Ecrin Guided Session # 1

A01• Ecrin overview

At installation time, you are given the choice to install Ecrin as an integrated workstation or a stand-alone application. If the choice is for a stand-alone application, the installation program asks which application to install (e.g. Saphir or Topaze). Although the same program (Ecrin) is installed, it will act as if it was the chosen application (e.g. Saphir or Topaze). In fact, the executable is renamed from Ecrin.exe to the standaloneapplication.exe (e. g. Saphir.exe). If this is the case, you will not have access to the module selections in the Application Settings panel or to the toolbar used to switch between modules . To change from a stand-alone application to workstation, you need to reinstall the program. However, the stand-alone executable name can also be changed to Ecrin.exe with the same results. If the choice is the workstation, the installation program requests which module(s) to install. By default, all modules are installed. Again, the same program will be installed but it will allow reading and creating files for all the installed modules (provided a valid license is found). If a module is installed that you do not have the required license for, the reader of that license will be available, this is indicated in the switch module toolbar with and 'R' superimposed on the icons .

Note: For this guided session it is assumed that you have installed the Ecrin workstation and have a valid license for Diamant, Saphir and Topaze.

B01 • Objectives

The objective of this document is to introduce the key features of the Ecrin suite of software and introduce you to the easy and intuitive interaction between the modules: Diamant, Saphir and Topaze.
You will be guided through the startup of the project with the loading of Permanent Gauge Data in the Data Management module Diamant. The loading will illustrate the data filtration and updating. You will then see the techniques of transferring this data with ease to the Pressure Transient Analysis module, Saphir, and you will be guided through a partial analysis of this data to highlight some of the features of the software.
Finally the data will be dragged and dropped to the Production Analysis package, Topaze, and a production analysis and a production forecast will be performed for illustration.

B01.2 • Requirements

The rate and pressure data used in this session consist of three files: EcrGS01q.txt, EcrGS01p.txt and EcrGS01qSimplified.txt. The three ASCII files are stored in a zipped file named "EcrGS01.zip" which can be downloaded from the KAPPA site, use the menu WEB in the main menu bar of Ecrin and choose to connect to Ecrin download.

Note: After unzipping, the files will occupy 150 Mb on the hard disk. If Ecrin has been installed from a KAPPA CD, the zip file will already have been copied to the Examples subdirectory.

B01.3 • Guided session organization

Section C: Guided session of Diamant

Section D: Guided session of Saphir

Section E: Guided session of Topaze

C01 • Creating a new Field/Document (Guided Session)

After startup of the new Ecrin session, you choose the module that will be the starting point of the project. The module toolbar contains all the active applications for which a license exists. Click on the icon to start Diamant and choose to start a new project with a click on the icon. You will then be prompted to enter some field information. Set the reference data and time **to 22 July 2001 at 07:00:00 (AM).**

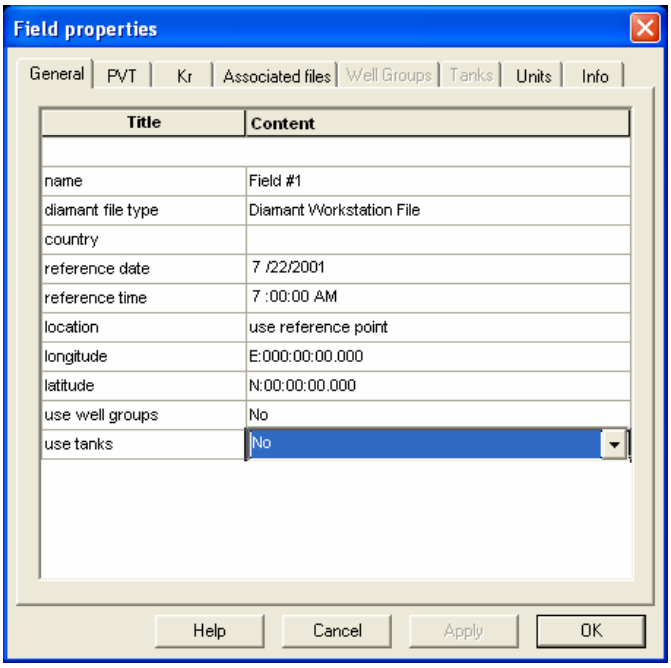


Fig C01.1 • Startup screen

You can enter general field characteristics, PVT, Kr, Associated files, Well Groups, Tanks, Units and general information in the above dialog. Each field is characterized by the followings:

- Name: editable at the field creation; named after the Diamant document thereafter.
- Country.
- Reference date and time, this would normally refer to first production start-up.
- Location: reference point in degrees, or reference point in decimal.
- Longitude and latitude: East and North coordinates according to the format defined in “location”.
- Use well groups: “Groups” can be created for wells contributing to the same production.
- Use tanks: for a specific field, “Tanks” are used to differentiate reservoir layers or area differences in PVT and Kr properties. The “Tanks” are then “linked” to the individual wells.

Click OK and the Diamant main screen is displayed.

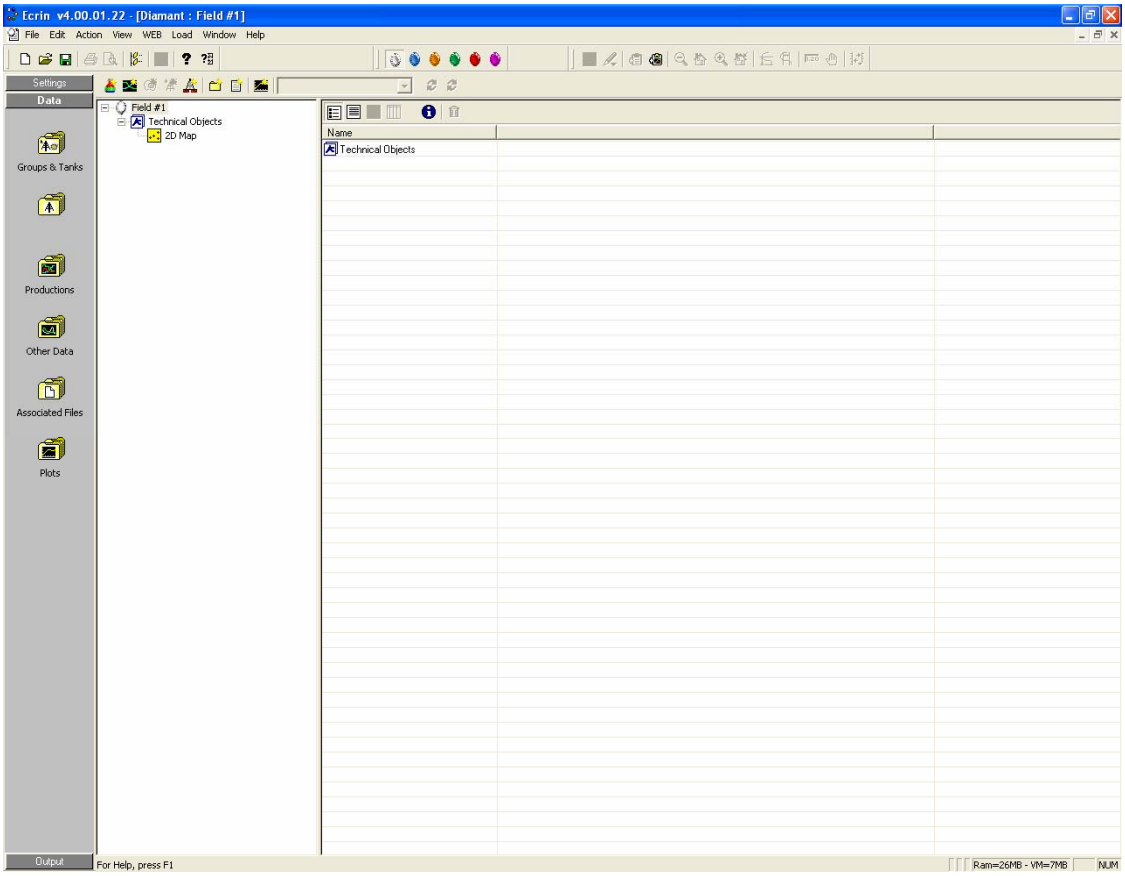


Fig. C01.2 • Main Screen

The left side of the main screen displays the content of the browser. The right side of the window is the “display” window for the current node in the hierarchical browser. After creating a new field there are 2 active display modes: View List , and View Info .

After data has been loaded the View Plot  and View Table  modes are also activated. Each node type has its own default view mode.

The Browser toolbar provides options to create items for the active field: PVT and Kr, Tanks, Well groups, Wells, Sub-folder for the “Associated files” directory, “Associated files”, and Plots can be added with a simple click on the corresponding icon.



We will add the PVT and Kr objects which characterize the reservoir of the newly created field by using their respective buttons and from the Browser toolbar.
Define a PVT for the current field by accepting the default PVT settings, and click OK. Define a default “Oil and Gas” Kr module in the same way.
Two new items have been added to the “Technical Objects” node (see right). Diamant gives an explicit name to each module depending on the selection made; this name can be changed.



The objective of this session is to load the production data (single oil rate and pressure) recorded respectively from a downhole venturi rate sensor and a permanent pressure gauge. Data are available in three ASCII files EcrGS01p.txt (pressure), EcrGS01qSimplified.txt (rate) and EcrGS01q.txt (rate). The three ASCII files are stored in a zipped file named “EcrGS01.zip” which can be downloaded from the KAPPA site, use the menu WEB in the main menu bar of Ecrin and choose to connect to Ecrin download.
If the installation has been done with a KAPPA CD, the files will already have been copied to the installation directory.
Extract the content of “EcrGS01.zip” towards the Example folder of the Ecrin main installation directory.
Note: After unzipping, the files will occupy 150 Mb on the hard disk.

C01.1 • Adding a new well to the field

Before loading the production data, we need to create a well for the field. Use for instance the “Add New Well” icon from the “Browser” toolbar

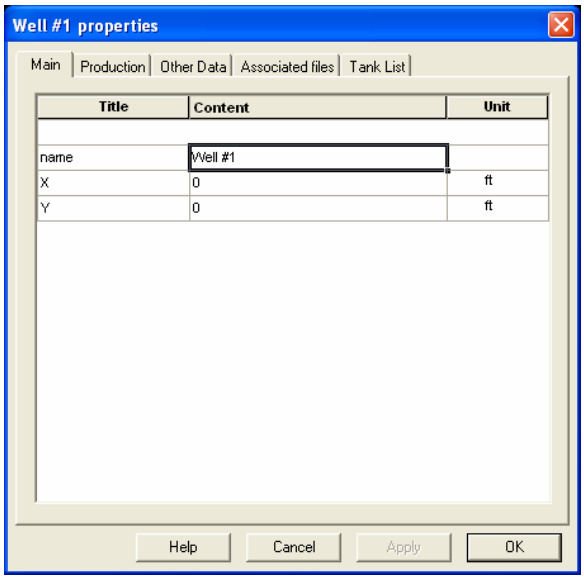
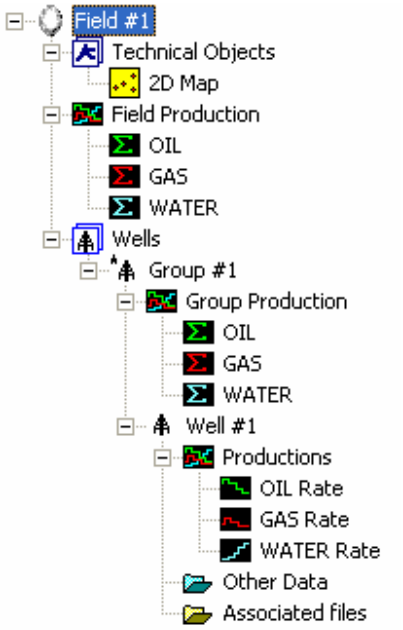


Fig. C01.3 • Well Properties

Accept the defaults and exit the Well Properties dialog with “OK”. In the Data Browser, a “Wells” node has been created under which the newly created “Well #1” node has been added. Expand the “Well #1 node (see right).

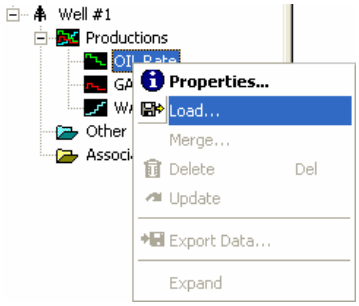
At the same time, a “Field Production” node is created; this node includes the cumulative rates (“Sigma” Rates) for each phase by adding up the wells production belonging to the same field.



C01.2 • Loading the oil rate

Click on the “Oil Rate” node in the browser and right-click. From the “OIL Rates” popup menu select “Load…” - see Fig. opposite.

We will load the full rate history comprising 3 MM points (EcrGS01q.txt).



Load - Step 1: Define Data Source

We load from an ASCII file.

Click on the “Open File”  icon and browse to the “EcrGS01q.txt” file (should be located in the Examples folder within your Ecrin directory). A window allows you to preview the file content.

Click the  button to proceed.

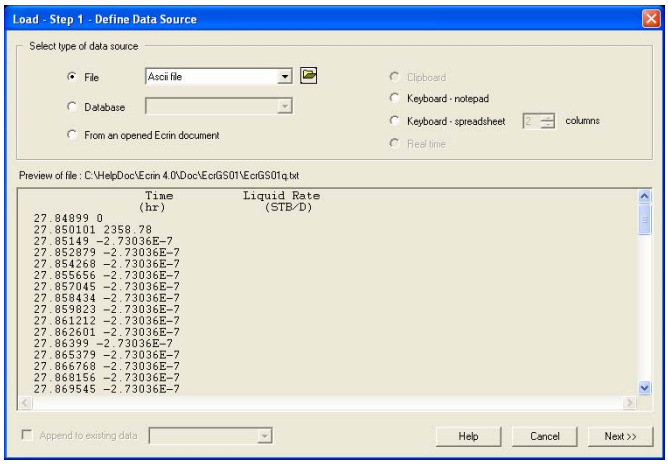


Fig. C01.4 • Loading the OIL Rate

Load - Step 2: Data Format

When selecting the ASCII File, the content of the file is displayed. Diamant automatically checks through the file lines for spaces or tabs, and shows the fields thus identified in a table. When there are as many fields as the number of required columns, Diamant automatically assigns a format to the identified fields, and this format is indicated in the “Type” column. A file that is properly formatted using the automatic identification is said to be in “Free” format. In other situations, you should use either the “Field” or “Column” format as a basis to identify and define the strings in the file.

An estimate of the total number of points is given (top text line). When this number exceeds the value set in the Settings the “Filter” option is automatically checked, as here.

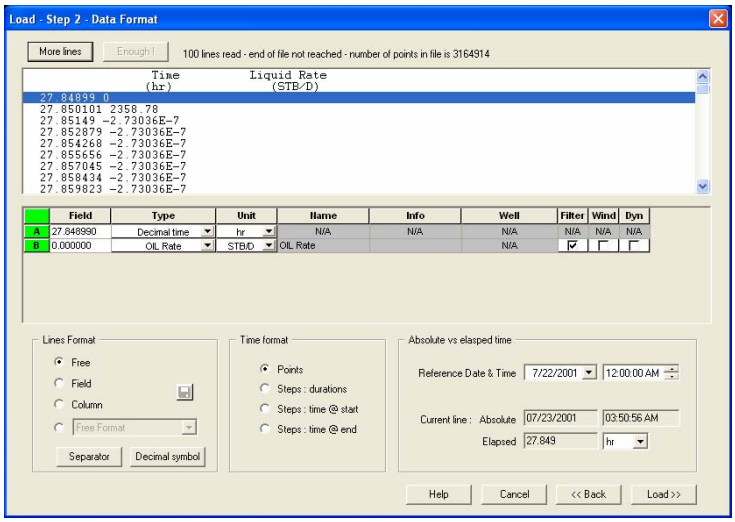


Fig. C01.5 • Loading the OIL Rate

Start the load 

. Diamant scans one point every 1000 (this parameter can be changed in the “Loading Data” option in the “Settings” control panel).

Load - Step 3: Filtration Process

Once the initial scan is completed, Diamant displays the filtering dialog which allows the following steps defined in the various tabs.

- Input file statistics
- Preview and Load Window
- Pre-load
- Filter
- Load

For quick statistics, if you want to change the scanning scheme set in the"Settings" panel (in this case one every 1000 points), check/enter the desired sampling rate ("Re-calculate Quick Stats scanning one data every..."), before clicking on the corresponding calculate icon. The software reads the file at the appropriate sampling rate and stores this sample in memory.

On this basis, an estimate of the number of points, and the spanned intervals (X&Y) are made. The next figure illustrates the results of this step.

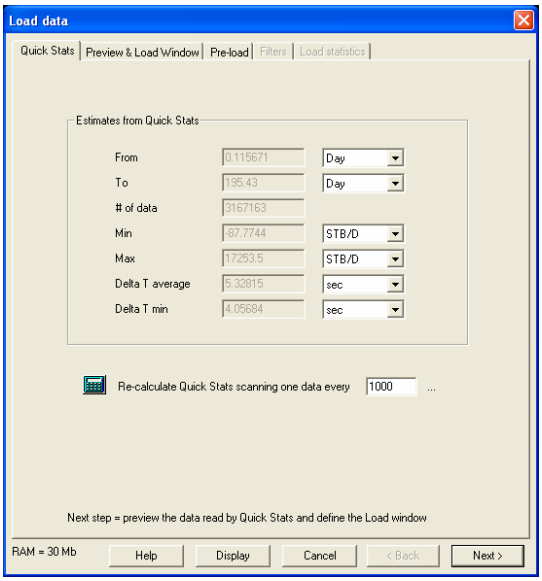


Fig. C01.6 • Load Data – Quick Stats

Click Next >>. A preview plot of the scanned data is displayed. In this plot the zoom functions can be used to set the load window and thereby easily eliminate outliers and obviously false data points. A white dotted lined rectangle indicates the load window after a click on the calculator button. There is a second level of discarding outliers where the wavelet algorithm is automatically used on the sample to determine the trend of the data. You can then set the pressure band (ribbon) to be applied on the trend. Points outside of this band are discarded as outliers.

At each step of the Load data process, text on the bottom of the dialog indicates what the next action is.

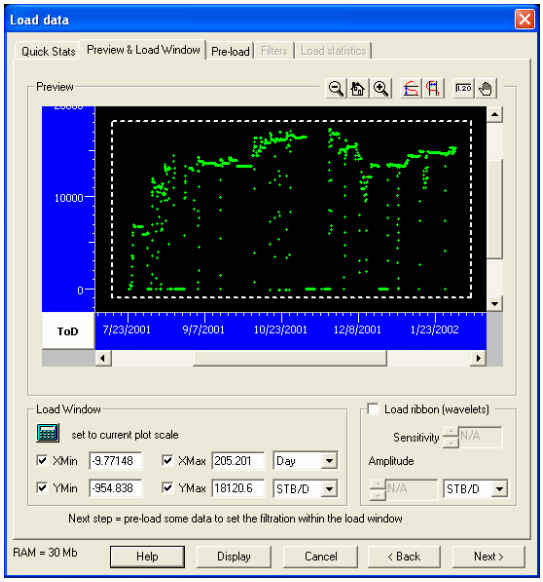


Fig. C01.7 • Load Data – Preview & Window

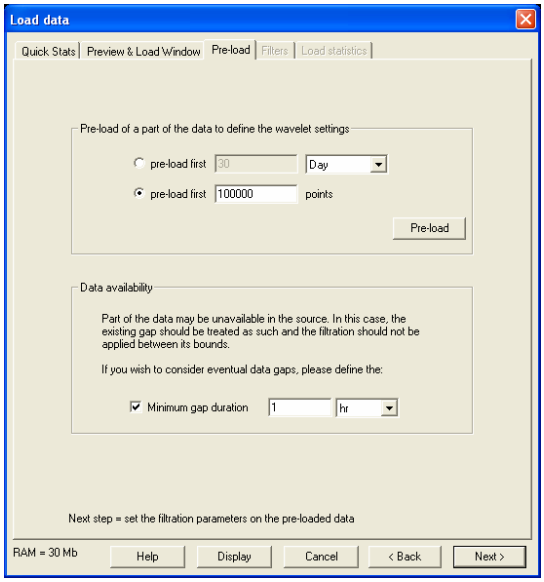


Fig. C01.8 • Load Data – Pre-load

The next step, Next >>, consists of pre-loading part of the data, a number of points is entered (see Fig. C01.8). Leave the default 100,000 and click the Pre-load or Next >> button.

The data is displayed and will undergo three steps: Re-sample / Wavelet / Post-filtration. The wavelet algorithm requires that the data be re-sampled evenly, and the sampling interval typically depends on the application type. For welltests, the minimum delta time may be used. For production data, a large time step is usually sufficient. An Intermediate value (15 sec) by default should provide a good compromise for both applications.
On the pre-loaded set, the wavelet algorithm is tuned (filter level wheel), and finally the post-filtration is set using default values. In this example we leave the filter level at zero. Click on the “TEST” button and it can be seen, figures below, that out of the 23040 points in the window, 766 are selected in the end.

On the right (Fig. C01.13 Load Data – Active Filtration), bottom view, the difference between the original and filtered sets is displayed.

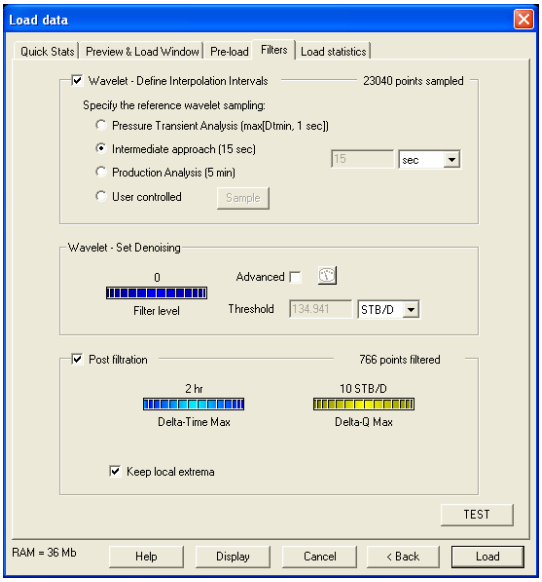


Fig. C01.9 • Load Data – Filters

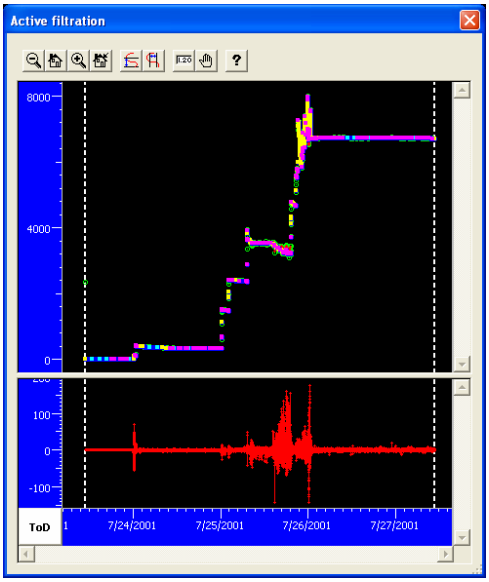
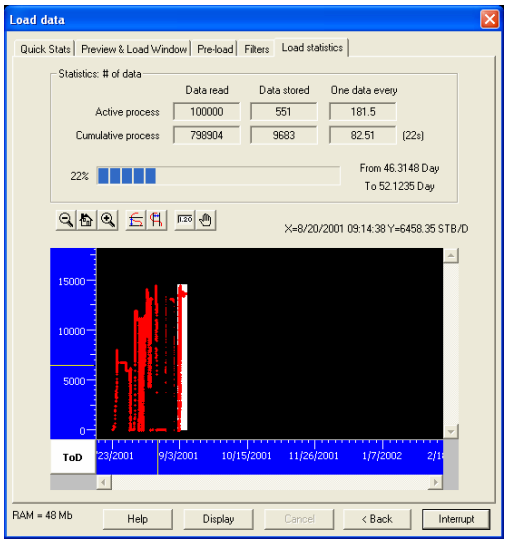


Fig. C01.10 • Load Data – Active Filtration

Once the filter parameters are selected the file can be loaded by parts of 100,000 points. Select the Load button at the bottom right of the dialog. For each new interval, the filter is applied, and the new section is visualized on the screen as can be seen on Fig. C01.11.

There are some time overlaps in the file, select “Ignore new data” and click on Apply to all, the load proceeds normally.



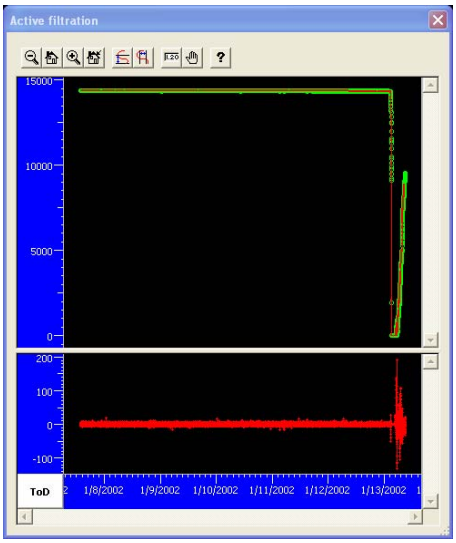
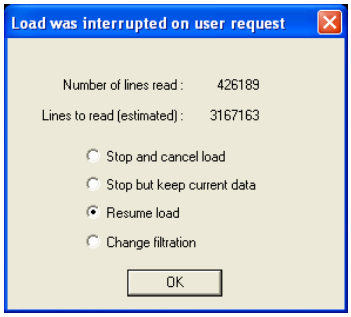


Fig. C01.11 • Load Data – Processing

The major advantage of this process is that the entire data is never loaded completely in memory. You can interrupt the process at any time and decide to:

- Stop the load without saving the current data,
- Stop and keep the loaded data,
- Resume load without changing any parameters,
- Change the filtration parameters for the rest of the data.



Complete the loading for the entire data set.

At the end of the process, the “Load statistics” dialog displays the global statistics information. Over the original 3,164,911 raw measurements, 34,980 (1.105 %) lines have been actually stored.
Exit the “Load data” dialog with an OK.

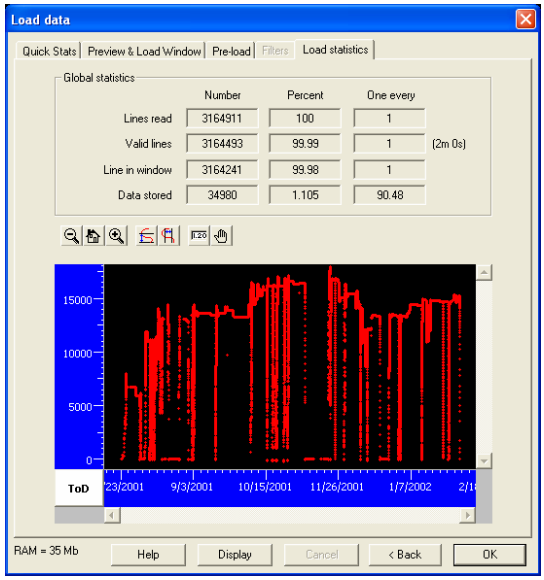
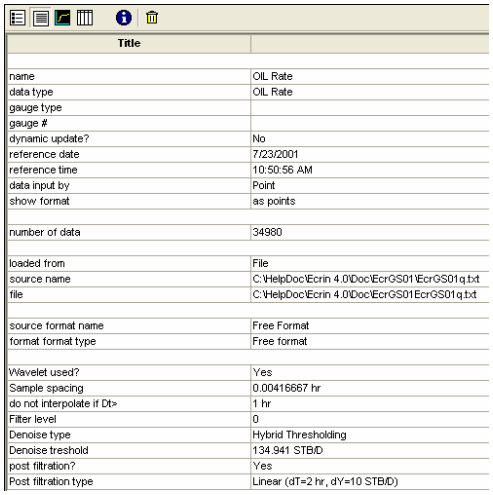


Fig. C01.12 • Load data finished

Select the “View Info” mode for the OIL Rate node: information related to the original file and loading process has been updated. Switching to the “View Plot” mode will display the OIL rate production plot as seen in Fig. C01.14. It can be noticed that although the OIL Rate has been input as Points, the data is displayed as steps by default.



Title	
name	OIL Rate
data type	OIL Rate
gauge type	
gauge #	
dynamic update?	No
reference date	7/23/2001
reference time	10:50:56 AM
data input by	Point
show format	as points
number of data	34980
loaded from	File
source name	C:\HelpDoc\Ecrin 4.0\Doc\EcrGS01\EcrGS01q.txt
file	C:\HelpDoc\Ecrin 4.0\Doc\EcrGS01EcrGS01q.txt
source format name	Free Format
format format type	Free format
Wavelet used?	Yes
Sample spacing	0.00416667 hr
do not interpolate if Dt>	1 hr
Filter level	0
Denoise type	Hybrid Thresholding
Denoise treshold	134.941 STB/D
post filtration?	Yes
Post filtration type	Linear (dT=2 hr, dY=10 STB/D)

Fig. C01.13 • Oil rate – View Info

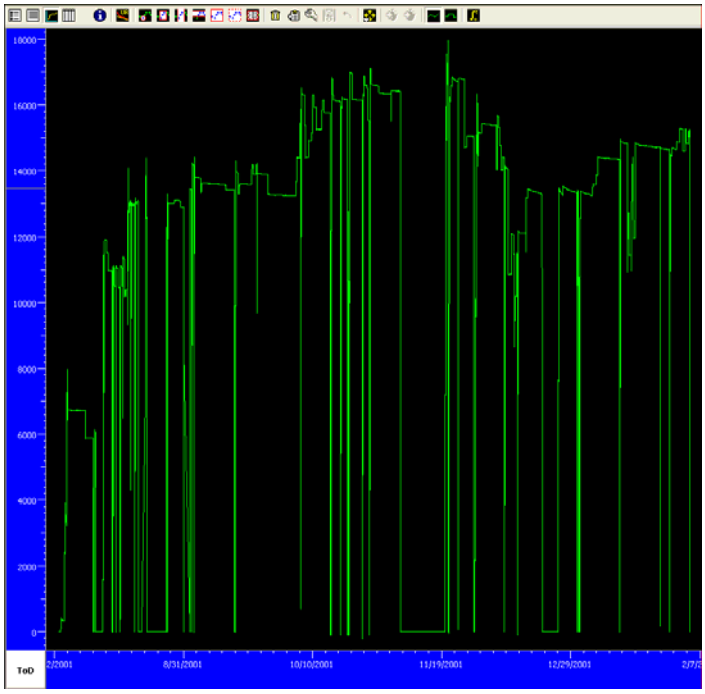
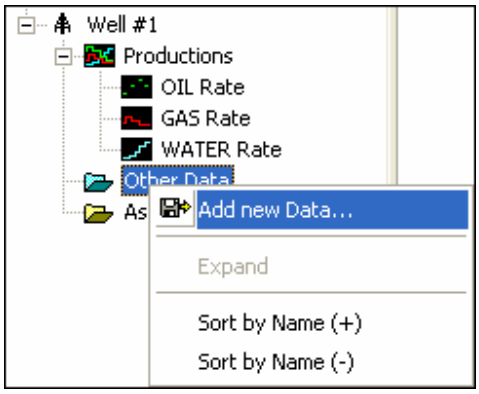


Fig. C01.14 • Oil rate – View Plot

C01.3 • Loading the pressure

In the browser select the node “Other data”, right click to display the popup menu and choose to “Add new data”. Now, repeat the loading process as the one used to load the production (rate data) with the pressure ASCII file “EcrGS01p.txt”.

In the “Data Format” dialog, the “Free” format will be recognized as valid. Leave everything else as default (“Filter box” must be on) and start loading.



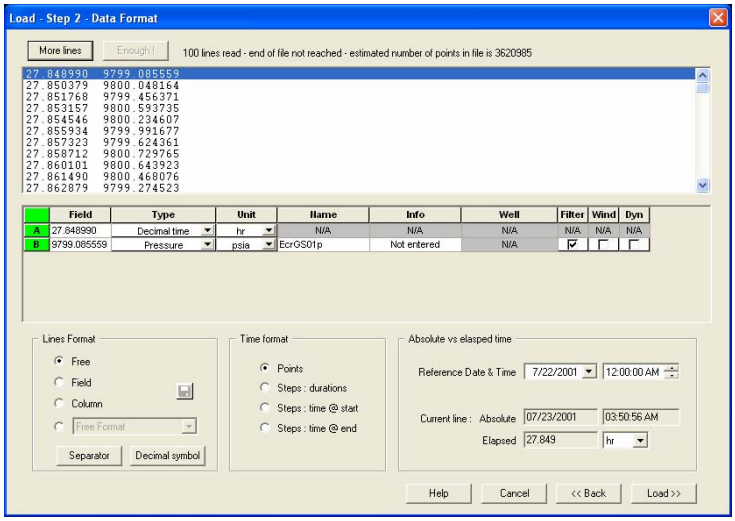


Fig. C01.15 • Data Format - Pressure

When the filtering dialog appears continue to click Next >> and accept the defaults until the “Filters” tab is displayed. Check the option “Intermediate approach (15 sec), leave the filter settings as their defaults suggested by Diamant. Check the post-filtration with defaults, click the “TEST” button, and then proceed to Load.

For the sake of illustrating the “Dynamic Update” option in Diamant, we will Interrupt the loading process, approximately half way before completion. This time, do not resume loading after the interruption, but choose the “Stop but keep current data” option.

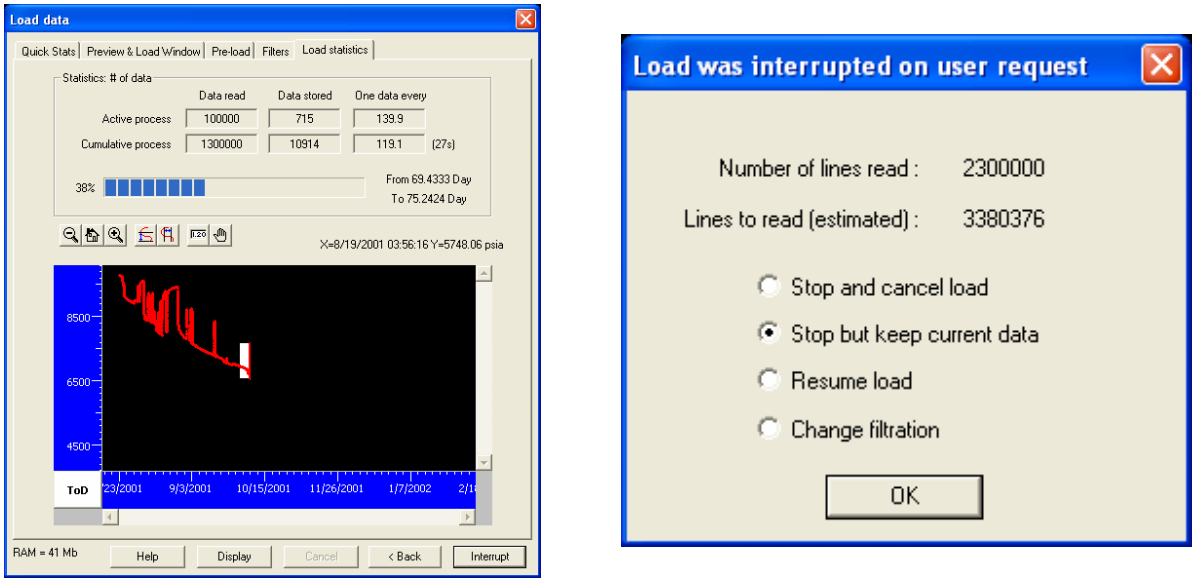


Fig. C01.16 • Loading Pressure

From the data browser, select the Pressure node and choose the “View Plot” display mode: Pressure data are shown as points by default as opposed to the rates that are shown as steps. Click on the icon and change the appearance of the pressure data from green points to red points, click on the button in the data set properties dialog, and change the screen appearance to red.
Click on the “Well #1” node: the plot is updated and now includes both the oil rate and the (incomplete) pressure data set as seen on Fig. C01.17.



Fig. C01.17 • View Plot – Well #1

C01.4 • Pressure Data Update

We will now proceed and update the partially loaded pressure. You can update a data set in two different ways:
Right click on the “Pressure” data set node, and select the” Update” option from the popup menu (see right).
In the main tool bar, click on the “Update Data” icon. In this case, Diamant will scan through the document to update ALL the data sets for which the “dynamic update” property is set to “yes”. To access the node “Properties” where the update value can be set to yes/no, again right click on the node and chose the option “Properties” from the popup menu (the choice can also be made in the Load dialog).

Choose to update the pressure data set using the popup menu. Diamant will scan through the file (the path is stored for each specific data set) and start the loading process from the last recorded data point (Fig. C01.18). The last filtration parameters used during the previous load have been memorized and are used. Validate with OK and at the end of the process, Diamant reports a summary of the data update (Fig. C01.19).

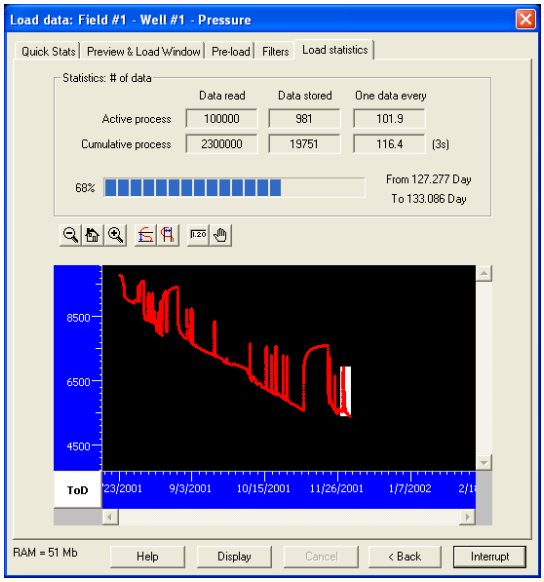


Fig. C01.18 • Load from last recorded point

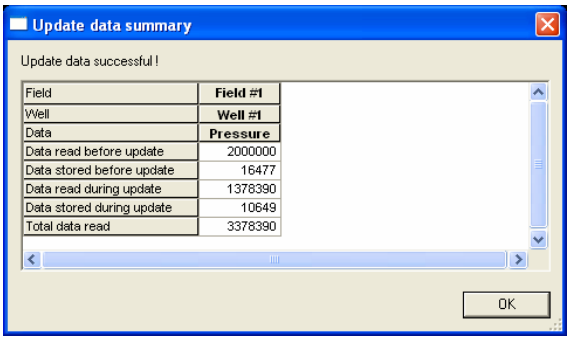


Fig. C01.19 • Update Data Summary

The “Well #1” view plot displays the entire pressure data set as one can see on Fig. C01.20 below:

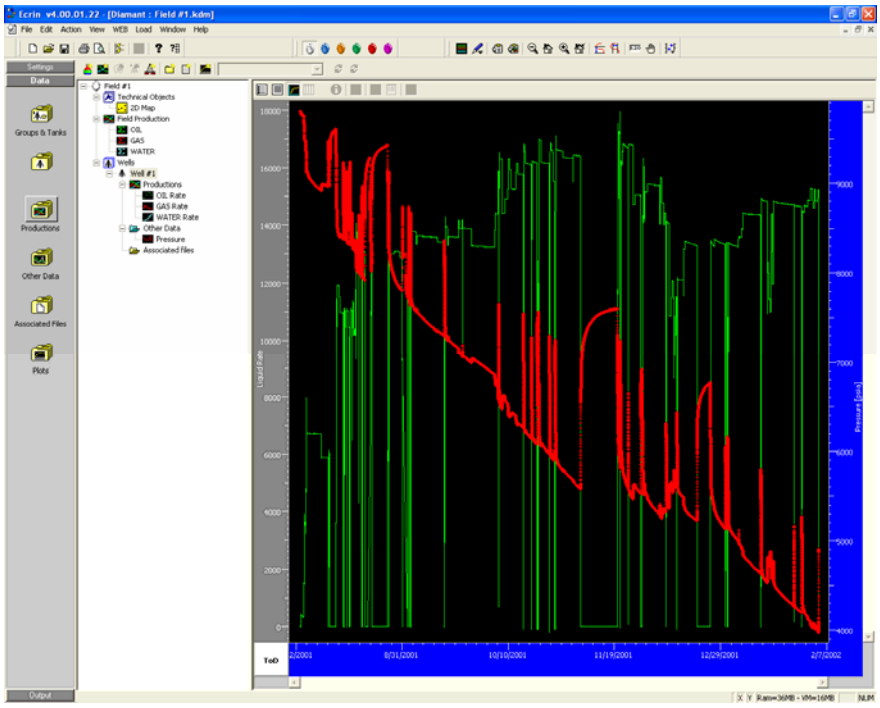


Fig. C01.20 • Pressure data updated

D01 • Initializing a Saphir (PTA) project based on data loaded in Diamant

In the application (module) toolbar , choose the Saphir application. Start a new project by a click on the icon, keep all parameters and PVT model as default except for the reference date that should be set to 22 July 2001. In order to ensure that you get very similar final results as this guided session make sure that B_o and μ_o is set to 1 (bbl/STB and cp respectively) and system compressibility is set to 3 e-6 psi-1 Open the browser and click on the button to display the hierarchical tree of both the Diamant and the Saphir project. Drag and drop the 2-Map as illustrated in Fig D01.1. Now drag the pressure gauge in Diamant to the Saphir project, this avoids having to load this data again through the load dialogs in Saphir (Fig D01.1).

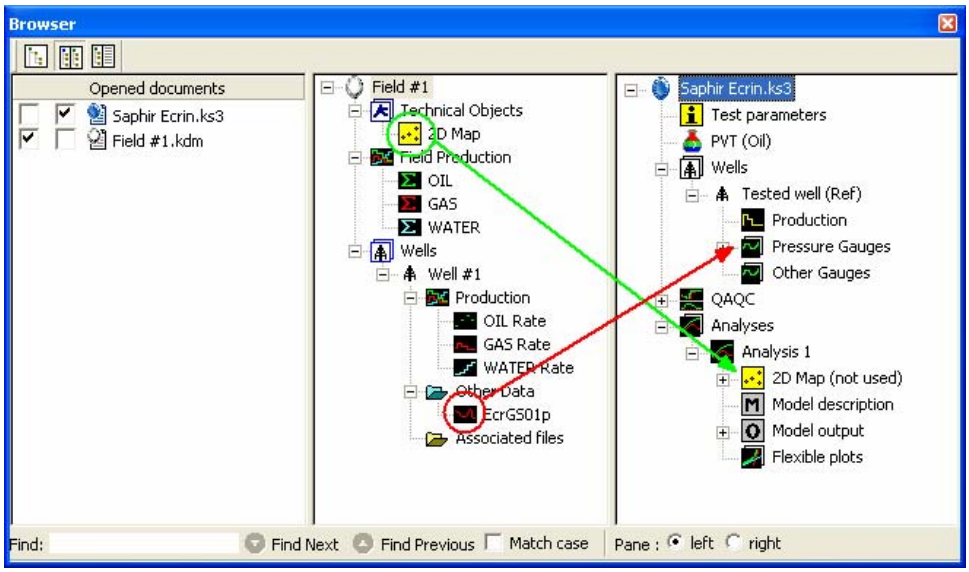


Fig D01.1 • Dual Browser

A history plot is created in the Saphir document and shows the pressure channel. We will not transfer the rates from Diamant as the data is very large and has many invalid points. Instead, we will load a simplified version of the production from the file called “EcrGS01qSimplified.txt”.

Click the load Q icon , select the file “EcrGS01qSimplified.txt” and follow the steps (see Fig. D01.2)
Check “**Steps: time @ end**” for the Time format
Select “Spreadsheet” for the “Lines format”
Click on any line with data and define the Types for the lines A,B,C as

A = Date (MM-DD-YYYY)
B = ToD - Auto
C = OIL Rate

Load.

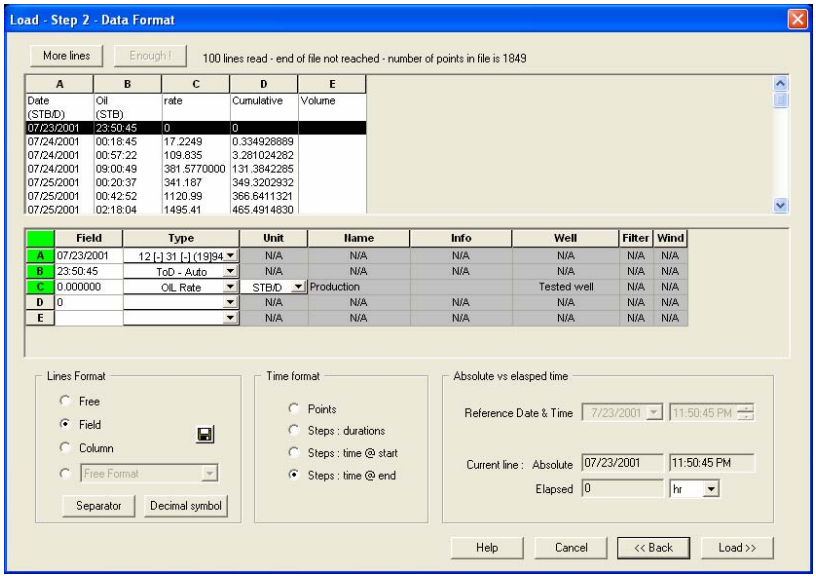


Fig D01.2 • Loading the simplified rate

Arriving at the simplified rate history requires a number of tedious steps that would be conducted in the “Edit Rates” option of Saphir. This operation is not covered in this session but is clearly a major part of the data preparation for analysis.

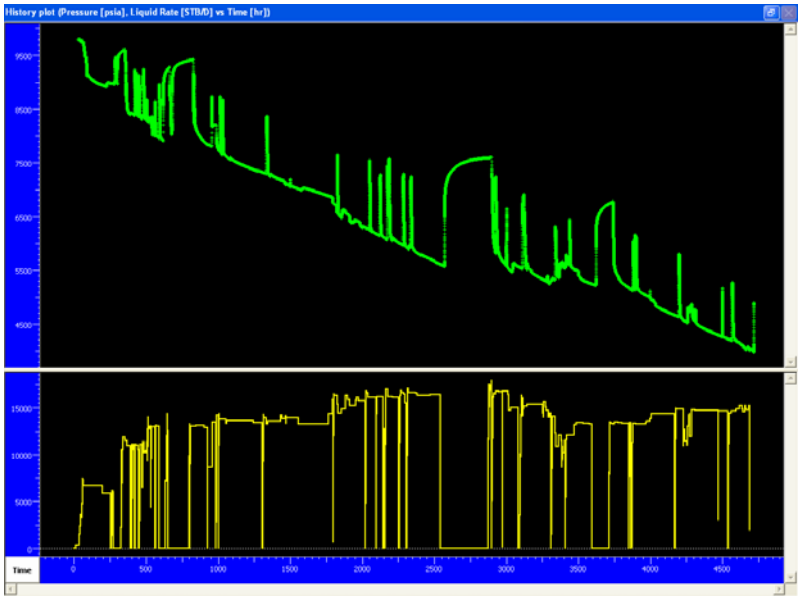
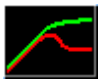
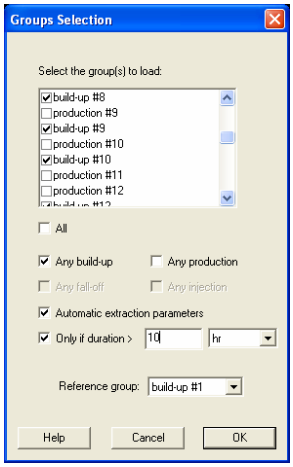
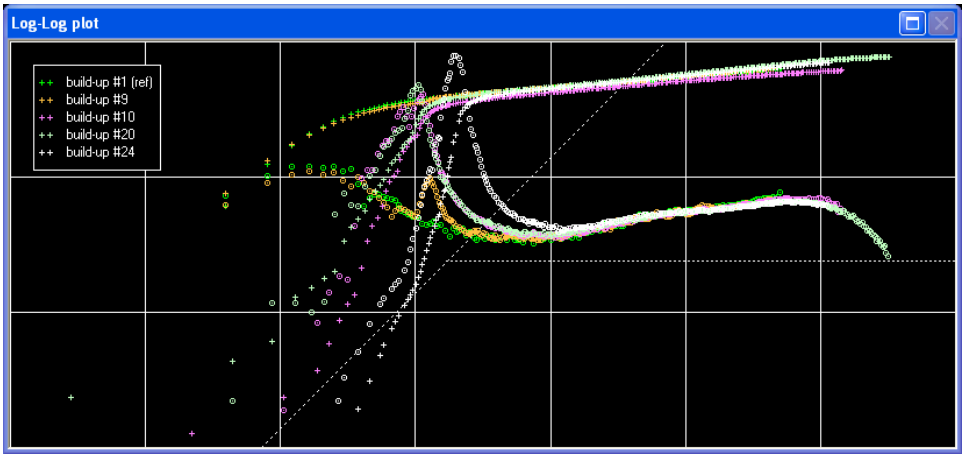


Fig D01.3 • Pressure and rate history plot after load

D01.1 • Extracting multiple buildups

Proceed to load multiple buildups. Click on the “Extract dP” icon  and choose “List” on the “Group” line in the next dialog. Then specify to extract “Any build-up” with duration of more than 10 hours. The loglog and semilog plots are shown, Fig D01.4.





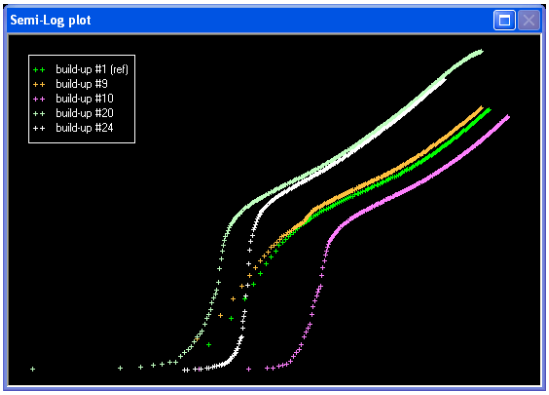
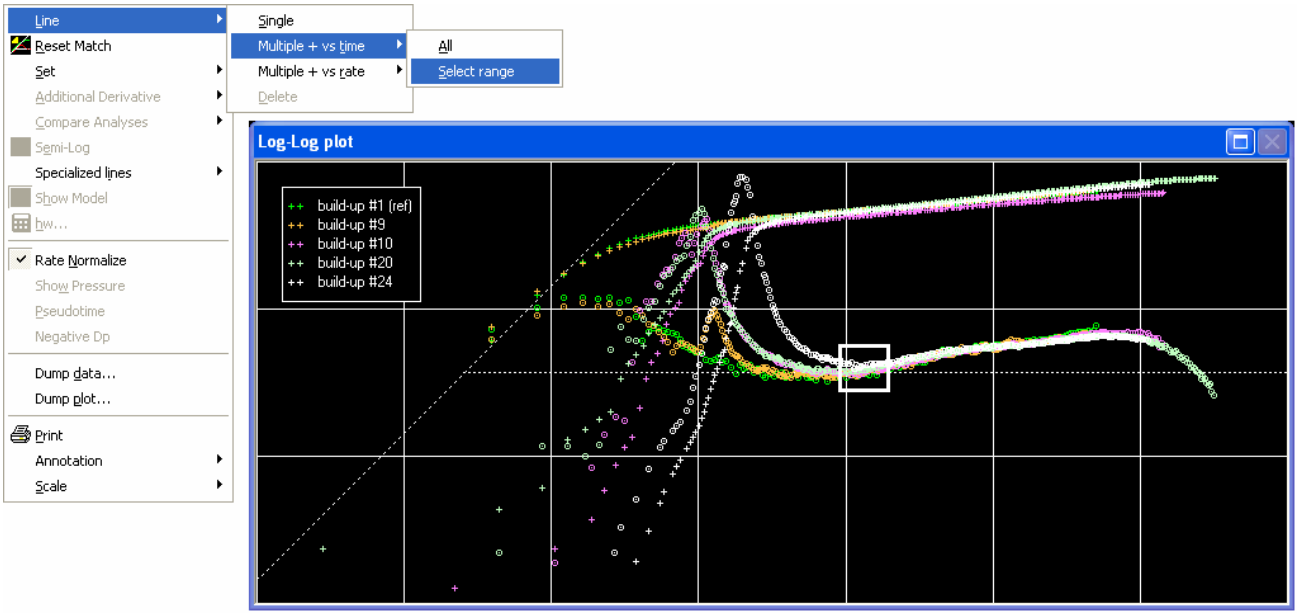


Fig D01.4 • Loglog and semilog of multiple extracted periods

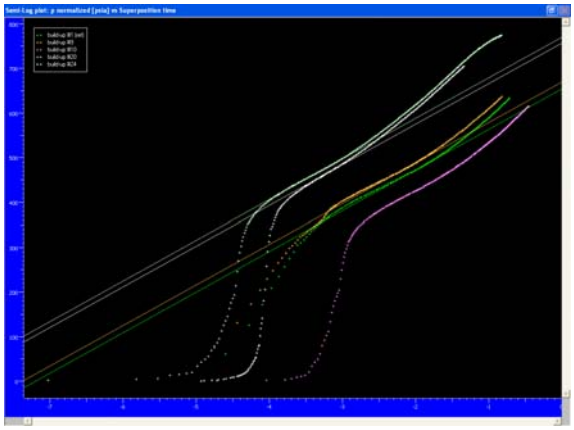
Before considering any model diagnostics a few Saphir options will be demonstrated. As a selection of the buildups has been extracted it is possible to investigate if there has been any major change in skin and permeability during the recorded production history (some 200 days).

Right click in the loglog plot and choose the option line as shown in the next figure, D1.05. “Multiple + vs time” and “Select range”. The range to select is indicated by the white square (click and drag) in the loglog plot of Fig D1.05.

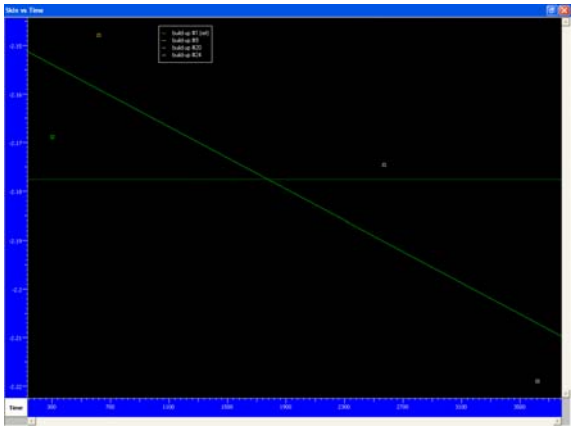


D1.05 • Multiple straight lines (vs. time + Select Range)

Two distinct options exist to draw lines simultaneously on a set of extracted build-ups: “All”, or “Select Range”. When using the “All” option, a time range is specified and Saphir runs a non-linear regression on each buildup in turn. When using “Select Range”, the process starts in the same manner, then any build-up with a deduced kh leading to a derivative level outside the specified box is discarded. For the valid buildups, (i.e. with a deduced stabilization level inside the box) a non-linear regression is run imposing a unique slope, and one intercept per period. A plot of skin versus time is displayed that can be used to evaluate the change of the well potential over time. Fig D01.6 is the semilog plot and Fig D01.7 is the plot of skin versus time, after deletion of one point.



D01.6 • Semilog plots



D01.7 • Skin versus time

The skin deduced from the straight line on Build-up #10 is off and this point can be deleted using the icon in the plot specific toolbar or the plot popup menu (right click in the maximized plot). Click on the delete option, move the mouse close to the point that needs to be deleted, the cursor will change to a litter box and the point can be deleted. Fig D01.7 shows a slight improvement of the well potential with time.

You also have the possibility to set straight-lines versus rate for the evaluation of rate dependent skin in gas wells. When choosing the option “All” rather than “Select Range” in setting the lines each individual curve will be regressed and you can evaluate if permeability is also time dependent.

D01.2 • Pressure Transient Analysis

To determine the most appropriate model extract Build-up #1 only. It is evident from both the derivative curve and the depleting pressure observed in the history plot that the reservoir is limited and bounded.

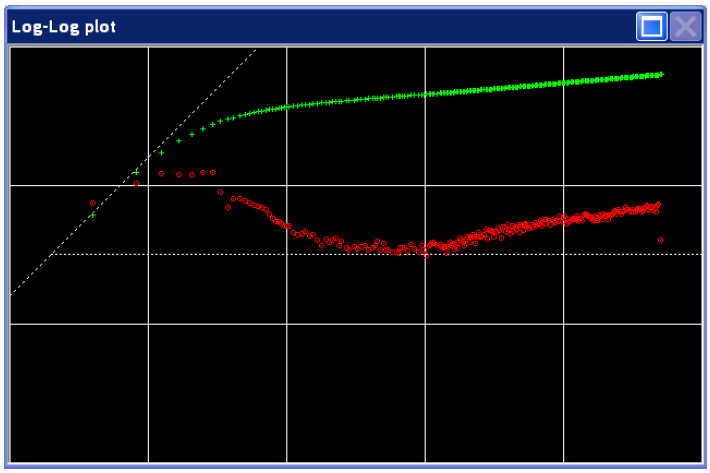
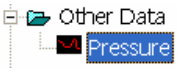


Fig D01.8 • Loglog plot of Buildup # 1

Since the pressure signal was filtered using wavelets we will first check that we did not distort the shape of the derivative. This can be done as follows:

1. Make Diamant active again
2. In Diamant, click the “Pressure” node 

and select the Plot View mode 
3. Zoom in on Build-up #1 (start around August 4th, 2001) and use the time selection icon in the plot toolbar to highlight a time interval containing the build-up.
4. It is now possible to re-load the data for the highlighted section only. The “Partial re-load” option is called with . Diamant reconnects to the source of the data and positions itself on the selected interval. We may change the filter settings for that section. Actually we will not use any filtering.
5. In the Filter dialog uncheck “Wavelet”, and “Post-filtration”. Press “Load”.
6. The modified “Pressure” gauge contains all the raw data in Build-up#1.
7. As illustrated on Fig. D01.1, drag and drop the “Pressure” to the “Pressure Gauges” node of the Saphir Tested well. A new gauge is added, and Build-up # 1 is extracted.

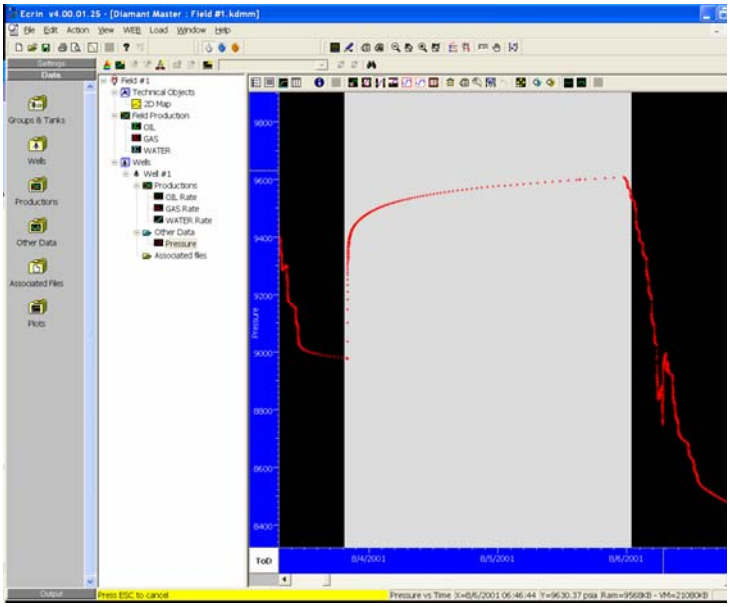


Fig D01.9 • Selecting the Buildup # 1

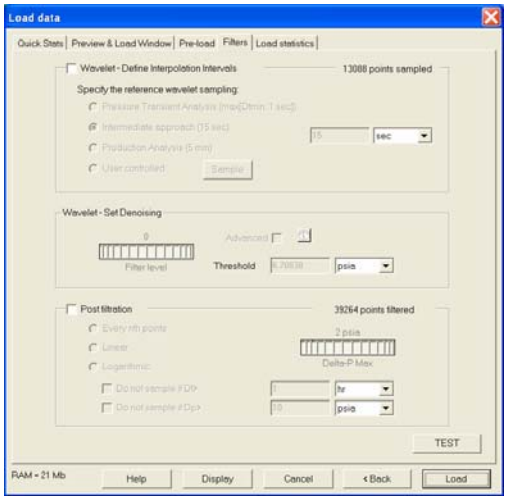
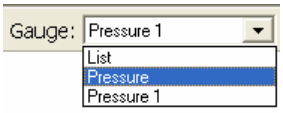


Fig D01.10 • Partial re-load with no filter

No noticeable different is seen in the shape of the derivative other than added noise, Fig. D01.11. The wavelet filter, as we set it originally, did capture the characteristic features of the response while significantly reducing the number of points and thus eliminating the noise. So in the Saphir document, we can safely revert the analysis pressure to the first gauge, see opposite >



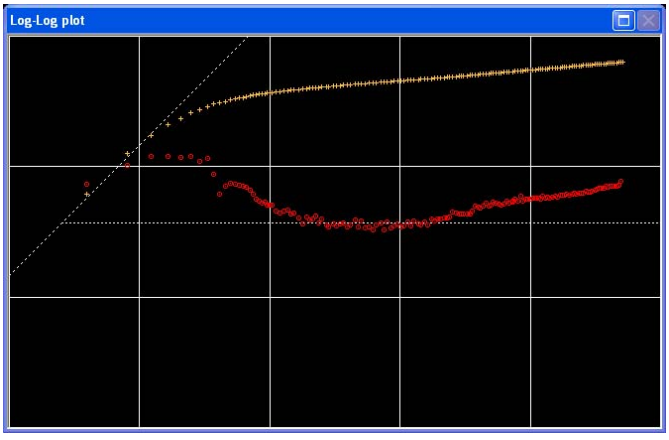


Fig D01.11 • Build-up#1 with all the raw data

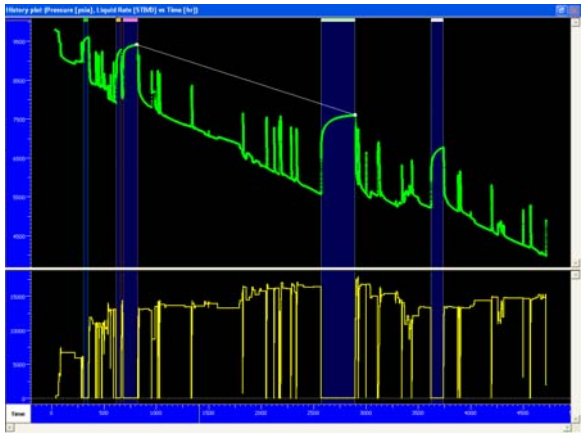


Fig D01.12 • History plot with material balance line

To have a first estimation of the size of the reservoir you can maximize the history plot and use the  icon to draw a straight line (click start and click end) on the depleting pressure as seen in Fig D01.12 (use the Material Balance option).
This line returns a drainage area of some 8000 acres and a STOIIP of 186 MMSTB – as seen in the history plot Results. With the radial flow line (white dotted line on the loglog) placed as illustrated in Fig D01.13 the diagnostic is quite straightforward: the system is closed and the well is near two faults much closer to the well.

After setting the radial flow line, start the interpretation using the automatic model  to estimate skin and adjust the early time match, then open the model dialog to add the closest faults, using the intersecting sealing fault option. Add a fault at 950 and 4700 ft at an intersecting angle of 90°. Set kh to 13000 mDft and C to 0.011 bbl/psi and S to -1.07. Run the model and the match between the model and the data in the loglog plot of Buildup # 1 should be perfect. See Fig D01.13.

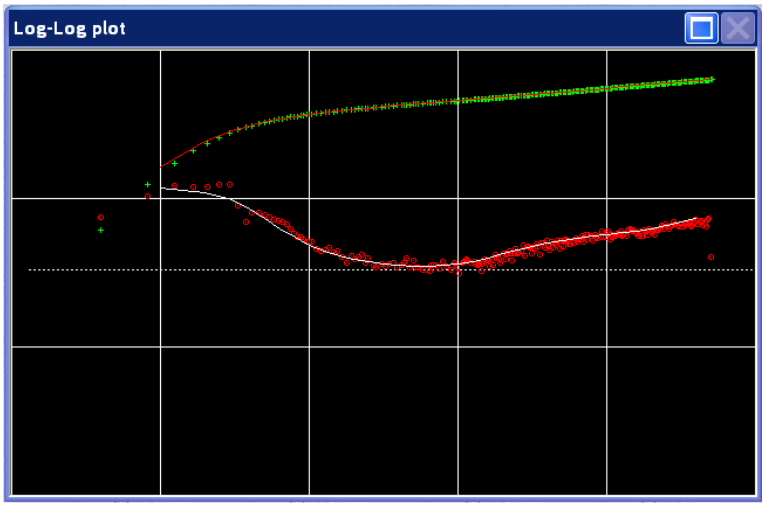


Fig D01.13 • Loglog match of Buildup # 1

Changing the extracted build-up to #20, and looking at the history plot however shows the necessity to close the reservoir system completely. See Figs D01.14 a&b.

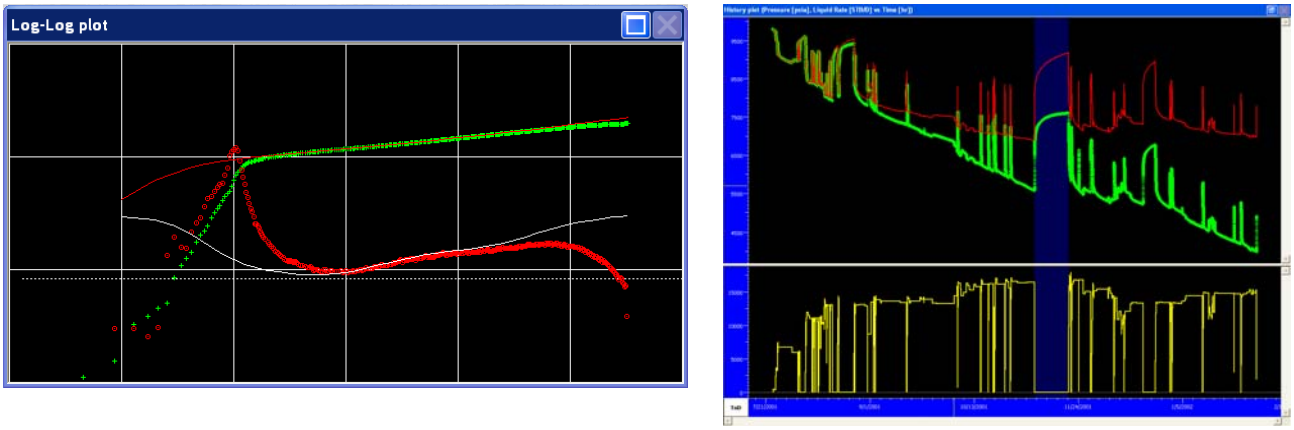


Fig D01.14 a&b • Model displayed on loglog for Build-up #20 and history plot

The challenge is now to change the model to a closed rectangle and vary the distance to the two other closed boundaries until a match has been obtained. The final match settled with in this guided session is a rectangle with the following distances to the closed boundaries:

South	950 ft
East	4700 ft
North	20,000 ft
West	12,000 ft

The Final match is shown in Fig D01.15. It should be noted that the drainage radius found using the straight line material balance analysis previously in this session (Fig D01.12) compares well with the area found in the pressure transient analysis; 8,000 versus 8,032 acres.

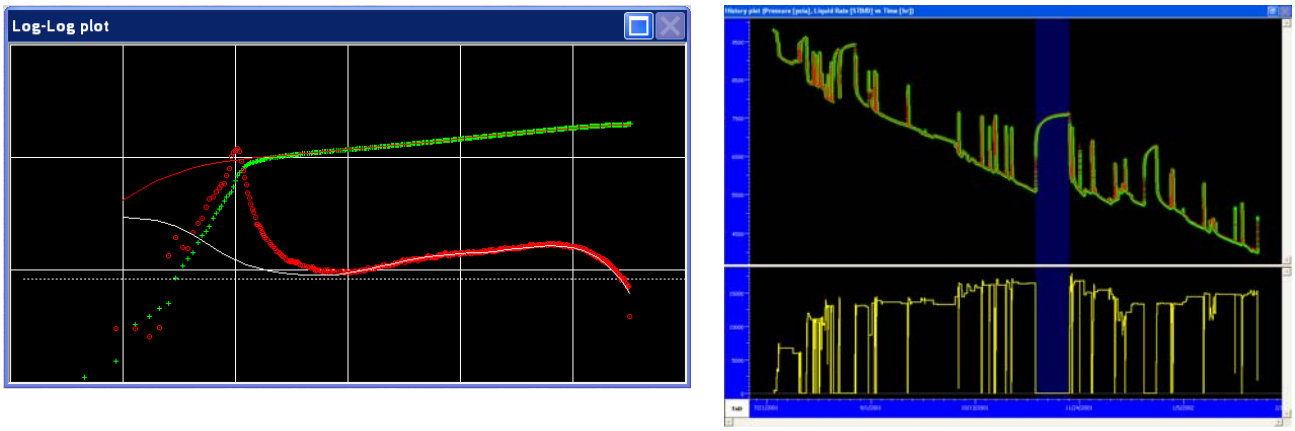


Fig D01.12 • Final match

E01 • Initializing a Topaze (PA) project based on data loaded in Diamant and Saphir

In the application (module) toolbar of Ecrin , choose the Topaze  application. Start a new project by a click on the  icon, keep all parameters default. Open the browser  and click on the  button to display the hierarchical tree of both the Topaze and the Saphir project. Drag the whole Saphir project and drop it on the newly created Topaze session.

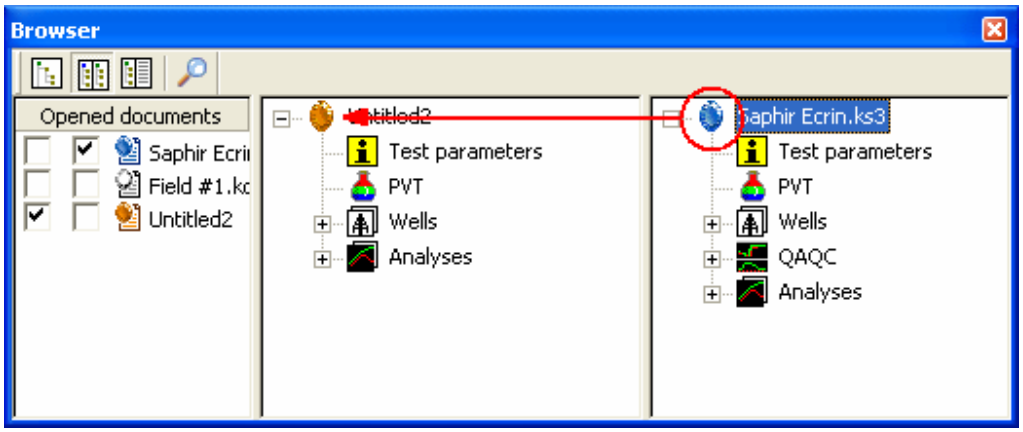


Fig E01.1 • Browser drag and drop

This will launch the complete startup process of Topaze automatically. All the information, well and reservoir characteristics, PVT and data will be copied. Extraction (make sure the initial pressure is 9800.23 psia) will take place, and you can generate the same model as the one used in the Saphir pressure transient analysis. By default you will end up with the screen seen in Fig E01.2.

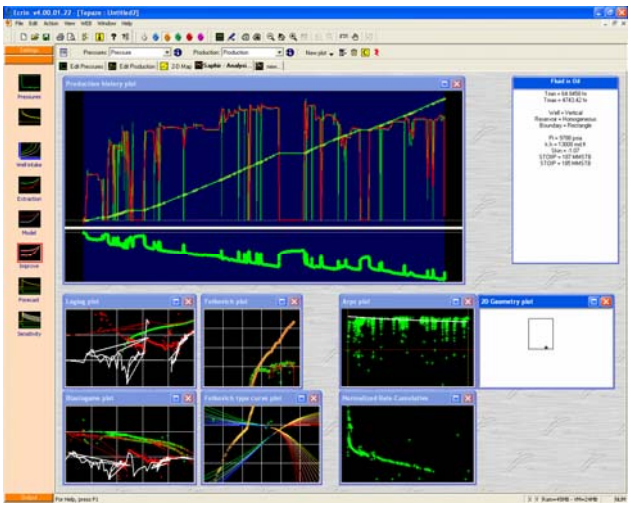


Fig E01.2 • Topaze window

By dragging the Saphir project directly to Topaze the Topaze file has used the simplified rate history that was prepared for Saphir. As Topaze is a production analysis tool it can use the original rate file loaded in Diamant. In the browser , drag and drop the oil rate from the Diamant project to the Topaze session as illustrated in Fig E01.3.

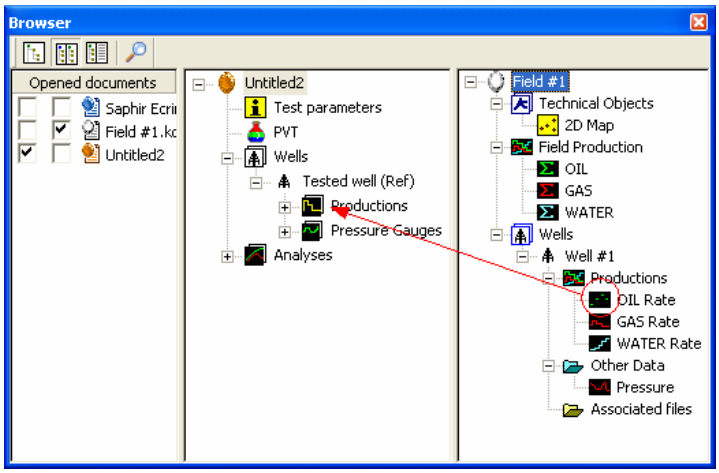
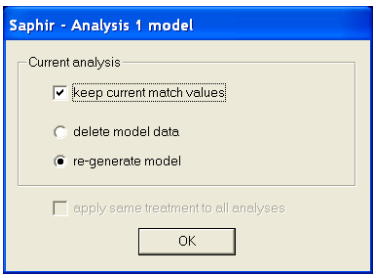
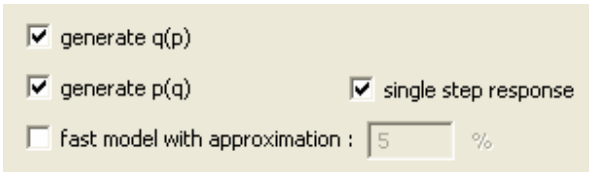


Fig E01.3 • Browser, drag and drop the “OIL Rate” from Diamant to Topaze



At the automatic extract make sure the initial pressure is set to 9800.23 psia. In the extract dialog specify a **rate threshold of 0.1**, and click OK. Be sure to “Keep the current match values” before re-generating.

Click on the model  icon, check generate q(p), p(q) and single step response.



Click Generate, the final results are obtained Fig. E01.4.

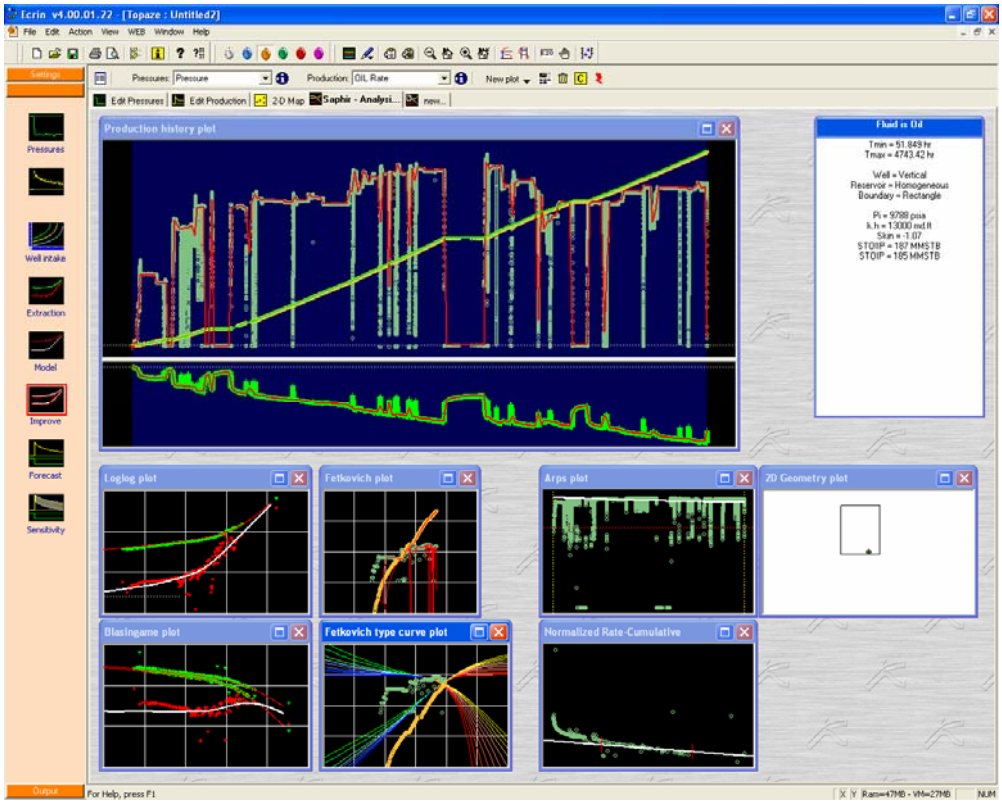
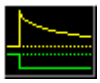


Fig E01.4 Topaze screen

In this case the Arps analysis is not useful since there is no significant rate decline during the history. The Fetkovich plot not useful either since its validity assumes constant flowing pressure which is not the case in this example.

This highlight the necessity to model the behavior with theoretical models similar to those used in pressure transient analysis as these are the only tools that can predict the future.

E01.1 • Forecast

Click the forecast  icon and choose to extrapolate the current model and to generate q(p). Click on the button  to enter the forecast criteria. Add two lines to forecast the production forward 200 days, respectively 100 days at a pressure of 4,900 psia and 100 days at a pressure of 4,890 psia.

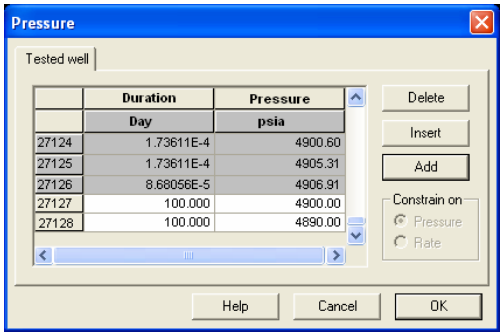


Fig E01.6 Forecast criteria

Click OK and generate. Forecast is displayed in the history plot Fig E01.7..

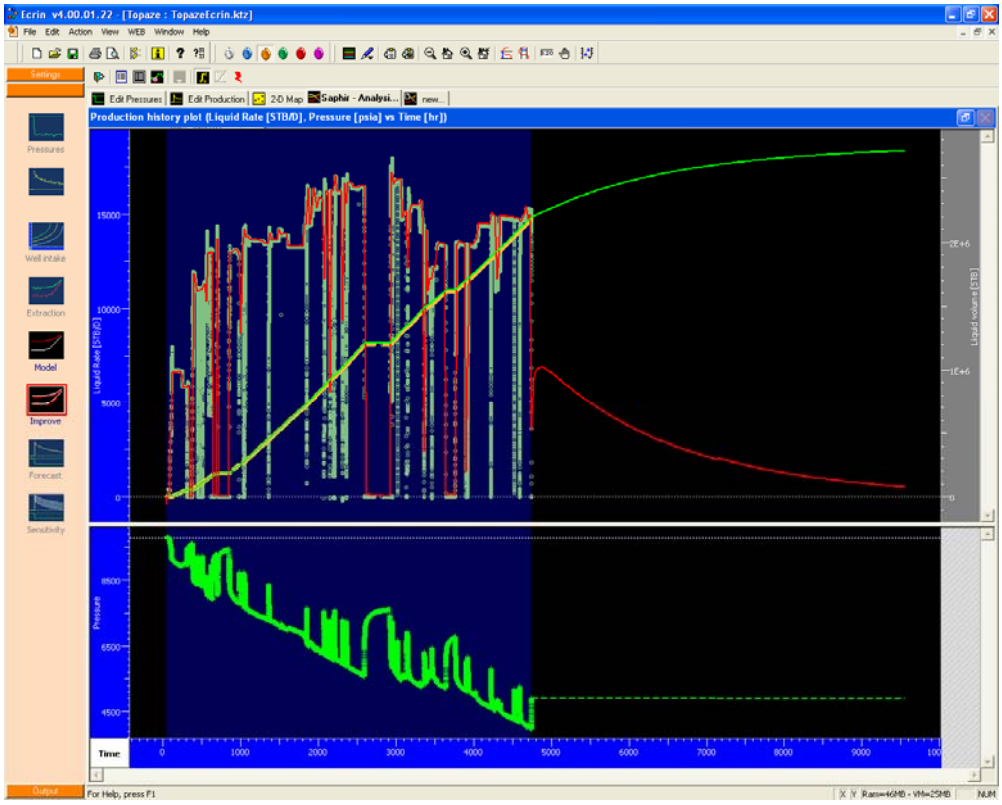


Fig E01.7 Forecast