

RBCC-E 2014 langley campaign the triad before Arosa/Davos campaing

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Introduction

- ▶ Initial comparison
- ▶ Instrumental characterization
- ▶ Wavelength calibration
- ▶ Langley calibration

Introduction II

Configuration evaluated

- ▶ **Initial configuration** The configuration after K&Z maintenance and the #145 supplied configuration
- ▶ **Operative configuration** The RBCC-E calibration provided by IOS until 2011, then extended by Langley by RBCC-E
- ▶ **Alternative configuration** We probe changes with this configuration, in particular DT values were maintained to IOS values in disagreement with the measurements, on the alternative configuration we use the measured values 4 ns lower than setting on the instrument.

This configuration files are available on the config directory of the campaign

Initial comparison

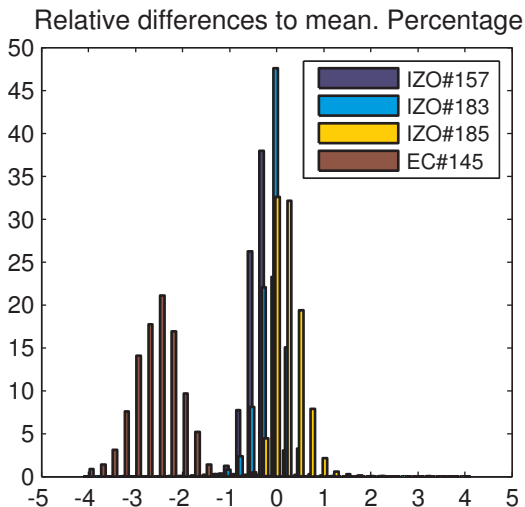


Figure 1 : Triad relative differences histogram ten minutes synchronized measurements.

Initial comparison

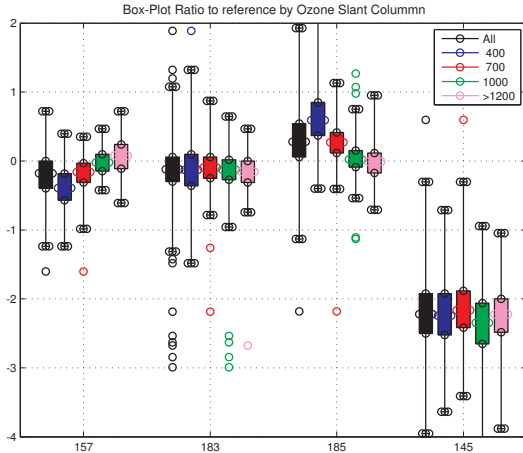


Figure 2 : triad relative differences , by ozone slant column interval

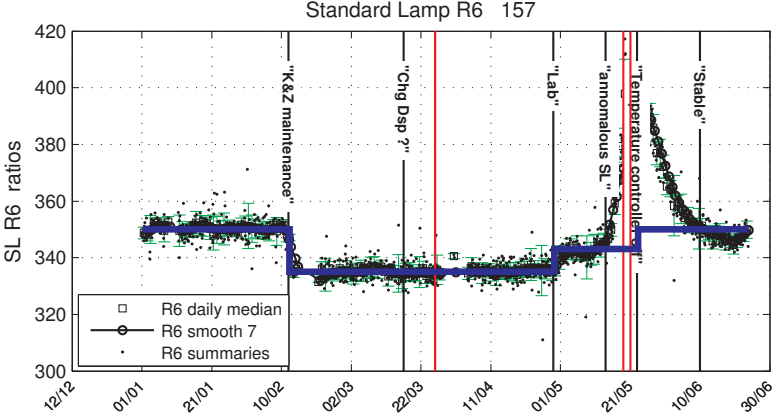
Table 1 : Differences % ratio total and by osc

	IZO#157	IZO#183	IZO#185	EC#145	
All	-0.2 +/-0.32	-0.1 +/-0.35	0.3 +/-0.42	-2.2 +/-0.5	616
400	-0.4 +/-0.34	-0.1 +/-0.38	0.6 +/-0.42	-2.2 +/-0.44	344
700	-0.2 +/-0.24	-0.1 +/-0.31	0.3 +/-0.27	-2.2 +/-0.57	520
1000	0 +/-0.18	-0.1 +/-0.42	0 +/-0.24	-2.4 +/-0.57	840
1200	0.1 +/-0.26	-0.2 +/-0.28	0 +/-0.21	-2.2 +/-0.39	1350

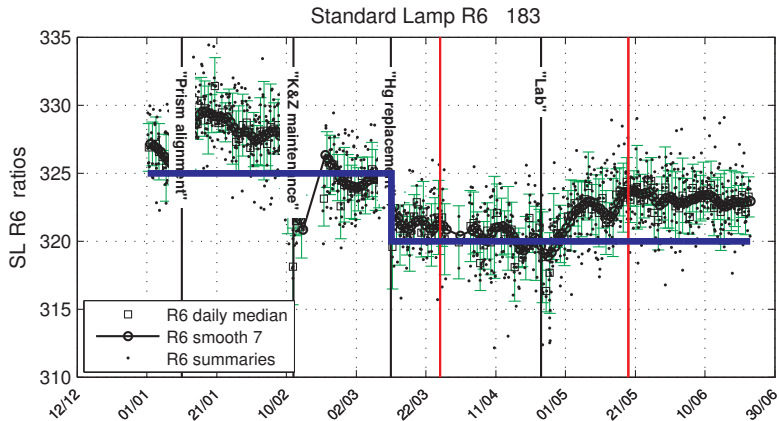
Initial Comparison

- ▶ The initial comparison using the operative configuration for all the campaign for first of April to 20 of May.
- ▶ The configuration used here were provisional after the maintenance of the Triad after of K&Z in late February.
- ▶ The agreement of the triad with this configuration is reasonable good but do not reflect all the changes due the maintenance and a small ozone slant column dependence of the ratios are found on brewer #157 and #185
- ▶ The brewer #145 underestimate the 2.2% in mean versus the average of the three brewer of the triad.
- ▶ The differences are almost constant during the campaign and flat against the ozone slant column
- ▶ **This clearly indicates that the difference is due a ozone cross section mismatch**

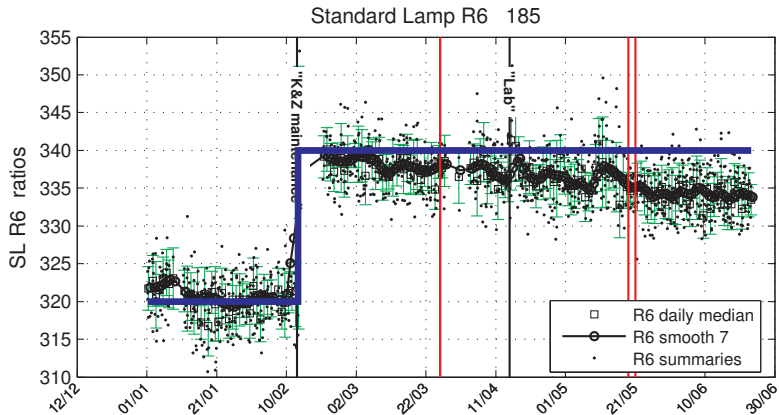
Instrumental Characterization : Brewer #157



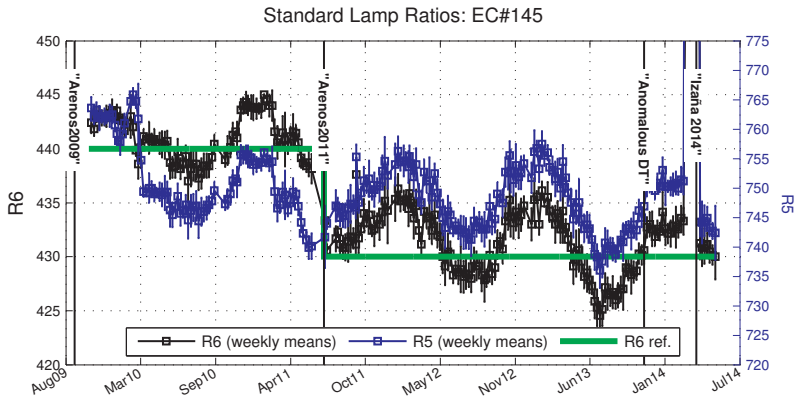
Instrumental Characterization : Brewer #183



Instrumental Characterization : Brewer #185



Instrumental Characterization : Brewer #145



Instrumental Characterization :Summary

- Brewer#157 : SL ratios unstable after beginning of may. The operative DT constant differs 4 *ns* from the calculated value.
- Brewer#183 : Stable instrument, but temperature dependence has to be checked.
- Brewer#185 : The operative DT constant differs 4 *ns* from the calculated value. Temperature dependence needs further analysis, some issue with neutral density filter#4.
- Brewer#145 : The operative DT constant differs 4 *ns* from the calculated value. Some small but significant temperature dependence is observed. *Neutral density filter issues #3 & #4 (not shown).*

Langley Calibration:Methodology

The methodology used is essentially the same that was described at Brewer Workshops in addition we also calculate the Dobson methodology (*Khomyr 1/mu*).

- ▶ The regression is performed on the [1.25 , 3.5] airmass range, using the brewer astronomical formulas for the airmass determination.
- ▶ The morning and afternoon Langley are taken separately.
- ▶ Individual measurements (not the average of 5) are considered with the cloud screen method of 2.5 ozone standard deviation.
- ▶ Also this limit 2.5 DU for the daily standard deviation are used to select the Langley events.
- ▶ MS9 double ratios are corrected for filter non linearity in the case of Brewer #185 (Filter 3).

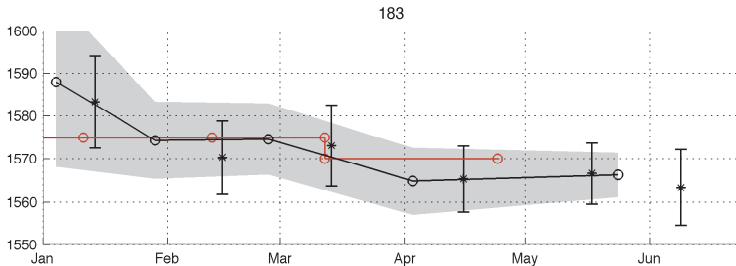
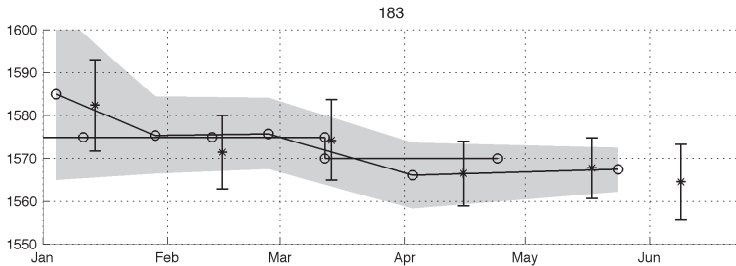
Langley Calibration:DT evaluation

We use the langley calibration to check the calibration and see effect on the determined ETC of the 4 ns on DT difference we found on Brewers 157,185, and 145.

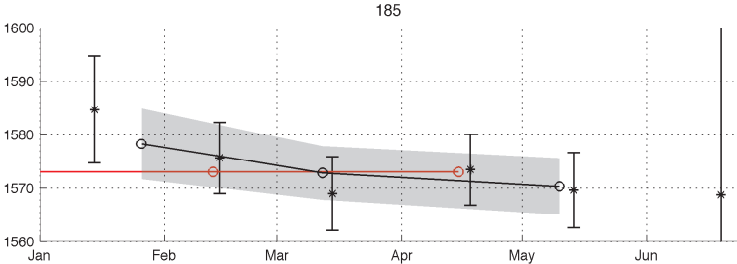
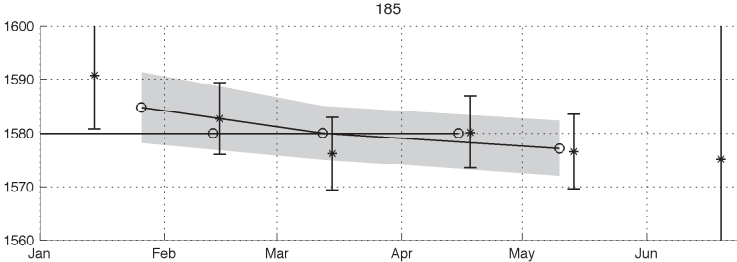
Table 2 : Langley ETC difference Operative - Alternative with diferent DT constans

	ETC (op-alt)	cfg op DT	cfg al DT
IZO#157	6	32	28
IZO#183	1.1	23	22
IZO#185	6.9	33	29
EC#145	6.6	32	28

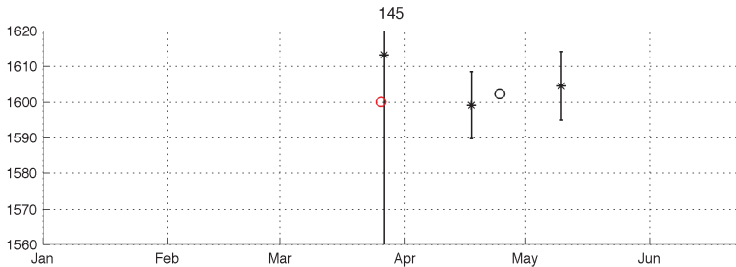
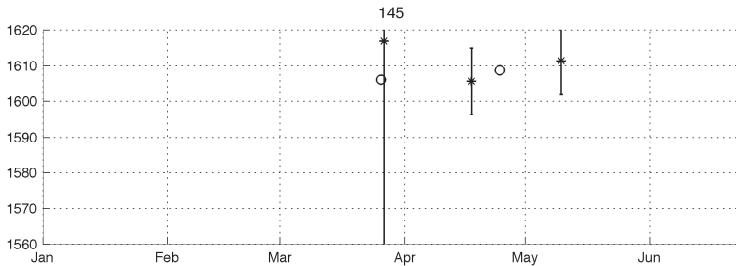
Langley #183



Langley #185



Langley #145



Langley Conclusions

ETC DT The 4 units in DT are translated in 5-7 units in the ETC constant in all the instruments, so the agreement of both configurations will be the same.

ETC#157 Tracks the changes detected on the SL due the temperature controller malfunction.

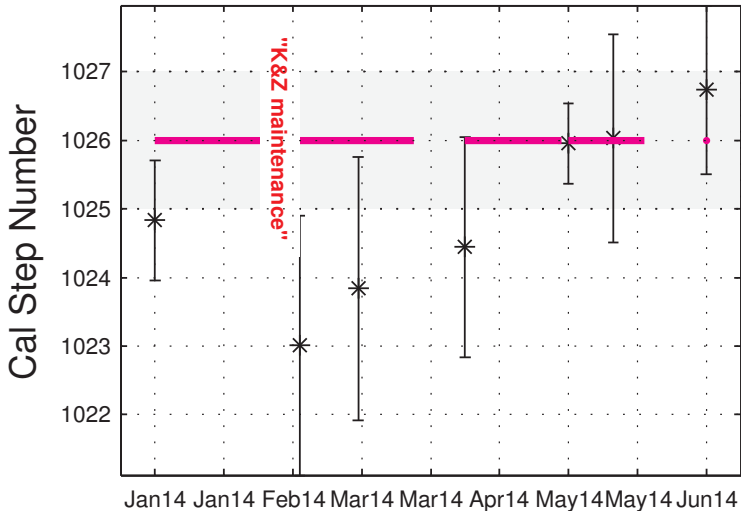
ETC#183 Tracks the changes detected on the SL after the HG replacement.

ETC#185 Shows the small decrease also shown on SL record.

ETC#145 Confirm the ETC value on the configuration file.

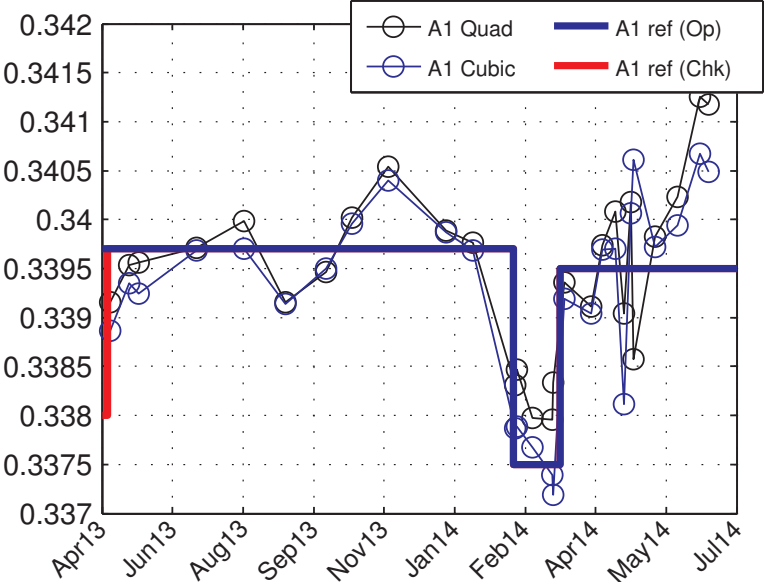
The Langley confirm the ETC constants of the configuration files

Brewer IZO#157

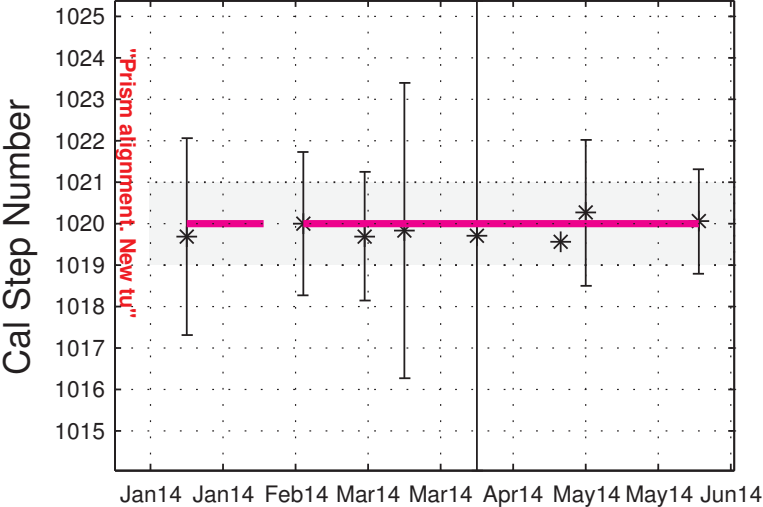


Brewer #157 DSP

IZO#157

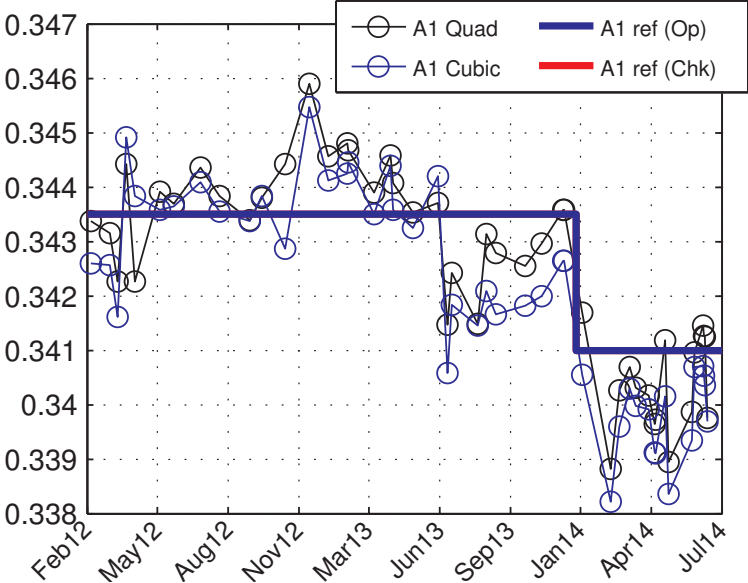


Brewer IZO#183

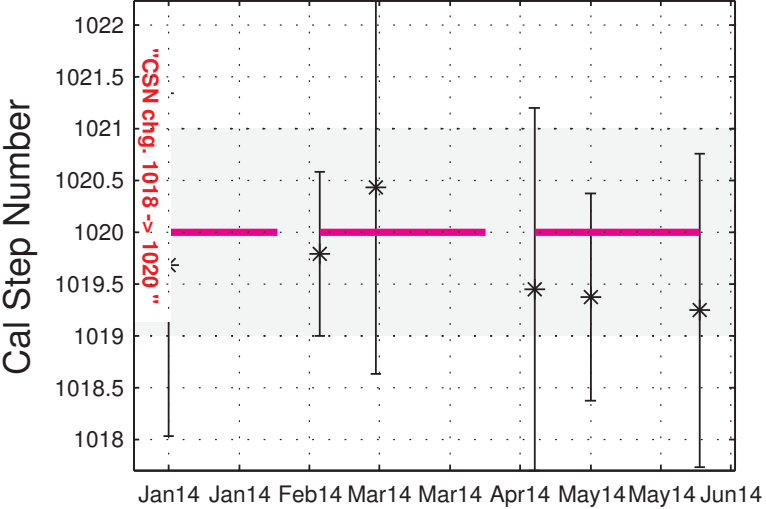


Brewer #183 DSP

IZO#183

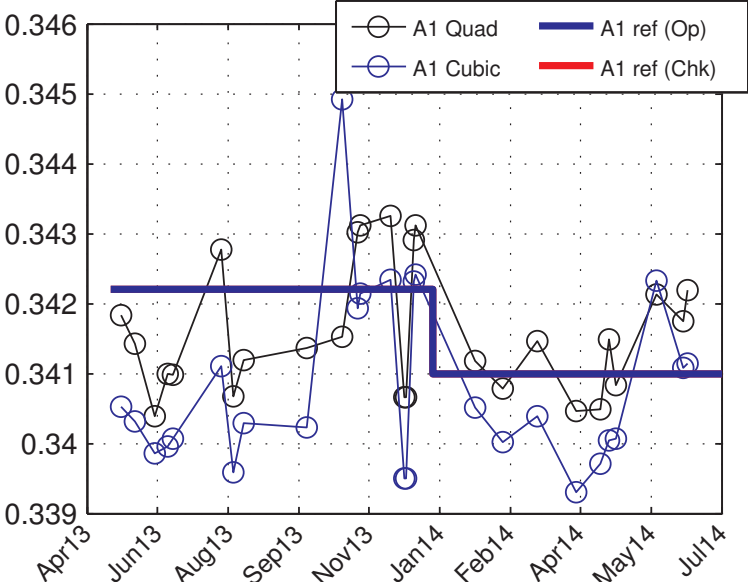


Brewer IZO#185



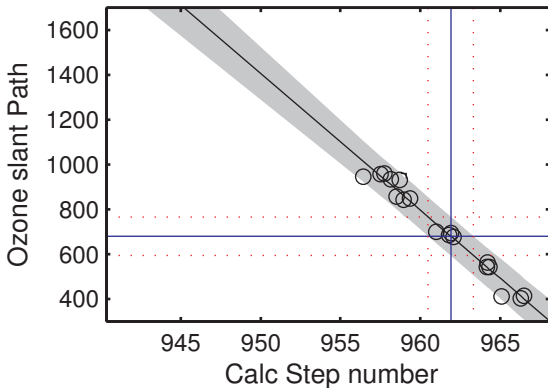
Brewer #185 DSP

IZO#185



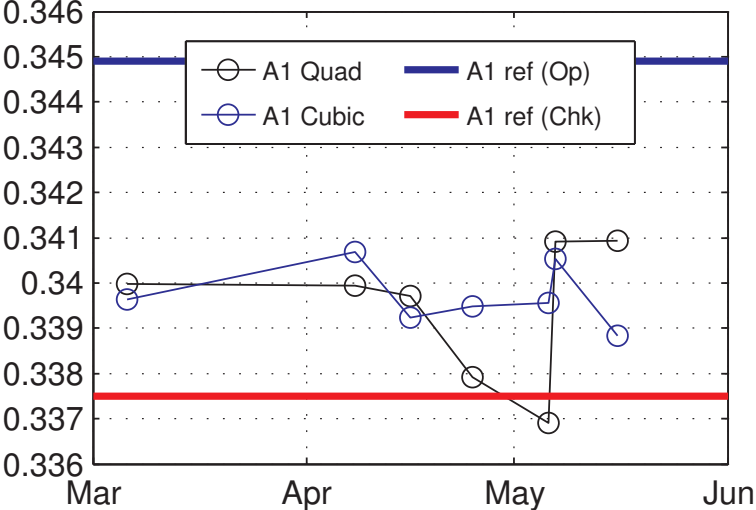
Brewer #145: CSN

OSC clim. = 680; CSN = 961.9 [960.5, 963.3]
CSN from config file = 967



Brewer #145: DSP

EC#145



Dispersion: Summary

DSP Brewer #145 Nine dispersion test were analyzed during the campaign

- ▶ The analyzed with our method is quite different to operational ones, a value of 0.3400 is obtained in most of the test very far from the 0.3449 operational value.
- ▶ The best agreement with the triad is obtained if we use the value obtained during the calibrations of 25 of April and 06 of May.

Dispersion: Summary

DSP Brewer #157 The instrument change during the maintenance (the Hg where replaced), and then slowly recover his historical value.

DSP Brewer #183 A change were detected after the prism alignment in January from the past value of 0.3422. After the february maintenance the value of 0.3400. A mid value of 0.3410 is used ,(one step from both values) as the cal-step is not indicating this change.

DSP Brewer #185 After January a value of 0.3410 is confirmed (cubic) one step bellow the operational value of 0.3422. The cubic fit is about 1 step below the quadratic one.

Final comparison

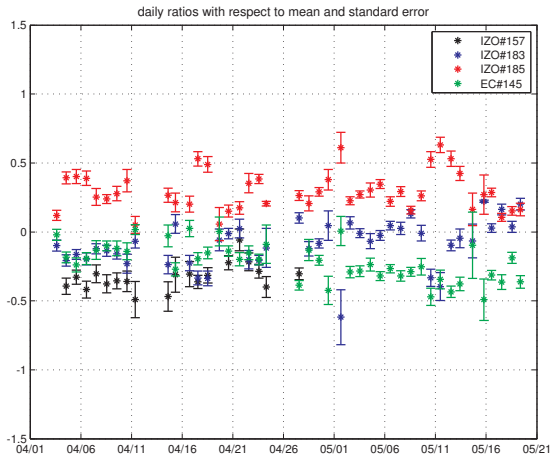


Figure 7 : triad evolution ten minutes synchronized measurements

Final comparison

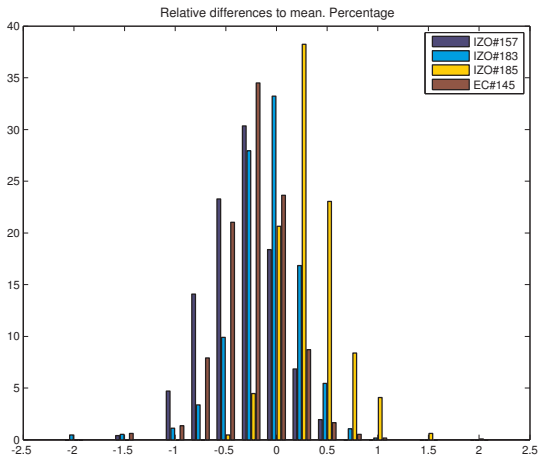


Figure 8 : triad relative differences histogram ten minutes synchronized measurements

Final comparison

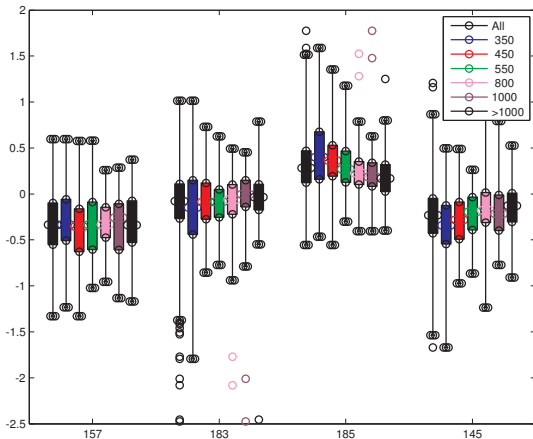


Figure 9 : triad relative differences , by ozone slant column interval

Final comparison

Table 3 : Differences % ratio total and by osc

	IZO#157	IZO#183	IZO#185	EC#145	
All	-0.3 +/-0.34	-0.1 +/-0.35	0.3 +/-0.3	-0.2 +/-0.31	612
350	-0.3 +/-0.35	-0.2 +/-0.46	0.4 +/-0.38	-0.4 +/-0.36	32
450	-0.4 +/-0.35	-0.1 +/-0.29	0.4 +/-0.28	-0.3 +/-0.28	39
550	-0.3 +/-0.36	-0.1 +/-0.24	0.3 +/-0.24	-0.2 +/-0.24	4
800	-0.3 +/-0.26	-0.1 +/-0.3	0.2 +/-0.23	-0.1 +/-0.3	65
1000	-0.3 +/-0.32	0 +/-0.38	0.2 +/-0.28	-0.2 +/-0.3	89
≥1000	-0.3 +/-0.35	0 +/-0.29	0.2 +/-0.22	-0.1 +/-0.28	138

Conclusions

1. The Langley properly tracks changes in the response of the instruments.
2. The issue on the reference comparison is due ozone absorption coefficients.
 - 2.1 The calibration methods : we are not allow to reproduce the calibration constant of brewer #145. The provided constant 0.3450 are far from our calculations 0.3400 for the dispersion performed in Canada.
 - 2.2 The best agreement with the RBCC-E triad is obtained using the the value 0.3375, this value is only obtained in two test of the seven performed during the campaing

Davos /Arosa the triad before the travel

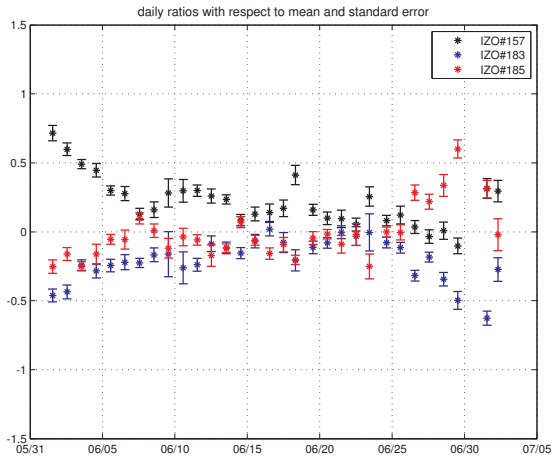


Figure 10 : triad evolution ten minutes synchronized measurements

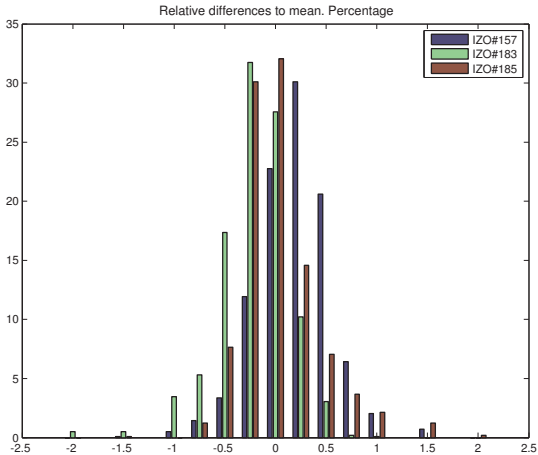


Figure 11 : triad relative differences histogram ten minutes synchronized measurements

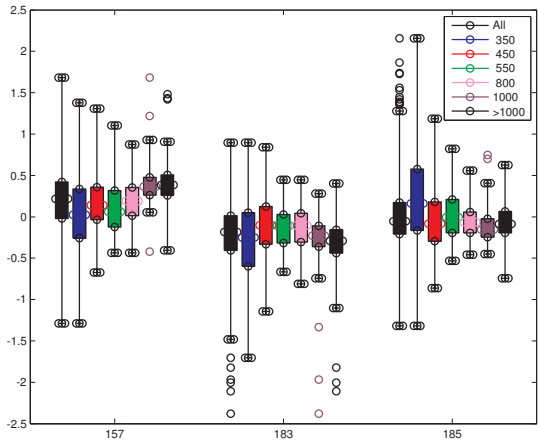


Figure 12 : triad relative differences , by ozone slant column interval

Table 4 : Differences % ratio total and by osc

	IZO#157	IZO#183	IZO#185	mean osc
All	0.2 +/-0.36	-0.2 +/--0.36	0 +/--0.39	633 +/--374.86
350	0.1 +/--0.48	-0.3 +/--0.47	0.2 +/--0.56	316.9 +/--17.1
450	0.2 +/--0.33	-0.1 +/--0.33	-0.1 +/--0.34	392.1 +/--25.6
550	0.1 +/--0.29	-0.1 +/--0.24	0 +/--0.28	501.9 +/--30.25
800	0.2 +/--0.23	-0.1 +/--0.24	-0.1 +/--0.18	645.5 +/--60.84
1000	0.4 +/--0.23	-0.3 +/--0.33	-0.1 +/--0.2	881.4 +/--54.2
≥1000	0.4 +/--0.25	-0.3 +/--0.32	-0.1 +/--0.21	1364.1 +/--237.52