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ROSETTA-COSIMA

To Planetary Science Archive Interface Control Document

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Change Log

Date	Sections Changed	Reasons for Change
1 March 2004	All sections	Draft 2
23.January.2006	All sections	First official release
18 June 2007	1.5, 2, 3,4.3	Dataset delivery scheme updated, geometry information added. All the labels updated. TARGET.CAT added.

TBD ITEMS

Section	Description
2	Transformation of time-of-flight spectra, level 2 to mass spectra, level 3
4	Level 3, calibrated mass spectra product is not defined yet

Table Of Contents

1 INTRODUCTION.....	3
1.1 PURPOSE AND SCOPE.....	3
1.2 ARCHIVING AUTHORITIES.....	3
1.3 CONTENTS.....	3
1.4 INTENDED READERSHIP.....	3
1.5 APPLICABLE AND REFERENCE DOCUMENTS.....	3
1.6 ACRONYMS AND ABBREVIATIONS.....	4
1.7 CONTACT NAMES AND ADDRESSES.....	5
2 OVERVIEW OF INSTRUMENT DESIGN, DATA HANDLING PROCESS AND PRODUCT GENERATION	6
2.1 SCIENTIFIC OBJECTIVES.....	6
2.2 INSTRUMENT SUB-SYSTEMS.....	7
2.2.1 <i>TMU</i>	8
2.2.2 <i>COSISCOPE</i>	10
2.2.3 <i>Primary Ion Source (PIS)</i>	11
2.2.4 <i>Primary Ion Beam System (PIBS)</i>	11
2.2.5 <i>Time-Of-Flight Spectrometer (TOF)</i>	11
2.2.6 <i>TDC</i>	11
2.3 DATA HANDLING PROCESS.....	11
2.4 OVERVIEW OF DATA PRODUCTS.....	12
2.4.1 <i>General</i>	12
2.4.2 <i>Software</i>	12
2.4.2.1 <i>Data processing software</i>	12
2.4.2.2 <i>Scientific analysis software</i>	13
2.4.3 <i>Documentation</i>	13
2.4.4 <i>Derived and other Data Products</i>	13
2.4.5 <i>Ancillary Data Usage</i>	13
3 ARCHIVE FORMAT AND CONTENT.....	14
3.1 DELIVERIES AND ARCHIVE VOLUME FORMAT.....	14
3.2 CONVENTIONS.....	14
3.2.1 <i>Data Set ID Formation</i>	14
3.2.2 <i>Data Directory Naming Convention</i>	15
3.2.3 <i>Filenaming Convention COSIMA data products will be named as follows:</i>	15
3.3 STANDARDS USED IN DATA PRODUCT GENERATION.....	15
3.3.1 <i>PDS Standards</i>	15
3.3.2 <i>Time Standards</i>	15
3.3.2.1 <i>Spacecraft Clock Count, OBT</i>	15
3.3.3 <i>Reference Systems</i>	16
3.3.4 <i>Other Applicable Standards</i>	16
3.4 DATA VALIDATION.....	16
3.5 CONTENT.....	16
3.5.1 <i>Volume Set</i>	16
3.5.2 <i>Data Set</i>	16

3.5.3 Directories.....	17
3.5.3.1 Root Directory.....	17
3.5.3.2 Calibration Directory.....	17
3.5.3.3 Catalog Directory.....	17
3.5.3.4 Index Directory.....	17
3.5.3.5 Browse Directory and Browse Files.....	17
3.5.3.6 Geometry Directory.....	17
3.5.3.7 Software Directory.....	17
3.5.3.8 Gazetter Directory.....	17
3.5.3.9 Label Directory.....	17
3.5.3.10 Document Directory.....	17
3.5.3.11 Extras Directory.....	18
3.5.3.12 Data Directory.....	18
4 DETAILED INTERFACE SPECIFICATIONS.....	19
4.1 STRUCTURE AND ORGANIZATION OVERVIEW.....	19
4.2 DATA SETS, DEFINITION AND CONTENT.....	19
4.3 DATA PRODUCT DESIGN.....	19
4.3.1 <i>Time-of-flight spectrum product</i>	19
4.3.1.1 General description.....	19
4.3.1.2 Label example.....	19
4.3.2 <i>Peak list product</i>	21
4.3.2.1 General Description.....	21
4.3.2.2 Label example.....	21
4.3.3 <i>Time-of-flight spectrum housekeeping data product</i>	23
4.3.3.1 General description.....	23
4.3.3.2 Label example.....	23
4.3.4 <i>COSISCOPE image product</i>	53
4.3.4.1 General description.....	53
4.3.4.2 Label example.....	53
4.3.5 <i>COSISCOPE dust grain list product</i>	54
4.3.5.1 General description.....	54
4.3.5.2 Label template.....	55
4.3.6 <i>COSISCOPE housekeeping product</i>	57
4.3.6.1 General information.....	57
4.3.6.2 Label example.....	57
4.3.7 <i>Substrate history ancillary product</i>	72
4.3.7.1 General description.....	72
4.3.7.2 Label example.....	72
5 APPENDIX: DIRECTORY LISTING OF DATA SET RO-CAL-COSIMA-2-V1.0.....	75

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 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 3.2, 05 June 2007

[RD-02] Kissel et al: COSIMA, a High Resolution Time-of-Flight Secondary Ion Mass Spectrometer for the Analysis of Cometary Dust Particles (submitted to be published in 2006)

[RD-03] Dahl, D.A., INEEL, Idaho Falls, Idaho 83415, DHL@inel.gov: The SIMION software manual, 1997 (and later versions).

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[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-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
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

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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 **Secondary Ion Mass Spectroscopy** (SIMS). A fast primary ion, in this case $^{115}\text{In}^+$ 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 may be later calibrated to mass spectra. Calibration TBD.

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 be found in ASCII and in PDF form from the DOCUMENT directory.

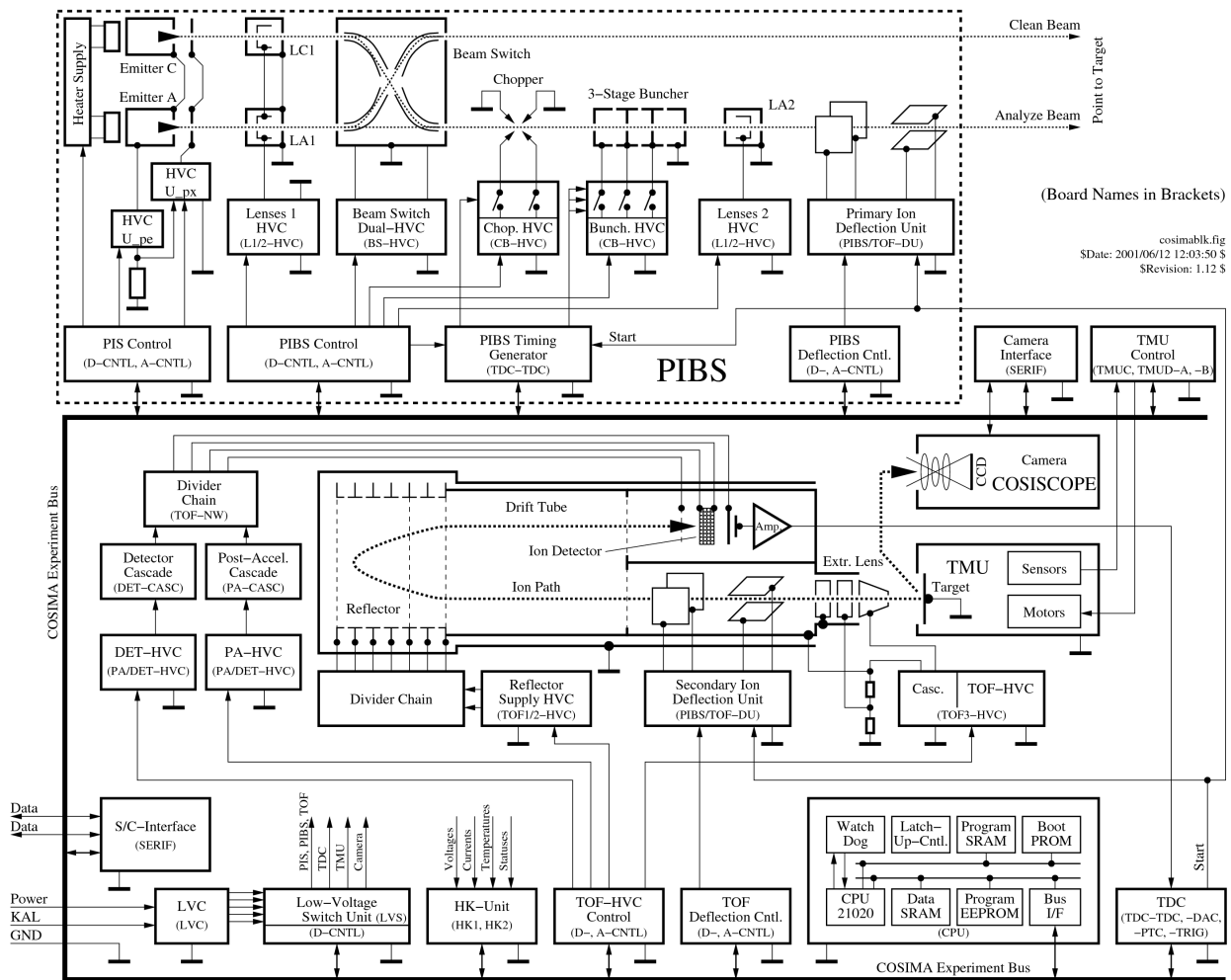


Figure 1: COSIMA subsystem figures schematics

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::

- DEPOSIT, to be positioned
- STORAGE, in target storage
- GRASPED, moved by the TMU
- IMAGE, substrate image
- GRAINS, dust position list
- PEAKS, peak list acquisition
- SCAN, total count acquisition
- SPECTRUM, spectrum acquisition
- EXPOSE, exposed to the outside
- CLEAN, at beam cleaning position
- CHEMISTRY, at heating station

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 substrates 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 $^{115}\text{In}^+$. 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: 'Analyse' 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 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 inorganic massed.

- 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)

Level 3 products will be:

- Calibrated mass spectra with relevant housekeeping data. Where possible, the time of flight spectra will be converted to mass spectra by automatic software. Some spectra will be checked by hand and marked as such in the data quality flags. The format of this data product is still TBD.

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 substrate history files contain time ordered information from actions taken with the substrate in question. For exposure, heating 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.
- peak list. The peak list is generated onboard COSIMA for integer mass lines for organic and inorganic masses separately. It used for pre-analysis, when full spectra would be too large to send due to operational and telemetry quota constrains
- 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.

The relevant calibrated housekeeping data is provided together the data products.

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 period(s) from the substrate history file and make his/her own judgement. 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, 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 TBD.

2.4.2.2 Scientific analysis software

N/A. Data product files will be either ASCII TABLEs or IMAGEs.

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-2-Vx.y. For the comet phase, the dataset name will be changed to RO-C-COSIMA-2-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	2006
RO-CAL-COSIMA-2-V2.0	adds active checkout data	2007
RO-CAL-COSIMA-2-V3.0	adds active checkout data	2008
RO-CAL-COSIMA-2-V4.0	adds active checkout data	2009
RO-CAL-COSIMA-2-V5.0	adds active checkout data	2010
RO-C-COSIMA-2-V1.0	adds comet approach data	mid 2014
RO-C-COSIMA-2-V2.0	adds close observations data	end 2014
RO-C-COSIMA-2-V3.0	adds comet escort data	mid 2015
RO-C-COSIMA-2-V4.0	adds comet escort data	end 2015
RO-C-COSIMA-2-V5.0	adds comet escort data	mid 2016
RO-C-COSIMA-2-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 organised according to tree stucture in the figure 2.

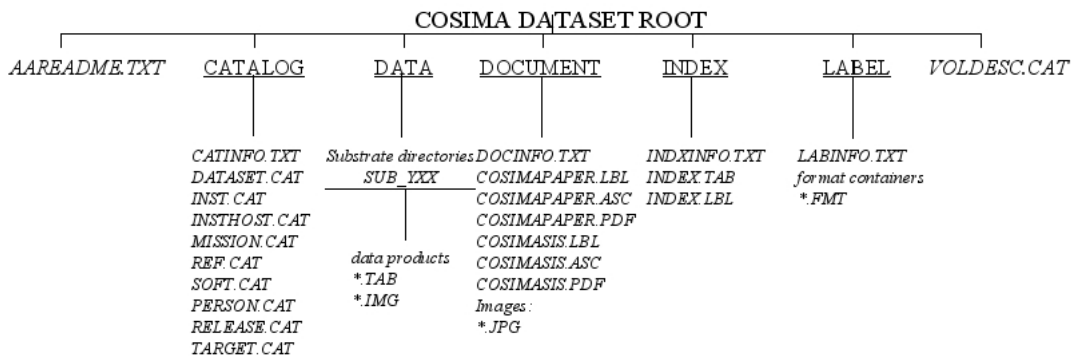


Figure 2: COSIMA dataset directory tree

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, 2 for datasets, where the mass scale for the spectra is not established
- 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-2-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_YYYYMMDDThhmmss_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_YYYYMMDDThhmmss_PK_Z.TAB, where YXX and Z as above.
- Cosiscope images of substrates: CS_YXX_YYYYMMDDThhmmss_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_YYYYMMDDThhmmss_GR_.TAB, where YXX as above.
- Housekeeping files: CS_YXX_YYYYMMDDThhmmss_S_HK.TAB (for spectra and peak lists) or CS_YXX_YYYYMMDDThhmmss_G_HK.TAB (for images and grain lists). YXX as above.
- Substrate history (ancillary data): CS_YXX_SUBSTRATE_HIST.TAB

YYYYMMDDThhmmss 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-DDThh: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 $2^{-16} = 1.53 \times 10^{-5}$ 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 $2^{-16} = 1.53 \times 10^{-5}$ 216 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 $392 \times 2^{-16} = 0.00598$ 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, published in 2006 within the frame of the ROSETTA instrument papers). COSIMA consists of groups in France, Finland and Germany and Col's 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 rendezvous 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, 2 for dataset, where the spectrum mass scale is not established
- Version number

Example: "ROSETTA-ORBITER 67P COSIMA 2 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

RELEASE.CAT – Release description

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 Gazetteer Directory

N/A

3.5.3.9 Label Directory

LABINFO.TXT

Format containers (*.FMT)

3.5.3.10 Document 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.

4.3.1.2 Label example

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

/* FILE FORMAT */
RECORD_TYPE               = FIXED_LENGTH
RECORD_BYTES              = 12
FILE_RECORDS              = 131366
LABEL_RECORDS             = 294
/* POINTER TO DATA OBJECT */
^SERIES                   = 295

/* GENERAL DATA DESCRIPTION PARAMETERS */
FILE_NAME                 = "CS_1C2_20020610T145823_SP_P.TAB"
DATA_SET_ID               = "RO-CAL-COSIMA-2-V1.0"
DATA_SET_NAME             = "ROSETTA-ORBITER CAL COSIMA 2 V1.0"
PRODUCT_ID               = "CS_1C2_20020610T145823_SP_P"
PRODUCT_CREATION_TIME     = 2006-09-25T00:48:47
```

PRODUCT_TYPE	= "REFDR"
PROCESSING_LEVEL_ID	= 2
MISSION_ID	= "ROSETTA"
MISSION_NAME	= "INTERNATIONAL ROSETTA MISSION"
MISSION_PHASE_NAME	= "GROUND"
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	= 2002-06-10T14:58:23
STOP_TIME	= 2002-06-10T14:59:09
SPACECRAFT_CLOCK_START_COUNT	= " N/A"
SPACECRAFT_CLOCK_STOP_COUNT	= " N/A"
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	= "1C2"
ROSETTA: COSIMA_SUBSTRATE_DESC	= "Silver, 73 micrometer thickness, blank with rectangular hole 3.5x3.5mm"
ROSETTA: COSIMA_SUBSTRATE_X	= 8000
ROSETTA: COSIMA_SUBSTRATE_Y	= 5500
ROSETTA: COSIMA_SPECTRUM_POL	= "POSITIVE"
ROSETTA: COSIMA_SPECTRUM_SHOTS	= 11358
OBJECT	= SERIES
NAME	= MASS_SPECTRUM
INTERCHANGE_FORMAT	= ASCII
ROWS	= 131072
COLUMNS	= 1
ROW_BYTES	= 10
ROW_SUFFIX_BYTES	= 2
SAMPLING_PARAMETER_NAME	= TIME
SAMPLING_PARAMETER_UNIT	= SECOND
SAMPLING_PARAMETER_INTERVAL	= 0.000000001953125
DESCRIPTION	= "COSIMA TIME OF FLIGHT MASS SPECTRUM"
OBJECT	= COLUMN
NAME	= MASS_COUNT
DATA_TYPE	= ASCII_INTEGER
START_BYTE	= 1
BYTES	= 10
MISSING_CONSTANT	= -1
FORMAT	= I10
DESCRIPTION	= "EVENT COUNT AT THE TIME BIN"
END_OBJECT	= COLUMN
END_OBJECT	= SERIES

END

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      = "V1.0"
RELEASE_ID                = 0001
REVISION_ID              = 0000

/* FILE FORMAT */
RECORD_TYPE               = FIXED_LENGTH
RECORD_BYTES              = 29
FILE_RECORDS              = 421
LABEL_RECORDS             = 120
/* POINTERS TO DATA OBJECTS */
^SCALE_TABLE              = 121
^PEAK_TABLE               = 122

/* GENERAL DATA DESCRIPTION PARAMETERS */
FILE_NAME                  = "CS_1C2_20020619T090349_PK_N.TAB"
DATA_SET_ID                = "RO-CAL-COSIMA-2-V1.0"
DATA_SET_NAME              = "ROSETTA-ORBITER CAL COSIMA 2 V1.0"
PRODUCT_ID                 = "CS_1C2_20020619T090349_PK_N"
PRODUCT_CREATION_TIME      = 2006-09-27T12:03:15
PRODUCT_TYPE               = "REFDR"
PROCESSING_LEVEL_ID        = 2
MISSION_ID                 = "ROSETTA"
MISSION_NAME                = "INTERNATIONAL ROSETTA MISSION"
MISSION_PHASE_NAME         = "GROUND"
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                 = 2002-06-19T09:03:49
STOP_TIME                  = 2002-06-19T09:03:49
SPACECRAFT_CLOCK_START_COUNT = "          N/A"
SPACECRAFT_CLOCK_STOP_COUNT = "          N/A"
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 = "1C2"
ROSETTA: COSIMA_SUBSTRATE_DESC = "Silver, 73 micrometer thickness,
                                   blank with rectangular hole 3.5x3.5mm"
ROSETTA: COSIMA_SUBSTRATE_X   = 8500
ROSETTA: COSIMA_SUBSTRATE_Y   = 5500
ROSETTA: COSIMA_SPECTRUM_POL  = "NEGATIVE"
ROSETTA: COSIMA_SPECTRUM_SHOTS = 34352

```

```

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
  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
  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
  NAME                        = SCALE_CONFIDENCE
  DATA_TYPE                   = ASCII_REAL
  START_BYTE                   = 23
  BYTES                        = 5

```

FORMAT = "F5.1"
DESCRIPTION = "MASS SCALE CONFIDENCE LEVEL IN PERCENTS"

END_OBJECT = COLUMN

COSIMA_SPECTRUM_PEAKS.FMT

OBJECT = COLUMN
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
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
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 = "V1.0"
RELEASE_ID = 0001
REVISION_ID = 0000

```

/* FILE FORMAT */
RECORD_TYPE           = FIXED_LENGTH
RECORD_BYTES         = 961
FILE_RECORDS         = 9
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_1C2_20020610T151707_S_HK.TAB"
DATA_SET_ID           = "RO-CAL-COSIMA-2-V1.0"
DATA_SET_NAME         = "ROSETTA-ORBITER CAL COSIMA 2 V1.0"
PRODUCT_ID            = "CS_1C2_20020610T151707_S_HK"
PRODUCT_CREATION_TIME = 2006-09-25T00:50:23
PRODUCT_TYPE          = "REFDR"
PROCESSING_LEVEL_ID   = 2
MISSION_ID            = "ROSETTA"
MISSION_NAME          = "INTERNATIONAL ROSETTA MISSION"
MISSION_PHASE_NAME    = "GROUND"
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            = 2002-06-10T15:17:07
STOP_TIME             = 2002-06-10T15:24:35
SPACECRAFT_CLOCK_START_COUNT = "          N/A"
SPACECRAFT_CLOCK_STOP_COUNT   = "          N/A"
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 = "1C2"
ROSETTA: COSIMA_SUBSTRATE_DESC = "Silver, 73 micrometer thickness,
                                blank with rectangular hole 3.5x3.5mm"
ROSETTA: COSIMA_SUBSTRATE_X = 8000
ROSETTA: COSIMA_SUBSTRATE_Y = 5500
ROSETTA: COSIMA_SPECTRUM_POL = "POSITIVE"
ROSETTA: COSIMA_SPECTRUM_SHOTS = 4545

OBJECT                = HK_TABLE
  NAME                 = HOUSEKEEPING
  INTERCHANGE_FORMAT   = ASCII
  ROWS                 = 1
  COLUMNS             = 120
  ROW_BYTES            = 961

```

```

^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 = 961
^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 = 2
COLUMNS = 5
ROW_BYTES = 961
^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

```



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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

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    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

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```

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

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```

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

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```

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
  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"

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```

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
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

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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

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FORMAT          = "F7.1"
DESCRIPTION     = "V_L2 LENS 2 VOLTAGE MAXIMUM,
                  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

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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
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
  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"

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```

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"
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,

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                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

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START_BYTE           = 681
BYTES                = 7
UNIT                 = "VOLT"
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"

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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

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```

OBJECT              = COLUMN
  COLUMN_NUMBER     = 92
  NAME              = "V_TIP_STD"
  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

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```

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

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```

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

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```

OBJECT              = COLUMN
  COLUMN_NUMBER     = 95
  NAME              = "C_TIP_MAX"
  DATA_TYPE        = ASCII_REAL
  START_BYTE        = 753

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    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

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
 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

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```

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

OBJECT = COLUMN
  COLUMN_NUMBER = 113
  NAME = "DELAY_ADJ_MIN"
  DATA_TYPE = ASCII_REAL
  START_BYTE = 897
  BYTES = 7
  MISSING_CONSTANT = 99999.9

```

FORMAT = "F7.1"
DESCRIPTION = "TIME TO DIGITAL UNIT DELAY ADJUSTMENT MINIMUM"
END_OBJECT = COLUMN

OBJECT = COLUMN
COLUMN_NUMBER = 114
NAME = "DELAY_ADJ_MEAN"
DATA_TYPE = ASCII_REAL
START_BYTE = 905
BYTES = 7
MISSING_CONSTANT = 99999.9
FORMAT = "F7.1"
DESCRIPTION = "TIME TO DIGITAL UNIT DELAY ADJUSTMENT MEAN"
END_OBJECT = COLUMN

OBJECT = COLUMN
COLUMN_NUMBER = 115
NAME = "DELAY_ADJ_MAX"
DATA_TYPE = ASCII_REAL
START_BYTE = 913
BYTES = 7
MISSING_CONSTANT = 99999.9
FORMAT = "F7.1"
DESCRIPTION = "TIME TO DIGITAL UNIT DELAY ADJUSTMENT MAXIMUM"
END_OBJECT = COLUMN

OBJECT = COLUMN
COLUMN_NUMBER = 116
NAME = "DELAY_ADJ_STD"
DATA_TYPE = ASCII_REAL
START_BYTE = 921
BYTES = 7
MISSING_CONSTANT = 99999.9
FORMAT = "F7.1"
DESCRIPTION = "TIME TO DIGITAL UNIT DELAY ADJUSTMENT STANDARD
DEVIATION"
END_OBJECT = COLUMN

OBJECT = COLUMN
COLUMN_NUMBER = 117
NAME = "HEATER RESISTANCE_R_MIN"
DATA_TYPE = ASCII_REAL
START_BYTE = 929
BYTES = 7
MISSING_CONSTANT = 99999.9
FORMAT = "F7.1"
UNIT = "OHM"
DESCRIPTION = "PRIMARY ION SOURCE HEATER RESISTANCE MINIMUM"
END_OBJECT = COLUMN

OBJECT = COLUMN
COLUMN_NUMBER = 118
NAME = "HEATER RESISTANCE_R_MEAN"
DATA_TYPE = ASCII_REAL
START_BYTE = 937
BYTES = 7
MISSING_CONSTANT = 99999.9
FORMAT = "F7.1"
UNIT = "OHM"

```

DESCRIPTION          = "PRIMARY ION SOURCE HEATER RESISTANCE MEAN"
END_OBJECT           = COLUMN

OBJECT               = COLUMN
  COLUMN_NUMBER      = 119
  NAME               = "HEATER RESISTANCE_R_MAX"
  DATA_TYPE         = ASCII_REAL
  START_BYTE         = 945
  BYTES              = 7
  MISSING_CONSTANT   = 99999.9
  FORMAT             = "F7.1"
  UNIT               = "OHM"
  DESCRIPTION        = "PRIMARY ION SOURCE HEATER RESISTANCE MAXIMUM"
END_OBJECT           = COLUMN

OBJECT               = COLUMN
  COLUMN_NUMBER      = 120
  NAME               = "HEATER RESISTANCE_R_STD"
  DATA_TYPE         = ASCII_REAL
  START_BYTE         = 953
  BYTES              = 7
  MISSING_CONSTANT   = 99999.9
  FORMAT             = "F7.1"
  UNIT               = "OHM"
  DESCRIPTION        = "PRIMARY ION SOURCE HEATER RESISTANCE STANDARD
                        DEVIATION"
END_OBJECT           = COLUMN

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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 = 10
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            = 12
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            = 16
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            = 21
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            = 26
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 COSISCOPE image product

4.3.4.1 General description

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

4.3.4.2 Label example

```

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

/* FILE FORMAT */
RECORD_TYPE           = FIXED_LENGTH
RECORD_BYTES          = 1024

```

```

FILE_RECORDS                = 1027
LABEL_RECORDS               = 3
/* POINTER TO DATA OBJECT */
^IMAGE                      = 4

/* GENERAL DATA DESCRIPTION PARAMETERS */
FILE_NAME                   = "CS_1C2_20020610T104348_IM_P.IMG"
DATA_SET_ID                 = "RO-CAL-COSIMA-2-V1.0"
DATA_SET_NAME               = "ROSETTA-ORBITER CAL COSIMA 2 V1.0"
PRODUCT_ID                 = "CS_1C2_20020610T104348_IM_P"
PRODUCT_CREATION_TIME       = 2006-09-25T00:46:36
PRODUCT_TYPE                = "REFDR"
PROCESSING_LEVEL_ID        = 2
MISSION_ID                 = "ROSETTA"
MISSION_NAME                = "INTERNATIONAL ROSETTA MISSION"
MISSION_PHASE_NAME         = "GROUND"
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                 = 2002-06-10T10:43:48
STOP_TIME                  = 2002-06-10T10:45:18
SPACECRAFT_CLOCK_START_COUNT = "          N/A"
SPACECRAFT_CLOCK_STOP_COUNT = "          N/A"
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 = "1C2"
ROSETTA: COSIMA_SUBSTRATE_DESC = "Silver, 73 micrometer thickness,
                                blank with rectangular hole 3.5x3.5mm"

OBJECT                      = IMAGE
  LINES                     = 1024
  LINE_SAMPLES              = 1024
  SAMPLE_TYPE               = UNSIGNED_INTEGER
  SAMPLE_BITS               = 16
  DESCRIPTION               = "COSISCOPE IMAGE OF THE SUBSTRATE"
END_OBJECT                 = IMAGE

END

```

4.3.5 COSISCOPE dust grain list product

4.3.5.1 General 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.

4.3.5.2 Label template

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

/* FILE FORMAT */
RECORD_TYPE              = FIXED_LENGTH
RECORD_BYTES             = 37
FILE_RECORDS             = 1226
LABEL_RECORDS           = 82
/* POINTER TO DATA OBJECT */
^FEATURE_TABLE          = 83

/* GENERAL DATA DESCRIPTION PARAMETERS */
FILE_NAME                = "CS_1C2_20020610T104348_GR__.TAB"
DATA_SET_ID              = "RO-CAL-COSIMA-2-V1.0"
DATA_SET_NAME            = "ROSETTA-ORBITER CAL COSIMA 2 V1.0"
PRODUCT_ID              = "CS_1C2_20020610T104348_GR__"
PRODUCT_CREATION_TIME    = 2006-09-25T00:46:36
PRODUCT_TYPE             = "REFDR"
PROCESSING_LEVEL_ID     = 2
MISSION_ID               = "ROSETTA"
MISSION_NAME             = "INTERNATIONAL ROSETTA MISSION"
MISSION_PHASE_NAME      = "GROUND"
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              = 2002-06-10T10:43:48
STOP_TIME               = 2002-06-10T10:45:18
SPACECRAFT_CLOCK_START_COUNT = "          N/A"
SPACECRAFT_CLOCK_STOP_COUNT = "          N/A"
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 = "1C2"
ROSETTA: COSIMA_SUBSTRATE_DESC = "Silver, 73 micrometer thickness,
                                   blank with rectangular hole 3.5x3.5mm"

OBJECT                  = FEATURE_TABLE
  NAME                  = FEATURES
  INTERCHANGE_FORMAT    = ASCII
  ROWS                  = 1144
```

```

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_GRAIN.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

```

4.3.6 COSISCOPE housekeeping product

4.3.6.1 General 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:

- Cosicope temperatures
- Substrate positioning information
- Imaging information

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

4.3.6.2 Label example

```

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

/* FILE FORMAT */
RECORD_TYPE = FIXED_LENGTH
RECORD_BYTES = 335
FILE_RECORDS = 10
LABEL_RECORDS = 9
/* POINTER TO DATA OBJECT */
^COSISCOPE_HK_TABLE = 10

/* GENERAL DATA DESCRIPTION PARAMETERS */
FILE_NAME = "CS_1C2_20020610T104348_G_HK.TAB"
DATA_SET_ID = "RO-CAL-COSIMA-2-V1.0"
DATA_SET_NAME = "ROSETTA-ORBITER CAL COSIMA 2 V1.0"
PRODUCT_ID = "CS_1C2_20020610T104348_G_HK"
PRODUCT_CREATION_TIME = 2006-09-25T00:46:36
PRODUCT_TYPE = "REFDR"
PROCESSING_LEVEL_ID = 2
MISSION_ID = "ROSETTA"
MISSION_NAME = "INTERNATIONAL ROSETTA MISSION"

```

```

MISSION_PHASE_NAME           = "GROUND"
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                  = 2002-06-10T10:43:48
STOP_TIME                   = 2002-06-10T10:45:18
SPACECRAFT_CLOCK_START_COUNT = "          N/A"
SPACECRAFT_CLOCK_STOP_COUNT = "          N/A"
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 = "1C2"
ROSETTA: COSIMA_SUBSTRATE_DESC = "Silver, 73 micrometer thickness,
                                blank with rectangular hole 3.5x3.5mm"

OBJECT                       = COSISCOPE_HK_TABLE
  NAME                       = COSISCOPE_HOUSEKEEPING
  INTERCHANGE_FORMAT         = ASCII
  ROWS                       = 1
  COLUMNS                   = 55
  ROW_BYTES                  = 335
  ^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 CDP"
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 CDP"
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 SEARCH
                      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 SUBTRACE 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

```

4.3.7 Substrate history ancillary product

4.3.7.1 General 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.

4.3.7.2 Label example

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

/* FILE FORMAT */
RECORD_TYPE             = FIXED_LENGTH
RECORD_BYTES           = 211
FILE_RECORDS           = 3810
LABEL_RECORDS          = 19
/* POINTER TO DATA OBJECT */
^HISTORY_TABLE         = 20

/* GENERAL DATA DESCRIPTION PARAMETERS */
FILE_NAME               = "CS_1C2_SUBSTRATE_HIST.TAB"
DATA_SET_ID             = "RO-CAL-COSIMA-2-V1.0"
DATA_SET_NAME           = "ROSETTA-ORBITER CAL COSIMA 2 V1.0"
PRODUCT_ID              = "CS_1C2_SUBSTRATE_HIST"
PRODUCT_CREATION_TIME   = 2006-10-05T10:26:39
PRODUCT_TYPE            = "ANCDR"
PROCESSING_LEVEL_ID     = 2
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               = 2006-08-28T00:00:00
SPACECRAFT_CLOCK_START_COUNT = "N/A"
SPACECRAFT_CLOCK_STOP_COUNT = "1/0115343974.01151"
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 = "1C2"
```

ROSETTA: COSIMA_SUBSTRATE_DESC = "Silver, 73 micrometer thickness,
blank with rectangular hole 3.5x3.5mm"

OBJECT = HISTORY_TABLE
NAME = SUBSTRATE_HISTORY
INTERCHANGE_FORMAT = ASCII
ROWS = 3791
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
DEPOSIT, to be positioned
STORAGE, in target storage
GRASPED, moved by the TMU
IMAGE, substrate image"

	GRAINS, dust position list
	PEAKS, peak list acquisition
	SCAN, total count acquisition
	SPECTRUM, spectrum acquisition
	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-2-V1.0

TOP-LEVEL-DIRECTORY

```
|  
|- AAREADME.TXT          Dataset Read Me 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  
|                        |  
|                        |- SOFTWARE.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
```


			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_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.IMG
			Substrate 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. Z is either P for plus

(left)		(right) side led or M for minus
		side led illumination.
		- CS_YXX_YYYYMMDDTHMMSS_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. YYYYMMDDTHMMSS 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
		images in JPG format.
		- 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_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

```

```
|      |
|      |- COSISCOPE_GRAINS.FMT      Cosiscope grain search result
|      |                             column object definitions
|      |
|      |- COSISCOPE_HK.FMT          Cosiscope housekeeping
statistics
|
|                             column object definitions
```