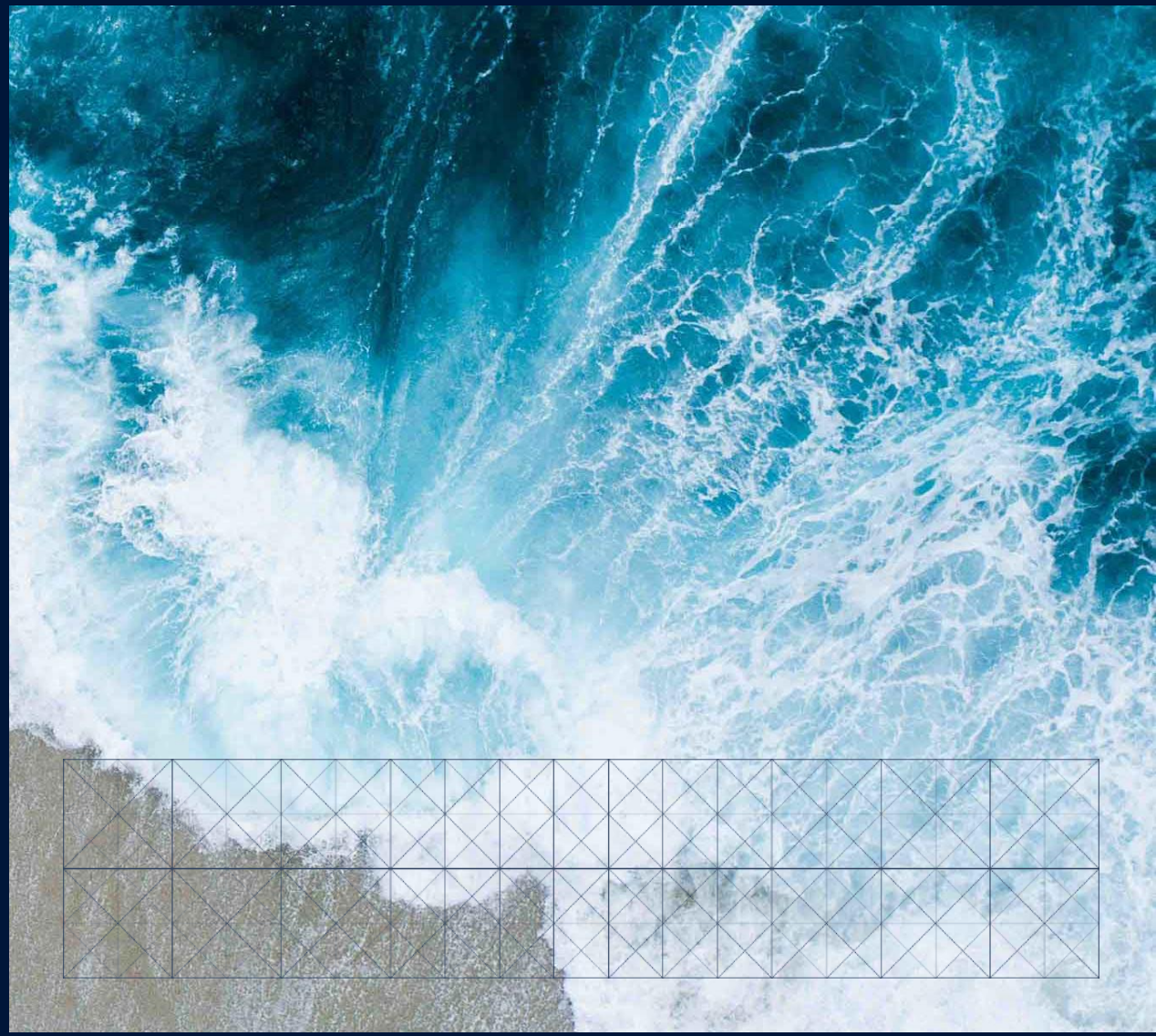
KONGSBERG

KONGSBERG SEATEX

SpotTrack



SpotTrack Operator & Technical Training

KONGSBERG

SpotTrack

Laser Based Relative Positioning System

SpotTrack Training

Course Content

- SpotTrack Training
- SpotTrack Operator Training
- SpotTrack Technical Training

SpotTrack Operator Training

Course Content

- SpotTrack Operator Training
  - SpotTrack Introduction
  - SpotTrack Principles
  - SpotTrack Product Modules
  - SpotTrack Operation

SpotTrack Operator Training

Course Content

- SpotTrack Operator Training
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  - SpotTrack Product Modules
  - SpotTrack Operation

SpotTracK

Laser Based DP Reference System

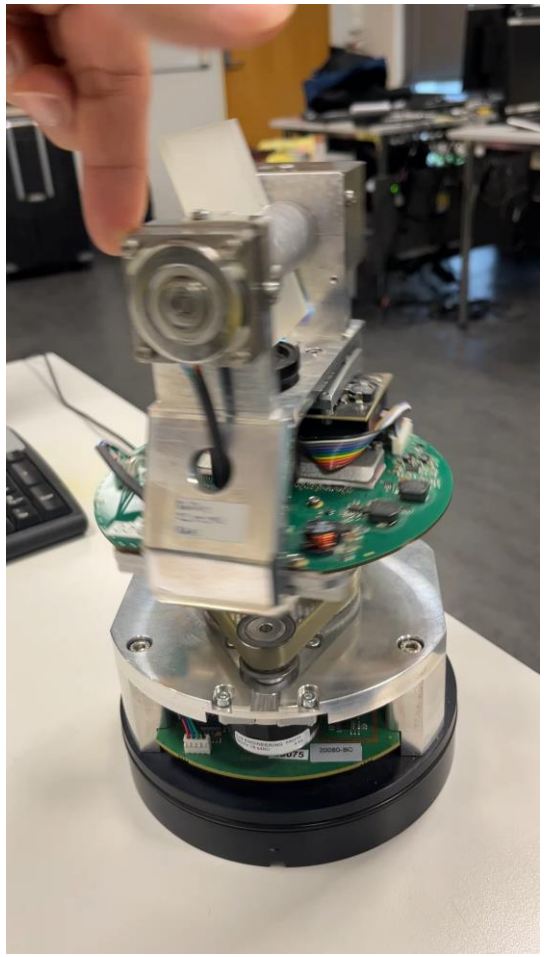
- Features:
  - Advanced multi-target tracking
  - Wide vertical field of regard for close-by operations
  - Interfaces to all DP systems
  - Easy to install and operate
  - Roll/pitch stabilization for high dynamic environments

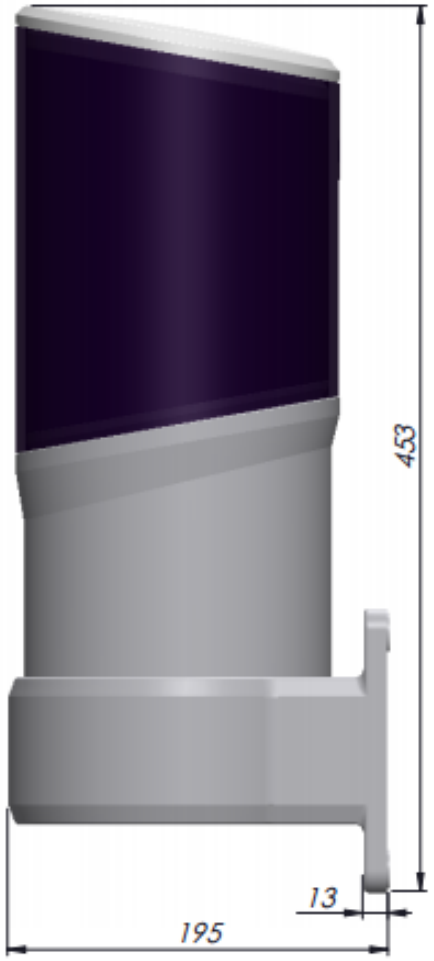
SpotTrack
Sensor unit

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





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°

SpotTrack

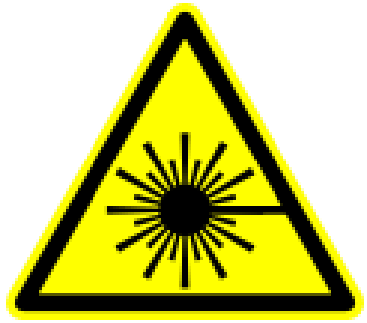
Technical Specifications

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

SpotTrack

Laser Classifications – Class I

Class IEC (EU)	Class FDA (US)	Laser Product Hazard	Product examles
Class 1, 1M	Class I	Considered non-hazardous. Hazard increases if viewed with optical aids.	• SpotTrack • Laser printers • CD/DVD players
Class 2, 2M	Class IIa, II	Hazard increases when viewed directly for long periods of time	• Bar code scanners
Class 3R	Class IIIa	Depending on power and beam area, can be momentarily hazardous when directly viewed or when staring directly at the beam with an unaided eye.	• Laser pointers
Class 3B	Class IIIb	Immediate skin hazard from direct beam and immediate eye hazard when viewed directly.	• 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.	• Laser light show • Industrial lasers • Research lasers



SpotTrack

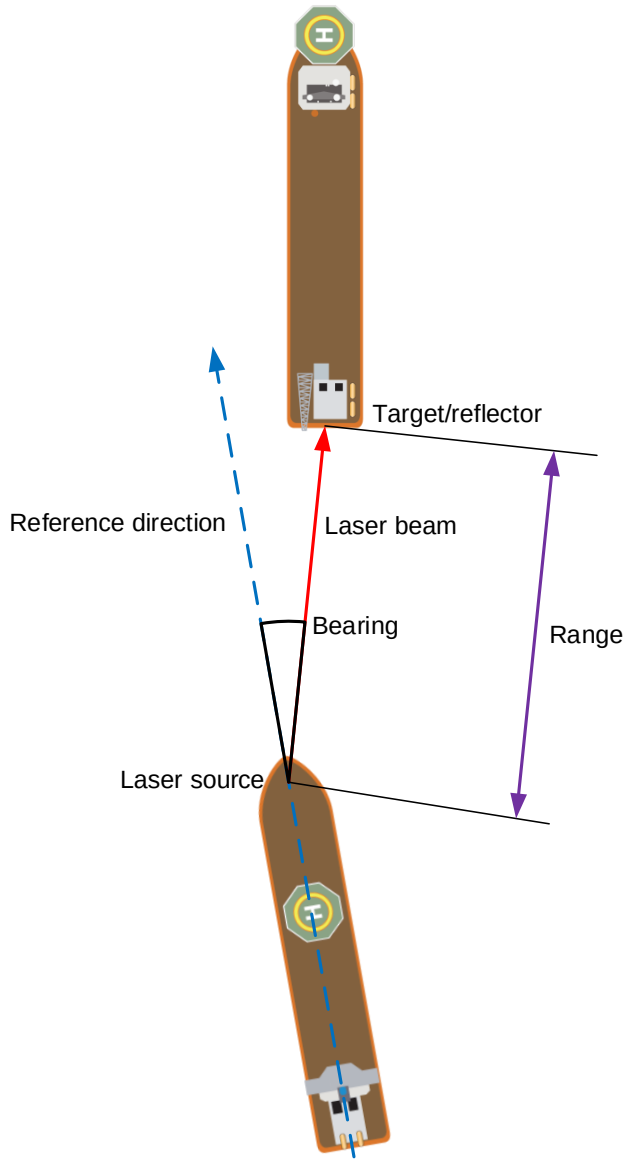
Course Content

- SpotTrack Operator Training
  - SpotTrack Introduction
  - SpotTrack Principles
  - SpotTrack Product Modules
  - SpotTrack Operation

SpotTrack

Measuring Principle

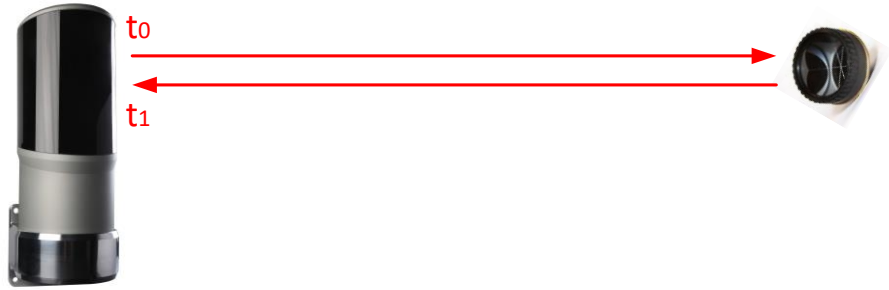
- A laser-based system is used to calculate range between a laser source and a reflector
- Bearing – the direction of the laser beam is also measured



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)



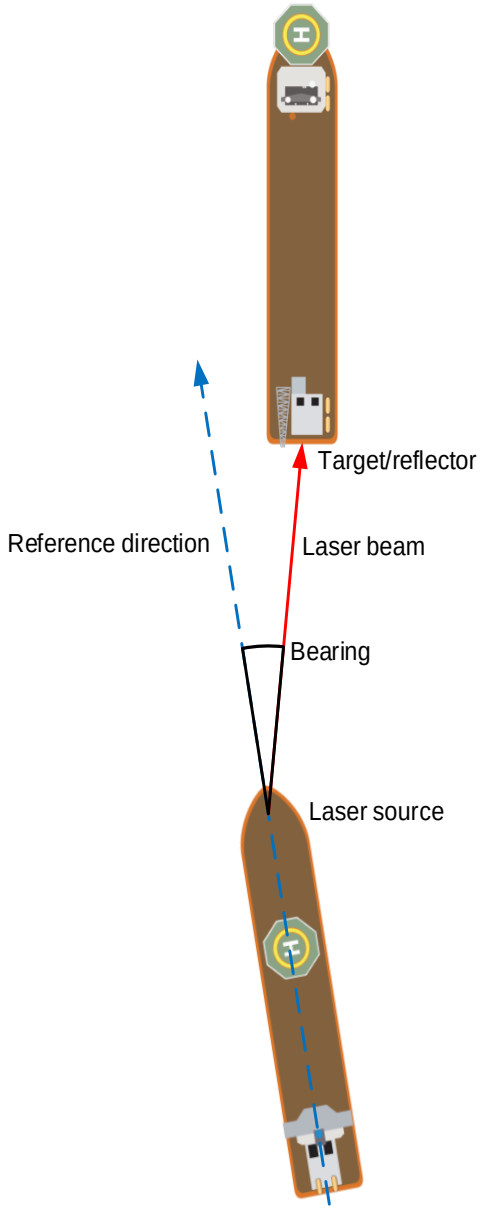
$$\text{Distance} = \frac{t_1 - t_0}{2} c$$

t_0= start time
t_1= stop time
c=speed of light

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)



SpotTrack

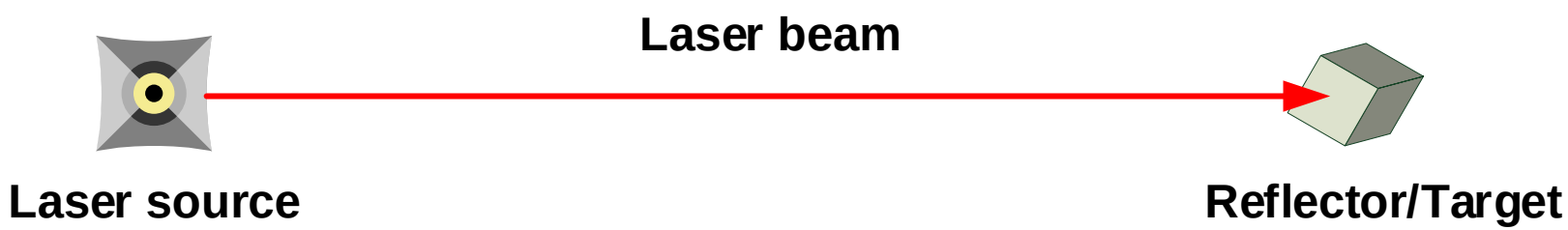
Measuring Challenges

- 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^{o}) 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

SpotTrack

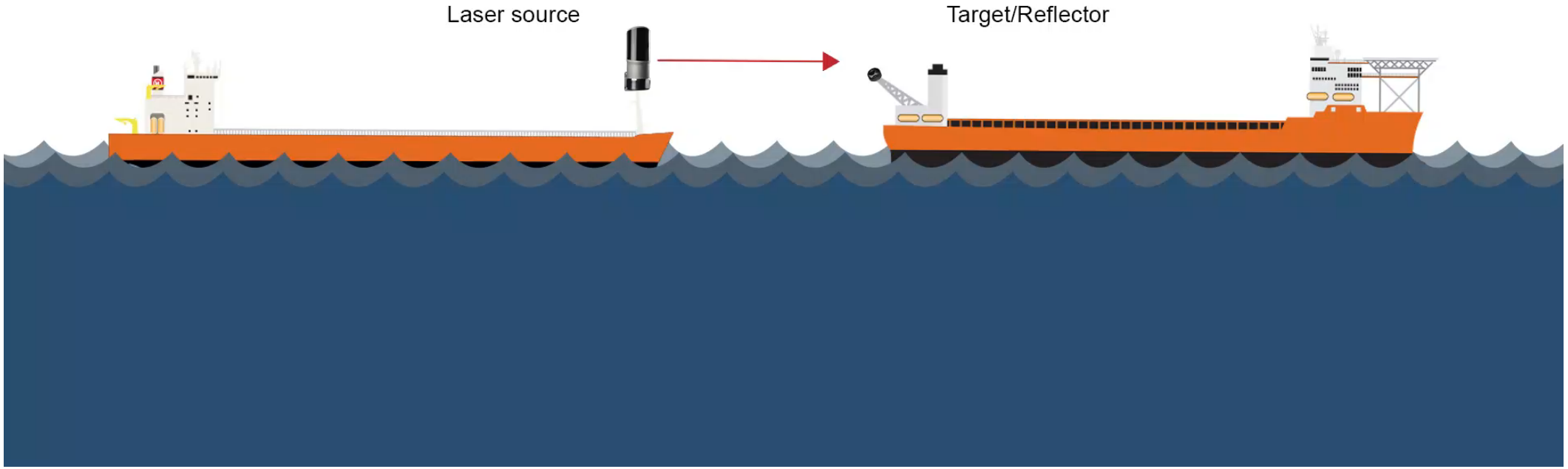
Narrow Laser Beam

- 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



SpotTrack

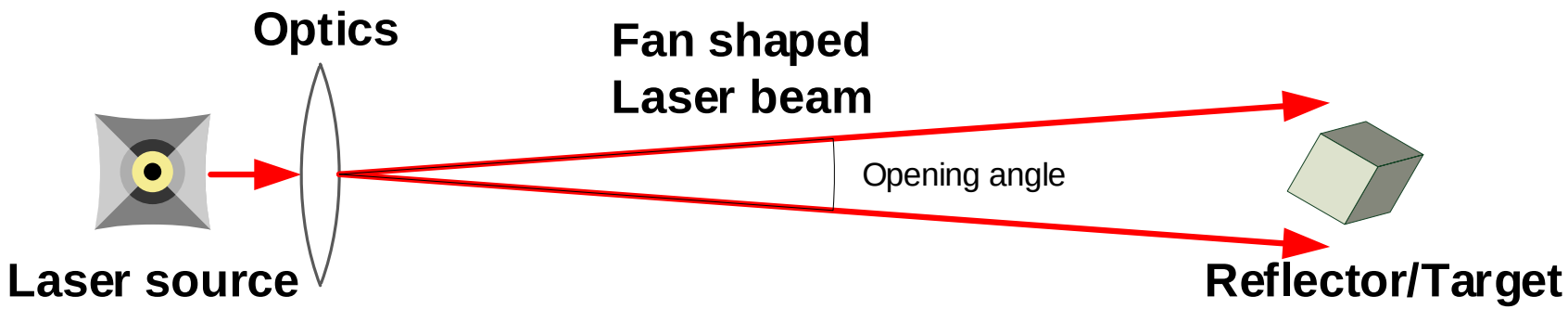
Narrow Laser Beam



SpotTrack

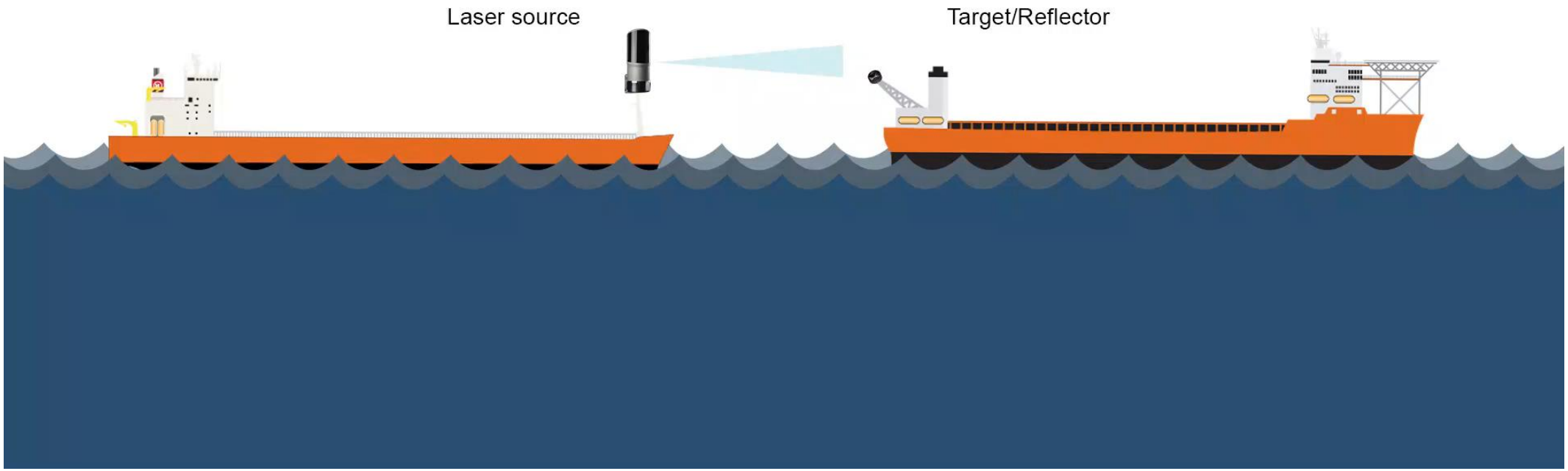
Fan Shaped Laser Beam

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



SpotTrack

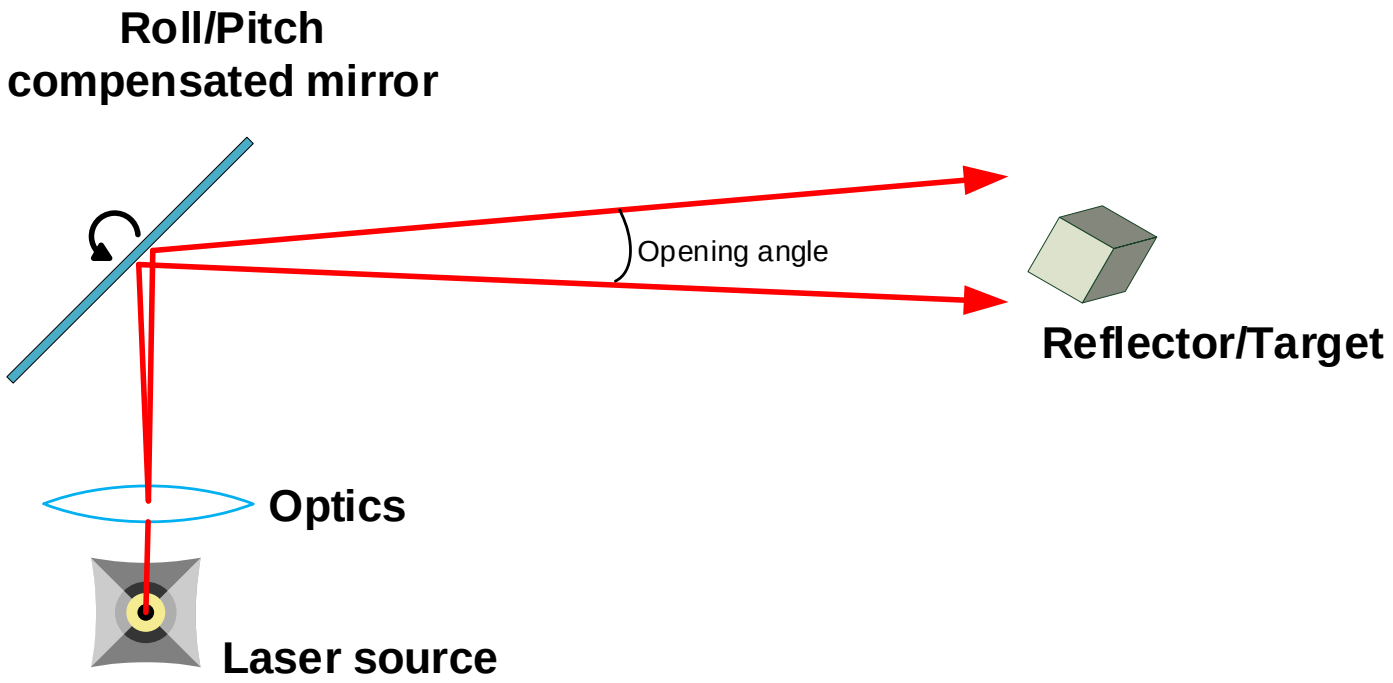
Fan Shaped Laser Beam



SpotTrack

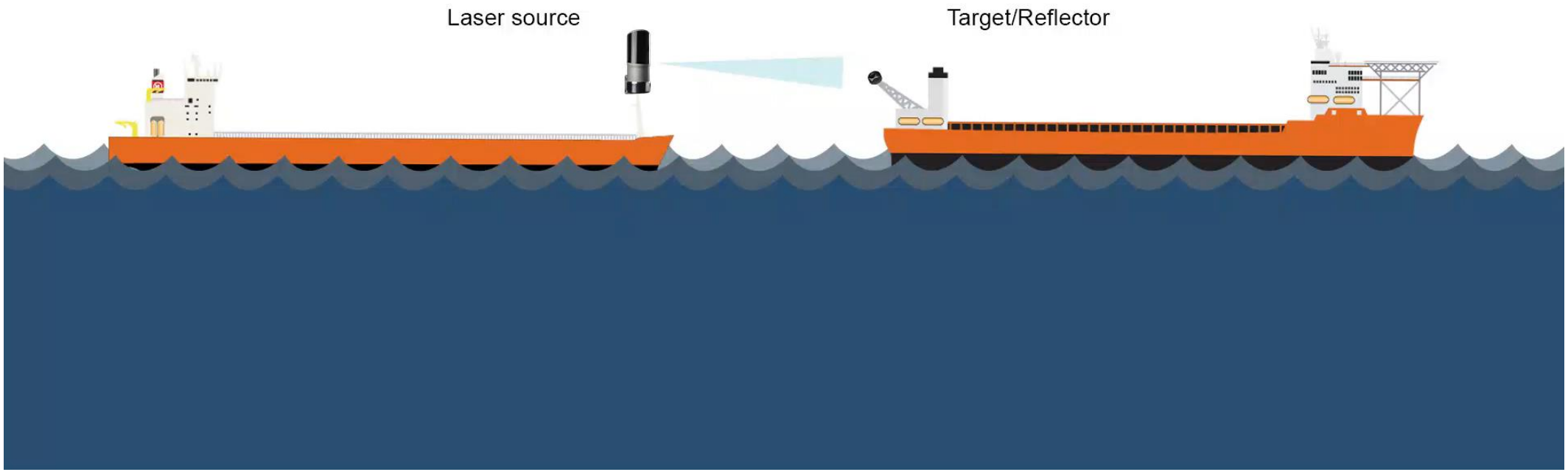
Fan Shaped Laser Beam with Roll and Pitch Compensation

- 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



SpotTrack

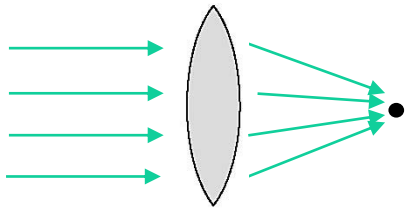
Fan Shaped Laser Beam with Roll and Pitch Compensation



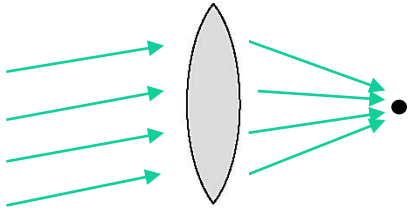
SpotTrack

Detector Array

Single Detector
(Normal)



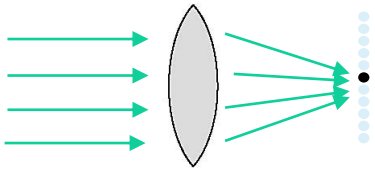
Single Detector
(Normal)



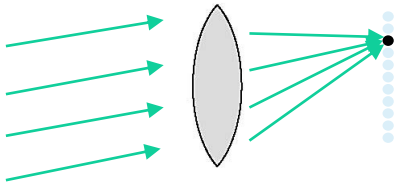
SpotTrack

Detector Array

Multiple Detectors
(SpotTrack)

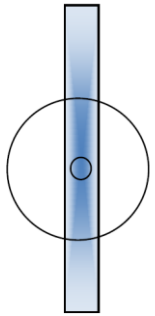


Multiple Detectors
(SpotTrack)

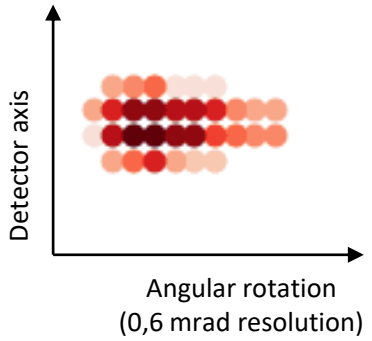


Advantages:

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

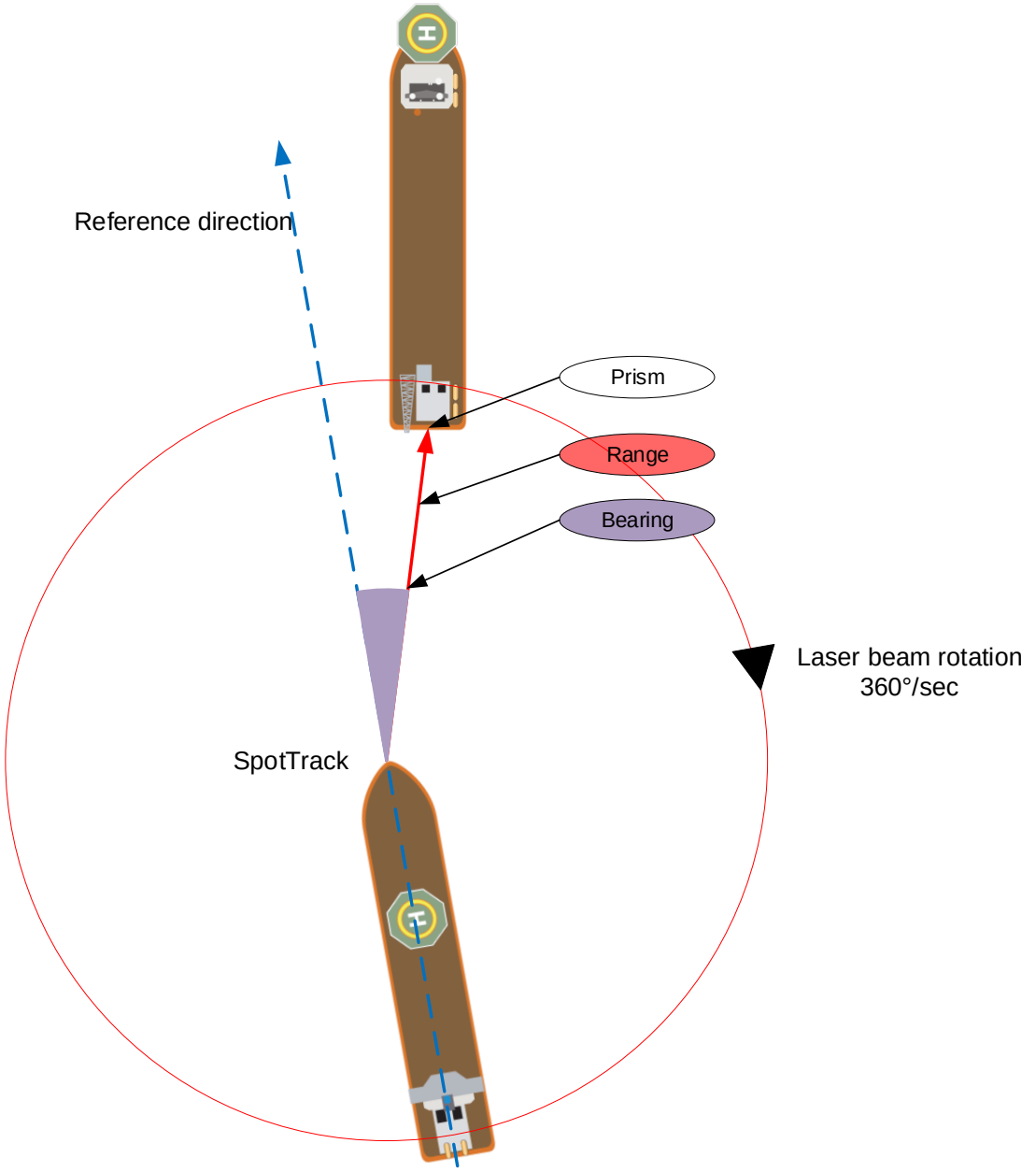


Target detection



SpotTrack
Single Target

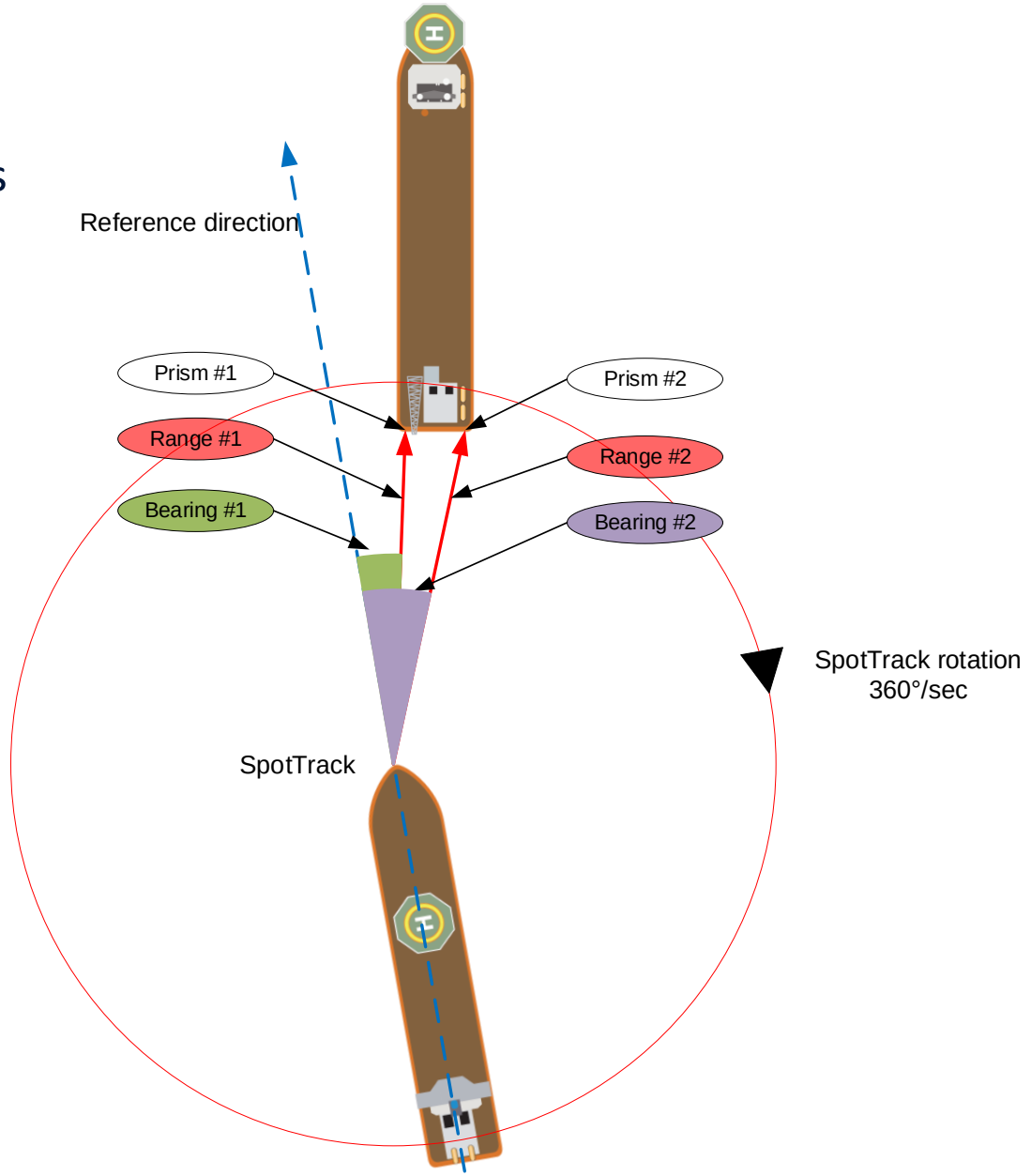
- SpotTrack tracking single target
  - Single target tracking



SpotTrack

Multiple Targets

- SpotTrack tracking multiple targets
  - Multiple targets tracking



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)

SpotTrack

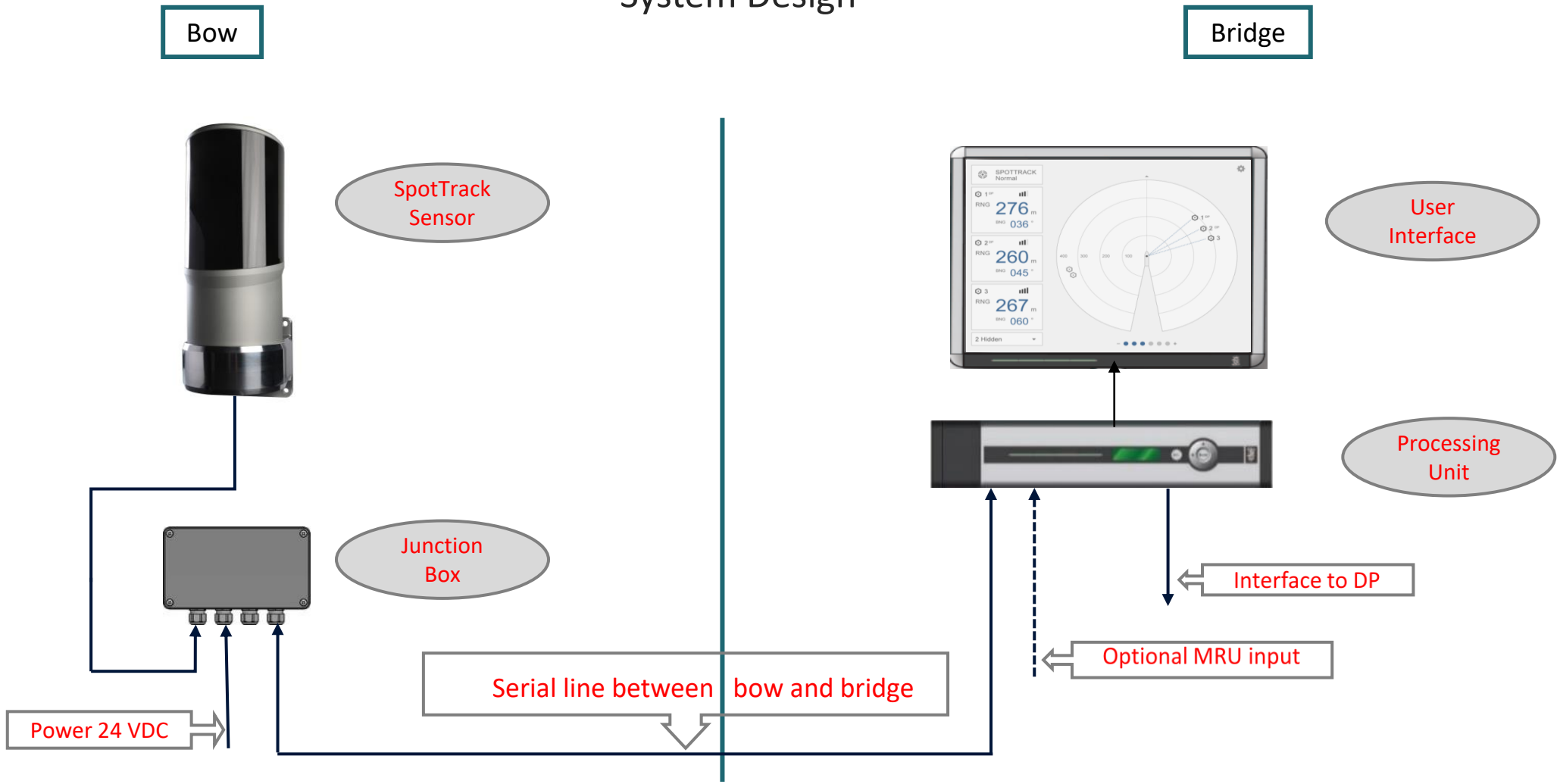
Course Content

SpotTrack Operator Training

- SpotTrack Introduction
- SpotTrack Principles
- SpotTrack Product Modules
- SpotTrack Operation

SpotTrack

System Design



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

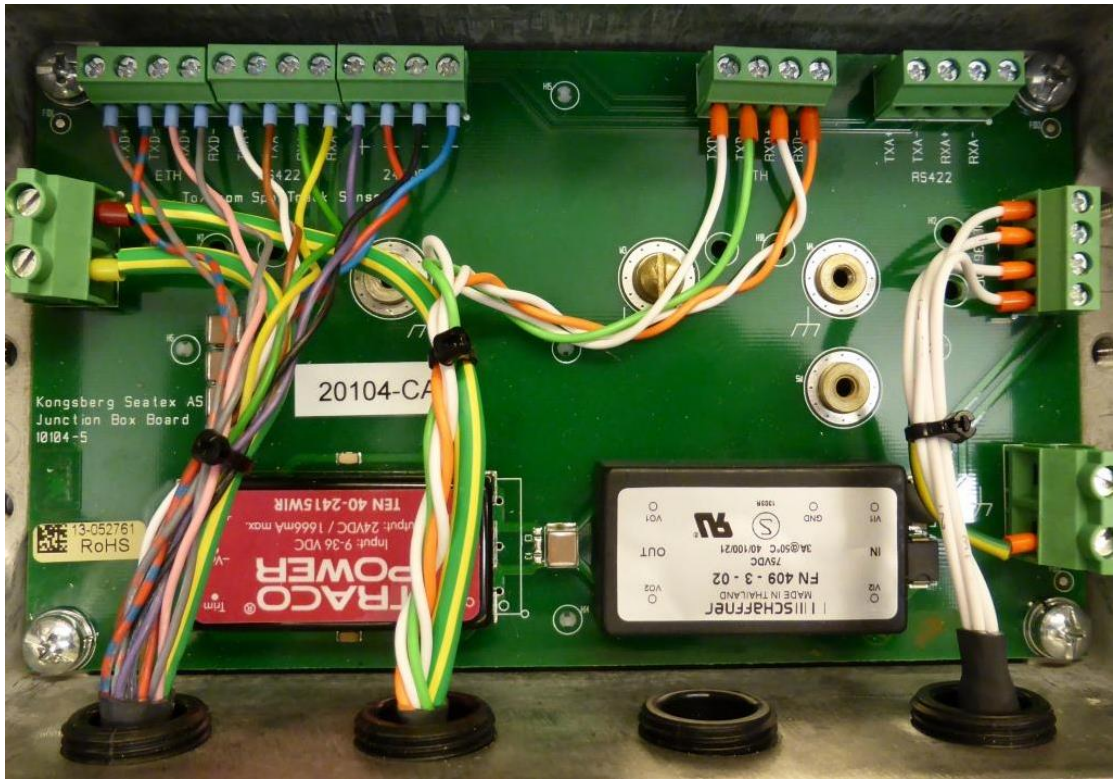
SpotTrack

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

SpotTrack

Junction Box



to SpotTrack sensor	Ethernet to PU	RS422 to DP (Optional)	Power 12 to 35 V DC

SpotTrack

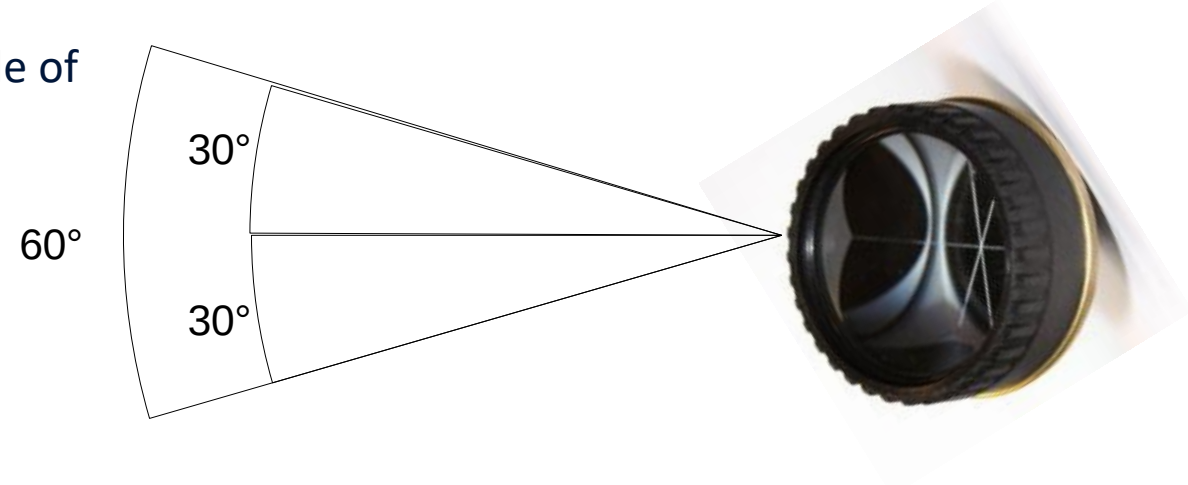
Reflector Types

- 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

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



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

SpotTrack

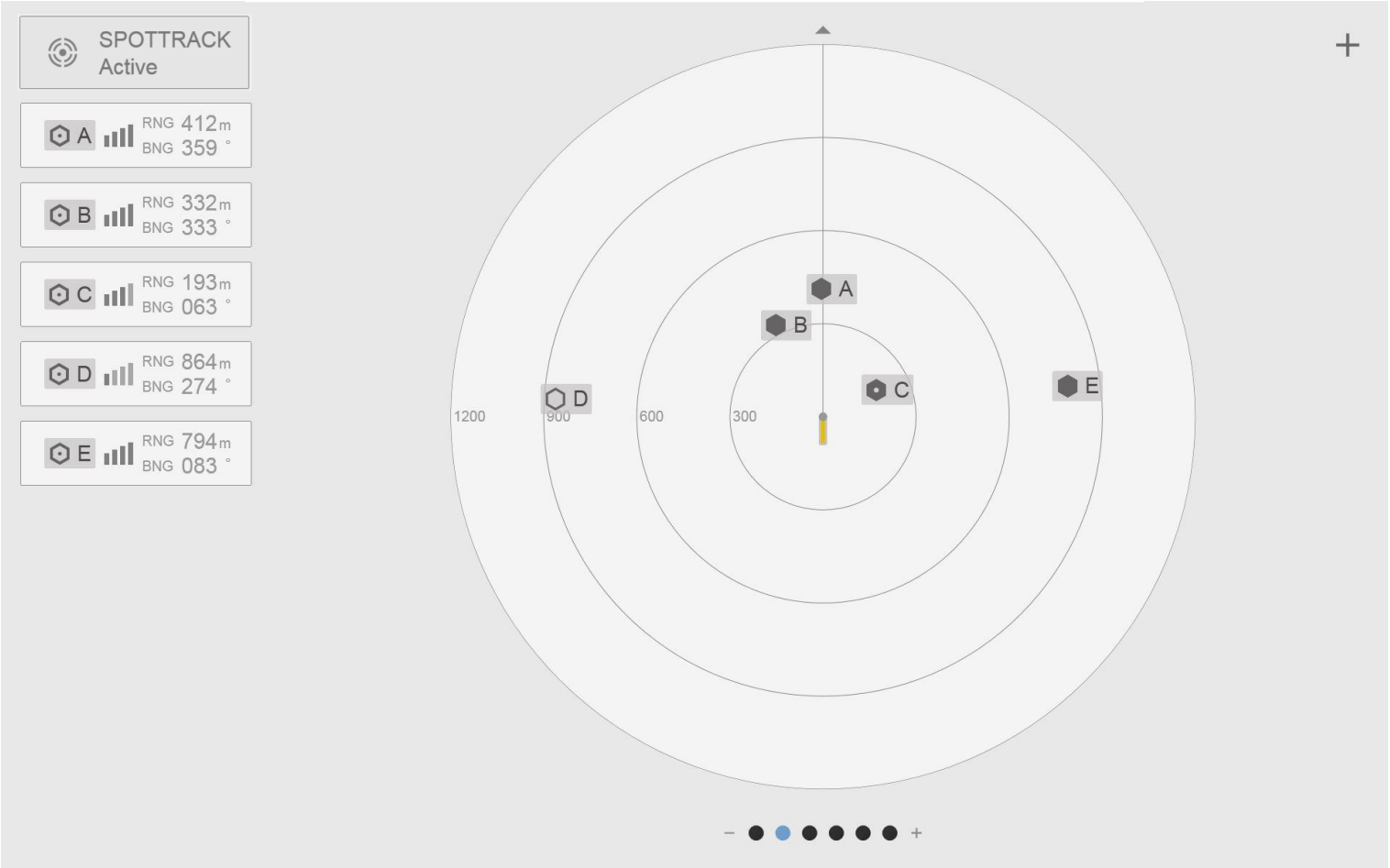
Course Content

SpotTrack Operator Training

- SpotTrack Introduction
- SpotTrack Principles
- SpotTrack Product Modules
- SpotTrack Operation

SpotTrack

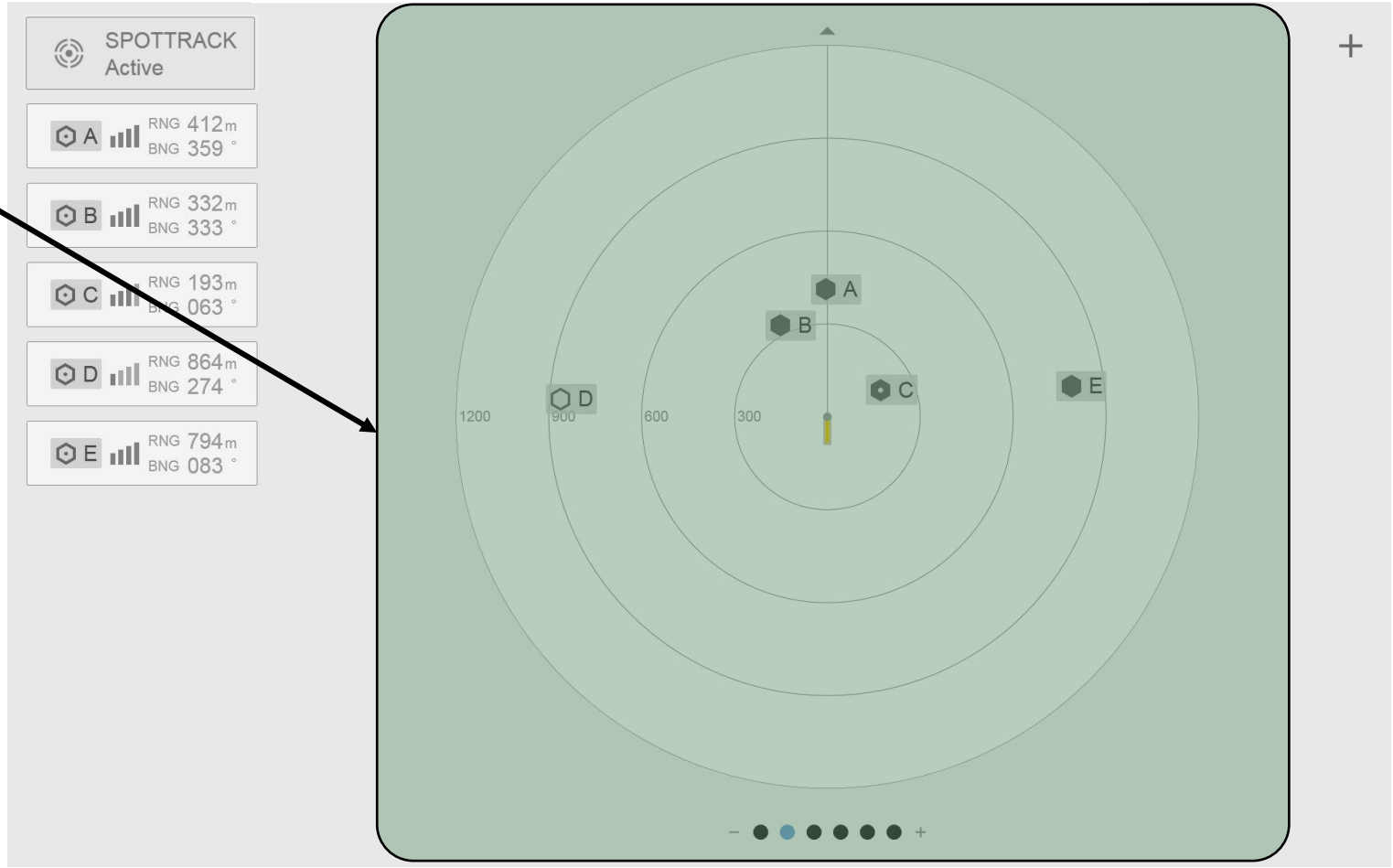
Main View



SpotTrack

Main View

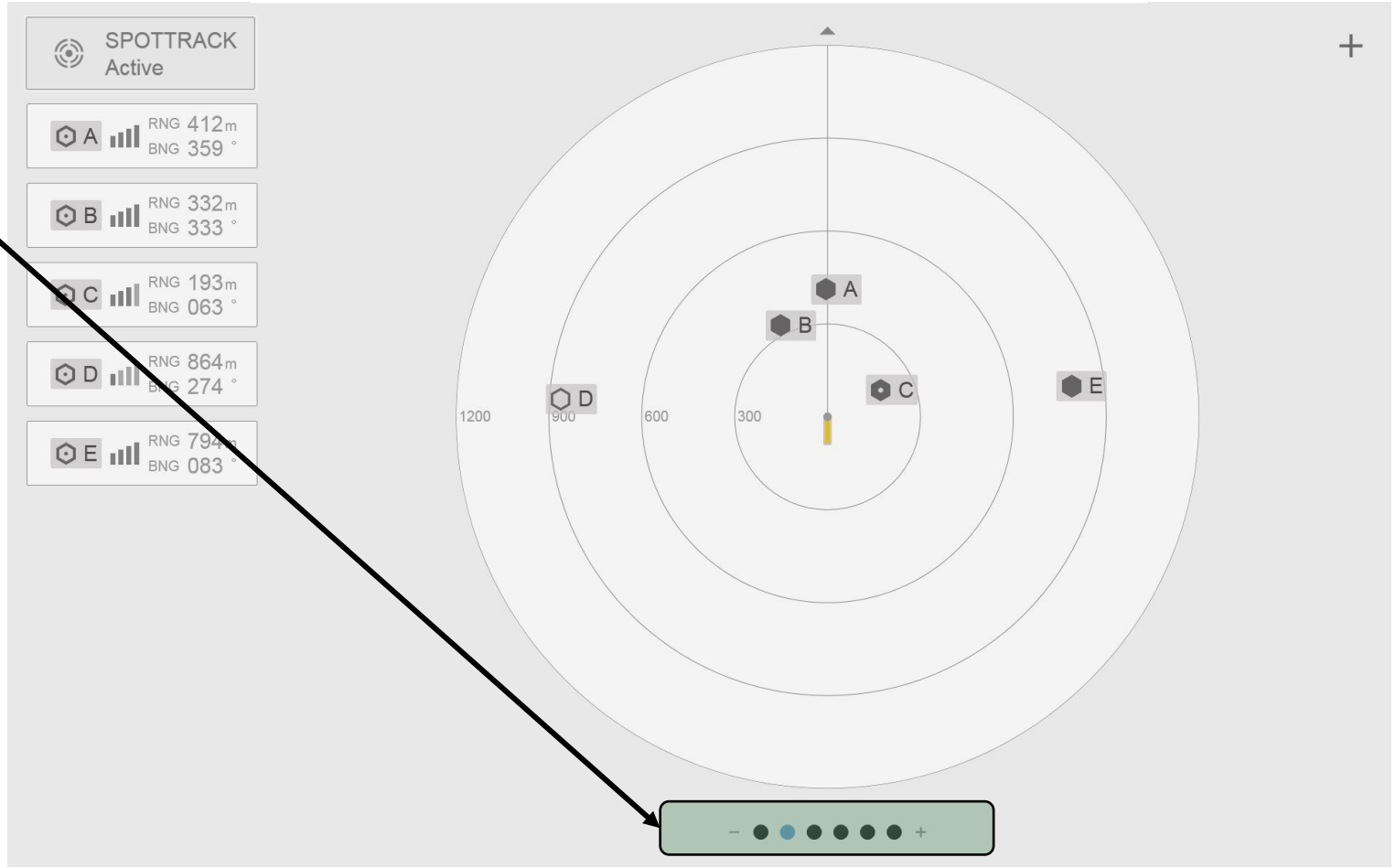
Radar View



SpotTrack

Main View

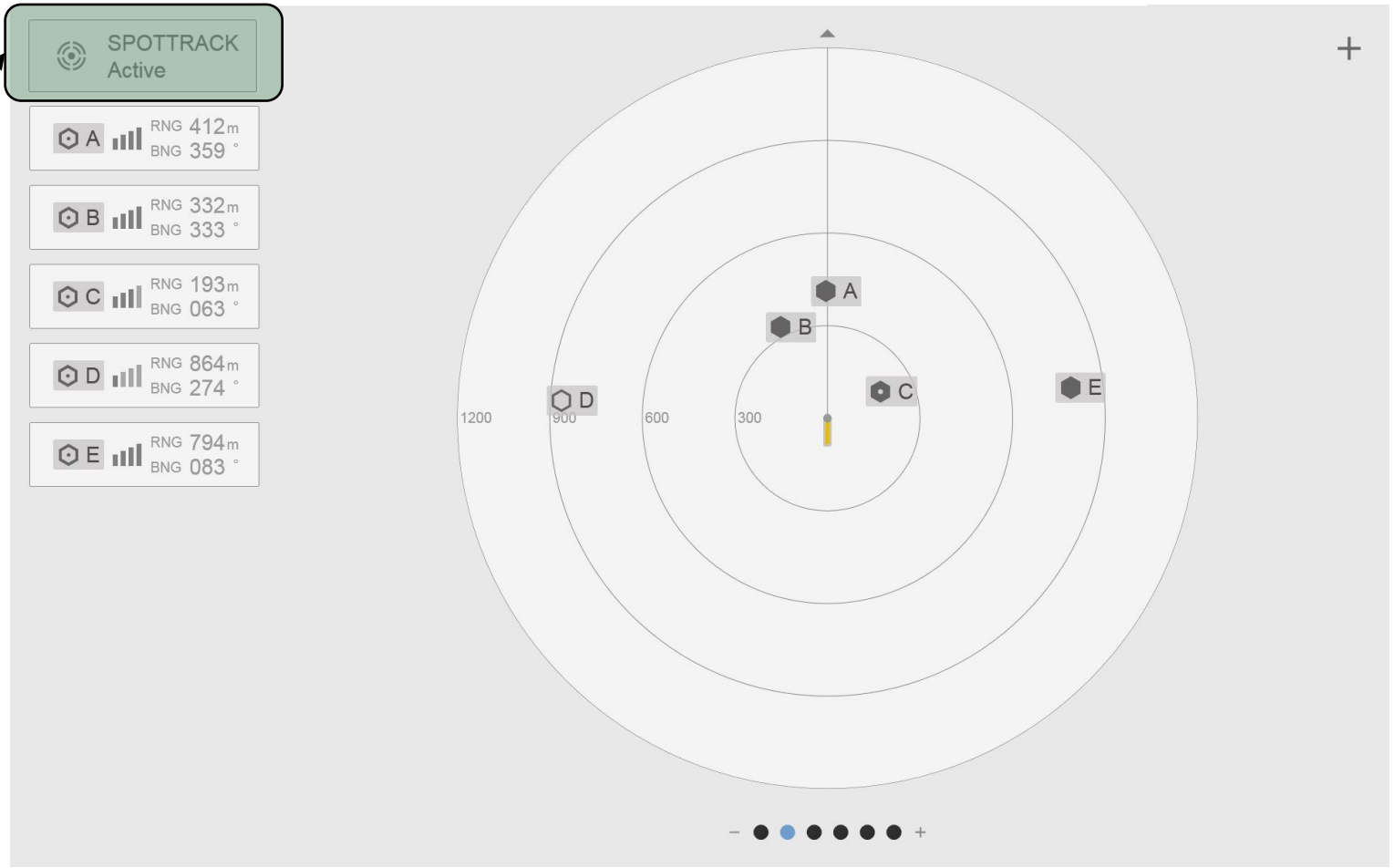
Zoom Buttons



SpotTrack

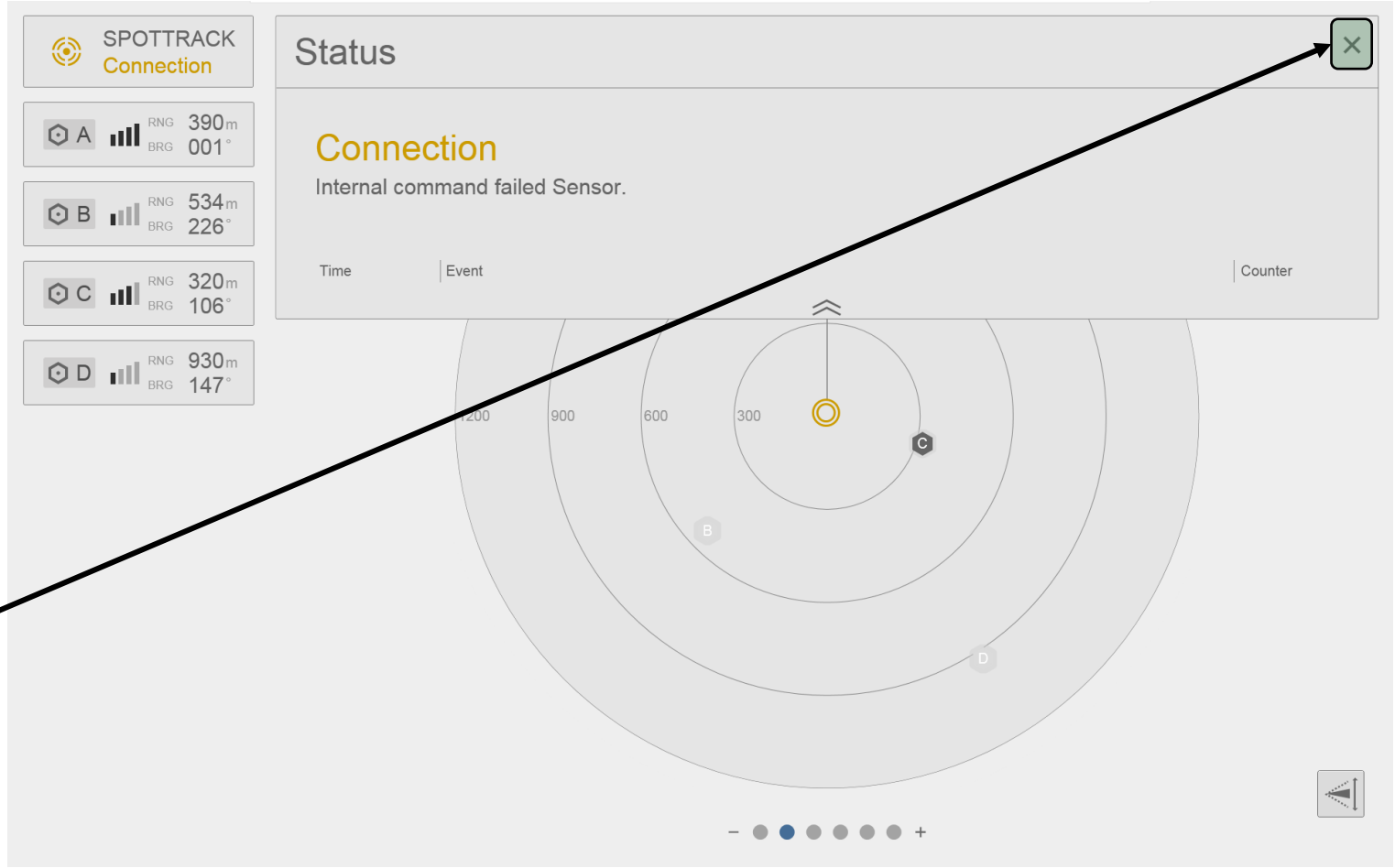
Main View

System Status
- Click to show overall status of system



SpotTrack

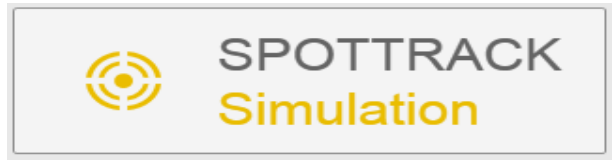
Main View

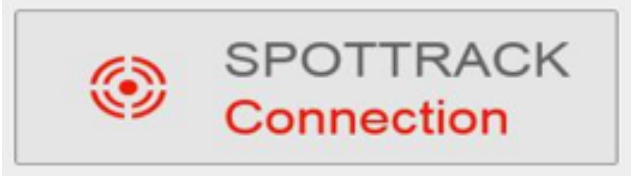


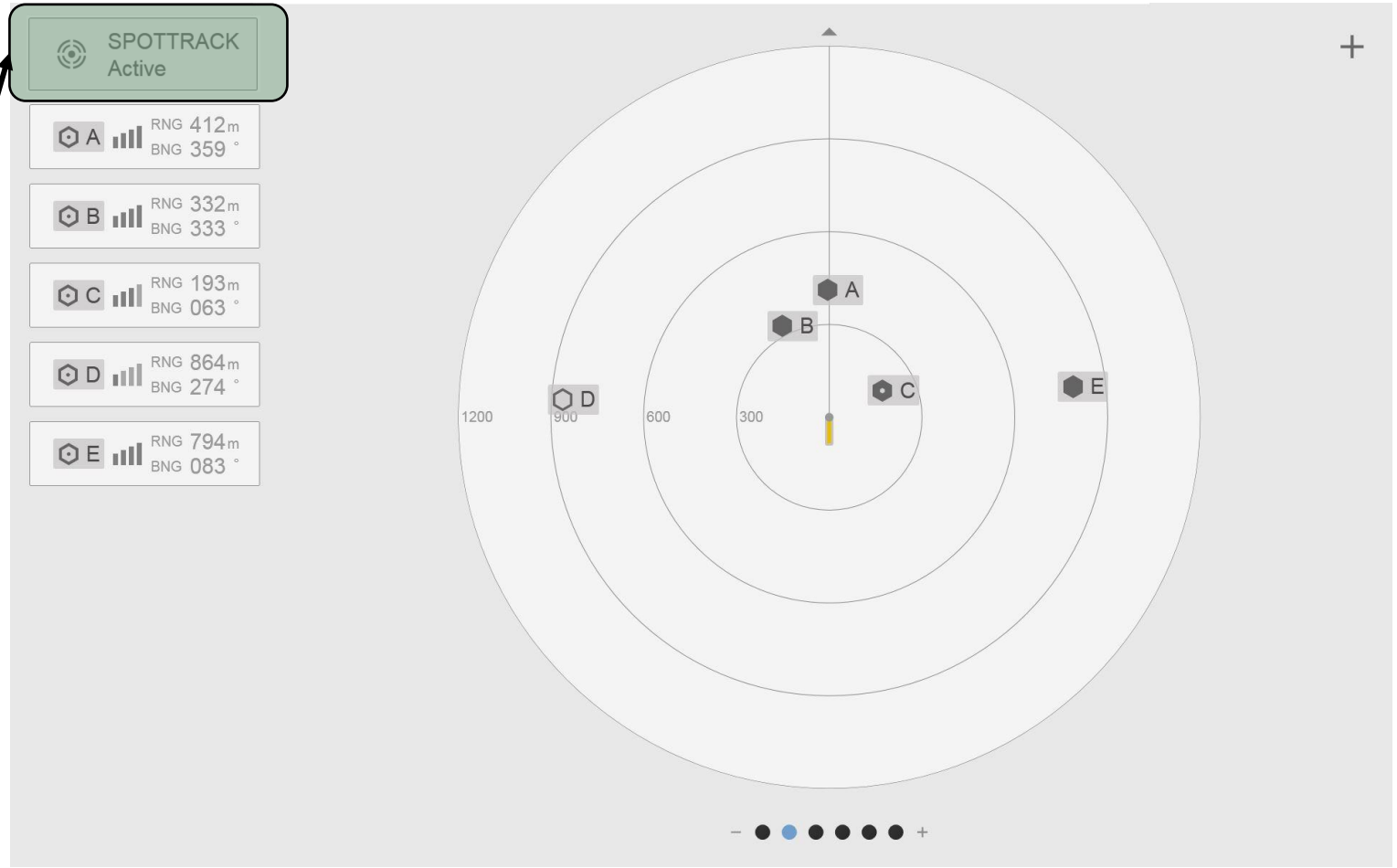
Close the view by clicking on the **X**

SpotTrack

Main View



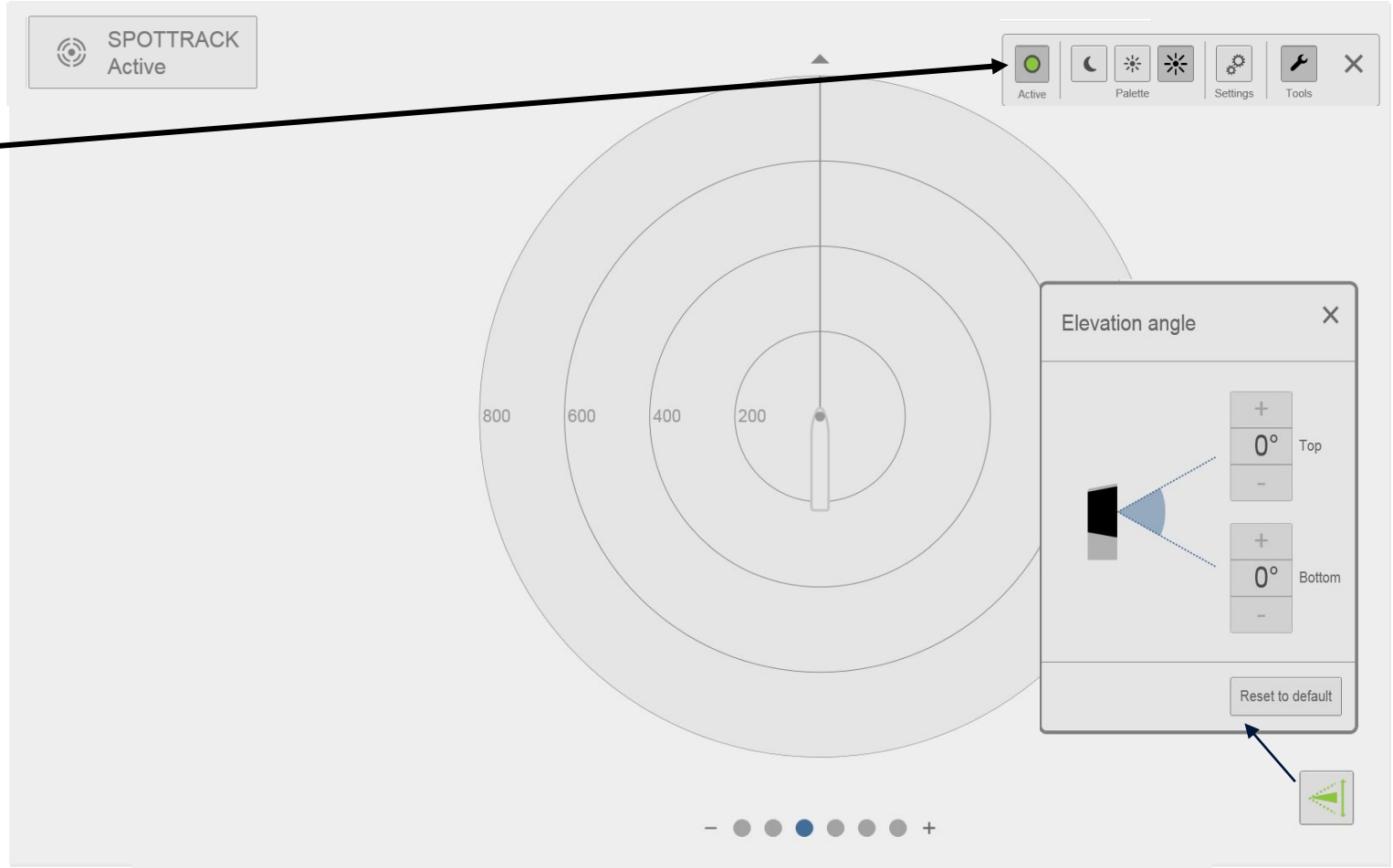




SpotTrack

Main View

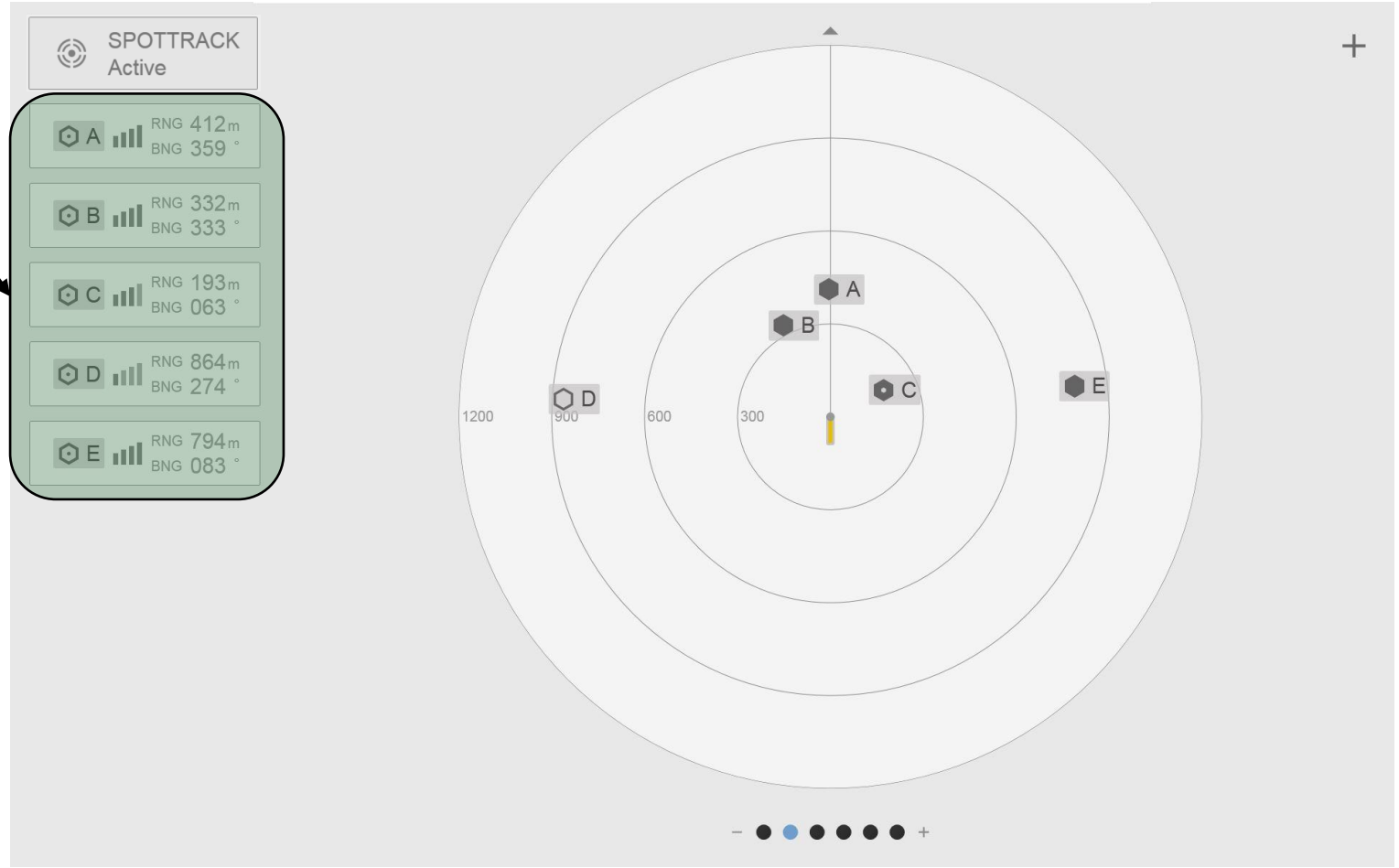
Click to set system active



SpotTrack

Reflector List

Reflector list



SpotTrack

Target Selection from Reflector List

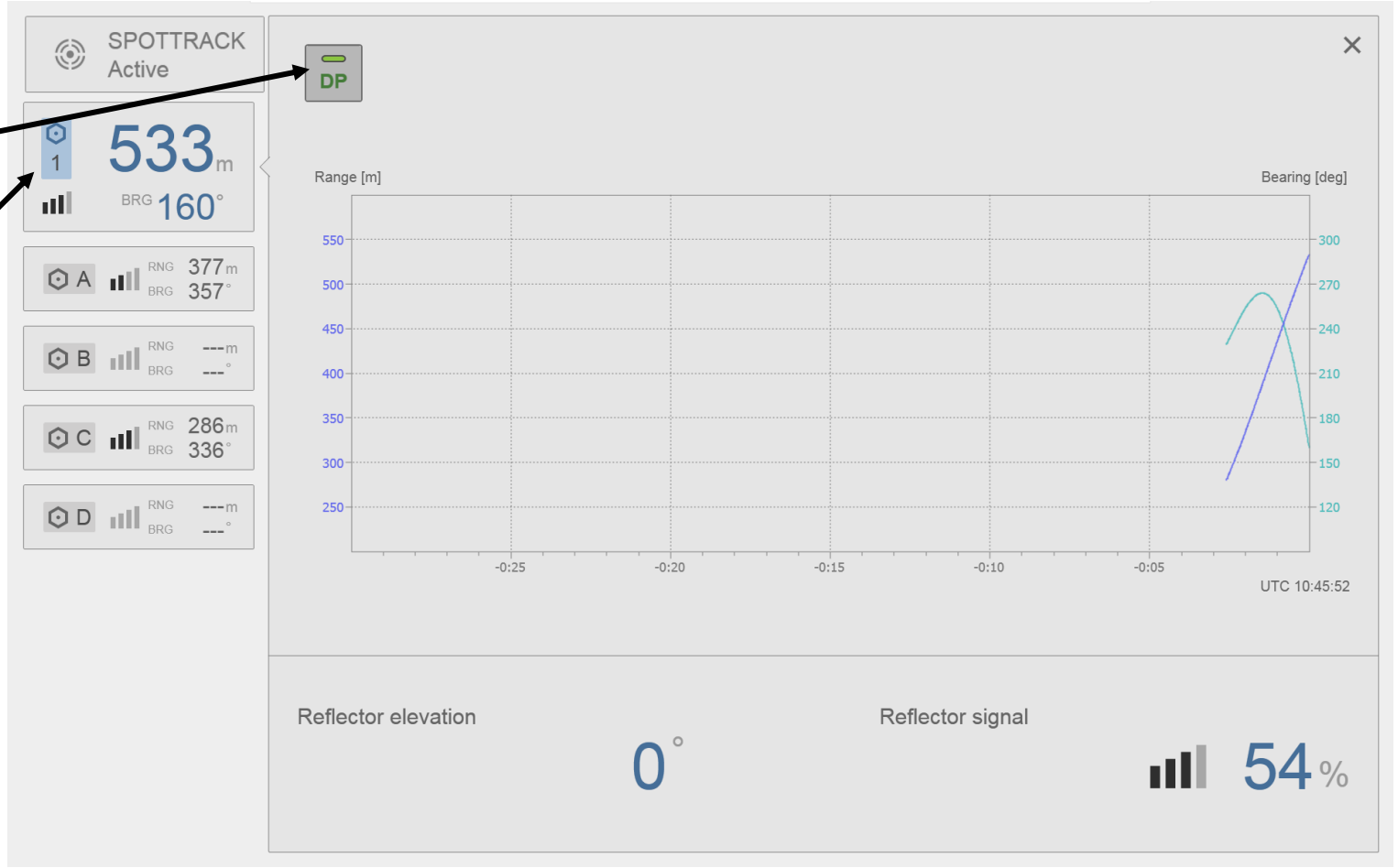
Target Not Selected

SpotTrack

Target Selection from Reflector List

Target Selected

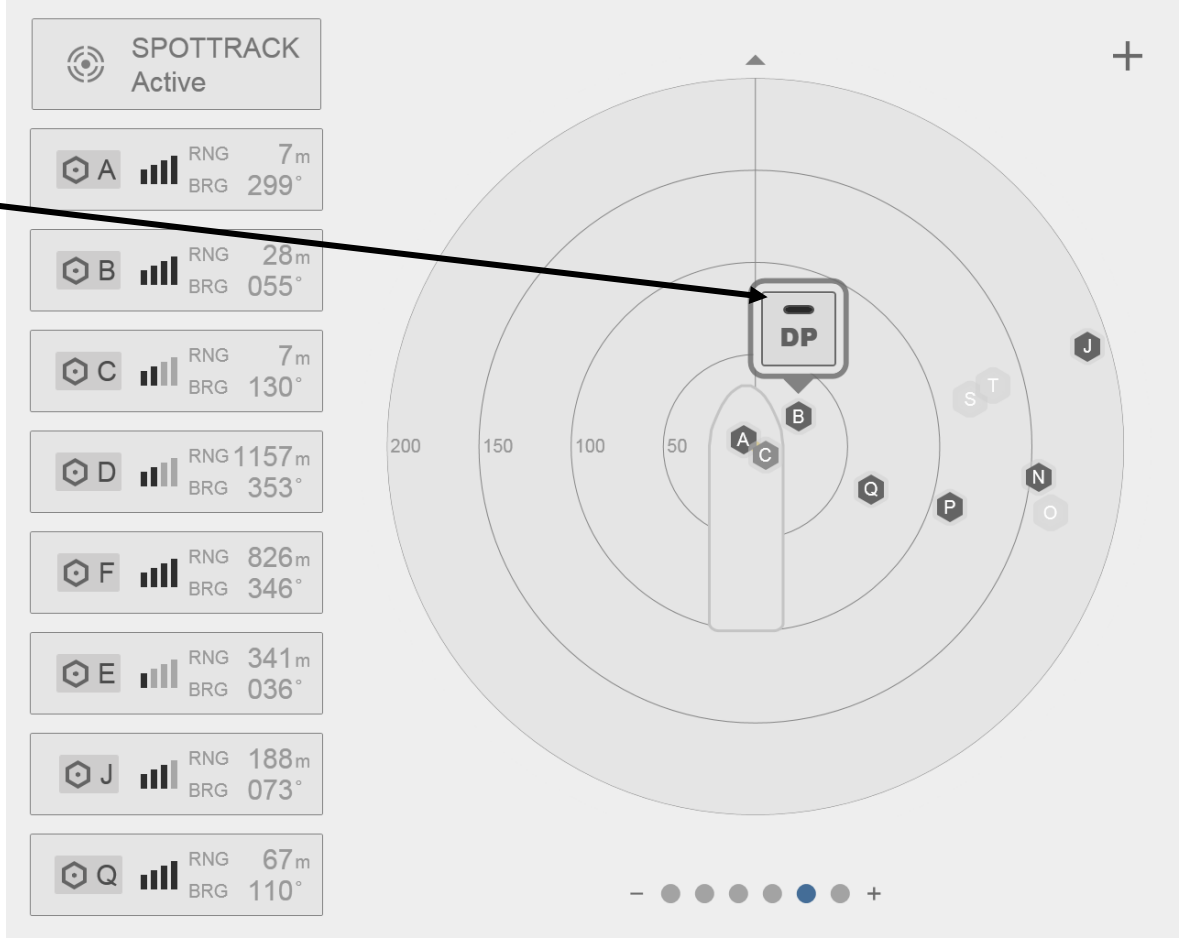
Target Turns Blue in Reflector List



SpotTrack

Target Selection from Radar View

Target Not Selected

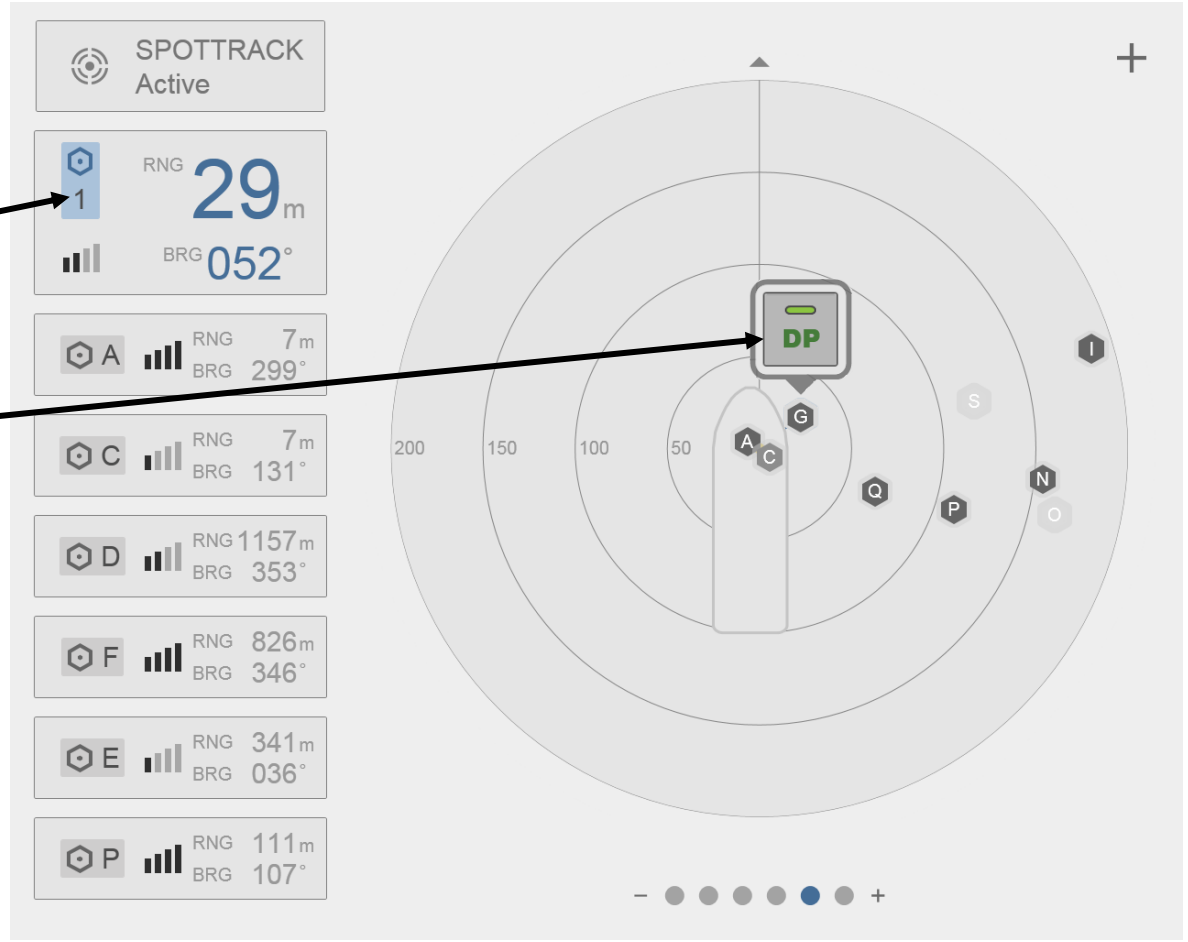


SpotTrack

Target Selection from Radar View

Target Turns Blue in Reflector List

Target Selected



SpotTrack Technical Training

Course Content

- SpotTrack Technical Training
  - SpotTrack System Description
  - SpotTrack Configuration
  - SpotTrack Maintenance
  - SpotTrack Service/Troubleshooting

SpotTrack Technical Training

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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

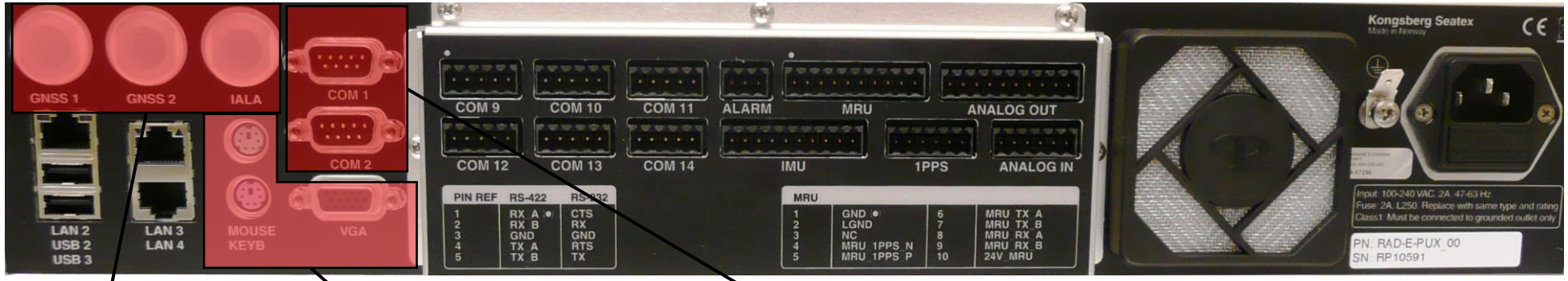
SpotTrack

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

SpotTrack

Processing Unit (Rear)



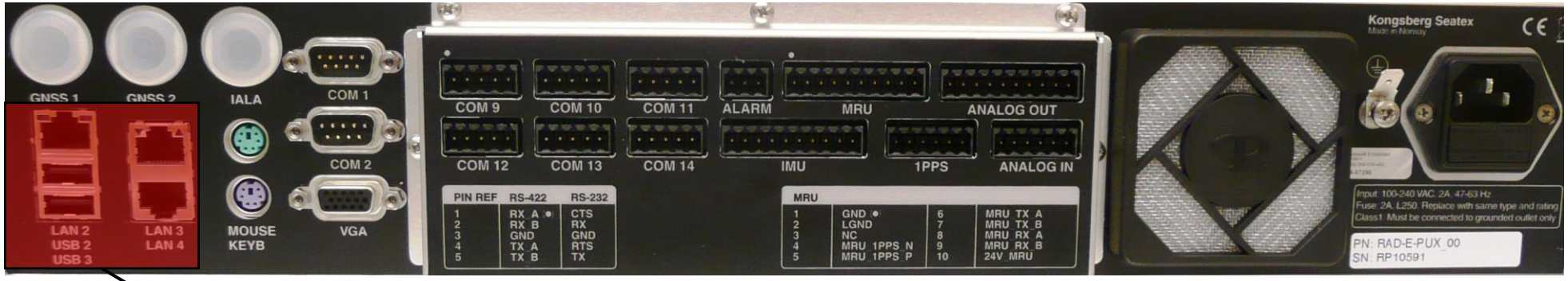
GNSS 1 – GNSS 2 – IALA
Not used by this system

Mouse – Keyboard-
Monitor connectors

COM1 – COM2
RS-232 user configurable

SpotTrack

Processing Unit (Rear)

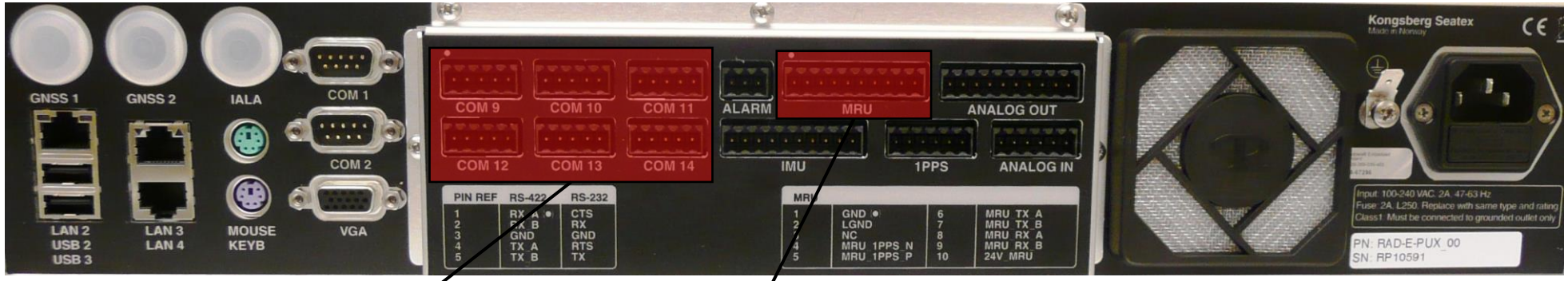


LAN 2 – User configurable
LAN 3 – Junction Box Field
LAN 4 – User configurable

USB 2 & 3 – User configurable

SpotTrack

Processing Unit (Rear)

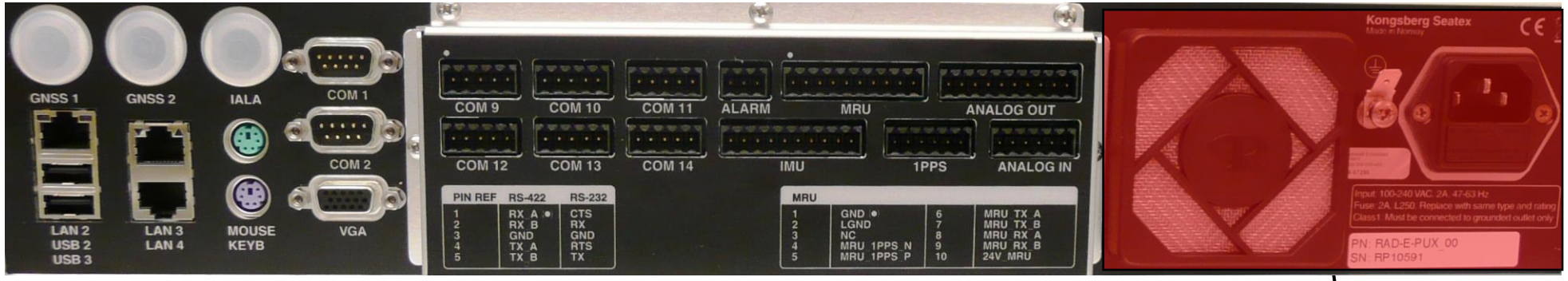


COM9 - COM14
RS-422, user configurable

MRU

SpotTrack

Processing Unit (Rear)



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

Cooling fan, with filter

SpotTrack Technical Training

Course Content

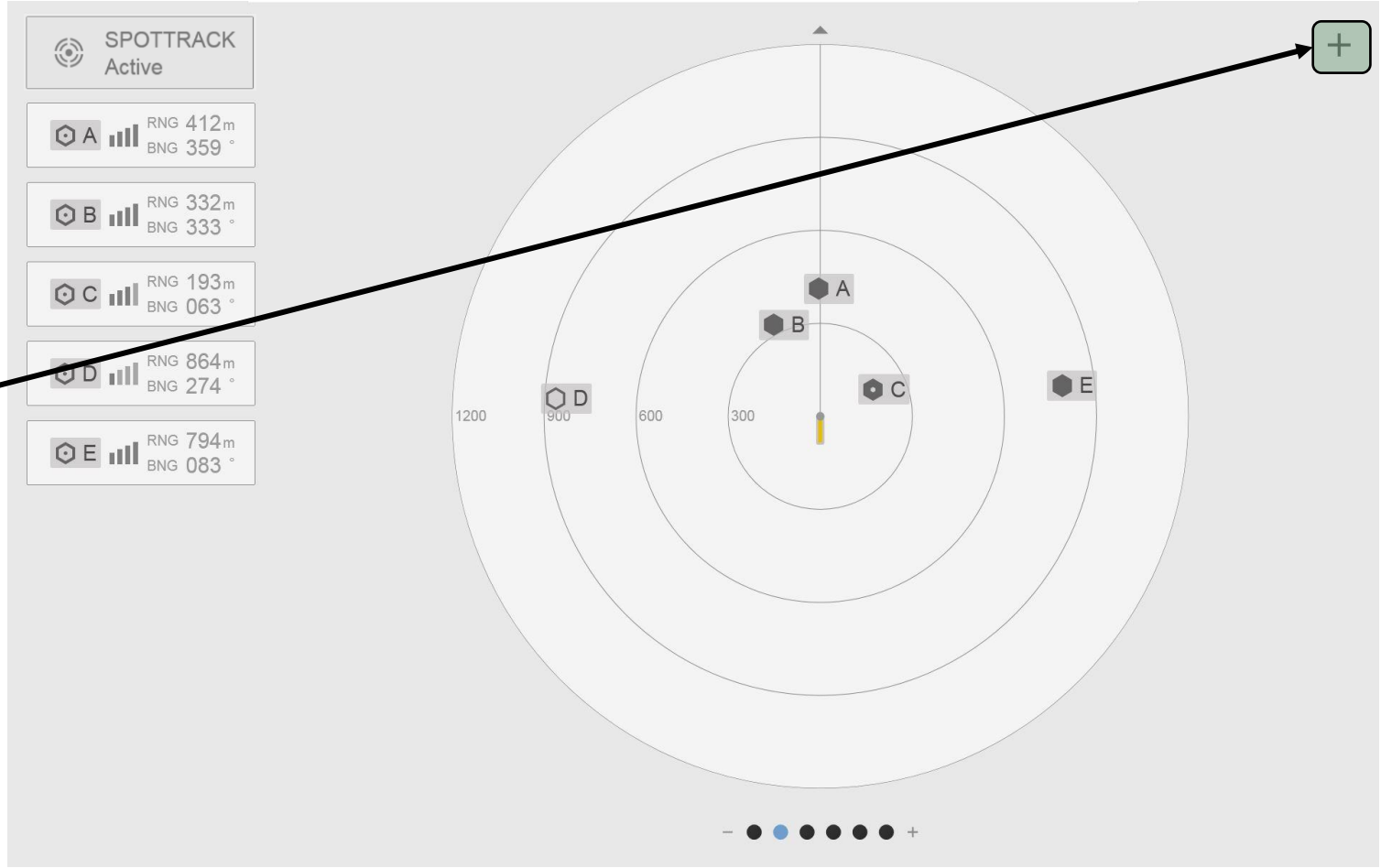
- SpotTrack Technical Training
  - SpotTrack System Description
  - SpotTrack Configuration
  - SpotTrack Maintenance
  - SpotTrack Service/Troubleshooting

SpotTrack

Configuration

Configuration menu is available from the Main menu

Click on the **+** sign to open Main menu



SpotTrack

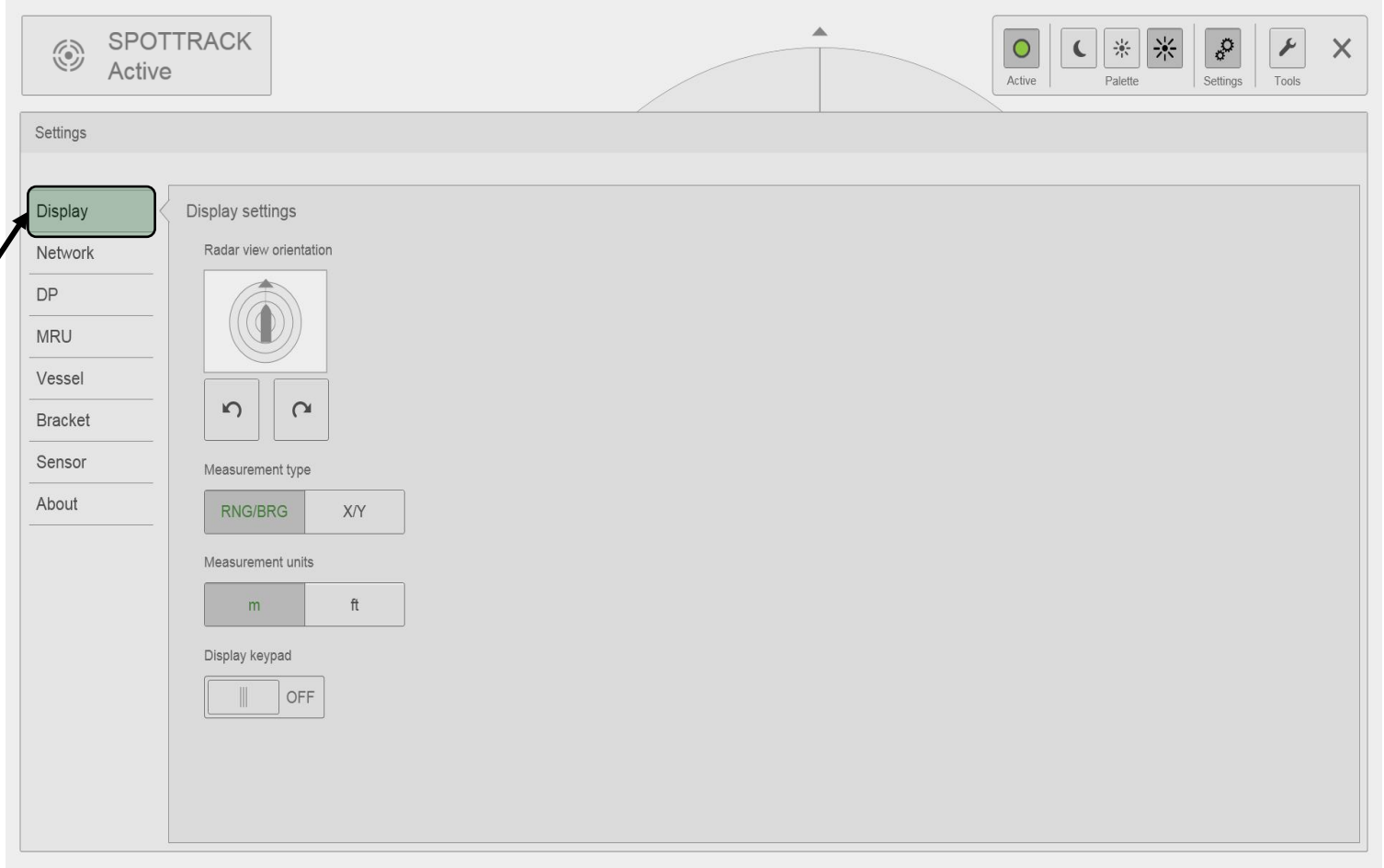
Configuration

Click Settings

SpotTrack

Settings Menu

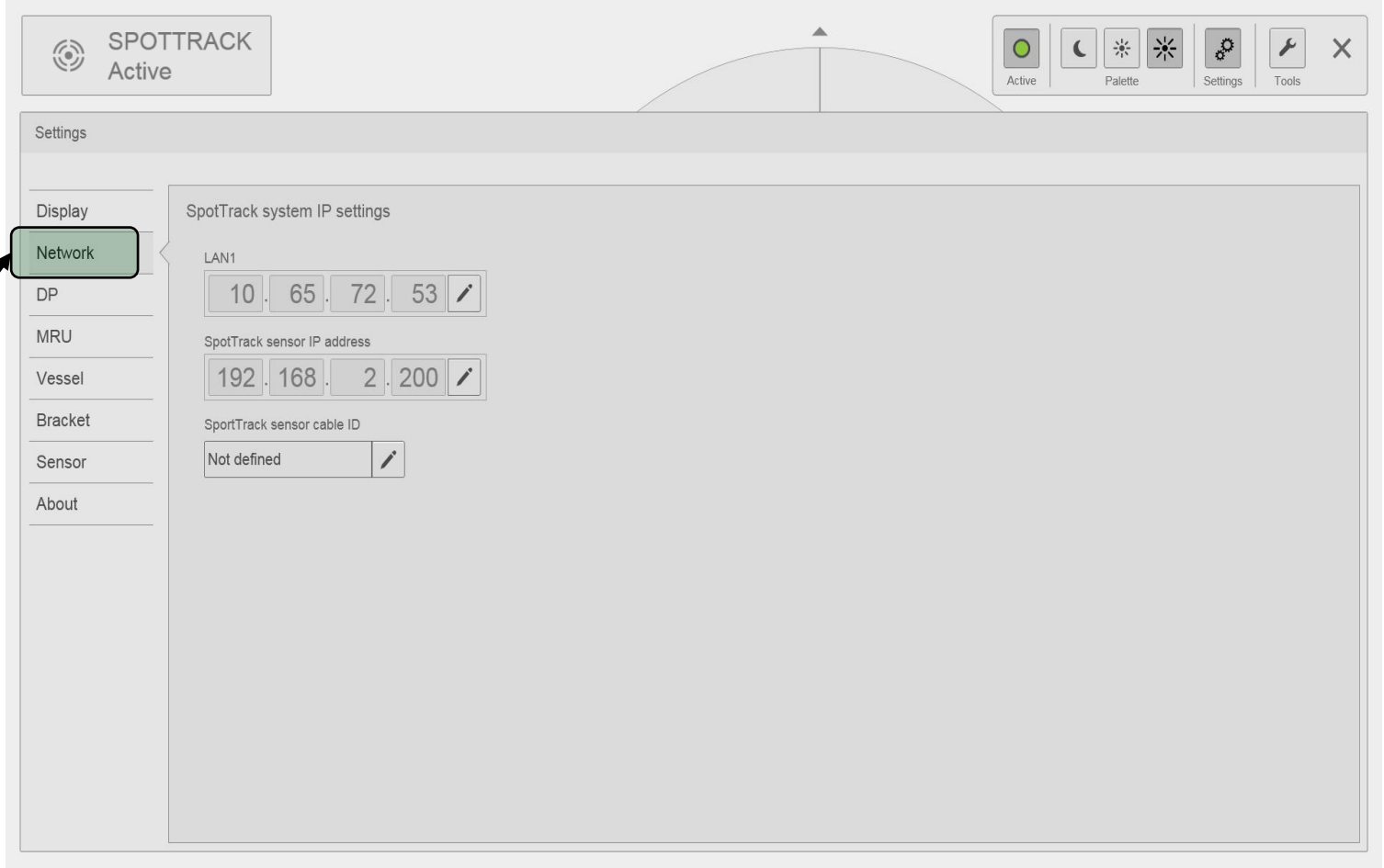
Display Setup:
- Radar view orientation
- Measurement type
- Measurement units



SpotTrack

Settings Menu

Network setup:
Default addresses
- PU
  192.168.2.50
- Sensor 192.168.2.200

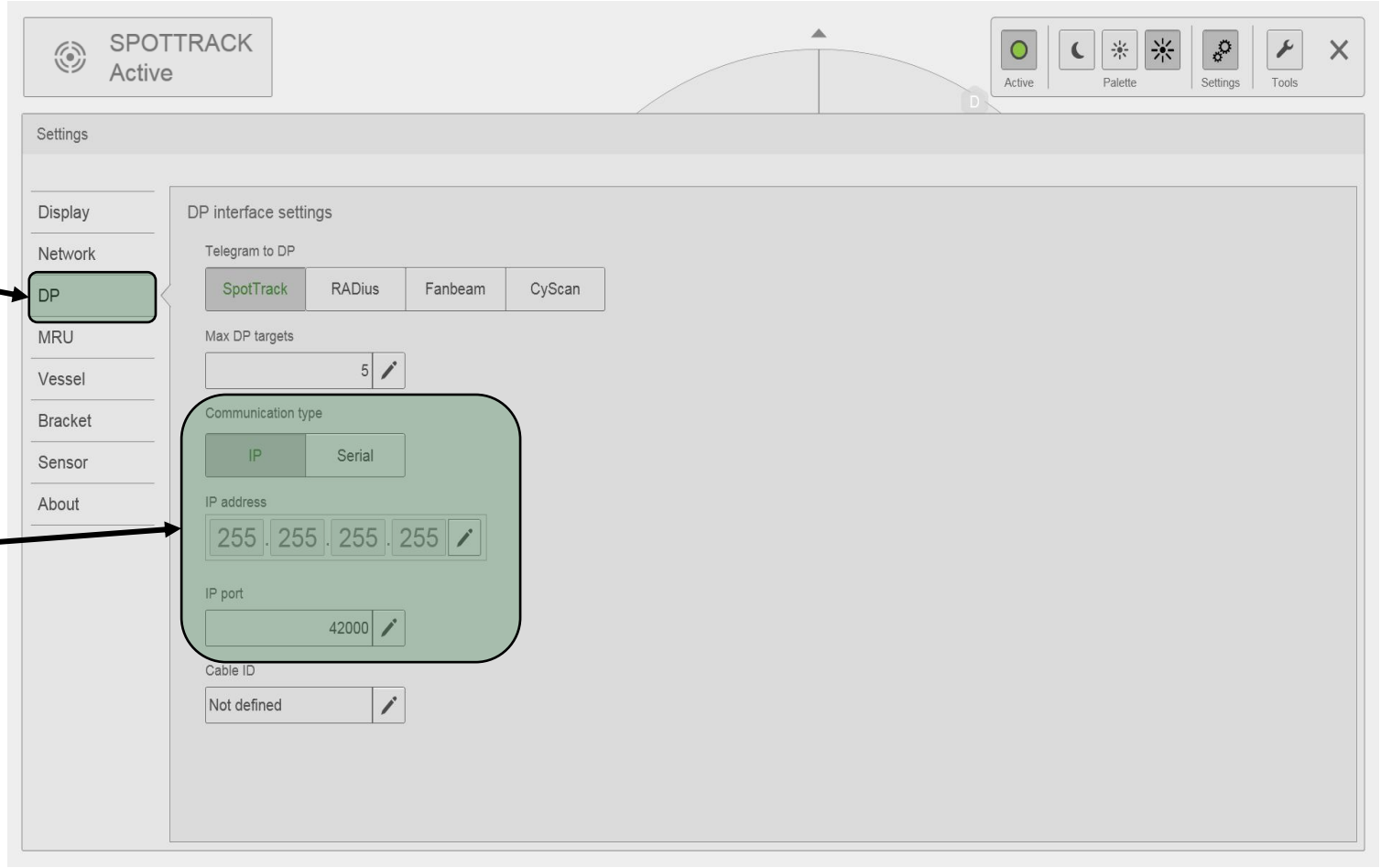


SpotTrack

Settings Menu

DP Setup:
- Select telegram to DP
- Select maximum number of targets

Communication type:
- IP Address



SpotTrack

Settings Menu

DP Setup:
- Select telegram to DP
- Select maximum number of targets

Communication type:
- Serial line

SpotTrack

Settings Menu

MRU Setup:
- Enabling MRU

Communication type:
- IP

SpotTrack

Settings Menu

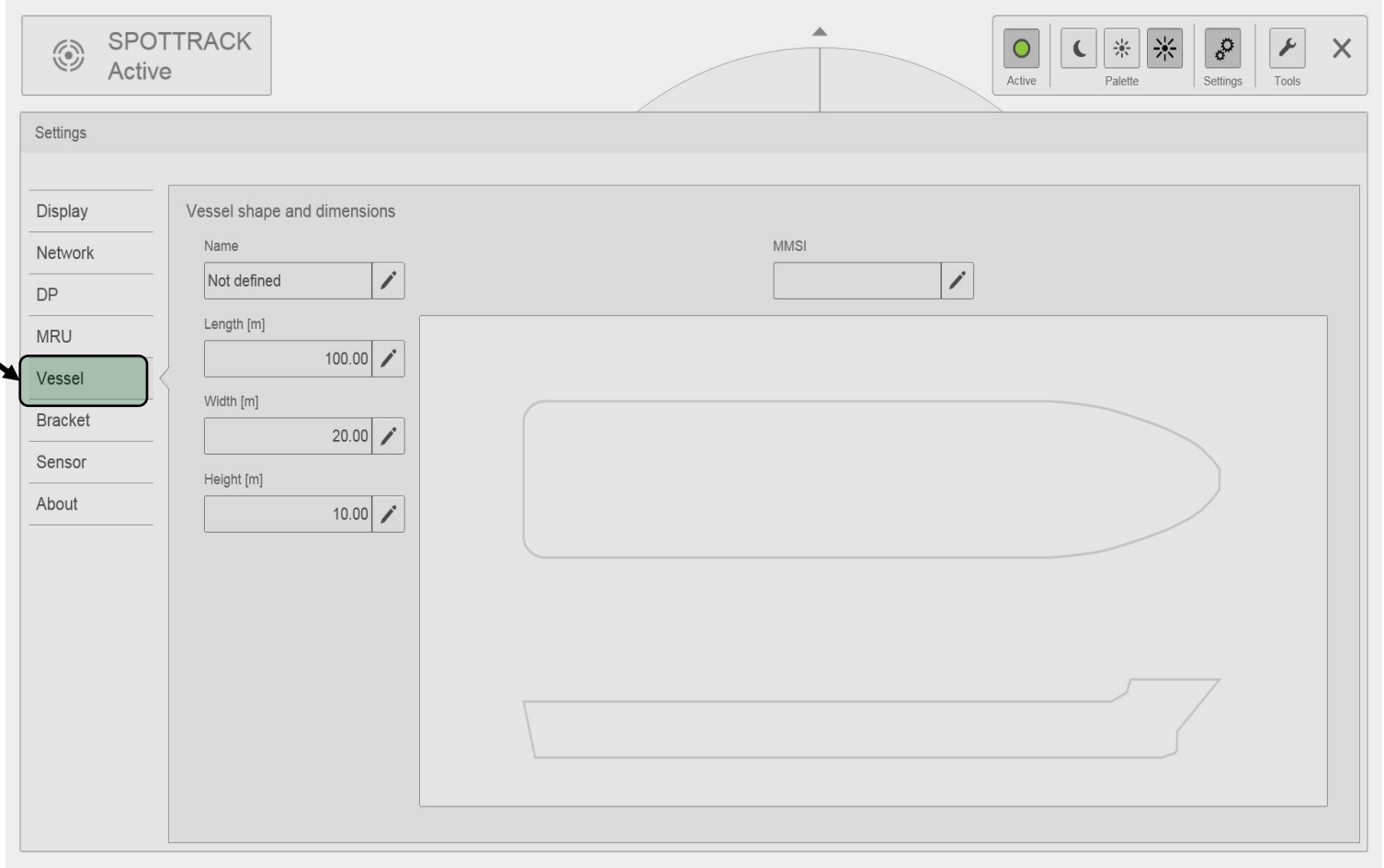
MRU Setup:
- Enabling MRU

Communication type:
- Serial

SpotTrack

Settings Menu

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



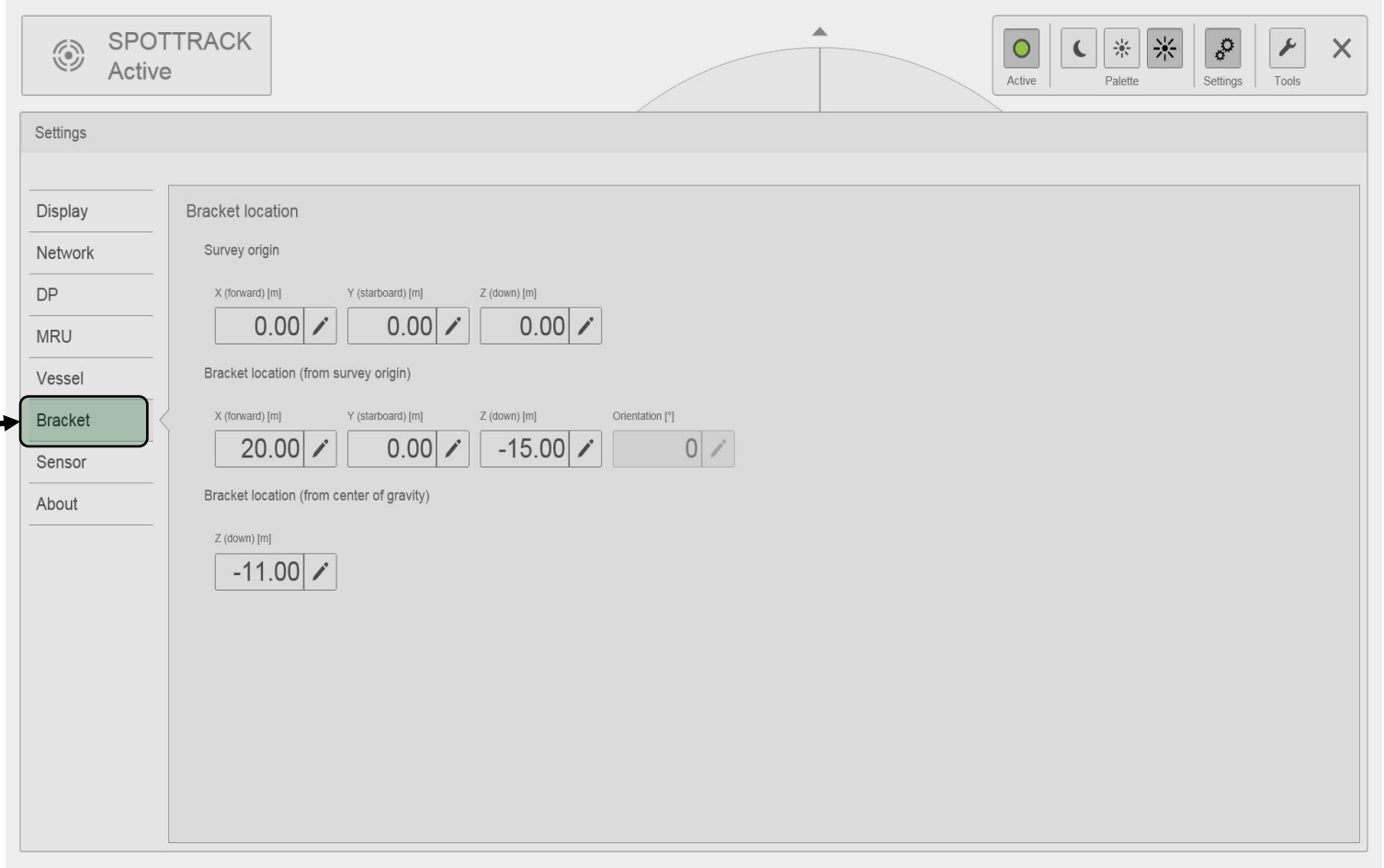
SpotTrack

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 (x)
positive clockwise

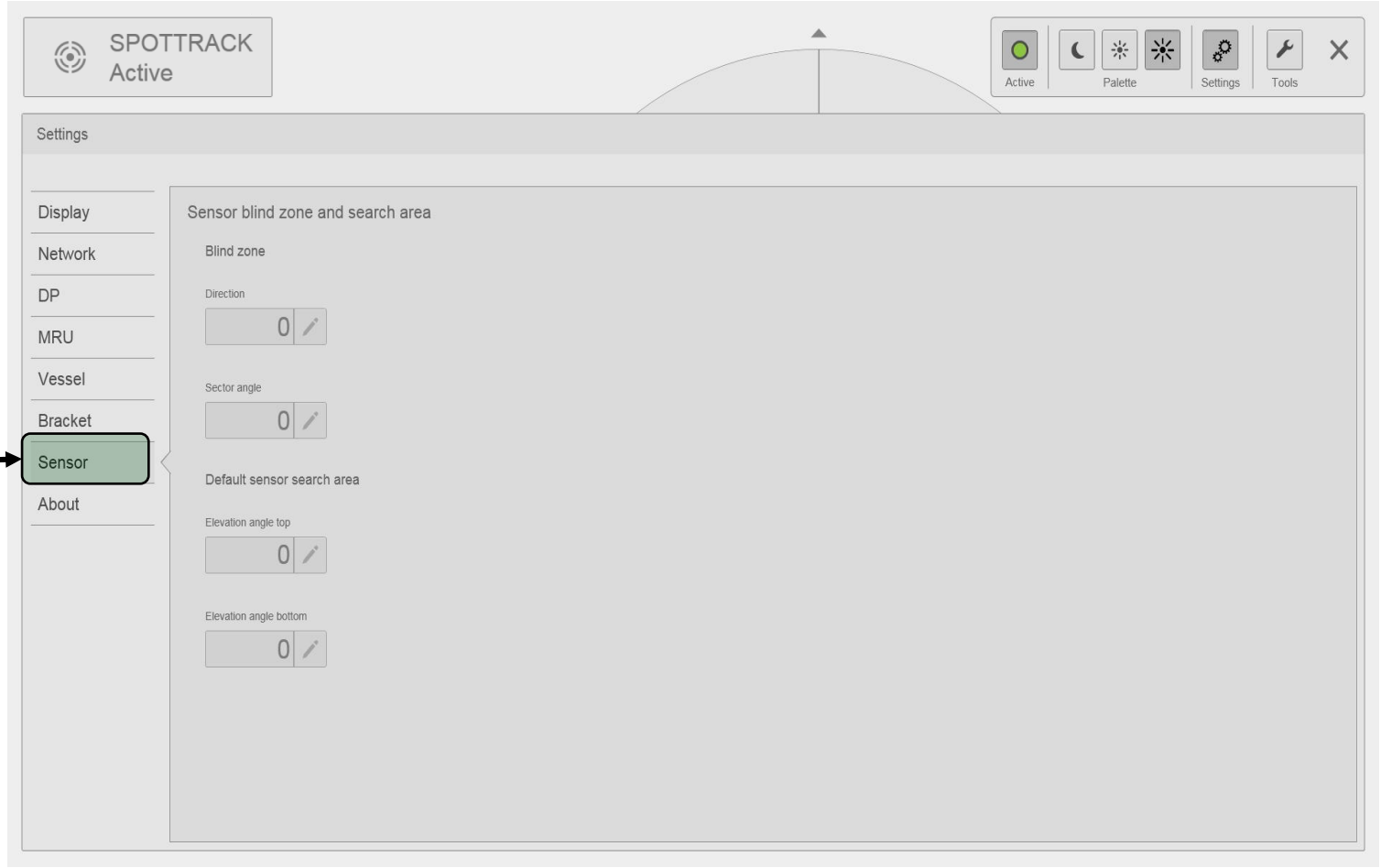


SpotTrack

Settings Menu

Sensor Setup:
Define blind zone

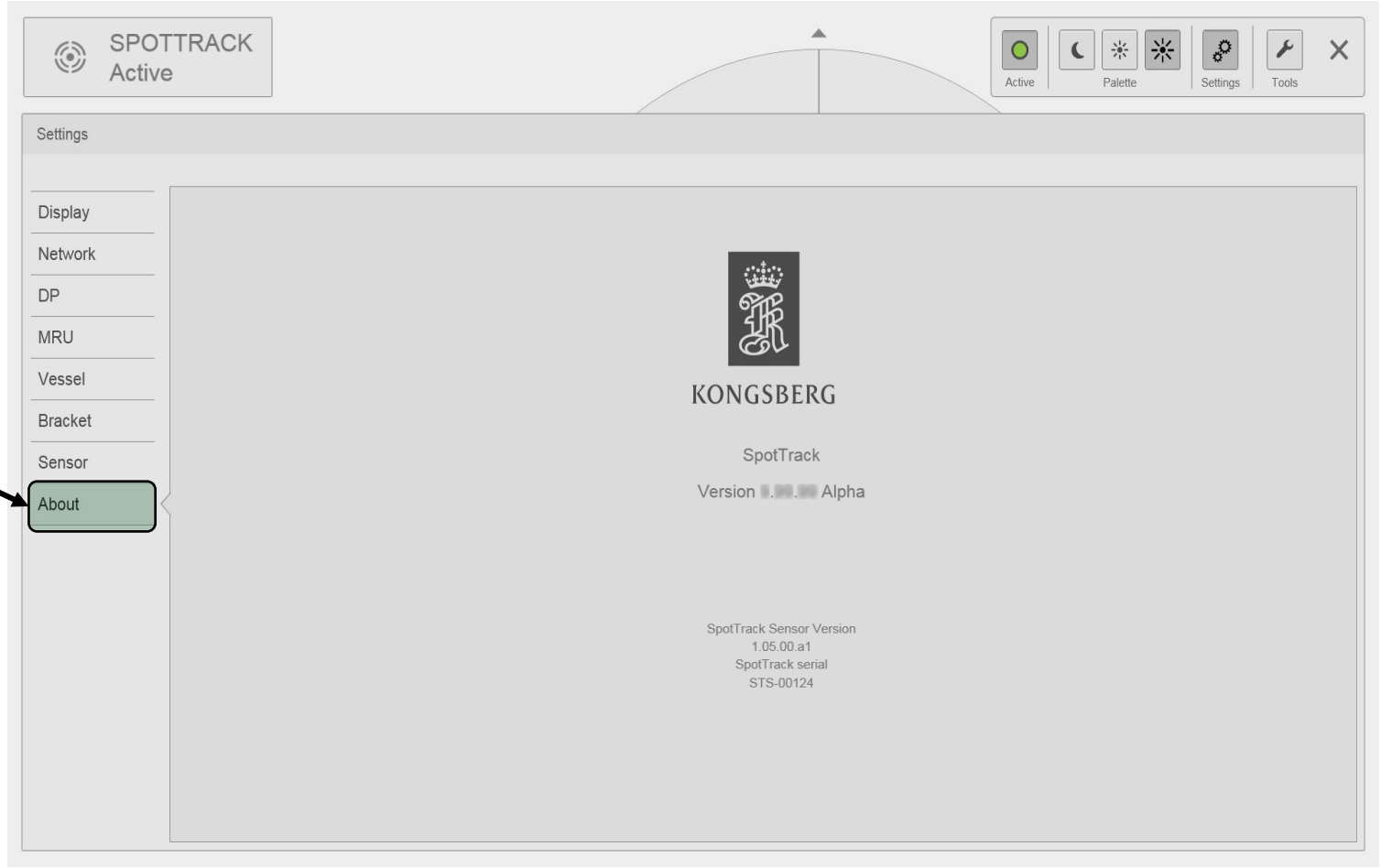
- Direction sector center (relative to vessel center line)
- Sector Angle (total opening angle)



SpotTrack

Settings Menu

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



SpotTrack Technical Training

Course Content

- SpotTrack Technical Training
  - SpotTrack System Description
  - SpotTrack Configuration
  - SpotTrack Maintenance
  - SpotTrack Service/Troubleshooting

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.

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:

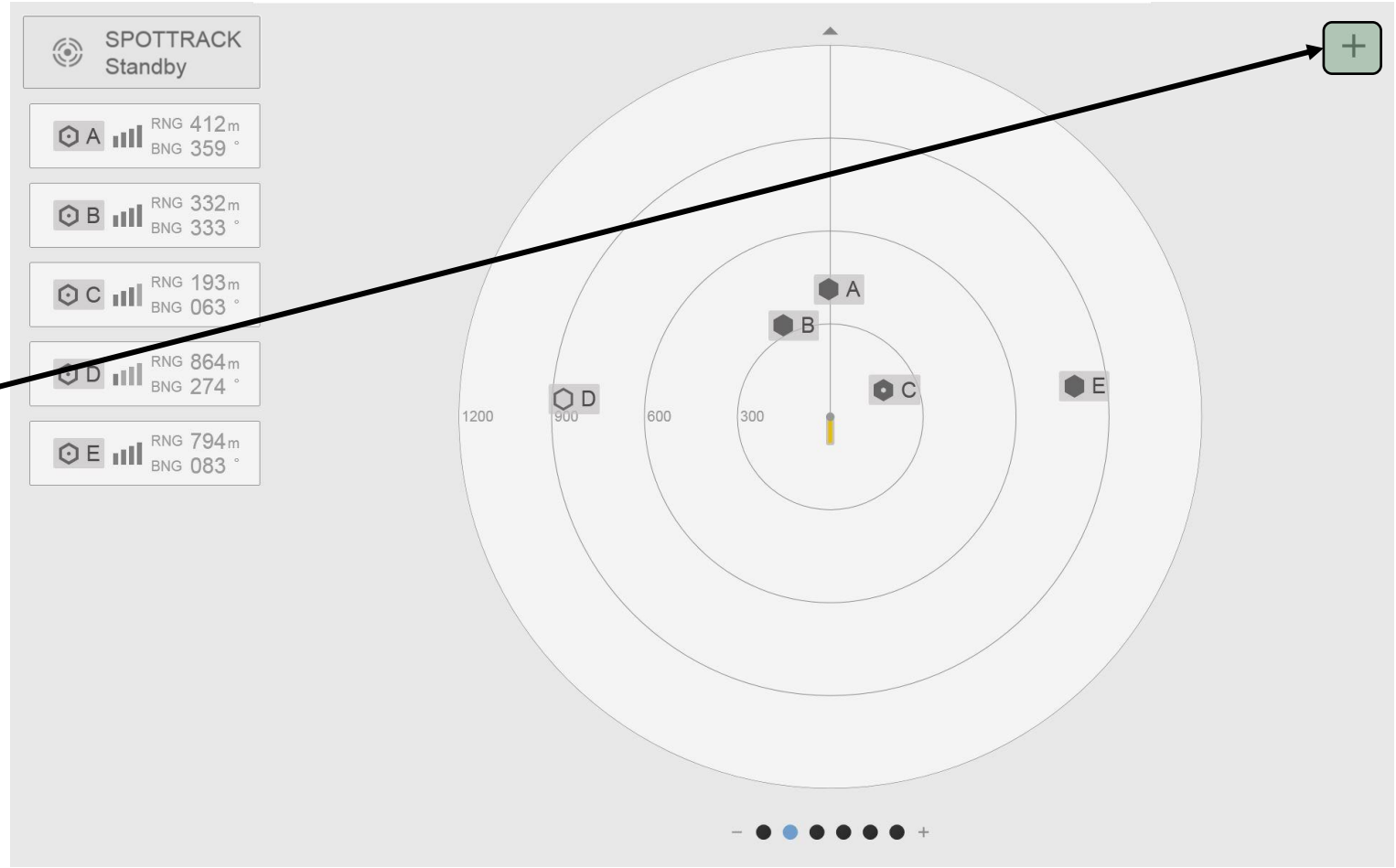
- Remove cover.
- Remove the filter and clean it by washing or vacuuming.
- Replace the plastic cover with the cleaned filter.

SpotTrack

Main Menu

The configuration menu is available from the Main Menu

Click on the **+** sign to open Main Menu



SpotTrack

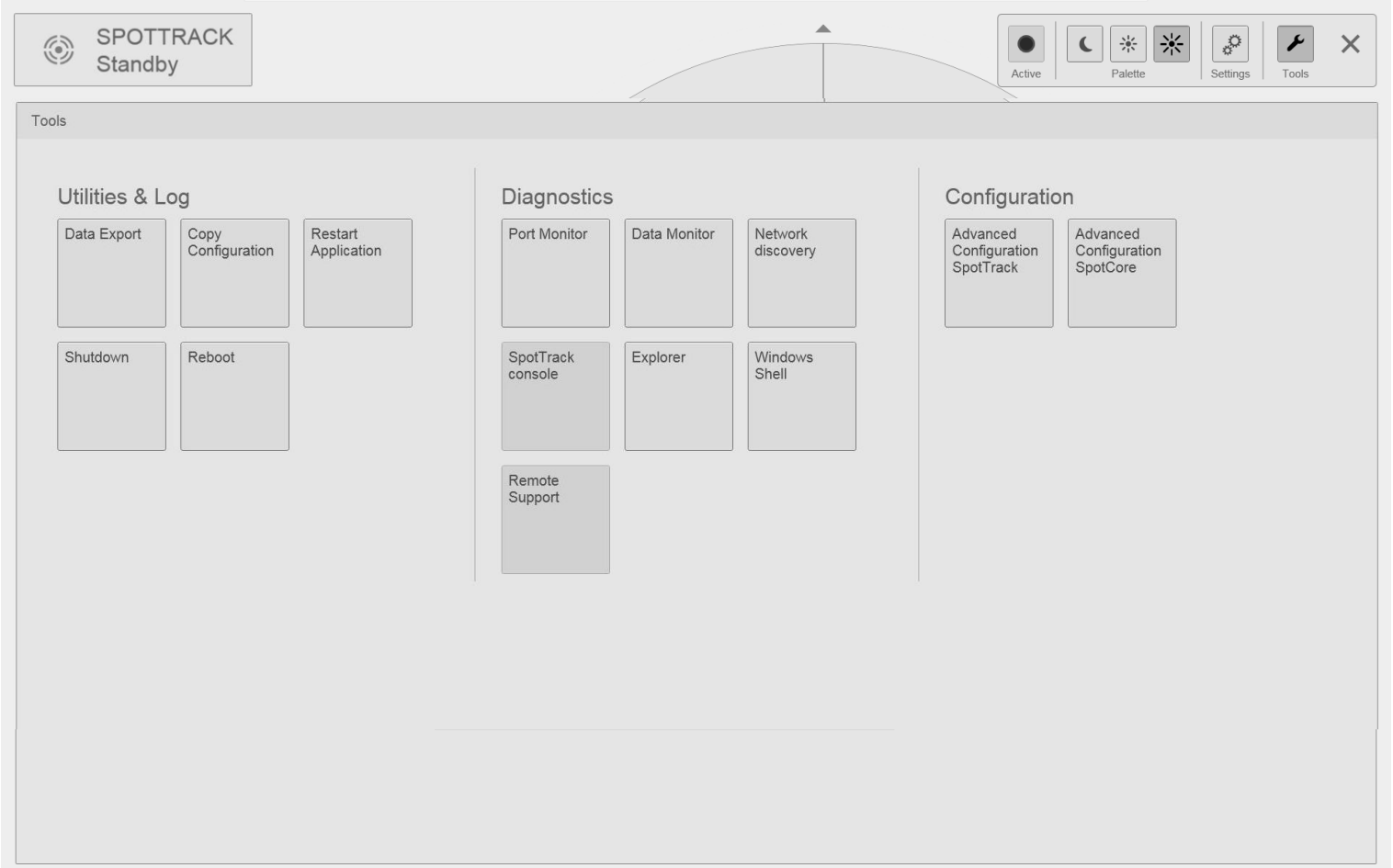
Tools Menu

Click on Tools

SpotTrack

Tools Menu

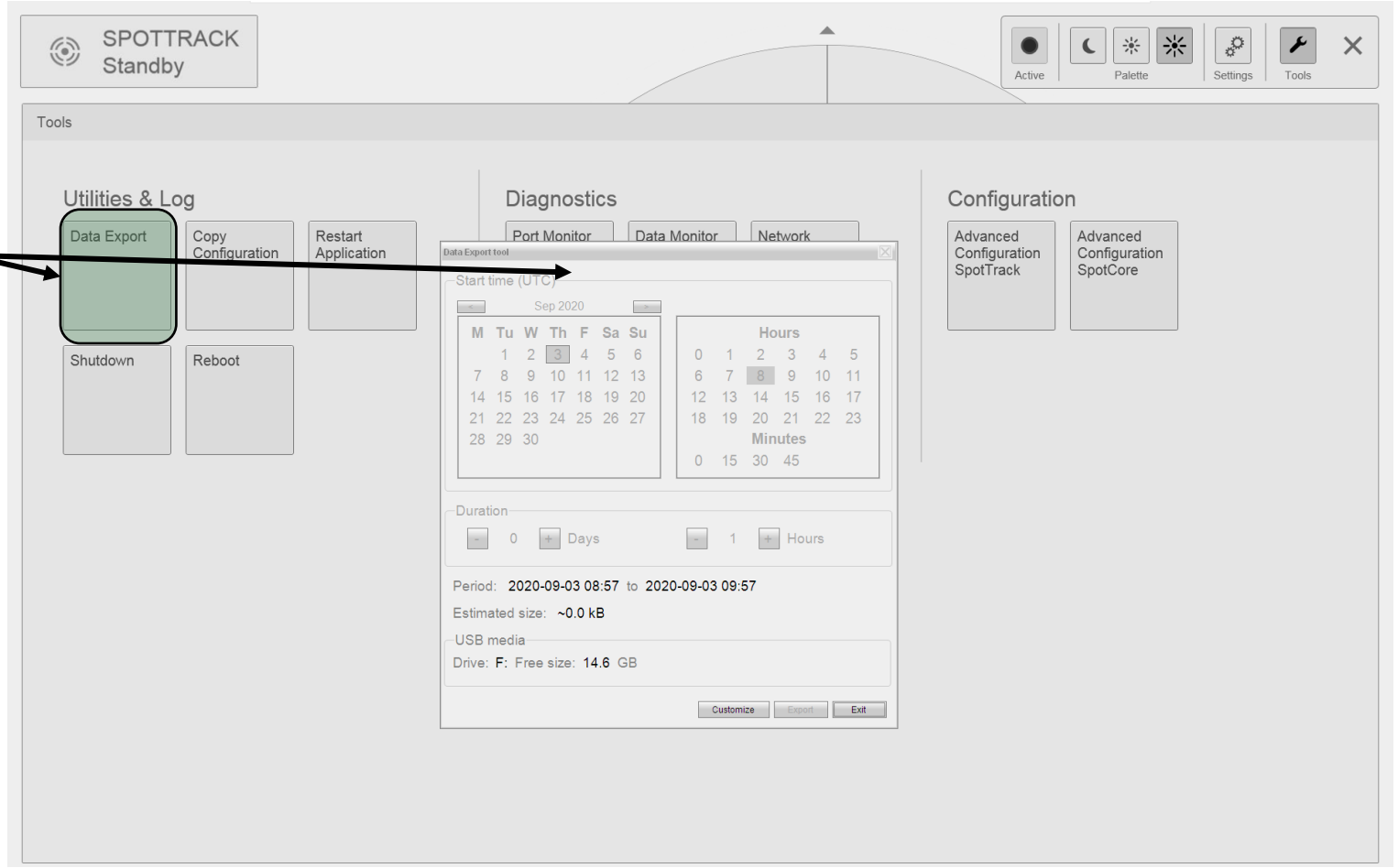
Tools:
- Utilities and Log
- Diagnostic
- Configuration



SpotTrack

Tools Menu

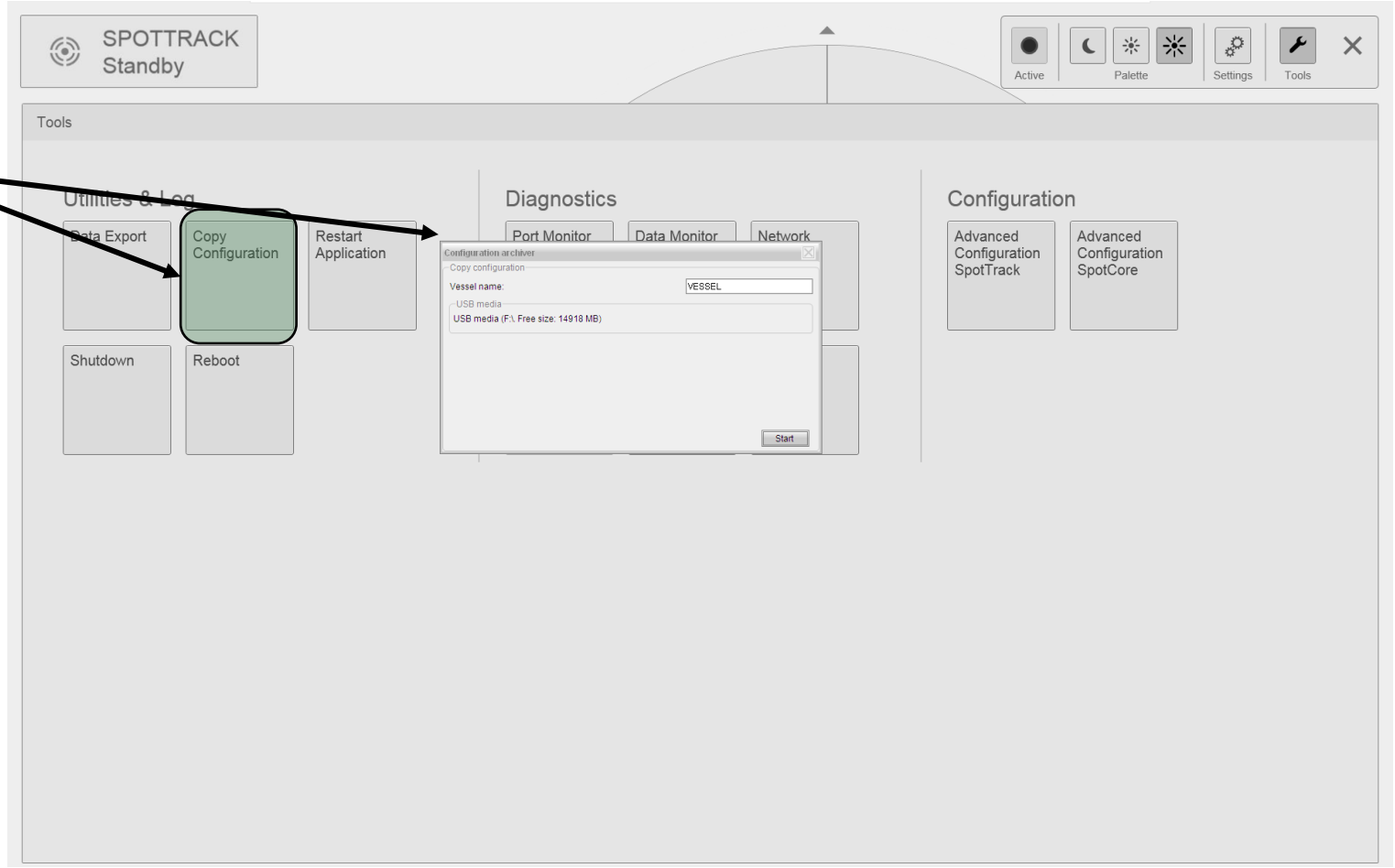
Data Export:
- export data from the system, either for documentation purposes, post-processing or diagnostics.



SpotTrack

Tools Menu

Copy Configuration:
- Backup configuration to USB



SpotTrack

Tools Menu

Restart Application:

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

SpotTrack Technical Training

Course Content

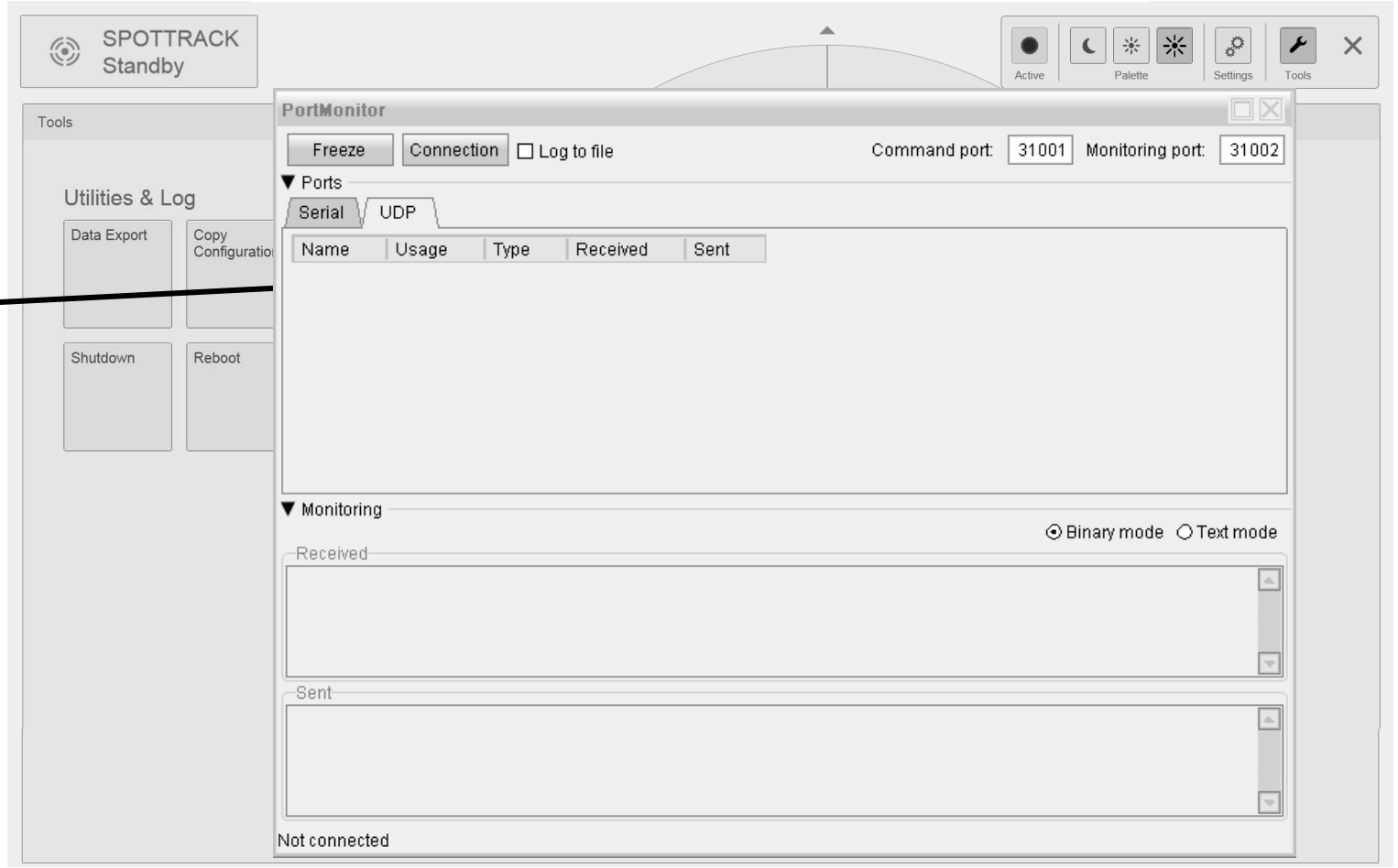
- SpotTrack Technical Training
  - SpotTrack System Description
  - SpotTrack Configuration
  - SpotTrack Maintenance
  - SpotTrack Service/Troubleshooting

SpotTrack

Tools Menu

Port Monitor:

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



SpotTrack

Tools Menu

SpotTrack Console
- Open a linux terminal window towards the SpotTrack sensor.

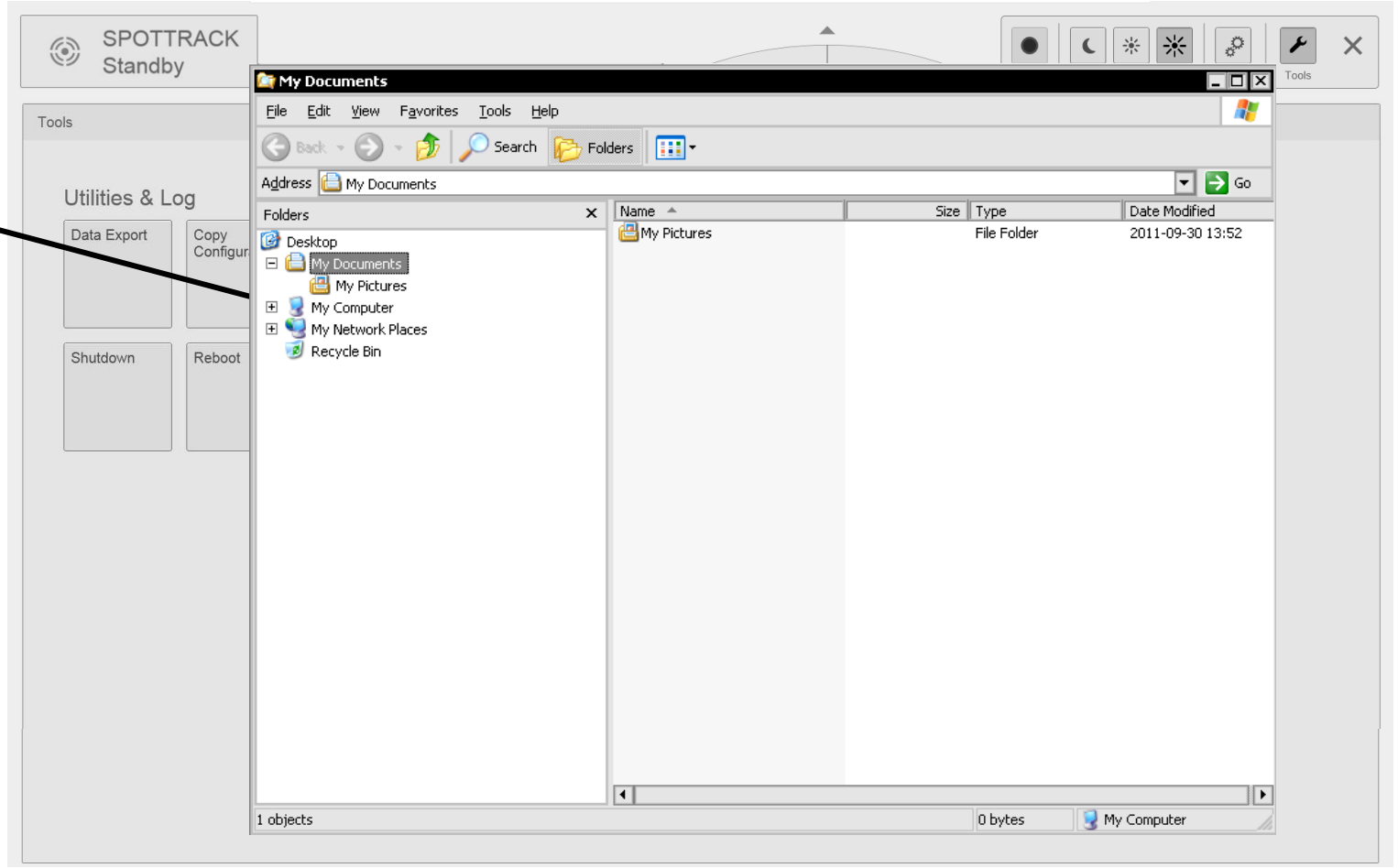
Caution

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.

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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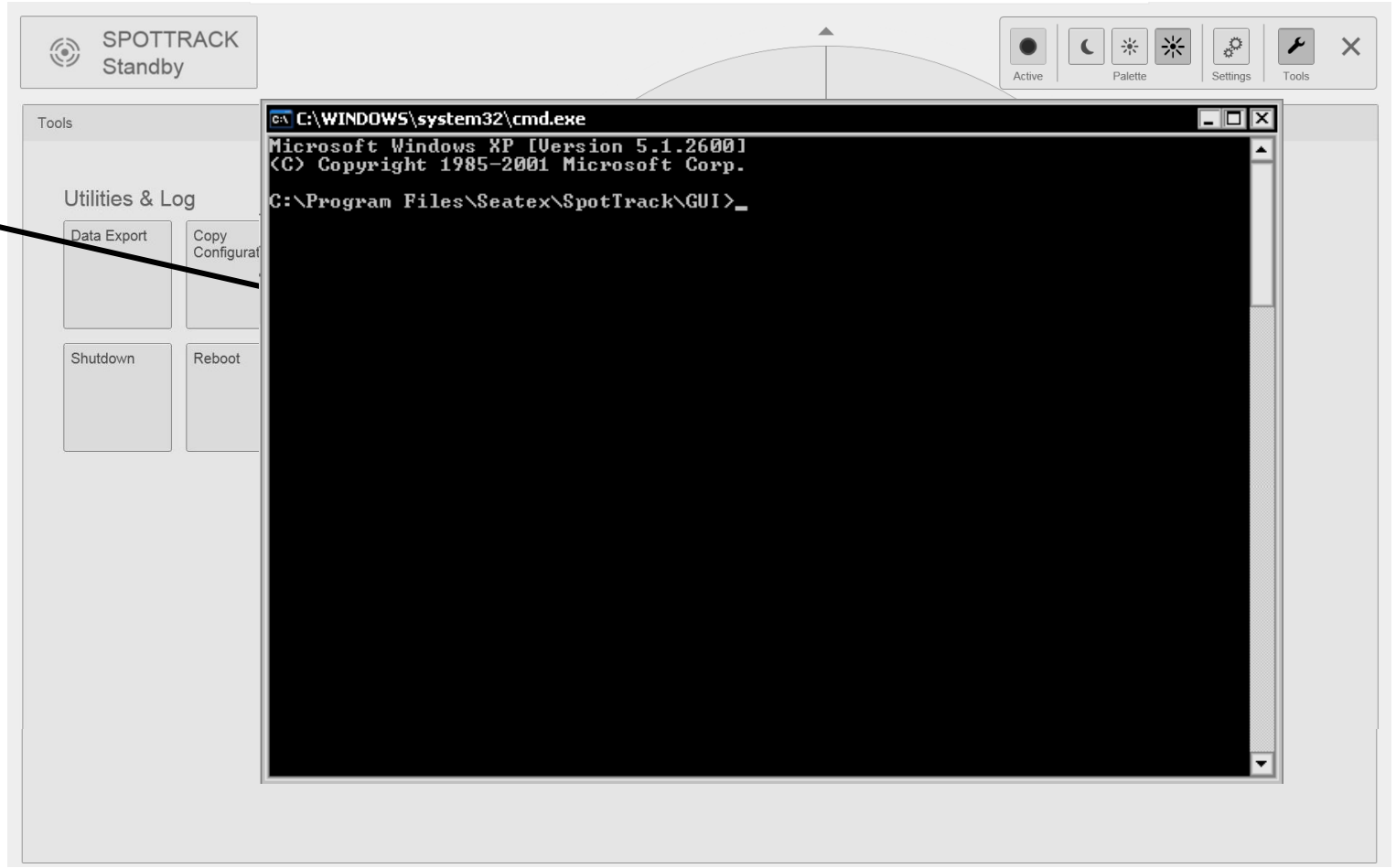

SpotTrack

Tools Menu

Advanced Configuration SpotTrack

- Not intended for use under normal conditions.

Caution

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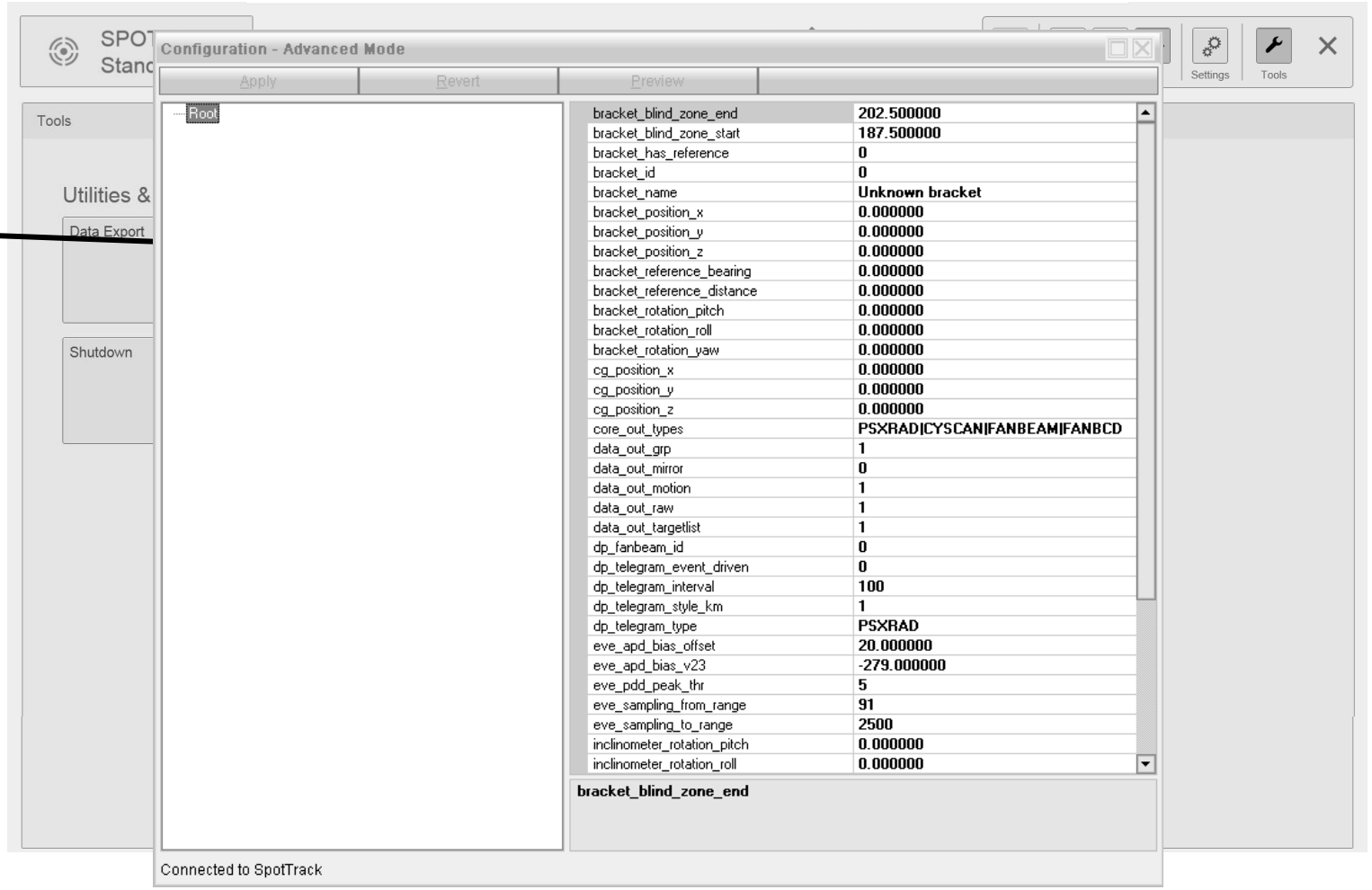


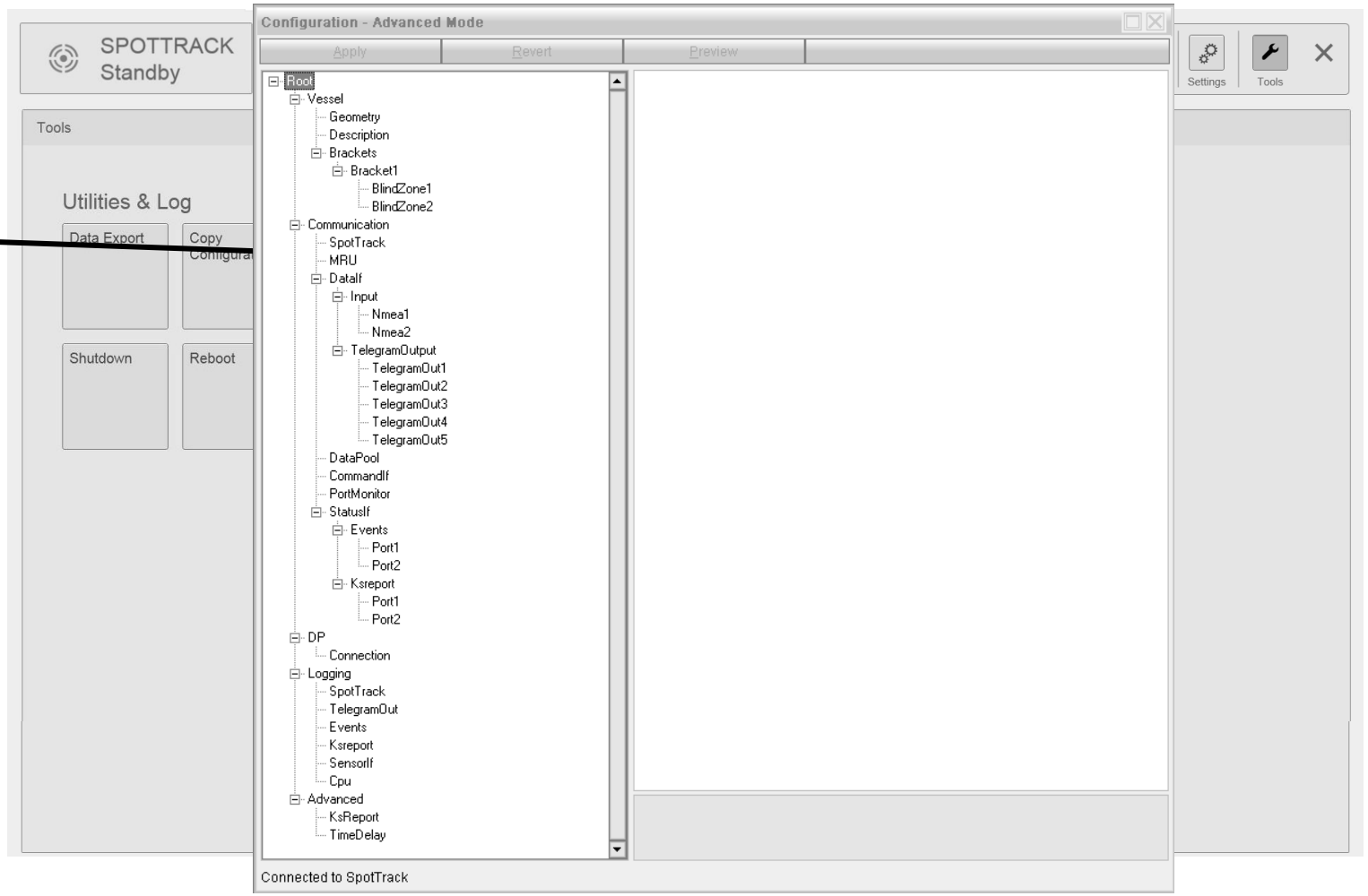
SpotTrack

Tools Menu

Advanced Configuration SpotCore
- Not intended for use under normal conditions.

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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End of Training