Taiwan CWB - 2010 Calibration Report of Brewer Ozone Spectrophotometers

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The annual calibration and service checks on the three Taiwan Brewers were completed at the Central Weather Bureau in Taipei. The weather was not very co-operative except for the first day for the ozone and UV calibration checks. The Chengkung instrument #061 without its tracker was relocated here for this campaign. The Taipei instruments, #129 and #023 have worked quite well during the past year, reference SL ratios and other graphs on pages 3-6. #061 received a new UV filter during this visit and so required two calibrations. This instrument stayed operating in Taipei until April 12 to obtain more direct sun data to obtain final calibration constants. The Canadian traveling standard Brewer #017 was used as the ozone reference instrument again.

MKIII #129 Brewer Taipei:

The standard lamp ratios have decreased slightly to values of 495/990 and were 510/1045 last year. It was determined that the ETC constants should be adjusted initially to values of 1755/590 to obtain near agreement to #017. Analysis of temperature dependency from the SL test results showed that the temperature coefficients should be revised. On page 7 are the results of this analysis and with the new temperature coefficients the SL ratios shifted to 530/1090 and the ETC constants were adjusted to final values of 1800/815. Reference the final ozone results on next page

Sun Scan tests showed the cal step of 285 continues to be proper. The dead time (DT) and run stop (RS) results have continued to be very stable this past year. Dispersion test results produced constants very close to the file (dcf05505.129) in use and so no changes were made.

This year's UV calibration results showed file from 2008 (file uvr08808.129) is still proper, reference ratio graph on last page.

MKIV Brewer #023 Taipei:

This Brewer was performing well and its standard lamp ratios have decreased to values of 1430/2635, change of –20/-30. The ozone results from #023 were lower by ~1% to #017 and so the ETC constants were reduced from 2540/2250 to 2510/2200. The DT measured results have been mostly stable at values of 29ns. There are periods when the ozone deviates more than normal and the reason is unknown. The neutral density filters and quartz diffuser were inspected and cleaned but nothing unusual was found.

Sun Scan test results showed that the cal step of 165 should be reduced to step 164. The dispersion test results were very similar to constants in use (< 4 steps difference and so file (dcf09299.023) was left in use. The NO2 results were quite similar the DS/ZS NO2 results from #061. UV calibration results produced file (uvr09510.023) that was found to be lower than the 2009 file by ~5% and so was put into use.

Brewer #061 from Chengkung:

The SL ratios increased last summer, reference graph on page 3 and since the instrument lost >20% sensitivity over the past year, it was decided that the PMT UV filter should be replaced and so this was completed on the third day. The SL ratios were initially at values of 1380/2065 from 2009 values of 975/1640. With the new filter the SL ratios were 1915/3720 and then 1880/3680 with new temperature coefficients – reference page 4. The sensitivity increased by factors of 2.7->1.8 over the UV range.

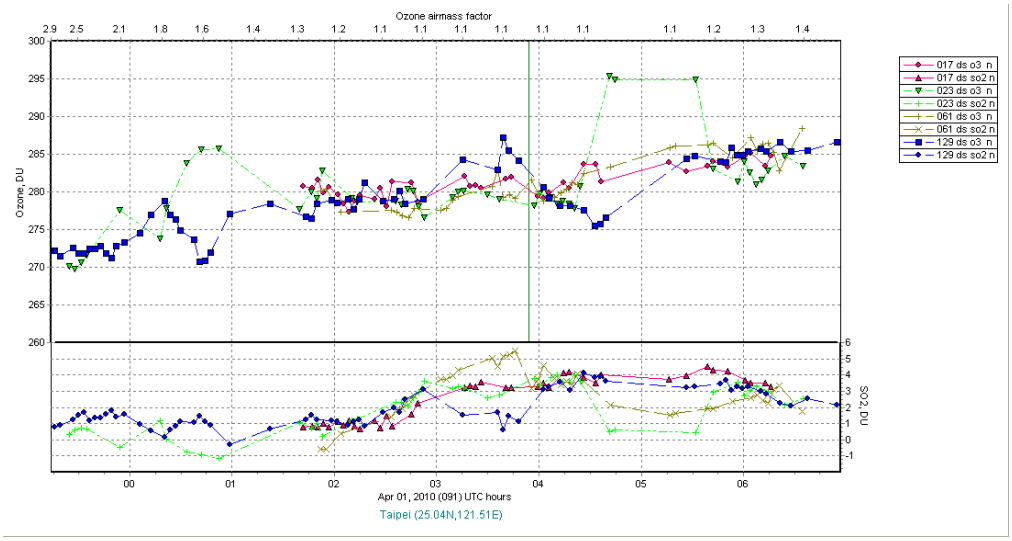
The ETC's in use were 2160/1280 from 2 months ago, adjusted for the change in the SL ratios. These ETC's were found to need adjustment to 2594/1680 for best initial agreement to #017, reference file (icf09110.061). Final ETC constants with the new filter are 3065/3260, reference file (icf10010.061).

Sun Scan test results showed that the cal step of 160 was still proper. The dispersion test results produced differences of <3 steps and so the file (dcf05505.061) was left in use. The NO_2 constants were not changed since the SL F-ratio has not changed in the past 5 years.

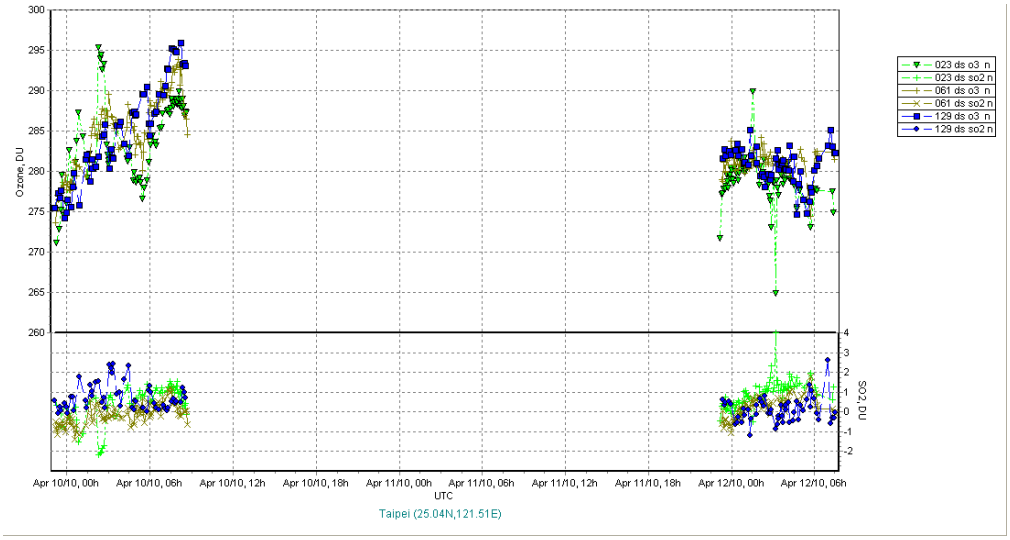
The final UV calibration stored in file (uvr09510.061) was higher by a factor of 2.7 -> 1.8 to the initial calibration file (uvr09210.061) and so was put into use.

Initial results:

Below are the ozone/SO_2 results from the first day (091) using final constants on all instruments; note that #061 still had old UV filter and so initial constants file was (icf09110.061). Note the final instrument constants file for #023 was (ICF09110.023) and for #129 was (icf09510.129).



Below are the final ozone/SO_2 results from April 10-12, 2010

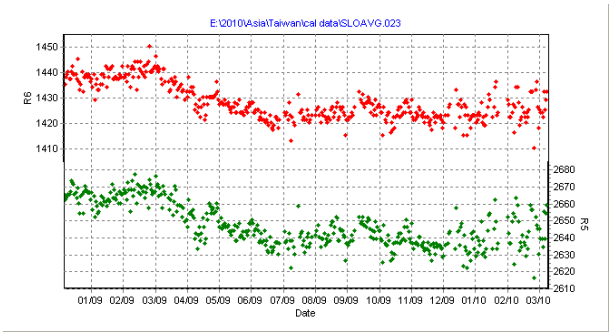


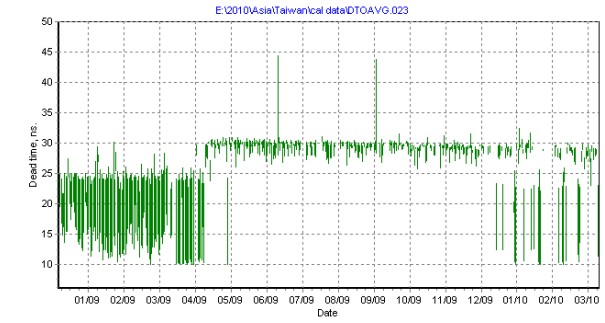
The major servicing was done on #061 with the replacement of the PMT UV filter. New temperature coefficients and ETC constants of 3165/3260 were installed in final constants file (icf10010.061).

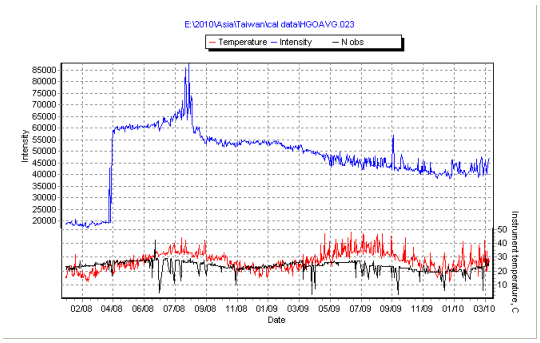
Time accuracy was found to be much better this year with use of XP operating system computers the GWBASIC clock is separate from internal clock and so the command TD must be used frequently in Brewer schedules to set the Brewer time to the computer time. #023 was still being operated from a W98 computer but on the last day was changed to a new computer using XP software. However the special startup program (test.bas) and reset routine without use of code files still had to be used which were necessary before the computer change.

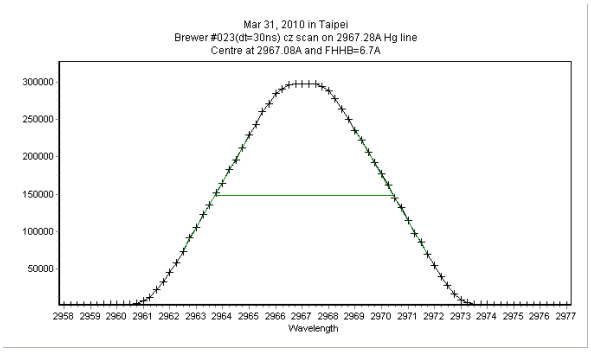
Taipei Calibration Results - Brewer #023 graphs 2010

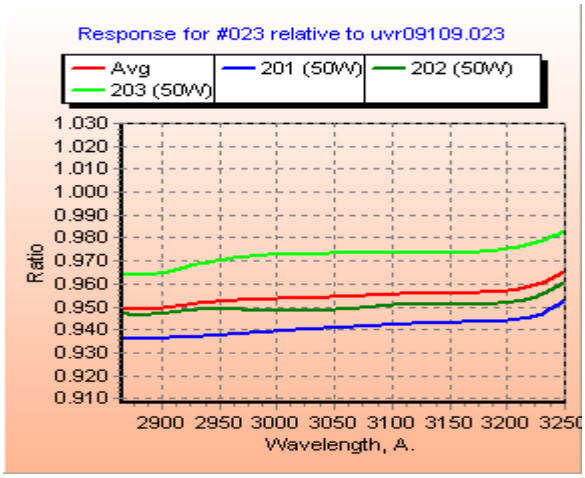
Below is graph of the SL ratio R6/R5 ratios. Next are the DT results for past year, which show some variability, cause is unknown. Then a graph of the sun scan results showing that cal step 165 is still proper. Then the HGOAVG results showing the step increase in intensity due change in filter wheel 2 setting and the CZ scan of the 2967A line from HG lamp. At the bottom of page is graph showing the ratio of the new UV response file (uvr09510.023) to the 2009 file. Finally a graph of the new response file is shown.

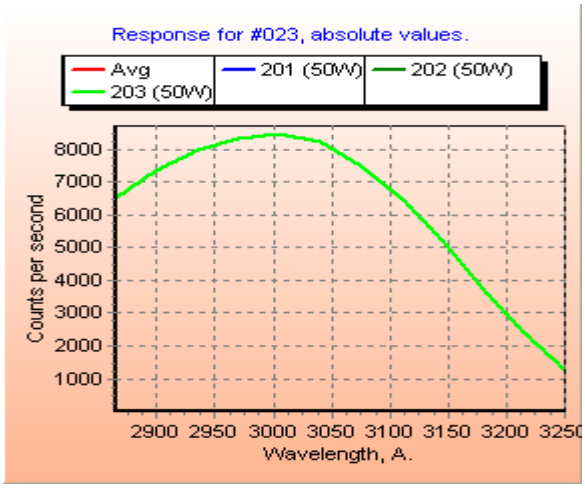






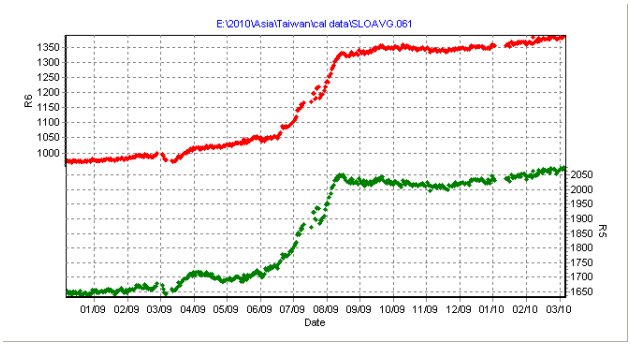


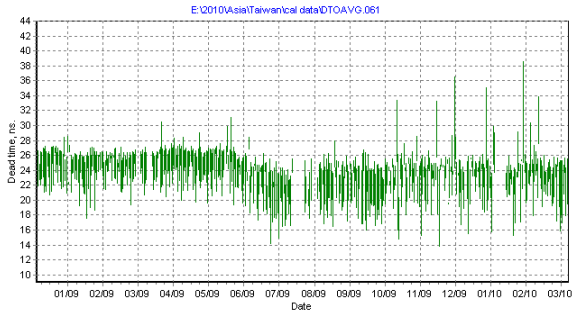


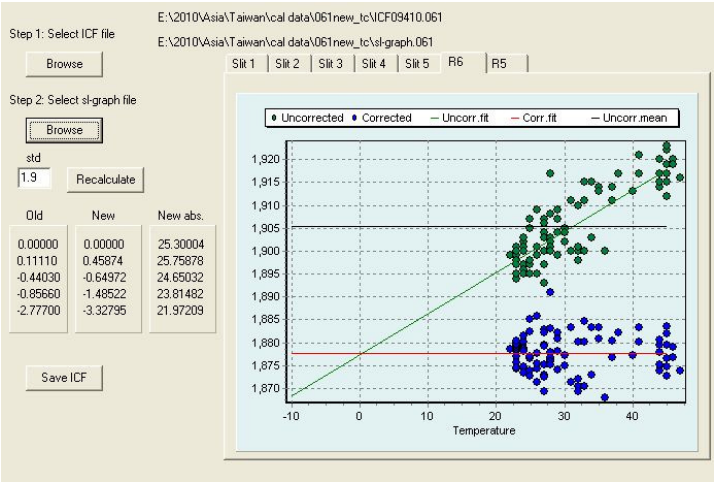


Taipei Calibration Results - Brewer #061 graphs 2010

The SL ratios and DT results for the past year from #061 are shown below. The sun scan results showed step 160 was still the proper setting. Standard Lamp CI scans before and after UV filter replacement showed similar ratio results to the UV results shown at the bottom of this page. New temperature coefficients were calculated as shown below and are now stored in file (icf10010.061), which should be put into use. The new SL ratios are 1880/3685 and final ETC constants are 3065/3260.





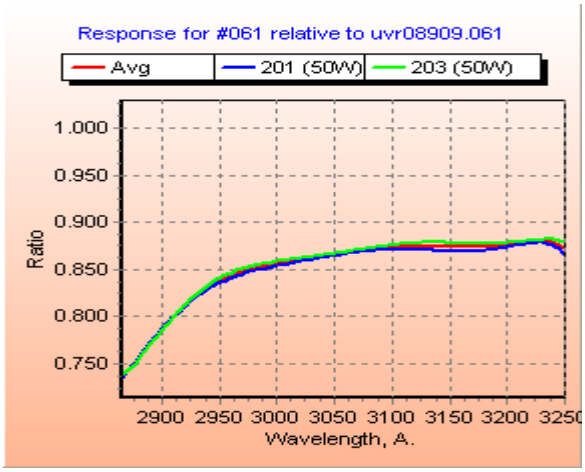


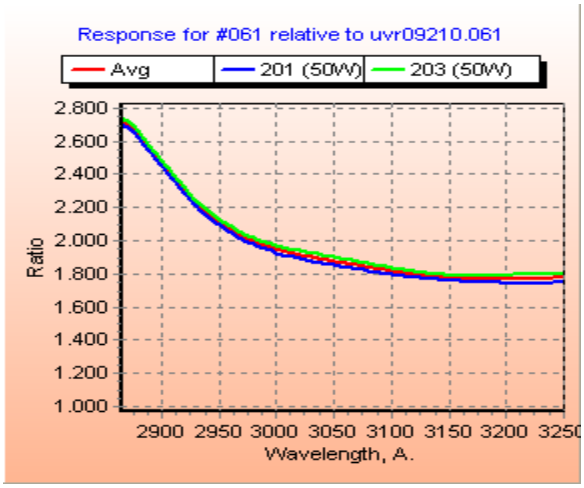
Opposite is graph from TCPRO program which calculated new temperature coefficients for #061 using SL results from the period: Apr 03-12, 2010
temperature range: 22 - 47

Mean R6/R5 before correction = 1905 / 3712
Mean R6/R5 after correction = 1878 / 3685

Final constants for slits 1-5 are:
5.300, 5.759, 4.650, 3.815, 1.972

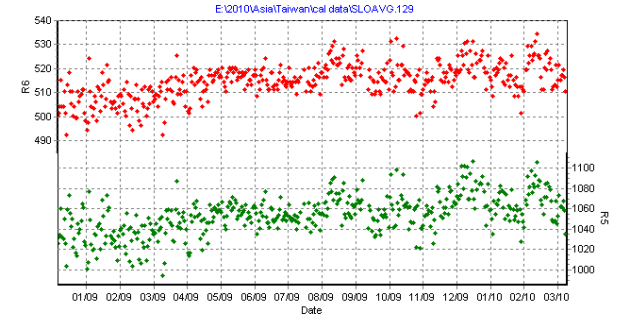
Below is graph of the initial UV response file (uvr09210.061) compared to 2009 response file and then the ratio of the final response file (uvr09510.061) to previous file (uvr09210.061).

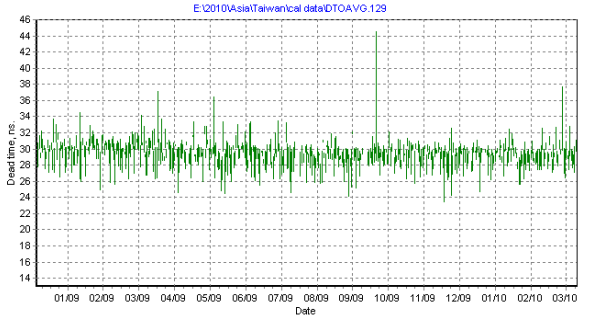


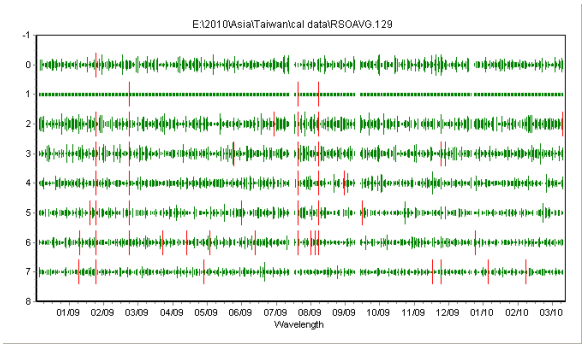


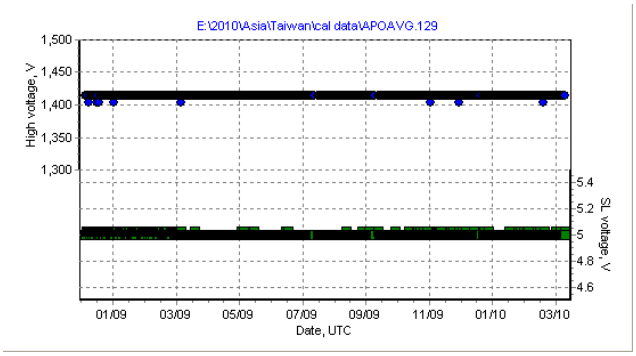
Taipei Calibration Results - Brewer #129 graphs 2010

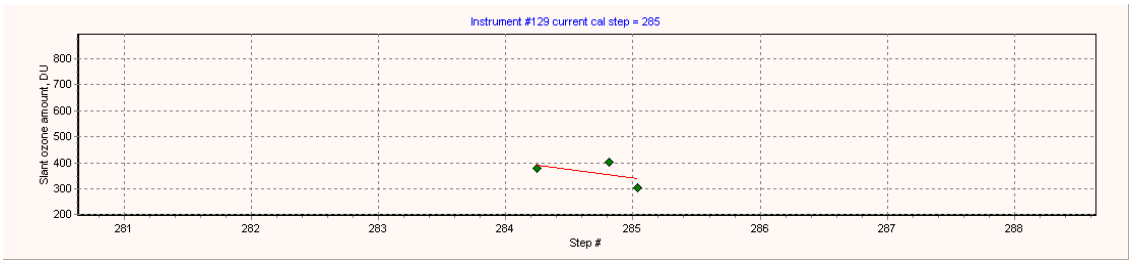
The SL ratios, DT, RS and AP test results are shown below for the past year. The sun scans showed that the cal step of 285 was still proper. Then graphs of HS and HL scan test results of 2967A and 3341A Hg lamp spectral lines.

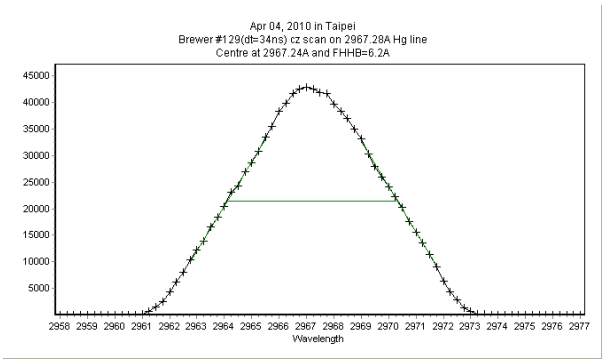


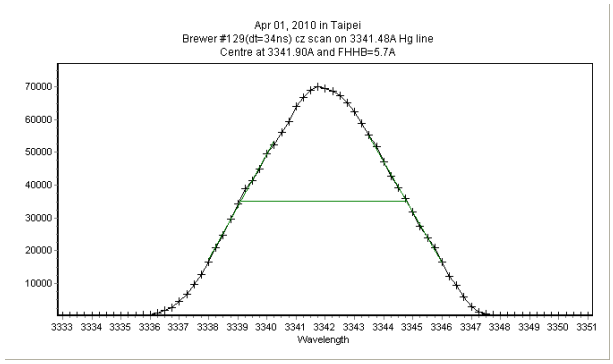




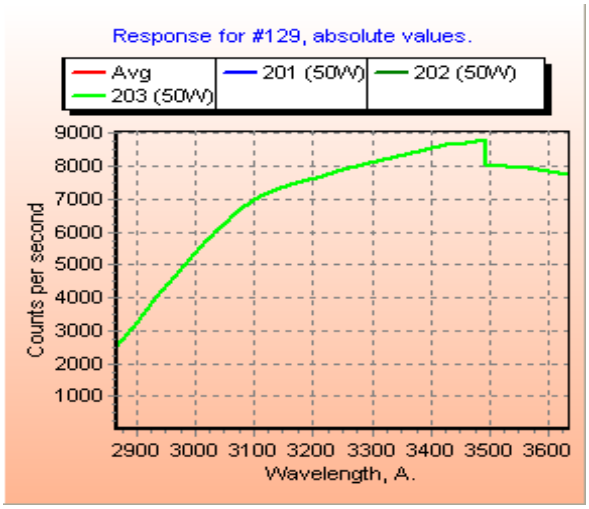


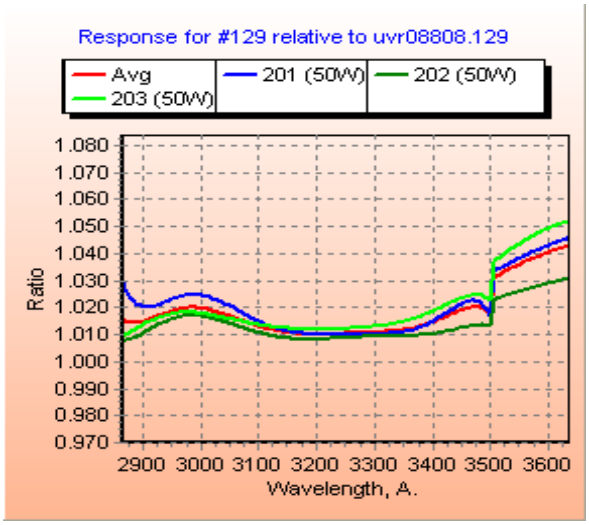




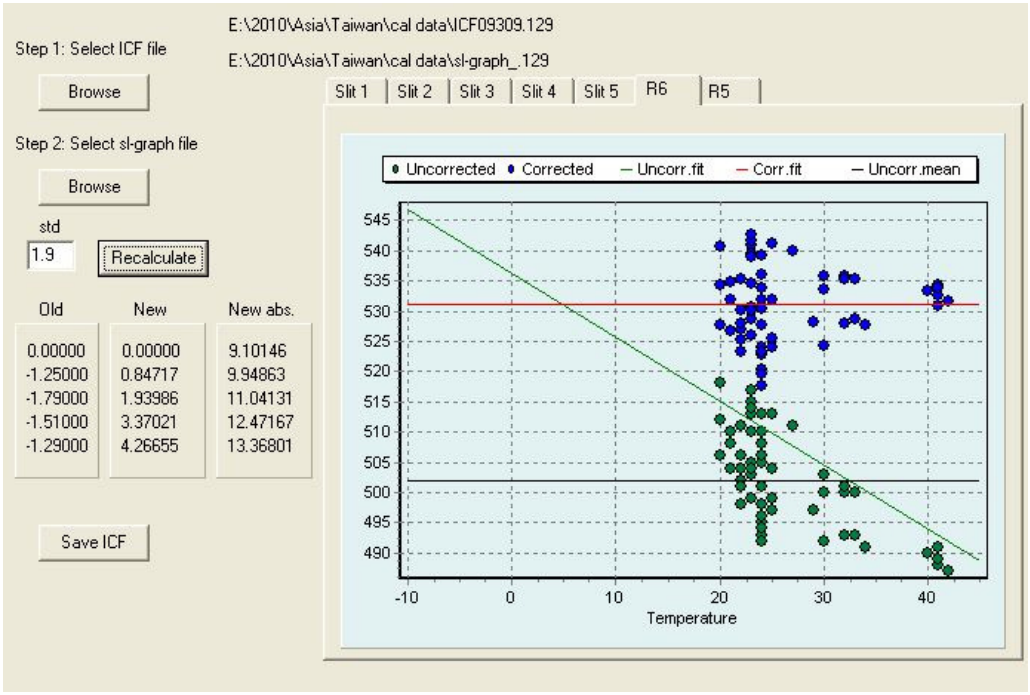


Below is a graph of the UV response file UVR09210.129 and in second graph it is compared to the in use file UVR08808.129, which was not changed due to the small differences.





New temperature coefficients were calculated for #129 as shown below and are included in file (icf09510.129), which was put into use during this visit. The new SL ratios are 530/1090 and final ETC constants are 1800/815. Reference final graph from TCPRO program which shows temperature dependence (green dots) and recalculated R6 ratio results (blue dots).



Original temperature range: 20 – 42 from the period: Mar 31 2010 to Apr 05 2010
Mean SL ratios R6/R5 before correction = 502 / 1019; after correction = 531 / 1091
Final constants for slits 1-5 are: 9.1015, 9.9486, 11.041, 12.472, 13.368