



DAWN

VIR Ground Segment

EGSE - PDS *Software Requirements Specification*

PREPARED by : R. Noschese

CHECKED by : Maria Teresa Capria

APPROVED by : A. Coradini



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DOCUMENT CHANGE LOG

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1.1 SCOPE

This document provides the basic requirements for the design and development of the VIR PDS.

1.1.1 VIR EDR DATA FILE STRUCTURE

The VIR EDR data sets use the 3-D Core structure to store the instrument data and a side plane that stores instrument housekeeping data. This implementation does not include backplanes (geometry data) or bottom planes. Spectra are stored intact for single sample (most rapidly varying component in the 3-D structure). All samples are collected at a single time, and are thus the next most rapidly varying component of the data core. Finally, QUBEs are constructed by assembling spatial lines that are either acquired in a push-broom mode or by using the VIR scan mirror that moves the slit across the target body. The line direction is the most slowly varying component in the data core.

The data files include both an attached PDS label, followed by a HISTORY object, and the data QUBE itself. Both the Label and the HISTORY are padded to maintain alignment with the 512 byte record boundaries. These portions of the file are ASCII text and can be viewed using normal text viewers.

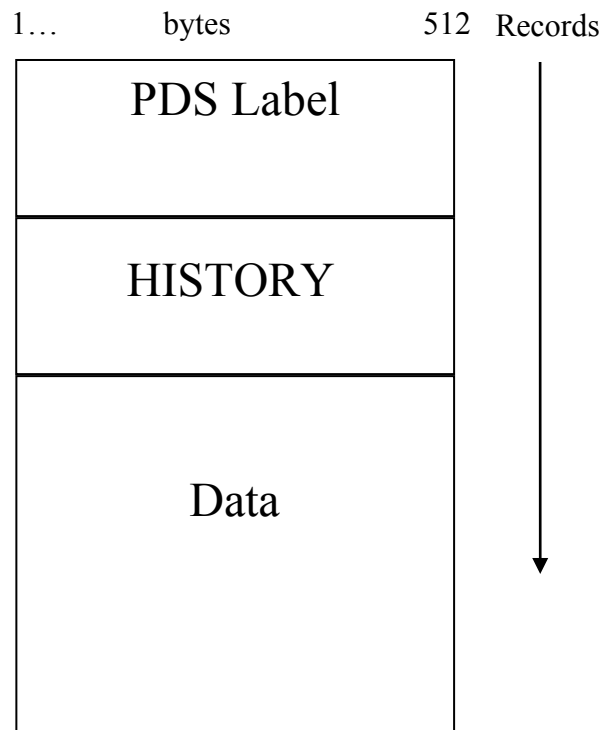

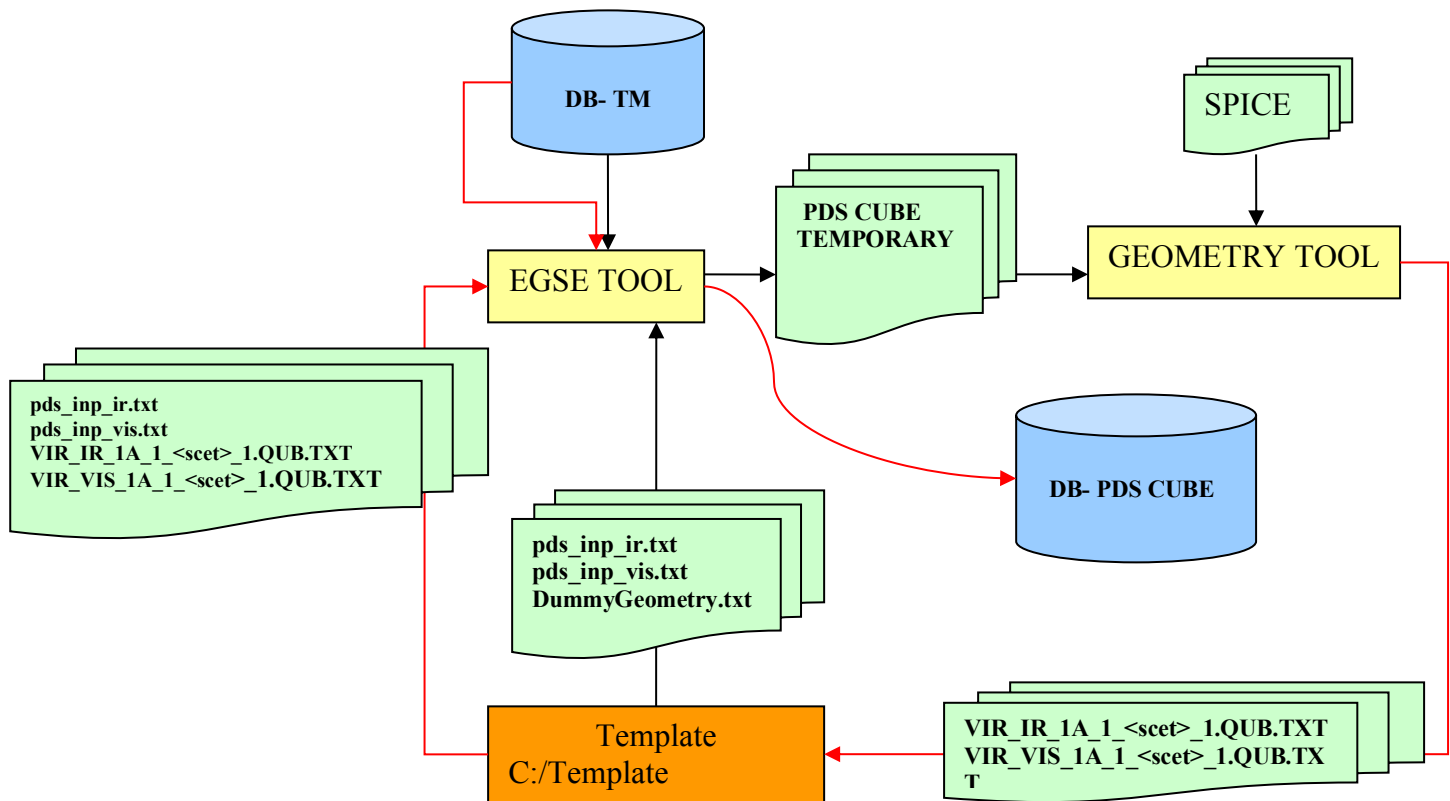


Figure 1: Internal Structure of VIR Data Files

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2 PDS VIR


The VIR Ground Segment EGSE Tool implements data conversion and management algorithms and user interfaces in such a way to permit a user to generate, from a set of raw instrument and S/C data, the PDS-formatted EDR data product.



Line black:

The EGSE TOOL inputs are the telemetries and the files: pds_inp_ir.txt, pds_inp_vis.txt and DummyGeometry.txt . The tool reads some keywords in the files pds_inp_ir.txt and pds_inp_vis.txt.(see in the appendix A) to generate the PDS label; the keywords are:

- LABEL_REVISION_NOTE
- DATA_SET_NAME
- DATA_SET_ID
- RESET
- TARGET_NAME


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- TARGET_TYPE
- MISSION_PHASE_NAME
- Band and wavelength (nm)

When the geometry files are absent, the geometry keywords are read in the file “**DummyGeometry.txt**” where the keywords are valorised with “**N/A**”

Line red:


When the geometry files are available the EGSE tool reads as input the files pds_inp_ir.txt, pds_inp_vis.txt and all files with geometry informations and generates the PDS compliant cubes.

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2.1 EDR DATA PRODUCT FORMAT DESCRIPTION

Table 2.1: VIR Data Label Content


| Keyword | Value Units | Value Description |
|------------------------------|-------------|--|
| PDS_VERSION_ID | | Value = "PDS3" This is the version number of the PDS standard document that is valid when a data product label is created. |
| LABEL_REVISION_NOTE | | Information on the actual version of the label |
| DATA_SET_NAME | | See Table 5 for a list of valid values |
| DATA_SET_ID | | See Table 5 for a list of valid values |
| PRODUCT_ID | | Actual name of the file containing the data; see section 5.6.1 |
| PRODUCT_TYPE | | Possible values: EDR or RDR |
| PRODUCER_FULL_NAME | | Value = "A. CORADINI" |
| PRODUCER_INSTITUTION_NAME | | Value = "ISTITUTO NAZIONALE DI ASTROFISICA" Identifies the organization responsible for developing the data products. |
| PRODUCT_CREATION_TIME | | Contains the date and time at which the PDS file was created in PDS time format. |
| PRODUCT_VERSION_ID | | The version number of the PDS product. |
| RECORD_TYPE | | Value = "FIXED_LENGTH" All VIR data files will be using a fixed-length record format. |
| RECORD_BYTES | | Value = 512 All VIR data files have a record length of 512 bytes. |
| FILE_RECORDS | | The number of records number in the data file, including the label. |
| LABEL_RECORDS | | The number of data file records used by the PDS label. Note that the label is padded at the end with ASCII spaces to be aligned with the record size.. |
| START_TIME | | START_TIME gives the corrected UTC spacecraft time of start and stop of observation Format: yyyy-mm-ddThh:mm:ss.sss |
| STOP_TIME | | STOP_TIME gives the corrected UTC spacecraft time of start and stop of observation; this keyword must always be present even if the stop time is unknown or unavailable. |
| SPACECRAFT_CLOCK_START_COUNT | | Start time represented in the native spacecraft clock counter format. Example: "1/250684401.857" |
| SPACECRAFT_CLOCK_STOP_COUNT | | Stop time represented in the native spacecraft clock counter format. |
| INSTRUMENT_HOST_NAME | | Value = "DAWN" |
| INSTRUMENT_HOST_ID | | Value = "DAWN" |
| MISSION_PHASE_NAME | | See DAWN_MISSION.CAT for list of valid values. |
| INSTRUMENT_NAME | | Value = "VISIBLE AND INFRARED SPECTROMETER" |
| INSTRUMENT_ID | | Value = "VIR" |
| INSTRUMENT_TYPE | | Value = "IMAGING SPECTROMETER" |

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| Keyword | Value Units | Value Description |
|-------------------------------|--------------------|---|
| RIGHT_ASCENSION | degree | Celestial geometry. |
| DECLINATION | degree | Celestial geometry. |
| TWIST_ANGLE | degree | Celestial geometry. |
| CELESTIAL_NORTH_CLOCK_ANGLE | degree | Celestial geometry. |
| QUATERNION | | Celestial geometry. Four values composition the quaternion; see kw QUATERNION_DESC |
| QUATERNION_DESC | | Celestial geometry. Value = " Above parameters are calculated at the center time of the observation which is 2008-04-06T07:09:05.166. The quaternion has the form: w, x, y, z (i.e. SPICE format)." |
| SPACECRAFT_SOLAR_DISTANCE | km | Solar geometry. |
| SC_SUN_POSITION_VECTOR | km | Solar geometry, two values. |
| SC_SUN_VELOCITY_VECTOR | Km/s | Solar geometry, two values. |
| SPICE_FILE_NAME | | Provides the name of the SPICE file that identifies kernels used in data processing and geometry parameter calculations. e.g. "DAWN_HAMO_KERNELS.TMK" |
| TARGET_TYPE | | Examples of values: "CALIBRATION", "PLANET", "ASTEROID", "STAR", "STAR CLUSTER" |
| TARGET_NAME | | Examples of values: "CALIBRATION", "MARS", "4 VESTA", "ALDEBARAN", "1 CERES", etc. |
| COORDINATE_SYSTEM_NAME | | Coordinate system |
| COORDINATE_SYSTEM_CENTER_NAME | | Coordinate system. |
| SUB_SPACECRAFT_LATITUDE | | Geometry in VESTA-fixed coordinates from SPICE |
| SUB_SPACECRAFT_LONGITUDE | | Geometry in VESTA-fixed coordinates from SPICE |
| SUB_SPACECRAFT_AZIMUTH | | Geometry in VESTA-fixed coordinates from SPICE |
| SPACECRAFT_ALTITUDE | km | This keyword provides the distance from the spacecraft to the nearest point on a reference surface of the target body measured normal to that surface. Expressed in km units, F14.3 format. |
| TARGET_CENTER_DISTANCE | | Geometry in VESTA-fixed coordinates from SPICE |
| ORBIT_NUMBER | | Geometry in VESTA-fixed coordinates from SPICE. Asteroid orbit number or "N/A" |
| SC_TARGET_POSITION_VECTOR | | Geometry in VESTA-fixed coordinates from SPICE |
| SC_TARGET_VELOCITY_VECTOR | | Geometry in VESTA-fixed coordinates from SPICE |
| LOCAL_HOUR_ANGLE | | Geometry in VESTA-fixed coordinates from SPICE |
| SUB_SOLAR_LATITUDE | | Geometry in VESTA-fixed coordinates from SPICE |
| SUB_SOLAR_LONGITUDE | | Geometry in VESTA-fixed coordinates from SPICE |

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| Keyword | Value Units | Value Description |
|------------------------|-------------|---|
| SUB_SOLAR_AZIMUTH | | Geometry in VESTA-fixed coordinates from SPICE |
| INCIDENCE_ANGLE | | Illumination |
| EMISSION_ANGLE | | Illumination |
| PHASE_ANGLE | | Illumination |
| SLANT_DISTANCE | | Image parameter |
| MAXIMUM_LATITUDE | deg | The MAXIMUM_LATITUDE specifies the northernmost latitude of the target, computed in the body-fixed, rotating coordinate system specified by the COORDINATE_SYSTEM_NAME keyword. For the determination of this values, the geometric values computed for the center of each element of the field of view (pixel) are considered. Each value is expressed in degrees in the [-90°, 90°] range, F9.5 format. |
| MINIMUM_LATITUDE | deg | The MINIMUM_LATITUDE specifies the southernmost latitude of the target, computed in the body-fixed, rotating coordinate system specified by the COORDINATE_SYSTEM_NAME keyword. For the determination of this values, the geometric values computed for the center of each element of the field of view (pixel) are considered. Each value is expressed in degrees in the [-90°, 90°] range, F9.5 format. |
| EASTERNMOST_LONGITUDE | deg | For Planetocentric coordinates and for Planetographic coordinates in which longitude increases toward the east, the easternmost (rightmost) longitude of a spatial area (e.g., a map, mosaic, bin, feature or region) is the maximum numerical value of longitude unless it crosses the Prime Meridian. Each value is expressed in degrees, F9.5 format, in the [0°, 360°] range. |
| WESTERNMOST_LONGITUDE | deg | For Planetocentric coordinates and for Planetographic coordinates in which longitude increases toward the east, the westernmost (leftmost) longitude of a spatial area (e.g., a map, mosaic, bin, feature or region) is the minimum numerical value of longitude unless it crosses the Prime Meridian. Each value is expressed in degrees, F9.5 format, in the [0°, 360°] range. |
| CENTER_LATITUDE | deg | Image parameter |
| CENTER_LONGITUDE | deg | Image parameter |
| HORIZONTAL_PIXEL_SCALE | | Image parameter |
| VERTICAL_PIXEL_SCALE | | Image parameter |
| NORTH_AZIMUTH | | Image parameter |
| PROCESSING_LEVEL_ID | | CODMAC level (2 for EDR, 3 for RDR) |
| DATA_QUALITY_ID | | Data quality indicator. Possible values are 0 if lines are missing, 1 if the data are complete; "NULL" is unevaluated. |
| DATA_QUALITY_DESC | | Description of data quality. |
| TELEMETRY_SOURCE_ID | | This keyword identifies the EGSE used to produce the data file. |
| CHANNEL_ID | | Possible values: "VIS" and "IR". This keyword identifies the instrument channel producing the data and can have 2 possible |
| SOFTWARE_VERSION_ID | | This keyword identifies the software used to write the labels and |

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| Keyword | Value Units | Value Description |
|----------------------|-------------|---|
| | | format the data. |
| INSTRUMENT_MODE_ID | | <p>The value of this keyword identifies the instrument mode. The valid values are the following mode</p> <ul style="list-style-type: none"> • S_H_SPE_H_SPA_F • S_H_SPE_L_SPA_F • S_H_SPE_L_SPA_F_SUM • S_L_SPE_H_SPA_F • S_L_SPE_L_SPA_F • S_L_SPE_L_SPA_F_SUM • S_H_SPE_H_SPA_Q • S_L_SPE_H_SPA_Q • S_H_SPE_L_SPA_F_MEA • S_L_SPE_L_SPA_F_MEA • C_H_SPE_H_SPA_F • C_H_SPE_L_SPA_F • SPARE • C_L_SPE_H_SPA_F • C_L_SPE_L_SPA_F • C_H_SPE_H_SPA_Q • C L SPE H SPA Q |
| INSTRUMENT_MODE_DESC | | <p>This keyword describes the different values that INSTRUMENT_MODE_ID can assume</p> <ul style="list-style-type: none"> • • S_H_SPE_H_SPA_F: Science, high spectral high spatial, Full slit • S_H_SPE_L_SPA_F: Science, high spectral low spatial, Full slit • S_H_SPE_L_SPA_F_SUM: Science, high spectral low spatial, Summing • S_L_SPE_H_SPA_F: Science, Low spectral high spatial, Full slit • S_L_SPE_L_SPA_F: Science, Low spectral low spatial, Full slit • S_L_SPE_L_SPA_F_SUM: Science, Low spectral low spatial, Summing • S_H_SPE_H_SPA_Q: Science, high spectral high spatial, Quarter slit • S_L_SPE_H_SPA_Q: Science, low spectral high spatial, Quarter slit |

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| Keyword | Value Units | Value Description |
|-------------------------------|-------------|---|
| | | <ul style="list-style-type: none"> S_H_SPE_L_SPA_F_MEA: Science, high spectral low spatial, Meaning S_L_SPE_L_SPA_F_MEA: Science, low spectral low spatial, Meaning C_H_SPE_H_SPA_F: Calibration, high spectral high spatial, Full slit C_H_SPE_L_SPA_F: Calibration, high spectral low spatial, Full slit SPARE: CALIBRATION Spare C_L_SPE_H_SPA_F: Calibration, low spectral high spatial, Full slit C_L_SPE_L_SPA_F: Calibration, low spectral low spatial, Full slit C_H_SPE_H_SPA_Q: Calibration, high spectral high spatial, Quarter slit C_L_SPE_H_SPA_Q: Calibration, low spectral high spatial, Quarter slit" |
| ENCODING_TYPE | | Value (normally) = "0" (decompressed) |
| SCAN_MODE_ID | | Scan mirror mode identifier. It is an integer in the range 1 to 10. The VIR scan mirror shall perform, when commanded, an angular movement around an axis parallel to the slit direction (y direction). There can be 10 different modes, each one identifying a given angular movement. |
| SCAN_PARAMETER | | See SCAN_PARAMETER_DESC. Example: "(-1.0, 0.1, 1, 33)" |
| SCAN_PARAMETER_DESC | | "SCAN_START_ANGLE", "SCAN_STOP_ANGLE", "SCAN_STEP_ANGLE", "SCAN_STEP_NUMBER" |
| DAWN: SCAN_PARAMETER_UNIT | | Value = (DEG, DEGREE, DEGREE, DIMENSIONLESS) |
| FRAME_PARAMETER | | See FRAME_PARAMETER_DESC e.g. (100, 1, 5000, 5) |
| FRAME_PARAMETER_DESC | | ("EXPOSURE_DURATION", "FRAME_SUMMING", "EXTERNAL_REPETITION_TIME", "DARK_ACQUISITION_RATE") |
| DAWN: FRAME_PARAMETER_UNIT | | Value =(S, DIMENSIONLESS, S, DIMENSIONLESS) |
| DAWN:VIR_IR_START_X_POSITION | | This keyword gives the X coordinate of the first CCD pixel used on the IR FPA. This quantity determines the correspondence between wavelength and spectral channels. |
| DAWN:VIR_IR_START_Y_POSITION | | This keyword gives the Y coordinate of the first CCD pixel used on the IR FPA. This quantity determines the correspondence between wavelength and spectral channels. |
| DAWN:VIR_VIS_START_X_POSITION | | This keyword gives the X coordinate of the first CCD pixel used on the VIS FPA. This quantity determines the correspondence between wavelength and spectral channels. |
| DAWN:VIR_VIS_START_Y_POSITION | | This keyword gives the Y coordinate of the first CCD pixel used on the VIS FPA. This quantity determines the correspondence between wavelength and spectral channels. |

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| Keyword | Value Units | Value Description |
|-----------------------------------|-------------|--|
| MAXIMUM_INSTRUMENT_TEMPERATURE | | See INSTRUMENT_TEMPERATURE_POINT keyword for specification of the measurement locations e.g. (176.6, 143.6, 144.6, 74.7) |
| INSTRUMENT_TEMPERATURE_POINT | | ("FOCAL_PLANE", "TELESCOPE", "SPECTROMETER", "CRYOCOOLER") |
| DAWN: INSTRUMENT_TEMPERATURE_UNIT | K | Value = (K, K, K, K) |
| PHOTOMETRIC_CORRECTION_TYPE | | Value (normally) = NONE |
| OBJECT = QUBE (EDR data) | | |
| AXES | | AXES is the number of data axes in the QUBE object (always 3). AXES = 3 |
| AXIS_NAME | | Value = "(BAND, SAMPLE, LINE)" AXIS_NAME indicates the organization of the object, bands interleaved by pixels, or BIP. It means that a complete spectrum is written contiguously, and spectra acquired at the same time step are written in sequence. |
| CORE_ITEMS | | CORE_ITEMS are the dimensions of the data cube. The three values specified are the spectral and spatial dimensions of the detector after binning (derived from INSTRUMENT_MODE_ID), and the number of frames acquired in the session. e.g. = (432, 256, 33) |
| CORE_ITEM_BYTES | | CORE_ITEM_BYTES and CORE_ITEM_TYPE give the type of data in the cube core: it is always 16 bits integers, MSB encoding, for raw data, whatever the architecture used to write the raw data files (i.e., EGSE will not change byte encoding relative to the output of the instrument). |
| CORE_ITEM_TYPE | | = MSB_INTEGER CORE_ITEM_BYTES and CORE_ITEM_TYPE give the type of data in the cube core: it is always 16 bits integers, MSB encoding, for raw data, whatever the architecture used to write the raw data files (i.e., EGSE will not change byte encoding relative to the output of the instrument). |
| CORE_BASE | | CORE_BASE and CORE_MULTIPLIER allow scaling of data (useful for calibrated data only): $true_value = BASE + (MULTIPLIER * stored_value)$. Values below the keyword CORE_VALID_MINIMUM are reserved for special use, following an ISIS convention. CORE_BASE = 0 always in this data set |
| CORE_MULTIPLIER | | CORE_MULTIPLIER = 1.0 always in this data set. |
| CORE_VALID_MINIMUM | | Values below the keyword CORE_VALID_MINIMUM are reserved for special use, following an ISIS convention. Value = "NULL" |
| CORE_NULL | | CORE_NULL is an optional code indicating invalid data. Value = "NULL" |
| CORE_LOW_REPR_SATURATION | | Value = -32767 – always in this data set |
| CORE_LOW_INSTR_SATURATION | | Value = -32767 – always in this data set |
| CORE_HIGH_REPR_SATURATION | | Value = 32767 – always in this data set |
| CORE_HIGH_INSTR_SATURATION | | Value = 32767 – always in this data set |

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| Keyword | Value Units | Value Description |
|---|-------------|---|
| CORE_NAME | | CORE_NAME is the physical quantity recorded in the cube (required for ISIS). Value = "RAW DATA NUMBER" |
| CORE_UNIT | | CORE_UNIT is the unit of data stored in the cube. Value = "DIMENSIONLESS" |
| CORE_UNIT_NOTE | | CORE_UNIT_NOTE can be used to explain the conversion to real values, or anything, and it is reserved for future use. |
| The following keyword/value pairs define the side plane of the EDR Qube. This plane contains instrument housekeeping data and is required to be ISIS compliant. The values associated with these keywords are invariant across the data set. | | |
| SUFFIX_BYTES | | This is the allocation in bytes of each suffix data value. This value is always 4 in labels written by EGSE. Value = 4 |
| SUFFIX_ITEMS | | Value = (0, 1, 0) SUFFIX_ITEMS gives the structure of the suffix area, listed in the storage order defined by AXIS_NAME. The value is (0,NI_s,0), where NI_s is the number of lines required to store the housekeeping and ancillary information related to each frame of data. Each line is equivalent to an extra spectrum for each frame. This corresponds to data transfer order and saves the maximum possible space in the file. In this case, it means that NI_s lines of Nb items will be written after the frame, where Nb is the number of spectral bands. |
| SAMPLE_SUFFIX_NAME | | This provides the name of the suffix items along the sample axis. SAMPLE_SUFFIX_NAME = "HOUSEKEEPING PARAMETERS" |
| SAMPLE_SUFFIX_UNIT | | SAMPLE_SUFFIX_UNIT = "DIMENSIONLESS" |
| SAMPLE_SUFFIX_ITEM_BYTE | | The sizes in bytes of the suffix items along the sample axis (part of the allocation reserved by SUFFIX_BYTES which is actually used). Value = 4. |
| SAMPLE_SUFFIX_ITEM_TYPE | | This provides the byte encoding of suffix items along the sample axis; always 32 bits integers, MSB encoding. SAMPLE_SUFFIX_ITEM_TYPE = "MSB_INTEGER" |
| SAMPLE_SUFFIX_BASE | | SAMPLE_SUFFIX_BASE = 0.0 |
| SAMPLE_SUFFIX_MULTIPLIER | | SAMPLE_SUFFIX_MULTIPLIER = 1.0 |
| SAMPLE_SUFFIX_VALID_MINIMUM | | SAMPLE_SUFFIX_VALID_MINIMUM = " NULL" |
| SAMPLE_SUFFIX_NULL | | SAMPLE_SUFFIX_NULL = 65535 |
| SAMPLE_SUFFIX_LOW_REPR_SAT | | SAMPLE_SUFFIX_LOW_REPR_SAT = 0 |
| SAMPLE_SUFFIX_LOW_INSTR_SAT | | SAMPLE_SUFFIX_LOW_INSTR_SAT = 0 |
| SAMPLE_SUFFIX_HIGH_REPR_SAT | | SAMPLE_SUFFIX_HIGH_REPR_SAT = 65535 |
| SAMPLE_SUFFIX_HIGH_INSTR_SAT | | SAMPLE_SUFFIX_HIGH_INSTR_SAT = 65535 |
| Spectral axis description (EDR data) | | |
| GROUP | | Value = BAND_BIN |
| BAND_BIN_CENTER | | Wavelengths of bands in a Standard Qube |
| BAND_BIN_UNIT | | Value = MICROMETER |
| BAND_BIN_ORIGINAL_BAND | | Original band numbers |

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The labels have stream record format, and line lengths of at most 80 characters (including the CR/LF line terminators). The carriage return and line feed (CR/LF) pair is the required line terminator for all PDS labels.

Each line in the label may be padded with space characters so that each line in the label has the same record length as the data file. In this case, the label line length may exceed the recommended 80 characters. PDS labels describing the content of data files are always attached (included in the files).

The PDS

labels for all VIR files have the same structure. The keywords are grouped in functional sections.

- Dataset and Product Information Data description
- File Information Instrument status description
- Time Information
- Mission description parameters
- Instrument description parameters
- Geometry description parameters
- Data description parameters
- Instrument Status
- Pointers to first record of objects in file

2.2 VIR-PDS: /*DATASET AND PRODUCT INFORMATION*/

```

PDS_VERSION_ID = PDS3
LABEL_REVISION_NOTE = "MTC_11-02-2010"

/* Dataset and Product Information */
DATA_SET_NAME = "DAWN VIR RAW (EDR) CRUISE CHECKOUT/CALIB IR SPECTRA V1.0"
DATA_SET_ID = "DAWN-X-VIR-2-EDR-IR-CRUISE-SPECTRA-V1.0"
PRODUCT_ID = "VIR_IR_1A_1_288176312_1.QUB"
PRODUCT_TYPE = EDR
PRODUCER_FULL_NAME = "A. CORADINI"
PRODUCER_INSTITUTION_NAME = "ISTITUTO NAZIONALE DI ASTROFISICA"
PRODUCT_CREATION_TIME = 2010-02-11T19:59:36.00
PRODUCT_VERSION_ID = "01"

```

DATA_SET_NAME; DATA_SET_ID; PRODUCT_ID; PRODUCT_VERSION_ID


These keywords assume values that the EGSE read in the file "pds_inp_ir.txt or pds_inp_vis.txt"

PRODUCT_TYPE; PRODUCER_FULL_NAME; PRODUCER_INSTITUTION_NAME;

These keywords have a fix values;

PRODUCT_CREATION_TIME;

This keyword is calculated from time to time.

| | | | |
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2.3 VIR-PDS: /*FILE INFORMATION*/

```

RECORD_TYPE = FIXED_LENGTH
RECORD_BYTES = 512
FILE_RECORDS = 15289
LABEL_RECORDS = 49

```

RECORD_TYPE; RECORD_BYTES;

These keywords have a fix values;

FILE_RECORDS; data element identifies the number of physical records in the file.

LABEL_RECORDS; data element identifies the number of physical records that make up the PDS product label.

2.4 VIR-PDS: /*TIME INFORMATION*/

```

START_TIME = 2009-02-17T20:57:30.171
STOP_TIME = 2009-02-17T21:10:20.320
IMAGE_MID_TIME = 2009-02-17T21:03:55.245
SPACECRAFT_CLOCK_START_COUNT = "1/288176312.1098"
SPACECRAFT_CLOCK_STOP_COUNT = "1/288177073.7980"

```

START_TIME; STOP_TIME;

IMAGE_MID_TIME;

SPACECRAFT_CLOCK_START_COUNT; SPACECRAFT_CLOCK_STOP_COUNT;


2.5 VIR-PDS: /*MISSION DESCRIPTION PARAMETERS*/

```

INSTRUMENT_HOST_NAME = "DAWN"
INSTRUMENT_HOST_ID = "DAWN"
MISSION_PHASE_NAME = "MARS-VESTA CRUISE (MVC) "

```

INSTRUMENT_HOST_NAME; INSTRUMENT_HOST_ID;

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These keywords have a settled values;

MISSION_PHASE_NAME;

These keywords assume values that the EGSE read in the files: “pds_inp_ir.txt or pds_inp_vis.txt”

2.6 VIR-PDS: /*INSTRUMENT DESCRIPTION PARAMETERS*/

```
INSTRUMENT_NAME = "VISIBLE AND INFRARED SPECTROMETER"
INSTRUMENT_ID = "VIR"
INSTRUMENT_TYPE = "IMAGING SPECTROMETER"
```

INSTRUMENT_NAME; INSTRUMENT_ID; INSTRUMENT_TYPE;

These keywords have a settled values;

2.7 VIR-PDS: /*INSTRUMENT DESCRIPTION PARAMETERS*/


- **Celestial Geometry**
- **Solar Geometry**
- **Spice Kernels**
- **COORDINATE SYSTEM**
- **Geometry in "VESTA_FIXED" coordinates from SPICE**
- **Illumination**
- **Image parameters**

The keywords in this section contain information on the target, timing and so on. Geometric keywords are listed in this group: values for these keywords are generated from processing with SPICE routines by external tool.

2.8 VIR-PDS: /*DATA DESCRIPTION PARAMETERS*/

```
PROCESSING_LEVEL_ID = 2
DATA_QUALITY_ID = 1
DATA_QUALITY_DESC = "0:INCOMPLETE; 1:COMPLETE"
TELEMETRY_SOURCE_ID = "EGSE"
CHANNEL_ID = "IR"
SOFTWARE_VERSION_ID = "EGSE V1.14,AMDLSpace"
```

DATA_QUALITY_ID is an error flag set by the EGSE during low level processing. A value of 0 indicates missing data paquets. Data are compressed on board and decompressed in the EGSE. A consistency check is performed during the decompression of the data stream. If the number of words required for decompression is

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different from the number of available data word the corresponding data slice is set to 0. Missing data can therefore correspond either to actually missing TM packets, or to a severe error from the decompression routine.

PROCESSING_LEVEL_ID; DATA_QUALITY_DESC; TELEMETRY_SOURCE_ID ; SOFTWARE_VERSION_ID

These keywords have a settled values;

2.9 VIR-PDS: /*INSTRUMENT STATUS*/

The instrument status description and the operating parameters are contained in the following keywords, which are different for theIR and VIS channels.

The keywords are as follows in the fig 3:

```

INSTRUMENT_MODE_ID = "C_H_SPE_H_SPA_F"
INSTRUMENT_MODE_DESC =
  "S_H_SPE_H_SPA_F: Science, high spectral high spatial, Full slit
  S_H_SPE_L_SPA_F: Science, high spectral low spatial, Full slit
  S_H_SPE_L_SPA_F_SUM: Science, high spectral low spatial, Summing
  S_L_SPE_H_SPA_F: Science, Low spectral high spatial, Full slit
  S_L_SPE_L_SPA_F: Science, Low spectral low spatial, Full slit
  S_L_SPE_L_SPA_F_SUM: Science, Low spectral low spatial, Summing
  S_H_SPE_H_SPA_Q: Science, high spectral high spatial, Quarter slit
  S_L_SPE_H_SPA_Q: Science, low spectral high spatial, Quarter slit
  S_H_SPE_L_SPA_F_MEA: Science, high spectral low spatial, Meaning
  S_L_SPE_L_SPA_F_MEA: Science, low spectral low spatial, Meaning
  C_H_SPE_H_SPA_F: Calibration, high spectral high spatial, Full slit
  C_H_SPE_L_SPA_F: Calibration, high spectral low spatial, Full slit
  SPARE: CALIBRATION Spare
  C_L_SPE_H_SPA_F: Calibration, low spectral high spatial, Full slit
  C_L_SPE_L_SPA_F: Calibration, low spectral low spatial, Full slit
  C_H_SPE_H_SPA_Q: Calibration, high spectral high spatial, Quarter slit
  C_L_SPE_H_SPA_Q: Calibration, low spectral high spatial, Quarter slit"
ENCODING_TYPE = "0"
SCAN_MODE_ID = 4
SCAN_PARAMETER = (-3.8, -3.7, 4500, 25)
SCAN_PARAMETER_DESC = ("SCAN_START_ANGLE", "SCAN_STOP_ANGLE",
  "SCAN_STEP_ANGLE", "SCAN_STEP_NUMBER")
DAWN:SCAN_PARAMETER_UNIT = (DEG, DEG, DEG, DIMENSIONLESS)
FRAME_PARAMETER = (0.0, 1, 20, 0)
FRAME_PARAMETER_DESC = ("EXPOSURE_DURATION", "FRAME_SUMMING",
  "EXTERNAL_REPETITION_TIME", "DARK_ACQUISITION_RATE")
DAWN:FRAME_PARAMETER_UNIT = (S, DIMENSIONLESS, S, DIMENSIONLESS)
DAWN:VIR_IR_START_X_POSITION=1
DAWN:VIR_IR_START_Y_POSITION=7
MAXIMUM_INSTRUMENT_TEMPERATURE = (81.5, 141.6, 142.6, 74.6)
INSTRUMENT_TEMPERATURE_POINT = ("FOCAL_PLANE", "TELESCOPE", "SPECTROMETER",
  "CRYOCOOLER")
DAWN:INSTRUMENT_TEMPERATURE_UNIT = (K, K, K, K)
PHOTOMETRIC_CORRECTION_TYPE = NONE

```



| | | | |
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Fig 3

INSTRUMENT_MODE_ID this keyword is read by EGSE in the side plane in the field "CUR_MODE_SUBMODE" see the table 1.1

| Mode (hex) bit 7-4 | Sub-mode (hex) bit 3-0 | Mode mnemonic | Sub-mode mnemonic |
|-----------------------|---------------------------|---------------|---|
| 0 | 0 | INIT&TEST | none |
| 1 | 0 | MAINTENANCE | none |
| 2 | 0 | MM_TEST | none |
| 3 | 1 | STAND_BY | COVER_CLOSE_COOL_OFF |
| 3 | 2 | STAND_BY | COVER_CLOSE_COOL_ON |
| 3 | 3 | STAND_BY | COVER_OPEN_COOL_OFF |
| 3 | 4 | STAND_BY | COVER_OPEN_COOL_ON |
| 3 | 5 | STAND_BY | COVER_MOVING_COOL_ON This code is provided also in case of cover failure or not controlled due to ECA |
| 3 | 6 | STAND_BY | COVER_MOVING_COOL_OFF This code is provided also in case of cover failure or not controlled due to ECA |
| 4 | 1 | SCIENCE | H_SPE_H_SPA_F |
| 4 | 2 | SCIENCE | H_SPE_L_SPA_F |
| 4 | 3 | SCIENCE | H_SPE_L_SPA_F_SUM |
| 4 | 4 | SCIENCE | L_SPE_H_SPA_F |
| 4 | 5 | SCIENCE | L_SPE_L_SPA_F |
| 4 | 6 | SCIENCE | L_SPE_L_SPA_F_SUM |
| 4 | 7 | SCIENCE | H_SPE_H_SPA_Q |
| 4 | 8 | SCIENCE | L_SPE_H_SPA_Q |
| 4 | 9 | SCIENCE | H_SPE_L_SPA_F_MEA |
| 4 | A | SCIENCE | L_SPE_L_SPA_F_MEA |
| 5 | 0 | COOL_DOWN | None |
| 6 | 1 | CALIB | H_SPE_H_SPA_F |
| 6 | 2 | CALIB | H_SPE_L_SPA_F |
| 6 | 3 | CALIB | Spare |
| 6 | 4 | CALIB | L_SPE_H_SPA_F |
| 6 | 5 | CALIB | L_SPE_L_SPA_F |
| 6 | 6 | CALIB | Spare |
| 6 | 7 | CALIB | H_SPE_H_SPA_Q |
| 6 | 8 | CALIB | L_SPE_H_SPA_Q |
| 7 | 0 | ANNEALING | None |
| 8 | 0 | MM_DUMP | None |
| 9 | 0 | SAFE | None |
| A | 0 | ECA | None |
| F | F | UNKNOWN | None |

Table 2.2 VIR_TM_SPECIFIC-CUR_MODE_SUBMODE field

| | | | |
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INSTRUMENT_MODE_DESC describes the values of the “**INSTRUMENT_MODE_ID**” keywords, Its values is settled

1. SCAN_START_ANGLE & SCAN_STOP_ANGLE

In the sideplane I read the value in ADU of the M_MIRROR_SIN_HK e M_MIRROR_COS_HK.

If **M_MIRROR_SIN_HK > 4095**

M_MIRROR_SIN_HK_1 = M_MIRROR_SIN_HK - 4095

M_MIRROR_COS_HK_1 = M_MIRROR_COS_HK

And the angle is negative (**sign = -1**)

Se **M_MIRROR_SIN_HK <= 4095**

M_MIRROR_SIN_HK_1 = M_MIRROR_SIN_HK

M_MIRROR_COS_HK_1 = M_MIRROR_COS_HK

And the angle is positive (**sign = +1**)

The angle value is evaluated in radians

M_MIRROR_SIN_HK_2 = M_MIRROR_SIN_HK_1 * 2.442E-04 (radianti)

M_MIRROR_COS_HK_2 = M_MIRROR_COS_HK_1 * 2.442E-04 (radianti)

The angle value is converted in degrees:

M_MIRROR_SIN_HK_2_deg = segno*(180/π * arcsin(M_MIRROR_SIN_HK_2))-3,8

M_MIRROR_COS_HK_2_deg = segno*(180/π * arcsin(M_MIRROR_COS_HK_2))-3,8

And then the average between the two angles


angle = (M_MIRROR_SIN_HK_2_deg + M_MIRROR_COS_HK_2_deg)/2

So the result is the value of the electric angle.

This procedure shall be performed for each FRAME and then shall be extracted the maximum and the minimum value. The next step is to compare the values obtained with those reported in the document "VID-GAF-MA-003-rev.4-SUM.pdf".

Mode 1

se -33 < max & min < 33

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SCAN_START_ANGLE = -33

SCAN_STOP_ANGLE = 33

Mode 2

-16,5 < max & min < 16,5

SCAN_START_ANGLE = -16,5

SCAN_STOP_ANGLE = 16,5

Mode 3

-8,25 < max & min < 8,25

SCAN_START_ANGLE = -8,25

SCAN_STOP_ANGLE = 8,25

Mode 4

-4,125 < max & min < 4,125

SCAN_START_ANGLE = -4,125

SCAN_STOP_ANGLE = 4,125

Mode 5

-2,0625 < max & min < 2,0625

SCAN_START_ANGLE = -2,0625

SCAN_STOP_ANGLE = 2,0625

Mode 6

max & min = 33

SCAN_START_ANGLE = 33

SCAN_STOP_ANGLE = 33


Mode 7

max & min = -33

SCAN_START_ANGLE = -33

SCAN_STOP_ANGLE = -33

Mode 8

| | | | |
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max & min = 8,25

SCAN_START_ANGLE = 8,25

SCAN_STOP_ANGLE = 8,25

Mode 9

max & min = -8,25

SCAN_START_ANGLE = -8,25

SCAN_STOP_ANGLE = -8,2

Mode 10

max & min = 0

SCAN_START_ANGLE = 0

SCAN_STOP_ANGLE = 0

The flow chart of the algorithm to calculate this keyword is reported in Appendix E.

2. SCAN_STEP_ANGLE

3. SCAN_STEP_NUMBER

All frames – dark frames.

“FRAME_PARAMETER”

Questa keyword è formata da 4 valori di cui i primi due

1) EXPOSURE_DURATION

2) FRAME_SUMMING


For each operative modes this keyword is = “1”,

for these operative modes:

S_H_SPE_L_SPA_F_SUM: Science, high spectral low spatial, Summing
 S_L_SPE_L_SPA_F_SUM: Science, Low spectral low spatial, Summing
 S_H_SPE_L_SPA_F_MEA: Science, high spectral low spatial, Meaning
 S_L_SPE_L_SPA_F_MEA: Science, low spectral low spatial, Meaning

This keyword is = “4”

3) EXTERNAL_REPETITION_TIME is constant for all cube and It is the difference between two Time_Code except that on the first line;

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4) **DARK_ACQUISITION_RATE** how often information is acquired dark
The EGSE read in the sideplane the field "SHUTTER_STATUS".

5)
DAWN:VIR_IR_START_X_POSITION=1
DAWN:VIR_IR_START_Y_POSITION=7

6)
MAXIMUM_INSTRUMENT_TEMPERATURE:
Questa temperatura
INSTRUMENT_TEMPERATURE_POINT = ("FOCAL_PLANE", "TELESCOPE", "SPECTROMETER",
"CRYOCOOLER")
DAWN:INSTRUMENT_TEMPERATURE_UNIT = (K, K, K, K)
PHOTOMETRIC_CORRECTION_TYPE = NONE

2.10 VIR-PDS: /* POINTERS TO FIRST RECORD OF OBJECTS IN FILE */

The type and location of data objects are provided through standard PDS syntax. Locations are always given as the first record number of the data object within the file, starting from 1.

```

^HISTORY = 50
OBJECT = HISTORY
END_OBJECT = HISTORY
^QUBE = 51

```

A HISTORY object is located on top of all *data* files (not geometry files). This object is always empty and one-record long (512 bytes set to ASCII 32).


2.11 VIR-PDS: /* POINTERS TO FIRST RECORD OF OBJECTS IN FILE */

```


/* Spectral axis description */
<CR><LF>

<CR><LF>
GROUP = BAND_BIN
<CR><LF>
BAND_BIN_CENTER =
<CR><LF>
(
<CR><LF>
1020.74932, 1030.20864, 1039.66796, 1049.12728, 1058.5866 , 1068.04592,
<CR><LF>

```

| | | | |
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1077.50524, 1086.96456, 1096.42388, 1105.8832 , 1115.34252, 1124.80184, <CR><LF>
 1134.26116, 1143.72048, 1153.1798 , 1162.63912, 1172.09844, 1181.55776, <CR><LF>
 1191.01708, 1200.4764 , 1209.93572, 1219.39504, 1228.85436, 1238.31368, <CR><LF>
 1247.773 , 1257.23232, 1266.69164, 1276.15096, 1285.61028, 1295.0696 , <CR><LF>
 1304.52892, 1313.98824, 1323.44756, 1332.90688, 1342.3662 , 1351.82552, <CR><LF>
 1361.28484, 1370.74416, 1380.20348, 1389.6628 , 1399.12212, 1408.58144, <CR><LF>
 1418.04076, 1427.50008, 1436.9594 , 1446.41872, 1455.87804, 1465.33736, <CR><LF>
 1474.79668, 1484.256 , 1493.71532, 1503.17464, 1512.63396, 1522.09328, <CR><LF>
 1531.5526 , 1541.01192, 1550.47124, 1559.93056, 1569.38988, 1578.8492 , <CR><LF>
 1588.30852, 1597.76784, 1607.22716, 1616.68648, 1626.1458 , 1635.60512, <CR><LF>
 1645.06444, 1654.52376, 1663.98308, 1673.4424 , 1682.90172, 1692.36104, <CR><LF>
 1701.82036, 1711.27968, 1720.739 , 1730.19832, 1739.65764, 1749.11696, <CR><LF>
 1758.57628, 1768.0356 , 1777.49492, 1786.95424, 1796.41356, 1805.87288, <CR><LF>
 1815.3322 , 1824.79152, 1834.25084, 1843.71016, 1853.16948, 1862.6288 , <CR><LF>
 1872.08812, 1881.54744, 1891.00676, 1900.46608, 1909.9254 , 1919.38472, <CR><LF>
 1928.84404, 1938.30336, 1947.76268, 1957.222 , 1966.68132, 1976.14064, <CR><LF>
 1985.59996, 1995.05928, 2004.5186 , 2013.97792, 2023.43724, 2032.89656, <CR><LF>
 2042.35588, 2051.8152 , 2061.27452, 2070.73384, 2080.19316, 2089.65248, <CR><LF>
 2099.1118 , 2108.57112, 2118.03044, 2127.48976, 2136.94908, 2146.4084 , <CR><LF>
 2155.86772, 2165.32704, 2174.78636, 2184.24568, 2193.705 , 2203.16432, <CR><LF>
 2212.62364, 2222.08296, 2231.54228, 2241.0016 , 2250.46092, 2259.92024, <CR><LF>
 2269.37956, 2278.83888, 2288.2982 , 2297.75752, 2307.21684, 2316.67616, <CR><LF>
 2326.13548, 2335.5948 , 2345.05412, 2354.51344, 2363.97276, 2373.43208, <CR><LF>
 2382.8914 , 2392.35072, 2401.81004, 2411.26936, 2420.72868, 2430.188 , <CR><LF>
 2439.64732, 2449.10664, 2458.56596, 2468.02528, 2477.4846 , 2486.94392, <CR><LF>
 2496.40324, 2505.86256, 2515.32188, 2524.7812 , 2534.24052, 2543.69984, <CR><LF>
 2553.15916, 2562.61848, 2572.0778 , 2581.53712, 2590.99644, 2600.45576, <CR><LF>
 2609.91508, 2619.3744 , 2628.83372, 2638.29304, 2647.75236, 2657.21168, <CR><LF>
 2666.671 , 2676.13032, 2685.58964, 2695.04896, 2704.50828, 2713.9676 , <CR><LF>
 2723.42692, 2732.88624, 2742.34556, 2751.80488, 2761.2642 , 2770.72352, <CR><LF>
 2780.18284, 2789.64216, 2799.10148, 2808.5608 , 2818.02012, 2827.47944, <CR><LF>
 2836.93876, 2846.39808, 2855.8574 , 2865.31672, 2874.77604, 2884.23536, <CR><LF>
 2893.69468, 2903.154 , 2912.61332, 2922.07264, 2931.53196, 2940.99128, <CR><LF>
 2950.4506 , 2959.90992, 2969.36924, 2978.82856, 2988.28788, 2997.7472 , <CR><LF>
 3007.20652, 3016.66584, 3026.12516, 3035.58448, 3045.0438 , 3054.50312, <CR><LF>
 3063.96244, 3073.42176, 3082.88108, 3092.3404 , 3101.79972, 3111.25904, <CR><LF>
 3120.71836, 3130.17768, 3139.637 , 3149.09632, 3158.55564, 3168.01496, <CR><LF>
 3177.47428, 3186.9336 , 3196.39292, 3205.85224, 3215.31156, 3224.77088, <CR><LF>
 3234.2302 , 3243.68952, 3253.14884, 3262.60816, 3272.06748, 3281.5268 , <CR><LF>
 3290.98612, 3300.44544, 3309.90476, 3319.36408, 3328.8234 , 3338.28272, <CR><LF>
 3347.74204, 3357.20136, 3366.66068, 3376.12 , 3385.57932, 3395.03864, <CR><LF>
 3404.49796, 3413.95728, 3423.4166 , 3432.87592, 3442.33524, 3451.79456, <CR><LF>
 3461.25388, 3470.7132 , 3480.17252, 3489.63184, 3499.09116, 3508.55048, <CR><LF>
 3518.0098 , 3527.46912, 3536.92844, 3546.38776, 3555.84708, 3565.3064 , <CR><LF>
 3574.76572, 3584.22504, 3593.68436, 3603.14368, 3612.603 , 3622.06232, <CR><LF>
 3631.52164, 3640.98096, 3650.44028, 3659.8996 , 3669.35892, 3678.81824, <CR><LF>
 3688.27756, 3697.73688, 3707.1962 , 3716.65552, 3726.11484, 3735.57416, <CR><LF>
 3745.03348, 3754.4928, 3763.95212 , 3773.41144, 3782.87076, 3792.33008, <CR><LF>
 3801.7894 , 3811.24872, 3820.70804, 3830.16736, 3839.62668, 3849.086 , <CR><LF>
 3858.54532, 3868.00464, 3877.46396, 3886.92328, 3896.3826 , 3905.84192, <CR><LF>
 3915.30124, 3924.76056, 3934.21988, 3943.6792 , 3953.13852, 3962.59784, <CR><LF>
 3972.05716, 3981.51648, 3990.9758 , 4000.43512, 4009.89444, 4019.35376, <CR><LF>
 4028.81308, 4038.2724 , 4047.73172, 4057.19104, 4066.65036, 4076.10968, <CR><LF>
 4085.569 , 4095.02832, 4104.48764, 4113.94696, 4123.40628, 4132.8656 , <CR><LF>
 4142.32492, 4151.78424, 4161.24356, 4170.70288, 4180.1622 , 4189.62152, <CR><LF>
 4199.08084, 4208.54016, 4217.99948, 4227.4588 , 4236.91812, 4246.37744, <CR><LF>
 4255.83676, 4265.29608, 4274.7554 , 4284.21472, 4293.67404, 4303.13336, <CR><LF>
 4312.59268, 4322.052 , 4331.51132, 4340.97064, 4350.42996, 4359.88928, <CR><LF>
 4369.3486 , 4378.80792, 4388.26724, 4397.72656, 4407.18588, 4416.6452 , <CR><LF>
 4426.10452, 4435.56384, 4445.02316, 4454.48248, 4463.9418 , 4473.40112, <CR><LF>


| | | | |
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```

4482.86044, 4492.31976, 4501.77908, 4511.2384 , 4520.69772, 4530.15704, <CR><LF>
4539.61636, 4549.07568, 4558.535 , 4567.99432, 4577.45364, 4586.91296, <CR><LF>
4596.37228, 4605.8316 , 4615.29092, 4624.75024, 4634.20956, 4643.66888, <CR><LF>
4653.1282 , 4662.58752, 4672.04684, 4681.50616, 4690.96548, 4700.4248 , <CR><LF>
4709.88412, 4719.34344, 4728.80276, 4738.26208, 4747.7214 , 4757.18072, <CR><LF>
4766.64004, 4776.09936, 4785.55868, 4795.018 , 4804.47732, 4813.93664, <CR><LF>
4823.39596, 4832.85528, 4842.3146 , 4851.77392, 4861.23324, 4870.69256, <CR><LF>
4880.15188, 4889.6112 , 4899.07052, 4908.52984, 4917.98916, 4927.44848, <CR><LF>
4936.9078 , 4946.36712, 4955.82644, 4965.28576, 4974.74508, 4984.2044 , <CR><LF>
4993.66372, 5003.12304, 5012.58236, 5022.04168, 5031.501 , 5040.96032, <CR><LF>
5050.41964, 5059.87896, 5069.33828, 5078.7976 , 5088.25692, 5097.71624 <CR><LF>
) <CR><LF>
BAND_BIN_UNIT = MICROMETER <CR><LF>
  BAND_BIN_ORIGINAL_BAND = <CR><LF>
( <CR><LF>
1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27, <CR><LF>
28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51, <CR><LF>
52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75, <CR><LF>
76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99, <CR><LF>
100,101,102,103,104,105,106,107,108,109,110,111,112,113,114,115,116,117, <CR><LF>
118,119,120,121,122,123,124,125,126,127,128,129,130,131,132,133,134,135, <CR><LF>
136,137,138,139,140,141,142,143,144,145,146,147,148,149,150,151,152,153, <CR><LF>
154,155,156,157,158,159,160,161,162,163,164,165,166,167,168,169,170,171, <CR><LF>
172,173,174,175,176,177,178,179,180,181,182,183,184,185,186,187,188,189, <CR><LF>
190,191,192,193,194,195,196,197,198,199,200,201,202,203,204,205,206,207, <CR><LF>
208,209,210,211,212,213,214,215,216,217,218,219,220,221,222,223,224,225, <CR><LF>
226,227,228,229,230,231,232,233,234,235,236,237,238,239,240,241,242,243, <CR><LF>
244,245,246,247,248,249,250,251,252,253,254,255,256,257,258,259,260,261, <CR><LF>
262,263,264,265,266,267,268,269,270,271,272,273,274,275,276,277,278,279, <CR><LF>
280,281,282,283,284,285,286,287,288,289,290,291,292,293,294,295,296,297, <CR><LF>
298,299,300,301,302,303,304,305,306,307,308,309,310,311,312,313,314,315, <CR><LF>
316,317,318,319,320,321,322,323,324,325,326,327,328,329,330,331,332,333, <CR><LF>
334,335,336,337,338,339,340,341,342,343,344,345,346,347,348,349,350,351, <CR><LF>
352,353,354,355,356,357,358,359,360,361,362,363,364,365,366,367,368,369, <CR><LF>
370,371,372,373,374,375,376,377,378,379,380,381,382,383,384,385,386,387, <CR><LF>
388,389,390,391,392,393,394,395,396,397,398,399,400,401,402,403,404,405, <CR><LF>
406,407,408,409,410,411,412,413,414,415,416,417,418,419,420,421,422,423, <CR><LF>
424,425,426,427,428,429,430,431,432 <CR><LF>
) <CR><LF>
  END_GROUP = BAND_BIN <CR><LF>

START_TIME , STOP_TIME

```

| | | | |
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3 SIDEPLANE

3.1 Side Plane brief description

Suffix areas can be along each axis. In the case of VIR cubes, the HK parameters are stored in the cube side planes as four bytes variables (ie., using a constant number of bits whatever the dynamic range and the number of bits used to store the information in the telemetry data flow).

Practically, this means that one (or some) complete line is added to each frame, the length of which is equal to the number of spectral bands, even if the number of housekeeping parameters stored in this line is smaller; in this case, this extra line must be padded with zeros. The information is stored according to the following rules:


- All data units (HK and other) must be stored as four-byte words and the bytes ordering is “**most significant bit**” (MSB).
- Elemental HK structures corresponding to the same frame must be written in sequence along a side plane row until there is no more space to add a complete structure in the row (ie., a side plane row should always contain an entire number of structures). The end of the row is then padded with binary 0, and the following structure is written at the beginning of the next row (this is intended to keep the same index number in all rows for a given data).
- The number of side plane rows used is identical for each frame. This number is written in the value field of **SUFFIX_ITEM** keyword.

In this document we should consider a cube 432(bands)x256(samples)x7(lines)x2bytes this information is reported in the label in the keywords:

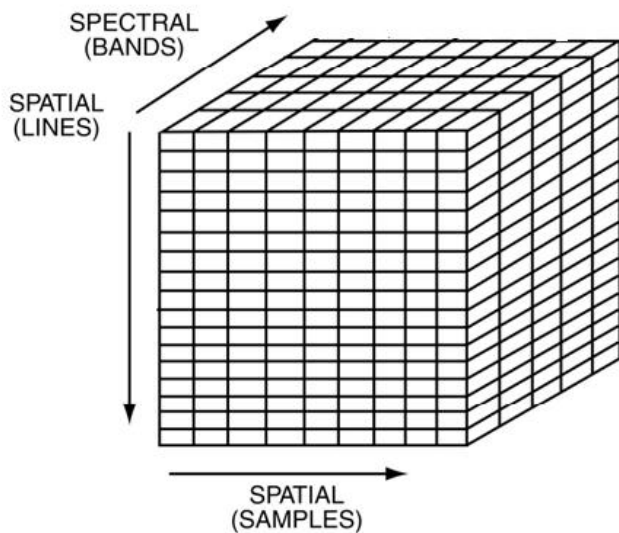
```

AXIS_NAME = (BAND, SAMPLE, LINE)
CORE_ITEMS = ( 432, 256, 7 )
CORE_ITEM_BYTES = 2

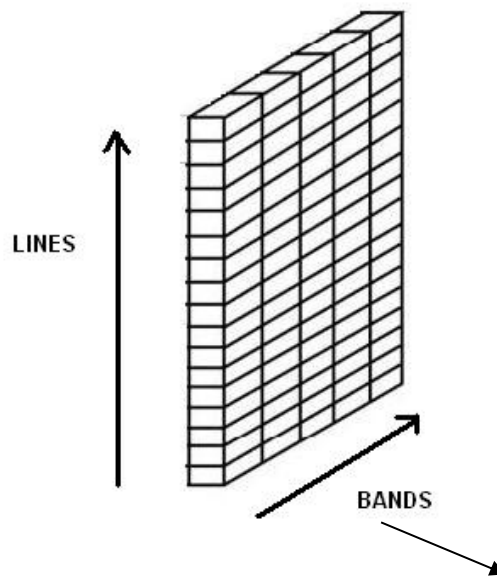
```

| | | | |
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CORE STRUCTURE



SIDE PLANE

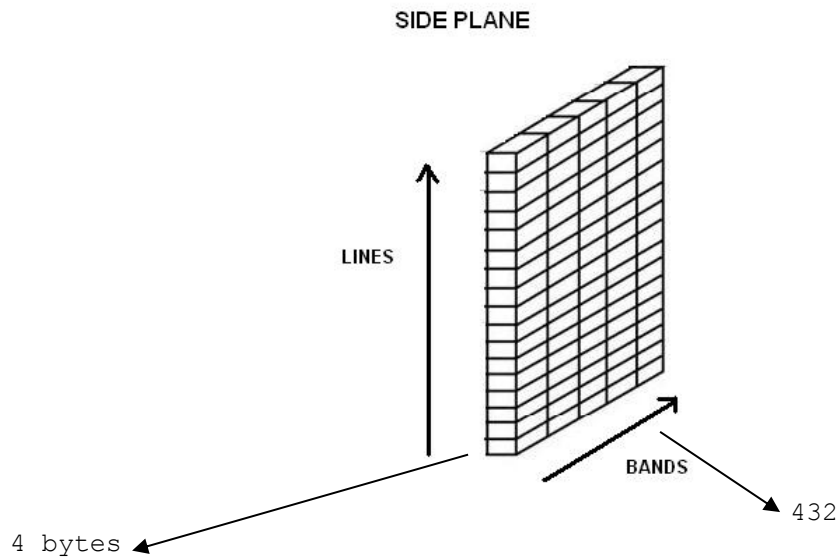


432

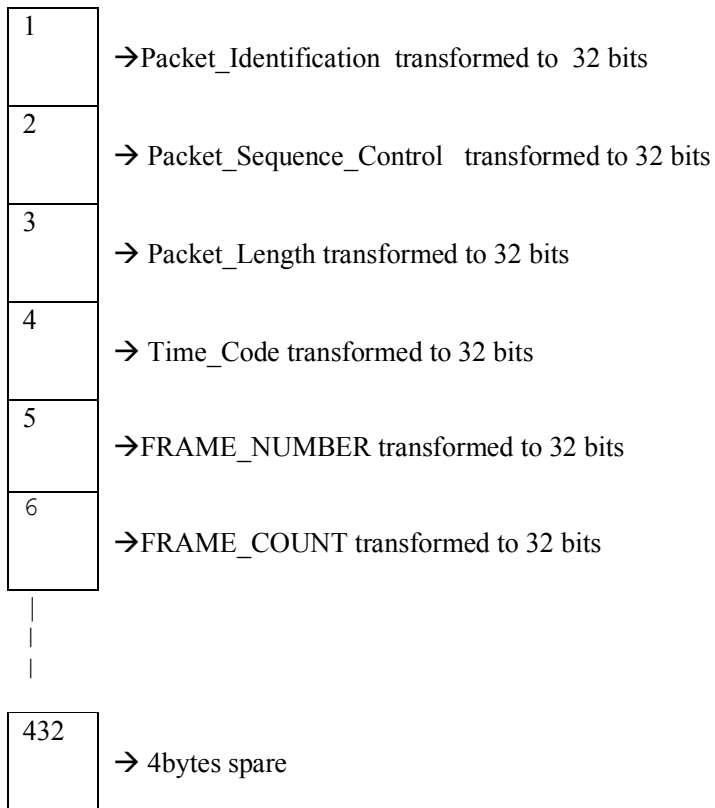
The side plane structure is reported in the keywords:


SUFFIX_BYTES = 4
SUFFIX_ITEMS = (0, 1, 0)
SAMPLE_SUFFIX_NAME = "HOUSEKEEPING PARAMETERS"
SAMPLE_SUFFIX_UNIT = DIMENSIONLESS
SAMPLE_SUFFIX_ITEM_BYTES = 4

There is only an auxiliary plane for the samples axe; if I want to read the side plane for each line I must read 432x1x4bytes = 1728 bytes (see fig 1.2)




The side plane is organization as follow:
 Respect to bands the Side plane for a line must be:



| | | | |
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The side plane information shows the current organization 432x4 bytes :


| FIELD | BITS |
|-------------------------|-------------|
| Packet_Identification | 32 |
| Packet_Sequence_Control | 32 |
| Packet_Length | 32 |
| Time_Code | 64 |
| FRAME_NUMBER | 32 |
| FRAME_COUNT | 32 |
| SUBFRAME_COUNT | 32 |
| PACKET_COUNT | 32 |
| SHUTTER_STATUS | 32 |
| CHANNEL_ID | 32 |
| COMP_STATUS | 32 |
| SPECTRAL_RANGE | 32 |
| CUR_MODE_SUBMODE | 32 |
| M_IR_EXPO_OUT | 32 |
| M_IR_TEMP | 32 |
| M_CCD_EXPO_OUT | 32 |
| M_CCD_TEMP | 32 |
| M_MIRROR_SIN_HK | 32 |
| M_MIRROR_COS_HK | 32 |
| M_SPECT_TEMP | 32 |
| M_TELE_TEMP | 32 |
| CCE_COLD_TIP | 32 |
| RADIATOR_TEMP | 32 |
| M_SU_MOTOR_CURR | 32 |
| LEDGE_TEMP | 32 |
| START_NOISY_BITS | 32 |
| END_NOISY_BIT | 32 |
| CR_ROW | 32 |

| | | | |
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| | |
|----------------|----|
| NOF_NOISY_BIT | 32 |
| SUB_FRAME_DATA | 32 |
| SEQUENCE_STEP | 32 |

Calibrated fields 64bits double little-endian

| | |
|----|-----------------|
| 33 | M_IR_EXPO_OUT |
| 34 | M_IR_TEMP |
| 35 | M_CCD_EXPO_OUT |
| 36 | M_CCD_TEMP |
| 37 | M_MIRROR_SIN_HK |
| 38 | M_MIRROR_COS_HK |
| 39 | M_SPECT_TEMP |
| 40 | M_TELE_TEM |
| 41 | CCE_COLD_TIP |
| 42 | RADIATOR_TEMP |
| 43 | M_SU_MOTOR_CURR |
| 44 | LEDGE_TEMP |

| | | | |
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APPENDIX A DUMMYGEOMETRY.TXT

```

/* Celestial Geometry                                     */
RIGHT_ASCENSION           = 99.432 <degree>
DECLINATION               = -53.014 <degree>
TWIST_ANGLE              = 215.088 <degree>
CELESTIAL_NORTH_CLOCK_ANGLE = 324.912 <degree>
QUATERNION                = ( 0.29355
                             0.92469
                             -0.21056
                             -0.12015 )

QUATERNION_DESC           = "
    Above parameters are calculated at the center time of the observation
    which is 2008-04-06T03:13:20.369.  The quaternion has the form:
    w, x, y, z (i.e. SPICE format)."
```

```

/* Solar geometry                                       */
SPACECRAFT_SOLAR_DISTANCE = 228387836.5 <km>
SC_SUN_POSITION_VECTOR    = ( 202290458.7 <km>
                             -96138630.8 <km>
                             -44687110.7 <km> )

SC_SUN_VELOCITY_VECTOR    = ( 14.163 <km/s>
                             16.181 <km/s>
                             6.933 <km/s> )

/* SPICE Kernels                                       */
SPICE_FILE_NAME           = "dawn EMC.mk"


TARGET_NAME               = "NULL"
TARGET_TYPE               = "NULL"

/* COORDINATE SYSTEM                                   */
COORDINATE_SYSTEM_NAME    = "N/A"
COORDINATE_SYSTEM_CENTER_NAME = "N/A"

/* Geometry in "VESTA_FIXED" coordinates from SPICE  */
SUB_SPACECRAFT_LATITUDE   = "N/A"
SUB_SPACECRAFT_LONGITUDE  = "N/A"
SUB_SPACECRAFT_AZIMUTH    = "N/A"
SPACECRAFT_ALTITUDE       = "N/A"
TARGET_CENTER_DISTANCE    = "N/A"
ORBIT_NUMBER               = "N/A"
SC_TARGET_POSITION_VECTOR = ( "N/A"
                             "N/A"
                             "N/A" )

SC_TARGET_VELOCITY_VECTOR = ( "N/A"
                             "N/A"
                             "N/A" )


LOCAL_HOUR_ANGLE          = "N/A"
```

| | | | |
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SUB_SOLAR_LATITUDE = "N/A"
SUB_SOLAR_LONGITUDE = "N/A"
SUB_SOLAR_AZIMUTH = "N/A"

/* Illumination */
INCIDENCE_ANGLE = "N/A"
EMISSION_ANGLE = "N/A"
PHASE_ANGLE = "N/A"

/* Image parameters */
SLANT_DISTANCE = "N/A"
MINIMUM_LATITUDE = "N/A"
CENTER_LATITUDE = "N/A"
MAXIMUM_LATITUDE = "N/A"
WESTERNMOST_LONGITUDE = "N/A"
CENTER_LONGITUDE = "N/A"
EASTERNMOST_LONGITUDE = "N/A"
HORIZONTAL_PIXEL_SCALE = "N/A"
VERTICAL_PIXEL_SCALE = "N/A"
NORTH_AZIMUTH = "N/A"

| | | | |
|---|-----------------|------|----------|
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APPENDIX B PDS_INP_IR.TXT

```


"MTC_11-02-2010"
"DAWN VIR RAW (EDR) CRUISE CHECKOUT/CALIB IR SPECTRA V1.0"
"DAWN-X-VIR-2-EDR-IR-CRUISE-SPECTRA-V1.0"
1
"MARS-VESTA CRUISE (MVC) "
"NULL"
"NULL"
"N/A"

/* Spectral axis description */

GROUP = BAND_BIN

BAND_BIN_CENTER =
(1.021,1.030,1.040,1.049,1.059,1.068,1.078,1.087,1.096,1.106,1.115,1.125,
1.134,1.144,1.153,1.163,1.172,1.182,1.191,1.200,1.210,1.219,1.229,1.238,
1.248,1.257,1.267,1.276,1.286,1.295,1.305,1.314,1.323,1.333,1.342,1.352,
1.361,1.371,1.380,1.390,1.399,1.409,1.418,1.428,1.437,1.446,1.456,1.465,
1.475,1.484,1.494,1.503,1.513,1.522,1.532,1.541,1.550,1.560,1.569,1.579,
1.588,1.598,1.607,1.617,1.626,1.636,1.645,1.655,1.664,1.673,1.683,1.692,
1.702,1.711,1.721,1.730,1.740,1.749,1.759,1.768,1.777,1.787,1.796,1.806,
1.815,1.825,1.834,1.844,1.853,1.863,1.872,1.882,1.891,1.900,1.910,1.919,
1.929,1.938,1.948,1.957,1.967,1.976,1.986,1.995,2.005,2.014,2.023,2.033,
2.042,2.052,2.061,2.071,2.080,2.090,2.099,2.109,2.118,2.127,2.137,2.146,
2.156,2.165,2.175,2.184,2.194,2.203,2.213,2.222,2.232,2.241,2.250,2.260,
2.269,2.279,2.288,2.298,2.307,2.317,2.326,2.336,2.345,2.355,2.364,2.373,
2.383,2.392,2.402,2.411,2.421,2.430,2.440,2.449,2.459,2.468,2.477,2.487,
2.496,2.506,2.515,2.525,2.534,2.544,2.553,2.563,2.572,2.582,2.591,2.600,
2.610,2.619,2.629,2.638,2.648,2.657,2.667,2.676,2.686,2.695,2.705,2.714,
2.723,2.733,2.742,2.752,2.761,2.771,2.780,2.790,2.799,2.809,2.818,2.827,
2.837,2.846,2.856,2.865,2.875,2.884,2.894,2.903,2.913,2.922,2.932,2.941,
2.950,2.960,2.969,2.979,2.988,2.998,3.007,3.017,3.026,3.036,3.045,3.055,
3.064,3.073,3.083,3.092,3.102,3.111,3.121,3.130,3.140,3.149,3.159,3.168,
3.177,3.187,3.196,3.206,3.215,3.225,3.234,3.244,3.253,3.263,3.272,3.282,
3.291,3.300,3.310,3.319,3.329,3.338,3.348,3.357,3.367,3.376,3.386,3.395,
3.405,3.414,3.423,3.433,3.442,3.452,3.461,3.471,3.480,3.490,3.499,3.509,
3.518,3.527,3.537,3.546,3.556,3.565,3.575,3.584,3.594,3.603,3.613,3.622,
3.632,3.641,3.650,3.660,3.669,3.679,3.688,3.698,3.707,3.717,3.726,3.736,
3.745,3.754,3.764,3.773,3.783,3.792,3.802,3.811,3.821,3.830,3.840,3.849,
3.859,3.868,3.877,3.887,3.896,3.906,3.915,3.925,3.934,3.944,3.953,3.963,
3.972,3.982,3.991,4.000,4.010,4.019,4.029,4.038,4.048,4.057,4.067,4.076,
4.086,4.095,4.104,4.114,4.123,4.133,4.142,4.152,4.161,4.171,4.180,4.190,
4.199,4.209,4.218,4.227,4.237,4.246,4.256,4.265,4.275,4.284,4.294,4.303,
4.313,4.322,4.332,4.341,4.350,4.360,4.369,4.379,4.388,4.398,4.407,4.417,
4.426,4.436,4.445,4.454,4.464,4.473,4.483,4.492,4.502,4.511,4.521,4.530,
4.540,4.549,4.559,4.568,4.577,4.587,4.596,4.606,4.615,4.625,4.634,4.644,
4.653,4.663,4.672,4.682,4.691,4.700,4.710,4.719,4.729,4.738,4.748,4.757,
4.767,4.776,4.786,4.795,4.804,4.814,4.823,4.833,4.842,4.852,4.861,4.871,
4.880,4.890,4.899,4.909,4.918,4.927,4.937,4.946,4.956,4.965,4.975,4.984,
4.994,5.003,5.013,5.022,5.032,5.041,5.050,5.060,5.069,5.079,5.088,5.098)


```

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|---|-----------------|------|----------|
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BAND_BIN_WIDTH =
(0.0140,0.0140,0.0140,0.0140,0.0140,0.0140,0.0140,0.0140,0.0139,
0.0139,0.0139,0.0139,0.0139,0.0139,0.0139,0.0139,0.0139,0.0139,0.0139,0.0139,
0.0139,0.0139,0.0139,0.0139,0.0139,0.0139,0.0139,0.0139,0.0138,0.0138,0.0138,
0.0138,0.0138,0.0138,0.0138,0.0138,0.0138,0.0138,0.0137,0.0137,0.0137,0.0137,
0.0137,0.0137,0.0137,0.0137,0.0137,0.0136,0.0136,0.0136,0.0136,0.0136,0.0136,
0.0136,0.0135,0.0135,0.0135,0.0135,0.0135,0.0135,0.0135,0.0134,0.0134,0.0134,
0.0134,0.0134,0.0134,0.0134,0.0133,0.0133,0.0133,0.0133,0.0133,0.0133,0.0132,
0.0132,0.0132,0.0132,0.0132,0.0132,0.0131,0.0131,0.0131,0.0131,0.0131,0.0131,
0.0130,0.0130,0.0130,0.0130,0.0130,0.0129,0.0129,0.0129,0.0129,0.0129,0.0129,
0.0128,0.0128,0.0128,0.0128,0.0128,0.0128,0.0127,0.0127,0.0127,0.0127,0.0127,
0.0126,0.0126,0.0126,0.0126,0.0126,0.0126,0.0125,0.0125,0.0125,0.0125,0.0125,
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0.0121,0.0121,0.0121,0.0121,0.0120,0.0120,0.0120,0.0120,0.0120,0.0120,0.0120,
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0.0118,0.0118,0.0118,0.0118,0.0118,0.0117,0.0117,0.0117,0.0117,0.0117,0.0117,
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0.0119,0.0120,0.0120,0.0120,0.0120,0.0120,0.0121,0.0121,0.0121,0.0121,0.0121,
0.0122,0.0122,0.0122,0.0122,0.0122,0.0123,0.0123,0.0123,0.0123,0.0124,0.0124,
0.0124,0.0124,0.0125,0.0125,0.0125,0.0125,0.0126,0.0126,0.0126,0.0126,0.0127,
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0.0171,0.0171,0.0172,0.0172,0.0173,0.0173,0.0174,0.0175,0.0175,0.0176,0.0176,
0.0177,0.0178,0.0178,0.0179,0.0180,0.0180,0.0181,0.0181,0.0182,0.0183,0.0183,
0.0184,0.0185,0.0185,0.0186)

BAND_BIN_UNIT = MICROMETER

BAND_BIN_ORIGINAL_BAND =
(1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28,
29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53,
54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78,
79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102,
103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121,
122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140,
141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159,
160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178,

| | | | |
|---|-----------------|------|----------|
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179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197,
198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216,
217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235,
236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254,
255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273,
274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292,
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312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330,
331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349,
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369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387,
388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406,
407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425,
426, 427, 428, 429, 430, 431, 432)

END_GROUP = BAND_BIN

/* Spectral axis description */

GROUP = BAND_BIN


BAND_BIN_CENTER =
(1.0302, 1.0586, 1.0870,
1.1153, 1.1437, 1.1721,
1.2005, 1.2289, 1.2572,
1.2856, 1.3140, 1.3424,
1.3707, 1.3991, 1.4275,
1.4559, 1.4843, 1.5126,
1.5410, 1.5694, 1.5978,
1.6262, 1.6545, 1.6829,
1.7113, 1.7397, 1.7680,
1.7964, 1.8248, 1.8532,
1.8816, 1.9099, 1.9383,
1.9667, 1.9951, 2.0234,
2.0518, 2.0802, 2.1086,
2.1370, 2.1653, 2.1937,
2.2221, 2.2505, 2.2788,
2.3072, 2.3356, 2.3640,
2.3924, 2.4207, 2.4491,
2.4775, 2.5059, 2.5342,
2.5626, 2.5910, 2.6194,
2.6478, 2.6761, 2.7045,
2.7329, 2.7613, 2.7896,
2.8180, 2.8464, 2.8748,
2.9032, 2.9315, 2.9599,
2.9883, 3.0167, 3.0450,
3.0734, 3.1018, 3.1302,
3.1586, 3.1869, 3.2153,
3.2437, 3.2721, 3.3005,
3.3288, 3.3572, 3.3856,
3.4140, 3.4423, 3.4707,
3.4991, 3.5275, 3.5559,
3.5842, 3.6126, 3.6410,

| | | | |
|---|-----------------|------|----------|
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3.6694,3.6977,3.7261,
3.7545,3.7829,3.8113,
3.8396,3.8680,3.8964,
3.9248,3.9531,3.9815,
4.0099,4.0383,4.0667,
4.0950,4.1234,4.1518,
4.1802,4.2085,4.2369,
4.2653,4.2937,4.3221,
4.3504,4.3788,4.4072,
4.4356,4.4639,4.4923,
4.5207,4.5491,4.5775,
4.6058,4.6342,4.6626,
4.6910,4.7193,4.7477,
4.7761,4.8045,4.8329,
4.8612,4.8896,4.9180,
4.9464,4.9748,5.0031,
5.0315,5.0599,5.0883)


BAND_BIN_WIDTH =
(0.0140,0.0140,0.0140,0.0140,0.0139,0.0139,
0.0139,0.0139,0.0139,0.0139,0.0139,0.0139,
0.0139,0.0138,0.0138,0.0138,0.0138,0.0137,
0.0137,0.0137,0.0137,0.0136,0.0136,0.0136,
0.0135,0.0135,0.0135,0.0135,0.0134,0.0134,
0.0134,0.0133,0.0133,0.0132,0.0132,0.0132,
0.0131,0.0131,0.0131,0.0130,0.0130,0.0129,
0.0129,0.0129,0.0128,0.0128,0.0127,0.0127,
0.0126,0.0126,0.0126,0.0125,0.0125,0.0125,
0.0124,0.0124,0.0123,0.0123,0.0123,0.0122,
0.0122,0.0122,0.0121,0.0121,0.0121,0.0120,
0.0120,0.0120,0.0119,0.0119,0.0119,0.0118,
0.0118,0.0118,0.0118,0.0117,0.0117,0.0117,
0.0117,0.0116,0.0116,0.0116,0.0116,0.0116,
0.0116,0.0115,0.0115,0.0115,0.0115,0.0115,
0.0115,0.0115,0.0115,0.0115,0.0115,0.0115,
0.0115,0.0115,0.0115,0.0115,0.0115,0.0115,
0.0116,0.0116,0.0116,0.0116,0.0117,0.0117,
0.0117,0.0117,0.0118,0.0118,0.0118,0.0118,
0.0119,0.0119,0.0120,0.0120,0.0121,0.0121,
0.0121,0.0122,0.0122,0.0123,0.0123,0.0124,
0.0125,0.0125,0.0126,0.0126,0.0127,0.0128,
0.0128,0.0129,0.0130,0.0130,0.0131,0.0132,
0.0133,0.0133,0.0134,0.0135,0.0136,0.0137,
0.0137,0.0138,0.0139,0.0140,0.0141,0.0142,
0.0143,0.0144,0.0145,0.0146,0.0147,0.0148,
0.0149,0.0150,0.0151,0.0152,0.0153,0.0154,
0.0156,0.0157,0.0158,0.0159,0.0160,0.0162,
0.0163,0.0164,0.0165,0.0167,0.0168,0.0169,
0.0171,0.0172,0.0173,0.0174,0.0176,0.0177,
0.0178,0.0180,0.0181,0.0183,0.0184,0.0185)

BAND_BIN_UNIT = MICROMETER

| | | | |
|---|-----------------|-------------|-----------------|
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BAND_BIN ORIGINAL_BAND =
 (2, 5, 8, 11, 14, 17, 20, 23, 26, 29, 32, 35,
 38, 41, 44, 47, 50, 53, 56, 59, 62, 65, 68, 71,
 74, 77, 80, 83, 86, 89, 92, 95, 98, 101, 104,
 107, 110, 113, 116, 119, 122, 125, 128, 131,
 134, 137, 140, 143, 146, 149, 152, 155, 158,
 161, 164, 167, 170, 173, 176, 179, 182, 185,
 188, 191, 194, 197, 200, 203, 206, 209, 212,
 215, 218, 219, 221, 224, 227, 230, 233, 236,
 239, 242, 245, 248, 251, 254, 257, 260, 263,
 266, 269, 272, 275, 278, 281, 284, 287, 290,
 293, 296, 299, 302, 305, 308, 311, 314, 317,
 320, 323, 326, 329, 332, 335, 338, 341, 344,
 347, 350, 353, 356, 359, 362, 365, 368, 371,
 374, 377, 380, 383, 386, 389, 392, 395, 398,
 401, 404, 407, 410, 413, 416, 419, 422, 425,
 428, 431)

END_GROUP = BAND_BIN

| | | | |
|---|-----------------|------|----------|
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APPENDIX C PDS_INP_VIS.TXT

"MTC_11-02-2010"

"DAWN VIR RAW (EDR) CRUISE CHECKOUT/CALIB VIS SPECTRA V1.0"

"DAWN-X-VIR-2-EDR-VIS-CRUISE-SPECTRA-V1.0"

1

"MARS-VESTA CRUISE (MVC) "

"NULL"

"NULL"

"N/A"


/* Spectral axis description */

GROUP = BAND_BIN

BAND_BIN_CENTER =

(0.255,0.257,0.259,0.261,0.263,0.265,0.266,0.268,0.270,0.272,0.274,0.276
0.278,0.280,0.282,0.284,0.285,0.287,0.289,0.291,0.293,0.295,0.297,0.299,
0.301,0.302,0.304,0.306,0.308,0.310,0.312,0.314,0.316,0.318,0.319,0.321,
0.323,0.325,0.327,0.329,0.331,0.333,0.335,0.336,0.338,0.340,0.342,0.344,
0.346,0.348,0.350,0.352,0.354,0.355,0.357,0.359,0.361,0.363,0.365,0.367,
0.369,0.371,0.372,0.374,0.376,0.378,0.380,0.382,0.384,0.386,0.388,0.389,
0.391,0.393,0.395,0.397,0.399,0.401,0.403,0.405,0.407,0.408,0.410,0.412,
0.414,0.416,0.418,0.420,0.422,0.424,0.425,0.427,0.429,0.431,0.433,0.435,
0.437,0.439,0.441,0.442,0.444,0.446,0.448,0.450,0.452,0.454,0.456,0.458,
0.459,0.461,0.463,0.465,0.467,0.469,0.471,0.473,0.475,0.477,0.478,0.480,
0.482,0.484,0.486,0.488,0.490,0.492,0.494,0.495,0.497,0.499,0.501,0.503,
0.505,0.507,0.509,0.511,0.512,0.514,0.516,0.518,0.520,0.522,0.524,0.526,
0.528,0.529,0.531,0.533,0.535,0.537,0.539,0.541,0.543,0.545,0.547,0.548,
0.550,0.552,0.554,0.556,0.558,0.560,0.562,0.564,0.565,0.567,0.569,0.571,
0.573,0.575,0.577,0.579,0.581,0.582,0.584,0.586,0.588,0.590,0.592,0.594,
0.596,0.598,0.600,0.601,0.603,0.605,0.607,0.609,0.611,0.613,0.615,0.617,
0.618,0.620,0.622,0.624,0.626,0.628,0.630,0.632,0.634,0.635,0.637,0.639,
0.641,0.643,0.645,0.647,0.649,0.651,0.652,0.654,0.656,0.658,0.660,0.662,
0.664,0.666,0.668,0.670,0.671,0.673,0.675,0.677,0.679,0.681,0.683,0.685,
0.687,0.688,0.690,0.692,0.694,0.696,0.698,0.700,0.702,0.704,0.705,0.707,
0.709,0.711,0.713,0.715,0.717,0.719,0.721,0.723,0.724,0.726,0.728,0.730,
0.732,0.734,0.736,0.738,0.740,0.741,0.743,0.745,0.747,0.749,0.751,0.753,
0.755,0.757,0.758,0.760,0.762,0.764,0.766,0.768,0.770,0.772,0.774,0.775,
0.777,0.779,0.781,0.783,0.785,0.787,0.789,0.791,0.793,0.794,0.796,0.798,
0.800,0.802,0.804,0.806,0.808,0.810,0.811,0.813,0.815,0.817,0.819,0.821,
0.823,0.825,0.827,0.828,0.830,0.832,0.834,0.836,0.838,0.840,0.842,0.844,
0.846,0.847,0.849,0.851,0.853,0.855,0.857,0.859,0.861,0.863,0.864,0.866,
0.868,0.870,0.872,0.874,0.876,0.878,0.880,0.881,0.883,0.885,0.887,0.889,
0.891,0.893,0.895,0.897,0.898,0.900,0.902,0.904,0.906,0.908,0.910,0.912,
0.914,0.916,0.917,0.919,0.921,0.923,0.925,0.927,0.929,0.931,0.933,0.934,
0.936,0.938,0.940,0.942,0.944,0.946,0.948,0.950,0.951,0.953,0.955,0.957,
0.959,0.961,0.963,0.965,0.967,0.968,0.970,0.972,0.974,0.976,0.978,0.980,
0.982,0.984,0.986,0.987,0.989,0.991,0.993,0.995,0.997,0.999,1.001,1.003,
1.004,1.006,1.008,1.010,1.012,1.014,1.016,1.018,1.020,1.021,1.023,1.025,
1.027,1.029,1.031,1.033,1.035,1.037,1.039,1.040,1.042,1.044,1.046,1.048,
1.050,1.052,1.054,1.056,1.057,1.059,1.061,1.063,1.065,1.067,1.069,1.071)

BAND_BIN_WIDTH =

| | | | |
|---|-----------------|------|----------|
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217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235,
236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254,
255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273,
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312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330,
331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349,
350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368,
369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387,
388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406,
407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425,
426, 427, 428, 429, 430, 431, 432)

END_GROUP = BAND_BIN

/* Spectral axis description */

GROUP = BAND_BIN

BAND_BIN_CENTER =
(0.25701, 0.26269, 0.26837,
0.27404, 0.27972, 0.28540,
0.29107, 0.29675, 0.30243,
0.30810, 0.31378, 0.31946,
0.32513, 0.33081, 0.33649,
0.34216, 0.34784, 0.35352,
0.35919, 0.36487, 0.37055,
0.37622, 0.38190, 0.38758,
0.39325, 0.39893, 0.40461,
0.41028, 0.41596, 0.42164,
0.42731, 0.43299, 0.43867,
0.44434, 0.45002, 0.45570,
0.46137, 0.46705, 0.47273,
0.47840, 0.48408, 0.48976,
0.49543, 0.50111, 0.50679,
0.51246, 0.51814, 0.52382,
0.52949, 0.53517, 0.54085,
0.54652, 0.55220, 0.55788,
0.56355, 0.56923, 0.57491,
0.58058, 0.58626, 0.59194,
0.59761, 0.60329, 0.60897,
0.61464, 0.62032, 0.62600,
0.63167, 0.63735, 0.64303,
0.64870, 0.65438, 0.66006,
0.66574, 0.67141, 0.67709,
0.68277, 0.68844, 0.69412,
0.69980, 0.70547, 0.71115,
0.71683, 0.72250, 0.72818,
0.73386, 0.73953, 0.74521,
0.75089, 0.75656, 0.76224,
0.76792, 0.77359, 0.77927,
0.78495, 0.79062, 0.79630,


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0.80198,0.80765,0.81333,
0.81901,0.82468,0.83036,
0.83604,0.84171,0.84739,
0.85307,0.85874,0.86442,
0.87010,0.87577,0.88145,
0.88713,0.89280,0.89848,
0.90416,0.90983,0.91551,
0.92119,0.92686,0.93254,
0.93822,0.94389,0.94957,
0.95525,0.96092,0.96660,
0.97228,0.97795,0.98363,
0.98931,0.99498,1.00066,
1.00634,1.01201,1.01769,
1.02337,1.02904,1.03472,
1.04040,1.04607,1.05175,
1.05743,1.06310,1.06878)

BAND_BIN_WIDTH =
(0.0021,0.0021,0.0021,
0.0021,0.002,0.002,0.002,0.002,
0.002,0.002,0.002,0.002,0.002,
0.002,0.0019,0.0019,0.0019,0.0019,
0.0019,0.0019,0.0019,0.0019,0.0019,
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0.0019,0.0019,0.0019,0.0019,0.0019,
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0.0019,0.0019,0.002,0.002,0.002,
0.002,0.002,0.002,0.002,0.002,
0.002,0.002,0.002,0.002,0.002,
0.002,0.002,0.002,0.002,0.002,
0.002,0.002,0.002,0.002,0.002,
0.002,0.002,0.002,0.002,0.0021)


BAND_BIN_UNIT = MICROMETER

BAND_BIN_ORIGINAL_BAND =
(2,5,8,11,14,17,20,23,26,29,32,35,

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|---|-----------------|-------------|-----------------|
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38, 41, 44, 47, 50, 53, 56, 59, 62, 65, 68, 71,
74, 77, 80, 83, 86, 89, 92, 95, 98, 101, 104,
107, 110, 113, 116, 119, 122, 125, 128, 131,
134, 137, 140, 143, 146, 149, 152, 155, 158,
161, 164, 167, 170, 173, 176, 179, 182, 185,
188, 191, 194, 197, 200, 203, 206, 209, 212,
215, 218, 219, 221, 224, 227, 230, 233, 236,
239, 242, 245, 248, 251, 254, 257, 260, 263,
266, 269, 272, 275, 278, 281, 284, 287, 290,
293, 296, 299, 302, 305, 308, 311, 314, 317,
320, 323, 326, 329, 332, 335, 338, 341, 344,
347, 350, 353, 356, 359, 362, 365, 368, 371,
374, 377, 380, 383, 386, 389, 392, 395, 398,
401, 404, 407, 410, 413, 416, 419, 422, 425,
428, 431)

END_GROUP = BAND_BIN

| | | | |
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APPENDIX D LABEL VIR

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PDS_VERSION_ID = PDS3
LABEL_REVISION_NOTE = "MTC_11-02-2010"

/* Dataset and Product Information */
DATA_SET_NAME = "DAWN VIR RAW (EDR) CRUISE CHECKOUT/CALIB IR SPECTRA V1.0"
DATA_SET_ID = "DAWN-X-VIR-2-EDR-IR-CRUISE-SPECTRA-V1.0"
PRODUCT_ID = "VIR_IR_1A_1_288176312_1.QUB"
PRODUCT_TYPE = EDR
PRODUCER_FULL_NAME = "A. CORADINI"
PRODUCER_INSTITUTION_NAME = "ISTITUTO NAZIONALE DI ASTROFISICA"
PRODUCT_CREATION_TIME = 2010-02-11T19:59:36.00
PRODUCT_VERSION_ID = "01"

/* File Information */
RECORD_TYPE = FIXED_LENGTH
RECORD_BYTES = 512
FILE_RECORDS = 15289
LABEL_RECORDS = 49

/* Time Information */
START_TIME = 2009-02-17T20:57:30.171
STOP_TIME = 2009-02-17T21:10:20.320
IMAGE_MID_TIME = 2009-02-17T21:03:55.245
SPACECRAFT_CLOCK_START_COUNT = "1/288176312.1098"
SPACECRAFT_CLOCK_STOP_COUNT = "1/288177073.7980"

/* Mission description parameters */
INSTRUMENT_HOST_NAME = "DAWN"
INSTRUMENT_HOST_ID = "DAWN"
MISSION_PHASE_NAME = "MARS-VESTA CRUISE (MVC)"


/* Instrument description parameters */
INSTRUMENT_NAME = "VISIBLE AND INFRARED SPECTROMETER"
INSTRUMENT_ID = "VIR"
INSTRUMENT_TYPE = "IMAGING SPECTROMETER"

/* Celestial Geometry */
RIGHT_ASCENSION = 36.590 <degree>
DECLINATION = 17.693 <degree>
TWIST_ANGLE = 19.639 <degree>
CELESTIAL_NORTH_CLOCK_ANGLE = 160.361 <degree>
QUATERNION = ( 0.23453
              -0.35112
              -0.47409
              -0.77263 )

QUATERNION_DESC = "
  Above parameters are calculated at the center time of the observation
  which is 2009-02-17T21:04:04.112. The quaternion has the form:
  w, x, y, z (i.e. SPICE format)."

/* Solar geometry */

```

| | | | |
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```
SPACECRAFT_SOLAR_DISTANCE = 210732914.1 <km>
SC_SUN_POSITION_VECTOR = ( -95213332.8 <km>
                          169894673.1 <km>
                          80489641.4 <km> )
```

```
SC_SUN_VELOCITY_VECTOR = ( -20.493 <km/s>
                           -13.970 <km/s>
                           -5.823 <km/s> )
```

```
/* SPICE Kernels */
SPICE_FILE_NAME = "dawn_MGA.mk"
```

```
TARGET_NAME = "NULL"
TARGET_TYPE = "NULL"
```

```
/* COORDINATE SYSTEM */
COORDINATE_SYSTEM_NAME = "N/A"
COORDINATE_SYSTEM_CENTER_NAME = "N/A"
```


```
/* Geometry in "VESTA_FIXED" coordinates from SPICE */
SUB_SPACECRAFT_LATITUDE = "N/A"
SUB_SPACECRAFT_LONGITUDE = "N/A"
SUB_SPACECRAFT_AZIMUTH = "N/A"
SPACECRAFT_ALTITUDE = "N/A"
TARGET_CENTER_DISTANCE = "N/A"
ORBIT_NUMBER = "N/A"
SC_TARGET_POSITION_VECTOR = ( "N/A"
                              "N/A"
                              "N/A" )
```

```
SC_TARGET_VELOCITY_VECTOR = ( "N/A"
                              "N/A"
                              "N/A" )
```

```
LOCAL_HOUR_ANGLE = "N/A"
SUB_SOLAR_LATITUDE = "N/A"
SUB_SOLAR_LONGITUDE = "N/A"
SUB_SOLAR_AZIMUTH = "N/A"
```

```
/* Illumination */
INCIDENCE_ANGLE = "N/A"
EMISSION_ANGLE = "N/A"
PHASE_ANGLE = "N/A"
```

```
/* Image parameters */
SLANT_DISTANCE = "N/A"
MINIMUM_LATITUDE = "N/A"
CENTER_LATITUDE = "N/A"
MAXIMUM_LATITUDE = "N/A"
WESTERNMOST_LONGITUDE = "N/A"
CENTER_LONGITUDE = "N/A"
EASTERNMOST_LONGITUDE = "N/A"
HORIZONTAL_PIXEL_SCALE = "N/A"
VERTICAL_PIXEL_SCALE = "N/A"
```

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NORTH_AZIMUTH = "N/A"


```

/* Data description parameters */
PROCESSING_LEVEL_ID = 2
DATA_QUALITY_ID = 1
DATA_QUALITY_DESC = "0:INCOMPLETE; 1:COMPLETE"
TELEMETRY_SOURCE_ID = "EGSE"
CHANNEL_ID = "IR"
SOFTWARE_VERSION_ID = "EGSE V1.14,AMDLSpace"

/* Instrument status */
INSTRUMENT_MODE_ID = "C_H_SPE_H_SPA_F"
INSTRUMENT_MODE_DESC =
  "S_H_SPE_H_SPA_F: Science, high spectral high spatial, Full slit
  S_H_SPE_L_SPA_F: Science, high spectral low spatial, Full slit
  S_H_SPE_L_SPA_F_SUM: Science, high spectral low spatial, Summing
  S_L_SPE_H_SPA_F: Science, Low spectral high spatial, Full slit
  S_L_SPE_L_SPA_F: Science, Low spectral low spatial, Full slit
  S_L_SPE_L_SPA_F_SUM: Science, Low spectral low spatial, Summing
  S_H_SPE_H_SPA_Q: Science, high spectral high spatial, Quarter slit
  S_L_SPE_H_SPA_Q: Science, low spectral high spatial, Quarter slit
  S_H_SPE_L_SPA_F_MEA: Science, high spectral low spatial, Meaning
  S_L_SPE_L_SPA_F_MEA: Science, low spectral low spatial, Meaning
  C_H_SPE_H_SPA_F: Calibration, high spectral high spatial, Full slit
  C_H_SPE_L_SPA_F: Calibration, high spectral low spatial, Full slit
  SPARE: CALIBRATION Spare
  C_L_SPE_H_SPA_F: Calibration, low spectral high spatial, Full slit
  C_L_SPE_L_SPA_F: Calibration, low spectral low spatial, Full slit
  C_H_SPE_H_SPA_Q: Calibration, high spectral high spatial, Quarter slit
  C_L_SPE_H_SPA_Q: Calibration, low spectral high spatial, Quarter slit"
ENCODING_TYPE = "0"
SCAN_MODE_ID = 4
SCAN_PARAMETER = (-3.8, -3.7, 4500, 25)
SCAN_PARAMETER_DESC = ("SCAN_START_ANGLE", "SCAN_STOP_ANGLE",
  "SCAN_STEP_ANGLE", "SCAN_STEP_NUMBER")
DAWN:SCAN_PARAMETER_UNIT = (DEG, DEG, DEG, DIMENSIONLESS)
FRAME_PARAMETER = (0.0, 1, 20, 0)
FRAME_PARAMETER_DESC = ("EXPOSURE_DURATION", "FRAME_SUMMING",
  "EXTERNAL_REPETITION_TIME", "DARK_ACQUISITION_RATE")
DAWN:FRAME_PARAMETER_UNIT = (S, DIMENSIONLESS, S, DIMENSIONLESS)
DAWN:VIR_IR_START_X_POSITION=1
DAWN:VIR_IR_START_Y_POSITION=7
MAXIMUM_INSTRUMENT_TEMPERATURE = (81.5, 141.6, 142.6, 74.6)
INSTRUMENT_TEMPERATURE_POINT = ("FOCAL_PLANE", "TELESCOPE", "SPECTROMETER",
  "CRYOCOOLER")
DAWN:INSTRUMENT_TEMPERATURE_UNIT = (K, K, K, K)
PHOTOMETRIC_CORRECTION_TYPE = NONE

/* Pointers to first record of objects in file */
^HISTORY = 50
OBJECT = HISTORY
END_OBJECT = HISTORY
^QUBE = 51

```

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```
/* Description of the object contained in the file */
OBJECT = QUBE
```


```
/* Standard cube Keywords */
AXES = 3
AXIS_NAME = (BAND, SAMPLE, LINE)
CORE_ITEMS = ( 432, 256, 35 )
CORE_ITEM_BYTES = 2
CORE_ITEM_TYPE = MSB_INTEGER
CORE_BASE = 0.0
CORE_MULTIPLIER = 1.0
CORE_VALID_MINIMUM = "NULL"
CORE_NULL = "NULL"
CORE_LOW_REPR_SATURATION = -32767
CORE_LOW_INSTR_SATURATION = -32767
CORE_HIGH_REPR_SATURATION = -32767
CORE_HIGH_INSTR_SATURATION = -32767
CORE_NAME = RAW_DATA_NUMBER
CORE_UNIT = DIMENSIONLESS
```

```
/* Suffix definition */
SUFFIX_BYTES = 4
SUFFIX_ITEMS = ( 0, 1, 0 )
SAMPLE_SUFFIX_NAME = "HOUSEKEEPING PARAMETERS"
SAMPLE_SUFFIX_UNIT = DIMENSIONLESS
SAMPLE_SUFFIX_ITEM_BYTES = 4
SAMPLE_SUFFIX_ITEM_TYPE = MSB_INTEGER
SAMPLE_SUFFIX_BASE = 0.0
SAMPLE_SUFFIX_MULTIPLIER = 1.0
SAMPLE_SUFFIX_VALID_MINIMUM = "NULL"
SAMPLE_SUFFIX_NULL = 65535
SAMPLE_SUFFIX_LOW_REPR_SAT = 0
SAMPLE_SUFFIX_LOW_INSTR_SAT = 0
SAMPLE_SUFFIX_HIGH_REPR_SAT = 65535
SAMPLE_SUFFIX_HIGH_INSTR_SAT = 65535
```

```
/* Spectral axis description */
```

```
GROUP = BAND_BIN
```


```
BAND_BIN_CENTER =
(1.021,1.030,1.040,1.049,1.059,1.068,1.078,1.087,1.096,1.106,1.115,1.125,
1.134,1.144,1.153,1.163,1.172,1.182,1.191,1.200,1.210,1.219,1.229,1.238,
1.248,1.257,1.267,1.276,1.286,1.295,1.305,1.314,1.323,1.333,1.342,1.352,
1.361,1.371,1.380,1.390,1.399,1.409,1.418,1.428,1.437,1.446,1.456,1.465,
1.475,1.484,1.494,1.503,1.513,1.522,1.532,1.541,1.550,1.560,1.569,1.579,
1.588,1.598,1.607,1.617,1.626,1.636,1.645,1.655,1.664,1.673,1.683,1.692,
1.702,1.711,1.721,1.730,1.740,1.749,1.759,1.768,1.777,1.787,1.796,1.806,
1.815,1.825,1.834,1.844,1.853,1.863,1.872,1.882,1.891,1.900,1.910,1.919,
1.929,1.938,1.948,1.957,1.967,1.976,1.986,1.995,2.005,2.014,2.023,2.033,
2.042,2.052,2.061,2.071,2.080,2.090,2.099,2.109,2.118,2.127,2.137,2.146,
2.156,2.165,2.175,2.184,2.194,2.203,2.213,2.222,2.232,2.241,2.250,2.260,
2.269,2.279,2.288,2.298,2.307,2.317,2.326,2.336,2.345,2.355,2.364,2.373,
2.383,2.392,2.402,2.411,2.421,2.430,2.440,2.449,2.459,2.468,2.477,2.487,
```

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2.496,2.506,2.515,2.525,2.534,2.544,2.553,2.563,2.572,2.582,2.591,2.600,
2.610,2.619,2.629,2.638,2.648,2.657,2.667,2.676,2.686,2.695,2.705,2.714,
2.723,2.733,2.742,2.752,2.761,2.771,2.780,2.790,2.799,2.809,2.818,2.827,
2.837,2.846,2.856,2.865,2.875,2.884,2.894,2.903,2.913,2.922,2.932,2.941,
2.950,2.960,2.969,2.979,2.988,2.998,3.007,3.017,3.026,3.036,3.045,3.055,
3.064,3.073,3.083,3.092,3.102,3.111,3.121,3.130,3.140,3.149,3.159,3.168,
3.177,3.187,3.196,3.206,3.215,3.225,3.234,3.244,3.253,3.263,3.272,3.282,
3.291,3.300,3.310,3.319,3.329,3.338,3.348,3.357,3.367,3.376,3.386,3.395,
3.405,3.414,3.423,3.433,3.442,3.452,3.461,3.471,3.480,3.490,3.499,3.509,
3.518,3.527,3.537,3.546,3.556,3.565,3.575,3.584,3.594,3.603,3.613,3.622,
3.632,3.641,3.650,3.660,3.669,3.679,3.688,3.698,3.707,3.717,3.726,3.736,
3.745,3.754,3.764,3.773,3.783,3.792,3.802,3.811,3.821,3.830,3.840,3.849,
3.859,3.868,3.877,3.887,3.896,3.906,3.915,3.925,3.934,3.944,3.953,3.963,
3.972,3.982,3.991,4.000,4.010,4.019,4.029,4.038,4.048,4.057,4.067,4.076,
4.086,4.095,4.104,4.114,4.123,4.133,4.142,4.152,4.161,4.171,4.180,4.190,
4.199,4.209,4.218,4.227,4.237,4.246,4.256,4.265,4.275,4.284,4.294,4.303,
4.313,4.322,4.332,4.341,4.350,4.360,4.369,4.379,4.388,4.398,4.407,4.417,
4.426,4.436,4.445,4.454,4.464,4.473,4.483,4.492,4.502,4.511,4.521,4.530,
4.540,4.549,4.559,4.568,4.577,4.587,4.596,4.606,4.615,4.625,4.634,4.644,
4.653,4.663,4.672,4.682,4.691,4.700,4.710,4.719,4.729,4.738,4.748,4.757,
4.767,4.776,4.786,4.795,4.804,4.814,4.823,4.833,4.842,4.852,4.861,4.871,
4.880,4.890,4.899,4.909,4.918,4.927,4.937,4.946,4.956,4.965,4.975,4.984,
4.994,5.003,5.013,5.022,5.032,5.041,5.050,5.060,5.069,5.079,5.088,5.098)

BAND_BIN_WIDTH =

(0.0140,0.0140,0.0140,0.0140,0.0140,0.0140,0.0140,0.0140,0.0140,0.0139,
0.0139,0.0139,0.0139,0.0139,0.0139,0.0139,0.0139,0.0139,0.0139,0.0139,0.0139,
0.0139,0.0139,0.0139,0.0139,0.0139,0.0139,0.0139,0.0139,0.0138,0.0138,0.0138,
0.0138,0.0138,0.0138,0.0138,0.0138,0.0138,0.0138,0.0137,0.0137,0.0137,0.0137,
0.0137,0.0137,0.0137,0.0137,0.0137,0.0136,0.0136,0.0136,0.0136,0.0136,0.0136,
0.0136,0.0135,0.0135,0.0135,0.0135,0.0135,0.0135,0.0135,0.0134,0.0134,0.0134,
0.0134,0.0134,0.0134,0.0134,0.0133,0.0133,0.0133,0.0133,0.0133,0.0133,0.0132,
0.0132,0.0132,0.0132,0.0132,0.0132,0.0131,0.0131,0.0131,0.0131,0.0131,0.0131,
0.0130,0.0130,0.0130,0.0130,0.0130,0.0129,0.0129,0.0129,0.0129,0.0129,0.0129,
0.0128,0.0128,0.0128,0.0128,0.0128,0.0128,0.0127,0.0127,0.0127,0.0127,0.0127,
0.0126,0.0126,0.0126,0.0126,0.0126,0.0126,0.0125,0.0125,0.0125,0.0125,0.0125,
0.0125,0.0124,0.0124,0.0124,0.0124,0.0124,0.0124,0.0123,0.0123,0.0123,0.0123,
0.0123,0.0123,0.0122,0.0122,0.0122,0.0122,0.0122,0.0122,0.0121,0.0121,0.0121,
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0.0115,0.0116,0.0116,0.0116,0.0116,0.0116,0.0116,0.0116,0.0116,0.0116,0.0116,
0.0116,0.0117,0.0117,0.0117,0.0117,0.0117,0.0117,0.0117,0.0117,0.0117,0.0118,
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0.0119,0.0120,0.0120,0.0120,0.0120,0.0120,0.0121,0.0121,0.0121,0.0121,0.0121,
0.0122,0.0122,0.0122,0.0122,0.0122,0.0123,0.0123,0.0123,0.0123,0.0124,0.0124,
0.0124,0.0124,0.0125,0.0125,0.0125,0.0125,0.0126,0.0126,0.0126,0.0126,0.0127,
0.0127,0.0127,0.0128,0.0128,0.0128,0.0128,0.0129,0.0129,0.0129,0.0130,0.0130,

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0.0130,0.0131,0.0131,0.0131,0.0132,0.0132,0.0132,0.0133,0.0133,0.0133,0.0134,
0.0134,0.0134,0.0135,0.0135,0.0135,0.0136,0.0136,0.0137,0.0137,0.0137,0.0138,
0.0138,0.0139,0.0139,0.0139,0.0140,0.0140,0.0141,0.0141,0.0141,0.0142,0.0142,
0.0143,0.0143,0.0144,0.0144,0.0144,0.0145,0.0145,0.0146,0.0146,0.0147,0.0147,
0.0148,0.0148,0.0148,0.0149,0.0149,0.0150,0.0150,0.0151,0.0151,0.0152,0.0152,
0.0153,0.0153,0.0154,0.0154,0.0155,0.0155,0.0156,0.0156,0.0157,0.0157,0.0158,
0.0158,0.0159,0.0159,0.0160,0.0160,0.0161,0.0162,0.0162,0.0163,0.0163,0.0164,
0.0164,0.0165,0.0165,0.0166,0.0167,0.0167,0.0168,0.0168,0.0169,0.0169,0.0170,
0.0171,0.0171,0.0172,0.0172,0.0173,0.0173,0.0174,0.0175,0.0175,0.0176,0.0176,
0.0177,0.0178,0.0178,0.0179,0.0180,0.0180,0.0181,0.0181,0.0182,0.0183,0.0183,
0.0184,0.0185,0.0185,0.0186)

BAND_BIN_UNIT = MICROMETER

BAND_BIN_ORIGINAL_BAND =

(1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,
29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,
54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,
79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100,101,102,
103,104,105,106,107,108,109,110,111,112,113,114,115,116,117,118,119,120,121,
122,123,124,125,126,127,128,129,130,131,132,133,134,135,136,137,138,139,140,
141,142,143,144,145,146,147,148,149,150,151,152,153,154,155,156,157,158,159,
160,161,162,163,164,165,166,167,168,169,170,171,172,173,174,175,176,177,178,
179,180,181,182,183,184,185,186,187,188,189,190,191,192,193,194,195,196,197,
198,199,200,201,202,203,204,205,206,207,208,209,210,211,212,213,214,215,216,
217,218,219,220,221,222,223,224,225,226,227,228,229,230,231,232,233,234,235,
236,237,238,239,240,241,242,243,244,245,246,247,248,249,250,251,252,253,254,
255,256,257,258,259,260,261,262,263,264,265,266,267,268,269,270,271,272,273,
274,275,276,277,278,279,280,281,282,283,284,285,286,287,288,289,290,291,292,
293,294,295,296,297,298,299,300,301,302,303,304,305,306,307,308,309,310,311,
312,313,314,315,316,317,318,319,320,321,322,323,324,325,326,327,328,329,330,
331,332,333,334,335,336,337,338,339,340,341,342,343,344,345,346,347,348,349,
350,351,352,353,354,355,356,357,358,359,360,361,362,363,364,365,366,367,368,
369,370,371,372,373,374,375,376,377,378,379,380,381,382,383,384,385,386,387,
388,389,390,391,392,393,394,395,396,397,398,399,400,401,402,403,404,405,406,
407,408,409,410,411,412,413,414,415,416,417,418,419,420,421,422,423,424,425,
426,427,428,429,430,431,432)

END_GROUP = BAND_BIN

END_OBJECT = QUBE
END

APPENDIX E ALGORITHM

