Sante DICOM Editor
The 3D Window
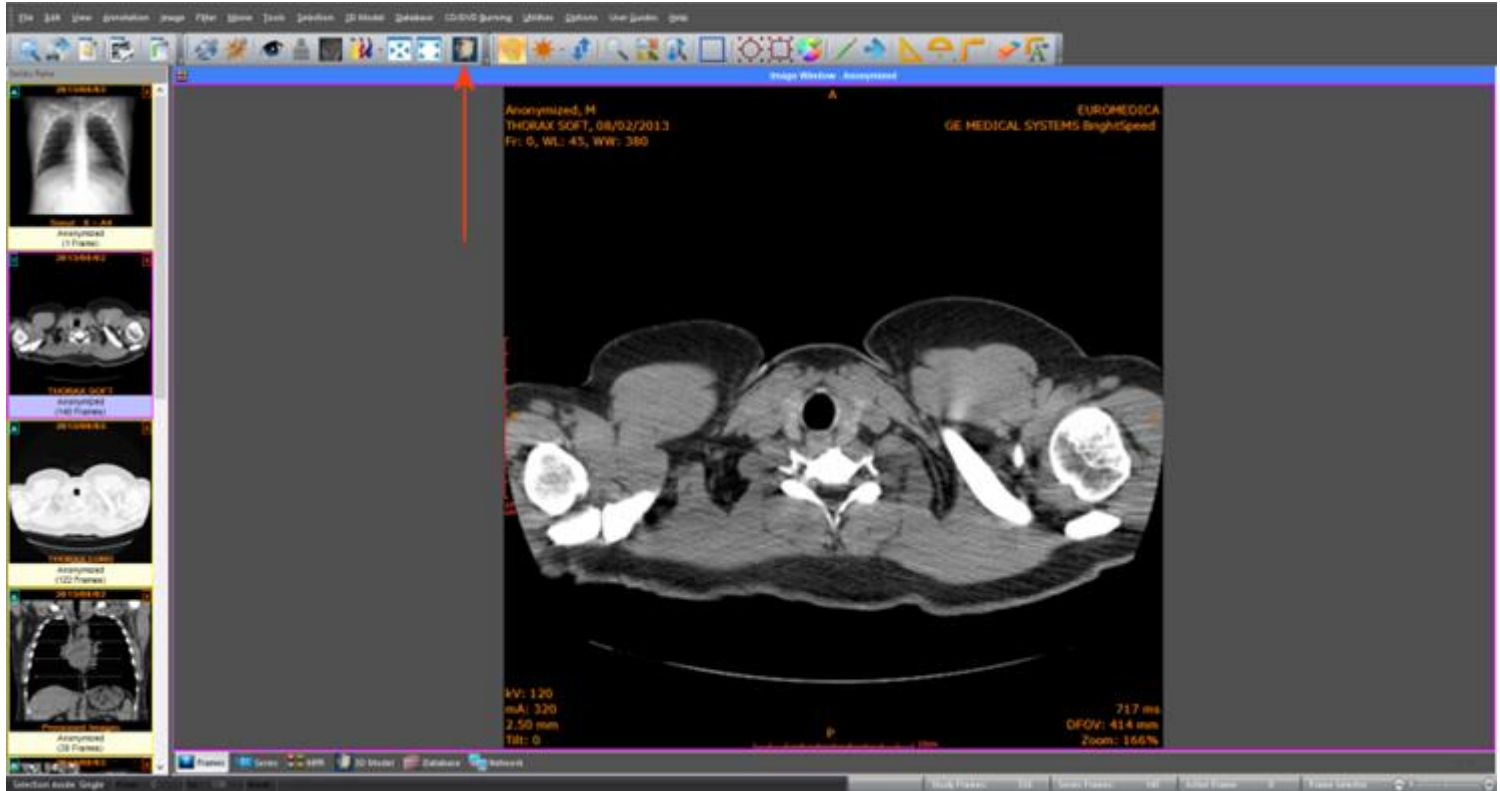
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Work with the 3D window

The program can create 3D models from multi-frames files or multi-file series with 2D image data of CT, MRI and US studies. The user can use the menu command **"3D Model ➔ Create 3D Model"** or the corresponding toolbar button to create a 3D model of the selected series.

The program offers three different 3D rendering techniques: The Isosurface technique, the Maximum Intensity Projection (MIP) technique, and the Transfer Function technique.
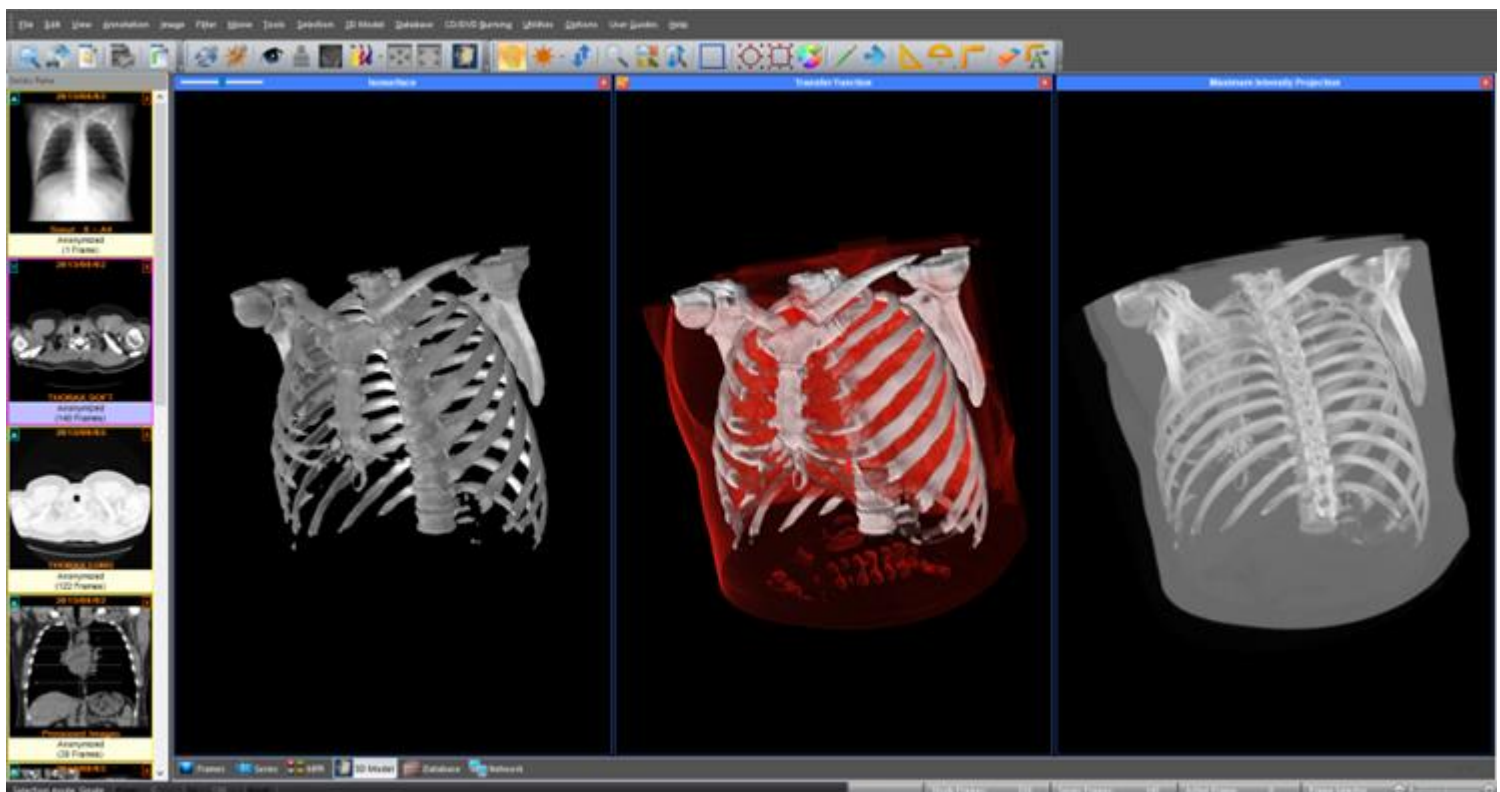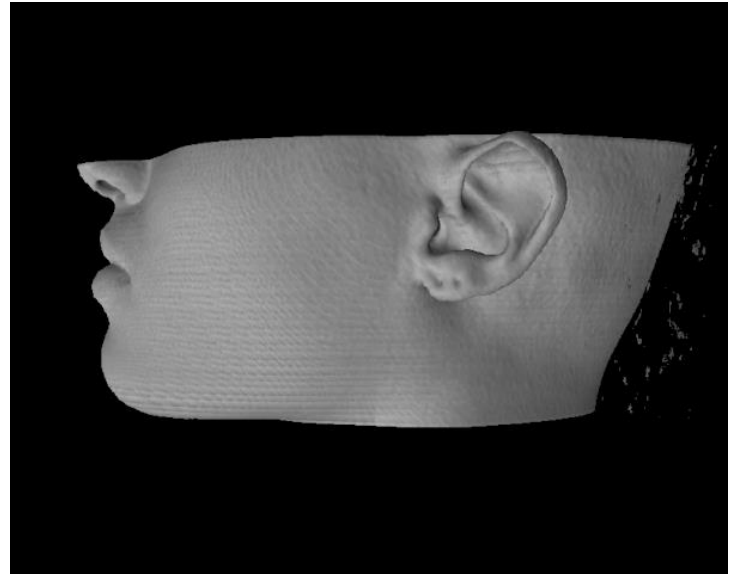

The program can display the 3d model of one, two or all the three techniques simultaneously on the screen.

The Isosurface technique

The program uses the marching cubes algorithm to construct the isosurface model and allows the user to select the isovalue to create a model from different parts of the human body.

A model with a middle isovalue

The same model with a low isovalue

In the upper-left corner of the isosurface window there is a slider control that allows the user to select the isovalue.

The user can enable this technique with the menu command **Show Isosurface Model** (3D Model menu).

The Maximum Intensity Projection (MIP) technique

In this technique the program projects in the visualization plane the voxels with maximum intensity that fall in the way of parallel rays traced from the viewpoint to the plane of projection.
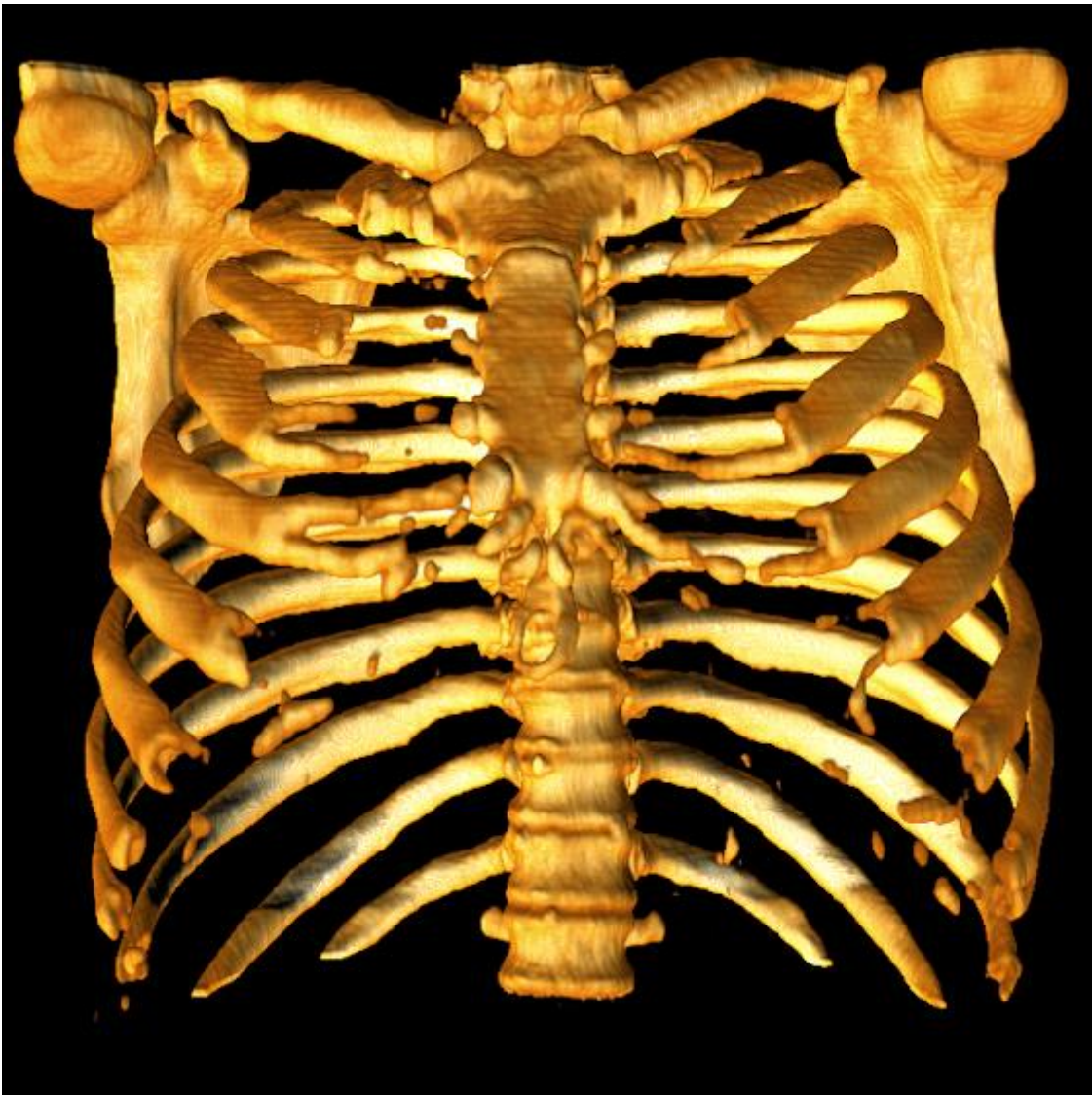

A model with the Maximum Intensity Projection (MIP) technique

The user can enable this technique with the menu command **Show MIP Model** (3D Model menu).

The Transfer Function technique

The Transfer Function technique is a volume ray casting and rendering method that assigns unique colors and opacity/transparency values to different intensity ranges. This is achieved using a histogram-based function called the **"transfer function"**. The transfer function consists of multiple control points, each corresponding to a specific intensity value. Every control point is defined by an RGB color and an opacity/transparency value. The intensity value at a control point is rendered using its assigned color and opacity, while the intensity values between two control points are rendered with interpolated colors and opacity values. By utilizing the transfer function, different parts of the human body can be visualized with distinct colors and varying levels of transparency, enhancing the clarity and differentiation of anatomical structures.


The user can enable this technique with the menu command **Show Transfer Function Model** (3D Model menu).

The Transfer Function Pane

The user can design the transfer function with use of the Transfer Function Pane that allows the user to insert a control point in a specific intensity value, and to define the color and the opacity/transparency value of the control point. The Transfer Function Pane is accessible via the menu command **"View➡Panes and Status Bar➡Transfer Function Pane"**.

In the background of the Transfer Function Pane there is the histogram of the image. The transfer function creates a palette of colors that is assigned to the intensity values and it is displayed at the bottom of the graph.
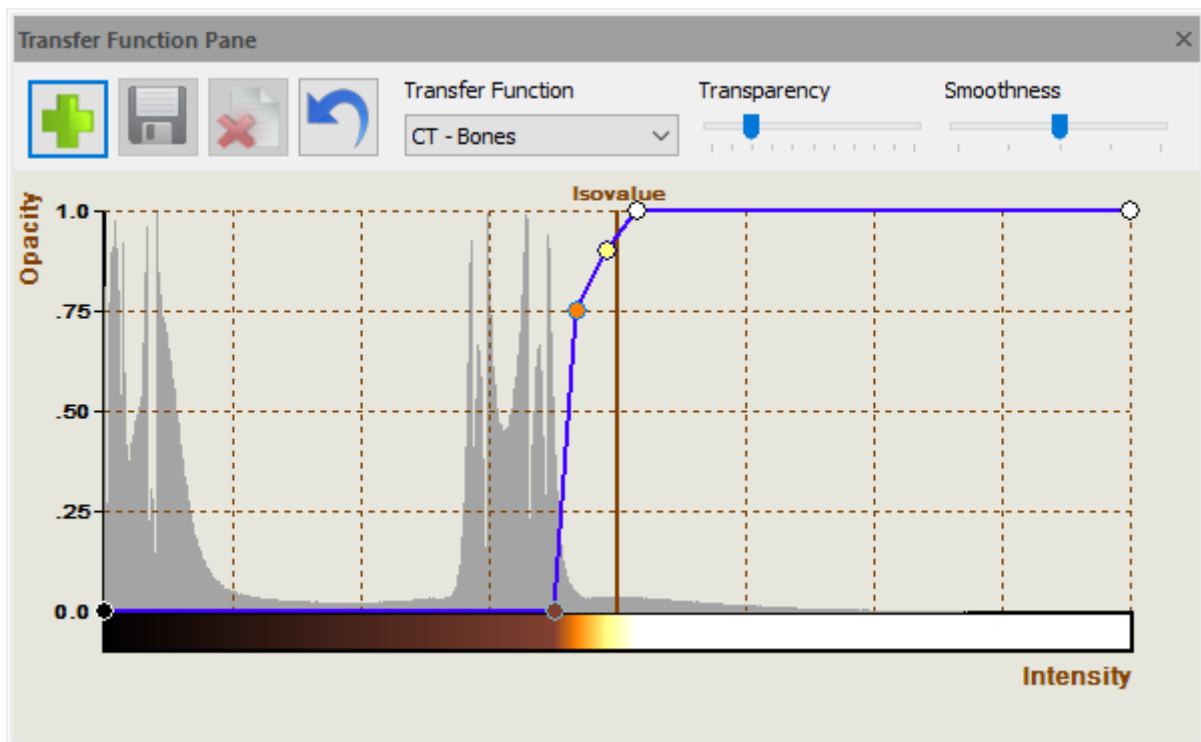
Insert a control point:
Hold down the **Ctrl** key of the keyboard and press the **left** mouse button on the desired point of the histogram.

Change the position of a control point (intensity value):
Press the **left** mouse button on the desired control point and move it left (in a lower intensity value) or right (in a higher intensity value).

Change the position of a control point (opacity value):
Press the **left** mouse button on the desired control point and move it down (for a lower opacity value) or up (in a higher opacity value).

Change the color of a control point:
Press the **right** mouse button on a control point and select the menu item "Change Color".

Delete a control point:
Press the **right** mouse button on a control point and select the menu item "Delete".

Move a portion of the function:
Hold down the **Shift** key of the keyboard, press the **left** mouse button on the desired control point and move it left and right.

The changes are immediately displayed on the 3D model.

Transfer Function Pane controls

The program provides several predefined transfer functions, along with user-defined functions, accessible through the **"Transfer Function"** combo box.

Copy button
Use this button to create a copy of the current transfer function. The user can create as many transfer functions as needed.

Save button
Use this button to save the current transfer function. While predefined transfer functions cannot be saved directly, users can create a copy, modify it, and save it under a different name.

Delete button
Use this button to delete the current transfer function. The user cannot delete the predefined transfer functions.

Invert button
Use this button to invert the colors of the current transfer function.
Hold down the **Ctrl** key of the keyboard and press this button to invert the entire transfer function.
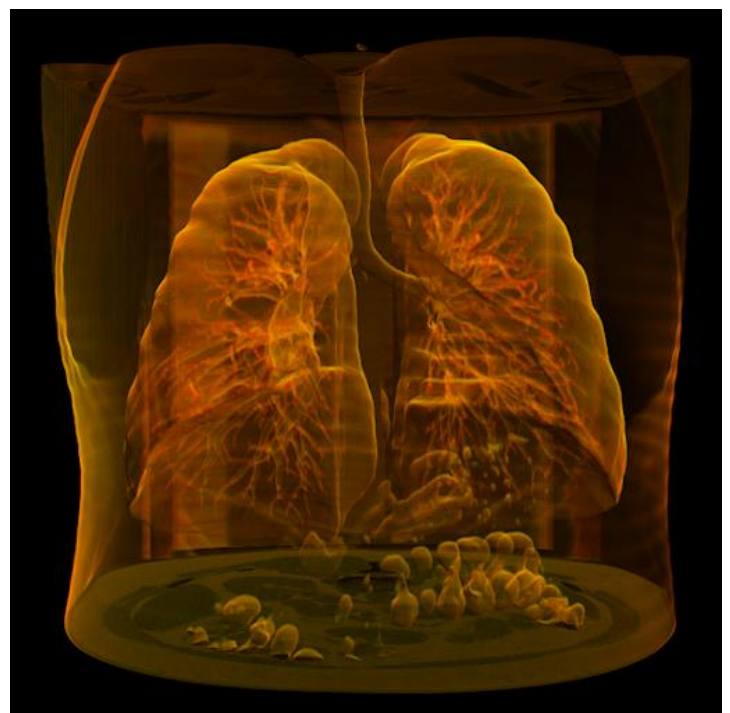
"Transfer Function" combo box
Allows the user to select one of the predefined or user-defined transfer functions.

"Transparency Strength" slider control
Adjusts the transparency of the model. The "Transparency Strength" setting is a part of the current transfer function and saved with it.

Low transparency value	**High transparency value**

"Smoothness" slider control

Adjusts the smoothness of the model. The "Smoothness" setting is part of the current transfer function and is saved along with it.
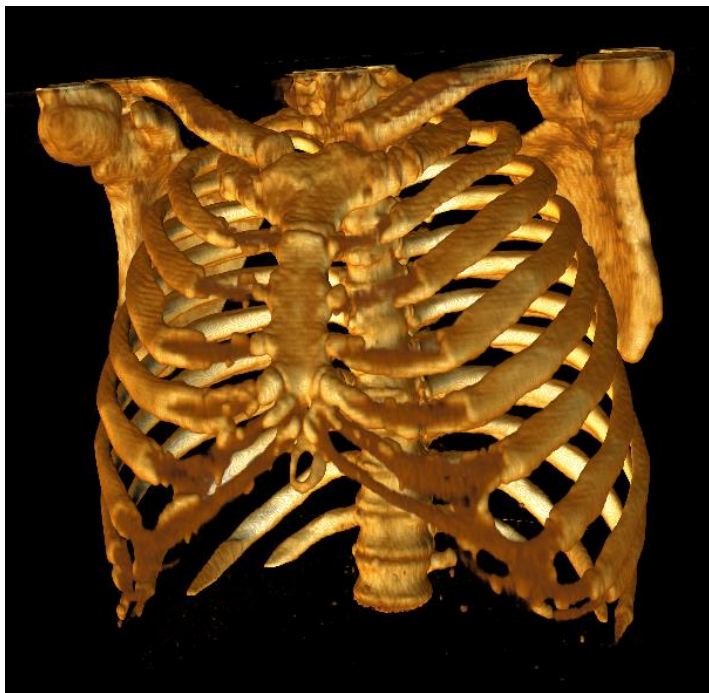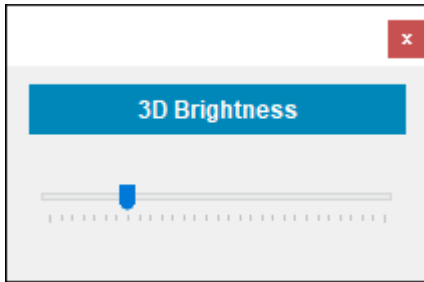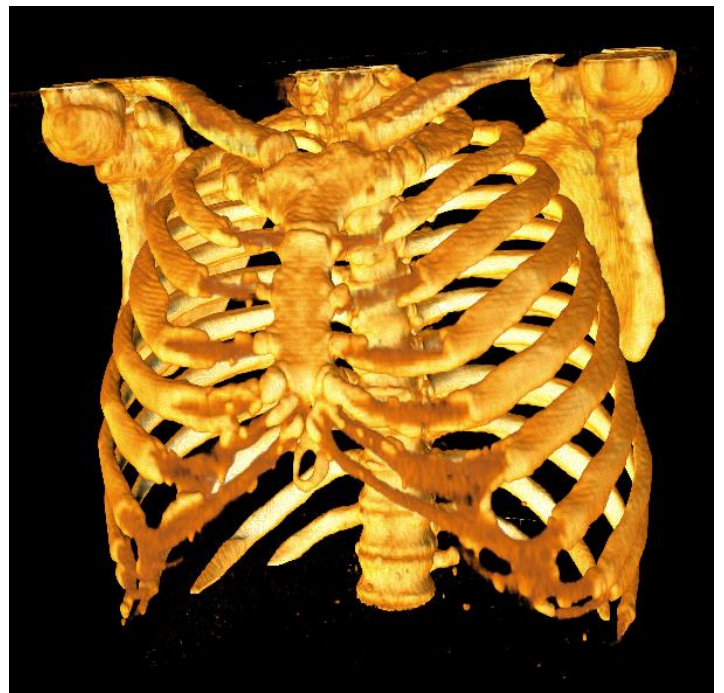

Low smoothness value

High smoothness value

Model Brightness

The user can use the menu command **"3D Model ➡ Brightness"** to change the brightness of the model.
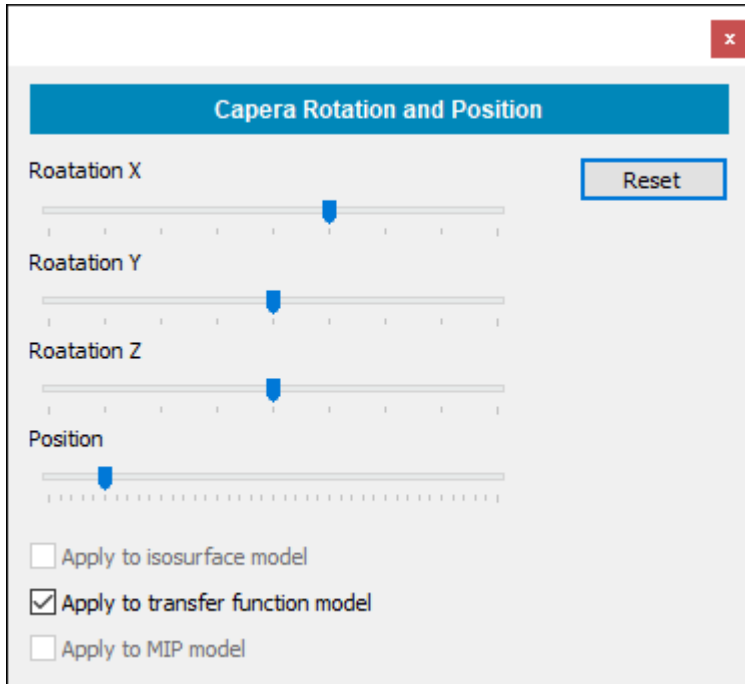

Low brightness value

High brightness value

Camera

The user can use the menu command **"3D Model➡ Camera"** to change the position of the model.

Rotation X
This slider adjusts the rotation of the model around the x axis.

Rotation Y
This slider adjusts the rotation of the model around the y axis.

Rotation Z
This slider adjusts the rotation of the model around the z axis.

Position
This slider adjusts the position of the model, how near or far from the viewer the model is.

Apply to isosurface model
Check this checkbox to set the model position and rotation in the isosurface model.

Apply to transfer function model
Check this checkbox to set the model position and rotation in the transfer function model.

Apply to MIP model
Check this checkbox to set the model position and rotation in the MIP model.

# Model creation commands of 3D Model menu

Create 3D Model
Use this command to create and display a 3D model from the active series. This command works with multi-file CT and MR series and with multi-frame US files.

Create 3D Model By Kept Selections command
Use this command to create a 3D model by the kept selections. The program creates a 3D model by the selected areas of each frame, instead of by the entire frame. This command works with multi-file CT and MR series and with multi-frame US files.

Create 3D Model By Histogram
Use this command to create a 3D model by a range of intensity values. The user can select the range of the intensity values by moving the two round control points of the histogram dialog box. This command works with multi-file CT and MR series and with multi-frame 3D US files.
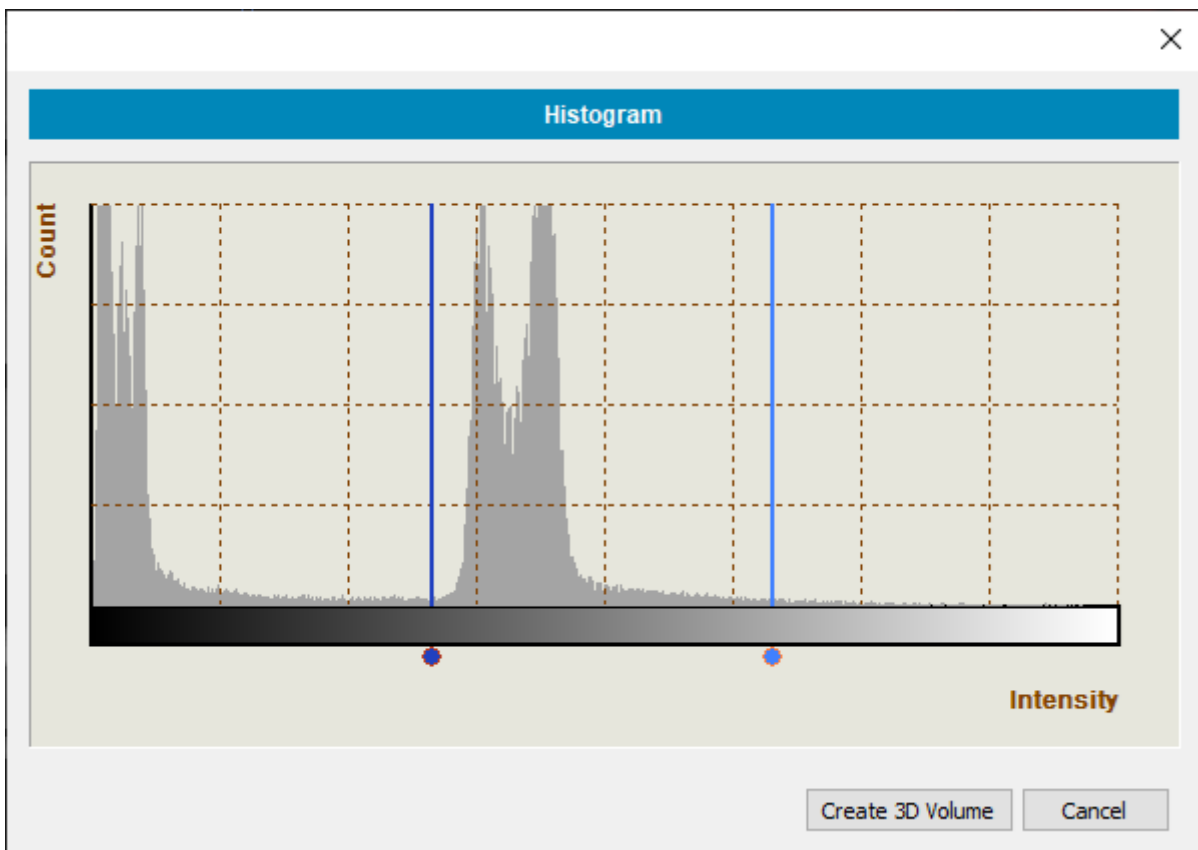
Create Video

Use this command to create a video from a 3D model.

3D Model controls
These controls allow the user to select the model of the video.

Start Position controls
These controls allow the user to define the start position of the model.

Movement controls
These controls allow the user to define movement of the model. The program supports only the rotation of the model in X, Y and Z axis.

Frames per second control
This control allows the user to select the frame per second between three predefined values (24 fps, 25 fps and 30 fps).

Bits Rate control
This control allows the user to select the quality and the size of the video. A small bits-rate value creates a small, low-quality video and a large value creates a large, high-quality video

Duration control
This control allows the user to select the duration of the video in seconds.