



DeepView 4.x

## 3.1 Side Scan Introduction

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# Introduction

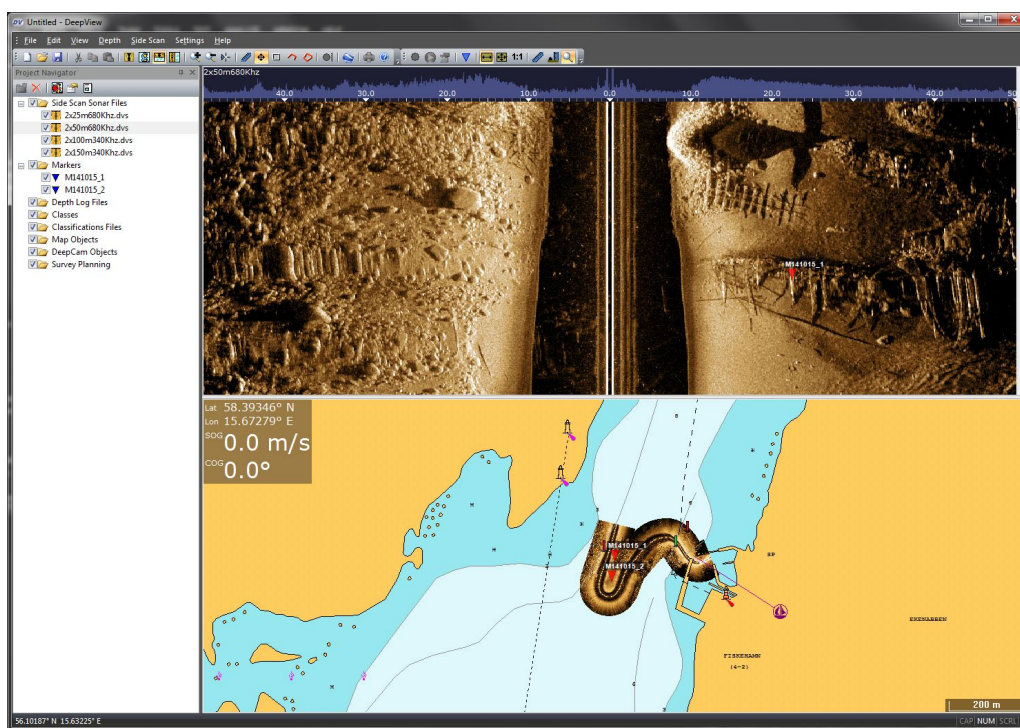
Thank you for choosing a high performance sonar system from DeepVision AB. If you have any comments or feedback on our products, we would appreciate hearing from you. It is very important for us to know what our customers think about our products, so that we can continue to improve them to suit your requirements.

This document introduces the DeepView Side Scan module. It will provide you with information of what Side Scan Sonar is, how it works, what is needed to make a Side Scan Sonar survey and the typical applications for a Side Scan Sonar.

To handle Side Scan Sonar data you need to have the Side Scan module activated in the DeepView software. Contact DeepVision if you are interested in purchasing a license. For more information of how to apply your license, read the user guide *1 System requirements and installation*.

If you are new to Side Scan Sonar, it is recommended that you read this document before proceeding with the other Side Scan Sonar user guides.

DeepView is a complete software environment for recording, processing and handling sonar data. The picture below displays the DeepView software environment.



**Figure 1:** The DeepView software environment.

# What is Side Scan Sonar

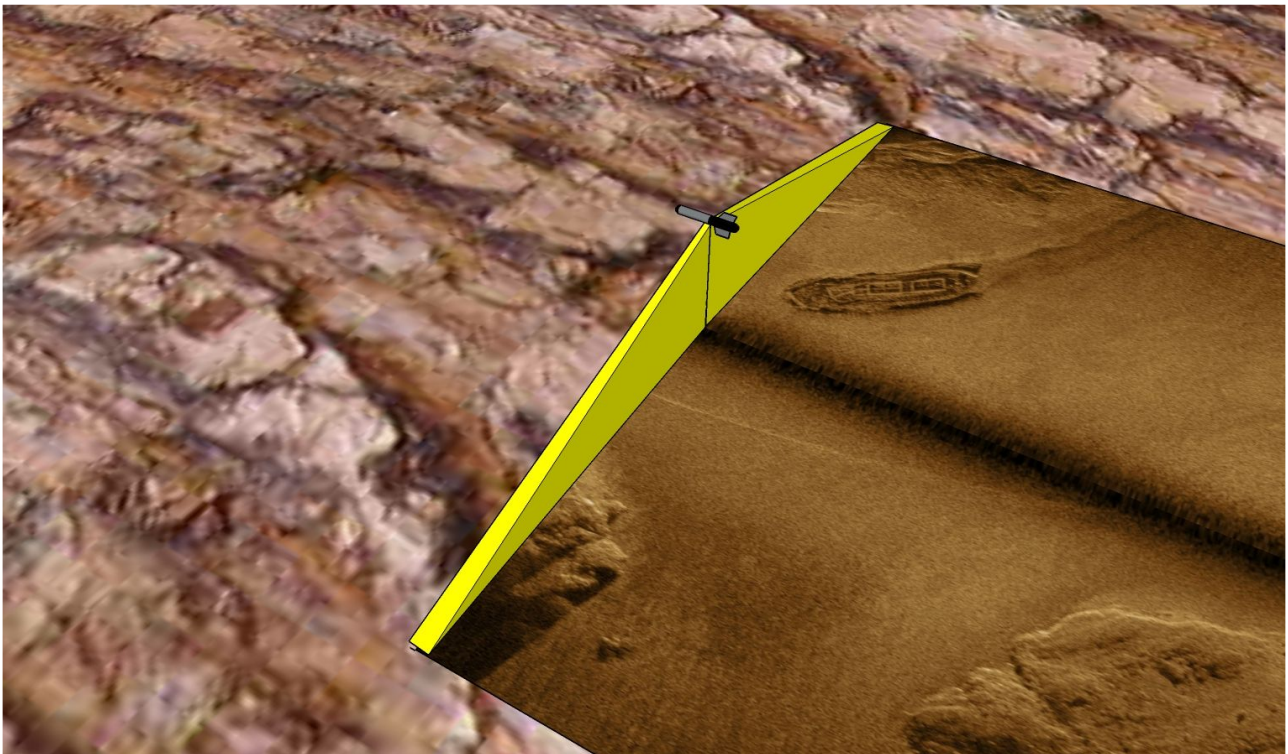
Side Scan Sonar is a sonar technology for effectively imaging big areas of the sea bottom. The Side Scan Sonar transmits fan-shaped pulses of sound waves, and creates an image according to the intensity of the received echoes reflected off the bottom. Because of the large range the beam is covering, the Side Scan Sonar is a very effective way of finding objects on the sea bottom, such as shipwrecks, pipelines, patches of vegetation, etc.

## The Side Scan Sonar image

The Side Scan Sonar image is created by measuring the signal strength of echoes with respect to time. The transducer transmits signals which will be reflected back as echoes. As the transducer receives the echoes, an image is created.

## The Side Scan Sonar beam

When recording Side Scan Sonar data, the transducer transmits pulses of sound waves, also known as pings. The pings are shaped as a fan, narrow in the direction of travel, but wide in the perpendicular direction. This is shown in Figure 2. Every ping will cover a wide but short area and result in a single line of the Side Scan Sonar image. A new ping is sent after a fixed amount of time, which is set according to the range settings in the software.



**Figure 2:** A display of a DeepEye towfish that transmits fan shaped sound waves.

To get high quality images, the DeepVision Side Scan Sonars use Chirp technology combined with pulse compression. Chirp is a technology where the frequency of the pulse changes with time. The DeepVision sonars use 10%-Chirp, which means that the increase of the frequency will be ten percent of the sonar frequency. The frequency of a ping will start 5% below the sonar frequency and finish 5% above. This means that the sonar frequency is the middle of the interval. An example of this is the DE340D sonar which transmits pulses with a frequency of 340 kHz. The pulse will start at 323 kHz and increase linearly to 357 kHz.

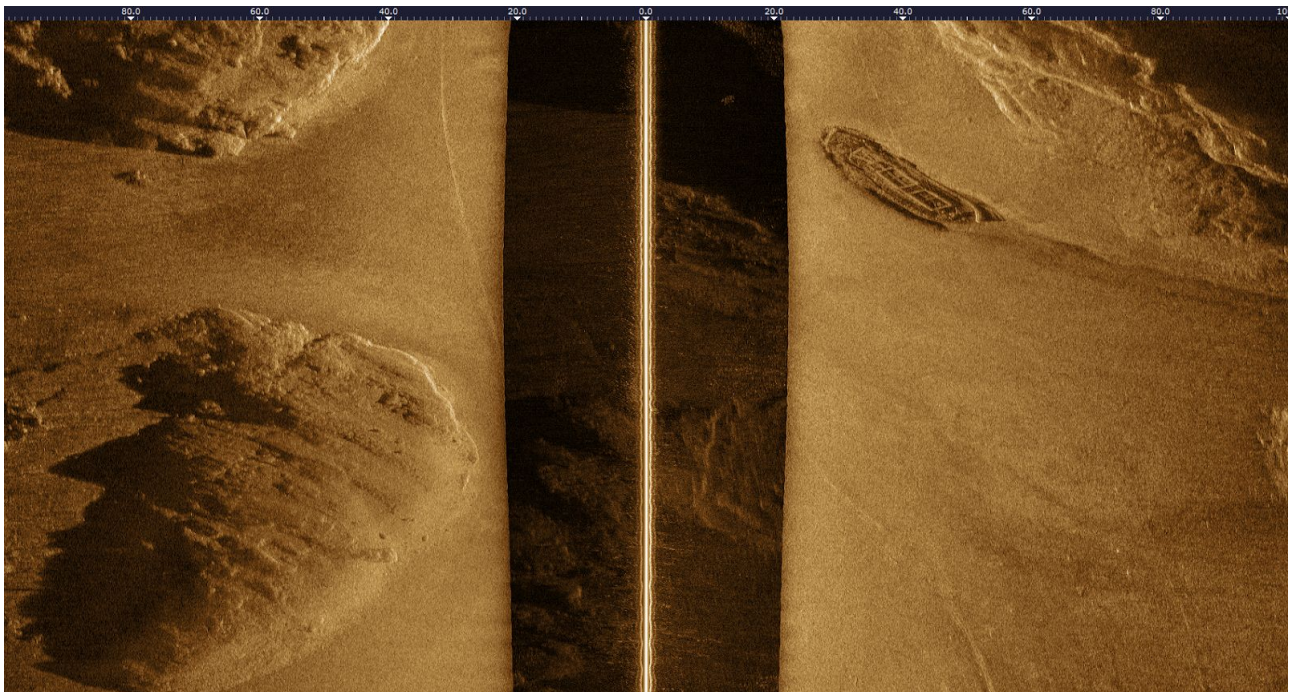


Pulse compression is a signal processing technique used to make a long duration pulse into a brief pulse with greatly increased amplitude. This is done by correlating the transmitted pulse with the received echo. This combined with the Chirp technology is how DeepView creates high resolution Side Scan Sonar images.

## Creating the image

The image is divided into a number samples, which will be drawn from the middle of the image and out horizontally. As the transducer receives echoes, the intensity of the echo will be drawn in the current sample. The last sample will therefore include the echo of the sound wave that has traveled the farthest distance. When this is received, a new ping is sent. The number of samples per ping depend on the speed setting of the towfish, which is set by the user. The setting of a high speed results in fewer samples compared to a lower speed. This is because the image must be drawn faster in the waterfall view to display the appearing objects in their true form. The mosaic drawn in the Map View will be drawn according to the GPS data and not be affected by the speed settings.

In the beginning of each ping no echoes will have reached the transducer, as the signal is traveling through open water. This results in a dark area in the middle of the Side Scan Sonar image and is known as the *water column*. The first received echo will be the one originating from the point directly below the transducer. This echo is seen in Figure 3 as the part drawn directly to each side of the water column. Both the point to the right and to the left of the water column is the same spot as seen by the two transducer elements. With the information of the speed of sound in water and the settings of the Sonar, the software calculates the distance to each sample and displays a ruler above the Side Scan Sonar image. From this ruler, the height of the sonar from the bottom can be read by the size of the water column.



**Figure 3:** Display of a Side Scan in DeepView. This image is the same as the one displayed above in the Side Scan beam section.

## The Waterfall view

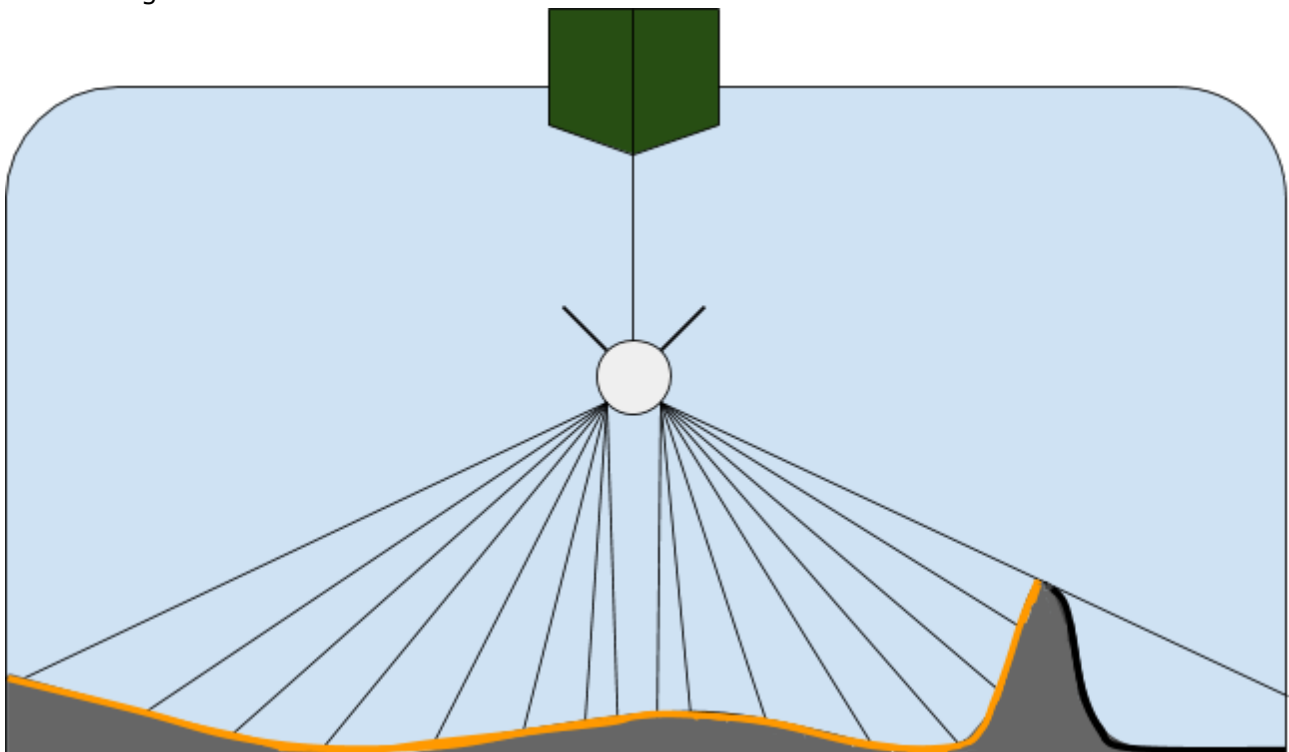
The waterfall view is one of the ways DeepView displays Side Scan Sonar data. Every ping is drawn on top of the one before and the image is moving downwards, making it look like a waterfall. When a complete image is constructed, the first ping will be visible at the bottom and last ping in the top. The waterfall view for Side Scan Sonar data is displayed in the Object View of the DeepView software.

The waterfall view will always display a straight image, even if the sonar is turning. The image may therefore be misleading when not surveying a straight line. For that reason it is recommended to use straight survey lines for the best display of a Side Scan Sonar data in the waterfall view.

## Objects

Objects in Side Scan Sonar images can often be most clearly seen by looking at their shadows. The shadows are created as the objects block the area behind them so that sound waves will not reach it and thus no echo will be received from the area. This can be seen in Figure 4.

The size of the shadow depends on two factors. The first factor is the height of the object above the bottom. A tall object will result in a larger shadow compared to that of a short object. The other factor is the angle at which the object is hit by the sound waves. A large angle will create a larger shadow compared to a small one. This means that two objects of the same size will be displayed differently depending on their respective distance to the Side Scan sonar. The object that is further away from the sonar will have a larger shadow.



**Figure 4:** Display of a Sonar beam hitting an object. The area behind the object is not hit and a shadow will be displayed in the image.

## Equipment

To record Side Scan Sonar data the following equipment is needed.

1. A computer that meets the minimum system requirements of DeepView. Read the user guide 1 *System Requirements and Installation* for more information about the minimum requirements.
2. Side Scan module activated in the DeepView software. To activate the Side Scan module it is necessary to purchase a license from DeepVision. More about applying licenses in the user guide 1 *System Requirements and Installation*.
3. A DeepVision Side Scan Sonar system for recording side scan sonar data. To purchase a DeepVision Side Scan Sonar system, contact DeepVision by sending a contact form on the [DeepVision website](#).

## Interface

The Side Scan module will add features to the base version of DeepView and extend the user interface. An extra toolbar for Side Scan Sonar and some menus will be accessible when the module has been added. Read more about the toolbar and the menus of the Side Scan Sonar module below.

### Toolbar

The Side Scan toolbar is shown in Figure 5. The features that the Side Scan toolbar offers are performed in the Object View.



**Figure 5:** The Side Scan toolbar.

The buttons have the following functions:



Start recording Side Scan Sonar data. A new Side Scan file named according to the current date and time is created in the project. The location of the recorded file is set in the recording properties. While recording, press this button to stop recording. The recording button will only work if there is a DeepVision Side Scan Sonar connected to your computer. If there is, the button will be of the red color that is displayed here, if not, the button will be gray.



Show Side Scan Sonar live data in waterfall view, this button is referred to as the Play button. When this button is pressed, the live Side Scan Sonar data will be displayed in the waterfall view. The Play button will only work if there is a DeepVision Side Scan Sonar connected to your computer. If there is, the button will be of the blue color that is displayed here, if not, the button will be gray.



Access the recording properties for Side Scan Sonar. This is only accessible if there is a DeepVision Side Scan Sonar connected to the computer. You can read more about the recording properties in the *Recording Properties* section in the document.



Playback of the selected Side Scan Sonar file. Reruns the Side Scan Sonar file in the waterfall view. The playback can also be done in the Map View by enabling *Playback Map View* in the Side Scan Files properties, which you can read more about in the *Side Scan Files Properties* section of the document.



Stretch the Side Scan Sonar file in the Object View to fit the width of the Object View.



Displays an overview of the Side Scan File in the Object View. If there is enough space in the Object View the Side Scan File will be split into parts and displayed side-by-side.



Displays the Side Scan Sonar file at its original size, with one pixel per sample.



The measure distance tool for Side Scan Sonar files. You can read more about this feature in *3.2 Measuring distance and height in Side Scan Sonar files*.



The measure height tool for Side Scan Sonar files. You can read more about this feature in *3.2 Measuring distance and height in Side Scan Sonar files*.

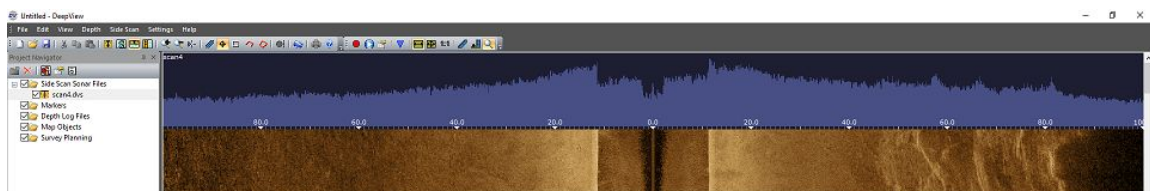


The zoom in tool for Side Scan Sonar files. Press the left mouse button in the waterfall view to zoom in at a point. A pane of the zoomed area is displayed.

## Received Signal Strength Graph

It is sometimes useful to view the received signal strength of a Side Scan Sonar image. In the DeepView software the signal strength graph of each ping of a Side Scan Sonar image can be displayed in the upper region of the Object view. The Received Signal Strength Graph has three modes, it is either hidden, small or large. The mode of the Received Signal Strength Graph is toggled by left clicking the ruler in the top of the object view.

The graph displays the ping indicated by the mouse pointer, if the play button is active the graph displays the latest recorded ping. A sample with a high received signal strength is represented by a high light blue bar, as can be seen in figure 6.



**Figure 6:** The Received Signal Strength Graph.

## Menus

When applying the Side Scan module to your DeepView software, some new menus will be available. Below you can read about the different menus and the features they offer.

### Side Scan Menu

As described in user guide 2.2 *User interface, toolbars and menus*, there is a Side Scan tab in the Main Menu. The features of the Side Scan tab are the same as those of the Side Scan toolbar described above. The Side Scan tab includes the following features:

- **Recording:** Start recording Side Scan Sonar data. A new Side Scan file named after the date and time is created in the project. The location of the file in the computer is set in the recording properties. While recording, press this button to stop recording. The recording button will only work if there is a DeepVision Side Scan Sonar connected to your computer. When a side scan sonar unit is connected the button will be of the red color that is displayed here. When no side scan sonar unit is connected the button will be gray.



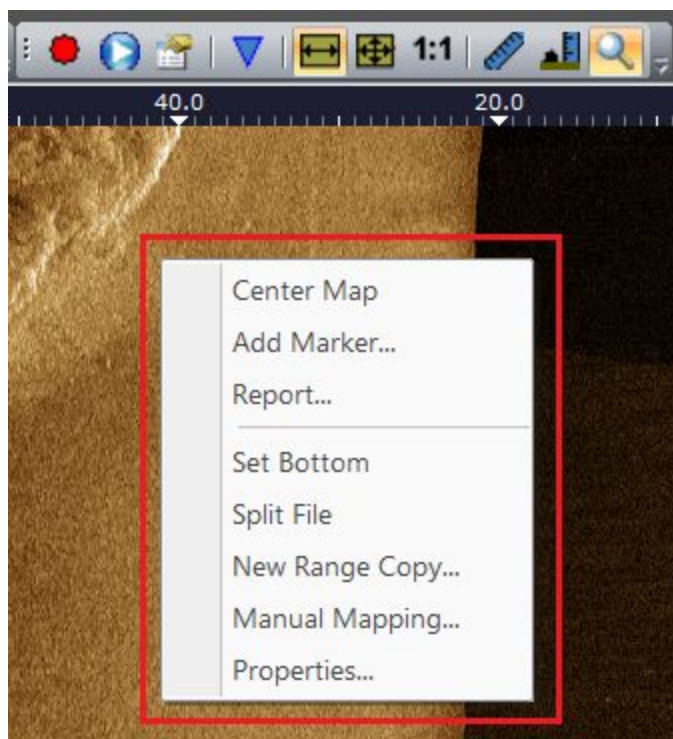
- **Play:** Side scan sonar live data is shown in the waterfall view. As you record side scan sonar data you can view this live in the waterfall view by pressing this button. The Play button will only work if there is a DeepVision Side Scan Sonar connected to your computer. When a side scan sonar is connected the button will be blue. When no side scan sonar is connected the button will be gray.
- **Recording Properties:** Access the recording properties for Side Scan Sonar. This is only accessible if there is a DeepVision Side Scan Sonar connected to the computer. You can read more about the recording properties in the *Recording Properties* section in the document.

## Right Click

Some menus are accessed by right clicking in different areas of the DeepView environment. You can read about the right click menus associated with the Side Scan module below.

## Object View

When you right click in the Object View while a Side Scan Sonar file is displayed, the menu shown in Figure 7 appears. The buttons marked with (PRO) are only available with the Pro version activated. To learn more about the Pro version and the features that it offers, read the Pro version user guides.



**Figure 7:** The menu that appears when right clicking in the Object View of a Side Scan file.

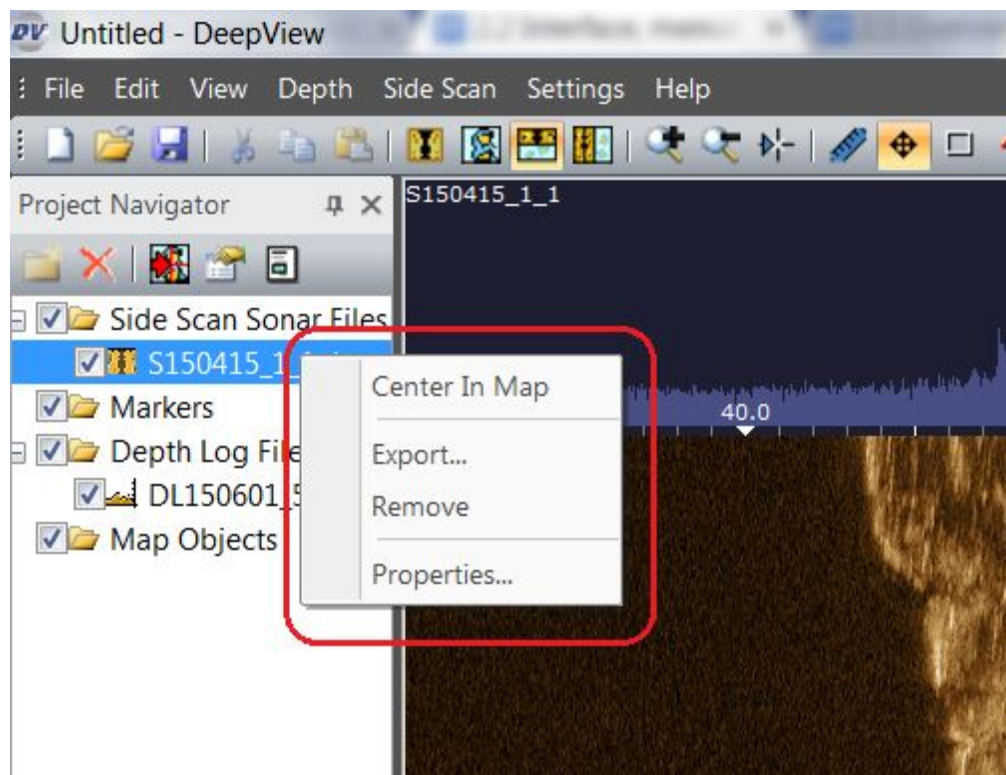
- **Center Map:** Center the map at the coordinates where you right clicked.
- **Add Marker...:** Add a marker in the Object View. The marker will also be shown in the Map View. To learn more about markers, read the user guide 2.3 *Markers*.
- **Report... (PRO):** Creates a report in .png format of the Side Scan image.
- **Set Bottom (PRO):** Displays the the bottom in the Side Scan file.
- **Split File (PRO):** Creates a copy of the Side Scan Sonar file that is split into two files.

The copy is split where you right clicked. The original file will remain in the project and on the disk.

- **New Range Copy... (PRO):** Creates a copy of the Side Scan Sonar file with a new range. The range sets the width of the Side Scan file and can be seen in the top of the Object View when viewing a Side Scan file. The original range of a recorded Side Scan file is set in the recording properties, which you can read more about in the menu section.
- **Manual Mapping...:** Opens the Manual Color Mapping Levels window which gives the user the ability to adjust the White level, Black level and White slope of the display of a Side Scan file. The Auto Color Mapping property of the Side Scan File Properties must be switched off for the Manual Mapping to be accessible.
- **Properties...:** Access the properties window for Side Scan files. This properties window is explained in the Side Scan Files Properties section further down in the document.

## Side Scan Object

The following menu appears when right clicking on a Side Scan object in the Project Navigator. To add an already existing Side Scan Sonar file, select <File> <Add File...> in the main menu.

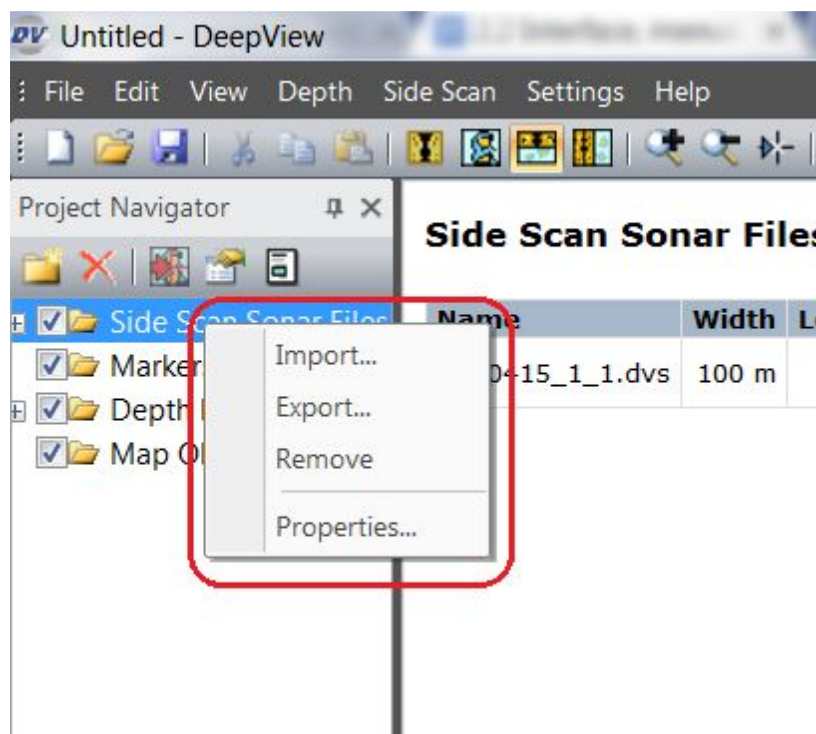


**Figure 8:** The menu that appears when right clicking on a Side Scan object in the Project Navigator.

- **Center In Map:** Center the coordinates of the Side Scan file in the Map View.
- **Export... (PRO):** Exports the Side Scan file as an .xtf file.
- **Remove:** Remove the file from the project. The file will be removed from the Project Navigator but not deleted from the computer.
- **Properties...:** Access the properties window for the Side Scan Sonar file. More information about this window in the menu section further down in the document.

## Side Scan Object Group

The menu shown in Figure 9 appears when right clicking the Side Scan object group in the Project Navigator.




**Figure 8:** The menu that appears when right clicking an object group in the Project Navigator.

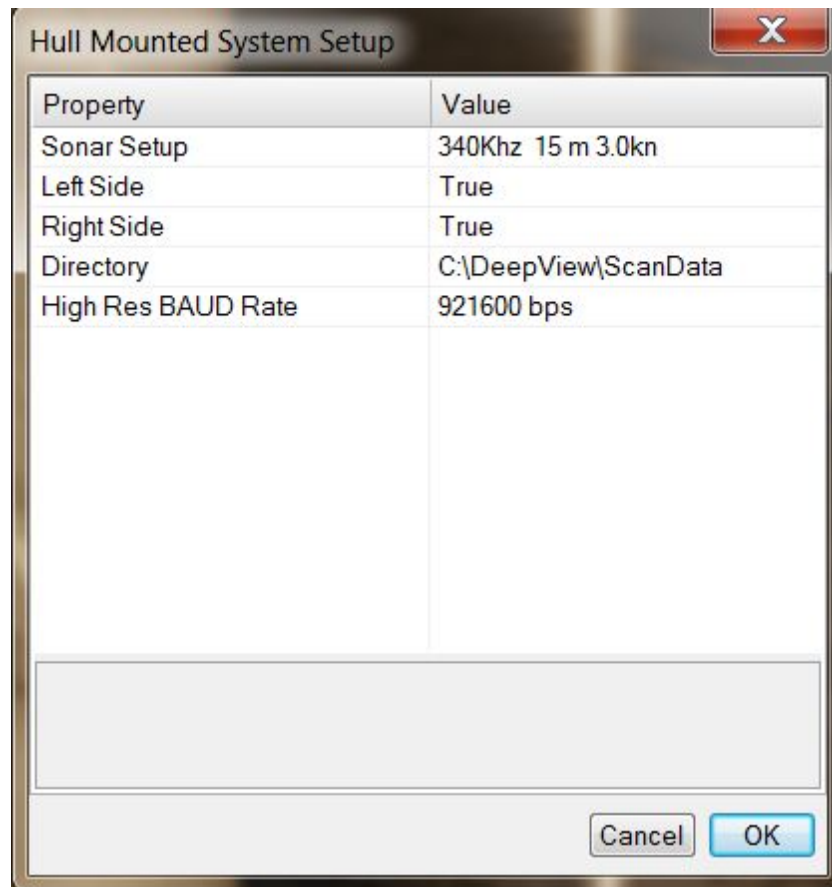
- **Import... (PRO):** Import .xtf files.
- **Export... (PRO):** Export .xtf files.
- **Remove:** Remove all Side Scan object paths from the project. The files are not deleted from the computer but only removed from the project.
- **Properties...:** Access the properties window for Side Scan files. This properties window is explained in the Side Scan Files Properties section further down in the document.

## Properties

The properties window for Side Scan is where you setup the appearance of Side Scan images, the recording settings etc.

## Recording Properties

The properties for recording Side Scan Sonar data is accessed by clicking the  icon in the Side Scan toolbar. This menu will only be accessible when a DeepVision sonar system is connected to your computer. In Figure 10 you see the properties menu. The name of the window depends on the kind of system connected, which in this case is a hull mounted sonar system.



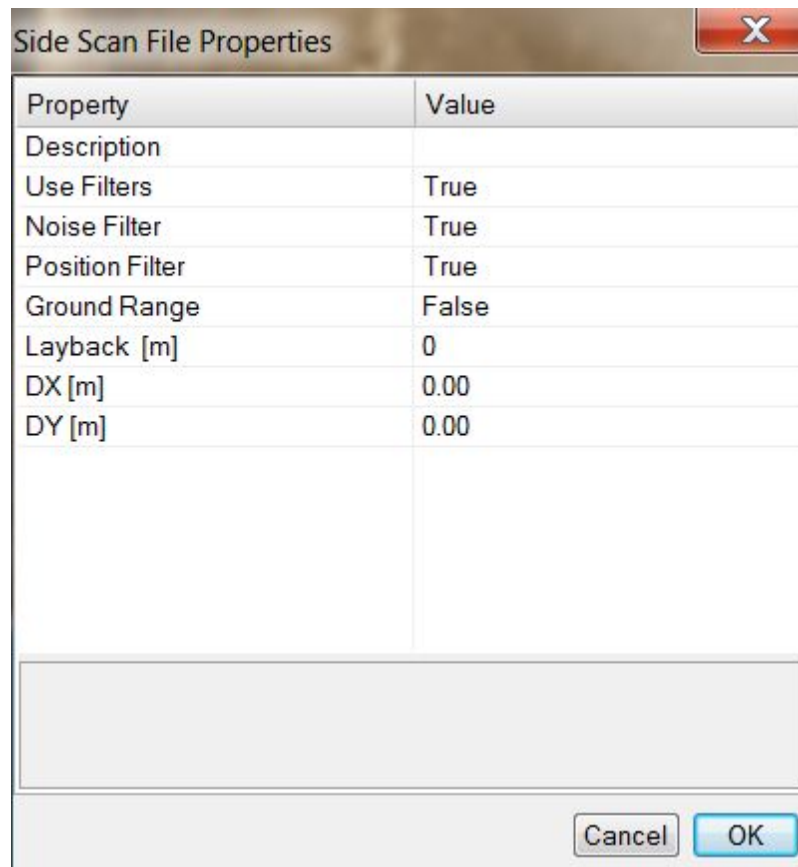
**Figure 10:** The recording properties for Side Scan.

- **Sonar Setup:** Set up the sonar frequency, range and speed.
- **Left Side:** True if the left/port side transducer shall be used. If a side is deactivated, the Sonar will not show or record any data from that side.
- **Right Side:** True if the right/starboard side transducer shall be used. If a side is deactivated, the Sonar will not show or record any data from that side.
- **Directory:** Set the directory where the Side Scan Sonar files are stored.
- **High Res BAUD Rate:** Set the BAUD rate used for the communication between the computer and the Sonar. Too low values might result in a lower resolution in the direction of travel as the system will have to wait on the data transfer. High values has been known to cause errors in old computers.

### Side Scan File Properties

The properties window of a Side Scan file is accessed by double clicking the left mouse button on the Side Scan object, or by selecting properties in the right click menu of a Side Scan file.





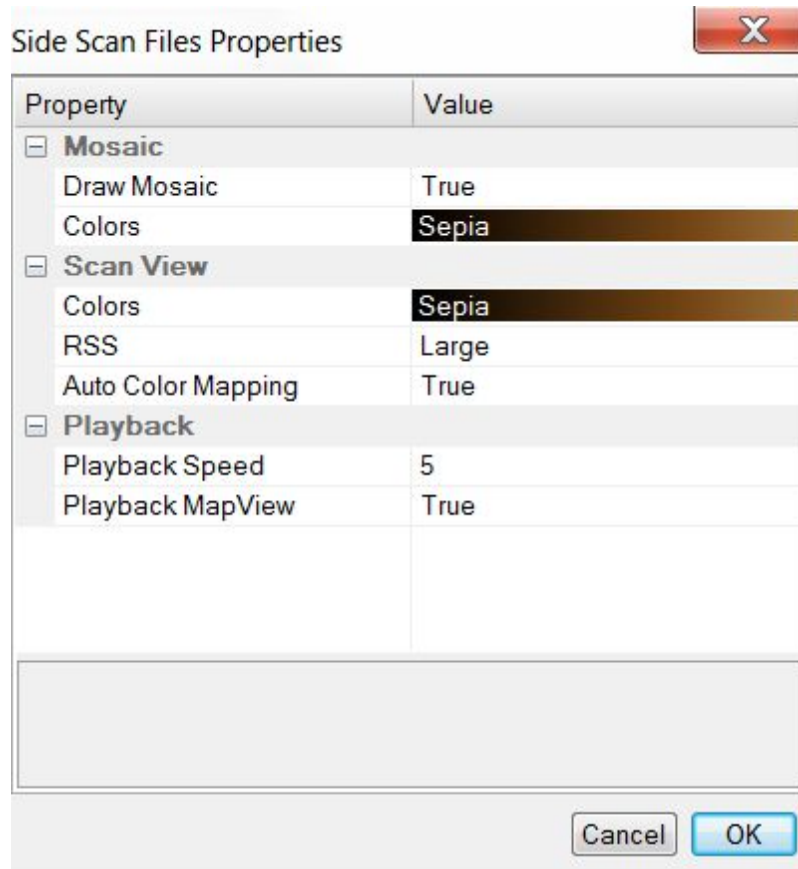
**Figure 11:** The Properties menu for a Side Scan object.

The Side Scan file properties can be seen in the Figure 11. The following options are available in the menu:

- **Description:** Description of the Side Scan Sonar file. To add a description, press the left mouse button in the value area to write a description.
- **Use Filters:** Choose true to apply filters to the Side Scan Sonar data. If this is false, none of the filters will be active.
- **Noise Filter:** Choose true to apply the noise filter. Applying the noise filter results in a sharper image and removes both acoustic and electric noise.
- **Position Filter:** Choose true to apply the selected position filters. The Position Filter compensates for uncertainties in the GPS data and enables the setting of Layback and offset set by the DY and DX settings.
- **Ground Range:** If Ground Range is set to false, the water column is shown. If it is set to true, the water column is removed from the sonar image.
- **Layback [m]:** Enter a layback distance. The layback distance is the distance of the towfish from the boat. To find out what the layback is, read *3.3 Side Scan Sonar at Sea*.
- **DX [m]:** Adjust the position of the transducer relative the GPS antenna. Positive values means the transducer is located to the **right** (starboard) of the GPS antenna.
- **DY [m]:** Adjust the position of the transducer relative the GPS antenna. Positive values means the transducer is located **ahead** (bow) of the GPS antenna.

## Side Scan Files Properties

The properties window for the Side Scan object group is accessed by double clicking the left mouse button on the Side Scan file folder, or by selecting properties in the right click menu of the Side Scan object group. The options in this menu affects all of the Side Scan files in the folder.



**Figure 12:** The properties menu for the Side Scan object group. These properties adjust the general settings of the Side Scan files.

The Side Scan object group properties are displayed in the picture above. The following options are available in this menu:

- **Mosaic**
  - **Draw Mosaic:** True if the Side Scan mosaic shall be drawn in the Map View.
  - **Colors:** The mosaic color scheme in the Map View.
- **Scan View**
  - **Colors:** The color scheme of the Side Scan Sonar data in the Object View.
  - **RSS:** Set the received signal strength appearance above the Object View.
  - **Auto Color Mapping:** Maps the colors in the Side Scan file automatically.
- **Playback**
  - **Playback Speed:** Choose the speed of the playback.
  - **Playback MapView:** True if the playback should be shown in the Map View.

## **Adding Existing Files to a Project**

To add a previously recorded Side Scan Sonar file to a project, select <File> <Add File...> in the main menu.