

## LAS Viewer

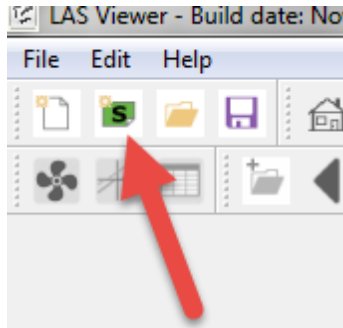
The below document contains a quick users-guide to the LAS Viewer application.

## Table of Contents

LAS Viewer .....	1
Getting Started .....	2
Create new survey to contain logging data .....	2
Add Files to Current Survey .....	2
Misc. ....	3
Features.....	4
Global Settings.....	4
Zoom.....	5
Delta Tool .....	5
Scales .....	6
View Relevant Data Views .....	7
Log Passes.....	8
Screens Toolbar .....	9
Browse Data in Survey.....	9
Well Details.....	11
User Views .....	14
Fill Area .....	15
Interpretation .....	16
Multi-Finger Caliper Data .....	19
DLIS File Format.....	22
DLIS Browser.....	22
DLIS Converter.....	22

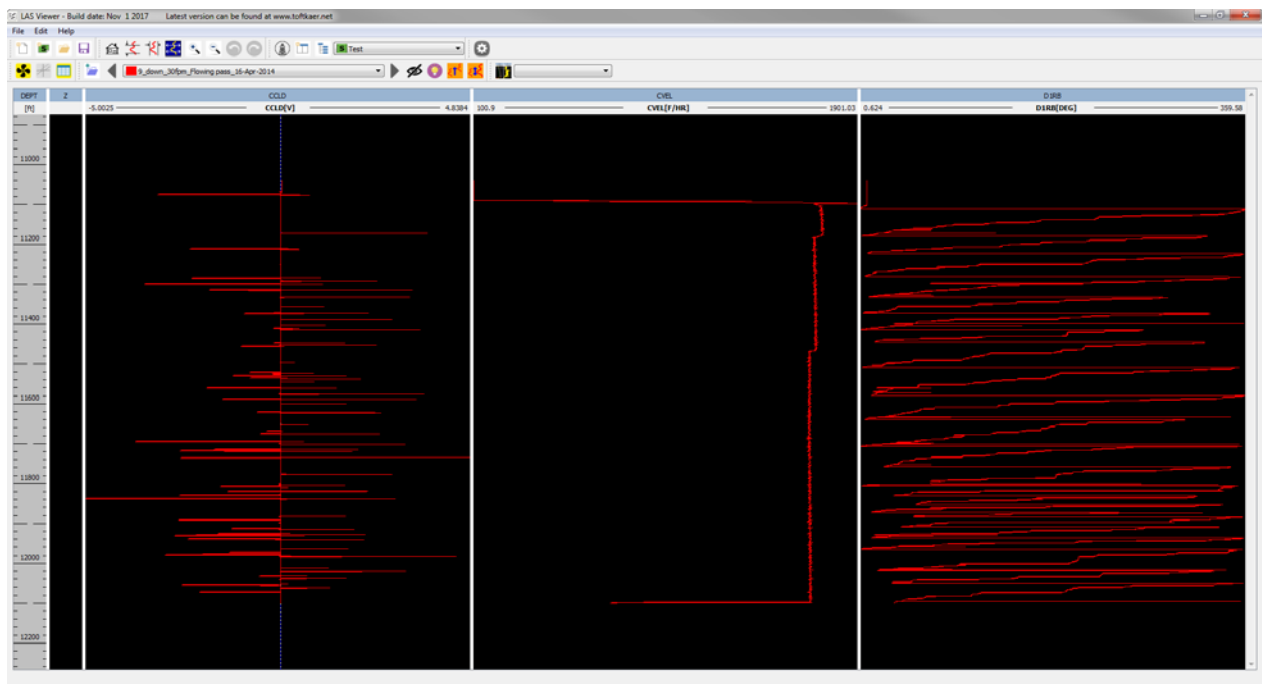
## Getting Started

Create new survey to contain logging data



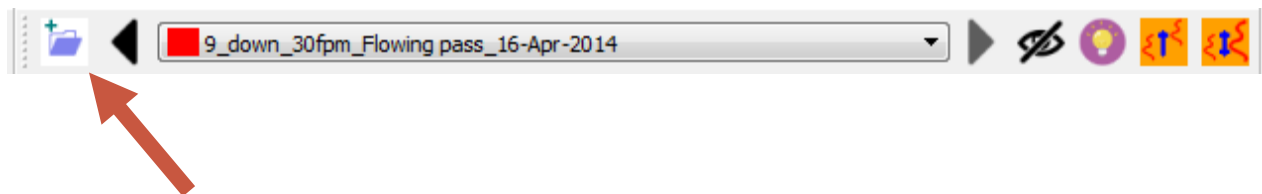
To create a *Survey* click on the green *New Survey* button. An input box will pop up asking for the name of the survey. Write something and click OK. A file selection dialog will be shown where relevant log files can be selected. It is possible to select several files at the same time.

After selecting the log files click OK. LAS Viewer will now generate curves for the data channels in the log file and show the 3 first ones.

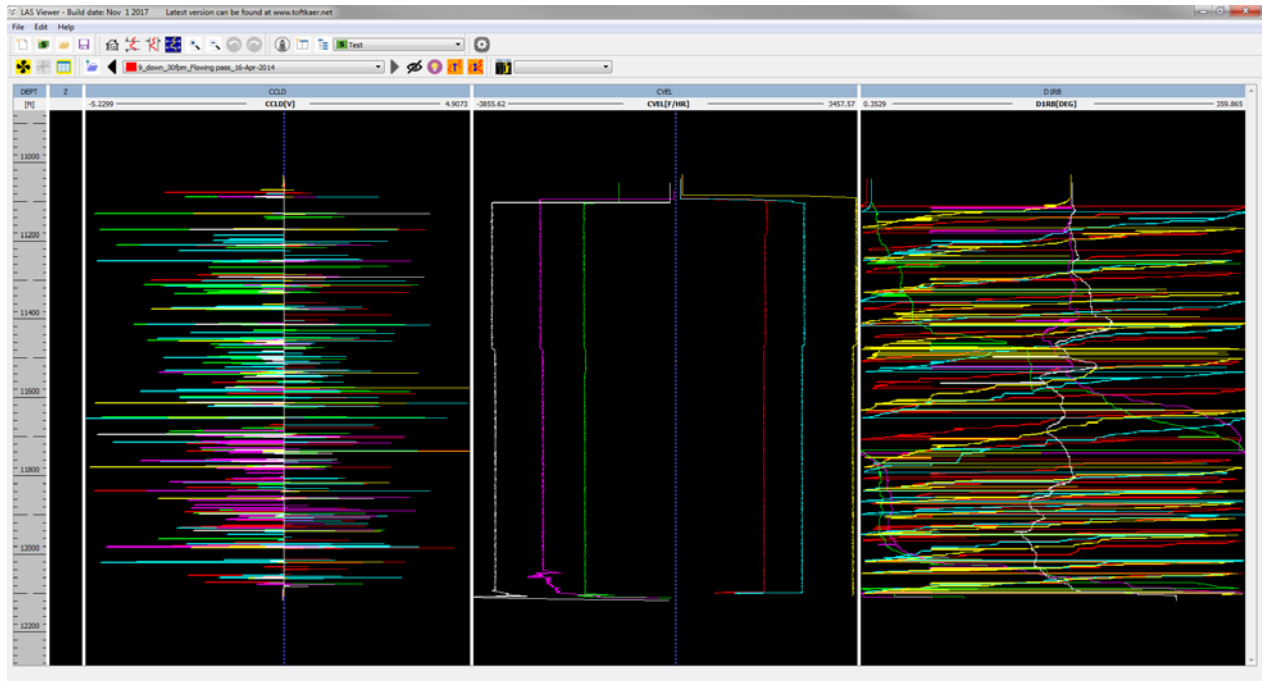


## Add Files to Current Survey

Additional log files can be added to the survey by clicking on the “Add logfile” button



If several files are added to the survey all data channels with the same MNEM will be shown in the same curve window (from here on called “Data Views”).



*Note that the order of Data Views can be changed by dragging the Data View name area (blue area above the scales) sideways. Dragging the name area upwards (or all the way below the application) will hide that Data View.*

#### Misc.



The *New Project* icon to the left will close the current project. All unsaved data will be lost.

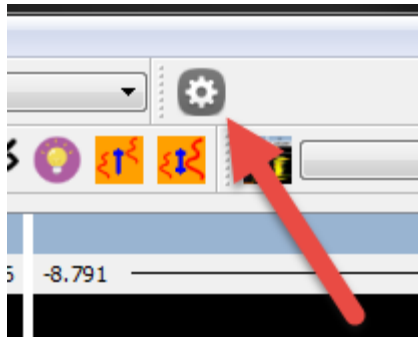
Clicking the *New Survey* button will add a new survey to the current project. It is possible to switch between surveys by using the survey drop-down menu.

Clicking on the *Open Project* button will bring up a file selection dialog. Opening a project save file will close the current project.

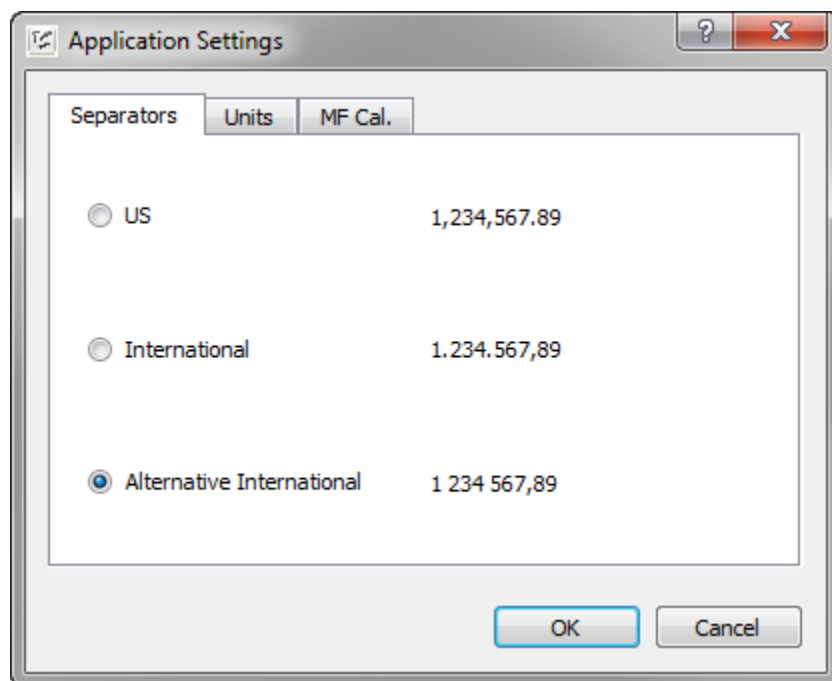
Clicking the *Save Project* button will bring up a file selection dialog. Either select a file to be overwritten or write a new name for the save file.

## Features

### Global Settings



The unit (imperial or metric) can be selected here as well as the format of floating point numbers.



The number format is particularly important when pasting in data from another source (e.g. Excel). If the thousands separator does not match, LAS Viewer may misinterpret the pasted data.

In the *MF Cal.* tab the data channel MNEMs for multifinger caliper radius data can be administrated. If a log file is added containing matching data channel MNEMs a *MFC Data View* will be generated.

Apart from units and number-format the position and size of the main window is also stored between sessions.

In case it is necessary to clear the settings start the application with a *-r* or *--reset* command line argument.

## Zoom

The easiest way to zoom is by holding down *CTRL* while turning the scroll wheel on the mouse. This will zoom in/out around the mouse cursor.

In addition to that other zoom options exist in the tool bar



The home icon will reset all views to show the entire range of the data (both depth and values).

By clicking the vertical zoom button, it is possible to drag over a depth interval on a Data View. Upon releasing the mouse all Data Views will zoom into that interval.

By selecting the horizontal zoom it is possible to zoom to a value interval in one Data View. Other Data Views will remain unaffected. For User Data Views only the selected data channel will be affected.

The *Adjust Scales to Visible Depth* button will change the scales so that all data in the visible depth interval will be visible (the scales will be set to the min/max value of each data channel in the depth interval)

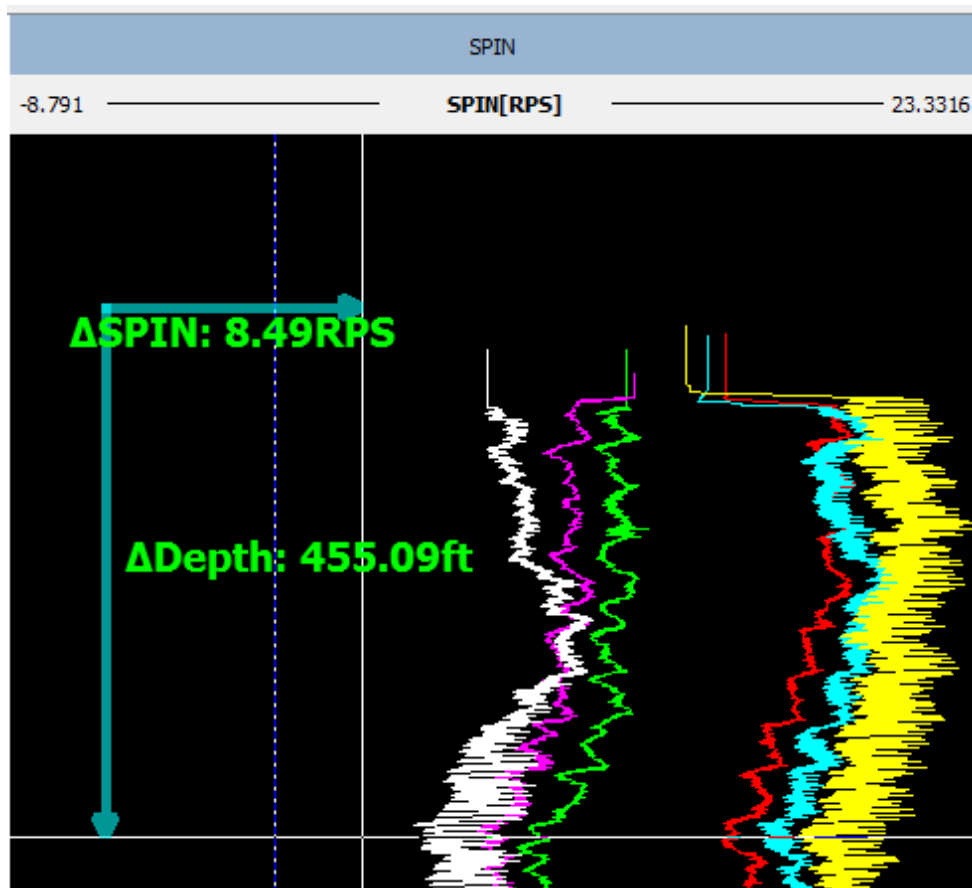
The zoom in/out buttons will zoom in/out on the center of the visible depth.

Undo / redo will move back and forth in the performed zoom operations (they will not affect any other changes performed)

## Delta Tool

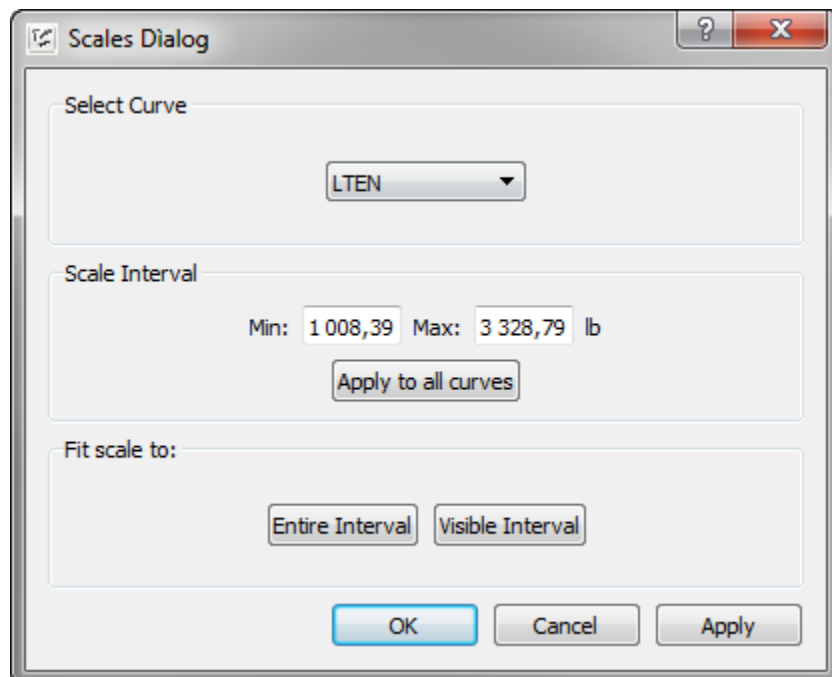
If no selection buttons are pressed (horizontal- / vertical zoom, interpretation zone definition) dragging the mouse cursor across a Data View will activate the Delta Tool.

The Delta Tool will show the delta depth and delta data channel value on top of the Data View. For User Data Views the delta value of the selected data channel will be shown.



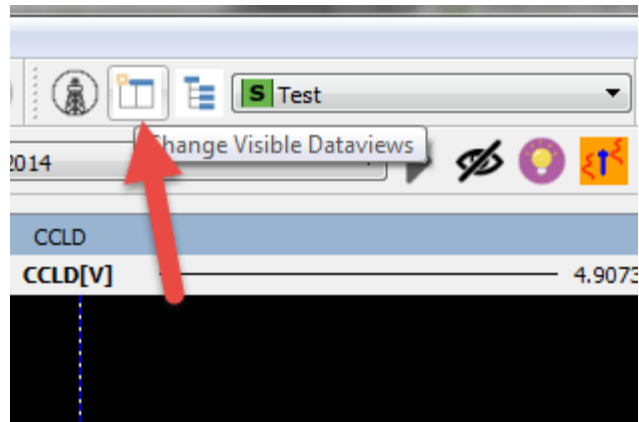
## Scales

Apart from horizontal zoom the scales for a Data View can be changed in the *Scales Dialog*. The dialog is accessed by right-clicking on a Data View and selecting *Horizontal Scales*.

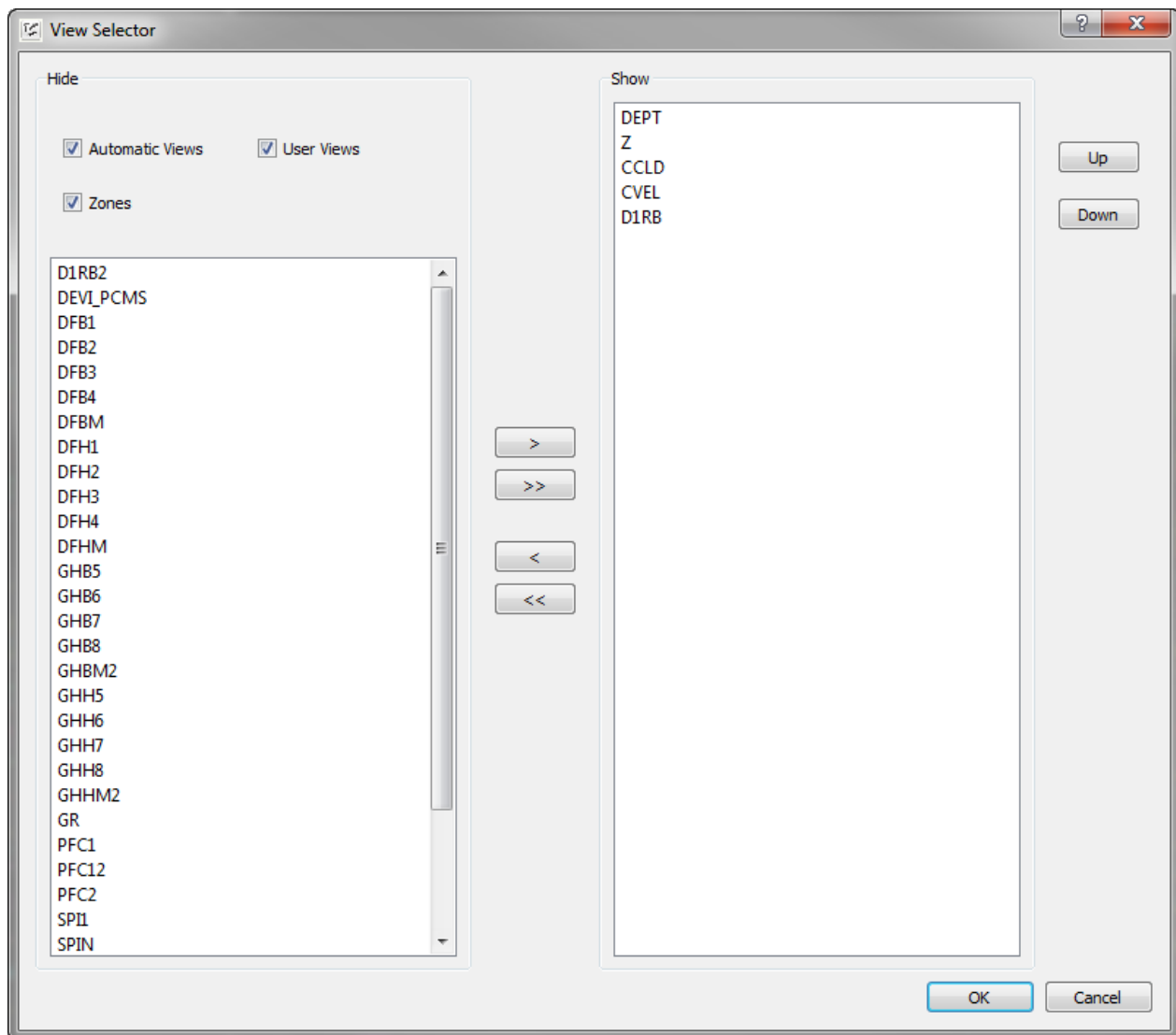


## View Relevant Data Views

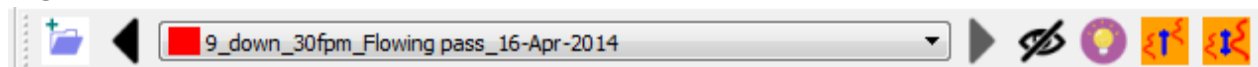
To select which data to view click on the View Selector icon



A dialog will come up indicating which Data Views are shown and which are hidden. Data Views can be moved between *hidden* and *shown*. It is also possible to change the order of the visible Data Views.



## Log Passes



The Log Pass toolbar contains a drop-down menu where the user can select the active log pass (data from one log file). The arrows on both sides allows to skip through all log passes.

By selecting the *Hide* button, the active log pass will not be shown. This also removes the log pass from the spinner calibration operation.

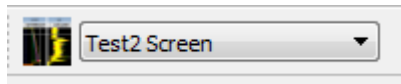
The high-light button will increase the thickness of the active log pass curves as well as changing the color to cyan.

The two last buttons are related to depth shifting and stretching. By clicking the depth shift button, it is possible to drag the active log pass up and down to correct for incorrect correlation.



By clicking the depth stretch button it is possible to compress / stretch the data. This can be used in case of an incorrectly calibrated depth counter.

#### Screens Toolbar

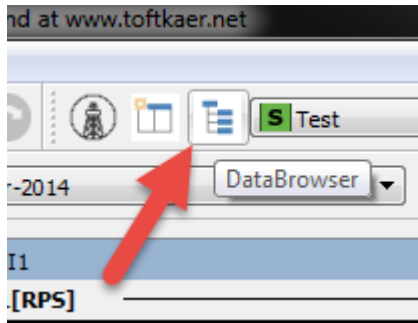


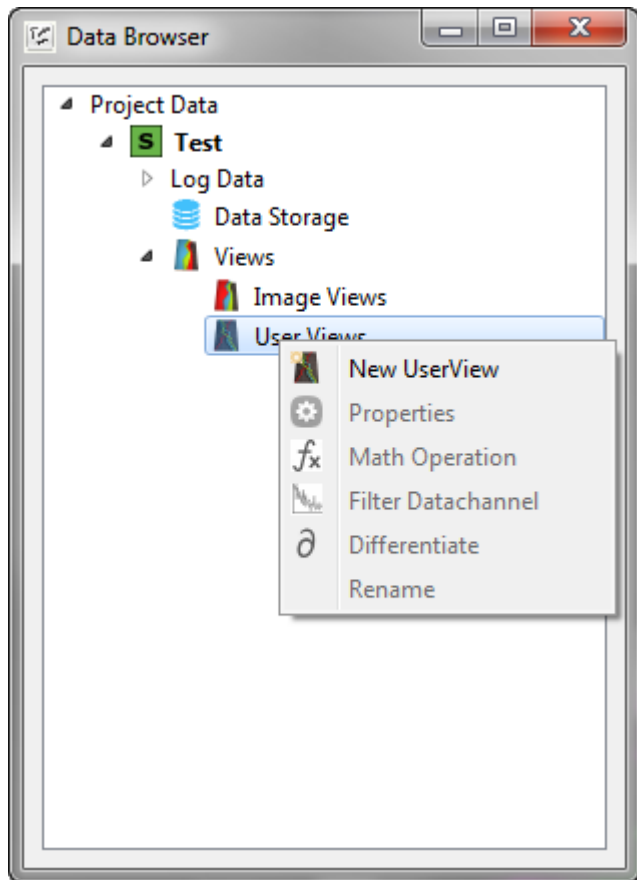
Sometimes it is useful to have several different screens, e.g. one screen showing correlation related Data Views and another screen showing interpretation related Data Views.

It is possible to save the current screen configuration by clicking the *Screens Manager* icon. Saved screens can be restored by selecting them from the drop-down menu.

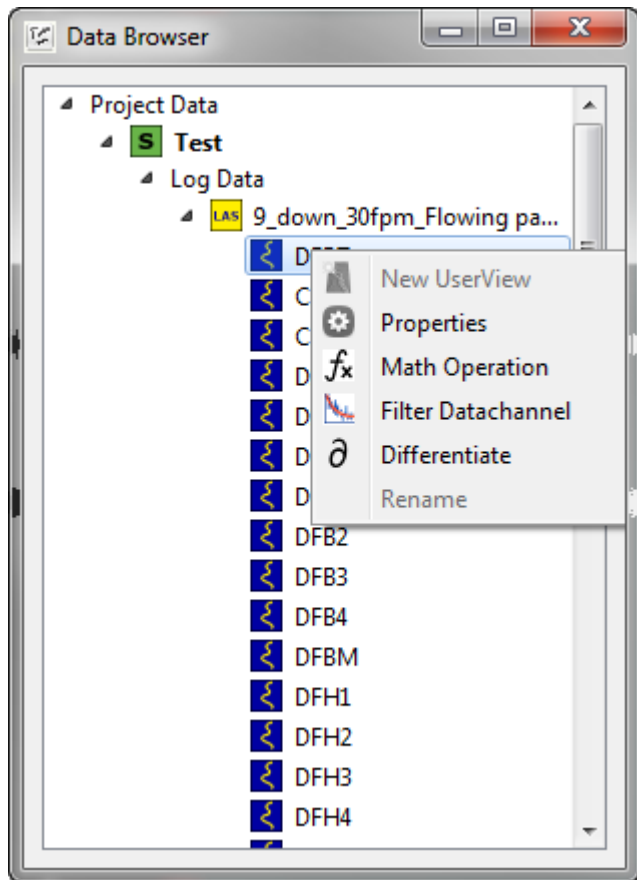
#### Browse Data in Survey

All the log data loaded into existing surveys can be displayed and manipulated using the Data Browser





- Log Data - Each loaded log file will be stored in the *Log Data* item. By expanding a log file all the data channels contained within the file will be displayed.
- Data Storage - Contains the results of mathematical operations on the data channels. Can also be used to store copies of data channels contained in the log files.
- Views – The user can create custom views containing different data channels. The data for a specific view can originate from any of the existing surveys.

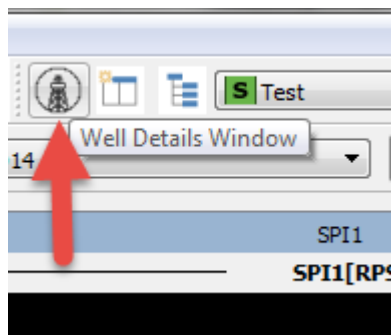


By right clicking on a data channel a pop-up menu appears with several options.

- Properties – display the values of the data channel
- Math Operation – Perform mathematical operations on one or several data channels.
- Filter Data Channel – Filter the channel using a moving average filter.
- Differentiate – Calculate the derivative of the data channel

For the three math operations the result will be stored under the “Data Storage” item – the original data will remain unchanged.

#### Well Details



The Well Details dialog allows entering deviation data as well as two types of markers.

All tables allow for pasting data from Excel or other sources. The pasted data needs to be Tab separated and each column must contain compatible data according to the target table (that is, correctly formatted numbers for depth columns).

	MD (ftWLIN)	TVD (ftWLIN)	DLS (°/
014	0	0	
014	519,9	519,9	
014	548,75	548,75	
014	550	550	
014	575	575	
014	600	600	
014	625	625	
014	650	650	
014	675	675	
014	700	700	
014	725	725	
014	750	750	
014	775	775	
014	800	799,99	
014	825	824,99	
014	850	849,99	
014	875	874,99	

Ensure that the number format selected in the *Global Settings* dialog matches the pasted data.

**Well Details**

Deviation | **Perfos** | **Zones** | Markers A | Markers B

	From	To	Name
1	11700	11900	Zone Test

Buttons: Delete, Insert, Add

Tooltip: Paste Excel data with correctly ordered From and To depth data. Name is optional. Ensure that decimal / thousands separators are in accordance with application settings.

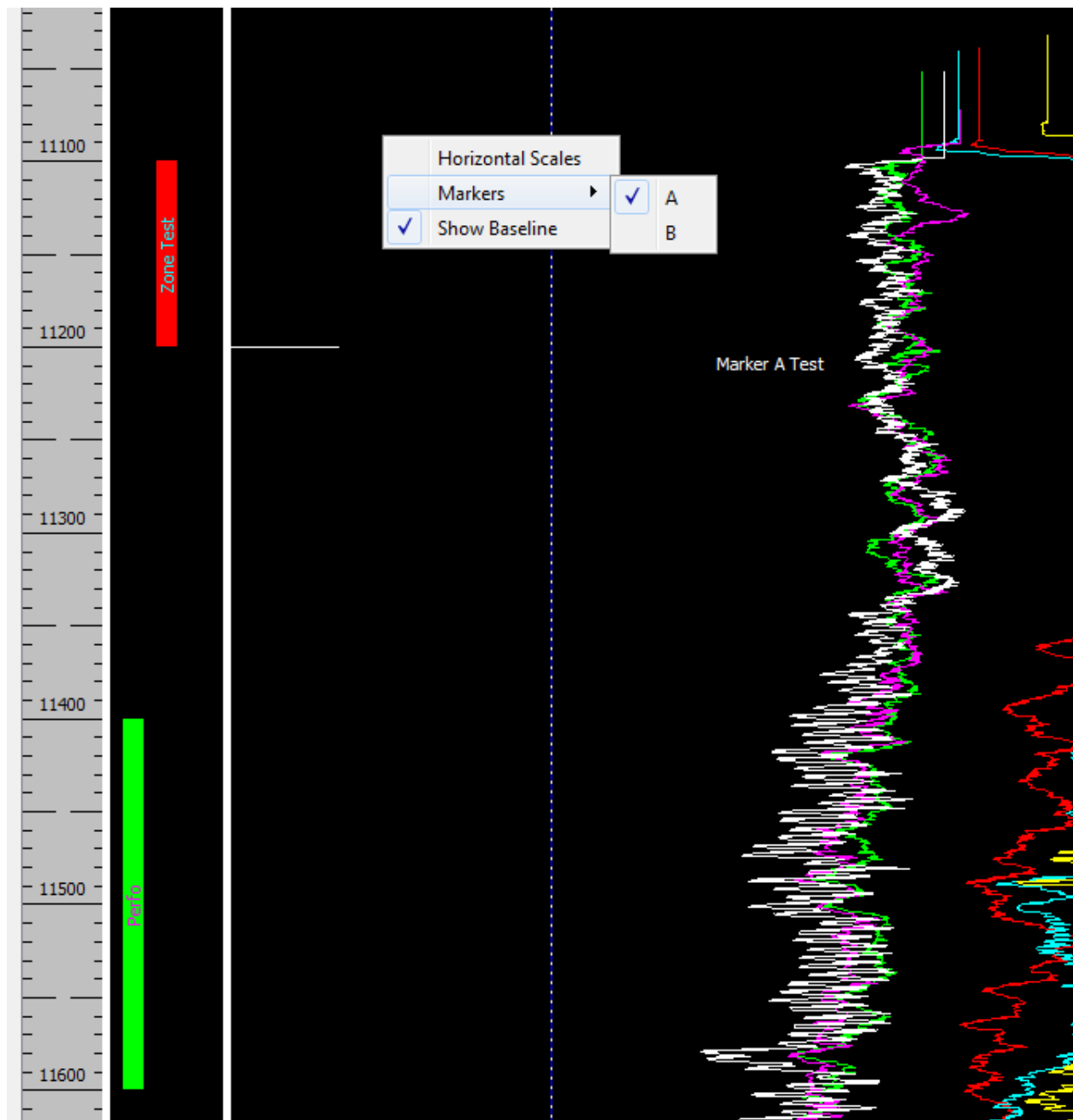
Buttons: OK, Cancel, Apply

The deviation tab contains the measured depth versus true vertical depth table. If data is entered the mouse cursor info text will display the current TVD as well the MD.

Depth: 10984.3ft (7305.5ft TVD), GR: 12.5652GAPI

The Perfos and Zones tabs both contains a depth interval and a zone label. Inputs here will be shown as rectangles on the Z Data View, green color for Perfos and red for Zones.

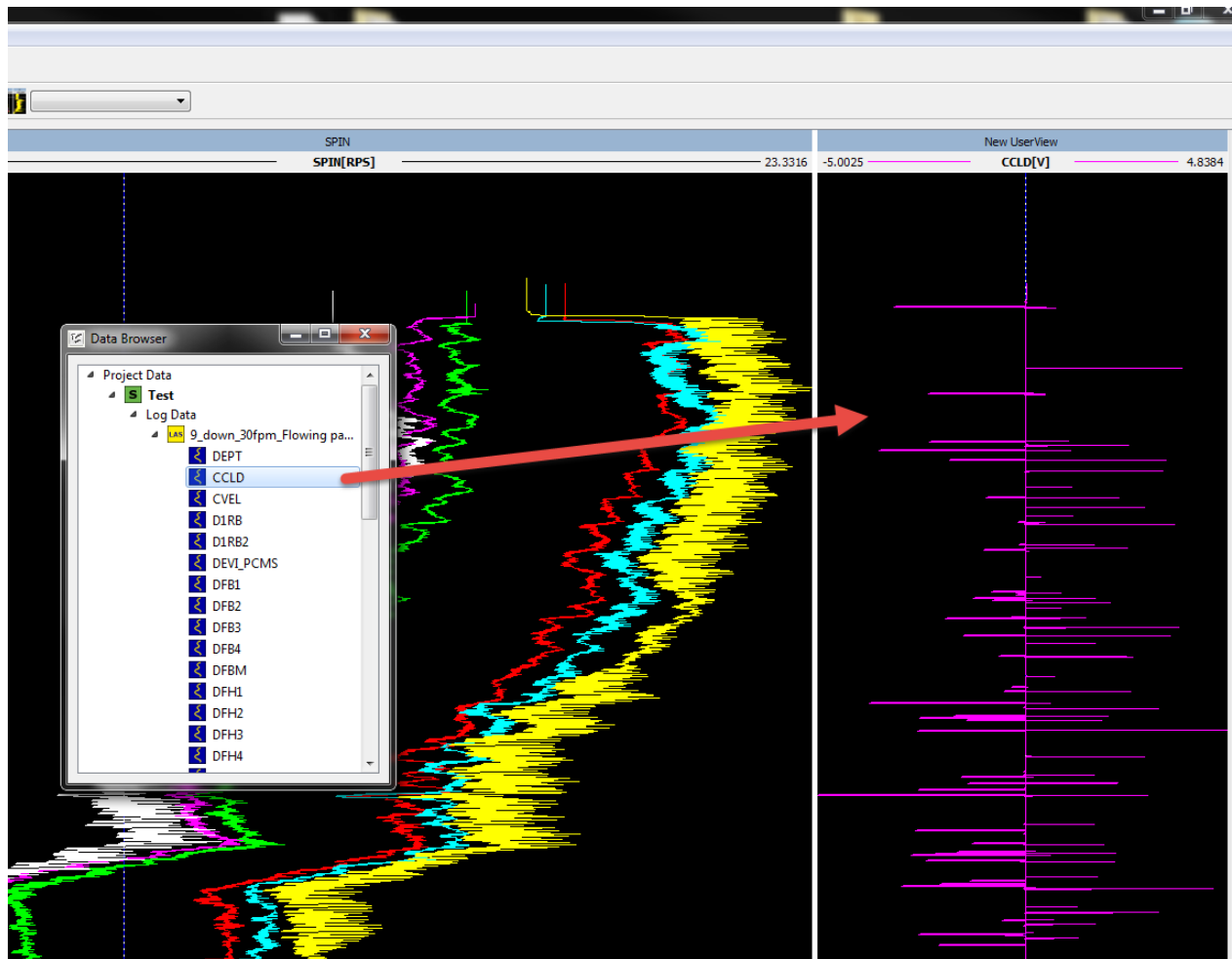
The two marker tabs contain a depth and label column. This can be used to display a pipe tally, or other depth related annotations. To display the markers right click on the appropriate Data View and select Markers A or B.



### User Views

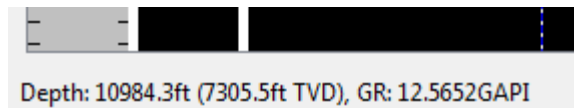
The user can create custom Data Views, called User Views, that contain specific data channels. This is done by right clicking on the *User View* icon in the data browser and selecting *New User View*.

An empty User View will now be displayed in the main window. It is now possible to either drag data channels directly onto the User View or drag the data channel to the User View icon in the Data Browser.



If several data channels are displayed in a User Dataview it is possible to select one of the data channels by clicking on the scale legend for that particular data channel. This select the data channel as indicated by highlighting the name of that data channel.

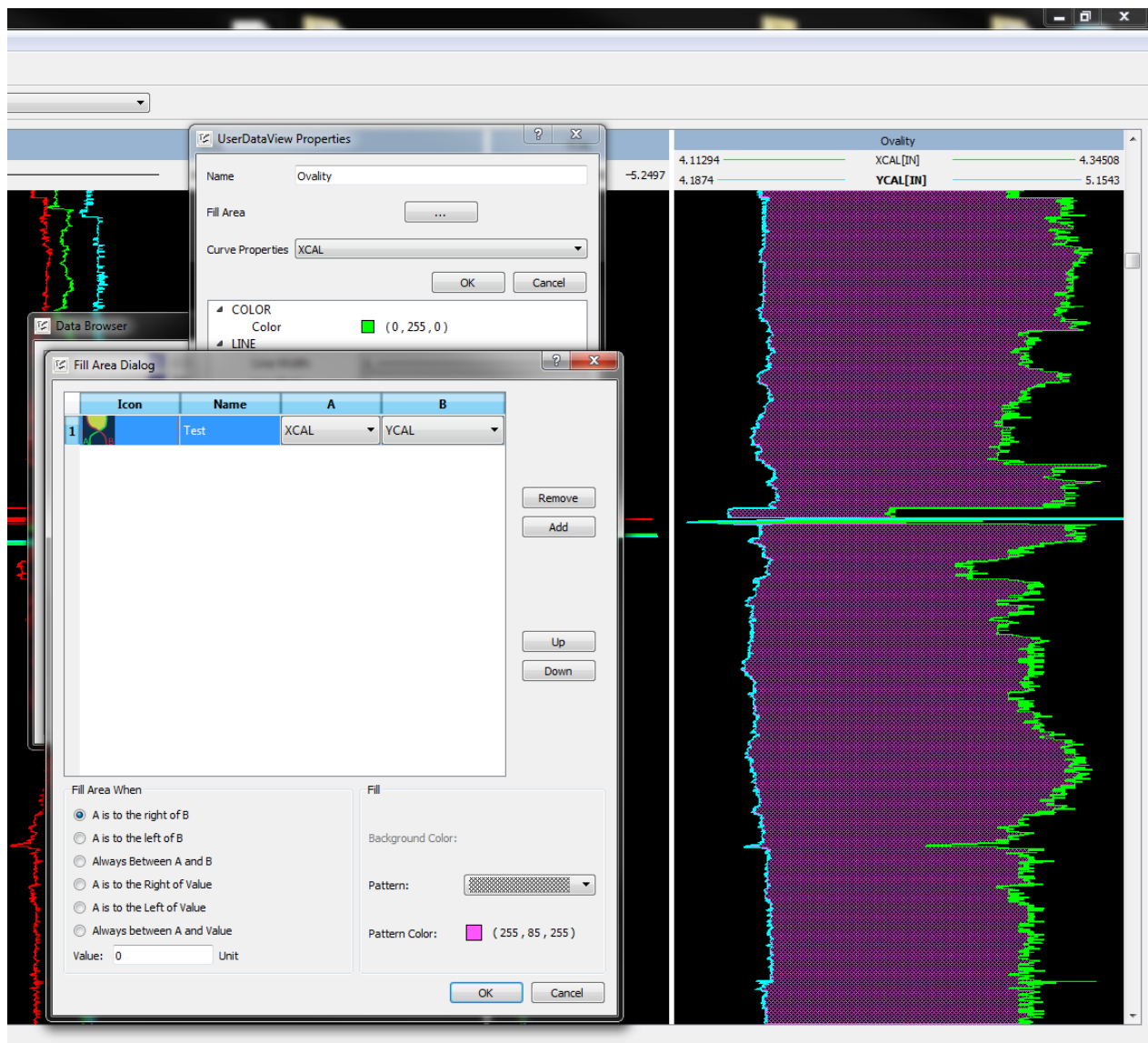
The value displayed in the right bottom corner will be in relation to the selected data channel



*(note that it is not the value of the curve at the current depth that is displayed but the value of the mouse pointer position)*

### Fill Area

In a User Data View it is possible to fill the area between two data channels or a data channel and a fixed value. To do so, right click on the User Data View in *Data Browser* and select *Properties*. The properties dialog comes up. Select *Fill Area*.



In the *Fill Area* dialog click *Add* to create a Fill Area. Select the relevant *Fill Area When* as well as the proper data channels. The color and pattern can be specified as well.

## Interpretation

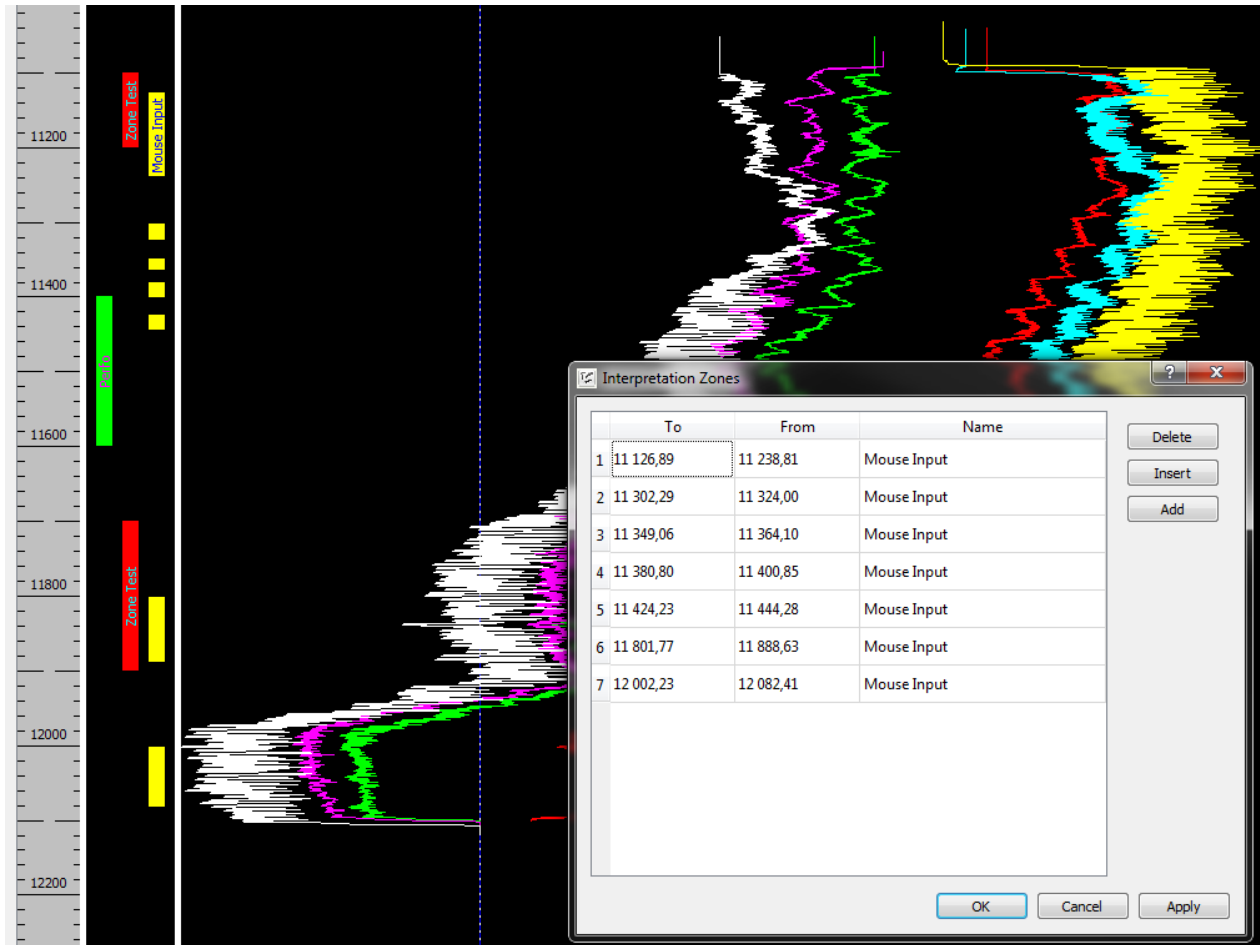
LAS Viewer supports basic spinner interpretation to allow for QC of logging data.



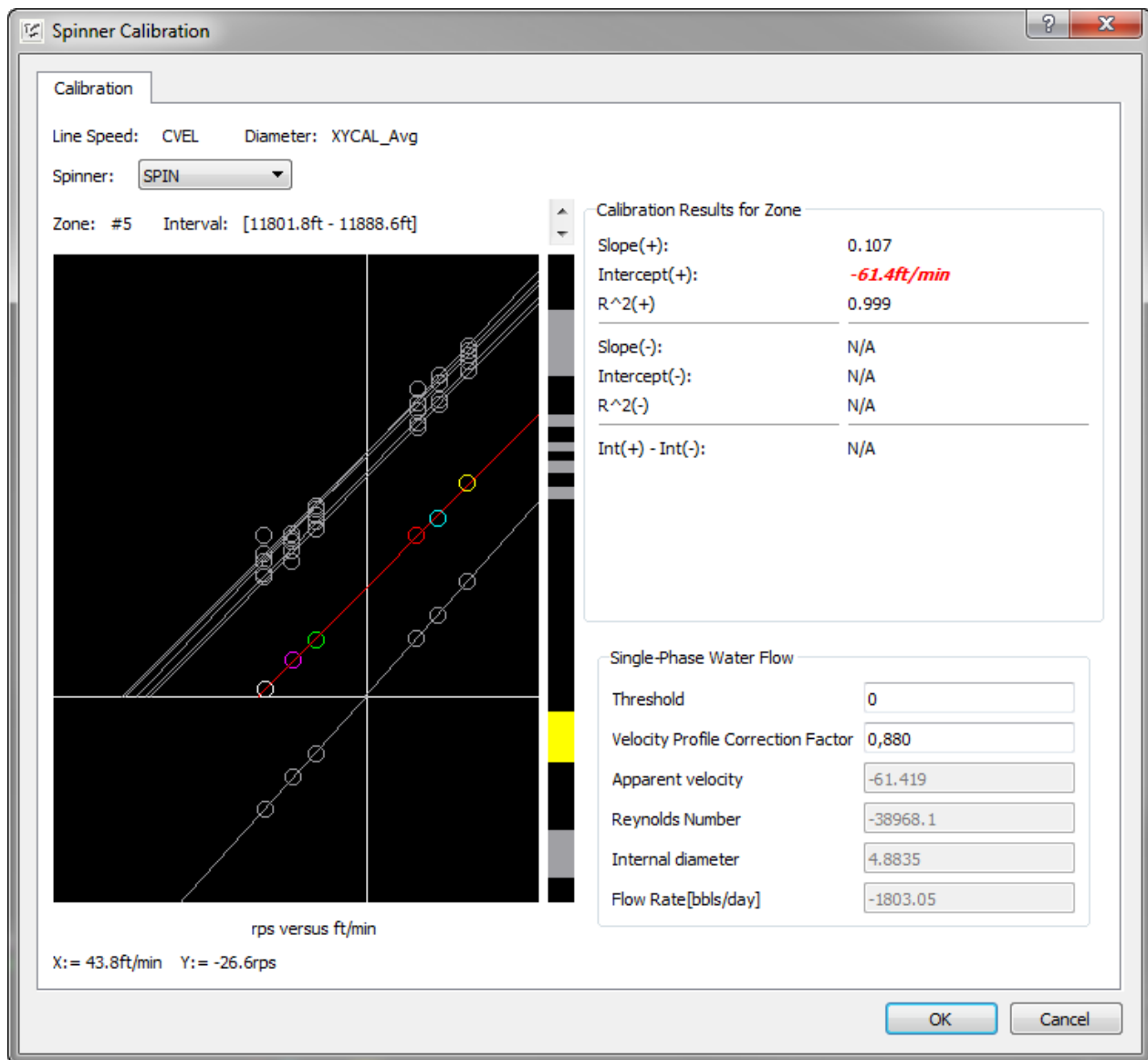
In order to check whether spinner data is of sufficient quality it is possible to perform a spinner calibration of a set of up/down passes.

First, load all passes and display the spinner data. Next click the *Define Interpretation Zones* button (the left most button) and select a depth interval by dragging over a Data View. Alternatively, the interpretation zones can manually be entered (or pasted) by clicking on the *Edit Interpretation Zones* button (the right most button).





When all interpretation zones are entered click the *Spinner Calibration* button (the middle button). This will bring up a selection dialog showing the identified Line Speed data channel as well as the available spinner data channels. If everything is fine click OK to see the spinner calibration.



The *Spinner Calibration* dialog will show a cross plot of the spinner passes. These should be straight lines with an  $R^2$  very close to 1. By clicking the gray boxes to the right of the chart the different interpretation zones can be selected. Alternatively, use the scroll wheel to skip through them.

To the right the *slope* and *intercept* (=flow velocity) for each zone are shown. A very basic *Single-Phase Water Flow* interpretation is shown as well. This is only valid in water injectors to give a rough estimate of the flow rate.

*Note that hidden log passes are disregarded in the spinner calibration and water flow interpretation.*

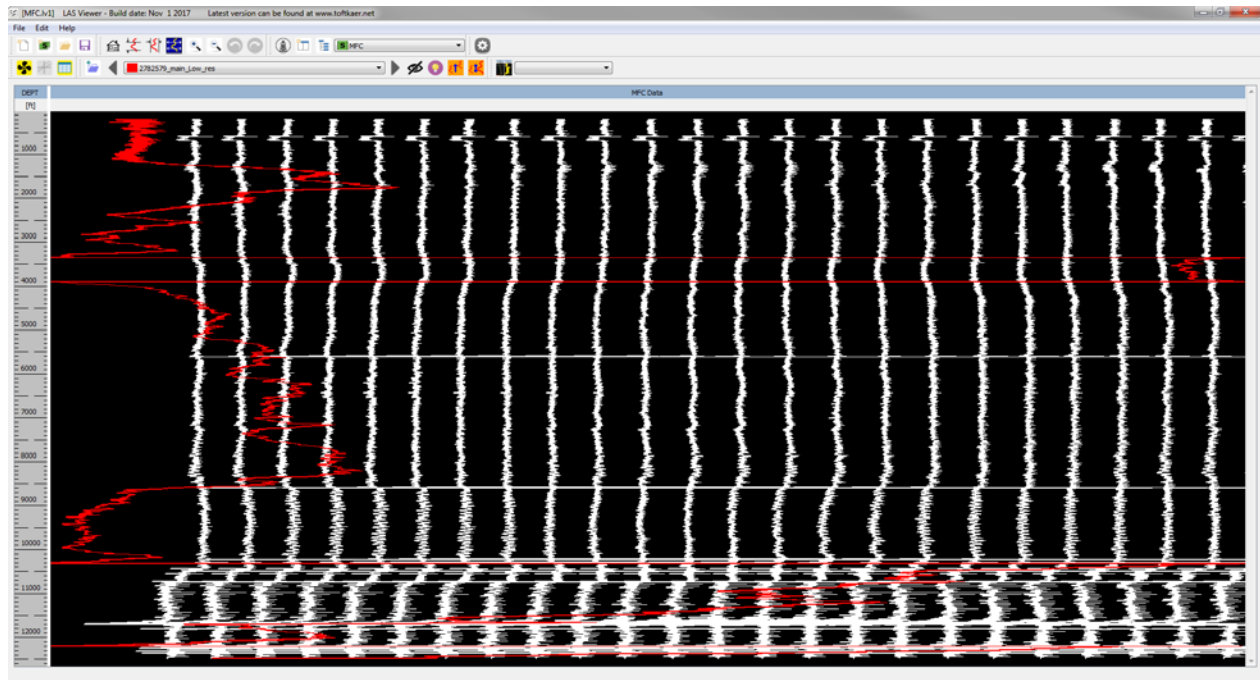
## Multi-Finger Caliper Data

If a log file containing multi-finger caliper radius-data is added to the survey the application will automatically generate a *MFC Data View*.

*Note: Adding two MFC log data files to the same survey may lead to problems redrawing the 3D model*

By default LAS Viewer only detects radius data if the logfile contains data channels with the following MNEMs: "RADI[XX]", "CRAD[XX]", "FINGXX", "RXX". Where XX is the finger index.

In Global Settings it is possible to add or remove MNEMs that triggers *MFC Data View* generation.

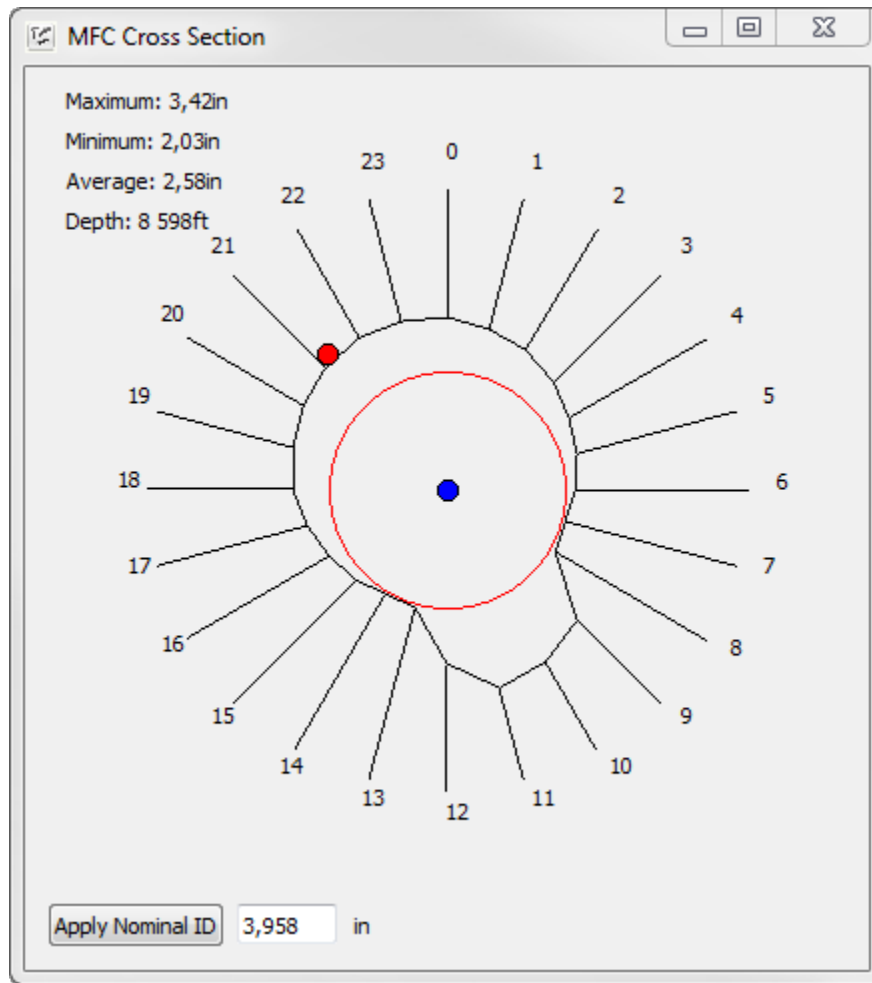


The MFC Data View will contain all the caliper fingers as well as, if available, a relative bearing.

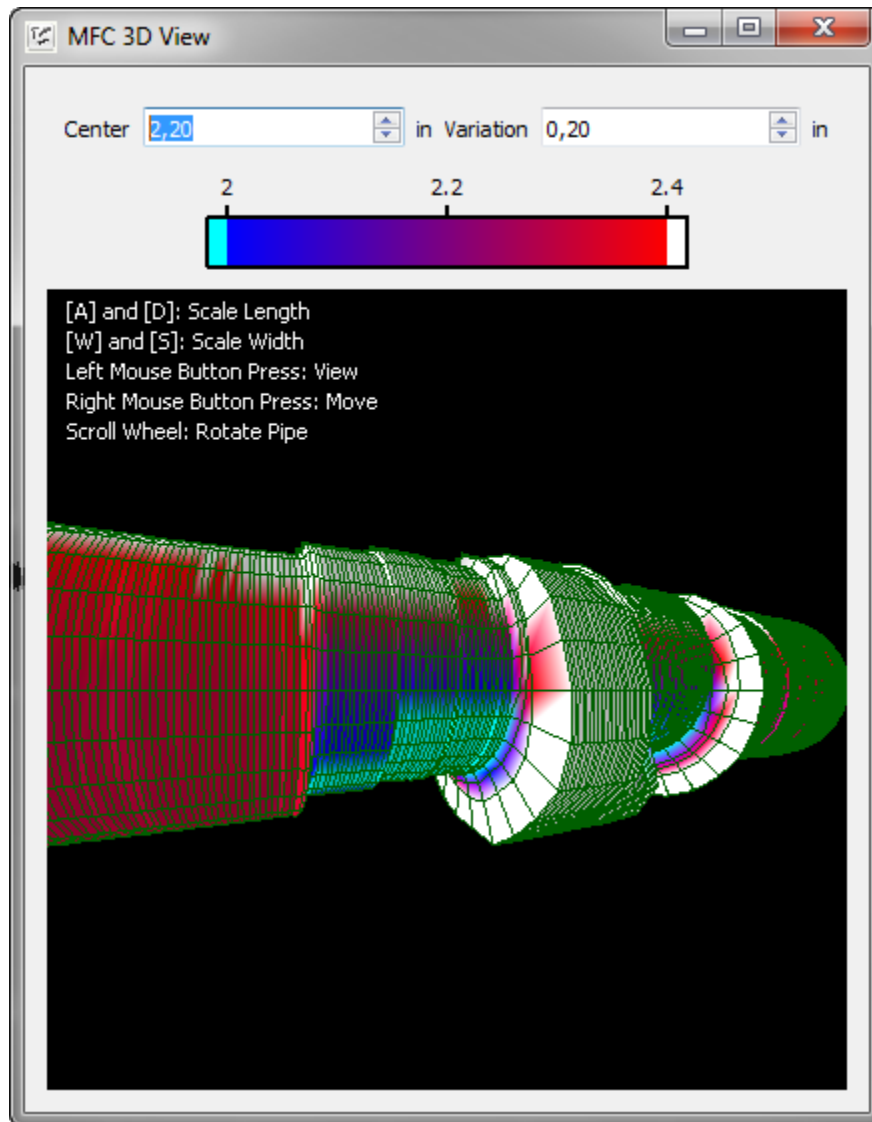
Relative bearing MNEMs supported: "RB\_PMIT", "MITROT".

In addition to the MFC Data View a MFC Cross Section window will appear. This will provide a cross sectional view at the depth of the mouse cursor, displaying the min, max and average finger reading. The red circle will indicate the position of the high-side.

It is possible to enter the nominal ID of the pipe at the current depth. This will draw a red circle with the specified ID that can be used for reference to compare with the actual caliper readings.



To give a more intuitive illustration of the MFC data a 3D MFC window is also created. This will draw a 3D model of the data overlaid with a wireframe model.



The scale of the model can be changed by the A, D, W or S key.

By pressing the left mouse button, the view can be panned right and left by moving the mouse.

By pressing the right mouse button, the model can be moved around by moving the mouse.

The scroll wheel will rotate the pipe.

The ID of each finger reading is indicated by the color of the 3D model. It is possible to adjust the color coding by changing the center point and variation. This makes it possible to optimize the sensitivity of the color scale to current conditions.

## DLIS File Format

LAS Viewer partially supports the DLIS format (API RP66 V1). The specification is fairly comprehensive so lots of features are left out. However, it has been tested on quite a few DLIS files from several vendors and it can handle those files.

## DLIS Browser

Displays the DLIS header – the actual log data is not shown.

	Object Name	LONG-NAME	PROPERTIES	REPRESENTATION-CODE	UNITS	DIMENSION	ELEMENT
1	78&l&TDEP	Tool Depth	440-BASIC	2	0.1 in	1	1
2	78&0&CCL	Casing Collar Locator Amplitude	440-BASIC	2		1	1
3	78&0&FCCL	Casing Collar Pip	440-CUSTOMER	2		1	1
4	78&0&RCCL	Raw Casing Collar Locator Amplitude	440-CUSTOMER	2		1	1
5	78&l&CS	Cable Speed	440-BASIC	2	ft/h	1	1
6	78&l&CVEL	Cable Velocity	440-BASIC	2	ft/h	1	1
7	78&l&TENS	Cable Tension	440-BASIC	2	lbf	1	1
8	78&0&SCCL	Shifted Casing Collar Locator	440-CUSTOMER	2		1	1
9	78&0&TDEP	Tool Depth	440-BASIC	2	0.1 in	1	1
10	78&0&GTEM	Generalized Borehole Temperature	440-CUSTOMER	2	degF	1	1
11	78&0&GHID	Generalized Hole Inside Diameter	440-CUSTOMER	2	in	1	1
12	78&0&DEPTH	Depth Index	440-CUSTOMER	2	ft	1	1
13	78&0&VSEC	Vertical Section	440-CUSTOMER	2	ft	1	1
14	78&0&IDWD	Borehole depth as measured by the IDW (Integrated Depth Wheel)	440-CUSTOMER	2	ft	1	1
15	78&0&BFHI	Borehole Fluid Hydrogen Index	440-CUSTOMER	2	%	1	1
16	78&0&TVDSS	Sub-sea TVD: True Vertical Depth measured from Mean Sea Level	440-CUSTOMER	2	ft	1	1
17	78&0&TDSP	Total Displacement (of survey measure point from vertical)	440-CUSTOMER	2	ft	1	1

## DLIS Converter

Converts DLIS files into LAS files which can be loaded in LAS Viewer.

After selecting a DLIS file to be converted the *Channel Selector* window will appear. Here it is possible to select which channels should be included in the LAS file as well as the target depth interval.

Channel Selector

Depth Interval[ft] : 12 537,9 - 13 052,2

☐ Top Depth

12 537,9

☐ Bottom Depth

13 052,2

☒ Extract data in native index(depth/time) resolution.  
\* Each Log Section will have its own file

Resample Log Sections and merge them into one file. Use following log section as depth reference

☐ 10B - 0,0833ft depth resolution

☐ 60B - 0,5000ft depth resolution

10B

<input type="checkbox"/>	MNEM	Long Name
<input checked="" type="checkbox"/>	TDEP	Tool Depth
<input type="checkbox"/>	CCL	Casing Collar Locator Amplitude
<input type="checkbox"/>	FCCL	Casing Collar Pip
<input type="checkbox"/>	RCCL	Raw Casing Collar Locator Amplitude
<input type="checkbox"/>	CS	Cable Speed
<input type="checkbox"/>	CVEL	Cable Velocity
<input type="checkbox"/>	TENS	Cable Tension
<input type="checkbox"/>	SCCL	Shifted Casing Collar Locator

60B

<input type="checkbox"/>	MNEM	Long Name
<input checked="" type="checkbox"/>	TDEP	Tool Depth
<input type="checkbox"/>	GTEM	Generalized Borehole Temperature
<input type="checkbox"/>	GHID	Generalized Hole Inside Diameter
<input type="checkbox"/>	DEPTH	Depth Index
<input type="checkbox"/>	VSEC	Vertical Section

OK

Cancel

It is also possible to select how the DLIS file will be converted. If *native index resolution* is selected each section of the DLIS file will be converted into its own LAS file in the original resolution. E.g. a CCL is usually sampled in a much higher resolution than temperature. Converting a such a file would generate a high-resolution LAS file containing CCL data and a low-resolution LAS file containing temperature data.

Alternatively, the DLIS data can be resampled to correspond to the resolution of one of the DLIS sections. This will produce only one LAS file containing all the selected data channels.