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INTEGRAL SPECTROMETER



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ANNEX 18

SPI SYSTEM TELEMETRY BUDGET



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INTERNATIONAL GAMMA RAY ASTROPHYSICS LABORATORY

SPI SYSTEM TELEMETRY BUDGET

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DOCUMENTATION CHANGE RECORD

Issue	Revision	Date	Modified Pages	Observations
1	0	10/04/99		First Issue
1	1	1/12/99	See vertical bars	No change in the TM rate
1	2	19/06/01	See vertical bars	No change in the TM rate
1	3	05/11/01	See vertical bars	Correction of the number of PSD curves in calibration and the corresponding required TM rate
1	4	16/04/02	See vertical bars	Change request SPI-DM-0-522-CNES



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0. INTRODUCTION

This document presents a system budget of the telemetry rate of the Integral Spectrometer. The goal of this budget is to evaluate the telemetry rate of the instrument depending of its configuration.

1. DOCUMENTATION

1.1. APPLICABLE DOCUMENTS

- AD0: Experiment Interface Document PART A
EID - Part A
- AD1: EID - B
SPI-SG-0/SAT-1111-CNES
- AD2: Instrument and System specification for the Integral Spectrometer
SPI-ST-0-91-CNES
- AD3: Spectrometer User Manual
SPI-MU-0-1062-CNES

1.2. REFERENCE DOCUMENTS

- RD1: ISWT #6 December 17-18,1996
- RD2: DPE IASW User's Requirements Document
SPI-ST-7-1047-CNES
- RD3: Science Performance Report
SPI-NS-0-9758-CSCI
- RD4: Possible Economic Telemetry Mode for SPI
SPI-NT-0-4080-CESR



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2. SPECIFICATIONS

In AD0 (Experiment Interface Document PART A), the resources allocation for the spectrometer are:

In solar min: 46 packet/cycles = 20,240 bits/s = 20.240 kb/s *

In solar max: 36 packet/cycles = 15,840 bits/s = 15.840 kb/s *

Moreover, ESA project requires that the instrument can have the possibility to work in case of excessive background by a factor around 3.

(*) K = 1000.

In AD1 and AD2, the telemetry specifications are:

- in Stand-by, Configuration, Cooling, Annealing and Outgassing modes: 3 kb/s;
- in Operational mode:
 - Photon/photon mode: 21 kb/s (48.9 packets) in solar min and 24 kb/s (55.8 packets) maximum (solar min + bursts);
 - TM Emergency mode: 24 kb/s maximum. This mode shall be used only in case of overflow of the telemetry due to excessive background.
- in Diagnostic and Calibration modes: 42 kb/s;

3. TELEMETRY BUDGET SYNTHESIS

3.1. HOUSEKEEPING DATA TELEMETRY

The detail of the contents of the HK data is presented in AD1, AD2 and AD3.

3.1.1. TECHNOLOGICAL HOUSEKEEPING DATA

There are analogue technological HK data (digitised by the mini RTU in DPE) and digital technological HK data. The detailed budget is presented in annex 1, chapter 3.1.

The technological HK data represent **3 packets per polling cycle (8s)** at maximum, including 1 packet for CSSW.

3.1.2. SCIENCE HOUSEKEEPING DATA

The science HK data require **5 packets per polling cycle (see annex 1 chapter 3.2)**.



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3.2. SCIENTIFIC TELEMETRY BUDGET

The detailed contents of the scientific data telemetry is presented in AD1, AD3 , annex 1 chapter2 and RD1.

3.2.1. SCIENTIFIC TELEMETRY FOR PHOTON/PHOTON DATA

Taking into account the number of events defined in AD2 (in accordance with the Instrument Mission Specification – SPI.SM.0.90.CSCI), the TM rate needed is:

- in solar min: **41 packets per polling cycle.**
- - in solar max: **17 packets per polling cycle.**

But , considering the value presented in RD1, and the estimation in annex 1, ones obtains the following realistic budget (including a weak margin):

- in solar min: **48 packets per polling cycle.**
- - in solar max: **24 packets per polling cycle.**

This last budget is considered as a maximum in annex1, but in fact the uncertainties of the background is higher than the little margin taken into account.

3.2.2. SCIENTIFIC TELEMETRY FOR SPECTRA

The size of the compressed spectra is 3,424,256 bits. With the SPI nominal accumulation duration for the spectra (of **27 min**), the TM rate is **5 packets per polling cycle to transmit a spectra each 30 min.**

If the spectra accumulation is the same than the dithering observation time for each point defined in the Core Program (965s), the TM rate becomes **9 packets per polling cycle.**

3.3. TELEMETRY BUDGET SYNTHESIS IN TM EMERGENCY MODE

This mode is detailed in RD4. In this mode only the spectra and the multiple detectors events (see annex1). The budgets are:

Nomimal values	Solar min
Scientific Telemetry	9
Spectra	5
Scientific HK data	5
Technological HK	3
Total packets	22

EID-A specification	46
---------------------	----

Maximal values	Solar min
Scientific Telemetry	11
Spectra	5
Scientific HK data	5
Technological HK	3
Total packets	24

EID-A specification	46
---------------------	----

This mode allows a margin greater than 3 on the background level at the end of the mission in solar minimum, but timing performances are very bad (125 ms) and therefore the science performances will extremely decrease.



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3.4. TELEMETRY BUDGET SYNTHESIS IN PHOTON/PHOTON MODE

The budgets are detailed in annex 1:

Nominal values	Solar min	Solar max
Scientific Telemetry	41	17
Spectra	5	5
Scientific HK data	5	5
Technological HK	3	3
Total packets (*)	54	30

EID-A specification (*)	46	36
-------------------------	----	----

Margin	-8 packets	6 packet
--------	------------	----------

Table 3.2.4.a

Maximal values	Solar min	Solar max
Scientific Telemetry	48	24
Spectra	5	5
Scientific HK data	5	5
Technological HK	3	3
Total packets (*)	61	37

EID-A specification (*)	46	36
-------------------------	----	----

Margin	-15 packets	-1 packet
--------	-------------	-----------

Table 3.2.4.b

These budgets are obtained with 20 keV for the AFEE energy threshold and 30 min for spectra accumulation. The **useful data rate is 23.9 kb/s at maximum and 20.9 kb/s in the nominal estimation**. These values are in accordance with the first estimation. The non compliance with the EID-A is not due to an increasing of the background estimation, and the non compliance in solar min with AD2 is due to the use of packets.

3.5. TELEMETRY BUDGET SYNTHESIS IN PSD CALIBRATION MODE

In this mode the DPE will transmit 40 curves per second. **The scientific TM rate will be 72 packets per polling cycle (≈38.7 kb/s). The total TM rate will be 80 packets per polling cycle.**

3.6. TELEMETRY BUDGET IN MODE WITH NO SCIENTIFIC DATA ACQUISITION

During the Stand-by, Configuration, Cooling, Annealing and Outgassing modes, only the Technological data are transmitted. The TM rate will be: **3 packets per polling cycle (≈ 1.29 kb/s).**



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3.7. POSSIBILITY OF REDUCTION OF THE TM RATE IN PHOTON/PHOTON MODE

If we don't expect any problem at the beginning of the mission (near the solar maximum) even certainly in case of burst, near the solar minimum, at the end of lifetime the TM rate will probably inadequate with the need. Therefore, before to use the TM Emergency mode, which is very poor in term of scientific data, one can explore the two possibilities to reduce the needed TM rate:

- **increasing of the duration of the spectra transmission** (by increasing the spectra accumulation time) until 134 min max (see annex1). By this way, 4 packets can be saved in the tables 3.2.4.a and 3.2.4.b.
- increasing of the AFEE energy threshold (see annex 1), but **the efficiency on the multiple events will decrease and therefore the sensitivity of the spectrometer in all the energy range will decrease too.**

In order to keep the EID-A specification in solar min, the TM rate shall be reduced at maximum by 14 packets. That can be done for example, by setting the AFEE energy threshold and the spectra accumulation time at the following value:

- AFEE energy threshold = 100 keV and spectra transmission duration = 134 min; But we will miss 4 spectra each 5 dithering points of 30 min.
- or AFEE energy threshold \approx 210 keV and spectra accumulation duration = 27 min (transmission duration of 30 min). But over 100 keV, the threshold will have a significant impact on the SPI performances.

If one wants to obtain spectra for each point during the dithering mode (16 min), the TM rate will increase by 4 packets. The energy threshold shall be set to 50 keV in solar max and around 410 keV in solar minimum !!

It should be noticed that the burst are taken into account, and if one wants to empty the 3 Mb buffer for the burst data in 30 min, the TM rate shall be increased by 4 packets.

4. CONCLUSION

The resource allocation in term of telemetry has been reduced, when the needs was increasing due to the TM loss in the packets. Therefore, the spectrometer could not be compliant with the resource allocation during all the mission.

This has been indicated at several ISWT (Integral Scientific Working Team) meeting (among others: ISWT number 5 and 6 in 1996) and during the CDR and ICDR. Moreover, when a significant increase of the total telemetry rate has been obtained by the project manager, the SPI telemetry allocation has been reduced, even if the evaluated counting rate of the Ge detectors has not been changed since the beginning of the SPI proposal.

At the beginning of the mission, the needed telemetry should be compliant with the allocation, but the Ge counting rates have been taken using background calculation without any margin and without



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considering the contribution of gamma ray lines (around 20% of the background). Even there is no real correlation between the orbit environment and the ground condition, we can point out that the background measurement during the test on ground at SPI level is less than the prediction at solar max in orbit.

If the policy is to keep the EID-A specification, the consequences are a decrease of the SPI scientific performances, because even if we accept an increase of the duration of the anti-off spectra accumulation, we need at the same time to increase the energy threshold on the Ge detectors. The consequence is not only an absence of analysis below this threshold (100 keV or more) but the decrease in sensitivity in all the energy range due to the decrease of the efficiency for multiple events detection. Moreover the increase of the duration of the anti-off spectra accumulation means we will miss spectra for some points of the dithering pattern. Finally, as we have no margin the management of the gamma ray bursts will be more critical. During the commissioning phase an evaluation of the background will be performed and the tuning of the instrument will be performed by the SPITOG in order to optimise the spectrometer performances and select the best compromise.



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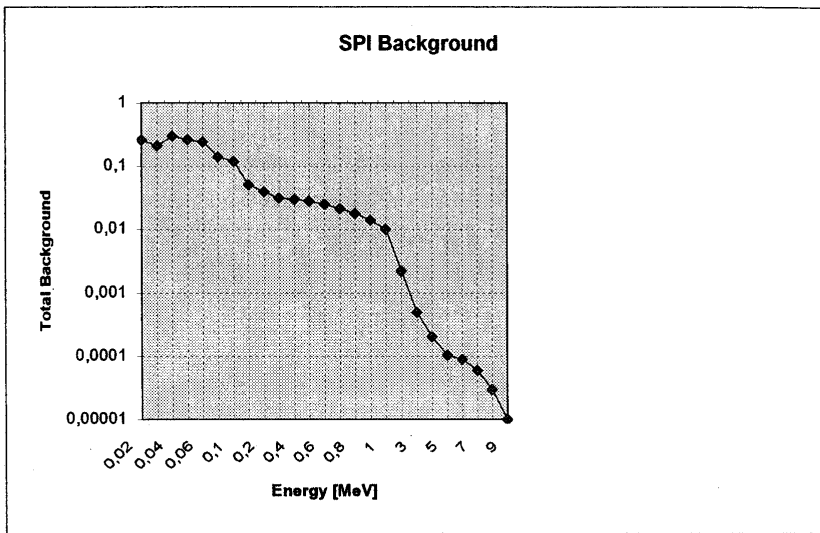
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ANNEX 1: DETAIL TELEMETRY BUDGET

SPI TELEMETRY BUDGET

1 . Events distribution evaluation:

Background on Solar max (see data chapter 5)



Factor solar min/solar max: 2,5 (20 events/s/det / 8 events/s/det)

Number of events per detector per second in Solar max

Energy	20 - 100 KeV	100 - 200 KeV	200 KeV - 2MeV	> 2 MeV	Total
Good	2,91	1,07	4,42	0,37	8,76

Number of events per detector per second in Solar min

Energy	20 - 100 KeV	100 - 200 KeV	200 KeV - 2MeV	> 2 MeV	Total
Good	7,26	2,68	11,04	0,92	21,90

Single-detector events out of PSD range:

100% of the 20 - 200 KeV energy range Photons
 55% of the > 2 MeV energy range Photons

4,18 events /s/Ge in Solar max
 10,44 events /s/Ge in Solar min

47,70% of the good events

Single-detector events in PSD range:

80% of the events in PSD range (200 KeV - 2 MeV)

3,53 events /s/Ge in Solar max
 8,83 events /s/Ge in Solar min

40,34% of the good events



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Multiple-detector events:

45% of the photons with energy > 2 MeV
20% of the photons in the PSD energy range

1,05 events /s/Ge in Solar max
2,62 events /s/Ge in Solar min

11,97% of the good events

Comparison with the data of P. Mandrou (ISWT#6 - December 17-18,1996)

Solar max

Energy	20 - 100 KeV	100 - 200 KeV	200 KeV - 2MeV	> 2 MeV	Total
Good (Solar max)	2,91	1,07	4,42	0,37	8,76
Good P. Mandrou	3,40	1,20	5,60	0,40	10,60
Ratio	1,17	1,12	1,27	1,09	1,21
Specified value					8,00

Solar min

Energy	20 - 100 KeV	100 - 200 KeV	200 KeV - 2MeV	> 2 MeV	Total
Good (Solar min)	7,26	2,68	11,04	0,92	21,90
Good P. Mandrou	6,80	2,40	11,20	0,80	21,20
Ratio	0,94	0,90	1,01	0,87	0,97
Specified value					20,00

Events repartition	Single	PSD	Multiple
Present values	47,70%	40,34%	11,97%
Values of P.Mandrou	45,47%	42,26%	12,26%
Specified Values	45,60%	42,30%	12,10%

Conclusions: The results are similar for the solar min and over the specification by around 6 to 10%.

2 - Scientific telemetry budget

2.1 hypothesis

2.1.1 Nominal values

Specified values

Solar min: 20,0 events/s/detector
Solar max: 8,0 events/s/detector

Distribution:

Single	PSD	Multiple
45,60%	42,30%	12,10%



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2.1.1 Maximum values

data of P. Mandrou (ISWT#6 - December 17-18, 1996)

Solar min:	21,2	events/s/detector
Solar max:	10,6	events/s/detector

We have to add the leakage of the ACS. There are defined in SPI.NT.1.2544.MPE.

Solar min:	44,75	events/s
Solar max:	17,9	events/s

With this leakage the maximum values are:

Solar min:	23,56	events/s/detector
Solar max:	11,54	events/s/detector

Distribution:	Single	PSD	Multiple
P.Mandrou	45,47%	42,26%	12,26%

2.2 Scientific TM budget in TM nominal mode

2.2.1 TM budget in TM nominal mode required for photon/photon data

Single-detector events out of PSD range:

Number of events/s/detector:

	Nominal values	Max. values
Solar min:	9,12 events/s/detector	10,71 events/s/detector
Solar max:	3,648 events/s/detector	5,25 events/s/detector

Word structure:

32 bits

Time (11bits)	@ (5 bits)
Energy (16bits)	

	Nominal values	Max. values
Number of bits needed	Solar min: 5544,96 bits/s	6512,27 bits/s
	Solar max: 2217,984 bits/s	3191,02 bits/s



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Single-detector events in PSD range:

Number of events/s/detector:

	Nominal values	Max. values
Solar min:	8,46 events/s/detector	9,96 events/s/detector
Solar max:	3,38 events/s/detector	4,88 events/s/detector

Word structure:

48 bits

Time (11bits)		@ (5 bits)
Energy (16bits)		
Flag (2bits)	Pulse Height (8 bits)	Time to Peak (6bits)

In addition every 4s, a PSD curve of 80 samples of 9 bits + 48 bits (event identification) => **192,0 bits/s**

	Nominal values	Max. values
Number of bits needed Solar min:	7907,52 bits/s	9271,35 bits/s
Solar max:	3278,208 bits/s	4640,89 bits/s

Multiple-detector events:

We will only consider the order 2 multidetectors events.
The other orders are marginal.

Number of events/s/detector:

	Nominal values	Max. values
Solar min:	2,42 events/s/detector	2,89 events/s/detector
Solar max:	0,97 events/s/detector	1,42 events/s/detector

Word structure:

80 bits

Time (11 bits)		Nb (5 bits)
Energy (16bits)		
Δt (11 bits)	@ (5 bits)	
Energy (16bits)		
Δt (11 bits)	@ (5 bits)	

	Nominal values	Max. values
Number of bits needed Solar min:	3678,4 bits/s	4391,06 bits/s
Solar max:	1471,36 bits/s	2151,62 bits/s

Total photon/photon scientific telemetry:

Nominal evaluation:

	Solar min	Solar max	
Single (out PSD range)	5544,96	2217,984	
PSD	7907,52	3278,208	
Multiple	3678,4	1471,36	
Total (bits/s)	17130,88	6967,552	
Total packets*	40,1	16,3	per polling cycle (8s)
	41	17	per polling cycle (8s)



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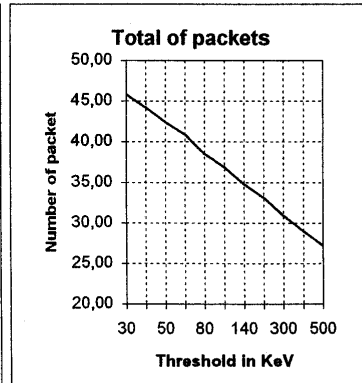
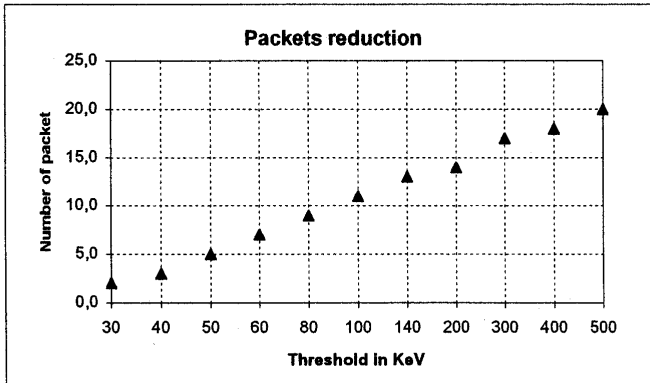
Maximal evaluation:

	Solar min	Solar max	
Single (out PSD range)	6512,27	3191,02	
PSD	9271,35	4640,89	
Multiple	4391,06	2151,62	
Total (bits/s)	20174,69	9983,54	
Total packets*	47,25	23,38	per polling cycle (8s)
	48	24	per polling cycle (8s)

* one packet has 427 bytes available for data

Number of packet reduction in solar min by increasing of the energy threshold

Threshold [KeV]	Events/s/Ge	bits/s	Total of Packets	Total	Reduction
30	1,03	625,10	45,78	46	2,0
40	2,14	1303,40	44,20	45	3,0
50	3,37	2048,20	42,45	43	5,0
60	4,46	2713,20	40,89	41	7,0
80	6,13	3724,00	38,53	39	9,0
100	7,26	4415,60	36,91	37	11,0
140	8,76	5325,32	34,78	35	13,0
200	9,94	6043,52	33,09	34	14,0
300	11,47	6974,52	30,91	31	17,0
400	12,81	7785,82	29,01	30	18,0
500	14,07	8557,22	27,21	28	20,0



Conclusion:

In nominal TM mode the scientific photon/photon data required 47 packets in solar min and 23 packets in solar max with the maximum evaluation.
The increasing of the threshold can allow us to save 14 packets in solar min with a threshold of 200 Kev, but induces an important scientific loss.



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2.2.2 Scientific TM required for the spectra

The compressed spectra size is 11 K words (2 bytes) x 19 detectors =>

3424256 bits

The nominal time for transmission is

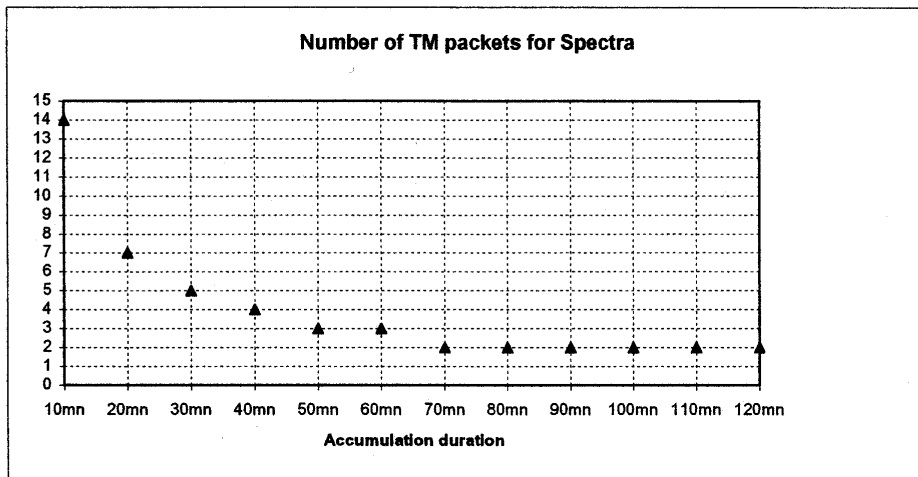
30mn the TM rate is

1902,36 bits/s

Duration of the spectra transmission :

4,5 packets

Duration	Bits/s	Packets	packets
10mn	5707,09	13,37	14
20mn	2853,55	6,68	7
30mn	1902,36	4,46	5
40mn	1426,77	3,34	4
50mn	1141,42	2,67	3
60mn	951,18	2,23	3
70mn	815,30	1,91	2
80mn	713,39	1,67	2
90mn	634,12	1,49	2
100mn	570,71	1,34	2
110mn	518,83	1,22	2
120mn	475,59	1,11	2
140mn	407,65	0,95	1



The nominal TM rate for 30 mn of transmission is: 5 pkts



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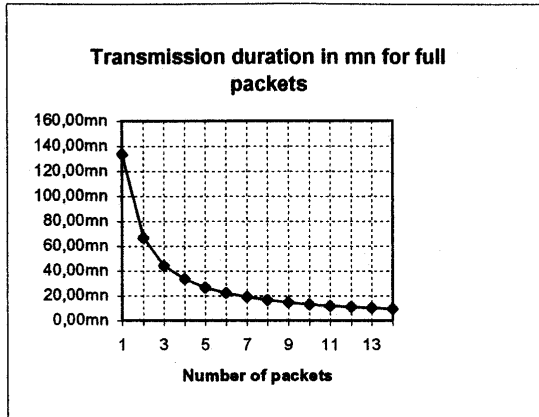
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Nb of packets Time for full packets

1	133,66mn
2	66,83mn
3	44,55mn
4	33,41mn
5	26,73mn
6	22,28mn
7	19,09mn
8	16,71mn
9	14,85mn
10	13,37mn
11	12,15mn
12	11,14mn
13	10,28mn
14	9,55mn

We can save 2 packets with a transmission time of 45mn and 3 packets with 67mn
Over this time, the win is very poor, and after 134 mn the reduction is nil.

2.3 Scientific TM budget in TM Emergency Mode

This mode is detailed in SPI.NT.0.4080.CESR written by P. Mandrou.
In this mode the scientific telemetry is composed only by spectra and multiple detector events.

Nominal evaluation of photon/photon telemetry rate:

	Solar min	Solar max	
Multiple	3678,4	1471,36	
Total (bits/s)	3678,4	1471,36	
Total packets*	8,6	3,4	per polling cycle (8s)
Total packets*	9	4	per polling cycle (8s)
Saving of packets	32	13	per polling cycle (8s)

Maximal evaluation of photon/photon telemetry rate:

	Solar min	Solar max	
Multiple	4391,06	2151,62	
Total (bits/s)	4391,06	2151,62	
Total packets*	10,28	5,0	per polling cycle (8s)
Total packets*	11	6	per polling cycle (8s)
Saving of packets	37	18	per polling cycle (8s)

* one packet has 427 bytes available for data

This mode offers a strong reduction of the scientific TM rate, but the timing performance will decrease from 127.5 µs to 125 ms !! Therefore the science performances will extremely decrease.

2.4 Scientific TM budget in PSD calibration Mode

In this mode 40 PSD curves of 80 samples of 9 bits + 48 bits (event identification) will be transmitted.

The TM rate will be: 30720 bits/s 30,0 kbits/s 72 packets per polling cycle (8s)



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3 - Housekeeping data telemetry budget

3.1 Technological HK data (channel VC0)

From AFEE

44 ⁽²⁾ bytes in 8s
6 ⁽¹⁾ bytes in 8s
148 bytes in 640s
78 bytes in 3840s

From DFEE

6 ⁽¹⁾ bytes in 8s
76 bytes in 3840s

From PSD

6 ⁽¹⁾ bytes in 8s
252 bytes in 64s
56 bytes in 640s
218 bytes in 3840s

From ACS

392 bytes in 8s
3 ⁽¹⁾ bytes in 8s
336 bytes in 640s
686 bytes in 3840s

From DPE (IASW)

5 bytes in 8s
15 bytes in 600s
106 bytes in 3840s

Total

36 ⁽¹⁾ bytes in 8s	Packets
397 ⁽³⁾ bytes in 8s	1 packet CSSW
252 bytes in 64s	1packet (60011)
599 ⁽³⁾ bytes in 640s	1packet (60060)
1164 bytes in 3840s	2 packets (60601;60602)
	3 packets (63841;63842;63843)

per polling cycle 2 **packets max**
 1 **packet for CSSW**

Total	3	packets
-------	---	---------

The number of packets per pooling is 2 or 3 (including the CSSW packet) depending of the cycle number.

⁽¹⁾ in CSSW packet / ⁽²⁾ every 8s for IASW processing and in HK packet every 640s only

⁽³⁾ because the number of byte is odd we add a byte filled with 0 to the packets 60011 and 60602

3.2 Scientific HK data

Packets	Number of used bytes
60000	428
60001	428
60002	428
60003	428
60004	320
	2032 bytes in 8s

1,984 Kb/s

5 packets per polling cycle



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4 - Synthesis of the telemetry budget

For the operational modes with a energy threshold of 20 KeV and a spectra every 30 mn:

Maximal values	Solar min	Solar max
Scientific Telemetry	48	24
Spectra	5	5
Scientific HK data	5	5
Technological HK	3	3
Total packets (*)	61	37

Useful data rate in solar min

20175 bits/s
1902 bits/s
2032 bits/s
474 bits/s
24583 bits/s 24,0 kbits/s

EID-A specification (*)	46	36
-------------------------	----	----

Margin	-15 packets	-1 packet
--------	-------------	-----------

(*) per polling cycle

In order to keep the EID-A specification in solar min we can save 15 packets by:

- increase the energy threshold to 100 KeV and transmit the spectra every 134 mn,
- or increase the energy threshold to around 210 KeV and transmit the spectra every 30 mn.

If one wants to obtain a spectra for each point of a dithering mode with 16 mn for each, the TM rate for the spectra will be 9 packets and the energy threshold shall be around 410 keV at the solar min and 50 keV at the solar max.

For the operational modes with a energy threshold of around 210 KeV and a spectra every 30 mn:

Maximal values	Solar min
Scientific Telemetry	33
Spectra	5
Scientific HK data	5
Technological HK	3
Total packets (*)	46

EID-A specification (*)	46
-------------------------	----

(*) per polling cycle

If there is still a problem we can used the TM Emergency mode:

Maximal values	Solar min
Scientific Telemetry	11
Spectra	5
Scientific HK data	5
Technological HK	3
Total packets	24

per polling cycle

EID-A specification	46
---------------------	----

per polling cycle

The science data event rate is: 4391,06 bits/s
The margin is: 9394 bits/s
=> the factor of margin is: 3,1

This mode allows a margin of 22 packets for Scientific telemetry under-evaluation that is to say that this mode provide us with a security margin of a factor 3.1 on the background evaluation.



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6 - SPI background data at solar maximum

This values are defined from the curve provide in the ISWT#6 minutes

Energy Energy [MeV]	Background C.s ⁻¹ .cm ⁻² .MeV ⁻¹	Trapèzes	Somme	Total sur 175 cm ³
0,02	0,26	0,00235	0,0166	2,91
0,03	0,21	0,00255		
0,04	0,3	0,0028		
0,05	0,26	0,0025		
0,06	0,24	0,0038		
0,08	0,14	0,0026		
0,1	0,12	0,00342	0,00612	1,07
0,14	0,051	0,0027		
0,2	0,039	0,0035	0,025236756	4,42
0,3	0,031	0,00305		
0,4	0,03	0,0029		
0,5	0,028	0,00265		
0,6	0,025	0,0023		
0,7	0,021	0,00195		
0,8	0,018	0,001593378		
0,9	0,013867558	0,001193378		
1	0,01	0,0061		
2	0,0022	0,00135	0,002095	0,37
3	0,0005	0,0003525		
4	0,000205	0,000155		
5	0,000105	0,0000975		
6	0,00009	0,000075		
7	0,00006	0,000045		
8	0,00003	0,00002		
9	0,00001			



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Synthesis

PST needed	Photon in solar min	Photon in solar max	Photon for PSD check	Calibration	Diagnostic	Diag for PSD	Emergency	Conf / Stand by
HK techno	3	3	3	3	3	3	3	3
HK science	5	5	5	5	5	5	5	5
Photon 20 events/det/s 8 events/det/s	40	16	40		40	40	9	
Spectra (30 min)	5	5	5		5	5	5	
PSD curves 1c/4s (nominal oper) 1 curve/125 ms (8 c/s) maximum 40 c/s	1	1	15	72	1	72		
Diagnostic packets					4	4		
Total of packets per polling cycle	54	30	68	80	58	129	22	3

Nota: a - for specific purpose the on-board spectra could be deactivated in particular for the PSD chek in photon or in diagnostic.
b - The diagnostic mode with the maximum of PSD curves has not been specified and tested. The test has been done with the nominal curve occurrence.