

Calibration Report on Brewers #157 and #033; Izaña, Spain; September 9-13, 2003

I. Overview and Instrument Status:

Brewer #157, a Mark III instrument was working well and been stable in past year. The instrument's constants were from 2001. Set at these values, the ozone readings were about 1-2 D.U. higher than traveling standard instrument #017 (see graph below of first day - 253). Standard Lamp (SL) ratios R6/R5 have been quite stable and still at 2002 values of 339/580.

Brewer #033, a MKII instrument has been operated at sea level in Santa Cruz during the past three years and was re-located here for this calibration. It was still working well and its SL ratios initially were near 2002 values of 2040/3880. Reference graph on page 4, #033 has shown some instability in past year. On the third day problems started with shutter motor operation during some moon measurements and motor was replaced. After re-alignments the SL ratios are now 2107/3970.

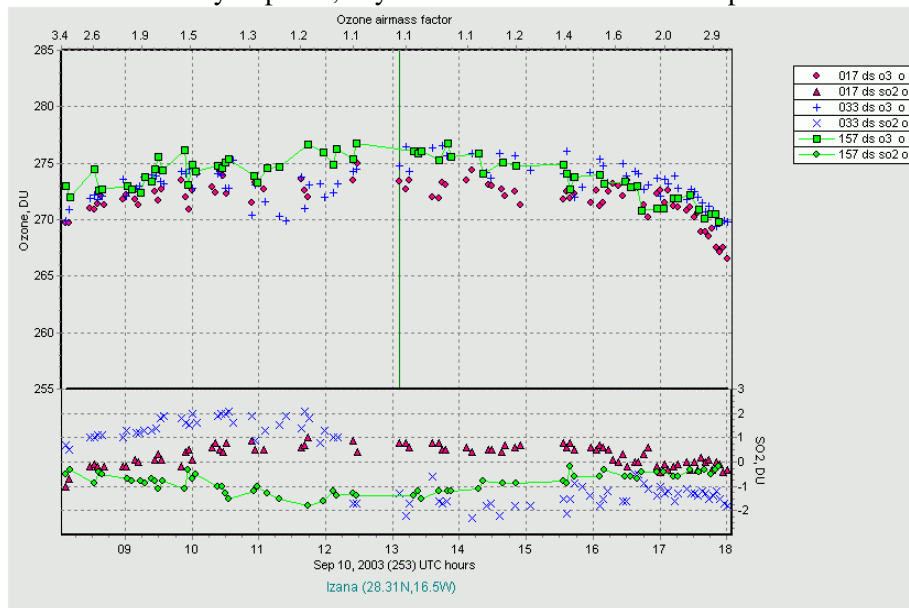
Traveling standard Brewer #017 was again used and has performed well this year after calibration in Mauna Loa in November 2002 and checks against triad.

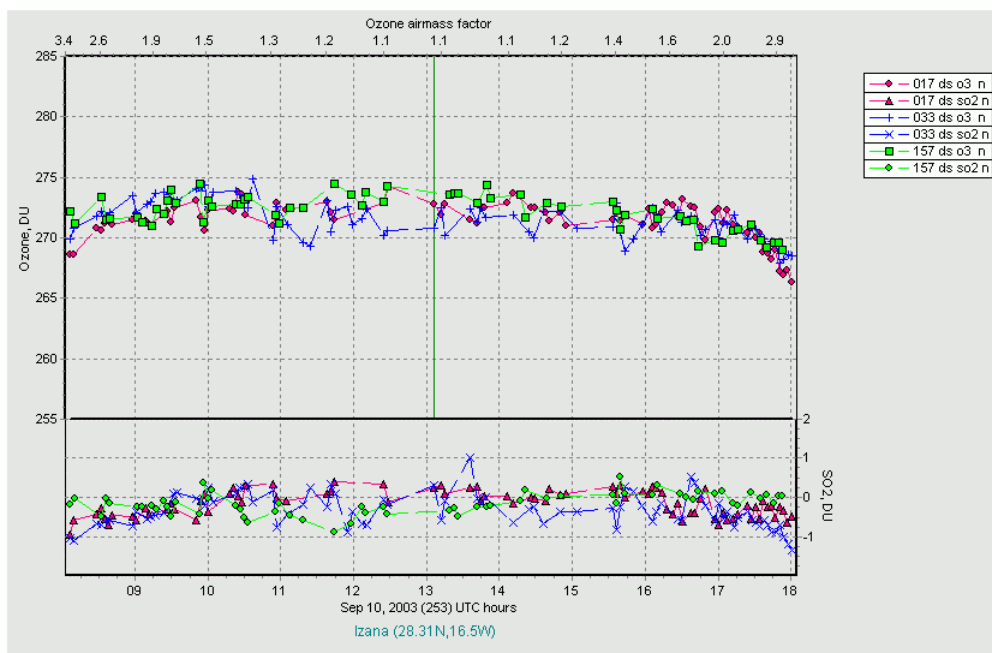
II. Ozone Test Results:

This inter-comparison resulted in approximately ~400 near simultaneous Direct Sun measurements with the three instruments over 4 days. The sun scan results for #157 showed (reference graph on next page) that the present cal step of 1027 was the proper setting. The dispersion test results at step 1027 produced an ozone absorption coefficient of 0.3376, a value very close to 0.3397 in use. After further analysis of this data and last year, it was determined that when the SL R6 change of +9 (late 2001) was applied to the ETC, the ozone and SO₂ agreement to #017 improved. So it is recommended that the ETC constants for #157 be changed to 1584/210 from 1575/210 and be applied back to when the ratio R6 changed.

The sun scan results for #033 showed that the cal step of 920, should be 921. The dispersion test results in files (lf25503.033 and dcf25503.033) were quite similar (above 295 nm) to file in use (dcf27900.033) and so no changes were made to these or absorption coefficients. The initial and final results using revised ETC constants are shown in following graphs.

Initial results for first day Sept. 10, day 253 are shown below and reprocessed results on next page:

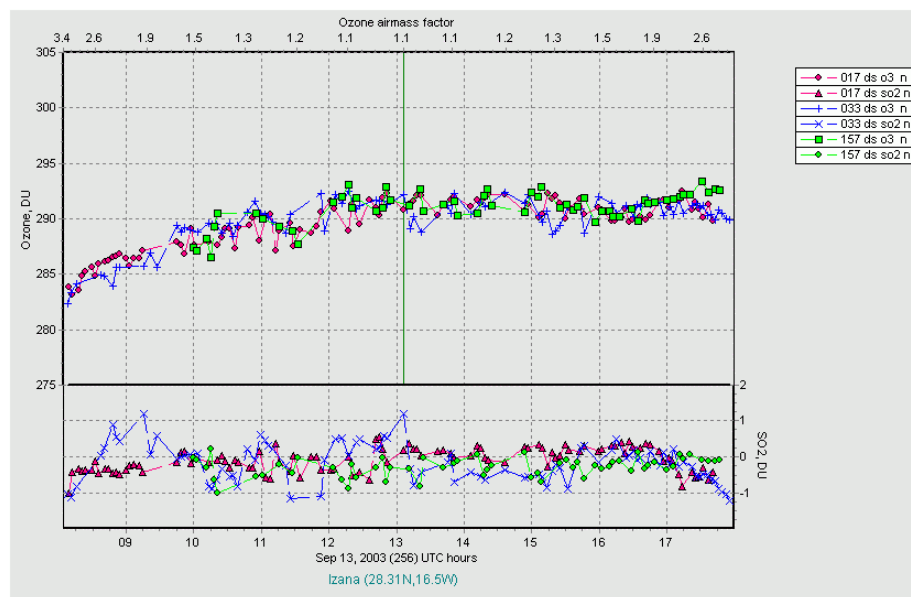




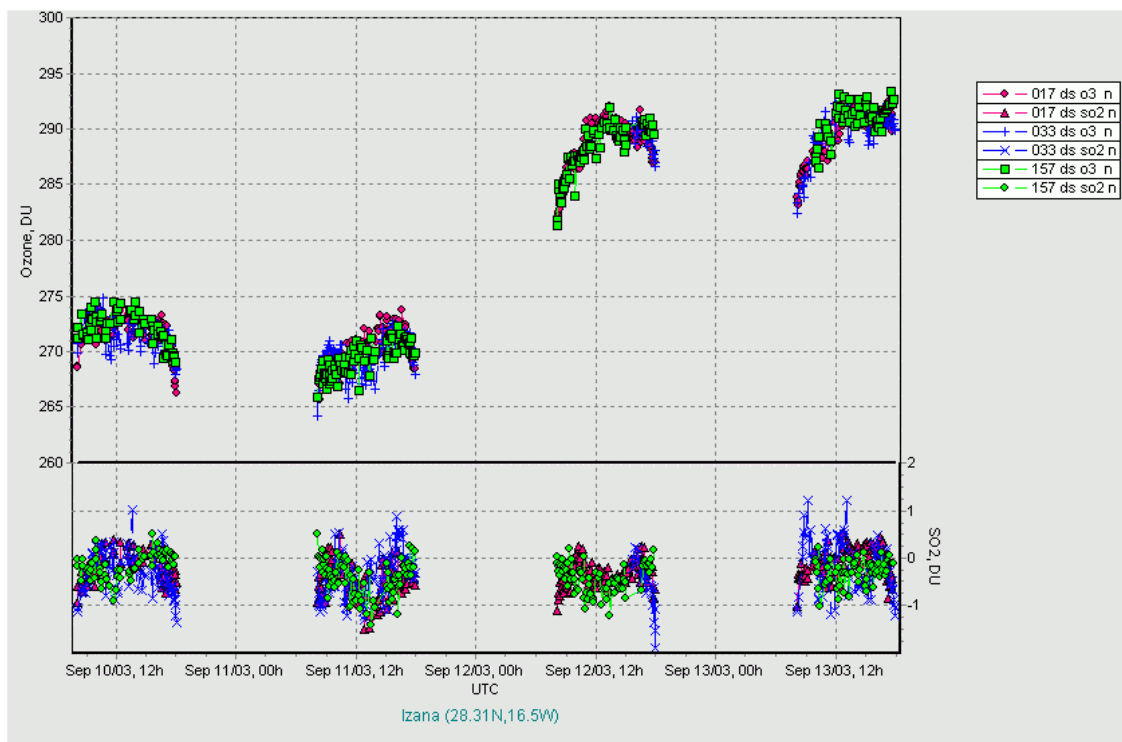
III. Summary of results and changes:

	Brewer #157	Brewer #033
SL ratios 2002	339 / 580	2040 / 3880
SL ratios 2003	339 / 580	2040 / 3880
Final SL ratios	339 / 580	2107 / 3970
Cal step	1027 n/c	920 -> 921
GS const. 2002	.998 / -10 n/c	n/a
ICF file to use	icf25603.157	icf25503.033
DT constant	32 ns	42 -> 40 ns

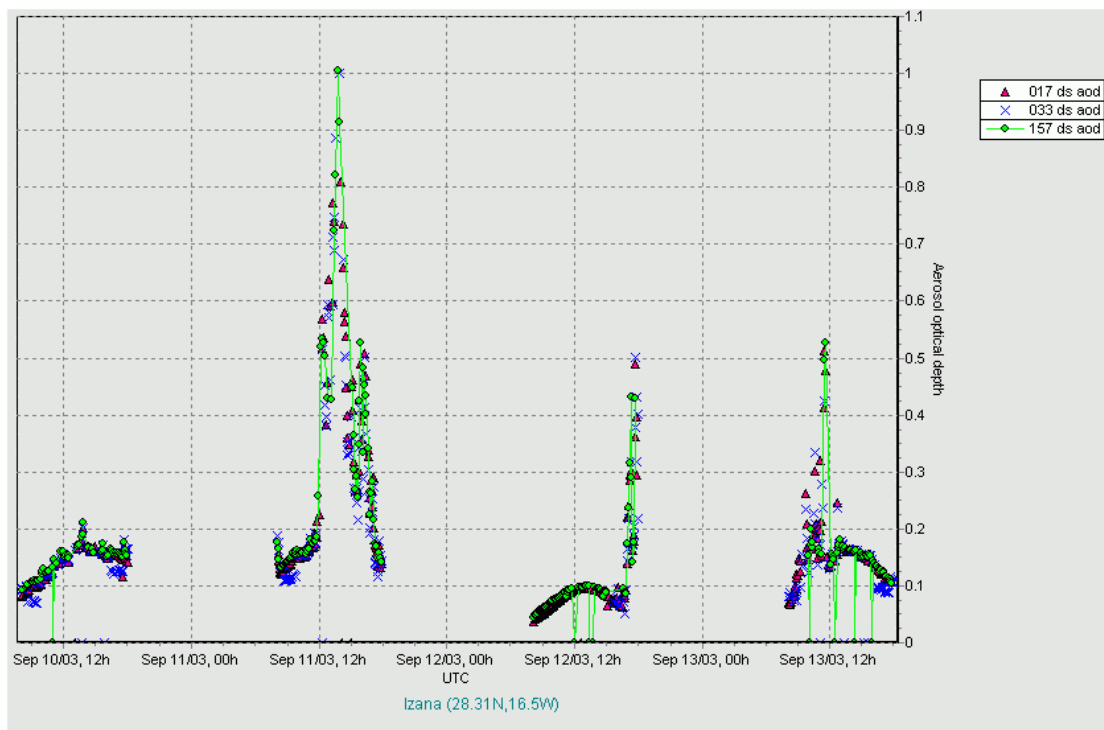
	Brewer #157	Brewer #033
ETCs 2002	1575 / 210	3320 / 3470
ETCs 2003 initial	1575 / 210	3333 / 3469
ETCs 2003 final	1584 / 210	3400 / 3565
Change in ETCs	+9 / 0	+80 / +95
Absn. - no chg.	0.3397 / 1.15	0.3365 / 1.1362
DCF file no chg.	dcf25601.157	dcf27900.033

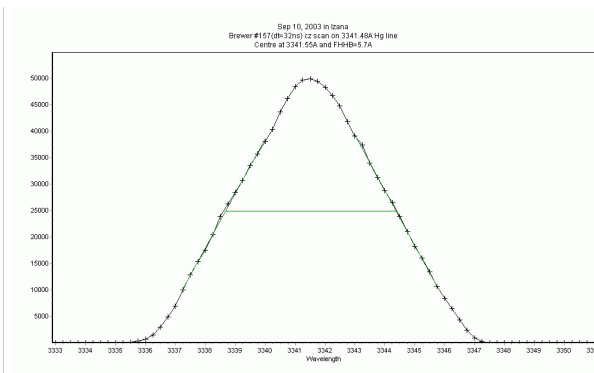
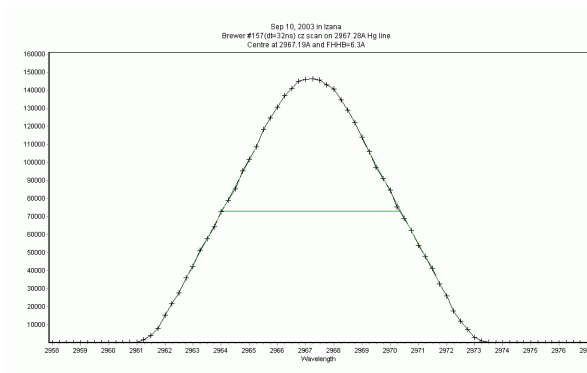
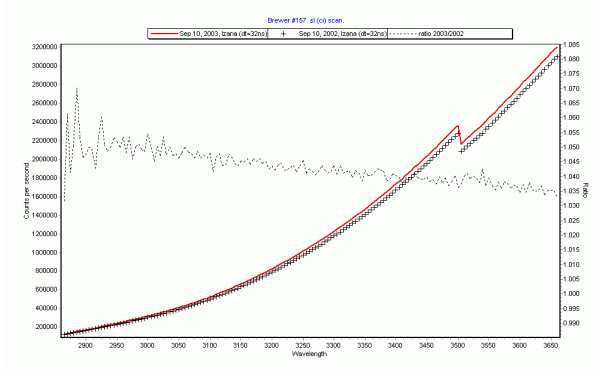
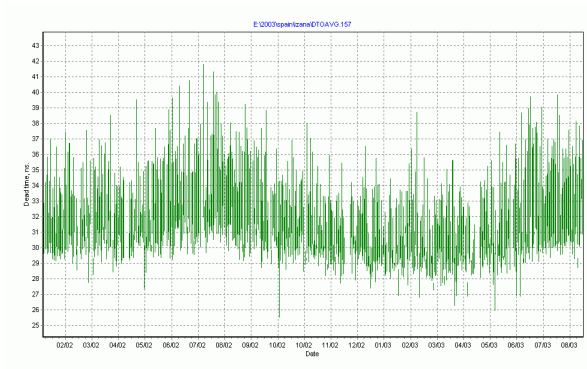
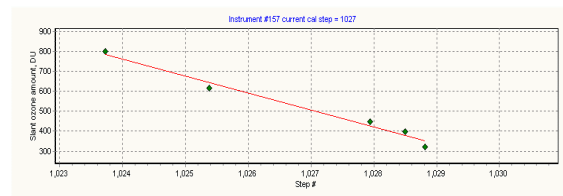
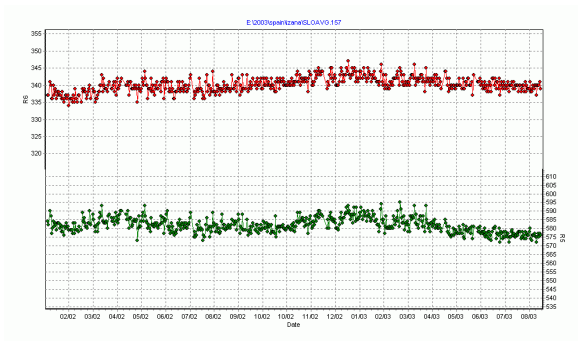


Izaña final results for Sept 13 (256) are shown above and all four days on next page:

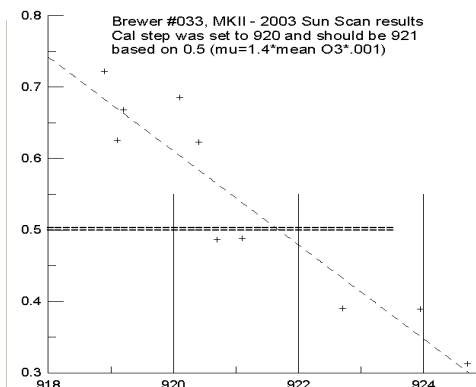
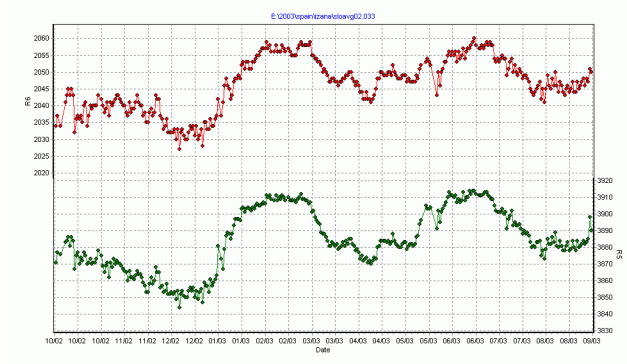


Below are the aerosol optical depth results from the three instruments for the four days using absolute ETC constants transferred from #017. For #157, constants from 2001 (etc.157) were used while some new constants (etc2003.033) were used for #033 on last two days after shutter/mirror re-alignment.



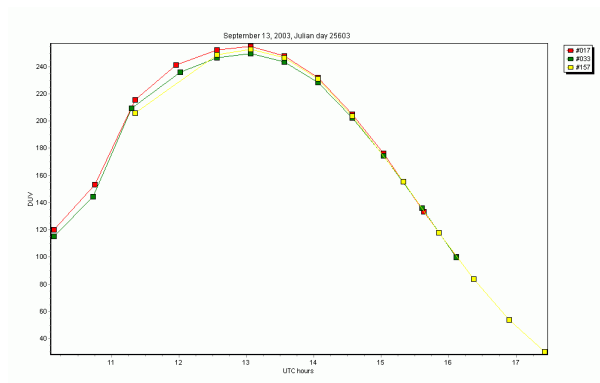
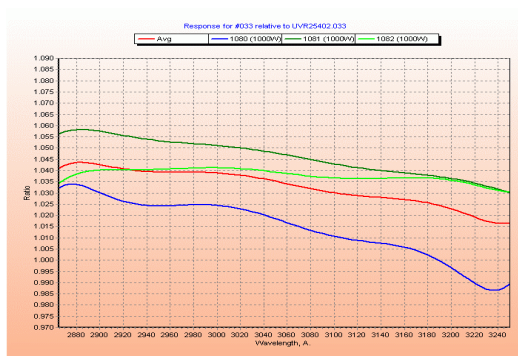
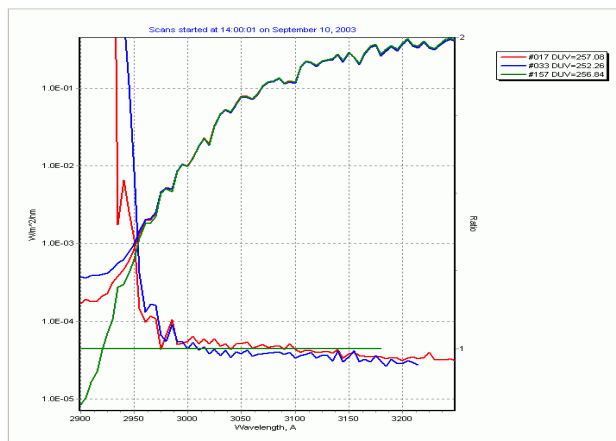
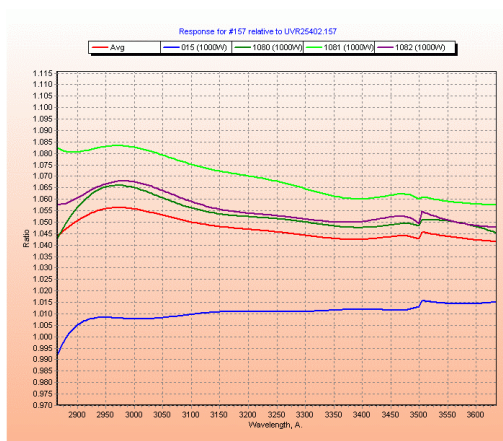


Above are graphs of Brewer #157: the SL ratios for past two years, sun scan results, DT, CI and CZ test results which show good performance and stability. Below are #033 graphs of SL ratios and sun scan results.



IV. UV calibration results:

Three new 1000w lamps were used this year along with lamp 15 and the response results from each lamp compared to 2002 response file are shown below. The calibrations of the new lamps are all ~5% higher than lamp 15, which has been indicating that #157 has not changed in the past year. #033 new response file with new lamps was also ~5% higher than lamp 15 and file from last year. The processed results of a timed UA scan from the three instruments and DUV results from last day (using 2001 response files) are shown below as well. The INM portable 1000w UV calibration system and small 50w systems were used to check the UV calibration of each instrument.



V. Servicing and Software changes:

The problem with #033 on the third day was traced to shutter motor failure and after replacement the mirror was also adjusted a small amount which improved shutter tests. The DT constant was reduced to 40ns from 42 and zenith gear tension adjusted as well. The micrometer gears were cleaned and the pushrod bearings lubricated on each. Shock mount rubber seals on #033 were replaced and on #157 seals around tracker leveling screws were installed.

The most recent software control programs (V375f from IOS) was installed and checked.

VI. Recommendations:

The past two years of data from #157 should be re-processed with new ETC constant for ozone. For #033 data should be reprocessed during periods when SL ratio R6 change by more than 10 units from the value of 2040 and applied to the ETC value of 3333.