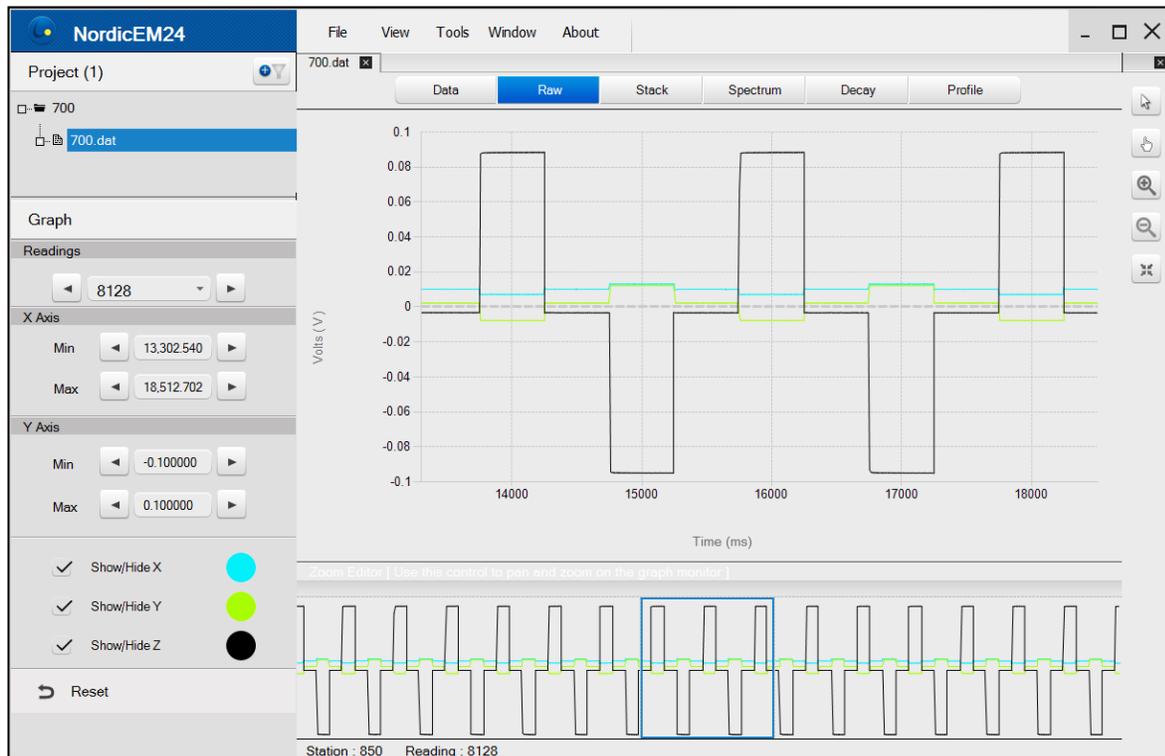


NordicEM24

Post-Process Software

Instruction Manual



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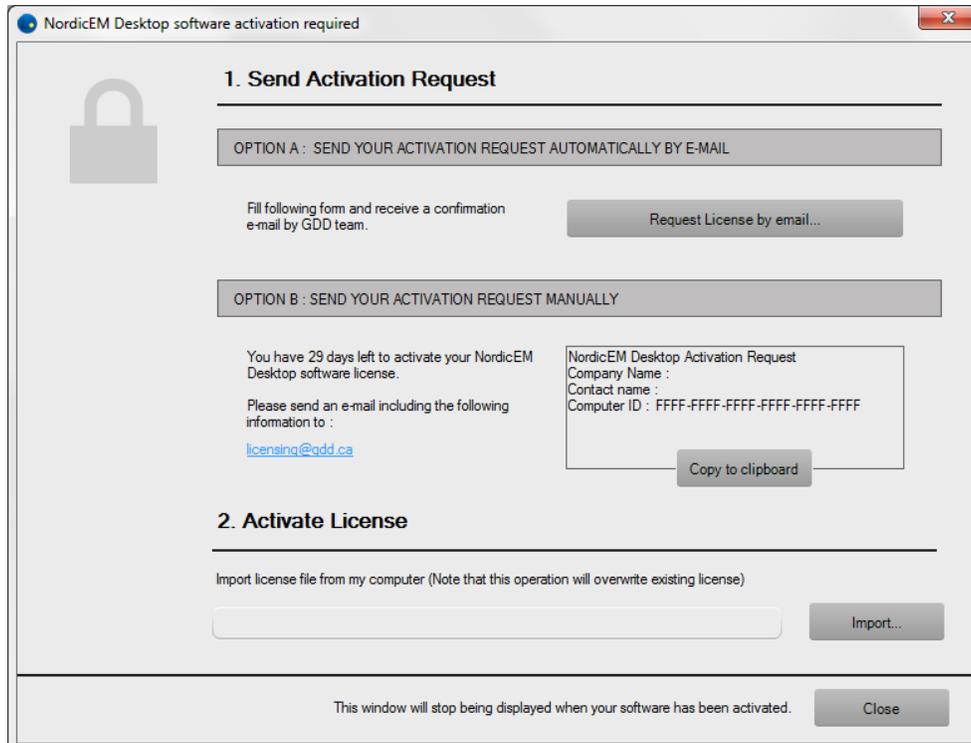
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1. Introduction

The NordicEM24 Post-Process utility developed by Instrumentation GDD allows you to visualize collected raw data, stacks, decays, profile, to compute a Spectrum analysis of the stacked data and to generate new output files from the raw data using different survey parameters. The original files can be re-processed with new parameters such as: Transmitter Current (for current normalization), Stacking Algorithm, Delay (correction for timing error), Ramp (turn-off time) and Window Scheme. You can also apply a sensor conversion factor, invert the signal of a single or multiple readings or discard noisy decays from the final stack. The output data file is compatible with third parties data analysis and inversion software. Custom Export functions can also be created on demand.

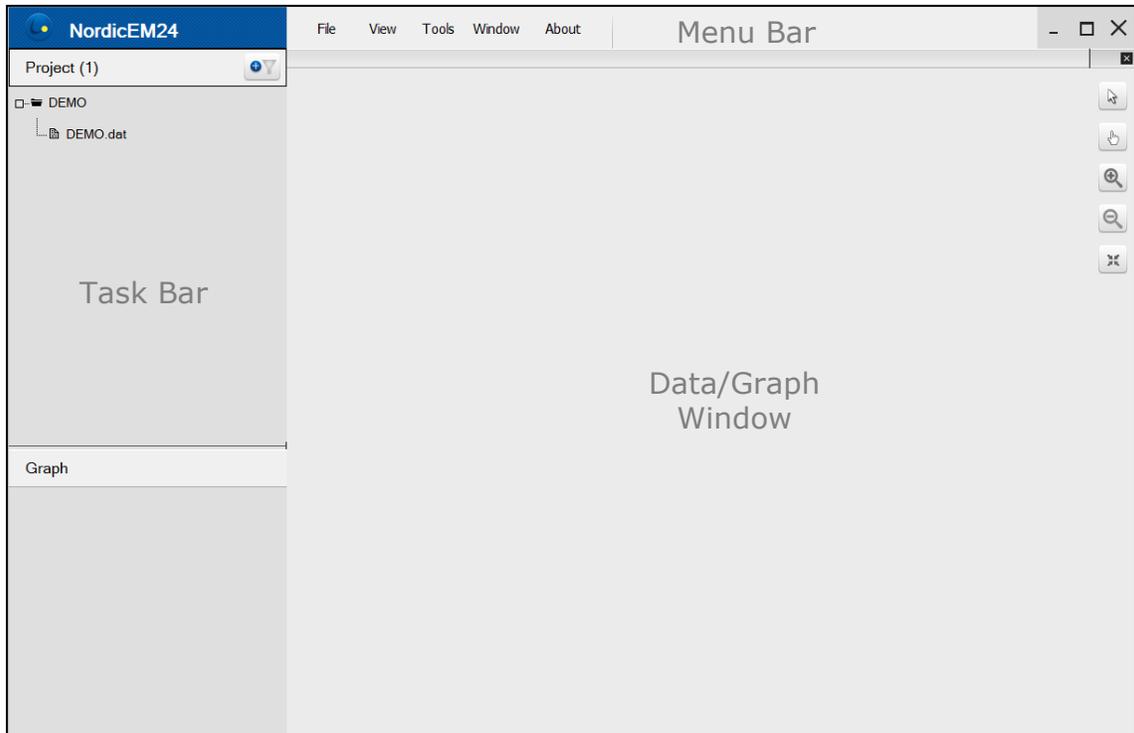
2. Installation

The NordicEM24 Post-Process utility will be provided with the purchase of the NordicEM24 receiver. The software is compatible with Windows XP, 7, 8 and 10. When installing the software for the first time, you will get a 30-days license activation. In order to get your full license, you will need to send an activation request by internet to Instrumentation GDD.



3. Software overview

Main Window



The Main Window is divided in three sections:

- Menu Bar: File, View, Tools, Window and About
- Task Bar: Project and Graph
- Data/Graph Window

Menu Bar

Use the Menu Bar to access software options and settings.

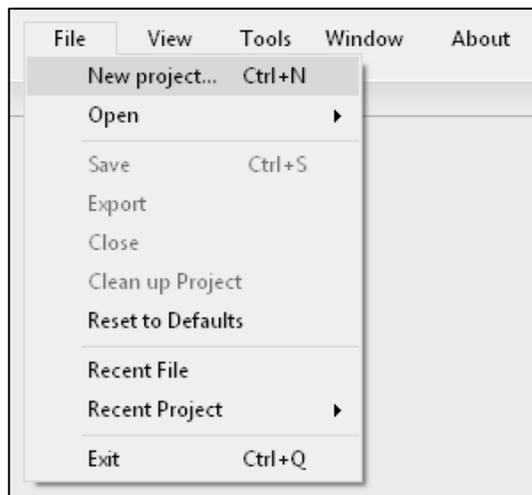
File menu: allows basic command such as opening a Project or File, Save, Close

Save: Save project files and create new binary stack files if required.

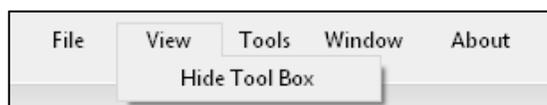
Export: Save the active window's raw or stacked data to a text file (ASCII). Use this option to import raw or stack data into a third-party data processing software. You must open the corresponding tab to select the input data file to be exported. Note that this option is not available for Data, Spectrum, Decay and Profile tab.

Clean up project: The project file will store information on associated stack and raw files. If the information is out of date, use this feature to re-scan the project folder and clean the file library. This will also clear the recent file/project history.

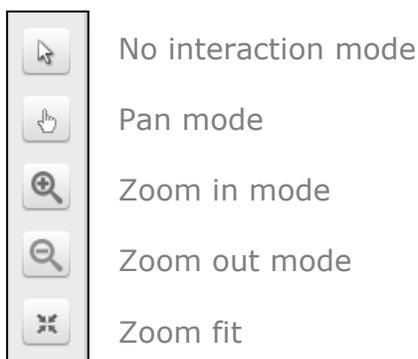
Reset to Defaults: Global settings will be cleared and reset to their installation defaults.



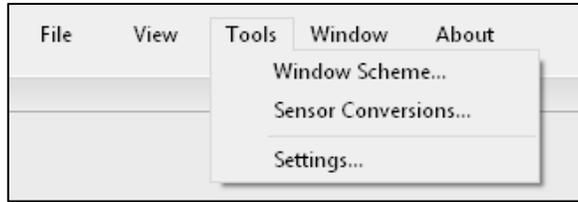
View menu: To open the graph tool box, use the View->Show tool box option.



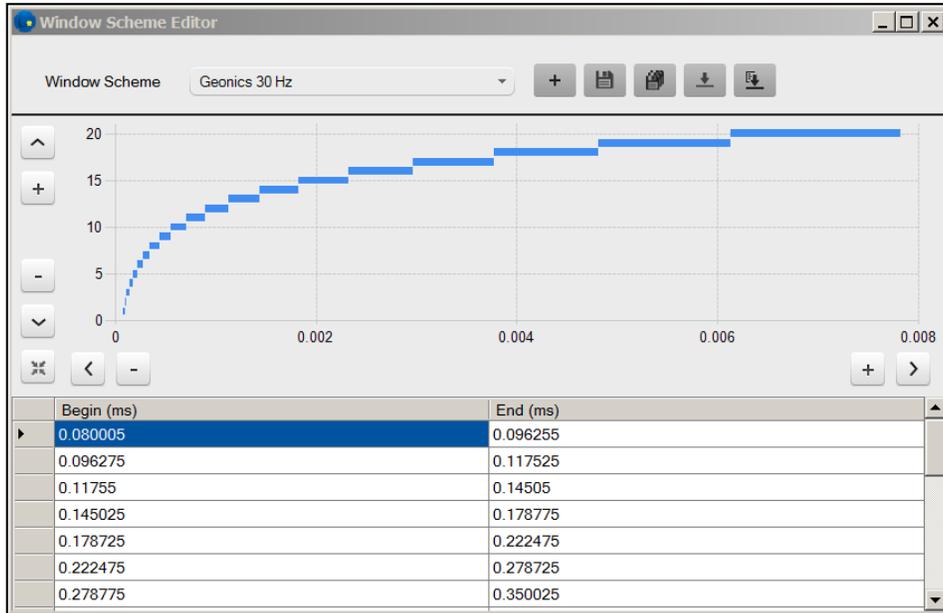
The tool box will appear to the top right of the Data/Graph window as:



Tools menu:

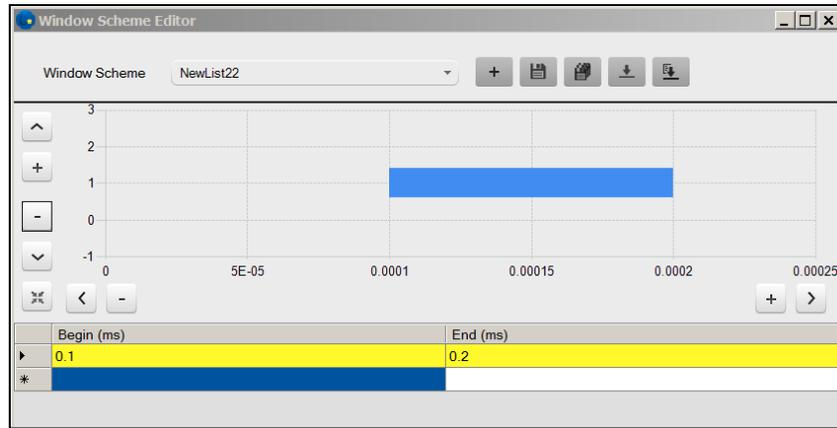


Window Scheme: Open the Window Scheme Editor. This feature allows changing the size of the window (Begin and End), visualizes the resulting windows on a graph and creating new schemes.



To create a new window scheme, click on





Note that by default the NordicEM24 post-process window scheme will be generated in *xml* format.

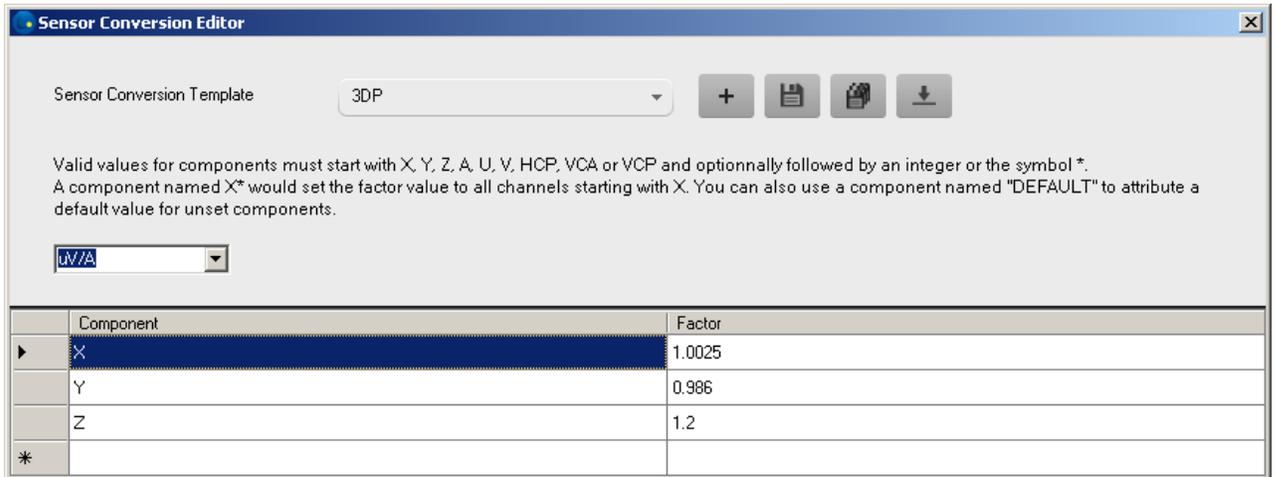
You can also import a window scheme from a *.csv or from a NordicEM24 *.dat file. Following is an example of a *.csv file with “beginning of time window, end of time window”.

```

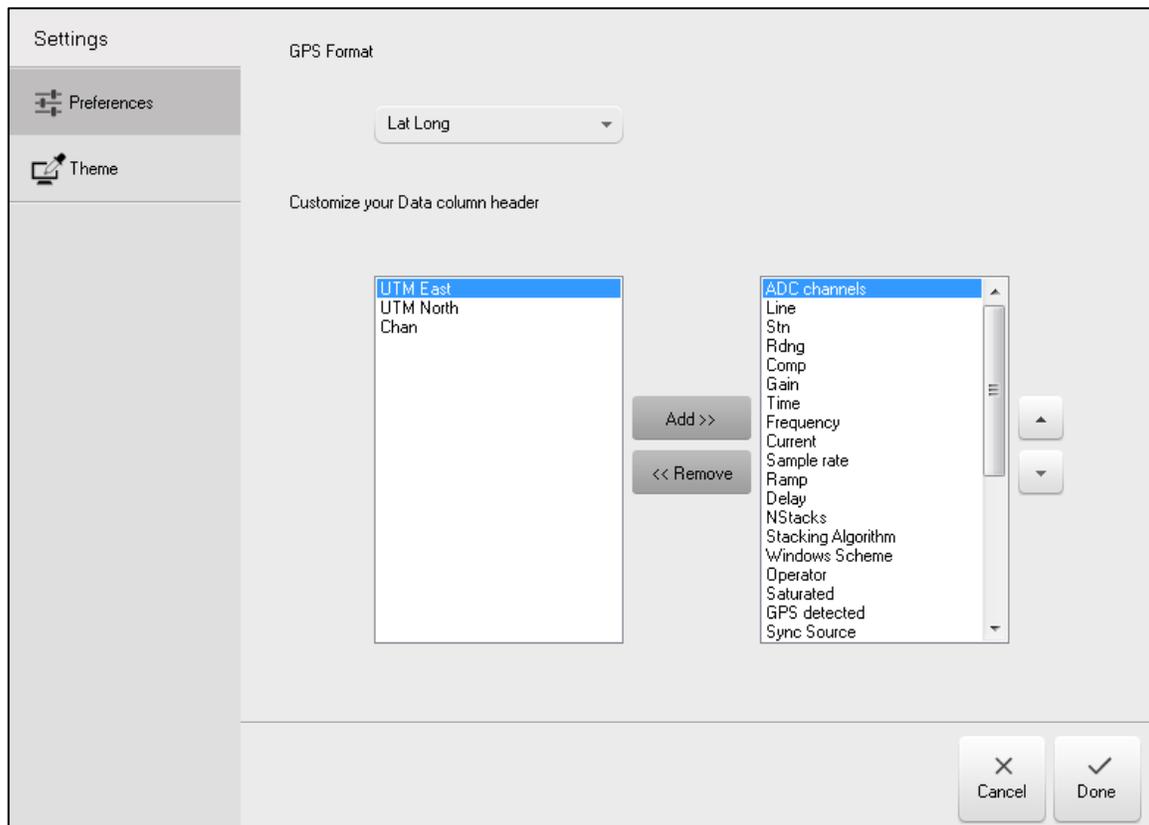
0.087499,0.112498,
0.108627,0.139664,
0.134858,0.173389,
0.167423,0.215258,
0.207852,0.267238,
0.258042,0.331769,
0.320353,0.411883,
0.397710,0.511342,
0.493747,0.634818,
0.612975,0.788111,
0.760993,0.978419,
0.944753,1.214683,
1.172887,1.507998,
1.456110,1.872142,
...

```

Sensor Conversions: Open the Sensor Conversion Editor to view, edit or create new sensor conversion template.

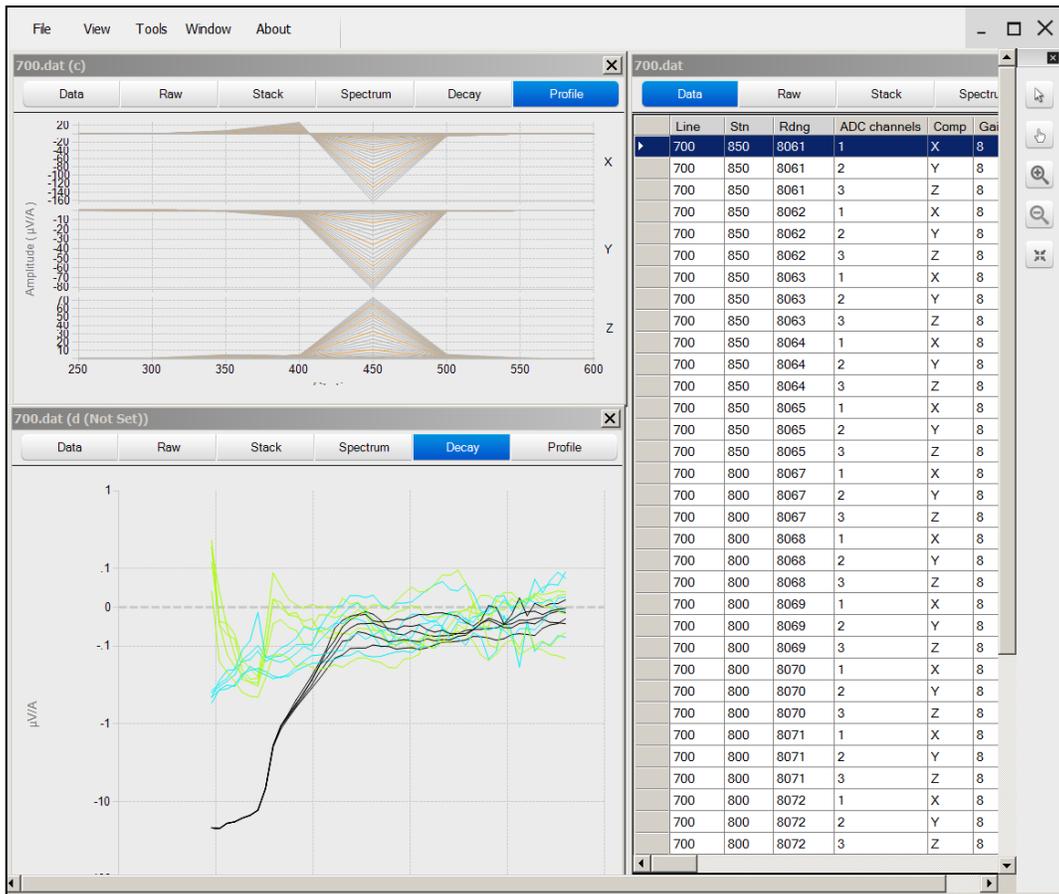
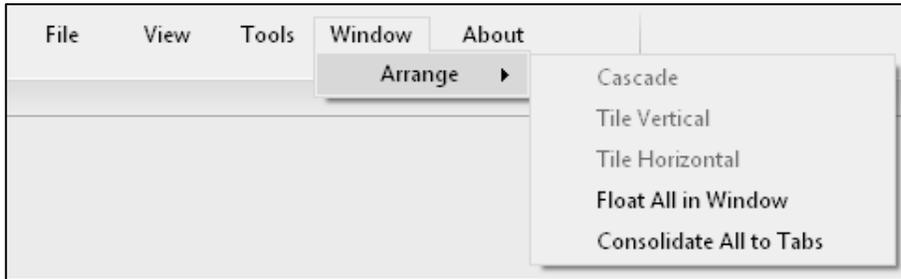


Settings: Set the GPS format and customise the DATA window headers. Change the Display theme (dark or light).

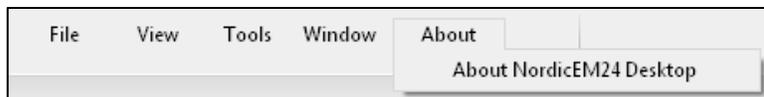




Window menu: Change the appearance of the opened graphical windows.

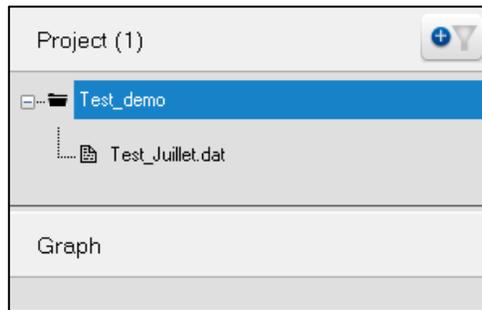


About: Displays the current version of the software.



Task Bar

The Task Bar gives information on the project and graph parameters.



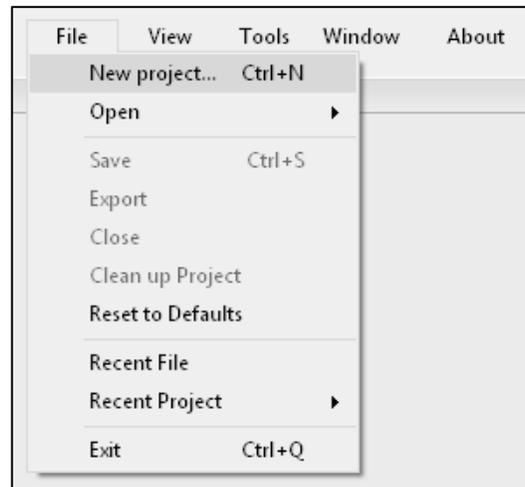
Data/Graph Window

The Main Window allows visualizing data and graphs.

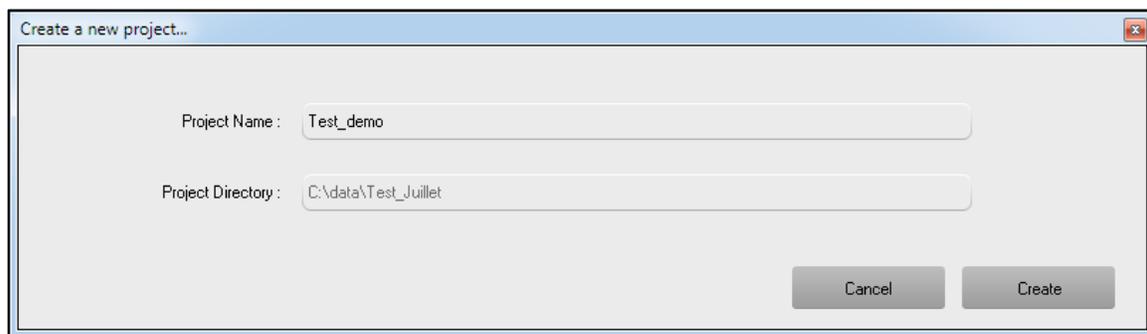
4. Getting started

Create a new project

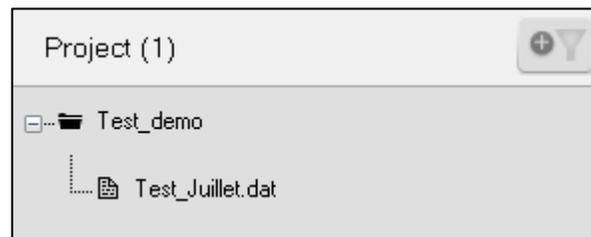
- Save your data files to your Computer
- Start the Post-Process software by clicking on the software icon .
- Create a project by selecting File->New project...



- Browse to the folder containing your data (*.dat, *.stk, *.raw) and open the Data file *.dat. The following window will appear, click on Create



- The project name will appear in the project window.



5. Visualizing your Data

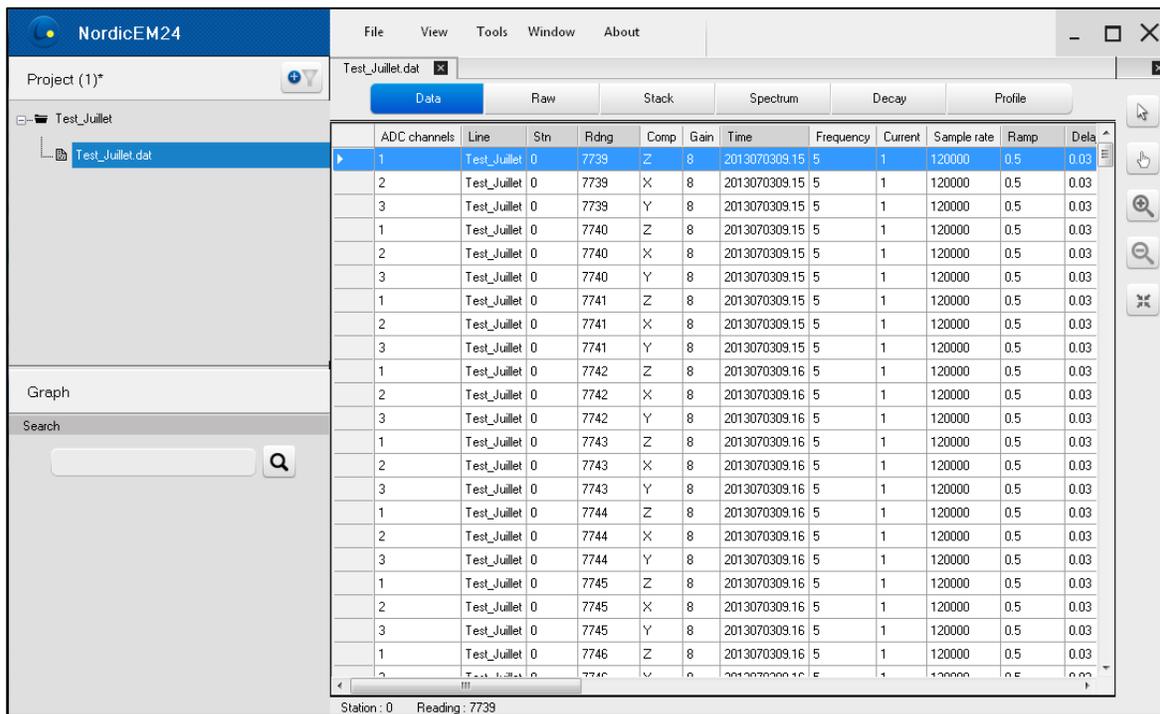
Double click on the file name in the project task bar. A progression bar will appear at the bottom of the window while the software scans the project folder to add associated stack and raw files (*.stk, *.raw) to the project.

Note: The data files must be located in the same directory or within up to 5 sub-directories. If the data files are added later, use the Cleanup Project to rebuild the library.



DATA panel

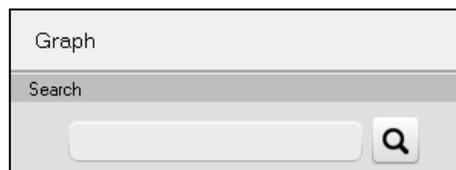
The following window will appear with the DATA tab opened. This table is a simple representation of the original *.dat file. Select a reading in the DATA table that will be displayed in the graphical windows.



The screenshot shows the NordicEM24 software interface. The main window displays a table of data readings under the 'Data' tab. The table has the following columns: ADC channels, Line, Strn, Rldng, Comp, Gain, Time, Frequency, Current, Sample rate, Ramp, and Dela. The data is organized into groups of three rows for each ADC channel (1, 2, and 3). The first row in each group is highlighted in blue. The status bar at the bottom indicates 'Station: 0 Reading: 7739'.

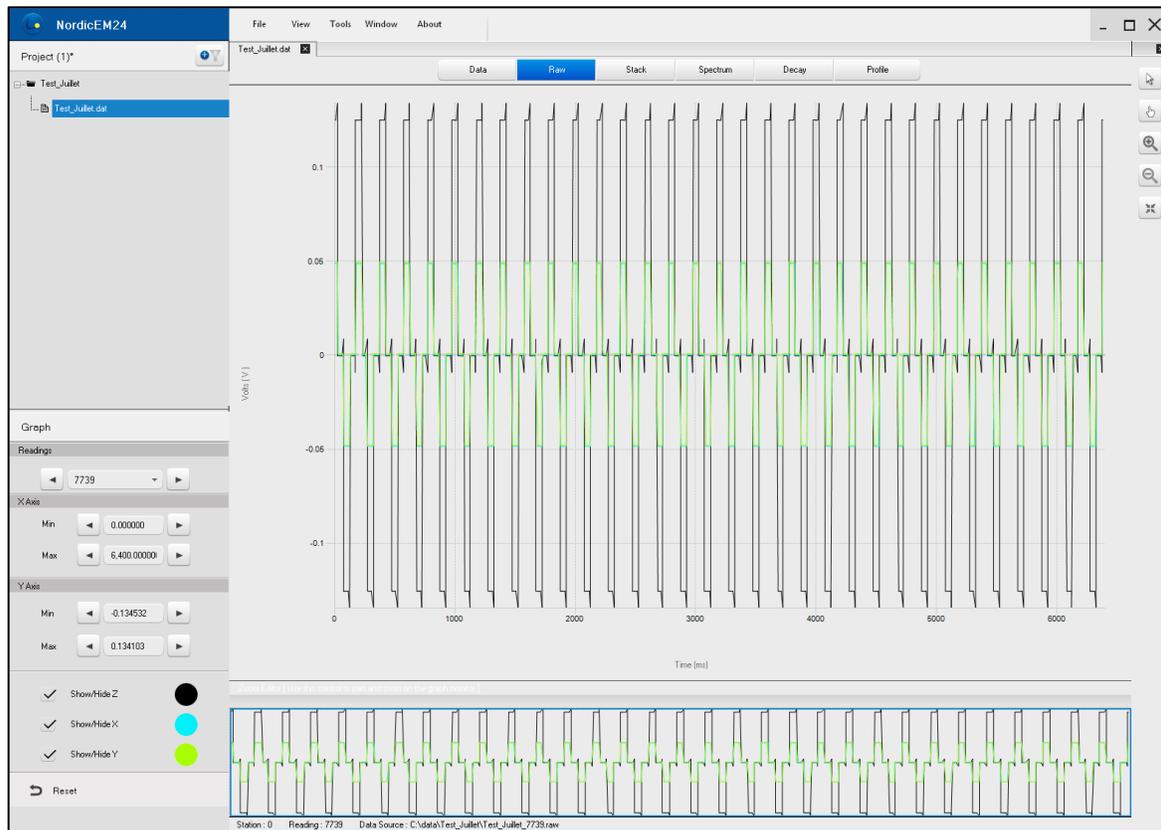
ADC channels	Line	Strn	Rldng	Comp	Gain	Time	Frequency	Current	Sample rate	Ramp	Dela
1	Test_Juillet	0	7739	Z	8	2013070309.15	5	1	120000	0.5	0.03
2	Test_Juillet	0	7739	X	8	2013070309.15	5	1	120000	0.5	0.03
3	Test_Juillet	0	7739	Y	8	2013070309.15	5	1	120000	0.5	0.03
1	Test_Juillet	0	7740	Z	8	2013070309.15	5	1	120000	0.5	0.03
2	Test_Juillet	0	7740	X	8	2013070309.15	5	1	120000	0.5	0.03
3	Test_Juillet	0	7740	Y	8	2013070309.15	5	1	120000	0.5	0.03
1	Test_Juillet	0	7741	Z	8	2013070309.15	5	1	120000	0.5	0.03
2	Test_Juillet	0	7741	X	8	2013070309.15	5	1	120000	0.5	0.03
3	Test_Juillet	0	7741	Y	8	2013070309.15	5	1	120000	0.5	0.03
1	Test_Juillet	0	7742	Z	8	2013070309.16	5	1	120000	0.5	0.03
2	Test_Juillet	0	7742	X	8	2013070309.16	5	1	120000	0.5	0.03
3	Test_Juillet	0	7742	Y	8	2013070309.16	5	1	120000	0.5	0.03
1	Test_Juillet	0	7743	Z	8	2013070309.16	5	1	120000	0.5	0.03
2	Test_Juillet	0	7743	X	8	2013070309.16	5	1	120000	0.5	0.03
3	Test_Juillet	0	7743	Y	8	2013070309.16	5	1	120000	0.5	0.03
1	Test_Juillet	0	7744	Z	8	2013070309.16	5	1	120000	0.5	0.03
2	Test_Juillet	0	7744	X	8	2013070309.16	5	1	120000	0.5	0.03
3	Test_Juillet	0	7744	Y	8	2013070309.16	5	1	120000	0.5	0.03
1	Test_Juillet	0	7745	Z	8	2013070309.16	5	1	120000	0.5	0.03
2	Test_Juillet	0	7745	X	8	2013070309.16	5	1	120000	0.5	0.03
3	Test_Juillet	0	7745	Y	8	2013070309.16	5	1	120000	0.5	0.03
1	Test_Juillet	0	7746	Z	8	2013070309.16	5	1	120000	0.5	0.03

The search bar allows you to quickly find readings by their number or custom properties.

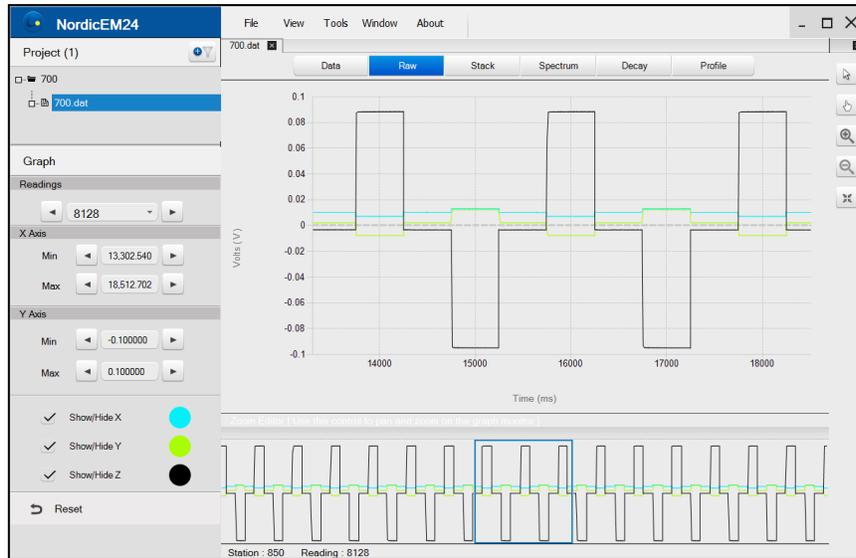


RAW panel

Open the RAW tab to visualise the RAW data. All sampled data points are saved in the raw file. You must have selected the SAVE RAW DATA option in the NordicEM24 receiver otherwise they were not saved.



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.

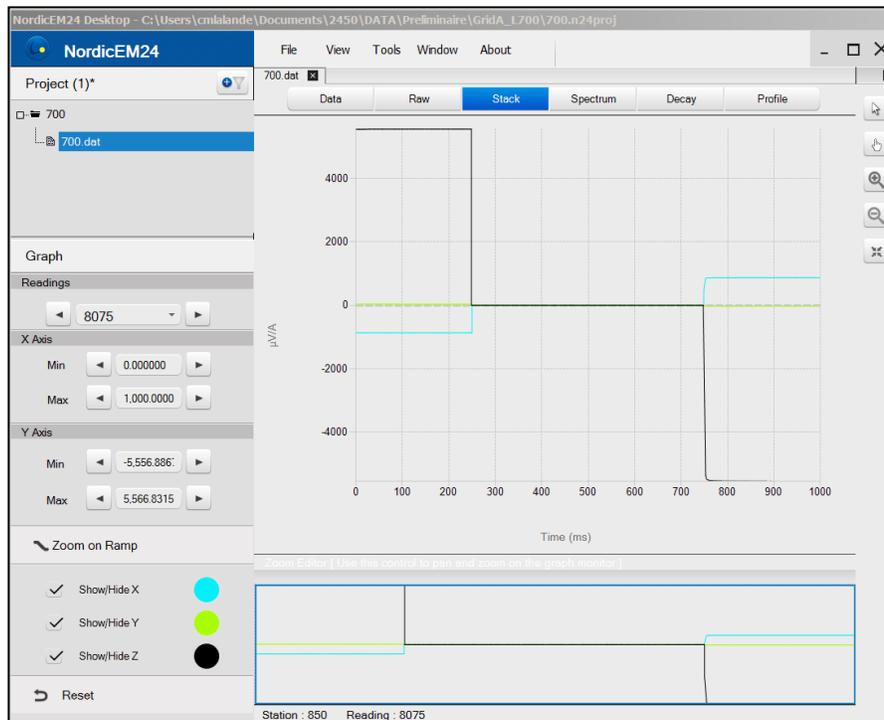


Use the **graph task bar** to the left of the screen to navigate through the readings, set axes limits, show or hide a component or reset to the default settings.

STACK panel

Click on the STACK tab to display the stacked data.

Along with the standard features, the graph task bar includes a “Zoom on Ramp” function to quickly zoom on the turn off ramp when the stack data is displayed.

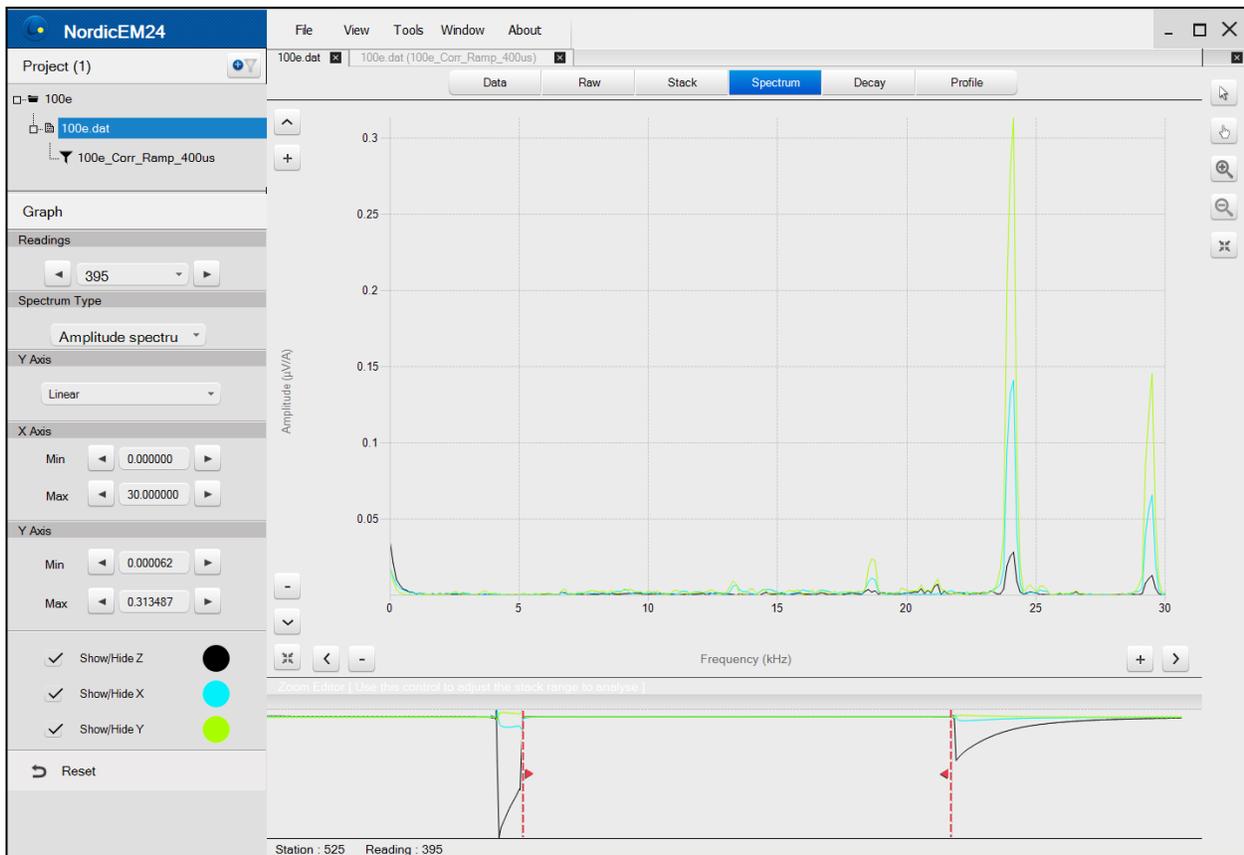


The **Zoom Editor window** at the bottom of the graphical window allows panning and zooming the content of the main window. Drag the edges of the blue rectangle to zoom on the selected area of the signal. You can also use the ZOOM tool located in the upright corner.

Use the **graph task bar** to the left of the screen to navigate through the readings, set axes limits, show or hide a component or reset to the default settings.

SPECTRUM panel

Open the SPECTRUM tab to analyse the frequency content of a stack file. As it is not relevant to analyse the signal when the transmitter is running, only the off time portion of the stacked data is processed. The Zoom Editor is replaced with a stack viewer along with two cursors (in red) that allow you to manually specify the spectral analyse interval. In order to get better results, you should move the cursors toward the center portion of the off time until the turn off ramp and the turn on spikes are rejected.



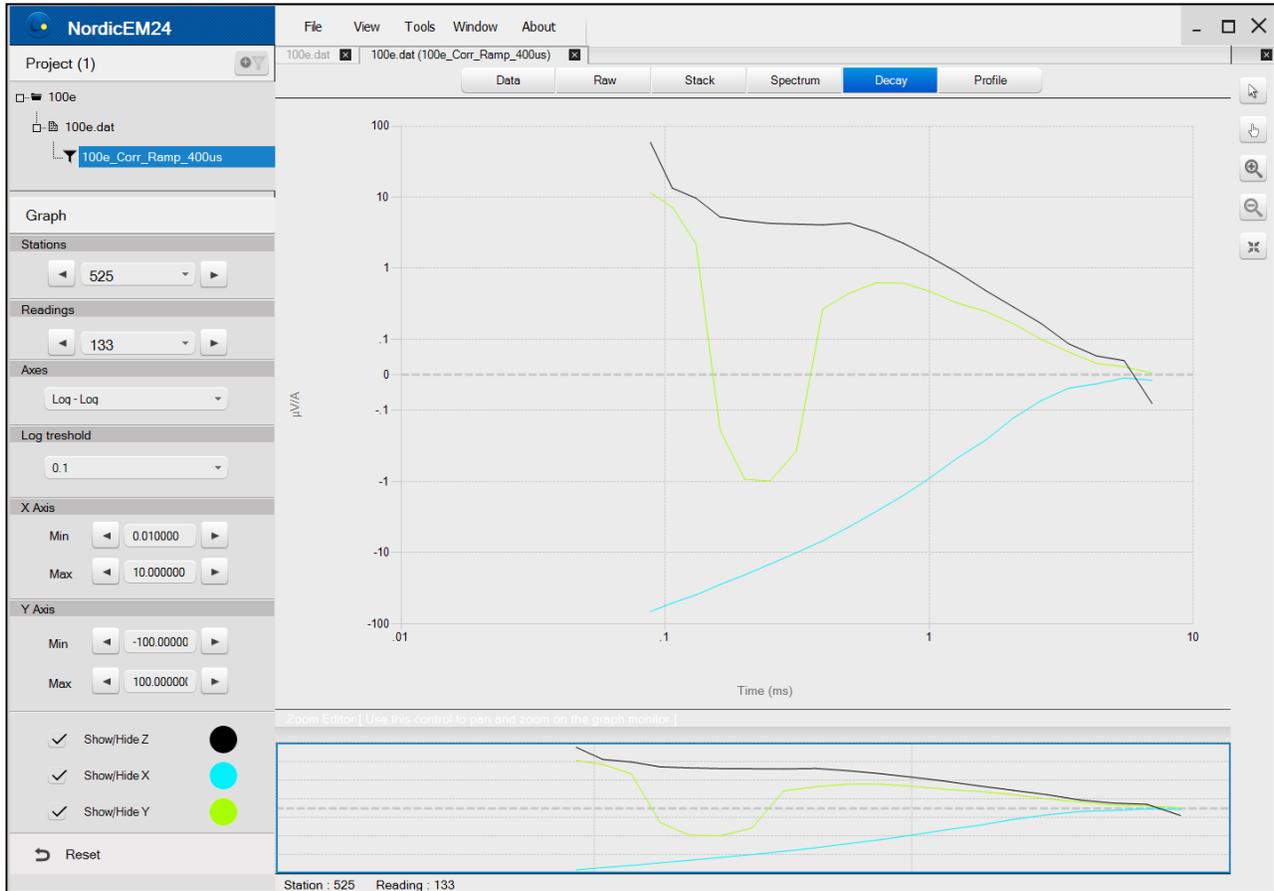
Use the **graph task bar** to apply a linear or logarithmic scale to the vertical axis and chose a specific Spectrum type between Amplitude Spectrum, Power Spectrum and Power Spectrum Density.

Zoom buttons are added to the graph to allow scaling the X and Y Axis:



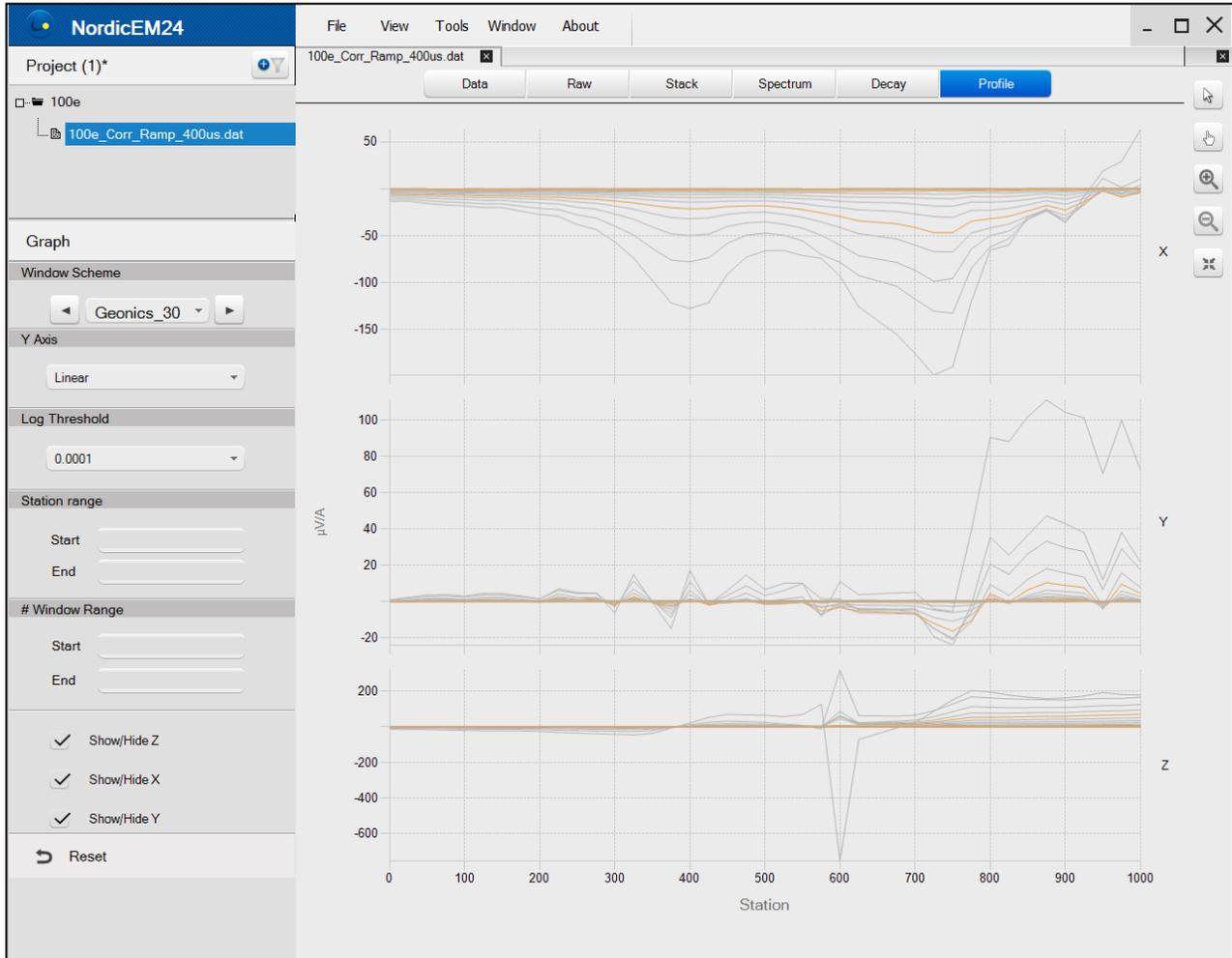
DECAY panel

Open the DECAY tab to display the windowed data. 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. Use the **graph task bar** to change the axes scales, set the logarithmic transition threshold and select the channels to be displayed.



PROFILE panel

If the input .dat file contains readings that were created with different window schemes, the **Graph task bar** will include a setting that allows you to choose either to plot the profile only with reading associated with a specific scheme or to plot them all on the same graph. You can also modify the vertical axis scale, set the logarithmic transition threshold, modify the station range on the X Axis and the Window # Range and select the channels to be displayed.



6. Modifying your survey parameters



To re-process your data, click on the Add Filter Icon  or right click on the .dat file in the **task bar** and choose *add new filter*. The Filter Editor will appear.

The upper part of the window contains the parameters controls while the lowest part recalls the current readings information.

Post Process Name

Tx Current

Stacking Algorithm

Windows Scheme

Sensor Conversion

Time Shift (ms)

Delay (ms)

Ramp (ms)

Spheric Filter

Frame Start/End

VPRI Start/End (ms)

	Reading Nb	Tx Current	Stacking Algorithm	Time Shift (ms)	Delay (ms)	Window Scheme	VPRI Start	VPRI End
	8075	20	Weighted M...	0	0	GDD	-200	-100
▶	8076	20	Weighted M...	0	0	GDD	-200	-100
	8077	20	Weighted M...	0	0	GDD	-200	-100
	8078	20	Weighted M...	0	0	GDD	-200	-100
	8079	20	Weighted M...	0	0	GDD	-200	-100

To modify a parameter, you must first select one or more reading. To do so, you can click directly in the corresponding cell to highlight it:

	Reading Nb	Tx Current	Stacking Algorithm
▶	7739	1	Weighted Mean
	7740	1	Weighted Mean
	7741	1	Weighted Mean

You can also select the whole line if you want to change more than one parameter by clicking in the left margin or select multiple cells to quickly change several parameters for a range of readings. By clicking on the upper left corner all cells are highlighted.

You may now enter a new value in the upper area.

If some data files are missing, a red icon will be displayed in the left margin of the Filter Editor. Put your mouse over it to get details. If only the stack file is missing a new one will be created with the raw file and all parameters might be modified. However if the raw file is missing, the stacking algorithm, the time shift and the stacking interval can't be modified. If both files are missing, no post-processing is possible. In this case the line will be grayed out. If the data files are added later, use the Cleanup Project to rebuild the library and reallow post-processing of this reading.

	Reading Nb	Tx Current	Stacking Algorithm	Delay (ms)	Window Scheme	VPRI Start	VPRI End	Ramp (ms)
	7739	1	<i>Weighted Mean</i>	0.03	userdef	-7	-2	0.5
	7740	1	Weighted Mean	0.03	userdef	-6	-2	0.5
	7741	1	Weighted Mean	0.03	userdef	-6	-2	0.5

If you want to cancel a modification, you can always revert back to the original value. Use the right mouse click to have access to this option.

	Reading Nb	Tx Current	Stacking Algorithm	Delay (ms)	Window Scheme	VPRI Start	VPRI End	Ramp (ms)
	7739	1	Weighted Mean	0.03	userdef	-7	-2	0.5
	7740	1	Weighted Mean	0.03	userdef	-6	-2	0.5
	7741	1	Weighted Mean	0.03	userdef	-6	-2	0.5
	7742	1	Weighted Mean	0.03	userdef	-6	-2	0.5

To save your filter, give it a name and click on the Save button.

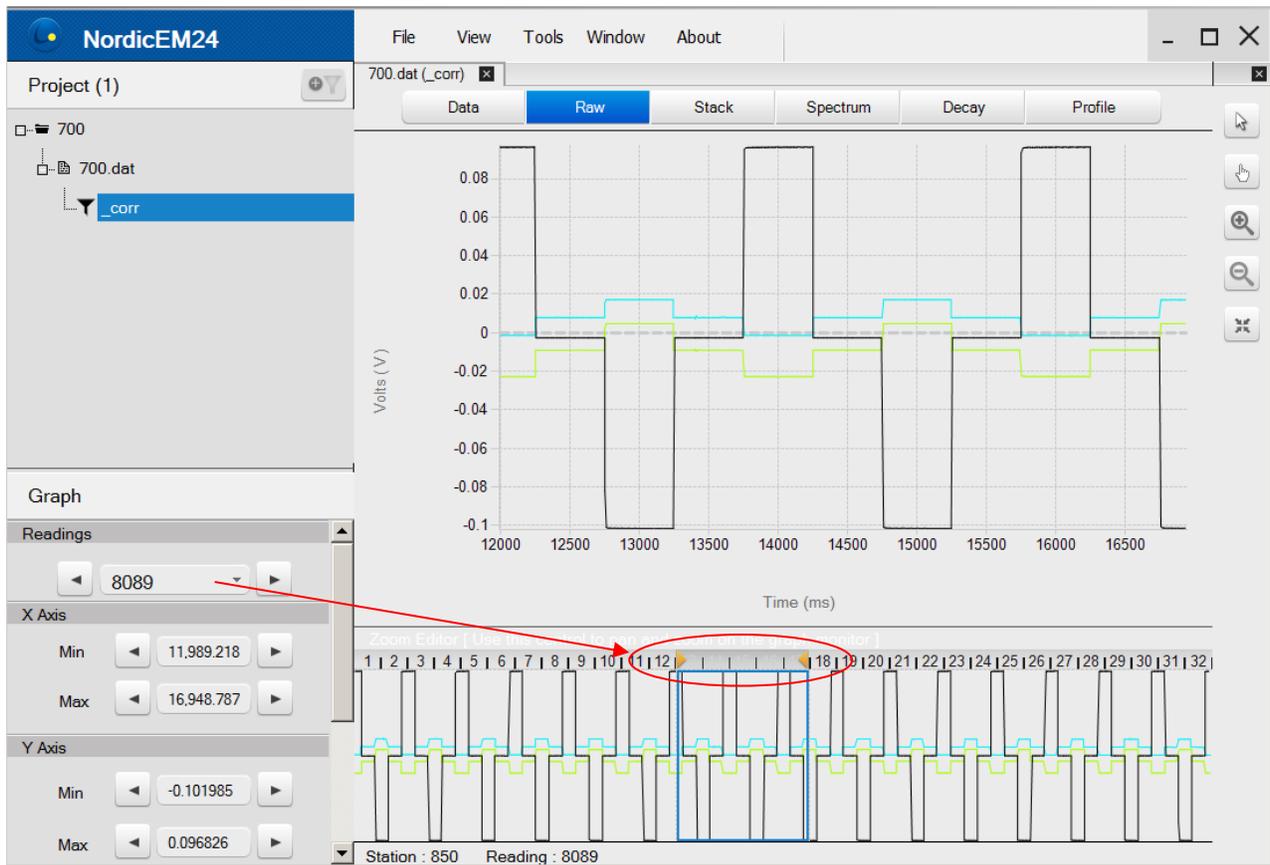
A new data file will appear in the Project task bar. You can double click on the file name to visualise the processed data.

The screenshot shows the NordicEM24 software interface. The top menu bar includes File, View, Tools, Window, and About. Below the menu is a project task bar with two open files: 'Test_Juillet.dat' and 'Test_Juillet.dat (New current)'. A 'Data' button is visible. The main window displays a file tree on the left with 'Test_Juillet' expanded to show 'Test_Juillet.dat' and 'New current'. On the right, a data table is shown:

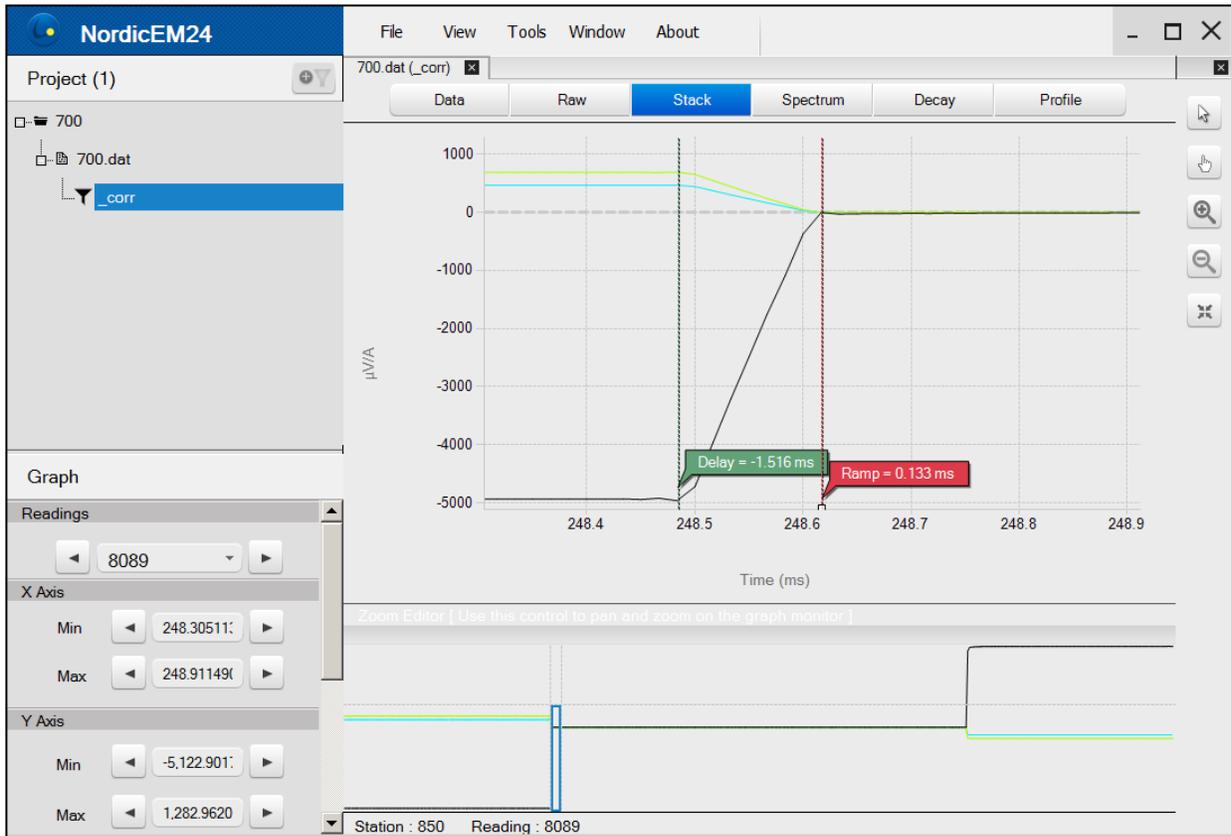
	ADC channels	Line	Stn	Rdng	Comp	Gain	Time
	1	Test_Juillet	0	7739	Z	8	201307
	2	Test_Juillet	0	7739	X	8	201307
	3	Test_Juillet	0	7739	Y	8	201307
	1	Test_Juillet	0	7740	Z	8	201307

Once the new filtered file has been created, you can navigate in the DATA, STACK, SPECTRUM, DECAY and PROFILE panels to visualize the results.

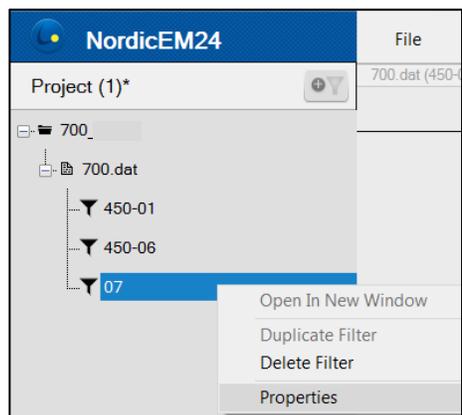
It will then be possible to re-stack one or more readings from the RAW data by manually selecting a series of half-cycles with the orange arrows of the Raw window. New *.stk files will be created accordingly in your working directly (the original files will remain intact). In addition, the filtered *.dat file will be updated.



It is also possible to graphically adjust the Delay and Ramp values of specific readings directly from the STACK panel. To do so, drag the green (Delay) and Red (Ramp) dashed line with your mouse to the desired time position.



You can always modify the parameters of a filter file by right-clicking on it in the Task Bar. Select “Properties” and the filter editor will open.



If you delete a filter, the corresponding .dat and .stk file(s) will be automatically deleted from your working repository.

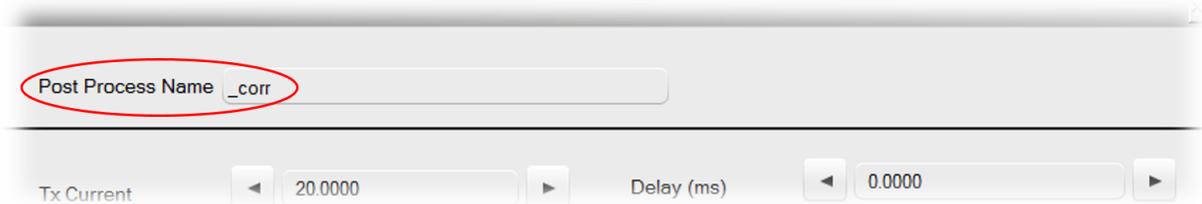
7. Discarding Noisy Decays

The NordicEM24 Desktop Post-Process software allows discarding noisy readings from a dataset. For every decay discarded, the corresponding data line in the .dat file will be erased in the new “_reduced.dat” file created by the software. The original .dat, .stk and .raw files will remain unchanged.

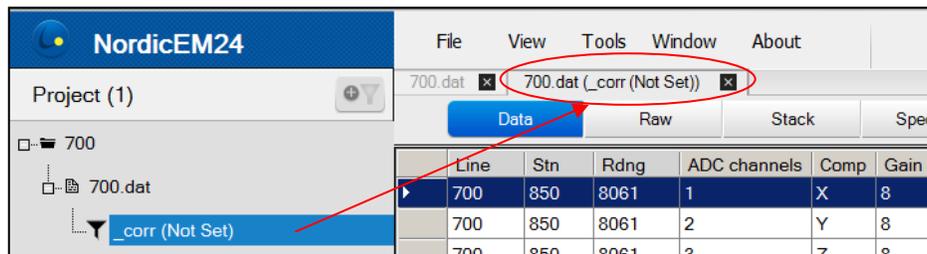
To proceed, click on the Add Filter Icon  or right click on the .dat file in the **task bar** and choose *add new filter*. The Filter Editor will appear.

In the case of discarding noisy decays, all that is required is to select the readings your wish to clean and rename your new post-process file. Note that you can still modify survey parameters if needed (refer to section 6).

To save your filter, give it a name and click on the Save button.

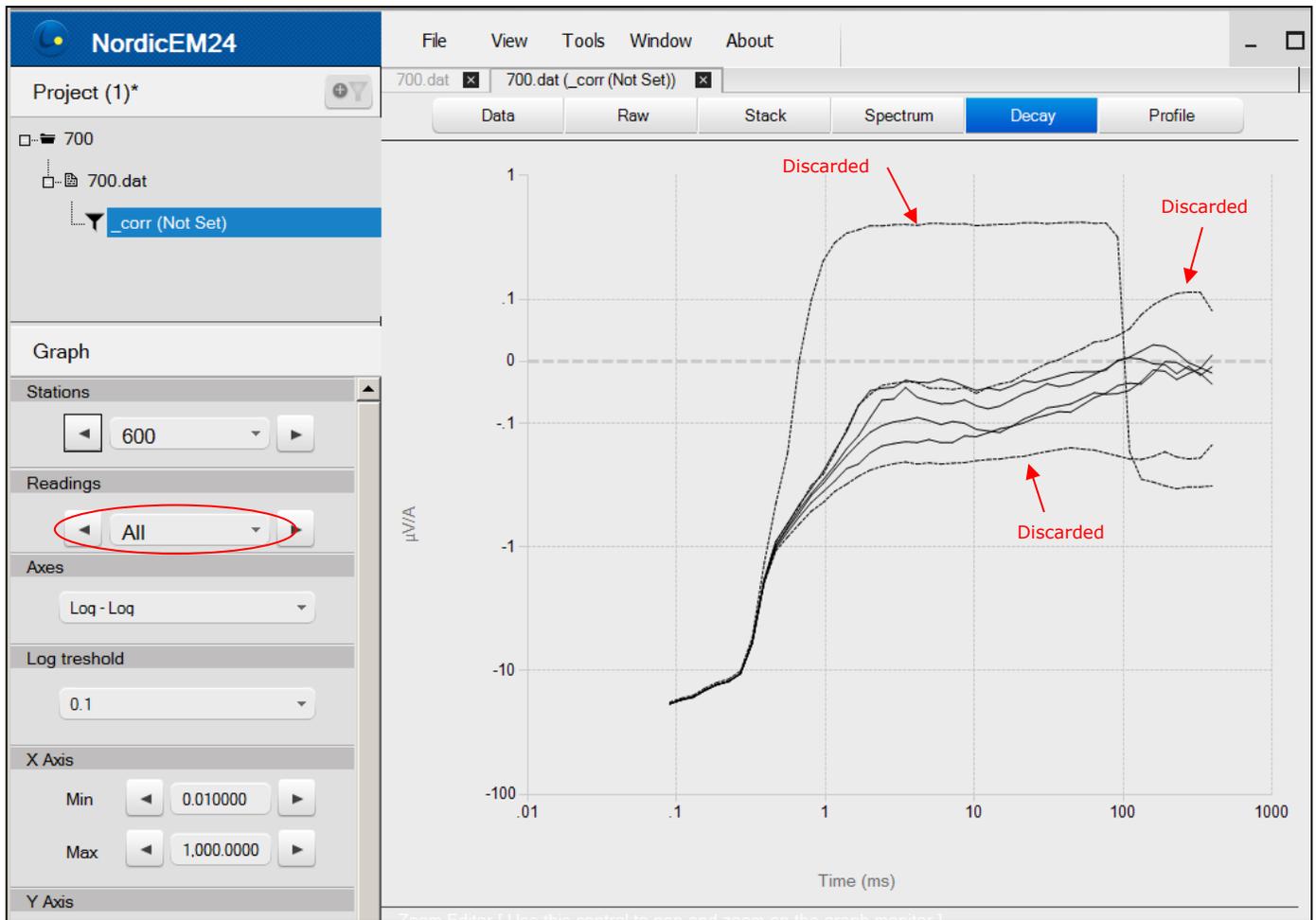


A new data file will appear in the Project task bar. You can double click on the file name to visualise the processed data.

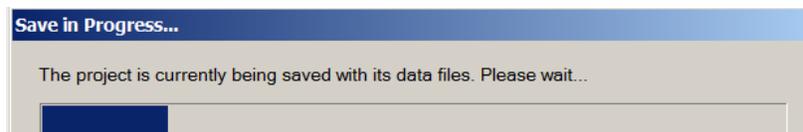


You can now discard noisy readings, component by component, by clicking them directly on the DECAy panel using your left mouse button. The selected decays curve will become dashed. You can unselect them by clicking again.

We recommend you use the display “All” option to visualise every decays at a specific station and validate which decays are erratic. Note that the PROFILE panel will be updated simultaneously as you discard readings.



The * next to the name of your project, eg. Project (1), at the top left of your screen indicates that your cleaned .dat file has not been saved yet. In order to save the cleaned .dat file, you need to go in the “File menu” and select “Save”. This may take some time and a Progress Bar will appear on your screen. Your new file will be labelled “_reduced.dat”.



Note that your Post-Process *.dat file will contain the whole set of data and will allow you to visualise through the NordicEM24 Desktop software, which decays were kept and which were taken out.

8. Generating a .dat file from .stk or .raw files

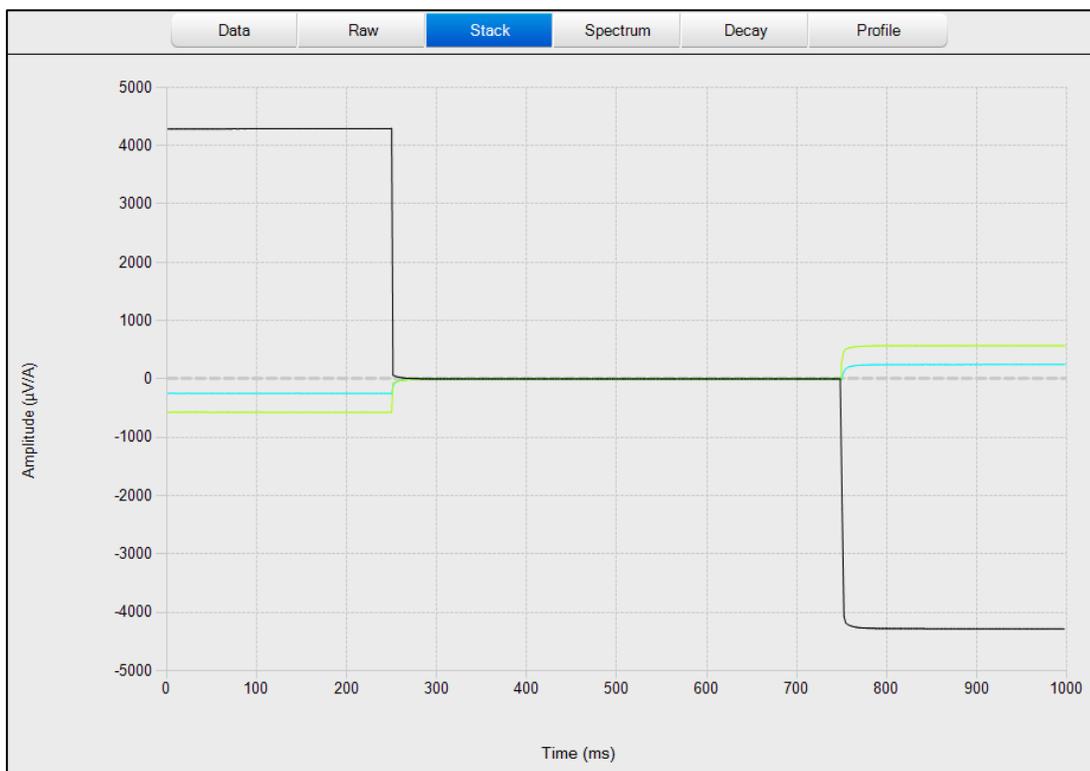
The NordicEM24 Desktop Post-Process software allows to regenerate a missing DAT file from a collection of STK or RAW binary files

1. Copy the binary *.raw and *.stk files from you NordicEM receiver to your computer
2. Open the GDD EM Post-Process software and create a New project. You might have to close the current project before.
3. In the open file dialog, change the target file type to "STK or RAW Data Files (*.stk, *.raw)"
4. Browse to the location were your binary files are saved and select them all to include them in the project.
5. Enter the name of the project. The new DAT file will be named after the project name
6. Since the original DAT file is missing, some associated survey parameters cannot be retrieved. You then have to manually set the Windows Scheme and Primary Voltage window's Start and End time (VPRI Start/End). The required fields will be highlighted in a Filter Editor dialog.
7. To properly set the missing parameters, select all reading by clicking in the upper left corner of the spreadsheet. In the upper part of the editor, you can now set the parameters globally.
8. Once you click on the Save button, the DAT file will be created in the same directory as the binary files.

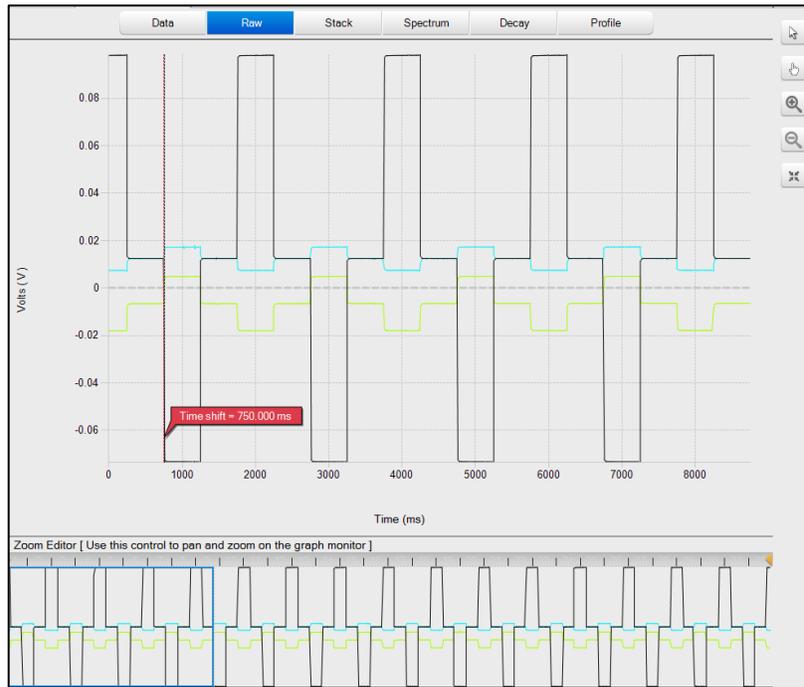
9. Time Shift option

The Time Shift filter option of the NordicEM24 Desktop Post-Process software allows to modify the way the STACK is organised time-wise. This option will be useful to extract decay channels out of the On-time portion of the full wave data. By default, the STACK is organised as followed, with the second half of the On-time (+), the full off-time and then the first portion of the next on-time (-). The Time Shift parameter will displace the STACK's starting time further away (i.e. later). Valid values must range between 0 and $1/(\text{Base frequency} \times 2)$.

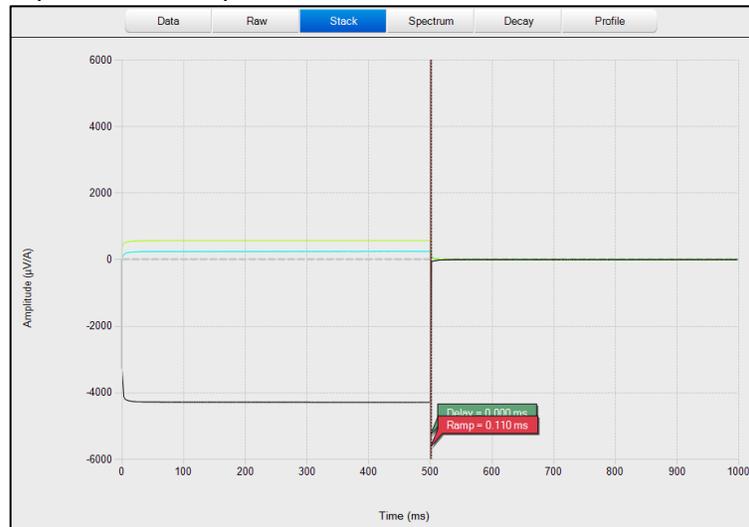
The following figure presents an example for a B-Field survey using a 0.5Hz base frequency (500ms off-time duration).



For example, by applying a Time Shift of 750ms to this dataset, the STACK starting point will be pushed 750ms later. The RAW panel of the corresponding filtered files will display the location of the new STACK starting time.



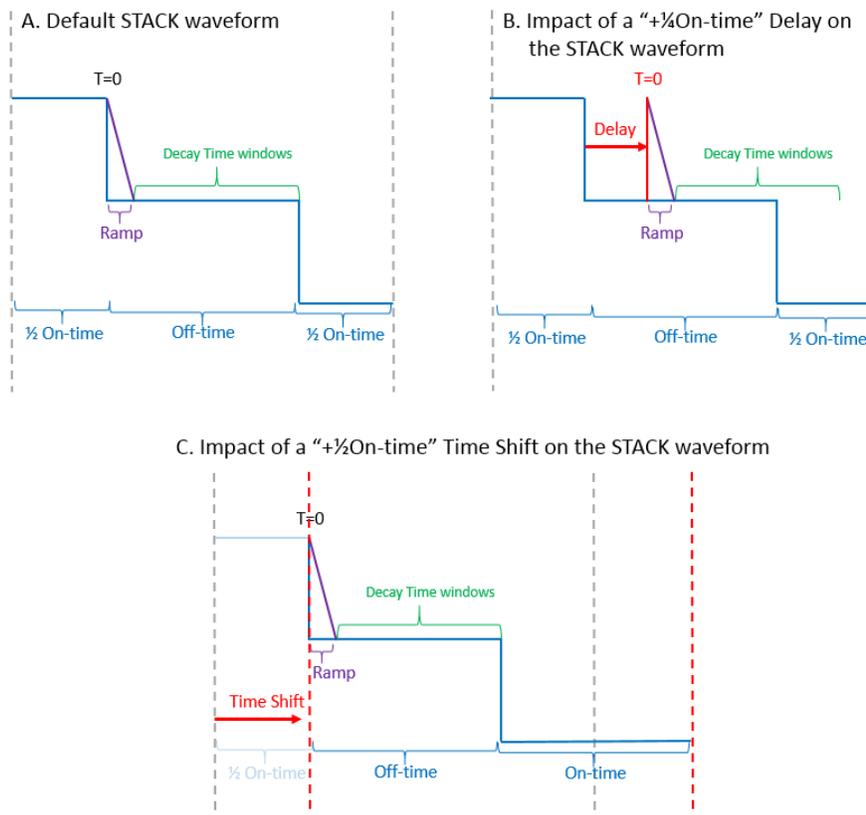
The filtered data will consequently be organised as follow, with one complete on-time (-) followed by a complete off-time period:



This new STACK will allow to extract decay channels from the on-time portion of the full wave data. Note that the first time window will be located by default in respect to the beginning of the off-time ($t=0$) even though its location has changed graphically using the Time Shift. User will have to create a new Windows Scheme with negative timing in order to extract on-time decays information.

10. Time reference

Time 0 ($T=0$) refers to the beginning of the turn-off time (or beginning of ramp). This time reference will be used when computing the primary field (VPRI). The Windows Scheme, used for the Decay discretization, will begin at $(T=0) + \text{Ramp}$. If a Time Shift is applied, the time reference will not change, thus, VPRI “start” and “end” values will remain coherent. Windowed decay data will not be affected by the Time Shift either meaning that the beginning of the first time window will still be relative to the end of the ramp. Note that time windows extending after the end of the Off-time will not be computed. On the other end, the Delay will impact on the location of $T=0$. It will push the stacked waveform back and forth. Refer to the figures below.



11. Technical help

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

Tel.: (418) 478-5469

e-mail: info@gddinstruments.com