CODAR
OCEAN SENSORS

SeaSonde AutoAPM

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AutoAPM Kit with AIS Pattern Suite

Overview

AutoAPM is an add-on to a SeaSonde Radial Site in order to produce real-time measurement loop files using the global Automatic Identification System (AIS). Ships of opportunity are matched up to their possible SeaSonde echo and stored as loop measurements which can then be processed in to antenna patterns used to compare with existing antenna pattern or installed for improved Radial output. AutoAPM consists of a hardware kit and a software bundle called "AIS Pattern Suite".

AutoAPM hardware kit contains an AIS Receiver, AIS Antenna and cabling. AutoAPM was developed and currently ships with a Comair AIS-3R Receiver.

AIS Pattern Suite is obtained from CODAR support and consists of three main components:

- AIS Recorder which processes and stores the AIS messages from the AIS receiver.
- AIS Web Server which serves up the recorded AIS ship info to be processed into track files.
- AIS Spectra Processing which generates track files, matches up the SeaSonde cross spectra (csq), and generates antenna loop measurements.

Kit Contents and Requirements

The AutoAPM hardware Kit contains the following hardware:

- one AIS Antenna
- one Comair AIS-3R Receiver
- one USB cable
- one Antenna cable

 AIS Pattern Suite **requires** a SeaSonde USB License Key containing a AIS Pattern Suite License. If you do not have the USB Key, you should contact CODAR support or sales on how to obtain one. The key needs to be plugged directly into a computer USB port (NOT the keyboard or other hub) in order for the AIS Pattern Suite to run.

Before you start, confirm that the computer meets the minimum requirements for proper SeaSonde operation. You can find the system specs by selecting "About This Mac" under the menu. Then click the "More Info" button to see the system's profile:

Recommended Configuration
Macintosh Intel (MacPro, MacMini, iMac)
4 GB RAM or more
100 GB or higher hard disk
OS X **10.6.8** to **10.10.x**

Installation

Installation of the AutoAPM Kit with AIS Pattern Suite requires the SeaSonde AIS Pattern Suite installer, a Comair AIS-3R Receiver, an AIS antenna, and a SeaSonde USB Hardware key containing an AIS Pattern Suite license. The AIS Pattern Suite is an add-on to the SeaSonde Radial Suite software, and requires SeaSonde Radial Suite Release 7 or later installed on the computer.

Hardware Installation

Connect the Comair AIS-3R Receiver to the Mac computer with the supplied USB cable. Connect the AIS antenna to the input on the AIS receiver labelled “Antenna” using the supplied cable labelled “AIS”.



Confirm that the Mac computer and AIS Receiver are connected as show in the photo above. There are three LED lights on the front of the AIS Receiver. Once all installation is complete, there will be one solid green light on the front of the AIS Receiver and two blinking red lights when receiving data.



The AIS antenna is approximately 1 meter tall and tuned to the AIS broadcast frequencies at approximately 160 MHz in the VHF band. To achieve the best range for receiving AIS signals, the antenna should be placed as high as possible at the SeaSonde site and should not have any significant structures between antenna and the water. It may be worth increasing the length of axial cable to get your AIS antenna higher, but keep in mind that longer cables will also attenuate the signal more. In general, the AIS antenna can be mounted near other antennas, including the GPS bullet antenna or SeaSonde antennas, however keep in mind that the best place for an AIS antenna, which needs line of sight to the horizon, is not necessarily the best place for a GPS antenna which needs a wide view of the sky, or an HF antenna, which is better to put low and close to the water.

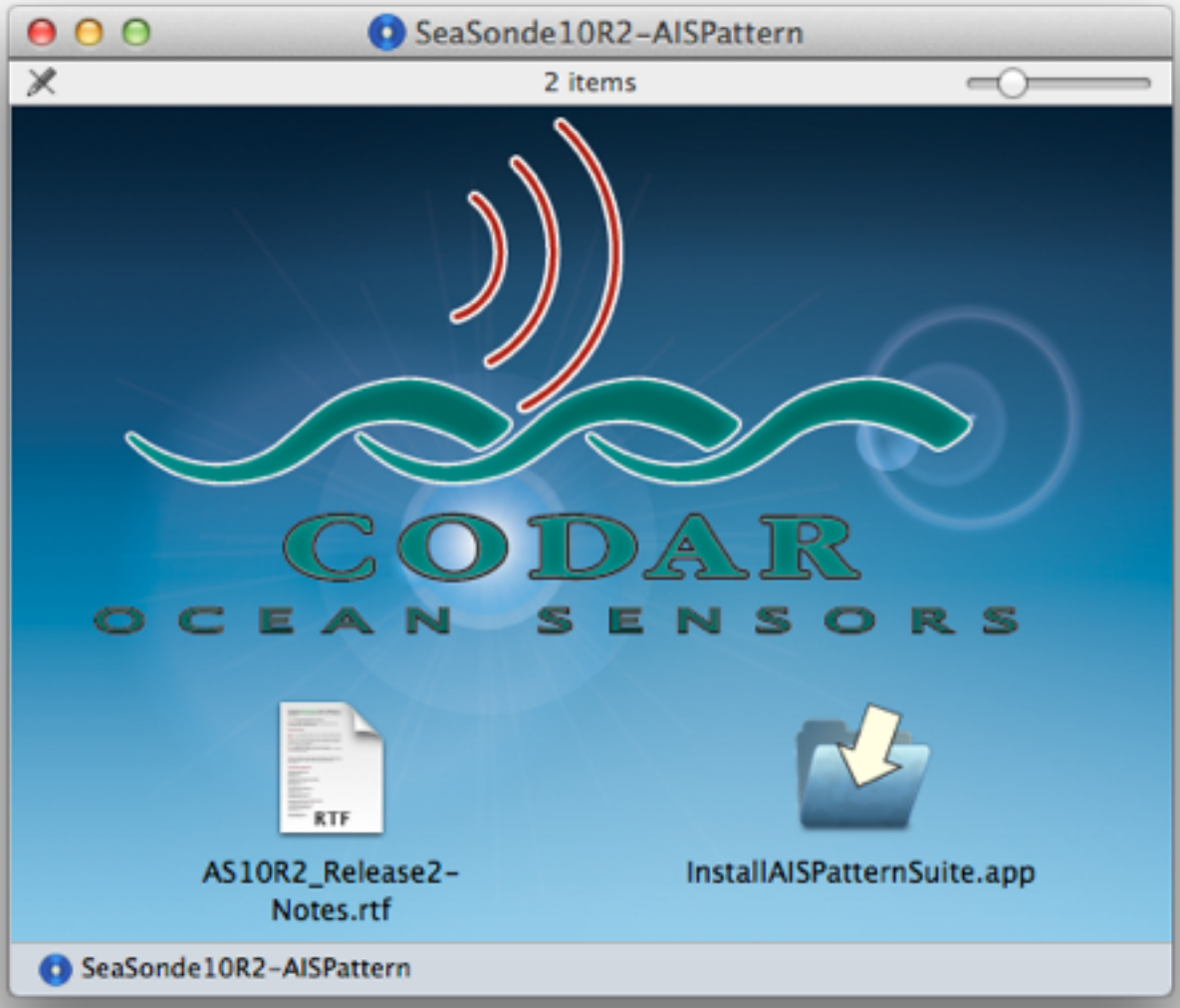
It is recommended to contact CODAR support technicians when planning your AIS hardware installation. Example AIS antenna installations are shown below:





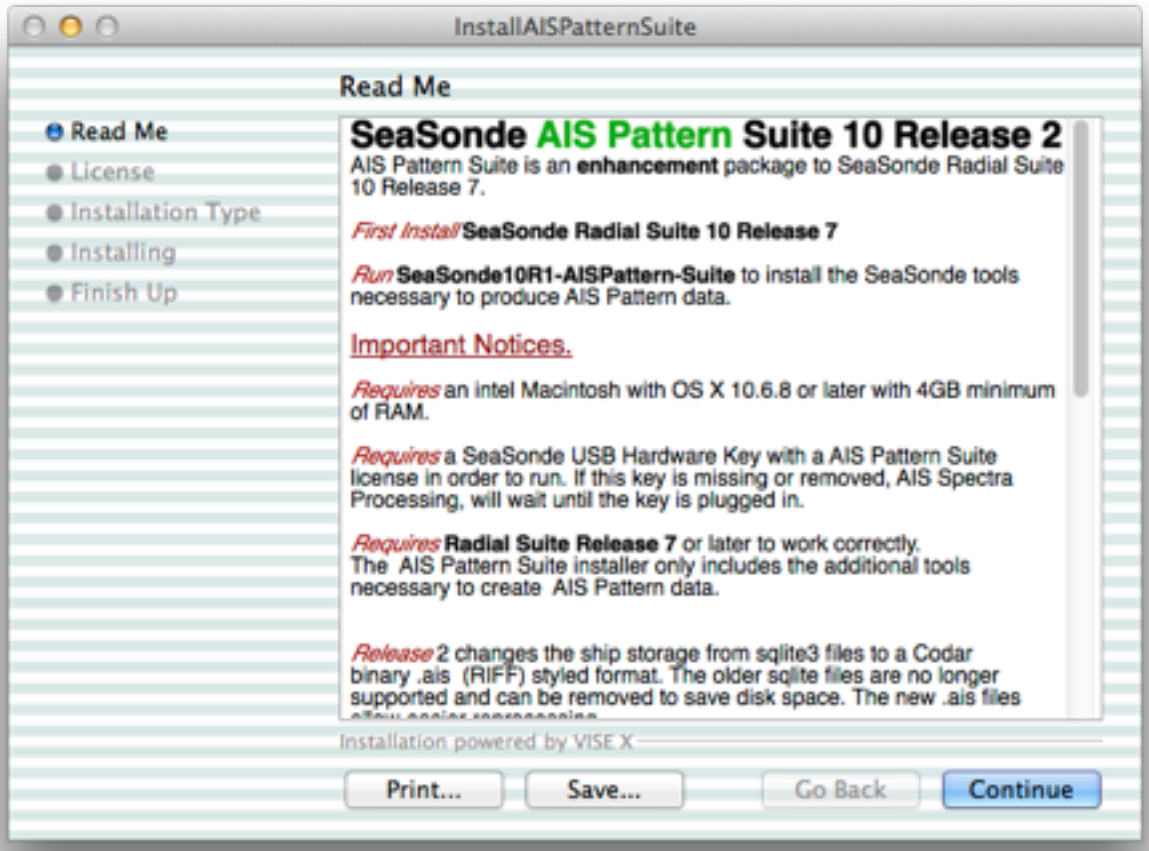
Software Installation

Plug the SeaSonde USB Hardware key in to the computer if it is not already plugged in. If an older Hardware key does not contain an AIS Pattern Suite license, it can be upgraded to include the AIS Pattern Suite license by CODAR staff (support@codar.com).



To install the AIS Pattern Suite from an installer disk image, double click the disk image file labelled “SeaSonde10R2-AISPattern-Suite.dmg.” A window will appear showing its contents.

Double click on the InstallAISPatternSuite app. Make sure you meet all of the requirements and that SeaSonde Radial Suite Release 7 is already installed. Click “Continue” and follow the onscreen instructions to install all AIS Pattern Suite components. Restart the computer to finish the installation.



Operation

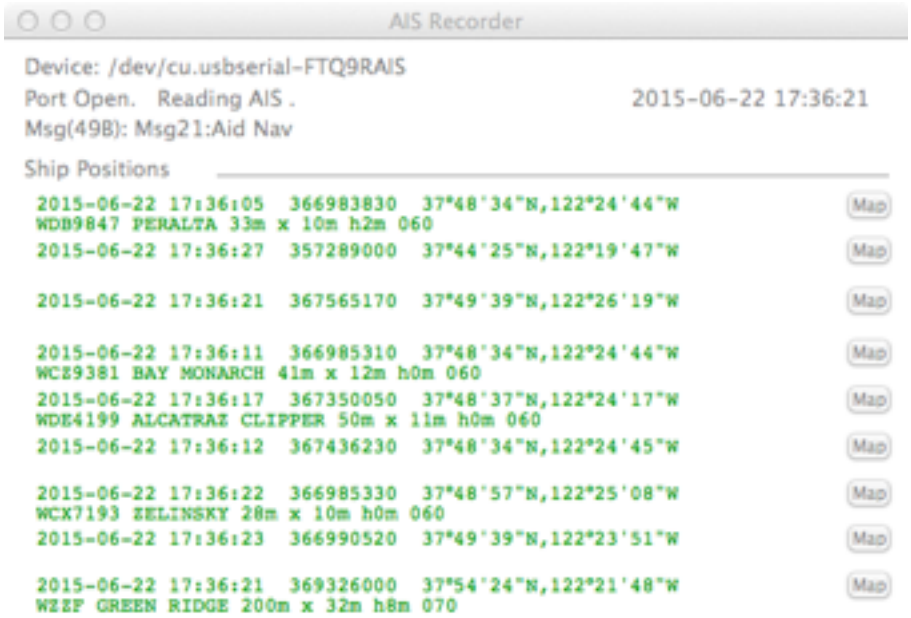
Operation of the AIS Pattern Suite to generate loop files is entirely automated. The necessary components launch in the background when the computer starts up. The Recorder, Tracker, and Looper processes use vessel position, and velocity information from the AIS message stream and the SeaSonde Doppler spectra to generate Track and Loop files in the /Codar/SeaSonde/Data/AISData/ directory.

AIS Recorder

The AIS Recorder process takes the raw AIS data from the antenna and decodes the messages into usable ship information. The raw AIS data is saved in files with the extension “nmea.” The files are located in the /Codar/SeaSonde/Data/AISData/AISStream/ directory. The AIS Recorder translates the AIS data and saves encoded ship positions in files with the “ais” extension. These files are located in the /Codar/SeaSonde/Data/AISData/AISPositions/ directory. A command line tool, AisExtractor, is used to translate the encoded “ais” files into readable text. The AIS Recorder is located in the dock when running.

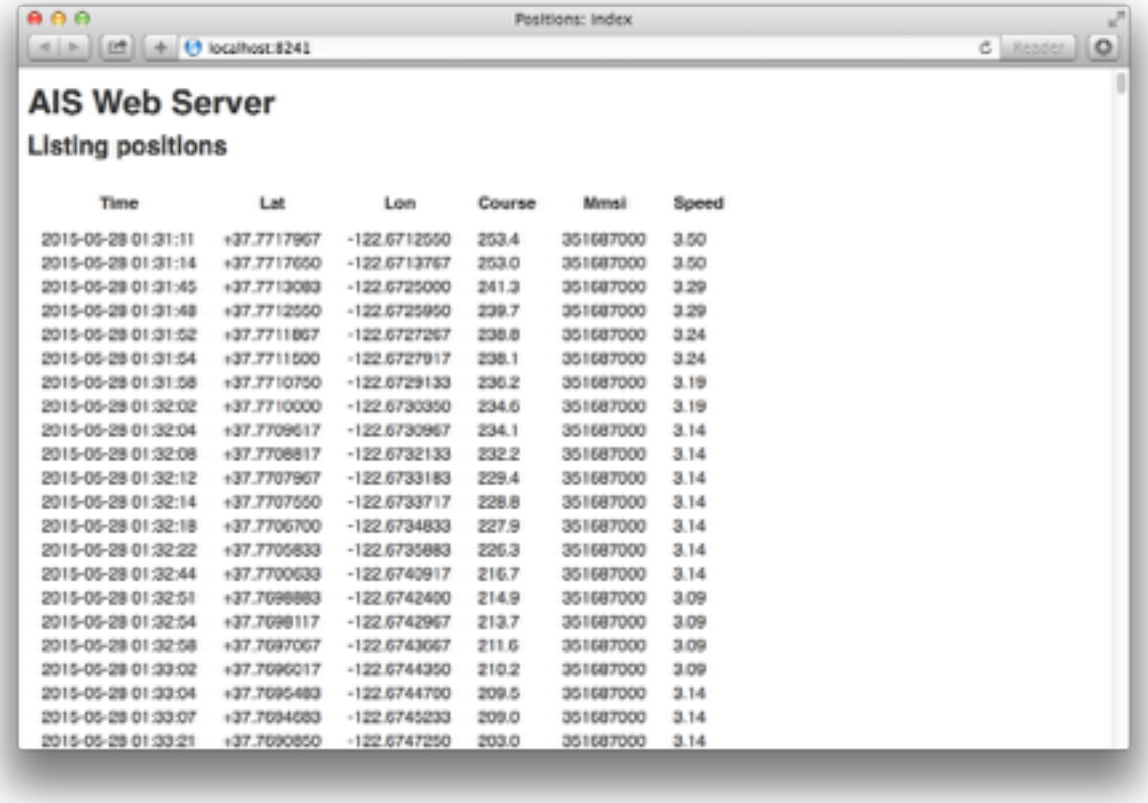


Clicking on the AIS Recorder icon will open the AIS Recorder window with details on recent AIS ship data.



AIS WebServer

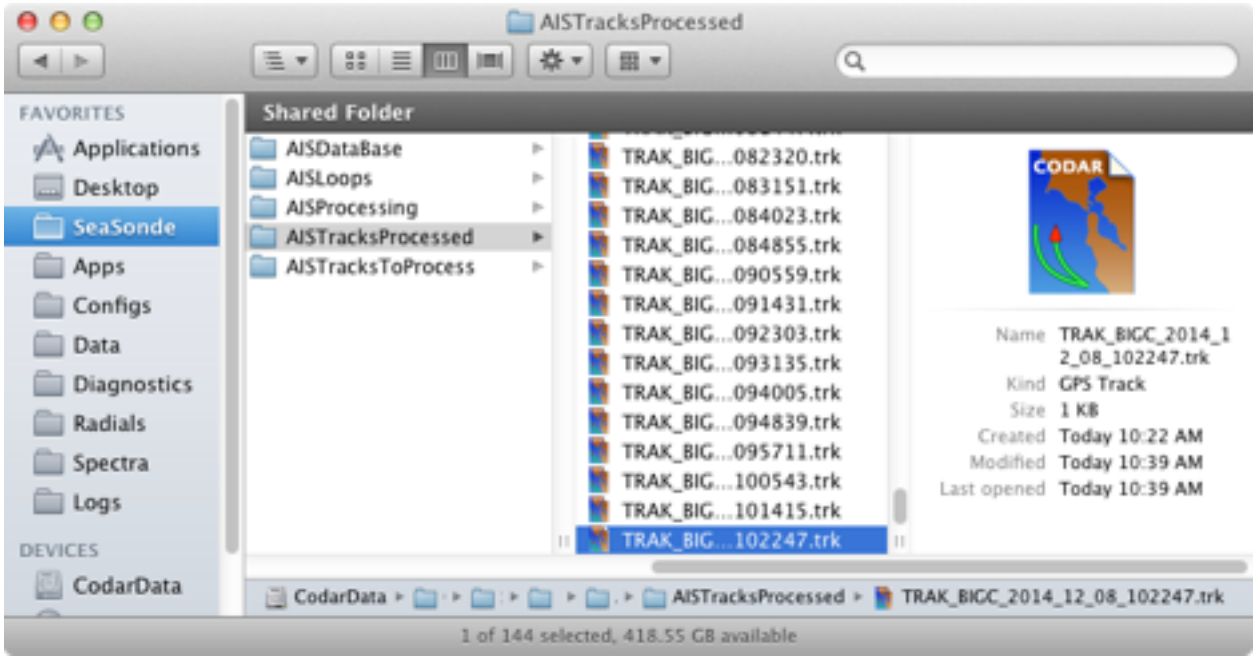
The AIS WebServer is a tool that provides access to the basic AIS data such as ship positions, headings, and other details. It is not necessary to use this for normal operation and generation of loop files, but can be useful in determining how much data the AIS receiver is collecting. The web server can be accessed through a web browser at the address http://localhost:8241/ to view ship position data. The address http://localhost:8241/ships also provides more detailed ship information.



Time	Lat	Lon	Course	Mmsi	Speed
2015-05-28 01:31:11	+37.7717967	-122.6712550	253.4	351687000	3.50
2015-05-28 01:31:14	+37.7717650	-122.6713767	253.0	351687000	3.50
2015-05-28 01:31:45	+37.7713083	-122.6725000	241.3	351687000	3.29
2015-05-28 01:31:48	+37.7712550	-122.6725950	239.7	351687000	3.29
2015-05-28 01:31:52	+37.7711867	-122.6727267	238.8	351687000	3.24
2015-05-28 01:31:54	+37.7711500	-122.6727917	238.1	351687000	3.24
2015-05-28 01:31:58	+37.7710750	-122.6729133	236.2	351687000	3.19
2015-05-28 01:32:02	+37.7710000	-122.6730350	234.6	351687000	3.19
2015-05-28 01:32:04	+37.7709617	-122.6730967	234.1	351687000	3.14
2015-05-28 01:32:08	+37.7708817	-122.6732133	232.2	351687000	3.14
2015-05-28 01:32:12	+37.7707967	-122.6733183	229.4	351687000	3.14
2015-05-28 01:32:14	+37.7707550	-122.6733717	228.8	351687000	3.14
2015-05-28 01:32:18	+37.7706700	-122.6734833	227.9	351687000	3.14
2015-05-28 01:32:22	+37.7705833	-122.6735883	226.3	351687000	3.14
2015-05-28 01:32:44	+37.7700533	-122.6740917	216.7	351687000	3.14
2015-05-28 01:32:51	+37.7698883	-122.6742400	214.9	351687000	3.09
2015-05-28 01:32:54	+37.7698117	-122.6742967	213.7	351687000	3.09
2015-05-28 01:32:58	+37.7697067	-122.6743667	211.6	351687000	3.09
2015-05-28 01:33:02	+37.7696017	-122.6744350	210.2	351687000	3.09
2015-05-28 01:33:04	+37.7695483	-122.6744700	209.5	351687000	3.14
2015-05-28 01:33:07	+37.7694683	-122.6745233	209.0	351687000	3.14
2015-05-28 01:33:21	+37.7690850	-122.6747250	203.0	351687000	3.14

AIS Tracker

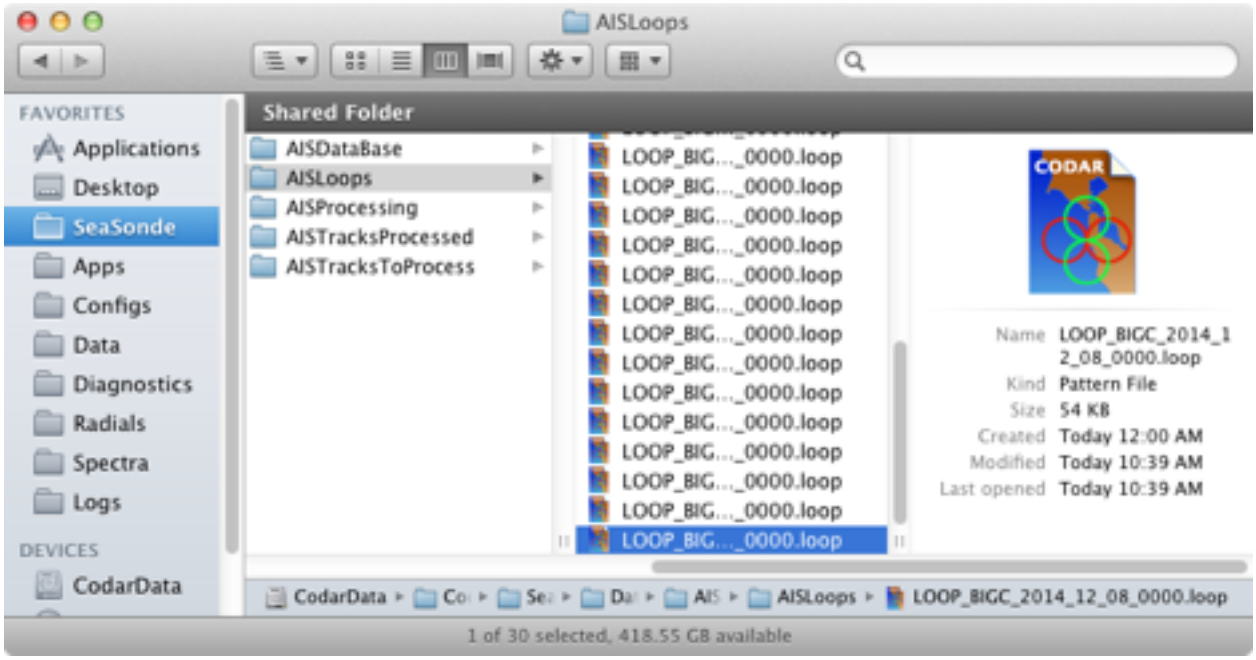
The AIS Tracker app queries the AIS Webserver for ship data based on the time window of each unaveraged Doppler spectrum (CSQ file) and generates a GPS Track file for each CSQ file. These files are created in the /Codar/SeaSonde/Data/AISData/AISTracksToProcess/ directory. Track files have the .trk file extension.



For the AIS Tracker software to function, Radial Suite Spectra Processing must also be operating and generating Cross Spectra (CSQ) files. The AIS Tracker will generate one TRAK file for each CSQ file. This interval will be different depending on frequency and settings at the site.

AIS Looper

The AIS Looper also runs in the background. It processes the AIS Track files with their associated CSQ files and generates daily Loop pattern files. Processed Track files are moved to the AISData/AISTracksProcessed/ directory, and new loop files are created in the AISData/AISLoops/ directory. Loop files have the .loop file extension.

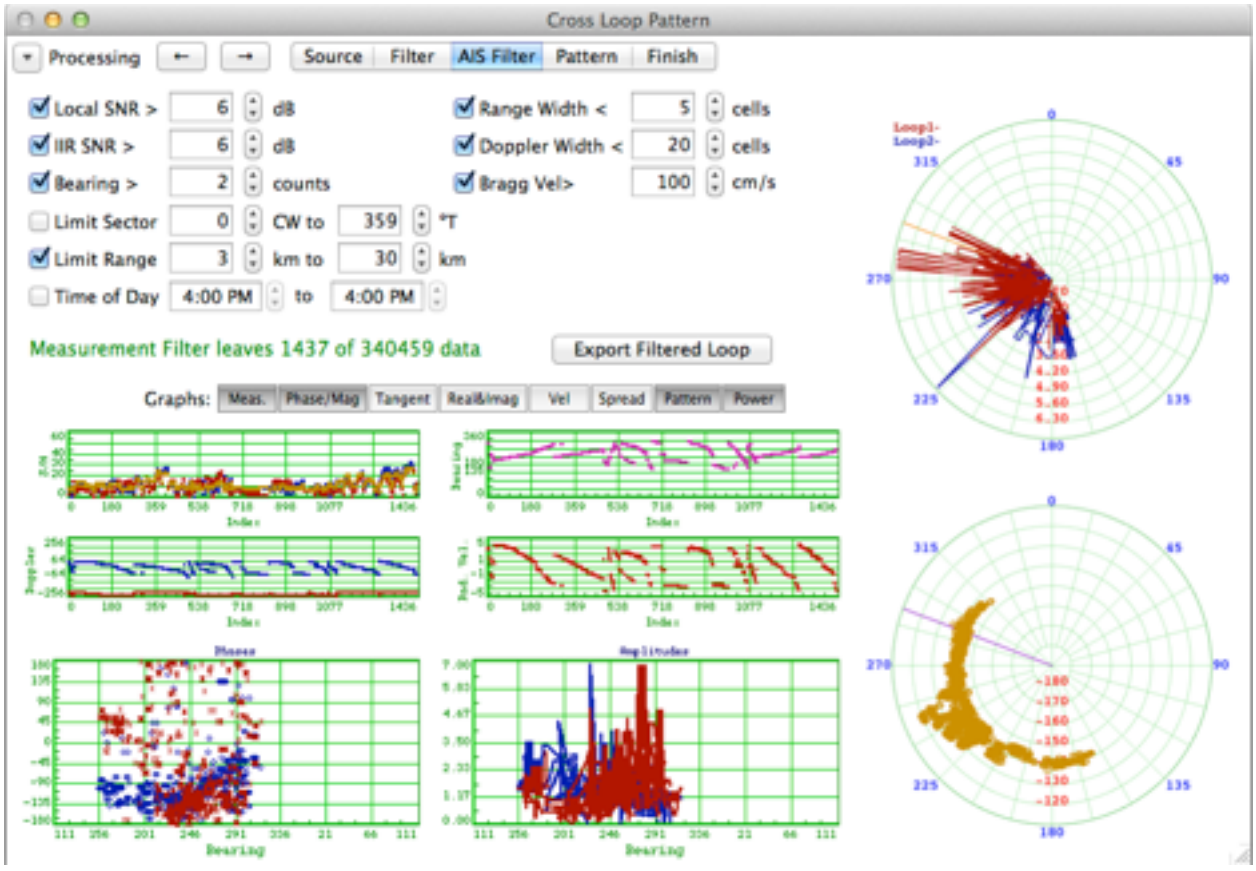


Only one loop file is generated each day and contains the information necessary to create antenna patterns.

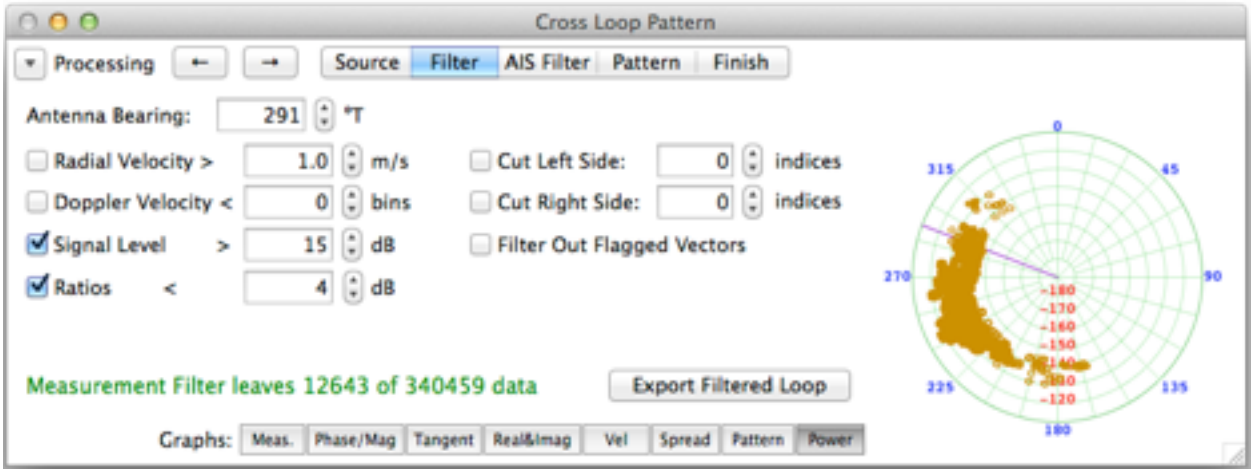
Cross Loop Patterner

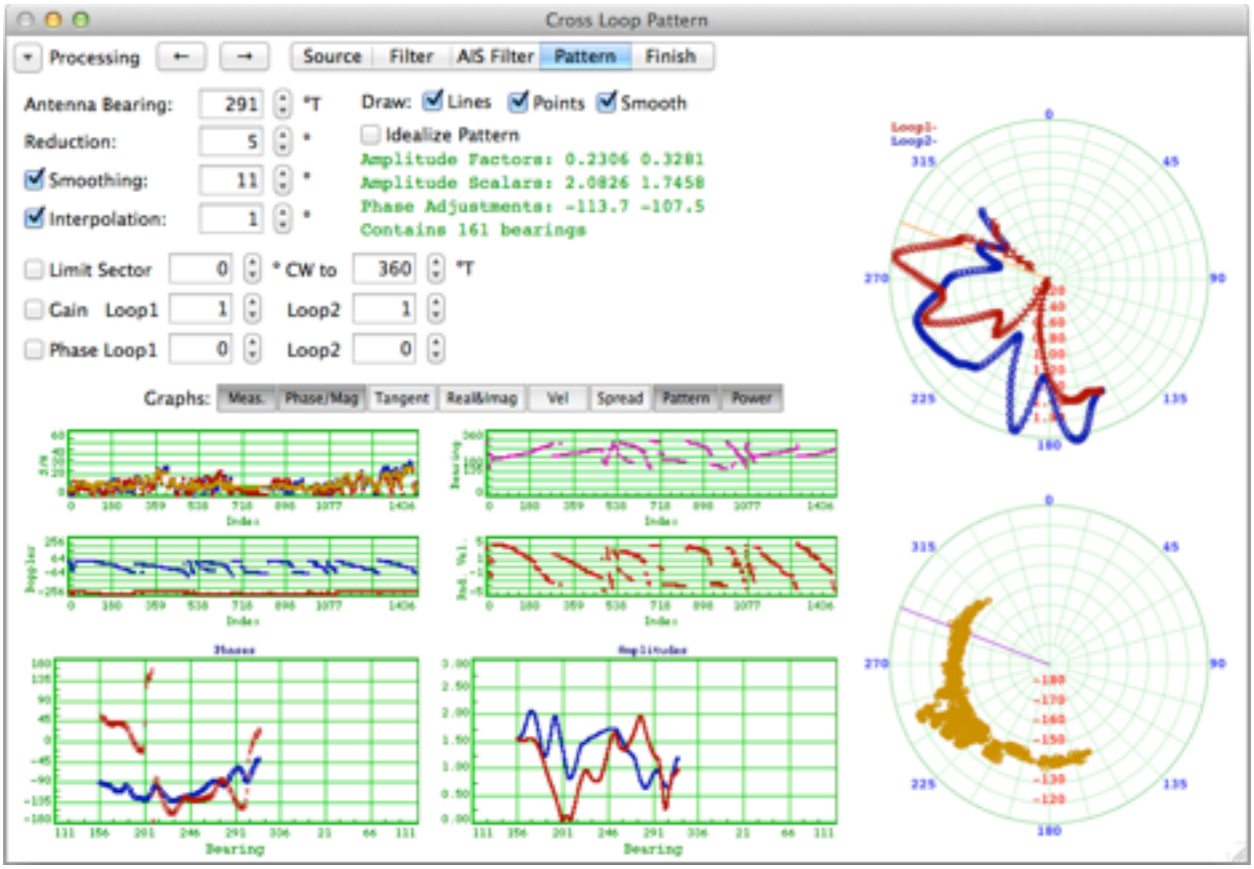
In order to create usable antenna patterns for use with Radial Suite software, AIS loop files should be filtered using the Cross Loop Patterner app. Cross Loop Patterner is included in SeaSonde Radial Suite software and can be found in /Codar/SeaSonde/Apps/Tools/CrossLoopPatterner.app. Cross Loop Patterner versions that can handle LOOP files generated by the AIS Pattern Suite are available beginning with Release 7 update 2.

Open Cross Loop Patterner and drop a selection of AIS Loop files on the application window. Multiple days/files may be selected at a time, but if LOOP files are large (tens of MB's) or you have many days worth, the response time of Cross Loop Patterner may be reduced. If they are properly formatted AIS Loop files, the top navigation tabs in the Cross Loop Patterner app will contain an option "AIS Filter." Select this tab.



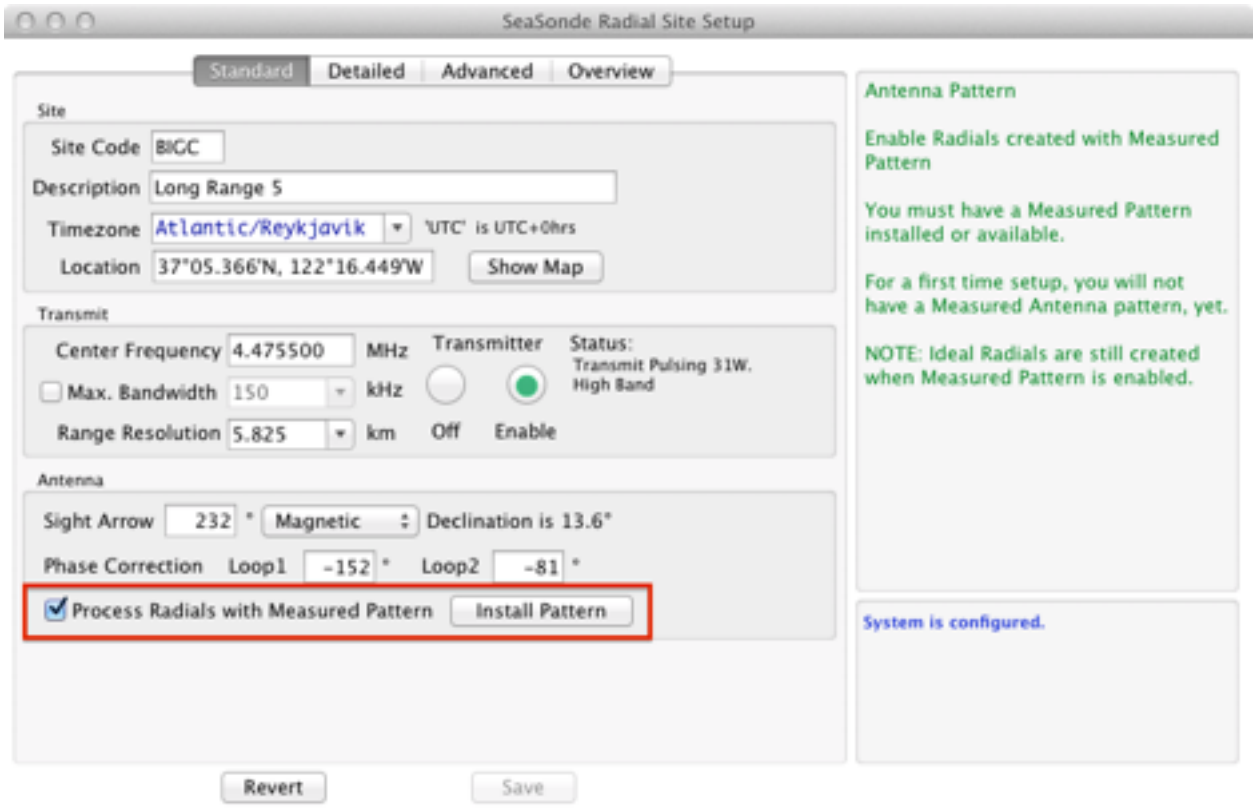
Default filtering values are already entered. Checking the associated boxes will enable the filter. The defaults are generally effective in removing extreme data points without omitting usable information. The standard “Filter” tab is also useful for removing unusable data points, especially the Signal Level and Ratio filter options.





After filtering the data down to a usable set of points, the “Pattern” tab can be used to apply smoothing and interpolation. Then select the “Finish” tab and press the save button to save a folder containing the pattern and data files including the file “MeasPattern.txt”.

To install the pattern for radial processing, first close all running applications. Open SeaSonde Radial Site Setup, which can be found in /Codar/SeaSonde/Apps/RadialTools/ if you cannot find it on your dock. Check the “Process Radials with Measured Pattern” box and then click the Install Pattern button. Navigate and select the MeasPattern.txt file.



Open Sentinel or restart the computer, and radial processing will now begin generating measured pattern radials in /Codar/SeaSonde/Data/Radials/MeasPattern/.

Troubleshooting

AIS Track files should be created every ten minutes and Loop Pattern files should be created once per day. If this is not occurring, then there are several ways to try and determine the cause.

The easiest check is the AIS WebServer. Load localhost:8241/ in a browser window. All AIS position messages should show, with the most recent messages at the top. If there are no messages then the antenna may not be receiving signals properly, or the AIS Recorder may not be running. The AIS Recorder will have an icon in the dock when it is running. It is possible for AIS messages to be infrequent in areas with low ship traffic.

Output logs for all AIS Pattern Suite processes can be found in /Codar/SeaSonde/Logs/AISLogs/. In the AISTrackerStatus log or AISTrackerError log, a License Key Not Found error suggests that the SeaSonde USB Hardware Key is not plugged into the computer properly, or does not include the AIS Suite license.

Components such as the AIS Webserver and AIS Spectra Processing can be disabled or enabled with scripts found in /Codar/SeaSonde/Apps/Scripts/AISScripts.

For additional help contact CODAR support at support@codar.com

Revision History

Jun 23, 2015 - Release Version Draft
Jun 24, 2015 - Formatting and Terminology Revision

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