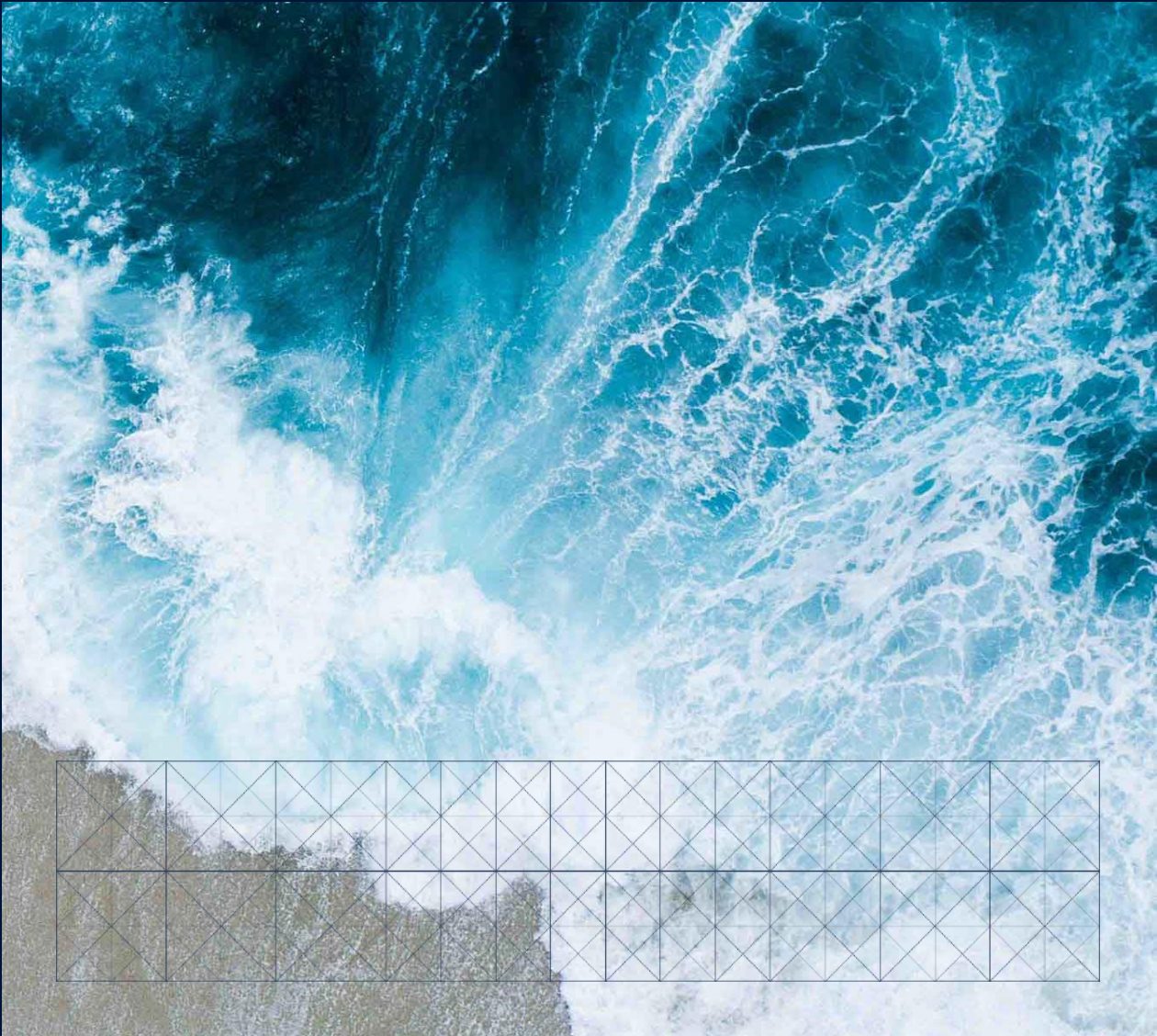




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SpotTrack



SpotTrack Operator & Technical Training



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SpotTrack

Laser Based Relative Positioning System





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SpotTrack Training

Course Content

SpotTrack Training

SpotTrack Operator Training

SpotTrack Technical Training



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SpotTrack Operator Training

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SpotTrack Operator Training

SpotTrack Introduction

SpotTrack Principles

SpotTrack Product Modules

SpotTrack Operation



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SpotTrack Operator Training

Course Content

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SpotTrack Operation



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SpotTrack

Laser Based DP Reference System

- Features:

- Advanced multi-target tracking
- Wide vertical field of regard for close-by operations
- Interfaces to all DP systems
- Easy to install and operate
- Roll/pitch stabilization for high dynamic environments



SpotTrack
Sensor unit



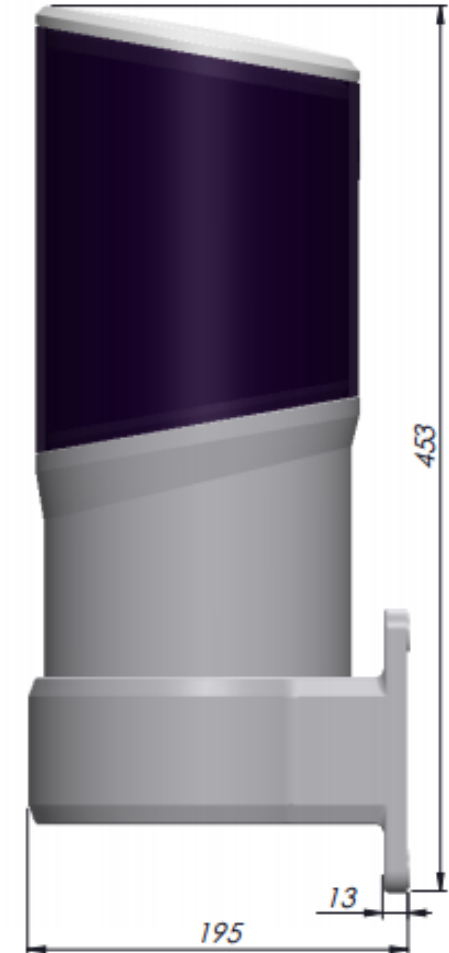
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SpotTrack

Laser based DP Reference System

■ Features:

- True 3D positioning system
- Vertical field-of-view stabilized for roll and pitch
- Automatic data recording
- Optional MRU interface
- Fanbeam and CyScan replacement kit available





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SpotTrack

Technical Specifications

Parameter	Specifications
Laser classification	Eye Safe Class IEC 60825
Pulsed laser diode transmitter	Repetition rate 10 – 20 kHz
Wavelength	905 nm
Instantaneous vertical field of vision (FOV)	10°
Horizontal angular coverage	360°



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SpotTrack

Technical Specifications

Parameter	Specifications
Vertical angular coverage	Min. 65° (-10° to +55°)
Scanning frequency	1 Hz
Horizontal Position accuracy (2σ)	1 m @ 1000 m range
Bearing accuracy (2σ)	1 mrad (~0.06°)
DP range	10 to 1500 m
Maximum range @ 360°/sec	2000 m

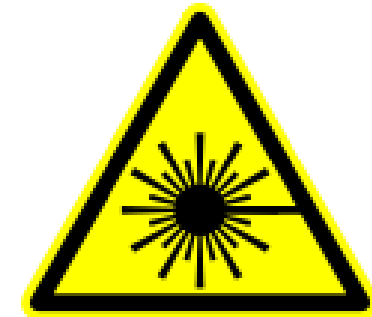


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SpotTrack

Laser Classifications – Class I

	Class IEC (EU)	Class FDA (US)	Laser Product Hazard	Product examples
	Class 1, 1M	Class I	Considered non-hazardous. Hazard increases if viewed with optical aids.	<ul style="list-style-type: none"> • SpotTrack • Laser printers • CD/DVD players
	Class 2, 2M	Class <u>IIa</u> , II	Hazard increases when viewed directly for long periods of time	<ul style="list-style-type: none"> • Bar code scanners
	Class 3R	Class <u>IIIa</u>	Depending on power and beam area, can be momentarily hazardous when directly viewed or when staring directly at the beam with an unaided eye.	<ul style="list-style-type: none"> • Laser pointers
	Class 3B	Class <u>IIIb</u>	Immediate skin hazard from direct beam and immediate eye hazard when viewed directly.	<ul style="list-style-type: none"> • Laser light show projectors • Industrial lasers • Research lasers
	Class 4	Class IV	Immediate skin hazard and eye hazard from exposure to either the direct or reflected beam; may also present a fire hazard.	<ul style="list-style-type: none"> • Laser light show • Industrial lasers • Research lasers





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SpotTrack

Course Content

SpotTrack Operator Training

SpotTrack Introduction

SpotTrack Principles

SpotTrack Product Modules

SpotTrack Operation

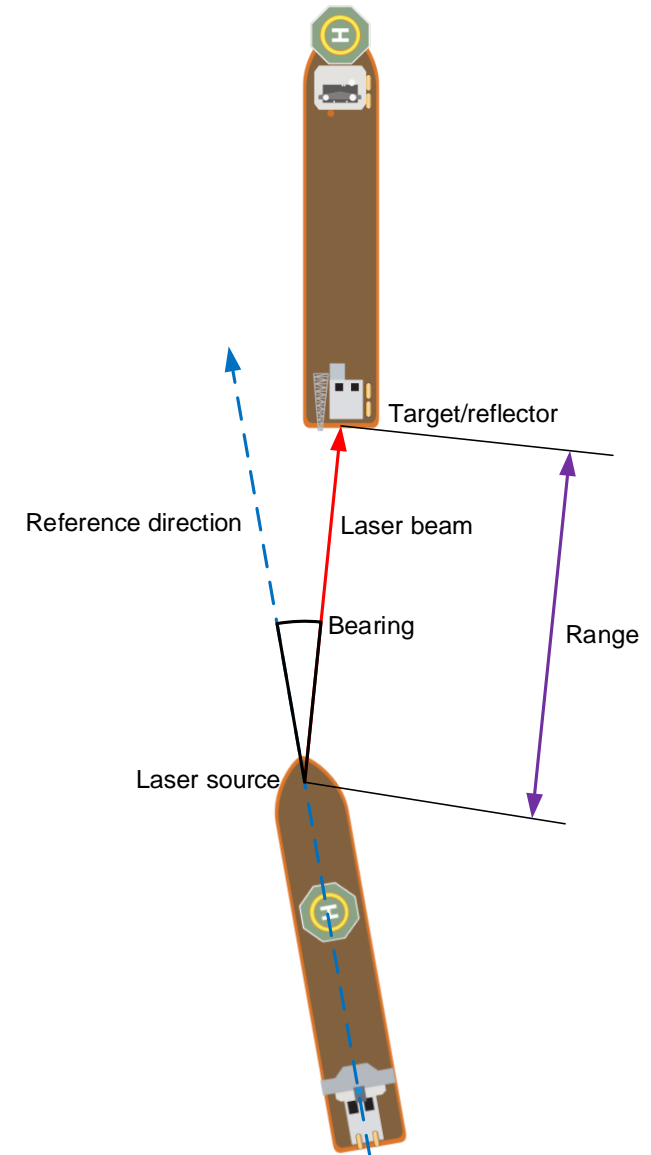


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SpotTrack

Measuring Principle

- A laser-based system is used to calculate range between a laser source and a reflector
- Bearing – the direction of the laser beam is also measured



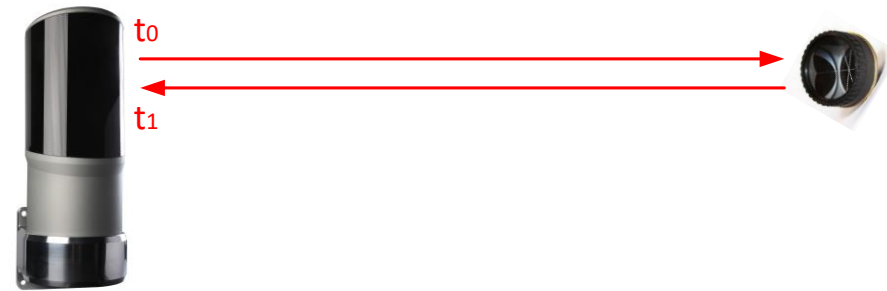


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SpotTrack

Measuring Principle

- Distance measurement:
 - Time is measured for a laser pulse to travel from the laser source to a target (prism/reflector) and back to the source (detector)
 - This is also called Time Of Flight (TOF)



$$\text{Distance} = \frac{t_1 - t_0}{2} c$$

t_0 = start time

t_1 = stop time

c = speed of light

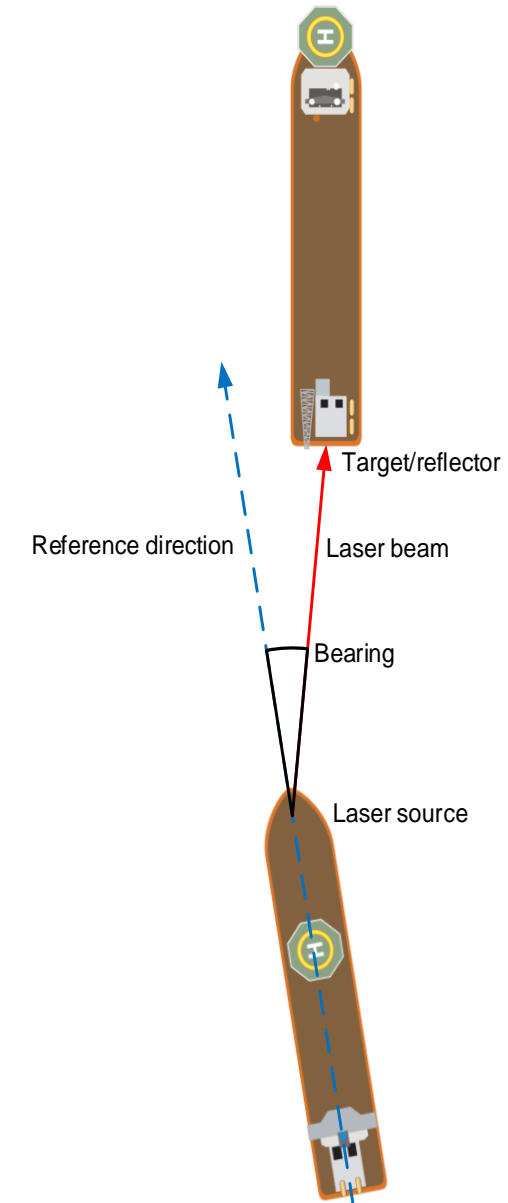


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SpotTrack

Measuring Principle

- Bearing measurement:
 - The laser beam rotates at 360°/sec
 - Bearing is measured by using an internal encoder
 - The encoder measures the rotation of the laser beam relative to a reference direction (bow of the vessel)





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SpotTrack

Measuring Challenges

- If a narrow beam laser is used the laser must be accurately pointed at the target
- SpotTrack uses laser optics that produces a vertically fan-shaped beam (10°) to compensate for high dynamic environments
- By scanning this vertical beam horizontally, a fixed target can be tracked from a moving vessel, and its bearing relative to the vessels heading and range can be determined



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SpotTrack

Narrow Laser Beam

- Laser Beam:
 - If a narrow beam laser is used the laser must be accurately pointed at the target
 - Vertical movements of the vessels will in this case cause problems keeping lock on target

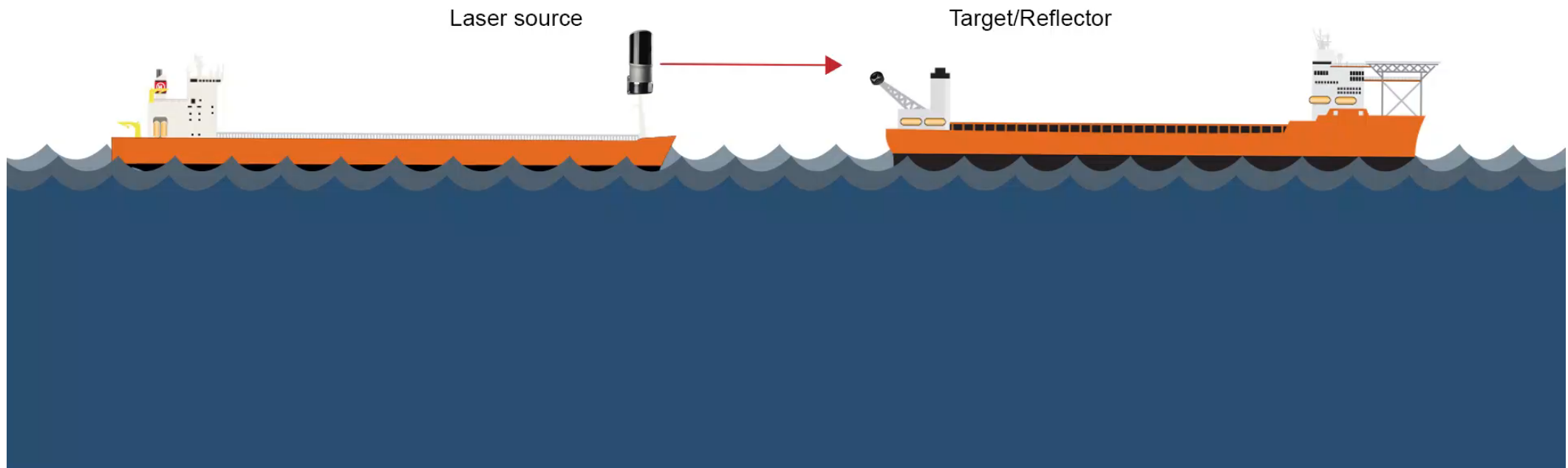




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SpotTrack

Narrow Laser Beam



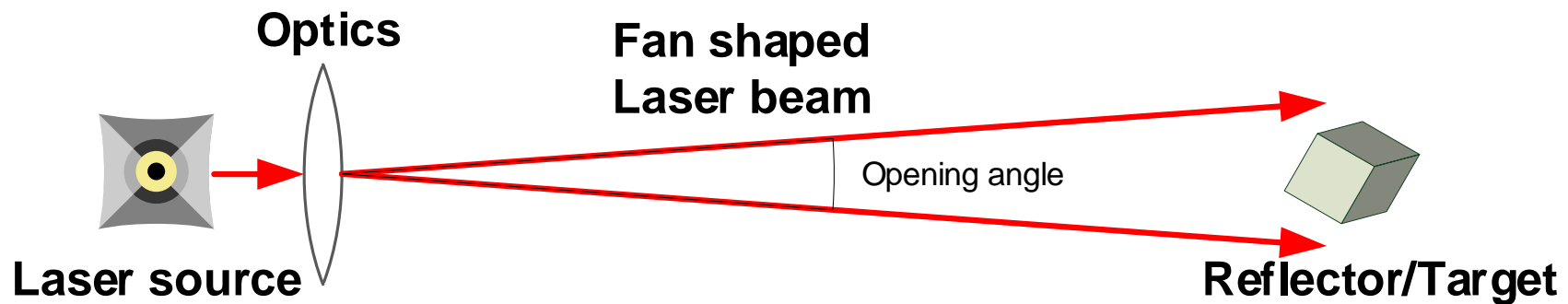


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SpotTrack

Fan Shaped Laser Beam

- Fan shaped laser beam
 - By using optics, a fan shaped laser beam can be created
 - This allows for more vertical movements of the vessels

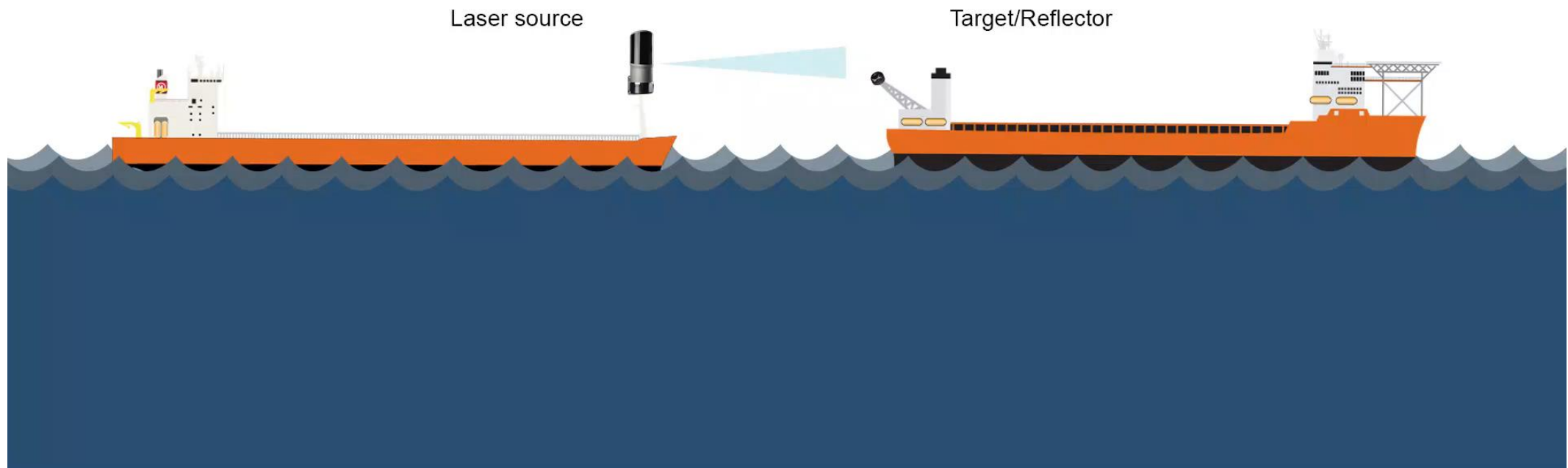




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SpotTrack

Fan Shaped Laser Beam



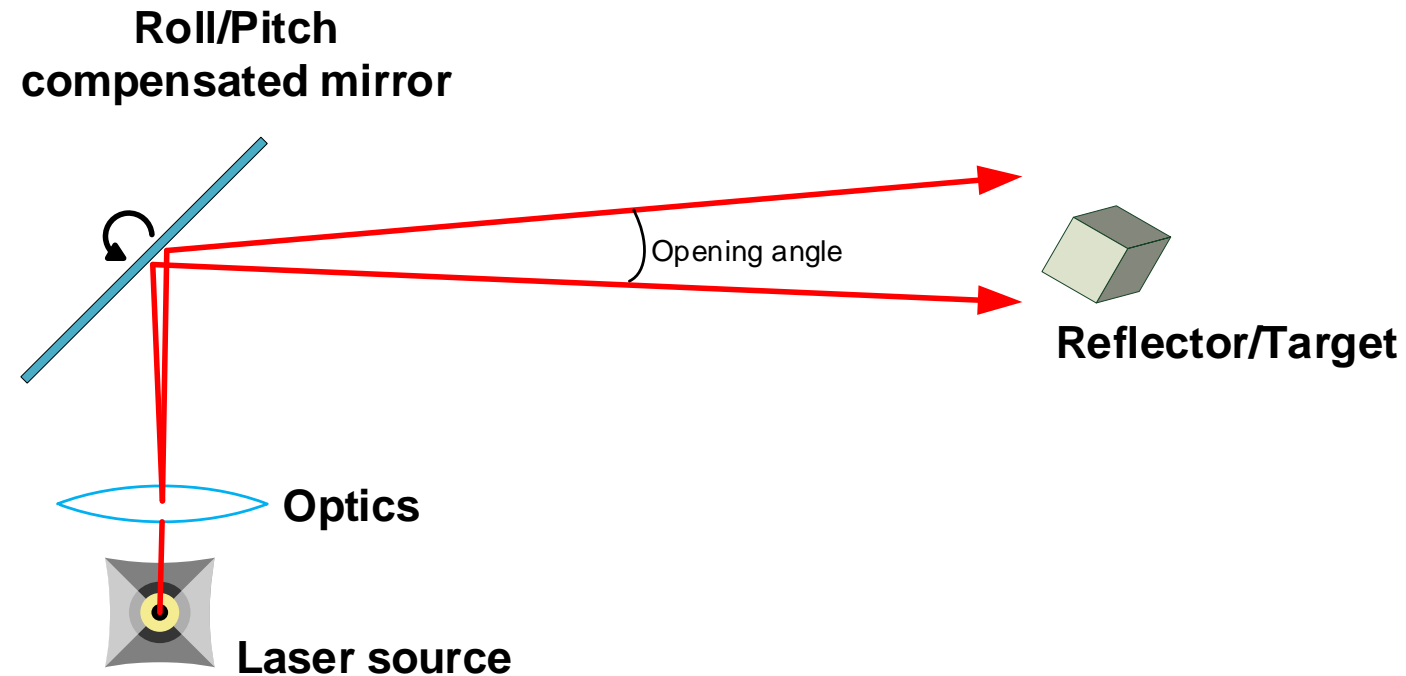


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SpotTrack

Fan Shaped Laser Beam with Roll and Pitch Compensation

- Fan shaped laser beam with roll/pitch compensation
 - By using optics, a fan shaped laser beam can be created
 - A motion sensor is used to measure the roll and pitch of the vessel
 - A mirror is used to control the fan shaped laser beam from the laser source

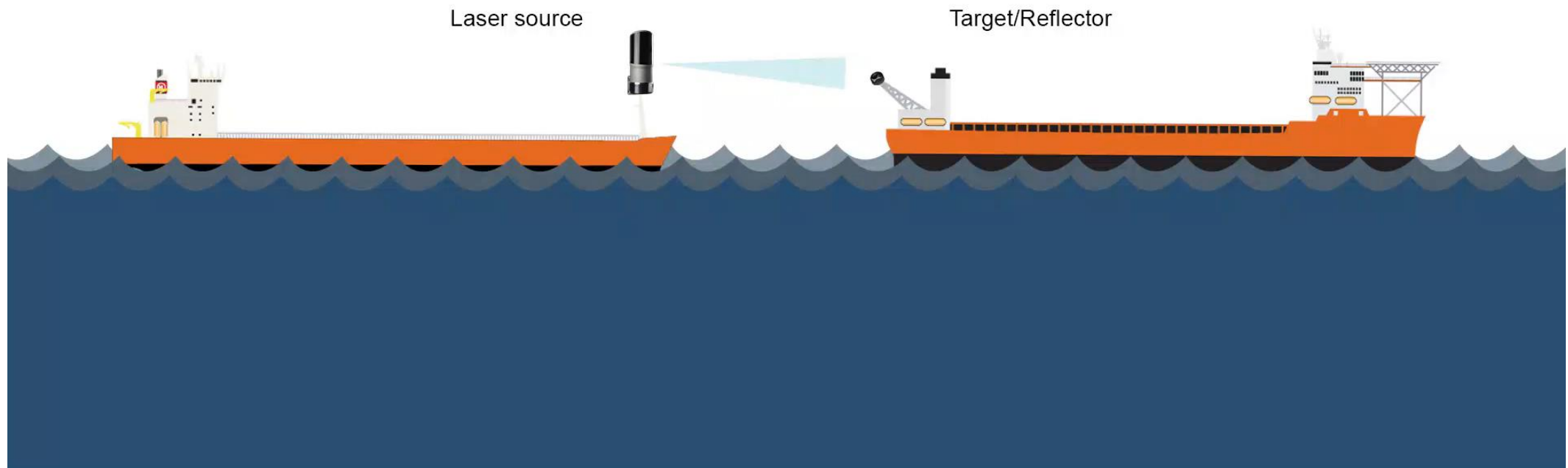




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SpotTrack

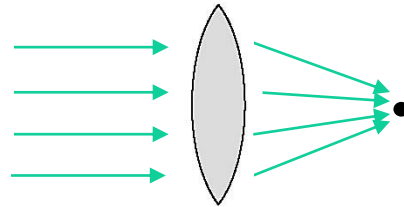
Fan Shaped Laser Beam with Roll and Pitch Compensation



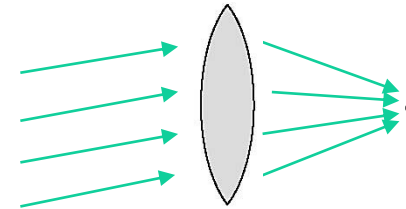
SpotTrack

Detector Array

Single Detector
(Normal)



Single Detector
(Normal)

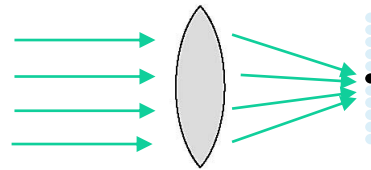




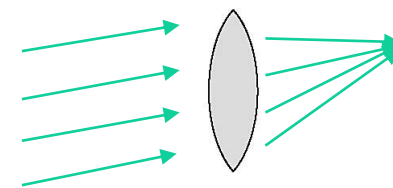
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SpotTrack Detector Array

Multiple Detectors
(SpotTrack)

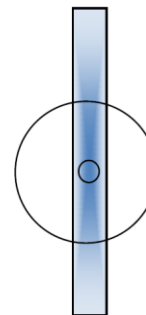


Multiple Detectors
(SpotTrack)

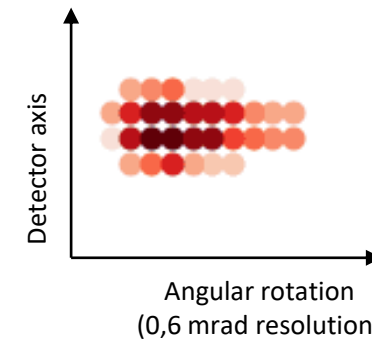


Advantages:

- Vertical distance
- More stable tracking
 - roll/pitch exposure
 - targets installed at different heights
- Increased integrity



Target detection



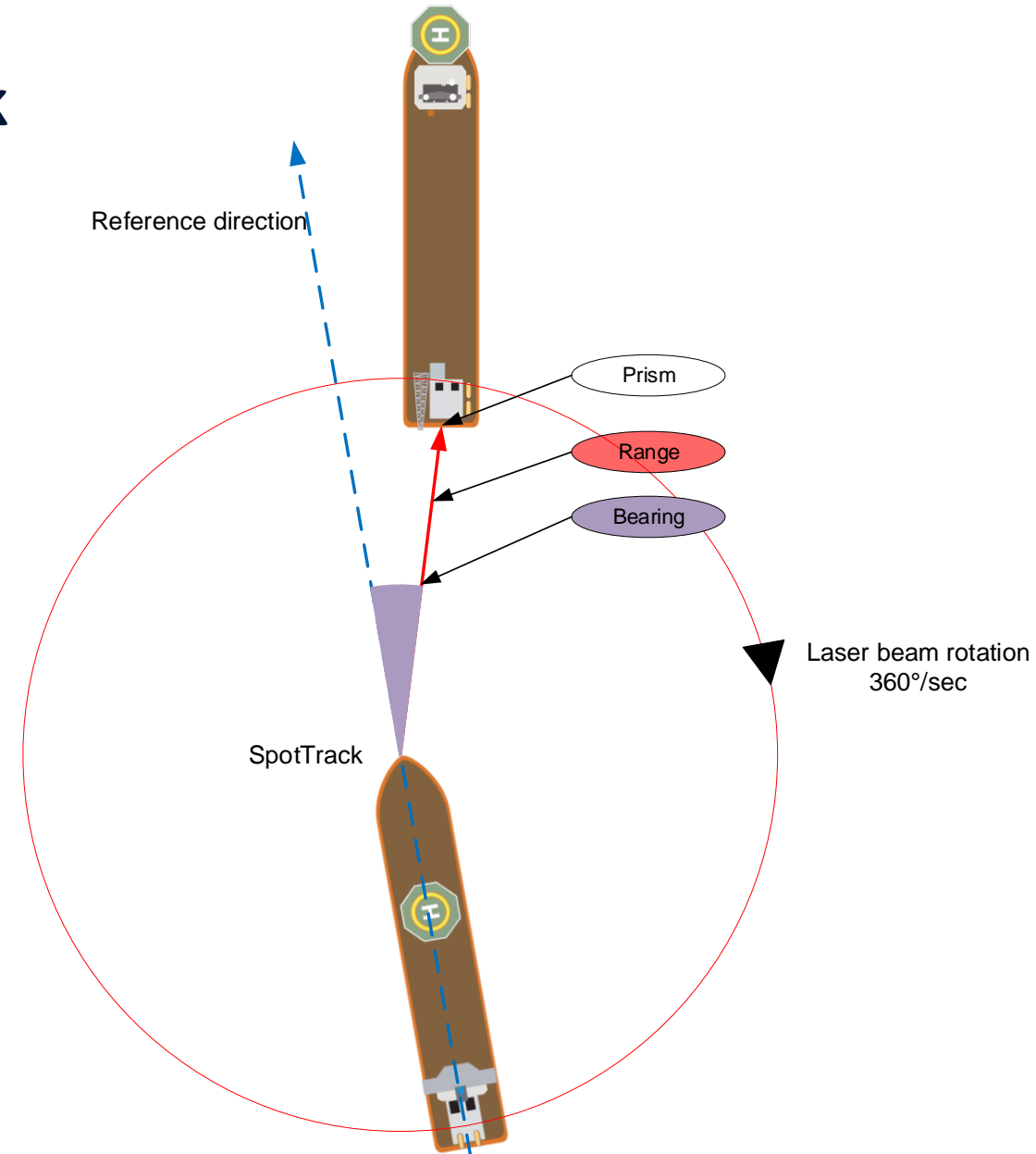


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- SpotTrack tracking single target
- Single target tracking

SpotTrack

Single Target



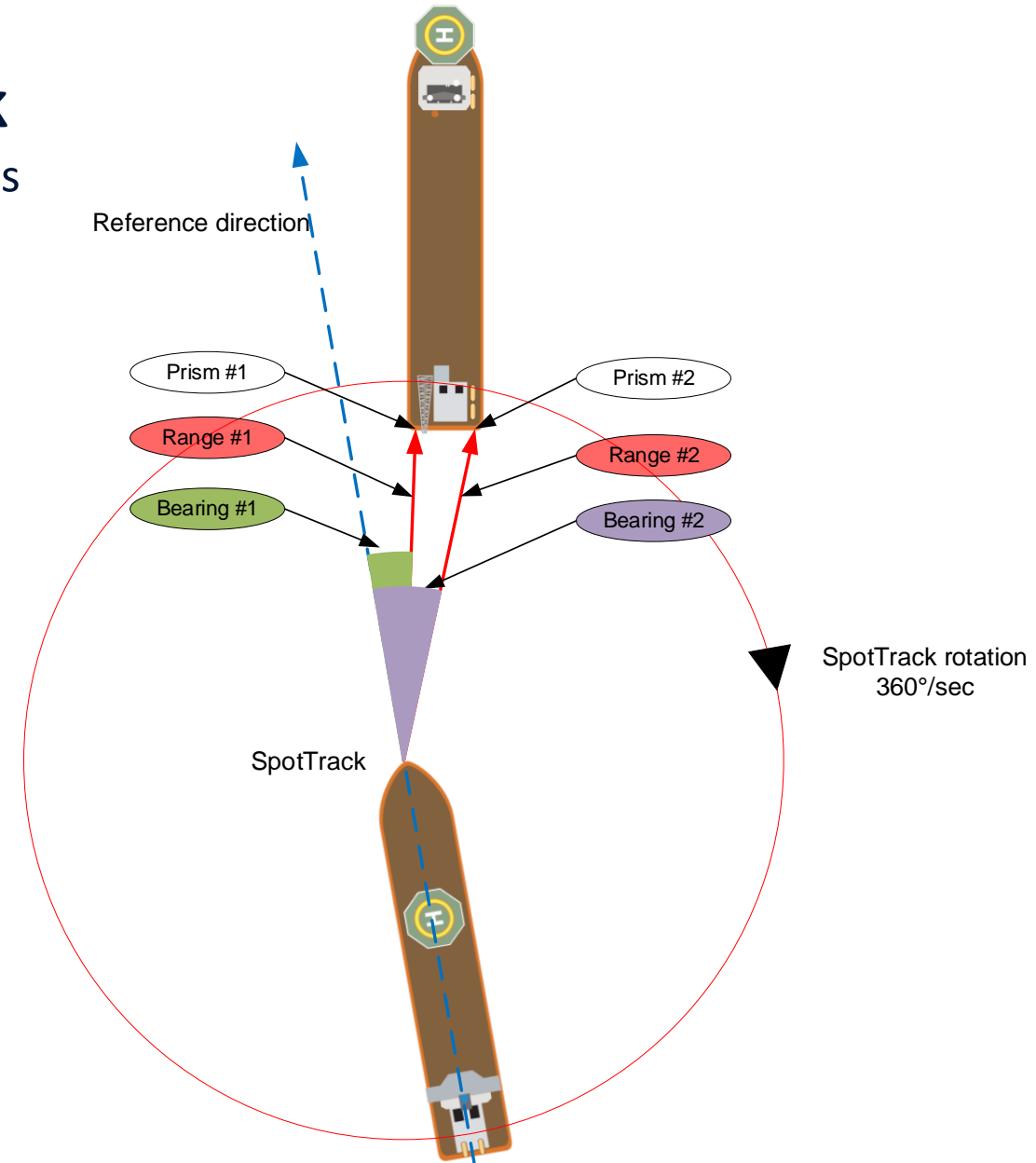


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SpotTrack

Multiple Targets

- SpotTrack tracking multiple targets
 - Multiple targets tracking





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SpotTrack

Factors Affecting Performance

- The SpotTrack needs free line of sight between SpotTrack sensor and the reflectors on the target side
- Any object in front of the interrogator might affect the performance of the SpotTrack
- Heavy rain/snow (reduced visibility for the laser)



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SpotTrack

Course Content

SpotTrack Operator Training

SpotTrack Introduction

SpotTrack Principles

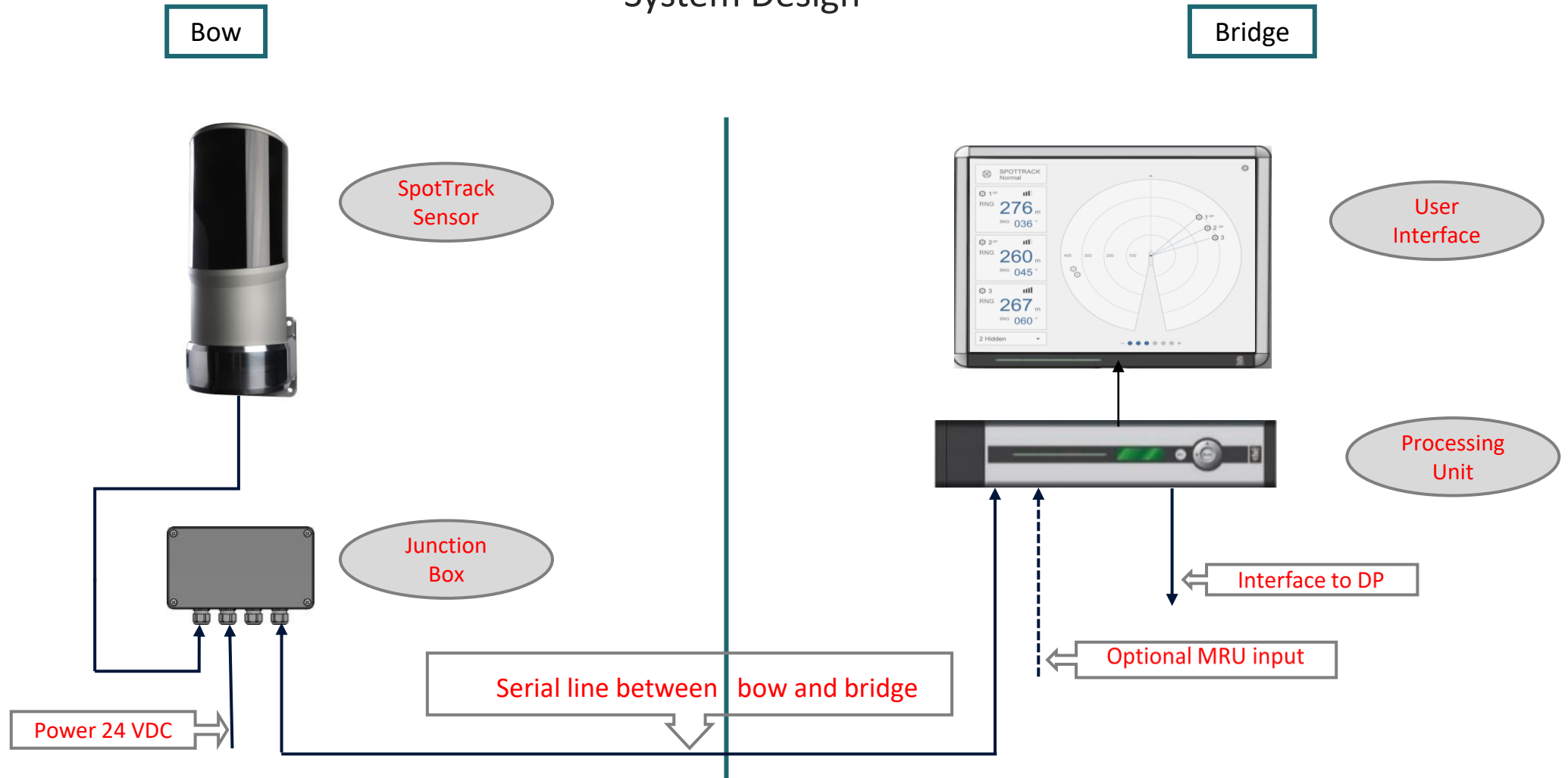
SpotTrack Product Modules

SpotTrack Operation



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SpotTrack System Design





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SpotTrack

System Design

- SpotTrack Sensor
 - Signal processing and range & bearing calculations
 - 1 Hz scanning frequency
 - Can feed signal directly to the DP system
 - Single or multiple target mode
 - MRU interface for true horizontal range (optional)
 - 1*RS-422 & 1*Ethernet/LAN





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SpotTrack

System Design

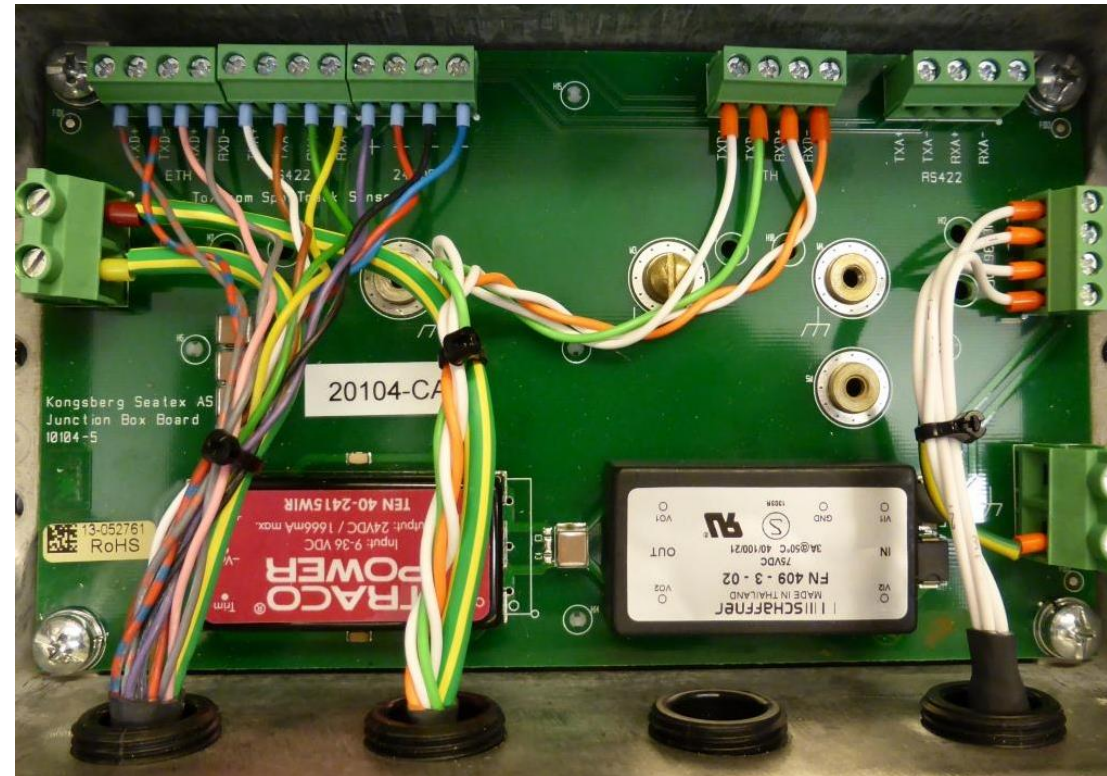
- SpotTrack HMI
 - Shows position of the vessel relative to the target(s) together with selected blanking zone
 - Target selection
 - Automatic data recording
 - Raw sensor data
 - Telegram output
 - DP Interface
 - 8 RS-232/422, 4 LAN, 3 USB





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SpotTrack Junction Box



to
SpotTrack sensor

Ethernet
to PU

RS422
to DP
(Optional)

Power
12 to 35 V DC



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SpotTrack

Reflector Types

- Reflective tube target
 - Reflective tube target/cylindrical target or diamond grade reflective tape are recommended used for close range DP work
 - Cylindrical targets (150mm diameter and 1m long) are recommended since they allow for viewing from all angles
 - Maximum distance should not exceed 200 meters when using this type of target





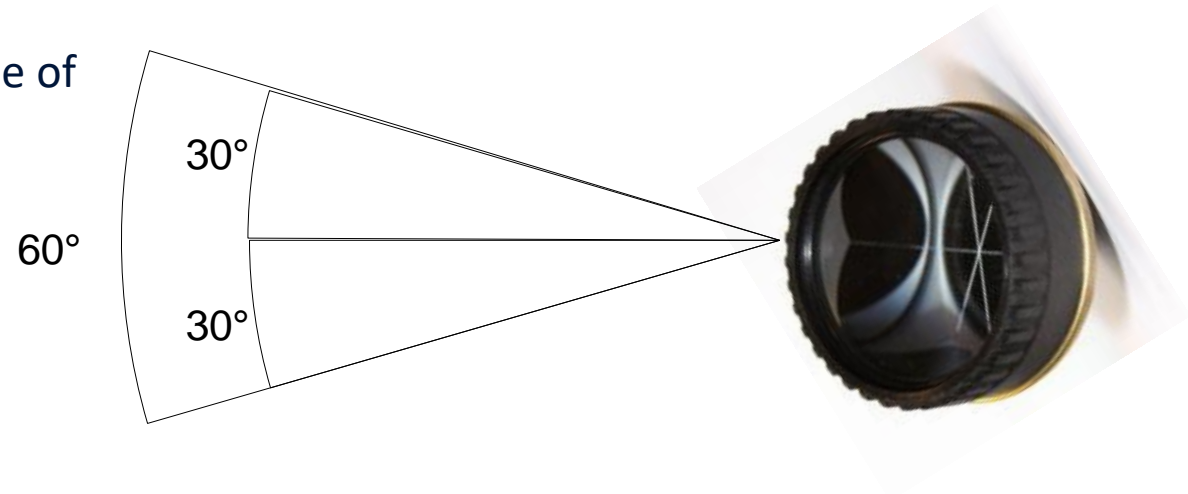
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SpotTrack

Reflector Types

▪ Single prism

- Prismatic reflectors are recommended used for longer range DP work
- A single prism is ok up to 1000m
- The prism has an opening angle of 30° other side of the center





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SpotTrack

Reflector Types

- Prism clusters
 - Prism clusters are recommended used for longer range DP work and where wider operational sector is wanted
 - For distances longer than 1000m prism clusters should be used
 - For offloading operations, it is recommended with two prism clusters. One on either side of the FPSO stern





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SpotTrack

Course Content

SpotTrack Operator Training

SpotTrack Introduction

SpotTrack Principles

SpotTrack Product Modules

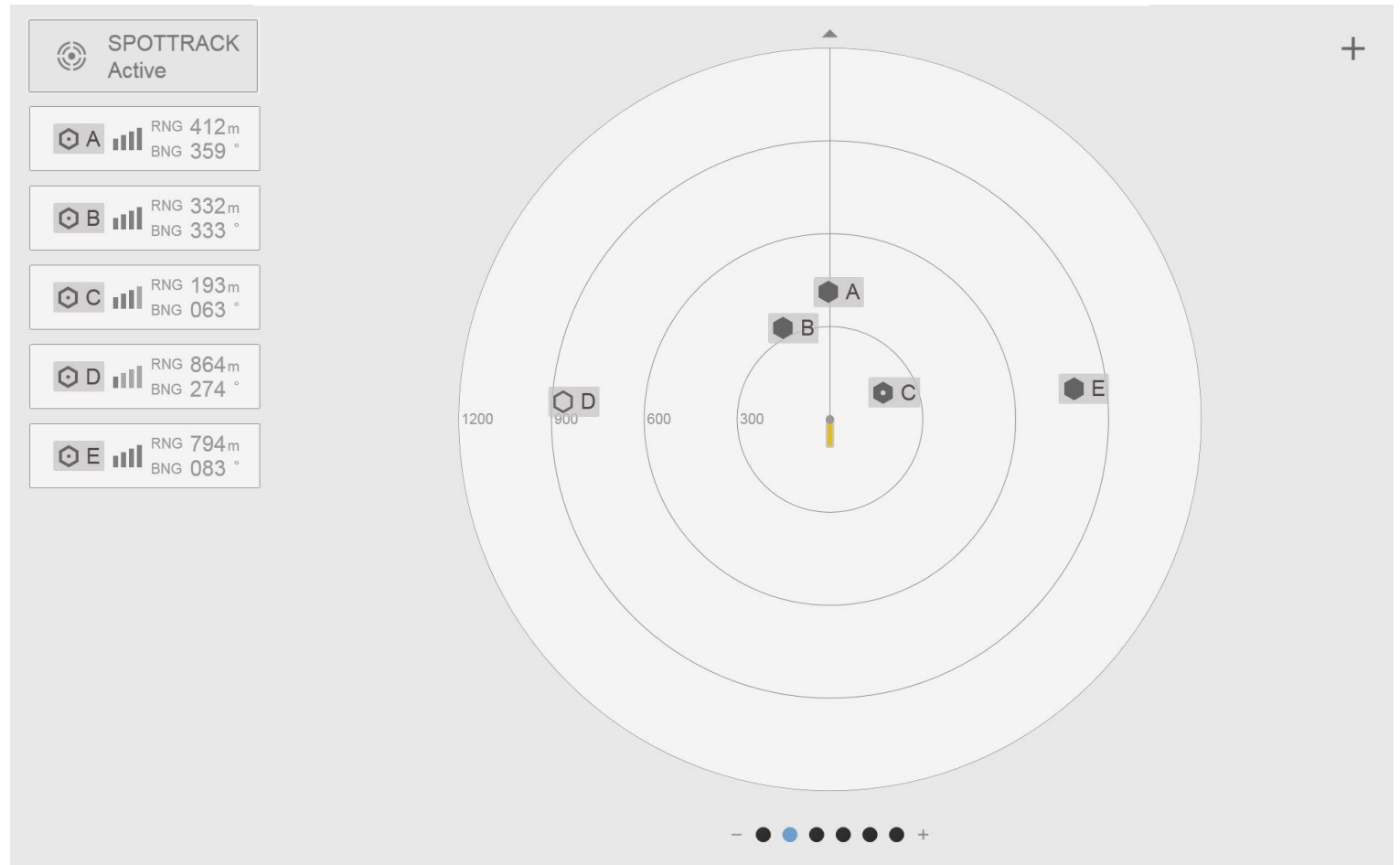
SpotTrack Operation



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SpotTrack

Main View



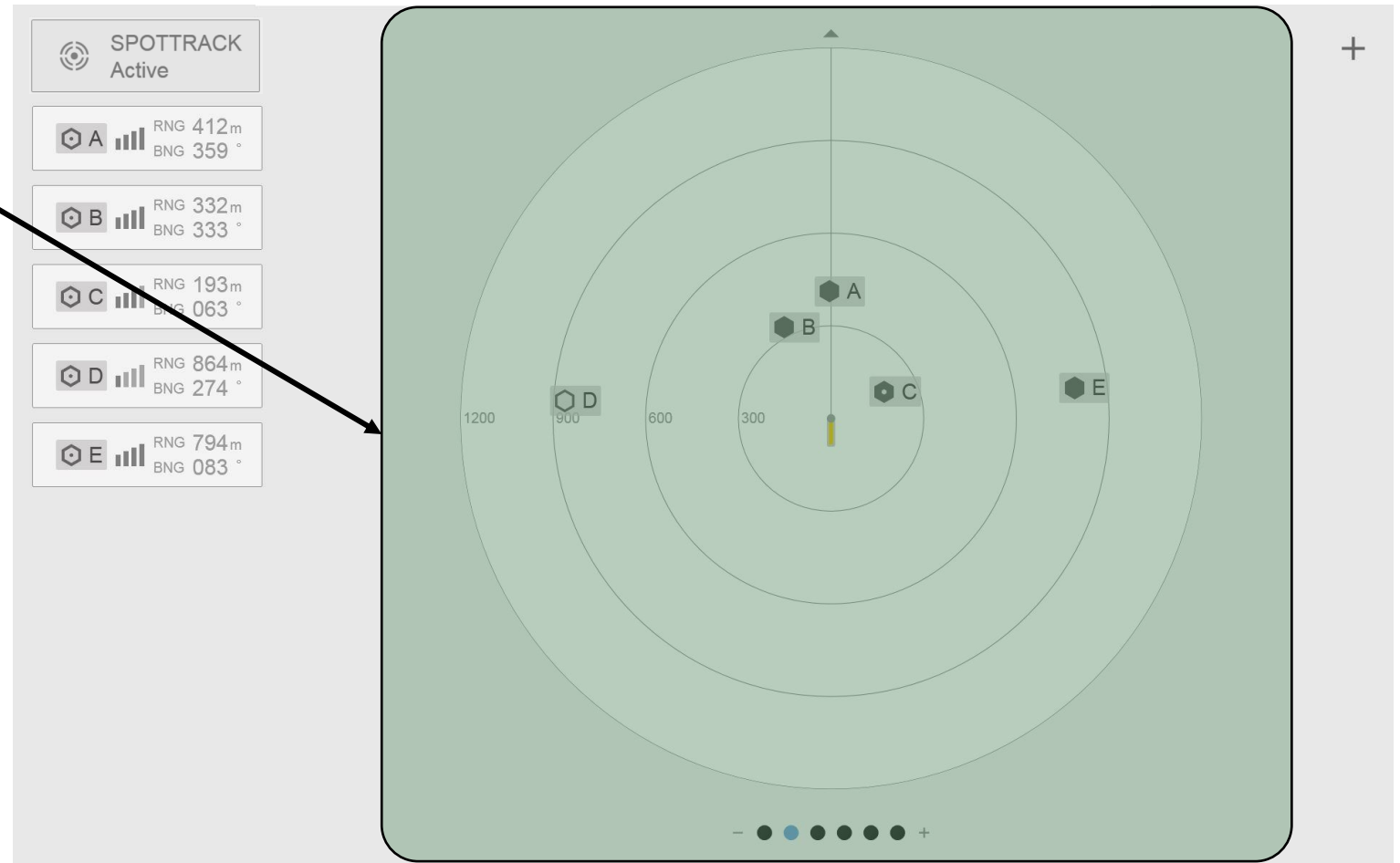


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SpotTrack

Main View

Radar View



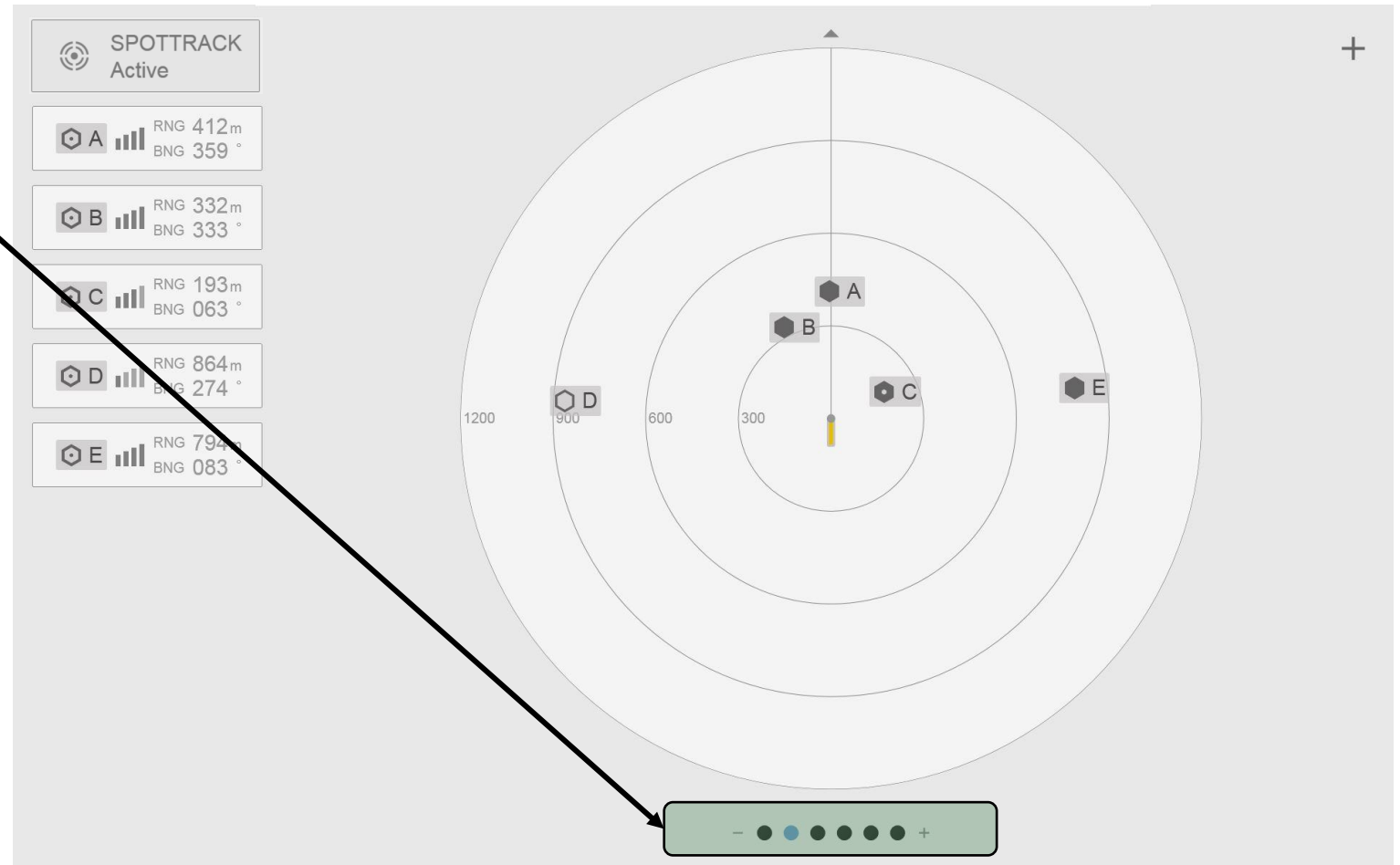


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SpotTrack

Main View

Zoom Buttons



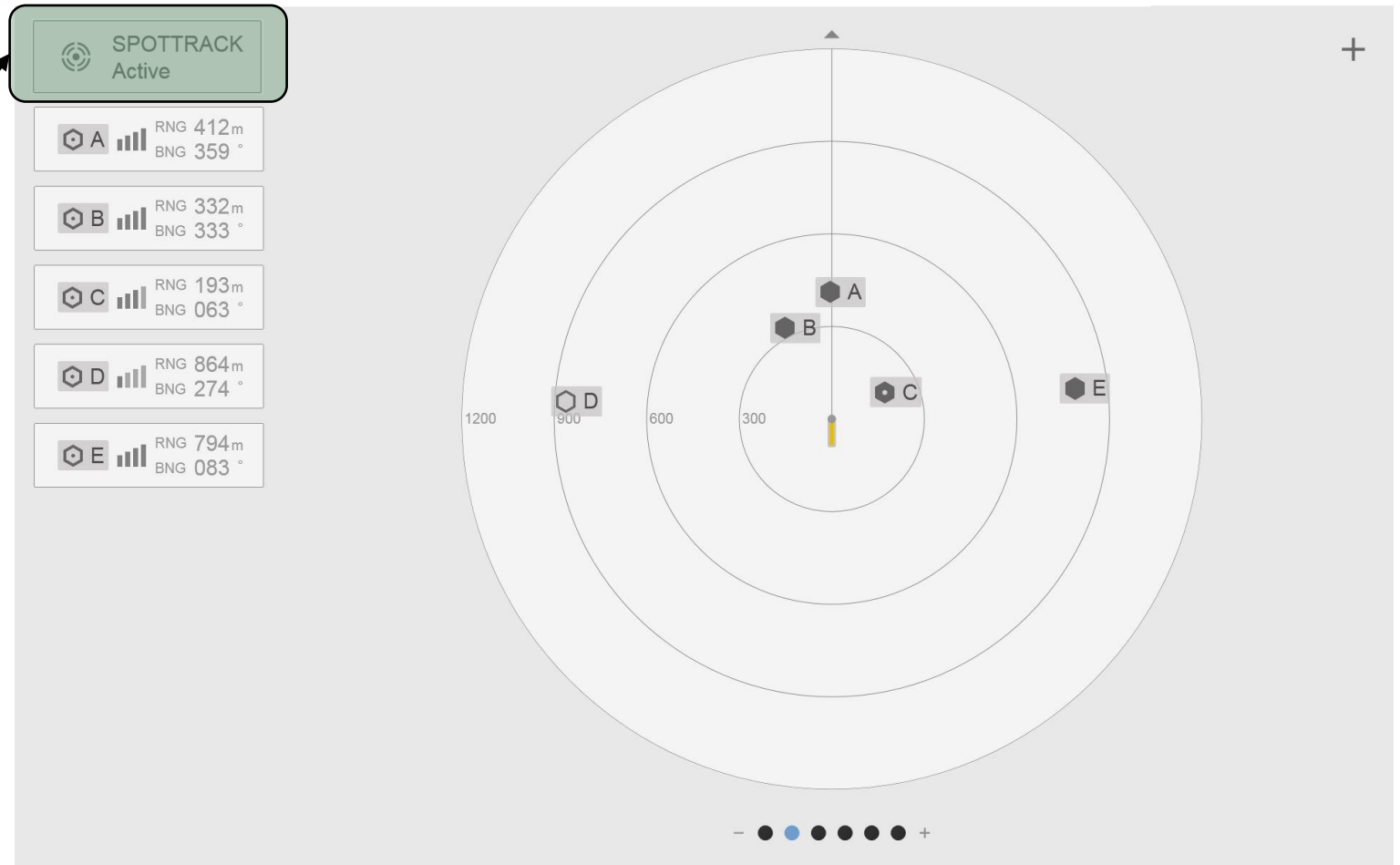


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SpotTrack

Main View

System Status
- Click to show overall status of system





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SpotTrack

Main View

SPOTTRACK Connection

Sensor	RNG	BRG
A	390m	001°
B	534m	226°
C	320m	106°
D	930m	147°

Status

Connection

Internal command failed Sensor.

Time	Event	Counter
------	-------	---------


Close the view by clicking on the X





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SpotTrack


Main View

 SPOTTRACK
Standby

 SPOTTRACK
Active

 SPOTTRACK
Simulation

 SPOTTRACK
Connection

 SPOTTRACK
Active

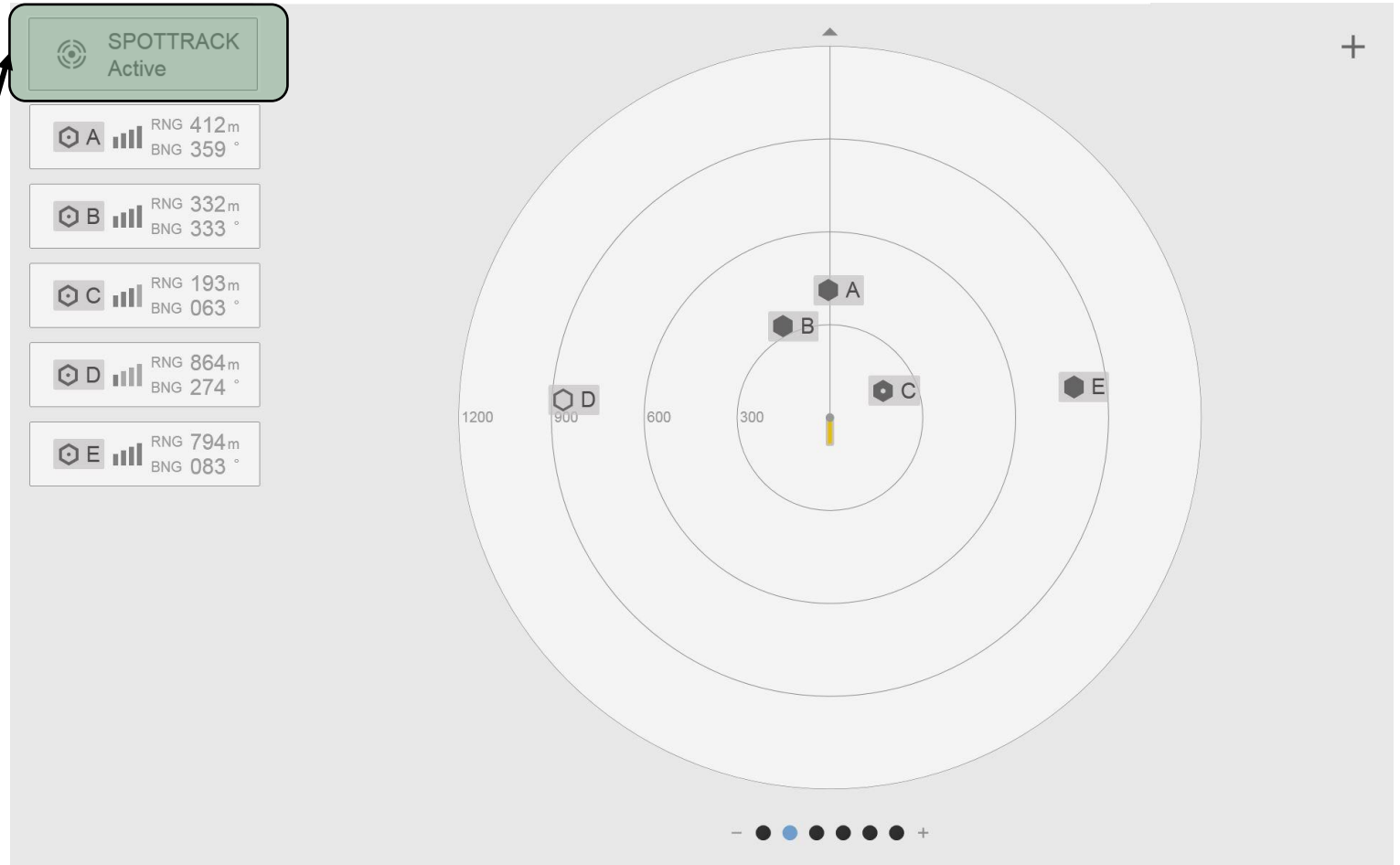
 A  RNG 412m
BNG 359 °

 B  RNG 332m
BNG 333 °

 C  RNG 193m
BNG 063 °

 D  RNG 864m
BNG 274 °

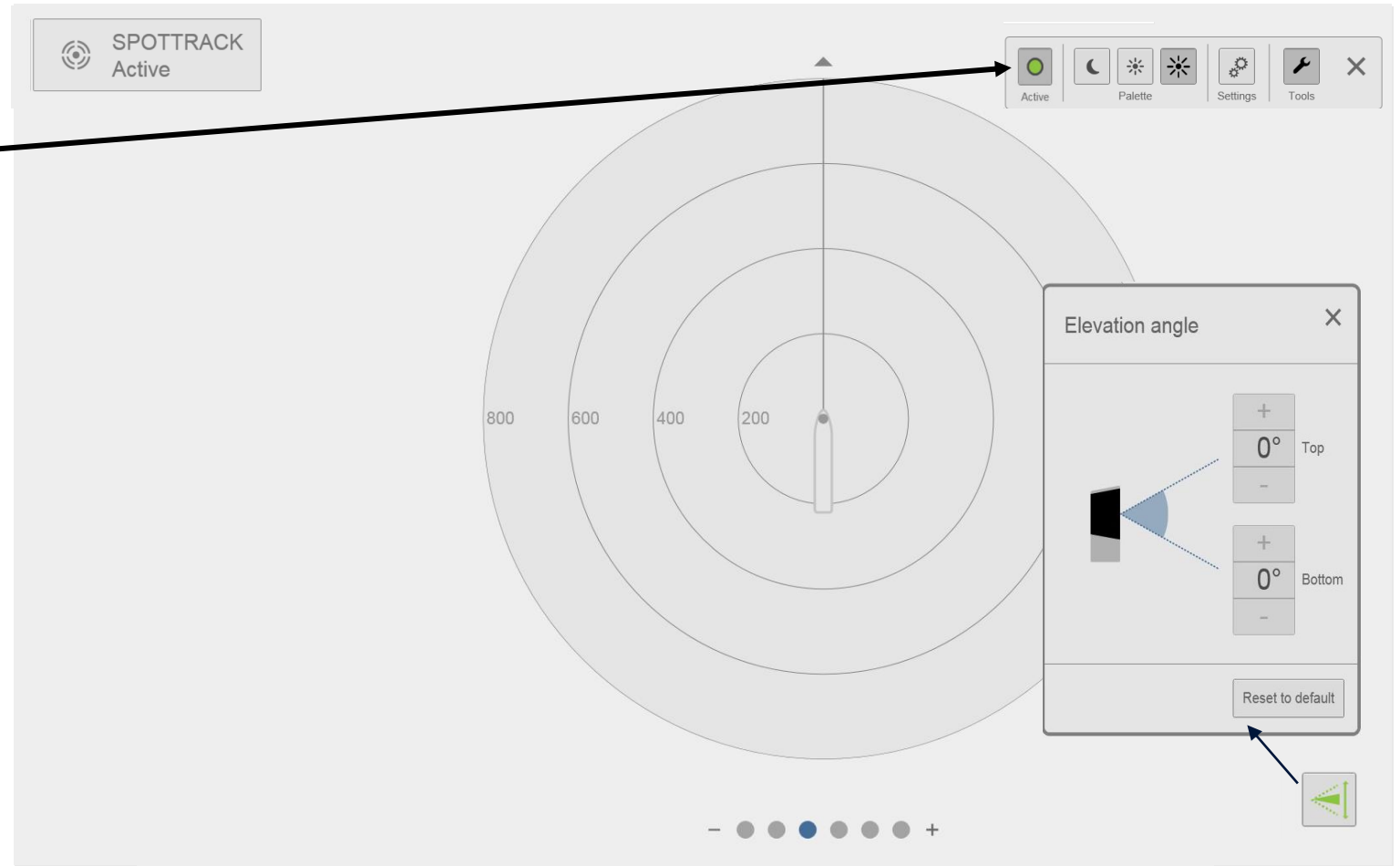
 E  RNG 794m
BNG 083 °



SpotTrack

Main View

Click to set system active



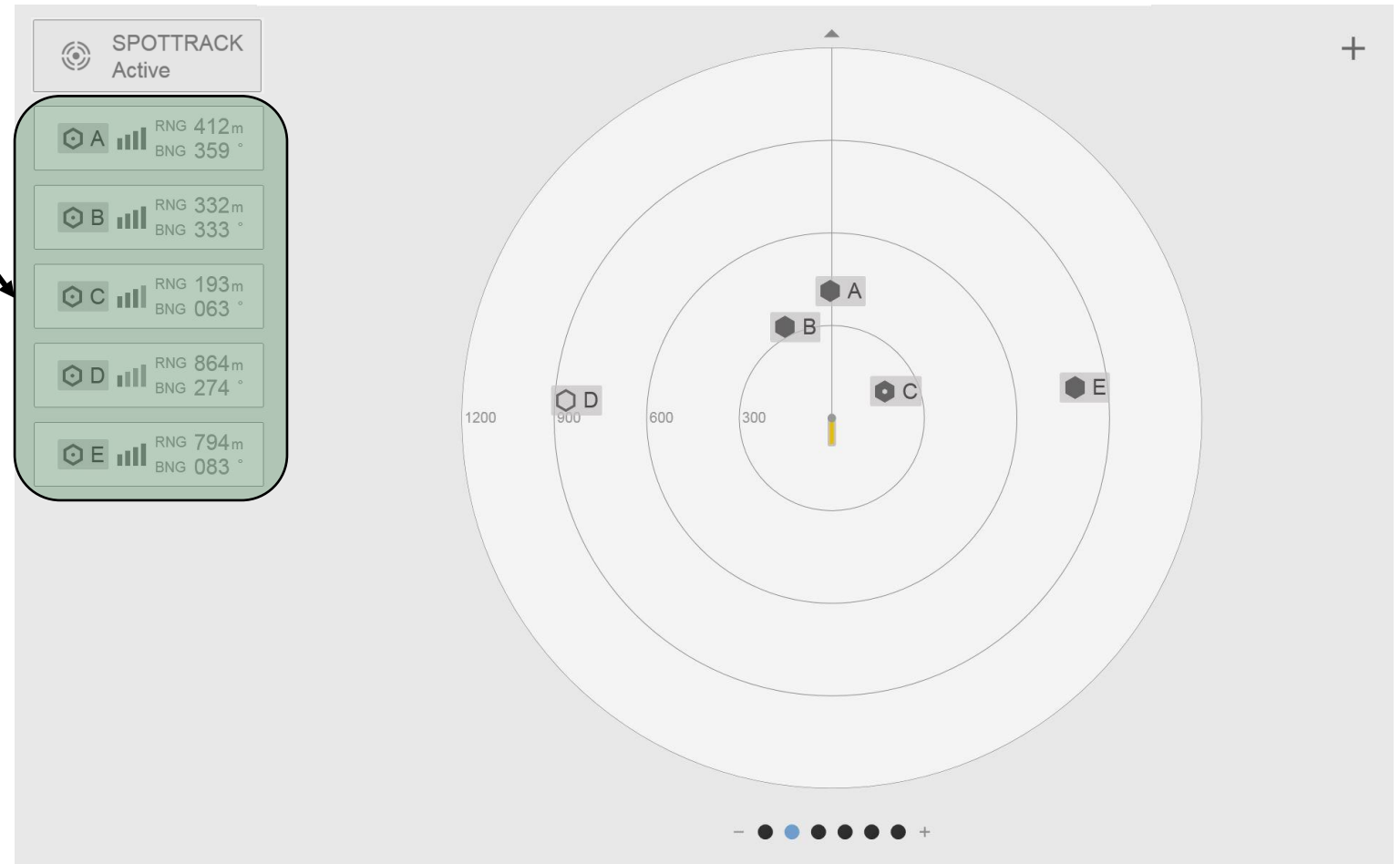


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SpotTrack

Reflector List

Reflector list





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SpotTrack

Target Selection from Reflector List

Target Not Selected

The interface displays the following data:

- SPOTTRACK Active** (with a minus sign icon and 'DP' label)
- Reflector A:** RNG 409m, BNG 359°
- Reflector B:** RNG 551m, BNG 215°
- Reflector C:** RNG 351m, BNG 167°
- Reflector D:** RNG --m, BNG --°
- Reflector E:** RNG 571m, BNG 070°

The plot shows Range [m] on the y-axis (250 to 550) and Bearing [deg] on the x-axis (-330 to 150). A blue curve is plotted, and the time is UTC 08:25:09.

REFLECTOR SIGNAL 83%



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SpotTrack

Target Selection from Reflector List

Target Selected

Target Turns Blue in Reflector List

The interface displays the following information:

- SPOTTRACK Active** status indicator.
- DP** (Data Point) button.
- Reflector List:**
 - 1** (Selected): 533 m, BRG 160°
 - A**: 377 m, BRG 357°
 - B**: --- m, BRG ---°
 - C**: 286 m, BRG 336°
 - D**: --- m, BRG ---°
- Range [m] vs Bearing [deg] Plot:** Shows a blue curve and a cyan curve. The y-axis ranges from 250 to 550 m, and the x-axis ranges from -0:25 to -0:05. The plot is timestamped **UTC 10:45:52**.
- Reflector elevation:** 0°
- Reflector signal:** 54%

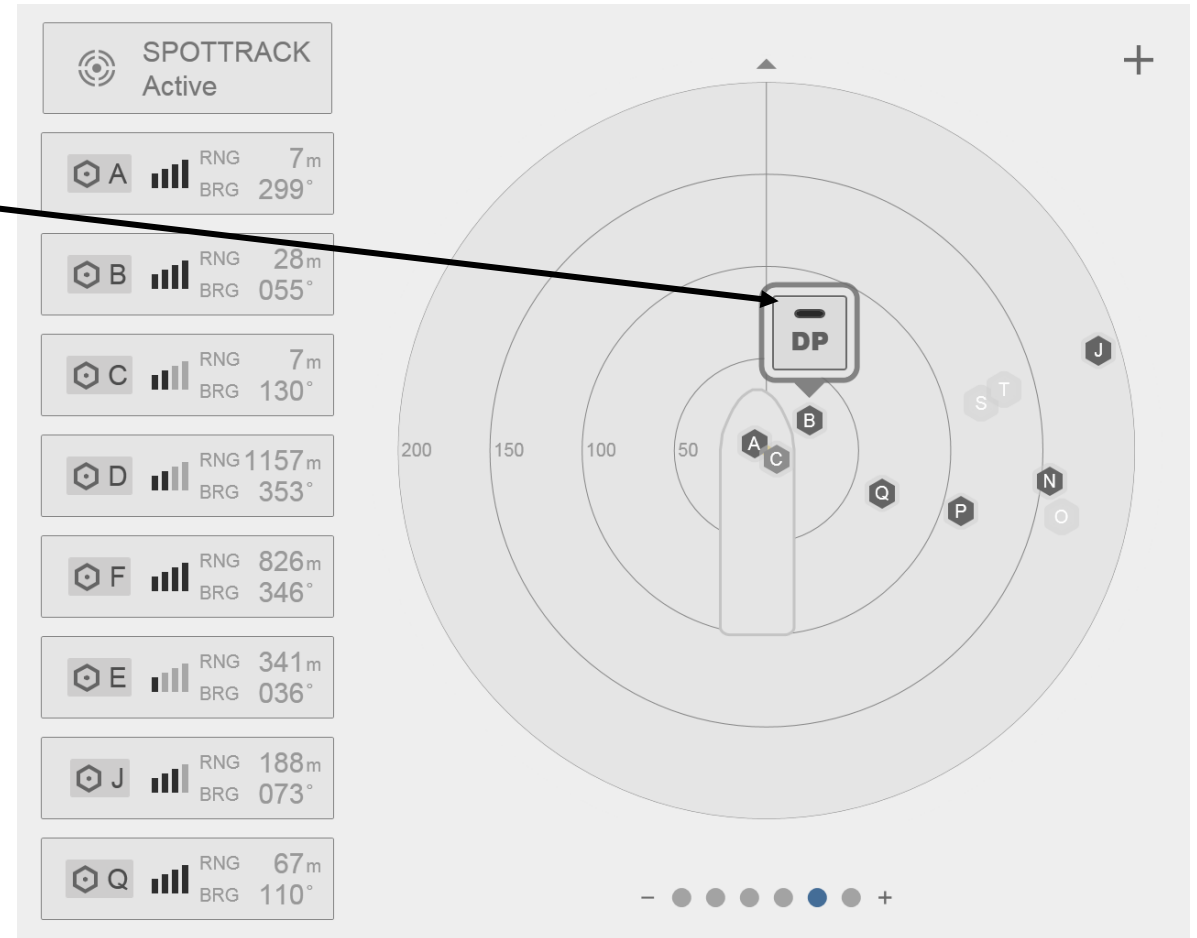


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SpotTrack

Target Selection from Radar View

Target Not Selected





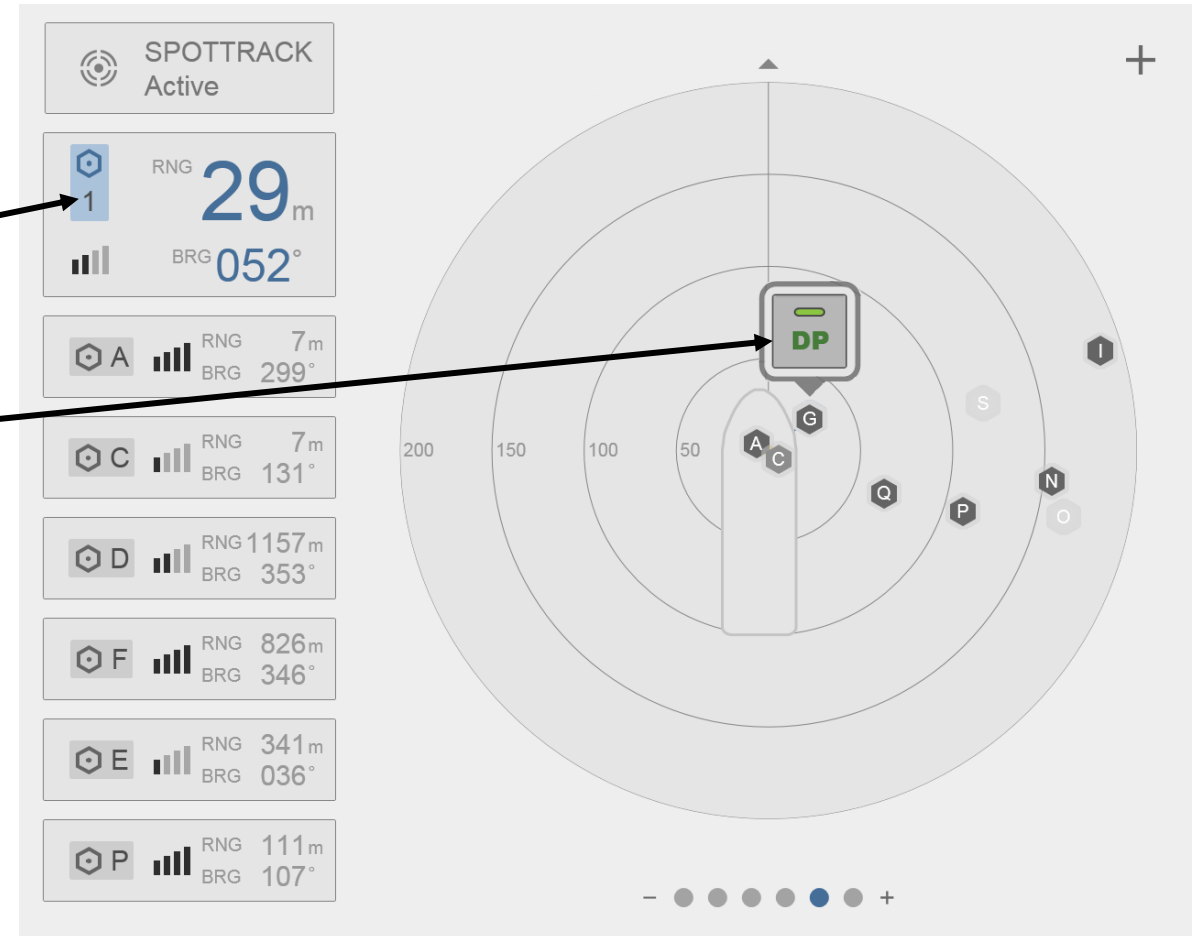
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Target Selection from Radar View

Target Turns Blue in Reflector List

Target Selected





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SpotTrack Technical Training

Course Content

SpotTrack Technical Training

SpotTrack System Description

SpotTrack Configuration

SpotTrack Maintenance

SpotTrack Service/Troubleshooting



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SpotTrack Technical Training

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SpotTrack

Processing Unit (Front)



Behind the lid on the left:

- Power switch
- LAN1, network connector, User configurable
- USB port for software upgrades, backup and to copy log files out from the system



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SpotTrack

Processing Unit (Front)

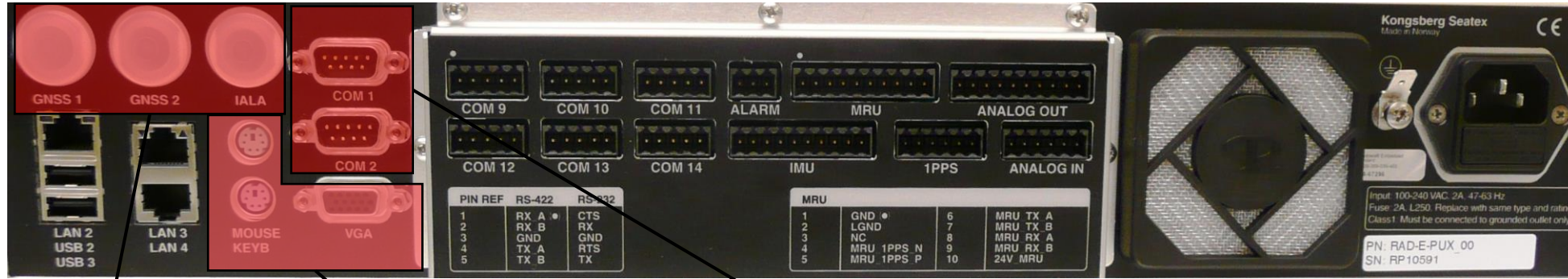


- There are 4 light indicators on the front
- LED 1, left most, Power/SW LED
 - LED 2-4, No function in this system



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SpotTrack Processing Unit (Rear)



GNSS 1 – GNSS 2 – IALA
Not used by this system

Mouse – Keyboard-
Monitor connectors

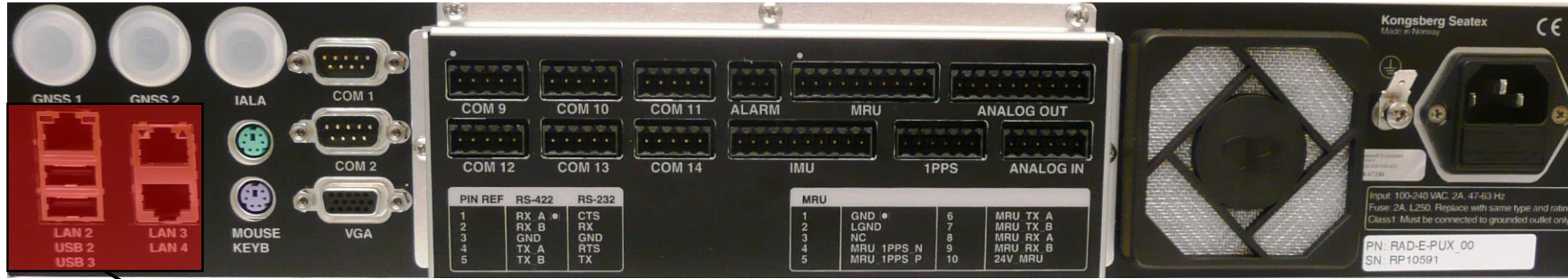
COM1 – COM2
RS-232 user configurable



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SpotTrack

Processing Unit (Rear)



LAN 2 – User configurable
LAN 3 – Junction Box Field
LAN 4 – User configurable

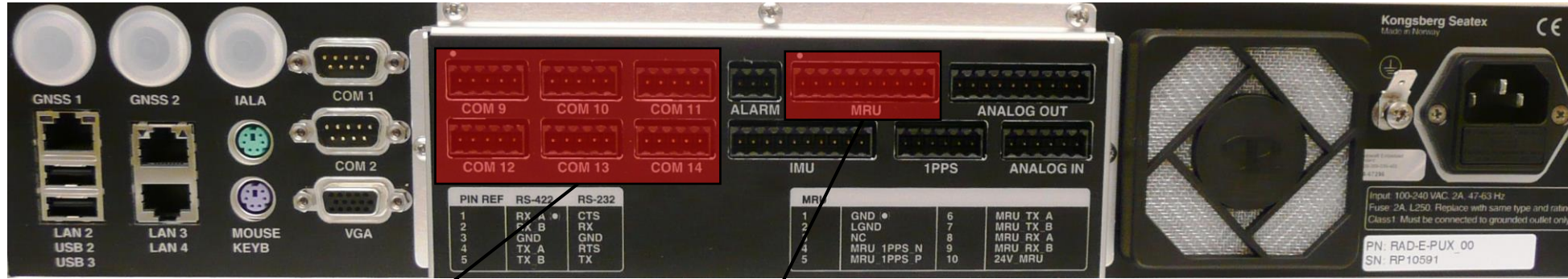
USB 2 & 3 – User configurable



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SpotTrack

Processing Unit (Rear)



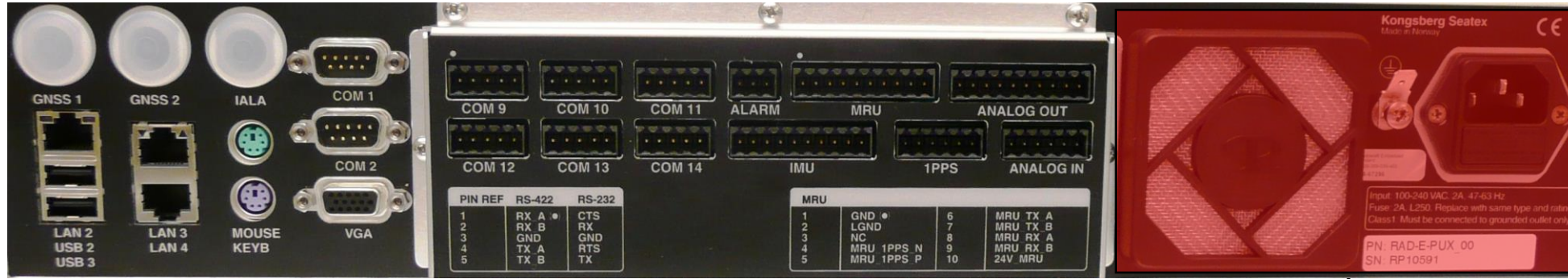
COM9 - COM14
RS-422, user configurable

MRU



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SpotTrack Processing Unit (Rear)



Power input, 100 to 240 V AC 50/60 Hz
Fuse, integrated in Power connector

Cooling fan, with filter



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SpotTrack Technical Training

Course Content

SpotTrack Technical Training

SpotTrack System Description

SpotTrack Configuration

SpotTrack Maintenance

SpotTrack Service/Troubleshooting

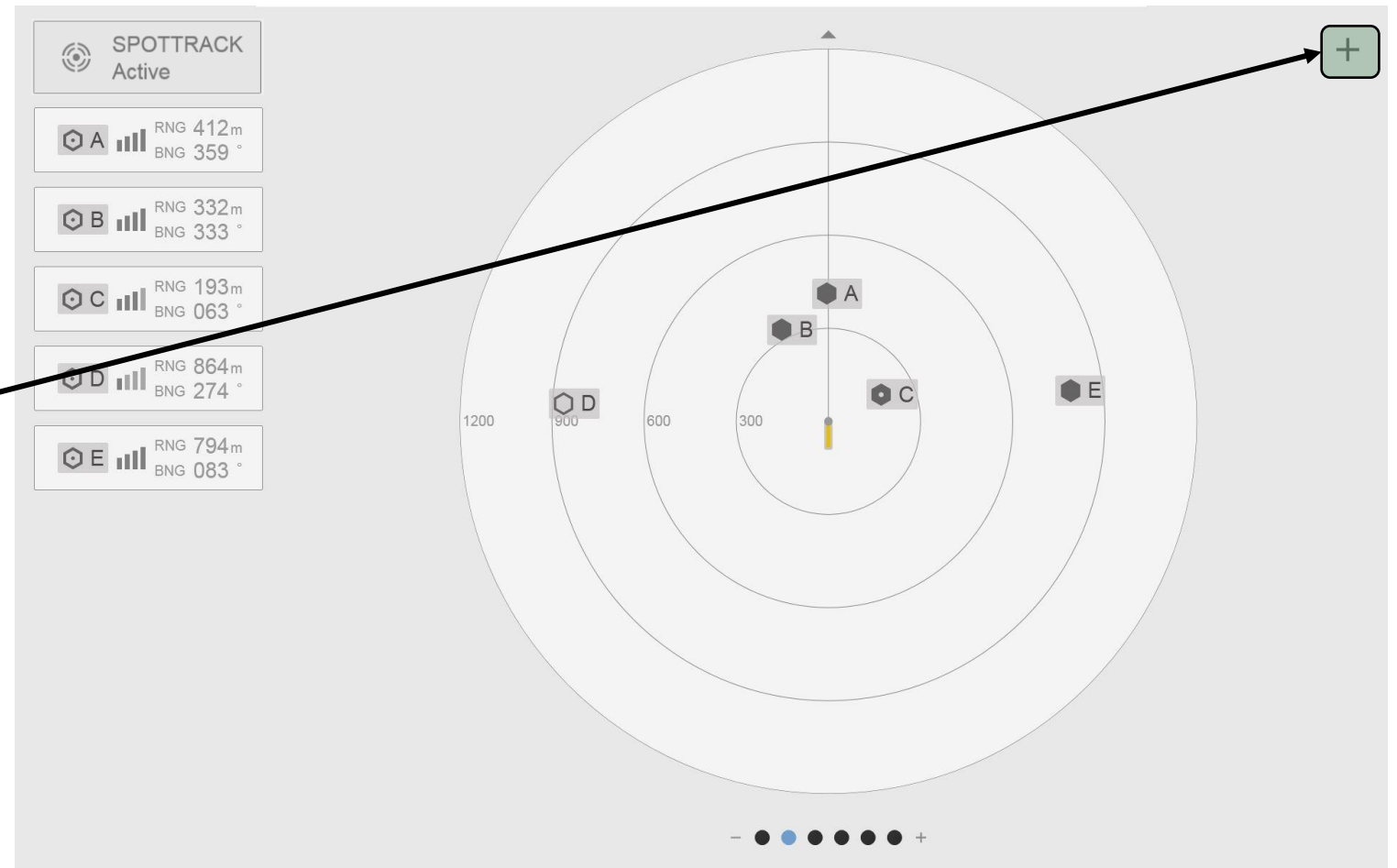


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SpotTrack Configuration

Configuration menu is available from the Main menu

Click on the + sign to open Main menu





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SpotTrack Configuration

Click Settings





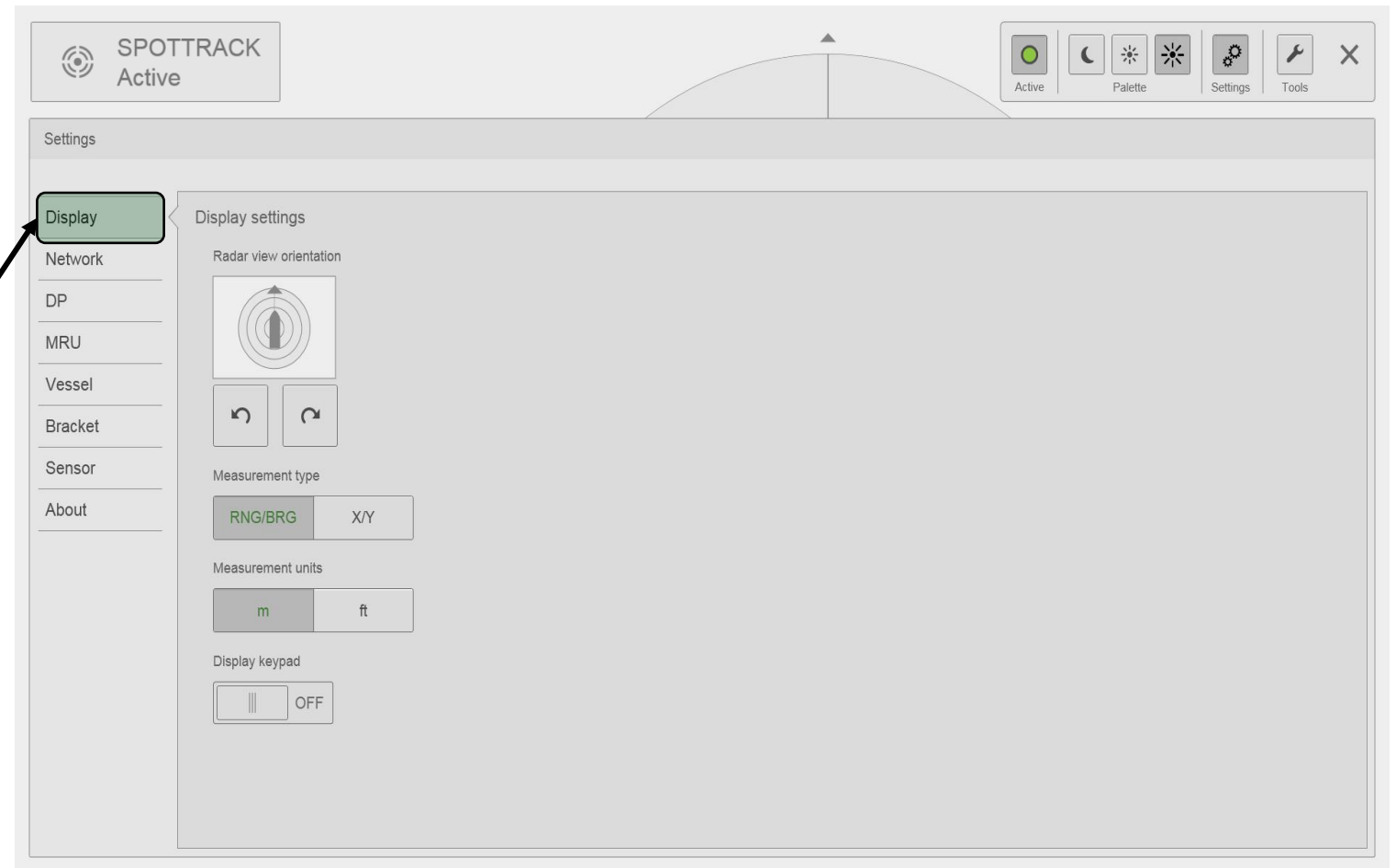
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SpotTrack

Settings Menu

Display Setup:

- Radar view orientation
- Measurement type
- Measurement units





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SpotTrack

Settings Menu

Network setup:
Default addresses
- PU
 192.168.2.50
- Sensor 192.168.2.200

The screenshot shows the SpotTrack Settings Menu. At the top left, there is a 'SPOTTRACK Active' status indicator. On the right, there are control icons for 'Active', 'Palette', 'Settings', and 'Tools'. The main content area is titled 'Settings' and has a sidebar menu with options: Display, Network (highlighted), DP, MRU, Vessel, Bracket, Sensor, and About. The 'Network' section is expanded to show 'SpotTrack system IP settings'. Under 'LAN1', the IP address is set to 10.65.72.53. Below that, the 'SpotTrack sensor IP address' is set to 192.168.2.200. At the bottom, the 'SpotTrack sensor cable ID' is set to 'Not defined'. Each IP address field has an edit icon (pencil) to its right.



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SpotTrack

Settings Menu

DP Setup:

- Select telegram to DP
- Select maximum number of targets

Communication type:

- IP Address





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SpotTrack

Settings Menu

DP Setup:

- Select telegram to DP
- Select maximum number of targets

Communication type:

- Serial line





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Settings Menu

MRU Setup:
- Enabling MRU

Communication type:
- IP





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SpotTrack

Settings Menu

MRU Setup:
- Enabling MRU

Communication type:
- Serial





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SpotTrack

Settings Menu

Vessel Setup:

- Vessel Name
- MMSI number
- Vessel Length
- Vessel Width
- Vessel Height

The screenshot displays the SpotTrack Active interface. At the top, there is a navigation bar with icons for Active, Palette, Settings, and Tools. Below this is a 'Settings' panel with a sidebar menu containing options: Display, Network, DP, MRU, Vessel (highlighted), Bracket, Sensor, and About. The main content area is titled 'Vessel shape and dimensions' and includes input fields for Name (set to 'Not defined'), MMSI, Length [m] (100.00), Width [m] (20.00), and Height [m] (10.00). To the right of these fields is a large canvas showing two vessel outlines: a larger one with a rounded bow and a smaller one with a flat bow.



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SpotTrack

Settings Menu

Bracket Setup:

- Origin relative to vessel
- Bracket relative to origin
- Orientation relative to vessel center line

positive forward (x)
positive starboard (y)
positive down (z)
positive clockwise

SPOTTRACK Active

Active Palette Settings Tools

Settings

Display

Network

DP

MRU

Vessel

Bracket

Sensor

About

Bracket location

Survey origin

X (forward) [m] Y (starboard) [m] Z (down) [m]

0.00 0.00 0.00

Bracket location (from survey origin)

X (forward) [m] Y (starboard) [m] Z (down) [m] Orientation [°]

20.00 0.00 -15.00 0

Bracket location (from center of gravity)

Z (down) [m]

-11.00



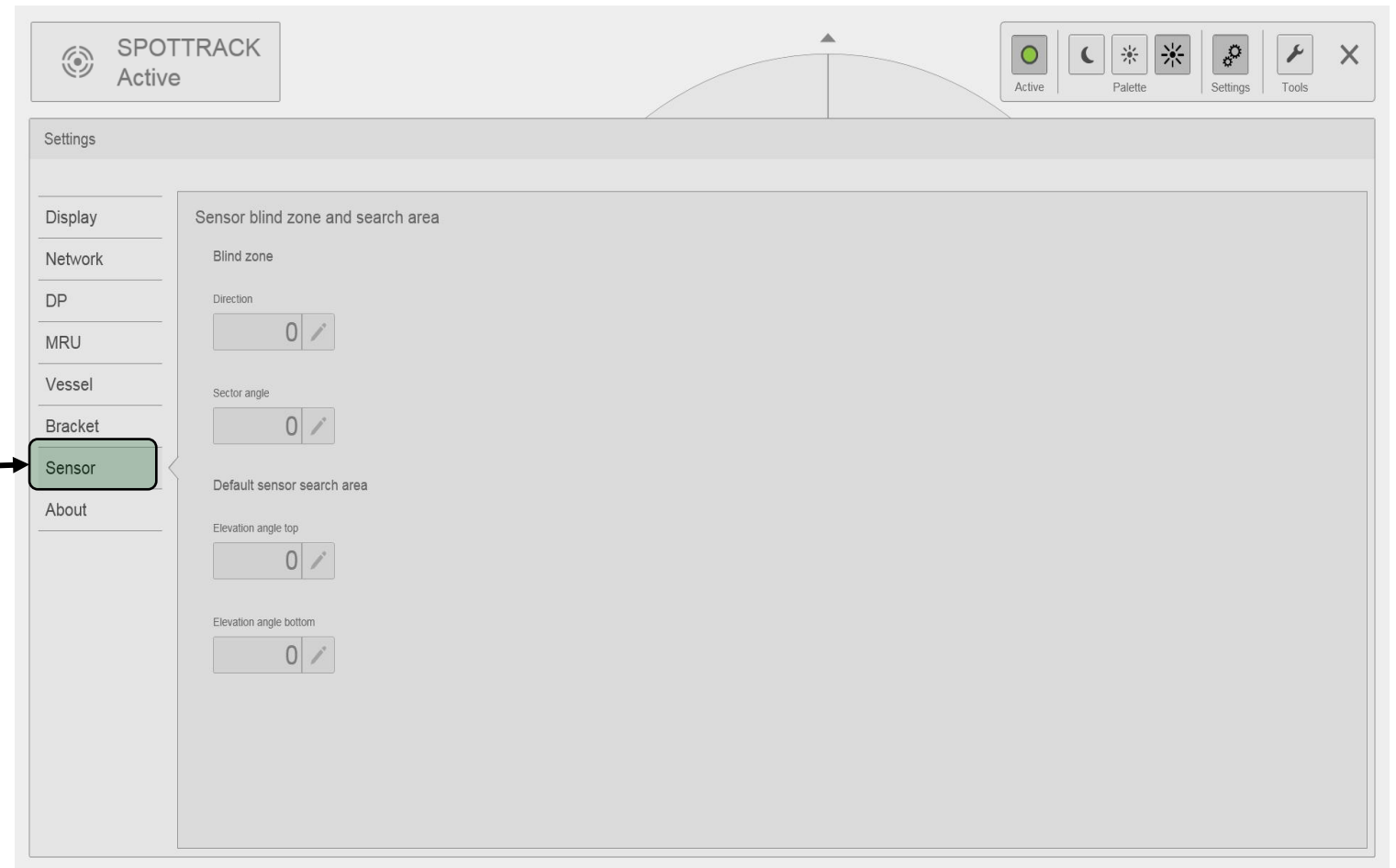
KONGSBERG

SpotTrack

Settings Menu

Sensor Setup:
Define blind zone

- Direction sector center (relative to vessel center line)
- Sector Angle (total opening angle)





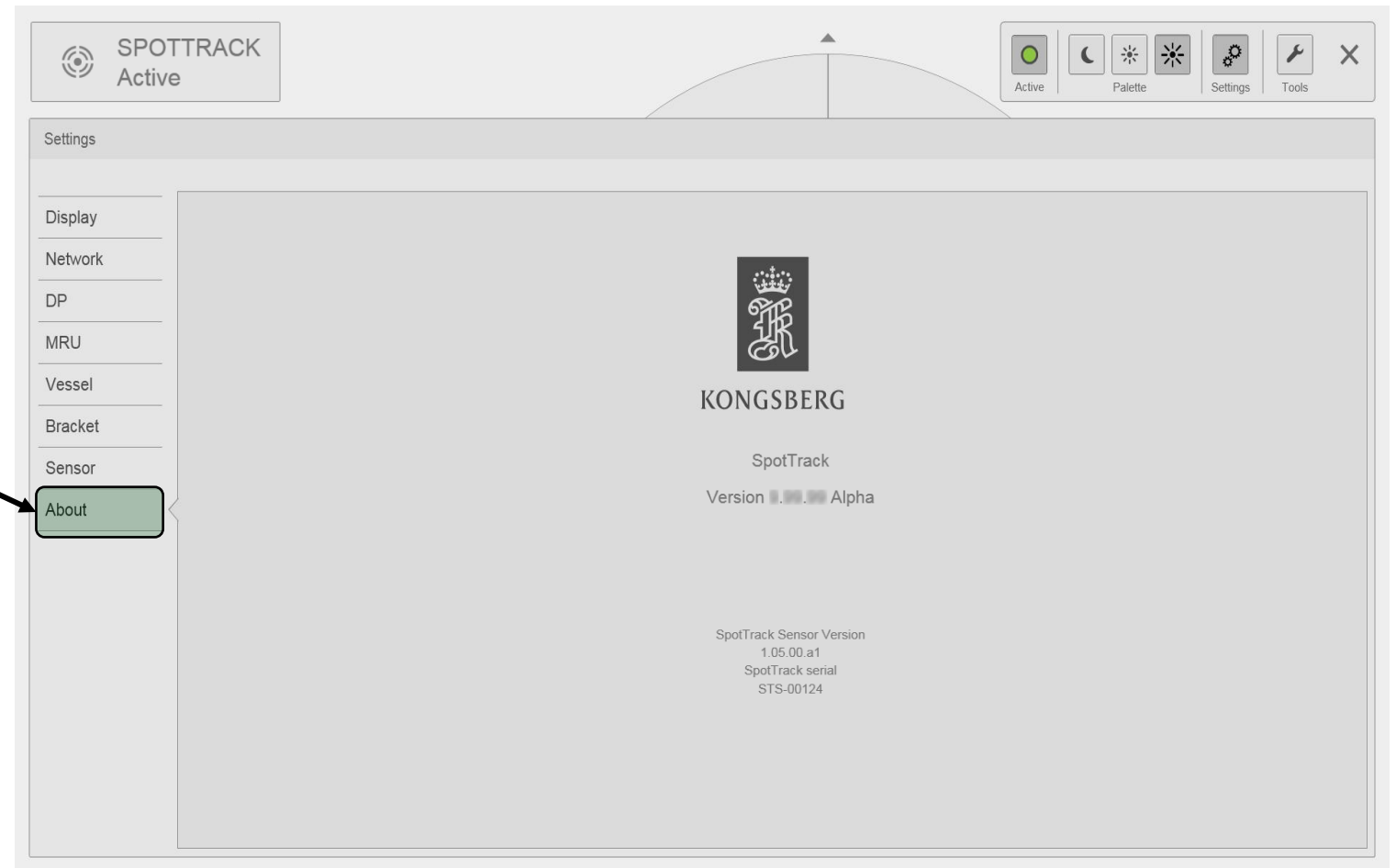
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SpotTrack

Settings Menu

Sensor Setup:

- SpotCore (PU unit) sw. version
- SpotTrack sensor sw. version
- SpotTrack serial no.





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SpotTrack Technical Training

Course Content

SpotTrack Technical Training

SpotTrack System Description

SpotTrack Configuration

SpotTrack Maintenance

SpotTrack Service/Troubleshooting



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SpotTrack

Periodic Maintenance

Periodic maintenance:

- It is important to keep the SpotTrack window clean to get optimum performance.
- Clean the SpotTrack window with a mild, non-abrasive, detergent and a soft cloth on a regular basis.
- Cleaning agent and cloth are provided in the Sensor Unit transportation container.





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SpotTrack

Periodic Maintenance

Periodic maintenance:

Cleaning of Processing Unit air inlet recommended every 6 months depending on the air quality in operation's location.

Steps:

- Remove cover.
- Remove the filter and clean it by washing or vacuuming.
- Replace the plastic cover with the cleaned filter.





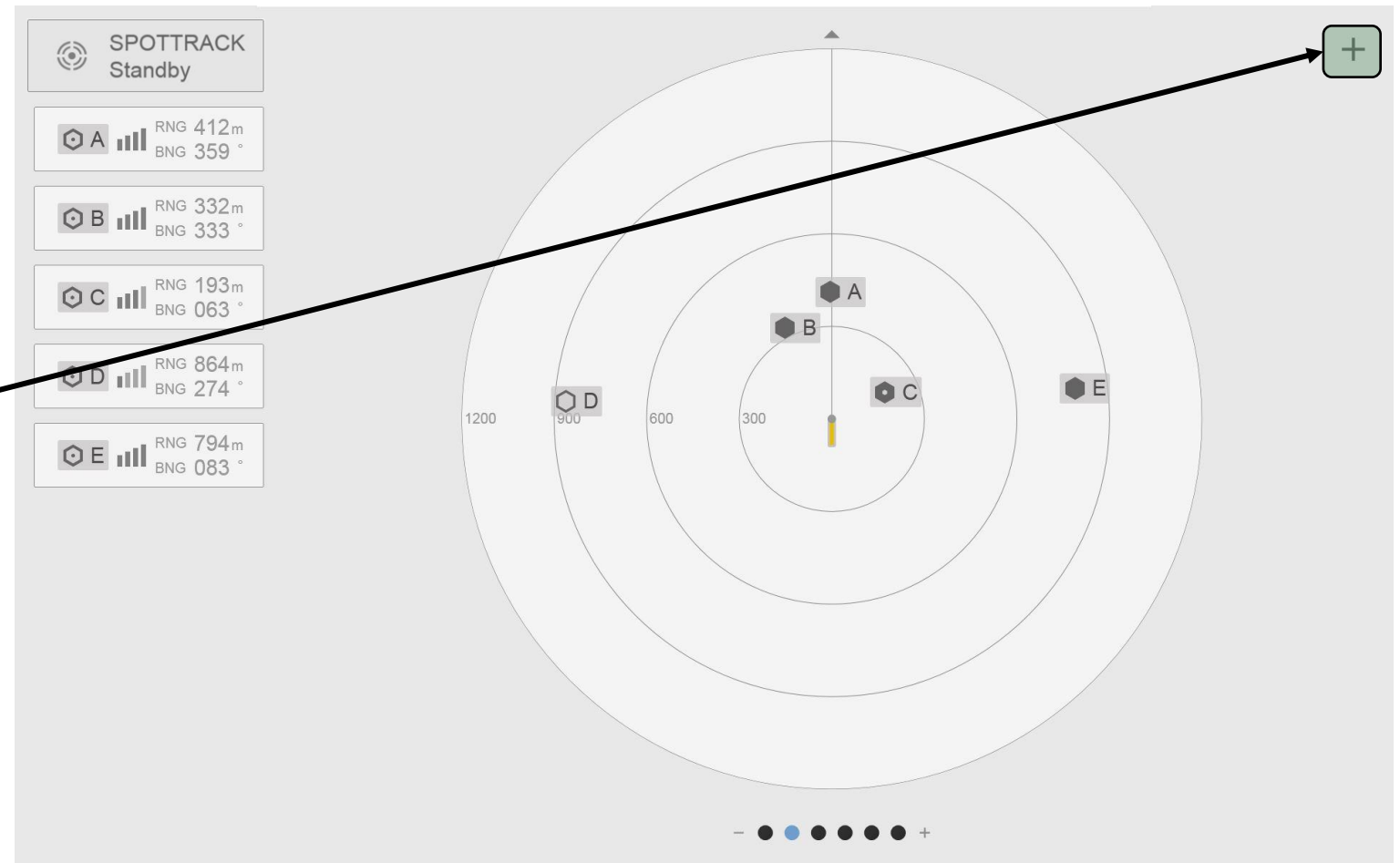
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SpotTrack

Main Menu

The configuration menu is available from the Main Menu

Click on the + sign to open Main Menu





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SpotTrack

Tools Menu

Click on Tools





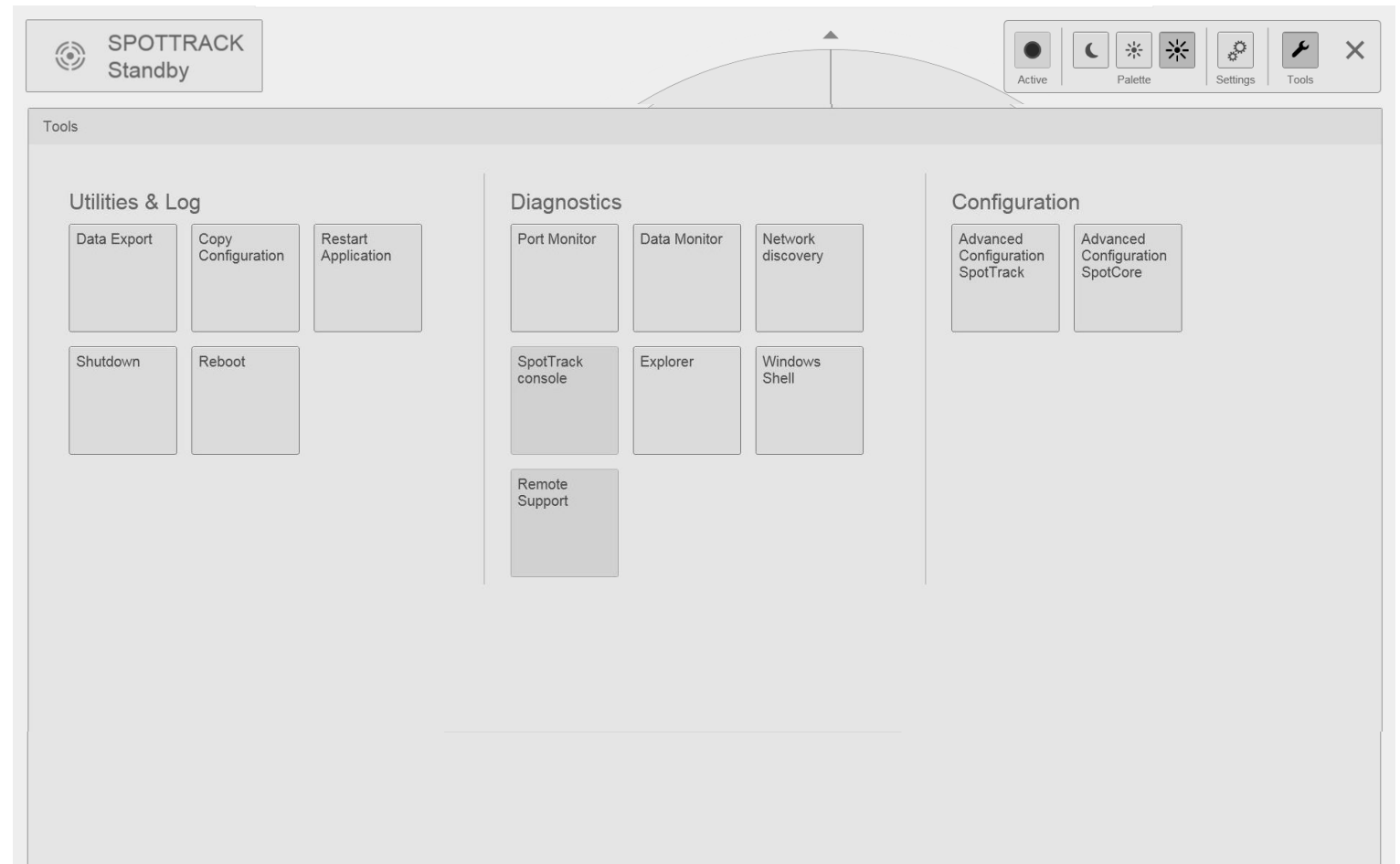
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SpotTrack

Tools Menu

Tools:

- Utilities and Log
- Diagnostic
- Configuration





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SpotTrack

Tools Menu

Data Export:
- export data from the system,
either for documentation
purposes, post-processing or
diagnostics.

The screenshot shows the SpotTrack Standby interface. The 'Tools' menu is open, displaying several utility buttons. The 'Data Export' button is highlighted with a green box and an arrow pointing to a 'Data Export tool' dialog box. The dialog box contains a calendar for September 2020, a time selection grid, and duration settings.

Calendar: Sep 2020

M	Tu	W	Th	F	Sa	Su
1	2	3	4	5	6	
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

Hours:

	0	1	2	3	4	5
6	7	8	9	10	11	
12	13	14	15	16	17	
18	19	20	21	22	23	

Minutes:

	0	15	30	45

Duration: 0 Days 1 Hours

Period: 2020-09-03 08:57 to 2020-09-03 09:57

Estimated size: ~0.0 kB

USB media: Drive: F: Free size: 14.6 GB

Buttons: Customize, Export, Exit

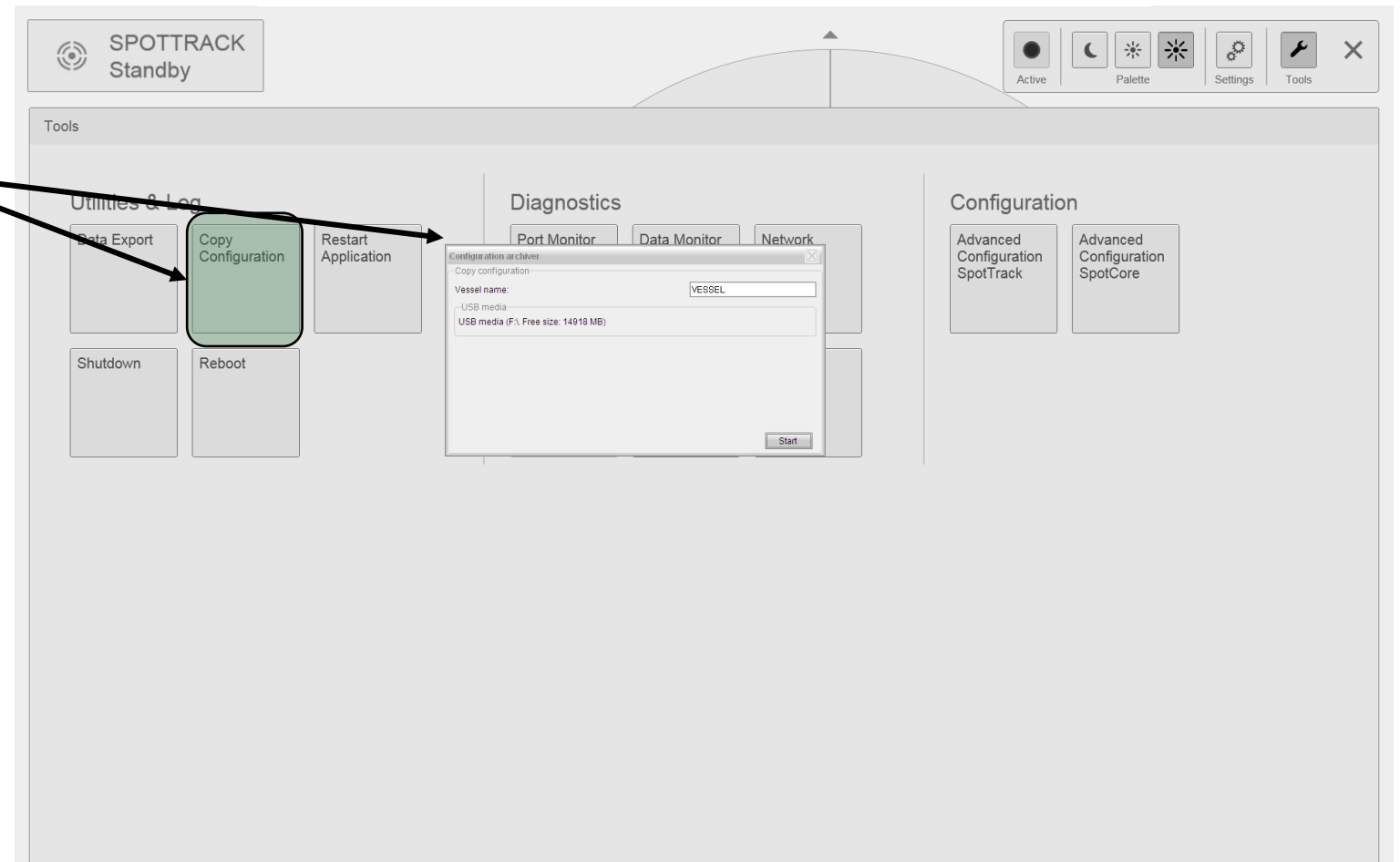


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SpotTrack

Tools Menu

Copy Configuration:
- Backup configuration to USB





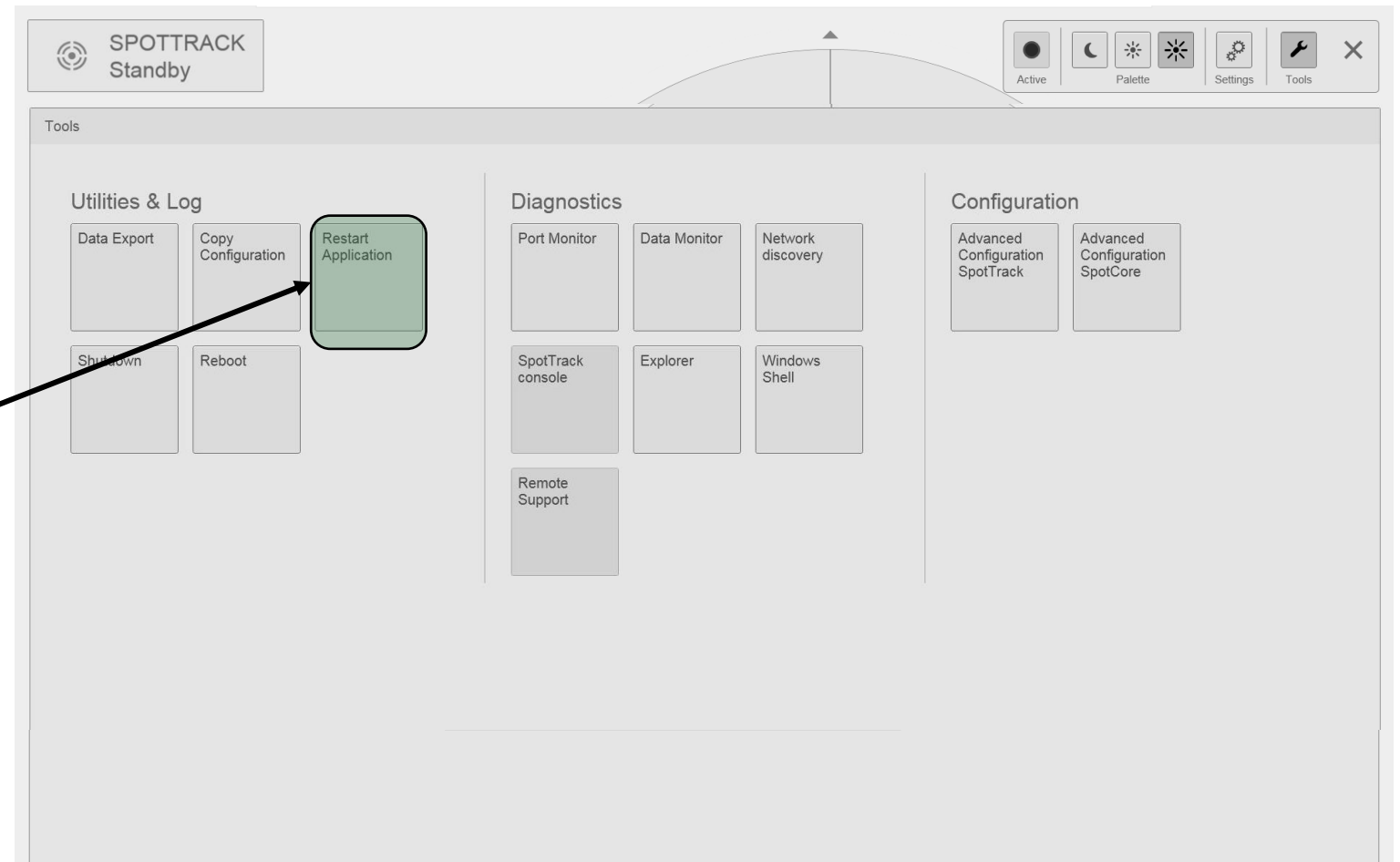
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SpotTrack

Tools Menu

Restart Application:

- Soft restart of the presentation application.
- SpotTrack sensor is not restarted.





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SpotTrack Technical Training

Course Content

SpotTrack Technical Training

SpotTrack System Description

SpotTrack Configuration

SpotTrack Maintenance

SpotTrack Service/Troubleshooting



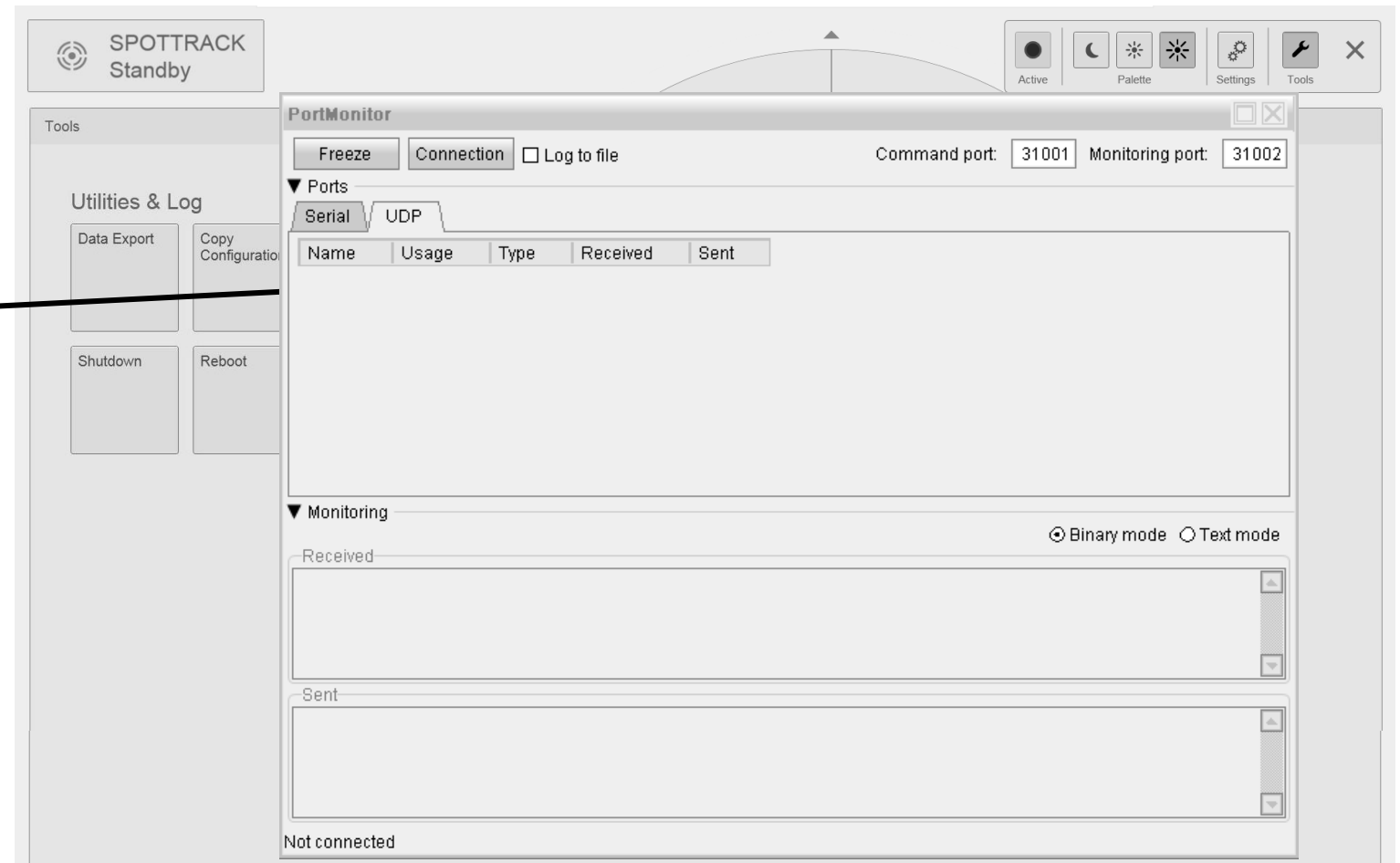
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SpotTrack

Tools Menu

Port Monitor:

- Diagnose how data are transported in the SpotTrack system and how to display sensor raw data.





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SpotTrack

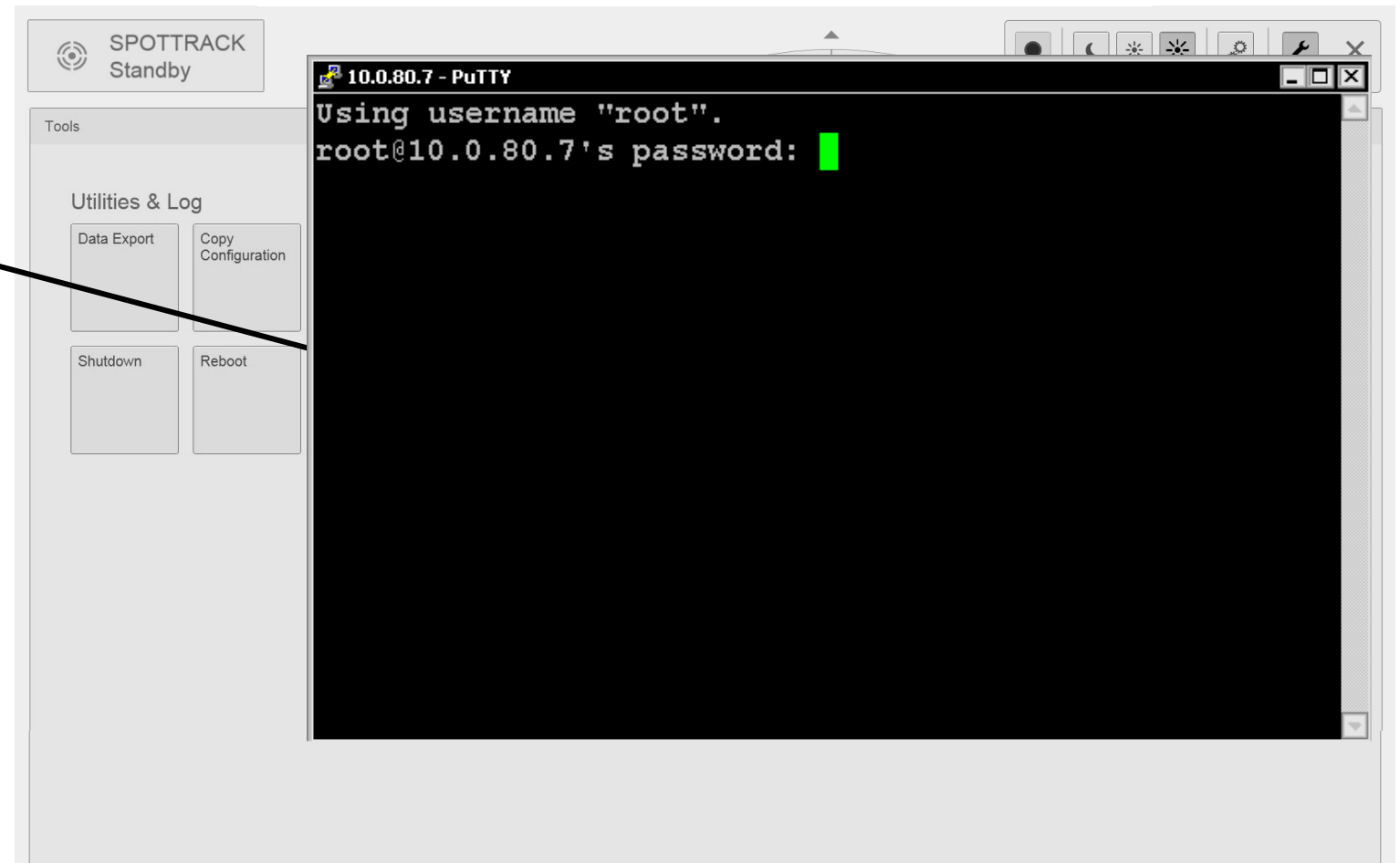
Tools Menu

SpotTrack Console

- Open a linux terminal window towards the SpotTrack sensor.

Caution

This is an expert feature and should be used with extreme care. Do not alter or delete information without consulting Kongsberg Seatex AS customer support.





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SpotTrack

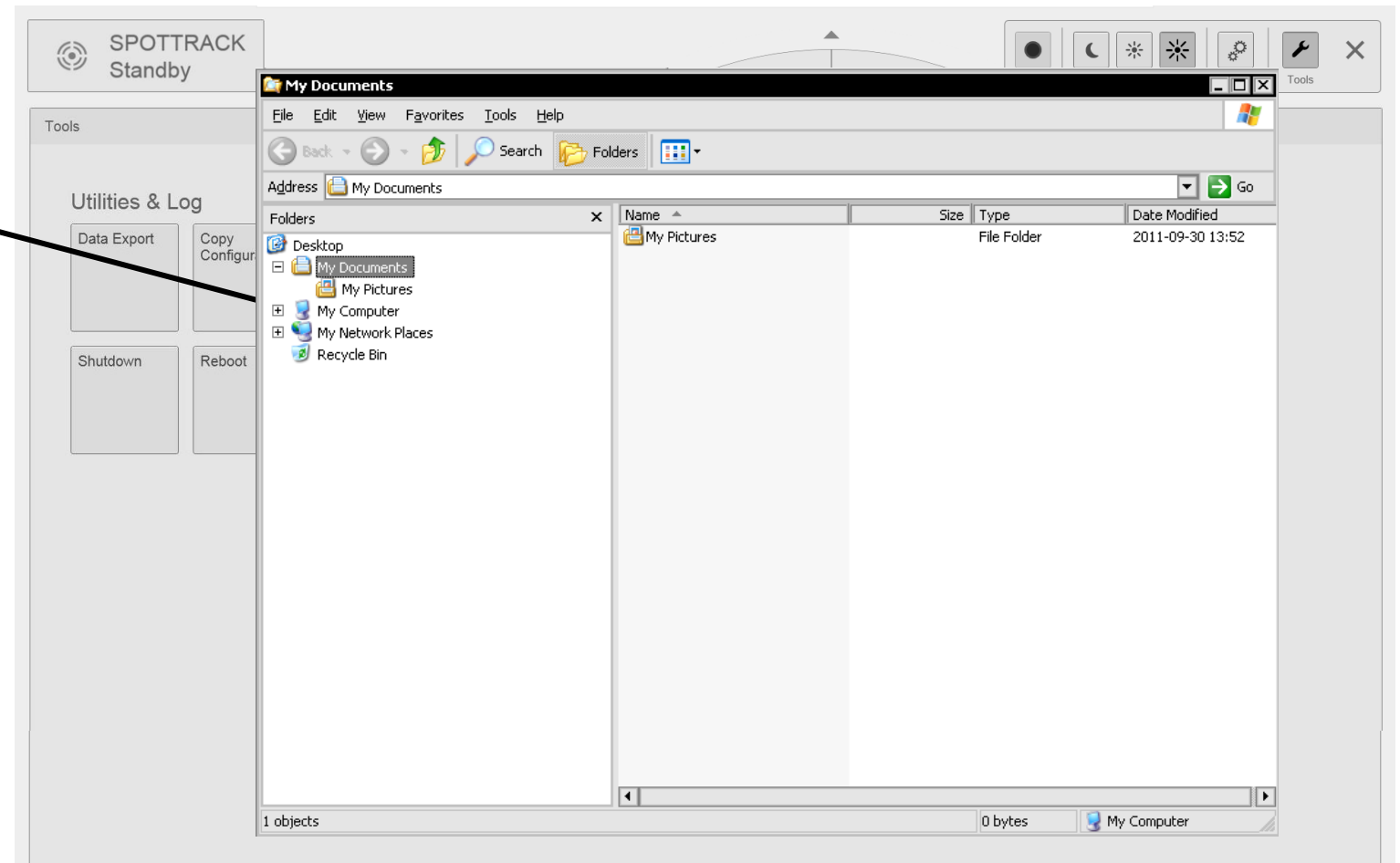
Tools Menu

Explorer

- Open a file system explorer

Caution

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SpotTrack

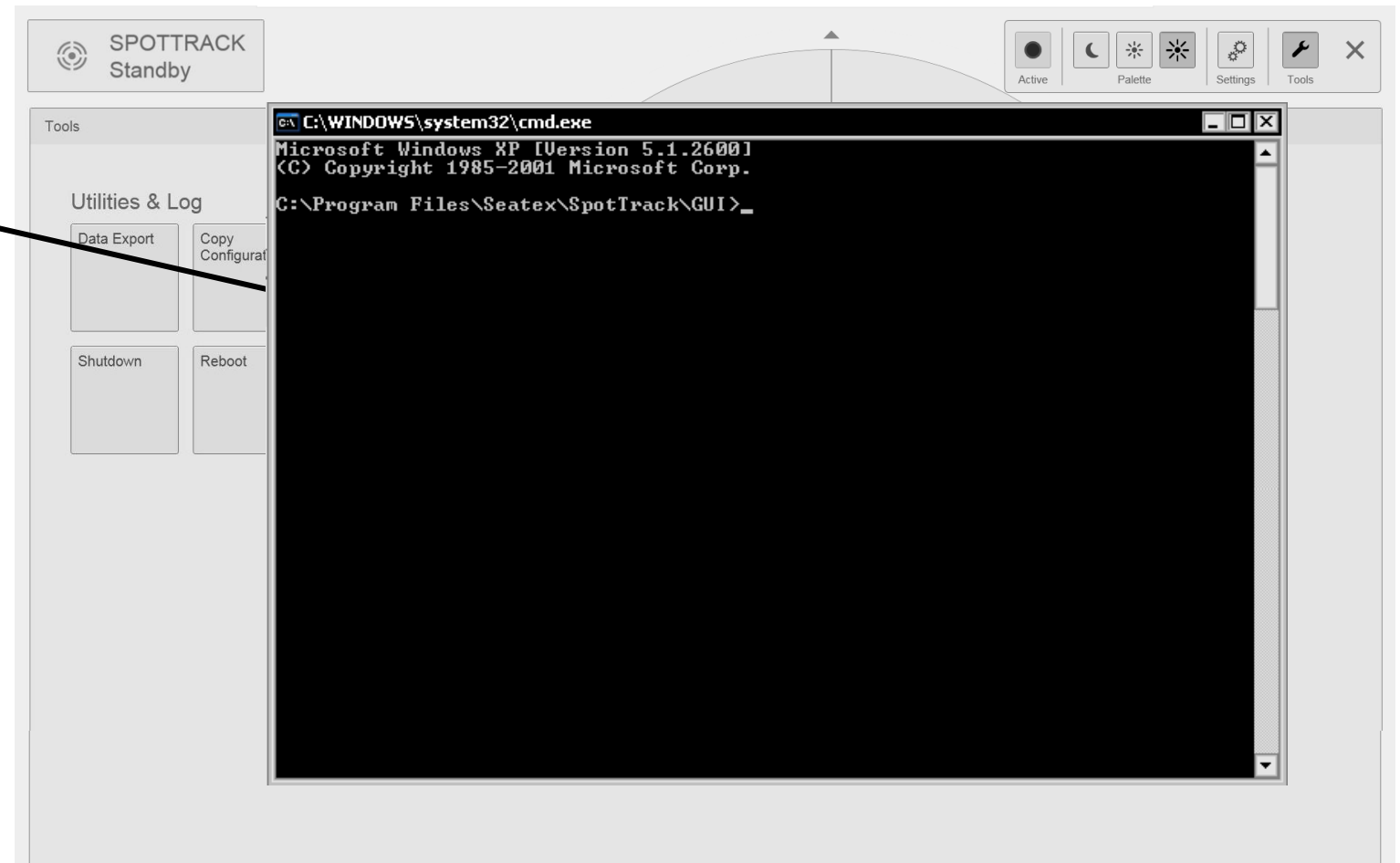
Tools Menu

Windows Shell

- Open a windows shell (command window).

Caution

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SpotTrack

Tools Menu

Advanced Configuration SpotTrack

- Not intended for use
under normal conditions.

Caution

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and should be used with
extreme care. Do not alter
or delete information
without consulting
Kongsberg Seatex AS
customer support.

Configuration - Advanced Mode

Tools

Utilities &
Data Export

Shutdown

bracket_blind_zone_end	202.500000
bracket_blind_zone_start	187.500000
bracket_has_reference	0
bracket_id	0
bracket_name	Unknown bracket
bracket_position_x	0.000000
bracket_position_y	0.000000
bracket_position_z	0.000000
bracket_reference_bearing	0.000000
bracket_reference_distance	0.000000
bracket_rotation_pitch	0.000000
bracket_rotation_roll	0.000000
bracket_rotation_yaw	0.000000
cg_position_x	0.000000
cg_position_y	0.000000
cg_position_z	0.000000
core_out_types	PSXRADICYSCANIFANBEAMIFANBCD
data_out_grp	1
data_out_mirror	0
data_out_motion	1
data_out_raw	1
data_out_targetlist	1
dp_fanbeam_id	0
dp_telegram_event_driven	0
dp_telegram_interval	100
dp_telegram_style_km	1
dp_telegram_type	PSXRAD
eve_apd_bias_offset	20.000000
eve_apd_bias_v23	-279.000000
eve_pdd_peak_thr	5
eve_sampling_from_range	91
eve_sampling_to_range	2500
inclinometer_rotation_pitch	0.000000
inclinometer_rotation_roll	0.000000

bracket_blind_zone_end

Connected to SpotTrack



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SpotTrack

Tools Menu

Advanced Configuration
SpotCore

- Not intended for use
under normal conditions.

Caution

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and should be used with
extreme care. Do not alter
or delete information
without consulting
Kongsberg Seatex AS
customer support.

The screenshot displays the 'Configuration - Advanced Mode' window. On the left, a sidebar contains the 'SPOTTRACK Standby' logo and a 'Tools' menu with options like 'Data Export', 'Copy Configuration', 'Shutdown', and 'Reboot'. The main area shows a hierarchical tree view of configuration settings. The tree includes categories like 'Vessel', 'Communication', 'DataPool', 'StatusIf', 'DP', 'Logging', and 'Advanced'. The 'Advanced' category is expanded, showing sub-items like 'KsReport' and 'TimeDelay'. The right side of the window is a large empty area for configuration details. The top of the window has 'Apply', 'Revert', and 'Preview' buttons. The bottom status bar indicates 'Connected to SpotTrack'.



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End of Training

