REGIONAL BREWER
CALIBRATION CENTER EUROPE
RBCC–E

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Brewer DMI#202 Calibration Report

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1 Calibration Summary

1.1 Setup and operation

The Intercomparison Campaign of the Regional Brewer Calibration Center Europe (RBCC-E) was held in November 2013 at the *Izaña Atmospheric Research Centre*, Tenerife, Spain. Brewer DMI#202 participated in the campaign for the period from Julian day 311 to 329. Main electronics board was replaced on this Brewer since the first day of the intercomparison, using rbcc-e spares. After this, several problems related to filter wheel #1 and with the slitmask were finally fixed on Julian day 320: problems with FW#1 were solved by using Filter #3 position on the main board (not used on this double Brewer), whereas problems with the slitmask were solved after updating the ORIGIN parameter from -11 to -10 (a new configuration was upload). Apart from a large change on SL ratios (≈ 40 units on R6 ratio, see Figure **??**), we did not detect any other significant change in the instrument's performance during the rest of the intercomparison days.

1.2 Instrumental calibration

Analysis of Brewer **DMI#202** AVG files since the last intercomparison campaign (IOS, June 2011) shows, overall, quite good instrument's performance, with Standard Lamp ratios in agreement with the provided reference values.The instrumental parameters analyzed (AP average file, Dead Time constant, Hg lamp intensity, HS & CI files) were normal.

Despite of a significant temperature dependence observed in SL ratios (see Section **??**), we prefer keeping the original coefficients on final configuration. The reasons for this decision were, first, we did not get a temperature range during the intercomparison wide enough so as to calculate reliable temperature coefficients (temperature ranging from **15° C** to **22° C**), and second, we did not detect any appreciable temperature dependence in direct-sun ozone measurements. No changes are suggested. As concerns to the neutral density filters, no non-linear effect was observed in ozone ratios.

1.3 Wavelength calibration

The sun-scan tests (SC) performed during the intercomparison days suggested a need for an improved Cal-Step Number (CSN) setting. We have accordingly used a new $CSN = 286$ three steps different from original one in final configuration file (see Figure **??**). The Ozone absorption coefficient has been quite stable during the last 4 years (within ± 1 steps from the operational value, see Table **??**). We updated the value corresponding to the new CSN which is very similar to the operative value..

1.4 ETC tranfer SL reference value

The original calibration constants performed bad, with ozone measurements on average 2% lower as compared to IZO#183 for $osc \leq 1000\,\mathrm{DU}$ (see Figure **??**, blue dashed line). Correcting for the standard lamp ratio change improved the comparison to within $\pm 0.5\%$ ($1\ \sigma$) (same Figure, red dashed line). The Extraterrestrial constant calculated ($ETC \approx 1545$, see Figure **??**) just confirmed the change in the standard lamp R6 ratio. We recommend using this new ETC, together with the new standard lamp R6 reference value **290** to be applied from day 32013.

During the inter comparison days a significant change in SL ratios was observed (more than 40 units for R6). As the main board was replaced at the beginning of the campaign we don't know if the change

Figure 1 – Mean direct-sun ozone column percentage difference between Brewer DMI#202 and Brewer IZO#183 as a function of ozone slant path. The shadow areas represent the standard deviation of the mean. Plotted are the final days of the campaign

was due transport o due the board replacement. The results shows that the R6 values to properly track changes in the instrument's response.

2 Instrument History: Analysis of Average Files

2.1 Standard Lamp Test

Analysis of Brewer **DMI#202** SLOAVG file since the last intercomparison campaign (IOS, June 2011) shows, overall, quite good instrument's performance, with Standard Lamp ratios values around $\approx 335 \pm 10$ units for R6 and $\approx 535 \pm 20$ units for R5, on average. Note that these values reasonably agreed the provided reference values. We proposed the values **290** (R6) and **440** (R5) as the new SL reference values.

Figure 2 – Standard Lamp test R6 (Ozone) ratios. Horizontal lines are labeled with the original and final reference values (the red and the light blue lines respectively)

2.2 Run Stop and Dead Time

Run stops test values are within the test tolerance range (Figure **??**).

The original Dead Time constant was $\mathbf{2.5 \cdot 10^{-8}}$ seconds, which was in good agreement with the observed value during the calibration period. This is also the same mean DT value recorded during the last two years (see Figure **??**), although with some slightly decreasing tendency.

2.3 CZ Scan on Internal Mercury Lamp

We analyzed the scans performed on the 296.728 *nm* mercury line, in order to check both the wavelength settings and the slit function width. As a reference, the calculated scan peak, in wavelength units, should be within 0.013 *nm* from the nominal value, whereas the calculated slit function width should be no more than 0.65 *nm*.

Analysis of CZ scans performed on Brewer **DMI#202** during the campaign show quite nice results, with the peak of the calculated scans within the accepted tolerance range. Regarding the slit function width we observe FWHM parameter lower than 6.5 Å.

Figure 3 – Standard Lamp test R5 (SO_2) ratios

Figure 4 – SL intensity slit five

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Figure 5 – Run Stop test

Figure 6 – Dead Time test. Horizontal lines are labeled with the original and final reference values (the red and the blue lines respectively)

Figure 7 – CZ scan on 296.728 *nm* Hg line. Upper figure shows differences with respect to the reference line (solid lines represent the limit ±0.013 *nm*) as computed by two different methods: slopes method (red circles) and center of mass method (green squares). Lower figure shows Full Width at Half Maximum value for each scan performed. Solid line represents the limit 0.65 *nm*

3 Absolute Temperature Coefficients

Temperature coefficients are determined using the standard lamp test. For every slit, the raw counts corrected for zero temperature coefficients are used in a linear regression against temperature with the slopes representing the instrument's temperature coefficients. From this we obtain the corrected *R6* and *R5* ratios to analyze the new temperature coefficients' performance.

The original temperature coefficients performed not so well during the campaign, with some significant temperature dependence ($-9\,units/10°$ C, see Figure **??**). However, we prefer keeping the original coefficients in final configuration. The reasons for this decision were, first, we did not get a temperature range during the intercomparison wide enough so as to calculate reliable temperature coefficients (temperature ranging from **15° C** to **22° C**), and second, we did not detect any appreciable temperature dependence in direct-sun ozone measurements. No changes are suggested.

Table 1 – Temperature Coefficients. Calculated coefficients are normalized to slit#2

	slit#2	**slit#3**	**slit#4**	**slit#5**	**slit#6**
Current	0.0000	-0.5461	-0.8458	-0.9926	-1.0442
Calculated	0.0000	-0.4000	-0.9000	-1.5000	-2.3000
Final	0.0000	-0.5461	-0.8458	-0.9926	-1.0442

Figure 8 – Temperature coefficients performance. Red circles represent standard lamp R6 ratio calculated from raw counts without temperature correction (temperature coefficients null). Black crosses and green circles represent standard lamp R6 ratio corrected with original temperature coefficients and corrected with calculated temperature coefficients respectively

4 Wavelength Calibration

4.1 Cal-Step Determination

The cal-step number (CSN) is calculated according to `IOS-Note #96.01` using the *sun scan* method.

The sun scan routine takes direct-sun ozone measurements by moving the micrometer about 15 steps below and above the ozone reference position (wavelength *Calibration step-number*). A Hg test is required before and after the measurement to assure the correct wavelength setting during the *sun scan* test. Ozone *versus* step number ideally shows a parabolic shape with maximum at the ozone reference position (Figure **??**). With this choice, small wavelength shifts ($\approx \pm$ 2 steps) do not affect the ozone value. This optimal micrometer position is a near-linear function of the ozone slant path at the time of the scan (Figure **??**). The final micrometer position is derived using this linear relation at the climatological ozone slant path for a particular station, whose geographic location determines the mean ozone value and the solar zenith angle for the observations. For midlatitude stations a value near 680 is normally used (340 ozone mean value $\times$ 2.0 airmass).

Figure 9 – Sun Scan plot example: Ozone *vs* Step Number

Only sun-scans satisfying the following criteria are selected:

1. HG step before and after the test $<$ 1step
2. Residual of the parabola fit $<$ 25
3. Neutral density filter $>$ 0

Sun-scan (SC) tests were performed before and after the electronic board was replaced on Brewer DMI#202 to derive the ozone cal-step position. For the optimization we used the midlatitude ozone slant path (osc) value **680** DU.

Both SC data sets, covering an osc range from 400 to 1200 DU (**11** good observations were collected during the *"final days"*), suggested a need for a CSN updating from the operational value 289 to a new 286 (see Figure **??**). We have accordingly updated the CSN in the final configuration file provided.

4.2 Dispersion Test

We analyzed four available dispersion tests during the period from 2009 to 2013. For all of them we processed data from external spectral lamps using quadratic functions to adjust the micrometer step number to wavelength positions. For ozone calibration only the lines corresponding to wavelengths shorter than 3410 Å were used.

4.2.1 Ozone

The quadratic fitting was good for all the dispersion tests, with residuals being lower than 0.1 Å in all slits, whereas the calculated Ozone absorption coefficient resulted quite stable and in agreement with

Figure 10 – Ozone Slant Path *vs* Cal – Step Number. Vertical solid line marks the calculated *CSN* for a climatological ozone slant path equal to **680** DU (horizontal solid line). Blue area represents a 95% confidence interval

the operational value ($\approx \pm 1$ micrometer step, see Tables **??** and **??**). Note in Table **??** that we have evaluated the dispersion test performed with the instrument fully operative using the calculated (286) and the operational (289) Cal-Step Numbers. No change is suggested.

Table 2 – Dispersion derived constants

	Calc-step	**O3abs coeff.**	**SO2abs coeff.**	**O3/SO2**
Current	289	0.3428	2.3500	1.1417
30-Nov-2009	289	0.3413	3.2030	1.1432
12-Jun-2011	289	0.3433	3.1780	1.1497
13-Nov-2013	286	0.3457	3.0845	1.1583
17-Nov-2013	289	0.3407	3.1673	1.1434
17-Nov-2013	286	0.3436	3.1370	1.1529
Final	286	0.3436	2.3500	1.1417

Individual wavelengths resolution, ozone absorption coefficient, sulphur dioxide absorption coefficient and Rayleigh absorption for the calculated cal-step number ± 1 step are shown below.

Table 3 – 2013 Dispersion derived constants

step= 285	slit#0	slit#1	slit#2	slit#3	slit#4	slit#5
WL(A)	3031.63	3062.74	3100.21	3134.81	3167.77	3199.8
Res(A)	5.5559	5.5422	5.4261	5.5756	5.5459	5.3207
O3abs(1/cm)	2.6085	1.7858	1.0061	0.67712	0.37502	0.29543
Ray abs(1/cm)	0.50526	0.48341	0.45866	0.43722	0.41798	0.40031
SO2abs(1/cm)	3.4953	5.5591	2.3769	1.9327	1.0507	0.61814
step= 286	slit#0	slit#1	slit#2	slit#3	slit#4	slit#5
WL(A)	3031.71	3062.81	3100.28	3134.88	3167.84	3199.87
Res(A)	5.5559	5.5421	5.426	5.5756	5.5459	5.3206
O3abs(1/cm)	2.6059	1.7843	1.0058	0.67686	0.37504	0.29495
Ray abs(1/cm)	0.50521	0.48336	0.45861	0.43718	0.41794	0.40028
SO2abs(1/cm)	3.4777	5.584	2.3842	1.9209	1.052	0.61603
step= 287	slit#0	slit#1	slit#2	slit#3	slit#4	slit#5
WL(A)	3031.78	3062.88	3100.35	3134.95	3167.91	3199.94
Res(A)	5.5558	5.542	5.426	5.5755	5.5458	5.3205
O3abs(1/cm)	2.6033	1.7828	1.0055	0.67654	0.37507	0.29447
Ray abs(1/cm)	0.50516	0.48331	0.45857	0.43714	0.4179	0.40024
SO2abs(1/cm)	3.4608	5.6074	2.3916	1.9095	1.0532	0.61381
	step	O3abs	Rayabs	SO2abs	O3SO2Abs	
	285	0.34469	10.1323	3.124	1.1561	
	286	0.34365	10.1295	3.137	1.1529	
	287	0.34264	10.1268	3.1482	1.1498	

5 ETC Transfer

5.1 Ozone Extraterrestrial Constant Transfer

The ETC is obtained by comparison with the reference brewer **IZO#183** using near-simultaneous measurements during **8** days (two measurements are considered near-simultaneous if they are taken less than **5** minutes apart). Measurements with airmass difference greater than 3% were removed from the analysis.

Ozone is calculated using the following formula:

$$O_3 = \frac{MS9 - ETC}{A1 \times M2} \tag{1}$$

where MS9 are Rayleigh corrected double ratios, A1 is the ozone absorption coefficient, M2 is the ozone air mass and ETC is the extraterrestrial constant. From this equation we can solve for ETC obtaining

$$ETC = MS9 - O_3 \times A1 \times M2 = MS9 - A1 \times O_3^{ref} \times M2$$

The corrected ratios MS9 and the ozone air mass factor (M2) are known and the ozone absorption coefficient can be computed from the wavelength calibration. Using the simultaneous ozone data from the reference instrument the ETC can be derived for each of the near-simultaneous observation pairs and then averaged (actually we take the median value of all ETC's).

5.1.1 Final Calibration

Brewer DMI#202 was installed on day 311, after replacement of the Main Electronics board. After this, several problems related to filter wheel #1 and with the slitmask were finally fixed on Julian day 320. Unfortunately, we could not collect direct-sun ozone data so as to assess the initial status of the instrument. However, we believe this instrument has been working fine during the last two years, and the original calibration constants corrected by the SL change should work fine, as it is shown in Figure **??**. We have used Julian days 320 to 329 for final calibration purposes (**225** near-simultaneous direct sun ozone measurements).

The original calibration constants performance was found to be bad, with ozone measurements on average 2% lower as compared to IZO#183 for $osc \leq 1000\,\mathrm{DU}$ (see Figure **??**, blue dashed line). This is due to a wrong ETC setting. Correcting for the standard lamp ratio change improved the comparison to within ±1% (same Figure, red dashed line). The Extraterrestrial constant calculated ($ETC \approx 1545$) just confirmed the change in the standard lamp R6 ratio. We recommend using this new ETC, together with the new proposed standard lamp reference value **290** for the standard lamp R6 ratio.

Table 4 – Daily mean ozone processed with original and final (*) calibration. Final Days

	Day	O3#183	O3std	N	O3#202	O3 std	%(202-183)/183	O3(*)#202	O3std	(*)%(202-183)/183
16-Nov-2013	320	270.7	1.3	24	261.8	2.9	-3.3	269.8	1.8	-0.3
17-Nov-2013	321	271.6	2.8	3	267.3	0.3	-1.6	270.8	2.1	-0.3
19-Nov-2013	323	281.7	1.7	7	273.3	3.4	-3	280.3	2.9	-0.5
21-Nov-2013	325	285.2	2	30	278.4	3.3	-2.4	284.5	1.8	-0.2
22-Nov-2013	326	283.5	0.8	44	275.1	1.6	-3	282.6	1.4	-0.3
23-Nov-2013	327	289.1	1.2	58	281.5	2.2	-2.6	288.6	1.6	-0.2
24-Nov-2013	328	278.6	1.6	58	272	2.3	-2.4	279.1	1.5	0.2
25-Nov-2013	329	261.3	0	1	254.9	0	-2.4	262.9	0	0.6

Figure 11 – Mean direct-sun ozone column percentage difference between Brewer DMI#202 and Brewer IZO#183 as a function of ozone slant path. Blue and red areas represent standard deviation and 95% confidence interval, respectively. Plotted are the final days of the campaign

Figure 12 – ETC determination by median of the values computed as defined in expression **??**

5.2 Standard Lamp Reference Values

The reference values of standard lamp ratios during the calibration period were **290** for R6 (Figure **??**) and **440** for R5 (Figure **??**).

Figure 13 – Standard Lamp O_3 R6 ratios: daily mean and standard deviation (squares), seven day running mean (circle) and individual tests (black dots)

Figure 14 – Standard Lamp SO_2 R5 ratios: daily mean and standard deviation (squares), seven day running mean (circle) and individual tests (black dots)

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6 Daily Summary Report

Figure 15 – Overview of the intercomparison. Brewer DMI#202 data are evaluated using final constants (blue circles)

Table 5 – Ozone Summary Report. Mean daily ozone, grouped by ozone slant path ranges, with original and final configuration (with an asterisk)

Day	osc range	O3#183	O3std	N	O3#202	O3 std	%(202-183)/183	(*)O3#202	O3 std	(*)%(202-183)/183
320	1500>osc>1000	270.4	0	2	267.9	0	-0.9	270.5	0	0
320	1000>osc>700	272.9	0	2	267.4	0	-2	272.1	0	-0.3
320	700>osc>400	271.8	1.6	22	264.7	2.4	-2.6	271.6	1.5	-0.1
320	osc<400	270	0.6	28	259.9	0.9	-3.7	268.6	0.9	-0.5
321	1500>osc>1000	269.3	0.7	12	267	0.6	-0.9	269.4	0.6	0
321	1000>osc>700	272	0	2	267	0	-1.8	270.7	0	-0.5
321	700>osc>400	275	0.4	4	267.4	0.3	-2.8	272.7	0.6	-0.8
323	1500>osc>1000	280.9	0.7	4	278.8	1.1	-0.8	281.1	1.6	0.1
323	1000>osc>700	277.7	0	2	272.5	0	-1.9	276.3	0	-0.5
323	700>osc>400	281.8	1.9	22	273.8	3	-2.8	280.5	2.5	-0.5
324	1500>osc>1000	285.5	1.1	6	280.7	1	-1.7	283.1	0.8	-0.9
325	1500>osc>1000	285.7	0.9	14	281.3	0.5	-1.5	284.2	0.3	-0.5
325	1000>osc>700	287	1	28	281.7	0.8	-1.8	285.9	0.8	-0.4
325	700>osc>400	284	1.3	40	276.5	2.6	-2.7	283.6	1.6	-0.1
326	osc>1500	281.3	0	4	279.2	0.2	-0.8	280.9	0.1	-0.1
326	1500>osc>1000	281.1	0.1	6	277.6	0.7	-1.2	279.9	0.6	-0.4
326	1000>osc>700	282.8	0.7	22	277.4	0.7	-1.9	281.4	0.4	-0.5
326	700>osc>400	283.5	0.8	88	275	1.4	-3	282.7	1.3	-0.3
327	osc>1500	289.6	0	4	286.9	0.1	-0.9	288.8	0.2	-0.3
327	1500>osc>1000	289.9	0.3	14	285.6	1.4	-1.5	288.3	1	-0.5
327	1000>osc>700	290	0.8	22	285.3	0.9	-1.6	289.3	1	-0.3
327	700>osc>400	289.1	1.3	120	281.1	2	-2.8	288.5	1.7	-0.2
328	osc>1500	273.4	0	2	270.9	0	-0.9	272.8	0	-0.2
328	1500>osc>1000	275.8	2.7	18	273.1	2	-1	275.7	2.3	0
328	1000>osc>700	279.5	2.7	24	275.9	2.7	-1.3	279.6	2.7	0
328	700>osc>400	278.7	1.2	114	271.7	1.8	-2.5	279.2	1.1	0.2
329	700>osc>400	261.3	0	2	254.9	0	-2.5	262.9	0	0.6

7 Configuration

7.1 Instrument Constant File

	Initial (ICF16011.202)	Final (ICF32013.202)
o3 Temp coef 1	0	0
o3 Temp coef 2	-0.5461	-0.5461
o3 Temp coef 3	-0.8458	-0.8458
o3 Temp coef 4	-0.9926	-0.9926
o3 Temp coef 5	-1.0442	-1.0442
Micrometer steps/deg	0.056	0.056
O3 on O3 Ratio	0.3428	0.3436
SO2 on SO2 Ratio	2.35	2.35
O3 on SO2 Ratio	1.1417	1.1417
ETC on O3 Ratio	1593	1545
ETC on SO2 Ratio	206	206
Dead time (sec)	2.5e-08	2.5e-08
WL cal step number	289	286
Slitmask motor delay	14	14
Umkehr Offset	1699	1699
ND filter 0	0	0
ND filter 1	4143	4143
ND filter 2	8938	8938
ND filter 3	14393	14393
ND filter 4	19432	19432
ND filter 5	25887	25887
Zenith steps/rev	2972	2972
Brewer Type	3	3
COM Port #	1	1
o3 Temp coef hg	0	0
n2 Temp coef hg	0	0
n2 Temp coef 1	0	0
n2 Temp coef 2	0	0
n2 Temp coef 3	0	0
n2 Temp coef 4	0	0
n2 Temp coef 5	0	0
O3 Mic #1 Offset	18	0
Mic #2 Offset	0	0
O3 FW #3 Offset	242	242
NO2 absn Coeff	-3	-3
NO2 ds etc	770	770
NO2 zs etc	740	740
NO2 Mic #1 Offset	8028	8028
NO2 FW #3 Offset	178	178
NO2/O3 Mode Change	2515	2515
Grating Slope	1	1
Grating Intercept	-18	-18
Micrometer Zero	2469	2469
Iris Open Steps	250	250
Buffer Delay (s)	0	0
NO2 FW#1 Pos	0	0
O3 FW#1 Pos	256	256
FW#2 Pos	0	0
uv FW#2 Pos	64	64
Zenith Offset	0	0
Zenith UVB Position	2210	2210

8 Appendix: Summary Plots

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9 Appendix: Calibration Checklist

Table 7 – Brewer#202 Checklist

	Description	**Y**	**N**	**Value**	**Comments**	**Last cal**	**Calc.**	**Final**
Instrument operation:								
Setup & Level		Y			Finally operative since day 320, after several problems affecting communications, FW#1 and slitmask were fully fixed.			
Location /time	Correct		N		We had to fix date trouble on Julian day 326			
Sitting (periodically)		Y						
Instrument Historic					We analyzed the time period from last IOS cal. (Jun2011)			
HP/HG	Hp/Hg tests repeatable	Y						
SH	SH shutter delay is correct		NaN					
RS	Run/Stop test within +/- 0.003 from unity for illuminated slits and between 0.5 and 2 for the dark count	Y						
DT	Dead time is between 28 ns and 45 ns for multiple-board Brewers and between 16 ns and 25 ns for single-board Brewers	Y		24	Quite stable, but slightly decreasing tendency	25		
SL R6	Stable and not seasonal variations		N		Not so bad until just before the IZO2013 campaign (335 +/-10 units)	335		
R6 temperature	Lower than 5 units/10 degrees		N	27				
SL R5	Stable and not seasonal variations		N		Not so bad until just before the IZO2013 campaign (520 +/- 20 units)	525		
R5 temperature	Lower than 10 units/10 degrees		N	43				
Instrument Campaign								
hp/hg	Hp/Hg tests repeatable	Y						
sh	SH shutter delay is correct		NaN					
DT	Dead time is within 2 ns from the historical record	Y		24		25	24	25
RS	Run/Stop test within +/- 0.003 from unity for illuminated slits and between 0.5 and 2 for the dark count	Y			Out-of-range during the first days of the intercomparison, but just due to comm. problems, solved after Julian day 320			
AP					Stable			

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Table 7 – Brewer#202 Checklist

	Description	Y	N	Value	Comments	Last cal	Calc.	Final
SL current								
SL voltage								
HT voltage								
SL R6	SL ratio R6 is within 5 units from calibration value		N	293		335	293	290
SL R5	SL ratio R5 is within 10 units from calibration value		N	440		525	440	440
SL intensity	Stable / no drops	Y						
Temperature Coeff & Filter								
Temperature								
SL temperature dep Linear	Is aprox. linear de dependence	Y						
SL temperature dep (campaign)	Lower than 5 units/10 degrees		N	-0.9				
temperature range				7	[15C - 22C] (not enough to change. In any case, we did not detect any critical Temp. dependance on ozone measurements)			
SL temperature dep (historic)	Lower than 5 units/10 degrees		N	-31	Very high !!			
temperature range				8	[9C - 17C]			
New TC			N		We maintain the orig. TC's			
Filter								
Filter attenuation (FI)	<10% when changing filter	Y						
Filter linearity (FI)	Lower than 5 units (when changing filter)	Y						
Filter Ozone Correction			N					
Wavelength								
SUN SCAN	Performed	Y			We analyzed SC's performed before and after several problems affecting to instrument's performance were solved. In both cases we obtained the same result, CSN=286, the value adopted in final configuration.	289	286	286
CALC STEP and error +/-	At station			NaN				
	Campaign			285.3	[283.7 - 286.9]			

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Table 7 – Brewer#202 Checklist

	Description	Y	N	Value	Comments	Last cal	Calc.	Final
OSC climatological value	At station			NaN				
	Campaign			680				
SC Range	At station			NaN				
	Campaign			900	[300 - 1200] DU			
DISPERSION	Performed	Y			We made two dispersion test: before and after several problems affecting to instrument's performance were solved. In both cases we obtained similar results (within +/-2 steps)	0.3428	0.3436	0.3436
	O3 absorption last calibration			0.3433	IOS, June 2011, processed with csn=289			
	O3 absorption during campaign			0.3436	Processed with csn=286			
O3 absorption coeff confirmed	(+/- 1 step)	Y						
GA	Performed		N					
HL/HS	Custom scans are within +/-0.13 A from nominal wavelengths 2967.28 (HS) and 3341.48 (HL)?	Y						
ETC transfer								
Initial Calibration					Unfortunately, we could not collect enough ozone data so as to assess the initial status of the instrument. However, we believe this instrument has been working fine during the last two years, and, accordingly, the original calibration constants corrected by the SL change should work fine.			
Airmas range	1.2-3.5							
Osc range	500-1200							
Ozone range								
1P /2P agree	etc +/- 5							
	etc +/- 10							
R6 change/ETC change	agree +/-5 ?							
Stray light at 1000 OSC								

(Continuing in next page)

Table 7 – Brewer#202 Checklist

	Description	Y	N	Value	Comments	Last cal	Calc.	Final
Final Calibration					We used for final calibration the period from day 320 to day 329. Final Calibration constants just confirming change in Standard Lamp ratio	1593	1545	1545
Airmas range	1.2-3.5		N		[1.5 - 4.4]			
Osc range	500-1200	Y		800	[400 - 1200] DU			
Ozone range					[261 - 291] DU			
1P /2P agree	etc +/- 5	Y			1P=1545; 2P=1543			
	etc +/- 10							
Stray light at 1000 OSC					Double Brewer			
Constant File								
	icf file				ICF32013.202			
	dcf file				DCF16211.202			
	uvr file							
End	end line							

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