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## 1 ACRONYMS

AIV	Assembly, Integration, Verification
AR	Anomaly Report
ASW	Application Software
BEM	Back End Module
BEU	Back End Unit
CCS	Central Check-out System
CDMU	Central Data Management Unit
CoP	Commissioning Phase
CPV	Calibration and Performance Verification
CSL	Centre Spatiale de Liège
DAE	Data Acquisition Electronics
DPU	Digital Processing Unit
EGSE	Electrical ground Support Equipment
FEM	Front End Module
I-EGSE	Instrument EGSE
ILT	Instrument Level Tests
IST	Integrated Satellite Test
OBC	On Board Clock
RAA	Radiometer Array Assembly
REBA	Radiometric Electronic Box Assembly
S/C	Spacecraft
SCOE	Spacecraft Control and Operation System
SPU	Signal Processing Unit
SUSW	Start- Up Software
SVM	Service Module
TBC	To Be Checked
TBW	To Be Written
TC	TeleCommand
TM	Telemetry
UFT	Unit Functional Test



## **2 APPLICABLE AND REFERENCE DOCUMENTS**

### **2.1 Applicable Documents**

- [AD1] Herschel/Planck Instrument Interface document Part A, SCI-PT-IIDA-04624 Issue 3.3
- [AD2] Herschel/Planck Instrument Interface document Part B, SCI-PT-IIDB-04142 Issue 3.1
- [AD3] Herschel/Planck Instrument Interface document Part B, SCI-PT-IIDB-04142 Issue 3.1, Annex 3, ICD 750800115
- [AD4] Herschel/Planck Instrument Interface document Part A, SCI-PT-IIDA-04624 Issue 3.3 Annex 10
- [AD5] Planck-LFI In-Orbit Calibration and Verification Phase Report: Executive Summary, PL-LFI-PST-RP-086 1.1

### **2.2 Reference Documents**

- [RD1] Planck Instrument Testing at PFM S/C levels, H-P-3-ASP-TN-0676, Issue 1.0
- [RD2] Planck LFI User Manual, PL-LFI-PST-MA-001 Issue 4.0
- [RD3] Planck LFI Operation Plan, PST-PL-011 Issue 3.0
- [RD4] Planck-LFI and SCS Monthly Report: November 2009, PL-LFI-PST-RP-087

### **2.3 Annex Documents**



### 3 INTRODUCTION

#### 3.1 Purpose and Scope

This document summarises the activities performed by the LFI Instrument Operation Team in December 2009 and January 2010.

#### 3.2 Team

LFI Personnel involved on a daily basis is:

LFI Instrument Operation Manager	Anna Gregorio UniTs <a href="mailto:anna.gregorio@ts.infn.it">anna.gregorio@ts.infn.it</a>
LFI Calibration Scientist	Aniello Mennella UniMi <a href="mailto:aniello.mennella@fisica.unimi.it">aniello.mennella@fisica.unimi.it</a>
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## 4 LFI Activities

### 4.1 Daily Operations

OD considered: 202 to 263 corresponding to DoY 335 of year 2009 to 31 of year 2010.

On a daily basis the LFI IOT performed the following analysis (see the LFI wiki <http://belzebu.lambrate.inaf.it/twiki/bin/view/LFI/DailyOperations>):

1. check science real time data during the DTCP: OK;
2. check the DQR and WHR (see § 4.3): OK;
3. check all the data per OD (first by looking at a Compressed Data Set produced by averaging daily data over 1 min and then if necessary on the full data set): OK;
4. check the TM rate by looking at the “Telemetry Bulletin” (<http://belzebu.lambrate.inaf.it/twiki/bin/view/LFI/DailyTelemetryBulletin>, <http://belzebu.lambrate.inaf.it/twiki/bin/view/LFI/TMBudgetAnalysis>, [ftp://FLTOPS\\_user@192.167.166.51:2121/Telemetry\\_DM/db](ftp://FLTOPS_user@192.167.166.51:2121/Telemetry_DM/db)): OK;
5. check of peculiar behaviour of the instrument (DAE gain change, change in Output Voltage, ...):
  - a. In Table 1 below the updated list of DAE gain change up to January the 31<sup>st</sup>;
  - b. Sudden Change in Output Voltage: 26 S;**
6. check any LFI production of event report TM(5,x) or TC rejection/failure TM(1,2) / TM(1,8):
  - a. Several TM(5,1) – alarm reports were produced in November, all related to an EDAC intervention. See § 5.2 for the complete list of these events, no TM(5,2) or TM(5,4);
  - b. No OOL were produced by the LFI;
  - c. No TM(1,2) or TM(1,8) were produced by the LFI.

Event #	OD	Channel	Time start	Time end	Gain before change			Gain after change			Saturated?	Flagged?
					DEC	BINARY	Physical	DEC	BINARY	Physical		
1	89-91	LFI24S-11	2009-08-11T04:25:06Z	2009-08-13T13:50:53Z	10	1010	4	-1	11111111	UNKNOWN	YES	YES
2	107-110	LFI21S-10	2009-08-28T16:36:28Z	2009-08-31T15:39:09Z	9	1001	6	15	1111	48	NO	YES
3	114-116	LFI23M-00	2009-09-04T17:15:05Z	2009-09-07T12:45:02Z	9	1001	6	11	1011	24	NO	YES
4	116	LFI25M-00	2009-09-07T04:51:20Z	2009-09-07T12:45:02Z	3	11	8	2	10	4	NO	YES
5	124	LFI20M-00	2009-09-15T10:30:07Z	2009-09-15T13:27:10Z	9	1001	6	11	1011	24	YES (only sky)	YES
6	126-127	LFI28S-11	2009-09-17T03:33:05Z	2009-09-18T11:16:45Z	9	1001	6	11	1011	24	YES (only sky)	YES
7	128	LFI23S-11	2009-09-18T17:14:20Z	2009-09-19T11:19:34Z	9	1001	6	-1	11111111	UNKNOWN	YES	YES
8	132	LFI22S-11	2009-09-23T08:23:38Z	2009-09-23T08:53:17Z	9	1001	6	8	1000	3	NO	YES
9	140	LFI23M-01	2009-10-01T07:31:38Z	2009-10-01T08:08:22Z	9	1001	6	11	1011	24	NO	YES
10	144	LFI18S-11	2009-10-05T09:59:02Z	2009-10-05T10:17:12Z	9	1001	6	-1	11111111	UNKNOWN	YES	YES
11	150	LFI23M-00	2009-10-11T02:34:42Z	2009-10-11T03:09:02Z	9	1001	6	11	1011	24	NO	YES
12	154	LFI18S-10	2009-10-14T18:08:46Z	2009-10-14T18:39:20Z	9	1001	6	8	1000	3	NO	YES
13	157	LFI20S-10	2009-10-18T04:18:55Z	2009-10-18T04:33:40Z	9	1001	6	-1	11111111	UNKNOWN	YES	YES
14	165	LFI25S-10	2009-10-26T10:33:36Z	2009-10-26T11:05:36Z	3	11	8	1	1	2	NO	YES
15	171	LFI21M-00	2009-10-31T17:06:57Z	2009-10-31T17:22:45Z	9	1001	6	8	1000	3	NO	YES
16	177	LFI21M-01	2009-11-07T07:49:20Z	2009-11-07T08:14:56Z	9	1001	6	-1	11111111	UNKNOWN	YES	YES
17	187	LFI22M-00	2009-11-16T15:57:53Z	2009-11-16T16:11:57Z	9	1001	6	-1	11111111	UNKNOWN	YES	YES
18	239	LFI28M-01	2010-01-08T06:35:27Z	2010-01-08T06:43:25Z	9	1001	6	-1	11111111	UNKNOWN	YES	YES
19	244	LFI26S-10	2010-01-12T15:31:09Z	2010-01-12T16:04:01Z	10	1010	12	-1	11111111	UNKNOWN	YES	YES
20	244	LFI19S-10	2010-01-12T17:07:11Z	2010-01-12T17:46:52Z	9	1001	6	8	1000	3	NO	YES
21	248	LFI25S-11	2010-01-17T04:52:50Z	2010-01-17T05:33:55Z	3	11	8	-1	11111111	UNKNOWN	YES	YES

Table 1 DAE Gain change events



#### 4.1.1 Instrument Commanding Requests

No Commanding Request was posted in December 2009 and January 2010. One single ICR, 4.1.1.1 P-ICR-0037: Restore step by step the default configuration on LFI 26 S, posted in November, was applied on December the 4<sup>th</sup>, 2009 (see also [RD-4]).

#### 4.2 SCS Operations

In the period OD202 to OD263 (DoY 335 - 31) SCS behaviour has been nominal, no event or alarm has been generated. Cooler operations have been based on the planned weekly adjustments. In January the Heatup Power has been updated together with the Desorption power to take into account the effects of cycle time reduction on the thermal dynamics of the beds. On Jan 14th (OD246, DOY14) the Bed temperature limit for transition from Normal into Startup (NORMAL\_ENTER\_STARTUP\_MNCET) has been raised from 480K to 500K to compensate for the effects of degradation on the compressor elements final desorption temperature.

Date of Upload	Actual Time of Upload	Parameters Change	TPF File
03.12.2009	337.17.38.35	LPSB power = 1.21 (was 1.22), Bed1 164 W to 165W, Bed2 163 W to 164W, Bed3 163W to 164W, Bed4 159W to 160W, Bed5 163W to 164W, Bed6 163W to 1643W, Decrease cycletime by 10 s to 895	PFSCCLPM_LUT_PWRT_N_0021.ipf
10.12.2009	344.20.31.02	5 s decrease in cycle-time (895 to 890), increase all desorption powers by 2 W: Bed 1 167, Bed 2 is 166, Bed 3 166, Bed 4 162, Bed 5 166, Bed 6 166	PFSCCLPM_LUT_PWRT_N_0022.ipf
17.12.2009	351.20.36.28	10 s decrease in cycle-time (890 to 880), increase all desorption powers by 2 W: Bed 1 169, Bed 2 is 168, Bed 3 168, Bed 4 164, Bed 5 168, Bed 6 168	PFSCCLPM_LUT_PWRT_N_0023.ipf
24.12.2009	358.20.16.13	All desorption powers up by 2W Bed 1 to 171W Bed 2 to 170 Bed 3 to 170 Bed 4 to 166 Bed 5 to 170 Bed 6 to 170 cycletime decreased by 5s (from 880 to 875s)	PFSCCLPM_LUT_PWRT_N_0024.ipf



31.12.2009	365.21.45.32	All desorption powers up by 2W Bed 1 to 173W Bed 2 to 172 Bed 3 to 172 Bed 4 to 168 Bed 5 to 172 Bed 6 to 172 cyclotime decreased by 5s (from 875 to 870s)	PFSCCLPM_LUT_PWRT_N_0025.ipf
07.01.2010	007.21.45.32	All desorption powers up by 2W Bed 1 to 175W Bed 2 to 174 Bed 3 to 174 Bed 4 to 170 Bed 5 to 174 Bed 6 to 174 cyclotime decreased by 5s (from 870 to 865s)	PFSCCLPM_LUT_PWRT_N_0026.ipf
14.01.2010	014.21.26.33	Heatup powers increased as follows:  Bed 1 from 109 to 112W Bed 2 from 109 to 112W Bed 3 from 109 to 112W Bed 4 from 109 to 110W Bed 5 from 109 to 110W Bed 6 from 107 to 108W  Bed temperature limit for transition from Normal into Startup (NORMAL_ENTER_STARTUP_MN CET) raised from 480K to 500K	PFSCCLPM_LUT_PWRT_N_0027.ipf PFSCCLPM_LUT_MODE_N_0002.ipf
21.01.2010	021.21.35.21	Heatup powers increased as follows:  Bed 1 from 112 to 113W Bed 2 from 112 to 113W Bed 3 from 112 to 113W Bed 4 from 110 to 112W Bed 5 from 110 to 112W Bed 6 from 108 to 110W  Desorption powers changed as follows:  Bed 1 from 175 to 177W Bed 2 from 174 to 176W Bed 3 from 174 to 176W Bed 4 from 170 to 169W Bed 5 from 174 to 173W Bed 6 from 174 to 173W	PFSCCLPM_LUT_PWRT_N_0028.ipf
28.01.2010	028.22.02.14	Heatup powers increased as follows:  Bed 1 from 113 to 115W (+2) Bed 2 from 113 to 115W (+2) Bed 3 from 113 to 115W (+2) Bed 4 from 112 to 113W (+1)	PFSCCLPM_LUT_PWRT_N_0029.ipf



		Bed 5 from 112 to 113W (+1) Bed 6 from 110 to 113W (+3)  Desorption powers changed as follows:  Bed 1 from 177 to 177W (+0) Bed 2 from 176 to 176W (+0) Bed 3 from 176 to 176W (+0) Bed 4 from 169 to 171W (+2) Bed 5 from 173 to 174W (+1) Bed 6 from 173 to 174W (+1)  Cyclotime is decreased by 5s (from 865s to 860s)	
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Table 2 SCS weekly adjustments in December 2009 - January 2010

SCS OT daily analysis has included the following steps:

- check all cooler data per OD with particular attention to main operational parameters
  - High Pressure
  - Cold End temperatures and their stability
  - LPSB pressure and temperature
  - Beds temperature and pressure
  - Warm Radiator interfaces
  - VG3 Interfaces
- check the DQR and WHR (see § 4.3), that are part of the LFI reports

### 4.3 Daily and Weekly Reports

DQR production normal:

DQR	Production Date	Time	Note
DQRL_LFISDA_D_03112009_0172_00001.PLAN	11/3/2009	14:38	
DQRL_LFISDA_D_04112009_0173_00001.PLAN	11/4/2009	16:17	
DQRL_LFISDA_D_05112009_0174_00001.PLAN	11/5/2009	16:45	
DQRL_LFISDA_D_06112009_0175_00001.PLAN	11/6/2009	23:03	
DQRL_LFISDA_D_07112009_0176_00001.PLAN	11/7/2009	15:56	
DQRL_LFISDA_D_09112009_0177_00001.PLAN	11/9/2009	14:29	
DQRL_LFISDA_D_09112009_0178_00001.PLAN	11/9/2009	16:13	
DQRL_LFISDA_D_10112009_0179_00001.PLAN	11/10/2009	13:48	
DQRL_LFISDA_D_11112009_0180_00001.PLAN	11/11/2009	14:15	
DQRL_LFISDA_D_12112009_0181_00001.PLAN	11/12/2009	15:19	
DQRL_LFISDA_D_12112009_0105_00002.PLAN	11/12/2009	17:21	New production (gain constant)
DQRL_LFISDA_D_12112009_0118_00004.PLAN	11/12/2009	17:21	New production (gain constant)



DQRL_LFISDA_D_12112009_0117_00003.PLAN	11/12/2009	17:21	New production (gain constant)
DQRL_LFISDA_D_12112009_0116_00003.PLAN	11/12/2009	17:21	New production (gain constant)
DQRL_LFISDA_D_12112009_0115_00003.PLAN	11/12/2009	17:21	New production (gain constant)
DQRL_LFISDA_D_12112009_0114_00002.PLAN	11/12/2009	17:21	New production (gain constant)
DQRL_LFISDA_D_12112009_0113_00003.PLAN	11/12/2009	17:21	New production (gain constant)
DQRL_LFISDA_D_12112009_0112_00003.PLAN	11/12/2009	17:21	New production (gain constant)
DQRL_LFISDA_D_12112009_0111_00002.PLAN	11/12/2009	17:21	New production (gain constant)
DQRL_LFISDA_D_12112009_0110_00002.PLAN	11/12/2009	17:21	New production (gain constant)
DQRL_LFISDA_D_12112009_0109_00002.PLAN	11/12/2009	17:21	New production (gain constant)
DQRL_LFISDA_D_12112009_0108_00002.PLAN	11/12/2009	17:21	New production (gain constant)
DQRL_LFISDA_D_12112009_0107_00002.PLAN	11/12/2009	17:21	New production (gain constant)
DQRL_LFISDA_D_12112009_0106_00002.PLAN	11/12/2009	17:21	New production (gain constant)
DQRL_LFISDA_D_13112009_0182_00001.PLAN	11/13/2009	13:24	
DQRL_LFISDA_D_14112009_0183_00001.PLAN	11/14/2009	15:27	
DQRL_LFISDA_D_16112009_0184_00001.PLAN	11/16/2009	14:19	
DQRL_LFISDA_D_16112009_0185_00001.PLAN	11/16/2009	14:20	
DQRL_LFISDA_D_17112009_0186_00001.PLAN	11/17/2009	14:30	
DQRL_LFISDA_D_18112009_0187_00001.PLAN	11/18/2009	15:01	
DQRL_LFISDA_D_19112009_0188_00001.PLAN	11/19/2009	16:45	
DQRL_LFISDA_D_20112009_0120_00002.PLAN	11/20/2009	16:14	New production (gain constant)
DQRL_LFISDA_D_20112009_0119_00003.PLAN	11/20/2009	16:14	New production (gain constant)
DQRL_LFISDA_D_20112009_0125_00002.PLAN	11/20/2009	16:14	New production (gain constant)
DQRL_LFISDA_D_20112009_0124_00002.PLAN	11/20/2009	16:14	New production (gain constant)
DQRL_LFISDA_D_20112009_0123_00002.PLAN	11/20/2009	16:14	New production (gain constant)
DQRL_LFISDA_D_20112009_0122_00002.PLAN	11/20/2009	16:14	New production (gain constant)
DQRL_LFISDA_D_20112009_0121_00003.PLAN	11/20/2009	16:14	New production (gain constant)
DQRL_LFISDA_D_20112009_0189_00001.PLAN	11/20/2009	16:18	
DQRL_LFISDA_D_21112009_0190_00001.PLAN	11/21/2009	16:12	
DQRL_LFISDA_D_23112009_0192_00001.PLAN	11/23/2009	13:44	SGR
DQRL_LFISDA_D_24112009_0191_00001.PLAN	11/24/2009	18:32	Scanning problem (HP-1134)
DQRL_LFISDA_D_25112009_0192_00002.PLAN	11/25/2009	11:15	SGR
DQRL_LFISDA_D_25112009_0193_00001.PLAN	11/25/2009	11:15	SGR
DQRL_LFISDA_D_25112009_0194_00001.PLAN	11/25/2009	14:10	
DQRL_LFISDA_D_26112009_0195_00001.PLAN	11/26/2009	10:53	
DQRL_LFISDA_D_27112009_0196_00001.PLAN	11/27/2009	11:59	
DQRL_LFISDA_D_28112009_0197_00001.PLAN	11/28/2009	18:03	
DQRL_LFISDA_D_30112009_0199_00001.PLAN	11/30/2009	14:01	
DQRL_LFISDA_D_30112009_0198_00001.PLAN	11/30/2009	14:01	
DQRL_LFISDA_D_01122009_0200_00001.PLAN	12/1/2009	15:06	
DQRL_LFISDA_D_02122009_0201_00001.PLAN	12/2/2009	15:20	

WHR production normal:

DQR	Production Date	Time	Note
WHRL_LFISDA_D_05112009_0012_00001.PLAN	11/5/2009	16:46	
WHRL_LFISDA_D_12112009_0004_00014.PLAN	11/12/2009	17:23	New production (gain constant)
WHRL_LFISDA_D_12112009_0003_00002.PLAN	11/12/2009	17:23	New production (gain constant)
WHRL_LFISDA_D_12112009_0013_00001.PLAN	11/12/2009	17:36	
WHRL_LFISDA_D_19112009_0014_00001.PLAN	11/19/2009	16:45	



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WHRL_LFISDA_D_20112009_0005_00001.PLAN	11/20/2009	16:16	New production (gain constant)
WHRL_LFISDA_D_26112009_0015_00001.PLAN	11/26/2009	14:18	
WHRL_LFISDA_D_03122009_0016_00001.PLAN	12/3/2009	16:46	



## 5 Anomaly Status

One anomaly was raised in November. Here a short report on all of the open ARs.

### 5.1 P\_SC-49: Anomalous variation on LFI RCA26 Drain Current channels

The observed misbehaviour is a sudden step change of the voltage output by about 5 % affecting both diodes in LFI26S (the change takes place almost instantaneously). The impact on science is estimated to be minimum. The nature of the effect is not yet understood though something can already be excluded (e.g. popcorn noise would be very strictly correlated with drain current behaviour which is not the case here).

From MOC analysis it is clear that no MTL commanding was on-going at the time, and there was no obvious TCS activity seen around this event.

An ad-hoc TC sequence was analysed and implemented by the LFI Instrument Team to recover the nominal setting, see also § **Errore. L'origine riferimento non è stata trovata..**  
See the TN with a detailed analysis of the problem here annexed [AN-1].

### 5.2 P\_SC-21: EDAC Intervention

Since LFI switch on (June 4<sup>th</sup>) many event reports have been generated all indicating that EDAC single errors have been encountered. The average rate is about 1 every 3 days. The corresponding memory areas are spread on DPU and SPU and both on Data and Program RAM.  
By now these memory areas were outside the used region of memories.

These types of events are indeed foreseen and indicate that the EDAC is working as expected. No double errors arose up to now, that would cause an error report TM(5,4), meaning that there is no memory damage.

In the table below the list of these events.

Type	Subtype	Sid	APID	SSC	Date	OB-time
5	1	5002	1536	16344	11/4/2009	05:12.4
5	1	5002	1536	11001	11/6/2009	05:13.8
5	1	5002	1536	13254	11/12/2009	28:42.6
5	1	5002	1536	8163	11/20/2009	28:49.5
5	1	5002	1536	11863	11/24/2009	05:20.3
5	1	5002	1536	6477	11/26/2009	05:29.4
5	1	5002	1536	12086	11/30/2009	05:29.5



## **6 Conclusions**

All the LFI activities foreseen during this month have been successfully completed.  
In summary the LFI is healthy and is behaving as expected.



## **7 Acknowledgements**

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