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VIR-IAS-TN-32
VIRTIS ROSETTA EGSE SW
Version 7.5
Functional Validation

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Sommario

1. Introduction

1.1. Scope

This document describes the validation of the maintenance activity carried out by Techno System Developments on the VIRTIS EGSE Software CIG Z571056CC1.

1.2. Applicable documents

N.A:

1.3. Reference documents

[RD.1]   EAICD Document for VIRTIS Rosetta, RO_VIRTIS_EAICD, Version 4.8;
[RD.2]   VIRTIS EGSE SW Maintenance PROPOSAL, VIR-TSD-RP-115, issue 1;
[RD.3]   Primo report sulle attività di manutenzione, VIR-TSD-RP-116, issue 1;
[RD.4]   Secondo report sulle attività di manutenzione, VIR-TSD-RP-117, issue 1;
[RD.5]   Terzo report sulle attività di manutenzione, VIR-TDS-RP-118, issue 1.

1.4. Acronyms

TSD	Techno System Developments
EGSE	Electrical Ground Support Equipment
MTP	Medium Term Plan
PDS	Planetary Data System
PSA	Planetary Science Archive
STP	Short Term Plan
SW	SoftWare
VIRTIS	VIsible InfraRed Thermal Imaging Spectrometer
VM	Virtual Machine

2. TSD Activity

2.1. Known bugs

The purpose of this maintenance activity is to solve bugs that involve two instrument parameters:

- INST_CMPRS_RATIO: provides the ratio of the size, in bytes, of the original uncompressed data file to its compressed form. The admitted values are: 16, N/A, 2, 1.5, 1 (see [RD.1]).
- INSTRUMENT_MODE_ID: is a code indicating the observation or the calibration mode. The admitted values are reported in Table 1 (see [RD.1])

Code	Instrument Mode	Code	Instrument Mode
1	M_Off	1	H_Off
2	M_Cool_Down	2	H_Cool_Down
3	M_Idle	3	H_Idle
4	M_Annealing	4	H_Annealing
5	M_PEM_On	5	H_PEM_On
6	M_Test	6	H_Test
7	M_Calibration	7	H_Calibration
8	M_Science_High_Spectral_1	8	H_Nominal_Simulation
9	M_Science_High_Spectral_2	9	H_Science_Maximum_Data_Rate
10	M_Science_High_Spectral_3	10	H_Science_Nominal_Data_Rate
11	M_Science_High_Spatial_1	11	H_Science_Minimum_Data_Rate
12	M_Science_High_Spatial_2	12	(deleted)
13	M_Science_High_Spatial_3	13	H_Science_Backup
14	M_Science_Nominal_1	14	H_User_Defined
15	M_Science_Nominal_2	15	(deleted)
16	M_Science_Nominal_3	16	(deleted)
17	M_Science_Nominal_Compressed	17	(deleted)
18	M_Science_Reduced_Slit	18	H_Spectral_Calibration_Simulation
19	M_User_Defined	19	H_Degraded
20	M_Degraded	63	H_ME_Test
63	M_ME_Test		

Table 1: Values admitted for INSTRUMENT_MODE_ID.

During the telemetry decoding we have:

- INST_CMPRS_RATIO always 1. In The previous versions of the software this parameter was correctly addressed.
- All sessions are acquired with INTRUMENT_MODE_ID M_User_Defined (ID = 19) due to a problem of the detector. The software needs to detect the internal calibration session and set the INSTRUMENT_MODE_ID to M_Calibration (ID = 7).

2.2. Implementation

In order to correct the bugs reported in the session 2.1, TSD delivered a new version of three software modules for the EGSE SW:

- CSWS Ver. 7.3
- PDS Converter Ver 7.5
- PDS Viewer Ver. 7.2

The CSWS Ver. 7.2 was not officially delivered.

3. Validation activity

3.1. Validation environment

The software validation environment is the same of the operative one. We create a clone of the VM used for the nominal pipeline, in order to preserve the original configuration.
In this test machine we installed the new software modules.

3.2. Pipeline schema

The data production pipeline is structured as the following schema:
- VSOC Converter
- CSWS
- PDS Session Converter
  - PDS Converter

The PDS Session converter is a batch file that run PDS Converter for each file in the session.

3.3. Previous software version

The previous version of the pipeline uses the following modules version:
- VSOC Converter   ver. 7.1
- CSWS   ver. 7.1
- PDS Session Converter ver. 7.1
- PDS Converter   ver. 7.4

3.4. Test Dataset

For all the test we used VIRTIS data coming from the Pre-Landing phase, MTP 9, STP 26 in the time range from October 30, 2014 10:00:00 to November 5, 2014 09:59:59. The data used for the test are available on the PSA Data Archive (https://archives.esac.esa.int/psa/)

3.5. Test Phases

3.5.1. Installation

The first step is the Validation of the installers.
We run the installation programs. The results of the test are:
- CSWS correct installation.
- PDS Converter correct installation.
- PDS Viewer correct installation.

3.5.2. Number of products.

The following table shows the number of products produced by the old and new versions of the pipeline for the three VIRTIS channels (VIRTIS-H, VIRTIS M-IR, VIRTIS M-VIS). For the channel H the products are grouped in the three VIRTIS-H transfer mode (see [RD.1]):

- **H**: H image transfer mode (backup observation mode);
- **S**: H single spectrum transfer mode (including dark current files in nominal mode);
- **T**: H "64-spectra frame" transfer mode (nominal mode).

	H			M-IR	M-Vis
	H	**S**	**T**		
Old	0	15	15	36	36
New	0	15	15	36	36

The number of products coming from the two pipelines is the same.

3.5.3. Instrument Compression Ratio Verification

We report the comparison between the file produced using the old (left) and the new (right) pipeline. The analyzed data cube is I1_00373395632.QUB (PIEAVG59.QUB), from the Pre-Landing phase, MTP009, STP027. The data cube is identified using two names, the first is the official one, reporting the channel, the spacecraft clock reset counter and the SCET, the second is an internal format, reported also in the PDS label, with the UTC date and time in hexadecimal code.

We compare the PDS labels of the data cube produced by the two versions of the EGSE.
The two files have different size, as is shown into following table, but this difference is due to the different number of records in the label.

Old (7.3)	New (7.5)

<pre>/* File format and length */
PRODUCT_ID   = "PIEAVG59.QUB"
ORIGINAL_PRODUCT_ID = "PIEAVG59.QUB"
RECORD_TYPE   = FIXED_LENGTH
RECORD_BYTES   = 512
FILE_RECORDS   = 36876
LABEL_RECORDS   = 11</pre>
	<pre>/* File format and length */
	PRODUCT_ID = "PIEAVG59.QUB"
	ORIGINAL_PRODUCT_ID = "PIEAVG59.QUB"
	RECORD_TYPE = FIXED_LENGTH
	RECORD_BYTES = 512
	FILE_RECORDS = 36875
	LABEL_RECORDS = 10</pre>

As shown in the following table the software version is reported correctly.

Old (7.3)	New (7.5)

<pre>PRODUCT_CREATION_TIME   =
          2016-07-08T09:34:21.00
TELEMETRY_SOURCE_ID = "VIRTIS_EGSE_3"
SOFTWARE_VERSION_ID =
{"EGSE_SOFT 7.3", "PDS_CONVERTER_7.3"</pre>
	<pre>PRODUCT_CREATION_TIME =
	          2019-02-04T13:09:45.000
	TELEMETRY_SOURCE_ID = "VIRTIS_EGSE_3"
	SOFTWARE_VERSION_ID =
	{"EGSE_SOFT 7.5", "PDS_CONVERTER_7.5"}</pre>

In the following table we check the compress ratio.

Old (7.3)	New (7.5)
`INST_CMPRS_RATE   = "N/A"` `INST_CMPRS_RATIO  = 1.000`	`INST_CMPRS_RATE   = "N/A"` `INST_CMPRS_RATIO  = 2.256`

The compression rate is not 1. As check we compare the results from an old EGSE software version (7.1) where the INST_CMPRS_RATIO was still correct.

Older (7.1)	New (7.5)

`PRODUCT_CREATION_TIME  =`
`          2014-11-02T08:23:51.00`
`SOFTWARE_VERSION_ID  =`
`{"EGSE_SOFT_7.1", "PDS_CONVERTER_7.1}`
`INST_CMPRS_RATE  = "N/A"`
`INST_CMPRS_RATIO  = 2.259`
	`PRODUCT_CREATION_TIME =`
	`          2019-02-04T13:09:45.000`
	`SOFTWARE_VERSION_ID  =`
	`{"EGSE_SOFT_7.5", "PDS_CONVERTER_7.5"}`
	`INST_CMPRS_RATE   = "N/A"`
	`INST_CMPRS_RATIO  = 2.256`

Please, note that there is a little difference between the two ratio.

As last check we compare the data size:

Old (7.3)	New (7.5)
`CORE_ITEMS  = (432,256,85)`	`CORE_ITEMS  = (432,256,85)`

But if we compare this information with the file produced in 2014 we found:

Older (7.1)	New (7.5)
`CORE_ITEMS  = (432,256,86)`	`CORE_ITEMS  = (432,256,85)`

The version 7.3 and 7.5 produce files with values of CORE_ITEMS different from version 7.1. The difference in the INST_CMPRS_RATIO between the versions 7.1 and 7.5 is probably due to this difference.

3.5.4. Instrument Mode ID verification

For the *Instrument Mode ID* verification, we use the file I1_00373395632.QUB, that is a common science file.
For this file the INSTRUMENT_MODE_ID is correctly set to 19 (*User Defined*).

In the dataset of the data cube used (I1_00373395632.QUB), MTP 9, STP 26, an internal calibration data cube is not present. For this reason, we processed the MTP 10, STP 30, in the time range from November 21, 2014 23:25:00 to November 25, 2014 23:24:59.
Using the new release we checked the two internal calibration files for this STP:
- For the file PVEBPJ58.QUB (V1_375566424.QUB) the *INSTRUMENT_MODE_ID* is set to 7 (*Internal Calibration*).
- For the file PIEBPJ58.QUB (I1_375566424.QUB) the *INSTRUMENT_MODE_ID* is set to 7 (*Internal Calibration*).

3.5.5. Lost Line

As reported in the section 3.5.3, there is a difference in the number of lines between the version 7.1 and the version 7.3 and 7.5.

Performing a comparison for the file size between the data produced by the 7.1 and by the 7.5 version we obtain:

Older (7.1)	New (7.5)

`/* File format and length */`
`RECORD_BYTES   = 512`
`FILE_RECORDS   = 37310`
`LABEL_RECORDS  = 11`
`CORE_ITEMS     = (432,256,86)`
	`/* File format and length  */`
	`RECORD_BYTES   = 512`
	`FILE_RECORDS   = 36875`
	`LABEL_RECORDS  = 10`
	`CORE_ITEMS     = (432,256,85)`

The difference is 435 records.
We performed a check for all the data VIS and IR in a section (PEAV) of this dataset.

Older (7.1)	New (7.5)
`PIEAV737.QUB:  CORE_ITEMS  = (432, 256, 92)`	`PIEAV737.QUB:  CORE_ITEMS  = (432, 256, 92)`
`PIEAV754.QUB:  CORE_ITEMS  = (432, 256, 86)`	`PIEAV754.QUB:  CORE_ITEMS  = (432, 256, 86)`
`PIEAV809.QUB:  CORE_ITEMS  = (432, 256, 86)`	`PIEAV809.QUB:  CORE_ITEMS  = (432, 256, 86)`
`PIEAV824.QUB:  CORE_ITEMS  = (432, 256, 86)`	**`PIEAV824.QUB:  CORE_ITEMS  = (432, 256, 85)`**
`PIEAVG12.QUB:  CORE_ITEMS  = (432, 256, 92)`	`PIEAVG12.QUB:  CORE_ITEMS  = (432, 256, 92)`
`PIEAVG29.QUB:  CORE_ITEMS  = (432, 256, 86)`	`PIEAVG29.QUB:  CORE_ITEMS  = (432, 256, 86)`
`PIEAVG44.QUB:  CORE_ITEMS  = (432, 256, 86)`	`PIEAVG44.QUB:  CORE_ITEMS  = (432, 256, 86)`
`PIEAVG59.QUB:  CORE_ITEMS  = (432, 256, 86)`	**`PIEAVG59.QUB:  CORE_ITEMS  = (432, 256, 85)`**
`PIEAVI37.QUB:  CORE_ITEMS  = (432, 256, 92)`	`PIEAVI37.QUB:  CORE_ITEMS  = (432, 256, 92)`
`PVEAV737.QUB:  CORE_ITEMS  = (432, 256, 92)`	`PVEAV737.QUB:  CORE_ITEMS  = (432, 256, 92)`
`PVEAV754.QUB:  CORE_ITEMS  = (432, 256, 86)`	`PVEAV754.QUB:  CORE_ITEMS  = (432, 256, 86)`
`PVEAV809.QUB:  CORE_ITEMS  = (432, 256, 86)`	`PVEAV809.QUB:  CORE_ITEMS  = (432, 256, 86)`
`PVEAV824.QUB:  CORE_ITEMS  = (432, 256, 86)`	**`PVEAV824.QUB:  CORE_ITEMS  = (432, 256, 85)`**
`PVEAVG12.QUB:  CORE_ITEMS  = (432, 256, 92)`	`PVEAVG12.QUB:  CORE_ITEMS  = (432, 256, 92)`
`PVEAVG29.QUB:  CORE_ITEMS  = (432, 256, 86)`	`PVEAVG29.QUB:  CORE_ITEMS  = (432, 256, 86)`
`PVEAVG44.QUB:  CORE_ITEMS  = (432, 256, 86)`	`PVEAVG44.QUB:  CORE_ITEMS  = (432, 256, 86)`
`PVEAVG59.QUB:  CORE_ITEMS  = (432, 256, 86)`	**`PVEAVG59.QUB:  CORE_ITEMS  = (432, 256, 85)`**
`PVEAVI37.QUB:  CORE_ITEMS  = (432, 256, 92)`	`PVEAVI37.QUB:  CORE_ITEMS  = (432, 256, 92)`

In bold are reported the discrepancies.

4. Conclusions

The updates reported in the [RD.5] fixed the known bugs:

- The instrument Compression Rate, defined wrongly to 1 in the version 7.1, was correctly update in the 7.3 version to a different value respect the older version, probably due to a different number of lines.
- In the new EGSE version Instrument Mode ID for the calibration cubes results correctly 7 and not 19 (this value is reserved to user defined data)

There is the open issue concerning lost line. As reported in section 3.5.5 not all the files are affected by this problem. It appears necessary to perform an analysis of the source code in order to identify the problem.