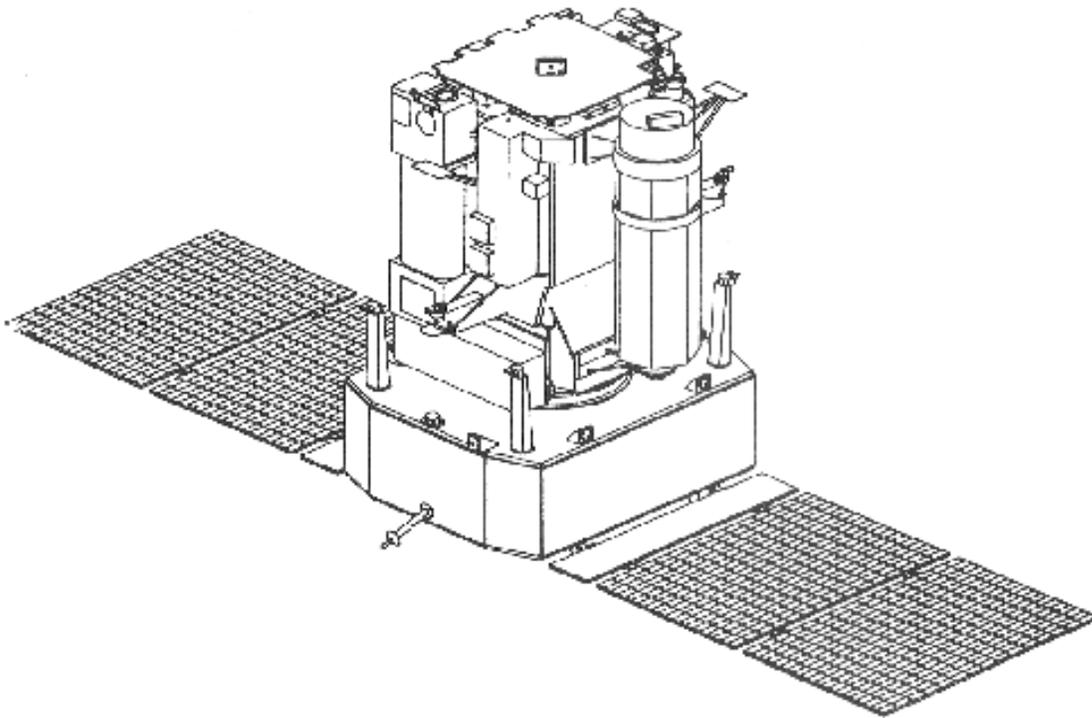


SOHO Monthly Trending Report February 2013

Ref: SOHO/PRG/TR/759 Mar 13, 2013



Prepared by: JP. OLIVE (EADS ASTRIUM)
Verified by: T. v OVERBEEK
Approved by: B. FLECK (ESA)

Table of Contents

Table of Contents	2
1 SOHO Spacecraft Status Synthesis	3
2 Detailed Trending Analysis	4
2.1 Power Sub-system.....	4
2.2 Data Handling Sub-system	5
2.3 Attitude and Orbit Control Sub-system	6
2.4 Propulsion Sub-system.....	6
2.4.1 Thruster Maneuvers	6
2.4.2 Remaining fuel (PVT analysis)	6
2.5 Thermal sub-system and thermoelasticity	7
3 Status of Anomalies	8
4 Configuration	8
4.1 Flight Software Configuration	8
4.2 Recent Changes (OCD's and UB's)	9
5 ANNEX	9
5.1 Power plots	10
5.1.1 Solar array degradation.....	10
5.1.2 Power margin	11
5.1.3 Main Bus Current daily min-MAX and Number of SA sections in shunt	12
5.1.4 UVCS power consumption	13
5.2 SSR / SEU Rate	14
5.2.1 Since Launch.....	14
5.2.2 Since 2009	15
5.2.3 Large scale.....	16
5.3 AOCS plots	17
5.3.1 FPSS degradation	17
5.3.2 Reaction Wheel 1 friction.....	18
5.3.3 Reaction Wheel 2 friction.....	19
5.3.4 Reaction Wheel 3 friction.....	20
5.4 Propulsion plots	21
5.4.1 Remaining amount of fuel.....	21
5.5 Plots of temperatures.....	22
5.5.1 Top panel	22
5.5.2 PLM +Y upper panel temperature	23
5.5.3 PLM +Z lower panel temperature	24
5.5.4 After UVCS turn OFF	25
5.6 SOHO Event List	26
5.7 Trend Files.....	27
6 Distribution List	28

1 SOHO Spacecraft Status Synthesis

General	Science data collection was nominal. Since Jan 7 2013 spacecraft is at a constant 0-degree roll angle	
Power	Solar array degradation	22.64% after 207 months of flight, equivalent to 1.31% per year.
DHSS	SSR	SEF's: average of 0.80 evt/min
	Tape Recorder	Not used this month
	OBT drift	Average of -0.5ms for the period
RF	Transponders/Antennae	Nominal.
AOCS	Reaction Wheels	RW 1, 2 and 3: work fine RW 4 was not used this month
	Fine Sun Sensor	FPSS-A works fine.
	Star Tracker	SSU-A works fine.
Propulsion	Fuel	Remaining fuel: about 114kg
	Thruster branch A	Not used this month
	Thruster branch B	Not used
Maneuvers	Station Keeping	None this month
	Momentum Management	None this month
	Roll	None this month
Thermal	Overall temperatures	on expected trend
	SVM Equipment	FPSS plate temperature at 47C
	PLM status	All experiments ON with: - SUMER : since March 23 2012, detector is ON (hence SH OFF) - GOLF sensor Substitution Heater ON (circuit 68 at 30%) - since Jan 6 2011, VIRGO uses its redundant power supply (VIPWB) - since Mar 23 2011, CTOF is OFF with its Substitution Heater ON (circuit 64 at 60%), - since Jan 23 2013, UVCS is OFF with its substitution heaters ON (circ 84 is at 0% since Feb 11 2013)
S/C Hardware failures:	Loss of fast loop of receiver 1 on April 23, 1997 Loss of all 3 gyros; September & December 1998 Loss of battery 1; March 7, 2002 HGA antenna Z motor stuck; May 2003 (still possible to move the antenna around Z axis with dual winding activation) Loss of FSPAAD on Apr 21, 2004 Loss of CSPAAD on May 3, 2012	

2 Detailed Trending Analysis

2.1 Power Sub-system

The performance of the power system is nominal.
All housekeeping parameters are within limits.

Since June 2012, it has been observed that several experiment LCL status toggled OFF and ON, reporting erroneous values.
No LCL toggling was reported this month.

Solar Array degradation:

The degradation this month was 0.21% (based on TSI value provided by VIRGO).

Total degradation after 207 months of flight is 22.64%, which corresponds to 1.31% per year (refer to plot in Annex 5.1.1).

Current Margin:

The present current margin (seasonally changing), based on the minimum value of shunt current (PISW2, for section 8) and the main bus peak current, as reported in TM (35A), is 6.6A (see plot in Annex 5.1.2).

The monthly highest values recorded by the onboard min/MAX monitoring of the main bus current was 34.7A; the lowest was 26.5A (see plot in Annex 5.1.3).

With UVCS OFF and its sensor substitution heater ramped down to 0% the power consumption decreased by 0.8A both in terms of:

- peaks (see plot of onboard min/MAX of "main bus current" in Annex 5.1.3)
- and in terms of average (see daily average of main bus current plotted in Annex 5.1.2)

As shown by table in annex 5.1.4, the expected saving of "UVCS OFF" was 1A (such level was not reached because of UVCS electronic substitution heater phase not optimized).

After Feb 11, it was observed that "Solar array section 3" was put on the bus each time the main bus current went above 30A which means there is an average capacity of about 6A per section for sections 4 to 8 (to be compared to the "working point current" of section 8 at 5.4A in TM).

2.2 Data Handling Sub-system

The performance of the Data Handling Subsystem is nominal.

The housekeeping parameters were stable.

CDMU:

The average onboard time drift was -0.5ms with a maximum delta of -1.3 ms.
The last OBT frequency adjustments were done on December 3 and 26 2012.

This month single bit errors have been reported in CDMU RAM memory (when using nominal processor) without any operational impact (always at the same address as observed since Sept 2008).

In order to follow COBS performances, the max execution time for both low and high priority cycles were added as trend parameters (OCD 2534) and following values were observed:

On February 11 2013:

- High priority (HPP) cycle: min 3.4ms on Feb 1; MAX 4.35ms on Feb 4
- Low priority (LPP) cycle: min 84.4ms on Feb 1; MAX 109.4ms on Feb 2

On March 8 2013:

- High priority cycle: min 3.4ms on Mar 1; MAX 4.5ms on Feb 20
- Low priority cycle: min 83.5ms on Mar 1; MAX 103.5ms on Mar 1

The slight decrease in LPP timer is due to UVCS sensor substitution heater (circ 84) being switched OFF on Feb 11.

Solid State Recorder:

The SEF count, at 0.805 evt/min, is average for the period (see plot in Annex 5.2.1 and Annex 5.2.2 (daily average of SEF counts plotted since 2009)).

Transponder:

Good performances of transponders and High Power Amplifiers.

HGA/APME:

High Gain Antenna nominally pointed around Y-axis; Z-axis at -16.7 degrees.

Tape Recorder:

Not used this month.

2.3 Attitude and Orbit Control Sub-system

The status of AOCS is nominal; all housekeeping parameters are within limits.

Star tracker

There was no star swap this month.

The background level is stable at 687mV (for gain 4).

FPSS

The FPSS outputs are well within limits (see plot in Annex 5.3.1).

No adjustment of FPSS outputs limits is needed before 2014, this all the more as the decrease in the output signal appears to slow down with time (see plot in Annex 5.3.1).

Reaction Wheels

The reaction wheels' friction torques are given well within trend (see plots of speeds vs torques in Annex 5.3.2 to 5.3.4).

CSPAAD replacement

Since June 2012, CSPAAD is replaced by new on-board monitorings of SAS1-B.

For additional robustness it was decided to use also the status ("shunt" or "on bus") of solar array section 2 to confirm a sun off-pointing during routine operations. The new monitoring of SA section 2 status is currently running (with no corrective action in order to check in-flight behavior). It is foreseen to use the final strategy in April 2013.

2.4 Propulsion Sub-system

2.4.1 Thruster Maneuvers

None this month.

2.4.2 Remaining fuel (PVT analysis)

According to PVT estimate, there are about 113.9kg of fuel remaining (with an uncertainty of about 3 kg) (see Annex 5.4.1).

2.5 Thermal sub-system and thermoelasticity

All temperatures are within limits.

The plots of the sun shield temperatures since launch are given in Annex 5.5.1.

Due to a decision to end UVCS science operations, UVCS was turned OFF on January 23 and the instrument door was left open.

To reduce power consumption, UVCS sensor substitution heater (circuit 84) was decreased from 50% to 0%, between January 23 and February 11.

The table in Annex 5.5.4 presents PLM temperatures after “UVCS turn OFF” and with the “ramp-down steps”.

UVCS sensor cooled down by 15.5°C.

For the PLM upper panels (+X and +Y panels), one can see that thanks to:

- UVCS door left open;
- and very good thermal isolation between UVCS and PLM;

there has been little effect on the PLM temperatures (maximum decrease is 1.1°C for QTO6) and on sun-pointing (as measured by MDI pzt: pointing excursions smaller than 2 arcseconds). See plot in Annex 5.5.2.

For the PLM+Z-lower panel, on which are located UVCS, CDS and GOLF electronics, the only noticeable change (i.e. larger than the seasonal cooling effect) is observed for “CDS power supply box” (QTCR3 decreased by 2.6°C). This box is the closest to “UVCS electronics” and so the most affected.

With QTCR3 now at 12.8°C, it is still well within its ground limits (6 to 34°C), even when including a drop of 3°C when CDS is switched OFF and a seasonal fluctuation of 3°C. So no change is needed. See plot in Annex 5.5.3.

3 Status of Anomalies

Anomalies during the reporting month:

Anomaly	Date	Title	Origin	Close-out reference
S13-0002	2013-02-01	CDMU SEU Counter Increase	SVM	CDMU single bit errors at the same location 0xDF9F
S13-0003	2013-02-01	CEPAC ERNE switched OFF by onboard monitoring	CEPAC	COBS St Monitoring of CEPAC current triggered.
S13-0004	2013-02-12	CEPAC ESU in stand-by	CEPAC	ESU data request error but this time no auto recovery by instrument. CEPAC switched back ON by FOT on Feb 12

The anomaly spreadsheet (see trend files in the annex) lists the status of all spacecraft anomalies since launch.

4 Configuration

4.1 Flight Software Configuration

Central On Board Software	V14 with: <ul style="list-style-type: none"> - patch 2 (gyroless functions) - patches of Sub-Formats 5 and 6 - patch for Intermittent recording V3 - patch for TCM in macros - patch for RW speed limits updating - patch to correct Scheduler Bug - patch for UVCS safing (thermally more robust in case of ESR or off-pointing) - patch to increase the number of Standard Monitorings - patch to fix intermittent recording to avoid a warm startup during RTU reconfiguration
Attitude Control Unit	FM_3_0 (i.e. FM_2_3A in PROM + ACU patch 8 for gyroless) + ACU patches 9, 10, 12, 13, 14, 15, 16 V2 and 17
Star Tracker	FM-5.0 with SSU patch 2A
Solid State Recorder	Version 2.03.0. (= Version 2.02 + SEF/DEF and IT2 patch)

4.2 Recent Changes (OCD's and UB's)

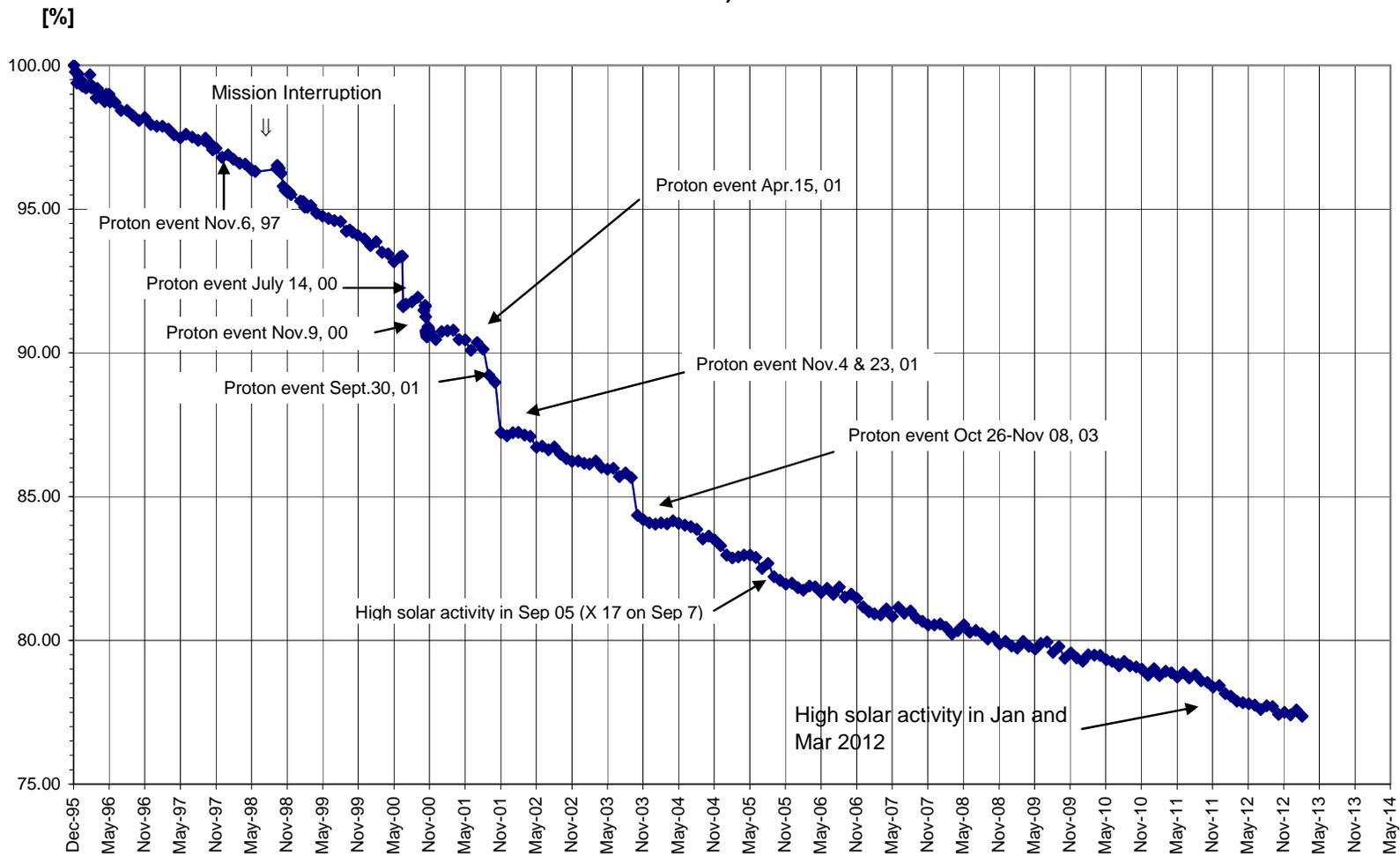
2385	5-May-09	HPA thermal limits
2387	12-May-09	SSU-B test
2389	1-Jun-09	Ground limits (tuned for a list of SVM parameters)
2392	6-Jun-09	If needed switch ON CDS electronics substitution heaters (not executed)
2406	14-Aug-09	Move HGA Z-axis +197 steps to -16.7 degrees (dual coil) to reduce Keyholes
2417	6-Oct-09	GOLF thermal limits and electronics substitution heater set at 90%
2418	6-Oct-09	APME-B switched OFF
2420	19-Oct-09	Enable PLM circuits already at 0%
2421	19-Oct-09	Battery 2 thermal threshold
2423	22-Oct-09	Upload ACU patch 16
2424	22-Oct-09	Tank and RWL heaters put in mode 2
2429	5-Nov-09	PLM heaters tuning (-7.6W)
2430	5-Nov-09	APMM Temperature limits
2431	2-Nov-09	SWAN thermal settings
2435	16-Nov-09	ATPTA-B Temperature limits
2443	23-Jan-10	SSR Memory Unit 9 switched back ON
2448	3-Feb-10	Upload COBS UVCS safing patch (SMILE CSEC018)
2453	8-Mar-10	VIPWA-B YLL and RLL decreased
2468	2-Aug-10	ATLVA-B YLL decreased from 12C to 11C
2478	29-Oct-10	PLM heaters reduction for Bogart (-12.5W)
2479	1-Nov-10	Widen ground limits for gyros outputs (ASFD55L, AXFD11, AXFD12)
2480	9-Nov-10	Upload COBS patch for more standard monitoring channels
2481	9-Nov-10	Test of COBS patch for more standard monitoring channels
2493	18-Jan-11	Switch back ON SSR Memory Unit number 10
2494	25-Jan-11	Upload ACU patch 16 V2 (clear mapping buffer spread over 16 slots)
2503	22-Apr-11	Upload ACU patch 17 (RSL processing changes for Bogart mission)
2504	22-Apr-11	Reduce CTOF nominal substitution heater from 80% to 60%
UB57	21-Jul-11	Update of COBS and ACU Gyroless SW (COBS patch for more St Mon and for UVCS; ACU patches 16 and 17). Updates of Applications SW UM, St Mon and Macros for Bogart.
2509	4-Jan-12	Upload new on-board monitorings for CEPAC/ERNE (HIPWA and QTH1A)
2516	30-Jan-12	Reduce CELIAS redundant substitution heater for circ 64, 65 and 66 (from 90% to 80%)
2520	14-May-12	Do Not Enable CSPAAD
2525	11-Jun-12	CSPAAD replaced by SAS1-B
2526	18-Jun-12	PLM heaters phase tuning (PPDU1)
2527	6-Jul-12	PSSSW2 mon no CA – TR mon in Th circ 99
2528	18-Sep-12	Upload Intermittent recording fix patch
2529	18-Sep-12	New monitoring to be used during CDS switch ON
2530	9-Oct-12	Reduced filter of Shunt status 2 Monitor to 2
2531	9-Oct-12	Decreased upper threshold of SSR Standard Monitoring to 47°C
2534	12-Dec-12	Collect COBS timer A and timer B max values for trending
2537	23-Jan-13	Turn OFF UVCS and circuit 84 ramp down to 0%

5 ANNEX

5.1 Power plots

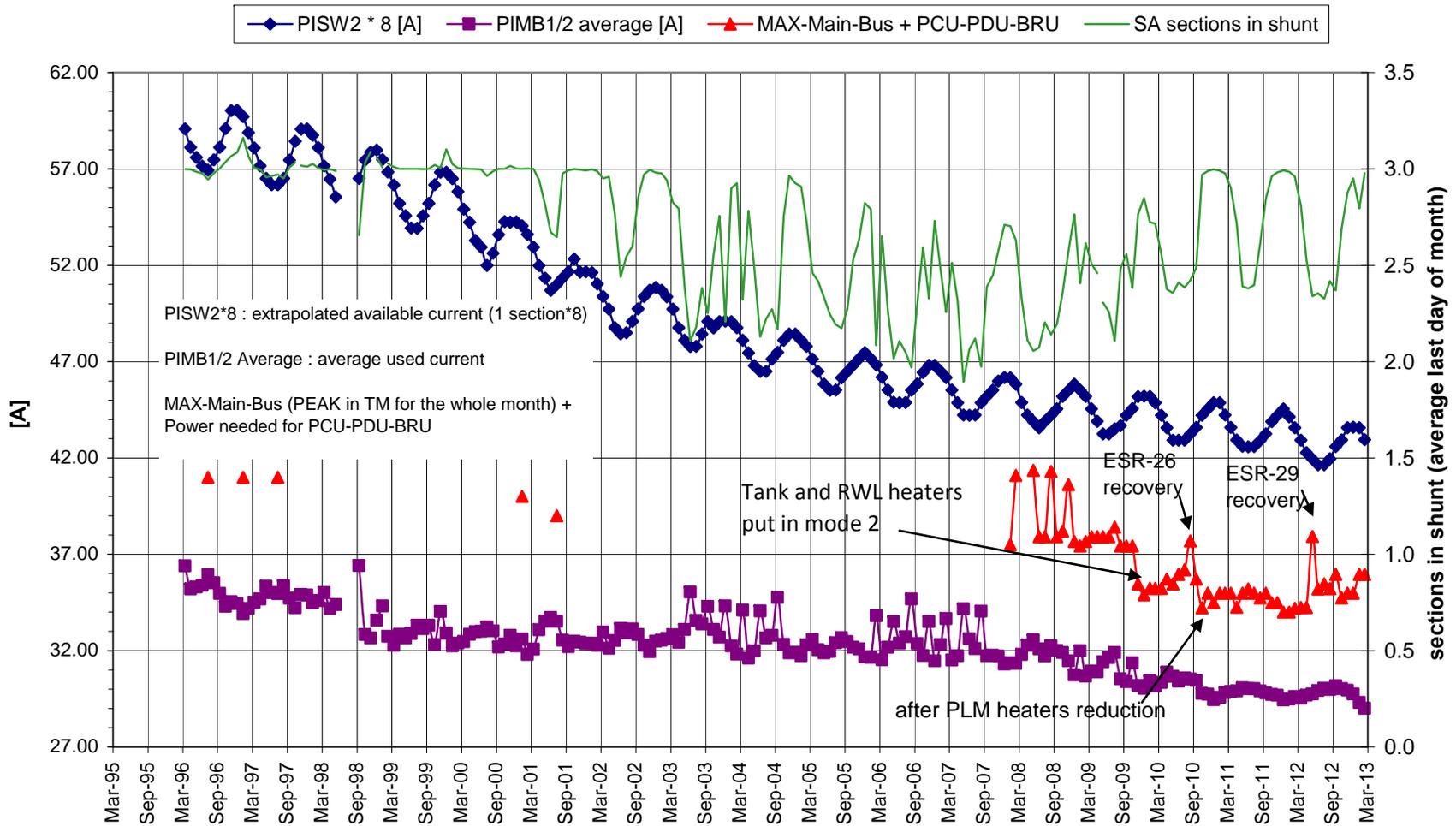
5.1.1 Solar array degradation

SOHO Solar Array Degradation, based on the average of the two section currents (PISW1 and PISW2)

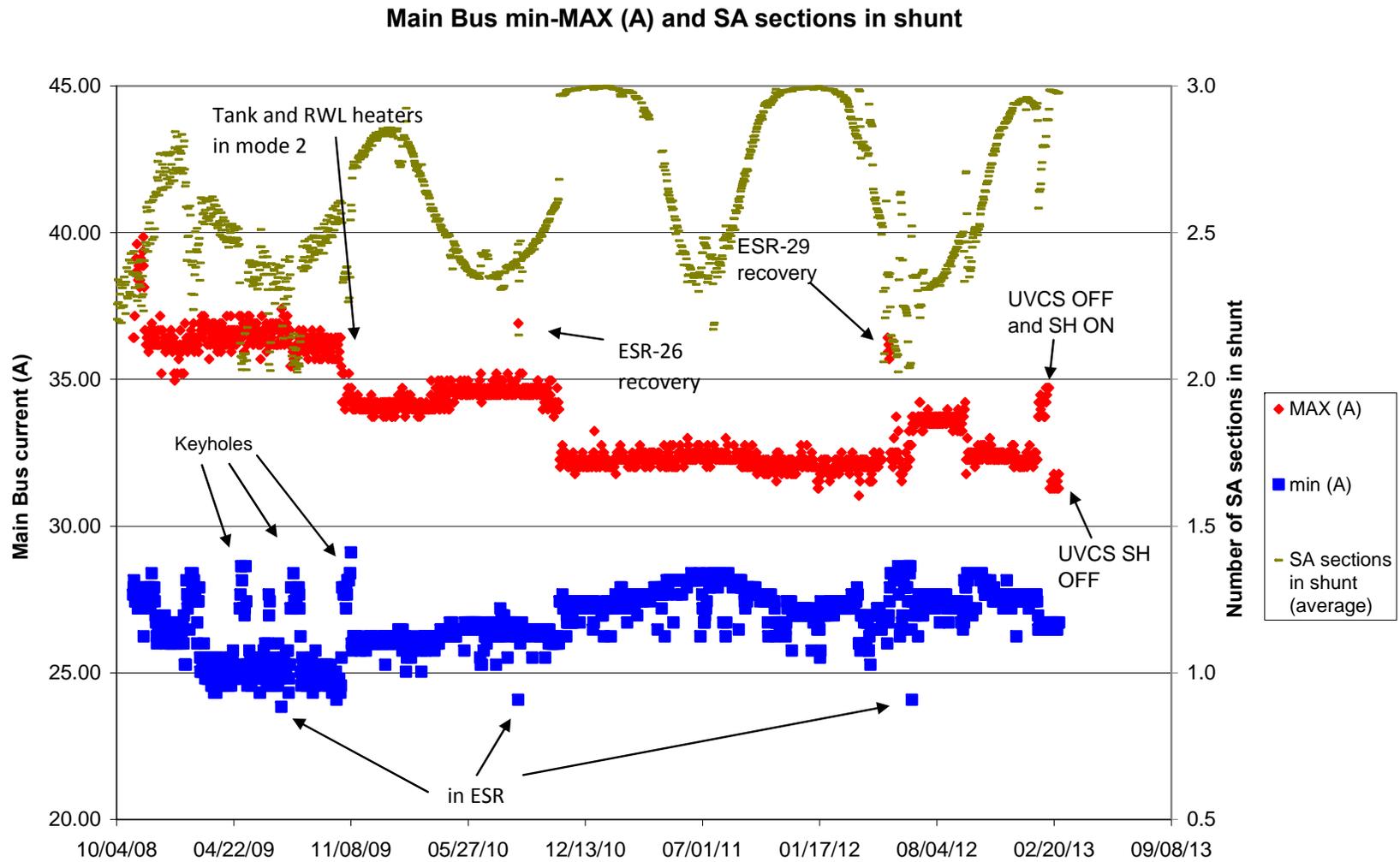


5.1.2 Power margin

SOHO Power Generation Margin



5.1.3 Main Bus Current daily min-MAX and Number of SA sections in shunt

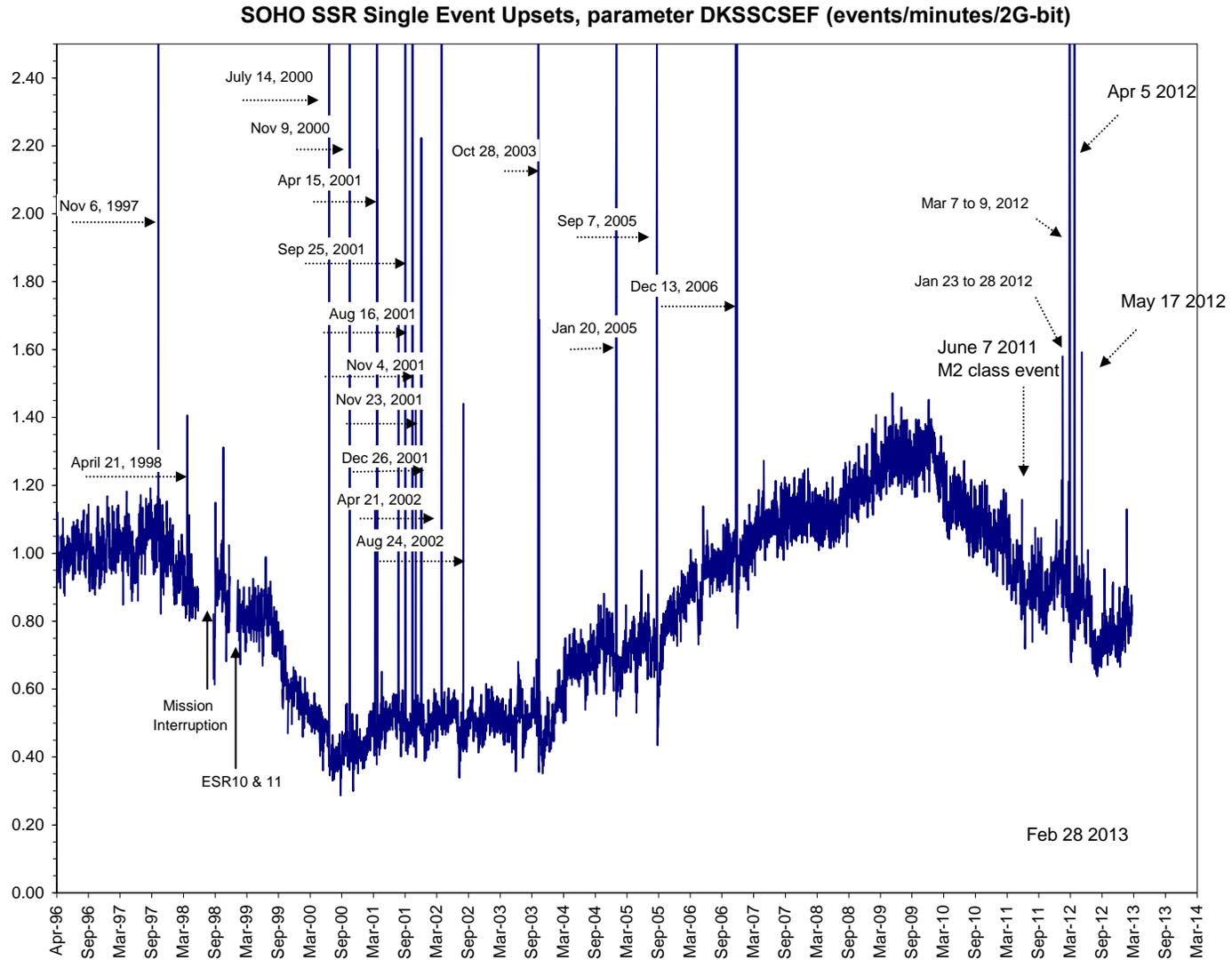


5.1.4 UVCS power consumption

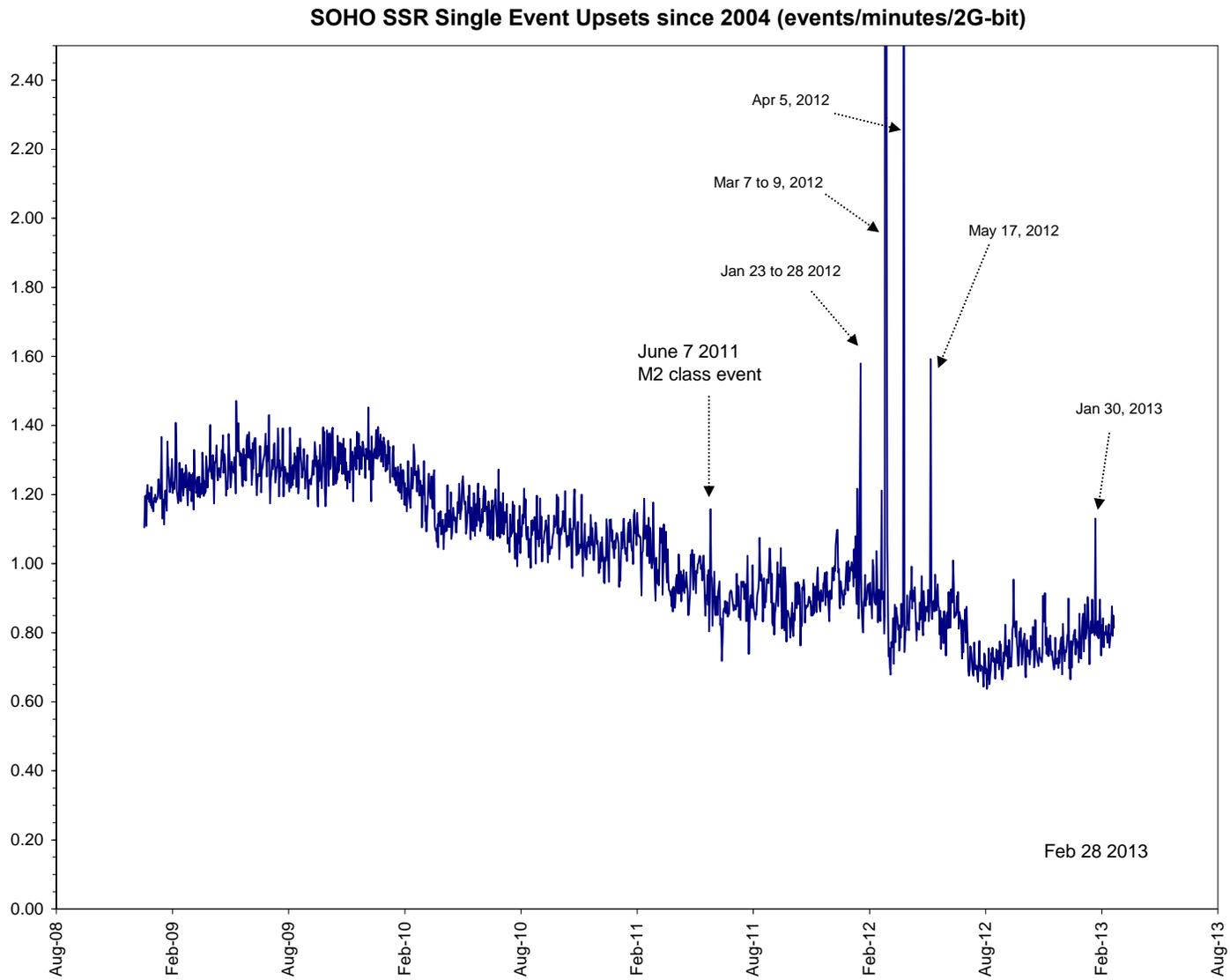
UVCS	Heater power (W)	Expe ON		Expe OFF and SH ON		Expe OFF and SH ON (reduced)		Comment
		Heater DC	current (A)	Heater DC	current (A)	Heater DC	current (A)	
UVCS	NA	NA	1.45	NA	0.00	NA	0.00	Max at 2.5A
SH circ 84	91.8	0%	0.00	60%	1.97	0%	0.00	Expe individually controlled, instrument door left open
SH circ 85	14.1	0%	0.00	90%	0.45	90%	0.45	Electronic collectively controlled
Total			1.5		2.4		0.5	

5.2 SSR / SEU Rate

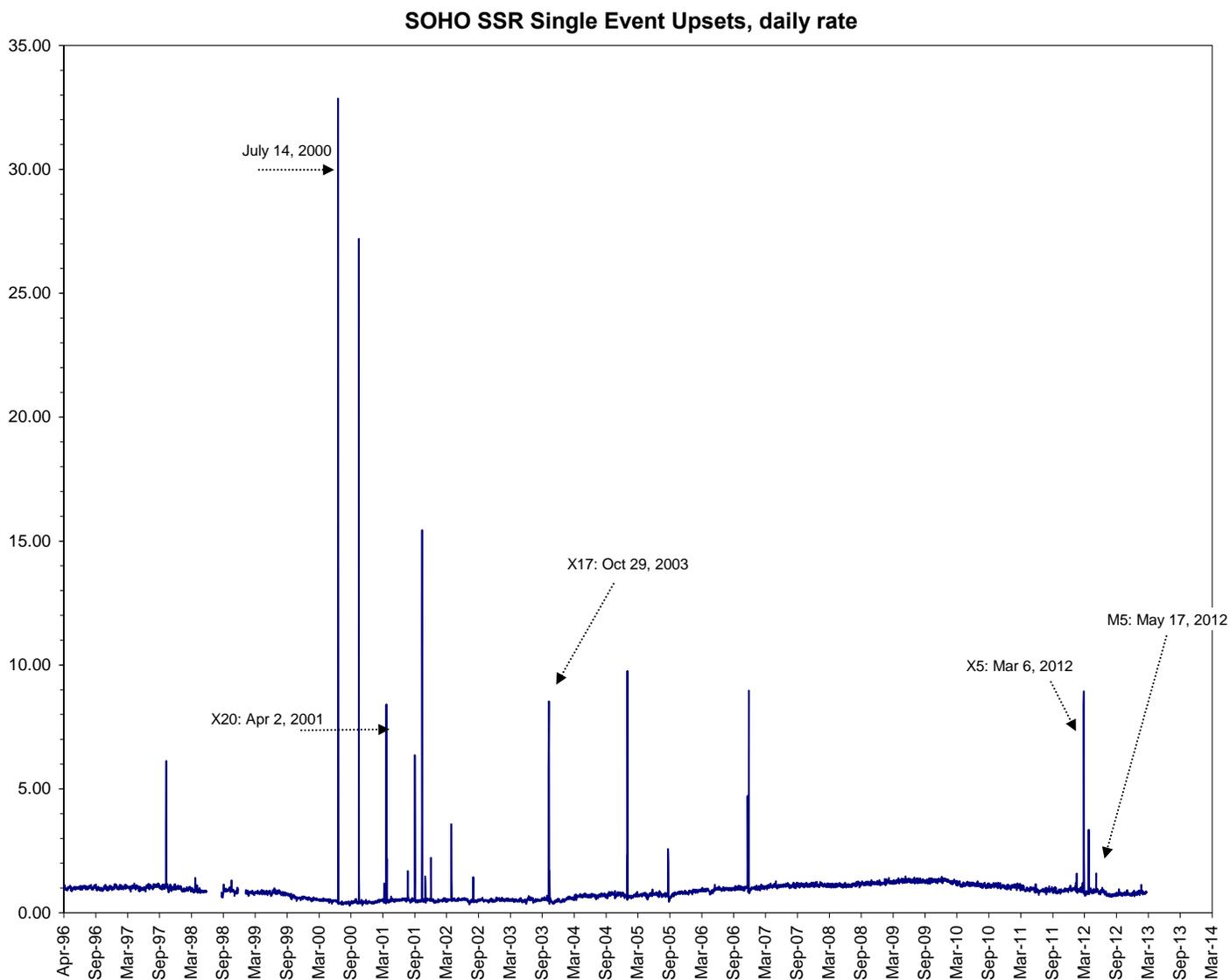
5.2.1 Since Launch



5.2.2 Since 2009



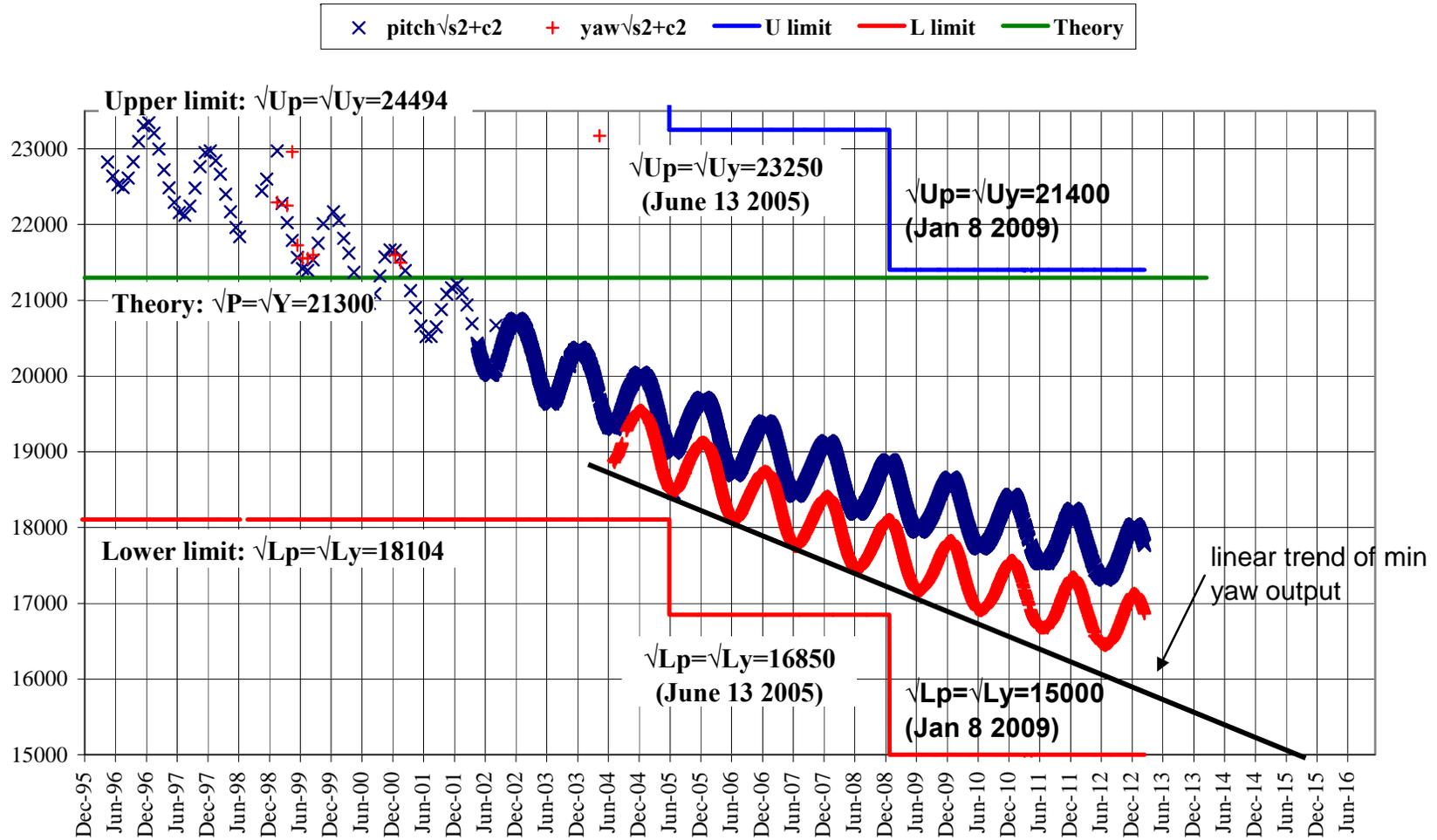
5.2.3 Large scale



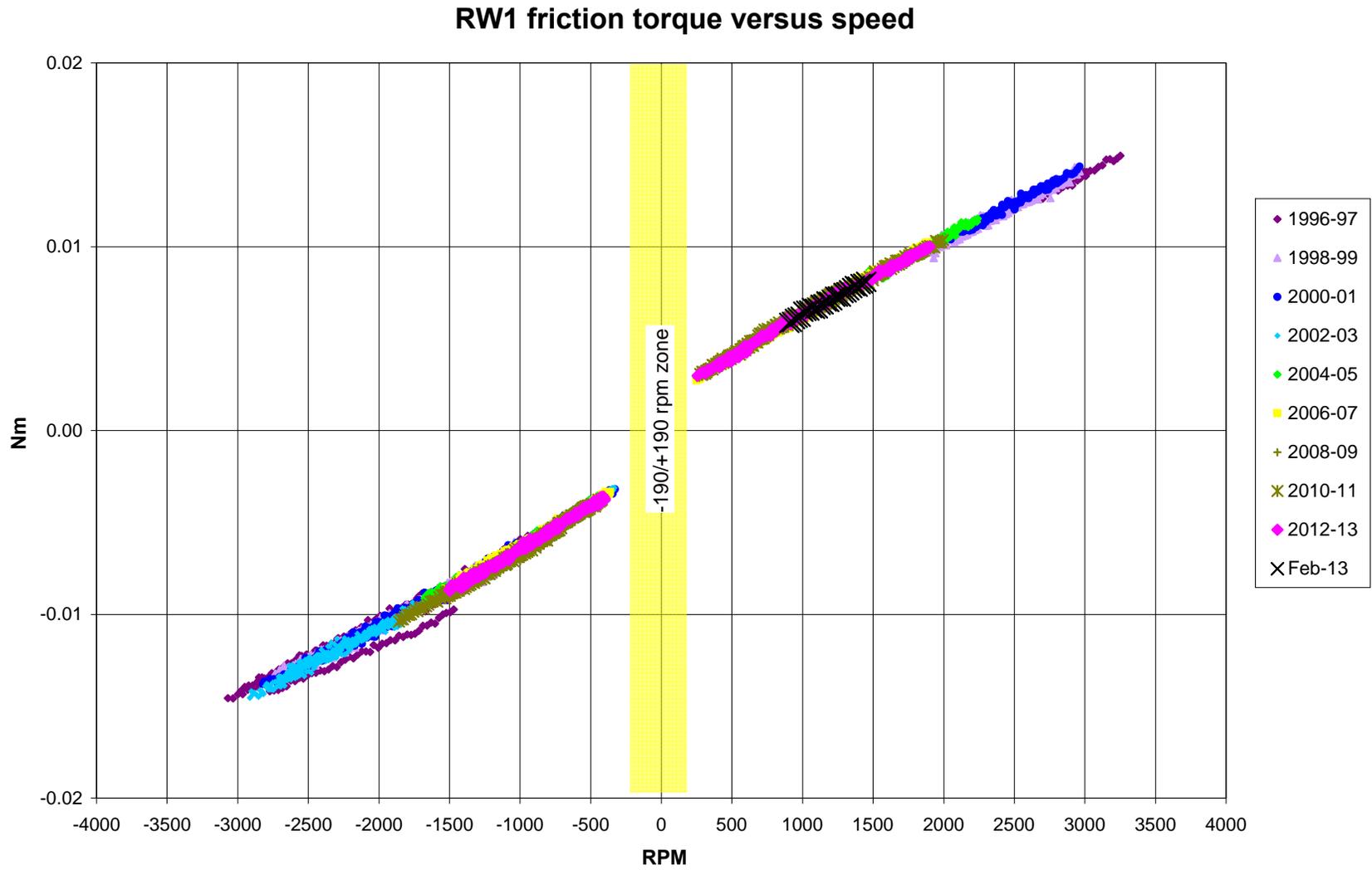
5.3 AOCS plots

5.3.1 FPSS degradation

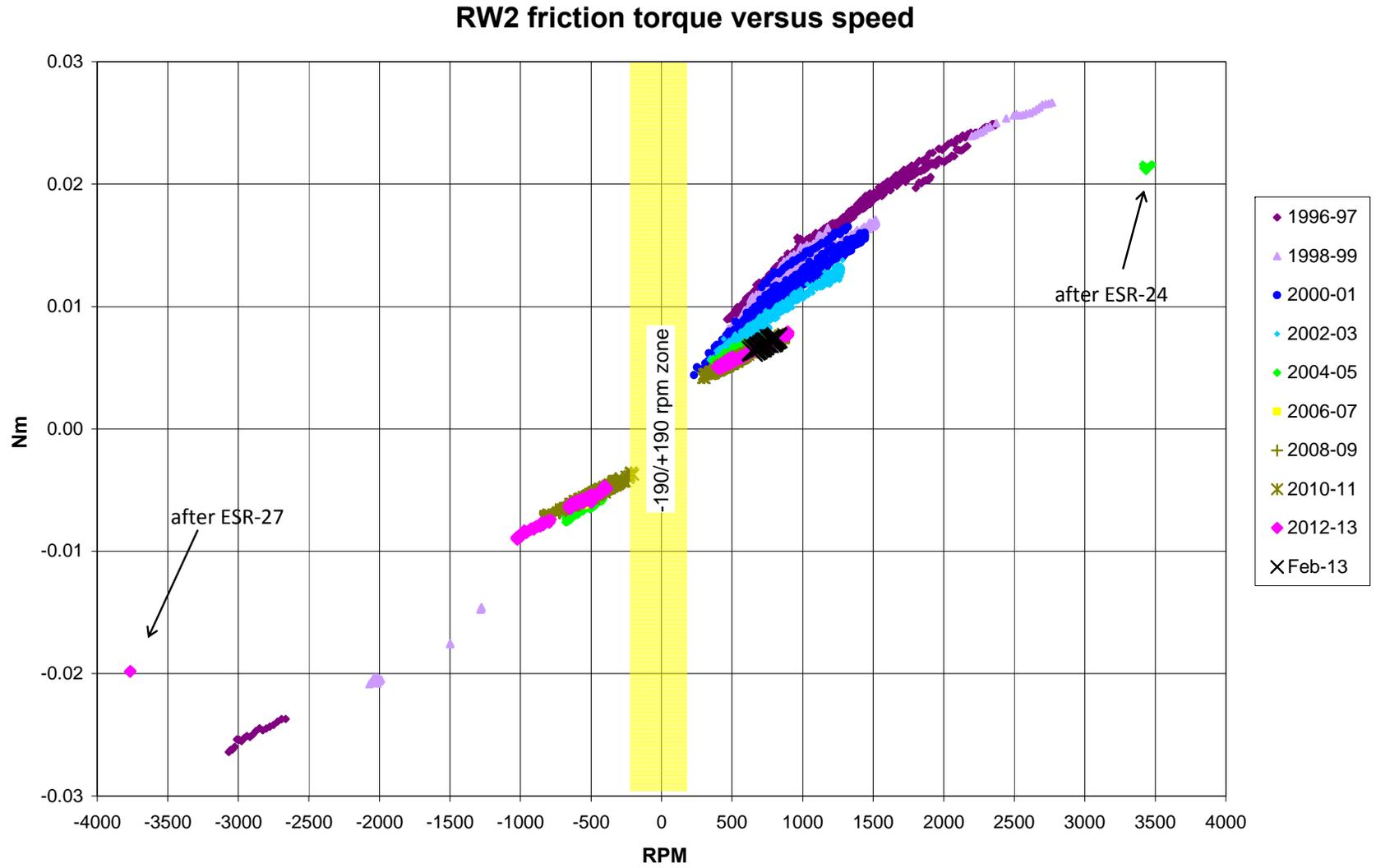
FPSS degradation



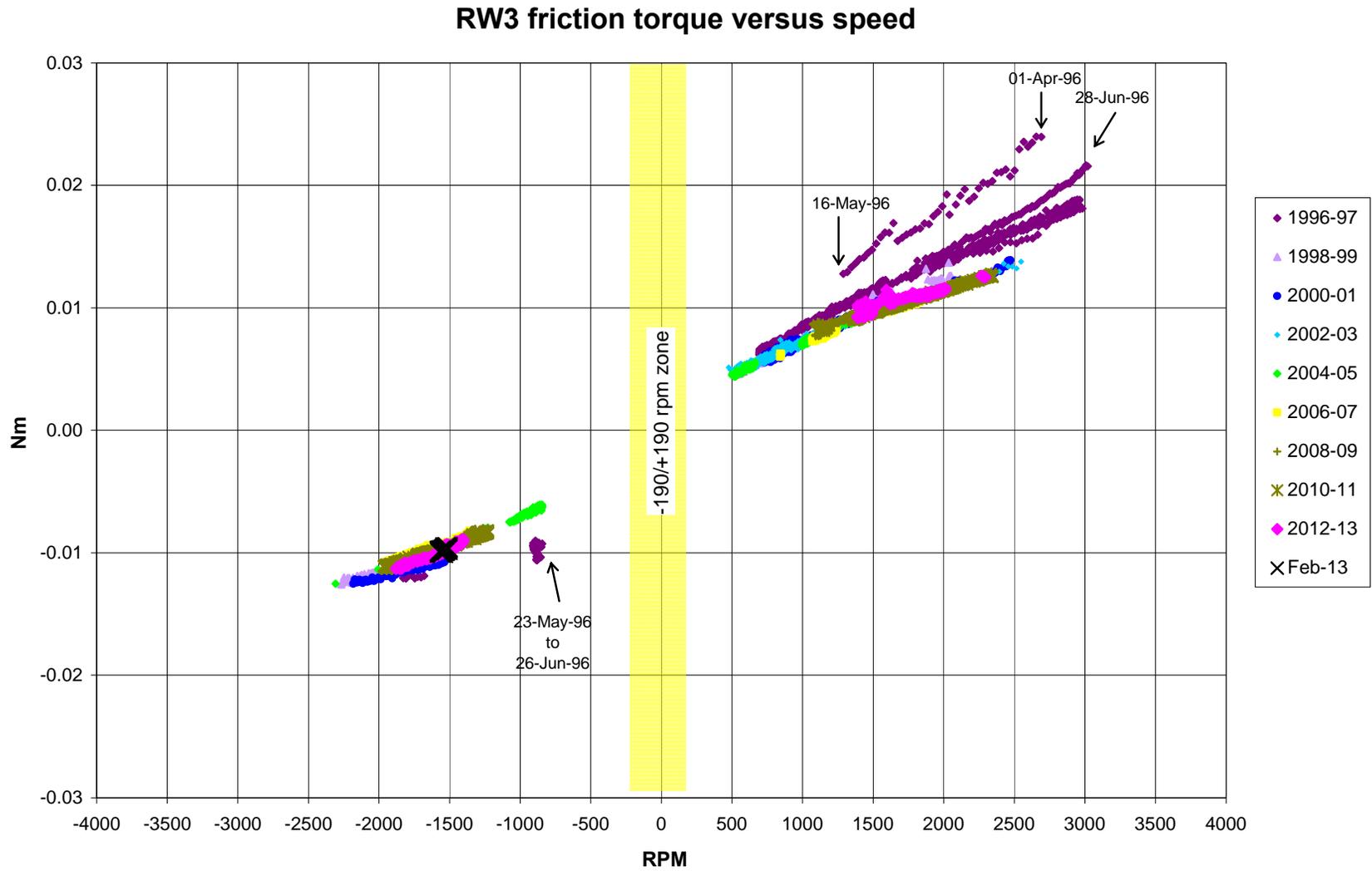
5.3.2 Reaction Wheel 1 friction



5.3.3 Reaction Wheel 2 friction



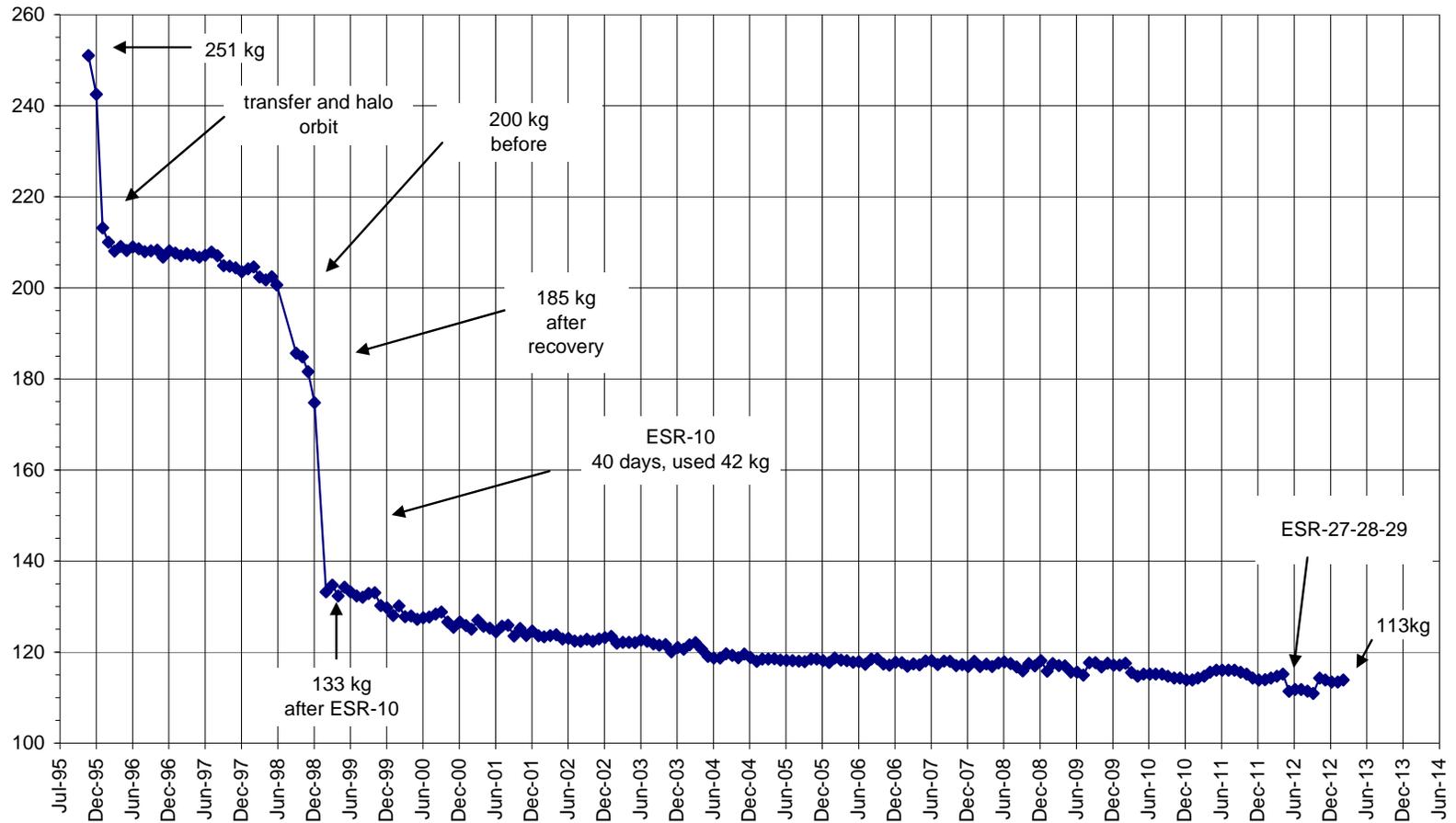
5.3.4 Reaction Wheel 3 friction



5.4 Propulsion plots

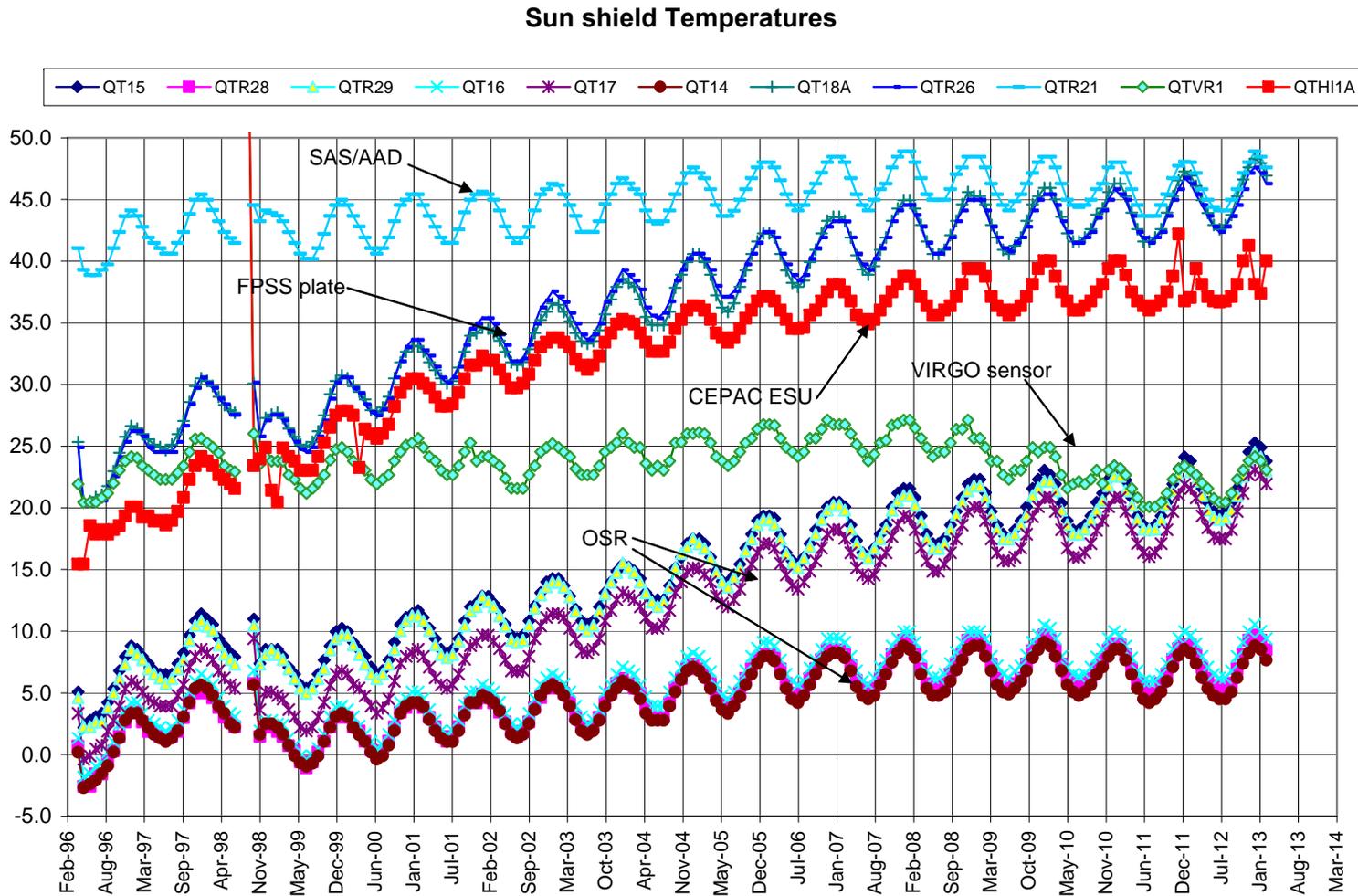
5.4.1 Remaining amount of fuel

Remaining Fuel (kg) estimated by PVT analysis

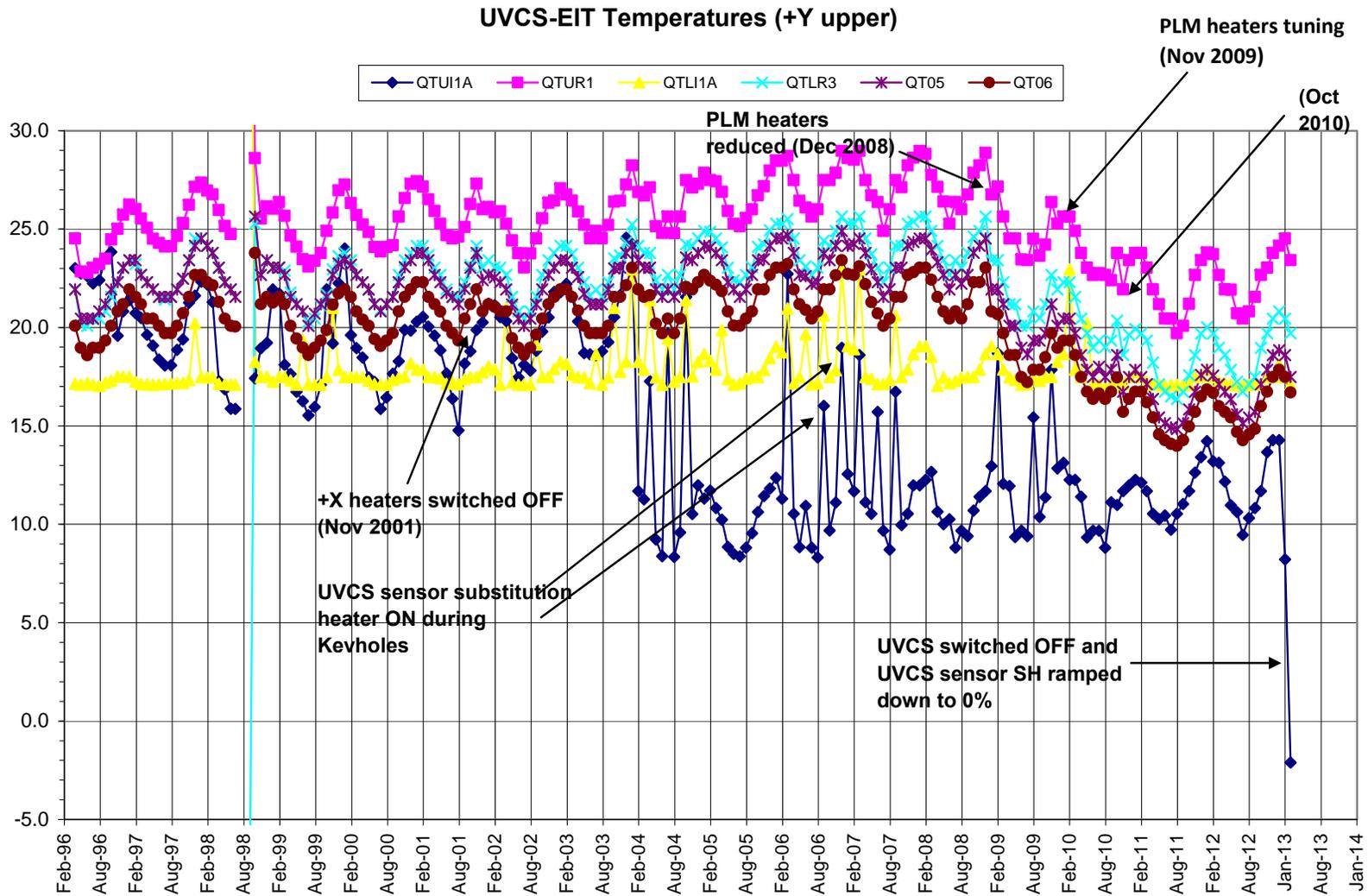


5.5 Plots of temperatures

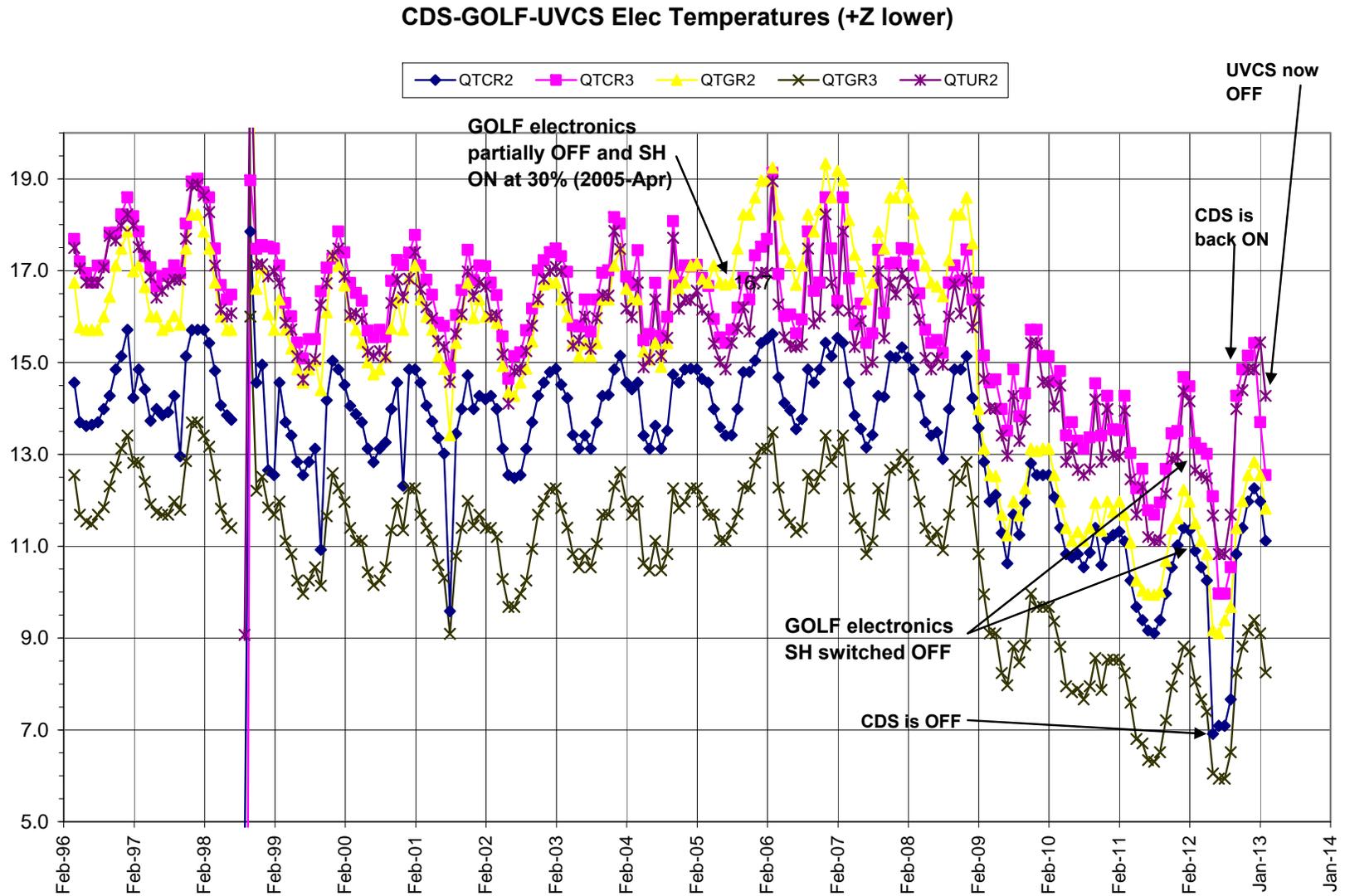
5.5.1 Top panel



5.5.2 PLM +Y upper panel temperature



5.5.3 PLM +Z lower panel temperature



5.5.4 After UVCS turn OFF

Panel	Description	QT	1/23/2013 11H45	1/23/2013 22H50	1/24/2013 7H00	1/24/2013 16H00	1/24/2013 20H25	1/25/2013 7H20	1/25/2013 15H45	1/28/2013 8H35	1/29/2013 10H00	1/30/2013 6H45	1/30/2013 21H45	1/31/2013 10H45	2/1/2013 10H35	2/6/2013 8H30	2/7/2013 9H39	2/8/2013 10H40	2/10/2013 14H10	2/12/2013 8H01	2/13/2013 12H45	2/14/2013 10H20	2/15/2013 14H30	delta vs before UVCS OFF			
sun shield	OSR	QTR28	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	-0.4			
	OSR	QTR29	24.1	24.1	24.1	24.1	24.1	24.1	24.1	24.1	24.1	24.1	24.1	24.1	24.1	24.1	23.7	23.7	23.7	23.7	23.7	23.7	23.7	-0.4			
	FPSS plate	QT18A	48.3	48.3	48.3	48.3	48.3	48.3	48.3	48.3	48.3	47.9	47.9	47.9	47.9	47.9	47.9	47.9	47.6	47.6	47.6	47.6	47.6	-0.7			
	FPSS leg	QTR26	47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.1	47.1	47.1	47.1	47.1	47.1	47.1	47.1	47.1	46.7	46.7	46.7	46.7	-0.9			
+Y	UVCS sensor TRP	QT1920A	26.6	26.6	26.6	26.6	26.6	26.6	26.6	26.6	26.6	26.4	26.4	26.4	26.4	26.2	26.2	26.2	26.0	26.0	26.0	26.0	25.8	25.8	-0.8		
		UVCS sensor internal	QTUR1	24.5	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.5	24.5	24.5	24.5	24.5	24.5	24.1	24.1	24.1	23.8	23.8	23.8	23.8	-0.7		
		QTUI1A	13.7	15.1	17.5	18.6	17.1	15.7	15.4	15.1	12.0	11.4	10.0	8.2	7.4	7.1	3.9	3.1	2.8	-0.4	-1.5	-1.5	-1.8	-15.5			
		QT05	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	18.6	18.6	18.6	18.6	18.6	18.2	18.2	18.2	18.2	18.2	18.2	17.8	17.8	17.8	-1.2		
	EIT telescope TRP	QTLR3	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.4	20.4	20.4	20.4	20.4	20.4	20.1	20.1	20.1	20.1	19.7	19.7	-1.1		
		EIT internal	QTLI1A	17.9	17.9	17.9	17.9	17.9	17.9	17.9	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1	-0.8	
	+Z lower	CDS3 elec TRP	QT06	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.5	17.5	17.5	17.5	17.5	17.5	17.1	17.1	17.1	17.1	17.1	17.1	16.7	16.7	-1.1	
			CDS2 elec TRP	QTCR3	15.4	14.8	14.6	14.6	14.3	14.3	14.3	14.3	14.0	14.0	13.7	13.7	13.7	13.4	13.4	13.1	13.4	12.8	12.8	12.8	12.8	-2.6	
			UVCS elec TRP	QTCR2	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.0	12.0	12.0	12.0	12.0	11.7	11.7	11.7	11.7	11.7	11.7	11.4	11.4	11.4	-0.9
			GOLF PSU TRP	QTUR2	15.1	17.5	16.7	16.7	17.5	17.5	16.4	16.4	16.0	15.7	15.7	15.4	15.4	15.4	15.1	15.1	15.1	14.8	14.6	14.6	14.6	-0.5	
		GOLF DPU TRP	QTGR2	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.5	12.5	12.5	12.5	12.5	12.5	12.3	12.3	12.3	12.3	12.3	12.0	12.0	12.0	-0.8	
			QTGR3	9.4	9.7	9.7	9.7	9.7	9.7	9.4	9.4	9.4	9.4	9.1	9.1	9.1	9.1	8.8	8.8	8.8	8.8	8.8	8.5	8.5	8.5	-0.9	
MDI pzt		E/W in arcseconds		1.9	2.1	2.1	2.1	2.4	2.3	2.3	2.2	2.3	2.3	2.2	2.2	2.7	2.3	2.4	2.3	2.3	2.3	2.3	2.3	2.0	2.0	0.1	
		N/S in arcseconds		-4	-4.2	-5.5	-5.5	-5.5	-5.0	-5.0	-4.6	-4.4	-4.3	-4.2	-3.9	-4.3	-4.3	-3.9	-3.9	-3.5	-3.4	-3.1	-2.7	-2.7	-2.3	1.7	

5.6 SOHO Event List

Month	Day	Year	1995-12-02	Affected	Day of Year	Flight Day	Time (UTC)	Event
JAN	3	2013		Spacecraft	3	6243	17:20	SK-82: jets 1A/2A; dV -0.206m/s. Wheels at -1495 / -750 / 2040 rpm
JAN	3	2013		Spacecraft	3	6243	18:50	Momentum Management 3 segments (jets 5A, 4A and 2A). Final wheels speeds: -1070 / -390 / 2260 rpm
JAN	7	2013		Spacecraft	7	6247	17:21	+180° Roll, satellite in 180-degree position. Final wheels speeds: 1900 / 400 / -1400 rpm
JAN	7	2013		Spacecraft	7	6247	19:40	Transponder Swap (2->1)
JAN	10	2013		Spacecraft	10	6250		<i>End of keyhole period for D27</i>
JAN	23	2013	2013-02-11	UVCS	23	6263	20:28	UVCS instrument turned OFF at LCL level, beginning of UVCS sensor substitution heater ramp down (circuit 84 reduced by 10%-steps, finally set at 0% on Feb 11)

5.7 Trend Files

The table hereafter gives the names and contents of the trend files, which are available on request from the authors of this document.

Topic	File name	Description
General	SOHO Events.xls	Log file of all the major SOHO events since launch
	Anomalies.xls	List of all the spacecraft anomalies with their closure reference
Power	SA Degradation.xls	Solar arrays data and degradation
	Power Trend Long.xls	Since April 96 daily average of power parameters for the last day of each month
	P_ESA_MM_1B.xls	Daily value of onboard min/MAX of main bus current since Nov 2008
DHSS	DHS Trend Long.xls	Since April 96 daily average of DHSS parameters for the last day of each month
	SEF Overall.xls	Daily rate of Single Event Failure on the Solid State Recorder (since launch)
	Tape Recorder.xls	Tape recorder parameters (when used)
RF	RF Trend Long_NEW.xls	With the automation, measurements not input anymore by console operator. This file is not maintained, its content has been included in RF Trend Long_fromITPS.xls
	RF Trend Long_fromITPS.xls	Uses ITPS to automatically get ground stations measurements for RF trending. Previous values since launch are also recorded in this file.
AOCS and Propulsion	Wheels Friction Long.xls	Wheel speeds and torques (daily average) + estimation of external disturbance torques since April 96
	Wheels Spikes.xls	Listing of all the spikes on Wheel speeds TM (follow up on the wheel speed TM anomaly).
	AOCS HK PVT Analysis.xls	AOCS housekeeping parameters with also the remaining amount of fuel (PVT analysis) and the SSU background level.
	PROS-thrusterOnTime.xls	Branch A thrusters firing times since launch.
	SSU SEU Stat.xls	Guide star and SEU information for each day of the month
	SSU SEU Log File Sum Up.xls	Guide star losses and star swaps since launch
	AOCS Counters.xls	Statistics on AOCS timers (AKNBSCH and AKTIMERB) counts per format over 1/2 hour on the last day of each month, since March 2000
Thermal	Temp SVM.xls	SVM temperatures since April 96
	Temp PLM.xls	PLM temperatures since April 96

6 Distribution List

<u>GSFC</u>	H. BENEFIELD N. PISTON E.SOTER G. DIXON Jr	D. QUINN R. BURNS L. JOHNSON	B. FLECK J. GURMAN T.v. OVERBEEK
<u>ESTEC</u>	J. ELLWOOD	P. RUMLER P. POINAS	F. TESTON P. STRADA
<u>EADS ASTRIUM</u> <u>Toulouse</u>	JP. OLIVE M. JANVIER S. JALLADE	D. LEBRETON P. TEMPORELLI	P. AYACHE A. REDON
<u>EADS ASTRIUM</u> <u>Portsmouth</u>	W. EDWARDS		
<u>EADS</u>	B. SIMONIN		
<u>SSTL</u>	T. HOLT		

Contacts:

JP. OLIVE tel: 33 5 62 19 60 42
 e-mail: jean-philippe.olive@astrium.eads.net

T. van OVERBEEK tel: 1 240 605 6214
 e-mail: tvooverbeek@hst.nasa.gov

B. FLECK tel: 1 301 286 4098
 e-mail: bfleck@esa.nascom.nasa.gov