STEREO

IMPACT

FM1 SWEA/STE-D Thermal Vacuum Retest Report

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Distribution List

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1. Overview

1.1. *Introduction*

The Solar Wind Electron Analyzer and Supra-Thermal Electron Detector (Downstream) (SWEA/STE-D) is the part of the STEREO IMPACT instrument suite. It resides at the end of the IMPACT boom.

This document describes the results of the thermal vacuum retest performed on the FM1 SWEA/STE-D unit. This retest was occasioned by the repairs made following the failure of the SWEA test pulser in observatory thermal balance test (PFR 176). This testing was performed at U.C. Berkeley based on the test procedure called out in reference 1, adjusted as follows (as agreed to by STEREO Project):

- 4 cycles were performed
- A different chamber was used which did not have provision for a cooling strap to STE-D, so the STE-D temperatures were significantly warmer than the qualification levels.

The SWEA/STE-D FM1 unit has satisfactorily completed this thermal vacuum test and passed the associated functional tests with no problems.

1.2. *Applicable Documents*

The following documents are closely interrelated with this specification. All documents can be found on the Berkeley STEREO/IMPACT FTP site unless otherwise indicated:

http://sprg.ssl.berkeley.edu/impact/dwc/

1. SWEA and STE-D Revised Test Plan1
2. APL Document APL 7381-9003 Rev A – STEREO Environment Definition, Observatory and Instrument (on APL web site)
3. IMACT-SWEA-CPT
4. IMPACT-SWEA-FM1-Tvac-Report

Fig 1. FM1 SWEA/STE-D

2. Test Setup

The “SNOUT2” thermal vacuum chamber at U.C. Berkeley was used for this thermal vac of the FM1 SWEA/STE-D.

The ETU IDPU was setup outside the chamber as indicated in the test plan (reference 1).

Four 10mCi Ni63 sources were mounted around SWEA on a test fixture to provide a nearly uniform illumination of the SWEA aperture with electrons to stimulate the instrument in and end-to-end test. STE-D also had some view of the Ni63 sources.

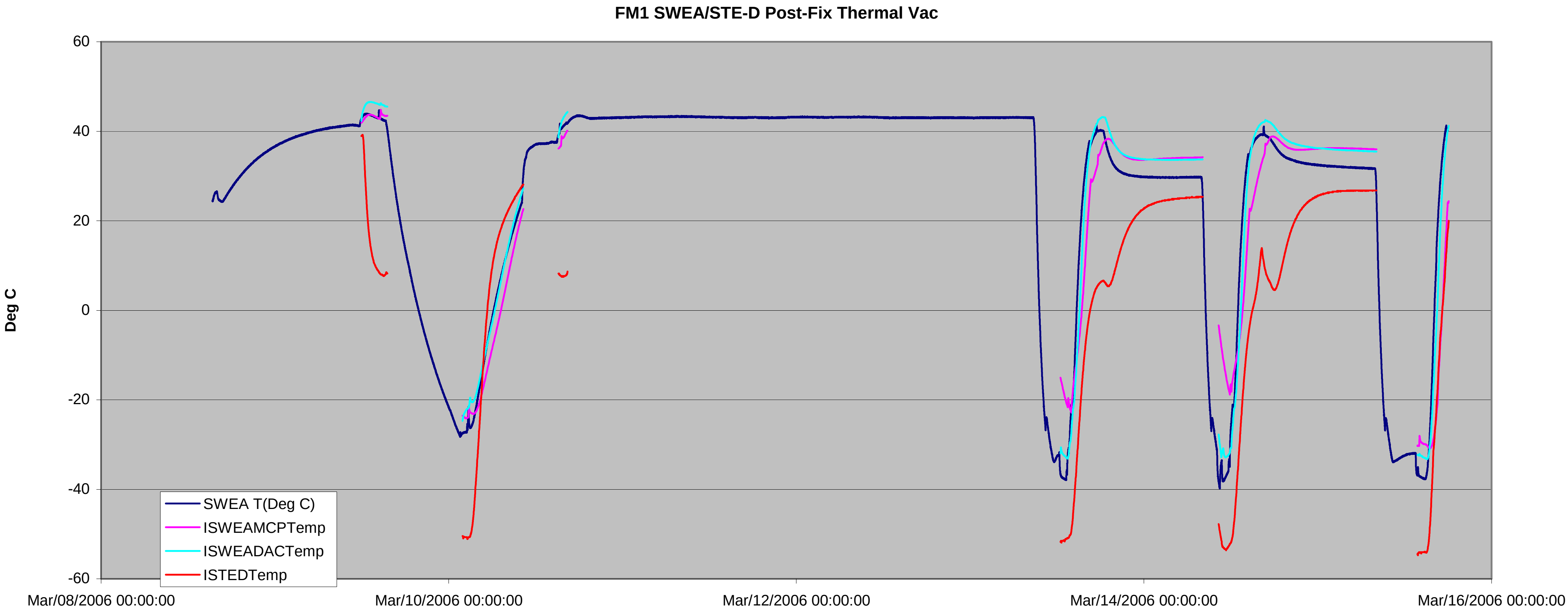
In addition to chamber monitoring TCs (on the baseplate, and shroud), a number of chamber TCs were attached to the exterior of the instrument to monitor the temperature. These instrument-mounted TCs, together with the internal passive PRT sensor attached to the SWEA chassis, were used to determine when temperature soaks were met. We could not mount a TC to the STE-D unit due to surface issues and size, so only the internal sensor was available for that.

3. Test History

This test started on 2006-March-9, following workmanship vibration testing. Following a ~19 hour bake at non-op hot (+40C), the system was transitioned to operational hot case. Baseplate plus main shroud were sent to +35C, and the end shroud was sent cold (-100C) to cool STE-D. The hot case CPT was performed with STE-D at +12C and the reset of SWEA at ~+40C. SWEA High voltage was powered on and a nominal distribution from the Ni63 sources was observed. STE_D also saw the Ni63 source when the door was opened. This CPT was repeated at each plateau with nominal results in each case. The instrument was then transitioned cold, with SWEA reaching –30C and STE-D reaching –50C. The survival heater was exercised (On at ~ –30C off at ~ -20C), the instrument was cold-started over a range of bus voltages (24V, 28V, 35V), and the CPT performed. The system was then sent to +40C with the instrument powered off over the weekend. The remaining 3 cycles were completed in the same way the following week, with the difference that the survival heater was not used for more than a few minutes, allowing SWEA to get down to the qualification temperature of –35C.

4. Temperature Profile

SWEA PRT is the spacecraft-monitored temperature sensor attached to the SWEA pedestal (internal). ISWEAMCPTemp is telemetry from a thermistor on the MCP board in the SWEA unit. ISWEADACTemp is telemetry from a thermistor on the DAC board in the SWEA pedestal. ISTEDTemp is telemetry from a PRT in the STE-D unit.


FM1 SWEA/STE-D Post-Fix Thermal Vac
Deg C
60
40
20
0
-20
-40
-60
Mar/08/2006 00:00:00
Mar/10/2006 00:00:00
Mar/12/2006 00:00:00
Mar/14/2006 00:00:00
Mar/16/2006 00:00:00
SWEA T(Deg C)
ISWEAMCPTemp
ISWEADACTemp
ISTEDTemp

5. Trending

5.1. *Trending Data Explanation*

The trending data on the following pages is extracted from the trending file for the FM1 STE-D and SWEA plus LVPS. It is composed of values measured during the CPT, either directly, or from a post-processing fitting function which evaluates the data collected.

- The Door Open and Door Close columns show two times; from application of power to the time when the door comes off the first switch (starts moving), and the time from the application of power to the time when the door reaches the destination switch.
- Threshold values are DAC levels, corresponding to ~100eV per step. Requirement is <5keV.
- The test pulser fit data measures the electronic performance. Of particular interest is the FWHM, which measures the electronic noise in the system. Other values can be used to look for thermal drift and other trends in energy gain and offset.
- The "door source" fit data measures the calibration source on the STE door, and so is a end-to-end measurement (albeit using mostly photons rather than electrons). Again the FWHM is of interest (requirement < 2keV). In a few cases the short integration door source test was skipped due to time limitations; the long integration test is a better test for most purposes.

- SWEA trends show the primary current (data logger) and secondary voltages (instrument housekeeping). High Voltage supply monitors are also trended.

5.2. ***STE-D Trending Data***

STE-D FM1 Performance Trend

													Test Pulser					Door Source						Long Integration Door Source (Door LUT)							
Date	File	Test	SWEA/STE-D Primary Current (mA)	STE-D Temp	SWEA / STE-D DAC Temp	ISTEDCur (mA)	Door Open (sec)	Door Close (sec)	Bias	Fit Rev	Det.	Thresh.	Offset (keV)	Gain (keV/Bin)	Curv. (1/keV)	Test Gain	FWHM (keV)	Offset (keV)	Gain (keV/Bin)	Curv. (1/keV)	6keV c/s	22keV c/s	FWHM	AccTime (sec)	Offset (keV)	Gain (keV/Bin)	Curv. (1/keV)	6keV c/s	22keV c/s	88keV c/s	FWHM
6-Mar-06	A0603061441.tlm	Post Fix CPT	142	24.3	29.2	14.7	0.38 / 0.50	0.38 / 0.50	100	2/24/2006	0	10	-0.10	0.3874	7.78E-05	13.1787	0.838							850	-0.06	0.3910	6e-5 (F)	38.19	13.66		0.931
											1	10	-0.03	0.3872	9.97E-05	12.2896	0.777								-0.02	0.3875	6e-5 (F)	39.28	13.54		0.869
											2	10	-0.06	0.3866	8.78E-05	12.9332	0.757								-0.02	0.3881	6e-5 (F)	31.08	11.30		0.864
											3	10	-0.07	0.3872	7.99E-05	13.3534	0.833								-0.04	0.3865	6e-5 (F)	30.26	10.78		0.919
8-Mar-06	A0603081119.tlm	Post Vib CPT	139	21.7	25.5	14.3	0.38 / 0.38	0.38 / 0.75	100	2/24/2006	0	11	-0.10	0.3874	7.75E-05	13.1768	0.803							1540	-0.08	0.3923	4.02E-05	39.19	13.13	8.28E-03	0.907
											1	11	-0.03	0.3874	9.73E-05	12.2988	0.743								-0.04	0.3886	7.39E-05	39.99	13.48	3.67E-03	0.855
											2	12	-0.05	0.3866	9e-5 (F)	12.9360	0.737								-0.03	0.3883	8.22E-05	31.69	11.47	6.50E-03	0.858
											3	12	-0.06	0.3871	8.12E-05	13.3566	0.802								-0.05	0.3869	5.45E-05	30.68	11.06	9.00E-03	0.902
9-Mar-06	A0603091140.tlm	Tvac Hot #1	144	9	46.1	15.2	0.25 / 0.38	0.25 / 0.38	100	2/24/2006	0	9	-0.09	0.3873	7.89E-05	13.1242	0.729	-0.02	0.3915	6e-5 (F)	40.74	13.34	0.846	1490	-0.02	0.3916	5.03E-05	40.35	13.21	4.77E-03	0.867
											1	9	-0.02	0.3877	9.84E-05	12.2760	0.671	0.01	0.3882	6e-5 (F)	41.96	14.18	0.831		0.01	0.3880	5.99E-05	41.00	13.52	9.18E-03	0.810
											2	10	-0.07	0.3866	8.64E-05	12.8747	0.662	0.04	0.3880	6e-5 (F)	33.00	11.20	0.796		0.03	0.3881	7.56E-05	32.82	11.62	8.20E-03	0.814
											3	10	-0.06	0.3869	8.09E-05	13.3004	0.730	0.04	0.3859	6e-5 (F)	32.45	11.06	0.845		0.02	0.3862	5.68E-05	31.53	11.01	7.10E-03	0.858
10-Mar-06	A0603100000.tlm	Tvac Cold #1	128	-50.4	-24.7	14.7	0.75 / 0.88	0.88 / 0.88	100	2/24/2006	0	12	-0.21	0.3875	7.16E-05	13.2204	0.910							2950	-0.10	0.3941	3.85E-05	36.97	12.69	4.81E-03	0.960
											1	11	-0.14	0.3881	9.69E-05	12.2666	0.547								-0.07	0.3938	7.12E-05	40.71	13.35	9.17E-03	0.683
											2	13	-0.19	0.3873	8.62E-05	12.9530	0.536								-0.08	0.3924	6e-5 (F)	32.26	11.61	4.65E-03	0.675
											3	12	-0.17	0.3873	7.73E-05	13.4059	0.597								-0.07	0.3890	5.72E-05	31.31	10.97	6.91E-03	0.729
10-Mar-06	A0603100000.tlm	Tvac Hot #2	141	8.1	39.8	14.3	0.25 / 0.38	0.25 / 0.38	100	2/24/2006	0	10	-0.09	0.3869	7.89E-05	13.1334	0.731	-0.04	0.3914	6e-5 (F)	39.83	13.37	0.852	1230	-0.02	0.3915	5.24E-05	40.62	13.17	1.25E-02	0.853
											1	10	-0.03	0.3875	9.84E-05	12.2808	0.669	0.03	0.3857	6e-5 (F)	41.98	14.19	0.834		0.10	0.3877	7.56E-05	41.49	13.45	9.53E-03	0.807
											2	11	-0.07	0.3871	8.74E-05	12.9074	0.660	0.01	0.3889	6e-5 (F)	32.15	11.97	0.790		0.02	0.3885	6.28E-05	32.60	11.69	2.51E-03	0.799
											3	11	-0.07	0.3867	8.19E-05	13.3123	0.718	0.00	0.3874	6e-5 (F)	31.68	11.37	0.859		0.02	0.3862	6.01E-05	31.05	10.92	1.02E-02	0.860
13-Mar-06	A0603131214.tlm	Tvac Cold #2	127	-51.5	-30.7	14.6	0.88 / 0.88	1.00 / 1.00	100	2/24/2006	0	9	-0.22	0.3874	7.22E-05	13.2373	0.591	-0.10	0.3930	6e-5 (F)	39.25	13.03	0.709	2570	-0.11	0.3933	6.19E-05	39.87	13.16	6.90E-03	0.725
											1	9	-0.15	0.3880	9.75E-05	12.2709	0.538	-0.08	0.3939	6e-5 (F)	38.93	13.43	0.663		-0.08	0.3939	7.47E-05	40.63	13.36	7.93E-03	0.681
											2	11	-0.22	0.3873	8.36E-05	12.9583	0.526	-0.08	0.3920	6e-5 (F)	31.22	11.56	0.648		-0.10	0.3925	6e-5 (F)	32.06	11.49	4.05E-03	0.676
											3	10	-0.19	0.3871	7.55E-05	13.4125	0.615	-0.08	0.3888	6e-5 (F)	30.21	10.96	0.747		-0.09	0.3892	5.48E-05	31.33	10.87	6.13E-03	0.724
13-Mar-06	A0603131214.tlm	Tvac Hot #3	150	4.7	41	14.7	0.25 / 0.38	0.25 / 0.38	100	2/24/2006	0	9	-0.11	0.3870	7.67E-05	13.1311	0.724							9390	-0.03	0.3913	5.91E-05	40.20	13.26	8.80E-03	0.861
											1	8	-0.03	0.3874	9.69E-05	12.2774	0.674								0.00	0.3884	6.47E-05	41.10	13.43	8.25E-03	0.802
											2	9	-0.05	0.3870	8.78E-05	12.9142	0.656								0.01	0.3885	6.28E-05	32.75	11.52	6.75E-03	0.796
											3	10	-0.05	0.3865	8.19E-05	13.3140	0.719								0.00	0.3860	6.65E-05	31.92	11.05	7.55E-03	0.845
14-Mar-06	A0603140000.tlm	Tvac Cold #3	133	-51.5	-32.6	14.4	0.88 / 0.88	1.00 / 1.00	100	2/24/2006	0	10	-0.22	0.3874	7.04E-05	13.2337	0.596							4090	-0.11	0.3931	6.21E-05	39.87	13.11	7.51E-03	0.719
											1	10	-0.13	0.3878	9.85E-05	12.2734	0.540								-0.08	0.3936	7.24E-05	40.48	13.46	8.37E-03	0.681
											2	12	-0.20	0.3872	8.23E-05	12.9531	0.527								-0.10	0.3923	6e-5 (F)	32.21	11.48	7.57E-03	0.666
											3	11	-0.17	0.3870	7.73E-05	13.4156	0.590								-0.08	0.3885	6.65E-05	31.36	10.86	7.12E-03	0.714
14-Mar-06	A0603140000.tlm	Tvac Hot #4	150	12.1	42	15	0.25 / 0.38	0.25 / 0.38	100	2/24/2006	0	9	-0.10	0.3870	7.69E-05	13.1373	0.749	-0.02	0.3909	6e-5 (F)	37.83	12.74	0.897	7000	-0.04	0.3916	4.88E-05	40.45	13.26	7.45E-03	0.858
											1	9	-0.02	0.3874	9.75E-05	12.2836	0.698	0.01	0.3877	6e-5 (F)	40.43	13.29	0.799		0.00	0.3884	5.57E-05	41.10	13.38	8.09E-03	0.798
											2	10	-0.05	0.3870	8.78E-05	12.9195	0.664	0.00	0.3891	6e-5 (F)	31.73	11.56	0.799		0.01	0.3883	6.97E-05	32.89	11.63	7.24E-03	0.794
											3	10	-0.04	0.3864	8.19E-05	13.3188	0.720	0.01	0.3863	6e-5 (F)	32.26	11.03	0.870		0.01	0.3860	6.20E-05	31.95	11.08	7.21E-03	0.844
15-Mar-06	A0603150000.tlm	Tvac Cold #4	134	-54.5	-32.3	14.4	0.88 / 0.88	1.00 / 1.00	100	2/24/2006	0	10	-0.23	0.3875	7e-5 (F)	13.2345	0.585	-0.11	0.3934	6e-5 (F)	39.43	13.30	0.788	2950	-0.11	0.3933	5.38E-05	39.66	13.14	5.88E-03	0.717
											1	10	-0.14	0.3879	9.90E-05	12.2731	0.538	-0.09	0.3942	6e-5 (F)	41.08	13.33	0.662		-0.09	0.3940	6e-5 (F)	40.40	13.28	6.44E-03	0.668
											2	12	-0.20	0.3871	8.70E-05	12.9630	0.524	-0.11	0.3929	6e-5 (F)	30.92	11.52	0.640		-0.10	0.3923	6e-5 (F)	31.90	11.46	5.94E-03	0.656
											3	11	-0.18	0.3870	7.72E-05	13.4158	0.586	-0.09	0.3891	6e-5 (F)	31.29	10.69	0.723		-0.08	0.3886	5.89E-05	31.25	10.80	7.04E-03	0.714

5.3. *SWEA, LVPS Trending Data*

SWEA FM1 Performance Trend (incl SWEA/STE-D LVPS)

Date	File	Test	SWEA Temp	ISWEAM CPTemp	ISWEAD ACTemp	Bus Voltage	Primary Current	2.5V	5VD	5VA	12VA	ISWEAST EDCur	ISWEAV0 @ DAC=128	ISWEANR 5V	ISWEAAnal	ISWEADefl1	ISWEADefl2	Open Door?	MCP On?
Mar 6 2006	A0603061441.tlm	Post-fix CPT		28.8	31.6	28	142	2.50	4.99	5.34	12.07	14.6	-12.48	6.61	65.84	156.94	92.64	Yes	No
Mar 8 2006	A0603081119.tlm	Post vib CPT	26	25.4	27.9	28	139	2.50	4.99	5.33	12.05	14.4	-12.49	6.58	66.26	157.79	93.48	No	No
Mar 9 2006	A0603091140.tlm	Tvac Hot #1	43	42.8	46	28	144	2.50	4.99	5.42	12.28	16.6	-12.47	6.76	65.42	156.1	91.8	Yes	Yes
						28	128	2.50	4.99	5.10	11.50								
Mar 10 2006	A0603100000.tlm	Tvac Cold #1				24	135	2.50	4.99	5.13	11.49								
			-27.3	-23.9	-22.9	35	128	2.50	4.99	5.10	11.49	13.8	-12.54	6.46	68.37	162.08	98.56	No	Yes
Mar 10 2006	A0603100000.tlm	Tvac Hot #2	39.5	36.6	41.1	28	141	2.50	4.99	5.36	12.13	14.6	-12.47	6.72	65.42	156.1	92.64	No	Yes
Mar 13 2006	A0603131214.tlm	Tvac Cold #2	-37.1	-17.3	-32.1	28	123	2.50	4.99	5.10	11.45	15.5	-12.55	6.4	68.8	162.9	98.6	No	Yes
Mar 13 2006	A0603131214.tlm	Tvac Hot #3	39.6	32.3	41.9	28	150	2.50	4.99	5.40	12.23	16.5	-12.48	6.74	65.42	156.94	92.64	No	Yes
Mar 14 2006	A0603140000.tlm	Tvac Cold #3	-38	-12	-32	28	133	2.50	4.99	5.12	11.52	14.6	-12.55	6.47	68.37	162.86	98.56	No	Yes
Mar 14 2006	A0603140000.tlm	Tvac Hot #4	39.2	34.8	42.1	28	150	2.50	4.99	5.41	12.24	14.4	-12.48	6.75	65.42	156.94	92.64	No	Yes
Mar 15 2006	A0603150000.tlm	Tvac Cold #4	-36.8	-30.3	-32.4	28	134	2.50	4.99	5.08	11.44	16.5	-12.55	6.41	68.8	162.9	98.6	No	Yes

6. TQCM Data

A bakeout was added to the end of the thermal vac cycling using a TQCM monitor to verify the outgassing rate meets the requirement (2.5E-11 g/cm2/sec). A final outgassing rate of ~0Hz/hour was measured, which is about the background rate of the chamber.