

Use of mAUUVs in the monitoring of benthic habitats and marine litter



ΔΗΜΟΚΡΙΤΕΙΟ
ΠΑΝΕΠΙΣΤΗΜΙΟ
ΘΡΑΚΗΣ

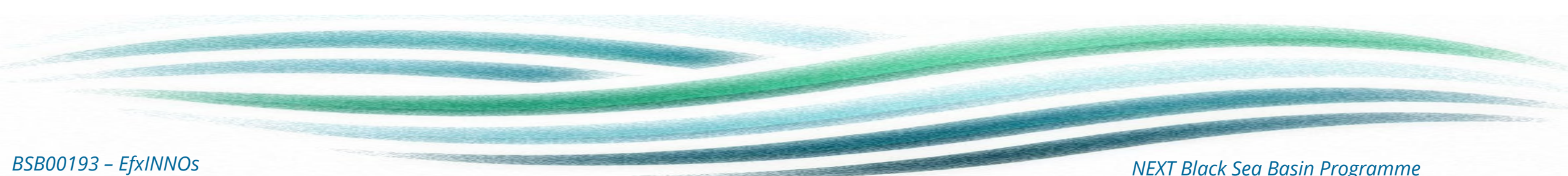
DEMOCRITUS
UNIVERSITY
OF THRACE

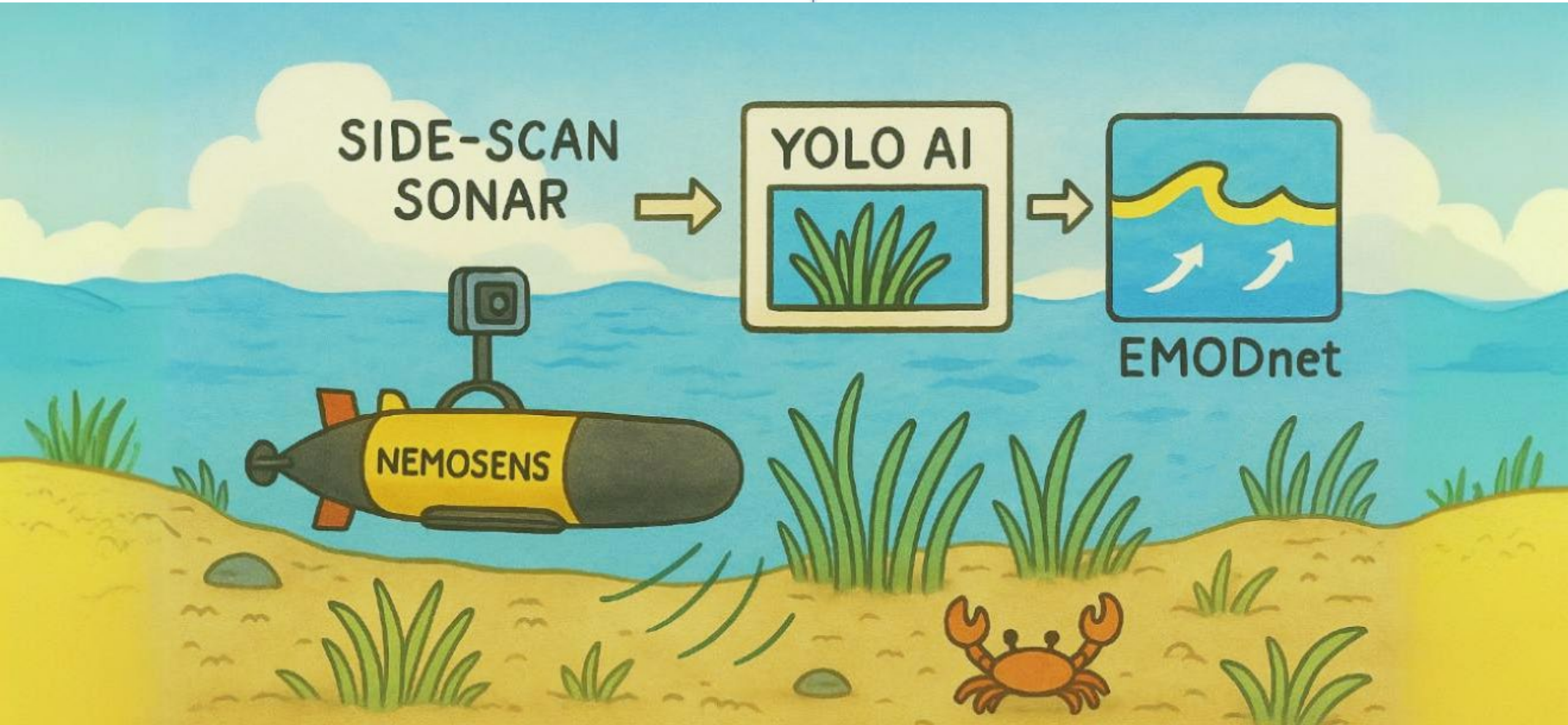
Myrintzou Vasiliki, DUTH
Nikolaos Kokkos, DOMI Dev. P.C.



DOMI Development P.C

17 April 2026, Tbilisi





micro-AUVs – What are they?

Autonomous Underwater Vehicles (AUVs)

are self-propelled, untethered robots that navigate underwater without real-time human control.

micro-AUVs (mAUVs) are a compact sub-class — typically **< 1 m in length and < 10 kg** — designed for shallow-water and coastal operations where larger AUVs cannot access.

They carry integrated sensor payloads and follow pre-programmed mission plans, enabling **repeatable, high-resolution surveys** with minimal ship time.

Small & Lightweight

< 1 m long, < 10 kg — deployable by hand from a small boat or shore

Fully Autonomous

Pre-programmed waypoint missions; no tether or constant operator input

Modular Payload Bay

Swappable sensors: side-scan sonar, camera, CTD, water sampler

Cost-Effective

10–50× cheaper to operate than crewed survey vessels

micro-AUVs – Key Advantages for Marine Monitoring

Access to Shallow & Complex Areas

Operate in water depths of 1–300 m, including rocky reefs, seagrass beds and confined areas inaccessible to survey vessels or towfish.

Proximity to the Seabed

Flying at 1–3 m altitude above the bottom, mAUVs dramatically improve the resolution of sonar imagery and optical data compared to surface-towed systems.

Repeatable Missions

Pre-programmed waypoint plans allow identical transects to be re-run across surveys, enabling robust temporal change detection of habitats and litter accumulation.

Multi-Sensor Integration

A single dive can simultaneously collect side-scan sonar, stereo video, USBL positioning and water quality data — reducing the number of field operations required.

Minimal Environmental Impact

Electric propulsion and small hydrodynamic profile reduce noise and physical disturbance to sensitive benthic communities compared to vessels or divers.

Reduced Cost & Crew

A two-person team can operate an mAUV from an inflatable boat, replacing crewed research vessels and significantly cutting survey costs and carbon footprint.

Technology platform and data collection

RTSYS NEMOSENS mAUV equipped with:

- **RBRlegato CTD**: salinity and temperature data
- **GoPro Camera**: RGB videos and images
- **StarFish 454 Side Scan Sonar**: acoustic images



Side-scan sonars

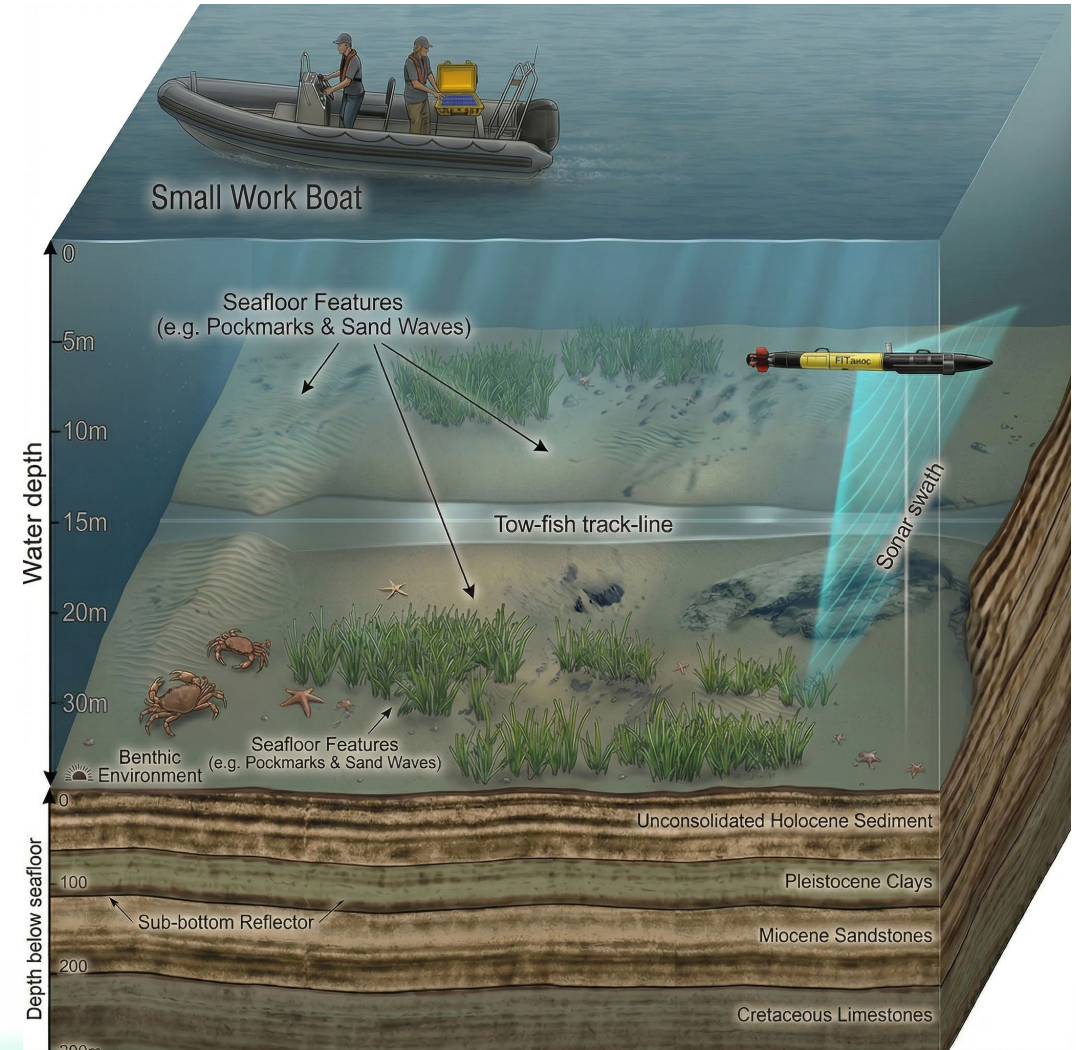
The Side Scan Sonar (SSS) is an acoustic reflection technology. **Basically, they use a swath of sound** to survey the seafloor.

Side-scan sonars **emit conical or fan-shaped pulses across a wide angle** perpendicular to the path of their towed sensors ('towfish' or 'rail') and record the echoes.

The received signals (echoes) create a detailed image of the **seafloor's reflectivity and its anomalies** ('sonograph') within the beam's swath (coverage range). The travel time and intensity of the returned pulse are recorded.

The **reflectivity** of the seafloor **depends on its roughness** and the nature of the topmost material:

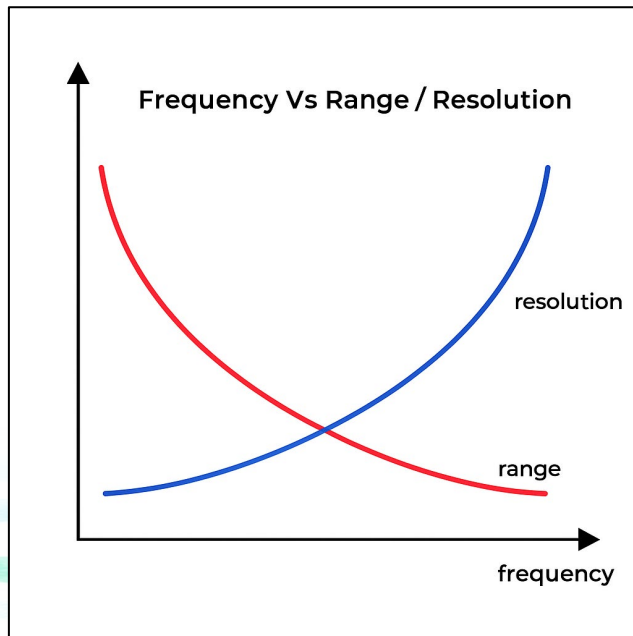
- coarse-grain sediments display higher reflectivity than fine-grain deposits,
- rocky outcrops reflect higher than sediments, etc.



Side-scan sonars – Range of detection

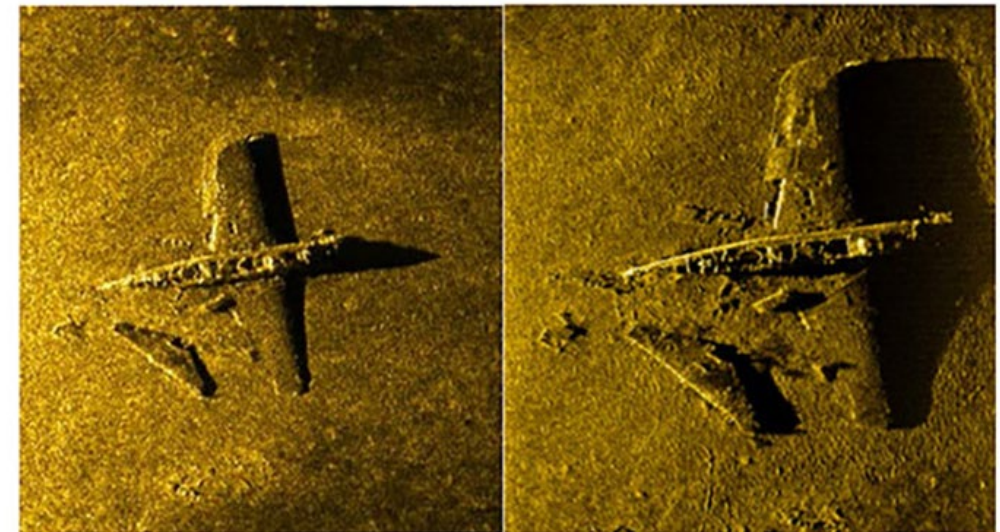
The **lower 200 kHz** frequency side scan sonar is capable of detecting large targets at **ranges of 150 meters**.

The **higher 455 kHz** frequency side scan sonar **has a narrow beam** and **shorter (100m) range** for **more detailed** images of closer targets.



400 KHz

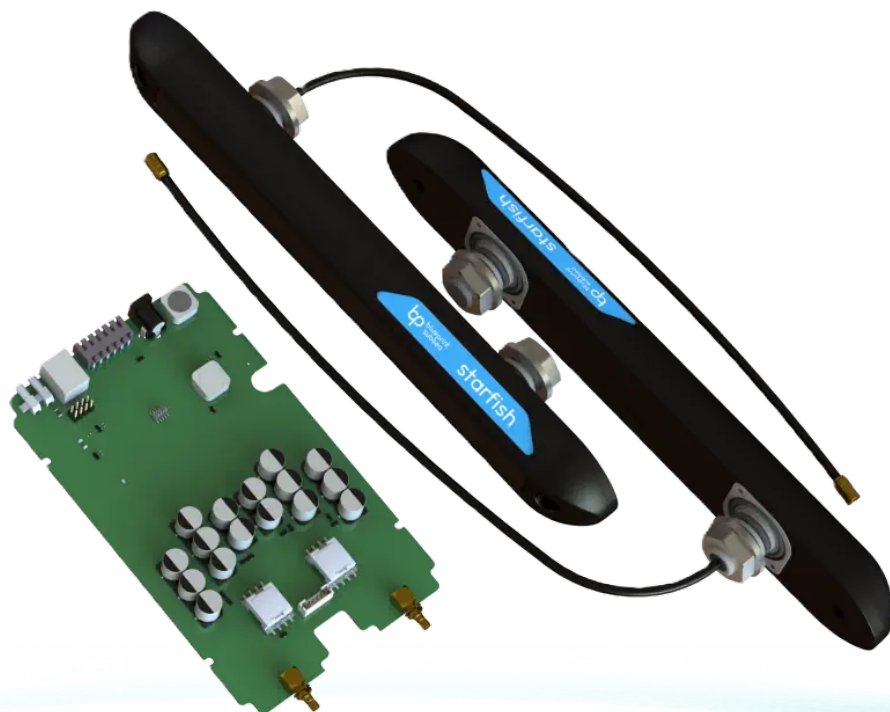
600 kHz



900 kHz

1600 kHz

Side-scan sonars – StarFish 454 OEM

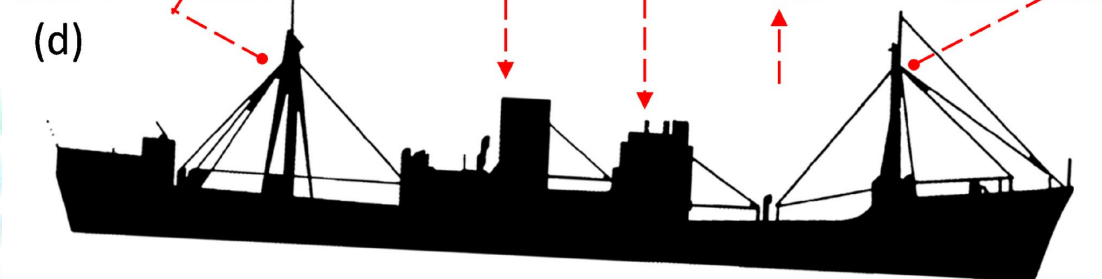
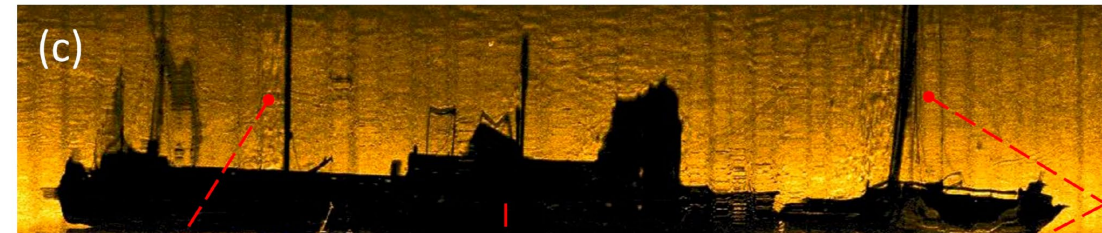
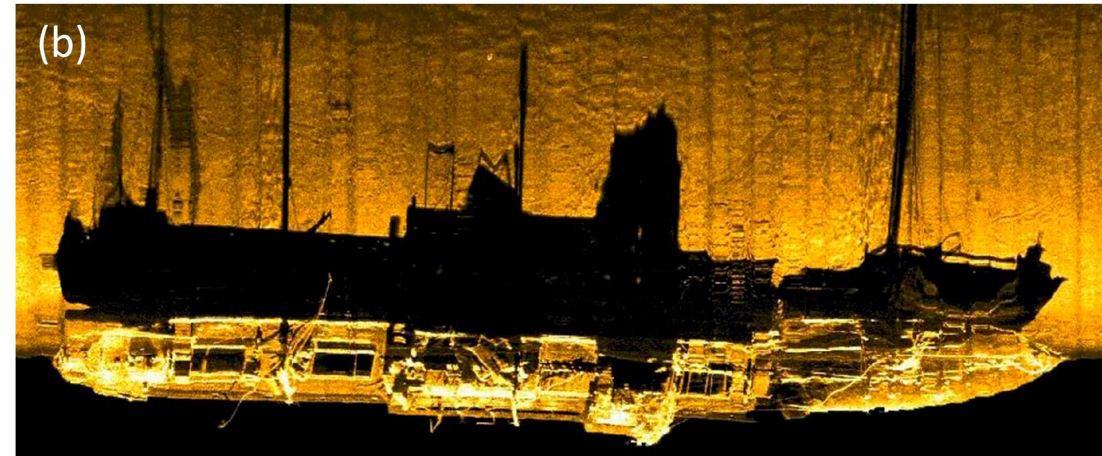
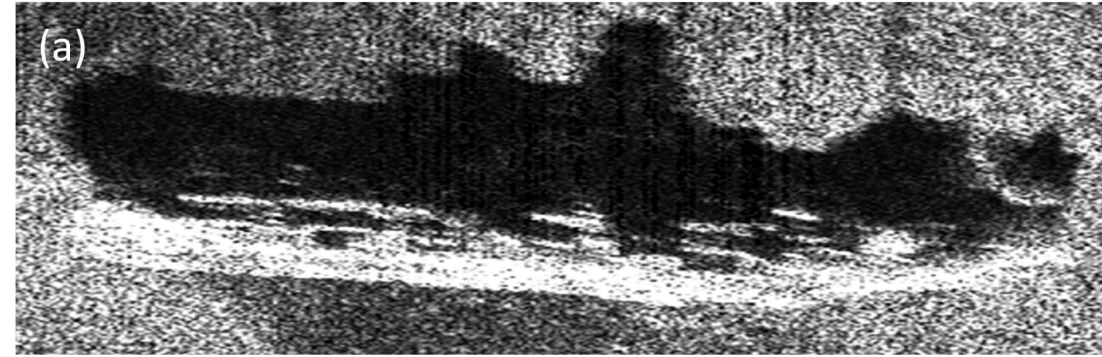
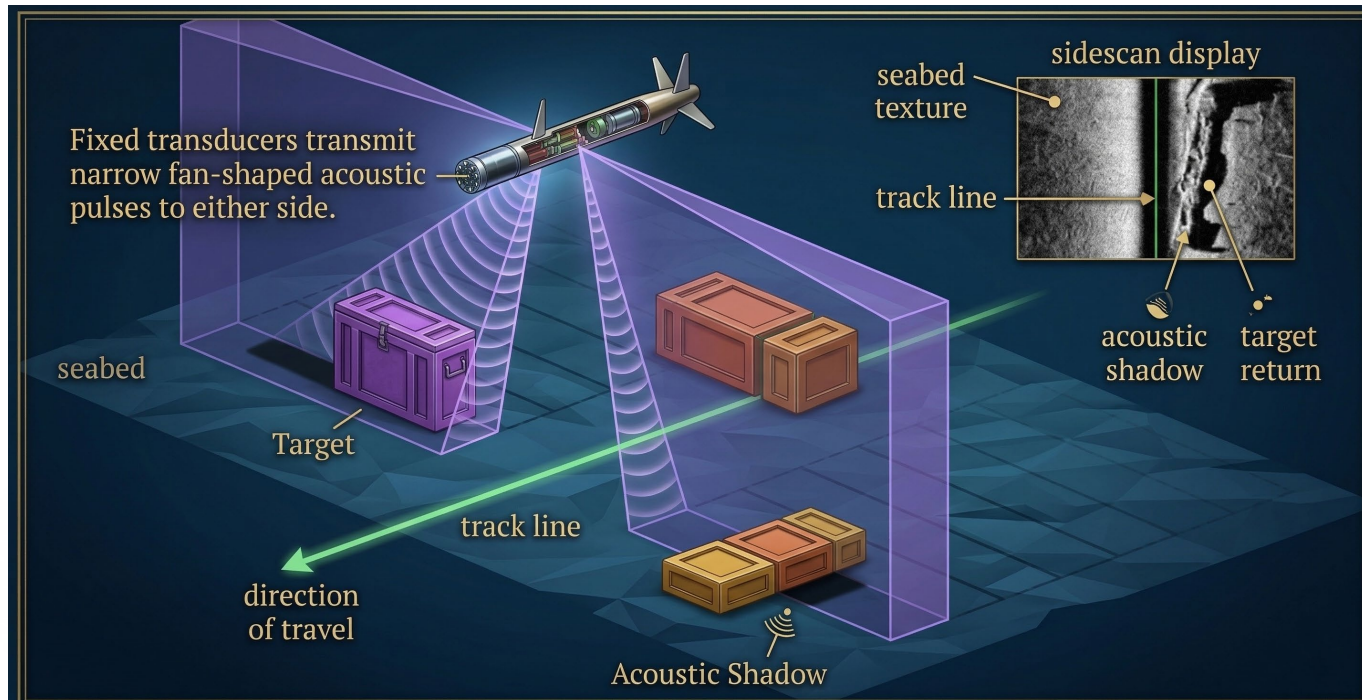


	StarFish 454 OEM
Frequency	450kHz CHIRP
Operating Range	Up to 100m per channel
Horizontal Beam Width	0.5°
Vertical Beam Width	60°
Transducer Angle	Variable (OEM Specified)
Dimensions	390mm x 22.5mm x 40mm
Weight (In Air)	0.8kg
Construction	Polyurethane Rubber (PA6 Housing)
Colour	Black

Side-scan sonars – Acoustic shadow

Using a side scan sonar is rather like **looking at a world made of shiny black plastic, in the dark, with only a narrow torch beam for illumination.**

It can be the most important sonar imagery feature as **it provides a three-dimensional quality** to a two-dimensional survey.

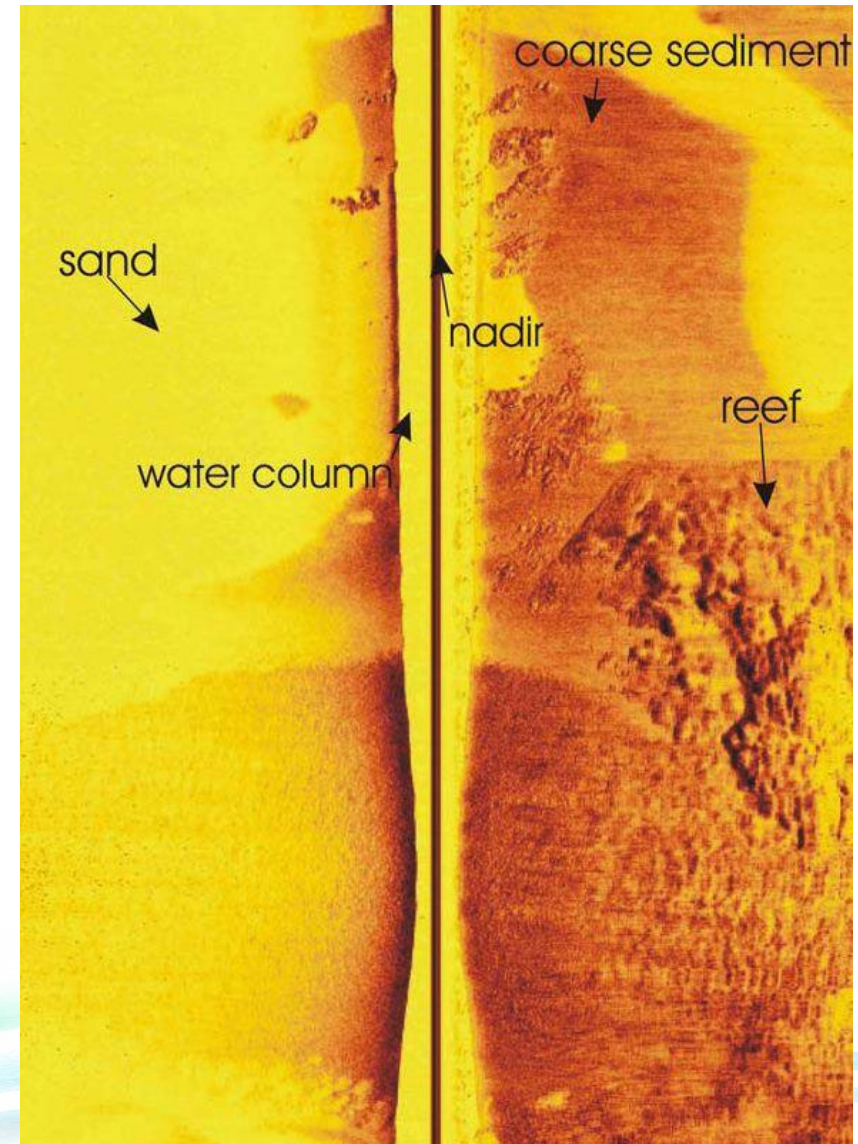
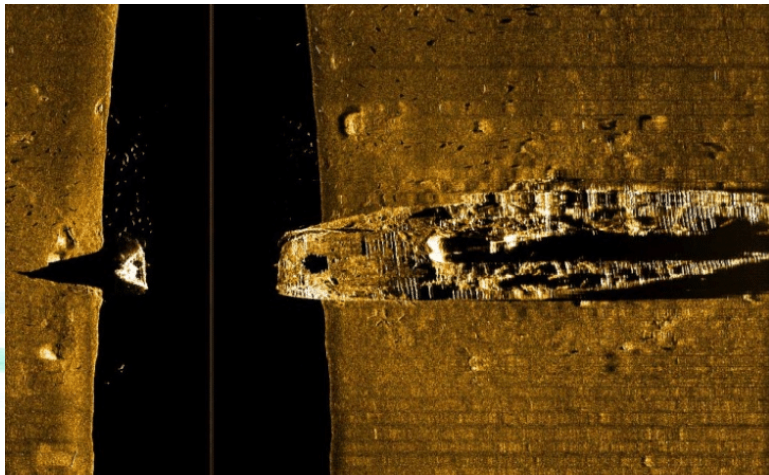


Side-scan sonars – Nadir line

Side-scan sonars **measure the time of each return to calculate the location of targets** on the seabed.

The **nadir zone** is the area on the seabed directly beneath the towfish where the beam hits at near-vertical incidence. It appears as a **bright line** in the sonar record because the strong vertical return creates ambiguity.

The **water column** is the area appearing to the left and to the right of the center line, making up approximately 5% of the range scale.



eXtented Triton Format (XTF) files

An XTF file can be thought of as a “**pool**” of data.

If you use XTF to collect data during a survey, you **can add data to the file at any time without needing to synchronize** your data packets.

For example:

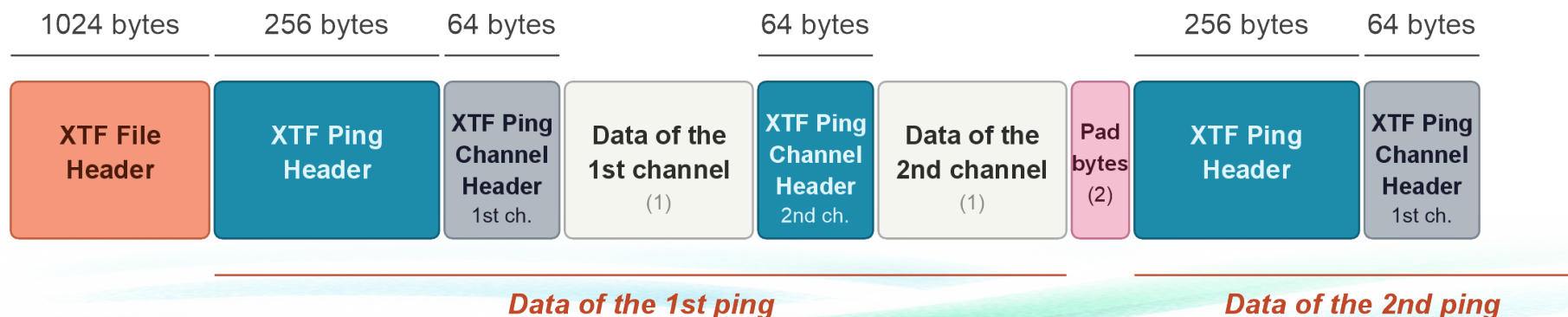
- bathymetry data may be logged five times per second
- sonar data is being logged at 10 times per second.

No storage space is wasted and no “holes” are created in the saved data stream.

Triton Imaging, Inc (1988)



XTF file structure



...



(1) Variable length — depends on samples per ping and bit depth.

(2) Pad bytes align the next ping block to a 512-byte boundary.

SONARWIZ

Developed by **Chesapeake Technology**, is an all-in-one software solution for geophysical, hydrographic, pipeline, and archaeological marine surveys.

- real-time data acquisition
- post-processing
 - sidescan,
 - sub-bottom,
 - bathymetry, and
 - magnetometry data

ReefMaster

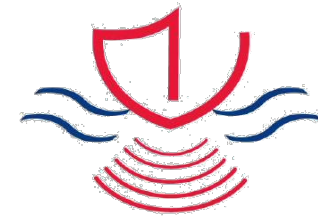


Developed by **ReefMaster Software**, is a Windows-based software.

- Track and depth log import
- Real-time mapping
- Sidescan mosaic creation
- Waypoint and route management
- Export to GPS

BSB00193 – EfxINNOs

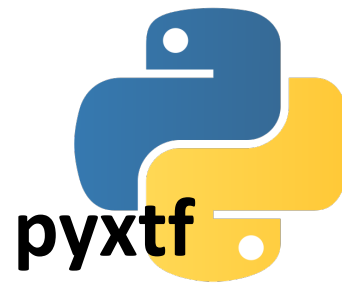
OpenSideScan



CIDCO

Developed by **CIDCO**.
Open-source software for:

- processing and
- visualizing sidescan sonar data



Developed by **Oystein Sture (oysstu)**, is a Python library for reading and writing eXtended Triton Format (XTF) files.

- Read and parse XTF files (file headers & sonar/sub-bottom/bathymetry packets)
- Write or generate XTF files
- Support for reading multiple data packet types (navigation, ping, attitude, etc.)

Interreg



Co-funded by
the European Union

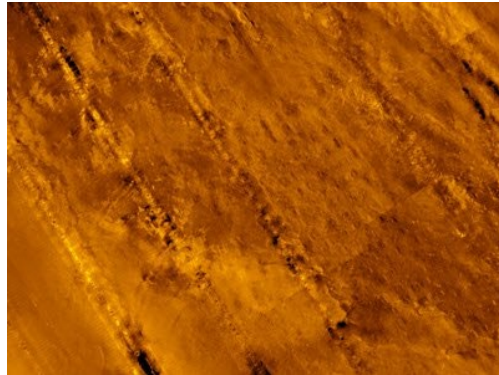
NEXT Black Sea Basin



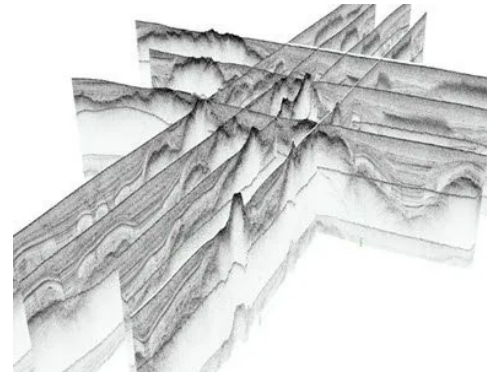
SONARWIZ

Developed by **Chesapeake Technology**, is an all-in-one software solution for geophysical, hydrographic, pipeline, and archaeological marine surveys.

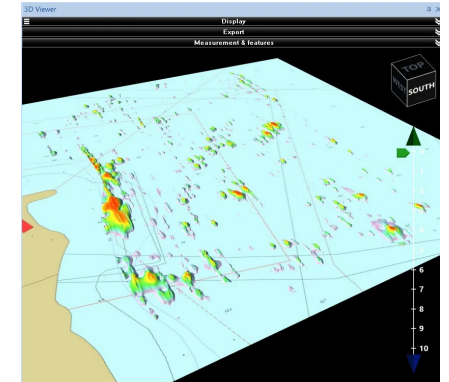
Sidescan



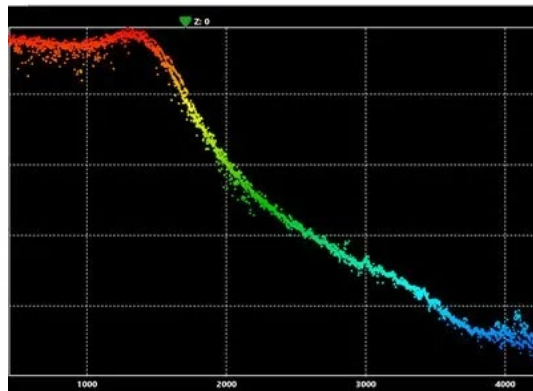
Sub-Bottom



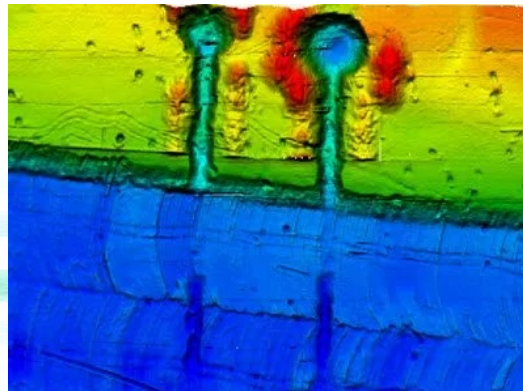
Magnetometry



Single beam



Multi-beam



<https://chesapeaketech.com/products/sonarwiz-sidescan/>



- EfxINNOs

Main view

The screenshot displays the SonarWiz 8 V8.3.0 x64 software interface. The main window is titled "SSS_Sonarwiz_Blank.mml - SonarWiz 8 V8.3.0 x64 Idle". The interface includes a menu bar (File, Data Acquisition, Post Processing, Bathymetry, Maps, View, Tools, Help, About) and a toolbar with icons for Data Acquisition Views, Vessel, Sonar, Navigation, Magnetometer, Motion Sensor, Remote Contacts, Layback, Outputs, Add Line, Line Manager..., Line Tools, Record..., Record Turn, Stop Recording, Auto Record, Real-time Mosaic, Sidescan..., Sub-bottom..., Bottom Tracker..., Event Setup..., Event Now!, Add Logbook Entry..., and Reset RT Coloring.

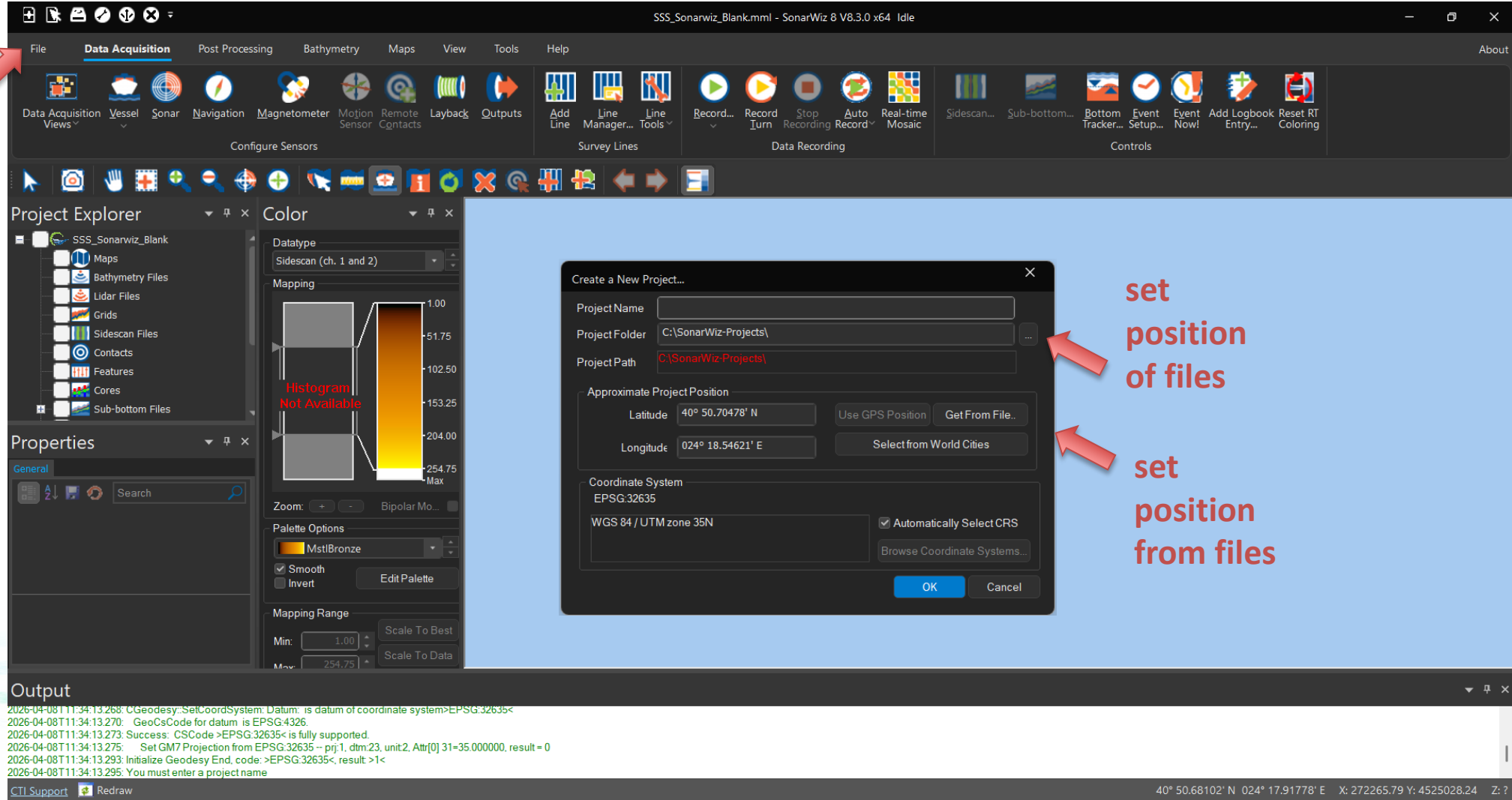
Below the toolbar is a "Configure Sensors" section with icons for various sensors. The main workspace is divided into several panels:

- Project Explorer:** Shows a tree view of the project structure, including Maps, Bathymetry Files, Lidar Files, Grids, Sidescan Files, Contacts, Features, Cores, and Sub-bottom Files.
- Color:** A panel for configuring the color mapping of the data. It includes a "Datatype" dropdown set to "Sidescan (ch. 1 and 2)", a "Mapping" section with a color bar and a "Histogram Not Available" message, and a "Zoom" section with "Bipolar Mo..." and "Scale To Best" options.
- Properties:** A panel for general properties, including a search bar and a "General" tab.
- Output:** A panel at the bottom showing a log of system messages, including coordinates and system status.

The main workspace area is currently empty, displaying a light blue background.

Project creation

Create
a new
project



The screenshot displays the SonarWiz 8 V8.3.0 x64 software interface. The main window shows the 'Data Acquisition' menu and various toolbars. A red arrow points to the 'File' menu, with the text 'Create a new project' next to it. The 'Project Explorer' on the left shows a tree view of project files. The 'Properties' panel on the right shows the 'General' tab. The 'Color' panel shows a 'Histogram Not Available' message. The 'Output' panel at the bottom shows a log of system messages.

Create a New Project...

Project Name:

Project Folder:

Project Path:

Approximate Project Position

Latitude:

Longitude:

Coordinate System

EPSG:32635

WGS 84 / UTM zone 35N ☒ Automatically Select CRS

set position of files

set position from files

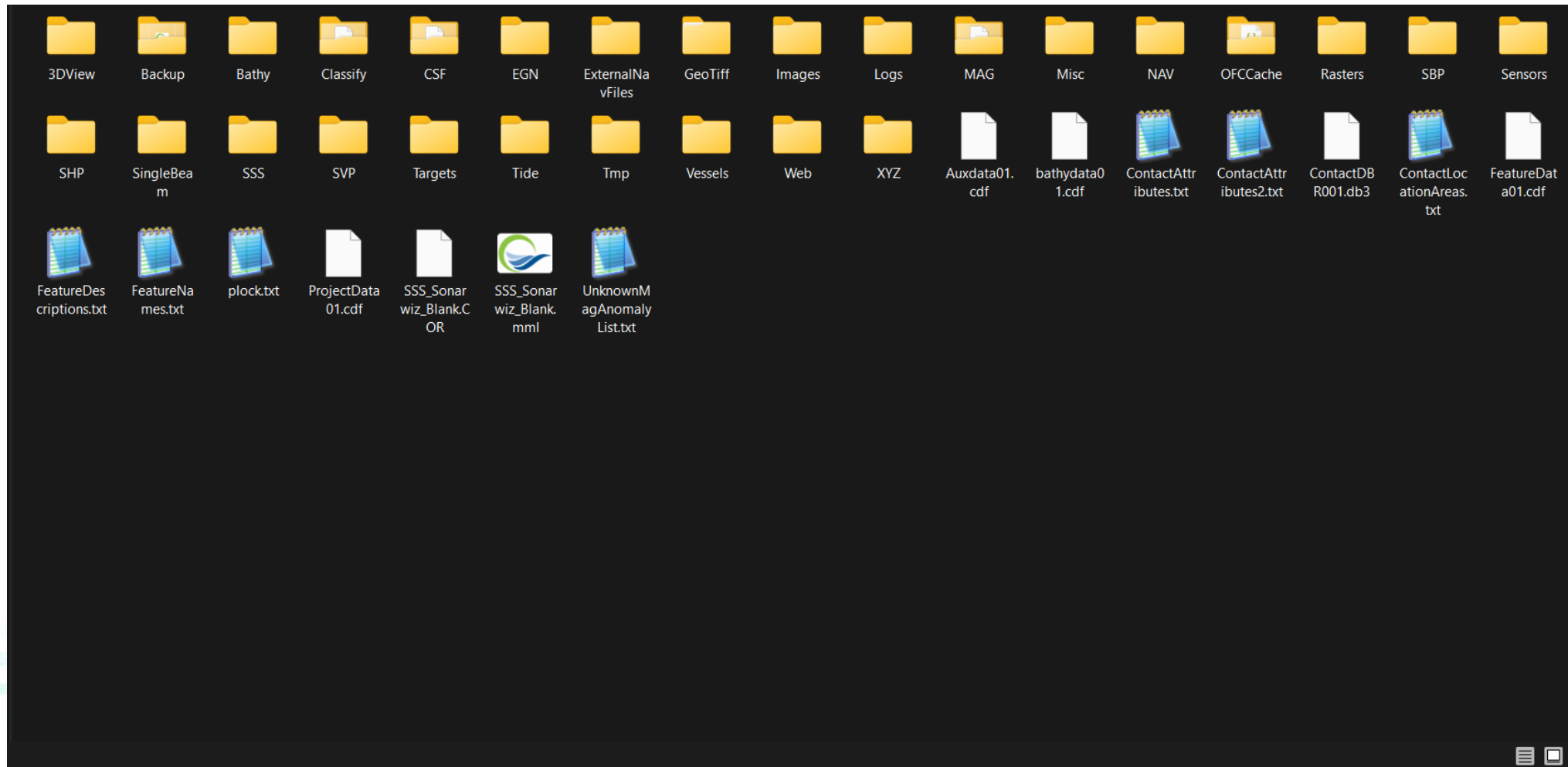
Output

2026-04-08T11:34:13.268: C:\Geodesy\SetCoordSystem: Datum: is datum of coordinate system>EPSG:32635<
2026-04-08T11:34:13.270: GeoCsCode for datum is EPSG:4326.
2026-04-08T11:34:13.273: Success: CSCode >EPSG:32635< is fully supported.
2026-04-08T11:34:13.275: Set GM7 Projection from EPSG:32635 -- proj.1, dtm.23, unit.2, Attr[0] 31=35.000000, result = 0
2026-04-08T11:34:13.293: Initialize Geodesy End, code: >EPSG:32635<, result: >1<
2026-04-08T11:34:13.295: You must enter a project name

CTI Support Redraw

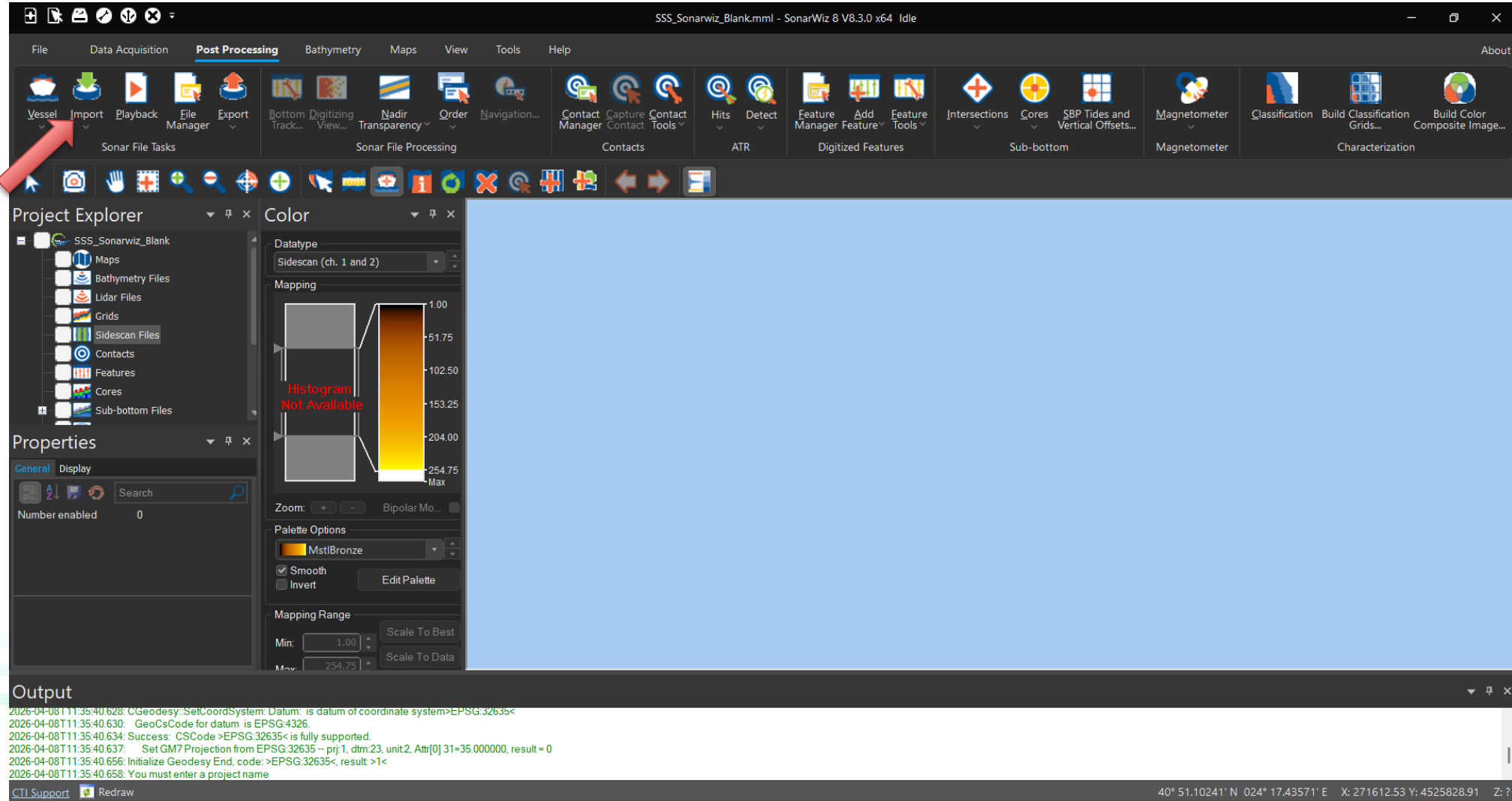
40° 50.68102' N 024° 17.91778' E X: 272265.79 Y: 4525028.24 Z: ?

Project folder



Import files

import
SSS files



SSS_Sonarwiz_Blank.mml - SonarWiz 8 V8.3.0 x64 Idle

File Data Acquisition **Post Processing** Bathymetry Maps View Tools Help

Vessel Import Playback File Manager Export Sonar File Tasks

Bottom Digitizing Track... View... Nadir Transparency Order Navigation... Sonar File Processing

Contact Manager Capture Contact Contact Tools Contacts

Hits Detect ATR

Feature Manager Feature Add Feature Tools Digitized Features

Intersections Cores SBP Tides and Vertical Offsets... Sub-bottom

Magnetometer Magnetometer

Classification Build Classification Grids... Build Color Composite Image... Characterization

Project Explorer

- SSS_Sonarwiz_Blank
 - Maps
 - Bathymetry Files
 - Lidar Files
 - Grids
 - Sidescan Files
 - Contacts
 - Features
 - Cores
 - Sub-bottom Files

Properties

General Display

Number enabled 0

Color

Datatype: Sidescan (ch. 1 and 2)

Mapping

Histogram Not Available

Zoom: + - Bipolar Mo...

Palette Options

MstlBronze

Smooth Invert Edit Palette

Mapping Range

Min: 1.00 Scale To Best

Max: 254.75 Scale To Data

Output

2026-04-08T11:35:40.628: CGeodesy.SetCoordSystem: Datum: is datum of coordinate system>EPSG:32635<
2026-04-08T11:35:40.630: GeoCsCode for datum is EPSG:4326.
2026-04-08T11:35:40.634: Success: CSCode>EPSG:32635< is fully supported.
2026-04-08T11:35:40.637: Set GM7 Projection from EPSG:32635 -- prj:1, dtm:23, unit:2, Attr[0] 31=35.000000, result = 0
2026-04-08T11:35:40.656: Initialize Geodesy End, code:>EPSG:32635<, result:>1<
2026-04-08T11:35:40.658: You must enter a project name

CTI Support Redraw

40° 51.10241' N 024° 17.43571' E X: 271612.53 Y: 4525828.91 Z: ?

Import files

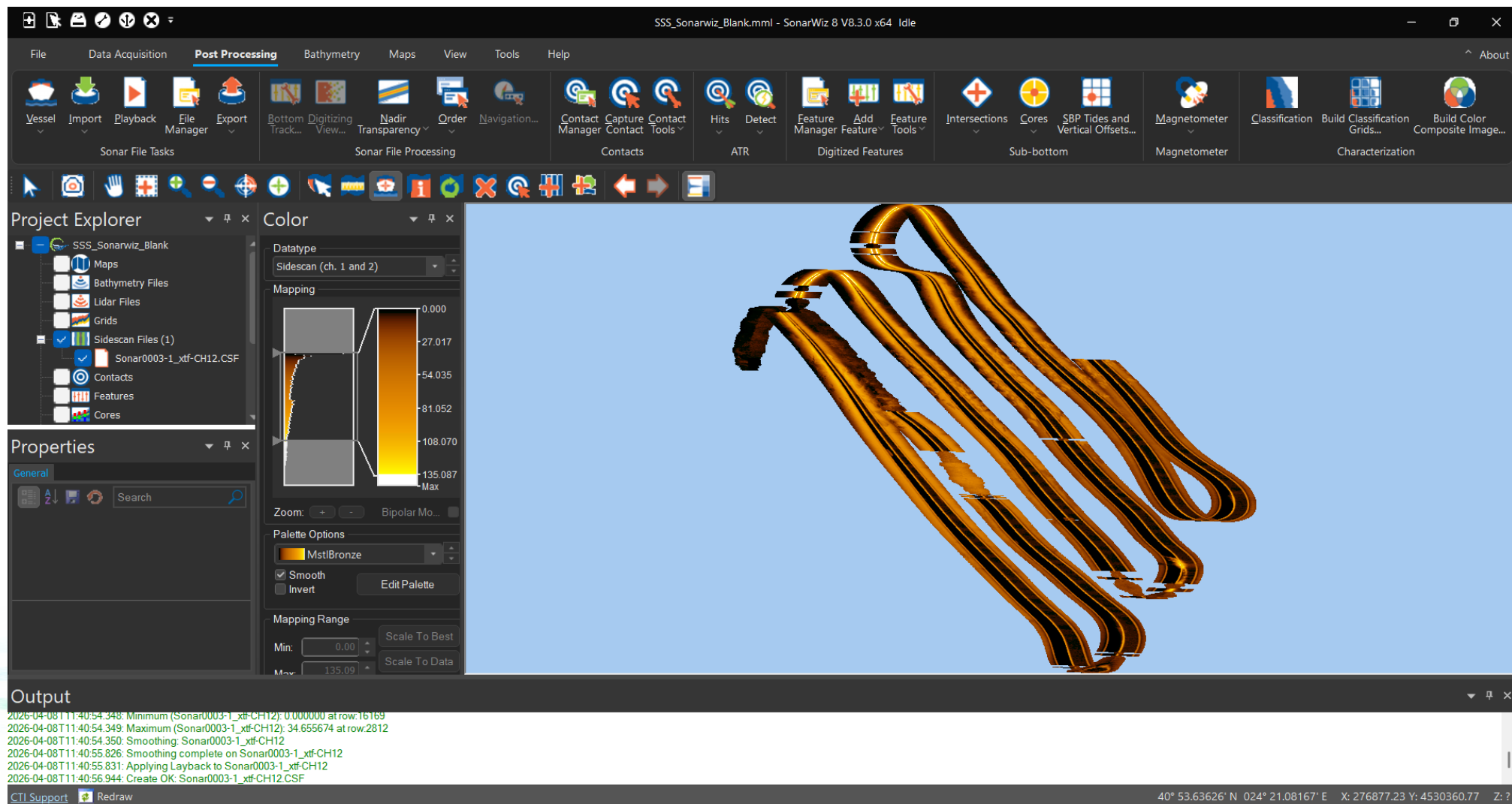
The screenshot displays the SONARWIZ software interface. The main window is titled 'Import' and shows a file explorer view of the 'Palio' folder on the desktop. The file list includes several .xtf files: Sonar0000.xtf, Sonar0002-1.xtf, Sonar0003.xtf, Sonar0003-1.xtf, Sonar0004.xtf, Sonar0005.xtf, and Sonar0006.xtf. The 'File name' field is empty, and the 'File Type' is set to 'All Acoustic Data'. The 'Import Settings' section shows 'Channels 1 and 2' and 'Channel 1' selected. The 'Import Spatial Reference ID' is set to 'EPSG:4326 WGS 84'. The 'Import' button is highlighted.

On the left side of the interface, the 'Project Explorer' shows a tree view of the project files, including 'SSS_Sonarwiz_Blank', 'Maps', 'Bathymetry Files', 'Lidar Files', 'Grids', 'Sidescan Files', 'Contacts', 'Features', 'Cores', and 'Sub-bottom Files'. The 'Properties' panel shows the 'General' tab with 'Number enabled' set to 0. The 'Output' panel at the bottom displays a log of system messages, including coordinate system settings and projection information.

A red arrow points to the 'Histogram Not Available' message in the 'Properties' panel, with the text 'check this' written next to it.

The bottom status bar shows the following coordinates: 40° 51.10241' N 024° 17.43571' E X: 271612.53 Y: 4525828.91 Z: ?

Import files



The screenshot displays the SonarWiz V8.3.0 software interface. The main window shows a 3D visualization of sonar data, rendered in a golden-brown color scheme, representing a bathymetric profile. The interface includes a menu bar (File, Data Acquisition, Post Processing, Bathymetry, Maps, View, Tools, Help) and a toolbar with various icons for file operations, data processing, and visualization. The left sidebar contains the Project Explorer, showing a tree view of the project files, including Maps, Bathymetry Files, Lidar Files, Grids, Sidescan Files (1), Sonar0003-1_xtf-CH12.CSF, Contacts, Features, and Cores. The Properties panel on the right shows the current file's settings, including Datatype (Sidescan (ch. 1 and 2)), Mapping, Zoom, Palette Options (MstlBronze), and Mapping Range. The Output window at the bottom displays a log of system messages, including file loading, smoothing, and visualization steps. The status bar at the bottom shows the current coordinates: 40° 53.63626' N 024° 21.08167' E, X: 276877.23 Y: 4530360.77, and Z: ?.

SSS_Sonarwiz_Blank.mml - SonarWiz 8 V8.3.0 x64 Idle

File Data Acquisition **Post Processing** Bathymetry Maps View Tools Help

Vessel Import Playback File Manager Export Bottom Digitizing Track... View... Nadir Transparency Order Navigation... Contact Manager Contact Capture Contact Tools Hits Detect Feature Manager Feature Add Feature Tools Intersections Cores SBP Tides and Vertical Offsets... Magnetometer Classification Build Classification Grids... Build Color Composite Image...

Sonar File Tasks Sonar File Processing Contacts ATR Digitized Features Sub-bottom Magnetometer Characterization

Project Explorer

- SSS_Sonarwiz_Blank
 - Maps
 - Bathymetry Files
 - Lidar Files
 - Grids
 - Sidescan Files (1)
 - Sonar0003-1_xtf-CH12.CSF
 - Contacts
 - Features
 - Cores

Properties

General

Search

Color

Datatype: Sidescan (ch. 1 and 2)

Mapping

Zoom: + - Bipolar Mo...

Palette Options

MstlBronze

Smooth

Invert

Edit Palette

Mapping Range

Min: 0.00 Scale To Best

Max: 135.09 Scale To Data

Output

2026-04-08T11:40:54.348: Minimum (Sonar0003-1_xtf-CH12): 0.000000 at row:16169

2026-04-08T11:40:54.349: Maximum (Sonar0003-1_xtf-CH12): 34.655674 at row:2812

2026-04-08T11:40:54.350: Smoothing: Sonar0003-1_xtf-CH12

2026-04-08T11:40:55.826: Smoothing complete on Sonar0003-1_xtf-CH12

2026-04-08T11:40:55.831: Applying Layback to Sonar0003-1_xtf-CH12

2026-04-08T11:40:56.944: Create OK: Sonar0003-1_xtf-CH12.CSF

CTI Support Redraw

40° 53.63626' N 024° 21.08167' E X: 276877.23 Y: 4530360.77 Z: ?

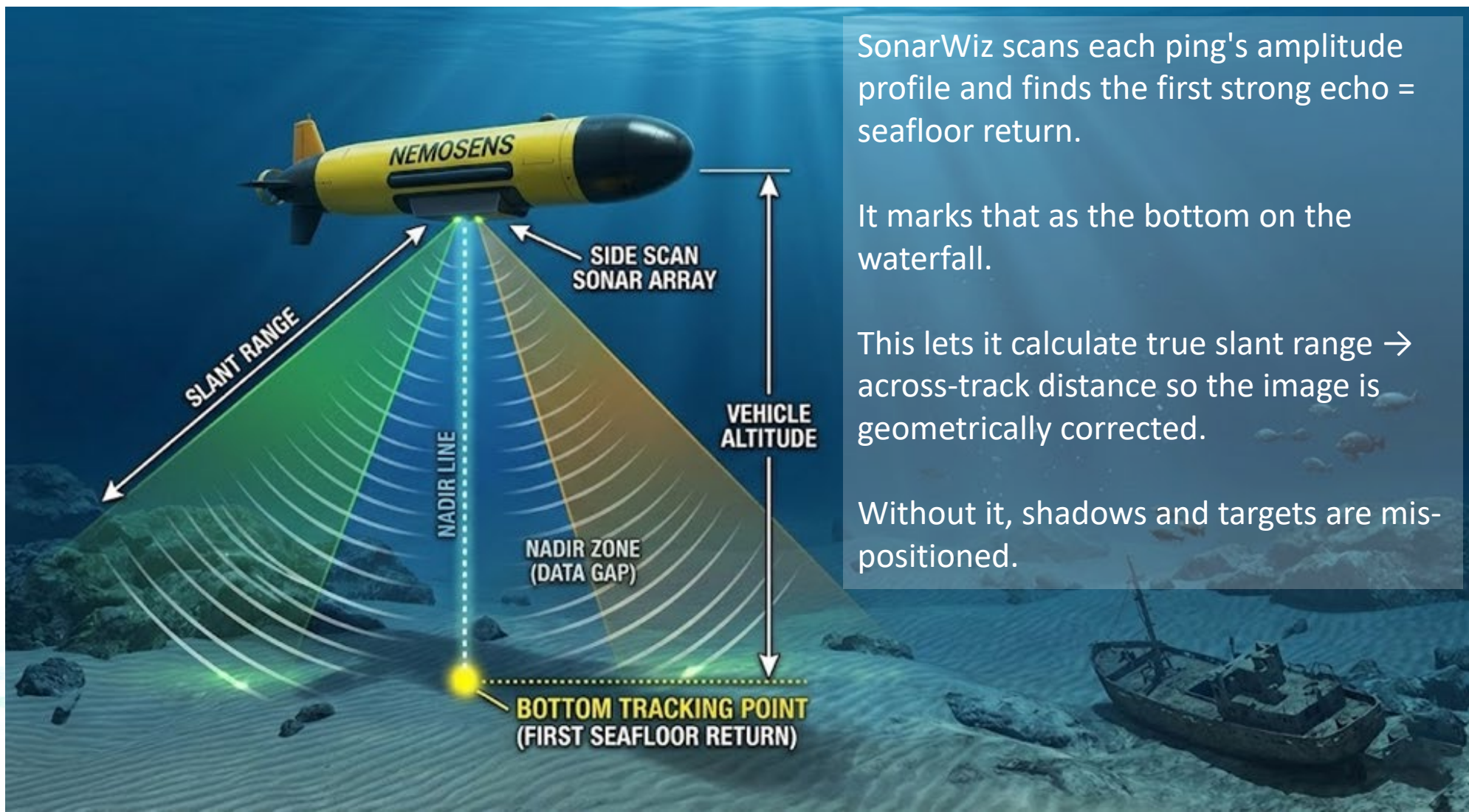
Bottom Track

Bottom track processing

select
SSS file

The screenshot displays the SonarWiz 8 V8.3.0 x64 software interface. The main window shows a 3D visualization of a sonar track, rendered in a yellow-to-orange color gradient, with red and green markers indicating specific data points. The interface includes a menu bar at the top with options like File, Data Acquisition, Post Processing, Symmetry, Maps, View, Tools, and Help. Below the menu bar is a toolbar with various icons for file operations, processing, and visualization. The left sidebar contains a Project Explorer with a tree view showing the project structure, including SSS files, Maps, Bathymetry Files, Lidar Files, Grids, and Sidescan Files. A red arrow points to the 'SSS' folder in the Project Explorer. The Properties panel on the left shows details for the selected file, 'Sonar0003-1_xtf-CH12.CSF', including its name, version, records, group name, and imported SRID. The Color panel on the right shows the mapping settings for the selected file, including a color scale and a mapping range. The Output panel at the bottom displays a log of processing steps, such as 'Minimum (Sonar0003-1_xtf-CH12): 0.000000 at row:16169' and 'Maximum (Sonar0003-1_xtf-CH12): 34.655674 at row:2812'.

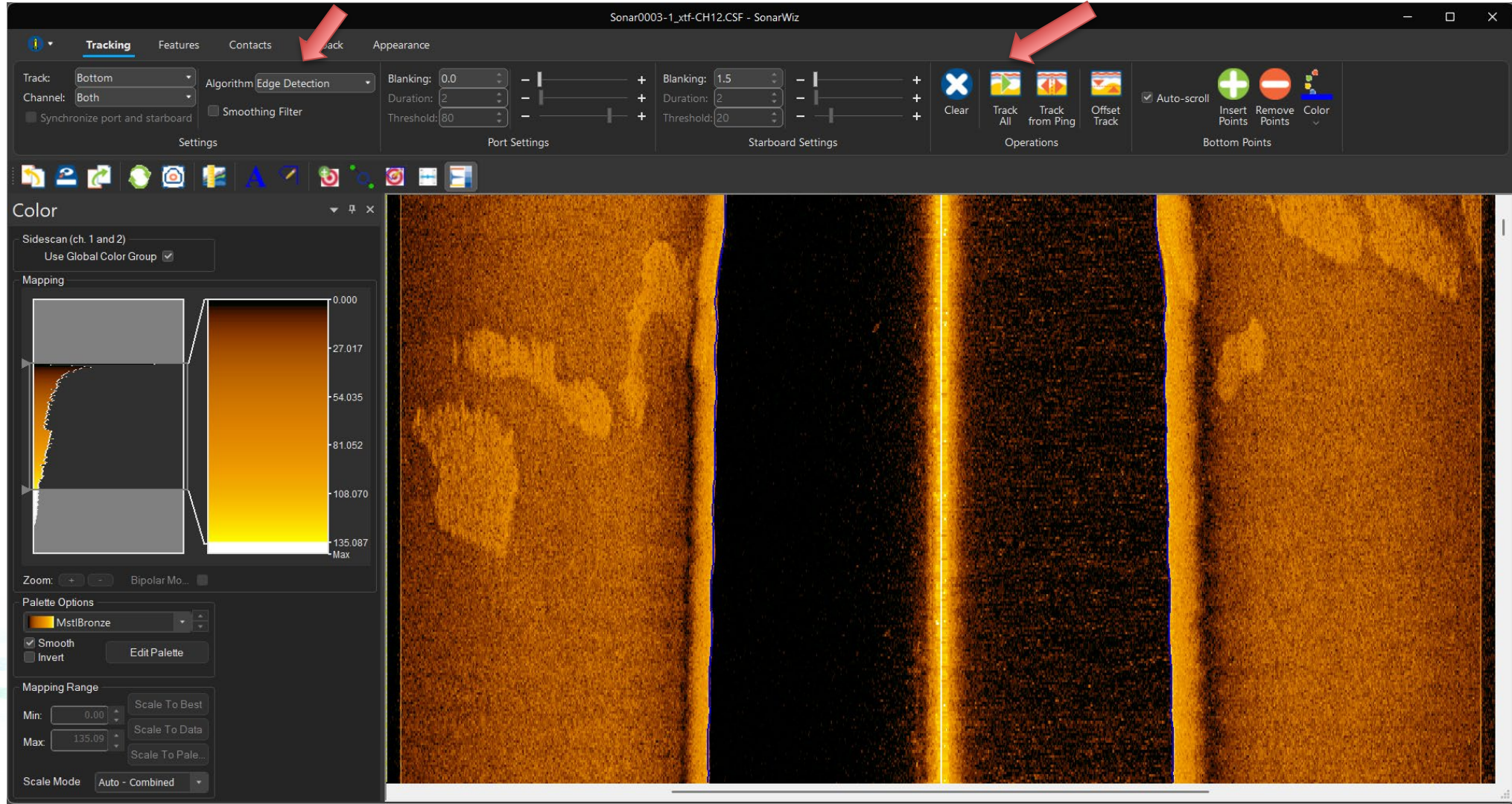
Bottom Track



Bottom Track

select algorithm

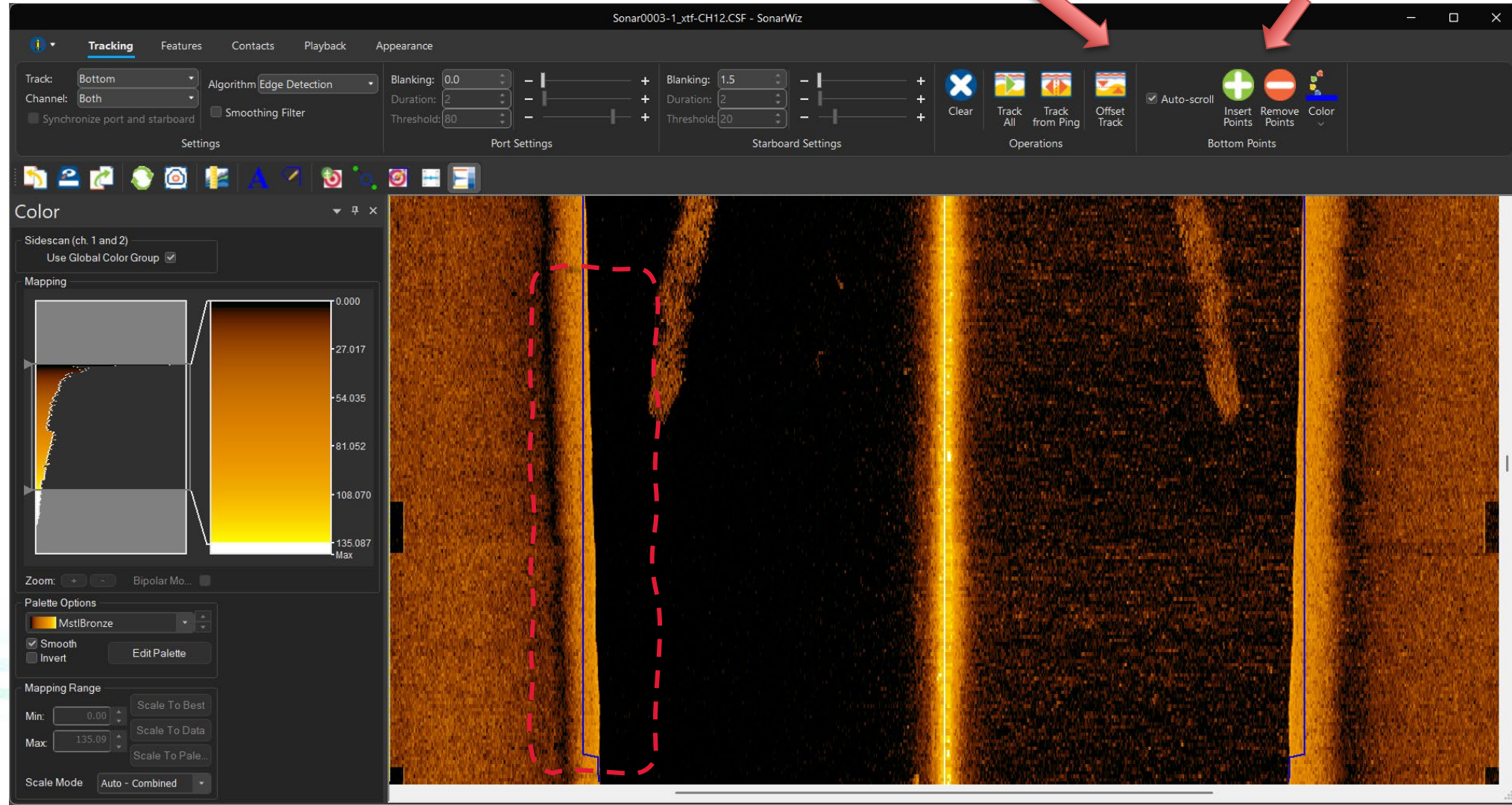
Track
processing



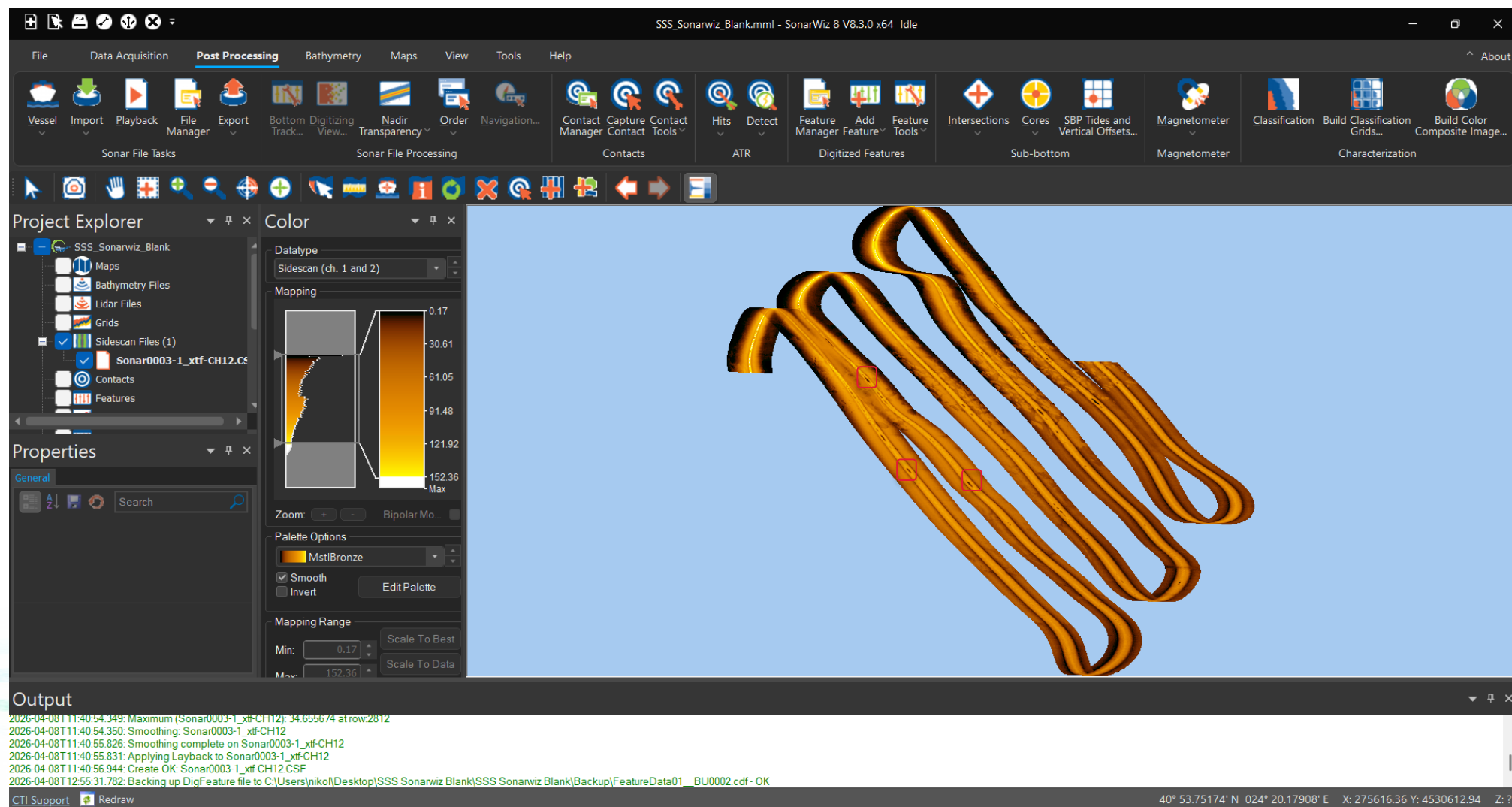
Bottom Track

add offset

remove/add points



Bottom Track



Sidescan Gain and Signal Processing

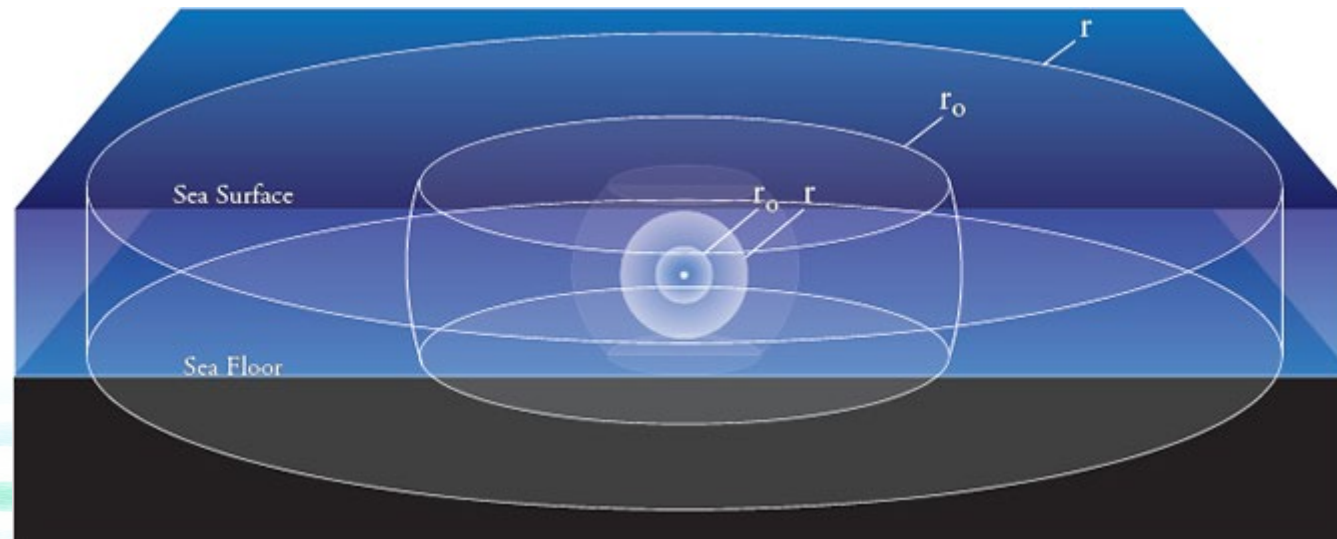
Sound **cannot propagate uniformly in all directions** from a source in the ocean forever.

Beyond some range the **sound will hit the sea surface or sea floor**.

Once the **sound is trapped between the top and bottom of the ocean** it gradually begins to spread cylindrically.

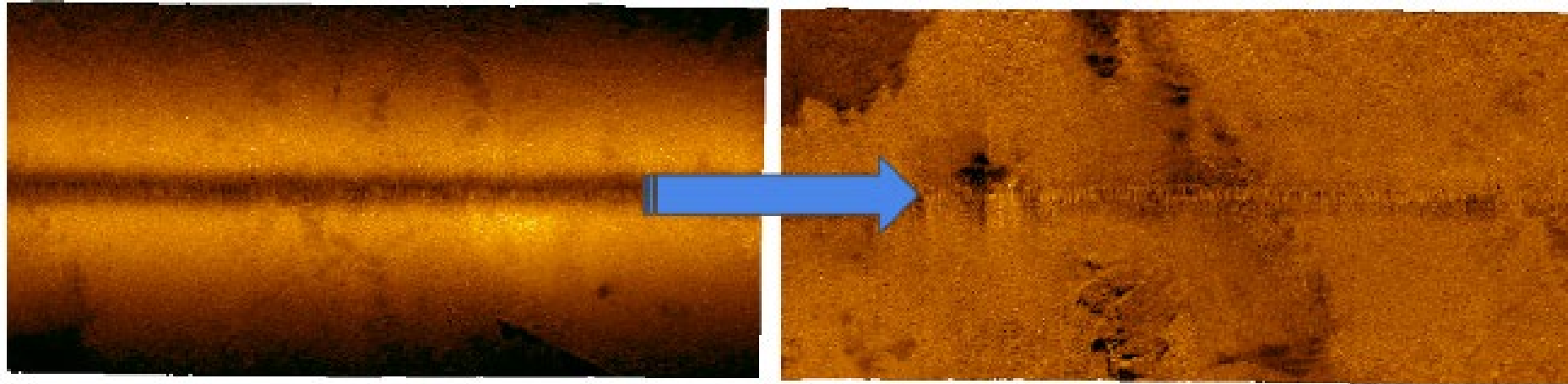
As acoustic waves propagate through the water, **they lose intensity** because of **geometric spreading** and **absorption**.

The result is an **across-track change in signal brightness** in the **waterfall** display.



Sidescan Gain and Signal Processing

SonarWiz provides algorithms for **leveling the brightness across track**.



Automatic Gain Control

Auto TVG

Beam Angle Correction

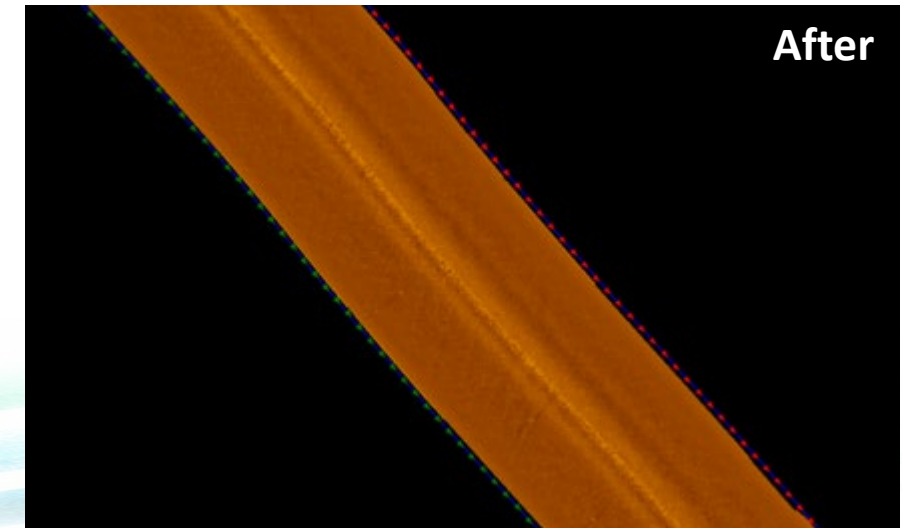
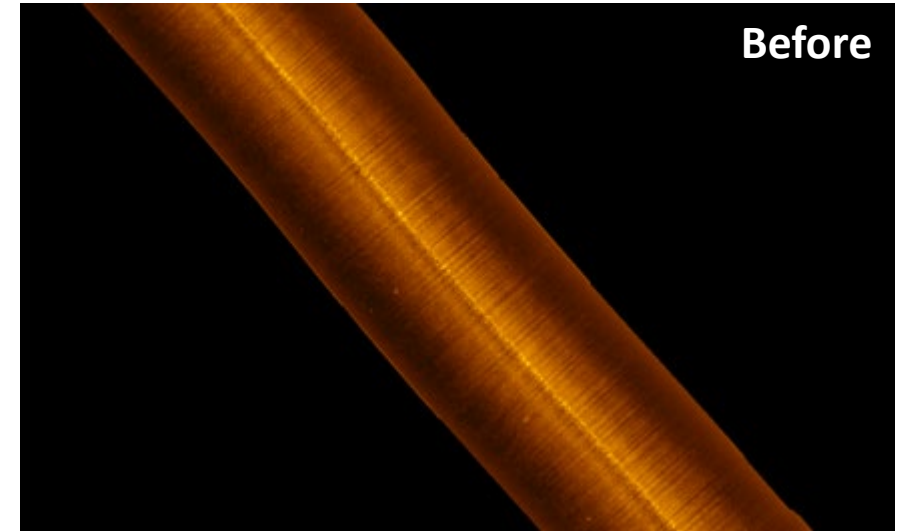
Empirical Gain Normalization

Automatic Gain Control

The AGC Algorithm:

1. **measures a local average signal strength**, and then
2. **rescales all the data** so that the local average is shifted to some **chosen global average** that determines on the large-scale how quiet or loud the data will be after rescaling.

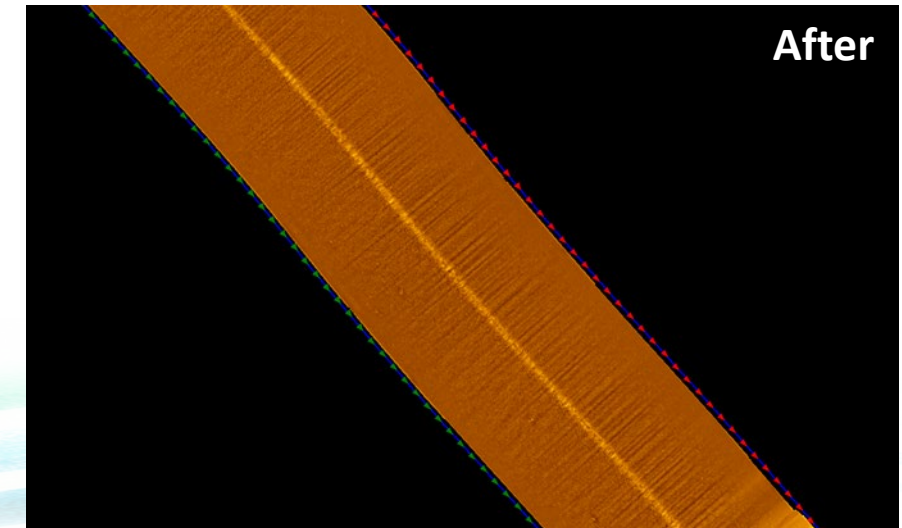
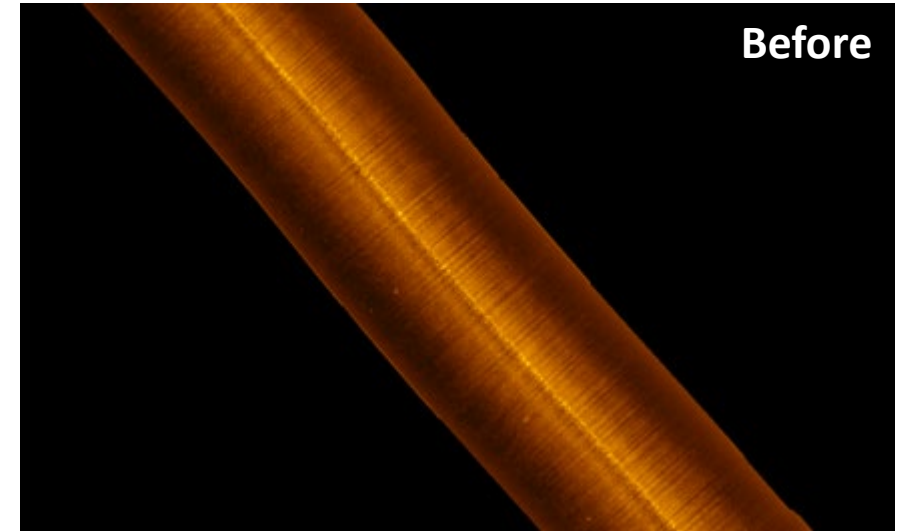
More specifically, the local average at a given ordinate is computed by averaging some number of samples to the left and right of this ordinate.



Beam Angle Correction

The Beam Angle Correction function (BAC):

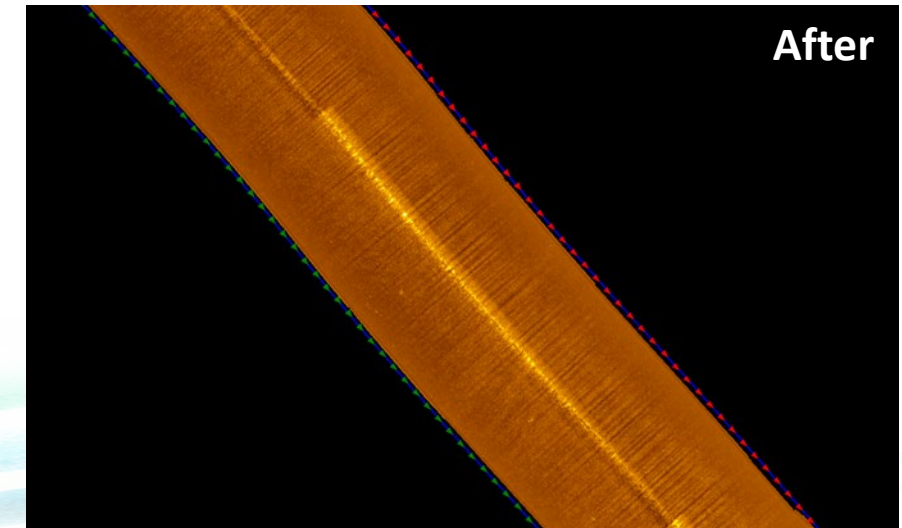
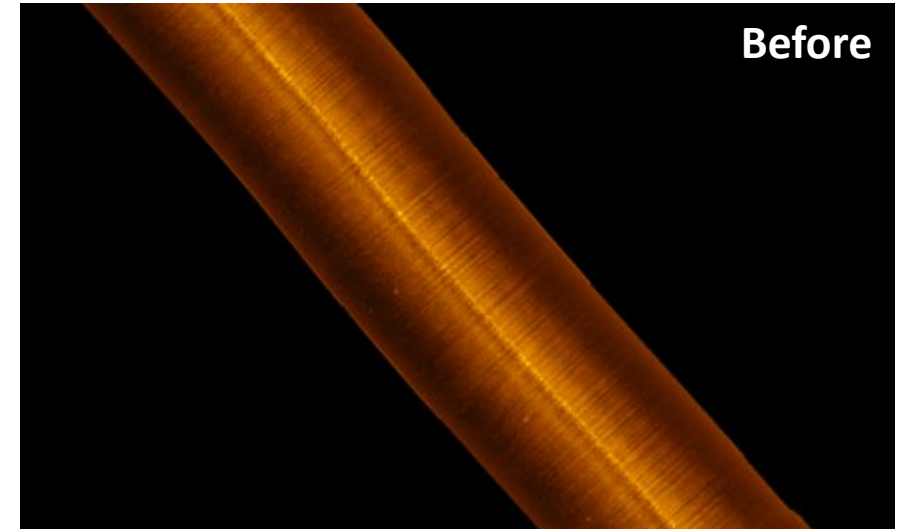
attempts to compensate for non-linear response characteristics of the sonar transducers.



Auto TVG (Time Varying Gain)

The Auto TVG function:

1. **dividing** the data into many **parallel swaths**,
2. attempting to **equalize the backscatter** of each swath.
3. The **Root Mean Square** (RMS) power of each **swath** is **compared** to a desired power level.
4. The **error signal is fed back to an infinite impulse response (IIR) filter** and
5. the **gain for that swath** is adjusted in the **opposite direction**.

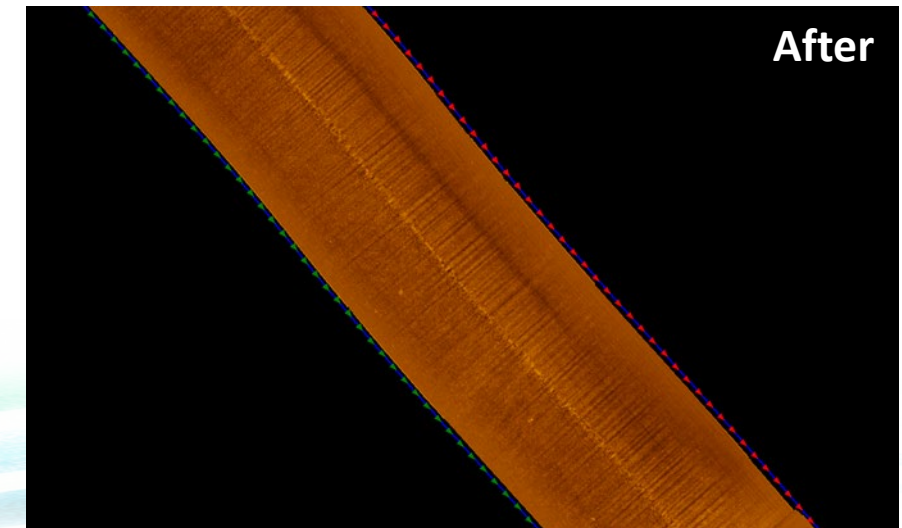
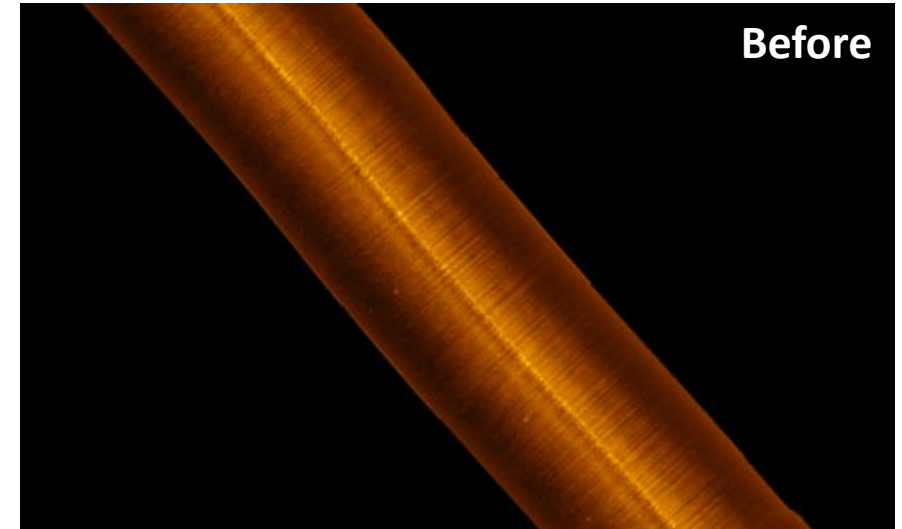


Empirical Gain Normalization

works extremely well in most situations and can be considered a replacement for BAC.

The Empirical Gain Normalization (EGN) function:

1. **sums and averages up all of the sonar amplitudes** in all pings in a set of sonar files **by altitude and range.**
2. **The amplitude values are summed and averaged by transducer** (port and starboard) so there are actually two tables.
3. The resulting table is used to work out the beam pattern of a sonar by **empirically looking at millions of samples of data.**



Sidescan Gain and Signal Processing

file
manager

The screenshot displays the SonarWiz 8 V8.3.0 x64 software interface. The main menu bar includes File, Data Acquisition, **Post Processing**, Bathymetry, Maps, View, Tools, and Help. The **Post Processing** menu is open, showing options like Vessel, Import, Playback, File Manager, Export, Bottom Digitizing, Nadir Transparency, Order, Navigation, Contact Manager, Contact Tools, Hits, Detect, Feature Manager, Add Feature, Feature Tools, Intersections, Cores, SBP Tides and Vertical Offsets, Magnetometer, Classification, Build Classification Grids, and Build Color Composite Image. A red arrow points to the **File Manager** option in the **Post Processing** menu.

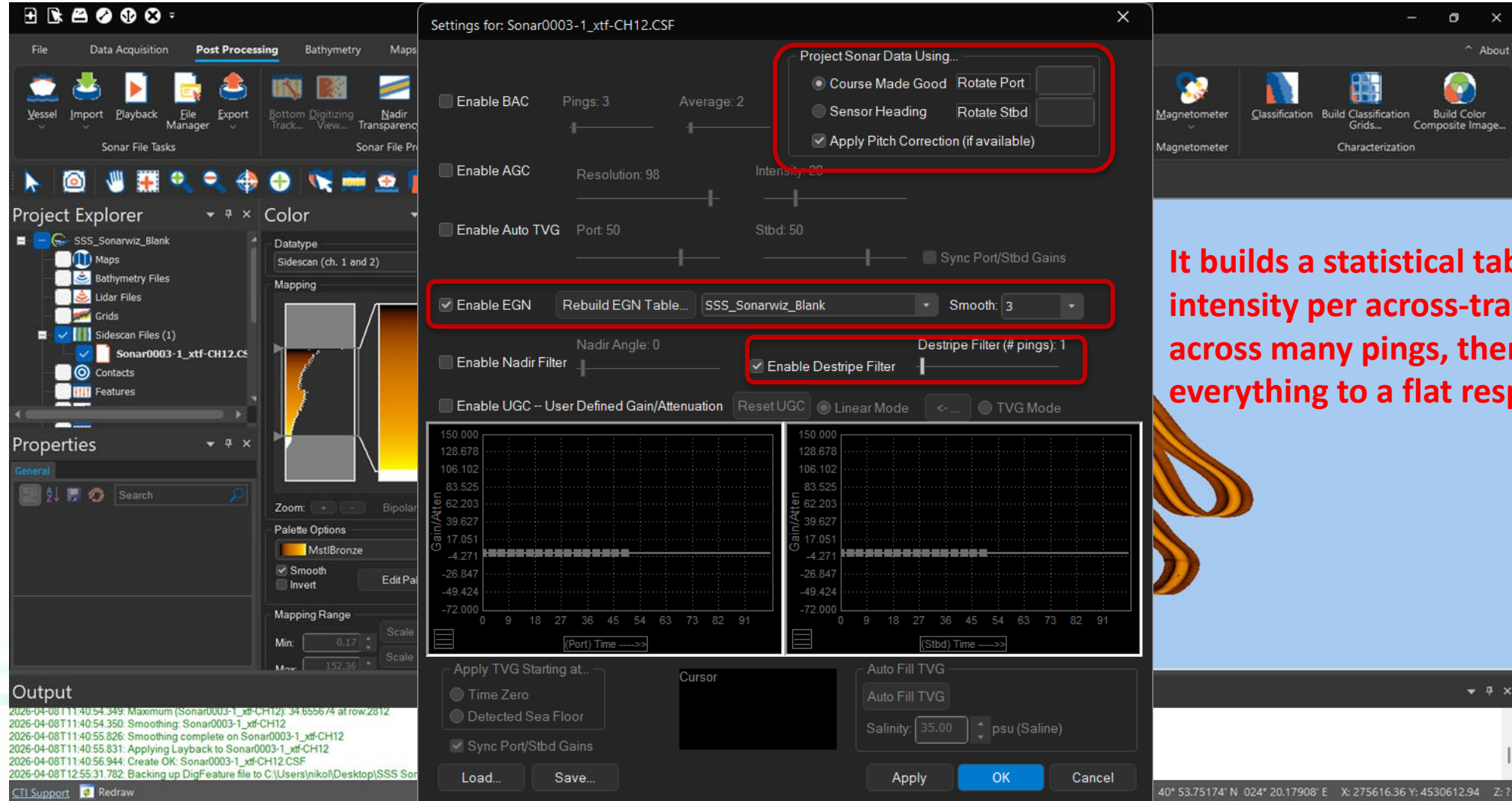
The **Project Explorer** on the left shows a tree view of the project files, including Maps, Bathymetry Files, Lidar Files, Grids, Sidescan Files (1), Contacts, and Features. The **Properties** panel on the right shows the general properties of the selected file, including Datatype (Sidescan (ch. 1 and 2)), Mapping, and Color mapping options.

The **Sonar File Manager** dialog is open, showing the project path: C:\Users\nikol\Desktop\SSS Sonarwiz Blank\SSS Sonarwiz Blank\SSS_Sonarwiz_Blank.mml. It displays the number of files in the project (1) and the number of files enabled (1). The dialog includes a table for file limits and a list of files.

Order	En...	Type	Group	File Name
0	☒	SSS		C:\Users\nikol\Desktop\SSS Sonarwiz Blank\SSS Sonarwiz Blank\CSF\Sonar0003

The **Output** panel at the bottom shows the log of operations, including file import, smoothing, and backup.

Sidescan Gain and Signal Processing



The screenshot displays the SonarWiz software interface, specifically the 'Settings for: Sonar0003-1_xtf-CH12.CSF' dialog box. The 'Post Processing' tab is active, showing various settings for data acquisition and processing. Key settings highlighted with red boxes include:

- Project Sonar Data Using...** (Red box):
 - ☒ Course Made Good Rotate Port
 - ☐ Sensor Heading Rotate Stbd
 - ☒ Apply Pitch Correction (if available)
- Enable EGN** (Red box):
 - ☒ Enable EGN
 - Rebuild EGN Table...
 - SSS_Sonarwiz_Blank
 - Smooth: 3
- Enable Destripe Filter** (Red box):
 - ☒ Enable Destripe Filter
 - Destripe Filter (# pings): 1

The 'Properties' panel on the left shows the 'General' tab with a search bar and a list of files. The 'Output' panel at the bottom displays a log of processing steps, including 'Maximum (Sonar0003-1_xtf-CH12): 34.6556/4 at row 2812', 'Smoothing: Sonar0003-1_xtf-CH12', 'Smoothing complete on Sonar0003-1_xtf-CH12', 'Applying Layback to Sonar0003-1_xtf-CH12', 'Create OK: Sonar0003-1_xtf-CH12.CSF', and 'Backing up DigFeature file to C:\Users\nikol\Desktop\SSS Sor'.

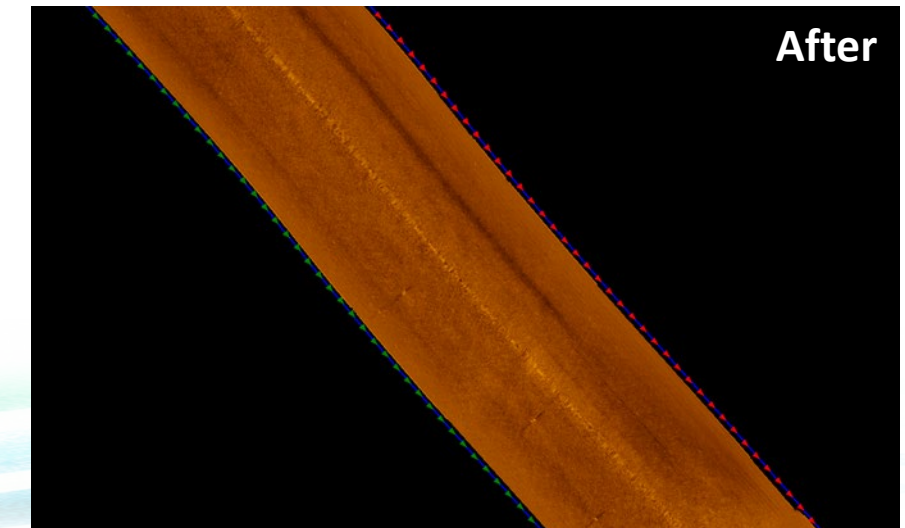
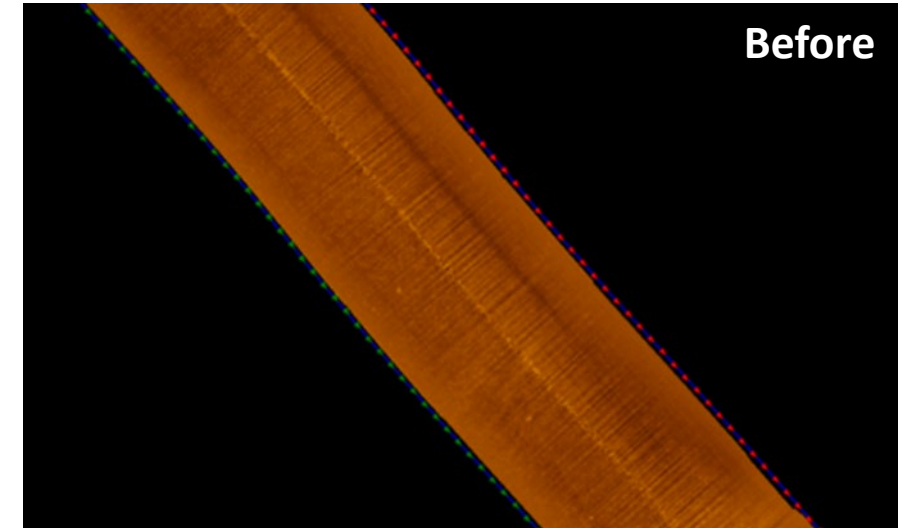
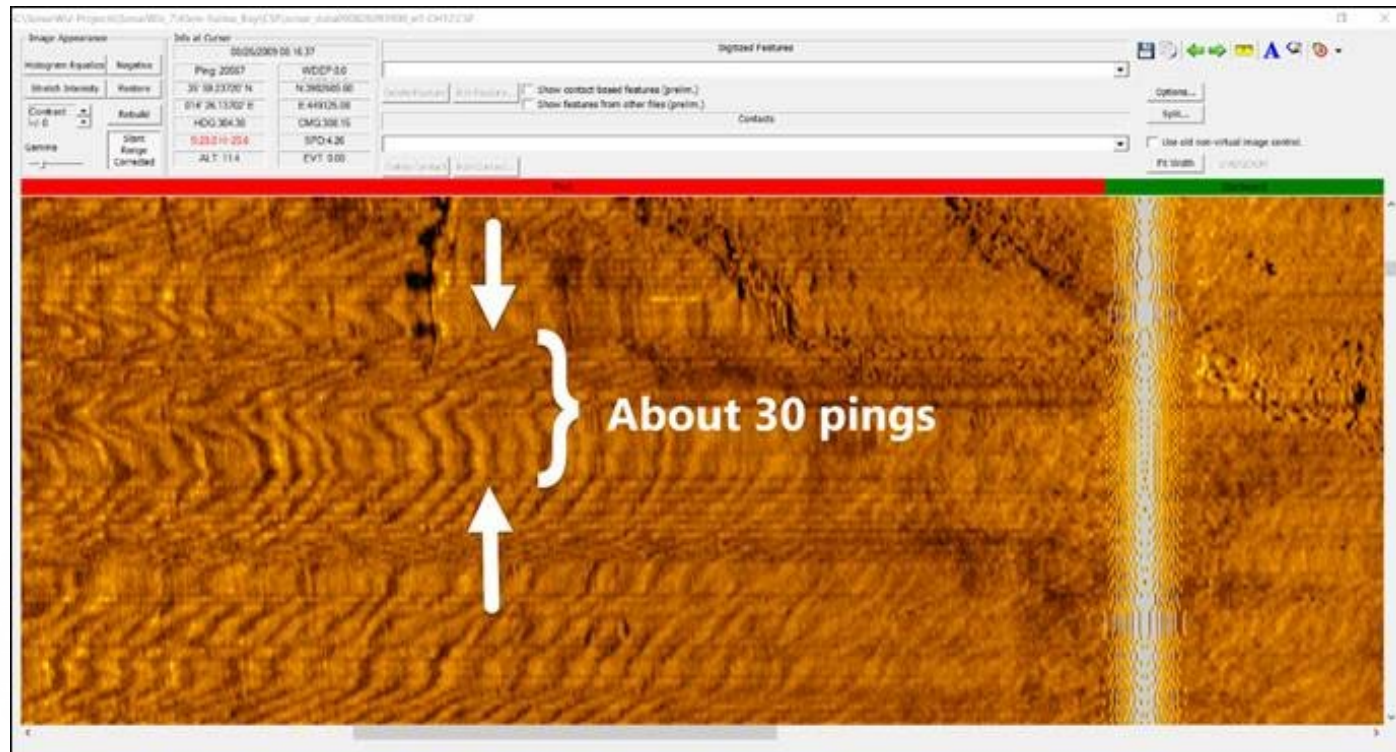
On the right, a sidebar shows a list of processing options: Magnetometer, Classification, Build Classification Grids..., Build Color Composite Image..., Magnetometer, and Characterization.

It builds a statistical table of average intensity per across-track position across many pings, then normalizes everything to a flat response.

De-Striping

The De-Striping function:

Is used to reduce the effects of a '**pitching**' sonar that is characterized by a pattern perpendicular to the direction of travel.



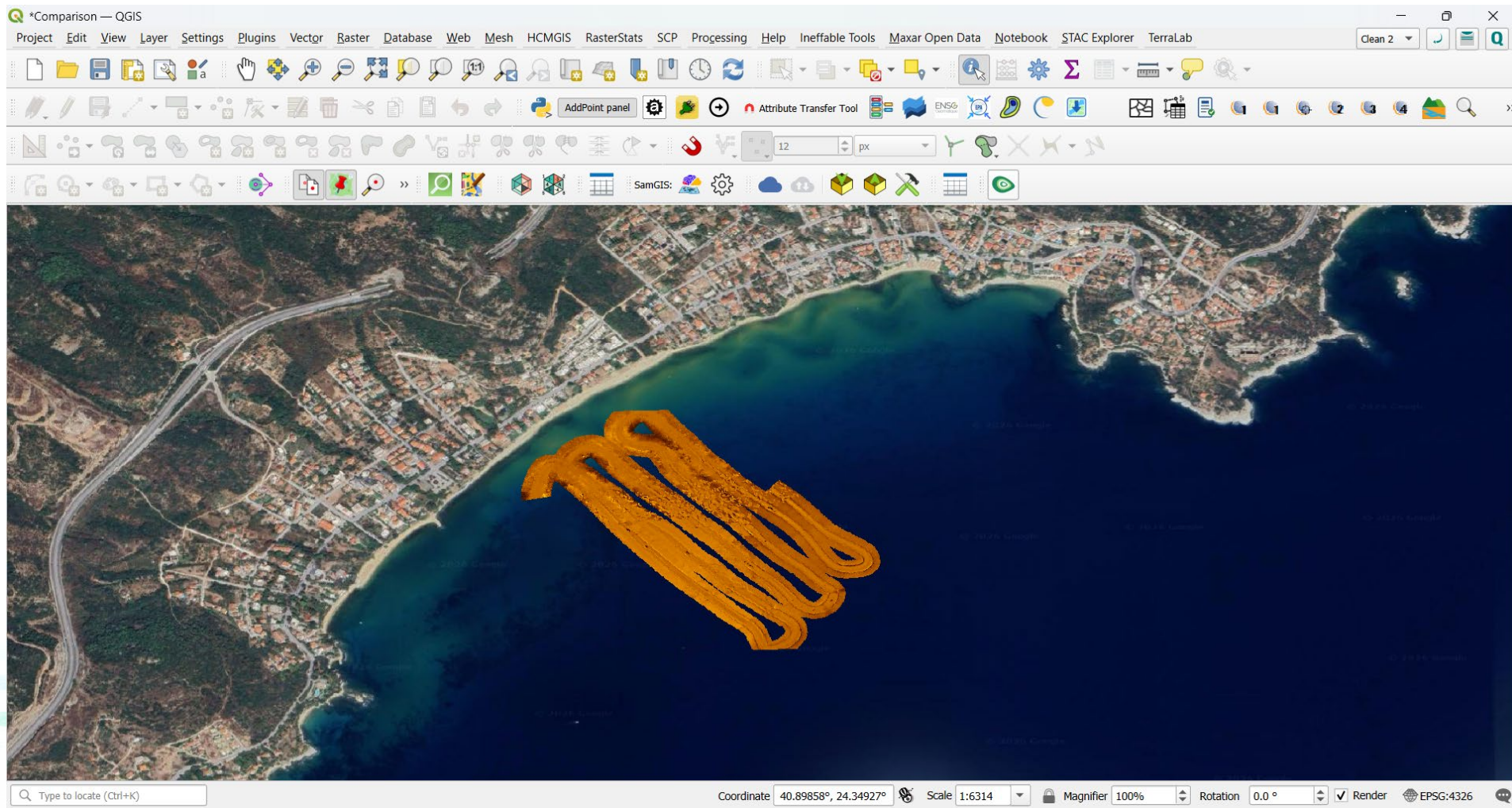
Export track

The screenshot displays the SonarWiz 8 V8.3.0 x64 software interface. The 'Post Processing' menu is open, and the 'Export' option is selected, leading to the 'Save As Image File' dialog box. The dialog box shows the following settings:

- Output image file name: SSS_Sonarwiz_Blank\SSS_Sonarwiz_Blank\GeoTiff\SSS_Sonarwiz_Blank.tif
- Output image file type: GeoTIFF
- Export data only: ☐ Export data values only, with no palettization or annotation
- Output resolution: 24-bit
- Background color: ☐ Make background color transparent. This option adds a transparency band to the output.
- Exclude tiles with no sonar data: ☐ Build tiles only
- Crop the output image to selected feature: Do Not Crop
- Launch viewer after saving: ☒
- Specify image resolution: 1,000 Meter/pixel
- Specify image size in pixels:
 - GeotImage pixel dimensions:
 - Make same size as current view
 - Size to fit printer
 - Specify size: Width: 1675 Height: 749
 - Grid lines and scale:
 - XY grid spacing: 200 Meter
 - Lat/lon grid: 0.1 minutes
 - Grid line thickness: 1 pixel
- Tiling: 1 rows x 2 cols = 2 total
 - 1000 X 1000 pixels per tile
 - 1000 X 1000 Meter per tile
 - Uncompressed tile size: 4.0 MB
 - 2000 x 1000 pixels total
 - 1675 X 749 Meter total
 - Uncompressed total size: 8.0 MB
 - Output: 1676 by 749 pixels total
 - 1675 by 749 Meter total
 - Uncompressed total size: 10.0 MB

The background of the software shows a sonar track visualization with a color scale ranging from -1.14 to 120.56. The 'Properties' panel on the left shows the 'General' tab with a search bar and a 'Zoom' section. The 'Output' panel at the bottom displays a log of operations.

Export track



Digitizing features

digitizing

SSS_Sonarwiz_Blank.mml - SonarWiz 8 V8.3.0 x64 Idle

File Data Acquisition **Post Processing** Bathymetry Maps View Tools Help

Vessel Import Playback File Manager Export Bottom Digitizing Track... View... Nadir Transparency Order Navigation... Contact Manager Capture Contact Tools Hits Detect Feature Manager Add Feature Tools Intersections Cores SBP Tides and Vertical Offsets... Magnetometer Classification Build Classification Grids... Build Color Composite Image...

Sonar File Tasks Sonar File Processing Contacts ATR Digitized Features Sub-bottom Magnetometer Characterization

Project Explorer

SSS_Sonarwiz_Blank

- Maps
- Bathymetry Files
- Lidar Files
- Grids
- Sidescan Files (1)
 - Sonar0003-1_xtf-CH12.CSF
- Contacts
- Features

Properties

General Gain Acoustic file Display

Name Sonar0003-1_xtf-C...

CSF Version 3.00

Records 27027

Group name

Imported SRID EPSG:4326

Color

Datatype Sidescan (ch. 1 and 2)

Mapping

Zoom: -1.14 23.20 47.54 71.88 96.02 120.56 Max

Palette Options

MstlBronze

Smooth Invert Edit Palette

Mapping Range

Min: -1.14 Scale To Best

Max: 120.56 Scale To Data

Scale Mode Auto - Combined

Sonar0003-1_xtf-CH12.CSF - SonarWiz

Tracking Features Contacts Appearance

Current features:

Show contact-based features

Show features from other files

New Delete Application Settings...

Color

Sidescan (ch. 1 and 2)

Use Global Color Group

Mapping

Zoom: -1.14 23.20 47.54 71.88 96.02 120.56 Max

Palette Options

MstlBronze

Smooth Invert Edit Palette

Mapping Range

Min: -1.14 Scale To Best

Max: 120.56 Scale To Data

Scale Mode Auto - Combined

Output

2026-04-08T13:51:33.129: Adding feature (waterfall) - Feature0000 type=2 coords=4)

2026-04-08T13:51:51.517: Deleting feature Feature0000 (ID 1)

2026-04-08T13:52:47.551: Adding feature (waterfall) - Feature0000 type=4 coords=13)

2026-04-08T13:53:00.602: Adding feature (waterfall) - Feature0001 type=4 coords=14)

2026-04-08T13:54:28.537: Deleting feature Feature0000 (ID 2)

2026-04-08T13:54:31.812: Deleting feature Feature0001 (ID 3)

CTI Support Redraw

40° 53.73984' N 024° 20.28053' E X: 275758.13 Y: 4530586.60 Z: 1

Digitizing features

Feature manager

The screenshot displays the SonarWiz 8 V8.3.0 software interface. The main window shows a sonar scan with a red arrow pointing to the 'Feature Manager' icon in the toolbar. A 'Feature Export' dialog box is open, showing the 'Export Format' list with 'ESRI Shapefiles SHP' selected. The 'Destination Folder' is set to 'C:\Users\nikol\Desktop\SSS Sonarwiz Blan'. The 'Feature Names' section shows 'Feature0000' and 'Feature0001'. The 'Output' panel at the bottom shows a log of feature additions and deletions.

Feature Export Dialog Box Details:

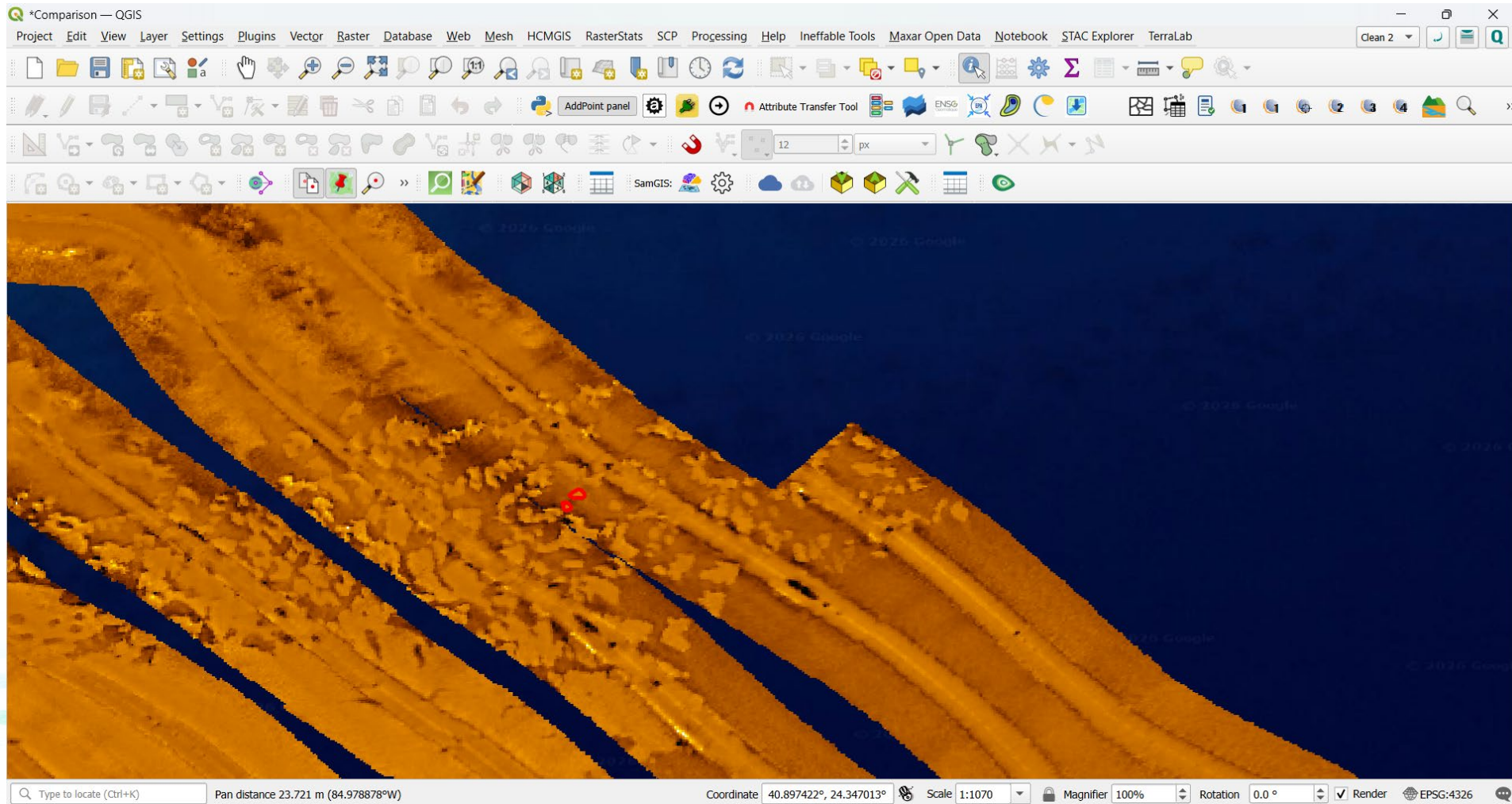
- Export by feature name:** ☐ All features with the same name will be exported to a single file.
- Destination Folder:** C:\Users\nikol\Desktop\SSS Sonarwiz Blan
- Export Format:**
 - Settings
 - ASCII CSV [ASC] CSV
 - ASCII Simple Thickness [THK] CSV
 - AutoCAD DXF [LOW] DXF
 - XYZ Text [DEP] XYZ
 - XYZ TOPO Text [TOPO] XYZ
 - Fledermaus SD (Ver 7 Only) SD
 - ESRI Shapefiles SHP**
 - XYZA (Amplitude) Text TXT
 - XYTime (milliseconds) [MSEC] TXT
 - XYTime (seconds) [SEC] TXT
 - AutoCAD DXF-High Res (SBP Only) [HIRES] DXF
 - 3D Feature Surface [CT3D] GRD
 - SMT X Y Line Time Amplitude [SMTA] CSV
 - SBP Thickness Detailed CSV [THKD] CSV
 - AutoChart SBP Reflectors [ACH] TXT
 - SMT X Y Line Shot Time Amplitude [SMTS] CSV
 - HD ASCII CSV [HDASC] CSV
 - Time Below Seabed (milliseconds) Ascii TXT [TBED] TXT
 - Time Below MSL (milliseconds) Ascii TXT [TMSL] TXT
- Feature Names:**
 - ☐ Select all
 - ☐ Export all seafloor features to a single file
 - Feature0000
 - Feature0001

Output Log:

```

2026-04-08T13:52:47.551: Adding feature (waterfall) - Feature0000 type=4 coords=12
2026-04-08T13:53:00.602: Adding feature (waterfall) - Feature0001 type=4 coords=12
2026-04-08T13:54:28.537: Deleting feature Feature0000 (ID 2)
2026-04-08T13:54:31.812: Deleting feature Feature0001 (ID 3)
2026-04-08T13:59:42.932: Adding feature (waterfall) - Feature0000 type=4 coords=12
2026-04-08T14:00:13.017: Adding feature (waterfall) - Feature0001 type=4 coords=12
    
```

Digitizing features



Capturing Contacts

Capture
contacts

The screenshot displays the SonarWiz software interface. A red arrow points to the 'Capture contacts' button in the 'Contacts' toolbar. The interface includes a 'Project Explorer' on the left, a 'Properties' panel, and a main display area showing a sonar scan with several contacts labeled (e.g., Contact0000, Contact0001, Contact0002). The 'Output' panel at the bottom shows a log of feature additions and deletions.

Output Log:

- 2026-04-08T13:52:47.551: Adding feature (waterfall) - Feature0000 type=4 coords=13
- 2026-04-08T13:53:00.602: Adding feature (waterfall) - Feature0001 type=4 coords=14
- 2026-04-08T13:54:28.537: Deleting feature Feature0000 (ID 2)
- 2026-04-08T13:54:31.812: Deleting feature Feature0001 (ID 3)
- 2026-04-08T13:59:42.932: Adding feature (waterfall) - Feature0000 type=4 coords=14
- 2026-04-08T14:00:13.017: Adding feature (waterfall) - Feature0001 type=4 coords=12

CTI Support Redraw

40° 53.82090' N 024° 20.77241' E X: 276453.35 Y: 4530715.60 Z: ?

Capturing Contacts

Contacts manager

The screenshot displays the SonarWiz 8 V8.3.0 x64 software interface. The main window shows a bathymetric map with a red arrow pointing to the 'Contact Manager' icon in the 'Contacts' toolbar. A 'Contact Manager' dialog box is open, showing a table of contacts and various management options.

Contact Manager Dialog Box:

Number of Contacts in Project: 4 Number of Contacts Enabled: 4

☒	☒	☒	☒	☒	Name	Latitude	Longitude	X	Y	
☒	☒	☒	☒	☒	Contact0000	40° 53.82978' N	024° 20.77060' E	276451.30	4530732.11	Sonar
☒	☒	☒	☒	☒	Contact0001	40° 53.83613' N	024° 20.76617' E	276445.44	4530744.04	Sonar
☒	☒	☒	☒	☒	Contact0002	40° 53.84395' N	024° 20.78223' E	276468.42	4530757.82	Sonar
☒	☒	☒	☒	☒	Contact0003	40° 53.84442' N	024° 20.78815' E	276476.77	4530758.45	Sonar

Buttons: OK, Select All, Edit Contact(s), Delete Contact(s), Sort Contacts..., Create from XY file or features..., Import..., Export..., S-57 Export..., Export to GeoTiff, Export to Google..., Report Generator..., Backup Contacts, Recompute All, Deleted Contacts (UnDelete, Purge, Show Deleted Contacts), Recapture, Preferences...

Output Log:

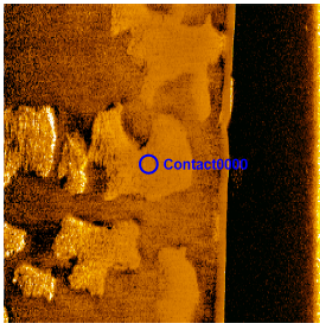
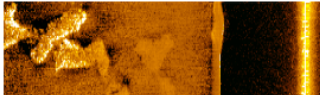
```
2026-04-08 11:52:47.551: Adding feature (waterfall) - Feature0000 type=4 coords=13)
2026-04-08 11:53:00.602: Adding feature (waterfall) - Feature0001 type=4 coords=14)
2026-04-08 11:54:28.537: Deleting feature Feature0000 (ID 2)
2026-04-08 11:54:31.812: Deleting feature Feature0001 (ID 3)
2026-04-08 11:59:42.932: Adding feature (waterfall) - Feature0000 type=4 coords=14)
2026-04-08 14:00:13.017: Adding feature (waterfall) - Feature0001 type=4 coords=12)
```

Status Bar: 40° 53.82090' N 024° 20.77241' E X: 276453.35 Y: 4530715.60 Z: ?

Capturing Contacts

Report PDF Small English

Generated on 8/4/2026 5:16:46 μμ

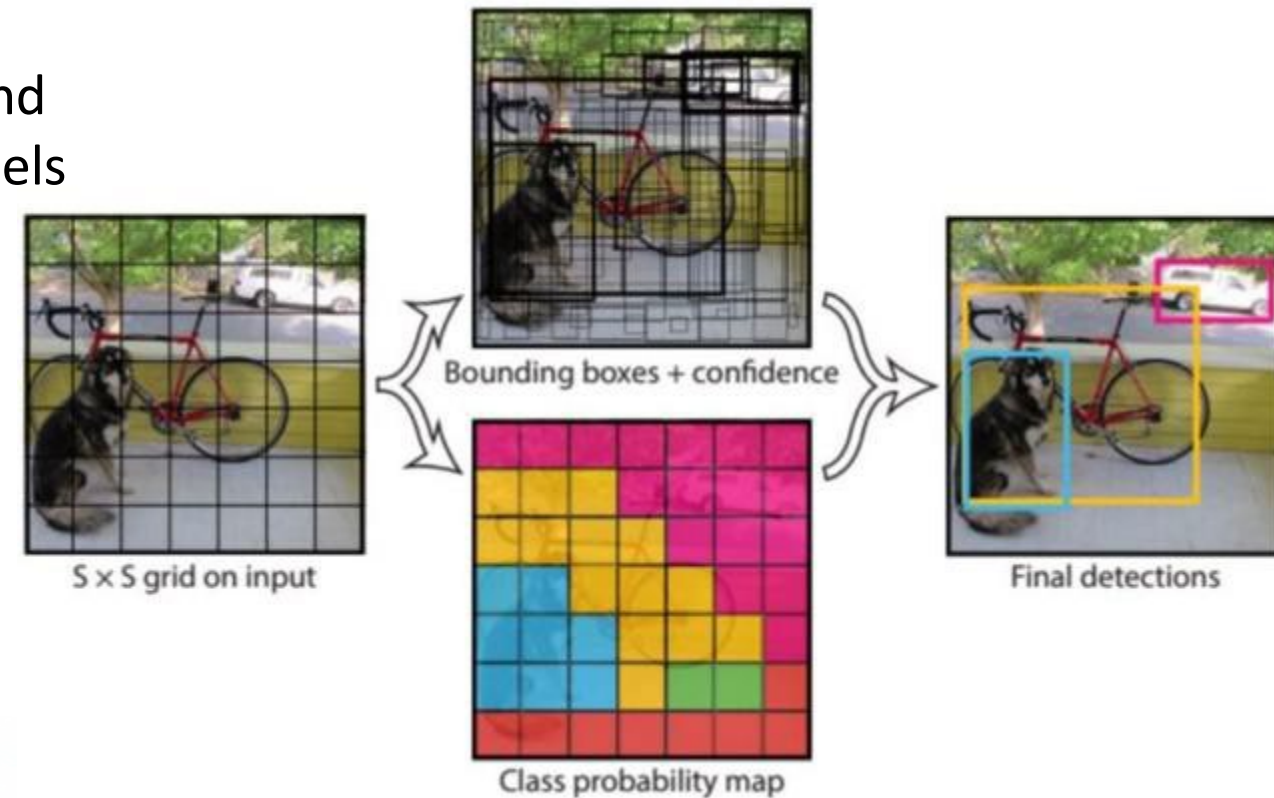
Target Image	Target Info	User Entered Info
	Contact0000 • Sonar Time at Target: 1/4/2016 3:34:40 μμ • Click Position 40.8971631525 24.3461766962 (WGS84) (X) 276451.30 (Y) 4530732.11 (Projected) • Map Projection: EPSG:32635 • Acoustic Source File: Sonar0003-1.xtf • Ping Number: 4457 • Range to target: 16.50 Meters • Fish Height: 10.48 Meters • Heading: 0.000 Degrees • Course Made Good: 314.614 Degrees • Event Number: (-1) • Line Name: Sonar0003-1 • Target depth: 10.48 Meters	Dimensions and attributes • Target Width: 0.00 Meters • Target Height: 0.00 Meters • Target Length: 0.00 Meters • Target Shadow: 0.00 Meters • Mag Anomaly: • Avoidance Area: • Classification1: • Classification2: • Area: • Block: • Description: • Water Depth: 10.50 Meters
	Contact0001 • Sonar Time at Target: 1/4/2016 3:34:48 μμ • Click Position 40.8972688649 24.3461029093 (WGS84) (X) 276445.44 (Y) 4530744.04 (Projected) • Map Projection: EPSG:32635 • Acoustic Source File: Sonar0003-1.xtf • Ping Number: 4534	Dimensions and attributes • Target Width: 0.00 Meters • Target Height: 0.00 Meters • Target Length: 0.00 Meters • Target Shadow: 0.00 Meters • Mag Anomaly: • Avoidance Area: • Classification1:

What is YOLO (You Only Look Once)?

- A real-time object detection algorithm
- Detects what objects are present in an image and where they are using bounding boxes and class labels

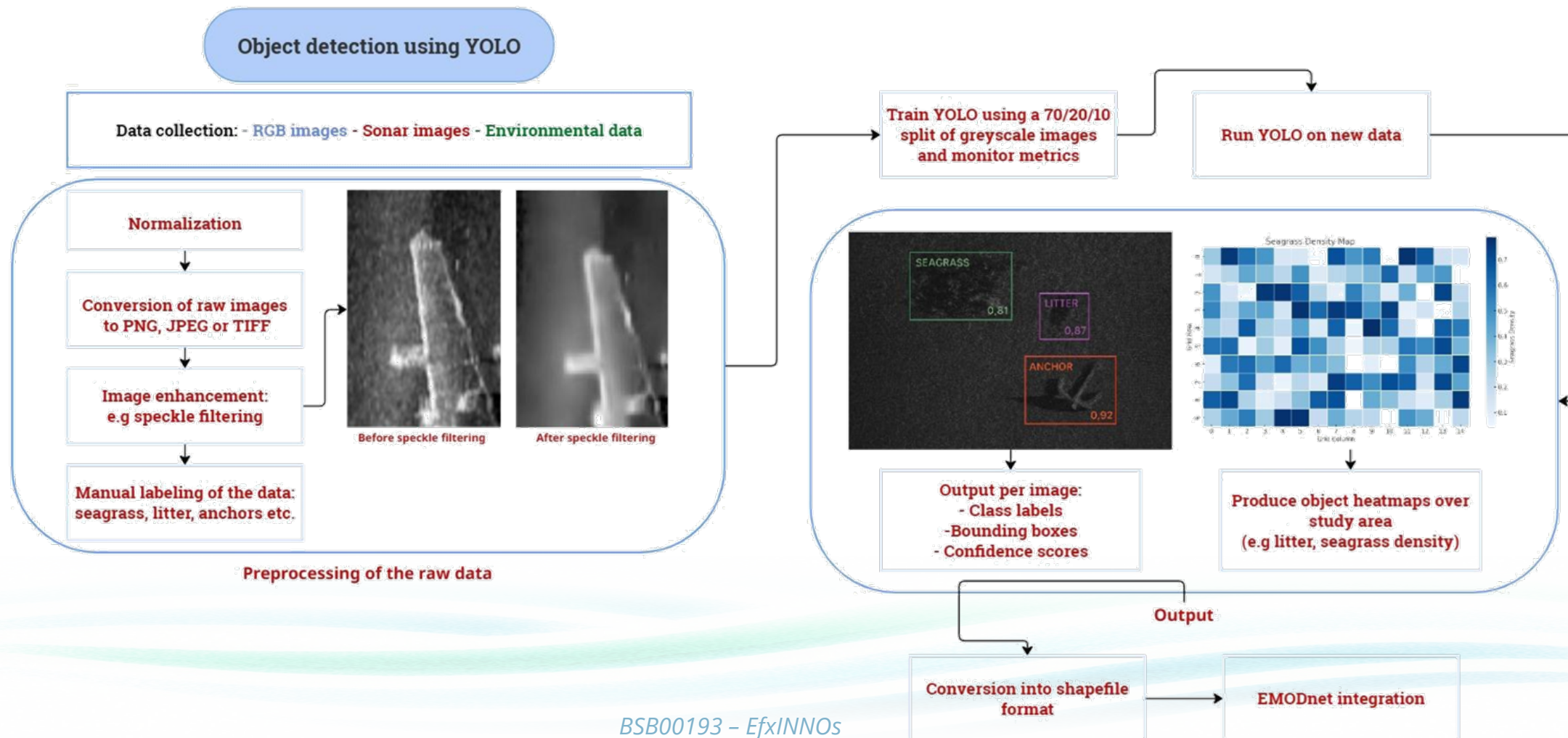
How does it work?

- Input image is divided into an $S \times S$ grid
- Each grid cell predicts:
 - Bounding boxes
 - Confidence score
 - Class probabilities
- All predictions are made in one forward pass through the network



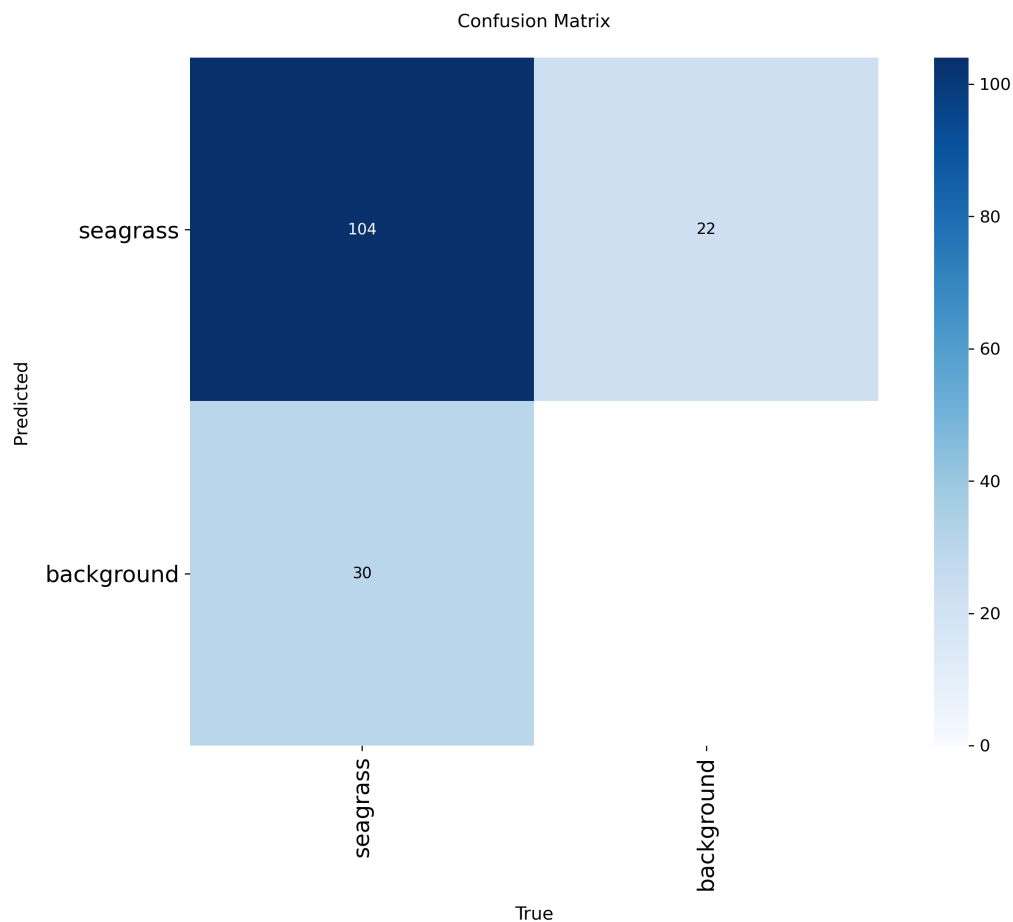
Rahman, Zillur & Ami, Amit & Ullah, Muhammad. (2022). A Real-Time Wrong-Way Vehicle Detection Based on YOLO and Centroid Tracking. 10.48550/arXiv.2210.10226.

Object detection workflow

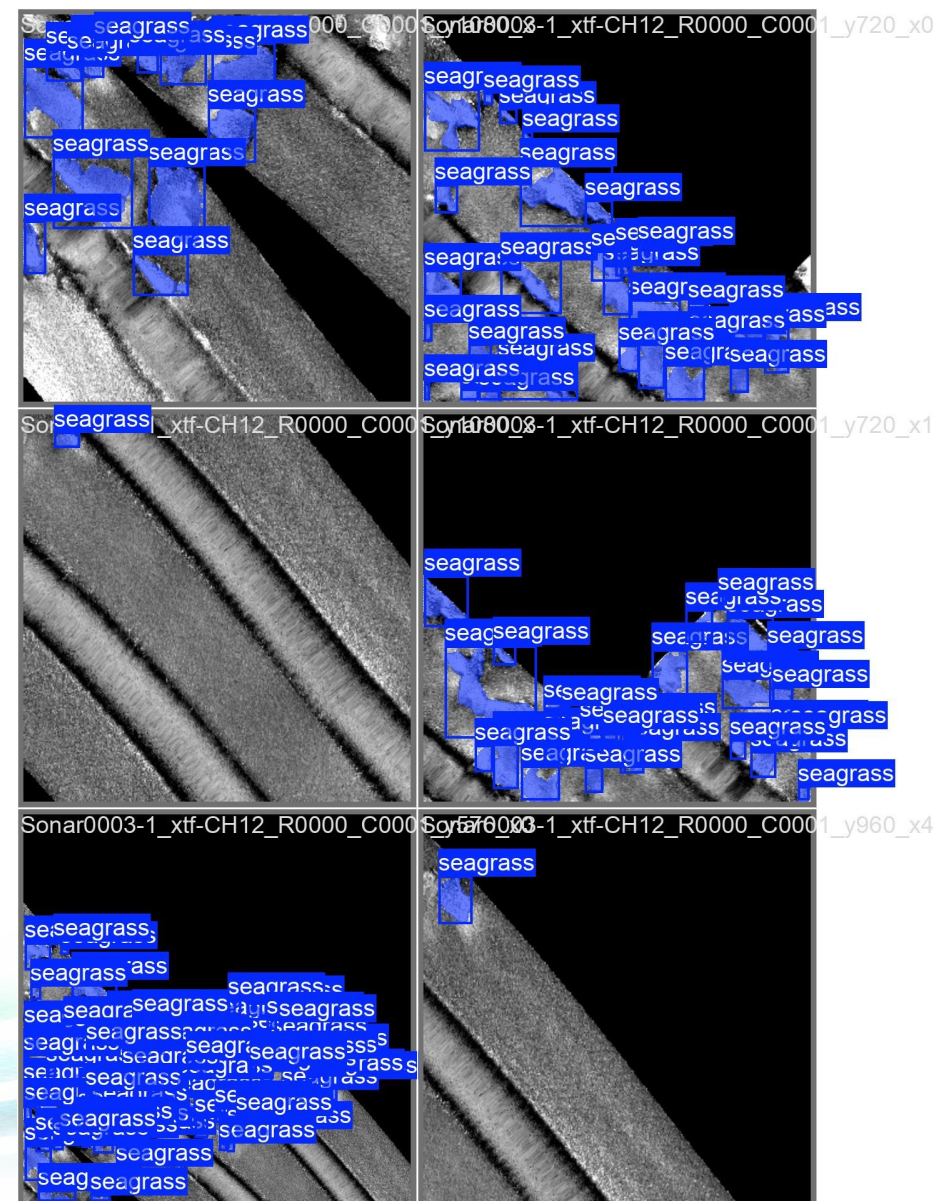


Object detection preliminary results

YOLO-8n model

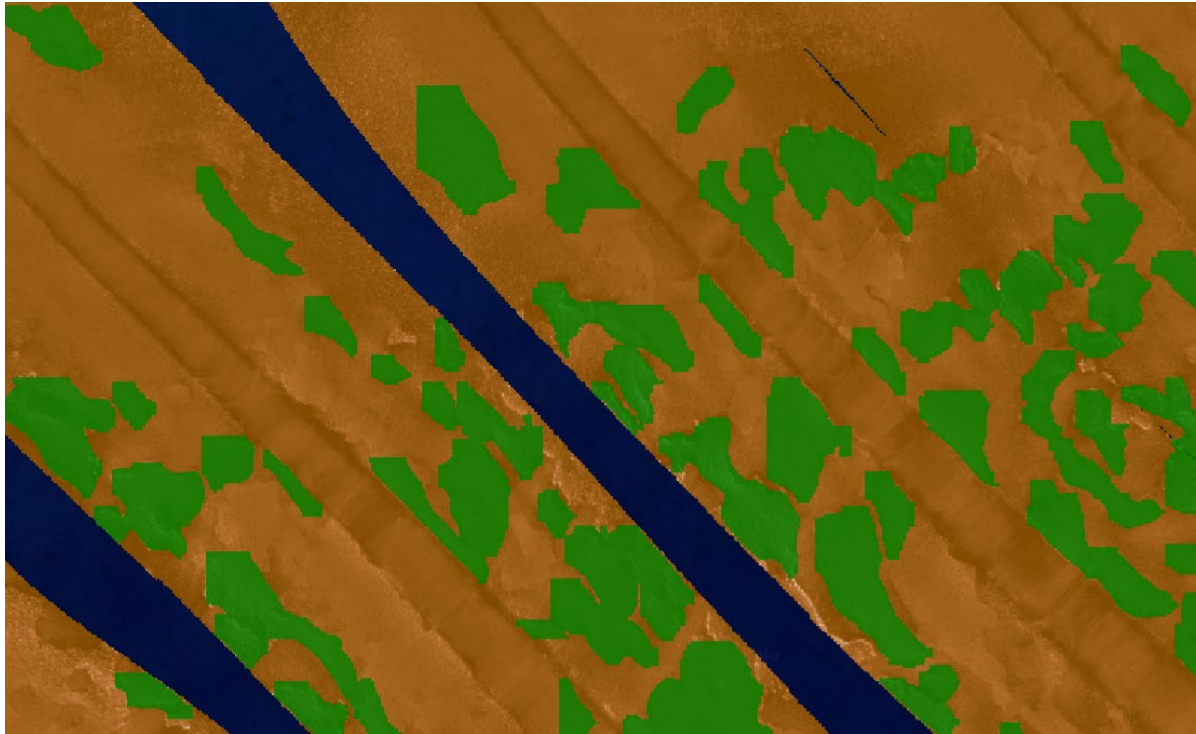


193 - EfxINNOs

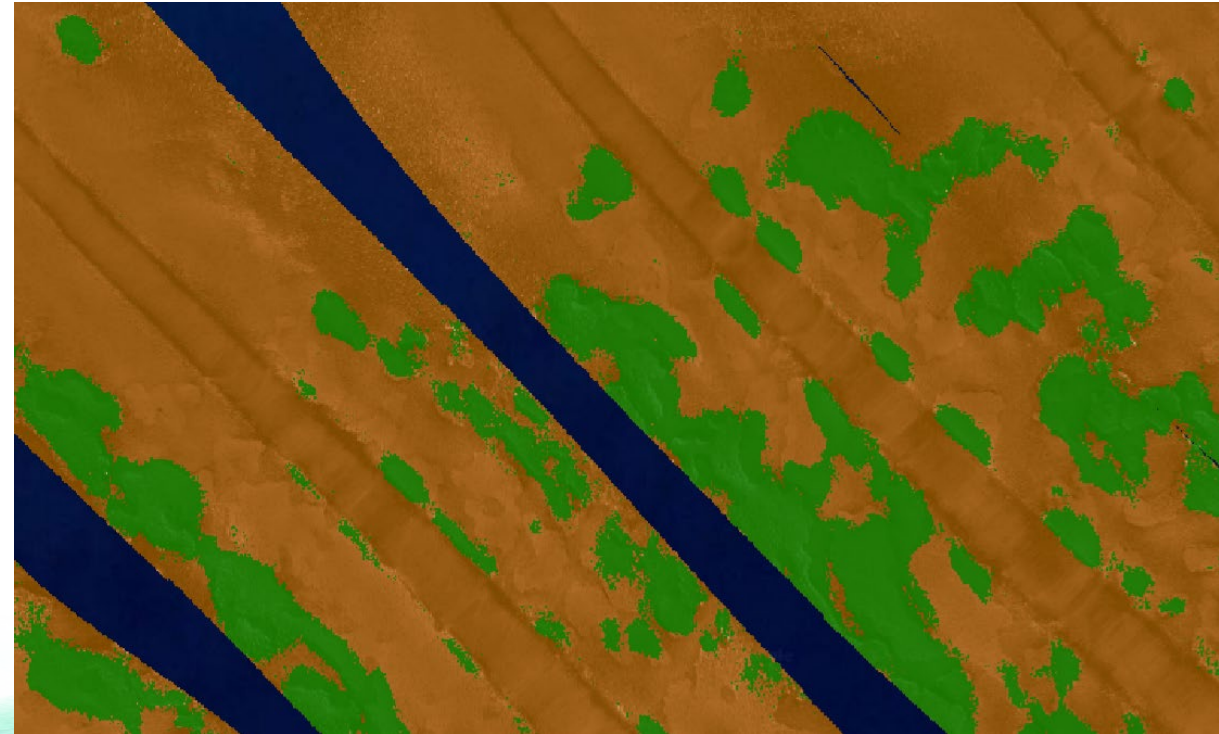


Object detection preliminary results

YOLO-8n model



U-Net model



EMODnet Submitter's Dashboard

|  DASHBOARD

WELCOME NIKOLAOS KOKKOS | VIEWING AS DATA SUBMITTER | ? | LOGOUT

Submitter's Data Submission List

Show entriesAddSubmission identifier
(UUID)↕

Title of dataset↕

Status↕

Last Update↕

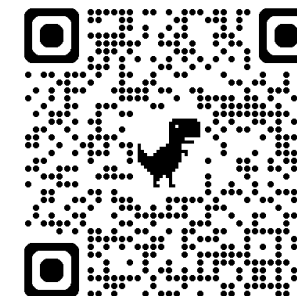
Controls

1dd3a10a-695e-40fc-9e20-
89dd9864d23b

Efxinnos - Seagrass - North Aegean

 Drafting form part 1 by Data
Submitter2025-06-20
19:23:57.522252ViewEdit37c2a56b-9f34-403a-baa7-
f6da8a4500dbFishing weir areas on the territory of the Black
Sea basin management region Drafting form part 1 by Data
Submitter2025-05-22
13:54:12.431628ViewEdit

Showing 2 entries of 2

1emodnet.ec.europa.eu/ingestion

Interreg



Co-funded by
the European Union



NEXT Black Sea Basin
NEXT Black Sea Basin

Thank you!

