GUIDELINEGEO

MALÅ

Global Leaders in GPR (Ground Penetrating Radar) solutions

Object Mapper 2018

Operating Manual

Version 2.0

Table of Contents

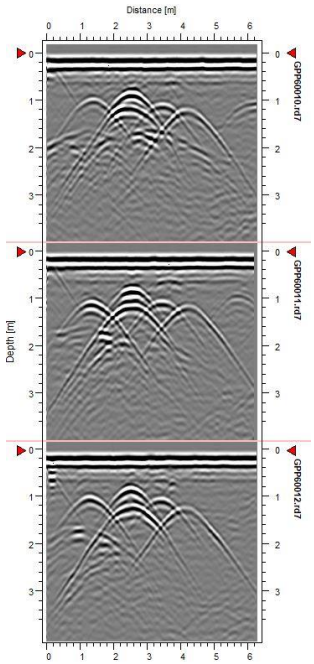
1 Introduction

Thank you for purchasing the MALÅ GeoScience software Object Mapper 2018. Object Mapper is a Windows™ based visualization software for MALÅ GPR radar data.

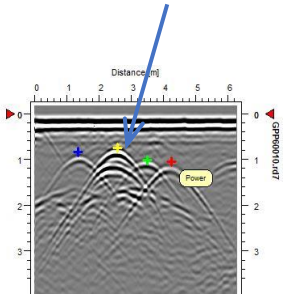
Object Mapper is developed to easily handle and interpret radar profiles acquired with the Object Mapper Option in the Easy Locator Pro, GX, CX or XV, where a number of radar profiles are linked to a common baseline or when measurements are carried out with a GPS for positioning.

Object Mapper includes such features as the visualization of several radar profiles simultaneously, filtering of data, and a report editor to mark and visualize objects on a map (see images below). Several different types of markers can be defined to illustrate the position of pipes, discrete objects etc.

Show a number of parallel lines…

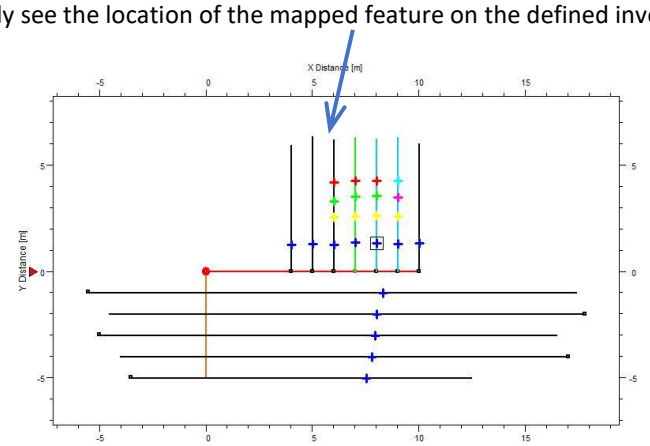


…pick the interesting features….



….from each of them…

…. and instantly see the location of the mapped feature on the defined investigation area



Object Mapper can also be used with previously acquired MALÅ GPR data profiles, as an Object Mapper project can easily be created within the Object Mapper software.

MALÅ GeoScience welcomes comments from you concerning your experience using the software, together with comments on the contents and usefulness of this manual. To help us deal with your comments, always include the software version number.

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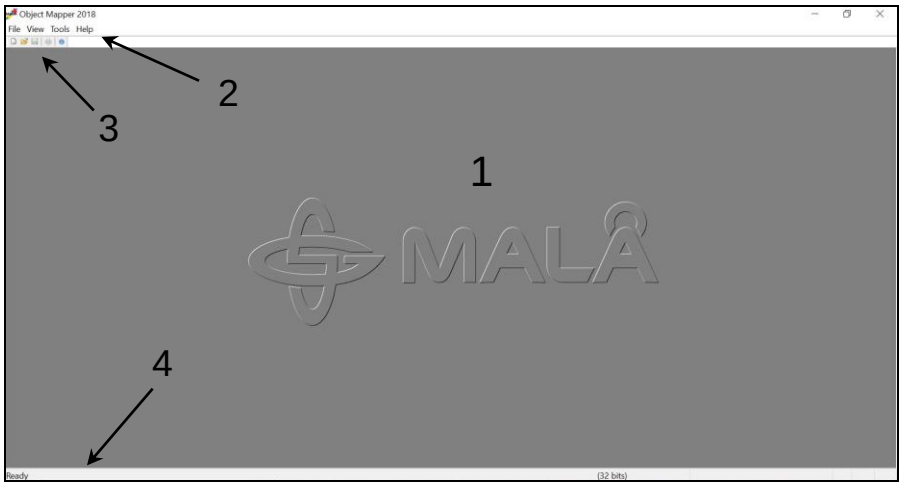
Information about MALÅ GeoScience's products is also available on the internet: http://www.guidelinegeo.com

2 Object Mapper Tutorial

This Object Mapper tutorial will guide the user through the main steps in visualizing underground features, e.g. water pipes. As the program is started, the following screen is displayed:

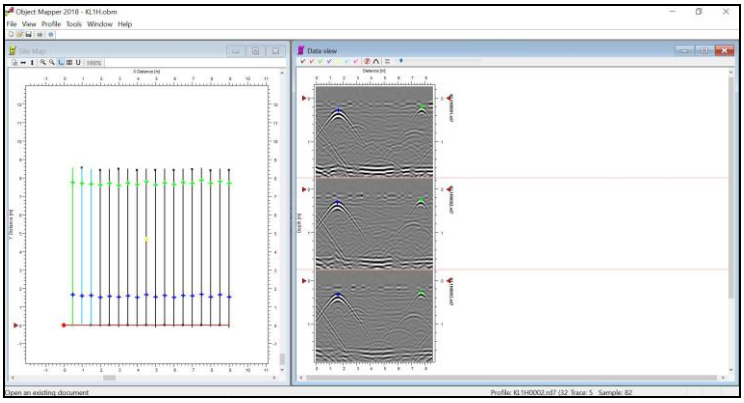


1. Main Screen for different views (Site Map and Data View, see Section 3.2 “View”)
2. Main Menu (Chapter “Main Menu”)
3. Toolbar (Section 3.2.1. “Toolbar”)
4. Status Bar, information on profile, x- and y-coordinates etc. (Section 3.2.2. “Status Bar”)

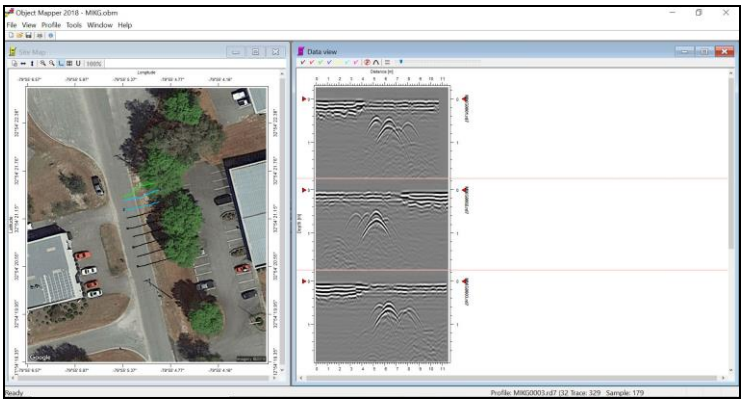
Start the mapping procedure by opening the Object Mapper project (created within MALÅ Easy Locator Pro, GX, CX or XV Monitor and saved as an *.obm file), by pressing in the Toolbar or by using the command “Open” under the File menu.

If using data files already acquired with Ground Vision or without the Object Mapper option in the Easy Locator Pro, GX, CX or XV Monitor, use the command “New” (-> File or) and follow the easy steps in the Project Manager (see Section 3.2.5. “Project Manager” below) to create a new Object Mapper Project.

As the chosen project is opened the following screen is seen:



Or if the Object Mapper project is measured with the GPS option ON:



Note: See Appendix 2 for information on GPS Measurements.
To the left the Site Map is displayed, with the baseline (as defined in the Easy Locator Pro, GX, CX or XV Monitor or in the Object Mapper software itself) in orange (if the baseline option was selected in the Monitor) and all the associated radar profiles in green, blue or black. If the GPS option was selected (in the Monitor) the profiles are displayed without any baseline.

In the right hand screen the radargrams are shown with the top radargram corresponding to the brown marked line on the Site Map. The green section of this brown line represents the visible part seen in the Data View window; this green highlighted section will move as the bottom scrollbar is dragged left or right in the radargram window. The visible radargrams are marked with blue colour on the Site Map.

Up to ten radargrams can be displayed simultaneously, see section Options to find out how.

The rolling wheel on the mouse can be used to scroll the radar data up and downwhen the Data View window is active.

To enhance the data quality, a number of different filters can be applied to the radar data. See Section 3.3.2 "Edit Filter List" and Appendix 1 "Filters".

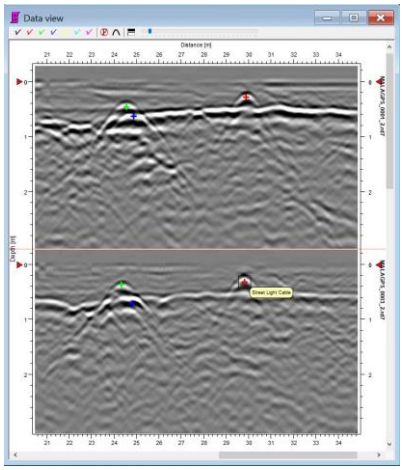
Furthermore, the contrast of the radargram can be adjusted with the contrast scrollbar at the top right in the Data View window, while the active filters can be turned on and off by pressing .

When processing data from the Easy Locator HDR PRO WideRange, click the icon to switch between the high and low frequency channels.

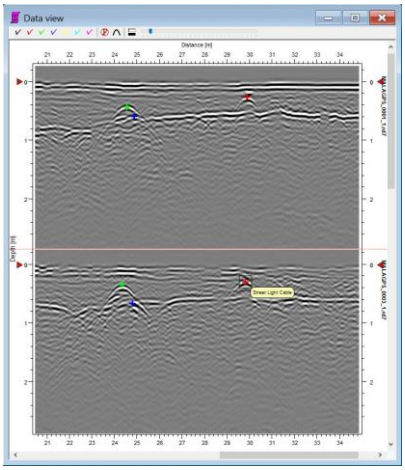
Indicates the high frequency (HF) is active

Indicates the low frequency (LF) is active

Note: this icon is only active when WideRange data is being processed.



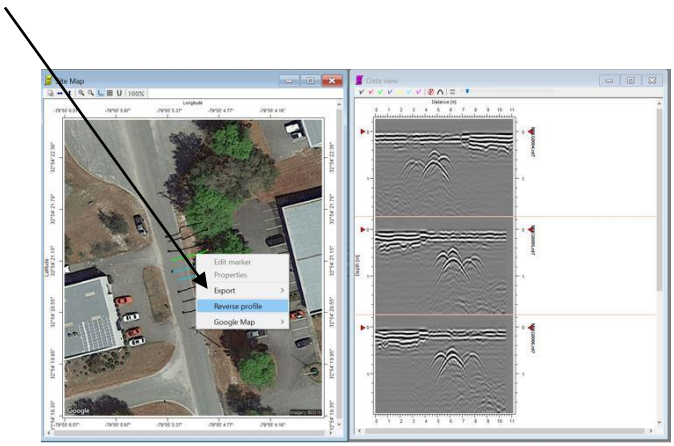
Low frequency channel



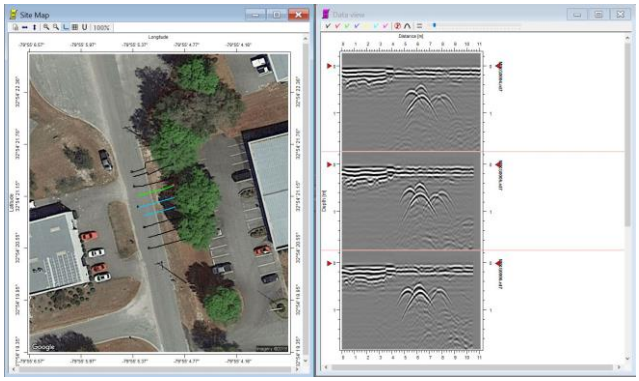
High Frequency channel

Note: When a marker is placed in either of the HF or LF channel in the WideRange data, the marker will automatically be placed in the other channel.

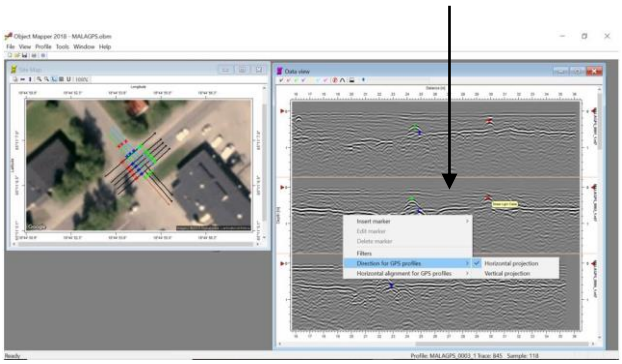
Use the "Reverse profile" option, if one of the viewed profiles needs reversing. In the example below, the top profile needs to be reversed, right click the profile to be corrected in the Site Map, and select the "Reverse profile" option.

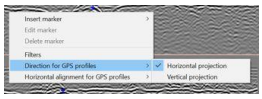


The direction of the profile will be corrected like so:



When measuring with the GPS option there are two ways of adjusting the display of the GPR profiles to make it as 'correct' as possible. See example below, where the long profile (at right) is displayed together with two shorter ones. When right-clicking in the profile the options Directions of GPS profiles and Horizontal Alignment for GPS profiles can be selected.





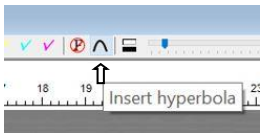
Directions for GPS profiles, Horizontal or Vertical

Horizontal Alignment for GPS profiles, Left or Right

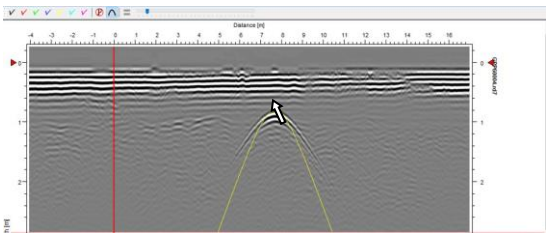
Note: Even with GPS, it is recommended to measure in parallel profiles, as this will enable the user to view several GPR profiles simultaneously and thus allow direct comparison of identified objects in different lines.

The depth of a feature in the radargram is often required. To obtain this value, the radar velocity in the soil under investigation is required. Where the velocity cannot be calculated via other techniques, the hyperbola fitting tool can be used.

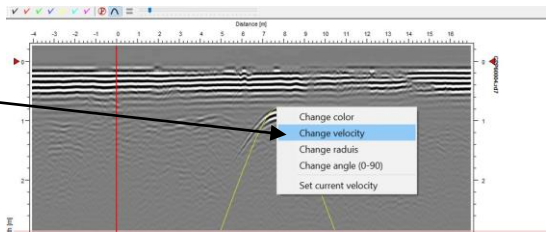
Click the hyperbola icon to activate the hyperbola fitting tool



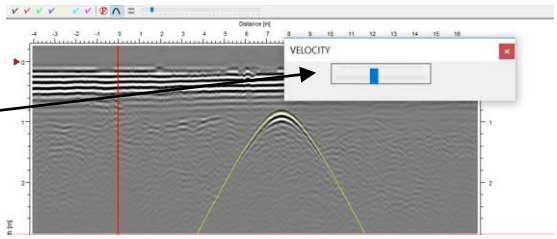
Next, place the mouse curser on the top of the actual hyperbolic reflection and right click to insert the synthetic (yellow) hyperbola



Next, select "Change velocity"

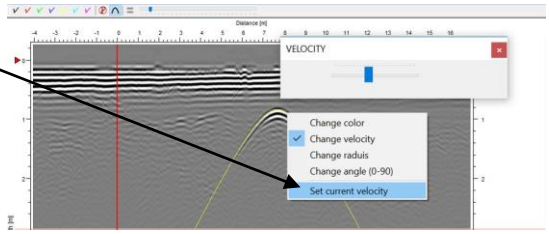


Then use the slider bar to increase or decrease the width of the yellow hyperbola, so it matches the width of the actual hyperbola.



Note: if it is not possible to match the shape at the top of the hyperbola, use the "Change radius" option to get increase or decrease the width of the synthetic hyperbola.

When the desired width is achieved, move you mouse curser back over the yellow hyperbola, right click and select “Set current Velocity”. The value will be displayed in the Status Bar at the bottom of the display.

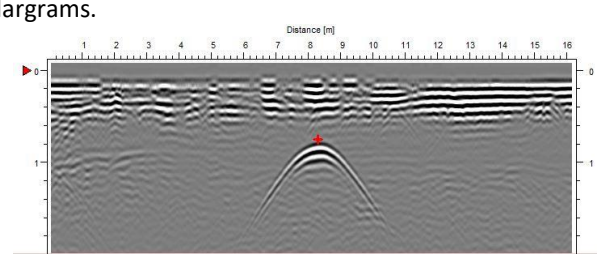


When the hyperbola matching is complete, click the “Insert Hyperbola” icon again to de-activate the tool.

Note: it is important that the selected hyperbola (for the fitting), is from a feature that is exactly perpendicular to the line of the profile, otherwise a false reading will be obtained. It is possible to change the angle value in the above dropdown box if the angle between the feature and the profile is known.

When the radar data are fully processed, the interpretation of objects/features can be started. To do this, click on one of the seven different marker types in the Data View window  . See Section 3.4 “Tools” to explore how these are defined.

After clicking on one marker type the mouse pointer changes to a cross which can be placed on an identified hyperbola in the different radargrams.



Note: The marker function is inactivated by pressing the marker type on toolbar again.

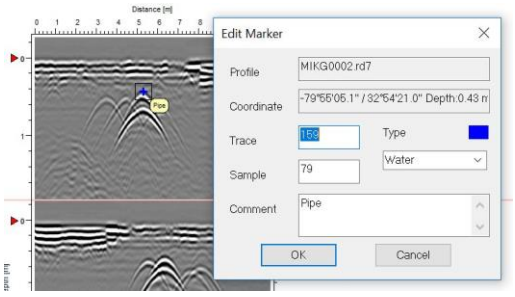
Markers can also be placed by right clicking on the correct position on the radargram and then choosing “Insert marker” from the pop-up menu (see below).

If a marker is activated (with left mouse click) a rectangle is seen around the marker and it can be moved by drag-and drop; when right clicking on the marker a pop-up menu appears as seen below.

Important note! The markers in the Toolbar must be inactivated; otherwise new markers will be will be set when attempting to select existing cross-hairs.

Several markers can be marked/activated simultaneously, by keeping the “Ctrl”-button on the keyboard down. Also see information on Marker lists in Section 3.2.3 “Marker list”

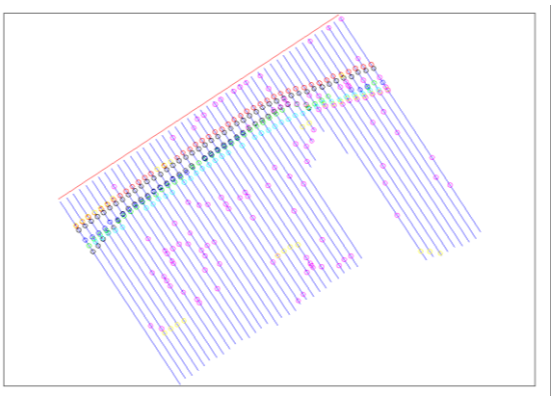
The “Edit marker” function enables manual input of the location of the marker and change of object type. A comment can also be made, see below. The “Edit marker” function is also reached by double-clicking on the marker.



To work and browse through all the files, click on the different radar profile lines on the Site Map. The selected profile will turn green and show up as the top radargram in the Data View window.

When all interesting features are identified, the project is saved and the resulting map, as shown below, can be printed immediately or exported in AutoCad dxf-format; see below. All the markers are also listed (as seen in Section Markers) and can be exported in ASCII-format with the correct position and depth.

Note! The marker to be exported **MUST** be marked in the marker list, prior to export. For more information see Section Markers 3.2.3 “Marker List”.



In the above example, the colours of the markers can, for instance, represent different depths or different types of identified structures.

Finally, if measurements have been taken in a grid pattern, these two projects can be combined into one, as in the example below. This makes the interpretation work much simpler. Choose the option “Add project” in the File menu to combine two projects. This option is available both when measuring with the baseline option and with the GPS option.

Projects close to each other in different directions can be gathered on the same site map.

Note: The same coordinate system must be used to define the baselines of the radar profiles or the GPS position.

Note: When editing the properties of projects with several baselines, mark the baseline to be edited in the Project Manager.

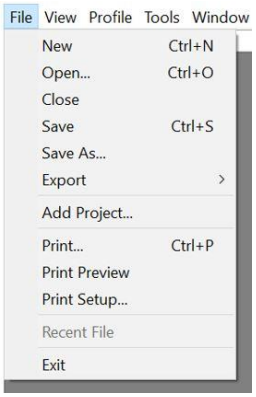
3 Main Menu

File View Profile Tools Window Help

The Main Menu of Object Mapper is found on the top of the screen.

3.1 File

In the File menu the Object Mapper projects can be created, opened and saved. It also contains the print functions.

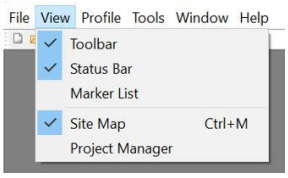


New: Creates a new project. See Section 3.2.5 "Project Manager" below.
Open: Opens an existing project.
Close: Closes an opened project.
Save: Saves an opened project using the same file name.
Save As: Saves an opened project to a specified file name.
Export: Exports the resulting map, with markers to DXF-format, markers to ASCII-format lists or to MALÅ GPS Mapper format. **Note! The markers to be exported must be selected in the Markers list.**
Add project: Adds another project to the existing one.
Print: Prints the current view.
Preview: Displays the document on the screen, as it would appear printed.
Print Setup: Selects a printer and printer connection.
Exit: Exits the application.

For the Export option to *.dxf, the different marker types on the map are exported to separate layers.

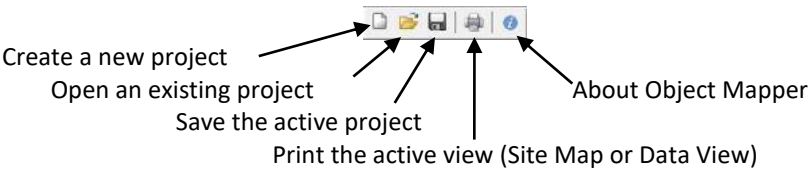
3.2 View

The menu View shows the different views and tools that can be shown on the screen.



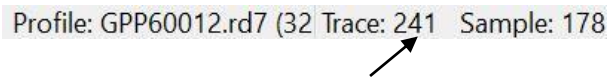
3.2.1 Toolbar

The Toolbar is displayed across the top of the application window, below the Main Menu bar. The Toolbar provides quick mouse access to some of the tools used in Object Mapper.

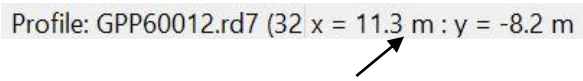


3.2.2 Status Bar

The Status Bar describes the commands activated by pressing the selected button in the different menus or toobar. It also shows details of the active profile, as well as information on mouse position in the different radargram or Site Map views. Examples of the Status Bar are shown below.



Position of the mouse curser in the Data View window

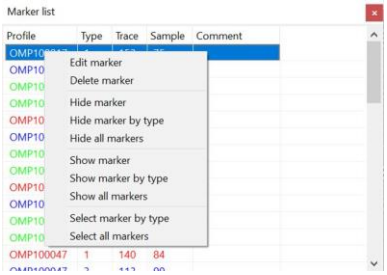


Position of the mouse curser in the Site Map window

3.2.3 Marker list

In the marker list, all the identified and marked features are saved, according to their type and position.

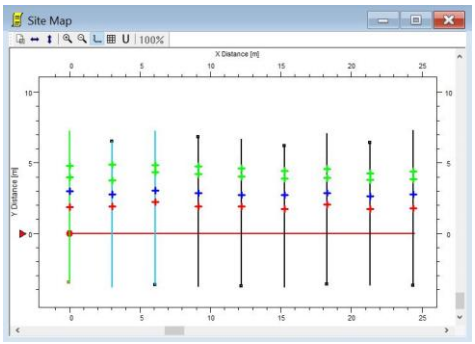
By right-clicking on one of the markers, the marker can be edited or deleted. It is also possible to choose to hide or select the marker (singly, by type or all together).



With the option Export (in the Main menu) this list with selected markers can be exported to ASCII-format, where all marked objects are listed together with type, trace-, sample-, x-, y- and z-position.

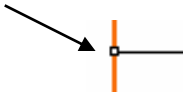
Note: The marker information also can be exported in DXF-format or to MALÅ GPS Mapper format.

3.2.4 Site Map

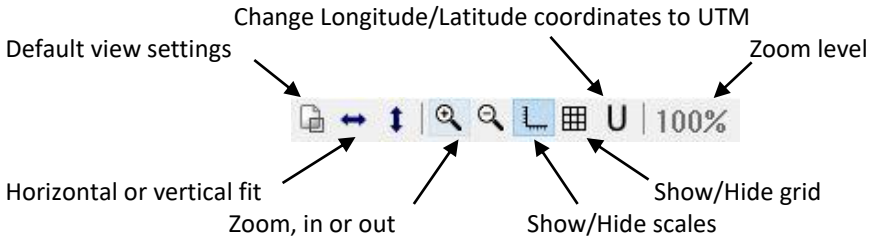


When this option is chosen, the Site Map, with the different measured radar profiles, is displayed on the screen.

The small rectangle on one end of the profiles (black, green or blue lines) shows the start point of the measured radar profile.



Site Map View Icons:



The map coordinate system can be turned left or right handed in the Tools Menu, see Section 3.4 “Tools”. This option is only available for Baseline projects.

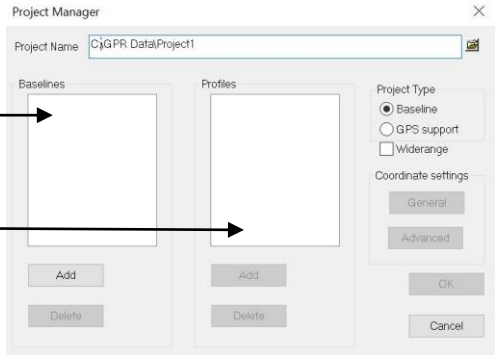
3.2.5 Project Manager

In the Project Manager a new project can be defined and the properties of current projects can be edited. The option General defines a simple baseline and evenly sorted profiles, while the option Advanced is used to define the baseline and every single profile in detail. **Note!** These options are only available for the Baseline project type.

If viewing the Project Manager within an existing Object Mapper project, the project manager window displays the baseline and the radar profiles included. The settings in an existing Object Mapper Project can be changed as described below.

If a new Object Mapper Project is desired (with profiles acquired with EL PRO, GX or XV Monitor but not in an OBM project), open the Project Manager and press Add under the Baselines window and then to add the profiles associate with that baseline using the button beneath Profiles window.

If the data were collected without baseline but with GPS, the Project Type is changed to GPS support and then only the option Add profiles is available.



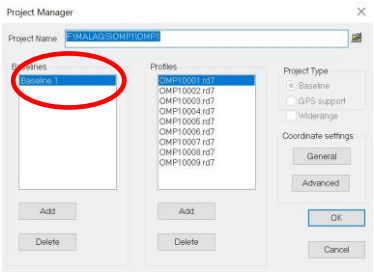
If WideRange data have been collected, click and check the Widerange option

For both project types, Baseline or GPS, the location and name of the new project is given in the top line.

Note: The project should be saved at the same location as the added radar profiles are situated. The possibility to browse between different folders to find an existing project is also available.

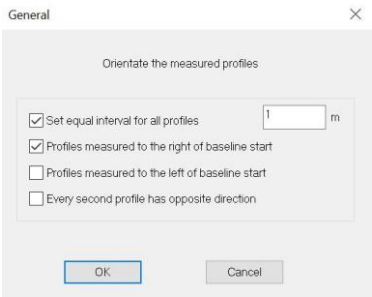
Several profiles can be added simultaneously by using “Ctrl” on the keyboard. The sequence of the radar profiles can be changed by “drag and drop” in the profiles list. If new files are added later on these are added, by default, in alphabetical order but can then be re-arranged manually.

Note: When editing the properties of projects with several baselines, mark the baseline to be edited in the Project Manager Advanced option



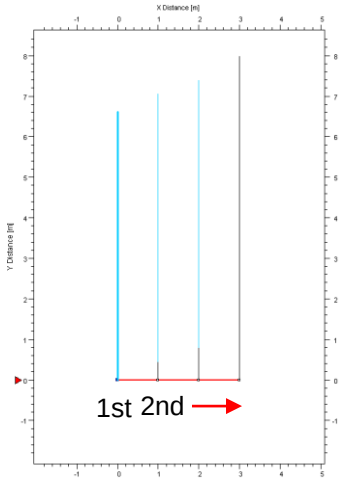
With the option General the layout of the profiles can be defined with:

- Equal interval for all profiles
- Profile offset direction increasing to the left or right of the baseline (see picture below).
- Every second profile's data reversed.



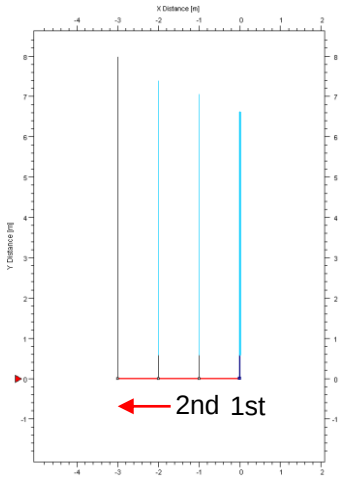
If the option "Profiles measured to the right of baseline start" is chosen the Site Map will be made as:

Note: The start point of the Baseline is set to X=0 and Y=0.



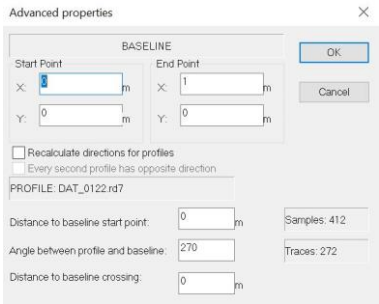
If the option "Profiles measured to the left of baseline start" is chosen the Site Map will be made as:

Note: The start point of the Baseline is set to X=0 and Y=0.



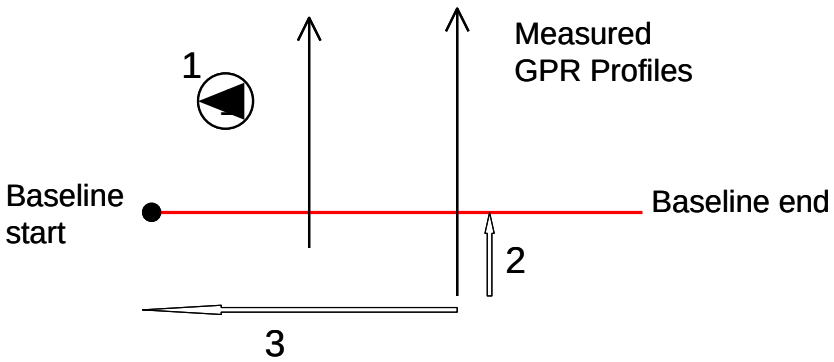
The baseline and the radar profile location can also be defined in detail by choosing Advanced

To reverse every second profile make sure that both options; “Recalculate directions for profiles” and “Every second profile has opposite direction”, is marked.



Here the baseline can also be given geographically correct coordinates, in meter-format.

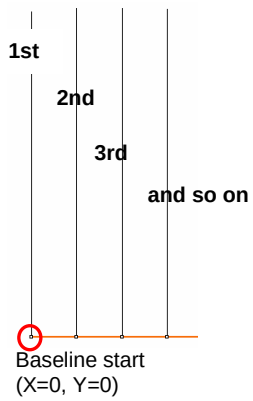
For definitions of the different parameters of the radar profile location, see picture below.



1: Orientation to baseline start point. In this case it is 270 degrees.
2: Distance from the start of the current profile to the baseline
3: Distance from baseline start to the current profile

The Properties dialog can also be reached by right clicking on the radargram lines in the Site Map window.

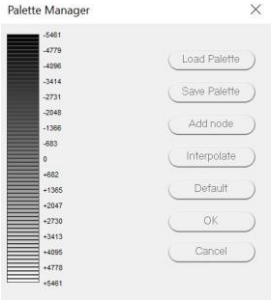
The example gives an angle of 270 degrees to the baseline start point. If the profiles are measured from right to left the angle to the baseline start point should be set to 90 degrees.



3.3 Profile

The Profile menu handles the colours and filters for the displayed radargrams.

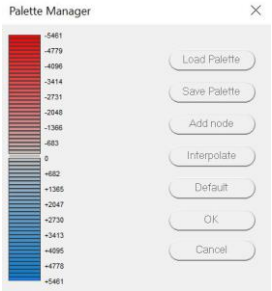
3.3.1 Change Palette



"Change Palette" opens the Palette Manager where the possibility to change the colour scheme from black/white to colour is available.

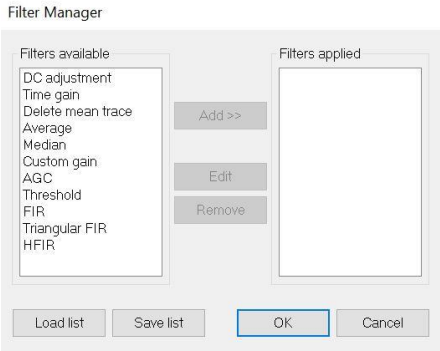
The palette shows the current colours for the open radargrams. To change single colour values, just double click on them. The operator can also change a spectrum of colours, by using the command "Interpolate", after having changed two colours. It is possible to select a number of colours and interpolate between them.

Here, three colours have been selected and interpolated: red - grey - blue



The command "Load Palette" will open previously designed and saved palettes.

3.3.2 Edit Filter List



The option "Set Filters" under the Profile menu will open the Filter Manager.

Here the operator can choose which filters and processing steps he/she wants to apply on the radar data, and also modify the settings of these.

Note: See also Appendix 1 for more information on filters.

Filters available Shows the available Object Mapper software filters.

Filters applied This box will list the current filters applied to the radar data. To edit the filters applied, mark the filter with the mouse and press Edit, or double-click.

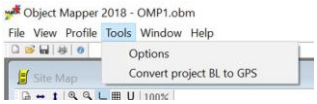
Add Add is used to add marked filters from the Filters Available list.

Remove Press remove to take away marked filters from the Filters Applied list.

The created filter list can be saved with Save list
and used again later by Load list

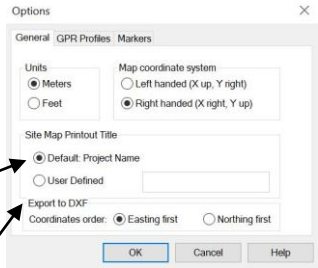
When viewing data, the command Ctrl+F will disable all filters at once; pressing Ctrl+F again the filters are turned on.

3.4 Tools



In the Tools menu the operator can change the settings of the Site Map and Data View windows. For instance, the operator can choose between meter and feet as measuring unit, how the coordinate system on the Site Map should be arranged, how many parallel profiles to display simultaneously and what velocity should be applied for the depth scale. Furthermore the different marker types can also be defined here. In the Dialog Options the following tabs can be found:

General Tab

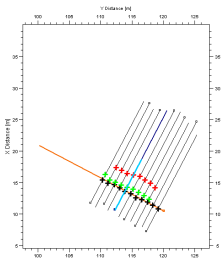


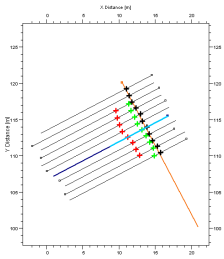
Here an example is given of the two map coordinate systems for the same project; left handed (at left below) and right handed (at right below).

The user can chose to use the project name when the Site Map is printed or on own defined name.

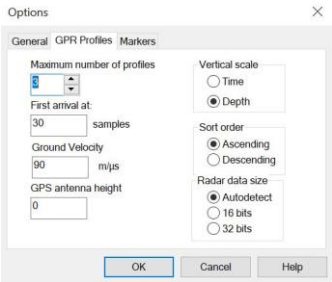
By using "Export to DXF" the coordinate order can be changed to have Eastings or Northing first

Here is an example of the two map coordinate systems for the same project; left handed (X up, Y right) and right handed (X right, Y up) respectively.



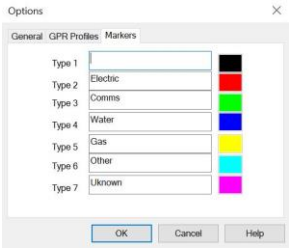


GPR Profiles Tab



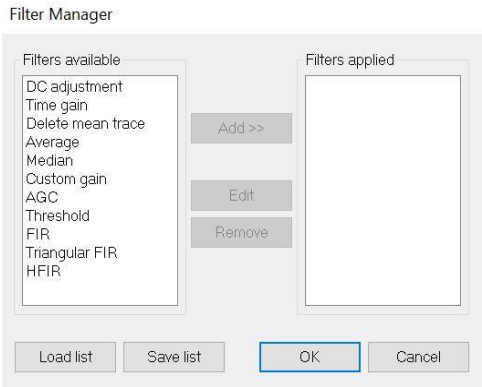
"Maximum number of profiles" refers to how many profiles will be shown at the same time in the Data View window.
The first arrival is set as a number of samples and defines the 0-level (ground surface). The first arrival can also be changed and set by clicking on the red triangles in the Data View and "drag and drop" to the correct position.
The correct ground velocity can be manually entered.
The GPS antenna height can be entered, measured from the ground to the geometric centre of the GPS antenna
The vertical scale can be changed to either Depth or Time.
The "Sort order" refers to the order of the radargrams in the GPR Profiles view.
Radar Data Size refers to the type of data file to be used. Older .rd3 data files are 16 bits and the newer .rd7 files are 32 bits. We recommend Autodetect is selected, though manual selection of 16 or 32 bits may be required occasionally.

Markers Tab



Your own definition of marker types can be noted. These descriptions are also seen in the Marker List and are included in the export to DXF and ASCII-format lists.

This appendix covers the available filters in the Object Mapper filter manager. Any filters that have user-definable settings will have a dialog connected to them. This dialog can be called from the "Filter Manager" and is shown in each filter description, below. Common to all filter dialogs is the trace window that shows the filtered trace. The trace window is updated when there is a change in the filter settings.



Which filter to use is will depend upon the application and the quality of the radar image. A filter very useful for some applications can be useless in others. The knowledge and experience of the user often determines the time it takes to produce a useful image. A general recommendation is to start with some form of DC filter and Gain. Below the available filters are listed and also if they are always, often, seldom or very seldom used in common GPR applications.

Always used: DC Adjustment or FIR

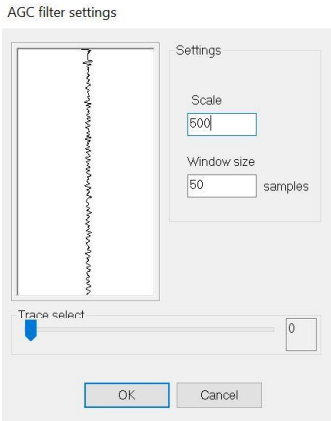
Often used: Delete Mean Trace, Time Gain, AGC

Seldom used: Custom Gain, Moving Average, Moving Median, Threshold

Very seldom used: Average, Median, Triangular FIR, HFIR

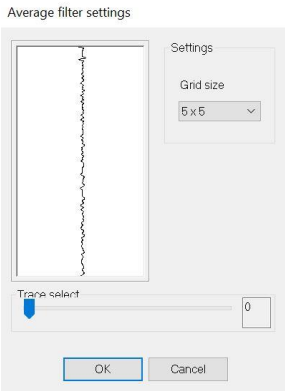
Automatic gain control (AGC)

This filter attempts to adjust the gain of each trace by equalizing the mean amplitudes observed in a sliding time window. A short window gives a more pronounced effect, the extreme of which would be a one-sample window, which would cause all amplitudes to be equal. The other extreme would be a time window of the same length as the trace; this would have no effect on the trace. After equalization a constant multiplier is applied to the trace to make the resulting amplitudes reasonable.

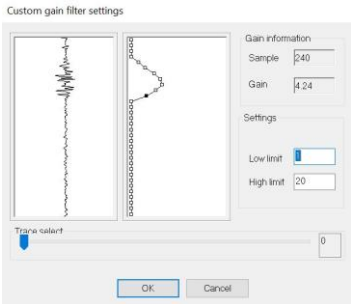


Average

The Average filter calculates a mean over a given number of samples and traces. The sample in the middle of the grid is replaced by the average value. This filter acts as a simple 2D-lowpass filter and gives a softer picture.

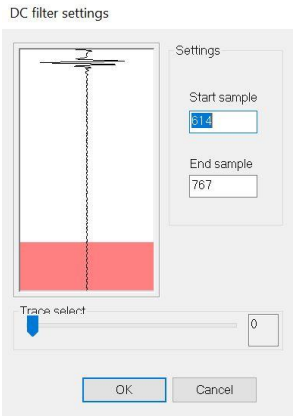


Custom Gain
An amplifying filter where the gain factor is given manually for 32 different sections of the trace. Click and drag the small squares in the right window until the desired level is reached.

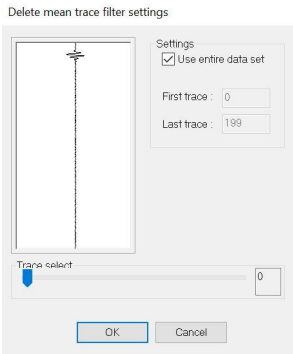


DC Adjustment
There is often a constant offset in the amplitude of the registered trace, this is known as the DC level or the DC offset. This filter removes the DC component from the data. The DC component is individually calculated and removed for each trace.

In the dialog the sample interval on which the DC component is calculated is specified. Values for the start and end samples can be entered in the edit boxes or by click-dragging in the trace view. The sample interval is shown as a red area in the trace view.

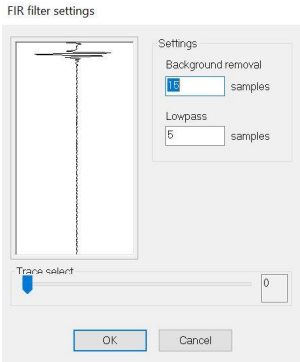


Delete mean trace
This filter is used to remove horizontal and nearly horizontal features in the radargram by subtracting a calculated mean trace from all traces, sample by sample. The mean trace can be calculated for the whole profile or for a specified section of the profile.

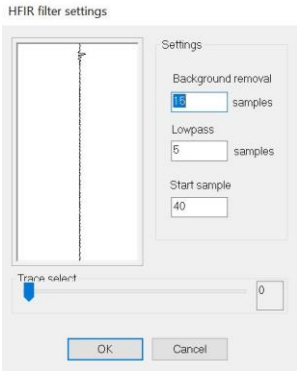


FIR
A quick band-pass filter, working with a combination of two boxcar (averaging) filters. The filter is run in two stages. First the lower frequencies are attenuated by subtracting the average in the longer boxcar from the raw data at the centre of the boxcar. Then the higher frequencies are attenuated by replacing each sample with the average calculated in the shorter boxcar.

Both boxes calculate along the whole trace.

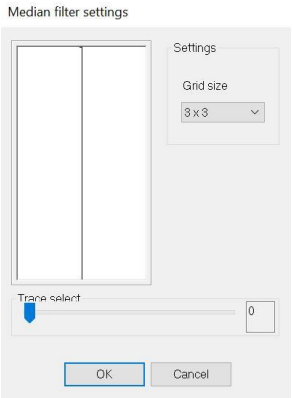


HFIR
The HFIR filter functions as the FIR filter, but the filter runs along the profile - not along the trace. The filter is a spatial band-pass filter and its effect is similar to that of the background removal filter



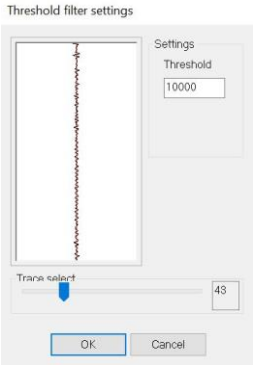
Median

The Median filter functions as the Average filter but, instead of the mean value, a median value is used. It removes spikes in the data efficiently while not blurring the image quite as much as the average filter does.



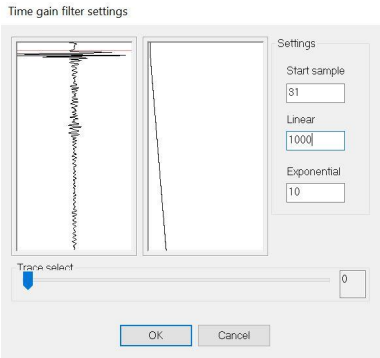
Threshold

All samples with a value below the threshold are set to zero.



Time-Gain Filter

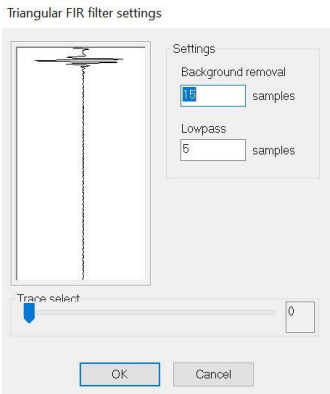
The Time-Gain filter applies a time-varying gain to compensate for amplitude loss due to spreading and attenuation. The trace is multiplied by a gain function combining linear and an exponential gain, with coefficients set by the user. In the Time-Gain dialog, there is one trace window and one gain window. The trace window shows a filtered trace and the gain window shows the gain function applied.



The red line in the trace window indicates the start of the filter (before this point the gain of the filter is unity).

Triangular FIR

The Triangular FIR filter functions as the FIR filter, but instead of using boxcar averages it uses averages in symmetrical triangular windows.



Appendix 2
GPS Measurements

This appendix covers some important issues when using a GPS to position the GPR measurements.

The MALÅ Easy Locator Pro and GX can be used together with GPS equipment which communicates via a 9-pin serial connector. The GPS must communicate with NMEA 0183 protocol with GGA sentence. The built GPS can be utilized if required, though the positioning of the internal GPS is lower resolution, a RTK GPS will provide the highest resolution.

The GPS equipment available today can be divided into three different types:

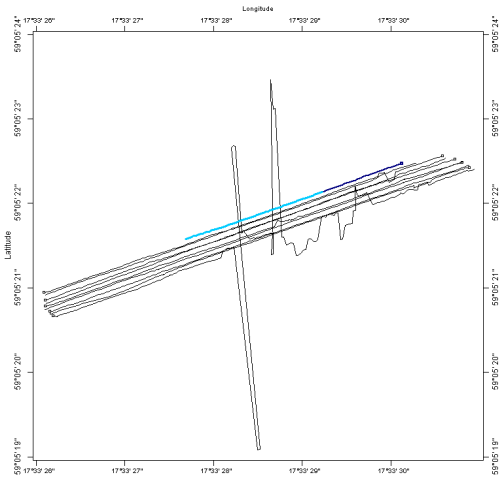
GPS: Relatively inexpensive, the GPS is using only satellites for positioning, accuracy around ± 4 m. Suitable for large scaled layer mapping etc.

DGPS: Differential GPS, uses satellites and a correction from the SBAS reference station/satellite network, accuracy around ± 0.5-2m.

RTK GPS: Real Time Kinematic GPS, either uses two GPS receivers (one stationary base and one rover), or a single rover unit with RTK corrections received via a GSM connection; accuracy for both is around ±1-2cm.". RTK GPS accuracy is recommended for utility mapping.

For all the three different GPS systems the following is very important to remember:

1) Regardless of the system used; GPS, DGPS or RTK, the positioning data gathered will be of bad quality if the measurements are made under bridges, in dense forest, close to high buildings etc. In the example below the lowermost line is measured 1 m from a building, resulting in incorrect positioning of that measurement line.



2) When using a GPS in motion, the GPS system is updated at different rates. Inexpensive systems may update 1 time/second while RTK systems can update 10 or more times/second.

3) The GPS antenna should be placed on the middle of the GPS antenna to give the most correct position of the GPR traces. This will be a problem when measuring with the MALÅ Geoscience RT antennas, and should be corrected afterwards.

4) It should be observed that during the day the connection to satellites can change, giving better or worse positioning capability.

Appendix 3
Software license

After installation of software, time limit license will be set for evaluation period.

When this time has expired, purchase of the license is required to continue the use of the software. After the time license has expired, the program will only open the demonstration project.

Object Mapper is only available in a hardware license format.

Hardware licensing uses a license stored on a special USB device (called a USB dongle). This type of license can be used on any computer with the Object Mapper software installed.

Contact MALÅ Geosciences on how to acquire a new license/hardware key.

Introduction

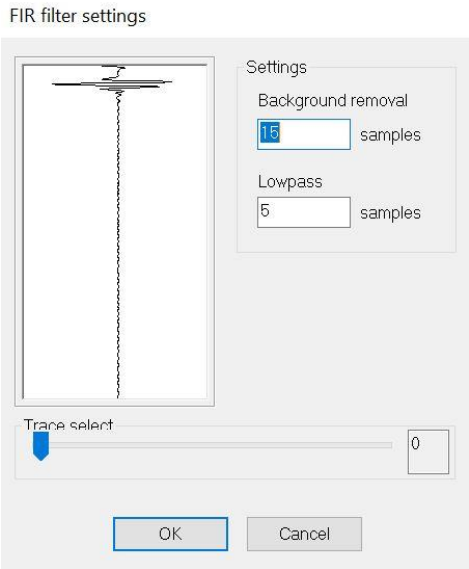
One of the most difficult things for a beginner to know, is “where do I start with the filters and what parameters should I use”. When it comes to data processing, every situation will be different due to the infinite differences in the soil conditions, user settings, antenna frequency and variety of other reasons. This short guide is for those who are not sure where to start and need a little help with their processing.

The following two routines are based on average soil conditions in the application of utility detection with HDR data; description of the filter is, can be found in Appendix 1. Please use the following guidance with caution, taking into consideration that for utility detection we are attempting to emphasize particular response types and, as such, the filtering presented will not be suitable for all applications and environments. If you are unsure about filtering and processing of data, always seek further help from experienced users or available GPR literature and consider that, in most cases, less-is-best. Every processing step risks removing useful information from the data or introducing 'artefacts' which are responses not resulting from real features but the applied processing routines. Seek further help if you are unsure.

Routine 1 - Semi-automated

1. Move the mouse icon into the data, right click and select Filters, the Filter Manager will be opened.

2. Select FIR and Add



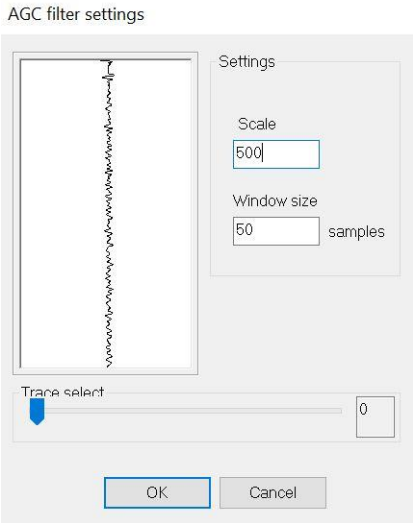
There are 2 parameter values to choose here:

Background removal
The default value is 15, try this value and see how the data look; you can increase this value to 20 or 25 if needed, never decrease below 15.

Lowpass
Leave this parameter set at 5, vary rarely does this need to be changed.

3. Click OK and you will go back to the Filter Manager. You can either continue adding further filters at this point or you can click OK on the Filter Manager window to see what effect the filter you have selected has had on the data

4. Now we need to add a level of gain and in this routine we will try AGC. From the Filter Manager, now click on AGC and this widow will open.



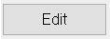
Again there are 2 parameter values to choose here:

Scale
The default value is 5000, reduce this value to 500 and see how the data look; you can vary this value (after changing the parameter below) from 300 to 700 if required.

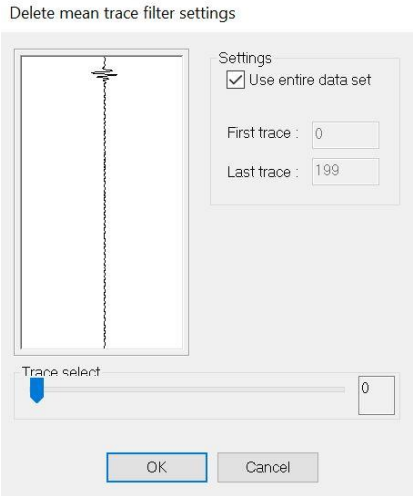
Window Size
The default value is 21, change this value to 50 and, once again, see what the data look like. This value can be changed from 30 to 100.

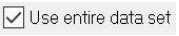
5. Click OK in the AGC window and OK again in the Filter Manager, to see the results of these 2 applied filters.

6. Often the contrast  will need to be changed at this point, use the slider to increase or decrease the contrast value, move until the desired level is reached.

Tip: If you need to change any of the values in any of the filters, go back into the Filter Manager, click once on the filter in the Applied Filter box (on the right hand side), then select 

7. Another filter to try at this stage is the Delete Mean Trace filter, go back into the Filter Manager, select and add Delete Mean Trace.



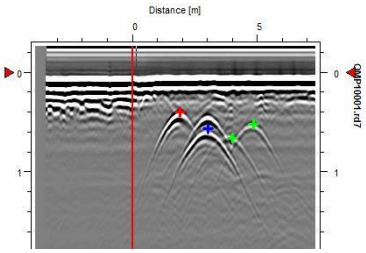
Make sure the 

box is ticked/checked and click OK.

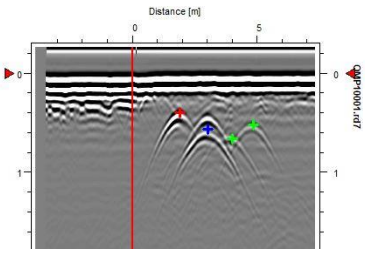
8. Click OK in the Filter Manager Widow to see how this has affected the data. Most of the first arrival (the upper banding in the data) will be removed.

Caution: Any horizontal reflections parallel to the surface will be removed from the data. These horizontal reflections could come from a pipe that is in the same direction as the profile. Use this filter with caution.

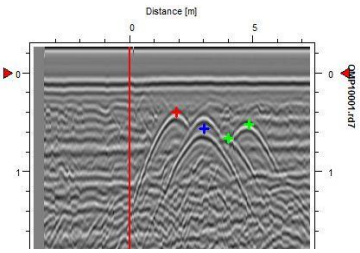
Here is a data set with the above filters applied one by one



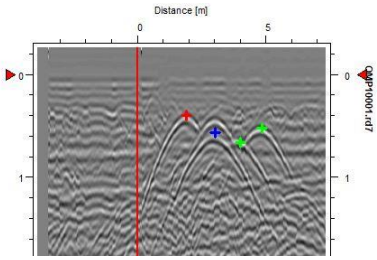
Raw Data



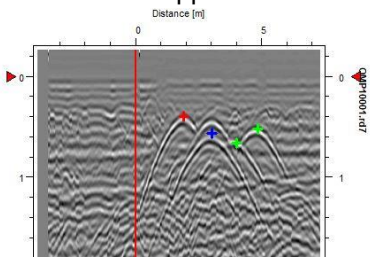
FIR Applied



AGC Applied



Delete Mean Trace Applied



Contrast Adjusted

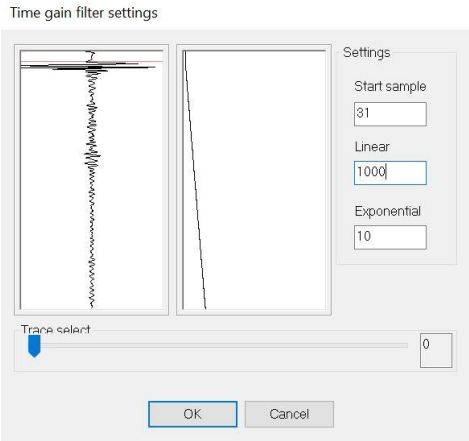
Note: you can stop at any point along these stages, though we recommend the FIR is applied as a minimum

Routine 2 – Manual

This routine will need more trial and error than Routine 1; don't be afraid to experiment with the values.

1. Open the Filter Manager, select FIR and Add, using the same parameters as above (Routine 1, step 1).

2. Next add Time Gain.



There are 3 parameter values to choose here:

Start Sample
First try an approximate value of 30. You can click in the left hand trace widow to move the red line. The value will change in the Start Sample box.

Linear
This value can vary over a very large range and a "trial and error" approach may be required. Try starting 1000 and then increase if needed, some big steps may be needed.

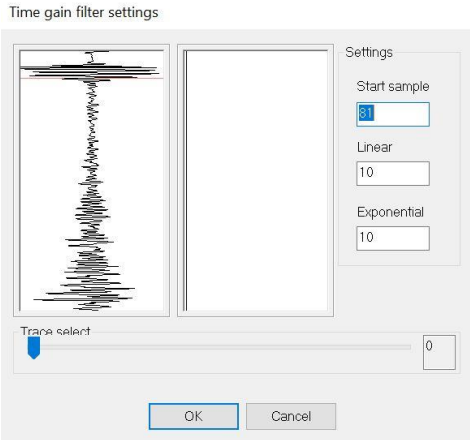
Exponential
Again, this value can vary, try starting at 10 and increase if needed

3. Add the Delete Mean Trace filter, the same as Step 7 in Routine 1.

4. Click OK in the Filter Manger and see how the data look, remember to change the contrast value if needed.

5. More amplification may be required to increase the strength of weak reflection towards the bottom of the data in the data (deeper utilities). This is often referred to as increasing gain lower down in the time window.

Additional gain



There are 3 parameter values to choose here:

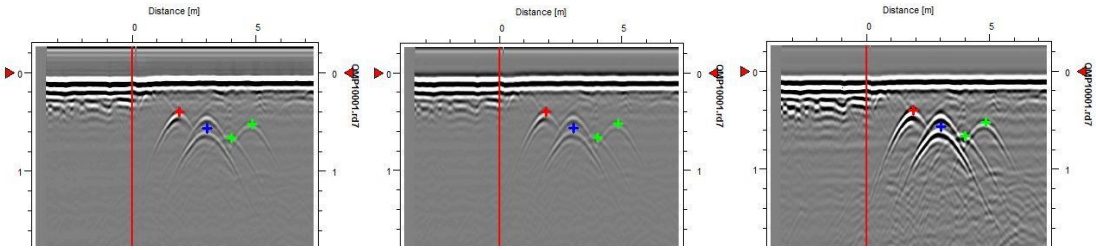
Start Sample
In this example, the start sample was moved to 81, this will often vary and "trial and error" will be needed.

Linear
This value was set to 10, you could increase this to 100 or higher if needed.

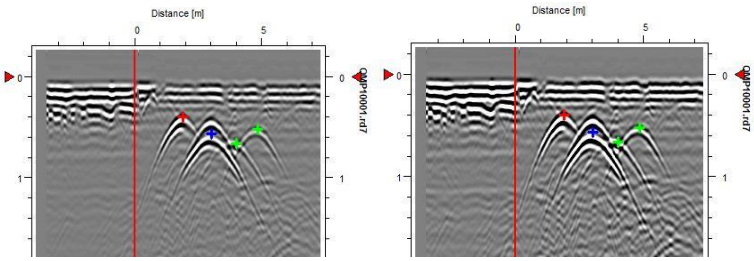
Exponential
Again, this value can vary, try starting at 10.

6. Back in the Data View, adjust the contrast  , if required.

Here are the results of this alternative processing flow on the same data set.



Raw Data FIR Applied Time Gain Applied



Delete Mean Trace Applied Second Time Gain Applied

Choose Routine 1 or 2 depending on your personal preference. Now you are ready to interpret the data and insert the markers, good luck!

For further help and assistance, please contact your local dealer, MALÅ office or representative. Also refer to the contact details on Page 5 of this manual.

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