

# Radiotherapy Support Functions (RSF)

Radiotherapy Support Functions are, as a basic description, general radiotherapy worker functions. RSF functions are used both various Dose Calculation Functions and Design Task Functions. The RSF function category encompass the remaining functions not classified as a DTF or DCF.

## Image Processing

Below is a list of some common image processing functions and a brief explanation of their intended usage (Specific details of each function, argument parameters, and return values are provided at the [Dosimetry App Manifest Guide](#)).

- **override\_image\_inside\_structure:**
  - Returns a new 3D image where the value of each voxel that is more than cutoff % contained within the structure is set to the provided override value.
- **override\_image\_outside\_structure:**
  - Modifies an image where the value of each voxel that is more than cutoff % contained within the structure is set to the provided override value (values outside the structure are not modified).
- **override\_image\_variant\_outside\_structure:**
  - Returns a new 3D image where the value of each voxel that is more than cutoff % outside the structure is set to the provided override value.
- **image\_histogram:**
  - Creates a histogram using the specified 1D image
- **combine\_images\_<N>d:**
  - Where N is the size of the image
  - Combine multiple images into single image
- **image\_bounding\_box\_<N>d:**
  - Where N is the size of the image
  - Returns the bounding box of an image of size N
- **bounding\_box\_<N>d:**
  - Where N is the size of the image
  - Returns the bounding box of an image\_geometry of size N. Allows support for non equal spacing of image pixels.
- **image\_min\_max\_<N>d:**
  - Where N is the size of the image
  - Get the minimum and maximum values in the given image.
- **image\_list\_min\_max\_<N>d:**
  - Where N is the size of the image
  - Get the overall minimum and maximum values for a vector of images.
- **create\_uniform\_image\_on\_grid\_<N>d:**
  - Where N is the size of the image
  - Create an image of uniform pixel values (e.g. water phantom) over a grid of size N.
  - See [thinknode™ Examples](#) for python for an example of using this function.

## Contour and Structure Modification

Below is a list of some common polygon, polyset, and structure manipulation functions and a brief explanation of their intended usage (Specific details of each function, argument parameters, and return values are provided at the [Dosimetry App Manifest Guide](#)).

- **polygon\_centroid:**
  - Computes the geometric center of a polygon
- **scale\_polygon:**
  - Scales a polygon shape in XY (independently) based on a vector2D factor
- **scale\_polyset:**
  - Scales a polyset shape in XY (independently) based on a vector2D factor
- **polyset\_expansion:**
  - Expands a polyset uniformly around the edges by the given amount. This function can be used to either expand or contract a polyset.
- **polyset\_combination:**
  - Compute a combination of two or more polysets. This function can operate as a union, intersection, difference, or exclusive or (xor).
- **structure\_combination:**
  - Compute a combination of two or more structures. This function can operate as a union, intersection, difference, or exclusive or (xor).
- **structure\_2d\_expansion:**
  - Compute the 2D expansion of a structure. The 2D expansion of a structure is computed by independently expanding each slice of the structure within its 2D plane. This function can be used to either expand or contract a structure.
- **structure\_3d\_expansion:**
  - When computing the 3D expansion of a structure, the structure's slices are allowed to expand into other slices. This function can be used to either expand or contract a structure.
- **point\_list\_bounding\_box\_<N>d:**
  - Where N is the size of the vector (1, 2, 3 dimensions).
  - Computes the bounding box of a list of N dimensional vectors

## Geometric Primitives

Below is a list of some common creation functions for geometric primitives and a brief explanation of their intended usage (Specific details of each function, argument parameters, and return values are provided at the [Dosimetry App Manifest Guide](#)).

- **make\_cube:**
  - Creates a triangle mesh representing a 3D box
- **make\_cylinder:**
  - Creates a triangle mesh representing an axis aligned, right 3D cylinder
- **make\_pyramid:**
  - Creates a triangle mesh representing a rectangular based, right 3D pyramid
- **make\_sphere:**

- Creates a triangle mesh representing a 3D sphere
- **make\_sliced\_box:**
  - Creates a structure geometry representing a 3D box (using a sliced mesh)
- **make\_sliced\_cylinder:**
  - Creates a structure representing an axis aligned, right 3D cylinder (using a sliced mesh)
- **make\_sliced\_parallelepiped:**
  - Creates a structure representing a generalized 3D parallelepiped (using a sliced mesh)
- **make\_sliced\_pyramid:**
  - Creates a structure representing a rectangular based, right 3D pyramid (using a sliced mesh)
- **make\_sliced\_sphere:**
  - Creates a structure representing a 3D sphere (using a sliced mesh)

## Degrader Manipulation

Below is a list of some common degrader manipulation functions and a brief explanation of their intended usage (Specific details of each function, argument parameters, and return values are provided at the [Dosimetry App Manifest Guide](#)).

- **make\_block:**
  - Create a degrader representing a block. A block has a uniform thickness within its shape and 0 thickness outside. Note that the shape is specified at the downstream edge of the block.
- **make\_shifter:**
  - A block has a uniform thickness within its shape and 0 thickness outside. A range shifter is modelled as extending infinitely in the X and Y directions, so its thickness is uniform across the field.
- **make\_rc:**
  - Create a degrader representing a range compensator. A range compensator is a degrader whose thickness is specified as an image. The image is specified in the plane of the downstream edge of the RC.
- **make\_rc\_nurb:**
  - Create a degrader representing a nurbs range compensator. A nurbs range compensator is a degrader whose thickness is specified as a smooth surface. The surface is specified in the plane of the downstream edge of the RC.
- **truncate\_rc:**
  - Shifts a range compensator surface such that the minimum thickness is set to the specified value.
- **make\_uniform\_rc:**
  - Create a degrader representing a uniform thickness range compensator.
- **make\_linear\_rc:**
  - Create a degrader representing a linearly varying thickness range compensator.

By changing the input (shape, image, etc) passed into the the degrader make functions, the resulting degrader can be manipulated as desired.

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