Taiwan CWB - 2009 Calibration Report of Brewer Ozone Spectrophotometers

Prepared by: Ken Lamb, Int'l Ozone Services Inc. March 30 – April 5, 2009

The annual calibration and service checks on the three Taiwan Brewers were completed at the Central Weather Bureau in Taipei. The weather was not co-operative until the last two days for the ozone and UV calibration checks. The Chengkung instrument #061 without tracker was relocated here for this campaign. The Taipei instruments, #129 and #023 have worked very well during the past year, reference SL ratios and other graphs on pages 3-6. The Canadian traveling standard Brewer #017 was used as the ozone reference instrument again.

MKIII #129 Brewer Taipei:

The standard lamp ratios have increased slightly to values of 510/1045 for the past year and were at values of 495/990 last year. The computer with XP operating system was controlling instrument very well and continued after the installation of the faster IOS microboard, (9600 baud). V376B software was upgraded and left in operation (in \brewer\brew376b directory).

It was determined that the ETC constants should be adjusted slightly to values of 1770/645 to obtain best agreement to #017. Reference the ozone results on next page note the scatter in ozone results for #129 The main program was changed and saved this way (line 5 - HIFW2=1) for #129 only.

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 last year (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 been quite stable at or near last year's values of 1442/2685. The ozone results from #023 were close to #017 but the agreement was improved with a reduction in the dead time (DT) constant to 30ns from 36 and setting the ETC constants to 2540/2250 from 2545/2265. The DT measured results have been stable at values of 25ns / 18ns which is not normal but the instrument produces normal performance otherwise.

Sun Scan test results showed that the cal step of 165 was still proper. The dispersion test results were very similar to constants in use (< 3 steps difference and so file (dcf09299.023) was left in use. The NO2 results using last year's revised NO2 ETC constants of 470/480 were found to be quite similar the DS/ZS NO2 results from #061. UV calibration results produced file UVR09109.023 that was found to be higher than the 2008 file by +10 to +6% and so was put into use. This difference is probably ~50% due to lower temperature of instrument this year during calibration measurements.

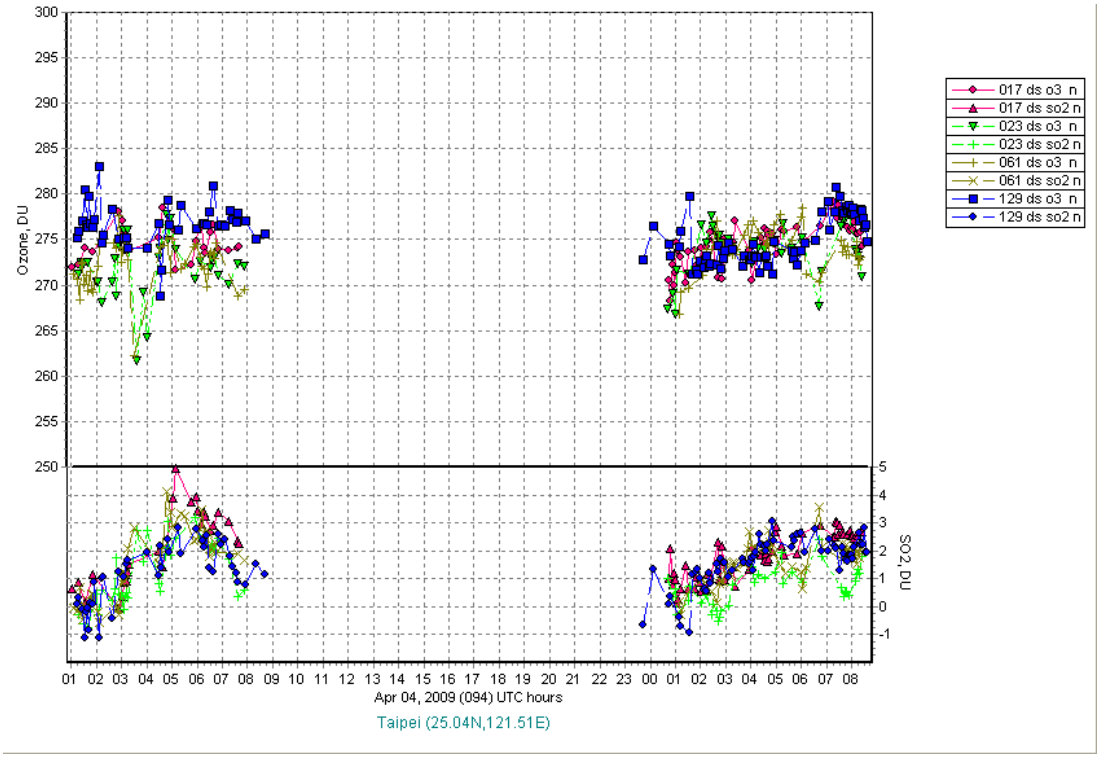
MKIV Brewer #061 from Chengkung:

The SL ratios were at values of 975/1640 from 2008 values of 775/1270. 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 2175/1285 for best agreement to #017, which were about 1% less than applying SL changes. 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 results from #061 were believed to be proper since the SL F-ratio has not changed in the past 5 years.

The final UV calibration stored in file UVR08909.061 was different by ~-6% to the calibration from last year and so was put into use. Note the instrument temperature was much cooler this year, which made this difference less than if temperature was constant.

Final results:

Below are the ozone and SO_2 results for the final 2 days using the final constants on all instruments. Note the final instrument constants files for all are named ICF09309.###.



There was no major servicing required on any of the instruments. The shock mount seals were ok. The air inlet tubes to desiccant container had deteriorated and were replaced.

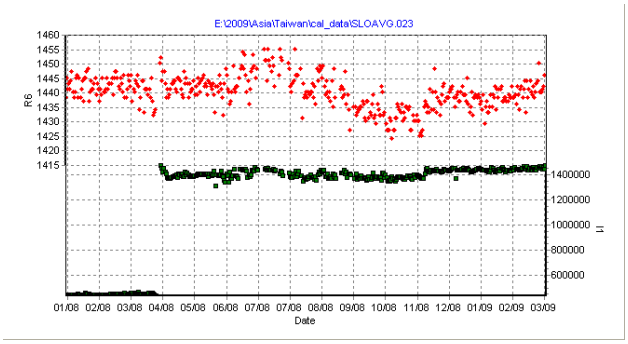
Time accuracy was found to be a problem on Taipei instruments due to the continued used of the internal Brewer clock, indicated by 'I' on top right of screen. In recent years with the use of Windows operating systems and timeservers, the best control of time for the Brewer software is with the internal clock turned off ("E" on the top right of screen). With W98 computer operation the Brewer software or GWBASIC clock stays the same as computer clock and so timeserver should set the computer time frequently. With 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 is the only instrument operated from a W98 computer.

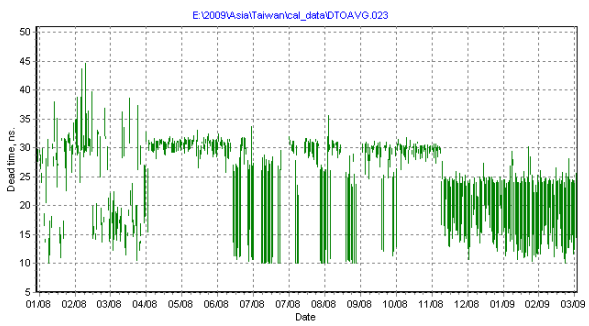
The AOD software (DS routine mainly) was updated to latest version during this visit that produces higher (x 2.3) results, due to a correction to algorithm, (log change).

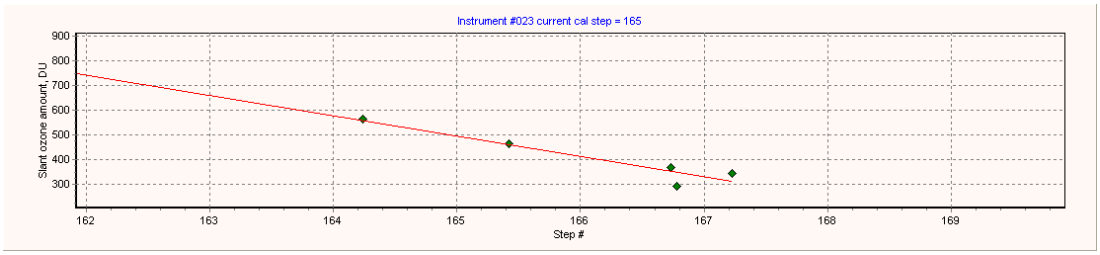
Some service parts which could be considered include right angle connectors for power and signal for #023 tracker and perhaps also for #061 tracker. Two handles (old style), an old style window for #023 and new style viewing window for #129. Window gaskets for all and cover gasket material should also be obtained.

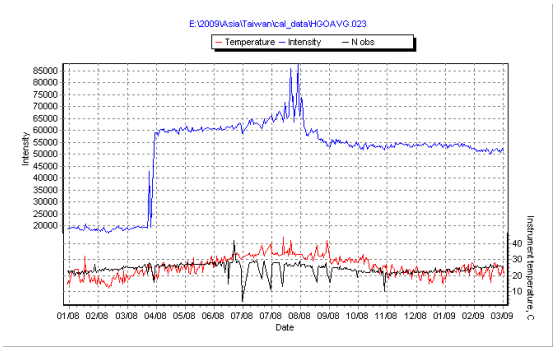
Taipei Calibration Results - Brewer #023 graphs 2009

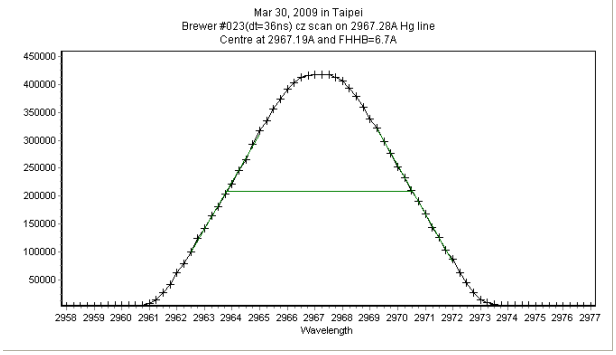
Below is graph of the SL ratio R6 and F1 counts. Next are the DT results for past year, which show some variability, cause is unknown. Then a graph of the sun scan results showing that cal step 165 is still proper. Then the HGOAVG results showing the step increase in intensity due change in filter wheel 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 (uvr09109.023) to the 2008 file. The increased sensitivity is mostly due to lower temperature this year (23C versus 37C). Finally a graph of the new response file is shown.

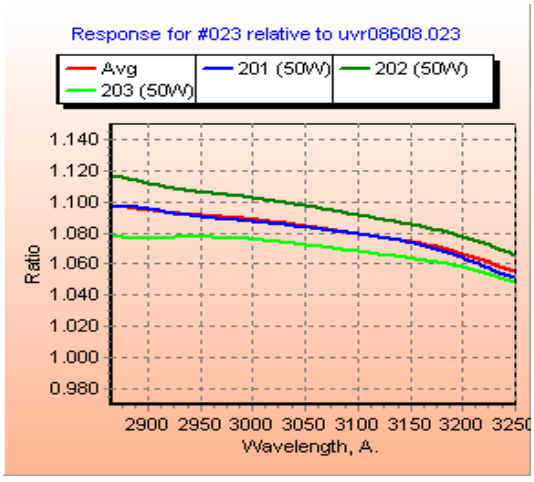


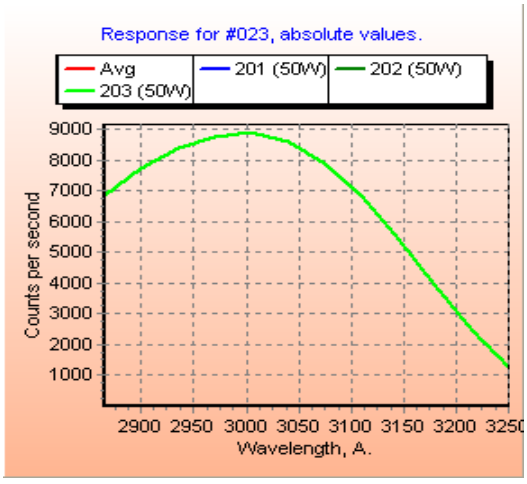






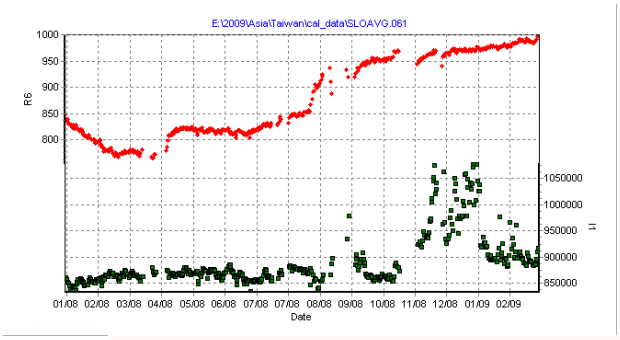


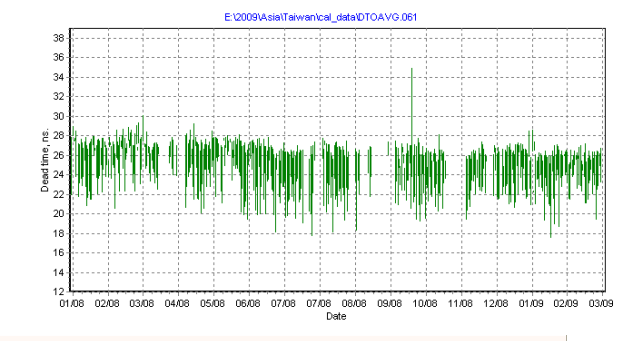


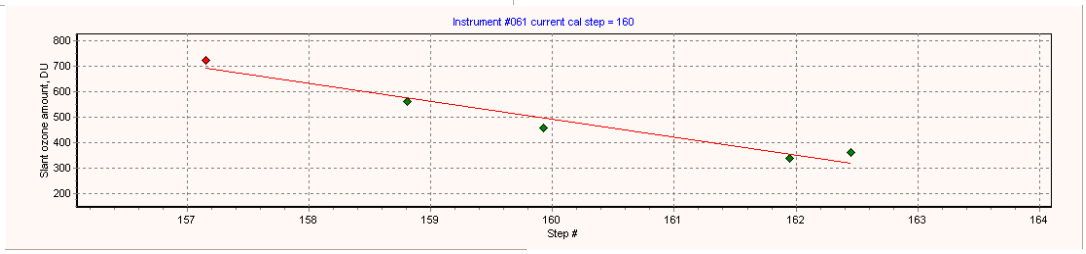


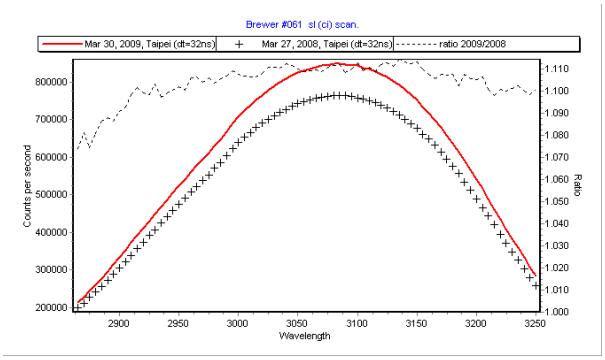
Taipei Calibration Results - Brewer #061 graphs 2009

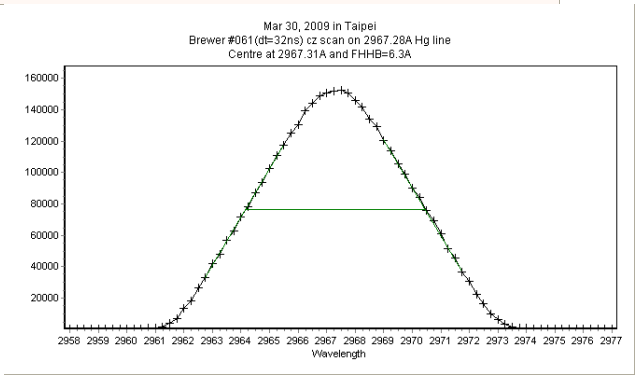
The SL ratios and DT results for the past year from #061 are shown below and then the sun scan results. If the weather had allowed calibration during the first days then the PMT UV filter would have been changed due to the unstable SL ratios. Then a SL CI scan compared to a 2008 scan and graph (CZ) of the Hg line 2967A. At the bottom is graph of the new UV response file (uvr08909.061) compared to 2008 response file. Finally a graph showing the irradiances from a UF scan with #129 and #061.

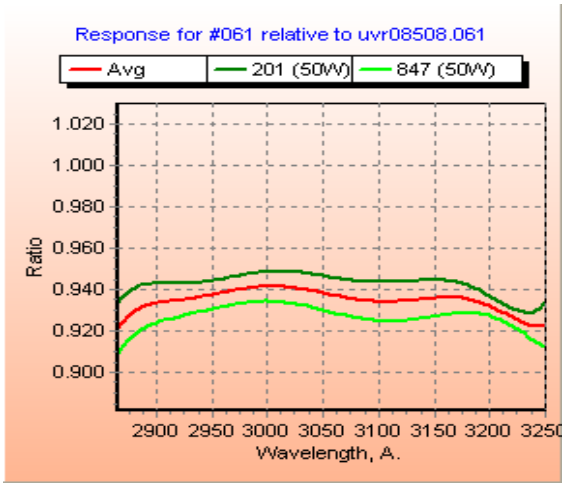


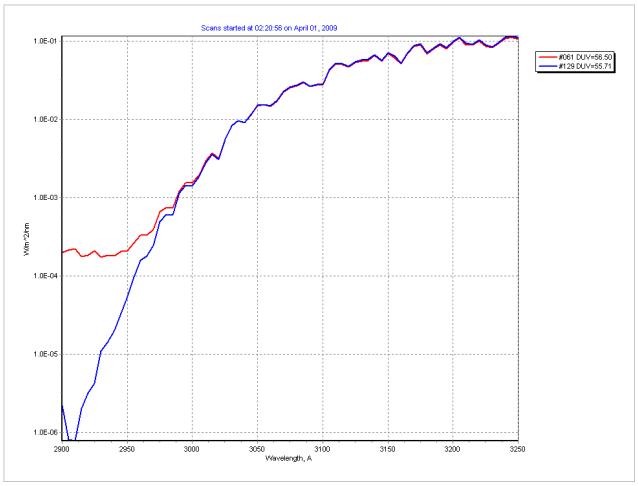






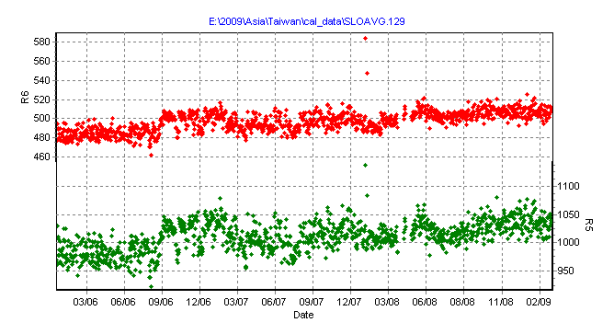


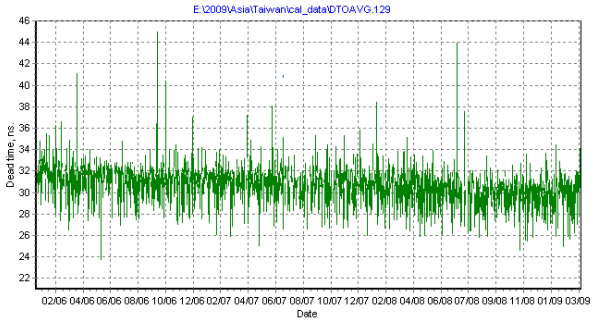


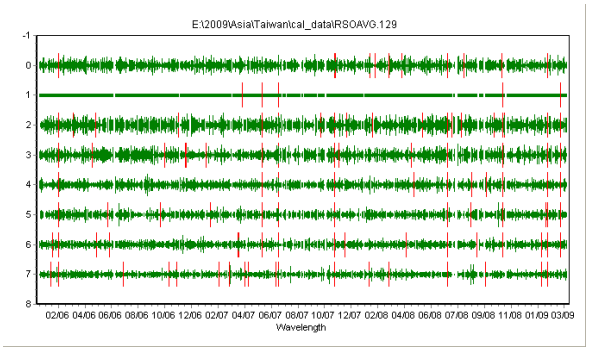


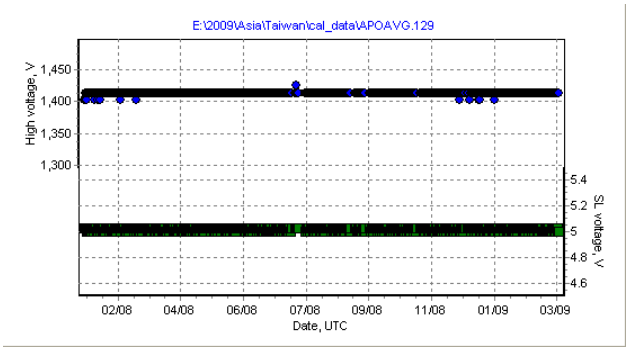
Taipei Calibration Results - Brewer #129 graphs 2009

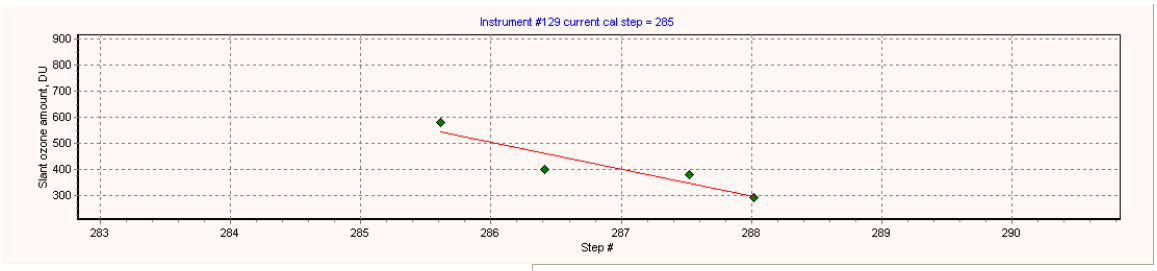
The stable SL ratios, DT, RS and AP test results are shown below for the past year. The sun scans showed that the cal step of 285 was still proper. Then graphs of HS and HL scan test results of 2967A and 3341A Hg lamp spectral lines.

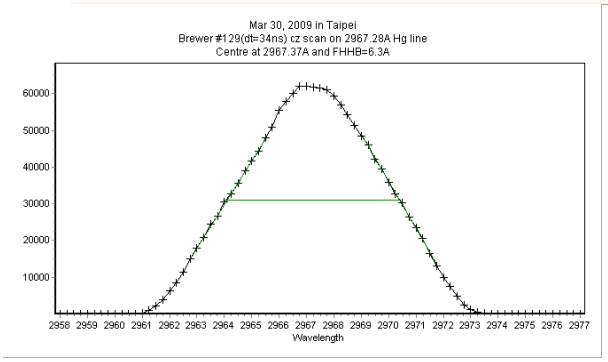


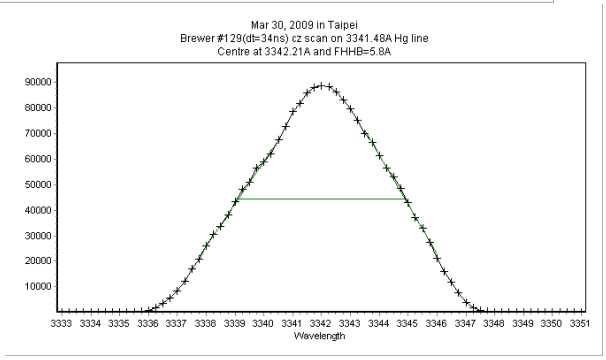




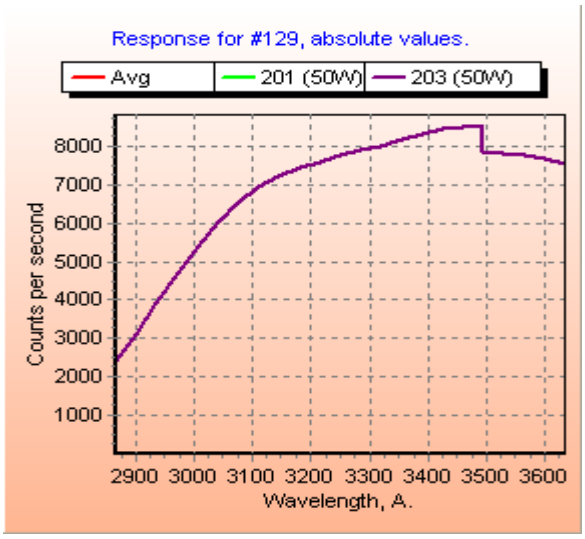


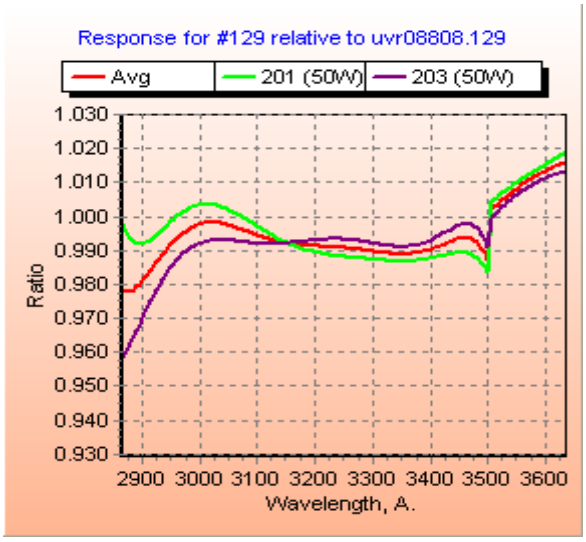






On the next page is a graph of the UV response file UVR08909.129 and in second graph it is compared to the file UVR08808.129 from last year obtained from IOS 50w lamps. It is not necessary to change to the new file due to the small differences.


Response for #129, absolute values.
Avg
201 (50W)
203 (50W)
Counts per second
8000
7000
6000
5000
4000
3000
2000
1000
2900 3000 3100 3200 3300 3400 3500 3600
Wavelength, A.


Response for #129 relative to uvr08808.129
Avg
201 (50W)
203 (50W)
Ratio
1.030
1.020
1.010
1.000
0.990
0.980
0.970
0.960
0.950
0.940
0.930
2900 3000 3100 3200 3300 3400 3500 3600
Wavelength, A.