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Planetary Missions Division

ROSETTA-COSIMA

To Planetary Science Archive Interface Control Document

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Prepared by: Maria Genzer, Jouni Rynö, FMI

Approved by: Johan Silen, FMI

Distribution List

Recipient	Organisation	Recipient

Change Log

Date	Sections Changed	Reasons for Change
1 March 2004	All sections	Draft 2
23.January.2006	All sections	First official release
9 October. 2006	1.5, 2, 3,4.3	Dataset delivery scheme updated, geometry information added. All the labels updated
12 December 2008		Spectrum data contains mass scale
3 February 2011	2.3, 2.4.1, 3.2.3, 4.3	New formats for images, new products for scans and heating

TBD ITEMS

Section	Description

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1 Introduction

1.1 Purpose and Scope

The purpose of this EAICD (Experimenter to (Science) Archive Interface Control Document) is two fold. First it provides users of the the COSIMA instrument with a detailed description of the product and a description of how it was generated, including data sources and destinations. Secondly, it is the official interface between the COSIMA instrument team and Rosetta archiving authority.

1.2 Archiving Authorities

ESA's Planetary Science Archive (PSA).

1.3 Contents

This document describes the data flow of the COSIMA instrument on ROSETTA from the spacecraft until the insertion into the PSA for ESA. It includes information on how data were processed, formatted, labeled and uniquely identified. The document discusses general naming schemes for data volumes, data sets, data and label files. Standards used to generate the product are explained. Software that may be used to access the product is explained further on.

The design of the data set structure and the data product is given. Examples of these are given in the appendix.

1.4 Intended Readership

The staff of the archiving authority (Planetary Science Archive, ESA, RSSD, design team) and any potential user of the COSIMA data.

1.5 Applicable and Reference Documents

[AD-01] Planetary Data System Data Preparation Workbook, February 17, 1995, Version 3.1, JPL, D-7669, Part 1

[AD-02] Planetary Data System Standards Reference, August 1, 2003, Version 3.6, JPL, D-7669, Part 2

[AD-03] ROSETTA Archive Generation, Validation and Transfer Plan, October 6, 2005, RO-EST-PL-5011, Issue 2, Revision 2

[AD-04] Rosetta Time Handling, February 28, 2006, RO-EST-TN-3165, Issue 1, Revision 1

[RD-01] COSIMA User Manual, Version 3.7, 16 June 2010

[RD-02] Kissel et al:"Kissel, J. et al., COSIMA - High resolution time-of-flight secondary ion mass spectrometer for the analysis of cometary dust particles onboard Rosetta, Space Sci. Rev., 128(1-4), 823-867, doi:10.1007/s11214-006-9083-0, 2007

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[RD-08] Kissel, J. and F.R. Krueger: “The Organic Component in Dust From Comet Halley as Measured by the PUMA Mass-Spectrometer on Board VEGA 1", NATURE 326, 755–760, 1987.

[RD-09] Krueger, F.R.: “Dust Collector Materials for SIMS Analysis in Space”, A Feasibility Study for CoMA, part 1, Aug. 1988, part 2, Jan. 1989, and part 3, Sept. 1989.

[RD-10] Krueger, F.R., A. Korth, and J. Kissel: "The Organic Matter of Comet Halley as Inferred by Joint Gas Phase and Solid Phase Analyses", Space Science Reviews 56, 167–175, 1991.

[RD-11] Mamyrin B.A., V.I. Karatyev, D.V. Shmikk, and V.A. Zagulin: “Mass-Reflectron - A New High-Resolution Nonmagnetic Time-of-Flight Mass-Spectrometer” Zh Eksp. i Teor. Fiz. 64, 82 or: Sov. Phys. JETP 37, No.1, July 1973.

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[RD-15] Stephan, T.: “TOF-SIMS in Cosmochemistry”, Planet. Space Sci., 49, 859–906, 2001.

[RD-16] Varmuza K., W. Werther, F.R. Krueger, J. Kissel, E.R. Schmid: “Organic substances in cometary grains: Comparison of secondary ion mass spectral data and californium-252 plasma desorption data from reference compounds”, Int. J. Mass Spectrom., 189, 79-92, 1999.

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1.6 Acronyms and Abbreviations

ANCDR	Ancillary Data Record
COSIMA	Cometary Secondary Ion Mass Analyzer
DDS	Data Distribution System
ESA	European Space Agency
FM	Flight Model
FMI	Finnish Meteorological Institute
HVC	High Voltage Control
LVC	Low Voltage Control
MPS	Max-Planc-Institut für Sonnensystemforschung
PDS	Planetary Data System

PIS	Primary Ion Source
PIBS	Primary Ion Beam System
PDF	Portable Document Format
PSA	Planetary Science Archive
REFDR	Reformatted Data Record
RSDB	Rosetta Database
SIMS	Secondary Ion Mass Spectrometer
TBC	To Be Confirmed
TBD	To Be Defined
TBW	To Be Written
TDC	Time-to-Digital Converter
TMU	Target Manipulator Unit
TOF	Time-Of-Flight
UTC	Universal Time Coordinated

1.7 Contact Names and Addresses

PDS datasets:

Finnish Meteorological Institute
Johan Silén, Jouni Rynö, Maria Genzer
E-mail: *firstname.lastname*@fmi.fi
Tel: + 358 9 19291
Fax: + 358 9 1929 4603

Address:

Finnish Meteorological Institute
Space Research
P.O. Box 503
00101 Helsinki, Finland

Science issues:

Dr. Martin Hilchenbach
Max-Planck-Institut für Sonnensystemforschung
Max-Planck-Str. 2
37191 Katlenburg-Lindau
Germany

Tel: +49 5556 979 162
Fax +49 5556 979 240

2 Overview of Instrument Design, Data Handling Process and Product Generation

2.1 Scientific Objectives

The in situ chemical analysis of solids in space is among the tasks which are technically most difficult. There are two main reasons for that: With a few exceptions solids in space are not abundant, and secondly it is not easy to remove small samples from the solid into the vacuum for the analysis in a mass spectrometer.

For COSIMA the objects of interest are cometary dust particles, which are abundant, indeed, in the neighbourhood of the comet nucleus. It remains, however, to collect and bring the particles to the entrance of the spectrometer.

Most mass spectrometers need parts of the sample to be analyzed, to carry an electronic charge. The process of removing an ion from the specimen is then the critical feature of the method to be chosen.

The only mass spectrometric data on cometary dust particles available to date, come from the dust impact mass spectrometers PIA and PUMA on the GIOTTO and VEGA spacecrafts, respectively. While other, remote, or indirect methods allow measurements of collective properties of the cometary dust, the mass spectrometers allowed the analysis of individual particles (cf Kissel et al. 1986a+b). Since then we know unambiguously that each particle is an intimate mixture of a mineral core and ices, and simple as well as complex organic molecules. Since the impact velocity was large (>60 km/s) mostly atomic ions were formed and analyzed in the Halley case. In a first attempt, however, Kissel and Krueger (1987) found evidence for the chemical nature of the organic cometary material. It is clear that not a few well known molecules constitute the cometary organics, but rather some chemical classes, with each being represented by a large number of individual substances. Indeed, it seems, that all stable molecules compatible with the chemical environment are formed and even cross-linked between them.

COSIMA therefore needed to be based on a method which is readily available in laboratory, and which allows for tracing the ion directly to the molecular and structural form in which it was present in the solid. Since the size distribution of the dust particles is known (cf, Mazets et al. 1987, McDonnell et al. 1989) a reasonable ionizing beam focus should be achieved under the limitations of space instrumentation. Even though the method would be destructive, its sensitivity should be high enough to allow several analyses at different depths for one individual, say 20 µm particle.

To satisfy all these requirements we choose the method of **S**econdary **I**on **M**ass **S**pectroscopy (SIMS). A fast primary ion, in this case $^{115}In^{+}$ at 10 keV, impacts the sample and releases by desorption molecules of the material under test, of which typically 0.1 to 10 % are ionized, the so-called secondary ions. For sensitivity reasons, the analysis of a rather large mass range should be achieved simultaneously, which in turn leads to the type of a time-of-flight mass spectrometer. The mass resolution must be high enough to resolve isobaric ions, at least between atomic and molecular ions. The total ion mass should at least cover 3500 Da. In total, the COSIMA instrument has the following main functional hardware elements:

- the dust collector and target manipulator (TMU),
- COSISCOPE, a microscope CCD camera for target inspection,
- the primary ion source,
- the mass spectrometer including the ion extraction optics and the ion detector
- Electronics and computer.

It should be mentioned at this point, that COSIMA did profit from but is not identical to the earlier development of the CoMA instrument for the NASA mission CRAF (Zscheeg, 1992) which was canceled in 1992.

The entire development of COSIMA was challenged by the complexity of the cometary material which has to be expected. This has focused the goal of COSIMA on the identification of chemical classes and functional groups rather than the identification of individual substances. Consequently the system must have the capability to use the methods of chemometry to compress the raw data on board, which helps to reduce the data volume without losing any of the chemical information.

There is also another important aspect for COSIMA, which comes from the rather long time the spacecraft travels from launch in 2004 until the core of the measurements takes place in 2014: Quite a large number of relevant results will be obtained from laboratory measurements with TOF SIMS, be it by the COSIMA team or be it in the published literature. In addition, NASA in its DISCOVERY program has several comet missions, which are expected to produce new, relevant data, before COSIMA enters its main analysis phase. Even if most of the flexibility is with the software involved, it is the hardware, which has to provide the resources necessary. Looking back at the fast development in the computer sector over the last ten years this alone is a demanding task, even without the complexity of an up to date analysis instrument.

The scientific return from COSIMA consists primarily of time-of-flight spectra supported by housekeeping data. In addition to this, a limited number of peaks presented as a peak list, may be available. The time-of-flight spectra are archived according to standard PDS rules. These spectra are calibrated to a preliminary mass scale by automatic software.

In addition to time-of-flight spectra, pictures of dust targets (substrates) taken by COSISCOPE camera, and lists of dust grains found on the targets, are also archived.

Operational history of each target substrate is given. The history contains information about substrate storage and expose periods, cleaning and heating actions, COSISCOPE camera images and grains lists and any spectra taken. The history product contains history from the moment substrates were installed in the COSIMA flight instrument.

2.2 Instrument sub-systems

COSIMA sub-systems are described in more detail in COSIMA paper [RD2]. Only a brief description is given here, as the paper can found in ASCII and in PDF form from the DOCUMENT directory.

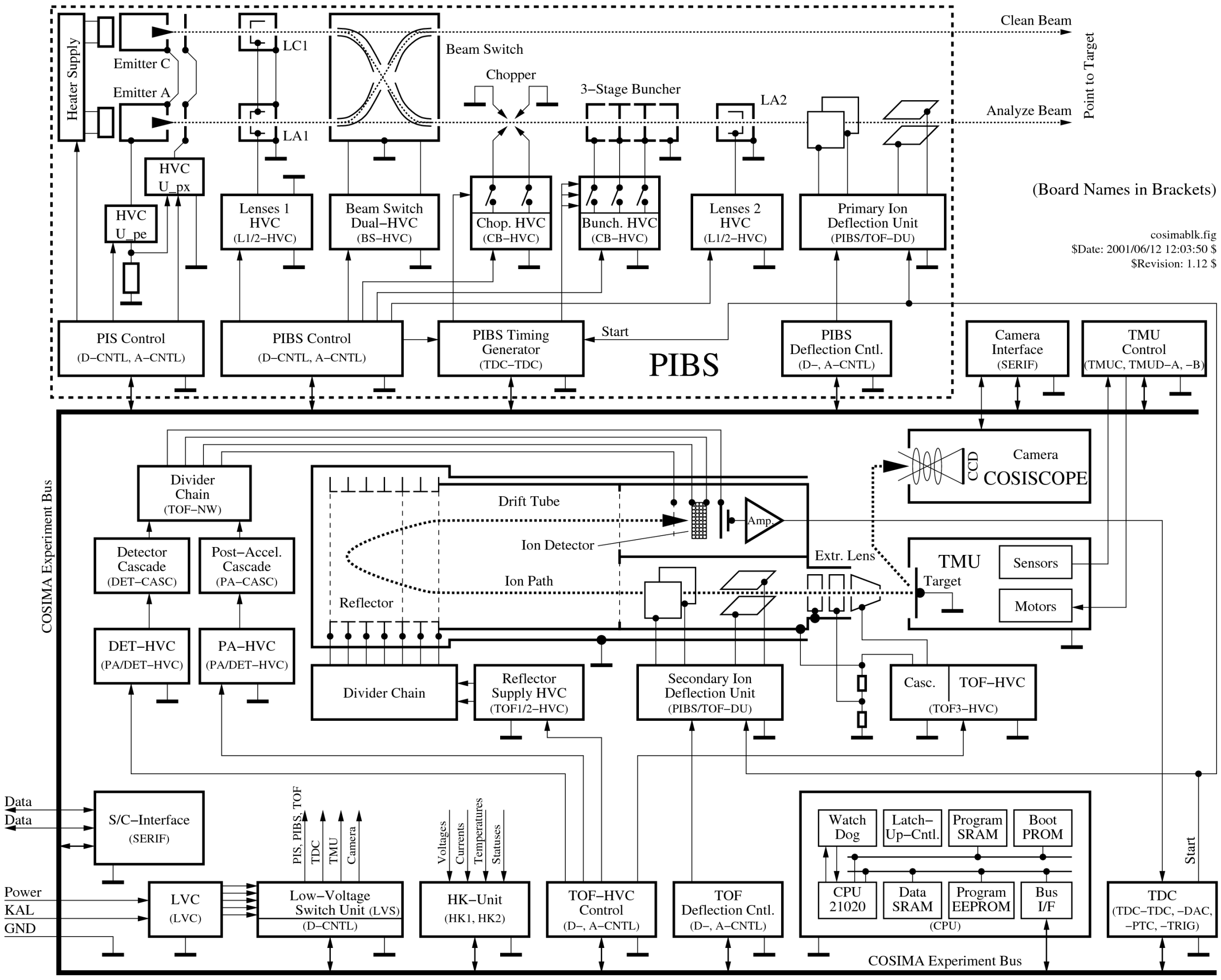

Figure 1: COSIMA subsystemFigures schematics

2.2.1 TMU

The Target Manipulator Unit keeps track of, stores and moves dust collection substrates in the instrument. There are total of 24 target holders, each containing 3 substrates. The substrate itself is a 10*10 millimeter plate, each having different chemical properties.The TMU can also be used to scan a substrate in front of an ion beam. The operation of the TMU is constrained by heat dissipation and is in general slow (tens of minutes per operation).

The substrates can have the following position identifications::

STORAGE, in target storage

IMAGE, substrate image

GRAINS, dust position list

PEAKS, peak list acquisition

SCAN, total count acquition

SPECTRUM, spectrum acquistion

EXPOSE, exposed to the outside, still in TMU grasp

COLLECT, exposed to the outside

CLEAN, at beam cleaning position

HEAT, at chemistry (heating) station

In the substrate history, if the substrate is not in the STORAGE, EXPOSE, COLLECT or HEAT position, it is grasped by the TMU and usually moved to the analysis position for SPECTRUM, SCAN or PEAKS or in front of the COSISCOPE for IMAGE or GRAINS.

The 24 target holders are numbered with hexadecimal numbers from #C1 to #D8. The top substrate is marked with the number #100, the middle with #200 and the low with #300. The combination of these numbers give the substrate identification number used in the instrument commanding and data handling.

The subsrates have the following properties:

#1C1	Palladium, black
#2C1	Platinum, deep black
#3C1	Platinum, deep black
#1C2	Silver, 73 micrometer thickness, blank with rectangular hole 3.5x3.5mm
#2C2	Silver, 69 micrometer thickness,blank with AgTe spot of about 3 mm size at center
#3C2	Gold, 17 micrometer thickness, olivine particles
#1C3	Gold, 8 micrometer thickness
#2C3	Gold, 15 micrometer thickness
#3C3	Gold, 20-30 micrometer thickness
#1C4	Palladium, black
#2C4	Silver, 14 micrometer thickness
#3C4	Gold, 12 micrometer thickness
#1C5	Platinum, light black,
#2C5	Platinum, deep black
#3C5	Gold, 13 micrometer thickness
#1C6	Platinum, deep black
#2C6	Platinum, deep black
#3C6	Gold, 8 micrometer thickness
#1C7	Silver, blank

#2C7	Silver, 21 micrometer thickness
#3C7	Gold, 15 micrometer thickness
#1C8	Platinum, deep black
#2C8	Platinum, deep black
#3C8	Gold, 20-30 micrometer thickness
#1C9	Gold, 5-8 micrometer thickness
#2C9	Gold, 5-8 micrometer thickness
#3C9	Gold, 11 micrometer thickness
#1CA	Gold, 5-8 micrometer thickness
#2CA	Gold, 16 micrometer thickness
#3CA	Silver, 10 micrometer thickness
#1CB	Gold, 17 micrometer thickness
#2CB	Gold, 14 micrometer thickness
#3CB	Gold, 20-30 micrometer thickness
#1CC	Silver, 21 micrometer thickness
#2CC	Silver, 21 micrometer thickness
#3CC	Silver, 24 micrometer thickness
#1CD	Gold, 5-8 micrometer thickness
#2CD	Gold, 14 micrometer thickness
#3CD	Gold, 20-30 micrometer thickness
#1CE	Gold, 5-8 micrometer thickness, Ag particles
#2CE	Gold, 11 micrometer thickness
#3CE	Gold, 20-30 micrometer thickness
#1CF	Gold, 8 micrometer thickness
#2CF	Gold, 12 micrometer thickness, Ag particles
#3CF	Gold, 20-30 micrometer thickness
#1D0	Gold, 20-30 micrometer thickness
#2D0	Gold, 20-30 micrometer thickness
#3D0	Gold, 20-30 micrometer thickness, Ag particles
#1D1	Silver, blank
#2D1	Gold, 13 micrometer thickness
#3D1	Gold, 13 micrometer thickness
#1D2	Gold, 8 micrometer thickness
#2D2	Gold, 8 micrometer thickness
#3D2	Silver, 30 micrometer thickness
#1D3	Silver, 10 micrometer thickness
#2D3	Silver, 10 micrometer thickness
#3D3	Silver, 32 micrometer thickness
#1D4	Platinum, sintered
#2D4	Platinum, deep black
#3D4	Platinum, deep black

#1D5	Platinum, deep black
#2D5	Silver, 22 micrometer thickness
#3D5	Silver, 21 micrometer thickness
#1D6	Platinum, deep black
#2D6	Palladium, black
#3D6	Platinum, deep black
#1D7	Silver, blank
#2D7	Platinum, sintered
#3D7	Platinum, sintered
#1D8	Silver, blank, square hole 3.5x3.5mm at center
#2D8	Silver, blank
#3D8	Gold, 8 micrometer thickness

Positions in the substrate are given in substrate coordinates, which have the origin at lower left corner and range from 0 to 10000 micrometers in both horizontal (X) and vertical (Y) direction.

2.2.2 COSISCOPE

COSISCOPE is a CCD camera that is used to take pictures of TMU target substrates and find dust grains on them. COSISCOPE returns CCD images and grain lists with dust grain coordinates, sizes and brightness properties. The gray image has a 10 bit depth with resolution of 1024*1024 pixels and covers an area of 14*14 millimeters.

The COSISCOPE pixel coordinates are converted to substrate coordinates, which have the origin at lower left corner and range from 0 to 10000 micrometers in both horizontal (X) and vertical (Y) direction.

2.2.3 Primary Ion Source (PIS)

The Primary Ion Source provides isotopically clean $^{115}In^{+}$. The ion source has a limited lifetime of nominally 2000 hours. After a long period of inactivity it may be difficult to start. The instrument contains two ion sources, both of which can be used. The startup of the PIS is slow (~ 0.5-1 hour). PIS has two ion sources, A (stands for ‘Analyse’) and C (stands for ‘Clean’). A is primarily used for analysis operations, and C for cleaning operations.

2.2.4 Primary Ion Beam System (PIBS)

The Primary Ion Beam System focuses, bunches and deflects ions into periodic pulse trains to hit the dust grains to be analyzed. The beam thickness is less than 100 μm and the pulse width a few ns. The PIBS can also be used to clean the target by a continuous beam. The instrument contains one analysis beam and one cleaning beam, each of which can use either ion source.

Ions from two emitters (A and C) can reach either of two positions: ‘Analyze’ or ‘Clean’, depending of the Beam Switch (BS) in the center. The focusing elements are electrically shared, as only one beam can be active at any time. Chopper and Bunchers (CB) provide the pulsed beam for analysis, the deflection plates (PX,PY) are used for steering the beam spot on the target.

On the analyse channel, a first lens LA1 (or LC1 in the backup configuration) gives an image of the emitter in the inlet plane of the CHOPPER, then the buncher compresses the ion beam into the short pulses required on the target. A second lens LA2 builds the final image on the target sample.

The other ion beam used for cleaning has a first lens LC1 (or LA1 in the backup configuration), which gives an image used by LC2 to build the final image on the target in the clean position. The ion beam for cleaning is not pulsed.

2.2.5 Time-Of-Flight Spectrometer (TOF)

The Time Of Flight spectrometer consists of an ion extraction part, an ion reflectron and a detector. The ion extraction section is equipped with deflection plates (TX, TY) to control which ions can reach the detector. The reflectron removes some energy dispersion of incident ions and improves the mass resolution of the instrument. The detector is of micro sphere type.

2.2.6 TDC

The Time to Digital Converter is a digital counter measuring the time of flight for each individual ion. The device is controlled by the onboard computer. The accumulated measurement represents the time-of-flight spectrum of COSIMA.

2.3 Data Handling Process

All PDS data products will be prepared at the Finnish Meteorological Institute (see chapter 1.7 for contact information). All data processing levels mentioned in this document are PSA-compliant, as defined in RO-EST-PL-5011.

Level 1a COSIMA data will be fetched from the Rosetta Data Distribution System (DDS) by FMI, where it will be processed to Level 2 (REFDR), and further to Level 3 products.

COSIMA Level 2 (REFDR) products are:

- Time-of-flight spectra, with automatically calibrated mass scale and relevant housekeeping data. Spectra can be of either Positive or Negative ions.
- Onboard calculated peak list and relevant housekeeping data. The spectrum is given as counts per integer mass lines, separated to organic and inorcanic massed.
- Scan over substrate position or some measurement control parameter and relevan housekeeping data. The data is total counts of the events from the time-of-flight spectra for three possible mass/time ranges. The time range of the scan can contain spectra or peak list data.
- Substrate heating information.
- Substrate cleaning with the ion bean and the related housekeeping data.
- Substrate images. The images can be illuminated with either plus (right) side or minus (left) side led.
- Substrate dust grain feature (position, size, brightness) lists and relevant housekeeping data.
- Substrate history (auxiliary data)

The mass scale is calibrated with only two lines:

- positive mode
  - H or ^{12}C for low masses
  - ^{115}In or ^{107}Ag or ^{109}Ag for high masses
- negative mode
  - H or CH for low masses
  - Cl or Br for high masses

There is no dead time correction nor background removal. The user should always check the calibration for any scientific analysis.

For the peak lists, the separation between organic and inorganic peaks is done according to the following formula:

Starting from the integer mass (M), the bin interval for the

- inorganic ions: M*1.0003 - Δm ... M*1.0003

- organic ions: M*1.0003 ... M*1.0003 + Δm

  where Δm = 0.2

For the calculated mass scale, a confidence number is calculated. This number is the procentual amount of counts inside the mass windows compared to the total counts. The mass window is defined as

m*f ± m^p*q, where

p = log(0.3/0.05)/log(300/12)

q = 0.0.5 / (12^p)

which gives mass 12±0.05 and mass 300±0.3. If suitable peaks to establish the scale cannot be found, the confidence number is 0.0% and the mass scale is calculated from the default values.

In the products PDS header there is a label DATA_QUALITY_ID. This is “-1”, when the mass scale is calculated by the software. In the future, when real comet dust spectra will be analyzed, the flag may change to inform, that the mass scale is established either by human or more advanced analysis software. When that happens, the product label will contain the description of the new flag values.

The HK data for the spectra and images is given in already calibrated form, without raw values. They can be used to check, if there's some instrument setup reason, why the spectrum signal to noise ratio or peak shape is as it is. The HK values don't contribute anything numerical to the spectrum mass scaling and are for background information only. The same goes with the image data.

It should be pointed out, that an established mass scale is already an interpretation of the data and regardless of the flag, each data user should check the scale.

2.4 Overview of Data Products

2.4.1 General

COSIMA contains 24 target holders, each having three different substrates for dust collection. From data analysis point of view, each substrate has different history. Each substrate can be exposed to dust, heated, imaged with COSISCOPE, and measured and cleaned by ion beam.

The data user should start the data analysis from the substrate history file stored in the substrate subdirectory in the data directory, The history files contain time ordered information from actions taken with the substrate in question. For exposure and storage there is only the time period. For the following products the archive pointer is given:

- time of flight ion spectrum. The main product of COSIMA, taken from a small area from the substrate surface. The preliminary mass scale is automatically generated with the equivalent software as onboard COSIMA for the peak list generation. For the comet phase data, the mass scale may also be established by a human or more advanced analysis software, case by case.

- peak list. The peak list is generated onboard COSIMA for integer mass lines for organic and inorganic masses separately. It may be used for pre-analysis of the grains, when full spectra would be too large to send due to operational and telemetry quota constrains

- scan. The measurement position or some measurement parameter is varied. The product is the total counts from the three possible time/mass ranges. During the scan COSIMA can also generate spectrum or peak data for each scan step value.

- image. The image is a COSISCOPE compressed image take from the whole substrate. The transmitted image may also contain only a subset of the image

- grain list. The COSISCOPE can detect individual dust grains from the substrate surface and provide them as a list with position, size and illumination characteristics.

- heat. The substrate is heated and the heat curve is available as the product.

- clean: The substrate is cleaned by the ion beam.

The relevant calibrated housekeeping data is provided together the data products for background information. They don't contribute anything numerical to the data products calibration.

During the ground calibration phase only few substrates were actively used for instrument calibration. These operations must be anyway used for background information in interpreting data during the comet phase.

Before the comet phase no real science is expected to be available from data.

Geometry information for the COSIMA products is not available. As the substrate exposure will take at least hours, often days, there is no simple way to tell, where the dust particles originate from. The data user should pick the exposure/collect period(s) from the substrate history file and make his/her own judgment. The time the individual spectrum or peak list product is made, has no connection to the time the dust particle is collected.

2.4.2 Software

2.4.2.1 Data processing software

An automatic script will retrieve data from the DDS and store it in an internal database. The housekeeping data will be plotted internally to check the general status of the instrument.

For PSA-compliant level 2 products generation (REFDR), data is retrieved from the internal database. The housekeeping data is calibrated with calibration coefficients stored in the RSDB, resulting in physical units. PDS data products are formed from mass spectra time series, parameter scan, substrate heating, substrate cleaning, COSISCOPE grain lists, COSISCOPE images, and calibrated housekeeping data. Peaks, images, and grain lists will need no additional calibration. In addition, target substrate history will be assembled as ancillary data products.

This software producing level 2 data from level 1b data stored in the internal database will be used only by the data producers and will not be archived.

Transformation of TOF spectra into mass spectra is done automatically with the equivalent software onboard the COSIMA instrument. See chapter 2.3.

2.4.2.2 Scientific analysis software

N/A. Data product files will be either ASCII TABLEs or FITS IMAGEs. For the FITS standard based images the DS9 software is recommend.

2.4.3 Documentation

The COSIMA instrument is extensively described in a paper “COSIMA, a High Resolution Time of Flight Spectrometer for Secondary Ion Mass Spectroscopy of Cometary Dust Particles” by Kissel et.al. [RD-02]. That paper together with this EAICD can be found from the DOCUMENT directory.

2.4.4 Derived and other Data Products

N/A

2.4.5 Ancillary Data Usage

The COSIMA instrument measures “off-line” in the sense that target assemblies are exposed independently of any spacecraft or COSIMA activity. For each target substrate, a list containing substrate history, including exposure time period, heating in the chemistry station, cleaning, analyzing and imaging is provided. The list is formatted as a table and stored in the same directory with the science products obtained from that substrate.

As stated in the 2.4.1, these history files are the starting point of the COSIMA data analysis.

3 Archive Format and Content

3.1 Deliveries and Archive Volume Format

There will be only one dataset available at all times. For all the pre-comet phases, it will be named RO-CAL-COSIMA-3-Vx.y. For the comet phase, the dataset name will be changed to RO-C-COSIMA-3-Vx.y.

For each delivery, the new data is incremented to the old data and the major version number is incremented by one. This scheme is used to make sure, that the data user always have the full substrate history available. The history products are essential in the spectrum interpretation and are the recommed starting point for the data browsing.The following delivery schedule is expected:

dataset ID	coverage	date
RO-CAL-COSIMA-2-V1.0	Ground calibration, commissioning, first cruise phases. No mass scale available	2006
RO-CAL-COSIMA-3-V2.0	adds active checkout data up to PC8	2008
RO-CAL-COSIMA-3-V3.0	adds active checkout data up to hibernation	2010
RO-C-COSIMA-3-V1.0	adds comet approach data	mid 2014
RO-C-COSIMA-3-V2.0	adds close observations data	end 2014
RO-C-COSIMA-3-V3.0	adds comet escort data	mid 2015
RO-C-COSIMA-3-V4.0	adds comet escort data	end 2015
RO-C-COSIMA-3-V5.0	adds comet escort data	mid 2016
RO-C-COSIMA-3-V6.0	adds final data	end 2016

The passive checkouts do not contribute much to the dataset, only one target is taken from the target storage and deposited back. No measurements are made.

The dataset is organized according to tree structure in the illustration 3.1.

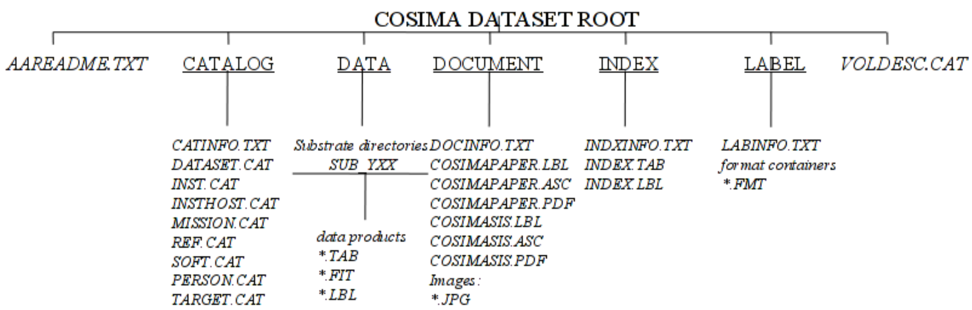

Illustration 3.1:

3.2 Conventions

3.2.1 Data Set ID Formation

Data set ID will be formed according to PDS standards and following the Rosetta Archive Plan (RO-EST-PL-5011). It will have the following components:

- Instrument host: RO

- Target: CAL for pre-flight data set, C for in-flight data set
- Instrument: COS
- Data processing level number, 3.
- Version number

The pre-comet dataset naming is thus starting from"RO-CAL-COSIMA-2-V1.0"

and changed in the comet phase to names starting from "RO-C-COSIMA-3-V1.0"

3.2.2 Data Directory Naming Convention

/DATA directory be divided to subdirectories for each Cosima target substrate. The subdirectory names will be of format SUB_*YXX*, where *Y* (1-3) is the substrate position in the target assembly, and *XX* is target assembly ID numbered from C1 to D8 hexadecimal. For example: SUB_1C1, SUB_2C1, etc. Substrate numbering is also explained in Chapter 4.1

3.2.3 Filenaming Convention *COSIMA data products will be named as follows:*

- Spectra: CS_*YXX*_*YYYYMMDD*T*hhmmss*_SP_*Z*.TAB, where *YXX* is substrate code as defined above (chapter 3.2.2), and *Z* is either 'P' for positive or 'N' for negative ions.
- Peak lists: CS_*YXX*_*YYYYMMDD*T*hhmmss*_PK_*Z*.TAB, where *YXX* and Z as above.
- Scan: CS_YXX_YYYYMMDDThhmmss_SCAN.TAB, where YXX as above
- Heat: CS_YXX_YYYYMMDDThhmmss_HEAT.TAB, where YXX as above
- Cleaning: CS_YXX_YYYYMMDDThhmmss_CLEA.TAB, where YXX as above
- Cosiscope images of substrates: CS_*YXX*_*YYYYMMDD*T*hhmmss*_IM_*Z*.IMG, where *YXX* as above, and *Z* is either 'P' for plus side led or 'M' for minus side led illumination.
- Grain lists: CS_*YXX*_*YYYYMMDD*T*hhmmss*_GR__.TAB, where *YXX* as above.
- Housekeeping files: CS_*YXX*_*YYYYMMDD*T*hhmmss*_S_HK.TAB (for spectra and peak lists), CS_YXX_YYYYMMDDThhmmss_SCHK (for scan housekeeping), CS_YXX_YYYYMMDDThhmmss_CLHK (for cleaning housekeeping) or CS_*YXX*_*YYYYMMDD*T*hhmmss*_G_HK.TAB (for images and grain lists). *YXX* as above.
- Substrate history (ancillary data): CS_*YXX*_SUBSTRATE_HIST.TAB

*YYYYMMDD*T*hhmmss* is the date and time of operation start in UTC.

3.3 Standards Used in Data Product Generation

3.3.1 PDS Standards

PDS standard used is 3.6. All data processing levels mentioned in this document are PSA-compliant, as defined in RO-EST-PL-5011.

3.3.2 Time Standards

Time standard used is UTC. Time format is *YYYY-MM-DD*T*hh:mm:ss.*

3.3.2.1 Spacecraft Clock Count, OBT

The PDS keywords SPACECRAFT_CLOCK_START_COUNT and SPACECRAFT_CLOCK_STOP_COUNT refer to OBT as defined in [AD 04, Rosetta Time Handling, chapter 4.2]]

The header of the experiment telemetry source packets contains the data acquisition start time in OBT as 32 bit of unit seconds followed by 16 bit of fractional seconds (see section 2.3). OBT = 0 is at 2003-01-01-T00:00:00 UTC. The time resolution is 2-16 = 1.53×10-5 seconds.

The OBT is represented in the following format:

SPACECRAFT_CLOCK_START/STOP_COUNT =

"<reset number>/<unit seconds>.<fractional seconds>"

The unit seconds and the fractional seconds are separated by the full stop character. Note that this is not a decimal point. The fractional seconds are expressed as multiples of 2-16 = 1.53×10-5 seconds and count from 0 to 2^{10}-1= 65535. E.g. in SPACECRAFT_CLOCK_START_COUNT = "1/21983325.392" the 392 fractional seconds correspond to 392 × 2-16 = 0.00598 decimal seconds.

The spacecraft clock could be reset during the mission (although this is not planned). This would imply a change of the zero point. The zero point of the OBT will be indicated by pre-pending the reset number (integer starting at 1) and a slash to the unit seconds, i.e. "1/" means OBT = 0 at 2003-01-01T00:00:00 UTC.

Examples:

SPACECRAFT_CLOCK_START_COUNT = "1/21983325.39258"

SPACECRAFT_CLOCK_START_COUNT = "1/21983325.392"

SPACECRAFT_CLOCK_STOP_COUNT = "1/21983342"

3.3.3 Reference Systems

N/A

3.3.4 Other Applicable Standards

N/A

3.4 Data Validation

Formats will be checked with PSA Validation and Verification Tool.

The instrument data is validated according to the outline of the COSIMA proposal and the COSIMA instrument paper (Kissel et al, to be published in 2006 within the frame of the ROSETTA instrument papers). COSIMA consists of groups in France, Finland and Germany and CoIs ins the US, Austria and The Netherlands. The COSIMA laboratory reference model is located at the Max-Planck-Insitut for Solar System Research in Katlenburg-Lindau, Germany. The COSIMA instrument is operated by FMI in Helsinki, Finland and MPS in Lindau, Germany. The reference model is used for calibration and cross-reference measurements of the COSIMA flight model. The flight data will be analysed in a near time frame. Since COSIMA stores the original cometary samples, with this approach interesting samples can be screened again, e.g. with an improved count statistics. The science goals are achieved in the pre-comet rendevous phase preparation with the reference model laboratory measurements and with the operational scenario of COSIMA in the comet orbiting phase of ROSETTA.

3.5 Content

3.5.1 Volume Set

1 volume will contain 1 COSIMA data set. Data set structure is defined in Chapter 3.1.

3.5.2 Data Set

COSIMA data will form one data set. It will contain time-of-flight spectra, peaks lists, target substrate images, grain lists and target history (ancillary data) obtained after the flight targets were installed in the flying instrument (XM).

The data set will be named according to PDS standards and following the Rosetta Archive Plan (RO-EST-PL-5011). Each component of the name will match the corresponding component of the data set ID.

Data set name components are:

- Instrument host: ROSETTA-ORBITER
- Target: CAL for pre-comet phase, 67P for comet phasedata sets

- Instrument name: COSIMA
- Data processing level, 3
- Version number

Example: "ROSETTA-ORBITER 67P COSIMA 3 V3.0"

3.5.3 Directories

3.5.3.1 Root Directory

General archive description: AAREADME.TXT, VOLDESC.CAT

3.5.3.2 Calibration Directory

N/A

3.5.3.3 Catalog Directory

CATINFO.TXT

MISSION.CAT and INSTHOST.CAT from ESA – Mission and spacecraft descriptions.

INST.CAT – Instrument description

DATASET.CAT – Dataset description

REF.CAT - References

SOFTWARE.CAT - empty for COSIMA datasets.

PERSON.CAT – COSIMA contacts

TARGET.CAT – Target descriptions

3.5.3.4 Index Directory

INDXINFO.TXT, INDEX.LBL and INDEX.TAB

3.5.3.5 Browse Directory and Browse Files

N/A

3.5.3.6 Geometry Directory

N/A

3.5.3.7 Software Directory

N/A

3.5.3.8 Gazetter Directory

N/A

3.5.3.9 Label Directory

LABINFO.TXT

Format containers (*.FMT)

3.5.3.10Document Directory

COSIMASIS: This EAICD with detached labels and images in JPG format.

COSIMAPAPER: COSIMA instrument paper with detached labels and images in JPG format

3.5.3.11 Extras Directory

N/A

3.5.3.12 Data Directory

See chapter 3.2.2.

4 Detailed Interface Specifications

4.1 Structure and Organization Overview

/DATA directory will be divided to sub-directories for each COSIMA target substrate. Names of these sub-directories will follow the scheme defined in chapter 3.2.2.

The target substrate code in the directory name consists of 3 alphanumeric characters. The last two characters represent hexadecimal code of the target substrate. There are 24 target assemblies, numbered C1-D8 (hex). Each assembly holds 3 substrates, resulting in total of 72 substrates. The first character in the code is a number defining the substrate position in the assembly. Possible numbers are 1,2 and 3 for top, middle and low substrate, respectively. Thus directory name SUB_1C1 identifies that the data inside contains measurements of top substrate of target assembly C1. Other directories containing measurements of target assembly C1 are SUB_2C1 and SUB_3C1.

Data products will be stored in sub-directories SUB_XYY. File naming of the data files is described in chapter 3.2.3. Each sub-directory SUB_XYY will also include the history of that substrate. The history contains information about substrate storage and expose periods, cleaning and heating actions, COSISCOPE camera images and grains lists and any spectra taken. The history product contains history from the moment substrates were installed in the COSIMA flight instrument.

4.2 Data Sets, Definition and Content

See chapter 3.5.2.

4.3 Data Product Design

4.3.1 Time-of flight spectrum product

4.3.1.1 General description

COSIMA time-of-flight spectrum product has the following elements:

- Time-of-flight spectrum: event count series in ascii format.
- Event count: number of events in a time bin.
- Mass: calibrated mass for the time bin.

4.3.1.2 Label example

```
PDS_VERSION_ID                = PDS3
LABEL_REVISION_NOTE           = "V1.1"

/* FILE FORMAT */
RECORD_TYPE                   = FIXED_LENGTH
RECORD_BYTES                  = 30
FILE_RECORDS                  = 131185
LABEL_RECORDS                 = 112
/* POINTER TO DATA OBJECTS */
^SCALE_TABLE                  = 113
^MASS_SPECTRUM_TABLE          = 114

/* GENERAL DATA DESCRIPTION PARAMETERS */
FILE_NAME                     = "CS_2D8_20070927T182348_SP_P.TAB"
DATA_SET_ID                   = "RO-CAL-COSIMA-3-V2.0"
DATA_SET_NAME                 = "ROSETTA-ORBITER CAL COSIMA 3 V2.0"
PRODUCT_ID                    = "CS_2D8_20070927T182348_SP_P.TAB"
PRODUCT_CREATION_TIME         = 2008-11-12T09:15:39
PRODUCT_TYPE                  = "REFDR"
PROCESSING_LEVEL_ID           = “3”
MISSION_ID                    = "ROSETTA"
MISSION_NAME                  = "INTERNATIONAL ROSETTA MISSION"
MISSION_PHASE_NAME            = "EARTH SWING-BY 2"
INSTRUMENT_HOST_ID            = "RO"
INSTRUMENT_HOST_NAME          = "ROSETTA-ORBITER"
```

```
INSTRUMENT_ID                   = "COSIMA"
INSTRUMENT_NAME                 = "COMETARY SECONDARY ION MASS ANALYZER"
INSTRUMENT_TYPE                 = "MASS SPECTROMETER"
INSTRUMENT_MODE_ID              = "SPECTRUM"
INSTRUMENT_MODE_DESC            = "TIME OF FLIGHT MASS SPECTRUM MEASUREMENT"
TARGET_NAME                     = "CALIBRATION"
TARGET_TYPE                     = "CALIBRATION"
START_TIME                      = 2007-09-27T18:23:48
STOP_TIME                       = 2007-09-27T18:33:53
SPACECRAFT_CLOCK_START_COUNT    = "1/0149538196.41251"
SPACECRAFT_CLOCK_STOP_COUNT     = "1/0149538801.41245"
SC_SUN_POSITION_VECTOR          = "N/A"
SC_TARGET_POSITION_VECTOR       = "N/A"
SC_TARGET_VELOCITY_VECTOR       = "N/A"
SPACECRAFT_ALTITUDE             = "N/A"
SUB_SPACECRAFT_LATITUDE         = "N/A"
SUB_SPACECRAFT_LONGITUDE        = "N/A"
PRODUCER_ID                     = "FMI"
PRODUCER_FULL_NAME              = "JOHAN SILEN"
PRODUCER_INSTITUTION_NAME       = "FINNISH METEOROLOGICAL INSTITUTE"
DATA_QUALITY_ID                 = -1
DATA_QUALITY_DESC               = "-1 = not checked"
ROSETTA:COSIMA_SUBSTRATE_ID     = "2D8"
ROSETTA:COSIMA_SUBSTRATE_DESC   = "Silver, blank"
ROSETTA:COSIMA_SUBSTRATE_X      = 5000
ROSETTA:COSIMA_SUBSTRATE_Y      = 5000
ROSETTA:COSIMA_SPECTRUM_POL     = "POSITIVE"
ROSETTA:COSIMA_SPECTRUM_SHOTS   = 795091

OBJECT                          = SCALE_TABLE
  NAME                          = SCALE
  INTERCHANGE_FORMAT            = ASCII
  ROWS                          = 1
  COLUMNS                       = 3
  ROW_BYTES                     = 30
  ^STRUCTURE                    = "COSIMA_SPECTRUM_PEAK_SCALE.FMT"
  DESCRIPTION                   = "COSIMA PEAK LIST MASS SCALE"
END_OBJECT                      = SCALE_TABLE

OBJECT                          = MASS_SPECTRUM_TABLE
  NAME                          = MASS_SPECTRUM
  INTERCHANGE_FORMAT            = ASCII
  ROWS                          = 131072
  COLUMNS                       = 3
  ROW_BYTES                     = 30
  ^STRUCTURE                    = "COSIMA_SPECTRUM_DATA.FMT"
  DESCRIPTION                   = "COSIMA TIME OF FLIGHT MASS SPECTRUM"
END_OBJECT                      = MASS_SPECTRUM_TABLE

END
```

COSIMA_SPECTRUM_PEAK_SCALE.FMT

```
  OBJECT                        = COLUMN
    COLUMN_NUMBER               = 1
    NAME                        = SCALE_A
    DATA_TYPE                   = ASCII_REAL
    START_BYTE                  = 1
    BYTES                       = 10
    FORMAT                      = "F10.2"
    DESCRIPTION                 = "FACTOR A FROM THE TIME TO MASS FUNCTION
                                   T = A * SQRT(M) + B"
  END_OBJECT                    = COLUMN
  OBJECT                        = COLUMN
    COLUMN_NUMBER               = 2
    NAME                        = SCALE_B
    DATA_TYPE                   = ASCII_REAL
    START_BYTE                  = 12
    BYTES                       = 10
    FORMAT                      = "F10.2"
    DESCRIPTION                 = "FACTOR B FROM THE TIME TO MASS FUNCTION
                                   T = A * SQRT(M) + B"
  END_OBJECT                    = COLUMN
  OBJECT                        = COLUMN
```

```
    COLUMN_NUMBER                = 3
    NAME                         = SCALE_CONFIDENCE
    DATA_TYPE                    = ASCII_REAL
    START_BYTE                   = 23
    BYTES                        = 5
    FORMAT                       = "F5.1"
    DESCRIPTION                  = "MASS SCALE CONFIDENCE LEVEL IN PROCENTS"
  END_OBJECT           = COLUMN
```

COSIMA_SPECTRUM_DATA.FMT

```
  OBJECT                         = COLUMN
    COLUMN_NUMBER                = 1
    NAME                         = INDEX
    DATA_TYPE                    = ASCII_INTEGER
    START_BYTE                   = 1
    BYTES                        = 6
    FORMAT                       = "I6"
    DESCRIPTION                  = "TIME OF FLIGHT TIME STEP INDEX.
                                    TIME STEP IS 0.000000001953125 SECONDS"
  END_OBJECT                     = COLUMN

  OBJECT                         = COLUMN
    COLUMN_NUMBER                = 2
    NAME                         = MASS_COUNT
    DATA_TYPE                    = ASCII_INTEGER
    START_BYTE                   = 8
    BYTES                        = 10
    FORMAT                       = "I10"
    DESCRIPTION                  = "TIME INTEGRAGED MASS COUNT AT THE TIME STEP"
  END_OBJECT                     = COLUMN

  OBJECT                         = COLUMN
    COLUMN_NUMBER                = 3
    NAME                         = MASS_NUMBER
    DATA_TYPE                    = ASCII_REAL
    START_BYTE                   = 19
    BYTES                        = 10
    FORMAT                       = "F10.5"
    DESCRIPTION                  = "CALIBRATED MASS NUMBER AT THE TIME STEP"
  END_OBJECT           = COLUMN
```

4.3.2 Peak list product

4.3.2.1 General Description

COSIMA peak list has the following elements:

- Instrument onboard calculated mass scale.
- Peak list for organic and inorganic masses

4.3.2.2 Label example

```
PDS_VERSION_ID                 = PDS3
LABEL_REVISION_NOTE            = "V1.1"

/* FILE FORMAT */
RECORD_TYPE                    = FIXED_LENGTH
RECORD_BYTES                   = 29
FILE_RECORDS                   = 446
LABEL_RECORDS                  = 115
/* POINTERS TO DATA OBJECTS */
^SCALE_TABLE                   = 116
^PEAK_TABLE                    = 117

/* GENERAL DATA DESCRIPTION PARAMETERS */
FILE_NAME                      = "CS_2D8_20070927T184705_PK_N.TAB"
DATA_SET_ID                    = "RO-CAL-COSIMA-3-V2.0"
DATA_SET_NAME                  = "ROSETTA-ORBITER CAL COSIMA 3 V2.0"
PRODUCT_ID                     = "CS_2D8_20070927T184705_PK_N.TAB"
PRODUCT_CREATION_TIME          = 2008-11-12T09:15:40
```

```
PRODUCT_TYPE                     = "REFDR"
PROCESSING_LEVEL_ID              = “3”
MISSION_ID                       = "ROSETTA"
MISSION_NAME                     = "INTERNATIONAL ROSETTA MISSION"
MISSION_PHASE_NAME               = "EARTH SWING-BY 2"
INSTRUMENT_HOST_ID               = "RO"
INSTRUMENT_HOST_NAME             = "ROSETTA-ORBITER"
INSTRUMENT_ID                    = "COSIMA"
INSTRUMENT_NAME                  = "COMETARY SECONDARY ION MASS ANALYZER"
INSTRUMENT_TYPE                  = "MASS SPECTROMETER"
INSTRUMENT_MODE_ID               = "SPECTRUM"
INSTRUMENT_MODE_DESC             = "TIME OF FLIGHT MASS SPECTRUM MEASUREMENT"
TARGET_NAME                      = "CALIBRATION"
TARGET_TYPE                      = "CALIBRATION"
START_TIME                       = 2007-09-27T18:47:05
STOP_TIME                        = 2007-09-27T18:57:10
SPACECRAFT_CLOCK_START_COUNT     = "1/0149539593.41237"
SPACECRAFT_CLOCK_STOP_COUNT      = "1/0149540198.41230"
SC_SUN_POSITION_VECTOR           = "N/A"
SC_TARGET_POSITION_VECTOR        = "N/A"
SC_TARGET_VELOCITY_VECTOR        = "N/A"
SPACECRAFT_ALTITUDE              = "N/A"
SUB_SPACECRAFT_LATITUDE          = "N/A"
SUB_SPACECRAFT_LONGITUDE         = "N/A"
PRODUCER_ID                      = "FMI"
PRODUCER_FULL_NAME               = "JOHAN SILEN"
PRODUCER_INSTITUTION_NAME        = "FINNISH METEOROLOGICAL INSTITUTE"
DATA_QUALITY_ID                  = -1
DATA_QUALITY_DESC                = "-1 = not checked"
ROSETTA:COSIMA_SUBSTRATE_ID      = "2D8"
ROSETTA:COSIMA_SUBSTRATE_DESC    = "Silver, blank"
ROSETTA:COSIMA_SUBSTRATE_X       = 5000
ROSETTA:COSIMA_SUBSTRATE_Y       = 5000
ROSETTA:COSIMA_SPECTRUM_POL      = "NEGATIVE"
ROSETTA:COSIMA_SPECTRUM_SHOTS    = 828459

OBJECT                           = SCALE_TABLE
  NAME                           = SCALE
  INTERCHANGE_FORMAT             = ASCII
  ROWS                           = 1
  COLUMNS                        = 3
  ROW_BYTES                      = 29
  ^STRUCTURE                     = "COSIMA_SPECTRUM_PEAK_SCALE.FMT"
  DESCRIPTION                    = "COSIMA PEAK LIST MASS SCALE"
END_OBJECT                       = SCALE_TABLE

OBJECT                           = PEAK_TABLE
  NAME                           = PEAK_LIST
  INTERCHANGE_FORMAT             = ASCII
  ROWS                           = 330
  COLUMNS                        = 3
  ROW_BYTES                      = 29
  ^STRUCTURE                     = "COSIMA_SPECTRUM_PEAKS.FMT"
  DESCRIPTION                    = "COSIMA SPECTRUM PEAK LIST"
END_OBJECT                       = PEAK_TABLE

END
```

COSIMA_SPECTRUM_PEAK_SCALE.FMT

```
  OBJECT                         = COLUMN
    COLUMN_NUMBER                = 1
    NAME                         = SCALE_A
    DATA_TYPE                    = ASCII_REAL
    START_BYTE                   = 1
    BYTES                        = 10
    FORMAT                       = "F10.2"
    DESCRIPTION                  = "FACTOR A FROM THE TIME TO MASS FUNCTION
                                    T = A * SQRT(M) + B"
  END_OBJECT                     = COLUMN
  OBJECT                         = COLUMN
    COLUMN_NUMBER                = 2
    NAME                         = SCALE_B
    DATA_TYPE                    = ASCII_REAL
    START_BYTE                   = 12
```

```
    BYTES                       = 10
    FORMAT                      = "F10.2"
    DESCRIPTION                 = "FACTOR B FROM THE TIME TO MASS FUNCTION
                                   T = A * SQRT(M) + B"
  END_OBJECT                    = COLUMN
  OBJECT                        = COLUMN
    COLUMN_NUMBER               = 3
    NAME                        = SCALE_CONFIDENCE
    DATA_TYPE                   = ASCII_REAL
    START_BYTE                  = 23
    BYTES                       = 5
    FORMAT                      = "F5.1"
    DESCRIPTION                 = "MASS SCALE CONFIDENCE LEVEL IN PROCENTS"
  END_OBJECT                    = COLUMN
```

COSIMA_SPECTRUM_PEAKS.FMT

```
  OBJECT                        = COLUMN
    COLUMN_NUMBER               = 1
    NAME                        = INDEX
    DATA_TYPE                   = ASCII_INTEGER
    START_BYTE                  = 1
    BYTES                       = 5
    FORMAT                      = "I5"
    DESCRIPTION                 = "INTEGER MASS. IF HIGHER THAN 300, THEN THE
                                   INTERVAL FROM PREVIOUS VALUE TO CURRENT
                                   VALUE"
  END_OBJECT                    = COLUMN
  OBJECT                        = COLUMN
    COLUMN_NUMBER               = 2
    NAME                        = INORGANIC_COUNT
    DATA_TYPE                   = ASCII_INTEGER
    START_BYTE                  = 7
    BYTES                       = 10
    FORMAT                      = "I10"
    DESCRIPTION                 = "INORGANIC PEAK HEIGHT COUNT. IF MASS INDEX
                                   IS HIGHER THAN 300, THEN THE SUM OF
                                   ORGANIC AND INORGANIC COUNTS FOR THE
                                   INTERVAL FROM PREVIOUS INDEX"
  END_OBJECT                    = COLUMN
  OBJECT                        = COLUMN
    COLUMN_NUMBER               = 3
    NAME                        = ORGANIC_COUNT
    DATA_TYPE                   = ASCII_INTEGER
    START_BYTE                  = 18
    BYTES                       = 10
    FORMAT                      = "I10"
    DESCRIPTION                 = "ORGANIC PEAK HEIGHT COUNT. IF MASS INDEX
                                   IS HIGHER THAN 300, THEN THE SUM OF
                                   INORGANIC AND ORGANIC COUNTS FOR THE
                                   INTERVAL FROM PREVIOUS INDEX"
  END_OBJECT                    = COLUMN
```

4.3.3 Time-of-flight spectrum housekeeping data product

4.3.3.1 General description

With each measured time-of-flight spectrum or peak list, housekeeping data is associated. The housekeeping product has the following elements:

- Voltages, currents and temperatures of the instrument during spectrum measurement
- TDC unit timing parameters
- TDC unit calibration results

Detailed contents of the elements are described in the label example below.

4.3.3.2 Label example

```
PDS_VERSION_ID                  = PDS3
LABEL_REVISION_NOTE             = "V1.1"
```

```
/* FILE FORMAT */
RECORD_TYPE                      = FIXED_LENGTH
RECORD_BYTES                     = 897
FILE_RECORDS                     = 11
LABEL_RECORDS                    = 5
/* POINTER TO DATA OBJECT */
^HK_TABLE                        = 6
^TDC_TIMING_TABLE                = 7
^TDC_CALIBRATION_TABLE           = 8

/* GENERAL DATA DESCRIPTION PARAMETERS */
FILE_NAME                        = "CS_2D8_20070927T182348_S_HK.TAB"
DATA_SET_ID                      = "RO-CAL-COSIMA-3-V2.0"
DATA_SET_NAME                    = "ROSETTA-ORBITER CAL COSIMA 3 V2.0"
PRODUCT_ID                       = "CS_2D8_20070927T182348_S_HK"
PRODUCT_CREATION_TIME            = 2008-11-12T09:15:38
PRODUCT_TYPE                     = "ANCDR"
PROCESSING_LEVEL_ID              = “6”
MISSION_ID                       = "ROSETTA"
MISSION_NAME                     = "INTERNATIONAL ROSETTA MISSION"
MISSION_PHASE_NAME               = "EARTH SWING-BY 2"
INSTRUMENT_HOST_ID               = "RO"
INSTRUMENT_HOST_NAME             = "ROSETTA-ORBITER"
INSTRUMENT_ID                    = "COSIMA"
INSTRUMENT_NAME                  = "COMETARY SECONDARY ION MASS ANALYZER"
INSTRUMENT_TYPE                  = "MASS SPECTROMETER"
INSTRUMENT_MODE_ID               = "SPECTRUM"
INSTRUMENT_MODE_DESC             = "TIME OF FLIGHT MASS SPECTRUM MEASUREMENT"
TARGET_NAME                      = "CALIBRATION"
TARGET_TYPE                      = "CALIBRATION"
START_TIME                       = 2007-09-27T18:23:48
STOP_TIME                        = 2007-09-27T18:33:53
SPACECRAFT_CLOCK_START_COUNT     = "1/0149538196.41251"
SPACECRAFT_CLOCK_STOP_COUNT      = "1/0149538801.41245"
SC_SUN_POSITION_VECTOR           = "N/A"
SC_TARGET_POSITION_VECTOR        = "N/A"
SC_TARGET_VELOCITY_VECTOR        = "N/A"
SPACECRAFT_ALTITUDE              = "N/A"
SUB_SPACECRAFT_LATITUDE          = "N/A"
SUB_SPACECRAFT_LONGITUDE         = "N/A"
PRODUCER_ID                      = "FMI"
PRODUCER_FULL_NAME               = "JOHAN SILEN"
PRODUCER_INSTITUTION_NAME        = "FINNISH METEOROLOGICAL INSTITUTE"
DATA_QUALITY_ID                  = -1
DATA_QUALITY_DESC                = "-1 = not checked"
ROSETTA:COSIMA_SUBSTRATE_ID      = "2D8"
ROSETTA:COSIMA_SUBSTRATE_DESC    = "Silver, blank"
ROSETTA:COSIMA_SUBSTRATE_X       = 5000
ROSETTA:COSIMA_SUBSTRATE_Y       = 5000
ROSETTA:COSIMA_SPECTRUM_POL      = "POSITIVE"
ROSETTA:COSIMA_SPECTRUM_SHOTS    = 795091

OBJECT                           = HK_TABLE
  NAME                           = HOUSEKEEPING
  INTERCHANGE_FORMAT             = ASCII
  ROWS                           = 1
  COLUMNS                        = 112
  ROW_BYTES                      = 897
  ^STRUCTURE                     = "COSIMA_SPECTRUM_HK.FMT"
  DESCRIPTION                    = "COSIMA SPECTRUM HOUSEKEEPING INFORMATION,
                                    INCLUDING VOLTAGES, CURRENTS AND
                                    TEMPERATUES"
END_OBJECT                       = HK_TABLE

OBJECT                           = TDC_TIMING_TABLE
  NAME                           = TDC_TIMING
  INTERCHANGE_FORMAT             = ASCII
  ROWS                           = 1
  COLUMNS                        = 7
  ROW_BYTES                      = 897
  ^STRUCTURE                     = "COSIMA_SPECTRUM_TDC_TIMING.FMT"
  DESCRIPTION                    = "TIME TO DIGITAL UNIT TIMING PARAMETERS"
END_OBJECT                       = TDC_TIMING_TABLE
```

```
OBJECT                          = TDC_CALIBRATION_TABLE
  NAME                          = TDC_CALIBRATION
  INTERCHANGE_FORMAT            = ASCII
  ROWS                          = 4
  COLUMNS                       = 5
  ROW_BYTES                     = 897
  ^STRUCTURE                    = "COSIMA_SPECTRUM_TDC_CALIB.FMT"
  DESCRIPTION                   = "TIME TO DIGITAL UNIT CALIBRATION RESULTS"
END_OBJECT                      = TDC_CALIBRATION_TABLE
```

END

COSIMA_SPECTRUM_HK.FMT:

```
OBJECT                  = COLUMN
  COLUMN_NUMBER         = 1
  NAME                  = "T_REF_MIN"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 1
  BYTES                 = 7
  UNIT                  = "DEGREE KELVIN"
  MISSING_CONSTANT      = 999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "T_REF TEMPERATURE MINIMUM AT REFERENCE POINT"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 2
  NAME                  = "T_REF_MEAN"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 9
  BYTES                 = 7
  UNIT                  = "DEGREE KELVIN"
  MISSING_CONSTANT      = 999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "T_REF TEMPERATURE MEAN AT REFERENCE POINT"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 3
  NAME                  = "T_REF_MAX"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 17
  BYTES                 = 7
  UNIT                  = "DEGREE KELVIN"
  MISSING_CONSTANT      = 999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "T_REF TEMPERATURE MAXIMUM AT REFERENCE POINT"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 4
  NAME                  = "T_REF_STD"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 25
  BYTES                 = 7
  UNIT                  = "DEGREE KELVIN"
  MISSING_CONSTANT      = 999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "T_REF TEMPERATURE STANDARD DEVIATION AT
                           REFERENCE POINT"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 5
  NAME                  = "T_TDC_MIN"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 33
  BYTES                 = 7
  UNIT                  = "DEGREE KELVIN"
  MISSING_CONSTANT      = 999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "T_TDC TIME TO DIGITAL UNIT DELAY LINE TEMPERATURE
```

```
                           MINIMUM"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 6
  NAME                  = "T_TDC_MEAN"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 41
  BYTES                 = 7
  UNIT                  = "DEGREE KELVIN"
  MISSING_CONSTANT      = 999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "T_TDC TIME TO DIGITAL UNIT DELAY LINE TEMPERATURE
                           MEAN"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 7
  NAME                  = "T_TDC_MAX"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 49
  BYTES                 = 7
  UNIT                  = "DEGREE KELVIN"
  MISSING_CONSTANT      = 999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "T_TDC TIME TO DIGITAL UNIT DELAY LINE TEMPERATURE
                           MAXIMUM"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 8
  NAME                  = "T_TDC_STD"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 57
  BYTES                 = 7
  UNIT                  = "DEGREE KELVIN"
  MISSING_CONSTANT      = 999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "T_TDC TIME TO DIGITAL UNIT DELAY LINE TEMPERATURE
                           STANDARD DEVIATION"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 9
  NAME                  = "T_PIBS_MIN"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 65
  BYTES                 = 7
  UNIT                  = "DEGREE KELVIN"
  MISSING_CONSTANT      = 999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "T_PIBS PRIMARY ION BEAM SYSTEM TEMPERATURE MINIMUM"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 10
  NAME                  = "T_PIBS_MEAN"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 73
  BYTES                 = 7
  UNIT                  = "DEGREE KELVIN"
  MISSING_CONSTANT      = 999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "T_PIBS PRIMARY ION BEAM SYSTEM TEMPERATURE MEAN"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 11
  NAME                  = "T_PIBS_MAX"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 81
  BYTES                 = 7
  UNIT                  = "DEGREE KELVIN"
  MISSING_CONSTANT      = 999.9
```

```
  FORMAT                  = "F7.1"
  DESCRIPTION             = "T_PIBS PRIMARY ION BEAM SYSTEM TEMPERATURE MAXIMUM"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
  COLUMN_NUMBER           = 12
  NAME                    = "T_PIBS_STD"
  DATA_TYPE               = ASCII_REAL
  START_BYTE              = 89
  BYTES                   = 7
  UNIT                    = "DEGREE KELVIN"
  MISSING_CONSTANT        = 999.9
  FORMAT                  = "F7.1"
  DESCRIPTION             = "T_PIBS PRIMARY ION BEAM SYSTEM TEMPERATURE STANDARD
                             DEVIATION"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
  COLUMN_NUMBER           = 13
  NAME                    = "T_LVC_MIN"
  DATA_TYPE               = ASCII_REAL
  START_BYTE              = 97
  BYTES                   = 7
  UNIT                    = "DEGREE KELVIN"
  MISSING_CONSTANT        = 999.9
  FORMAT                  = "F7.1"
  DESCRIPTION             = "T_LVC LOW VOLTAGE CONVERTER TEMPERATURE MINIMUM"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
  COLUMN_NUMBER           = 14
  NAME                    = "T_LVC_MEAN"
  DATA_TYPE               = ASCII_REAL
  START_BYTE              = 105
  BYTES                   = 7
  UNIT                    = "DEGREE KELVIN"
  MISSING_CONSTANT        = 999.9
  FORMAT                  = "F7.1"
  DESCRIPTION             = "T_LVC LOW VOLTAGE CONVERTER TEMPERATURE MEAN"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
  COLUMN_NUMBER           = 15
  NAME                    = "T_LVC_MAX"
  DATA_TYPE               = ASCII_REAL
  START_BYTE              = 113
  BYTES                   = 7
  UNIT                    = "DEGREE KELVIN"
  MISSING_CONSTANT        = 999.9
  FORMAT                  = "F7.1"
  DESCRIPTION             = "T_LVC LOW VOLTAGE CONVERTER TEMPERATURE MAXIMUM"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
  COLUMN_NUMBER           = 16
  NAME                    = "T_LVC_STD"
  DATA_TYPE               = ASCII_REAL
  START_BYTE              = 121
  BYTES                   = 7
  UNIT                    = "DEGREE KELVIN"
  MISSING_CONSTANT        = 999.9
  FORMAT                  = "F7.1"
  DESCRIPTION             = "T_LVC LOW VOLTAGE CONVERTER TEMPERATURE STANDARD
                             DEVIATION"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
  COLUMN_NUMBER           = 17
  NAME                    = "T_CPU_MIN"
  DATA_TYPE               = ASCII_REAL
  START_BYTE              = 129
  BYTES                   = 7
  UNIT                    = "DEGREE KELVIN"
  MISSING_CONSTANT        = 999.9
```

```
    FORMAT                  = "F7.1"
    DESCRIPTION             = "T_CPU PROCESSOR TEMPERATURE MINIMUM"
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    COLUMN_NUMBER           = 18
    NAME                    = "T_CPU_MEAN"
    DATA_TYPE               = ASCII_REAL
    START_BYTE              = 137
    BYTES                   = 7
    UNIT                    = "DEGREE KELVIN"
    MISSING_CONSTANT        = 999.9
    FORMAT                  = "F7.1"
    DESCRIPTION             = "T_CPU PROCESSOR TEMPERATURE MEAN"
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    COLUMN_NUMBER           = 19
    NAME                    = "T_CPU_MAX"
    DATA_TYPE               = ASCII_REAL
    START_BYTE              = 145
    BYTES                   = 7
    UNIT                    = "DEGREE KELVIN"
    MISSING_CONSTANT        = 999.9
    FORMAT                  = "F7.1"
    DESCRIPTION             = "T_CPU PROCESSOR TEMPERATURE MAXIMUM"
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    COLUMN_NUMBER           = 20
    NAME                    = "T_CPU_STD"
    DATA_TYPE               = ASCII_REAL
    START_BYTE              = 153
    BYTES                   = 7
    UNIT                    = "DEGREE KELVIN"
    MISSING_CONSTANT        = 999.9
    FORMAT                  = "F7.1"
    DESCRIPTION             = "T_CPU PROCESSOR TEMPERATURE STANDARD DEVIATION"
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    COLUMN_NUMBER           = 21
    NAME                    = "T_HVC_MIN"
    DATA_TYPE               = ASCII_REAL
    START_BYTE              = 161
    BYTES                   = 7
    UNIT                    = "DEGREE KELVIN"
    MISSING_CONSTANT        = 999.9
    FORMAT                  = "F7.1"
    DESCRIPTION             = "T_HVC MOTHERBOARD TEMPERATURE MINIMUM"
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    COLUMN_NUMBER           = 22
    NAME                    = "T_HVC_MEAN"
    DATA_TYPE               = ASCII_REAL
    START_BYTE              = 169
    BYTES                   = 7
    UNIT                    = "DEGREE KELVIN"
    MISSING_CONSTANT        = 999.9
    FORMAT                  = "F7.1"
    DESCRIPTION             = "T_HVC MOTHERBOARD TEMPERATURE MEAN"
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    COLUMN_NUMBER           = 23
    NAME                    = "T_HVC_MAX"
    DATA_TYPE               = ASCII_REAL
    START_BYTE              = 177
    BYTES                   = 7
    UNIT                    = "DEGREE KELVIN"
    MISSING_CONSTANT        = 999.9
    FORMAT                  = "F7.1"
    DESCRIPTION             = "T_HVC MOTHERBOARD TEMPERATURE MAXIMUM"
```

```
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 24
  NAME                  = "T_HVC_STD"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 185
  BYTES                 = 7
  UNIT                  = "DEGREE KELVIN"
  MISSING_CONSTANT      = 999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "T_HVC MOTHERBOARD TEMPERATURE STANDARD DEVIATION"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 25
  NAME                  = "V_EL1_MIN"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 193
  BYTES                 = 7
  UNIT                  = "VOLT"
  MISSING_CONSTANT      = 99999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "V_EL1 EXTRACTION LENS 1 VOLTAGE MINIMUM,
                           IN THE TIME-OF-FLIGHT SECTION"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 26
  NAME                  = "V_EL1_MEAN"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 201
  BYTES                 = 7
  UNIT                  = "VOLT"
  MISSING_CONSTANT      = 99999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "V_EL1 EXTRACTION LENS 1 VOLTAGE MEAN,
                           IN THE TIME-OF-FLIGHT SECTION"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 27
  NAME                  = "V_EL1_MAX"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 209
  BYTES                 = 7
  UNIT                  = "VOLT"
  MISSING_CONSTANT      = 99999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "V_EL1 EXTRACTION LENS 1 VOLTAGE MAXIMUM,
                           IN THE TIME-OF-FLIGHT SECTION"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 28
  NAME                  = "V_EL1_STD"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 217
  BYTES                 = 7
  UNIT                  = "VOLT"
  MISSING_CONSTANT      = 99999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "V_EL1 EXTRACTION LENS 1 VOLTAGE STANDARD DEVIATION,
                           IN THE TIME-OF-FLIGHT SECTION"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 29
  NAME                  = "V_TOF1_MIN"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 225
  BYTES                 = 7
  UNIT                  = "VOLT"
  MISSING_CONSTANT      = 99999.9
```

```
    FORMAT                 = "F7.1"
    DESCRIPTION            = "V_TOF1 HIGH VOLTAGE CONVERTER 1 VOLTAGE MINIMUM,
                              IN THE TIME-OF-FLIGHT SECTION"
  END_OBJECT               = COLUMN

  OBJECT                   = COLUMN
    COLUMN_NUMBER          = 30
    NAME                   = "V_TOF1_MEAN"
    DATA_TYPE              = ASCII_REAL
    START_BYTE             = 233
    BYTES                  = 7
    UNIT                   = "VOLT"
    MISSING_CONSTANT       = 99999.9
    FORMAT                 = "F7.1"
    DESCRIPTION            = "V_TOF1 HIGH VOLTAGE CONVERTER 1 VOLTAGE MEAN,
                              IN THE TIME-OF-FLIGHT SECTION"
  END_OBJECT               = COLUMN

  OBJECT                   = COLUMN
    COLUMN_NUMBER          = 31
    NAME                   = "V_TOF1_MAX"
    DATA_TYPE              = ASCII_REAL
    START_BYTE             = 241
    BYTES                  = 7
    UNIT                   = "VOLT"
    MISSING_CONSTANT       = 99999.9
    FORMAT                 = "F7.1"
    DESCRIPTION            = "V_TOF1 HIGH VOLTAGE CONVERTER 1 VOLTAGE MAXIMUM,
                              IN THE TIME-OF-FLIGHT SECTION"
  END_OBJECT               = COLUMN

  OBJECT                   = COLUMN
    COLUMN_NUMBER          = 32
    NAME                   = "V_TOF1_STD"
    DATA_TYPE              = ASCII_REAL
    START_BYTE             = 249
    BYTES                  = 7
    UNIT                   = "VOLT"
    MISSING_CONSTANT       = 99999.9
    FORMAT                 = "F7.1"
    DESCRIPTION            = "V_TOF1 HIGH VOLTAGE CONVERTER 1 VOLTAGE STANDARD
                              DEVIATION, IN THE TIME-OF-FLIGHT SECTION"
  END_OBJECT               = COLUMN

  OBJECT                   = COLUMN
    COLUMN_NUMBER          = 33
    NAME                   = "V_TOF2_MIN"
    DATA_TYPE              = ASCII_REAL
    START_BYTE             = 257
    BYTES                  = 7
    UNIT                   = "VOLT"
    MISSING_CONSTANT       = 99999.9
    FORMAT                 = "F7.1"
    DESCRIPTION            = "V_TOF2 HIGH VOLTAGE CONVERTER 2 VOLTAGE MINIMUM,
                              IN THE TIME-OF-FLIGHT SECTION"
  END_OBJECT               = COLUMN

  OBJECT                   = COLUMN
    COLUMN_NUMBER          = 34
    NAME                   = "V_TOF2_MEAN"
    DATA_TYPE              = ASCII_REAL
    START_BYTE             = 265
    BYTES                  = 7
    UNIT                   = "VOLT"
    MISSING_CONSTANT       = 99999.9
    FORMAT                 = "F7.1"
    DESCRIPTION            = "V_TOF2 HIGH VOLTAGE CONVERTER 2 VOLTAGE MEAN,
                              IN THE TIME-OF-FLIGHT SECTION"
  END_OBJECT               = COLUMN

  OBJECT                   = COLUMN
    COLUMN_NUMBER          = 35
    NAME                   = "V_TOF2_MAX"
    DATA_TYPE              = ASCII_REAL
```

```
  START_BYTE            = 273
  BYTES                 = 7
  UNIT                  = "VOLT"
  MISSING_CONSTANT      = 99999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "V_TOF2 HIGH VOLTAGE CONVERTER 2 VOLTAGE MAXIMUM,
                           IN THE TIME-OF-FLIGHT SECTION"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 36
  NAME                  = "V_TOF2_STD"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 281
  BYTES                 = 7
  UNIT                  = "VOLT"
  MISSING_CONSTANT      = 99999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "V_TOF2 HIGH VOLTAGE CONVERTER 2 VOLTAGE STANDARD
                           DEVIATION, IN THE TIME-OF-FLIGHT SECTION"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 37
  NAME                  = "V_DT_MIN"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 289
  BYTES                 = 7
  UNIT                  = "VOLT"
  MISSING_CONSTANT      = 99999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "V_DT DRIFT TUBE VOLTAGE MINIMUM,
                           IN THE TIME-OF-FLIGHT SECTION"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 38
  NAME                  = "V_DT_MEAN"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 297
  BYTES                 = 7
  UNIT                  = "VOLT"
  MISSING_CONSTANT      = 99999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "V_DT DRIFT TUBE VOLTAGE MEAN,
                           IN THE TIME-OF-FLIGHT SECTION"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 39
  NAME                  = "V_DT_MAX"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 305
  BYTES                 = 7
  UNIT                  = "VOLT"
  MISSING_CONSTANT      = 99999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "V_DT DRIFT TUBE VOLTAGE MAXIMUM,
                           IN THE TIME-OF-FLIGHT SECTION"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 40
  NAME                  = "V_DT_STD"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 313
  BYTES                 = 7
  UNIT                  = "VOLT"
  MISSING_CONSTANT      = 99999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "V_DT DRIFT TUBE VOLTAGE STANDARD DEVIATION,
                           IN THE TIME-OF-FLIGHT SECTION"
END_OBJECT              = COLUMN
```

```
OBJECT                  = COLUMN
  COLUMN_NUMBER         = 41
  NAME                  = "V_PA_MIN"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 321
  BYTES                 = 7
  UNIT                  = "VOLT"
  MISSING_CONSTANT      = 99999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "V_PA POST-ACCELERATION VOLTAGE MINIMUM,
                           IN THE TIME-OF-FLIGHT SECTION"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 42
  NAME                  = "V_PA_MEAN"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 329
  BYTES                 = 7
  UNIT                  = "VOLT"
  MISSING_CONSTANT      = 99999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "V_PA POST-ACCELERATION VOLTAGE MEAN,
                           IN THE TIME-OF-FLIGHT SECTION"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 43
  NAME                  = "V_PA_MAX"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 337
  BYTES                 = 7
  UNIT                  = "VOLT"
  MISSING_CONSTANT      = 99999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "V_PA POST-ACCELERATION VOLTAGE MAXIMUM,
                           IN THE TIME-OF-FLIGHT SECTION"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 44
  NAME                  = "V_PA_STD"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 345
  BYTES                 = 7
  UNIT                  = "VOLT"
  MISSING_CONSTANT      = 99999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "V_PA POST-ACCELERATION VOLTAGE STANDARD DEVIATION,
                           IN THE TIME-OF-FLIGHT SECTION"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 45
  NAME                  = "V_DET_MIN"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 353
  BYTES                 = 7
  UNIT                  = "VOLT"
  MISSING_CONSTANT      = 99999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "V_DET ION DETECTOR VOLTAGE MINIMUM,
                           IN THE TIME-OF-FLIGHT SECTION"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 46
  NAME                  = "V_DET_MEAN"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 361
  BYTES                 = 7
  UNIT                  = "VOLT"
  MISSING_CONSTANT      = 99999.9
  FORMAT                = "F7.1"
```

```
  DESCRIPTION           = "V_DET ION DETECTOR VOLTAGE MEAN,
                           IN THE TIME-OF-FLIGHT SECTION"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 47
  NAME                  = "V_DET_MAX"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 369
  BYTES                 = 7
  UNIT                  = "VOLT"
  MISSING_CONSTANT      = 99999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "V_DET ION DETECTOR VOLTAGE MAXIMUM,
                           IN THE TIME-OF-FLIGHT SECTION"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 48
  NAME                  = "V_DET_STD"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 377
  BYTES                 = 7
  UNIT                  = "VOLT"
  MISSING_CONSTANT      = 99999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "V_DET ION DETECTOR VOLTAGE STANDARD DEVIATION,
                           IN THE TIME-OF-FLIGHT SECTION"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 49
  NAME                  = "V_DX_TOF_MIN"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 385
  BYTES                 = 7
  UNIT                  = "VOLT"
  MISSING_CONSTANT      = 99999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "V_DX_TOF X-DIRECTION DEFLECTION VOLTAGE MINIMUM,
                           IN THE TIME-OF-FLIGHT SECTION"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 50
  NAME                  = "V_DX_TOF_MEAN"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 393
  BYTES                 = 7
  UNIT                  = "VOLT"
  MISSING_CONSTANT      = 99999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "V_DX_TOF X-DIRECTION DEFLECTION VOLTAGE MEAN,
                           IN THE TIME-OF-FLIGHT SECTION"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 51
  NAME                  = "V_DX_TOF_MAX"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 401
  BYTES                 = 7
  UNIT                  = "VOLT"
  MISSING_CONSTANT      = 99999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "V_DX_TOF X-DIRECTION DEFLECTION VOLTAGE MAXIMUM,
                           IN THE TIME-OF-FLIGHT SECTION"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 52
  NAME                  = "V_DX_TOF_STD"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 409
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  BYTES                  = 7
  UNIT                   = "VOLT"
  MISSING_CONSTANT       = 99999.9
  FORMAT                 = "F7.1"
  DESCRIPTION            = "V_DX_TOF X-DIRECTION DEFLECTION VOLTAGE STANDARD
                            DEVIATION, IN THE TIME-OF-FLIGHT SECTION"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 53
  NAME                   = "V_DY_TOF_MIN"
  DATA_TYPE              = ASCII_REAL
  START_BYTE             = 417
  BYTES                  = 7
  UNIT                   = "VOLT"
  MISSING_CONSTANT       = 99999.9
  FORMAT                 = "F7.1"
  DESCRIPTION            = "V_DY_TOF Y-DIRECTION DEFLECTION VOLTAGE MINIMUM,
                            IN THE TIME-OF-FLIGHT SECTION"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 54
  NAME                   = "V_DY_TOF_MEAN"
  DATA_TYPE              = ASCII_REAL
  START_BYTE             = 425
  BYTES                  = 7
  UNIT                   = "VOLT"
  MISSING_CONSTANT       = 99999.9
  FORMAT                 = "F7.1"
  DESCRIPTION            = "V_DY_TOF Y-DIRECTION DEFLECTION VOLTAGE MEAN,
                            IN THE TIME-OF-FLIGHT SECTION"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 55
  NAME                   = "V_DY_TOF_MAX"
  DATA_TYPE              = ASCII_REAL
  START_BYTE             = 433
  BYTES                  = 7
  UNIT                   = "VOLT"
  MISSING_CONSTANT       = 99999.9
  FORMAT                 = "F7.1"
  DESCRIPTION            = "V_DY_TOF Y-DIRECTION DEFLECTION VOLTAGE MAXIMUM,
                            IN THE TIME-OF-FLIGHT SECTION"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 56
  NAME                   = "V_DY_TOF_STD"
  DATA_TYPE              = ASCII_REAL
  START_BYTE             = 441
  BYTES                  = 7
  UNIT                   = "VOLT"
  MISSING_CONSTANT       = 99999.9
  FORMAT                 = "F7.1"
  DESCRIPTION            = "V_DY_TOF Y-DIRECTION DEFLECTION VOLTAGE STANDARD
                            DEVIATION, IN THE TIME-OF-FLIGHT SECTION"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 57
  NAME                   = "V_L1_MIN"
  DATA_TYPE              = ASCII_REAL
  START_BYTE             = 449
  BYTES                  = 7
  UNIT                   = "VOLT"
  MISSING_CONSTANT       = 99999.9
  FORMAT                 = "F7.1"
  DESCRIPTION            = "V_L1 LENS 1 VOLTAGE MINIMUM,
                            IN THE PRIMARY ION BEAM SYSTEM"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
```

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  COLUMN_NUMBER         = 58
  NAME                  = "V_L1_MEAN"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 457
  BYTES                 = 7
  UNIT                  = "VOLT"
  MISSING_CONSTANT      = 99999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "V_L1 LENS 1 VOLTAGE MEAN,
                           IN THE PRIMARY ION BEAM SYSTEM"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 59
  NAME                  = "V_L1_MAX"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 465
  BYTES                 = 7
  UNIT                  = "VOLT"
  MISSING_CONSTANT      = 99999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "V_L1 LENS 1 VOLTAGE MAXIMUM,
                           IN THE PRIMARY ION BEAM SYSTEM"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 60
  NAME                  = "V_L1_STD"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 473
  BYTES                 = 7
  UNIT                  = "VOLT"
  MISSING_CONSTANT      = 99999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "V_L1 LENS 1 VOLTAGE STANDARD DEVIATION,
                           IN THE PRIMARY ION BEAM SYSTEM"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 61
  NAME                  = "V_L2_MIN"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 481
  BYTES                 = 7
  UNIT                  = "VOLT"
  MISSING_CONSTANT      = 99999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "V_L2 LENS 2 VOLTAGE MINIMUM,
                           IN THE PRIMARY ION BEAM SYSTEM"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 62
  NAME                  = "V_L2_MEAN"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 489
  BYTES                 = 7
  UNIT                  = "VOLT"
  MISSING_CONSTANT      = 99999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "V_L2 LENS 2 VOLTAGE MEAN,
                           IN THE PRIMARY ION BEAM SYSTEM"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 63
  NAME                  = "V_L2_MAX"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 497
  BYTES                 = 7
  UNIT                  = "VOLT"
  MISSING_CONSTANT      = 99999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "V_L2 LENS 2 VOLTAGE MAXIMUM,
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                             IN THE PRIMARY ION BEAM SYSTEM"
END_OBJECT                 = COLUMN

OBJECT                     = COLUMN
  COLUMN_NUMBER            = 64
  NAME                     = "V_L2_STD"
  DATA_TYPE                = ASCII_REAL
  START_BYTE               = 505
  BYTES                    = 7
  UNIT                     = "VOLT"
  MISSING_CONSTANT         = 99999.9
  FORMAT                   = "F7.1"
  DESCRIPTION              = "V_L2 LENS 2 VOLTAGE STANDARD DEVIATION,
                             IN THE PRIMARY ION BEAM SYSTEM"
END_OBJECT                 = COLUMN

OBJECT                     = COLUMN
  COLUMN_NUMBER            = 65
  NAME                     = "V_BS1_MIN"
  DATA_TYPE                = ASCII_REAL
  START_BYTE               = 513
  BYTES                    = 7
  UNIT                     = "VOLT"
  MISSING_CONSTANT         = 99999.9
  FORMAT                   = "F7.1"
  DESCRIPTION              = "V_BS1 BEAM SWITCH 1 VOLTAGE MINIMUM,
                             IN THE PRIMARY ION BEAM SYSTEM"
END_OBJECT                 = COLUMN

OBJECT                     = COLUMN
  COLUMN_NUMBER            = 66
  NAME                     = "V_BS1_MEAN"
  DATA_TYPE                = ASCII_REAL
  START_BYTE               = 521
  BYTES                    = 7
  UNIT                     = "VOLT"
  MISSING_CONSTANT         = 99999.9
  FORMAT                   = "F7.1"
  DESCRIPTION              = "V_BS1 BEAM SWITCH 1 VOLTAGE MEAN,
                             IN THE PRIMARY ION BEAM SYSTEM"
END_OBJECT                 = COLUMN

OBJECT                     = COLUMN
  COLUMN_NUMBER            = 67
  NAME                     = "V_BS1_MAX"
  DATA_TYPE                = ASCII_REAL
  START_BYTE               = 529
  BYTES                    = 7
  UNIT                     = "VOLT"
  MISSING_CONSTANT         = 99999.9
  FORMAT                   = "F7.1"
  DESCRIPTION              = "V_BS1 BEAM SWITCH 1 VOLTAGE MAXIMUM,
                             IN THE PRIMARY ION BEAM SYSTEM"
END_OBJECT                 = COLUMN

OBJECT                     = COLUMN
  COLUMN_NUMBER            = 68
  NAME                     = "V_BS1_STD"
  DATA_TYPE                = ASCII_REAL
  START_BYTE               = 537
  BYTES                    = 7
  UNIT                     = "VOLT"
  MISSING_CONSTANT         = 99999.9
  FORMAT                   = "F7.1"
  DESCRIPTION              = "V_BS1 BEAM SWITCH 1 VOLTAGE STANDARD DEVIATION,
                             IN THE PRIMARY ION BEAM SYSTEM"
END_OBJECT                 = COLUMN

OBJECT                     = COLUMN
  COLUMN_NUMBER            = 69
  NAME                     = "V_BS2_MIN"
  DATA_TYPE                = ASCII_REAL
  START_BYTE               = 545
  BYTES                    = 7
```

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  UNIT                   = "VOLT"
  MISSING_CONSTANT       = 99999.9
  FORMAT                 = "F7.1"
  DESCRIPTION            = "V_BS2 BEAM SWITCH 2 VOLTAGE MINIMUM,
                            IN THE PRIMARY ION BEAM SYSTEM"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 70
  NAME                   = "V_BS2_MEAN"
  DATA_TYPE              = ASCII_REAL
  START_BYTE             = 553
  BYTES                  = 7
  UNIT                   = "VOLT"
  MISSING_CONSTANT       = 99999.9
  FORMAT                 = "F7.1"
  DESCRIPTION            = "V_BS2 BEAM SWITCH 2 VOLTAGE MEAN,
                            IN THE PRIMARY ION BEAM SYSTEM"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 71
  NAME                   = "V_BS2_MAX"
  DATA_TYPE              = ASCII_REAL
  START_BYTE             = 561
  BYTES                  = 7
  UNIT                   = "VOLT"
  MISSING_CONSTANT       = 99999.9
  FORMAT                 = "F7.1"
  DESCRIPTION            = "V_BS2 BEAM SWITCH 2 VOLTAGE MAXIMUM,
                            IN THE PRIMARY ION BEAM SYSTEM"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 72
  NAME                   = "V_BS2_STD"
  DATA_TYPE              = ASCII_REAL
  START_BYTE             = 569
  BYTES                  = 7
  UNIT                   = "VOLT"
  MISSING_CONSTANT       = 99999.9
  FORMAT                 = "F7.1"
  DESCRIPTION            = "V_BS2 BEAM SWITCH 2 VOLTAGE STANDARD DEVIATION,
                            IN THE PRIMARY ION BEAM SYSTEM"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 73
  NAME                   = "V_CB1_MIN"
  DATA_TYPE              = ASCII_REAL
  START_BYTE             = 577
  BYTES                  = 7
  UNIT                   = "VOLT"
  MISSING_CONSTANT       = 99999.9
  FORMAT                 = "F7.1"
  DESCRIPTION            = "V_CB1 BEAM CHOPPER POSITIVE VOLTAGE MINIMUM,
                            IN THE PRIMARY ION BEAM SYSTEM"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 74
  NAME                   = "V_CB1_MEAN"
  DATA_TYPE              = ASCII_REAL
  START_BYTE             = 585
  BYTES                  = 7
  UNIT                   = "VOLT"
  MISSING_CONSTANT       = 99999.9
  FORMAT                 = "F7.1"
  DESCRIPTION            = "V_CB1 BEAM CHOPPER POSITIVE VOLTAGE MEAN,
                            IN THE PRIMARY ION BEAM SYSTEM"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 75
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  NAME                    = "V_CB1_MAX"
  DATA_TYPE               = ASCII_REAL
  START_BYTE              = 593
  BYTES                   = 7
  UNIT                    = "VOLT"
  MISSING_CONSTANT        = 99999.9
  FORMAT                  = "F7.1"
  DESCRIPTION             = "V_CB1 BEAM CHOPPER POSITIVE VOLTAGE MAXIMUM,
                             IN THE PRIMARY ION BEAM SYSTEM"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
  COLUMN_NUMBER           = 76
  NAME                    = "V_CB1_STD"
  DATA_TYPE               = ASCII_REAL
  START_BYTE              = 601
  BYTES                   = 7
  UNIT                    = "VOLT"
  MISSING_CONSTANT        = 99999.9
  FORMAT                  = "F7.1"
  DESCRIPTION             = "V_CB1 BEAM CHOPPER POSITIVE VOLTAGE STANDARD
                             DEVIATION, IN THE PRIMARY ION BEAM SYSTEM"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
  COLUMN_NUMBER           = 77
  NAME                    = "V_CB2_MIN"
  DATA_TYPE               = ASCII_REAL
  START_BYTE              = 609
  BYTES                   = 7
  UNIT                    = "VOLT"
  MISSING_CONSTANT        = 99999.9
  FORMAT                  = "F7.1"
  DESCRIPTION             = "V_CB2 BEAM CHOPPER NEGATIVE VOLTAGE MINIMUM,
                             IN THE PRIMARY ION BEAM SYSTEM"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
  COLUMN_NUMBER           = 78
  NAME                    = "V_CB2_MEAN"
  DATA_TYPE               = ASCII_REAL
  START_BYTE              = 617
  BYTES                   = 7
  UNIT                    = "VOLT"
  MISSING_CONSTANT        = 99999.9
  FORMAT                  = "F7.1"
  DESCRIPTION             = "V_CB2 BEAM CHOPPER NEGATIVE VOLTAGE MEAN,
                             IN THE PRIMARY ION BEAM SYSTEM"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
  COLUMN_NUMBER           = 79
  NAME                    = "V_CB2_MAX"
  DATA_TYPE               = ASCII_REAL
  START_BYTE              = 625
  BYTES                   = 7
  UNIT                    = "VOLT"
  MISSING_CONSTANT        = 99999.9
  FORMAT                  = "F7.1"
  DESCRIPTION             = "V_CB2 BEAM CHOPPER NEGATIVE VOLTAGE MAXIMUM,
                             IN THE PRIMARY ION BEAM SYSTEM"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
  COLUMN_NUMBER           = 80
  NAME                    = "V_CB2_STD"
  DATA_TYPE               = ASCII_REAL
  START_BYTE              = 633
  BYTES                   = 7
  UNIT                    = "VOLT"
  MISSING_CONSTANT        = 99999.9
  FORMAT                  = "F7.1"
  DESCRIPTION             = "V_CB2 BEAM CHOPPER NEGATIVE VOLTAGE STANDARD
                             DEVIATION, IN THE PRIMARY ION BEAM SYSTEM"
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END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 81
  NAME                   = "V_DX_PIBS_MIN"
  DATA_TYPE              = ASCII_REAL
  START_BYTE             = 641
  BYTES                  = 7
  UNIT                   = "VOLT"
  MISSING_CONSTANT       = 99999.9
  FORMAT                 = "F7.1"
  DESCRIPTION            = "V_DX_PIBS X-DIRECTION DEFLECTION VOLTAGE MINIMUM,
                             IN THE PRIMARY ION BEAM SYSTEM"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 82
  NAME                   = "V_DX_PIBS_MEAN"
  DATA_TYPE              = ASCII_REAL
  START_BYTE             = 649
  BYTES                  = 7
  UNIT                   = "VOLT"
  MISSING_CONSTANT       = 99999.9
  FORMAT                 = "F7.1"
  DESCRIPTION            = "V_DX_PIBS X-DIRECTION DEFLECTION VOLTAGE MEAN,
                             IN THE PRIMARY ION BEAM SYSTEM"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 83
  NAME                   = "V_DX_PIBS_MAX"
  DATA_TYPE              = ASCII_REAL
  START_BYTE             = 657
  BYTES                  = 7
  UNIT                   = "VOLT"
  MISSING_CONSTANT       = 99999.9
  FORMAT                 = "F7.1"
  DESCRIPTION            = "V_DX_PIBS X-DIRECTION DEFLECTION VOLTAGE MAXIMUM,
                             IN THE PRIMARY ION BEAM SYSTEM"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 84
  NAME                   = "V_DX_PIBS_STD"
  DATA_TYPE              = ASCII_REAL
  START_BYTE             = 665
  BYTES                  = 7
  UNIT                   = "VOLT"
  MISSING_CONSTANT       = 99999.9
  FORMAT                 = "F7.1"
  DESCRIPTION            = "V_DX_PIBS X-DIRECTION DEFLECTION VOLTAGE STANDARD
                             DEVIATION, IN THE PRIMARY ION BEAM SYSTEM"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 85
  NAME                   = "V_DY_PIBS_MIN"
  DATA_TYPE              = ASCII_REAL
  START_BYTE             = 673
  BYTES                  = 7
  UNIT                   = "VOLT"
  MISSING_CONSTANT       = 99999.9
  FORMAT                 = "F7.1"
  DESCRIPTION            = "V_DY_PIBS Y-DIRECTION DEFLECTION VOLTAGE MINIMUM,
                             IN THE PRIMARY ION BEAM SYSTEM"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 86
  NAME                   = "V_DY_PIBS_MEAN"
  DATA_TYPE              = ASCII_REAL
  START_BYTE             = 681
  BYTES                  = 7
  UNIT                   = "VOLT"
```

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    MISSING_CONSTANT      = 99999.9
    FORMAT                = "F7.1"
    DESCRIPTION           = "V_DY_PIBS Y-DIRECTION DEFLECTION VOLTAGE MEAN,
                             IN THE PRIMARY ION BEAM SYSTEM"
  END_OBJECT              = COLUMN

  OBJECT                  = COLUMN
    COLUMN_NUMBER         = 87
    NAME                  = "V_DY_PIBS_MAX"
    DATA_TYPE             = ASCII_REAL
    START_BYTE            = 689
    BYTES                 = 7
    UNIT                  = "VOLT"
    MISSING_CONSTANT      = 99999.9
    FORMAT                = "F7.1"
    DESCRIPTION           = "V_DY_PIBS Y-DIRECTION DEFLECTION VOLTAGE MAXIMUM,
                             IN THE PRIMARY ION BEAM SYSTEM"
  END_OBJECT              = COLUMN

  OBJECT                  = COLUMN
    COLUMN_NUMBER         = 88
    NAME                  = "V_DY_PIBS_STD"
    DATA_TYPE             = ASCII_REAL
    START_BYTE            = 697
    BYTES                 = 7
    UNIT                  = "VOLT"
    MISSING_CONSTANT      = 99999.9
    FORMAT                = "F7.1"
    DESCRIPTION           = "V_DY_PIBS Y-DIRECTION DEFLECTION VOLTAGE STANDARD
                             DEVIATION, IN THE PRIMARY ION BEAM SYSTEM"
  END_OBJECT              = COLUMN

  OBJECT                  = COLUMN
    COLUMN_NUMBER         = 89
    NAME                  = "V_TIP_MIN"
    DATA_TYPE             = ASCII_REAL
    START_BYTE            = 705
    BYTES                 = 7
    UNIT                  = "VOLT"
    MISSING_CONSTANT      = 99999.9
    FORMAT                = "F7.1"
    DESCRIPTION           = "V_TIP TIP VOLTAGE MINIMUM,
                             IN THE PRIMARY ION SOURCE"
  END_OBJECT              = COLUMN

  OBJECT                  = COLUMN
    COLUMN_NUMBER         = 90
    NAME                  = "V_TIP_MEAN"
    DATA_TYPE             = ASCII_REAL
    START_BYTE            = 713
    BYTES                 = 7
    UNIT                  = "VOLT"
    MISSING_CONSTANT      = 99999.9
    FORMAT                = "F7.1"
    DESCRIPTION           = "V_TIP TIP VOLTAGE MEAN,
                             IN THE PRIMARY ION SOURCE"
  END_OBJECT              = COLUMN

  OBJECT                  = COLUMN
    COLUMN_NUMBER         = 91
    NAME                  = "V_TIP_MAX"
    DATA_TYPE             = ASCII_REAL
    START_BYTE            = 721
    BYTES                 = 7
    UNIT                  = "VOLT"
    MISSING_CONSTANT      = 99999.9
    FORMAT                = "F7.1"
    DESCRIPTION           = "V_TIP TIP VOLTAGE MAXIMUM,
                             IN THE PRIMARY ION SOURCE"
  END_OBJECT              = COLUMN

  OBJECT                  = COLUMN
    COLUMN_NUMBER         = 92
    NAME                  = "V_TIP_STD"
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  DATA_TYPE              = ASCII_REAL
  START_BYTE             = 729
  BYTES                  = 7
  UNIT                   = "VOLT"
  MISSING_CONSTANT       = 99999.9
  FORMAT                 = "F7.1"
  DESCRIPTION            = "V_TIP TIP VOLTAGE STANDARD DEVIATION,
                            IN THE PRIMARY ION SOURCE"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 93
  NAME                   = "C_TIP_MIN"
  DATA_TYPE              = ASCII_REAL
  START_BYTE             = 737
  BYTES                  = 7
  UNIT                   = "MICROAMPERE"
  MISSING_CONSTANT       = 99999.9
  FORMAT                 = "F7.1"
  DESCRIPTION            = "C_TIP TIP CURRENT MINIMUM,
                            IN THE PRIMARY ION SOURCE"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 94
  NAME                   = "C_TIP_MEAN"
  DATA_TYPE              = ASCII_REAL
  START_BYTE             = 745
  BYTES                  = 7
  UNIT                   = "MICROAMPERE"
  MISSING_CONSTANT       = 99999.9
  FORMAT                 = "F7.1"
  DESCRIPTION            = "C_TIP TIP CURRENT MEAN,
                            IN THE PRIMARY ION SOURCE"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 95
  NAME                   = "C_TIP_MAX"
  DATA_TYPE              = ASCII_REAL
  START_BYTE             = 753
  BYTES                  = 7
  UNIT                   = "MICROAMPERE"
  MISSING_CONSTANT       = 99999.9
  FORMAT                 = "F7.1"
  DESCRIPTION            = "C_TIP TIP CURRENT MAXIMUM,
                            IN THE PRIMARY ION SOURCE"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 96
  NAME                   = "C_TIP_STD"
  DATA_TYPE              = ASCII_REAL
  START_BYTE             = 761
  BYTES                  = 7
  UNIT                   = "MICROAMPERE"
  MISSING_CONSTANT       = 99999.9
  FORMAT                 = "F7.1"
  DESCRIPTION            = "C_TIP TIP VOLTAGE STANDARD DEVIATION,
                            IN THE PRIMARY ION SOURCE"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 97
  NAME                   = "V_EXT_MIN"
  DATA_TYPE              = ASCII_REAL
  START_BYTE             = 769
  BYTES                  = 7
  UNIT                   = "VOLT"
  MISSING_CONSTANT       = 99999.9
  FORMAT                 = "F7.1"
  DESCRIPTION            = "V_EXT EXTRACTOR VOLTAGE MINIMUM,
                            IN THE PRIMARY ION SOURCE"
END_OBJECT               = COLUMN
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OBJECT                  = COLUMN
  COLUMN_NUMBER         = 98
  NAME                  = "V_EXT_MEAN"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 777
  BYTES                 = 7
  UNIT                  = "VOLT"
  MISSING_CONSTANT      = 99999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "V_EXT EXTRACTOR VOLTAGE MEAN,
                           IN THE PRIMARY ION SOURCE"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 99
  NAME                  = "V_EXT_MAX"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 785
  BYTES                 = 7
  UNIT                  = "VOLT"
  MISSING_CONSTANT      = 99999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "V_EXT EXTRACTOR VOLTAGE MAXIMUM,
                           IN THE PRIMARY ION SOURCE"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 100
  NAME                  = "V_EXT_STD"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 793
  BYTES                 = 7
  UNIT                  = "VOLT"
  MISSING_CONSTANT      = 99999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "V_EXT EXTRACTOR VOLTAGE STANDARD DEVIATION,
                           IN THE PRIMARY ION SOURCE"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 101
  NAME                  = "C_EXT_MIN"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 801
  BYTES                 = 7
  UNIT                  = "MICROAMPERE"
  MISSING_CONSTANT      = 99999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "C_EXT EXTRACTOR CURRENT MINIMUM,
                           IN THE PRIMARY ION SOURCE"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 102
  NAME                  = "C_EXT_MEAN"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 809
  BYTES                 = 7
  UNIT                  = "MICROAMPERE"
  MISSING_CONSTANT      = 99999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "C_EXT EXTRACTOR CURRENT MEAN,
                           IN THE PRIMARY ION SOURCE"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 103
  NAME                  = "C_EXT_MAX"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 817
  BYTES                 = 7
  UNIT                  = "MICROAMPERE"
  MISSING_CONSTANT      = 99999.9
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  FORMAT                 = "F7.1"
  DESCRIPTION            = "C_EXT EXTRACTOR CURRENT MAXIMUM,
                            IN THE PRIMARY ION SOURCE"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 104
  NAME                   = "C_EXT_STD"
  DATA_TYPE              = ASCII_REAL
  START_BYTE             = 825
  BYTES                  = 7
  UNIT                   = "MICROAMPERE"
  MISSING_CONSTANT       = 99999.9
  FORMAT                 = "F7.1"
  DESCRIPTION            = "C_EXT EXTRACTOR CURRENT STANDARD DEVIATION,
                            IN THE PRIMARY ION SOURCE"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 105
  NAME                   = "V_HEATER_MIN"
  DATA_TYPE              = ASCII_REAL
  START_BYTE             = 833
  BYTES                  = 7
  UNIT                   = "VOLT"
  MISSING_CONSTANT       = 99999.9
  FORMAT                 = "F7.1"
  DESCRIPTION            = "V_HEATER HEATER VOLTAGE MINIMUM,
                            IN THE PRIMARY ION SOURCE"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 106
  NAME                   = "V_HEATER_MEAN"
  DATA_TYPE              = ASCII_REAL
  START_BYTE             = 841
  BYTES                  = 7
  UNIT                   = "VOLT"
  MISSING_CONSTANT       = 99999.9
  FORMAT                 = "F7.1"
  DESCRIPTION            = "V_HEATER HEATER VOLTAGE MEAN,
                            IN THE PRIMARY ION SOURCE"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 107
  NAME                   = "V_HEATER_MAX"
  DATA_TYPE              = ASCII_REAL
  START_BYTE             = 849
  BYTES                  = 7
  UNIT                   = "VOLT"
  MISSING_CONSTANT       = 99999.9
  FORMAT                 = "F7.1"
  DESCRIPTION            = "V_HEATER HEATER VOLTAGE MAXIMUM,
                            IN THE PRIMARY ION SOURCE"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 108
  NAME                   = "V_HEATER_STD"
  DATA_TYPE              = ASCII_REAL
  START_BYTE             = 857
  BYTES                  = 7
  UNIT                   = "VOLT"
  MISSING_CONSTANT       = 99999.9
  FORMAT                 = "F7.1"
  DESCRIPTION            = "V_HEATER HEATER VOLTAGE STANDARD DEVIATION,
                            IN THE PRIMARY ION SOURCE"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 109
  NAME                   = "C_HEATER_MIN"
  DATA_TYPE              = ASCII_REAL
```

```
  START_BYTE            = 865
  BYTES                 = 7
  UNIT                  = "AMPERE"
  MISSING_CONSTANT      = 99999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "C_HEATER HEATER CURRENT MINIMUM,
                           IN THE PRIMARY ION SOURCE"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 110
  NAME                  = "C_HEATER_MEAN"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 873
  BYTES                 = 7
  UNIT                  = "AMPERE"
  MISSING_CONSTANT      = 99999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "C_HEATER HEATER CURRENT MEAN,
                           IN THE PRIMARY ION SOURCE"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 111
  NAME                  = "C_HEATER_MAX"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 881
  BYTES                 = 7
  UNIT                  = "AMPERE"
  MISSING_CONSTANT      = 99999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "C_HEATER HEATER CURRENT MAXIMUM,
                           IN THE PRIMARY ION SOURCE"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 112
  NAME                  = "C_HEATER_STD"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 889
  BYTES                 = 7
  UNIT                  = "AMPERE"
  MISSING_CONSTANT      = 99999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "C_HEATER HEATER CURRENT STANDARD DEVIATION,
                           IN THE PRIMARY ION SOURCE"
END_OBJECT              = COLUMN
```

COSIMA_SPECTRUM_TDC_TIMING.FMT:

```
  OBJECT                        = COLUMN
    COLUMN_NUMBER               = 1
    NAME                        = CHOPPER_ON
    DATA_TYPE                   = ASCII_REAL
    START_BYTE                  = 1
    BYTES                       = 9
    UNIT                        = "NANOSECOND"
    FORMAT                      = "F9.2"
    DESCRIPTION                 = "TIME TO DIGITAL UNIT CHOPPER ON TIME"
  END_OBJECT                    = COLUMN
  OBJECT                        = COLUMN
    COLUMN_NUMBER               = 2
    NAME                        = CHOPPER_OFF
    DATA_TYPE                   = ASCII_REAL
    START_BYTE                  = 11
    BYTES                       = 9
    UNIT                        = "NANOSECOND"
    FORMAT                      = "F9.2"
    DESCRIPTION                 = "TIME TO DIGITAL UNIT CHOPPER OFF TIME"
  END_OBJECT                    = COLUMN
  OBJECT                        = COLUMN
    COLUMN_NUMBER               = 3
    NAME                        = BUNCHER_1_ON
    DATA_TYPE                   = ASCII_REAL
```

```
    START_BYTE                   = 21
    BYTES                        = 9
    UNIT                         = "NANOSECOND"
    FORMAT                       = "F9.2"
    DESCRIPTION                  = "TIME TO DIGITAL UNIT BUNCHER 1 ON TIME"
  END_OBJECT                     = COLUMN
  OBJECT                         = COLUMN
    COLUMN_NUMBER                = 4
    NAME                         = BUNCHER_2_ON
    DATA_TYPE                    = ASCII_REAL
    START_BYTE                   = 31
    BYTES                        = 9
    UNIT                         = "NANOSECOND"
    FORMAT                       = "F9.2"
    DESCRIPTION                  = "TIME TO DIGITAL UNIT BUNCHER 2 ON TIME"
  END_OBJECT                     = COLUMN
  OBJECT                         = COLUMN
    COLUMN_NUMBER                = 5
    NAME                         = BUNCHER_3_ON
    DATA_TYPE                    = ASCII_REAL
    START_BYTE                   = 41
    BYTES                        = 9
    UNIT                         = "NANOSECOND"
    FORMAT                       = "F9.2"
    DESCRIPTION                  = "TIME TO DIGITAL UNIT BUNCHER 3 ON TIME"
  END_OBJECT                     = COLUMN
  OBJECT                         = COLUMN
    COLUMN_NUMBER                = 6
    NAME                         = PIBS_OFF
    DATA_TYPE                    = ASCII_REAL
    START_BYTE                   = 51
    BYTES                        = 9
    UNIT                         = "NANOSECOND"
    FORMAT                       = "F9.2"
    DESCRIPTION                  = "TIME TO DIGITAL UNIT PRIMARY ION BEAM
                                    SYSTEM OFF TIME"
  END_OBJECT                     = COLUMN
  OBJECT                         = COLUMN
    COLUMN_NUMBER                = 7
    NAME                         = TOF_OFF
    DATA_TYPE                    = ASCII_REAL
    START_BYTE                   = 61
    BYTES                        = 9
    UNIT                         = "NANOSECOND"
    FORMAT                       = "F9.2"
    DESCRIPTION                  = "TIME TO DIGITAL UNIT TIME OF FLIGHT UNIT
                                    OFF TIME"
  END_OBJECT                     = COLUMN
```

COSIMA_SPECTRUM_TDC_CALIB.FMT:

```
  OBJECT                         = COLUMN
    COLUMN_NUMBER                = 1
    NAME                         = TDC_CALIBRATION_OFFSET
    DATA_TYPE                    = ASCII_INTEGER
    START_BYTE                   = 1
    BYTES                        = 11
    UNIT                         = "SECOND"
    FORMAT                       = "I11"
    DESCRIPTION                  = "OFFSET IN SECONDS FROM THE START OF THE
                                    SPECTRUM MEASUREMENT"
  END_OBJECT                     = COLUMN
  OBJECT                         = COLUMN
    COLUMN_NUMBER                = 2
    NAME                         = TDC_DELAY_LINE
    DATA_TYPE                    = ASCII_INTEGER
    START_BYTE                   = 13
    BYTES                        = 3
    FORMAT                       = "I3"
    DESCRIPTION                  = "TIME TO DIGITAL UNIT DELAY LINE
                                    DAC CONTROL VALUE"
  END_OBJECT                     = COLUMN
  OBJECT                         = COLUMN
    COLUMN_NUMBER                = 3
```

```
    NAME                          = TDC_CALIBRATION_MEAN
    DATA_TYPE                     = ASCII_INTEGER
    START_BYTE                    = 17
    BYTES                         = 4
    FORMAT                        = "I4"
    DESCRIPTION                   = "TIME TO DIGITAL UNIT CHANNEL
                                     CALIBRATION MEAN"
  END_OBJECT                      = COLUMN
  OBJECT                          = COLUMN
    COLUMN_NUMBER                 = 4
    NAME                          = TDC_CALIBRATION_STD
    DATA_TYPE                     = ASCII_INTEGER
    START_BYTE                    = 22
    BYTES                         = 4
    FORMAT                        = "I4"
    DESCRIPTION                   = "TIME TO DIGITAL UNIT CHANNEL
                                     CALIBRATION STANTARD DEVIATION"
  END_OBJECT                      = COLUMN
  OBJECT                          = COLUMN
    COLUMN_NUMBER                 = 5
    NAME                          = TDC_CHANNEL_DIFFERENCE
    DATA_TYPE                     = ASCII_INTEGER
    START_BYTE                    = 27
    BYTES                         = 79
    ITEMS                         = 16
    ITEM_BYTES                    = 4
    ITEM_OFFSET                   = 5
    FORMAT                        = "I4"
    DESCRIPTION                   = "TIME TO DIGITAL UNIT CHANNEL
                                     DIFFERENCE FROM THE MEAN"
  END_OBJECT                      = COLUMN
```

4.3.4 Scan data product

4.3.4.1 General description

With each scan step, the following elements are given:

- total counts in the three time/mass ranges
- number of ion shots
- total counts
- substrate position
- time/mass range limits
- varied parameters, step values

Detailed contents of the elements are described in the label example below.

4.3.4.2Label example

```
PDS_VERSION_ID                    = PDS3
LABEL_REVISION_NOTE               = "V1.1"

/* FILE FORMAT */
RECORD_TYPE                       = FIXED_LENGTH
RECORD_BYTES                      = 153
FILE_RECORDS                      =  19
LABEL_RECORDS                     =  18
/* POINTER TO DATA OBJECTS */
^SCAN_TABLE                       =  19

/* GENERAL DATA DESCRIPTION PARAMETERS */
FILE_NAME                         = "CS_2D8_20100508T104500_SCAN.TAB"
DATA_SET_ID                       = "RO-CAL-COSIMA-3-V3.0"
DATA_SET_NAME                     = "ROSETTA-ORBITER CAL COSIMA 3 V3.0"
PRODUCT_ID                        = "CS_2D8_20100508T104500_SCAN"
PRODUCT_CREATION_TIME             = 2010-08-28T15:13:27
PRODUCT_TYPE                      = "REFDR"
PROCESSING_LEVEL_ID               = “3”
MISSION_ID                        = "ROSETTA"
MISSION_NAME                      = "INTERNATIONAL ROSETTA MISSION"
```

```
MISSION_PHASE_NAME               = "CRUISE 5"
INSTRUMENT_HOST_ID               = "RO"
INSTRUMENT_HOST_NAME             = "ROSETTA-ORBITER"
INSTRUMENT_ID                    = "COSIMA"
INSTRUMENT_NAME                  = "COMETARY SECONDARY ION MASS ANALYZER"
INSTRUMENT_TYPE                  = "MASS SPECTROMETER"
INSTRUMENT_MODE_ID               = "SPECTRUM"
INSTRUMENT_MODE_DESC             = "TIME OF FLIGHT MASS SPECTRUM MEASUREMENT"
TARGET_NAME                      = "CALIBRATION"
TARGET_TYPE                      = "CALIBRATION"
START_TIME                       = 2010-05-08T10:45:00
STOP_TIME                        = 2010-05-08T10:59:19
SPACECRAFT_CLOCK_START_COUNT     = "1/0231936259.28265"
SPACECRAFT_CLOCK_STOP_COUNT      = "1/0231937118.28261"
SC_SUN_POSITION_VECTOR           = "N/A"
SC_TARGET_POSITION_VECTOR        = "N/A"
SC_TARGET_VELOCITY_VECTOR        = "N/A"
SPACECRAFT_ALTITUDE              = "N/A"
SUB_SPACECRAFT_LATITUDE          = "N/A"
SUB_SPACECRAFT_LONGITUDE         = "N/A"
PRODUCER_ID                      = "FMI"
PRODUCER_FULL_NAME               = "JOHAN SILEN"
PRODUCER_INSTITUTION_NAME        = "FINNISH METEOROLOGICAL INSTITUTE"
DATA_QUALITY_ID                  = -1
DATA_QUALITY_DESC                = "-1 = not checked"
ROSETTA:COSIMA_SUBSTRATE_ID      = "2D8"
ROSETTA:COSIMA_SUBSTRATE_DESC    = "Silver, blank"
ROSETTA:COSIMA_SPECTRUM_POL      = "NEGATIVE"

OBJECT                           = SCAN_TABLE
  NAME                           = SCAN_DATA
  INTERCHANGE_FORMAT             = ASCII
  ROWS                           =    1
  COLUMNS                        = 17
  ROW_BYTES                      = 153
  ^STRUCTURE                     = "COSIMA_SCAN_DATA.FMT"
  DESCRIPTION                    = "COSIMA SCAN DATA"
END_OBJECT                       = SCAN_TABLE

END
```

COSIMA_SCAN_DATA.FMT

```
OBJECT                   = COLUMN
  COLUMN_NUMBER          = 1
  NAME                   = WINDOW_1_COUNT
  DATA_TYPE              = ASCII_INTEGER
  START_BYTE             = 1
  BYTES                  = 11
  MISSING_CONSTANT       = -999999999
  FORMAT                 = "I11"
  DESCRIPTION            = "COUNT OF THE EVENTS
                            INSIDE THE FIRST TIME(MASS) WINDOW"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 2
  NAME                   = WINDOW_2_COUNT
  DATA_TYPE              = ASCII_INTEGER
  START_BYTE             = 13
  BYTES                  = 11
  MISSING_CONSTANT       = -999999999
  FORMAT                 = "I11"
  DESCRIPTION            = "COUNT OF THE EVENTS
                            INSIDE THE SECOND TIME(MASS) WINDOW"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 3
  NAME                   = WINDOW_3_COUNT
  DATA_TYPE              = ASCII_INTEGER
  START_BYTE             = 25
  BYTES                  = 11
  MISSING_CONSTANT       = -999999999
```

```
    FORMAT                  = "I11"
    DESCRIPTION             = "COUNT OF THE EVENTS
                               INSIDE THE THIRD TIME(MASS) WINDOW"
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    COLUMN_NUMBER           = 4
    NAME                    = SPECTRUM_SHOTS
    DATA_TYPE               = ASCII_INTEGER
    START_BYTE              = 37
    BYTES                   = 11
    MISSING_CONSTANT        = -999999999
    FORMAT                  = "I11"
    DESCRIPTION             = "NUMBER OF INDIUM ION SHOTS USED"
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    COLUMN_NUMBER           = 5
    NAME                    = TOTAL_COUNT
    DATA_TYPE               = ASCII_INTEGER
    START_BYTE              = 49
    BYTES                   = 11
    MISSING_CONSTANT        = -999999999
    FORMAT                  = "I11"
    DESCRIPTION             = "TOTAL COUNT OF EVENTS DURING ACQUISITION"
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    COLUMN_NUMBER           = 6
    NAME                    = SUBSTRATE_X
    DATA_TYPE               = ASCII_INTEGER
    START_BYTE              = 61
    BYTES                   = 5
    UNIT                    = "MICROMETER"
    MISSING_CONSTANT        = -9999
    FORMAT                  = "I5"
    DESCRIPTION             = "SUBSTRATE X-COORDINATE IN MICROMETERS,
                               ZERO IS AT LEFT"
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    COLUMN_NUMBER           = 7
    NAME                    = SUBSTRATE_Y
    DATA_TYPE               = ASCII_INTEGER
    START_BYTE              = 67
    BYTES                   = 5
    UNIT                    = "MICROMETER"
    MISSING_CONSTANT        = -9999
    FORMAT                  = "I5"
    DESCRIPTION             = "SUBSTRATE Y-COORDINATE IN MICROMETERS,
                               ZERO IS AT BOTTOM"
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    COLUMN_NUMBER           = 8
    NAME                    = WINDOW_1_START
    DATA_TYPE               = ASCII_INTEGER
    START_BYTE              = 73
    BYTES                   = 6
    MISSING_CONSTANT        = -1
    FORMAT                  = "I6"
    DESCRIPTION             = "START BIN FOR THE FIRST TIME(MASS) WINDOW"
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    COLUMN_NUMBER           = 9
    NAME                    = WINDOW_1_STOP
    DATA_TYPE               = ASCII_INTEGER
    START_BYTE              = 80
    BYTES                   = 6
    MISSING_CONSTANT        = -1
    FORMAT                  = "I6"
    DESCRIPTION             = "STOP BIN FOR THE FIRST TIME(MASS) WINDOW"
  END_OBJECT                = COLUMN
```

```
OBJECT                  = COLUMN
  COLUMN_NUMBER         = 10
  NAME                  = WINDOW_2_START
  DATA_TYPE             = ASCII_INTEGER
  START_BYTE            = 87
  BYTES                 = 6
  MISSING_CONSTANT      = -1
  FORMAT                = "I6"
  DESCRIPTION           = "START BIN FOR THE SECOND TIME(MASS) WINDOW"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 11
  NAME                  = WINDOW_2_STOP
  DATA_TYPE             = ASCII_INTEGER
  START_BYTE            = 94
  BYTES                 = 6
  MISSING_CONSTANT      = -1
  FORMAT                = "I6"
  DESCRIPTION           = "STOP BIN FOR THE SECOND TIME(MASS) WINDOW"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 12
  NAME                  = WINDOW_3_START
  DATA_TYPE             = ASCII_INTEGER
  START_BYTE            = 101
  BYTES                 = 6
  MISSING_CONSTANT      = -1
  FORMAT                = "I6"
  DESCRIPTION           = "START BIN FOR THE THIRD TIME(MASS) WINDOW"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 13
  NAME                  = WINDOW_3_STOP
  DATA_TYPE             = ASCII_INTEGER
  START_BYTE            = 108
  BYTES                 = 6
  MISSING_CONSTANT      = -1
  FORMAT                = "I6"
  DESCRIPTION           = "STOP BIN FOR THE THIRD TIME(MASS) WINDOW"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 14
  NAME                  = OUTER_PARAMETER
  DATA_TYPE             = CHARACTER
  START_BYTE            = 116
  BYTES                 = 10
  MISSING_CONSTANT      = "UNKNOWN"
  FORMAT                = "A10"
  DESCRIPTION           = "THE VARIED PARAMETER DURING THE SCAN.
                           THE POSSIBLE VALUES ARE
                           TOF1          TIME OF FLIGHT 1 VOLTAGE
                           TOF2          TIME OF FLIGHT 2 VOLTAGE
                           TOF3          TIME OF FLIGHT 3 VOLTAGE
                           PA            POST ACCELERATION VOLTAGE
                           DET           DETECTOR VOLTAGE
                           DX_TOF        TOF X DEFLECTOR VOLTAGE
                           DY_TOF        TOF Y DEFLECTOR VOLTAGE
                           L1            PIBS LENS 1 VOLTAGE
                           L2            PIBS LENS 2 VOLTAGE
                           BS1           BEAM SWITCH 1 VOLTAGE
                           BS2           BEAM SWITCH 2 VOLTAGE
                           CB            CHOPPER BUNCHER VOLTAGE
                           DX_PIBS       PIBS X DEFLECTOR VOLTAGE
                           DY_PIBS       PIBS Y DEFLECTOR VOLTAGE
                           TMU_X         TMU X AXIS MOVEMENT
                           TMU_Y         TMU Y AXIS MOVEMENT
                           TMU_CLEAN_X   TMU X AXIS MOVEMENT
                                         FOR CLEANING
                           TMU_CLEAN_Y   TMU Y AXIS MOVEMENT
```

```
                                      FOR CLEANING
                           NOP           NO OPERATION"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 15
  NAME                   = OUTER_STEP
  DATA_TYPE              = ASCII_INTEGER
  START_BYTE             = 128
  BYTES                  = 5
  MISSING_CONSTANT       = -9999
  FORMAT                 = "I5"
  DESCRIPTION            = "RAW VALUE OF THE PARAMETER STEP, SEE
                           MATCHING HK DATA FOR CALIBRATED VALUE"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 16
  NAME                   = INNER_PARAMETER
  DATA_TYPE              = CHARACTER
  START_BYTE             = 135
  BYTES                  = 10
  MISSING_CONSTANT       = "UNKNOWN"
  FORMAT                 = "A10"
  DESCRIPTION            = "THE VARIED PARAMETER DURING THE SCAN.
                           THE POSSIBLE VALUES ARE
                           TOF1          TIME OF FLIGHT 1 VOLTAGE
                           TOF2          TIME OF FLIGHT 2 VOLTAGE
                           TOF3          TIME OF FLIGHT 3 VOLTAGE
                           PA            POST ACCELERATION VOLTAGE
                           DET           DETECTOR VOLTAGE
                           DX_TOF        TOF X DEFLECTOR VOLTAGE
                           DY_TOF        TOF Y DEFLECTOR VOLTAGE
                           L1            PIBS LENS 1 VOLTAGE
                           L2            PIBS LENS 2 VOLTAGE
                           BS1           BEAM SWITCH 1 VOLTAGE
                           BS2           BEAM SWITCH 2 VOLTAGE
                           CB            CHOPPER BUNCHER VOLTAGE
                           DX_PIBS       PIBS X DEFLECTOR VOLTAGE
                           DY_PIBS       PIBS Y DEFLECTOR VOLTAGE
                           TMU_X         TMU X AXIS MOVEMENT
                           TMU_Y         TMU Y AXIS MOVEMENT
                           TMU_CLEAN_X   TMU X AXIS MOVEMENT
                                         FOR CLEANING
                           TMU_CLEAN_Y   TMU Y AXIS MOVEMENT
                                         FOR CLEANING
                           NOP           NO OPERATION"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 17
  NAME                   = INNER_STEP
  DATA_TYPE              = ASCII_INTEGER
  START_BYTE             = 147
  BYTES                  = 5
  MISSING_CONSTANT       = -9999
  FORMAT                 = "I5"
  DESCRIPTION            = "RAW VALUE OF THE PARAMETER STEP, SEE
                           MATCHING HK DATA FOR CALIBRATED VALUE"
END_OBJECT               = COLUMN
```

4.3.5 Scan housekeeping data product

4.3.5.1 General description

With each scan step, housekeeping data is associated. The housekeeping product has the following elements:

- Voltages, currents and temperatures means of the instrument during spectrum measurement
- TDC unit timing parameters
- TDC unit calibration results

Detailed contents of the elements are described in the label example below.

4.3.5.2Label example

```
PDS_VERSION_ID                 = PDS3
LABEL_REVISION_NOTE            = "V1.1"

/* FILE FORMAT */
RECORD_TYPE                    = FIXED_LENGTH
RECORD_BYTES                   = 897
FILE_RECORDS                   =  10
LABEL_RECORDS                  =   5
/* POINTER TO DATA OBJECT */
^HK_TABLE                      =   6
^TDC_TIMING_TABLE              =   7
^TDC_CALIBRATION_TABLE         =   8

/* GENERAL DATA DESCRIPTION PARAMETERS */
FILE_NAME                      = "CS_2D8_20100508T104500_SCHK.TAB"
DATA_SET_ID                    = "RO-CAL-COSIMA-3-V3.0"
DATA_SET_NAME                  = "ROSETTA-ORBITER CAL COSIMA 3 V3.0"
PRODUCT_ID                     = "CS_2D8_20100508T104500_SCHK"
PRODUCT_CREATION_TIME          = 2010-08-28T15:13:27
PRODUCT_TYPE                   = "ANCDR"
PROCESSING_LEVEL_ID            = “6”
MISSION_ID                     = "ROSETTA"
MISSION_NAME                   = "INTERNATIONAL ROSETTA MISSION"
MISSION_PHASE_NAME             = "CRUISE 5"
INSTRUMENT_HOST_ID             = "RO"
INSTRUMENT_HOST_NAME           = "ROSETTA-ORBITER"
INSTRUMENT_ID                  = "COSIMA"
INSTRUMENT_NAME                = "COMETARY SECONDARY ION MASS ANALYZER"
INSTRUMENT_TYPE                = "MASS SPECTROMETER"
INSTRUMENT_MODE_ID             = "SPECTRUM"
INSTRUMENT_MODE_DESC           = "TIME OF FLIGHT MASS SPECTRUM MEASUREMENT"
TARGET_NAME                    = "CALIBRATION"
TARGET_TYPE                    = "CALIBRATION"
START_TIME                     = 2010-05-08T10:45:00
STOP_TIME                      = 2010-05-08T10:59:19
SPACECRAFT_CLOCK_START_COUNT   = "1/0231936259.28265"
SPACECRAFT_CLOCK_STOP_COUNT    = "1/0231937118.28261"
SC_SUN_POSITION_VECTOR         = "N/A"
SC_TARGET_POSITION_VECTOR      = "N/A"
SC_TARGET_VELOCITY_VECTOR      = "N/A"
SPACECRAFT_ALTITUDE            = "N/A"
SUB_SPACECRAFT_LATITUDE        = "N/A"
SUB_SPACECRAFT_LONGITUDE       = "N/A"
PRODUCER_ID                    = "FMI"
PRODUCER_FULL_NAME             = "JOHAN SILEN"
PRODUCER_INSTITUTION_NAME      = "FINNISH METEOROLOGICAL INSTITUTE"
DATA_QUALITY_ID                = -1
DATA_QUALITY_DESC              = "-1 = not checked"
ROSETTA:COSIMA_SUBSTRATE_ID    = "2D8"
ROSETTA:COSIMA_SUBSTRATE_DESC  = "Silver, blank"
ROSETTA:COSIMA_SPECTRUM_POL    = "NEGATIVE"

OBJECT                         = HK_TABLE
  NAME                         = HOUSEKEEPING
  INTERCHANGE_FORMAT           = ASCII
  ROWS                         = 1
  COLUMNS                      = 112
  ROW_BYTES                    = 897
  ^STRUCTURE                   = "COSIMA_SPECTRUM_HK.FMT"
  DESCRIPTION                  = "COSIMA SPECTRUM HOUSEKEEPING INFORMATION,
                                  INCLUDING VOLTAGES, CURRENTS AND
                                  TEMPERATUES"
END_OBJECT                     = HK_TABLE

OBJECT                         = TDC_TIMING_TABLE
  NAME                         = TDC_TIMING
  INTERCHANGE_FORMAT           = ASCII
  ROWS                         = 1
  COLUMNS                      = 7
  ROW_BYTES                    = 897
```

```
  ^STRUCTURE                    = "COSIMA_SPECTRUM_TDC_TIMING.FMT"
  DESCRIPTION                   = "TIME TO DIGITAL UNIT TIMING PARAMETERS"
END_OBJECT                      = TDC_TIMING_TABLE

OBJECT                          = TDC_CALIBRATION_TABLE
  NAME                          = TDC_CALIBRATION
  INTERCHANGE_FORMAT            = ASCII
  ROWS                          = 3
  COLUMNS                       = 5
  ROW_BYTES                     = 897
  ^STRUCTURE                    = "COSIMA_SPECTRUM_TDC_CALIB.FMT"
  DESCRIPTION                   = "TIME TO DIGITAL UNIT CALIBRATION RESULTS"
END_OBJECT                      = TDC_CALIBRATION_TABLE
END
```

4.3.6 Heating data product

4.3.6.1 General description

The substrate heating curve is given

Detailed contents of the elements are described in the label example below.

4.3.6.2Label example

```
PDS_VERSION_ID                  = PDS3
LABEL_REVISION_NOTE             = "V1.1"

/* FILE FORMAT */
RECORD_TYPE                     = FIXED_LENGTH
RECORD_BYTES                    = 25
FILE_RECORDS                    = 137
LABEL_RECORDS                   = 125
/* POINTER TO DATA OBJECTS */
^HEATING_SETUP_TABLE            = 126
^HEATING_TABLE                  = 127

/* GENERAL DATA DESCRIPTION PARAMETERS */
FILE_NAME                       = "CS_2D8_20090930T051206_HEAT.TAB"
DATA_SET_ID                     = "RO-CAL-COSIMA-3-V2.0"
DATA_SET_NAME                   = "ROSETTA-ORBITER CAL COSIMA 3 V2.0"
PRODUCT_ID                      = "CS_2D8_20090930T051206_HEAT"
PRODUCT_CREATION_TIME           = 2010-07-18T09:23:10
PRODUCT_TYPE                    = "REFDR"
PROCESSING_LEVEL_ID             = “3”
MISSION_ID                      = "ROSETTA"
MISSION_NAME                    = "INTERNATIONAL ROSETTA MISSION"
MISSION_PHASE_NAME              = "EARTH SWING-BY 3"
INSTRUMENT_HOST_ID              = "RO"
INSTRUMENT_HOST_NAME            = "ROSETTA-ORBITER"
INSTRUMENT_ID                   = "COSIMA"
INSTRUMENT_NAME                 = "COMETARY SECONDARY ION MASS ANALYZER"
INSTRUMENT_TYPE                 = "MASS SPECTROMETER"
INSTRUMENT_MODE_ID              = "CHEMISTRY"
INSTRUMENT_MODE_DESC            = "SUBSTRATE HEATING"
TARGET_NAME                     = "CALIBRATION"
TARGET_TYPE                     = "CALIBRATION"
START_TIME                      = 2009-09-30T05:12:06
STOP_TIME                       = 2009-09-30T05:22:10
SPACECRAFT_CLOCK_START_COUNT    = ""
SPACECRAFT_CLOCK_STOP_COUNT     = ""
SC_SUN_POSITION_VECTOR          = "N/A"
SC_TARGET_POSITION_VECTOR       = "N/A"
SC_TARGET_VELOCITY_VECTOR       = "N/A"
SPACECRAFT_ALTITUDE             = "N/A"
SUB_SPACECRAFT_LATITUDE         = "N/A"
SUB_SPACECRAFT_LONGITUDE        = "N/A"
PRODUCER_ID                     = "FMI"
PRODUCER_FULL_NAME              = "JOHAN SILEN"
PRODUCER_INSTITUTION_NAME       = "FINNISH METEOROLOGICAL INSTITUTE"
DATA_QUALITY_ID                 = -1
DATA_QUALITY_DESC               = "-1 = not checked"
ROSETTA:COSIMA_SUBSTRATE_ID     = "2D8"
ROSETTA:COSIMA_SUBSTRATE_DESC   = "Silver, blank"
```

```
OBJECT                          = HEATING_SETUP_TABLE
  NAME                          = HEATING_SETUP
  INTERCHANGE_FORMAT            = ASCII
  ROWS                          = 1
  COLUMNS                       = 1
  ROW_BYTES                     = 25
  ^STRUCTURE                    = "COSIMA_HEATING_SETUP.FMT"
  DESCRIPTION                   = "COSIMA SUBSTRATE HEATING SETUP"
END_OBJECT                      = HEATING_SETUP_TABLE

OBJECT                          = HEATING_TABLE
  NAME                          = HEATING_POINTS
  INTERCHANGE_FORMAT            = ASCII
  ROWS                          =  12
  COLUMNS                       = 4
  ROW_BYTES                     = 25
  ^STRUCTURE                    = "COSIMA_HEATING_DATA.FMT"
  DESCRIPTION                   = "COSIMA SUBSTRATE HEATING DATA POINTS"
END_OBJECT                      = HEATING_TABLE

END
```

COSIMA_HEATING_SETUP.FMT

```
OBJECT                  = COLUMN
  COLUMN_NUMBER         = 1
  NAME                  = HEAT_TIME
  DATA_TYPE             = ASCII_INTEGER
  START_BYTE            = 1
  BYTES                 = 11
  MISSING_CONSTANT      = -999999999
  UNIT                  = "SECOND"
  FORMAT                = "I11"
  DESCRIPTION           = "HEATING TIME IN SECONDS"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 2
  NAME                  = HEAT_LEVEL
  DATA_TYPE             = ASCII_INTEGER
  START_BYTE            = 13
  BYTES                 = 1
  MISSING_CONSTANT      = 9
  FORMAT                = "I1"
  DESCRIPTION           = "HEAT_SETUP
                           0 =  66 C
                           1 =  77 C
                           2 =  86 C
                           3 =  94 C
                           4 = 104 C
                           5 = 113 C
                           6 = 122 C
                           7 = 132 C"
END_OBJECT              = COLUMN
```

COSIMA_HEATING_DATA.FMT

```
OBJECT                  = COLUMN
  COLUMN_NUMBER         = 1
  NAME                  = TMU_2_TEMPERATURE
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 1
  BYTES                 = 5
  MISSING_CONSTANT      = 999.9
  UNIT                  = "KELVIN"
  FORMAT                = "F5.1"
  DESCRIPTION           = "T_TMU2 TARGET MANIPULATOR TEMPERATURE
                           AT THE CHEMISTRY(HEATING) STATION"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 2
  NAME                  = TMU_1_TEMPERATURE
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 7
```

```
  BYTES                 = 5
  MISSING_CONSTANT      = 999.9
  UNIT                  = "KELVIN"
  FORMAT                = "F5.1"
  DESCRIPTION           = "T_TMU1 TARGET MANIPULATOR TEMPERATURE
                           AT THE SUBSTRATE STORAGE"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 3
  NAME                  = TMU_2_RAW_TEMPERATURE
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 13
  BYTES                 = 5
  MISSING_CONSTANT      = 99999
  UNIT                  = "KELVIN"
  FORMAT                = "I5"
  DESCRIPTION           = "RAW T_TMU2 TARGET MANIPULATOR TEMPERATURE
                           AT THE CHEMISTRY(HEATING) STATION"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 4
  NAME                  = TMU_1_RAW_TEMPERATURE
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 19
  BYTES                 = 5
  MISSING_CONSTANT      = 99999
  UNIT                  = "KELVIN"
  FORMAT                = "I5"
  DESCRIPTION           = "RAW T_TMU1 TARGET MANIPULATOR TEMPERATURE
                           AT THE SUBSTRATE STORAGE"
END_OBJECT              = COLUMN
```

4.3.7 Cleaning data product

4.3.7.1 General description

The cleaning product contains the following elements:

- time used
- emitter tip current housekeeping data

Detailed contents of the elements are described in the label example below.

Label example

```
PDS_VERSION_ID                  = PDS3
LABEL_REVISION_NOTE             = "V1.1"

/* FILE FORMAT */
RECORD_TYPE                     = FIXED_LENGTH
RECORD_BYTES                    = 45
FILE_RECORDS                    = 131185
LABEL_RECORDS                   = 112
/* POINTER TO DATA OBJECTS */
^CLEANING_TABLE                 = 113

/* GENERAL DATA DESCRIPTION PARAMETERS */
FILE_NAME                       = "CS_2D8_20070927T182348_CLEA.TAB"
DATA_SET_ID                     = "RO-CAL-COSIMA-3-V2.0"
DATA_SET_NAME                   = "ROSETTA-ORBITER CAL COSIMA 3 V2.0"
PRODUCT_ID                      = "CS_2D8_20070927T182348_CLEA.TAB"
PRODUCT_CREATION_TIME           = 2008-11-12T09:15:39
PRODUCT_TYPE                    = "REFDR"
PROCESSING_LEVEL_ID             = “3”
MISSION_ID                      = "ROSETTA"
MISSION_NAME                    = "INTERNATIONAL ROSETTA MISSION"
MISSION_PHASE_NAME              = "EARTH SWING-BY 2"
INSTRUMENT_HOST_ID              = "RO"
INSTRUMENT_HOST_NAME            = "ROSETTA-ORBITER"
```

```
INSTRUMENT_ID                   = "COSIMA"
INSTRUMENT_NAME                 = "COMETARY SECONDARY ION MASS ANALYZER"
INSTRUMENT_TYPE                 = "MASS SPECTROMETER"
INSTRUMENT_MODE_ID              = "CLEANING"
INSTRUMENT_MODE_DESC            = "SUBSTRATE CLEANING WITH ION BEAM"
TARGET_NAME                     = "CALIBRATION"
TARGET_TYPE                     = "CALIBRATION"
START_TIME                      = 2007-09-27T18:23:48
STOP_TIME                       = 2007-09-27T18:33:53
SPACECRAFT_CLOCK_START_COUNT    = "1/0149538196.41251"
SPACECRAFT_CLOCK_STOP_COUNT     = "1/0149538801.41245"
SC_SUN_POSITION_VECTOR          = "N/A"
SC_TARGET_POSITION_VECTOR       = "N/A"
SC_TARGET_VELOCITY_VECTOR       = "N/A"
SPACECRAFT_ALTITUDE             = "N/A"
SUB_SPACECRAFT_LATITUDE         = "N/A"
SUB_SPACECRAFT_LONGITUDE        = "N/A"
PRODUCER_ID                     = "FMI"
PRODUCER_FULL_NAME              = "JOHAN SILEN"
PRODUCER_INSTITUTION_NAME       = "FINNISH METEOROLOGICAL INSTITUTE"
DATA_QUALITY_ID                 = -1
DATA_QUALITY_DESC               = "-1 = not checked"
ROSETTA:COSIMA_SUBSTRATE_ID     = "2D8"
ROSETTA:COSIMA_SUBSTRATE_DESC   = "Silver, blank"
ROSETTA:COSIMA_SUBSTRATE_X      = 5000
ROSETTA:COSIMA_SUBSTRATE_Y      = 5000

OBJECT                          = CLEANING_TABLE
  NAME                          = CLEANING
  INTERCHANGE_FORMAT            = ASCII
  ROWS                          = 1
  COLUMNS                       = 5
  ROW_BYTES                     = 45
  ^STRUCTURE                    = "COSIMA_CLEANING.FMT"
  DESCRIPTION                   = "COSIMA SUBSTRATE CLEANING"
END_OBJECT                      = CLEANING_TABLE

END
```

COSIMA_CLEANING.FMT

```
OBJECT                  = COLUMN
  COLUMN_NUMBER         = 1
  NAME                  = CLEANING_TIME
  DATA_TYPE             = ASCII_INTEGER
  START_BYTE            = 1
  BYTES                 = 11
  MISSING_CONSTANT      = 99999999999
  UNIT                  = "SECOND"
  FORMAT                = "I11"
  DESCRIPTION           = "SUBSTRATE CLEANIG TIME WITH INDIUM BEAM"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 2
  NAME                  = "C_TIP_MIN"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 13
  BYTES                 = 7
  UNIT                  = "MICROAMPERE"
  MISSING_CONSTANT      = 99999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "C_TIP TIP CURRENT MINIMUM,
                           IN THE PRIMARY ION SOURCE"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 3
  NAME                  = "C_TIP_MEAN"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 21
  BYTES                 = 7
  UNIT                  = "MICROAMPERE"
  MISSING_CONSTANT      = 99999.9
  FORMAT                = "F7.1"
```

```
  DESCRIPTION           = "C_TIP TIP CURRENT MEAN,
                           IN THE PRIMARY ION SOURCE"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 4
  NAME                  = "C_TIP_MAX"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 29
  BYTES                 = 7
  UNIT                  = "MICROAMPERE"
  MISSING_CONSTANT      = 99999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "C_TIP TIP CURRENT MAXIMUM,
                           IN THE PRIMARY ION SOURCE"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 5
  NAME                  = "C_TIP_STD"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 37
  BYTES                 = 7
  UNIT                  = "MICROAMPERE"
  MISSING_CONSTANT      = 99999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "C_TIP TIP VOLTAGE STANDARD DEVIATION,
                           IN THE PRIMARY ION SOURCE"
END_OBJECT              = COLUMN
```

4.3.8 Cleaning housekeeping data product

4.3.8.1 General description

With each cleaning operationhousekeeping data is associated. The housekeeping product has the following elements:

- Voltages, currents and temperatures of the instrument during spectrum measurement

Detailed contents of the elements are described in the label example below.

4.3.8.2Label example

```
PDS_VERSION_ID                  = PDS3
LABEL_REVISION_NOTE             = "V1.1"

/* FILE FORMAT */
RECORD_TYPE                     = FIXED_LENGTH
RECORD_BYTES                    = 897
FILE_RECORDS                    = 11
LABEL_RECORDS                   = 5
/* POINTER TO DATA OBJECT */
^HK_TABLE                       = 6

/* GENERAL DATA DESCRIPTION PARAMETERS */
FILE_NAME                       = "CS_2D8_20070927T182348_CLHK.TAB"
DATA_SET_ID                     = "RO-CAL-COSIMA-3-V2.0"
DATA_SET_NAME                   = "ROSETTA-ORBITER CAL COSIMA 3 V2.0"
PRODUCT_ID                      = "CS_2D8_20070927T182348_CLHK"
PRODUCT_CREATION_TIME           = 2008-11-12T09:15:38
PRODUCT_TYPE                    = "ANCDR"
PROCESSING_LEVEL_ID             = “6”
MISSION_ID                      = "ROSETTA"
MISSION_NAME                    = "INTERNATIONAL ROSETTA MISSION"
MISSION_PHASE_NAME              = "EARTH SWING-BY 2"
INSTRUMENT_HOST_ID              = "RO"
INSTRUMENT_HOST_NAME            = "ROSETTA-ORBITER"
INSTRUMENT_ID                   = "COSIMA"
INSTRUMENT_NAME                 = "COMETARY SECONDARY ION MASS ANALYZER"
INSTRUMENT_TYPE                 = "MASS SPECTROMETER"
INSTRUMENT_MODE_ID              = "CLEANING"
INSTRUMENT_MODE_DESC            = "SUBSTRATE CLEANING WITH ION BEAM"
TARGET_NAME                     = "CALIBRATION"
TARGET_TYPE                     = "CALIBRATION"
```

```
START_TIME                       = 2007-09-27T18:23:48
STOP_TIME                        = 2007-09-27T18:33:53
SPACECRAFT_CLOCK_START_COUNT     = "1/0149538196.41251"
SPACECRAFT_CLOCK_STOP_COUNT      = "1/0149538801.41245"
SC_SUN_POSITION_VECTOR           = "N/A"
SC_TARGET_POSITION_VECTOR        = "N/A"
SC_TARGET_VELOCITY_VECTOR        = "N/A"
SPACECRAFT_ALTITUDE              = "N/A"
SUB_SPACECRAFT_LATITUDE          = "N/A"
SUB_SPACECRAFT_LONGITUDE         = "N/A"
PRODUCER_ID                      = "FMI"
PRODUCER_FULL_NAME               = "JOHAN SILEN"
PRODUCER_INSTITUTION_NAME        = "FINNISH METEOROLOGICAL INSTITUTE"
DATA_QUALITY_ID                  = -1
DATA_QUALITY_DESC                = "-1 = not checked"
ROSETTA:COSIMA_SUBSTRATE_ID      = "2D8"
ROSETTA:COSIMA_SUBSTRATE_DESC    = "Silver, blank"
ROSETTA:COSIMA_SUBSTRATE_X       = 5000
ROSETTA:COSIMA_SUBSTRATE_Y       = 5000

OBJECT                           = HK_TABLE
  NAME                           = HOUSEKEEPING
  INTERCHANGE_FORMAT             = ASCII
  ROWS                           = 1
  COLUMNS                        = 112
  ROW_BYTES                      = 897
  ^STRUCTURE                     = "COSIMA_SPECTRUM_HK.FMT"
  DESCRIPTION                    = "COSIMA SPECTRUM HOUSEKEEPING INFORMATION,
                                    INCLUDING VOLTAGES, CURRENTS AND
                                    TEMPERATUES"
END_OBJECT                       = HK_TABLE
```

4.3.9 COSISCOPE image product

4.3.9.1 General description

COSISCOPE image contains an image of target substrate in FITS format. P or M in the end of the product ID corresponds to the led illumination from Plus side (right) or Minus side (left).

4.3.9.2 Label example

```
PDS_VERSION_ID                   = PDS3
LABEL_REVISION_NOTE              = "V1.1"

/* FILE FORMAT */
RECORD_TYPE                      = FIXED_LENGTH
RECORD_BYTES                     = 2880
FILE_RECORDS                     = 730
/* POINTER TO DATA OBJECTS */
^COSISCOPE_FITS_HEADER           = ("CS_2D8_20080722T171038_IM_M.LBL",1<BYTES>)
^COSISCOPE_FITS_IMAGE         = ("CS_2D8_20080722T171038_IM_M.LBL",2881<BYTES>)

/* GENERAL DATA DESCRIPTION PARAMETERS */
FILE_NAME                        = "CS_2D8_20080722T171038_IM_M.LBL"
DATA_SET_ID                      = "RO-CAL-COSIMA-3-V2.0"
DATA_SET_NAME                    = "ROSETTA-ORBITER CAL COSIMA 3 V2.0"
PRODUCT_ID                       = "CS_2D8_20080722T171038_IM_M"
PRODUCT_CREATION_TIME            = 2010-07-18T09:22:20
PRODUCT_TYPE                     = "REFDR"
PROCESSING_LEVEL_ID              = “3”
MISSION_ID                       = "ROSETTA"
MISSION_NAME                     = "INTERNATIONAL ROSETTA MISSION"
MISSION_PHASE_NAME               = "STEINS FLY-BY"
INSTRUMENT_HOST_ID               = "RO"
INSTRUMENT_HOST_NAME             = "ROSETTA-ORBITER"
INSTRUMENT_ID                    = "COSIMA"
INSTRUMENT_NAME                  = "COMETARY SECONDARY ION MASS ANALYZER"
INSTRUMENT_TYPE                  = "MASS SPECTROMETER"
INSTRUMENT_MODE_ID               = "IMAGE"
INSTRUMENT_MODE_DESC             = "COSISCOPE IMAGING"
TARGET_NAME                      = "CALIBRATION"
TARGET_TYPE                      = "CALIBRATION"
START_TIME                       = 2008-07-22T17:10:38
```

```
STOP_TIME                          = 2008-07-22T17:14:16
SPACECRAFT_CLOCK_START_COUNT       = ""
SPACECRAFT_CLOCK_STOP_COUNT        = ""
SC_SUN_POSITION_VECTOR             = "N/A"
SC_TARGET_POSITION_VECTOR          = "N/A"
SC_TARGET_VELOCITY_VECTOR          = "N/A"
SPACECRAFT_ALTITUDE                = "N/A"
SUB_SPACECRAFT_LATITUDE            = "N/A"
SUB_SPACECRAFT_LONGITUDE           = "N/A"
PRODUCER_ID                        = "FMI"
PRODUCER_FULL_NAME                 = "JOHAN SILEN"
PRODUCER_INSTITUTION_NAME          = "FINNISH METEOROLOGICAL INSTITUTE"
DATA_QUALITY_ID                    = -1
DATA_QUALITY_DESC                  = "-1 = not checked"
ROSETTA:COSIMA_SUBSTRATE_ID        = "2D8"
ROSETTA:COSIMA_SUBSTRATE_DESC      = "Silver, blank"

OBJECT                             = COSISCOPE_FITS_HEADER
  BYTES                            = 2880
  HEADER_TYPE                      = FITS
  INTERCHANGE_FORMAT               = BINARY
  RECORDS                          = 1
  DESCRIPTION                      = "COSISCOPE FITS IMAGE HEADER"
END_OBJECT                         = COSISCOPE_FITS_HEADER

OBJECT                             = COSISCOPE_FITS_IMAGE
  LINES                            = 1024
  LINE_SAMPLES                     = 1024
  SAMPLE_TYPE                      = MSB_INTEGER
  SAMPLE_BITS                      = 16
  AXIS_ORDER_TYPE                  = "FIRST_INDEX_FASTEST"
  LINE_DISPLAY_DIRECTION           = "UP"
  SAMPLE_DISPLAY_DIRECTION         = "RIGHT"
  MISSING_CONSTANT                 = -1
  DESCRIPTION                      = "COSISCOPE FITS IMAGE OF THE SUBSTRATE"
END_OBJECT                         = COSISCOPE_FITS_IMAGE

END
```

4.3.10 COSISCOPE dust grain list product

4.3.10.1General description

COSISCOPE dust grain list can be associated with a Cosiscope image product, or it can be self-standing. Dust grain list product contains a list of dust grains (also called features) found on a target substrate.

4.3.10.2Label template

```
PDS_VERSION_ID                     = PDS3
LABEL_REVISION_NOTE                = "V1.0"

/* FILE FORMAT */
RECORD_TYPE                        = FIXED_LENGTH
RECORD_BYTES                       = 37
FILE_RECORDS                       = 6542
LABEL_RECORDS                      = 78
/* POINTER TO DATA OBJECT */
^FEATURE_TABLE                     = 79

/* GENERAL DATA DESCRIPTION PARAMETERS */
FILE_NAME                          = "CS_2D8_20070927T175457_GR__.TAB"
DATA_SET_ID                        = "RO-CAL-COSIMA-3-V2.0"
DATA_SET_NAME                      = "ROSETTA-ORBITER CAL COSIMA 3 V2.0"
PRODUCT_ID                         = "CS_2D8_20070927T175457_GR__"
PRODUCT_CREATION_TIME              = 2008-11-12T09:15:37
PRODUCT_TYPE                       = "REFDR"
PROCESSING_LEVEL_ID                = “3”
MISSION_ID                         = "ROSETTA"
MISSION_NAME                       = "INTERNATIONAL ROSETTA MISSION"
MISSION_PHASE_NAME                 = "EARTH SWING-BY 2"
INSTRUMENT_HOST_ID                 = "RO"
INSTRUMENT_HOST_NAME               = "ROSETTA-ORBITER"
```

```
INSTRUMENT_ID                    = "COSIMA"
INSTRUMENT_NAME                  = "COMETARY SECONDARY ION MASS ANALYZER"
INSTRUMENT_TYPE                  = "MASS SPECTROMETER"
INSTRUMENT_MODE_ID               = "IMAGE"
INSTRUMENT_MODE_DESC             = "COSISCOPE IMAGING"
TARGET_NAME                      = "CALIBRATION"
TARGET_TYPE                      = "CALIBRATION"
START_TIME                       = 2007-09-27T17:54:57
STOP_TIME                        = 2007-09-27T17:55:20
SPACECRAFT_CLOCK_START_COUNT     = "1/0149536465.41269"
SPACECRAFT_CLOCK_STOP_COUNT      = "1/0149536488.41269"
SC_SUN_POSITION_VECTOR           = "N/A"
SC_TARGET_POSITION_VECTOR        = "N/A"
SC_TARGET_VELOCITY_VECTOR        = "N/A"
SPACECRAFT_ALTITUDE              = "N/A"
SUB_SPACECRAFT_LATITUDE          = "N/A"
SUB_SPACECRAFT_LONGITUDE         = "N/A"
PRODUCER_ID                      = "FMI"
PRODUCER_FULL_NAME               = "JOHAN SILEN"
PRODUCER_INSTITUTION_NAME        = "FINNISH METEOROLOGICAL INSTITUTE"
DATA_QUALITY_ID                  = -1
DATA_QUALITY_DESC                = "-1 = not checked"
ROSETTA:COSIMA_SUBSTRATE_ID      = "2D8"
ROSETTA:COSIMA_SUBSTRATE_DESC    = "Silver, blank"

OBJECT                           = FEATURE_TABLE
  NAME                           = FEATURES
  INTERCHANGE_FORMAT             = ASCII
  ROWS                           = 6464
  COLUMNS                        = 6
  ROW_BYTES                      = 37
  ^STRUCTURE                      = "COSISCOPE_GRAINS.FMT"
  DESCRIPTION                    = "COSISCOPE GENERATED LIST OF PROMINENT
                                    FEATURES IN THE SUBSTRATE IMAGE. THE
                                    SUBSTRATE HAS AREA OF 10000X10000
                                    MICROMETERS."
END_OBJECT                       = FEATURE_TABLE
```

END

COSISCOPE_GRAINS.FMT:

```
  OBJECT                         = COLUMN
    COLUMN_NUMBER                = 1
    NAME                         = X_LEFT
    DATA_TYPE                    = ASCII_INTEGER
    START_BYTE                   = 1
    BYTES                        = 6
    UNIT                         = "MICROMETER"
    FORMAT                       = I6
    DESCRIPTION                  = "FEATURE LOWER LEFT X-COORDINATE"
  END_OBJECT                     = COLUMN
  OBJECT                         = COLUMN
    COLUMN_NUMBER                = 2
    NAME                         = Y_BOTTOM
    DATA_TYPE                    = ASCII_INTEGER
    START_BYTE                   = 8
    BYTES                        = 6
    UNIT                         = "MICROMETER"
    FORMAT                       = I6
    DESCRIPTION                  = "FEATURE LOWER LEFT Y-COORDINATE"
  END_OBJECT                     = COLUMN
  OBJECT                         = COLUMN
    COLUMN_NUMBER                = 3
    NAME                         = X_RIGHT
    DATA_TYPE                    = ASCII_INTEGER
    START_BYTE                   = 15
    BYTES                        = 6
    UNIT                         = "MICROMETER"
    FORMAT                       = I6
    DESCRIPTION                  = "FEATURE UPPER RIGHT X-COORDINATE"
  END_OBJECT                     = COLUMN
  OBJECT                         = COLUMN
    COLUMN_NUMBER                = 4
```

```
    NAME                        = Y_TOP
    DATA_TYPE                   = ASCII_INTEGER
    START_BYTE                  = 22
    BYTES                       = 6
    UNIT                        = "MICROMETER"
    FORMAT                      = I6
    DESCRIPTION                 = "FEATURE UPPER RIGHT Y-COORDINATE"
  END_OBJECT                    = COLUMN
  OBJECT                        = COLUMN
    COLUMN_NUMBER               = 5
    NAME                        = QUALITY_PX
    DATA_TYPE                   = ASCII_INTEGER
    START_BYTE                  = 29
    BYTES                       = 3
    FORMAT                      = I3
    MISSING_CONSTANT            = 0
    DESCRIPTION                 = "FEATURE QUALITY FROM +X-SIDE LED
                                   ILLUMINATION. THE QUALITY FROM 0 TO 255
                                   IS MAINLY RELATED TO THE CONTRAST FROM
                                   THE BACKGROUND"
  END_OBJECT                    = COLUMN
  OBJECT                        = COLUMN
    COLUMN_NUMBER               = 6
    NAME                        = QUALITY_MX
    DATA_TYPE                   = ASCII_INTEGER
    START_BYTE                  = 33
    BYTES                       = 3
    FORMAT                      = I3
    MISSING_CONSTANT            = 0
    DESCRIPTION                 = "FEATURE QUALITY FROM -X-SIDE LED
                                   ILLUMINATION. THE QUALITY FROM 0 TO 255
                                   IS MAINLY RELATED TO THE CONTRAST FROM
                                   THE BACKGROUND"
  END_OBJECT                    = COLUMN
```

4.3.11 COSISCOPE housekeeping product

4.3.11.1General information

With each Cosicope grain list, housekeeping data is associated. If the grain list has a corresponding Cosicope image, the housekeeping data applies also to that image. The Cosicope housekeeping product has the following elements:

- Cosiscope temperatures
- Substrate positioning information
- Imaging information

Detailed description of the Cosiscope housekeeping product is given in the label example.

4.3.11.2Label example

```
PDS_VERSION_ID                  = PDS3
LABEL_REVISION_NOTE             = "V1.0"
RELEASE_ID                      = 0001
REVISION_ID                     = 0000

/* FILE FORMAT */
RECORD_TYPE                     = FIXED_LENGTH
RECORD_BYTES                    = 334
FILE_RECORDS                    = 10
LABEL_RECORDS                   =  9
/* POINTER TO DATA OBJECT */
^COSISCOPE_HK_TABLE             = 10

/* GENERAL DATA DESCRIPTION PARAMETERS */
FILE_NAME                       = "CS_2D8_20070927T175457_G_HK.TAB"
DATA_SET_ID                     = "RO-CAL-COSIMA-3-V2.0"
DATA_SET_NAME                   = "ROSETTA-ORBITER CAL COSIMA 3 V2.0"
PRODUCT_ID                      = "CS_2D8_20070927T175457_G_HK"
PRODUCT_CREATION_TIME           = 2008-11-12T09:15:37
PRODUCT_TYPE                    = "ANCDR"
PROCESSING_LEVEL_ID             = “6”
```

```
MISSION_ID                        = "ROSETTA"
MISSION_NAME                      = "INTERNATIONAL ROSETTA MISSION"
MISSION_PHASE_NAME                = "EARTH SWING-BY 2"
INSTRUMENT_HOST_ID                = "RO"
INSTRUMENT_HOST_NAME              = "ROSETTA-ORBITER"
INSTRUMENT_ID                     = "COSIMA"
INSTRUMENT_NAME                   = "COMETARY SECONDARY ION MASS ANALYZER"
INSTRUMENT_TYPE                   = "MASS SPECTROMETER"
INSTRUMENT_MODE_ID                = "IMAGE"
INSTRUMENT_MODE_DESC              = "COSISCOPE IMAGING"
TARGET_NAME                       = "CALIBRATION"
TARGET_TYPE                       = "CALIBRATION"
START_TIME                        = 2007-09-27T17:54:57
STOP_TIME                         = 2007-09-27T17:55:20
SPACECRAFT_CLOCK_START_COUNT      = "1/0149536465.41269"
SPACECRAFT_CLOCK_STOP_COUNT       = "1/0149536488.41269"
SC_SUN_POSITION_VECTOR            = "N/A"
SC_TARGET_POSITION_VECTOR         = "N/A"
SC_TARGET_VELOCITY_VECTOR         = "N/A"
SPACECRAFT_ALTITUDE               = "N/A"
SUB_SPACECRAFT_LATITUDE           = "N/A"
SUB_SPACECRAFT_LONGITUDE          = "N/A"
PRODUCER_ID                       = "FMI"
PRODUCER_FULL_NAME                = "JOHAN SILEN"
PRODUCER_INSTITUTION_NAME         = "FINNISH METEOROLOGICAL INSTITUTE"
DATA_QUALITY_ID                   = -1
DATA_QUALITY_DESC                 = "-1 = not checked"
ROSETTA:COSIMA_SUBSTRATE_ID       = "2D8"
ROSETTA:COSIMA_SUBSTRATE_DESC     = "Silver, blank"

OBJECT                            = COSISCOPE_HK_TABLE
  NAME                            = COSISCOPE_HOUSEKEEPING
  INTERCHANGE_FORMAT              = ASCII
  ROWS                            = 1
  COLUMNS                         = 55
  ROW_BYTES                       = 334
  ^STRUCTURE                      = "COSISCOPE_HK.FMT"
  DESCRIPTION                     = "COSISCOPE HOUSEKEEPING INFORMATION"
END_OBJECT                        = COSISCOPE_HK_TABLE

END
```

COSISCOPE_HK.FMT:

```
OBJECT                  = COLUMN
  COLUMN_NUMBER         = 1
  NAME                  = "T1_SCOPE_MIN"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 1
  BYTES                 = 7
  UNIT                  = "DEGREE KELVIN"
  MISSING_CONSTANT      = 999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "T1_SCOPE COSISCOPE TEMPERATURE MINIMUM AT CAMERA"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 2
  NAME                  = "T1_SCOPE_MEAN"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 9
  BYTES                 = 7
  UNIT                  = "DEGREE KELVIN"
  MISSING_CONSTANT      = 999.9
  FORMAT                = "F7.1"
  DESCRIPTION           = "T1_SCOPE COSISCOPE TEMPERATURE MEAN AT CAMERA"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 3
  NAME                  = "T1_SCOPE_MAX"
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 17
  BYTES                 = 7
```

```
    UNIT                    = "DEGREE KELVIN"
    MISSING_CONSTANT        = 999.9
    FORMAT                  = "F7.1"
    DESCRIPTION             = "T1_SCOPE COSISCOPE TEMPERATURE MAXIMUM AT CAMERA"
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    COLUMN_NUMBER           = 4
    NAME                    = "T1_SCOPE_STD"
    DATA_TYPE               = ASCII_REAL
    START_BYTE              = 25
    BYTES                   = 7
    UNIT                    = "DEGREE KELVIN"
    MISSING_CONSTANT        = 999.9
    FORMAT                  = "F7.1"
    DESCRIPTION             = "T1_SCOPE COSISCOPE TEMPERATURE STANDARD DEVIATION
                               AT CAMERE"
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    COLUMN_NUMBER           = 5
    NAME                    = "T3_SCOPE_MIN"
    DATA_TYPE               = ASCII_REAL
    START_BYTE              = 33
    BYTES                   = 7
    UNIT                    = "DEGREE KELVIN"
    MISSING_CONSTANT        = 999.9
    FORMAT                  = "F7.1"
    DESCRIPTION             = "T3_SCOPE COSISCOPE TEMPERATURE MINIMUM AT CDPU"
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    COLUMN_NUMBER           = 6
    NAME                    = "T3_SCOPE_MEAN"
    DATA_TYPE               = ASCII_REAL
    START_BYTE              = 41
    BYTES                   = 7
    UNIT                    = "DEGREE KELVIN"
    MISSING_CONSTANT        = 999.9
    FORMAT                  = "F7.1"
    DESCRIPTION             = "T3_SCOPE COSISCOPE TEMPERATURE MEAN AT CDPU"
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    COLUMN_NUMBER           = 7
    NAME                    = "T3_SCOPE_MAX"
    DATA_TYPE               = ASCII_REAL
    START_BYTE              = 49
    BYTES                   = 7
    UNIT                    = "DEGREE KELVIN"
    MISSING_CONSTANT        = 999.9
    FORMAT                  = "F7.1"
    DESCRIPTION             = "T3_SCOPE COSISCOPE TEMPERATURE MAXIMUM AT CDPU"
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    COLUMN_NUMBER           = 8
    NAME                    = "T3_SCOPE_STD"
    DATA_TYPE               = ASCII_REAL
    START_BYTE              = 57
    BYTES                   = 7
    UNIT                    = "DEGREE KELVIN"
    MISSING_CONSTANT        = 999.9
    FORMAT                  = "F7.1"
    DESCRIPTION             = "T3_SCOPE COSISCOPE TEMPERATURE STANDARD DEVIATION
                               AT CDPU"
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    COLUMN_NUMBER           = 9
    NAME                    = "T4_SCOPE_MIN"
    DATA_TYPE               = ASCII_REAL
    START_BYTE              = 65
    BYTES                   = 7
```

```
    UNIT                    = "DEGREE KELVIN"
    MISSING_CONSTANT        = 999.9
    FORMAT                  = "F7.1"
    DESCRIPTION             = "T4_SCOPE COSISCOPE TEMPERATURE MINIMUM AT OPTICS"
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    COLUMN_NUMBER           = 10
    NAME                    = "T4_SCOPE_MEAN"
    DATA_TYPE               = ASCII_REAL
    START_BYTE              = 73
    BYTES                   = 7
    UNIT                    = "DEGREE KELVIN"
    MISSING_CONSTANT        = 999.9
    FORMAT                  = "F7.1"
    DESCRIPTION             = "T4_SCOPE COSISCOPE TEMPERATURE MEAN AT OPTICS"
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    COLUMN_NUMBER           = 11
    NAME                    = "T4_SCOPE_MAX"
    DATA_TYPE               = ASCII_REAL
    START_BYTE              = 81
    BYTES                   = 7
    UNIT                    = "DEGREE KELVIN"
    MISSING_CONSTANT        = 999.9
    FORMAT                  = "F7.1"
    DESCRIPTION             = "T4_SCOPE COSISCOPE TEMPERATURE MAXIMUM AT OPTICS"
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    COLUMN_NUMBER           = 12
    NAME                    = "T4_SCOPE_STD"
    DATA_TYPE               = ASCII_REAL
    START_BYTE              = 89
    BYTES                   = 7
    UNIT                    = "DEGREE KELVIN"
    MISSING_CONSTANT        = 999.9
    FORMAT                  = "F7.1"
    DESCRIPTION             = "T4_SCOPE COSISCOPE TEMPERATURE STANDARD DEVIATION
                               AT OPTICS"
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    COLUMN_NUMBER           = 13
    NAME                    = MODE
    DATA_TYPE               = ASCII_INTEGER
    START_BYTE              = 97
    BYTES                   = 1
    FORMAT                  = "I1"
    DESCRIPTION             = "0 = ONLY GRAINS INFORMATION,
                               1 = ONE OR TWO COMPRESSED IMAGES ARE ALSO
                                   GENERATED DEPENDING ON THE COMMAND WORD"
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    COLUMN_NUMBER           = 14
    NAME                    = CCD_CLEAN
    DATA_TYPE               = ASCII_INTEGER
    START_BYTE              = 99
    BYTES                   = 1
    FORMAT                  = "I1"
    DESCRIPTION             = "NUMBER OF ADDITIONAL CLEAN IMAGES WHICH HAVE BEEN
                               PROGRAMMED TO GET RID OF ACCUMULATED CHARGES ON
                               THE CCD. NOMINAL IS 0 FROM -20 CELSIUS DEGREE TO
                               +25 CELSIUS DEGREE OPERATING TEMPERATURE"
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    COLUMN_NUMBER           = 15
    NAME                    = DARK
    DATA_TYPE               = ASCII_INTEGER
    START_BYTE              = 101
    BYTES                   = 1
```

```
  FORMAT                 = "I1"
  DESCRIPTION            = "0=NO DARK CURRENT SUBTRACTION,
                            1=DARK CURRENT SUBTRACTION
                            THIS PARAMETER DEFINES WHETHER A DARK CURRENT IMAGE
                            WAS TO BE SUBTRACTED FROM THE COSISCOPE IMAGE
                            BEFORE THE IMPLEMENTATION OF THE GRAIN SEACH
                            ALGORITHM AND (IF REQUIRED BY THE COMMAND)
                            THE TRANSMISSION OF THE IMAGE(S)"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 16
  NAME                   = DETECTION
  DATA_TYPE              = ASCII_INTEGER
  START_BYTE             = 103
  BYTES                  = 1
  FORMAT                 = "I1"
  DESCRIPTION            = "0 = GRAINS ARE SEARCHED FOR AS POSITIVE ALBEDO
                                CONTRASTS
                            1 = EACH LINE (TOWARDS THE LED) IS FIRST
                                DIFFERENTIATED, THEN GRAINS ARE SEARCHED FOR
                                AS PEAKS IN THE DIFFERENTIALS"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 17
  NAME                   = THRESHOLD
  DATA_TYPE              = ASCII_INTEGER
  START_BYTE             = 105
  BYTES                  = 1
  FORMAT                 = "I1"
  DESCRIPTION            = "THE DETECTION LEVEL (0 TO 7) DEFINE THE FACTOR
                            ABOVE THE BACKGROUND, WHICH CONSTITUTES A DETECTION
                            FOR VALUES 1 TO 7 FACTORS 5,6,7,8,10,12,16.
                            A VALUE OF 0 GENERATES A TEST IMAGE WHICH IS
                            PROCESSED NOMINALLY."
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 18
  NAME                   = PACKING
  DATA_TYPE              = ASCII_INTEGER
  START_BYTE             = 107
  BYTES                  = 1
  FORMAT                 = "I1"
  DESCRIPTION            = "IMAGE COMPRESSION MODE (0 TO 3)
                            0: BIT-PACKING (10 BITS / PIXELS
                            1: REVERSIBLE COMPRESSION
                            2: WAVELET COMPRESSION, 1 BIT/PIXEL
                            3: WAVELET COMPRESSION, 2 BITS/PIXEL"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 19
  NAME                   = MINUS_X_LED
  DATA_TYPE              = ASCII_INTEGER
  START_BYTE             = 109
  BYTES                  = 1
  FORMAT                 = "I1"
  DESCRIPTION            = "0,1,2,4 =NO -X LED USED, 3,5,6,7=-X LED USED"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 20
  NAME                   = PLUS_X_LED
  DATA_TYPE              = ASCII_INTEGER
  START_BYTE             = 111
  BYTES                  = 1
  FORMAT                 = "I1"
  DESCRIPTION            = "0,1,2,4=NO +X LED USED, 3,5,6,7=+X LED USED"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 21
```

```
  NAME                   = PLUS_X_LED_ACQ_TIME
  DATA_TYPE              = ASCII_INTEGER
  START_BYTE             = 113
  BYTES                  = 5
  UNIT                   = "MILLISECOND"
  FORMAT                 = "I5"
  DESCRIPTION            = "PLUS X LED ACQUISITION TIME IN MS, DEFAULT 300 MS"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 22
  NAME                   = MINUS_X_LED_ACQ_TIME
  DATA_TYPE              = ASCII_INTEGER
  START_BYTE             = 119
  BYTES                  = 5
  UNIT                   = "MILLISECOND"
  FORMAT                 = "I5"
  DESCRIPTION            = "MINUS X LED ACQUISITION TIME IN MS, DEFAULT 300 MS"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 23
  NAME                   = PLUS_X_LED_BIAS
  DATA_TYPE              = ASCII_INTEGER
  START_BYTE             = 125
  BYTES                  = 3
  FORMAT                 = "I3"
  DESCRIPTION            = "PLUS X LED BIAS"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 24
  NAME                   = MINUS_X_LED_BIAS
  DATA_TYPE              = ASCII_INTEGER
  START_BYTE             = 129
  BYTES                  = 3
  FORMAT                 = "I3"
  DESCRIPTION            = "MINUS X LED BIAS"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 25
  NAME                   = PLUS_X_LED_GAIN
  DATA_TYPE              = ASCII_INTEGER
  START_BYTE             = 133
  BYTES                  = 3
  FORMAT                 = "I3"
  DESCRIPTION            = "PLUS X LED GAIN"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 26
  NAME                   = MINUS_X_LED_GAIN
  DATA_TYPE              = ASCII_INTEGER
  START_BYTE             = 137
  BYTES                  = 3
  FORMAT                 = "I3"
  DESCRIPTION            = "MINUS X LED GAIN"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 27
  NAME                   = PLUS_X_CAL_QUALITY
  DATA_TYPE              = ASCII_INTEGER
  START_BYTE             = 141
  BYTES                  = 5
  FORMAT                 = "I5"
  MISSING_CONSTANT       = 43960
  DESCRIPTION            = "PLUS X LED CALIBRATION STRIP POSITION QUALITY"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 28
  NAME                   = PLUS_X_AX
```

```
  DATA_TYPE               = ASCII_INTEGER
  START_BYTE              = 147
  BYTES                   = 5
  FORMAT                  = "I5"
  MISSING_CONSTANT        = 43960
  DESCRIPTION             = "PLUS X LED A DOT X POSITION"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
  COLUMN_NUMBER           = 29
  NAME                    = PLUS_X_AY
  DATA_TYPE               = ASCII_INTEGER
  START_BYTE              = 153
  BYTES                   = 5
  FORMAT                  = "I5"
  MISSING_CONSTANT        = 43960
  DESCRIPTION             = "PLUS X LED A DOT Y POSITION"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
  COLUMN_NUMBER           = 30
  NAME                    = PLUS_X_BX
  DATA_TYPE               = ASCII_INTEGER
  START_BYTE              = 159
  BYTES                   = 5
  FORMAT                  = "I5"
  MISSING_CONSTANT        = 43960
  DESCRIPTION             = "PLUS X LED B DOT X POSITION"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
  COLUMN_NUMBER           = 31
  NAME                    = PLUS_X_BY
  DATA_TYPE               = ASCII_INTEGER
  START_BYTE              = 165
  BYTES                   = 5
  FORMAT                  = "I5"
  MISSING_CONSTANT        = 43960
  DESCRIPTION             = "PLUS X LED B DOT Y POSITION"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
  COLUMN_NUMBER           = 32
  NAME                    = PLUS_X_LABEL
  DATA_TYPE               = ASCII_INTEGER
  START_BYTE              = 171
  BYTES                   = 5
  FORMAT                  = "I5"
  MISSING_CONSTANT        = 43960
  DESCRIPTION             = "PLUS X LED SUBSTRATE LABEL
                             THE SUBSTRATE ID:S MATCH THE SUBSTRATE LABELS
                             IN THE REFERENCE STRIP WITH THE FOLLOWING TABLE:
                             1C1 = 63
                             2C1 = 95
                             3C1 = 111
                             1C2 = 119
                             2C2 = 123
                             3C2 = 125
                             1C3 = 126
                             2C3 = 159
                             3C3 = 175
                             1C4 = 183
                             2C4 = 187
                             3C4 = 189
                             1C5 = 190
                             2C5 = 207
                             3C5 = 215
                             1C6 = 219
                             2C6 = 221
                             3C6 = 222
                             1C7 = 231
                             2C7 = 235
                             3C7 = 237
                             1C8 = 238
```

```
                             2C8 = 243
                             3C8 = 245
                             1C9 = 246
                             2C9 = 249
                             3C9 = 250
                             1CA = 252
                             2CA = 287
                             3CA = 303
                             1CB = 311
                             2CB = 315
                             3CB = 317
                             1CC = 318
                             2CC = 335
                             3CC = 343
                             1CD = 347
                             2CD = 349
                             3CD = 350
                             1CE = 359
                             2CE = 363
                             3CE = 365
                             1CF = 366
                             2CF = 371
                             3CF = 373
                             1D0 = 374
                             2D0 = 377
                             3D0 = 378
                             1D1 = 380
                             2D1 = 399
                             3D1 = 407
                             1D2 = 411
                             2D2 = 413
                             3D2 = 414
                             1D3 = 423
                             2D3 = 427
                             3D3 = 429
                             1D4 = 430
                             2D4 = 435
                             3D4 = 437
                             1D5 = 438
                             2D5 = 441
                             3D5 = 442
                             1D6 = 444
                             2D6 = 455
                             3D6 = 459
                             1D7 = 461
                             2D7 = 462
                             3D7 = 467
                             1D8 = 469
                             2D8 = 470
                             3D8 = 473"
END_OBJECT                 = COLUMN

OBJECT                     = COLUMN
  COLUMN_NUMBER            = 33
  NAME                     = PLUS_X_SUBST_QUALITY
  DATA_TYPE                = ASCII_INTEGER
  START_BYTE               = 177
  BYTES                    = 5
  FORMAT                   = "I5"
  MISSING_CONSTANT         = 43960
  DESCRIPTION              = "PLUS X LED SUBSTRACE POSITION QUALITY"
END_OBJECT                 = COLUMN

OBJECT                     = COLUMN
  COLUMN_NUMBER            = 34
  NAME                     = PLUS_X_CX
  DATA_TYPE                = ASCII_INTEGER
  START_BYTE               = 183
  BYTES                    = 5
  FORMAT                   = "I5"
  MISSING_CONSTANT         = 43960
  DESCRIPTION              = "PLUS X LED C DOT X POSITION"
END_OBJECT                 = COLUMN
```

```
OBJECT                  = COLUMN
  COLUMN_NUMBER         = 35
  NAME                  = PLUS_X_CY
  DATA_TYPE             = ASCII_INTEGER
  START_BYTE            = 189
  BYTES                 = 5
  FORMAT                = "I5"
  MISSING_CONSTANT      = 43960
  DESCRIPTION           = "PLUS X LED C DOT Y POSITION"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 36
  NAME                  = PLUS_X_DX
  DATA_TYPE             = ASCII_INTEGER
  START_BYTE            = 195
  BYTES                 = 5
  FORMAT                = "I5"
  MISSING_CONSTANT      = 43960
  DESCRIPTION           = "PLUS X LED D DOT X POSITION"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 37
  NAME                  = PLUS_X_DY
  DATA_TYPE             = ASCII_INTEGER
  START_BYTE            = 201
  BYTES                 = 5
  FORMAT                = "I5"
  MISSING_CONSTANT      = 43960
  DESCRIPTION           = "PLUS X LED D DOT Y POSITION"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 38
  NAME                  = PLUS_X_TARGET_LABEL
  DATA_TYPE             = ASCII_INTEGER
  START_BYTE            = 207
  BYTES                 = 5
  FORMAT                = "I5"
  MISSING_CONSTANT      = 43960
  DESCRIPTION           = "PLUS X LED TARGET LABEL (N/A WITH FLIGHT TARGETS)"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 39
  NAME                  = MINUS_X_CAL_QUALITY
  DATA_TYPE             = ASCII_INTEGER
  START_BYTE            = 213
  BYTES                 = 5
  FORMAT                = "I5"
  MISSING_CONSTANT      = 43960
  DESCRIPTION           = "MINUS X LED CALIBRATION STRIP POSITION QUALITY"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 40
  NAME                  = MINUS_X_AX
  DATA_TYPE             = ASCII_INTEGER
  START_BYTE            = 219
  BYTES                 = 5
  FORMAT                = "I5"
  MISSING_CONSTANT      = 43960
  DESCRIPTION           = "MINUS X LED A DOT X POSITION"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  COLUMN_NUMBER         = 41
  NAME                  = MINUS_X_AY
  DATA_TYPE             = ASCII_INTEGER
  START_BYTE            = 225
  BYTES                 = 5
  FORMAT                = "I5"
  MISSING_CONSTANT      = 43960
```

```
  DESCRIPTION            = "MINUS X LED A DOT Y POSITION"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 42
  NAME                   = MINUS_X_BX
  DATA_TYPE              = ASCII_INTEGER
  START_BYTE             = 231
  BYTES                  = 5
  FORMAT                 = "I5"
  MISSING_CONSTANT       = 43960
  DESCRIPTION            = "MINUS X LED B DOT X POSITION"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 43
  NAME                   = MINUS_X_BY
  DATA_TYPE              = ASCII_INTEGER
  START_BYTE             = 237
  BYTES                  = 5
  FORMAT                 = "I5"
  MISSING_CONSTANT       = 43960
  DESCRIPTION            = "MINUS X LED B DOT Y POSITION"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  COLUMN_NUMBER          = 44
  NAME                   = MINUS_X_LABEL
  DATA_TYPE              = ASCII_INTEGER
  START_BYTE             = 243
  BYTES                  = 5
  FORMAT                 = "I5"
  MISSING_CONSTANT       = 43960
  DESCRIPTION            = "MINUS X LED SUBSTRATE LABEL
                            THE SUBSTRATE ID:S MATCH THE SUBSTRATE LABELS
                            IN THE REFERENCE STRIP WITH THE FOLLOWING TABLE:
                            1C1 = 63
                            2C1 = 95
                            3C1 = 111
                            1C2 = 119
                            2C2 = 123
                            3C2 = 125
                            1C3 = 126
                            2C3 = 159
                            3C3 = 175
                            1C4 = 183
                            2C4 = 187
                            3C4 = 189
                            1C5 = 190
                            2C5 = 207
                            3C5 = 215
                            1C6 = 219
                            2C6 = 221
                            3C6 = 222
                            1C7 = 231
                            2C7 = 235
                            3C7 = 237
                            1C8 = 238
                            2C8 = 243
                            3C8 = 245
                            1C9 = 246
                            2C9 = 249
                            3C9 = 250
                            1CA = 252
                            2CA = 287
                            3CA = 303
                            1CB = 311
                            2CB = 315
                            3CB = 317
                            1CC = 318
                            2CC = 335
                            3CC = 343
                            1CD = 347
                            2CD = 349
```

```
                             3CD = 350
                             1CE = 359
                             2CE = 363
                             3CE = 365
                             1CF = 366
                             2CF = 371
                             3CF = 373
                             1D0 = 374
                             2D0 = 377
                             3D0 = 378
                             1D1 = 380
                             2D1 = 399
                             3D1 = 407
                             1D2 = 411
                             2D2 = 413
                             3D2 = 414
                             1D3 = 423
                             2D3 = 427
                             3D3 = 429
                             1D4 = 430
                             2D4 = 435
                             3D4 = 437
                             1D5 = 438
                             2D5 = 441
                             3D5 = 442
                             1D6 = 444
                             2D6 = 455
                             3D6 = 459
                             1D7 = 461
                             2D7 = 462
                             3D7 = 467
                             1D8 = 469
                             2D8 = 470
                             3D8 = 473"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
  COLUMN_NUMBER           = 45
  NAME                    = MINUS_X_SUBST_QUALITY
  DATA_TYPE               = ASCII_INTEGER
  START_BYTE              = 249
  BYTES                   = 5
  FORMAT                  = "I5"
  MISSING_CONSTANT        = 43960
  DESCRIPTION             = "MINUS X LED SUBSTRACE POSITION QUALITY"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
  COLUMN_NUMBER           = 46
  NAME                    = MINUS_X_CX
  DATA_TYPE               = ASCII_INTEGER
  START_BYTE              = 255
  BYTES                   = 5
  FORMAT                  = "I5"
  MISSING_CONSTANT        = 43960
  DESCRIPTION             = "MINUS X LED C DOT X POSITION"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
  COLUMN_NUMBER           = 47
  NAME                    = MINUS_X_CY
  DATA_TYPE               = ASCII_INTEGER
  START_BYTE              = 261
  BYTES                   = 5
  FORMAT                  = "I5"
  MISSING_CONSTANT        = 43960
  DESCRIPTION             = "MINUS X LED C DOT Y POSITION"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
  COLUMN_NUMBER           = 48
  NAME                    = MINUS_X_DX
  DATA_TYPE               = ASCII_INTEGER
  START_BYTE              = 267
```

```
  BYTES                   = 5
  FORMAT                  = "I5"
  MISSING_CONSTANT        = 43960
  DESCRIPTION             = "MINUS X LED D DOT X POSITION"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
  COLUMN_NUMBER           = 49
  NAME                    = MINUS_X_DY
  DATA_TYPE               = ASCII_INTEGER
  START_BYTE              = 273
  BYTES                   = 5
  FORMAT                  = "I5"
  MISSING_CONSTANT        = 43960
  DESCRIPTION             = "MINUS X LED D DOT Y POSITION"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
  COLUMN_NUMBER           = 50
  NAME                    = MINUS_X_TARGET_LABEL
  DATA_TYPE               = ASCII_INTEGER
  START_BYTE              = 279
  BYTES                   = 5
  FORMAT                  = "I5"
  MISSING_CONSTANT        = 43960
  DESCRIPTION             = "MINUS X LED TARGET LABEL (N/A WITH FLIGHT TARGETS)"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
  COLUMN_NUMBER           = 51
  NAME                    = X_OFFSET
  DATA_TYPE               = ASCII_REAL
  START_BYTE              = 285
  BYTES                   = 9
  UNIT                    = "MICROMETER"
  FORMAT                  = "F9.2"
  DESCRIPTION             = "SUBSTRATE OFFSET IN X"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
  COLUMN_NUMBER           = 52
  NAME                    = Y_OFFSET
  DATA_TYPE               = ASCII_REAL
  START_BYTE              = 295
  BYTES                   = 9
  UNIT                    = "MICROMETER"
  FORMAT                  = "F9.2"
  DESCRIPTION             = "SUBSTRATE OFFSET IN Y"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
  COLUMN_NUMBER           = 53
  NAME                    = X_ORIGIN
  DATA_TYPE               = ASCII_REAL
  START_BYTE              = 305
  BYTES                   = 9
  UNIT                    = "MICROMETER"
  FORMAT                  = "F9.2"
  DESCRIPTION             = "SUBSTRATE ORIGIN X IN COSISCOPE FIELD OF VIEW"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
  COLUMN_NUMBER           = 53
  NAME                    = Y_ORIGIN
  DATA_TYPE               = ASCII_REAL
  START_BYTE              = 315
  BYTES                   = 9
  UNIT                    = "MICROMETER"
  FORMAT                  = "F9.2"
  DESCRIPTION             = "SUBSTRATE ORIGIN Y IN COSISCOPE FIELD OF VIEW"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
  COLUMN_NUMBER           = 54
```

```
  NAME                  = ROTATION
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 325
  BYTES                 = 8
  UNIT                  = "DEGREE"
  FORMAT                = "F8.4"
  DESCRIPTION           = "SUBSTRATE ROTATION ANGLE"
END_OBJECT              = COLUMN
```

4.3.12 Substrate history ancillary product

4.3.12.1General description

Substrate history product contains information about substrate storage and expose periods, cleaning and heating actions, COSISCOPE camera images and grains lists and any spectra taken. The history product contains history from the moment substrates were installed in the COSIMA flight instrument.

4.3.12.2Label example

```
PDS_VERSION_ID                  = PDS3
LABEL_REVISION_NOTE             = "V1.1"

/* FILE FORMAT */
RECORD_TYPE                     = FIXED_LENGTH
RECORD_BYTES                    = 148
FILE_RECORDS                    =   67
LABEL_RECORDS                   = 18
/* POINTER TO DATA OBJECT */
^HISTORY_TABLE                  = 19

/* GENERAL DATA DESCRIPTION PARAMETERS */
FILE_NAME                       = "CS_2D8_SUBSTRATE_HIST.TAB"
DATA_SET_ID                     = "RO-CAL-COSIMA-3-V2.0"
DATA_SET_NAME                   = "ROSETTA-ORBITER CAL COSIMA 3 V2.0"
PRODUCT_ID                      = "CS_2D8_SUBSTRATE_HIST"
PRODUCT_CREATION_TIME           = 2008-11-12T09:15:54
PRODUCT_TYPE                    = "ANCDR"
PROCESSING_LEVEL_ID             = 6
MISSION_ID                      = "ROSETTA"
MISSION_NAME                    = "INTERNATIONAL ROSETTA MISSION"
MISSION_PHASE_NAME              = "N/A"
INSTRUMENT_HOST_ID              = "RO"
INSTRUMENT_HOST_NAME            = "ROSETTA-ORBITER"
INSTRUMENT_ID                   = "COSIMA"
INSTRUMENT_NAME                 = "COMETARY SECONDARY ION MASS ANALYZER"
INSTRUMENT_TYPE                 = "MASS SPECTROMETER"
INSTRUMENT_MODE_ID              = "N/A"
INSTRUMENT_MODE_DESC            = "N/A"
TARGET_NAME                     = "CALIBRATION"
TARGET_TYPE                     = "CALIBRATION"
START_TIME                      = 2002-05-29T00:00:00
STOP_TIME                       = 2008-07-24T00:00:00
SPACECRAFT_CLOCK_START_COUNT    = "N/A"
SPACECRAFT_CLOCK_STOP_COUNT     = "1/0175478364.35517"
SC_SUN_POSITION_VECTOR          = "N/A"
SC_TARGET_POSITION_VECTOR       = "N/A"
SC_TARGET_VELOCITY_VECTOR       = "N/A"
SPACECRAFT_ALTITUDE             = "N/A"
SUB_SPACECRAFT_LATITUDE         = "N/A"
SUB_SPACECRAFT_LONGITUDE        = "N/A"
PRODUCER_ID                     = "FMI"
PRODUCER_FULL_NAME              = "JOHAN SILEN"
PRODUCER_INSTITUTION_NAME       = "FINNISH METEOROLOGICAL INSTITUTE"
DATA_QUALITY_ID                 = -1
DATA_QUALITY_DESC               = "-1 = not checked"
ROSETTA:COSIMA_SUBSTRATE_ID     = "2D8"
ROSETTA:COSIMA_SUBSTRATE_DESC   = "Silver, blank"

OBJECT                          = HISTORY_TABLE
  NAME                          = SUBSTRATE_HISTORY
  INTERCHANGE_FORMAT            = ASCII
```

```
  ROWS                          = 49
  COLUMNS                       = 9
  ROW_BYTES                     = 148
  ^STRUCTURE                    = "COSIMA_HISTORY.FMT"
  DESCRIPTION                   = "SUBSTRATE HISTORY"
END_OBJECT                      = HISTORY_TABLE

END
```

COSIMA_HISTORY.FMT:

```
  OBJECT                        = COLUMN
    COLUMN_NUMBER               = 1
    NAME                        = UTC_START_DATE
    DATA_TYPE                   = DATE
    START_BYTE                  = 1
    BYTES                       = 19
    FORMAT                      = "A19"
    DESCRIPTION                 = "START TIME IN UTC"
  END_OBJECT                    = COLUMN
  OBJECT                        = COLUMN
    COLUMN_NUMBER               = 2
    NAME                        = UTC_STOP_DATE
    DATA_TYPE                   = DATE
    START_BYTE                  = 21
    BYTES                       = 19
    FORMAT                      = "A19"
    DESCRIPTION                 = "STOP TIME IN UTC"
  END_OBJECT                    = COLUMN
  OBJECT                        = COLUMN
    COLUMN_NUMBER               = 3
    NAME                        = TIME
    DATA_TYPE                   = ASCII_INTEGER
    START_BYTE                  = 41
    BYTES                       = 10
    UNIT                        = "SECOND"
    MISSING_CONSTANT            = -1
    FORMAT                      = "I10"
    DESCRIPTION                 = "TIME SPENT IN THE POSITION IN SECONDS"
  END_OBJECT                    = COLUMN
  OBJECT                        = COLUMN
    COLUMN_NUMBER               = 4
    NAME                        = POSITION
    DATA_TYPE                   = CHARACTER
    START_BYTE                  = 53
    BYTES                       = 9
    FORMAT                      = "A9"
    DESCRIPTION                 = "POSITION, POSSIBLE VALUES ARE
                                     STORAGE, in target storage
                                       IMAGE, substrate image
                                      GRAINS, dust position list
                                       PEAKS, peak list acquisition
                                        SCAN, total count acquition
                                    SPECTRUM, spectrum acquistion
                                      EXPOSE, exposed to the outside
                                       CLEAN, at beam cleaning position
                                   CHEMISTRY, at heating station"
  END_OBJECT                    = COLUMN
  OBJECT                        = COLUMN
    COLUMN_NUMBER               = 5
    NAME                        = X_COORDINATE
    DATA_TYPE                   = ASCII_INTEGER
    START_BYTE                  = 64
    BYTES                       = 5
    UNIT                        = "MICROMETER"
    MISSING_CONSTANT            = -1
    FORMAT                      = "I5"
    DESCRIPTION                 = "SUBSTRATE X-COORDINATE IN MICROMETERS,
                                   ZERO IS AT LEFT"
  END_OBJECT                    = COLUMN
  OBJECT                        = COLUMN
    COLUMN_NUMBER               = 6
    NAME                        = Y_COORDINATE
    DATA_TYPE                   = ASCII_INTEGER
```

```
    START_BYTE                  = 70
    BYTES                       = 5
    UNIT                        = "MICROMETER"
    MISSING_CONSTANT            = -1
    FORMAT                      = "I5"
    DESCRIPTION                 = "SUBSTRATE Y-COORDINATE IN MICROMETERS,
                                   ZERO IS AT BOTTOM"
  END_OBJECT                    = COLUMN
  OBJECT                        = COLUMN
    COLUMN_NUMBER               = 7
    NAME                        = TIP_CURRENT
    DATA_TYPE                   = ASCII_INTEGER
    START_BYTE                  = 76
    BYTES                       = 3
    MISSING_CONSTANT            = -99
    FORMAT                      = "I3"
    UNIT                        = "MICROAMPERE"
    DESCRIPTION                 = "INDIUM BEAM TIP CURRENT"
  END_OBJECT                    = COLUMN
  OBJECT                        = COLUMN
    COLUMN_NUMBER               = 8
    NAME                        = SCIENCE_FILENAME
    DATA_TYPE                   = CHARACTER
    START_BYTE                  = 81
    BYTES                       = 31
    FORMAT                      = "A31"
    DESCRIPTION                 = "SCIENCE DATA LABEL FILENAME"
  END_OBJECT                    = COLUMN
  OBJECT                        = COLUMN
    COLUMN_NUMBER               = 9
    NAME                        = HOUSEKEEPING_FILENAME
    DATA_TYPE                   = CHARACTER
    START_BYTE                  = 115
    BYTES                       = 31
    FORMAT                      = "A31"
    DESCRIPTION                 = "SCIENCE DATA RELATED HOUSEKEEPING LABEL
                                   FILENAME"
  END_OBJECT                    = COLUMN
```

5 Appendix: Directory Listing of Data Set RO-CAL-COSIMA-3-V3.0

```
TOP-LEVEL-DIRECTORY
|
|- AAREADME.TXT               This file
|
|- VOLDESC.CAT                Description of the data volume
|
|- [CATALOG]                  The directory containing information
|      |                      about COSIMA calibration data set
|      |
|      |- CATINFO.TXT         Info about CATALOG directory contents
|      |
|      |- MISSION.CAT         Rosetta mission description, provided
|      |                      by Rosetta project
|      |
|      |- INSTHOST.CAT        Rosetta spacecraft description,
|      |                      provided by Rosetta project
|      |
|      |- INST.CAT            COSIMA instrument description
|      |
|      |- DATASET.CAT         Dataset description
|      |
|      |- SOFT.CAT            Software description. Empty for
|      |                      COSIMA datasets
|      |
|      |- PERSON.CAT          Dataset provider contact information
```

```
|      |
|      |- REF.CAT                 References
|      |
|      |- TARGET.CAT              Target descriptions
|
|- [DATA]                        The directory for instrument data
|      |                          products
|      |
|      |- [SUB_YXX]               Substrate YXX data products, where
|      |      |                   Y is substrate target holder position
|      |      |                   1=top, 2=middle, 3=bottom. XX is
|      |      |                   target holder ID number, range
|      |      |                   from C1 to D8, where counting is done
|      |      |                   in hexadecimal
|      |      |
|      |      |- CS_YXX_SUBSTRATE_HIST.TAB
|      |      |                   Substrate history product, where
|      |      |                   Y is substrate target holder position
|      |      |                   1=top, 2=middle, 3=bottom. XX is
|      |      |                   target holder ID number, range
|      |      |                   from C1 to D8, where counting is done
|      |      |                   in hexadecimal
|      |      |
|      |      |- CS_YXX_YYYYMMDDTHHMMSS_SP_Z.TAB
|      |      |                   Substrate spectrum, where
|      |      |                   Y is substrate target holder position
|      |      |                   1=top, 2=middle, 3=bottom. XX is
|      |      |                   target holder ID number, range
|      |      |                   from C1 to D8, where counting is done
|      |      |                   in hexadecimal. YYYYMMDDTHHMMSS is
|      |      |                   the date. Z is either P for positive
|      |      |                   or N for negative spectrum.
|      |      |
|      |      |- CS_YXX_YYYYMMDDTHHMMSS_PK_Z.TAB
|      |      |                   Substrate peak list, where
|      |      |                   Y is substrate target holder position
|      |      |                   1=top, 2=middle, 3=bottom. XX is
|      |      |                   target holder ID number, range
|      |      |                   from C1 to D8, where counting is done
|      |      |                   in hexadecimal. YYYYMMDDTHHMMSS is
|      |      |                   the date. Z is either P for positive
|      |      |                   or N for negative peak list.
|      |      |
|      |      |- CS_YXX_YYYYMMDDTHHMMSS_S_HK.TAB
|      |      |                   Substrate spectrum or peak list
|      |      |                   housekeeping data, where
|      |      |                   Y is substrate target holder position
|      |      |                   1=top, 2=middle, 3=bottom. XX is
|      |      |                   target holder ID number, range
|      |      |                   from C1 to D8, where counting is done
|      |      |                   in hexadecimal. YYYYMMDDTHHMMSS is
|      |      |                   the date.
|      |      |
|      |      |- CS_YXX_YYYYMMDDTHHMMSS_SCAN.TAB
|      |      |                   Substrate scan data, where
|      |      |                   Y is substrate target holder position
|      |      |                   1=top, 2=middle, 3=bottom. XX is
|      |      |                   target holder ID number, range
|      |      |                   from C1 to D8, where counting is done
|      |      |                   in hexadecimal. YYYYMMDDTHHMMSS is
```

```
|       |       |                     the date.
|       |       |
|       |       |- CS_YXX_YYYYMMDDTHHMMSS_SCHK.TAB
|       |       |                     Substrate scan
|       |       |                     housekeeping data, where
|       |       |                     Y is substrate target holder position
|       |       |                     1=top, 2=middle, 3=bottom. XX is
|       |       |                     target holder ID number, range
|       |       |                     from C1 to D8, where counting is done
|       |       |                     in hexadecimal. YYYYMMDDTHHMMSS is
|       |       |                     the date.
|       |       |
|       |       |- CS_YXX_YYYYMMDDTHHMMSS_HEAT.TAB
|       |       |                     Substrate heating data, where
|       |       |                     Y is substrate target holder position
|       |       |                     1=top, 2=middle, 3=bottom. XX is
|       |       |                     target holder ID number, range
|       |       |                     from C1 to D8, where counting is done
|       |       |                     in hexadecimal. YYYYMMDDTHHMMSS is
|       |       |                     the date.
|       |       |
|       |       |- CS_YXX_YYYYMMDDTHHMMSS_CLEA.TAB
|       |       |                     Substrate cleaning data, where
|       |       |                     Y is substrate target holder position
|       |       |                     1=top, 2=middle, 3=bottom. XX is
|       |       |                     target holder ID number, range
|       |       |                     from C1 to D8, where counting is done
|       |       |                     in hexadecimal. YYYYMMDDTHHMMSS is
|       |       |                     the date.
|       |       |
|       |       |- CS_YXX_YYYYMMDDTHHMMSS_CLHK.TAB
|       |       |                     Substrate cleaning
|       |       |                     housekeeping data, where
|       |       |                     Y is substrate target holder position
|       |       |                     1=top, 2=middle, 3=bottom. XX is
|       |       |                     target holder ID number, range
|       |       |                     from C1 to D8, where counting is done
|       |       |                     in hexadecimal. YYYYMMDDTHHMMSS is
|       |       |                     the date.
|       |       |
|       |       |- CS_YXX_YYYYMMDDTHHMMSS_GR__.TAB
|       |       |                     Substrate grain list, where
|       |       |                     Y is substrate target holder position
|       |       |                     1=top, 2=middle, 3=bottom. XX is
|       |       |                     target holder ID number, range
|       |       |                     from C1 to D8, where counting is done
|       |       |                     in hexadecimal. YYYYMMDDTHHMMSS is
|       |       |                     the date.
|       |       |
|       |       |- CS_YXX_YYYYMMDDTHHMMSS_IM_Z.FIT
|       |       |                     Substrate FITS-format image, where
|       |       |                     Y is substrate target holder position
|       |       |                     1=top, 2=middle, 3=bottom. XX is
|       |       |                     target holder ID number, range
|       |       |                     from C1 to D8, where counting is done
|       |       |                     in hexadecimal. YYYYMMDDTHHMMSS is
|       |       |                     the date. ZZ is either P for right
|       |       |                     (plus) side led or M (minus) for
|       |       |                     left side led illumination.
|       |       |
```

```
|      |      |- CS_YXX_YYYYMMDDTHHMMSS_G_HK.TAB
|      |      |                 Substrate grain list or image
|      |      |                 housekeeping data, where
|      |      |                 Y is substrate target holder position
|      |      |                 1=top, 2=middle, 3=bottom. XX is
|      |      |                 target holder ID number, range
|      |      |                 from C1 to D8, where counting is done
|      |      |                 in hexadecimal. YYYYMMDDTHHMMSS is
|      |      |                 the date.
|
|- [DOCUMENT]                   The directory for documentation
|      |
|      |- DOCINFO.TXT           Info about DOCUMENT directory
|      |                        contents
|      |
|      |- COSIMASIS.ASC         COSIMA PDS interface description
|      |                        in ASCII format
|      |
|      |- COSIMASIS.PDF         COSIMA PDS interface description
|      |                        in PDF format
|      |
|      |- COSIMASISXXX.JPG      COSIMA PDS interface description
|      |                        figures for ASCII version,
|      |                        XXX is gives the figure number in
|      |                        the form 001, 002
|      |
|      |- COSIMAPAPER.ASC       COSIMA instrument paper
|      |                        in ASCII format
|      |
|      |- COSIMAPAPER.PDF       COSIMA instrument paper
|      |                        in PDF format
|      |
|      |- COSIMAPAPERXXX.JPG   COSIMA instrument paper
|      |                        images in JPG format.
|
|- [INDEX]                      The directory for index files
|      |
|      |- INDEX.LBL             A PDS detached label describing
|      |                        INDEX.TAB
|      |
|      |- INDEX.TAB             Tabular summary of the data files
|      |
|      |- INDXINFO.TXT          Info about INDEX directory contents
|
|- [LABEL]                      The directory for formatting files
|      |                        used by the attached labels
|      |
|      |- LABINFO.TXT           Info about LABEL directory contents
|      |
|      |- COSIMA_HISTORY.FMT    Substrate history column object
|      |                        definitions
|      |
|      |- COSIMA_SPECTRUM_DATA.FMT
|      |                        Spectrum column object
|      |                        definitions
|      |
|      |- COSIMA_SPECTRUM_HK.FMT Spectrum housekeeping statistics
|      |                        column object definitions
|      |
|      |- COSIMA_SPECTRUM_PEAKS.FMT
```

```
|      |                         Spectrum peak data column object
|      |                         definitions
|      |
|      |- COSIMA_SPECTRUM_PEAK_SCALE.FMT
|      |                         Spectrum peak data scaling column
|      |                         object definitions
|      |
|      |- COSIMA_SPECTRUM_TDC_CALIB.FMT
|      |                         Spectrum time to digital unit
|      |                         temperature calibration result
|      |                         column object definitions
|      |
|      |- COSIMA_SPECTRUM_TDC_TIMING.FMT
|      |                         Spectrum time to digital unit
|      |                         timing setup column object
|      |                         definitions
|      |
|      |- COSIMA_CLEANING.FMT    Substrate cleaning column
|      |                         object definitions
|      |
|      |- COSIMA_HEATING_DATA.FMT
|      |                         Substrate heating data column
|      |                         object definitions
|      |
|      |- COSIMA_HEATING_SETUP.FMT
|      |                         Substrate heating setup column
|      |                         object definitions
|      |
|      |- COSIMA_SCAN_DATA.FMT   Substrate scan column
|      |                         object definitions
|      |
|      |- COSISCOPE_GRAINS.FMT   Cosiscope grain search result
|      |                         column object definitions
|      |
|      |- COSISCOPE_HK.FMT       Cosiscope housekeeping statistics
|                                column object definitions
```