

User Documentation for IDVR

(Importance driven volume rendering)

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Loading a Dataset

After the start of the program you will see the following window:

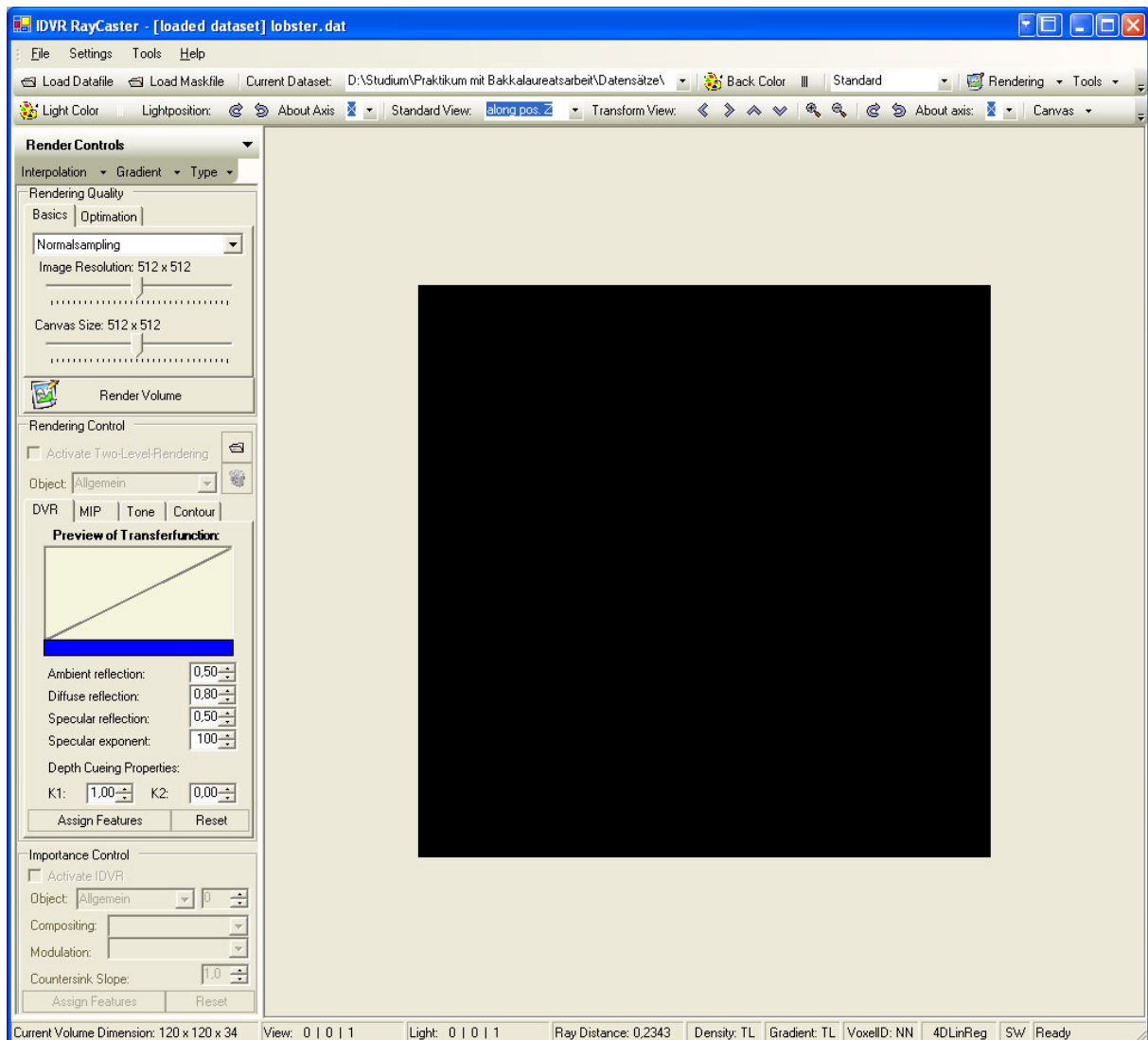


Figure 1: Screenshot of the Program

You can load a volume dataset by clicking on the “Load Datafile” button. Additionally you can load a maskfile for an already loaded dataset by clicking on the “Load Maskfile” Button.

Render Controls

Here you can choose between the different interpolation and gradient estimation methods:



Figure 2: Interpolation Methods and Gradient Estimation

Interpolation

You have the possibility to choose the interpolation method for the voxel density, the gradient and the voxelID. There are two different interpolation modes:

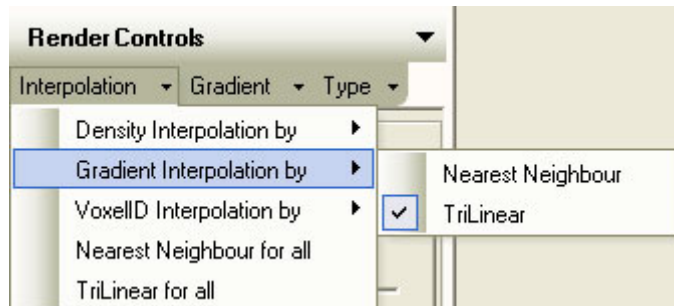


Figure 3: Interpolation

- Nearest neighbour: The raysample gets the value of the voxel with the smallest distance (8-neighbourhood).
- Trilinear interpolation: The raysample gets the trilinear interpolated value of all voxels in the 8-neighbourhood.

Default values:

- Density interpolation: Trilinear
- Gradient interpolation: Trilinear
- VoxelID interpolation: Nearest neighbour

It is also possible to change all interpolation methods at the same time.

Gradient Estimation

Here you can choose between the different gradient estimation modes:

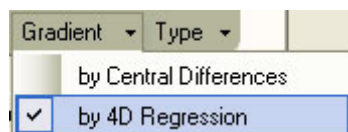


Figure 4: Gradient Estimation

You can choose between central differences and 4D linear regression.

Rendering Quality

Basics

You can change various parameters concerning the quality of the rendered image.

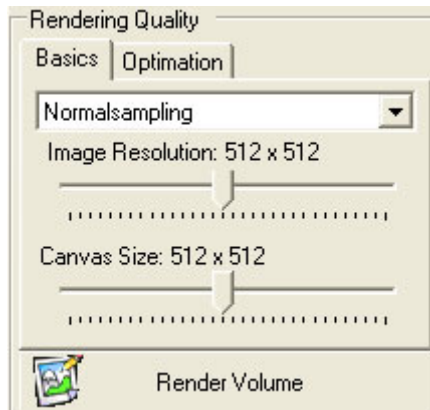


Figure 5: Rendering Quality

Here you can choose the resolution of the rendered image (Image Resolution) (default: 512 x 512) and the size of the canvas onto which the rendered image will be drawn (default 512 x 512).

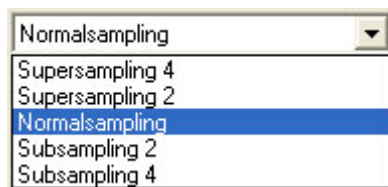


Figure 6: Sampling

With “Normalsampling”, the ration between image resolution and canvas size is 1:1, with “Supersampling 2, it is 2:1, and so on.

Optimization

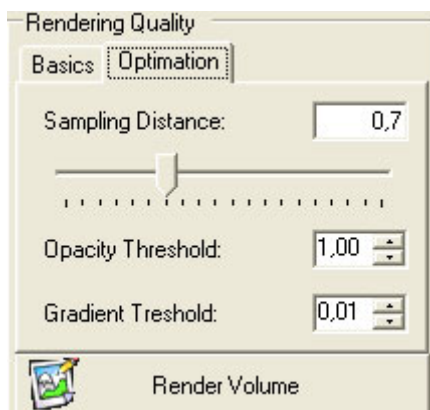


Figure 7: Optimization

Here you can choose the sampling distance, the distance between two adjacent raysamples (default: 0.7). There is also the possibility to change the opacity threshold (default: 1.0) and the gradient threshold (default 0.01, which means 1% of the maximal gradient length).

Rendering Control

Here you can choose the different renderer for the loaded volume dataset and the segmented objects respectively. There are four different standard rendering methods: “Direct Volume Rendering” (default), “Maximum Intensity Projection (MIP)”, “Tone Shading” and “Contour Shading”.

Direct Volume Rendering

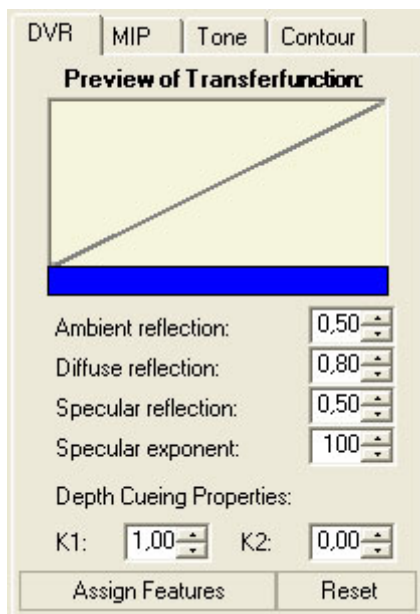


Figure 8: Direct Volume Rendering

First, a preview of the chosen transfer function is shown. By clicking on the preview you can change the transfer function in the opening “Edit Transfer Function” dialog, which will be described later.

The following properties of the renderer can be changed:

- Ambient Reflection: The ambient reflection coefficient of the object.(default: 0.50)
- Diffuse Reflection: The diffuse reflection coefficient of the object. (default: 0.80).
- Specular Reflection: The specular reflection coefficient of the object. (default: 0.50).
- Specular Exponent: The specular exponent of the object. (default: 100).
- Depth Cueing K1 und K2: Depth cueing constants. (default: K1: 1.00, K2: 0.00).

By clicking on the button “Assign”, the chosen properties are assigned to the renderer. By clicking on the button “Reset”, all properties are set to the default value.

Maximum Intensity Projection (MIP)

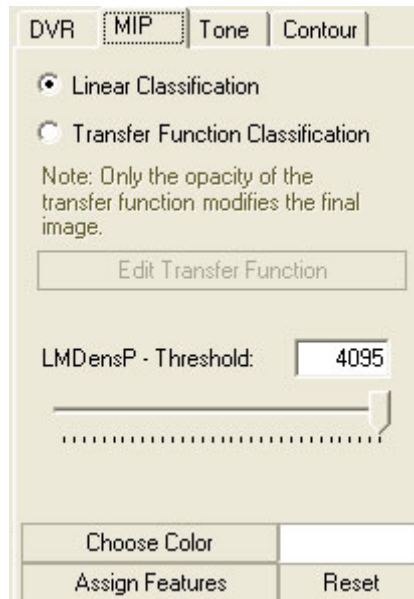


Figure 9: Maximum Intensity Projection (MIP)

The following properties of the renderer can be changed:

Here you can choose between linear classification (default) and transfer function classification. If you choose the second one, you can edit the transfer function by clicking on the “Edit Transfer Function” button in the opening “Edit Transfer Function” dialog, which will be described later.

You can also choose the density threshold for the LMIP compositing (default: 4095).

By clicking on the “Choose Color” button, you can choose the standard color of the MIP renderer, which will be shown in the label aside (default: white).

By clicking on the button “Assign”, the chosen properties are assigned to the renderer. By clicking on the button “Reset”, all properties are set to the default value.

Tone Renderer

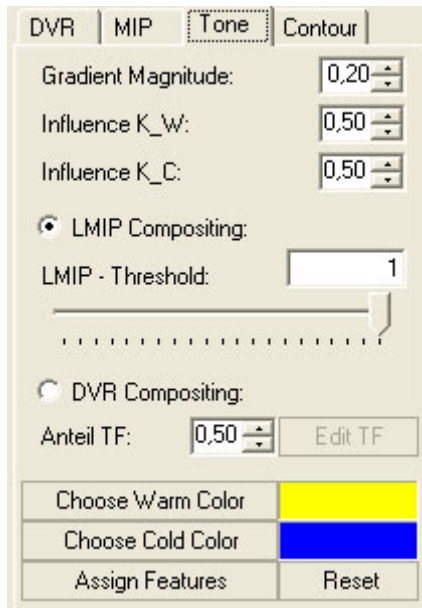


Figure 10: Tone Renderer

The following properties of the renderer can be changed:

- Gradient magnitude threshold: The minimum length of a raysample's gradient, so that it will be used for the rendering calculations (0.01 means 1% of the maximum gradient length) (default: 0.20).
- Influence K_W: The ratio of the warm color to the resulting image in percent (default: 0.50).
- Influence K_C: The ratio of the cold color to the resulting image in percent (default: 0.50).

The sum of K_W and K_C does not have to be 1.

Furthermore you have the possibility to change between LMIP (default) and DVR compositing. With LMIP compositing, you can choose the LMIP threshold (default: 4095). With DVR compositing, you can edit the transfer function by clicking on the "Edit TF" button in the opening "Edit Transfer Function" dialog, which will be described later. You can also change the influence of the transfer function in the numeric up-down aside (default: 0.50). The color of the resulting image will so be mixed with the color of the transfer function.

By clicking on the button "Choose Warm Color", you can change the warm color. It will be shown in the label aside (default: yellow).

By clicking on the button "Choose Cold Color", you can change the cold color. It will be shown in the label aside (default: blue).

By clicking on the button "Assign", the chosen properties are assigned to the renderer.

By clicking on the button "Reset", all properties are set to the default value.

Contour Renderer

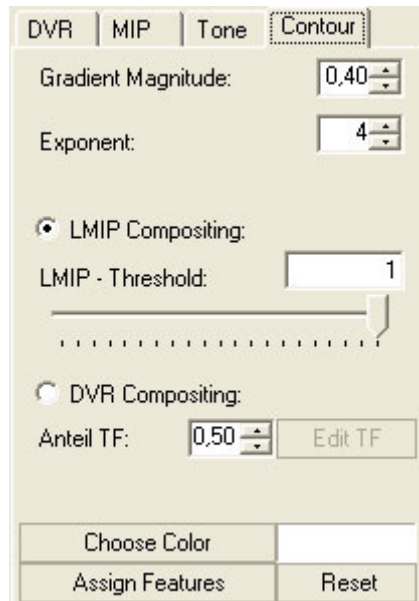


Figure 11: Contour Renderer

The following properties of the renderer can be changed:

- Gradient magnitude: The minimum length of a raysample's gradient, so that it will be used for the rendering calculations (0.01 means 1% of the maximum gradient length) (default: 0.20).
- Exponent: The bigger the exponent, the thinner the contour lines will be.

Furthermore you have the possibility to change between LMIP (default) and DVR compositing. With LMIP compositing, you can choose the LMIP threshold (default: 4095). With DVR compositing, you can edit the transfer function by clicking on the "Edit TF" button in the opening "Edit Transfer Function" dialog, which will be described later. You can also change the influence of the transfer function in the numeric up-down aside (default: 0.50). The color of the resulting image will so be mixed with the color of the transfer function, which means, the contour lines will be amplified.

By clicking on the "Choose Color" button, you can choose the standard color of the contour renderer, which will be shown in the label aside (default: white).

By clicking on the button "Assign", the chosen properties are assigned to the renderer. By clicking on the button "Reset", all properties are set to the default value.

Two-Level Rendering

Here you can change the properties of two-level rendering.



Figure 12: Two-Level Rendering

By clicking on the “Activate Two-Level-Rendering” checkbox, you can enable two-level rendering. Of course there has to be loaded at least one maskfile before. You can load an additional maskfile by clicking on the “Open” icon and change its name in the opening dialog. Clicking on the “Trashcan” icon will delete the selected maskfile. Object “Allgemein” is, at the beginning, the whole volume dataset, and later, when there are some maskfiles loaded, only those voxels, that do not belong to any object.

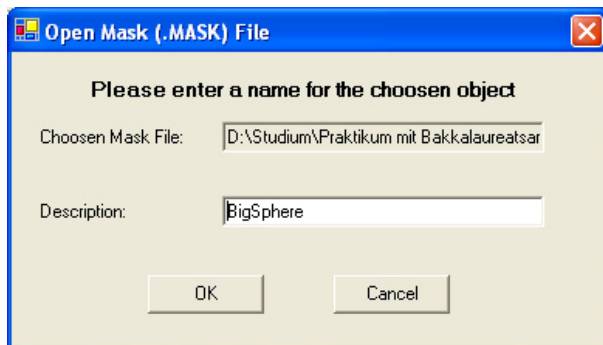


Figure 13: Open Maskfile Dialog

In the combobox “Object” you have a list of all loaded maskfiles, respectively objects of the volume dataset. You can now choose any one of them and assign to it a special local renderer to it.

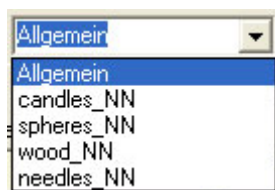


Figure 14: Object List

Importance Driven Volume Rendering (IDVR)

Here you can change the properties of the importance driven volume rendering.

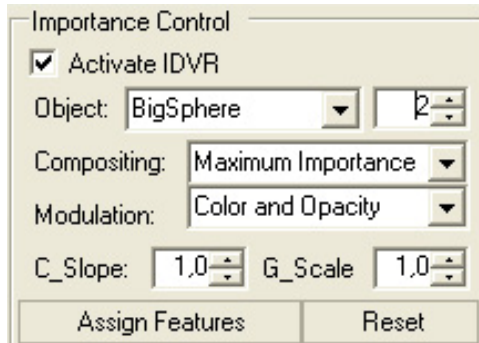


Figure 15: Importance Driven Volume Rendering

Clicking on the “Activate IDVR” checkbox enables the importance driven volume rendering. Of course there has to be loaded at least one maskfile before. You now have the possibility to choose one object and assign a special importance value to it (By default, all objects have an importance value 0). Here, the object “BigSphere” has an importance value “2”. You can also change between different Compositing and modulation modes, but by now there is only one compositing (Maximum Importance) and one modulation mode (Color and Opacity) implemented. The C_Slope indicates the slope of the countersink geometry of the cut-out volume (default: 1.0). The G_Scale indicates, how the gradient on the cut-out volume has to be scaled (default: 1.0).

By clicking on the button “Assign”, the chosen properties are assigned to the IDVR. By clicking on the button “Reset”, all properties are set to the default value.

Tools

There are various useful tools in the program.

Preview Canvas

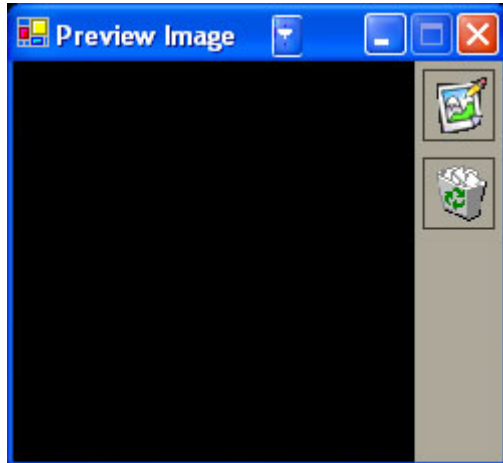


Figure 16: Preview Canvas

Here you have the possibility to obtain a fast preview image of the chosen rendering properties. Of course, the quality of the preview is not very good (for example, there is only nearest neighbour interpolation used), but it is very fast and so you can get a first overview of how the image will look in the end. By clicking the “Render Icon”, the preview will be rendered, by clicking on the “Trashcan” icon, the preview will be deleted.

Transfer Function Editor

Here you have the possibility to create a user specified transfer function.

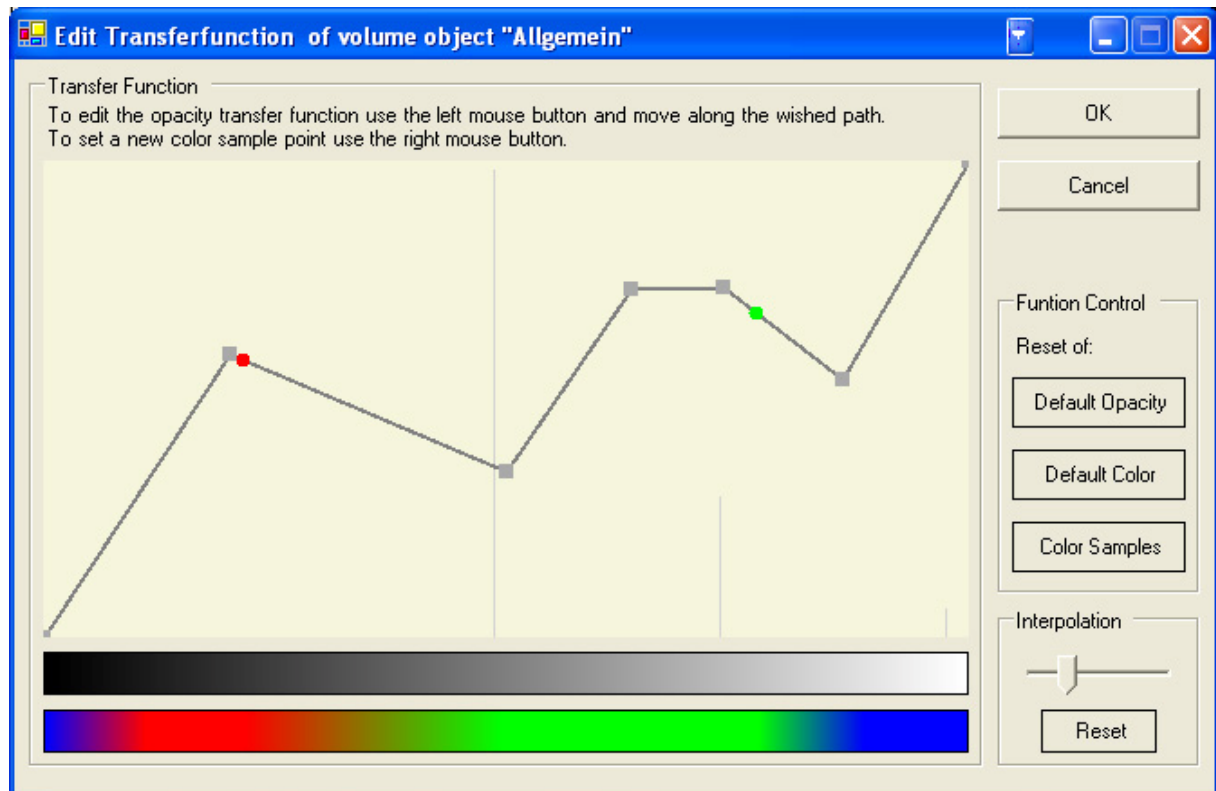


Figure 17: Transfer Function Editor

Left click on the panel adds an opacity control point, right click a color control point. You can also move already added control points simply per “drag & drop”. Between color control points, the color is automatically interpolated, but you can also change the interpolation by dragging the interpolation trackbar (of course, you can reset it by clicking the “Reset” button under it). By clicking one of the three “Default” buttons, you can reset the opacity or color samples. You can also give the transfer function a default color. The button “OK” assigns the new transfer function to the specified object; the button “Cancel” closes the editor without doing anything.

Slice Viewer

Here you can view the volume dataset slice per slice.



Figure 18: Slice Viewer

You can view slices in x-, y- or z-direction. You can also choose the color of the slices by clicking on the “Color” button. It is also possible to enlarge the slices up to 8 times of the original size. By dragging the trackbar, you can change the number of the viewed slice. The current number is also shown in the textfield aside. Of course you can also view a particular slice by simply typing its number into the textfield.

Animation Editor

With the animation editor you can automatically render a sequence of images which can be used for an animation later on.

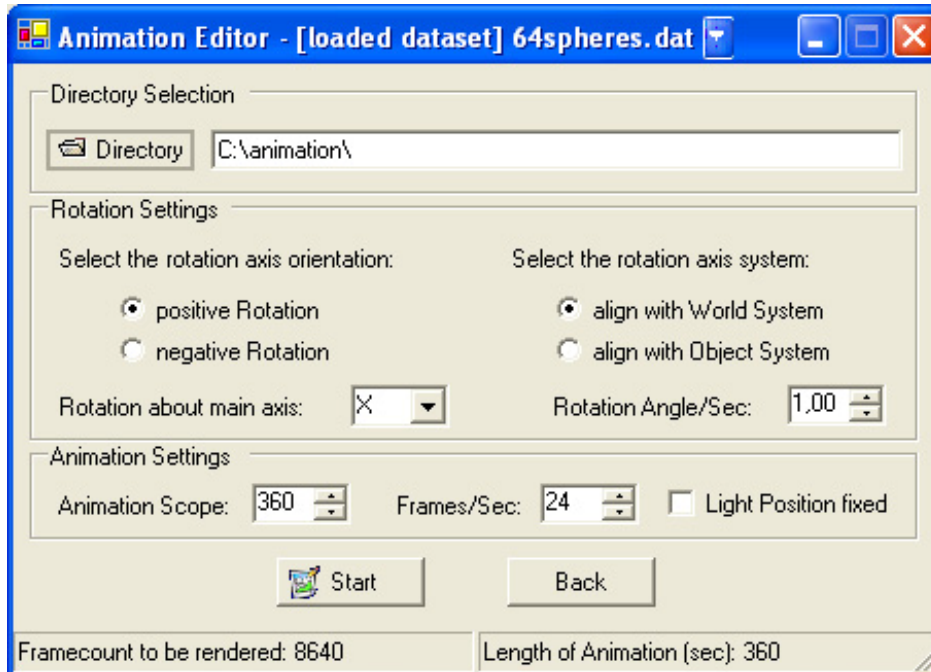


Figure 19: Animation Editor

You can change the path of the saved image sequence by clicking on the “Directory” button. The current path is shown aside.

In the “Rotation Settings” section, you can decide, around which axis the dataset will rotate, either in positive or in negative rotation. You can also decide if the volume dataset should rotate around the world or object coordinate system. At last you can change the angle, the volume dataset will rotate per second.

In the “Animation Settings”, you can setup the “Animation Scope”, which is the total angle, the dataset will rotate and the framerate. It is also possible to decide, whether the volume dataset should rotate with a fixed light position or not.

In the statusbar you can see how many frames will be rendered and how long the animation will be. Here, an animation of 360 degrees with one degree per second will need 8640 rendered images and have a total length of 360 seconds.

By clicking on the button “Start”, the rendering calculation for the sequence will start. By clicking on the button “Back”, the window will close without doing anything.

Transformations

You can transform the dataset simply per “drag and drop” on the canvas.

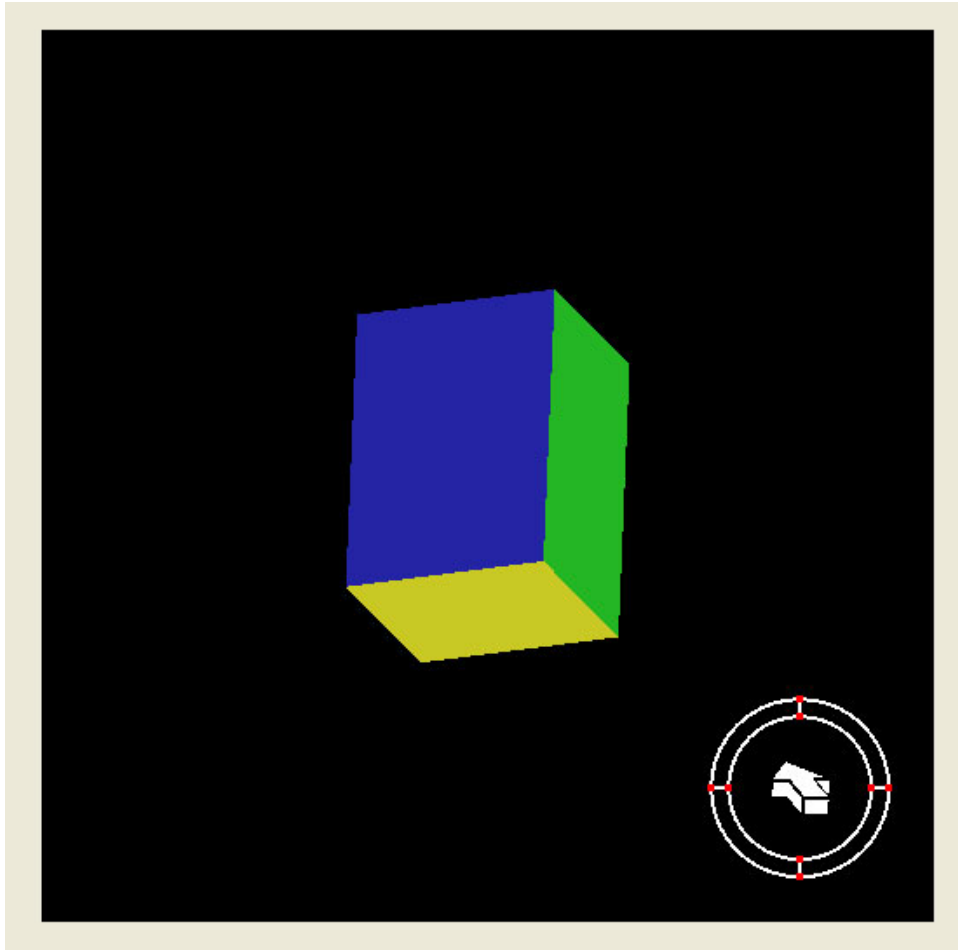


Figure 20: Transformation

When you click on the canvas you will see a proxy object which represents the volume dataset with correct sidelength according to the original volume dimension.

Rotation

Simply left click on the canvas and moving the mouse will rotate the proxy object and the whole volume dataset respectively.

Zoom

Rotating the mouse wheel will zoom in or out the proxy object and the whole volume dataset respectively.

Light Rotation

The white arrow on the bottom right corner of the canvas indicates the direction of the light. You can modify it simply by right clicking on the canvas and moving the mouse.