

The BOUSSOLE project technical reports; report #7-16, issue 1.

BOUSSOLE buoy deployment & maintenance log. September 16, 2011 - September 07, 2012

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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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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 XIII", from September 16th of 2011 to September 07th of 2012.

2. DESCRIPTION OF OPERATIONS

2.1 UPPER SECTION PREPARATION (2011-08)

The buoy System (buoy XIII called system #1) was delivered from Satlantic on August 09th, and installation on the structure began on August 16th. Then the deployment took place on September 16th 2011.

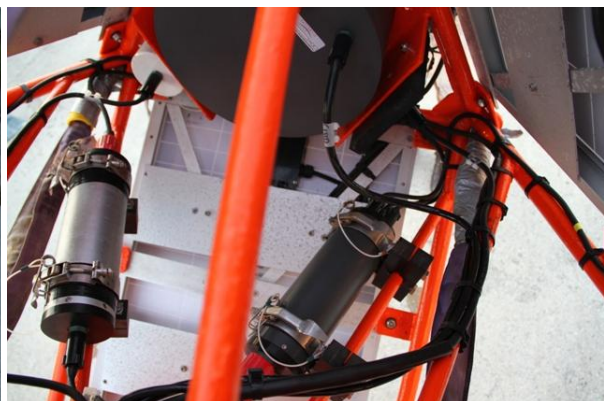
The Buoy was equipped with sensors used for the deployment of the buoy XI recovered on April 1st. The system was prepared in the CCI local in Villefranche-Sur-Mer and since the 26th of August was ready for the deployment. Copper sheets and pieces were again fixed wherever possible to avoid biofouling arising. Aluminium plates (3 mm thickness) have again been fixed on the back side of the solar panels to reinforce them. No Bio-shutter was installed. Two Hyperpectral underwater irradiance radiometers were added to the system. As a consequence the suggested schedule from Satlantic was modified, reducing the number of instruments and acquisition frequency at night. The system was tested for some days running both with solar panel or ground alimentation. The following anomalies were observed:

- Eu(490) 9m signal is not stable (start-up current, but the median value should not be affected).
- The HyperOCR #242 (Lu 9m) was not working correctly after few days of testing.

A different schedule was also tested to verify the system functioning every 15 minutes day and night, avoiding data acquisition for the mvd and Stor-x sensors. The systems ran correctly for two days and half on battery (and very low light/recharge).

A comparison of all radiometers before deployment was also done (see appendix. Since comparison were not satisfactory and the HyperOCR #242 was not working, the whole set of Hyperspectral radiometers was sent back to factory for repair, verification and recalibration.

Dark IOPs measurements were also made for dark corrections.









2.2 MOORING DEPLOYMENT

2.2.1 Saturday 16th September 2011

The upper structure to be deployed was brought to the Rochambeau field at local 06:30am with the help of 5 people from the LOV. The 4 arms were assembled and connected to the buoy. A GOPRO camera was installed on the 4 m arm to take a film of the buoy flight. However it was found drowned when recovered. At 08:30am divers gave the OK for the buoy transport and the helicopter was called and arrived 15 minutes later. As usual the go/return trip lasted about one hour. At about 12h the ARGOS messages arrived regularly, though they stopped two days later. No data came from the Strain sensor.

At this date, buoy is equipped with

- DACNet #011
- CLC #002
- Junction Box #004
- Rads set: OCI #035_Eu4m, #040_Ed4m, #109_Eu9m, #047_Ed9m #095_Es, OCR #035_Lu4m and #038_Lu9m), MVDS #053, OCP #036(4m) and OCP 041(9m)
- STOR-X #032 (no Hyperspectral).
- 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 CSSPE00356
- PAR #097

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

2.2.2 Tuesday 04th October 2011

This day the private boat LOLLIPOP from Darkpelikan Company in Villefranche was rent for going to the BOUSSOLE site with 3 divers from LOV. When on site, divers went at sea for cleaning sensors and performing dark measurements on the IOPs. In the meantime, sensors and connections on the buoy head were cleaned and data downloaded. Divers also verified the correct connections of the strain Gauge. The ARGOS dispatch restarted correctly after its cleaning.

2.2.3 Tuesday 18th October 2011

This day is part of the B#116 mission. 3 divers from LOV plus one private went at sea for cleaning the optical sensors and performing dark IOPs measurements. In the meantime a CISCO connection attempt was unsuccessful and a direct connection on the buoy was obtained using the AK connector since weather was worsening and no time was available for other autonomous attempt. Data were downloaded and head connectors and sensor were cleaned.

2.2.4 Tuesday 15-18th November 2011

These days are part of the BOUSSOLE#117 cruise. The first and second days a CISCO connection was attempted unsuccessfully. The third day a first CISCO connection was successful but the connection was lost and data were only partially downloaded; a second connection attempt was unsuccessful. The last day divers went at sea to clean the buoy sensors and perform dark measurements. A new Strain-Gauge/Strain-100 cable was also installed. A direct connection on the top of the buoy allowed downloading all data and verifying that the Strain was still not operational. Then divers removed the new cable and installed a second one (with crossed pin). Data were downloaded again thanks to an AK switch. Since the Strain was still not working, divers removed the second cable and the Strain-100. Sensors and connectors on the buoy head were also cleaned. In the following days the Strain was checked in the lab and no output voltage was detected when powered at nominal 12 V.

2.2.5 Wednesday 23rd November 2011

Voltage data from the buoy ARGOS indicates the probable rupture of a solar panel.

2.2.6 Wednesday 9th-10rd December 2011

These days are part of the B#118 cruise. The first day no operation was made on the buoy; except an inspection of the solar panels from the ship: 2 solar panels were broken.

The second day divers went at sea for cleaning the sensors on the buoy head in the morning. Neoprene caps where also punt on IOPs instruments for dark measurements, though it was not certain the system was running at that time (due to power limitation). In the meantime one of the solar panel was replaced with a new one. The one having less photovoltaic surface was removed (5.4 V output). The only solar panel fully operational had no more the top bar. In the afternoon, data were downloaded with a direct connection on the top of the buoy to save power; the voltage on the buoy was 11.4. The bar dismounted from the removed solar panel did not match the length of that on the buoy so a repair was not possible. Connectors and sensors on the buoy head were also cleaned.

2.2.7 Wednesday 21th December 2011

From this day the OCP_4m instruments started to send a constant signal.

2.2.8 Wednesday 28th December 2011

These day divers from MARE NOSTRUM company went to the BOUSSOLE site for sensors cleaning and dark measurements.

2.2.9 Wednesday 5th December 2011

Voltage data from the buoy ARGOS indicates the probable rupture of another solar panel.

2.2.10 Wednesday 11th January 2012

This day the private boat KINKA II from Darkpelican Company was rent in Villfranche for going to the Boussole site. Three divers were on board (2 from LOV 1 from UNICE). When on site we had the confirmation that two solar panels were broken and they were both substituted. In the meantime divers went at sea to inspect the OCP_4m-DACNet cable that seemed ok. So the system was turned off and the DACNet dismounted and bought at surface. The fuses in the DACNet were all good so the DACNet was reinstalled without any change. Before restarting the system the Hyperspectral radiometers, the Strain-100, and a new OCP were installed. Underwater sensors were also cleaned but no dark was made. Connectors and sensors on the buoy head were also cleaned and data downloaded. The Strain Gauge started to transmit data regularly, but the OCP4m instrument were still not working.

At this date, buoy is equipped with

- **Hyper spectral units HO�R #241_Lu4m, #242_Lu9m, #279_Es, #399_Ed4m and #405_Ed9m (no Bio-shutters).**
- **Strain-100 #002**
- **OCP4m #040**

2.2.11 Wednesday-Friday 25th-27th January 2012

These days are part of the B#119 cruise. The first day the ANTEA stayed around BOUSSOLE and the light on the buoy head was checked to be OK. The second day the connector on the buoy head were cleaned and the ARGOS dispatch restarted after few days of stop. The optical

sensors were also cleaned on the head and data were downloaded with a direct connection. The third day divers were on board but the weather on site was worst than forecasted and the diving cannot take place.

2.2.12 Wednesday-Friday 15th-18th February 2012

These days are part of the B#120 cruise. The first two days the buoy was completely underwater. The third day there was still some current but the buoy was visible though not till the floatation point. Diver went at sea for cleaning the optical sensors. Then the buoy was turned off and the previous OCP re-installed and a "new" OCP-DACNet cable installed. Then the buoy was restarted and data retrieved with a direct connection on the buoy through an AK reboot after an acquisition and again data from OCP 4m instruments were not acquired. So the buoy was again turned off and the DACNet exchanged. After this operation the buoy was almost diving and it was not possible to retrieve new data. Connectors and optical sensors on the buoy head were cleaned but no dark IOP was measured. Then an attempt of CISCO connection was made unsuccessfully, but from land we were informed of the good functioning of OCP related sensors at 4m. The instrument configuration on the DACNet has a wrong serial # for the strain sensor that still has to be correct for. One of the solar panels has lost the bottom protection but the photovoltaic cells were intact. **Due to DACNet exchange the compass should have a bias of about 45° that has to be verified on data** (after verification the shift is of about 17°).

The pictures made from divers show that the block of the **Ed_4m** connector was unscrewed, causing intermitting bad values on data.

At this date, buoy is equipped with

- OCP4m #036
- DACNet #002

2.2.13 Thursday 15th March 2012

This day the private boat Dione II from Darkpelican in Villefranche was rent for going to the Boussole site to dive on the buoy since during the March cruise the weather conditions were not good. When on site divers went at sea for cleaning the instruments and performing black IOPs measurements. The unscrewed connector was also fixed with tie wraps since it didn't fit well. Data were downloaded on the top of the buoy (AK) and sensors, solar panels and connectors were cleaned. The correct serial number for the strain sensors was uploaded on the Dacnet configuration.

2.2.14 Thursday 5th Avril 2012

This day is part of the B#122 cruise. When on site divers went at sea to clean buoy instruments. They also put neoprene caps on the HS4 and on the transmissometers at 4m for acquiring 1 set of dark measurements and they changed 3 locking sleeves of the buoy radiometers connectors. In parallel to diving operations, a direct connection with the buoy was established for data retrieval and

solar panels, sensors and ARGOS and CISCO connectors on the top of the buoy were cleaned.

2.2.15 Thursday 19th Avril 2012

The ARGOS dispatch stopped on this date.

2.2.16 Tuesday-Friday 15-18th Mai 2012

This days are part of the B#123 cruise. The first day two divers from LOV and a private one were onboard. When on site one of the solar panels was found completely broken. Then divers went at sea to clean the instruments and in the meantime the broken solar panel was removed from the buoy head. Then the buoy was turned off and the two assemblages of multispectral radiometers were dismounted and brought to surface to replace the copper tape on them. The copper plates upon transmissometers windows were also exchanged with new ones. Then instruments were mounted again and the buoy turned on. Then data were downloaded on the top of the buoy (AK connector) and sensors and connectors cleaned. The ARGOS dispatch restarted regularly. Data since May 5th were missing, after verification of data it seemed to be due to the microdrive whose space was exhausted. A successive CISCO connection confirmed the problem was only due to space on disk and the buoy had restarted recording data correctly, however a wrong configuration for multispectral Es was noticed (no data were recorded during night). The second day the ARGOS dispatch stopped again. The third day a CISCO connection was attempted unsuccessfully. On last day a direct connection on the buoy was obtained, data downloaded and the correct schedule loaded on the DACNet. Connectors were again cleaned (ARGOS restarted) and a new solar panel was installed.

2.2.17 Saturday 02th Jun 2012

This day divers from private company MARE NOSTRUM went to the BOUSSOLE site for cleaning the instruments and performing dark measurements.

2.2.18 Saturday 13th Jun 2012

This day the microdrive exhausted the free space and data are no more recorded.

2.2.19 Saturday-Monday 17th-18th Jun 2012

These days are part of the B#124 cruise.

2.2.20 Thursday 28th Jun 2012

This day the ARGOS message dispatch stopped.

2.2.21 Thursday-Saturday 12th-14th Jul 2012

These days are part of the B#125 cruise.
pCO2 sensor on buoy, 16 July sensor cleaning + dark IOP.

2.2.22 Thursday-Saturday 11th-13th August 2012

These days are part of the B#126 cruise. pCO2 sensor off the buoy.

2.2.23 Friday 7th September 2012

The buoy was turned off on 7th September in the early morning and dismantled from the lower structure from Léo Gimenez and other divers with the help of the GGIX ship from IXSURVEY. At about 09h15 the helicopter delivered the structure that was in good condition thought with much fouling. The buoy was then cleaned with Karcher on the Rochembau site and then transported into the CCI local and data downloaded. The buoy was dismantled in the following days. Instruments were shipped for calibration on September 13th and arrived to the different companies within few days. The aluminium structure was sent to the CNB on October 18th.

3. QUANTITATIVE SUMMARY

The deployment lasted 356 days, among which 15 days were without data recording due to filling of the microdrive.

4. INSTRUMENT SCHEDULE

1 minute acquisition every 15 minutes. The timing of the schedule was modified: 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 1 Gb microdrive was full three times and data not recorded due to the augmented size of data for the introduction of the new Hyperspectral Irradiance sensors.
- 2- The ARGOS dispatch stopped several times.
- 3- The CISCO connection didn't work sometimes.

6. LESSONS LEARNED

- 1- Do not install 1 Gb microdrive for next deployments with the new configuration of instruments.
- 2- The new light-dark schedule was successfully used during this deployment and no power failure occurred.

7. ACKNOWLEDGEMENTS

The BOUSSOLE project has been set up thanks to the work of numerous people, and thanks to the support and funding of several Agencies and Institutions. The latter are listed in the foreword of this report. Specifically, the following contracts are acknowledged : the French Space Agency CNES provided funds through the TAOB and TOSCA scientific committees, ESA through ESTEC contract N°14393/00/NL/DC, including CCNs #1, #2 and #3, ESRIN through contract N° 17286/03/I-OL, and NASA through a "Letter of Agreement". Funding has been also obtained from the French CSOA committee and the "Observatoire Océanologique de Villefranche".

The crews and Captains of the following ships are also warmly thanked for their help at sea: the Castor-02 vessel from the Fosevel Marine company (buoy/mooring operations), the INSU R/V Téthys-II and Georges Petit (regular monthly cruises), the GG-IX from the Samar company and the Nika-III (on-demand short operations on site). Pilots and crew members of the Valair and Commerçair helicopter companies are also thanked for their willingness in accomplishing for us unusual survey missions above the BOUSSOLE site. Emmanuel Bosc, Maria Vlachou, Guillaume Lecomte, who have occasionally provided some help in collecting data, are also thanked for their help.

The French institute IFREMER and the Norwegian Marintek company are also thanked for their help and fairness in the engineering studies that were ordered to them after the major failure of the buoy in spring of 2002.

The data that are collected for several years near the BOUSSOLE site by the French weather forecast Agency, "Meteo France", and which are provided in real time on the internet, have been of great help in the day-to-day management of the monthly cruises.

Two companies have largely contributed to the BOUSSOLE project, namely the ACRI-in/Genimar company, Sophia Antipolis, France (buoy conception) and Satlantic Inc., Halifax, NS Canada (buoy centralized acquisition system and radiometers); their help is specifically acknowledged here.

8. APPENDIX

The following page contains the schema of the buoy and the list of the calibration files.

Radiometer Test

On August 11th 2011 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.

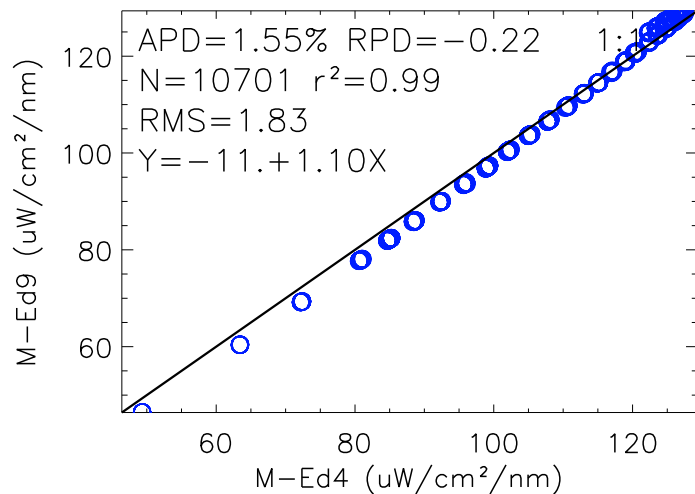
All the radiometers used for the buoy were fixed upon a table facing the zenith. The Lu and Eu sensors were covered with respectively two and one neutral filters to minimize saturation.

The instruments were all connected as for the buoy deployment (OCPs, DACNet, cables etc.) and powered with a battery. The schedule was modified to acquire data every 10 minutes instead of 15.

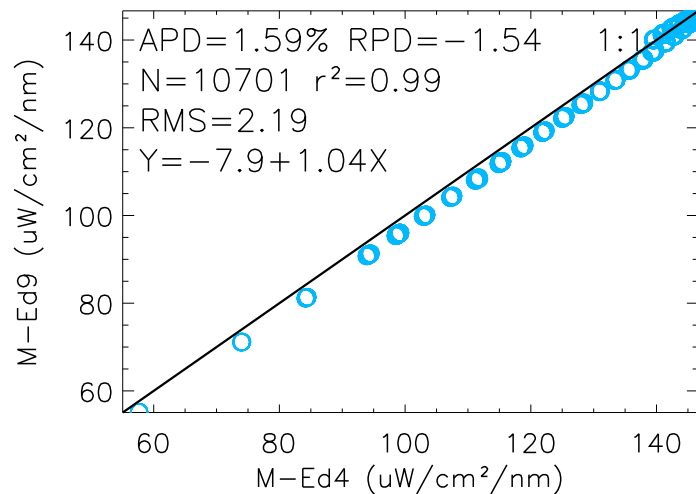
Data were acquired for about 6 hours.

Sky conditions were very good and stable. Single data were compared by using the TIMETAG variable recorded in data files.

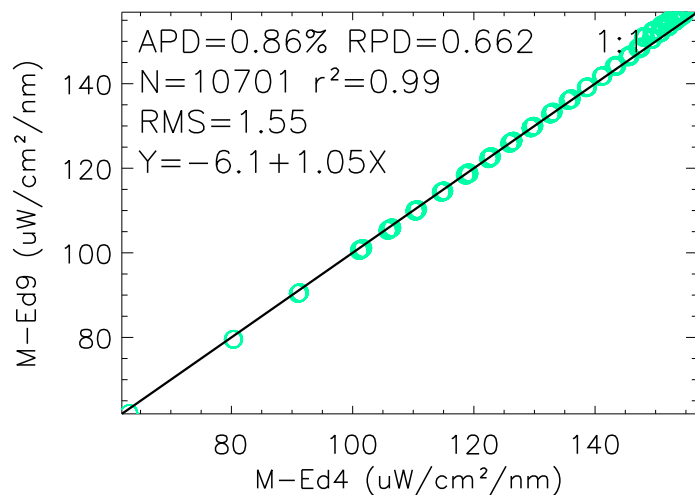
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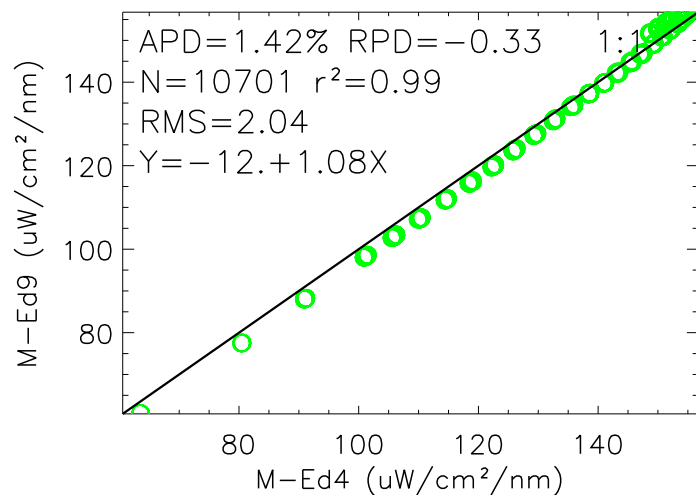
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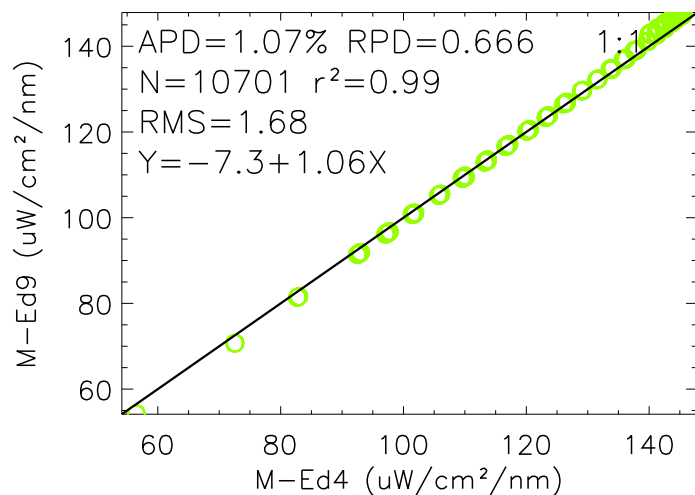
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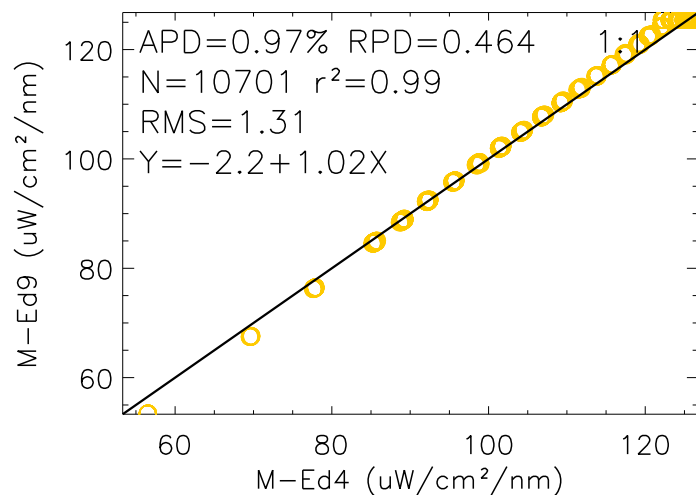
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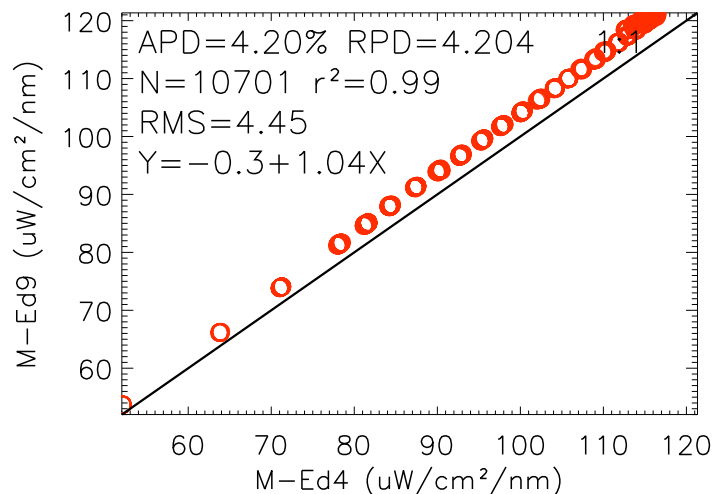
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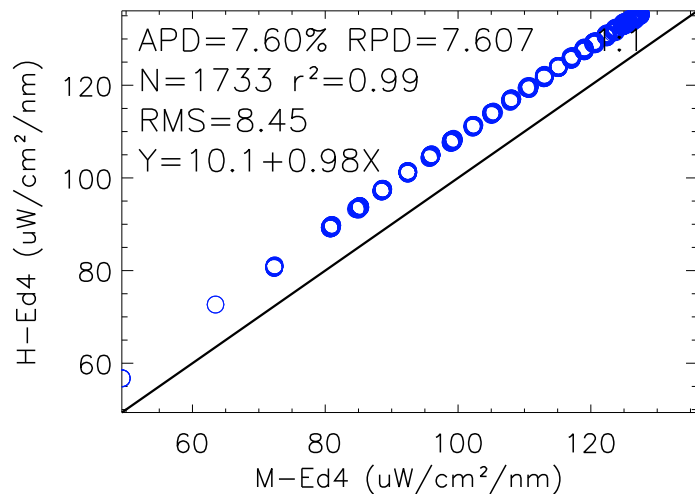
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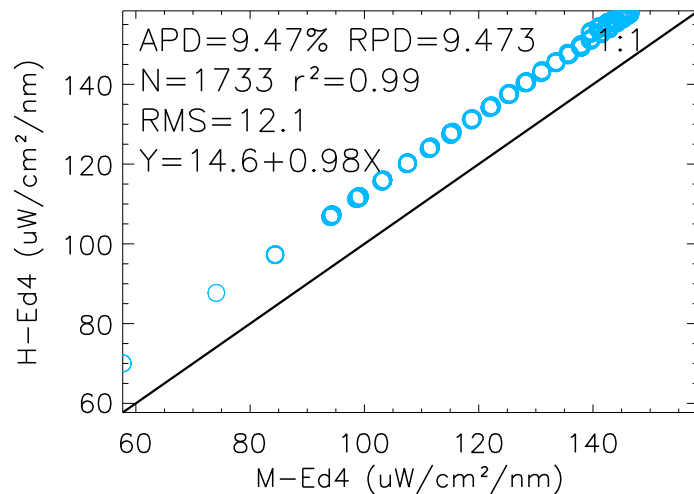
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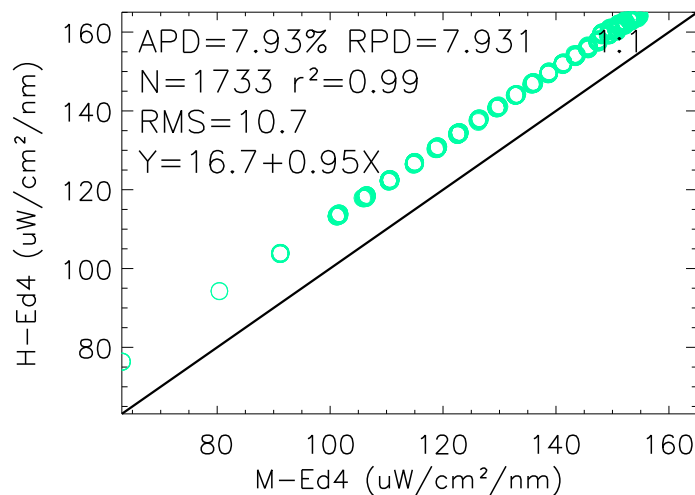
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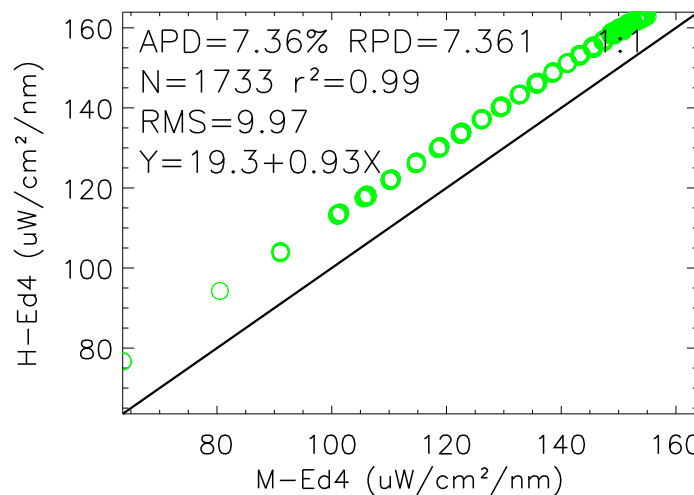
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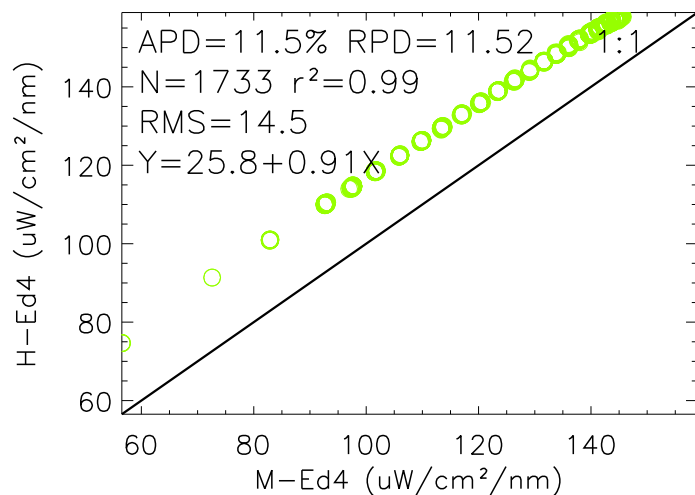
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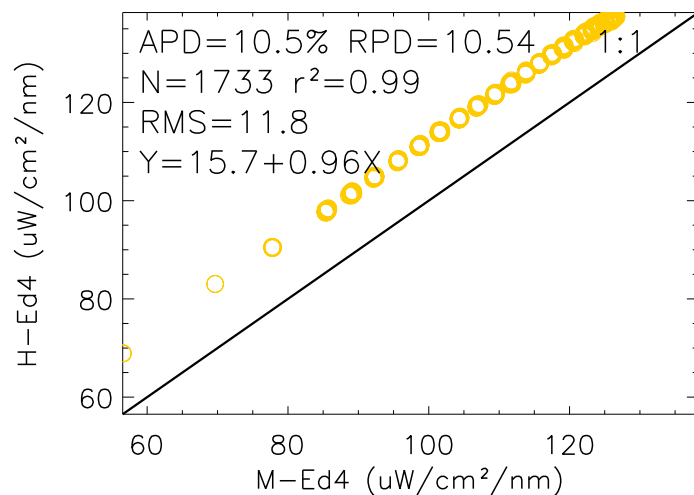
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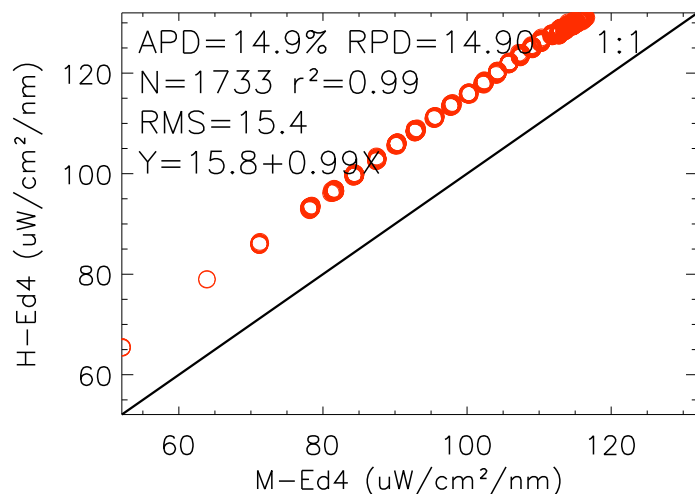
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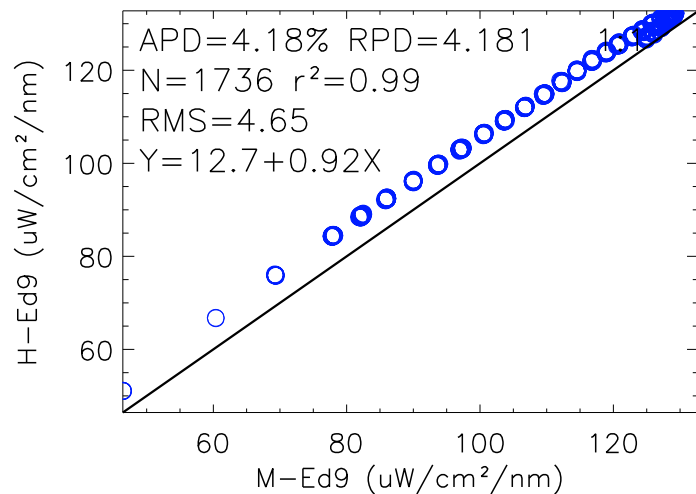
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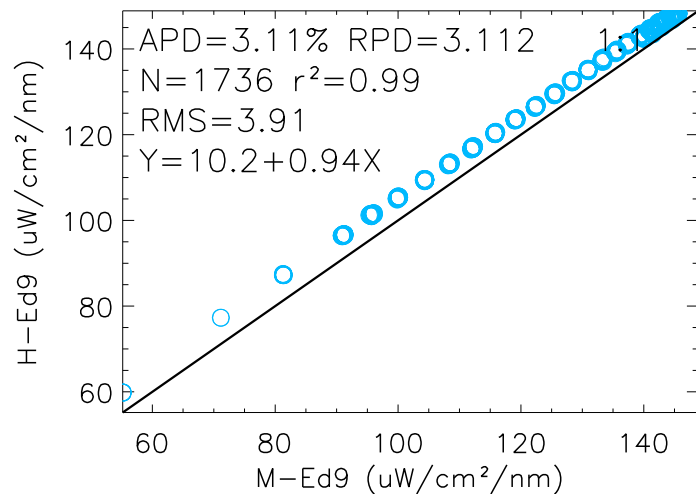
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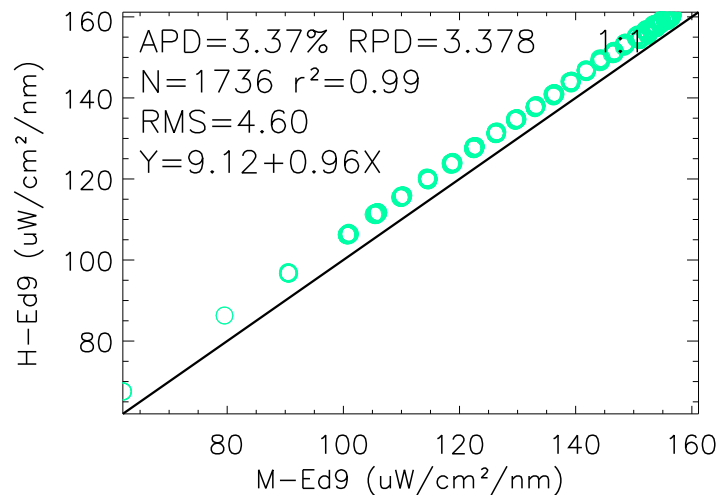
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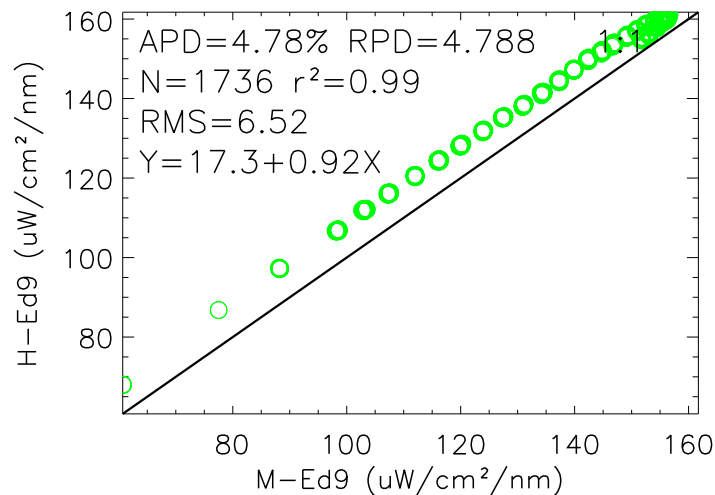
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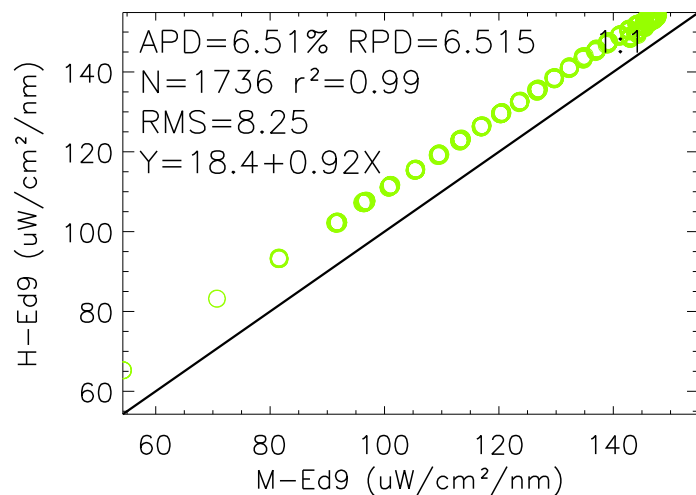
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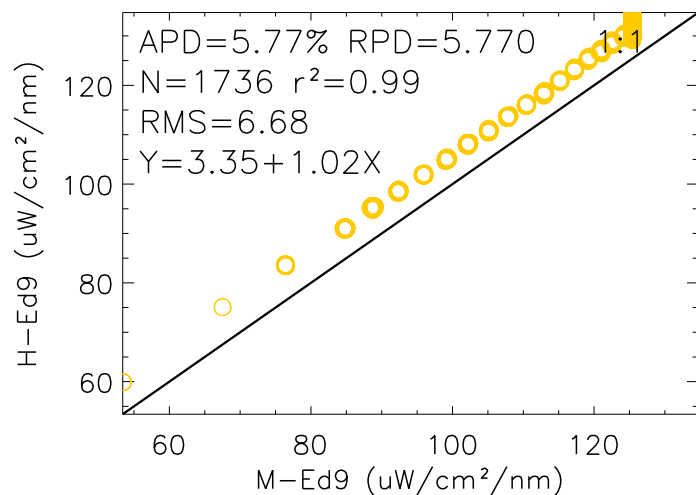
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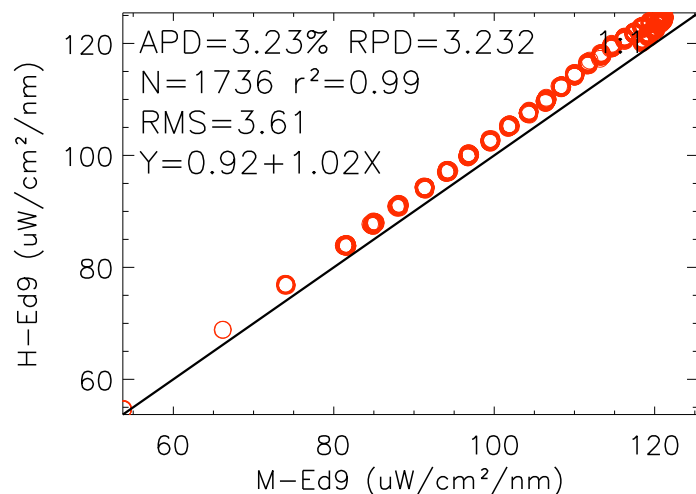
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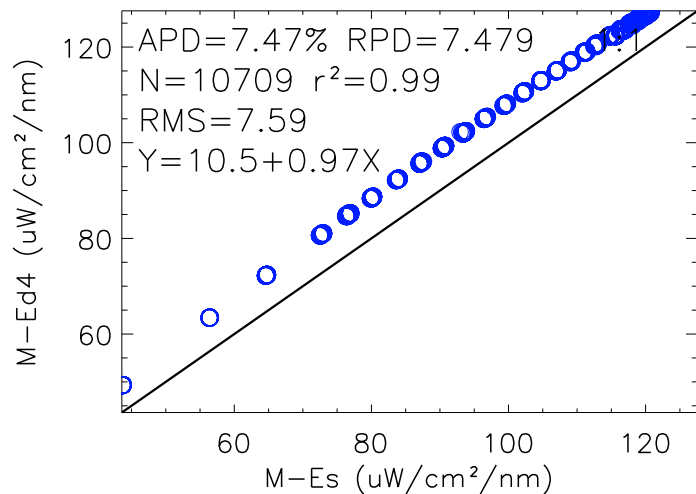
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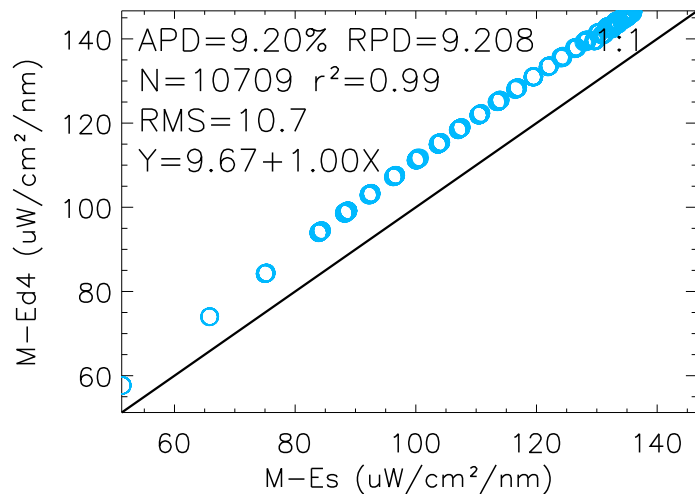
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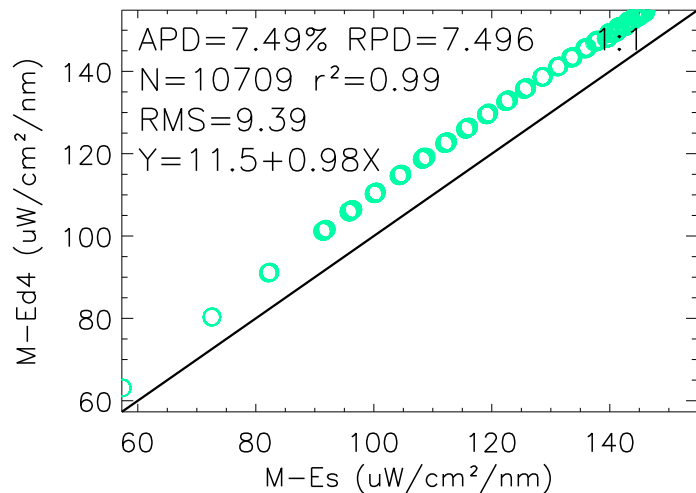
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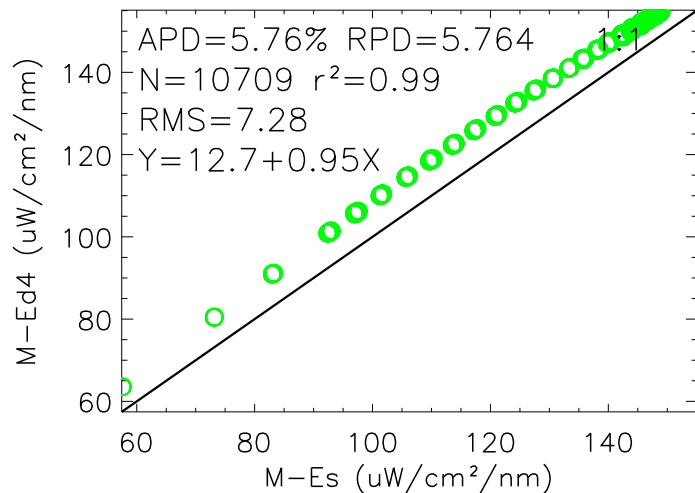
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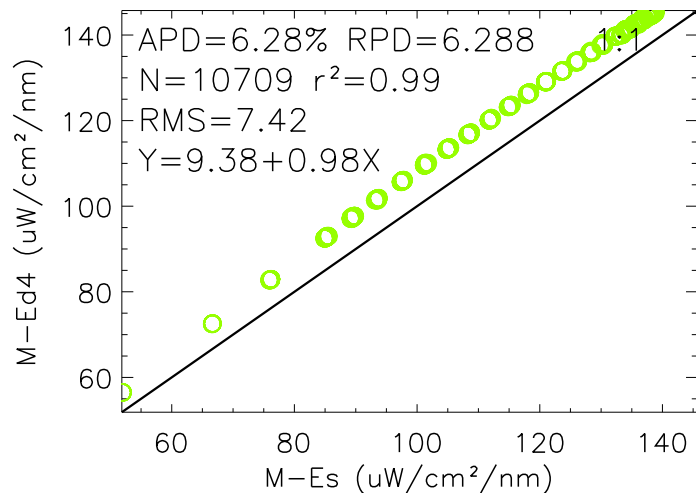
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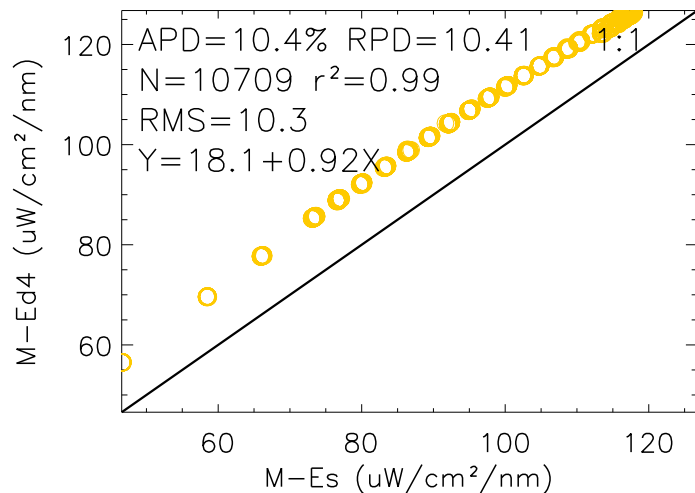
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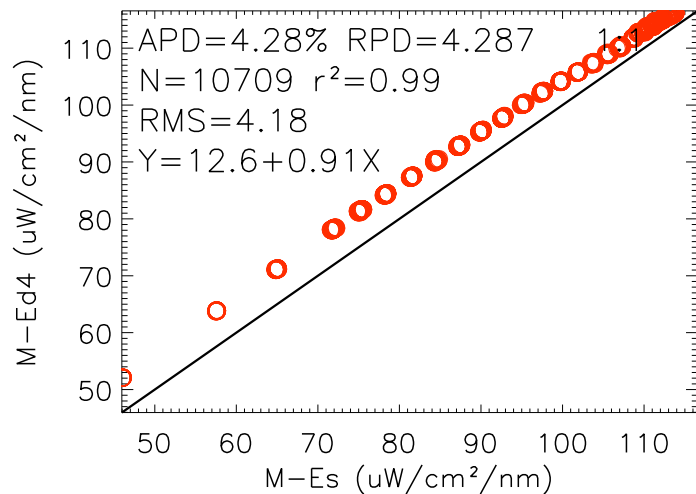
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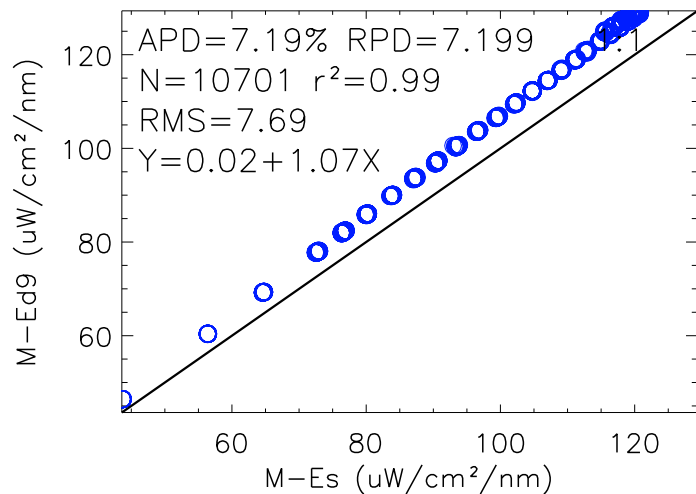
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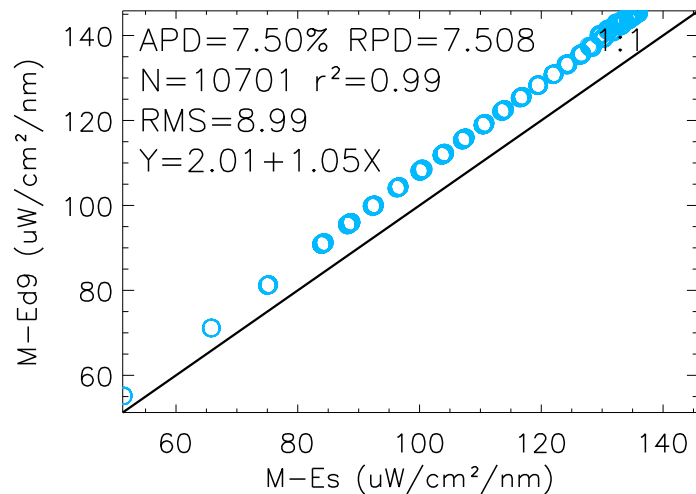
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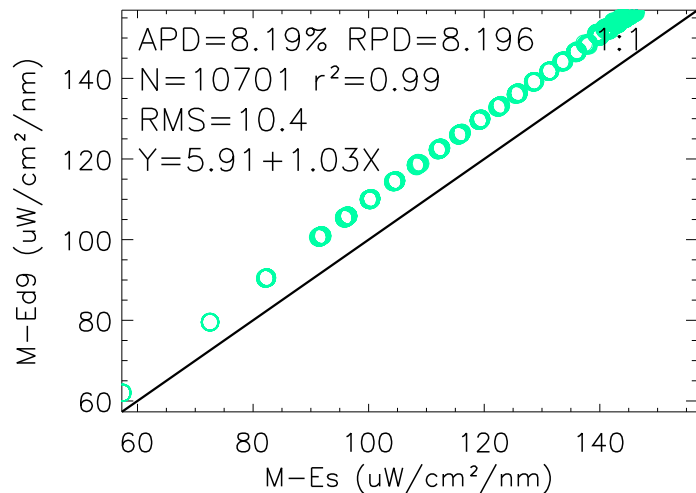
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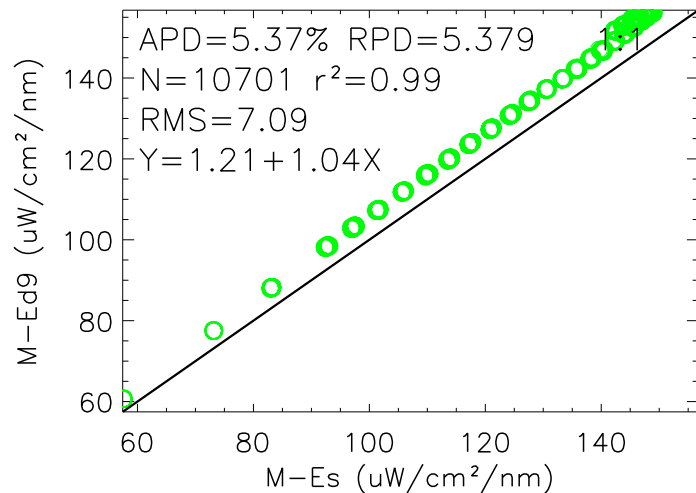
442.300



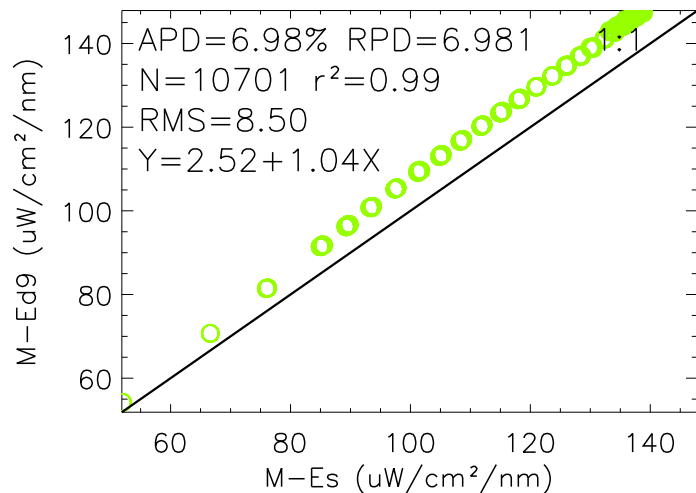
489.500



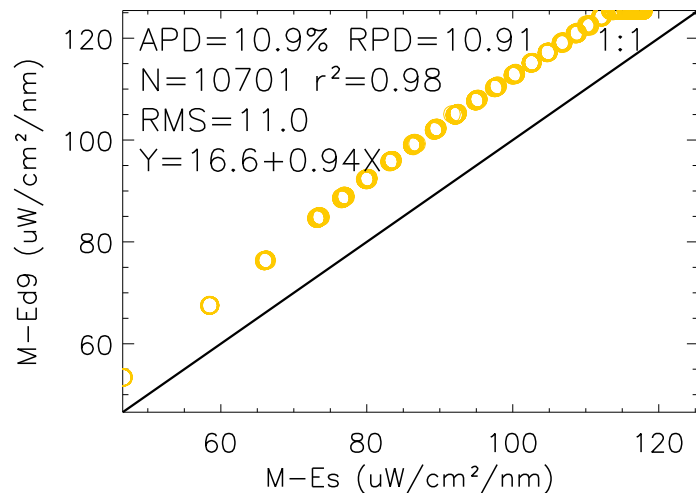
510.600



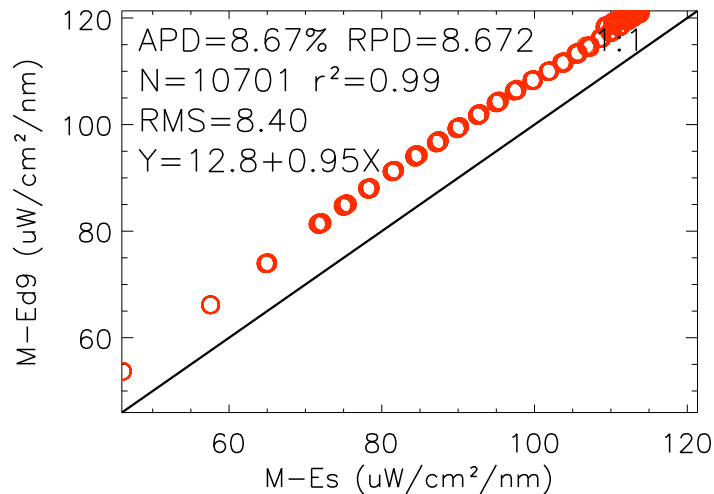
560.200



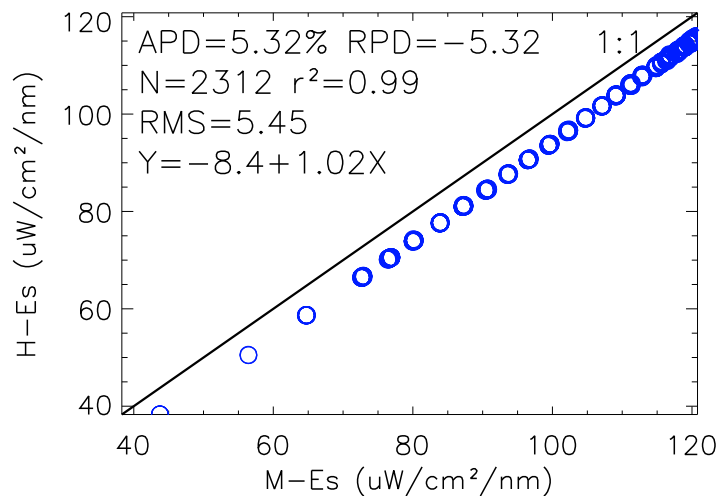
669.500



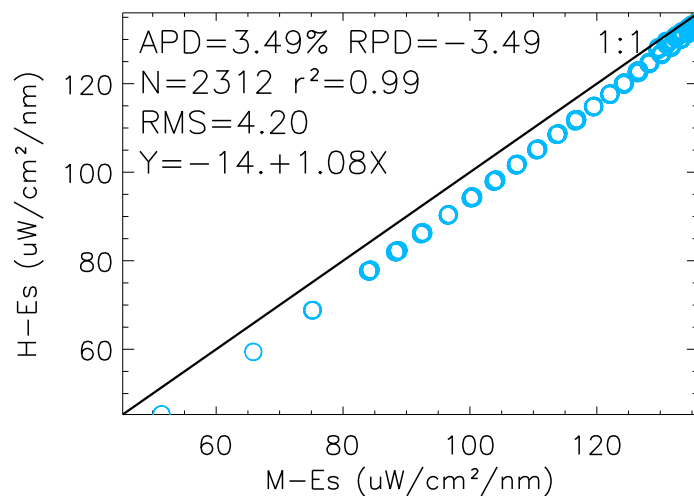
682.300



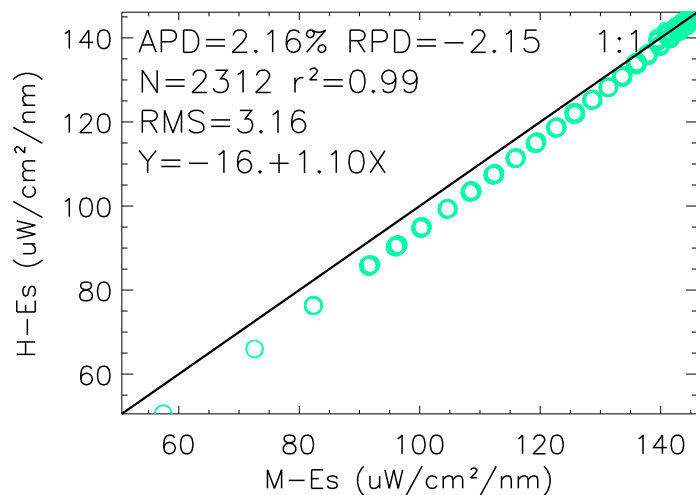
412.300



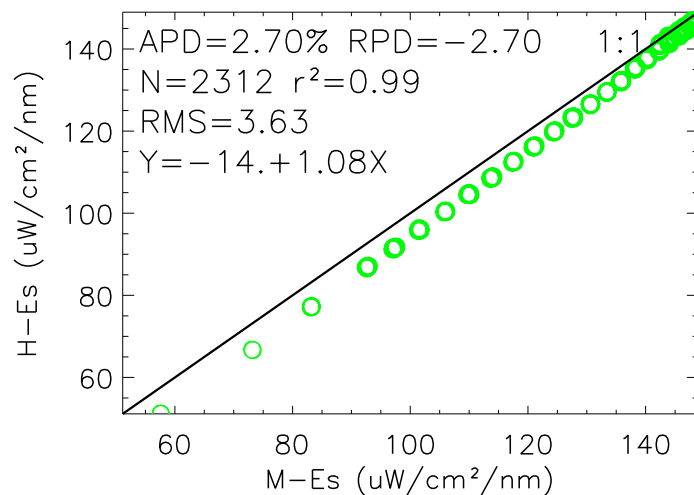
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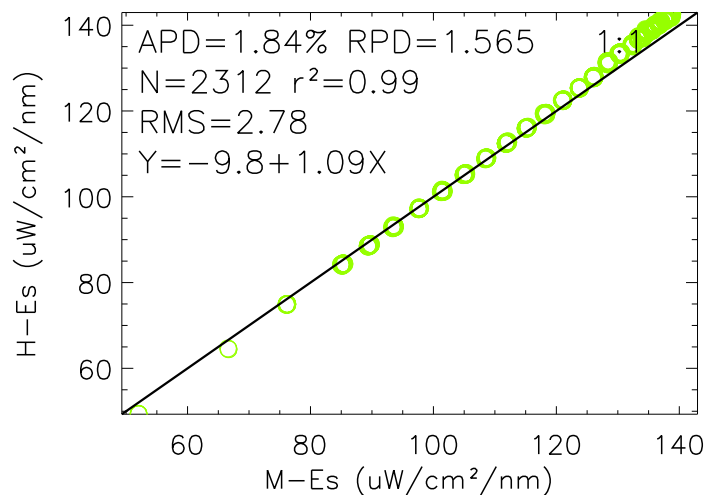
489.500



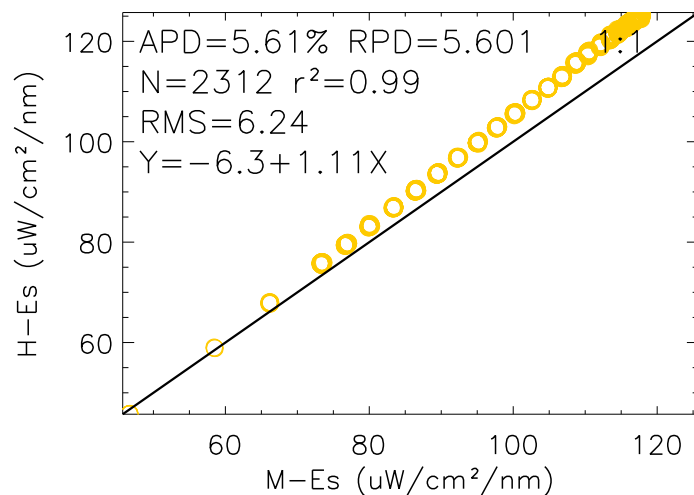
510.600



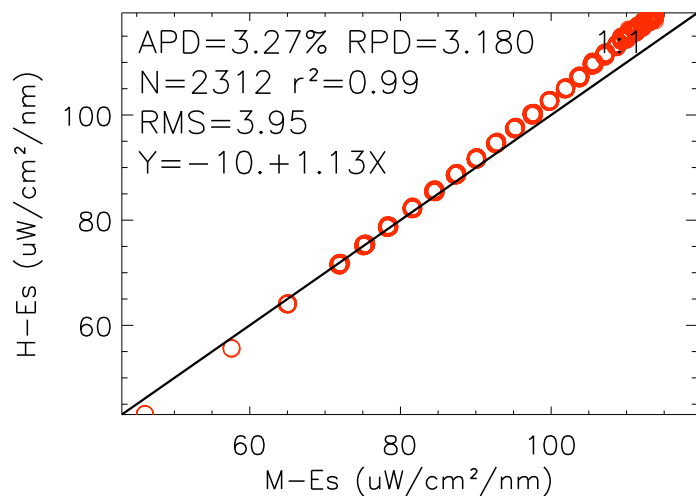
560.200

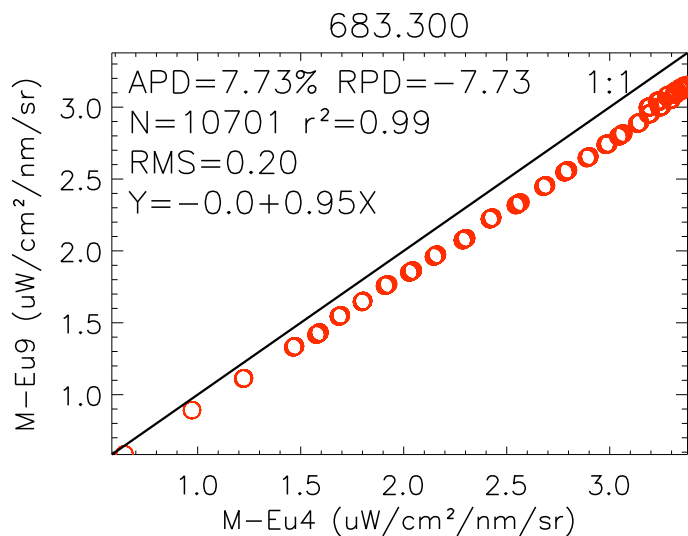
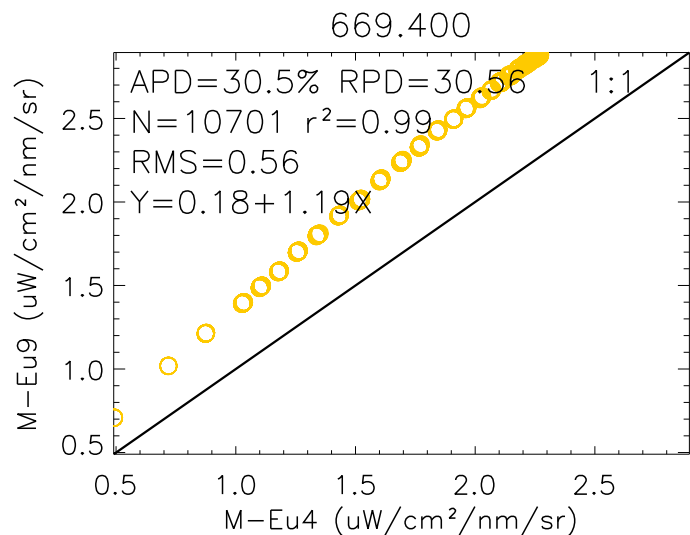
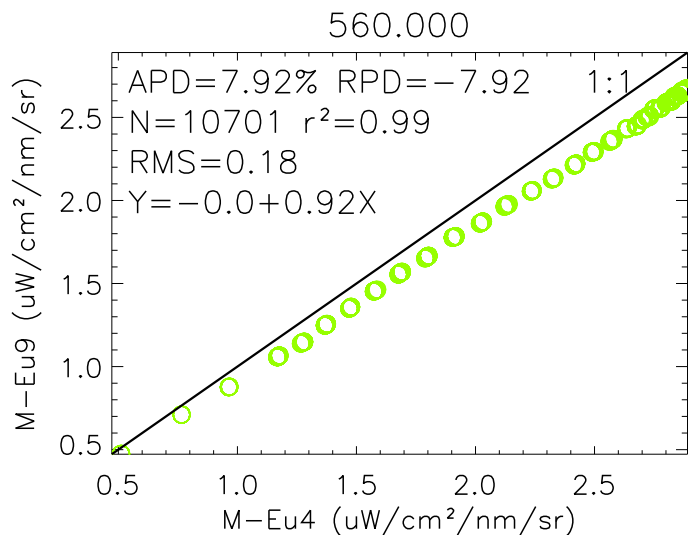
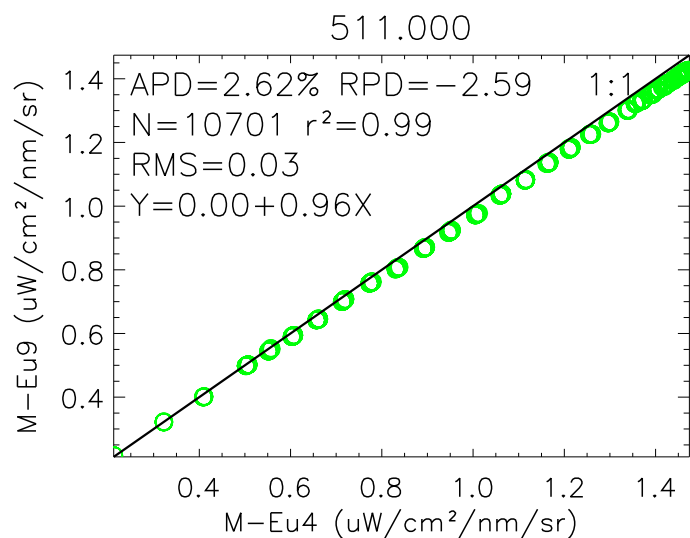
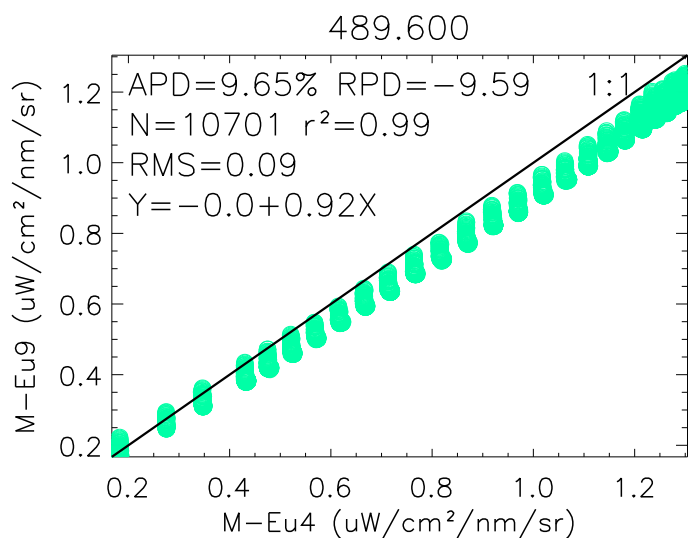
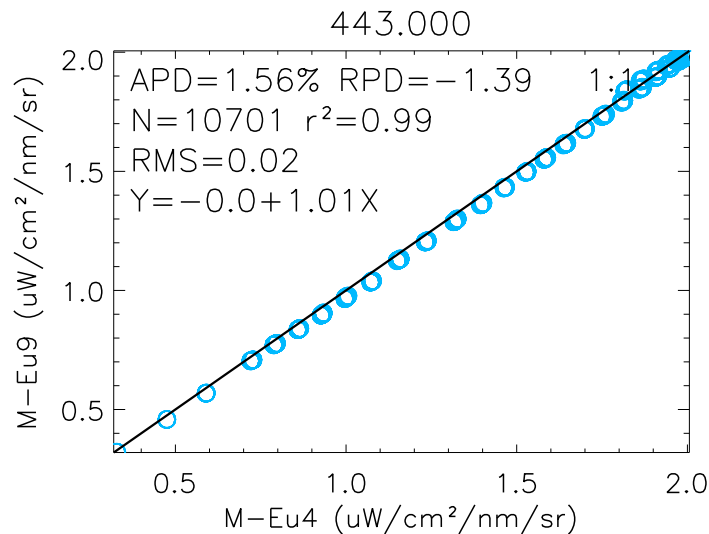
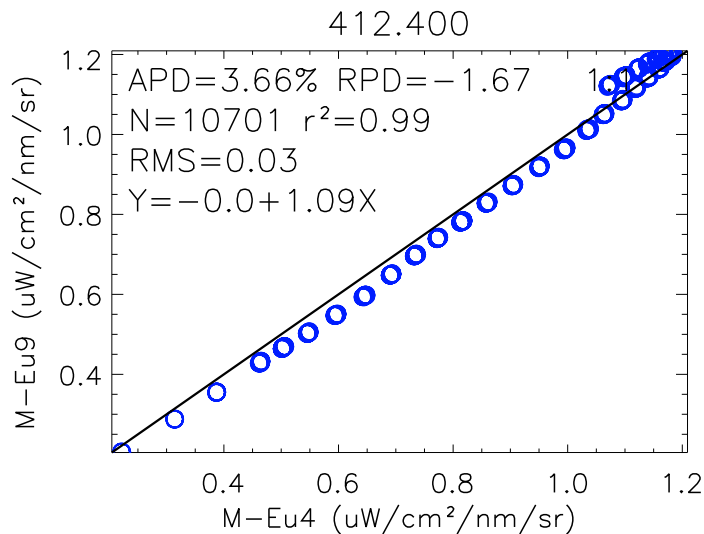


669.500

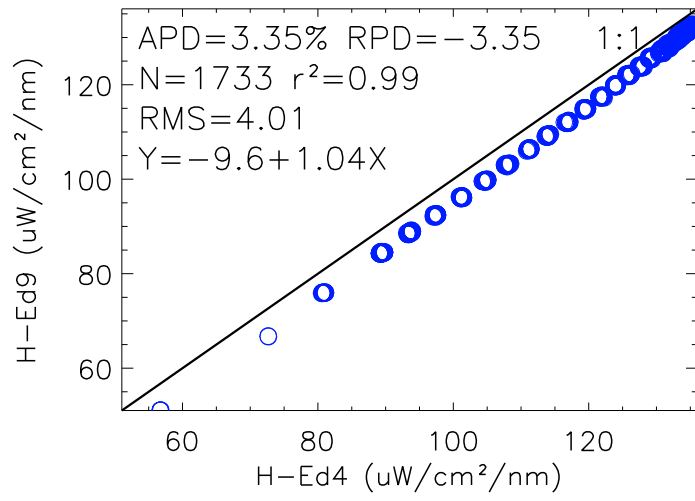


682.300

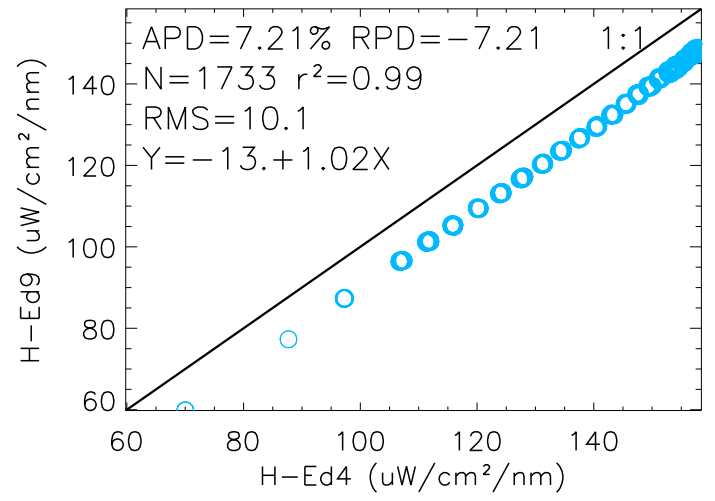




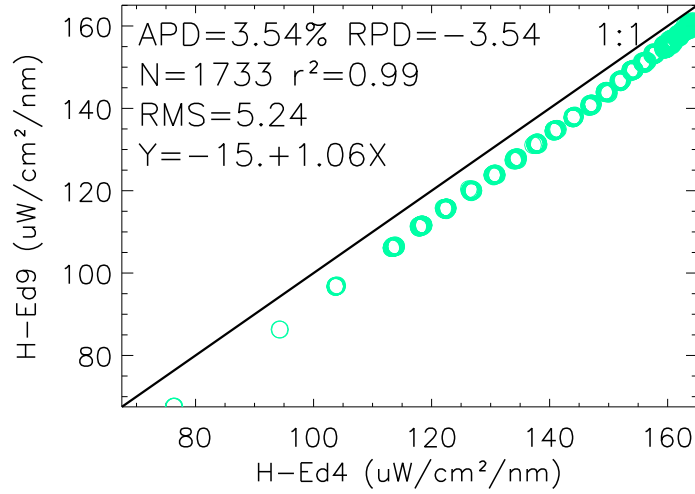
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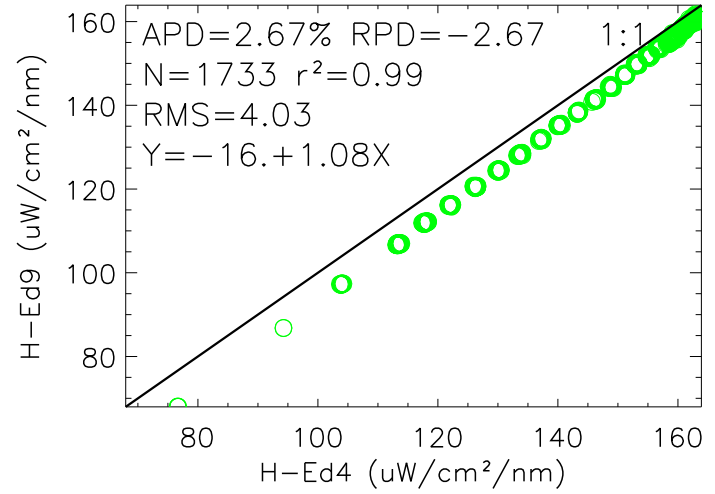
442.300



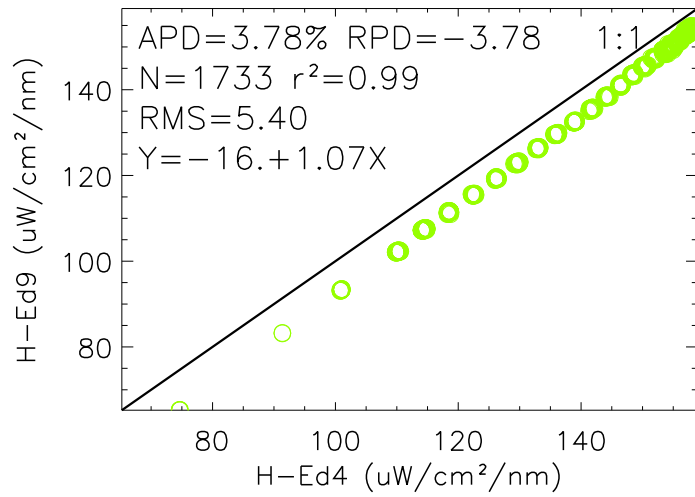
489.500



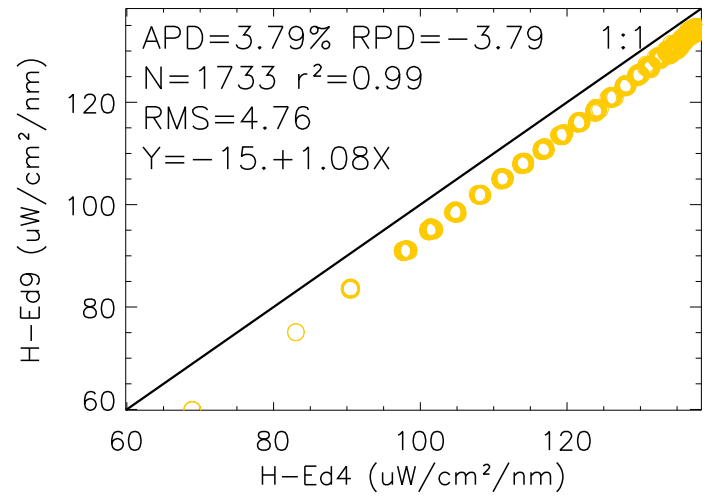
510.600



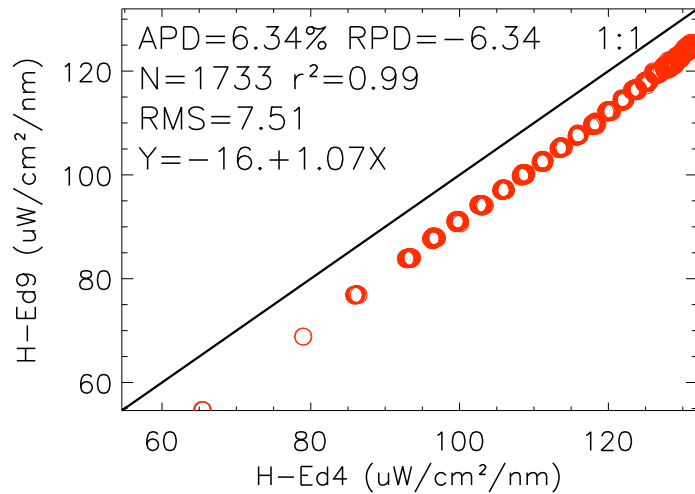
560.200

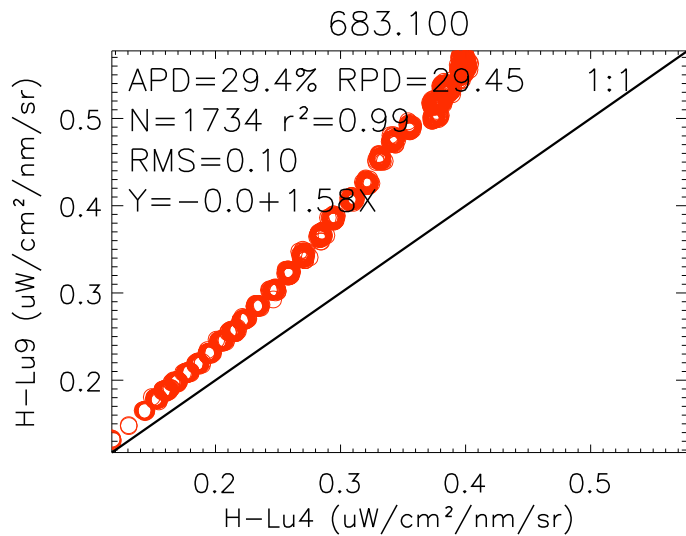
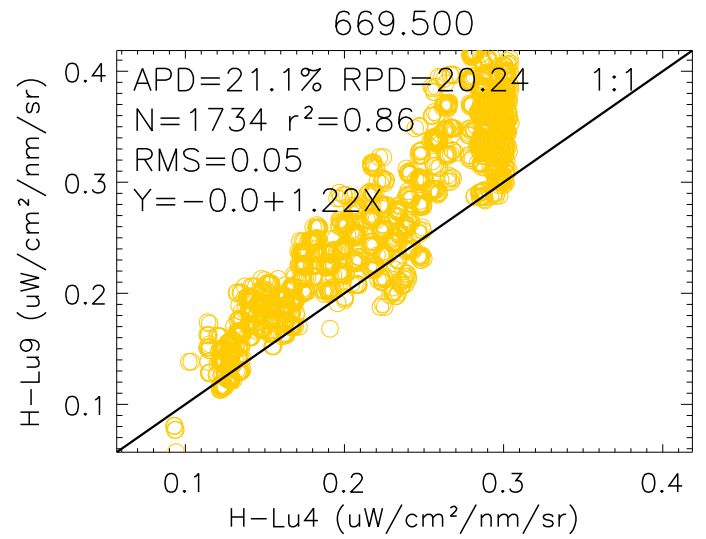
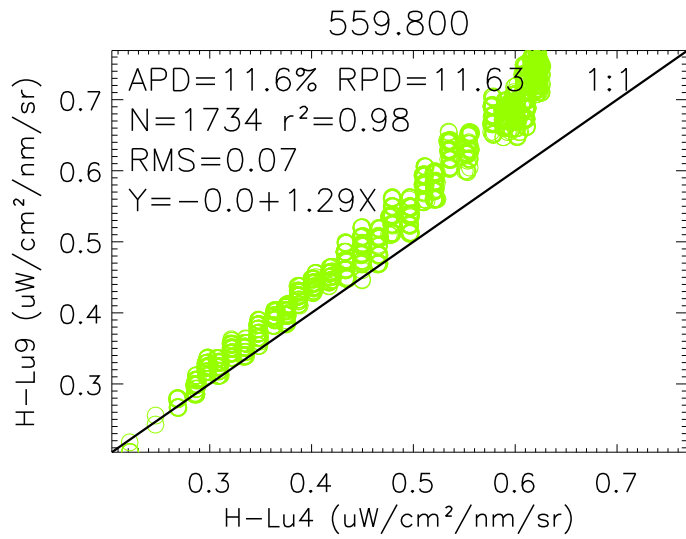
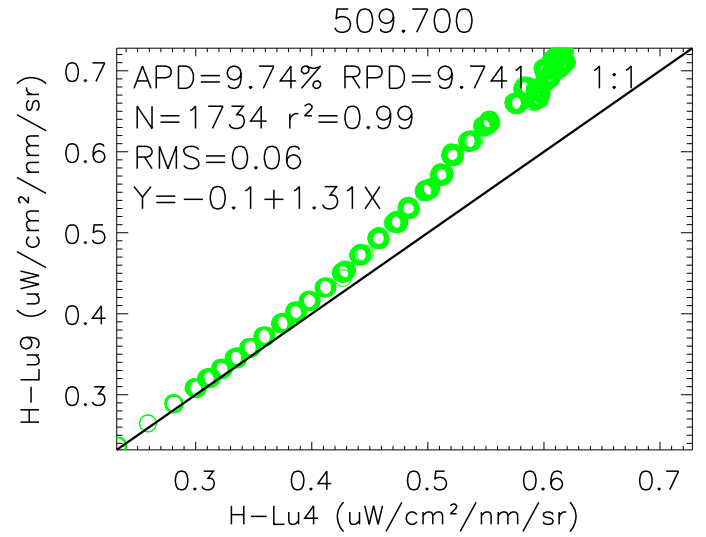
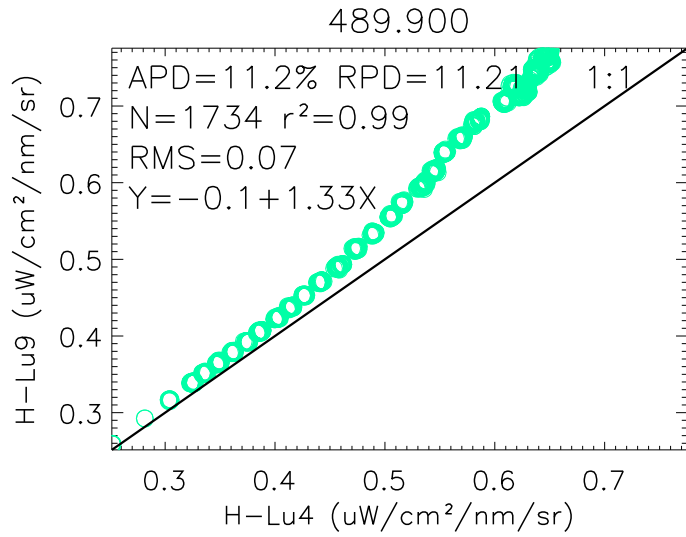
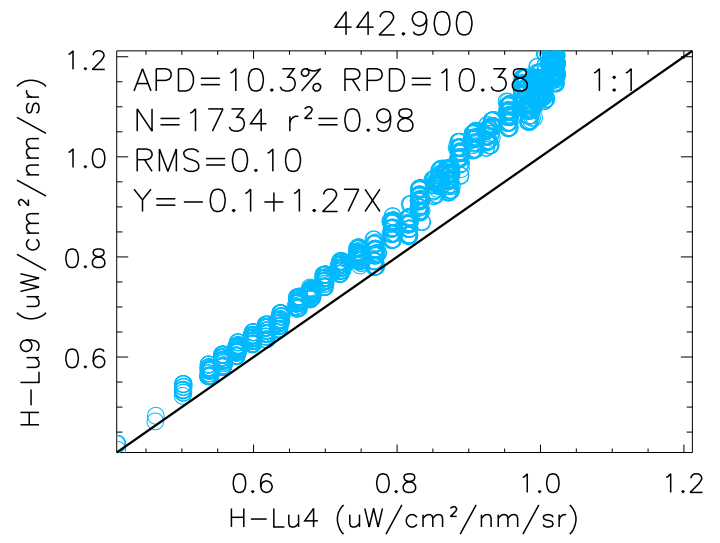
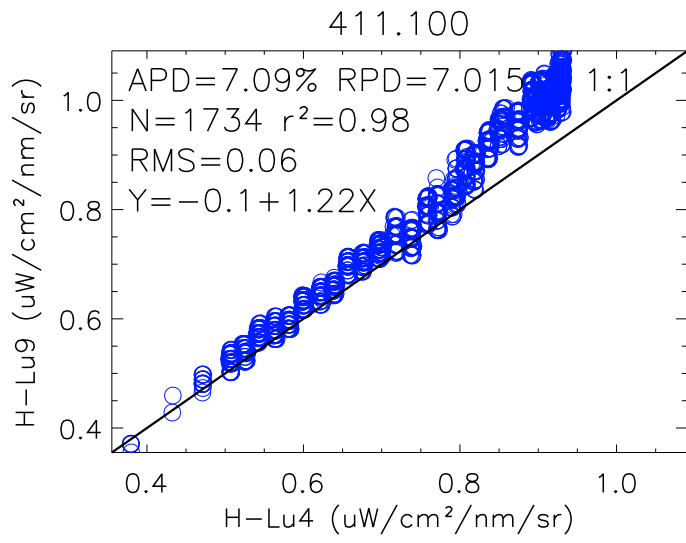


669.500

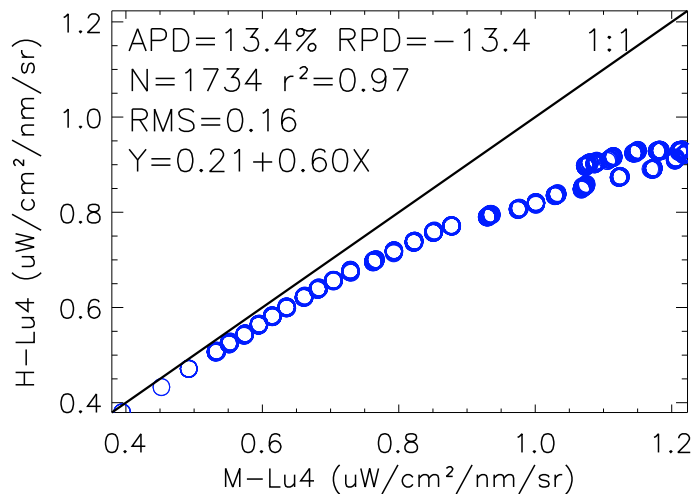


682.300

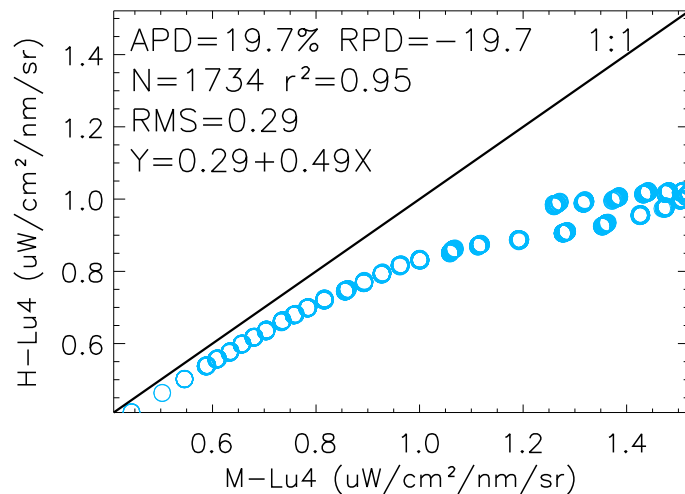




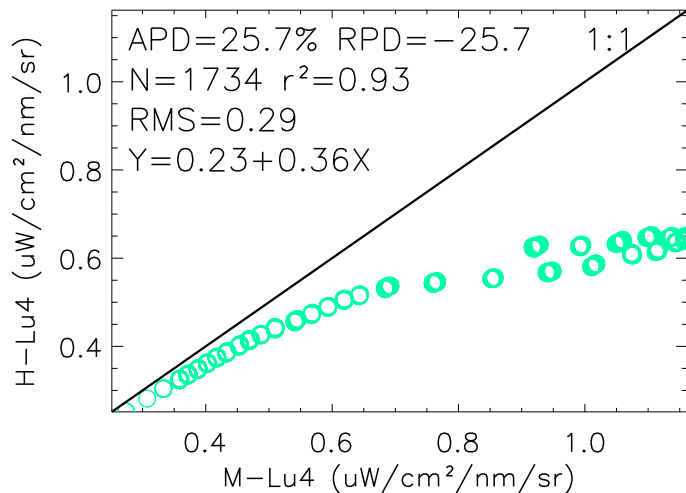
411.100



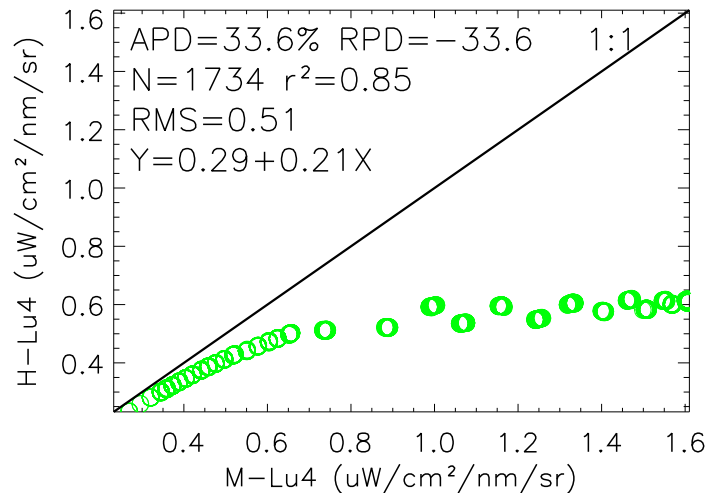
442.900



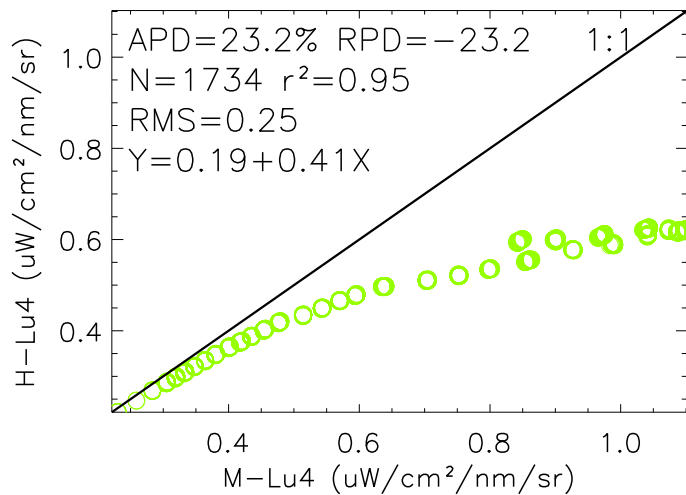
489.900



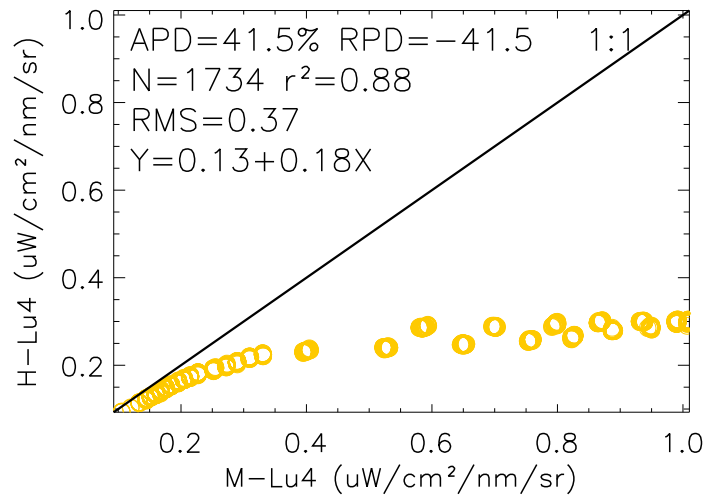
509.700



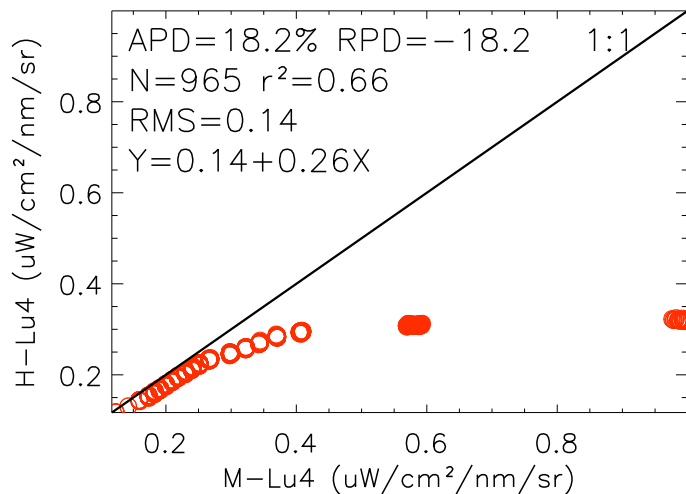
559.800



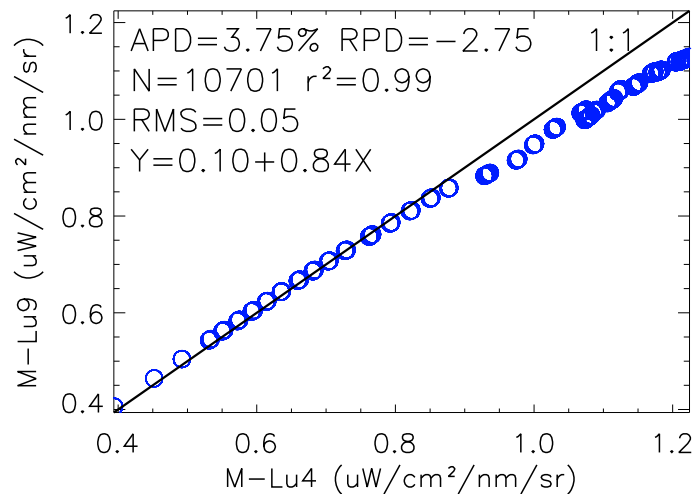
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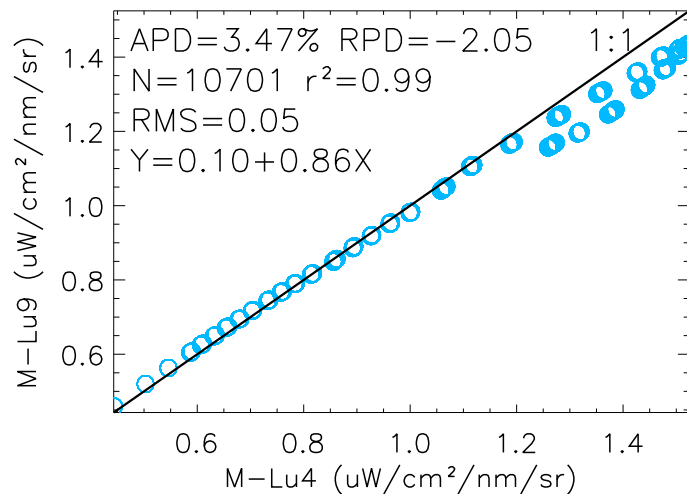
683.100



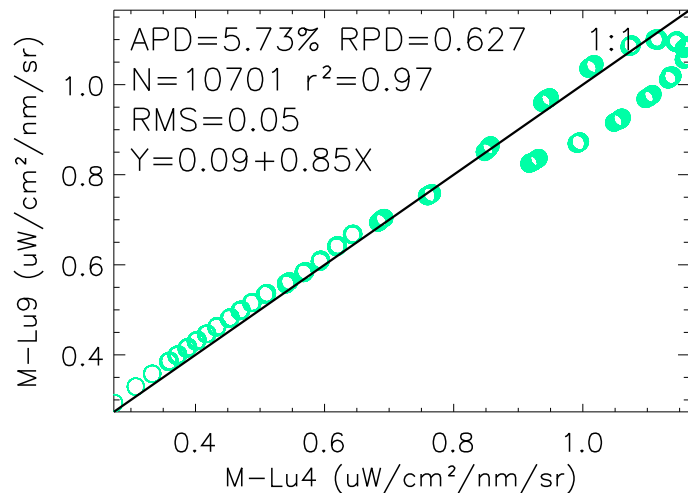
411.100



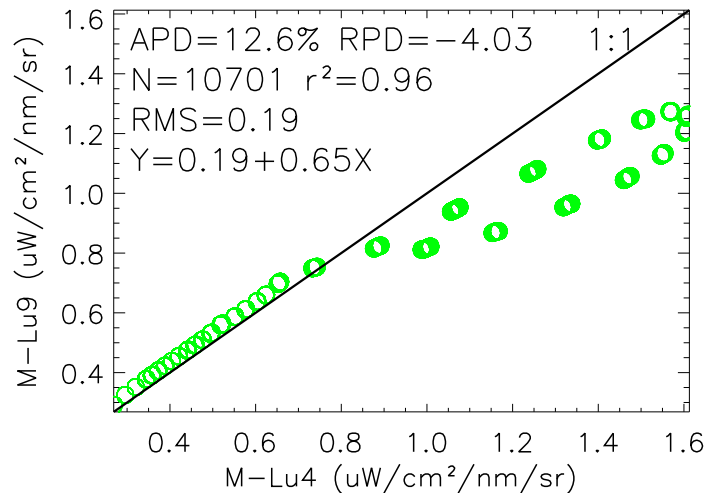
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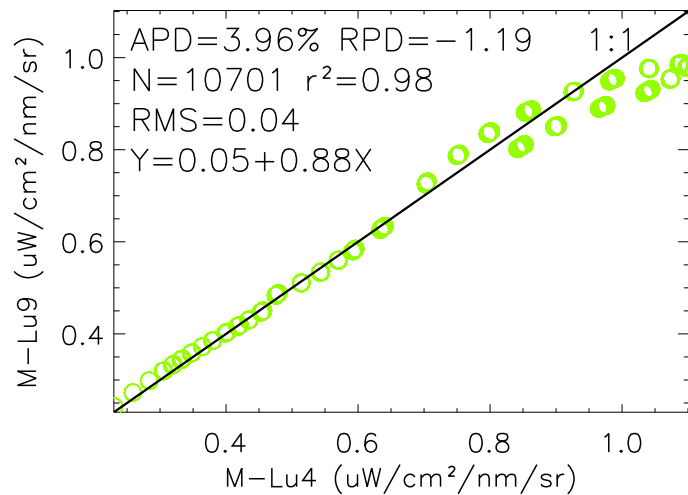
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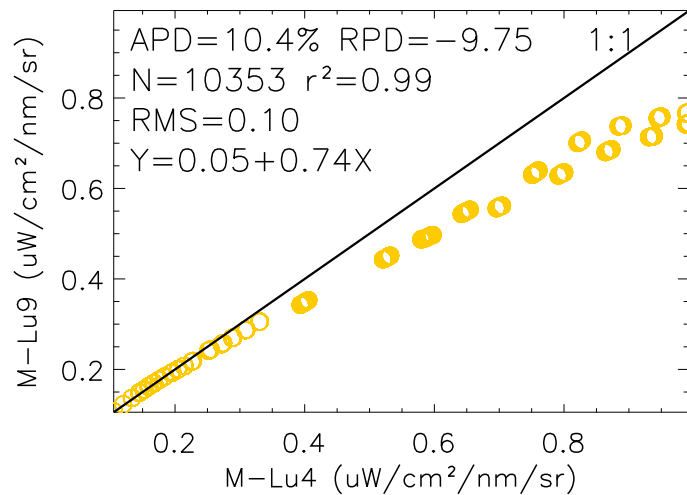
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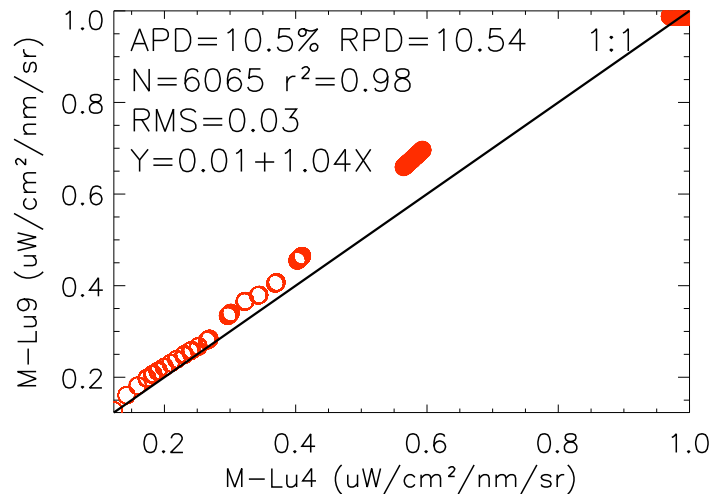
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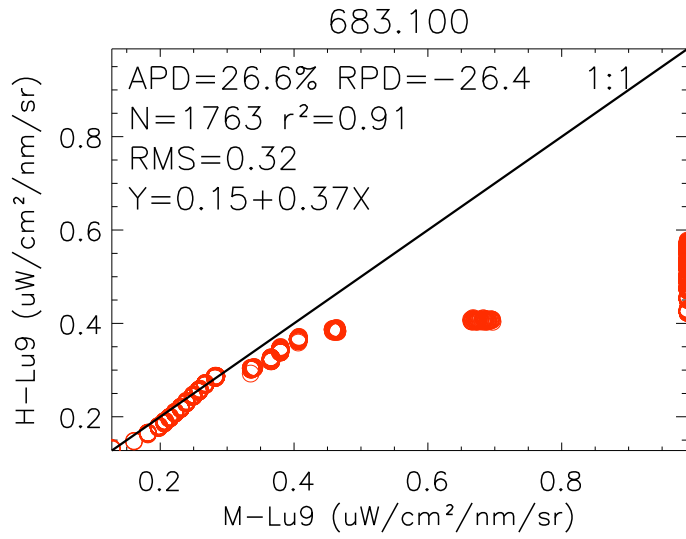
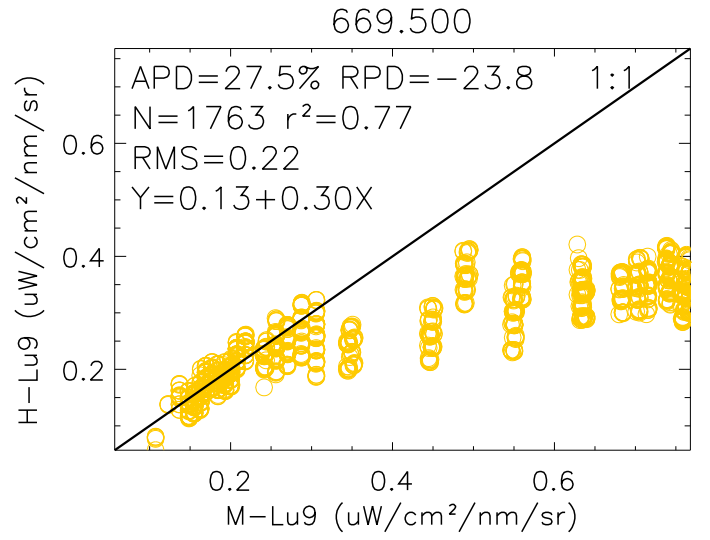
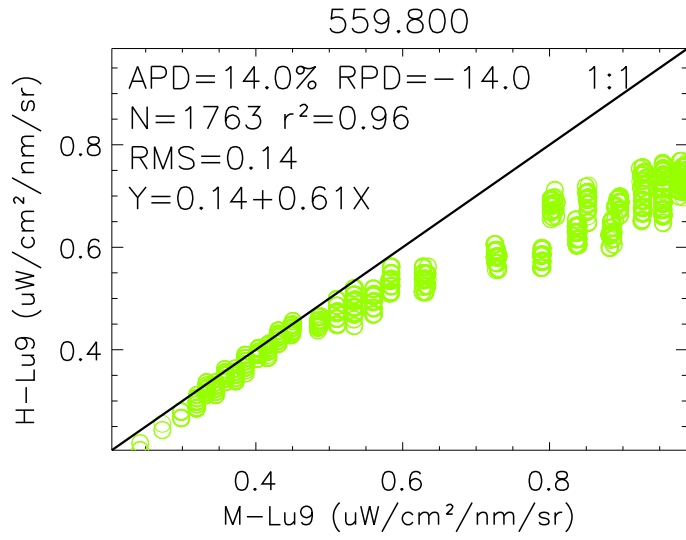
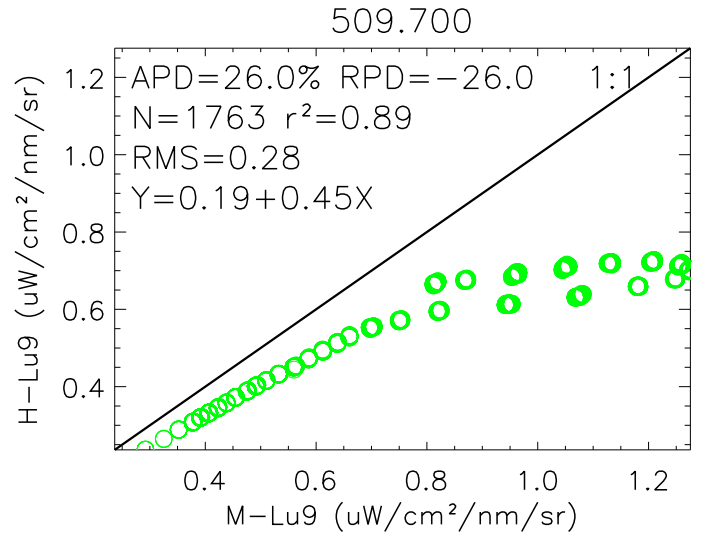
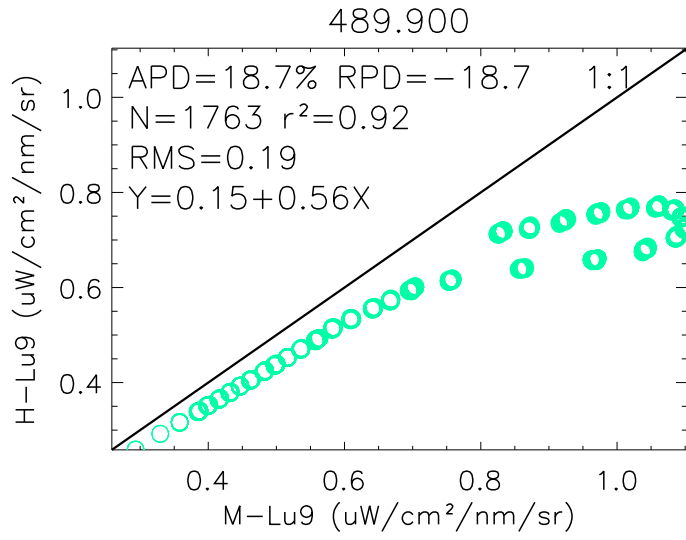
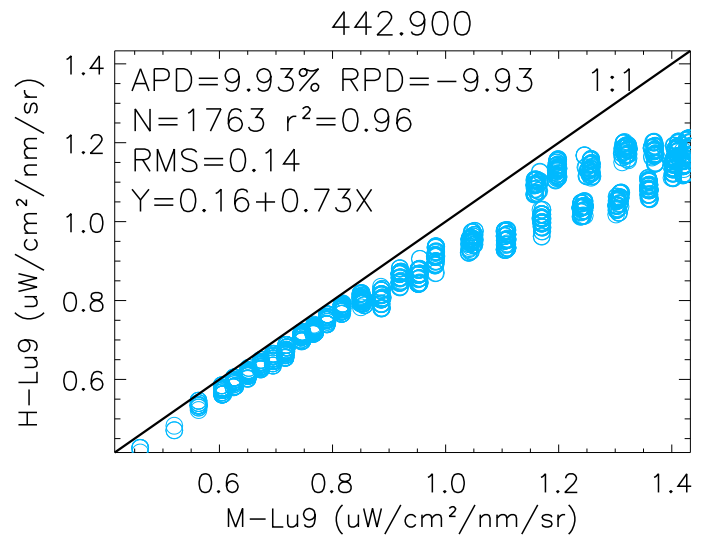
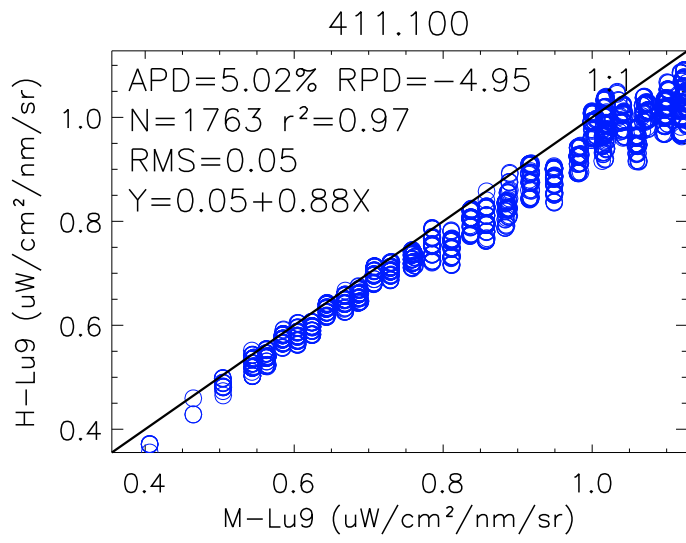


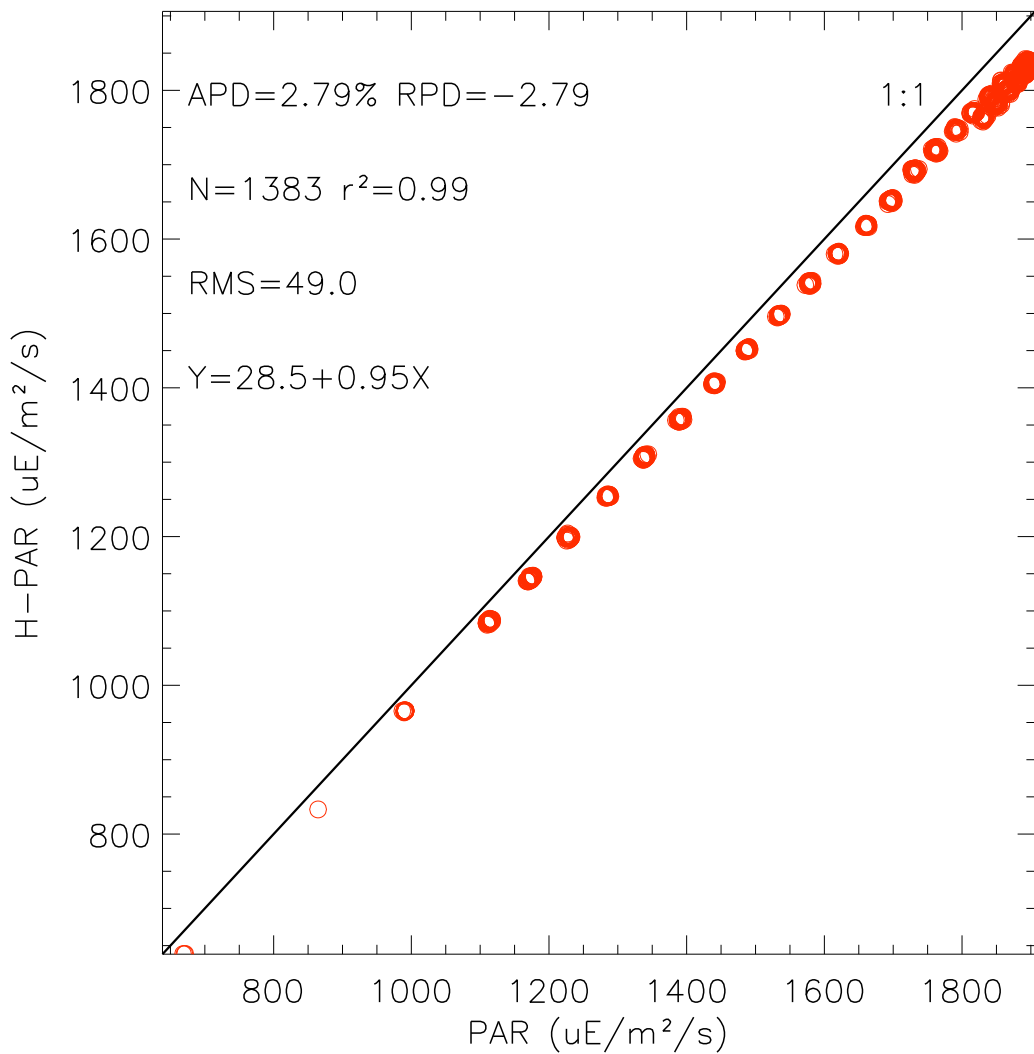
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683.100

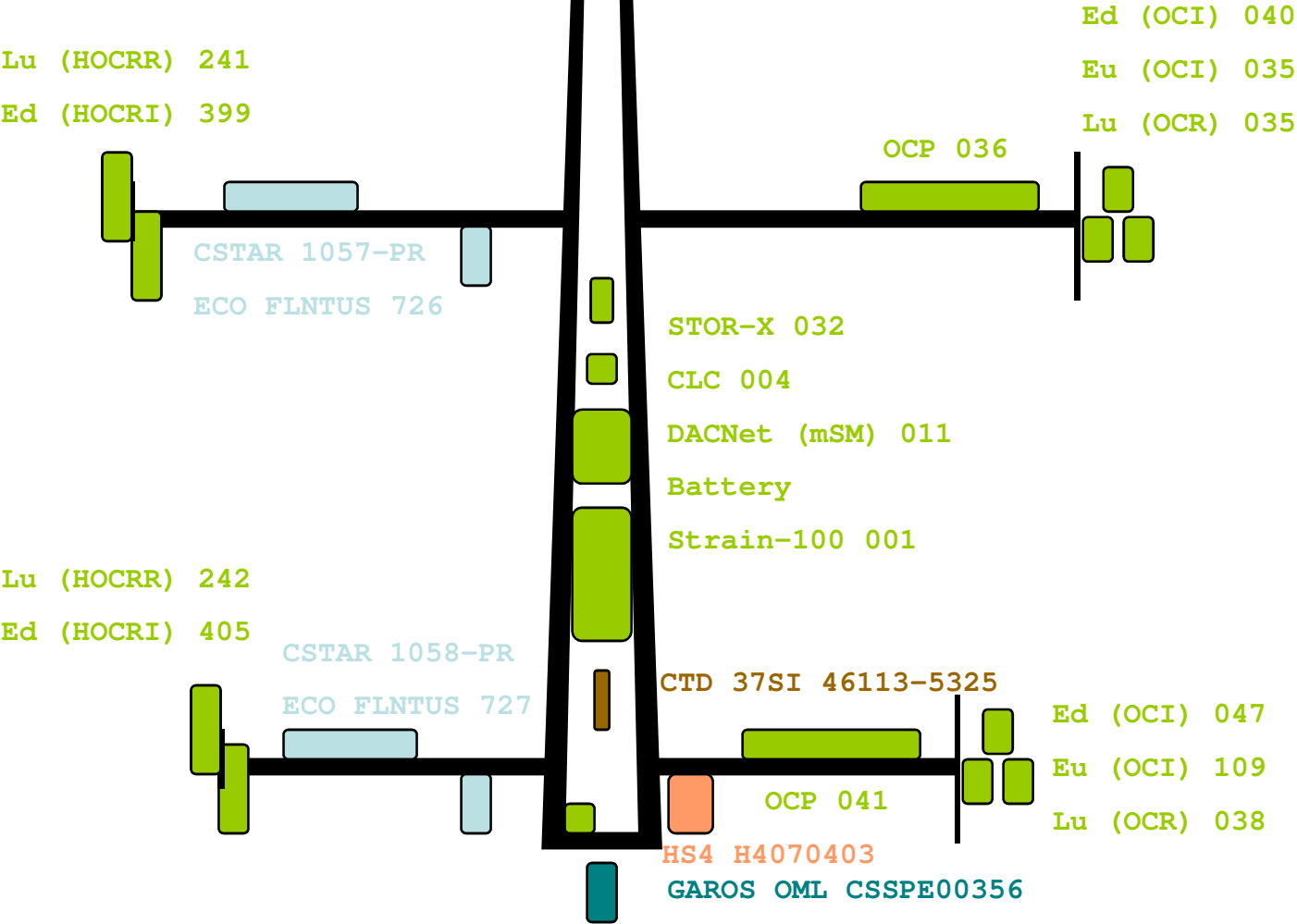


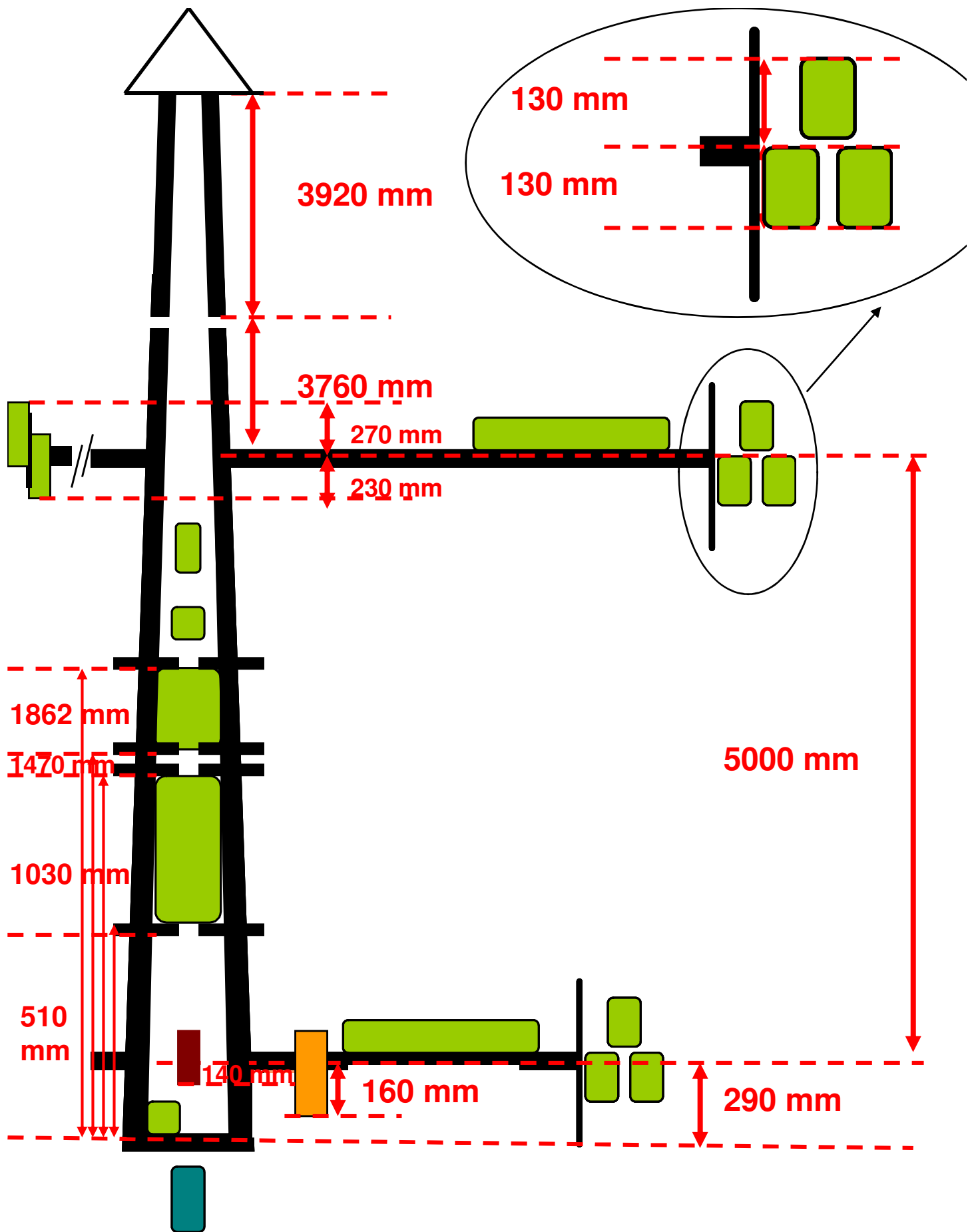


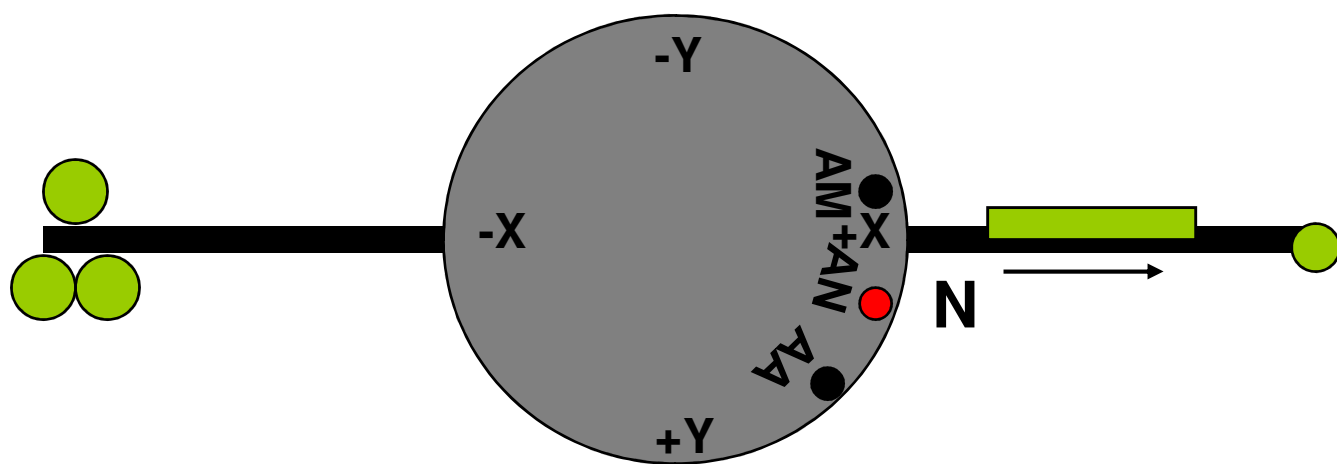


- SATLANTIC
- HOBI LABS
- WET LABS
- SEABIRD
- GARROS

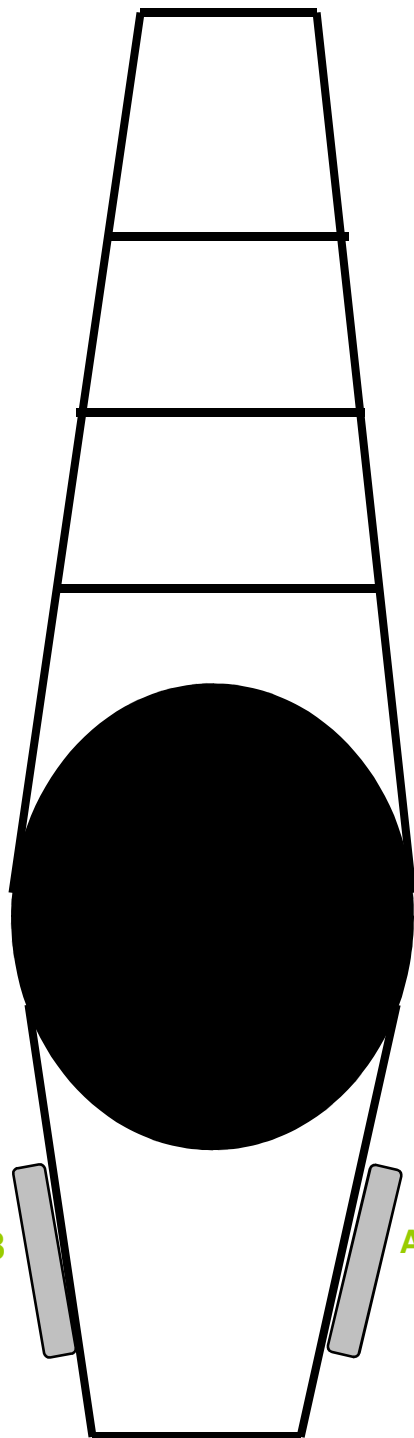
MVD (OCI) 095
ARGOS 17152 (18797)
Es (HO CI) 279
Junction Box SJB 004
MVDS 053
PAR 097
Feux:
Solar Panels:



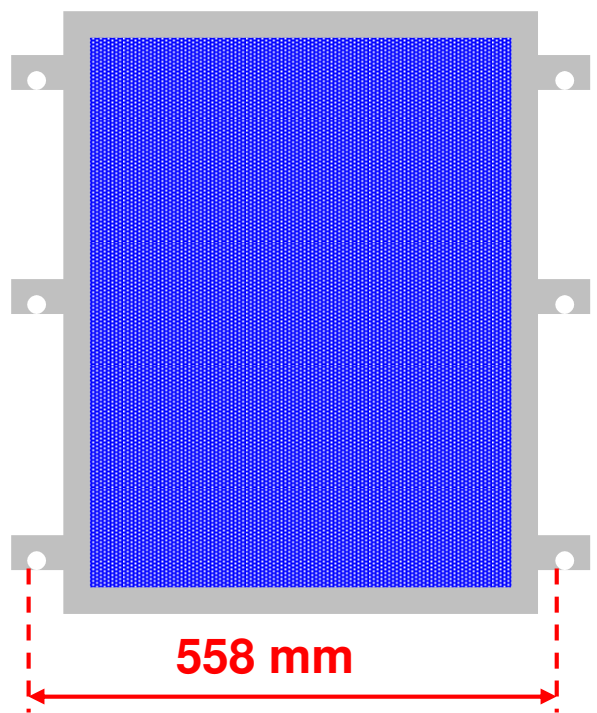




ARGOS 5433



ARGOS 74605



2012													
JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER		
11-Jan	17-Feb	15-Mar	5-Apr	15-May	2-Jun	18-Jun	16-Jul	13-Aug	22-Sep	5-Oct	27-Oct	20-Nov	20-Dec
(only rads cleaning)													
ocp036n.cal									ocp040l.cal				
CST-1057PR 726_2011-08-05			HPL241h & PLD241h.cal HPE399B & PED399B						CST-626PR 608_2012-01-10		HPL276H.cal & PLD276H.cal HPE421A.cal & PED421A.cal		
ocp041j.cal									ocp037m.cal				
CST-1058PR 727_2011-08-05			HPL242i & PLD242i.cal HPE405B & PED405B						CST-847PR 609_2012-01-10		HPL277F.cal & PLD277F.cal HPE422A.cal & PED422A.cal		
mvd053l.cal									mvd062l.cal				
HED279i.cal & Hse279i.cal									HED327J.cal & HSE327J.cal				
H4070403 2011-5-21.cal									H4080705 2011-11-13.cal				
Strain100_001b.cal									Strain100_001b.cal				
SATSTX0032d.cal									SATSTX0068d.cal				

buoy XIV deployment (2012-09-07, vf2)

OCI 040	(⇒MVD 095)	OCI 047	
OCI 035	OCR 035	OCI 109	OCR 038
<u>s04</u>		<u>s09</u>	

PAR 097	(⇒HOCR Es 279)
HOCRR 241 HOCRI 399	HOCRR 242 HOCRI 405
4 m	9 m
(⇒STOR-X 032)	

OCI 050		(⇒MVD 030)	OCI 164	
OCI 048	OCR 036		OCI 163	OCR 037
<u>b04</u>			<u>b09</u>	

PAR 061	(⇒HOCR Es 327)
HOCR 276	HOCR 277
4 m	9 m
(⇒STOR-X 068)	

same configuration of buoy X

