

Brewer Temperature Coefficient Correction

A correction to the temperature coefficients is required when the change in the Standard Lamp (SL) R6 ratio with temperature is larger than the variation that is observed within the daily average plot of the R6 ratio.

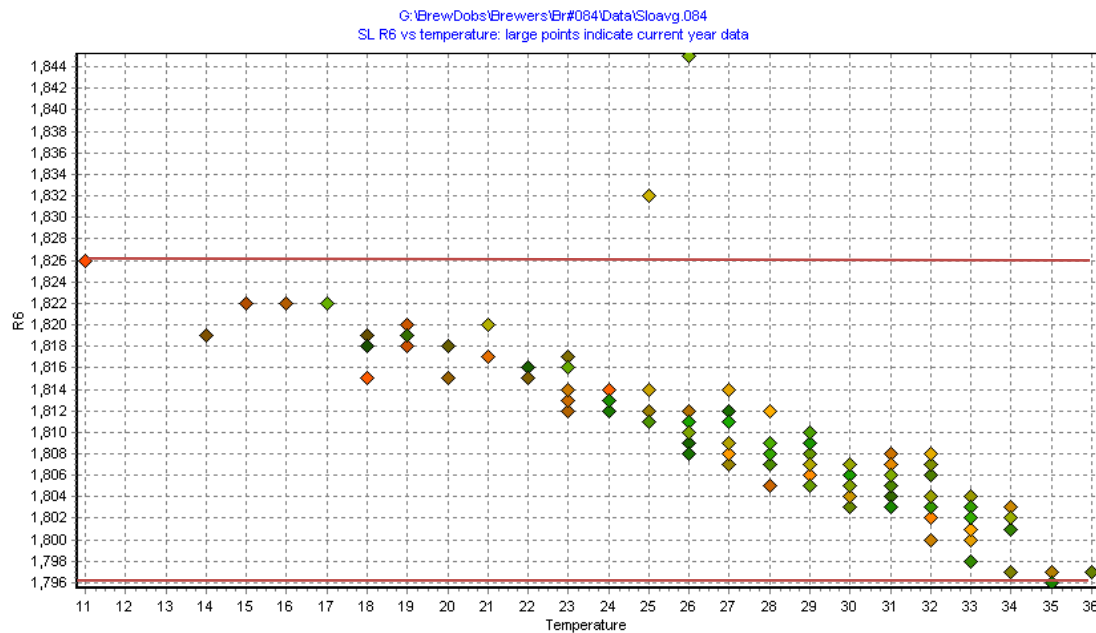


Figure 1: SL R6 ratio vs temperature plot demonstrates a 30-unit change (1796 – 1826)

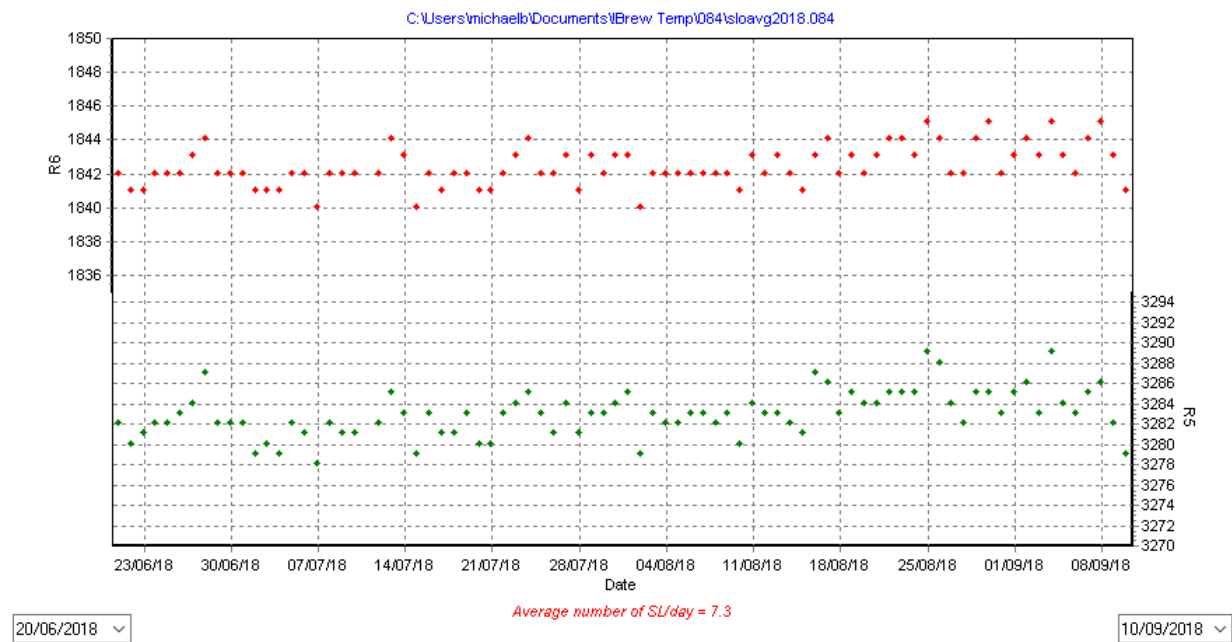
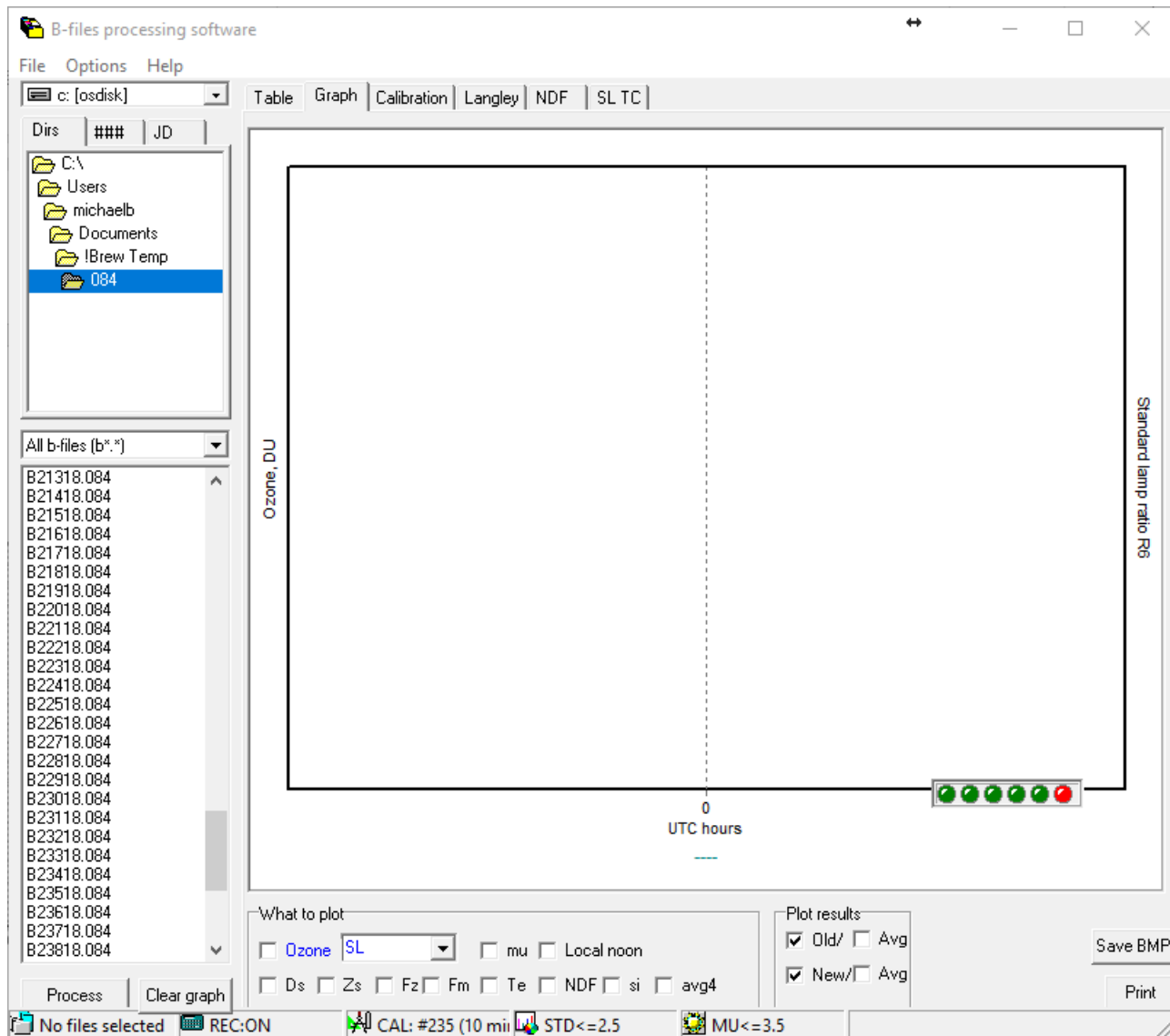


Figure 2: Average daily variation in the SL R6 ratio (seen in red) demonstrates only a 5-unit change (1840 – 1845)

Figures 1 and 2 show a situation where a temperature coefficient correction is required for Brewer instrument #084.

Once it is determined that the temperature coefficients require correction (using PReport), b-files (raw Brewer data) need to be prepared for processing by BFile Pro.

1. Copy enough data to cover the temperature extents seen by the instrument (eg. Brewer #084) into a directory that you will use for processing (eg. C:\Brew Temp\084). Typically, a year worth of b- files from the instrument are used to meet these requirements.



2. At least one b-file from the reference instrument needs to be included in the same processing directory for the program to be able to generate the temperature coefficients file. In this example, we used Brewer #015 for intercomparison.
 - a. In BFile Pro, select the **Options** tab
 - b. Under options, select the **Intercomparison** tab and input the reference instrument number. In this example, 015.
 - c. Press the “OK” button.

The screenshot shows the 'Options' dialog box in BFile Pro, with the 'Intercomparison' tab selected. The 'Options' title bar is circled in red. The 'Intercomparison' tab is also circled in red. The 'Standard instrument' section contains a text box for 'The reference instrument's number' with the value '015' entered, which is circled in red. Below this are two radio buttons: 'Do not calculate calibration if no data from this instrument provided' (selected) and 'Remind me to provide data from this instrument'. The 'New instruments' section contains three options: 'Use new calibration to recalculate data 'on the fly'' (selected), 'Calculate the constants only', and 'Do not change the absorption coefficients' (checked). There is also a checked option 'Make SO2 zero (ignore SO2 from the reference)'. At the bottom, there is a spin box for 'Maximum number of minutes between the two instruments' measurements' set to '10'. The 'Save these options' checkbox is unchecked. 'Cancel' and 'OK' buttons are at the bottom right.

Options

Program Calculations Instrument constants
Output **Intercomparison** Graphics Advanced

☒ Calculate calibration information

Standard instrument

The reference instrument's number

☒ Do not calculate calibration if no data from this instrument provided
☐ Remind me to provide data from this instrument

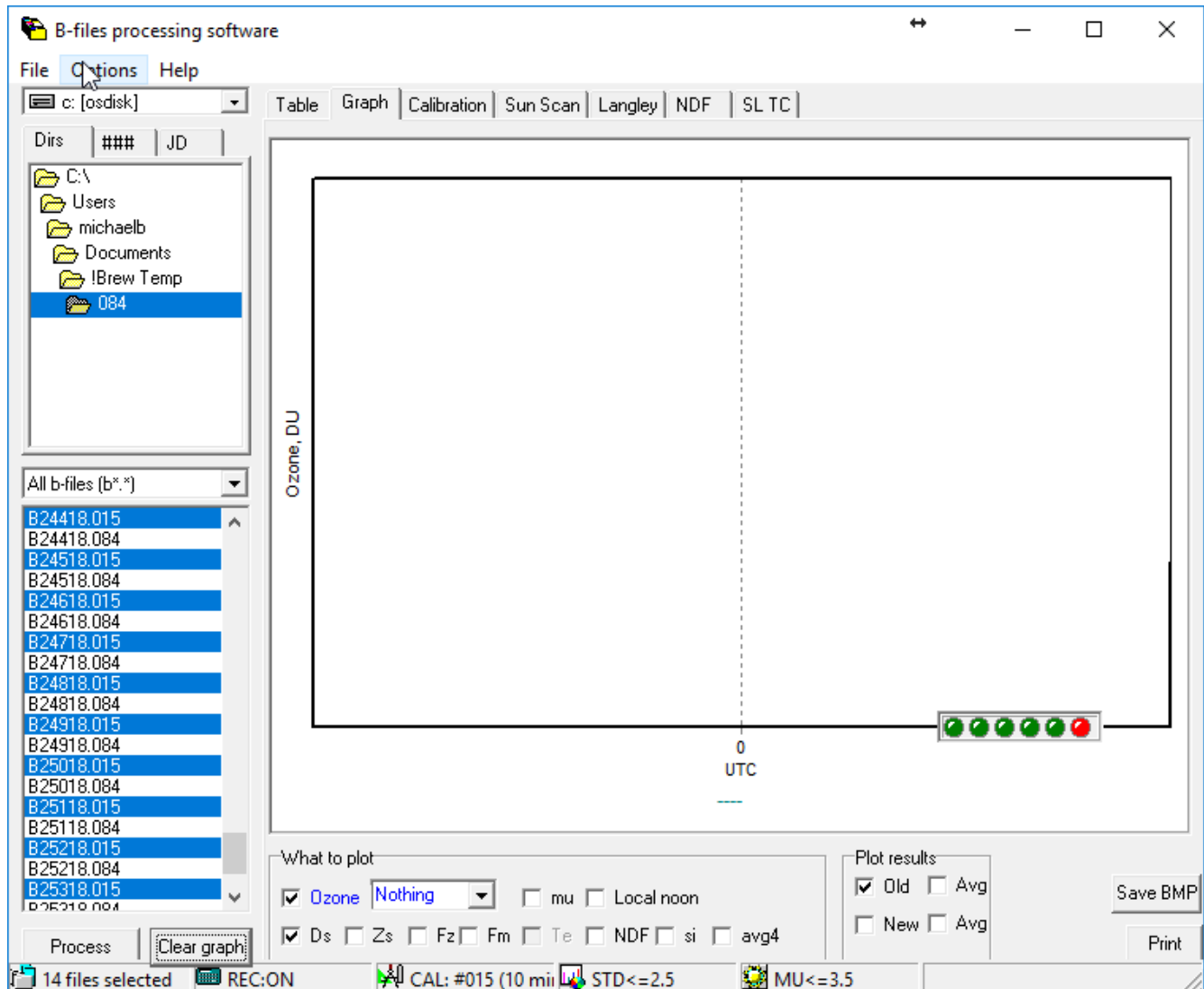
New instruments

☒ Use new calibration to recalculate data 'on the fly'
☐ Calculate the constants only
☒ Do not change the absorption coefficients
☒ Make SO2 zero (ignore SO2 from the reference)

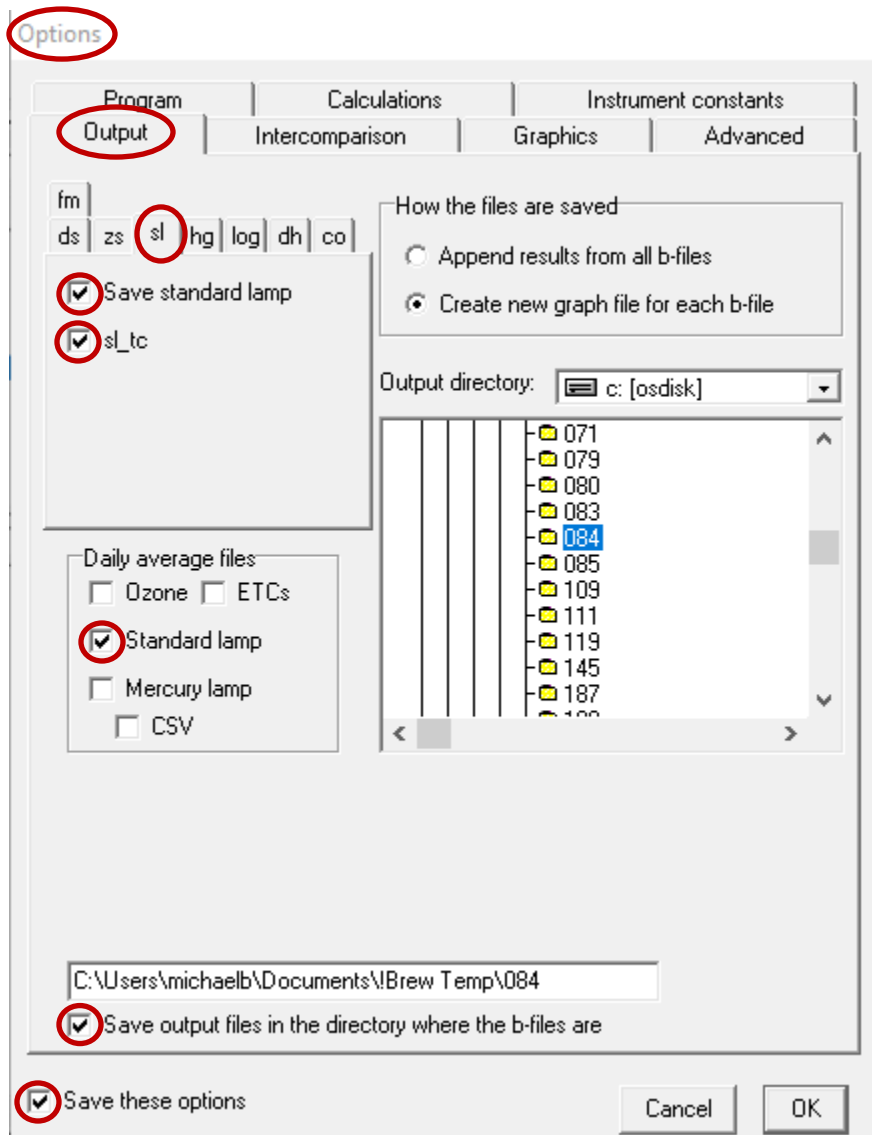
Maximum number of minutes between the two instruments' measurements

☐ Save these options Cancel OK

- Copy at least one b-file from the reference instrument (in this case #015) into the same directory that you will use for processing. Just as you have copied Brewer #084 data into the temporary processing directory (eg. C:\Brew Temp\ 084) in step 1, now you need to also copy some #015 reference Brewer b-files into the same directory.



4. To configure BFile Pro to process the newly added files:
 - a. Select the **Options** tab
 - b. Select the **Output** tab
 - c. Select the **SL** tab
 - i. Check the “Save standard lamp” box.
 - ii. Check the “sl_tc” box.
 - iii. Under Daily average files, check “Standard Lamp” box.
 - iv. Check “Save output files in the directory where the b-files are” box.
 - v. Check “Save these options” box.
 - vi. Press the “OK” button



5. BFile Pro needs further configuration
 - a. Select the **Calculations** tab
 - i. Check the "Calculate aerosol" box.
 - ii. Press the "OK" button

Options

Output | Intercomparison | **Calculations** | Graphics | Advanced

Program | Instrument constants

General

- ☒ Recalculate b-files
- ☒ Calculate aerosol
- ☐ Use O3FromBfile
- ☐ Calculate temperature
- ☐ Quick process
- ☐ Read DS only
- ☐ Check for UV files
- ☐ Save Umkher files
- ☐ MustHaveDh
- ☒ Apply SL correction
- ☐ Interpolate calibrations

Air mass factor parameters Default

Ozone layer height, km ☒

Rayleigh height, km*10 ☒

☐ Use real Rayleigh correction

SL limits

☐ Limit SL values

R6 std limit

Limitations

☐ Limit max ozone

☐ Limit min ozone

Plot ADD at slit

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☒ 5

FW2 positions to include

☒ 0 ☒ 1 ☒ 2 ☒ 3 ☒ 4 ☐ 5

☐ Limit Intensity to >10000

Ozone limitations

☒ Limit std values, DU

☒ Old style QControl:

☒ Limit mu values

☐ Max slant ozone, DU

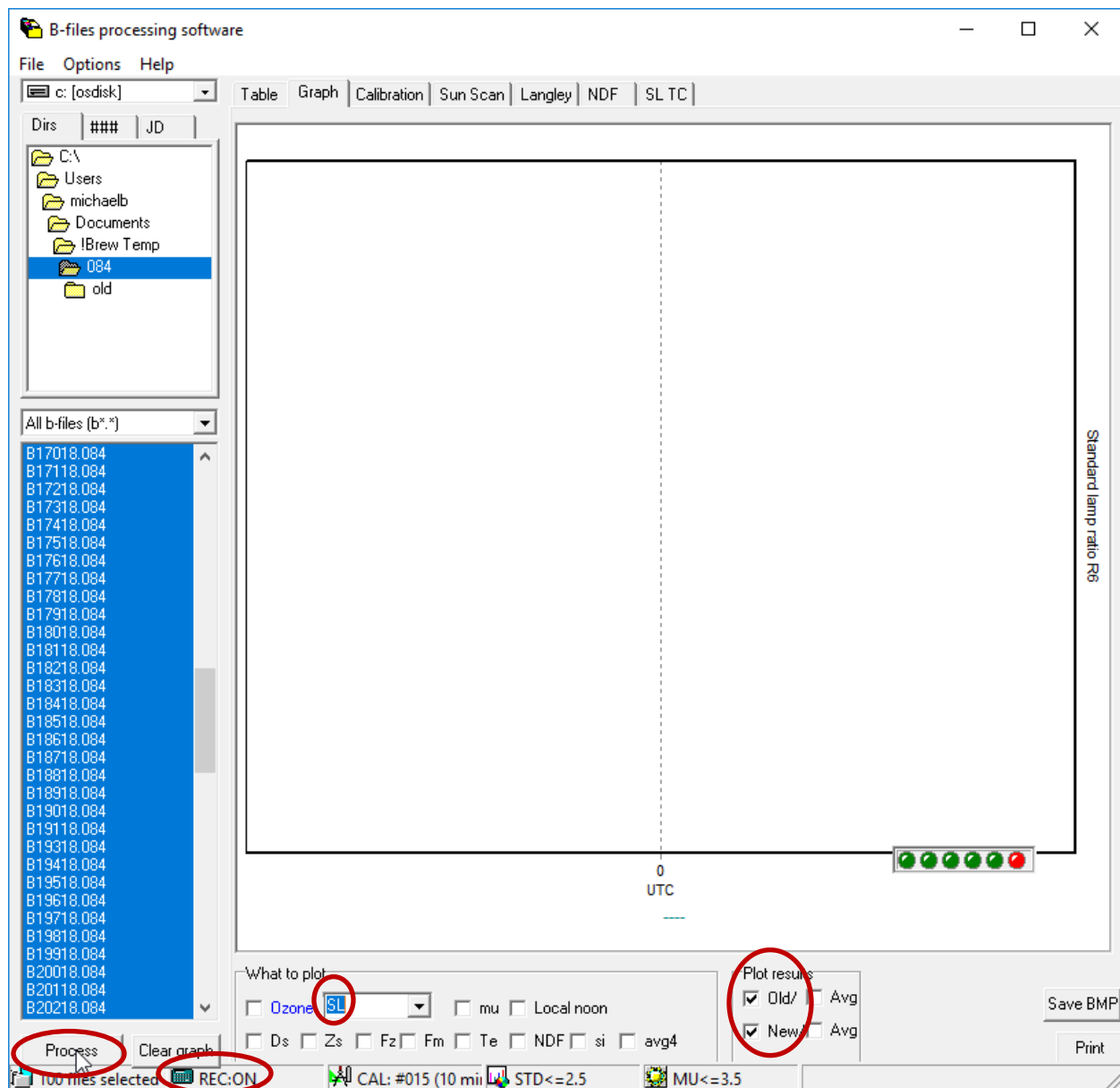
☐ Separate MK's:

MKII/V MKIII MKIV

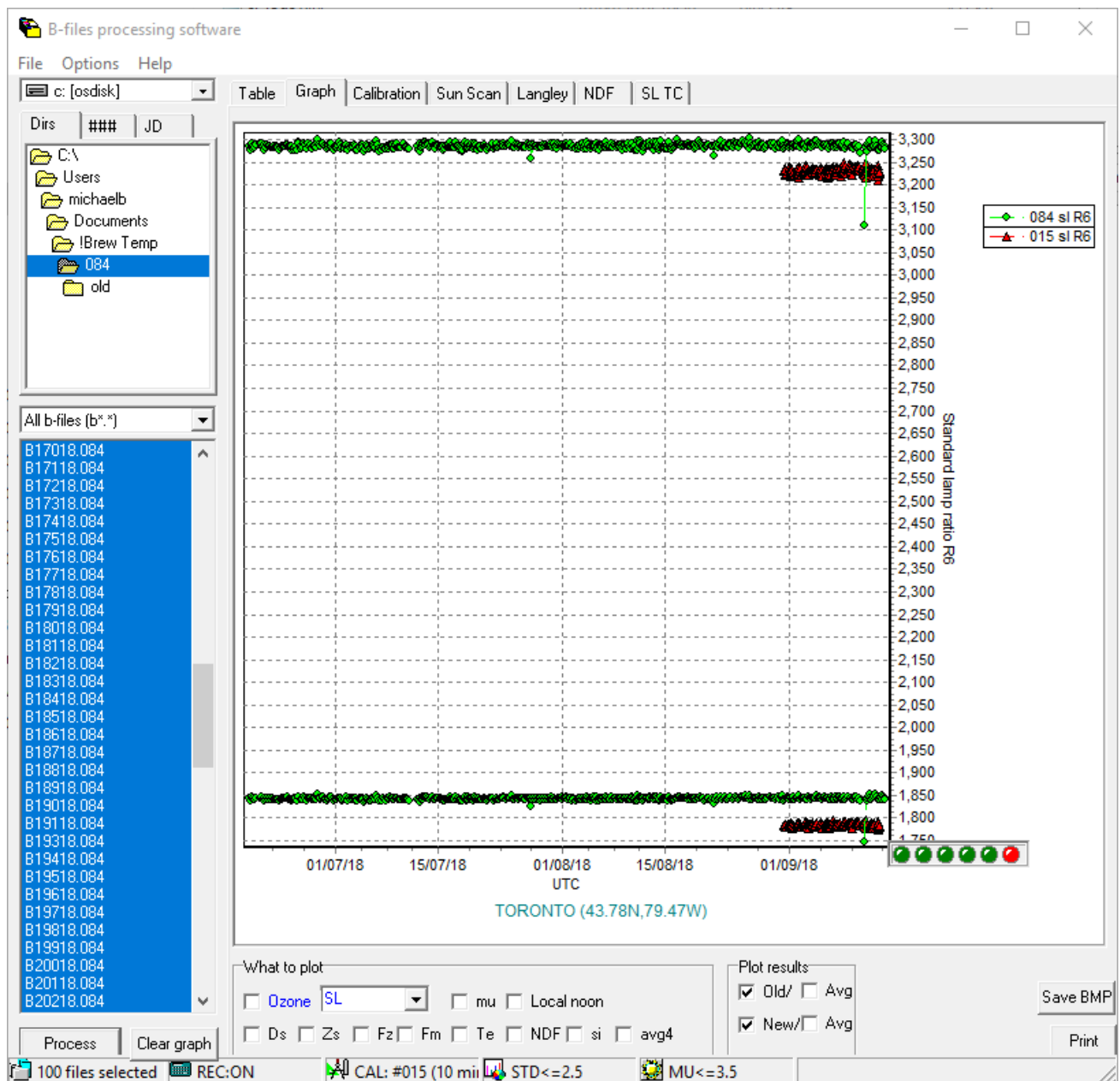
☐ Save these options

Cancel OK

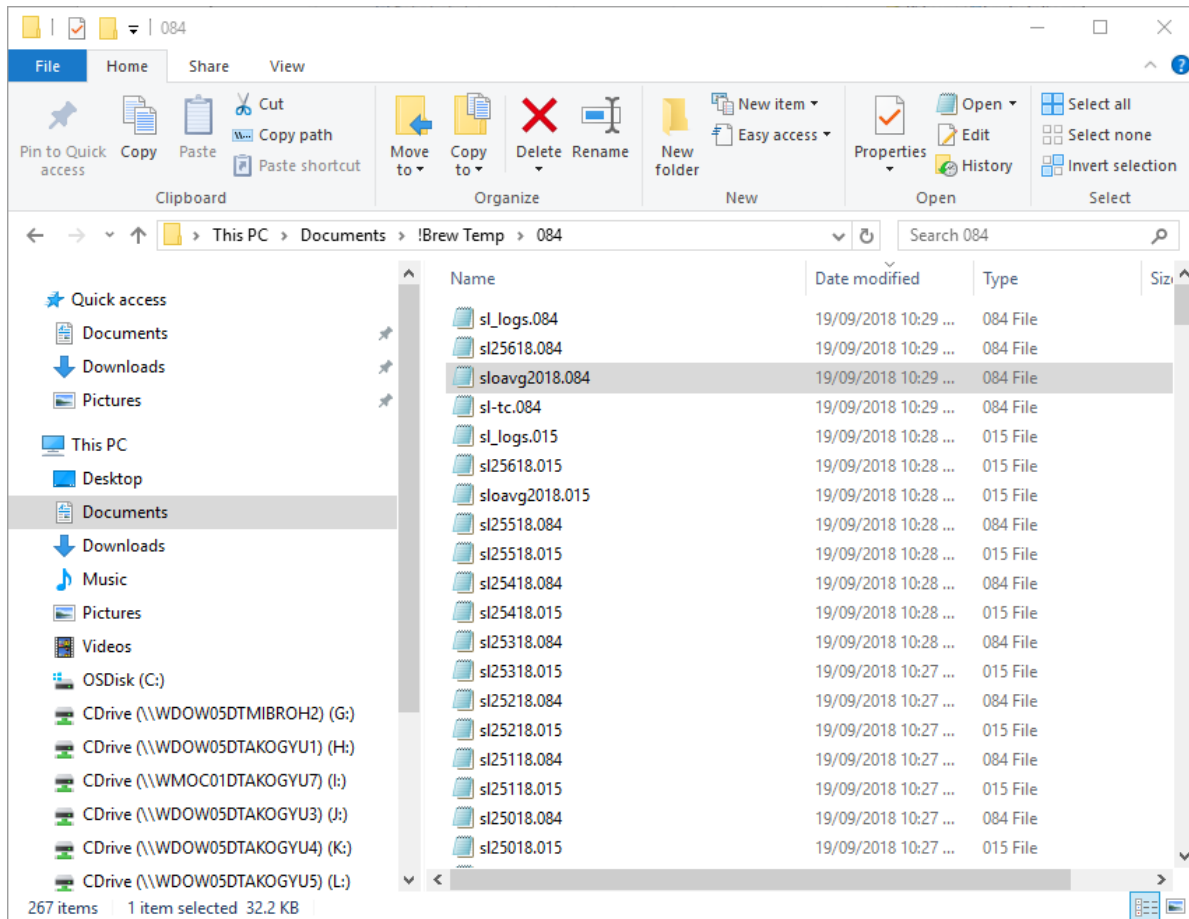
6. Now that the configuration is set, options for the calculations must be set.
- d. Ensure the Recalculation is set to “**REC:ON**” if it is set to “REC:OFF”, double click on “REC” at the bottom of the window and it will change to “ON”
 - e. Select all the files to be processed from the created temporary directory including those from the reference Brewer
 - f. Under “What to Plot” uncheck all boxes and pick **SL** from the drop down menu
 - g. Under “Plot results” check “**Old**” and “**New**” to have the R5 ratios (reference data associated with the SO2 correction) and the R6 ratios (reference data associated with the O3 correction) plotted on the graph.
 - h. Press the “Process” button.



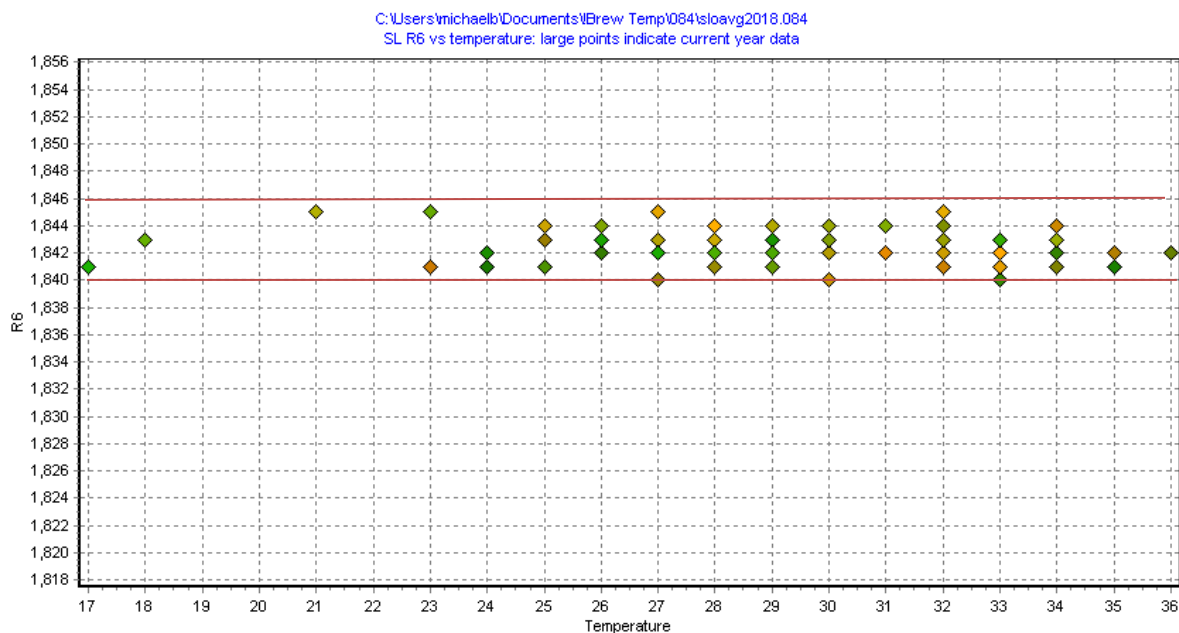
7. BFile Pro will process and plot the data. Standard Lamp temperature coefficients and sloavg files will be generated within the created temporary directory.



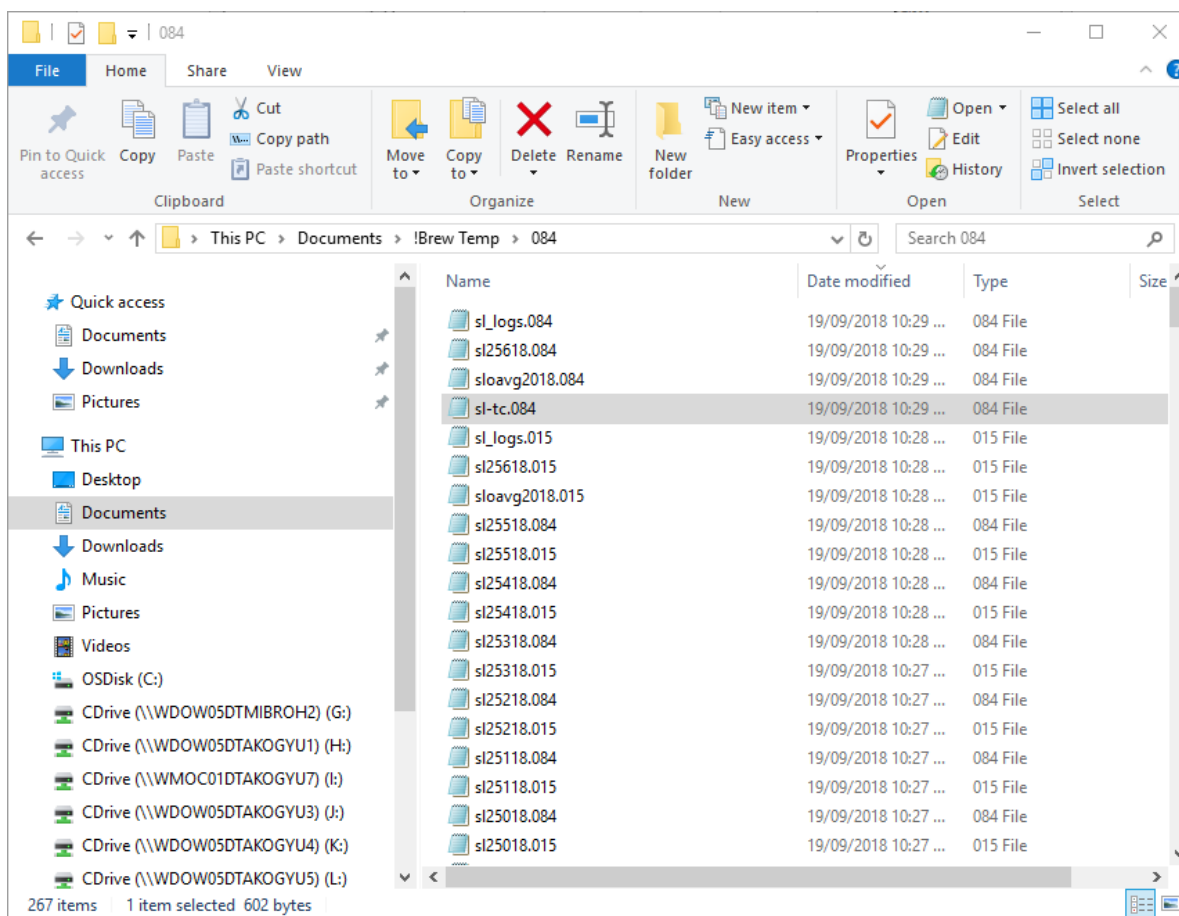
8. Use PReport to verify the effect of the newly created temperature coefficients by plotting the created sloavg file. In this example, sloavg2018.084.



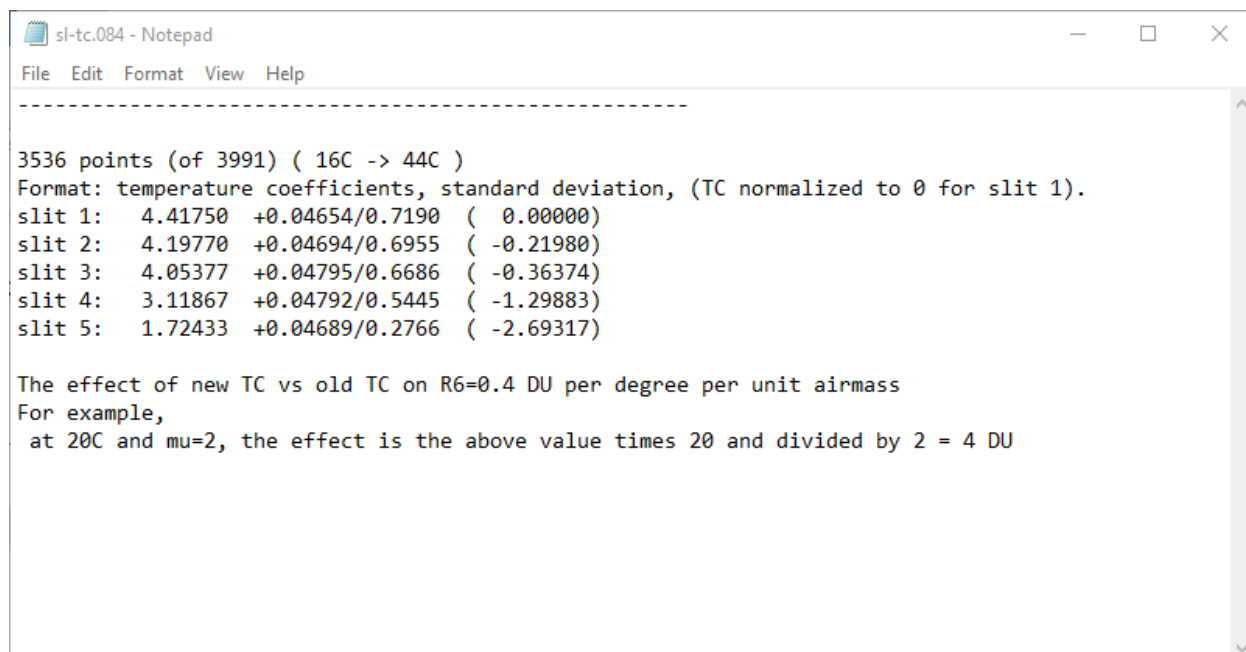
9. The R6 ratio vs Temperature will be displayed. Note the improvement from 30-units in the example down to only 6-units spread (1840 to 1846).



10. Open the newly created temperature coefficients file, sl-tc, in this example, sl-tc.084.



11. The values within the parentheses are the new temperature coefficients to be applied



12. Reviewing historic data and consulting with the scientific authority for guidance will determine what date range requires reprocessing and new coefficients to be applied.

- a. To apply the new coefficients to Bfile Pro for instrument ozone calibration:
 - i. Select **Options**
 - ii. Select **Instrument Constants**
 - iii. Under **Instrument Number**, select the instrument from the drop down menu
 - iv. Under **Calibration Date**, select the starting calibration date
 - v. Under **TC**, edit the temperature coefficients
 - vi. Press the "OK" button.

Options

Output | Intercomparison | Graphics | Advanced
Program | Calculations | **Instrument constants**

Instrument number
084 Add [Green Box] >> Original data Recalculated data
Remove Rectangle Dot Solid

Calibration date 109 effective until Today 262
19/04/2018 12:00:00 AM

ICF file | DCF file | ZS file | UVRES file | Advanced | History
C:\Users\michaelb\Documents\BFile Pro Cal Files\#084\2018\ICF25318.0

TC	Abs	ETC	SL	Cal	Zero	Dead time
0	0.3402	2930	1838	1068	2693	40
-0.2198	2.35	2630	3273	0.0000	0.00	
-0.36374						
-1.29883						
2.69317	0	4882	9214	13657	18387	24568

Add a new calibration Remove this calibration Edit this calibration

☐ Save these options Cancel OK

13. The newly created corrected SL average file needs to be manually applied to the master sloavg.III file in the instrument data directory.

- Ensure a backup copy is made prior to any changes to the master file in case problems occur or mistakes are discovered and a recovery is required. i.e. copy sloavg.III to sl_oldYYYYJJJ.III (today's date).
- In this example, the data from the new file sloavg2018.084 would be used to overwrite the matching date range within the instrument sloavg file, In this case sloavg.084 in \BR#084\Data.

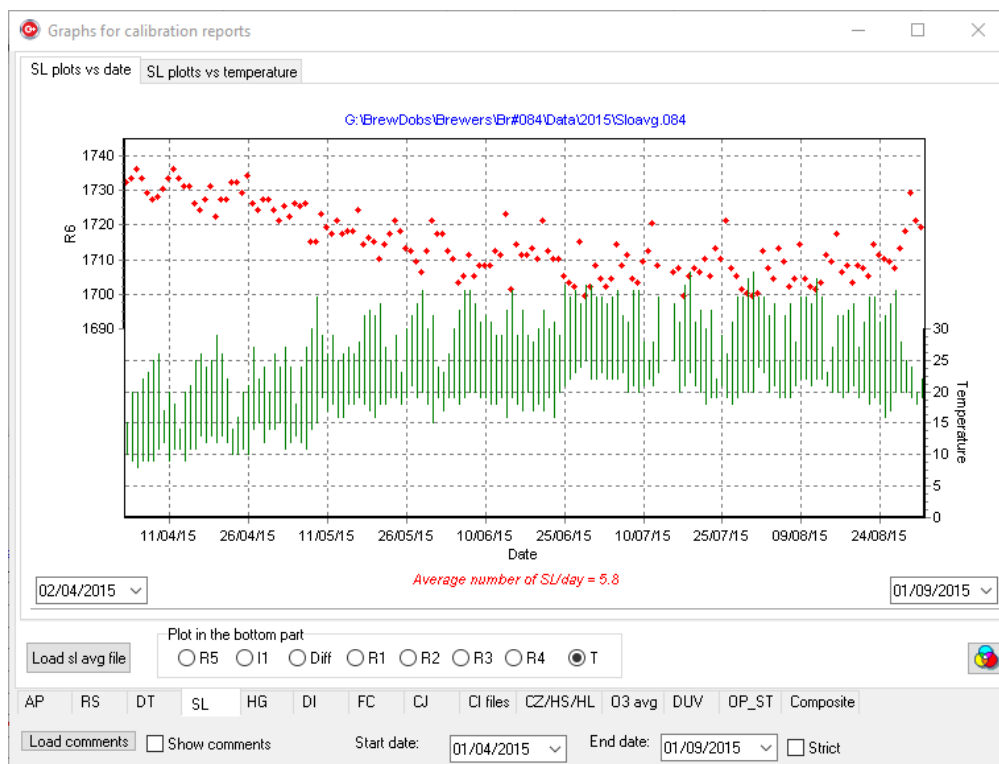
This is a manual copy and paste process

ENSURE ONLY THE DATA THAT HAS BEEN REPROCESSED IS REPLACED, NOT THE WHOLE RECORD.

sloavg2018.084 - Notepad																
File	Edit	Format	View	Help												
20918	20	30	7	-711	-684	-808	-1248	3283	1842	1926956	2	2	1	1	2	1 6860
21018	19	36	7	-712	-685	-808	-1249	3285	1843	1926150	1	1	1	1	2	1 10853
21118	22	34	8	-709	-684	-808	-1248	3285	1843	1927111	1	1	1	2	5	2 8414
21218	24	34	8	-712	-685	-809	-1249	3286	1843	1925627	2	2	2	1	3	2 8537
21318	26	33	7	-711	-684	-808	-1249	3287	1844	1926262	1	1	1	1	3	2 4219
21418	24	36	7	-712	-686	-809	-1248	3282	1840	1926027	1	2	2	1	3	2 11882
21518	25	36	8	-711	-685	-808	-1249	3285	1842	1924325	2	2	1	1	3	2 13012
21618	25	40	8	-711	-685	-809	-1249	3285	1842	1920793	2	2	2	2	5	3 15446
21718	26	41	9	-711	-684	-808	-1248	3284	1842	1920455	1	2	1	1	5	3 15239
21818	26	40	9	-711	-684	-808	-1249	3285	1843	1923716	1	1	1	1	4	2 15898
21918	25	39	9	-710	-684	-809	-1248	3285	1842	1927850	1	1	1	1	4	2 13807
22018	24	31	8	-711	-685	-809	-1249	3284	1842	1931675	2	1	1	1	4	2 7592
22118	22	38	7	-710	-684	-808	-1249	3285	1842	1927102	1	1	1	1	4	2 13099
22218	22	36	8	-711	-685	-809	-1248	3282	1841	1925360	2	1	1	2	6	4 13927
22318	22	39	8	-710	-684	-809	-1249	3286	1843	1923616	2	1	1	2	7	4 15176
22418	25	40	8	-710	-684	-808	-1249	3285	1843	1922527	2	1	1	1	4	2 15555
22518	24	36	8	-710	-683	-808	-1249	3285	1843	1927771	1	2	1	2	6	3 9809
22618	26	41	7	-709	-683	-808	-1248	3284	1842	1922533	2	2	1	2	6	3 16367
22718	26	40	7	-709	-683	-807	-1248	3283	1842	1918396	1	1	1	2	6	3 13155
22818	26	39	8	-709	-684	-808	-1249	3289	1844	1926698	5	1	1	1	5	2 12429
22918	26	33	8	-710	-684	-808	-1249	3288	1844	1933949	1	1	1	1	3	2 5461
23018	24	34	8	-710	-684	-808	-1248	3285	1842	1929603	1	1	1	1	3	2 8222
23118	21	34	7	-710	-685	-809	-1249	3287	1843	1929748	2	1	1	1	5	2 9862
23218	23	34	7	-710	-685	-808	-1249	3286	1842	1929216	1	1	1	1	4	2 8581
23318	25	28	5	-710	-684	-808	-1249	3286	1843	1935879	2	2	1	1	2	2 5324
23418	23	27	7	-710	-683	-808	-1249	3287	1844	1933176	1	2	1	1	5	3 4335
23518	18	35	7	-709	-683	-808	-1249	3287	1844	1932019	2	2	2	1	4	2 9021
23618	22	35	7	-711	-685	-808	-1249	3287	1843	1928558	2	1	1	1	5	2 10220
23718	25	30	7	-710	-684	-808	-1250	3291	1845	1934080	2	1	1	1	3	2 4754
23818	24	37	6	-709	-684	-808	-1250	3290	1844	1930358	2	2	1	2	8	3 11184
23918	26	33	8	-709	-684	-808	-1249	3286	1843	1933942	1	2	1	2	5	2 4085
24018	28	39	6	-711	-685	-809	-1249	3285	1842	1927612	1	1	1	1	4	2 13343
24118	23	35	8	-711	-684	-808	-1250	3288	1844	1928881	2	2	1	1	4	2 7363
24218	19	28	8	-711	-684	-809	-1249	3287	1845	1935006	2	2	1	1	5	3 3450
24318	22	33	8	-710	-684	-808	-1249	3285	1843	1931647	1	1	1	1	3	2 10713
24418	21	36	7	-710	-684	-809	-1249	3287	1843	1929829	3	1	1	1	4	3 9665
24518	27	36	6	-710	-684	-809	-1250	3288	1844	1930024	1	0	0	2	6	3 9389
24618	28	39	9	-711	-684	-808	-1249	3286	1843	1921630	2	2	1	1	4	2 12217
24718	26	39	8	-710	-684	-808	-1250	3291	1845	1927930	2	2	1	1	4	2 11068
24818	28	40	6	-711	-684	-808	-1249	3286	1843	1922363	1	1	1	1	3	2 14657
24918	22	34	9	-712	-685	-808	-1249	3285	1842	1932371	1	2	1	1	4	2 5724
25018	21	35	9	-711	-684	-808	-1249	3287	1844	1932968	2	1	1	2	5	2 7968
25118	18	24	6	-711	-684	-808	-1249	3287	1845	1932986	1	1	1	2	5	3 6404
25218	15	21	6	-713	-684	-810	-1249	3284	1843	1930193	2	1	1	1	4	2 4327
25318	17	18	4	-712	-684	-808	-1248	3281	1841	1930822	2	1	2	2	7	3 4952
25418	20	30	8	-656	-641	-782	-1224	3262	1832	638878	96	70	39	50	62	34 2185
25518	18	34	8	-691	-664	-796	-1242	3282	1845	638970	2	2	2	2	7	4 3554
25618	22	34	7	-690	-665	-796	-1242	3284	1844	639258	2	1	1	2	6	3 3975

New Temperature coefficients Results

SL R6 ratio decreases as temperature increases (original slavg.084 - old TC - plotted in PReport)



SL R6 ratio is stable with temperature fluctuations (new sloavg.084 using new TC - plotted in PReport)

