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BOUSSOLE buoy deployment & maintenance log.

June 2, 2017 - February 15, 2019

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Foreword

This report is part of the technical report series that is being established by the BOUSSOLE project.

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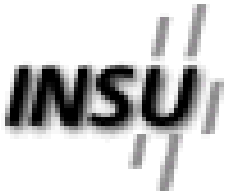

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1 SCOPE OF DOCUMENT

The BOUSSOLE buoy deployment and maintenance log is a record of all events that occur from the deployment to the recovery of one of the two upper sections of the buoy.

The aim is to keep track of all maintenance operations, such as instruments cleaning or rotations, instruments malfunctions, incidents with the buoy structure, if any, biofouling development and so on.

This information is crucial to a subsequent correct interpretation of the data.

Keeping track of these events also allows their analysis in view of the permanent improvement of protocols.

The present report concerns "buoy deployment XIX", from June 2th of 2017 to February 15th of 2019.

2 DESCRIPTION OF OPERATIONS

2.1 UPPER SECTION PREPARATION (2017-04)

The buoy System (buoy XIX called system #1) was delivered from Satlantic on April 21th. The installation on the structure began soon after the instruments arrival. The deployment took place on June 2th 2017, on the first ship availability time slot.

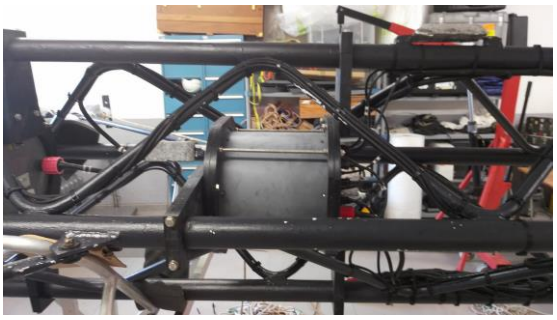
The Buoy was equipped with sensors used for the deployment of the buoy XVII recovered on June 6th 2016. The multispectral radiometers could not be repaired by the manufacturer so they are not integrated on the buoy from now on. The Strain-100 data logger could not be repaired as well, so the Strain-100 from the System #2 was used. The buoy was prepared in the CCI local in Villefranche-sur-Mer as usual.

Copper sheets and pieces were again fixed wherever possible to avoid biofouling arising. Aluminium plates (3 mm thickness) have again been fixed on the back side of the solar panels to reinforce them. The schedule used in more recent deployments was kept. The system was tested for some days running both with solar panel or ground alimentation.

The Delrin sleeves formerly used to fix the arms on the buoy structure were replaced by Erthalon articulated sleeves. This novelty was introduced to facilitate the deployment of the buoy at sea by divers. New "V" supports were also mounted on the trolleys to support the buoy when on land. These devices allowed not to dismount the arms for transport from the CCI local to the deployment site (see pictures below).

An intercalibration of all radiometers was performed before launch (see appendix) on May 11th 2017 (see appendix).





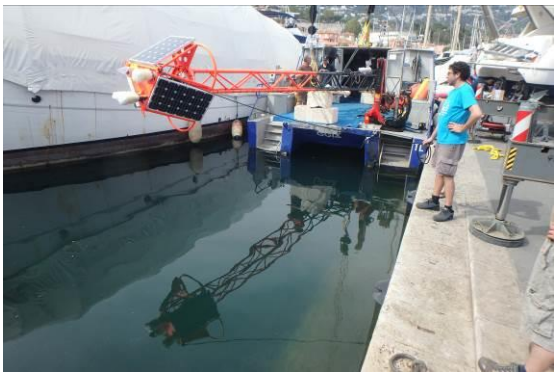












2.2 MOORING DEPLOYMENT

2.2.1 Friday 2nd June 2017

The upper structure to be deployed was brought to La Darse port in Villefranche at local 3:45 pm with the help of 6 people from LOV. Once unloaded the old structure, the buoy was loaded on board the GGIX with the help of the CCI crane. The 4 arms were fixed along the buoy structure with the new articulated sleeves positioned at 90°.

The Strain-100, pCO2 and 02 sensors at 3 m, and F3 at 9 m were dismounted from buoy XVIII and installed on buoy XIX. A recently calibrated ctd was also mounted at 3 m. The GGIX stayed in the Villefranche bay overnight and went to the BOUSSOLE site the day after to complete the installation of the upper superstructure. At about 9h00 the ARGOS messages started being dispatched, however they indicated a buoy malfunctioning.

At this date, buoy is equipped with:

- **DACNet #002**
- **CLC #002**
- **Junction Box #004**
- **OCP #040(4m) and OCP 041(9m)**
- **Hyper spectral units HOCR-RW #241_Lu4m and #242_Lu9m, HOCR-IW #399_Ed9m and #405_Ed9m, HOCR-IA #279_Es, STOR-X #032.**
- **HS4 #H4070403**
- **Strain-100 #001**
- **Transmissometers C-Star #1057-PR(4m) and #1058-PR(9m)**
- **ECOFLNTUs #726(4m) and #727(9m)**
- **ARGOS beacon #18797 (prog id#26021)**
- **CTD #37SI 46113-5325**
- **Strain gauge OML CSCB40K**
- **PAR #097**

The lower part of the buoy is still equipped with the two emergency ARGOS beacons.

2.2.2 Friday 9th June 2017

This day is part of the B#184 cruise. Divers went at sea to clean the underwater sensors, to perform dark measurements of the transmissometer and the backscattering meter and to take pictures. They also installed a newly calibrated pCO2 CARIOCA sensor at 10 m depth and a CONTROS HydroC CO2 sensor at 20 m depth for the MOOSE programme. In the meantime, buoy data were downloaded using the cable available at the top of the buoy, surface sensors and solar panels were cleaned.

2.2.3 Monday 3rd July 2017

This day is part of the B#185 cruise. Divers went at sea to perform maintenance on the buoy. Firstly, the connectors of the hyperspectral sensors at 9 m depth were checked: terminations of the Ed/Lu cables were inverted by mistake before the deployment of the buoy. So the divers reconnected the terminations at the correct instrument. Then, underwater sensors were cleaned, dark measurements of the transmissometer and the backscattering meter were performed and pictures were taken. The ARGOS beacon on the top of the buoy was replaced. Buoy data were downloaded using the cable available on the top of the buoy and surface sensors were cleaned. The configuration of the strain gauge interface on the DACNet was modified because the sensor was not working since the deployment of the buoy.

At this date, buoy is equipped with

- **ARGOS beacon #003 (prog id#26021)**

2.2.4 Tuesday 18rd July 2017

This day data transmitted by the ARGOS beacon indicated the buoy stopped working.

2.2.5 Thursday 20rd July 2017

This day the private boat PAPETEE from *Mediterranée Peche et Decouverte* in Beaulieu-sur-Mer was rent to go to the BOUSSOLE site. Two divers from OOV, Vincenzo Vellucci and Yann Hello were on board. First a seismic float was recovered 2 miles from the buoy. Then a ProVal float was deployed close to BOUSSOLE. Then divers went at sea and an AK connection on the top of the buoy was attempted unsuccessfully. Thee buoy was switched off and the DACNet dismounted. The Microdrive was removed and replaced with a spare retrieved from the previous deployment. The correct schedule was loaded on the Microdrive and tested before deployment. Fuses and battery within the DACNet were checked to be working correctly. In the meantime divers cleaned the optical sensors underwater and installed neoprene caps over the HSIV and transmissometer optical windows. Finally the DACNEt was mounted again on the buoy and a connection was obtained at 12h00 UTC, the buoy was working again correctly though the HyperEd9 was not working. Surface sensors were cleaned too. Then some connection attempt with the MUG sensor from Geoazur laboratory was performed before going back to Villefranche-sur-Mer.

2.2.6 Tuesday 8th August 2017

This day the private boat PAPETEE from *Mediterranée Peche et Decouverte* in Beaulieu-sur-Mer was rent to go to the BOUSSOLE site. Vincenzo Vellucci was on board with two divers from OOV. The mission was organized to replace the diving operations scheduled on board the *Thethys II* as divers were unavailable on those days. First divers went at sea to recover the F3 fluorometer for data download and battery replacement. Then the buoy was switched off and a cable from the old system was tested on the hyperspectral set at 9 m. The buoy was then switched on and an AK connection attempted unsuccessfully. Then a nominal connection was obtained and data downloaded, the hyperspectral Ed sensor at 9 m was now working correctly. The new cable was then fixed with tie-wraps. In the meantime in water and above water optical sensors were cleaned along with solar panels and ARGOS connector. Dark IOPs measurement were performed too. The Xmiss-OCP cable at 9 m was found to be damaged (see picture below).

2.2.7 Tuesday 22nd August 2017

This day the private boat PAPETEE from *Mediterranée Peche et Decouverte* in Beaulieu-sur-Mer was rent to go to the BOUSSOLE site. Emilie Diamond was on board with two divers from OOV. First the buoy

was switched off and the MOOSE pCO_2 sensor at 10 m was dismounted for battery replacement and data download (unsuccessful). Then the OCP-Xmiss cable at 9 m was replaced and buoy switched on. Optical sensors were cleaned underwater and on the buoy head, and dark IOPs measurements performed. Finally the MOOSE pCO_2 sensor was mounted again at 10 m depth.

2.2.8 Thursday 31st August 2017

This day the ARGOS messages indicated the buoy stopped working.

2.2.9 Saturday 16th September 2017

This day the private boat PAPETEE from *Mediterranée Peche et Decouverte* in Beaulieu-sur-Mer was rent to go to the BOUSSOLE site. Vincenzo Vellucci was on board with two divers from OOV. First the buoy was switched off and the DACNet dismounted then optical sensors underwater cleaned. The Microdrive was removed from the DACNet motherboard and replaced with a new one. Fuses and internal battery were checked to be OK. The schedule for the buoy XIX was loaded before mounting again the DACNet on the buoy. After that the buoy was switched on and the site was left before the arrival of strong wind on site.

2.2.10 Saturday 16th September 2017

This day is part of the MOOSE#112 cruise. Three divers from OOV were on board the *Tethys II* and went to the BOUSSOLE site for cleaning operations and dark IOPs measurements.

2.2.11 Tuesday 3th October 2017

This day is part of the MOOSE#113 cruise. Three divers from OOV were on board the *Tethys II* and went to the BOUSSOLE site for cleaning operations, dark IOPs measurements and taking pictures of the buoy.

2.2.12 Tuesday-Wednesday 18th October 2017

This day is part of the B#188 cruise. As the ARGOS sensor of the buoy did not transmit data, the first day the functioning of the buoy was verified. Then ARGOS connector, surface sensors and solar panels were cleaned. The second day divers went at sea to remove the CONTROS HydroC PCO2 sensor (MOOSE programme). They also cleaned the underwater sensors, performed dark IOPs measurements and took pictures. In the meantime, buoy data were downloaded using the cable available on the top of the buoy.

2.2.13 Saturday 22nd November 2017

This day the private boat PAPETEE from *Mediterranée Peche et Decouverte* in Beaulieu-sur-Mer was rent to go to the BOUSSOLE site. Vincenzo Vellucci was on board with two divers from OOV. First a new float equipped with a hydrophone was deployed close to the *Cote d'azur* buoy. Then the boat moved to BOUSSOLE and one of the three buoy solar panels was found broken. The buoy was switched off, the DACNet dismounted and the broken solar panel dismounted. The

Microdrive was removed from the DACNet motherboard and replaced with a new one. The new Microdrive, fuses and internal battery were checked to be OK. In the meantime then optical sensors underwater were cleaned. A Contros pC02 sensor was mounted at 20 m (and wrongly plugged to its battery underwater), whereas a Carioca pC02 sensor was dismounted at 3 m and replaced with recently calibrated one. The DACNet was mounted again on the buoy then the Battery and J/Box switched on. The buoy start working for few cycles then stopped again.

2.2.14 Tuesday 5th December 2017

This day is part of the B#190 cruise. When arrived at the BOUSSOLE site, divers went at sea to remove the DACNet from the buoy for its maintenance on board. The Microdrive was replaced. Then, the DACNet was reinstalled during a second dive. The oxygen optode sensor at 10 m depth was replaced with a newly calibrated one. Divers also cleaned the sensors and took pictures of the buoy. Surface sensors, solar panels and ARGOS connector were cleaned on the top of the buoy.

2.2.15 Monday 18th December 2017

This day the private boat PAPETEE from *Mediterranée Peche et Decouverte* in Beaulieu-sur-Mer was rent to go to the BOUSSOLE site. Melek Golbol was on board with two divers from OOV. Divers cleaned the underwater optical sensors and performed dark IOPs measurements. Data were downloaded after an AK reboot. The downloaded data started from January 1st 1970.

1970-01-01_00-15-00 is **2017-12-06_07-59-28.**

Sensors on the top of the buoy, solar panels and ARGOS connector were cleaned too.

2.2.16 Wednesday 24th January 2018

This day is part of the B#191 cruise. Divers went at sea to clean the sensors and to perform dark IOPs measurements. They also checked the connections (cables and connectors) of the STOR-X because the hyperspectral radiometers were not functioning. All the connections seemed to be alright. The CONTROS HydroC PCO2 sensor at 20 m depth was recovered in order to download data and change the batteries in the lab. It will be reinstalled during a following cruise, next to the PCO2 CARIOCA at 10 m depth. Buoy data were downloaded using the cable available at the top of the buoy and the configuration file in the DACNet was replaced. The ARGOS beacon connector and the solar panels were cleaned.

2.2.17 Monday-Friday 19th March 2018

This day is part of the B#193 cruise. The buoy was almost entirely under water because of strong currents. No operation was possible. Only the top of the buoy including solar panels, surface sensors and

ARGOS beacon were seen from the ship at the surface. One of the solar panel was broken.

2.2.18 Monday 26th March 2018

This day the private boat PAPETEE from *Mediterranée Peche et Decouverte* in Beaulieu-sur-Mer was rent to go to the BOUSSOLE site. Vincenzo Vellucci was on board with 3 divers from OOV. When on site divers dismounted DACNet from the buoy for exchange of the Microdrive and cleaned optical sensors. In the meantime a broken solar panel on the buoy head was replaced with a new one. Then divers definitively dismounted the F3 fluorometer from the buoy and replaced the CARIOCA pC02 at 10m with a recently calibrated one. Finally the DACNet, which had several connectors oxidized, mounted again on the buoy. The buoy started working again, though from ARGOS message dispatch the CTD probe seemed to be out of order, likely due to the DACNet connector. Two days after the buoy stopped working again. Surprisingly data retrieved from the corrupted Microdrive included data from the Hyperspectral set of radiometers + PAR. Given the recurrent issues experienced on this system the decision to wait for the delivery of the twin system for a deployment as soon as possible is taken.

2.2.19 Wednesday 18th April 2018

This day is part of the B#194 cruise. One of the solar panel on the buoy was broken.

2.2.20 Thursday 26th July 2018

This day is part of the B#198 cruise on board the Sagitta III. When arrived at BOUSSOLE, divers went at sea to clean the instruments, to take photos and to install a CTD at 3 m (and recover the one previously at sea) and a pCO2 CARIOCA sensor at 10 m depth. The O2 optode sensor at 3 m depth was recovered. Data were not acquired from this instruments. Further test in the lab revealed that the start logging command based on the date does not work (software bug). For next deployments a manual start is recommended.

2.2.21 Friday 28th September 2018

This day the private boat PAPETEE from *Mediterranée Peche et Decouverte* in Beaulieu-sur-Mer was rent to go to the BOUSSOLE site (Y. Hello program). Two divers from OOV were on board and cleaned the optical sensors.

2.2.22 Wednesday 5th December 2018

This day is part of the B#203 cruise. When arrived on site, divers went at sea to install the PCO2 CARIOCA sensor at 3 m depth. The sensor in place at 3 m was left in place and recovered later (after buoy recovery. Divers also cleaned the optical sensors but they could not take pictures because of the strong currents.

2.2.23 Fryday 15th February 2019

The buoy was dismounted from the lower structure from Léo Gimenez and other divers with the help of the GGIX ship from IXSURVEY. The buoy was then transported to the Villefranche port and unloaded with the help the port authorities' crane at about 17h30, where it spent the night. A pCO2 sensor and a CTD were dismounted for being mounted on the second buoy (buoy XX). The day after the buoy was cleaned with Karcher before being stored into the CCI local. The buoy was dismounted in the following days and instruments were shipped for calibration on July 15th and arrived to the different companies within few days. The aluminium structure was sent to the BSS Company in Biot on September 26th.

3 QUANTITATIVE SUMMARY

The deployment lasted 564 days, 361 days were without data due to a failure of the Microdrive/DACNet (this include data acquired without Tilt/Compass).

4 INSTRUMENT SCHEDULE

1 minute acquisition every 15 minutes. The timing of the schedule was: light 03:00:00 to 21:00; dark 21:00:00 to 03:00:00. Store-X and CISCO were cut off during night.

5 ANY PROBLEMS ENCOUNTERED?

1- The ARGOS dispatch stopped several times.

2- The microdrive failed five times.

3- Three solar panel broke during the deployment

4- All but Hyperspectral package failed after February 2018.

6 LESSONS LEARNED

1- The new articulated arms were successful, a minor modification on the structure is needed to introduce a fixation point for the buoy arms in the closed position. The buoy can exit from the buoy workshop without dismounting the arms.

7 APPENDIX

The following pages contains the results of the radiometers test, the schema of the buoy, the list of the calibration files, and calibration/repair reports from factories.

Radiometer Test

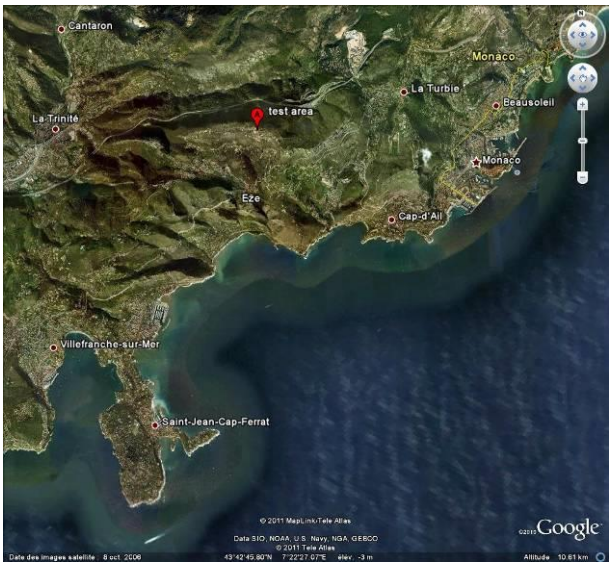
On May 11th 2017 a field campaign to test the buoy radiometers relative performances was organized at the Fort de la Revere. The fort is located at north of the Eze village at about 700m on the sea level (see images below), and near the fort there's a plane field free of obstacles that could cause shadow or glint above radiometers.

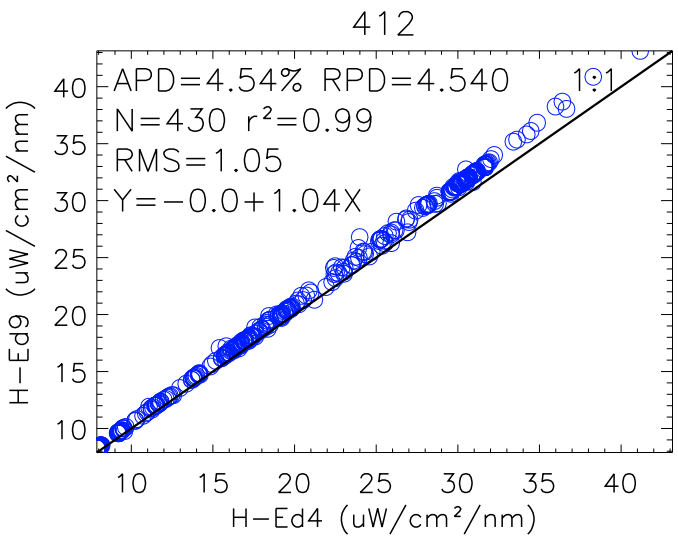
All the radiometers used for the buoy were fixed upon a table facing the zenith. The Ed sensors were covered with teflon caps produced at LOV whereas Lu sensors were looking at 45° towards a white Tarpaulin textile target.

The radiometers were all connected as for the buoy deployment. The system schedule was modified to acquire data every 10 minutes instead of 15.

Data were acquired for about 7 hours.

Sky conditions were good. The choice to compare single data by using the TIMETAG variable recorded in data files was maintained.

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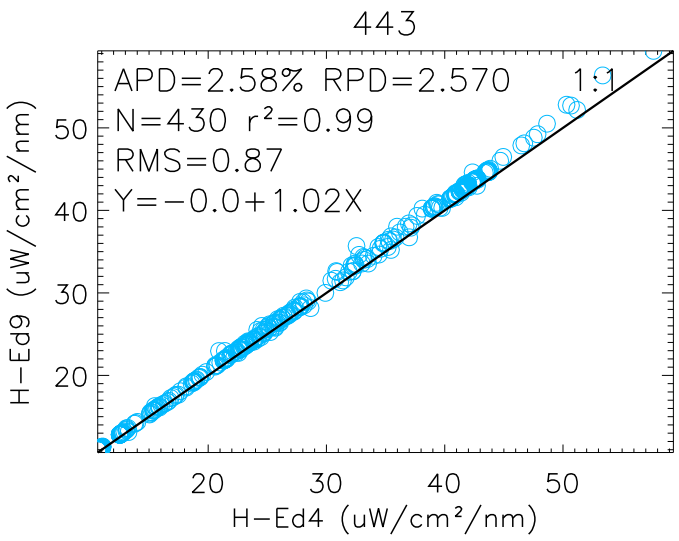
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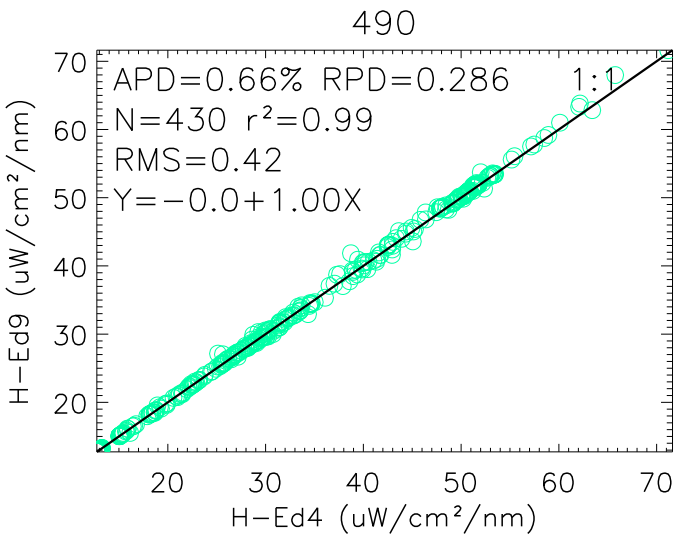
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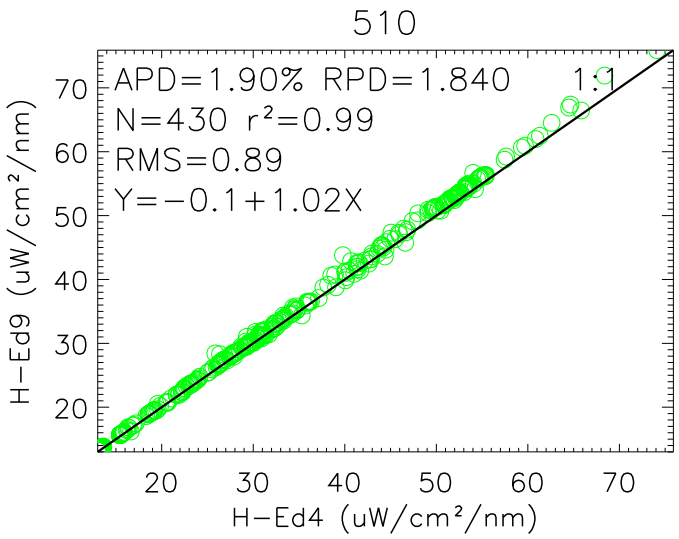
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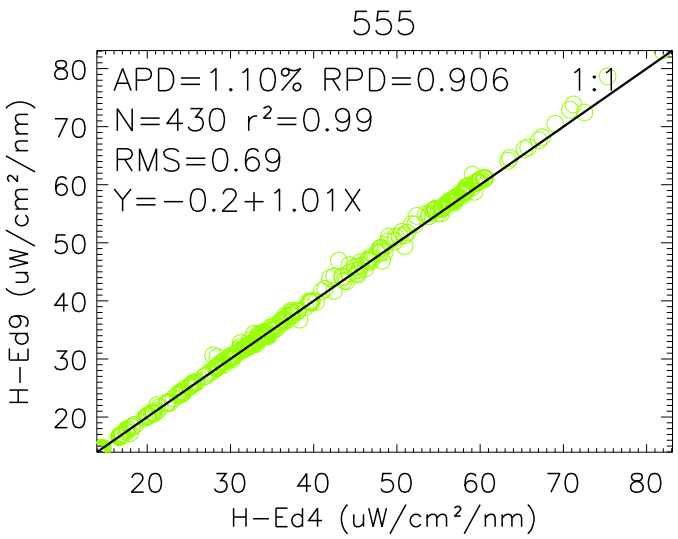
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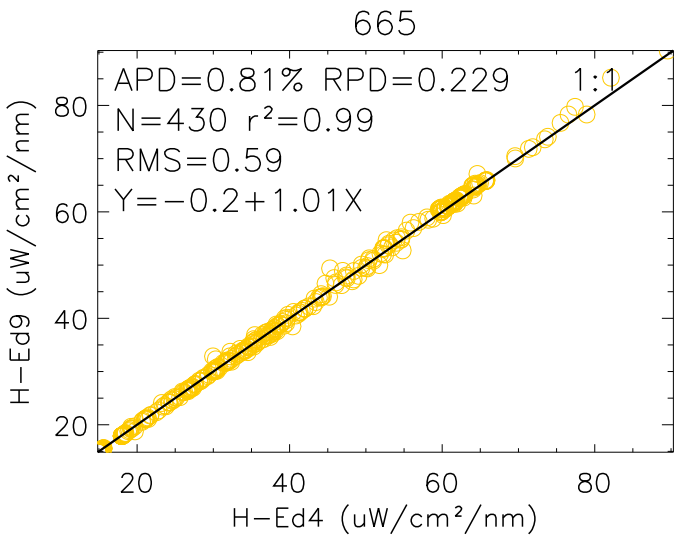
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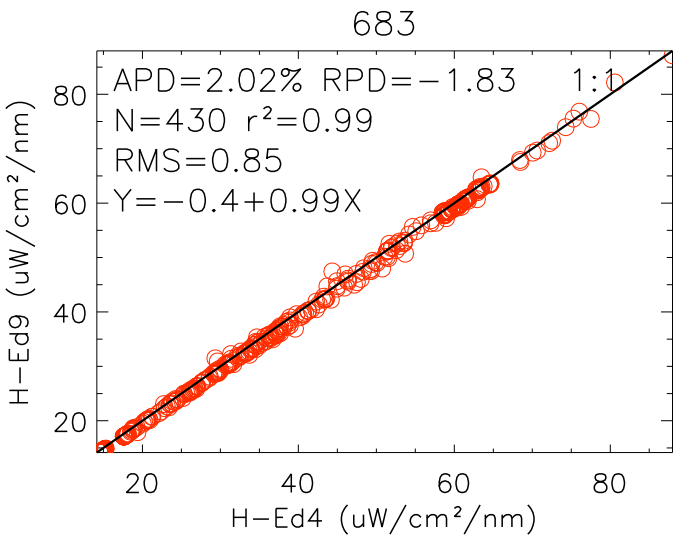
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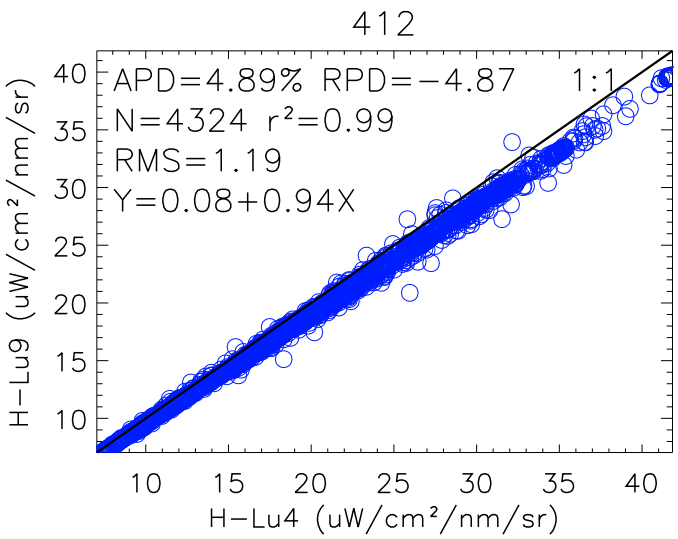
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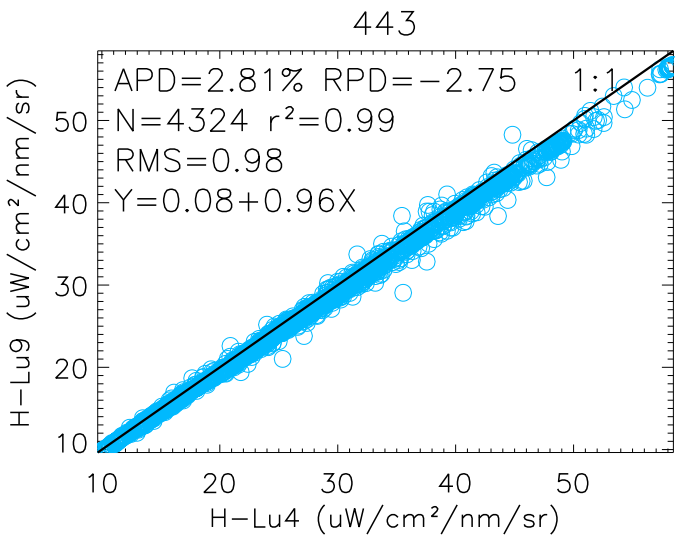
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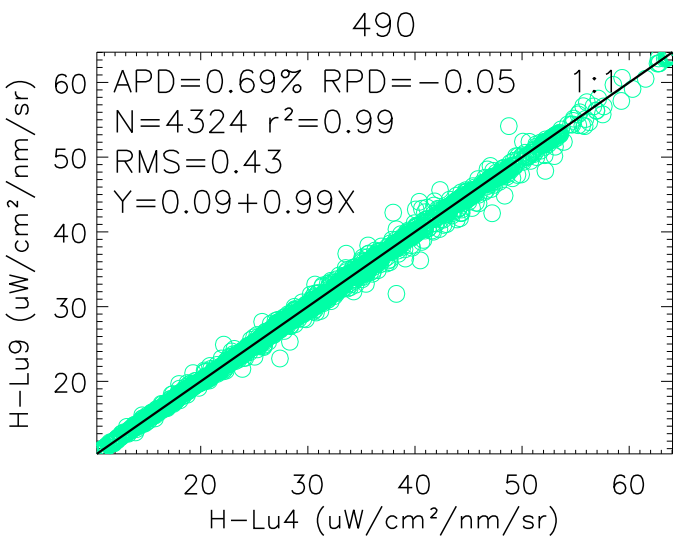
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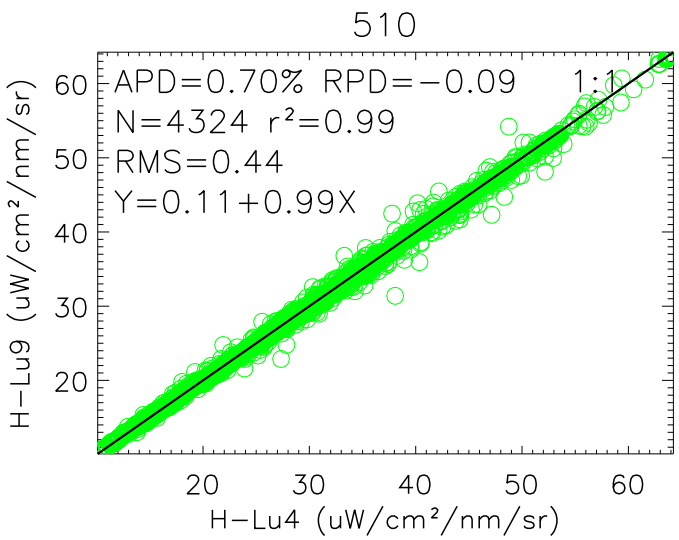
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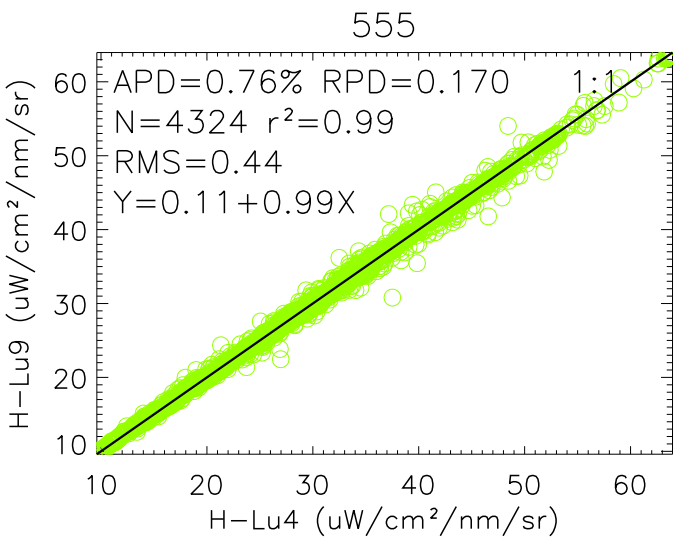
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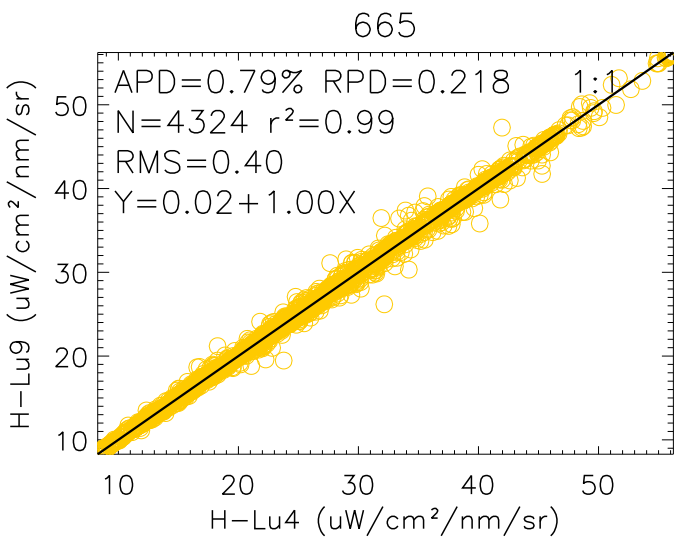
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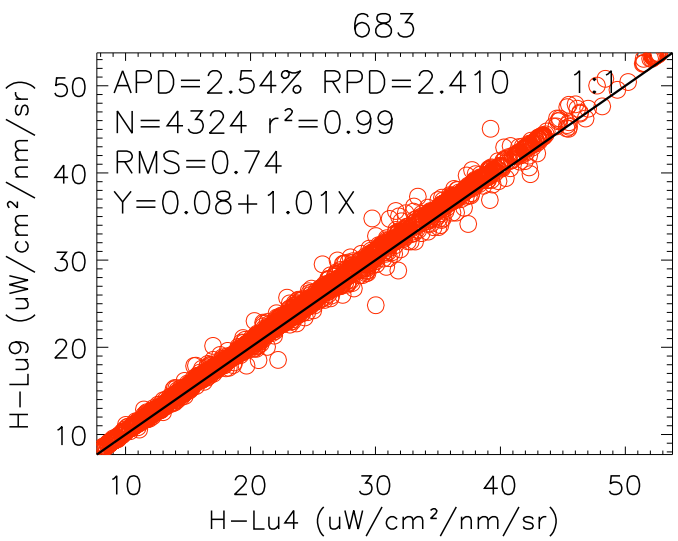
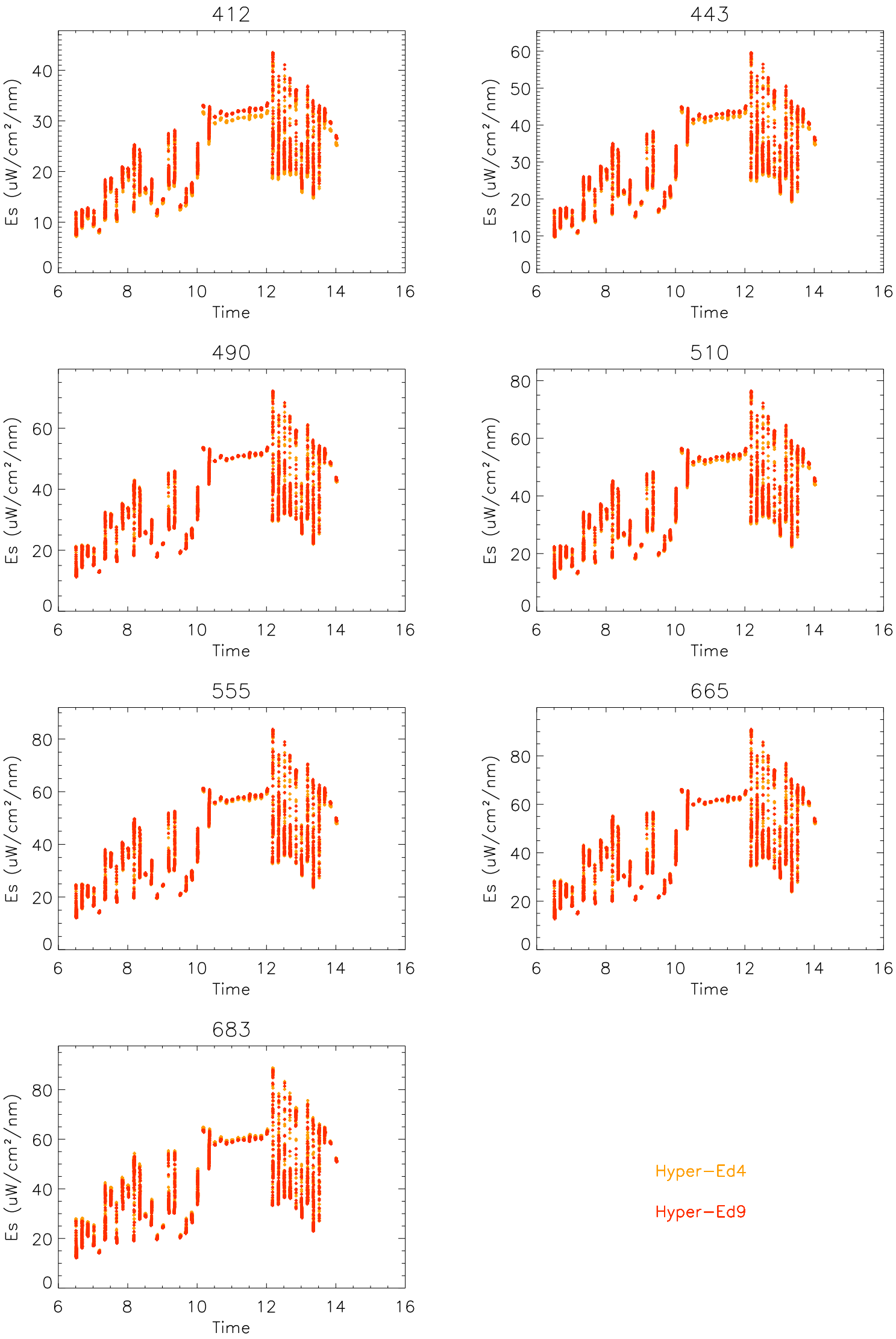
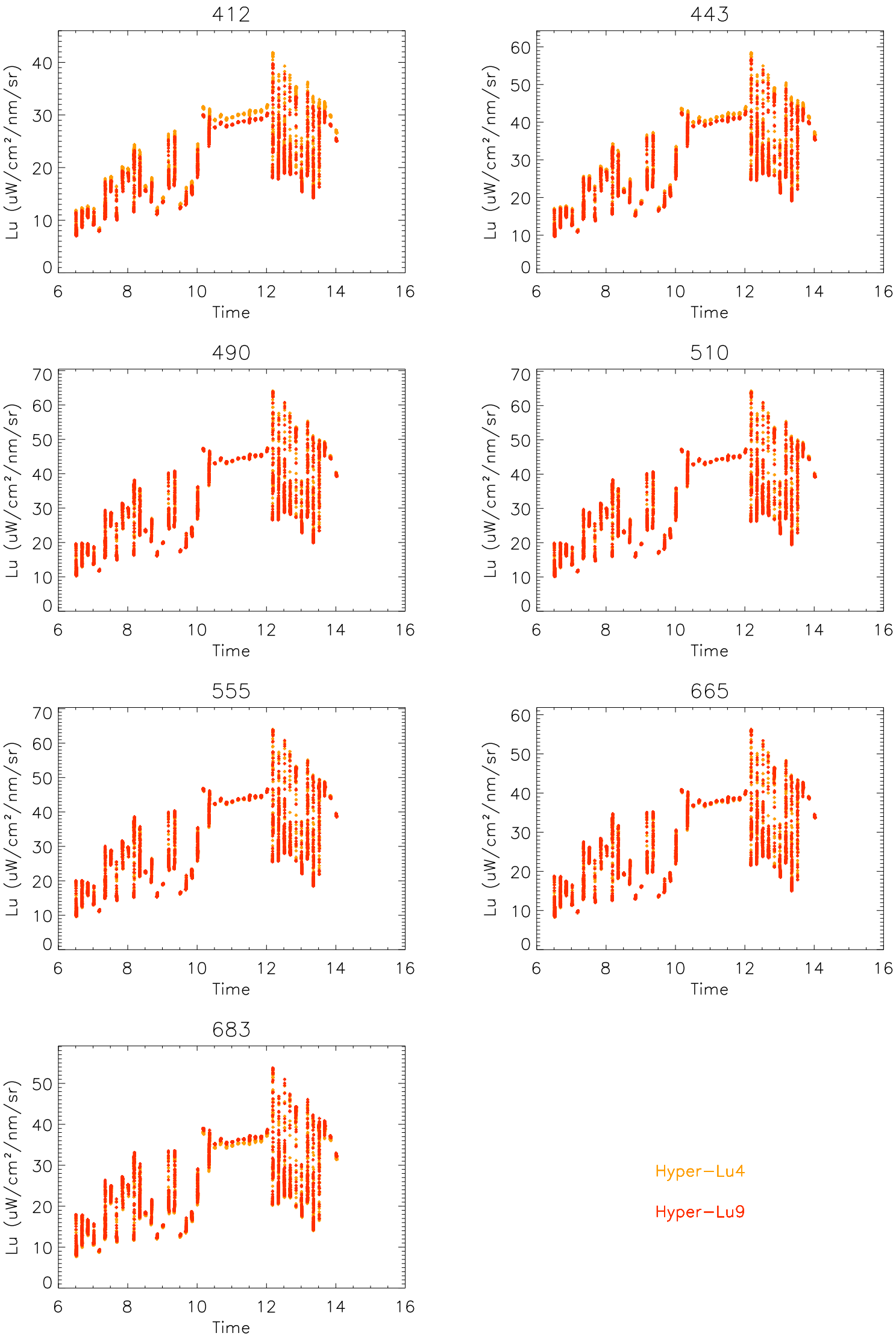
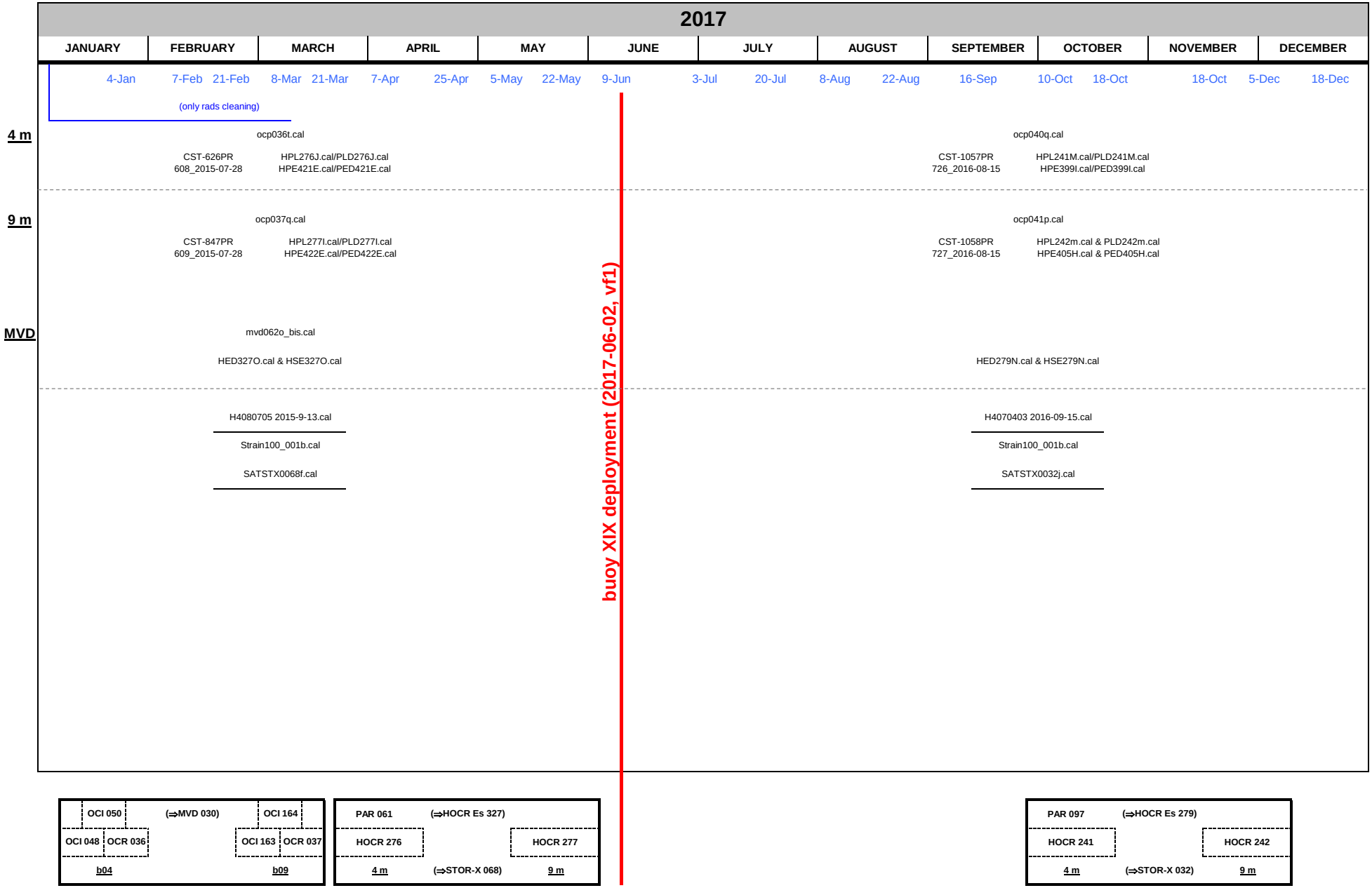
H−Lu9 (uW/cm²/nm/sr)
H−Lu4 (uW/cm²/nm/sr)


683
APD=2.54% RPD=2.410 1:1
N=4324 r²=0.99
RMS=0.74
Y=0.08+1.01X
H−Lu9 (uW/cm²/nm/sr)
H−Lu4 (uW/cm²/nm/sr)


412
443
490
510
555
665
683
Es (uW/cm²/nm)
Time
Hyper−Ed4
Hyper−Ed9


412
443
490
510
555
665
683
Lu (uW/cm²/nm/sr)
Time
Hyper−Lu4
Hyper−Lu9


2017
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER
4-Jan
7-Feb
21-Feb
8-Mar
21-Mar
7-Apr
25-Apr
5-May
22-May
9-Jun
3-Jul
20-Jul
8-Aug
22-Aug
16-Sep
10-Oct
18-Oct
18-Oct
5-Dec
18-Dec
(only rads cleaning)
4 m
ocp036t.cal
CST-626PR
608_2015-07-28
HPL276J.cal/PLD276J.cal
HPE421E.cal/PED421E.cal
ocp040q.cal
CST-1057PR
726_2016-08-15
HPL241M.cal/PLD241M.cal
HPE399I.cal/PED399I.cal
9 m
ocp037q.cal
CST-847PR
609_2015-07-28
HPL277I.cal/PLD277I.cal
HPE422E.cal/PED422E.cal
ocp041p.cal
CST-1058PR
727_2016-08-15
HPL242m.cal & PLD242m.cal
HPE405H.cal & PED405H.cal
MVD
mvd062o_bis.cal
HED327O.cal & HSE327O.cal
HED279N.cal & HSE279N.cal
H4080705 2015-9-13.cal
Strain100_001b.cal
SATSTX0068f.cal
H4070403 2016-09-15.cal
Strain100_001b.cal
SATSTX0032j.cal
buoy XIX deployment (2017-06-02, vf1)
OCI 050
(⇒MVD 030)
OCI 164
OCI 048
OCR 036
OCI 163
OCR 037
b04
b09
PAR 061
(⇒HOCR Es 327)
HOCR 276
HOCR 277
4 m
(⇒STOR-X 068)
9 m
PAR 097
(⇒HOCR Es 279)
HOCR 241
HOCR 242
4 m
(⇒STOR-X 032)
9 m

2018

JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER

24-Jan

(only rads cleaning)

26-Mar

26-Jul

28-Sep

4 m

ocp040q.cal

CST-1057PR
726_2016-08-15

HPL241M.cal/PLD241M.cal
HPE399I.cal/PED399I.cal

9 m

ocp041p.cal

CST-1058PR
727_2016-08-15

HPL242m.cal & PLD242m.cal
HPE405H.cal & PED405H.cal

HED279N.cal & HSE279N.cal

H4070403 2016-09-15.cal

Strain100_001b.cal

SATSTX0032j.cal

PAR 097	(⇒HOCR Es 279)	
HOCR 241		HOCR 242
4 m	(⇒STOR-X 032)	9 m

Customer Service Report

SATLANTIC

RMA 2016-208

Instrument (S/N)	DACNet (002)
Reason for return	Recal
Arrived	Jul.14/2016

Vincenzo Vellucci
CNRS-UPMC

Calibration Details
None

Customer Observations
Radiometers: inspection + post calibration +cosine scans +final calibration + final test with solar panels
Other components: inspection + final test with solar panels

Service Observations
2 pin manual reset connector requires replacement. New microdrive required.

Physical check
2 pin micro connector has some corrosion. Otherwise acceptable condition.

Final cal results
none

Post cal summary
none

Under warranty
no

Description of Work Performed

Date	Work Done	Tech
Nov.22/2016	Replaced manual reset 2 pin connector. Cleaned all connectors. Removed Hitachi 3GB microdrive B4RN99JA 54A for archiving. Noted endcap orientation for reinstall.	DA
Nov.25/2016	Checked all internal wiring, and replaced fuses. Installed new microdrive Hitachi 3GB B4R5AAMA 53A. Installed 9 volt Lithium battery. Powered with DC power supply, and verified correct operation. Set system to run with CLC and Battery, and external supply to simulate solar charge.	DA
Mar.24/2017	Installed new Lithium 9 Volt battery. Set system to run with all sensor overnight.	DA
Mar.25/2017	Overnight test found no data logged for StorX system. Ran port link testing. Discovered problem of no StorX data coming through. StorX system runs fine separated from DacNET.	DA
Mar.27/2017	Discovered problem with StorX (Port AG) operation. Replaced 6 pin bulkhead connector on port AG. Installed new wiring for Port AG to use relay #7. Altered telemetry.xml file to specify relay 7 for StorX and HyperOCR instruments. Installed new quad port serial card for "A" ports. Problem solved. Altered dark schedule file to start at 21:15 (rather than 21:00). This solves the MVD file lockup problem which occurs on schedule change from light to dark.	DA

	Verified port link operation with all instruments. Completed Verification checks on system. Set system running on schedule with all instruments attached.	
Mar.29/2017	Verified data logging as expected. Reassembled Dacnet enclosure, aligning 2 pin power connector with North orientation of tilt module.	DA

Work/Quality Verification Results

Boat Test [ ]

Intercomparison Test [ ]

Post Cal [ ]

Quality Assurance

Signed _____

Date March 30, 2017

Customer Service Report

SATLANTIC

RMA 2016-208

Instrument (S/N) Stor-X (032)
Reason for return Recal
Arrived Jul.14/2016

Vincenzo Vellucci
CNRS-UPMC

Calibration Details

Head	S/N	Digital NID	Comments	Post Cal File	Final Cal File
HPL	242			HPL242M.cal, PLD242M.cal, STX0032_17Feb15.sip	
PAR	097			satstx0032i.cal	satstx0032j.cal, STX0032_17Feb15.sip
HPE	399			HPE399H.cal PLD399H.cal	HPE399I.cal, PLD399I.cal, STX0032_17Feb15.sip
HSE	279			HSE279N.cal, HLD279N.cal, STX0032_17Feb15.sip	
HPL	241			HPL241M.cal, PLD241M.cal, STX0032_17Feb15.sip	
HPE	405			HPE405F.cal PLD405F.cal	HPE405H.cal, PED405H.cal, STX0032_17Feb15.sip

Customer Observations

Radiometers: inspection + post calibration +cosine scans +final calibration + final test with solar panels
Other components: inspection + final test with solar panels

Physical check

Stor-X 032 arrived in good physical condition.

Post cal summary

For HSE s/n 279, all of the wavelengths are within spec.
For HPE s/n 399, all of the wavelengths are within

Service Observations

Stor-X 032 was operational as received, but telemetry was not functional on port 5.

Final cal results

Final calibration completed on PAR s/n 0097 and HPE s/n 0399 and 405.

Under warranty

no

spec.But darks are noisy.
For HPE s/n 405, all of the wavelengths are within spec.But darks are noisy.
For HPL s/n 241, all of the wavelengths are within spec.
For HPL s/n 242, all of the wavelengths are within spec.But darks looks like light spectrum but at low levels. This was seen the last time it was caled too.
For PAR s/n 097, it is not within spec. Cosine collector is damaged.

Description of Work Performed

Date	Work Done	Tech
Jul.29/2016	Post calibrations completed on HyperOCRs only.	JS
Aug.31/2016	Completed initial inspection for Stor-X. Captured customer configuration and setup for Stor-X.	MJ
Sep.22/2016	STOR-X: Replaced RTC battery. Tested clock - passed Tested all ports - passed. Replaced desiccant, nitrogen-purged.	JF
Oct.3/2016	Post calibrations completed on PAR s/n 097	JS
Oct.3/2016	HPL 241 & 242 intercompared & reality-checked - passed.	RB
Oct.4/2016	HPE 279 intercompared & reality-checked - passed.	RB
Oct.7/2016	Final calibration completed on PAR s/n 0097.	JS
Oct.11/2016	Final calibration completed on HPE s/n 399	JS
Oct.12/2016	Final calibration completed on HPE s/n 405	JS
Oct.12/2016	HPE 399 intercompared & reality-checked - passed.	RB
Dec.13/2016	HPE 405 cosine scanned - failed.	SM
Dec.14/2016	HSE 279 cosine scanned - passed.	SM
Dec.20/2016	HPE 399 cosine scanned - passed.	SM
Dec.21/2016	Replaced HPE 405 outer diffuser.	KD
Feb.14/2017	HPE 405 cosine scanned - passed.	SM
Feb.15/2017	Final calibration completed on HPE s/n 405	JS
Feb.16/2017	HPE 405 intercompared & reality-checked - passed.	KD
Mar.27/2017	Performed final testing of StorX and HyperOCR sensor on DacNET.	DA

Work/Quality Verification Results

Boat Test	[ ]
Intercomparison Test	[✓]
Post Cal	[✓]

Quality Assurance

Signed _____

Date March 30, 2017

Customer Service Report

SATLANTIC

RMA 2016-208

Instrument (S/N) OCP-100 (41)
Reason for return Recal
Arrived Jul.14/2016

Vincenzo Vellucci
CNRS-UPMC

Calibration Details

Head	S/N	Digital NID	Comments	Post Cal File	Final Cal File
OCI-200	047			OCP041O.cal	OCP041P.cal
OCI-200	109			OCP041O.cal	OCP041P.cal
OCR-200	038			OCP041O.cal	OCP041P.cal

Customer Observations
Radiometers: inspection + post calibration +cosine scans +final calibration + final test with solar panels
Other components: inspection + final test with solar panels

Service Observations
Ed channel 1 needs repair to correct dark offset.

Physical check
4 pin connector has some damage - replacement required.

Final cal results
none

Post cal summary
FOR OCR200 s/n 038, all of the filters are within spec.
FOR OCI200 s/n 109, all of the filters are within spec, except for 412, 490, 510 and 560.
FOR OCI200 s/n 047, all of the filters are within spec.

Under warranty
no

Description of Work Performed

Date	Work Done	Tech
Aug.12/2016	Post calibrations completed.	JS
Nov.23/2016	Cleaned and checked connectors. Port testing found Ed port Channel 1 has dark offset that requires repair. 4 pin connector has some damage.	DA
Nov.24/2016	Repaired channel 1 of ANC 1. Replaced 4 pin connector. Replaced endcap o-rings and sealed instrument.	DA
Nov.25/2016	Updated calibration file for Cstar Transmissometer	DA
Mar.27/2017	OCP is operational and all dark currents are with specification. Radiometers are not working, so final testing was completed without radiometers connected.	DA

Work/Quality Verification Results

Boat Test	[ ]
Intercomparison Test	[ ]
Post Cal	[✓]

Quality Assurance

Signed _____

Date March 30, 2017

Customer Service Report

SATLANTIC

RMA 2016-208

Vincenzo Vellucci
CNRS-UPMC

Instrument (S/N)	OCP-100 (40)
Reason for return	Recal
Arrived	Jul.14/2016

Calibration Details

Head	S/N	Digital NID	Comments	Post Cal File	Final Cal File
OCI-200	040			OCP040P.cal	OCP040Q.cal
OCI-200	035			OCP040P.cal	OCP040Q.cal
OCR-200	035			OCP040P.cal	OCP040Q.cal

Customer Observations

Radiometers: inspection + post calibration +cosine scans +final calibration + final test with solar panels
Other components: inspection + final test with solar panels

Service Observations

none

Physical check

none

Final cal results

none

Post cal summary

For OCI-200 s/n 035, all of the filters are within spec, except for 412. Further testing is required.Also there are high darks on channels 1,2,3,5,6,7
For OCI-200 s/n 040, all of the filters are within spec, except for 510. Further testing is required Also there are noise on channels 2,3,7
For OCR-200 s/n 035, all of the filters are within spec.

Under warranty

no

Description of Work Performed

Date	Work Done	Tech
Aug.15/2016	Post calibrations completed.	JS
Nov.3/2016	OCI-200 035: Replaced bulkhead connection to interface circuit board.	KD
Nov.23/2016	Inspected and cleaned connectors. Performed port testing, no additional repair required.	DA
Nov.25/2016	Updated calibration file for Cstar Transmissometer	DA
Dec.13/2016	OCI-200 035: Adjusted saturation value on 560nm channel.	KD
Mar.27/2017	OCP is operational and all dark currents are with specification. Radiometers are not working, so final testing was completed without radiometers connected.	DA

Work/Quality Verification Results

Boat Test	[ ]
Intercomparison Test	[ ]
Post Cal	[✓]

Quality Assurance

Signed Darell Adams

Date March 30, 2017

Customer Service Report

SATLANTIC

RMA 2016-208

Vincenzo Vellucci
CNRS-UPMC

Instrument (S/N)	Battery Case (04)
Reason for return	Recal
Arrived	Jul.14/2016

Calibration Details
None

Customer Observations
Radiometers: inspection + post calibration +cosine scans +final calibration + final test with solar panels
Other components: inspection + final test with solar panels

Service Observations
Verified switch functionality and action
Replaced fuses

Physical check
none

Final cal results
none

Post cal summary
none

Under warranty
no

Description of Work Performed

Date	Work Done	Tech
Oct.25/2016	Replaced fuses and verified switch action and functionality.	SM
Mar.24/2017	Inspected battery internals. Inspected valve core. Cleaned o-ring. Upon inspection valve core was set to ~0.75 turns from fully seated. Reset to 4 turns from bottom. Verified operation - Battery pack used for testing and charging functionality for several weeks. Switch was cycled many times in both directions during testing with no problem found.	DA

Work/Quality Verification Results

Boat Test	[ ]
Intercomparison Test	[ ]
Post Cal	[ ]

Quality Assurance

Signed David Allen

Date March 30, 2017

Customer Service Report

SATLANTIC

RMA 2016-208

Vincenzo Vellucci
CNRS-UPMC

Instrument (S/N)	MVDS (053)
Reason for return	Recal
Arrived	Jul.14/2016

Calibration Details

Head	S/N	Digital NID	Comments	Post Cal File	Final Cal File
MVDS	053			MVD053Q.cal	

Customer Observations

Radiometers: inspection + post calibration +cosine scans +final calibration + final test with solar panels
Other components: inspection + final test with solar panels

Service Observations

none

Physical check

none

Final cal results

none

Post cal summary

For OCI200 s/n 095, all of the filters are NOT within spec except for 670. There is cosine collector damage to 6 channels.

Under warranty

no

Description of Work Performed

Date	Work Done	Tech
Aug.12/2016	Post calibration completed on OCI200 s/n 095.	JS
Mar.27/2017	Final testing performed on DacNET. Instrument dark current is normal. No radiometer was used for final testing.	DA

Work/Quality Verification Results

Boat Test	[ ]
Intercomparison Test	[ ]
Post Cal	[ ]

Quality Assurance

Signed _____

Date March 30, 2017

Customer Service Report

SATLANTIC

RMA 2016-208

Vincenzo Vellucci
CNRS-UPMC

Instrument (S/N)	HyperOCR I (399)
Reason for return	Recal
Arrived	Jul.14/2016

Calibration Details
None

Customer Observations
Radiometers: inspection + post calibration +cosine scans +final calibration + final test with solar panels
Other components: inspection + final test with solar panels

Service Observations
Sensor is operational and current draw is ~10 mA higher than expected.

Physical check
none

Final cal results
none

Post cal summary
none

Under warranty
no

Description of Work Performed

Date	Work Done	Tech
Oct.7/2016	Replaced analog board. Cleaned and re-greased Orings.	RB
Oct.12/2016	Performed intercomparison.	RB

Work/Quality Verification Results

Boat Test	[ ]
Intercomparison Test	[ ]
Post Cal	[ ]

Quality Assurance

Signed David Adam

Date March 30, 2017

Customer Service Report

SATLANTIC

RMA 2016-208

Instrument (S/N) Strain-100 (002)
Reason for return Recal
Arrived Jul.14/2016

Vincenzo Vellucci
CNRS-UPMC

Calibration Details
None

Customer Observations
Radiometers: inspection + post calibration +cosine scans +final calibration + final test with solar panels
Other components: inspection + final test with solar panels

Service Observations
none

Physical check
4 pin connector is damaged

Final cal results
none

Post cal summary
none

Under warranty
no

Description of Work Performed

Date	Work Done	Tech
Mar.27/2017	Final testing found that voltage out to strain sensor is only ~3 volts. Unit has voltage regulator circuit damage that is not able to be repaired. 4 pin connector not replaced as a result.	DA

Work/Quality Verification Results

Boat Test [ ]
Intercomparison Test [ ]
Post Cal [ ]

Quality Assurance

Signed
Date March 30, 2017

March 30, 2017

Customer Service Report

SATLANTIC

RMA 2016-208

Vincenzo Vellucci
CNRS-UPMC

Instrument (S/N)	ARGOS (18797)
Reason for return	Recal
Arrived	Jul.14/2016

Calibration Details
None

Customer Observations
Radiometers: inspection + post calibration +cosine scans +final calibration + final test with solar panels
Other components: inspection + final test with solar panels

Service Observations
Instrument has no physical problems

Physical check
Instrument has no physical problems

Final cal results
none

Post cal summary
none

Under warranty
no

Description of Work Performed

Date	Work Done	Tech
Mar.27/2017	Tested for several weeks. Correct operation verified using signal tester.	DA

Work/Quality Verification Results

Boat Test	[ ]
Intercomparison Test	[ ]
Post Cal	[ ]

Quality Assurance

Signed _____

Date March 30, 2017

Customer Service Report

SATLANTIC

RMA 2016-208

Instrument (S/N)	Junction Box (004)	Vincenzo Vellucci
Reason for return	Recal	CNRS-UPMC
Arrived	Jul.14/2016	

Calibration Details
None

Customer Observations
Radiometers: inspection + post calibration +cosine scans +final calibration + final test with solar panels
Other components: inspection + final test with solar panels

Service Observations
Service complete.
-Replaced fuses
-Verified diodes

Physical check
none

Final cal results
none

Post cal summary
none

Under warranty
no

Description of Work Performed

Date	Work Done	Tech
Oct.21/2016	Service complete. Replaced fuses. Verified diodes.	SM
Nov.25/2016	Verified correct operation	DA
Mar.27/2017	Performed final testing. Used all 3 solar panel ports individually to verify correct operation.	DA

Work/Quality Verification Results

Boat Test	[ ]
Intercomparison Test	[ ]
Post Cal	[ ]

Quality Assurance
Signed David Allen
Date March 30, 2017

Customer Service Report

SATLANTIC

RMA 2016-208

Vincenzo Vellucci
CNRS-UPMC

Instrument (S/N)	CLC (002)
Reason for return	Recal
Arrived	Jul.14/2016

Calibration Details
None

Customer Observations
Radiometers: inspection + post calibration +cosine scans +final calibration + final test with solar panels
Other components: inspection + final test with solar panels

Service Observations
No problems found

Physical check
No problems found

Final cal results
none

Post cal summary
none

Under warranty
no

Description of Work Performed

Date	Work Done	Tech
Nov.25/2016	Verified correct operation. Low voltage disconnect is 9.49 Volts. 10.71 Volts required to trigger load power after LVD. 15.5 Volts required from solar panel to turn on load (without battery).	DA
Mar.27/2017	Final testing performed without issue	DA

Work/Quality Verification Results

Boat Test	[ ]
Intercomparison Test	[ ]
Post Cal	[ ]

Quality Assurance

Signed Dan Wade

Date March 30, 2017

Customer Service Report

SATLANTIC

RMA 2016-208

Instrument (S/N) Solar Panels ()
Reason for return Recal
Arrived Jul.14/2016

Vincenzo Vellucci
CNRS-UPMC

Calibration Details
None

Customer Observations
Radiometers: inspection + post calibration +cosine scans +final calibration + final test with solar panels
Other components: inspection + final test with solar panels

Service Observations
3 Solar panels received and inspected.
1 panel is an older model.

Physical check
Visual inspection of panel surfaces and cables

Final cal results
none

Post cal summary
none

Under warranty
no

Description of Work Performed

Date	Work Done	Tech
Oct.25/2016	Visual inspection of panel surfaces and cables.	SM

Work/Quality Verification Results

Boat Test [ ]
Intercomparison Test [ ]
Post Cal [ ]

Quality Assurance

Signed
Date March 30, 2017

Customer Service Report

SATLANTIC

RMA 2016-208

Instrument (S/N) Various Cables ()
Reason for return Recal
Arrived Jul.14/2016

Vincenzo Vellucci
CNRS-UPMC

Calibration Details
None

Customer Observations
Radiometers: inspection + post calibration +cosine scans +final calibration + final test with solar panels
Other components: inspection + final test with solar panels

Service Observations
Found the STOR-X-HyperEs to not have connections on 3-3 and 4-4 - will need to be repaired/replaced.

Physical check
DACNet-MVD: Nothing to report.
DACNet-OCP 4m: Nothing to report.
DACNet-OCP 9m: Not returned.
DACNet-ECO-FLNTU 4m: Nothing to report.
DACNet-ECO-FLNTU 9m: Nothing to report.
DACNet-CTD: Nothing to report.
DACNet-HS4: Nothing to report.
DACNet-CLC: Nothing to report.
DACNet-STOR-X: Nothing to report.
DACNet -Strain-100: Nothing to report.
STOR-X-HyperEs: 3-3 and 4-4 do not connect.
STOR-X_HyperEd/Lu 4m: Nothing to report.
STOR-X_HyperEd/Lu 9m: Nothing to report.
STOR-X-PAR:
OCP-C-Star 4m:
OCP-C-Star 9m:
CLC-J/Box: Nothing to report.
CLC-Battery: Nothing to report.

Final cal results
none

Post cal summary
none

Under warranty
no

Description of Work Performed

Date	Work Done	Tech
Jul.25/2016	Performed physical inspection of cables.	CB
Mar.24/2017	Verified operation of all cables. New cables include:	DA

	Qty 7, 12pin radiometer cables OCP to Cstar Cable AGROs wildcat to DacNET cable OCP 9M to DacNET Port AE Cable DacNET to CISCO Ethernet Cable	

Work/Quality Verification Results

Boat Test	[ ]
Intercomparison Test	[ ]
Post Cal	[ ]

Quality Assurance

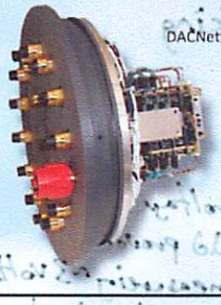
Signed Dall Allan

Date March 30, 2017

SAT-QR-87001
Verification Checklist
CNRS Mooring System (Page 1 of 3)

SATLANTIC

This document is the final inspection, verification checklist for Satlantic's CNRS Mooring System. The inspection is performed after all other work has been completed, before it is shipped to a customer. The inspection is conducted and QA counter signed by qualified Satlantic Technicians.


DACNet with enclosure removed

RMA Number: 2016-208
Date: March 25, 2017
Primary Technician: Darrell Adams

Satlantic Mooring System Manager:

- [DA] Final internal inspection (wiring, loctite, silicone, etc)
- [DA] Verify fuses
- [DA] Install new 9 Volt Lithium Battery March 24, 2017
- [DA] Verify operation of ports:
  Serial: [✓] CISCO: [✓] Manual Override: [✓] Console: [✓]
- [DA] Current draw at 12 Volts 1240 mA
- [DA] Archive Microdrive Incoming B4RN995A 54A
- [DA] Archive Microdrive Outgoing B4R5AAMA 53A

Satlantic MORS 4 Meter:

- [DA] Reality Check document complete:
  OCP SN 040 OCI-200 SN 040 Ed OCI-200 SN X OCR-200 SN X
- [DA] Verify Port Link operation
- [DA] Verify logged data set

Satlantic MORS 9 Meter:

- [DA] Reality Check document complete:
  OCP SN 041 OCI-200 SN X OCI-200 SN X OCR-200 SN X
- [DA] Verify Port Link operation
- [DA] Verify logged data set

Satlantic Stor-X System:

- [DA] Reality Check document complete:
  Stor-X SN 032
  HyperOCR I SN 0279 with Bioshutter SN N/A — HyperOCR Ed SN 0399 (4M)
  HyperOCR R SN 0241 (4M) with Bioshutter SN N/A — HyperOCR Ed SN 0405 (9M)
  HyperOCR R SN 0242 (9M) with Bioshutter SN N/A
  PAR SN 097
- [DA] In-water test — Lu sensors set as Masters' Spectrometer measurements of 256 channels all HyperOCRs.
- [DA] Verify Port Link operation
- [DA] Verify logged data set

SAT-QR-87001
Verification Checklist
CNRS Mooring System (Page 2 of 3)

SATLANTIC

Satlantic MVDS:

[DA] Reality Check document complete:
MVD SN 053 OCI-200 SN 095 MVD is functional OCIEs 095 is Not working
[DA] Verify Port Link operation
[DA] Verify logged data set

Satlantic Strain Guage:

[DA] Verify correct operation: Dacnet Port worked ok with Strain.
Strain-100 SN 002 However Strain sn002 not providing correct voltage
[DA] Verify Port Link operation out. Repair not possible. Strain 100 should provide
[DA] Verify logged data set * 11.15 Volts out to strain guage. It is measuring ~3 volts.
→ data recorded as strain 100 still has serial output.

CISCO Wireless Hub:

[N/A] Internal inspection
[N/A] Verify correct operation

WildCat PTT:

[DA] Verify correct operation CATS MEOW

HobiLabs HydroScat:

[DA] Verify correct operation:
HydroScat SN #4070403
[DA] Verify Port Link operation
[DA] Verify logged data set

SeaBird MicroCat:

[DA] Verify correct operation:
MicroCat SN 5325
[DA] Verify Port Link operation
[DA] Verify logged data set

WetLabs ECOFLNTUS:

[DA] Verify correct operation:
ECOFLNTUS 4 Meter SN 726
ECOFLNTUS 9 Meter SN 727
[DA] Verify Port Link operation
[DA] Verify logged data set

Satlantic Cables:

[DA] Visual inspection
[DA] Connect components with RMA cables
[DA] Notes: New 12pin cables checked on OCPs-voltage and darks, New ocp to Cstar cable. New ARGOS (wildcat) Cable. New OCP 9Meter to DacNET PortAE cable.

SAT-QR-87001
Verification Checklist
CNRS Mooring System (Page 3 of 3)

SATLANTIC

Power System - Solar Panels:

[DA] Voltage under full sun:
Panel #1 22.75 V HP12-75 Panel #2 21.23 V BP450J Panel #3 22.45 V HP 12-75

[SM] Visual inspection

Power System - Solar Panel Junction Box:

[SM] Internal inspection and diode check
[DA] Verify operation of each port
[DA] Verify switch function in both directions (20 cycles)

Power System - Charge Load Controller:

[DA] Internal inspection
[DA] Verify correct operation
[DA] Float voltage 14.22 V
[DA] Low voltage cutoff 9.49 V
[DA] Check fuses

Power System - Battery Pack:

[N/A] Check battery condition if applicable
[DA] Internal inspection
[DA] Test temperature sensor with CLC
[DA] Verify switch function in both directions (20 cycles)
[DA] Check vent valve Cleaned and set to 4 rotations (was set at 0.75 turns)

Operation:

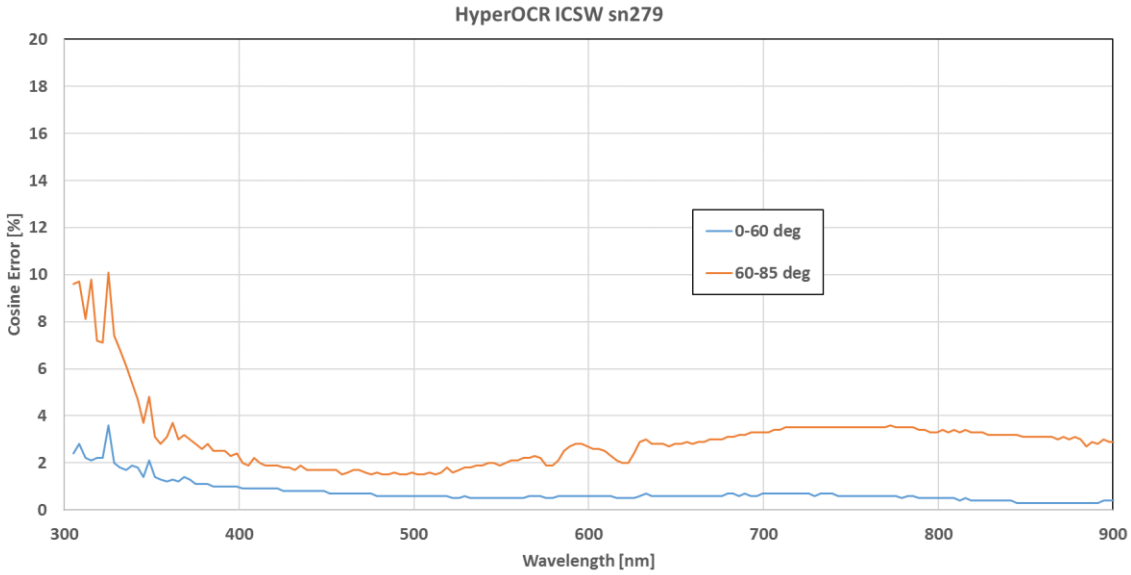
[DA] System operating within parameters of data collection schedule
[N/A] Wireless telemetry system and software operating correctly connected directly via RS45 ethernet cable
[DA] Mooring System manager software version 2008.2
[DA] Inspect node manager files
[DA] Delete test data from disk

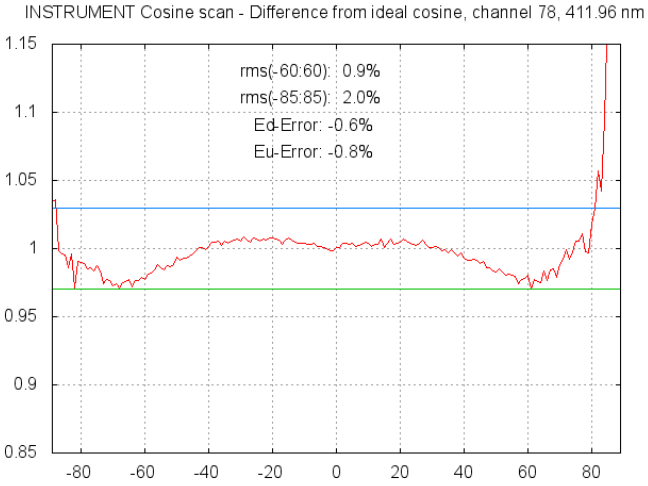
Additional Notes:

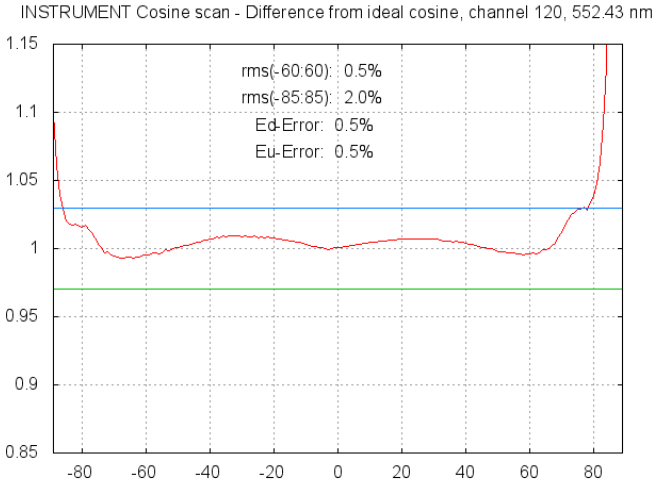
Cisco unit not returned. Used direct connection to Ethernet port through 8 pin cable. Laptop set @ 10.1.1.4 and using DacNET Basestation software.

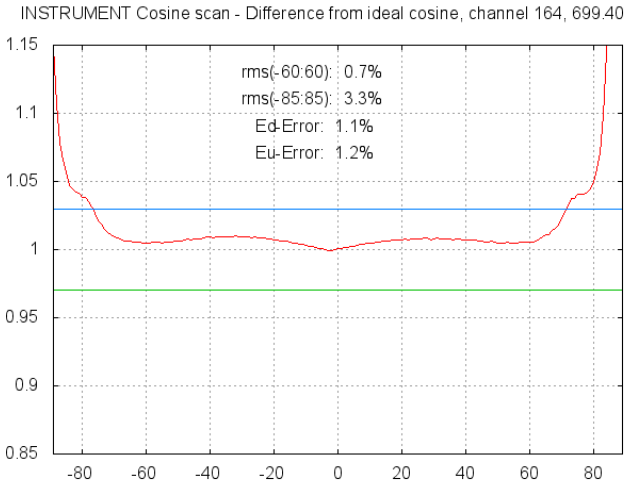
Shifted dark schedule start time from 21:00 to 21:15. This prevents error when switching schedules for MVD → "File lockup"

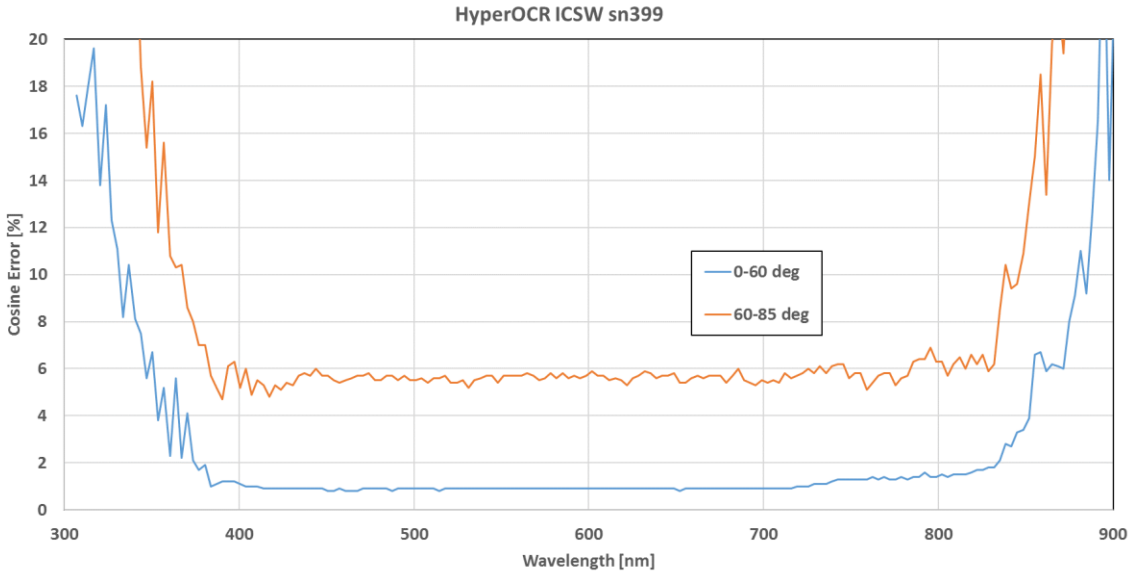
Quality Assurance: [signature] Date: March 30, 2017

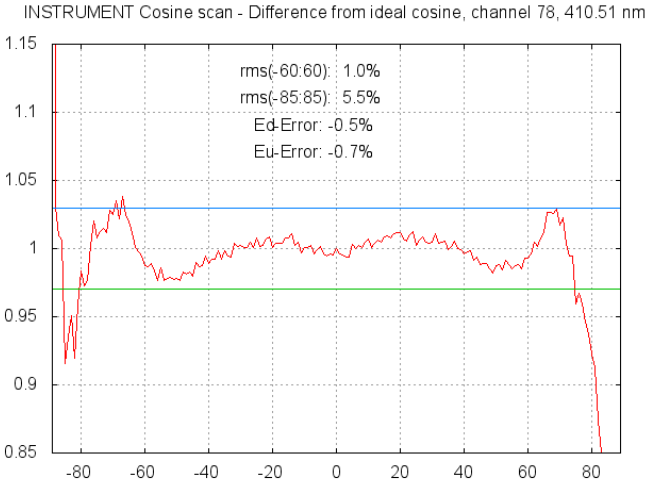

HyperOCR ICSW sn279
Cosine Error [%]
Wavelength [nm]
0-60 deg
60-85 deg
0
2
4
6
8
10
12
14
16
18
20
300
400
500
600
700
800
900

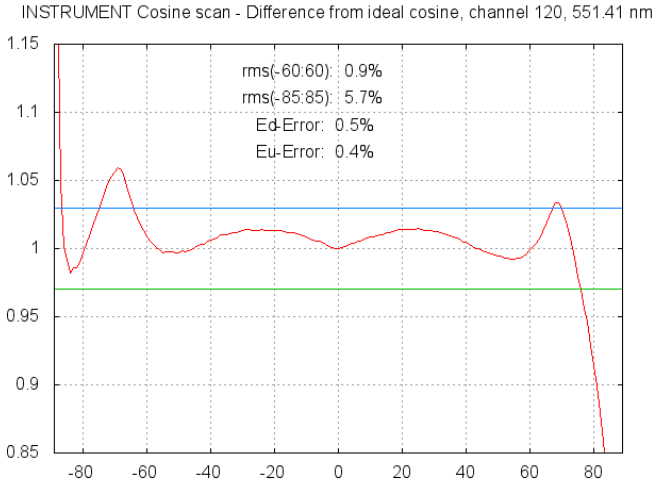

INSTRUMENT Cosine scan - Difference from ideal cosine, channel 78, 411.96 nm
rms(-60:60): 0.9%
rms(-85:85): 2.0%
Ed-Error: -0.6%
Eu-Error: -0.8%
1.15
1.1
1.05
1
0.95
0.9
0.85
-80
-60
-40
-20
0
20
40
60
80

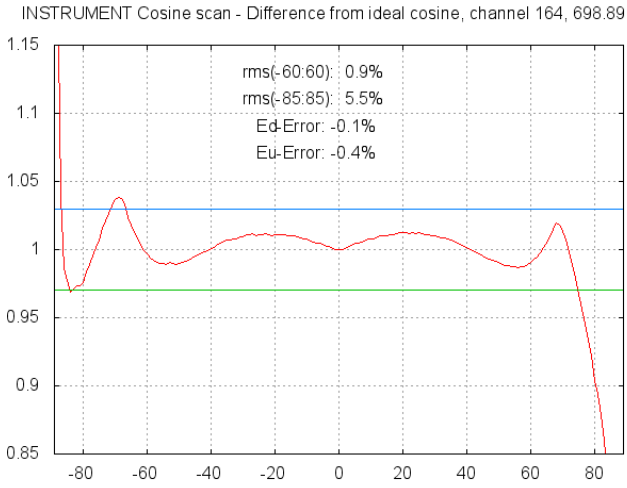

INSTRUMENT Cosine scan - Difference from ideal cosine, channel 120, 552.43 nm
rms(-60:60): 0.5%
rms(-85:85): 2.0%
Ed-Error: 0.5%
Eu-Error: 0.5%
1.15
1.1
1.05
1
0.95
0.9
0.85
-80
-60
-40
-20
0
20
40
60
80

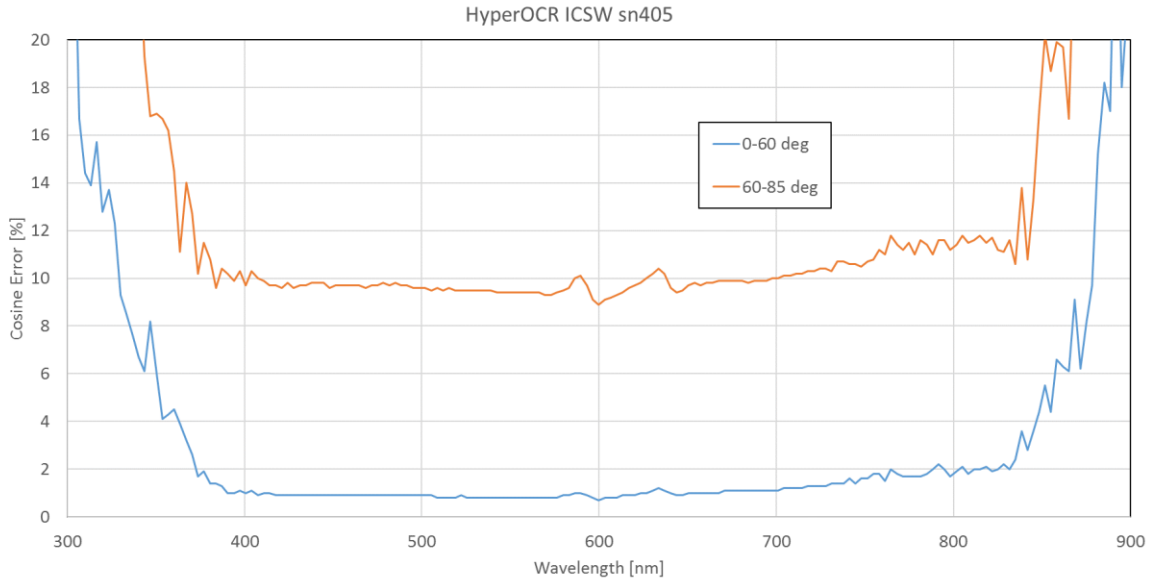

INSTRUMENT Cosine scan - Difference from ideal cosine, channel 164, 699.40 nm
rms(-60:60): 0.7%
rms(-85:85): 3.3%
Ed-Error: 1.1%
Eu-Error: 1.2%
1.15
1.1
1.05
1
0.95
0.9
0.85
-80
-60
-40
-20
0
20
40
60
80

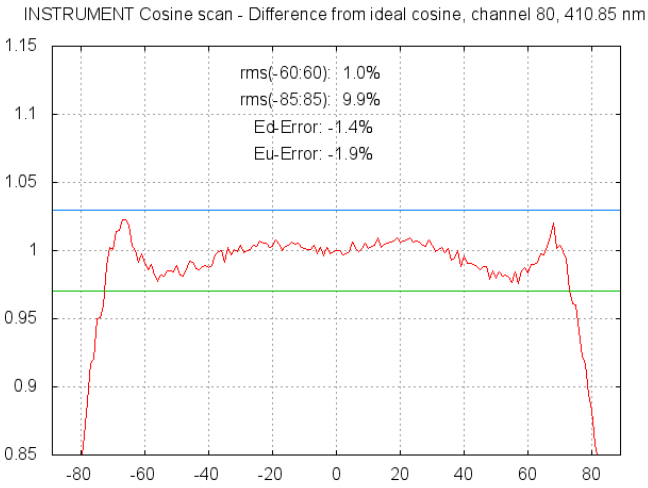

HyperOCR ICSW sn399
Cosine Error [%]
Wavelength [nm]
0-60 deg
60-85 deg

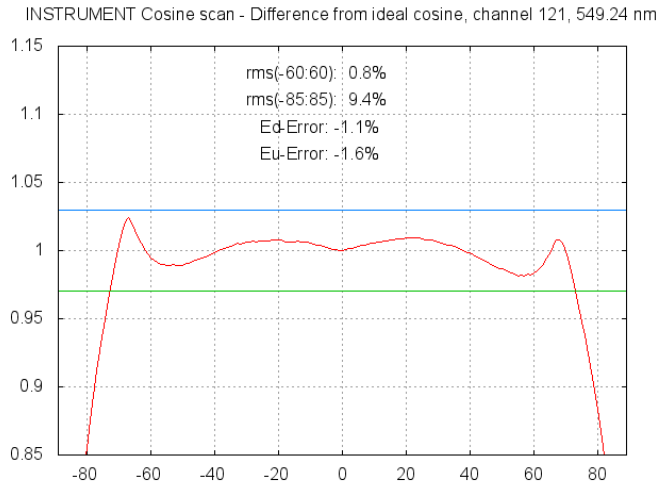

INSTRUMENT Cosine scan - Difference from ideal cosine, channel 78, 410.51 nm
rms(-60:60): 1.0%
rms(-85:85): 5.5%
Ed-Error: -0.5%
Eu-Error: -0.7%

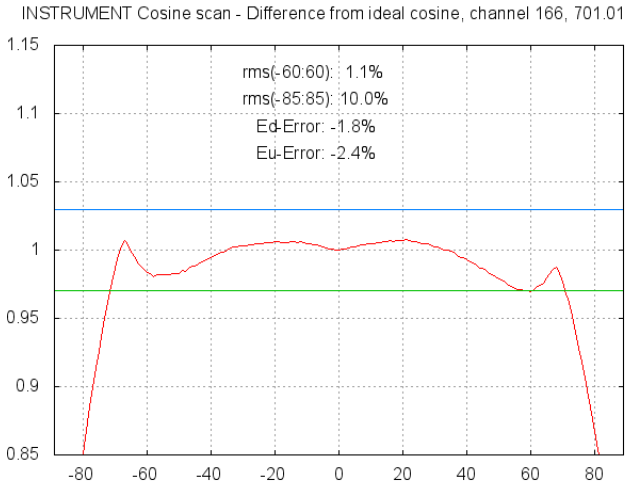

INSTRUMENT Cosine scan - Difference from ideal cosine, channel 120, 551.41 nm
rms(-60:60): 0.9%
rms(-85:85): 5.7%
Ed-Error: 0.5%
Eu-Error: 0.4%


INSTRUMENT Cosine scan - Difference from ideal cosine, channel 164, 698.89 nm
rms(-60:60): 0.9%
rms(-85:85): 5.5%
Ed-Error: -0.1%
Eu-Error: -0.4%


HyperOCR ICSW sn405
Cosine Error [%]
Wavelength [nm]
0-60 deg
60-85 deg
0
2
4
6
8
10
12
14
16
18
20
300
400
500
600
700
800
900


INSTRUMENT Cosine scan - Difference from ideal cosine, channel 80, 410.85 nm
rms(-60:60): 1.0%
rms(-85:85): 9.9%
Ed-Error: -1.4%
Eu-Error: -1.9%
1.15
1.1
1.05
1
0.95
0.9
0.85
-80
-60
-40
-20
0
20
40
60
80


INSTRUMENT Cosine scan - Difference from ideal cosine, channel 121, 549.24 nm
rms(-60:60): 0.8%
rms(-85:85): 9.4%
Ed-Error: -1.1%
Eu-Error: -1.6%
1.15
1.1
1.05
1
0.95
0.9
0.85
-80
-60
-40
-20
0
20
40
60
80


INSTRUMENT Cosine scan - Difference from ideal cosine, channel 166, 701.01 nm
rms(-60:60): 1.1%
rms(-85:85): 10.0%
Ed-Error: -1.8%
Eu-Error: -2.4%
1.15
1.1
1.05
1
0.95
0.9
0.85
-80
-60
-40
-20
0
20
40
60
80

Hobi Instrument Services

HydroScat-4 Calibration Certificate

Cert Date: **September 13, 2015**

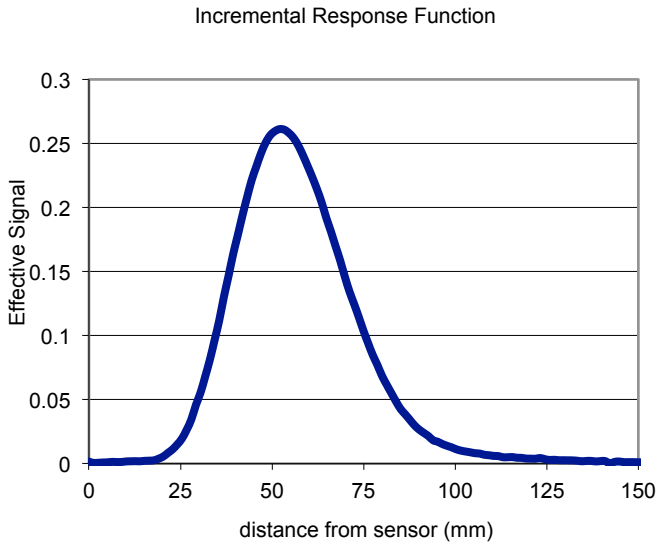
Serial Number: **H4080705**

Configuration: **B0**

Channel 1: bb442

mu:	33.96
mu Rho:	1.1
SigmaExp:	0.116
Temp Coeff:	0.00173

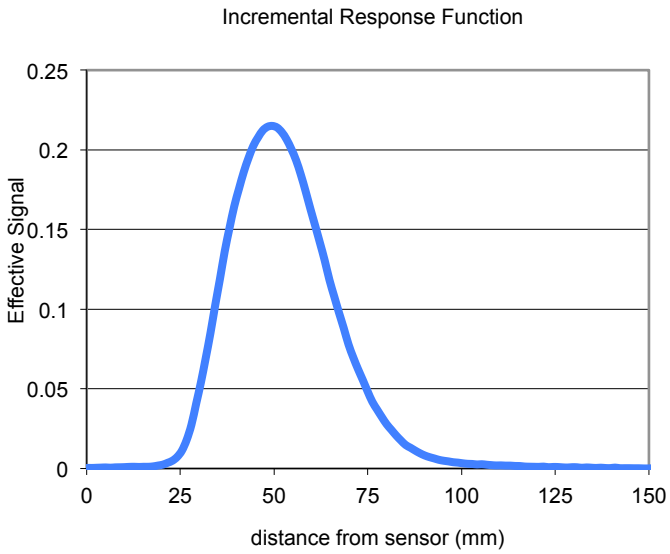
	Gain Factor	Dark Offset
Gain 1:	1.000	11
Gain 2:	9.616	9
Gain 3:	94.473	10
Gain 4:	847.13	14
Gain 5:	9538.9	15



Channel 2: bb488

mu:	45.78
mu Rho:	1.1
SigmaExp:	0.109
Temp Coeff:	-0.0006

	Gain Factor	Dark Offset
Gain 1:	1.000	22
Gain 2:	9.660	23
Gain 3:	95.789	23
Gain 4:	869.51	8
Gain 5:	9794.3	-123



Hobi Instrument Services

HydroScat-4 Calibration Certificate

Cert Date: **September 13, 2015**

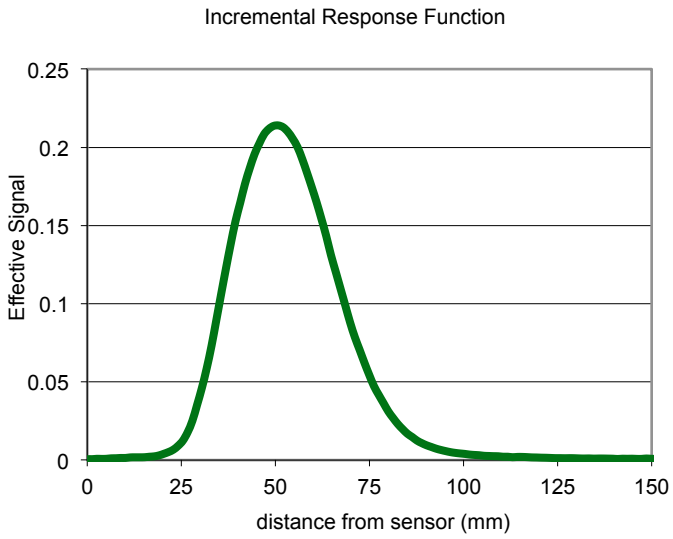
Serial Number: **H4080705**

Configuration: **B0**

Channel 4: bb550

mu:	45.73
mu Rho:	1.1
SigmaExp:	0.111
Temp Coeff:	0.00048

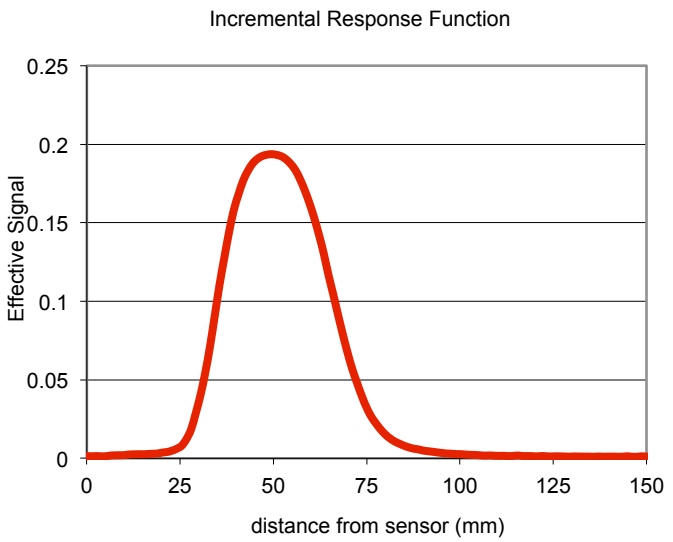
	Gain Factor	Dark Offset
Gain 1:	1.000	5
Gain 2:	9.530	6
Gain 3:	93.399	5
Gain 4:	842.27	2
Gain 5:	9073.8	-241



Channel 5: bb620

mu:	51.39
mu Rho:	1.1
SigmaExp:	0.107
Temp Coeff:	-0.0107

	Gain Factor	Dark Offset
Gain 1:	1.000	30
Gain 2:	9.649	30
Gain 3:	95.370	30
Gain 4:	875.36	24
Gain 5:	9724.1	-57

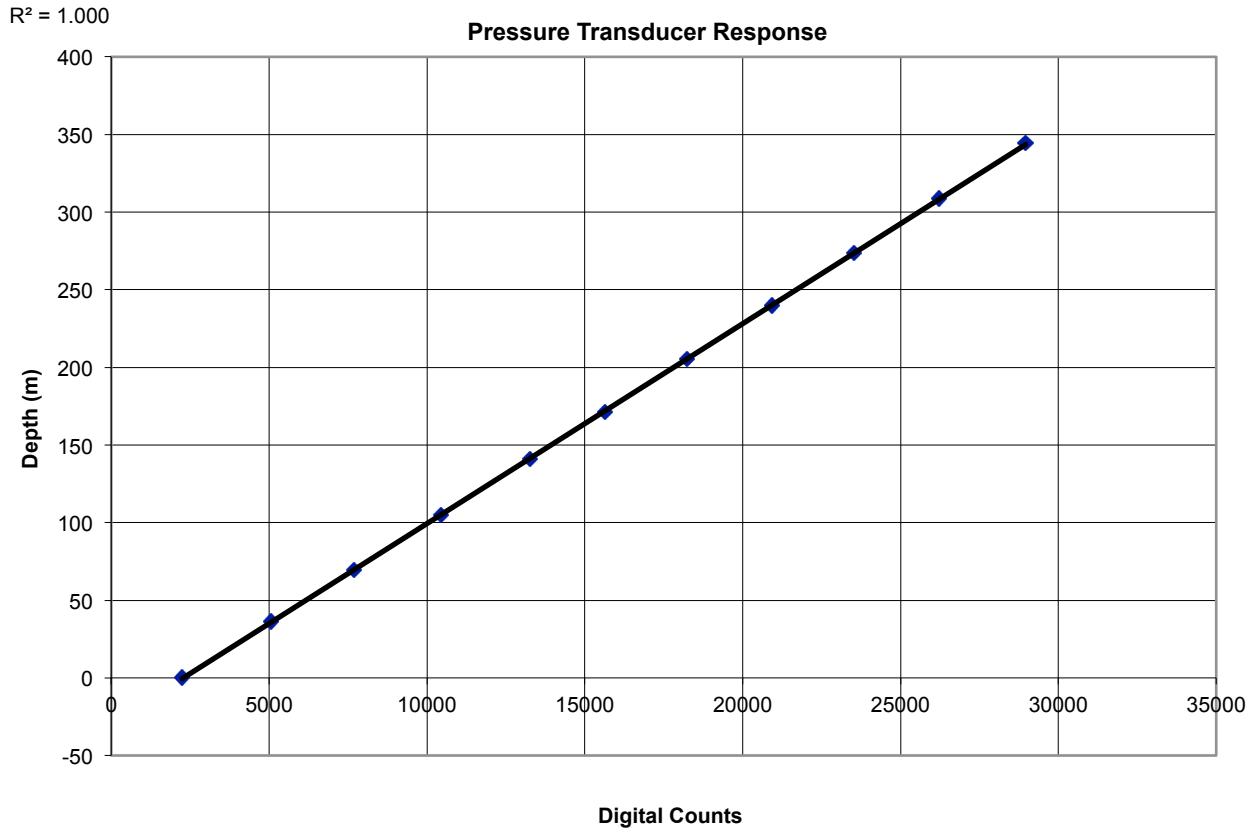


Hobi Instrument Services

Cert Date: **September 13, 2015**
Serial Number: **H4080705**
Configuration: **B0**
Depth Cal Date **9/13/15**

Depth Calibration

Coefficient:	0.0129	meter (sea water)/count
Offset:	29.0	meters (sea water)



PO Box 518
620 Applegate St.
Philomath, OR 97370

(541) 929-5650
Fax (541) 929-5277
www.wetlabs.com

ECO Calibration and Repairs

Date	8/15/2016	Customer	LOV
S/N#	FLNTUS-726	Technician	dcm

Diagnosis

Evaluated instrument and found operational, but wiper was not functioning properly.

Repairs

Found opti-stop system in the optics head failed. Replaced optics head to resolve issue.Standard Service performed.

ECO Standard Service Definition

The bulkhead connector, pressure housing and window on the instrument are first inspected for possible damage.
The instrument then is powered on and the current data is checked to determine if the instrument is working properly.
The instrument pre-service characterization is perfromed
The head is next inspected for cracks in the LED, the detector and the motor bores.
The digital and analog operations are checked.
The instruments scaling is checked with dye or scatter proxy as determined by the instrument type.
The firmware version on the instrument is updated as necessary.
The case seals, desiccant, shaft seal, faceplate, and shaft are replaced as the instrument is reassembled.
The instrument is rescaled if needed after reassembly.
Standard testing is performed on the instrument and characterized before being returned to the customer.

ECO Standard Testing Definition

- Performed noise test: 1 sample/sec for 60 sec
- Performed stability test: 1 sample/sec for 12 hrs as needed
- Performed thermistor calibration if installed
- Performed live 6hr pressure test: 5 samples every 4 minutes as needed
- Pressure-tested unit
- Completed instrument characterization
- Updated unit's characterization sheet and included on CD
- Updated unit's device file and included on CD

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ECO Calibration and Repairs

Date 8/8/2016 Customer LOV France

S/N# FLNTUS-727 Technician SML

Diagnosis

Evaluated instrument and found no problems.

Repairs

Standard Service performed. Verified tuning, tested, and characterized instrument. Replaced shutter, shutter shaft, shaft seal, faceplate, and case seal.

ECO Standard Service Definition

The bulkhead connector, pressure housing and window on the instrument are first inspected for possible damage.
The instrument then is powered on and the current data is checked to determine if the instrument is working properly.
The instrument pre-service characterization is perfromed
The head is next inspected for cracks in the LED, the detector and the motor bores.
The digital and analog operations are checked.
The instruments scaling is checked with dye or scatter proxy as determined by the instrument type.
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The case seals, desiccant, shaft seal, faceplate, and shaft are replaced as the instrument is reassembled.
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