RBR

rbr-global.com

A new generation of glider sensors

Jon Taylor
Sensor team manager

About RBR

- Established in 1973
- Offices: Ottawa (HQ), Halifax, Qingdao, Seattle, Brest, Hobart

- 120+ highly technical, dedicated staff members
- Global sales and support network
- Developing high precision, low-power oceanographic instruments calibrated to WOCE standards
- RBR instruments have been deployed around the globe

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RBR Ottawa Headquarters

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Loggers

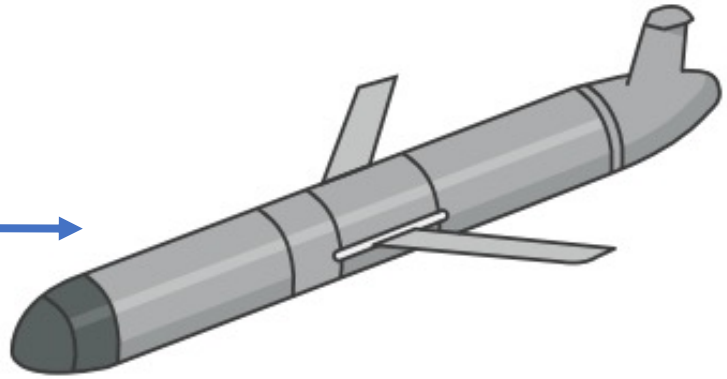
OEM

Sensors

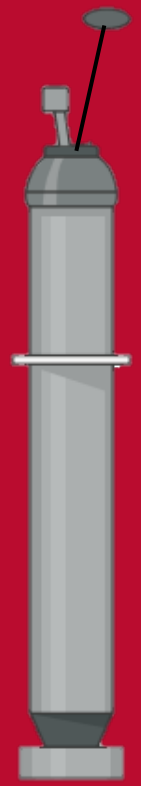
Systems

Floats

Gliders



Value to Argo Program



- Low power electronics
- No pump needed
- High sensor stability
- Sensor hub

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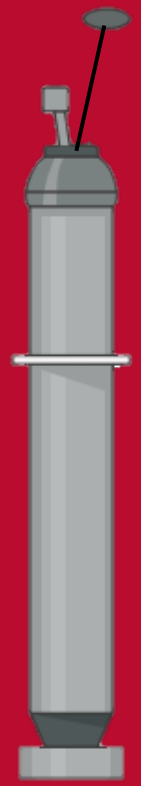
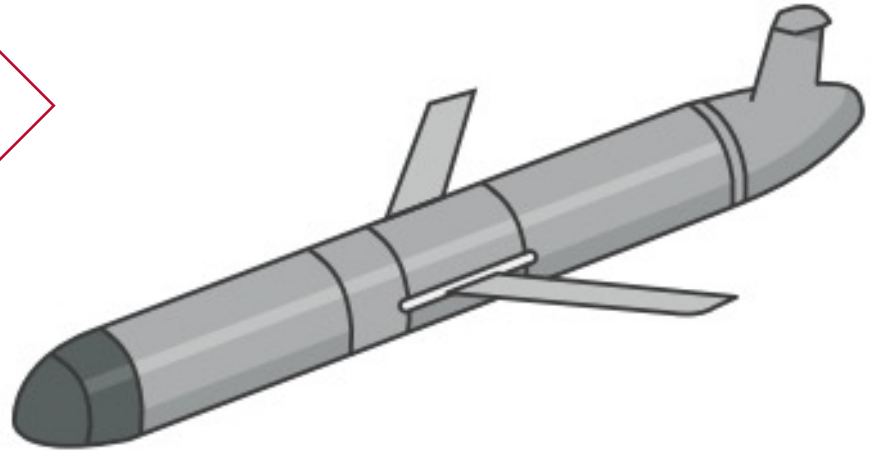
Value to Argo Program



Value to Glider Program



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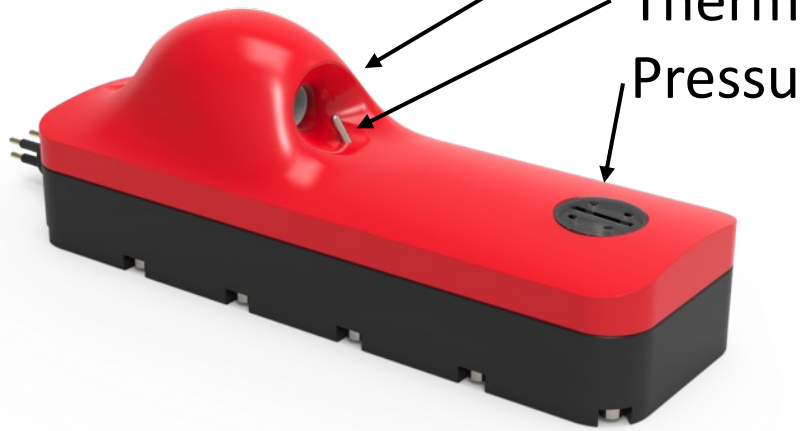
RBR*legato*^{3} CTD

Wet Bay

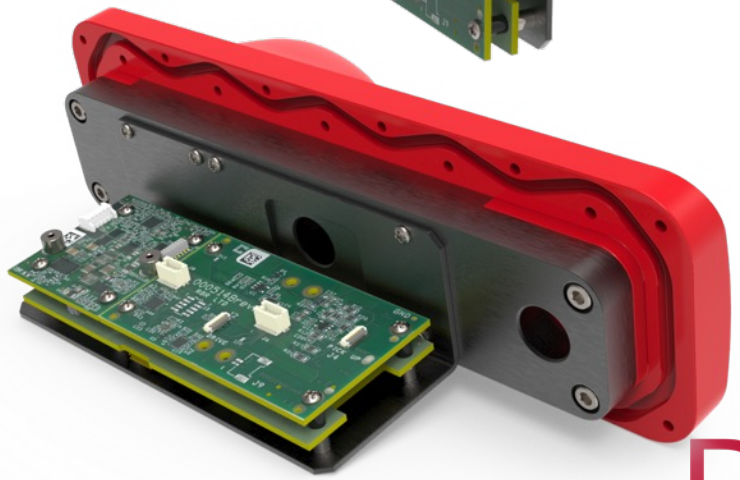
Inductive conductivity cell

Thermistor

Pressure sensor



Dry Bay



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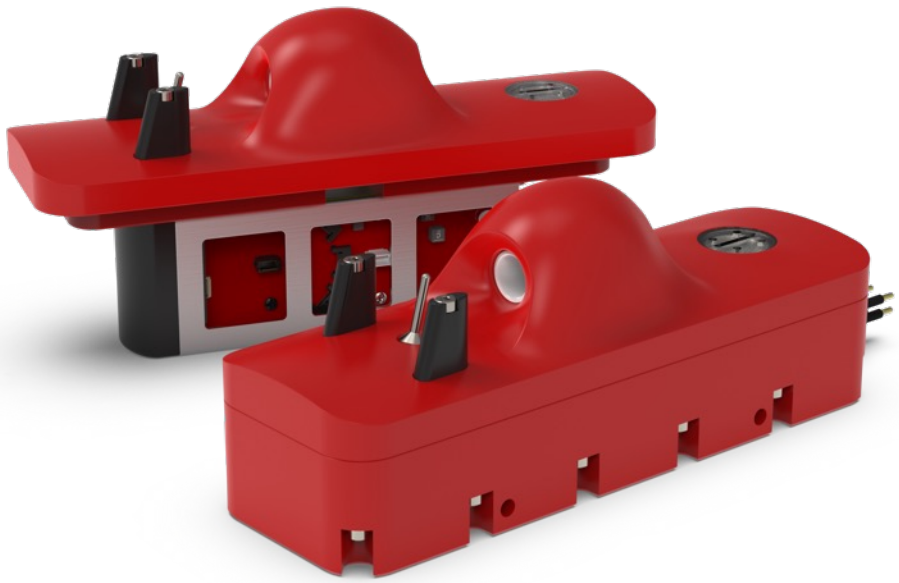
RBR*legato*^{3}: How does it work?

The RBR*legato*^{3} has an inductive conductivity cell. What does that mean?

- Conductivity is measured by an electric field circulating through the seawater
- Sensitive to “proximity effect”: Anything disturbing that field (<15 cm from cell) would affect the conductivity measurement
- No need for a pump = energy savings + no clogging + silent operations

RBR*legato*^{3} CTD



Specifications

- Standard 7 inch by 2 inch bay
- 1250m depth rating
- Up to 16Hz sample rate
- Up to 100ms response thermistor
- 18mJ energy per sample (GPCTD 175mJ)
- Same CTD accuracy as SBE and no pump required (natural flushing)
- Custom radius to fit each vehicle

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RBR CTD

Accuracy	RBR	Pumped CTD
Conductivity	±0.003 mS/cm	±0.003 mS/cm
Temperature	±0.002°C	±0.002°C
Depth	±0.05% FS	±0.1% FS
Power Req	18mJ	175mJ

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RBR*legato*^{3} CTD

Key benefits

- Low power
  - Greatly extend missions
  - Sample on descent & ascent
- User removable (Wet Bay)
  - Wet-pluggable connector
  - Quick calibration (3 weeks)
- Silent operation
  - No pump
  - Improves passive acoustics
  - Improves turbulence studies

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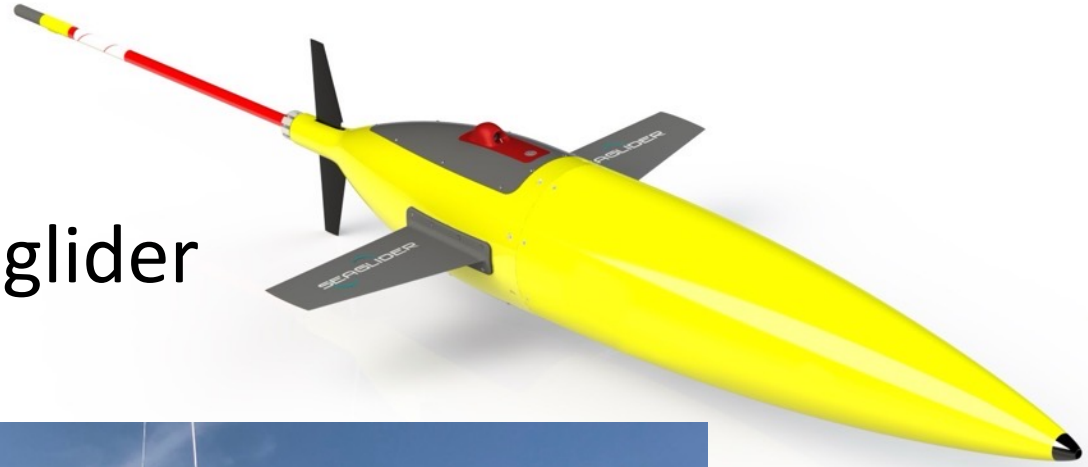
Gliders & AUVs with the RBR*legato*^{3} CTD

RBR*legato*^{3} CTD



Seaglider

Slocum

Petrel

SeaExplorer

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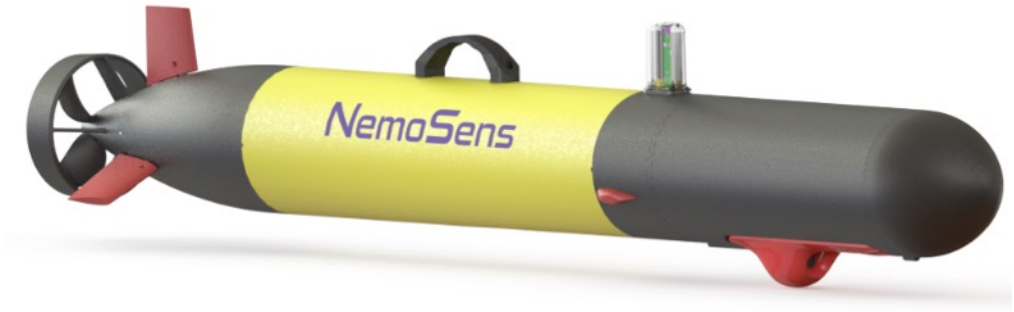
RBR*legato*³ CTD on AUVs



RTsys NemoSens

Riptide µUUV

Seaber YUCO

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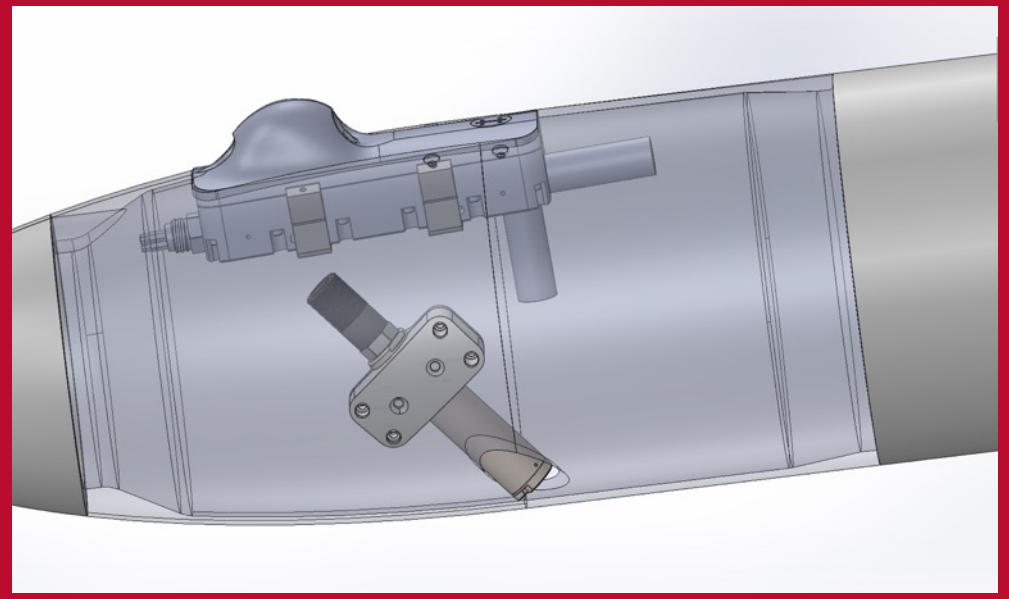
Sensor Hub of RBR*legato*^{3} CTD

Common sensor integrations



All RBR sensors, as well as some third-party sensors

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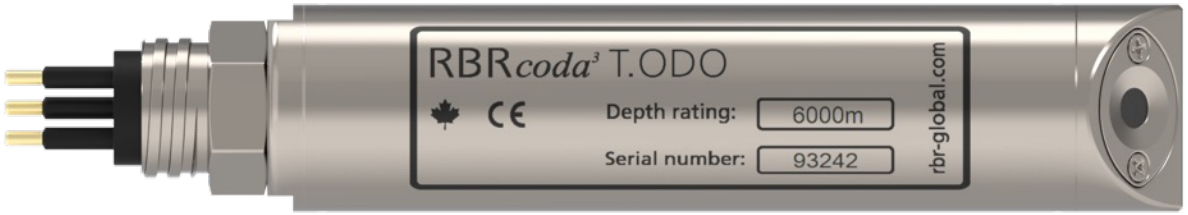
Optical dissolved oxygen



	Oxygen	Temperature
Measurement range	0-1000 µM	n/a
Calibrate range	0-500 µM	-5-35˚C
Initial accuracy	±8 µM or 5% (|fast) ±2 µM or 1.5% (|slow)	±0.002˚C
Resolution	<1 µM or 0.4% (|fast) 0.1 µM or 0.4% (|slow)	<0.00005˚C
Time constant	1s |fast, ~30s |slow	<1s
Sampling rates	24hr to 1Hz	

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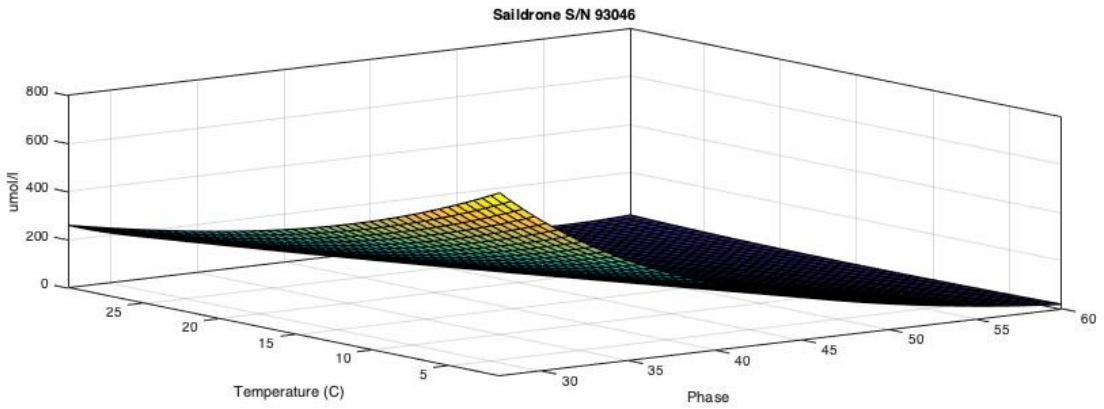
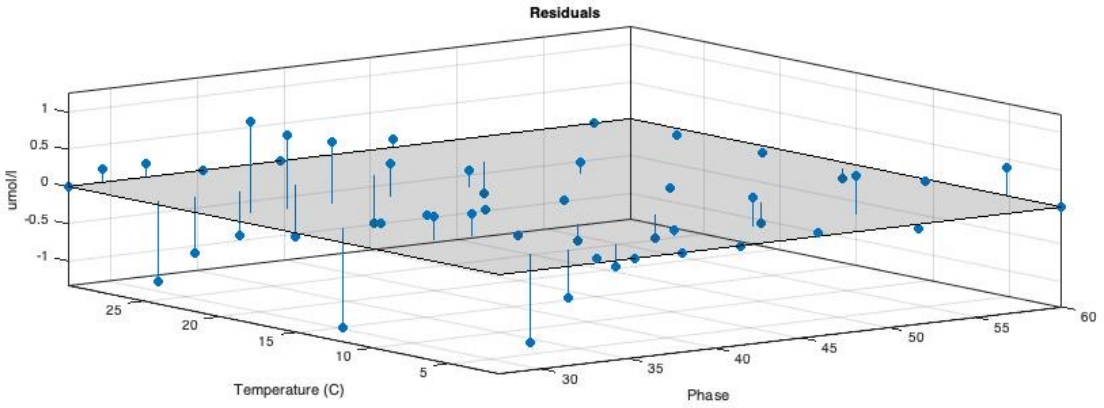
RBR*coda*³ T.ODO calibration





- 49 multipoint calibration:
  - Temperature range: 1.5 – 30 °C
  - Saturation: 0 – 120%
- Winkler calibrated references
- Fitting residuals: < 2 µmol/l (|slow)

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RBR*tridente*³

3-channel fluorescence and backscatter sensor

- Multiple simultaneous fluorometer and backscatter measurements
- Superior sensor performance at 5% the power consumption of comparable sensors
- 20mJ / sample
- Up to 32Hz
- Depths up to 6000m
- Standard 63mm form factor easily integrates into existing payload bays

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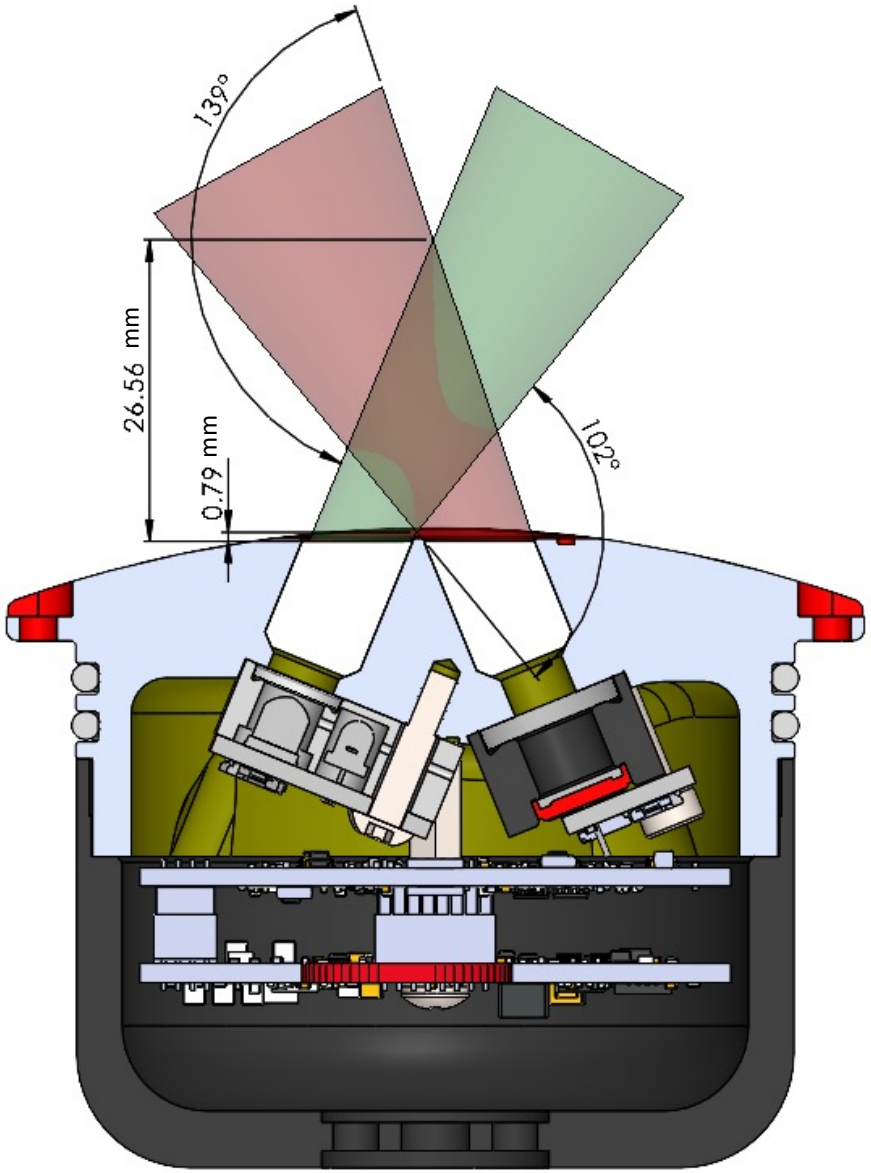
RBR*tridente*³

- Optical geometry tuned for backscatter measurement
- Chief ray @ ~119º
- Reference photodiode to compensate for any change in the LED
- Custom filters designed for each parameter
- Non-fluorescing materials
- No pressure effect
- Thermistor for internal compensation



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RBR*tridente*³ - Parameters

Parameter	Wavelength (nm)	Limit of Detection
Backscatter	470, 525, 650, 700	$1E^{-6}$ $m^{-1}sr^{-1}$
Chlorophyll-a	470/695 435/695	0.01 µg/L*
fDOM	365/440	0.03 ppb
Phycocyanin	620/654	0.2 µg/L
Phycoerythrin	525/600	1.5 µg/L
Rhodamine	550/600	0.02 µg/L

Backscatter
- Calibrated in NIST traceable 100nm beads
- Best LOD possible

Chlorophyll-a
- Calibrated in chl-a pigment in acetone
- In vivo scalar to align with reference of choice
- In discussion with the Argo TTT on standardisation of the calibration standard

*scaled to a monoculture of Thalassiosira weissflogii

fDOM
- Calibrated in quinine
- No fluorescing materials in the optical path

Phycocyanin
- Calibrated in phycocyanin pigment
- Filters designed to minimise chlorophyll and phycoerythrin sensitivity

Phycoerythrin
- Calibrated in phycoerythrin pigment

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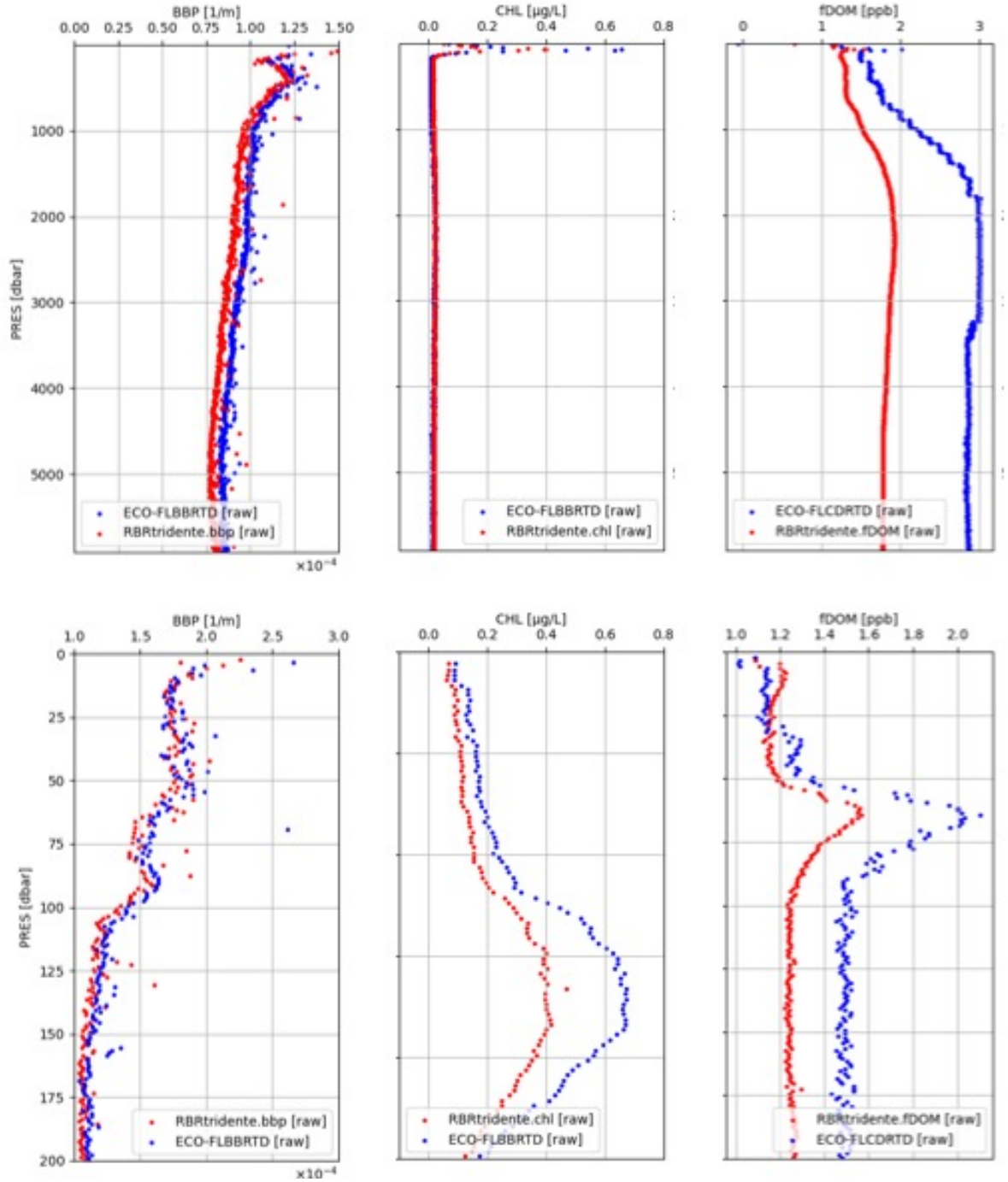
RBRtridente – Investigator 2024

- Highlights the high resolution of all channels
- Great alignment of BBP
- Cross-calibration/shared standard required for chl-a
- Expected scalar difference for fDOM



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RBR*quadrante*³

4-channel radiometer

- Four radiometers in a single sensor package
- PAR (400-700nm) and a range of narrow-band channels from 413nm to 560nm
- Depths up to 2000m
- Optimized cosine response
- Excellent low-light detection
- Temperature corrected dark reading

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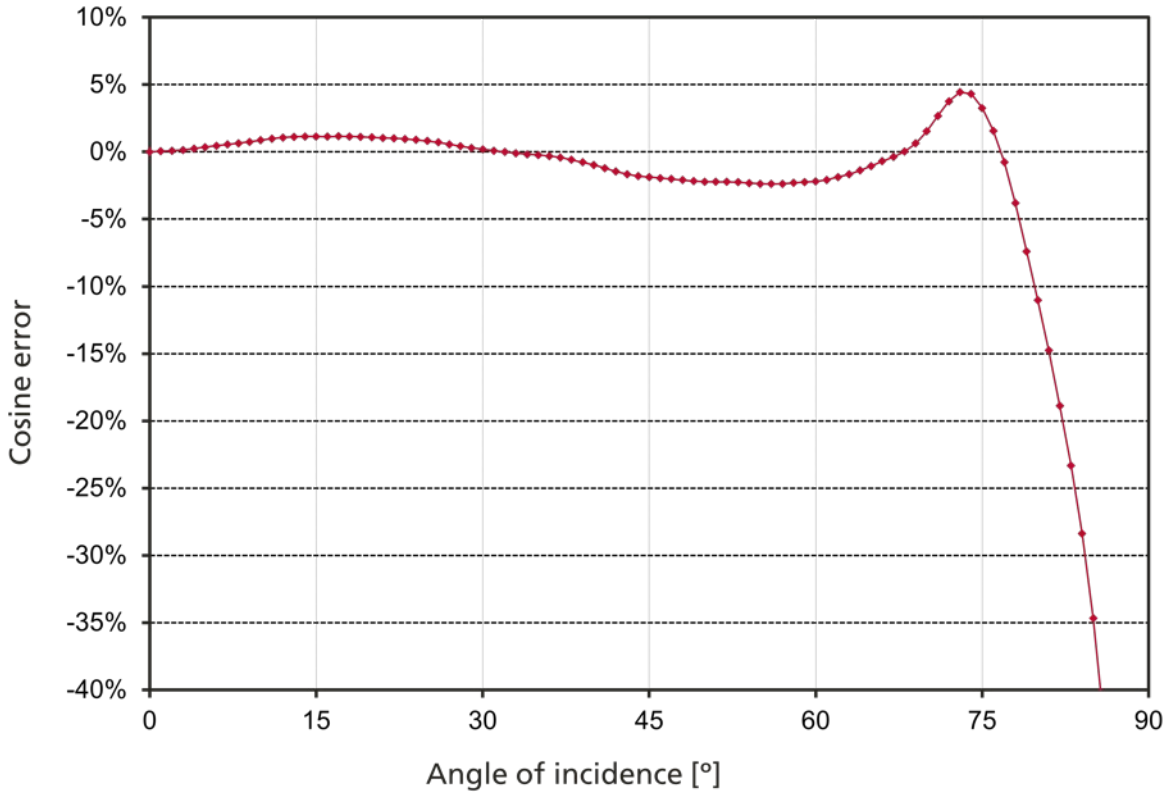
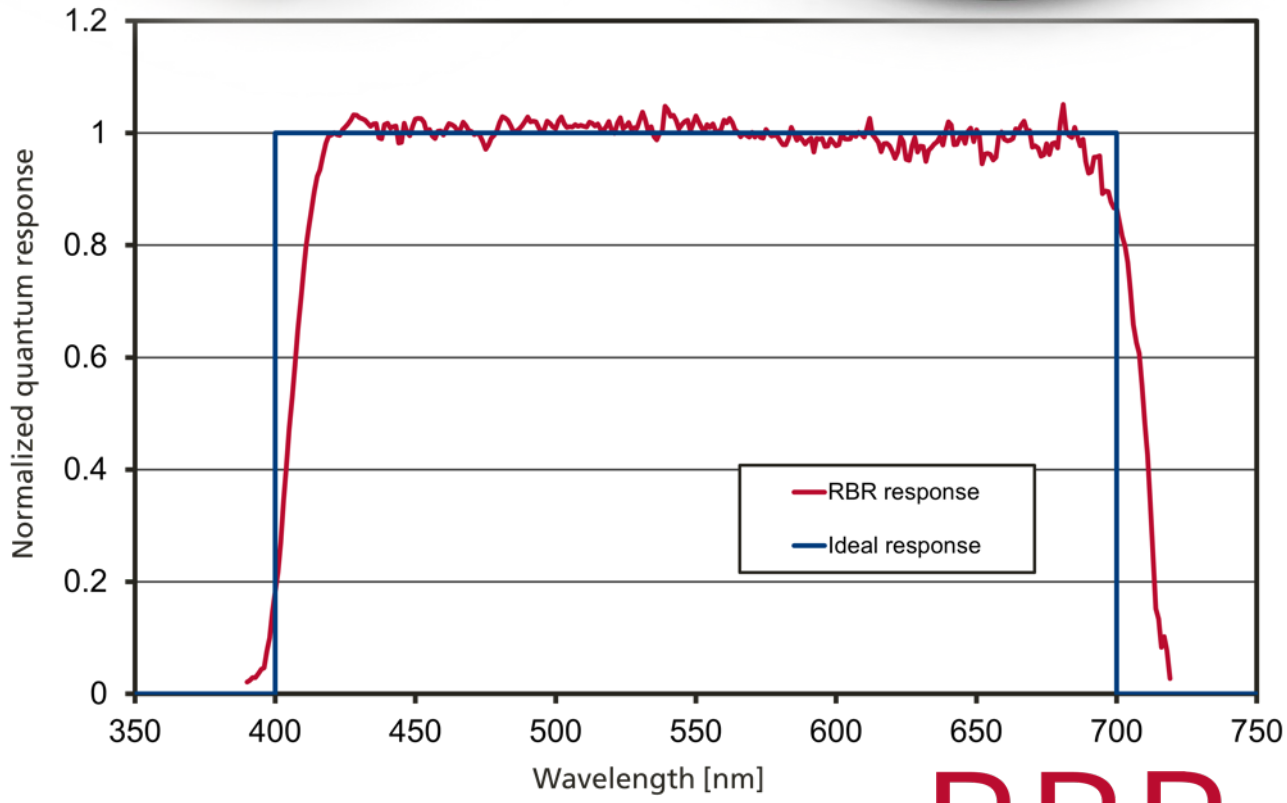
RBR – PAR Performance

RBRcoda³PAR cosine response measured in water



Spectral response



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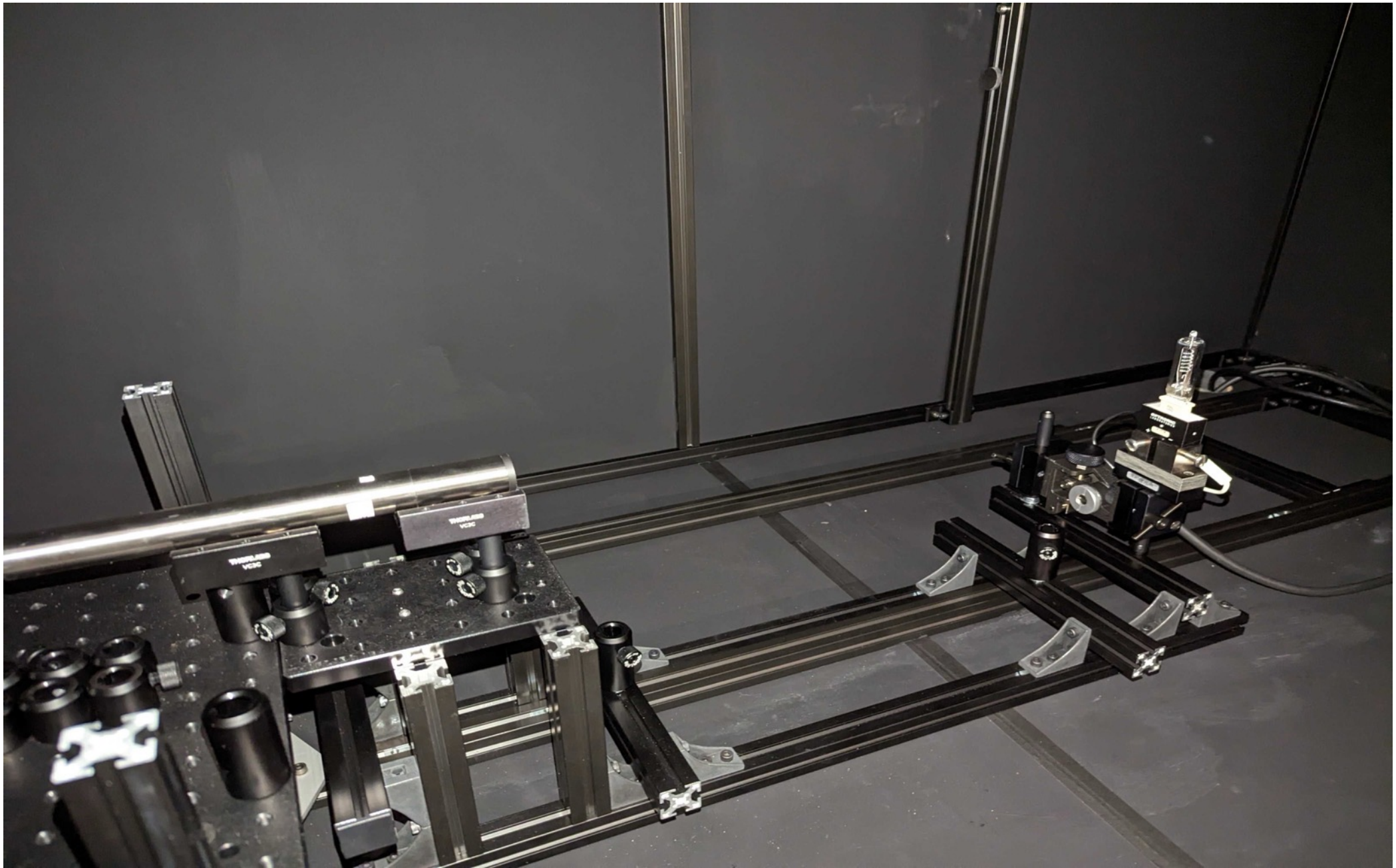
Radiometer calibration



- NIST traceable FEL source
- Repeatability error <0.15%
- Agreement with secondary lab >98%

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Future of Glider Technology – Sensor Perspective

Longer missions ➔ lower power

Deeper ➔ high-pressure designs

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Service and Support

Talented team of engineers!!

Responses < 1 day

1 Year warranty

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Questions?

Contact Us

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