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BC-SIM-TR-006
Delta NECP
Data Produced Analysis

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1. Introduction



1.1. Scope

This document describes all the tests performed during the second session of the Near Earth Commissioning Phase (dNECP) by the Spectrometers and Imagers for MPO BepiColombo Integrated Observatory SYSTEM (SIMBIO-SYS). The test session whose plan is described in [RD.1] was performed on June 6th 2019. For each test, a sheet with the pipeline report and a discussion eventually on the detected anomalies is given.

1.2. Reference Documents

- [RD.1] BC-SIM-PL-003 Delta NECP Test Summary Issue1 Revision0
(DOI: <http://dx.doi.org/10.20371/INAF/TechRep/66>)
- [RD.2] BC-SIM-TN-003 – Reports and Notes Layout and Flow
(DOI: <http://dx.doi.org/10.20371/INAF/TechRep/36>)
- [RD.3] BC-SIM-ICD-001_SIMBIOSYS_EAICD
- [RD.4] BC-SIM-GAF-IC-002_rev12 – SIMBIO-SYS Software Interface Control Document
- [RD.5] BC-SIM-TN-004_-_SIMBIO-SYS FOP update after NECP
(DOI: <http://dx.doi.org/10.20371/INAF/TechRep/58>)
- [RD.6] BC-ASD-SP-00176_1_4 SIMBIO URD
- [RD.7] BC-SIM-GAF-MA-002 10 001 – SIMBIO-SYS User Manual

1.3. Attached Document

- [AT.1] Command_Stack_dNECP.xlsx 
- [AT.2] Event_dNECP.log 

1.4. Acronyms

| | |
|-------------------|---|
| ACK | Acknowledgment |
| APID | Application Process IDentifier |
| CSV | Comma Separated Values |
| FPA | Focal Plane Assembly |
| HK | Housekeeping |
| HRIC | High spatial Resolution Imaging Channel |
| ME | Main Electronics |
| NECP | Near Earth Commissioning Phase |
| dNECP | delta Near Earth Commissioning Phase |
| PDS | Planetary Data System |
| PE | Proximity Electronics |
| PNG | Portable Network Graphics |
| PSC | Packet Sequence Control |
| SIMBIO-SYS | Spectrometers and Imagers for MPO BepiColombo Integrated Observatory SYSTEM |
| SSC | Source Sequence Count |



STC STereo imaging Channel
TC Telecommand
TM Telemetry
VIHI VIsible and Hyper-spectral Imaging channel
XML eXtensible Markup Language

1.5. Document Format and Repository

This document is compliant with the SIMBIO-SYS Report and Note Layout and Flow [RD.2] **Errore. L'origine riferimento non è stata trovata.** and will be archived both on the INAF Open Access repository and the SIMBIO-SYS team Archive.

1.6. The test plan

According to [RD.1] Table 1-1 reports the list of the performed tests during the dNECP together with:

- the start time, defined as the execution time of the first Telecommand (TC) of the test.
- the stop time, defined as the execution time of the first TC of the next test session minus 1 second or the the execution time of the instrument shutdown.

| ID | Test description | Start Time | Stop Time | Test Duration |
|----|-------------------------|-------------------------|-------------------------|---------------|
| 01 | STC All FPA Test | 2019-06-06T06:30:00.00Z | 2019-06-06T06:59:59.00Z | 29m 59s |
| 02 | STC Mitigate Reset Test | 2019-06-06T07:00:00.00Z | 2019-06-06T07:00:24.00Z | 24s |
| 03 | STC Hot Pixel Test | 2019-06-06T07:00:25.00Z | 2019-06-06T07:19:25.00Z | 19m |
| 04 | VIHI Calib Test | 2019-06-06T07:19:26.00Z | 2019-06-06T08:09:33.00Z | 50m 07s |
| 05 | VIHI Deector Bias Test | 2019-06-06T08:09:35.00Z | 2019-06-06T08:43:00.00Z | 33m 25s |
| 06 | Orbit test | 2019-06-06T08:49:00.00Z | 2019-06-06T10:20:00.00Z | 1h 31m |

Table 1-1: Tests Schedules

The entire duration of the dNECP session is 3h 43m 55s.

1.7. Report scheme

For each test we report the analysis of the results according to the structure shown in Table 1-2 and described in the following subsections.

| Session Number | Session Name |
|----------------|----------------|
| 1 | Telecommands |
| 2 | Data Procedure |
| 3 | Events Check |
| 4 | PE Event |
| 5 | Lost packets |
| 6 | TCs Check |
| 7 | Discussion |

Table 1-2 Section structure defined for each Test.



1.7.1. Telecommands (TCs)

In this Section the list of TCs used for the test are reported. For each of them, the software performs an analysis of the parameters and an estimation of the produced data. This information is derived by the TC Stack downloaded from the spacecraft.

All the TCs used for the tests and their parameters are described in [AT.1]

1.7.2. Data produced

This Section reports the produced data organized in two subsections:

1. the first one contains the number of valid packets and the data volume downloaded from the instrument;
2. the second one contains the information about the output files, which are:
 - a. CSV files for the diagnostic housekeeping (HK);
 - b. CSV files for the housekeeping parameters related to a single image;
 - c. DAT files containing the image data in binary format.

All the data are stored in PDS4 format, which means that they include an XML file containing all the acquisition parameters as generated by the instrument or the spacecraft. A complete description of the file structure and the folder tree structure is reported in [RD.3]. Each image has an extra file in PNG format as a quick preview.

For each output group, the number of files and total data volume is reported.

1.7.3. Events check

In this section, the results of the event checks are reported, including:

- all the negative TC acknowledgments,
- the rejected TC (i.e, for which it is received a TM(1,2)),
- the failed TC (i.e, for which it is received a TM(1,8)).

For each rejected or failed TC event, it is reported a sheet with all the relative information (i.e., mnemonic name, description, time of execution, and all the parameters).

For each event, it is reported a list of low severity (TM(5,2)), medium severity (TM(5,3)), and high severity (TM(5,4)) telemetry errors with a description of the event.

The complete list of events and TC acknowledgments is reported into the Event file [AT.2]. All the information for the event and TC acknowledgments are described in [RD.4].

1.7.4. PE Events

From an automatic analysis of the diagnostic HK, a list of the negative event alerts, sent by the Proximity Electronics (PE) to the Main Electronics (ME), is created. Each alert is reported with the decimal ID and with its complete description. The information for the PE events is described in [RD.4].



1.7.5. Lost packets

The automatic check on the lost packets is performed using the Packet Sequence Control (PSC) number (see [RD.4]). The PSC is a progressive number associated to the Telemetry packets and follows a different numeration for each different APID. A list of the used APID is reported in Table 1-3 .

| APID | Description |
|------|-------------------------|
| 801 | TC Verification |
| 804 | HK Reports |
| 807 | Event Reports |
| 828 | HRIC Data High Priority |
| 844 | STC Data High Priority |
| 860 | VIHI Data High Priority |
| 870 | HRIC Data Low Priority |
| 892 | STC Data Low Priority |
| 908 | VIHI Data Low Priority |

Table 1-3 List of the APIDs associated to each dataflow.

The PSC number is stored in 14 bits format. This means that the maximum value is 16383, after that the counter is reinitialized.

NB: A manual check is required in order to evaluate if some packets are lost at the begin and at the end of the acquisition. The automatic check detects only gaps in the PSC sequence.

1.7.6. Telecommand Check

This section reports the analysis relative to the acceptance and execution of the TC received by the ME/PE during the test.

1.7.7. Discussion

In this section we will discuss the results and any discrepancies and errors detected during the execution of the test.

2. dNECP Results Analysis

2.1. General Discussion

With reference to Table 1-1, we summarize the following quality table:

| Satisfaction Table | | |
|--------------------|-------------------------|-------------------------|
| 01 | STC All FPA Test | 8 TC Failed |
| 02 | STC Mitigate Reset Test | 3 TC Ignored |
| 03 | STC Hot Pixel Test | |
| 04 | VIHI Calib Test | 1 TC time out |
| 05 | VIHI Deector Bias Test | |
| 06 | Orbit test | 3 VIHI Sessions missing |

Table 2-1: Quality Table.

2.2. STC All FPA Test

2.2.1. Test Scope

The aim of the test is the monitoring of the Dark Current (DC), Dark Signal Non Uniformity (DSNU) and the ReadOut Noise (RON) with the acquisition of a large area of the detector (all_fpa test).

2.2.2. Test Execution

Time Frame: 2019-06-06T06:30:00.00Z ÷ 2019-06-06T06:59:59.00Z

In the Table 2-2 the initial status of the instrument is reported:

| INSTRUMENT INITIAL STATUS | | | |
|---------------------------|------|-----|------|
| ME | HRIC | STC | VIHI |
| OFF | OFF | ON | OFF |

Table 2-2: Instrument status before the STC All FPA Test.

2.2.3. Science

Table 2-3 reports the number of the performed science sessions with an indication of their duration, and the number of images and frames expected for each TCs commanded during test.

| ID | SSC | Duration | Mode | Repetition Time [s] | Expected Acquisition | Expected Frame |
|----|-----|------------|---------|---------------------|----------------------|----------------|
| 1 | 236 | 3 seconds | Limited | 0.70 | 5 | 5 |
| 2 | 237 | 3 seconds | Limited | 0.70 | 5 | 5 |
| 3 | 238 | 25 seconds | Limited | 5.0 | 5 | 5 |
| 4 | 239 | 25 seconds | Limited | 5.0 | 5 | 5 |
| 5 | 240 | 3 seconds | Limited | 0.70 | 5 | 5 |
| 6 | 241 | 3 seconds | Limited | 0.70 | 5 | 5 |
| 7 | 242 | 25 seconds | Limited | 5.0 | 5 | 5 |
| 8 | 243 | 25 seconds | Limited | 5.0 | 5 | 5 |
| 9 | 244 | 6 seconds | Limited | 1.2 | 5 | 5 |
| 10 | 245 | 6 seconds | Limited | 1.2 | 5 | 5 |



| ID | SSC | Duration | Mode | Repetition Time [s] | Expected Acquisition | Expected Frame |
|----|-----|------------|---------|---------------------|----------------------|----------------|
| 11 | 246 | 25 seconds | Limited | 5.0 | 5 | 5 |
| 12 | 247 | 25 seconds | Limited | 5.0 | 5 | 5 |
| 13 | 248 | 6 seconds | Limited | 1.2 | 5 | 5 |
| 14 | 249 | 6 seconds | Limited | 1.2 | 5 | 5 |
| 15 | 250 | 25 seconds | Limited | 5.0 | 5 | 5 |
| 16 | 251 | 25 seconds | Limited | 5.0 | 5 | 5 |
| 17 | 252 | 6 seconds | Limited | 1.2 | 5 | 5 |
| 18 | 253 | 6 seconds | Limited | 1.2 | 5 | 5 |
| 19 | 254 | 25 seconds | Limited | 5.0 | 5 | 5 |
| 20 | 255 | 25 seconds | Limited | 5.0 | 5 | 5 |
| 20 | --- | 5 minutes | --- | --- | 100 | 100 |

Table 2-3: TC used during the STC ALL FPA Test.

The data reported in Table 2-3 are in agreement with [RD.1]

2.2.4. Data Produced

2.2.4.1. Data Volume

| | #Packets | DV |
|-------------------|----------|-----------|
| HK | 111 | 4.1 kib |
| STC low priority | 53880 | 220.7 Mib |
| STC high priority | 0 | 0.00 Mib |

Table 2-4: DV produced during the STC ALL FPA Test.

2.2.4.2. Output Files

| Bundle Miscellaneous | | | |
|----------------------|-----|------|---------|
| File | CSV | | |
| | | # | 2 |
| | | Size | 39.1 kB |

| Bundle Raw STC | | | |
|----------------|-----|------|----------|
| File | CSV | | |
| | | # | 60 |
| | | Size | 55.2 kB |
| DAT | | | |
| | | # | 60 |
| | | Size | 251.7 MB |

Table 2-5: Data produced during the STC ALL FPA Test.

2.2.5. ME Events

None.

2.2.6. PE Events

None.

2.2.7. Lost Packets

| | | |
|---------------------------|-------|---------------------|
| Telecommand Verification: | 66 | [lost packet(s): 0] |
| HK Report: | 111 | [lost packet(s): 0] |
| Event/Anomaly Report: | 47 | [lost packet(s): 0] |
| HRIC low Priority: | 0 | [lost packet(s): 0] |
| STC low Priority: | 53880 | [lost packet(s): 0] |
| VIHI low Priority: | 0 | [lost packet(s): 0] |
| HRIC high Priority: | 0 | [lost packet(s): 0] |
| STC high Priority: | 0 | [lost packet(s): 0] |
| VIHI high Priority: | 0 | [lost packet(s): 0] |

Table 2-6: Packets and lost packet report for the STC ALL FPA Test.

2.2.8. Telecommands check

| Telecommand Status | # |
|--------------------|----|
| Accepted | 33 |
| Executed | 25 |
| Refuted | 0 |
| Failed | 8 |

Table 2-7: Packets and lost packet report for the STC ALL FPA Test.

2.2.8.1. Failed Telecommands

1. [2019-06-06T06:50:00.017] - TM(1,8) - [APID 801] - Event N/A - Telecommand Execution Failure [Failure ID: 40000, APID: 812, Sequence n. 236]
2. [2019-06-06T06:50:30.017] - TM(1,8) - [APID 801] - Event N/A - Telecommand Execution Failure [Failure ID: 40000, APID: 812, Sequence n. 237]
3. [2019-06-06T06:51:00.017] - TM(1,8) - [APID 801] - Event N/A - Telecommand Execution Failure [Failure ID: 40000, APID: 812, Sequence n. 238]
4. [2019-06-06T06:51:30.017] - TM(1,8) - [APID 801] - Event N/A - Telecommand Execution Failure [Failure ID: 40000, APID: 812, Sequence n. 239]
5. [2019-06-06T06:52:00.016] - TM(1,8) - [APID 801] - Event N/A - Telecommand Execution Failure [Failure ID: 40000, APID: 812, Sequence n. 240]
6. [2019-06-06T06:52:30.016] - TM(1,8) - [APID 801] - Event N/A - Telecommand Execution Failure [Failure ID: 40000, APID: 812, Sequence n. 241]
7. [2019-06-06T06:53:00.016] - TM(1,8) - [APID 801] - Event N/A - Telecommand Execution Failure [Failure ID: 40000, APID: 812, Sequence n. 242]
8. [2019-06-06T06:53:30.016] - TM(1,8) - [APID 801] - Event N/A - Telecommand Execution Failure [Failure ID: 40000, APID: 812, Sequence n. 243]

2.2.9. Discussion

8 TC failed due to wrong parameters initialization values. The missing images are related to those TC.

The details are reported in Table 2-8 with information from section 2.2.3 and 2.2.4.

| | Commanded | From TM |
|------------------|-----------|---------|
| Images | 100 | 60 |
| Science Sessions | 20 | 12 |

Table 2-8: Comparison between data commanded and produced during the STC ALL FPA Test.

2.3. STC Mitigate Reset Test

2.3.1. Test Scope

The aim of the test is to monitor offset behaviour (mitigate_reset test)

2.3.2. Test Execution

Time Frame: 2019-06-06T07:00:00.00Z ÷ 2019-06-06T07:00:24.00Z

In Table 2-9 is reported the initial status of the instrument:

| INSTRUMENT INITIAL STATUS | | | |
|---------------------------|------|-----|------|
| ME | HRIC | STC | VIHI |
| ON | OFF | ON | OFF |

Table 2-9: Instrument status before the STC Mitigate Reset Test.

2.3.3. Science

Table 2-10 reports the number of the performed science sessions with an indication of their duration, and the number of images and frames expected for each TC commanded during the test.

| ID | SSC | Duration | Mode | Repetition Time [s] | Expected Acquisition | Expected Frame |
|----|-----|--------------------------|------------|---------------------|----------------------|----------------|
| 1 | 256 | 10 seconds | Limited | 0.2 | 50 | 250 |
| 2 | 257 | 20 seconds | Limited | 2.0 | 10 | 50 |
| 3 | 258 | 0 milliseconds | Limited | 0.15 | 3 | 3 |
| 4 | 259 | 6 seconds | Limited | 2.0 | 3 | 15 |
| 5 | 260 | 1 second | Continuous | 0.15 | 6 | 6 |
| 6 | 261 | 20 seconds | Limited | 2.0 | 10 | 50 |
| 7 | 262 | 0 milliseconds | Limited | 0.15 | 1 | 1 |
| 8 | 263 | 20 seconds | Limited | 2.0 | 10 | 50 |
| 9 | 264 | 1 second | Limited | 0.9 | 2 | 2 |
| 10 | 265 | 20 seconds | Limited | 2.0 | 10 | 50 |
| 11 | 266 | 1 second | Limited | 0.95 | 2 | 2 |
| 12 | 267 | 20 seconds | Limited | 2.0 | 10 | 50 |
| 13 | 268 | 1 second | Limited | 0.98 | 2 | 2 |
| 14 | 269 | 20 seconds | Limited | 2.0 | 10 | 50 |
| 15 | 270 | 1 second | Limited | 0.99 | 2 | 2 |
| 16 | 271 | 20 seconds | Limited | 2.0 | 10 | 50 |
| 17 | 272 | 1 second | Limited | 0.495 | 3 | 3 |
| 18 | 273 | 20 seconds | Limited | 2.0 | 10 | 50 |
| 19 | 274 | 1 second | Limited | 1.2 | 1 | 1 |
| 20 | 275 | 20 seconds | Limited | 2.0 | 10 | 50 |
| 21 | 276 | 16 seconds | Limited | 4.0 | 4 | 20 |
| 22 | 277 | 1 second | Continuous | 0.2 | 5 | 5 |
| 23 | 278 | 4 seconds | Limited | 4.0 | 1 | 5 |
| 24 | 279 | 1 second | Continuous | 0.2 | 5 | 5 |
| 25 | 280 | 4 seconds | Limited | 4.0 | 1 | 5 |
| 26 | 281 | 1 second | Continuous | 0.2 | 5 | 5 |
| 27 | 282 | 4 seconds | Limited | 4.0 | 1 | 5 |
| 27 | --- | 3 minutes and 59 seconds | --- | --- | 189 | 787 |

Table 2-10: TC used during the STC Mitigate Reset Test.

The data reported in Table 2-10 are in agreement with [RD.1].



2.3.4. Data Produced

2.3.4.1. Data Volume

| | #Packets | DV |
|-------------------|----------|------------|
| HK | 26 | 7.72 kb |
| STC low priority | 4381 | 134.48 Mib |
| STC high priority | 0 | 0.00 Mib |

Table 2-11: DV produced during the STC Mitigate Reset Test.

2.3.4.2. Output Files

| Bundle Miscellaneous | | | |
|----------------------|-----|------|---------|
| File | CSV | | |
| | | # | 2 |
| | | Size | 10.1 KB |

| Bundle Raw STC | | | |
|----------------|-----|------|----------|
| File | CSV | | |
| | | # | 773 |
| | | Size | 711.2 kB |
| DAT | | | |
| | | # | 773 |
| | | Size | 76.5 MB |

Table 2-12: Data produced during the STC Mitigate Reset Test.

2.3.5. ME Events

None.

2.3.6. PE Events

None.

2.3.7. Lost Packets

| Type of Packets | # | Note |
|--------------------------|------|--------------------|
| Telecommand Verification | 51 | [Lost Packet(s) 0] |
| HK Report | 26 | [Lost Packet(s) 0] |
| Event/Anomaly Report | 25 | [Lost Packet(s) 0] |
| STC low Priority | 4381 | [Lost Packet(s) 0] |
| STC high Priority | 0 | [Lost Packet(s) 0] |

Table 2-13: Packets and lost packet report for the STC Mitigate Reset Test.

2.3.8. Telecommands check



| Telecommand Status | # |
|--------------------|----|
| Accepted | 27 |
| Executed | 24 |
| Refuted | 0 |
| Failed | 0 |

Table 2-14: Packets and lost packet report for the STC Mitigate Reset Test.

2.3.9. Discussion

The produced output is not in line with what is expected. The TCs with SSC 277, 279, and 281 were ignored. No reject ACK was produced. The missing images are due to the ignored TCs.

The details are reported Table 2-15 in with information from section 2.3.3 and 2.3.4.

| | Commanded | From TM |
|------------------|-----------|---------|
| Images | 788 | 773 |
| Science Sessions | 27 | 24 |

Table 2-15: Comparison between data commanded and produced during the STC Mitigate Reset Test.

2.4. STC Hot Pixel Test

2.4.1. Test Scope

The aim of the test is to monitor the spurious charge and popcorn effect on the hot pixel distribution.

2.4.2. Test Execution

Time Frame: 2019-06-06T07:00:25.00Z ÷ 2019-06-06T07:19:25.00Z

In the table below the initial status of the instrument is reported:

| INSTRUMENT INITIAL STATUS | | | |
|---------------------------|------|-----|------|
| ME | HRIC | STC | VIHI |
| ON | OFF | ON | OFF |

Table 2-16: Instrument status before the STC Hot Pixel Test.

2.4.3. Science

Table 2-17 reports the number of of the performed science sessions with an indication of their duration, and the number of images and frames expected for each TCs commanded during test.

| ID | SSC | Duration | Mode | Repetition Time [s] | Expected Acquisition | Expected Frame |
|----|-----|------------|---------|---------------------|----------------------|----------------|
| 1 | 283 | 10 seconds | Limited | 1.0 | 10 | 10 |
| 2 | 284 | 10 seconds | Limited | 1.0 | 10 | 10 |
| 3 | 285 | 10 seconds | Limited | 1.0 | 10 | 10 |
| 4 | 286 | 10 seconds | Limited | 1.0 | 10 | 10 |
| 5 | 287 | 10 seconds | Limited | 1.0 | 10 | 10 |
| 6 | 288 | 10 seconds | Limited | 1.0 | 10 | 10 |
| 7 | 289 | 10 seconds | Limited | 1.0 | 10 | 10 |
| 8 | 290 | 10 seconds | Limited | 1.0 | 10 | 10 |
| 9 | 291 | 10 seconds | Limited | 1.0 | 10 | 10 |
| 10 | 292 | 10 seconds | Limited | 1.0 | 10 | 10 |
| 11 | 293 | 10 seconds | Limited | 1.0 | 10 | 10 |
| 12 | 294 | 10 seconds | Limited | 1.0 | 10 | 10 |
| 13 | 295 | 10 seconds | Limited | 1.0 | 10 | 10 |
| 14 | 296 | 10 seconds | Limited | 1.0 | 10 | 10 |
| 15 | 297 | 10 seconds | Limited | 1.0 | 10 | 10 |
| 16 | 298 | 10 seconds | Limited | 1.0 | 10 | 10 |
| 17 | 299 | 10 seconds | Limited | 1.0 | 10 | 10 |
| 18 | 300 | 10 seconds | Limited | 1.0 | 10 | 10 |
| 19 | 301 | 2 minutes | Limited | 12.0 | 10 | 60 |
| 20 | 302 | 2 minutes | Limited | 12.0 | 10 | 60 |
| 21 | 303 | 2 minutes | Limited | 12.0 | 10 | 60 |
| 21 | --- | 9 minutes | --- | --- | 210 | 360 |

Table 2-17: TC used during the STC Hot Pixel Test.

The data reported in Table 2-17 are in line with [RD.1].



2.4.4. Data Produced

2.4.4.1. Data Volume

| | #Packets | DV |
|-------------------|----------|----------|
| HK | 49 | 14.36 kb |
| STC low priority | 98230 | 3.00 Gib |
| STC high priority | 0 | 0.00 Mib |

Table 2-18: DV produced during the STC Hot Pixel Test.

2.4.4.2. Output Files

| Bundle Miscellaneous | | | |
|----------------------|-----|------|---------|
| File | CSV | | |
| | | # | 2 |
| | | Size | 18.1 KB |

| Bundle Raw STC | | | |
|----------------|-----|------|----------|
| File | CSV | | |
| | | # | 360 |
| | | Size | 331.2 KB |
| DAT | | | |
| | | # | 360 |
| | | Size | 459.1 MB |

Table 2-19: Data produced during the STC Hot Pixel Test.

2.4.5. ME Events

None.

2.4.6. PE Events

None.

2.4.7. Lost Packets

| Type of Packets | # | Note |
|--------------------------|-------|--|
| Telecommand Verification | 42 | [Lost Packet(s) 0] |
| HK Report | 49 | [Lost Packet(s) 0] |
| Event/Anomaly Report | 36 | [Lost Packet(s) 0] |
| HRIC low Priority | 0 | [Lost Packet(s) 0] |
| STC low Priority | 98230 | [Lost Packet(s) 1] |
| | | [2019-06-06T07:07:50.628159Z] [Position : 31606] packet number(s): 895 |
| | | [2019-06-06T07:07:50.628190Z] [Position : 31607] packet number(s): -896 |
| | | [2019-06-06T07:07:51.628937Z] [Position : 32502] packet number(s): 1 |
| VIHI low Priority | 0 | [Lost Packet(s) 0] |
| HRIC high Priority | 0 | [Lost Packet(s) 0] |
| STC high Priority | 0 | [Lost Packet(s) 0] |
| VIHI high Priority | 0 | [Lost Packet(s) 0] |

Table 2-20: Packets and lost packet report for the STC Hot Pixel Test.

The first two missing packets error suggest a misplaced packet. The wrong position of a packet is currently under investigation.

2.4.8. Telecommands check

| Telecommand Status | # |
|--------------------|----|
| Accepted | 21 |
| Executed | 21 |
| Refuted | 0 |
| Failed | 0 |

Table 2-21: Comparison between data commanded and produced during the STC Hot Pixel Test.

2.4.9. Discussion

The analysis shows the presence of a badly positioned packet. The packet is in the right position when sorting according to the time index, but in a wrong position when sorting to the SSC index. The issue is under investigation.

The details are reported in Table 2-22 with information from Section 2.4.3 and 2.4.4.

| | Commanded | From TM |
|------------------|-----------|---------|
| Images | 360 | 360 |
| Science Sessions | 21 | 21 |

Table 2-22: Comparison between data commanded and produced during the STC Hot Pixel Test.

2.5. VIHI Calib Test

2.5.1. Test Scope

The aim of this test is to verify the performance of the internal calibration by changing some parameters controlling the Focal Plane Assembly (FPA).

In particular, the FPA parameters VDet_Com and VDet_Adj have been programmed onboard with non-nominal values; the correct values are listed in [RD.7], chapter 8.3.1.10.

During the test an Internal Calibration sequence was executed two times: the first by commanding onboard non-nominal parameters; the second with the the nominal values.

2.5.2. Test Execution

Time Frame: 2019-06-06T07:19:26.00Z ÷ 2019-06-06T08:09:33.00Z

In the table the initial status of the instrument is reported:

| INSTRUMENT INITIAL STATUS | | | |
|---------------------------|------|-----|------|
| ME | HRIC | STC | VIHI |
| ON | OFF | OFF | ON |

Table 2-23: Instrument status before the VIHI Calib Test.

2.5.3. Science

Table 2-24 reports the number of of the performed science sessions with an indication of their duration, and the number of images and frames expected for each TCs commanded during test.

| ID | SSC | Duration | Mode | Repetition Time [s] | Expected Acquisition | Expected Frame |
|----|-----|----------------------------|------------|---------------------|----------------------|----------------|
| 1 | 321 | 15 seconds | Continuous | 1.020 | 15 | 15 |
| 2 | 322 | 14.28 seconds | Continuous | 1.020 | 15 | 15 |
| 3 | 323 | 13.98 seconds | Continuous | 1.015 | 15 | 15 |
| 4 | 324 | 14.22 seconds | Continuous | 1.020 | 15 | 15 |
| 5 | 327 | 1 minute and 59.04 seconds | Continuous | 2.010 | 60 | 60 |
| 6 | 329 | 1 minute and 59.56 seconds | Continuous | 2.025 | 60 | 60 |
| 7 | 331 | 1 minute and 59.92 seconds | Continuous | 2.010 | 61 | 61 |
| 8 | 333 | 1 minute and 58.67 seconds | Continuous | 2.015 | 60 | 60 |
| 9 | 336 | 1 minute and 58.21 seconds | Continuous | 2.025 | 59 | 59 |
| 10 | 338 | 1 minute and 59.25 seconds | Continuous | 2.010 | 60 | 60 |
| 11 | 340 | 1 minute and 59.34 seconds | Continuous | 2.010 | 60 | 60 |
| 12 | 342 | 1 minute and 59.26 seconds | Continuous | 2.010 | 60 | 60 |
| 13 | 344 | 1 minute and 59.34 seconds | Continuous | 2.010 | 60 | 60 |
| 14 | 348 | 1 minute and 59.26 seconds | Continuous | 2.010 | 60 | 60 |
| 15 | 350 | 1 minute and 59.34 seconds | Continuous | 2.015 | 60 | 60 |
| 16 | 352 | 1 minute and 59.56 seconds | Continuous | 2.015 | 60 | 60 |
| 17 | 354 | 1 minute and 59.34 seconds | Continuous | 2.015 | 60 | 60 |
| 17 | --- | 27 minutes and 12 seconds | --- | --- | 840 | 840 |

Table 2-24: TC used during the VIHI Calib Test.

The data reported in Table 2-24 are in line with [RD.1].



2.5.4. Data Produced

2.5.4.1. Data Volume

| | #Packets | DV |
|--------------------|----------|------------|
| HK | 2120 | 1.01 Mib |
| VIHI low priority | 26760 | 812.46 Mib |
| VIHI high priority | 0 | 0.00 Mib |

Table 2-25: DV produced during the VIHI Calib Test.

2.5.4.2. Output Files

| Bundle Miscellaneous | | | |
|----------------------|-----|------|--------|
| File | CSV | | |
| | | # | 2 |
| | | Size | 1.5 MB |

| Bundle Raw VIHI | | | |
|-----------------|-----|------|----------|
| File | CSV | | |
| | | # | 840 |
| | | Size | 1.2 MB |
| DAT | | | |
| | | # | 840 |
| | | Size | 107.4 MB |

Table 2-26: Data produced during the VIHI Calib Test.

2.5.5. ME Events

None.

2.5.6. PE Events

VIHI PE Negative events: 1

- [2019-06-06T08:08:56.021019Z] TC time-out (32)

2.5.7. Lost Packets

| Type of Packets | # | Note |
|--------------------------|-------|--------------------|
| Telecommand Verification | 124 | [Lost Packet(s) 0] |
| HK Report | 2120 | [Lost Packet(s) 0] |
| Event/Anomaly Report | 29 | [Lost Packet(s) 0] |
| VIHI low Priority | 26760 | [Lost Packet(s) 0] |
| VIHI high Priority | 0 | [Lost Packet(s) 0] |

Table 2-27: Packets and lost packet report for the VIHI Calib Test.



2.5.8. Telecommands check

| | |
|----------|----|
| Accepted | 62 |
| Executed | 62 |

Table 2-28: Comparison between data commanded and produced during the VIHI Calib Test.

2.5.9. Discussion

The details are reported in Table 2-29 with information from section 2.5.3 and 2.5.4.

| | Commanded | From TM |
|------------------|-----------|---------|
| Images | 840 | 840 |
| Science Sessions | 17 | 17 |

Table 2-29: Comparison between data commanded and produced during the VIHI Calib Test.

Although the number of sessions and images are correct, there is a TC timeout message by the PE in the HK



2.6. VIHI Detector Bias Test

2.6.1. Test Scope

The scope of this test is to detect the presence of detector bias.

2.6.2. Test Execution

Time Frame: 2019-06-06T08:09:35.00Z ÷ 2019-06-06T08:43:00.00Z

In the table below the initial status of the instrument is reported:

| INSTRUMENT INITIAL STATUS | | | |
|---------------------------|------|-----|------|
| ME | HRIC | STC | VIHI |
| ON | OFF | OFF | ON |

Table 2-30: Instrument status before the VIHI Detector Bias Test.

2.6.3. Science

Table 2-31 reports the number of of the performed science sessions with an indication of their duration, and the number of images and frames expected for each TCs commanded during test.

| ID | SSC | Duration | Mode | Repetition Time [s] | Expected Acquisition | Expected Frame |
|----|-----|----------------------------|------------|---------------------|----------------------|----------------|
| 1 | 366 | 15 seconds | Continuous | 1.020 | 15 | 15 |
| 2 | 367 | 14.28 seconds | Continuous | 1.020 | 15 | 15 |
| 3 | 368 | 13.98 seconds | Continuous | 1.015 | 15 | 15 |
| 4 | 369 | 14.22 seconds | Continuous | 1.020 | 15 | 15 |
| 5 | 372 | 1 minute and 59.04 seconds | Continuous | 2.010 | 60 | 60 |
| 6 | 374 | 1 minute and 59.56 seconds | Continuous | 2.025 | 60 | 60 |
| 7 | 376 | 1 minute and 59.92 seconds | Continuous | 2.010 | 61 | 61 |
| 8 | 378 | 1 minute and 58.67 seconds | Continuous | 2.015 | 60 | 60 |
| 9 | 381 | 1 minute and 58.21 seconds | Continuous | 2.025 | 59 | 59 |
| 10 | 383 | 1 minute and 59.25 seconds | Continuous | 2.010 | 60 | 60 |
| 11 | 385 | 1 minute and 59.34 seconds | Continuous | 2.010 | 60 | 60 |
| 12 | 387 | 1 minute and 59.26 seconds | Continuous | 2.010 | 60 | 60 |
| 13 | 389 | 1 minute and 59.34 seconds | Continuous | 2.010 | 60 | 60 |
| 14 | 393 | 1 minute and 59.26 seconds | Continuous | 2.010 | 60 | 60 |
| 15 | 395 | 1 minute and 59.34 seconds | Continuous | 2.015 | 60 | 60 |
| 16 | 397 | 1 minute and 59.56 seconds | Continuous | 2.015 | 60 | 60 |
| 17 | 399 | 1 minute and 59.34 seconds | Continuous | 2.015 | 60 | 60 |
| 17 | --- | 27 minutes and 12 seconds | --- | --- | 840 | 840 |

Table 2-31: TC used during the VIHI Detector Bias Test.

The data reported in Table 2-31 are in line with [RD.1].



2.6.4. Data Produced

2.6.4.1. Data Volume

| | #Packets | DV |
|--------------------|----------|------------|
| HK | 2037 | 0.997 Mib |
| VIHI low priority | 26760 | 812.46 Mib |
| VIHI high priority | 0 | 0.00 Mib |

Table 2-32: DV produced during the VIHI Detector Bias Test.

2.6.4.2. Output Files

| Bundle Miscellaneous | | | |
|----------------------|-----|------|--------|
| File | CSV | | |
| | | # | 2 |
| | | Size | 1.4 MB |

| Bundle Raw VIHI | | | |
|-----------------|-----|------|----------|
| File | CSV | | |
| | | # | 840 |
| | | Size | 1.2 MB |
| DAT | | | |
| | | # | 840 |
| | | Size | 107.4 MB |

Table 2-33: Data produced during the VIHI Detector Bias Test.

2.6.5. ME Events

None.

2.6.6. PE Events

None.

2.6.7. Lost Packets

| Type of Packets | # | Note |
|--------------------------|-------|--------------------|
| Telecommand Verification | 124 | [Lost Packet(s) 0] |
| HK Report | 2120 | [Lost Packet(s) 0] |
| Event/Anomaly Report | 29 | [Lost Packet(s) 0] |
| HRIC low Priority | 0 | [Lost Packet(s) 0] |
| STC low Priority | 0 | [Lost Packet(s) 0] |
| VIHI low Priority | 26760 | [Lost Packet(s) 0] |
| HRIC high Priority | 0 | [Lost Packet(s) 0] |
| STC high Priority | 0 | [Lost Packet(s) 0] |
| VIHI high Priority | 0 | [Lost Packet(s) 0] |

Table 2-34: Packets and lost packet report for the VIHI Detector Bias Test.



2.6.8. Telecommands check

| Telecommand Status | # |
|--------------------|----|
| Accepted | 62 |
| Executed | 62 |
| Refuted | 0 |
| Failed | 0 |

Table 2-35: Comparison between data commanded and produced during the VIHI Detector Bias Test.

2.6.9. Discussion

The produced output is in line with what expected.

The details are reported in Table 2-36 with information from section 2.6.3 and 2.6.4.

| | Commanded | From TM |
|------------------|-----------|---------|
| Images | 824 | 840 |
| Science Sessions | 17 | 17 |

Table 2-36: Comparison between data commanded and produced during the VIHI Detector Bias Test.

2.7.Orbit Test

2.7.1. Test Scope

The aim of this test is the repetition of the test performed during the NECP and obtain the complete dataset.

2.7.2. Test Execution

Time Frame: 2019-06-06T08:49:00.00Z ÷ 2019-06-06T10:20:00.00Z

In the table below the initial status of the instrument is reported:

| INSTRUMENT INITIAL STATUS | | | |
|---------------------------|------|-----|------|
| ME | HRIC | STC | VIHI |
| ON | ON | ON | ON |

Table 2-37: Instrument status before the Orbit Test.

2.7.3. Science

Table 2-38, Table 2-39, and Table 2-40 report, for each channel, the number of the performed science sessions with an indication of their duration, and the number of images and frames expected for each TCs commanded during test.

| ID | SSC | Duration | Mode | Repetition Time [s] | Expected Acquisition | Expected Frame |
|----|-----|-------------------------|---------|---------------------|----------------------|----------------|
| 1 | 421 | 4 minutes | Limited | 2.0 | 120 | 120 |
| 2 | 427 | 2 minutes | Limited | 1.5 | 80 | 80 |
| 3 | 436 | 2 seconds | Limited | 2.5 | 1 | 1 |
| 3 | --- | 6 minutes and 2 seconds | --- | --- | 201 | 201 |

Table 2-38: TC used during the Orbit Test by HRIC.

| ID | SSC | Duration | Mode | Repetition Time [s] | Expected Acquisition | Expected Frame |
|----|-----|------------------------------|------------|---------------------|----------------------|----------------|
| 1 | 416 | 9 minutes | Continuous | 12.300 | 45 | 132 |
| 2 | 419 | 4 minutes and 48.93 seconds | Continuous | 11.575 | 26 | 78 |
| 3 | 422 | 2 minutes and 48.89 seconds | Continuous | 10.320 | 18 | 54 |
| 4 | 423 | 4 minutes and 56.18 seconds | Continuous | 8.700 | 35 | 102 |
| 5 | 425 | 12 minutes and 59.65 seconds | Continuous | 7.665 | 103 | 306 |
| 6 | 428 | 3 minutes and 54.48 seconds | Continuous | 7.970 | 30 | 90 |
| 7 | 429 | 2 minutes and 56.65 seconds | Continuous | 8.695 | 21 | 63 |
| 8 | 431 | 3 minutes and 57.22 seconds | Continuous | 9.635 | 25 | 75 |
| 9 | 432 | 2 minutes and 54.03 seconds | Continuous | 11.24 | 16 | 48 |
| 9 | --- | 49 minutes and 35 seconds | --- | --- | 319 | 948 |

Table 2-39: TC used during the Orbit Test by STC.

| ID | SSC | Duration | Mode | Repetition Time [s] | Expected Acquisition | Expected Frame |
|----|-----|-----------------------------|------------|---------------------|----------------------|-------------------|
| 1 | 417 | 4 minutes | Continuous | 0.13 | 1847 | 1847 |
| 2 | 418 | 7 minutes and 59.98 seconds | Continuous | 0.1 | 4800 | 2400 ¹ |
| 3 | 420 | 4 minutes and 59.92 seconds | Continuous | 0.08 | 3748 | 1874 ¹ |
| 4 | 424 | 7 minutes | Continuous | 0.06 | 7000 | 1750 ² |
| 5 | 426 | 15 minutes | Continuous | 0.04 | 22496 | 5624 ² |
| 6 | 430 | 11 minutes | Continuous | 0.05 | 13200 | 6600 ² |
| 7 | 434 | 3 minutes | Continuous | 0.07 | 2571 | 2571 |
| 8 | 435 | 5 minutes and 59.97 seconds | Continuous | 0.08 | 4500 | 4500 |
| 8 | --- | 59 minutes | --- | --- | 60162 | 27166 |

Table 2-40: TC used during the Orbit Test by VIHI.

The data reported in Table 2-38 and Table 2-40 are in line with [RD.1]. The data reported in Table 2-39 show some discrepancies.

2.7.4. Data Produced

2.7.4.1. Data Volume

| | #Packets | DV |
|--------------------|----------|------------|
| HK | 1035 | 423.13 kib |
| HRIC low priority | 16584 | 513.95 Mib |
| STC low priority | 7006 | 216.39 Mib |
| VIHI low priority | 18248 | 295.89 Mib |
| HRIC high priority | 0 | 0.00 |
| STC high priority | 0 | 0.00 |
| VIHI high priority | 0 | 0.00 |

Table 2-41: DV produced during the Orbit Test.

2.7.4.2. Output Files

| Bundle Miscellaneous | | | |
|----------------------|------|----------|--|
| File | CSV | | |
| | # | 4 | |
| | Size | 566.4 kB | |

| Bundle Raw HRIC | | | |
|-----------------|------|----------|--|
| File | CSV | | |
| | # | 201 | |
| | Size | 182.5 kB | |
| DAT | # | 201 | |
| | Size | 527.1 MB | |

| Bundle Raw STC | | | |
|----------------|------|----------|--|
| File | CSV | | |
| | # | 948 | |
| | Size | 872.2 kB | |
| DAT | | | |

¹ The acquisition is performed with a frame binning equal to 1, binning on 2 frames.

² The acquisition is performed with a frame binning equal to 2, binning on 4 frames.

| | | |
|--|------|----------|
| | # | 948 |
| | Size | 225.3 MB |

| Bundle Raw | | VIHI | |
|------------|-----|------|----------|
| File | CSV | | |
| | | # | 18248 |
| | | Size | 26.2 MB |
| DAT | | | |
| | | # | 18248 |
| | | Size | 325.2 MB |

Table 2-42: Data produced during the Orbit Test.

2.7.5. ME Events

None.

2.7.6. PE Events

None.

2.7.7. Lost Packets

| Type of Packets | # | Note |
|--------------------------|-------|--------------------|
| Telecommand Verification | 70 | [Lost Packet(s) 0] |
| HK Report | 1035 | [Lost Packet(s) 0] |
| Event/Anomaly Report | 15 | [Lost Packet(s) 0] |
| HRIC low Priority | 16584 | [Lost Packet(s) 0] |
| STC low Priority | 7006 | [Lost Packet(s) 0] |
| VIHI low Priority | 18248 | [Lost Packet(s) 0] |
| HRIC high Priority | 0 | [Lost Packet(s) 0] |
| STC high Priority | 0 | [Lost Packet(s) 0] |
| VIHI high Priority | 0 | [Lost Packet(s) 0] |

Table 2-43: Packets and lost packet report for the Orbit Test.

2.7.8. Telecommands check

| Telecommand Status | # |
|--------------------|----|
| Accepted | 35 |
| Executed | 35 |
| Refuted | 0 |
| Failed | 0 |

Table 2-44: Comparison between data commanded and produced during the Orbit Test.

2.7.9. Discussion

For three TCs the ME returns Executed ACKs but the PE does not perform the corresponding commanded acquisitions.

In Table 2-45 are reported the science sessions commanded and acquired:



| Session # | SSD | Execution Time | First image time |
|-----------|-----|-----------------------------|----------------------------|
| 1 | 417 | 2019-06-06T09:09:28.000000Z | MISSING |
| 2 | 418 | 2019-06-06T09:13:28.000000Z | 2019-06-06T09:13:26.963064 |
| 3 | 420 | 2019-06-06T09:21:28.000000Z | 2019-06-06T09:21:26.963644 |
| 4 | 424 | 2019-06-06T09:26:28.000000Z | 2019-06-06T09:26:26.924078 |
| 5 | 426 | 2019-06-06T09:33:28.000000Z | 2019-06-06T09:33:26.884710 |
| 6 | 430 | 2019-06-06T09:48:28.000000Z | 2019-06-06T09:48:26.656545 |
| 7 | 434 | 2019-06-06T09:59:28.000000Z | MISSING |
| 8 | 435 | 2019-06-06T10:02:28.000000Z | MISSING |

Table 2-45: Details of the VIHI Science Session

The details of all the acquisition are reported in Table 2-46 with information from section 2.7.3 and 2.7.4.

| HRIC | Commanded | From TM |
|------------------|-----------|---------|
| Images | 201 | 201 |
| Science Sessions | 3 | 3 |
| STC | Commanded | From TM |
| Images | 948 | 948 |
| Science Sessions | 9 | 9 |
| VIHI | Commanded | From TM |
| Images | 60166 | 18248 |
| Science Sessions | 8 | 5 |

Table 2-46: Comparison between data commanded and produced during the Orbit Test.



3. Summary

| ID | Test description | Test Last | Science Sessions | Data from TLM | | | | | | | # Images | | | Failure | | | | | | | | | |
|----|-------------------------|---------------------------|------------------|-----------------|------------------|-----------------|-----------------|----------|----------|----------|------------|-------------|--------------|----------|----------|----------|-----------|----------------|----------|----------|----------------|----------|---|
| | | | | HK | HRIC LP | STC LP | VIHI LP | HRIC HP | STC HP | VIHI HP | HRIC | STC | VIHI | HRIC | | | STC | | | VIHI | | | |
| 01 | STC All FPA Test | 5 minutes | 20 | 4.1 kib | 0 | 270.7 Mib | 0 | 0 | 0 | 0 | 0 | 60 | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 0 |
| 02 | STC Mitigate Reset Test | 3 minutes and 59 seconds | 27 | 7.72 kib | 0 | 134.48 Mib | 0 | 0 | 0 | 0 | 0 | 773 | 0 | 0 | 0 | 0 | 0 | 3 ³ | 0 | 0 | 0 | 0 | 0 |
| 03 | STC Hot Pixel Test | 9 minutes | 21 | 14.36 kib | 0 | 3.00 Gib | 0 | 0 | 0 | 0 | 0 | 360 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 04 | VIHI Calib Test | 27 minutes and 12 seconds | 17 | 1.01 Mib | 0 | 0 | 812.46 Mib | 0 | 0 | 0 | 0 | 0 | 840 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 05 | VIHI Deector Bias Test | 27 minutes and 12 seconds | 17 | 0.997 Mib | 0 | 0 | 812.46 Mib | 0 | 0 | 0 | 0 | 0 | 840 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 06 | Orbit test | 1 hour and 31 minutes | 20 | 423.13kib | 513.95 Mib | 216.39 Mib | 295.89 Mib | 0 | 0 | 0 | 201 | 948 | 18248 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 ³ | 0 | 0 |
| | | | 122 | 2.46 Mib | 538.92Mib | 3.60 Gib | 1.86 Gib | 0 | 0 | 0 | 201 | 2141 | 19928 | 0 | 0 | 0 | 11 | 0 | 0 | 3 | 0 | 1 | |

Table 3-1: dNECP Summary of all the tests

| Data Volume | |
|-------------|-----------------|
| HRIC | 538.92 Mib |
| STC | 3.60 Gib |
| VIHI | 1.86 Gib |
| | 5.99 Gib |

Table 3-2: Data volume produced in the dNECP

³ No failure ACKs were produced.