WLD 3D Visualizer
User Guide

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Introduction

WLD 3D Visualizer (Well Logging Data 3D Visualizer) is a simple application for visualizing well logging data as 3-dimensional images. The 3D representation allows truly imaging of some borehole parameters. The program allows 3D visualization of curves and 2D channels. All curves (1D channels) are visualized as cylindrical surfaces along the depth axis. The radius of the cylinder on each depth reflects the curve value measured on this depth. The 2-dimensional channels (having an array of values on each depth) are visualized as 3D surfaces along the depth axis.

User Interface

The WLD 3D Visualizer user interface is shown on picture 1.
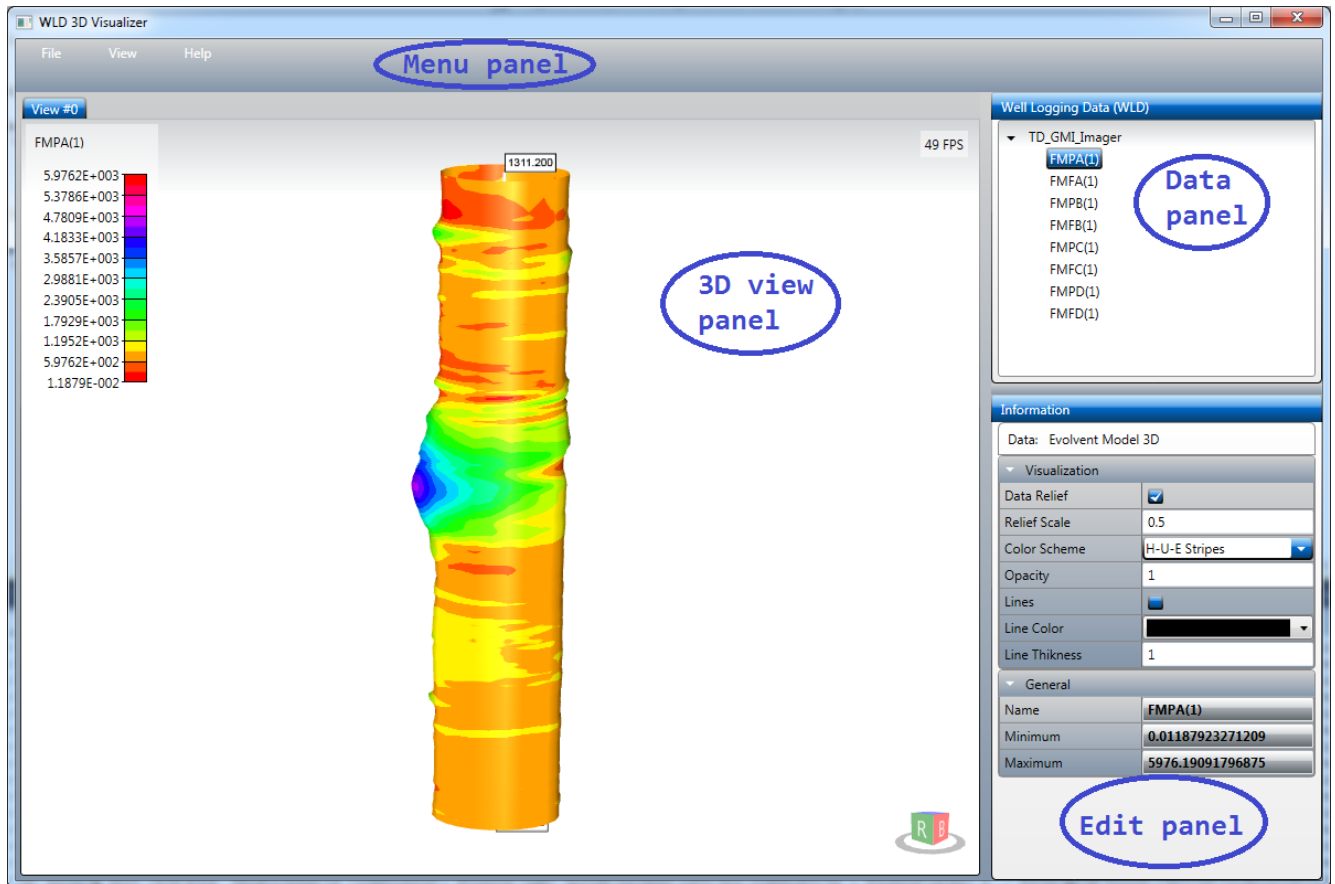
Picture 1. Program user interface.

The user interface consists of four main panels:
1. Menu Panel – contains menu to implement main actions, such as data loading, view adding and deleting and so on.
2. Data Panel – contains a tree representation of current loaded well logging data. The tree nodes can be selected from the panel to implement actions with them.
3. Edit Panel – contains properties of currently selected object (channel, view model, borehole model). Some of the properties are for information purposes only. For example, data depth parameters, names and so on. Other properties can be edited for changing 3D view representation.
4. 3D View Panel – contains multi-tab views of 3D channel models. One view can contain many channels 3D models on the same depth interval. The 3D view and depth range are easily manipulated with the mouse device.

Loading Well Logging Data

To load a well logging data use the main menu action *File – Load Data*. In the file open dialog select a type of file format to load and open the data file. The following well logging data format supported:

- LAS (Log ASCII Standard);
- LIS (Log Information Standard);
- DLIS (Digital Log Interchange Standard).

After loading, the data is shown on the Data Panel as a tree (picture 2). The outer tree nodes represent well logs – entire data record, written by a logging device during one borehole measurement. The inner tree nodes represent log items - channels (curves, 2D channels), that is data record got from one of the device sensor (gamma ray sensor, sonic sensor).
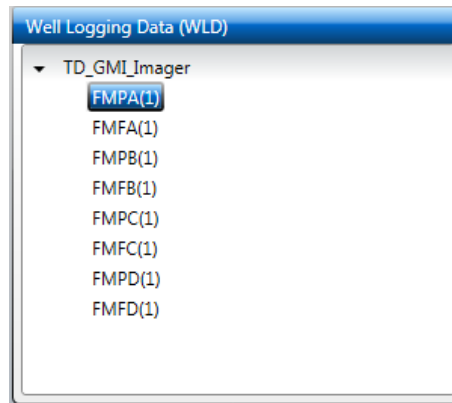

Picture 2. Well Logging Data panel.

The log and the channel items can be selected in the tree, then the information about the selected object (such as name, unit of measurement, depth range) appears in the editing panel.

Displaying data in 3D

To display a channel data in 3D just drag a channel and drop it to a view. The default 3D model of the channel will be displayed on the view (picture 3).
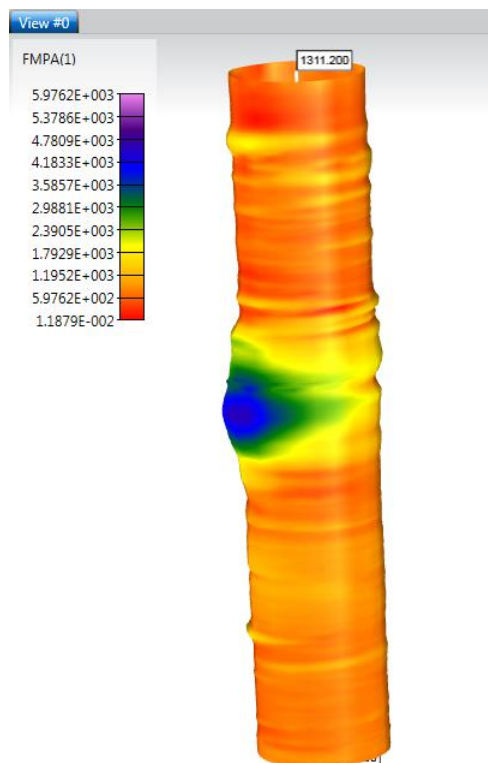
Picture 3. Channel 3D model displayed on a view.

The displayed data is the channel 3D representation and the value pallet. The channel data is presented as a 3D color map. The 2D channels can be presented as evolvent models (data on some depth changed along the cylindrical angle axis) and as radial models (data on some depth changed along the

cylindrical radial axis, for wave signals as example). The curve data (1D channels) is always represented as cylindrical 3D color map with one radial value for a depth.

A 3D channel model can be displayed on a view only. To add new view use the main menu action ***View – Add New View*** (or use the pop-up menu on the View Panel). To delete the active view use the main menu action ***View – Delete Active View*** (or use the pop-up menu on the View Panel).

The program allows multiple channel models simultaneously displayed on one view. The channel models displayed at the same current depth range. To delete a channel model from a view – select the model (by mouse picking) and use the main menu action **View – Delete Selected Channel View.**
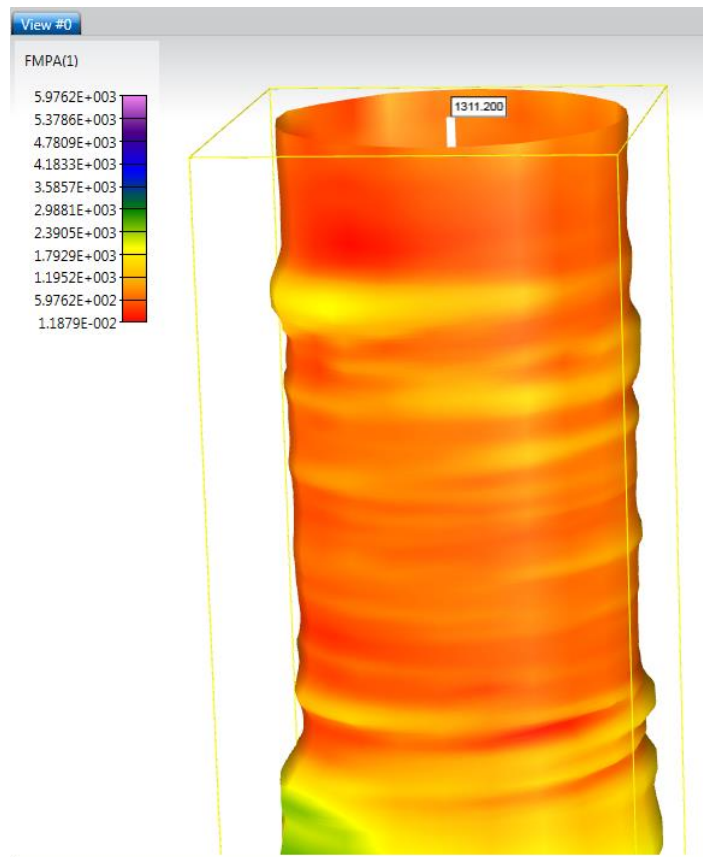
Manipulating 3D view and Depth range

The 3D view (distance, position, rotation angles) and the displayed depth range can be easily manipulated with the mouse device. The following actions allowed:
- Zoom In, Zoom Out the model: Mouse Wheel scroll Up (Down);
- Pan the model: Mouse Wheel button Down + Mouse Move;
- Rotate the model: Mouse Right button Down + Mouse Move;
- Depth range Down, Up: Shift + Mouse Wheel scroll Down (Up);
- Accelerated Depth range Down, Up: Ctrl + Shift + Mouse Wheel scroll Down (Up).

All view manipulations are performed in the real time with movement smoothing for better visualization. The depth range scrolling with the mouse wheel allows real visual investigation of the "virtual borehole model".

Editing channels 3D visualization models

To edit a channel visualization model it must be selected. To select the model just click on it or on its color pallet. The selected model will be displayed on the view with the bounding box (picture 4) and its properties will be shown on the Edit Panel (picture 5).

Picture 4. Selected channel model on a view.

Picture 5. Channel model properties.

Some of the properties shown for the information purpose only (such as model's channel, data value range) and may not be changed. The following main properties allow change the visualization of the a channel:
- Data Relief: display the 3D color map with relief;
- Relief Scale: the scale of the relief relative to the borehole tube radius;
- Color Scheme: one of the predefined schemes for mapping the data with colors;
- Opacity: opacity values for the model 0..1 (a value less than 1 allows 'see through the model');
- Lines: show the grid lines for the channel model;
- Line Thickness: the line thickness value.

Any changes in a channel model immediately displayed on the view.

Editing borehole 3D view

By default, a borehole model presented on a view as the depth axis arrow with top and bottom depth labels (picture 4). The model also includes the "virtual" borehole and tube. The properties of a borehole model can be changed via the Edit Panel. For doing this the borehole model can be selected by mouse click or using the main menu action View – Edit Active View Borehole Model.

Picture 6. Borehole model properties.

The borehole model properties includes visualization category and 3D view category. The visualization properties affect on the borehole view representation:
- Pipe Visible: show the virtual pipe cylinder;
- Borehole Visible: show virtual borehole cylinder;
- Pipe Color: color value of the virtual pipe cylinder;
- Pipe Opacity: opacity value of the virtual pipe cylinder;
- Borehole Color: color value of the virtual borehole cylinder;
- Borehole Opacity: opacity value of the virtual borehole cylinder.

The 3D view properties affect oh the borehole view and the channel visualization too:
- Top Depth: current top depth value;
- Bottom Depth: current bottom depth value;
- Pipe Outer Radius: outer radius value of the virtual pipe cylinder;
- Pipe Inner Radius: inner radius value of the virtual pipe cylinder;
- Pipe Thickness: thickness value of the virtual pipe cylinder;
- Borehole Radius: radius value of the virtual borehole cylinder;
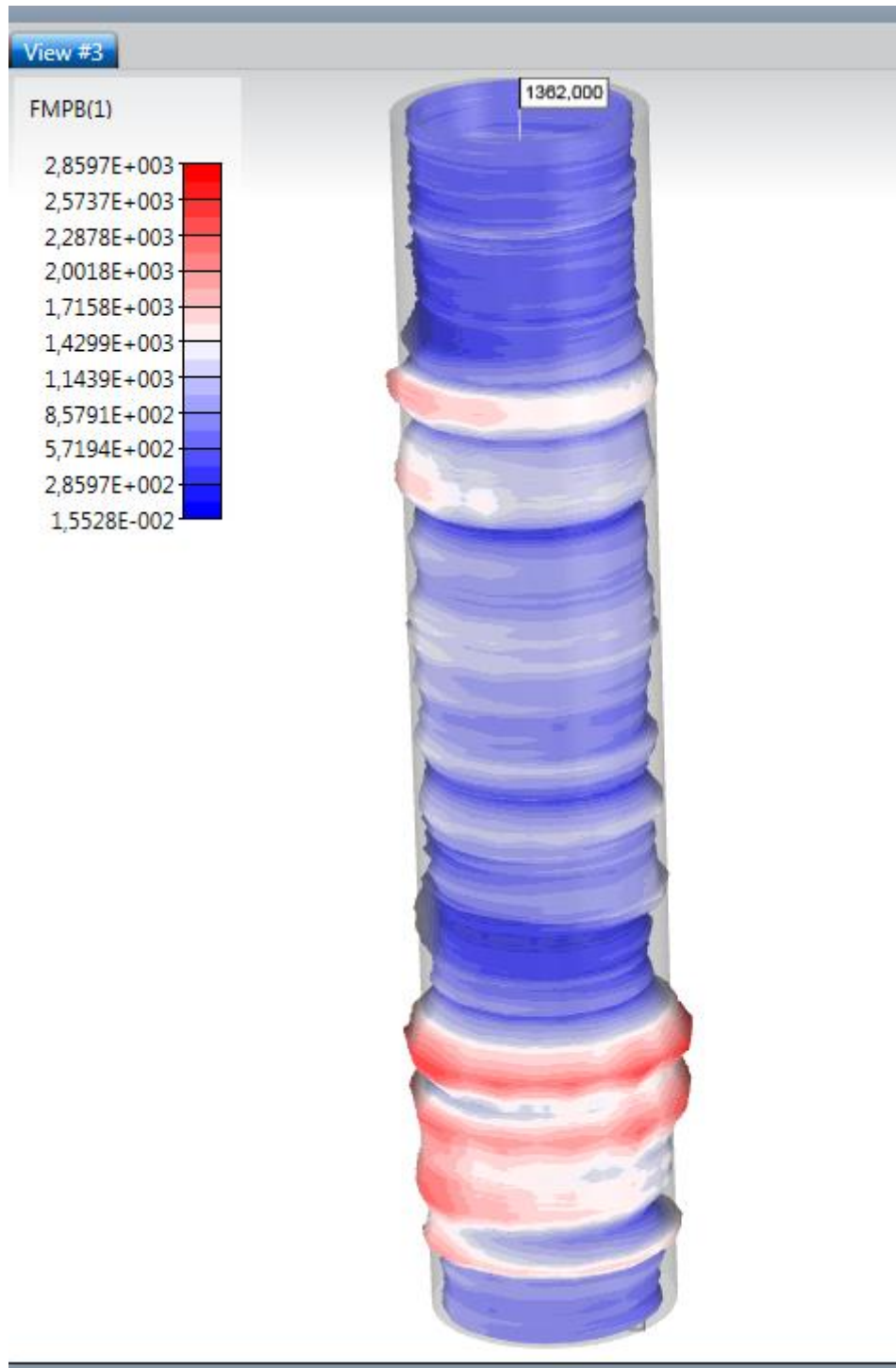- View Height: height of the current depth range for displaying channel data.

Changing the View Height property, for example, allows viewing the displayed channel data on different intervals.

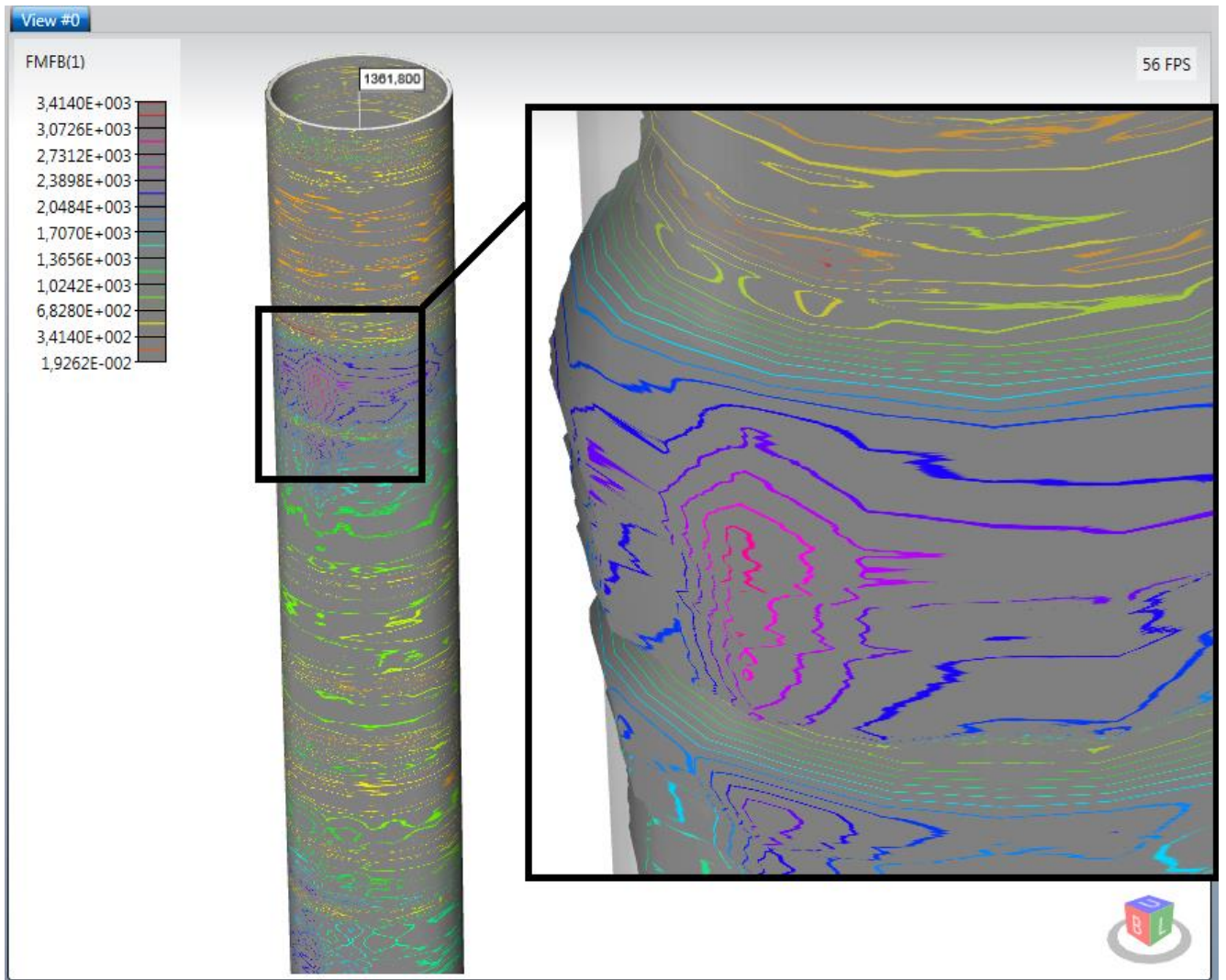## Appendix A. Examples of channel 3D visualizations
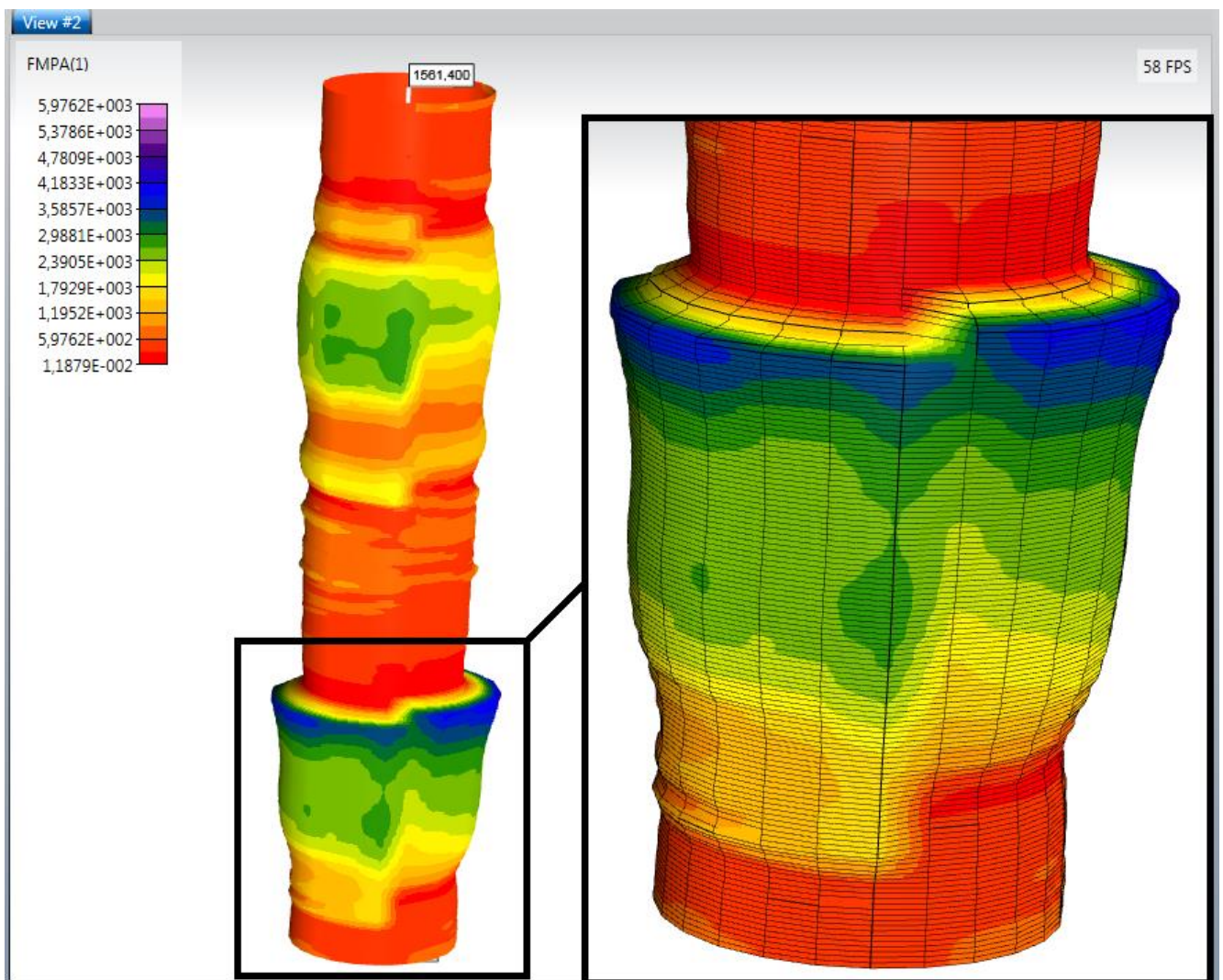
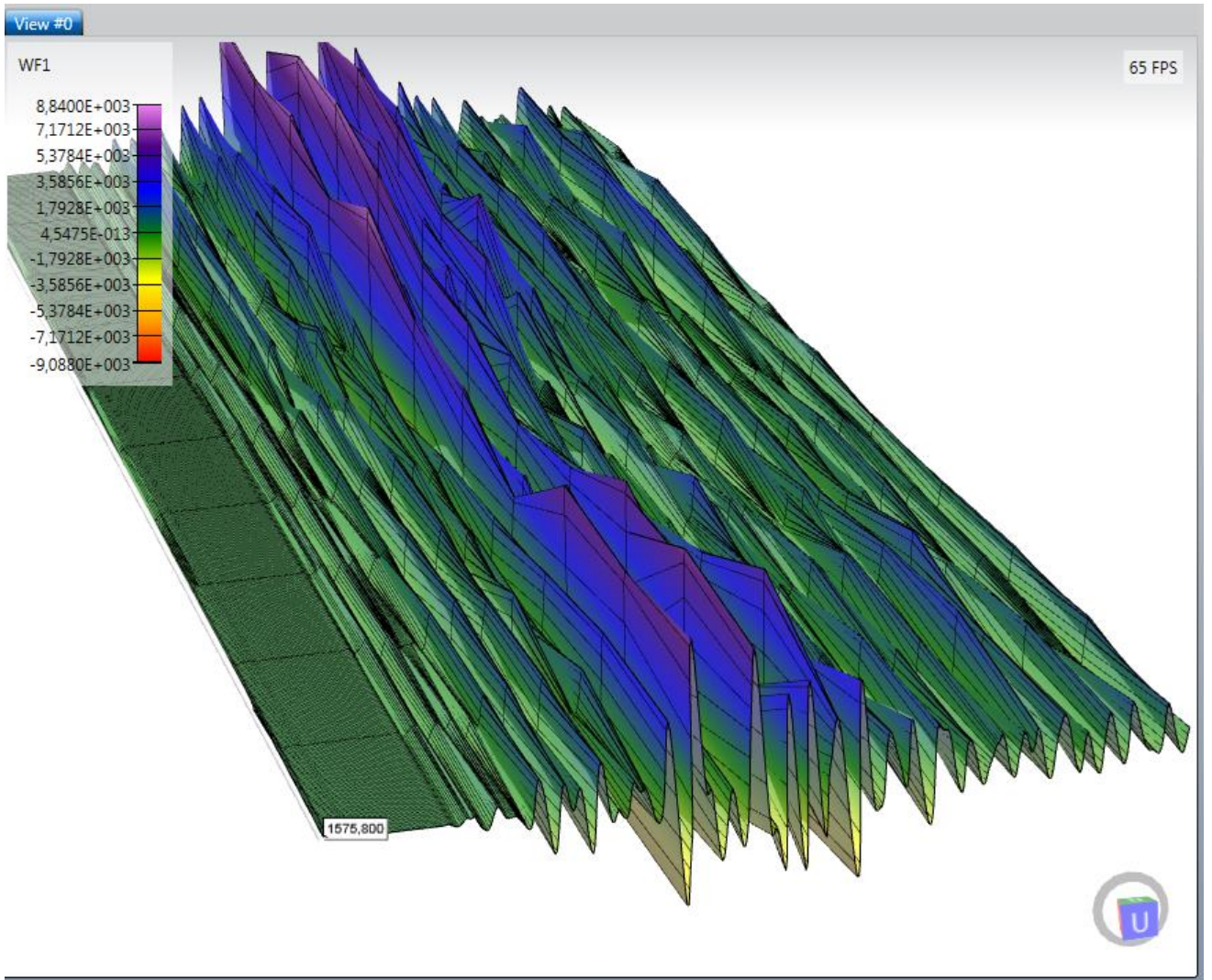Picture A.1. Evolvent 3D visualization (with increased bottom area view).

Picture A.2. Evolvent 3D color map inside the transparent virtual tube cylinder.

Picture A.3. Evolvent 3D isoline map (with increased bottom area and relief).

Picture A.4. Wave signal 3D relief map.