

Optimization Constraints

About Constraints

Constraints can be specified at various levels (*Plan*, *Fraction Group*, *Target/Beam Set*) with Astroid and they will affect different groups of beams depending on their level. *Constraints* at the *Plan* level are applied to the total dose resulting from all beams. *Constraints* at the *Fraction Group* level are applied to the total dose resulting from only the beams in the current Fraction Group. *Constraints* at the *Target/Beam Set* level are split evenly and applied individually to each Beam Set. In other words, the *Constraint* dose is divided by the number of *Beam Sets* in the *Target*, and this dose is then applied as a constraint to each Beam Set, so that either SFO and IMPT can be achieved (see [Fraction Groups](#)). The section below will provide a walk through of the different levels and how constraints are applied at each one.

It should be noted that all constraints are considered “hard limits”- values that must be achieved. *Constraints* drive the feasibility calculation- whether the plan is achievable and should be used to ensure certain minimal clinical parameters are met.

The following constraint types are available. Note certain constraints are available only for *Target* type structures.

- **Min:** The minimum dose the structure must receive
- **Max:** The maximum dose the structure may receive
- **Min Mean:** The minimum mean dose a structure must receive
 - This will drive the dose up across the structure
- **Max Mean:** The maximum mean dose a structure may receive
 - This will limit the mean dose across the structure

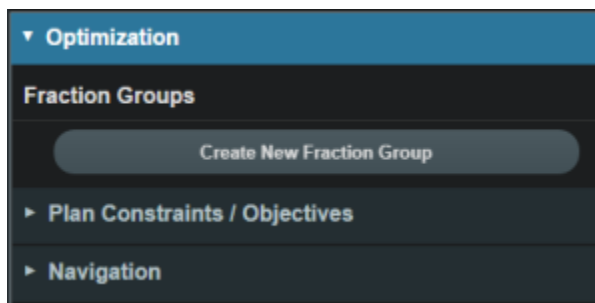
The user can choose to apply one or multiple of these constraints to any number of structure.

Working with Constraints

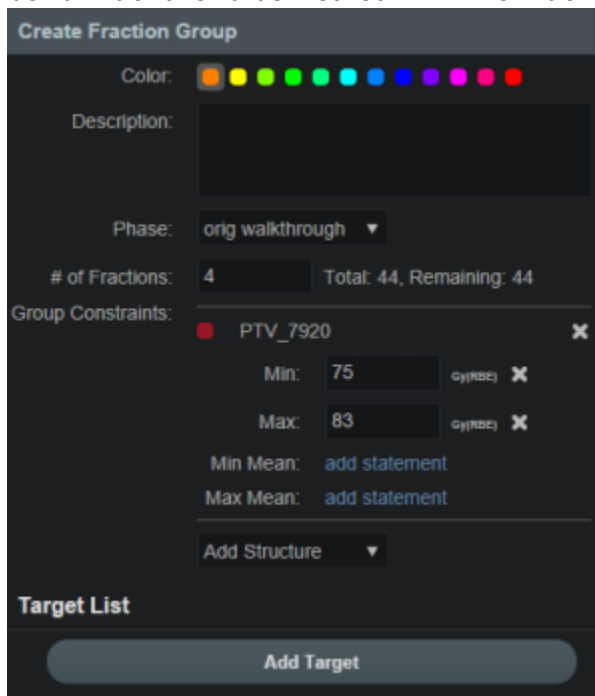
Working with Fraction Group and Target/Beam Set Constraints

Constraints at the *Fraction Group* level are applied to the total dose resulting from only those beams in the current *Fraction Group*. *Constraints* at the *Target/Beam Set* level are equally split among the Beam Sets within the Target and are applied to the total dose resulting from the beams in each of the *Beam Sets*. The following steps are a brief walkthrough for creating a max constraint of 73 Gy(RBE) to the PTV for the whole Fraction Group, and then creating two SFO beams that each provide a minimum dose of 35 Gy(RBE).

1. Select the *Fraction Group* if it has been created or create a new one by clicking *Create New Fraction Group*



2. Choose the phase and number of fractions to be treated with this Fraction Group



3. Under *Group Constraints* one can add any desired structures to which the Fraction Group level constraints will be applied

1. Select the PTV from the drop down of structures
2. Define what constraint(s) should be applied to each structure by choosing the constraint and entering the dose
 1. In the field beside Max, enter the value 73

Edit Fraction Group

Color:

Description:

Phase: orig walkthrough ▼

of Fractions: 44 Total: 44, Remaining: 44

Group Constraints:

● PTV_7920 ✕

Min: add statement

Max: 73 Gy(RBE) ✕

Min Mean: add statement

Max Mean: add statement

Add Structure ▼

Target List

Add Target

4. Once the constraints are set in the *Fraction Group* the user will add *Targets* to the *Target List* and assign additional *Constraints* if desired
5. The assigned constraint doses at this level will be divided evenly among the *Beam Sets* in the *Target*
6. Add a new Target, then create two Beam Sets, each with a single beam
 1. Under *Constraints* select the PTV from the drop down of structures
 1. Now set the Min field to 70 (this 70 Gy(RBE) dose will be split 35 per beam set, creating the desired two SFO beams

Target List

Add Target

Target: PTV_7920

Beam Sets:

- beam set remove
b1 - G90 C0; 12 cm; no shifter; X
add beam
- beam set remove
b2 - G270 C0; 12 cm; no shifter; X
add beam

add beam set

Constraints:

- PTV_7920 X
 - Min: 70 Gy(RBE) X
 - Max: add statement
 - Min Mean: add statement
 - Max Mean: add statement

Add Structure

Done Cancel

Working with Plan Constraints

Constraints at the *Plan* level are applied to the total dose across all beams.

1. Open the *Constraint* sub block contained in the *Plan Constraints/Objectives* block and choose the *Edit* button.

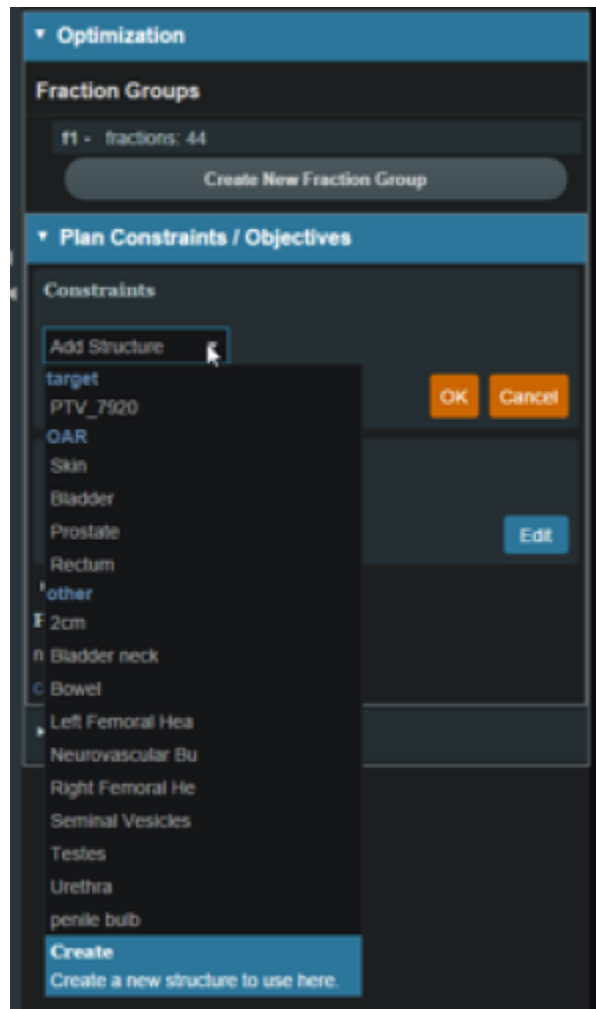
Plan Constraints / Objectives

Constraints

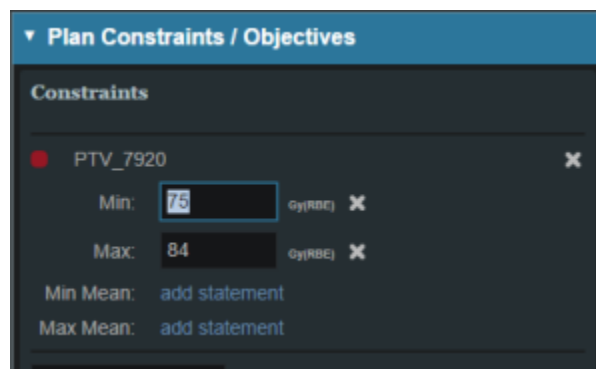
no constraints

Edit

2. Choose from the drop down the structure or structures to which constraints should be added



3. Define what constraint(s) should be applied to each structure by choosing the constraint and entering the dose



4. Follow this and enter the constraints for all applicable structures.

Plan Constraints / Objectives

Constraints

- PTV_7920**
 - Min: 75 Cy(RBE) ✕
 - Max: 84 Cy(RBE) ✕
 - Min Mean: add statement
 - Max Mean: add statement
- Rectum**
 - Max: add statement
 - Max Mean: 49 Cy(RBE) ✕
- Bladder**
 - Max: add statement
 - Max Mean: 45 Cy(RBE) ✕

Add Structure ▼

OK Cancel

5. When finished click the *OK* button.
6. Once all the Constraints have been set the user can either start the Feasibility or move on to defining the Objectives

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