

# Use of mAUVs in the monitoring of benthic habitats and marine litter



ΔΗΜΟΚΡΙΤΕΙΟ  
ΠΑΝΕΠΙΣΤΗΜΙΟ  
ΘΡΑΚΗΣ

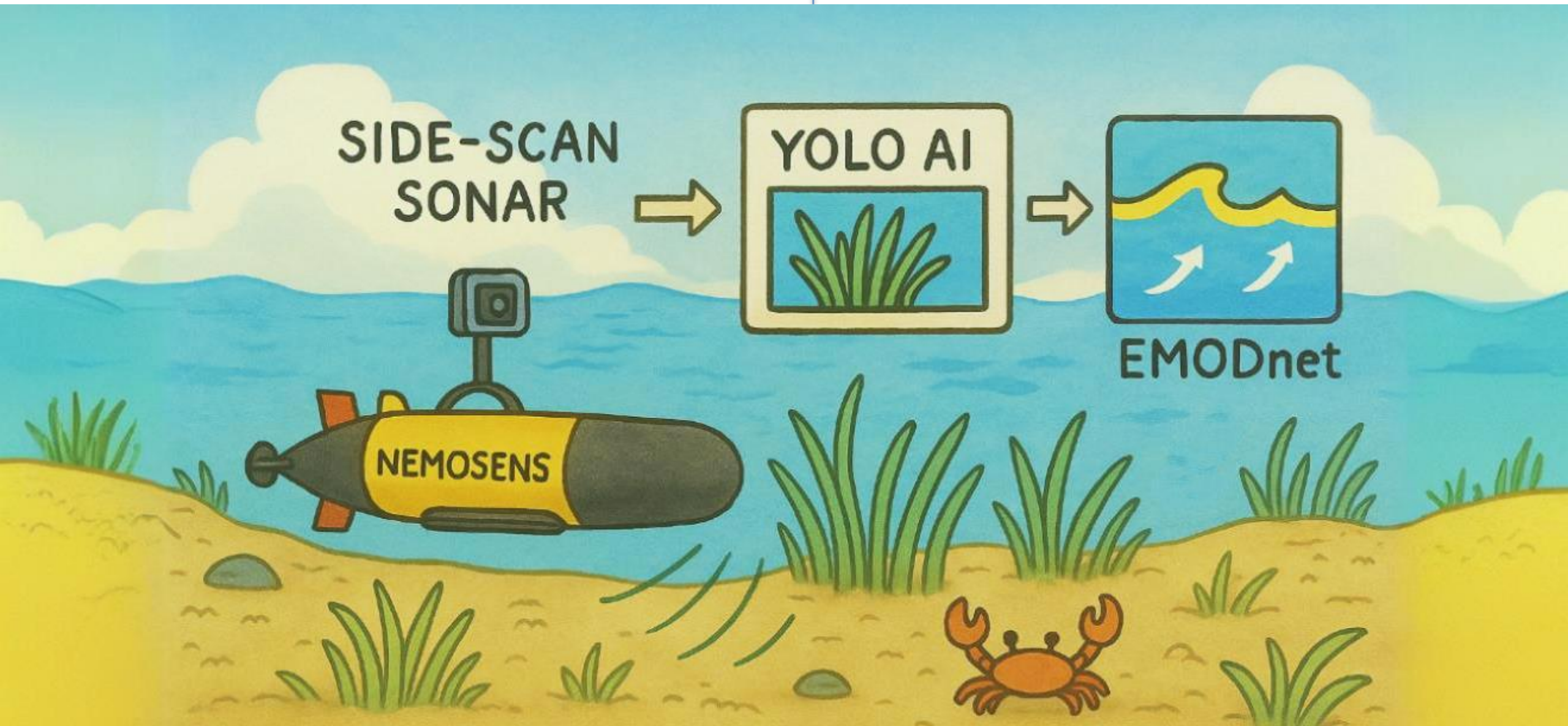
DEMOCRITUS  
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OF THRACE

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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, mAUUVs 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 mAUUV 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

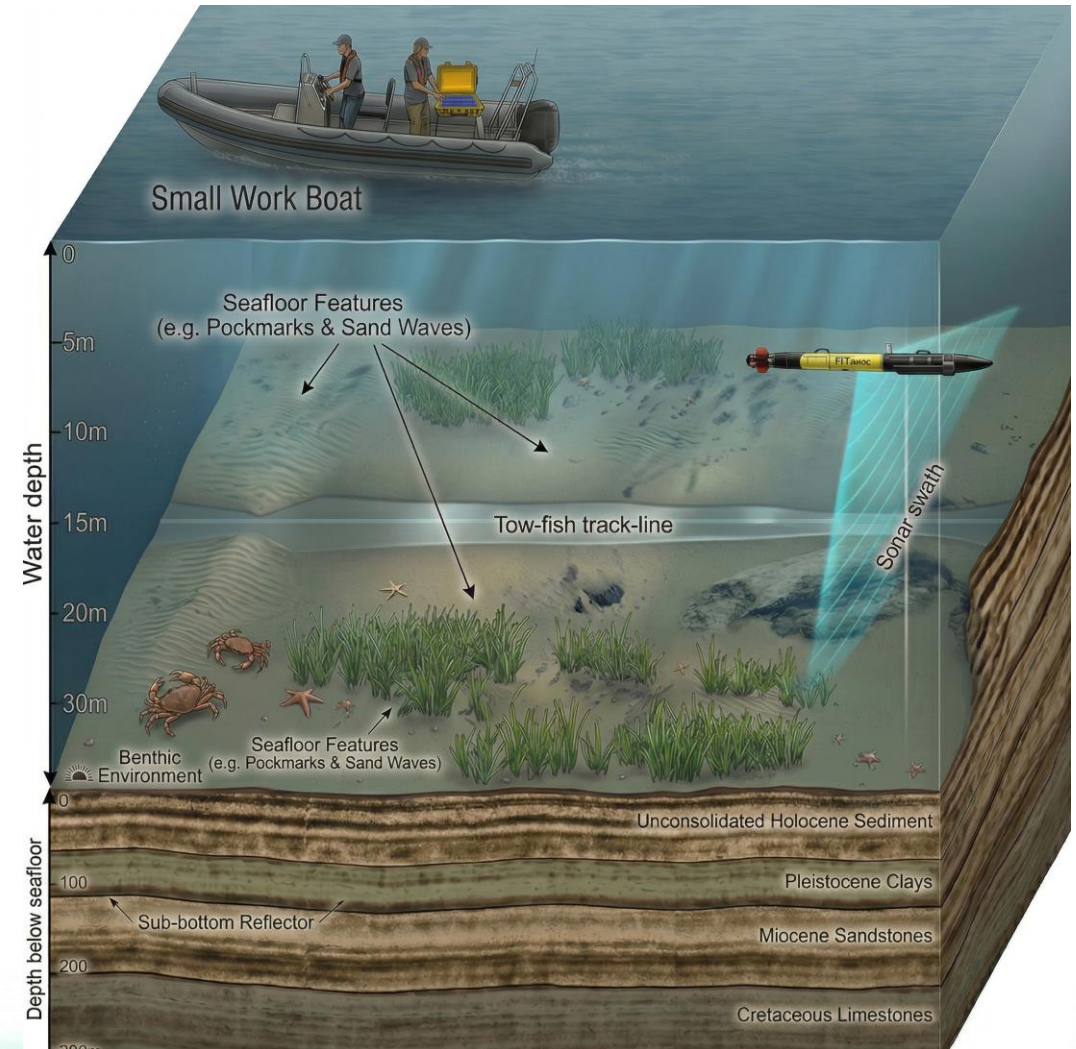
The Side Scan Sonar (SSS) is an acoustic reflection technology. **Basically, they use a swath of sound** to survey the seafloor.

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:

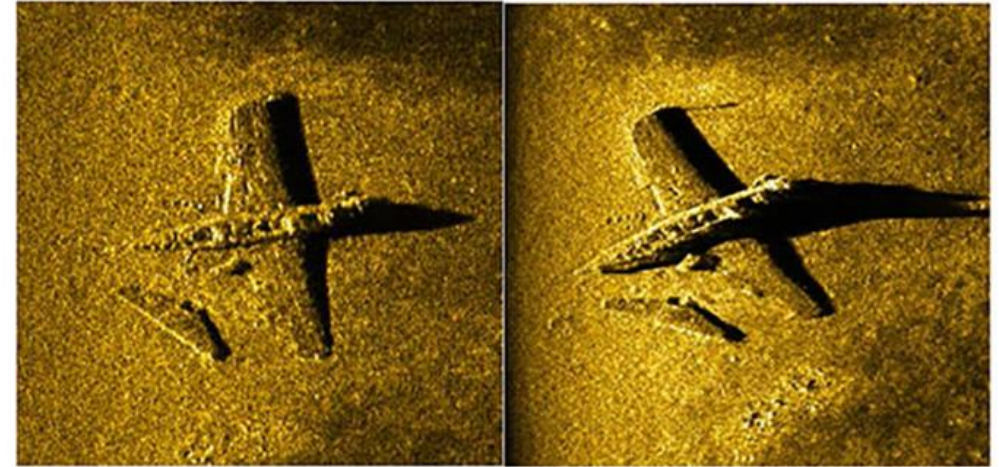
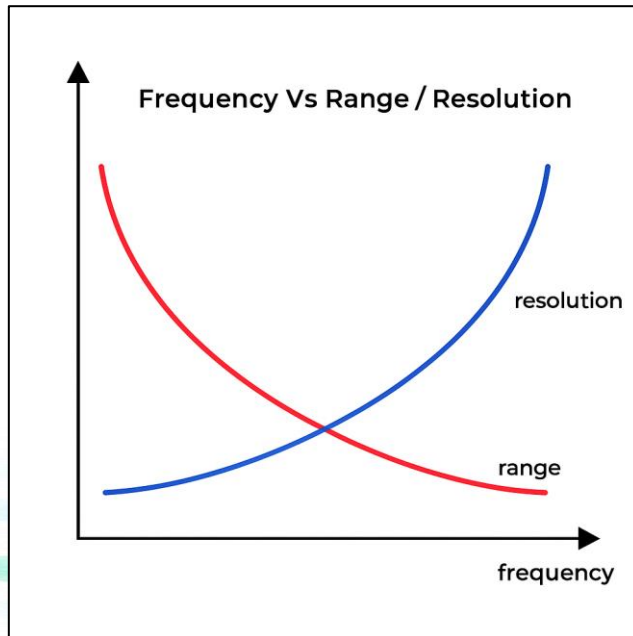
- coarse-grain sediments display higher reflectivity than fine-grain deposits,
- rocky outcrops reflect higher than sediments, etc.



## Side-scan sonars – Range of detection

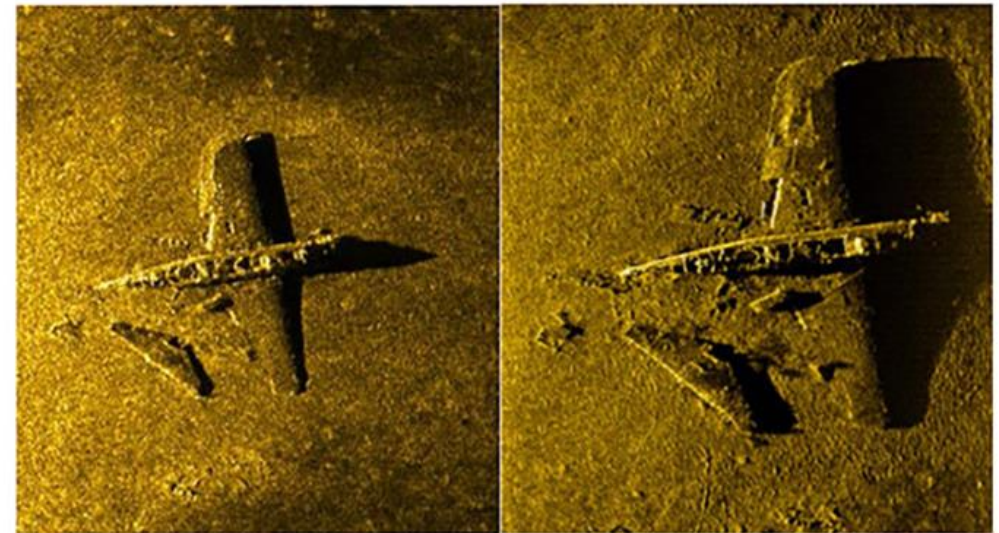
The **lower 200 kHz** frequency side scan sonar is capable of detecting large targets at **ranges of 150 meters**.

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

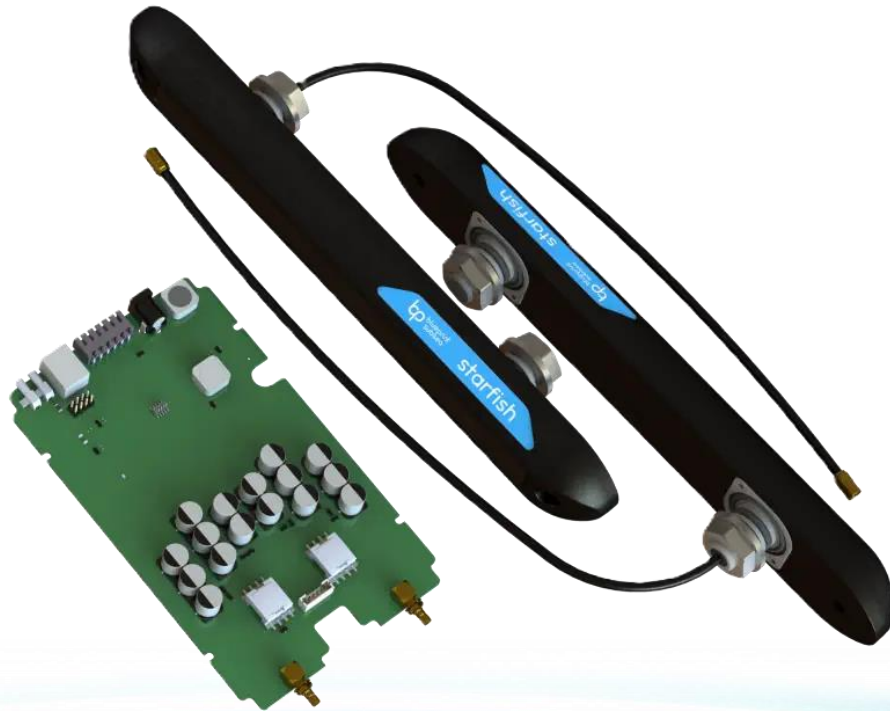
600 kHz



900 kHz

1600 kHz

## Side-scan sonars – StarFish 454 OEM

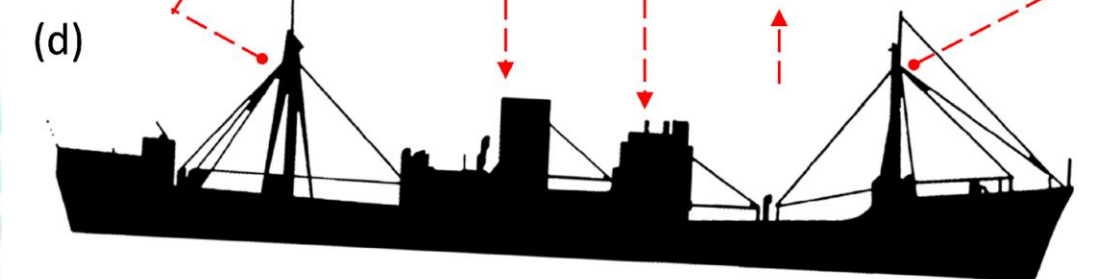
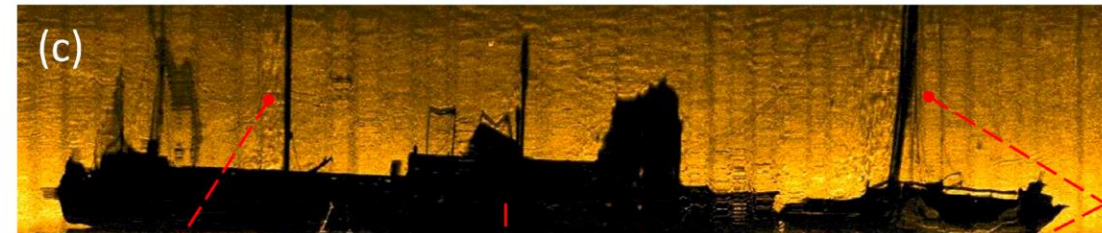
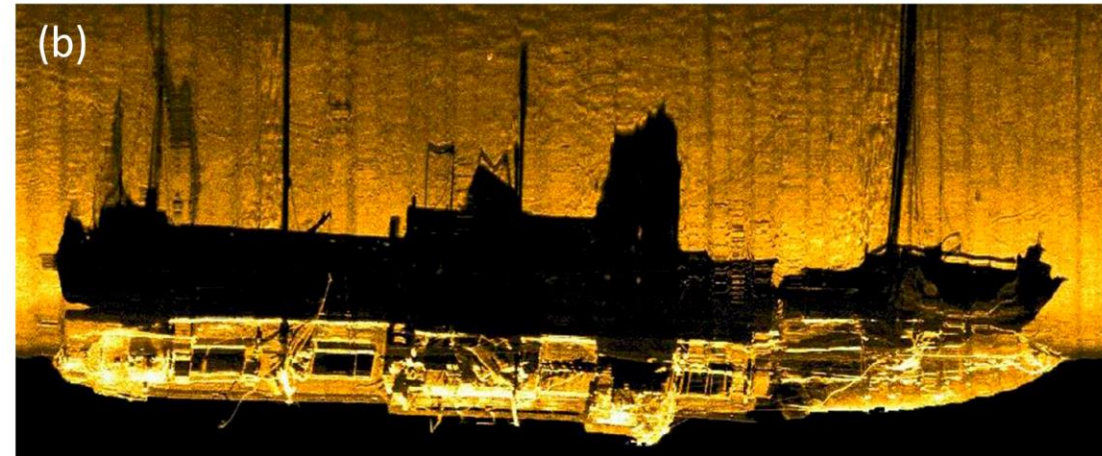
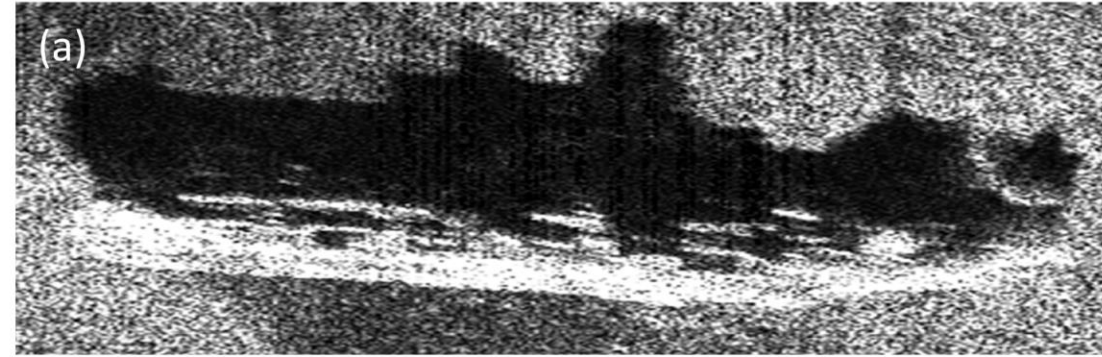
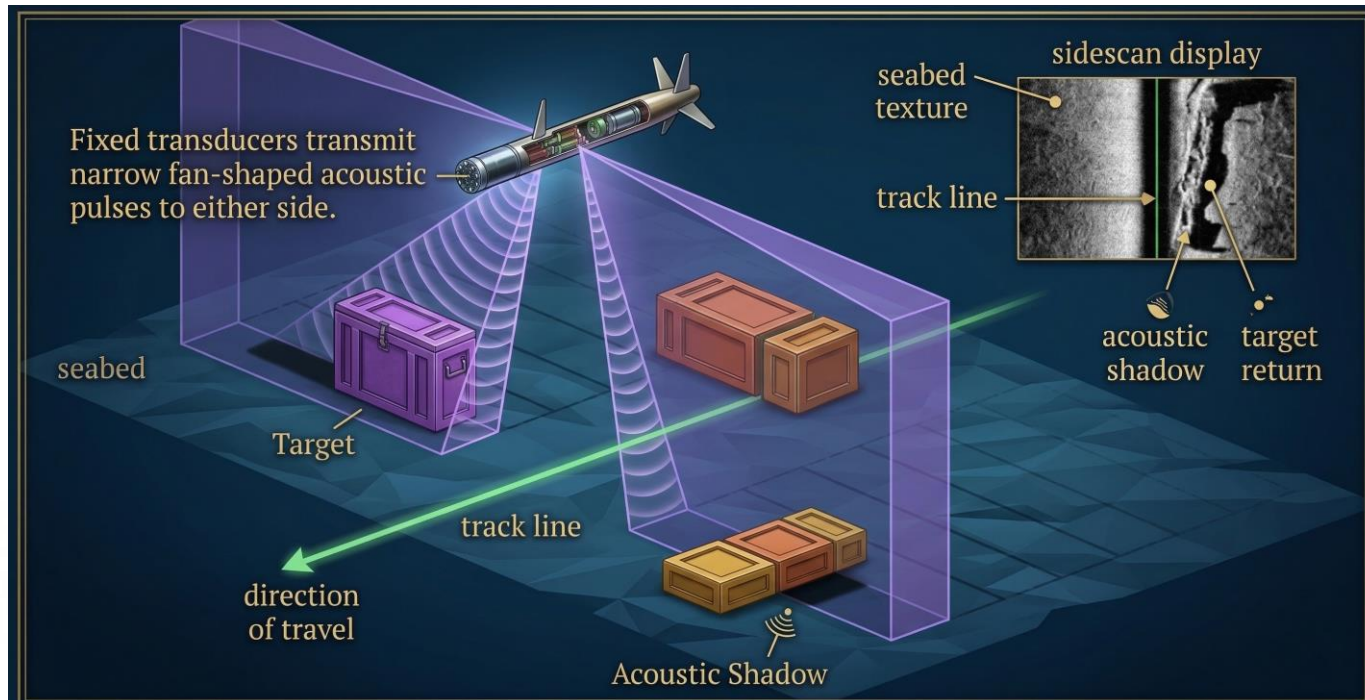


	StarFish 454 OEM
Frequency	450kHz CHIRP
Operating Range	Up to 100m per channel
Horizontal Beam Width	0.5°
Vertical Beam Width	60°
Transducer Angle	Variable (OEM Specified)
Dimensions	390mm x 22.5mm x 40mm
Weight (In Air)	0.8kg
Construction	Polyurethane Rubber (PA6 Housing)
Colour	Black

## 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.

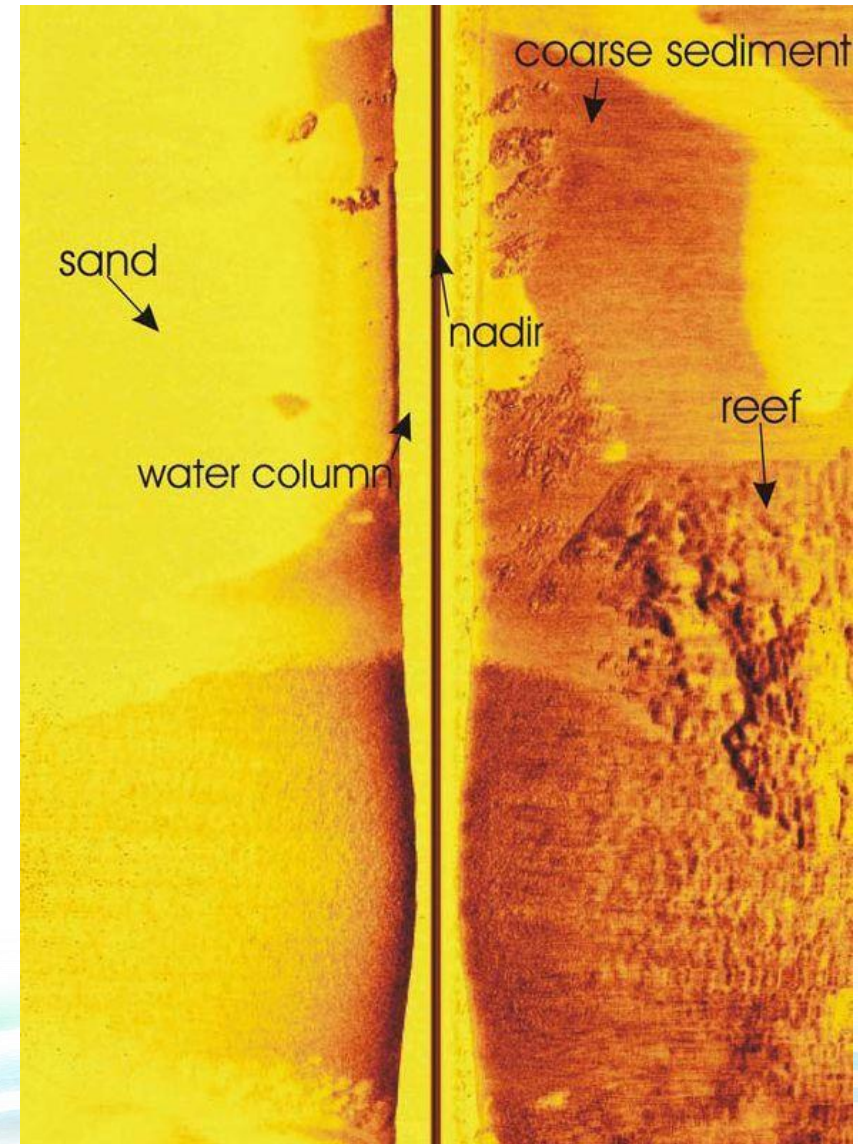
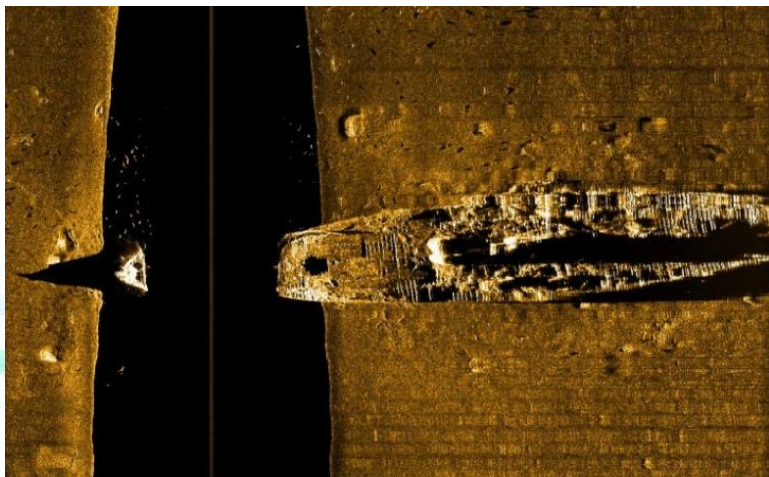


## Side-scan sonars – Nadir line

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.

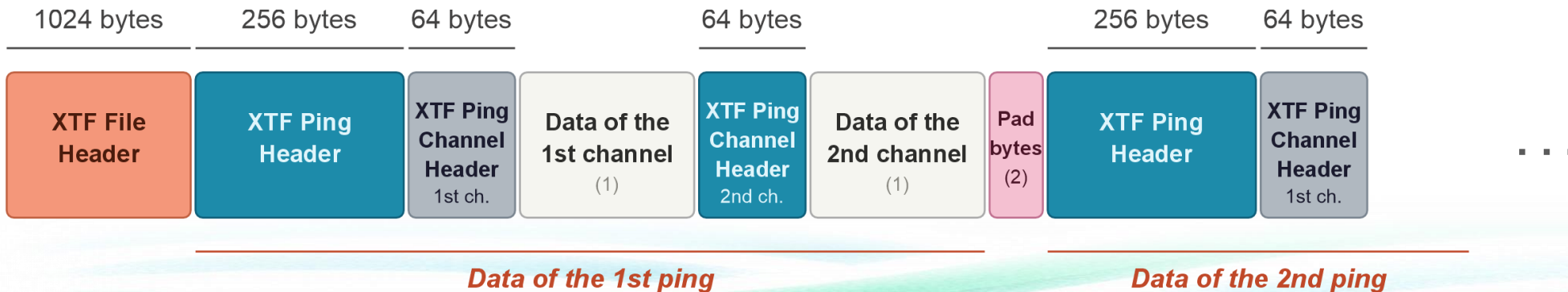
For example:

- 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.



### 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

## OpenSideScan



# CIDCO

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

- processing and
- visualizing sidescan sonar 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

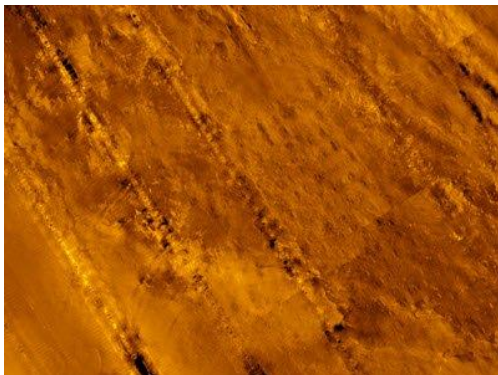


Developed by **Oystein Sture (oysstu)**, is a Python library for reading and writing eXtended Triton Format (XTF) files.

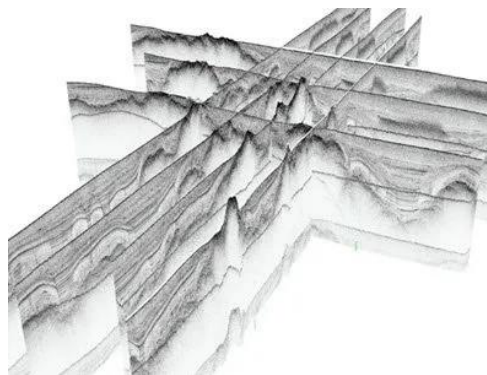
- Read and parse XTF files (file headers & sonar/sub-bottom/bathymetry packets)
- Write or generate XTF files
- Support for reading multiple data packet types (navigation, ping, attitude, etc.)

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

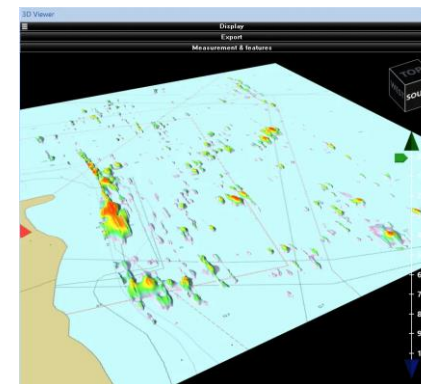
Sidescan



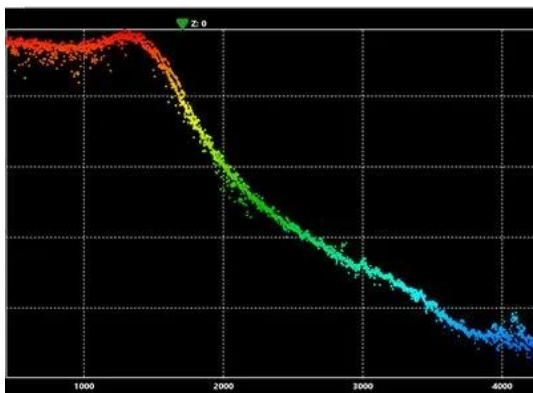
Sub-Bottom



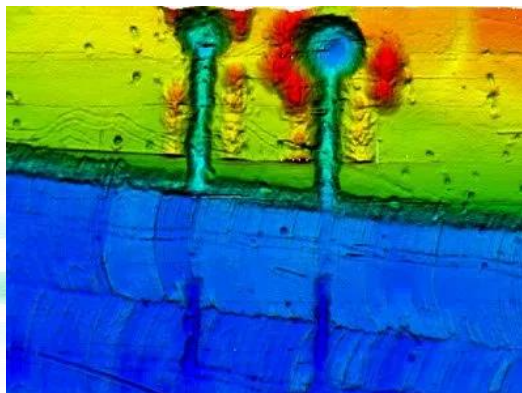
Magnetometry



Single beam



Multi-beam



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





## Main view

The screenshot displays the main interface of the SonarWiz software. At the top, the title bar reads "SSS\_Sonarwiz\_Blank.mml - SonarWiz 8 V8.3.0 x64 - Idle". The menu bar includes File, Data Acquisition, Post Processing, Bathymetry, Maps, View, Tools, Help, and About. Below the menu bar is a toolbar with icons for various functions, grouped into sections like "Configure Sensors", "Survey Lines", "Data Recording", and "Controls".

The main workspace is a large blue area. On the left side, there are three panels: "Project Explorer" showing a tree view of project files (Maps, Bathymetry Files, Lidar Files, Grids, Sidescan Files, Contacts, Features, Cores, Sub-bottom Files), "Properties" with a search bar, and "Color" which is currently active. The "Color" panel shows a vertical color scale for "Sidescan (ch. 1 and 2)" with a "Histogram Not Available" message. The scale ranges from 1.00 to 254.75 (Max). Below the scale are "Zoom" controls, "Palettes" (currently "MstlBronze"), and "Mapping Range" settings (Min: 1.00, Max: 254.75).

At the bottom, there is an "Output" window displaying a log of system messages, including coordinate system settings and projection information. The status bar at the very bottom shows coordinates: 40° 50.68102' N 024° 17.91778' E, X: 272265.79 Y: 4525028.24, and Z: ?.

# Project creation

Create a new project

The screenshot shows the SonarWiz V8.3.0 x64 software interface. A 'Create a New Project...' dialog box is open in the center. The dialog contains the following fields and options:

- Project Name:** An empty text input field.
- Project Folder:** A text input field containing 'C:\SonarWiz-Projects\' with a browse button (...).
- Project Path:** A text input field containing 'C:\SonarWiz-Projects\'.
- Approximate Project Position:**
  - Latitude:** 40° 50.70478' N. Includes 'Use GPS Position' and 'Get From File...' buttons.
  - Longitude:** 024° 18.54621' E. Includes a 'Select from World Cities' button.
- Coordinate System:**
  - Selected: EPSG:32635
  - Alternative: WGS 84 / UTM zone 35N
  - Checked: Automatically Select CRS
  - Button: Browse Coordinate Systems...
- Buttons:** OK and Cancel.

Red arrows point to the 'Project Folder' and 'Project Path' fields with the text 'set position of files'. Another red arrow points to the 'Get From File...' button with the text 'set position from files'. The background shows the software's main interface with a menu bar (File, Data Acquisition, Post Processing, Bathymetry, Maps, View, Tools, Help), a toolbar, and a Project Explorer on the left.

set position of files

set position from files

Output

```

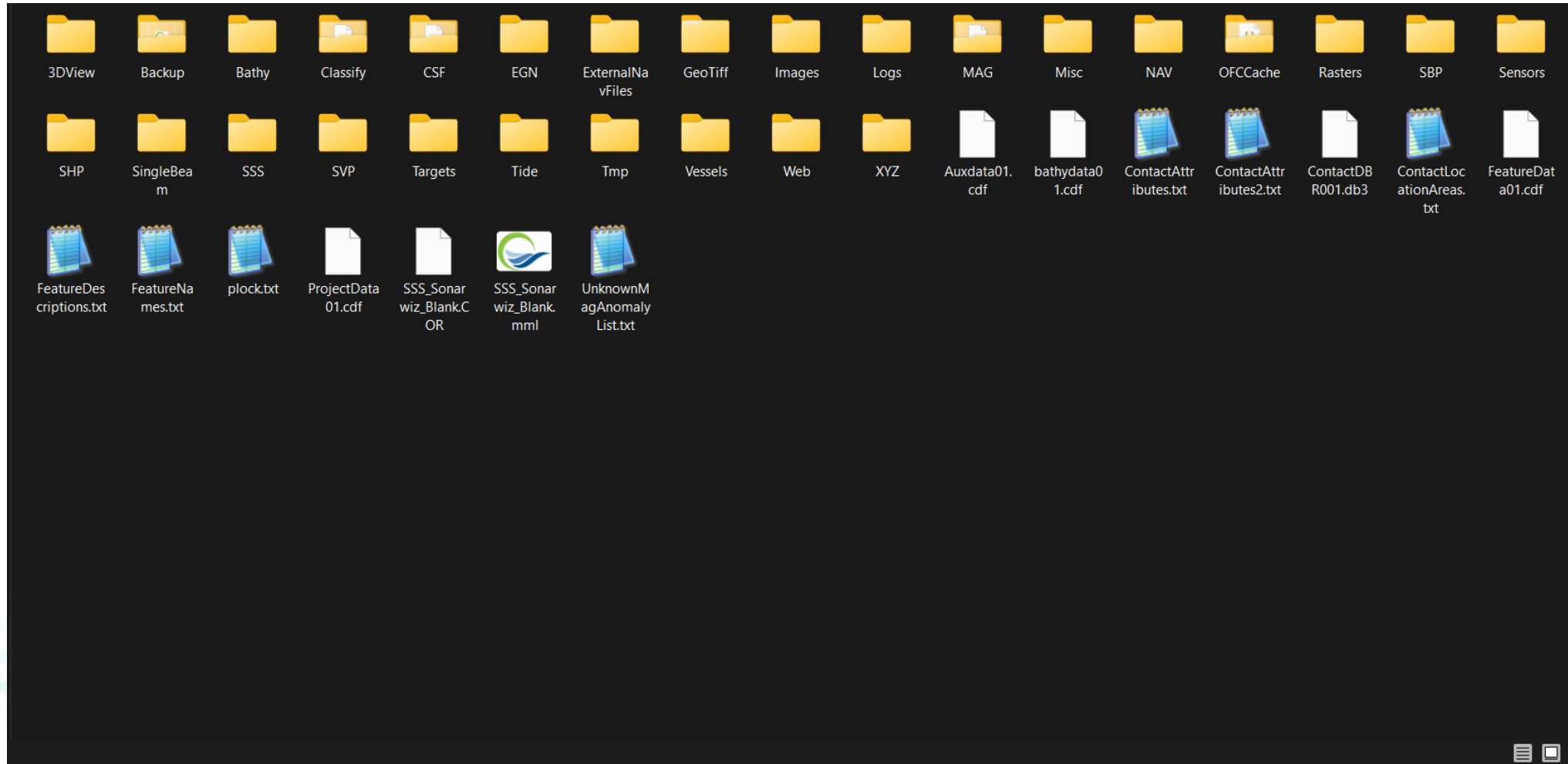
2026-04-08T11:34:13.268: CGeodesy::SetCoordSystem: Datum: is datum of coordinate system>EPSG:32635<
2026-04-08T11:34:13.270: GeoCsCode for datum is EPSG:4326.
2026-04-08T11:34:13.273: Success: CSCode >EPSG:32635< is fully supported.
2026-04-08T11:34:13.275: Set GM7 Projection from EPSG:32635 - proj.1, dtm.23, unit2, 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

The screenshot shows the SonarWiz V8.3.0 software interface. The 'Post Processing' ribbon is active, and the 'Import' button is highlighted with a red arrow. The Project Explorer on the left shows a project named 'SSS\_Sonarwiz\_Blank' with various data categories. The Color panel shows a mapping range from 1.00 to 254.75 with a 'Histogram Not Available' message. The Output window at the bottom displays system logs.

```
2026-04-08T11:35:40.628: C:\Geodesy\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
```

### Import files

The screenshot shows the SONARWIZ software interface. The 'Post Processing' menu is active, with options like 'Vessel', 'Import', 'Playback', 'File Manager', and 'Export'. The 'Project Explorer' on the left shows a project named 'SSS\_Sonarwiz\_Blank' with various data layers like 'Maps', 'Bathymetry Files', and 'Lidar Files'. The 'Properties' panel at the bottom shows 'Number enabled' set to 0. The 'Output' window at the very bottom displays system logs.

The 'Import' dialog box is open, showing a file explorer view of the 'Palio' folder on the desktop. It lists several '.xtf' files. The 'File name' field is empty, and the 'File Type' is set to 'All Acoustic Data'. The 'Import Settings' section is expanded, showing options for 'Sidescan' (checked), 'Sub-bottom', 'Bathymetry', 'Magnetometer', 'Single-beam', 'LIDAR', and 'Forward-looking'. The 'Import Settings' for 'Sidescan' are: Channels 1 and 2, Channel 1, Mag Log Type 5 / CH1 / Downsample 10 Hz, XTF Single Beam, Range: 0.0 to 200.0, Angle: 0.0 to 360.0, Intensity: 0.0 to 255.0, and Sampling Area: W: 5% - 95% | H: 47% - 50% Frames skipped: 0. The 'Import Spatial Reference ID' is set to 'EPSG:4326 WGS 84'. A red arrow points to the 'Sidescan' checkbox with the text 'check this'.

This screenshot shows the main SONARWIZ interface with the 'Import' dialog box overlaid. The background shows a map view with a blue area. The 'Import' dialog box is the same as shown in the previous block, but it is positioned over the main application window.

```
2026-04-08T11:35:40.628: CGeodesy.SetCoordSystem: Datum: is datum of coordinate system
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 - proj.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
```

### Import files

The screenshot displays the SonarWiz V8.3.0 x64 software interface. The main window shows a 3D visualization of sonar data, rendered in a golden-brown color scheme, against a light blue background. 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 and processing. On the left, there is a Project Explorer showing a tree view of the project files, including Maps, Bathymetry Files, Lidar Files, Grids, Sidescan Files (1), and Contacts. Below the Project Explorer is the Properties panel, which is currently showing the 'Color' properties for the selected data. The 'Color' panel includes a 'Datatype' dropdown set to 'Sidescan (ch. 1 and 2)', a 'Mapping' section with a color scale from 0.000 to 135.087, and 'Palette Options' set to 'MstlBronze'. The 'Output' panel at the bottom shows a log of operations, including 'Minimum (Sonar0003-1\_xtf-CH12): 0.000000 at row:16169', 'Maximum (Sonar0003-1\_xtf-CH12): 34.655674 at row:2812', and 'Smoothing complete on Sonar0003-1\_xtf-CH12'. The status bar at the bottom indicates the current coordinates: 40° 53.63626' N 024° 21.08167' E X: 276877.23 Y: 4530360.77 Z: ?

Bottom Track

Bottom track processing

The screenshot displays the SonarWiz 8 V8.3.0 x64 software interface. The main window title is "SSS\_Sonarwiz\_Blank.mml - SonarWiz 8 V8.3.0 x64 - Idle". The menu bar includes "File", "Data Acquisition", "Post Processing", "Geometry", "Maps", "View", "Tools", and "Help". The toolbar contains various icons for processing tasks, grouped into categories like "Sonar File Tasks", "Sonar File Processing", "Contacts", "ATR", "Digitized Features", "Sub-bottom", "Magnetometer", and "Characterization".

On the left side, the "Project Explorer" shows a tree view of the project "SSS\_Sonarwiz\_Blank". A red arrow points to the "Sonar0003-1\_xtf-CH12.CSF" file under the "Sidescan Files (1)" folder. The "Properties" panel below it shows details for this file, including Name, CSF Version (3.00), Records (27027), Group name, and Imported SRID (EPSG:4326).

The "Color" panel shows the mapping settings for the selected file, including Datatype (Sidescan (ch. 1 and 2)), Mapping (a color scale from 0.000 to 135.087), Zoom, and Palette Options (MstlBronze, Smooth checked, Invert unchecked).

The main visualization area shows a 3D perspective view of sonar tracks, rendered in a color gradient from blue to red, with small red and green triangles marking specific points along the tracks.

The "Output" window at the bottom displays the following log messages:

```

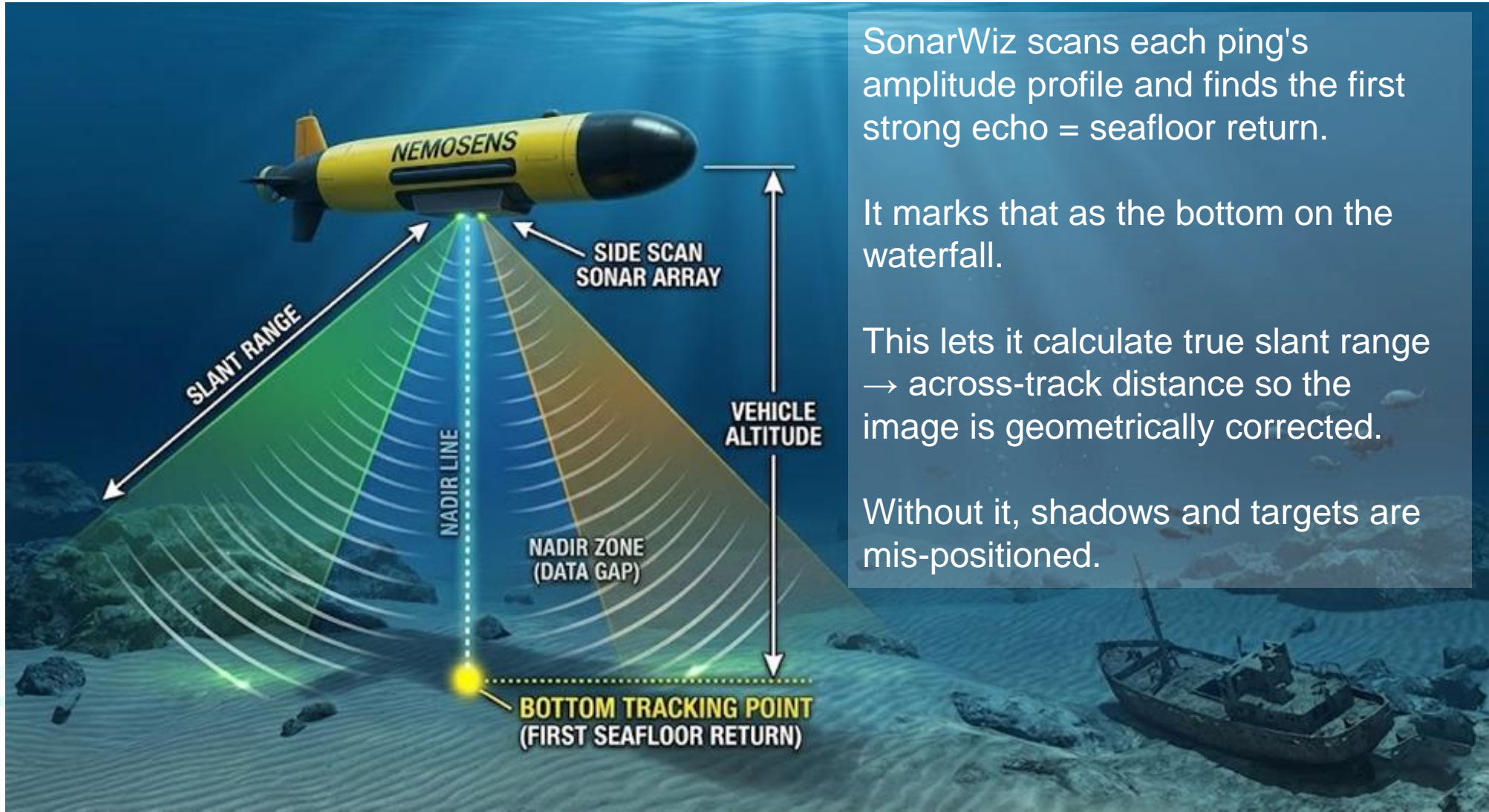
2026-04-08T11:40:54.348: Minimum (Sonar0003-1_xtf-CH12): 0.000000 at row:16169
2026-04-08T11:40:54.349: Maximum (Sonar0003-1_xtf-CH12): 34.655674 at row:2812
2026-04-08T11:40:54.350: Smoothing: Sonar0003-1_xtf-CH12
2026-04-08T11:40:55.826: Smoothing complete on Sonar0003-1_xtf-CH12
2026-04-08T11:40:55.831: Applying Layback to Sonar0003-1_xtf-CH12
2026-04-08T11:40:56.944: Create OK: Sonar0003-1_xtf-CH12.CSF

```

At the bottom right, the status bar shows coordinates: "40° 53.93190' N 024° 20.40596' E X: 275945.07 Y: 4530936.63 Z: ?".

select SSS file

## Bottom Track



SonarWiz scans each ping's amplitude profile and finds the first strong echo = seafloor return.

It marks that as the bottom on the waterfall.

This lets it calculate true slant range → across-track distance so the image is geometrically corrected.

Without it, shadows and targets are mis-positioned.

Bottom Track

select algorithm

Track processing

The screenshot displays the SonarWiz software interface. At the top, the title bar reads "Sonar0003-1\_xtf-CH12.CSF - SonarWiz". The main menu includes "Tracking", "Features", "Contacts", "Track", and "Appearance". The "Tracking" panel is active, showing "Track: Bottom" and "Algorithm: Edge Detection". It also includes sliders for "Blanking" (0.0 and 1.5) and "Threshold" (80 and 20) for both port and starboard settings. A toolbar contains icons for "Clear", "Track All", "Track from Ping", "Offset Track", "Auto-scroll", "Insert Points", "Remove Points", and "Color".

Below the settings is a "Color" panel for "Sidescan (ch. 1 and 2)". It features a "Mapping" section with a depth scale from 0.000 to 135.087 Max. The "Palette Options" section shows "MstiBronze" selected, with "Smooth" checked and "Invert" unchecked. The "Mapping Range" section has "Min: 0.00" and "Max: 135.09", with "Scale To Best" selected. The "Scale Mode" is set to "Auto - Combined".

The main visualization area shows a sonar track with a blue line indicating the bottom track. The track is color-coded according to the "MstiBronze" palette, showing a gradient from dark brown to bright yellow.

# Bottom Track

add offset

remove/add points

The screenshot displays the SonarWiz software interface. At the top, the window title is "Sonar0003-1\_xtf-CH12.CSF - SonarWiz". The main menu includes "Tracking", "Features", "Contacts", "Playback", and "Appearance". The "Tracking" panel is active, showing settings for "Track" (Bottom), "Channel" (Both), "Algorithm" (Edge Detection), "Blanking" (0.0), "Duration" (2), and "Threshold" (80). There are also "Port Settings" and "Starboard Settings" sections. The "Operations" section contains icons for "Clear", "Track All", "Track from Ping", and "Offset Track". The "Bottom Points" section includes "Auto-scroll", "Insert Points", "Remove Points", and "Color".

The central part of the interface shows a sonar image with a bottom track highlighted in red. The track is a vertical line of bright yellow and orange, indicating the seabed. A red dashed box highlights the track, and a red arrow points to the "Offset Track" icon in the top toolbar. Another red arrow points to the "Remove Points" icon in the "Bottom Points" section.

On the left side, there is a "Color" panel with a "Mapping" section showing a depth scale from 0.000 to 135.087 Max. Below this, there are "Palette Options" (MstlBronze) and "Mapping Range" settings (Min: 0.00, Max: 135.09).

## Bottom Track

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 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.CS
  - Contacts
  - Features

Properties

General

Color

Datatype: Sidescan (ch. 1 and 2)

Mapping

Zoom: + - Bipolar Mo...

Palette Options

MstlBronze

Smooth  Invert Edit Palette

Mapping Range

Min: 0.17 Scale To Best

Max: 152.36 Scale To Data

Output

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  
2026-04-08T12:55:31.782: Backing up DigFeature file to C:\Users\nikol\Desktop\SSS Sonarwiz Blank\SSS Sonarwiz Blank\Backup\FeatureData01\_\_BU0002.cdf - OK

CTI Support Redraw

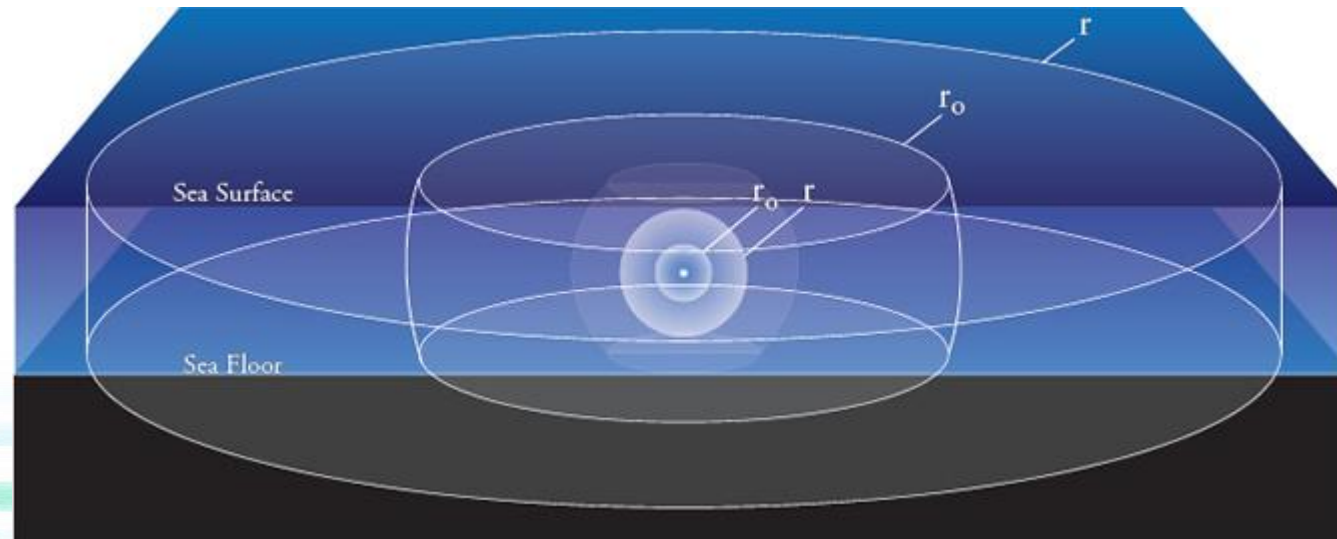
40° 53.75174' N 024° 20.17908' E X: 275616.36 Y: 4530612.94 Z: ?

## 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.

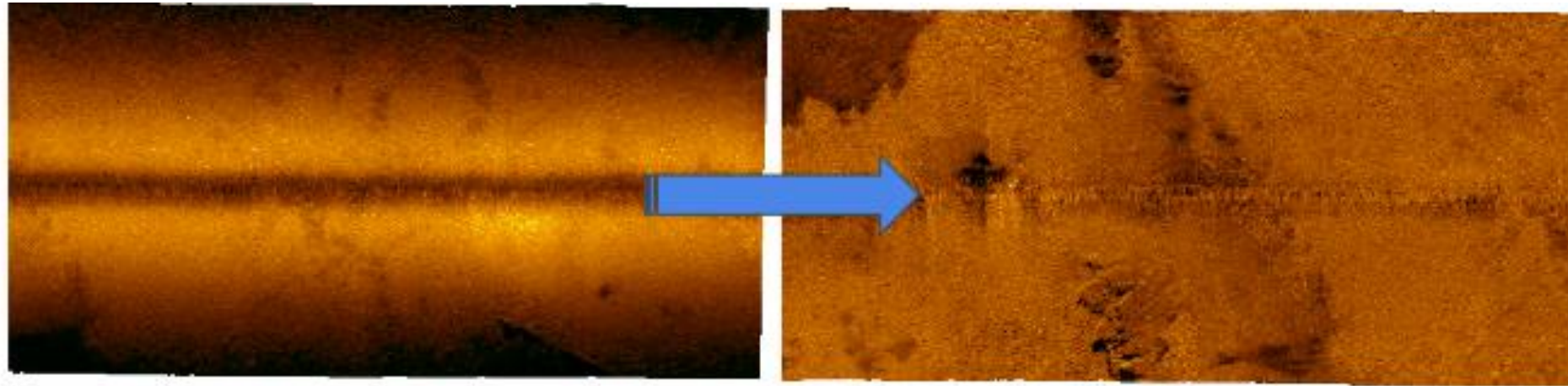


As acoustic waves propagate through the water, they lose intensity because of geometric spreading and absorption.

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**

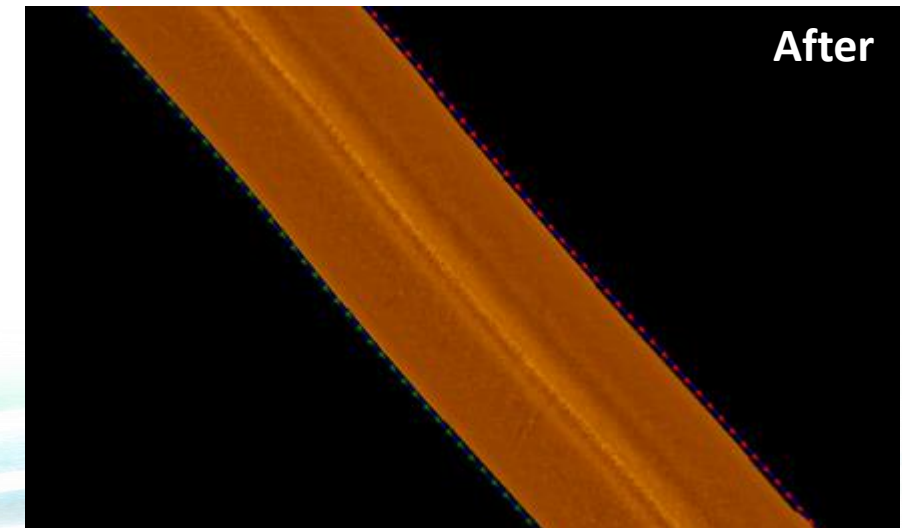
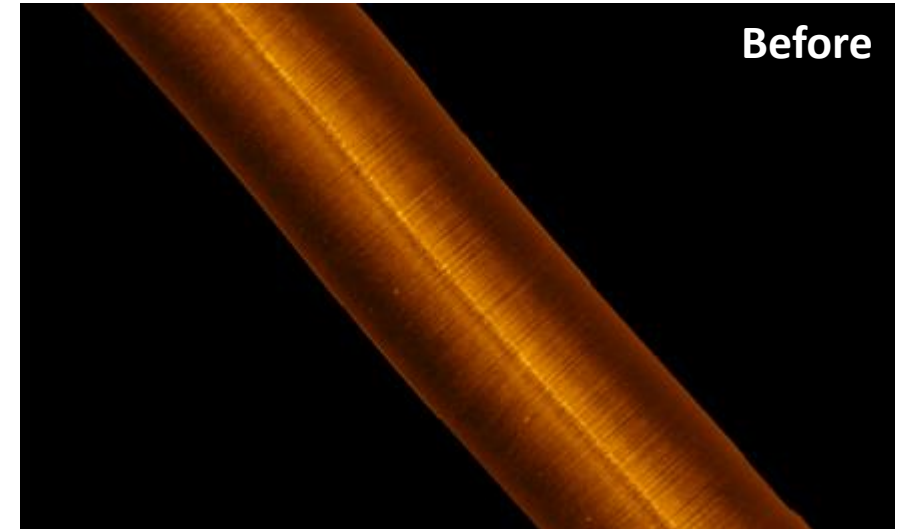
**Empirical Gain Normalization**

## 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.

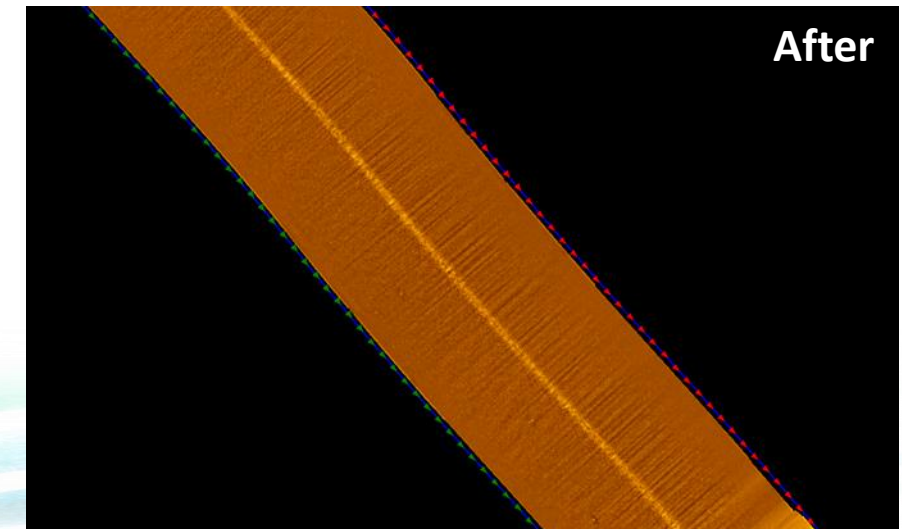
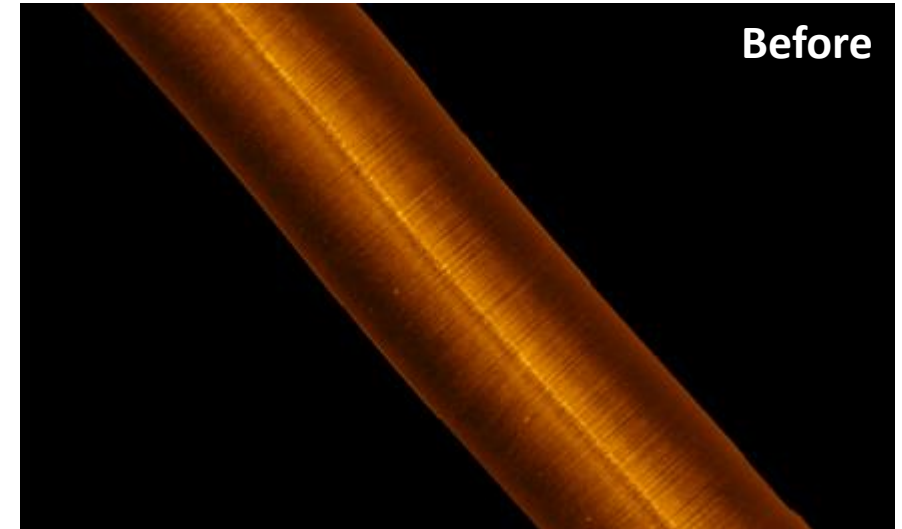
More specifically, the local average at a given ordinate is computed by averaging some number of samples to the left and right of this ordinate.



## Beam Angle Correction

The Beam Angle Correction function (BAC):

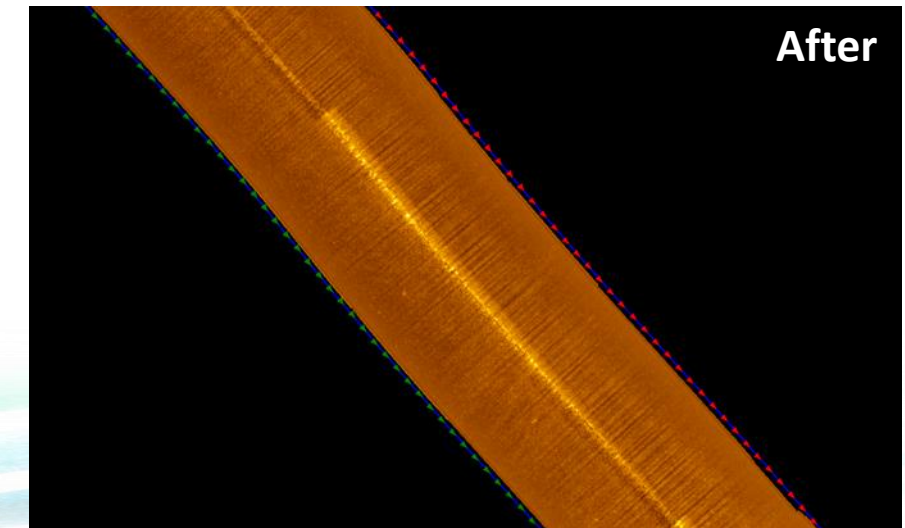
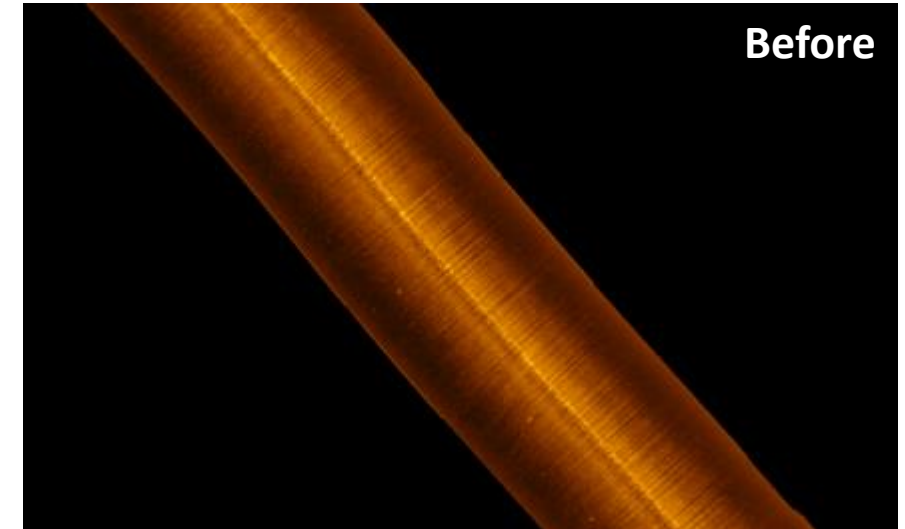
attempts to compensate for non-linear response characteristics of the sonar transducers.



## 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.

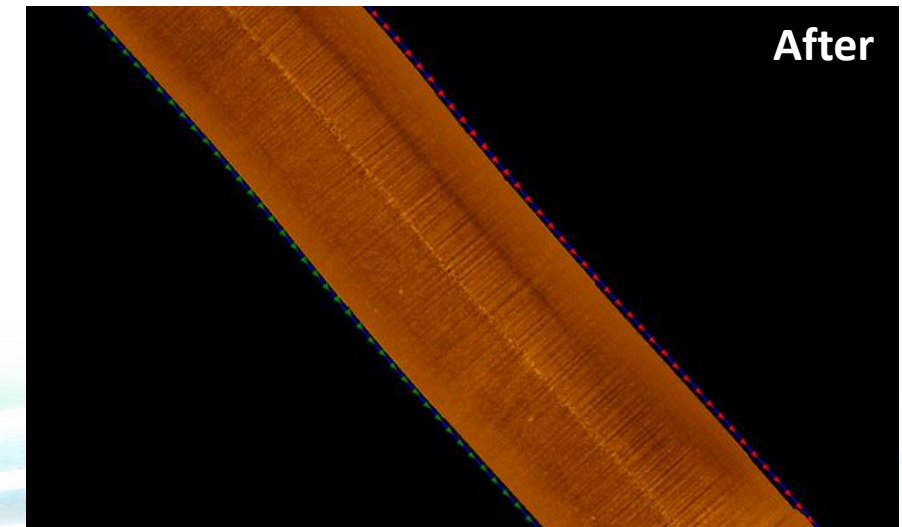
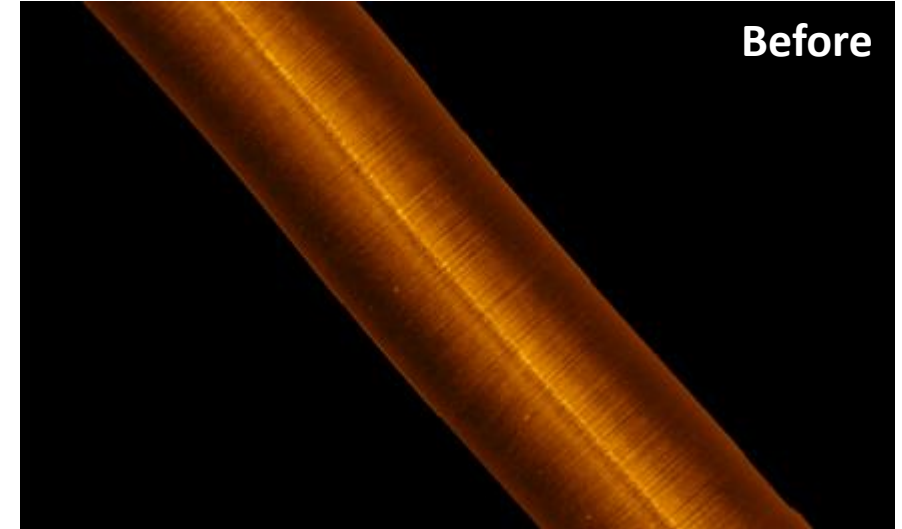


## Empirical Gain Normalization

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 shows the SonarWiz software interface with the 'Sonar File Manager' dialog box open. The dialog box contains the following information:

- Project: C:\Users\nikol\Desktop\SSS Sonarwiz Blank\SSS Sonarwiz Blank\SSS\_Sonarwiz\_Blank.mml
- Number of Files in Project: 1
- Number of Files Enabled: 1
- Limits of All Files:
 

	Minimum	Maximum	Range
X:	275970	276818	848
Y:	4530186	4531005	819
- Limits of Enabled Files:
 

	Minimum	Maximum	Range
X:	275970	276818	848
Y:	4530186	4531005	819
- Table with columns: Order, En..., Type, Group, File Name. One row is visible:
 

Order	En...	Type	Group	File Name
0	<input checked="" type="checkbox"/>	SSS		C:\Users\nikol\Desktop\SSS Sonarwiz Blank\SSS Sonarwiz Blank\CSF\Sonar0003-1_xtf-CH12.CSF

The right-hand menu of the dialog box includes buttons for: Add File(s)..., Remove File(s), Rescan Limits, Select All, Aggregate, Bottom Track..., Digitizer View, Navigation..., Properties..., Gain Settings..., Report..., Coverage..., Set Cable Out..., Offset Cable Out..., Set Sensor Depth..., Offset Sensor Depth..., SetAntenna Ht..., Import Bottom Track, and Set Draw Order.

Output

```

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
2026-04-08T12:55:31.782: Backing up DigFeature file to C:\Users\nikol\Desktop\SSS Sonarwiz Blank\SSS Sonarwiz Blank\Backup\FeatureData01..._BU0002.cdf - OK
  
```

# Sidescan Gain and Signal Processing

**Settings for: Sonar0003-1\_xtf-CH12.CSF**

**Project Sonar Data Using...**

- Course Made Good Rotate Port
- Sensor Heading Rotate Stbd
- Apply Pitch Correction (if available)

**Enable EGN** Rebuild EGN Table... SSS\_Sonarwiz\_Blank Smooth: 3

**Enable Destripe Filter** Destripe Filter (# pings): 1

**Gain/Atten vs Time (Port)**

Time	Gain/Atten
0	-4.271
9	-4.271
18	-4.271
27	-4.271
36	-4.271
45	-4.271
54	-4.271
63	-4.271
73	-4.271
82	-4.271
91	-4.271

**Gain/Atten vs Time (Stbd)**

Time	Gain/Atten
0	-4.271
9	-4.271
18	-4.271
27	-4.271
36	-4.271
45	-4.271
54	-4.271
63	-4.271
73	-4.271
82	-4.271
91	-4.271

**Output Log:**

```

2026-04-08T11:40:54.349: Maximum (Sonar0003-1_xtf-CH12): 34.6556/4 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
2026-04-08T12:55:31.782: Backing up DigFeature file to C:\Users\niko\Desktop\SSS_Sonarwiz\
  
```

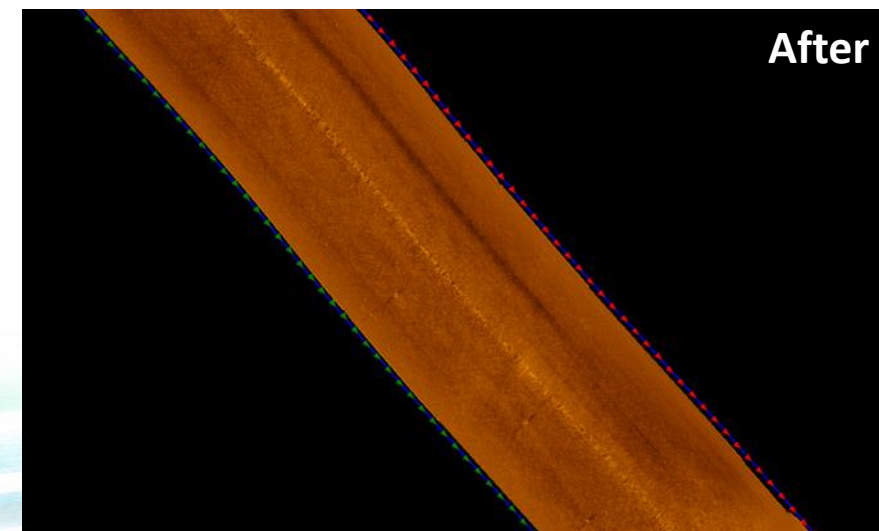
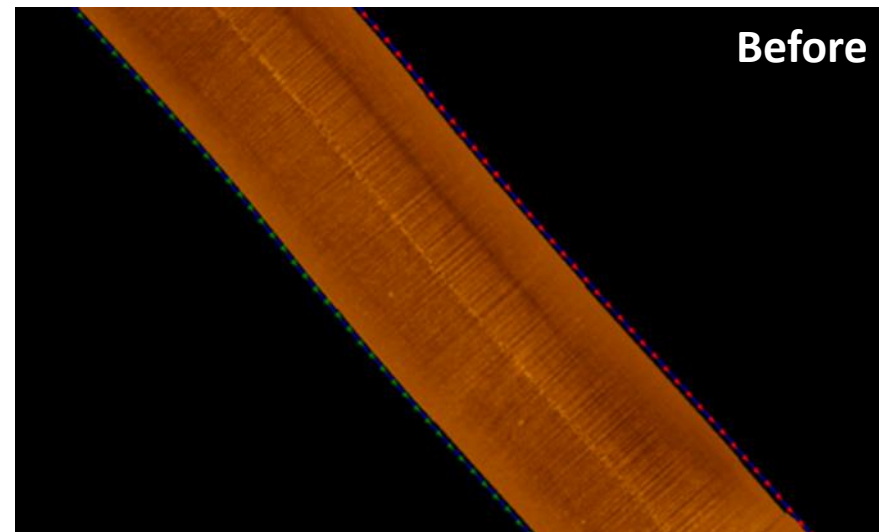
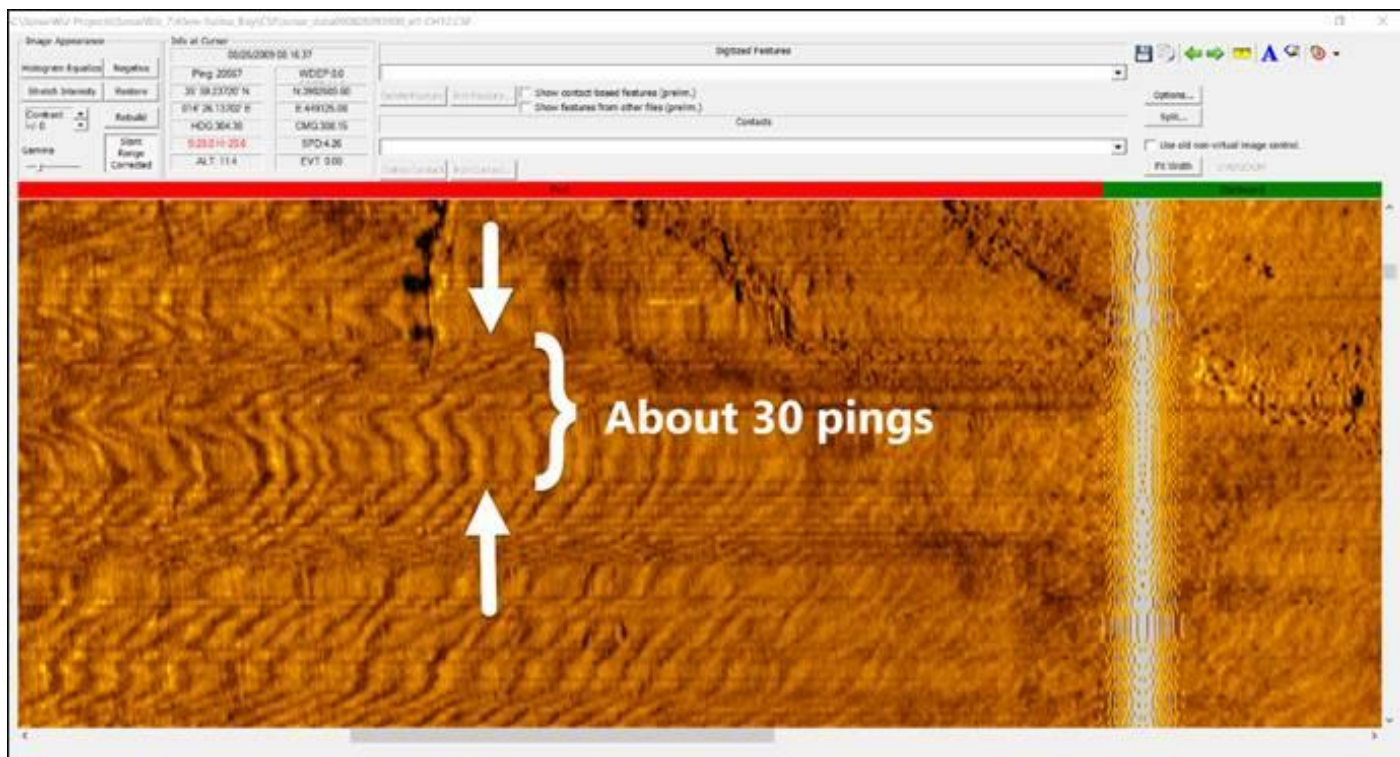
**It builds a statistical table of average intensity per across-track position across many pings, then normalizes everything to a flat response.**



### 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 software interface with the 'Export' menu open. A red arrow points to the 'Export' button in the top toolbar. The 'Save As Image File' dialog box is open, showing the following settings:

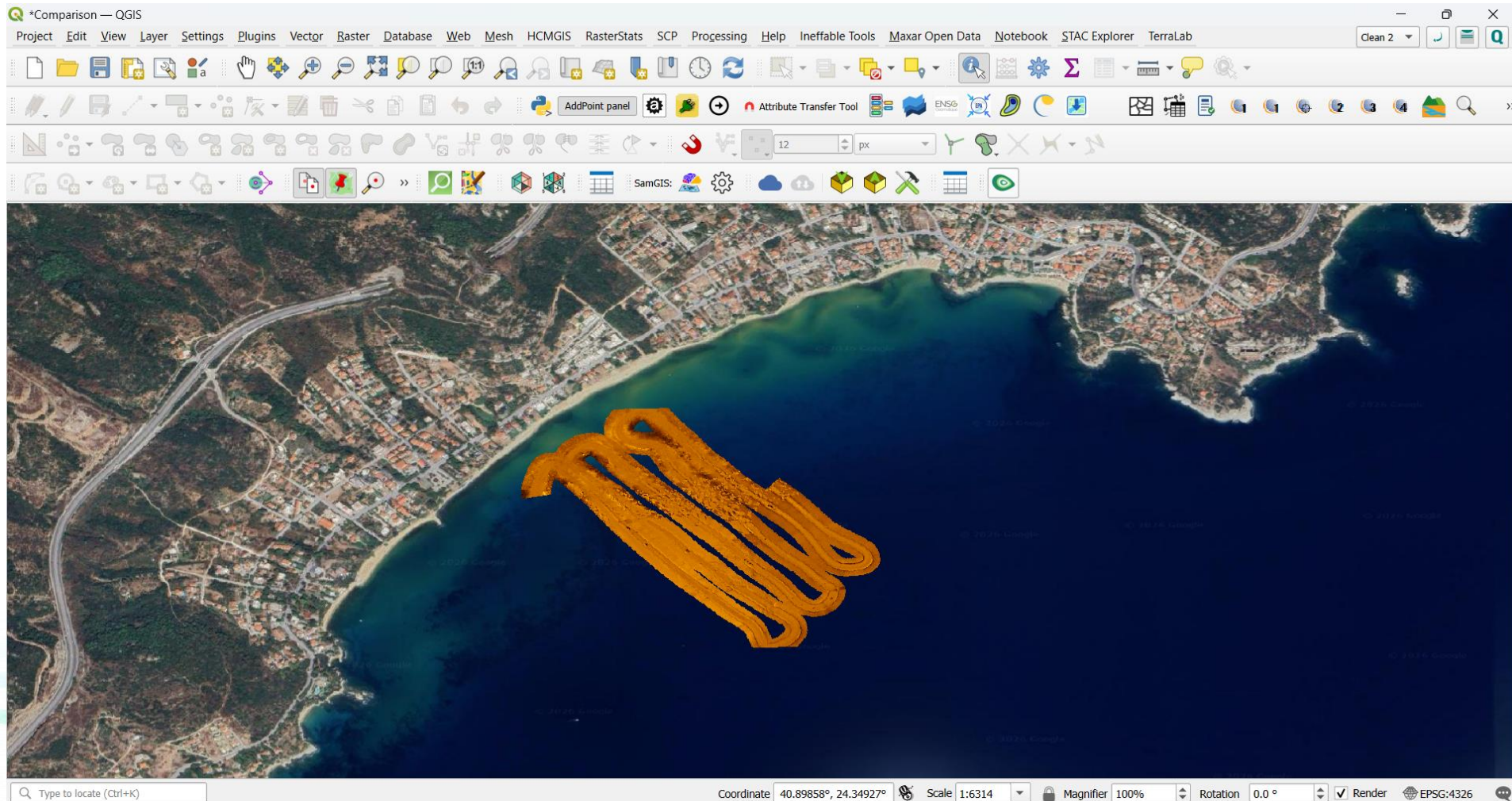
- Output image file name: SSS Sonarwiz Blank\SSS Sonarwiz Blank\GeoTiff\SSS\_Sonarwiz\_Blank.tif
- Output image file type: GeoTIFF
- Export data only:  Export data values only, with no palettization or annotation
- Output resolution: 24-bit
- Background color:  Make background color transparent. This 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:  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

The dialog box also displays tiling information:

- 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
- 1676 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 shows a bathymetry map with a track highlighted in orange. The interface includes a Project Explorer, Properties panel, and an Output log at the bottom.

## Export track



### Digitizing features

### digitizing

The screenshot displays the SonarWiz software interface. The main window shows a sonar image with two red circles highlighting digitized features. A smaller window titled 'Features' is open, showing a 'New' button circled in red. The interface includes a menu bar (File, Data Acquisition, Post Processing, Bathymetry, Maps, View, Tools, Help), a toolbar with various icons, and a Project Explorer on the left. The Properties panel on the right shows settings for the selected feature. The Output panel at the bottom displays a log of actions such as 'Adding feature (waterfall) - Feature000 type=2 coords=4' and 'Deleting feature Feature000 (ID 1)'. The status bar at the bottom shows coordinates: 40° 53.73984' N 024° 20.28053' E X: 275758.13 Y: 4530586.60 Z: 7.

# Digitizing features

Feature manager

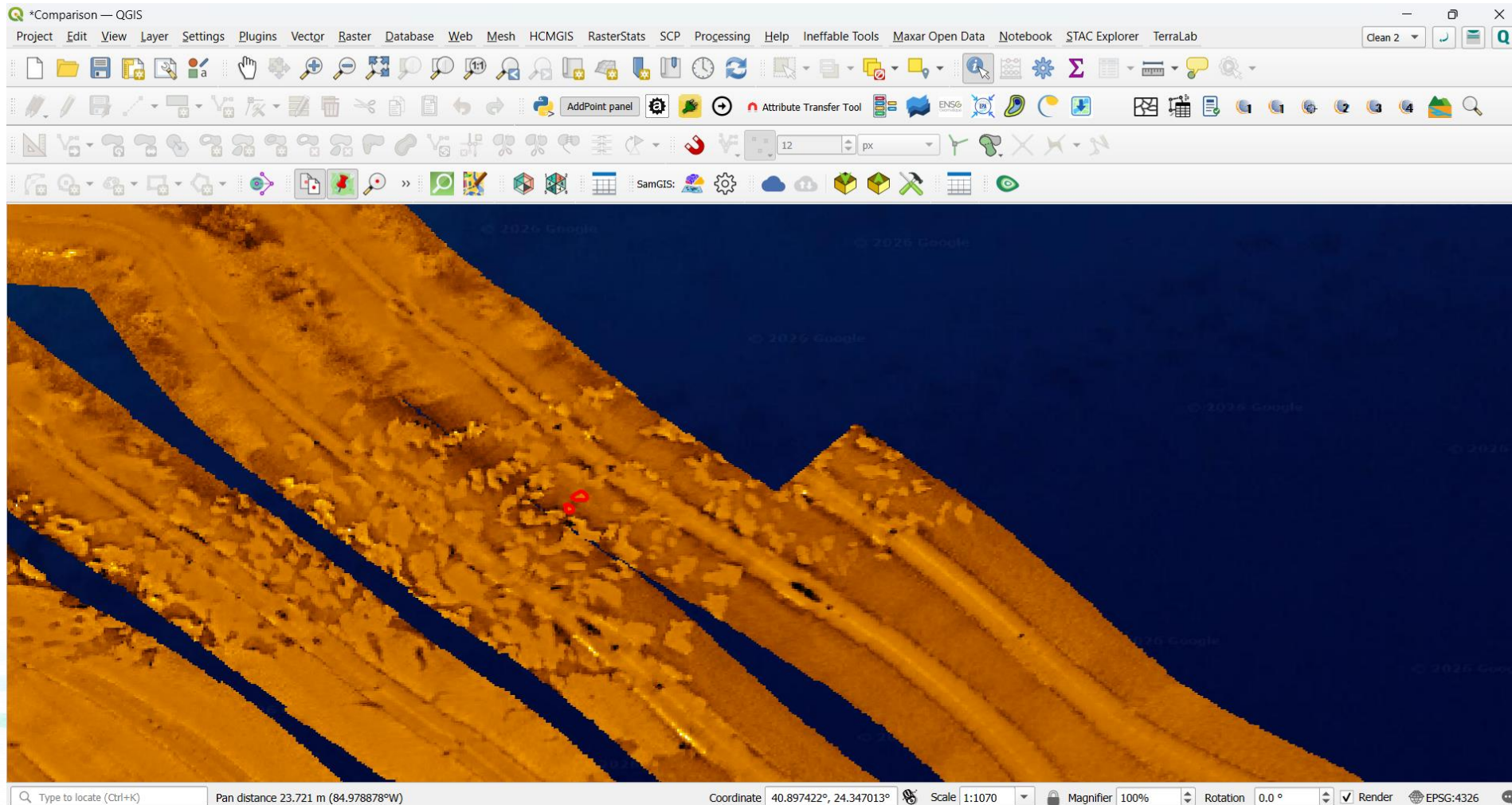
The screenshot displays the SonarWiz V8.3.0 software interface. The main window shows a sonar data visualization with a red arrow pointing to a specific feature. Overlaid on this is the 'Feature Export' dialog box, which is used to export digitized features. The dialog includes the following sections:

- Export by feature name:** A checkbox option with the note: "All features with the same name will be exported to a single file."
- Destination Folder:** A text field showing "C:\Users\nikol\Desktop\SSS Sonarwiz Blan" and a "Browse" button.
- Export Format:** A list of file formats including:
  - 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** (highlighted)
  - XYZA (Amplitude) Text TXT
  - XYTime (milliseconds) [MSEC] TXT
  - XYTime (seconds) [SEC] TXT
  - AutoCAD DXF-High Res (SBP Only) [HIRES] DXF
  - 3D Feature Surface [CTBD] 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:** A list of feature names, currently showing "Feature000" and "Feature001".

At the bottom of the dialog are "OK" and "Cancel" buttons. The background interface includes a menu bar (File, Data Acquisition, Post Processing, Bathymetry, Maps, View, Tools, Help), a toolbar with various icons, and a Project Explorer on the left showing a tree view of the project files.

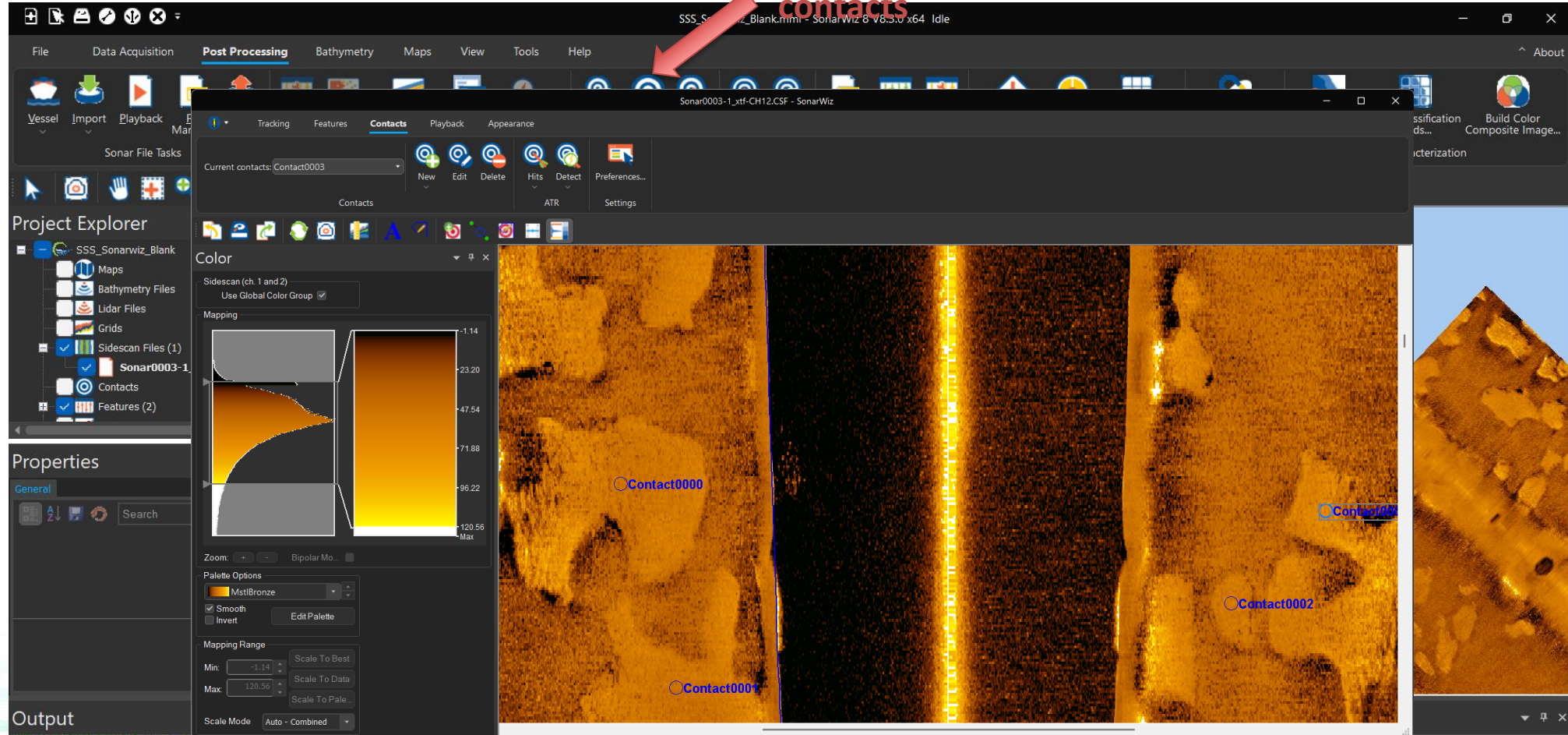
2026-04-08T11:35:24.7551: Adding feature (waterfall) - Feature0000 type=4 coords=12  
 2026-04-08T11:35:00.602: Adding feature (waterfall) - Feature0001 type=4 coords=12  
 2026-04-08T11:34:28.537: Deleting feature Feature0000 (ID 2)  
 2026-04-08T11:34:31.812: Deleting feature Feature0001 (ID 3)  
 2026-04-08T11:35:42.932: Adding feature (waterfall) - Feature0000 type=4 coords=12  
 2026-04-08T11:00:13.017: Adding feature (waterfall) - Feature0001 type=4 coords=12

# Digitizing features



# Capturing Contacts

Capture contacts



2026-04-08T11:35:24.7551: Adding feature (waterfall) - Feature0000 type=4 coords=15)  
 2026-04-08T11:35:30.602: Adding feature (waterfall) - Feature0001 type=4 coords=14)  
 2026-04-08T11:35:42.537: Deleting feature Feature0000 (ID 2)  
 2026-04-08T11:35:43.812: Deleting feature Feature0001 (ID 3)  
 2026-04-08T11:35:49.932: Adding feature (waterfall) - Feature0000 type=4 coords=14)  
 2026-04-08T14:00:13.017: Adding feature (waterfall) - Feature0001 type=4 coords=12)

### Capturing Contacts

### Contacts manager

**Contacts Manager**

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

<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Name	Latitude	Longitude	X	Y	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Contact0000	40° 53.82978' N	024° 20.77060' E	276451.30	4530732.11	Sonar
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Contact0001	40° 53.83613' N	024° 20.76617' E	276445.44	4530744.04	Sonar
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Contact0002	40° 53.84395' N	024° 20.78223' E	276468.42	4530757.82	Sonar
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	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, UnDelete, Purge, Show Deleted Contacts, Recapture, Preferences...

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)

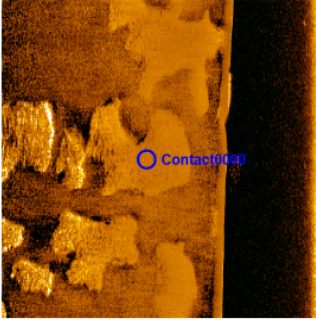
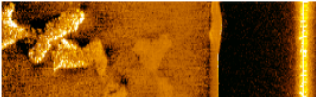
CTI Support    Redraw

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

## Capturing Contacts

### Report PDF Small English

Generated on 8/4/2026 5:16:46 μμ

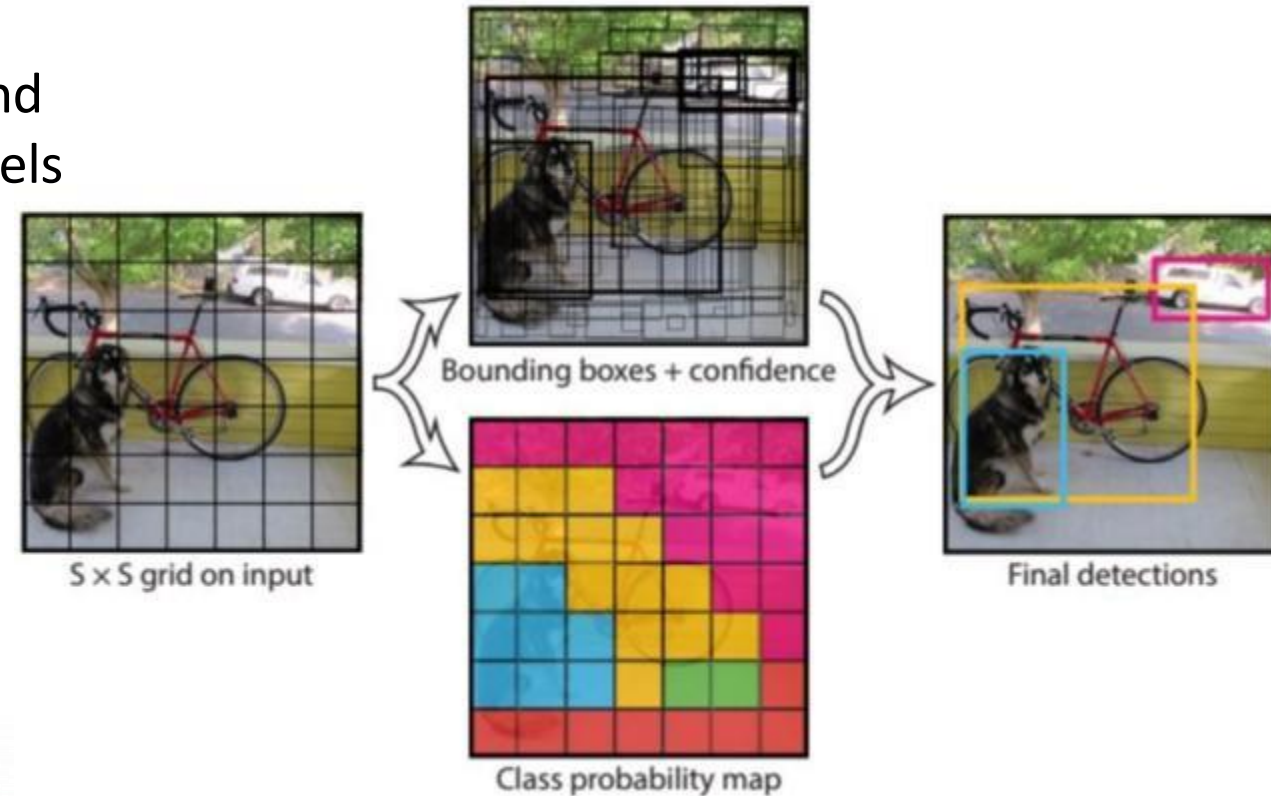
Target Image	Target Info	User Entered Info
	<p>Contact0000</p> <ul style="list-style-type: none"> <li>• Sonar Time at Target: 1/4/2016 3:34:40 μμ</li> <li>• Click Position 40.8971631525 24.3461766962 (WGS84) (X) 276451.30 (Y) 4530732.11 (Projected)</li> <li>• Map Projection: EPSG:32635</li> <li>• Acoustic Source File: Sonar0003-1.xtf</li> <li>• Ping Number: 4457</li> <li>• Range to target: 16.50 Meters</li> <li>• Fish Height: 10.48 Meters</li> <li>• Heading: 0.000 Degrees</li> <li>• Course Made Good: 314.614 Degrees</li> <li>• Event Number: (-1)</li> <li>• Line Name: Sonar0003-1</li> <li>• Target depth: 10.48 Meters</li> </ul>	<p>Dimensions and attributes</p> <ul style="list-style-type: none"> <li>• Target Width: 0.00 Meters</li> <li>• Target Height: 0.00 Meters</li> <li>• Target Length: 0.00 Meters</li> <li>• Target Shadow: 0.00 Meters</li> <li>• Mag Anomaly:</li> <li>• Avoidance Area:</li> <li>• Classification1:</li> <li>• Classification2:</li> <li>• Area:</li> <li>• Block:</li> <li>• Description:</li> <li>• Water Depth: 10.50 Meters</li> </ul>
	<p>Contact0001</p> <ul style="list-style-type: none"> <li>• Sonar Time at Target: 1/4/2016 3:34:48 μμ</li> <li>• Click Position 40.8972688649 24.3461029093 (WGS84) (X) 276445.44 (Y) 4530744.04 (Projected)</li> <li>• Map Projection: EPSG:32635</li> <li>• Acoustic Source File: Sonar0003-1.xtf</li> <li>• Ping Number: 4534</li> </ul>	<p>Dimensions and attributes</p> <ul style="list-style-type: none"> <li>• Target Width: 0.00 Meters</li> <li>• Target Height: 0.00 Meters</li> <li>• Target Length: 0.00 Meters</li> <li>• Target Shadow: 0.00 Meters</li> <li>• Mag Anomaly:</li> <li>• Avoidance Area:</li> <li>• Classification1:</li> </ul>

## What is YOLO (You Only Look Once)?

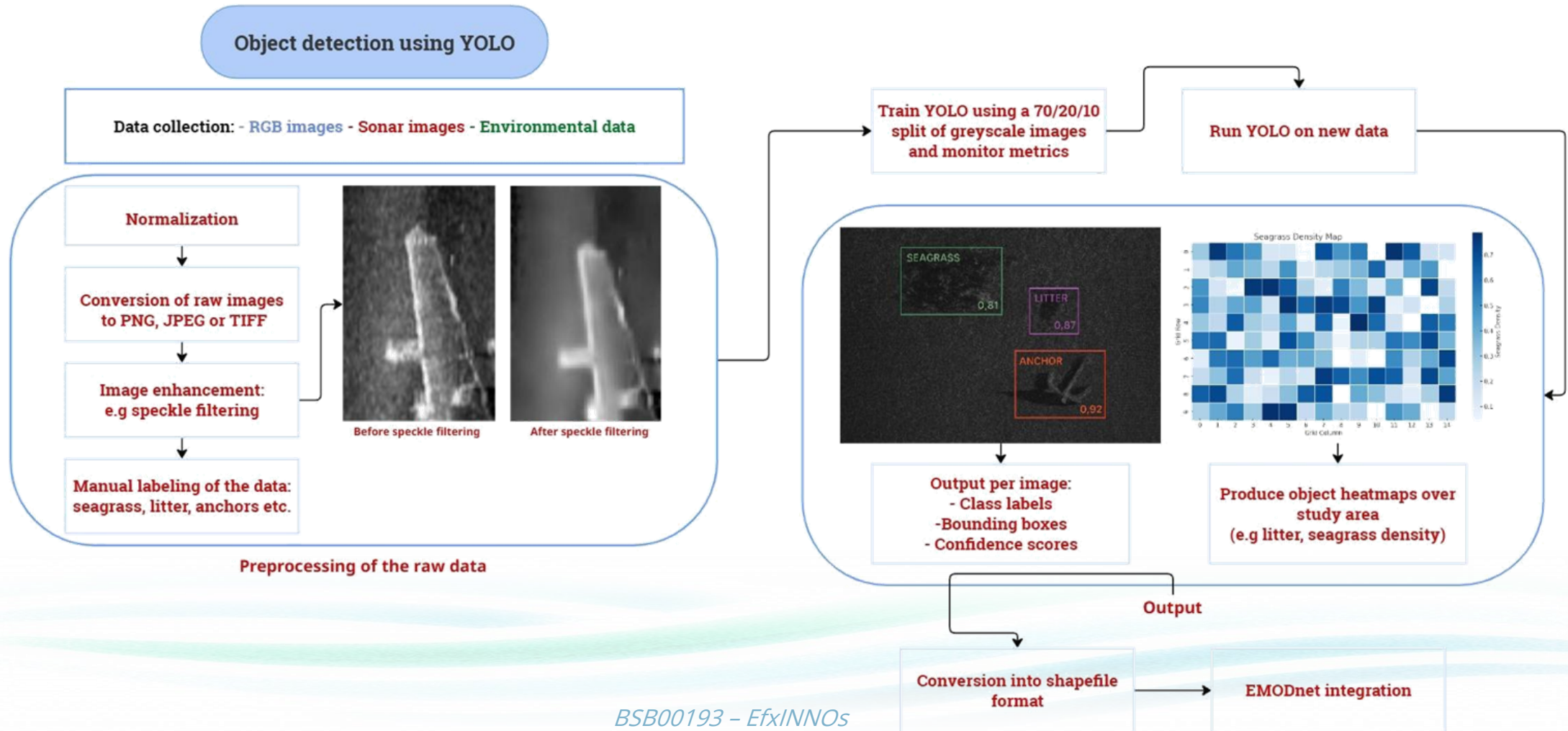
- A real-time object detection algorithm
- Detects what objects are present in an image and where they are using bounding boxes and class labels

### 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

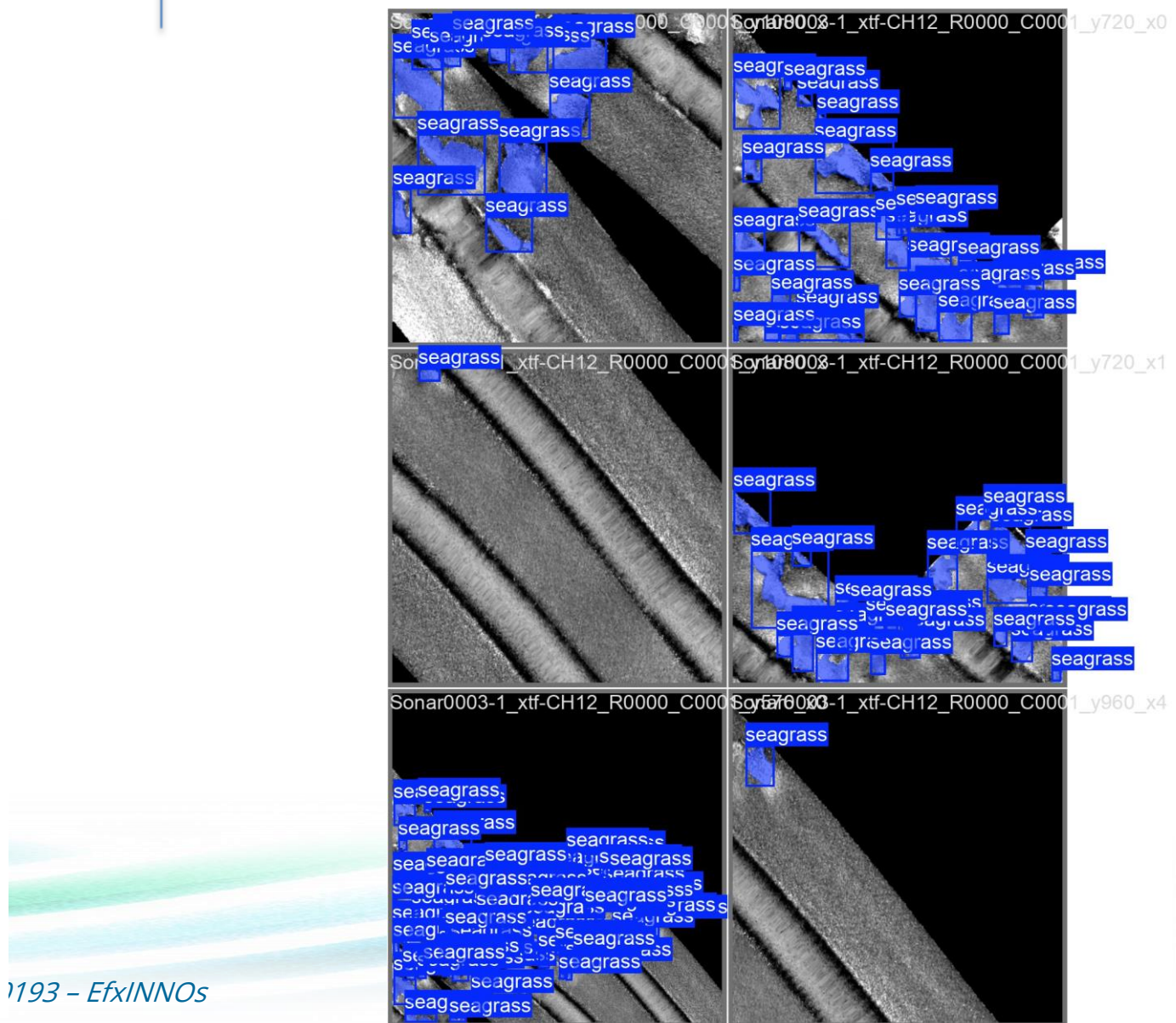
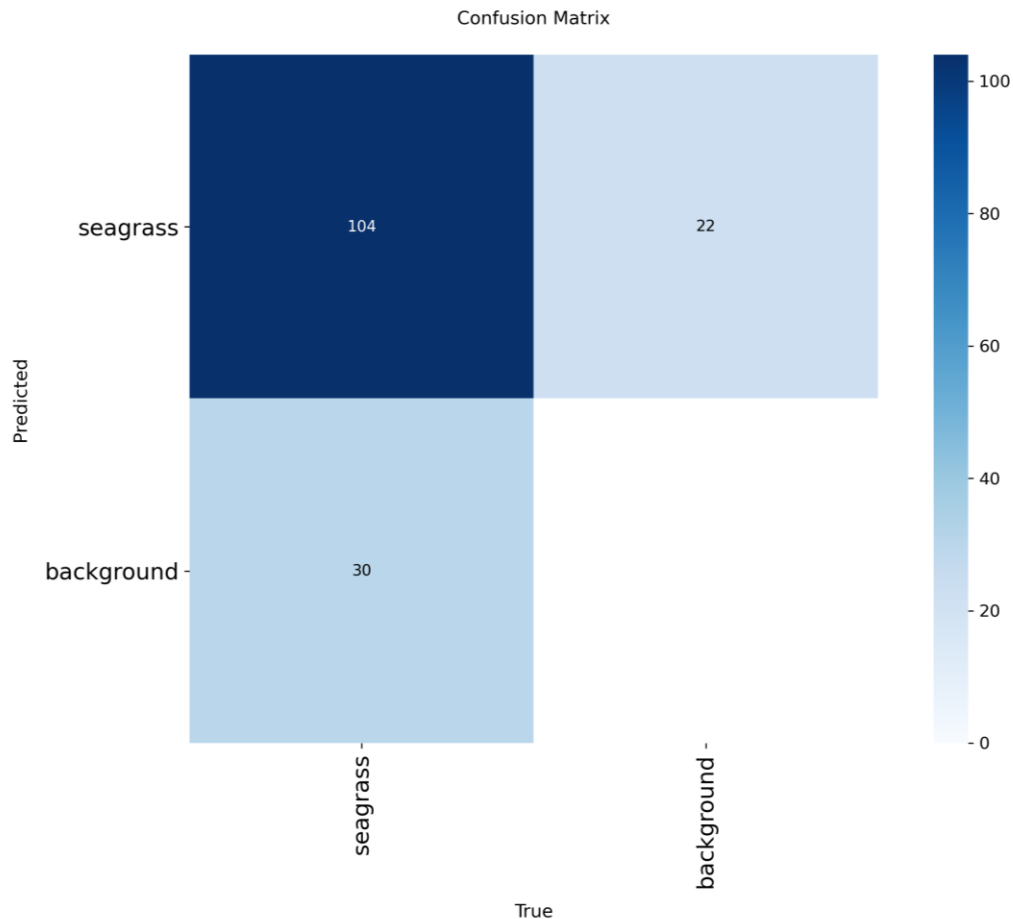


# Object detection workflow



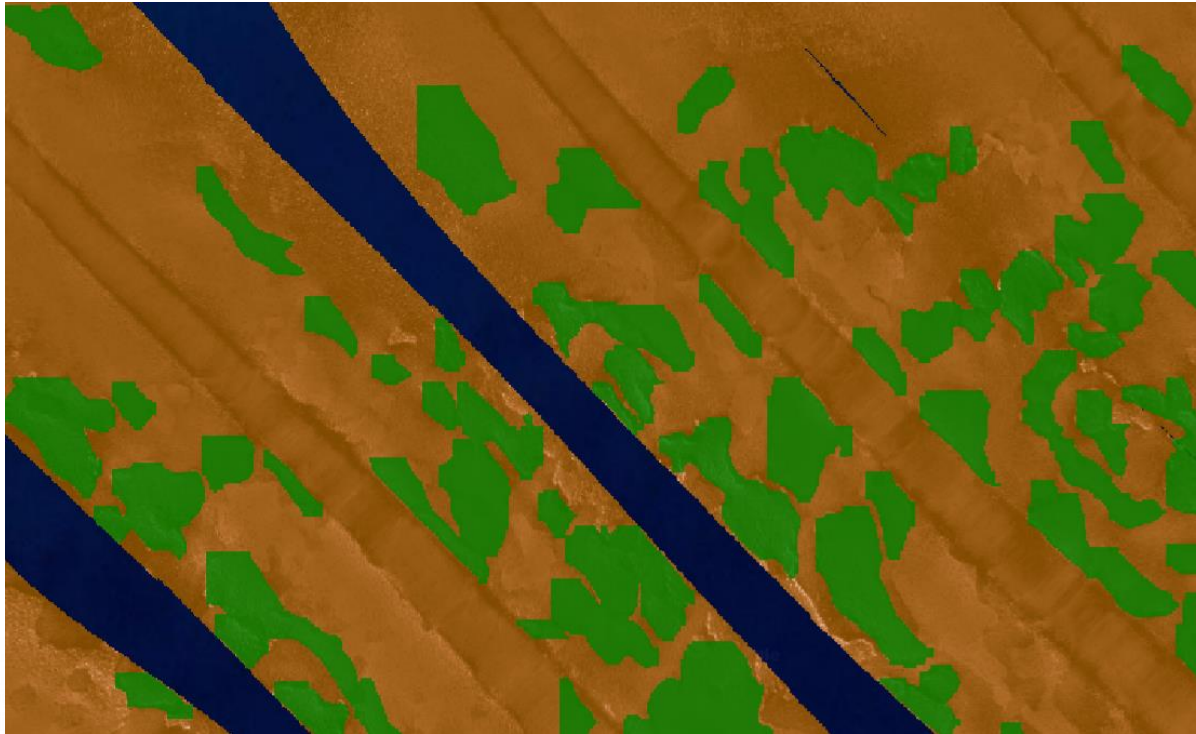
### Object detection preliminary results

#### YOLO-8n model

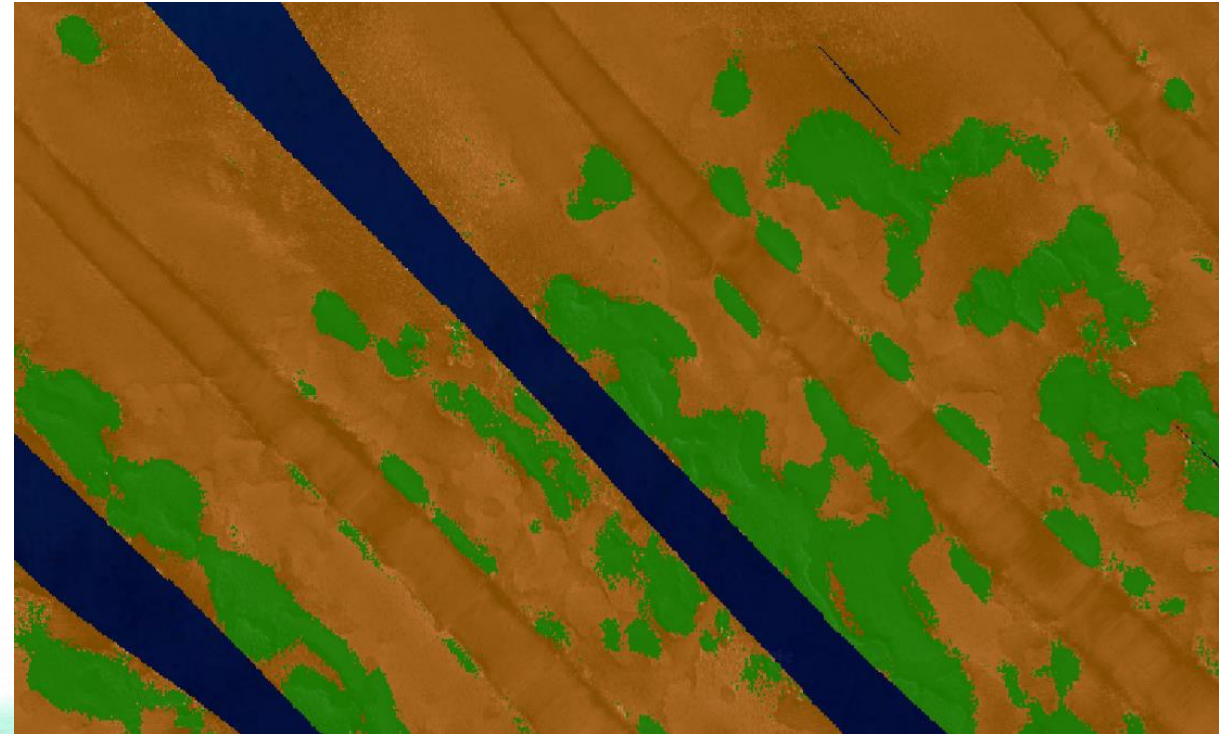


## Object detection preliminary results

YOLO-8n model



U-Net model



# EMODnet Submitter's Dashboard

HOME | DASHBOARD

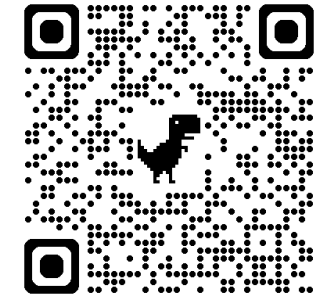
WELCOME NIKOLAOS KOKKOS | VIEWING AS DATA SUBMITTER | ? | LOGOUT

## Submitter's Data Submission List

Add

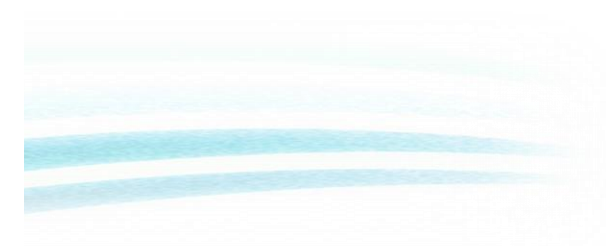
Show 10 entries

Submission identifier (UUID) ↕	Title of dataset ↕	Status ↕	Last Update ↕	Controls
<input type="text" value="Enter Submission identifie"/>	<input type="text" value="Enter Title of dataset..."/>	<input type="text" value="Select..."/>		
1dd3a10a-695e-40fc-9e20-89dd9864d23b	Efxinnos - Seagrass - North Aegean	Drafting form part 1 by Data Submitter	2025-06-20 19:23:57.522252	<input type="button" value="View"/> <input type="button" value="Edit"/>
37c2a56b-9f34-403a-baa7-f6da8a4500db	Fishing weir areas on the territory of the Black Sea basin management region	Drafting form part 1 by Data Submitter	2025-05-22 13:54:12.431628	<input type="button" value="View"/> <input type="button" value="Edit"/>



[emodnet.ec.europa.eu/ingestion](https://emodnet.ec.europa.eu/ingestion)

Showing 2 entries of 2



**Interreg**



Co-funded by  
the European Union



**NEXT** Black Sea Basin  
**NEXT** Black Sea Basin

