Matt's Copies, Originals are with Pedro

Ocean Optics

Ocean Optics, Inc.
Calibration Laboratories located in:
Winter Park, Florida, USA
Ostfildern, Germany

Certificate of Radiometric Calibration

Certificate Number: 19331
Date: 12/2/2015

Calibration Performed By:

OOI WINTER PARK
4301 METRIC DRIVE
WINTER PARK, FL 32792

For:

OCEAN OPTICS B.V. SALES
GEOGRAAF 24
DUIVEN, THE NETHERLANDS 6921EW

Calibrated Equipment Information

Description:	SPECTROMETER, UV- VIS
Model Number:	FLAME-S-XR1-ES
Serial Number:	FLMS00673
Nomenclature:	SPECTROMETER
Temp. [°F] / RH [%]:	70 / 56
Cal. Interval:	12 MONTHS
Cal Date [MM/DD/YYYY]:	12/2/2015
Cal. Due Date:	12/2/2016

Manufacturer: OCEAN OPTICS INC.
Performed By: BERNARDA CYGAN
Signature: BCyg
Calibration Result: PASS

The calibration values in units [uJoule/counts] are stored on CD provided with this certificate.
As Found and As Left data are the same unless indicated otherwise in Calibration Notes

Calibration Notes

Calibrated Sysytem Configuration: FLAME-S-XR1-ES S/N:FLMS00673 with CC-3-DA
Calibration is voided CC-3-DA cosine corrector is removed.

Standards Used To Calibrate Equipment

ID	Model Number	Description	Last Cal.	Cal. Due Date
11066045	TH803	TEMPERATURE / HUMIDITY RECORDER	8/24/2015	8/24/2016
12221337	OL 83A	PROGRAMMABLE DC CURRENT SOURCE	10/8/2015	10/8/2016
665	68840	POWER SUPPLY, DEUTERIUM	9/29/2015	9/29/2016
AS012494	953.46317178	CALIPER, VERNIER, 24 INCH	11/13/2015	11/13/2017
CH6907	63345	STANDARD LAMP, DEUTERIUM, CATHODEON R48	6/2/2015	
F-1312	OL FEL-C	STANDARD OF SPECTRAL IRRADIANCE, 1000W C	4/30/2015	

Procedures Used In This Event

Procedure	Title	Revision	Revision Date
MET.009	CAL OF SPECTROMETERS	5	8/2/2013

Linearity Test

Serial Number **FLMS00673**

Tech: Bill.Hays

Linearity: **99.81781**

Tested: 11/13/15

Test # 135,759.00

Intercept	0.878133
Coefficient 1	8.83404e-006
Coefficient 2	-5.07091e-010
Coefficient 3	3.80507e-014
Coefficient 4	-1.84551e-018
Coefficient 5	4.64183e-023
Coefficient 6	-5.62435e-028
Coefficient 7	2.56084e-033

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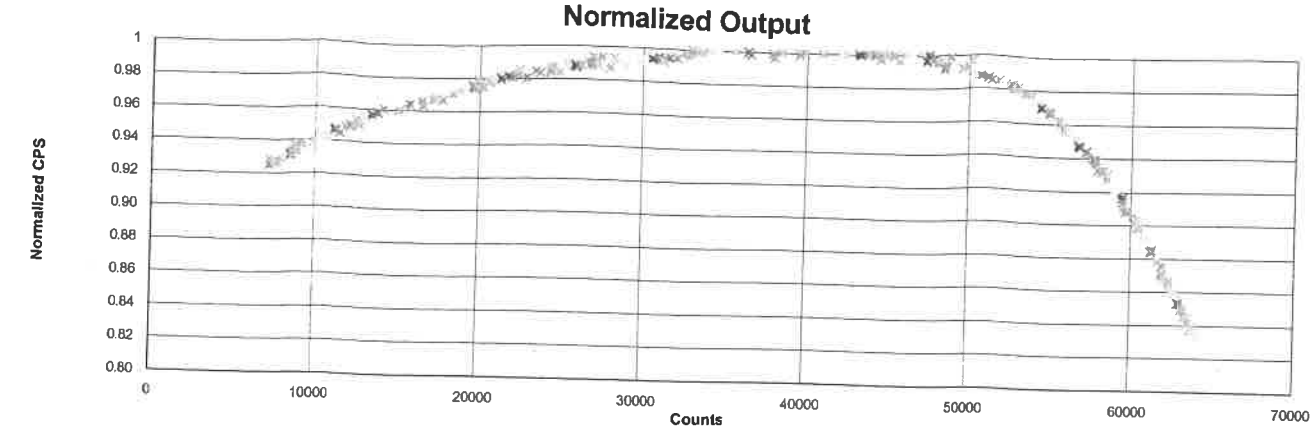
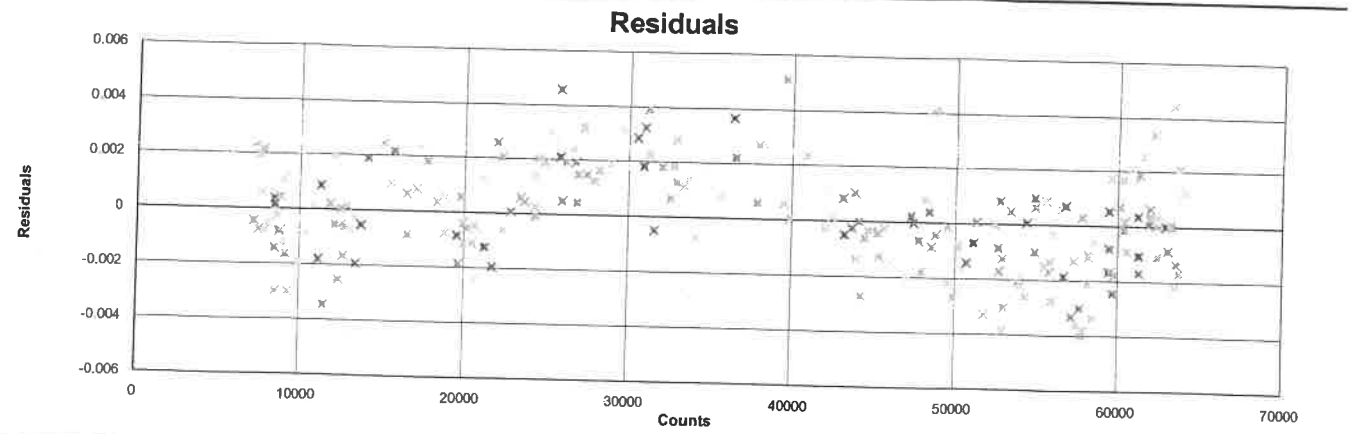
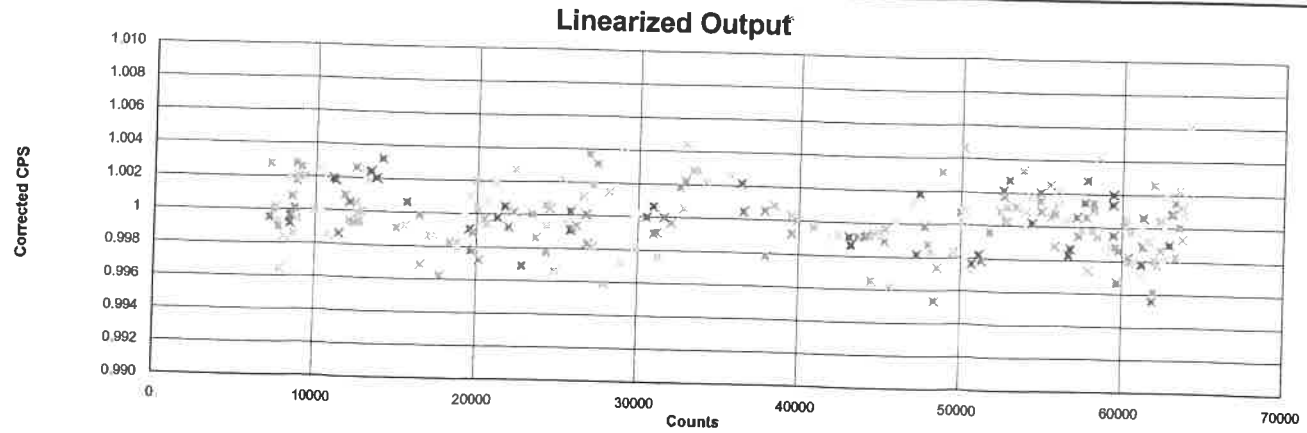


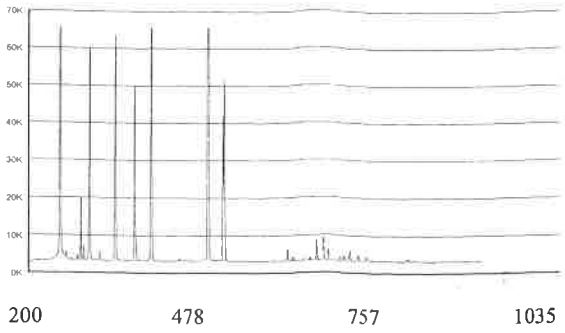




Max **1.00615394**

Min **0.99543571**

HG-1 Spectrum



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Wavelength Calibration Data Sheet

Built for:
Order Number:
Model: **FLAME-S-XR1-ES**
Grating: GRATING_#XR1
Bandwidth: 200 - 1035 nm
Options: DET2B-200-1100 Detector, L2Lens, INTSMA-025 Slit,

Serial Number: **FLMS00673**

λ	Pixel #	Predicted λ	Δλ
253.652	141	253.579	0.073
296.728	235	296.713	0.015
302.150	247	302.162	-0.012
313.155	271	312.941	0.214
326.106	300	326.087	0.019
334.148	318	334.216	-0.068
334.557	318	334.573	-0.016
365.015	387	365.207	-0.192
404.656	475	404.702	-0.046
435.834	546	435.827	0.007
467.816	619	467.801	0.015
472.216	629	472.194	0.022
479.992	647	479.977	0.015
508.582	713	508.552	0.030
546.074	801	546.013	0.061
585.249	894	585.214	0.035
587.091	898	587.114	-0.023
594.483	916	594.473	0.010
602.999	936	603.021	-0.022
621.728	981	621.737	-0.009
626.649	993	626.658	-0.009
630.479	1002	630.476	0.003
633.443	1009	633.478	-0.035
650.653	1051	650.670	-0.017
692.947	1154	692.965	-0.018
696.543	1163	696.535	0.008
724.516	1232	724.480	0.036
727.294	1239	727.314	-0.020
738.398	1266	738.411	-0.013
743.890	1280	743.876	0.014
748.887	1293	748.883	0.004
763.511	1329	763.505	0.006
794.818	1408	794.825	-0.007
811.531	1450	811.383	0.148
826.452	1489	826.358	0.094
842.465	1530	842.244	0.221
852.144	1555	852.031	0.113
912.297	1713	912.323	-0.026

This is a sample of calibration peaks used as there were more than can be shown on this page

Calibration Coefficients

First Coefficient:	0.4673083127
Second Coefficient:	-2.60286e-005
Third Coefficient:	-3.68223e-011
Intercept:	188.41407776
Regression Fit:	0.9999993443

Stray Light Measurements (AU)

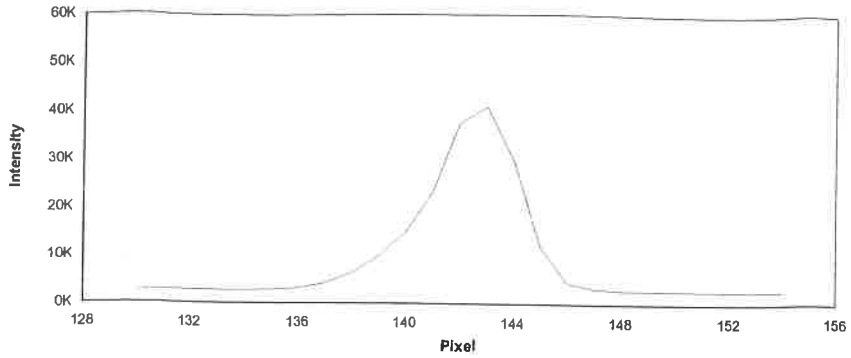
Holmium Oxide (444nm):	1.85
Yellow Dye:	2.46
Blue Dye:	2.64
Molybdate:	2.21
OG550 Filter:	2.52
RG850 Filter:	3.05
FG3 Filter:	1.29

Cielo Gonzalez

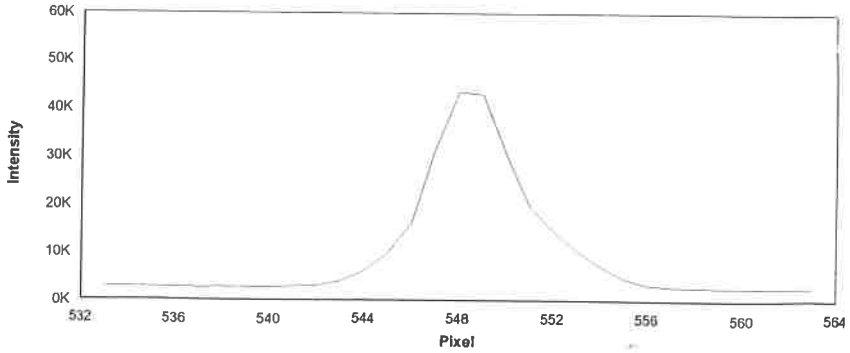
Calibrated By: Bill.Hays
Calibrated: 13-November-2015

Resolution and Accuracy for FLMS00673

Result	FWHM in Pixels	Delta	Wavelength	Peak Source	Date
Passed	3.63	-0.08	253.65	HG-1	11/12/15 1:25 pm



Result	FWHM in Pixels	Delta	Wavelength	Peak Source	Date
Passed	4.26	-0.08	435.83	HG-1	11/12/15 1:25 pm



esult	FWHM in Pixels	Delta	Wavelength	Peak Source	Date
assed	4.71	-0.08	763.51	Ar	11/12/15 1:25 pm