The V^3 Usage Guide

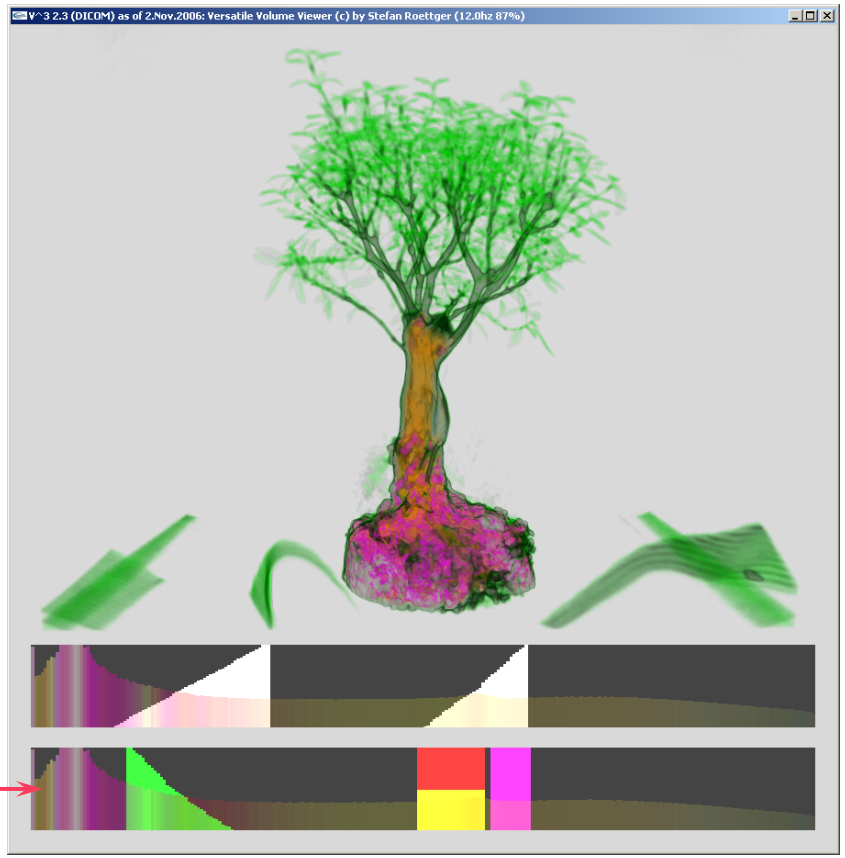
Stefan Roettger, Jan. 2007

Part #2: Advanced Features

V^3 Usage

Step 15: The Manually Colored Bonsai Revisited

In part #1 of the usage guide we tried to make a standard visualization of the Bonsai. The result is depicted below. You were also invited to improve the 1D TF even further and you may have noticed that the problem with tweaking the TF is that you never know how far you might get. In the following we introduce some advanced methods that make the TF setup more convenient.

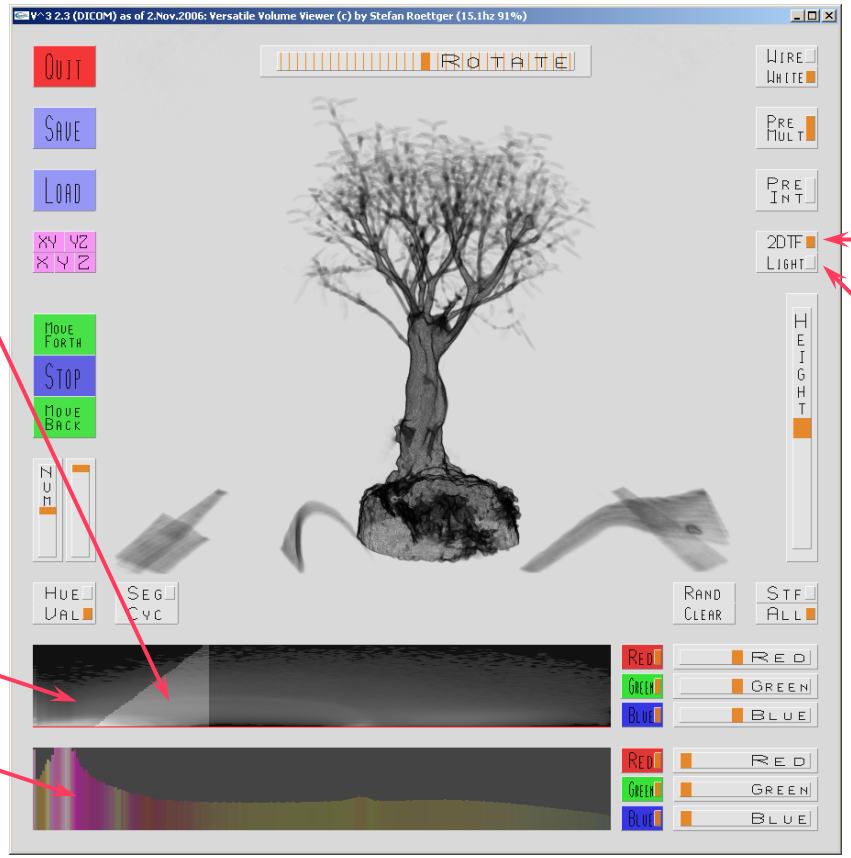


Is this an optimal setting? Which TF is optimal?

V^3 Usage

Step 16: 2D TF

Multi-dimensional TF are an advanced and powerful visualization method, but the setup of a 2D TF can be even more tedious than a standard 1D TF. Thus, if you enable 2D TF mode in the V^3, a simplified 2D TF mode is activated first which is equivalent to gradient-magnitude volume rendering. As a starting point we enable 2D TF, adjust the opacity in x-ray mode, and draw one white ramp.



2D TF button

Lighting is only a prototype so far

Please do not use it unless you know what you are doing

The same holds for the “seg” and “cyc” buttons

2D histogram

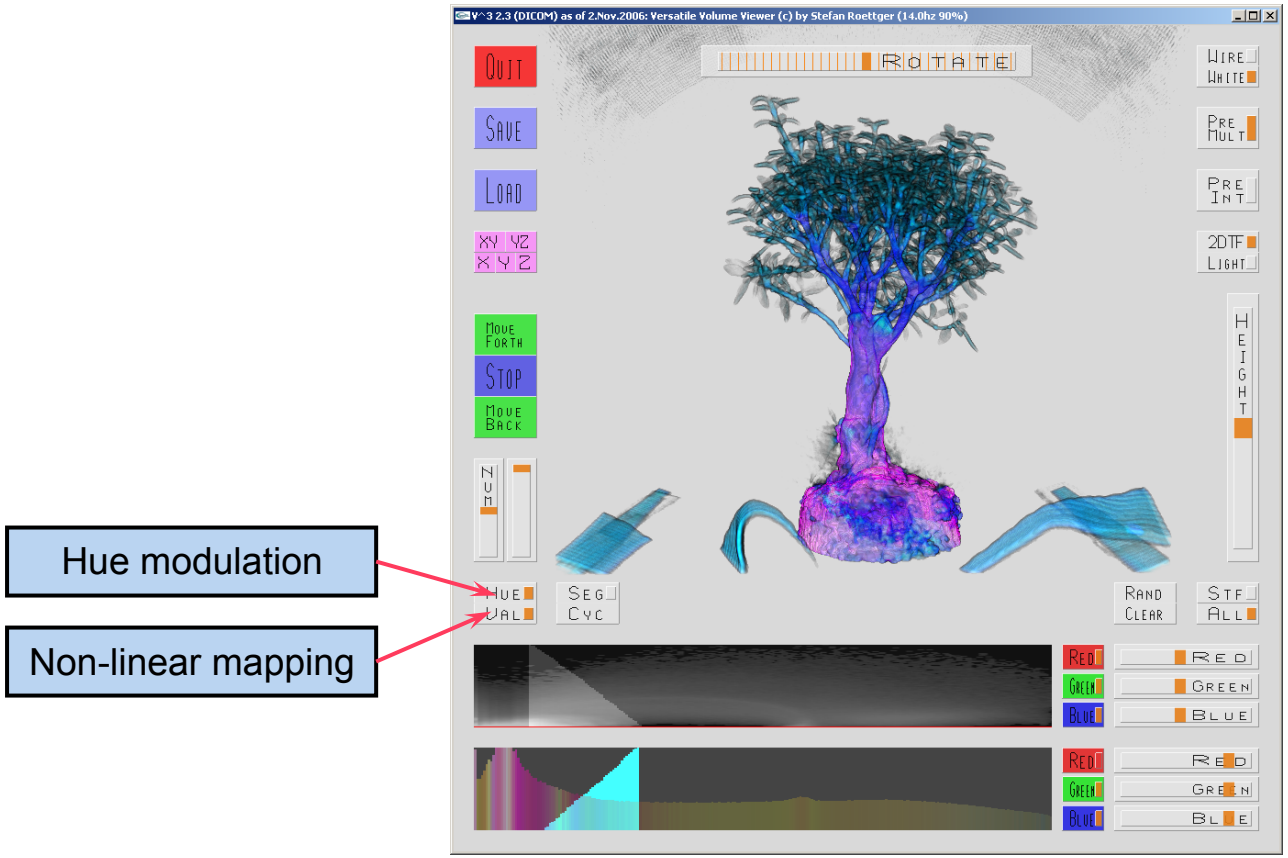
The arcs correspond to the boundaries that separate the materials in the volume

1D histogram

V^3 Usage

Step 17: Colored 2D TF

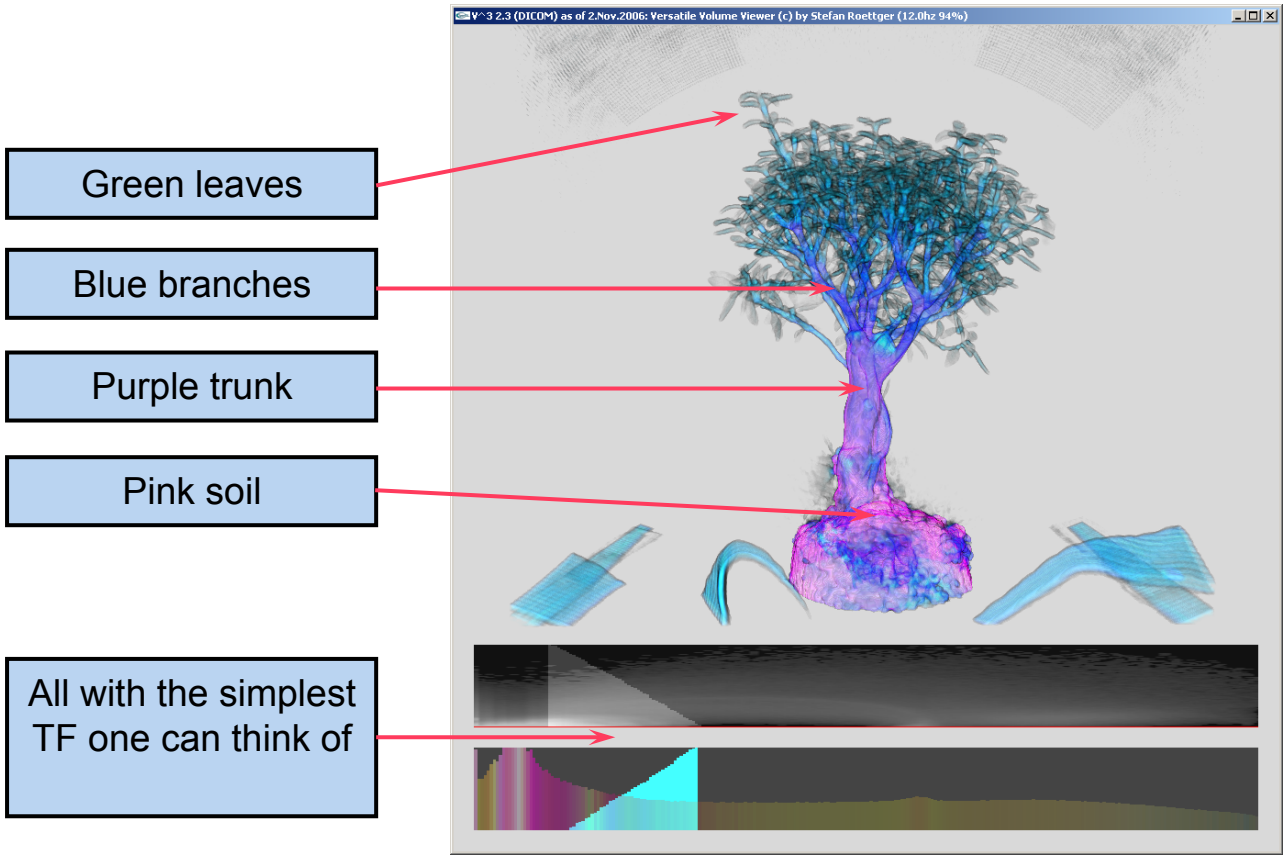
Now we bring back the color by drawing one cyan (green+blue) ramp, The entire Bonsai will be colored cyan, but we can achieve an automatical coloring by modulating the hue with respect to the gradient magnitude (hue button). We can also emphasize low contrast structures like the leaves by applying a non-linear mapping to the gradient magnitued values (val button).



V^3 Usage

Step 18: 2D TF Result

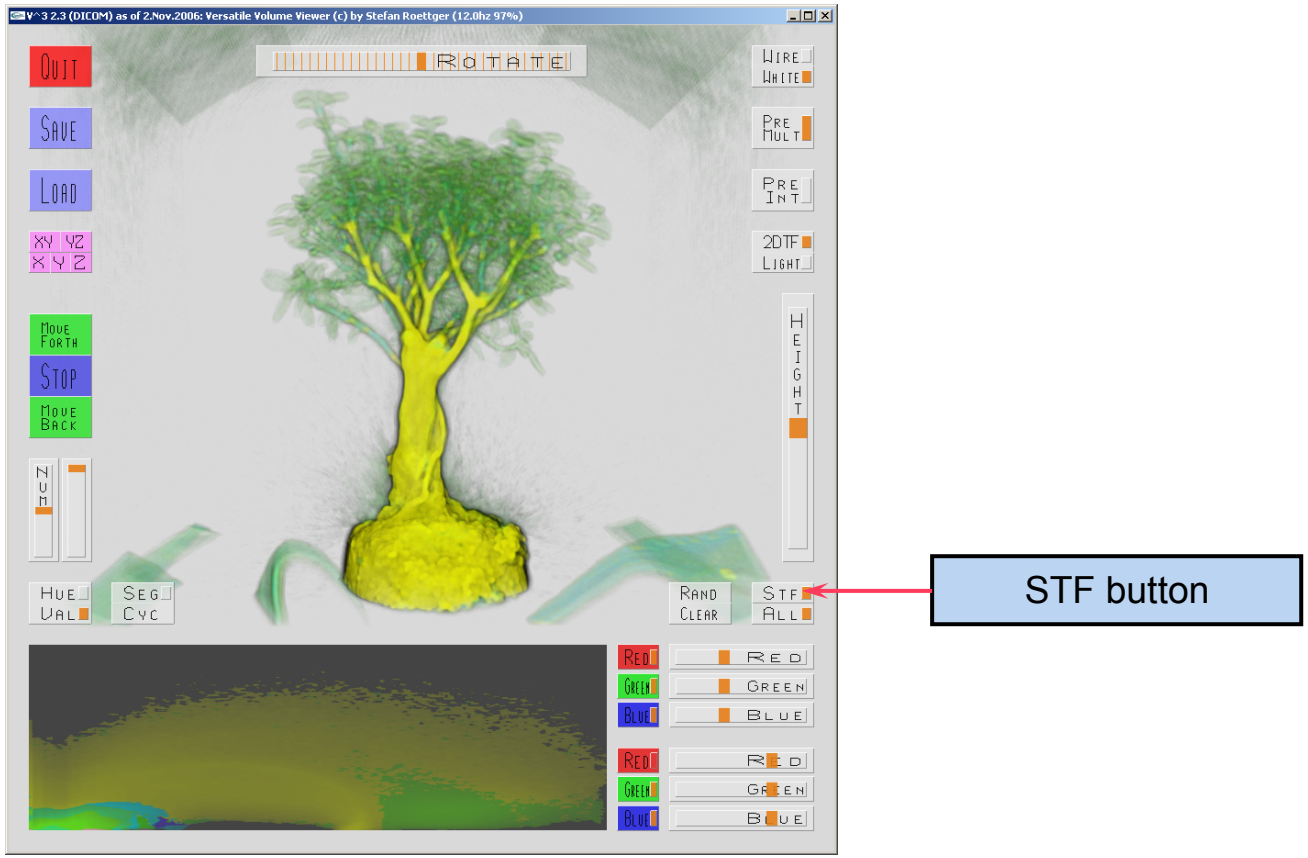
With only two ramps we have achieved an automatic separation of the leaves and the trunk. With 1D TF we needed at least two ramps and 2 different colors. Gradient-Magnitude is also much more insensitive to small changes in the TF. As a further suggestion, try to invert the ramps.



V^3 Usage

Step 19: 2D STF

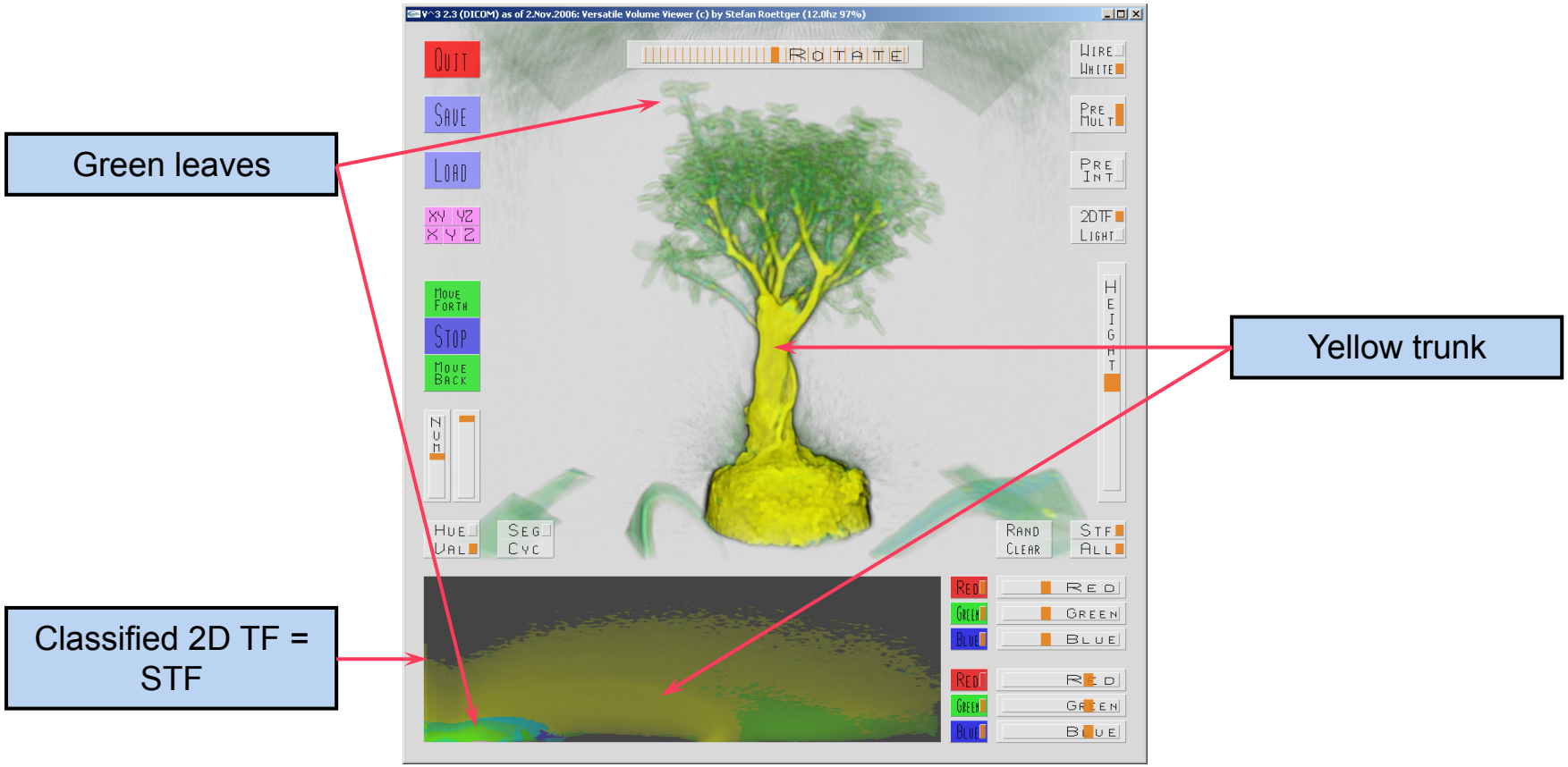
We have seen that certain regions in the TF map to certain areas in the volume. The main problem was to find those regions in the TF that map to the area of interest. Spatialized transfer functions (STF) are one approach to make the identification easier. First click the „STF“ button to get the picture below.



V^3 Usage

Step 20: 2D TF Classification

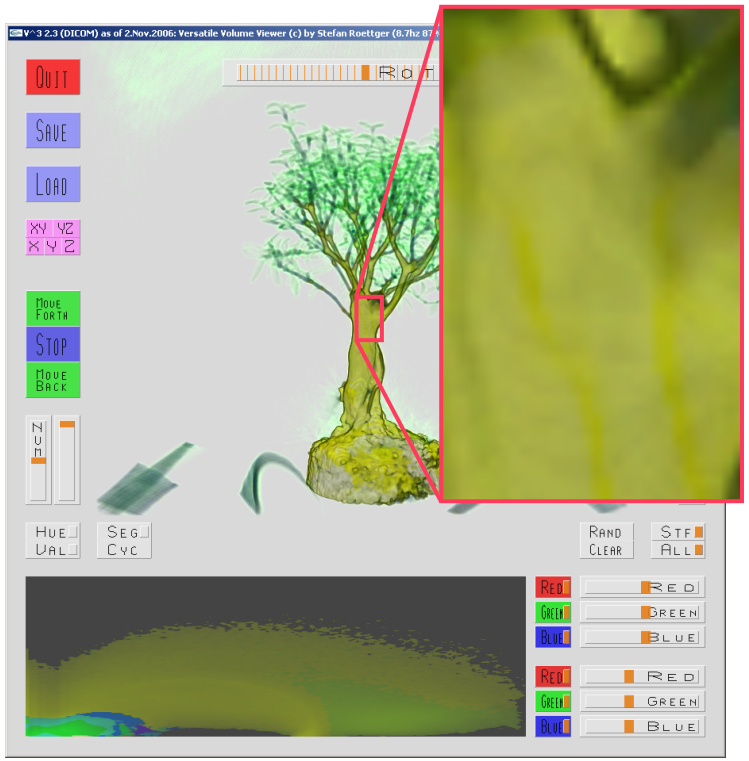
As the result, we see a classification of the 2D TF area into a set of pseudo-colored regions. The STF takes spatially coherent samples of the histogram (e.g. the leaves) and groups them together into a single region with a unique color. The only parameter needed is the number of classes. It is 4 in the example below.



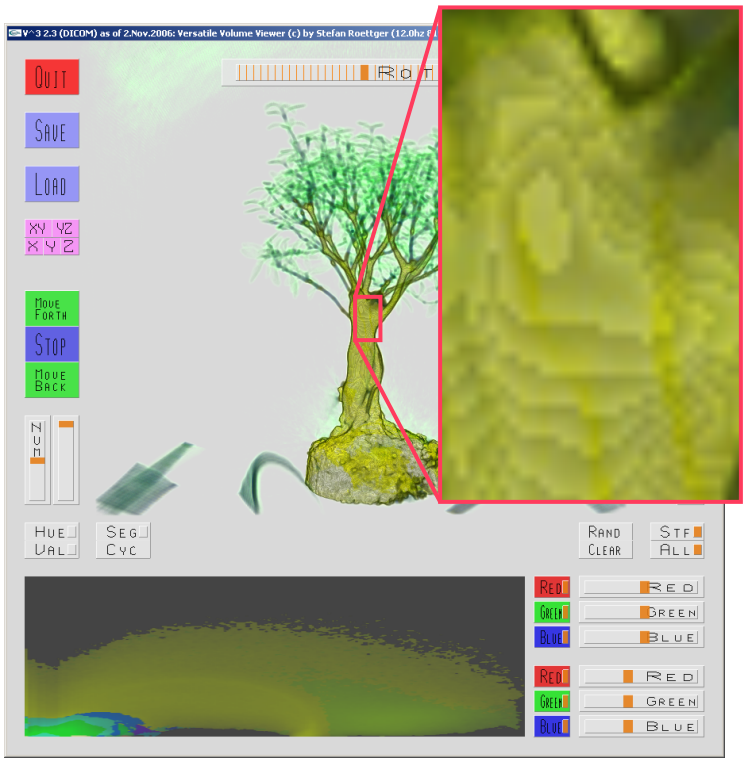
V^3 Usage

Step 21: 2D Pre-Integration

For 2D TF the pre-integration technique also applies. However, the pre-integration time is much higher than in the 1D case. If the TF is changed the delay caused by 2D pre-integration slows down the frame rate significantly. For this reason, pre-integration should be enabled only for the final image to get the highest quality possible.



With pre-integration

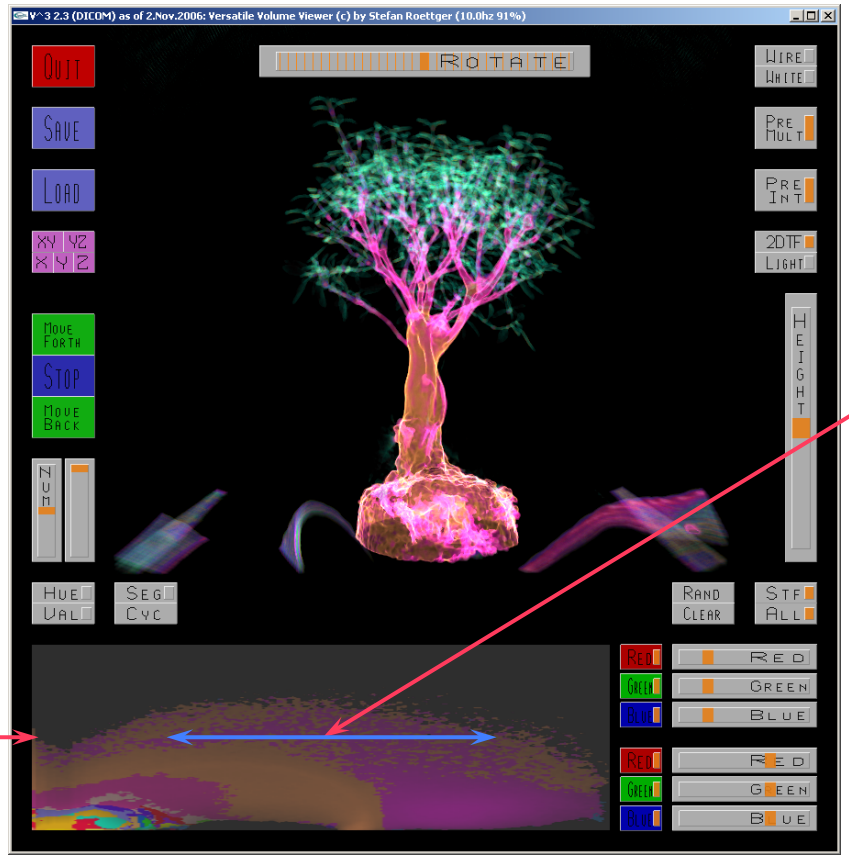


Without pre-integration

V^3 Usage

Step 22: Modifying the Number of Classes

We can interactively modify the number of classes by clicking or dragging at the 2D TF area. The horizontal position of the mouse translates to the number of classes used to derive the STF. By increasing the number of classes the former yellow trunk breaks into two different classes, a brown one for the trunk itself and a pink one for the branches.



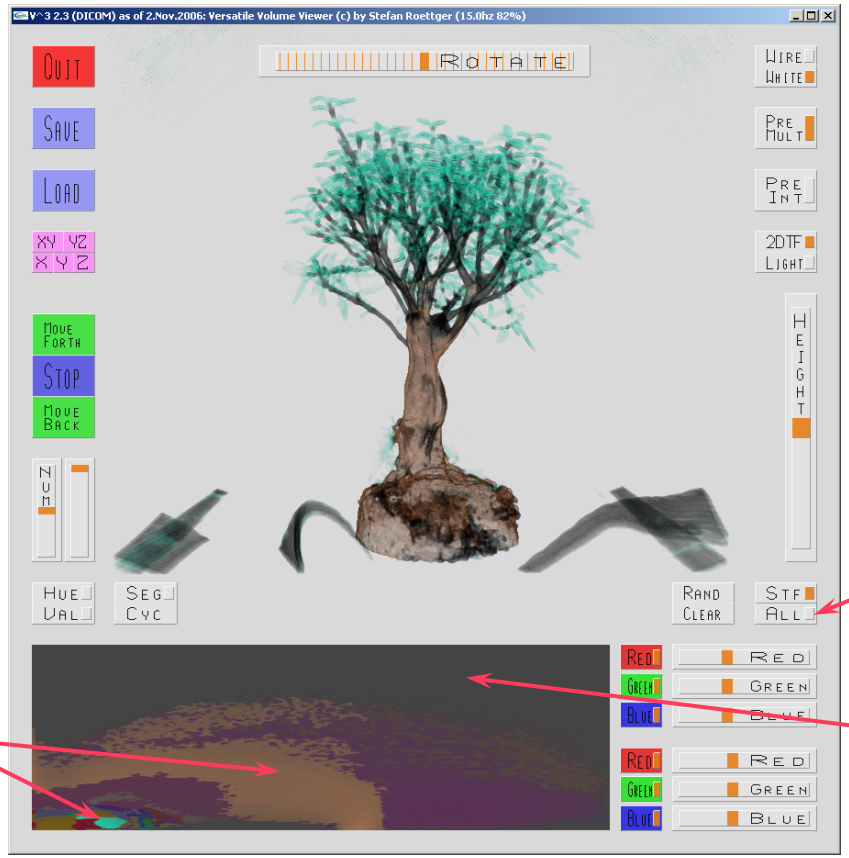
Click and drag to change the number of STF classes

STF with roughly 20 classes

V^3 Usage

Step 23: Selecting a Specific Set of Classes

By default each class of the STF is given a pseudo-random color, but we can disable or enable specific classes to blend out unwanted regions. Selection mode is toggled by clicking at the „all“ button. Then click at a class in the 2D TF area to select or deselect it. In the example below we have clicked at the hilighted green and brown classes. Double-clicking at „empty space“ disables all classes.



Click to toggle selection mode

STF with two selected classes

Double-click to disable all classes

V^3 Usage

Step 24:Final Results

We finally have a look at the final results. Explore the Bonsai by making it more transparent (left) or more opaque (right).