Saphir Guided Session # 2

A01 • Requirements

It is assumed that you have already studied the guided session #1 in order to know how to load and organize the data. In this session we will bypass the initialization phase and load directly an already created Saphir file SapGS02.ks3 that you will find in the installation Examples directory.
The session will cover the building of a manual model and pick options, KIWI and multiple models.

B01 • Pseudo steady state double porosity

Launch the application. Saphir has already been installed either as stand alone or as part of the Ecrin suite workstation. In case that you are running the workstation, click on the icon and then on icon to open the file, in case Saphir is running as stand alone click directly on the icon. Browse to the Examples directory and open SapGS02.ks3. Your screen should look like Fig B01.1.

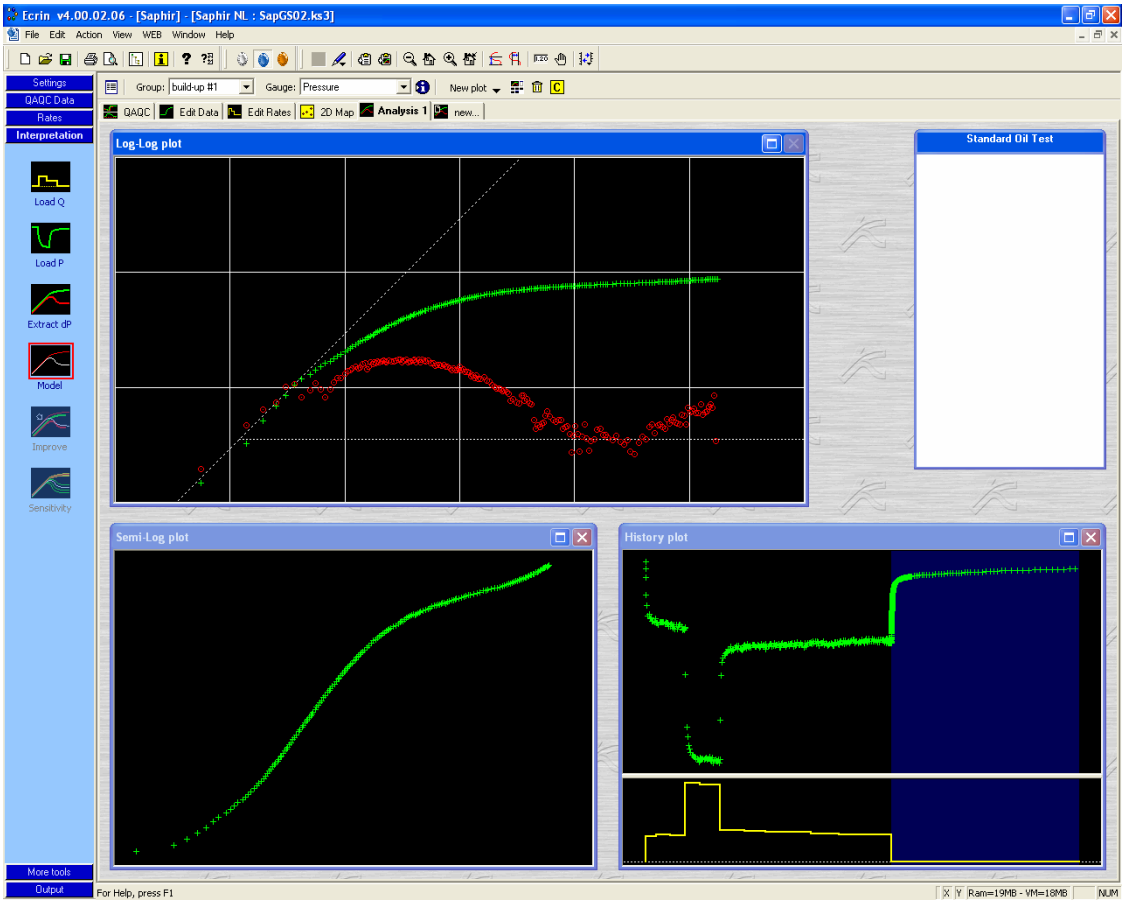


Fig B01.1 Saphir main screen

The pressure derivative shows the typical trends of a reservoir with pseudo steady state double-porosity. However, none of the theoretical stabilization levels is apparent in the data. In a double-porosity (or 2 layer) model, IARF (Infinite Acting Radial Flow) must correspond to radial flow in the total system. The final diagnostic (the decision as to which interpretation model may be the most appropriate) can only be made after the interpreter has fixed the level of the IARF flow line (the dotted white horizontal line). In this case as the shape of the derivative curve indicated the response from a double porosity reservoir it is obvious that the white dotted line has to be moved above the tell tale valley in the derivative. This can be achieved by simply click and drag in the loglog plot moving the white dotted line to correspond to the very end of the derivative curve. You can also use the semilog straight-line option and regress a line in the loglog plot through the end of the derivative data.
Maximize the log-log plot using a double click in the plot header. Define a semilog line at the end of the derivative; right click in the log-log plot to access the popup menu, Line > Regression. Click from your chosen start of the semilog straight-line and click again at the end. The maximized loglog plot reverts to the semilog plot automatically. De-maximize the semilog plot and return to the maximized loglog plot. Now you can reset the match by using the  icon, the pressure match snaps to the IARF straight line making the semilog slope and the pressure match consistent. Fig B01.2.

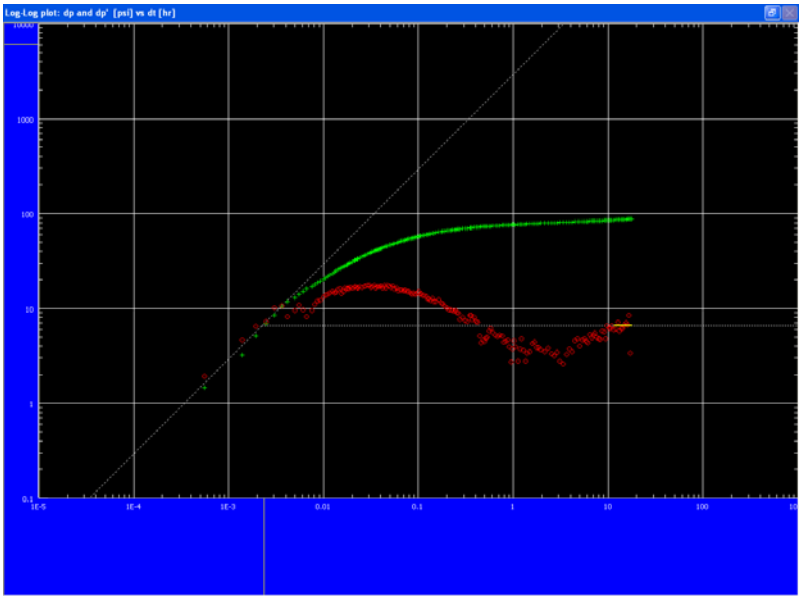


Fig B01.2 Loglog plot

The semilog straight line is shown in the loglog plot as a yellow line, and this line is also shown in the semilog plot as illustrated in Fig B01.3.

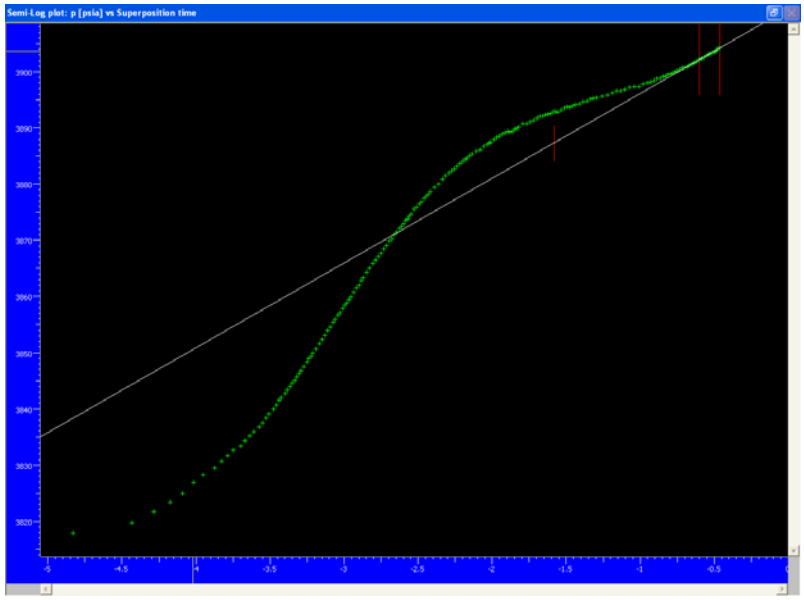


Fig B01.3 Semilog plot

The next step in the workflow is to generate the model that will fit the well response. In most cases the best approach is to generate an automatic model to estimate the skin, however the automatic model is always the model with wellbore storage and skin in an infinite homogeneous reservoir and does not include the effects of double porosity. The automatic model will therefore not immediately match the response as seen in Fig B01.4 but at least provide a close estimate of skin.



Fig B01.4 Loglog model match after automatic model

The next natural step is to define the model manually. Select the model dialog and choose the reservoir model to be Two Porosity PSS. Fig B01.5

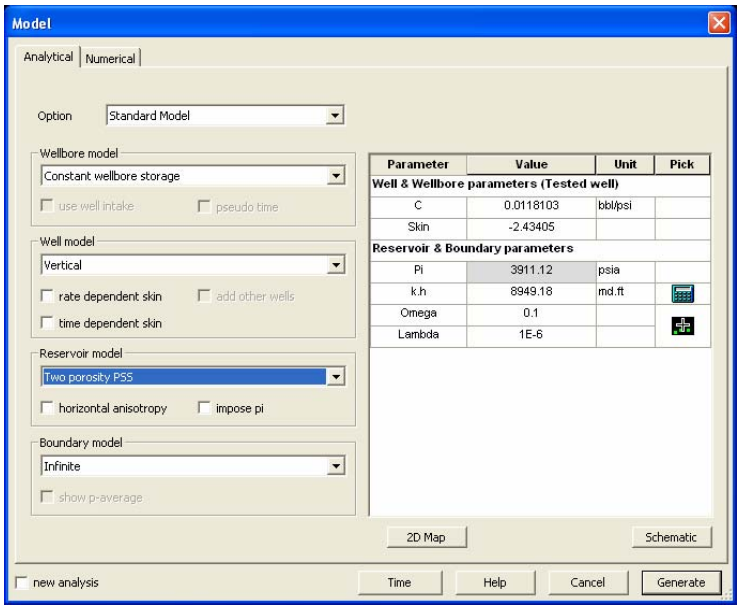


Fig B01.5 Model dialog

To estimate the values for Omega and Lambda we will use the pick option , move the mouse to fit the valley of the double porosity response as seen in Fig B01.6.

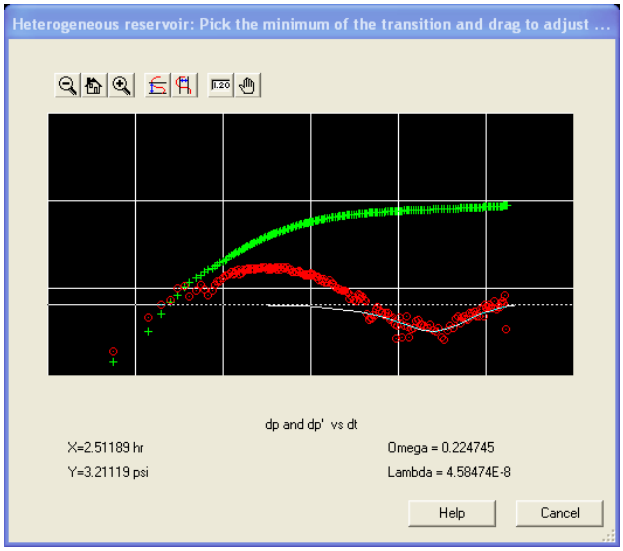


Fig B01.6 Pick option

Note that setting the IARF at the proper level is critical for the pick option to work.

Now generate the model again, a near perfect match is obtained as seen in Fig B01.7.



Fig B01.7 Model match with double porosity

Pick options exist for all the built-in models and provide a quick estimate of model parameters. By starting with a good first estimate the non-linear regression (Improve) will be made more efficiently.
We will improve the model match using the option improve. Click on manual improve and let all the variables but the permeability, run. The result is illustrated in Fig B01.8.

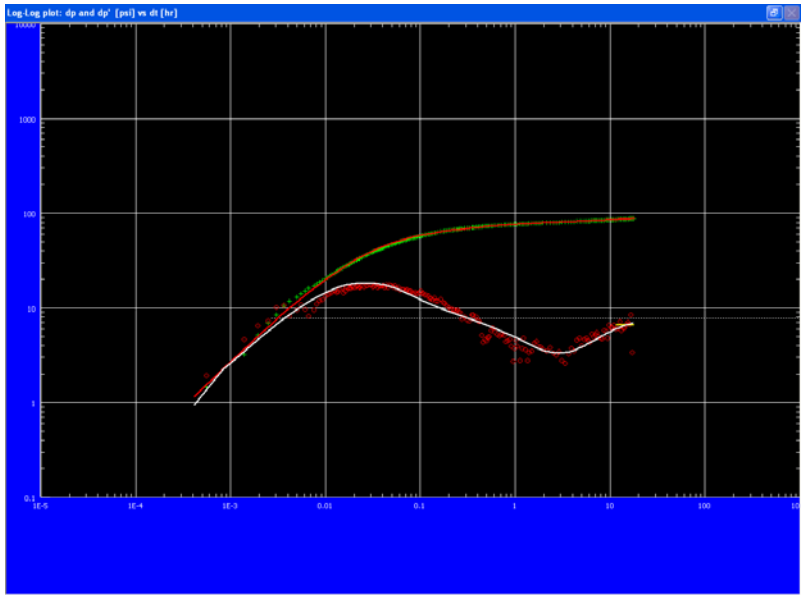


Fig B01.8 Final model match double porosity

B02 • Kappa intelligent well test interpretation (KIWI)

KIWI is an Artificial Intelligence (AI) module, an interpretation model advisor, aimed at helping you to make quick interpretations by suggesting possible analytical models and estimating the relevant parameters. It can also be used as a training tool or simply to "ring a bell" from time to time and remind you of possible alternative interpretation models.

KIWI does NOT have ANY knowledge of the geology, the geophysics, the history of the field or any other information on the reservoir and fluids. KIWI bases its analysis purely on the shape of the derivative and gives you a list of models (with parameters) that may reproduce the shape of the derivative, it is your decision as to what makes sense physically.

KIWI is NOT a substitute for user judgment and common sense. The only time that it does not give you a CHOICE of solutions is in the case of homogeneous infinite behavior.

KIWI is only enabled when there is a single dP set displayed. It is disabled if several gauges or several groups are displayed.

The KIWI option is not enabled in case of Multilayer or NonLinear numerical analyses.

When KIWI is invoked the first time, a Loglog plot is created on which the trend identification is done. The data is plotted together with a sketch (in white) and a spline (in yellow). The cubic spline fit is made on the sketch and non linear regression minimizes the curvature. After this pre-processing, the spline provides a (hopefully) smooth description of the response that can be used for model identification. The response is represented as "sections" characterized as Up, Down, Flat, etc.

Immediately after, the symbolic description and the spline are passed to the knowledge base module. The description of analytical model components is embedded in this module together with rules defining how they can be combined. In addition, each model is associated with quantitative constraints expressing slopes of characteristic regimes, etc. Upon completion of the search, a dialog pops up listing the possible interpretation models found by KIWI.

When a KIWI plot already exists, pressing the "KIWI" icon of the control panel calls the dialog with the list of solutions. KIWI specific options can be accessed directly in the plot pop-up menu (right-click on the plot).

Choose a new analysis by clicking on the tab new 

, choose to start “from nothing” and re-extract the loglog plot.

Open the 

panel (page) and click on the KIWI  icon. The loglog plot with its sketch and spline is made automatically and transparent to you but immediately you will se the suggested list of models. In the list illustrated in Fig B02.1 it can be observed that the first choice made by KIWI is indeed a double porosity model, however the PSS model is only the third choice.



Fig B02.1 KIWI list and plot

Choose the last choice in the list which is the 2-Layer (or double permeability) model. This model is equivalent to the double porosity PSS model when the permeability in one layer is negligible.
Generate the model and launch the improve option running on all parameters. The model match in this second analysis using a different model is excellent as illustrated in Fig. B02.2.

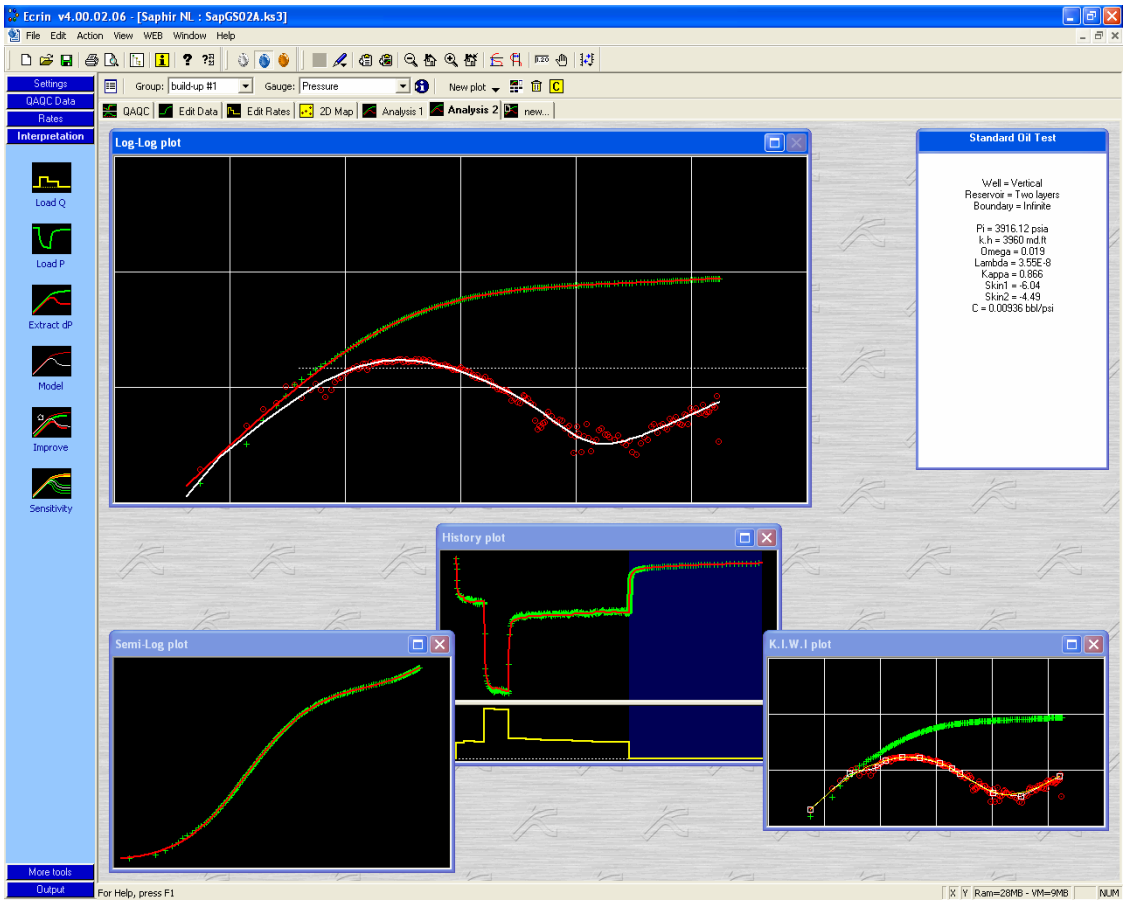


Fig B02.2 Saphir screen, match with the 2-layer model

You can keep on adding new analysis 

and call the KIWI list by clicking back on the KIWI icon , choose another model and build your cases like this. In the end you can compare all the analysis. Maximize any of the main plots in the Saphir screen and click on the  icon to display all the models on the same plot. This is illustrated in the loglog plot in Fig B02.3.



Fig B02.3 Compare analysis