

MFRSR Re-Analysis & Refurbishment

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Outline

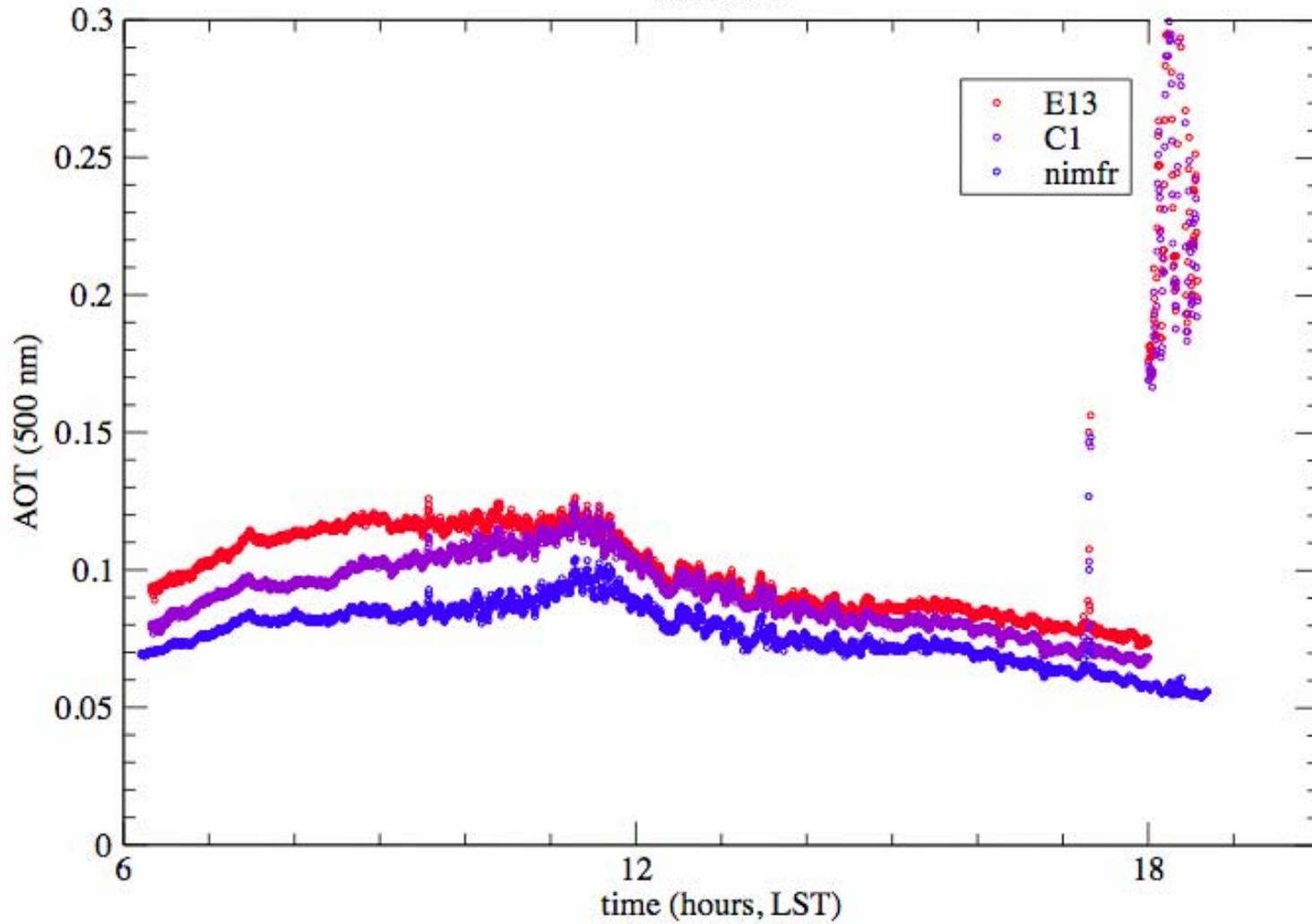
- Data reduction issues
- Hardware issues
- Hardware fixes

Symptoms of Problems

- Simultaneous, co-located MFRSR aerosol optical depths do not agree (as well as we would like)
- Simultaneous, co-located diffuse/direct ratios do not agree

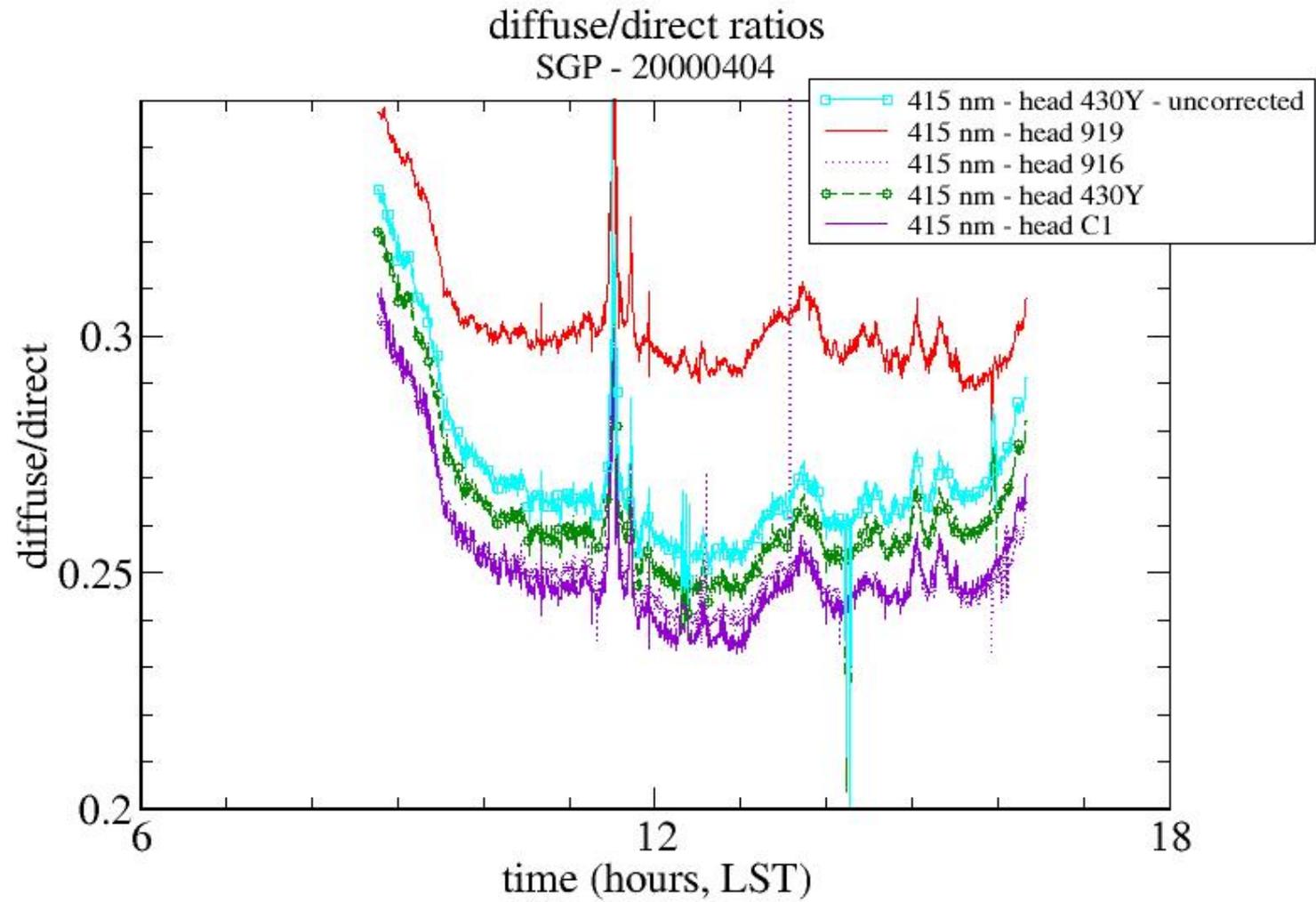
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Symptoms of Problems

- Simultaneous, co-located MFRSR aerosol optical depths do not agree
- Simultaneous, co-located diffuse/direct ratios do not agree





Courtesy: John Schmelzer

Data reduction issues

- Offsets subtracted when there were none (**Direct in MFRSR is calculated from total and diffuse, which have same offset, subtraction should = 0**)
- Offsets subtracted were too large (**Clear cases where offset was too large -- by the gain**)
- Uncertainty over what the proper offsets are since no nighttime data (**Currently based on lab dark**)
- Cosine response correction not applied to diffuse

917c measured offsets

channel	offset	gain(yes)	counts	+	board	=?	nightcounts
open	-.008 mv	* -5.479 = 0.04 mv=>	0		0		0
415	-.589 mv	* -8.032 = 4.70 mv=>	5		0 to 1		5
500	-.392 mv	* -2.424 = 0.95 mv=>	1		0		1
615	-.659 mv	* -1.429 = 0.94 mv=>	1		0		0
673	-.623 mv	* -2.000 = 1.25 mv=>	1		0		1
870	-.610 mv	* -1.538 = 0.94 mv=>	1		0		0
940	-.567 mv	* -2.424 = 1.37 mv=>	1		0		1

241c measured offsets

open	0.05	* -5.479 = -0.27 mv=>	-0		0		0
415	1.08	* -8.032 = -8.67 mv=>	-9		0 to -1		-10
500	-0.84	* -2.424 = 2.036 mv=>	2		0		1
615	1.09	* -1.429 = -1.558 mv=>	-2		0		-2
673	1.35	* -2.000 = -2.700 mv=>	-3		0		-3
870	1.17	* -1.538 = -1.799 mv=>	-2		0		-2
940	0.835	* -2.424 = -2.024 mv=>	-2		0		-2

229c measured offsets

open	0.010	* -5.479 = -0.05=>	-0		0 to -1		0
415	-0.454	* -8.032 = 3.647=>	4		-1		3
500	-0.542	* -2.424 = 1.314=>	1		0 to -1		0
615	-0.652	* -1.429 = 0.932=>	1		-1		0
673	-0.673	* -2.000 = 1.346=>	1		-1		0
870	-0.585	* -1.538 = 0.900=>	1		-1		0
940	-0.252	* -2.424 = 0.611=>	1		-1		0

Hardware issues

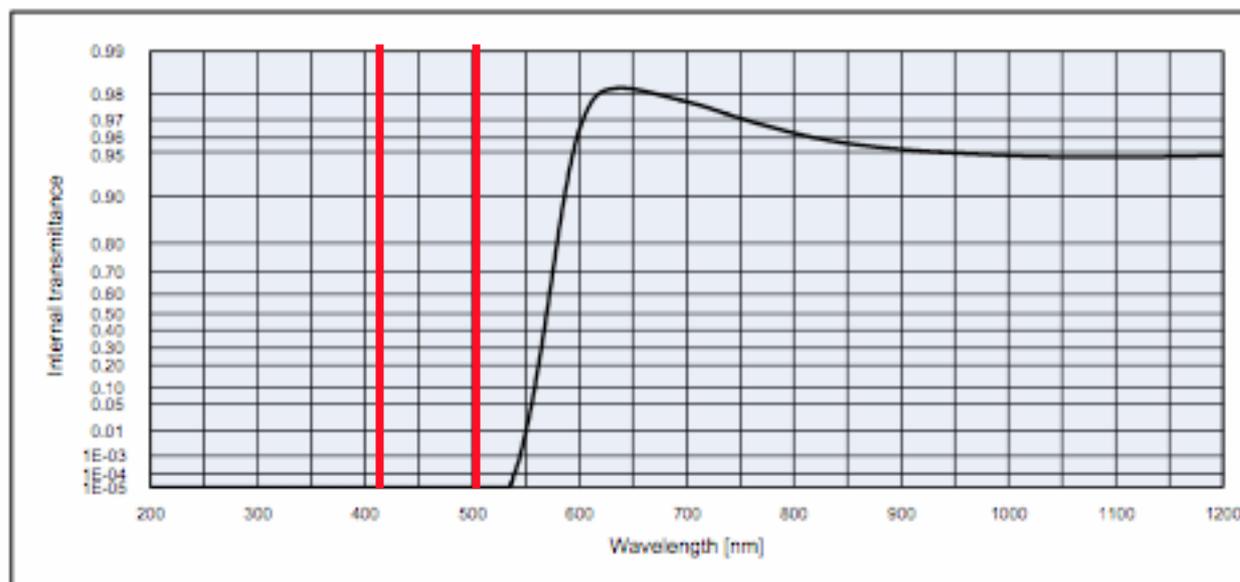
- Out-of-band signal unacceptable in many filters
- Uncertainty about filter profile central wavelength
- Calibration dependence on temperature

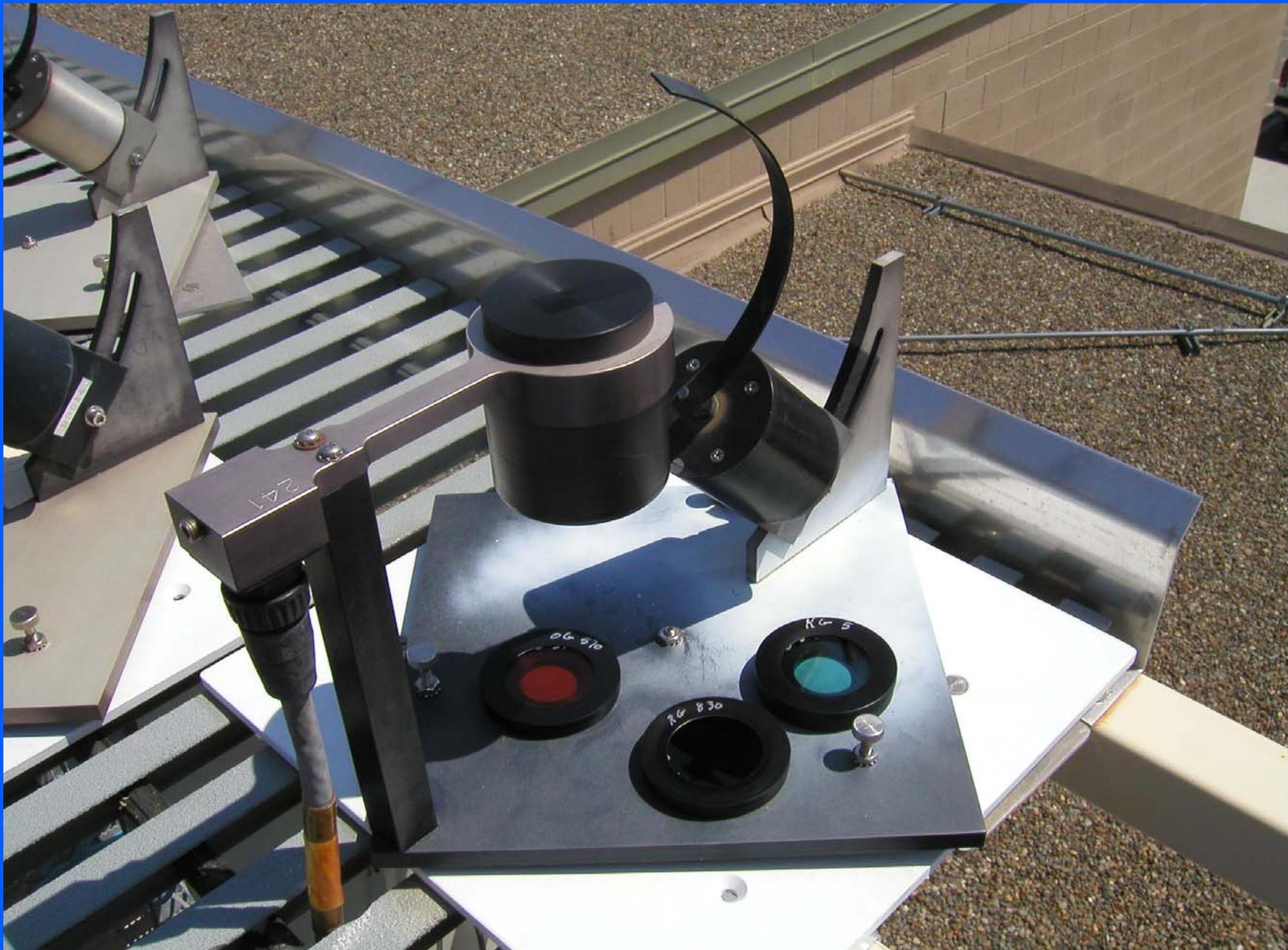
Refractive index n		
λ [nm]	Element	n
587.6	He	1.51
852.1	Cs	1.51
1014	Hg	1.50

Temperature coefficient	
T_s [nm/°C]	0.12

All data without tolerances are to be understood to be reference values.
 Guaranteed values are only those values listed in the section "Spectral values guaranteed".

Colorimetric evaluation											
Illuminant	A (Planck T = 2856 K)			Illuminant	Planck T = 3200 K			Illuminant	D65 ($T_s = 6504$ K)		
	d [mm]	1	2		3	d [mm]	1		2	3	d [mm]
x	0.600	0.619	0.627	x	0.595	0.616	0.624	x	0.566	0.600	0.611
y	0.394	0.380	0.372	y	0.398	0.384	0.375	y	0.412	0.399	0.389
Y	56	49	46	Y	53	47	44	Y	43	36	33
λ_s [nm]	596	598	600	λ_s [nm]	595	598	599	λ_s [nm]	591	595	597
P_s	0.96	1.00	1.00	P_s	0.96	1.00	1.00	P_s	0.94	1.00	1.00





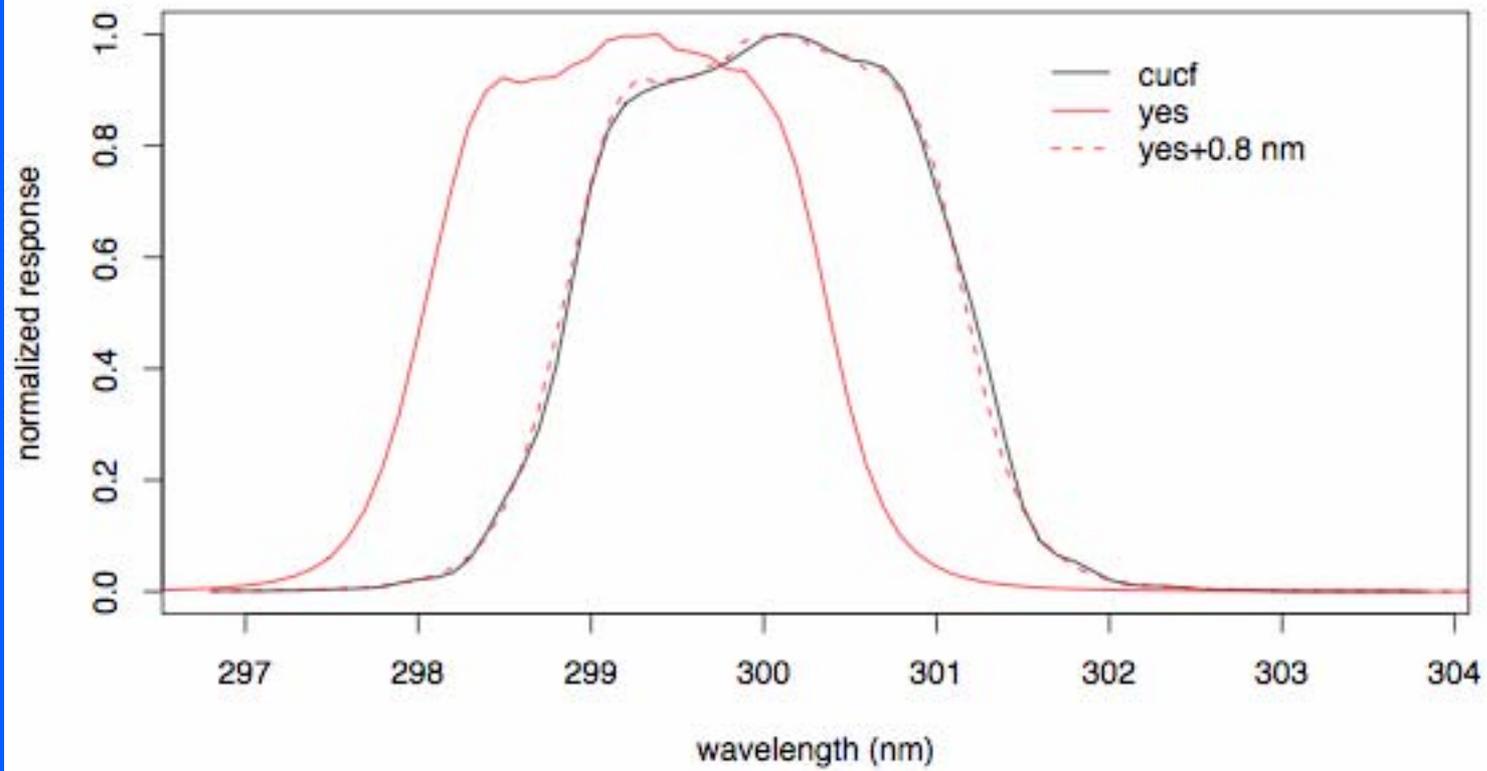
Courtesy: John Schmelzer

Open 415 500 615 673 870 940

38776.82708	0.59433	2796	2991	1821	1733	1977	917	2531	1411
38776.82719	0.59437	2791	2988	1819	1732	1975	917	2530	1411
38776.82731	0.59441	2783	2989	1821	1733	1977	918	2533	1413
38776.82743	0.59445	2772	2992	1821	1734	1979	919	2537	1415
38776.82754	0.59448	2759	2987	1819	1732	1977	918	2534	1413
38776.82766	0.59452	2745	2979	1814	1728	1972	915	2527	1409
38776.82777	0.59456	2729	0	2	0	1	0	0	0
38776.82789	0.59459	2713	0	2	0	0	0	0	0
38776.82800	0.59463	2696	0	2	0	0	0	0	0
38776.82812	0.59466	2679	0	2	0	0	0	0	0
38776.82824	0.59470	2662	0	2	0	0	0	0	0
38776.82835	0.59473	2644	0	6	0	1	0	1	1
38776.82847	0.59477	2626	2527	20	3	1970	920	2554	1431
38776.82858	0.59480	2609	2527	19	3	1970	920	2553	1429
38776.82870	0.59483	2592	2524	18	3	1970	920	2553	1429
38776.82881	0.59487	2575	2528	18	3	1975	922	2560	1431

Hardware issues

- Out-of-band signal unacceptable in many filters
- Uncertainty about filter profile central wavelength
- Calibration dependence on temperature



Hardware fixes

- New filters carefully specified, ordered, and tested; old head assessed for problem before old filter head assemblies replaced
- Spectral calibration checked against spectral line sources before each run; more physically stable spectral bench
- Could check temperature dependence in laboratory, but will try to use field data to assess

Five P-E 673 nm filters

PKI-1	PKI-1A	PKI-2	PKI-3	PKI-3A	PKI-4	
3242	3216	2980	3169	2797	2800	Full Sun
3264	3238	2999	3191	2816	2818	
3252	3226	2989	3179	2806	2809	
3243	3216	2980	3169	2798	2800	
4	2	2	1	1	2	Schott Glass
4	2	2	1	1	2	
4	2	2	1	1	2	
4	2	2	1	1	2	
4	2	2	1	1	2	
4	2	2	1	1	2	
3295	3268	3027	3220	2842	2845	Full Sun
3298	3271	3030	3223	2844	2847	
3303	3276	3035	3228	2848	2851	
3310	3284	3041	3236	2855	2858	
3317	3290	3049	3243	2861	2864	
3321	3294	3052	3247	2865	2868	
0	1	0	0	0	0	Full Block
0	1	0	0	0	0	
1	1	1	0	0	0	
0	1	1	0	0	0	
0	1	1	0	0	0	
0	0	0	0	1	0	
3359	3332	3086	3284	2898	2901	Full Sun
3359	3331	3086	3283	2897	2901	
3358	3331	3084	3282	2896	2900	
3364	3338	3091	3288	2902	2905	

Hardware fixes

- New filters carefully specified, ordered, and tested; old head assessed for problem before old filter head assemblies replaced
- Spectral calibration checked against spectral line sources before each run; more physically stable spectral bench
- Onerous task to check temperature dependence in laboratory, so will use field data to assess

Now for More Fixes from
Annette Koontz