Electron Beams

In the Beams block users can manage all the beams, as well as any blocks, boluses, or other devices included with them, included in the plan. In addition, new beams can be created and added to the plan from here.

Note: The Beams block will be disabled if no machine or CT curve exists in the site configuration.
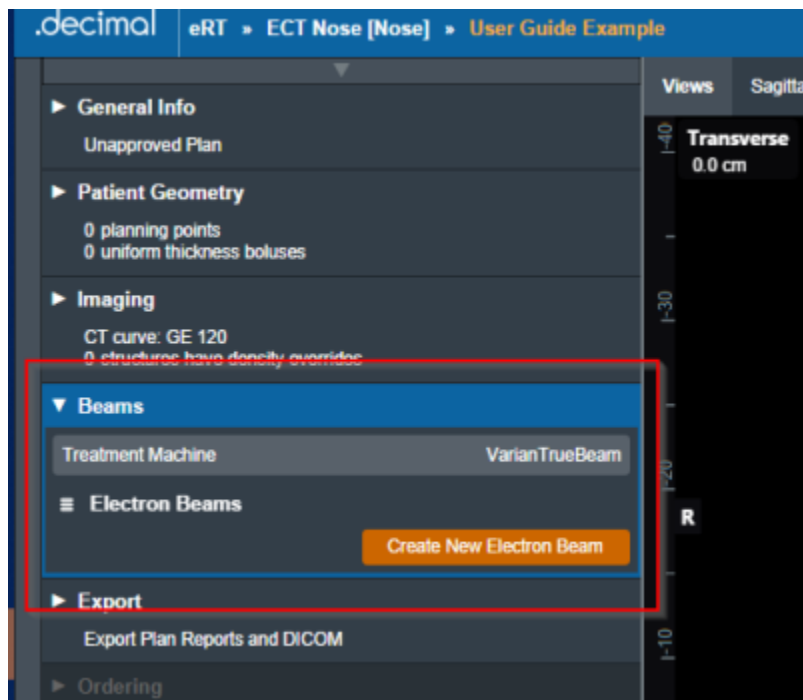

Fig. 1: Beams Block

Managing Existing Beams

The electronRT application will list all beams included in a plan. For each of these existing beams, selecting it will show a summary of the details for that beam. Additionally, as shown below, the user has three options for the selected beam:

- **Clone**: Create an identical copy of the selected beam and add it to the plan.
- **Edit**: Open the editing dialog to change any editable property of the beam.
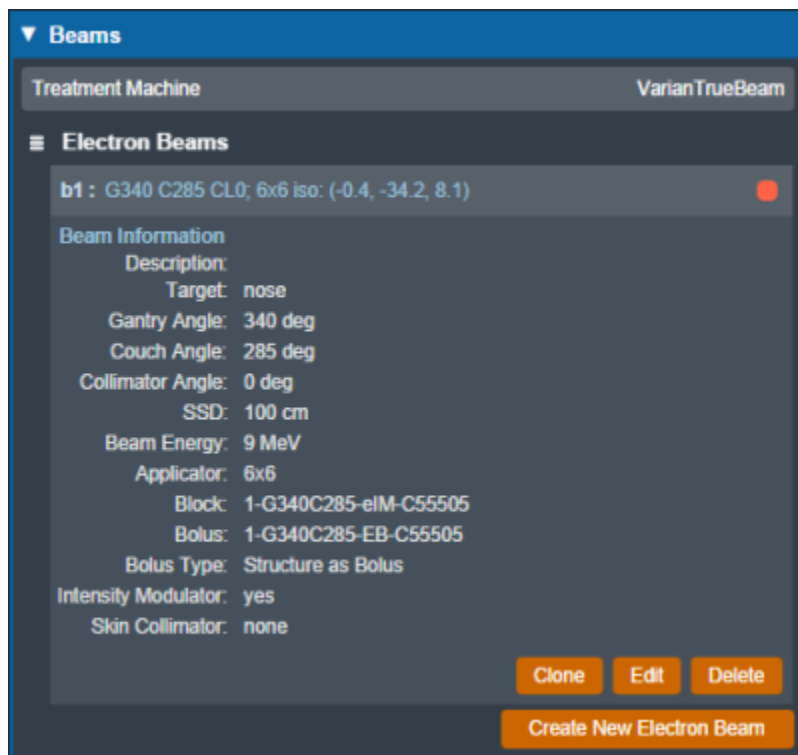- **Delete**: Remove this beam from the plan.

Fig. 2: Existing Beam Example

The editing dialog allows the user to edit any property of the beams that is defined in the "Structure of a Beam" section below. All changes made in this section will be saved to the beam once the user selects "Done".

Fig. 3: Beam Editing

Creating New Beams

Selecting "Create New Electron Beam" directs the user to a similar section as editing an existing beam with the exception that some blocks are disabled until prior required steps are completed. An in-depth

explanation of each of these sections is defined in the "Structure of a Beam" section below.
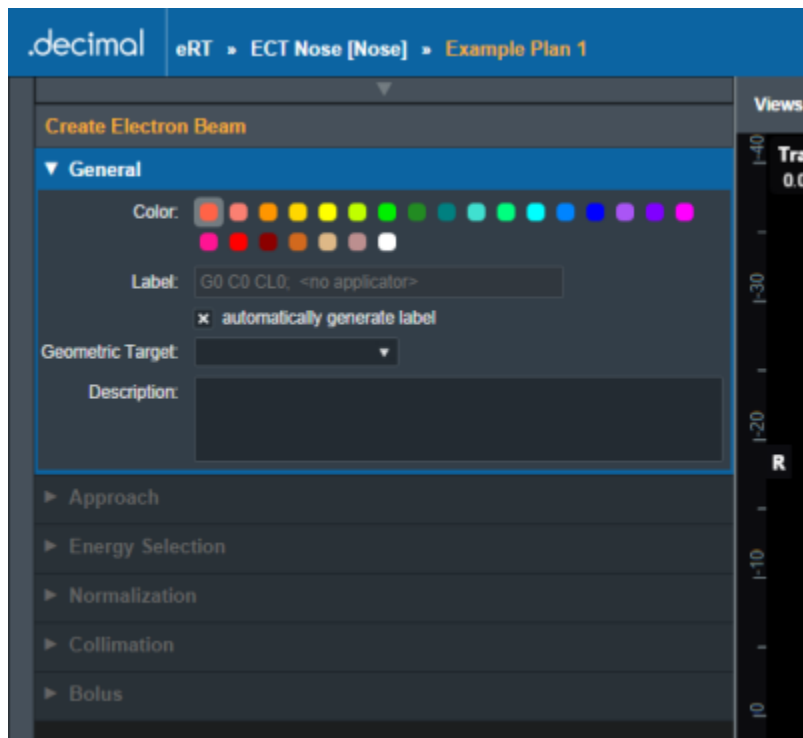

Fig. 4: Creating a New Beam

Structure of a Beam

General

The "General" Section of the Beams block allows the user to set the following fields for the beam:

- **Color**: Sets the color for this beam, this is used for displays, graphs and beam lists in the User Interface.
- **Label**: Sets the Label (name) of the beam. By default, the "automatically generate label" option is enabled for new beams, un-selecting this option allows the user to manually edit the beam label.
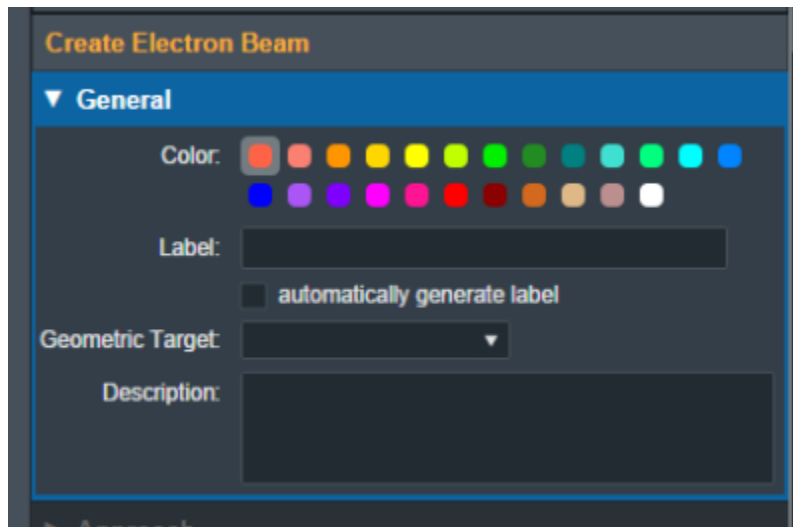
Fig. 5: General Block

- **Geometric Target**: Sets the target structure for this beam. Only "target" type structures will be available for selection in this list. The following criteria must be met for structures to be able to be selected as a beam target:
  - Structures flagged in the imported DICOM RT Structure Set with the following RT ROI Interpreted Type (3006,00A4):
    - CTV
    - GTV
    - PTV
    - CONTROL
  - Structures with the following within their name:
    - "ctv"
    - "gtv"
    - "ptv"
    - "target"
  - Refer to Editing a Course Structure to change a structure type

Once a geometric target has been set, the application will attempt to automatically calculate and set:

1. **Beam Approach:** A computed best guess at an orthogonal beam approach. The gantry or couch angles will be snapped to 0 degrees if:
   1. The gantry angle is less than 5.0 or greater than 355.0 degrees
   2. The couch angle is less than 10.0 or greater than 350.0 degrees
2. **Beam Energy:** The minimum commissioned energy with an R90 large enough to reach the deepest portion of the distal surface of the target
3. **Block Size:** The smallest fitting block size enabled for the selected treatment machine
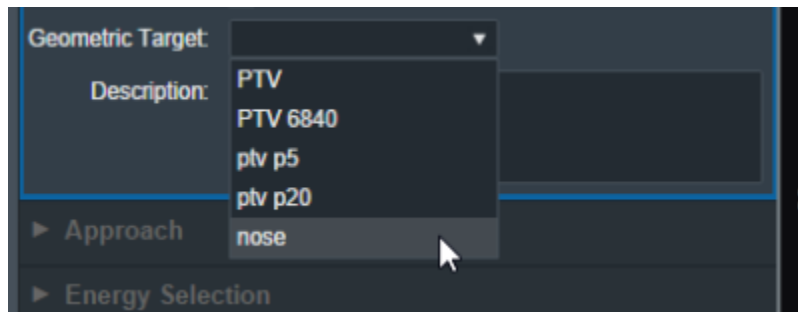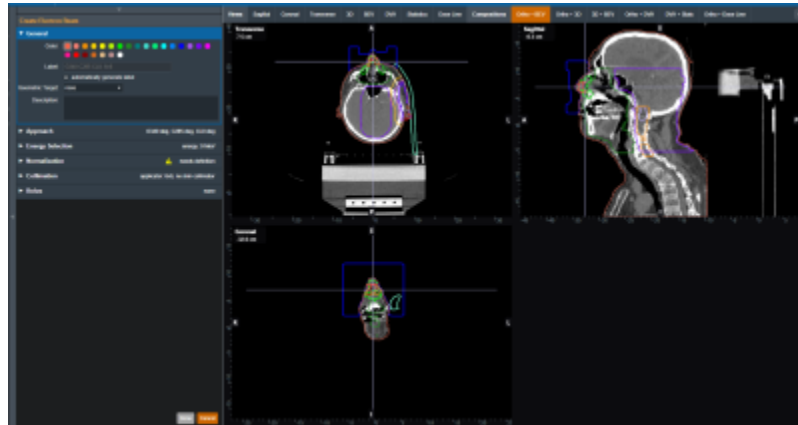
Fig. 6: Geometric Target Options

Fig. 7: UI updated with the new target

Once the beam has a color, label, and target the user will be able to move on to the next block in the beam creation if this is a new beam.
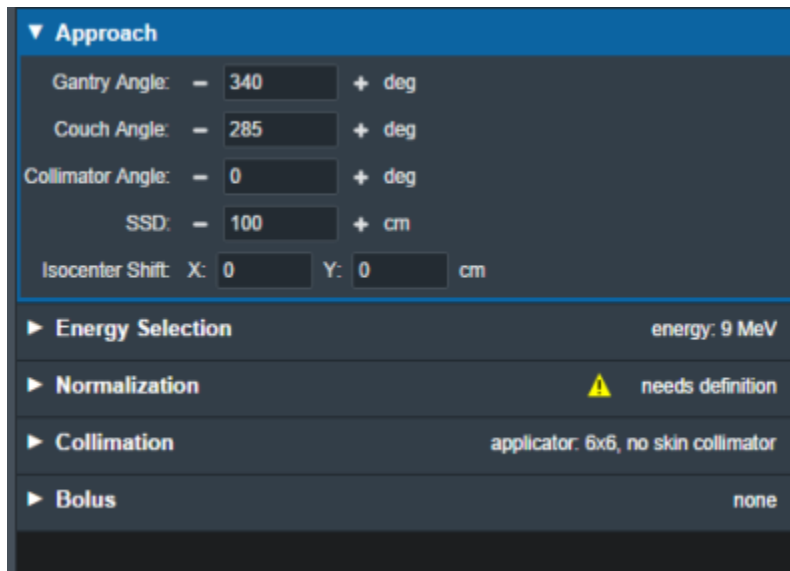
Approach

The Approach block is where the user can control the direction and position of the treatment beam. Here the user can set:

- **Gantry Angle**: Sets the Gantry angle for the beam.
- **Couch Angle**: Sets the Couch angle for the beam.
- **Collimator Angle**: Sets the Collimator angle for the beam.
- **SSD**: Sets the Source-to-surface distance.
- **Isocenter Shift**: Shifts the beam's isocenter. This shift is within the beam space coordinate system where the SSD is the beam "Z" shift. This can be used to manually shift a beam based on the center of the target.

As the values are set and changed in the "Approach" Block you should see the image of the beam update in the UI.

Note: If the combination of approach settings cause a collision between the applicator and the patient, you will receive a warning and the beam will be unable to be created/saved until the collision is cleared or the warning is specifically overridden.
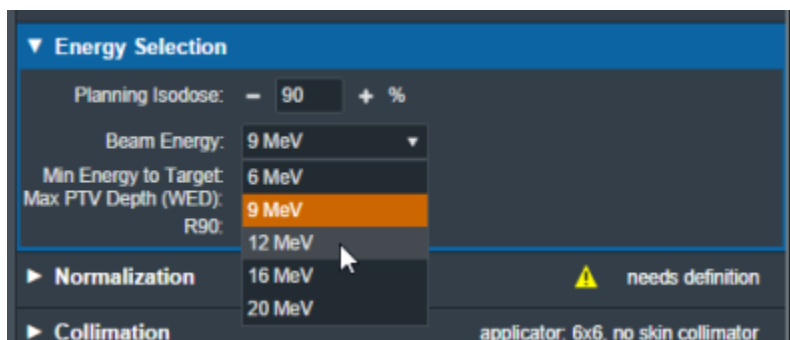
Fig. 8: Approach Block

Energy Selection

In this block the user can select the treatment energy for the beam. Users are able to set:

- **Planning Isodose:** The user can set the planning isodose level (relative dose) for the distal edge of the selected target.
- **Beam Energy:** The user is able to select an energy for this beam. This list of energies is derived from the machine data in the site configuration.
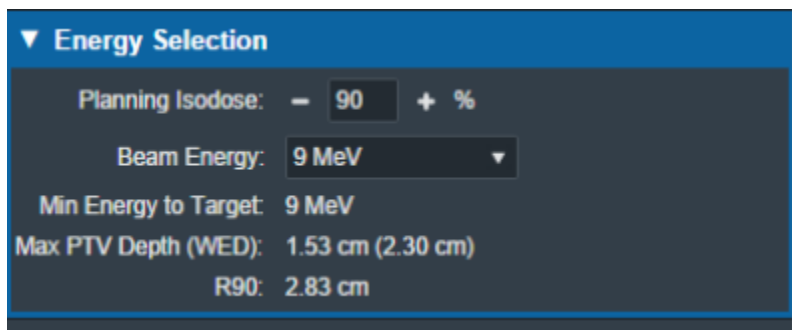
Fig. 9: Energy selection block

This block also displays the following values that are calculated and are not editable.

- **Min Energy to Target:** The minimum energy necessary to reach the entire selected target.
- **Max PTV Depth (WED):** The maximum physical depth (and water equivalent depth) to the distal target surface.
- **R##:** The computed beam range at the Planning Isodose level (range = depth of the point on the PDD at the Planning Isodose for a beam at the selected energy and specified field size).
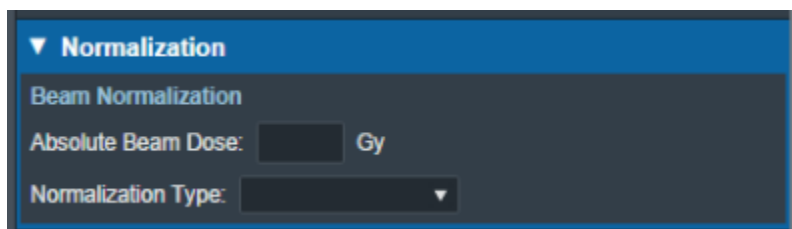
Fig. 10: Beams Block

Electron Beam Normalization

In this block the user can specify how the electron beam will be normalized to scale the computed relative dose (%) to absolute (Gy) dose. The eRT application provides the following normalization options:

> **Note:**
> When creating a new Electron Beam you will be unable to see your beam approach or dose until a beam normalization is fully specified.

Fig. 11

- **Location**: Normalize the dose to a spherical radius around a specific point.
  - Users are able to specify the point, sphere's radius, and the absolute dose value to set.
  - The dose voxels values within the specified sphere averaged together and applied to the *Absolute Beam Dose* value set when normalizing.
- **Structure**: Normalize the dose to a structure from the imported DICOM Structure Set. The following structure options are available to normalize dose to a structure:
  - Min: Compute the min relative dose value of all dose voxels within the specified structure. This computed min is then used to scale the beam dose along with the provided *Absolute Beam Dose* value.
  - Mean: Compute the mean relative dose value of all dose voxels within the specified structure. This computed mean is then used to scale the beam dose along with the provided *Absolute Beam Dose* value.
  - Vol: 🔧 **Fix Me!**
- **Isodose**: Set the relative Isodose dose value to the specified *Absolute Beam Dose* value.

Block

Here the user can add or edit an electron block for this beam, more details on electron blocks can be found in the Electron Block Creation section below.

Skin Collimator

Here the user can add or edit a skin collimator for this beam, more details on skin collimator creation can be found in the Skin Collimator Creation section below.

Bolus

Here the user can add or edit a bolus for this beam, more details on bolus creation can be found in the Electron Bolus Creation section below (Intensity Modulators can also be added here).

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