

SCANCO MEDICAL

Ray Tracer

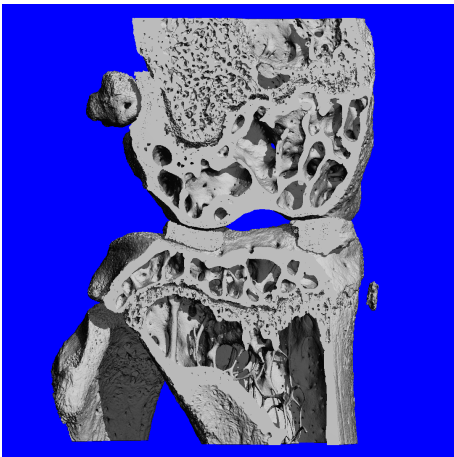


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1 Starting the Ray Tracer application

After logging in to the Application Center, click the **RT** button to start the Ray Tracer.



Figure 1: Start Ray Tracer

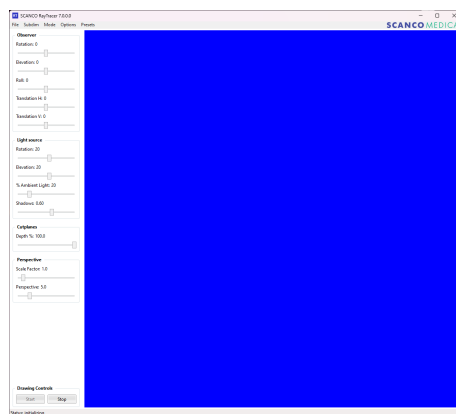


Figure 2: Main application window

2 Selecting the Sample and the Scan

When you start the application, the selection dialog appears automatically. If you want to choose another sample after displaying the first one, go to **File > Open...** in the main menu. The following dialog appears:

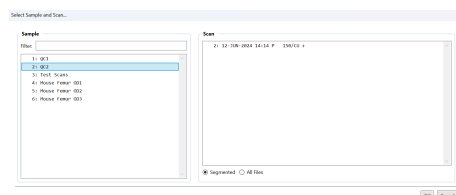


Figure 3: Selecting the sample and the scan

First, choose the type of data by clicking on either **Segmented** or **All Files**.

Then click on the sample you want to display. If there is data of the corresponding type available, it appears on the right side. Click on the scan you want to display. The data is loaded after you confirmed your choice with **OK**.

To display the data, click on the **Start** button at the bottom left of the screen.

2.1 Start/Stop

Start the calculation of the 3D scene by clicking the **Start** button. You can interrupt the calculations by clicking the **Stop** button.



Figure 4: Start/Stop calculation

Alternatively, you can click in the display pane to start/stop the calculation and the display.

3 Visual Effects

3.1 General 3D Scene

There is an observer who moves around in the scene and looks at an object which is positioned at the origin. The observer is at a specific elevation (angle) and looking either from above, below or straight on the object. The observer also moves around the object, given by a rotation angle.

The light source is given relative to the observer. So if the observer moves, the light source also moves. Standard values are 20° higher and 20° to the right from the observer's position.

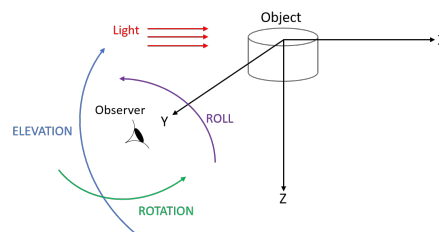


Figure 5: 3D-Scene

3.2 Observer

By changing the rotation, elevation and roll in the **Observer** pane, you change the angle from which you look at the object (see [General 3D Scene](#) for more information). You can also move the object horizontally by changing the **Translation H** value and/or vertically by changing the **Translation V** value.

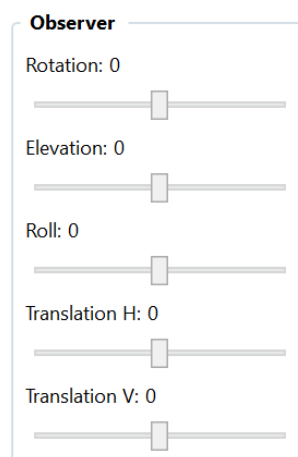


Figure 6: Observer

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Alternatively, you can click in the display pane and move the cursor up and down to change the elevation. Move left or right to change the rotation. Click in the display pane to start the calculation (rendering). Right-click in the display pane and move the cursor up and down or left and right to adjust the horizontal or vertical translation.

If the image is being rendered, interrupt the rendering by clicking in the display pane. Then the observer settings can be modified again by click-and-drag or with the sliders of the respective settings.

Hold **Shift** to display the coordinates of the object where the cursor is pointing.

Hold **Ctrl** and move the cursor to measure the distance between two points on the object.

3.3 Light Source

By changing the **Rotation** and **Elevation** values in the **Light source** pane, you change the light and shading effects on the object. The values are relative to the observer's position.

The **% Ambient Light** slider affects the shading of the object, where 0% means direct lighting only and 100% means ambient lighting only. The values in between are a mixture of both light source types. The **Shadows** slider affects the translucency of the shadow.

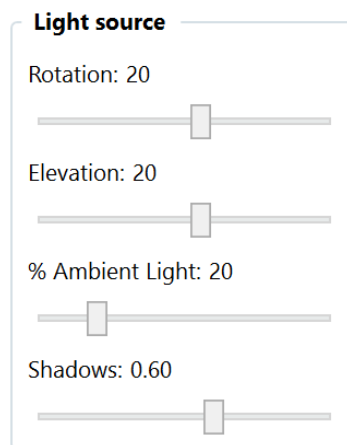


Figure 7: Light source pane

3.4 Cutplanes

To perform a virtual cut through the displayed object, use the **Depth %** slider in the **Cutplanes** pane. Values range from -100% to +100%. 0 is a cut through the middle of the object, parallel to the monitor layer.

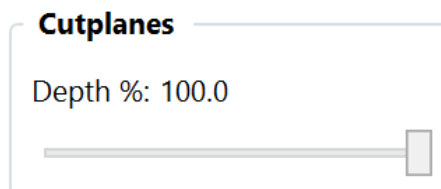


Figure 8: Cutplanes pane

3.5 Other effects

Use the **Scale Factor** slider in the **Perspective** pane to enlarge or shrink the object. The **Perspective** slider lets you change the visual effect as if you moved to the object closer or further away. The scale hereby is modified in a way that the size is not affected.

Alternatively, you can use the mouse scroll wheel in the display pane to change the scaling.

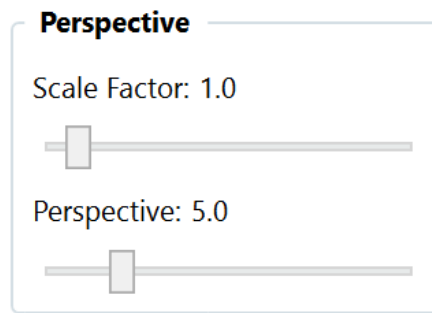


Figure 9: Other effects

3.6 Subdim

Select **Subdim** from the main menu to open the **Subdim** dialog. Move the sliders to perform virtual cuts through the object along the principal axes of the image volume.

The default coordinates in the **Subdim** feature are set to local.

- **Local:** Coordinates are taken from the dimensions of the loaded AIM file.
- **Global:** Coordinates are taken from the ISQ dimensions and the AIM position relative to it.
- **Percent:** Local coordinates are converted into percentage of "size", allowing for virtual cuts at the same location without manual calculations.

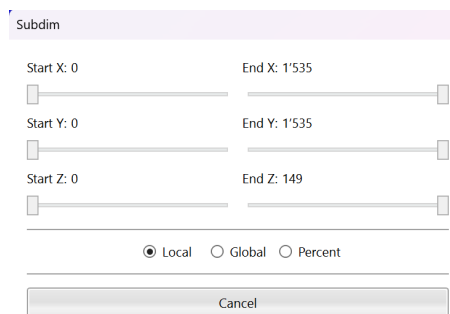


Figure 10: Subdim

3.7 Mode

There are six different display modes available as listed in the figure below.

- **3D Standard:** The default mode showing grayscale or segmented data in 3D.
- **3D Stereo:** Renders the same data from two angles and superimposes the two views in magenta and cyan, for viewing 3D images using 3D glasses.
- **X-Ray:** Mimics an X-ray image from any angle, useful only on grayscale data.
- **Minimum / Maximum Intensity Projection:** Shows the lowest / highest value found on the path from the observer through the object.
- **Grayscale Section:** Allows adding a grayscale plane to the standard rendering.
- **Surface Normal:** Allows easy visualization of surfaces facing the same direction.

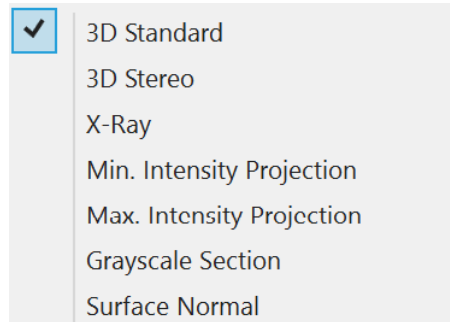


Figure 11: Display modes

3.7.1 Grayscale Section Mode

The **Grayscale Cutplane Position** dialog allows selection and positioning of the grayscale plane along the **X**, **Y** or **Z** axis and also allows to define the position and size of the resulting 2D grayscale image on top of the 3D rendering. Positive values for the position set the image relative to the top and left edge, negative values relative to the right or bottom edge. Negative dimensions invert the 2D image.

The datafile for the grayscale image is chosen by default: First the application looks for the grayscale AIM file, if not found, the ISQ file is taken.

1. Positioning of grayscale plane along selected axis
2. Selection of plane/axis
3. Choice of position and dimension of 2D image

A control window allows to select and position the grayscale plane along X, Y or Z axis and also allows to define the position and size of the resulting 2D grayscale image on top of the 3D rendering. Positive values for the position set the image relative to the top and left edge, negative values relative to the right or bottom edge. Negative dimensions invert the 2D images.

The datafile for the grayscale image is chosen by default, first the program looks for the grayscale AIM file, if not found, the ISQ file is taken.

1. Positioning of grayscale plane along selected axis
2. Selection of plane/axis
3. Choose position and dimension of 2D image

Alternatively, a specific text file can be placed into the folder of the scan data to allow arbitrary cutplanes, given by the coordinates of the edge points. The text file has to have the following format:

cutplanes.txt (with following content):

```
E:\MICROCT_DATA\33\4\4\e1000858.isq
-10 -10 250 250
L
2
0 0 0 480 0 0 0 304 653
100 0 0 580 0 0 100 304 653
Line 1, Grayscale file to be used (either AIM or ISQ)
Line 2, Position and dimension of 2D image
Line 3, Local or Global coordinates for cutplanes
Line 4, Number of cutplanes to be used
Line 5 ... , Coordinates (3x3 edge points) of cutplanes
```

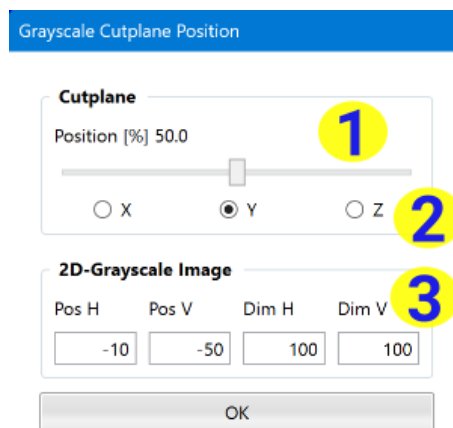


Figure 12: Grayscale Cutplane Position dialog



Figure 13: Rendered image

3.8 Object Properties

Go to **Options > Object+Display Properties...** in the main menu to open the **Object properties** dialog. This allows you to show or hide objects, change display colors, etc. Find a more detailed description on our webpage (FAQ: "Options of the 3D display program").

1. The two sliders at the top select different objects in the AIM file, defined by their value ranges. For a segmented file, there are only two objects, where 0 is the background and 1 is the segmented object. If the volume contains voxels with different values, they will be shown in bins, 1 to about 255. With the sliders you can select e.g. 1 to 80. The values and the corresponding thresholds are displayed just below the sliders. Once a range has been selected the display properties of those values can be altered, see points below for options.
2. Display properties of an object within the selected range.
 - Show:** Display objects in range as a solid object.
 - Transparent/Join:** Joins all selected objects into one transparent object.
 - Transparent/Separate:** Each object is displayed as a separate object but transparent.
 - Transparency:** Regulates the percentage of transparency.
 - Hide:** Hides all objects within the range.
3. **Surface**
 - Object color:** Each object within the given range is displayed in the color given in the color bar below. Click on the color bar to open the **Color** dialog (see [Figure 15](#)) and select a different color.
 - Value color:** Each object is colored according to its value in the AIM file. The color map can be changed using the [Object Values](#) dialog.
4. **Faces**
 - Colors the artificial faces of the boundary box or along the defined cutplanes.

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Like Surface: Uses the same color for faces as for the rest of the object surface.

Object Color: Uses the same color for faces as for the rest of the object.

Face Color: Uses a user-defined color for the face. This color can be changed by clicking on the color bar that appears when you select this option.

Value Color: The face is colored according to the value of the object that is saved in the file. The color lookup table can be changed using the [Object Values](#) dialog (see [Figure 16](#)).

5. Light Sources / Background / Visual Effects

Change the color of the light sources using the **Ambient** and **Direct** color bars. Change the background color by clicking on the **Background** color bar.

Limit Transparent Intersection Display: This slider is active for transparent objects and regulates how many transitions between objects (or object/air) are displayed.

6. Printing/Display Options: Toggle checkboxes to show or hide information in the display window and in printed copies.

Options: **Print Name**, **Print LUT** (lookup table/color map), **Print Company**, **Print Scale**.

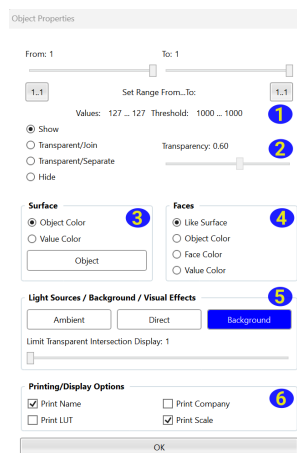


Figure 14: Object properties dialog

3.8.1 Color

Click on a color bar in the **Object properties** dialog to open the **Color** dialog and select different colors.

1. Basic colors pane

All predefined color options are displayed in this section.

2. Custom colors pane

User-defined colors are stored in this section for later use.

3. Manual color definition

Define a custom color by clicking in the color spectrum pane or by modifying the RGB or hue, saturation, luminosity (HSL) color values. The luminosity of the color can also be adjusted with the vertical slider.

4. Add to Custom Colors button

Click this button to add a manually defined color to the **Custom colors** pane.

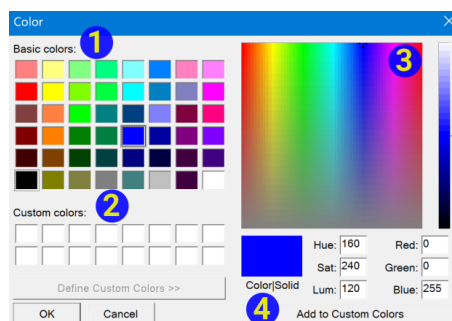


Figure 15: Color dialog

3.9 Object Values

Go to **Options > Values...** in the main menu to open the **Object Values** dialog and change the brightness of the displayed image and the color map. You may want to enter 0 for **Min** for better contrast. To further increase brightness, enter a lower **Max** value than proposed. Click on the color bar to toggle between different color maps. Click **OK** and click in the display pane to update the image rendering.

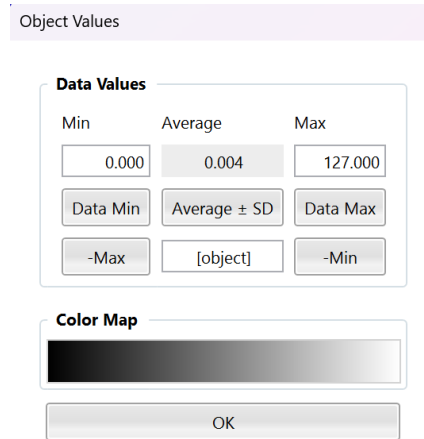


Figure 16: Object Values dialog

4 Print to File

Once your 3D scene is finalized, you can save it as an EPS or TIFF file. Go to **File > Print...** in the main menu to open the **Print to File...** dialog shown in the figure below.

1. Under **Format**, select the type of printout by clicking on one of the options **EPS** or **TIFF**.
2. If saving to TIFF, you can specify the location and filename under **Directory**: e.g. to **Scratch/Temp**, **Export** (as defined in the WebAdmin Logicals) or to the **Measurement** directory on the data disk.
3. Under **Destination**, ensure the option **File** is selected.
4. Under **Color options**, specify the output color mode: **Color** or **B/W**.
5. Under **Autoprint**, select the **Auto-Print** checkbox to automatically save the rendered image to the directory. This way, several images can be generated in quick sequence. The number included in the filename is incremented each time to distinguish the images.
6. Click **OK** to execute the print job.

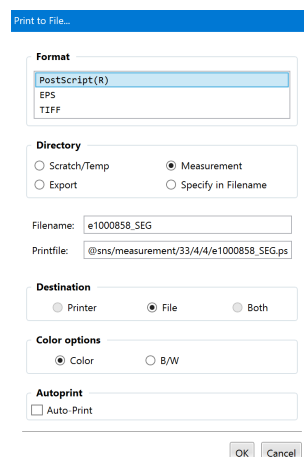


Figure 17: Print to File... dialog

5 Calculating 3D Image Sequences for Animations

Go to **Options > Animation...** in the main menu to open the **Animation** dialog.

To generate an image sequence for animation, rotate the object into the desired initial position for the animation and click **Get Preset A**. Then move the object to the desired end position and click **Get Preset B**. When you move the object using the sliders (**Rotation, Elevation, Translation** etc.), you need to click **Start** in the **Drawing Controls** pane to update the rendering.

Use the **No. of frames** slider to select the the number of intermediate images that you would like to create between the initial and the end position.

Before starting the image generation, activate the auto-print mode as follows:

1. Go to **File > Print...** in the main menu to open the **Print to File...** dialog.
2. Select **TIF** under **Format**.
3. In the **Filename** field below **Directory**, enter the root of a file name, e.g. `Animation_output`. Depending on the selected output directory the joined virtual or physical path will be displayed under **Printfile:**. The application will append `_0000 . TIF`, `_0001 . TIF`, etc afterwards.
4. Select the **Auto-Print** checkbox.
5. Click **OK**.

Now click **Start Calculation** in the **Animation** dialog to generate the image sequence.

Transfer the generated TIF files to your local computer, and combine the sequences in the application that you are using to convert the TIF files to AVI or MOV files (like Windows Movie Maker 2, or Quick Time Pro, or Adobe Premiere etc.).

The order in the above list can also be reversed: You can first activate the auto-print mode and then open the **Animation** dialog, choose start and end positions, and click **Start Animation**.

The positions A and B can be chosen freely: e.g. with **Subdim**, you can first show the entire object (A), then slide it back to hide the entire object (B).

You can also gradually change the color of an object. Or gradually hide objects: under **Object Properties** choose **Transparent/Separate** for object, but change **Transparency** from 0.0 (A) to 1.0 (B)

If you want to create an animation with different sections, e.g. first rotate the object around, then slowly make the object transparent, then cut in, do this in multiple sections with the Ray Tracer application: First generate TIF files `rotation_0000` to `rotation_0200`, then `transp_0000` to `transp_0050`, and then `cut_0000` to `cut_0100`. Make sure ALL the settings from the last view of the previous section match those of the first view of the next section to achieve smooth transitions.

To save the animation presets A and B for reuse on another sample, click **Save Presets File....** A dialog will open where you can define folder and file name for the file. The file should be saved in .DAT format.

Animation

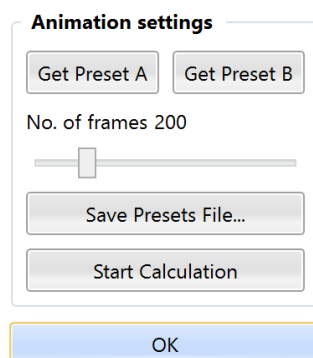


Figure 18: Animation dialog

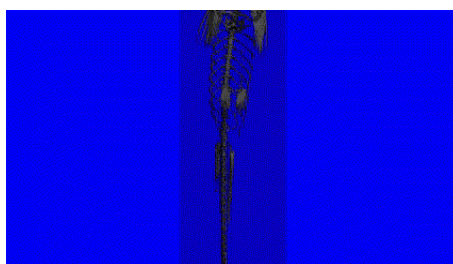


Figure 19: Animation of a zebrafish

5.1 Presets

Under **Presets** in the main menu, select **Write Presets** to write the currently applied settings from the display pane to a DAT file. Select **Read Presets** to open an existing presets file. Select **Apply Preset A** and **Apply Preset B** (only activated if two sets of presets are defined in the file) to apply the settings defined in the opened presets file.

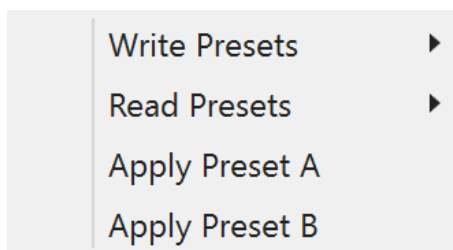


Figure 20: Presets menu