ANNEX 17

SPI OPERATIONS DURING LEOP AND COMMISSIONING PHASE

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INTERNATIONAL GAMMA RAY ASTROPHYSICS LABORATORY

SPI operations during LEOP and Commissioning Phase

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Management configuration	OUI	**X**
	NON	

Applicable Document	OUI	
	NON	**X**

Models	**SSTM**	**STM**	**SEM**	**EM**	**FM**	**ALL**	**OTHERS**
					X		

DOCUMENTATION CHANGE RECORD

Issue	Revision	Date	Modified Pages	Observations
0	Draft	02/05/01		First issue
0	Draft 1	29/05/01		See vertical lines
1	0	29/06/01		See vertical lines Sub-phases III A and III B description added
1	1	26/09/01		See vertical lines Sub-phases III C, III D and E description added
1	2	05/10/01		See vertical lines
1	3	15/10/01		See vertical lines
1	4	13/11/01		See vertical lines
2	0	29/11/01		All the pages
2	1	11/02/02		See vertical bars

Table of content

1. GOAL OF THIS NOTE

- Preliminary description of the operations to be performed during commissioning phase
- To give our understanding of how the first operations will be scheduled.
- Base of further discussions.
- Reply to the project request during UMR co-ordination meeting.

This operations description will be included in the SPI UM latter after discussion.

2. REFERENCE DOCUMENTS

- RD1 - S/C User Manual INT-MA-AI-0001 issue 3.1
- RD2 - Minutes of SPITOG meeting # 2 12 april 2000
- RD3 - Minutes of SPI commissioning phase meeting 30 may 2001 (INT-MI-AI-1180)
- RD4 – Minutes of SPI internal meeting (SPI-CR-0-16640-CN)
- RD5 – GeD thermal profile specification for Outgassing (SPI-ST-0-16641-CNES)
- RD6 – Minutes of SPITOG meeting #8, 12 october 2001
- RD7 – SPI User's Manual (SPI-MU-0-1062V2-CNES)
- RD8 – Préparation de la commissioning phase (Internal meeting – 12/11/01) (SPI-CR-0-16646-CN)
- RD9 – SPI Interface Meeting # 22 (Ground segment) (INT-MN-40379)

3. COMMISSIONING PHASE STAGES

3.1. OBJECTIVES OF THE COMMISSIONNING PHASE STAGES

The main commissioning stages foreseen are as follow:

- **Phase 0 – Pre-Launch** (< 1 h)

This phase is dedicated to set the SPI in launch configuration: lock the cryocoolers for the launch vibrations and activate the redundant S/A heaters to guarantee the minimum start-up temperature of the S/A.

- **Phase I – Out-gassing** (~ 12 days) (Without specific pointing requirements)

  This phase is dedicated to the outgassing of the spectrometer (MLI, structures, electronic boxes and detection plate) and also to the activation and checking of the S/A. Then a control at hot detector temperature of the AFEE and DFEE in operational mode will be performed. An ACS even trigger thresholds control and energy discriminator thresholds calibration will be also performed 1 week (TBC) after the launch over 60 000 km.

- **Phase II – Cooling** (~ 8 days including 2 in parallel with the phase III to cool down from 117 K to 90 K see § 4) (Without specific pointing requirements but only on the orbit part over 60000 km)

This phase, mainly dedicated to the cooling of the detection plate, is splitted in two sub-phase:
- the first one is the passive cooling of the detection plate (72 h),
- the second is the active cooling using the cryocoolers.

During the first sub-phase a first tuning of the ACS is performed. It concerns the analysis of the distribution of the FEE counting rates. That will be done with the analysis of the FEE counting rates with 4 energy thresholds determined during the ground tests (100keV, 150keV, 200 keV, 300 keV).
Then after a control of the counting rate equilibrium for the 4 selected energy threshold, we will measure the influence of the veto overrange signal extension and the energy thresholds on the dead time. The influence of the different parts (see figure 3.1 and table 3.2) of the ACS on the dead time will be characterised.

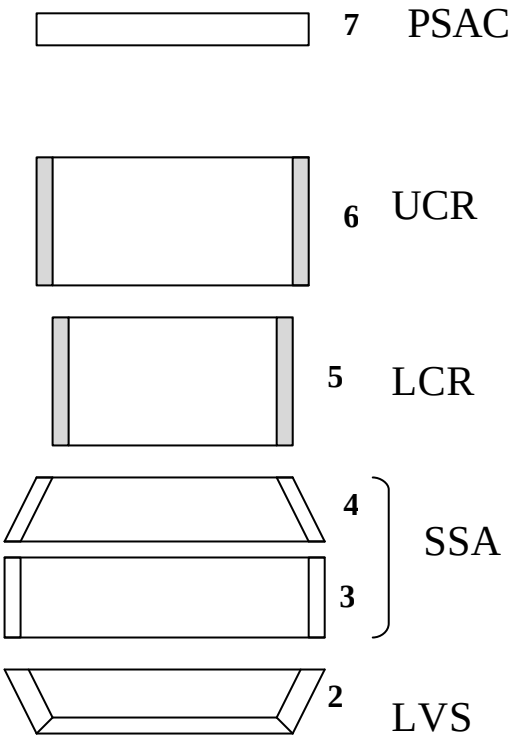

Figure 3.1.a: ACS part identification

During the second sub-phase (active cooling), the PSD thresholds will be checked and adjusted

♦ **<u>Phase III</u> – Instrument tuning and configuration optimization**
(Orbit altitude over 60 000 km - See § 3.3 for specific pointing requirements)

This phase is dedicated to the tuning and the optimization of the spectrometer:

- At first, we have to switch ON the camera at around 117K and check the Camera health,
- control the good behaviour of the main channels of spectrometer and the adequation of the setting with the TM allocation,
- control the camera performances evolution until the cold plate temperature equilibrium at around 90 K.
- Then a depletion measurement (influence of the high voltage on the camera performances) will be performed,
- Measurement of the influence of High Energy clamping of preamplifiers,
- At this step, we will calibrate the AFEE and PSD thresholds,
- After this calibration, the adaptation of these thresholds and of the Ge high voltages will be checked,
- When theses values have been determined, we will performed the SPI internal timing optimisation:
    - PSD and AFEE time tags alignment and multiple window size control and setting,
    - Veto pulse and AFEE time tags control and setting,
    - Veto pulse and PSD time tags control and setting
- Then a first step of PSD calibration will be done (around 1 week of data processing),
- Influence of ACS thresholds on the background (one part with various energy thresholds, the rest with the nominal thresholds),
- Influence of the extension of the ACS saturated events on the background with two ACS energy thresholds,
- Influence of the ACS+PSAC parameters on the sensibility:
    - Tests of few ACS configurations (2 or 3 TBC) defined from the previous measurements,
    - Control of the PSAC effect on the sensibility at 511 keV in the best ACS configuration + PSAC OFF then PSAC ON with an high energy thresholds,
    - In the final ACS + PSAC configuration, measurement of the extension of the ACS saturated events.
- Measurement of the background with one ACS SSA BGO inactive (for mathematical model setting)
- Second step of PSD calibration

♦ **<u>Phase IV</u> – ¨Performances verification and Initial Calibration**

♦ **<u>Sub-phase IV A</u> – Scientific Performance Validation (estimated date: dec 2002)**

This sub-phase, dedicated to scientific performance validation: the proof for a working scientific instrument, with Spectral and Imaging Performance Tests for point-like and diffuse sources, continuum and line sources:

- Pointings to Vela and Cygnus
- Pointings to Empty field
- Galactic Plane Scan

- **Sub-phase IV B – Efficiency Calibration (estimated date: feb 2003)**

This sub-phase, dedicated to the efficiency calibration: using the Crab pulsar

- Crab period measurement for timing check
- Crab flux measurement for efficiencies/sensitivity measurement
- Crab on/off measurement, ^{26} Al search towards Galactic Centre and Cygnus
- Fluxes, spectra, pulsar light curves verification
- Comparison with pre-launch simulations
- Comparison of results using Instrument Team computing and ISDC computing

3.2. PLAN OF THE COMMISSIONNING PHASE

Commissioning Phase Stages	Main Activities	Comments
Phase 0 – Pre-launch (<1h)		
Phase 0. 1	Pre-launch activities (P1-A)	SPI is set in launch configuration
Phase I – Out-gassing (~ 12 days)		
Phase I. 1	MLI , electronic and cryostat Outgassing	First part of the outgassing phase at around 37°C
Phase I. 2	SPI partial functional test with hot detectors	Operational mode with GE High Voltage OFF (during the Outgassing – one week after the beginning of the orbit life). The ACS high voltages will be switched on one week after the beginning of the phase, could be in parallel of the outgassing at low or high cold plate temperature
Phase I. 3	Outgassing at high temperature (around 80°C) and in parallel: ACS even trigger thresholds control Then ACS calibration	Outgassing at high temperature (around 80°C control by ground) The ACS high voltages will be switched on during the phase I.2 .
Phase II – Cooling (~ 8 days)		
Phase II. 1	Passive cooling of the detection plate until the cryocooler can be used	Monitoring of the temperature decreasing
Phase II. 2	First ACS tuning of the homogeneity of the FEE counting rate	In parallel of the passive cooling
Phase II. 3	Influence on the dead time of the saturating extension for 4 energy thresholds	In parallel of the passive cooling
Phase II. 4	Influence of the different parts of the ACS on the dead time	In parallel of the passive cooling

Phase II. 5	Active cooling starting	Transition to Cooling mode: 3 days after the beginning of the phase II
Phase II. 6	PSD thresholds adjustment	In parallel of the active cooling, before 117 K on the cold plate are obtained.
Phase III – Instrument tuning and configuration optimization (~ days)		
Phase III. 1	Camera switch ON at 117 K	Include a TM rate checking
Phase III. 2	SPI main health status check	During the cold plate temperature decreasing (PST = 46)
Phase III. 3	Camera performances checking during the cooling until 90K	Acquisition in operational mode until the equilibrium
Phase III. 4	Camera performances for various High voltages at 90 K	
Phase III. 5	Influence of High Energy clamping of preamplifiers	
Phase III. 6	PSD thresholds and AFEE energy thresholds calibrations	
Phase III. 7	Ge High Voltages + (AFEE, PSD) thresholds adaptation control	
Phase III. 8	Internal SPI timing optimisation	
Phase III. 9	First step of PSD calibration will be done	An empty field is required
Phase III. 10	Influence of ACS thresholds on the background	
Phase III. 11	Influence of the extension of the ACS saturated events on the background	
Phase III. 12	Influence of the ACS+PSAC parameters on the sensibility	
Phase III. 13	Measurement of the background with one ACS SSA BGO inactive	
Phase III. 14	Second step of PSD calibration	An empty field is required
Phase IV – Performances verification and Initial Calibration		
Sub-phase IV A – Scientific Performance Validation (estimated date: dec 2002)		
Phase IV.A. 1	Pointings to Vela and Cygnus	
Phase IV.A. 2	Pointings to Empty field	
Phase IV.A. 3	Galactic Plane Scan	
Sub-phase IV B – Efficiency Calibration (estimated date: feb 2003)		
Phase IV.B. 1	Pointings to Crab	
Phase IV.B. 2	Pointings to Galactic Centre and Cygnus	

3.3. SEQUENCE OF THE COMMISSIONNING PHASE STAGES

Sequence Number	Main Activities	Comments	Activity Card
	Phase 0 – Pre-launch (<1h)		
Phase 0. 1	Pre-launch activities (P1-A):	Launch-lock of the cryocoolers and activation of the S/A redundant heaters lines	**000**
	Phase I – Out-gassing (~ 12 days) Without specific pointing requirements		
Phase I. 1	**MLI , electronic and cryostat Outgassing** 1. Activation of the main thermal control heaters (P1-B) 2. Transition Launch to Inactive (P2) 3. Transition Inactive to Stand-by (P4) 4. Check the S/A default configuration; send On Request TC 5. Transition Stand-by to Outgassing (P19):	First part of the outgassing phase at around 37°C In this procedure the AFEE TM/TC are configured for outgassing with **LVPS and HVPS OFF**	**001**
Phase I. 2	**SPI partial functional test with hot detectors** During the outgassing the S/A are in configuration mode except for this short test 1. Software maintenance (P23): if required. 2. AFEE, ACS, DFEE, PSD configuration up-loading (P17) ➢ *Check S/A TM and the power consumptions* 3. SPI partial functional test in operational with hot detectors **GE HV OFF**: (P13-P) ➢ *Control of the AFEE TT counting rate during around 10 s* After this brief acquisition in operational, the S/A are set again in configuration mode (P??)	It is better to perform this test during the first part of the outgassing at low temperature (around 37°C). with the Flight Nominal S/A configuration (except **GE HV OFF**) setting. The ACS high voltages will be switched on one week after the beginning of the phase, could be in parallel of the outgassing at low or high cold plate temperature. PST of 46 TBC	**002**
Phase I. 3	**Outgassing at high temperature (around 80°C)** 1. Outgassing at high temperature control by ground at around 80°C: (P19 from step to) Configuration of the AFEE TM/TC for annealing **with LVPS ON and HVPS OFF** ➢ *Check AFEE TM* Control by ground of the cold plate temperature: ➢ *Check the cold plate temperature to switch ON and OFF the annealing heaters lines*	Outgassing at high temperature (around 80°C control by ground)	**003**

	ACS even trigger thresholds control 2. ACS configuration up-loading (P17) with Flight Nominal ACS configuration TC except E6100 to E6190 = 1 to generate a veto by each valid event trigger threshold. ➢ *Check in ACS HK TM the FEE counting rate (keep ACS in configuration mode)* **ACS calibration** 3. ACS configuration up-loading (P17) with Flight Nominal ACS configuration TC. ➢ *Check ACS TM* 4. ACS calibration (requires ACS HV On) (P25)	The ACS high voltages will be switched on during the phase I.2.	**004** **005**
	Phase II – Cooling (~ 8 days)		
Phase II. 1	**Passive cooling of the detection plate** Transition Outgassing to Configuration (P??) Cold plate temperature monitoring on ground.	End of the cold plate Outgassing and beginning of the passive cooling detection plate (cooling by thermal leakage) in configuration mode, Monitoring of the temperature decreasing until 35°C	**006**
Phase II. 2	**First ACS tuning of the homogeneity of the FEE counting rate** Using the on-ground ACS energy thresholds setting, load configurations with for all the ACS the a threshold at 100 keV, 150 keV, 200 keV and then 300 keV (the Ge HV shall remain OFF) ➢ FEE count rates, dead time and number of veto gate analysis during 100 min (in operational mode with Ge HV OFF).	During the passive cooling and before to reach 117 K on the cold plate In order to have DFEE science HK we need to be in operational mode, **but check before carefully that the Ge HV are OFF**	**007**
Phase II. 3	**Influence on the dead time of the saturating extension for 4 energy thresholds** Loading of ACS configurations with energy threshold of 100 keV, 150 keV, 200 keV and then 300 keV and for each 3 values of the extention of the veto saturated events (the nominal and 2 others TBD). ➢ FEE count rates, dead time and number of veto gate analysis during 1 min (in operational mode with Ge HV OFF).	In parallel of the passive cooling Using the ACS energy thresholds defined on ground. In order to have DFEE science HK we need to be in operational mode, **but check before carefully that the Ge HV are OFF**	**008**
Phase II. 4	**Influence of the different parts of the ACS on the dead time** Using the result of the FEE counting balancing defined phase	In parallel of the passive cooling We perform dead time	**009**

	II.2 with a threshold around 100 keV, load configurations with FEE veto masked in VCU in order to keep active the parts (see figure 3.1.a): 1 alone then 1 + 2 then 1 + 2 + 3; 1 + 2 + 3 + 4; 1 + 2 + 3 + 4 + 5; 1 + 2 + 3 + 4 + 5 + 6; 1 + 2 + 3 + 4 + 5 + 6 + 7; 2 + 3 + 4 + 5 + 6 + 7; 3 + 4 + 5 + 6 + 7; 4 + 5 + 6 + 7; 5 + 6 + 7; 6 + 7; 7; ➢ FEE count rates, dead time and number of veto gate analysis during 10 min for each configuration(in operational mode with Ge HV OFF).	measurements with various configuration in order to determine the contribution of the different ACS parts In order to have DFEE science HK we need to be in operational mode, **but check before carefully that the Ge HV are OFF**	
Phase II. 5	**<u>Active cooling starting</u>** Transition Configuration to Cooling mode (P??) ➢ CDE and cryocoolers configuration setting and check	Transition to Cooling mode: when the real temperature of the thermal braids and the compressors are below 40°C (3 days after the beginning of the phase II)	**010**
Phase II. 6	**<u>PSD thresholds adjustment</u>** PSD various thresholds loading : ➢ Control of the PSD channel counting rates (with the PSD in configuration mode)	In parallel of the active cooling, before 117 K on the cold plate are obtained. When the PA2 temperatures are stabilised PST of 3 minimum	**011**
<u>Phase III – Instrument tuning and configuration optimization</u> (~ days)			
Phase III. 1	**<u>Camera switch ON at 117 K</u>** <u>1. increasing of the Ge high voltage</u> 500, 1000, 1500 with control of the DC output voltage <u>2. increasing of the Ge high voltage</u> 2000, 2500, 3000, 3500 and 4000 V with control of the DC output voltage stabilisation and then control the detector resolutions (2 hours in operational mode for each high voltage value). ➢ Camera health first evaluation, and estimation (the ACS is not finely tuned) of the adequation of the TM rate needed and the allocation (operational mode with on-board spectra each 30 mn) + for 4000V a dithering check 6 X 30 min + 30 min in operational to downloading the last spectra,	The cold plate temperature shall be enable before to set the high voltage. On request TCs are used to control the DC voltage evolution. PST of 46 TBC Include a TM rate checking	**012**
Phase III. 2	**<u>SPI main health status check</u>** <u>1. TM emergency mode with on-board spectra</u> (spectra	During the cold plate temperature decreasing (117K => 90K), the SPI main health status in the	**013**

	accumulation during 8 min) acquisition during 30 min (TBC): ➢ S/A and On-board application software functional testing 2. S/A Diagnostic modes: with spectra accumulation during 30 min, acquisition during 1 hour 30 min (TBC) ➢ S/A and On-board application software functional testing 3. PSD calibration mode: with spectra accumulation during 30 min, acquisition during 1 hour 30 min (TBC) S/A and On-board application software functional testing	higher level modes, not tested previously, will be control. PST of 46 Diagnostic mode for the ACS, DFEE and PSD (PST of respectively: 58, 58 and 129) PST of 80	
Phase III. 3	**Camera performances checking during the cooling until 90K:** SPI will be set in operational mode, as soon as the previous step is performed, until the cold temperature equilibrium is reached (with spectra accumulation during 30) ➢ Influence of temperature on camera performances	Acquisition in operational mode until the cold temperature equilibrium is reached. PST of 36 TBC	**014**
Phase III. 4	**Camera performances for various High voltages at 90 K** Set the detector high voltages at 1500, 2000, 2500, 3000, 3500, 4000, 4500 and finally 5000 and performed at each step acquisition during 2 hours in operational mode with spectra each 30 min ➢ Detectors characterisation, energy resolutions, count rates, first assessment of background dead time	PST of 36 TBC	**015**
Phase III. 5	**Influence of High Energy clamping of preamplifiers** 1. Set the AFEE with the 19 high energy clamping parameters OFF, 2. Acquisition during 2 hours (TBC) in operational mode with the spectra each 30 min ➢ Energy resolutions checking	PST of 36 TBC	**016**
Phase III. 6	**PSD thresholds and AFEE energy thresholds calibrations** Acquisition during 1 hour in operational with various AFEE and PSD thresholds (15 keV; 20 keV; 30 keV and 40 keV for the AFEE – TBD for the PSD):	PST of 80	**017**
Phase III. 7	**Ge High Voltages + (AFEE, PSD) thresholds adaptation control** Using the results of the previous measurements (Phase III-4 and III-6), we load the optimal configuration and then control with 2 hours of acquisition in operational with spectra every 30 min ➢ New threshold configuration checking Eventually, we will modify 2 times the configuration and control again to obtain the best set-up.	PST of 36 TBC	**018**
Phase III. 8	**Internal SPI timing optimisation**	These measurements will be performed at least in 3 step:	

	1. PSD and AFEE time tags alignment and multiple window size control, setting and check: ➢ Science data collection to check the internal timing and defined in orbit the optimal multiple window size 2. Veto pulse and AFEE time tags size control, setting and check: ➢ Science data collection for instrument optimisation and tuning 3. Veto pulse and PSD time tags size control, setting and check: ➢ Science data collection for instrument optimisation and tuning	1. Measurement with the nominal delay configuration, 2. Defined the optimal DFEE delay values 3. Control the new configuration PST of TBD	**019** **020** **021**
Phase III. 9	**First step of PSD calibration will be done** Acquisition during 1 day in Calibration mode with the PSD configuration defined after Phase III-7: ➢ PSD curves analysis	An empty field is required for this calibration. PST of 80. After acquisition around 1 week is needed for the data processing to elaborate a new PSD library	**022**
Phase III. 10	**Influence of ACS thresholds on the background** ACS part 1 with various energy thresholds (redefined after the phase II measurements) of 100 keV, 150 keV, 200 keV then 300 keV with the rest with the nominal thresholds of 100 keV: 1 hour in operational with nominal on-board spectra: ➢ Science data collection for instrument optimisation Same measurement with the other parts (2, 3, 4, 5 and 6) with various thresholds ➢ Science data collection for instrument optimisation	PST of 36 TBC	**023**
Phase III. 11	**Influence of the extension of the ACS saturated events on the background** ACS energy thresholds at 100 keV then at 300 keV and for two values of the parameter extended veto gate above for both thresholds, we performed an acquisition in operational mode during 1 hour. ➢ Science data collection for instrument optimisation	PST of 36 TBC	**024**
Phase III. 12	**Influence of the ACS+PSAC parameters on the sensibility** 1. Tests of the best ACS configurations (2 or 3 TBC) defined from the previous measurements (Phase III-10 and Phase III-11) with 12 hours for each acquisitions in operational mode. ➢ Science data collection for instrument optimisation 2. Control of the PSAC effect on the sensibility: at 511 keV in the best ACS configuration + PSAC OFF then PSAC ON with	PST of 36 TBC	**025** **026**

	an high energy thresholds (value TBD) with 12 hours for each acquisitions in operational mode. ➢ Science data collection for instrument optimisation 3. In the final ACS + PSAC configuration: measurement with 2 values of the extension of the ACS saturated events with 12 hours for each acquisitions in operational mode. ➢ Science data collection for instrument optimisation		**027**
Phase III. 13	**Measurement of the background with one ACS SSA BGO inactive** (for mathematical model correlation) acquisition during 12 hours in operational mode with two FEE of the SSA desactivated for the veto signal. ➢ Science data collection for instrument optimisation	PST of 36 TBC	**028**
Phase III. 14	**Second step of PSD calibration** 1 - Uploading the new library tables generated from the first part of PSD calibration (Phase III-9) 2 - Perform a verification: acquisition during 12 hours in Calibration mode: ➢ PSD curves and on-board processing control	An empty field is required for this calibration. PST of 80	**029**
Phase IV – Performances verification and Initial Calibration			
Sub-phase IV A – Scientific Performance Validation (estimated date: dec 2002)			
Phase IV.A. 1	**Pointings to Vela and Cygnus**	PST of 36 TBC	**030**
Phase IV.A. 2	**Pointings to Empty field**	PST of 36 TBC	**031**
Phase IV.A. 3	**Galactic Plane Scan**	PST of 36 TBC	**032**
Sub-phase IV B – Efficiency Calibration (estimated date: feb 2003)			
Phase IV.B. 1	**Pointings to Crab** Crab period measurement for timing check Crab flux measurement for efficiencies/sensitivity measurement Crab on/off measurement, Fluxes, spectra, pulsar light curves verification	Comparison with pre-launch simulations Comparison of results using Instrument Team computing and ISDC computing	**033**
Phase IV.B. 2	**Pointings to Galactic Centre and Cygnus** ^{26}Al search towards Galactic Centre and Cygnus,	Comparison with pre-launch simulations	**034**

4. COMMISSIONING CALENDAR

October 02															November 02													
Week 42				Week 43							Week 44							Week 45							Week 46				
17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
																			Phase III Instrument tuning and configuration optimisation										
Launch	Phase I Outgassing														Phase II Cooling														

November 02															December 02													
Week 46		Week 47							Week 48						Week 49								Week 50					
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Phase III Instrument tuning and configuration optimisation																													
																			Phase IV A Scientific Performance Validation									

February 2003 ?													
Week n° ?							Week n° ?						
Phase IV B Efficiency Calibration													

5. SPI COMMISSIONING ACTIVITY CARDS

SPI COMMISSIONING ACTIVITIES

Doc.Ref.: INT-MOC-SYS-TN-1012-TOS-OGI - Annex A

Prepared by: P.Hebert / Y. Andre / F.Cordero

Organisation: CNES / ESOC

Issue: 1

Rev: 0

LEOP SPI - 000

Title: Phase 0. Pre Launch and Launch stage

Description (Purpose): This phase is not under the MOC responsability.
Lasts until S/C separation.

For record

Initial Configuration: SPI OFF

Constraints:

Special Pointing Requirements: None

Success Criteria: Launch Lock Mode bit status = 1

Inputs:

Involved Teams: Alenia at launch pad

Phase 0.1 Pre-launch configuration setting

Step Nr	Description	Estimated Duration hh	mm	UM Procedure	FOP Procedure	HK or Science Feedback	Conf /Special Tool
10	CDEs setting in Launch lock mode and redundant heaters switched ON	0	00	P1 A		☐	None
	Total Duration :	0	00				

LEOP SPI - 010

Title: Phase I Outgassing

Description (Purpose): The first part of the outgassing phase at around 37° C

Initial Configuration: End of LEOP SPI-000

Constraints: Solar array deployed

Special Pointing Requirements: None

Success Criteria: Transition to the new mode OK.
HK control OK
Temperatures and stage duration OK

Inputs: Step 30 : S/A that must be switched ON

Involved Teams:

Phase I.1 MLI, electronic and cryostat Outgassing

Step Nr	Description	Estimated Duration hh	mm	UM Procedure	FOP Procedure	HK or Science Feedback	Conf /Special Tool
10	Activation of the main thermal control heaters	0	00	P1 - B		☐	None
20	Transition Launch to Inactive	0	00	P2		☐	None
30	Transition Inactive to Stand-by	0	00	P4		☐	Conf IASW FM01 HK control SPI-010-000
40	Check the S/A on-board default configuration : send On Request TCs	0	00	P (TBD)		☐	
50	Transition Stand-by to Outgassing and stay in Outgassing	288	00	P19		☐	HK control SPI-010-001
	Total Duration :	288	00				

LEOP SPI - 020

Title: Phase I Outgassing

Description (Purpose): First test of the detection chains at hot temperature and first switch ON of the ACS High voltages.

Note: ACS PMT High voltages will be switched ON one week after the Outgassing phase beginning. This duration is included in the procedure P19.

During the outgassing the S/A are in configuration mode except for this short test which will be performed in operational mode.

Initial Configuration: Steps 50 to 80 : with the Flight Nominal S/A configuration (except GeD HV OFF) setting
Step 90 : to be perform one week after the beginning of the orbit life

Constraints: Perform this test during the first part of the outgassing at low temperature (around 37° C).
The steps 10 to 80 shall be performed in parallel with the step 110 of the procedure P19 of the step 50 of LEOP SPI-010.
The step 90 shall be performed in parallel with the step 130 of the procedure P19 of the step 50 of LEOP SPI-010.

Special Pointing Requirements: None

Success Criteria: AFEE counting rates > 0

Inputs:

Involved Teams:

Phase I.2 SPI partial functional test with hot detectors

Step Nr	Description	Estimated Duration hh	mm	UM Procedure	FOP Procedure	HK or Science Feedback	Conf /Special Tool
10	IASW software maintenance if required	0	00	P (TBD)		☐	None
20	DFEE software maintenance if required	0	00	P23-DF		☐	None
30	PSD software maintenance if required	0	00	P23-PD		☐	None
40	ACS software maintenance if required	0	00	P23-AS		☐	None
50	AFEE configuration uploading	0	00	P17-		☐	Conf AFEE TBD LVPS ON GeD HV OFF Thresholds TBD
60	ACS configuration uploading	0	00	P17-		☐	Flight configuration
70	PSD configuration uploading	0	00	P17-		☐	Flight configuration
80	DFEE configuration uploading	0	00	P17-		☐	Flight configuration
90	SPI partial functional test in operational mode with hot detectors GeD HV OFF Control of the AFEE Time Tag counting rate during around 10 s	0	00	P13-P		☐	None
100	Back to configuration mode	0	00	P16		☐	None
	Total Duration :	0	00				

LEOP SPI - 040

Title: Phase I Outgassing

Description (Purpose): Control of the event trigger thresholds by setting E6100 to E6190 = 1 to generate a veto by each valid event trigger threshold.

Initial Configuration: Flight nominal ACS configuration after LEOP SPI-020

Constraints: End of LEOP SPI-020. Keep ACS in configuration mode

Special Pointing Requirements: None

Success Criteria: FEE counting rates < TBD

Inputs:

Involved Teams:

Phase I.3 ACS event trigger thresholds control

Step Nr	Description	Estimated Duration hh	mm	UM Procedure	FOP Procedure	HK or Science Feedback	Conf /Special Tool
10	ACS configuration up-loading	0	00	P17-		☐	Analyse FEE counting rates in ACS HK TM ACS flight configuration TBC with E6100 to E6190 = 1
20	Check in ACS TM the FEE counting rate	1	20			☐	None
	Total Duration :	1	20				

LEOP SPI - 050

Title: Phase I Outgassing

Description (Purpose): ACS calibration during cryostat outgassing.

Initial Configuration: ACS in configuration mode after LEOP SPI-040

Constraints: End of LEOP SPI-040

Special Pointing Requirements: No special pointing requirements

Success Criteria: 50 ACS calibration runs have been succefully performed: all the TM packets have been acquired.

Inputs:

Involved Teams:

Phase I.3 ACS calibration

Step Nr	Description	Estimated Duration hh	mm	UM Procedure	FOP Procedure	HK or Science Feedback	Conf /Special Tool
10	ACS configuration calibration up-loading	0	00	P17-		☐	ACS configuration TBD
20	Perform 50 ACS calibration runs	5	00	P25		☐	None
	Total Duration :	5	00				

Total Duration of SPI Activities (Estimated): 294 hours 20 min