Analysis of HY2A @ GSC

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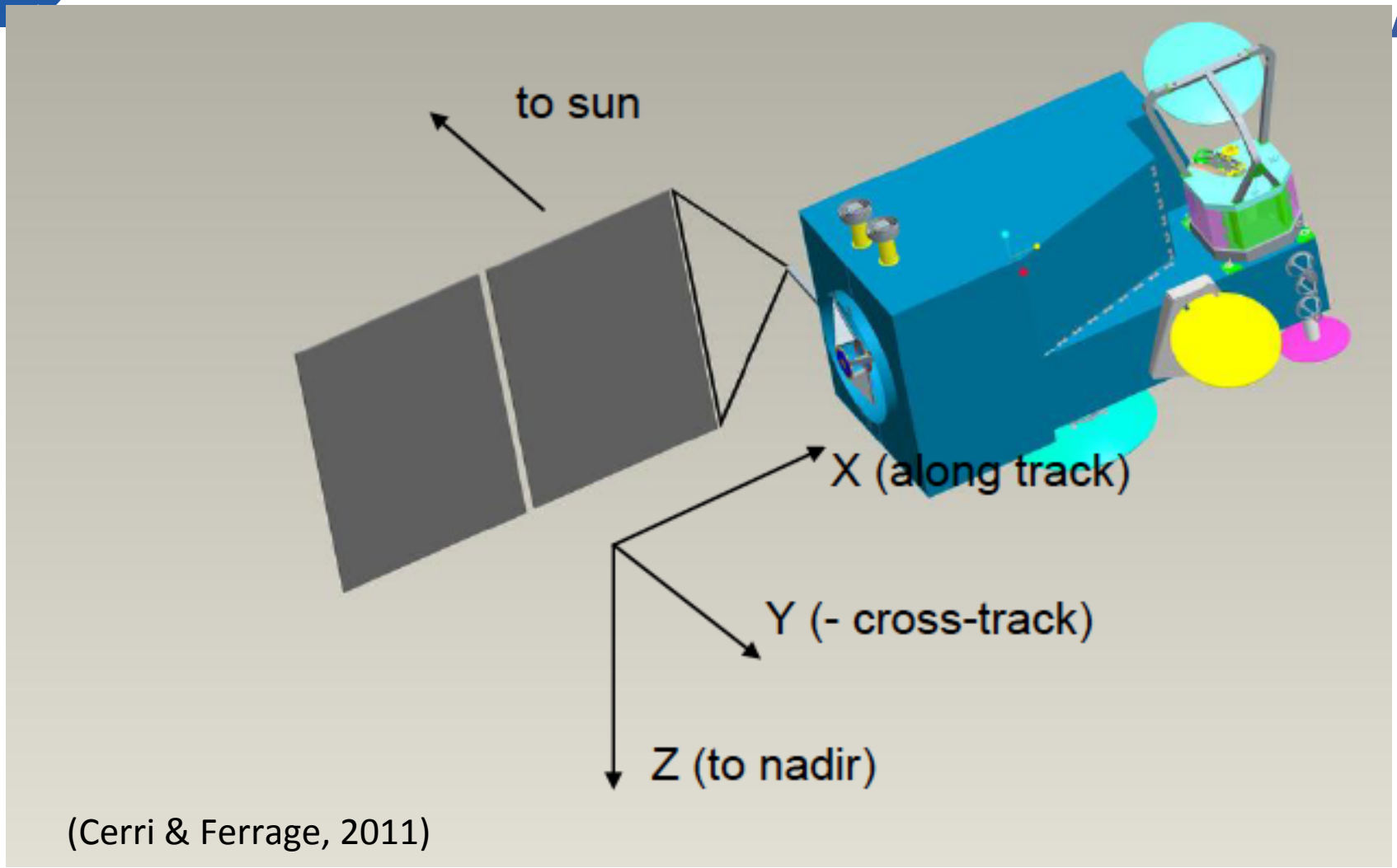
HY2A Macromodel Tests

1. Start with CNES-supplied macromodel, Cr=1.146 (determined from ??).
2. Process DORIS data, November 6, 2011 – October 6, 2012 (approx 63 arcs).
3. Create normal equations per arc; Aggregate and Solve for various macromodel parameters. Negative or unreasonable adjustments disregarded.
4. Specular reflectivity of solar array – from diagonals has largest sensitivity (+Y Specular).
5. The next most “sensitive” panels, as measured by diagonal strength are +X, -X parameters (+X = along-track) and –Z (anti-nadir direction).
6. Spacecraft is in near-full Sun orbit. It experiences a small season of eclipses *(May-July 2011; no more than 10 percent of orbit enters ecli*pse).

HY2A Satellite Orientation



(Cerri & Ferrage, 2011)

HY2A Nominal Macromodel Parameters
(optical parameters only)

Panel	Area	Specular	Diffuse	Abs.
+X	3.21	0	0.97	0.03
-X	3.52	0	0.97	0.03
+Y	15.79	0	0.45	0.55
-Y	15.80	0	0.64	0.36
+Z	6.43	0	0.96	0.04
-Z	6.43	0	0.96	0.04

HY2A Macromodel Parameters for Test Models
(optical parameters only)

Panel	Parameters adjusted	
newpan1	+Y spec.	0.1806
newpan2	+Y spec +X diff	0.2205 0.5638
newpan3	+Y spec -X diff	0.2468 0.1827
newpan4	+Y spec -Z spec	0.2415 0.5200
newpan5	+Y spec -Z spec -Z diff	0.1806 0.5200 0.40

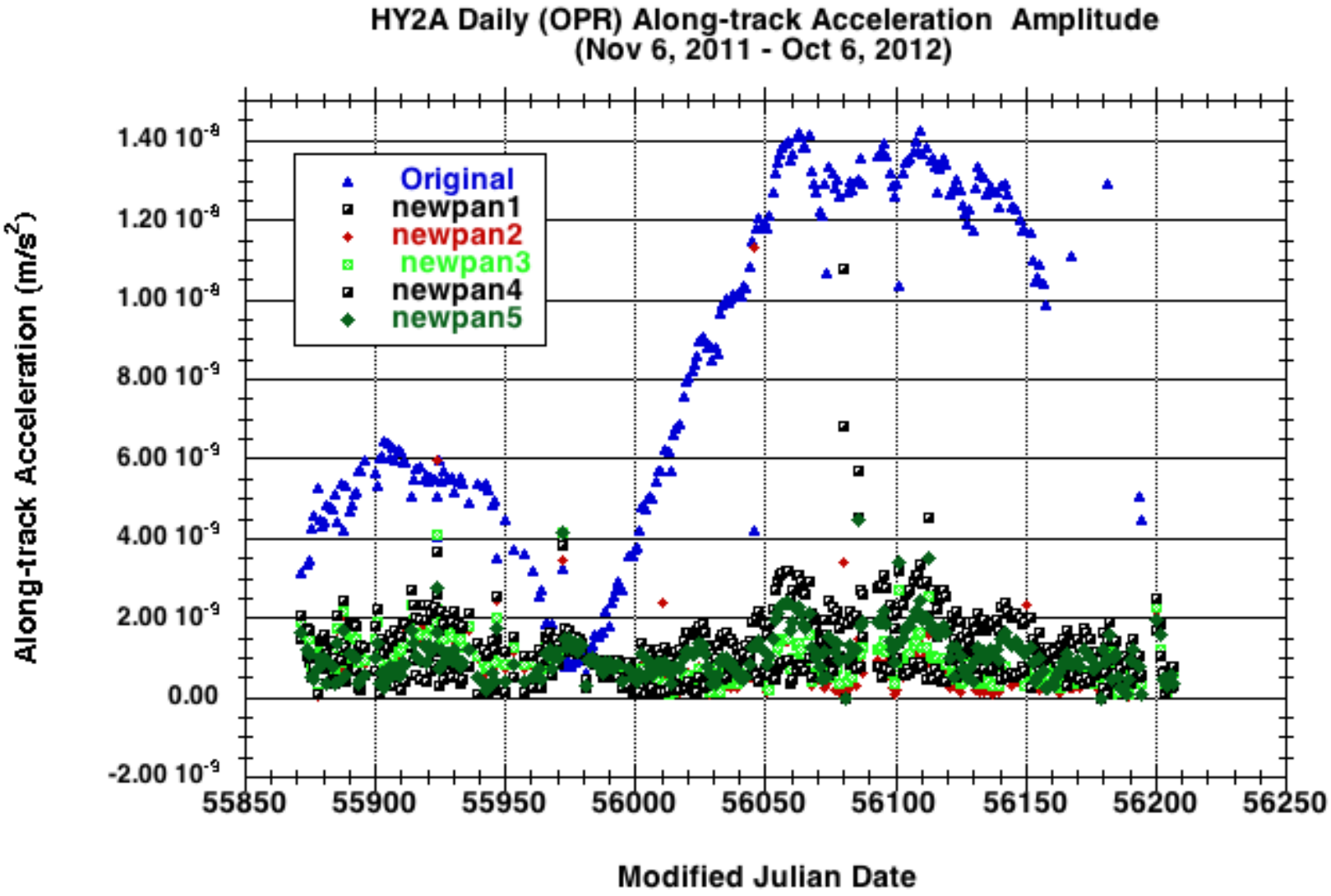
HY2A OPR Acceleration Summary

(Over arcs, Nov 2011 – Oct 2012)

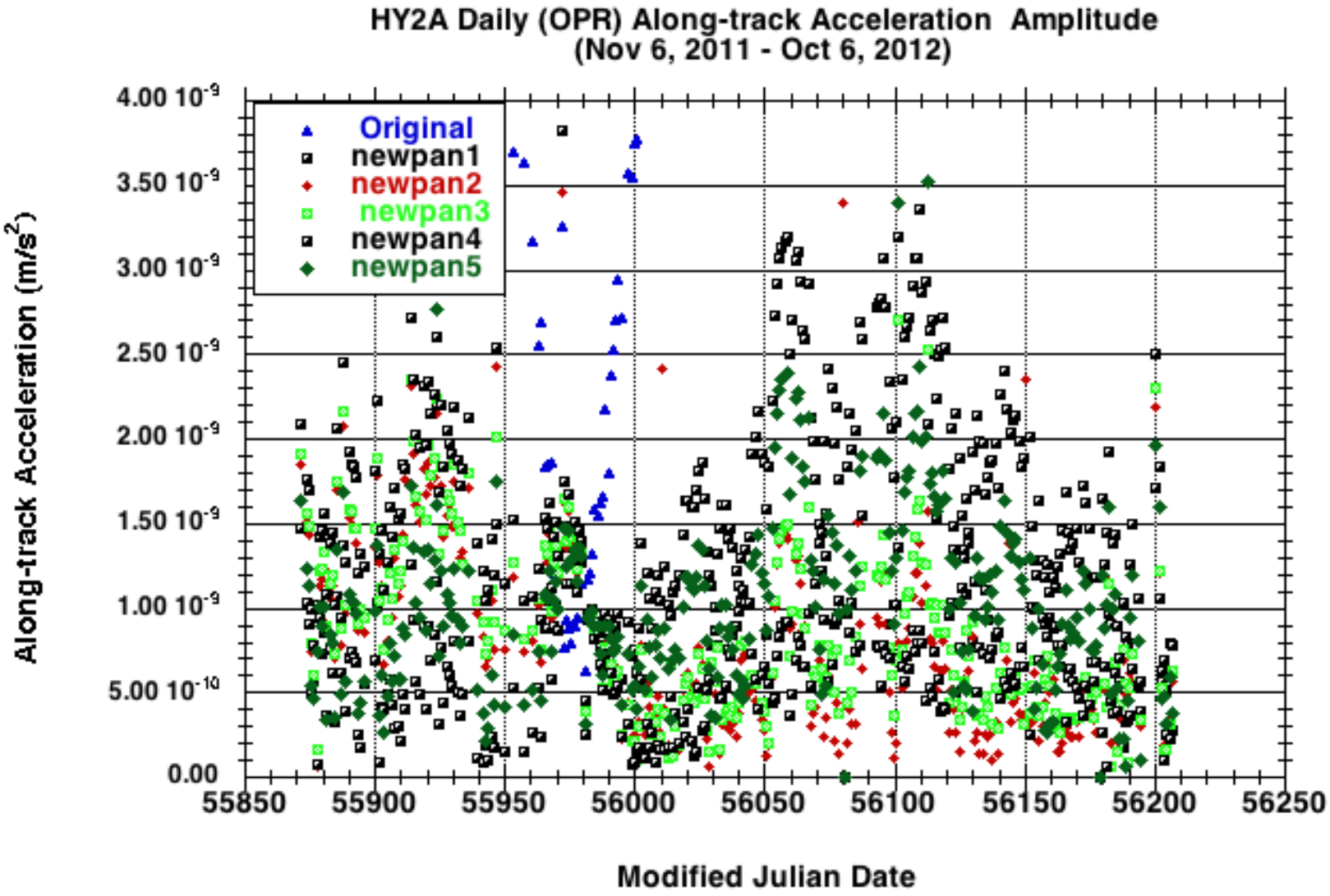
Model	Along-track (nm/s²)		Cross-track (nm/s²)		Cr
	Mean	Median	Mean	median	
Original	31.5	10.1	23.4	2.9	1.146
Newpan1	4.3	1.28	4.76	2.61	1.000
Newpan2	2.41	0.652	5.79	2.60	1.000
Newpan3	7.47	0.753	25.6	2.88	1.000
Newpan4	4.03	0.891	4.49	2.51	1.000
Newpan5	48.3	1.60	6.99	2.52	1.000

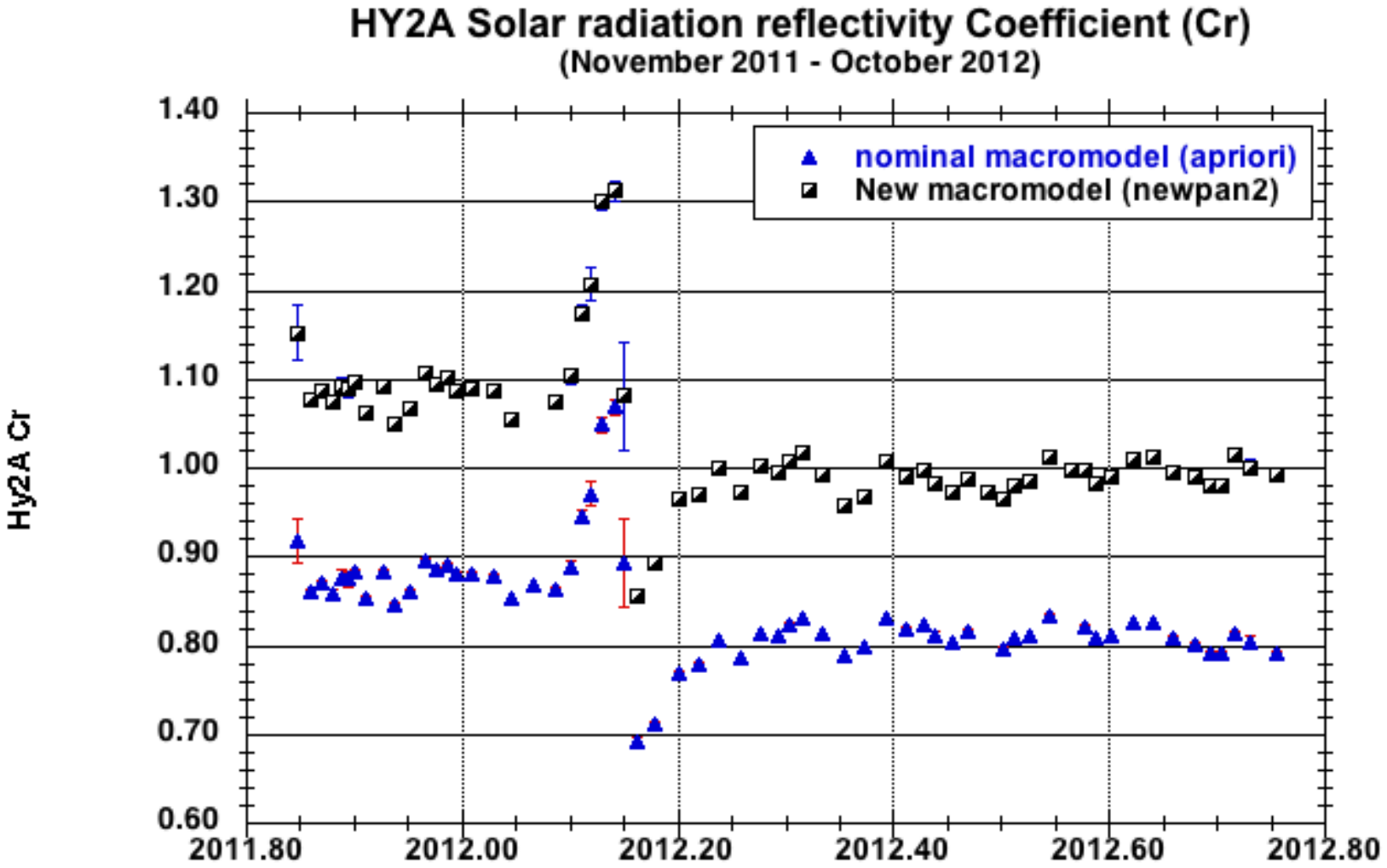
Conclusions:

1. A simple modification of Cr and the specular reflectivity of the solar array (+Y panel) makes a substantial reduction in the along-track OPR's.
2. Models "newpan2" and "newpan4" overall provide best improved performance.
3. There is little change in the cross-track OPR behaviour.

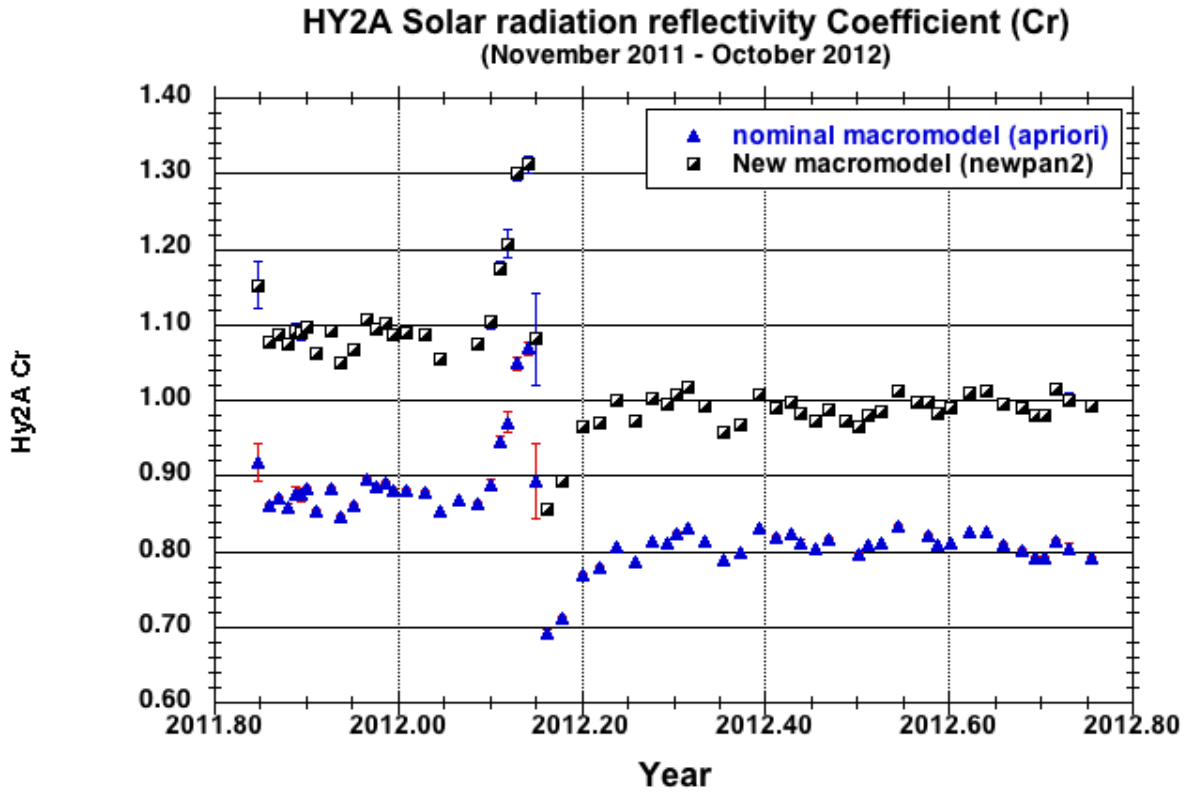


Lemoine et al., GSC HY2A analyses, IDS AWG, Apr 04, 2013


HY2A Daily (OPR) Along-track Acceleration Amplitude
(Nov 6, 2011 - Oct 6, 2012)
Original
newpan1
newpan2
newpan3
newpan4
newpan5
Along-track Acceleration (m/s²)
4.00 10⁻⁹
3.50 10⁻⁹
3.00 10⁻⁹
2.50 10⁻⁹
2.00 10⁻⁹
1.50 10⁻⁹
1.00 10⁻⁹
5.00 10⁻¹⁰
0.00
55850
55900
55950
56000
56050
56100
56150
56200
56250
Modified Julian Date



1. Adjust Cr for nominal and new macromodel without OPRs (empirical accelerations).
2. The Cr's show a change in the 'state' (orientation wrt. the Sun) of the spacecraft in February 2012. In Feb 2012, there is an anomalous period of a few weeks, and then after 2012-02-26, the new Cr is about 10 percent lower than before Feb. . This is true when using both the a priori and the new macromodels.



Arc 2011-1106 (1-day) is ignored;

Cr Values: 2011-1106 to 2012-0205:

A priori macromodel: mean=0.8750; median = 0.876; std=0.017;

New macromodel: mean=1.091; median = 1.090; std=0.028.

Cr Values: 2012-0311 to 2012-1006:

A priori macromodel: mean=0.808; median=0.809; std=0.0.012;

New macromodel: mean=0.996; median = 0.996; std=0.011.

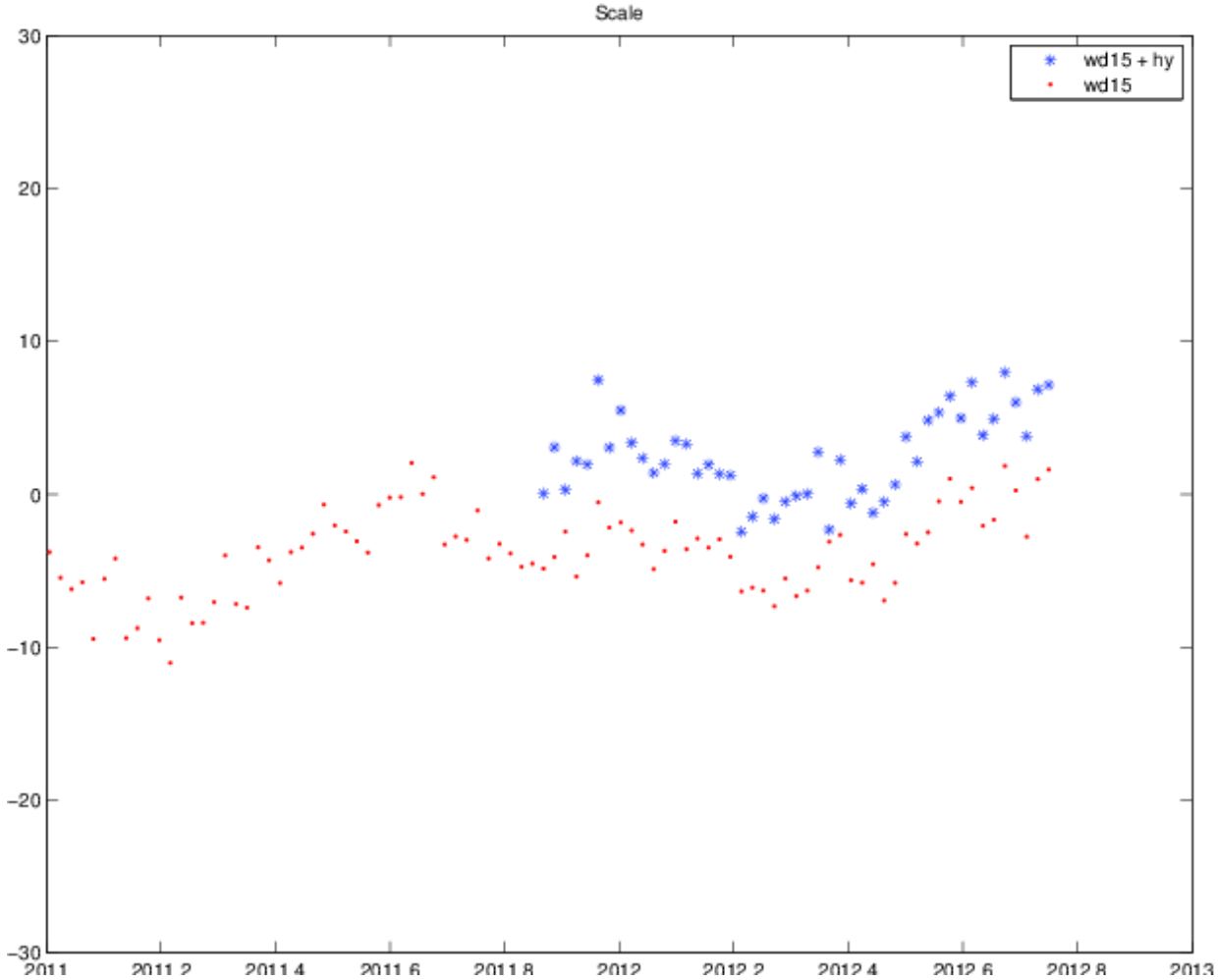
Cr Values: 2012-0205 to 2012-0311:

Recommend to adjust Cr on arc-by-arc basis, first in arc with no opr's, and apply the new value (holding fixed) for those arcs.

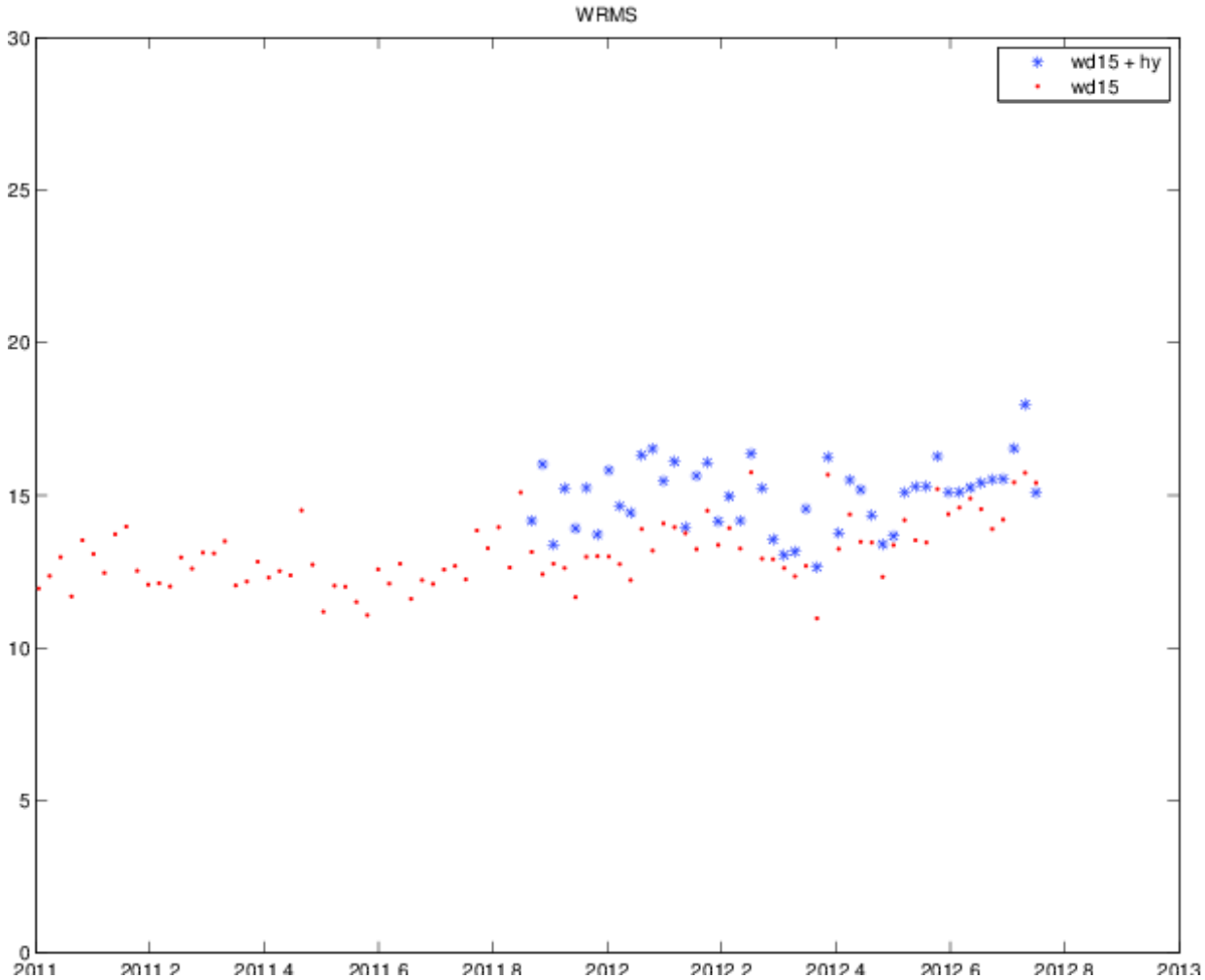
HY2A GSFC-tuned Macromodel Parameters
(optical parameters only)

Panel	Area	Specular	Diffuse	Abs.
+X	3.21	0	0.5634	0.03
-X	3.52	0	0.97	0.03
+Y	15.79	0.22054	0.45	0.55
-Y	15.80	0	0.64	0.36
+Z	6.43	0	0.96	0.04
-Z	6.43	0	0.96	0.04

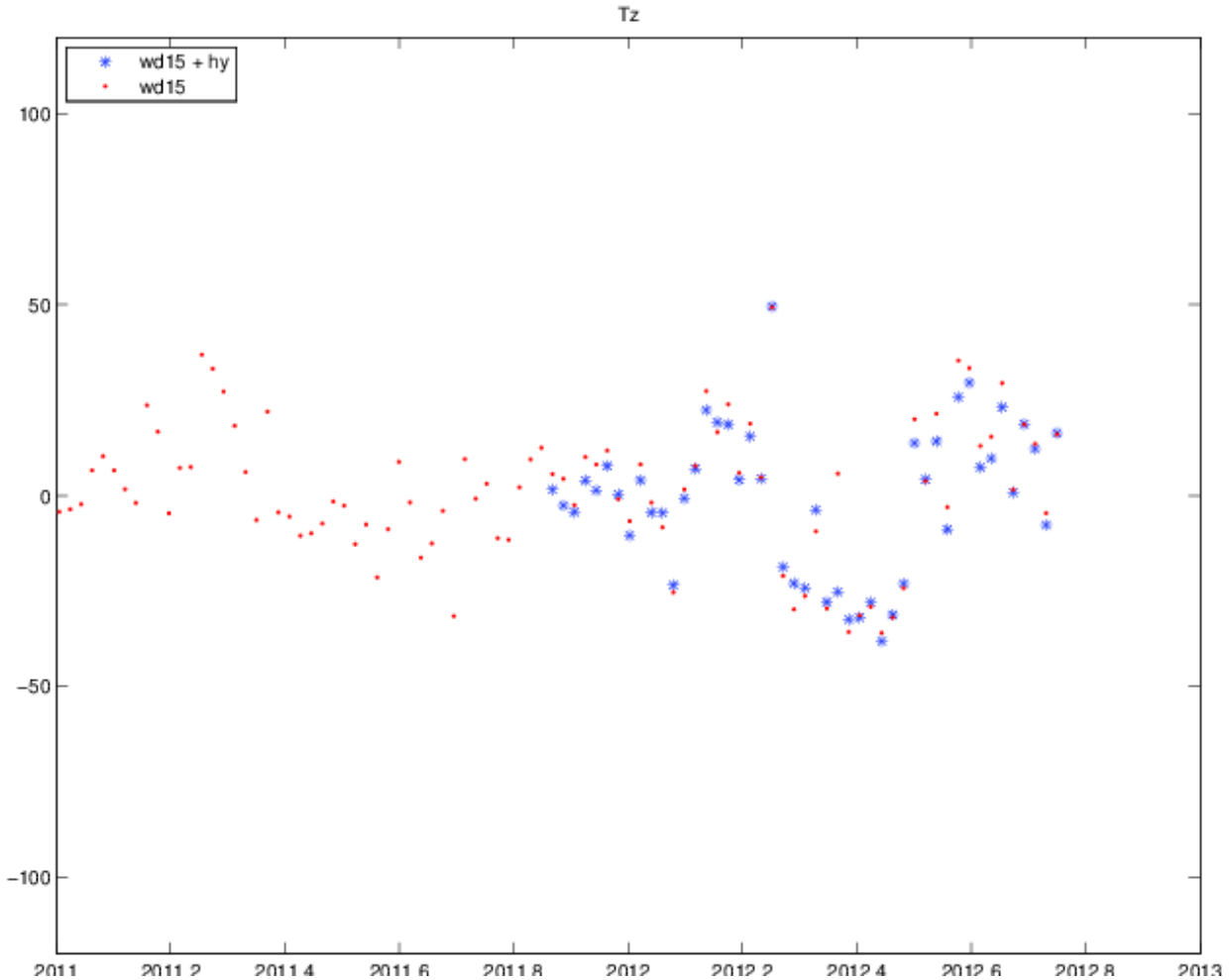
HY2A Scale (wd15 + Hy2a)



HY2A WRMS (wd15 + Hy2a)



HY2A Tz (wd15 + Hy2a)



Summary Combination of Hy2a with wd15 Solution Parameters

	Wd15 (standard)	Wd15 + Hy2a
Avg. WRMS (mm)	13.68	15.22
Helmert Parameters of Weekly Solutions		
Tx (mean, std) mm	-2.81 / 5.12	-5.59 / 4.32
Ty (mean, std) mm	-13.25 / 6.15	-18.02 / 6.77
Tz (mean, std) mm	3.19 / 20.39	0.70 / 18.56
Scale (mean, std) mm	-2.65 / 2.67	3.44 / 3.71