Planetary and Space Sciences Research Institute
The Open University

ROSETTA-MODULUS-Ptolemy

To Planetary Science Archive Interface Control Document

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Distribution List

Recipient	Organisation	Recipient

Change Log

Date	Sections Changed	Reasons for Change
23 December 2010	Creation of Issue 1 Revision 0	Delivery of Issue 1.0 to PSA after peer review
02 July 2015	Updated: 1.7 Change of contact address 2 Correction to system diagram to include hydrogen solenoid valve 2.4.3 Inclusion of calibration information for flight mass spectrometer operations 2.4.5 In-Flight data products 2.4.9 Ancillary Data Usage 4.2 Datasets, Definition and Content Added: 3.2.2.2.5 Spacecraft Clock Count in PDS Labels Deleted: 3.4.3.4.2 Geometric Index File	Issue 1.1 with updates for the Comet phase

TBD ITEMS

Section	Description
2.4.4	Other Files written during Calibration
2.4.5	In-Flight Data Products, level 5
2.4.8	combined data products with other instruments such as SD2, ÇIVA and COSAC.

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1 Introduction

1.1 Purpose and Scope

The purpose of this EAICD (Experimenter to (Science) Archive Interface Control Document) is two fold. First it provides users of the MODULUS-Ptolemy instrument with 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 instrument team and the archiving authority

1.2 Archiving Authorities

The Planetary Data System Standard is used as archiving standard by

- NASA for U.S. planetary missions, implemented by PDS
- ESA for European planetary missions, implemented by the Research and Scientific Support Department (RSSD) of ESA

ESA's Planetary Science Archive (PSA)

ESA implements an online science archive, the PSA,

- to support and ease data ingestion
- to offer additional services to the scientific user community and science operations teams as e.g.
    - search queries that allow searches across instruments, missions and scientific disciplines
    - several data delivery options as
        - direct download of data products, linked files and data sets
        - ftp download of data products, linked files and data sets

The PSA aims for online ingestion of logical archive volumes and will offer the creation of physical archive volumes on request.

1.3 Contents

This document describes the data flow of the MODULUS-Ptolemy instrument on the Rosetta Lander Philæ from the s/c until the insertion into the PSA for ESA. It includes information on how data were processed, formatted, labelled 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 MODULUS-Ptolemy data.

1.5 Applicable Documents

[AD1] Planetary Data System Data Preparation Workbook, February 17, 1995, Version 3.1, JPL, D-7669, Part1
[AD2] Planetary Data System Standards Reference, August 1, 2003, Version 3.6, JPL, D-7669, Part 2
[AD3] Rosetta Archive Generation, Validation and Transfer Plan, January 10, 2006, Issue 2, Rev. 3, RO-EST-PL-5011
[AD4] Ptolemy FM Acceptance Data Pack (RO-LPT-OU-DP-3205)
[AD5] Ptolemy Telecommand and Telemetry Definitions (RO-LPT-RAL-TN-3403)
[AD6] Ptolemy Experiment Flight Operation Plan for Cruise, RO-LPT-OU-PL-3114
[AD7] CDMS Command and Data Management System - Subsystem Specification RO-LCD-SP-3101 29/08/2001, Issue 3, Rev. 5
[AD8] CDMS Command and Data Management System - Operation Manual RO-LCD-SW-3402 12/02/2001, Issue 1, Rev. 2
Rosetta Time handling RO-EST-TN-3165, issue 1 rev 0, February 9, 2004
[AD9] DDID- Data Delivery Interface Document RO-ESC-IF-5003 Issue B6 23/10/2003
[AD10] ROSETTA Archive Conventions RO-EST-TN-3372 Issue 7, Rev. 9, 06 April 2015
[AD11] "CDMS – SD2 Data Interface Control Document", SHARK-ICD-TS-043, October 2002, Revision G

1.6 Acronyms and Abbreviations

CASE	Comet Atmosphere Sampling Experiment (special oven for atmosphere sampling)
CDMS	Command and Data Management System
CNES	Centre National d'Etudes Spatiales
DDS	Data Delivery System (ESOC server)
DECW	Data Error Control Word
EAICD	Experiment Archive Interface Control Document
EEPROM	Electrically Erasable Programmable Read Only Memory
EGSE	Electronic Ground Support Equipment

ESA	European Space Agency
ESS	Electrical Support System
FM	Flight Model
GRM	Ground Reference Model
HK	Housekeeping
HTO	High Temperature Oven
LOBT	Lander On Board Time
MODULUS	Methods Of Determining and Understanding Light elements from Unequivocal Stable isotope compositions
MTO	Medium Temperature Oven
OBDH	On Board Data Handling
OBT	On Board Time
PDS	Planetary Data System
PECW	Packet Error Control Word
PI	Principal Investigator
PID	Process Identifier
PSA	Planetary Science Archive
PVV	PSA Volume Verifier
QM	Qualification Model
RF	Radio Frequency
S/C	Spacecraft
SCET	Spacecraft Elapsed Time
SD2	Sample Drill & Distribution system
SFDU	Standard Formatted Data Unit
SONC	Science Operations and Navigation Centre (CNES-Toulouse)
TBC	To Be Confirmed
TBD	To Be Define
TC	Telecomand

1.7 Contact Names and Addresses

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

Ptolemy is the name given to the MODULUS instrument on board the Rosetta Lander Philæ. Ptolemy is effectively a miniature gas-processing laboratory, which utilises chemical processing, gas chromatography, in situ calibration and mass spectrometry to determine the nature, abundance and stable isotope compositions of volatile species. The instrument can also measure the stable isotopic compositions of any other species (for instance, any volatile or refractory organic molecules) that can be converted to appropriate gases for analysis. In addition to measuring stable isotope ratios, Ptolemy can also act as an analytical system providing compound identification and abundance measurements of minor and trace components.

Ptolemy is capable of analyzing samples from both the nucleus and coma. The Lander oven/carousel system provides the primary route for the introduction of samples. Solid samples of ice/organics/silicates extracted from the cometary nucleus are obtained by the drilling system of SD^2. The solid samples are placed into ovens that are mounted on a carousel which allows them to be rotated from the loading position beneath the drill to a so-called "tapping station" which connects an individual oven with Ptolemy. The carousel includes ovens that can attain either high-temperatures (HTOs, up to 800ºC) or intermediate temperatures (180ºC); these medium temperature ovens (MTOs) are common to Ptolemy, COSAC and CIVA-ROLIS. In principle any of these three experiments could share any of these MTOs, but in practice the HTOs provide the primary scientific return for Ptolemy.

Near-surface atmospheric samples are obtained by cryogenically trapping volatile species onto an adsorbent contained within a single high temperature oven on the SD^2 carousel. The oven is uniquely identified as the CASE oven, the name being derived from the Cometary Atmosphere Sampling Experiment. Once sufficient material has been adsorbed, the oven is docked with the tapping station and a gas tight seal produced. The adsorbent is then heated and the volatile analytes transferred to the chemical-processing manifold, as with solid samples. In addition to the use of the CASE oven the near-surface coma may be directly sampled via the mass spectrometer vent pipe.

Gases generated by heating the oven system (in a stepwise manner from ambient up to a maximum of 800ºC) can be transferred to a static manifold, whereupon they are conditioned and processed through the use of solid-state chemical reactors (operated at elevated temperatures). A number of shut-off valves direct the flow of gases through the pipe-work of the manifold; pressure sensors assist with the flow management and the quantification process. There are essentially two parameters that are of importance to the scientific enquiry – namely the temperature of the oven (i.e. which constrains the nature of the material being liberated) and the amount of gas evolved. This information is provided as outputs from a thermocouple and pressure sensors, respectively.
The static manifold is interfaced to the dynamic part of the system via a micro-machined valve block. From here a small portion of the overall gas sample is admitted to a flowing stream of high-purity helium gas, which carries the gas mixture through one of three gas chromatography channels. Gas chromatography separates the gas mixture into individual components, which helps to produce a clean sample for making the analytical and isotopic measurements. In addition, in-line heated chemical reactors continue the process of gas conditioning. The interplay between the components utilised in the chemical processing section of Ptolemy, is represented schematically by the flow chart in Figure 1.

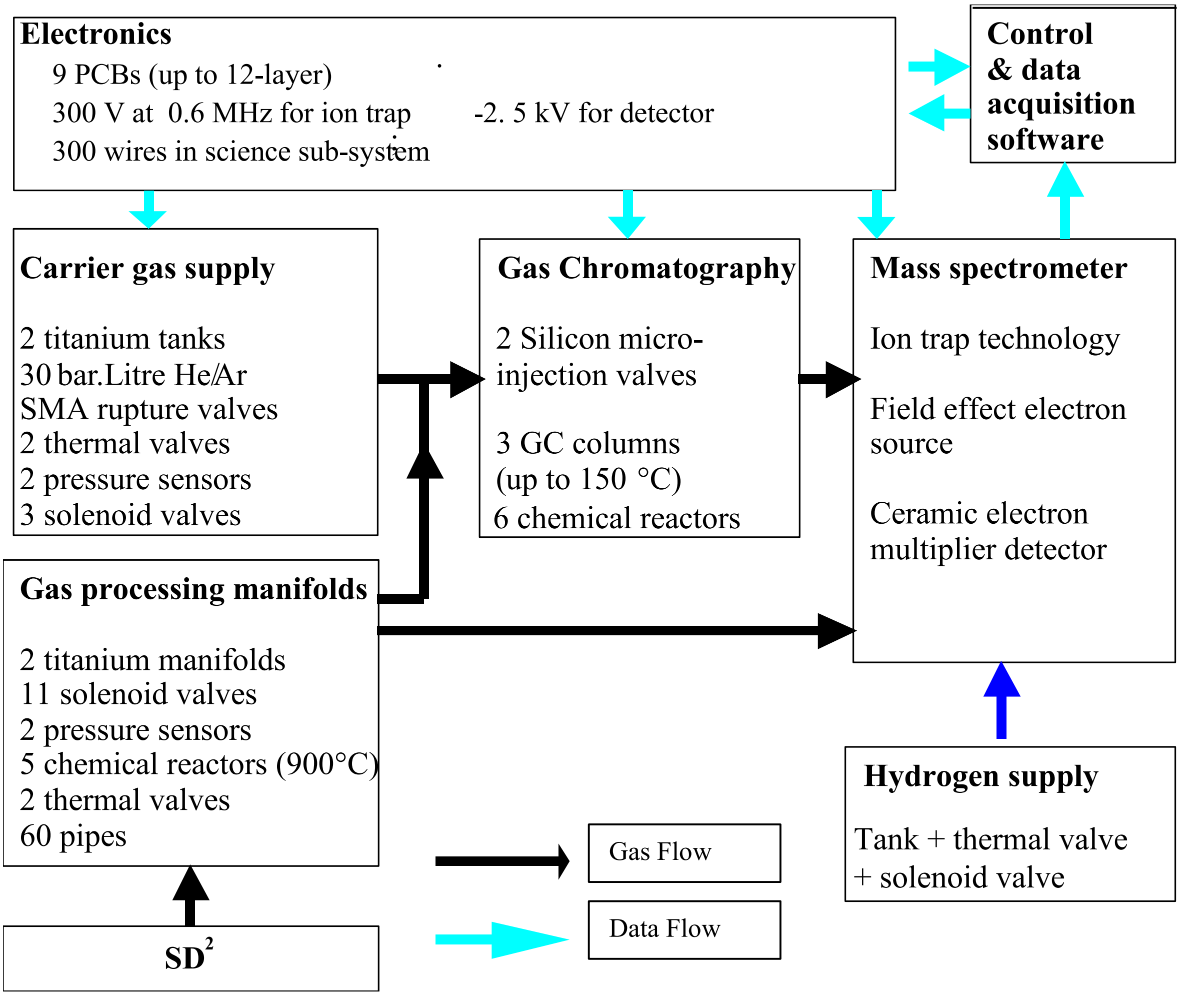

Figure 1: Schematic representation of the components required to process samples within Ptolemy.

At the end of the gas chromatography section all three outlets are connected directly to a cavity containing an ion trap mass spectrometer. This device has a mass range of 15-150 amu, with a mass resolution (M/ΔM) of better than unity across the range. The mass spectrometer has an overall mass of less than 500 g, including electronics, and uses less than 1 Watt of power. A ceramic, spiral electron multiplier in pulse counting mode is used as the detector and a field effect electron source, made up of an array of nanotips, is used to generate the ions.

In order to calibrate the instrument in situ a number of materials are included within Ptolemy that can be used to produce reference gases. These are admitted to the mass spectrometer in the same way as the unknown cometary gases. Since the reference gases are well characterised this provides not only a mass calibration of the instrument, but also serves as a means of correcting the measured isotope ratios (thereby improving accuracy). Hydrogen gas is also admitted into the mass spectrometer to aid measurement of isotopes. Operation of the various components of Ptolemy is controlled by its own on board processor and software. Ptolemy has three main software modes shown in the diagram in Figure 2:

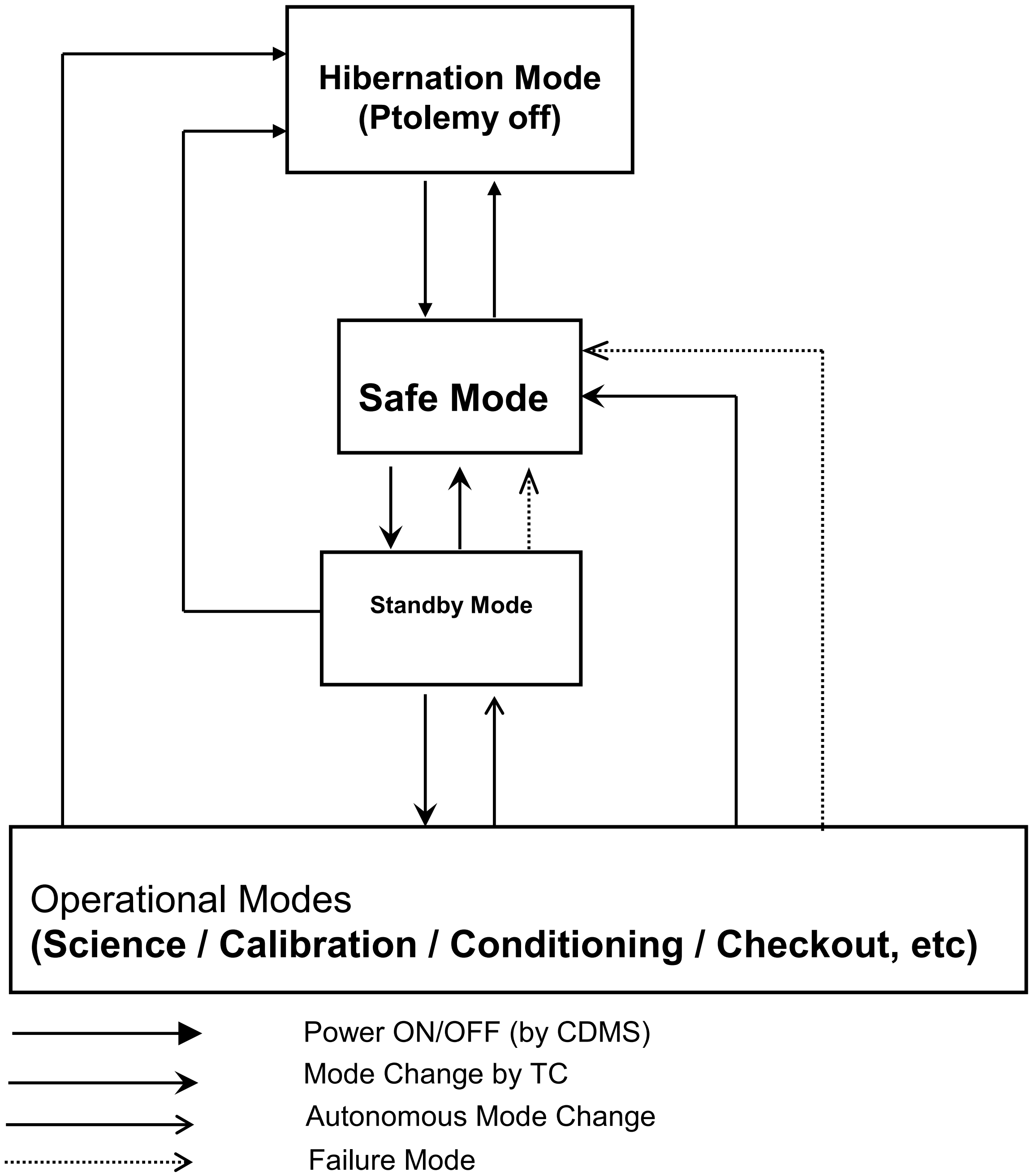

Figure 2: Ptolemy software modes

When switched on Ptolemy enters Safe mode. In Safe mode none of the chemistry components are active and all enabled components are disabled. Memory management commands TCs be processed. The only mode change allowed is from Safe to Standby mode.

Standby mode is used to enable the various chemistry components, although they are still not active. Ptolemy can then by comanded to enter any of the 16 Science modes or be returned to Safe mode.

Science modes consist of a sequence of commands stored in Ptolemy memory to operate the chemistry components. The results of a Science mode will depend on the contents of Ptolemy memory as well as the TCs issued before entering the mode. Once a mode has started all TCs to Ptolemy are ignored except for the return to Safe mode TC where upon the Science mode is aborted immediately and Ptolemy enters Safe mode. At the conclusion of a Science mode sequence, Ptolemy returns to Standby mode.

During Standby and Science modes, Ptolemy monitors its sensor readings. If any fall outside acceptable ranges then Ptolemy aborts the mode and returns to Safe mode. Ptolemy can be powered off at any time and will always restart in Safe mode.

Data from Ptolemy is transmitted to the Lander CDMS as either Housekeeping or Science packets. Each packet contains 256 bytes of Ptolemy data. The CDMS usually requests housekeeping packets at the rate of 1 byte per second. Ptolemy Housekeeping packets consist of a series of reports. The normal type of report is a concise Sensor report of 64 bytes which contains information on the Ptolemy sensors, there can be up to 4 concise Sensor reports in a housekeeping packet. Ptolemy generates a new Sensor report once the last byte from the previous report has been transmitted to the CDMS, the values are held in a Ptolemy buffer until requested by the CDMS. Other types of report that can be included in the housekeeping packet are listed below.

Sensor (concise)	A report of all sensor readings (temperatures, pressures, voltages), accuracy 8-bit.
Sensor (complete)	Similar to a concise report, but also contains information about Ptolemy hardware state, useful in interpreting fault conditions
Memory Dump	Report containing part of the contents of Ptolemy EEPROM
Memory Check	Report on the results of up to 5 checksums over a range of the Ptolemy EEPROM
Event	Report about some event such as a mode change or power on.
TC Accept/Fail	Either a report acknowledging acceptance of a TC (if acknowledgement requested) or that a TC was rejected.

Science packets contain a single Ptolemy report and can be of the following types.

Auxiliary Data	The measured readings of up to 29 sensors at 16 bit accuracy
Summary Mass Spec.	A compressed mass spectrum of the largest peaks.
Full Mass Spec.	Part of a mass spectrum, data not compressed. The full mass spectrum can be in up to 10 Science packets

Ptolemy report name	Rolbin Packet	Packet Size (bytes)	PDS Two letter acronym
Sensor Concise	HK	64	SN
Sensor Complete	HK	96	SN
Memory Dump	HK	64	MD

Memory Checksum	HK	64	MC
Event	HK	64	EV
TC Accept/Fail	HK	32	AF (TA/TF)
Auxiliary Data	Sc	256	AX
Summary Mass Spectrum	Sc	256	S1
Complete Mass Spectrum	Sc	256	S2

2.1 Scientific Objectives

Ptolemy is the first example of an experiment concept known as MODULUS.

MODULUS (Methods Of Determining and Understanding Light elements from Unequivocal Stable isotope compositions) is the philosophy behind a suite of experiments aimed at establishing the identity, abundance and the isotopic make-up of major, minor and trace constituents of a cometary nucleus and coma and employing these data to learn more about the processes which make comets one of Nature's most impressive phenomena. The primary aim of MODULUS is to determine $^{13}C/^{12}C$, $^{15}N/^{14}N$, $^{18}O/^{16}O$, $^{17}O/^{16}O$ and D/H ratios of the major constituents of a comet. These major constituents include components such as H_2O, CO, CO_2 and refractory material.

2.2 Data Handling Process

The data handling processed is summarized in the Figure 3. Responsibilities are divided between SONC and Ptolemy team (see section 1.7 for contact details of Ptolemy team).

The Ptolemy data is grouped into sessions, where one session comprises all the data generated from when Ptolemy is powered on until it is powered off.

Ptolemy data from the Lander is delivered to SONC in the form of "Rolbin" files. During construction and testing of the Ptolemy instrument, the Ptolemy team have developed their own bespoke software to interpret the "Rolbin" files from the CDMS. This software will be on the PDS archive however it is not in PDS format and no guarantee is given on it working. The Ptolemy Rolbin files will be stored on the PDS archive.

The Ptolemy Rolbin shall be processed by SONC to PDS level 1 Raw data. Housekeeping files will be split into individual Ptolemy reports and sorted into the appropriate directory. Both types of sensor reports will have the same format. A column will be added indicating whether the original sensor report was a concise or complete sensor report. (Usually the extra information obtained in a complete sensor report is of no use in interpreting the data and is available in the Rolbin file if required). Science packets shall be processed by SONC and placed in the appropriate directory. Compressed spectra will be decompressed. Packets of complete spectra will be recombined to form the complete mass spectrum.

Formation of PDS level 3 calibrated data will mostly by performed by SONC. Ptolemy Summary Spectra and Ptolemy Full spectra require detailed and expert analysis on a case by case basis and therefore Ptolemy team shall be responsible for providing Calibrated data from the Ptolemy Summary Spectra and Ptolemy Full spectra.

As shown in the Figure 3 :

Ptolemy team will provide to SONC team :
The Ptolemy documents : once at the beginning, and at each release
The images generated at lab to be inserted directly in the archive.

All the rest will be extracted from the SONC data base : raw data, edited data, calibrated data.
The calibrated spectrum will be generated at SONC, but with Mass tables provided by Ptolemy team.

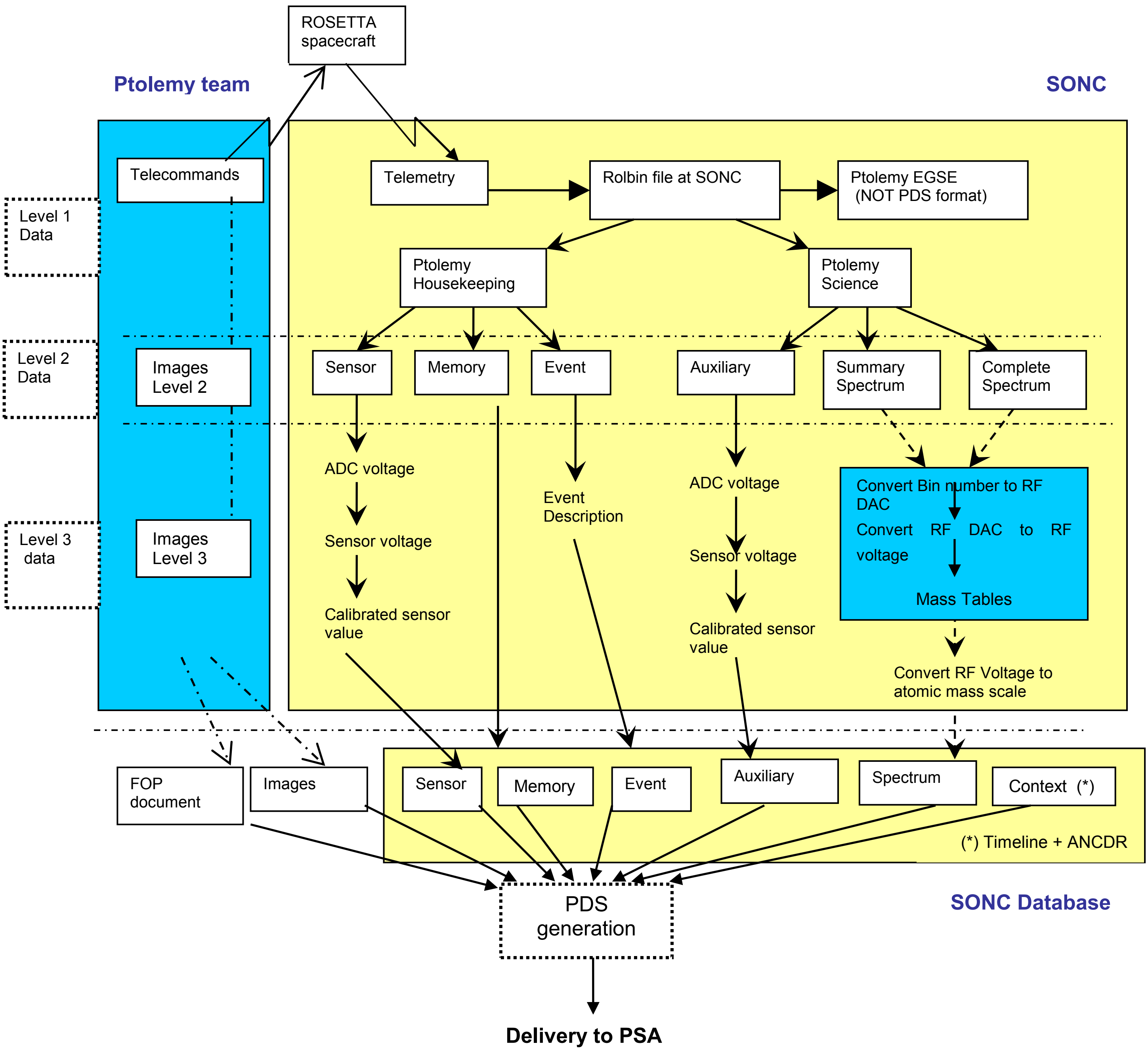

Figure 3 : Ptolemy data handling process

Ptolemy is classed as an intelligent instrument in that the actions it performs once switched on are largely independent of the Lander CDMS. Once commanded to enter a mode it will perform a sequence of internally stored commands until either the mode is completed, an anomaly occurs causing it to enter Safe mode or it is switched off by the CDMS. The actions it performs during a mode depends upon previous TCs and the content of its own EEPROM.

In order to help interpretation TC and Context files are included in the PDS archive. The TCs directory contains the TCs sent to Ptolemy during a session. The Context files are general documents (timeline and logbook) included in the DOCUMENT directory.

2.3 Product Generation

The final delivery of data into the PSA will be by SONC.

2.4 Overview of Data Products

2.4.1 Pre-Flight Data Products

QM data from testing of the Ptolemy instrument during instrument Thermal Vacuum (2006/08/24) is included in the Archive.

2.4.2 Sub-System Tests

No sub-system tests are necessary to understand the Ptolemy FM data.

2.4.3 Instrument Calibrations

The behaviour of ions in the Ptolemy ion trap mass spectrometer is controlled by the frequency and amplitude of a radiofrequency (RF) field applied to the ring electrode of the ion trap. During the acquisition of a mass spectrum the amplitude of the RF field as a function of time is controlled by a so-called "scan function". The RF scan function depends upon the science mode selected and the contents of the RF scan function stored in Ptolemy EEPROM which are described in the Document directory.

The frequency of the RF field is determined by a selectable clock signal. The frequency of the clock signal is set to the resonant frequency of the tuned LC (inductance-capacitance) circuit used to generate the RF field; this achieves the maximum amplifier gain.

Mass calibration of the spectra obtained therefore depends upon the scan function, the frequency of the RF and the amplitude of the RF.

Both RF frequency and RF amplifier gain are affected by the temperature of the control electronics and of the ion trap.

Ptolemy FM will calibrate itself at the comet in several ways:

1) RF calibration – this is a function by which the mass spectrometer tunes the ion trap RF signal to the resonant frequency of the amplifier. The calibration value is outputted to an event report within a Ptolemy HK packet. Once the RF cal has been done, the selected frequency is used until repeating the RF calibration
2) RF amplifier gain is not readily determined by onboard calibration. If a reasonable calibration can be estimated (by QM experiments or performing specific modes) then these shall be included.
3) Mass calibration – Ptolemy was to be commanded to analyse one or more of the reference gases contained within the chemistry set. The results of the analysis were to be archived to aid the interpretation of the results obtained during subsequent analyses of comet sample. This was not possible during the First Science Sequence, and as such calibration was undertaken using known peaks within individual mass spectra.
4) Calibration parameters for flight data can be found in the file PTOLEMY_CALIBRATION_DESC.txt

In addition, relevant calibration (or rather more precisely, characterisation) data will be produced by the Ptolemy Qualification Model (QM). The QM is based at the Open University and will be operated to produce data that can subsequently be used to characterise the FM instrument. The QM will therefore be used for refining the experiments to be performed by Ptolemy FM at the comet.

2.4.4 Other Files written during Calibration

Other files shall be provided containing data on the lab analyses of the composition (molecular and isotopic) of reference gases contained within Ptolemy (TBD).

2.4.5 In-Flight Data Products

The in-flight data correspond to all the onboard data. They can be produced during following mission phases :

MISSION_PHASE_NAME	**Abbreviation**	**Start Date** (dd/mm/yyyy)	**End Date** (dd/mm/yyyy)	**PTOLEMY data** (1)
Commissioning (part 1)	CVP1	05/03/2004	06/06/2004	X
Cruise 1	CR1	07/06/2004	05/09/2004	
Commissioning (part 2)	CVP2	06/09/2004	16/10/2004	X
Earth Swing-by 1 (including PC#0)	EAR1	17/10/2004	04/04/2005	X
Cruise 2 (including PC#1,2)	CR2	05/04/2005	28/07/2006	X
Mars Swing-by (including PC#3,4,5)	MARS	29/07/2006	28/05/2007	X
Cruise 3	CR3	29/05/2007	12/09/2007	
Earth Swing-by 2 (including PC#6,7)	EAR2	13/09/2007	27/01/2008	X
Cruise 4-1 (including PC#8)	CR4A	28/01/2008	03/08/2008	X
Steins Flyby	AST1	04/08/2008	05/10/2008	
Cruise 4-2 (including PC#9)	CR4B	06/10/2008	13/09/2009	X
Earth Swing-by 3 (including PC#10)	EAR3	14/09/2009	13/12/2009	X
Cruise 5 (including PC#12)	CR5	14/12/2009	06/06/2010	X
Lutetia Flyby	AST2	07/06/2010	10/09/2010	X
RV Manoeuver 1 (including PC#13)	RMV1	11/09/2010	13/07/2011	X
Cruise 6	CR6	14/07/2011	22/01/2014	
Post Hibernation Commissionning	PHC	09/04/2014	24/04/2014	X
Pre-delivery calibration Science	PDCS	25/04/2014	11/11/2014	X

(1) The last column indicates if PTOLEMY data are available

(2)

After the release of the Lander, we distinguish four phases, characterized by:

- The Start and Stop dates need to be expressed in seconds
- The Lander has its own Auxiliary data

Separation/Descent/Landing	SDL	2014/11/12 08:35:02	2014/11/12 15:34:04	
Rebounds	RBD	2014/11/12 15:34:05	2014/11/12 17:30:20	**X**
First Science Sequence	FSS	2014/11/12 17:30:21	2014/11/15 01:00:00	**X**
Long Term Science	LTS	tbd	tbd	tbc

In flight data products covers 4 levels (see table below) :

- Raw data (CODMAC level 1) : HK and SC PTOLEMY packets as received from DDS.
- Uncalibrated data (CODMAC level 2) : all HK and SC data (Sensor, Memory Dump, Memory Checksums, Event, Auxiliary, Summary Spectrum, Full Spectrum)
- Calibrated HK data (CODMAC level 3) : Sensor HK data in scientific units, Event
- Calibrated SC data (CODMAC level 3) : Auxiliary data and Mass spectrum
- Reduced (or derived) data (CODMAC level 5) : Any higher level data products (e.g. plots of pressure, isotope analyze etc.), any combined products with other instruments (e.g. SD2, COSAC and ÇIVA). See 2.4.8
  Data Level 5 remains to be defined (TBD).

These data come from SC and HK telemetry. They will be archived with :

- TCs transmitted to Ptolemy
- Context files for each Ptolemy session
- Documents
- Browse (png files)

The 2 tables below summarize the content of the PDS archive :

Data type	Origin	Acronym	Data Level (*)		
			1	2	3
Rolbin Housekeeping only	HK	RH	√		
Rolbin Science only	HK	RS	√		
Rolbin, both Science and Housekeeping	HK, SC	RB	√		
Sensor (Ptolemy housekeeping)	HK	SN		√	√
Memory Dump	HK	MD		√	
Memory Checksum	HK	MC		√	
TC Acceptance	HK	TA		√	
TC Failure	HK	TF		√	
Event	HK	EV		√	
Auxiliary	SC	AX		√	√
Summary spectrum	SC	S1		√	
Full spectrum	SC	S2		√	
Spectrum (Ptolemy Science)	SC	S3			√

(*) Data level 5 remains TBD

In order to analyse correctly the HK and SC archived, context files (describing the measurement context) must be added :
- Telecomands covering general documents (ex. : "Ptolemy Experiment Flight Operation Plan for Cruise, RO-LPT-OU-PL-3114, Issue 2.1, 29/04/05")
- Logbook containing the list of all the activities done by/with Rosetta PTOLEMY during each session
- Timeline files produced for each PTOLEMY session
- Images produced at lab (interesting events with additional comments) and provided to SONC to be added in the PDS archive.

2.4.6 Software

Ptolemy EGSE software shall be provided. The EGSE shall be compatible only with a particular Windows operating system, and is not a PDS-compliant system – it does not conform to any known software writing protocols. The Ptolemy EGSE software is used by the Ptolemy team to interpret "Rolbin" files. It does not generate any PDS compliant data.
Note: as the Level 2 data are archived, the EGSE software usage shouldn't be needed.

2.4.7 Documentation

The documentation directory will contain the following documents:

- EAICD (this document)
- PTOLEMY_CALIBRATION_DESC.TXT
- Hardware software interface, RO-LPT-RAL-TN-3401.PDF
- Ptolemy Telecommand and Telemetry Definitions, RO-LPT-RAL-TN-3403.PDF
- Ptolemy Experiment Flight Operation Plan for Cruise, RO-LPT-OU-PL-3114.PDF
- Ptolemy Experiment Flight Operation Plan, RO-LPT-OU-PL-3101.PDF
- MODULUS – Ptolemy GRM User Manual, RO-LPT-OU-MA-3102.PDF
- WGA and RICA Applicability to RF Scan Function Design, RO-BER-RAL-TN-3401.PDF
- TIMELINE_ph.TXT, timeline Ascii file for phase ph
- TIMELINE_ph_DESC.TXT, description of the timeline file for phase ph
- TIMELINE_ph_obty.PNG, timeline Image file for phase ph and observation type obty

2.4.8 Derived and other Data Products

Derived data shall include the isotopic composition of the samples and references gases analysed by Ptolemy FM. There may be combined data products with other instruments (TBD) such as SD2, ÇIVA and COSAC.

2.4.9 Ancillary Data Usage

The Lander Auxiliary Data on the comet (Position/Orientation/Illumination at any time + Comet models + Ancillary Data from the instruments) will be available in an ANCDR (Ancillary Data Record) whose definition is in progress, pending the Lander auxiliary data reconstruction.

The ancillary data needed by PTOLEMY is the drill depth provided by SD2.

3 Archive Format and Content

3.1 Format and Conventions

Data processing level number used in Ptolemy naming scheme conforms to CODMAC norm :

1: Raw Data Telemetry data with data embedded.

2: Edited Data Corrected for telemetry errors and split or decommutated into a data set for a given instrument. Sometimes called Experimental Data Record. Data are also tagged with time and location of acquisition. Corresponds to NASA Level 0 data.

3: Calibrated Data Edited data that are still in units produced by instrument, but that have been corrected so that values are expressed in or are proportional to some physical unit such as radiance. No resampling, so edited data can be reconstructed. NASA Level 1A.

5: Derived Data Derived results, as maps, reports, graphics, etc. NASA Levels 2 through 5

3.1.1 Deliveries and Archive Volume Format

A data set will be delivered for each **simple mission phase.** Each data set will contain **only one level data processing**.

The list of simple mission phases is given in [AD10].

A data set will be level-stamped as below :

- Level 1 when it will contain :
SC and HK raw data (packets) contained in .rolbin file (CODMAC level 1).

- Level 2 when it will contain uncalibrated data (CODMAC level 2)

- Level 3 when it will contain Calibrated SC and/or HK data (CODMAC level 3)

In addition a data set will contain :
Software (see chapter 3.4.3.6)
Documents (see chapter 3.4.3.8)

A new release is provided when :
- calibration information refining
- new data processing
- higher levels production.

3.1.2 Data Set ID Formation

The following naming convention will be used for the data sets:

DATA_SET_ID = <INSTRUMENT_HOST_ID>-<target id>-<INSTRUMENT_ID>-<data processing level number>-<mission phase abbreviation>-<description>-<version>
DATA_SET_NAME = <INSTRUMENT_HOST_NAME>-<target name>-<INSTRUMENT_ID>-<data processing level number>-<mission phase abbreviation>-<description>-<version>

See [AD10].

Examples of DATA_SET_ID and DATA_SET_NAME for PTOLEMY level 3 data obtained from the Comet phase :

DATA_SET_ID = "RL-C-PTOLEMY-3-COM-V1.0"

DATA_SET_NAME= "ROSETTA-LANDER 67P PTOLEMY 3 COM V1.0"

3.1.3 Data Directory Naming Convention

Directories named below the /data directory are explained in section 3.4.3

3.1.4 Filenaming Convention

The following file naming scheme shall be used:

{exp}_{datatype}_{Beginning of observation}_{duration}.{ext}

- **exp** (3 character) = PTO (fixed)
- **datatype** (4 characters) = VXYZ
  - V = source, **F** for flight, **Q** for qualification model, **G** for ground reference model and **C** for Chemistry set simulator
  - XY = type of data (see table below /Acronym)
  - Z = CODMAC level : **1** for raw data, **2** for edited data and **3** for calibrated data, **P** for PTOLEMY types (TC, IM) and Plots
- **begin of observation** (12 characters) = time of start of session yymmddhhmnss:
  - yy = year
  - mm = month
  - dd = day
  - hh=hour
  - mm = minute
  - ss = second
- **duration** = for Rolbin, Context and Telecommand files this is the duration of the session in minutes (no session will last longer than 1 day)

  Two working sessions are separated by a gap greater than 900.

  Remark: however, two working sessions are separated by pre-defined intervals in the special case of CODMAC level 1 data sets.

  For the plot files, the "duration" field is replaced by a two digits index which corresponds to the spectrum number (chronological order) in a TAB file.

- **ext** = extension of file. For PTOLEMY possible extensions are:
  - DAT for HK and SC telemetry packets (CODMAC level 1)
  - TAB for edited and calibrated SC and HK Data (CODMAC level 2 and 3)
  - PNG for Plot Data in BROWSE directory (plots of TAB data)

Data type	Origin	Acronym	Data Level (*)		
			1	2	3
Rolbin Housekeeping only	HK	RH	√		
Rolbin Science only	HK	RS	√		
Rolbin, both Science and Housekeeping	HK, SC	RB	√		
Sensor (Ptolemy housekeeping)	HK	SN		√	√
Memory Dump	HK	MD		√	
Memory Checksum	HK	MC		√	
TC Acceptance	HK	TA		√	
TC Acceptance/Failure	HK	TF		√	

Event	HK	EV		√	
Auxiliary	SC	AX		√	√
Summary spectrum	SC	S1		√	
Full spectrum	SC	S2		√	
Spectrum (Ptolemy Science)	SC	S3			√

Example :

PTO_FSN3_ 040603123400_0042.TAB
Data included in this file are calibrated flight sensor data recorded on 03 Jun 2004 beginning at 12:34:00 (UTC) for a duration of 42 minutes.

3.2 Standards Used in Data Product Generation

3.2.1 PDS Standards

The archive structure given in this document complies with PDS standard version 3.6.

3.2.2 Time Standards

3.2.2.1 Generalities

This paragraph gives a summary of the different existing formats in the Rosetta Ground segment, from their generation by the instruments to their availability at SONC :

- The Lander CDMS requires the scientific instruments to transmit the data by bursts of 8 or 64 bytes (4 or 32 16-bit words)

- When sufficient data are received, the CDMS builds packets containing 256 bytes of instrument data. The CDMS adds 18 bytes header (unit PID, sequence count, OOBT : Orbiter OBT, data type) and a 2 bytes checksum (DECW) and creates packets with a fixed length of 276 bytes[1]. For transmission between Lander and Orbiter, a 4 bytes synchro header and a 2 bytes trailing checksum (PECW) are added, increasing the packet size to 282 bytes. The extra bytes are removed by the ESS.

  To comply with ESA requirements, the time registered in the CDMS packets is the **OOBT**. It is reconstituted from the LOBT, as shown in Figure 4:

[1] The Lander CDMS header and the headers of the telemetry source packets from the Orbiter instruments are quite similar. There is a difference in the data field header. The byte containing PUS version, checksum flag and spare fields is set to zero in the CDMS header. Besides the last byte of the OOBT is set to zero in the CDMS header. The CDMS header has an additional word (2 bytes) after the data field header named "FORMAT ID". This word is mainly used for HK data and it contains the HK scanning period and the SID (structure identification).

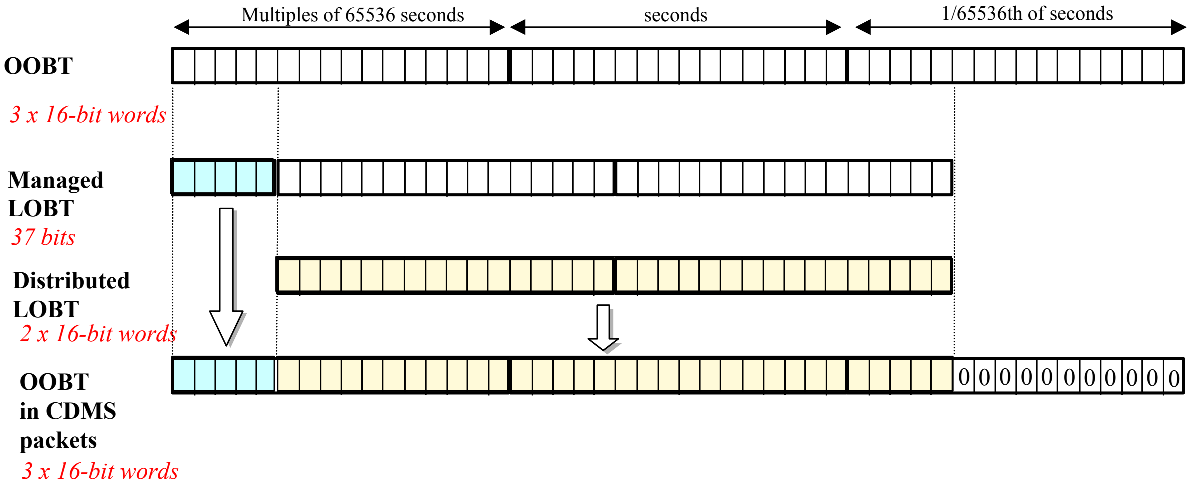

Figure 4 : Reconstruction of on board time in CDMS packets

- The ESS groups together several packets and passes them to the Orbiter OBDH, which transmits them according to the Space/Ground interface. This part is transparent for the Lander ground segment.
- The data are delivered by the Rosetta Data Distribution System (DDS) to the SONC in SFDU format. A SFDU file is basically a collection of 276-byte packets interspersed with auxiliary information records. An 18 bytes SFDU header is added to the CDMS 276-byte packets. This header contains information added at the ground station (time correlated OBT, ground station id, virtual channel id, service channel, type of data, time quality)
- SONC processes the SFDU files to retrieve the 276-byte packets. This format is available in the SONC database.

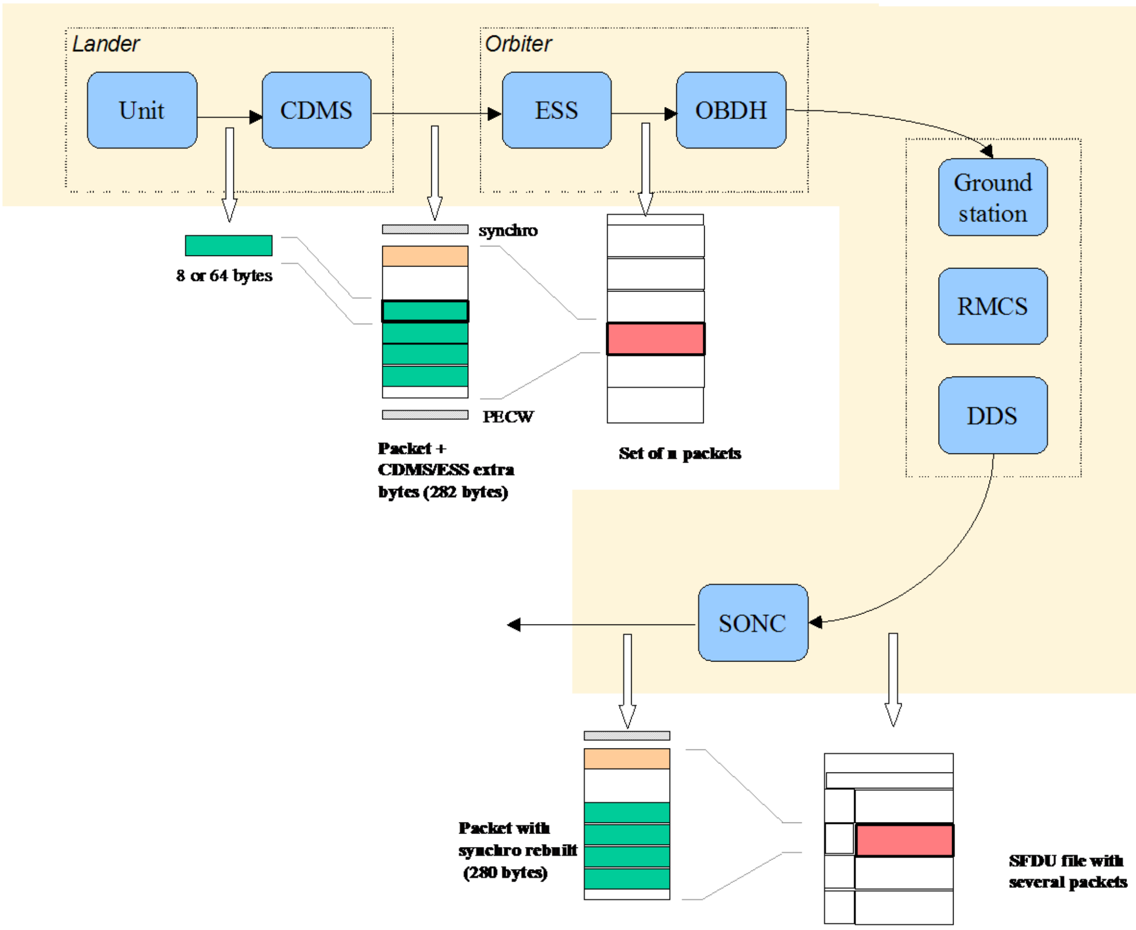

Figure 5 : On board data flow

- Afterwards, SONC processes science raw packets in order to recompose the science measurement (e.g. an image, a spectrum, ...).

Figure 5 gives an overview of this data flow.

Only the following principles are applied :

- the packet wrapping is removed, and science frames that had to be split into several raw data packets are rebuilt. Basic error detection controls are applied, to recover from possible problems in the transmission chain.

- the Lander On-Board time (LOBT) (synchronised with OOBT) extracted from the packet, and corresponding UTC time coming from the SFDU header, are added.

- in few cases, bit fields are expanded : flags that were stored as bits in the telemetry (to save bandwidth) are stored as integer values instead ; the aim is to ease further processing.

- UTC time is calculated from the On-Board time taking into account the On-Board clock drift as following :
UTC (seconds since 01/01/1970) = LOBT(seconds) * Gradient + Offset (these coefficients are extracted from TCP packets delivered by DDS).
LOBT is either the LOBT extracted from CDMS header or the Experiment internal clock when it exists (CIVA, COSAC, PTOLEMY, ROMAP, ROLIS, SESAME). In the last case, it must be taken into account that the Internal clock (32 bits) resets all 4 years, 4 months, 3 days (first reset : 03/04/2007 10 :42 :07).

UTC time-stamped Science and HK data are available in the SONC database and used to generate PDS format.

3.2.2.2 PTOLEMY Time standards

The time standards used in the PTOLEMY data products are :
- the PTOLEMY on-board time,
- the Lander on-board time,
- the DDS header time correlated,
- the UTC.

3.2.2.2.1 The PTOLEMY On-Board Time

The On-Board time (seconds and fractions of seconds since last switch-on of the spacecraft, nominally after launch) is the only time available to the instrument during operation. It is reset each time a "time" TC is received by PTOLEMY. PTOLEMY uses a timer to update this time between two successive time TCs. Ptolemy HK Sensor reports contain the onboard time at which the report was generated. Science reports contain the onboard time that the Science report was generated. Each complete packet contains the onboard time that the data was acquired by the CDMS.

3.2.2.2.2 The Lander On-Board Time (LOBT)

The instruments on board the spacecraft (Orbiter) generate telemetry source packets with an OOBT (orbiter on board time) time stamp in the header.
The OOBT written into the packet header specifies the time, when CDMS can complete a packet.

In terms of HK packets this is the time of the last HK word. Using the HK scanning rate, which is given in word #9 of the packet, one can calculate the OBT of every individual word in this packet. Note that this is only valid if packets with SID (word #9) 1 or 2 are generated. Packets with SID 4 and 5 are "snapshots", which means you can apply the packet OOBT for every word in this packet. SID 3 packets have to be analysed case by case.

In terms of SC packets this is the reception of the last 32 word block by CDMS, which also completes the SC packet. How often 32 word blocks are created (and sent) by the unit, and corresponding to this the delta time between each block, might be different for each unit. So, re-calculation of OOBT for SC words depends on this unit feature.

The Orbiter On-Board Time (OOBT) is a linear binary counter having a resolution of 1/65536 sec stored in 3 16-bit words.

The <u>Lander On-Board Time</u> (LOBT) is a linear binary counter having a resolution of 1/32 sec, kept in 37 bits. Only the 32 least significant bits are distributed to the instruments, in 2 16-bit words. The 5 most significant bits are supposed constant during most of the mission, they are available through a specific service.
The LOBT is derived from the Orbiter On-Board Time (OOBT) : the 11 least significant bits of the OOBT are discarded to obtain the LOBT, hence the reduced resolution. A re-synchronization between OOBT and LOBT is performed regularly (see [AD7]).
The Lander will be synchronized prior to Separation and during every RF link after landing. So, during descent and the First Science Sequence this should not be a problem, since LOBT will be kept synchronized as long as the Lander is powered.

Technical details about sychronisation of Lander On-board Time can be found in § 2.3.2.6 of [AD7].

For a description of time handling in the Rosetta project see [AD8].
For a description of Lander on board time handling see [AD7] :
§ 2.3.2.6 Synchronisation and Adjustment of Lander On-board Time
§ 2.3.2.6.1 Absolute vs. relative time references
§ 2.3.2.6.2 On-board Time Failure Modes and Recovery Procedures
and [AD8], § 6. About Lander On-board Time.

3.2.2.2.3 The DDS header time correlated

The OOBT is converted to UTC (Coordinated Universal Time) by means of time correlation and included in the additional DDS packet header when the packets are distributed via the DDS server.
The **DDS header time correlated** (SCET field in the DDS header) is the UTC of the start of measurement derived from the OOBT by time correlation.

Its format is the Sun Modified Julian Time (MJT) i.e. two 32 bit integers. The first (MSB) contains the number of seconds since 00:00:00 on 1st January 1970 and the second (LSB) integer the number of micro-seconds from seconds in the first field.

Time correlation is described in [AD9], Appendix 18 § 18.1.2.1.

3.2.2.2.4 The UTC (Universal Time Coordinated)

The **UTC** is used as time stamp for SC and HK PTOLEMY data products (from level 2 to level 3) and calculated from the internal on-board time taking into account the drift and reset clock. See [AD8] for more details.

3.2.2.2.5 Spacecraft Clock Count in PDS Labels

The PDS keywords SPACECRAFT_CLOCK_START_COUNT and SPACECRAFT_CLOCK_STOP_COUNT refer to LOBT.
The LOBT 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^{-5} = 0,03125. seconds and count from 0 to $2^5 - 1$ = 31. E.g. in SPACECRAFT_CLOCK_START_COUNT = "3/356281394.21" the 21 fractional seconds correspond to 21 × 2^{-5} = 0.65625 decimal seconds.
The reset number is an integer starting at 1, i.e. "1/" means LOBT = 0 at 2003-01-01T00:00:00 UTC.

3.2.3 Reference Systems

There is only one reference system used to evaluate the position of the carousel rotation and determine which of the SD2 ovens is beneath the Ptolemy docking station. The carousel reference system is shown in [AD11] and the measurement of the carousel position is in "arcmin".

3.3 Data Validation

The Ptolemy data products will be delivered to PSA by SONC. The data will be validated by the Ptolemy PI. These data are also distributed via the W3-SONC server and can be used by all Lander experiment teams.

3.3.1 Data Quality ID

Data quality ID is indicated with 1 byte. Possible values of the DATA_QUALITY_ID are :

0	Sequence performed as expected
1	Minor anomalies
2 to 127	Not assigned
128	Sequence failed
65 to 255	Not assigned

If anomalies occur then one of the free values will be assigned and a description will be provided. One byte should be sufficient as Ptolemy operates only a few distinct sequences and most have performed as expected. If it runs out of values then Ptolemy is probably not a viable instrument.

3.4 Content

3.4.1 Volume Set

One volume corresponds to one data set. The possible values of VOLUME keywords can be found in [AD10]. The volume keyword values for the Steins mission phase are given in the following example.

```
DESCRIPTION          = "This volume contains Rosetta PTOLEMY
                        level 2 data products and supporting
                        documentation from the Commissioning phase"
VOLUME_ID            = "RLPTO2_1001"
VOLUME_NAME          = "PTOLEMY CALIBRATED DATA FOR THE STEINS PHASE"
VOLUME_SERIES_NAME   = "ROSETTA SCIENCE ARCHIVE"
VOLUME_SET_ID        = "UK_OU_PSSRI_RLPTO_10XX"
VOLUME_SET_NAME      = "ROSETTA PTOLEMY DATA"
VOLUME_VERSION_ID    = "VERSION 1"
VOLUMES              = 60
VOLUME_FORMAT        = "ISO-9660"
MEDIUM_TYPE          = "ONLINE"
PUBLICATION_DATE     = YYYY-MM-DD
```

3.4.2 Data Set

The PTOLEMY data will be archived in as many Data Sets as simple mission phases and level data processing.

The organisation (directories) of each dataset type is given in the file enclosed :

Name element	**Data Set ID**	**Data Set Name**
INSTRUMENT_HOST_ID / INSTRUMENT_HOST_NAME	RL (Rosetta Lander)	ROSETTA-LANDER
Target id / target name	See [AD10]	in [AD10]
INSTRUMENT_NAME	PTOLEMY - GAS CHROMATOGRAPH ISOTOPE RATIO MASS SPECTROMETER	
INSTRUMENT_ID	PTOLEMY	

Data processing level number	* Level 1 contains SC and HK raw data * Level 2 contains SC and HK edited data * Level 3 contains SC and HK calibrated data * Level 5 contains derived data TBD Remark : all are delivered directly after the end of the proprietary period (except level 5, delivered when ready)	
mission phase abbreviation	See [AD10]	
description	N/A	N/A
version	The first version of a data set is V1.0	

4 types of datasets will be delivered :

- one for Level 1 data (TM packets) :

DATA_SET_ID = "RL->-<target name>-PTOLEMY-1->-<mission phase abbreviation>-<*description*>-Vx.x"

- one for Level 2 data (edited data) :

DATA_SET_ID = "RL->-<target name>-PTOLEMY-2->-<mission phase abbreviation>-<*description*>-Vx.x"

- one for Level 3 data (calibrated data) :

DATA_SET_ID = "RL->-<target name>-PTOLEMY-3->-<mission phase abbreviation>-<*description*>-Vx.x"

- one for Level 5 data (derived data) :

DATA_SET_ID = "RL->-<target name>-PTOLEMY-5->-<mission phase abbreviation>-<*description*>-Vx.x"

3.4.3 Directories

The organisation (directories) of each dataset type is shown below.

Level 1 dataset :

```
                        |-AAREADME.TXT
                        |-CALIB-
                        |-CATALOG-
                        |
                        |-DATA----
|-root directory------ |
                        |-DOCUMENT-
                        |-EXTRAS-
                        |-INDEX-
                        |-VOLDESC.CAT
```

Level 2 dataset :

```
                        |-AAREADME.TXT
```

```
                          |-BROWSE-
                          |-CALIB-
                          |-CATALOG-      |-AUXILIARY-
                          |               |-EVENT-
                          |-DATA--------- |-FULL_SPECTRUM-
|-root directory------    |               |-MEMORY-
                          |               |-SUMMARY_SPECTRUM-
                          |               |-SENSOR-
                          |               |-TC-
                          |-DOCUMENT-
                          |-INDEX-
                          |-LABEL-
                          |-VOLDESC.CAT
```

Level 3 dataset :

```
                          |-AAREADME.TXT
                          |-BROWSE-
                          |-CALIB-
                          |-CATALOG-      |-AUXILIARY-
                          |               |-EVENT-  (Level 2)
                          |-DATA--------- |-MASS_SPECTRUM-
|-root directory------    |               |-SENSOR-
                          |
                          |-DOCUMENT-
                          |-INDEX-
                          |-LABEL-
                          |-VOLDESC.CAT
```

Level 5 dataset :

```
                          |-AAREADME.TXT
                          |-BROWSE-
                          |-CALIB-
                          |-CATALOG-
                          |
                          |-DATA--------- |-TBD-
|-root directory------    |
                          |
                          |-DOCUMENT-
                          |-INDEX-
                          |-LABEL-
                          |-VOLDESC.CAT
```

Remark : The name of Root Directory will be the DATA_SET_ID.

3.4.3.1 Root Directory

The root directory contains the following files

File Name	Contents
AAREADME.TXT	Volume content and format information
VOLDESC.CAT	A description of the contents of this volume in PDS format readable by both humans and computers

The name of the root directory is the data set ID.

3.4.3.2 Calibration Directory

The calibration directory shall contain the following:
Table that describes the conversion of Sensor byte values to calibrated Sensor values
Table that describes the conversion of Auxiliary byte values to calibrated Auxiliary values
Tables to convert thermocouple voltages to temperatures for both type K and type N thermocouples.
These information's can be found in the file PTOLEMY_CALIBRATION_DESC.TXT located in the DOCUMENT directory.

3.4.3.3 Catalog Directory

The catalog directory provides a top level understanding of the mission, spacecraft, instruments and data sets.The catalog directory contains the following files:

File Name	Contents
CATINFO.TXT	A description of the contents of the catalog directory
DATASET.CAT	Data set information
INST.CAT	Instrument information
INSTHOST.CAT	Instrument host (spacecraft) information
MISSION.CAT	Mission information
PERSON.CAT	PDS personnel catalog information about the instrument team responsible for generating the data products. There will be one file for each instrument team providing data to this data set.
REF.CAT	Full citations for references mentioned in any and all of the catalog files, or in any associated label files
SOFTWARE.CAT	Information about the software included in the SOFTWARE directory

3.4.3.4 Index Directory

The index directory contains the indices for all data products on the data set. The following files are included in the index directory :

3.4.3.4.1 Dataset Index File

File Name	Contents
INDEX.LBL	PDS label for the volume index file, INDEX.TAB
INDEX.TAB	Volume index in tabular format
INDXINFO.TXT	A description of the contents of the Index Directory
BROWSE_INDEX.LBL	PDS label for the volume index file, BROWSE_INDEX.TAB
BROWSE _INDEX.TAB	Volume index in tabular format for browse directory

3.4.3.5 Directory and Browse Files

The Browse Directory contains plots (PNG files) of mass spectra contained in the data files (.TAB).

For file naming convention see 3.1.4.

For example the file `PTO_FS33_080731133446_0002.TAB` contains 15 mass spectra. Accordingly the BROWSE directory contains the following 15 image files (one for each spectrum).

`PTO_FS3P_080731133446_01.PNG`

`PTO_FS3P_080731133446_02.PNG`

…

`PTO_FS3P_080731133446_15.PNG`

The browse directory contains also the file BROWINFO.TXT which describes the contents of the browse directory.

3.4.3.6 Software Directory

The EGSE software is used to read raw telemetry data (CDMS rolbin files). As it does not comply with PDS strong requirements on software for long term archiving, it is instead located in the EXTRAS directory.

3.4.3.7 Label Directory

The Label directory contains the .FMT files (structure of the TABLE objects used for the data description). This directory contains the following files:

File Name	**Contents**	**Directory** DATA/
LABINFO.TXT	A description of the contents of this directory	
PTOLEMY_S1.FMT	Table Object for Uncalibrated Summary Spectrum, Codmac 2	SUMMARY_SPECTRUM
PTOLEMY_S2.FMT	Table Object for Uncalibrated Full Spectrum, Codmac 2	FULL_SPECTRUM
PTOLEMY_AX2.FMT	Table Object for Uncalibrated Auxiliary Data, Codmac 2	AUXILIARY
PTOLEMY_SN2.FMT	Table Object for Uncalibrated HK Sensor, Codmac 2	SENSOR
PTOLEMY_TA.FMT	Table Object for TC Acceptance, Codmac 2	TC
PTOLEMY_TF.FMT	Table Object for TC Acceptance Failure, Codmac 2	TC
PTOLEMY_MD.FMT	Table Object for Memory Dump, Codmac 2	MEMORY
PTOLEMY_MC.FMT	Table Object for Memory Checksum, Codmac 2	MEMORY
PTOLEMY_EV.FMT	Table Object for Event (Normal Progress and Warning Anomalous, Codmac 2 and 3	EVENT
PTOLEMY_S3.FMT	Table Object for Calibrated Spectrum, Codmac 3	MASS_SPECTRUM
PTOLEMY_SN3.FMT	Table Object for Calibrated HK Sensor, Codmac 3	SENSOR
PTOLEMY_RH.FMT	Table Object for Raw Data Housekeeping, Codmac 1	
PTOLEMY_RS.FMT	Table Object for Raw Data Science, Codmac 1	
PTOLEMY_RB.FMT	Table Object for Raw Data both Housekeeping and Science, Codmac 1	

Table Object for Calibrated Auxiliary Data (AX3) is directly described into the label file .LBL and not into the descriptor file .FMT.

3.4.3.8 Document Directory

This directory contains documentation to help the user to understand and use the archive data. The following files are contained in the document directory:

File Name	Contents
DOCINFO.TXT	A description of the contents of this directory
EAICD_PTOLEMY.PDF	This document
EAICD_PTOLEMY.LBL	PDS label for file EAICD_PTOLEMY.PDF
PTOLEMY_CALIBRATION_DESC.TXT	Calibration information for PTOLEMY calibrated data
PTOLEMY_CALIBRATION_DESC.LBL	PDS label for file PTOLEMY_CALIBRATION_DESC.TXT
RL_PTOLEMY_LOGBOOK.TXT	This document contains a listing of all activities done by/with Rosetta PTOLEMY
RL_PTOLEMY_LOGBOOK.LBL	PDS label for file RL_PTOLEMY_LOGBOOK.TXT
RO-BER-RAL-TN-3401.PDF	WGA And RICA Applicability To RF Scan Function Design
RO-BER-RAL-TN-3401.LBL	PDS label for file RO-BER-RAL-TN-3401.PDF
RO-LPT-RAL-TN-3403.PDF	Ptolemy Telecommand and Telemetry Definitions
RO-LPT-RAL-TN-3403.LBL	PDS label for file RO-LPT-RAL-TN-3403.PDF
RO-LPT-OU-PL-3114.PDF	Ptolemy Experiment Flight Operation Plan for Cruise
RO-LPT-OU-PL-3114.LBL	PDS label for file RO-LPT-OU-PL-3114.PDF
RO-LPT-OU-PL-3101.PDF	Ptolemy Experiment Flight Operation Plan
RO-LPT-OU-PL-3101.LBL	PDS label for file RO-LPT-OU-PL-3101.PDF
RO-LPT-RAL-MA-3102.PDF	Ptolemy On Board Software User Manual
RO-LPT-RAL-MA-3102.LBL	PDS label for file RO-LPT-OU-MA-3102.PDF
RO-LPT-OU-TN-3146.PDF	Ptolemy Sensors Calibration
RO-LPT-OU-TN-3146.LBL	PDS label for file RO-LPT-OU-TN-3146.PDF
TIMELINE_*ph*_DESC.TXT	Description of the timeline file for phase *ph*
TIMELINE_*ph*_*obty*.PNG	Timeline Image file for phase *ph* and observation type *obty*
TIMELINE_*ph*_*obty*.LBL	PDS label for image TIMELINE_*ph*_*obty*.PNG
TIMELINE_*ph*_*obty*.TXT	Timeline ASCII file (attached label) for phase *ph* and observation type *obty*

3.4.3.9 Extras Directory

The Extras directory contains EGSE software to read and visualize raw telemetry data (CDMS rolbin files, CODMAC level 1). The contents of the EXTRAS directory are shown below :

The EXTRAS directory contains the following files :

File Name	Contents
PTOLEMY_EGSE.ZIP	EGSE software in zip compressed format for extracting data from the raw data product files (rolbin), calibration and visualisation.
PTOLEMY_EGSE.LBL	PDS label for file PTOLEMY_EGSE.ZIP
RO-LPT-OU-MA-3101_EGSE_SUM.PDF	EGSE software user manual
RO-LPT-OU-MA-3101_EGSE_SUM.LBL	PDS label for file RO-LPT-OU-MA-3101_EGSE_SUM.PDF
PTOLEMY_EGSE_VB_CODE.PDF	Listing of EGSE software source code
PTOLEMY_EGSE_VB_CODE.LBL	PDS label for file PTOLEMY_EGSE_VB_CODE.PDF
EXTRTINFO.TXT	A description of the contents of the Extras Directory

The content of the PTOLEMY_EGSE.ZIP file is shown below:

```
                                   |-Component Ranges.txt
                                   |-Default_Pressure sensors.txt
                |-EGSE_INFO---------------|-N-Type.txt
```

```
                   |                               |-Pressure sensors.txt
                   |                               |-sensors.txt
                   |-MSVBVM60.DLL
   |-PTOLEMY------|-Pto Egse1.5.exe
                   |-Ptolemy_Files.txt
                   |-readme.txt
```

3.4.3.10 Data Directory

The structure and naming scheme of the data directory is described in chapter 3.4.3

4 Detailed Interface Specifications

4.1 Structure and Organization Overview

The data files will be archived in a data set on the basis of the mission phase relative to the production of the data.
Each .DAT (rolbin) file containing the raw data (telemetry packets, CODMAC level 1) will be placed in the DATA directory of the corresponding dataset (with level 1 data files, HK and SC mixed).
Each .TAB file containing uncalibrated SC data (CODMAC level 2) and each uncalibrated HK (CODMAC level 2) data will be archived in the DATA directory of the corresponding dataset (with level 2 data files).
Each .TAB file containing calibrated SC data (CODMAC level 3) and each .TAB file containing calibrated HK (CODMAC level 3) data will be archived in the DATA directory of the corresponding datasets (with level 3 HK data files and level 3 SC data files).
The file names follow the rules explained in this document (§ 3.1.4).

4.2 Data Sets, Definition and Content

Data Set ID	**Data Set Name**
RL-CAL-PTOLEMY-1-GRND-V1.0	ROSETTA-LANDER CAL PTOLEMY 1 GRND V1.0
RL-CAL-PTOLEMY-1-CVP-V1.0	ROSETTA-LANDER CAL PTOLEMY 1 CVP V1.0
RL-CAL-PTOLEMY-1-CR2-V1.0	ROSETTA-LANDER CAL PTOLEMY 1 CR2 V1.0
RL-CAL-PTOLEMY-1-CR4A-V1.0	ROSETTA-LANDER CAL PTOLEMY 1 CR4A V1.0
RL-CAL-PTOLEMY-1-CR4B-V1.0	ROSETTA-LANDER CAL PTOLEMY 1 CR4B V1.0
RL-CAL-PTOLEMY-1-CR5-V1.0	ROSETTA-LANDER CAL PTOLEMY 1 CR5 V1.0
RL-E-PTOLEMY-1-EAR1-V1.0	ROSETTA-LANDER EARTH PTOLEMY 1 EAR1 V1.0
RL-E-PTOLEMY-1-EAR2-V1.0	ROSETTA-LANDER EARTH PTOLEMY 1 EAR2 V1.0
RL-E-PTOLEMY-1-EAR3-V1.0	ROSETTA-LANDER EARTH PTOLEMY 1 EAR3 V1.0
RL-M-PTOLEMY-1-MARS-V1.0	ROSETTA-LANDER MARS PTOLEMY 1 MARS V1.0
RL-A-PTOLEMY-1-AST2-V1.0	ROSETTA-LANDER LUTETIA PTOLEMY 1 AST2 V1.0
RL-C-PTOLEMY-1-PHC-V1.0	ROSETTA-LANDER 67P PTOLEMY 1 PHC V1.0
RL-C-PTOLEMY-1-PDCS-V1.0	ROSETTA-LANDER 67P PTOLEMY 1 PDCS V1.0
RL-C-PTOLEMY-1-RBD-V1.0	ROSETTA-LANDER 67P PTOLEMY 1 RBD V1.0
RL-C-PTOLEMY-1-FSS-V1.0	ROSETTA-LANDER 67P COSAC 1 FSS V1.0
RL-CAL-PTOLEMY-2-GRND-V1.0	ROSETTA-LANDER CAL PTOLEMY 2 GRND V1.0
RL-CAL-PTOLEMY-2-CVP-V1.0	ROSETTA-LANDER CAL PTOLEMY 2 CVP V1.0
RL-CAL-PTOLEMY-2-CR2-V1.0	ROSETTA-LANDER CAL PTOLEMY 2 CR2 V1.0
RL-CAL-PTOLEMY-2-CR4A-V1.0	ROSETTA-LANDER CAL PTOLEMY 2 CR4A V1.0
RL-CAL-PTOLEMY-2-CR4B-V1.0	ROSETTA-LANDER CAL PTOLEMY 2 CR4B V1.0
RL-CAL-PTOLEMY-2-CR5-V1.0	ROSETTA-LANDER CAL PTOLEMY 2 CR5 V1.0

RL-E-PTOLEMY-2-EAR1-V1.0	ROSETTA-LANDER EARTH PTOLEMY 2 EAR1 V1.0
RL-E-PTOLEMY-2-EAR2-V1.0	ROSETTA-LANDER EARTH PTOLEMY 2 EAR2 V1.0
RL-E-PTOLEMY-2-EAR3-V1.0	ROSETTA-LANDER EARTH PTOLEMY 2 EAR3 V1.0
RL-M-PTOLEMY-2-MARS-V1.0	ROSETTA-LANDER MARS PTOLEMY 2 MARS V1.0
RL-A-PTOLEMY-2-AST2-V1.0	ROSETTA-LANDER LUTETIA PTOLEMY 2 AST2 V1.0
RL-C-PTOLEMY-2-PHC-V1.0	ROSETTA-LANDER 67P PTOLEMY 2 PHC V1.0
RL-C-PTOLEMY-2-PDCS-V1.0	ROSETTA-LANDER 67P PTOLEMY 2 PDCS V1.0
RL-C-PTOLEMY-2-RBD-V1.0	ROSETTA-LANDER 67P PTOLEMY 2 RBD V1.0
RL-C-PTOLEMY-2-FSS-V1.0	ROSETTA-LANDER 67P COSAC 2 FSS V1.0
RL-CAL-PTOLEMY-3-GRND-V1.0	ROSETTA-LANDER CAL PTOLEMY 3 GRND V1.0
RL-CAL-PTOLEMY-3-CVP-V1.0	ROSETTA-LANDER CAL PTOLEMY 3 CVP V1.0
RL-CAL-PTOLEMY-3-CR2-V1.0	ROSETTA-LANDER CAL PTOLEMY 3 CR2 V1.0
RL-CAL-PTOLEMY-3-CR4A-V1.0	ROSETTA-LANDER CAL PTOLEMY 3 CR4A V1.0
RL-CAL-PTOLEMY-3-CR4B-V1.0	ROSETTA-LANDER CAL PTOLEMY 3 CR4B V1.0
RL-CAL-PTOLEMY-3-CR5-V1.0	ROSETTA-LANDER CAL PTOLEMY 3 CR5 V1.0
RL-E-PTOLEMY-3-EAR1-V1.0	ROSETTA-LANDER EARTH PTOLEMY 3 EAR1 V1.0
RL-E-PTOLEMY-3-EAR2-V1.0	ROSETTA-LANDER EARTH PTOLEMY 3 EAR2 V1.0
RL-E-PTOLEMY-3-EAR3-V1.0	ROSETTA-LANDER EARTH PTOLEMY 3 EAR3 V1.0
RL-M-PTOLEMY-3-MARS-V1.0	ROSETTA-LANDER MARS PTOLEMY 3 MARS V1.0
RL-A-PTOLEMY-3-AST2-V1.0	ROSETTA-LANDER LUTETIA PTOLEMY 3 AST2 V1.0
RL-C-PTOLEMY-3-PHC-V1.0	ROSETTA-LANDER 67P PTOLEMY 3 PHC V1.0
RL-C-PTOLEMY-3-PDCS-V1.0	ROSETTA-LANDER 67P PTOLEMY 3 PDCS V1.0
RL-C-PTOLEMY-3-RBD-V1.0	ROSETTA-LANDER 67P PTOLEMY 3 RBD V1.0
RL-C-PTOLEMY-3-FSS-V1.0	ROSETTA-LANDER 67P PTOLEMY 3 FSS V1.0
RL-CAL-PTOLEMY-5-GRND-V1.0	ROSETTA-LANDER CAL PTOLEMY 5 GRND V1.0
RL-CAL-PTOLEMY-5-CVP-V1.0	ROSETTA-LANDER CAL PTOLEMY 5 CVP V1.0
RL-CAL-PTOLEMY-5-CR2-V1.0	ROSETTA-LANDER CAL PTOLEMY 5 CR2 V1.0
RL-CAL-PTOLEMY-5-CR4A-V1.0	ROSETTA-LANDER CAL PTOLEMY 5 CR4A V1.0
RL-CAL-PTOLEMY-5-CR4B-V1.0	ROSETTA-LANDER CAL PTOLEMY 5 CR4B V1.0
RL-CAL-PTOLEMY-5-CR5-V1.0	ROSETTA-LANDER CAL PTOLEMY 5 CR5 V1.0
RL-E-PTOLEMY-5-EAR1-V1.0	ROSETTA-LANDER EARTH PTOLEMY 5 EAR1 V1.0
RL-E-PTOLEMY-5-EAR2-V1.0	ROSETTA-LANDER EARTH PTOLEMY 5 EAR2 V1.0
RL-E-PTOLEMY-5-EAR3-V1.0	ROSETTA-LANDER EARTH PTOLEMY 5 EAR3 V1.0
RL-M-PTOLEMY-5-MARS-V1.0	ROSETTA-LANDER MARS PTOLEMY 5 MARS V1.0
RL-A-PTOLEMY-5-AST2-V1.0	ROSETTA-LANDER LUTETIA PTOLEMY 5 AST2 V1.0
RL-C-PTOLEMY-5-PHC-V1.0	ROSETTA-LANDER 67P PTOLEMY 5 PHC V1.0
RL-C-PTOLEMY-5-PDCS-V1.0	ROSETTA-LANDER 67P PTOLEMY 5 PDCS V1.0
RL-C-PTOLEMY-5-RBD-V1.0	ROSETTA-LANDER 67P PTOLEMY 5 RBD V1.0
RL-C-PTOLEMY-5-FSS-V1.0	ROSETTA-LANDER 67P PTOLEMY 5 FSS V1.0

4.3 Data Product Design

All PTOLEMY data products have PDS detached labels.

4.3.1 Data Product design of Raw data (Level 1)

Level 1 contains housekeeping only or science only or mixed housekeeping and science raw data packets delivered by the Rosetta Lander with minimal detached PDS labels.

4.3.1.1 File Characteristics Data Elements

The raw data file contains telemetry packets which are described in [AD4].
The file characteristic data elements are RECORD_TYPE, PRODUCT_TYPE and FILE_NAME. The PRODUCT_TYPE is UDR. The RECORD_TYPE for raw data is UNDEFINED, i.e. the structure of records is not described in the PDS labels since these data are intended to be processed with the EGSE software available in the EXTRAS directory.

4.3.1.2 Instrument and Detector Descriptive Data Elements

```
INSTRUMENT_HOST_NAME      = "ROSETTA LANDER"
INSTRUMENT_HOST_ID= RL
INSTRUMENT_ID             = PTOLEMY
INSTRUMENT_NAME           = "PTOLEMY - GAS CHROMATOGRAPH ISOTOPE RATIO MASS
SPECTROMETER"
INSTRUMENT_TYPE           = "GAS ISOTOPE RATIO ANALYSER"
INSTRUMENT_MODE_ID= "N/A"
INSTRUMENT_MODE_DESC      = "N/A"
```

4.3.1.3 Description of Instrument

A description of the instrument is given in AD4. A brief overview is in the INST.CAT catalog file as well as this document

4.3.2 Data Product Design of Level 2 Data

The Level 2 data product contains uncalibrated complete and summary mass spectra with relevant housekeeping information. The following data are included in the level 2 product:

- From science telemetry
    - Auxiliary data,
    - Summary Mass Spectrum,
    - Full Mass Spectrum
- From housekeeping telemetry
    - TC Acceptance/Failure,
    - Memory Dump,
    - Memory Checksum,
    - Event
    - Sensor

4.3.2.1 File Characteristics Data Elements

The PDS file characteristic data elements for PTOLEMY level 2 products are:

```
RECORD_TYPE            = FIXED_LENGTH
RECORD_BYTES
FILE_RECORDS
PRODUCT_TYPE           = RDR
PROCESSING_LEVEL_ID    =  1
```

The values of keywords RECORD_BYTES and FILE_RECORDS depend on the data product type.

4.3.2.2 Data Object Pointers Identification Data Elements

The PTOLEMY level 2 data are organized as ASCII tables. The data object pointers (^TABLE) reference TAB files.

4.3.2.3 Instrument and Detector Descriptive Data Elements

```
INSTRUMENT_HOST_NAME      = "ROSETTA LANDER"
INSTRUMENT_HOST_ID        = RL
INSTRUMENT_ID             = PTOLEMY
INSTRUMENT_NAME           = "PTOLEMY - GAS CHROMATOGRAPH ISOTOPE RATIO MASS
                             SPECTROMETER"
INSTRUMENT_TYPE           = "GAS ISOTOPE RATIO ANALYSER"
INSTRUMENT_MODE_ID        = "N/A"
INSTRUMENT_MODE_DESC      = "N/A"
```

4.3.2.4 Data Object Definition

4.3.2.4.1 Sensor (housekeeping)

```
OBJECT                = SENSOR_UNCAL_TABLE
  NAME                = "SENSOR_UNCALIB"
  INTERCHANGE_FORMAT  = ASCII
  ROWS                = 3
  COLUMNS             = 44
  ROW_BYTES           = 370
  DESCRIPTION         = "Uncalibrated HK sensor data"
 ^STRUCTURE           = "PTOLEMY_SN2.FMT"
END_OBJECT            = SENSOR_UNCAL_TABLE
```

The structure of the TABLE object is described in the file PTOLEMY_SN2.FMT as follows:

```
/*     Contents of format file  "PTOLEMY_SN2.FMT"  (Uncalibrated HK sensor) */


OBJECT                    = COLUMN
   NAME                   = "TIME_CODE"
   DATA_TYPE              = CHARACTER
   START_BYTE             = 2
   BYTES                  = 17
   DESCRIPTION            = "Time code at which sensor acquisition initiated
                             in lander On Board Time; LOBT IS REPRESENTED AS :
                             Reset number (integer starting at 1) / seconds.
                             Reset number 1 starts at 2003-01-01T00:00:00 UTC
                             The time resolution is 0.03125 s"
 END_OBJECT               = COLUMN

OBJECT                    = COLUMN
   NAME                   = "UTC"
   DATA_TYPE              = TIME
   START_BYTE             = 21
   BYTES                  = 23
   DESCRIPTION            = "Date at which sensor acquisition initiated
                             in On-Ground time (UTC)
                             Format : YYYY-MM-DDThh:mm:ss.sss"
 END_OBJECT               = COLUMN

 OBJECT                   = COLUMN
```

```
   NAME                    = "SENSOR_REPORT_TYPE"
   DATA_TYPE               = CHARACTER
   START_BYTE              = 46
   BYTES                   = 7
   UNIT                    = "N/A"
   DESCRIPTION             = "The type of the sensor report.
                              Can take the values:
                                 Concise
                                 Summary"
END_OBJECT                 = COLUMN

OBJECT                     = COLUMN
   NAME                    = "OP_MODE"
   DATA_TYPE               = ASCII_INTEGER
   START_BYTE              = 55
   BYTES                   = 3
   UNIT                    = "N/A"
   FORMAT                  = "I3"
   DESCRIPTION             = "Ptolemy operating mode"
END_OBJECT                 = COLUMN

OBJECT                     = COLUMN
   NAME                    = "TC_MODE"
   DATA_TYPE               = ASCII_INTEGER
   START_BYTE              = 59
   BYTES                   = 3
   UNIT                    = "N/A"
   FORMAT                  = "I3"
   DESCRIPTION             = "TC mode (zero in safe mode)"
END_OBJECT                 = COLUMN

OBJECT                     = COLUMN
   NAME                    = "LINE_NUMBER"
   DATA_TYPE               = ASCII_INTEGER
   START_BYTE              = 63
   BYTES                   = 6
   UNIT                    = "N/A"
   FORMAT                  = "I6"
   DESCRIPTION             = "Line number for current mode event (zero in safe
                              mode)"
END_OBJECT                 = COLUMN

OBJECT                     = COLUMN
   NAME                    = "ST_TC_RQD"
   DATA_TYPE               = ASCII_INTEGER
   START_BYTE              = 70
   BYTES                   = 6
   UNIT                    = "N/A"
   FORMAT                  = "I6"
   DESCRIPTION             = "Number of stored TCs requested (zero in safe mode)"
END_OBJECT                 = COLUMN

OBJECT                     = COLUMN
   NAME                    = "ST_TC_RCVD"
   DATA_TYPE               = ASCII_INTEGER
   START_BYTE              = 77
   BYTES                   = 6
   UNIT                    = "N/A"
   FORMAT                  = "I6"
   DESCRIPTION             = "Number of stored TCs received (zero in safe mode)"
END_OBJECT                 = COLUMN
```

```
OBJECT                    = COLUMN
   NAME                   = "TC_TYPE"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 84
   BYTES                  = 3
   UNIT                   = "N/A"
   FORMAT                 = "I3"
   DESCRIPTION            = "Type of last received TC (zero if no TC received)"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
   NAME                   = "TC_SUBTYPE"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 88
   BYTES                  = 3
   UNIT                   = "N/A"
   FORMAT                 = "I3"
   DESCRIPTION            = "Subtype of last TC received (zero if no TC
                             received)"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
   NAME                   = "TR1"
   DATA_TYPE              = ASCII_REAL
   START_BYTE             = 92
   BYTES                  = 8
   UNIT                   = VOLT
   FORMAT                 = "F8.4"
   DESCRIPTION            = "reactor R1 thermocouple reading"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
   NAME                   = "TR2"
   DATA_TYPE              = ASCII_REAL
   START_BYTE             = 101
   BYTES                  = 8
   UNIT                   = VOLT
   FORMAT                 = "F8.4"
   DESCRIPTION            = "reactor R2 thermocouple reading"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
   NAME                   = "TR4"
   DATA_TYPE              = ASCII_REAL
   START_BYTE             = 110
   BYTES                  = 8
   UNIT                   = VOLT
   FORMAT                 = "F8.4"
   DESCRIPTION            = "reactor R4 thermocouple reading"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
   NAME                   = "TR5"
   DATA_TYPE              = ASCII_REAL
   START_BYTE             = 119
   BYTES                  = 8
   UNIT                   = VOLT
   FORMAT                 = "F8.4"
   DESCRIPTION            = "reactor R5 thermocouple reading"
END_OBJECT                = COLUMN
```

```
OBJECT                   = COLUMN
   NAME                  = "TR6"
   DATA_TYPE             = ASCII_REAL
   START_BYTE            = 128
   BYTES                 = 8
   UNIT                  = VOLT
   FORMAT                = "F8.4"
   DESCRIPTION           = "reactor R6 thermocouple reading"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
   NAME                  = "TR7"
   DATA_TYPE             = ASCII_REAL
   START_BYTE            = 137
   BYTES                 = 8
   UNIT                  = VOLT
   FORMAT                = "F8.4"
   DESCRIPTION           = "reactor R7 thermocouple reading"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
   NAME                  = "TR8"
   DATA_TYPE             = ASCII_REAL
   START_BYTE            = 146
   BYTES                 = 8
   UNIT                  = VOLT
   FORMAT                = "F8.4"
   DESCRIPTION           = "reactor R8 thermocouple reading"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
   NAME                  = "TR9"
   DATA_TYPE             = ASCII_REAL
   START_BYTE            = 155
   BYTES                 = 8
   UNIT                  = VOLT
   FORMAT                = "F8.4"
   DESCRIPTION           = "reactor R9 thermocouple reading"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
   NAME                  = "TR13"
   DATA_TYPE             = ASCII_REAL
   START_BYTE            = 164
   BYTES                 = 8
   UNIT                  = VOLT
   FORMAT                = "F8.4"
   DESCRIPTION           = "reactor R13 thermocouple reading"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
   NAME                  = "TR15"
   DATA_TYPE             = ASCII_REAL
   START_BYTE            = 173
   BYTES                 = 8
   UNIT                  = VOLT
   FORMAT                = "F8.4"
   DESCRIPTION           = "reactor R15 thermocouple reading"
END_OBJECT               = COLUMN
```

```
OBJECT                  = COLUMN
   NAME                 = "TLV1"
   DATA_TYPE            = ASCII_REAL
   START_BYTE           = 182
   BYTES                = 8
   UNIT                 = VOLT
   FORMAT               = "F8.4"
   DESCRIPTION          = "Lindau valve 1 thermocouple reading"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
   NAME                 = "TLV2"
   DATA_TYPE            = ASCII_REAL
   START_BYTE           = 191
   BYTES                = 8
   UNIT                 = VOLT
   FORMAT               = "F8.4"
   DESCRIPTION          = "Lindau valve 2 thermocouple reading"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
   NAME                 = "TLV5"
   DATA_TYPE            = ASCII_REAL
   START_BYTE           = 200
   BYTES                = 8
   UNIT                 = VOLT
   FORMAT               = "F8.4"
   DESCRIPTION          = "Lindau valve 5 thermocouple reading"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
   NAME                 = "TLV6"
   DATA_TYPE            = ASCII_REAL
   START_BYTE           = 209
   BYTES                = 8
   UNIT                 = VOLT
   FORMAT               = "F8.4"
   DESCRIPTION          = "Lindau valve 6 thermocouple reading"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
   NAME                 = "TLV7"
   DATA_TYPE            = ASCII_REAL
   START_BYTE           = 218
   BYTES                = 8
   UNIT                 = VOLT
   FORMAT               = "F8.4"
   DESCRIPTION          = "Lindau valve 7 thermocouple reading"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
   NAME                 = "TGC"
   DATA_TYPE            = ASCII_REAL
   START_BYTE           = 227
   BYTES                = 8
   UNIT                 = VOLT
   FORMAT               = "F8.4"
   DESCRIPTION          = "Thermocouple reading for Gas Chromatograph columns"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
```

```
   NAME                     = "TENCA"
   DATA_TYPE                = ASCII_REAL
   START_BYTE               = 236
   BYTES                    = 8
   UNIT                     = VOLT
   FORMAT                   = "F8.4"
   DESCRIPTION              = "Thermal Enclosure A thermocouple reading"
END_OBJECT                  = COLUMN

OBJECT                      = COLUMN
   NAME                     = "TENCB"
   DATA_TYPE                = ASCII_REAL
   START_BYTE               = 245
   BYTES                    = 8
   UNIT                     = VOLT
   FORMAT                   = "F8.4"
   DESCRIPTION              = "Thermal Enclosure B thermocouple reading"
END_OBJECT                  = COLUMN

OBJECT                      = COLUMN
   NAME                     = "TION"
   DATA_TYPE                = ASCII_REAL
   START_BYTE               = 254
   BYTES                    = 8
   UNIT                     = VOLT
   FORMAT                   = "F8.4"
   DESCRIPTION              = "Ion Trap thermocouple reading"
END_OBJECT                  = COLUMN

OBJECT                      = COLUMN
   NAME                     = "TOVEN"
   DATA_TYPE                = ASCII_REAL
   START_BYTE               = 263
   BYTES                    = 8
   UNIT                     = VOLT
   FORMAT                   = "F8.4"
   DESCRIPTION              = "Oven thermocouple reading"
END_OBJECT                  = COLUMN

OBJECT                      = COLUMN
   NAME                     = "TPIPE"
   DATA_TYPE                = ASCII_REAL
   START_BYTE               = 272
   BYTES                    = 8
   UNIT                     = VOLT
   FORMAT                   = "F8.4"
   DESCRIPTION              = "Pipe heater thermocouple reading"
END_OBJECT                  = COLUMN

OBJECT                      = COLUMN
   NAME                     = "PG1"
   DATA_TYPE                = ASCII_REAL
   START_BYTE               = 281
   BYTES                    = 8
   UNIT                     = VOLT
   FORMAT                   = "F8.4"
   DESCRIPTION              = "Pressure of Helium as indicated by sensor G1"
END_OBJECT                  = COLUMN

OBJECT                      = COLUMN
   NAME                     = "PG2"
```

```
   DATA_TYPE              = ASCII_REAL
   START_BYTE             = 290
   BYTES                  = 8
   UNIT                   = VOLT
   FORMAT                 = "F8.4"
   DESCRIPTION            = "Pressure of Helium as indicated by sensor G2"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
   NAME                   = "PG3"
   DATA_TYPE              = ASCII_REAL
   START_BYTE             = 299
   BYTES                  = 8
   UNIT                   = VOLT
   FORMAT                 = "F8.4"
   DESCRIPTION            = "Absolute Pressure as indicated by sensor G3"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
   NAME                   = "PG4"
   DATA_TYPE              = ASCII_REAL
   START_BYTE             = 308
   BYTES                  = 8
   UNIT                   = VOLT
   FORMAT                 = "F8.4"
   DESCRIPTION            = "Pressure of Helium as indicated by sensor G4"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
   NAME                   = "PG5"
   DATA_TYPE              = ASCII_REAL
   START_BYTE             = 317
   BYTES                  = 8
   UNIT                   = VOLT
   FORMAT                 = "F8.4"
   DESCRIPTION            = "Differential Pressure as indicated by sensor G5"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
   NAME                   = "TR14"
   DATA_TYPE              = ASCII_REAL
   START_BYTE             = 326
   BYTES                  = 8
   UNIT                   = VOLT
   FORMAT                 = "F8.4"
   DESCRIPTION            = "Reactor R14 thermocouple reading"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
   NAME                   = "AD590"
   DATA_TYPE              = ASCII_REAL
   START_BYTE             = 335
   BYTES                  = 8
   UNIT                   = VOLT
   FORMAT                 = "F8.4"
   DESCRIPTION            = "Reference junction thermometer (AD590)"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
   NAME                   = "VDS"
   DATA_TYPE              = ASCII_REAL
```

```
   START_BYTE             = 344
   BYTES                  = 8
   UNIT                   = VOLT
   FORMAT                 = "F8.4"
   DESCRIPTION            = "Docking station potentiometer"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
   NAME                   = "INT"
   DATA_TYPE              = ASCII_REAL
   START_BYTE             = 353
   BYTES                  = 8
   UNIT                   = VOLT
   FORMAT                 = "F8.4"
   DESCRIPTION            = "Nanotip drive current"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
   NAME                   = "VDET"
   DATA_TYPE              = ASCII_REAL
   START_BYTE             = 362
   BYTES                  = 8
   UNIT                   = VOLT
   FORMAT                 = "F8.4"
   DESCRIPTION            = "Detector Bias"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
   NAME                   = "V5V"
   DATA_TYPE              = ASCII_REAL
   START_BYTE             = 371
   BYTES                  = 8
   UNIT                   = VOLT
   FORMAT                 = "F8.4"
   DESCRIPTION            = "5V voltage monitor"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
   NAME                   = "V28V"
   DATA_TYPE              = ASCII_REAL
   START_BYTE             = 380
   BYTES                  = 8
   UNIT                   = VOLT
   FORMAT                 = "F8.4"
   DESCRIPTION            = "28V voltage monitor"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
   NAME                   = "I5V"
   DATA_TYPE              = ASCII_REAL
   START_BYTE             = 389
   BYTES                  = 8
   UNIT                   = VOLT
   FORMAT                 = "F8.4"
   DESCRIPTION            = "Current monitored on 5 volt rail"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
   NAME                   = "I28V"
   DATA_TYPE              = ASCII_REAL
   START_BYTE             = 398
```

```
   BYTES                   = 8
   UNIT                    = VOLT
   FORMAT                  = "F8.4"
   DESCRIPTION             = "Current monitored on 28V bus"
END_OBJECT                 = COLUMN

OBJECT                     = COLUMN
   NAME                    = "VRFCAL"
   DATA_TYPE               = ASCII_REAL
   START_BYTE              = 407
   BYTES                   = 8
   UNIT                    = VOLT
   FORMAT                  = "F8.4"
   DESCRIPTION             = " VRFCAL is a measurement of the RF voltage,
                          which is used during the RF Calibration procedure"
END_OBJECT                  = COLUMN
```

4.3.2.4.2 Telecommands

4.3.2.4.2.1 TC Acceptance

```
OBJECT                 = TA_TABLE
  NAME                 = "PTOLEMY_TC_Acceptance"
  INTERCHANGE_FORMAT = ASCII
  ROWS                 = 2
  COLUMNS              = 3
  ROW_BYTES            = 30
  DESCRIPTION          = "PTOLEMY TC Acceptance"
 ^STRUCTURE            = "PTOLEMY_TA.FMT"
END_OBJECT             = TA_TABLE
```

The structure of the TABLE object is described in the file PTOLEMY_TA.FMT as follows:

```
/*    Contents of format file  "PTOLEMY_TA.FMT"     (TC Acceptance)     */

OBJECT                    = COLUMN
  NAME                    = "TIME_CODE"
  DATA_TYPE               = CHARACTER
  START_BYTE              = 2
  BYTES                   = 17
  DESCRIPTION             = "On board time represented as :
                           Reset number (integer starting at 1) / seconds.
                           Reset number 1 starts at 2003-01-01T00:00:00 UTC
                           The time resolution is 0.03125 s"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
  NAME                    = "UTC_TIME"
  DATA_TYPE               = TIME
  START_BYTE              = 21
  BYTES                   = 23
  DESCRIPTION             = "This column represents the UTC Time in PDS standard
                             format YYYY-MM-DDThh:mm:ss.sss"
END_OBJECT      = COLUMN

OBJECT                     = COLUMN
   NAME                    = "TC_PCKT_ID"
   DATA_TYPE               = CHARACTER
   START_BYTE              = 46
   BYTES                   = 4
```

```
   DESCRIPTION          = "The packet ID of the accepted TC
                            (hexadecimal format)"
END_OBJECT              = COLUMN

OBJECT                 = COLUMN
   NAME                 = "TC_SEQ_CTRL"
   DATA_TYPE            = CHARACTER
   START_BYTE           = 53
   BYTES                = 4
   DESCRIPTION          = "The sequence control field for the accepted TC
                            (hexadecimal format)"
END_OBJECT          = COLUMN
```

4.3.2.4.2.2 TC Acceptance Failure

```
OBJECT                = TF_TABLE
  NAME                = "PTOLEMY_TC_Failure"
  INTERCHANGE_FORMAT = ASCII
  ROWS                = 2
  COLUMNS             = 10
  ROW_BYTES           = 73
  DESCRIPTION         = "PTOLEMY TC Failure"
 ^STRUCTURE           = "PTOLEMY_TF.FMT"
END_OBJECT            = TF_TABLE
```

The structure of the TABLE object is described in the file PTOLEMY_TF.FMT as follows:

```
/* Contents of format file  "PTOLEMY_TF.FMT" (TC Acceptance Failure)     */

OBJECT                 = COLUMN
  NAME                 = "TIME_CODE"
  DATA_TYPE            = CHARACTER
  START_BYTE           = 2
  BYTES                = 17
  DESCRIPTION          = "On board time represented as :
                          Reset number (integer starting at 1) / seconds.
                          Reset number 1 starts at 2003-01-01T00:00:00 UTC
                          The time resolution is 0.03125 s"
END_OBJECT              = COLUMN

OBJECT         = COLUMN
  NAME         = "UTC_TIME"
  DATA_TYPE    = TIME
  START_BYTE   = 21
  BYTES        = 23
  DESCRIPTION  = "This column represents the UTC Time in PDS standard format
                  YYYY-MM-DDThh:mm:ss.sss"
END_OBJECT     = COLUMN

OBJECT                 = COLUMN
   NAME                 = "TC_PCKT_ID"
   DATA_TYPE            = CHARACTER
   START_BYTE           = 46
   BYTES                = 4
   DESCRIPTION          = "The packet ID of the accepted TC
                            (hexadecimal format)"
END_OBJECT             = COLUMN

OBJECT                 = COLUMN
   NAME                 = "TC_SEQ_CTRL"
```

```
   DATA_TYPE              = CHARACTER
   START_BYTE             = 53
   BYTES                  = 4
   DESCRIPTION            = "The sequence control field for the accepted TC
                              (hexadecimal format)"
END_OBJECT               = COLUMN

OBJECT                    = COLUMN
   NAME                   = "FAILURE_CODE"
   DATA_TYPE              = CHARACTER
   START_BYTE             = 60
   BYTES                  = 4
   DESCRIPTION            = " Failure code (hexadecimal format)"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
   NAME                   = "TC_PCKT_TYPE"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 66
   BYTES                  = 3
   FORMAT                 = "I3"
   DESCRIPTION            = "Packet type of the rejected TC"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
   NAME                   = "TC_PCKT_SUBTYPE"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 70
   BYTES                  = 3
   FORMAT                 = "I3"
   DESCRIPTION            = "Packet subtype of the rejected TC"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
   NAME                   = "PARAM_3"
   DATA_TYPE              = CHARACTER
   START_BYTE             = 75
   BYTES                  = 4
   DESCRIPTION            = "3rd parameter (hexadecimal format)
                             depends on failure code :

    Failure code    Reason for rejection            Parameter 3

        1             Incomplete packet       Number of bytes in packet header
        2             Incorrect checksum      Checksum received in TC packet
        3          Incorrect Application ID         Not used (=0)
        4             Invalid command code          Always =0
        5            Not allowed in this        Current operating mode
                         mode/state                or SD2 status
        6          Packet data field            Word position (offset 0)
                    inconsistent                 of first field error"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
   NAME                   = "PARAM_4"
   DATA_TYPE              = CHARACTER
   START_BYTE             = 82
   BYTES                  = 4
   DESCRIPTION            = "4th parameter  (hexadecimal format)
                            depends on failure code :
```

```
    Failure code    Reason for rejection            Parameter 4

        1             Incomplete packet       Number of bytes actualy received
        2             Incorrect checksum      Expected (calculated) checksum
        3          Incorrect Application ID          Not used (=0)
        4             Invalid command code           Always =0
        5            Not allowed in this             Always =0
                        mode/state
        6             Packet data field            Erroneous word value
                        inconsistent                                    "
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
   NAME                   = "PARAM_5"
   DATA_TYPE              = CHARACTER
   START_BYTE             = 89
   BYTES                  = 4
   DESCRIPTION            = "5th parameter  (hexadecimal format)
                            Additional Parameter for failure code 6
                             depends on TC Type and TC Subtype :

        TC Type   TC Subtype        TC Name                  Parameter 5

         193        5            HTO Conditioning            SD2 Oven No
                    6            MTO Conditioning            SD2 Oven No
                    7            CASE Conditioning         Position tolerance

         193        1              Ground Test             Lowest valid tank no
                  9-16             Tank Rupture-           Lowest valid tank no
                                 Additional Science

         195        1             Parameter Update         Lowest valid number
                                                              of parameters"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
   NAME                   = "PARAM_6"
   DATA_TYPE              = CHARACTER
   START_BYTE             = 96
   BYTES                  = 4
   DESCRIPTION            = "6th parameter  (hexadecimal format)
                            Additional Parameter for failure code 6
                             depends on TC Type and TC Subtype :

       TC Type   TC Subtype        TC Name                  Parameter 6

        193        5            HTO Conditioning                 -
                   6            MTO Conditioning                 -
                   7            CASE Conditioning         Position tolerance

        193        1              Ground Test            Highest valid tank no
                 9-16             Tank Rupture-          Highest valid tank no
                                Additional Science

        195        1             Parameter Update        Highest valid number
                                                             of parameters"
END_OBJECT                = COLUMN
```

4.3.2.4.3 Memory

4.3.2.4.3.1 Memory dump

Memory dump header label

```
OBJECT                    = PTOLEMY_MD_HEADER_TABLE
  NAME                    = "MD_HEADER"
  INTERCHANGE_FORMAT = ASCII
  ROWS                    = 1
  COLUMNS                 = 3
  ROW_BYTES               = 28
  DESCRIPTION             = "HEADER for Ptolemy Memory Dump"
 ^STRUCTURE               = "PTOLEMY_MD_HEADER.FMT"
END_OBJECT                = PTOLEMY_MD_HEADER_TABLE
```

The structure of the TABLE object is described in the file PTOLEMY_MD_HEADER.FMT as follows:

```
/*  Contents of format file "PTOLEMY_MD_HEADER.FMT" (Header Memory Dump)  */


OBJECT               = COLUMN
   NAME              = "TIME_CODE"
   DATA_TYPE         = CHARACTER
   START_BYTE        = 2
   BYTES             = 17
   DESCRIPTION       = "On board time represented as :
                        Reset number (integer starting at 1) / seconds.
                        Reset number 1 starts at 2003-01-01T00:00:00 UTC
                        The time resolution is 0.03125 s"
END_OBJECT           = COLUMN

OBJECT            = COLUMN
  NAME            = "UTC_TIME"
  DATA_TYPE       = TIME
  START_BYTE      = 21
  BYTES           = 23
  DESCRIPTION     = "This column represents the UTC Time in PDS standard format
                     YYYY-MM-DDThh:mm:ss.sss"
END_OBJECT        = COLUMN


OBJECT                     = COLUMN
   NAME                     = "MEMORY_TYPE"
   DATA_TYPE                = CHARACTER
   START_BYTE               = 46
   BYTES                    = 6
   DESCRIPTION              = " ID for memory type ;three possible values :
                                      PROM
                                      EEPROM
                                      RAM"
END_OBJECT                  = COLUMN

OBJECT                      = COLUMN
   NAME                     = "NBR_BLOCKS"
   DATA_TYPE                = ASCII_INTEGER
   START_BYTE               = 54
   BYTES                    = 2
   FORMAT                   = "I2"
   DESCRIPTION              = "Number of memory dumps blocks in the packet)"
END_OBJECT                  = COLUMN
```

Memory dump label

```
OBJECT                 = PTOLEMY_MD_TABLE
  NAME                 = "PTOLEMY_MD"
  INTERCHANGE_FORMAT = ASCII
  ROWS                 = 2
  COLUMNS              = 3
  ROW_BYTES            = 660
  DESCRIPTION          = " Ptolemy Memory Dump"
 ^STRUCTURE            = "PTOLEMY_MD.FMT"
END_OBJECT             = PTOLEMY_MD_TABLE
```

The structure of the TABLE object is described in the file PTOLEMY_MD.FMT as follows:

```
/*          Contents of format file  "PTOLEMY_MD.FMT"   (Memory Dump)    */

OBJECT                   = COLUMN
  NAME                   = "MEMORY_ADDRESS"
  DATA_TYPE              = CHARACTER
  START_BYTE             = 2
  BYTES                  = 8
  DESCRIPTION            = "32 bits start address of the memory dump block
                             (Hexadecimal format)"
 END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  NAME                   = "MEMORY_LENGTH"
  DATA_TYPE              = ASCII_INTEGER
  START_BYTE             = 12
  BYTES                  = 3
  FORMAT                 = "I3"
  DESCRIPTION            = "Length (in bytes) of the memory dump block
                             (32 words - of 2 bytes - maximum)"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
  NAME                   = "MEMORY_DUMP"
  DATA_TYPE              = CHARACTER
  START_BYTE             = 17
  BYTES                  = 159
  DESCRIPTION            = "Contents of the  memory block (Hexadecimal format)
                            Two consecutives blocks of 4 Hexadecimal characters
                            are separated by a space "
END_OBJECT               = COLUMN
```

4.3.2.4.3.2 Memory Checksum report

Memory checksum report header

```
OBJECT                 = PTOLEMY_MC_HEADER_TABLE
  NAME                 = "MC_HEADER"
  INTERCHANGE_FORMAT = ASCII
  ROWS                 = 1
  COLUMNS              = 3
  ROW_BYTES            = 27
  DESCRIPTION          = "HEADER for Ptolemy Checksum Report"
 ^STRUCTURE            = "PTOLEMY_MC_HEADER.FMT"
```

```
END_OBJECT            = PTOLEMY_MC_HEADER_TABLE
```

The structure of the TABLE object is described in the file PTOLEMY_MC_HEADER.FMT as follows:

```
/* Contents of format file "PTOLEMY_MC_HEADER.FMT" (Header Memory Checksum) */

OBJECT              = COLUMN
   NAME             = "TIME_CODE"
   DATA_TYPE        = CHARACTER
   START_BYTE       = 2
   BYTES            = 17
   DESCRIPTION      = "On board time represented as :
                       Reset number (integer starting at 1) / seconds.
                       Reset number 1 starts at 2003-01-01T00:00:00 UTC
                       The time resolution is 0.03125 s"
END_OBJE            = COLUMN

OBJECT           = COLUMN
  NAME           = "UTC_TIME"
  DATA_TYPE      = TIME
  START_BYTE     = 21
  BYTES          = 23
  DESCRIPTION    = "This column represents the UTC Time in PDS standard format
                    YYYY-MM-DDThh:mm:ss.sss"
END_OBJECT       = COLUMN

OBJECT                  = COLUMN
   NAME                  = "MEMORY_TYPE"
   DATA_TYPE             = CHARACTER
   START_BYTE            = 46
   BYTES                 = 6
   DESCRIPTION           = " ID for memory type ;three possible values :
                                PROM
                                EEPROM
                                RAM"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
   NAME                  = "NUMBER_OF_CHECKSUM"
   DATA_TYPE             = ASCII_INTEGER
   START_BYTE            = 54
   BYTES                 = 1
   FORMAT                = "I1"
   DESCRIPTION           = "Number of Checksum (maximum 5)"
END_OBJECT               = COLUMN
```

Memory checksum report table

```
OBJECT                = PTOLEMY_MC_TABLE
  NAME                = "PTOLEMY_MC"
  INTERCHANGE_FORMAT  = ASCII
  ROWS                = 3
  COLUMNS             = 4
  ROW_BYTES           = 28
  DESCRIPTION         = " Ptolemy Checksum Report"
 ^STRUCTURE           = "PTOLEMY_MC.FMT"
END_OBJECT            = PTOLEMY_MC_TABLE
```

The structure of the TABLE object is described in the file PTOLEMY_MC.FMT as follows:

```
/*    Contents of format file  "PTOLEMY_MC.FMT"  (Memory Checksum report)    */
```

```
OBJECT                  = COLUMN
   NAME                 = "MEMORY_PAGE"
   DATA_TYPE            = CHARACTER
   START_BYTE           = 2
   BYTES                = 4
   DESCRIPTION          = "Memory Page for Checksum (Hexadecimal Format)"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
   NAME                 = "MEMORY_ADDRESS"
   DATA_TYPE            = CHARACTER
   START_BYTE           = 9
   BYTES                = 4
   DESCRIPTION          = "Memory_Address for Checksum (Hexadecimal Format)"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
   NAME                 = "NUMBER_OF_WORDS "
   DATA_TYPE            = ASCII_INTEGER
   START_BYTE           = 15
   BYTES                = 5
   FORMAT               = "I5"
   DESCRIPTION          = "Number of words for Checksum"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
   NAME                 = "CHECKSUM_RESULT "
   DATA_TYPE            = CHARACTER
   START_BYTE           = 22
   BYTES                = 4
   DESCRIPTION          = "Checksum results for Checksum (Hexadecimal Format)"
END_OBJECT              = COLUMN
```

4.3.2.4.4 Event

```
OBJECT               = EV_TABLE
  NAME               = "PTOLEMY_EVENTS"
  INTERCHANGE_FORMAT = ASCII
  ROWS               = 2
  COLUMNS            = 3
  ROW_BYTES          = 134
  DESCRIPTION        = "PTOLEMY Events"
 ^STRUCTURE          = "PTOLEMY_EV.FMT"
END_OBJECT           = EV_TABLE
```

The structure of the TABLE object is described in the file PTOLEMY_EV.FMT as follows:

```
/*          Contents of format file  "PTOLEMY_EV.FMT"              */
/*      Ptolemy Event    (Normal Progress and Warning Anomalous)   */

OBJECT          = COLUMN
  NAME          = "TIME CODE"
  DATA_TYPE     = CHARACTER
  START_BYTE    = 2
  BYTES         = 17
  DESCRIPTION   = "On board time represented as :
                   Reset number (integer starting at 1) / seconds.
                   Reset number 1 starts at 2003-01-01T00:00:00 UTC
                   The time resolution is 0.03125 s"
```

```
END_OBJECT       = COLUMN

OBJECT          = COLUMN
  NAME          = "UTC_TIME"
  DATA_TYPE     = TIME
  START_BYTE    = 21
  BYTES         = 23
  DESCRIPTION   = "This column represents the UTC Time in PDS standard format
                   YYYY-MM-DDThh:mm:ss.sss"
END_OBJECT      = COLUMN

OBJECT                = COLUMN
  NAME                = "EVENT_ID"
  DATA_TYPE           = ASCII_INTEGER
  START_BYTE          = 45
  BYTES               = 5
  FORMAT              = "I5"
  DESCRIPTION         = "Each Ptolemy event has one 16 bits word ID
                          and a maximum of 22 words (16 bits) parameters
                          described below in EVENT_PARAMS field"
END_OBJECT            = COLUMN

 OBJECT                  = COLUMN
   NAME                  = "EVENT_PARAMS"
   DATA_TYPE             = CHARACTER
   START_BYTE            = 52
   BYTES                 = 109
   DESCRIPTION           = "twenty two 16 bits words in hexadecimal format
                             separated by a space :

         ---------------------   Normal Progress Events  ---------------------

     Event ID(decimal) :  55103

                    Event description : WGA memory check status as produced
                                        by WGA memory check Mode Event
                    Parameters :
                        3 words: Spacecraft time when the check was started
                        1 word : number of memory locations with DEU
                                 corruption;  Special values for this are :

               FFFF : All table start addresses are corrupt
               FFFE : All or all but one wave start/stop address
                      combinations are corrupt
               FFFD : All but 2 or more of table RAM addresses are corrupt
               FFFC : All but 7 or more wave RAM addresses are corrupt.

                      If none of the above values, the following parameters
                      are   also included:
                         - 1 word containing the number of locations
                           in the memory that are SEU corrupted
                         - 18 words or fewer containing a part of the
                           WGA Error Memory Map (this is 192 words long)
                           Each 2 bit field represents the state
                           of a memory location :
                                0 : Error free
                                1 : SEU corrupted
                                2 : DEU corrupted
                      11 of these packets make up a WGA memory report.

     Event ID(decimal) :   55107
```

```
        Event description : Mode Execution Completed
                            memory check Mode Event
        Parameters : 1 word containing the operating mode
                     just completed

Event ID(decimal) :    55101

        Event description : Ptolemy Power-on Start

        Parameters        : 1 word containing the operating
                            mode just completed

         1    (MSB) Startup Type = Start (AAh)
         1    (LSB) Startup Cause = Power-On (00H)
         2    DAC control register
         3    PWM control register
         4    Valve control register
         5    Critical functions control register
         6    Data bus test result lower RAM devices (1)
         7    Address bus test result lower RAM devices (1)
         8    Memory locations test result, first page
         9,10,11  Memory locations test result, remaining pages
         12   Data bus test result, upper RAM devices (1)
         13   Address bus test result, lower RAM devices (1)
         14,15,16,17  Memory locations test result,
                      upper RAM devices
         18       Upper RAM device
         18 (MSB)     Page 3 test results
         18 (15:14)       00 : all test passed
                          01 : failed memory locations test
                          10 : failed address bus test
                          11 : failed data bus test
                       Results for remaining pages as for page 3
         18 (13:08)  Lower RAM device : results as for upper RAM
         18 (LSB)    device
         19          Selected RAM code page
         20

Event ID(decimal) :    55005

        Event description : Operating Mode Selection

        Parameters :
                      1 :  Current Operating Mode
                      2 :  Selected Operating mode
                      3 :  Mode Selection TC parameter 1
                      4 :  Mode Selection TC parameter 2
                      5 :  Mode Selection TC parameter 3

Event ID(decimal) :    55010

        Event description : SD2 Backup RAM Received

        Parameters :
                      1 :  SD2 Status
                      2 :  SD2 Drill Depth
                      3 :  SD2 Carousel Position
                      4 :  SD2 Oven Number
Event ID(decimal) :    55011
```

Event description : Ptolemy Backup RAM received

Parameters :

1 : Carousel Use State
2 : RF Calibration Word
3 : Docking station motor upper position
4 : Docking station motor lower position
5 : Docking station undocked sensor value
6 : Docking station docked sensor value

Event ID(decimal) : 55013

Event description : RF Frequency Calibration Report

Parameters : RF calibration word

Event ID(decimal) : 55014

Event description : Docking Station Sensor Data

Parameters : 1-23 words of docking station potentiometer readings used for docking station calibration.
Unused (trailing) words filled with zeros

Event ID(decimal) : 55015

Event description : Docking Station Calibration Data

Parameters :

1 : Lowest sensor value
2 : Highest sensor value
3 : Docking station motor upper position
4 : Docking station motor lower position
5 : DAC Maximum value recorded during calibration
6 : ADC Maximum value recorded during calibration

(1) Set bit indicates bus failure for that line

--------------------- Anomalous Events ------------------------

Event ID(decimal) : 55101

Event description : Monitor Mode Event Timed out

Parameters : 6 byte field describing mode event that has timed out 1 word containing the sensor value at timeout

Event ID(decimal) : 55102

Event description : WGA communication error
Parameters : 6 byte field describing the mode event in which this occurred

Event ID(decimal) : 55104

Event description : Scan function in WGA does not match that written

Parameters : 6 byte field describing the mode event in which this occurred

Event ID(decimal) : 55105

Event description : HT did not ramp to required value within timeout period

Parameters : 6 byte field describing the mode event in which this occurred word containing the reading of the HT voltage sensor at timeout

Event ID(decimal) : 55106

Event description : Docking station failed to dock/undock within timeout period

Parameters :
1 : Last potentiometer value at timeout
2 : Target potentiometer value
3 : Tolerance on target potentiometer value

Event ID(decimal) : 55108

Event description : Parameters for a mode event are incorrect

Parameters :
1 word containing the current operating mode
1 word containing the line number of the current mode event in the mode event sequence up to 6 bytes describing the mode event in question

Event ID(decimal) : 55109

Event description : No RAM page available for Science Spectra storage

Parameters :
6 byte field describing the mode event in which this occurred

Event ID(decimal) : 55110

Event description : Spectra storage data page is full

Parameters :
6 byte field describing the mode event in which this occurred

Event ID(decimal) : 55111

Event description : Science data packets buffer is full

```
        Parameters :
                       6 byte field describing the mode event
                       in which this occurred


Event ID(decimal) :  55112

        Event description : No RAM page available for Science
                            data packet storage
        Parameters :
                       6 byte field describing the mode event
                       in which this occurred

Event ID(decimal) :  55002

        Event description : Ptolemy Failure

        Parameters :
                       1 (MSB) : Startup Type = Restart (55H)
                       1 (LSB) : Startup Cause = Failure (20H)
                       2 :  DAC control register
                       3 :  PWM control register
                       4 :  Valve control register
                       5 :  Critical functions control register


Event ID(decimal) :  55003

        Event description : Ptolemy Timeout

        Parameters :
                       1 (MSB) : Startup Type = Restart (55H)
                       1 (LSB) : Startup Cause = Timeout (04H)
                       2  : DAC control register
                       3  : PWM control register
                       4  : Valve control register
                       5  : Critical functions control register
                       6  : DPR (Data page register)
                       7  : UPR (User page register)
                       8  : UBR (User base register)
                       9  : SPR (Stack pointer register)
                       10 : SVR (Stack overflow limits register
                       11 : IVR  (Interrupt vector register)
                       12 : IBC  (Interrupt base/control register)
                       12 : IMR (Interrupt mask register)
                       14 : CR  (Configuration register)
                       15-23 : first 9 words from return stack


Event ID(decimal) :  55004

       Event description : RSST checksum failure

       Parameters :
                    1-22 : First 22 words of the Receive
                           Service System Status command Message
                    23   : Calculated checksum

Event ID(decimal) :  55006
```

```
                 Event description : Memory check failure

                 Parameters :
                                1 :  Start address of memory test
                                2 :  End address of memory test
                                3 :  Checksum accumulated during memory test
                                4 :  Checksum expected for memory test

     Event ID(decimal) :  55007

                 Event description : Safe limit violation

                 Parameters :
                                1 :  TM channel
                                2 :  Value from ADC
                                3 :  Upper safe limit for this channel
                                4 :  Lower safe limit for this channel


     Event ID(decimal) :  55008

                 Event description : Operating Limit Excursion
                 Parameters :
                                1 :  TM channel
                                2 :  Value from ADC
                                3 :  Upper operating  limit for this channel
                                4 :  Lower operating  limit for this channel


     Event ID(decimal) :  55009

                 Event description : Operating Limit Return
                 Parameters :
                                1 :  TM channel
                                2 :  Value from ADC
                                3 :  Upper operating  limit for this channel
                                4 :  Lower operating  limit for this channel"
 END_OBJECT             = COLUMN
```

4.3.2.4.5 Auxiliary

```
OBJECT                 = AUX_TABLE
  NAME                 = "AUXILIARY"
  INTERCHANGE_FORMAT = ASCII
  ROWS                 = 2
  COLUMNS              = 4
  ROW_BYTES            = 45
  DESCRIPTION          = "PTOLEMY Auxiliary data"
 ^STRUCTURE            = "PTOLEMY_AX2.FMT"
END_OBJECT             = AUX_TABLE
```

The structure of the TABLE object is described in the file PTOLEMY_AX2.FMT as follows:

```
/* Contents of format file  "PTOLEMY_AX2.FMT" (Uncalibrated Auxiliary Data) */

OBJECT                    = COLUMN
   NAME                   = "LOBT"
   DATA_TYPE              = CHARACTER
   START_BYTE             = 2
   BYTES                  = 17
```

```
   DESCRIPTION            = "Date of collection in lander On Board Time ;
                             LOBT IS REPRESENTED AS :
                             Reset number (integer starting at 1) / seconds.
                             Reset number 1 starts at 2003-01-01T00:00:00 UTC
                             The time resolution is 0.03125 s"
 END_OBJECT               = COLUMN

OBJECT                    = COLUMN
   NAME                   = "UTC"
   DATA_TYPE              = TIME
   START_BYTE             = 21
   BYTES                  = 23
   DESCRIPTION            = "Date of collection in On-Ground time (UTC)
                             Format : YYYY-MM-DDThh:mm:ss.sss"
 END_OBJECT               = COLUMN

OBJECT                    = COLUMN
   NAME                   = "CHANNEL_ID"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 45
   BYTES                  = 3
   FORMAT                 = "I3"
   DESCRIPTION            = "Identifier for analogue channel with the
                             following meaning (Id first):
                             00  Thermocouple Reactor R1
                             01  Thermocouple Reactor R2
                             02  Thermocouple Reactor R4
                             03  Thermocouple Reactor R5
                             04  Thermocouple Reactor R6
                             05  Thermocouple Reactor R7
                             06  Thermocouple Reactor R8
                             07  Thermocouple Reactor R9
                             08  Thermocouple Reactor R13
                             09  Thermocouple Reactor R15
                             10  L-Valve Thermocouple Lv1
                             11  L-Valve Thermocouple Lv2
                             12  NOT USED
                             13  NOT USED
                             14  L-Valve Thermocouple Lv5
                             15  L-Valve Thermocouple Lv6
                             16  L-Valve Thermocouple Lv7
                             17  Gc Heater Thermocouple
                             18  Manifold1 Heater Thermocouple
                             19  Manifold2 Heater Thermocouple
                             20  Ion Trap Heater Thermocouple
                             21  Sample Oven Heater Thermocouple
                             22  Transfer Pipe Heater Thermocouple
                             23  Pressure gauge G1
                             24  Pressure gauge G2
                             25  Pressure gauge G3
                             26  Pressure gauge G4
                             27  Pressure gauge G5
                             28  Thermocouple Reactor R14
                             29-31  NOT USED
                             32-47  Reference Junction Thermometer (Ad590)
                             48-63  Docking Station Position
                             64-79  Nanotip Drive Voltage
                             80-95  Detector Voltage (Ht)
                             69-111  5v Voltage Monitor
                             112-127  28v Voltage Monitor
                             128-143  5v Current Monitor
```

```
                           144-159  28v Current Monitor
                           160-175  Rf Calibration
                           176-255  NOT USED"

 END_OBJECT             = COLUMN

OBJECT                  = COLUMN
   NAME                 = "ADC_READING"
   DATA_TYPE            = ASCII_REAL
   START_BYTE           = 49
   BYTES                = 8
   UNIT                 = VOLT
   FORMAT               = "F8.4"
   DESCRIPTION          = " 16 bit ADC reading of channel "
 END_OBJECT             = COLUMN
```

4.3.2.4.6 Summary Spectrum

Summary spectrum header table:

```
OBJECT               = SPECTRUM_HEADER_TABLE
  NAME               = "SPECTRUM_HEADER"
  INTERCHANGE_FORMAT = ASCII
  ROWS               = 1
  COLUMNS            = 8
  ROW_BYTES          = 103
  DESCRIPTION        = "HEADER for Ptolemy Spectrum (complete or summary)"
 ^STRUCTURE          = "PTOLEMY_SPECTRUM_HEADER.FMT"
END_OBJECT           = SPECTRUM_HEADER_TABLE
```

The structure of the TABLE object is described in the file PTOLEMY_SPECTRUM_HEADER.FMT as follows:

```
/* Contents of format file "PTOLEMY_SPECTRUM_HEADER.FMT" (Header Spectrum) */

OBJECT                  = COLUMN
   NAME                 = "FIRST_BIN_LOBT"
   DATA_TYPE            = CHARACTER
   START_BYTE           = 2
   BYTES                = 17
   DESCRIPTION          = "Time of the first bin in the spectrum in lander On
                           Board Time ;  LOBT IS REPRESENTED AS :
                           Reset number (integer starting at 1) / seconds.
                           Reset number 1 starts at 2003-01-01T00:00:00 UTC
                           The time resolution is 0.03125 s"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
   NAME                 = "UTC"
   DATA_TYPE            = TIME
   START_BYTE           = 21
   BYTES                = 23
   DESCRIPTION          = "UTC of first bin of the spectrum
                           Format : YYYY-MM-DDThh:mm:ss.sss"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
   NAME                 = "DEU_FLAG"
   DATA_TYPE            = CHARACTER
   START_BYTE           = 46
   BYTES                = 28
```

```
   DESCRIPTION          = "Double Event Upset termination flag
                           This field take the values:
                           no DEU
                           spectrum terminated by a DEU"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
   NAME                 = "RICA_FIFO_FULL"
   DATA_TYPE            = CHARACTER
   START_BYTE           = 77
   BYTES                = 3
   DESCRIPTION          = "Tells if the RICA FIFO was full at least once
                           during spectrum collection (if yes, some
                           measurement data may have been lost)
                           This field takes the values:
                           no
                           yes"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
   NAME                 = "NBR_BIN_OVERFLOWS"
   DATA_TYPE            = ASCII_INTEGER
   START_BYTE           = 82
   BYTES                = 4
   FORMAT               = "I4"
   DESCRIPTION          = "Number of bin overflows in RICA for
                           this spectrum"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
   NAME                 = "FIRST_BIN_OVERFLOW"
   DATA_TYPE            = ASCII_INTEGER
   START_BYTE           = 87
   BYTES                = 4
   FORMAT               = "I4"
   DESCRIPTION          = "Bin number for first bin overflow
                           for this spectrum"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
   NAME                 = "NBR_BIN_DEU"
   DATA_TYPE            = ASCII_INTEGER
   START_BYTE           = 92
   BYTES                = 4
   FORMAT               = "I4"
   DESCRIPTION          = "Number of bins corrupted by DEUs"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
   NAME                 = "FIRST_BIN_DEU"
   DATA_TYPE            = ASCII_INTEGER
   START_BYTE           = 97
   BYTES                = 4
   FORMAT               = "I4"
   DESCRIPTION          = "First bin in spectrum that suffered a DEU"
END_OBJECT              = COLUMN
```

Summary spectrum table:

```
OBJECT                 = SPECTRUM_S1_TABLE
  NAME                 = "SPECTRUM_S1"
  INTERCHANGE_FORMAT = ASCII
  ROWS                 = 12
  COLUMNS              = 2
  ROW_BYTES            = 17
  DESCRIPTION          = " Ptolemy Summary Spectrum"
 ^STRUCTURE            = "PTOLEMY_S1.FMT"
END_OBJECT             = SPECTRUM_S1_TABLE
```

The structure of the TABLE object is described in the file PTOLEMY_S1.FMT as follows:

```
/* Contents of format file "PTOLEMY_S1.FMT" (Uncalibrated Summary Spectrum) */

OBJECT                    = COLUMN
   NAME                   = "BIN_NBR"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 1
   BYTES                  = 4
   FORMAT                 = "I4"
   DESCRIPTION            = "Bin number of this bin"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN
   NAME                   = "BIN_CNT"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 6
   BYTES                  = 10
   FORMAT                 = "I10"
   DESCRIPTION            = "Counts for this bin"
END_OBJECT                = COLUMN
```

4.3.2.4.7 Complete Spectrum

The complete spectrum header table is the same as the summary spectrum header table described in §4.3.2.4.6

Complete spectrum table:

```
OBJECT                 = SPECTRUM_S2_TABLE
  NAME                 = "SPECTRUM_S2"
  INTERCHANGE_FORMAT = ASCII
  ROWS                 = 13
  COLUMNS              = 2
  ROW_BYTES            = 17
  DESCRIPTION          = " Ptolemy Summary Spectrum"
 ^STRUCTURE            = "PTOLEMY_S2.FMT"
END_OBJECT             = SPECTRUM_S2_TABLE
```

The structure of the TABLE object is described in the file PTOLEMY_S2.FMT as follows:

```
/*Contents of format file "PTOLEMY_S2.FMT" (Uncalibrated Complete Spectrum)*/

OBJECT                    = COLUMN
   NAME                   = "BIN_NBR"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 1
   BYTES                  = 4
```

```
   FORMAT                  = "I4"
   DESCRIPTION             = "Bin number of this bin"
END_OBJECT                 = COLUMN

OBJECT                     = COLUMN
   NAME                    = "BIN_CNT"
   DATA_TYPE               = ASCII_INTEGER
   START_BYTE              = 6
   BYTES                   = 10
   FORMAT                  = "I10"
   DESCRIPTION             = "Counts for this bin"
END_OBJECT                 = COLUMN
```

4.3.2.5 Description of Instrument

A description of the instrument is given in AD4. A brief overview is in the INST.CAT catalog file as well as this document

4.3.2.5.1 Sample Tracking Specific Keywords

These keywords has been defined to track the cometary material drilled and distributed by SD2 system. They are N/A during the cruise.

ROSETTA : SD2_OVEN_FILLING
- **Type:** character
- **Standard values:** "YES" or "NO"
- **Description:** filling conditions of the pictured oven as deduced from the SD2 data

ROSETTA : SD2_DRILL_DEPTH
- **Type**: real, unit mm
- **Standard values**: refer to SD2 data (or missing value)
- **Description:** depth of the drilling process as deduced from the SD2 data

ROSETTA : SD2_OVEN_NUMBER
- **Type:** integer
- **Standard values:** 1 to 26
- **Description:** number of the oven filled by the SD2 system

ROSETTA : SD2_OVEN_TYPE
- **Type:** character
- **Standard values**: "MTO" or "HTO"
- **Description:** type of the oven filled by the SD2 system (Medium Temperature Oven or High Temperature Oven)

ROSETTA : SAMPLE_TAPPING
- **Type:** character
- **Standard values:** "YES" or "NO" or "N/A"
- **Description:** tapping conditions of the pictured oven as deduced from the PTOLEMY or COSAC data

ROSETTA : SAMPLE_NUMBER
- **Type:** integer
- **Standard values**: 1, 2,…or missing value
- **Description:** number of number of sample (1 for the first sample of the mission and n+1 for the following ones)

ROSETTA : SAMPLE_VOLUME
- **Type:** real, mm3

- **Standard values**: from Volume Checker
- **Description:** amount of sample discharged into the oven from the Volume Checker data

4.3.3 Data Product Design of Level 3 Data

The Level 3 data product contains calibrated complete mass spectra with relevant information data and housekeeping data. The following data are included in the level 3 product:

- From science telemetry
  - Auxiliary data,
  - Mass Spectrum
- From housekeeping telemetry
  - Sensor
  - Event (Level 2)

4.3.3.1 File Characteristics Data Elements

The PDS file characteristic data elements for PTOLEMY level 3 products are:

```
RECORD_TYPE            = FIXED_LENGTH
RECORD_BYTES
FILE_RECORDS
PRODUCT_TYPE           = RDR
PROCESSING_LEVEL_ID    = 3
```

The values of keywords RECORD_BYTES and FILE_RECORDS depend on the data product type.

4.3.3.2 Data Object Pointers Identification Data Elements

The PTOLEMY level 3 data are organized as ASCII tables. The data object pointers (^TABLE) reference TAB files.

4.3.3.3 Instrument and Detector Descriptive Data Elements

```
INSTRUMENT_HOST_NAME      = "ROSETTA LANDER"
INSTRUMENT_HOST_ID        = RL
INSTRUMENT_ID             = PTOLEMY
INSTRUMENT_NAME           = "PTOLEMY - GAS CHROMATOGRAPH ISOTOPE RATIO MASS
                             SPECTROMETER"
INSTRUMENT_TYPE           = "GAS ISOTOPE RATIO ANALYSER"
INSTRUMENT_MODE_ID        = "N/A"
INSTRUMENT_MODE_DESC      = "N/A"
```

Data Object Definition

4.3.3.3.1 Event (Level 2)

See § 4.3.2.4.4

4.3.3.3.2 Sensor (housekeeping) calibrated data

```
OBJECT               = SENSOR_CAL_TABLE
  NAME               = "SENSOR_CAL"
  INTERCHANGE_FORMAT = ASCII
  ROWS               = 2
  COLUMNS            = 44
```

```
  ROW_BYTES            = 226
  DESCRIPTION          = "Calibrated HK sensor data"
 ^STRUCTURE            = "PTOLEMY_SN3.FMT"
END_OBJECT             = SENSOR_CAL_TABLE
```

The structure of the TABLE object is described in the file PTOLEMY_SN3.FMT as follows:

```
/*    Contents of format file  "PTOLEMY_SN3.FMT"   (Calibrated HK SENSOR)  */

OBJECT                    = COLUMN
   NAME                   = "TIME_CODE"
   DATA_TYPE              = CHARACTER
   START_BYTE             = 2
   BYTES                  = 17
   DESCRIPTION            = "Time code at which sensor acquisition initiated
                             in lander On Board Time; LOBT IS REPRESENTED AS :
                             Reset number (integer starting at 1) / seconds.
                             Reset number 1 starts at 2003-01-01T00:00:00 UTC
                             The time resolution is 0.03125 s"
 END_OBJECT               = COLUMN

OBJECT                    = COLUMN
   NAME                   = "UTC"
   DATA_TYPE              = TIME
   START_BYTE             = 21
   BYTES                  = 23
   DESCRIPTION            = "Date at which sensor acquisition initiated
                             in On-Ground time (UTC)
                             Format : YYYY-MM-DDThh:mm:ss.sss"
 END_OBJECT               = COLUMN

 OBJECT                   = COLUMN
   NAME                   = "SENSOR REPORT_TYPE"
   DATA_TYPE              = CHARACTER
   START_BYTE             = 46
   BYTES                  = 7
   DESCRIPTION            = "The type of the sensor report.
                             Can take the values:
                                Concise
                                Summary"
 END_OBJECT               = COLUMN

OBJECT                    = COLUMN
   NAME                   = "OP_MODE"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 55
   BYTES                  = 3
   FORMAT                 = "I3"
   DESCRIPTION            = "Ptolemy operating mode"
 END_OBJECT               = COLUMN

OBJECT                    = COLUMN
   NAME                   = "TC_MODE"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 59
   BYTES                  = 3
   FORMAT                 = "I3"
   DESCRIPTION            = "TC mode (zero in safe mode)"
```

```
 END_OBJECT                = COLUMN

OBJECT                     = COLUMN
   NAME                    = "LINE_NUMBER"
   DATA_TYPE               = ASCII_INTEGER
   START_BYTE              = 63
   BYTES                   = 6
   FORMAT                  = "I6"
   DESCRIPTION             = " Line number for current mode event (zero in safe
                              mode)"
 END_OBJECT                = COLUMN

OBJECT                     = COLUMN
   NAME                    = "ST_TC_RQD"
   DATA_TYPE               = ASCII_INTEGER
   START_BYTE              = 70
   BYTES                   = 6
   FORMAT                  = "I6"
   DESCRIPTION             = "Number of stored TCs requested (zero in safe mode)"
 END_OBJECT                = COLUMN

OBJECT                     = COLUMN
   NAME                    = "ST_TC_RCVD"
   DATA_TYPE               = ASCII_INTEGER
   START_BYTE              = 77
   BYTES                   = 6
   FORMAT                  = "I6"
   DESCRIPTION             = " Number of stored TCs received (zero in safe mode)"
 END_OBJECT                = COLUMN

OBJECT                     = COLUMN
   NAME                    = "TC_TYPE"
   DATA_TYPE               = ASCII_INTEGER
   START_BYTE              = 84
   BYTES                   = 3
   FORMAT                  = "I3"
   DESCRIPTION             = "Type of last received TC (zero if no TC received)"
 END_OBJECT                = COLUMN

OBJECT                     = COLUMN
   NAME                    = "TC_SUBTYPE"
   DATA_TYPE               = ASCII_INTEGER
   START_BYTE              = 88
   BYTES                   = 3
   FORMAT                  = "I3"
   DESCRIPTION             = " Subtype of last TC received (zero if no TC
                              received)"
 END_OBJECT                = COLUMN

OBJECT                     = COLUMN
   NAME                    = "TR1"
   DATA_TYPE               = ASCII_INTEGER
   START_BYTE              = 92
   BYTES                   = 4
   UNIT                    = KELVIN
   FORMAT                  = "I4"
   DESCRIPTION             = " reactor R1 thermocouple reading "
 END_OBJECT                = COLUMN

OBJECT                     = COLUMN
   NAME                    = "TR2"
```

```
   DATA_TYPE            = ASCII_INTEGER
   START_BYTE           = 97
   BYTES                = 4
   UNIT                 = KELVIN
   FORMAT               = "I4"
   DESCRIPTION          = " reactor R2 thermocouple reading "
 END_OBJECT             = COLUMN

OBJECT                  = COLUMN
   NAME                 = "TR4"
   DATA_TYPE            = ASCII_INTEGER
   START_BYTE           = 102
   BYTES                = 4
   UNIT                 = KELVIN
   FORMAT               = "I4"
   DESCRIPTION          = " reactor R4 thermocouple reading "
 END_OBJECT             = COLUMN

OBJECT                  = COLUMN
   NAME                 = "TR5"
   DATA_TYPE            = ASCII_INTEGER
   START_BYTE           = 107
   BYTES                = 4
   UNIT                 = KELVIN
   FORMAT               = "I4"
   DESCRIPTION          = " reactor R5 thermocouple reading "
 END_OBJECT             = COLUMN

OBJECT                  = COLUMN
   NAME                 = "TR6"
   DATA_TYPE            = ASCII_INTEGER
   START_BYTE           = 112
   BYTES                = 4
   UNIT                 = KELVIN
   FORMAT               = "I4"
   DESCRIPTION          = " reactor R6 thermocouple reading "
 END_OBJECT             = COLUMN

OBJECT                  = COLUMN
   NAME                 = "TR7"
   DATA_TYPE            = ASCII_INTEGER
   START_BYTE           = 117
   BYTES                = 4
   UNIT                 = KELVIN
   FORMAT               = "I4"
   DESCRIPTION          = " reactor R7 thermocouple reading "
 END_OBJECT             = COLUMN

OBJECT                  = COLUMN
   NAME                 = "TR8"
   DATA_TYPE            = ASCII_INTEGER
   START_BYTE           = 122
   BYTES                = 4
   UNIT                 = KELVIN
   DESCRIPTION          = " reactor R8 thermocouple reading "
   FORMAT               = "I4"
 END_OBJECT             = COLUMN

OBJECT                  = COLUMN
   NAME                 = "TR9"
   DATA_TYPE            = ASCII_INTEGER
```

```
   START_BYTE           = 127
   BYTES                = 4
   UNIT                 = KELVIN
   FORMAT               = "I4"
   DESCRIPTION          = " reactor R9 thermocouple reading "
 END_OBJECT             = COLUMN

OBJECT                  = COLUMN
   NAME                 = "TR13"
   DATA_TYPE            = ASCII_INTEGER
   START_BYTE           = 132
   BYTES                = 4
   UNIT                 = KELVIN
   FORMAT               = "I4"
   DESCRIPTION          = " reactor R13 thermocouple reading "
 END_OBJECT             = COLUMN

OBJECT                  = COLUMN
   NAME                 = "TR15"
   DATA_TYPE            = ASCII_INTEGER
   START_BYTE           = 137
   BYTES                = 4
   UNIT                 = KELVIN
   FORMAT               = "I4"
   DESCRIPTION          = " reactor R15 thermocouple reading "
 END_OBJECT             = COLUMN

OBJECT                  = COLUMN
   NAME                 = "TLV1"
   DATA_TYPE            = ASCII_INTEGER
   START_BYTE           = 142
   BYTES                = 3
   UNIT                 = KELVIN
   FORMAT               = "I3"
   DESCRIPTION          = " Lindau valve 1 thermocouple reading "
 END_OBJECT             = COLUMN

OBJECT                  = COLUMN
   NAME                 = "TLV2"
   DATA_TYPE            = ASCII_INTEGER
   START_BYTE           = 146
   BYTES                = 3
   UNIT                 = KELVIN
   FORMAT               = "I3"
   DESCRIPTION          = " Lindau valve 2 thermocouple reading "
 END_OBJECT             = COLUMN

OBJECT                  = COLUMN
   NAME                 = "TLV5"
   DATA_TYPE            = ASCII_INTEGER
   START_BYTE           = 150
   BYTES                = 3
   UNIT                 = KELVIN
   FORMAT               = "I3"
   DESCRIPTION          = " Lindau valve 5 thermocouple reading "
 END_OBJECT             = COLUMN

OBJECT                  = COLUMN
   NAME                 = "TLV6"
   DATA_TYPE            = ASCII_INTEGER
   START_BYTE           = 154
```

```
   BYTES                    = 3
   UNIT                     = KELVIN
   FORMAT                   = "I3"
   DESCRIPTION              = " Lindau valve 6 thermocouple reading "
END_OBJECT                  = COLUMN

OBJECT                      = COLUMN
   NAME                     = "TLV7"
   DATA_TYPE                = ASCII_INTEGER
   START_BYTE               = 158
   BYTES                    = 3
   UNIT                     = KELVIN
   FORMAT                   = "I3"
   DESCRIPTION              = " Lindau valve 7 thermocouple reading "
END_OBJECT                  = COLUMN

OBJECT                      = COLUMN
   NAME                     = "TGC"
   DATA_TYPE                = ASCII_INTEGER
   START_BYTE               = 162
   BYTES                    = 3
   UNIT                     = KELVIN
   FORMAT                   = "I3"
   DESCRIPTION              = "Thermocouple reading for Gas Chromatograph columns"
END_OBJECT                  = COLUMN

OBJECT                      = COLUMN
   NAME                     = "TENCA"
   DATA_TYPE                = ASCII_INTEGER
   START_BYTE               = 166
   BYTES                    = 3
   UNIT                     = KELVIN
   FORMAT                   = "I3"
   DESCRIPTION              = " Thermal Enclosure A thermocouple reading "
 END_OBJECT                 = COLUMN

OBJECT                      = COLUMN
   NAME                     = "TENCB"
   DATA_TYPE                = ASCII_INTEGER
   START_BYTE               = 170
   BYTES                    = 3
   UNIT                     = KELVIN
   FORMAT                   = "I3"
   DESCRIPTION              = "Thermal Enclosure B thermocouple reading "
END_OBJECT                  = COLUMN

OBJECT                      = COLUMN
   NAME                     = "TION"
   DATA_TYPE                = ASCII_INTEGER
   START_BYTE               = 174
   BYTES                    = 3
   UNIT                     = KELVIN
   FORMAT                   = "I3"
   DESCRIPTION              = "Ion Trap thermocouple reading "
 END_OBJECT                 = COLUMN

OBJECT                      = COLUMN
   NAME                     = "TOVEN"
   DATA_TYPE                = ASCII_INTEGER
   START_BYTE               = 178
   BYTES                    = 3
```

```
   UNIT                     = KELVIN
   FORMAT                   = "I3"
   DESCRIPTION              = " Oven thermocouple reading "
 END_OBJECT                 = COLUMN

OBJECT                      = COLUMN
   NAME                     = "TPIPE"
   DATA_TYPE                = ASCII_INTEGER
   START_BYTE               = 182
   BYTES                    = 3
   UNIT                     = KELVIN
   FORMAT                   = "I3"
   DESCRIPTION              = " Pipe heater thermocouple reading "
 END_OBJECT                 = COLUMN

OBJECT                      = COLUMN
   NAME                     = "PG1"
   DATA_TYPE                = ASCII_INTEGER
   START_BYTE               = 186
   BYTES                    = 6
   UNIT                     = PASCAL
   FORMAT                   = "I6"
   DESCRIPTION              = "Pressure of Helium as indicated by sensor G1"
 END_OBJECT                 = COLUMN

OBJECT                      = COLUMN
   NAME                     = "PG2"
   DATA_TYPE                = ASCII_INTEGER
   START_BYTE               = 193
   BYTES                    = 6
   UNIT                     = PASCAL
   FORMAT                   = "I6"
   DESCRIPTION              = "Pressure of Helium as indicated by sensor G2"
 END_OBJECT                 = COLUMN

OBJECT                      = COLUMN
   NAME                     = "PG3"
   DATA_TYPE                = ASCII_INTEGER
   START_BYTE               = 200
   BYTES                    = 6
   UNIT                     = PASCAL
   FORMAT                   = "I6"
   DESCRIPTION              = " Pressure of Helium as indicated by sensor G3 "
 END_OBJECT                 = COLUMN

OBJECT                      = COLUMN
   NAME                     = "PG4"
   DATA_TYPE                = ASCII_INTEGER
   START_BYTE               = 207
   BYTES                    = 6
   UNIT                     = PASCAL
   FORMAT                   = "I6"
   DESCRIPTION              = " Pressure of Helium as indicated by sensor G4 "
 END_OBJECT                 = COLUMN

OBJECT                      = COLUMN
   NAME                     = "PG5"
   DATA_TYPE                = ASCII_INTEGER
   START_BYTE               = 214
   BYTES                    = 6
   UNIT                     = PASCAL
```

```
   FORMAT                  = "I6"
   DESCRIPTION             = " Pressure of Helium as indicated by sensor G5 "
 END_OBJECT                = COLUMN

OBJECT                     = COLUMN
   NAME                    = "TR14"
   DATA_TYPE               = ASCII_INTEGER
   START_BYTE              = 221
   BYTES                   = 4
   UNIT                    = KELVIN
   FORMAT                  = "I4"
   DESCRIPTION             = " Reactor R14 thermocouple reading "
 END_OBJECT                = COLUMN

OBJECT                     = COLUMN
   NAME                    = "AD590"
   DATA_TYPE               = ASCII_INTEGER
   START_BYTE              = 226
   BYTES                   = 3
   UNIT                    = KELVIN
   FORMAT                  = "I3"
   DESCRIPTION             = " Reference junction thermometer (AD590) "
 END_OBJECT                = COLUMN

OBJECT                     = COLUMN
   NAME                    = "VDS"
   DATA_TYPE               = ASCII_REAL
   START_BYTE              = 230
   BYTES                   = 5
   UNIT                    = MILLIMETER
   FORMAT                  = "F5.2"
   DESCRIPTION             = " Docking station potentiometer "
 END_OBJECT                = COLUMN

OBJECT                     = COLUMN
   NAME                    = "INT"
   DATA_TYPE               = ASCII_INTEGER
   START_BYTE              = 236
   BYTES                   = 4
   UNIT                    = MICROAMPERE
   FORMAT                  = "I4"
   DESCRIPTION             = " Nanotip drive current "
END_OBJECT                 = COLUMN

OBJECT                     = COLUMN
   NAME                    = "VDET"
   DATA_TYPE               = ASCII_INTEGER
   START_BYTE              = 241
   BYTES                   = 4
   UNIT                    = VOLT
   FORMAT                  = "I4"
   DESCRIPTION             = " Detector Bias "
END_OBJECT                 = COLUMN

OBJECT                     = COLUMN
   NAME                    = "V5V"
   DATA_TYPE               = ASCII_REAL
   START_BYTE              = 246
   BYTES                   = 4
   UNIT                    = VOLT
   FORMAT                  = "F4.2"
```

```
   DESCRIPTION           = " 5V voltage monitor "
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
   NAME                  = "V28V"
   DATA_TYPE             = ASCII_REAL
   START_BYTE            = 251
   BYTES                 = 4
   UNIT                  = VOLT
   FORMAT                = "F4.1"
   DESCRIPTION           = " 28V voltage monitor "
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
   NAME                  = "I5V"
   DATA_TYPE             = ASCII_INTEGER
   START_BYTE            = 256
   BYTES                 = 4
   UNIT                  = MILLIAMPERE
   FORMAT                = "I4"
   DESCRIPTION           = " Current monitored on 5 volt rail "
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
   NAME                  = "I28V"
   DATA_TYPE             = ASCII_INTEGER
   START_BYTE            = 261
   BYTES                 = 4
   UNIT                  = MILLIAMPERE
   FORMAT                = "I4"
   DESCRIPTION           = " Current monitored on 28V bus "
END_OBJECT               = COLUMN

OBJECT                   = COLUMN
   NAME                  = "VRFCAL"
   DATA_TYPE             = ASCII_INTEGER
   START_BYTE            = 266
   BYTES                 = 3
   UNIT                  = VOLT
   FORMAT                = "I3"
   DESCRIPTION           = " RF calibration "
END_OBJECT               = COLUMN
```

4.3.3.3.3 Auxiliary

The calibrated auxiliary data files are organized by channel ID, i.e. there is one file per channel ID. The calibrated auxiliary data are described by TABLE objects with four columns, Lander on board time, UTC, channel ID and channel reading. The first two columns are the same for all channels:

```
OBJECT                   = COLUMN
   NAME                  = "LOBT"
   DATA_TYPE             = CHARACTER
   START_BYTE            = 2
   BYTES                 = 17
   DESCRIPTION           = "Date of collection in lander On Board Time
                            LOBT IS REPRESENTED AS :
                            Reset number (integer starting at 1) / seconds.
                            Reset number 1 starts at 2003-01-01T00:00:00 UTC
                            The time resolution is 0.03125 s"
END_OBJECT               = COLUMN
```

```
OBJECT                    = COLUMN
   NAME                   = "UTC"
   DATA_TYPE              = TIME
   START_BYTE             = 21
   BYTES                  = 23
   DESCRIPTION            = "Date of collection in On-Ground time (UTC)
                             Format : YYYY-MM-DDThh:mm:ss.sss"
END_OBJECT                = COLUMN
```

The last two columns (and consequently the possible types of labels) are listed below for each channel ID:

```
/* Contents of format file "PTOLEMY_AX3.TXT"(Calibrated Auxiliary Data) */

/* --------------------   Thermocouple Reactor R1 ------------------  */

OBJECT                    = COLUMN
   NAME                   = "CHANNEL_00"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 45
   BYTES                  = 3
   FORMAT                 = "I3"
   DESCRIPTION            = "CHANNEL_00"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN"
   NAME                   = "TR1"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 49
   BYTES                  = 4
   UNIT                   = KELVIN
   FORMAT                 = "I4"
   DESCRIPTION            = "reactor R1 thermocouple reading "
END_OBJECT                = COLUMN

/* --------------------   Thermocouple Reactor R2 ------------------  */

OBJECT                    = COLUMN
   NAME                   = "CHANNEL_01"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 45
   BYTES                  = 3
   FORMAT                 = "I3"
   DESCRIPTION            = "CHANNEL_01"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN"
   NAME                   = "TR2"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 49
   BYTES                  = 4
   UNIT                   = KELVIN
   FORMAT                 = "I4"
   DESCRIPTION            = "reactor R2 thermocouple reading"
END_OBJECT                = COLUMN

/* --------------------   Thermocouple Reactor R4 ------------------  */

OBJECT                    = COLUMN
   NAME                   = "CHANNEL_02"
```

```
   DATA_TYPE                = ASCII_INTEGER
   START_BYTE               = 45
   BYTES                    = 3
   FORMAT                   = "I3"
   DESCRIPTION              = "CHANNEL_02"
END_OBJECT                  = COLUMN

OBJECT                      = COLUMN"
   NAME                     = "TR4"
   DATA_TYPE                = ASCII_INTEGER
   START_BYTE               = 49
   BYTES                    = 4
   UNIT                     = KELVIN
   FORMAT                   = "I4"
   DESCRIPTION              = "reactor R4 thermocouple reading"
END_OBJECT                  = COLUMN

/* --------------------   Thermocouple Reactor R5 ------------------  */

OBJECT                      = COLUMN
   NAME                     = "CHANNEL_03"
   DATA_TYPE                = ASCII_INTEGER
   START_BYTE               = 45
   BYTES                    = 3
   FORMAT                   = "I3"
   DESCRIPTION              = "CHANNEL_03"
END_OBJECT                  = COLUMN

OBJECT                      = COLUMN"
   NAME                     = "TR5"
   DATA_TYPE                = ASCII_INTEGER
   START_BYTE               = 49
   BYTES                    = 4
   UNIT                     = KELVIN
   FORMAT                   = "I4"
   DESCRIPTION              = "reactor R5 thermocouple reading"
END_OBJECT                  = COLUMN

/* --------------------   Thermocouple Reactor R6 ------------------  */

OBJECT                      = COLUMN
   NAME                     = "CHANNEL_04"
   DATA_TYPE                = ASCII_INTEGER
   START_BYTE               = 45
   BYTES                    = 3
   FORMAT                   = "I3"
   DESCRIPTION              = "CHANNEL_04"
END_OBJECT                  = COLUMN

OBJECT                      = COLUMN"
   NAME                     = "TR6"
   DATA_TYPE                = ASCII_INTEGER
   START_BYTE               = 49
   BYTES                    = 4
   UNIT                     = KELVIN
   FORMAT                   = "I4"
   DESCRIPTION              = "reactor R6 thermocouple reading"
END_OBJECT                  = COLUMN

/* --------------------   Thermocouple Reactor R7 ------------------  */
```

```
OBJECT                    = COLUMN
   NAME                   = "CHANNEL_05"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 45
   BYTES                  = 3
   FORMAT                 = "I3"
   DESCRIPTION            = "CHANNEL_05"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN"
   NAME                   = "TR7"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 49
   BYTES                  = 4
   UNIT                   = KELVIN
   FORMAT                 = "I4"
   DESCRIPTION            = "reactor R7 thermocouple reading"
END_OBJECT                = COLUMN

/* --------------------   Thermocouple Reactor R8 ------------------  */

OBJECT                    = COLUMN
   NAME                   = "CHANNEL_06"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 45
   BYTES                  = 3
   FORMAT                 = "I3"
   DESCRIPTION            = "CHANNEL_06"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN"
   NAME                   = "TR8"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 49
   BYTES                  = 4
   UNIT                   = KELVIN
   DESCRIPTION            = "reactor R8 thermocouple reading"
   FORMAT                 = "I4"
END_OBJECT                = COLUMN

/* --------------------   Thermocouple Reactor R9 ------------------  */

OBJECT                    = COLUMN
   NAME                   = "CHANNEL_07"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 45
   BYTES                  = 3
   FORMAT                 = "I3"
   DESCRIPTION            = "CHANNEL_07"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN"
   NAME                   = "TR9"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 49
   BYTES                  = 4
   UNIT                   = KELVIN
   FORMAT                 = "I4"
   DESCRIPTION            = "reactor R9 thermocouple reading"
END_OBJECT                = COLUMN
```

```
/* --------------------   Thermocouple Reactor R13 ------------------  */

OBJECT                  = COLUMN
   NAME                 = "CHANNEL_08"
   DATA_TYPE            = ASCII_INTEGER
   START_BYTE           = 45
   BYTES                = 3
   FORMAT               = "I3"
   DESCRIPTION          = "CHANNEL_08"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN"
   NAME                 = "TR13"
   DATA_TYPE            = ASCII_INTEGER
   START_BYTE           = 49
   BYTES                = 4
   UNIT                 = KELVIN
   FORMAT               = "I4"
   DESCRIPTION          = "reactor R13 thermocouple reading"
END_OBJECT              = COLUMN

/* --------------------   Thermocouple Reactor R15 ------------------  */

OBJECT                  = COLUMN
   NAME                 = "CHANNEL_09"
   DATA_TYPE            = ASCII_INTEGER
   START_BYTE           = 45
   BYTES                = 3
   FORMAT               = "I3"
   DESCRIPTION          = "CHANNEL_09"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN"
   NAME                 = "TR15"
   DATA_TYPE            = ASCII_INTEGER
   START_BYTE           = 49
   BYTES                = 4
   UNIT                 = KELVIN
   FORMAT               = "I4"
   DESCRIPTION          = "reactor R15 thermocouple reading"
END_OBJECT              = COLUMN

/* --------------------    L-Valve Thermocouple Lv1  ------------------  */

OBJECT                  = COLUMN
   NAME                 = "CHANNEL_10"
   DATA_TYPE            = ASCII_INTEGER
   START_BYTE           = 45
   BYTES                = 3
   FORMAT               = "I3"
   DESCRIPTION          = "CHANNEL_10"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN"
   NAME                 = "TLV1"
   DATA_TYPE            = ASCII_INTEGER
   START_BYTE           = 49
   BYTES                = 3
   UNIT                 = KELVIN
   FORMAT               = "I3"
   DESCRIPTION          = "Lindau valve 1 thermocouple reading"
```

```
END_OBJECT               = COLUMN

/* --------------------    L-Valve Thermocouple Lv2  ------------------  */

OBJECT                   = COLUMN
   NAME                  = "CHANNEL_11"
   DATA_TYPE             = ASCII_INTEGER
   START_BYTE            = 45
   BYTES                 = 3
   FORMAT                = "I3"
   DESCRIPTION           = "CHANNEL_11"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN"
   NAME                  = "TLV2"
   DATA_TYPE             = ASCII_INTEGER
   START_BYTE            = 49
   BYTES                 = 3
   UNIT                  = KELVIN
   FORMAT                = "I3"
   DESCRIPTION           = "Lindau valve 2 thermocouple reading"
END_OBJECT               = COLUMN

/* --------------------    L-Valve Thermocouple Lv5  ------------------  */

OBJECT                   = COLUMN
   NAME                  = "CHANNEL_14"
   DATA_TYPE             = ASCII_INTEGER
   START_BYTE            = 45
   BYTES                 = 3
   FORMAT                = "I3"
   DESCRIPTION           = "CHANNEL_14"
END_OBJECT               = COLUMN

OBJECT                   = COLUMN"
   NAME                  = "TLV5"
   DATA_TYPE             = ASCII_INTEGER
   START_BYTE            = 49
   BYTES                 = 3
   UNIT                  = KELVIN
   FORMAT                = "I3"
   DESCRIPTION           = "Lindau valve 5 thermocouple reading"
END_OBJECT               = COLUMN

/* --------------------    L-Valve Thermocouple Lv6  ------------------  */

OBJECT                   = COLUMN
   NAME                  = "CHANNEL_15"
   DATA_TYPE             = ASCII_INTEGER
   START_BYTE            = 45
   BYTES                 = 3
   FORMAT                = "I3"
   DESCRIPTION           = "CHANNEL_15"
END_OBJECT               = COLUMN
OBJECT                   = COLUMN"
   NAME                  = "TLV6"
   DATA_TYPE             = ASCII_INTEGER
   START_BYTE            = 49
   BYTES                 = 3
   UNIT                  = KELVIN
   FORMAT                = "I3"
```

```
   DESCRIPTION            = "Lindau valve 6 thermocouple reading"
END_OBJECT                = COLUMN

/* --------------------    L-Valve Thermocouple Lv7  ------------------  */

OBJECT                    = COLUMN
   NAME                   = "CHANNEL_16"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 45
   BYTES                  = 3
   FORMAT                 = "I3"
   DESCRIPTION            = "CHANNEL_16"
END_OBJECT                = COLUMN
OBJECT                    = COLUMN"
   NAME                   = "TLV7"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 49
   BYTES                  = 3
   UNIT                   = KELVIN
   FORMAT                 = "I3"
   DESCRIPTION            = "Lindau valve 7 thermocouple reading"
END_OBJECT                = COLUMN

/* --------------------    Gc Heater Thermocouple   ------------------  */

OBJECT                    = COLUMN
   NAME                   = "CHANNEL_17"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 45
   BYTES                  = 3
   FORMAT                 = "I3"
   DESCRIPTION            = "CHANNEL_17"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN"
   NAME                   = "TGC"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 49
   BYTES                  = 3
   UNIT                   = KELVIN
   FORMAT                 = "I3"
   DESCRIPTION            = "Thermocouple reading for Gas Chromatograph columns"
END_OBJECT                = COLUMN

/* -----------------    Manifold1 Heater Thermocouple   ---------------  */

OBJECT                    = COLUMN
   NAME                   = "CHANNEL_18"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 45
   BYTES                  = 3
   FORMAT                 = "I3"
   DESCRIPTION            = "CHANNEL_18"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN"
   NAME                   = "TENCA"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 49
   BYTES                  = 3
   UNIT                   = KELVIN
```

```
   FORMAT                  = "I3"
   DESCRIPTION             = "Thermal Enclosure A thermocouple reading"
END_OBJECT                 = COLUMN

/* ------------------    Manifold2 Heater Thermocouple   ----------------  */

OBJECT                     = COLUMN
   NAME                    = "CHANNEL_19"
   DATA_TYPE               = ASCII_INTEGER
   START_BYTE              = 45
   BYTES                   = 3
   FORMAT                  = "I3"
   DESCRIPTION             = "CHANNEL_19"
END_OBJECT                 = COLUMN

OBJECT                     = COLUMN"
   NAME                    = "TENCB"
   DATA_TYPE               = ASCII_INTEGER
   START_BYTE              = 49
   BYTES                   = 3
   UNIT                    = KELVIN
   FORMAT                  = "I3"
   DESCRIPTION             = "Thermal Enclosure B thermocouple reading"
END_OBJECT                 = COLUMN

/* -----------------   Ion Trap Heater Thermocouple   ---------------  */

OBJECT                     = COLUMN
   NAME                    = "CHANNEL_20"
   DATA_TYPE               = ASCII_INTEGER
   START_BYTE              = 45
   BYTES                   = 3
   FORMAT                  = "I3"
   DESCRIPTION             = "CHANNEL_20"
END_OBJECT                 = COLUMN

OBJECT                     = COLUMN"
   NAME                    = "TION"
   DATA_TYPE               = ASCII_INTEGER
   START_BYTE              = 49
   BYTES                   = 3
   UNIT                    = KELVIN
   FORMAT                  = "I3"
   DESCRIPTION             = "Ion Trap thermocouple reading"
END_OBJECT                 = COLUMN

/* -----------------   Sample Oven Heater Thermocouple   --------------  */

OBJECT                     = COLUMN
   NAME                    = "CHANNEL_21"
   DATA_TYPE               = ASCII_INTEGER
   START_BYTE              = 45
   BYTES                   = 3
   FORMAT                  = "I3"
   DESCRIPTION             = "CHANNEL_21"
END_OBJECT                 = COLUMN

OBJECT                     = COLUMN"
   NAME                    = "TOVEN"
   DATA_TYPE               = ASCII_INTEGER
   START_BYTE              = 49
```

```
   BYTES                  = 3
   UNIT                   = KELVIN
   FORMAT                 = "I3"
   DESCRIPTION            = "Oven thermocouple reading"
END_OBJECT                = COLUMN

/* -----------------   Transfer Pipe Heater Thermocouple   ---------  */

OBJECT                    = COLUMN
   NAME                   = "CHANNEL_22"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 45
   BYTES                  = 3
   FORMAT                 = "I3"
   DESCRIPTION            = "CHANNEL_22"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN"
   NAME                   = "TPIPE"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 49
   BYTES                  = 3
   UNIT                   = KELVIN
   FORMAT                 = "I3"
   DESCRIPTION            = "Pipe heater thermocouple reading"
END_OBJECT                = COLUMN

/* --------------------   Pressure gauge G1   ------------------  */

OBJECT                    = COLUMN
   NAME                   = "CHANNEL_23"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 45
   BYTES                  = 3
   FORMAT                 = "I3"
   DESCRIPTION            = "CHANNEL_23"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN"
   NAME                   = "PG1"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 49
   BYTES                  = 5
   UNIT                   = PASCAL
   FORMAT                 = "I5"
   DESCRIPTION            = "Pressure of Helium as indicated by sensor G1"
END_OBJECT                = COLUMN

/* --------------------   Pressure gauge G2   ------------------  */

OBJECT                    = COLUMN
   NAME                   = "CHANNEL_24"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 45
   BYTES                  = 3
   FORMAT                 = "I3"
   DESCRIPTION            = "CHANNEL_24"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN"
   NAME                   = "PG2"
```

```
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 49
   BYTES                  = 5
   UNIT                   = PASCAL
   FORMAT                 = "I5"
   DESCRIPTION            = "Pressure of Helium as indicated by sensor G2"
END_OBJECT                = COLUMN

/* --------------------   Pressure gauge G3   ------------------  */

OBJECT                    = COLUMN
   NAME                   = "CHANNEL_25"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 45
   BYTES                  = 3
   FORMAT                 = "I3"
   DESCRIPTION            = "CHANNEL_25"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN"
   NAME                   = "PG3"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 49
   BYTES                  = 5
   UNIT                   = PASCAL
   FORMAT                 = "I5"
   DESCRIPTION            = "Pressure of Helium as indicated by sensor G3"
END_OBJECT                = COLUMN

/* --------------------   Pressure gauge G4   ------------------  */

OBJECT                    = COLUMN
   NAME                   = "CHANNEL_25"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 45
   BYTES                  = 3
   FORMAT                 = "I3"
   DESCRIPTION            = "CHANNEL_26"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN"
   NAME                   = "PG4"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 49
   BYTES                  = 5
   UNIT                   = PASCAL
   FORMAT                 = "I5"
   DESCRIPTION            = "Pressure of Helium as indicated by sensor G4"
END_OBJECT                = COLUMN

/* --------------------   Pressure gauge G5   ------------------  */

OBJECT                    = COLUMN
   NAME                   = "CHANNEL_27"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 45
   BYTES                  = 3
   FORMAT                 = "I3"
   DESCRIPTION            = "CHANNEL_27"
END_OBJECT                = COLUMN
```

```
OBJECT                    = COLUMN"
   NAME                   = "PG5"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 49
   BYTES                  = 5
   UNIT                   = PASCAL
   FORMAT                 = "I5"
   DESCRIPTION            = "Pressure of Helium as indicated by sensor G5"
END_OBJECT                = COLUMN

/* --------------------  Thermocouple Reactor R14   ------------------  */

OBJECT                    = COLUMN
   NAME                   = "CHANNEL_28"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 45
   BYTES                  = 3
   FORMAT                 = "I3"
   DESCRIPTION            = "CHANNEL_28"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN"
   NAME                   = "TR14"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 49
   BYTES                  = 4
   UNIT                   = KELVIN
   FORMAT                 = "I4"
   DESCRIPTION            = "Reactor R14 thermocouple reading"
END_OBJECT                = COLUMN

/* --------------  Reference Junction Thermometer  (Ad590)  -------------  */

OBJECT                    = COLUMN
   NAME                   = "CHANNEL_32_47"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 45
   BYTES                  = 3
   FORMAT                 = "I3"
   DESCRIPTION            = "Range of Channels between
                             CHANNEL_32 and CHANNEL_47
                             each channel in that range reads
                             the same sensor"
END_OBJECT                = COLUMN

OBJECT                    = COLUMN"
   NAME                   = "AD590"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 49
   BYTES                  = 3
   UNIT                   = KELVIN
   FORMAT                 = "I3"
   DESCRIPTION            = "Reference junction thermometer (AD590)"
END_OBJECT                = COLUMN

/* ----------------------- Docking Station Position   -----------------  */

OBJECT                    = COLUMN
   NAME                   = "CHANNEL_48_63"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 45
```

```
   BYTES                     = 3
   FORMAT                    = "I3"
   DESCRIPTION               = "Range of Channels between
                                CHANNEL_48 and CHANNEL_63
                                each channel in that range reads
                                the same sensor "
END_OBJECT                   = COLUMN

OBJECT                       = COLUMN"
   NAME                      = "VDS"
   DATA_TYPE                 = ASCII_REAL
   START_BYTE                = 49
   BYTES                     = 5
   UNIT                      = MILLIMETER
   FORMAT                    = "F5.2"
   DESCRIPTION               = "Docking station potentiometer"
END_OBJECT                   = COLUMN

/* -----------------------   Nanotip Drive Voltage   -----------------  */

OBJECT                       = COLUMN
   NAME                      = "CHANNEL_64_79"
   DATA_TYPE                 = ASCII_INTEGER
   START_BYTE                = 45
   BYTES                     = 3
   FORMAT                    = "I3"
   DESCRIPTION               = "Range of Channels between
                                CHANNEL_64 and CHANNEL_79
                                each channel in that range reads
                                the same sensor "
END_OBJECT                   = COLUMN

OBJECT                       = COLUMN"
   NAME                      = "INT"
   DATA_TYPE                 = ASCII_INTEGER
   START_BYTE                = 49
   BYTES                     = 3
   UNIT                      = MICROAMPERE
   FORMAT                    = "I3"
   DESCRIPTION               = "Nanotip drive current"
END_OBJECT                   = COLUMN

/* -----------------------  Detector Voltage (Ht)  -----------------  */

OBJECT                       = COLUMN
   NAME                      = "CHANNEL_80_95"
   DATA_TYPE                 = ASCII_INTEGER
   START_BYTE                = 45
   BYTES                     = 3
   FORMAT                    = "I3"
   DESCRIPTION               = "Range of Channels between
                                CHANNEL_80 and CHANNEL_95
                                each channel in that range reads
                                the same sensor "
END_OBJECT                   = COLUMN

OBJECT                       = COLUMN"
   NAME                      = "VDET"
   DATA_TYPE                 = ASCII_INTEGER
   START_BYTE                = 49
   BYTES                     = 4
```

```
   UNIT                    = VOLT
   FORMAT                  = "I4"
   DESCRIPTION             = "Detector Bias"
END_OBJECT                 = COLUMN

/* -----------------------  5v Voltage Monitor  -----------------  */

OBJECT                     = COLUMN
   NAME                    = "CHANNEL_69_111"
   DATA_TYPE               = ASCII_INTEGER
   START_BYTE              = 45
   BYTES                   = 3
   FORMAT                  = "I3"
   DESCRIPTION             = "Range of Channels between
                              CHANNEL_69 and CHANNEL_111
                              each channel in that range reads
                              the same sensor "
END_OBJECT                 = COLUMN

OBJECT                     = COLUMN"
   NAME                    = "V5V"
   DATA_TYPE               = ASCII_REAL
   START_BYTE              = 49
   BYTES                   = 4
   UNIT                    = VOLT
   FORMAT                  = "F4.2"
   DESCRIPTION             = "5V voltage monitor"
END_OBJECT                 = COLUMN

/* -----------------------  28v Voltage Monitor  -----------------  */

OBJECT                     = COLUMN
   NAME                    = "CHANNEL_112_127"
   DATA_TYPE               = ASCII_INTEGER
   START_BYTE              = 45
   BYTES                   = 3
   FORMAT                  = "I3"
   DESCRIPTION             = "Range of Channels between
                              CHANNEL_112 and CHANNEL_127
                              each channel in that range reads
                              the same sensor "
END_OBJECT                 = COLUMN

OBJECT                     = COLUMN"
   NAME                    = "V28V"
   DATA_TYPE               = ASCII_REAL
   START_BYTE              = 49
   BYTES                   = 4
   UNIT                    = VOLT
   FORMAT                  = "F4.1"
   DESCRIPTION             = "28V voltage monitor"
END_OBJECT                 = COLUMN

/* -----------------------  5v Current Monitor  -----------------  */

OBJECT                     = COLUMN
   NAME                    = "CHANNEL_128_143"
   DATA_TYPE               = ASCII_INTEGER
   START_BYTE              = 45
   BYTES                   = 3
   FORMAT                  = "I3"
```

```
   DESCRIPTION            = "Range of Channels between
                             CHANNEL_128 and CHANNEL_143
                             each channel in that range reads
                             the same sensor "
END_OBJECT                = COLUMN

OBJECT                    = COLUMN"
   NAME                   = "I5V"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 49
   BYTES                  = 4
   UNIT                   = MILLIAMPERE
   FORMAT                 = "I4"
   DESCRIPTION            = "Current monitored on 5 volt rail"
END_OBJECT                = COLUMN

/* -----------------------  28v Current Monitor  -----------------  */

OBJECT                    = COLUMN
   NAME                   = "CHANNEL_144_159"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 45
   BYTES                  = 3
   FORMAT                 = "I3"
   DESCRIPTION            = "Range of Channels between
                             CHANNEL_144 and CHANNEL_159
                             each channel in that range reads
                             the same sensor "
END_OBJECT                = COLUMN

OBJECT                    = COLUMN"
   NAME                   = "I28V"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 49
   BYTES                  = 4
   UNIT                   = MILLIAMPERE
   FORMAT                 = "I4"
   DESCRIPTION            = "Current monitored on 28V bus"
END_OBJECT                = COLUMN

/* -----------------------  Rf Calibration  -----------------  */

OBJECT                    = COLUMN
   NAME                   = "CHANNEL_160_175"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 45
   BYTES                  = 3
   FORMAT                 = "I3"
   DESCRIPTION            = "Range of Channels between
                             CHANNEL_160 and CHANNEL_175
                             each channel in that range reads
                             the same sensor "
END_OBJECT                = COLUMN

OBJECT                    = COLUMN"
   NAME                   = "VRFCAL"
   DATA_TYPE              = ASCII_INTEGER
   START_BYTE             = 49
   BYTES                  = 3
   UNIT                   = VOLT
   FORMAT                 = "I3"
```

```
   DESCRIPTION           = "RF calibration"
END_OBJECT               = COLUMN
```

An example of calibrated auxiliary data label for channel 23 is listed below:

```
OBJECT                 = AUX_CAL_TABLE
  NAME                 = "AUXILIARY_CAL"
  INTERCHANGE_FORMAT = ASCII
  ROWS                 = 2
  COLUMNS              = 4
  ROW_BYTES            = 55
  DESCRIPTION          = "PTOLEMY Auxiliary data"

  OBJECT                    = COLUMN
     NAME                   = "LOBT"
     DATA_TYPE              = CHARACTER
     START_BYTE             = 2
     BYTES                  = 17
     DESCRIPTION            = "Date of collection in lander On Board Time
                             LOBT IS REPRESENTED AS :
                             Reset number (integer starting at 1) / seconds.
                             Reset number 1 starts at 2003-01-01T00:00:00 UTC
                             The time resolution is 0.03125 s"
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
     NAME                   = "UTC"
     DATA_TYPE              = TIME
     START_BYTE             = 21
     BYTES                  = 23
     DESCRIPTION            = "Date of collection in On-Ground time (UTC)
                             Format : YYYY-MM-DDThh:mm:ss.sss"
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
     NAME                   = "CHANNEL_23"
     DATA_TYPE              = ASCII_INTEGER
     START_BYTE             = 45
     BYTES                  = 3
     FORMAT                 = "I3"
     DESCRIPTION            = "CHANNEL_23"
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
     NAME                   = "PG1"
     DATA_TYPE              = ASCII_INTEGER
     START_BYTE             = 49
     BYTES                  = 5
     UNIT                   = PASCAL
     FORMAT                 = "I5"
     DESCRIPTION            = "Pressure of Helium as indicated by sensor G1"
  END_OBJECT                = COLUMN
END_OBJECT             = AUX_CAL_TABLE
```

4.3.3.3.4 Mass Spectrum

```
OBJECT                 = SPECTRUM_HEADER_TABLE
  NAME                 = "SPECTRUM_HEADER"
```

```
  INTERCHANGE_FORMAT = ASCII
  ROWS               = 1
  COLUMNS            = 8
  ROW_BYTES          = 103
  DESCRIPTION        = "HEADER for Ptolemy Spectrum (complete or summary)"
 ^STRUCTURE          = "PTOLEMY_SPECTRUM_HEADER.FMT"
END_OBJECT           = SPECTRUM_HEADER_TABLE

OBJECT               = SPECTRUM_S3_TABLE
  NAME               = "SPECTRUM_S3"
  INTERCHANGE_FORMAT = ASCII
  ROWS               = 13
  COLUMNS            = 2
  ROW_BYTES          = 21
  DESCRIPTION        = " Ptolemy Spectrum"
 ^STRUCTURE          = "PTOLEMY_S3.FMT"
END_OBJECT           = SPECTRUM_S3_TABLE
```

The structure of the TABLE object is described in the file PTOLEMY_S3.FMT as follows:

```
/*  Contents of format file  "PTOLEMY_S3.FMT"  (Calibrated Spectrum)  */

OBJECT                  = COLUMN
   NAME                 = "BIN_MASS"
   DATA_TYPE            = ASCII_REAL
   START_BYTE           = 1
   BYTES                = 8
   UNIT                 = AMU
   FORMAT               = "F8.3"
   DESCRIPTION          = "Mass value corresponding to this bin expressed in
                           Atomic mass unit ;
                           One Atomic mass unit = 1.6605 * 10**-27 Kg"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
   NAME                 = "BIN_CNT"
   DATA_TYPE            = ASCII_INTEGER
   START_BYTE           = 10
   BYTES                = 10
   FORMAT               = "I10"
   DESCRIPTION          = "Counts for this bin"
END_OBJECT              = COLUMN
```

4.3.3.4 Description of Instrument

A description of the instrument is given in AD4. A brief overview is in the INST.CAT catalog file as well as this document

4.3.3.5 Mission Specific Keywords

Mission Specific Keywords are described in chapter 4.3.2.5.1.

4.3.4 Data Product Design of Level 5 Data

TBD

4.3.4.1 File Characteristics Data Elements

TBD

4.3.4.2 Data Object Pointers Identification Data Elements

TBD

4.3.4.3 Instrument and Detector Descriptive Data Elements

TBD

4.3.4.4 Structure Definition of Instrument Parameter Objects

TBD

4.3.4.5 Data Object Definition

TBD

4.3.4.6 Mission Specific Keywords

TBD

5 Appendix A : Available Software to read PDS files

The level 3 housekeeping and science PDS files can be read with the PDS table verifier tool "tbtool" and readpds (Small Bodies Node tool).

6 Appendix B : Example of PDS label for PTOLEMY level 2 data product

```
PDS_VERSION_ID               = PDS3
LABEL_REVISION_NOTE  = "2007-07-16, SONC, version 1.0"
/* PVV version 3.5.2 */

/*      Edited Complete Spectrum (Level 2    */

/* FILE CHARACTERISTIC DATA ELEMENTS */

RECORD_TYPE           = FIXED_LENGTH
RECORD_BYTES          = 115
FILE_RECORDS          = 15360
FILE_NAME             = "PTO_FS22_080729203341_0002.TAB"


/* DATA OBJECT POINTERS  */

^SPECTRUM_S2_TABLE     = ("PTO_FS22_080729203341_0002.TAB",1 <BYTES>)

DATA_SET_ID            = "RL-CAL-PTOLEMY-2-CR4A-V1.0"
DATA_SET_NAME          = "ROSETTA-LANDER CAL PTOLEMY 2 CR4A V1.0"
PRODUCT_ID             = "PTO_FS22_080729203341_0002"
PRODUCT_CREATION_TIME = 2010-06-10T07:14:38
MISSION_NAME            = "INTERNATIONAL ROSETTA MISSION"
MISSION_PHASE_NAME     = "CRUISE 4-1"
MISSION_ID              = ROSETTA
INSTRUMENT_HOST_NAME    = "ROSETTA-LANDER"
INSTRUMENT_HOST_ID      = RL
OBSERVATION_TYPE     = "ACTIVE CHECKOUT 8"

PRODUCT_TYPE           = EDR
```

```
START_TIME             = 2008-07-29T20:33:41.791
STOP_TIME              = 2008-07-29T20:36:20.166
SPACECRAFT_CLOCK_START_COUNT = "2/175984384.26"
SPACECRAFT_CLOCK_STOP_COUNT  = "2/175984543.06"

PRODUCER_ID             = "SONC"
PRODUCER_FULL_NAME      = "SCIENCE OPERATIONS AND NAVIGATION CENTER"
PRODUCER_INSTITUTION_NAME = "CNES"

INSTRUMENT_ID           = PTOLEMY
INSTRUMENT_NAME         ="PTOLEMY - GAS CHROMATOGRAPH ISOTOPE RATIO MASS
SPECTROMETER"
INSTRUMENT_TYPE         = "GAS ISOTOPE RATIO ANALYSER"
INSTRUMENT_MODE_ID      = "N/A"
INSTRUMENT_MODE_DESC    = "N/A"
TARGET_NAME            = "CALIBRATION"
TARGET_TYPE            = "CALIBRATION"

PROCESSING_LEVEL_ID     = 2
DATA_QUALITY_ID         = -1
DATA_QUALITY_DESC       = "-1 : NOT QUALIFIED"

/* GEOMETRY PARAMETERS */

/* SPACECRAFT LOCATION: Position <km> */
SC_SUN_POSITION_VECTOR = (  148248948.8, 238980407.9, 111086801.3)
/* TARGET PARAMETERS: Position <km>, Velocity <km/s> */
SC_TARGET_POSITION_VECTOR = ("N/A","N/A","N/A")
SC_TARGET_VELOCITY_VECTOR = ("N/A","N/A","N/A")
/* SPACECRAFT POSITION WITH RESPECT TO CENTRAL BODY */
SPACECRAFT_ALTITUDE =   278564008.6 <km>
SUB_SPACECRAFT_LATITUDE =   -12.99 <deg>
SUB_SPACECRAFT_LONGITUDE =   315.82 <deg>
NOTE = "The values of the keywords SC_SUN_POSITION_VECTOR,
       SC_TARGET_POSITION_VECTOR and SC_TARGET_VELOCITY_VECTOR
       are related to the EMEJ2000 reference frame.
       The values of SUB_SPACECRAFT_LATITUDE and SUB_SPACECRAFT_LONGITUDE
       are northern latitude and eastern longitude in the standard
       planetocentric IAU_<TARGET_NAME> frame.
       All values are computed for the time = START_TIME.
       Distances are given in <km> velocities in <km/s>, Angles in <deg>"

/* SD2 PARAMETERS */
ROSETTA:SD2_OVEN_FILLING = "YES"
ROSETTA:SD2_DRILL_DEPTH  = 10.00
ROSETTA:SD2_OVEN_NUMBER  = 3
ROSETTA:SD2_OVEN_TYPE    = "MTO"
ROSETTA:SAMPLE_NUMBER    = 1
ROSETTA:SAMPLE_TAPPING   = "YES"
ROSETTA:SAMPLE_VOLUME    =  1.00


/* DATA OBJECT DEFINITION  */


OBJECT                =  SPECTRUM_S2_TABLE
  NAME                = "SPECTRUM_S2"
  INTERCHANGE_FORMAT = ASCII
  ROWS                = 15360
  COLUMNS             = 10
  ROW_BYTES           = 115
```

```
  DESCRIPTION         = "Ptolemy Complete Spectrum"
  ^STRUCTURE          = "PTOLEMY_S2.FMT"
END_OBJECT            = SPECTRUM_S2_TABLE


END
```

7 Appendix C : Example of Directory Listing of Data Set RL-CAL-PTOLEMY-2-CR4A-V1.0

```
|-AAREADME.TXT
|
|          |-BROWINFO.TXT
|-BROWSE---|-PTO_FAXP_080710035502_I01.LBL
|          |-PTO_FAXP_080710035502_I01.PNG
|
|          |-CATINFO.TXT
|          |-DATASET.CAT
|-CATALOG--|-INST.CAT
|          |-INSTHOST.CAT
|          |-MISSION.CAT
|          |-PERSON.CAT
|          |-REF.CAT
|          |-SOFTWARE.CAT
|
|                       |-PTO_FAX2_080731133309_0068.LBL
|                       |-PTO_FAX2_080731133309_0068.TAB
|                       |-PTO_FAX2_080729203214_0002.LBL
|                       |-PTO_FAX2_080729203214_0002.TAB
|                       |-PTO_FAX2_080729060128_0072.LBL
|          |-AUXILIARY--|-PTO_FAX2_080729060128_0072.TAB
|          |            |-PTO_FAX2_080718011824_0011.LBL
|          |            |-PTO_FAX2_080718011824_0011.TAB
|          |            |-PTO_FAX2_080710160003_0004.LBL
|          |            |-PTO_FAX2_080710160003_0004.TAB
|          |            |-PTO_FAX2_080710035502_0004.LBL
|          |            |-PTO_FAX2_080710035502_0004.TAB
|          |
|-DATA-----|
|          |            |-PTO_FEV2_080801185146_0006.LBL
|          |            |-PTO_FEV2_080801185146_0006.TAB
|          |            |-PTO_FEV2_080731133146_0075.LBL
|          |            |-PTO_FEV2_080731133146_0075.TAB
|          |            |-PTO_FEV2_080730123146_0055.LBL
|          |            |-PTO_FEV2_080730123146_0055.TAB
|          |            |-PTO_FEV2_080730111546_0052.LBL
|          |            |-PTO_FEV2_080730111546_0052.TAB
|          |-EVENT------|-PTO_FEV2_080729203046_0007.LBL
|          |            |-PTO_FEV2_080729203046_0007.TAB
|          |            |-PTO_FEV2_080729060047_0075.LBL
|          |            |-PTO_FEV2_080729060047_0075.TAB
|          |            |-PTO_FEV2_080718010046_0031.LBL
|          |            |-PTO_FEV2_080718010046_0031.TAB
|          |            |-PTO_FEV2_080710155249_0013.LBL
|          |            |-PTO_FEV2_080710155249_0013.TAB
|          |            |-PTO_FEV2_080710034748_0013.LBL
|          |            |-PTO_FEV2_080710034748_0013.TAB
|          |
|          |               |-PTO_FS22_080731140407_0002.LBL
|          |               |-PTO_FS22_080731140407_0002.TAB
|          |-FULL_SPECTRUM-|-PTO_FS22_080731133446_0002.LBL
|          |               |-PTO_FS22_080731133446_0002.TAB
|          |               |-PTO_FS22_080729203341_0002.LBL
|          |               |-PTO_FS22_080729203341_0002.TAB
|          |
```

```
                             |          |            |-PTO_FMC2_080801185131_0005.LBL
                             |          |            |-PTO_FMC2_080801185131_0005.TAB
                             |          |            |-PTO_FMC2_080731133026_0050.LBL
                             |          |            |-PTO_FMC2_080731133026_0050.TAB
                             |          |            |-PTO_FMC2_080730123026_0000.LBL
                             |          |            |-PTO_FMC2_080730123026_0000.TAB
                             |          |            |-PTO_FMC2_080730111526_0000.LBL
                             |          |            |-PTO_FMC2_080730111526_0000.TAB
                             |          |            |-PTO_FMC2_080729203026_0000.LBL
                             |          |            |-PTO_FMC2_080729203026_0000.TAB
                             |          |            |-PTO_FMC2_080729060026_0000.LBL
                             |          |-MEMORY-----|-PTO_FMC2_080729060026_0000.TAB
                             |          |            |-PTO_FMC2_080718010026_0013.LBL
                             |          |            |-PTO_FMC2_080718010026_0013.TAB
                             |          |            |-PTO_FMC2_080710155233_0003.LBL
                             |          |            |-PTO_FMC2_080710155233_0003.TAB
                             |          |            |-PTO_FMC2_080710034732_0002.LBL
                             |          |            |-PTO_FMC2_080710034732_0002.TAB
                             |          |            |-PTO_FMD2_080731141259_0000.LBL
                             |          |            |-PTO_FMD2_080731141259_0000.TAB
                             |          |            |-PTO_FMD2_080730132806_0000.LBL
                             |          |            |-PTO_FMD2_080730132806_0000.TAB
                             |          |            |-PTO_FMD2_080718011207_0003.LBL
                             |          |            |-PTO_FMD2_080718011207_0003.TAB
                             |          |
                             |          |            |-PTO_FSN2_080801185233_0039.LBL
                             |          |            |-PTO_FSN2_080801185233_0039.TAB
                             |          |-SENSOR-----|-PTO_FSN2_080731133842_0075.LBL
                             |          |            |-PTO_FSN2_080731133842_0075.TAB
                             |          |            |-PTO_FSN2_080730123146_0066.LBL
                             |          |            |-PTO_FSN2_080730123146_0066.TAB
                             |          |            |-PTO_FSN2_080730111904_0057.LBL
                             |          |            |-PTO_FSN2_080730111904_0057.TAB
                             |          |            |-PTO_FSN2_080729203101_0017.LBL
                             |          |            |-PTO_FSN2_080729203101_0017.TAB
                             |          |            |-PTO_FSN2_080729060843_0075.LBL
                             |          |            |-PTO_FSN2_080729060843_0075.TAB
                             |          |            |-PTO_FSN2_080718010842_0030.LBL
                             |          |            |-PTO_FSN2_080718010842_0030.TAB
                             |          |            |-PTO_FSN2_080710155818_0033.LBL
                             |          |            |-PTO_FSN2_080710155818_0033.TAB
                             |          |            |-PTO_FSN2_080710035316_0033.LBL
                             |          |            |-PTO_FSN2_080710035316_0033.TAB
                             |
|-RL-CAL-PTOLEMY-2-CR4A-V1.0-|
                             |
                             |          |-DOCINFO.TXT
                             |          |-EAICD_PTOLEMY.LBL
                             |          |-EAICD_PTOLEMY.PDF
                             |          |-RO-BER-RAL-TN-3401.PDF
                             |          |-RO-BER-RAL-TN-3401.LBL
                             |          |-RO-LPT-OU-PL-3101.PDF
                             |          |-RO-LPT-OU-PL-3101.LBL
                             |-DOCUMENT-|-RO-LPT-OU-PL-3114.PDF
                             |          |-RO-LPT-OU-PL-3114.LBL
                             |          |-RO-LPT-RAL-TN-3403.PDF
                             |          |-RO-LPT-RAL-TN-3403.LBL
                             |          |-RO-LPT-RAL-MA-3102.PDF
                             |          |-RO-LPT-RAL-MA-3102.LBL
                             |          |-TIMELINE_CR4A_PC8.TXT
                             |          |-TIMELINE_CR4A_DESC.TXT
                             |          |-TIMELINE_CR4A_PC8.LBL
                             |          |-TIMELINE_CR4A_PC8.PNG
                             |
                             |          |-BROWSE_INDEX.LBL
                             |          |-BROWSE_INDEX.TAB
                             |-INDEX----|-INDXINFO.TXT
```

```
|           |-INDEX.LBL
|           |-INDEX.TAB
|
|           |- LABINFO.TXT
|           |- PTOLEMY_AX2.FMT
|           |- PTOLEMY_EV.FMT
|           |- PTOLEMY_MC.FMT
|-LABEL----|- PTOLEMY_MD.FMT
|           |- PTOLEMY_S1.FMT
|           |- PTOLEMY_S2.FMT
|           |- PTOLEMY_SN2.FMT
|           |- PTOLEMY_TA.FMT
|           |- PTOLEMY_TF.FMT
|
|-VOLDESC.CAT
```