to fulfill all portions of the Course Clinical Goals and Prescriptions
 - 2. If a plan will only fulfill a portion of the Prescription, then this information should be edited to reflect this, otherwise just proceed past this block
- 2. In this case, we will be fulfilling the entire prescription with a single plan, so no editing is needed
- 3. Generating our plan will now progress to the *Patient Geometry* block, where we will create any points or planning structures that are needed (if not created in contouring software), such as a combination of the left and right femoral heads (see <u>Structure Geometry</u> for details on how to create structures)
- 4. We will create a new point to use for the isocenter (note this step is done for illustration purposes and is not necessary for most plans)

≡ Points	
	Create New Point

1. Select a type of isocenter and create the point at the centroid of the PTV (as shown below)

Create P	oint		
▼ Gener	al		
Lab	el: iso		
Тур	e: Isocenter	*	
Col	or: 📒 🔿 🔵 🧧		• •
Descriptio	xn:		
Centro Create Explici	id a point at the cen t	rold of a structure.	
Create	a point at a speci	ied location.	
Structure	PTV	*	
Position:	(-3.3, -2.4, -424.0)		
			jump to point position

2. Click DONE button at the bottom of the page

HU to RSP

Next we will move on to defining the HU to Proton Relative Stopping Power (RSP) conversion

- 1. Click to open the RSP Image block
 - 1. If any density overrides are needed they are entered here in the RSP Image block
 - 2. If the HU to RSP curve chosen upon patient import needs to be changed the user may do so at this point
 - 3. We do have any density overrides to apply for this case and the proper HU curve has already been selected

4. Click the *Cancel* button to close this block if you have already clicked on the *edit* button

Calculation Grid

We are now ready to define the dose calculation grid (see Defining the Dose Grid for a detailed explanation)

- 1. Click to open the Calculation Grid block
 - 1. Click the *Edit* button
 - 2. Create a grid by performing the following steps:
 - 1. Set the base grid resolution to 8 mm
 - Click on Add Structure drop down menu and select the "2cm" structure then set the size to 4 mm
 - 3. Click on Add Structure drop down menu and select the "PTV" then set the size to 2 mm

▼ Calculation Grid					
Base resolution (over the whole patient)					
8 mm		I			
Total Grid Voxel Count: 71817		I			
Specify spacings for structures					
2cm –	4 mm	+ ×			
PTV –	2 mm	+ ×			
Add Structure					
	ОК	Cancel			

- 4. The Prostate is included in the PTV volume so there is no need to set a separate grid size
- 5. Click the OK button

Beams

We are now ready to begin defining the treatment beams

- 1. Click to expand the *Beams* block (see Creating a New Beam for detailed explanation)
 - 1. Before defining individual beams, we will first set some shared beam properties
 - 2. Set the *Treatment Room* by clicking on *treatment room* (this will bring up a drop down menu where the appropriate treatment room can be selected)

▼ Beams		
Treatment Room:	Proton System: Large_PBS	
	Proton System: Medium_PBS	
	Proton System: Small_PBS	
		OK Cancel
Spot Placement Parameters		machine defaults

- 3. Click the OK button
- 2. Click on the Spot Placement sub-block to set the following values (note these are the plan level

spot placement parameters, so it will apply to all our beams, unless we specifically override the values within an individual beam)

▼ Beams					
Treatment Roor	n				Proton System: Medium_PBS
Spot Placement	t Paramet	ers			
Lateral Margin:	15	mm			
Distal Margin:	10	mm			
Spot Spacing:	1	Sigma	۳		
Layer Spacing:	0.7	Distal W80	۲		
					OK Cancel
≡ PBS Beams					
					Create New PBS Beam

- 1. Lateral margin- 15 mm
- 2. Distal margin- 10 mm
- 3. Spot spacing- 1 sigma
- 4. Layer spacing- 0.8 Distal W80
- 5. Click the OK button
- 3. Now we are ready to make our beams
 - 1. Start by clicking Create New PBS Beam

▼ Beams					
Treatment Room	Proton System: Medium_PBS				
Spot Placement Parameters	machine defaults				
≡ PBS Beams					
	Create New PBS Beam				

- 1. Enter the following for each beam
 - 1. General
 - Select the PTV as the Geometric Target and if desired, enter a description for the beam, for other selections leave the defaults (see Structure Geometry)

▼ General	
Color:	
Label:	G0 C0; no snout; no shifter;
	× automatically generate label
Geometric Target:	PTV 🔹
Spot Target:	use fraction group target use hear accomptric target
Description	
crossignion.	

- 2. Approach
 - 1. At this point the user will specify the geometry of the beam by setting the isocenter as well as the gantry and couch angles
 - Two beams at gantry angles of 90 and 270, respectively, will be used here, which is typical (+/- 5 degrees) for standard prostate plans such as this example

- 3. Couch angle of 0 is used here for each beam
 - 1. You may use the sliders, the +/- buttons, or simply type in the values to adjust these angles



- 3. Snout
 - 1. For this example any snout can be selected

▼ Snout		t	nout	Sno	'
Snou	ut: 20x20	u	Snout:	s	
	30x30				
L					

- 4. Aperture (if desired)
 - 1. If there is the need to use an Aperture for sharper penumbra the user can do so at this time (see Creating an Aperture)
 - 2. Note that Astroid has the ability to utilize an Aperture with pencil beam scanning for both SFUD and IMPT plans and the aperture construction will be based on the Geometric Target selection
 - 3. For this plan, no apertures are necessary
- 5. Shifter
 - 1. Simply choose a shifter from the list if one is needed
 - 2. For this plan, no shifters are necessary

۲	Shifter						
	Shifter:	none					
		30 mm					
Mir	n WET to Ta	arget: 175	mm				

- 6. Air gap
 - 1. The air gap is specified as the distance from the final beamline device (aperture or shifter) or the snout end if no devices are present
 - 2. The view automatically shifts to the 3D view when entering this sub-block and you can adjust the air gap to ensure patient collisions are avoided
 - 3. The default air gap is sufficient for both beams in this example
- 7. Spot placement
 - 1. Since we want both beams to use the same spot settings, we have those at the plan level and there is no need to edit the spot placements here for the beams
- 8. DRR options
 - 1. The Proton DRRs shown in the *Beam* task are generally used to help determine appropriate treatment angles
 - 2. In cases such as these, appropriate angles are readily determined and there is no need to utilize the DRR sub-task
 - 1. If you wish to explore this feature however, you may choose one of

the preset *HU Settings* from the drop down or manually set the *level*, *window*, *min HU* and *max HU* or go into *Advanced Options* for additional control of the DRR's

2. These proton DRRs are used only for visualization purposes and will have no effect on the plan construction process

Proton Di	▼ Proton DRR Options					
Window: 1500) Level:	750				
Image Z Positio	n: 0	mm				
Hu Settings 1						
Bone	•	Weight: 1	•			
Hu Settings 2						
Soft Tissue	•	Weight: 0	٥			

- 2. Click Done to complete the first beam
- 4. After creating the first beam, at gantry angle 90, it is recommended that you *Clone* it and simply change new beam's ganry angle to save time in creating the second beam at gantry angle 270 (the *Clone* button is available under a beam when it is selected for viewing from the list of beams)

▼ Beams		
Treatment Room		Proton System: Medium_PBS
Spot Placement Parameters		machine defaults
■ PBS Beams		
b1: G90 C0; 20x20; no	shifter;	•
Beam Information Description: Isocenter: Gantry Angle: Couch Angle: Geometric Target: Spot Target Air Gap (snout ext.): Entrance Z: Snout Aperture: Shifter: PBS Spot Placement using plan settings:	iso 90 deg 0 deg PTV using fraction group target 50 mm (251.7mm) 202 mm 20x20 none none	Cione Edit Delete
		Create New PBS Beam

1. Once you have *Cloned* the beam choose the *Edit* button to make changes to the gantry angle

•	Beams			
Tr	eatment Room		Proton System: Medium_PBS	
Sp	ot Placement Parameters		machine defaults	
=	PBS Beams			
	b1: G90 C0; 20x20; no	shifter;	•	
	b2: G90 C0; 20x20; no	shifter;		
	Beam Information Description: Isocenter: Gantry Angle: Couch Angle: Geometric Target: Spot Target Air Gap (snout ext.): Entrance Z: Snout Aperture: Shifter: PBS Spot Placement using plan settings:	iso 90 deg 0 deg PTV using fraction group target 50 mm (251.7mm) 202 mm 20x20 none none		
			Clone Edit Delete	
			Create New PBS Beam	

1. Note for more complex plans, there are often additional parameters to change (such as the aperture and the air gap) when creating additional beams via the *Clone* option

Optimization

With the two beams completely defined, we can now move on to organizing our treatment fraction groups and specifying the constraints and objectives for the treatment

1. Open the *Optimization* block (see Astroid Optimization for a detailed explanation of *Optimization*, *Feasibility* and *Constraints*, as well as *Running the Optimizer*)

Fraction Group

1. Choose *Create a New Fraction Group* under the *Fraction Group* block (See Fraction Groups for a more detailed explanation)

▼ Optimization	
▼ Fraction Groups	
≡ Fraction Groups	
	Create New Fraction Group

- 1. In the *Prescription* drop down, select the Prescription that was created earlier in the Course ("PRO")
- 2. Enter 44 for the Number of Fractions
- 3. Select IMPT as the *Type*
- 4. Set the *Target* to the PTV

- 5. Add both beams that were created above
- 6. Next to Constraints click the Add Structure drop down and choose the PTV
 - 1. Add a min dose constraint of 79.2 Gy (1.8 Gy per fx)
 - 2. Add a max dose constraint of 85.5 Gy
- 7. At this point your Fraction Group should appear as shown below

Create Fraction G	iroup				
Color:			• • •	• • •	
Description:					
Prescription:	prostate				
Number of Fractions:	44	Total: 44,	Remaining:	44	
Туре:	IMPT				
Target:	PTV				
Beams:	b1 - G90 C0;	12 cm; no	shifler;		×
	b2 - G270 C0	12 cm; no	shifter;		×
	Add Beam		Ŧ		
Constraints:	PTV				×
	Min:	79.2	Cy(REE)	×	
	Max	85.5	Gy(MBE)	×	
	Min Mean:				
	Max Mean:				
	Add Structure				

8. Click Done to complete the Fraction Group

Constraints and Feasibility

- 1. This is our only Fraction Group for this plan, so we'll move on to the plan level constraints and feasibility
- 2. Open the Constraints / Feasibility sub-block
 - 1. First we'll enter the *Constraints* for the planning (target) volumes and a global maximum constraint
 - 1. Remember these are the "hard stops/non negotiables" for the plan
 - 2. These doses will be decided per the users' department protocols
 - 3. For this case do the following:
 - 1. Click Add Structure and select External_body (Skin)
 - 1. Add a max set to 85.5
 - 2. Click OK
 - 3. Note that we already have PTV dose constraints at the Fraction Group Target level, so no additional ones are needed here



After the target constraints have been entered, it's generally good practice to test the plan feasibility. The Feasibility calculation is run by clicking *calculate* at the bottom of this block. The Feasibility calculation is based solely on the constraints and it should be used to ensure there is a possible solution (plan) that can meet the specified constraints. Establishing Feasibility is often an iterative process in order to get appropriate constraints established for a particular plan. In other words, the user may need to enter a constraint, check the feasibility, then progressively tighten the constraint and check the



feasibility until the plan is no longer feasible. It is recommended practice to start by obtaining a feasible plan utilizing only target constraints (and a global max constraint) then add OAR constraints as desired. Remember, using a narrow range of constraints can improve the optimizer performance and improve the resolution of the Pareto surface navigation.

1. Run the *Feasibility* by clicking the *calculate* link



- 1. The feasibility should return as passing, if not, please confirm your plan parameters match those shown throughout this walkthrough and try again
- 2. Now with the target constraints set, we'll move on to our OAR's
 - 1. Again these will be set per department protocol
 - 2. For this example create the following OAR constraints:
 - 1. Rectum max mean 50 Gy
 - 2. Bladder max mean 60 Gy

▼ Constraints / Feasibility		
structure	type	dose Gy(RBE)
 External_body (Skin) Rectum Bladder 	max max_mean max_mean	85.5 50 50 Edit
Advanced Feasibility status: not calculated calculate		

- 3. Run Feasibility as before
 - 1. The feasibility should return as passing again, if not, please confirm your plan parameters match those shown throughout this walkthrough and try again

Objectives and Optimizer

- 1. With narrow constraints set and feasibility established, we will now turn our attention to *Objectives*
 - 1. *Objectives* are the goals that you would like to achieve and these will be the driving forces for the *Optimizer*
 - 2. Expand the Objectives / Optimizer sub-block and then click Edit under the Objectives section
 - 3. For this example we will use the following objectives:
 - 1. The External_Body (Skin) will automatically populate
 - 2. Rectum min_mean (Minimize the mean dose to the Rectum)
 - 3. Testes min_max (Minimize the maximum dose to the Testes)
 - 4. Left & Right Femur min_overdose 45 Gy (Minimize the amount of the structure the receives dose above 45 Gy)
 - 5. PTV min_max (Minimize the maximum dose within the PTV)

14/15

▼ Objectives / Optimizer	
Targets PTV min_max min_mean max_mean min_overdose min_underdose	×
Non-Targets External_body (Skin) min_max min_mean min_overdose	×
Rectum min_max x min_mean min_overdose	×
Left Femoral Hea min_max min_mean K min_overdose 45 Gy(R8E)	×
 Right Femoral He min_max min_mean тпin_overdose 45 су(яве) 	×
Add Structure	ancel

- 2. Click OK to complete the Objectives
- 3. We are now ready to run the MCO, by opening the *Navigation* sub-block and clicking the *calculate* link
 - 1. This may take up to 10 minutes for this plan depending upon your available cloud services resources
 - 2. Keep in mind that even though this process may take some time, the planner will be able to make adjustments easily in the Navigation without running a new plan

Navigation

1. Once the MCO has been completed, you can adjust the relative importance of the objectives using the slider bars in the *Navigation* block by clicking the *Edit* button in the *Navigation* block(see Astroid Optimization Navigating the Solutions for a detailed explanation of using the slider bars)

Navigation		
navigation sliders locked		
Export DICOM Dose	Export DICOM Plan	Edit

1. Adjust the slider bars in the *Navigation* block to find what you feel is the optimal plan for this case

1. Note: All of these adjustments are made without having to run a new plan

- 2. If you find a plan that you like, but wish to continue exploring further, you can click the *Save* button to save the current slider state and then continue exploring
- 3. You may return to the last saved state at any time by clicking the Reset button
- 4. The Cancel button will close the navigation block, reverting back to the last Saved state

▼ Navigation	
Max Dose	
Value: 81.67 Gy(RBE) jump to	
 Current Plan 	
External_body (Skin)	min_max 81.68 < 85.50
79.79	85.50
Rectum	min_mean 22.50 < 32.40
17.61	32.40
Left Fernoral Hea	min_overdose 0.00 < 0.01
0.00	0.01
Right Fernoral He	min_overdose 0.00 < 0.01
0.00	0.01
• PTV	min_max 81.68 < 85.50
/9./9	85.50
Reset	Save Cancel

- 2. The plan is ready for physician review at this point
 - 1. Physicians often find it useful to Navigate the solution and explore trade-offs in real time, which can often alter the traditional physician approval process into an interactive, real-time trade-off analysis and on the spot plan approval
- 3. After the physician has decided on a treatment plan the user may then proceed to export the chosen plan to the EMR
 - 1. Note that these standard (non-plan specific) features are covered in other guides and not repeated herein

From: https://apps.dotdecimal.com/ - **decimal App Documentation**

Permanent link: https://apps.dotdecimal.com/doku.php?id=planning:userguide:walkthroughs:prostate_plan&rev=1534440881

Last update: 2021/07/29 18:25