Updates 26_22 New Log Viewer and Some minor 2D enhancements

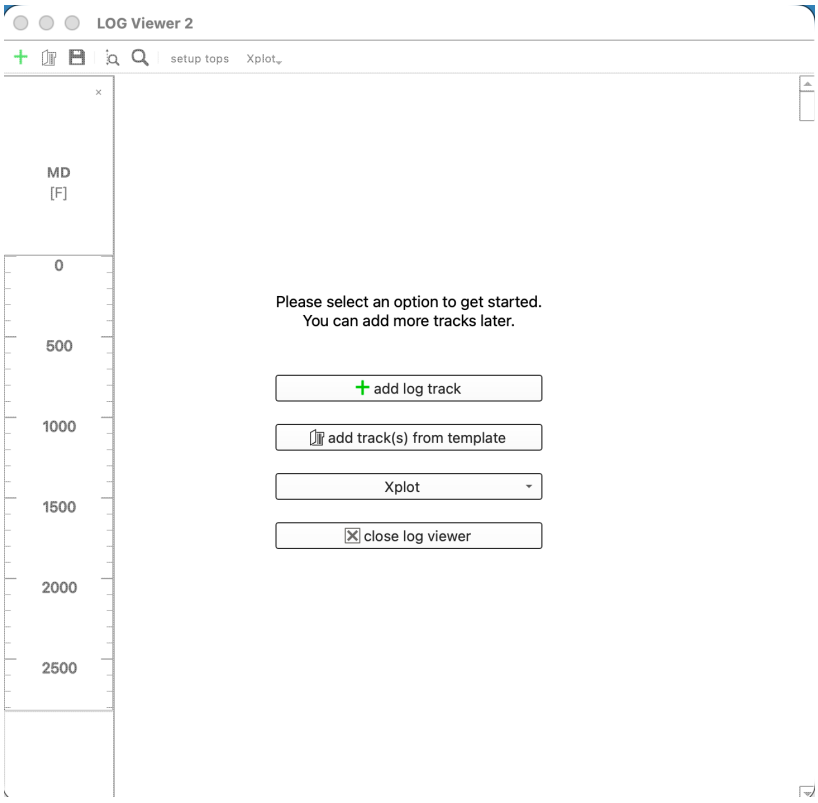
LOG VIEWER

On the main launcher window, there is a new button on the right-hand panel near the bottom. The button is labelled, “open log viewer (new)”. This viewer provides more features than are available in the LAS Viewer. However, for now, the LAS Viewer remains, but it may be removed in subsequent versions. One of the functions in the LAS Viewer, the filtering options, is not available in the Log Viewer, so if you want to filter your logs, do so in the LAS Viewer and save them. You can then see them in the Log Viewer.

The main features of the Log Viewer are that for a single well, you can open multiple tracks with multiple logs in each track. You can also open multiple wells with a single track each or multiple wells with multiple tracks each. With multiple wells open, you can adjust to the kb so as to have a elevation (subsea) structural cross section display which allows you view the structure from the well logs. Tops can also be displayed. At this time, there is no top picking capability, but it may be available in subsequent versions.

IMPORTANT POINT: All wells, LAS files and tops MUST be loaded with a consistent UWI. That includes using any and all trailing zeros, etc. If this loading procedure is not followed, the full functionality of the Log Viewer will be compromised.

When you click on the “open log viewer (new)” button, the following window opens.



First, one needs to choose one of the options available in the body of window. 'Add log track' allows one to choose an LAS file and then a log or logs from that file. After that window is open, you can add additional logs to that track. One should not mix logs with different types of scales (linear or logarithmic) in the same track. Don't worry if you don't get all the logs you want in that track or if you get logs you don't want in the track. You can add or remove logs later by right clicking on the track.

The second opening option is to add a track or tracks from a template. Obviously, if you haven't created a template, you don't have that option yet, but it is a time-saver. Create templates.

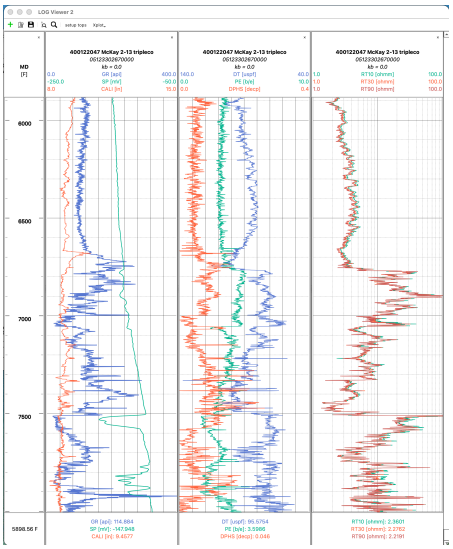
The third button allows one to immediately go to the cross-plot option. Here you have the choice of the standard cross plot…any two logs from the same well and a third log as the point color or a Pickett plot.

The last button is pretty self-explanatory…close the log viewer.

Now let's look at the top menu bar which comes into play once one of the primary buttons is selected. Some of these buttons duplicate the opening actions, but there are some additional features.

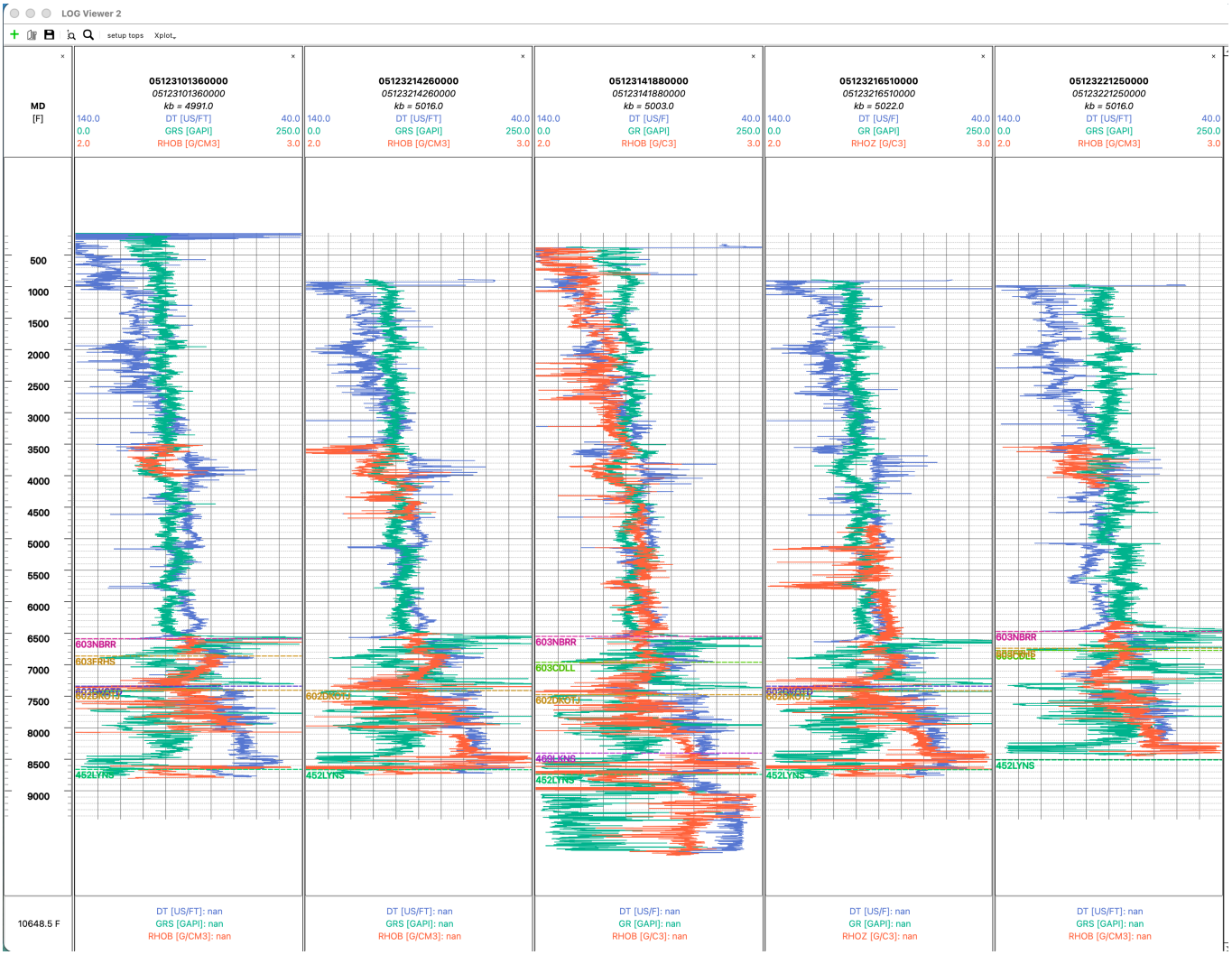
The top menu bar has a + symbol to add log tracks, an open symbol to open templates, a disk symbol to save templates, a zoom out symbol, a zoom symbol, setup tops and xplot dropdown with a basic standard cross plot and a built-in Pickett plot.

Below is an example of 3 tracks from a single well (LAS file). Notice two of the tracks have linear scales and one has a logarithmic scale. The linear scale always has 10 divisions for every log, so one has to do a little mental arithmetic to determine the scalar per division, but subtracting min from max and dividing by 10 is pretty straight forward. There is a maximum of 4 logs/track.



Right clicking on any track, opens a window that allows you to add a log, configure the range of values for all of the curves displayed (check box for logarithmic), configure the curves with different colors, line thicknesses and whether to fill from right or left, if desired. If you have more than one curve displayed, there is also the option to remove a curve.

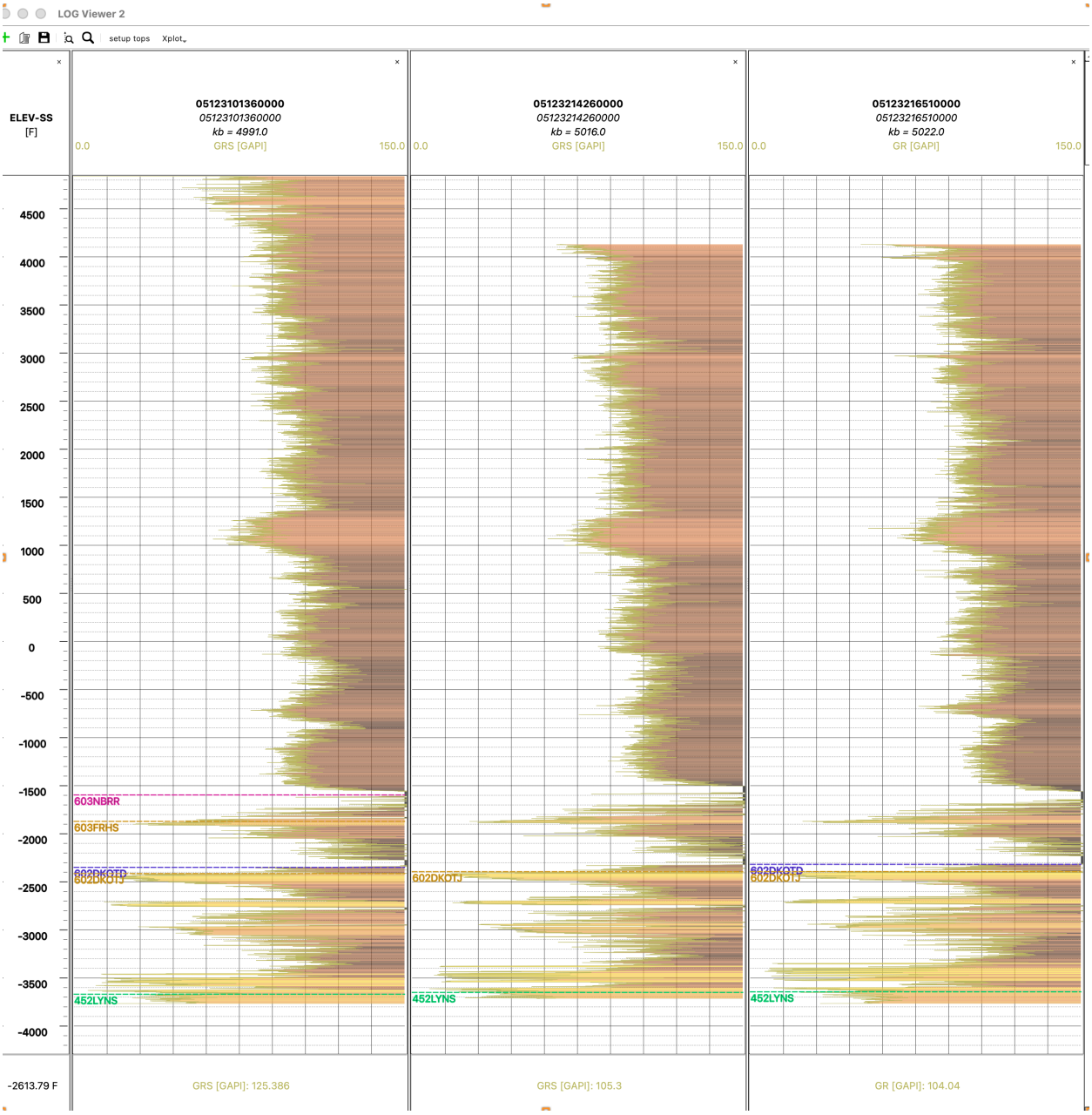
Below is an example with multiple wells with multiple logs (sonic, gamma ray, and density) from each well in a single track. The first well was loaded, the ranges and curve paraments were set, and the track was saved as a template. The other 5 wells were added by going to the open template icon (2nd from left), and choosing an LAS file, one also chooses the template from the dropdown. After the first time it is chosen, it defaults to the same template. If the LAS file has logs with the same name as the template (DT, GRS, RHOB), then the logs will load automatically. If there is no log with the same mnemonic as the template, it will ask you to choose a substitute (or if there is no good substitute, skip the log). Notice on the 3rd log from the left, the gamma ray is GR and not GRS, while on the 4th log from the left, the density is RHOZ and not RHOB.



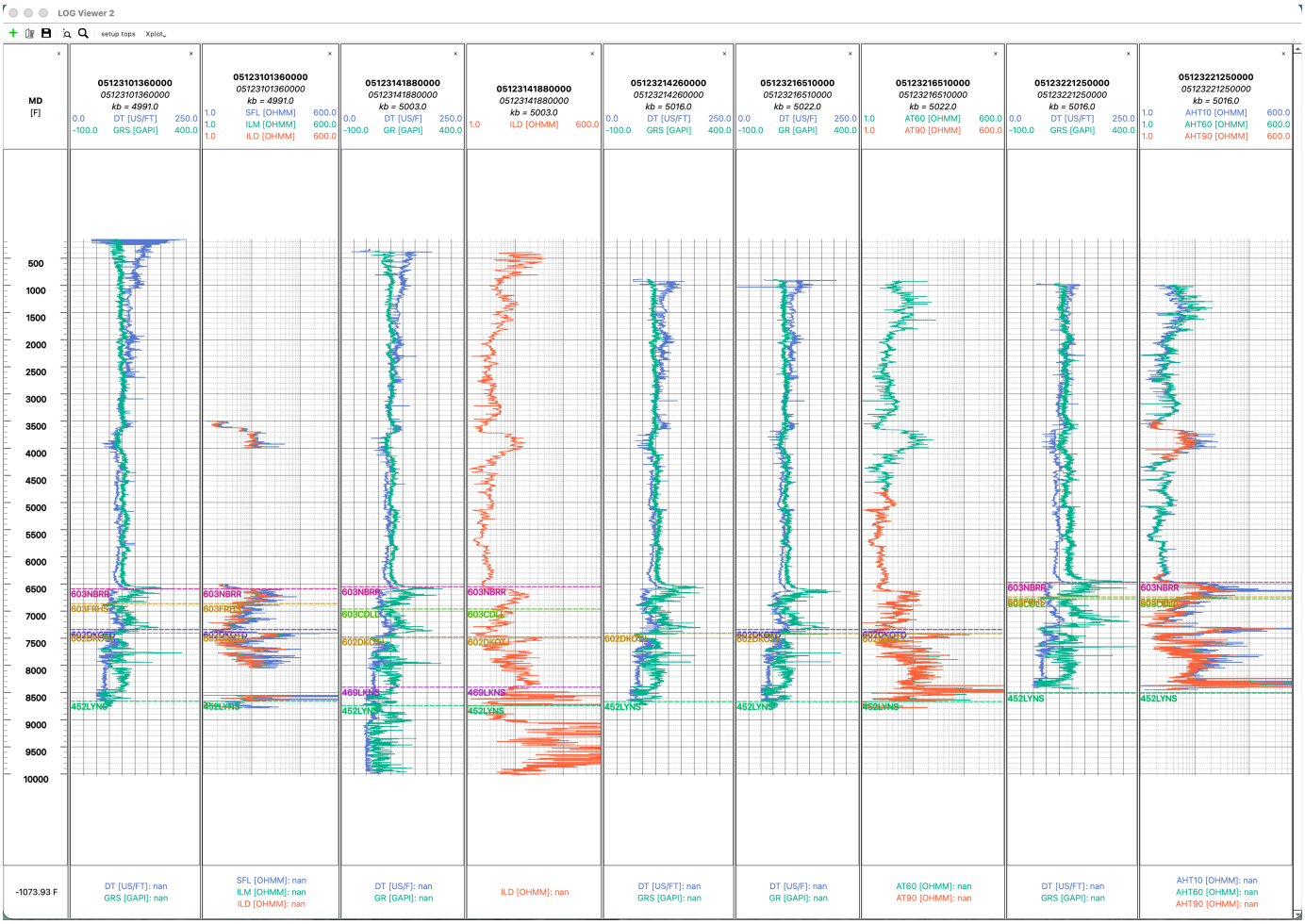
Note that I have only one track per well. However, when you are building your cross section, you can have multiple tracks per well and save them as a template. The more complex your template, the more likely you will have to choose different mnemonics for additional wells. Notice that the above log section has tops marked. If you have tops loaded and choose the 'setup tops' in the menu, the window below appears. You can choose individual tops or select all tops. You can also use the 'unselect tops' to remove tops.

In the figure below, I have chosen to display only the gamma ray log from each well. I first loaded the gamma ray (no matter the mnemonic) so that I could set a standard scale and choose a color bar to fill the curve from the right. I chose a new color bar that I created, yellow_brown_black, using the Colortable Editor (top menu under Tools). I wanted it to graphically represent clean-sand_dirty-sand_shale. In order to not have to choose the parameters each time I opened a new log, I saved the set up as a template. After setting up the cross section, I right-clicked in the depth track and chose 'configure depth axis'. This gives me options to set a depth range to display, and also the scale setup. One can configure the scale to what one desires. If you are displaying multiple wells as in the example above, you will notice that maximum depth defaults to the maximum depth of the 1st well. This can be changed by setting the 'stop' depth manually to a deeper value or by clicking the button 'get from data' which will choose the deepest log depth for all the wells displayed. Also, at the top of the window, there is a drop down to select the scale either as MD or Elevation relative to sea level. In order for this to work accurately, a KB must be loaded for each well. Below, the displayed log section has all tops selected and each log is adjusted for its KB. This results in a structural cross section. Notice that the scale bar has changed and I have zoomed in on the deeper portion of the log.

To zoom in on any area interest as in the section below, one can zoom by using the magnifying icon in the menu bar, or by holding ctrl and the left mouse button and highlighting the depth range to zoom. On Macs, use the command key instead of ctrl with the left mouse button.

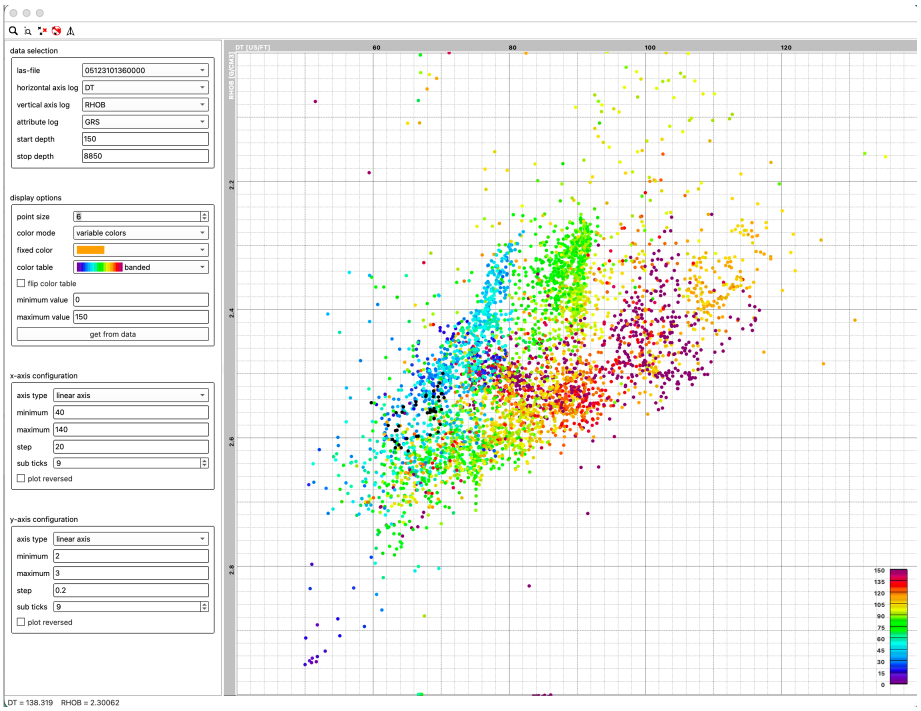


One is not limited to displaying only a single track for multiple wells, in the figure below, there are two log tracks displayed for each of the wells, except for the middle well which did not have any resistivity logs. Each of the other wells has a linear log track with DT & GRS and a logarithmic log track with an assortment of resistivity curves depending on what was available. The tops for each well are also shown. This display can be converted to a true elevation display by choosing the kb in the left depth track.

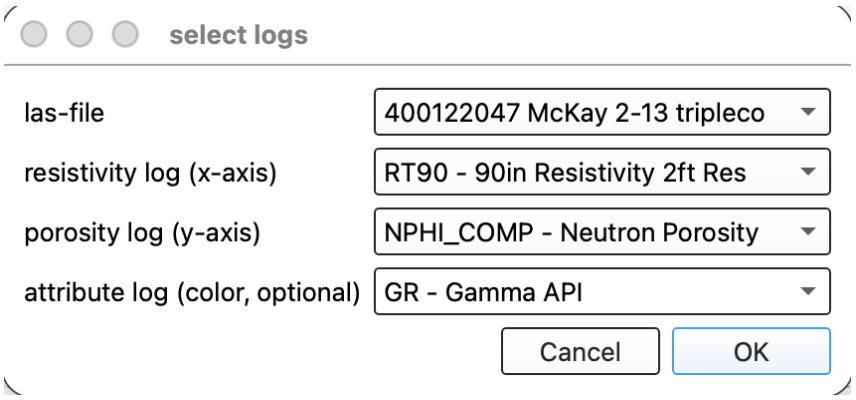


The last option in the upper menu bar is an option for cross plotting. When you click on the symbol, you have two options, 'standard cross plot' and 'Pickett Plot'. In the standard cross plot below, you can choose any two logs for the x and y axis, and a third log (displayed in color) for the vertical axis.

A standard cross plot is shown below. This graph functions very similarly to the previous version in that you select the logs to plot on the x and y axis and can use color for a third log. You can use either linear or logarithmic scales on either axis. The color scale is only a single color or a linear scale for the color bar. As before, you can vary the range on all 3 axes and also the point size.



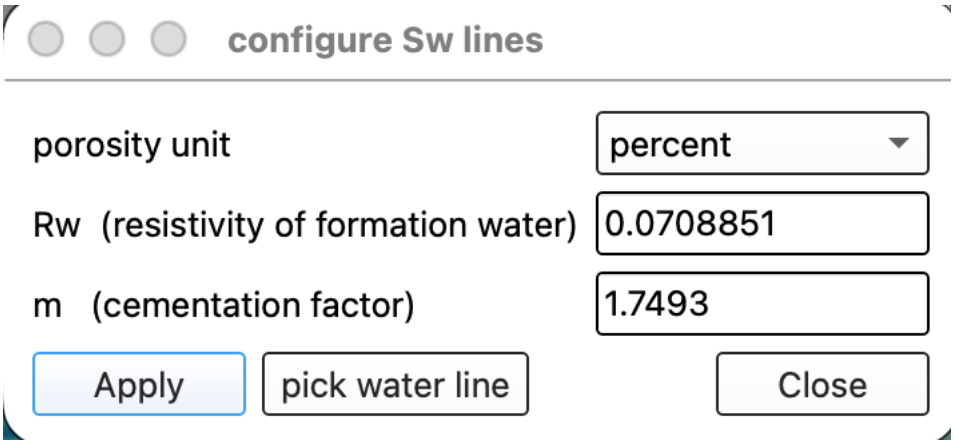
The Pickett plot works very similarly to previous versions with a few enhancements. When you click on the Pickett plot option a window opens (below) allowing you to choose the LAS file, Resistivity log, the Porosity log, and an attribute log. Once those are populated and you hit okay, the Pickett plot opens. There has been an attempt to set the data ranges from the data, but it is not always successful. You may need to adjust the data ranges to get a better-looking plot.

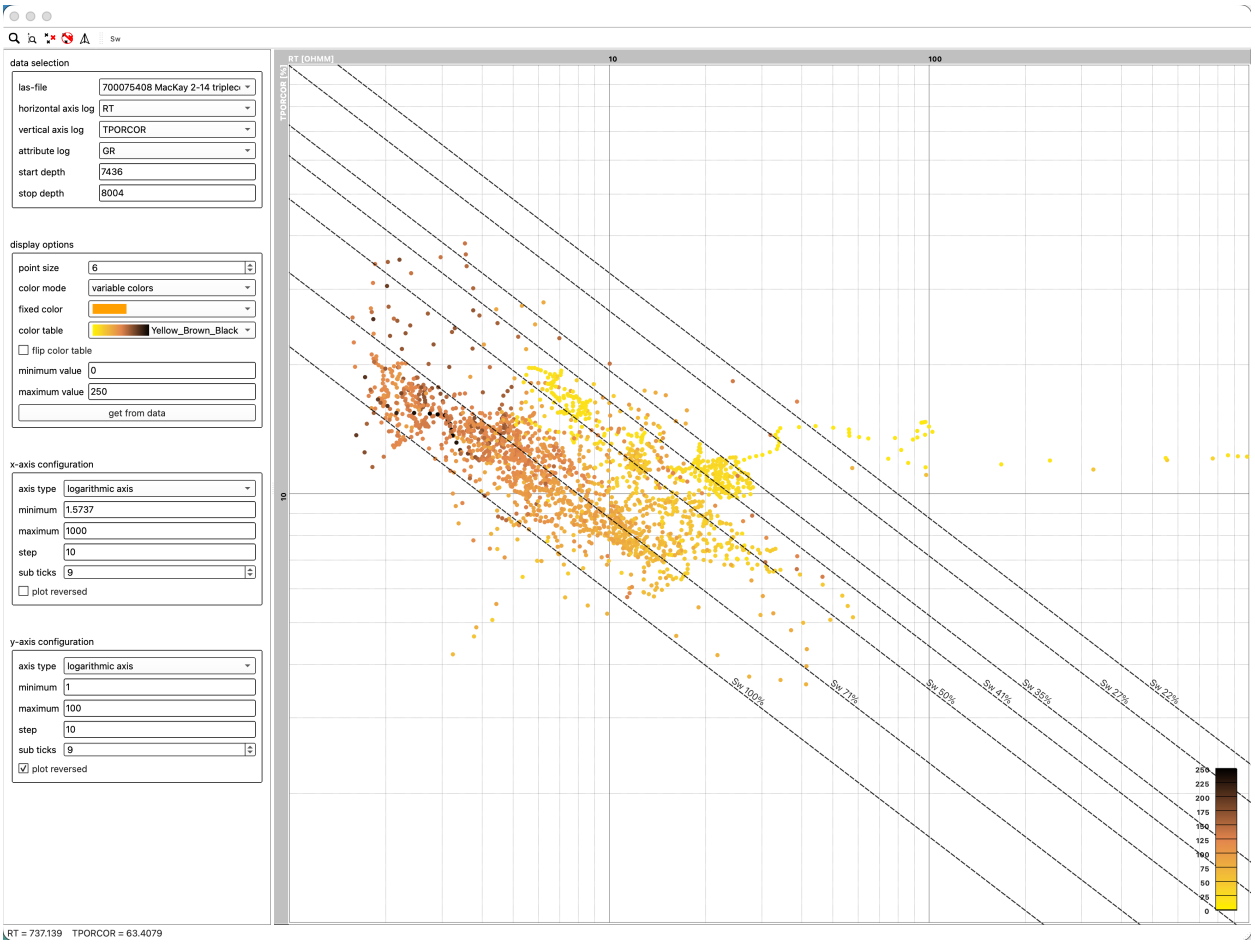


Once the plot has opened (see below), you can adjust the depth range, the color table for the attribute, and refine your scales. Limiting the depth range can be very helpful. Dr. George R. (Dick) Pickett (and Dr. Gus Archie) made it very clear that R_w can vary for different formations. Therefore, to get a reasonable result it is often useful to limit the depth range which I have done.

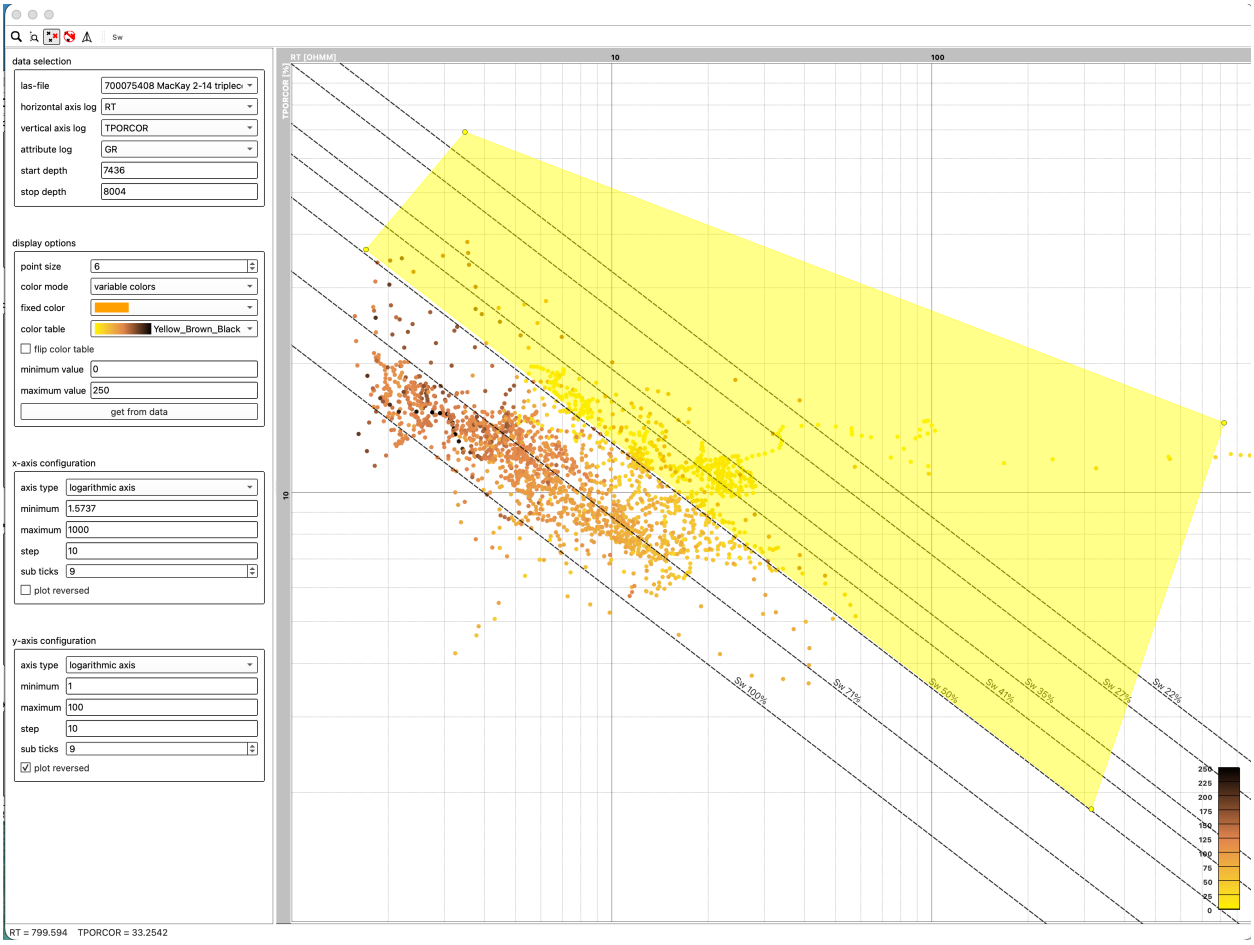
After you have a plot and you are happy with it. You can start doing a little analysis. Click on the S_w button and the window below opens. Look at your data and decide where you are going to draw your 100% water line. Click on the 'pick water line' and draw a 100% water line. You draw the line by choosing a start point (line can be short or long), hold down the mouse button and draw the line. The R_w and m value are automatically calculated. If you don't like the results, click on the 'pick water line' again and redraw. Keep this up until you are satisfied. Sometimes this is easy, but sometimes it isn't (remember R_w often varies with formation). The resulting plot shows lines for various water saturations. The third icon from left allows one to select points. Select any number of points by drawing a polygon around them. If you don't like your selection, you can delete them by clicking on the 4th icon from the left. If you like them, you can click on the 5th icon from the left and the points will be projected to the well in your display as a yellow highlighted area.

I experimented and ended drawing the 100% water line shown in the figure below. Notice the 'configure S_w lines' box is now populated with the valued for R_w and m. Note also the first box says that our porosity is in percent. This is automatically selected (percent or fraction), but there be time that you have to override it.

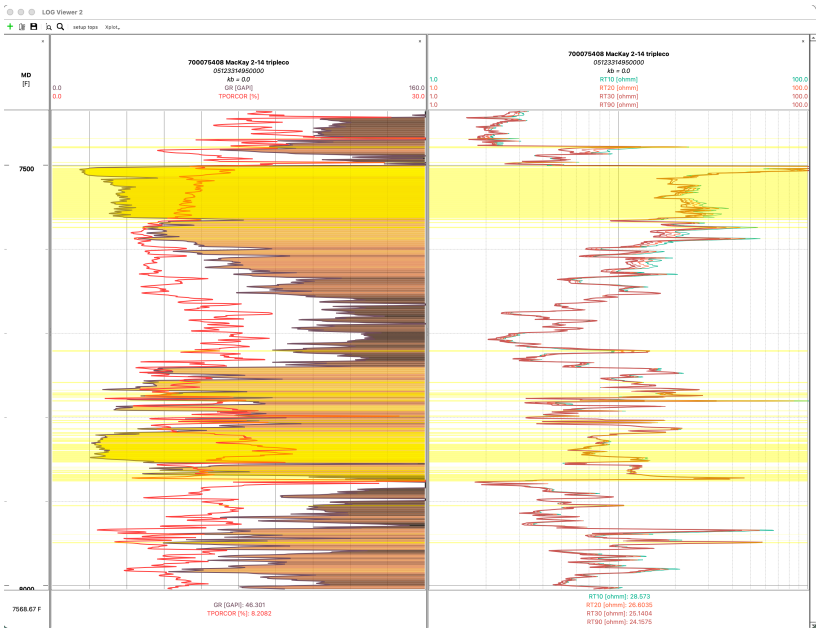




In the figure below, I clicked on the point selection icon (3rd from the left) and selected all the points with less than 50% water saturation and projected them to the log plot.

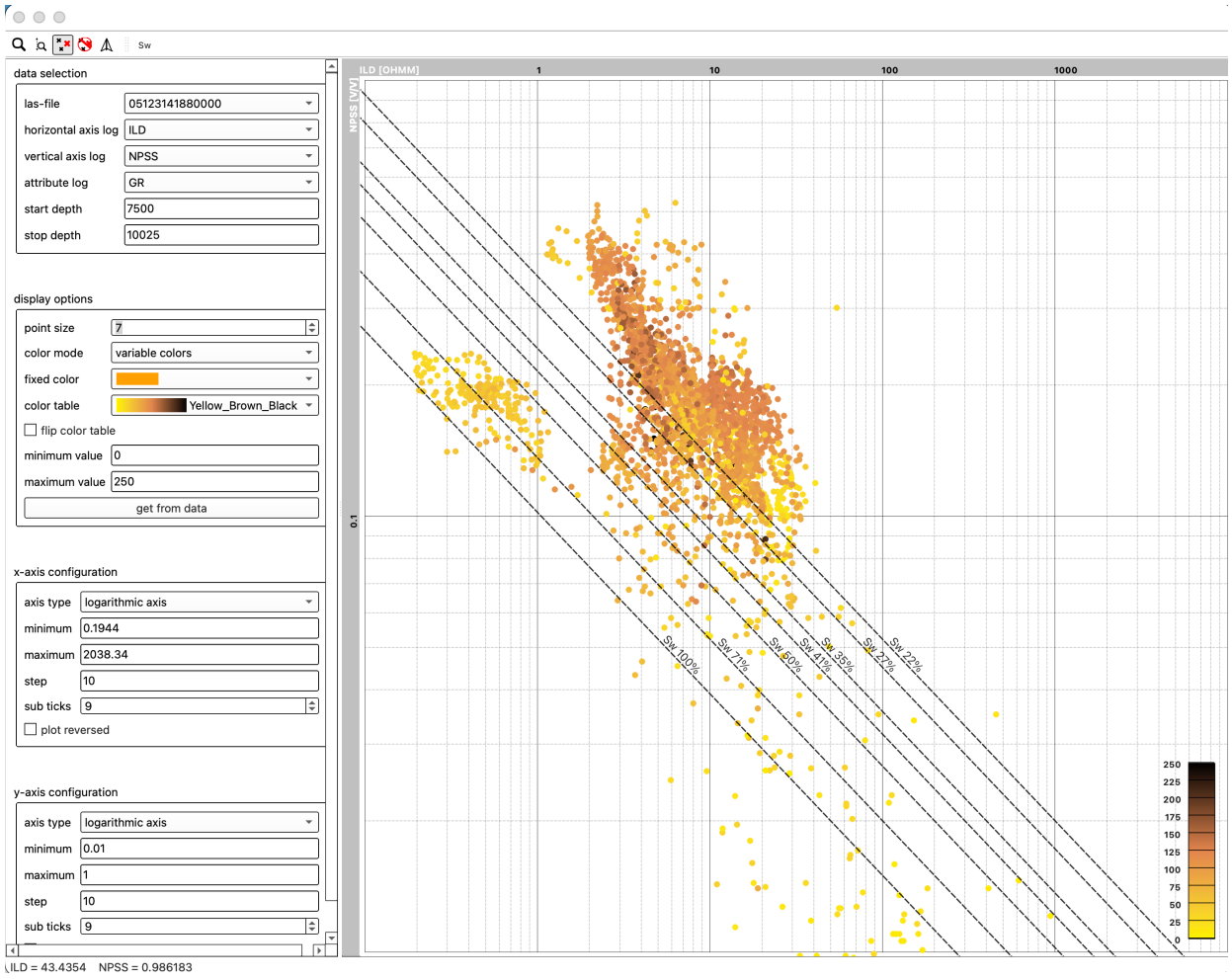


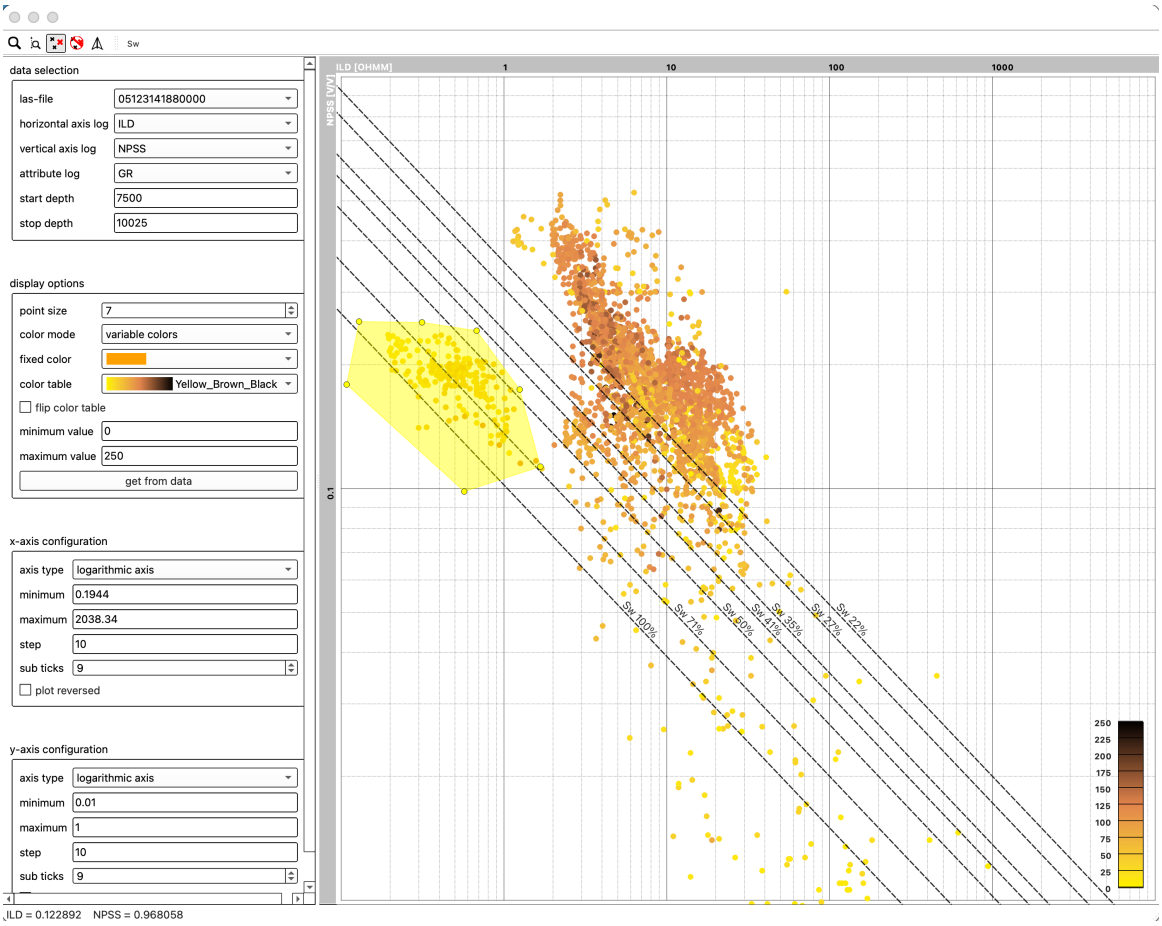
Below are the logs for the cross-plotted well. The yellow bands that go all the way across the track show where the selected data points fall.



The following figures illustrate some of the possible problems if one blindly takes the points further to the lower left on a Picket plot as the correct R_w. In the example, the points to the lower left, when selected and projected to the logs plot in the clearly wet sand at a depth of 8750 to 8850 ft. This can't be the correct R_w for all the data on the plot (about 2500 ft of section), or the plot would indicate that almost whole interval should be productive, and yet the well was a dry hole.

In the very rare case, there may not be a water line. As a student in Pickett's class, he gave us a log to analyze. It was hand-plotting days, we plotted up the data for a few 100 ft…we had a perfect water line, a straight line, almost no scatter…a dry hole. Then Dick pointed out to us that the log was from Ghawar, the world's largest oilfield. Several 100 ft of oil…no water. The point was you have to think about the plot you are using and all of the other data available to you.

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display options
point size
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color mode
variable colors
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color table
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x-axis configuration
axis type
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plot reversed
y-axis configuration
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ILD [OHMM]
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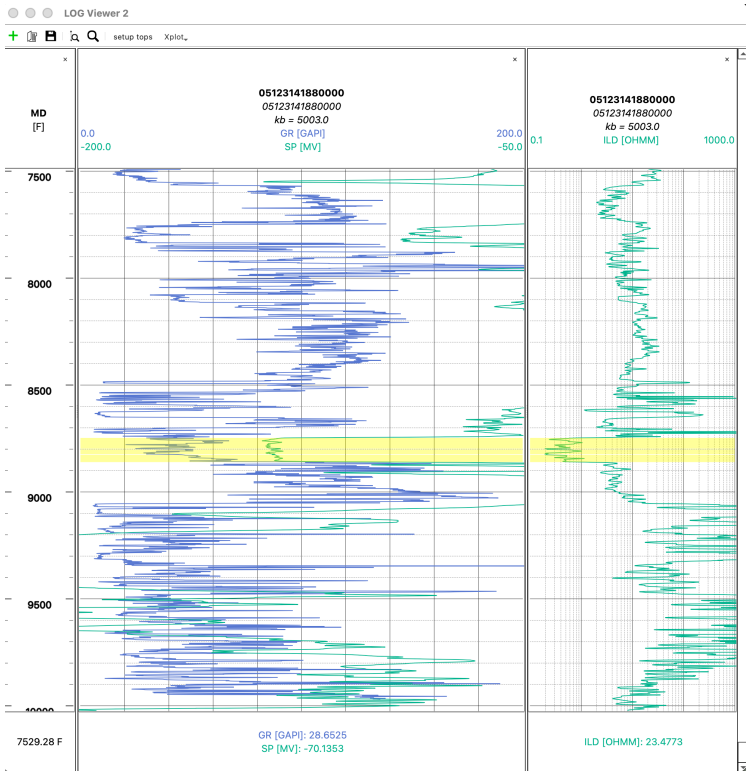
LOG Viewer 2
setup tops
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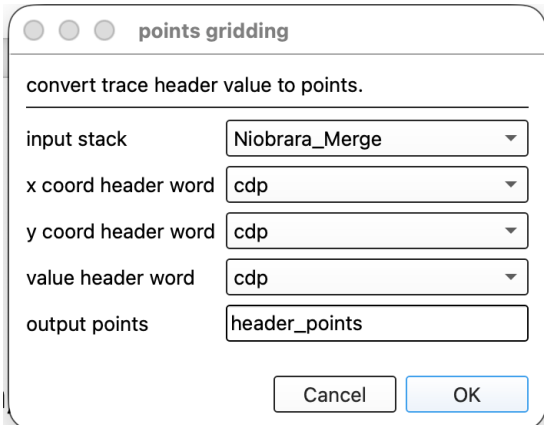
2D SEISMIC LOADING

When you now load 2D seismic data, there is a new default header word to load the shot point number (we call it ep, energy point, to be more general). This was possible to do before, but you had to add a header word manually. However, loading the ep doesn't give you any real information. For 2D (and 3D), the only coordinates that you are usually provided are for the CMPs. These do not provide the locations of the EPs. If there coordinates for your EPs (generally labelled sx and sy) in your SEGY file, then you can add the header words for those and sx and sy will load. Then to generate the option to display the EPs, one would go to the 'processing' button on the main window and select 'convert header values to points'. The figure below shows this dialog box. This process generates a points file for the EP locations using the data imported from SEGY.



The other option is to ask your processor to generate a *.SP1 file. Depending on how they output it, you might be able to directly load it using the 'import points' option under 'add data'. However, the file may also require some massaging in Excel to produce a useable text file. Once it is loaded the resulting points file can be displayed on a map.