MANUAL

Instruction manual

LogScope is Windows and iPad application software that has been developed by

Harvey Rock Physics
10497 Town & Country Way, Suite 700
Houston, Texas 77024
Tel: +1 713 239 1107
Fax +1 866 283 2218

Level 28, AMP Tower
140 St.Georges Terrace
Perth, WA
Tel. +61 8 6102 6245
Ph +61 8 6102 6245 Fx +61 8 9240 5676
info@logscope.net

LogScope well log display is an application what can also be used to do well log analysis which can be purchased at low cost to process logs.

Revision Version	Revision Date	Comments
1.0	19/01/2015	First manual
1.1	6/05/2015	Revision to add depth shifting, text editing zones regions scripting solver and equations
2.0	04/09/2016	Update consolidating iPad and Windows manual into one document. Includes addition of new features listed below.

Contents

1 Introduction

LogScope is a package developed by Harvey Rock Physics (HRP). The main purpose is to allow importation of a LAS, DLIS or LogScope archive file from email or a cloud based service and allow display, annotation and analysis of the data before exporting as a graphical scaled plot (e.g.: PDF) or as a data store (e.g.: LAS, DLIS and LogScope archive).

The data is stored locally on the Windows or iPad device and the limitation of number of files is governed by the maximum amount of free space on the device.

It is composed of several modules, which can be licensed:

- Basic Display Module
- Export module
- Log analysis module
- Solver module
- Scripting module
- Deviation module
- DLIS module

These modules are presented in the following easy to identify packages as shown in Table 1.1

LogScope

Module	Option	Download	Basic Module	Basic Plus	Advanced Bundle	Advanced Bundle Plus	Advanced Display	Solver	Scripting	DLIS
	Display LAS	✔	✔	✔	✔	✔				
Display	Add Curves		✔	✔	✔	✔				
	Add shading		✔	✔	✔	✔				
	Add text		✔	✔	✔	✔				
	Create Crossplots		✔	✔	✔	✔				
Export	Export plots		✔	✔	✔	✔				
	Export Data		✔	✔	✔	✔				
Advanced	VDL/Waveforms				✔	✔	✔			
	Colour Images				✔	✔	✔			
Deviation	Deviation Plot		✔	✔	✔	✔				
Log Analysis	Log Analysis			✔		✔				
	Zoning			✔		✔				
Solver	Simple equations							✔		
Scripting	Python Scripting								✔	
DLIS	Import/export				✔	✔				✔

Table 1.1 – Module Selection

The main graphics module reads in a LAS file from email or your favorite cloud service and it automatically loads the file into LogScope using a default template, which can be edited and saved.

The log analysis module permits a basic single zone log interpretation to be performed on the data. Any or all of the steps can be executed provided the appropriate logs are available. HRP recommend that the full log analysis suite be run to achieve a balanced result. Supplementary basic unit conversion and linear and logarithmic functionality is included.

The LAS/CSV export module provides the ability to export or email the results to colleagues as well as export and email custom templates to other users of LogScope.

2 Accessing LogScope

LogScope requires a registration in order to access the functionality built in and the functionality is selected by purchasing a module or group of modules.

When the user registers they are required to confirm their registration from an email they will receive from the server. Please ensure you use same email to register and purchase.

Tap or click on the LogScope icon and the user will be presented with the screen shown in Figure 2.1a (Windows) or Figure 2.1b (iPad) shown below.

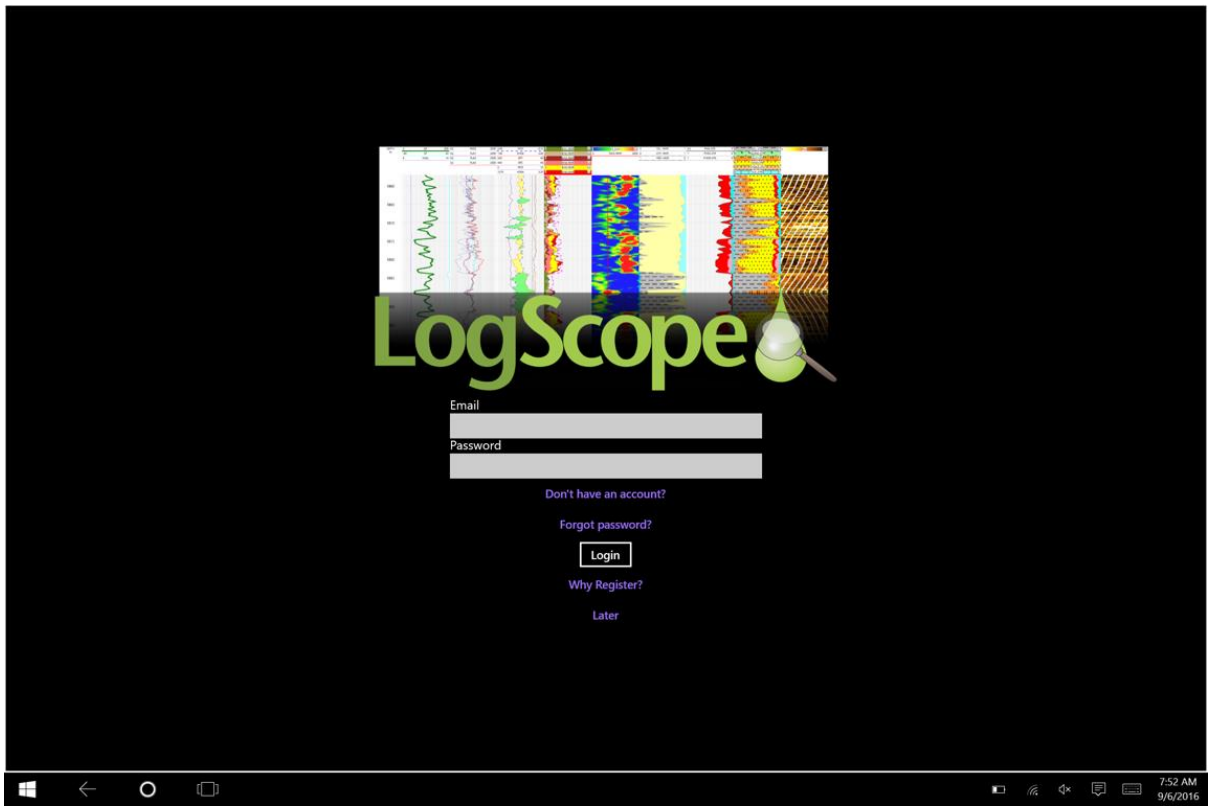


Figure 2.1a – Windows Startup screen

Figure 2.1b –iPad Startup screen

Once logged in the user will be presented with the following upgrade screen and will need to select the option they wish to purchase. Figure 2.2a(Windows) and Figure 2.2b (iPad) show the above option. Tapping on an option will open the web browser and take the user to the desired option for purchase. The subscription for that option will automatically be added to the users account **provided** they use the same email address for login as for the purchase. If not an activation code will be supplied in an email and will have to be entered manually.

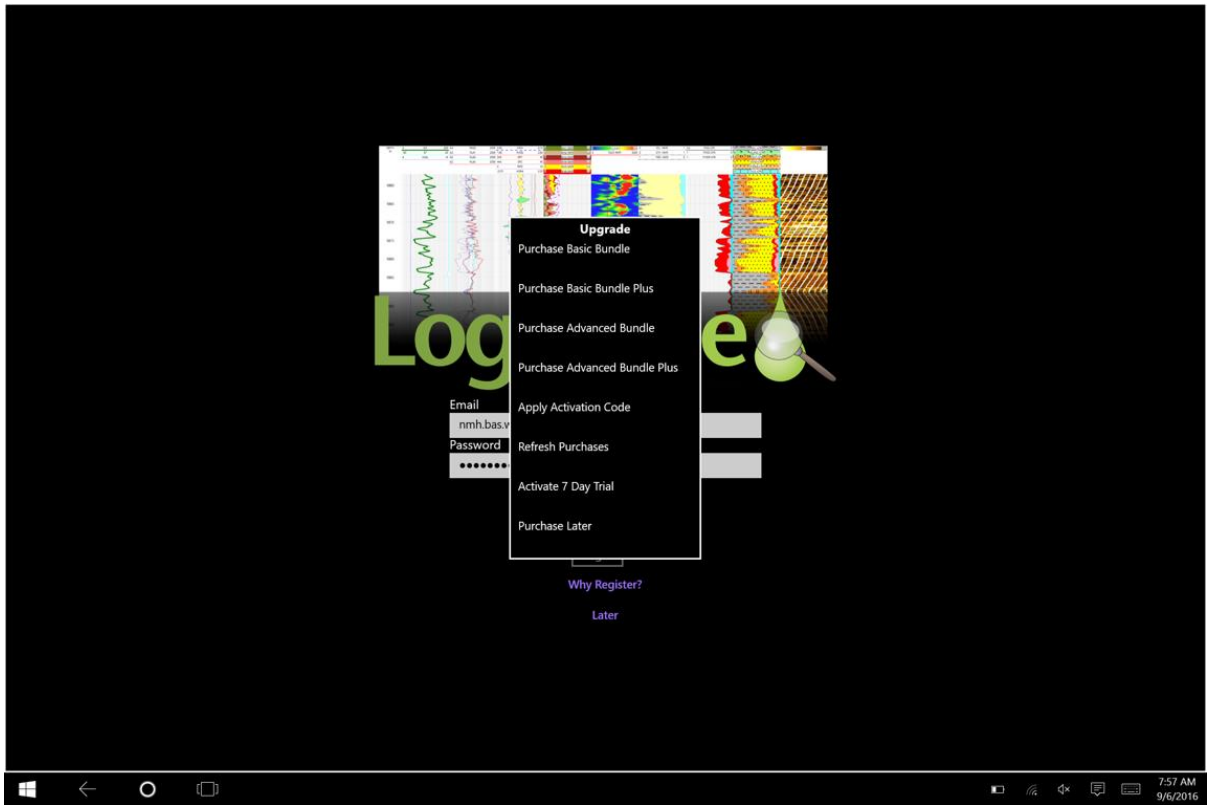


Figure 2.2a – Windows Upgrade screen

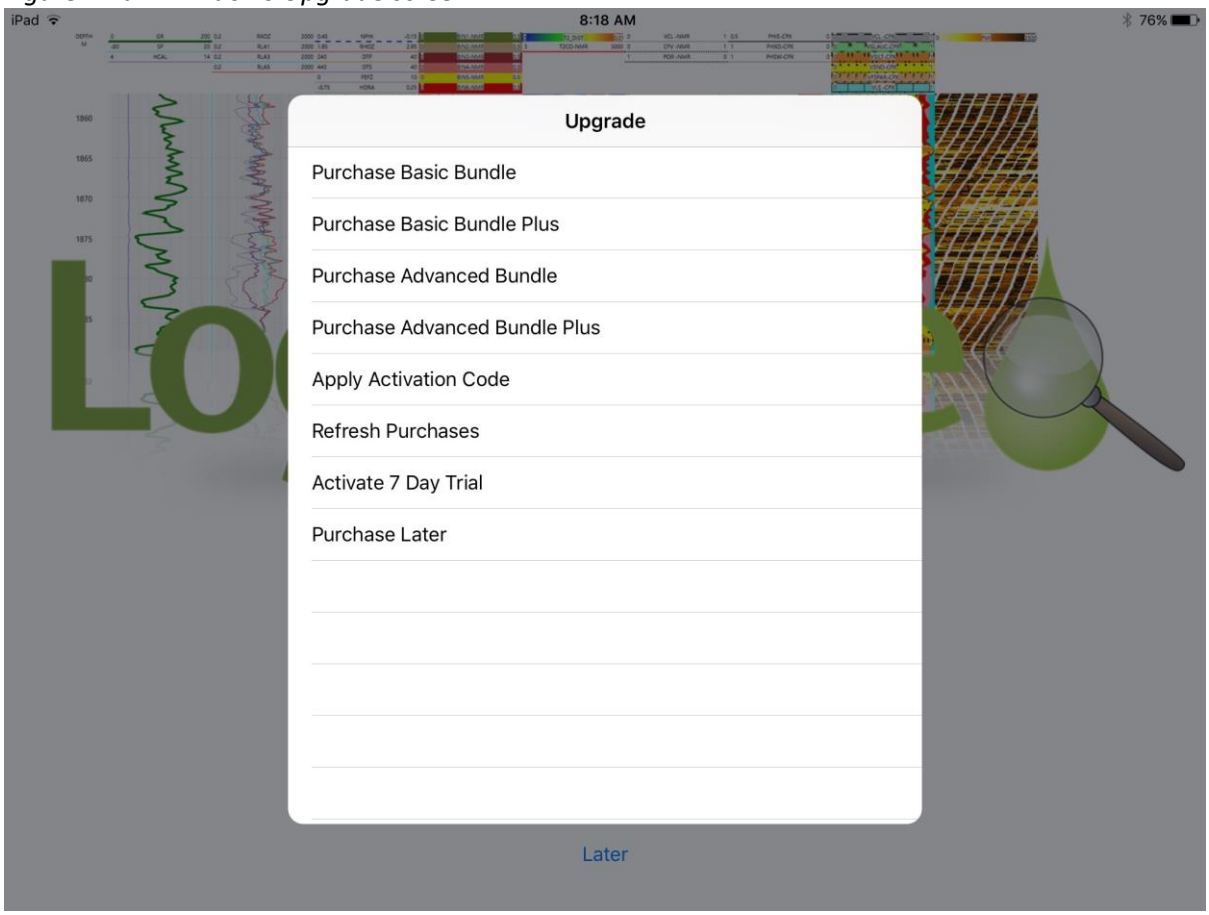


Figure 2.2b – iPad Upgrade screen

3 Common Gestures

3.1 Windows

The menus at the top and base are accessed by swiping down from top in tablet mode or selecting the APPS menu or right click on Windows running in conventional mode.

Selecting a track – simply tap the track and it will highlight in yellow.

Selecting a curve – tap curve title

Selecting shading – tap shading and selecting shading (dialog prompts for shading or track)

Selecting an annotation – tap annotation and select annotation.

Edit – tap to edit selected object (track, curve, shading or text)

Delete – tap to delete selected object (track, curve, shading or text)

Changing scale done using present scales or using two-finger pinch gesture on the plot.

Curves and shading can use text import to find appropriate curve as shown in **Error! Reference source not found.**

3.2 iPad

Selecting a track – simply tap the track and it will highlight in yellow.

Selecting a curve – tap curve title

Selecting shading – tap shading and selecting shading (dialog prompts for shading or track)

Selecting an annotation – tap annotation and select annotation.

Edit – tap to edit selected object (track, curve, shading or text)

Delete – tap to delete selected object (track, curve, shading or text)

Changing scale done using present scales or using two-finger pinch gesture on the plot.

Curves and shading can use text import to find appropriate curve as shown in **Error! Reference source not found.**

4 Loading Data and Project Functions

The initial screen shown by LogScope is the project explorer. It has three sections:

- Projects which is where the wells are stored
- Demo – Demo data set(s)
- Loading.

The user can rename, archive and delete projects. The preferences and account menus are located here as well.

To archive a projects right click or swipe down from top and tap on projects to archive. The archive will be given the date it is created in the form ArchiveYYYYMMDDXX where XX is the number of the archive exported. This is a similar format to that used for individual wells except the user has the option to include global items such as templates, scripts and solver algorithms to the archive. These Archives will have a “g” appended to the name. Note the user has the ability to change archive name at save time.

4.1 Windows

Importing a LAS or DLIS file from email or a cloud service is shown in Figure 4.1.1 below.

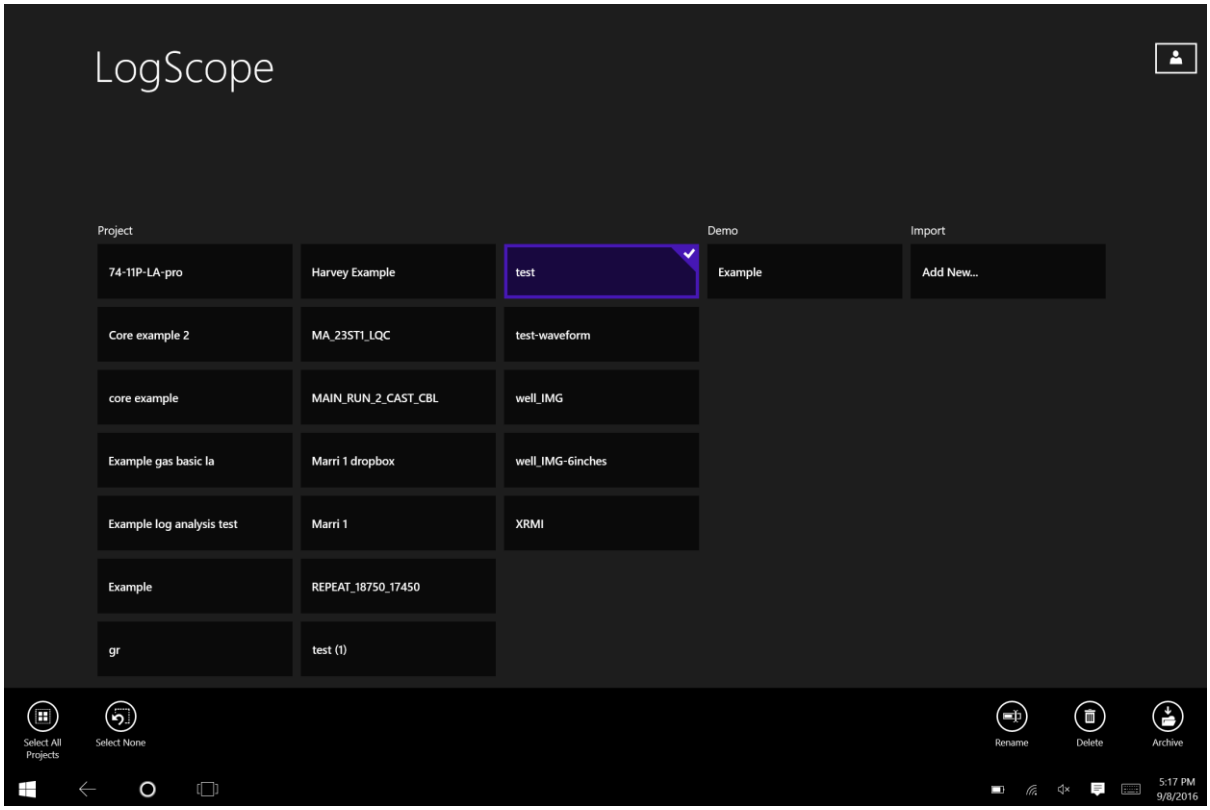


Figure 4.1.1: Importing from mail or cloud application under import tap Add new.

Figure 4.1.1 shows not only the importing but also the functions to delete and archive project(s) to a directory. HRP recommend that projects should be **archived** periodically for safekeeping.

To archive a projects right click or swipe down from top and tap on projects to archive. The archive will be given the date it is created in the form ArchiveYYYYMMDDXX where XX is the number of the archive exported. This is a similar format to that used for individual wells except the user has the option to include global items such as templates, scripts and solver algorithms to the archive. These Archives will have a “g” appended to the name. Note the user has the ability to change archive name at save time.

The delete function serves to delete projects and again multiple projects can be deleted by selecting them by tapping on them.

4.2 iPad

Importing a LAS file from email or a cloud service is shown in Figure 4.1.1 below.

Figure 4.2.2: Importing from mail or cloud application – Tap LogScope.

Once imported the data files are shown as projects in *Figure 4.2.3* below.

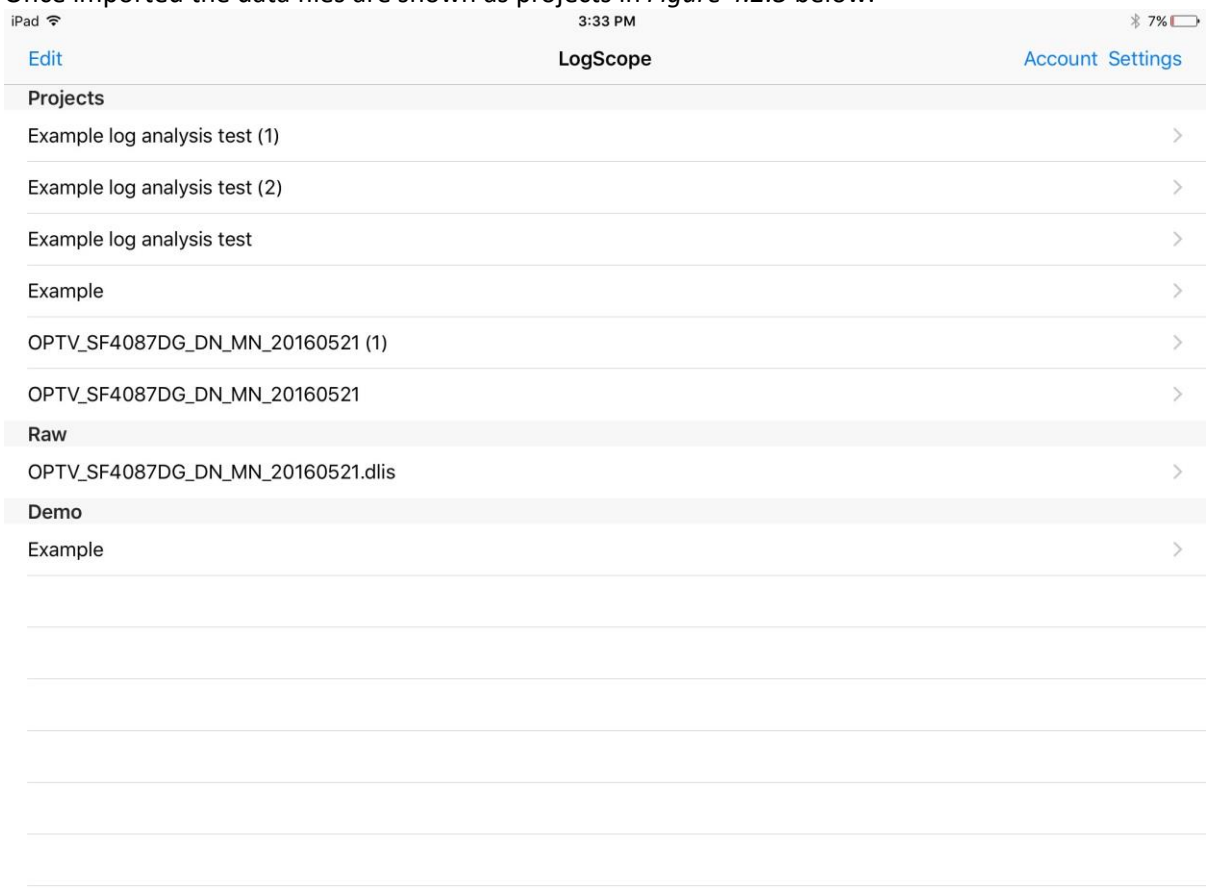
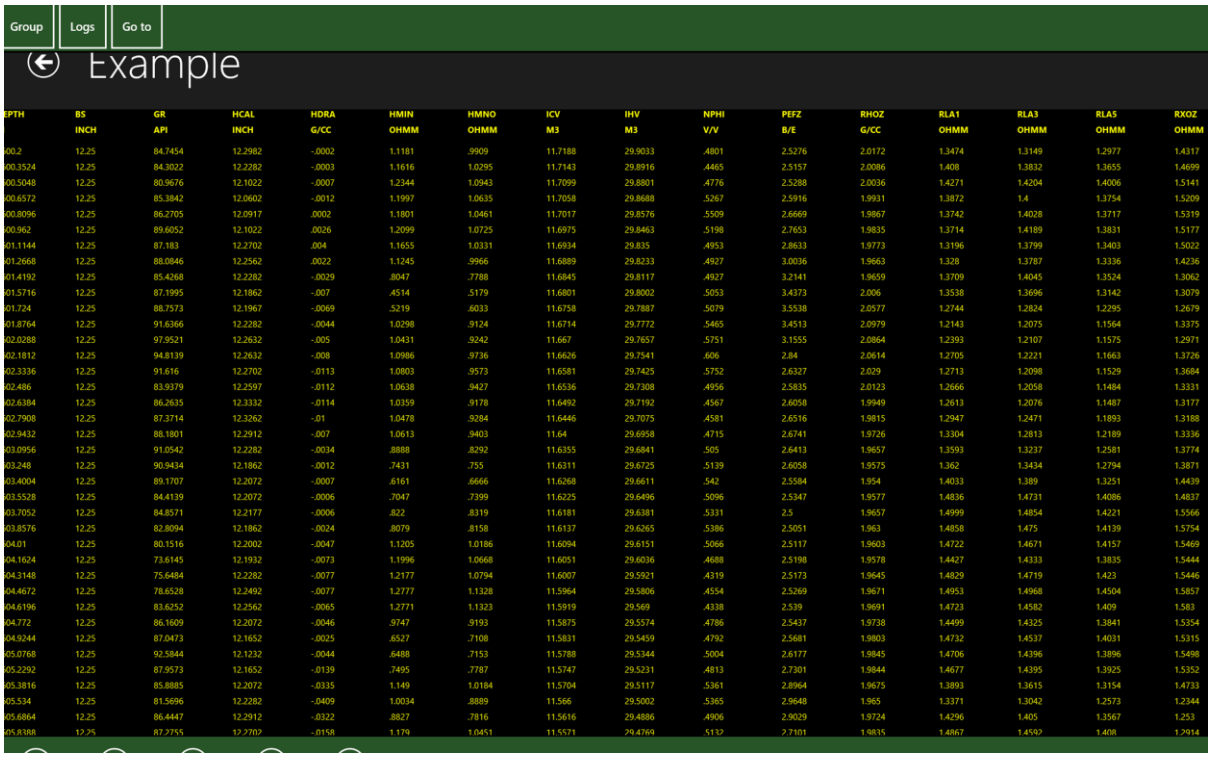


Figure 4.2.3: Project Manager on the iPad

5 Data View

5.1 Windows

The data view is accessible from the bottom tab bar. It offers a way to examine a project's log data as a grid. Each log appears as a column and each row represents a depth. See Figure 5.1.1.1 for an example of the view.



EPTH	BS	GR	HCAL	HDRA	HMIN	HMNO	ICV	IHV	NPHI	PEFZ	RHOZ	RLA1	RLA3	RLA5	RXOZ
	INCH	API	INCH	G/CC	OHMM	OHMM	M3	M3	V/V	B/E	G/CC	OHMM	OHMM	OHMM	OHMM
00.2	12.25	84.7454	12.2982	-.0002	1.1181	.9909	11.7188	29.9033	.4801	2.5276	2.0172	1.3474	1.3149	1.2977	1.4317
00.3524	12.25	84.3022	12.2282	-.0003	1.1616	1.0295	11.7143	29.8916	.4465	2.5157	2.0086	1.408	1.3832	1.3655	1.4699
00.5048	12.25	80.9676	12.1022	-.0007	1.2344	1.0943	11.7099	29.8801	.4776	2.5288	2.0036	1.4271	1.4204	1.4006	1.5141
00.6572	12.25	85.3842	12.0602	-.0012	1.1997	1.0635	11.7058	29.8688	.5267	2.5916	1.9931	1.3872	1.4	1.3754	1.5209
00.8096	12.25	86.2705	12.0917	.0002	1.1801	1.0461	11.7017	29.8576	.5509	2.6669	1.9867	1.3742	1.4028	1.3717	1.5319
00.962	12.25	89.6052	12.1022	.0026	1.2099	1.0725	11.6975	29.8463	.5198	2.7653	1.9835	1.3714	1.4189	1.3831	1.5177
01.1144	12.25	87.183	12.2702	.004	1.1655	1.0331	11.6934	29.835	.4953	2.8633	1.9773	1.3196	1.3799	1.3403	1.5022
01.2668	12.25	88.0846	12.2562	.0022	1.1245	.9966	11.6889	29.8233	.4927	3.0036	1.9663	1.328	1.3787	1.3336	1.4236
01.4192	12.25	85.4268	12.2282	-.0029	.8047	.7788	11.6845	29.8117	.4927	3.2141	1.9659	1.3709	1.4045	1.3524	1.3062
01.5716	12.25	87.1995	12.1862	-.007	.4514	.5179	11.6801	29.8002	.5053	3.4373	2.006	1.3538	1.3696	1.3142	1.3079
01.724	12.25	88.7573	12.1967	-.0069	.5219	.6033	11.6758	29.7887	.5079	3.5538	2.0577	1.2744	1.2824	1.2295	1.2679
01.8764	12.25	91.6366	12.2282	-.0044	1.0298	.9124	11.6714	29.7772	.5465	3.4513	2.0979	1.2143	1.2075	1.1564	1.3375
02.0288	12.25	97.9521	12.2632	-.005	1.0431	.9242	11.667	29.7657	.5751	3.1555	2.0864	1.2393	1.2107	1.1575	1.2971
02.1812	12.25	94.8139	12.2632	-.008	1.0986	.9736	11.6626	29.7541	.606	2.84	2.0614	1.2705	1.2221	1.1663	1.3726
02.3336	12.25	91.616	12.2702	-.0113	1.0803	.9573	11.6581	29.7425	.5752	2.6327	2.029	1.2713	1.2098	1.1529	1.3684
02.486	12.25	83.9379	12.2597	-.0112	1.0638	.9427	11.6536	29.7308	.4956	2.5835	2.0123	1.2666	1.2058	1.1484	1.3331
02.6384	12.25	86.2635	12.3332	-.0114	1.0359	.9178	11.6492	29.7192	.4567	2.6058	1.9949	1.2613	1.2076	1.1487	1.3177
02.7908	12.25	87.3714	12.3262	-.01	1.0478	.9284	11.6446	29.7075	.4581	2.6516	1.9815	1.2947	1.2471	1.1893	1.3188
02.9432	12.25	88.1801	12.2912	-.007	1.0613	.9403	11.64	29.6958	.4715	2.6741	1.9726	1.3304	1.2813	1.2189	1.3336
03.0956	12.25	91.0542	12.2282	-.0034	.8888	.8292	11.6355	29.6841	.505	2.6413	1.9657	1.3593	1.3237	1.2581	1.3774
03.248	12.25	90.9434	12.1862	-.0012	.7431	.755	11.6311	29.6725	.5139	2.6058	1.9575	1.362	1.3434	1.2794	1.3871
03.4004	12.25	89.1707	12.2072	-.0007	.6161	.6666	11.6268	29.6611	.542	2.5584	1.954	1.4033	1.389	1.3251	1.4439
03.5528	12.25	84.4139	12.2072	-.0006	.7047	.7399	11.6225	29.6496	.5096	2.5347	1.9577	1.4836	1.4731	1.4086	1.4837
03.7052	12.25	84.8571	12.2177	-.0006	.822	.8319	11.6181	29.6381	.5331	2.5	1.9657	1.4999	1.4854	1.4221	1.5566
03.8576	12.25	82.8094	12.1862	-.0024	.8079	.8158	11.6137	29.6265	.5386	2.5051	1.963	1.4858	1.475	1.4139	1.5754
04.01	12.25	80.1516	12.2002	-.0047	1.1205	1.0186	11.6094	29.6151	.5066	2.5117	1.9603	1.4722	1.4671	1.4157	1.5469
04.1624	12.25	73.6145	12.1932	-.0073	1.1996	1.0668	11.6051	29.6036	.4688	2.5198	1.9578	1.4427	1.4333	1.3835	1.5444
04.3148	12.25	75.6484	12.2282	-.0077	1.2177	1.0794	11.6007	29.5921	.4319	2.5173	1.9645	1.4829	1.4719	1.423	1.5446
04.4672	12.25	78.6528	12.2492	-.0077	1.2777	1.1328	11.5964	29.5806	.4554	2.5269	1.9671	1.4953	1.4968	1.4504	1.5857
04.6196	12.25	83.6252	12.2562	-.0065	1.2771	1.1323	11.5919	29.569	.4338	2.539	1.9691	1.4723	1.4582	1.409	1.583
04.772	12.25	86.1609	12.2072	-.0046	.9747	.9193	11.5875	29.5574	.4786	2.5437	1.9738	1.4499	1.4325	1.3841	1.5354
04.9244	12.25	87.0473	12.1652	-.0025	.6527	.7108	11.5831	29.5459	.4792	2.5681	1.9803	1.4732	1.4537	1.4031	1.5315
05.0768	12.25	92.5844	12.1232	-.0044	.6488	.7153	11.5788	29.5344	.5004	2.6177	1.9845	1.4706	1.4396	1.3896	1.5498
05.2292	12.25	87.9573	12.1652	-.0139	.7495	.7787	11.5747	29.5231	.4813	2.7301	1.9844	1.4677	1.4395	1.3925	1.5352
05.3816	12.25	85.8885	12.2072	-.0335	1.149	1.0184	11.5704	29.5117	.5361	2.8964	1.9675	1.3893	1.3615	1.3154	1.4733
05.534	12.25	81.5696	12.2282	-.0409	1.0034	.8889	11.566	29.5002	.5365	2.9648	1.965	1.3371	1.3042	1.2573	1.2344
05.6864	12.25	86.4447	12.2912	-.0322	.8827	.7816	11.5616	29.4886	.4906	2.9029	1.9724	1.4296	1.405	1.3567	1.253
05.8388	12.25	87.2755	12.2702	-.0158	1.179	1.0451	11.5571	29.4769	.5132	2.7101	1.9835	1.4867	1.4592	1.408	1.2914

Figure 5.1.1: Data View

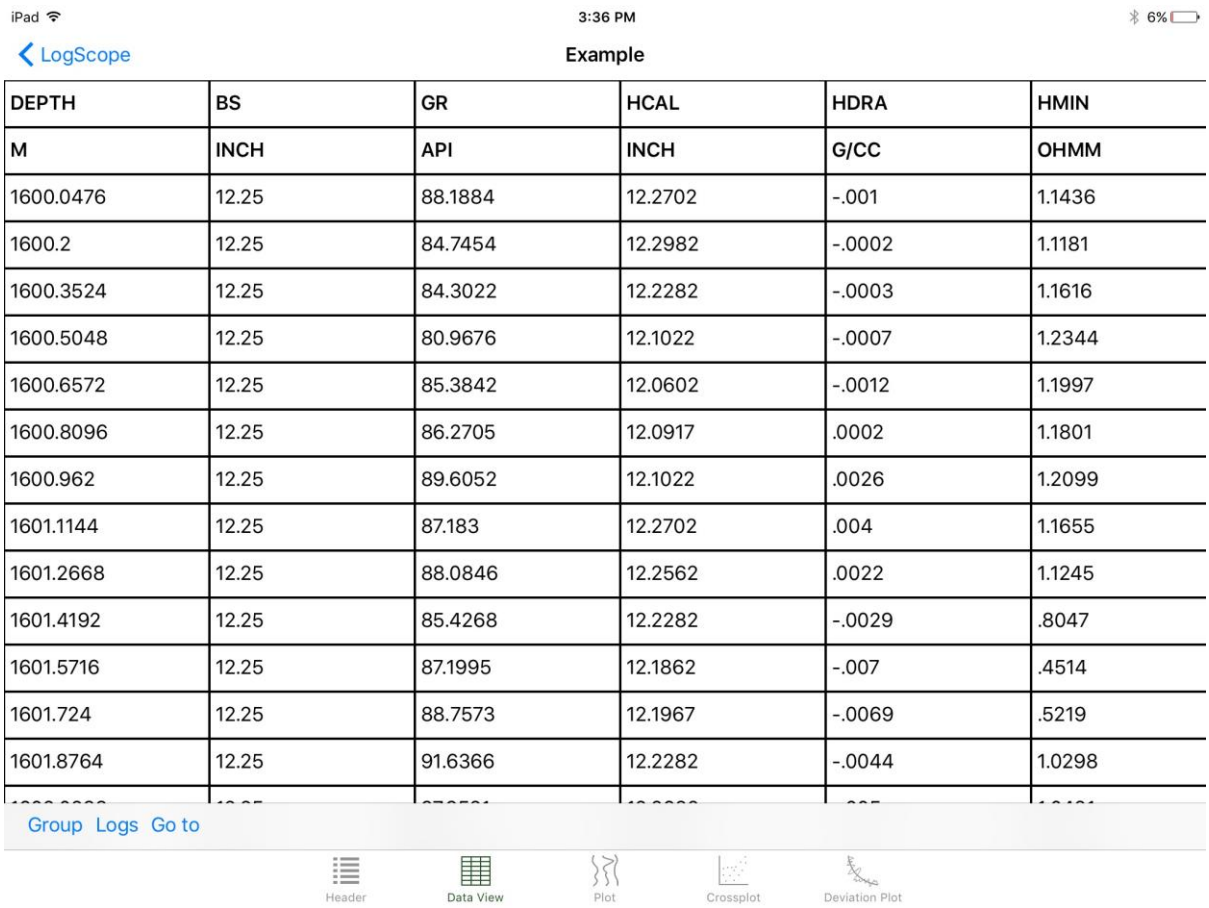
The bottom toolbar has the following:

- **Group** Choose the group from which to select logs to display.
- **Logs** Choose which logs to display in the columns of the grid.
- **Go to** Scroll to the depth specified (in depth units).

The log name and units can be changed by tapping on the name and units respectively. If the units are tapped on the units as stored remain the same and the displayed units is changed (i.e. % to volume for volume or V/V).

5.2 iPad

The data view is accessible from the bottom tab bar. It offers a way to examine a project's log data as a grid. Each log appears as a column and each row represents a depth. See Figure 5.1.1.1 for an example of the view.



DEPTH	BS	GR	HCAL	HDRA	HMIN
M	INCH	API	INCH	G/CC	OHMM
1600.0476	12.25	88.1884	12.2702	-.001	1.1436
1600.2	12.25	84.7454	12.2982	-.0002	1.1181
1600.3524	12.25	84.3022	12.2282	-.0003	1.1616
1600.5048	12.25	80.9676	12.1022	-.0007	1.2344
1600.6572	12.25	85.3842	12.0602	-.0012	1.1997
1600.8096	12.25	86.2705	12.0917	.0002	1.1801
1600.962	12.25	89.6052	12.1022	.0026	1.2099
1601.1144	12.25	87.183	12.2702	.004	1.1655
1601.2668	12.25	88.0846	12.2562	.0022	1.1245
1601.4192	12.25	85.4268	12.2282	-.0029	.8047
1601.5716	12.25	87.1995	12.1862	-.007	.4514
1601.724	12.25	88.7573	12.1967	-.0069	.5219
1601.8764	12.25	91.6366	12.2282	-.0044	1.0298

Figure 5.2.1: Data View

The bottom toolbar has the following:

- **Group** Choose the group from which to select logs to display.
- **Logs** Choose which logs to display in the columns of the grid.
- **Go to** Scroll to the depth specified (in depth units).

The log name and unit type can both be changed. Tap on the name and units respectively. If the units is tapped on the units as stored remain the same and the displayed units is changed (i.e. % to volume for volume or V/V)

6 Graphics Display (Basic Display)

To view the log plot simply tap the LAS file and it will open using the BASIC log presentation template as shown in Figure 6.1 and Figure 6.2:

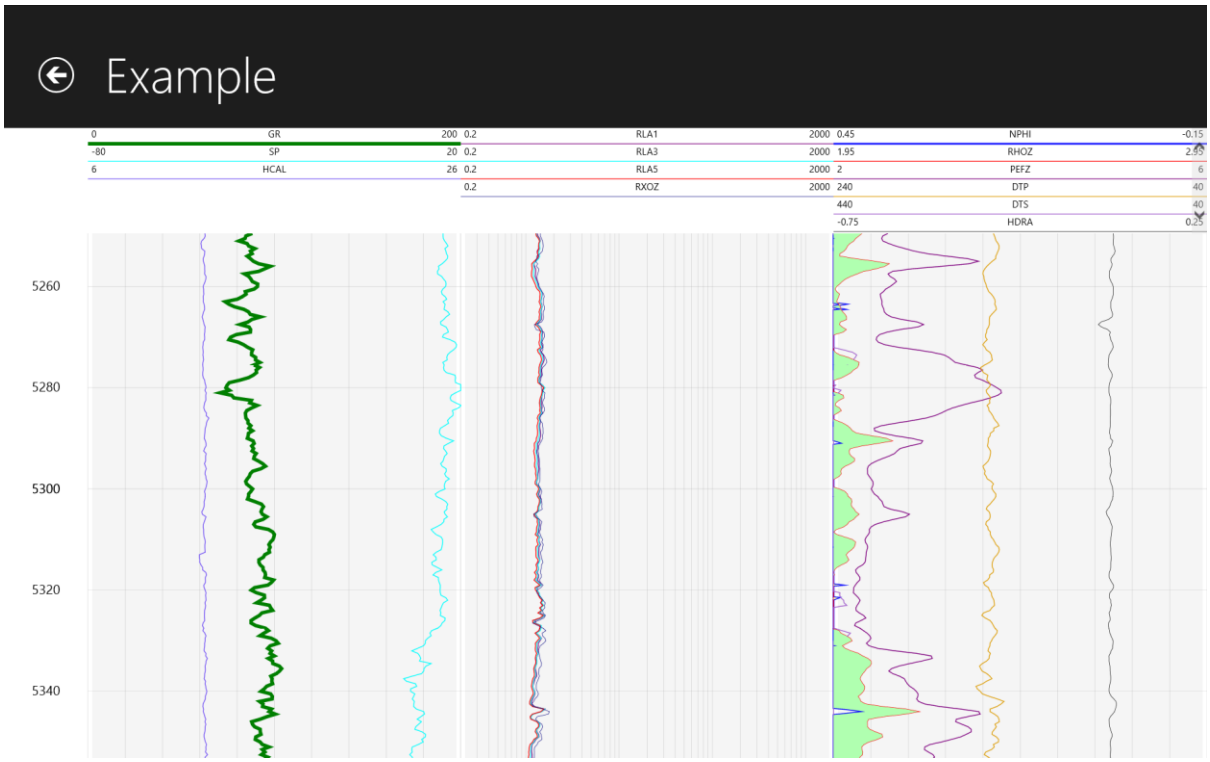


Figure 6.1: Basic default plot template - Windows

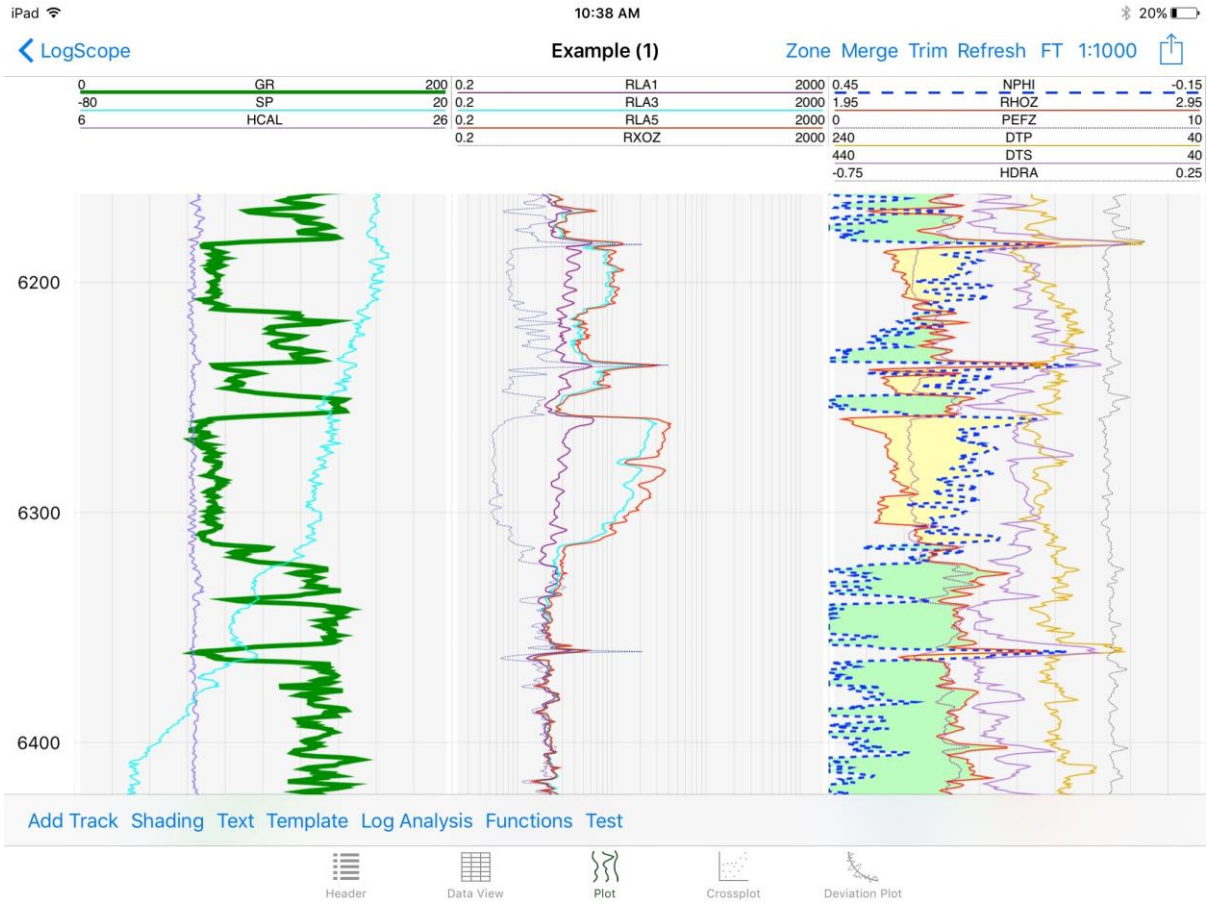


Figure 6.2: Basic default plot template - iPad

Plot templates can be changed to other saved templates by tapping the template button and selecting load as shown in 6.3 and 6.4 below:

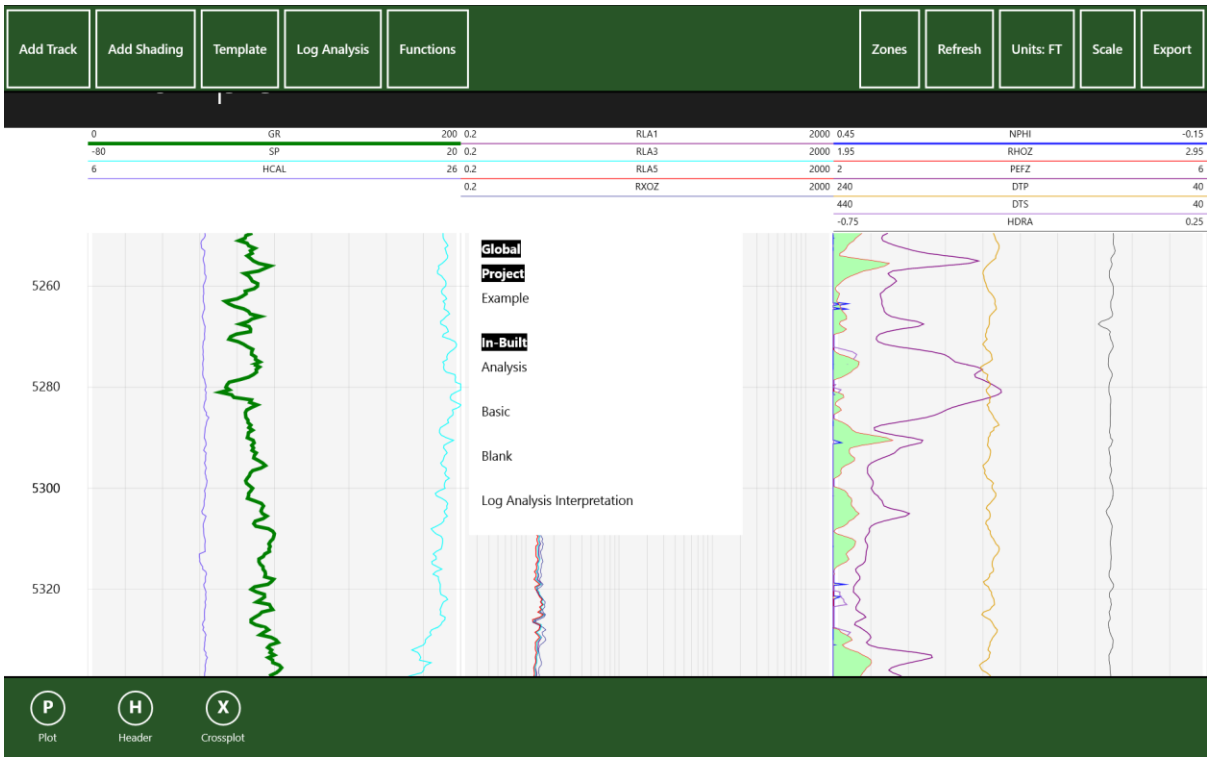


Figure 6.3: Template chooser on Windows

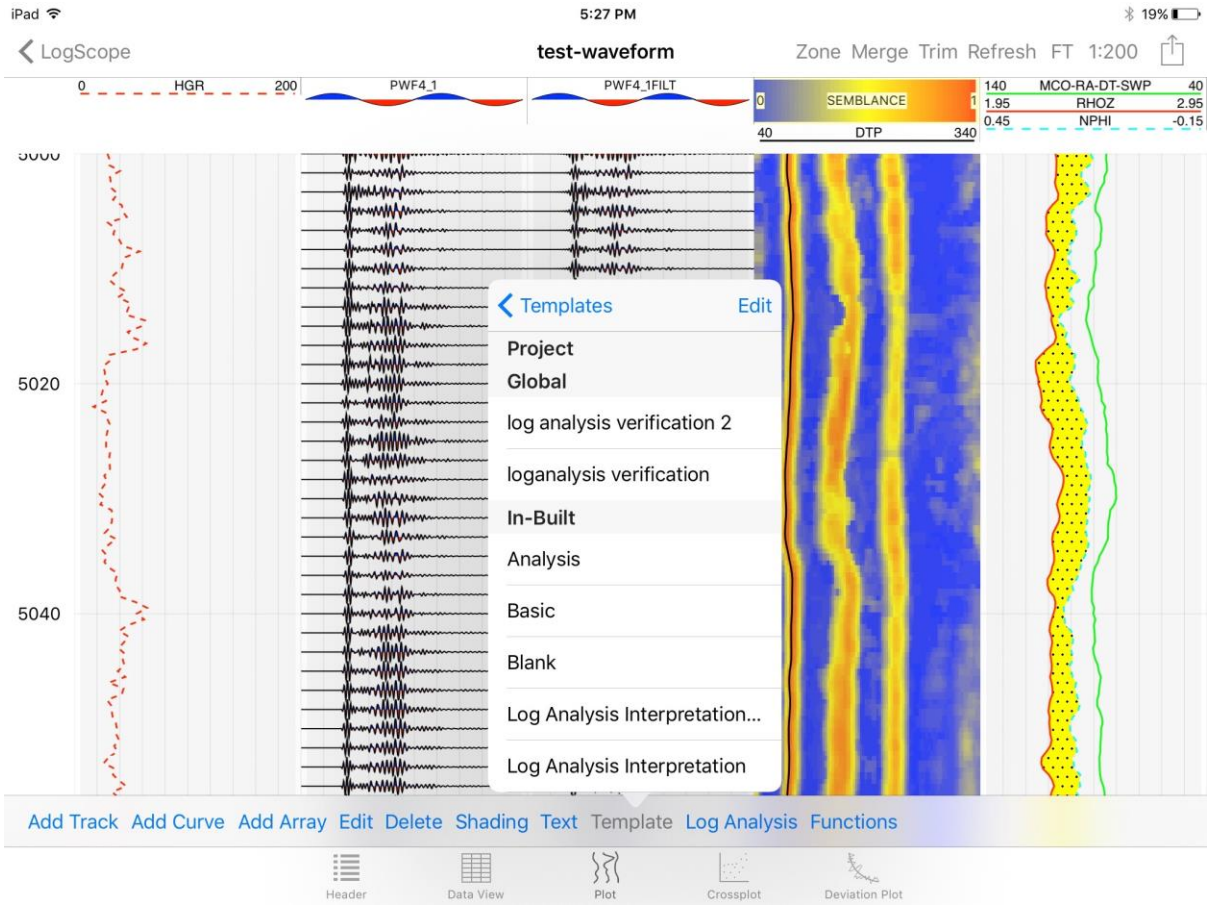


Figure 6.4: Template chooser on iPad

Note that curves not plotted will be greyed out.

Figure 6.1 and 6.4 show depth scale can be changed by tapping the scale button located top right hand side of screen. Pinch gesture can be used to change scale also.

Plot can be changed from Feet to Meters and vice versa by tapping the M/FT shown in Figures 6.3 and 6.4.

6.1 Adding Tracks (Basic Display)

A maximum of 15 log tracks can be created and we recommend using the LogScope package in landscape if working with more than 4 or 5 tracks.

A Track can be added by tapping “Add Track” as seen in Figure 6.1.3 and 6.1.2. Select either linear or logarithmic. The track will be added to the display.

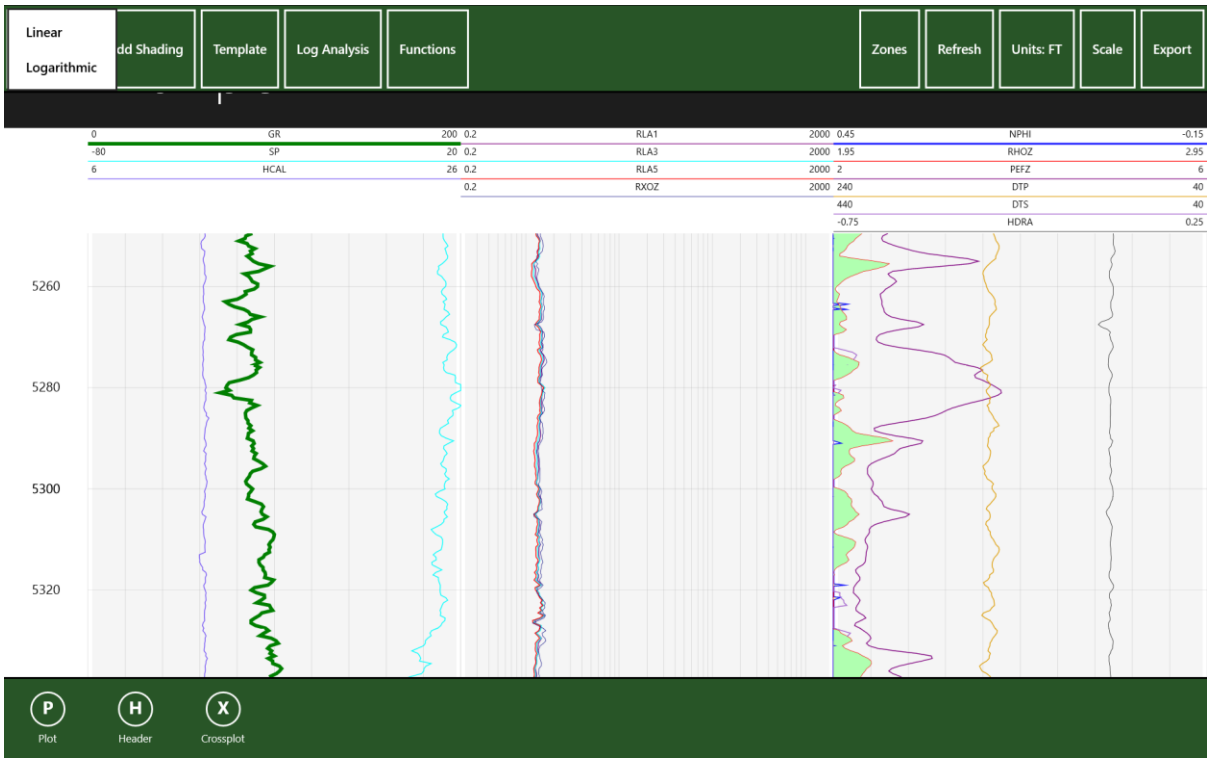


Figure 6.1.3: Adding Linear or Logarithmic track

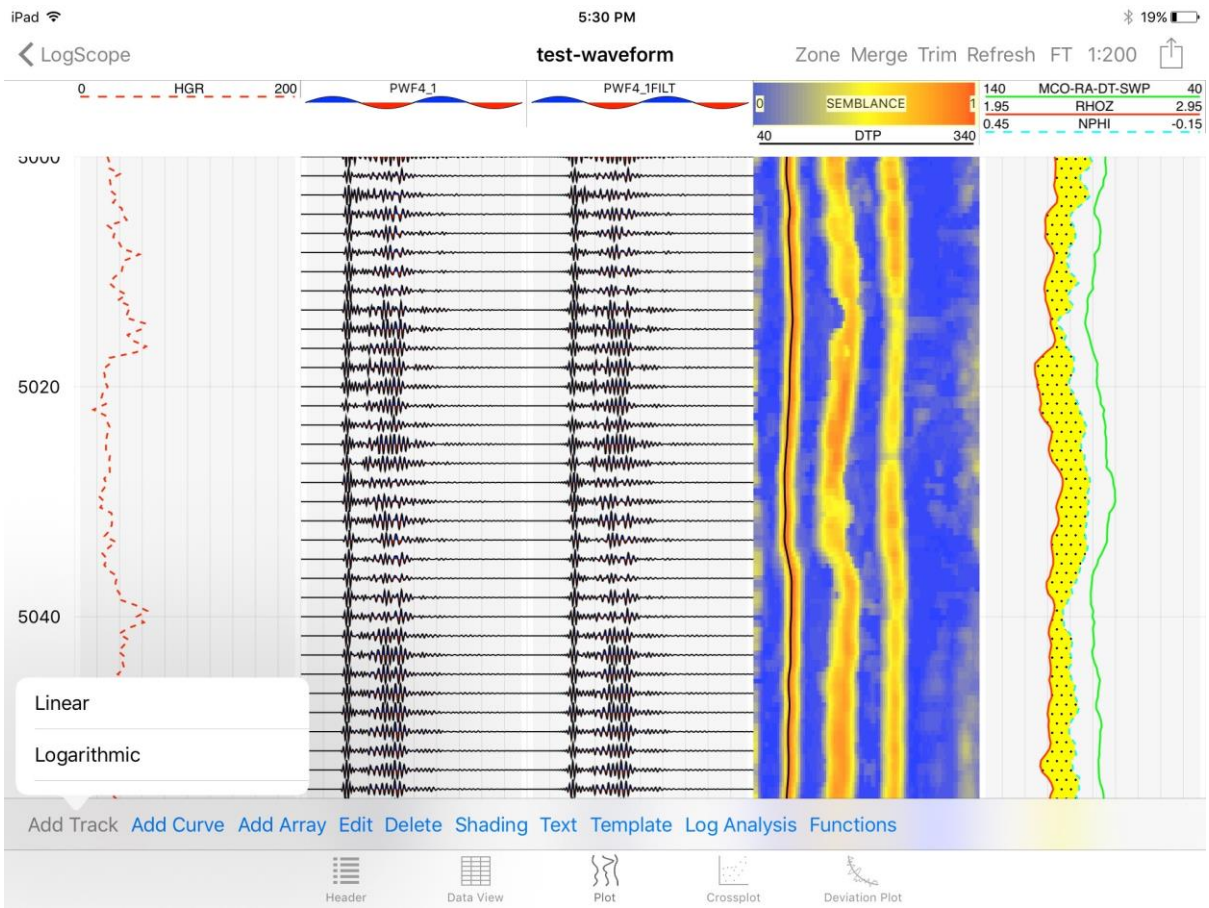


Figure 6.1.2: Adding Linear or Logarithmic track iPad

A track can be inserted by tapping the track on display and it will highlight yellow as shown in Figures 6.1.3 and 6.1.4. Tapping Add Track will cause a linear or logarithmic track to be inserted. To deselect the track tap the track and the yellow highlight will disappear.

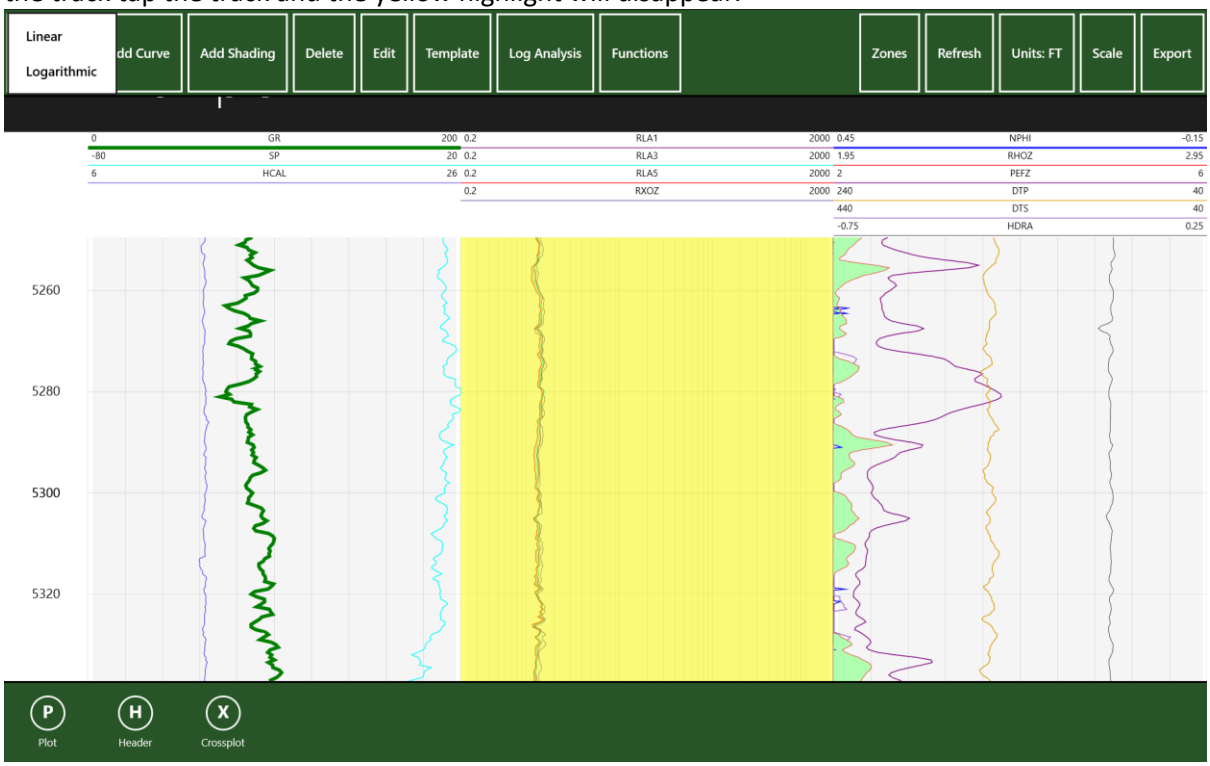


Figure 6.1.3: Select track to insert a new track on Windows

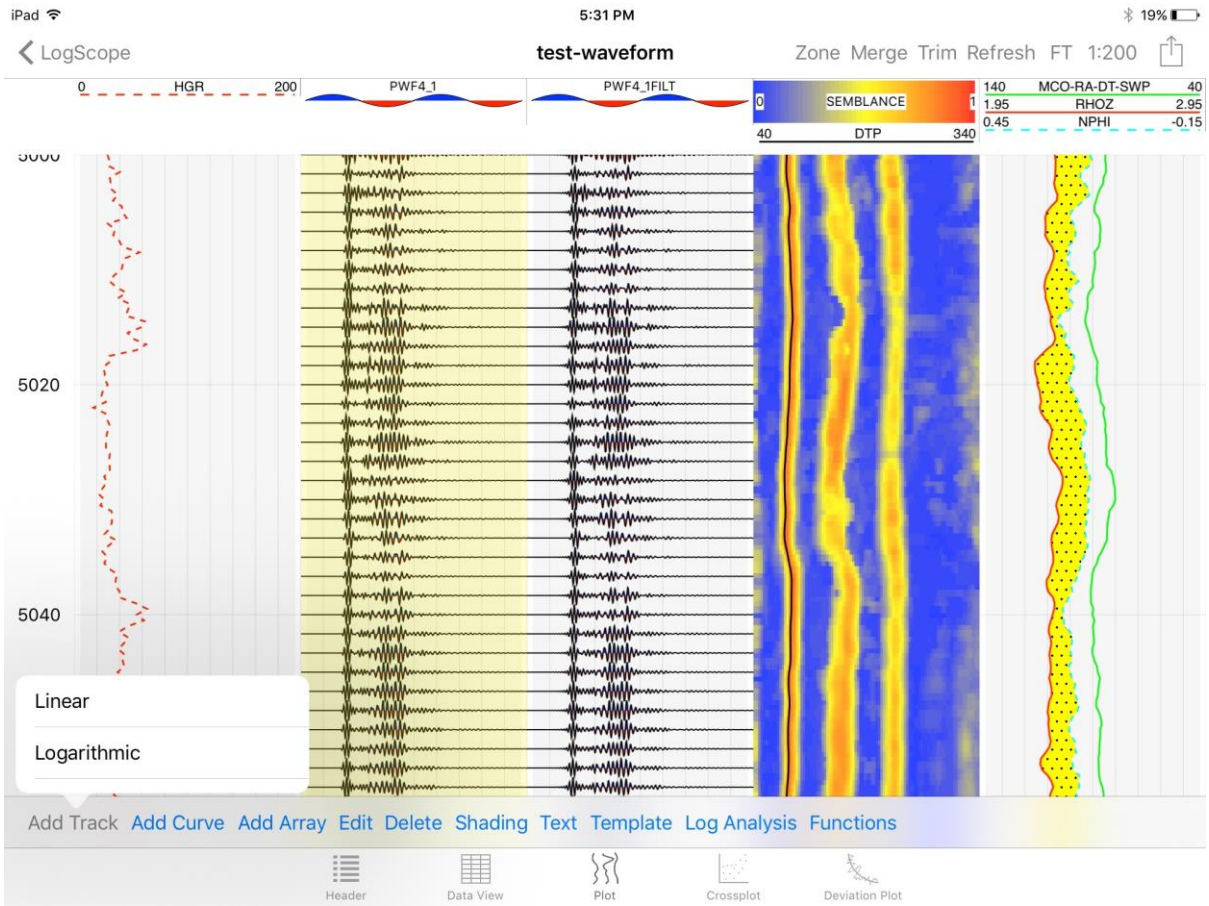


Figure 6.1.4: A new track inserted on iPad

The number of divisions and logarithmic cycles can be edited by selecting the track and tapping edit as shown in Figure 6.1.5 and 6.1.6.

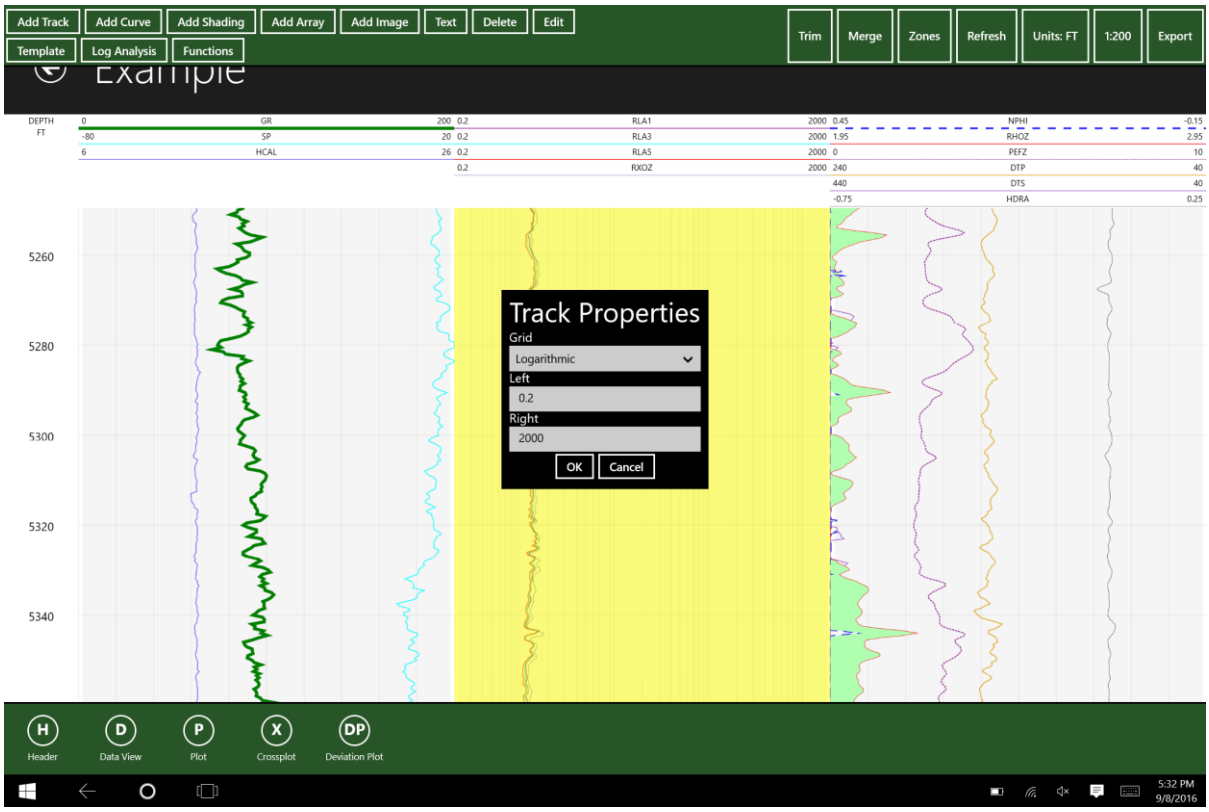


Figure 6.1.5: Logarithmic track edited on Windows

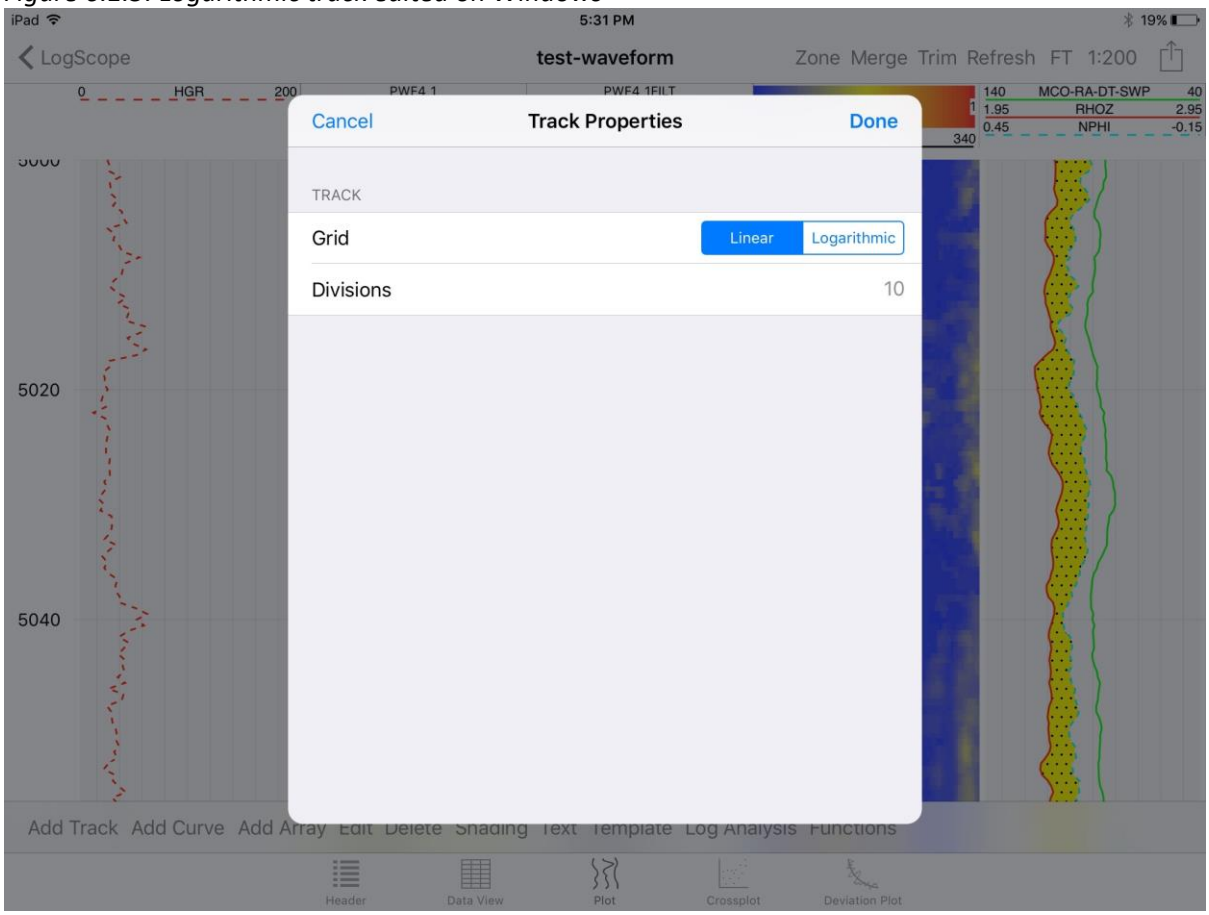


Figure 6.1.6: Logarithmic track edited on iPad

6.2 Adding Curves (Basic Display)

Each track can hold multiple curves scaled linearly or logarithmically and you can change scale range, colors, style and thickness. Curves can be plotted so that they can be stacked. User has control over whether curves wrap, are unwrapped (plot into adjacent tracks) or simply are clipped.

To select a curve tap on the curve header so it highlights yellow and then tap edit and the following dialog will be presented:

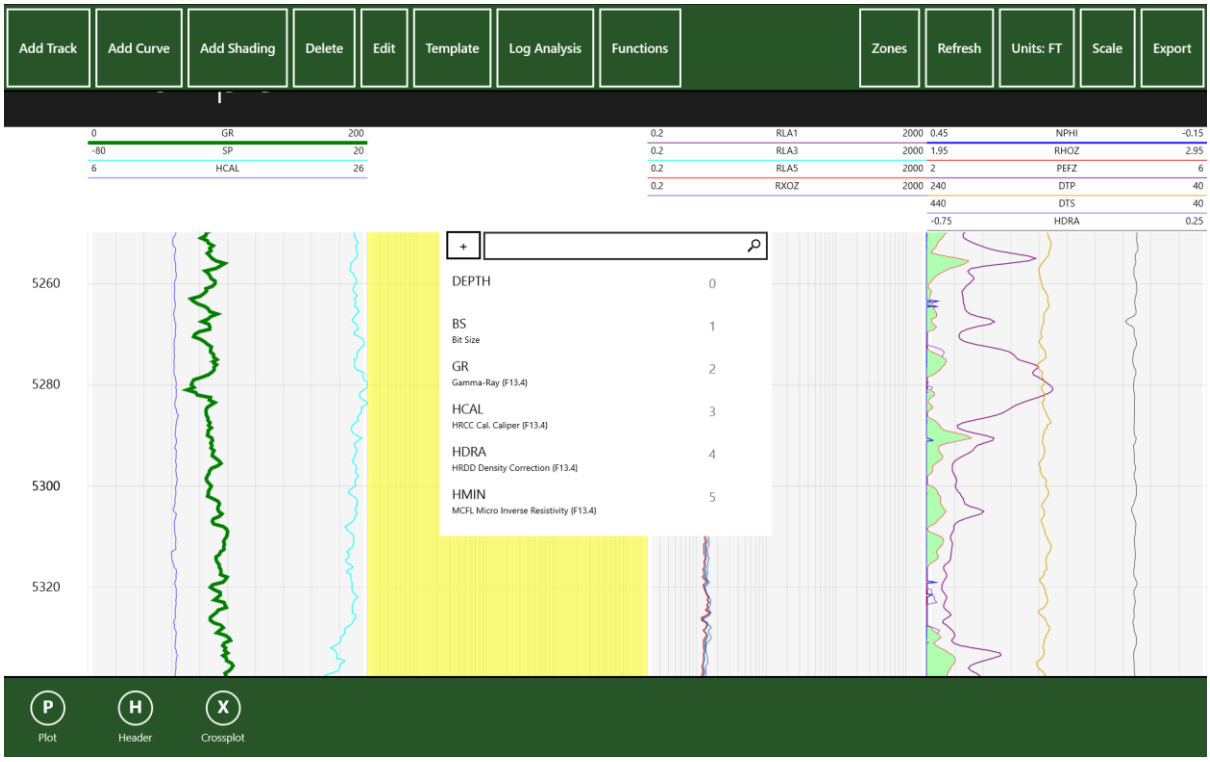


Figure 6.2.4: Adding a Curve Windows

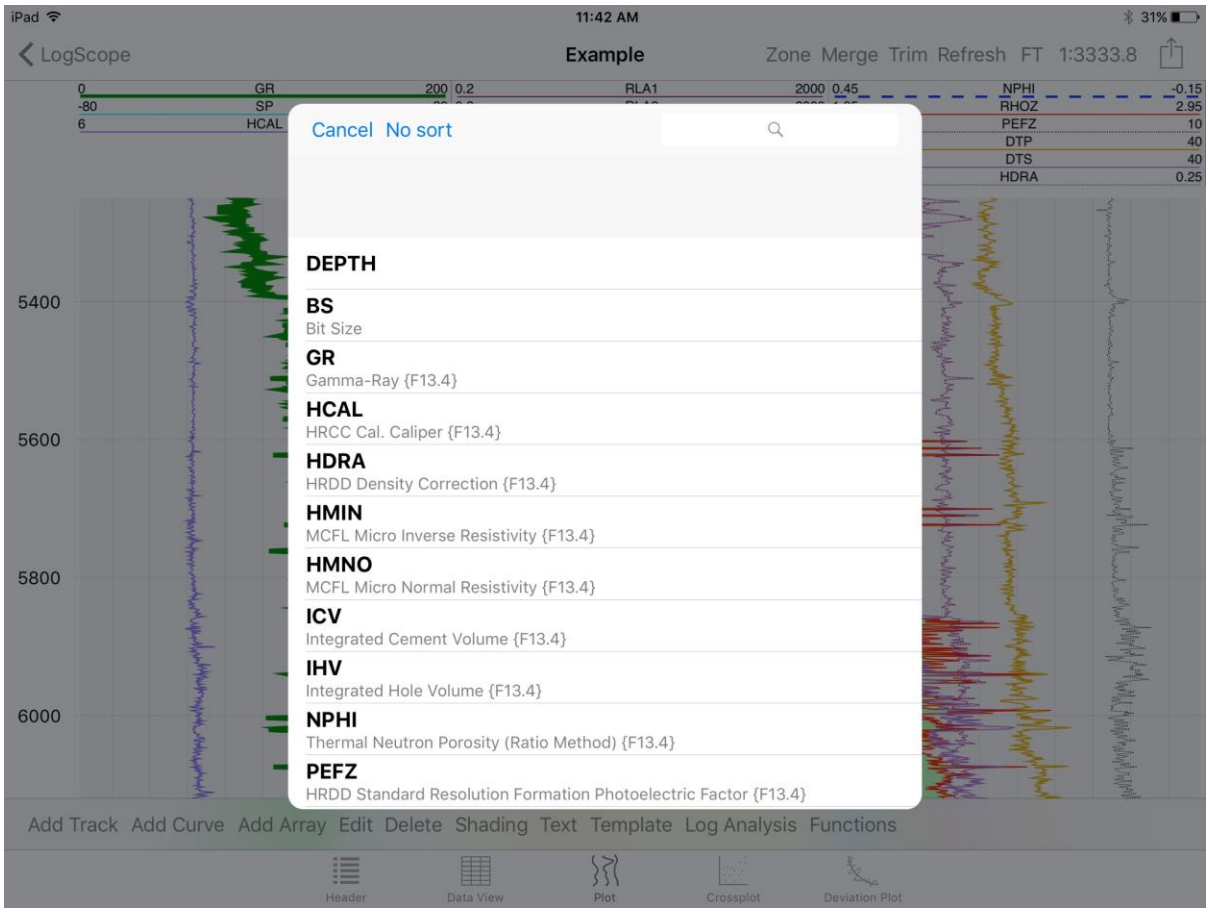


Figure 6.2.2: Adding a Curve iPad

6.3 Adding Arrays (Advanced Display)

Arrays can be added as either Waveforms or as Variable Density Logs. Figure 6.3.1 and 6.3.2 show the menu from where the items can be added to the plot.

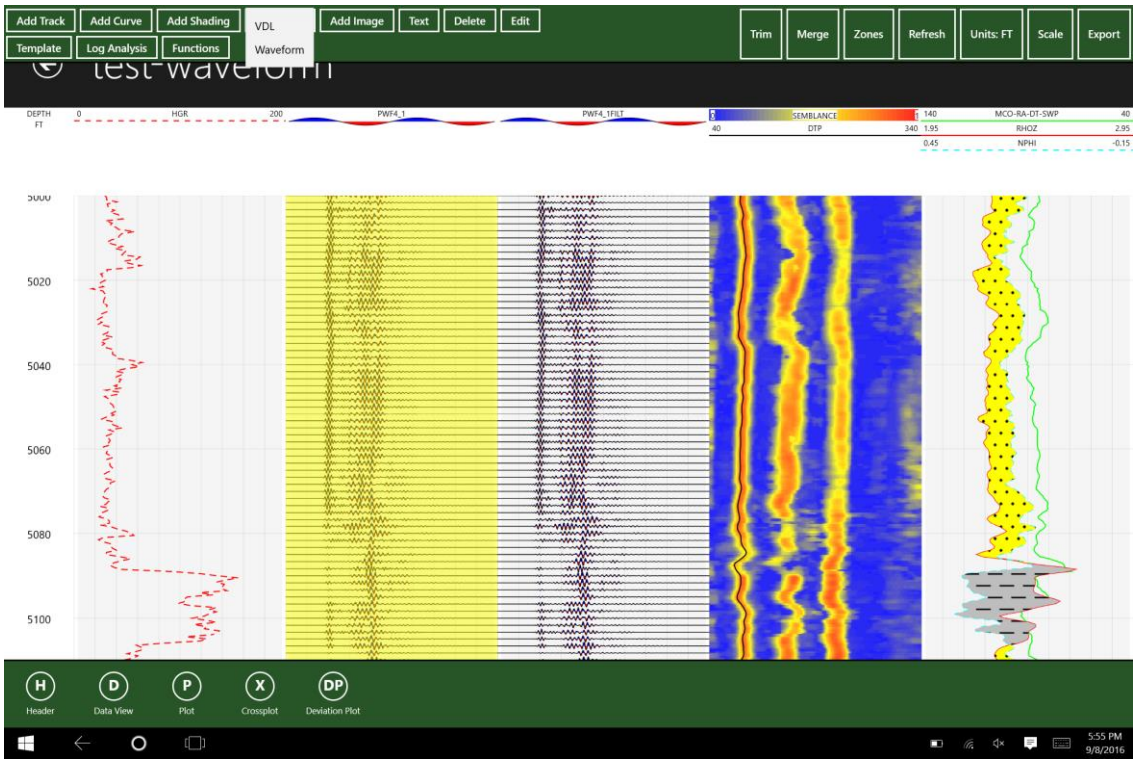


Figure 6.3.1 Adding an array to plot on Windows

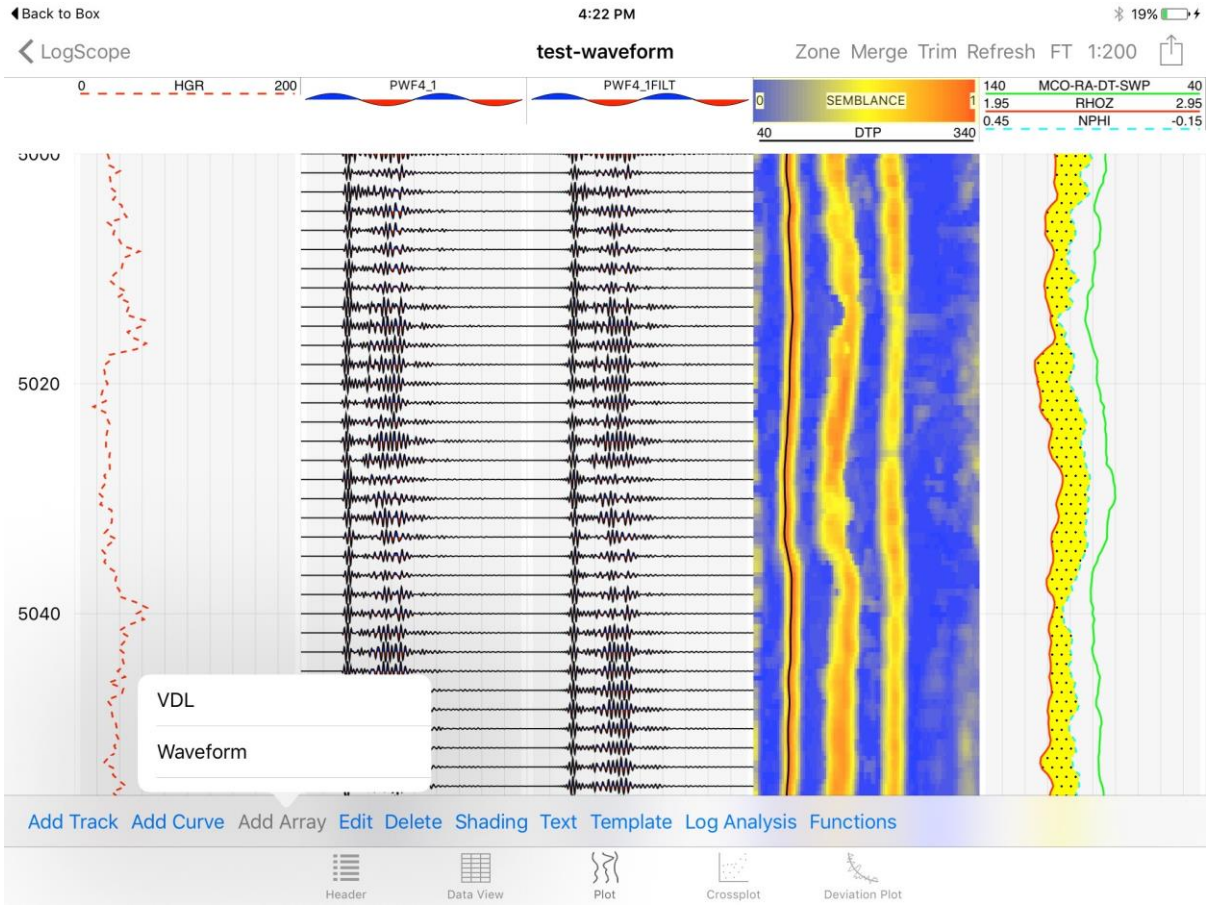


Figure 6.3.2 Adding an array to plot on iPad

The menu for the Waveform is illustrated in Figures 6.3.3 and 6.3.4. The user has control over the Amplitude (inches), spacing (inches), plotted maximum and whether there is shading on positive and negative peaks.

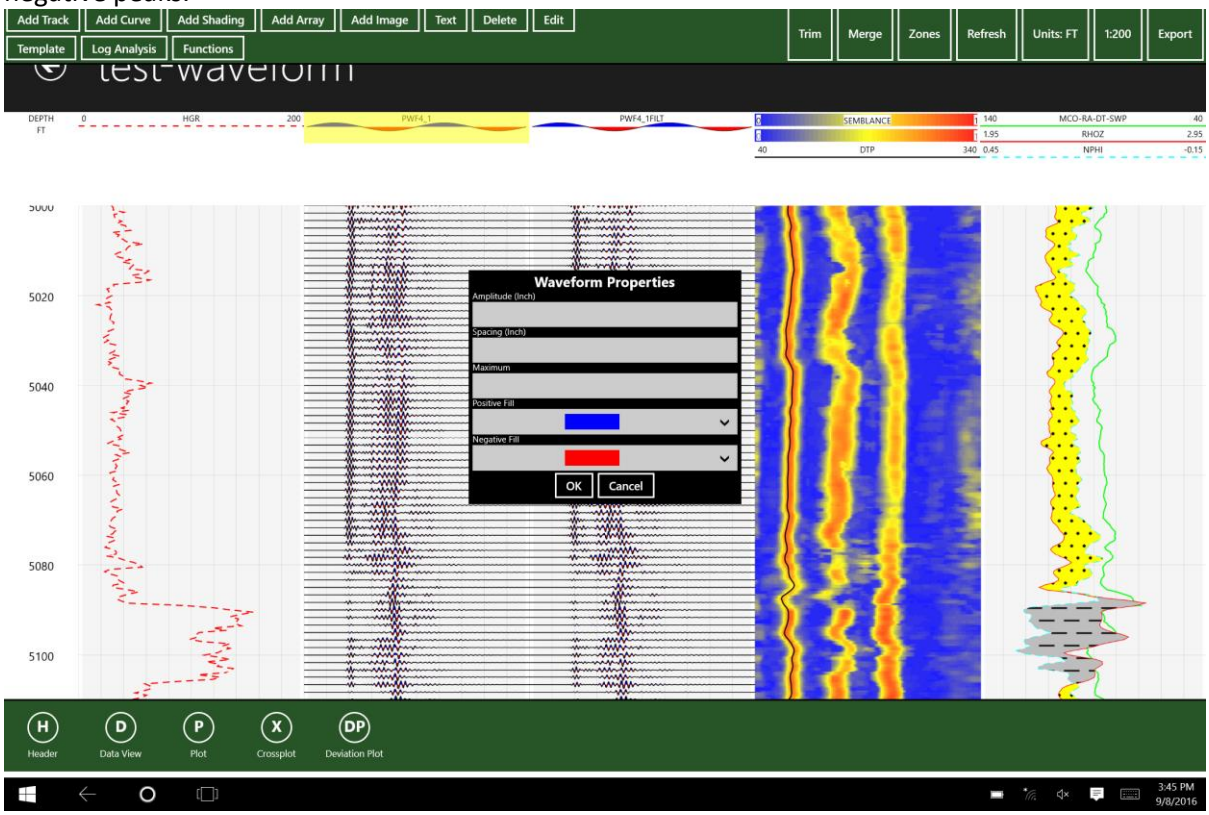


Figure 6.3.3 Adding an array to plot on Windows

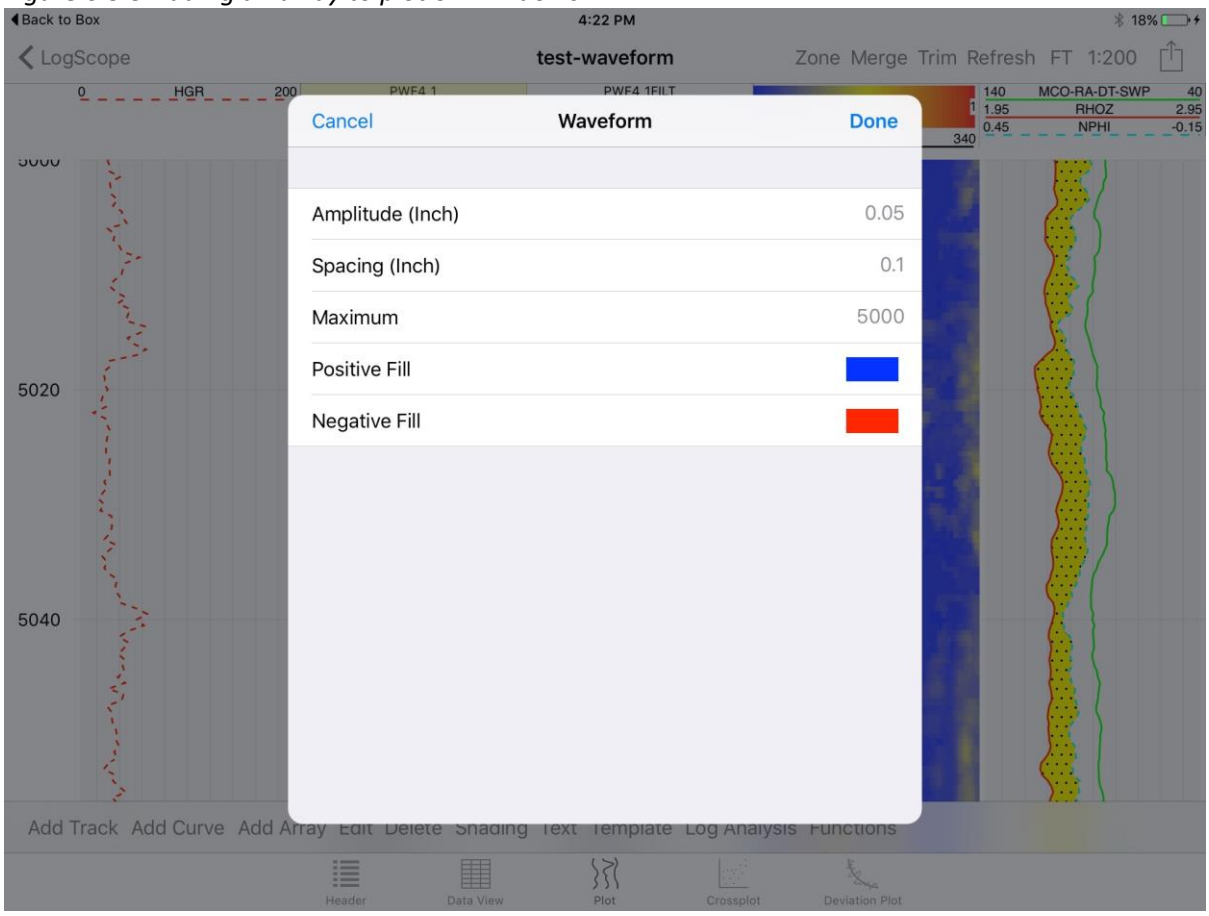


Figure 6.3.4 Adding an array to plot on iPad

If a Variable Density Log is selected then the controls are illustrated in Figures 6.3.5 and 6.3.6. The parameters are spectrum, left value, right value, left array index and right array index. The latter two values allow a particular segment of an array to be displayed.

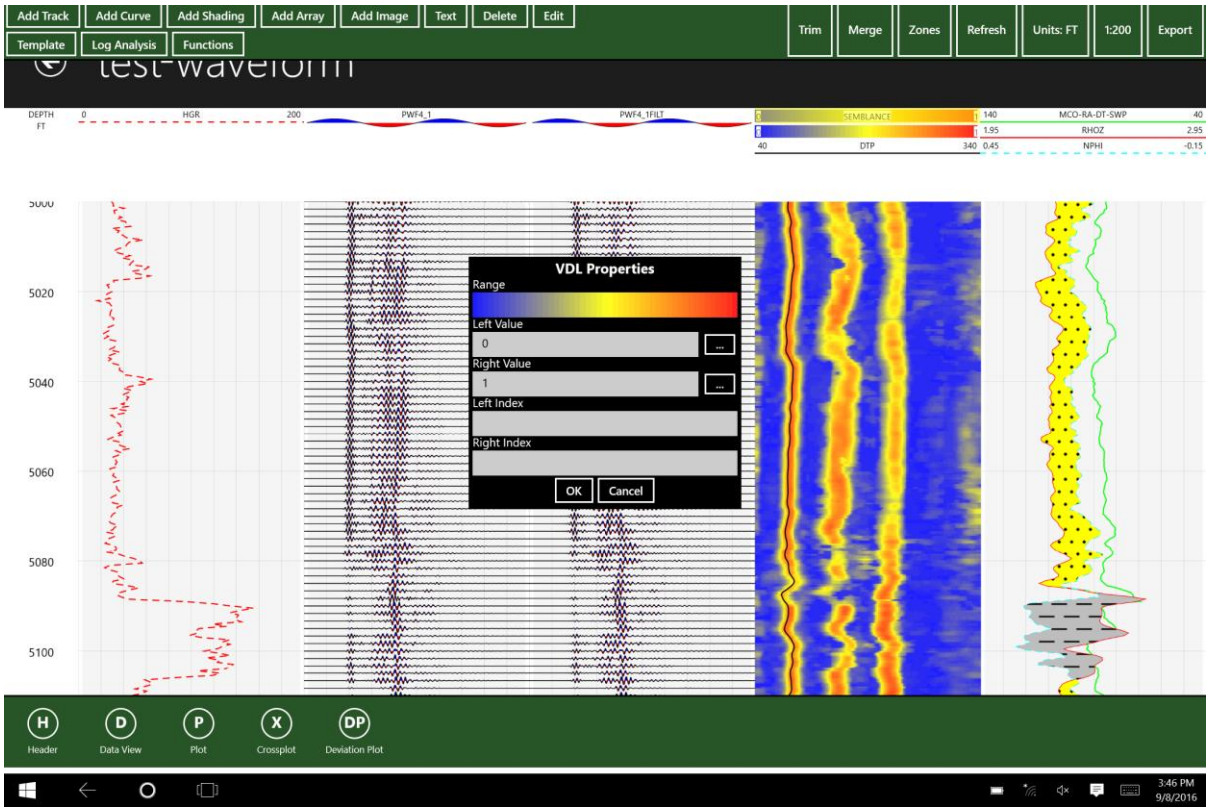


Figure 6.3.5 Adding a Variable Density Log to plot on Windows

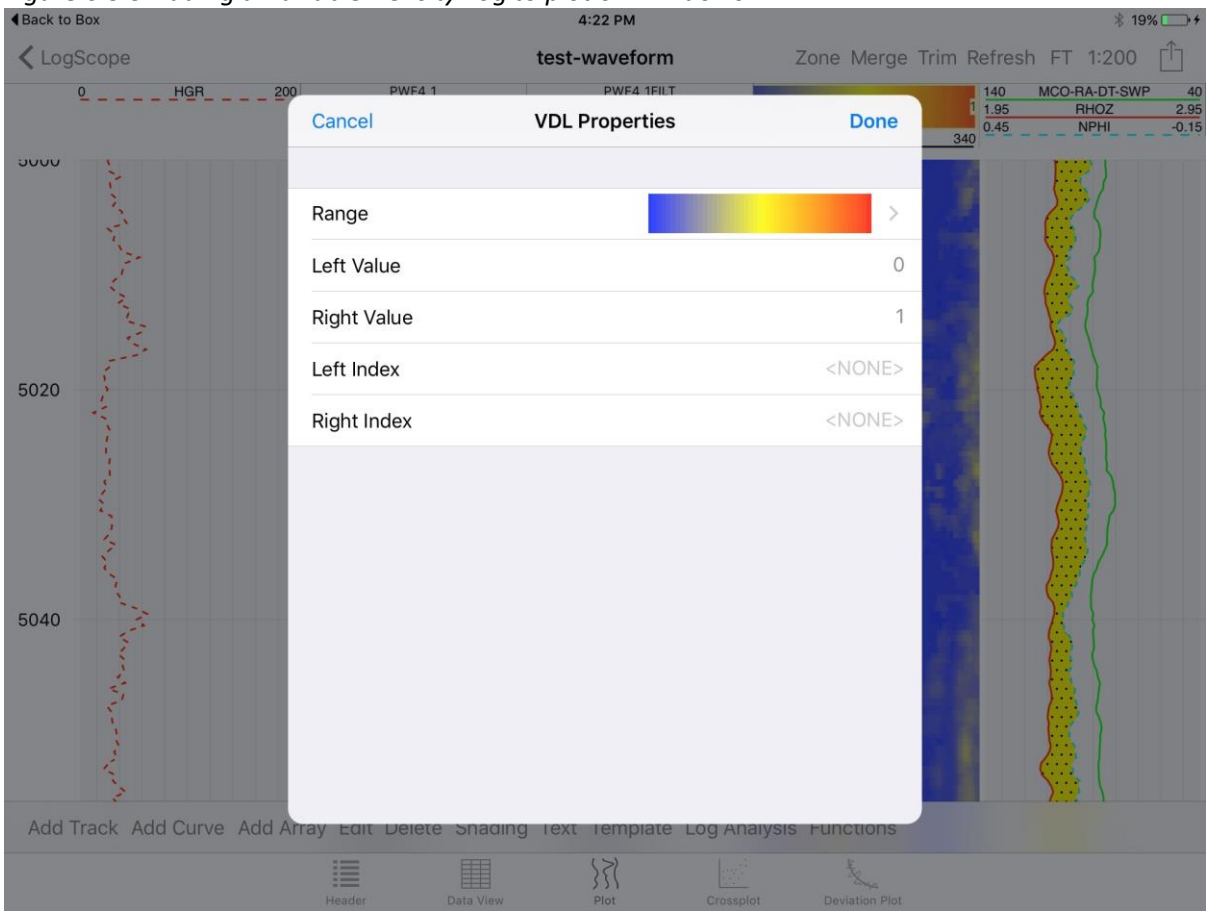


Figure 6.3.6 Adding a Variable Density Log to plot on iPad

6.4 Adding Images (Advanced Display)

Full color pictures can be added to a plot by adding images. The methodology for Windows and iPad differ slightly in that the Windows device can load images from disk whilst the iPad at this particular point in time can only display preloaded images. Figures 6.4.1 and 6.4.2 illustrate adding color images to both Windows and iPad respectively.

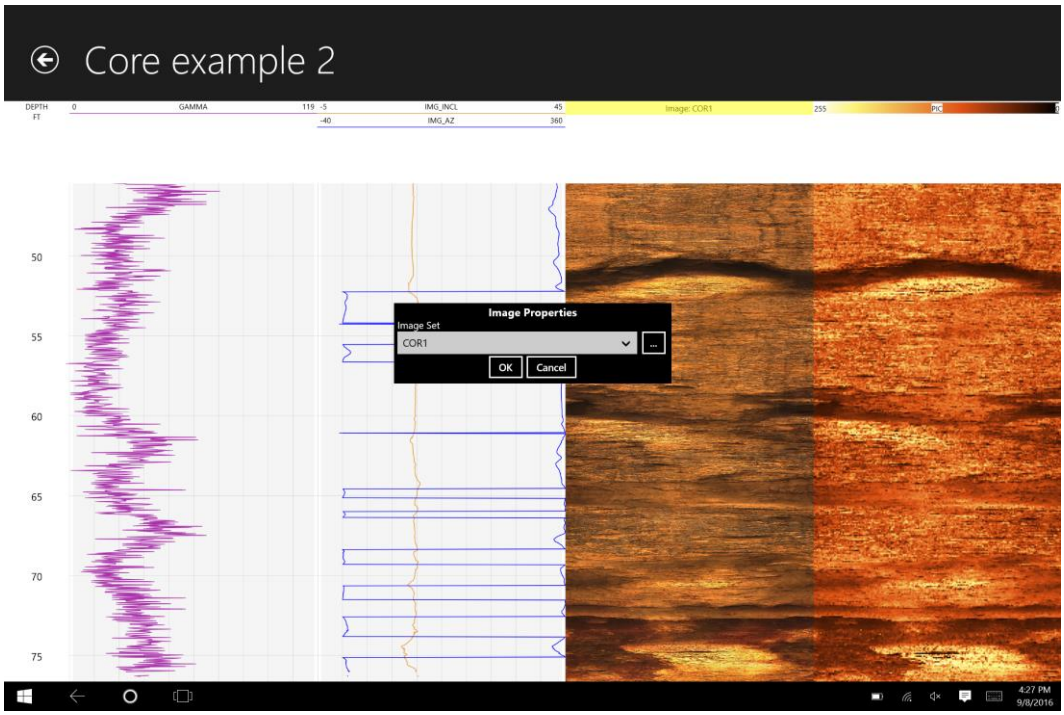


Figure 6.4.1 Adding a color image plot on Windows

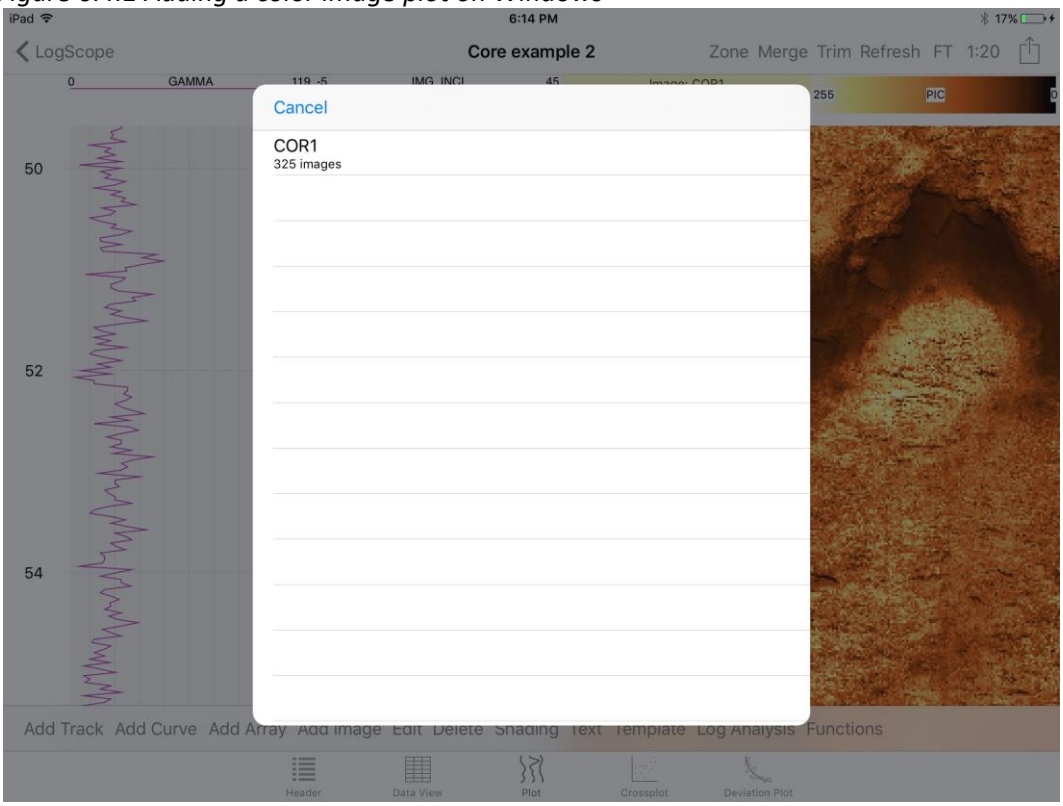


Figure 6.4.2 Adding a color image plot on iPad

Full color pictures added in Windows are added by tapping the ellipsis symbol button and loaded as shown in Figure 6.4.3. If the file name contains depths, LogScope will automatically assign the depth to the particular file. We recommend that the depths be as follows in the file name for smooth loading: "text_XXXXXXX_YYYYYYY.jpeg" where X and Y represent the start and stop depth of the core. The units can be M, MM, Inches and Feet.

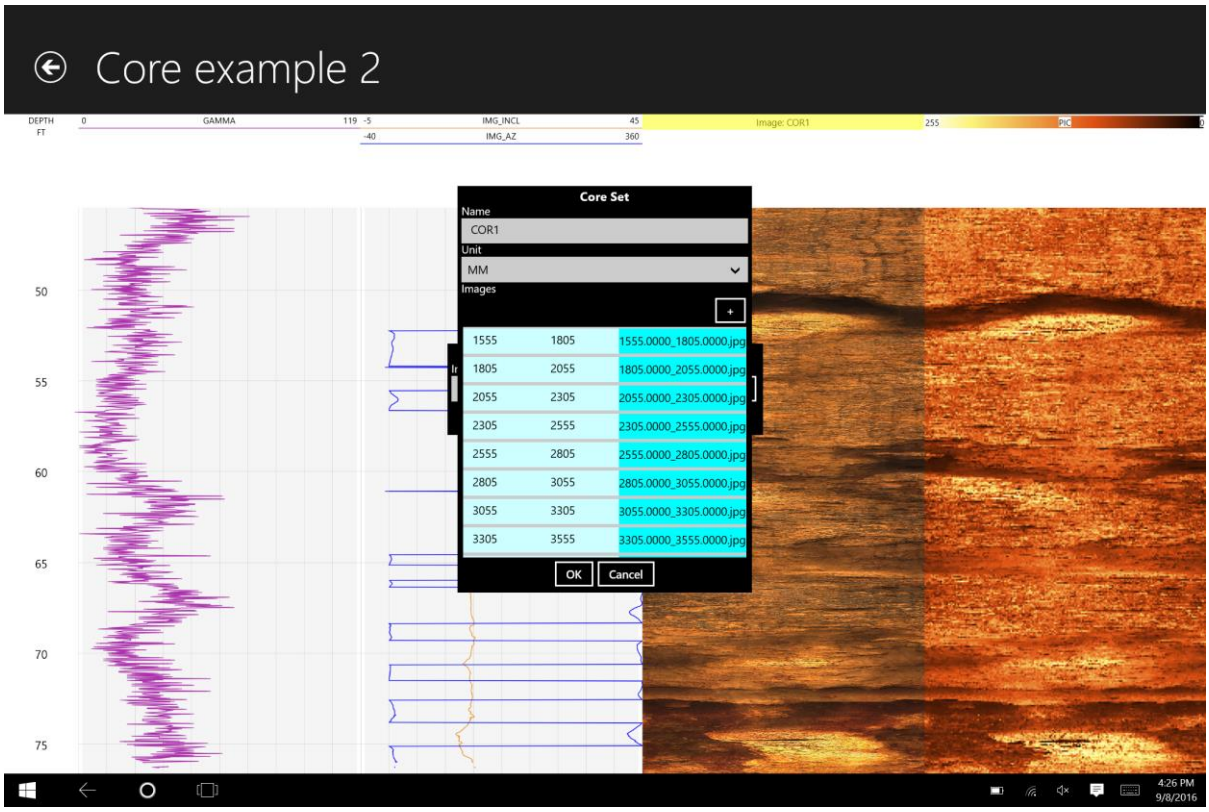


Figure 6.4.3 Selected jpeg files with depts. As file name and added.

6.5 Depth Shifting Curves (Advanced Display)

Figures 6.5.1 and 6.5.2 shows a curve is selected for it to be depth shifted. Once in depth shift mode the depth shift is applied to the single curve or alternately the user can elect to apply the same depth shift to multiple curves as seen in Figure 8.3. The user has the ability to elect whether a curve is scaled linearly or logarithmically with the depth shift.

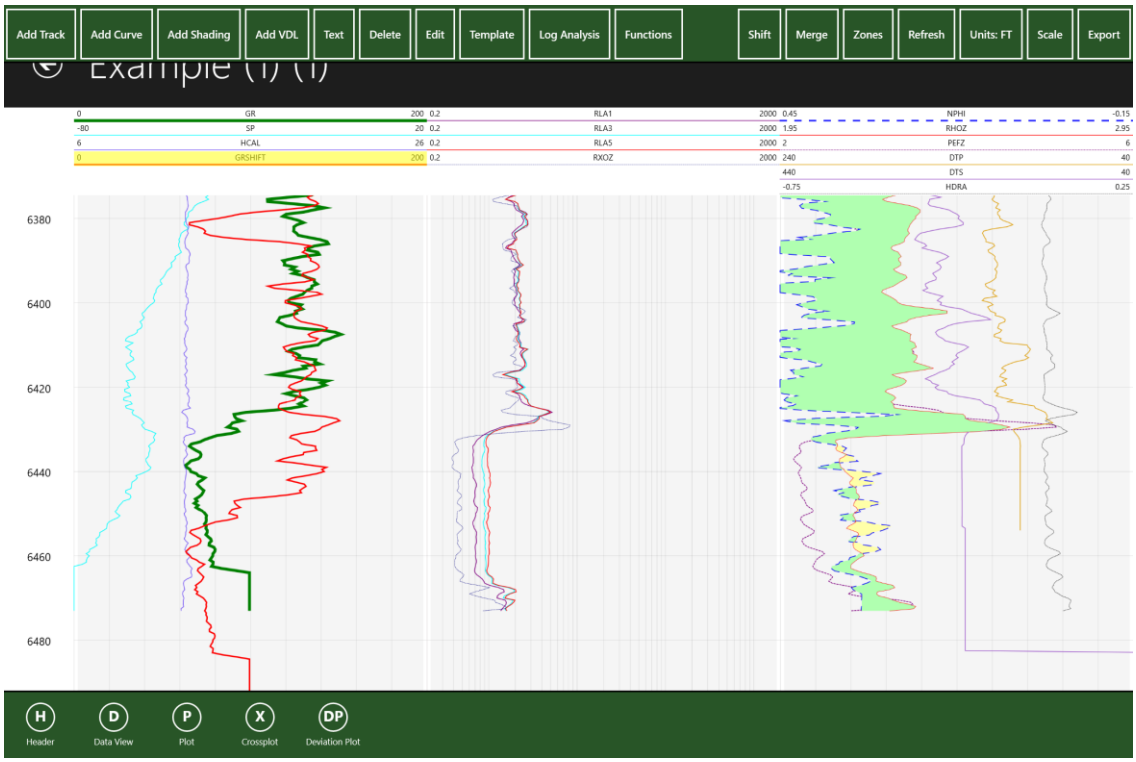


Figure 6.5.1: Curve shift menu selected by tapping shift on Windows

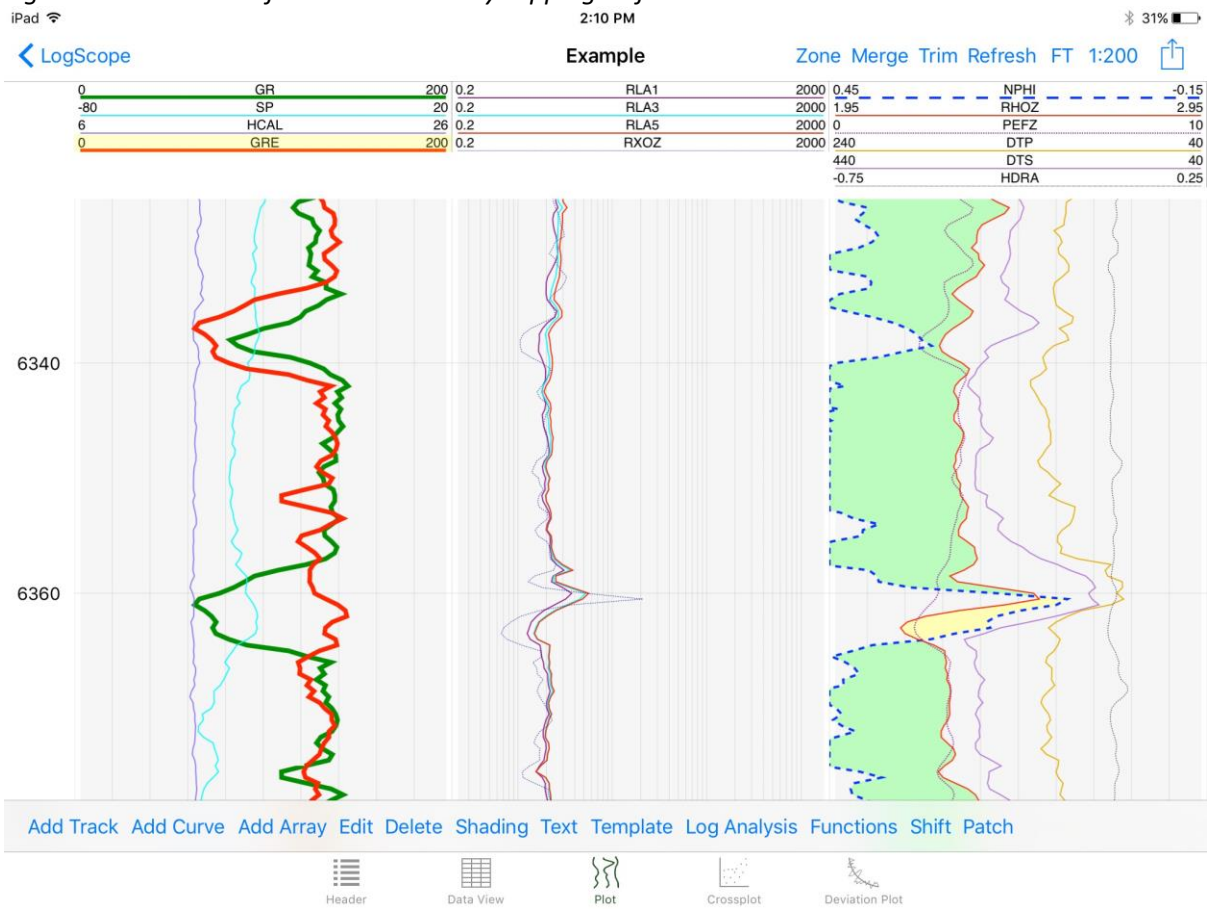


Figure 6.5.2: Curve shift menu selected by tapping shift on Windows

The actual shifting is accomplished by using your finger or a stylus to move the curve up or down. Figure 6.5.3 and 6.5.4 show the depth shifting with red up and blue down. One depth shift entry will allow linear but multiple will allow rubber band depth shifting.

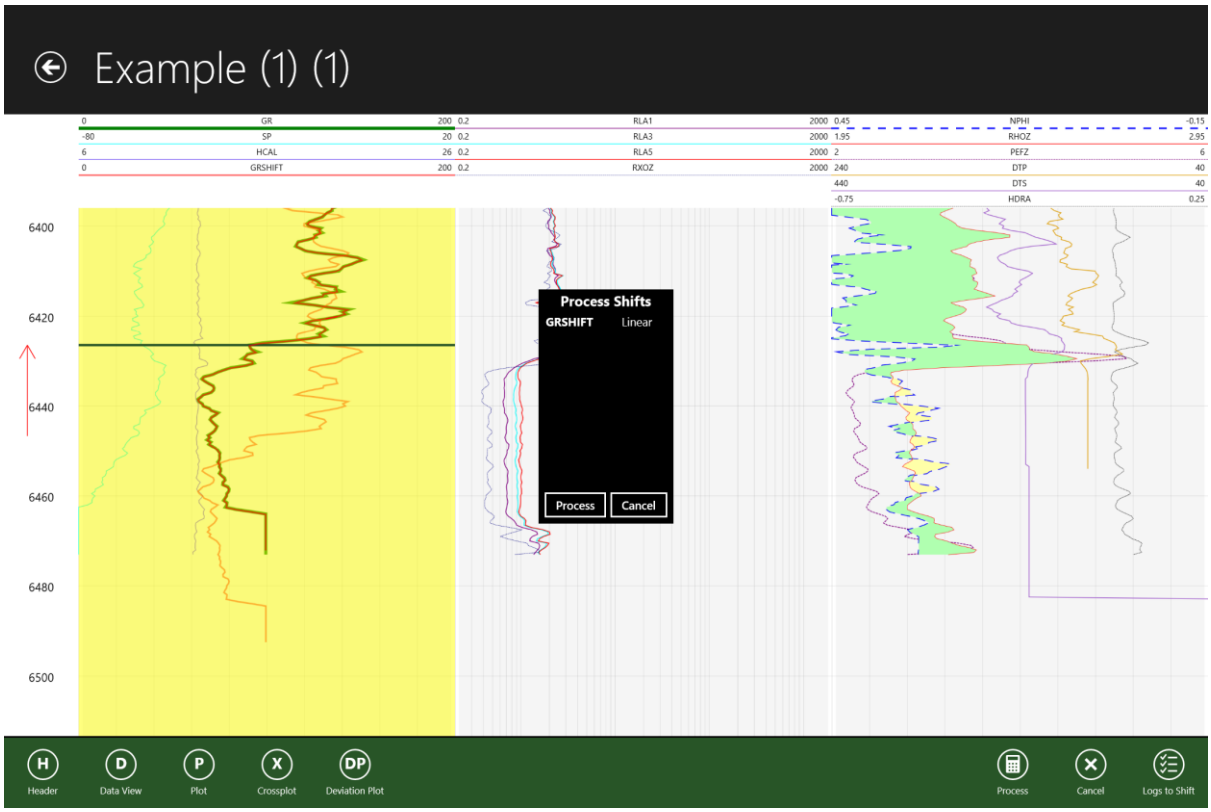


Figure 6.5.3: Curve shifts are illustrated by red for up and blue for down shift on Windows

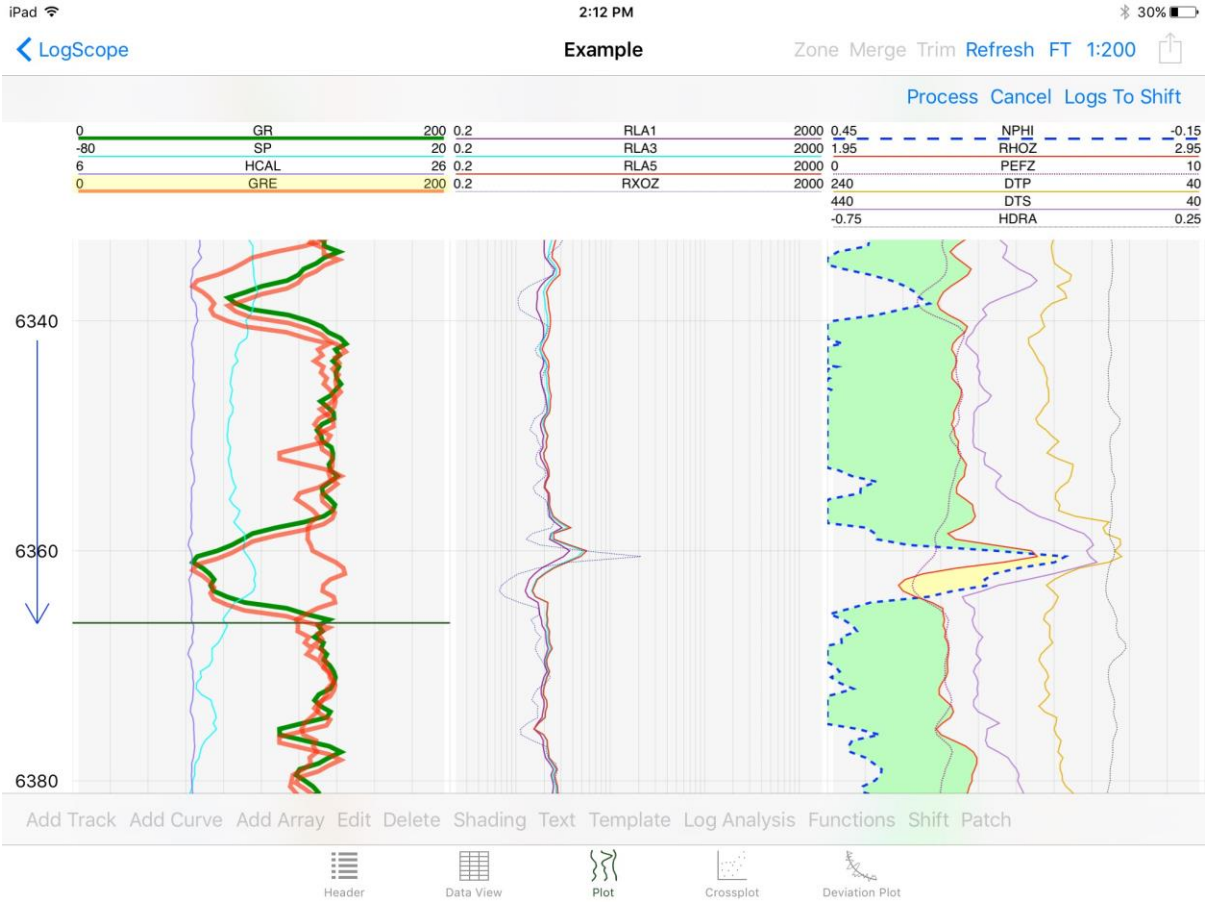


Figure 6.5.4: Curve shifts are illustrated by red for up and blue for down shift on iPad

The shift can be applied to multiple logs as illustrated in Figures 6.5.5 and 6.5.6. The user taps on “Logs to Shift” and the menu is presented to select logs to shift.

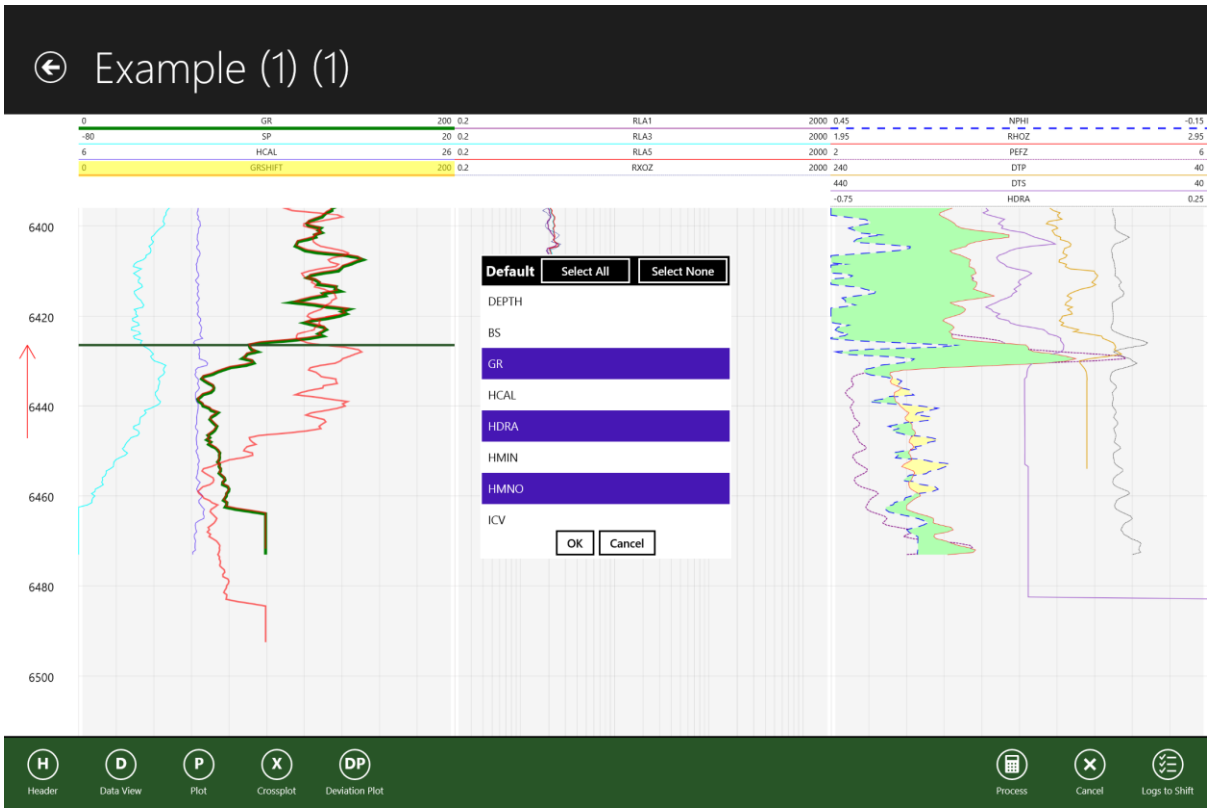


Figure 6.5.5: Multiple curve selection on Windows

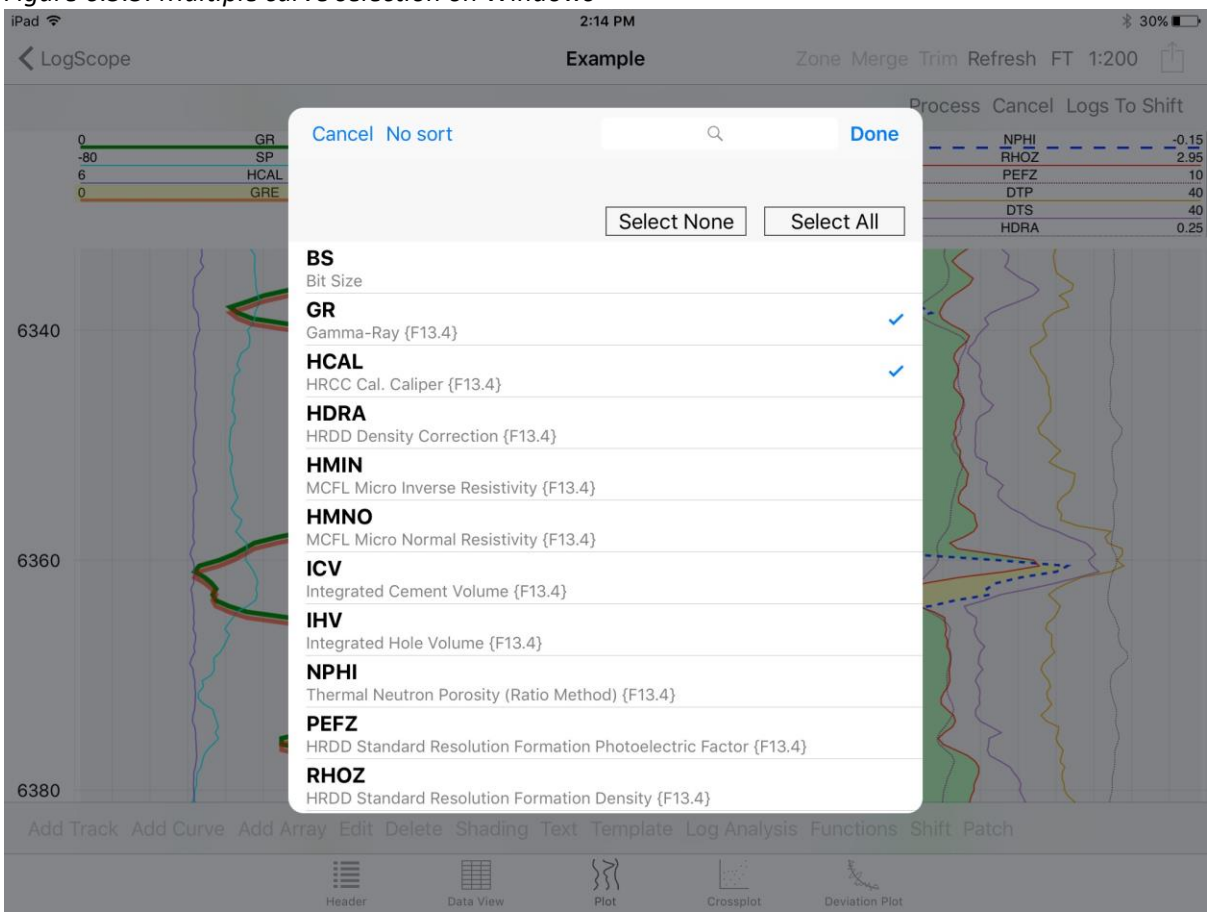


Figure 6.5.6: Multiple curve selection on iPad

The shifts applied can be recorded to a text files (CSV) or emailed. The user is prompted for this at the end of the shifting.

6.6 Patching Curves (Advanced Display)

LogScope provides the ability to patch or remove features that are undesirable such as tool pickup and casing effects graphically by the following method. Figure 6.6.1 and 6.6.2 illustrate the selection of the curve by tapping on it and it becomes highlighted. The patching is the default mode and the curve can be patched by touching lightly on the screen until a red dot is seen then proceed to retrace the curve. On Windows it is sensitive to touch. If using mouse or pen also wait for red dot to appear and then retrace curve. Start at top of plot and work down.

Figure 6.6.1 Curve selection by tapping and highlighting curve on windows

Setting curve to missing is slightly different as shown in Figures 6.6.3 and 6.6.4. The patch button or text on the screen should be tapped to reveal erase mode. Then select the top of interval to be erased and tap at bottom of interval to be erased. The resulting erasure and patching can be committed to the file by tapping process.

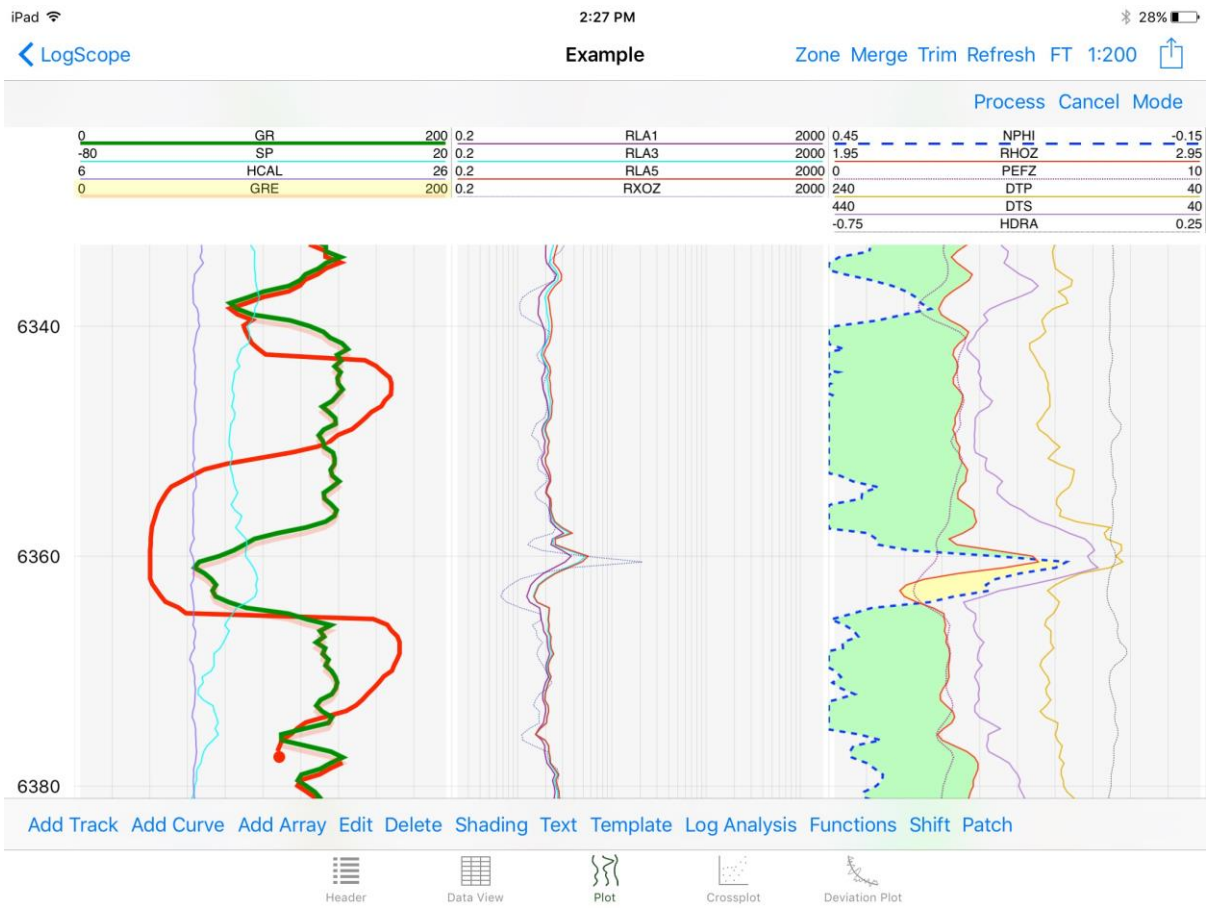


Figure 6.6.2 Curve selection by tapping and highlighting curve on iPad

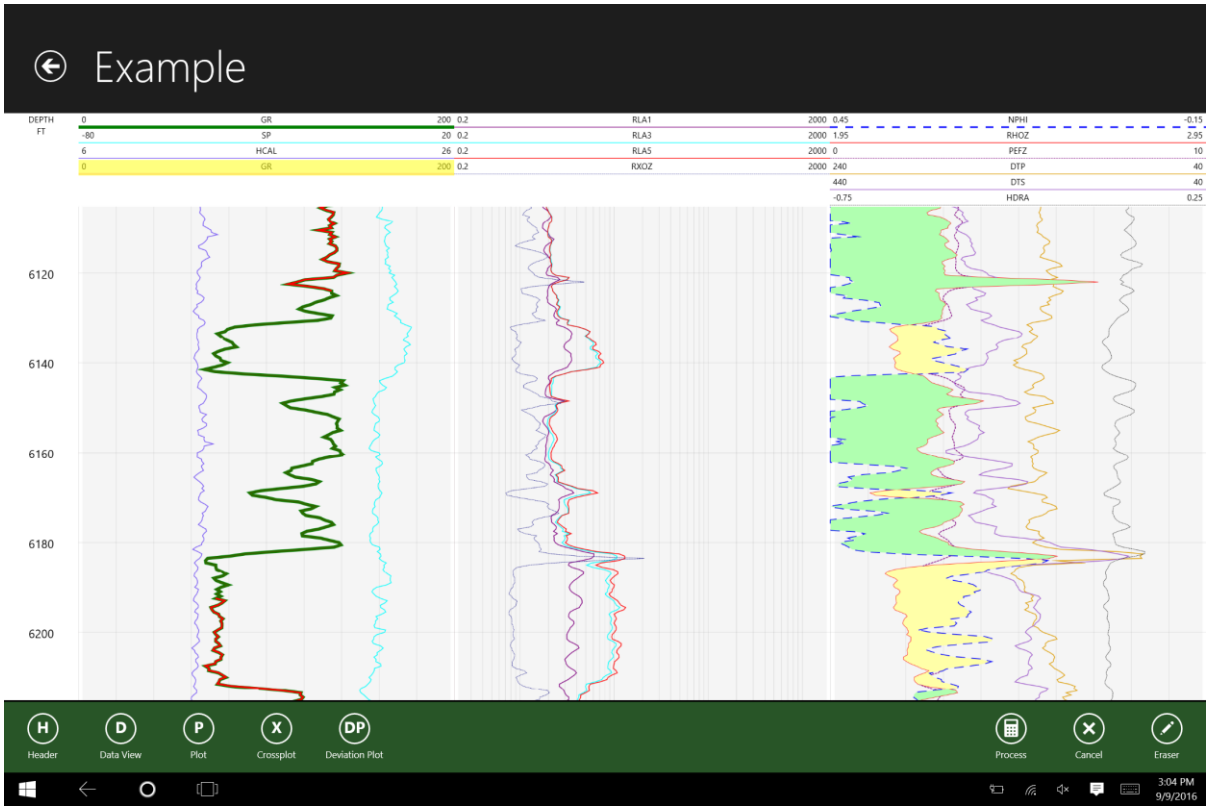


Figure 6.6.3 Curve selection by tapping and highlighting curve on iPad. The curve is removed by selecting erase mode and tapping top and base of interval to remove

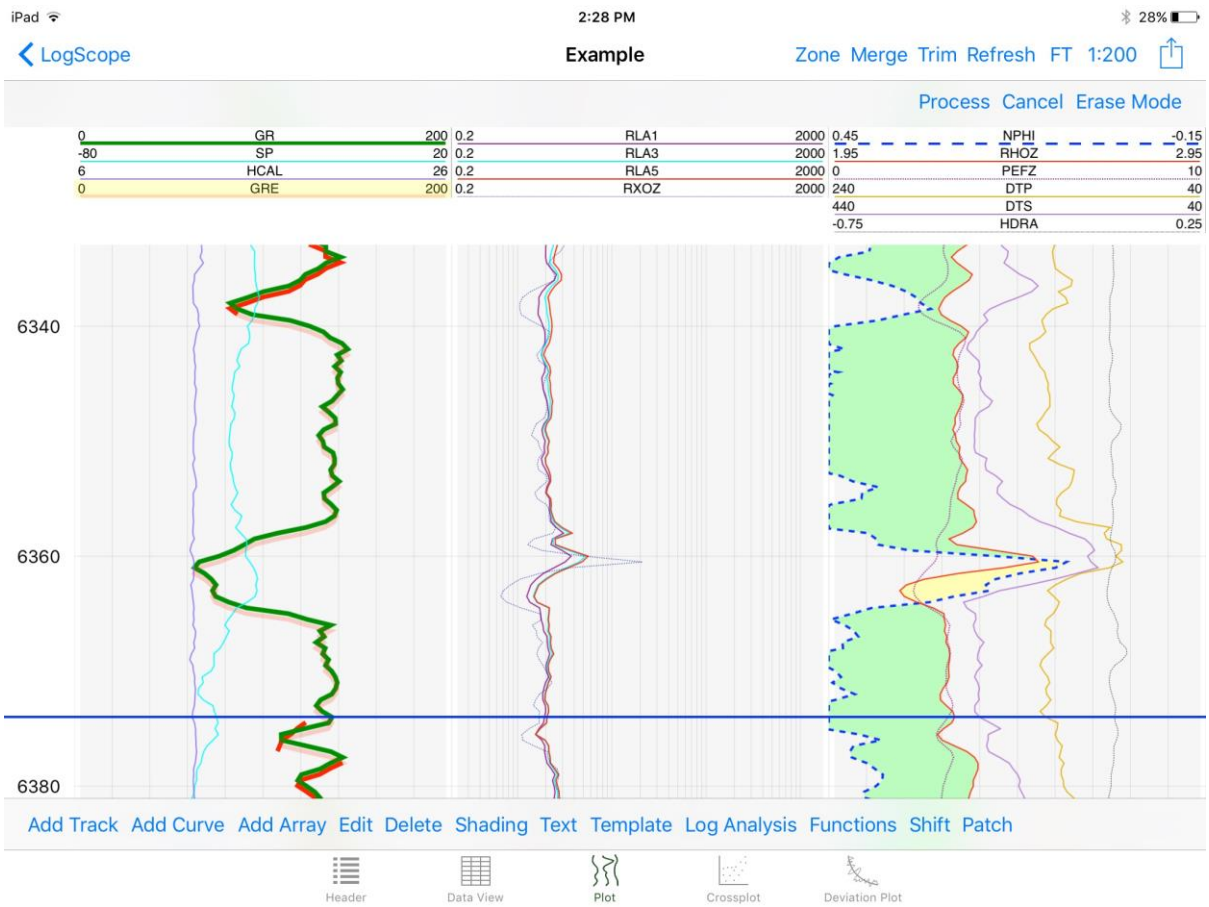


Figure 6.6.4 Curve selection by tapping and highlighting curve on iPad. The curve is removed by selecting erase mode and tapping top and base of interval to remove

6.7 Adding shading (Basic Display)

Shading can be added by tapping shading and tapping and holding the desired shading. Use your finger to drag to track where you wish to display shading. The process is illustrated in Figure 6.7.1 and 6.7.2. Select shading type and drag to where you wish it to be. If you wish to shade between two curves choose an appropriate place on the plot and drag the shading to there.

Figures 6.7.3 and 6.7.4 show the result after dragging and dropping the shading on the plot.

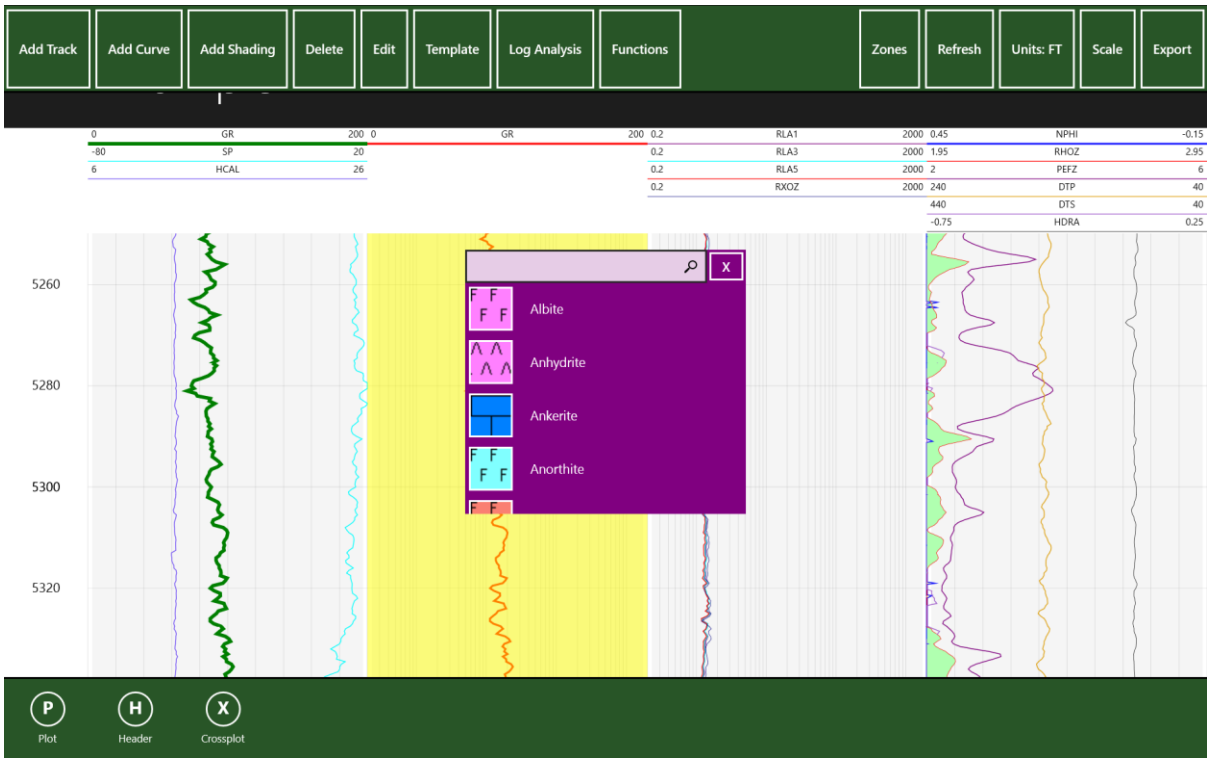


Figure 6.7.1: Shading popup on Windows

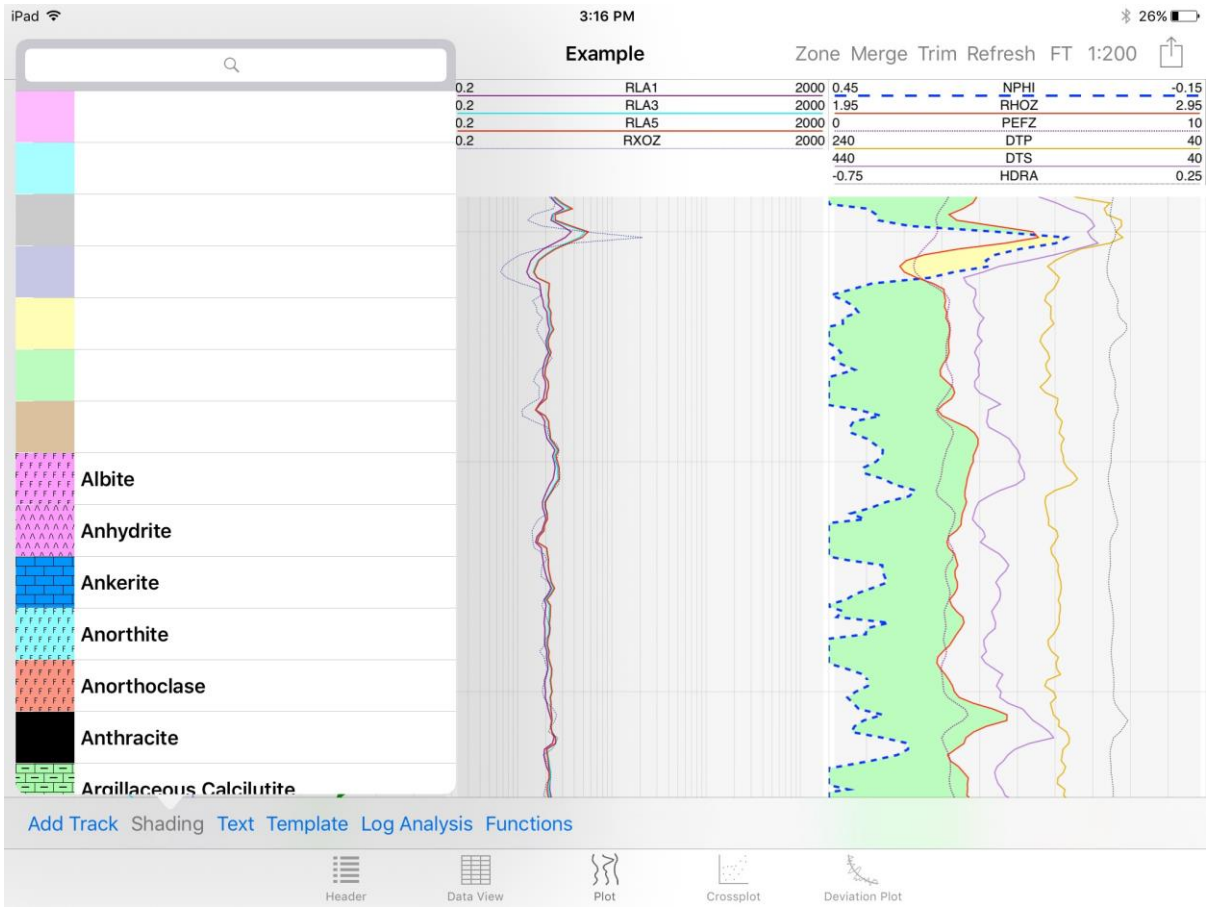


Figure 6.7.2: Shading popup on iPad

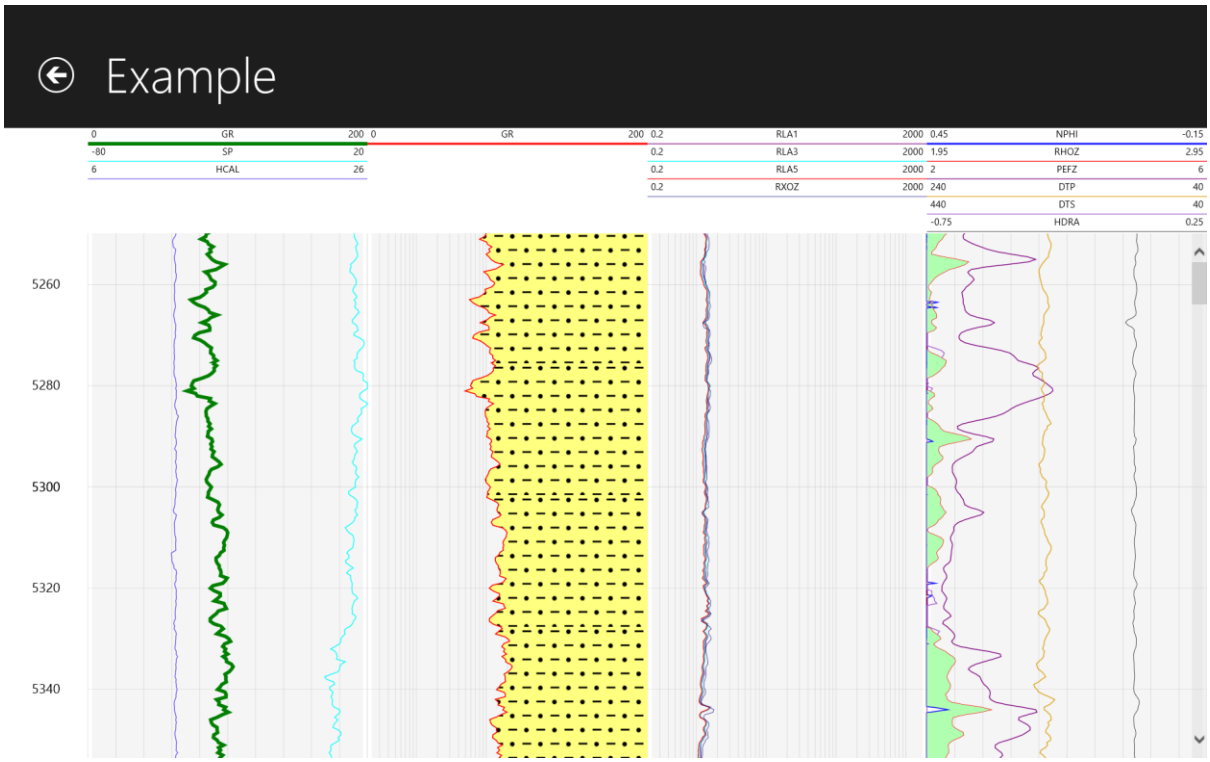


Figure 6.7.3: After dragging and dropping shading on Windows

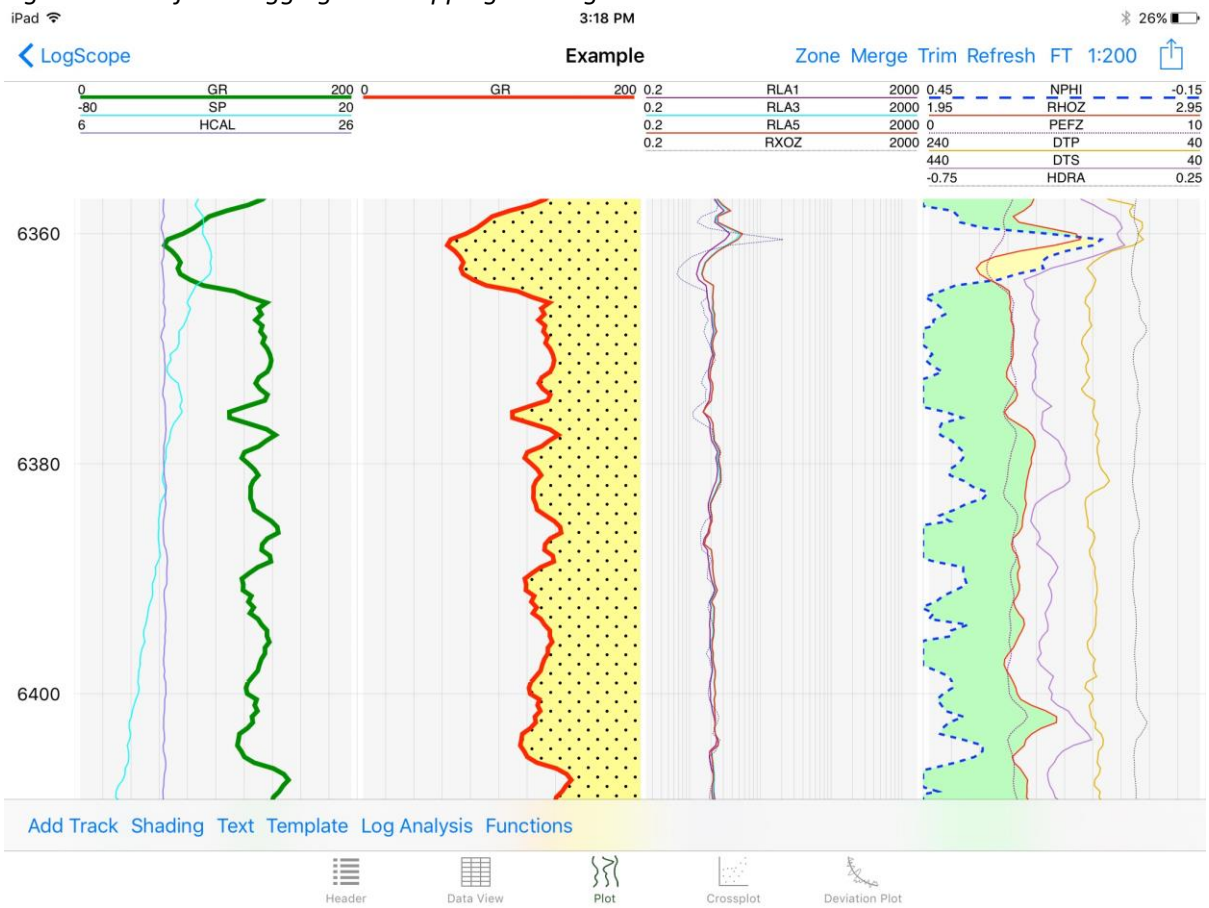


Figure 6.7.4: After dragging and dropping shading on iPad

If the shading is in the wrong place you can edit the shading by tapping on the shading then selecting it as shown in Figures 6.7.5 and 6.7.6. When shading is selected Figures 6.7.7 and 6.7.8 show the menu presented. The user can change the track percentage and curve used.

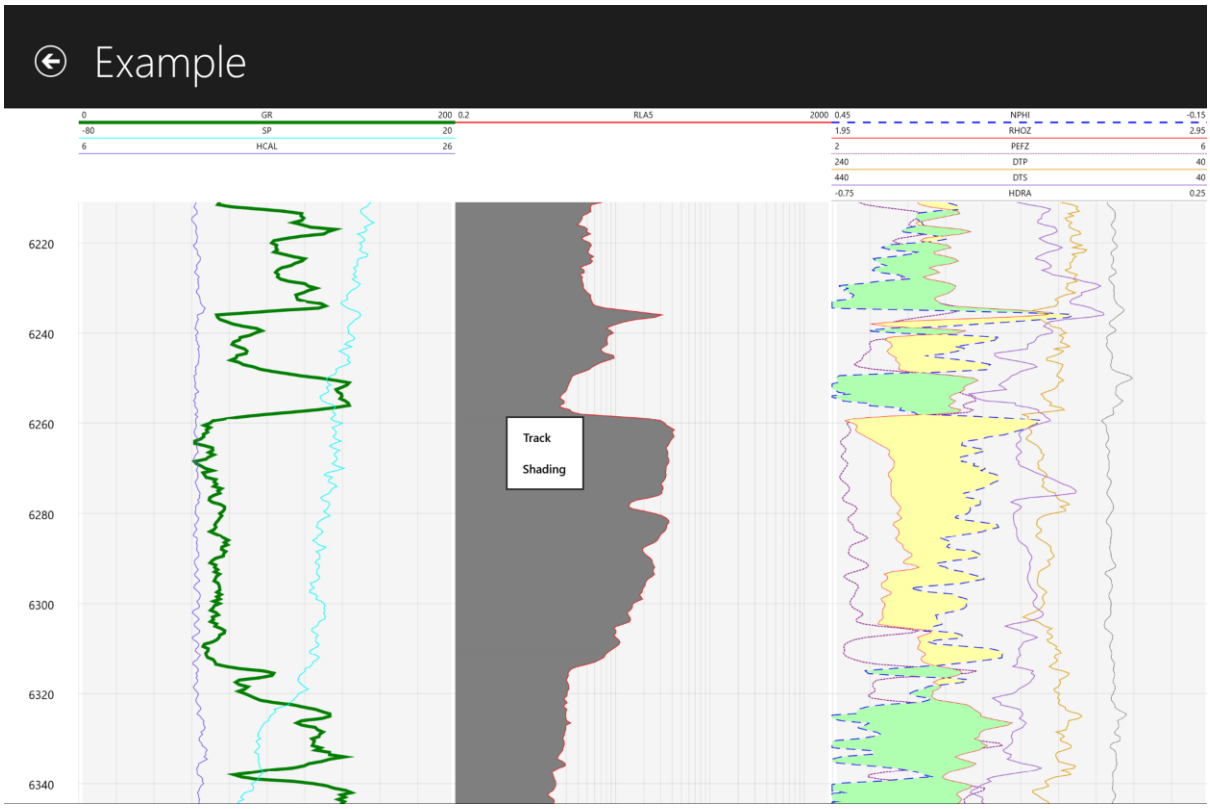


Figure 6.7.5: Selecting shading to edit on windows

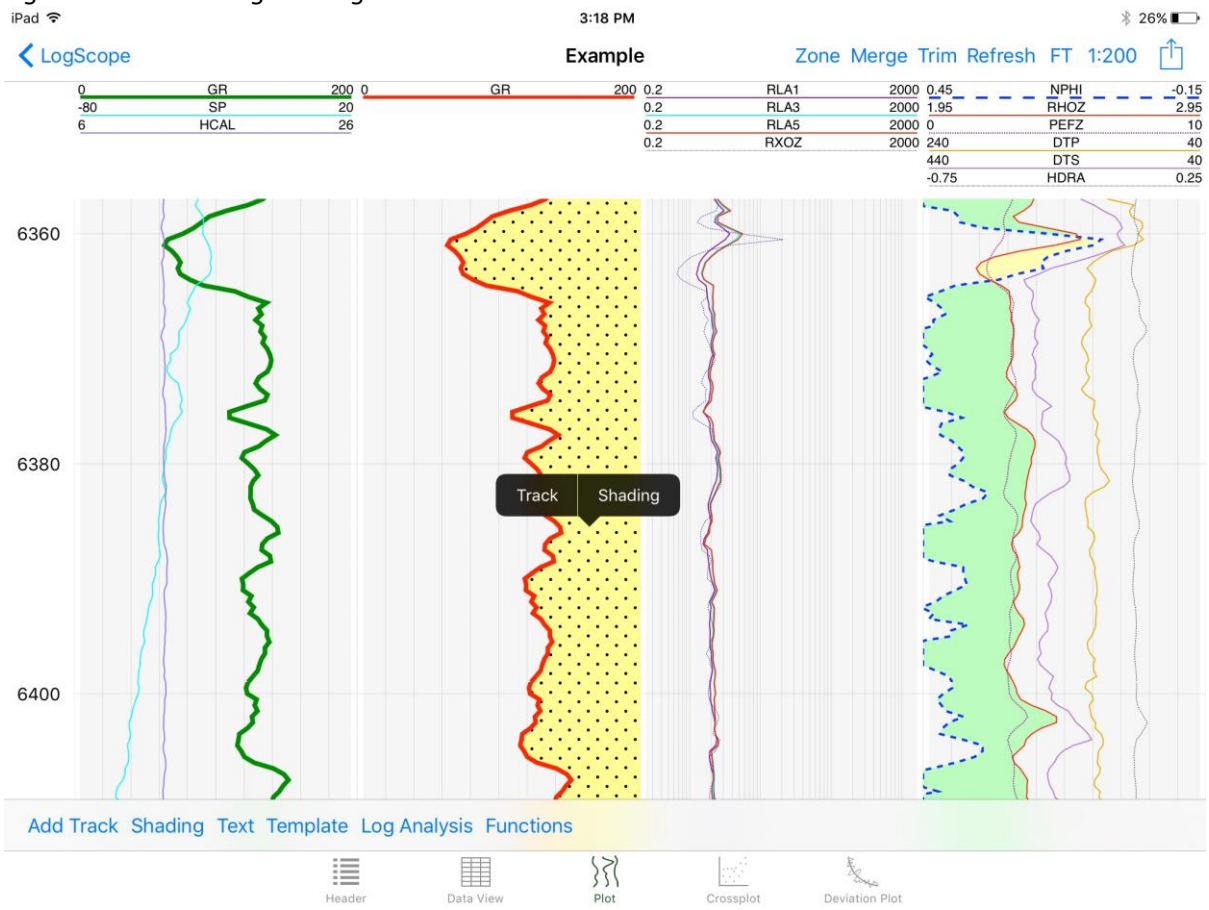


Figure 6.7.6: Selecting shading to edit on iPad

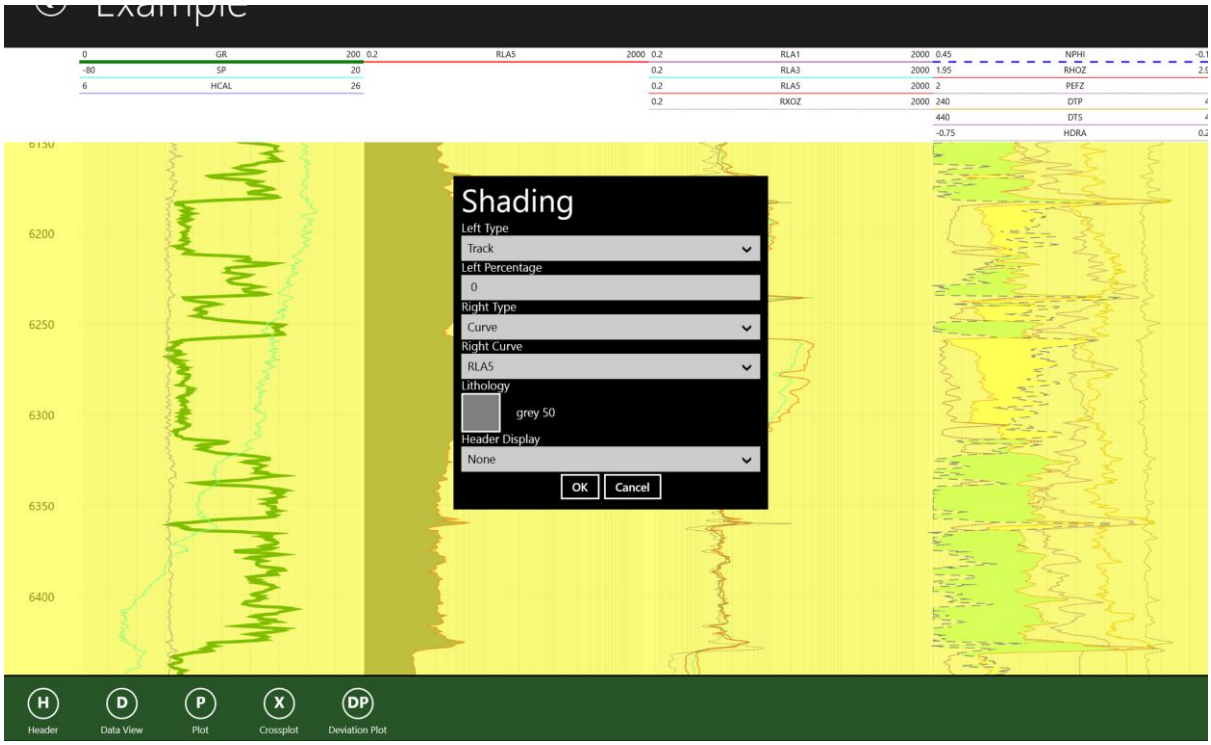


Figure 6.6.7 Shading editing on Windows

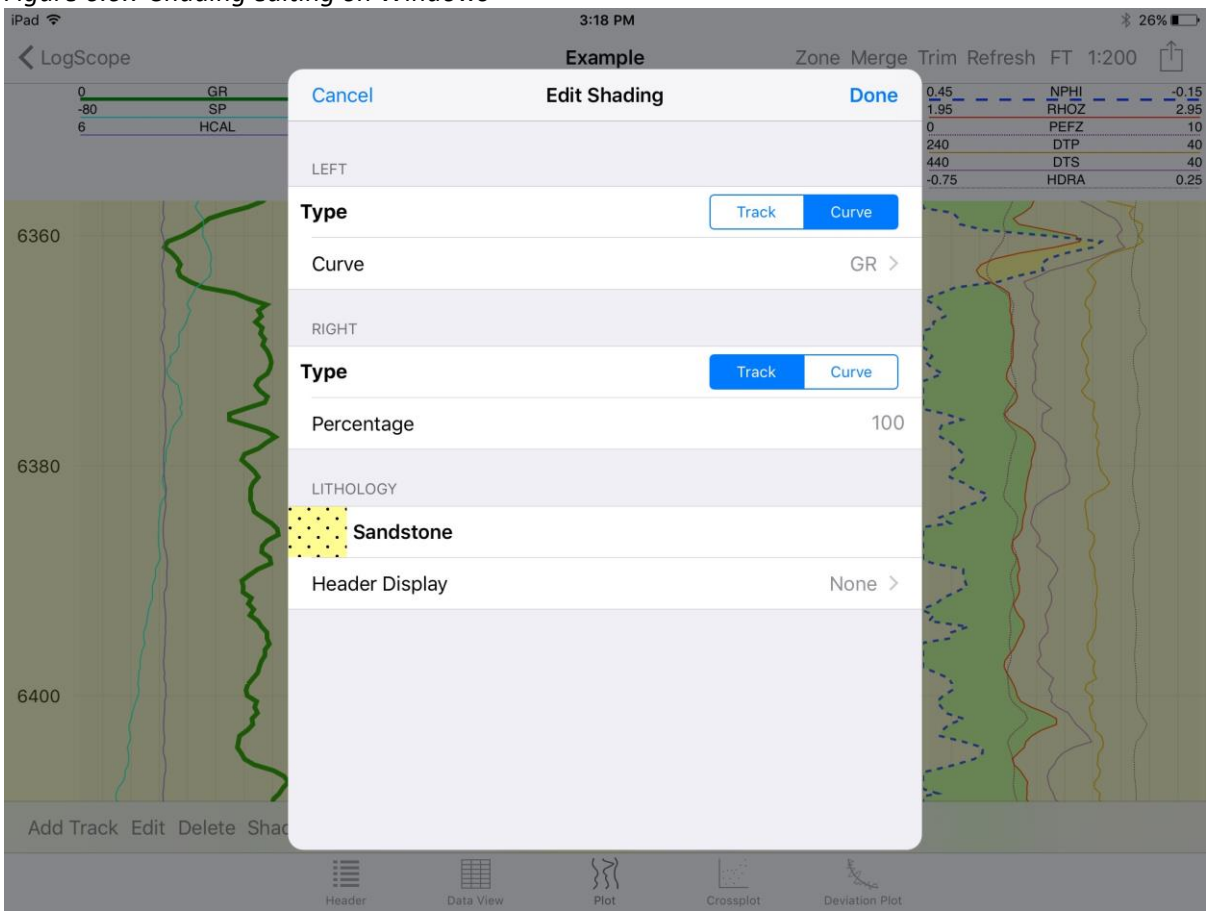


Figure 6.6.8 Shading editing on iPad

6.8 Adding text (Basic Display)

Tap TEXT and then tap desired location on plot and start typing. To finish text simply tap the plot screen area again.

To change the text, tap the text just typed and tap the option you wish to change as shown in Figures 6.8.1 and 6.8.2

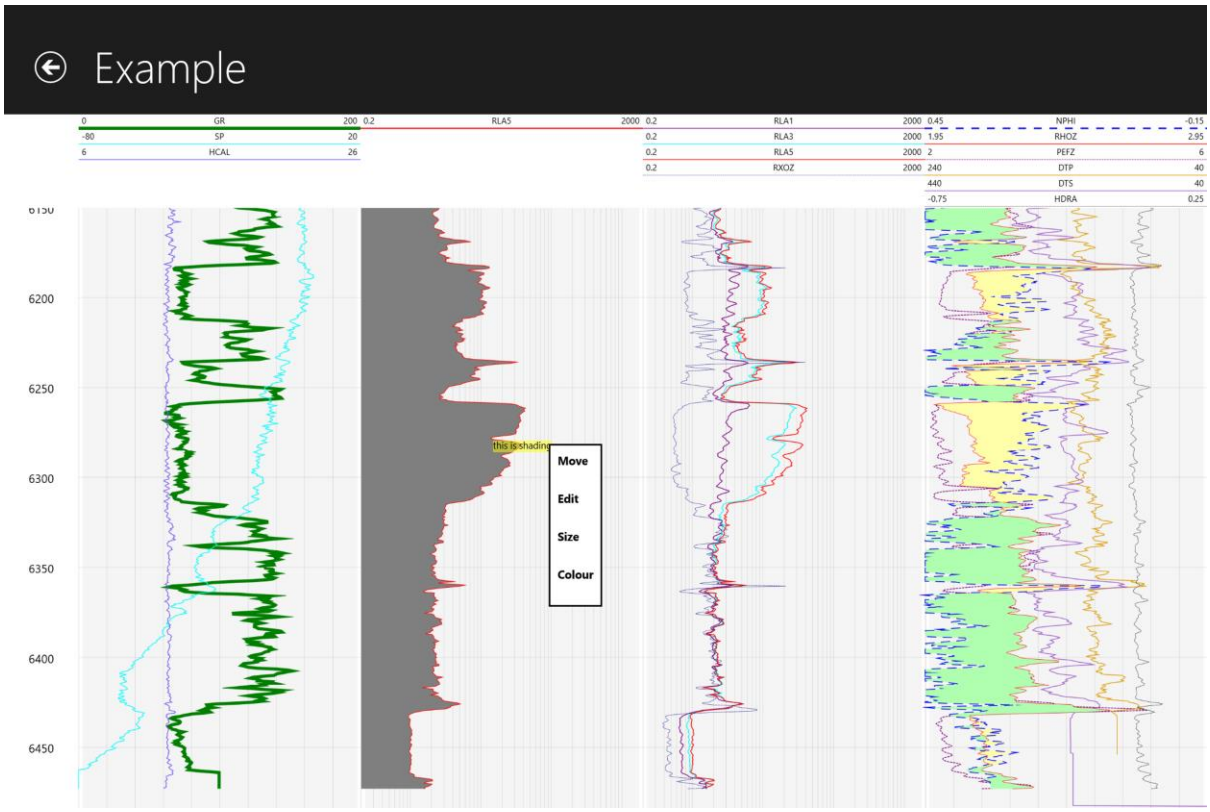


Figure 6.8.1: Text edit options on Windows

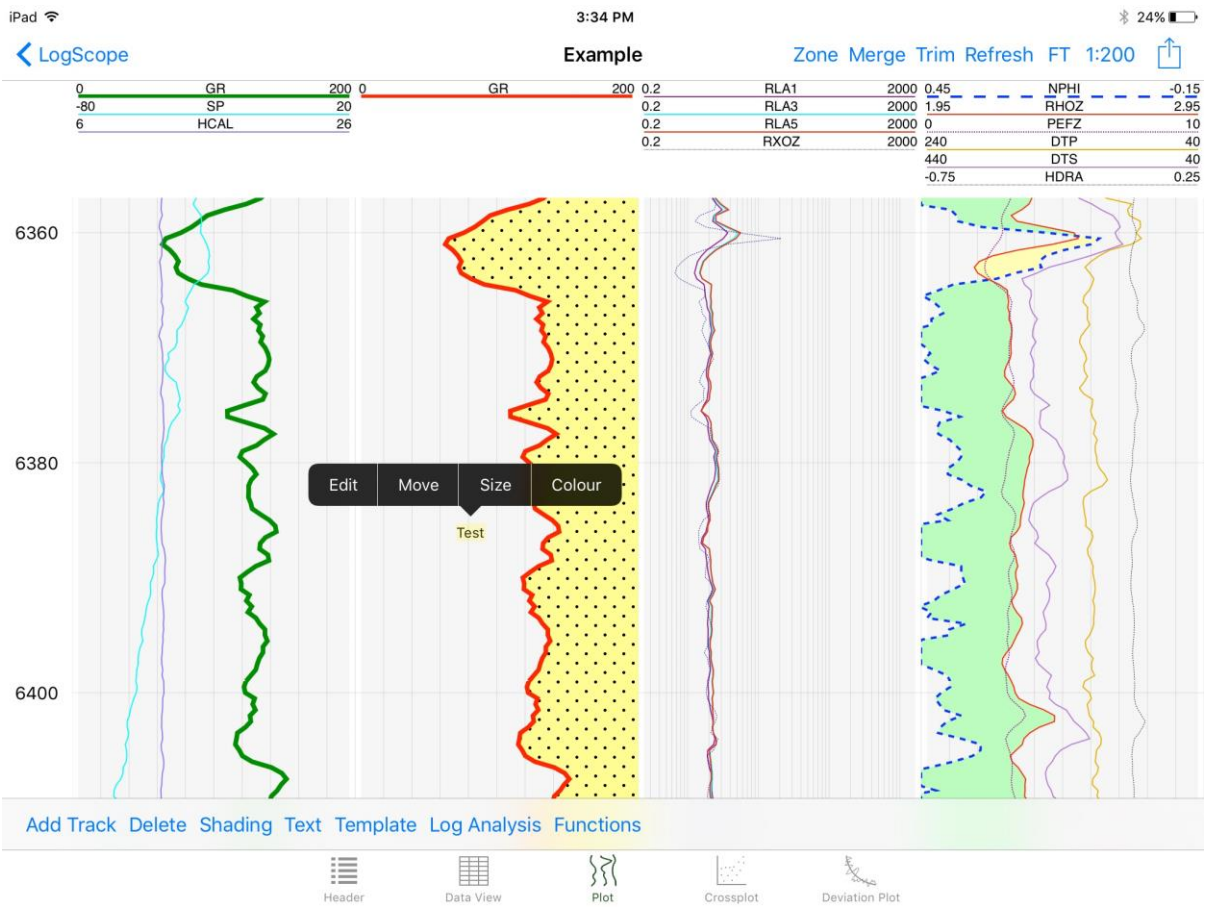


Figure 6.8.2: Text edit options on iPad

6.9 Additional Functionality (Basic Display)

The following additional functionality exists in LogScope:

- Curves can be reordered in a track by tapping and holding, then moving curve to new position
- Curves can be moved to a new track by tapping and holding and dragging to new track. Note that moving a curve to a new track will result in loss of shading.
- Elements of the plot which include Text, Shading, Curve and Track can be deleted by tapping and highlighting (yellow color) and tapping delete

7 Deviated Plots (Deviated Plots)

LogScope has an option provided there is an azimuth and deviation curve in the file to plot a deviated trajectory. Simply select at the bottom of the screen the deviated plot. The deviated plot uses the **first two tracks** of the currently open template in the plot to create the plot. Figures 7.1 and 7.2 show the initial display of the deviation plot.

In the deviation plot the user can use the pinch gesture to see more of the well. Zones can be added by using the zone button and setup allows selection of Azimuth, Deviation, track width, sample rate and units plotted in. Figures 7.3 and 7.4 illustrate these parameters.

Figures 7.5 and 7.6 show the zone addition. Simply touch the zone button and zones can be added and labeled anywhere along the well path. The text and location can be edited by tapping the zones as illustrated in Figures 7.7 and 7.8.

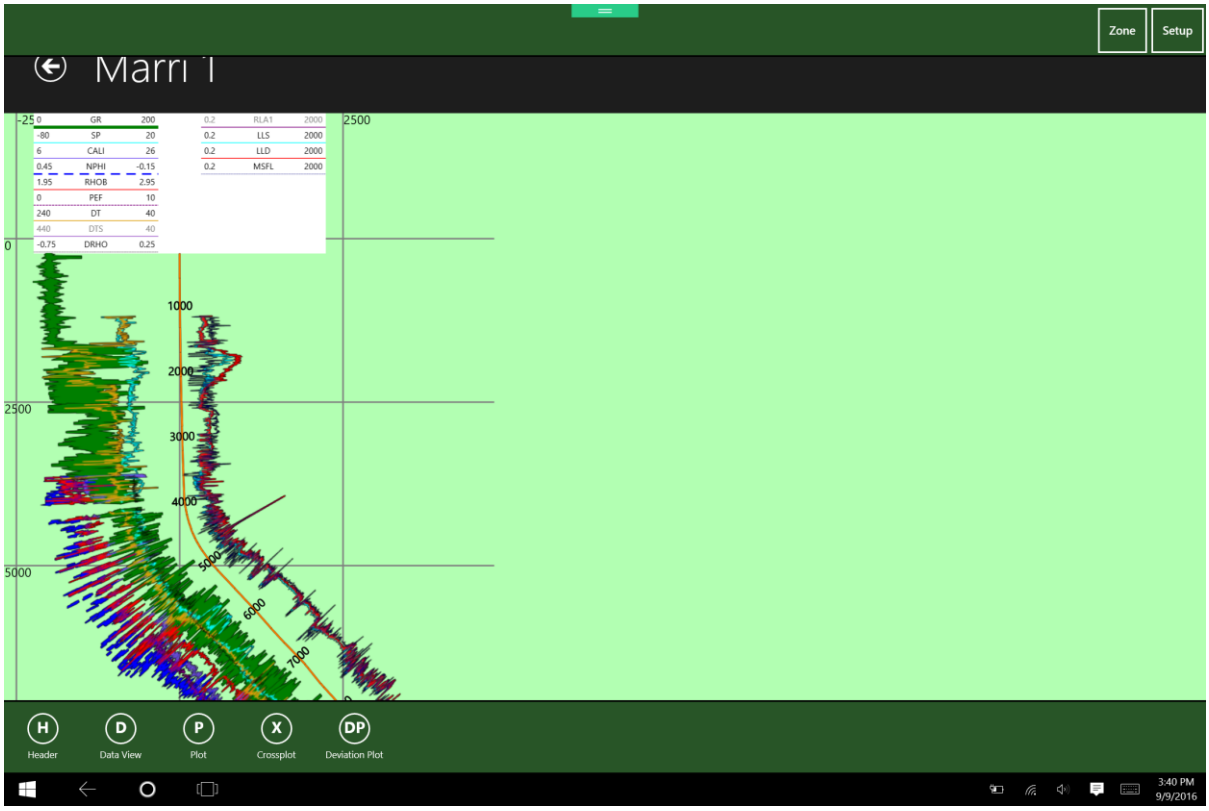


Figure 7.1 Deviation plot on Windows

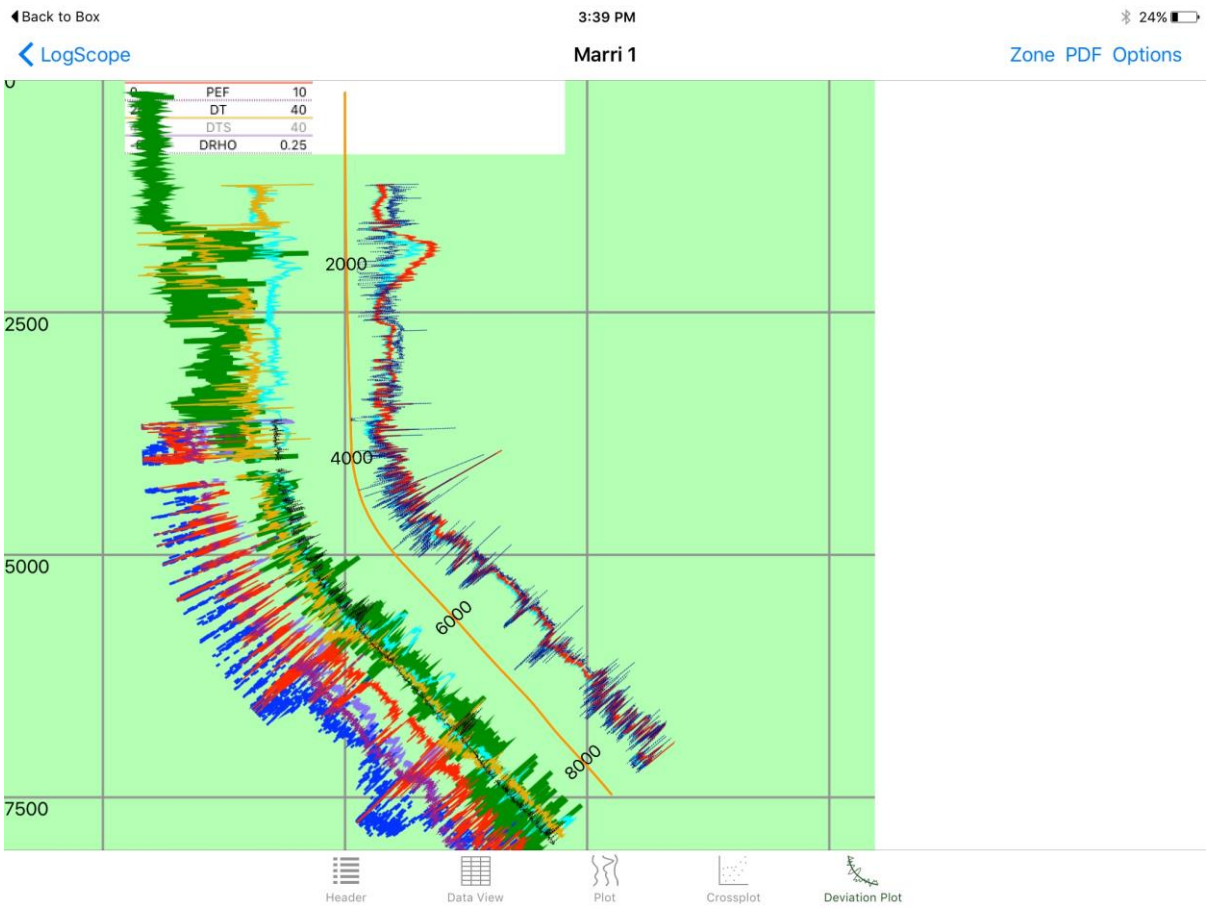


Figure 7.2 Deviation plot on iPad

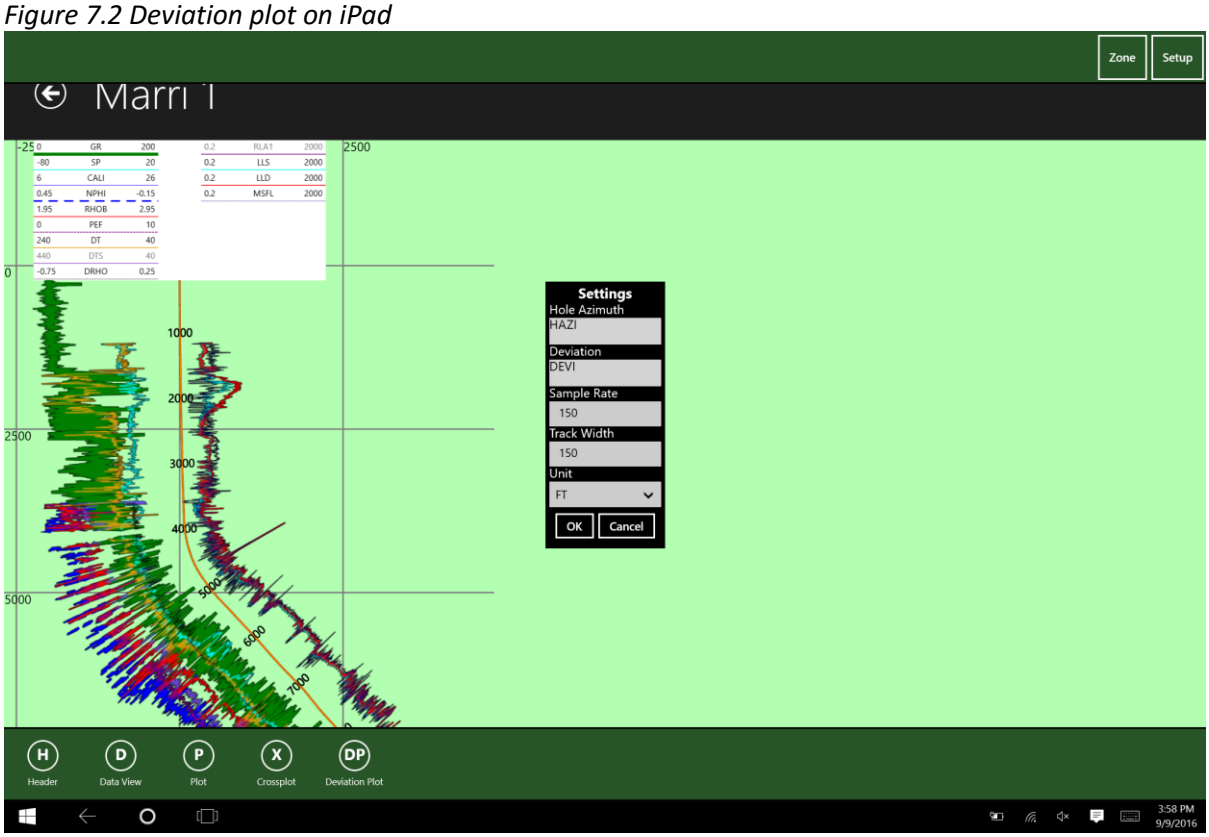


Figure 7.3 Deviation plot Setup menu on Windows

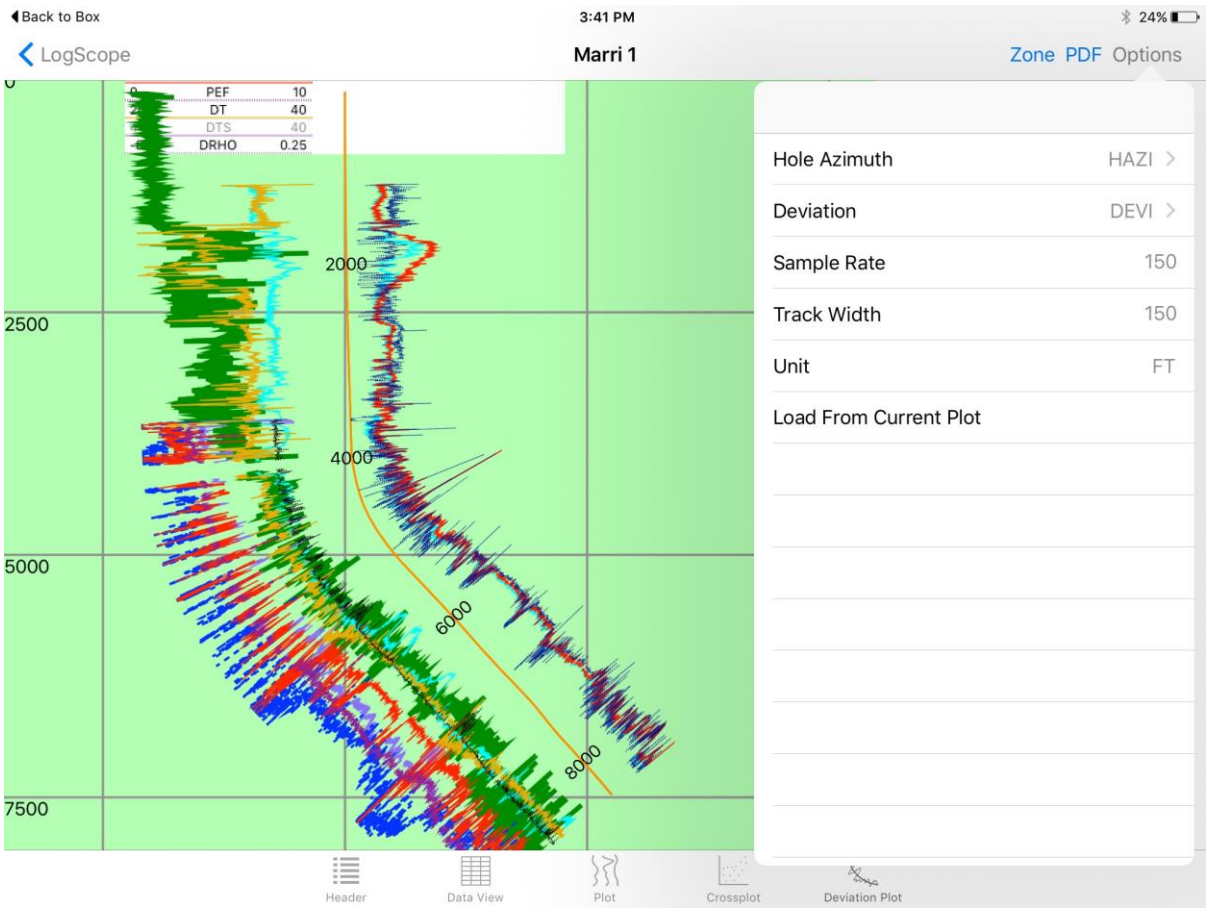


Figure 7.4 Deviation plot Setup menu on iPad

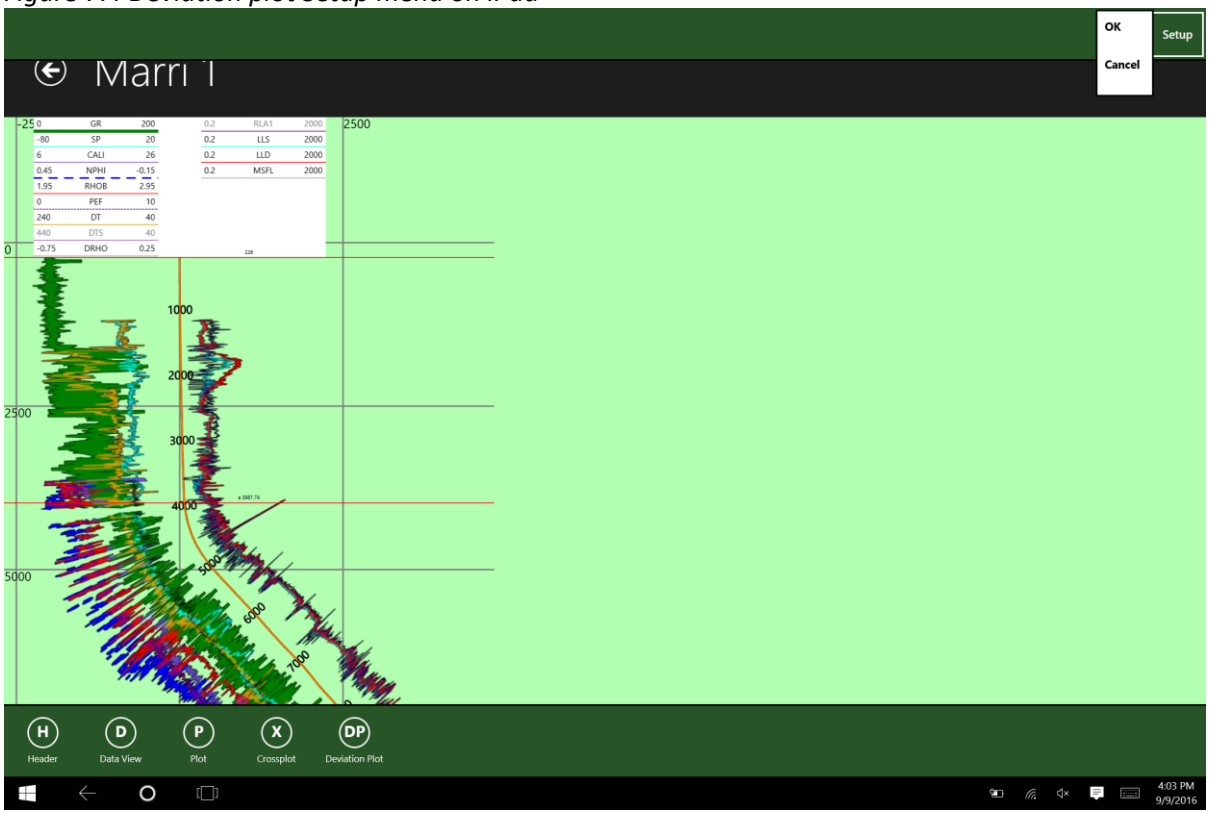


Figure 7.5 Deviation plot Zone menu on Windows

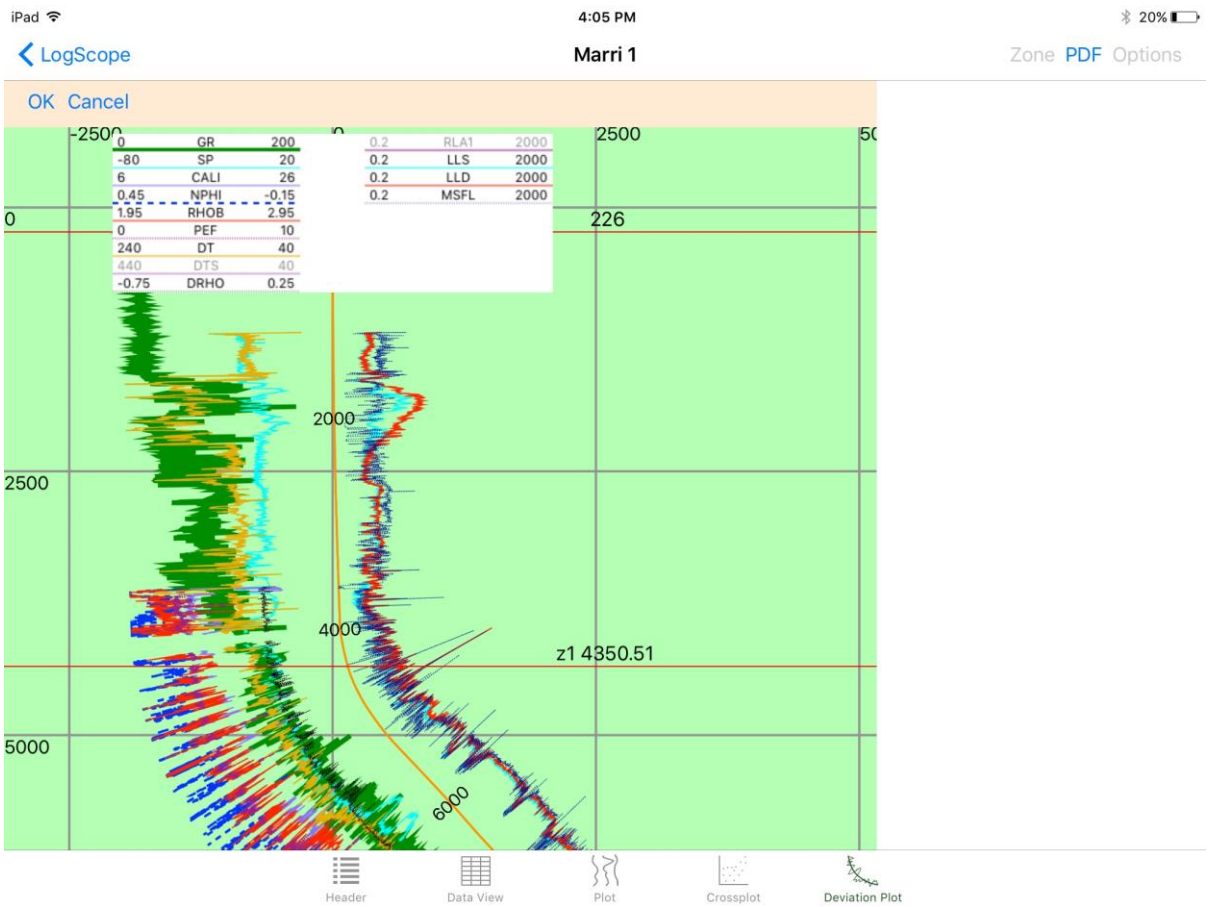


Figure 7.6 Deviation plot Zone menu on iPad

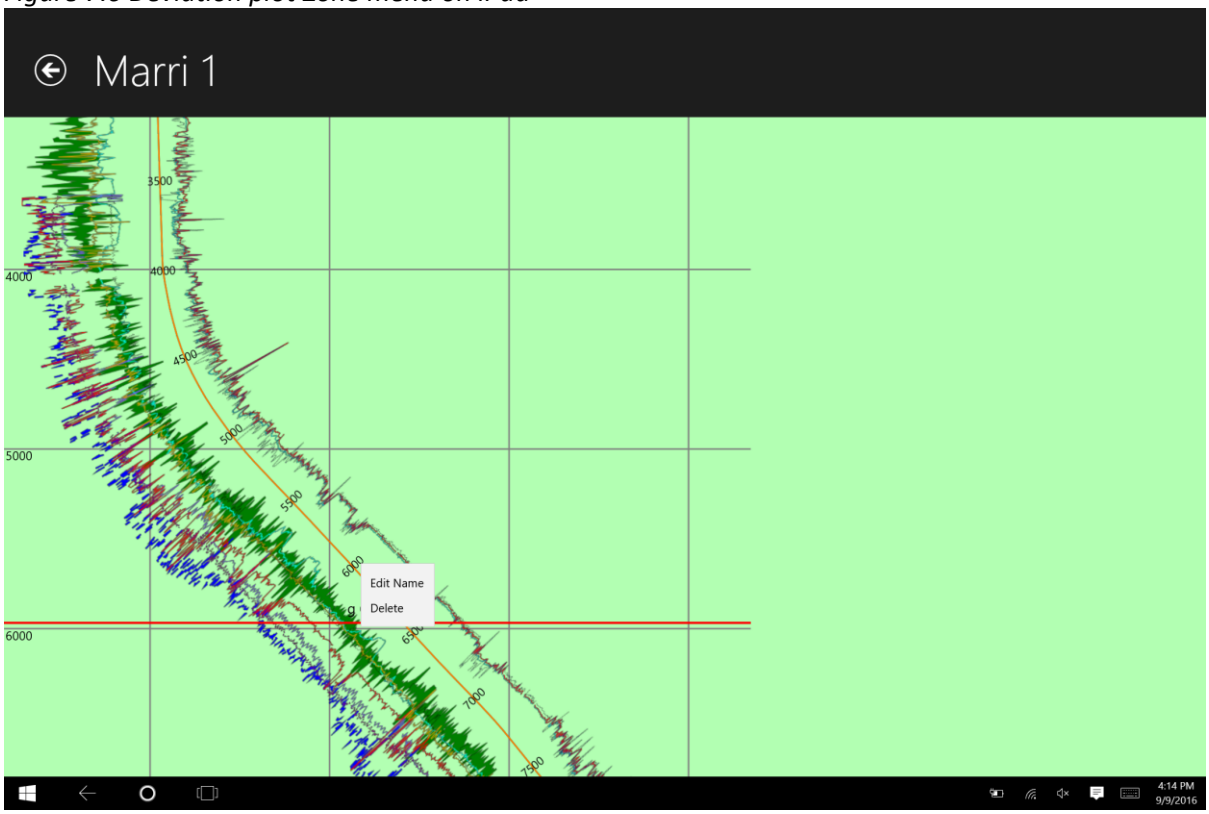


Figure 7.7 Deviation plot Zone edit menu on Windows

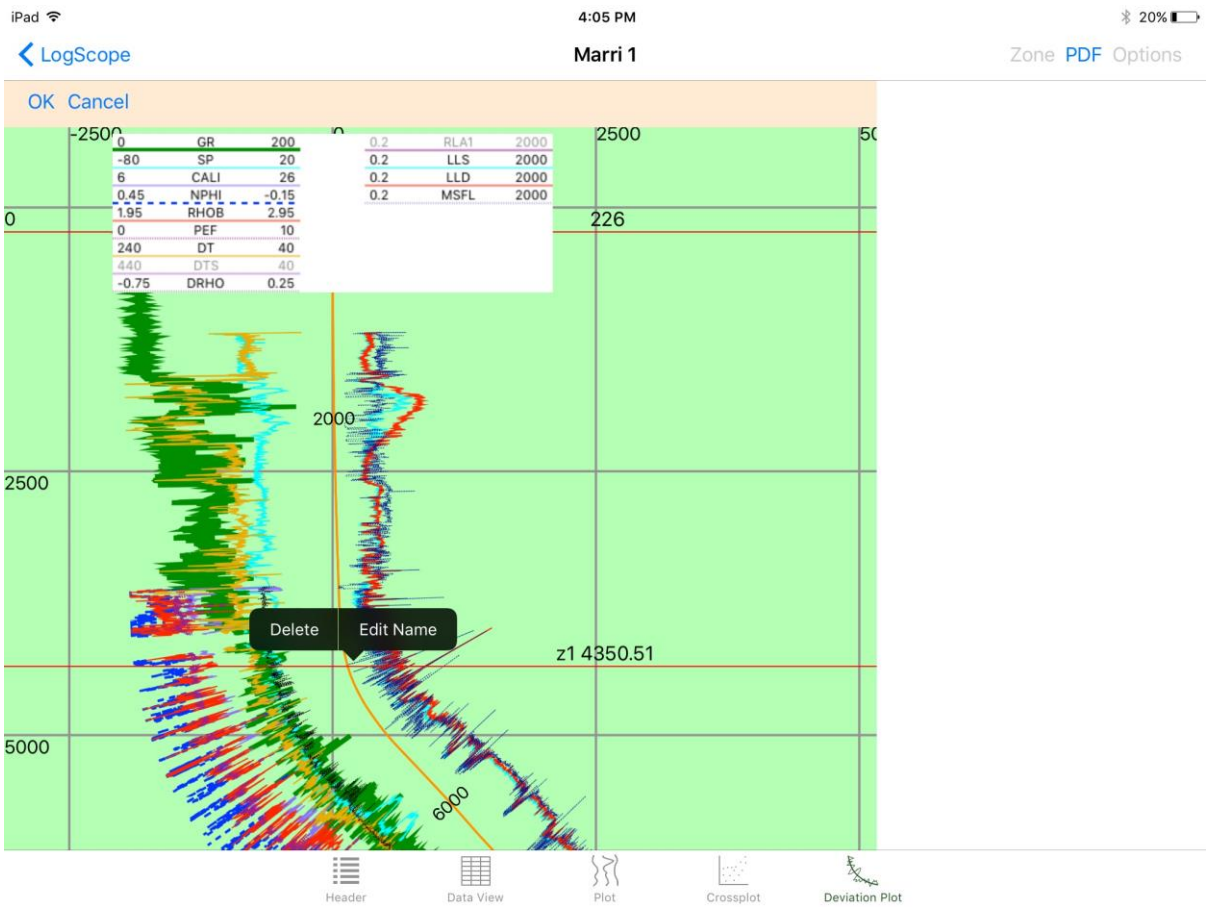


Figure 7.8 Deviation plot Zone edit menu on iPad

8 Exporting Plot (Export Module)

Plot export is included in the LAS/CSV in app purchase for export and is enabled once this is purchased.

The basic package will only permit data presentation. The presentation can be exported, as a PDF will look like the following as shown in Figure 8.1. The filename is used for the plot title and the remaining text. Note that the text in the LAS file will be used and Plots are true scale and paginated.

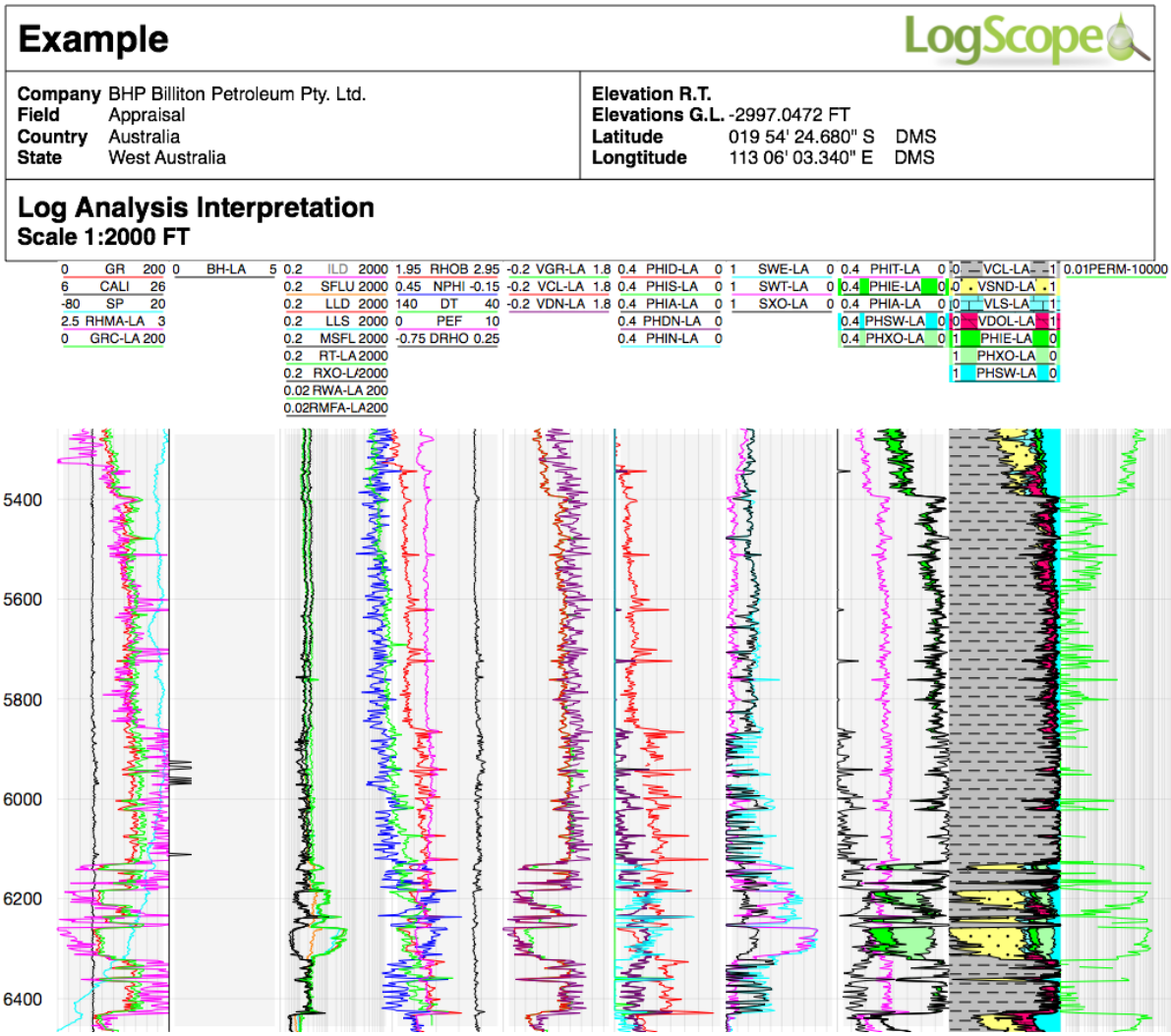


Figure 8.1 – Output for Printers and PDF

The options in export are shown in Figures 8.2 and 8.3. In the export module the following are available:

- LAS export
- CSV Export
- CGM Graphics export
- PDF export
- Template (plots) Export

- Project export (Complete well project can be exported and saved)
- Petrolog Control File export.

DLIS export and import is available when the DLIS module is added to the module suite. The DLIS module does full import and export of DLIS files. In addition, LogScope will also encapsulate the jpeg files used in the true color display or images (See Section 6.4). Any installation of LogScope will be able (provided they have the DLIS module) to read this in and display the data automatically.

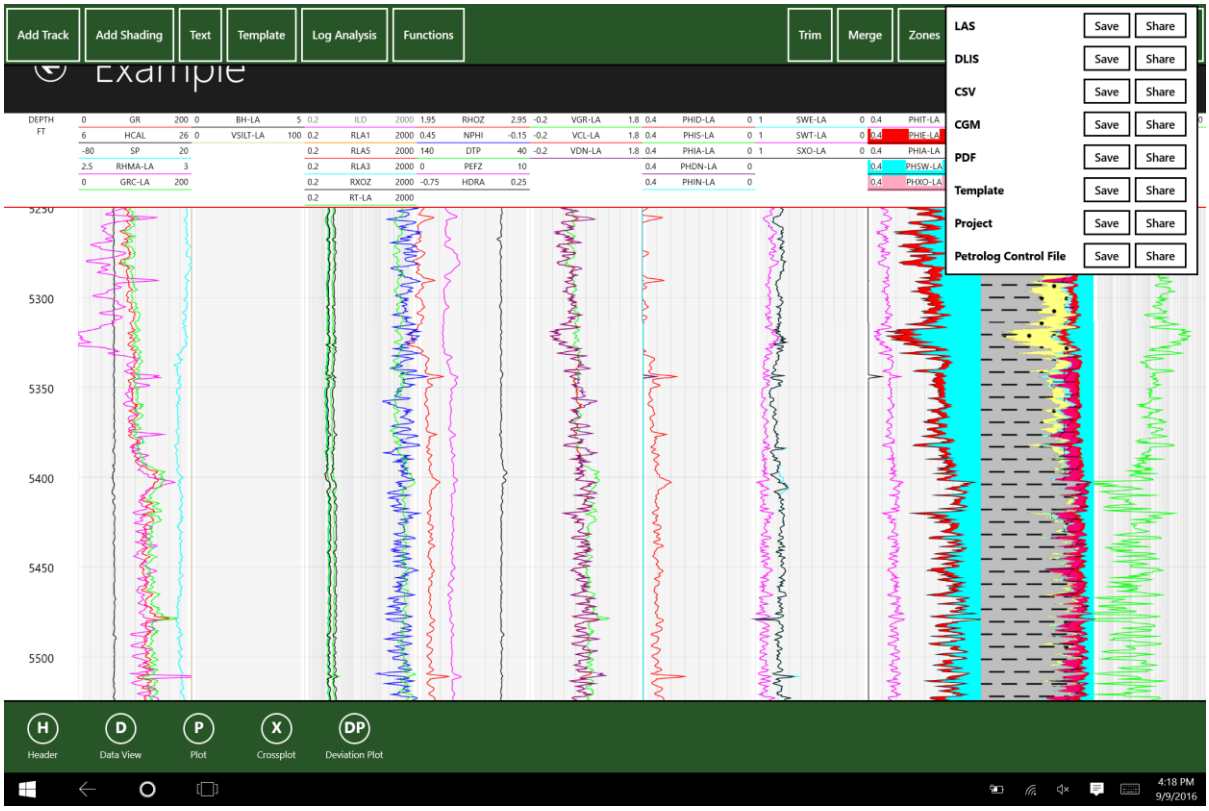


Figure 8.2 – Export options on windows

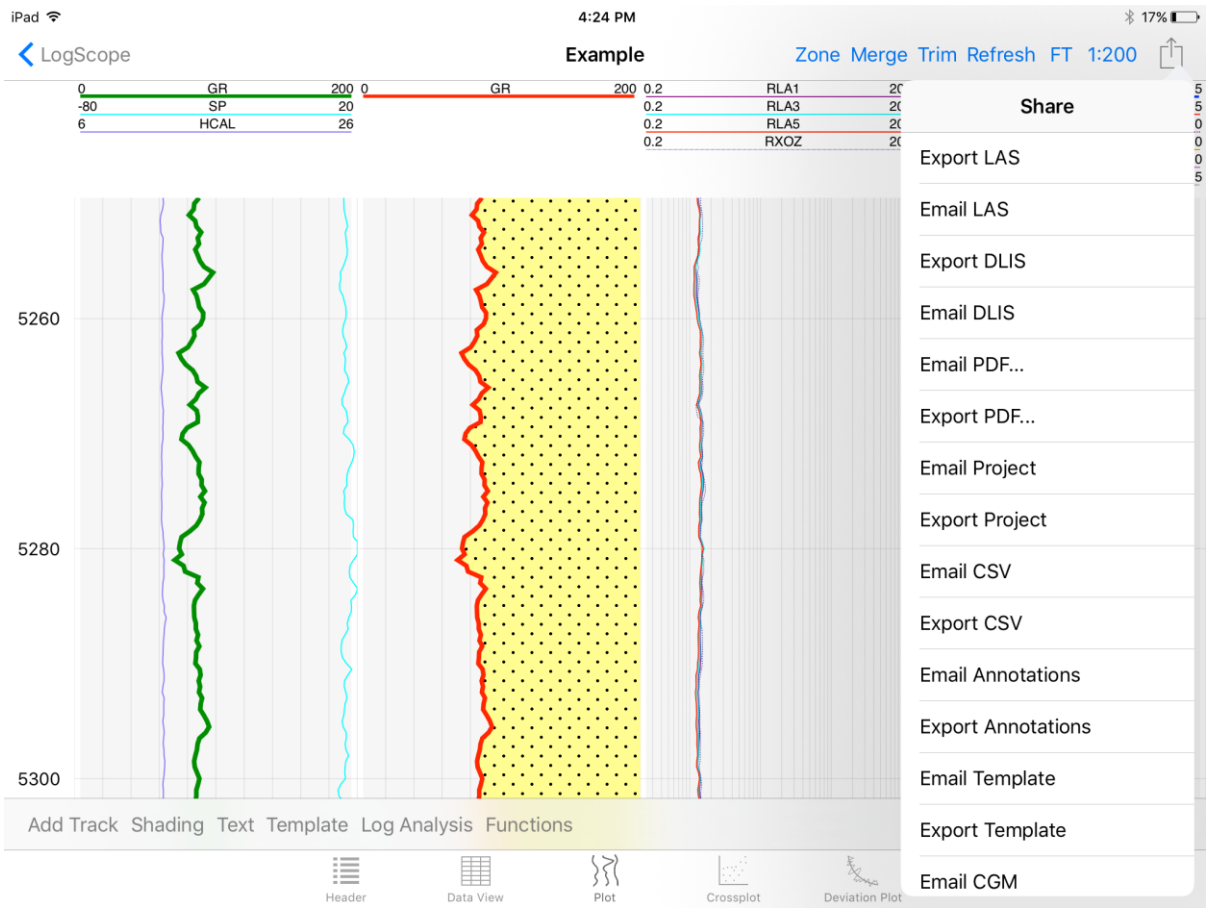


Figure 8.3 –Export options on iPad

9 Zones (Log Analysis)

A zone is a defined contiguous range in the data, between a top and bottom depth. They are defined by boundaries, and so gaps or overlaps cannot exist between two consecutive zones. The user may configure zones such that they do not cover the entire range of data, or may cover more than the data range.

Zones can have parameters attached to them, allowing data to be processed differently for different sections. Any parameters that have been defined exist for all zones in the project.

Zone groups are named containers for parameters and all parameters must belong to a zone group.

All parameters have a name and a default value. The name of the parameter must be unique within its zone group.

9.1 Zone Editor

The zone editor is accessible via the “Zone” button at the top of the plot view.

Upon entering zone editing mode, the boundaries of the zones are displayed on the plot and a toolbar appears.

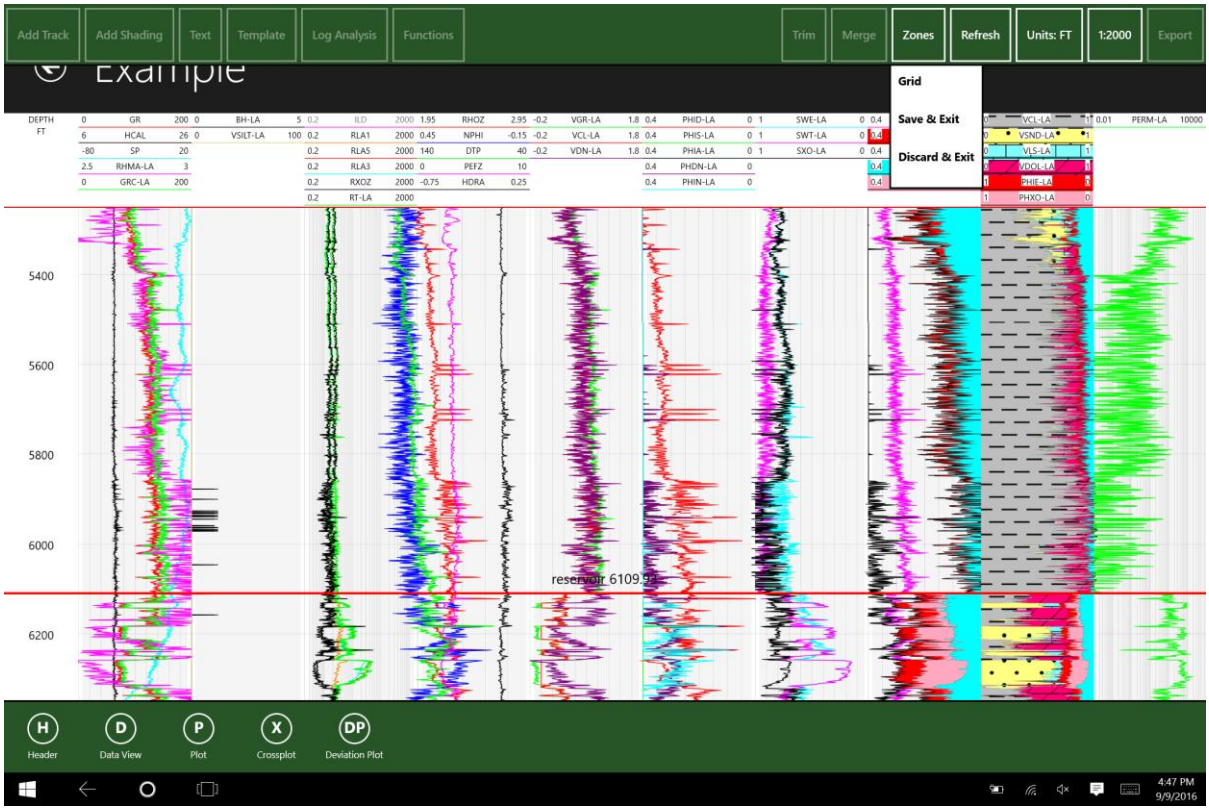


Figure 9.1.1: Zone Editor on Windows

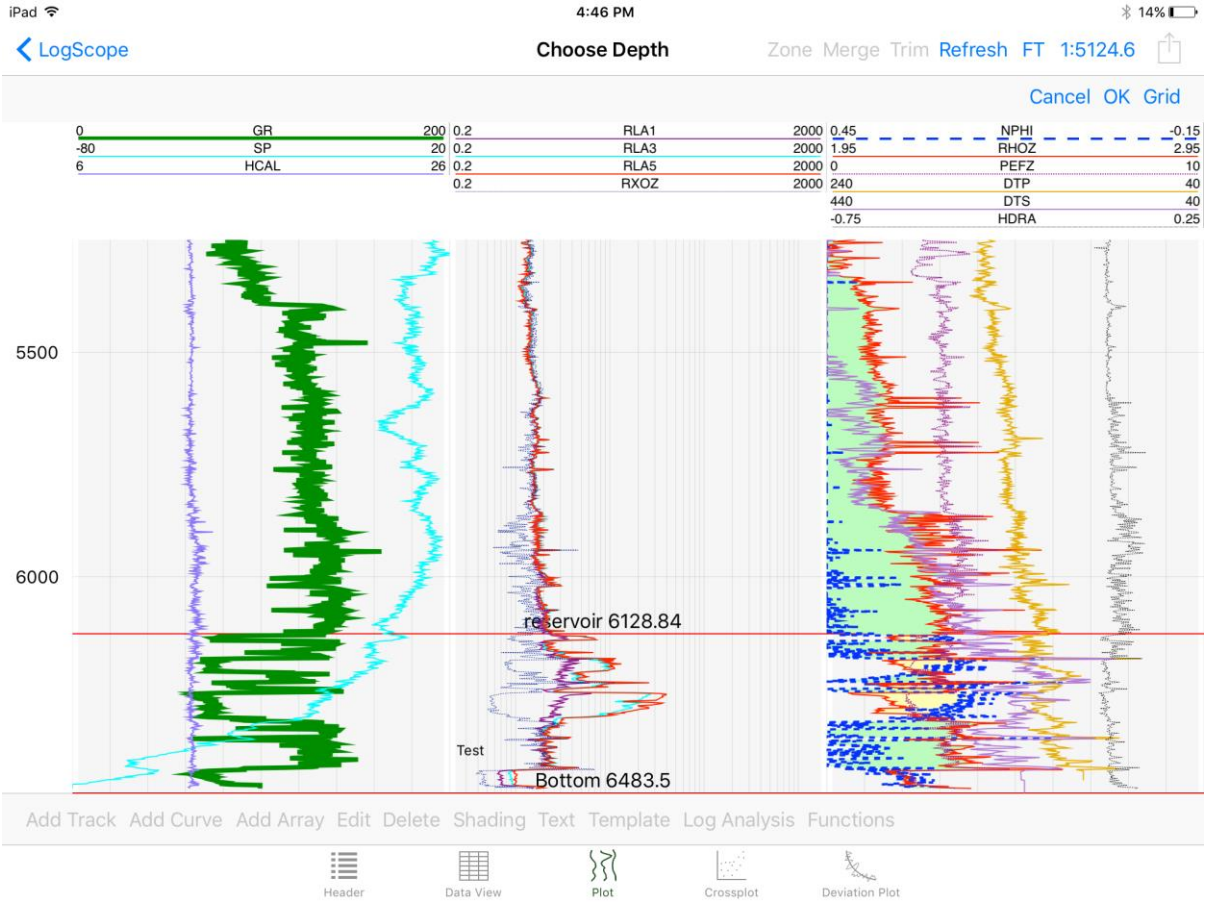


Figure 9.1.1: Zone Editor on iPad

Various zone interactions are possible:

- To **add** a zone, tap on the plot to mark the top of the zone and a prompt will appear to name the zone.
- To **remove** a zone, tap on the zone boundary line and select “Delete”.
- To **move** a zone, drag the boundary line.
- To **rename** a zone, tap on the zone boundary line and select “Edit Name”.

The options on the toolbar are as follows:

- **Cancel** Discards changes made (including any made in the zone grid)
- **OK** Saves changes made
- **Grid** Displays the zone grid

9.2 Zone Grid

The zone grid shows, in grid form, what the zone set looks like. All zones and all parameters are displayed in the grid.

The top few rows specify the name and depth range of the different zones, while the grey row indicates a zone group, and the other rows are parameters.

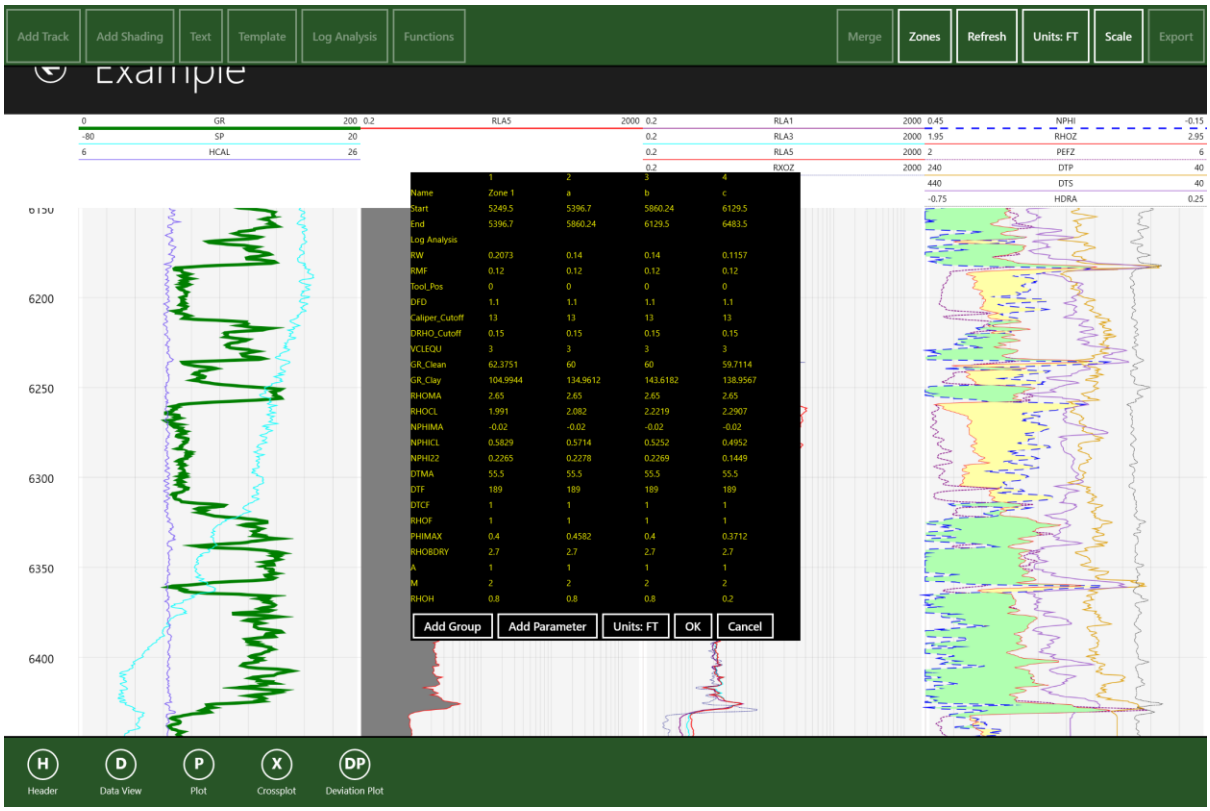
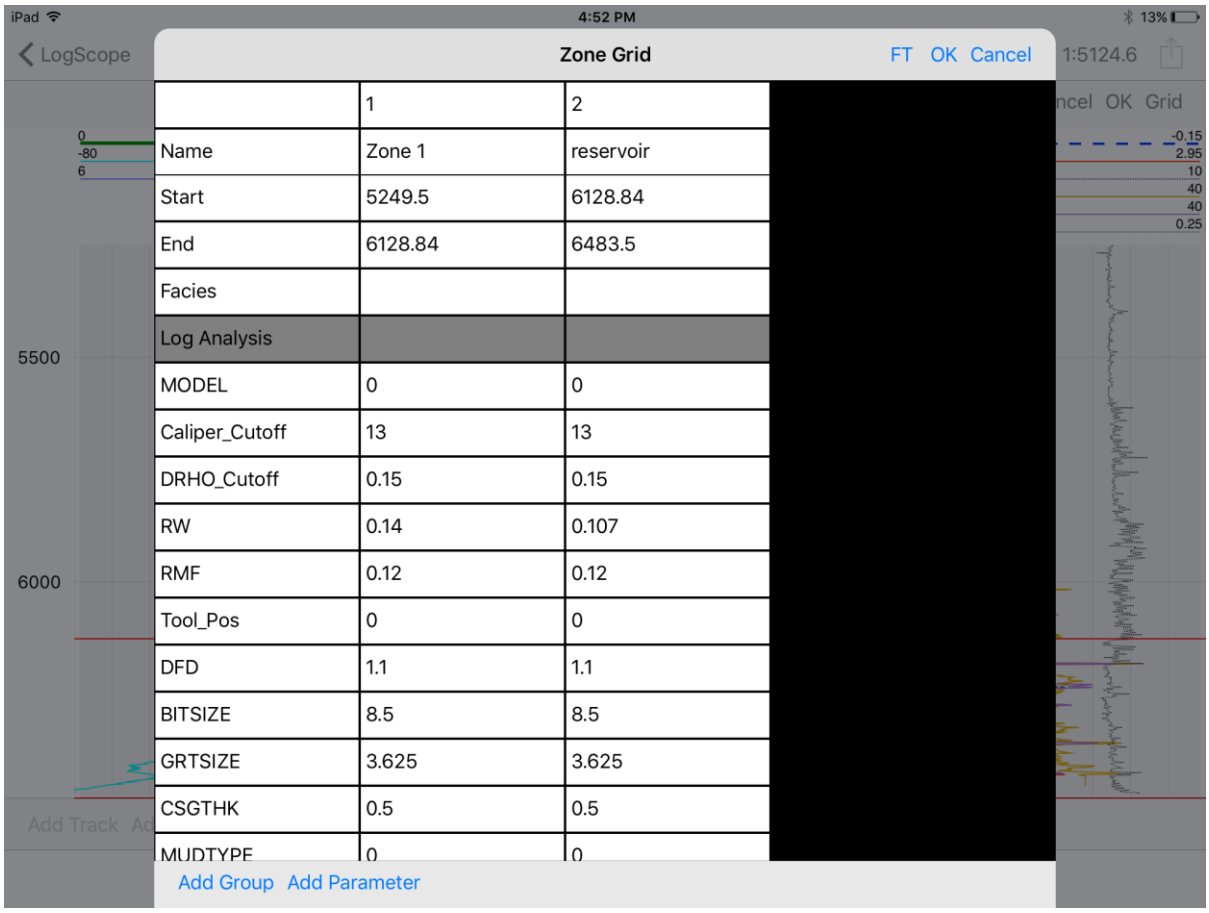


Figure 9.2.1: Zone Grid editor on Windows



	1	2
Name	Zone 1	reservoir
Start	5249.5	6128.84
End	6128.84	6483.5
Facies		
Log Analysis		
MODEL	0	0
Caliper_Cutoff	13	13
DRHO_Cutoff	0.15	0.15
RW	0.14	0.107
RMF	0.12	0.12
Tool_Pos	0	0
DFD	1.1	1.1
BITSIZE	8.5	8.5
GRTSIZE	3.625	3.625
CSGTHK	0.5	0.5
MUDTYPE	0	0

Figure 9.2.1: Zone Grid editor on iPad

Units may be changed between M and FT in the top toolbar of the Zone Grid view.

Zones may be deleted by tapping on the zone number and selecting “Delete”. This can likewise be done with zone groups and parameters by tapping on their row headers.

10 Cross plots (Basic Display)

Cross plots can be viewed by tapping the cross plot icon in the bottom tab bar. The curves that are to be cross plotted can be presented by simply tapping X or Y curve and Z curve as shown in Figures 10.1 and 10.2. Note that the data will not be displayed until all three curves are selected. Figures 10.3 and 10.4 shows the menu associated with setting desired properties.

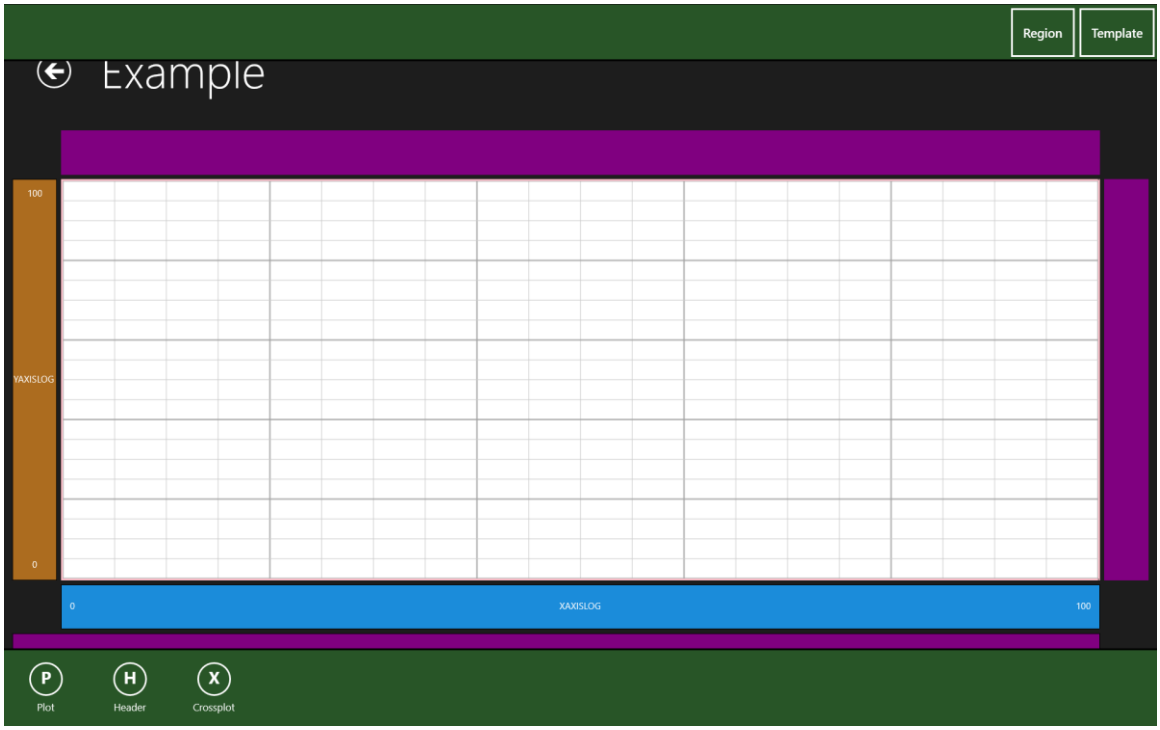


Figure 10.1 Cross plot on Windows

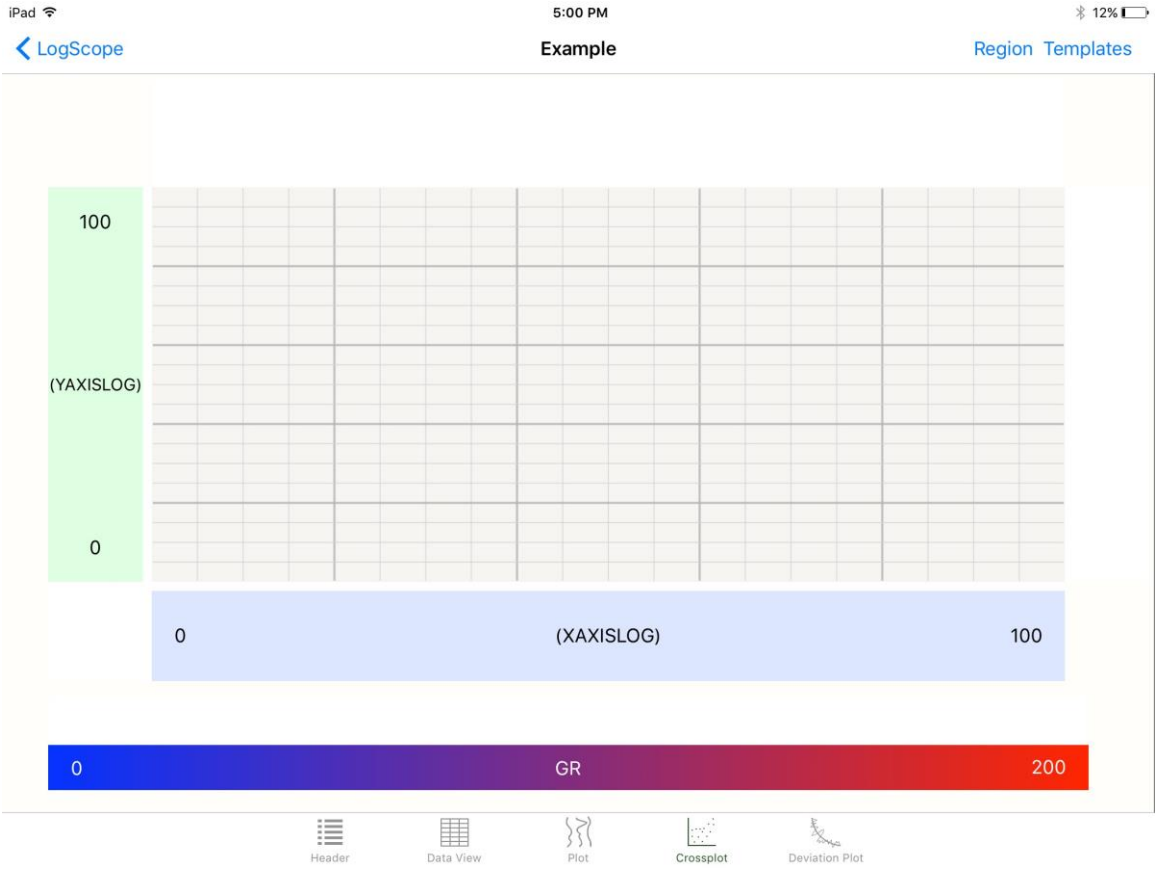


Figure 10.2 Cross plot on iPad

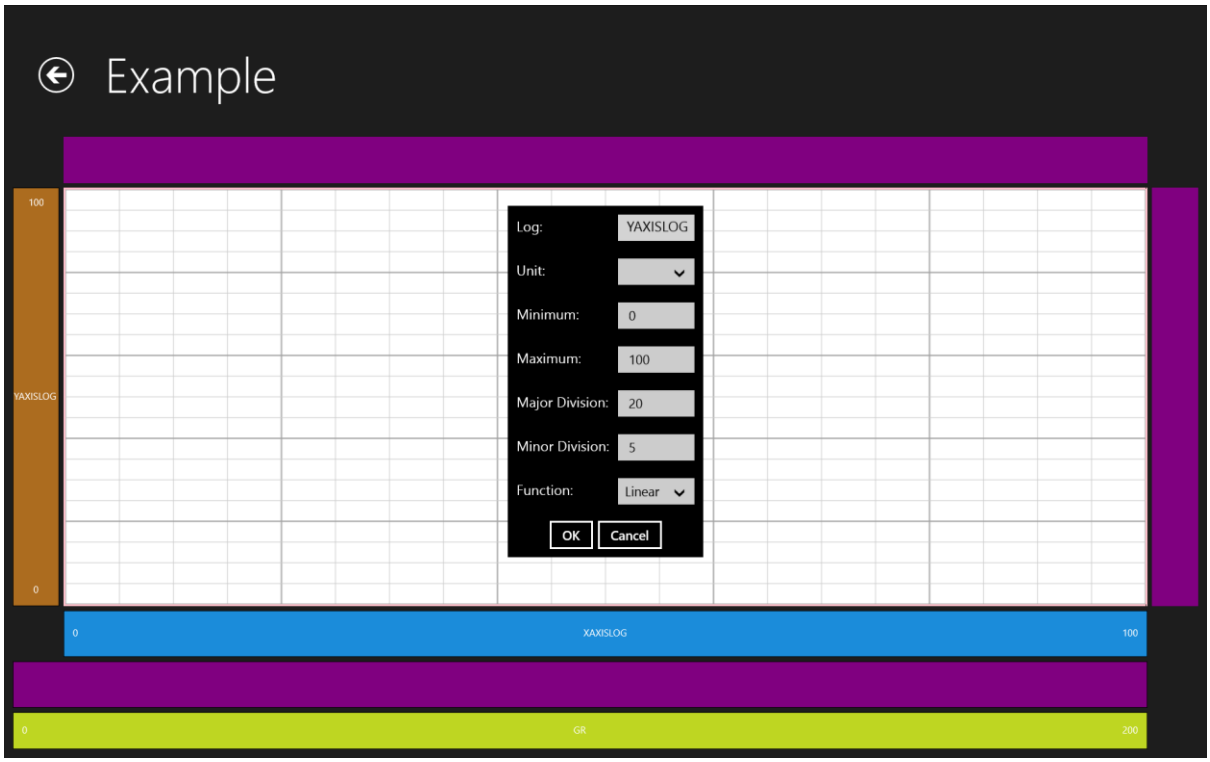


Figure 10.3: Setting curve properties on Windows

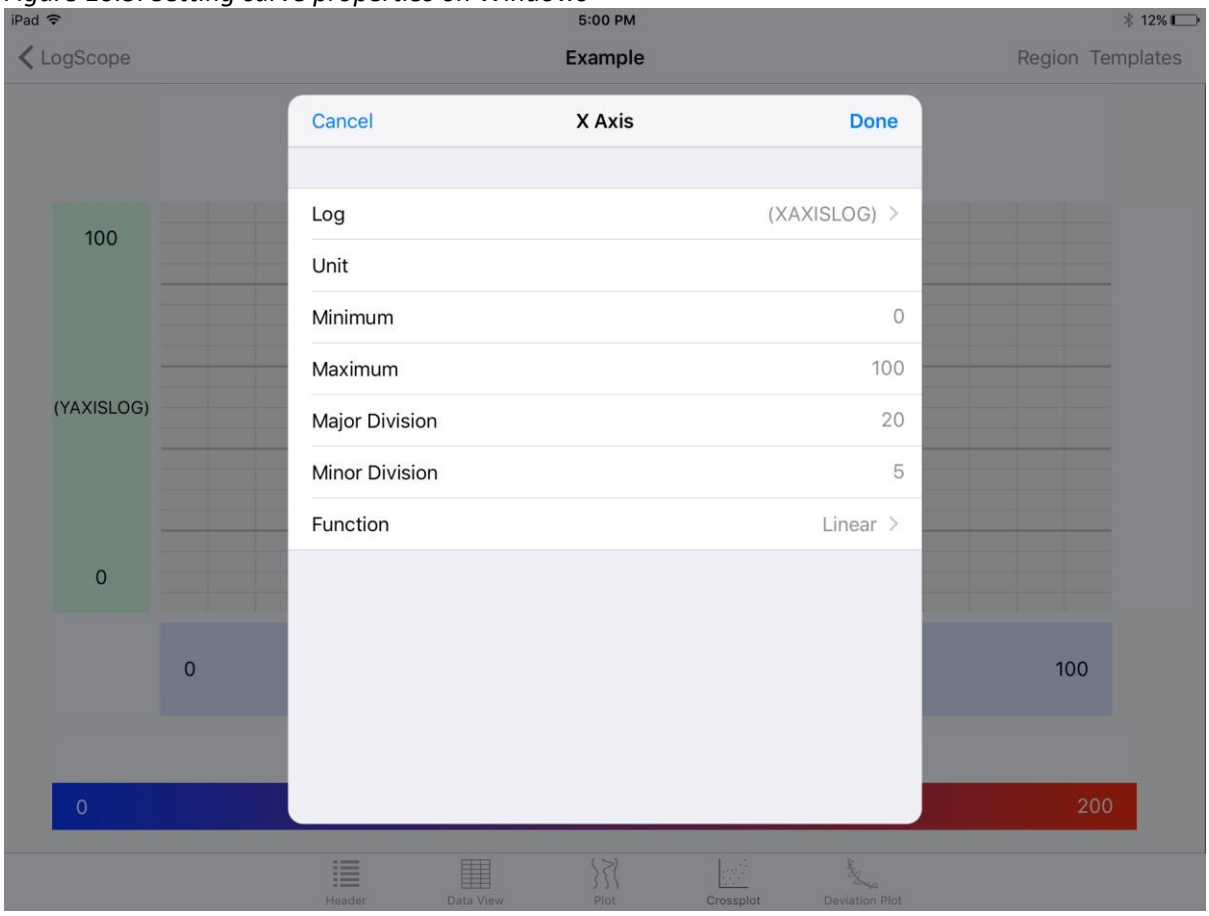


Figure 10.4: Setting curve properties on iPad

The cross plot when defined can be saved as a template by using the save button as shown in Figures 10.5 and 10.6. The template can be saved as Global or project specific.

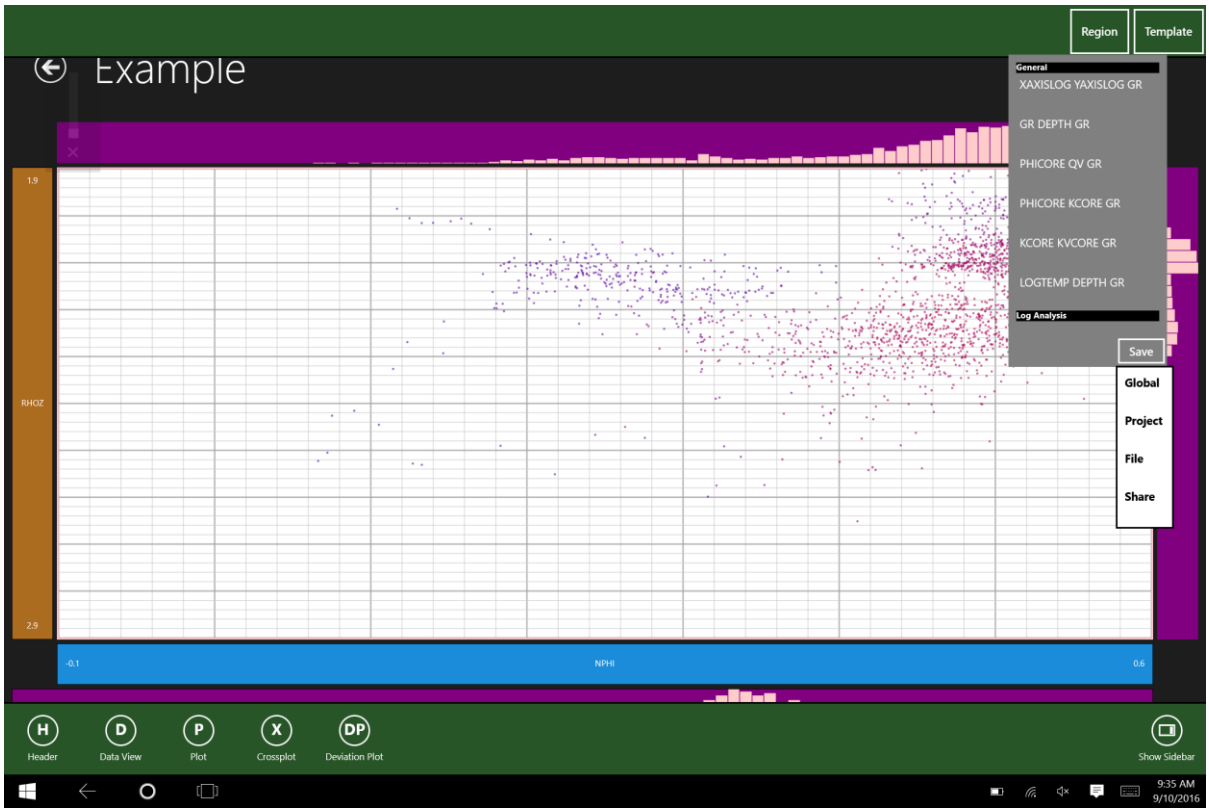


Figure 10.5: Saving a cross plot template on Windows

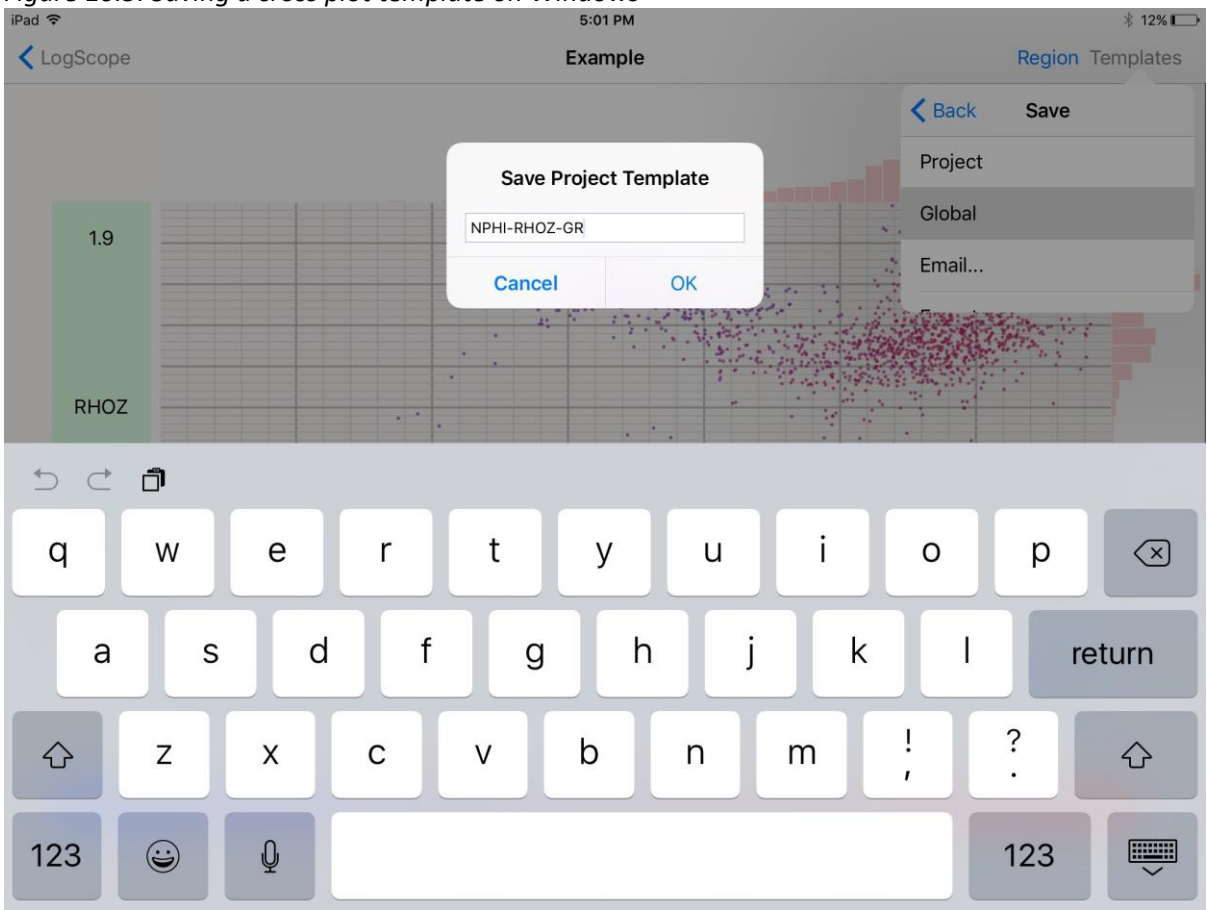


Figure 10.6: Saving a cross plot template on iPad

10.1 Zone Support (Log Analysis)

- Data is viewed *by zone* for log analysis cross plots
- Various cross plot parameters are displayed as points on the cross plot canvas
- Swipe to the left (outside the cross plot canvas) to display the log analysis menu

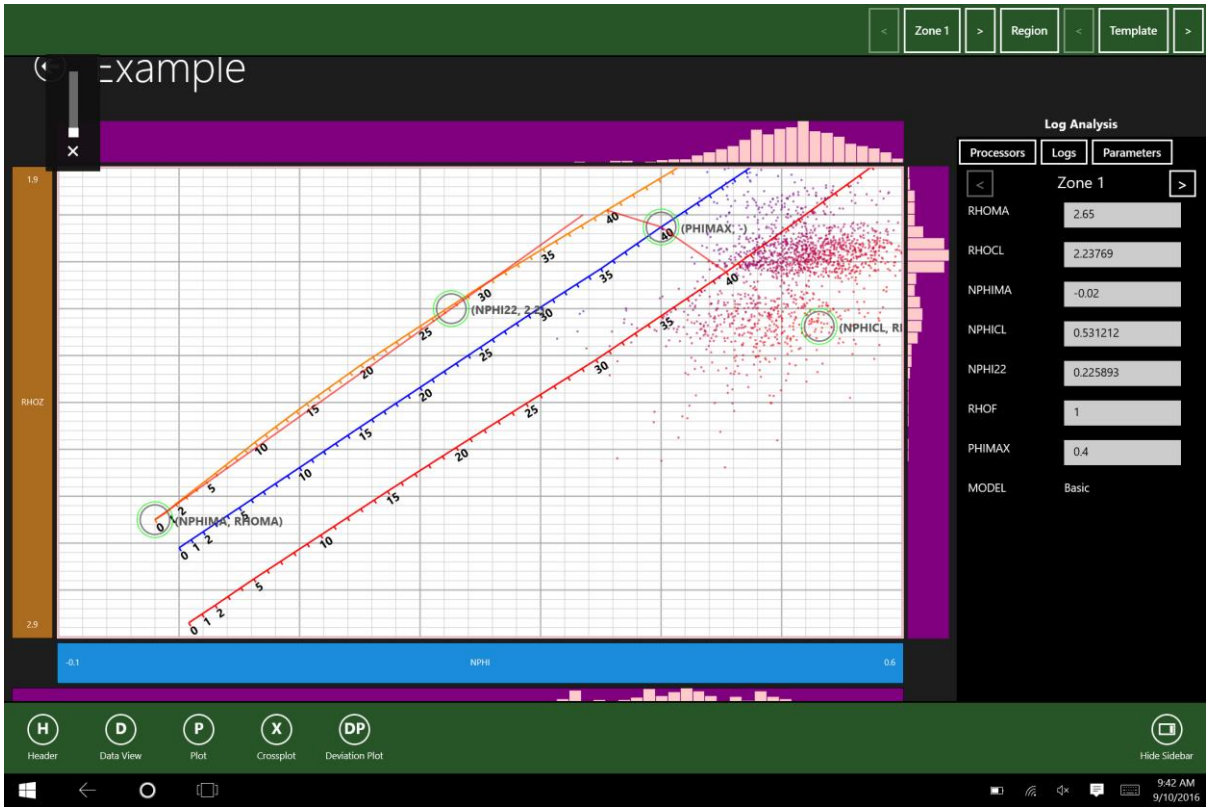


Figure 10.1.1: Cross plot with interactive parameter points and log analysis menu on Windows

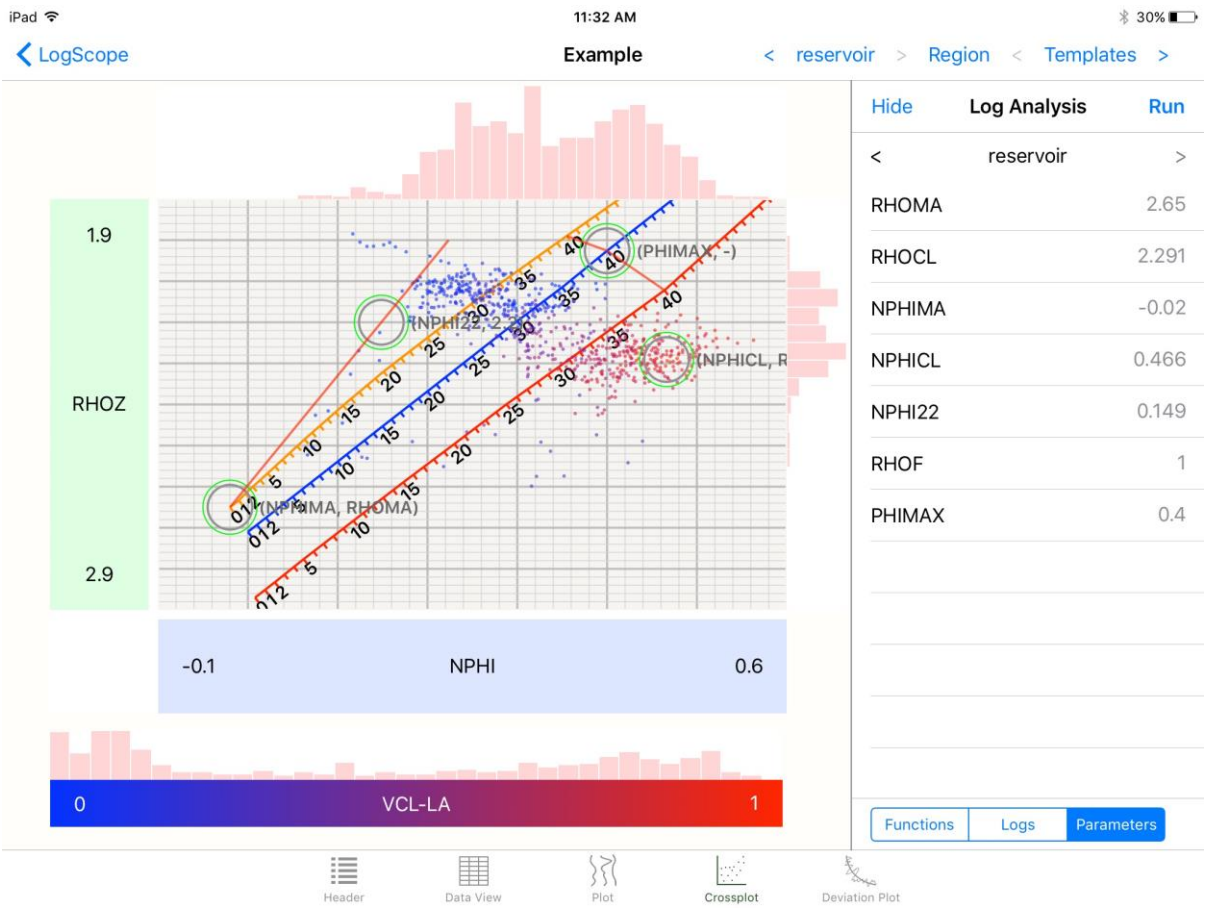


Figure 10.1.2: Cross plot with interactive parameter points and log analysis menu on iPad

The zones can be navigated by using the left and right arrows, whilst the various cross plots can also be navigated by using the arrows associated with the templates button. The Log Analysis parameters will change as cross plot changes showing the parameters associated with the cross plot. If there are no parameters on the cross plot, the entire parameter list will be displayed.

10.2 Regions

Region functionality is available as part of the log analysis module. From the Region menu, tap on "Add Region" to enter region mode as illustrated in Figures 10.2.1 and 10.2.2

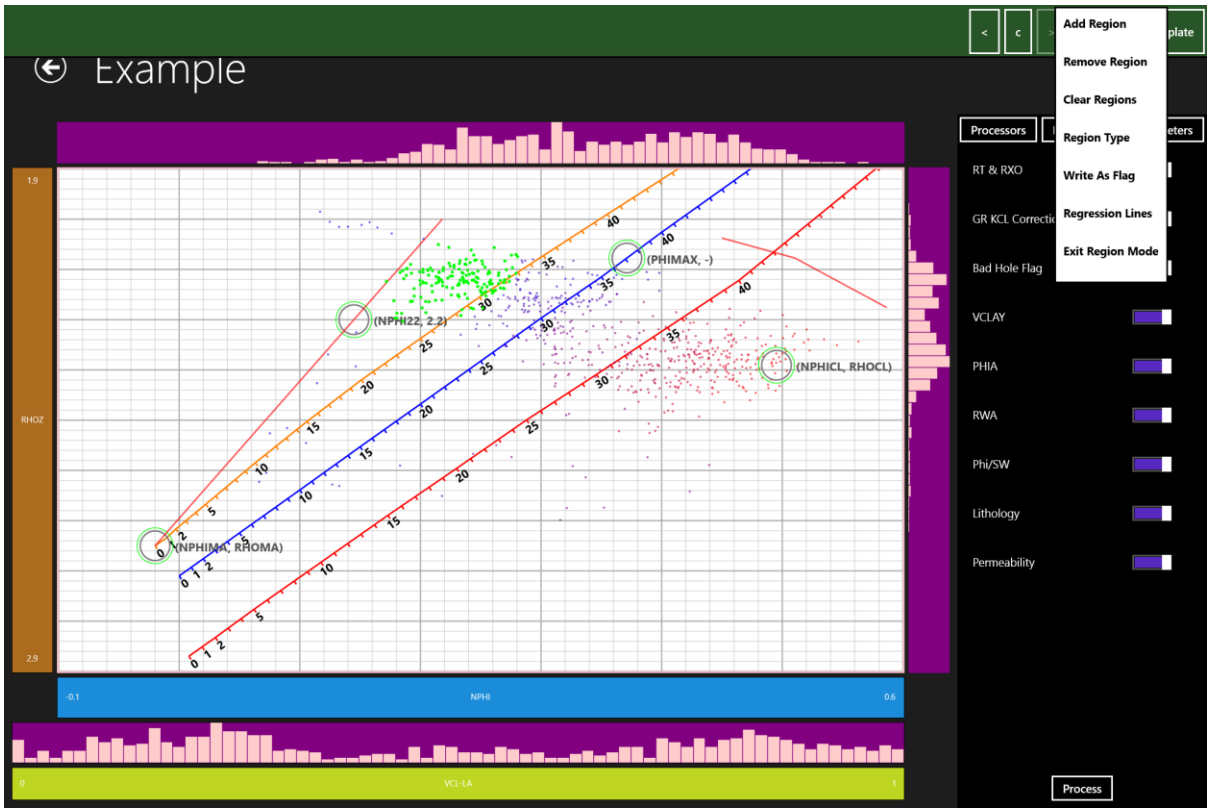


Figure 10.2.1: Cross plot with interactive parameter points and log analysis menu with region selection on Windows

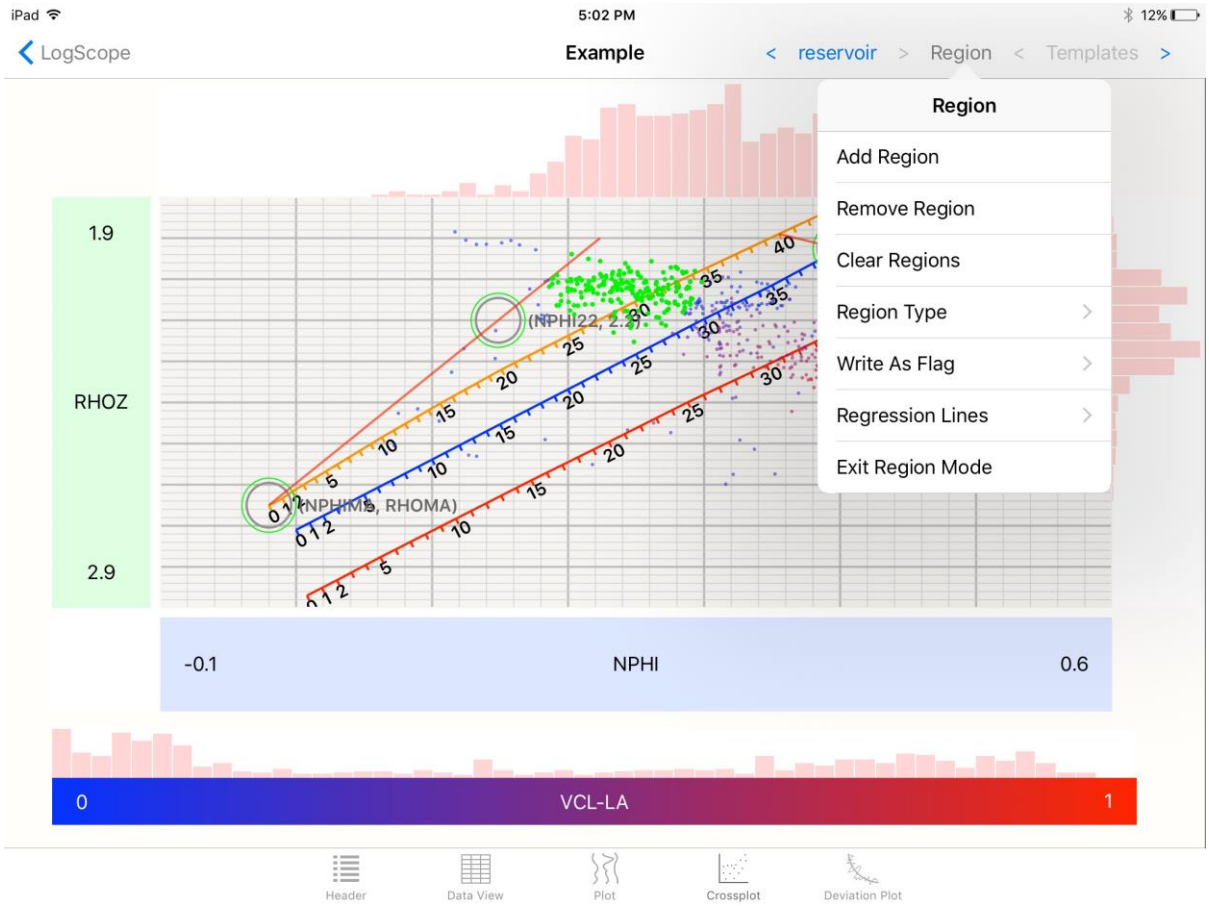


Figure 10.2.2: Cross plot with interactive parameter points and log analysis menu with region selection on iPad

In region mode, you may lasso points that appear on the cross plot canvas. Selected points are highlighted green.

The menu offers the following:

- **Add Region** causes future selections on the cross plot to add to the current region.
- **Remove Region** causes future selections on the cross plot to remove from the current region.
- **Clear Regions** unselects all selected points.
- **Write As Flag**
    - **Clear All** clears the region flag completely
    - **Clear Selected** clears the region flag based on the current selection
    - **0** to **8** sets the region flag to the specified number, based on the selection
- **Regression Line** will attempt to fit various functions to the selected data and will display the lines on the plot and equations in a table.
- **Exit Region Mode** Clears the selection and exits from region mode

11 Header Editing

The header fields can be edited as per Figures 11.1 and 11.2. The logo plotted on the plots can be changed to a company logo by selecting an appropriately sized graphics file of that particular logo.

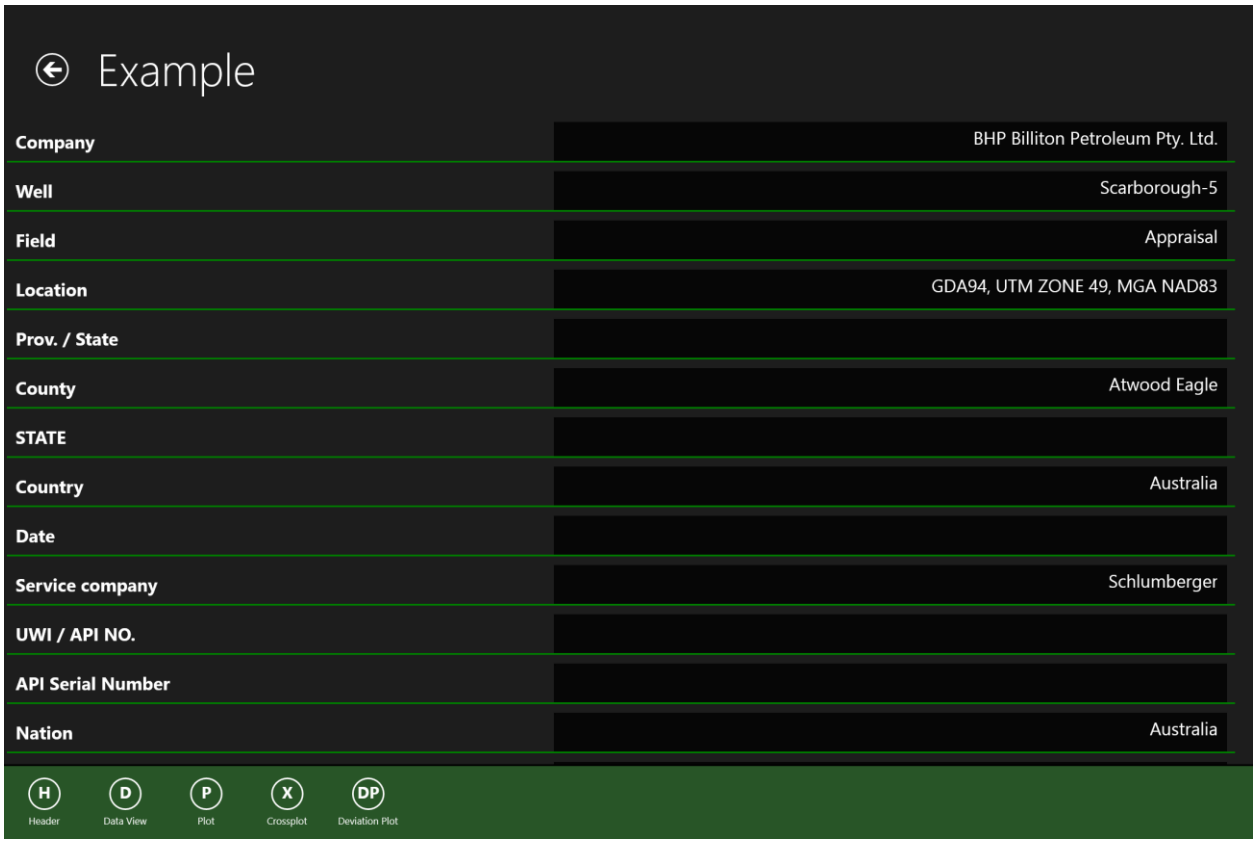


Figure 11.1: Header fields for editing on Windows

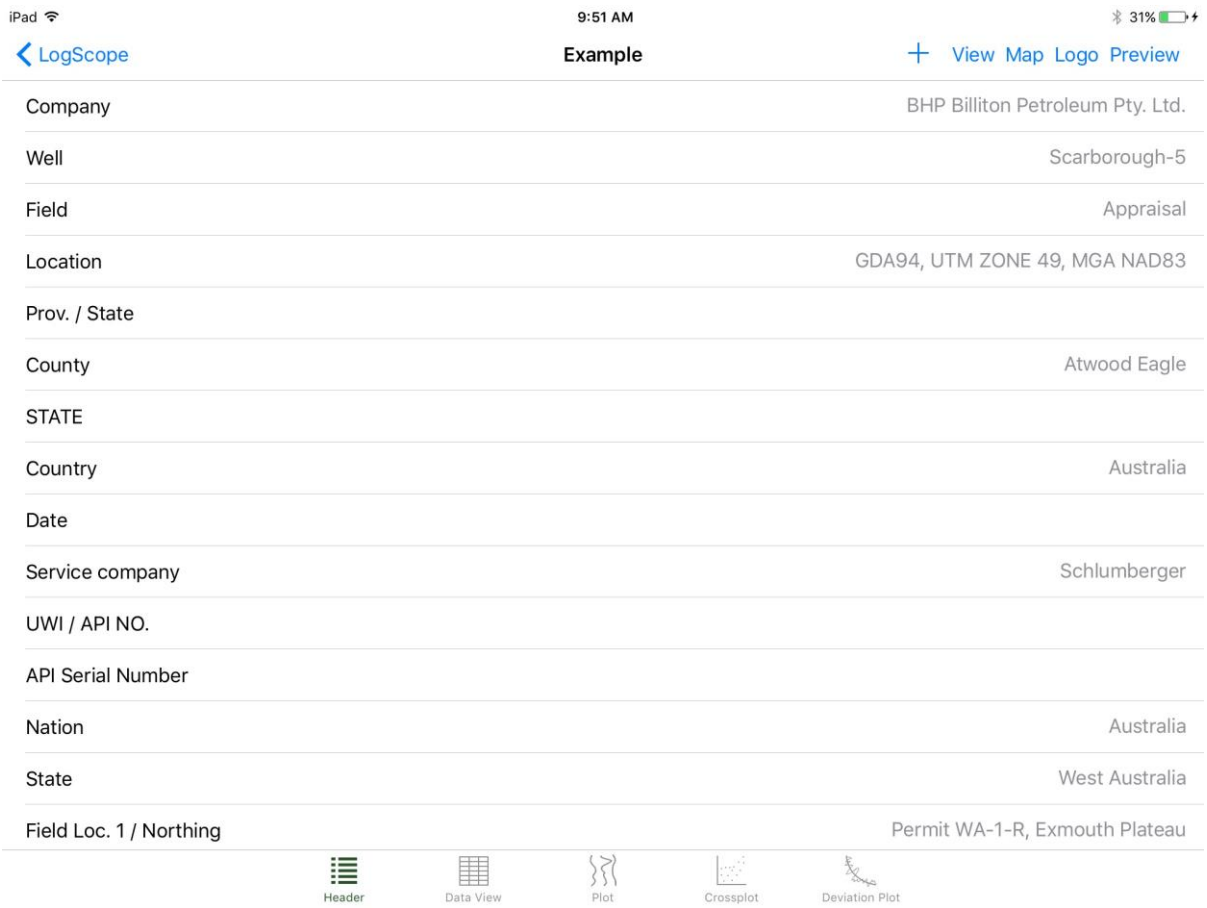


Figure 11.2: Header fields for editing on iPad

Figure 11.3 show the additional capabilities of the header editor on the iPad. You can:

- Edit Runs and comments
- Produce a map of well location

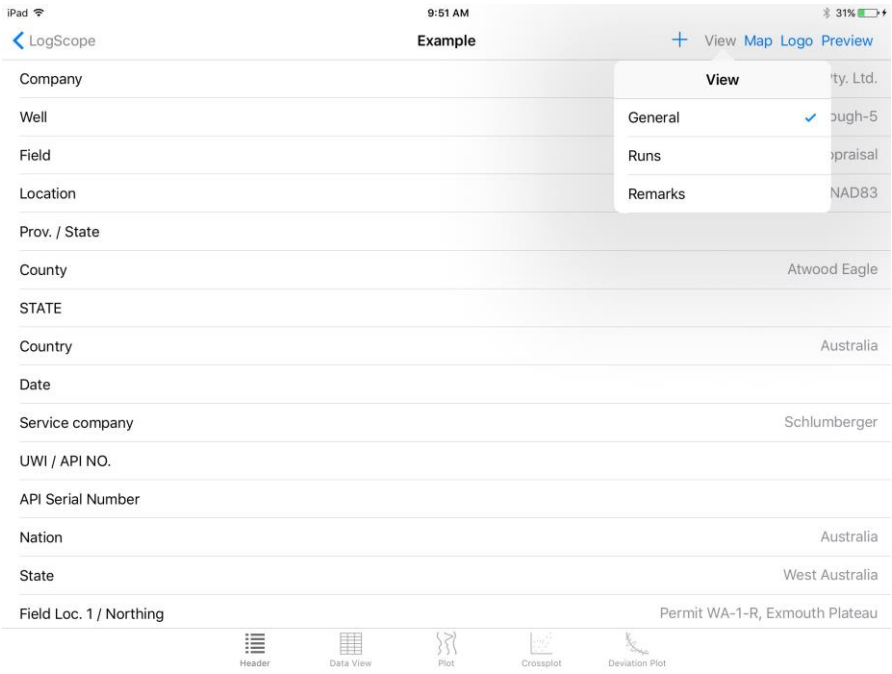


Figure 11.3: Additional sections for editing on iPad

12 Solver (Solver Module)

LogScope has a Solver application that is available as an in-app purchase. It permits the computation of logs based on an algebraic equation that is entered into the software.

The solver provides for equations to be saved and loaded for reuse on different project wells.

Figure 12.1 and 12.2 show the initial screen which describes the equation, curve mapping and limits on the solving range for the equation:

Figure 12.1: Initial solver menu on Windows

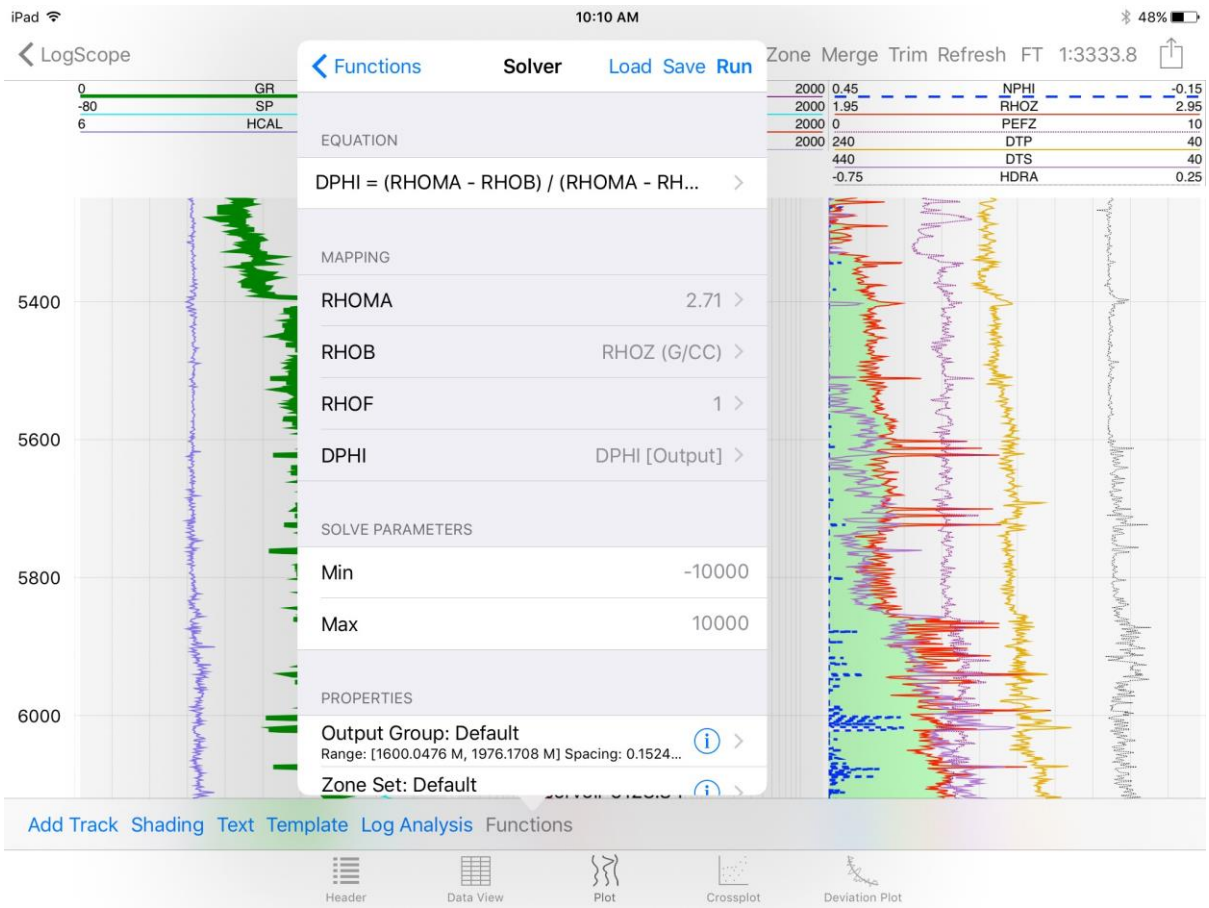


Figure 12.2: Initial solver menu on iPad

The equation has a result and variables, which can be either curves or constants. If we select the variable a, Figure 12. and 12.4 illustrate how it is set up as an input curve. You can solve as a curve, any component on either side of the equation provided you have all the other entries.

Figures 12.5 and 12.6 illustrate setting up a variable as a constant.

Figure 12.3: Selecting a variable as an input curve on Windows

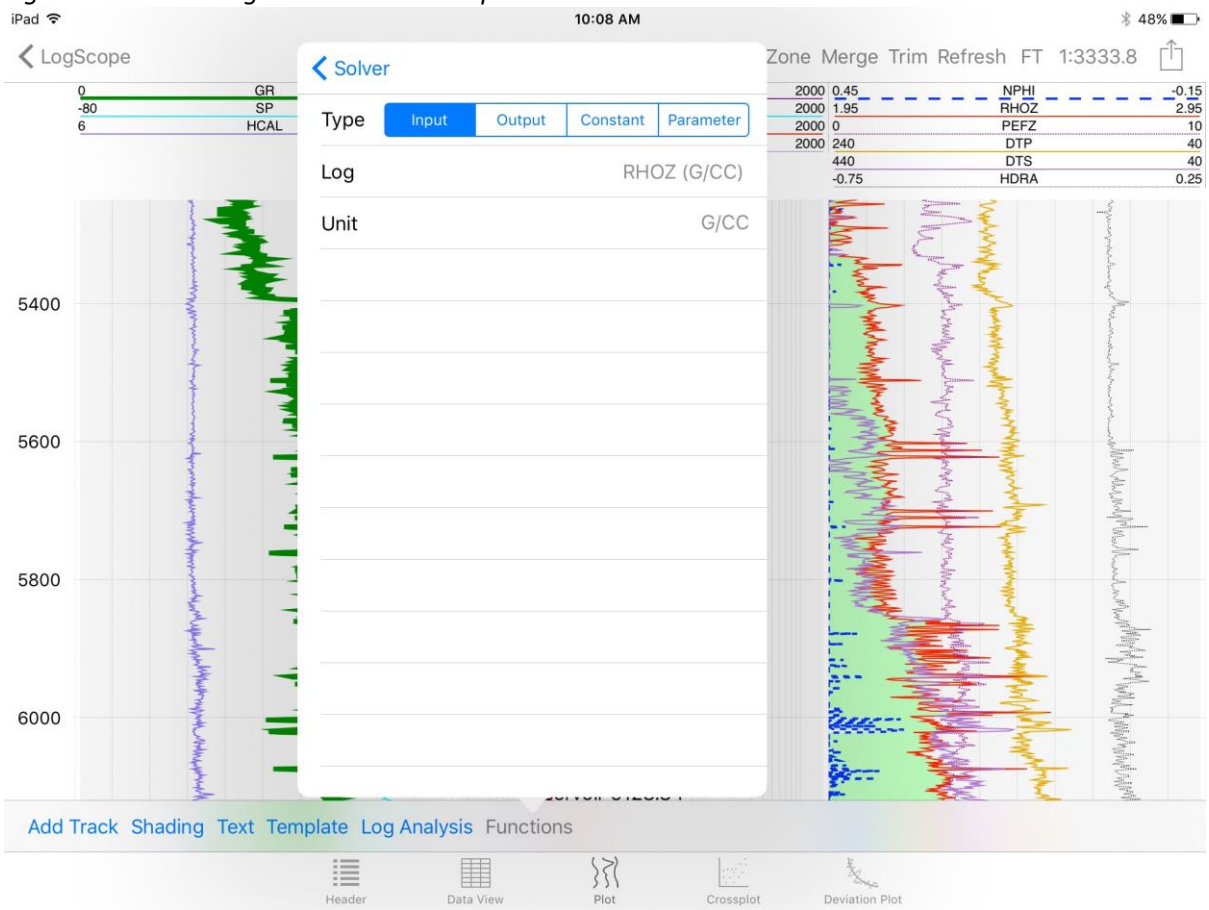


Figure 12.4: Selecting a variable as an input curve on iPad

Figure 12.5: Selecting a variable as a constant on Windows

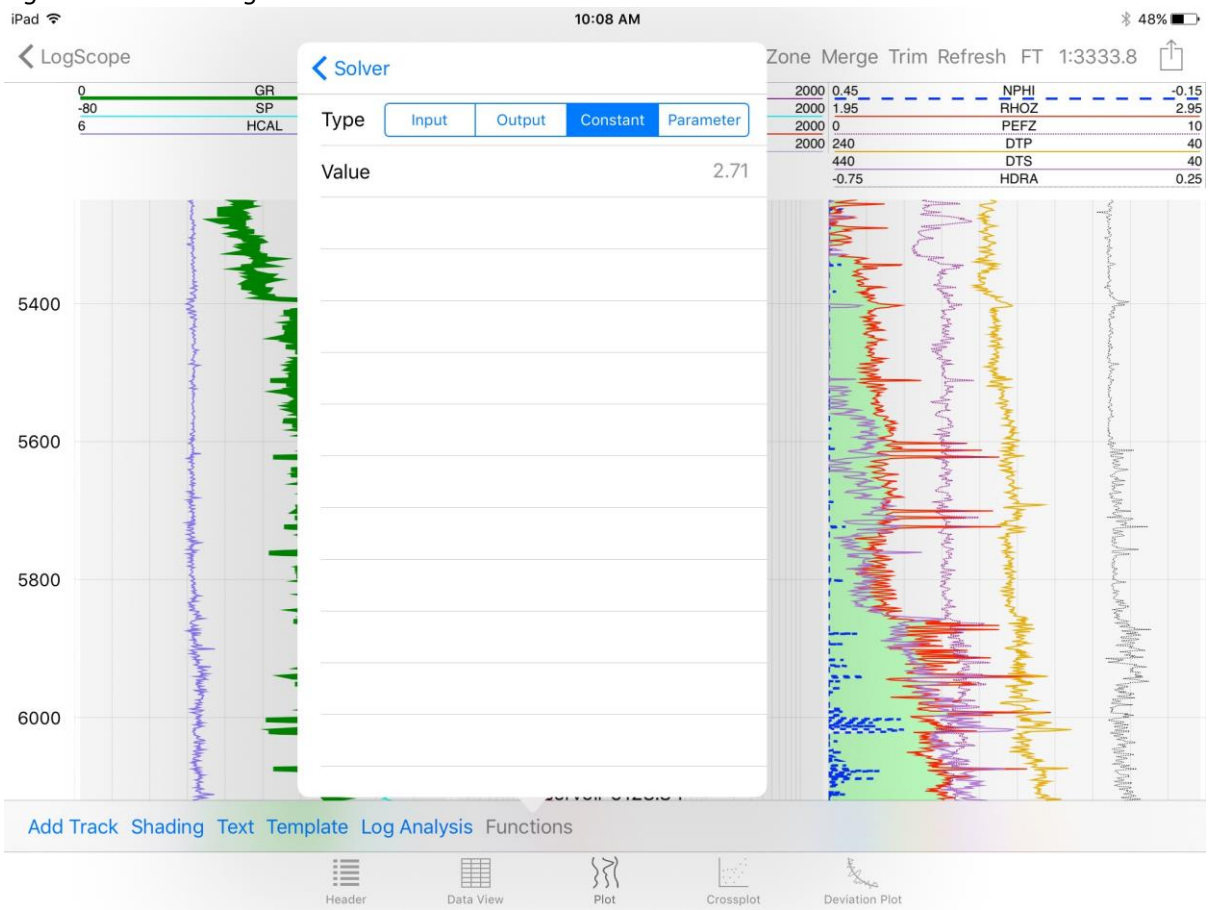


Figure 12.3: Selecting a variable as a constant on iPad

The inputs and outputs can be selected as either an input, output, constant or zone parameter. One output log must be specified.

Figures 12.6 and 12.7 show how the parameter option allows you to set up the constant to actually be a parameter. Note to use the option you need to have the Log Analysis module.

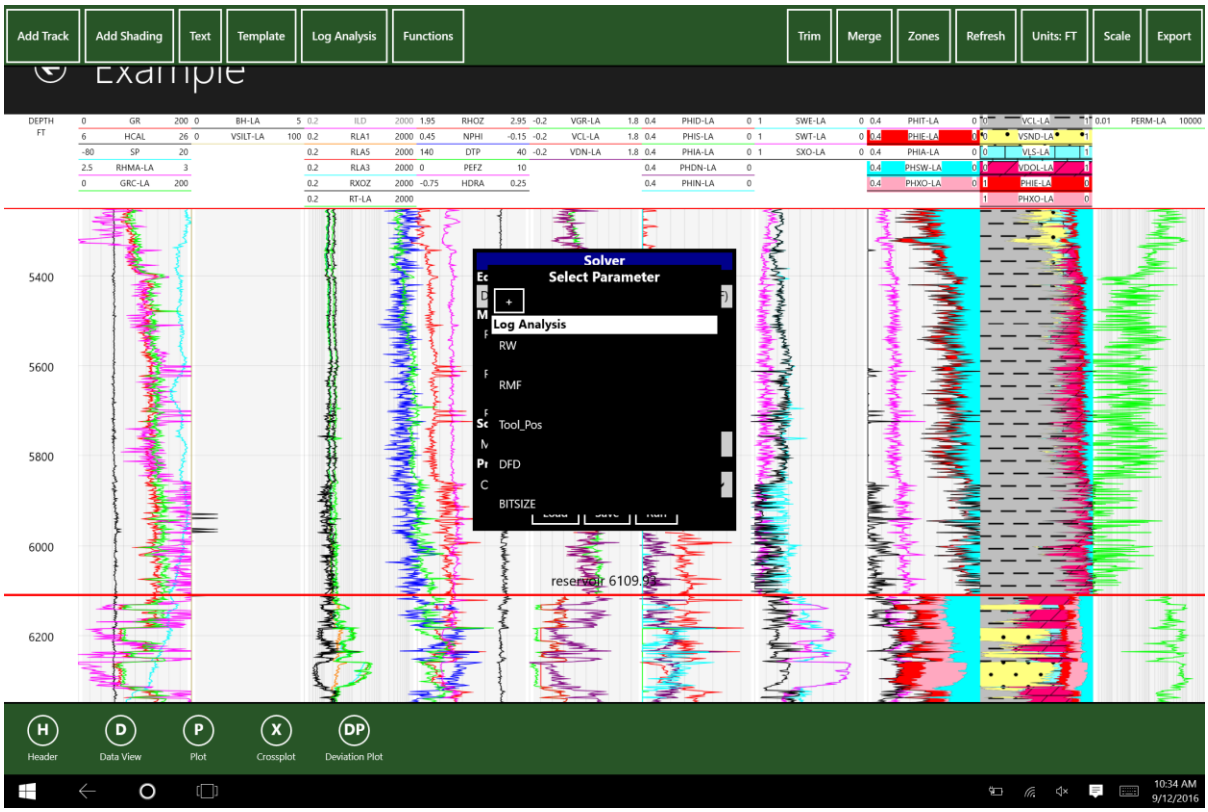


Figure 12.6 Setting a variable to be a parameter in zone file on Windows

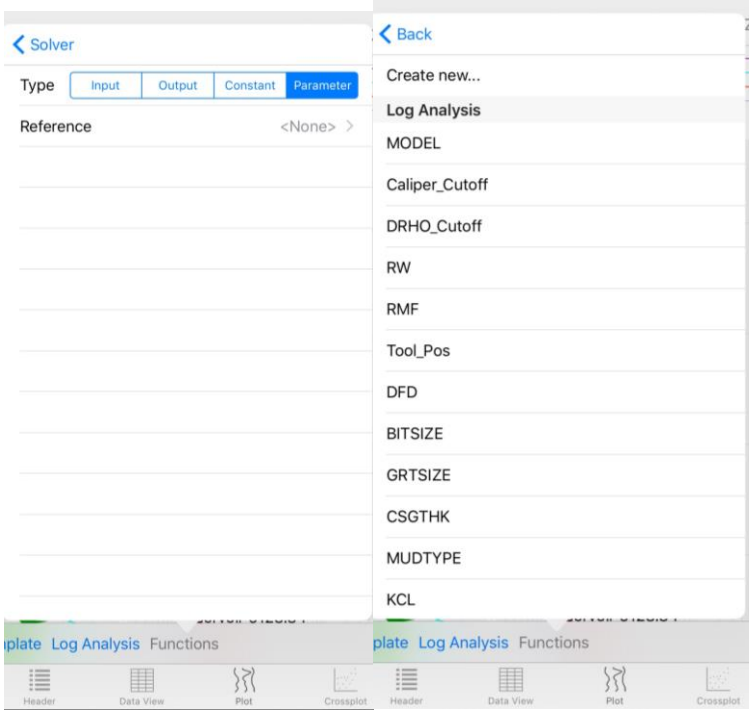


Figure 12.7 Setting a variable to be a parameter in zone file on iPad

Each equation must be written in the form:

`A=Expression`

The binary operators are:

Operator	Description
+	Addition
-	Subtraction
/	Division
*	Multiplication
^	Exponentiation

Functions Available are:

Function	Description
`abs(x)`	Absolute value of x
`acos(v)`	Arc cosine of v. Result in degrees.
`asin(v)`	Arc sine of v. Result in degrees.
`atan(v)`	Arc tangent of v. Result in degrees.

Function	Description
`atan2(y, x)`	Arc tangent of x and y. Result in degrees.
`ceil(x)`	Ceiling of x.
`cos(x)`	Cosine of x, where x is in degrees.
`exp(x)`	e^x
`floor(x)`	Floor of x.
`log(x)`	Base e logarithm of x.
`log10(x)`	Base 10 logarithm of x.
`max(x, y)`	Maximum of x and y.
`min(x, y)`	Minimum of x and y.
`sin(x)`	Sine of x, where x is in degrees.
`sqrt(x)`	Square root of x.
`tan(x)`	Tangent of x, where x is in degrees.

13 Scripting (Scripting Module)

Scripting is available as an in-app purchase, and enables the user to write their own processing code. The scripting module makes use of Python 2.7 for the processing. For more information, see https://docs.python.org/2.7/

To begin, all scripts must have a `loop_iterate(r)` function defined. This function is run for each data record in the output group specified.

The script also has to know which logs and parameters it is working with, so a mapping of these needs to be explicitly specified by the user. The mapping types available are as follows:

Mapping Type	Description	How to access
Input logs	Logs that are read from	`r.i`
Output logs	Logs that are written to	`r.o`
Parameters	These are specific to the script and stored in the script	`r.p`
Zoned Parameters	References to zone parameters	`r.z`

Important things to note:

- All mapping names are case sensitive
- If the user does not specify all of the mappings, errors will result in the script

The script excerpt also has the capability to handle arrays as indicated by the following example:

```
#Permeability-curve
totalperm = r.i.permhrp
vals = [x for x in get_arr_values(totalperm, r.p.arr_min, r.p.arr_max, r.p.arr_func) if ((x != None) and (x != 0))]
if (len(vals) > 1):
 stats = Statistics(vals)
 # Calculate mean
 r.o.permmean = stats.mean()
 # Calculate standard deviation
 r.o.permstddev = stats.stddev()
 # Calculate skewness
 r.o.permskewness=stats.skewness()
 # Calculate kurtosis
 r.o.permkurtosis=stats.kurtosis()
 # Calculate Variance
 r.o.permvariance=stats.variance()
```

The following variables are defined:

r.i.permhrp – input permeability distribution array

r.p.arr_min – Minimum permeability value of array (i.e. 0.1 mD)

r.p.arr_max – Maximum permeability value (i.e., 1000 mD)

r.p.arr_func – A function that defines whether logarithmic or linear (1 or 0)

This uses a statistical python library based on http://www.johndcook.com/running_regression.html

13.1 Example 1

Type	Name	Reference
Input	PEF	PEFZ
Output	OUT	
Zoned Parameter	param1	NOTE: The user will need to create this parameter

```
# This gives us access to the math module
import math
global math

# This allows simple_func to be accessed within loop_iterate
global simple_func

def simple_func(a, b):
    return math.floor(a) + math.ceil(b)

# This is the main loop and will be run once for each data
record
def loop_iterate(r):
    # Is there a value for PEF?
    if (r.i.PEF != None):
        if (r.i.PEF > 5):
            # We print out the PEF value if it is greater than 5
            print r.i.PEF
        r.o.OUT = simple_func(r.i.PEF, r.z.param1)
    # No value for PEF
    else:
        # Set output value to missing
        r.o.OUT = None
```

This example sets the output log to missing if no PEF value is present, otherwise, it sets OUT to be the floor of PEF plus the ceiling of the zone parameter param1.
Please note the following:

- A `loop_iterate(r)` function has to be specified. “r” stands for “record”.
- Imports and functions must be marked as `global` to access them
- Variable names are case sensitive
- `print` can be used for diagnostic purposes, but the user should *avoid excessive output*
- Missing values (represented by `None`) must be handled by the user or errors may result
- Indentation in Python is essential

13.2 Example 2

Porosity from the density log

```
# This gives us access to the math module
import math
global math

# This allows simple_func to be accessed within loop_iterate

global mat_den
```

```
def mat_den(mat, den):
     return mat-den
def loop_iterate(r):

# Is there a value for RHOB?
    if (r.i.rhob != None):
     r.o.phi=(r.p.rhoma-r.i.rhob)/(r.p.rhoma-r.p.rhofl)
    # Run our simple mat_den function
     r.o.deltaden= mat_den(r.p.rhoma, r.i.rhob)
```

13.3 Scripting menus

This menu for the scripting is set out in Figures 13.3.1 and 13.3.2. Any output or input curve that is in the LogScope curve alias database will be automatically mapped. The Auto-mapping can be refreshed by tapping the auto-mapping button.

The scripting can access zoned parameters as well as global parameters so parameters in the Log Analysis that are zone specific can be used in the script. This means that a script can be written to use formation specific parameters without coding for specific depth ranges. Such a capability allows for tight integration of scripts with the inbuilt log analysis.

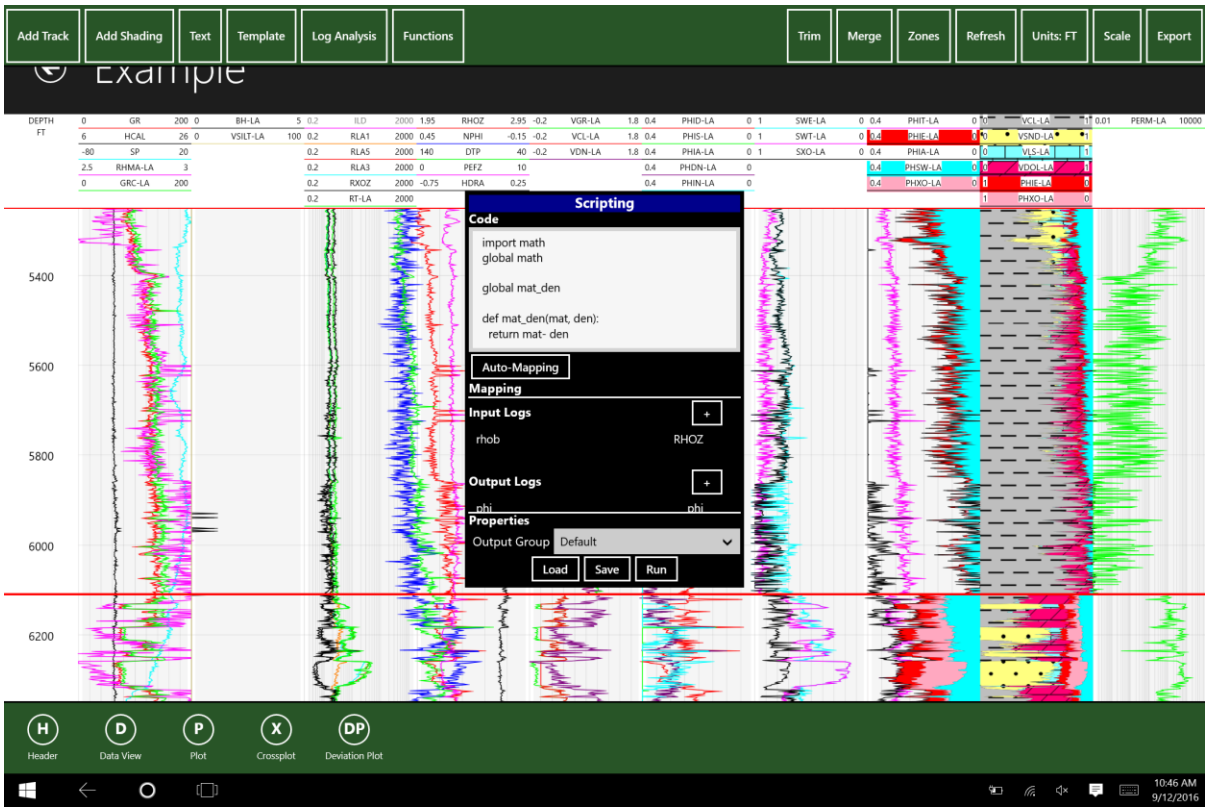


Figure 13.3.1 Scripting menu on Windows

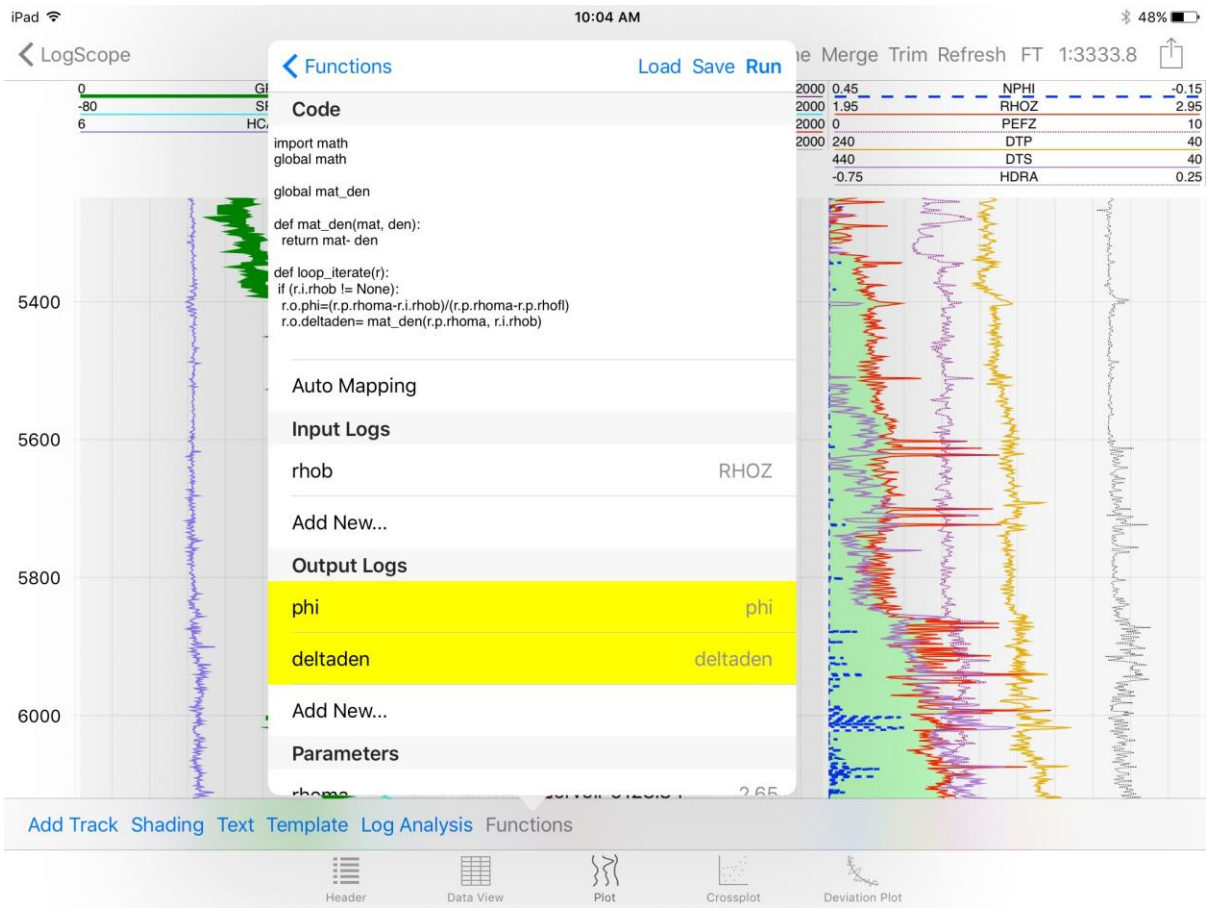


Figure 13.3.2 Scripting menu on iPad

14 Log Analysis (Basic Log Analysis Module)

Covered in a separate manual also downloadable.

15 DLIS Import and Export (DLIS Module)

The DLIS module allows both import and export. The export as well as import allows for individual logs and arrays to be selected.

It is important to note that the DLIS module in LogScope will read in and export jpeg files as a component. This component does not affect the ability of other packages to read the DLIS file but unless they are aware of the data and how to read it, the contents will simply be ignored.

16 Known Limitations

- Only 15 Tracks can be presented including depth track
- Tracks cannot at this stage be reordered. Work around is insert new track and drag all curves to that track.
- All tracks are same width except depth track.

- Curve header text occasionally overwrites on plots.
- On the iPad files over 1 Gbyte will function slowly and we recommend iPad Pro for displaying such files.