



This session is an introduction to the basic features of Emeraude v2.60 through a two-phase Oil-Gas example. The session is limited to loading and processing a single production period with emphasis on software mechanics rather than interpretation methodology. The original log data has been submitted to various manipulations including some mnemonic redefinition.

➤ In the examples, this symbol represents an interactive step or action.

*Even though this is not always an explicit step of the Guided Session, we recommend that you call the Help button in the various dialogs. All the software reference is on-line, and is accessed contextually.*

### B01.1 • Creating an Emeraude document

➤ Start Emeraude.

The main program window is displayed with a control panel to the left, several toolbars at the top, and an empty area that will subsequently be used for plotting the logs. Every toolbar has a 'grip control' (shown with 2 vertical lines) that can be used to drag the toolbar and dock it at a different position, or leave it as a 'floating' toolbar inside the plotting area. The original layout of the toolbars will depend on your screen resolution.

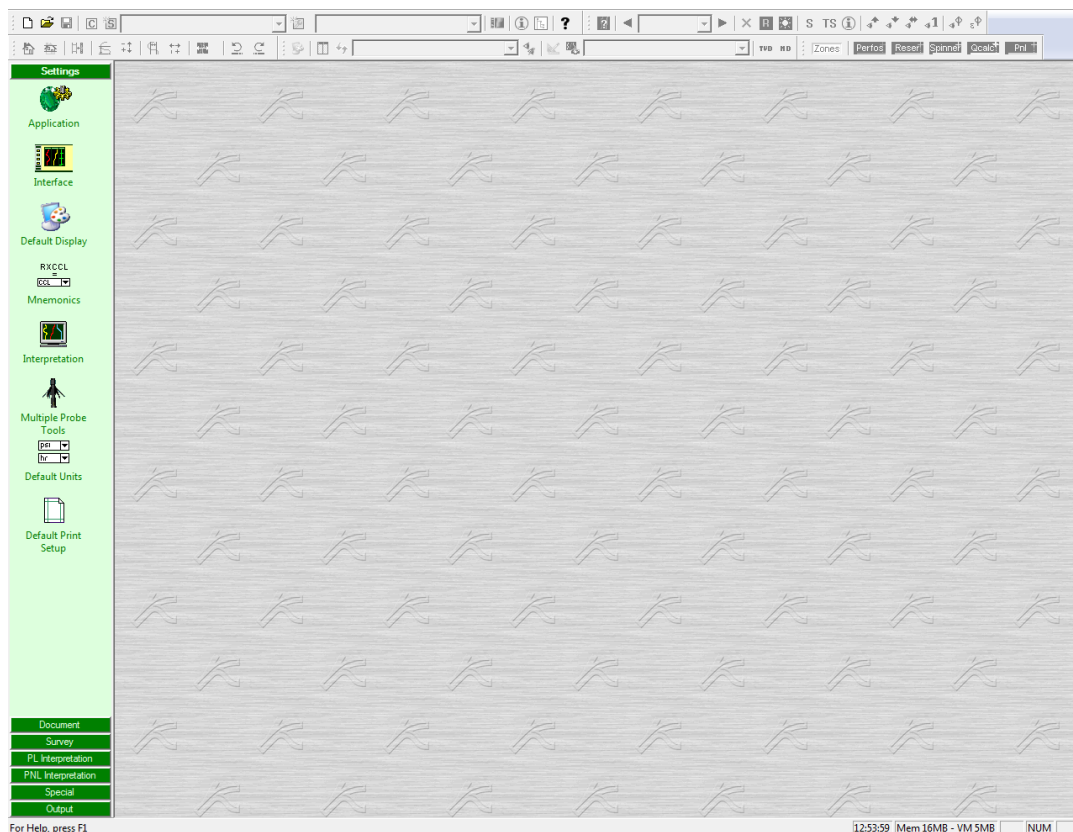


Fig. B01.1 • Settings screen

The control panel contains 7 different 'pages' that may be activated by clicking on the corresponding button: **Settings, Document, Survey, PL Interpretation, PNL Interpretation, Special** and **Output**.

When the mouse cursor is moved on top of any toolbar or control panel button, a brief description of the corresponding option appears in a popup window and in the status bar.

**Settings** is the opened page when Emeraude is started. This mode can be used to define permanent user settings in order to customize the following:

- **Application:** Autosave option, path to external user DLL's (for user editions in the browser) and a 'Licenses' tab to browse, define and update your license settings.
- **Interface:** Color of the control panel buttons and the background aspect.
- **Default Display:** Define all other display options: passes aspect, views aspects, view templates, etc...
- **Mnemonics:** Edit/create a list of user defined mnemonics.
- **Interpretation:** Define subsets and defaults for PVT, slippage correlations and calibration options.  
Activate some specific modeling options.
- **Multi Probe Tools:** Specify the tool definition and color scale for imaging tool processing.
- **Default Units:** System of units at program startup and for new documents.
- **Default Print Setup:** Define the default print settings.

➤ Create a new document using the 'New' icon in the toolbar (or the 'New' option in the 'File' menu).

The 'Job Information' dialog is opened, Fig. B01.2. This dialog has 3 tabs:

- **Information:** Basic information on the job as it will appear in the report.
- **Comments:** They can be typed in or pasted from the clipboard. They are printed on the first report page.
- **Document Units:** Display and edit the system of units to be used in the active document.

The screenshot shows the 'Job Information' dialog box with the 'Information' tab selected. The fields are as follows:

Company	
Field	
Well	
Test	
Date	
Service company	
Interpretation date	09/07/2010
Done by	
<input type="checkbox"/> Casing shoe at	0 ft

Buttons: Help, Cancel, OK

Fig. B01.2 • Job Information dialog

➤ Enter the required information and validate with OK.

## B01.2 • Emeraude Document mode

After creating a new interpretation file the Document page is opened, Fig. B01.3. From top to bottom, the icons in the Document mode are:

- **Information:** accesses the initialization dialog with the Information, Comments and Units pages.
- **Load Well Data:** loads general well logs e.g. open-hole gamma ray, deviation survey, caliper, etc.
- **Well Details:** accesses a series of tables where the following information can be typed in manually: Deviation (or TVD), Internal diameter (steps), Roughness, Perfos and Reservoir Zones, Markers.
- **Well sketch:** is used to create and edit a Well Sketch view.

If a deviation survey or a TVD curve is available, they should be loaded using the 'Load Well Data' option. The 'Well Details' option is really for manual input.

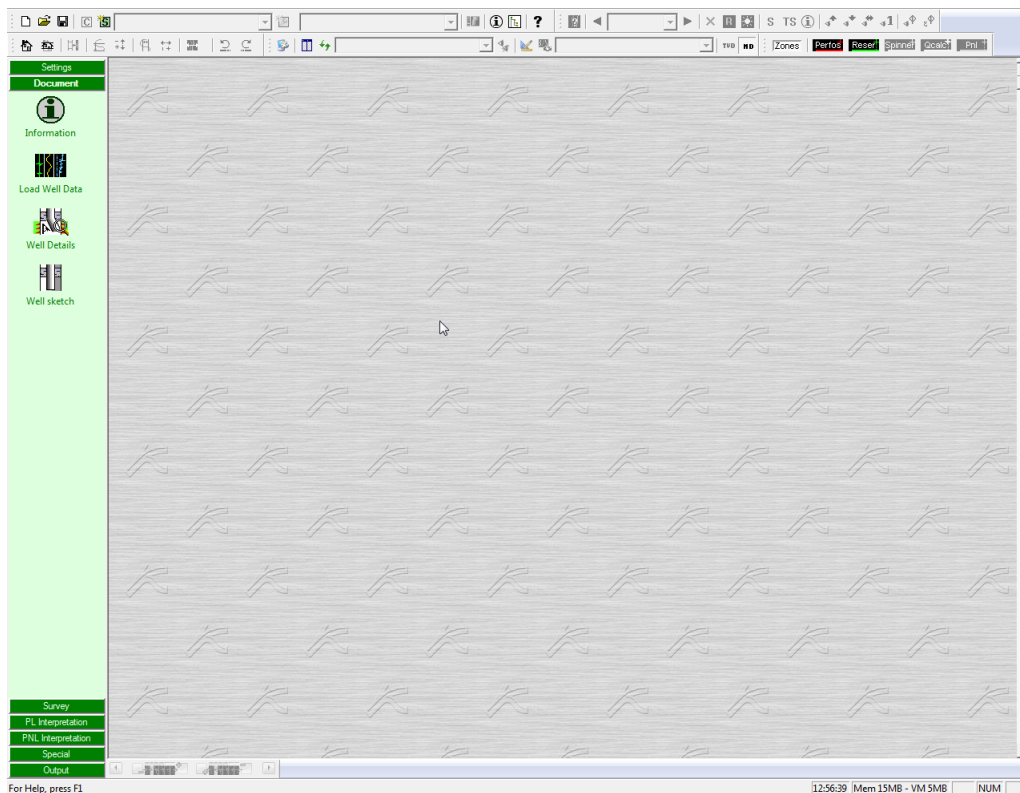


Fig. B01.3 • Document page

As a rule, unless there is general well data to be loaded from files, it is always advisable to start with the load of survey data, using the Load dialog of the Survey panel. This ensures in particular that the automatic depth range used for plotting will be the logged interval. In this example, we do not have an open-hole gamma-ray, the well is vertical, and the only information that has to be defined is the I.D. and the roughness. This information will not be needed until we compute rates, so we can move to the 'Survey' mode directly and return to the 'Document' mode later.

In the document control panel, click on the Icon 'Information', in the displayed dialog:

- The first tab corresponds to the information dialog called at the document creation.
- The second tab can be used to enter 'Comments'.
- The third tab, 'Document Units', allows the user to adjust the unit system for the current document (when creating a new document the assigned unit system is the default one defined in the Settings page).

- Select the tab 'Document Units'.

The Doc Unit dialog is displayed (Fig. B01.4). The user may select or define the system of units, either at installation level (will apply to all new documents) or at document level (applies to the active document only). There are 5 preset systems: SI, Oilfield, Hydro-geology, French and Metric Oilfield. One can also customize a system and store it, or load an existing system. The system of units can be changed at any time during the interpretation process.

- Click the contextual help if you wish to have more information on Units handling.
- Validate with OK.

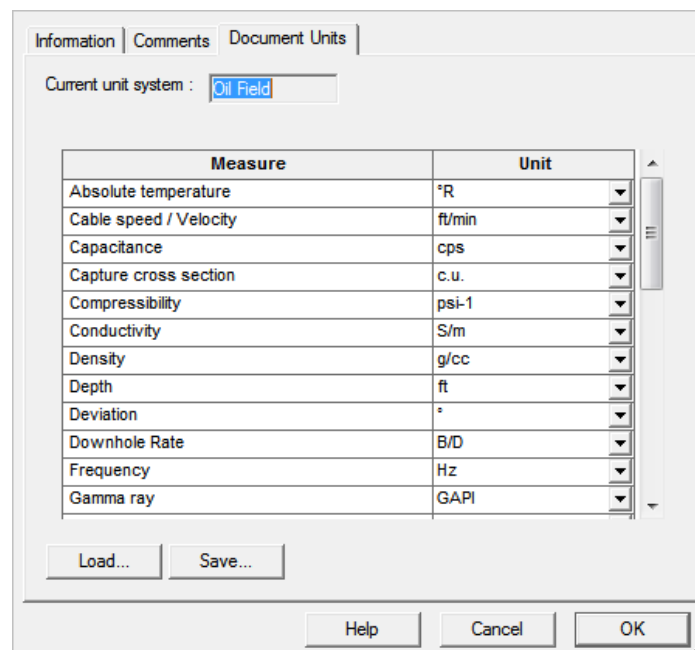


Fig. B01.4 • Doc Units dialog

For the purpose of the demonstration we will add two markers A.

- In the control panel, press the 'Well details' icon, in the dialog hit the 'Makers A' tab.
- Input 'Mark I' at 8200 ft and activate the 'Show' checkbox.
- Press 'Add', enter 'Mark III' at 8400 ft and activate the 'Show' checkbox.
- Enable the 'Show in all views' option.

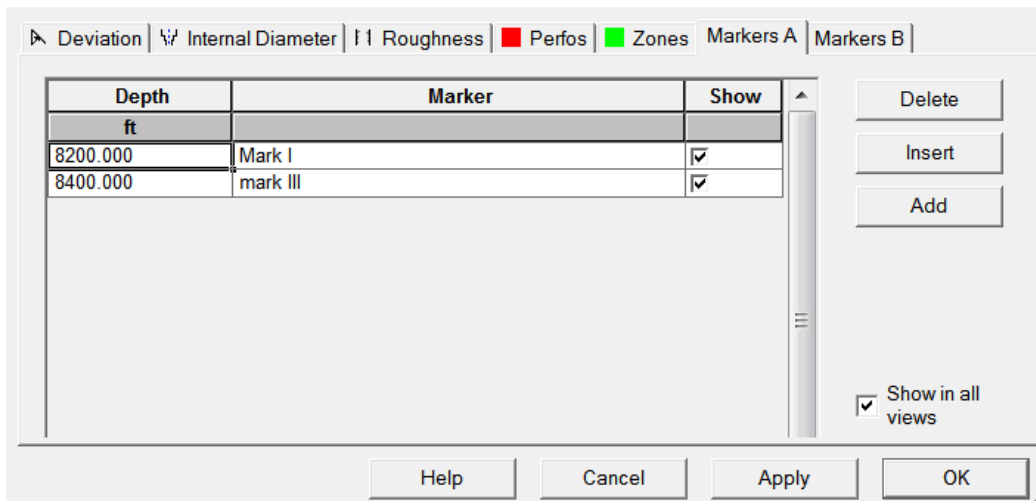


Fig. B01.5 • Markers A in 'Well details'

➤ Validate with OK.

### B01.3 • Data hierarchy in an Emeraude document

Emeraude uses a hierarchical representation of the data as opposed to a flat structure.

First in the hierarchy is the Document, i.e. data whose definition is unique and will be used in the different surveys and interpretations. In the document, common information is stored as the **General Well Data**. Typically the General Well Data will include (some of) the following: open-hole Gamma-Ray, T.V.D. or deviation log, zoned I.D. or caliper log, perforations, etc.

At the same level as the General Well Data level is the **Survey**, i.e. a set of data/information pertaining to a particular well condition. Several surveys may be stored in the same document. The main Survey data is the actual **Log Data**, consisting of passes (**Up** and **Down**, and possibly **Stations**). Each pass contains a series of measurements. Finally, survey data provides the basis for one or several **Interpretations**. Multiple interpretations can be, for instance, due to the existence of several tools of the same kind (e.g. in-line and full bore flow meters).

The data hierarchy is mirrored by the 3 control panel modes: Document - Survey - Interpretation. As will be illustrated further, the data browser can be used at any point in the session to get a hierarchical view similar to that on Fig. B01.6.

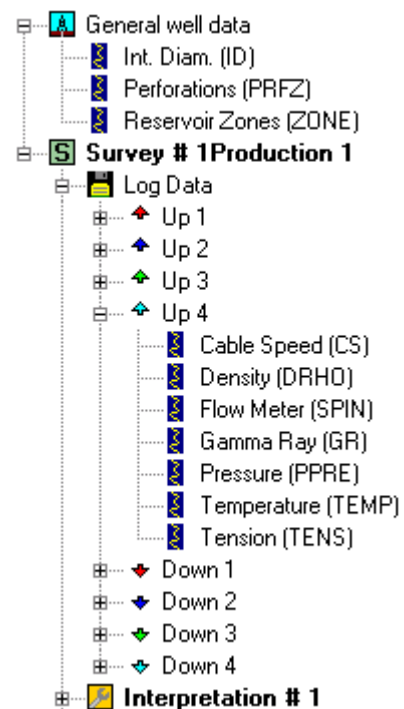



Fig.B01.6 • Document data hierarchy

## B01.4 • Emeraude Survey mode

- Click on the 'Survey' button of the control panel. Options in the survey page are:
  - **Information:** Edit properties of the active survey or create the first survey for the active document.
  - **Load:** Load Up/Down data in the active survey.
  - **Load stations:** Load stationary data in the active survey.
  - **Tool info:** Enter/review characteristics of the tools used in the active survey.
  - **Stretch:** Interactive depth stretch definition for all the passes in the survey.
  - **Zone Stretch:** Interactive stretch definition on a selected zone only.
  - **Spinner Reversal:** Interactive definition of reversal depth for unsigned spinners.
- Click on the 'Information' button. A new survey is automatically created named 'Survey # 1' by default. Note: To create a new survey after one exists, use the  icon in front of the survey drop list of the main toolbar.
- Change the survey names (Fig. B01.7): Name = **Production #1**; Short name = **P1**. Confirm with OK.

Note: The use of the short name will be illustrated later in the session. Typically this should start with a letter indicating the period type followed by the index in the given type.

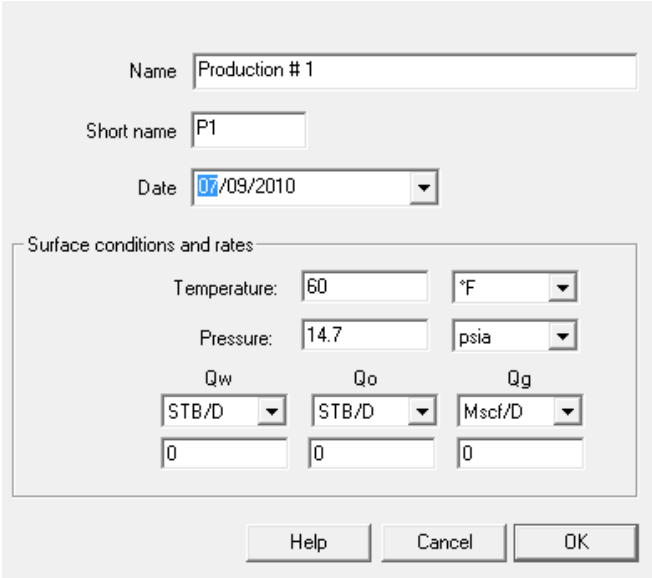


Fig. B01.7 • Survey Infos

## B01.5 • Loading data

In the survey page the 'Load' button is now enabled, Fig. B01.8. Emeraude can load data in LIS, LAS, or ASCII format. The load option automatically recognizes the file format and decodes it as appropriate. When nothing in the file is recognized, the inconsistency is pointed out and the user is prompted to correct it. In this session the survey data consists of 8 passes, 4 up and 4 down. They are physically stored in Log ASCII Standard (LAS) files and the file names indicate their type and index: B01d1.las, B01d2.las, B01d3.las, B01d4.las, B01u1.las, B01u2.las, B01u3.las, B01u4.las.

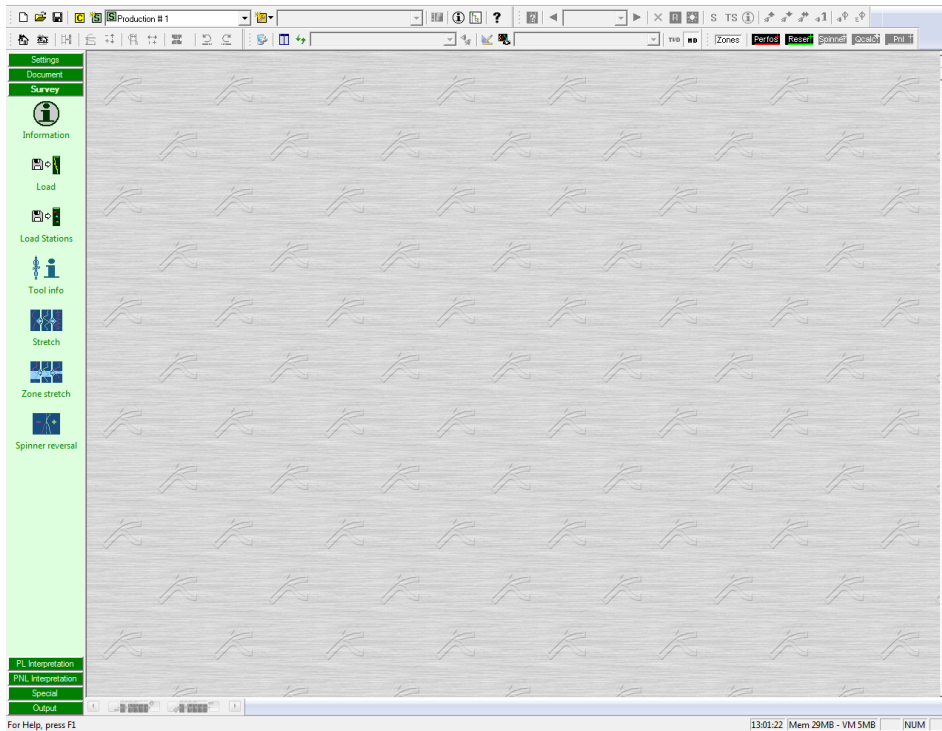


Fig. B01.8 • Survey mode after creation of the survey 'Production #1'

- Click on 'Load', the Load dialog is displayed.
- Select 'Add...' and in the subsequent 'open file' dialog, select the 8 files: B01\*.las.
- Note: you can select all files at once with the 'Ctrl' key pressed or one after the other with the 'Shift' key pressed. You can also click on 'Add...' every time a new file is selected. When all files are selected the Load dialog looks as shown on Fig. B01.9.

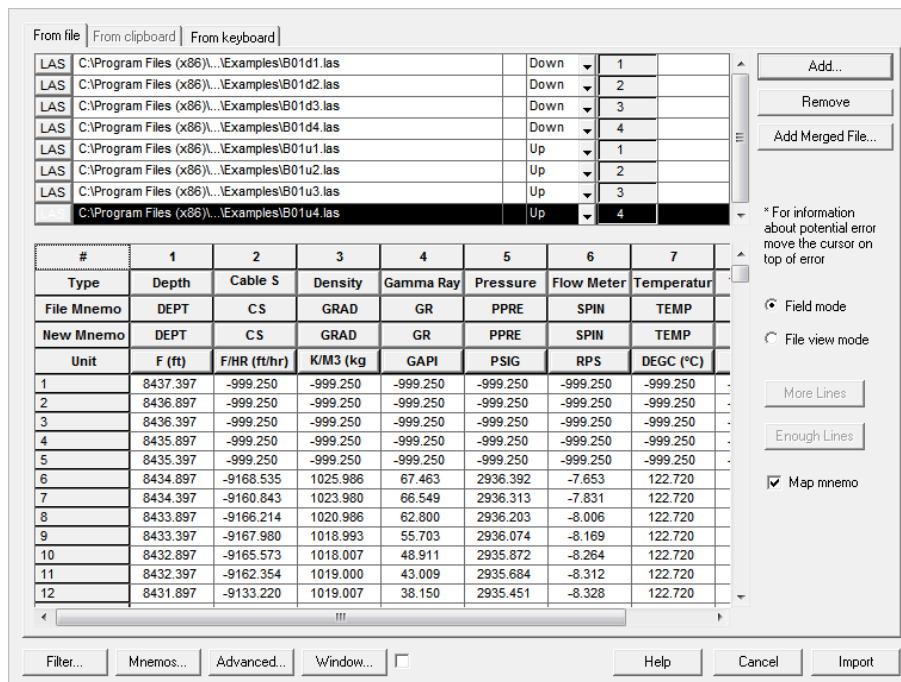


Fig. B01.9 • Load dialog after file selection

The top part of the dialog shows the list of logical files. A logical file corresponds to one pass. There can be only one logical file per ASCII or LAS file, but a LIS file will typically contain several logical files, normally all the files of a given survey or job.

For each file, the following information/controls are given:

- **File type:** indicated in the line header button.
- **Pass type:** Up or Down as read in the file. If the information is not present in the file or not read properly, clicking on the type accesses a drop list where the selection can be changed.
- **Index in type:** A click on the value accesses a control with up and down arrows to increase/decrease the value. It is also possible to type in the new value directly. By default, Emeraude uses alphabetical order.

When two passes have the same type and number, '! Error' appears on the corresponding lines. This indication disappears as soon as the conflict is resolved. A '!' may also appear on any given line to indicate that something in the file is incorrect. By moving the cursor on top of the error, the user is informed on the potential source of error.

The lower part of the dialog shows the formatting of the currently selected file. Each column in the display corresponds to a particular field in the file and has 4 header buttons, from top to bottom:

- **Type:** this is the measure type, e.g. Pressure, Temperature, etc.
- **File Mnemonic:** measure mnemonic found in the file.
- **New Mnemonic:** allows the user to change the mnemonic.
- **Unit:** unit of the data in the file.

Clicking on any of these buttons (except the File Mnemonic) accesses a pop-up menu that can be used when the necessary information for a given curve is not present in the file. The second guided interpretation will show in detail how to use these options. In the current example, there is no conflict or incorrect information so the load can be done at once.

- Click on 'Import' to execute the load.
- When the Load has completed select File, Save as, enter EX1 and Save, Fig. B01.10.

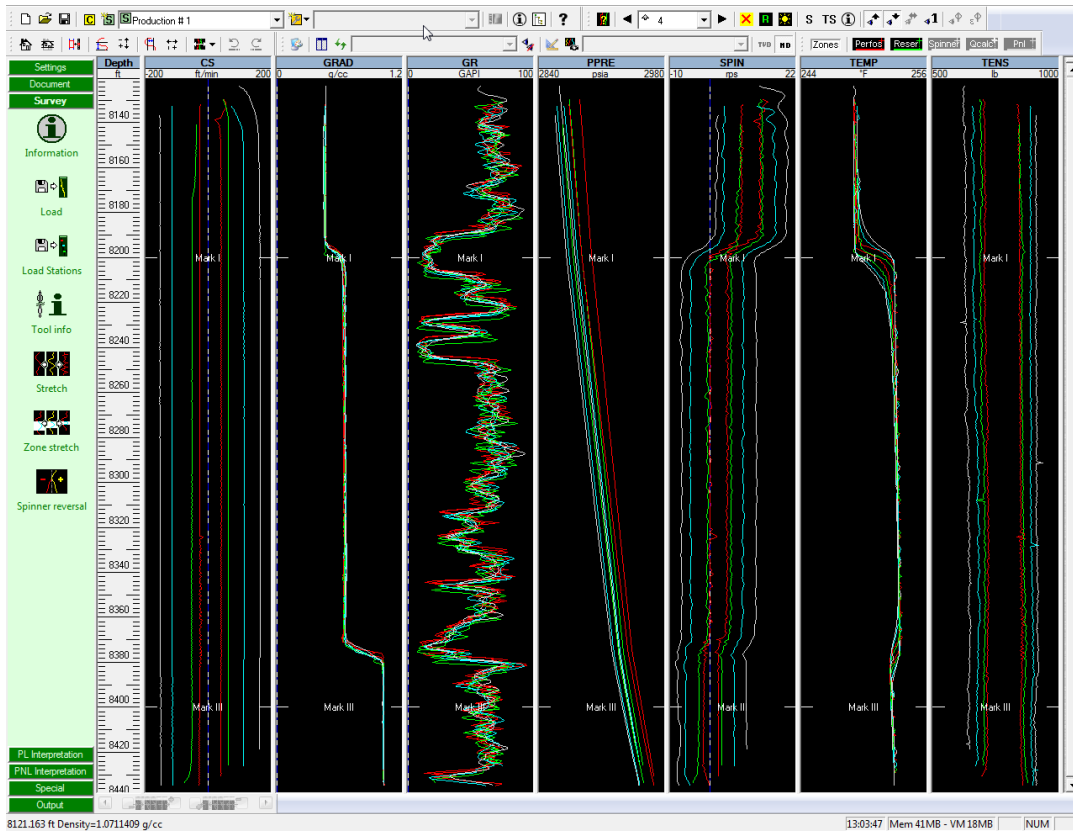


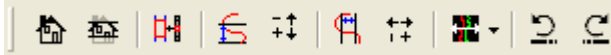
Fig. B01.10 • Main screen after loading

### B01.6 • Creating and manipulating plots

The eight passes have been loaded in the 'Production #1' survey. Emerade automatically creates a plot for each channel type and each mnemonic found in the up and down passes. These plots are also scaled automatically to the entire logged interval and show all the acquired curves. In this example, there are 7 automatic plots: Cable Speed (CS), Density (GRAD), Gamma Ray (GR), Pressure (PPRE), Flow Meter (SPIN), Temperature (TEMP), Tension (TENS).

All channels in a particular pass are plotted with a unique aspect corresponding to the index of the pass in the type (red=1, green=2, etc) defined by the Document Display Settings. The application default Display Settings, used to initialize the Document Display Settings, can be changed in the Default Display option of the Settings panel.

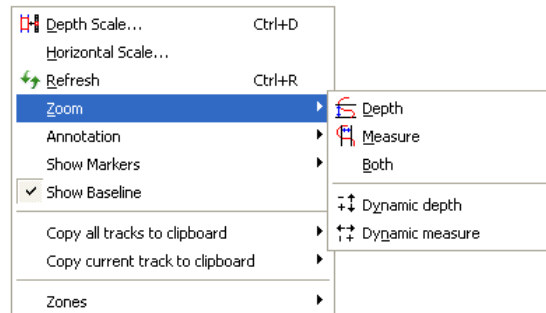
## Scaling plots



Scale options can be accessed through the 'scale toolbar': From left to right the options are:

- **Zoom reset on full logs range:** reset the horizontal scales and the depth scale of all the visible views in Emeraude.
- **Zoom reset on current depth window:** reset the horizontal scales of all the visible views in Emeraude, without resetting the depth scale.
- **Set depth limits:** changes the depth or scrolling window range manually.
- **Zoom on depth:** redefines the scrolling window range by click and drag: after selecting this option click in any plot for the top limit, drag down to the desired bottom limit, release the mouse button.
- **Dynamic depth zoom:** the scale changes dynamically with the mouse displacements
- **Zoom on measure:** same as zoom on depth, but the zoom is now on the measure.
- **Dynamic measure zoom:** the scale changes dynamically with the mouse displacements.
- **User view horizontal scale settings:** the user can choose to zoom on all, on active or on the same type of measure (user views only).
- **Undo last scale operation**
- **Redo last scale operation**

Clicking the right mouse button with the cursor in any plot accesses a pop-up menu, Fig. B01.11. In the 'Horizontal Scale' dialog the horizontal range of the particular plot can be entered directly. When the cursor is moved onto the plots, it changes to a crosshair over the full plot area. The position (depth, value) of the cursor is shown in the message bar at the bottom of the window. The cursor appearance can be modified in the 'Display' menu, selecting the 'Cursor' option.



*Fig. B01.11 • Plot pop-up menu*

By default Emeraude shows the total data range. Click with the right-hand mouse button in any plot to access the above popup menu and select 'Depth Scale' (Fig.B01.12).

- In the 'Depth Scale' dialog, set the size of the display window to 100 ft.

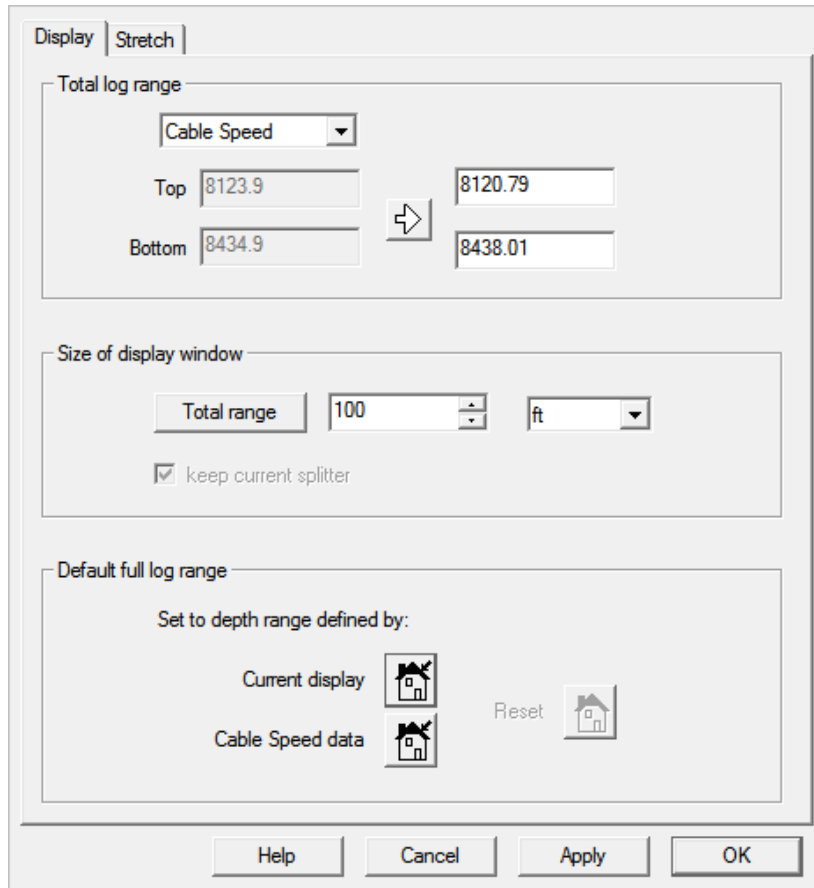


Fig. B01.12 • Depth Scale dialog

You can scroll the log using the scroll bar on the right of the plots. By default the scroll is complete: all channels scroll together. For less powerful machines, you can use the fast scroll option (accessible in the 'Display' menu, selecting the 'Scroll' option). In this mode, only the depth scale and the zones visualisation (described later) are scrolled continuously. The other channels are only updated when the scroll is over, i.e. the mouse button is released.

At the top of the scroll bar is a thin rectangle, the splitter handle: you can slide this handle down to split vertically the display window in two parts. Each part can be scrolled independently, allowing two separate regions of the log to be viewed at the same time. The splitter is removed by dragging the splitter handle to the top or bottom of the scroll bar. Up to 16 splits can be made simultaneously.



**Display toolbar**



Dragging its title bar above the plotting area can hide a plot. A hidden plot appears in the drop list of the Display toolbar and can be retrieved later from this drop list. The 'Display' option allows setting the document display settings. The 'Tile' option optimizes the use of the full window width, dividing the available space equally between the displayed plots. Only the depth scale and the zone visualisation plot (described later) keep their size. The well sketch view also keeps its size by default, but this can be changed in the well sketch view properties dialog, accessed via the view popup menu. The 'Refresh' icon is used to refresh the screen if needed (only when symbols are used). Views can be shown/hidden using the 'Show/hidden views' option.

Templates can be invoked to create the corresponding view(s) via the 'Invoke template' icon. The 'Store current screen' icon is the screen capture facility in Emeraude. The last two buttons labelled 'TVD' and 'MD' can be used to switch the display mode provided there is a TVD channel in the General Well Data, and the well TVD is strictly increasing.

*Note: the view templates are created at the level of the application settings and can be shared by saving / loading them to / from files. The view templates allow predefining specific settings for some views (rate views, automatic views, user views and cumulative user views) and can be combined into full layout templates in order to organise Emeraude display. When invoked, the view templates are bound to the data to be displayed (by default, an automatic data binding is done if possible). More about the View templates features is described in the Guided Session B05.*

- Hide the plots for Pressure, Temperature, and Tension, by dragging their title bars above the plotting area.
- Again by dragging the title bars, change the position of the remaining plots as shown below.
- Use the Tile option to use all the available space.
- With the splitter handle, split the log in two equal parts.
- With the splitter controls, scroll the upper and lower logs to the desired position (Fig. B01.13).

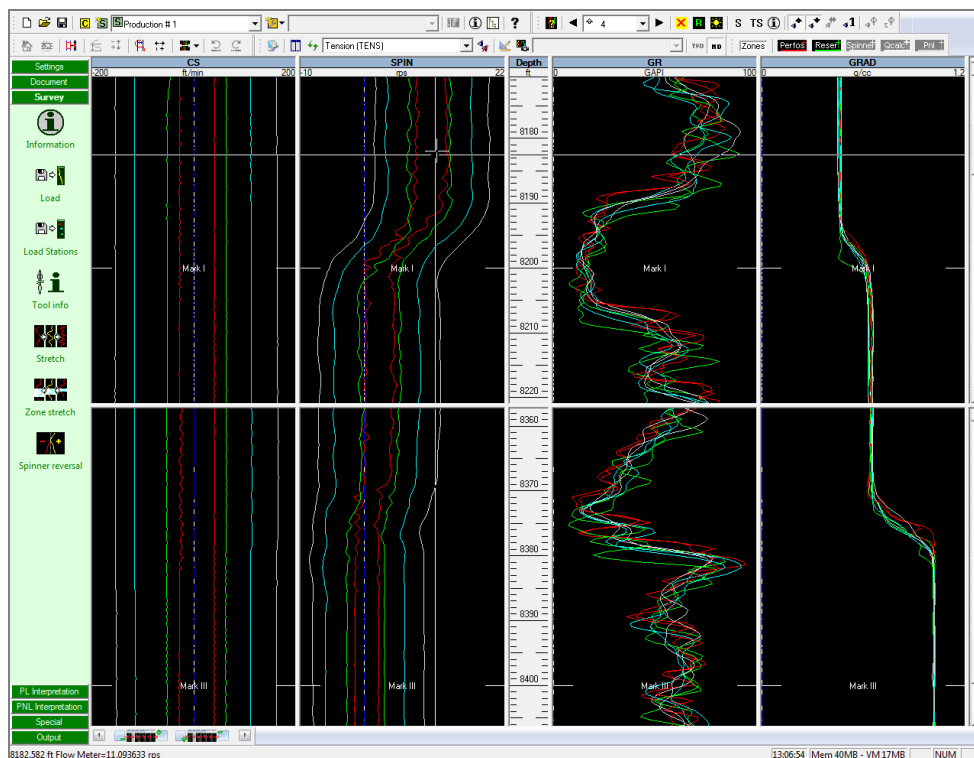


Fig. B01.13 • Main screen after hiding / moving plots and splitting

### Cyclic views

In Emeraude, no more than 15 views can be displayed side by side. The cyclic display mode, activated in Settings – Default Display - Views tab, allows overcoming this limitation: if the maximum number of displayed views is reached, when a new view is added to the right, all views are automatically translated to the left. Two dedicated buttons (bottom-left) allow sliding the views to right or left. The show-hide dialog helps defining the views in the cycle. More information on this in the online help.

### B01.7 • Using the Data Browser

In addition to the Scale and Display toolbars, the main screen contains the Main toolbar. From left to right options are: New, Open, Save, Edit comment, Create a new survey, Survey list, Create a new interpretation, Interpretation list, Calculation of schematic rate logs, General job information, the Data browser, and Help.



The survey and interpretation lists are used to view/change the active survey/interpretation. At this stage, the Interpretation list is empty and the survey list contains only 'Production #1'.

- Click on the browser icon to open the browser dialog.

The window is divided into two areas. On the left is a hierarchical tree view of the data in the file (Fig. B01.14). A node in the tree starting with a '+' can be unfolded with a click on the '+' (or double-click on the icon).


- Open the 'Production #1' node.




A node labelled 'Log data' contains all passes. This node in turn unfolds to show the individual pass nodes, which contain the individual channels, or curves. Inside the survey icon also appears a 'Data Store' icon. The data store is used to store copies of existing channels for data manipulation, averaging, etc. The right side of the browser contains 5 tabs: **List**, **Info**, **Grid**, **Plot**, **Plot vs Time**, used when the selected node in the tree is a channel.

	Depth	Cable Speed
	ft	ft/min
1	8131.897	-25.929950
2	8132.397	-26.776883
3	8132.897	-27.485750
4	8133.397	-27.186233
5	8133.897	-28.102333
6	8134.397	-28.211133
7	8134.897	-28.507050
8	8135.397	-28.692183
9	8135.897	-28.507800
10	8136.397	-28.680900
11	8136.897	-28.202650
12	8137.397	-28.270567
13	8137.897	-28.787883
14	8138.397	-28.496717
15	8138.897	-28.420800
16	8139.397	-28.936000
17	8139.897	-28.593033
18	8140.397	-28.422850
19	8140.897	-28.993450
20	8141.397	-28.844567

Fig. B01.14 • Browser tree

In addition to providing a clear view of the data structure, the browser gives access to most of the Emeraude editing options. Options are selected in the browser toolbar or alternatively with a right mouse button click in the browser window. A quick description of the browser toolbar options can be obtained by moving the mouse successively on top of each button (without clicking). You may also access the specific help on the browser by clicking the 'F1' key when the browser dialog is active.

If several documents are opened in Emeraude, the browser can display the hierarchical trees of all the documents by clicking on the button  in the browser toolbar. In this mode, by drag/drop operations, it is possible to transfer data from one document to the other, such as an interpretation PVT. The active document is highlighted with a yellow background and double clicking on the document node allows activating it in Emeraude.

- Minimize the browser window, either by double-clicking on the browser window header or by clicking on the  icon in the browser window header (top right of the window). Note: the browser window can be closed by clicking on the browser button of the main toolbar or by using the  icon of the browser window header. If the  icon is pushed down, it will allow to automatically minimize or maximize the browser window, depending on the mouse cursor position: if the mouse cursor is moved outside of the browser window, this one is minimized, and it will be restored to its maximized state if the mouse cursor is moved on top of the browser window header.

## B01.8 • Depth matching



After loading the log data, operations such as Depth shifting can be applied to a whole pass. These operations are accessed through the pass toolbar.

From left to right: **Nearest curve, Go to Previous pass, Active pass, Go to next pass, Hide, Reference, Highlight, Depth Shift, Tool Shift, Info, Show/Hide all Up passes, Show/Hide all Down passes, Show/Hide Stationary passes, Show only the active pass.** *The last 2 icons are for MPT tools and are covered in sessions B08 and B09.*

As with all other Emeraude toolbars, you can get a quick description of the options by moving the mouse cursor on top of the desired option. We do not have a separate reference gamma ray for this session and we will assume that the depth of the Down 1 gamma ray is correct.

- Remove the splitter by grabbing it and dragging it to the top or bottom of the display area.
- Set the display range as total range: click on the first 'home' button of the scale toolbar.

Note: in order to precisely adjust the depth scale to some particular data range, right click in a log, select 'Depth scale', chose the data of interest for the 'Total log range' limits, press 'Total range' and OK. In this example, this will set the depth range to the total range of the Cable Speed data, and you should see the whole log on the screen. It is possible to set a particular depth range as the default one, using one of the options at the bottom of the 'Depth Scale' dialog, as shown below:

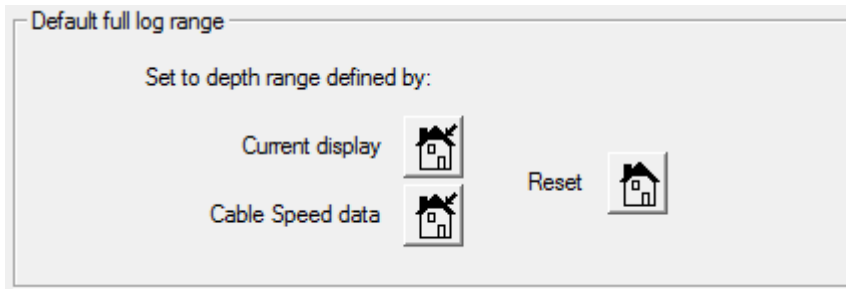






Fig. B01.15 • Range display


- Click in the pass drop list and activate Down 1.
- Select it as the 'Reference' . All the channels of this pass are now plotted in white.
- Activate the pass up 1 and 'Highlight' the pass, with .
- Select the 'Shift' icon of the toolbar  and, in the Gamma Ray plot, click and drag the channel to try out the shift option. Note: a double click in the Gamma Ray Header will maximize the track to make it easier to do the depth shift. Double clicking again in the track header will return the screen to the status before.
- Then repeat for any other curve as required: activate one pass after the other using the 'Next pass' or 'Previous pass' buttons besides the pass drop list. The active pass is highlighted if the 'Highlight' option has been kept active.

Pass activation can also be made with the 'Nearest curve' option .

- Click on this option.
  - Click on, or close to, a channel of the pass you want to identify.
  - The selected channel is indicated in the browser, close the browser.
  - Use highlight to verify that the correct pass has been activated.
- The pass will automatically be activated.

Plots can be temporarily set to full page by double-clicking on the header:

- Double-click on the header of the gamma-ray plot to bring it full-page.
- Double-click on the header again to return to the previous screen layout.

You can click on the 'Pass Info' icon  to view, for any pass, the value of the shift after depth matching.

## B01.9 • Tool info

- Click on the 'Tool info' button  of the 'Survey' panel (Fig. B01.15).

In the 'Tool Information' dialog, characteristics of the tool string used in the survey are entered. A tool is defined for each mnemonic of type pressure, temperature, flowmeter, density, or capacitance. If a mnemonic is present in several surveys, it is assumed that the same tool was used.

Emeraude accepts other input measurements (any phase holdup, velocity, or rate) for which the tool characteristics are not entered. This is because the measure in this case is a direct physical property involved in the rate calculation. The default tool O.D. is correct in this case.

The Density section is used to characterize the type of density tool used. For the 'Gradio', a drop list indicates the correction that Emeraude will apply. For instance, in this case the density channel is not corrected for deviation so we select:

- Apply deviation correction: selecting the option 'Uncorrected pressure gradient' in the drop-down menu.

The default choice of correction is based on the mnemonic but should always be checked. In this example the well is vertical so this will not have any influence on the calculations.

- Change the spinner O.D. to **3.5 in** and validate with OK.

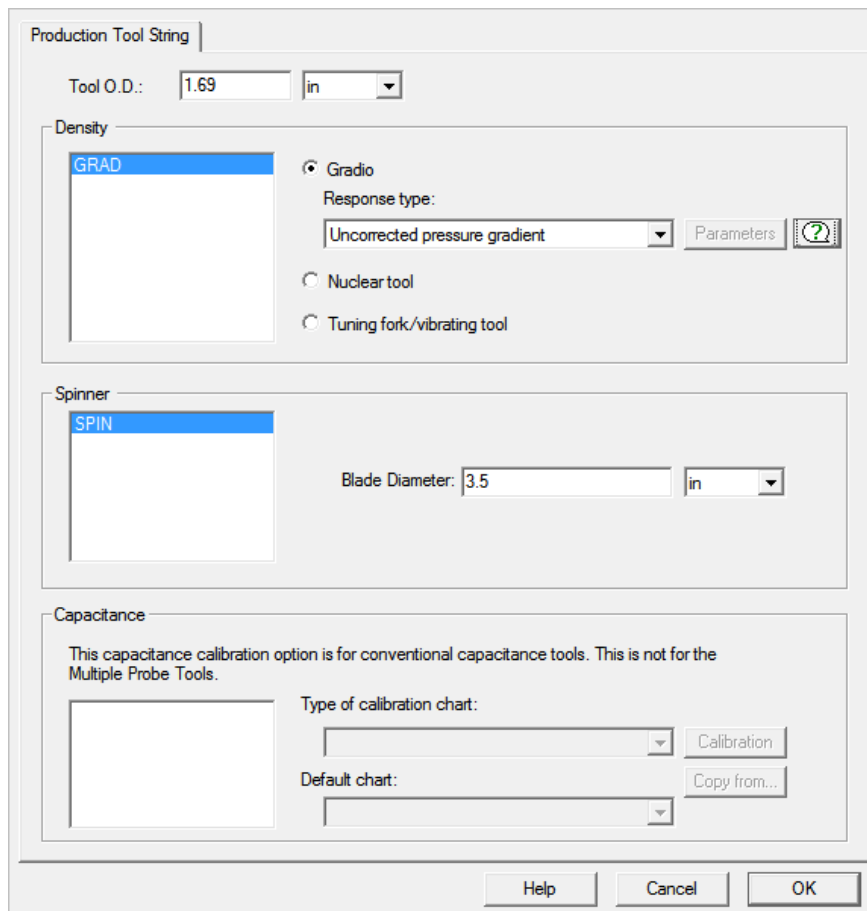



Fig. B01.16 • Tool info dialog (after input)

In this example we do not need to consider stretch or spinner reversal.

- Restore all the views (except the one for the Tension) by selecting them from the Hidden plot list. Note that if you press the  icon, next to the Hidden plot list, a dialog appears where you can select and restore several tracks at once.
- Setup your screen as on Fig. B01.17.

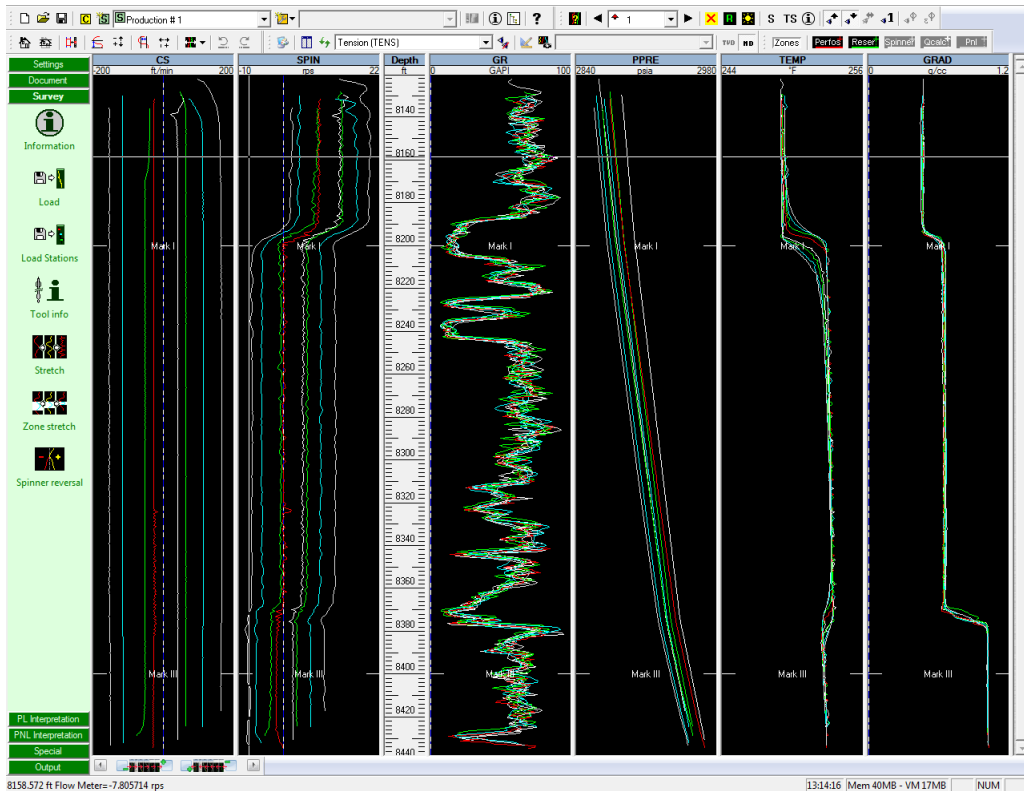


Fig. B01.17 • Views restored

You may hide the markers from Document / Well Details, selecting the 'Markers A' tab.

- Disable the 'Show in all views' option as shown in Fig. B01.18.

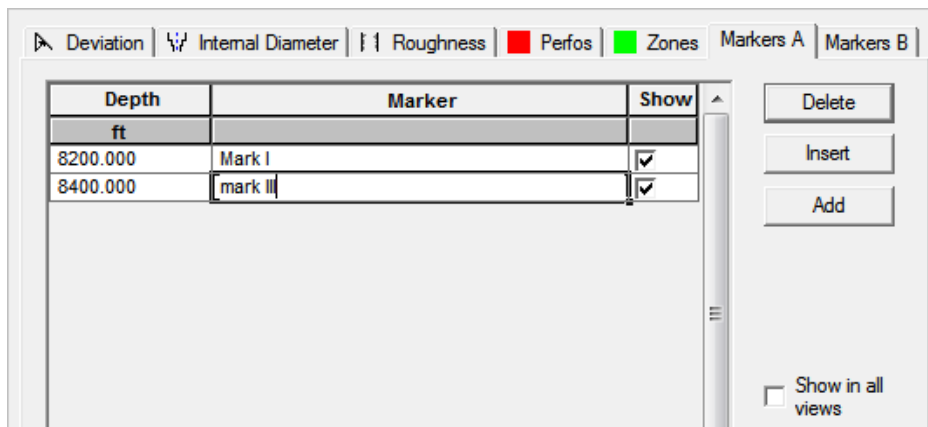


Fig. B01.18 • Markers A in 'Well Details'

### B01.10 • Creating an Interpretation

- Click on the 'PL Interpretation' button of the control panel.


The options in this mode are:

- **Information:** edits properties of the active interpretation or creates the first interpretation for the active survey.
- **Calibrate:** spinner calibration.
- **V apparent:** generates an apparent velocity channel.
- **PVT:** Input PVT parameters by phase.

- **MPT Processing:** For MPT tools only
- **Zone rates:** Zonal rate calculations.
- **Log:** generates schematic of zonal results or complete rate logs.
- **Time Lapse:** The objective of this option is to produce at the end of the report an additional log presenting in chronological order, the past and present productions in terms of schematic rates QZT or ratios QZTR.

In Emerade, an interpretation is built on user defined reference channels of temperature, pressure, and any measurement that the calculation can match: density, capacitance, phase holdups, phase velocity, or rate and temperature. Reference channels will be typically either a straight copy of an already existing channel, or the result of averaging channels from several passes. Deciding which channels needs averaging, possible editing, filtering, etc will require looking in detail at the various plots, sometimes to create and compare several averages. These manipulations are beyond the scope of the first guided session and will be illustrated, to some extent, in the Guided Session #2. A user view of the reference and match channels is automatically created once the user has defined the appropriate reference channels.

- Click on the first button labelled 'Information'.

This option is primarily used to edit the active interpretation properties. It also automatically creates a first interpretation when none exists. Beware that to create a new interpretation after one exists, you need to use the  icon in front of the interpretation drop list of the main toolbar and to specify if it is a PL or PNL interpretation. When an interpretation is created the only required entry is a name and a short name.

Some components may be copied directly from existing interpretations (if any in the session). Note that such copy operations can also be executed at any time inside the data browser.

- Accept the defaults and Validate with OK.

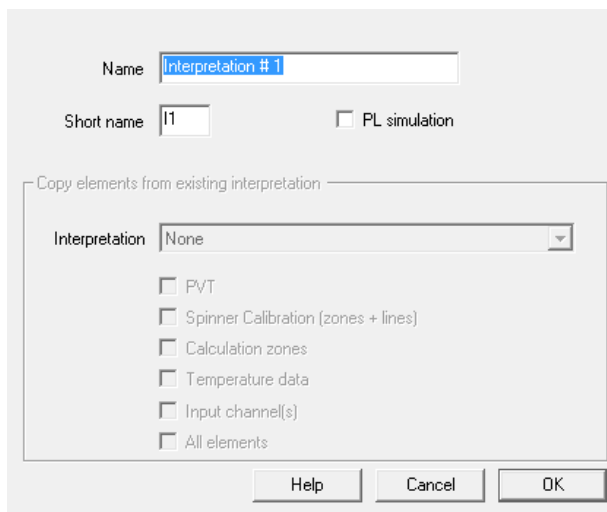


Fig. B01.19 • New interpretation

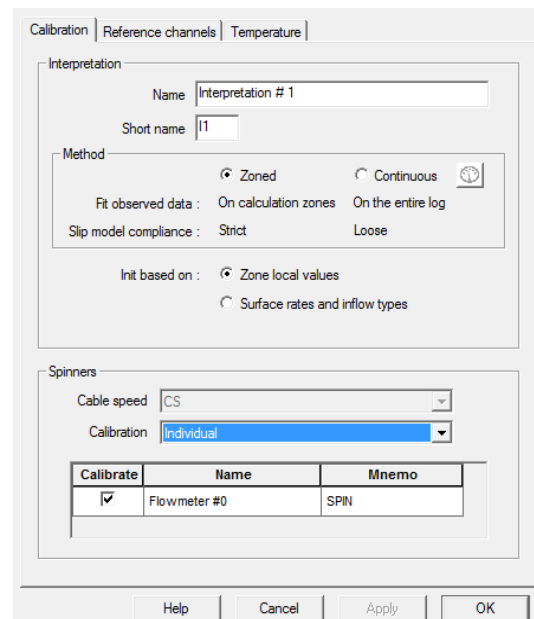



Fig. B01.20 • Interpretation settings

The 'Interpretation Settings' dialog appears, Fig. B01.19. The first tab allows to specify the interpretation mode (Zoned or Continuous), the way the calculations are initialized, and the spinner calibration. Interpretation modes are described in more details in Guided Session#3; in this first session we will use the defaults. The 'Calibration' drop list gives access to the calibration mode [None – Individual]. The 'Individual' spinner calibration mode is the default and allows selecting individually the spinners to calibrate. Depending on the calibration mode, the table beneath allows selecting the spinner tools for calibration. Note: if several spinners have been run together, an inline and a fullbore spinner for instance, the 'Individual' calibration mode allows using both in the same interpretation. Before defining the reference channels we will save the screen layout for later use.

- Click OK without defining any reference channels.
- Tile the plots if necessary.
- Click the snapshot button , store current screen.
- Click Add to create 'Capture 1' with the defaults

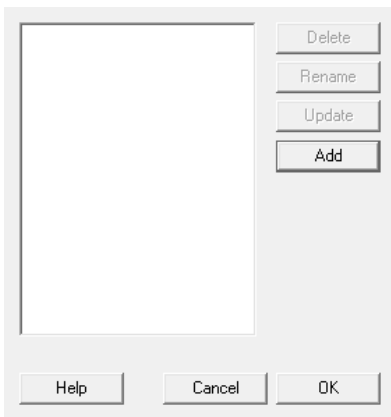


Fig. B01.21a • Snapshot Manager

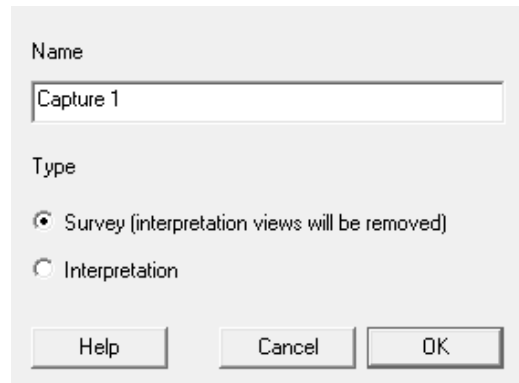


Fig. B01.21b • Adding a new snapshot

The reference channels can be defined in the second tab of the Interpretation settings dialog, Fig. B01.22.

- Click on the 'Information' button and select the 'Reference channels' tab.

If the well internal diameter has not been defined, a red warning appears in the Interpretation Settings dialog, in front of the internal diameter information string, to warn the user.

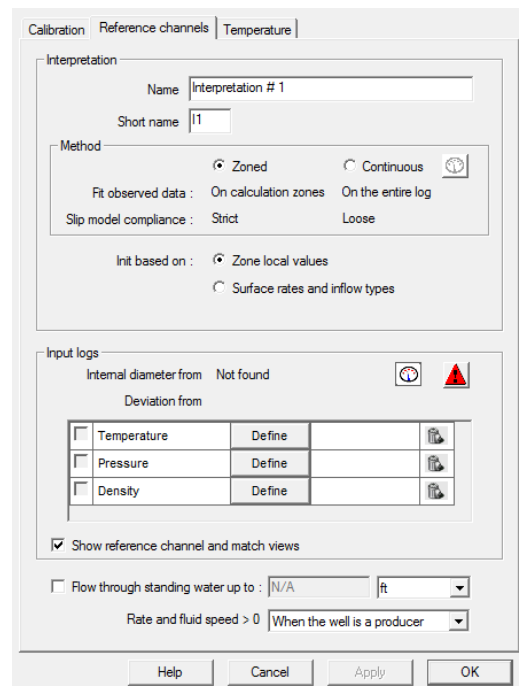


Fig. B01.22 • Reference Channels

- Click on the 'Define' button next to 'Temperature'. This opens a dialog listing all the temperature passes in the current survey.
- Select the pass 'Down 1' and validate with OK, Fig. B01.23. The check box on the Temperature line is now checked and the mnemonic displayed. Clicking on the trash icon allows deleting the considered reference channel.
- Click on the 'Define' button next to 'Pressure'.
- This time, in the Average dialog tree view, click on the 'Log Data' node to select the pressure data of all the passes in the survey and then press OK. Emeraude creates a lateral average of the selected channels inside the interpretation (Hodges - Lehman averaging).
- For 'Density' select the 'Down 1' channel and validate with OK.

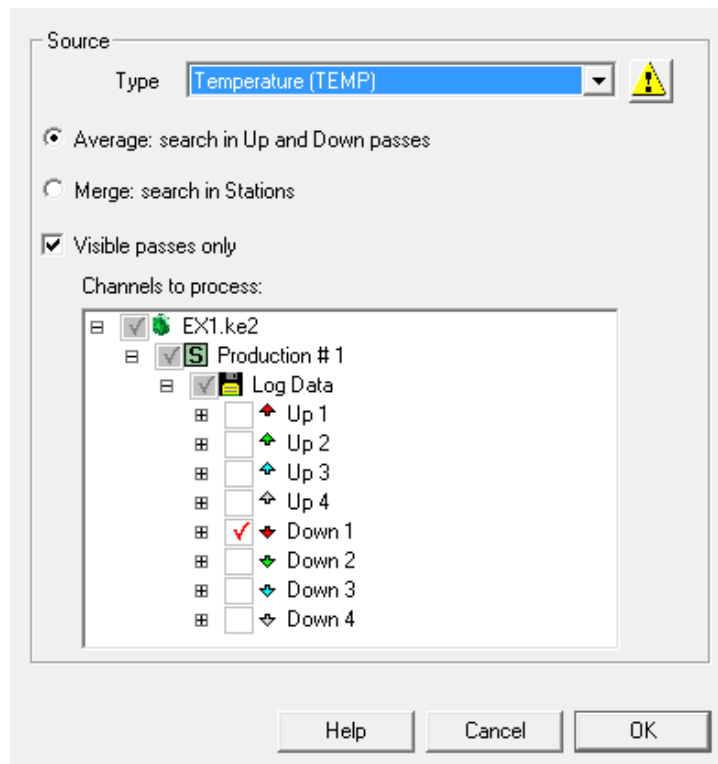



Fig. B01.23 • Reference channel definition / Average dialog

The last tab in the 'Interpretation settings' dialog is the Temperature tab.

The 'Temperature' option will be discussed in Guided Session #4. Exit the dialog with OK, and 'Save'.

- Open the 'Browser' using the browser icon on the main toolbar .
- Check the content of the interpretation node.

Reference pressure, temperature, densities (and capacitance) did not need to be defined at this point. More complex processing may be required than that offered by the 'Define' dialog above. Additional features are available in the data browser and are described in the Guided session #2.

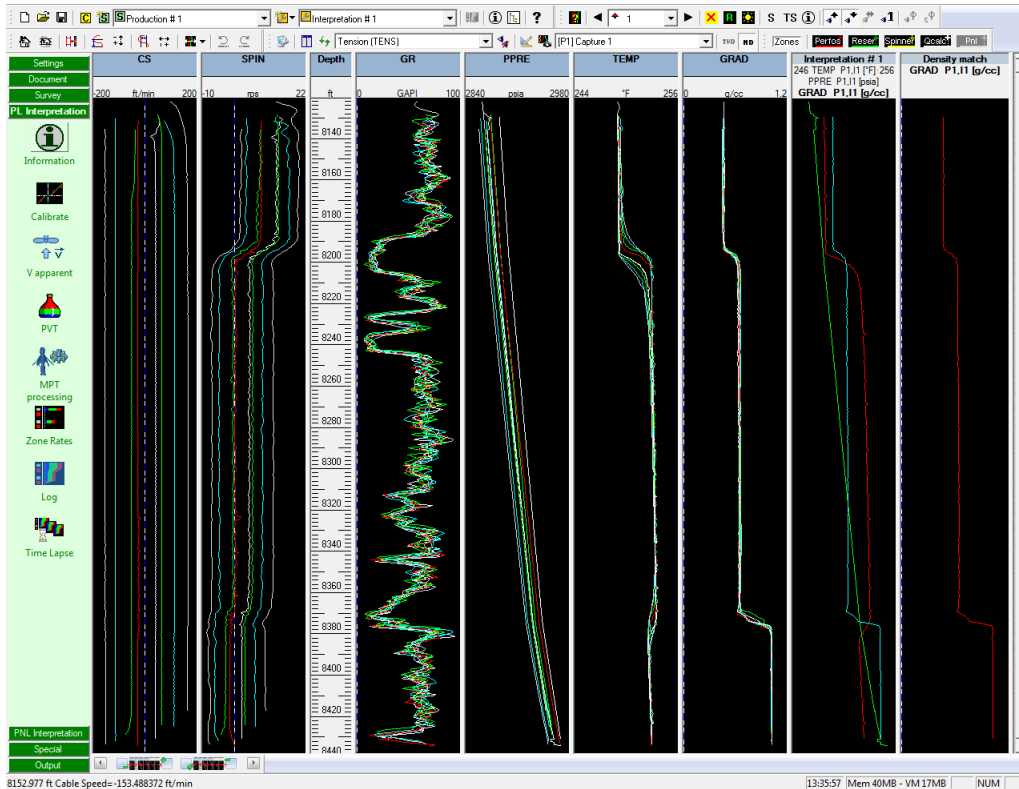


Fig. B01.24 • Interpretation main screen

Fig. B01.24 illustrates the screen after the definition of the reference channels. The rightmost track, called 'Density match' view will be used to overlay the measured and simulated density resulting from the diagnostic at a later stage of the interpretation.

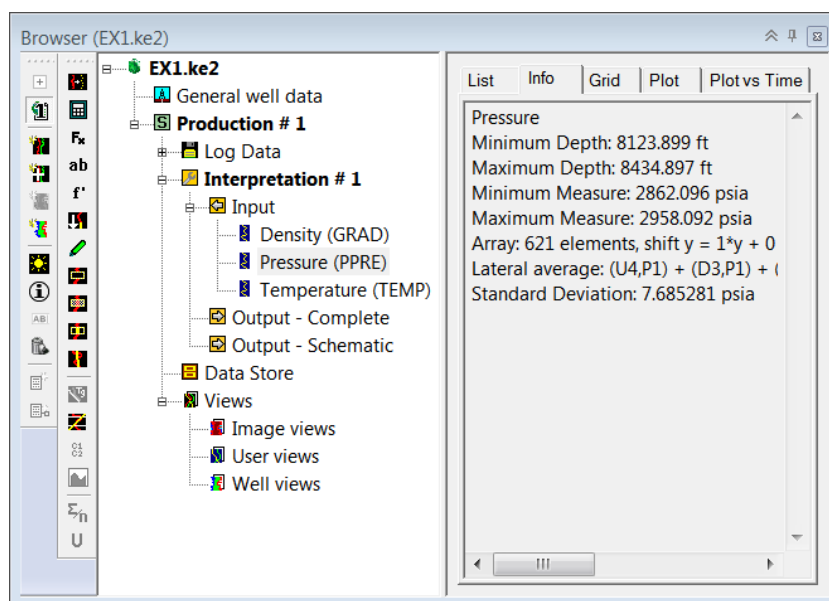


Fig. B01.25 • Info page of the data browser

A record of the way each of the reference input channel has been built is kept under the info page of the data browser (Fig. B01.25). This info is recorded for any 'created average or merged channel from list' processing.

- Since we have now selected the reference channels for Temperature, Pressure, and Density we will hide the tracks for the raw measurements. Hide also the Gamma Ray, and setup your screen as on Fig. B01.26. Use 'Tile' to optimize the use of the full window width.

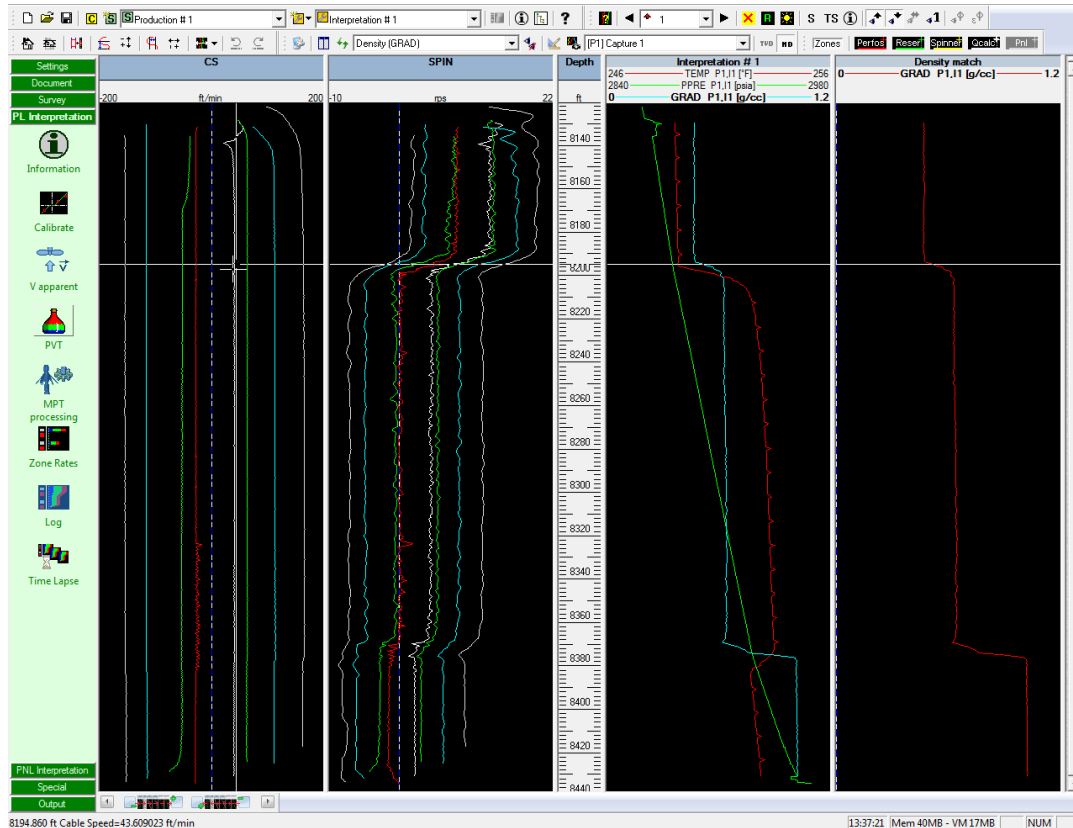


Fig. B01.26 • Layout for interpretation

### B01.11 • Entering the general well data

At the beginning of the session the general well information was not entered. To make an interpretation it is now necessary to enter this information (ID, deviation, etc) as it will be required in the calculations.

- Select the 'Document' control panel, click on 'Well Details', and activate the 'Internal Diameter' tab. Make sure the input mode is on 'Int. Diam.' (as opposed to Caliper) and enter: **8000**, press <Tab> and input **6.184** (Fig. B01.26).
- Activate the 'Roughness', press <Tab> and enter **8000** <Tab> **6e-4**.
- Select the 'Perfos', press <Tab>. Enter **8190**, press <Tab> **8200**, < Tab> 3 times to go to the second line, then input **8365** <Tab> **8375**.

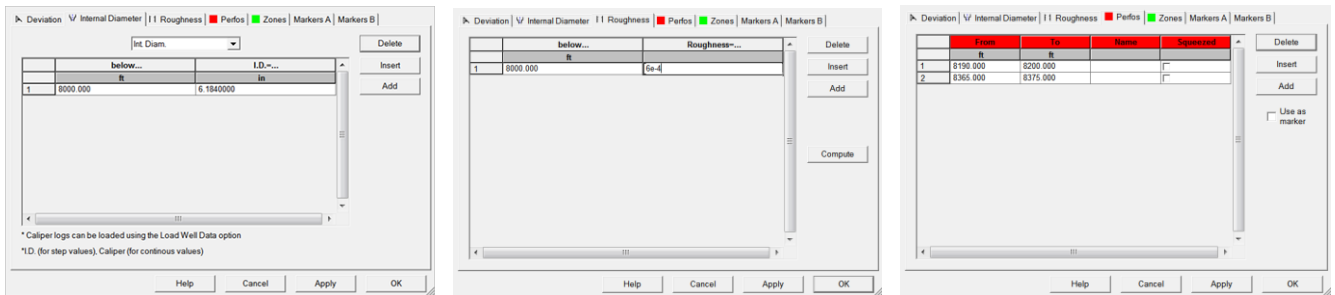


Fig. B01.27 • I.D. / Roughness / Perfos

- Validate with OK.

A new plot named 'ID' is created and displayed, as well as a track labelled 'Z' with the perfos indicated using red markers.

- Hide the ID plot by dragging its title bar outside the plotting area.
- To enlarge the Z track, position the mouse above the right border of the Z view, click and drag the right border to the right.
- Move the view to the left of the Depth track, and Tile the plots: Fig. B01.28.

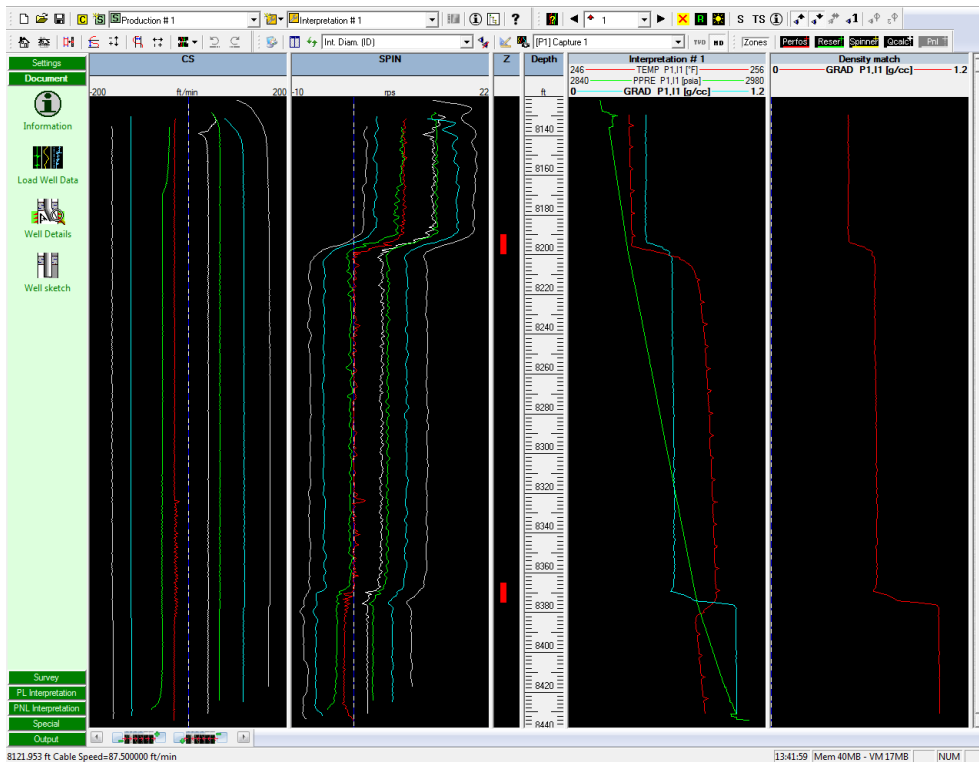



Fig. B01.28 • General Well data entered

**A note on Reservoir Zones:**

Reservoir zones present in the 'Well Details' dialog are distinct from the perforated interval and they are used to materialize the actual reservoir(s). The reservoir zones are displayed with green markers by default and are only used in SIP analysis. For all other purposes they are for visual illustration. The aspect of all zones (perfos, reservoir, etc) can be modified in the 'Document Display Settings', which can be accessed via the  icon in the display toolbar, under the 'General/Zone colors' item.

### B01.12 • Spinner calibration and V apparent calculation

➤ Return to the 'PL Interpretation' panel.


If you try to select 'Calibrate', which is the second option of the panel, Emeraude will indicate that calibration zones should first be created using the 'Zones toolbar':



This toolbar gathers the following options: Tabular Zones edition, Interactive Perfos, Interactive Reservoir zone, Interactive Spinner calibration zone, Interactive rate (Q) calculation zone, interactive Pnl crossplot zone.

Interactive creation is done zone-by-zone, clicking for the first limit, then dragging and releasing for the second limit. Spinner calibration zones should be selected where the spinner and cable speed responses are reasonably stable. The calibration zones will be shown as yellow markers on the Z plot. Once created, they can be edited manually using the first icon of the Zones toolbar, or interactively in the Z track. On this track a single click makes a zone active; a subsequent 'Del' deletes it, or the zone can be resized by grabbing and dragging handles appearing at each extremity.

➤ Click on the 'Spinner' (calibration zone) icon of the Zones toolbar repeatedly to define 3 calibration zones, above, between and below the 2 reservoir zones. For example, the calibration zones could be **8140-8160 ft**, **8280-8320 ft** and **8390-8420 ft**.

If you would like to view/edit your input, select the  icon and the 'Calibration' tab, as illustrated in Fig. B01.29.

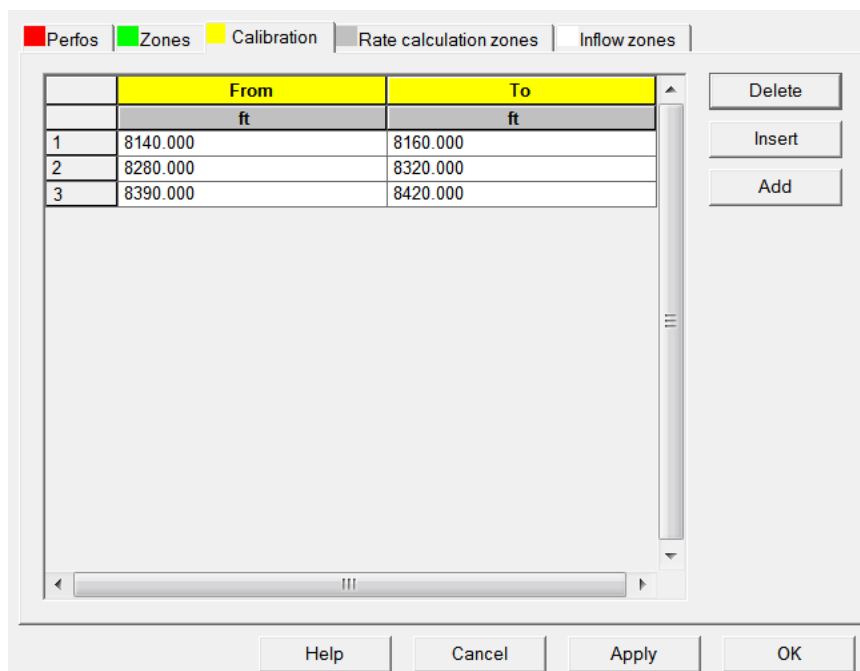


Fig. B01.29 • View/edit the calibration zones

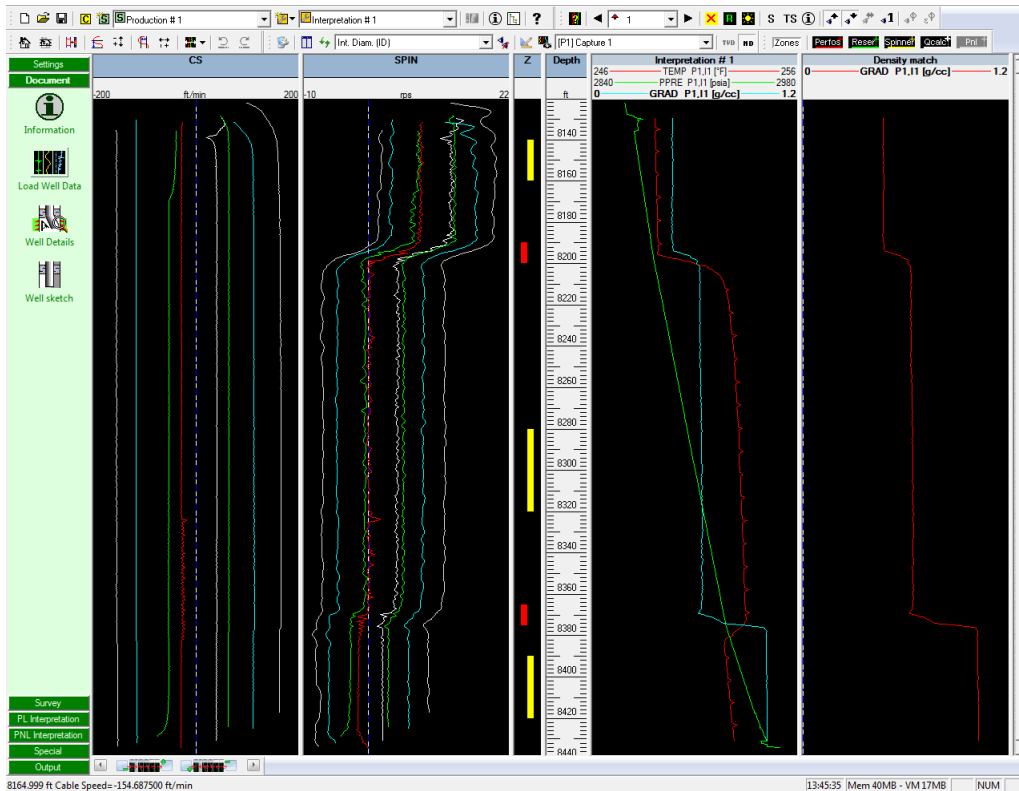


Fig. B01.30 • Calibration zones defined

- Go to PL Interpretation tab and click on the 'Calibrate' icon.

The calibration plot is displayed (Fig. B01.31). Right click in the plot window and a zoom menu is available. The active zone is highlighted in red. To activate a different zone, you may click on the vertical schematic showing the 3 zones, or use the up / down arrows above. The slopes and intercepts can be modified manually or copied from one zone to another. The two buttons at the top labelled 'Actions for all zones' and 'Actions for active zone' give additional options.

- In the 'Actions for all zones' button select: 'Set all positive slopes to average'.
- In the 'Actions for all zones' button select: 'Set all negative slopes to average'.
- Click on the 'Thresh (+)' button. A drop list to the right gives access to the possible no flow zones. In this case there is only zone 3.
- Select 'Copy' and the positive intercept value is copied as the tool threshold. Validate with OK.
- Do the same for the negative threshold 'Thresh (-)'.

For each line, an arrow pointing down shows the apparent velocity value for the positive line, taking into account the positive threshold. Similarly, a line pointing up shows the value of apparent velocity for the negative line. On zone 3, these two arrows coincide at 0 as we have just defined the thresholds as the intercepts. This is not the case for zone 2. A difference in those values could be due to a centralization problem and may well have to remain. If we believe that the error is irrelevant we can unify all intercepts/slopes.

- Make 'zone 2' active.
- In 'Actions for active zone' select 'Recompute zone with tool threshold'.

The program re-calculates the calibration for this zone, by imposing the distance between the two intercepts equal to the sum of the thresholds, hence giving a coherent rate value for both negative and positive lines: the two 'arrows' now coincide for this zone as well.

Note: by default, a linear interpolation will take place in the region between two consecutive calibration zones. The 'Transition' tab allows introducing more flexibility: you can define calibration application zones different from the calibration zones. In this case, the regions where the linear interpolation applies can be reduced as far as a sharp transition is considered between the calibrations.

- Validate the calibration with OK.

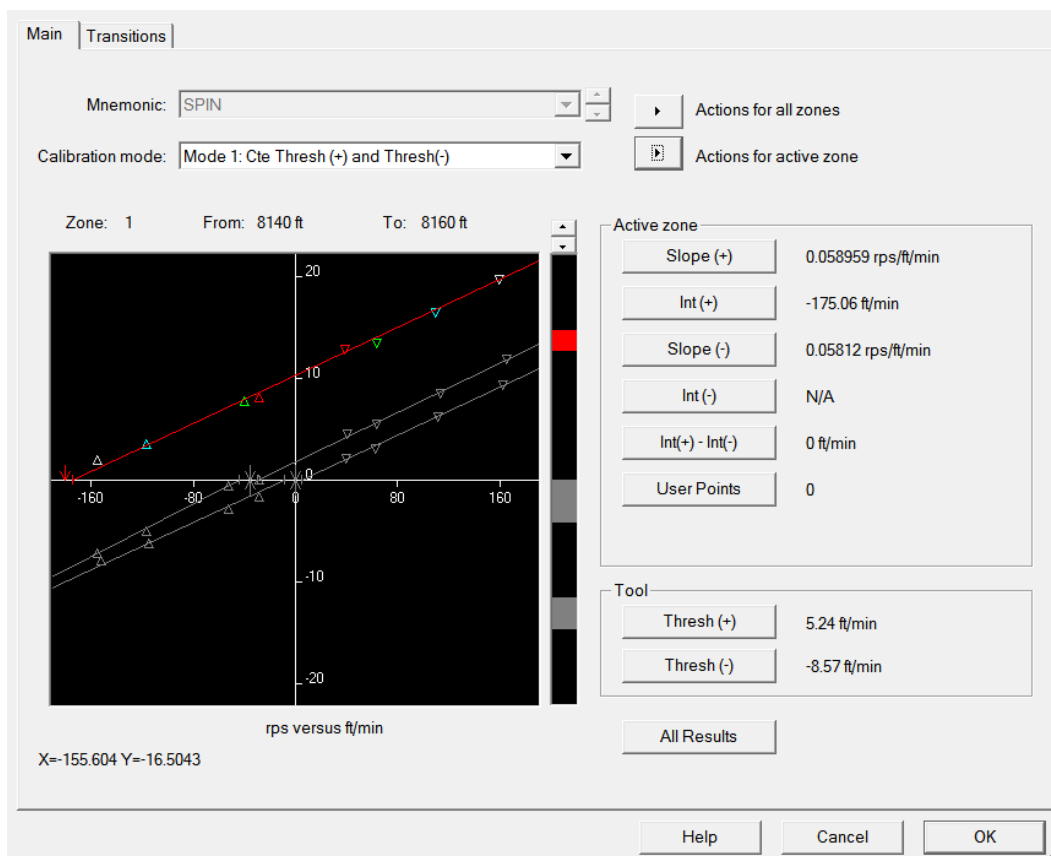


Fig. B01.31 • Final Calibration

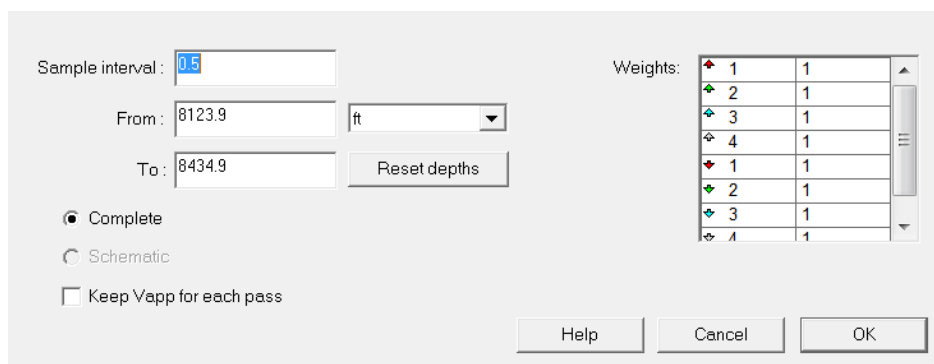


Fig. B01.32 • Apparent velocity calculation

When the calibration is accepted, Emerade automatically calls the 'V apparent' option. This is called V apparent because it only corresponds to the speed of the fluid seen from the spinner location in the wellbore. This is different from the average fluid velocity.

In this dialog the interval for the generation as well as the depth increment can be set. At each depth, the default is to compute a V apparent channel resulting from an average of the calculation for each spinner pass. This default can be changed by assigning different weights (possibly 0) to different passes. You can edit and change the weight value if you wish. Finally, the V apparent channel for each individual pass can be kept and the overlay can be checked to assess the calibration quality and flow stability.

- Leave or reset all weights to 1 and validate with OK.

A velocity match view is added to the interpretation, showing the V Apparent channel just added inside the interpretation. The mnemonic associated with a V apparent channel is automatically built by Emerade: it associates 'VA' to the mnemonic of the spinner tool of interest. In the present case, VASPIN.

- You can hide the Cable speed and Flowmeter views and tile the plots, Fig. B01.33.

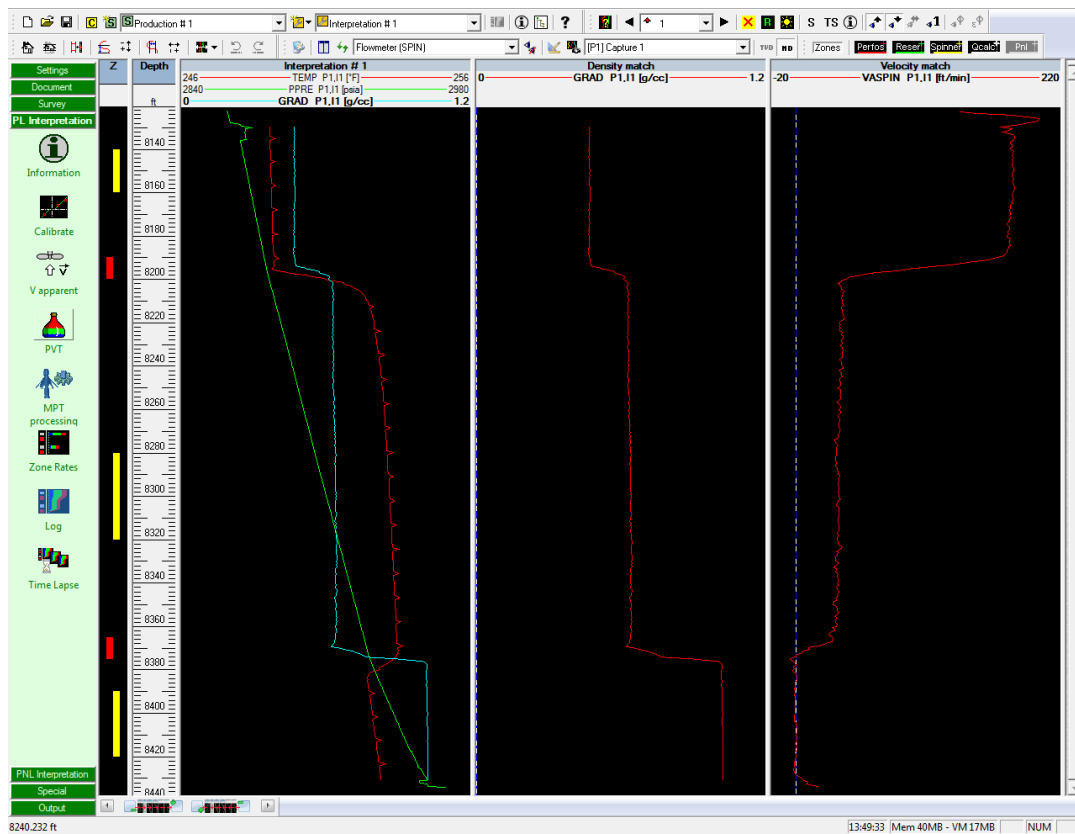


Fig. B01. 33 • Apparent velocity calculated

### B01.13 • Entering PVT information

Before starting the rate calculation process, Emerade needs a PVT model.

- Click on the 'PVT' icon: the main PVT dialog pops up (Fig. B01.34 left).

Default fluid type consists of 'Saturated Oil (bubble point fluid)' with no water. Although there is no water production at surface, it is evident from the density log that there is standing water in the bottom of the well so we will check the 'Water' box. The temperature is the default one for viewing the correlations. Note that if user data have been entered, the display will switch to the temperature of the first constraint point. The pressure range and increment are used to display the correlations in a table. Some reservoir parameters may be also required depending on the fluid type, e.g. the solution GOR for a bubble point fluid.

- Enter the following **GOR = 1100 cf/bbl**.
- Tick the **Water**.

When the PVT model is created or changed, each phase present should be defined from left to right, using the corresponding toolbar. For each phase dialog, input data are entered and correlations are selected in the first page; each additional page is assigned a property. The list of correlations as well as the default correlation can be changed permanently with the 'Interpretation' option of the 'Settings' panel.

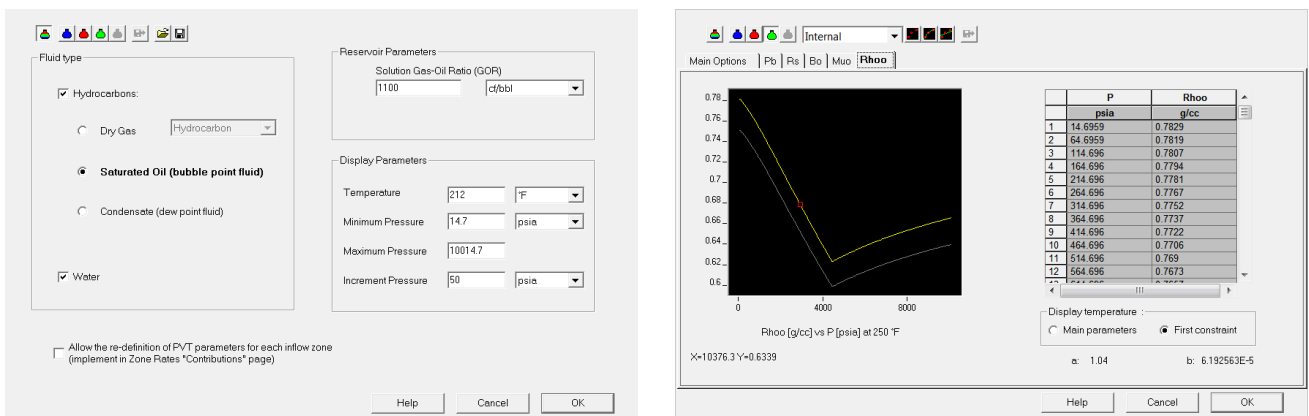




Fig. B01.34 • PVT

Clicking on the adequate phase icon ( , ,  ), the used correlations can be viewed and matched to fit defined 'Constraints' (Fig. B01.34 right).






The 'Constraints' icon  opens a grid where measurements of the property can be entered for a set of (T, P) values.

The 'Match Constraints' icon  runs a non-linear regression on the constraints; the original correlation shows in blue and the fitted one appears in yellow.

The 'Reset Constraints' icon  returns to the original correlation.

Most correlations give a PVT property as a function of T and P. PVT plots show the property as a function of P, at a given T. In case correlation is constrained, the display T can be set to the main display temperature or to the temperature of the first constraint. This temperature value has no influence on the calculations, it only affects the display.

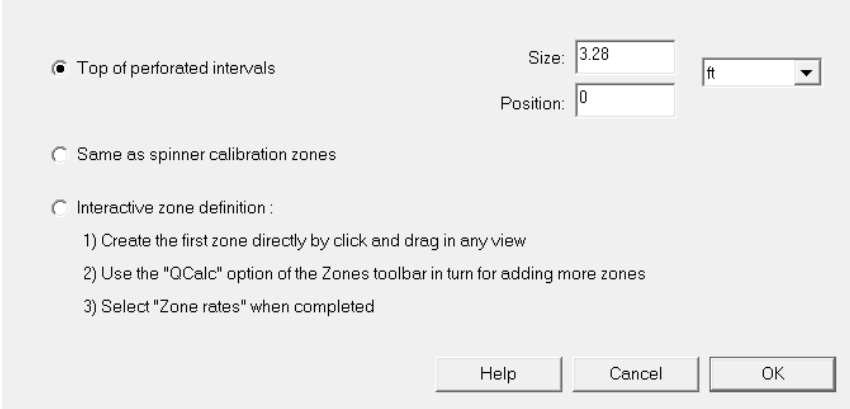
To access the zooming options on a PVT plot, you can right-click in the plot area to display the required popup menu.

- Edit the water properties with  and enter: **Salinity 80000 ppm.**  
This button is activated provided the 'Water' option is selected in the 'PVT Definition' dialog.
- Edit the gas properties with  and enter: **Specific gravity=0.7 • %N2=0 • %CO2=0 • %H2S=0.**
- Edit the oil properties with  and enter **Gravity=39.7 API.**
- Input a constraint () to the oil density: **T=250°F, P=2865 psia, Rhoo=0.68.**
- Apply the constraint by clicking on .
- Validate the PVT and return to the main screen.

## B01.14 • Zone Rates

Rates will be computed on defined zones as well as continuously on the entire log interval.

- Click on the 'Zone rates' icon.



The dialog box for 'Init rate calculation zones' contains the following elements:

- Radio button:  Top of perforated intervals
- Size:
- Position:
- Radio button:  Same as spinner calibration zones
- Radio button:  Interactive zone definition :
  - 1) Create the first zone directly by click and drag in any view
  - 2) Use the "QCalc" option of the Zones toolbar in turn for adding more zones
  - 3) Select "Zone rates" when completed
- Buttons: Help, Cancel, OK

Fig. B01.35 • Init rate calculation zones dialog

The first time this icon is pressed (or if all existing calculation zones have been deleted) a dialog appears with the default parameters for creating the zones. The zones can either match the spinner calibration zones or be located above all the perfos (plus one zone below the last perfo). The user can also choose to interactively create the zones using the mouse with click and drag. The initialization based on the perfs defines a position above the perfs (default 0) and size (default 1 m).

- Select 'Same as spinner calibration zones' and click OK.

*In the Z view, gray markers will be added to represent the newly created rate calculation zones. In the Z track, a zone can be activated by a single click and its limits changed by dragging its top and bottom handles. An activated zone can be deleted by pressing the 'Del' key. When calculation zones exist, the 'Qcalc' option of the Zones toolbar can be used to define new zones interactively, in a similar way as for the spinner calibration zones.*

As will be seen later, Emeraude automatically creates one inflow zone between each 2 consecutive calculation zones. By default in this case, the inflow zones are identical to the perforation zones, but they can be resized as needed, to adapt/correct the shape of the schematic logs.

Except when selecting the Interactive zone creation, the Zone rates option is called automatically. The first page is defined by the 'Init' tab. (Fig. B01.36) This option requires the selection of an initial flow model and associated flow correlation. In this case, the PVT model was defined as Oil-Gas and Water. Since only two measurements are available (density and VAPP) Emeraude suggests a model that does away with one unknown: the Water-Hydrocarbons model, a Liquid-Liquid model accounting for gas only up to the amount given by the PVT, and considering no slippage between the gas and oil. This model would be adequate if we were only flowing water and oil downhole, but on the contrary, we can infer from the density channel, the well deviation and surface productions, that there is water in the sump only, and that the flowing fluids are oil and gas. We will therefore change the model to Liquid-Gas.

➤ Select 'Liquid-Gas' and 'Dukler'.

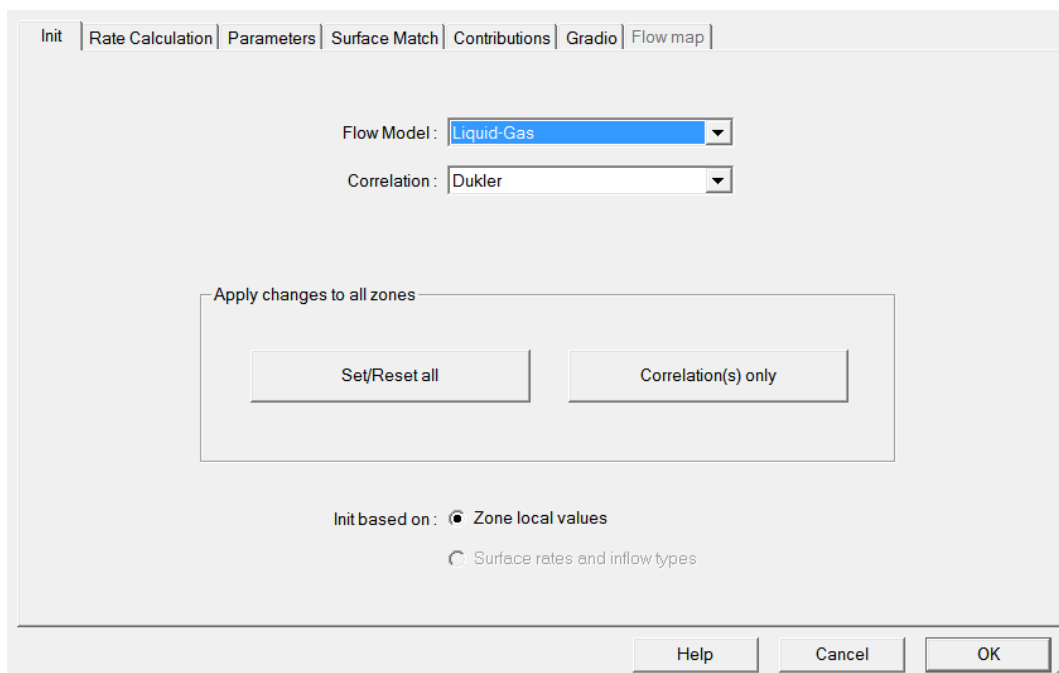


Fig. B01.36 • Zone Rate Init

By clicking on 'Set/Reset all zones', it passes directly to the next tab, or, at the top of the dialog, click on 'Rate Calculation' tab (Fig. B01.37).

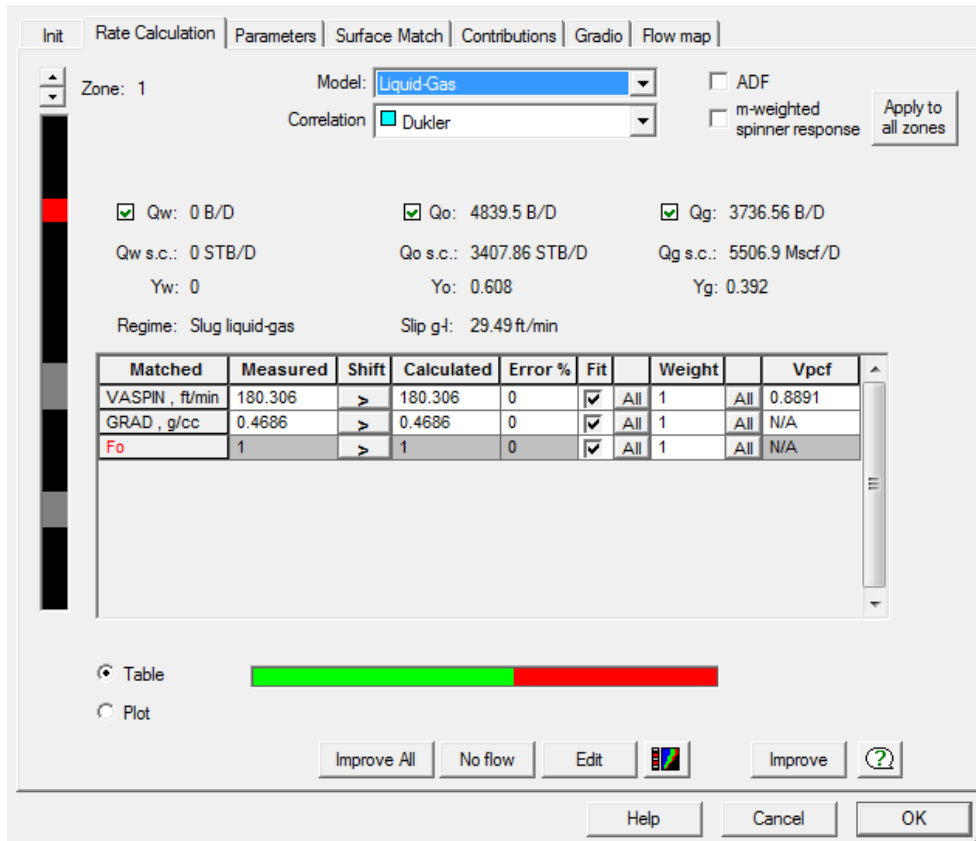


Fig. B01.37 • Rate calculation dialog

The values displayed in the dialog correspond to a given calculation zone. Similar to the spinner calibration dialog, a small schematic shows the active zone and can be used to change the zone under investigation.

For Liquid-Gas flow, a model is basically the conjunction of two main components: a flow regime map and a slippage (or holdup) correlation for each regime. For any couple of rate values (gas and liquid rates), the flow model can be used to predict the flow regime, the slippage value and thus the phase holdups. Given the holdup, and knowing individual densities from the PVT model the mixture density is calculated. Knowing the transfer function of the density tool used (possibly involving frictions and deviation) it is possible to compute the theoretical value that the density tool should read, assuming this flow model. Similarly, it is possible to compute an expected value of apparent velocity and practically this is done by estimating the value of a correction factor,  $V_{pcf} = V_m / V_{app}$ .

To summarize, for any assumption of the rates at a given depth, and any flow correlation, we can calculate the simulated apparent velocity, and the simulated density. Emeraude can then run a non-linear regression in order to match measured and simulated values. The displayed values of rates result from this calculation. The bottom table indicates the measured and simulated values.

Note the green checks in front of the Qw, Qo, and Qg buttons, they mean that all three rates were variables. Only 2 measurements were however available and Emeraude had to consider a third information for closure. This third value is listed in red in the table, and is 'Fo', the oil fraction in the liquid rate. The current value of 1 is a default and means that there is no water; this corresponds to our assumption.

Clicking on the 'Plot' button at the bottom left shows a graphical display of the correlations, and the error, Fig. B01.38:

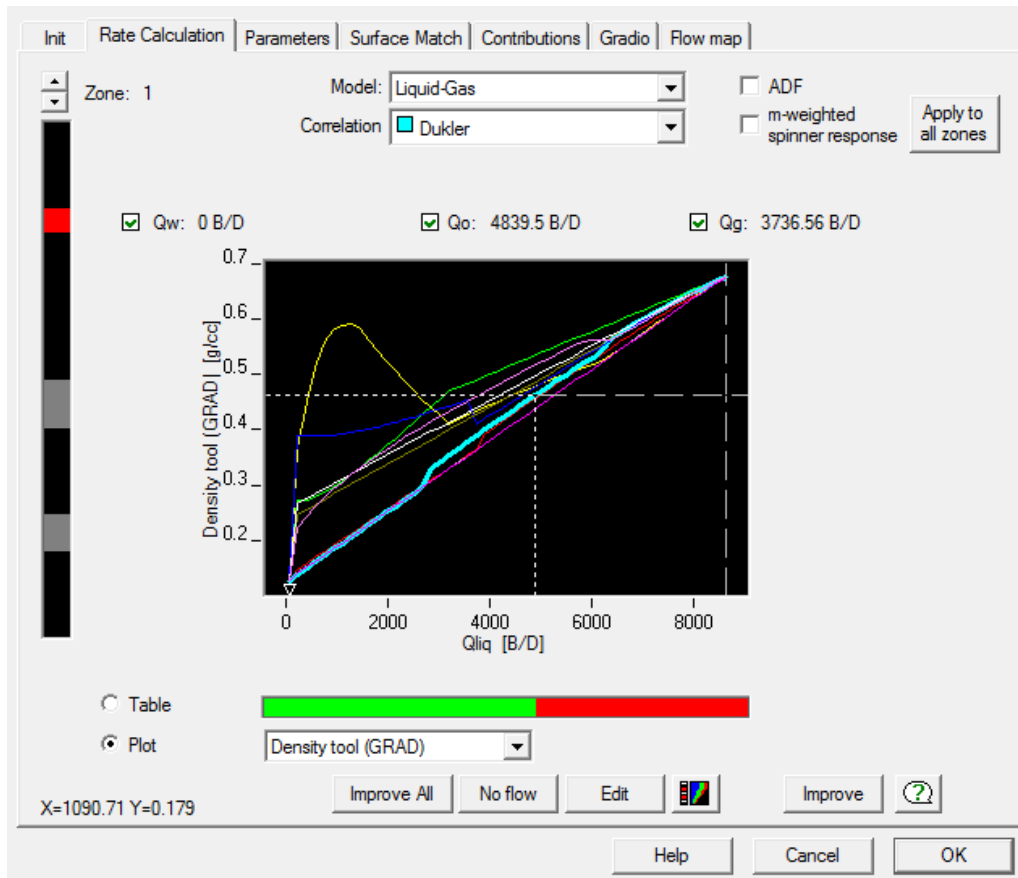


Fig. B01.38 • Rate calculation dialog: plot mode

The plot shows the density tool response versus possible values of Qliq (here Qo) and Qg for the current value of the total rate. On the plot, the current value of total rate is displayed with a vertical dashed line. Allowable values on the X-axis go between 0 and Qt and represent the oil rate. The difference between Qt and Qo represents Qg. On the Y-axis (density tool response) a horizontal dashed line shows the measured density (this is an average value of the density channel across the zone). Colored curves show the simulated density tool response for various correlations (the active correlation curve is thicker). The current solution is indicated by a vertical dotted line and the simulated density tool response with a horizontal dotted line. In this case on the plot the simulated and measured density tool responses are equal, as shown respectively by the dotted and dashed horizontal lines.

Note: as usual, a right mouse button click in the plot gives access to a contextual menu gathering the various zoom facilities. A 'Legend' option is also available in this menu.

➤ Click on the 'Flow map' tab.

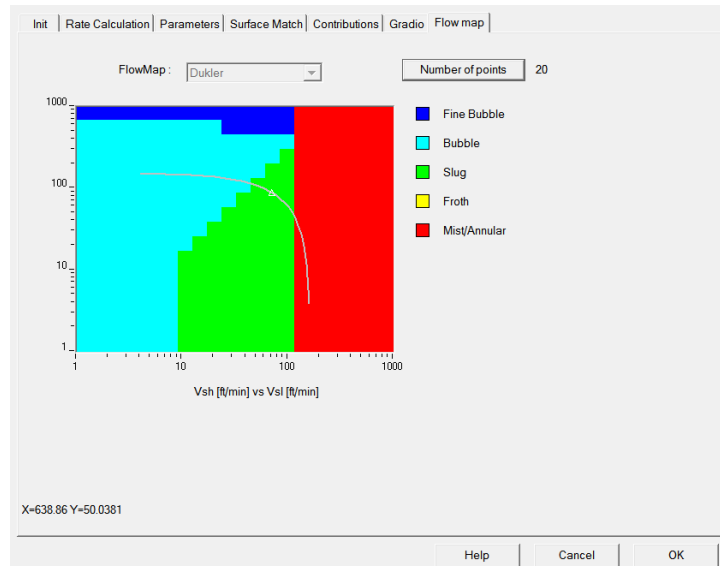


Fig. B01.39 • Flow map

The flowmap is presented in terms of superficial velocities Vsh and Vsl. Superficial velocities are defined as the rates divided by the cross section. 'h' refers to 'heavy', i.e. liquid phase here; 'l' refers to 'light', i.e. gas phase here. The gray line on the flow map is for  $Vsh + Vsl = Vm$  and the white triangle shows the current solution.

The resolution of the flow map may be improved by changing the number of points.

All input parameters, other than those used in the matching can be viewed in the 'Parameters' page. When the density tool is not a nuclear tool, the 'Gradio' page lists all the gradient components.

Until this stage, we have disregarded the surface conditions.

- Select the 'Surface Match' tab Fig. B01.40.
- Enter the surface rate values as **Surface oil Qo = 2700 STB/D; Surface gas Qg = 4500 MSCF/D.**
- Return to the 'Rate Calculation' tab, and if the Plot is not currently displayed, select this mode. Make sure also that you are looking the top zone, Fig. B01.41.

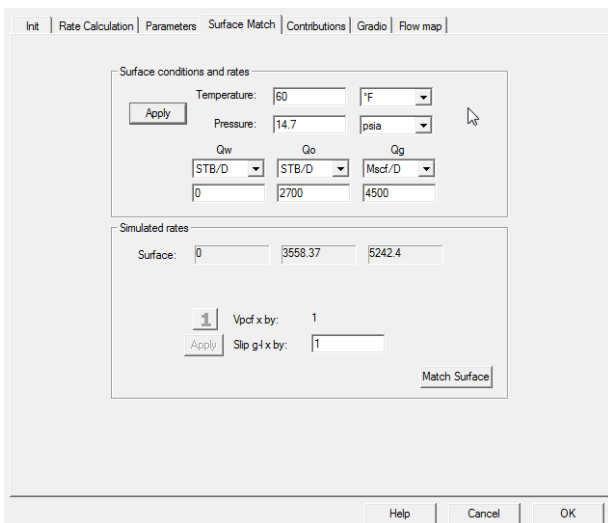


Fig. B01.40 • Surface production entered

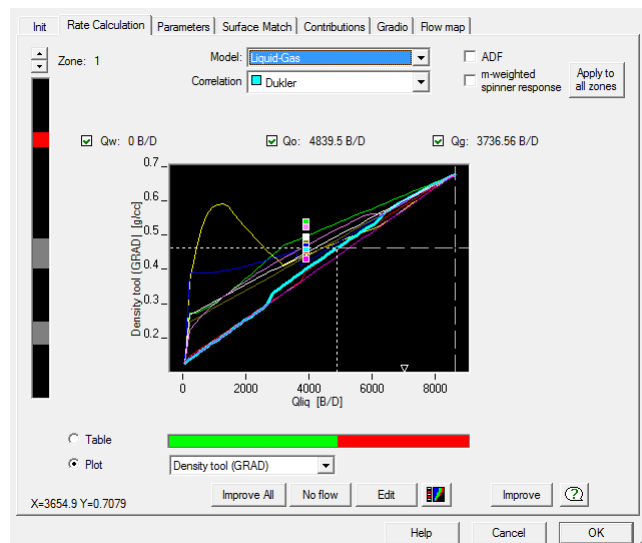


Fig. B01.41 • Top zone; Plot mode

On the plot are symbols representing the surface conditions. On the X-axis a white triangle shows the value of downhole total rate as computed from the surface rates (and the PVT model). Colored squares indicate, for each flow correlation, the density tool response the correlation would predict if the downhole rates were those corresponding to surface conditions.

Hence, on the plot:

- $Q_t$  does not match the  $Q_t$  from surface conditions (vertical dashed line does not match the white triangle).
- $Q_o/Q_g$  do not match the surface conditions (squares are not aligned with the dotted white line).

The difference between the simulated and measured surface rates may come from an inaccuracy in either the data or the models used for the simulation. The second guided session will illustrate how the data quality can be assessed using a shut-in survey. In this session there is no further information and the assumption is made that the surface data is correct and the accuracy of the model is questioned. Two variables can be used to modify both the slippage correlation and the model predicting the correction factor  $V_{pcf}$ . These are the  $V_{pcf}$  multiplier and the  $V_{slip}$  multiplier. These are initially equal to 1 (i.e. no change to the models).

- Activate the 'Surface Match' tab.
- Select the 'Match Surface' button.

Rates are set to honor the surface values. The  $V_{pcf}$  and  $V_{slip}$  multipliers are then adjusted so that consistency is kept between measured and simulated data. When the value of the multipliers has been obtained Emeraude automatically re-runs a non-linear regression **for all zones** using those values. When the calculation is finished it can be seen that surface conditions are honored and the measurements are coherent for all zones.

- Return to the 'Rate calculation' tab. You can check on the plot the effect of the Surface Match, Fig. B01.42.
- Select the bottom zone and click on 'NoFlow' to set the mixture velocity to **0** (this will also automatically set the water holdup to 1).

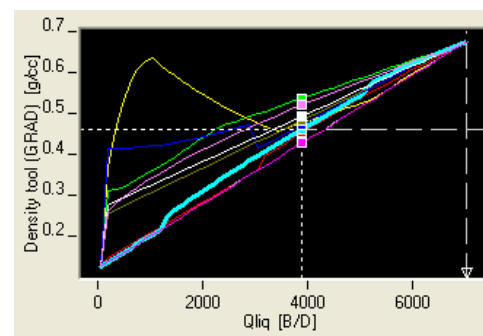


Fig B01.42 • Surface Match effect

- Validate the zone rate calculation with OK. The 'Rate Log Settings' option of the control panel is called directly, and the dialog in Fig. B01.43 appears.

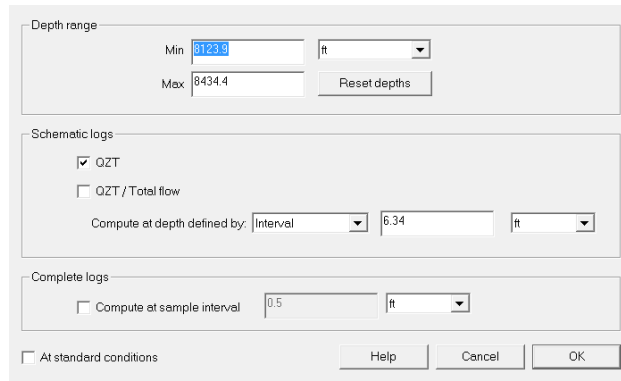


Fig. B01.43 • Log generation

The rate log can either be a schematic or the result of a complete calculation. The latter invokes the non-linear regression scheme described earlier at every depth. This option is described in the next section. The schematic is simply a graphical presentation of the zone rates. Note the option to generate the schematic rate log at standard conditions rather than the default downhole conditions.

- Leave 'Schematic' checked and uncheck 'Complete'. Do not change the other settings.
- Validate with OK.

Emerade generates 4 new logs in the interpretation: QOZT, QGZT, QOZI, QGZI. 'O' stands for oil and 'G' for gas. 'Z' stands for 'zoned'. 'T' stands for total (or cumulative) and 'I' for incremental. Two plots are automatically added to the main screen, one for cumulative rates, and the other for incremental contributions. The simulated density and velocity are added to the match plots.

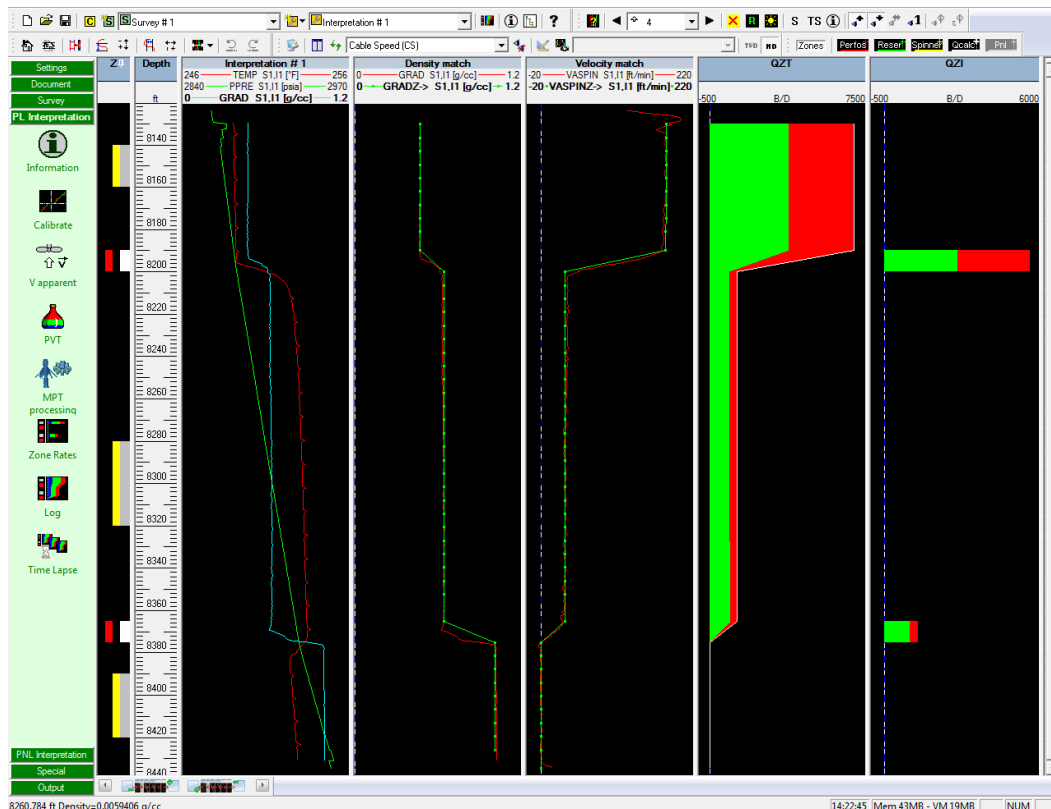


Fig. B01.44 • Schematic calculated

### B01.15 • Generating a complete rate log

➤ Return to the 'Log' option and this time select only 'Complete'.

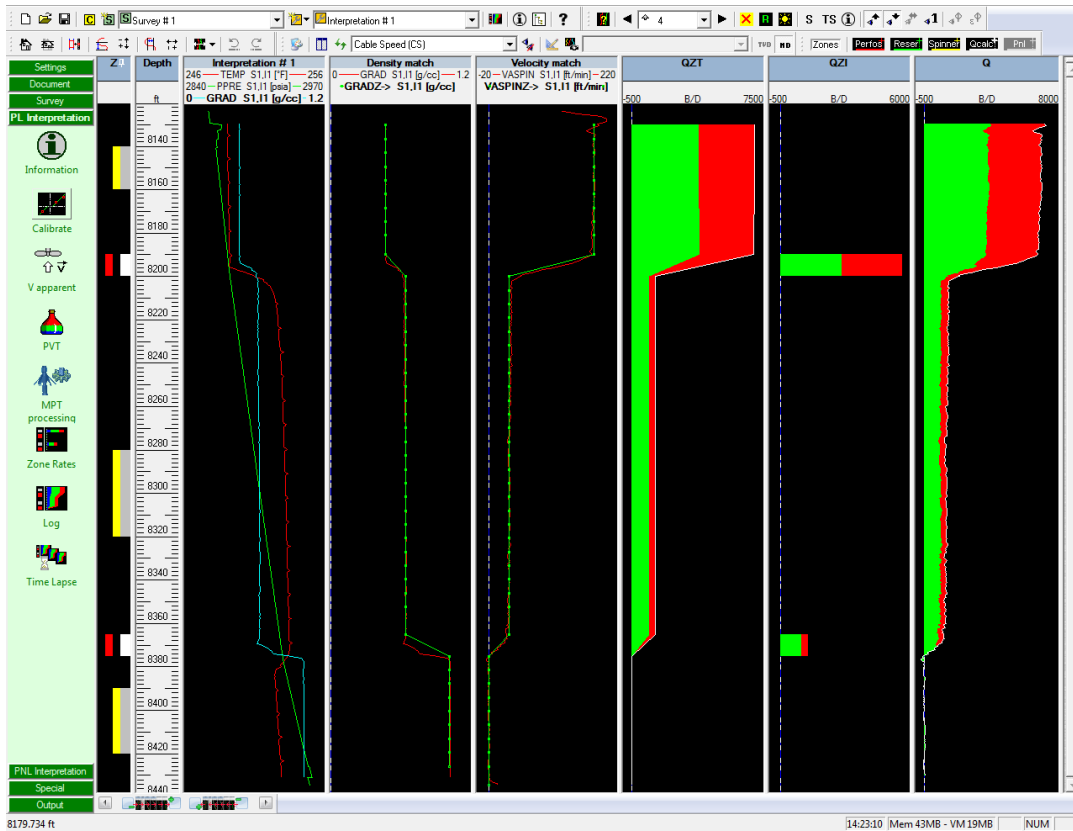




Fig. B01.45 • Complete log calculated

Proceed to capture the current screen by clicking on the button .

The screen can be called 'Final' for instance. You can now switch between the original data and the final data by clicking on  and choosing the screen capture in the list.

### B01.16 • Outputs

➤ Move to the 'Output' page of the control panel.

There are 5 possible types of outputs in Emerald: Log, Report, Summary table, Export and MSWord report.

#### Log

The Log printout shows by default the plots present on the screen when the option is called. The Log output can be checked with the corresponding Preview option. Note that fonts, margins, lines, and the type of output can be changed in the 'Setup' and the 'Display' options of 'Preview'. In the Setup dialog one can also create API layout that can be recalled at any later stage (see the on-line help in the Print Setup dialog). The log output is made by default to the installed printer drivers. Note that a CGM, or TIFF output can also be generated with the last option of the output panel (*the CGM output option is not part of the standard distribution*).

## Report

The report consists of the following pages (depending on the level of the interpretation): Job Information, PVT, Calibration, Incremental zone contributions at S.C.; Incremental zone contributions at reservoir conditions; Cumulative zone contributions (standard and reservoir conditions); Detailed Results (multi-phase interpretation only). Use the Preview option to check the report.

## Summary Table

Provides, in tabular format, the zones results. The results can be copied to the clipboard.

## Export

Creates an output file (LIS, LAS, or plain ASCII) of the current interpretation contents. Note that export options in the data browser can be used to generate customized report files.

## MSWord report

Emeraude is provided with a template Word report, 'SampleReport.doc' which reproduces the Emeraude built-in report.

With an opened document in Emeraude, open 'SampleReport.doc'. At the top of the document, you will see the specific toolbar below:



With Word 2007, click on 'Add-Ins' tab to see the toolbar below:



Assuming that your active Emeraude document shows a completed interpretation, click on the second icon (Reset Emeraude variables): all relevant information will be filled-in, rows will be added in all tables and completed, and a calibration plot will be created on page 3.

## Customizing the result or the template

The results can be fully customized since this is a Word document. Fonts can be changed, colors, table formats, etc. In addition, the calibration plot is an active object of the document. If you double click on this plot a dialog will appear where you can change colors scales, etc (see next page).

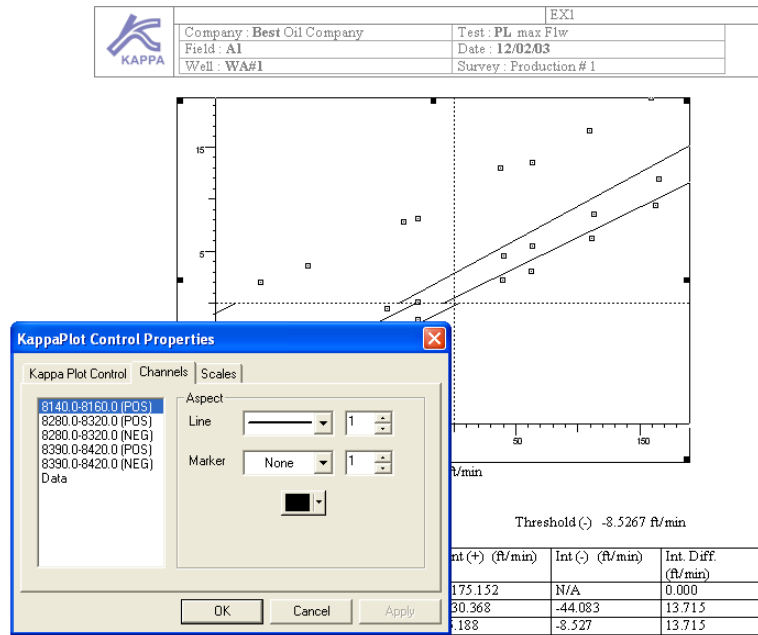


Fig. B01.46 • KAPPA Plot Control Properties

The third icon of the Emerade toolbar inside the Word document gives access to the dialog opposite.

With this dialog you can define entirely the types of results that you want to see in your report.

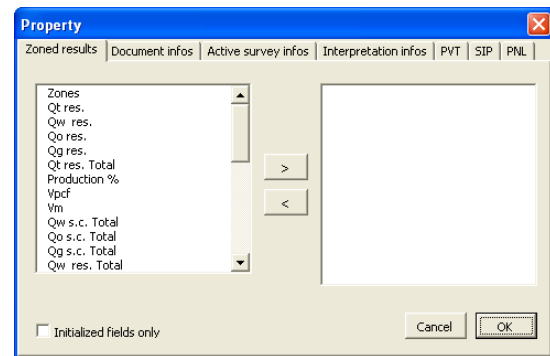


Fig. B01.47 • Property dialog

- Save and Quit Emerade.

*This completes Guided Session #1. KAPPA software is designed to be highly intuitive and therefore we recommend that you run this session again on your own in order to become more familiar with the options. Try and refer to this documentation only when you are stuck. Running your own simple data set at this stage is also recommended.*

*We would advise you to get familiar with the facilities demonstrated in this guided session before moving to the Guided Session #2, where you will be trained on adding new mnemonics, handling multiple surveys, multiple interpretations, and comparing shut-in and flowing surveys.*