1. INTRODUCTION

This document reports the results of the first COLD SPIRE Spectrometer Mechanism (SMEC) functional tests performed on 16th May 2008 in the IST campaign. As a result of the delayed start and difficulties encountered during the tests it was only possible to complete the tests on the Prime side.

1.1 SCOPE

To judge the success or failure of a warm functional test by checking that:

- The telecommand sequence generated for a particular functional test is correctly received and executed on board by the SPIRE DPU.
- No error/event reports or command failures are generated during the execution of these commands.
- Telemetry is generated by the instrument as a result of telemetry requests to its different subunits.
- Particular telemetry parameters for each functional test change in an expected manner.
- A particular success criterion (specified in this document) is met.

1.2 REFERENCE DOCUMENTS

Ref	Document	Name	Version/Issue No.
RD01	SPIRE-RAL-DOC-001652	SPIRE Functional Tests Specification	Issue 1.4
RD02	SPIRE-RAL-DOC-001630	SPIRE I-EGSE Set-up Procedure	Issue 2.2
RD03	SPIRE-RAL-PRJ-001078	SPIRE Data ICD	Issue 2.1
RD04	Sap-SPIRE-CCa-076-02	DRCU/DPU Interface Control Document	Issue 1.3
RD05	LAM.PJT.SPI.NOT.011011	MCU/DPU Command List ICD	Issue 5.0
RD06	SPIRE-IFS-PRJ-001391	SPIRE OBS User Manual	Issue 2.2.H
RD07	SPIRE-RAL-PRC-002398	SPIRE FM Cold Functional Test Procedures	Issue 2.4
RD08	SPIRE-RAL-REP-003087	IST WARM FUNCTIONAL TEST REPORT III – Prime Side (After Harness Repair)	Issue 1.0
RD09	HP-2-ASED-SD-0203	SPIRE WFT after repair of pixel anomalies on SVM-SIH connectors based on HP-112000-ASED-NC-3725	Issue 01

1.3 CHANGE RECORD

Document	Change date	Changes
Issue 1.0	16/05/2008	First Version

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2. FUNCTIONAL TEST CONFIGURATION

2.1 Software Configuration

Write down in the table the current EGSE software configuration for the tests:

EGSE component	Version/Build number	Comment
SCOS2000	2.3eP5	
IEGSE MIB	SPIRE MIB in H-P-2-ASP-LI-1424_04 - SPIRE-cryo Merged database Merged with the Minimum EGSE MIB provided by Serge Valera	Only the Prime SCU DC and AC thermometry tables will be used on SCOS for both the Prime & Redundant SMEC tests.
IEGSE Database	spire_fm_ist_db1 on spireqla	
HCSS	v0.6.1 Build (#1430)	
QLA	v3.3	
QLA scripts	Latest versions from CVS	
CCS scripts	Tag SPIRE_COLDFT_PROC_V2	
CUS Scripts	Mission configurations at start: • fm_ist_cft_config3p (Prime) • fm_ist_cft_config3r (Redundant)	

2.2 EGSE Configuration Checks

To check for the success of failure of a functional test, the real time telemetry of the instrument has to be monitored. The following applications must be running to do so. Before the test sequence starts, make the following checks:

Workstation	EGSE component	Status	Check
hspireegse	EGSE router	Started	✓
hspireegse	EGSE Gateway	Started	✓
hspireegse	Pipe Gateway	Started	✓
hspireqla	Telemetry Ingestion	Started	✓
hspireqla	Packet Display	Started via ssh (ssh –X spire@spireqla) from hspireegse	✓
spires2k	SCOS2000	Started	✓
hspireqla	CCS Handler (Server)	Started	✓

3. TEST PROCEDURE

The following two sections describe general pass/fail criteria (Section 3.1), the general test layout (Section 3.2) and the detailed procedure for each functional test (Section 3.3).

3.1 GENERAL PASS/FAIL CRITERIA

The general criteria for declaring a single test failed is the repeated failure of 2 consecutive runs of this test. In that case the functional test procedure should be aborted and the overall functional testing declared FAILED.
In the case of a 'first run' failure followed by a successful execution a third run of the same test should be performed and in the unlikely event of this third run being a failure the test procedure should be also aborted and the overall functional testing declared FAILED, as this would imply a not reliable operability of the instrument.
As a general remark ANY failure should be closely analysed.

Note: If the functional test is declared FAILED refer to section 4.1 for instrument switch OFF.

3.2 GENERAL TEST PROCEDURE LAYOUT

The table below shows the general CFT sequence as it should be performed. In each step of this procedure the operator should refer to the detailed procedure in Section 3.3. Test Control TCL scripts are available to invoke the correspondent CUS script stored in the HCSS database for each functional test. These CUS scripts will generate the appropriate command sequence for the particular functional test.

Step #	Procedure Name	Purpose	Duration/min
1.	SPIRE-IST-COLD-DPU-ON-P	DPU PRIME Power up and OBS start	5
2.	SPIRE-IST-COLD-DRCU-ON-P	DRCU PRIME Power up	4
3.	SPIRE-IST-COLD-SCU-03-P	SCU PRIME DC Thermometry check	8
4.	SPIRE-IST-COLD-SCU-06-P	SCU PRIME AC Thermometry check	2
5.	SPIRE-IST-COLD-FUNC-MCU-01-P	MCU Boot Check PRIME	5
6.	SPIRE-IST-COLD-FUNC-MCU-03-P	MCU Nom. Science Contents Check PRIME	5
7.	SPIRE-IST-COLD-FUNC-SMEC-01-P	SMEC Encoder and LVDT check PRIME	5
8.	SPIRE-IST-COLD-FUNC-SMEC-03-P	SMEC Encoder Levels Check PRIME	5
9.	SPIRE-IST-COLD-FUNC-SMEC-02A-P	SMEC Open Launch Latch PRIME	5
10.	SPIRE-IST-COLD-FUNC-SMEC-FFOFFSET-P	SMEC (PRIME) Open Loop Feed Forward Offset Test	15
11.	SPIRE-IST-COLD-FUNC-SMEC-FFGAIN-P	SMEC (PRIME) Open Loop Feed Forward Gain Test	100
12.	SPIRE-IST-COLD-FUNC-SMEC-04A-P	SMEC Open Loop Position check PRIME	5
13.	SPIRE-IST-COLD-FUNC-SMEC-09-P	SMEC Open Loop Scan check PRIME	5
14.	SPIRE-IST-COLD-FUNC-SMEC-07-P	SMEC Close Loop Scan check PRIME	10

15.	SPIRE-IST-COLD-FUNC-SMEC-04B-P	SMEC Close Loop Position check PRIME	10
16.	**SPIRE-IST-SMEC-RAMP-MICROVIBRATION-TEST**	**SMEC variable frequency microvibration test**	**70**
~~17.~~	~~SPIRE-IST-COLD-FUNC-SMEC-LVDT-P~~	~~SMEC Backup LVDT Close Loop Check PRIME~~	~~90~~
18.	SPIRE-IST-COLD-FUNC-SMEC-02B-P	SMEC Close Launch Latch PRIME	5
19.	SPIRE-IST-COLD-SMEC-OFF-P	SMEC switch OFF PRIME	5
20.	SPIRE-IST-COLD-MCU-OFF-P	MCU switch OFF PRIME	2
21.	SPIRE-IST-COLD-SCU-OFF-P	SCU switch OFF PRIME	2
22.	SPIRE-IST-COLD-DRCU-OFF-P	DRCU power OFF PRIME	5
23.	SPIRE-IST-COLD-DPU-OFF-P	DPU power OFF PRIME	5
24.	SPIRE-IST-COLD-LPU-01-P	Checkout of LPU PRIME	5
25.	**Change the SPIRE I-EGSE setup for the Standalone SMEC Functional Tests (Redundant side)**		**15**
26.	**Change the CCS setup for the Standalone SMEC Functional Tests (Redundant side)**		**To be specified by CCS**
27.	**Configure 1553 Spacecraft bus from SPIRE DPU PRIME to SPIRE DPU REDUNDANT.**		**To be specified by CCS**
28.	SPIRE-IST-COLD-DPU-ON-R	DPU REDUN. Power up and OBS start	5
29.	SPIRE-IST-COLD-DRCU-ON-R	DRCU REDUN. Power up	4
30.	SPIRE-IST-COLD-SCU-03-R	SCU REDUN. DC Thermometry check	8
31.	SPIRE-IST-COLD-SCU-06-R	SCU REDUN. AC Thermometry check	2
32.	SPIRE-IST-COLD-FUNC-MCU-01-R	MCU Boot Check REDUN.	5
33.	SPIRE-IST-COLD-FUNC-MCU-03-R	MCU Nom. Science Contents Check REDUN.	5
34.	SPIRE-IST-COLD-FUNC-SMEC-01-R	SMEC Encoder and LVDT check REDUN.	5
35.	SPIRE-IST-COLD-FUNC-SMEC-03-R	SMEC Encoder Levels Check REDUN.	5
36.	SPIRE-IST-COLD-FUNC-SMEC-02A-R	SMEC Open Launch Latch REDUN.	5
37.	SPIRE-IST-COLD-FUNC-SMEC-FFOFFSET-R	SMEC (REDUNDANT) Open Loop Feed Forward Offset Test	15
38.	SPIRE-IST-COLD-FUNC-SMEC-FFGAIN-R	SMEC (REDUNDANT) Open Loop Feed Forward Gain Test	100
39.	SPIRE-IST-COLD-FUNC-SMEC-04A-R	SMEC Open Loop Position check REDUN.	5
40.	SPIRE-IST-COLD-FUNC-SMEC-09-R	SMEC Open Loop Scan check REDUN.	5
41.	SPIRE-IST-COLD-FUNC-SMEC-07-R	SMEC Close Loop Scan check REDUN.	10
42.	SPIRE-IST-COLD-FUNC-SMEC-04B-R	SMEC Close Loop Position check REDUN.	10
~~43.~~	~~SPIRE-IST-COLD-FUNC-SMEC-LVDT-P~~	~~SMEC Backup LVDT Close Loop Check REDUN.~~	~~90~~

44.	SPIRE-IST-COLD-FUNC-SMEC-02B-R	SMEC Close Launch Latch REDUN.	5
45.	SPIRE-IST-COLD-SMEC-OFF-R	SMEC switch OFF REDUN.	5
46.	SPIRE-IST-COLD-MCU-OFF-R	MCU switch OFF REDUN.	2
47.	SPIRE-IST-COLD-SCU-OFF-R	SCU switch OFF REDUN.	2
48.	SPIRE-IST-COLD-DRCU-OFF-R	DRCU power OFF REDUN.	5
49.	SPIRE-IST-COLD-DPU-OFF-R	DPU power OFF REDUN.	5
50.	SPIRE-IST-COLD-LPU-01-R	Checkout of LPU REDUN.	5
Total Duration ~ 8-9 Hours (plus time needed by the CCS to switch from Prime to Redundant)			

3.3 DETAILED TEST PROCEDURE

The following is a detailed (test by test) procedure including the steps required to perform each functional test individually.

3.3.1 SPIRE-IST-COLD-DPU-ON-P

Version	2.4
Date	6th December 2007
Purpose	To switch on the SPIRE DPU PRIME and start generating housekeeping
Initial configuration	SPIRE DPU and DRCU PRIME are switched off
Final configuration	SPIRE DPU PRIME is ON and SPIRE HK is being produced , SPIRE DRCU PRIME is OFF
Preconditions	• SPIRE FM DPU is electrically integrated with the Herschel Satellite • SPIRE MIB PRIME is imported in the CCS database. • CCS is up and running • FUNCTIONAL TEST PARAMETERS display is selected on the CCS
Duration	5 minutes
Pass/Fail Criteria	Nominal and critical HK reports start being generated at their nominal rates of 1Hz and 0.5Hz respectively.

Procedure Steps:

Step	Description	Parameter	Expected Values Before/After	Actual Values Before/After	Pass/ Fail
1	Select DPU AND OBS PARAMETERS display is on the CCS	—	—	—	**Pass**
2	**Power ON the SPIRE DPU PRIME unit using the dedicated spacecraft LCL line and configure 1553 Spacecraft bus for SPIRE DPU PRIME (RT = 21)**	—	—	—	**Pass**
3	Wait for the boot software to produce at least 2 event packets (5,1)	—	—	—	**Pass**
4	Execute TCL script SPIRE-IST-COLD-DPU-START-P.tcl	—	—	—	**Pass**
5	Check that Nominal and Critical HK packets are arriving at the CCS: **SPIRE Nominal HK:** • (type ,subtype) : (3,25) • APID : 0x502 **SPIRE Critical HK:** • (type ,subtype) : (3,25) • APID: 0x500	—	—	—	**Pass**
6	Check that THSK parameter is refreshing every second	THSK	Refreshing @ 1 Hz	—	**Pass**
7	Check that TM2N parameter is incrementing by 1 every second	TM2N	Incrementing by 1 @ 1Hz	—	**Pass**
8	Check that TM1N parameter is incrementing by 1 every 2 second	TM1N	Incrementing by 1 @ 0.5Hz	—	**Pass**
9	**On CCS check the consistency of the SPIRE on board time to the HCDMU time and the CCS.** *	—	—	—	**Pass**
10	On I-EGSE check the consistency between SCOS time and THSK and QLA time.	THSK	Incrementing once per second	—	**Pass**
Test Result (Pass/Fail): **Pass** **– Booted from the secondary partition**					

** Assuming that OBT is provided by the HCDMU following RD02, i.e, OBT is TAI, there should be a 33 second difference between OBS and CCS time (assuming CCS is using UTC). In the case the HCDMU is using UTC to specify the on board time, there should be no difference between THSK and the CCS/I-EGSE system time.*

3.3.2 SPIRE-IST-COLD-DRCU-ON-P

Version	2.4
Date	6th December 2007
Purpose	To switch on the SPIRE DRCU PRIME and start generating housekeeping
Initial configuration	SPIRE DPU PRIME is ON and DRCU PRIME is switched OFF
Final configuration	SPIRE DPU and DRCU PRIME are ON and SPIRE HK is being produced
Preconditions	• SPIRE FM DRCU is electrically integrated with the Herschel Satellite • SPIRE DRCU is switched OFF • SPIRE MIB PRIME is imported in the CCS database. • CCS is up and running • FUNCTIONAL TEST PARAMETERS display is selected on the CCS
Duration	5 minutes
Pass/Fail Criteria	DRCU voltages show expected ‘ON’ values

Procedure steps:

Step	Description	Parameter	Expected Values Before/After	Actual Values Before/After	Success/ Failure
1	Execute TCL script SPIRE-IST-COLD-DRCU-START-P-STEP1.tcl	—	—	—	**Pass**
2	Check that THSK parameter is not refreshing anymore	THSK	Not refreshing	—	**Pass**
3	Check that TM2N parameter is not incrementing anymore	TM2N	Not incrementing	—	**Pass**
4	**Power ON the SPIRE DRCU PRIME unit using the dedicated spacecraft LCL line.**	—	—	—	**Pass**
5	Execute TCL script SPIRE-IST-COLD-DRCU-START-P-STEP2.tcl Note: The two TCs to clear the SPIRE Critical and Nominal HK reports will fail during execution of this script. These should be ignored because the HK reports will already have been cleared by script SPIRE-IST-COLD-DRCU-START-P-STEP1.tcl	—	—	—	**Pass**
6	Check that THSK parameter is again refreshing every second	THSK	Refreshing @ 1Hz	—	**Pass**
7	Check that TM2N parameter is again incrementing every second	TM2N	Incrementing by 1 @ 1Hz	—	**Pass**
8	Check that the SCU/DCU voltages show nominal values	SCUP5V SCUP9V SCUM9V BIASP5V BIASP9V BIASM9V	~ 5.2 ± 0.5V ~ 9.0 ± 0.2V ~ -9.0 ± 0.2V ~ 5.1 ± 0.5V ~ 9.0 ± 0.2V ~ -9.0 ± 0.2V	5.239V 9.087V -9.081V 5.18V 8.99V -9.05 **BIASTEMP 295.55K**	**Pass**
Test Result (Pass/Fail): Pass					

3.3.3 SPIRE-IST-COLD-FUNC-SCU-03-P

Test Id:	SPIRE-IST-COLD-FUNC-SCU-03-P
Test Purpose:	FPU DC Thermometry Check
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON
Duration	8 minutes (CUS = 28 seconds)
Success Criteria:	Test passed if thermometry channels show temperature values indicating a correct functioning of the sensor, not open/short-circuited. If ANY reading is anomalous check RAW sensor reading. **Open Circuit Criterion:** **RAW reading in the range [0, -100]** **Short Circuit Criterion:** **RAW reading of -32768**
CUS Parameters	CUS parameter dcparam = 0xffff = 65535

Test Procedure:

Step#	Action
1	Run QLA script FUNC-SCU-03.py on QLA console.
2	Run SPIRE-IST-COLD-FUNC-SCU-03-P.tcl test procedure from the CCS.
3	Contingency: If test fails: 1. Execute SCU_OFF procedure. 2. Execute SPIRE-IST-COLD-FUNC-SCU-03-P.tcl procedure. 3. Repeat step 1 of the Test Procedure.

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
FUNC-SCU-03	**SCUTEMPSTAT**	**0xFFFF/0xFFFF**	**0xFFFF/0xFFFF**	**N/A**	PASS

Start time @: 09:03
End time @:
OBSID: 0xb00010bb

Comments:
L0 ~4.49K (T225)
L1 ~9.7K (T248)
Optical Bench ~17.3K (T254)

Cryostat temperature oscillations are well damped on the SPIRE instrument side.

QLA script did not trigger

The script was run later at RAL (From qla@salisbury SPIRE Build #751, HCSS Build #1464)

```
SCU-03 Thermometry Check
OBSID = 0xb00010bb

PUMPHTRTEMP  5.24    56820
PUMPHSTEMP   6.94    53926
EVAPHSTMP    6.62    54114
SHUNTTEMP    4.57    52644
EMCFILTMP    10.21   60864
SL0TEMP      4.81    52356
PL0TEMP      4.88    52814
OPTTEMP      10.25   58487
BAFTEMP      10.75   59688
BSMIFTEMP    10.34   57406
SCAL2TEMP    10.27   58812
SCAL4TEMP    10.12   58819
SCALTEMP     10.21   58032
SMECIFTEMP   10.05   57489
SMECTEMP     10.08   46282
BSMTEMP      10.21   36084

************************************************************

FINISHED. File written to /home/qla/FuncTestData/FS1_FuncTestData/FUNC-SCU-03_B00010BB.txt
```

3.3.4 SPIRE-IST-COLD-FUNC-SCU-06-P

Test Id:	SPIRE-IST-COLD-FUNC-SCU-06-P
Test Purpose:	SCU/FPU AC Thermometry Check
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON
Duration	2 minutes (CUS: 25 seconds)
Success Criteria:	At ~ 4K the SUBKTEMP reading should calibration should start being in range. **Open Circuit Criterion:** **RAW reading in the range 0 -100** **Short Circuit Criterion:** **RAW reading of -32768**
CUS Parameters	acparam = 0x1

Test Procedure:

Step#	Action
1	Run SPIRE-IST-COLD-FUNC-SCU-06-P.tcl test procedure from the CCS.
2	Contingency: If test fails : 1. Send manual command: SEND_DRCU_COMMAND Parameter1 = 0xA0860000 Parameter2 = 0 2. Then repeat steps 1 and 2 of the Test Procedure. **Note:** **If the test fails and the SUBKTEMP channel is switched OFF manually, the expected value before/after execution of FUNC-SCU-06 for SUBKSTAT is 0/1**

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
FUNC-SCU-06	**SUBKSTAT** **SUBKTEMP**	**0/1** **He I (~4K)** **He II (~1.7K)**	0/1	**N/A**	PASS

Start time @: 09:14
End time @:
OBSID: 0xb00010bc

Comments:
SUBKTEMP ~4.83K (On SCOS)

QLA script did not trigger

The script was run later at RAL (From qla@salisbury SPIRE Build #751, HCSS Build #1464)

```
SCU-06
Start time @: 16-May 09:13:35
End time @: 16-May 09:13:47
OBSID: 0xB00010BC

SUBKSTAT:
Start value: 0x0
End value: 0x1

SUBKTEMP
RAW value before: 32757

RAW value after: 32631
Converted after: 4926 mK

Written results to file /home/qla/FuncTestData/FS1_FuncTestData/FUNC-SCU-06_B00010BC.txt
```

3.3.5 SPIRE-IST-COLD-FUNC-MCU-01-P

Test Id:	SPIRE-IST-COLD-FUNC-MCU-01-P
Test Purpose:	MCU Boot Check
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON
Duration	5 mins (CUS 64.0)
Success Criteria:	Test passed if: 1. MCU boots. 2. MCU voltages show expected values. 3. MAC Board Temperature Reading shows ambient temperature.

Test Procedure:

Step#	Action
1	Run SPIRE-IST-COLD-FUNC-MCU-01-P test procedure from the CCS.
2	When procedure is finished, write down the values of the MCU voltages.
3	Contingency: If test fails repeat steps 1 and 2.

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
SPIRE-IST-COLD-FUNC-MCU-01-P	**MCUP5V** **MCUP15V** **MCUP14V** **MCUM14V** **MCUM15V** **MCUMACTEMP** **MCUBSMTEMP** **MCUSMECTEMP**	**N/A/ ~ 5V** **N/A / ~15V** **N/A / ~ 14V** **N/A / ~ -14V** **N/A / ~ -15V** **N/A / ~ 300K** **N/A / ~ 300K** **N/A / ~ 300K**	5.01 V 15.54 V 14.15V -14.46 V -15.63 V 292.47 K 297.26 K 296.91 K	**N/A**	PASS

Start time @: 09:18

OBSID: 0xb00010BD
Comments:
MCU booted OK

3.3.6 SPIRE-IST-COLD-FUNC-MCU-03-P

Test Id:	SPIRE-IST-COLD-FUNC-MCU-03-P
Test Purpose:	MCU Nominal Science Generation Check
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON
Duration	5 mins (CUS 69.0)
Success Criteria:	Test passed if : 1. MCU produces each type of the frames requested and with the following characteristics. 2. No events are generated during the different frames generation.

Frame	APID	Type	Subtype	SID	FrameID	Frame length
Eng.	**0x508**	**21**	**3**	**0x814**	**0x14**	**0x15**
BSM	**0x508**	**21**	**1**	**0x612**	**0x12**	**0xD**
SMEC	**0x508**	**21**	**1**	**0x410**	**0x10**	**0xC**
BSM +SMEC						

CUS Parameters	n_eng_frames = 100; //number of engineering frames
	f_eng_frames = 64.1; //frequency of engineering frames generation
	n_smec_frames = 100; //number of smec frames
	f_smec_frames = 250.0; //frequency of smec frames generation
	n_bsm_frames = 100; //number of bsm frames
	f_bsm_frames = 64.1; //frequency of bsm frames generation
	ftime = 10; //time for continuous generation

Test Procedure:

Step#	Action
1	Write down the current value of MCUFRAMECNT located in MCU_PARAMETERS display
2	Run SPIRE-IST-COLD-FUNC-MCU-03-P test procedure from the CCS.
3	When test is finished Write down the current value of MCUFRAMECNT.
4	Contingency: If test fails repeat steps 1 to 4.

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
SPIRE-IST-COLD-FUNC-MCU-03-P.tcl	**MCUFRAMECNT**	**0/ ~ 297**	**0 / 297**		**Pass**

Start time @: 09:25
End time @:
OBSID: 0xb00010be

Comments: QLA script failed both on the I-EGSE and at RAL on qla@salisbury.

CVS version of script: # $Id: FUNC-MCU-03.py,v 1.9 2007/01/31 17:47:11

Error on the I-EGSE:

```
QLA-MCU-03: executing start
AttributeError: module 'library' has no attribute 'ClockGui'
```

Error on Salisbury:

```
QLA-MCU-03: starting to gather data at e,h 0.0 1.5896210739348602E9
04-Jun-08 14:11:45.860 Controller: Adding data listener, StateMonitor for
BBFULLTYPE=35073,STEP=65535, will call back <function end_test1 at 22723359>
04-Jun-08 14:11:45.861 Controller$Monitor: callback complete
04-Jun-08 14:11:46.944 Controller$Monitor: firing event... callback is <function end_test1
at 22723359>...
In end test 1
0 0
0.0 0.0 1.5896210739348602E9 1.5896210739348602E9
Science Data04-Jun-08 14:11:46.990 PacketReceiver: java.lang.RuntimeException: Exception
dispatching data event: Traceback (innermost last):
  File "<string>", line 278, in end_test1
java.lang.IllegalArgumentException: Cannot handle time before 1972 UTC
        at herschel.share.fltdyn.time.LeapSeconds.checkTai(LeapSeconds.java:149)
        at
herschel.share.fltdyn.time.LeapSeconds.compressLeapSeconds(LeapSeconds.java:212)
        at herschel.share.fltdyn.time.DateConverter.fineTimeToDate(DateConverter.java:69)
        at herschel.share.fltdyn.time.FineTime.toDate(FineTime.java:86)
        at herschel.spire.qla.Timeline.taiToDate(Timeline.java:238)
        at sun.reflect.NativeMethodAccessorImpl.invoke0(Native Method)
        at sun.reflect.NativeMethodAccessorImpl.invoke(NativeMethodAccessorImpl.java:39)
        at
sun.reflect.DelegatingMethodAccessorImpl.invoke(DelegatingMethodAccessorImpl.java:25)
        at java.lang.reflect.Method.invoke(Method.java:585)
        at org.python.core.PyReflectedFunction.__call__(PyReflectedFunction.java)
        at org.python.core.PyReflectedFunction.__call__(PyReflectedFunction.java)
        at org.python.core.PyObject.__call__(PyObject.java)
        at org.python.core.PyObject.invoke(PyObject.java)
        at org.python.pycode._pyx60.end_test1$4(<string>:278)
        at org.python.pycode._pyx60.call_function(<string>)
        at org.python.core.PyTableCode.call(PyTableCode.java)
        at org.python.core.PyTableCode.call(PyTableCode.java)
        at org.python.core.PyFunction.__call__(PyFunction.java)
        at org.python.core.PyObject.__call__(PyObject.java)
        at herschel.spire.qla.Controller$Monitor.fireEvent(Controller.java:59)
        at herschel.spire.qla.Controller$Monitor.stateChanged(Controller.java:52)
        at herschel.spire.qla.Controller.fireDataEvent(Controller.java:299)
        at herschel.spire.qla.DataAccumulator.dispatchEvent(DataAccumulator.java:350)
        at herschel.spire.qla.DataAccumulator.packetReceived(DataAccumulator.java:343)
        at herschel.spire.qla.Controller.firePacketEvent(Controller.java:288)
        at herschel.spire.qla.PacketReceiver.process(PacketReceiver.java:80)
        at herschel.access.util.DataSelector.processAllData(DataSelector.java:835)
        at herschel.access.util.DataSelector$OpenHandler.run(DataSelector.java:361)
        at java.lang.Thread.run(Thread.java:595)
```

3.3.7 SPIRE-IST-COLD-FUNC-SMEC-01-P

Test Id:	SPIRE-IST-COLD-FUNC-SMEC-01-P
Test Purpose:	SMEC Switch ON Check. Encoder and LVDT alive check.
Initial Configuration:	DRCU_ON + AC/DC thermometry ON +MCU ON+ SMEC ON (open loop)
Final Configuration:	DRCU_ON + AC/DC thermometry ON +MCU ON+ SMEC ON (open loop)
Duration	5 Minutes (CUS 40 seconds)
Success Criteria:	Test passed if : 1. SMECENCPWR HK parameter changes from 0 to 4. 2. SMEC encoder signals 1 and 2 show variation when encoder is switched ON. 3. SMEC LVDT is switched ON. 4. SMEC LVDT DC and AC signals show variation when LVDT is switched ON.

Test Procedure:

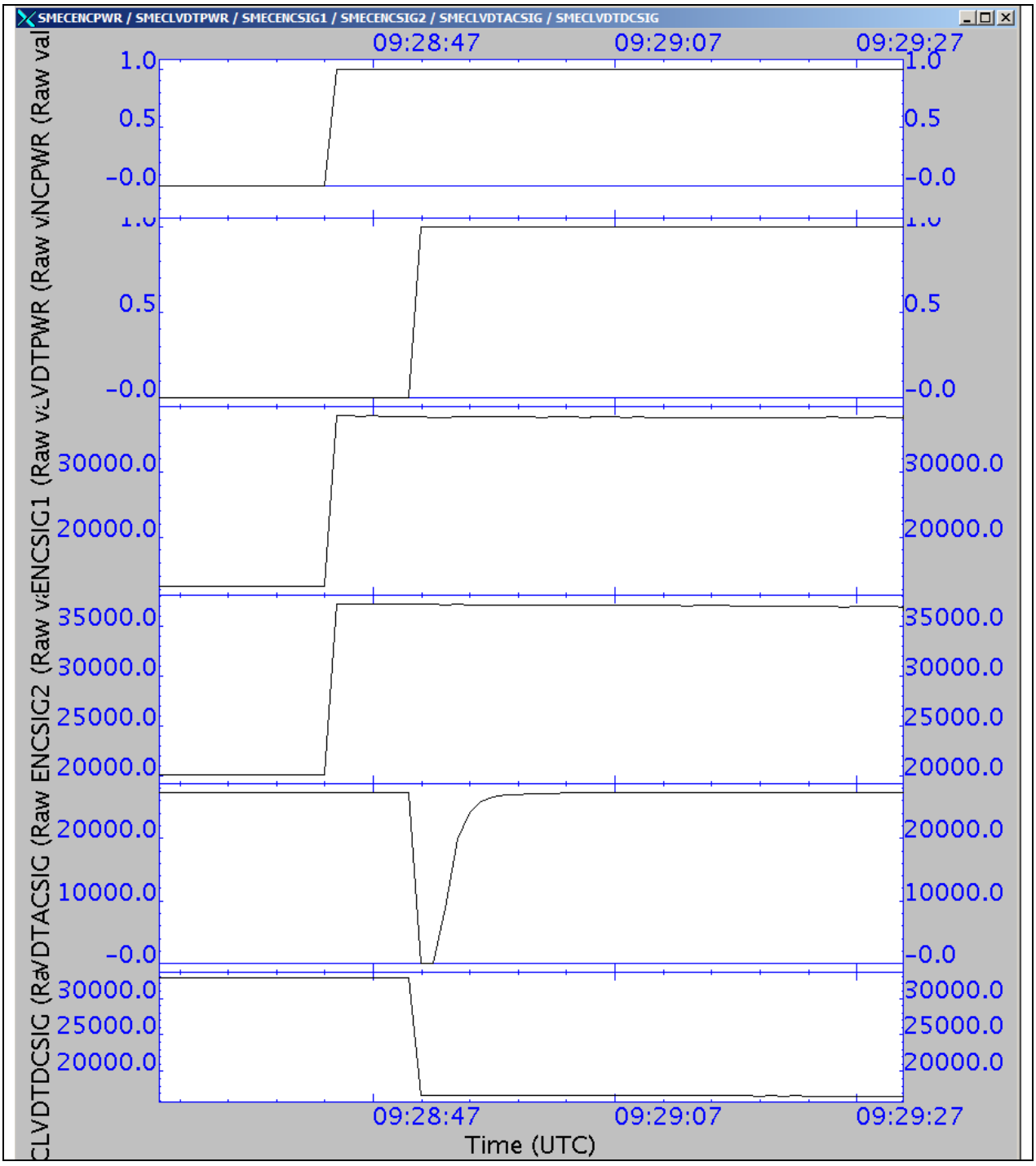
Step#	Action	Comments
1	Run FUNC-SMEC-01.py script on QLA	
2	Run SPIRE-IST-COLD-FUNC-SMEC-01-P test procedure from the CCS.	
3	Contingency: If test fails repeat steps 1.	

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
SPIRE-IST-COLD-FUNC-SMEC-01-P	SMECENCPWR SMECLVDTPWR SMECENCSIG1 SMECENCSIG2	0/-/1 0/-/1		N/A	Pass

Start time @: 09:29
End time @:
OBSID: 0xb00010BF

Comments:


SMECENCPWR / SMECLVDTPWR / SMECENCSIG1 / SMECENCSIG2 / SMECLVDTACSIG / SMECLVDTDCSIG
09:28:47
09:29:07
09:29:27
Time (UTC)

3.3.8 SPIRE-IST-COLD-FUNC-SMEC-03-P

Test Id:	SPIRE-IST-COLD-FUNC-SMEC-03-P
Test Purpose:	SMEC (PRIME) Encoder Integrity Check.
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON+ SMEC ON (open loop)
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON+ SMEC ON (open loop)
Duration	5 minutes (CUS: 49 seconds)
Success Criteria:	Test passed if: SMEC encoder signals 1 and 2 show a variation on their amplitudes from one LED illumination level to another. (i.e. MCUENGSMECENCSIG1/2 increase as the encoder power is increased.)

CUS Parameters	frametype = "ENG"; // Specifies MCU frame type [BSM,SMEC,BSM+SMEC,ENG,TEST]
	framerate = 64.0; // Specifies the frame rate
	framenumber = 0xffff; // Frame number
	level_init = 1; //
	level_start = 1;
	level_end = 3;
	level_step = 1;
	led_delay = 5; // Time at each level in seconds

Test Procedure:

Step#	Action
1	**Run FUNC-SMEC-03.py script on QLA**
2	**Run SPIRE-IST-COLD-FUNC-SMEC-03-P test procedure from the CCS.**
3	Contingency: If test fails repeat steps 1 and 2.

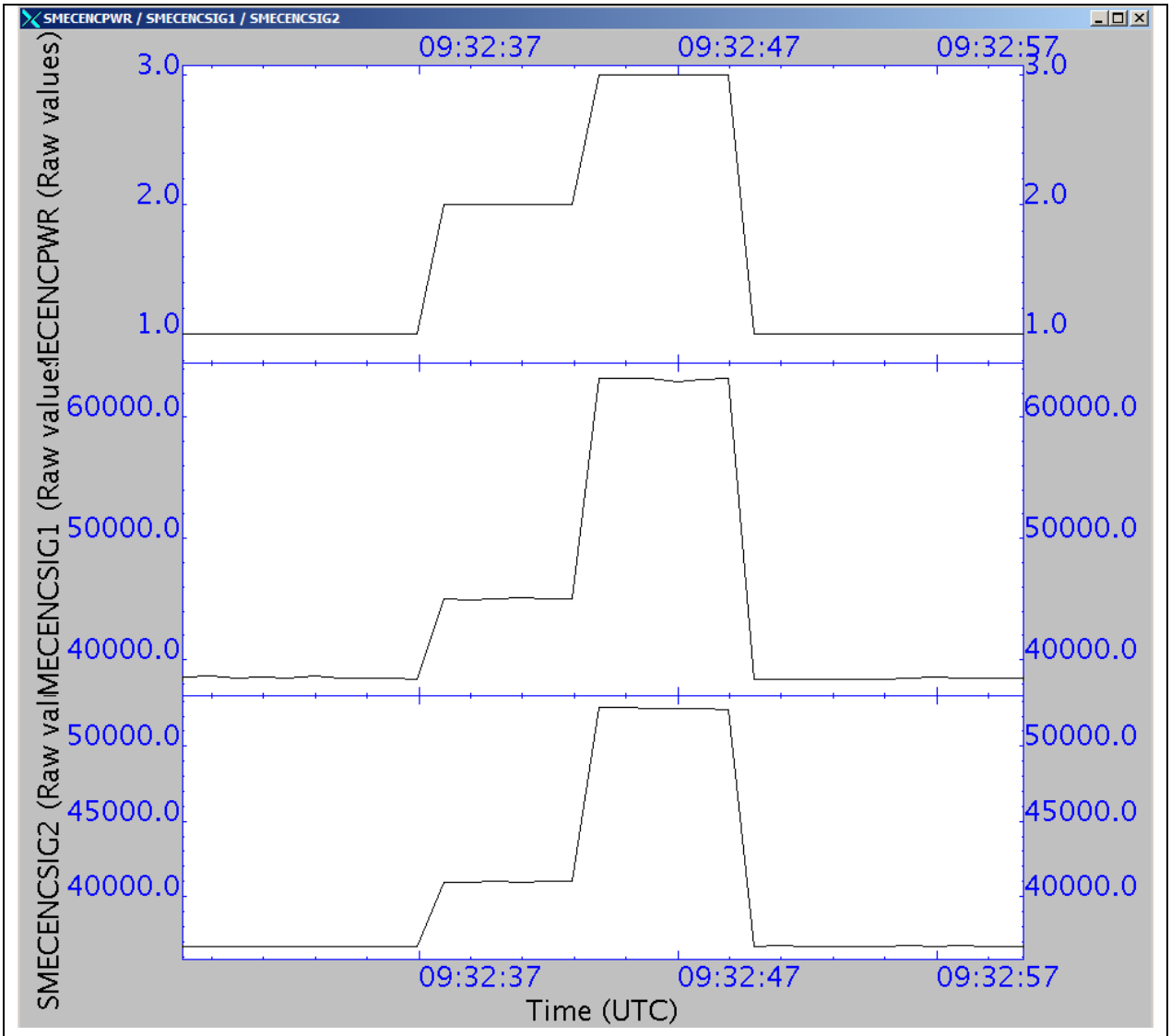
Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
SPIRE-IST-COLD-FUNC-SMEC-03-P	**SMECENCPWR SMECENCSIG1 SMECENCSIG2**		See plots below		**Pass**

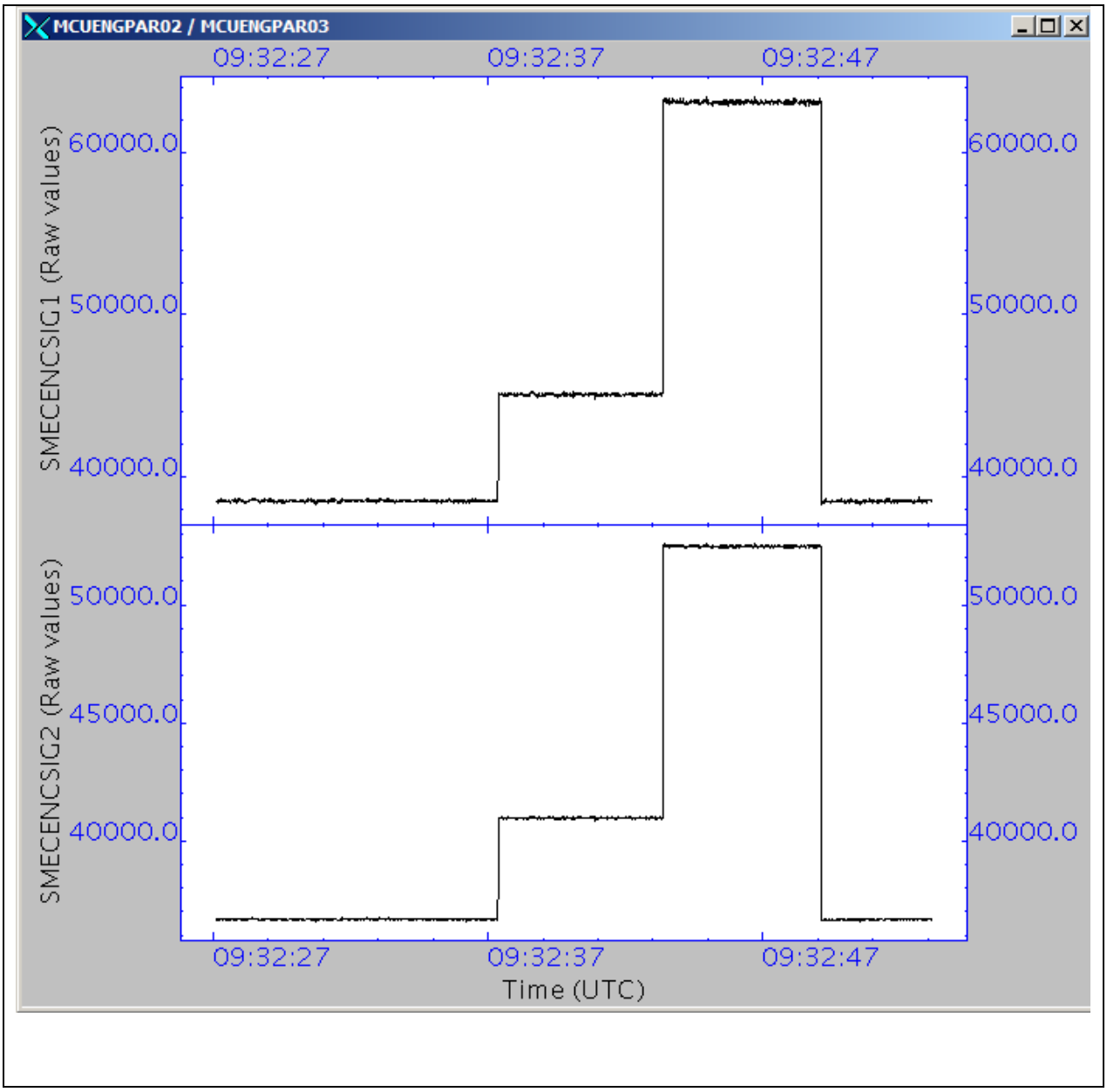
Start time @: 09:32
End time @:
OBSID: 0xb00010C0

Comments: Encoder signals 1 & 2 both remain below saturation level for power levels 1 to 3.

HK plot:



MCU Engineering data plot:


MCUENGPAR02 / MCUENGPAR03
09:32:27
09:32:37
09:32:47
SMECENCSIG1 (Raw values)
60000.0
50000.0
40000.0
SMECENCSIG2 (Raw values)
50000.0
45000.0
40000.0
Time (UTC)

3.3.9 SPIRE-IST-COLD-FUNC-SMEC-02A-P

Test Id:	SPIRE-IST-COLD-FUNC-SMEC-02A-P
Test Purpose:	SMEC (PRIME) Open Launch Latch Check.
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON+ SMEC ON (open loop) SMEC latched
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON+ SMEC ON (open loop) SMEC unlatched
Duration	5 minutes (CUS 38 seconds)
Success Criteria:	Test passed if: SMEC moves after SMEC is unlatched. The script tries to move the SMEC to 20mm in open loop at 0.5mm/s.
CUS Parameters	string ltch = "unlatch"; // Command SMEC to unlatch

Test Procedure:

Step#	Action
1	**Use QLA plot time series of MCU engineering parameters** **MCUENGPAR01 – SMECENCPOSN** **MCUENGPAR02 – SMECENCSIG1** **MCUENGPAR03 – SMECENCSIG2** **MCUENGPAR05 – SMECLVDTDCSIG** **MCUENGPAR07 – SMECMOTORCURR** **MCUENGPAR13 – SMECDACVAL** **MCUENGPAR14 – SMECLVDTPOSN** **The same parameters can also be plotted from the nominal HK packet.**
2	**Run SPIRE-IST-COLD-FUNC-SMEC-02A-P test procedure from the CCS.**
3	Contingency: If test fails repeat steps 1 and 2.

Test Log:

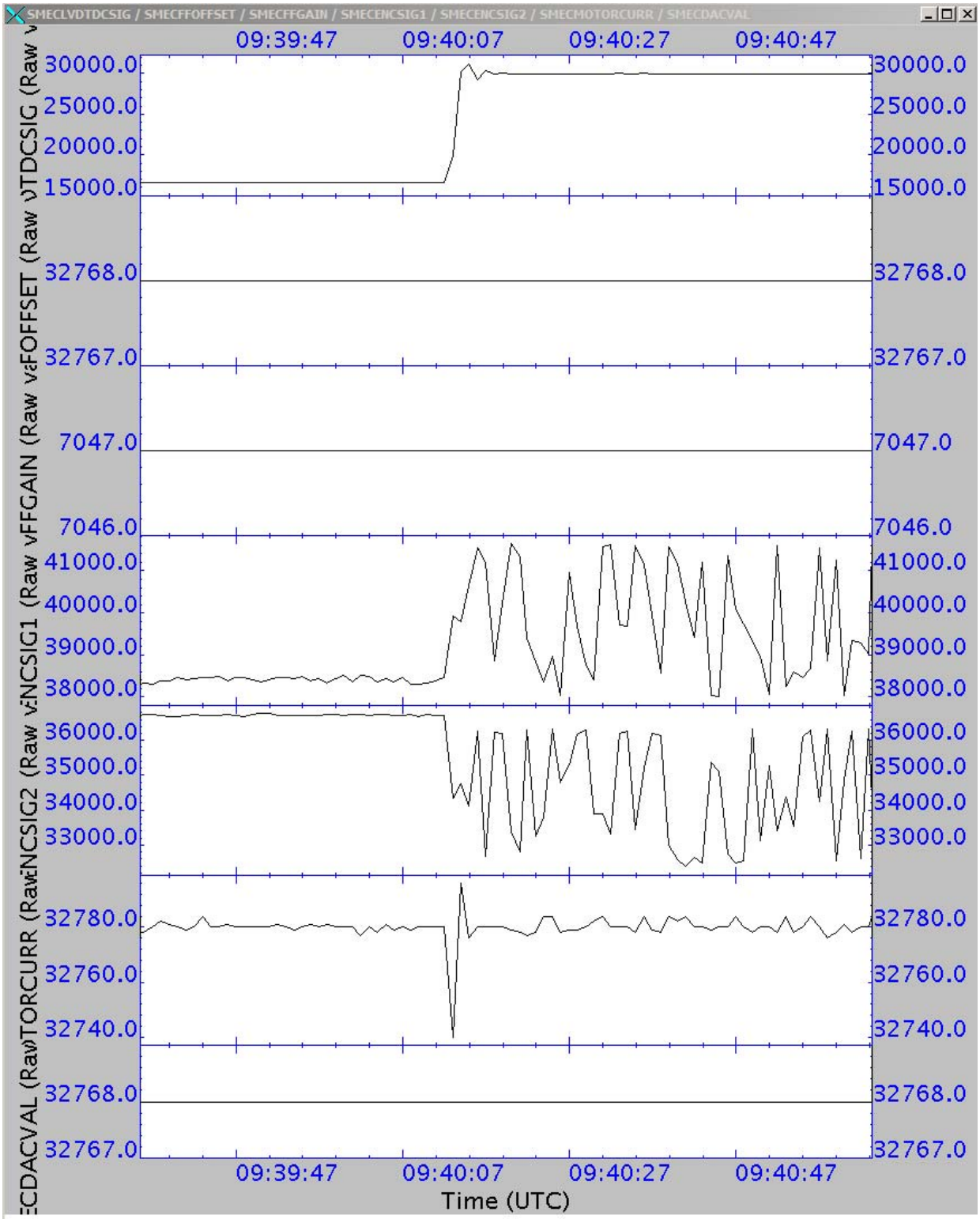
Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
SPIRE-IST-COLD-FUNC-SMEC-02A-P	**SMECENCPWR SMECENCSIG1 SMECENCSIG2**		See plots below		**Pass**

Start time @: 09:40
End time @:
OBSID: 0xb00010C1

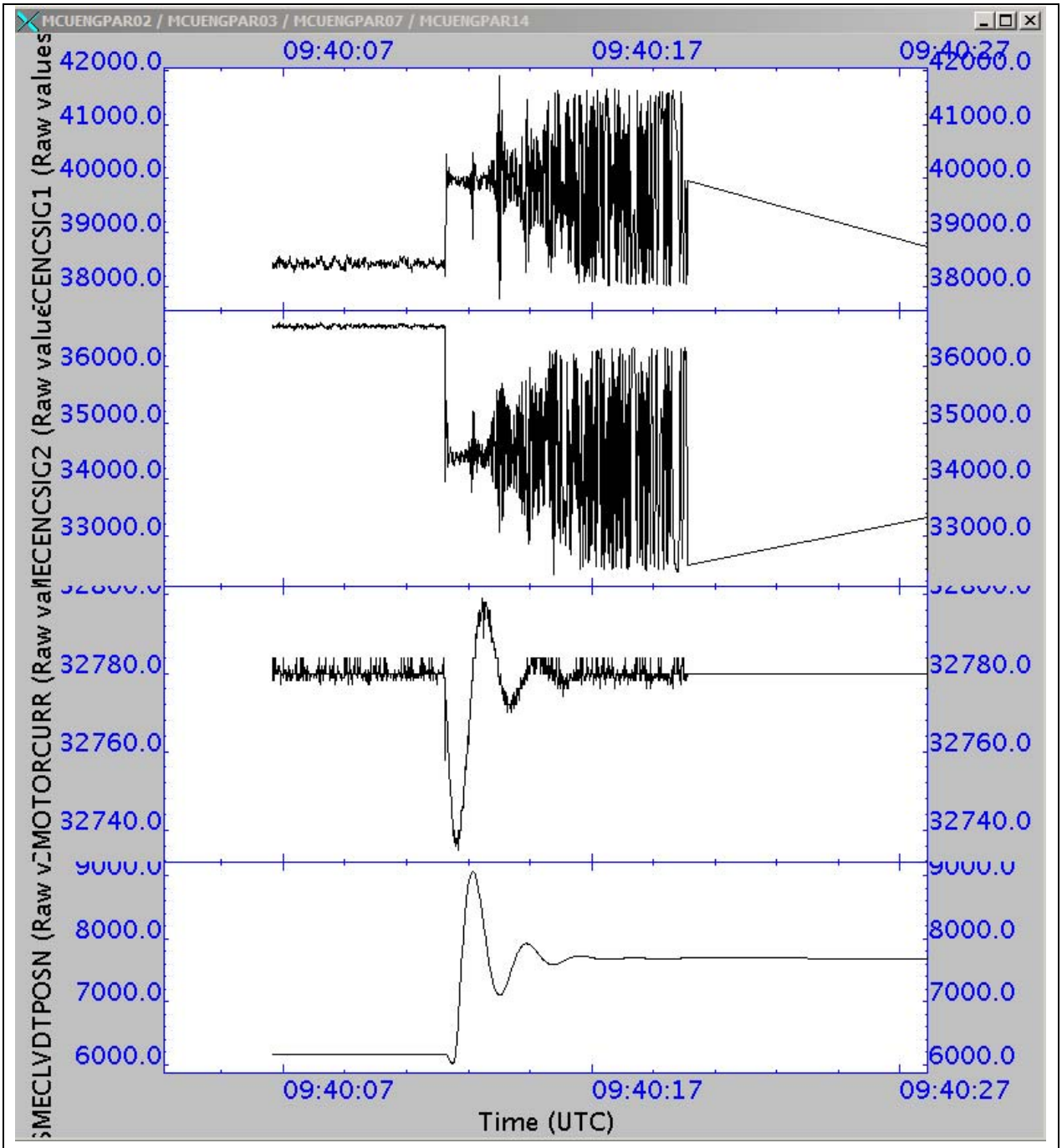
Comments: SMECLVDTPOSN has changed from ~6000 to ~7500 with a damped oscillation

The RELEASE_LATCH command SCL03515 was sent at 09:40:41 (CCS TC History Display)

HK plot:



MCU Engineering data plot:



Post-test comment: These plots clearly show that the mechanism is unlatched.

From the SMECLVDTDCSIG & SMECLVDTPOSN there is no evidence of sticking.

At equilibrium (when SMECMOTORCURR is 0 mA, ~0x8000 raw) SMECLVDTPOSN is 7.687mm and SMECLVDTDCSIG is ~30005.

3.3.10 SPIRE-IST-COLD-FUNC-SMEC-FFOFFSET-P

Test Id:	SPIRE-IST-COLD-FUNC-SMEC-FFOFFSET-P
Test Purpose:	SMEC (PRIME) Open Loop Feed Forward Offset Test
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON+ SMEC ON (open loop)
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON+ SMEC ON (open loop)
Duration	10-15 minutes (CUS: 283 seconds)
Success Criteria:	Test passed if: MCU engineering data allow the SMEC FF offset to be determined

CUS Parameters	string frametype = "ENG"; // Specifies MCU frame type
	double framerate = 250.0; // Specifies the frame rate
	int ftime = 120; // Time allowed for the SMEC position to stabilise after setting the FF offset

Test Procedure:

Step#	Action
1	**Use QLA plot time series of MCU engineering parameters** **MCUENGPAR02 – SMECENCSIG1** **MCUENGPAR03 – SMECENCSIG2** **MCUENGPAR05 – SMECLVDTDCSIG** **MCUENGPAR07 – SMECMOTORCURR** **MCUENGPAR13 – SMECDACVAL** **MCUENGPAR14 – SMECLVDTPOSN** **The same parameters can also be plotted from the nominal HK packet.**
2	**Run SPIRE-IST-COLD-FUNC-SMEC-FFOFFSET-P test procedure from the CCS.**
3	Contingency: If test fails repeat steps 1 and 2.

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
SPIRE-IST-COLD-FUNC-SMEC-FFOFFSET-P	See plots below				**Pass**

Start time @: 09:45
End time @:
OBSID: 0xb00010c2

Comments: At the time of the test it appeared that there was no significant change in the SMECLVDTPOSN.

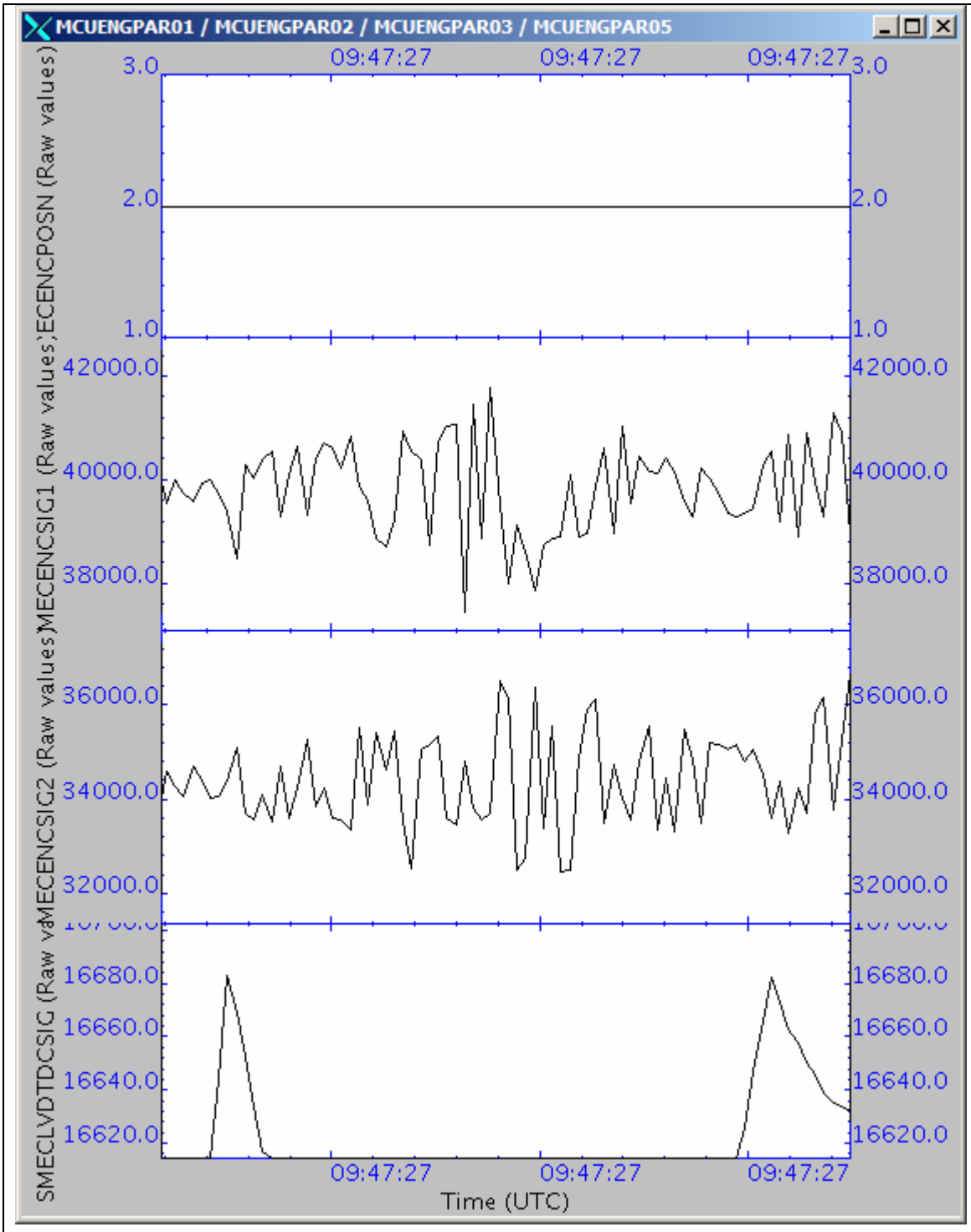
SMECMOTORCURR remained at ~-99mA. Will need to change the script to set it to zero as the temperatures are slowly increasing.

Set the SMEC FF offset to zero:

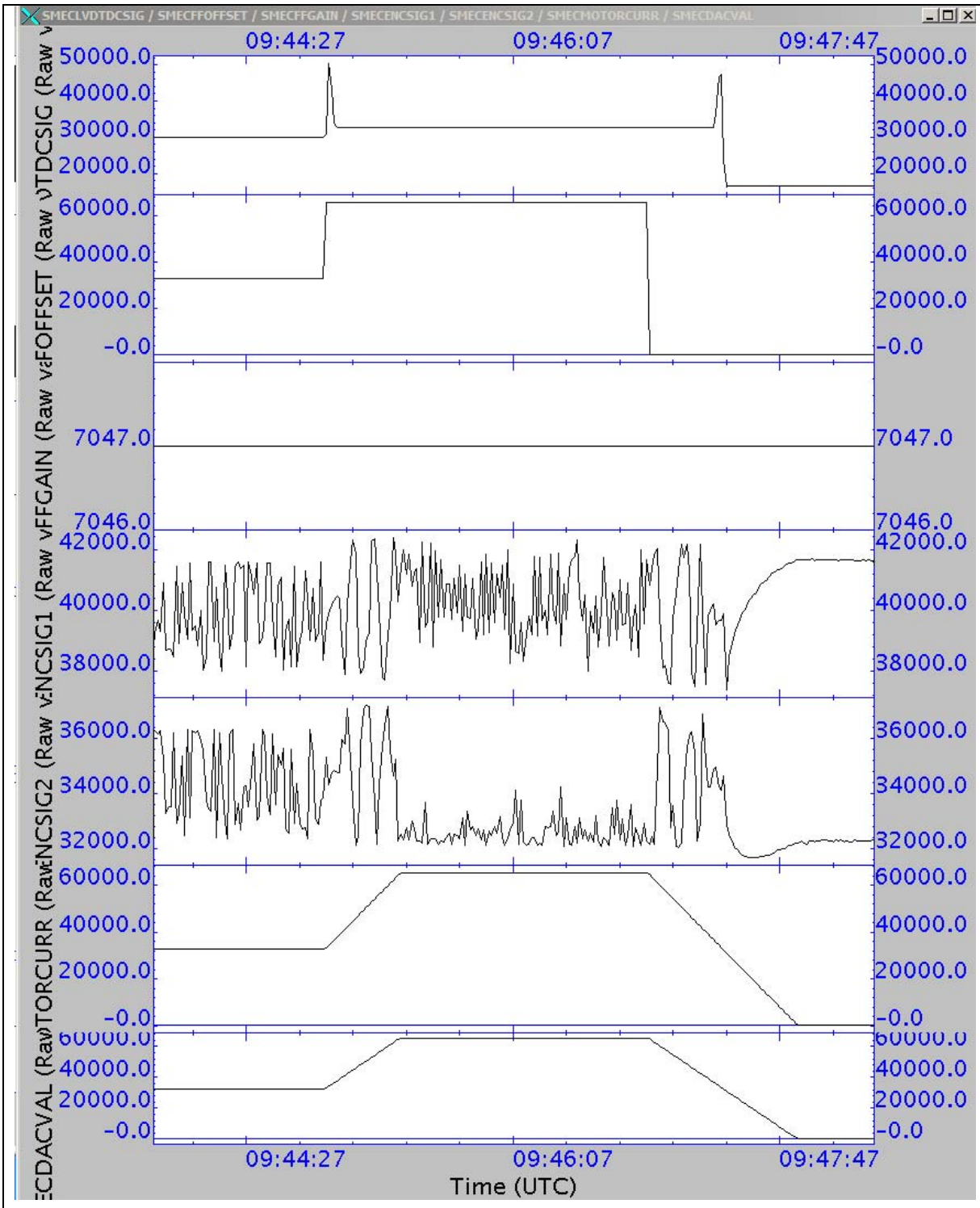
10:02:35: SEND_DRCU_COMMAND(0x90558000)

Post-test plots below show that the SMEC moved freely. The SMEC LVDT position and encoder signals changed as expected.

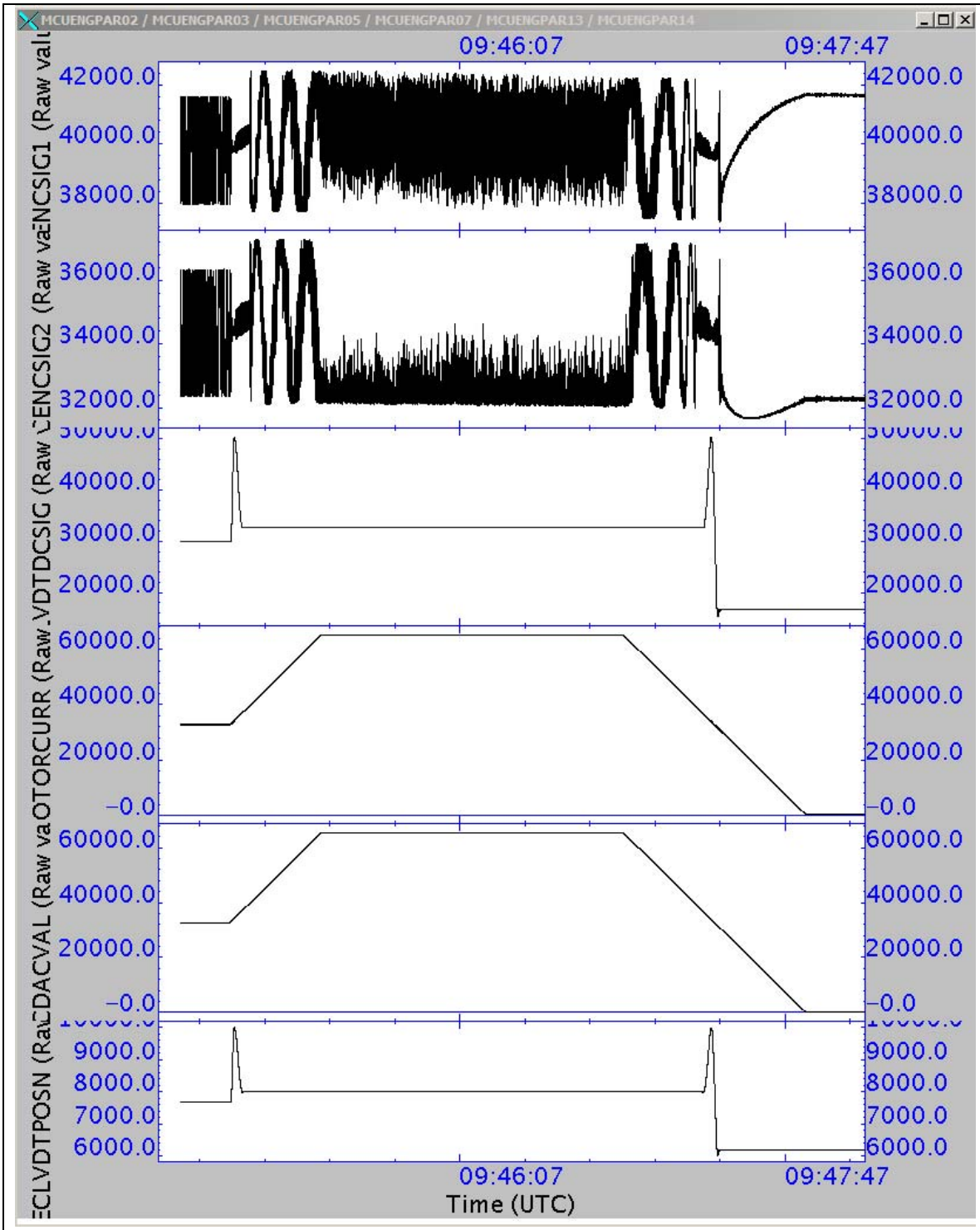
The hitting of the end stop by the SMEC shows no evidence of sticking. See the zoomed plot below of SMECLVDTDCSIG at rebound. From this plot we can deduce the value of SMECFFOFFSET from the SMECDACVAL. The SMECFFOFFSET should be ~30900 (0x78B4).


MCUENGPAR01 / MCUENGPAR02 / MCUENGPAR03 / MCUENGPAR05
09:47:27
09:47:27
09:47:27
3.0
2.0
1.0
42000.0
40000.0
38000.0
36000.0
34000.0
32000.0
16680.0
16660.0
16640.0
16620.0
SMECLVDTDCSIG (Raw values)
MECENCSIG2 (Raw values)
MECENCSIG1 (Raw values)
ECENCPOSN (Raw values)
Time (UTC)

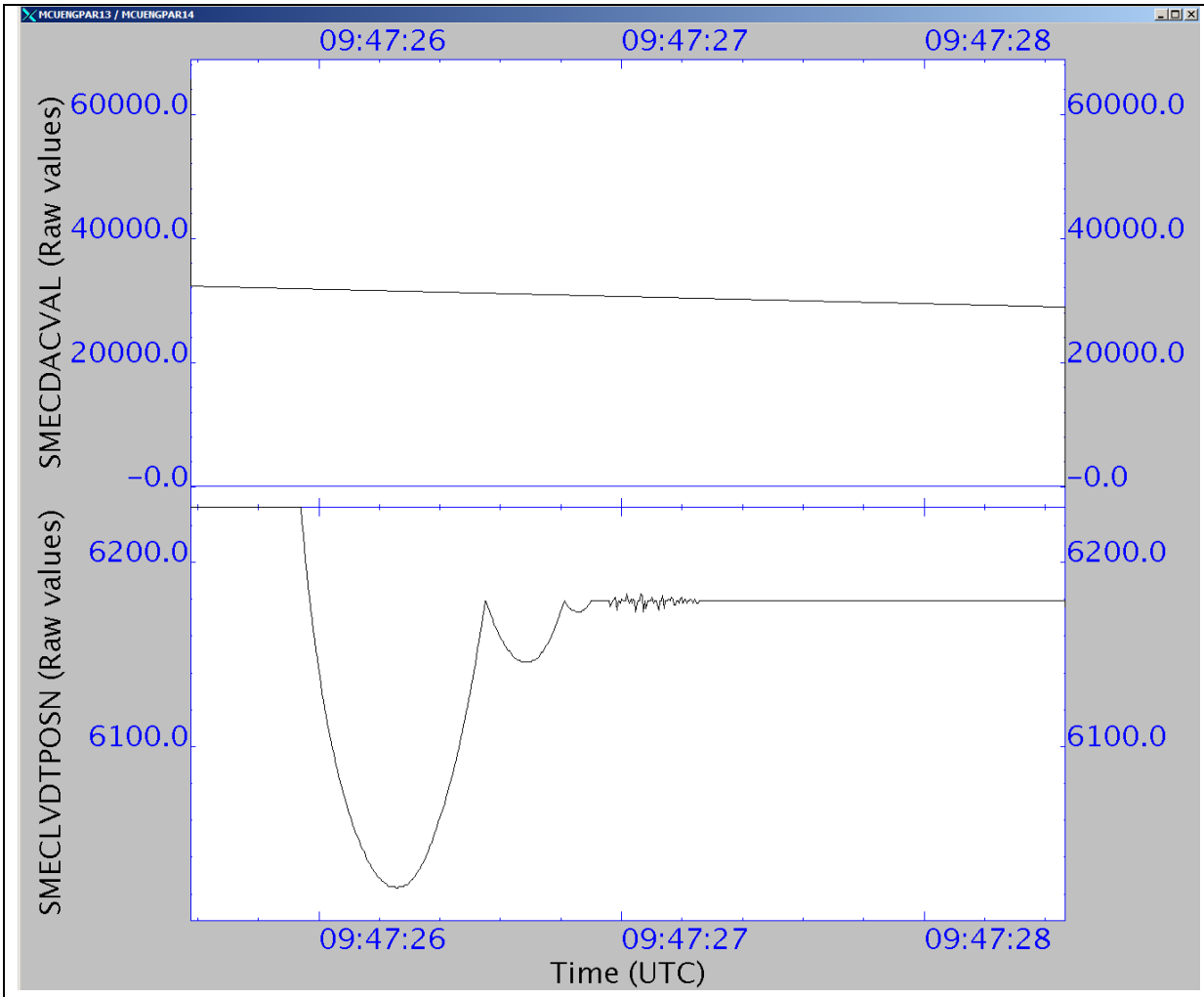
HK Plot:



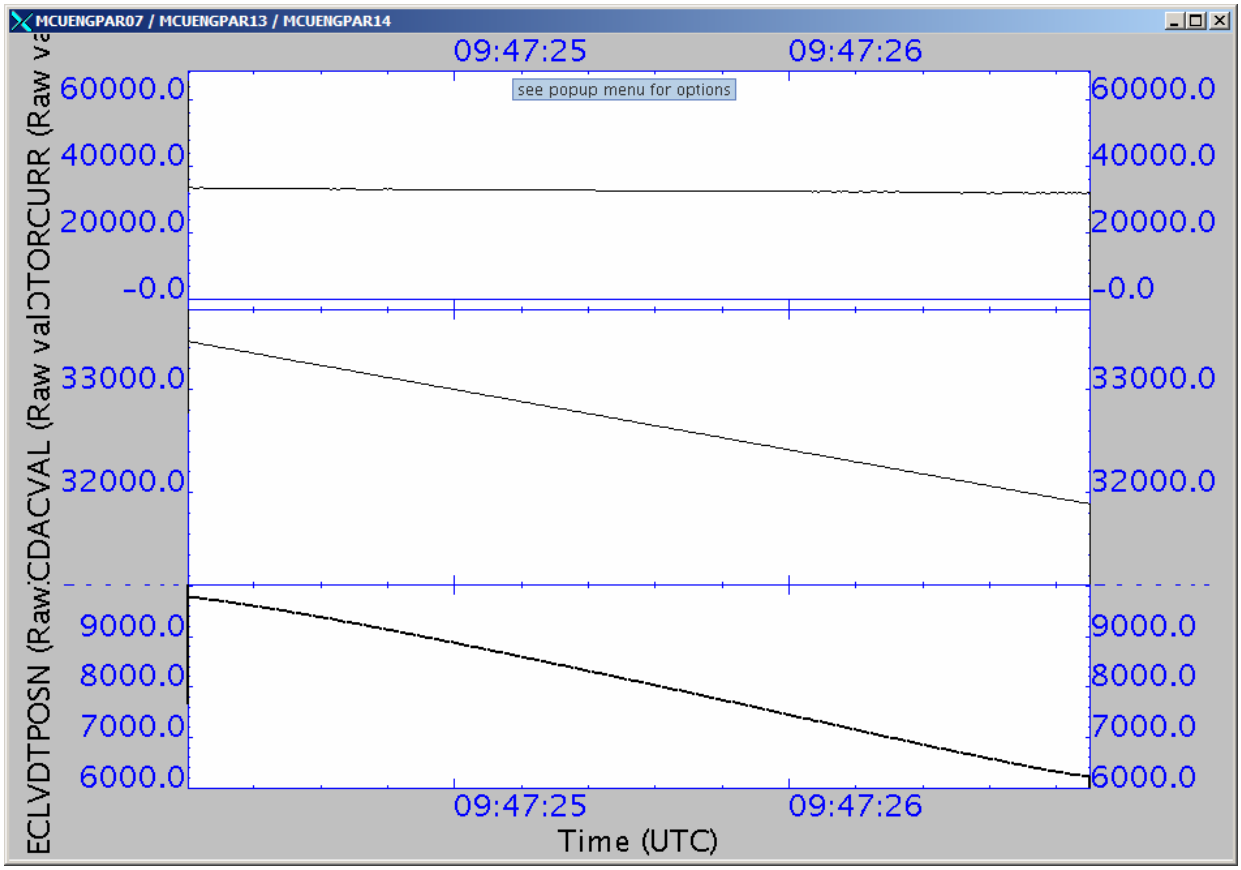
MCU Eng data plot:



MCU Eng plot showing the second rebound after the SMEC hits the end stop:



MCU Eng plot showing the region of interest for the FF gain determination:



SMECDACVAL	SMECLVDTPOSN	SMECLVDTDCSIG
33000	**8900**	**42000**
32290	**7100**	**25000**

Note that FUNC-SMEC-01 sets the SMECLVDTSCALE to 0x161C (decimal 5600). This parameter, which is used in converting from SMECLVDTDCSIG to SMECLVDTPOSN, appears to have remained unchanged from the value used with MCU QM1.

SMECLVDTSCALE varies with temperature (can be significantly different at 4K and at 10K).

The LVDT sensitivity is given by:

LVDT SENSITIVITY = (ΔSMECENCCOUNT / Δ SMECLVDTDCSIG) µm / ADU

At LAM, for a temperature of ~10K, the LVDT sensitivity is 0.17 µm / ADU (see SMECm FM - Performance test report Reference: LAM.PJT.SPI.PRV.060726_01 Issue 1 Rev 0)

With this sensitivity and for the above SMECLVDTDCSIG and SMECDACVAL the FF gain is:

30518 * (33000-32290) / [0.17*(42000-25000)] = 7498 (0x14DA)

This value FF gain is valid for these tests (viz. 16th May 2008) and will need to be recalculated for the

Need to set the correct LVDTSCALE factor in FUNC-SMEC-01 for the next SMEC tests. The value should be $0.5*10^5 * 0.17 = 8500$ (0x2134).

Note that the LVDTSCALE factor will need to be re-determined in flight. It can be done from the results of FUNC-SMEC-09, providing the LVDT is moving and the encoder is counting.

Several investigations were then carried out in order to determine why the SMEC LVDT position did not appear to change:

> **Connected up the external EGSE to see if the SMEC is latched or not: The green LED came on – this indicates the SMEC is *still* latched**
>
> **10:46:57: SEND_DRCU_COMMAND(0x90430002)**
>
> **The EGSE box still shows green light.**
>
> **11:52 In order to perform the LPU check switched off the SMEC and MCU**
> **OBSIDs: 0xb00010c3 and 0xb00010c4**
>
> **LPU check performed successfully**

Now switch on the MCU and repeat the SMEC unlatch test:

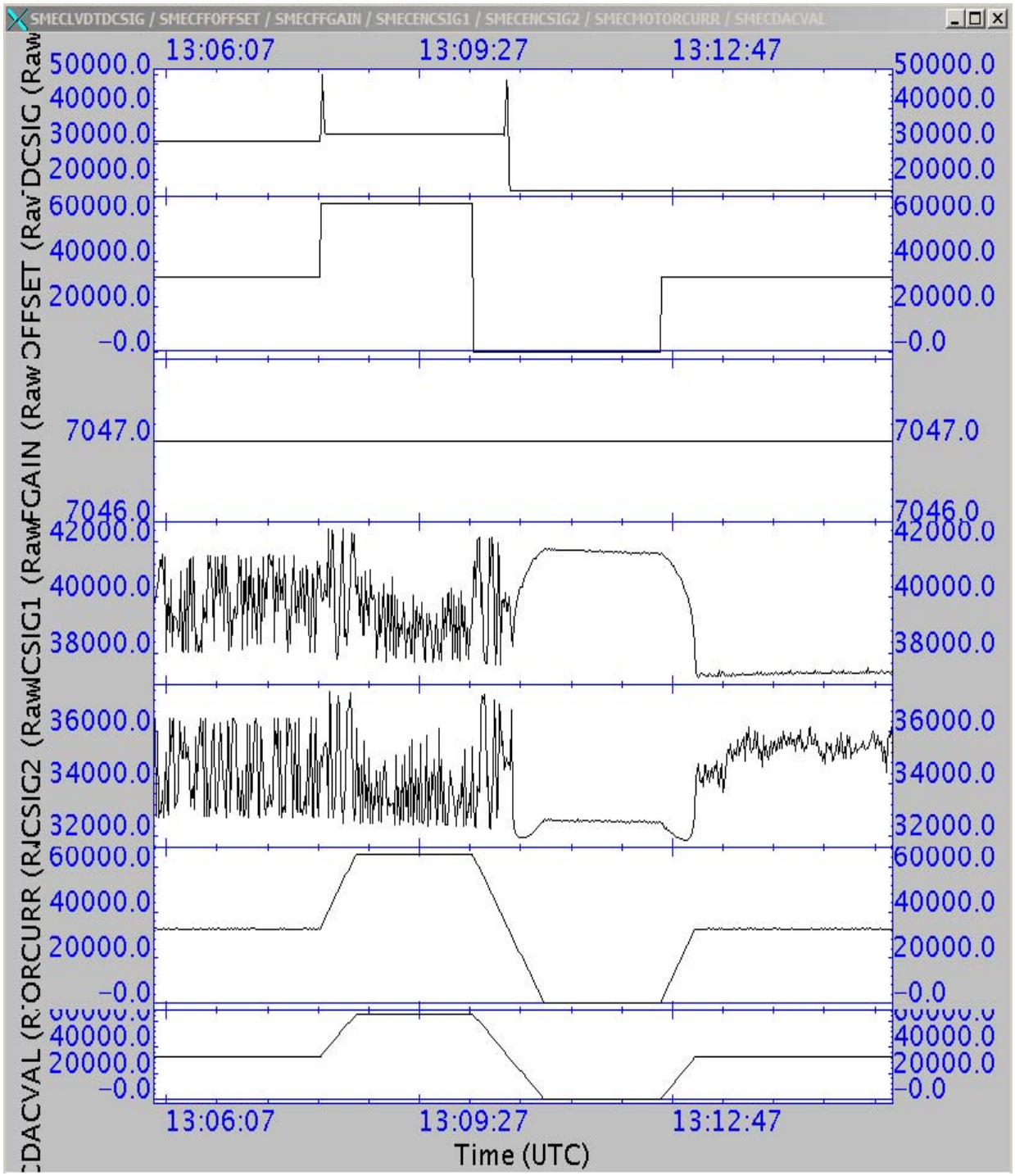
> **SPIRE-IST-COLD-FUNC-MCU-01:**
> **OBSID: 0xb00010c5**
> **Start Time: 12:45**
> **All test parameters nominal**
>
> **SPIRE-IST-COLD-FUNC-SMEC-01:**
> **OBSID: 0xb00010c6**
> **Start Time: 12:47**
> **All test parameters nominal**
>
> **SPIRE-IST-COLD-FUNC-SMEC-02A:**
> **OBSID: 0xb00010c7**
> **Start Time: 12:50**
> **The latch EGSE box still shows the green LED**
>
> **Try the unlatch command from MSTK:**
>
> **12:56:34 - 0x90430002**
>
> **The latch EGSE box still shows the green LED**

Now repeat the SMEC FF Offset test:

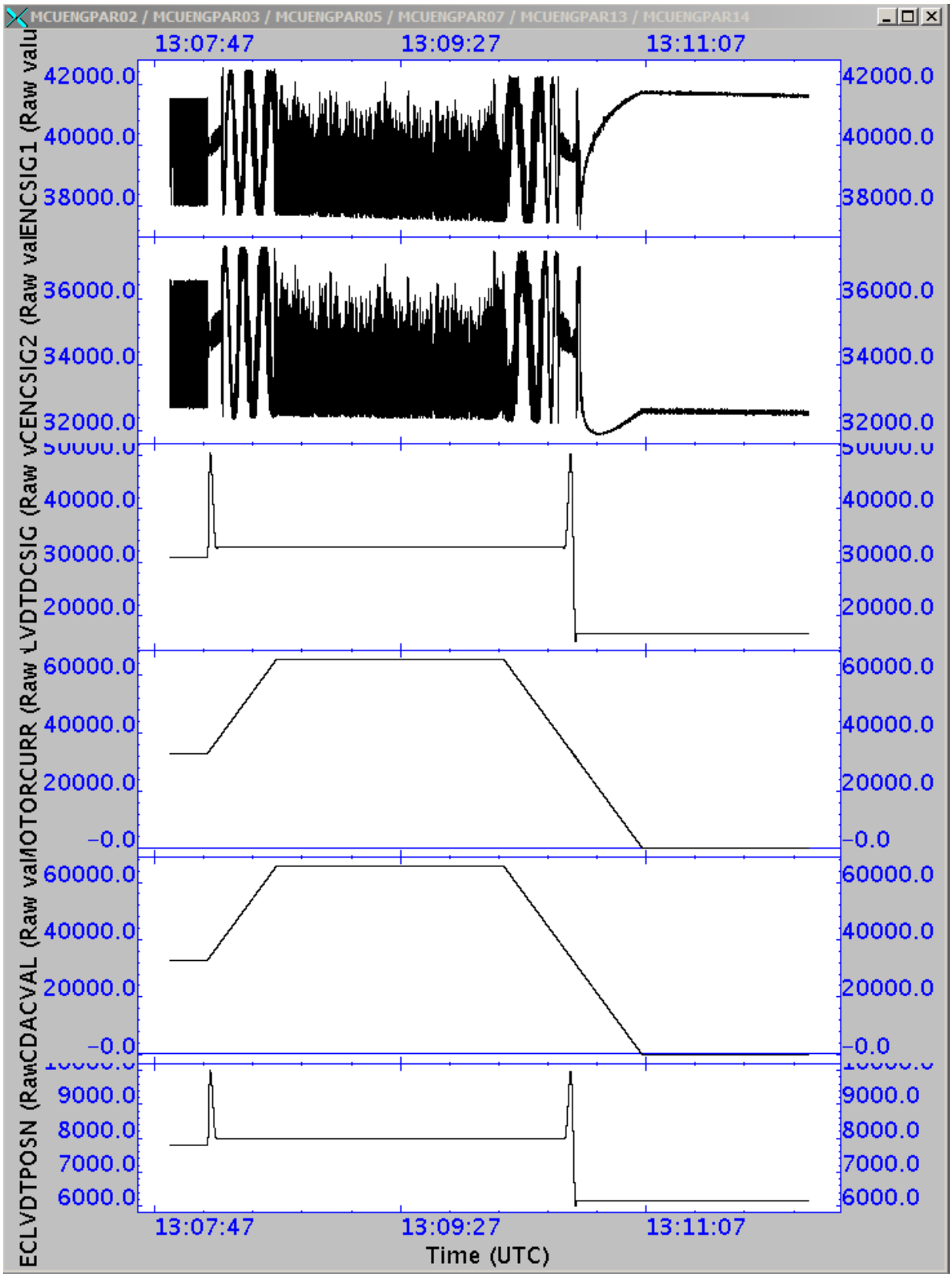
SPIRE-IST-COLD-FUNC-SMEC-FFOFFSET-P
OBSID: 0xb00010c8
Start Time: 13:08

During the test it again appeared that there was no significant change in the LVDT position.
Post-test comments: The plots below show that the SMEC *did* move:-

HK plot:



MCU Eng plot:



Set the SMEC FF offset back to 0 from the MSTK:

13:13:07 - 0x90558000

Another NRB was held to decide the course of action. Decision was made to latch/unlatch the SMEC using MSTK commands and to check the LED on the latch EGSE box at each stage

14:01:06: 0x90430001 – LED green

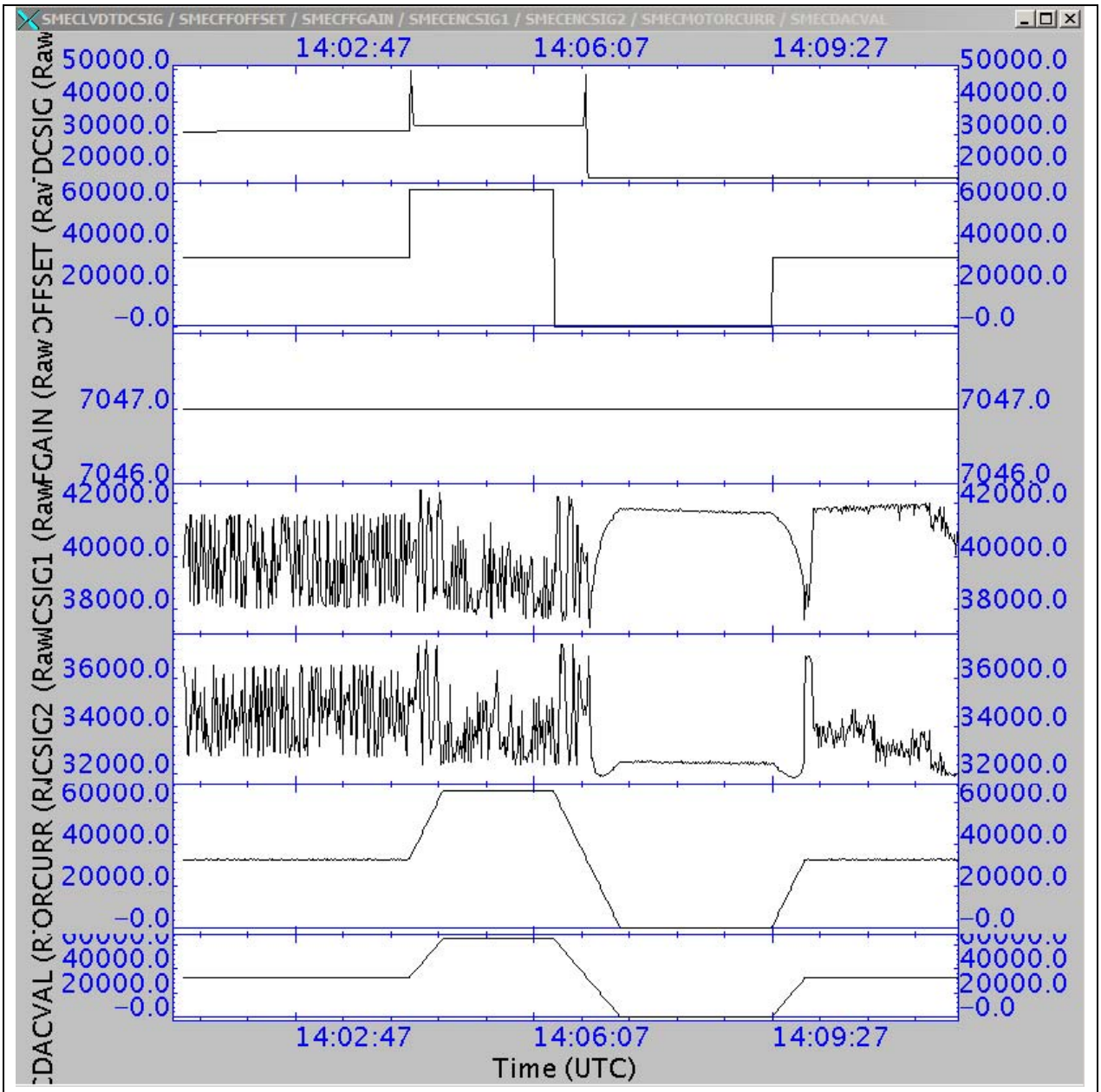
14:02:11: 0x90430002 – LED still green

NCR ASED-4223 raised

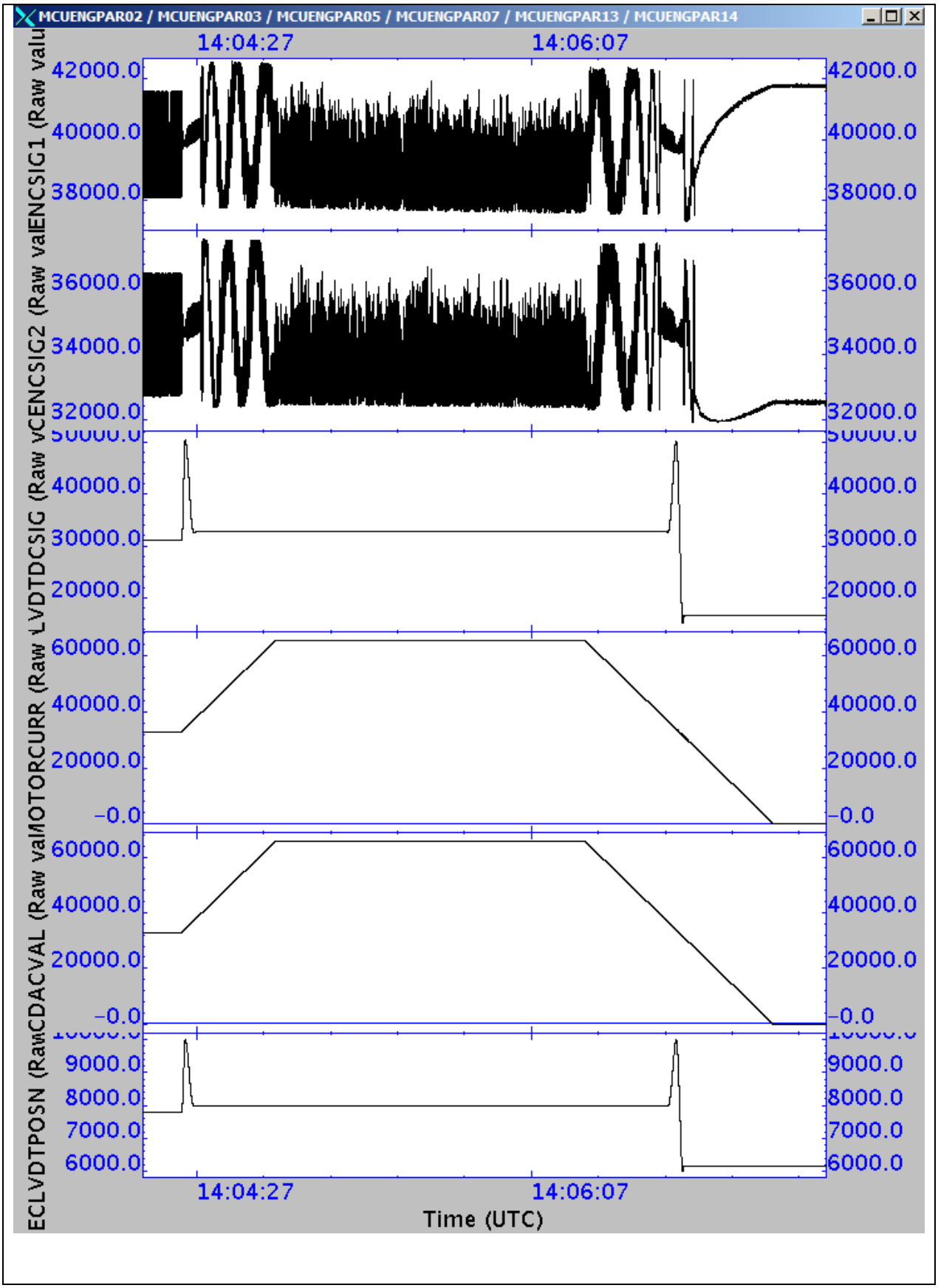
Post-test comment:
The explanation of the non-functioning of the SMEC launch latch EGSE was that the shorting plug in the redundant harness (P/J02 on CIB312300) was left in place when the EGSE was fitted. Procedure LAM.ELE.SPI.PRC.060721 has been used. Shorting plug on P/J02 was still in place. ASED used ACS HP-2-ASED-SD-0278 which calls up the RAL procedure, which in turn calls up the LAM procedure.

SPIRE-IST-COLD-FUNC-SMEC-FFOFFSET-P
OBSID: 0xb00010c9
Start Time: 14:04

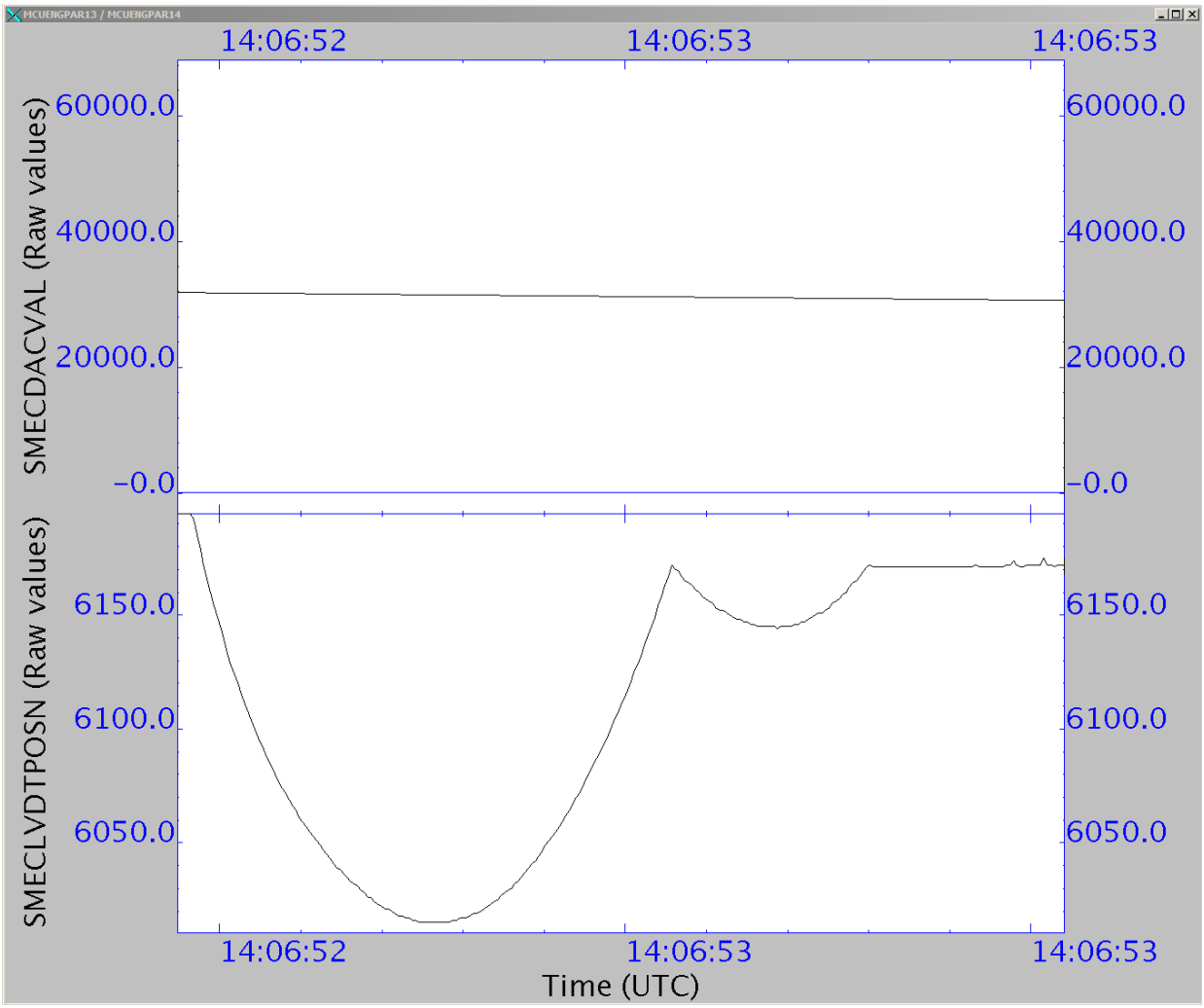
HK Plot:


SMECLVDTDCSIG / SMECFFOFFSET / SMECFFGAIN / SMECENCSIG1 / SMECENCSIG2 / SMECMOTORCURR / SMECDACVAL
14:02:47
14:06:07
14:09:27
50000.0
40000.0
30000.0
20000.0
60000.0
40000.0
20000.0
-0.0
7047.0
7046.0
42000.0
40000.0
38000.0
36000.0
34000.0
32000.0
60000.0
40000.0
20000.0
-0.0
40000.0
20000.0
-0.0
14:02:47
14:06:07
14:09:27
Time (UTC)

MCU Eng plot:


MCUENGPAR02 / MCUENGPAR03 / MCUENGPAR05 / MCUENGPAR07 / MCUENGPAR13 / MCUENGPAR14
14:04:27
14:06:07
ECLVDTPOSN (RawCDACVAL (Raw valMOTORCURR (Raw LVDTDCSIG (Raw vCENCSIG2 (Raw valENCSIG1 (Raw valu
42000.0
40000.0
38000.0
36000.0
34000.0
32000.0
30000.0
20000.0
60000.0
-0.0
9000.0
8000.0
7000.0
6000.0
Time (UTC)

LVDT position 2nd rebound:



The LVDT position changed. The SMECDACVAL at the second rebound is ~31000. Set it to a slightly lower value of ~30000 (0x7530).

There is no evidence for the SMEC sticking.

Set the SMEC FF Offset to 0x7530

14:34:37 - 0x90557530

3.3.11 SPIRE-IST-COLD-FUNC-SMEC-FFGAIN-P

Test Id:	SPIRE-IST-COLD-FUNC-SMEC-FFGAIN-P
Test Purpose:	SMEC (PRIME) Open Loop Feed Forward Gain Test
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON+ SMEC ON (open loop)
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON+ SMEC ON (open loop)
Duration	10-15 minutes (CUS: 4955 seconds)
Success Criteria:	Test passed if: MCU engineering data allow the SMEC FF gain to be determined

CUS Parameters	string frametype = "ENG"; // Specifies MCU frame type
	double framerate = 250.0; // Specifies the frame rate
	int ff_gain_start = 0x1800;
	int ff_gain_end = 0x1c00;
	int ff_gain_step = 0x25;
	int scan_start = 1000 in [100,39900]; //Scan starting point (um)
	int scan_end = 39500 in [100,39900]; //Scan ending point (um)
	int scan_fspeed = 500 in [50,2000]; //Scan forward speed (um/s)
	int scan_rspeed = 500 in [50,2000]; //Scan reverse speed (um/s)
	int nscans = 2 in [2,65535]; //Number of scans (has to be even)

Test Procedure:

Step#	Action
1	**Use QLA plot time series of MCU engineering parameters** **MCUENGPAR01 – SMECENCPOSN** **MCUENGPAR02 – SMECENCSIG1** **MCUENGPAR03 – SMECENCSIG2** **MCUENGPAR05 – SMECLVDTDCSIG** **MCUENGPAR07 – SMECMOTORCURR** **MCUENGPAR13 – SMECDACVAL** **MCUENGPAR14 – SMECLVDTPOSN** **The same parameters can also be plotted from the nominal HK packet.**
2	**Run SPIRE-IST-COLD-FUNC-SMEC-FFGAIN-P test procedure from the CCS.**
3	Contingency: If test fails repeat steps 1 and 2.

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
SPIRE-IST-COLD-FUNC-SMEC-FFGAIN-P					**Not performed**

Start time @:
End time @:
OBSID:

Comments:

HK plot:

MCU Engineering data plot:

3.3.12 SPIRE-IST-COLD-FUNC-SMEC-04A-P

Test Id:	SPIRE-IST-COLD-FUNC-SMEC-04A-P
Test Purpose:	SMEC (PRIME) Open Loop Positioning Test
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON+ SMEC ON (open loop)
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON+ SMEC ON (open loop)
Duration	5 minutes (CUS: 201 seconds)
Success Criteria:	Test passed if: SMEC moves to the commanded positions

CUS Parameters	string frametype = "ENG"; // Specifies MCU frame
	double framerate = 64.0; // Specifies the frame rate
	int scan_start = 1000 in [0,39900]; // Step look scan starting point (um)
	int scan_end = 15000 in [0,39900]; // Step look scan ending point (um)
	int scan_step = 1000 in [0,39900]; // Step look scan step size (um)
	int scan_fspeed = 500 in [0,2000]; // Scan forward speed (um/s)
	int scan_rspeed = 500 in [0,2000]; // Scan fly back speed (um/s)
	int ftime = 5; // Time at each target position in seconds

Test Procedure:

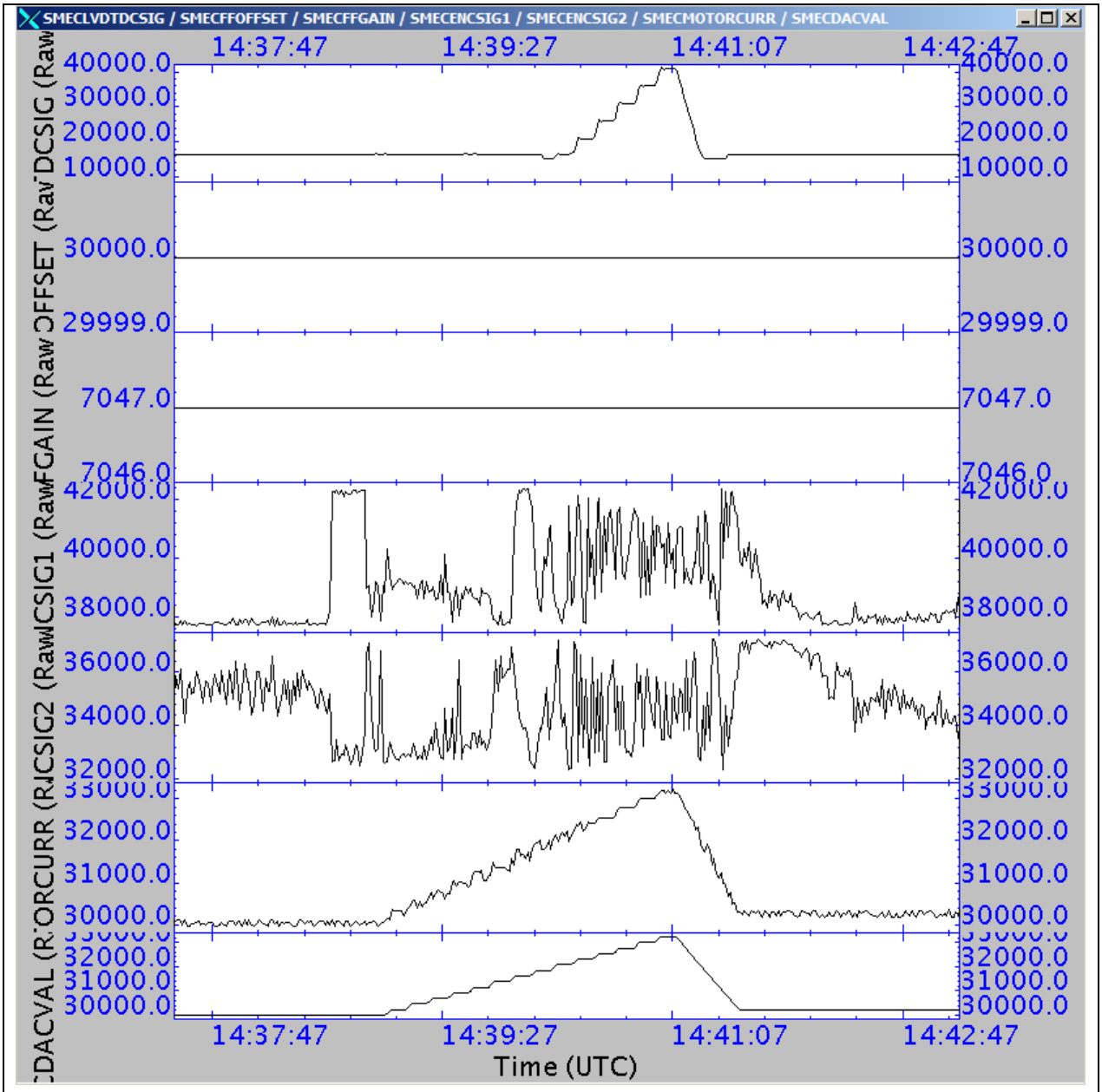
Step#	Action
1	**Use QLA plot time series of MCU engineering parameters** **MCUENGPAR01 – SMECENCPOSN** **MCUENGPAR02 – SMECENCSIG1** **MCUENGPAR03 – SMECENCSIG2** **MCUENGPAR05 – SMECLVDTDCSIG** **MCUENGPAR07 – SMECMOTORCURR** **MCUENGPAR13 – SMECDACVAL** **MCUENGPAR14 – SMECLVDTPOSN** **The same parameters can also be plotted from the nominal HK packet.**
2	**Run SPIRE-IST-COLD-FUNC-SMEC-04A-P test procedure from the CCS.**
3	Contingency: If test fails repeat steps 1 and 2.

Test Log:

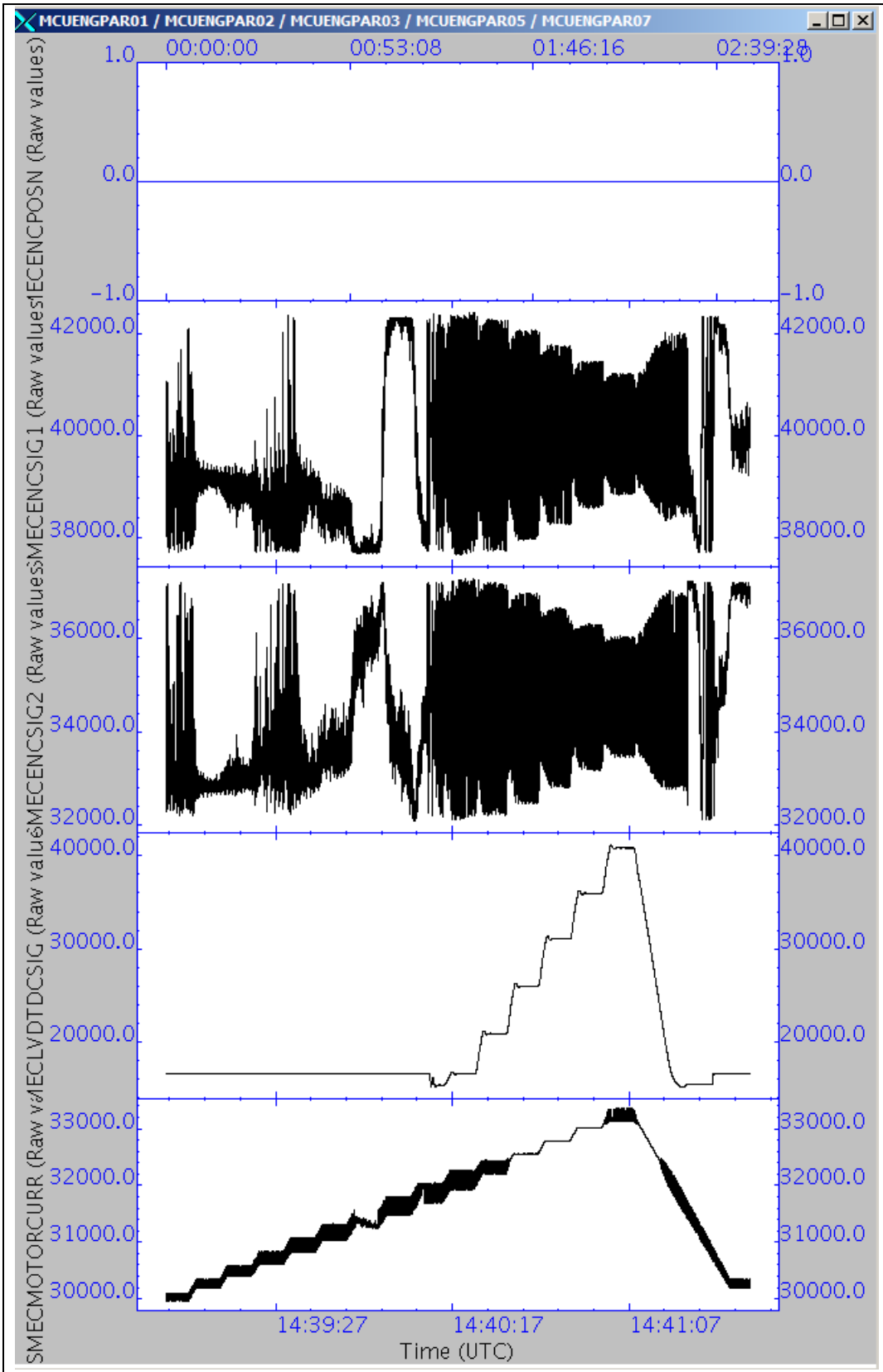
Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
SPIRE-IST-COLD-FUNC-SMEC-04A-P	See plots below				**Pass**

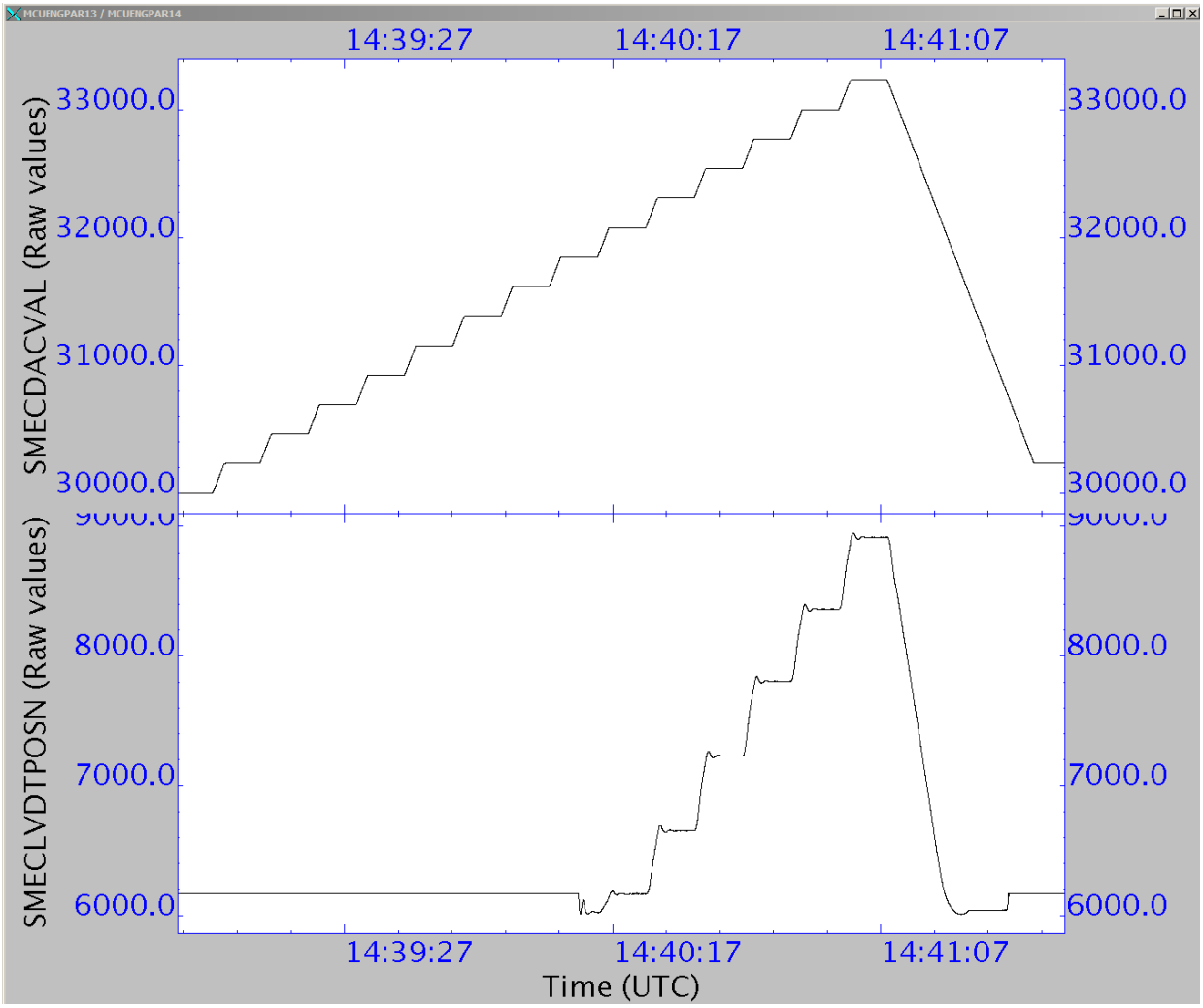
Start time @: 14:39
End time @:
OBSID: 0xb00010ca

HK plot:



MCU Engineering data plots:

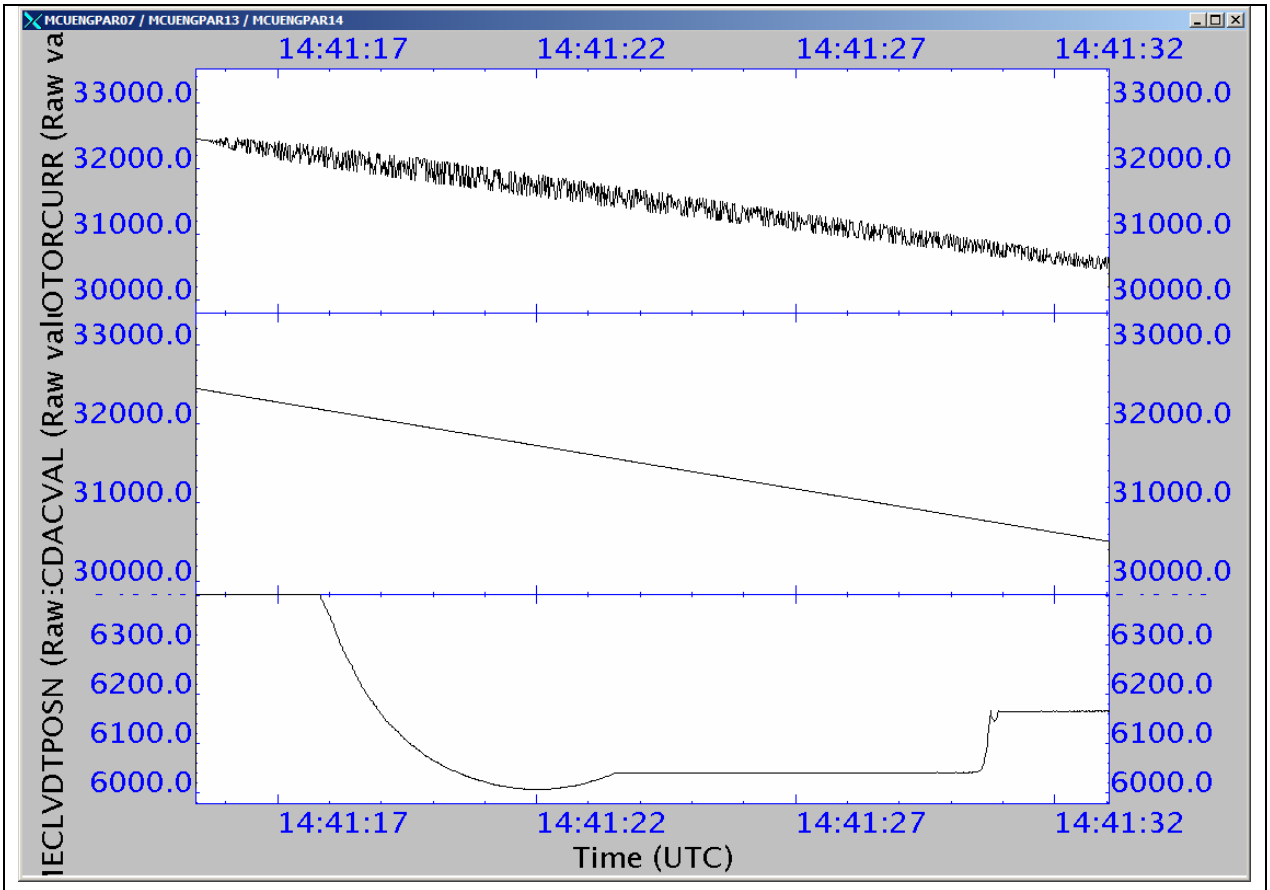

MCUENGPAR01 / MCUENGPAR02 / MCUENGPAR03 / MCUENGPAR05 / MCUENGPAR07
00:00:00
00:53:08
01:46:16
02:39:28
SMECMOTORCURR (Raw v\ECLVDTDCSIG (Raw value\MECENCSIG2 (Raw values\MECENCSIG1 (Raw values\ECENCPOSN (Raw values)
1.0
0.0
-1.0
42000.0
40000.0
38000.0
36000.0
34000.0
32000.0
30000.0
20000.0
33000.0
31000.0
14:39:27
14:40:17
14:41:07
Time (UTC)



The SMECLVDTPOSN does not change by 1mm between steps. This is a consequence of using the wrong SMECLVDTSCALE factor.

For SMECDACVAL of ~31000 the LVDT should show movement – but it does not move until ~31850. The difference in the current for these two values is < 1 mA. But we have not set the FF offset to better than this precision, so the behaviour is not unusual.

After stepping through all the positions the SMEC was commanded to go back to 1mm. The following zoomed plot shows that after the rebound at the end stop, the SMEC appears to stick for a while before going back to the position consistent with the SMECDACVAL. It seems that this final position is still at the end stop:



Comments: Need to set the encoder signal offsets 1 & 2

3.3.13 SPIRE-IST-COLD-FUNC-SMEC-09-P

Test Id:	SPIRE-IST-COLD-FUNC-SMEC-09-P
Test Purpose:	SMEC (PRIME) Open Loop Scan Test
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON+ SMEC ON (open loop)
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON+ SMEC ON (open loop)
Duration	10-15 minutes (CUS: 99 seconds)
Success Criteria:	Test passed if: SMEC scans in open loop and allows the encoder signal offsets 1 & 2 to be established.

CUS Parameters	int scan_start = 1000 in [0,39900]; //Scan starting point (um)
	int scan_end = 15000 in [0,39900]; //Scan ending point (um)
	int scan_fspeed = 500 in [0,2000]; //Scan forward speed (um/s)
	int scan_rspeed = 500 in [0,2000]; //Scan reverse speed (um/s)
	int nscans = 2 in [2,65535]; //Number of scans (has to be even)
	double framerate = 64.0; // Specifies the frame rate

Test Procedure:

Step#	Action
1	**Use QLA plot time series of MCU engineering parameters** **MCUENGPAR01 – SMECENCPOSN** **MCUENGPAR02 – SMECENCSIG1** **MCUENGPAR03 – SMECENCSIG2** **MCUENGPAR05 – SMECLVDTDCSIG** **MCUENGPAR07 – SMECMOTORCURR** **MCUENGPAR13 – SMECDACVAL** **MCUENGPAR14 – SMECLVDTPOSN** **The same parameters can also be plotted from the nominal HK packet.**
2	**Run SPIRE-IST-COLD-FUNC-SMEC-09-P test procedure from the CCS.**
3	Contingency: If test fails repeat steps 1 and 2.

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
SPIRE-IST-COLD-FUNC-SMEC-09-P	SMECENCPWR SMECENCSIG1 SMECENCSIG2		See plots below		**Partial Success**

Set the Encoder signal 1&2 offsets from the MSTK:
14:47 - 0x90589c40 (40000 decimal)
0x905a88b8 (35000 decimal

Start time @: 14:49
End time @: 14:51
OBSID: 0xb00010cb

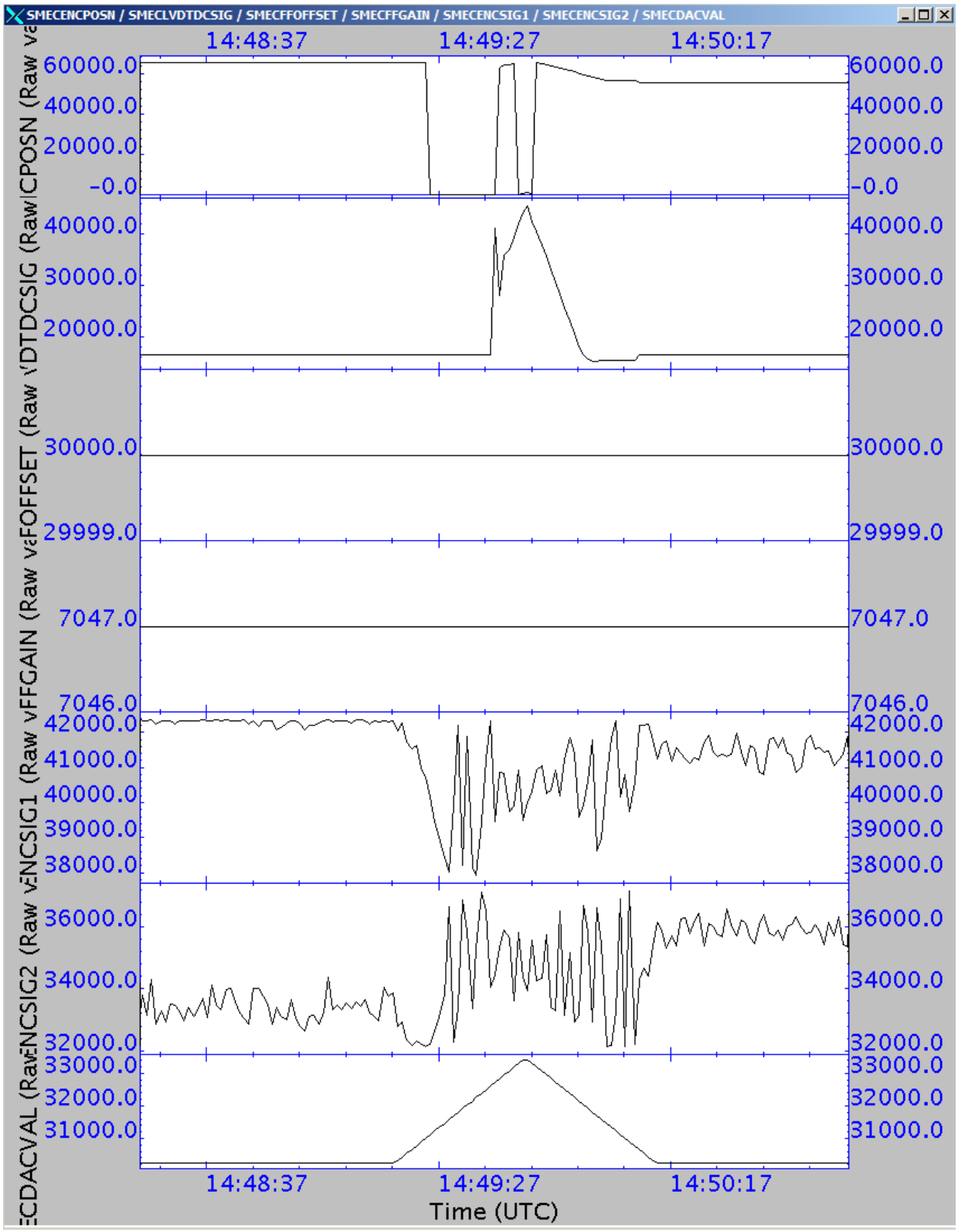
Comments: The encoder is not counting from the start of the test but does start counting when the encoder signals 1 & 2 match the commanded signal offsets 1 & 2.

The LVDT output looks very odd

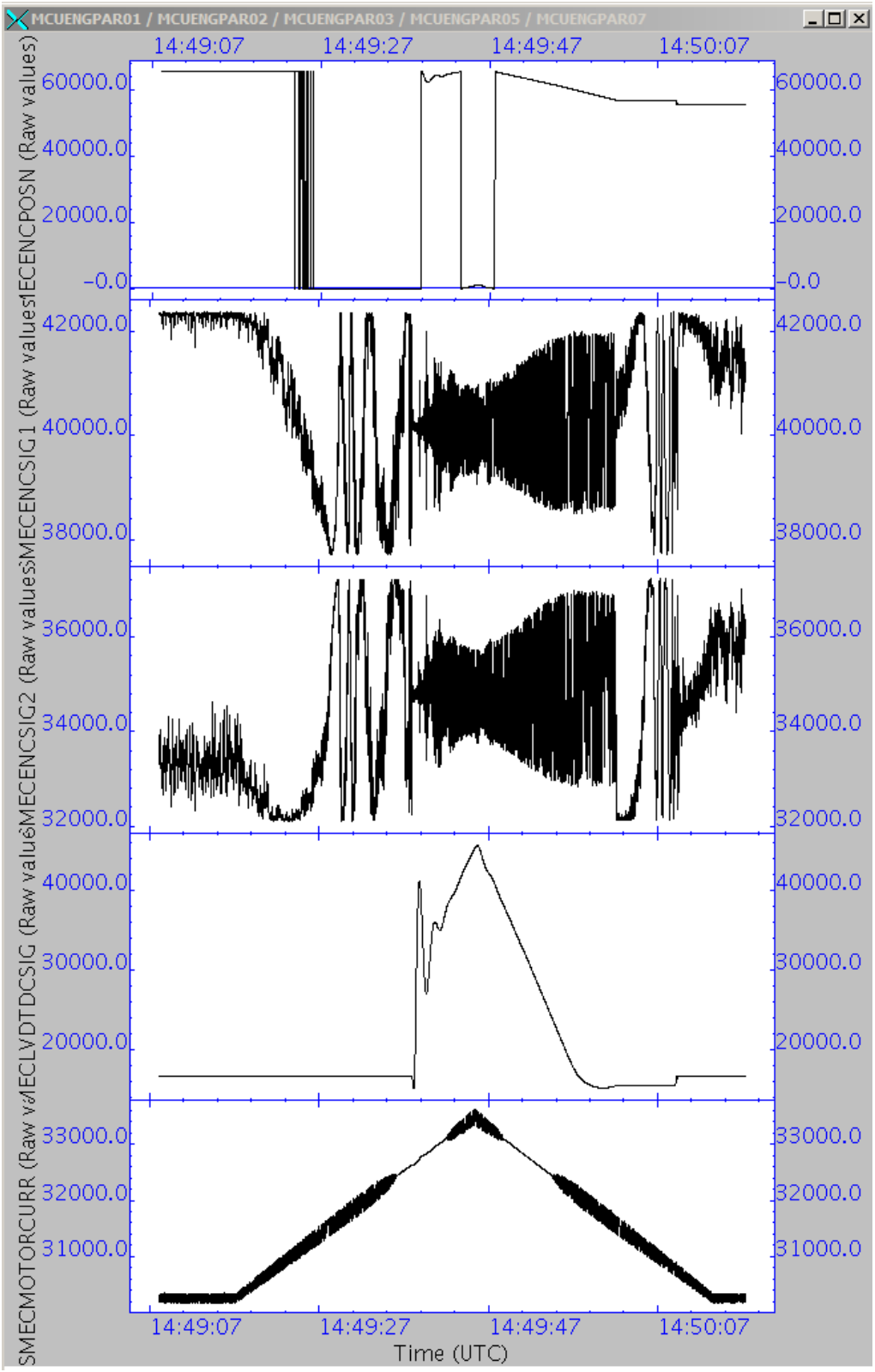
Post-test comments:

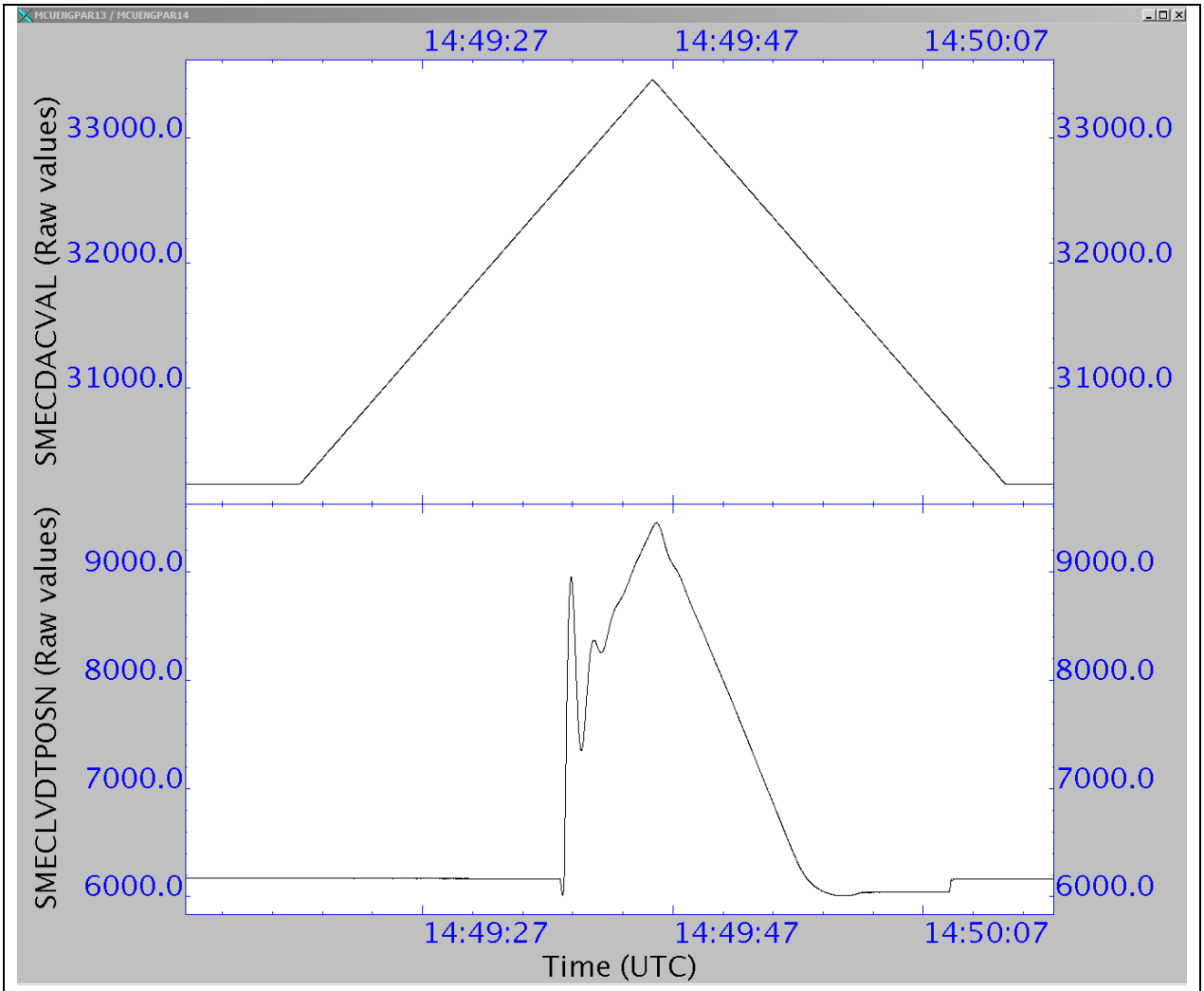
- **These values of offsets are wrong because the encoder signals are not changing, but especially encoder signal 2. This is because the SMEC is at the end stop and the offset values correspond to the SMEC at mid-range of travel. This explains why the encoder did not start counting.**
- **The SMECLVDTPOSN and SMECLVDTDCSIG plots look odd because there appears to be some friction.**
- **The converted SMECMEANSPEED can be computed from (SMECMEANSPEED(Raw)-65535) - units are 0.1µm/s**

HK plot:


SMECENCPOSN / SMECLVDTDCSIG / SMECFFOFFSET / SMECFFGAIN / SMECENCSIG1 / SMECENCSIG2 / SMECDACVAL
14:48:37
14:49:27
14:50:17
Time (UTC)

MCU Engineering data plots:



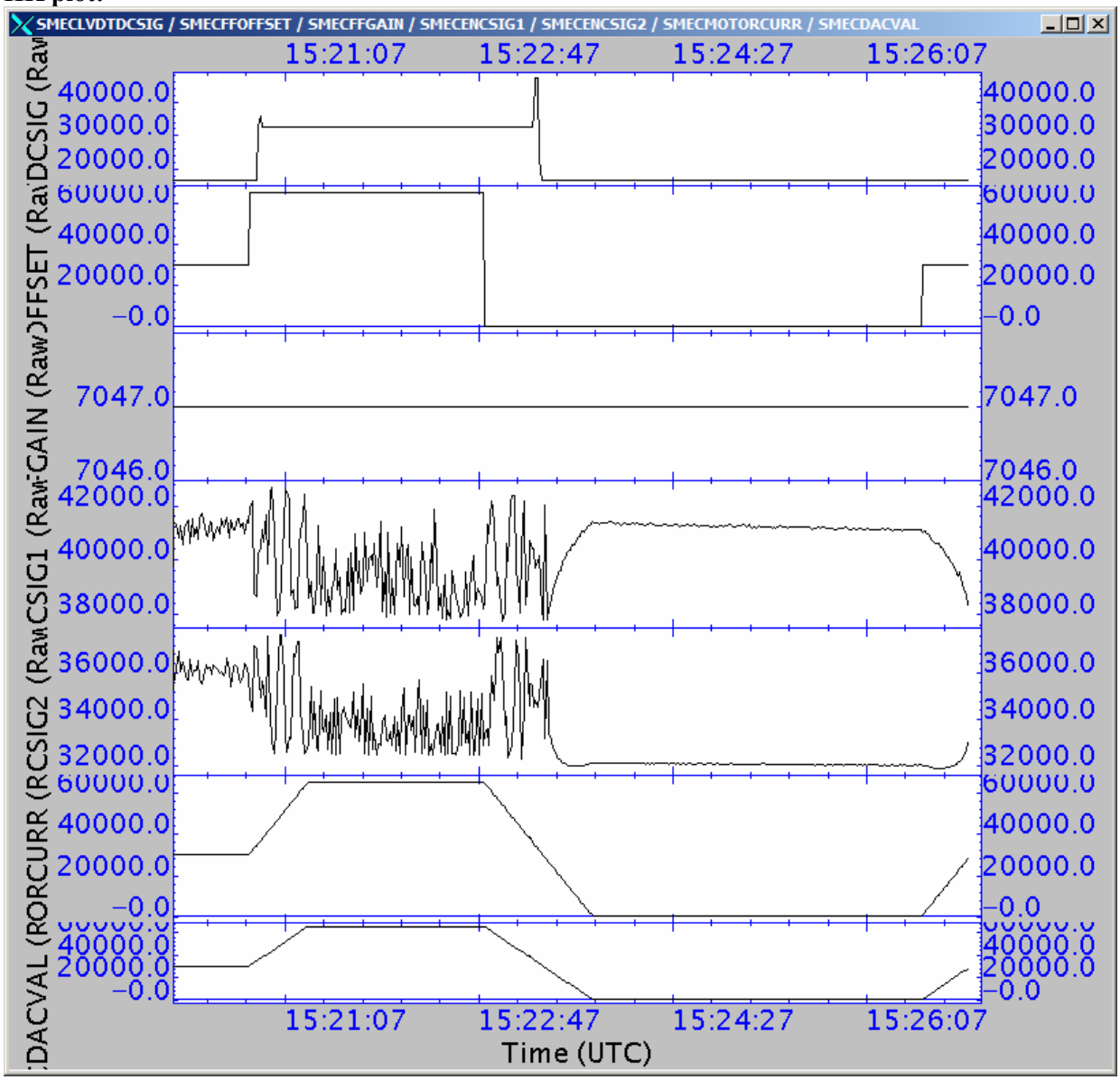


Investigations into the odd behaviour seen in the above plots:-

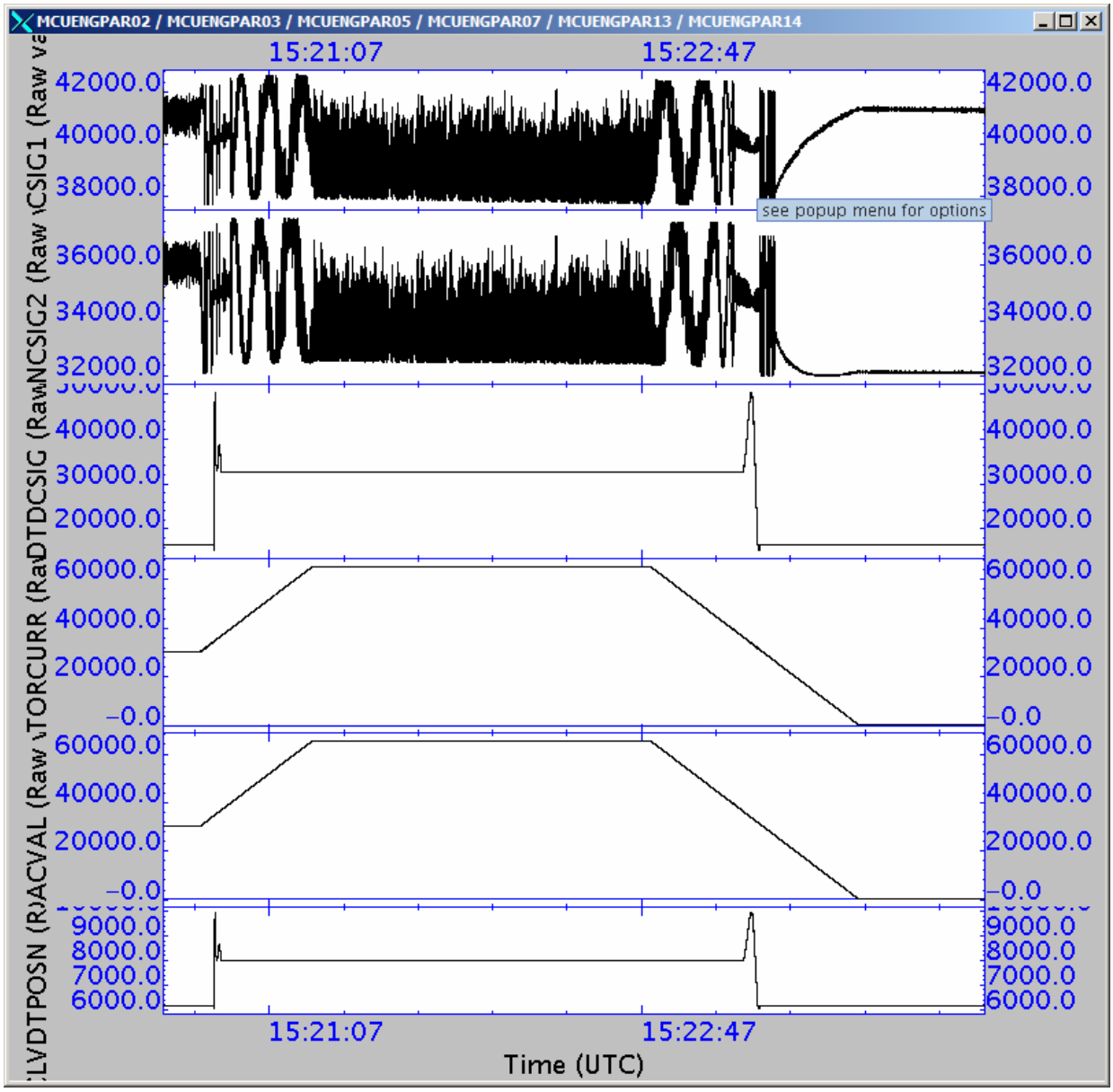
Decided to repeat the FF Offset test

SPIRE-IST-COLD-FUNC-SMEC-FFOFFSET-P:
OBSID: 0xb00010cc

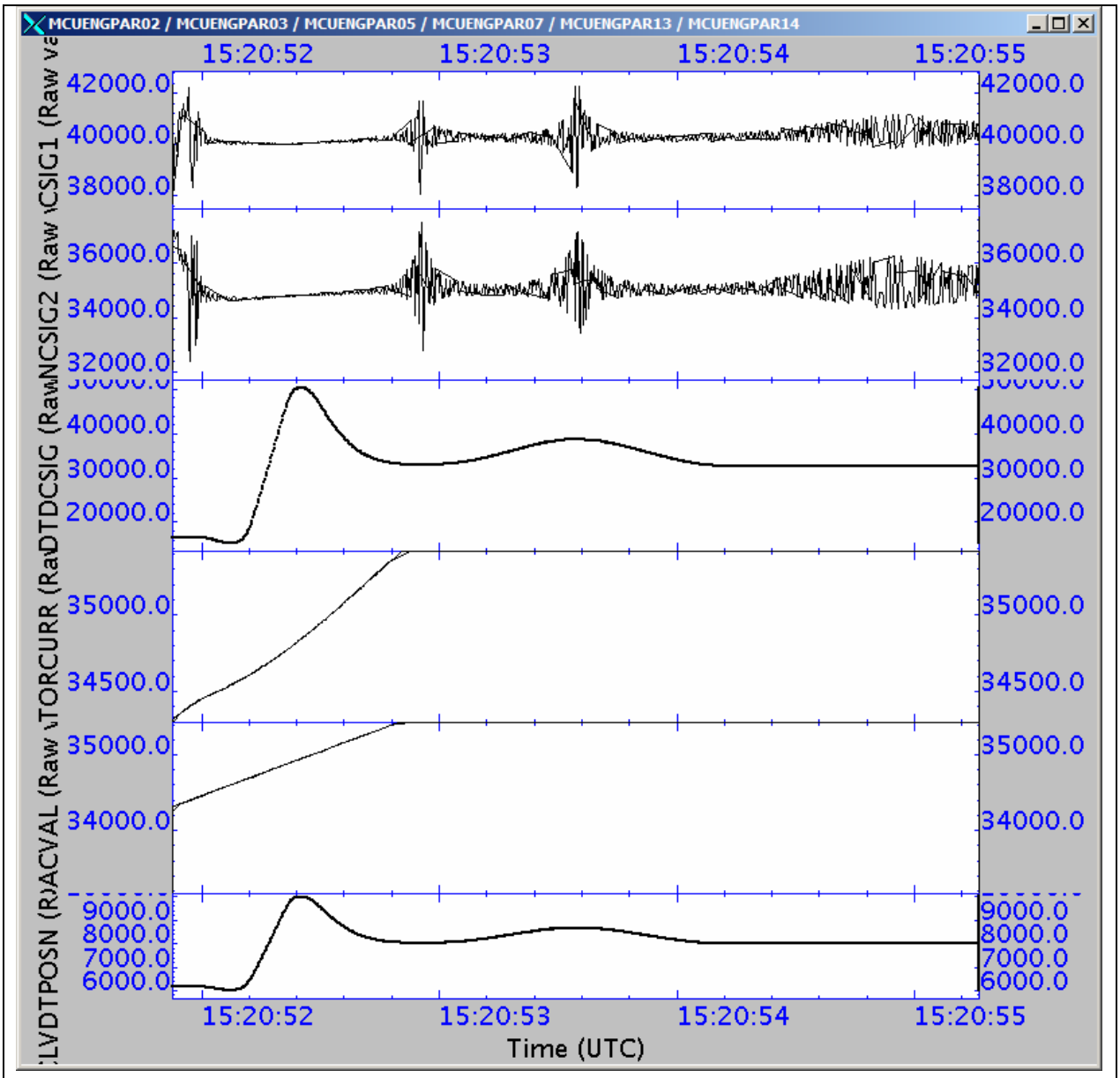
HK plot:


SMECLVDTDCSIG / SMECFFOFFSET / SMECFFGAIN / SMECENCSIG1 / SMECENCSIG2 / SMECMOTORCURR / SMECDACVAL
15:21:07
15:22:47
15:24:27
15:26:07
40000.0
30000.0
20000.0
60000.0
40000.0
20000.0
-0.0
7047.0
7046.0
42000.0
40000.0
38000.0
36000.0
34000.0
32000.0
60000.0
40000.0
20000.0
-0.0
40000.0
20000.0
-0.0
15:21:07
15:22:47
15:24:27
15:26:07
Time (UTC)

MCU Eng data plot:

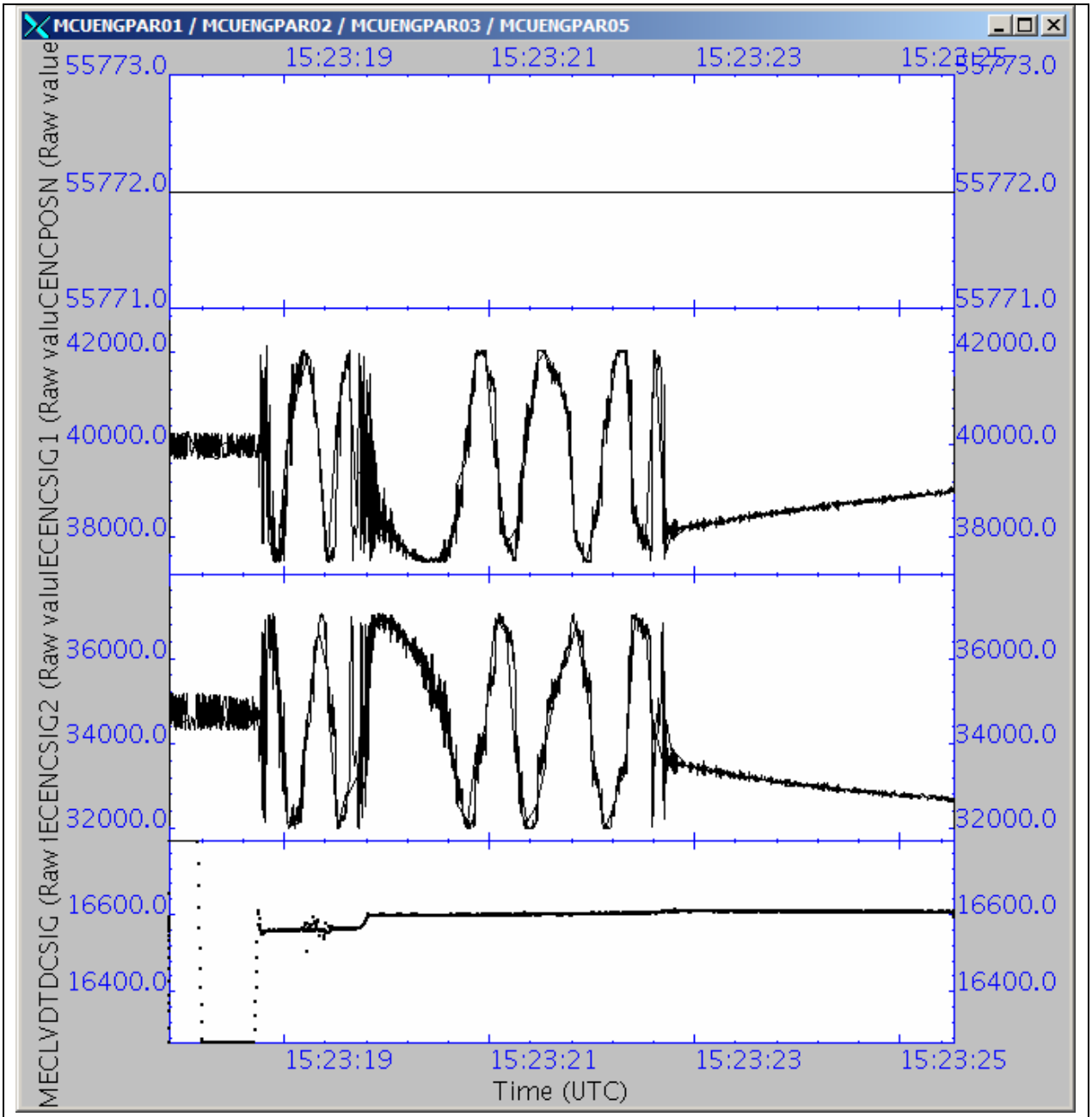


Zoomed MCU Eng plot showing the change in the LVDT position as maximum FF offset is applied:



Based on the results of these tests the FF gain was set to 891 (post-test comment: this value is wrong).

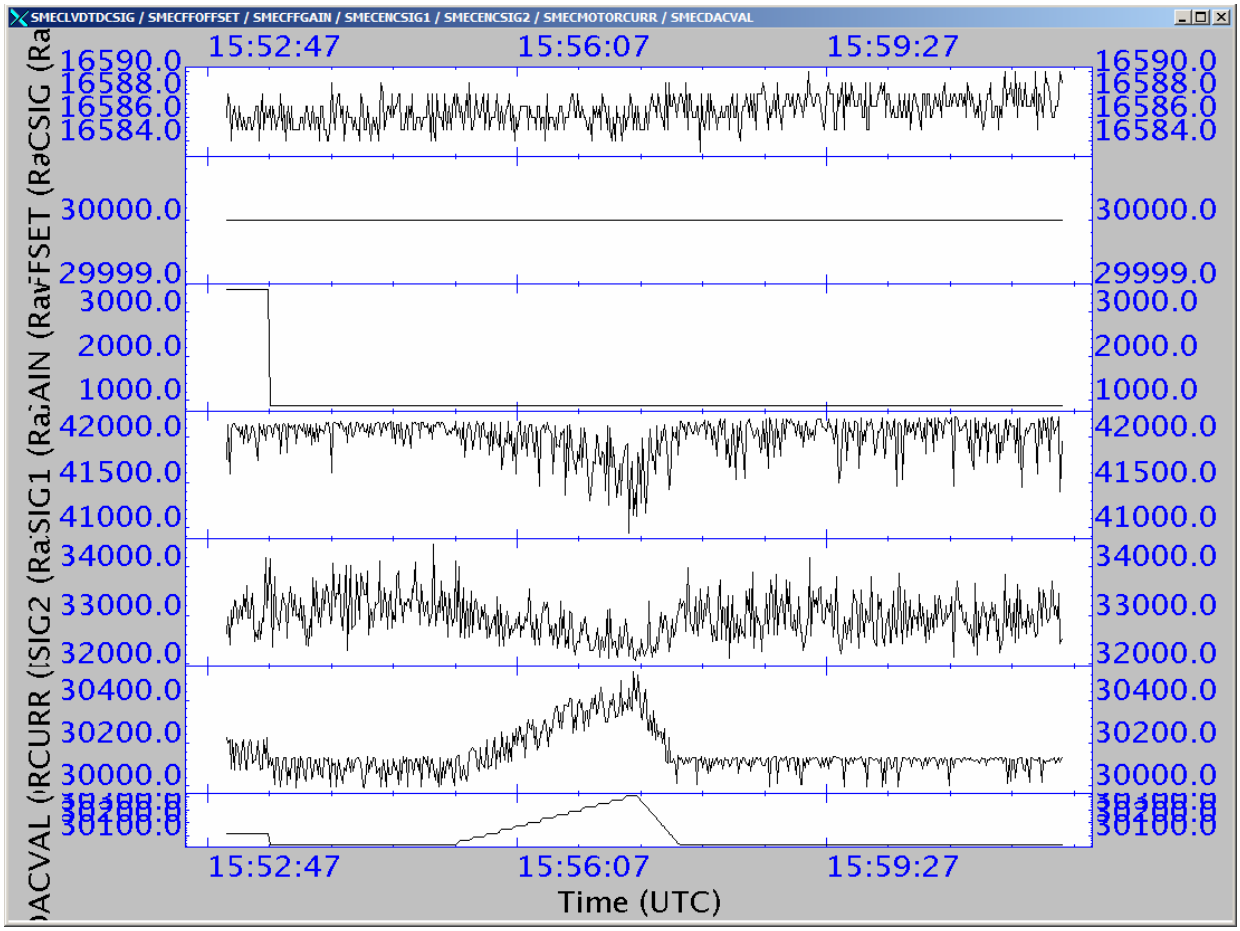
Zoomed plot showing the small beginning of a rebound in the SMECLVDTDCSIG which gets stuck:



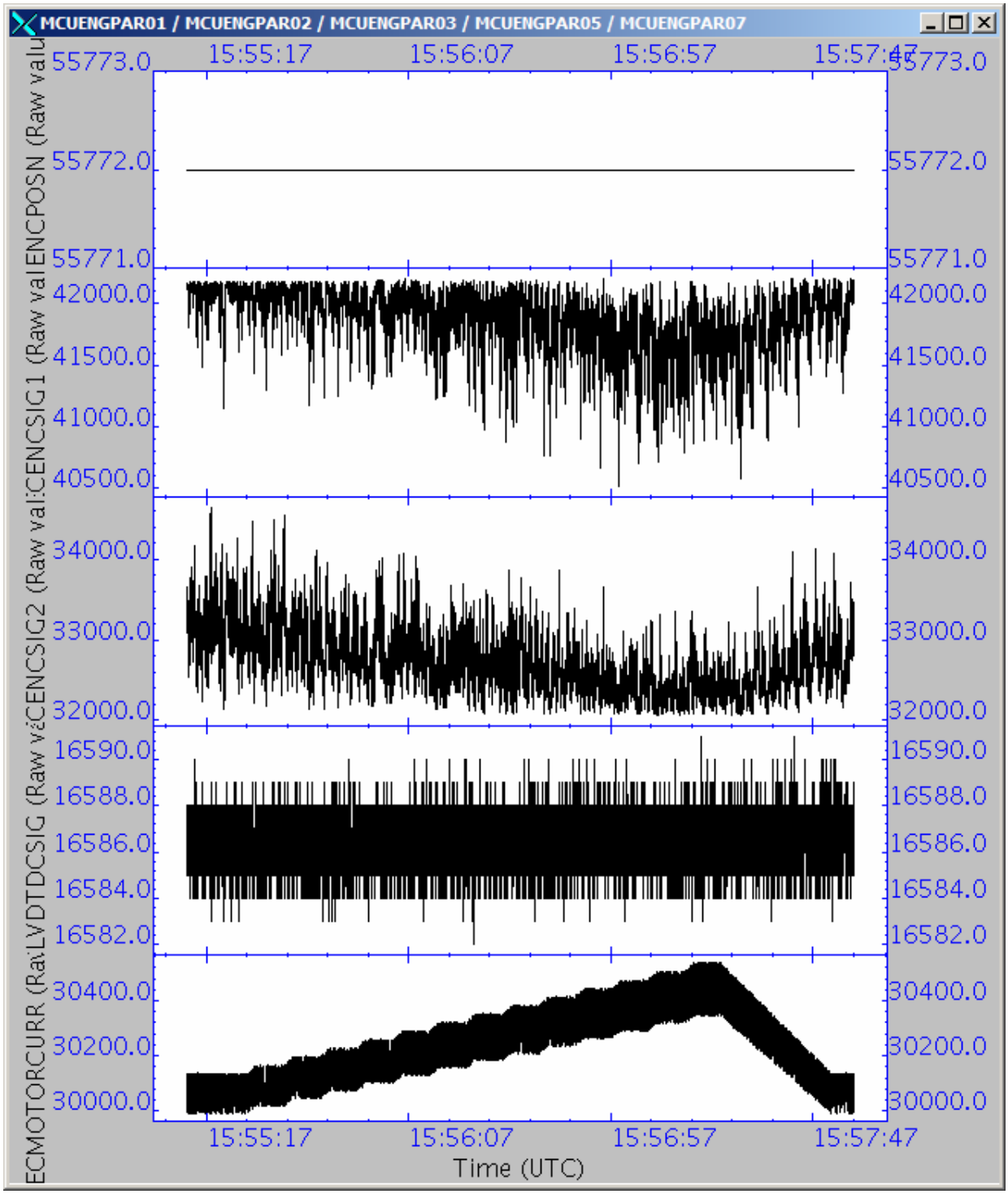
SMEC-04A
OBSID: 0xb00010ce
Start time: 15:54

Comments: The SMEC did not move because the FF gain was set to too low a value (viz. 891) and FF offset was also not optimum.

HK plot:


SMECLVDTDCSIG / SMECFFOFFSET / SMECFFGAIN / SMECENCSIG1 / SMECENCSIG2 / SMECMOTORCURR / SMECDACVAL
15:52:47
15:56:07
15:59:27
16590.0
16588.0
16586.0
16584.0
30000.0
29999.0
3000.0
2000.0
1000.0
42000.0
41500.0
41000.0
34000.0
33000.0
32000.0
30400.0
30200.0
30000.0
30100.0
Time (UTC)

MCU Eng data plot:



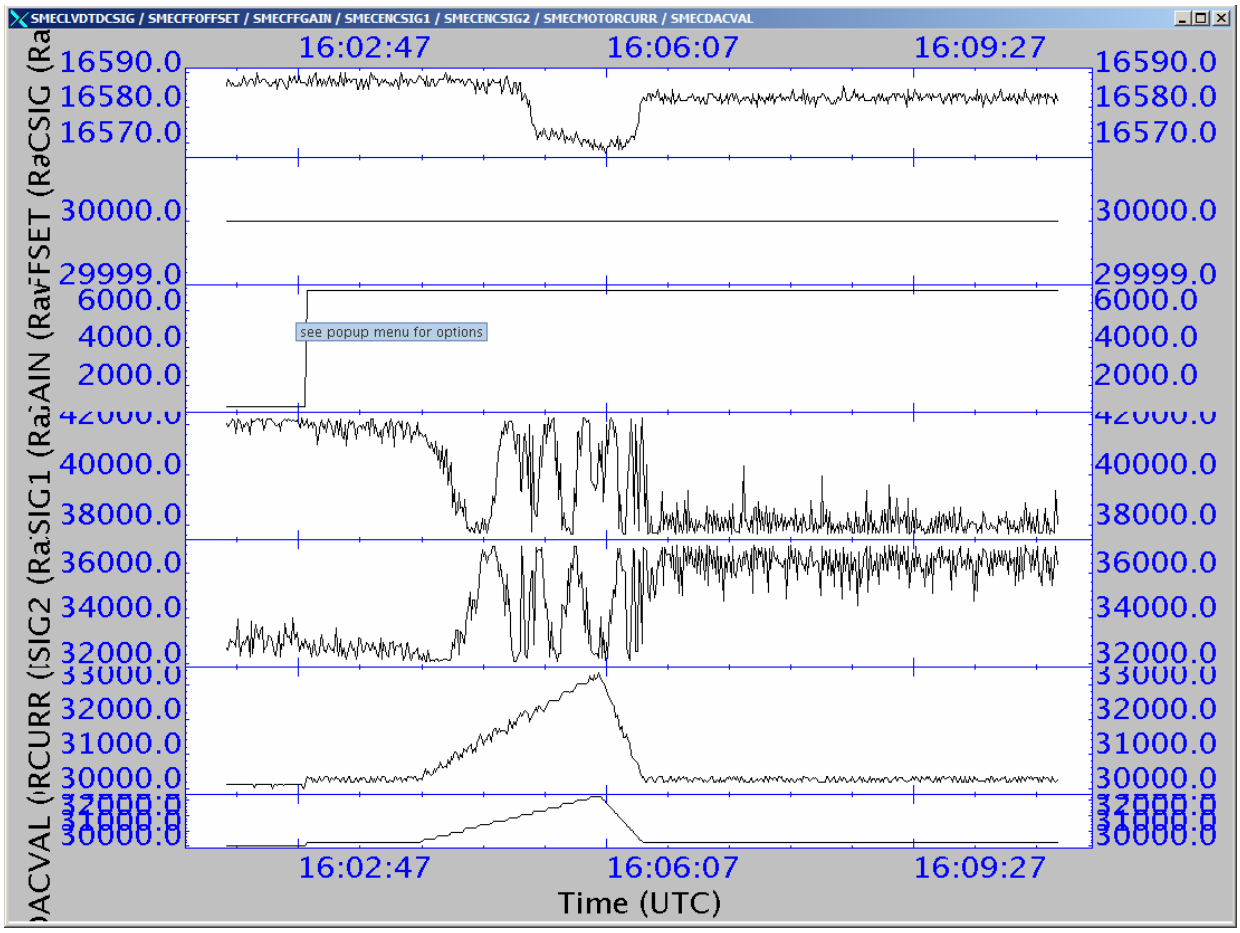
The SMEC is at the mechanical stop, which is why it did not move with FF gain applied.

Now set the FF gain back to 0x1b87 from the MSTK:

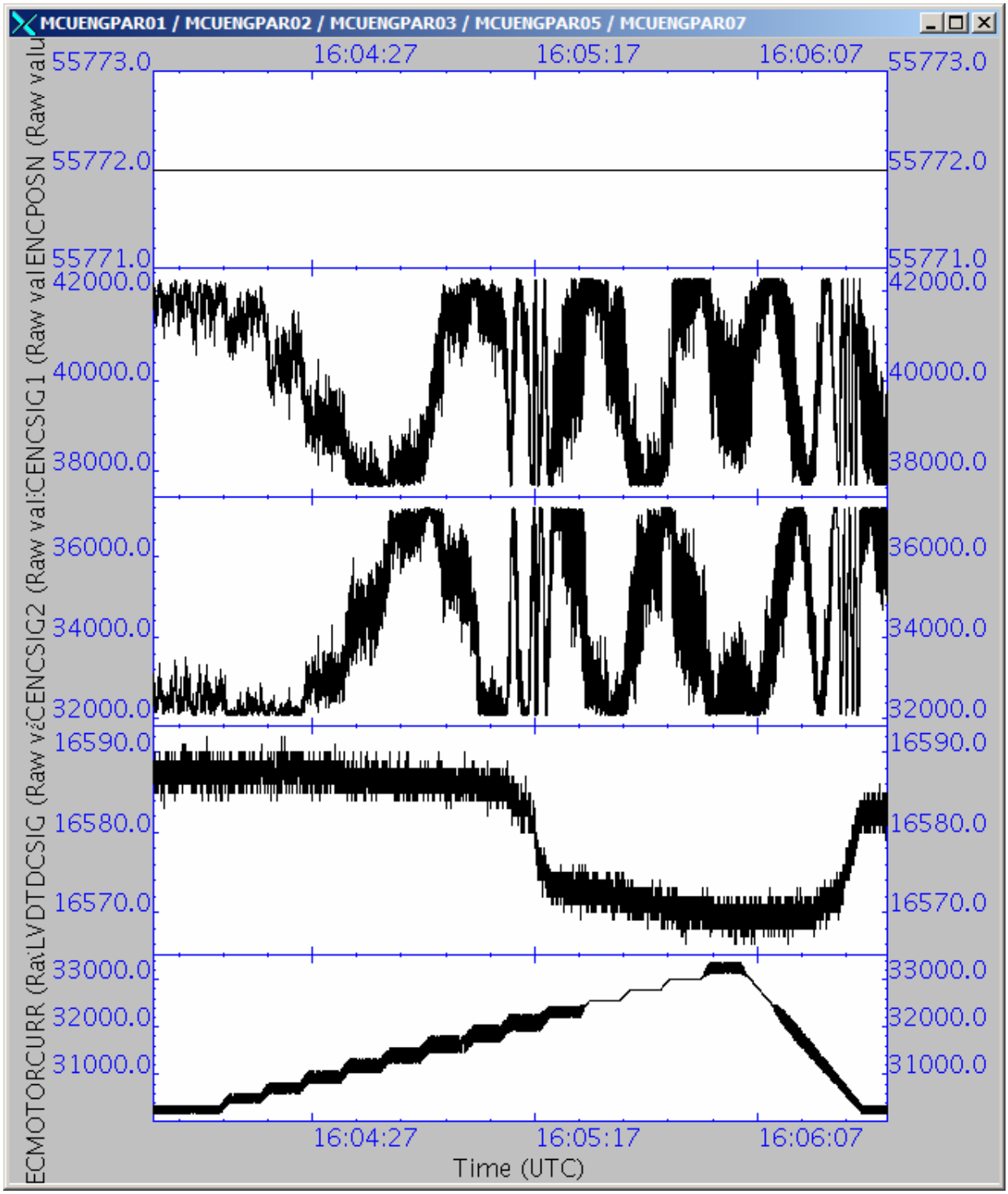
0x90541b87

SMEC-04A
OBSID: 0xb00010cf
Start Time: 16:03

HK plot:



MCU Eng data plot:



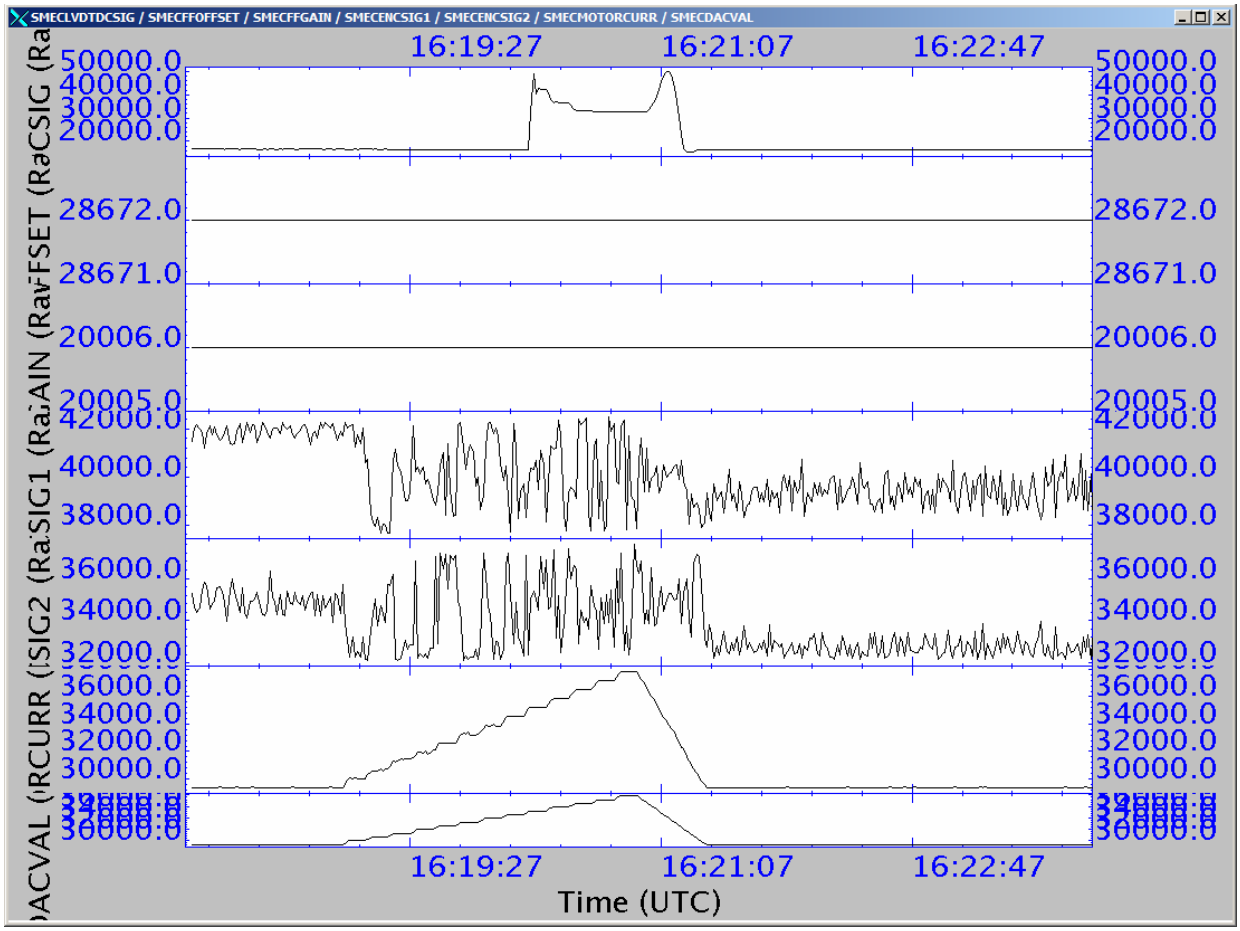
Again the SMEC did not move at all, despite all the settings being identical to the FUNC-SMEC-04A run at 14:39 OBSID: 0xb00010ca.

Decided to set the FF offset and gain to the WFT values from Oct 2007 (see RD08):
0x90557000 (FF offset 28672)
0x90544e26 (FF gain 20006)

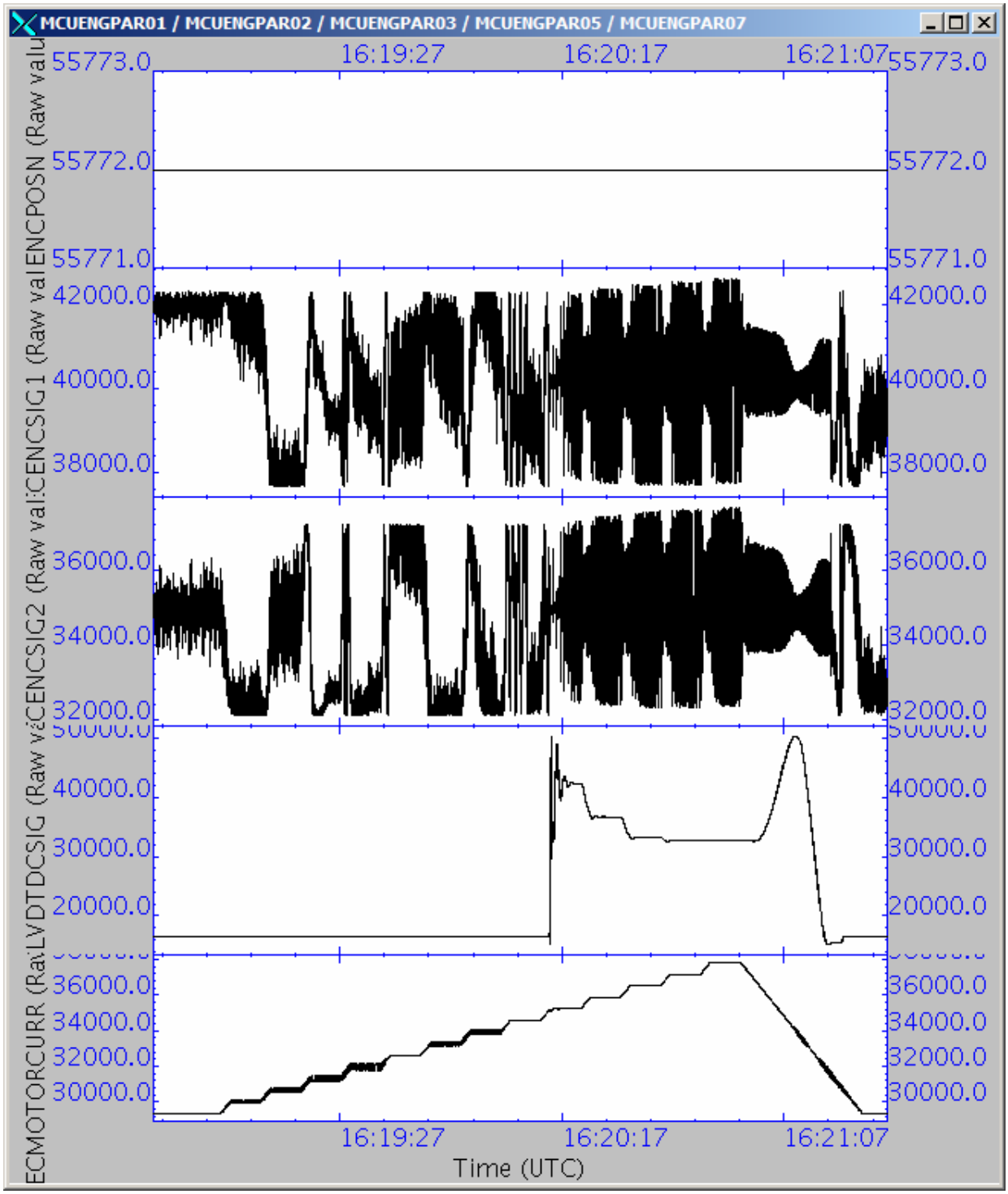
SMEC-04A:
OBSID: b00010d0
Start Time: 16:19

The SMEC LVDT signal did change significantly. But the SMEC sticks on the way back. On the way forward it is late in moving but does move smoothly.

HK plot:



MCU Eng data plot:



16:26 – Started MCU Eng data from the MSTK so that the encoder signals could be recorded: 0x91c10001

Encoder Signal 1: 39500 (0x9a4c)
Encoder Signal 2: 32500 (0x7ef4)

16:31 – Set the encoder signal 1 & 2 offsets from the MSTK:

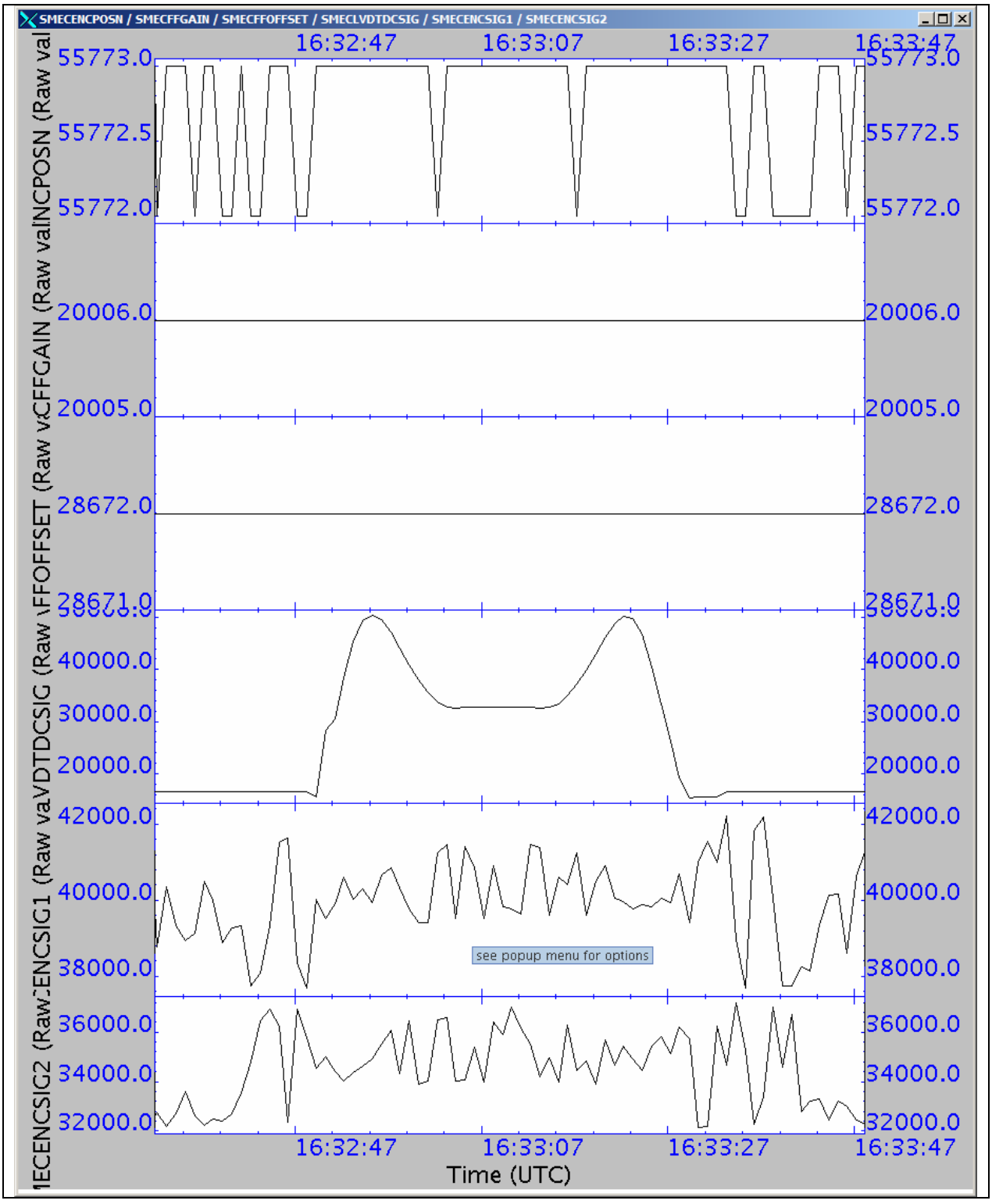
0x90589a4c
0x905a7ef4

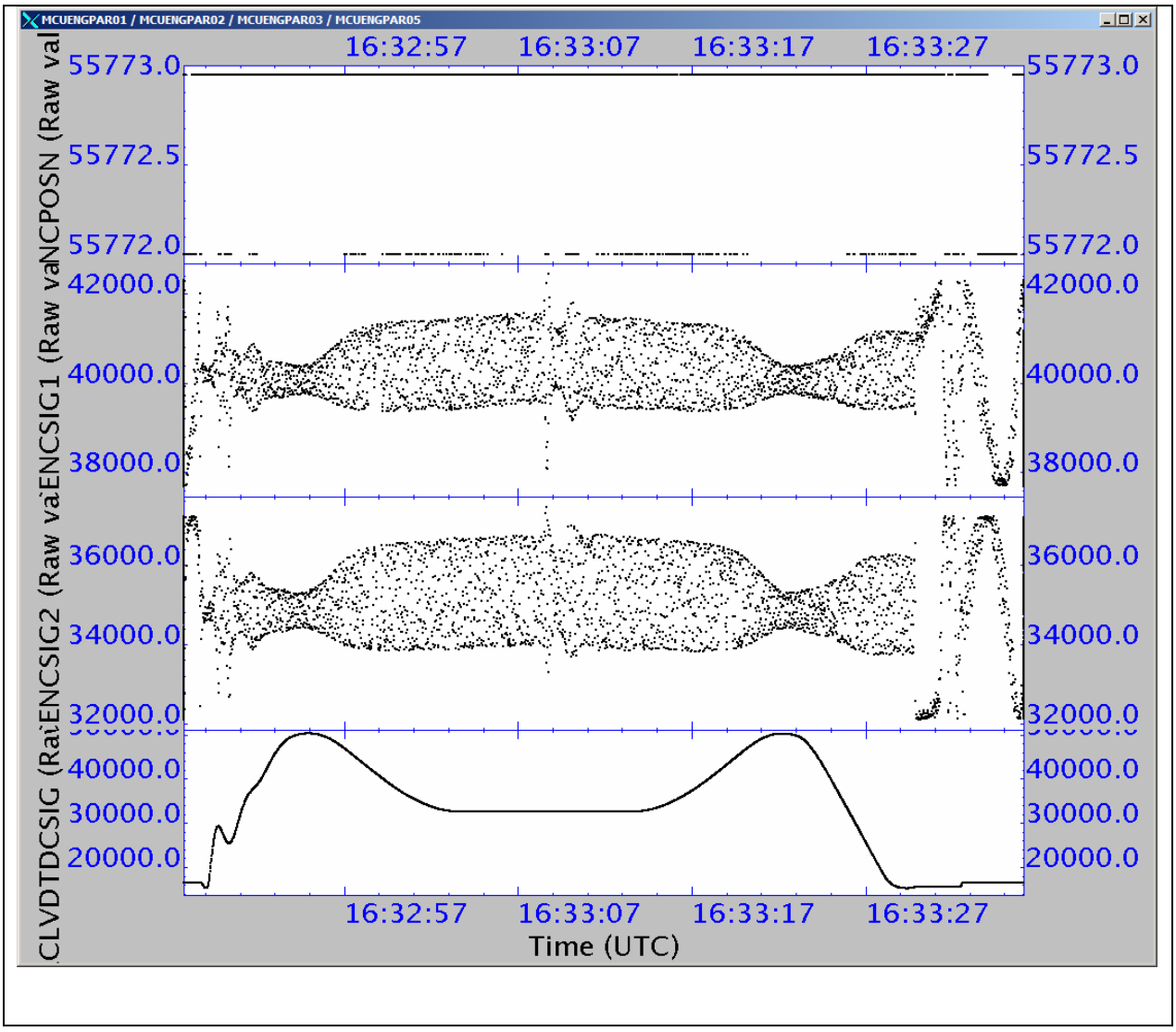
SPIRE-IST-COLD-FUNC-SMEC-09-P
OBSID: 0xb00010d1
Start Time: 16:32

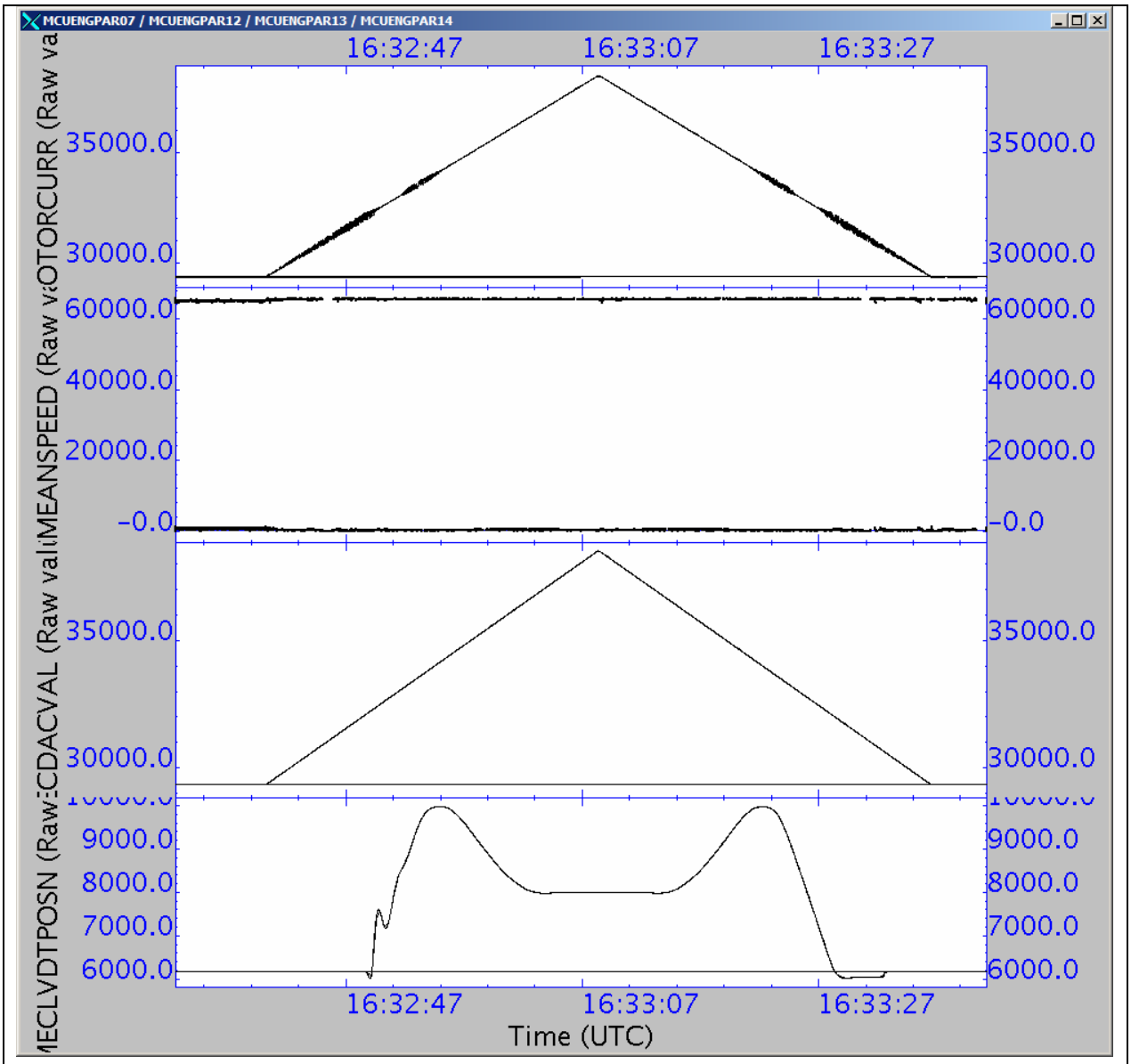
The encoder did not count despite setting the signal 1 & 2 offsets. The reason for this is because we did not use the encoder signals from the middle of the open loop position test. The signal 1 & 2 offsets should have been ~40000 and 35000 respectively.

[In this test the SMEC FF gain is almost 3 times higher than in the last open loop scan test (viz. OBSID: 0xb00010cb, 14:49). The FF offset now is 28672, whereas last time it was ~30000. The effect of higher FF gain is to increase the actual speed – but the SMECMEANSPEED parameter remains close to the commanded speed in open loop].

SMEC seems to be sticking in both directions (see SMECLVDTDCSIG plot) but more smoothly on the way out than before:


SMECENCPOSN / SMECFFGAIN / SMECFFOFFSET / SMECLVDTCSIG / SMECENCSIG1 / SMECENCSIG2
16:32:47
16:33:07
16:33:27
16:33:47
55773.0
55772.5
55772.0
20006.0
20005.0
28672.0
28671.0
40000.0
30000.0
20000.0
42000.0
40000.0
38000.0
36000.0
34000.0
32000.0
see popup menu for options
Time (UTC)


MCUENGPAR01 / MCUENGPAR02 / MCUENGPAR03 / MCUENGPAR05
16:32:57
16:33:07
16:33:17
16:33:27
55773.0
55772.5
55772.0
42000.0
40000.0
38000.0
36000.0
34000.0
32000.0
40000.0
30000.0
20000.0
CLVDTDCSIG (Raw val ENCSIG2 (Raw val ENCSIG1 (Raw val NCPOSN (Raw val
Time (UTC)



New config created to move the SMEC at 0.1mm/s in FUNC-SMEC-09-P

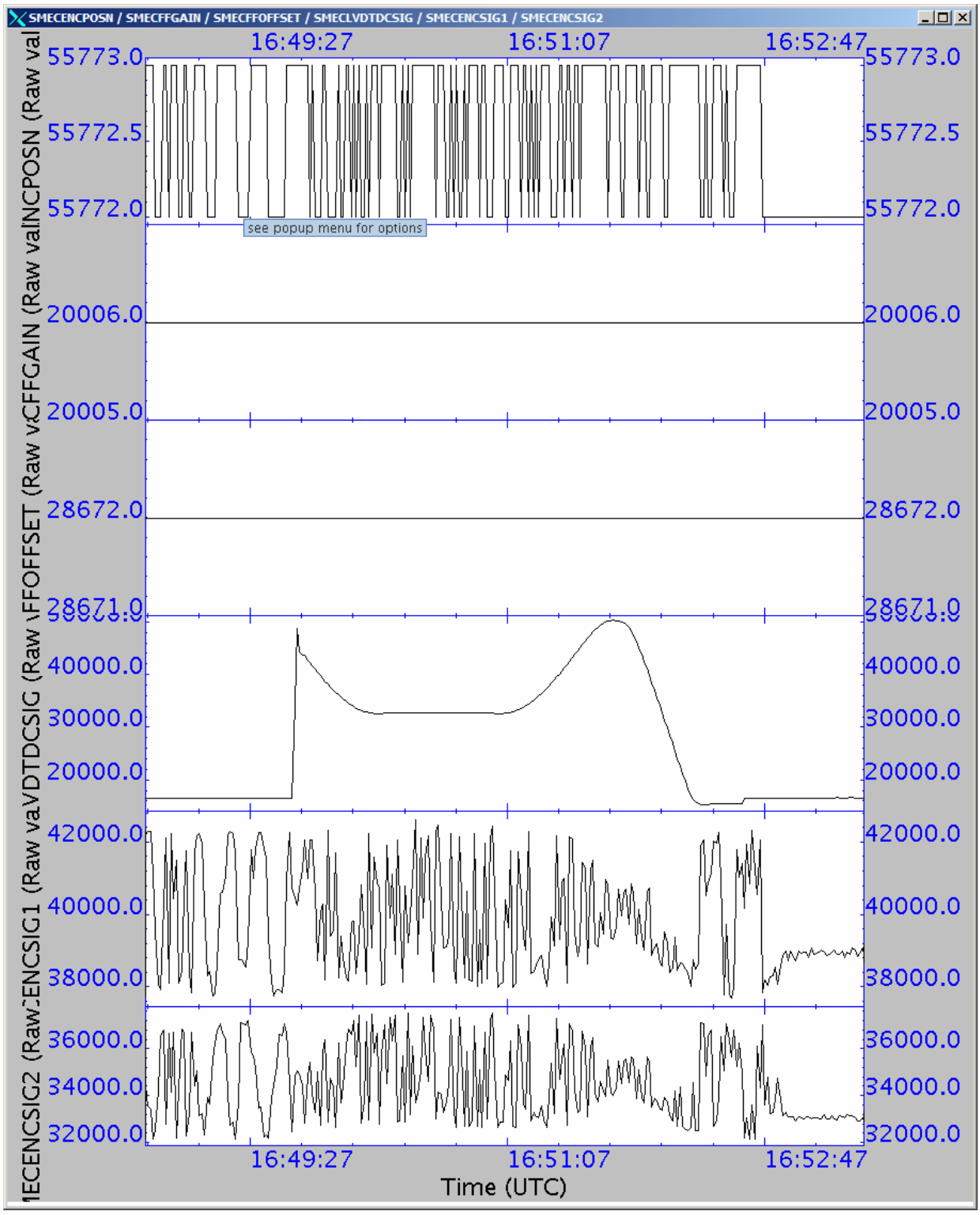
Stopped and restarted the CCS handler server

SPIRE-IST-COLD-FUNC-SMEC-09-P
16:48
Obsid: 0xb00010d2
0.1mm/s scan speed

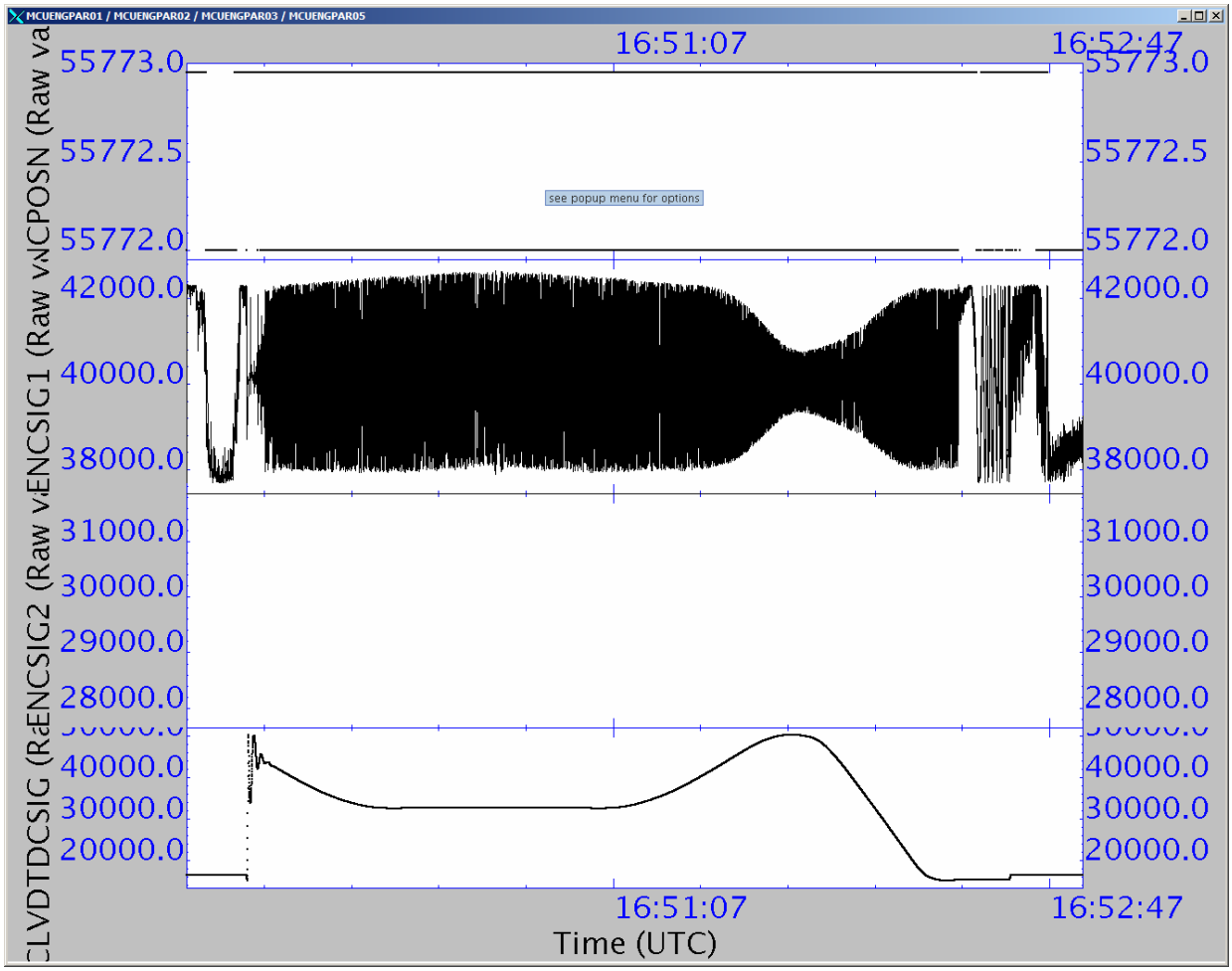
The encoder is not counting because the offsets were not correct.

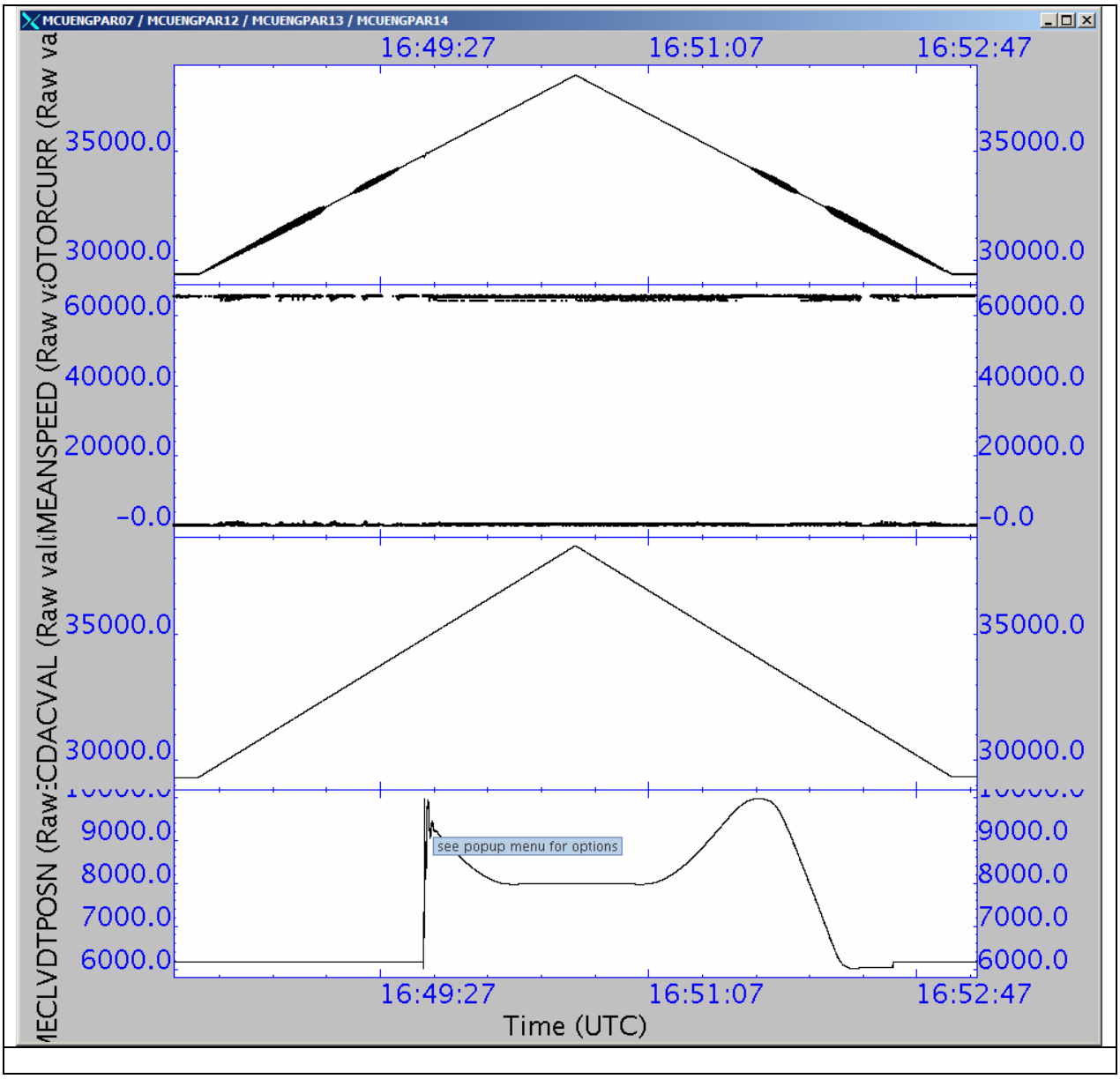
Sticking much more because of the slower speed.

HK plot:


SMECENCPOSN / SMECFFGAIN / SMECFFOFFSET / SMECLVDTCSIG / SMECENCSIG1 / SMECENCSIG2
16:49:27
16:51:07
16:52:47
55773.0
55772.5
55772.0
see popup menu for options
20006.0
20005.0
28672.0
28671.0
40000.0
30000.0
20000.0
42000.0
40000.0
38000.0
36000.0
34000.0
32000.0
Time (UTC)

MCU Eng plots:




MCUENGPAR07 / MCUENGPAR12 / MCUENGPAR13 / MCUENGPAR14
16:49:27
16:51:07
16:52:47
35000.0
30000.0
60000.0
40000.0
20000.0
-0.0
35000.0
30000.0
9000.0
8000.0
7000.0
6000.0
see popup menu for options
Time (UTC)

3.3.14 SPIRE-IST-COLD-FUNC-SMEC-07-P

Test Id:	SPIRE-IST-COLD-FUNC-SMEC-07-P
Test Purpose:	SMEC (PRIME) Closed Loop Scan Test
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON+ SMEC ON (open loop)
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON+ SMEC ON (closed loop)
Duration	10 minutes (CUS: 199 seconds)
Success Criteria:	Test passed if: SMEC stays in closed loop mode while scanning

CUS Parameters	int scan_start = 1000 in [0,39900]; //Scan starting point (um)
	int scan_end = 39500 in [0,39900]; //Scan ending point (um)
	int scan_fspeed = 500 in [0,2000]; //Scan forward speed (um/s)
	int scan_rspeed = 500 in [0,2000]; //Scan reverse speed (um/s)
	int nscans = 50 in [2,65535]; //Number of scans (has to be even)
	double framerate = 250.0; // Specifies the frame rate

Test Procedure:

Step#	Action
1	**Use QLA plot time series of MCU engineering parameters** **MCUENGPAR01 – SMECENCPOSN** **MCUENGPAR02 – SMECENCSIG1** **MCUENGPAR03 – SMECENCSIG2** **MCUENGPAR05 – SMECLVDTDCSIG** **MCUENGPAR07 – SMECMOTORCURR** **MCUENGPAR10 – SMECPOSNERROR** **MCUENGPAR13 – SMECDACVAL** **MCUENGPAR14 – SMECLVDTPOSN** **The same parameters can also be plotted from the nominal HK packet.**
2	**Run SPIRE-IST-COLD-FUNC-SMEC-07-P test procedure from the CCS.**
3	Contingency: If test fails repeat steps 1 and 2.

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
SPIRE-IST-COLD-FUNC-SMEC-07-P	SMECENCPWR SMECENCSIG1 SMECENCSIG2		See plots below		**Partial Success**

SPIRE-IST-COLD-SMEC-INIT-P: Commands to put the SMEC into closed loop were executed manually.

Control Loop Parameters:

Parameter	Value used here	PFM ILT Value
SMECKP	**1000 – 0x03e8**	**2000 – 0x07d0**
SMECKI	**2000 – 0x07d0**	**1000 – 0x03e8**
SMECKD	**10000 – 0x2710**	**700 – 0x02bc**
SMECDFILT	**7000 – 0x1b58**	**2000 – 0x07d0**

Log of the manual commands to put the SMEC into closed loop:

```
SCD06505   SEND_DRCU_COMMAND                 2008.137.18.44.03  2008.137.18.44.03.372 E E E
MS hpws22   2008.137.18.44.05.428 S SS  S S        S
  SPD4N505 DRCUCOMMAND              Raw      Hex                904D07D0
  SPD9N505 OVERRIDE                 Raw      Hex                0
SCD06505   SEND_DRCU_COMMAND                 2008.137.18.43.29  2008.137.18.43.29.106 E E E
MS hpws22   2008.137.18.43.33.384 S SS  S S        S
  SPD4N505 DRCUCOMMAND              Raw      Hex                904A03E8
  SPD9N505 OVERRIDE                 Raw      Hex                0
SCD06505   SEND_DRCU_COMMAND                 2008.137.18.42.18  2008.137.18.42.18.839 E E E
MS hpws22   2008.137.18.42.25.277 S SS  S S        S
  SPD4N505 DRCUCOMMAND              Raw      Hex                90440001
  SPD9N505 OVERRIDE                 Raw      Hex                0
SCD06505   SEND_DRCU_COMMAND                 2008.137.18.42.09  2008.137.18.42.09.448 E E E
MS hpws22   2008.137.18.42.13.765 S SS  S S        S
  SPD4N505 DRCUCOMMAND              Raw      Hex                904B2710
  SPD9N505 OVERRIDE                 Raw      Hex                0
SCD06505   SEND_DRCU_COMMAND                 2008.137.18.41.59  2008.137.18.41.59.620 E E E
MS hpws22   2008.137.18.42.01.740 S SS  S S        S
  SPD4N505 DRCUCOMMAND              Raw      Hex                904C1B58
  SPD9N505 OVERRIDE                 Raw      Hex                0
SCD06505   SEND_DRCU_COMMAND                 2008.137.18.09.46  2008.137.18.09.46.458 E E E
MS hpws22   2008.137.18.09.53.426 S SS  S S        S
  SPD4N505 DRCUCOMMAND              Raw      Hex                90490001
  SPD9N505 OVERRIDE                 Raw      Hex                0
SCD06505   SEND_DRCU_COMMAND                 2008.137.18.09.16  2008.137.18.09.16.357 E E E
MS hpws22   2008.137.18.09.21.397 S SS  S S        S
  SPD4N505 DRCUCOMMAND              Raw      Hex                90490004
  SPD9N505 OVERRIDE                 Raw      Hex                0
SCD06505   SEND_DRCU_COMMAND                 2008.137.18.07.27  2008.137.18.07.27.088 E E E
MS hpws22   2008.137.18.07.33.223 S SS  S S        S
  SPD4N505 DRCUCOMMAND              Raw      Hex                90450000
  SPD9N505 OVERRIDE                 Raw      Hex                0
SCD06505   SEND_DRCU_COMMAND                 2008.137.18.05.04  2008.137.18.05.04.694 E E E
MS hpws22   2008.137.18.05.09.515 S SS  S S        S
  SPD4N505 DRCUCOMMAND              Raw      Hex                904512C0
  SPD9N505 OVERRIDE                 Raw      Hex                0
SCD06505   SEND_DRCU_COMMAND                 2008.137.18.03.29  2008.137.18.03.29.552 E E E
MS hpws22   2008.137.18.03.31.366 S SS  S S        S
  SPD4N505 DRCUCOMMAND              Raw      Hex                90490001
  SPD9N505 OVERRIDE                 Raw      Hex                0
SCD06505   SEND_DRCU_COMMAND                 2008.137.18.01.50  2008.137.18.01.50.682 E E E
MS hpws22   2008.137.18.01.53.730 S SS  S S        S
  SPD4N505 DRCUCOMMAND              Raw      Hex                90490004
  SPD9N505 OVERRIDE                 Raw      Hex                0
SCD06505   SEND_DRCU_COMMAND                 2008.137.18.01.04  2008.137.18.01.04.080 E E E
MS hpws22   2008.137.18.01.09.665 S SS  S S        S
  SPD4N505 DRCUCOMMAND              Raw      Hex                905A88B8
  SPD9N505 OVERRIDE                 Raw      Hex                0
Command history printout from time: 2008.137.09.45.00.000 to time: 2008.137.19.35.00.000
Current printout time: 2008.140.15.22.48.867  Print view mode: FULL  Sort order: RELEASE
Filter: INACTIVE

Name       Description              Sequence Release Time       Execution Time        S D C G B
IL ST Source   Update Time           R GTO A S 012345 C
-------------------------------------------------------------------------------------------------
-----------------------------------------------------

SCD06505   SEND_DRCU_COMMAND                 2008.137.18.00.50  2008.137.18.00.50.751 E E E
MS hpws22   2008.137.18.00.57.642 S SS  S S        S
  SPD4N505 DRCUCOMMAND              Raw      Hex                90589C40
```

```
SCD06505   SEND_DRCU_COMMAND                 2008.137.17.57.26  2008.137.17.57.26.356 E E E
MS hpws22   2008.137.17.57.29.352 S SS  S S        S
  SPD4N505 DRCUCOMMAND              Raw      Hex                90559000
  SPD9N505 OVERRIDE                 Raw      Hex                0
SCD06505   SEND_DRCU_COMMAND                 2008.137.17.54.48  2008.137.17.54.48.673 E E E
MS hpws22   2008.137.17.54.57.612 S SS  S S        S
  SPD4N505 DRCUCOMMAND              Raw      Hex                9055FFFF
  SPD9N505 OVERRIDE                 Raw      Hex                0
SCD06505   SEND_DRCU_COMMAND                 2008.137.17.54.10  2008.137.17.54.10.758 E E E
MS hpws22   2008.137.17.54.13.552 S SS  S S        S
  SPD4N505 DRCUCOMMAND              Raw      Hex                91C10001
  SPD9N505 OVERRIDE                 Raw      Hex                0
SCD06505   SEND_DRCU_COMMAND                 2008.137.17.52.22  2008.137.17.52.22.802 E E E
MS hpws22   2008.137.17.52.25.412 S SS  S S        S
  SPD4N505 DRCUCOMMAND              Raw      Hex                90559000
  SPD9N505 OVERRIDE                 Raw      Hex                0
```

It was decided to perform SMEC closed loop scans at 0.1mm/s. Therefore the CUS script for FUNC-SMEC-07 was changed so that the speed was reduced from 0.5 mm/s to 0.1 mm/s. The number of scans was reduced from 50 to 4 (the 50 scans were intended for the microvibration test configuration). Also the scan range was changed from 0-39.5 mm to 0-8 mm as we are using a higher SMEC FF offset.

Mission configuration fm_ist_cft_config5p created.

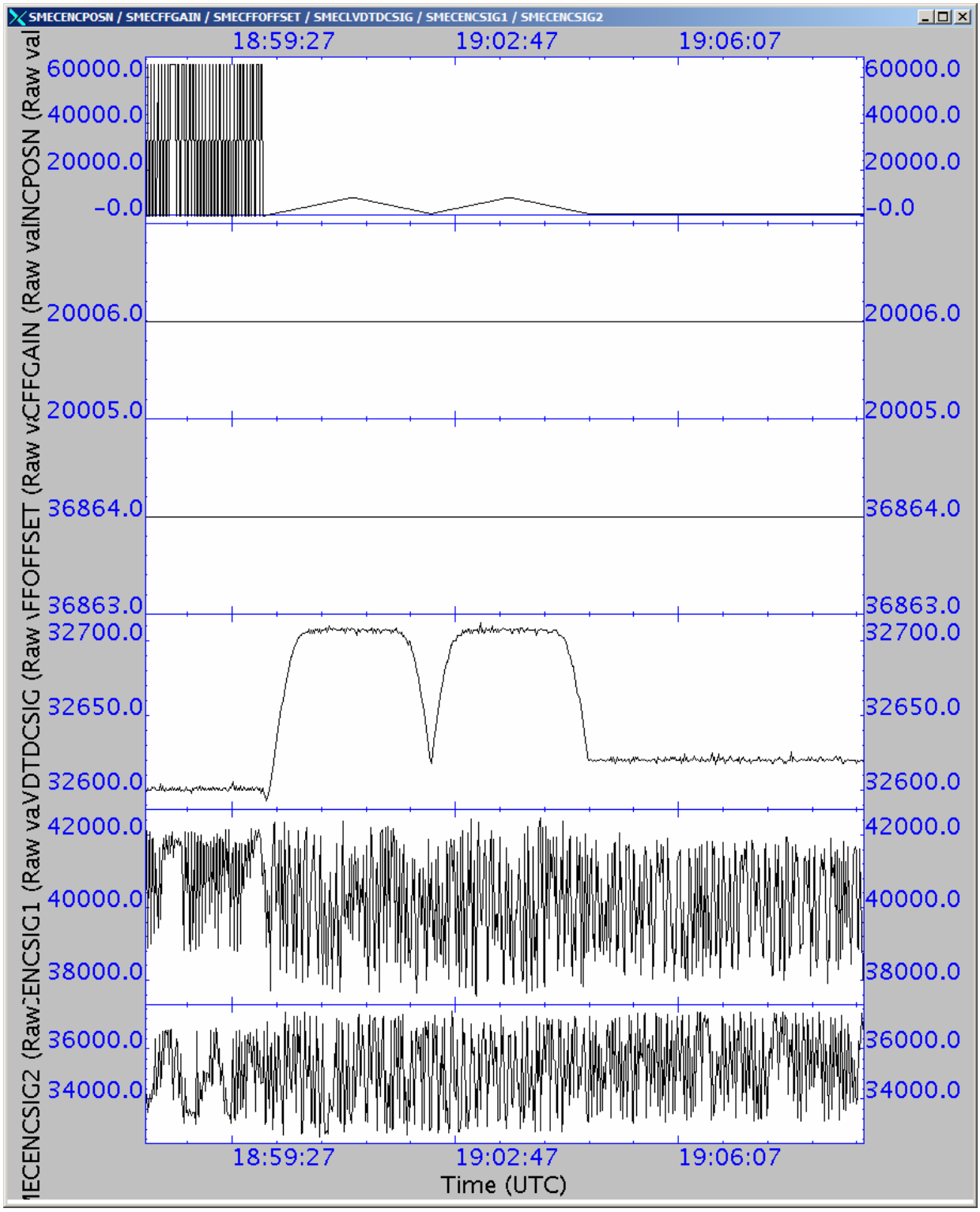
The connection to the PipeGW was stopped.
The CCS handler was stopped and restarted
The connection to the PipeGW was restarted

SPIRE-IST-COLD-FUNC-SMEC-07-P:
Start time @: 18:50
End time @:
OBSID: NA

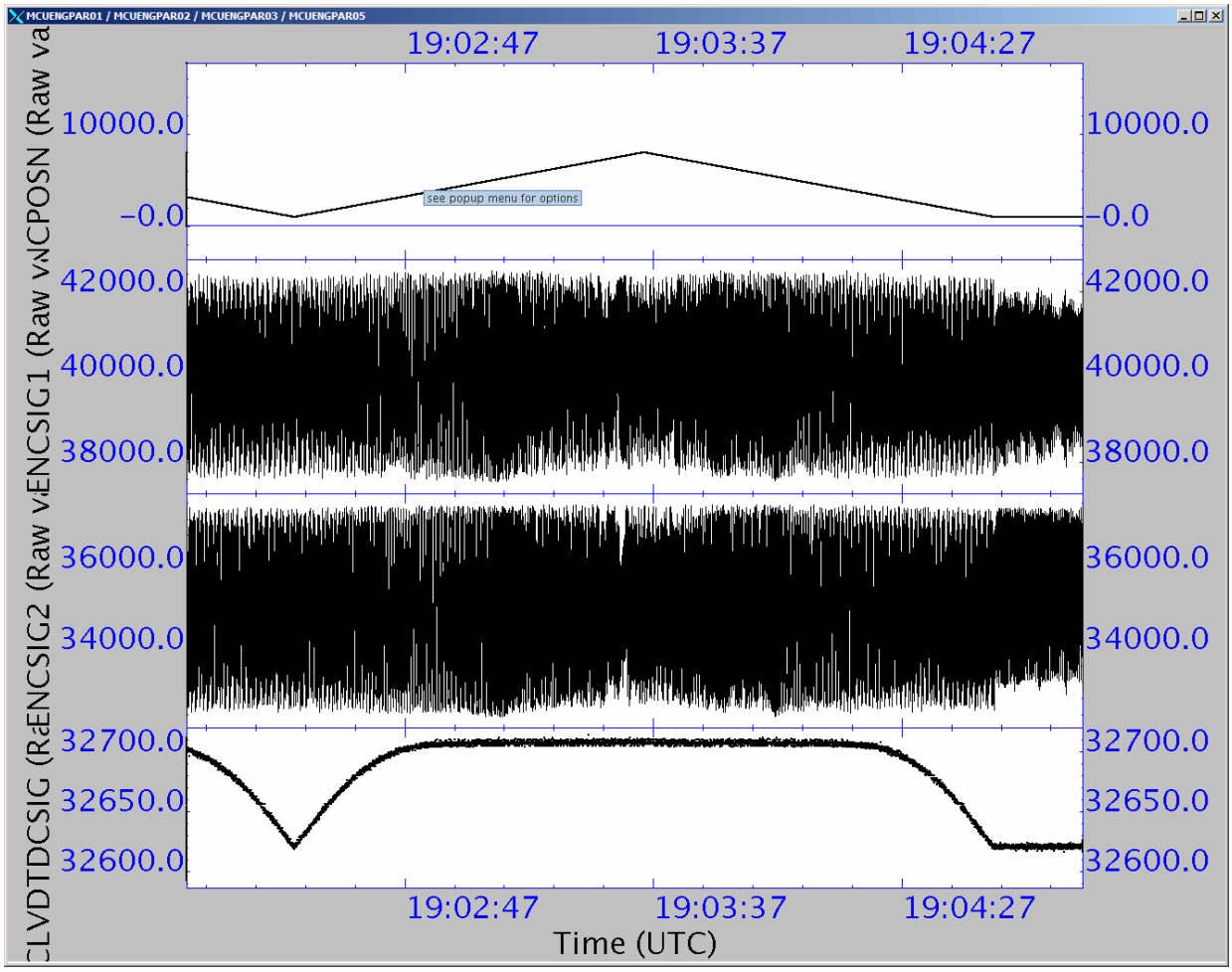
Comments: The script did not work. Resorted to running the closed loop scans manually. Request 2 triangular scans from 1mm to 8mm (should take ~5 minutes at 0.1mm/s speed)

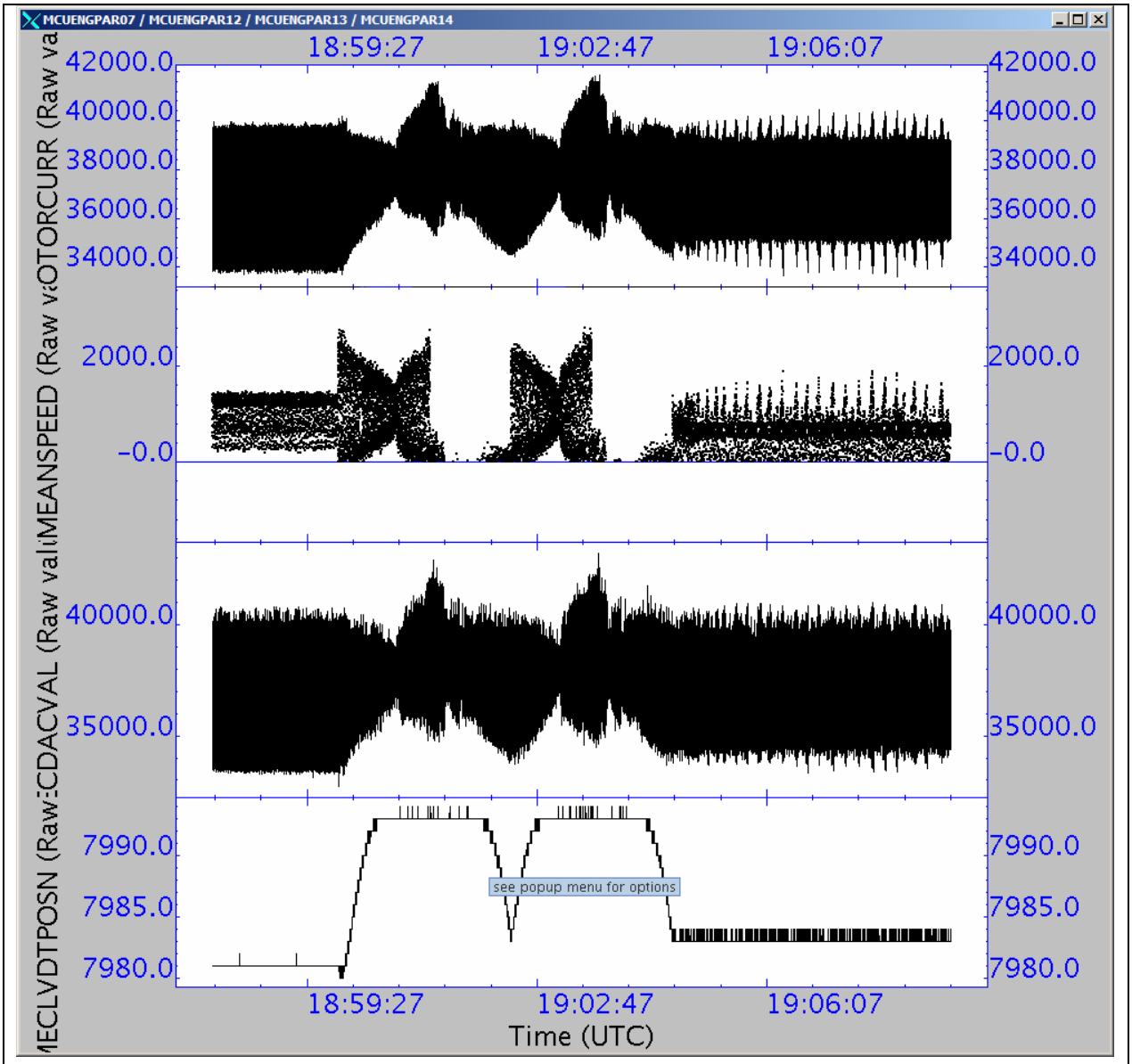
```
SCD06505   SEND_DRCU_COMMAND                 2008.137.19.01.28  2008.137.19.01.28.255 E E E
MS hpws22   2008.137.19.01.33.454 S SS  S S        S
  SPD4N505 DRCUCOMMAND              Raw      Hex                90490002
  SPD9N505 OVERRIDE                 Raw      Hex                0
Command history printout from time: 2008.137.09.45.00.000 to time: 2008.137.19.35.00.000
Current printout time: 2008.140.15.22.48.867  Print view mode: FULL  Sort order: RELEASE
Filter: INACTIVE

Name       Description              Sequence Release Time       Execution Time        S D C G B
IL ST Source   Update Time           R GTO A S 012345 C
-------------------------------------------------------------------------------------------------
-----------------------------------------------------

SCD06505   SEND_DRCU_COMMAND                 2008.137.19.00.44  2008.137.19.00.44.801 E E E
MS hpws22   2008.137.19.00.49.405 S SS  S S        S
  SPD4N505 DRCUCOMMAND              Raw      Hex                90480004
  SPD9N505 OVERRIDE                 Raw      Hex                0
SCD06505   SEND_DRCU_COMMAND                 2008.137.19.00.24  2008.137.19.00.25.035 E E E
MS hpws22   2008.137.19.00.33.371 S SS  S S        S
  SPD4N505 DRCUCOMMAND              Raw      Hex                90451F40
  SPD9N505 OVERRIDE                 Raw      Hex                0
```

HK plot:


SMECENCPOSN / SMECFFGAIN / SMECFFOFFSET / SMECLVDTCSIG / SMECENCSIG1 / SMECENCSIG2
18:59:27
19:02:47
19:06:07
60000.0
40000.0
20000.0
-0.0
20006.0
20005.0
36864.0
36863.0
32700.0
32650.0
32600.0
42000.0
40000.0
38000.0
36000.0
34000.0
Time (UTC)

MCU Engineering data plots:

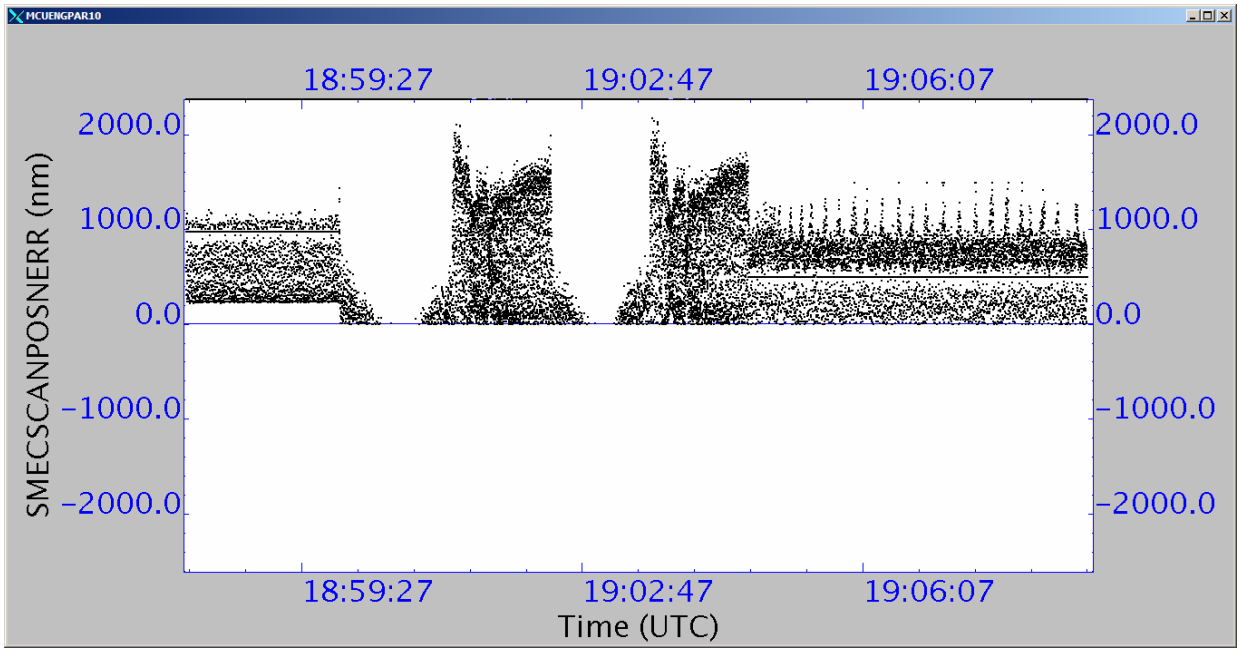




Comments:

- **The loop remained closed throughout.**
- **The speed given by the SMECMEANSPEED parameter in the MCU Eng packet is correct, i.e. 0.1 mm/s**
- **The SMECLVDTDCSIG is just showing bit noise because we are outside the LVDT range while scanning.**

Plot of the SMEC position error:



The unfiltered position error is ~600 nm. This is perhaps a little large but could be partially due to using the LAM control loop parameter values rather than those from PFM ILT campaigns.

3.3.15 SPIRE-IST-COLD-FUNC-SMEC-04B-P

Test Id:	SPIRE-IST-COLD-FUNC-SMEC-04B-P
Test Purpose:	SMEC (PRIME) Closed Loop Positioning Test
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON+ SMEC ON closed loop)
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON+ SMEC ON (closed loop)
Duration	10 minutes (CUS: 452 seconds)
Success Criteria:	Test passed if: SMEC moves to the commanded positions in closed loop

CUS Parameters	string frametype = "ENG"; // Specifies MCU frame type
	double framerate = 250.0; // Specifies the frame rate
	int scan_start = 1000 in [0,39900]; // Step look scan starting point (um)
	int scan_end = 39000 in [0,39900]; // Step look scan ending point (um)
	int scan_step = 1000 in [0,39900]; // Step look scan step size (um)
	int scan_fspeed = 500 in [0,2000]; // Scan forward speed (um/s)
	int scan_rspeed = 500 in [0,2000]; // Scan fly back speed (um/s)
	int ftime = 5; // Time at each scan position

Test Procedure:

Step#	Action
1	**Run FUNC-SMEC-03.py script on QLA**
2	**Run SPIRE-IST-COLD-FUNC-SMEC-04B-P test procedure from the CCS.**
3	Contingency: If test fails repeat steps 1 and 2.

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
SPIRE-IST-COLD-FUNC-SMEC-04B-P	SMECENCPWR SMECENCSIG1 SMECENCSIG2		See plots below		**Not run due to lack of time**

Start time @:
End time @:
OBSID:

Comments:

HK plot:

MCU Engineering data plot:

3.3.16 SPIRE-IST-SMEC-RAMP-MICROVIBRATION

Test Id:	SPIRE-IST-SMEC-RAMP-MICROVIBRATION
Test Purpose:	SMEC (PRIME) Closed loop microvibration test while the S/C reaction wheels are in operation and the SMEC is scanning
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON+ SMEC ON (closed loop)
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON+ SMEC ON (closed loop)
Duration	68 minutes (CUS: 4030 seconds)
Success Criteria:	Test passed if: SMEC remains in closed loop during the test while the S/C reaction wheels are ramped over the full range of operational speed
CUS Parameters	• The script is run standalone from the CCS. • The OBSID will be prompted for on the CCS (Available range: 0xB00003F3 to 0xB00003FF. • 50 full range SMEC scans are planned at 0.5mm/s scan speed. • If the SMEC goes into open loop the test may have to be aborted (TBC).

Test Procedure:

Step#	Action
1	**Use QLA plot time series of MCU engineering parameters** **MCUENGPAR01 – SMECENCPOSN** **MCUENGPAR02 – SMECENCSIG1** **MCUENGPAR03 – SMECENCSIG2** **MCUENGPAR05 – SMECLVDTDCSIG** **MCUENGPAR07 – SMECMOTORCURR** **MCUENGPAR10 – SMECPOSNERROR** **MCUENGPAR13 – SMECDACVAL** **MCUENGPAR14 – SMECLVDTPOSN** **The same parameters can also be plotted from the nominal HK packet.**
2	**Run SPIRE-IST-SMEC-RAMP-MICROVIBRATION test procedure from the CCS.**
3	Contingency: If test fails repeat steps 1 and 2.

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
SPIRE-IST-SMEC-RAMP-MICROVIBRATION	**SMECENCPWR** **SMECENCSIG1** **SMECENCSIG2**		See plots below		**Not run due to lack of time**

Start time @:
End time @:
OBSID:

Comments:

HK plot:

MCU Engineering data plot:

3.3.17 SPIRE-IST-COLD-FUNC-SMEC-02B-P

Test Id:	SPIRE-IST-COLD-FUNC-SMEC-02B-P
Test Purpose:	SMEC (PRIME) Close Launch Latch Check.
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON+ SMEC ON (closed loop) SMEC unlatched
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON +MCU ON+ SMEC ON (open loop) SMEC latched
Duration	5 minutes (CUS: 222 seconds)
Success Criteria:	Test passed if: SMEC does not move after SMEC is latched. The script tries to scan the SMEC to 20mm in open loop at 0.5mm/s.
CUS Parameters	string ltch = "latch"; // Command SMEC to unlatch

Test Procedure:

Step#	Action
1	**Use QLA plot time series of MCU engineering parameters** **MCUENGPAR01 – SMECENCPOSN** **MCUENGPAR02 – SMECENCSIG1** **MCUENGPAR03 – SMECENCSIG2** **MCUENGPAR05 – SMECLVDTDCSIG** **MCUENGPAR07 – SMECMOTORCURR** **MCUENGPAR13 – SMECDACVAL** **MCUENGPAR14 – SMECLVDTPOSN** **The same parameters can also be plotted from the nominal HK packet.**
2	**Run SPIRE-IST-COLD-FUNC-SMEC-02B-P test procedure from the CCS.**
3	Contingency: If test fails repeat steps 1 and 2.

Test Log:

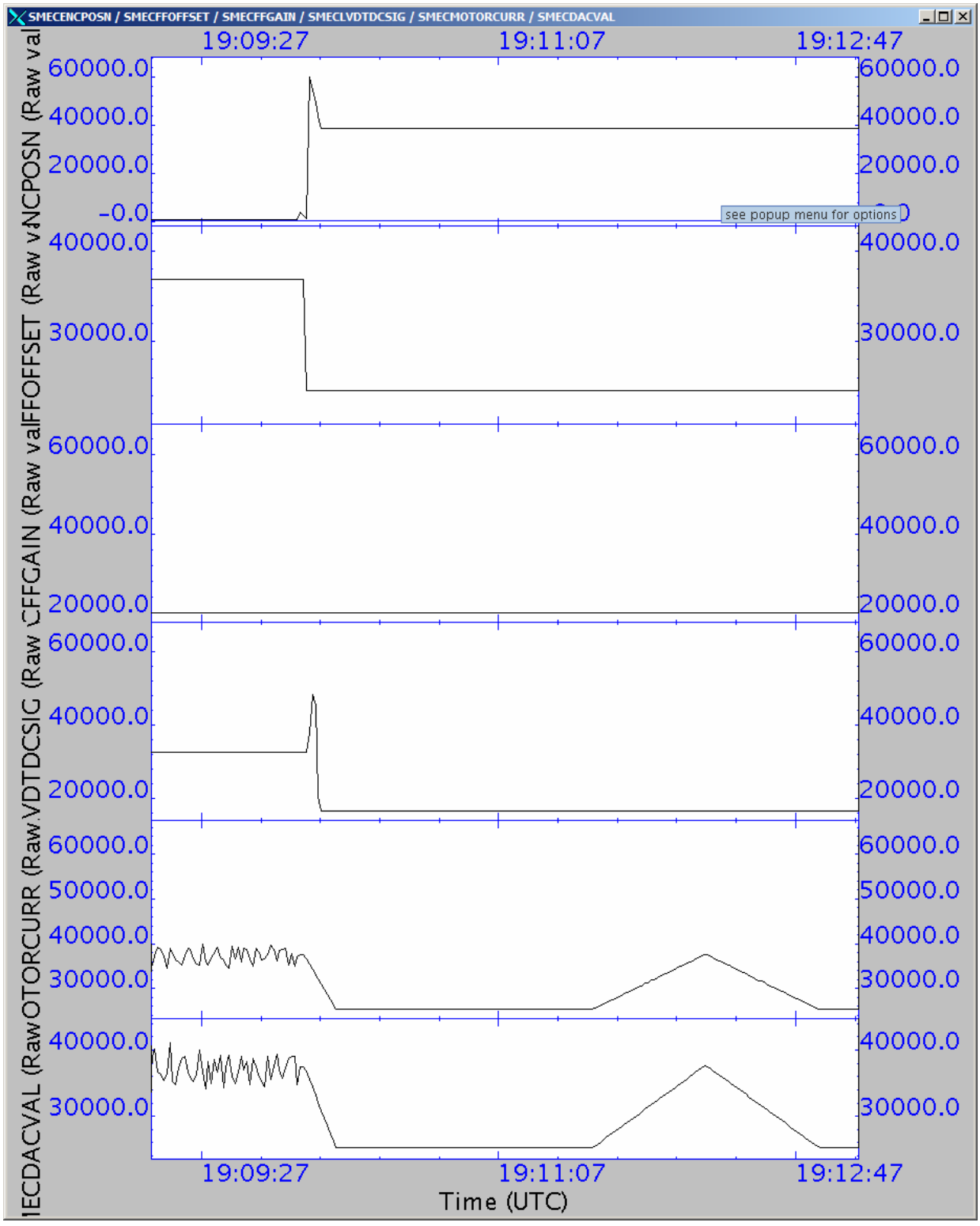
Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
SPIRE-IST-COLD-FUNC-SMEC-2B-P	SMECENCPWR SMECENCSIG1 SMECENCSIG2		See plots below		**Pass**

Start time @: 19:09
End time @:
OBSID: 0xb00010d5

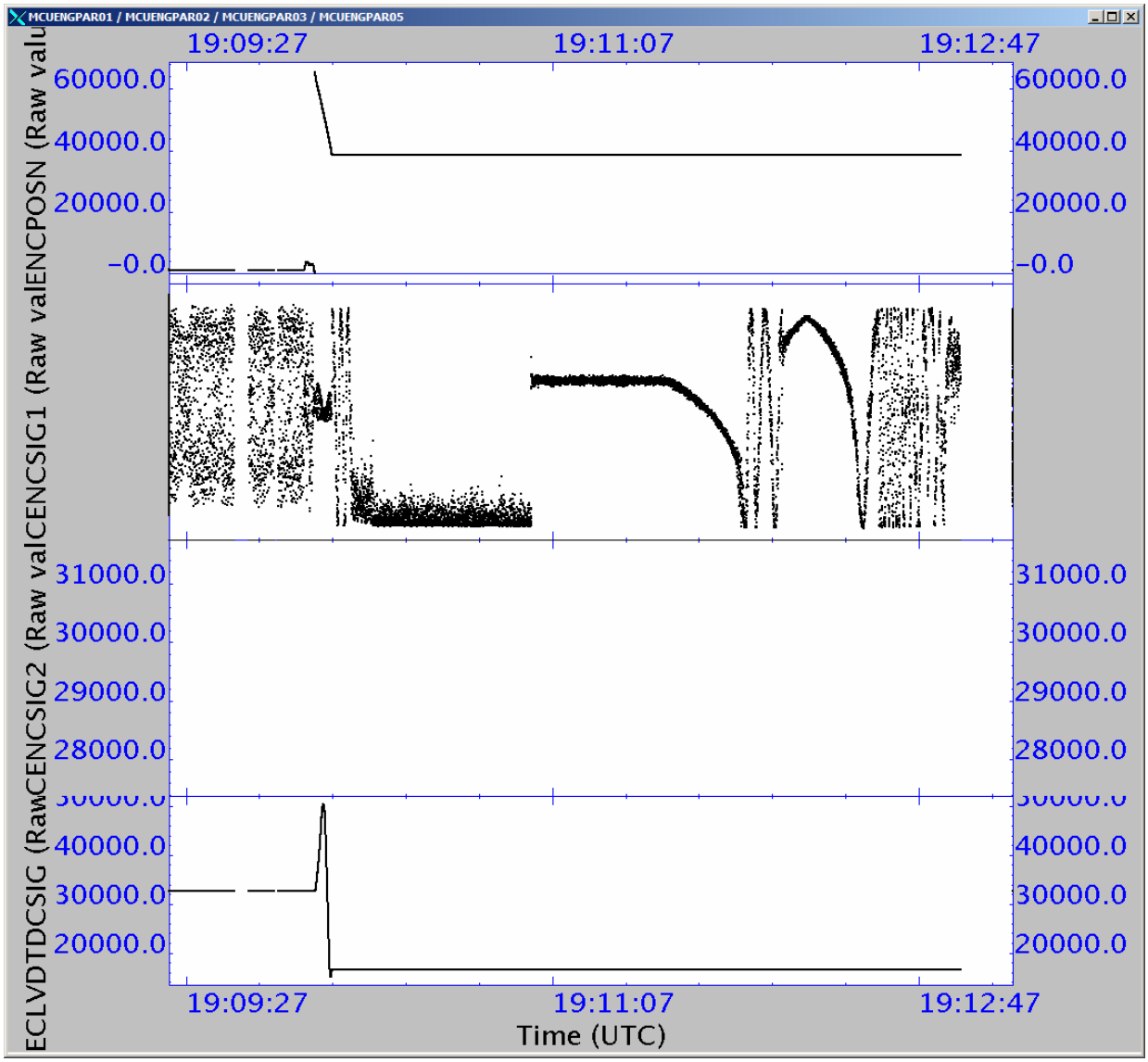
Comments: The SMEC is brought back to its mechanical stop and then latched.

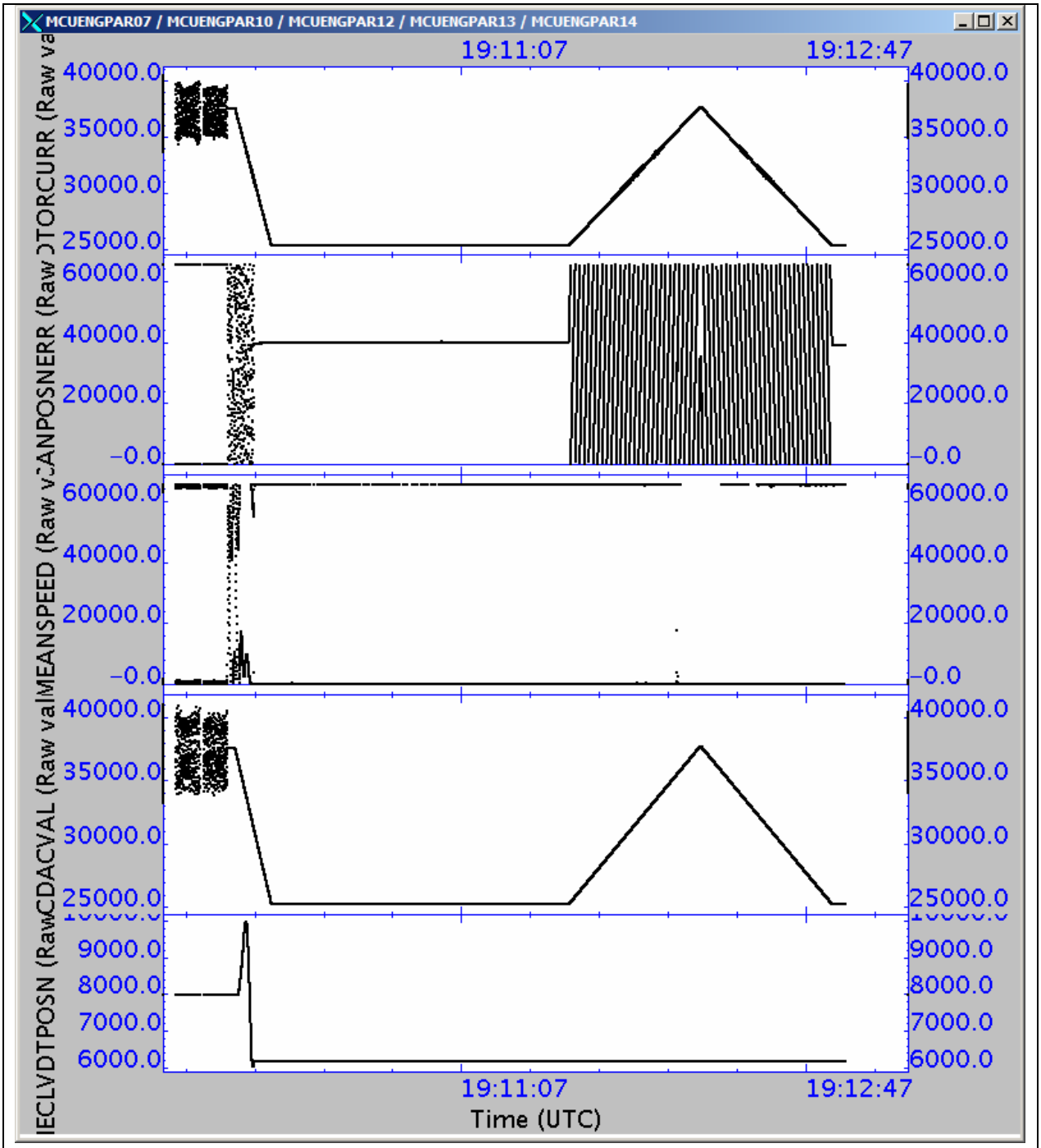
The SMEC does get latched

HK plot:

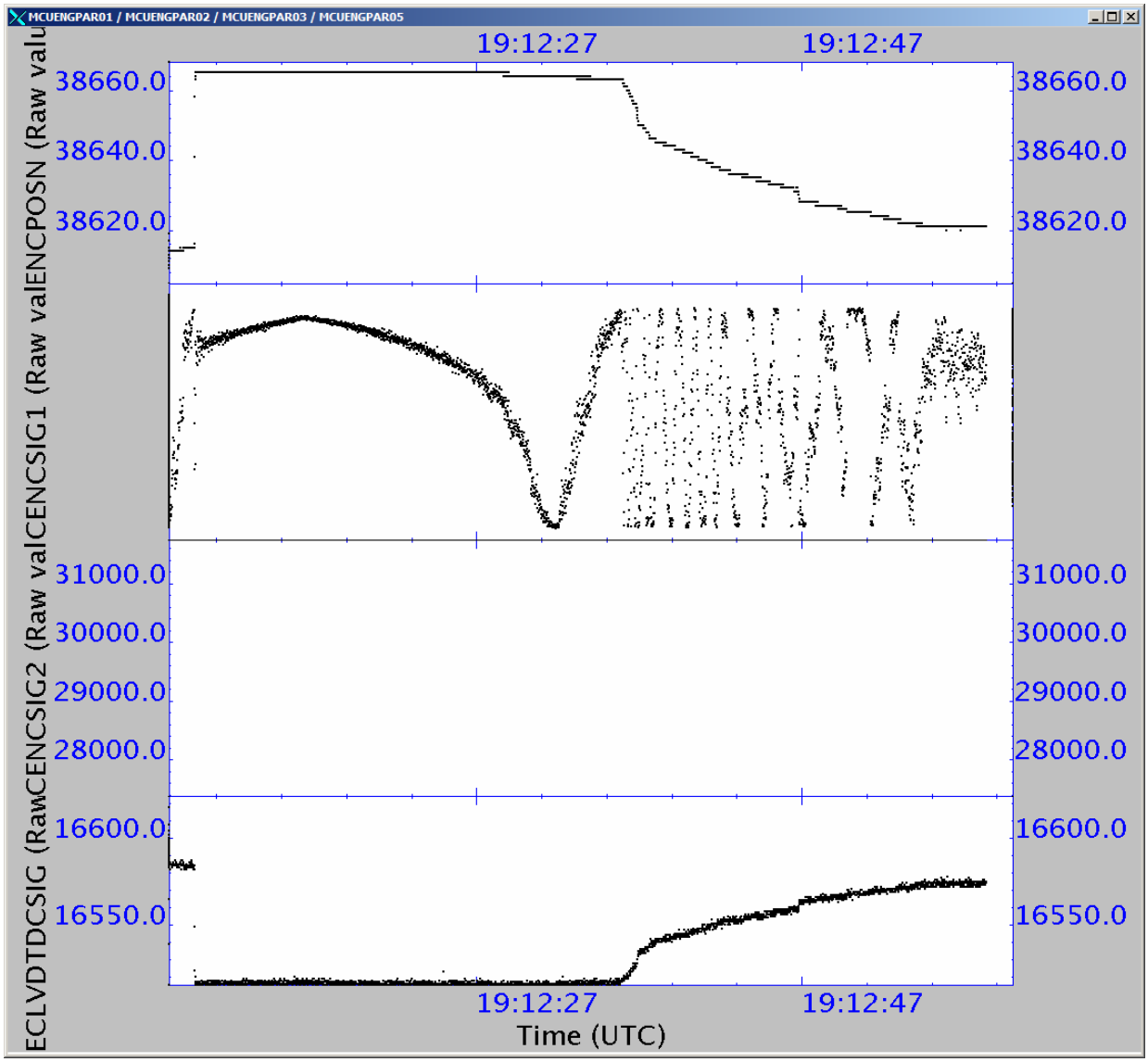

SMECENCPOSN / SMECFFOFFSET / SMECFFGAIN / SMECLVDTDCSIG / SMECMOTORCURR / SMECDACVAL
19:09:27
19:11:07
19:12:47
see popup menu for options
SMECENCPOSN (Raw val
SMECFFOFFSET (Raw val
SMECFFGAIN (Raw val
SMECLVDTDCSIG (Raw
SMECMOTORCURR (Raw
SMECDACVAL (Raw
Time (UTC)

MCU Engineering data plots:




MCUENGPAR07 / MCUENGPAR10 / MCUENGPAR12 / MCUENGPAR13 / MCUENGPAR14
19:11:07
19:12:47
40000.0
35000.0
30000.0
25000.0
60000.0
40000.0
20000.0
-0.0
9000.0
8000.0
7000.0
6000.0
Time (UTC)

Zoom of the SMECENCPOSN and SMECLVDTDCSIG showing the ~50µm gap around the latch pin:

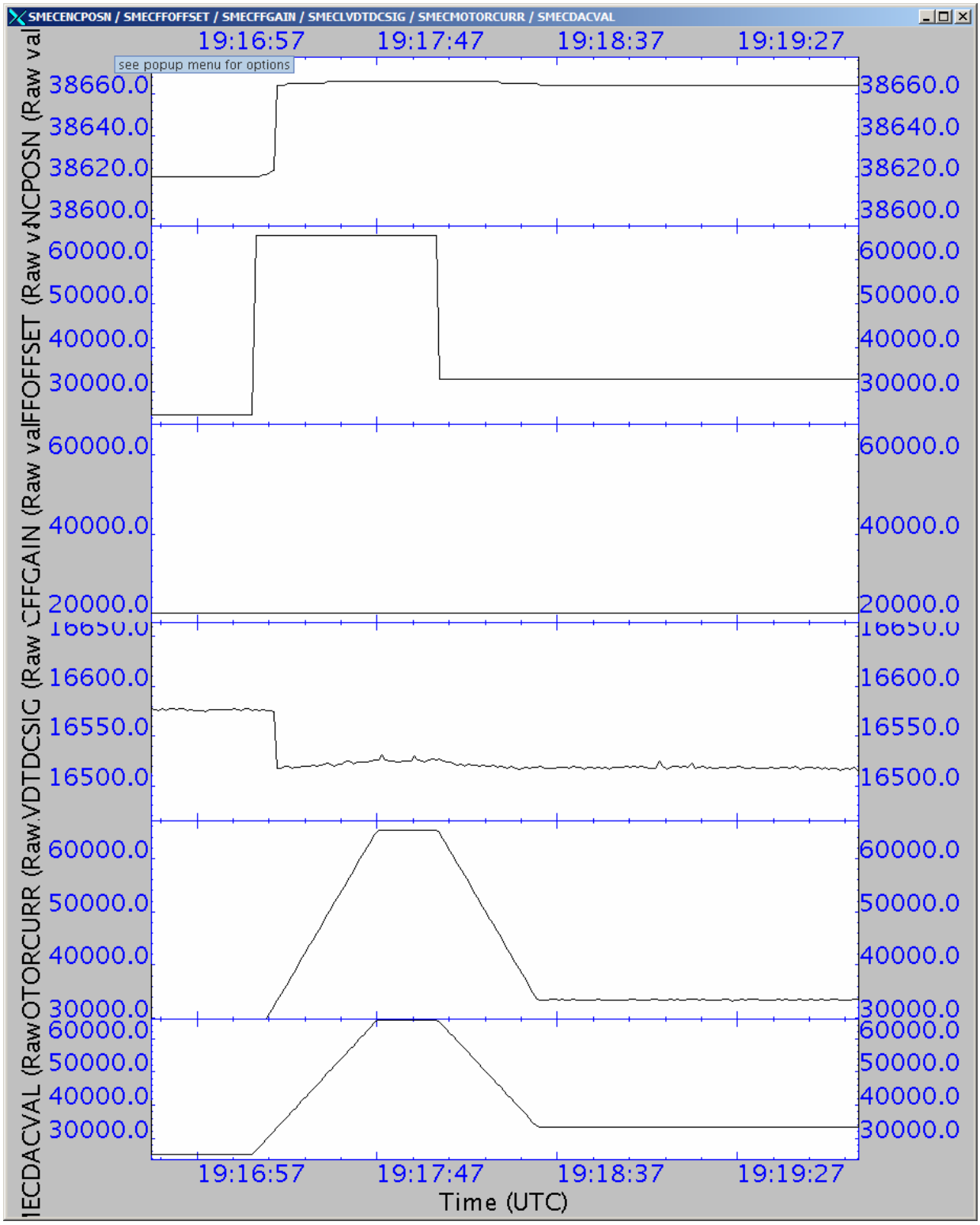


The only conclusion which can be made here is that the SMEC does not stick significantly within the latch pin gap.

Following the latch test there was a manual check to confirm whether the mechanism was truly latched (the SMEC FF offset was first set to 0xFFFF and then back to 0x8000):

```
SCD06505    SEND_DRCU_COMMAND                  2008.137.19.18.34  2008.137.19.18.34.122 E E E
MS hpws22    2008.137.19.18.37.451 S SS  S S         S
  SPD4N505 DRCUCOMMAND               Raw       Hex                90558000
  SPD9N505 OVERRIDE                  Raw       Hex                0
SCD06505    SEND_DRCU_COMMAND                  2008.137.19.17.43  2008.137.19.17.43.418 E E E
MS hpws22    2008.137.19.17.45.390 S SS  S S         S
  SPD4N505 DRCUCOMMAND               Raw       Hex                9055FFFF
  SPD9N505 OVERRIDE                  Raw       Hex                0
```

Only HK data was being generated during this manual test.



SMECENCPOSN and SMECLVDTDCSIG remain at their new values because the FF offset is set to 0mA (0x8000) at the end.

3.3.18 SPIRE-IST-COLD-FUNC-SMEC-OFF-P

Test Id:	SPIRE-IST-COLD-FUNC-SMEC-OFF-P
Test Purpose:	SMEC (PRIME) Switch OFF
Initial Configuration:	DRCU_ON + AC/DC thermometry ON +MCU ON+ SMEC ON (open loop)
Final Configuration:	DRCU_ON + AC/DC thermometry ON +MCU ON+ SMEC OFF
Duration	3 minutes
Success Criteria:	HK Parameters SMECENCPWR and SMECLVDTPWR show expected OFF values.

Test Procedure:

Step#	Action
1	Run Execute SPIRE-IST-COLD-SMEC-OFF-P.tcl test procedure from the CCS.

Test Log:

Test Id	Key Parameter(s)	Expected Value Before/After	Actual Value Before/After	No. of frames received	Test Result
SPIRE-IST-COLD-SMEC-OFF-P	SMECENCPWR SMECLVDTPWR	1/-/0 1/-/0	**1/0** **1/0**		**Pass**

Start time @: 19:21
End time @:
OBSID: 0xb00010d6

Comments:

3.3.19 SPIRE-IST-COLD-MCU-OFF-P

Test Id:	SPIRE-IST-COLD-MCU-OFF-P
Purpose	MCU Prime Switch OFF
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON+MCU Prime ON
Final Configuration:	**DRCU_ON** + AC/DC thermometry ON+MCU Prime OFF
Duration	5 minutes
Success Criteria:	MCU HK parameters show expected values

Procedure Steps:

Step	Description	Parameter – Unit	Expected Values Before/ During/ After	Actual Values Before/ During/ After	Success/ Failure
1	Execute SPIRE-IST-COLD-MCU-OFF-P.tcl	—	—	—	**OBSID: 0xb00010d7 Time: 19:22**
2	Check that the MCU is switched off	MCUBITSTAT	1/-/0	1/-/0	✓

Test Result (Pass/Fail): Pass

3.3.20 SPIRE-IST-COLD-SCU-OFF-P

Test Id:	SPIRE-IST-COLD-SCU-OFF-P
Purpose	SCU Prime Switch OFF
Initial Configuration:	**DRCU_ON** + AC/DC thermometry ON
Final Configuration:	**DRCU_ON** + AC/DC thermometry OFF
Duration	5 minutes
Success Criteria:	SCU HK parameters show expected values

Procedure Steps:

Step	Description	Parameter - Unit	Expected Values Before/ During/ After	Actual Values Before/ During/ After	Success/ Failure
1	Execute TCL script SPIRE-IST-COLD-SCU-OFF-P.tcl	—	—	—	**OBSID: 0xb00010d8 Time: 19:24**
2	A few seconds later record the value of parameter SCUTEMPSTAT	SCUTEMPSTAT	0xFFFF/-/0	**0xFFFF/-/0**	✓
3	A few seconds later record the value of parameter SUBKSTAT	SUBKSTAT	1/-/0	**1/-/0**	✓
Test Result (Pass/Fail): Pass					

3.3.21 SPIRE-IST-COLD-DRCU-OFF-P

Test Id:	SPIRE-IST-COLD-DRCU-OFF-P
Purpose	DRCU PRIME Switch OFF
Initial Configuration:	SPIRE DPU and DRCU PRIME are ON
Final Configuration:	SPIRE DPU PRIME is ON, SPIRE DRCU PRIME is OFF and SPIRE HK is not being produced.
Duration	5 minutes
Success Criteria:	THSK and TM2N stop refreshing/incrementing

Procedure Steps:

Step	Description	Parameter - Unit	Expected Values Before/ During/ After	Actual Values Before/ During/ After	Success/ Failure
1	Execute TCL script SPIRE-IST-COLD-DRCU-OFF.tcl	—	—	—	**OBSID: 0xb00010d9 Time: 19:30**
2	Check that THSK parameter is not refreshing anymore	THSK	Not refreshing	—	✓
3	Check that TM2N parameter is not incrementing anymore	TM2N	Not incrementing	—	✓
4	**Power OFF the SPIRE DRCU PRIME unit.**	—	—	—	✓
Test Result (Pass/Fail): **Pass**					

3.3.22 SPIRE-IST-COLD-DPU-OFF-P

Test Id:	SPIRE-IST-COLD-DPU-OFF-P
Purpose	DPU PRIME Switch OFF
Initial Configuration:	SPIRE DPU PRIME is ON but not generating HK.
Final Configuration:	SPIRE DPU PRIME is OFF.
Duration	5 minutes
Success Criteria:	Power to SPIRE DPU PRIME is OFF

Procedure Steps:

Step	Description	Parameter – Unit	Expected Values Before/ During/ After	Actual Values Before/ During/ After	Success/ Failure
1	**Power OFF the SPIRE DPU PRIME unit.**	—	—	—	✓ **Time: 19:32**
Test Result (Pass/Fail): **Pass**					

4. CONCLUSIONS

The principal conclusions of the tests are:

- Beginning with the 14:39 UTC test (SPIRE-IST-COLD-FUNC-SMEC-04A-P, OBSID: 0xb00010ca), the SMEC experiences some friction as it moves away from the mechanical end stop. This friction is also apparent when it moves back to the end stop. There is no explanation as to why it did not stick in all the previous tests up to and including 14:02 UTC.
- Except (!) for that sticking, the SMECm PRIME chain behaved nominally.
- The SMEC LPU check procedure was successfully verified.
- After increasing the feed forward offset the SMEC could be operated in closed loop.
- The SMECm REDUNDANT chain was not tested. Thus, its status is unknown.
- For the next SMEC tests the LVDT scale factor will need to be set for consistency with the PFM ILT value.
- For the next SMEC tests the I-EGSE setup procedure (RD02) will be updated to ensure that HK and science TM is correctly stored in the database.