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 SFUD 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

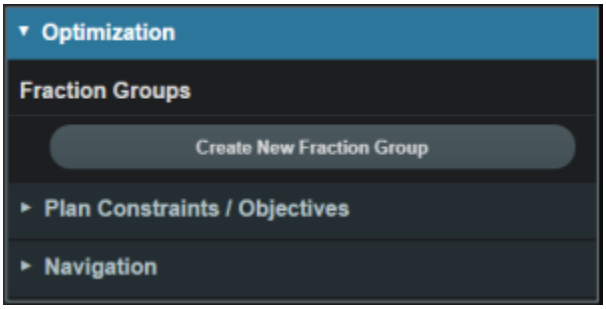
Working with Fraction Group and Target/Beam Set Constraints

Fix Me! - new pics

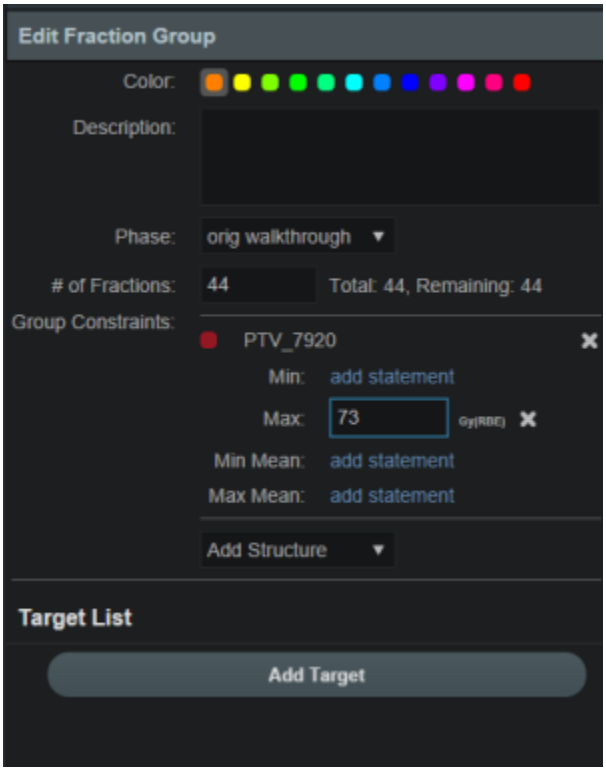
Constraints at the *Fraction Group* level are applied to the total dose resulting from only those beams in the current *Fraction Group*. *Constraints* at the *Target / Beam Set* level are equally split among the Beam Sets within the Target and are applied to the total dose resulting from the beams in 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 SFUD beams that each provide a minimum dose of 35 Gy(RBE). Note that this configuration with the max constraint at the Fraction Group Level is different

than if we had put both the min and max at the Target / Beam Set level. In the case shown, it is only the total dose from the two beams that is constrained to be below 73 Gy(RBE). Had both constraints been placed at the Target Level, then each beam would instead be constrained to a max of 36.5 Gy(RBE).

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

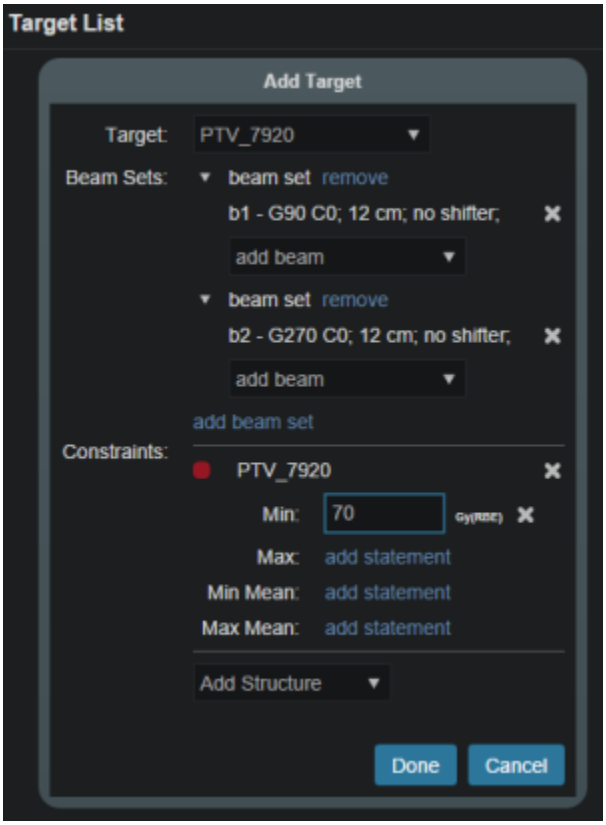


2. Choose the phase and number of fractions to be treated with this Fraction Group
3. Under *Group Constraints* one can add any desired structures to which the Fraction Group level constraints will be applied
    1. Select the PTV from the drop down of structures
    2. Define what constraint(s) should be applied to each structure by choosing the constraint and entering the dose
        1. In the field beside Max, enter the value 73



4. Once the constraints are set in the *Fraction Group* the user will add *Targets* to the *Target List* and assign additional *Constraints* at that level if desired
    1. The assigned constraint doses at this level will be divided evenly among the *Beam Sets* in the *Target*, which allows for quick creation of SFUD treatments
5. 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

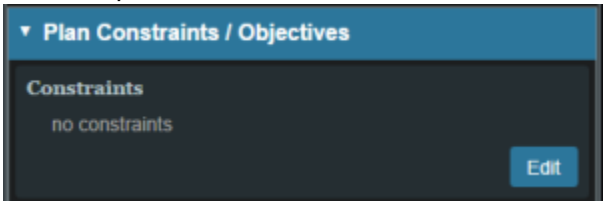
the desired two SFUD beams



Working with Plan Constraints

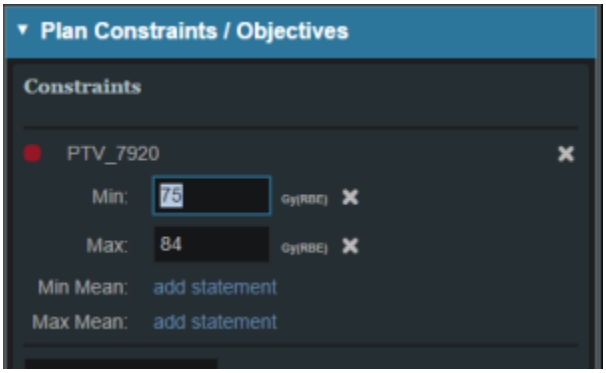
Constraints at the *Plan* level are applied to the total dose across all beams.

1. Open the *Constraint/Feasibility* sub block contained in the *Optimization* block and choose the *Edit* button. Fix Me! new pic

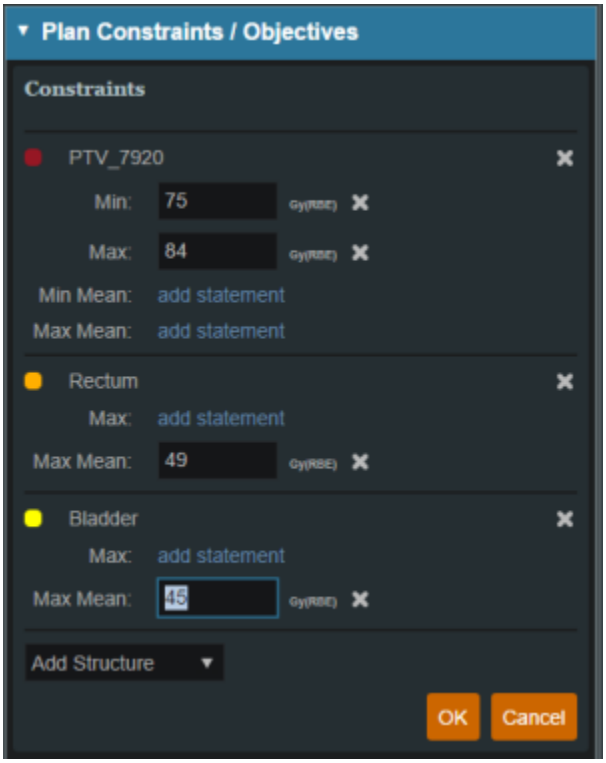


2. Choose from the drop down the structure or structures to which constraints should be added Fix Me! new pic

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.



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