IP Post-Process Software

Version 1.2.9
Instruction Manual

INSTRUMENTATION
GDD

Contents

1. Introduction

The IP Post-Process software developed by Instrumentation GDD allows you to visualize collected fullwave raw data, but also the stacked readings and the chargeability decay (M) for each acquisition channel. You can also visualize the Pseudo Section of your original and processed IP data, for each Rx-Tx line combination. In addition, you can choose between the GDD Noise Rejection algorithm or manually discard noisy half-cycles, enhance your Rx – Tx synchronisation, modify the Windows Scheme and deactivate from individual channels to entire readings. Furthermore, data from multiple receivers can be merged, original files can be re-processed with a transmitted current file (collected with GDD's EM-IP Tx Controller) to improve apparent resistivity calculation. Also, the telluric noise can be removed from survey data using data collected at a remote station.

Once your data has been post-processed, you can generate new output files (*.gdd, *.dat, *.csv, *.gps, *.fullwave & customised formats). These are compatible with a wide range of third-party data analysis and inversion software. Custom filter functions can also be implemented on demand.

2. Release Notes

Version 1.2.X is no longer a release candidate (RC). The software has been tested by numerous clients and improved consequently. We still invite all our clients to report any problems encountered with the IP Post-Process software (other than the known limitations listed below).

Main updates	
1.2.0	Pseudo Section panel; Export project directly from an original *.mem file; Possibility of modifying the Tx current using a fixed value.
1.2.1	Merge of multiple *.mem files.
1.2.2	Telluric rejection option (*.bdf file, Telluric panel); Custom export file format editor; Possibility of modifying the Duty Cycle (DC = 50% or 100%); Measurement of chargeability (M) during ON Time (DC = 100%).
1.2.3	Discard individual channels or a complete reading; Improvements to Pseudo Section and Synchronization algorithms.

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1.2.4	Synchronization mode "Quick";
	Improvements to Pseudo Section.
1.2.5	Synchronization mode "Enhanced" removed;
	Synchronization mode "Quick" renamed in "Auto";
	Synchronization mode "Auto" made default;
	Detailed data presentation text mode.
1.2.6	Processing of SCIP's data files.
	Import Windows Scheme from memory file.
1.2.7	Multiselecting and auto matching of .IFI files for selected readings in the filter.
	Option "Auto adjust zoom" prevents from changing graph's zoom between readings.
1.2.8	Multiselecting and auto matching of .BDF files for selected readings in the filter.
	Option "Enabled for post-processing" in the filter.
1.2.9	Editing positions in the filter allows to re-calculate the apparent resistivity (Rho).

3. Installation

The IP Post-Process software can be used with GDD's IP receivers and EM-IP Tx Controller datasets. The software is compatible with Windows XP, 7, 8 and 10. When installing the software for the first time, you will get 30-days license activation.

In order to get your full license, you will need to send an activation request by internet to Instrumentation GDD.
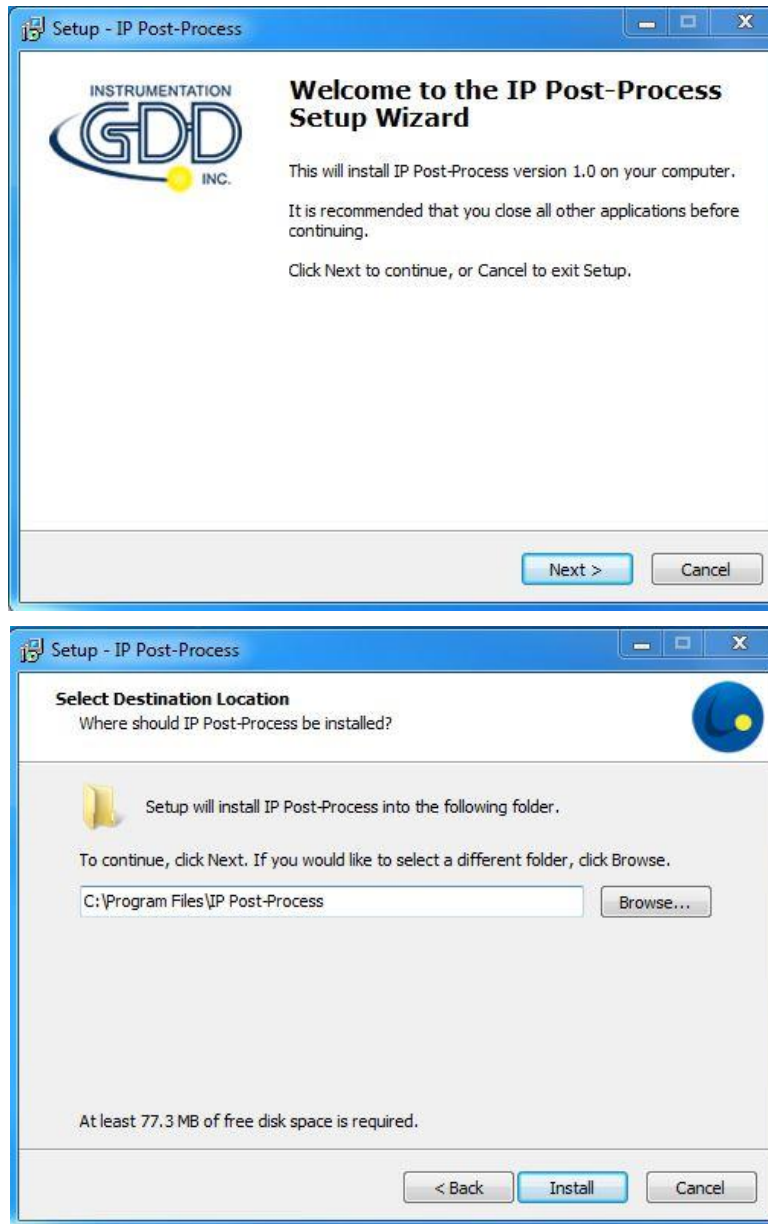
The IP Post-Process software requires that the following applications are installed on your computer: .NET Framework 4.6.2 and Microsoft Visual C++ 2017 Redistributable (x86). The installation of these two applications is included when installing the IP Post-Process software.
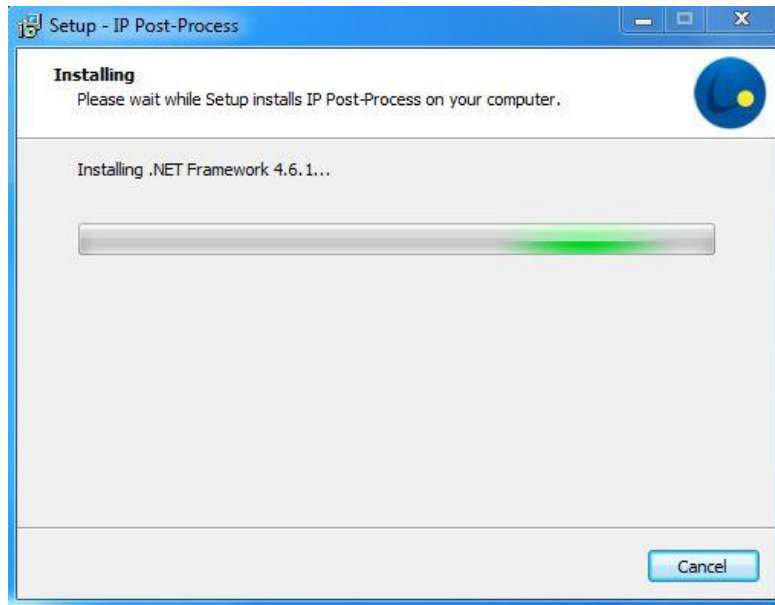
Once the installation is successful, you will have a 30-day license.

In order to extend your license for a longer period, please fill the Licensing Activation form.
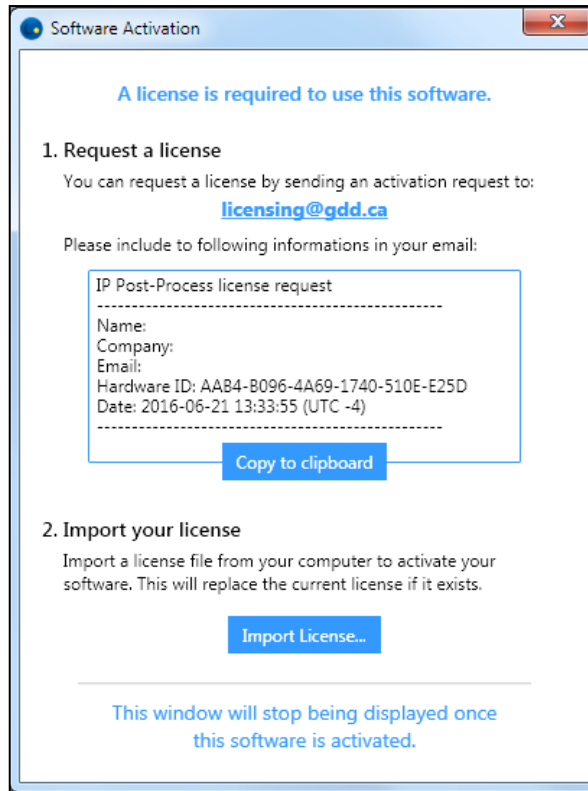
4. Software overview

Main Window
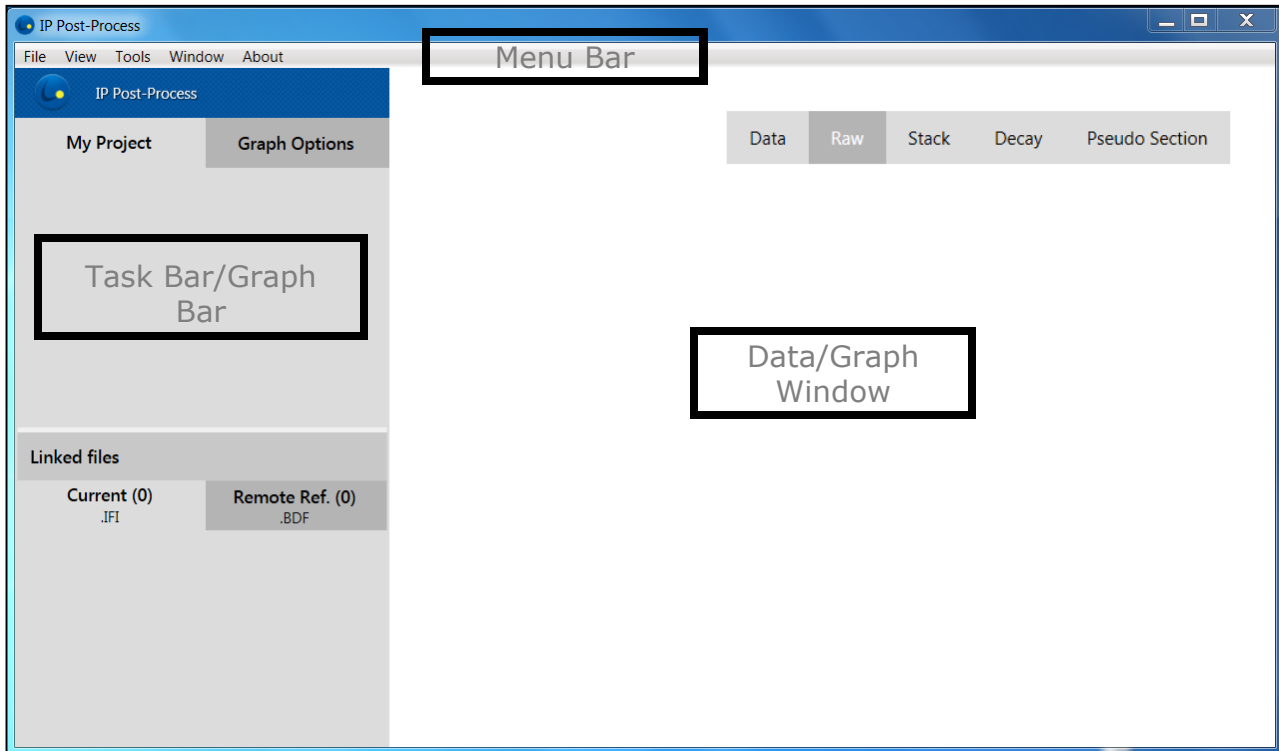
The Main Window is divided in three sections:

- Menu Bar: File, View, Tools, Window and About

- Task Bar/Graphic Bar: My Project and Graph Options

    The list of the Linked file will display the current *.ifi (from GDD EM-IP TX Controller) and remote reference *.bdf (from stand-alone GDD IP Receiver) imported files. These files can be imported from the Data Filter Editor (section 8).

- Data/Graph Window: Data, Raw, Stack, Decay, Telluric and Pseudo Section panels

    The tabs or panels will become available or not according to the type of data and processing being undertaken.

Menu Bar

Use the Menu Bar to access software options and settings.

File menu:

Allows basic command such as opening a Project or File (recent or new), Save and Close.

- New Project: Create a project by importing one or multiple binary GDD IP Rx *.mem files. Post-Process options will only be available through a project.

- Open: Open an existing Project (*.ipp), a binary file (*.mem, *.ifi, *.bdf) or a *.fullwave ASCII file (from a GDD IP receiver or a GDD SCIP Tester). Note that you need to generate a project to be able to process your dataset. The "Open \ file" will only enable display options.

- Export: Save your processed (filter) files in GDD (*.gdd, *.fullwave, *.gps), Amira (*.dat), Prosys (*.csv) or Geosoft (*.dat) ascii format. It is also possible to customize the export format. Note that the file to be exported will be the one activated in the Data/Graph Window (active tab).
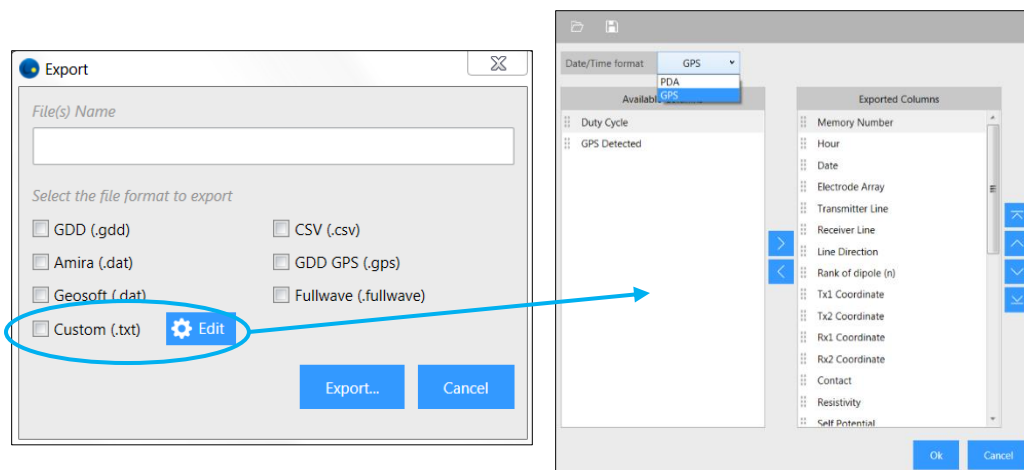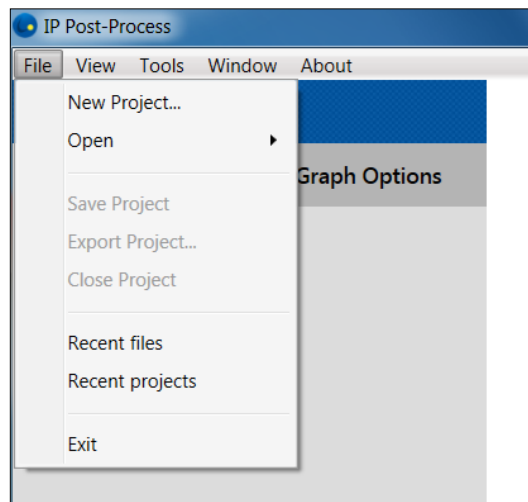
View menu:

To hide \ open the graph tool box, use the View->Show/Hide ToolBox option.
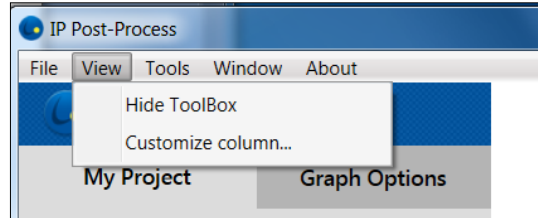
The tool box will appear to the top right of the Data/Graph window as followed for the Raw, Stack, Decay and Telluric panels. Note that the "Half Cycle Selection" and the "Delay and Period modification" are only enabled in the Raw panel of the Post-Process (filter) data.

↖	Pan mode (Default)
↖(x,y)	Pan mode with (x,y) data value
🔍	Zoom in mode
🔍	Zoom out mode
	Half Cycle selection (with Stacking Algo set to Average)
	Delay and Period modification (with Sync. set to Manual)
⛶	Reset Zoom (Extents)
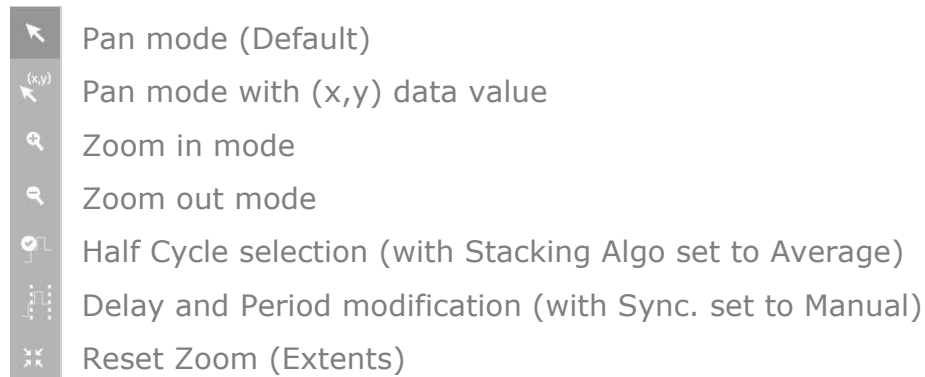
Customize column: define information to display in the Data window.
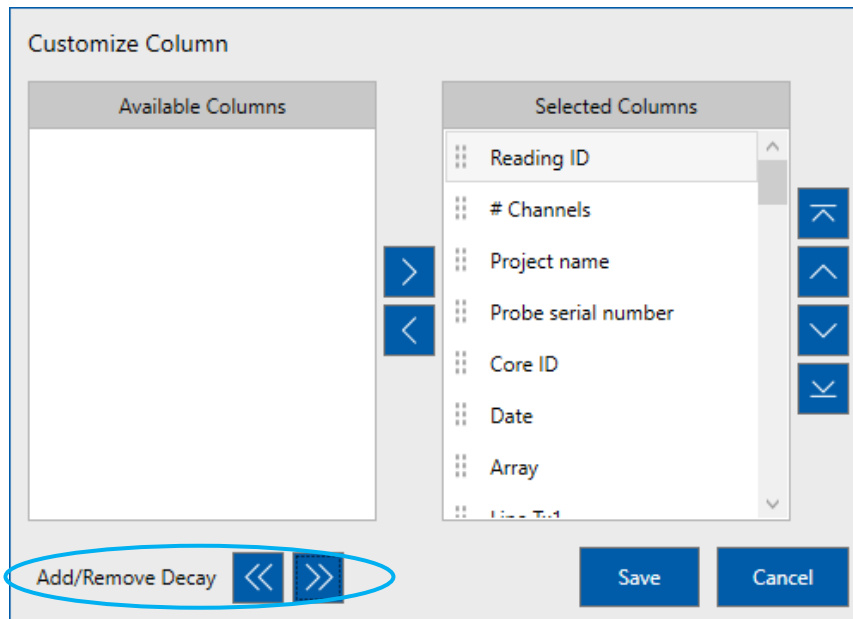
Add/Remove Decay buttons allow to add or remove all decay windows M01, M02, M03 … M20 together.

Tools menu:

Window Scheme: open the Window Scheme Editor. This feature allows changing the size of the window (initial delay and width), visualizes the resulting windows on a graph and creating new schemes.
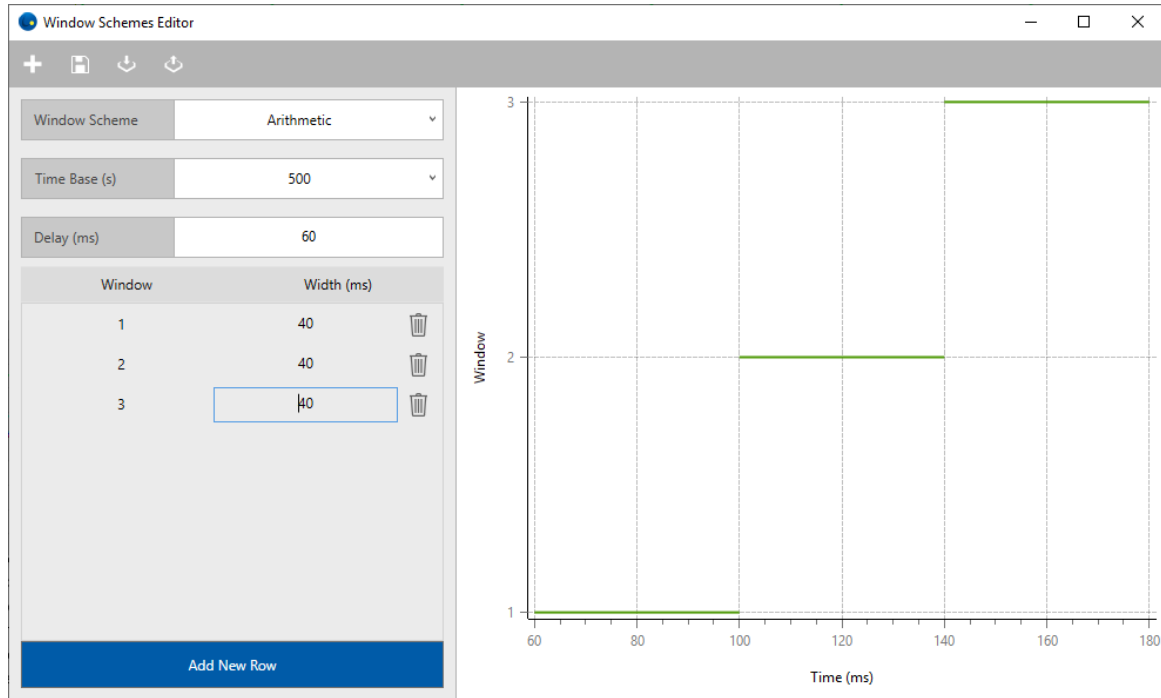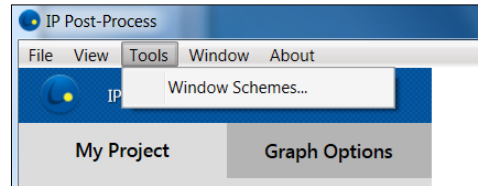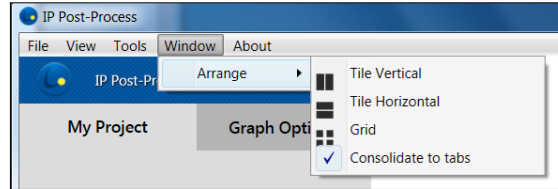

Note that the "Delay" refers to the time between the beginning of the OFF-time and the start of the first-time window. The "width" is the time window's width. All windows are contiguous. Refer to section 8.3 for additional information.

Window menu:

Change the appearance of the opened graphical windows.

This is an example of a processed file and the corresponding original *.mem file in the Tile Vertical format:
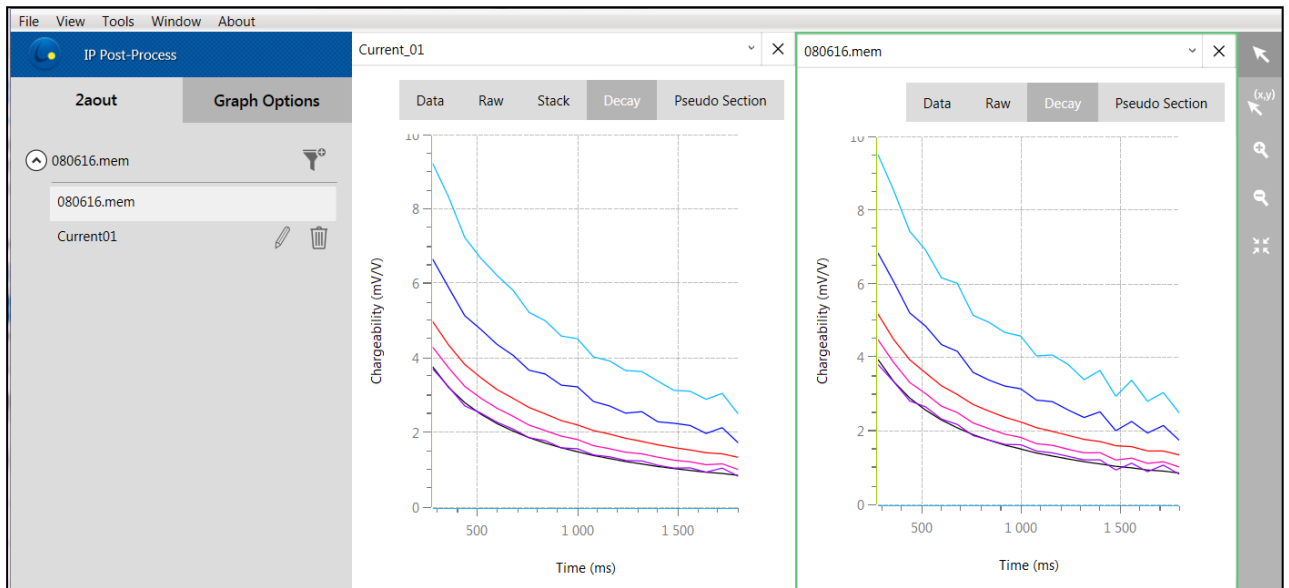
About:

Displays the current version of the software, remaining license time and the possibility to renew license before expiration.
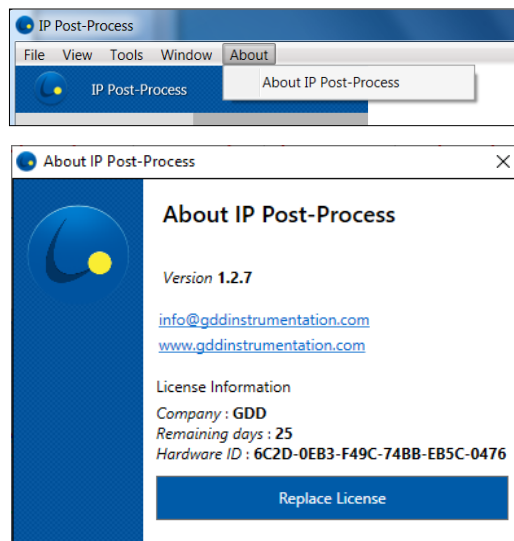
Task Bar

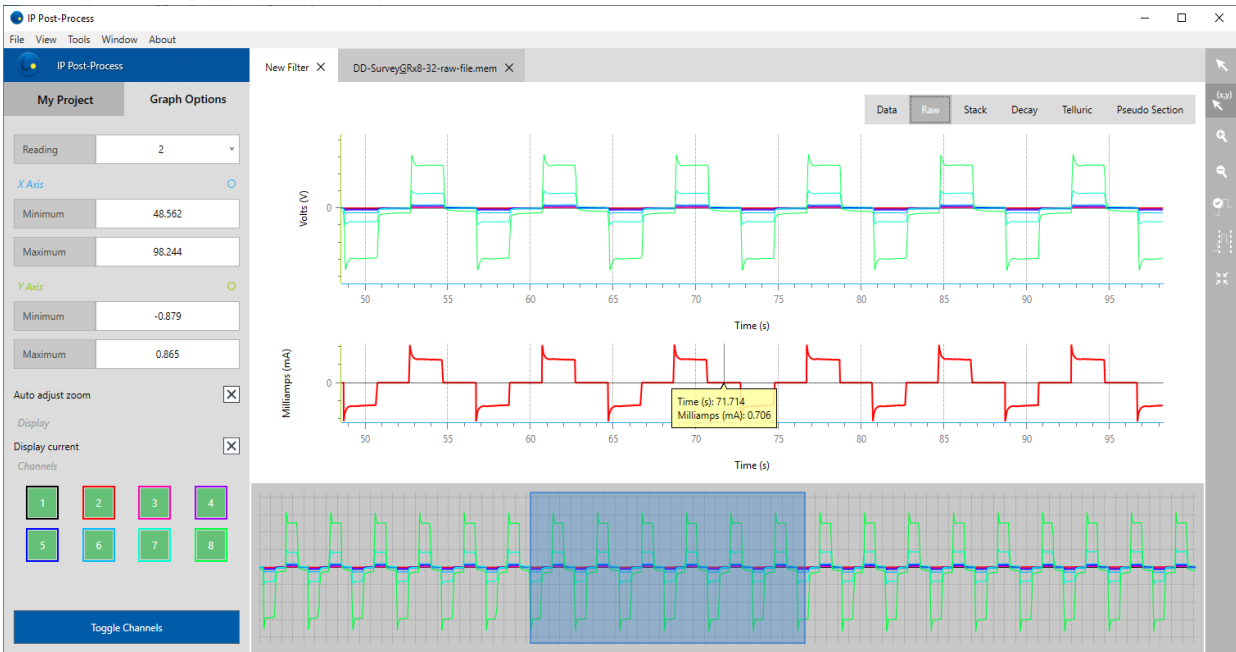The Task Bar gives information on the project, processed files and current / remote reference files.

Project name

*.mem file

Processed files or Filter

Add Filter button

Delete this filter

Edit this filter

Active Current / Remote reference files in Project

IP Post-Process

Project 245   Graph Options

test_10_23_2015.mem

test10_23_2015.mem

#07 Current file

New Windows Scheme

Linked files

Current (0)   Remote Ref. (0)
.IFI   .BDF

CURR0001.IFI
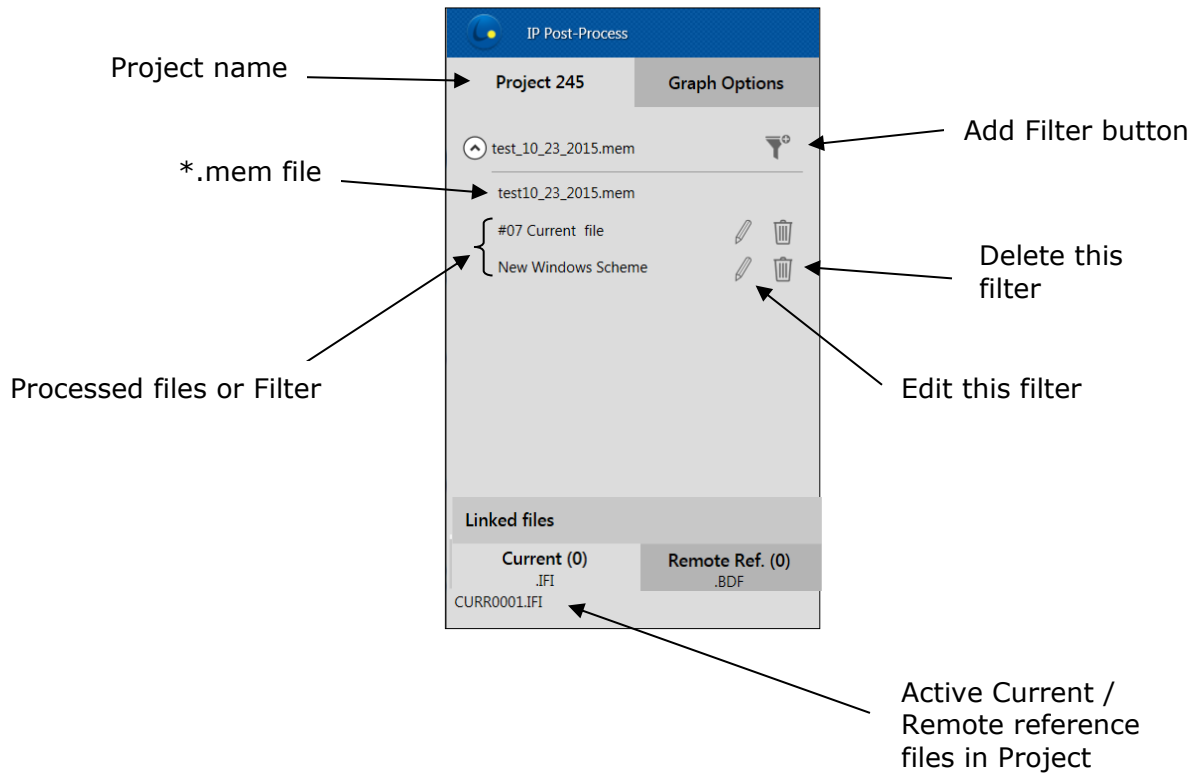
Graph Bar

The Graphic Bar provides a search tool for the Data panel (right) and display options for the Raw, Stack, Decay, Telluric and Pseudo Sections panels (left).

Reading to be displayed in the Raw, Stack, Decay and Telluric panels of the Graph Windows

X axis settings

Y axis settings

Change or not graph's zoom while changing readings

Display channel-specific data (Vp, Sp, M, Decay …) in the table

Displayed channels (up to 32)

Select \ Unselect all Channels

Display current file associated to IP readings

Data/Graph Window

The Main Window allows visualizing data and graphs for each of your opened files and active filter files.

Data: Spreadsheet displaying every reading included within the active *.mem or *.fullwave file. Note that the data to be displayed will slightly differ if it comes from an IP receiver or a SCIP tester;

Raw: Fullwave raw primary voltage data in volts, available for every active input channel;

Stack: Averaged half-cycle (ON+, OFF) in volts. Computed from our GDD noise rejection algorithm or manually, using the half-cycle rejection tool. This panel is not available for files opened outside a project or a filter.

Decay: Off-time chargeability Decay (in mV/V). Not available for *.fullwave files;

Telluric: Raw signal collected at a remote reference station from a *.bdf file. Only the signal of the two (2) first active receiver channels will be displayed and considered for processing.

Pseudo Section: Pseudo Section of Apparent Resistivity and Chargeability of each surveyed lines.

Note that by double-clicking on any current *.ifi or remote reference *.bdf file from the Linked files menu, a new window will appear with the corresponding data file displayed. These files are generally voluminous and may take time to be loaded.
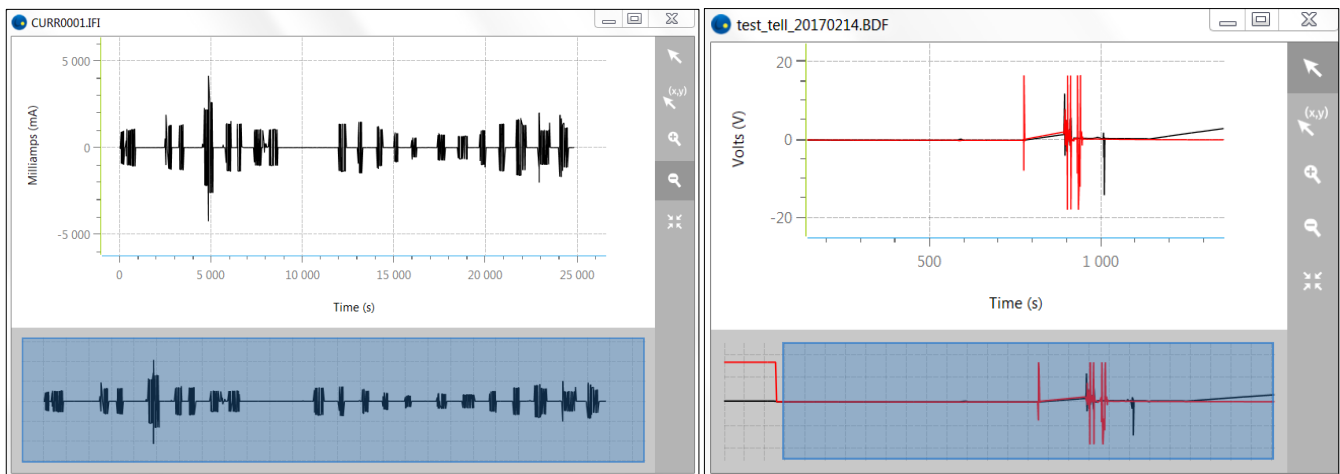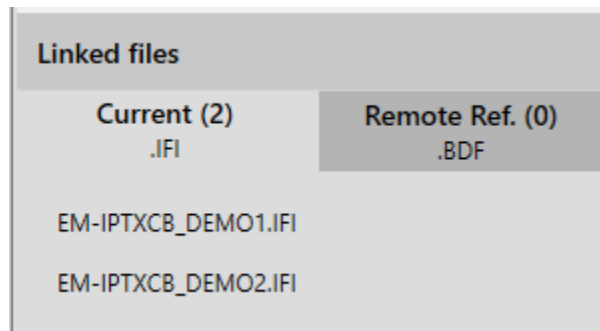
5. Getting started

Create a new project

- Save your data files to your computer:
    - o *.mem files from GDD IP receiver
    - o *.ifi files from GDD EM-IP Tx Controller
    - o *.bdf files from your remote reference station (GDD IP receiver)

- Start the IP Post-Process software by clicking on the software icon 🔵.
- Create a project by selecting File->New project…
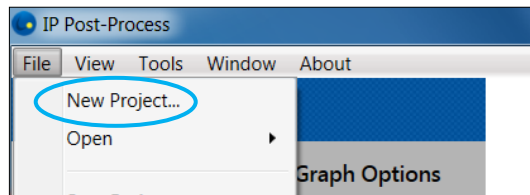
- Browse to the folder containing your data and open the binary data *.mem file(s). The following window will appear, click on OK once your project name is typed.
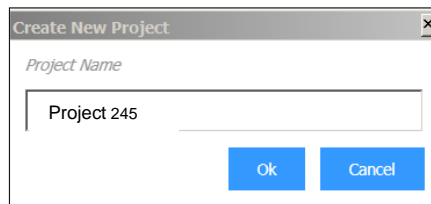
- The project name will appear in the Task Bar.
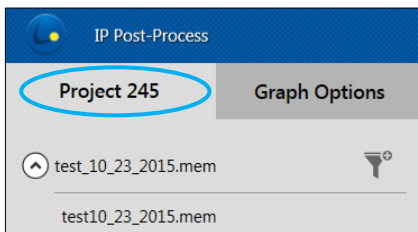
- It is possible to create a project using more than one *.mem file (collected using one or more IP receivers. To do so, copy all the *.mem files in the same directory and select them all when creating a new project. A "file Group" will then be created.
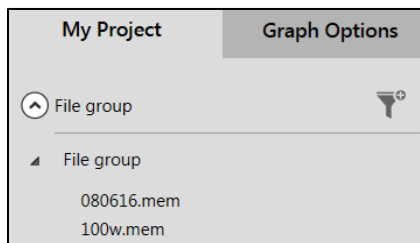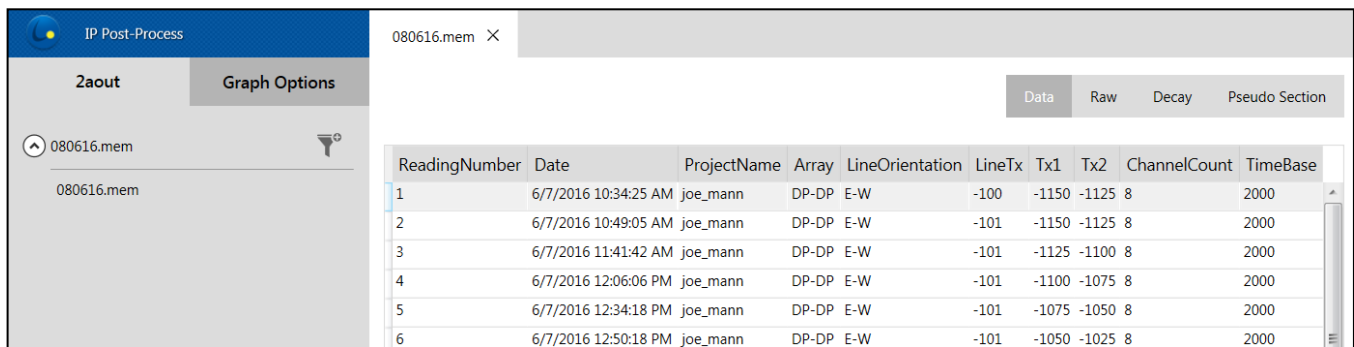
6. Visualizing your Data

Double click on the file name (*.mem file or filter) in the project task bar. This may take some time depending on the size of your *.mem file.

DATA panel

The following window will appear with the DATA tab opened. This table is a simple representation of the original *.mem file with columns displayed as per what has been selected in the View\Customize Column menu. Select a reading in the DATA table that will be displayed in the graphical windows. If you have loaded more than one *mem files, the merged dataset will be displayed.

The search bar in the Option Bar allows you to quickly find readings by their number or custom properties.
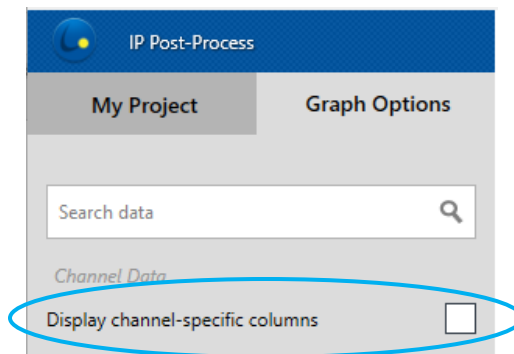
If you select "Display channel-specific columns" option, the detailed Data table is shown.

You can see Vp, Sp, M, Decay and other parameters per channel, according to the settings made in the View\Customize Column menu.

The "Display channel-specific columns" option is deactivated by default, because it takes an extra time to display details.

RAW panel

Open the RAW tab to visualise the fullwave *.mem data. All sampled data points from the GDD IP receiver are saved in the *.mem file.

For a Filter file, if a Remote Reference *.bdf file has been associated to a *.mem file (one or more readings), the data displayed in the RAW panel will then be the processed with telluric signal removed. The correlation factors used for the telluric removal calculation can be exported using the Export Format Editor (Remote Correction).

The **Zoom Editor window** at the bottom of the graphical window allows panning and zooming the content of the main window. Drag the edges of the blue rectangle to zoom on the selected area of the signal. You can also use the ZOOM tool located in the upright corner. Use the **graph task bar** to the left of the screen to navigate through the readings, set axes limits or show / hide specific channels.

Disable "Auto adjust zoom" option, if you want to apply the selected zoom while changing readings. Otherwise, the zoom will be adjusted automatically, if you choose another reading to be shown.

STACK panel

Click on the STACK tab to display the stacked data. The stacked panel is only available for Post-Process files (filter).

The **Zoom Editor window** at the bottom of the graphical window allows panning and zooming the content of the main window. Drag the edges of the blue rectangle to zoom on the selected area of the signal. You can also use the ZOOM tool located in the upright corner. Use the **graph task bar** to the left of the screen to navigate through the readings, set axes limits or show / hide specific channels.

Disable "Auto adjust zoom" option, if you want to apply the selected zoom while changing readings. Otherwise, the zoom will be adjusted automatically, if you choose another reading to be shown.

DECAY panel

Open the DECAY tab to display the Off-time chargeability Decay (in mV/V). Not available for *.fullwave files. In order to plot both positive and negative values on the same graph, a linear transition is created around zero when the logarithmic scale is selected.

The **Zoom Editor window** at the bottom of the graphical window allows panning and zooming the content of the main window. Drag the edges of the blue rectangle to zoom on the select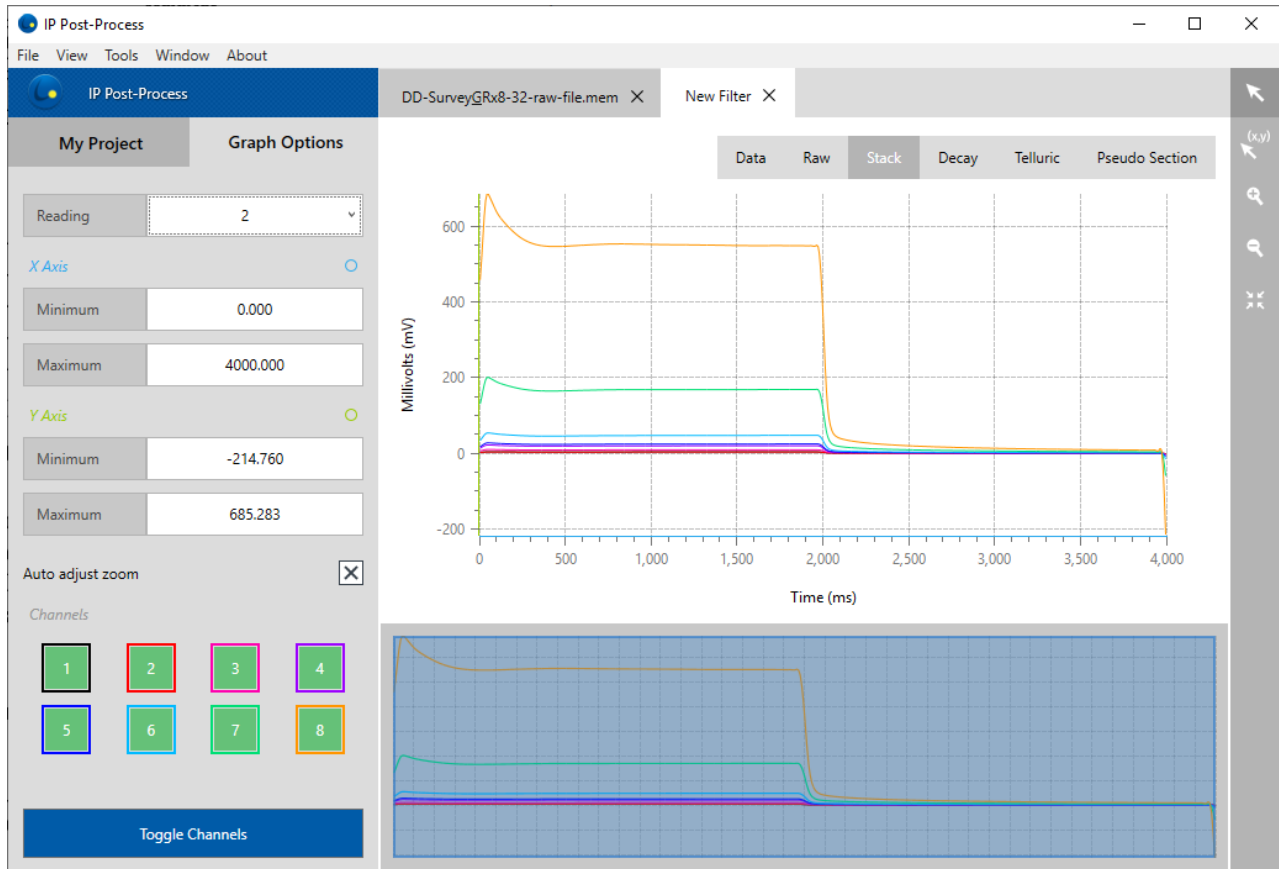ed area of the signal. You can also use the ZOOM tool located in the upright corner. Use the **graph task bar** to the left of the screen to navigate through the readings, set axes limits or show / hide specific channels.

Disable "Auto adjust zoom" option, if you want to apply the selected zoom while changing readings. Otherwise, the zoom will be adjusted automatically, if you choose another reading to be shown.

Pseudo Section panel

Open the Pseudo Section tab to display the Pseudo Section of each surveyed lines. Both Apparent Resistivity and Chargeability Pseudo Section can be displayed. Note that it can take some time for the software to compute the Pseudo Section of a filter file.

The Graph Options allow to set manually the X and Y axis values. There are also graphical options such as displaying and defining the contours and the color range.
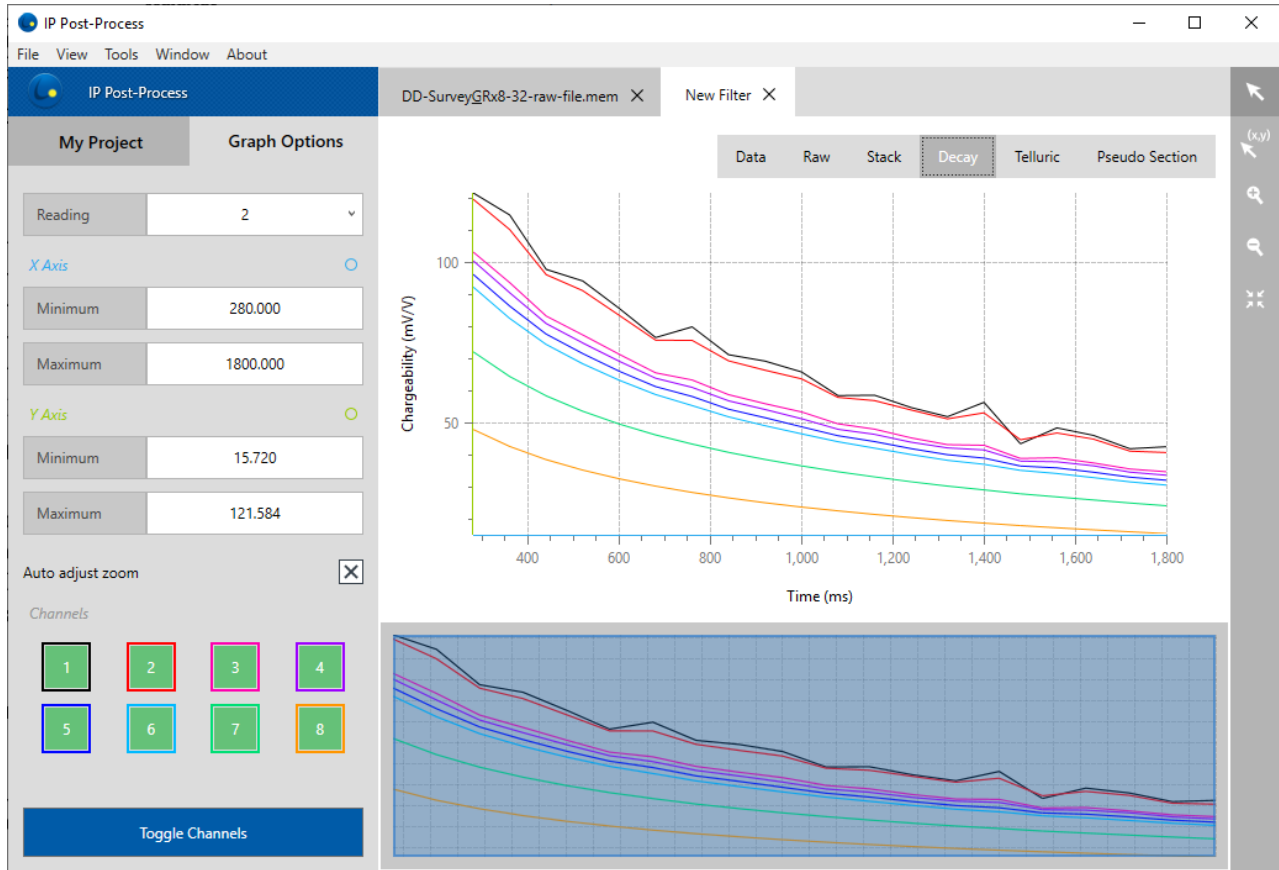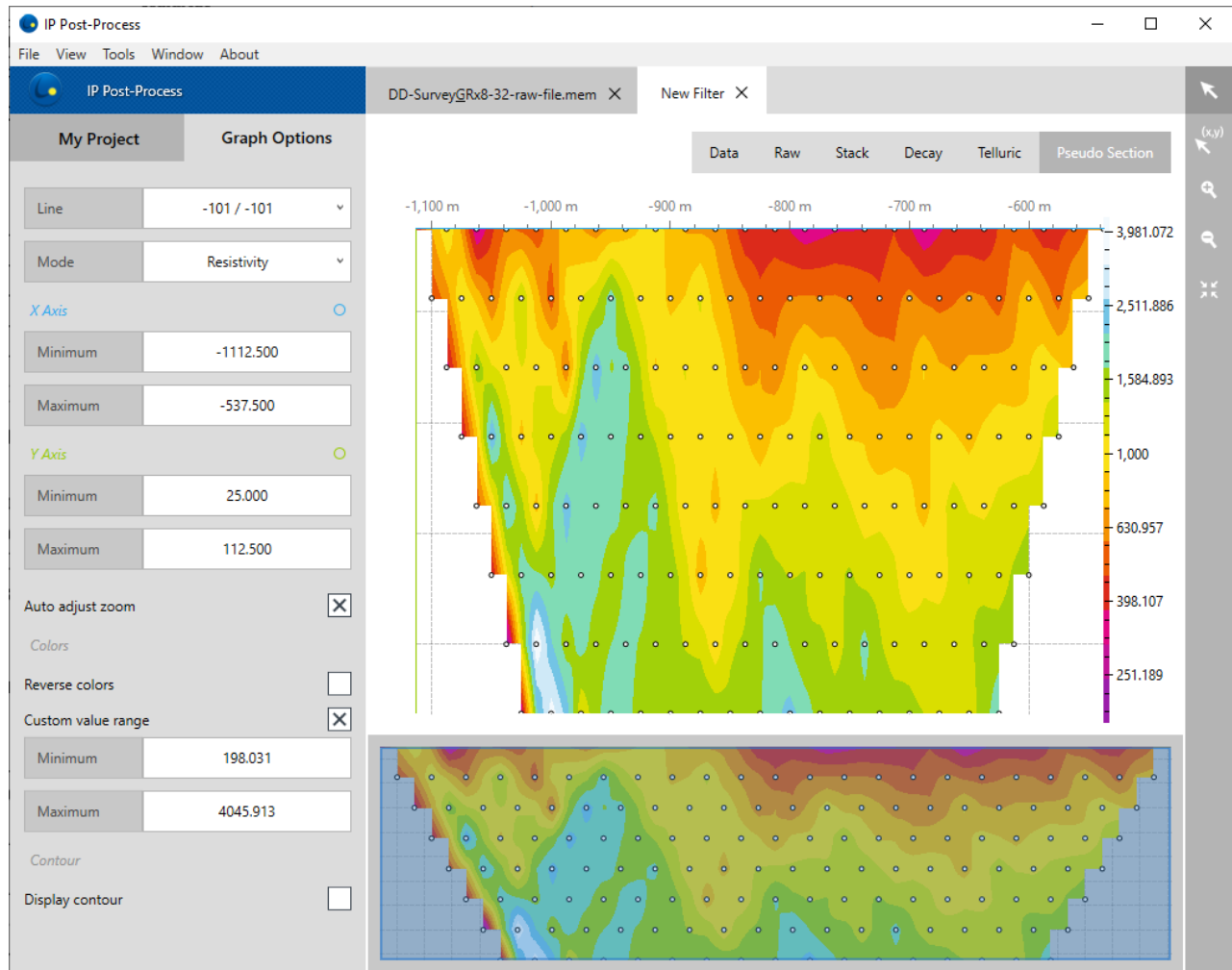

The **Zoom Editor window** at the bottom of the graphical window allows panning and zooming the content of the main window. Drag the edges of the blue rectangle to zoom on the selected area of the signal. You can also use the ZOOM tool located in the upright corner. Use the **graph task bar** to the left of the screen to navigate through the lines, set axes limits or define custom colors range.

Disable "Auto adjust zoom" option, if you want to apply the selected zoom while changing lines. Otherwise, the zoom will be adjusted automatically, if you choose another line to be shown.

In the Pseudo Section panel, when using the Pan mode with (x,y) data value , the X value refers to the survey station, the Y refers to the graphical vertical position of the data point from the electrode spacing (does not corresponds to a true depth) and Value returns the Resistivity or Chargeability result at this survey station.
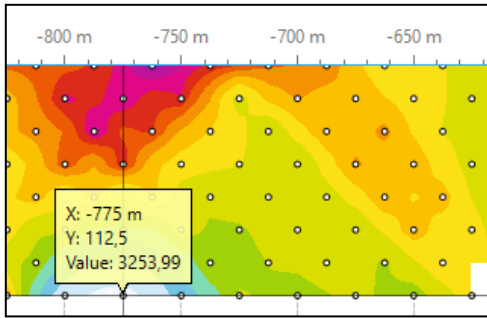
Note that intermediate values used in the pseudo section interpolation will be displayed using this Pan mode. These values are not considered in the exported datasets.

Telluric panel

The Telluric panel will be available if one or more remote reference *.bdf files have been associated to the *.mem readings. In which case, the data displayed in the RAW panel will then be the processed data with telluric signal removed. The correlation factors used for the telluric removal calculation can be exported using the Export Format Editor (Remote Correction).

The **Zoom Editor window** at the bottom of the graphical window allows panning and zooming the content of the main window. Drag the edges of the blue rectangle to zoom on the selected area of the signal. You can also use the ZOOM tool located in the upright corner. Use the **graph task bar** to the left of the screen to navigate through the readings, set axes limits or show / hide specific channels.

Disable "Auto adjust zoom" option, if you want to apply the selected zoom while changing readings. Otherwise, the zoom will be adjusted automatically, if you choose another reading to be shown.

7. Modifying your survey parameters
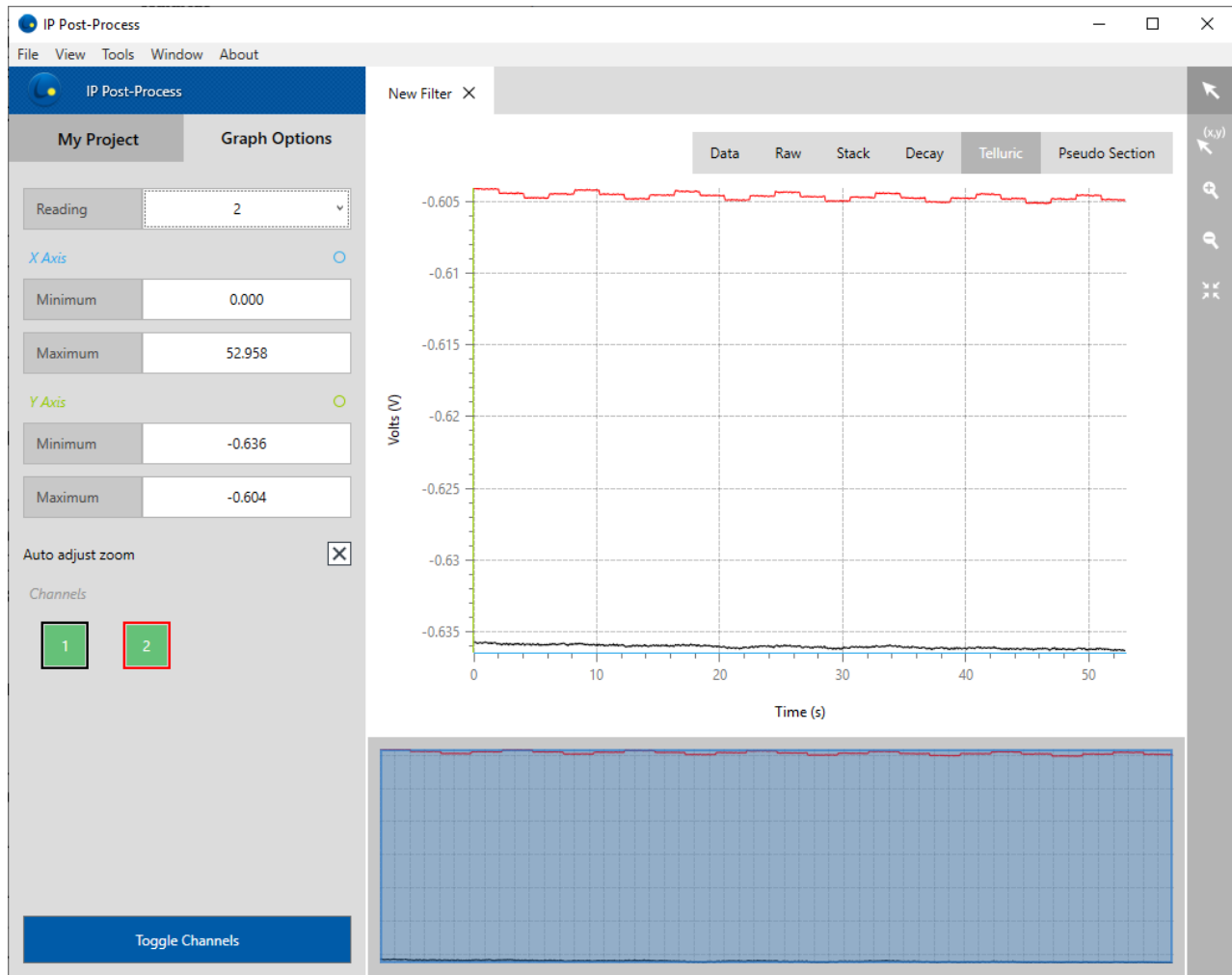
To re-process your data, select your *.mem file or file group and click on the Add Filter Icon in the **task bar**.
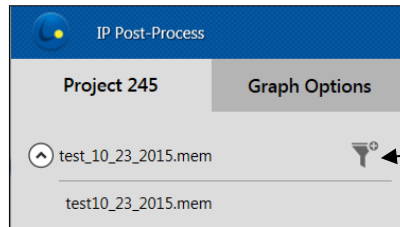
The Filter Editor will appear. The left part of the window contains the parameters controls while the right part recalls the readings information.

To modify a parameter, you must first select one or more readings. To do so, you can click directly in the corresponding reading(s) to highlight it (to select more than one reading, hold the Ctrl button while clicking on the readings). You can select all the readings by clicking on the top left corner of the data window.

You may now change the following survey parameters:

7.1 Tx Current

Changing the current (constant or *.ifi file collected using GDD'S EM-IP Tx Controller) will modify the apparent resistivity (Rho) accordingly. The use of a current file (*.ifi) will result in a very accurate Rho calculation.

When a current file is associated to a reading, it can be displayed in the Raw panel.
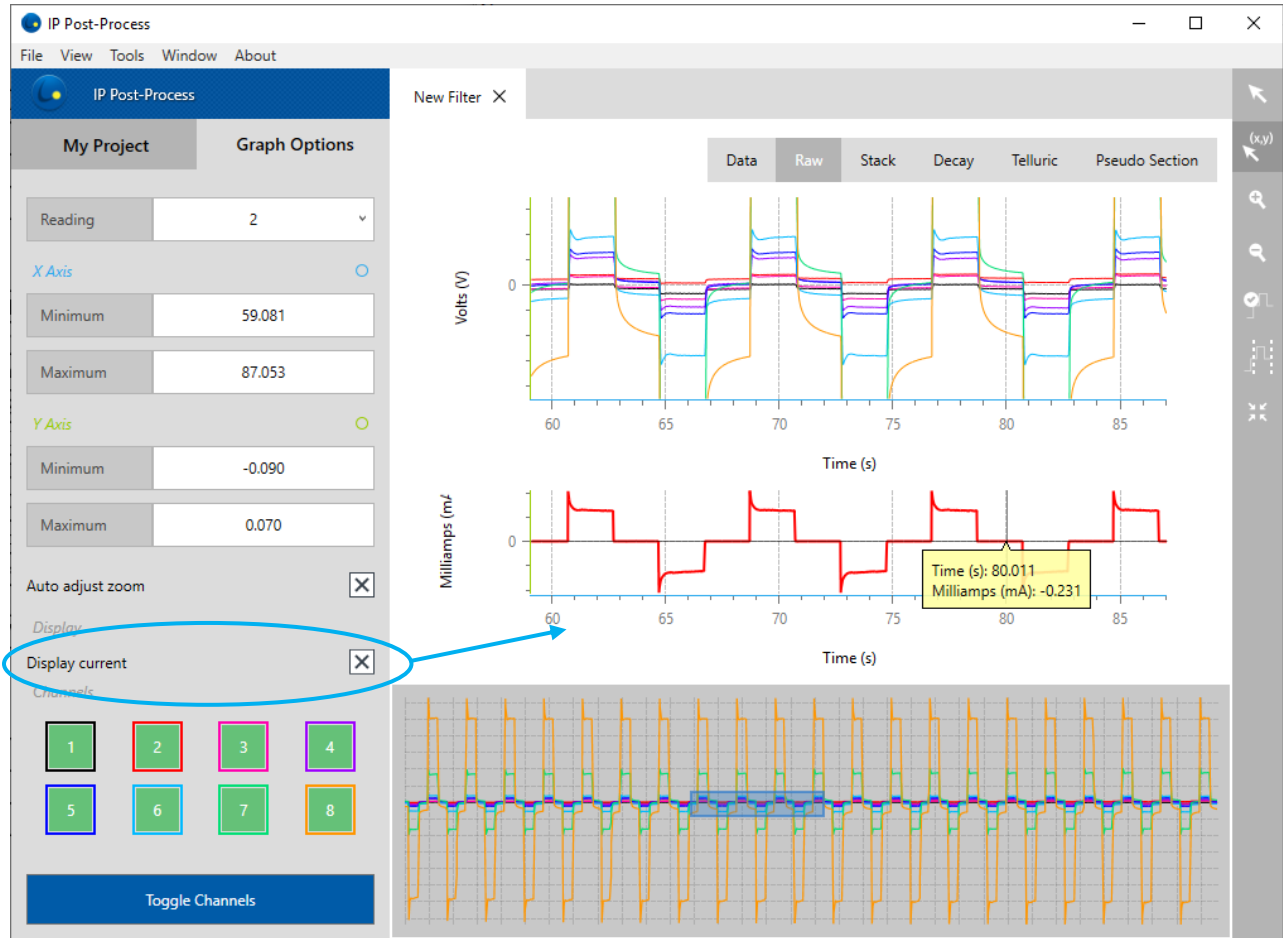
You can select multiple *.ifi files and apply it for multiple readings in the filter. Based on the GPS time, the filter will automatically find the match between *.ifi files and selected readings and warn you with the number of readings for which the match wasn't found.
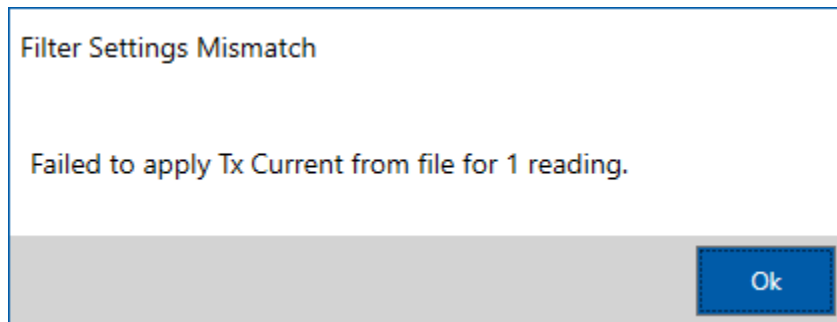
7.2 Stacking algorithm

The Stacking algorithm will allow computing the final stack half-cycle. You can choose between the default stacking algorithm GDD "Noise rejection" or the "Average" mode. The latter will allow you to un-select undesired half-cycles and to re-compute the stack.
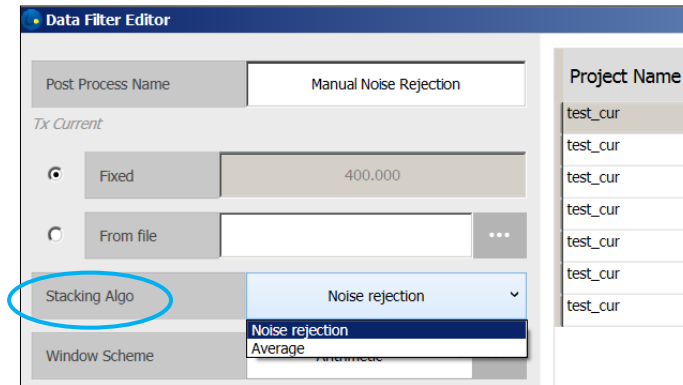
When using the "Average" mode, click on the half-cycle selection icon and highlight (in pink) the half-cycle to discard from the final stack calculation. Discarding a half-cycle implies that every channel will be discarded.
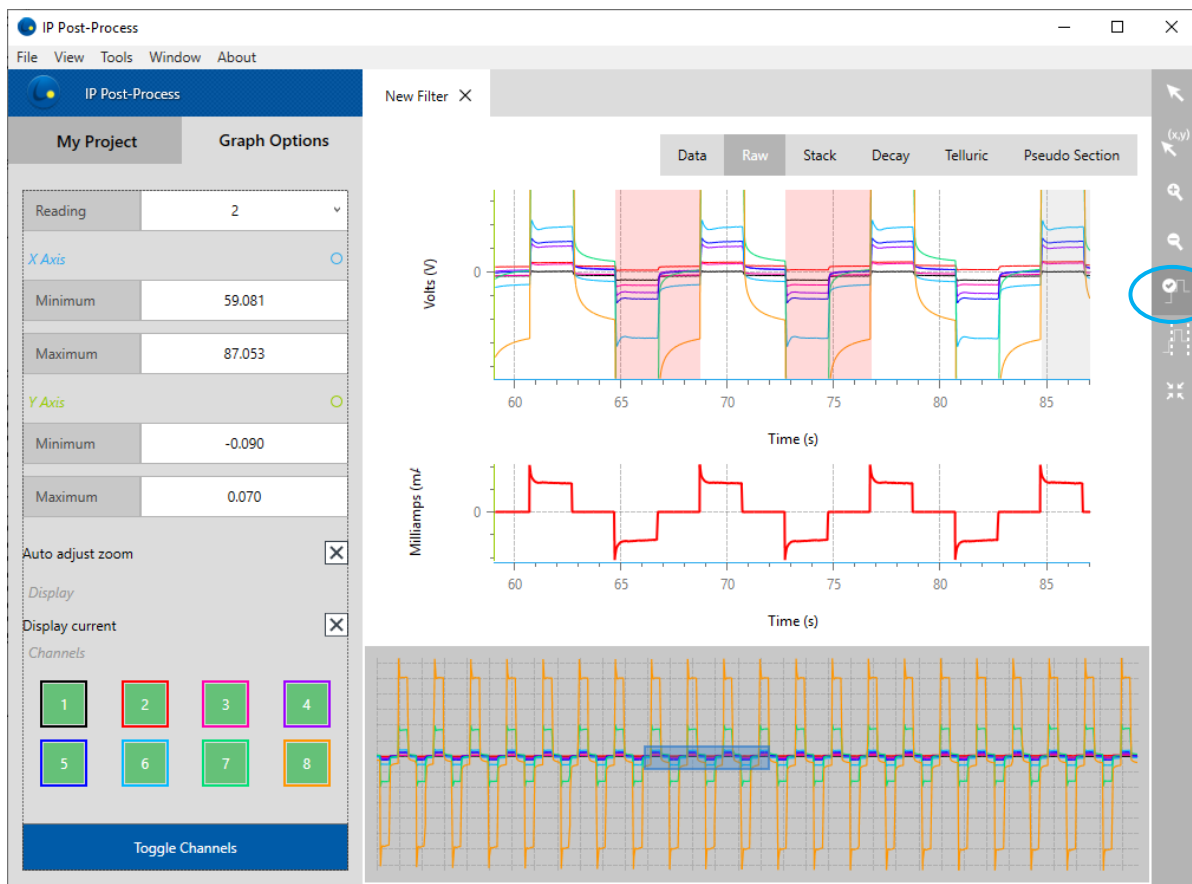
7.3 Windows Scheme

The Windows Scheme is set to sample the Vs decay for chargeability calculation purpose. This IP Post-Process software provides the user with an interface to modify the Windows Scheme used during acquisition with very little limitations.
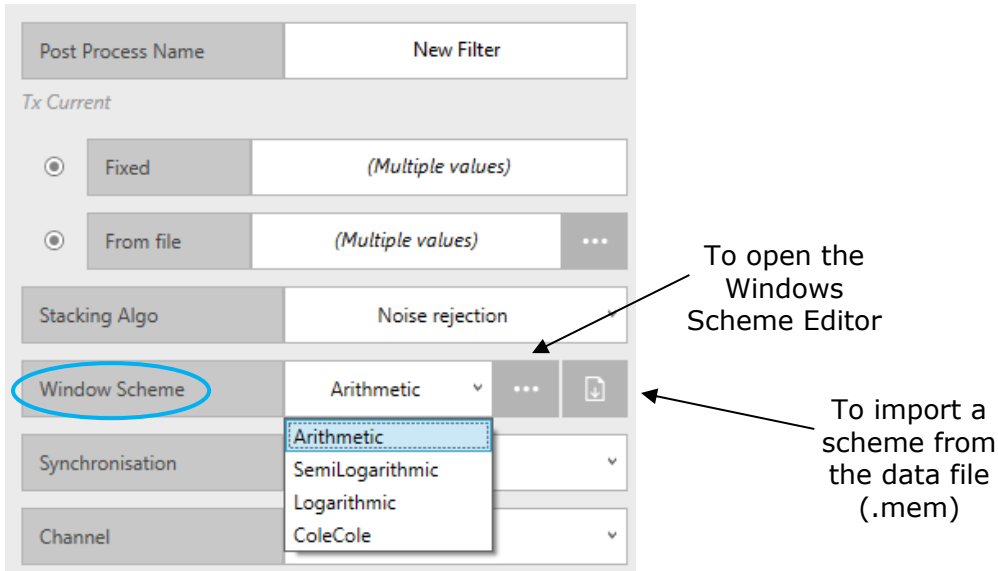
All non standard windows schemes used while acquisition and stored in the data file (.mem) are unnamed. When you click the "Import scheme" button ⬓, the software searches for the match between windows schemes on the list and the windows schemes in the data file. If a match is found, the software applies the name of the windows scheme on the list to the windows scheme in the reading. If no match is found, the user is asked to name a new windows scheme and this one is added to the list.

7.4 Synchronisation

The synchronisation of the data collected at the IP receiver in regards to signal emitted at the transmitter can be modified using this post-process option.

The step of validating the data synchronization is very important since it will impact on your post-processed Vp and Chargeability results.

By default, "Auto" is selected and the Post-Process software find the synchronisation itself. The software uses fullwave and applies a more sophisticated algorithm then the one in the receiver to find a more accurate synchronisation. Generally, it is the best option.
You can choose the trigger channel used for synchronisation.

Normally, it should be the channel with the strongest signal.

If "Not Set" is selected, the Post-Process software uses the synchronisation found by the receiver while acquisition.

In order to use the "GPS" synchronisation mode, your IP data must have been collected from a GDD IP receiver and IP transmitter (with GDD EM-IP Tx Controller) both synchronised using GPS signal.

The "Manual" mode allows setting the "initial offset (ms)" and "Half cycle width (ms)" which correspond respectively to the beginning of the first ON-time and to the cycle duration (time base). Note that a slight adjustment of the "time base" actually refers to adjusting the number of samples in each half-cycle. The Duty Cycle menu can be accessed in "Manual" mode only. If required, it can be changed from 50% to 100% or vice versa.

Synchronisation	Manual
Initial Offset (ms)	0
Half cycle width (ms)	4,000.000
Duty Cycle	50%
	50%
	100%
Remote reference	

You can visualize the synchronisation parameters (i.e. Initial offset and Period) in the RAW panel as red vertical bars by clicking on the "Delay and Period modification" icon in the Tool

Bar: [icon]. You can then manually adjust the initial offset by dragging the first bar and the period with the other ones.
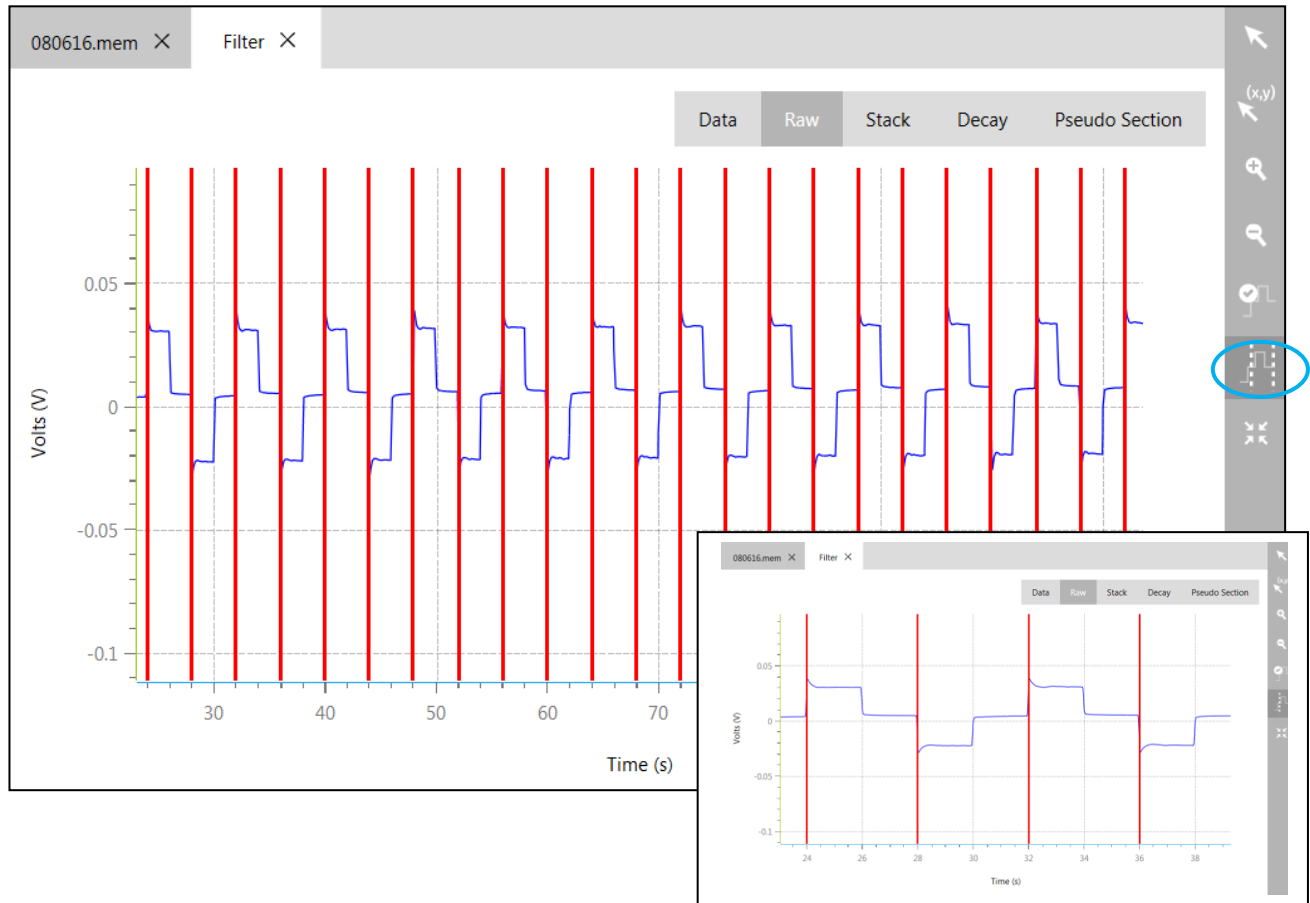
The STACK panel will help validating your IP data synchronisation. For a conventional 50% duty cycle survey, The ON-time and OFF-time cycles should be of the same duration than half of the survey time base.

Accurate synchronisation

Example of an inaccurate synchronisation
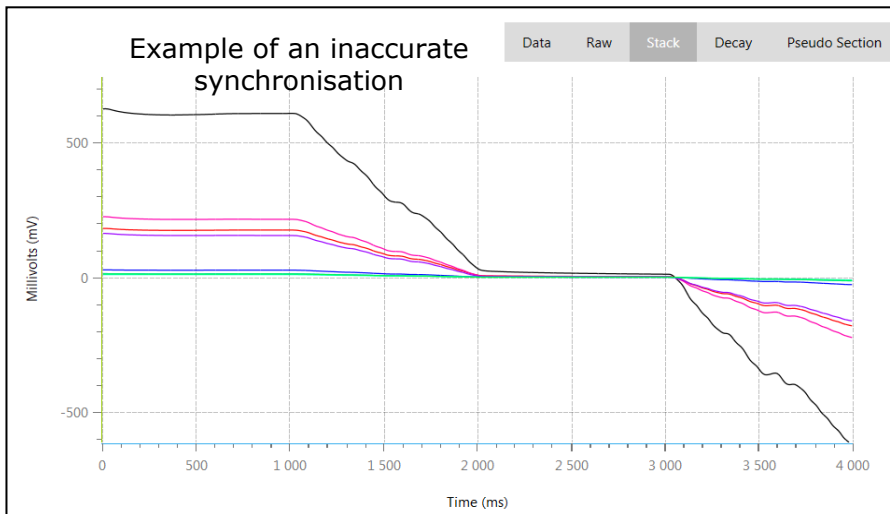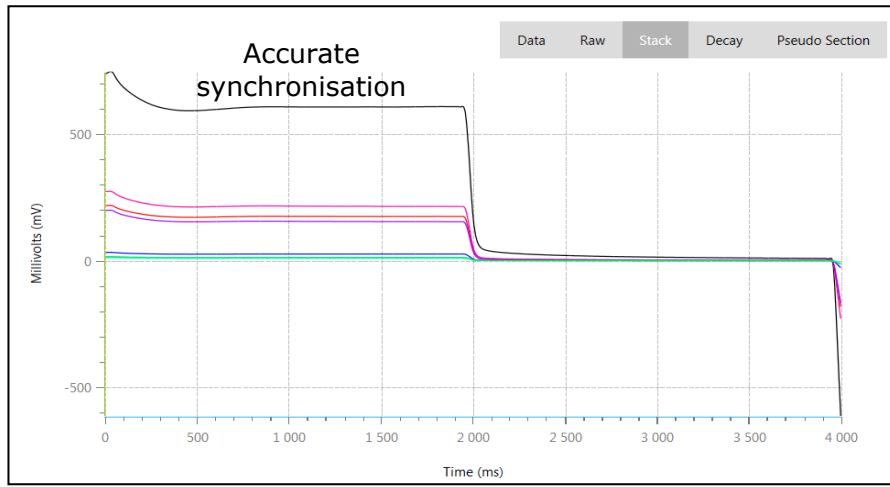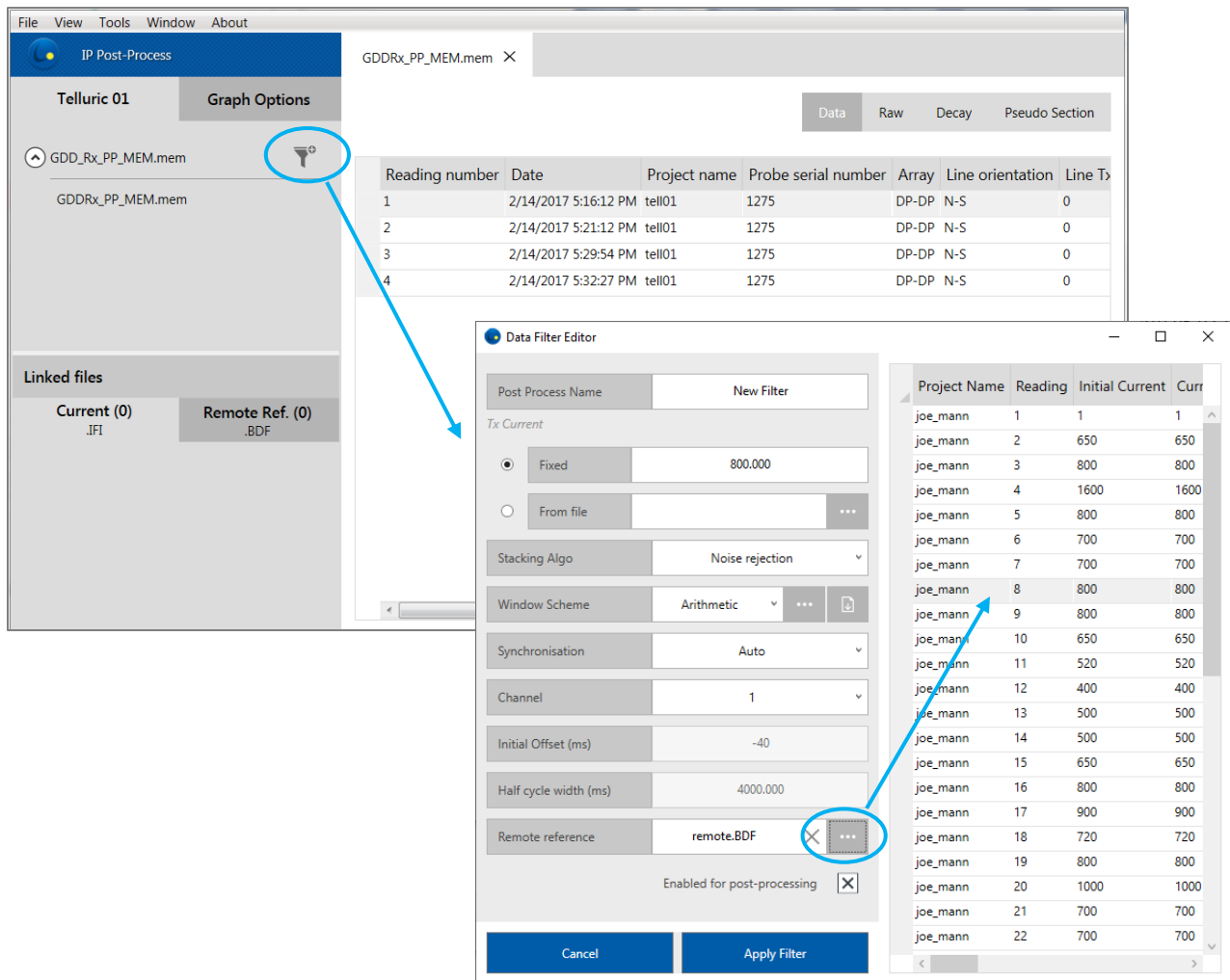
7.5 Remote reference

To cancel telluric noise from a Resistivity / IP survey dataset, start by creating a new project using your survey *.mem file. Next, add a new Filter file. From the Data Filter Editor, select and associate a Remote reference *.bdf file using [...] to each of your readings. Generally, a single .bdf file will be measured for the entire .mem dataset and thus the entire set of readings can be selected by clicking [▲].

You can select multiple *.bdf files and apply it for multiple readings in the filter. Based on the GPS time, the filter will automatically find the match between *.bdf files and selected readings and warn you with the number of readings for which the match wasn't found.

Apply the telluric correction by clicking on "Apply Filter".

Refer to the example below for which Remote reference file "test_tell_20170214.bdf'' has been associated to Reading 2 of the "GDDRx_PP_MEM.mem" IP survey file.

The "New Filter" processed file will allow the display of a new panel (i.e. Telluric) on which the Remote reference data (from *.bdf) corresponding to the survey period will be plotted. In the example presented here, the Remote reference station included two (2) orthogonal dipoles (channels 1 and 2).
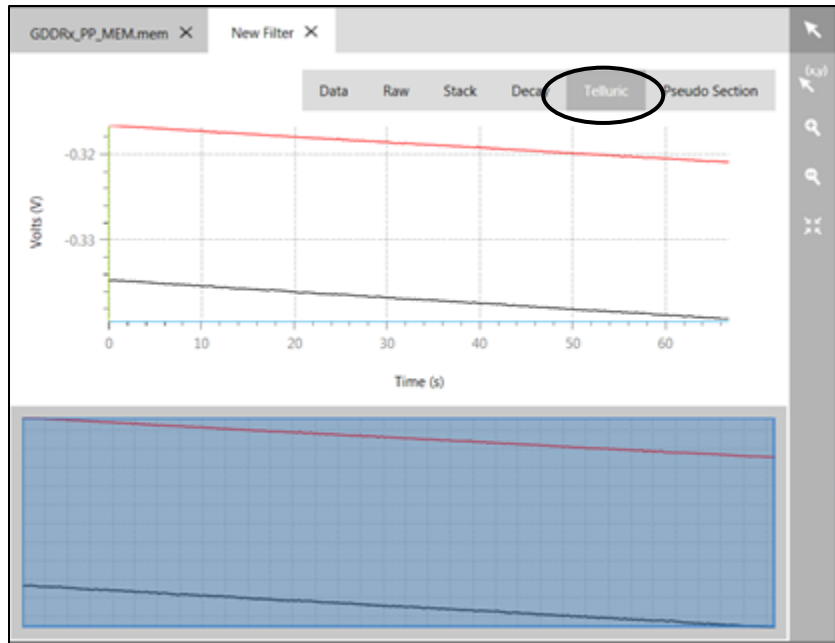
The RAW panel of the Filter file will display the processed result with Telluric noise collected at the Remote reference station extracted (refer to section 7). Figure below presents the original RAW data (left) against the processed file (right).
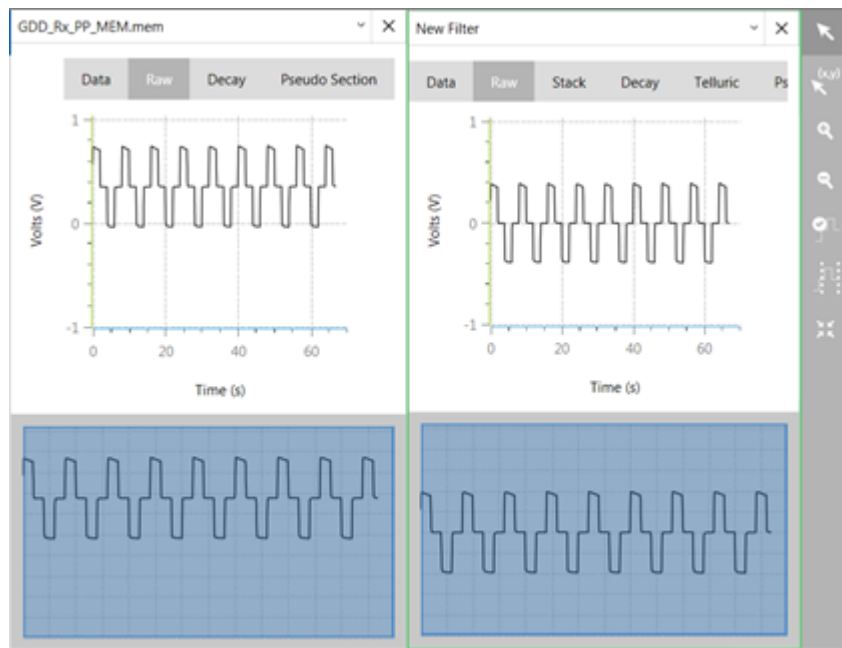
The correlation factors resulting from the Telluric noise cancellation can be exported using the Export Format Editor (refer to section 5). Select the following exported columns: "Remote refence" and "Remote Correction".

```
Instrumentation GDD customized IP data file
Version_PPC:0.4.2.41  Version_Rx:8.1.0.0  RxSN:1275  Project:tell01  Windows:20  Setting:Arithmetic  Delay_(ms):240  Time_Format:GPS
Timing_(ms):80,80,80,80,80,80,80,80,80,80,80,80,80,80,80,80,80,80,80,80
  Mem Array ...     Tx1     Tx2     Rx1    Rx2 Contact      Rho   ...   M20                                         RemoteCorr RemoteRef
   2 DP-DP ...     1.00    2.00    3.00    4.00    0.3    79.46   ... 1.323 OF:-5.998856e+01,R1:+4.088803e+00,R2:-5.615436e+00      RX1260
   3 DP-DP ...     2.00    3.00    4.00    5.00    0.3    38.34   ... 1.410                                                NO        *
   4 DP-DP ...     3.00    4.00    5.00    6.00    0.6    85.59   ... 1.394                                                NO        *
```
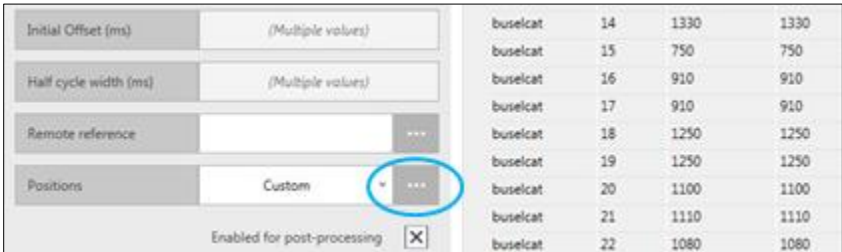
7.6 Positions

Editing positions is possible for the following modes: Dipole-Dipole, Pole-Dipole, Pole-Pole, Gradient and Distributed. This function has been added in order to help you to fix the positioning errors occurred while doing survey in the field or to put more accurate positions from the GPS after the survey.

To put your custom positions in the **Filter Editor**, change the **Positions** from **Initial** to **Custom** and click the [...] button.

The following window will be opened, allowing you to edit positions.

If you confirm the modifications, the apparent resistivity (Rho) will be recalculated and shown in the **Data** tab of the filter. The **Pseudo Section** will be also updated.

If you want to create an output file (*.gdd, *.dat, *.csv) with modified parameters, do the **Export Project** for the selected filter.

7.7 Enabled for post-processing

Disabling a complete reading is possible while creating a filter.

Select the readings you want to discard from the final dataset and uncheck the following option Enabled for post-processing ✗ .

Once disabled, the corresponding RAW, STACK signals and DECAY curves will be displayed as dash line to indicate that they are no longer activate and the Pseudo Section will be adjusted accordingly.
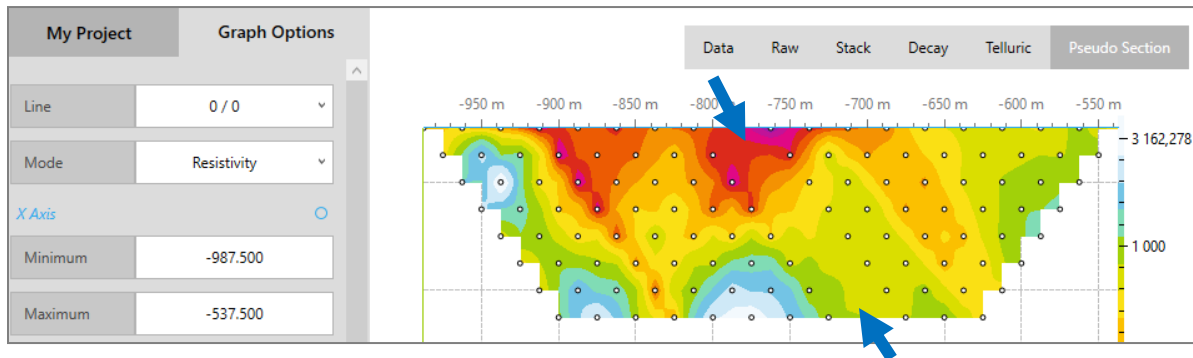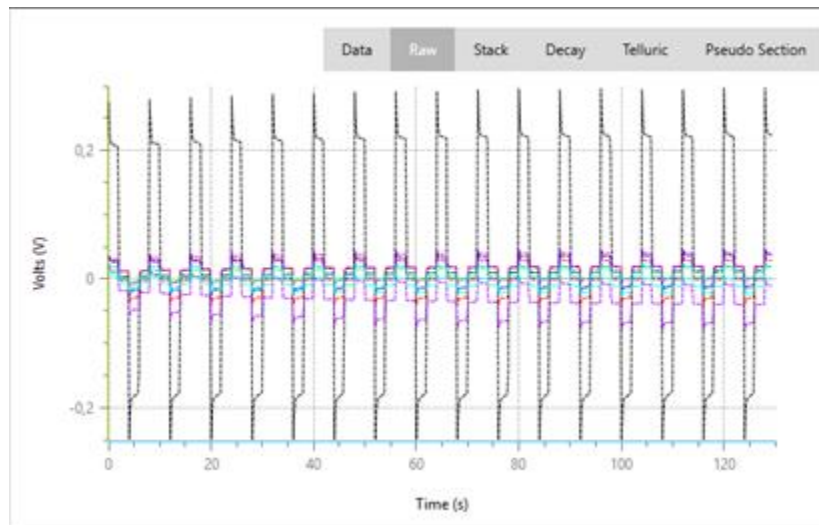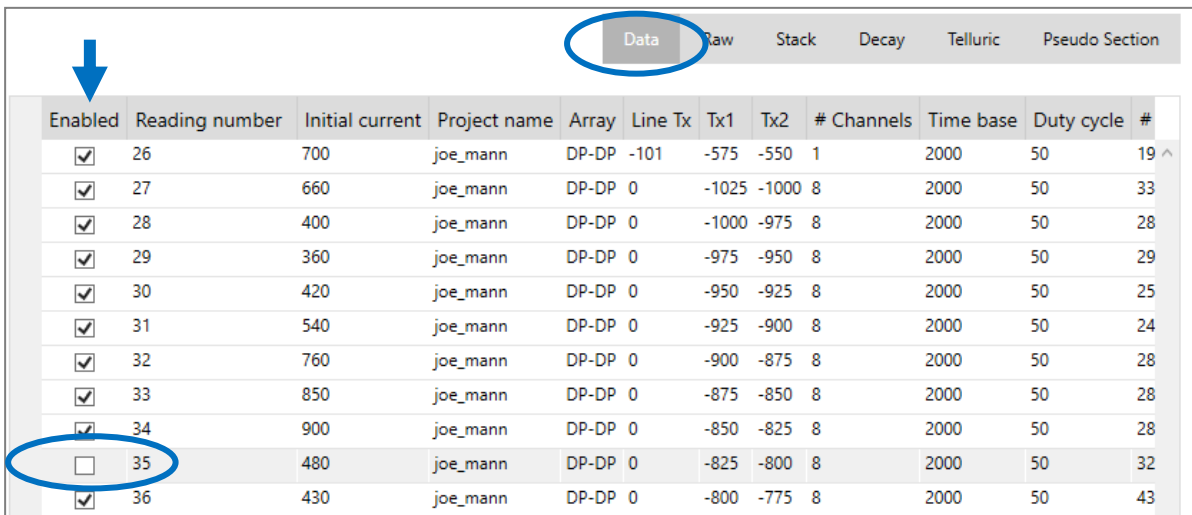
7.8 Apply Filter

To save your filter, give it a "Post-Process" name (top left of the Data Filter Editor) and click on the "Apply Filter" button. A new file will appear in your Task Bar. <u>Double-click on it to activate a tab in the Data\Graph window and navigate in the Data, Raw, Stack, Decay and Pseudo Section panels to visualize the results.</u>

At any time, you can modify a Post-Process file by clicking on the corresponding [✏] edit button or you can delete it using the [🗑] remove filter button in the Task Bar.

7.9 Disabling a reading

Disabling a complete reading is possible once a filter file has been created. Go to the DATA panel of your filter file and uncheck any reading to be discarded from the final dataset.

						Data	Raw	Stack	Decay	Telluric	Pseudo Section	
Enabled	Reading number	Initial current	Project name	Array	Line Tx	Tx1	Tx2	# Channels	Time base	Duty cycle	#
☑	26	700	joe_mann	DP-DP	-101	-575	-550	1	2000	50	19
☑	27	660	joe_mann	DP-DP	0	-1025	-1000	8	2000	50	33
☑	28	400	joe_mann	DP-DP	0	-1000	-975	8	2000	50	28
☑	29	360	joe_mann	DP-DP	0	-975	-950	8	2000	50	29
☑	30	420	joe_mann	DP-DP	0	-950	-925	8	2000	50	25
☑	31	540	joe_mann	DP-DP	0	-925	-900	8	2000	50	24
☑	32	760	joe_mann	DP-DP	0	-900	-875	8	2000	50	28
☑	33	850	joe_mann	DP-DP	0	-875	-850	8	2000	50	28
☑	34	900	joe_mann	DP-DP	0	-850	-825	8	2000	50	28
☐	35	480	joe_mann	DP-DP	0	-825	-800	8	2000	50	32
☑	36	430	joe_mann	DP-DP	0	-800	-775	8	2000	50	43

Once disabled, the corresponding RAW, STACK signals and DECAY curves will be displayed as dash line to indicate that they are no longer activate and the Pseudo Section will be adjusted accordingly.
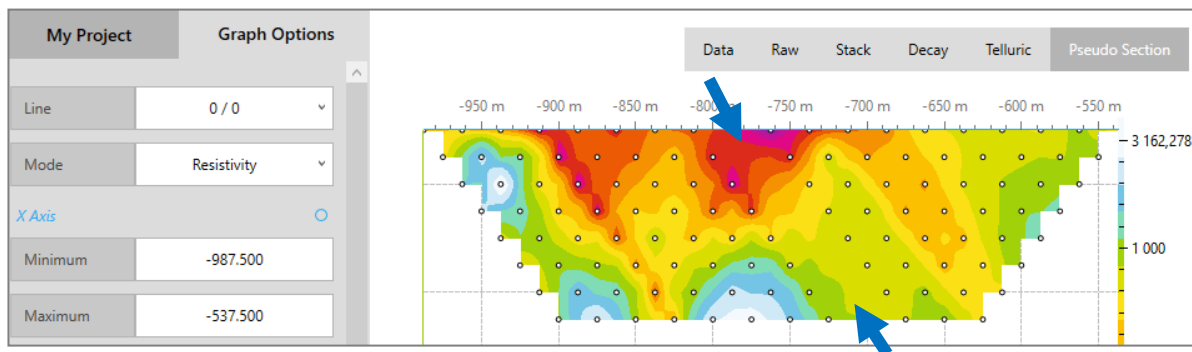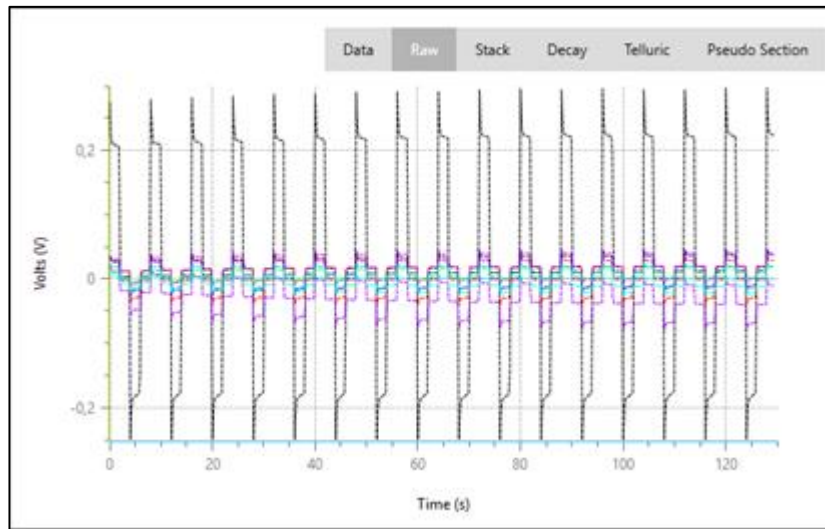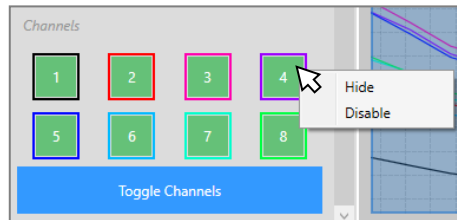
7.10 Disabling a channel

Disabling a channel is possible in the RAW, STACK and DECAY panels using the Channel display tool of the Graph Options:
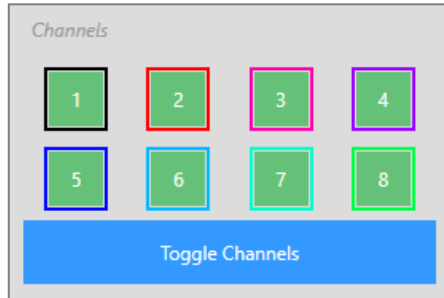

Right-Clicking on any of the available channels will activate a menu with two options: Hide or Disable.

If a channel is hidden, it will no longer be displayed in the RAW, STACK and DECAY panels but will still be included in the final database. On the other hand, if a channel is deactivated, it will be displayed as a dash-line in the panels so you know it is no longer part of the final dataset. You can deactivate one or more channels of each Filter file reading.

Original *.mem file   **Processed Filter file**

Decay Panel of 5 active channels

Decay Panel with CH2(red) disabled and CH3 (pink) hidden
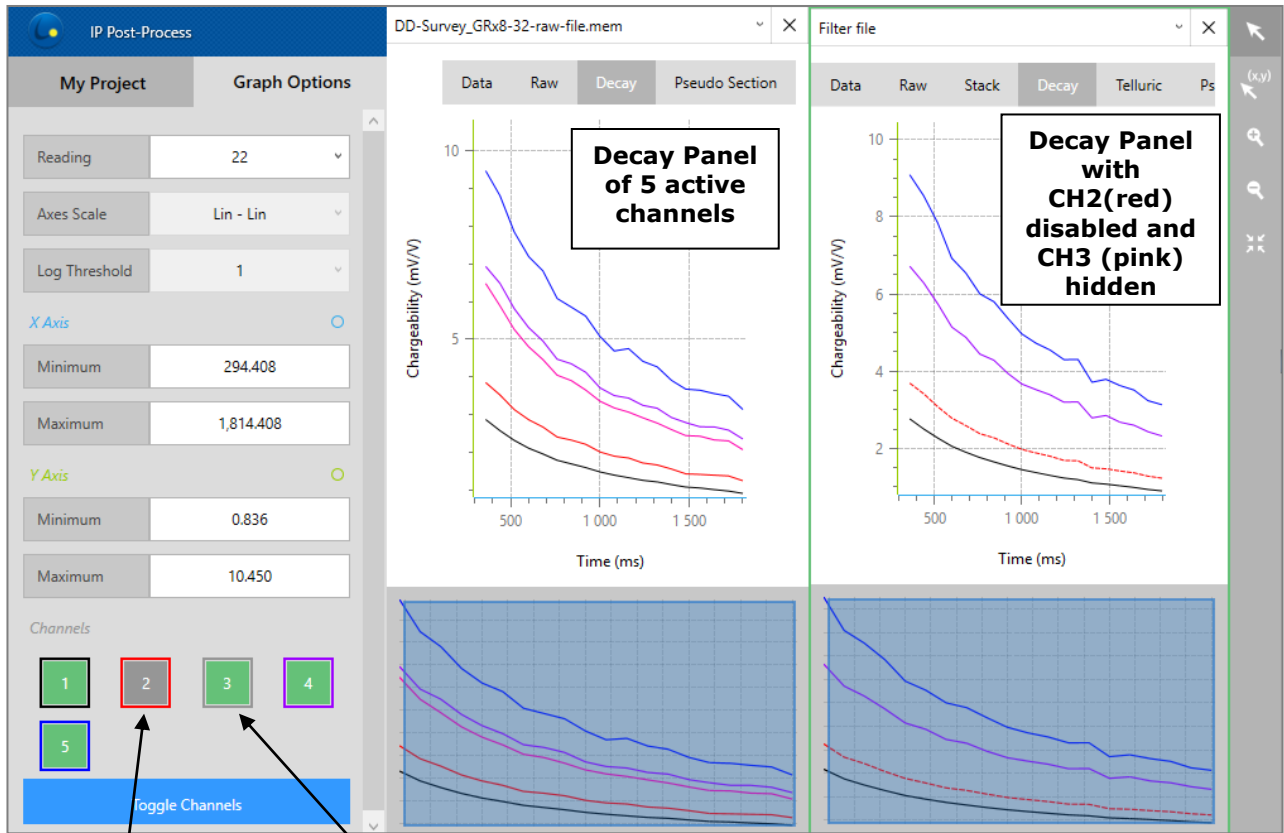
Visual aspect of a channel being deactivated

Visual aspect of a channel being simply hidden

8. Technical Support

If you encounter a problem not described in this manual, do not hesitate to contact **Instrumentation GDD** for assistance at:

Tel.:   +1 (418) 478-5469

e-mail: **info@gddinstruments.com**