Diamant Guided Session # 1

A01 • Introduction

Diamant is the Data Management module of Ecrin. The objective of this session is to illustrate the key features of Diamant in its application to Permanent Gauge Data. You will be guided through the startup of a project and the loading of Permanent Gauge Data; the loading will illustrate the data filtration based on wavelets, and the data dynamic updating.
This session is actually the first part of the Ecrin Guided Session #1. If you have a Saphir and a Topaze license, you may extend the present session by joining the EcrGS01 at section D01 when you are finished. This will illustrate the overall workflow using the Ecrin integrated environment to transfer data, technical object, and models between the data and analysis modules.

A01.1 • Requirements

The rate and pressure data used in this session consist of two files: EcrGS01q.txt, EcrGS01p.txt. The two 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 • Diamant overview

Before going through the tutorial itself, the following sections give a brief description of the main software characteristics and key features.

B01.1 • Diamant Master

Diamant Master is a “super” version of Diamant which aim is to centralize on a server the creation of the data structure and the data filtration, and to make this information easily available to workstation users. Diamant Master and Diamant are the same executable and the behavior depends only on the license. This means that to run in Master mode, you need a specific privilege. Diamant Master has several functions not present in Diamant Workstation, namely:
The ability to read data from data servers other than SQL, Oracle, or those with an ODBC interface. Access to PI through its OLEDB interface is in particular restricted to the Diamant Master
The ability to create a mirror in BLIF format of any data source. This option is a must when dealing with large amounts of data and a data server with slow access. BLIF stands for “Binary Large Index Files”. This is a KAPPA internal format providing a fast data access in a compact form.
The ability to write back a channel to a database, in particular Oracle, and thus make it
When opening a Diamant Master file with a Diamant Reader, you can drag-and-drop any channel to your Saphir or Topaze analysis.

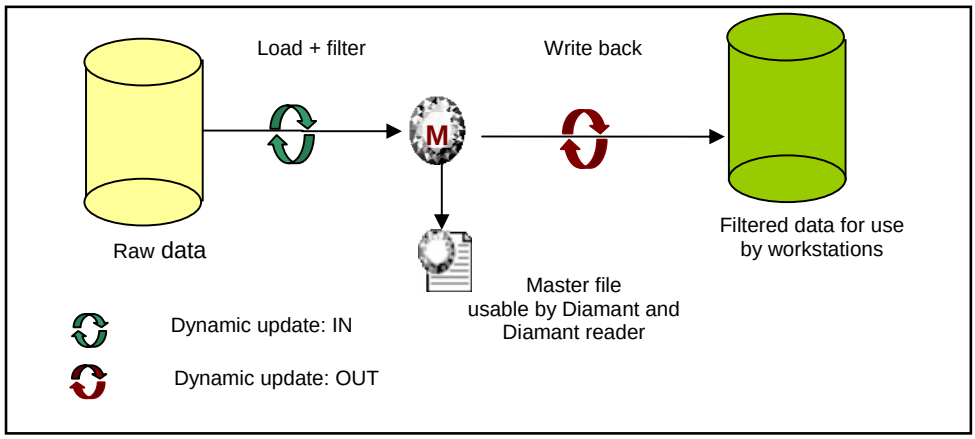


Fig B01.1 • Diamant Master

B01.2 • Extensive data access and data filtration

Diamant can load data from multiple data sources. From flat files, predefined databases, or production database servers via tailored ODBC. In Master mode data can be read from PI servers using the PI OLEDB Provider. Finally Production can be read for a group of wells from DMP2 files.

B01.3 • Wavelet filtering

Permanent gauge data can contain pressure, temperature and rate history over large production time periods; accidental or planned shut-ins become 'free' transient tests that may be analyzed in Saphir. Whereas combined pressures and rates allow for advanced production analysis in Topaze. The problem is that with current downhole and surface acquisition the amount of raw data is vast. Simple filtering will exclude significant changes in the signature of the data while using all data will saturate the CPU and the memory of any application. Diamant smart wavelet filtration can reduce the data volume by several orders of magnitude without missing significant events such as choke (rate) changes and shut-ins.

B01.4 • Versatile data management

Even the most rigorous engineer ends up fighting with directories and obscure file names. Diamant mirrors the loaded production data structure on the engineer screen in a clear and interactive data browser (see Fig. B01.2 next page). A Diamant document represents a Field with its associated data, files, and analyses. Wells can be gathered in groups, and the structure can make use of "Tanks". At the Field level, technical objects such as a 2D-map, Black-Oil PVT, or Kr models can be created, the PVT and relative permeability objects can then be assigned to individual defined "Tanks" allowing for changes in theses properties throughout the field. Production of individual wells, groups of wells, or the entire field can be readily plotted or viewed as tables (see Diamant Display section below). For nodes that correspond to files created by other program (typically "Associated files"), a double click launches the corresponding application and opens the file. In the case of KAPPA applications it is possible to configure these to store bitmap copies of the various plots so that this information can be directly accessed within the Diamant browser.

The tree structure opposite shows a typically data hierarchy as seen within Diamant. Nodes in the tree can be viewed in 4 different display modes when applicable:


View list.


View information.


View plot


View tables.

The list mode is for nodes such as associated files folders; plots etc, and provides a view of their contents.
The info mode typically gives a summary of the properties for the various elements or nodes.
The plot mode, relevant for rate data or any other data loaded for a particular well, displays a plot with that data alone if the active node is single value or multiple plots if the active node contains more than one value.
The plot is the basis for editing, the partial reload option and this mode is also used to view associated picture files.
Finally, in table mode, the actual data or production values are displayed in tabular form. The display time step can be customized.

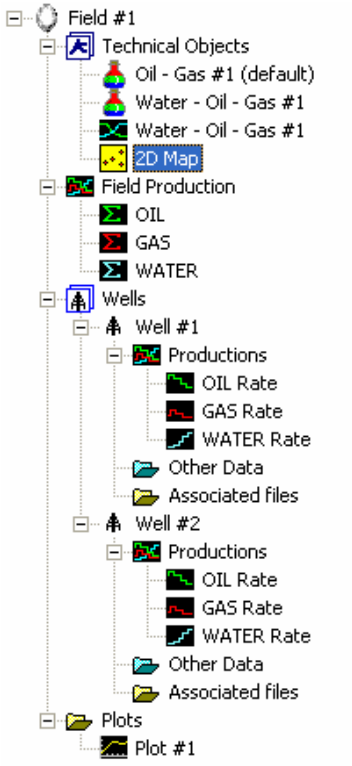


Fig B01.2 • Data browser

B01.5 • Dynamic update / partial reload

Data in Diamant can be “dynamically updated”. This means that at selected times, or on user request, the software will query the data source for newly acquired data and then apply the same user-defined filter processing to the data and automatically append to the existing data.
Since Diamant remembers the source of the data, the user may return to any part of the data history and locally re-populate sequences of interest. This can be especially useful for Pressure Transient Analysis where all, pre-filtered data can be easily recalled.

B01.6 • Associated file management / Data repository

The Diamant browser positions files in a logical hierarchy that includes fields, tanks, well groups and wells, wherever the physical files are located, physical files can be moved / duplicated / deleted from Diamant, and a “gather” option allows the copying or moving of all files in a hierarchy of directories that reflects exactly the field data structure. As a result the engineer knows exactly where to get the information and can, with a double click, open the relevant files.
A significant part of data handling is the repeated entry of the same reservoir information such as PVT and Kr. Not only does Diamant store file and data pointers, but also technical objects that can be used by other applications. For applications from 3rd party vendors, the same process will copy the corresponding tables to the clipboard, allowing any application with a paste option to get the data much faster than with ASCII import and export that is also available in Diamant.

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).**

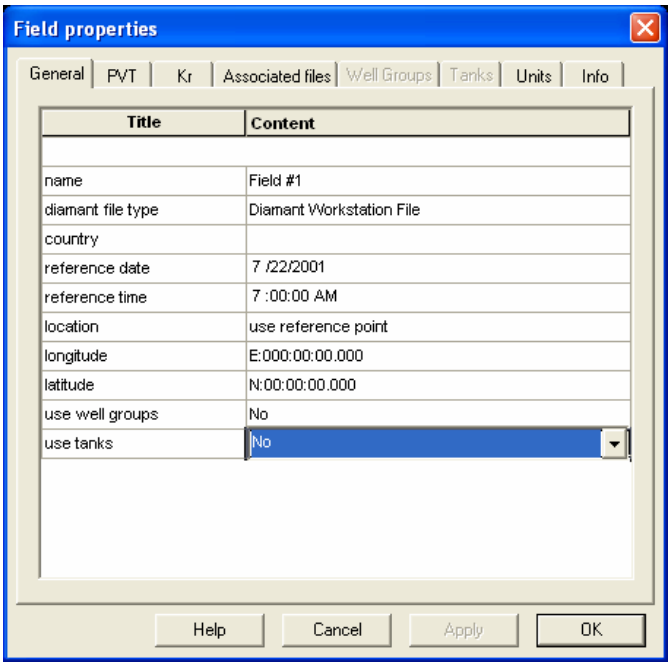


Fig C01.1 • Startup screen

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.

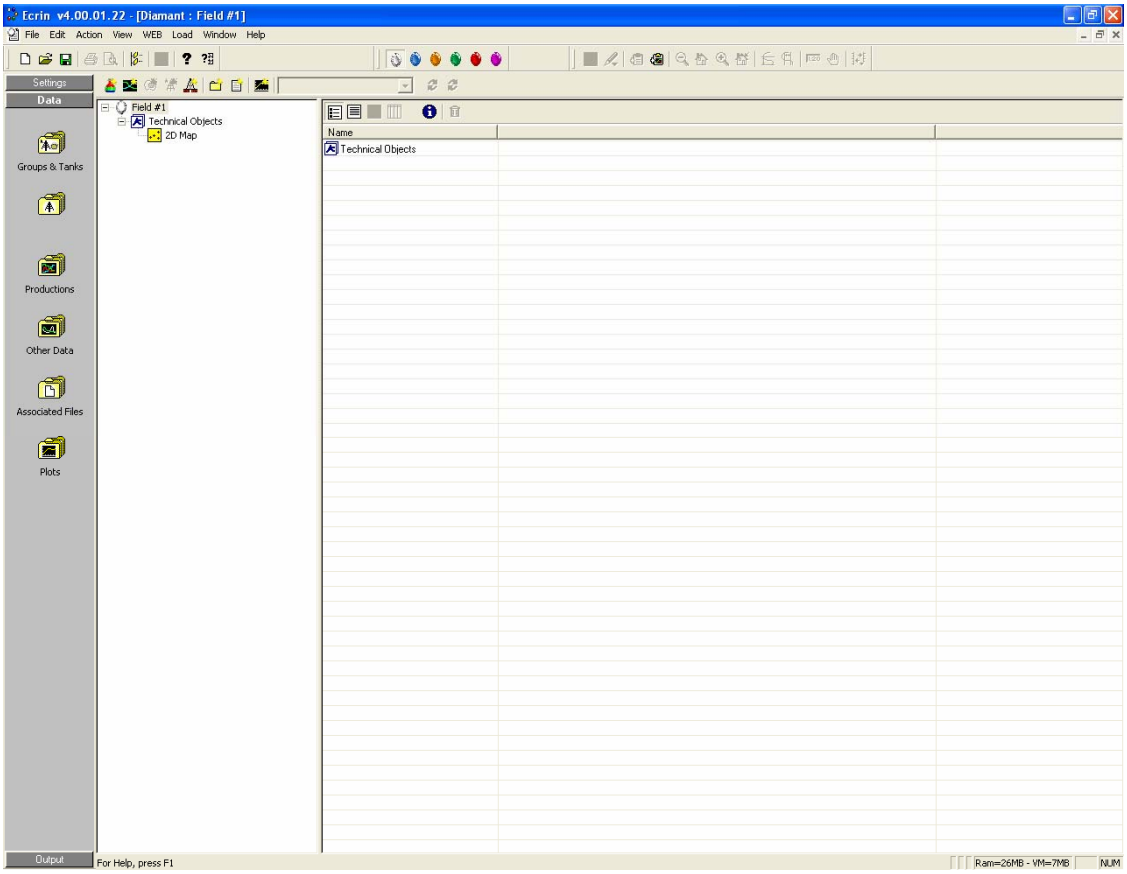


Fig. C01.2 • Main Screen

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 two ASCII files EcrGS01p.txt (pressure) and EcrGS01q.txt (rate). “EcrGS01.zip” can be downloaded from the KAPPA website, 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

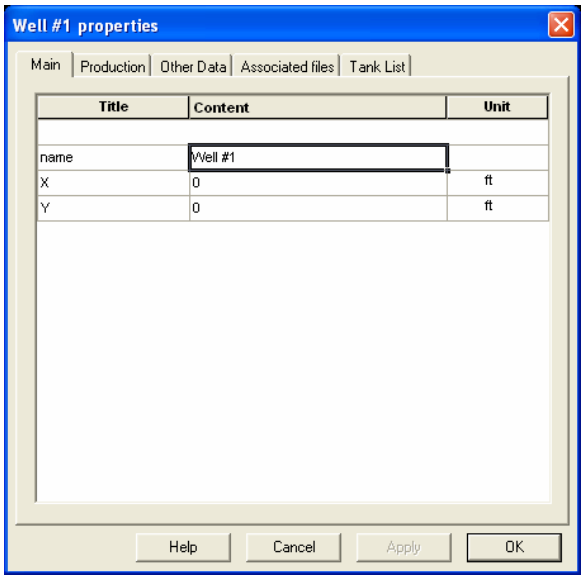
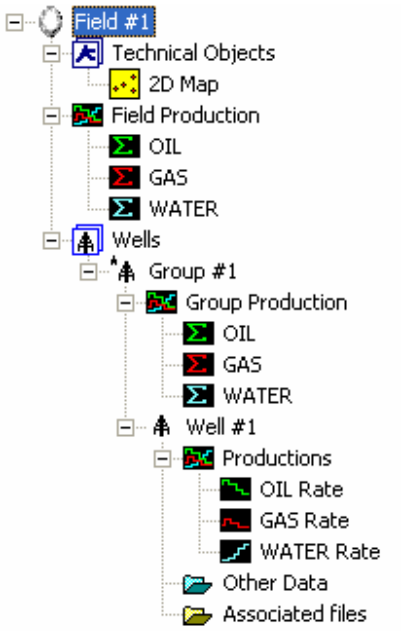


Fig. C01.3 • Well Properties

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).

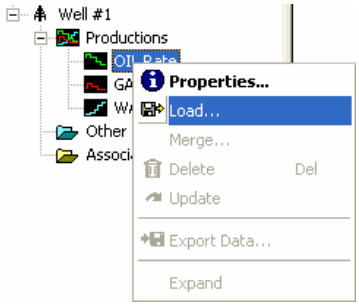
At the same time, a “Field Production” node is created; this node includes the cumulative rates (“Sigma” Rates) for each phase by adding up the wells production belonging to the same field.



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 Next >> button to proceed.

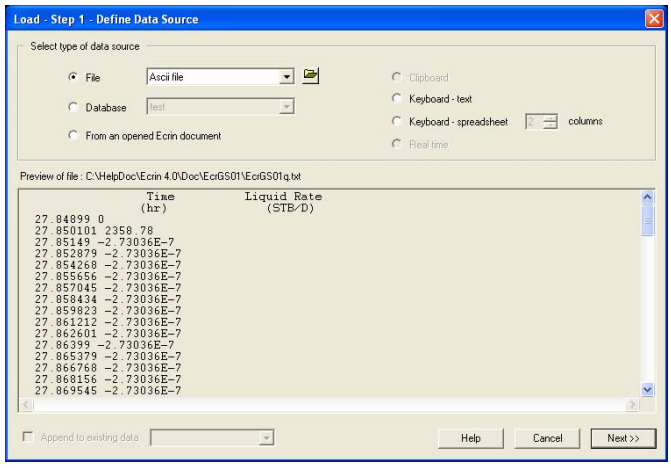


Fig. C01.4 • Loading the OIL Rate

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 "Text" or "Spreadsheet" 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.

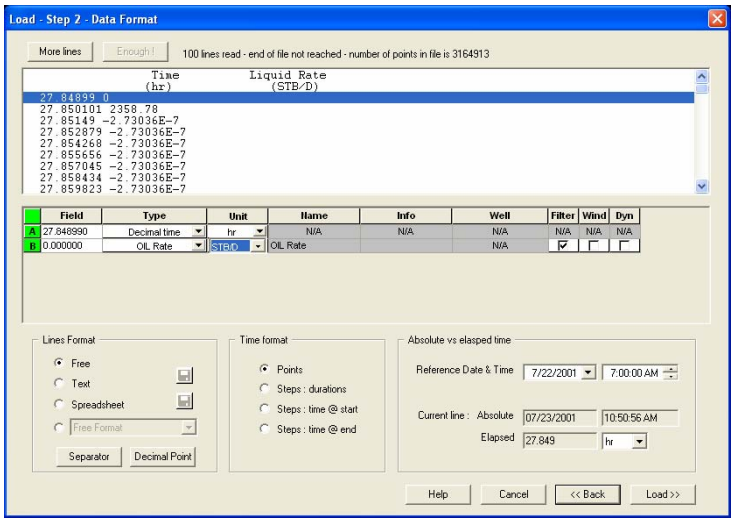


Fig. C01.5 • Loading the OIL Rate

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.

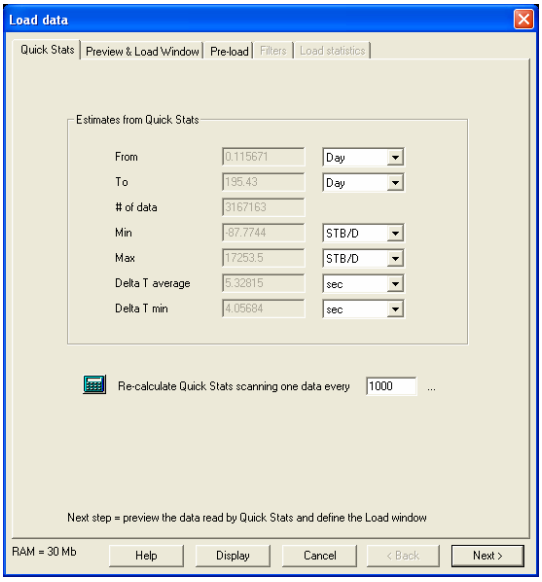


Fig. C01.6 • Load Data – Quick Stats

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.

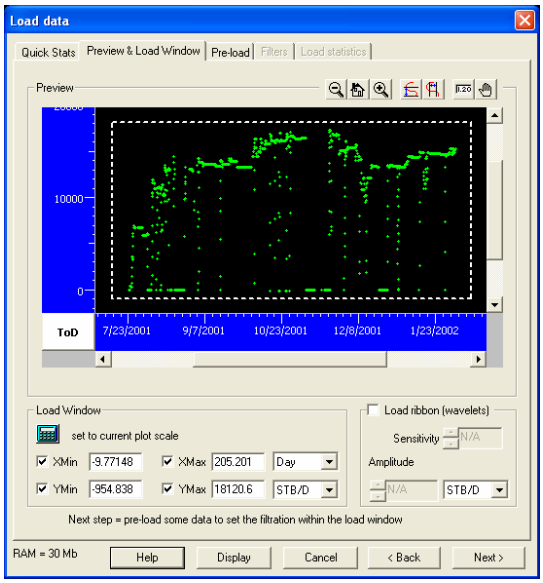


Fig. C01.7 • Load Data – Preview & Window

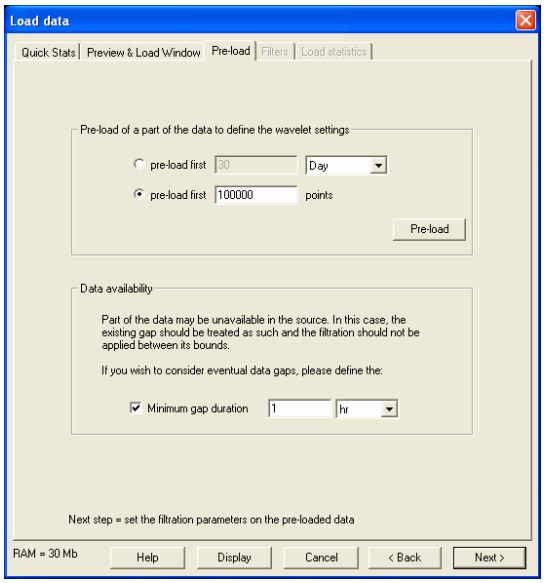


Fig. C01.8 • Load Data – Pre-load

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.

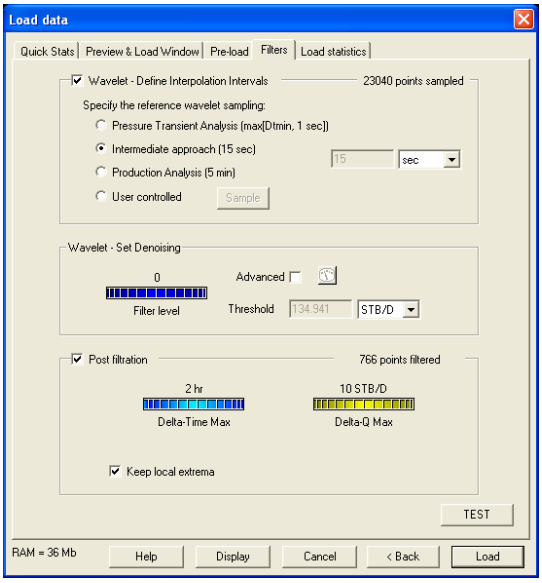


Fig. C01.9 • Load Data – Filters

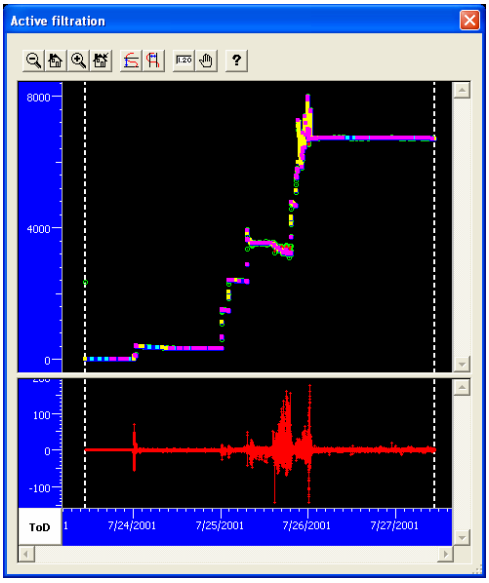


Fig. C01.10 • Load Data – Active Filtration

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.

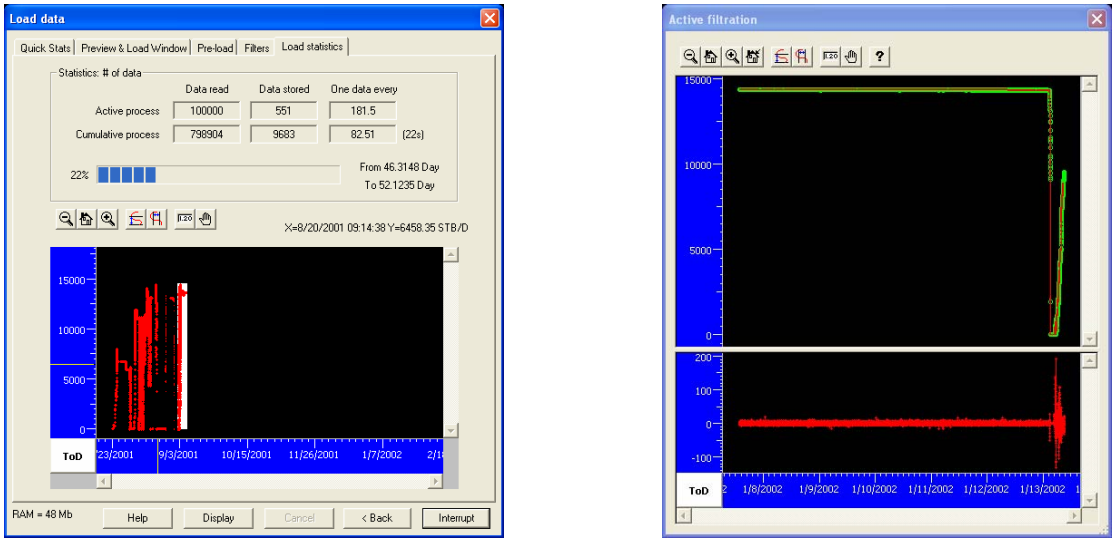
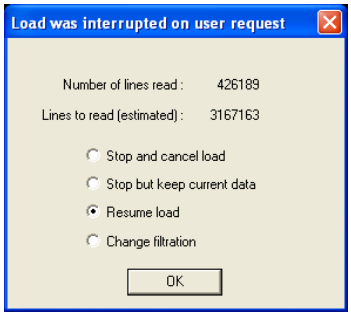


Fig. C01.11 • Load Data – Processing

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.

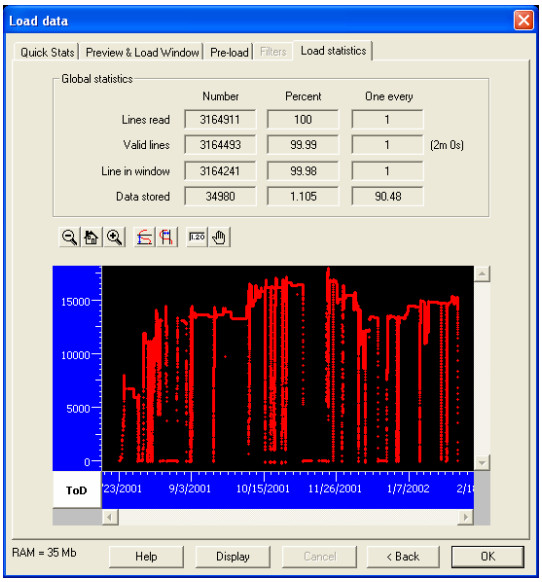


Fig. C01.12 • Load data finished

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

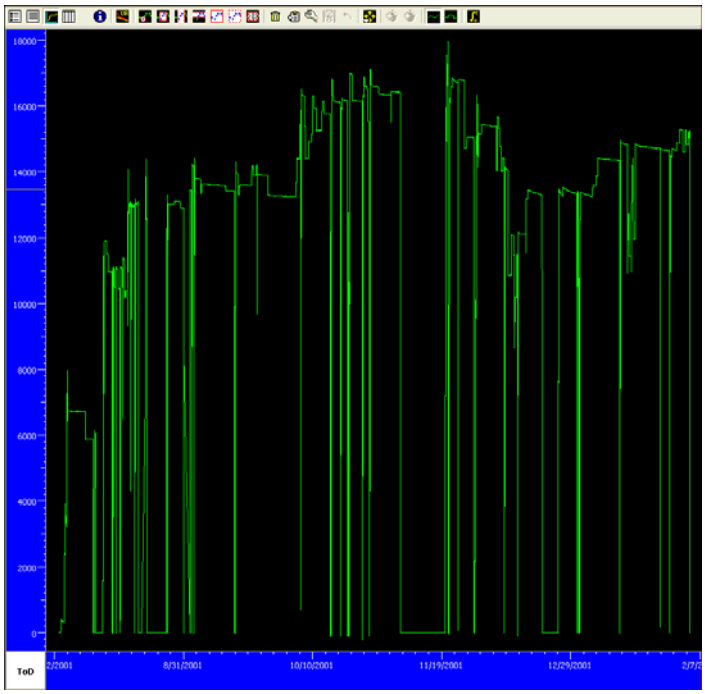
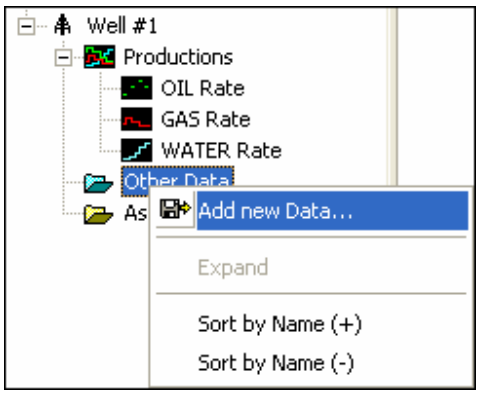


Fig. C01.14 • Oil rate – View Plot

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, but you should set the data type to Pressure. The default unit of psia will appear. Leave everything else as default (“Filter box” must be on) and start loading.

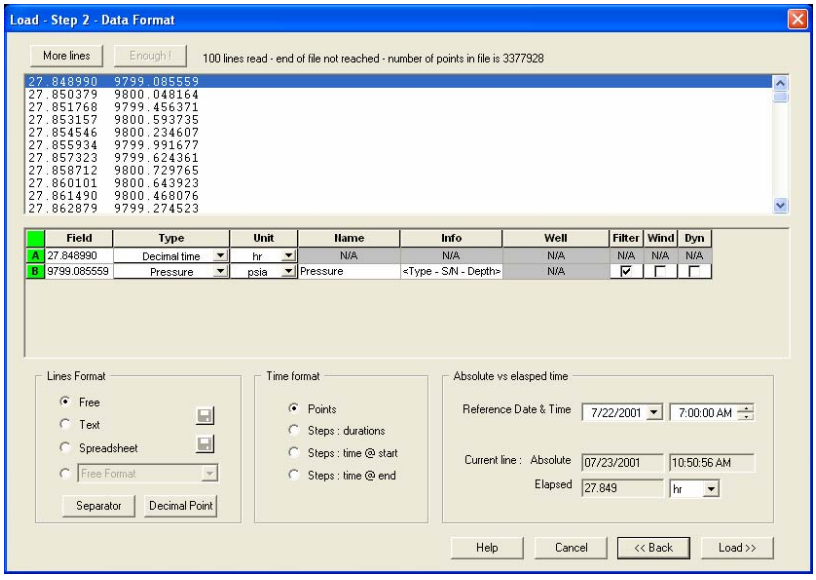


Fig. C01.15 • Data Format - Pressure

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.

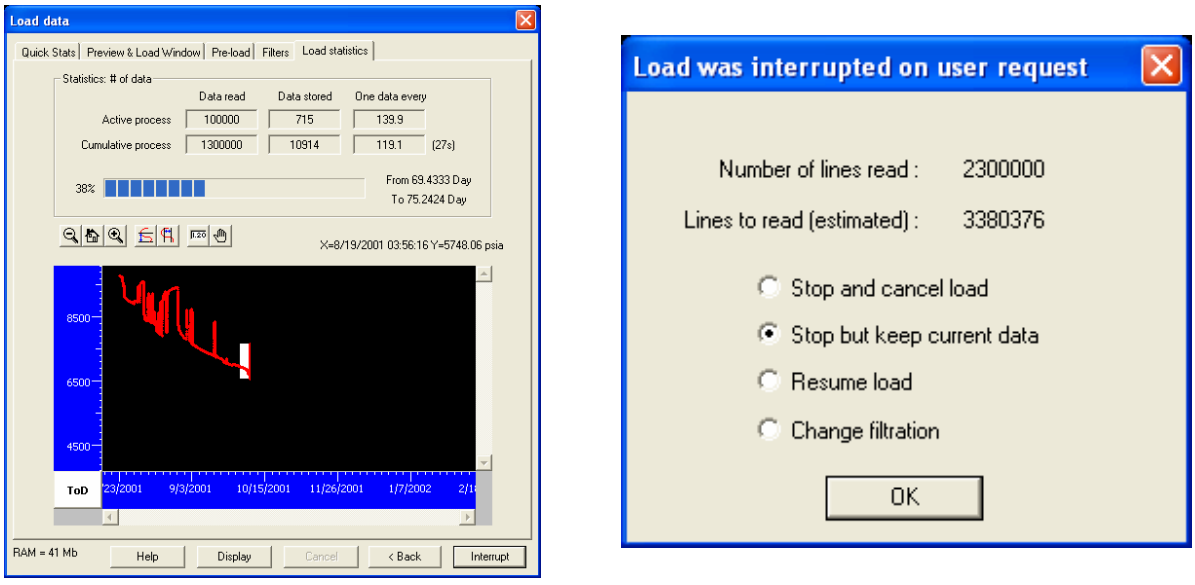


Fig. C01.16 • Loading Pressure

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.
Clcik 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” button . 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).

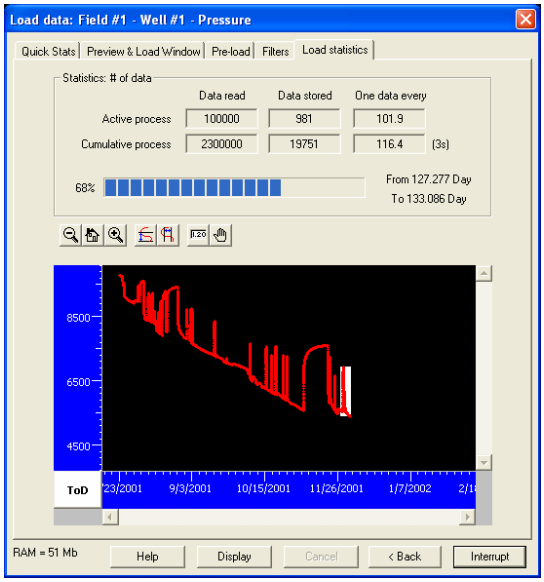


Fig. C01.18 • Load from last recorded point

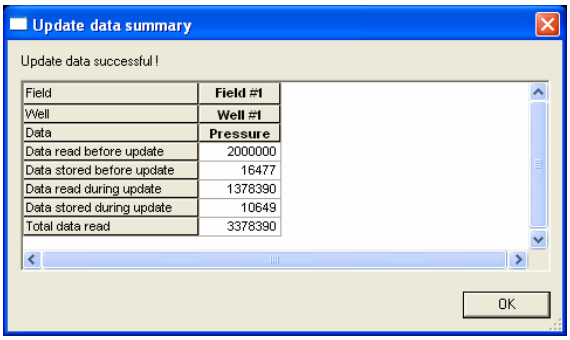


Fig. C01.19 • Update Data Summary

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

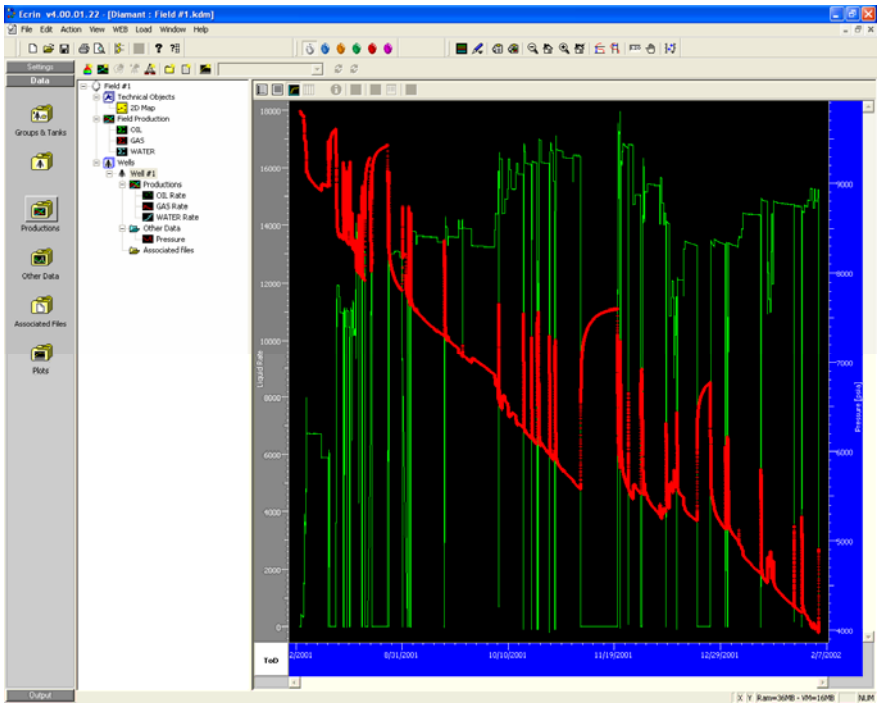


Fig. C01.20 • Pressure data updated

This completes the Diamant Guided Session#1. If you have a Saphir and a Topaze license, you may extend the present session by joining the first Ecrin Guided Session, at section D01. This will illustrate the overall workflow using the Ecrin integrated environment to transfer data, technical object, and models between the data and analysis modules. It will also show the partial reload function of Diamant, i.e. its ability to re-filter a section of an already loaded data set.