

Rosetta - ROMAP

To Planetary Science Archive Interface Control
Document

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RO-ROL-ROMAP-EAICD

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1 Introduction

1.1 Purpose and Scope

The purpose of this EAICD (Experimenter to Planetary Science Archive Interface Control Document) is two fold. First it provides users of the ROMAP 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 document between ROMAP and Planetary Science Archive (PSA) of ESA.

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 offers the creation of physical archive volumes on request.

1.3 Contents

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

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

1.4 Intended Readership

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

1.5 Applicable Documents

- AD 1. Planetary Data System Preparation Workbook, February 17, 1995, Version 3.1, JPL, D-7669, Part1
- AD 2. Planetary Data System Standards Reference, August 1, 2003, Version 3.6, JPL, D-7669, Part 2
- AD 3. Rosetta Archive Generation, Validation and Transfer Plan, January 10, 2006, Issue 2, Rev. 3, RO-EST-PL-5011
- AD 4. ROSETTA Archive Conventions RO-EST-TN-3372 Issue 5, Rev. 6, 25 March 2010
- AD 5. ROSETTA-RPC-MAG To Planetary Science Archive Interface Control Document EAICD RO-IGEP-TR0009 Issue 2.1
- AD 6. ROMAP Electronics FM2 ADP, RO-LRO-DP-300002-UA, Issue 1, Revision 0, 16/05/2001
- AD 7. ROMAP Boom & Sensor FM2 ADP, RO-LRO-DP-300003-UA, Issue 1, Revision 1, 16/07/2001
- AD 8. ROMAP Instrument Calibration Report FM2, RO-LRO-TR-300010-WM, Issue 1, Rev. 1, 15/11/2000
- AD 9. CDMS Command and Data Management System - Subsystem Specification RO-LCD-SP-3101 29/08/2001, Issue 3, Rev. 5
- AD 10. CDMS Command and Data Management System - Operation Manual RO-LCD-SW-3402 12/02/2001, Issue 1, Rev. 2
- AD 11. Rosetta Time handling RO-EST-TN-3165, issue 1 rev 0, February 9, 2004
- AD 12. DDID- Data Delivery Interface Document RO-ESC-IF-5003 Issue B6 23/10/2003

1.6 Acronyms and Abbreviations

| | |
|--------|--|
| CDMS | Command and Data Management System |
| CEM | Channel Electron Multiplier |
| CNES | Centre National d'Etudes Spatiales |
| CODMAC | Committee On Data Management, Archiving, and Computation |
| COSAC | Cometary Sampling And Composition |
| DDS | Data Delivery System (ESOC server) |
| DECW | Data Error Control Word |
| EAICD | Experiment Archive Interface Control Document |
| EGSE | Electronic Ground Support Equipment |
| ESA | European Space Agency |
| ESOC | European Space Operation Center |
| ESTEC | European Space Research and Technology Center |
| ESS | Electrical Support System |
| FM | Flight Model |
| FPGA | Field-Programmable Gate Array |
| GRM | Ground Reference Model |
| HK | Housekeeping |
| IWF | Institut für Weltraumforschung (IWF) in Graz |
| LOBT | Lander On Board Time |
| MPS | Max-Planck-Institut für Sonnensystemforschung |
| N/A | Not Applicable |
| NASA | National Aeronautics and Space Administration |
| OBDAH | On Board Data Handling |
| OBT | Orbiter On Board Time |
| 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 |
| SC | Science |
| QM | Qualification Model |

| | |
|-------|---|
| RF | Radio Frequency |
| ROMAP | Rosetta Magnetometer and Plasma Monitor |
| S/C | Spacecraft |
| SCET | Spacecraft Event Time |
| SFDU | Standard Formatted Data Unit |
| SONC | Science Operations and Navigation Center(CNES-Toulouse) |
| TBC | To Be Confirmed |
| TBD | To Be Defined |
| TC | Telecomand |
| UTC | Universal Time Coordinated |

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

Main scientific goals of ROMAP are (1) long term measurements on the surface to study the cometary activity as function of the distance from the Sun and (2) magnetic measurements during the descent phase of the Lander to investigate the structure of the remnant magnetization of the nucleus.

The ROMAP sensors (fluxgate magnetometer, electrostatic analyser and Faraday cup) measure the magnetic field from 0 to 32Hz, ions up to 8.0 keV and electrons up to 4.2 keV. High integration level of

sensors and electronics. That is the basic for a combined field/plasma measurement instrument with less than 1 Watt power consumption and 1 kg mass. Additional two pressure sensors are included in the ROMAP sensor arrangement. The sensors are moved from COSAC to ROMAP to optimise long term operation of pressure sensors. Data of both pressure sensors are transmitted within the housekeeping frame and are handled / archived as housekeeping values

2.1 Scientific Objectives

The Magnetometer (MAG) and the Simple Plasma Monitor (SPM) are the two experiments of the Small Instrument Package ROMAP, which complement the plasma packages onboard the ROSETTA Orbiter. Both instruments deliver data about the comet / solar wind interaction and the cometary activity as function of the distance from the sun and the onset of the diamagnetic cavity formation. The SPM sensor is able to determine the major solar wind parameters like density, speed, temperature, and flow direction. The Magnetometer sensor is able to determine the magnetic field vector.

Based on camera data from the flybys of the VEGA/GIOTTO spacecrafts at comet p/Halley in 1986, it was found that only a small part of the nucleus is active. As a consequence, new models about the internal structure of the nucleus were developed, in which the heat conductivity of the surface material is a key parameter. Up to the present, however, there are no direct measurements. On the background of such models, the gas production rate Q of the target comet p/Wirtanen was calculated as function of its radial distance to the Sun [Fuselier 1995; Kührt 1995]. Whereas the predictions of both models for perihelion distances are almost identical, they significantly differ for greater distances. For $R=3.5\text{AU}$, for example, there is a discrepancy of about four orders of magnitude: $Q=10^{23}\text{ s}^{-1}$ according to Fuselier's model and $Q=10^{27}\text{ s}^{-1}$ from Kührt. This great discrepancy is an example, which demonstrates the large uncertainties about the internal structure of the nucleus.

To date, most of the studies of comet-solar wind interaction address a well-developed cometary atmosphere. During the last decade, however, it has become apparent from both observation and theory that even weakly outgassing (or weakly magnetized) bodies may act as obstacles to the solar wind, creating effects that spacecraft magnetometers can resolve. As a result of bi-ion fluid simulations of the solar wind interaction with a weakly outgassing comet (Bogdanov et al. 1995), for example, one can distinguish between three main interaction regimes ordered with increasing neutral gas production rate Q . For $Q < 10^{25}\text{ s}^{-1}$ the cometary activity is negligible and the body behaves like an asteroid. In the range $10^{25}\text{ s}^{-1} < Q < 10^{27}\text{ s}^{-1}$ effects become important that cannot be explained in the framework of classical one-fluid MHD theory since the characteristic scale lengths are smaller than the heavy ion gyro-radius. There is no bow shock, only Mach cone-like structures, and the heavy ion fluid flows along a cycloidal orbit accompanied by a small-scale structuring (heavy ion bunching). This structuring is sensitive to the parameters involved (Alfven Mach number, plasma beta, production rate). In the range $10^{27}\text{ s}^{-1} < Q$ one is confronted with a well-developed cometary atmosphere as, for example, found at p/Grigg-Skjellerup, p/Giacobini-Zinner and p/Halley. Characteristic features are the formation of a diamagnetic cavity in the immediate vicinity of the nucleus, a cometopause (ion composition boundary) and a bow shock.

For the formation of a magnetic cavity around the nucleus, from which the solar wind is excluded, a rough estimate can be derived. According to the momentum flux balance of solar wind and purely cometary plasma at the interface, the cavity radius is given by



(σ ionisation rate, μ mass ratio cometary ions to protons, n_{sw} solar wind density, v_{sw} solar wind velocity; see also Haerendel 1987). A cavity with a radius of 10km (as a reasonable lower limit) requires a production rate $Q=5 \times 10^{27}\text{ s}^{-1}$, which appears to be a threshold value for the existence of a cavity.

After landing, magnetometer and plasma monitor shall operate in a common mode (surface mode). Aim is to measure during a full cometary rotation period (8h). If the operation time is limited for energy reasons operation during a full cometary day (4h) is planned. The measurement shall be repeated in regular intervals (e.g. each 4 days) to monitor the plasma evolution with closer distance to Sun. Measurements have to be done synchronously with RPC onboard the orbiter.

For the first time ever, the ROSETTA mission provides magnetic field measurements at very low distances from a cometary nucleus in a situation where the cometary activity is not yet fully developed. If the nucleus is not protected by an atmosphere produced by outgassing, the solar wind interacts directly with the intrinsic field and one can expect a situation similar to that observed at GALILEO's flyby at the asteroids Gaspra and Ida. Whereas the closest approach at these flybys was of the order of 1000 km, the situation here is much better because the surface field can be measured directly, practically not affected by the solar wind. In addition, during the approach to the nucleus, the probe can measure the variation of the magnetic field with distance and thus one should be able to clearly identify the type of the possible remnant magnetization.

Magnetometer data from GALILEO's flyby at the two asteroids Gaspra and Ida [Kivelson et al. 1993] together with model calculations [Baumgärtel et al. 1994, Kivelson et al. 1995a,b] have been interpreted in terms of an intrinsic magnetization of these bodies. It is generally assumed that this is remnant magnetization due to magnetic minerals such as iron-nickel, magnetite, and pyrrhotite, which were magnetized by relatively strong magnetic fields in the early solar nebula [e.g., Sugiura and Strangway 1988]. In the case of a generic relationship between asteroids and comets as to their refractory components, the magnetism of cometary nuclei could be caused by material exhibiting a natural remnant magnetization (NRM) in much the same way. Whether or not such material is present in cometary nuclei is still under debate.

Both, experimental results (mass spectrometry of particles escaped from p/Halley) and theoretical models point out primary magnetic minerals and possibly secondary magnetic material as well. One should expect the more pristine bright cometary regions to be characterized by rather primary magnetic material whereas the dark fractionated regions should be enriched by secondary magnetic material. More specifically, the following magnetic minerals/materials are being considered: Fe_3O_4 (magnetite), Fe-Ni (metal) and $(\text{Fe,Ni})_{0.9}\text{S}$ (pyrrhotite) as major carriers in the light regions and magnetite and a Fe-S-Ni-Si-O-rich phase in the dark regions. This is probably the main carrier of the NRM in bulk samples of C1-chondrites.

The growth of fractal aggregates from collisions between small dust grains is generally accepted to be the first step in the formation of planetesimals and cometesimals in the early solar system. Until now, the grain-grain interactions considered within this scenario were of mechanical and electrostatic nature only. If magnetized material were present at this stage, as is suggested by meteoritic and asteroidal evidence, magnetic interactions between dust particles should be taken into account as well. It has been shown experimentally [Nuth et al. 1994] and numerically [Nübold and Glassmeier 1999, 2000] that magnetized grains tend to build elongated structures of low fractal dimension and non-vanishing magnetic moment (see Figure 1). In case of enough magnetic material is available, this process may lead to centimetre or even metre sized magnetic structures, which ROMAP might be able to detect. Remnant magnetization of primitive objects such as comets could thus be called "accretional remanence".

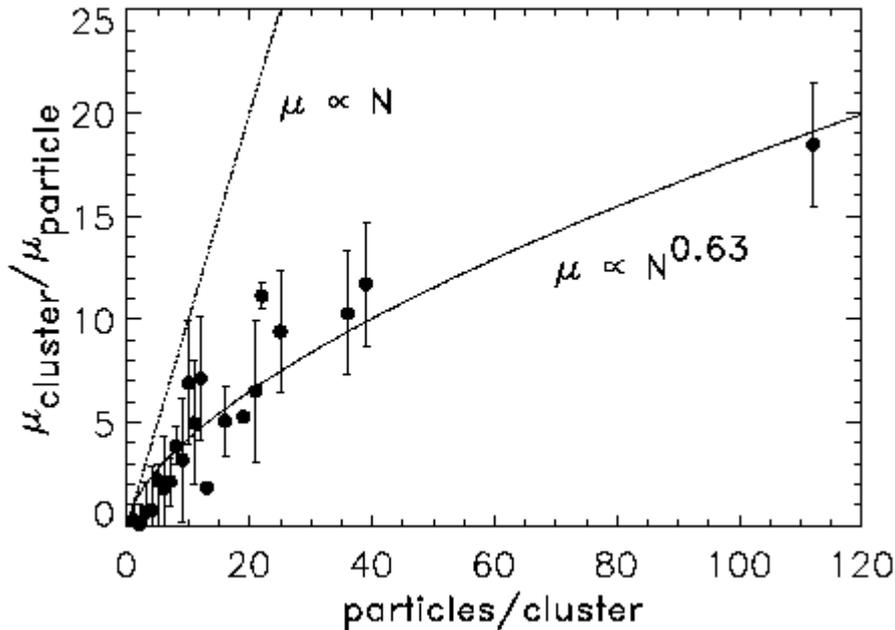


Figure 1 . Accretional remanence of growing magnetic dust aggregates in a numerical simulation [Nübold and Glassmeier, 2000].

2.2 Instrument Design

The ROMAP hardware consists of a combined magnetic field (MAG) and plasma (SPM) sensor mounted on a small boom, the near sensor electronics, a high-voltage generator (HV-part) and a small DPU (controller).

2.2.1 ROMAP Sensors

The magnetic field is measured with a vector compensated ringcore fluxgate magnetometer designed by the TU-Braunschweig and manufactured by the MPE Garching. The sensor consists of two ringcores (crossed in to each other) as well as pick-up coils and Helmholtz coils for each sensor axis. The coil system design without mechanical support allows the compensation of the external field on the ringcore position with high homogeneity and low weight (the overall sensor weight is 30g). Dynamic feedback fields as well as offset fields up to 2000nT can be generated in order to compensate Lander and/or Orbiter DC stray fields. The determination of Lander and Orbiter offsets could be done during the cruise phase using non compressible waves in the solar wind [Hedgecock 1975]. Parallel measurements of Lander and Orbiter magnetometer during Lander eject, descent and during measurement campaigns on the cometary surface gives an additional input for the inflight calibration.

The main part of the SPM-sensor is a hemispherical electrostatic analyzer with two channeltrons (CEM's) for ions measurement and one for electrons measurement. The entry of the ion channels is equipped with deflection plates to realize the spatial resolution. Despite the small size of the sensor, the sensitivity and resolution of the instrument are high and its field of view wide (appr. 100 degree). The E/q-range extends from 0 to 8 kV. Using CEMs in counting mode the electrostatic analyzer measures electron and ion distribution in a wide energy range. Hemispherical deflection plates analyze the energy in 32 or 64 steps. All major plasma parameters as electron-, proton and proton bulk velocity, density and isotropic temperature can be derived. A retarding-grid Faraday cup sensor is implemented to measure currents due to fluxes of low energy charged particles on a collector plate. The Faraday cup measures the „reduced“ velocity distribution of the plasma due

to its inherent integration over velocities contained in a plane of differential thickness perpendicular to the axis of the sensor. Because the sensor is not differential in angle, the Faraday cup requires relatively low data rates. But for a given orientation it provides differential information in velocity space only along a direction perpendicular to the retarding grid [Lazarus et al. 1993].

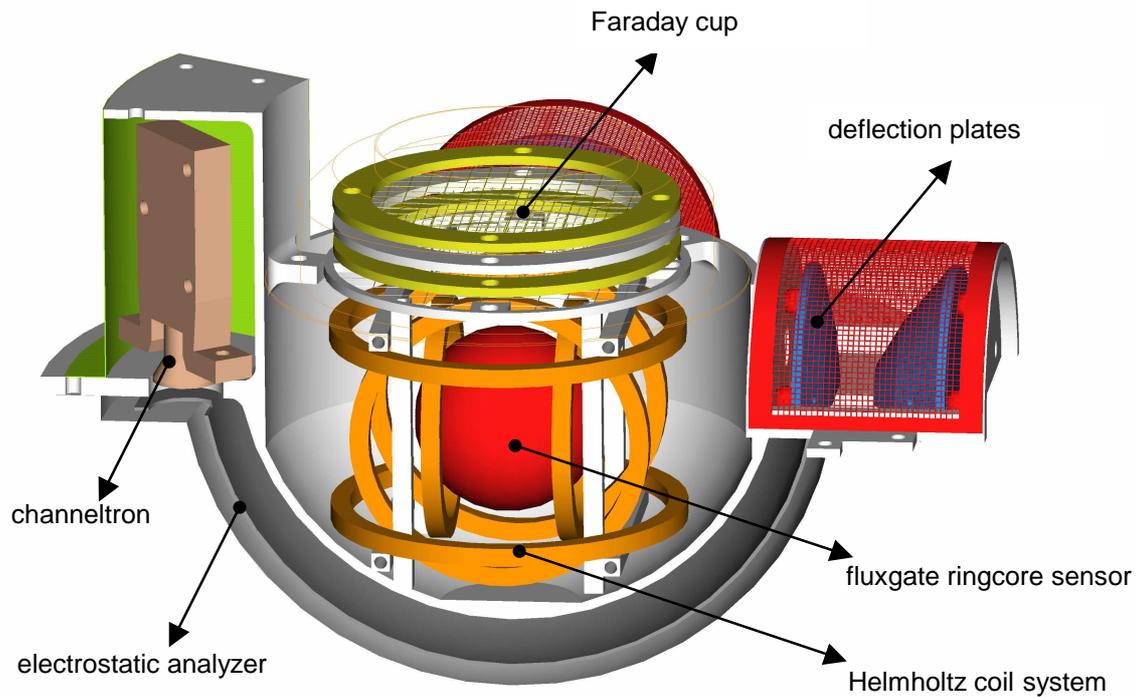


Figure 2 ROMAP MAG and SPM sensors compartment.

SPM sensor and fluxgate sensor integrated within one spherical sensor head. Figure 2 shows the sensor compartment. The sensor head is mounted on a 60 cm boom which is fixed with a hinge on the upper edge of the Lander structure and with a launch lock on the Lander balcony. After opening the launch lock, the boom

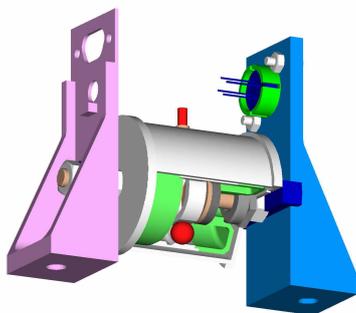


Figure 3 Pressure sensors

is deployed by two springs inside the hinge.

Two pressure sensors are selected to cover the whole pressure range from 10^{-8} mbar to 10^1 mbar. For the range from 10^{-8} mbar to 10^{-3} mbar an ionising system (Penning) is deployed while for the range from 10^{-3} mbar to 10^1 mbar a heat conduction sensor (Minipirani) is available. The pressure data are transmitted in the housekeeping frames. They are handled and archived as housekeeping and not as scientific values. The combined magnetometer / SPM sensor is mounted on a 60 cm boom which is fixed with a hinge on the upper edge of the Lander structure and with a launch lock on the Lander balcony. After opening the launch lock, the boom is deployed by two springs inside the hinge. Boom and the related coordinate systems are shown in Figure 4.

The SPM sensor, the Pressure sensors and all boom parts are designed by the MPS Lindau.

ROMAP sensor orientation

Coordinates (in Lander system) of rotation centre:

X: 186.82mm
Y: -315.0mm
Z: 526.2mm

Sensor centre in stowed position:

X: 20.2mm
Y: -315.0mm
Z: 58.7mm

Sensor centre in fully deployed position:

X: -329.1mm
Y: -315.0mm
Z: 526.2mm

Conversion of ROMAP system (R) in Lander System (L):

Stowed:

$$(L) = \begin{pmatrix} 0 & 0.336 & -0.942 \\ 1 & 0 & 0 \\ 0 & 0.942 & 0.336 \end{pmatrix} (R)$$

Deployed:

$$(L) = \begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{pmatrix} (R)$$

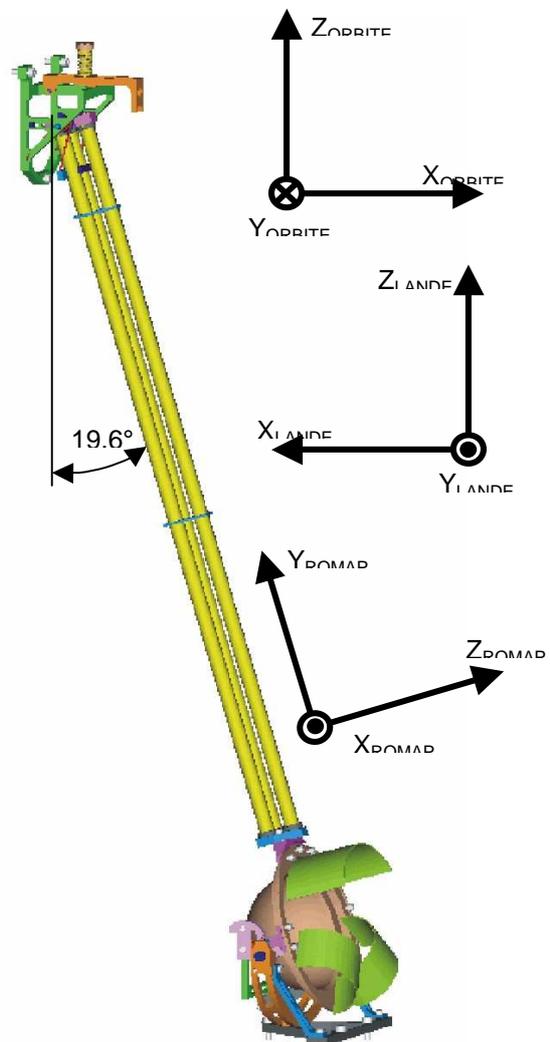


Figure 4 ROMAP sensors orientation

2.2.2 ROMAP Electronics

The ROMAP electronics consists of two boards placed inside the common electronics box. The central part of the near sensor electronics on the first board is a FPGA which controls AD and DA-converters. The 16-bit AD converters are digitising science and housekeeping data from all three sensors. In the block diagram (Figure 5) this data flow is drawn with dotted lines.

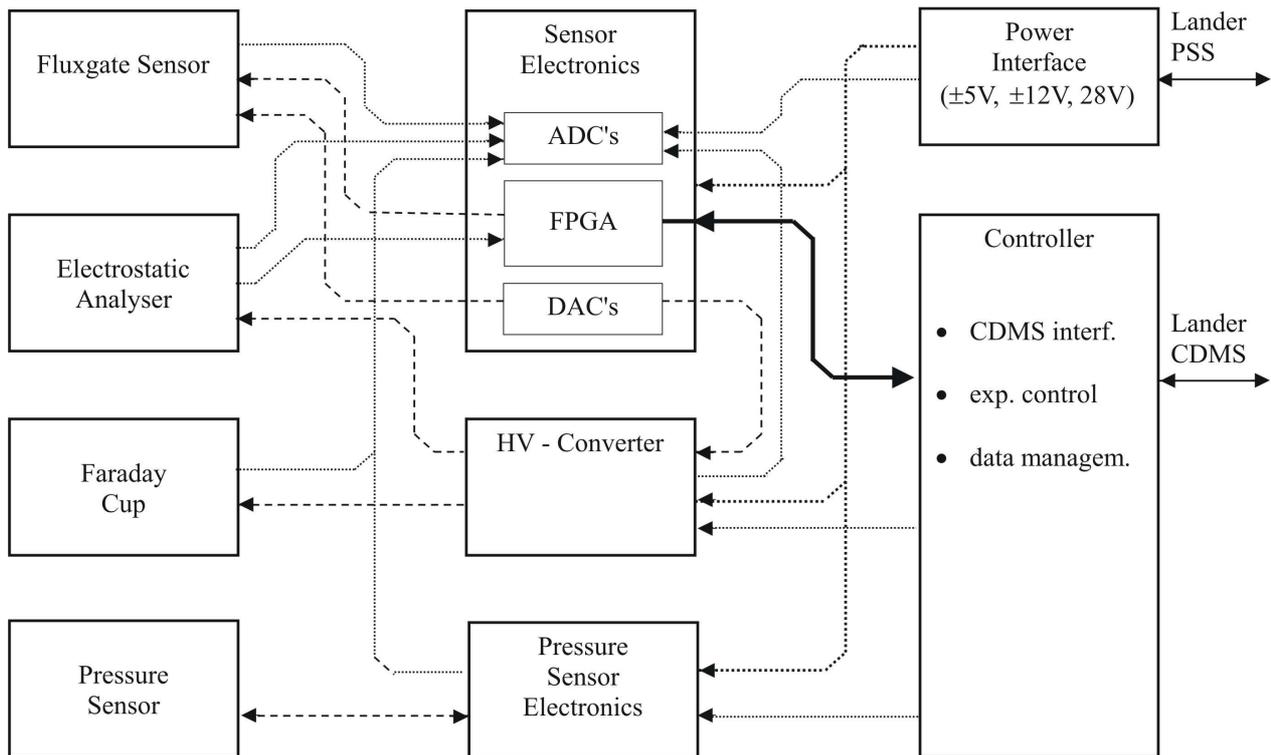


Figure 5 ROMAP electronics

Typical analogue parts of fluxgate magnetometers like filters or phase-sensitive integrators are substituted by fast digitalization of the sensor AC-signal and the following data processing in FPGA's (which overtakes the functions of the former analogue parts) [Auster et al. 1995]. In this way mass is saved without any loss of accuracy. The resolution is still restricted by sensor noise (less than $5\text{pT}/\sqrt{\text{Hz}}$ at 1Hz) [Fornacon et al. 1999], not by electronics. Compensation fields for the magnetometer and high voltage steps for electrostatic analyser and Faraday cup are controlled via DA-converters (dashed lines). The near sensor electronics is developed by Magson GmbH Berlin. The high voltage generator (developed by the KFKI) is in a separate shielded box on the front panel of the common electronics box..

The controller is located on the second ROMAP board. It controls MAG and SPM, stores their data output and implements the interface to the Lander Command and Data Management System (CDMS). It triggers the measurement cycle of the magnetometer, implements the digital magnetometer algorithm, controls the magnetometer feedback and generates data frames. For the SPM sensors the controller has implemented the counting logic for electrons and ions, samples Faraday cup data, generates SPM data frames, controls the high voltage parameters (energy, elevation), controls the channeltron HV-supply and computes the plasma parameters. In the parameter mode only the sums of the rows and columns of the sampled ion and ion-current arrays are transmitted. The controller is based on a RTX2010. Address decoder, reset logic, clock generators, control signals generator, watchdog logic and CDMS interface are integrated within a FPGA. Hard- and software are developed by the IWF Graz.

The instrument parameters and the required recourses are given in the following tables:

Instrument parameters:

| type of sensor | parameter | value |
|---|---|--|
| Fluxgate Magnetometer | dynamic range resolution sensor noise frequency range offset drift | ±2.000nT 10pT <5pT/√Hz 0...32Hz <0.1nT/°C |
| Electrostatic, Hemispherical Analyzer | channels energy range field of view energy steps max. count rate exposition time | ions electrons ions electrons ions electrons 32 or 64, log. scaled 10 ⁶ counts/s 40 ... 1.000ms |
| Faraday cup | ion integral energy distribution resolution (current mode) field of view energy steps entrance area | up to 2000 eV ±1.5 10 ⁻¹² - ±5.10 ⁻¹⁰ A 140 ⁰ x 140 ⁰ 16 steps 6 cm ² |
| Penning Sensor | range electric Field magnetic field | 10 ⁻⁸ – 10 ⁻³ mbar 10 ⁶ V/m 700 Gauss |
| Pirani Sensor | range bridge resistors | 10 ⁻³ – 10 mbar 1kOhm |

ROMAP Resources

| recourses | experiment part | requirements | Σ |
|------------------|---|------------------------|-------------|
| mass | MAG sensor | 40g | 930g |
| | SPM sensor | 120g | |
| | Pressure sensor | 110g | |
| | boom + hinge + cable | 80g | |
| | launch lock | 40g | |
| | pressure harness | 50g | |
| | electronics in CEB (interface, analogue, controller, HV-box, connectors, frontplate) | 360g | |
| | Pressure E-Box | 130g | |
| power | sensor electronics | 350...550mW | <900mW |
| | controller | 180mW | |
| | penning electronics | 100mW | |
| | pirani electronics | 50mW | |
| | HV-part | 200mW | |
| telemetry rate | surface mode MAG SPM | 70 bits/s 30 bits/s | 80 bits/s |
| | slow mode MAG | 70 bits/s | 68 bits/s |
| | fast mode MAG | 4400 bits/s | 4369 bits/s |

2.3 Data Handling Process

SONC is responsible for data preparation and TU-BS is responsible for the distribution to Col's. The relevant contact information is provided in section 1.7.

The SONC is responsible for PDS ROMAP data sets generation and delivery to the PSA.

The ROMAP telemetry data are provided by the ESA DDS (Data Distribution Server). Following the operations plan the SONC pulls out archived packets (Science and HK) by direct request to the DDS via FTP and stores them into SONC database.

SONC also handles Auxiliary data (Attitude and Orbit files) pushed by the ESA DDS (data distribution system) server.

As soon as they are received, the Science and HK data raw packets are passed through data processing software. The SONC data processing system takes as input raw telemetry data (packets) and raw attitude and orbit files. The SPM raw data are decommutated into ions energy and angle distributions (currents and counts), Faraday cup current and electron energy distribution (counts) and preliminary calibrated. The magnetic field vectors in instrument frame are extracted, time stamped in UTC, converted to physical units (nT) and stored in the SONC database. These data are furthermore draft calibrated (offset, sensitivity and alignment calculation) and rotated into different coordinate systems (EMEJ2000, ECLIPJ2000, SM, GSM, GSE, MSO). The calibration can be performed with different sets of calibration data (alignment and sensitivity matrices and offset vectors) that are stored in the SONC data base. This allows the use of different calibrations for different time intervals. The calibrated data are not stored in the SONC database but produced on the fly from the raw data and a selected calibration set.

Consequently, the following data are immediately available through W3-SONC server (<http://sonc-rosetta.cnes.fr>) and the authorized¹ users can get them for a selected time interval :

- Science (SC) and Housekeeping (HK) raw packets as binary files
- Preliminary calibrated magnetometer data (SONC level 1) in selectable coordinate systems as ASCII files
- Preliminary calibrated plasma monitor data (SONC level 1)
- Calibrated HK data as ASCII files

Moreover, the W3-SONC provides interactive plots of ROMAP science and housekeeping data.

After the proprietary period, the SONC team provides the raw data, preliminary calibrated data to the PSA team.

ROMAP-MAG Final calibration (SONC level 1_lab) has to be done by TU-BS using RPC data. Only some selected data intervals are provided to SONC and PDS during cruise.

The delivery format is described in this document.

2.4 Overview of Data Products

2.4.1 Pre-Flight Data Products

Preflight data are not subject of archiving. MAG as well as SPM data measured on ground are not representative due to environmental conditions (Earth field, stray fields, non vacuum): All relevant calibration results are summarized in the ADP.

¹ The authorization is controlled by PI (TU-BS). At his request, SONC delivers a login/password to the authorized user.

2.4.2 Sub-System Tests

No sub-system test data are provided.

2.4.3 Instrument Calibrations

MAG : Only selected calibration data (interpretable with limited setup information) are archived.

SPM : Instrument calibration data are not archived.

The file ROMAP_CALIBRATION_DESC.TXT (located in the DOCUMENT directory) contains information about MAG and SPM calibration.

2.4.4 Other Files written during Calibration

No additional files are available.

2.4.5 In-Flight Data Products

The in-flight data correspond to all the on board data.

They can be produced during following mission phases :

| MISSION_PHASE_NAME | Abbreviation | Start Date (dd/mm/yyyy) | End Date (dd/mm/yyyy) | ROMAP data (1) | |
|--|--------------|----------------------------|--------------------------|----------------|-----|
| | | | | MAG | SPM |
| 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 | X | |
| 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 | RMV1 | 11/09/2010 | 13/07/2011 | X (tbc) | |
| Cruise 6 | CR6 | 14/07/2011 | 22/01/2014 | X (tbc) | |
| RV Manoeuver 2 | RVM2 | 23/01/2014 | 17/08/2014 | X (tbc) | |
| Comet | COM | 18/08/2014 | 31/12/2015 | X (tbc) | |

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

Table 2-1 Mission phases

The data, both scientific and housekeeping, are listed in document AD 6.

Data products :

ROMAP-MAG

Edited (digital units) and draft calibrated data (in nT) are available for all mission phases. Calibrated data (in nT and cleaned from interferences) are available only for selected time intervals. The time intervals are selected when data from the Orbiter magnetometer (RPC-MAG) are available (see table Table 2-2 and §3.3.1). Only calibrated data are useful for scientific interpretation.

Edited (raw) data (in ADC units) provided by SONC
Science : UTC, OBT, BX, BY, BZ

Draft Calibrated Data (in physical units, draft aligned and very draft offset corrected), provided by SONC

Science_A (in Mag Coordinates) : UTC, OBT, POS_X, POS_Y, POS_Z, BX, BY, BZ
Science_B (in Lander Coordinates): UTC, OBT, POS_X, POS_Y, POS_Z, BX, BY, BZ
Science_C (in S/C Coordinates): UTC, OBT, POS_X, POS_Y, POS_Z, BX, BY, BZ
Science_D (in ECLIPJ2000): UTC, OBT, POS_X, POS_Y, POS_Z, BX, BY, BZ

Final calibrated Data (in physical units, cleaned from offset and spacecraft disturbances), provided by IGeP (TU-BS)

Science_E (in Mag Coordinates): UTC, OBT, POS_X, POS_Y, POS_Z, BX, BY, BZ
Science_F (in Lander Coordinates): UTC, OBT, POS_X, POS_Y, POS_Z, BX, BY, BZ
Science_G (in S/C Coordinates): UTC, OBT, POS_X, POS_Y, POS_Z, BX, BY, BZ
Science_H (in ECLIPJ2000): UTC, OBT, POS_X, POS_Y, POS_Z, BX, BY, BZ

| Mission phase | Start time (UTC) | Stop time (UTC) | Remarks |
|---------------|---------------------|---------------------|--|
| Mars swing-by | 2007-02-25T01:28:04 | 2007-02-25T02:28:01 | |
| Steins fly-by | 2008-09-05T18:08:17 | 2008-09-05T19:08:16 | ROMAP-MAG is switched into fast mode (64 Hz). However these data are reduced to 1Hz because correction has been derived from RPC-ROMAP comparison. |

Table 2-2 Final calibrated ROMAP-MAG data time intervals

The center of the ecliptic J2000 frame is chosen according to the mission phase. During the cruise, the center is the Sun, except for the flybys of the Earth, Mars and asteroids where the center is the Earth, or Mars or asteroids. The center for different time intervals is given in Table 2-3. Only centers different from Sun are given in the table.

| Start time (UTC) | Stop time (UTC) | ECLIP J2000 center |
|---------------------|---------------------|--------------------|
| 2005/03/01 01:00:09 | 2005/03/07 23:29:42 | Earth |
| 2007/11/07 01:30:18 | 2007/11/13 22:38:18 | Earth |
| 2007/11/13 22:38:18 | 2007/11/20 13:19:01 | Earth |
| 2007/02/24 01:01:08 | 2007/02/25 13:53:32 | Mars |

Table 2-3 The center of the ECLIP J2000 reference system for different time intervals

ROMAP-SPM

Edited data (in instrument coordinates)

The ROMAP electronics generates 2 types of data frames - Raw Data Frames and Parameter Data frames. The SPM data products are separated accordingly, in RAW and SPM files. The sampling procedure is the same for both modes. Only the way of transmitting the data differs.

In the **RAW mode**, the sampled data of one measurement cycle for the ion and ion-current channels are held in arrays (energy-elevation) in the ROMAP-Controller RAM.

After sampling for one measurement cycle is finished, data is packet into a specific amount of science data frames and transmitted via the CDMS interface.

For reducing the data amount, even and odd energies of both ion and ion-current channels can be transmitted alternating in consecutive Raw Data measurement cycles (at one measurement cycle the even energies of one ion channel and the odd energies of the other ion channel are transmitted and at the next measurement cycle vice versa). This is the default setting for SPM.

But also a full transmission of all energies can be selected. In this case for one cycle all data of one ion channel is transmitted and at the next cycle all of the other.

In the **PAR mode**, for reducing the amount of data to transmit, only the sums of the rows and columns of the sampled ion and ion-current arrays are transmitted. The sampling procedure is the same as for Raw Data transmission. The sums are computed when the sampling is finished.

Further details about ROMAP modes can be found in AD 6.

SC data products

For every science cycle:

UTC, OBT, Status of SPM (from HK parameters in SC data frame),
Raw Data

16 (for different angles) energy distributions (counts and current) for Ion1 and Ion2 sensors,
1 energy distributions (current) for Faraday Cup sensors,
1 energy distributions (counts) for Electron sensors

Parameter Data

1 energy distributions (counts and current) for Ion1 and Ion2 sensors,
1 angle distributions (counts and current) for Ion1 and Ion2 sensors,
1 energy distributions (current) for Faraday Cup sensors,
1 energy distributions (counts) for Electron sensors

Calibrated data : the same as for SC data, but in physical units: energy - in keV, angle - deg, count - in sm², current - in nA - all in accordance with calibration data.

Moreover for the calibrated data the orientation of sensors in ECLIPJ2000 coordinates is added for each distribution.

Derived data generated by SPM science group.

HK data products

Edited data (ADC counts)

16 housekeeping parameters : UTC, OBT, HK1, HK2, ..., HK16

Calibrated data (in physical units)

Same parameters as for edited data but in physical units : UTC, OBT, HK1, HK2, ..., HK16

2.4.6 Documentation

The documentation directory contains the following documents:

- ROMAP Electronics FM2 ADP, RO-LRO-DP-300002-UA, Issue 1, Revision 0, 16/05/2001
- EAICD (this document)
- ROMAP_CALIBRATION_DESC.TXT
- 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

2.4.7 Derived and other Data Products

MAG : The final calibrated data are considered as CODMAC level 5 (derived product) since the correction procedure can not be described sufficiently and is not reproducible. It depends on detailed situation on board (temperatures, variable currents ...) and on availability of RPC data (for the detection of changing supply currents).

SPM : **TBD**

2.4.8 Ancillary Data Usage

The following orbit and attitude files from ESOC are used for the generation of ROMAP data products:

ATNR (Rosetta orbiter attitude, EMEJ2000)

ORER, ORFR (Rosetta orbit, Earth Centric Earth swing by 1 and 2, EMEJ2000)

ORHR (Rosetta orbit, Heliocentric, EMEJ2000)

ORMR (Rosetta orbit, Mars Centric, EMEJ2000)

3 Archive Format and Content

3.1 Format and Conventions

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

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 is delivered for each **simple mission phase**. Each data set contains **only one level data processing**. The ROMAP MAG and SPM data are archived in a separate data sets.

The list of simple mission phases is given in Table 2-1.

A data set is level-stamped as below :

- Level 2 when it contains :
 - Uncalibrated SC or HK data (CODMAC level 2)
- Level 3 when it contains :
 - Calibrated SC or HK data (CODMAC level 3)
- Level 5 when it contains derived data (CODMAC level 5)

In addition a data set contains :

- Documents (see chapter 3.4.3.9)

A new version of a data set is provided when :

- calibration information refining
- new data processing
- higher levels production.

3.1.2 Data Set ID Formation

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>

Note: The description field is used to distinguish ROMAP-MAG and ROMAP-SPM datasets.

See appendix F (16.1.1, 16.1.2) of Archive Plan Issue 2/2.

Examples of DATA_SET_ID and DATA_SET_NAME for ROMAP-MAG data obtained in-flight during CVP :

DATA_SET_NAME = "ROSETTA-LANDER CAL ROMAP 3 CVP MAG V1.0"

DATA_SET_ID = "RL-CAL-ROMAP-3-CVP-MAG-V1.0"

3.1.3 Data Directory Naming Convention

See § 3.4.3.

3.1.4 Filenaming Convention

The following file **naming scheme** is used:

{exp}_{datatype}_{begin of observation}_{length of observation}_{modeSPM}.{ext}

- **exp** (3 character) = RHK (HK), MAG or SPM (SC)
- **datatype** (3 character) = XYZ
 - X = **G** for Ground, **F** for Flight
 - Y = **S** for Science Data, **H** for Housekeeping Data,
 - Z = Data processing level :
 - MAG :
 - 2** for edited data (HK, SC)
 - 3** for calibrated data (HK)
 - A** for preliminary calibrated SC data, in physical units, draft aligned and very draft offset corrected, in MAG coordinates
 - B** for preliminary calibrated SC data, in physical units, draft aligned and very draft offset corrected, in Lander coordinates
 - C** for preliminary calibrated SC data, in physical units, draft aligned and very draft offset corrected, in S/C coordinates
 - D** for preliminary calibrated SC data, in physical units, draft aligned and very draft offset corrected, in ECLIPJ2000 coordinates
 - E** for final calibrated SC data, in physical units, cleaned from offset and spacecraft disturbances, in MAG coordinates
 - F** for final calibrated SC data, in physical units, cleaned from offset and spacecraft disturbances, in Lander coordinates
 - G** for final calibrated SC data, in physical units, cleaned from offset and spacecraft disturbances, in S/C coordinates
 - H** for final calibrated SC data, in physical units, cleaned from offset and spacecraft disturbances, in ECLIPJ2000 coordinates
 - SPM :
 - 2** for edited data (HK, SC), in MAG coordinates
 - 3** for calibrated data (HK, SC), in Lander coordinates
 - 5** for derived data (SC), in Lander coordinates
- **begin of observation** (12 characters) = time of test or working session in UTC
yymmddhhmmss:
 - yy = year
 - mm = month
 - dd = day
 - hh = hour
 - mm = minute
 - ss = second
- **length of observation** (5 characters) = duration of test or working session expressed in minutes. A file do not contain more than 10 day of data
Two working sessions are separated by a gap greater than 100 seconds for MAG (SC), greater than 200 seconds for SPM (SC). A gap of 500 secondes is used for HK data.
- **modeSPM** = data type for SPM label file .LBL (only). Not encountered for MAG file or other extension of files. Possible values:
 - RAW
 - PAR
- **ext** = extension of file. For ROMAP possible extensions are:
 - ROL for Raw Data containing HK and SC data mixed together (CODMAC level 1)
 - TAB for SC or HK Data (CODMAC level 2, 3 and 5)
 - LBL for label file associated to file .TAB

Examples :

MAG_FSA_040603123400_01542.TAB

Data included in this file are ROMAP-MAG Science data recorded on flight on 03 June 2004 beginning at 12:34:00 (UTC) for a duration of 1542 minutes. They are preliminary calibrated, in MAG coordinates.

SPM_FS2_050103123400_00220.TAB

Data included in this file are ROMAP-SPM Science data recorded on flight on 03 Jan 2005 beginning at 12:34:00 (UTC) for a duration of 220 minutes. These are edited data.

RHK_FH3_040903121000_00800.TAB

Data included in this file are calibrated HK flight data recorded on 09 Sep 2004 beginning at 12:10:00 (UTC) for a duration of 800 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 bytes². 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 6:

² 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).

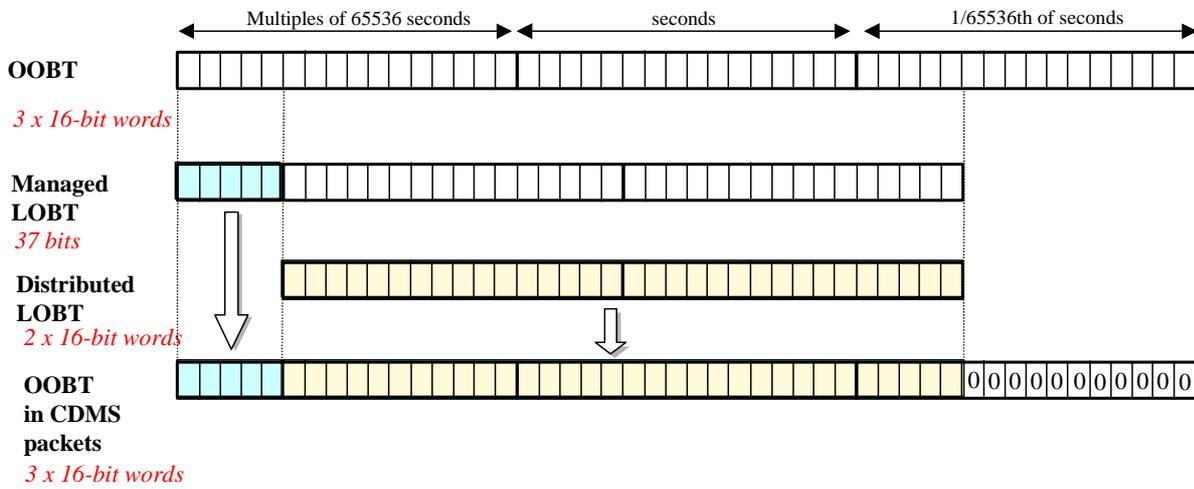


Figure 6 Reconstruction of on board time in CDMS packets

- ◆ 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.

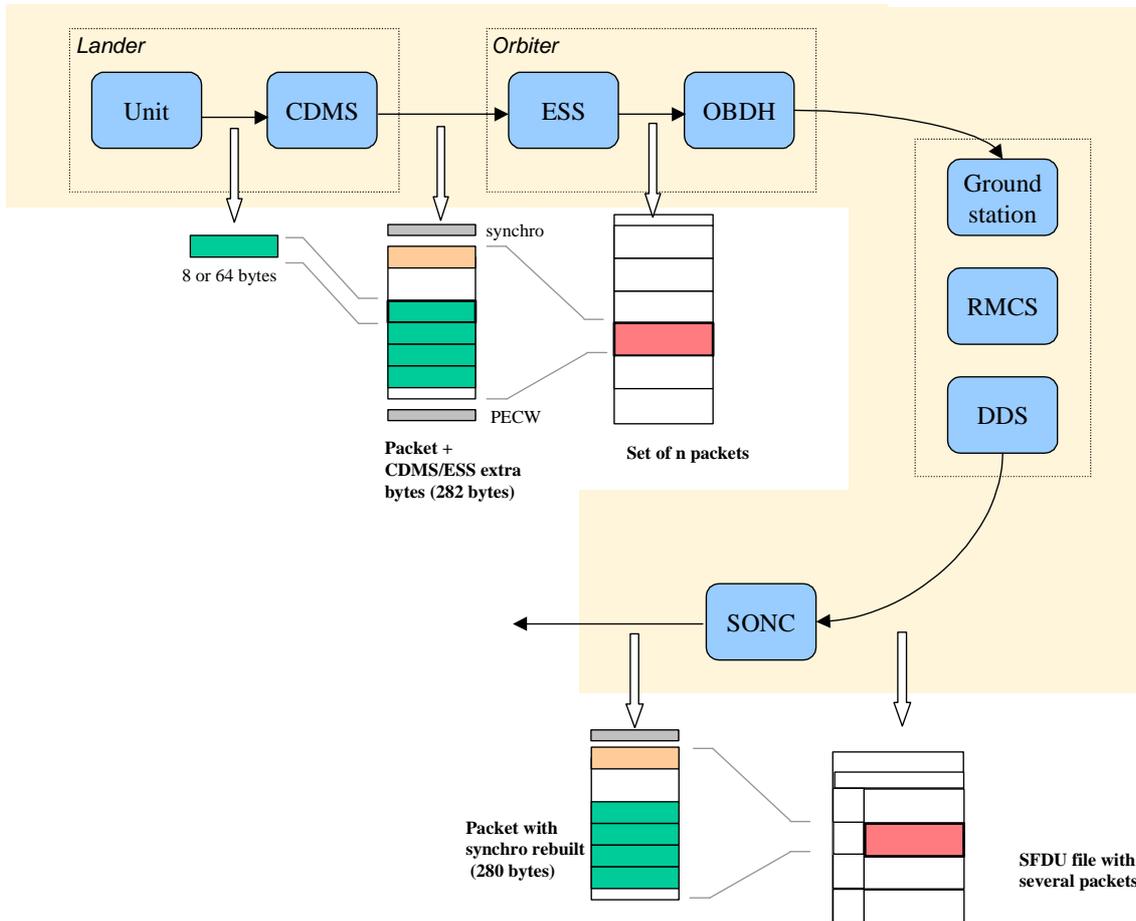


Figure 7 On board data flow

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

Figure 7 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.
- UTC time is calculated from the On-Board time taking into account the On-Board clock drift as following :

$$\text{UTC (seconds since 01/01/1970)} = \text{LOBT(seconds)} * \text{Gradient} + \text{Offset}$$
 (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 ROMAP Time standards

The time standards used in the ROMAP data products are :

- the ROMAP on-board time,
- the Lander on-board time,
- the DDS header time correlated,
- the UTC.

3.2.2.2.1 The ROMAP On-Board Time

ROMAP puts a time stamp of the first vector in a science data frame (MAG) or of the beginning of a data collection cycle (SPM) into the frame header. The timing information for subsequent data in the frame can be computed with the time stamp as reference. Because the interval of the received OBT is too low, the ROMAP-Controller integrates a 16bit counter with 1/32s resolution that is reset when a new OBT is received. For getting accurate time stamps, the value of the internal counter is read and added to the last received OBT. Then the time is stored to the data frame.

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 Lander On-Board Time (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 AD 9).

The Lander is 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 is kept synchronized as long as the Lander is powered.

Technical details about synchronisation of Lander On-board Time can be found in § 2.3.2.6 of AD 9.

For a description of time handling in the Rosetta project see AD 11.

For a description of Lander on board time handling see AD 9 :

§ 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 AD 10 § 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 AD 12 § 18.1.2.1.

3.2.2.2.4 The UTC (Coordinated Universal Time)

The **UTC** used as time stamp for SC and HK ROMAP data products (from level 2 to level 3) is calculated from the experiment on-board time taking into account the drift and reset clock.

3.2.3 Reference Systems

The reference systems used for ROMAP data products are as follows :

The GSE, GSM, and SM systems are Earth-centered coordinate systems, they are used to study the space ionized environment of the Earth and its interaction with the interplanetary medium (solar wind and its embedded interplanetary magnetic field).

The geocentric solar ecliptic system, GSE, has its X-axis and Y-axis in the ecliptic plane. The X-axis points from the Earth towards the Sun and the Y-axis points towards dusk. The Z-axis is therefore parallel to the ecliptic north pole. Relative to an inertial system this system has a yearly rotation (one Earth's year).

The geocentric solar magnetospheric system, GSM, has its X-axis in common with the GSE, while now the Y-axis is defined to be perpendicular to the Earth's magnetic dipole. In this way, the X-Z plane turns out to contain the dipole axis. It is worth noting that the GSM is then deduced from the GSE by a rotation about the X-axis.

In the solar magnetic coordinates SM the Z-axis is parallel to the north magnetic pole and the Y-axis is perpendicular to the Earth-Sun line towards dusk. The difference between this system and the GSM system is a rotation about the Y-axis. The amount of rotation is the dipole tilt angle.

The MSO is a Mars-centered coordinate system, it is the one actually used to study the space environment of Mars and its interaction with the solar wind. The X-axis and Y-axis of the Mars solar orbital system, MSO, are in the Mars solar orbital plane. This plane is inclined at 1.9 degree above the ecliptic plane. The X-axis points to the Sun, the Z-axis is the cross-product of the X-axis and Y-axis, and points to the North Mars solar orbital plane. The Y-axis is thus in the Mars solar orbital plane and points towards dusk (opposing planetary motion). Relative to an inertial system this system has a yearly rotation (two Earth's years).

At comet and asteroids, body-centered coordinate systems is also used. They are similar to the GSE (for the Earth) and MSO (for Mars) systems. The X-axis and Y-axis are in the respective body solar orbital planes. The X-axis points towards the Sun.

For cruise phases the ECLIPJ2000 is used. (Ecliptic coordinates based upon the J2000 frame, i.e. the Earth mean equator and dynamical equinox of J2000). The X-axis is aligned with the cross product of the

north-pointing vectors normal to the Earth's mean equator and mean orbital plane of J2000 epoch. The Z-axis is aligned with the second of these normal vectors. The Y axis is the cross product of the Z and X axes.

Finally, Instrument coordinates, Rosetta Orbiter coordinates and Rosetta Lander coordinates are also used as reference systems. See 2.1 and INSTHOST.CAT file for more details.

3.3 Data Validation

The ROMAP data products are delivered to PSA by SONC. All the levels SC and HK data produced by SONC are validated by ROMAP PIs. These data are also distributed via the W3-SONC server and used by all the experiment team.

3.3.1 MAG quality parameter

Magnetometer quality parameter are given for draft calibrated (CODMAC level 3) and final calibrated data (CODMAC level 5). Five levels are defined as follow.

- Level 0: absolute error less than 1nT
- Level 1: absolute error less than 5nT
- Level 2: absolute error less than 10nT
- Level 3: absolute error less than 100nT
- Level 4: absolute error exceed 100nT

Draft calibrated data are processed from edited data by linear transformation using a default calibration matrix and an preliminary offset (averaged value). As long the Lander is not released the data are disturbed by an offset drift due to changing balcony temperatures (temperature coefficient of compensation magnet) and the magnetic field caused by the supply current of the Lander (GND loop due to electrical contact between orbiter and lander structure). Especially the dependency on supply current can be in the order of several hundred nT (1mA corresponds to about 1nT) and leads sometimes to saturation of the magnetic field measurement. Therefore for most of the intervals in which the lander is active (AFT's) are draft calibrated data are level 4 data. Some quite intervals can be archived as level 3 data.

Final calibrated data are processed by draft calibrated data by applying a manually generated correction function. Drifts are related to TCU temperature measurements, signatures of changing supply currents are detected by comparison of RPC-MAG and Romap data. This part of the procedure can not be automated. It is done for selected intervals and only the calibrated data and not procedure and correction function are subject of archiving. Expected levels are 0-2.

3.3.2 SPM quality parameter

Three data quality levels are defined for SPM. We keep however four levels (with level 2 not used) in order to have the same scheme for quality definition as for MAG data, i.e. quality ID goes from level 0 – best quality to level 4 - worst quality.

- Level 0: data quality is perfect, that means counts doesn't depends on high voltage level
- Level 1: data are scientifically of interest, but calibration could be wrong due to too low high voltage level (degradation of channeltrons might be the reason)
- Level 2: not used for SPM

- Level 3: data are scientifically wrong e.g. because sensor is directed to orbiter (all times during cruise) but technologically usable
- Level 4: data are scientifically and technologically wrong

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 **Erreur ! Source du renvoi introuvable.** The volume keyword values for the Mars mission phase are given in the following example.

```
VOLUME_NAME           = "ROMAP MAG RAW DATA FOR
                        THE MARS SWING-BY"
VOLUME_SERIES_NAME    = "ROSETTA SCIENCE ARCHIVE"
VOLUME_SET_ID         = "DE_TUBS_IGEP_RLMAG_10XX"
VOLUME_SET_NAME       = "ROSETTA ROMAP MAG DATA"
VOLUME_ID             = "RLMAG2_1023"
VOLUME_VERSION_ID    = "VERSION 1"
VOLUME_FORMAT         = "ISO-9660"
MEDIUM_TYPE          = "ONLINE"
VOLUMES               = 35
PUBLICATION_DATE      = 2009-06-29
DESCRIPTION           = " This volume contains data
                        and supporting documentation
                        from the Rosetta Mars swing by
                        mission phase "
```

3.4.2 Data Set

The ROMAP data are archived in as many Data Sets as simple mission phase and level data processing. The MAG and SPM data are archived in a separate data sets

| Name element | Data Set ID | Data Set Name |
|--|--|----------------|
| INSTRUMENT_HOST_ID / INSTRUMENT_HOST_NAME | RL (Rosetta Lander) | ROSETTA-LANDER |
| Target id / target name | See AD 4 | AD 4 |
| INSTRUMENT_NAME | ROSETTA LANDER MAGNETOMETER AND PLASMA MONITOR | |
| INSTRUMENT_ID | ROMAP | |
| Data processing level number | * Level 2 contains level 2 SC and HK * Level 3 contains preliminary level 3 SC and level 3 HK * Level 5 contains derived data <u>Remark</u> : Level 2 and preliminary level 3 data are delivered directly after the end of the proprietary period. Level 5 data are delivered when ready. | |
| mission phase abbreviation | See Table 2-1 | |
| description | N/A | N/A. |
| version | The first version of a data set is V1.0 | |

The archive contains 5 types of data sets.

- two for Level 2 data (edited data) :

DATA_SET_ID = "RL"><target name>-ROMAP-2><mission phase abbreviation>-<MAG>- Vx.x"
DATA_SET_ID = "RL"><target name>-ROMAP-2><mission phase abbreviation>-<SPM>- Vx.x"

- two for Level 3 data (preliminary and final calibrated data) :

DATA_SET_ID = "RL"><target name>-ROMAP-3><mission phase abbreviation>-<MAG>- Vx.x"
DATA_SET_ID = "RL"><target name>-ROMAP-3><mission phase abbreviation>-<SPM>- Vx.x"

- one for Level 5 data (derived data) :

DATA_SET_ID = "RL"><target name>-ROMAP-5><mission phase abbreviation>-<SPM>- Vx.x"

3.4.3 Directories

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

Level 2 datasets :

```

| -root directory-----
|
| -AAREADME.TXT
| -CATALOG-
| -DATA----- | --SC (Level 2 SC data files)
|                | --HK (Level 2 HK data files)
| -DOCUMENT-
| -INDEX-
| -LABEL-
| -VOLDESC.CAT

```

Level 3 datasets :

```

| -root directory-----
|
| -AAREADME.TXT
| -CATALOG-
| -DATA----- | --SC_PRELIMINARY (MAG A,B,C,D)
|                | --HK (Level 3 HK data files)
| -DOCUMENT-
| -INDEX-
| -LABEL-
| -VOLDESC.CAT

```

Level 5 datasets :

```

| -root directory-----
|
| -AAREADME.TXT
| -CATALOG-
| -DATA----- | --SC_FINAL (MAG E,F,G,H)
|                | --HK (Level 3 HK data files)
| -DOCUMENT-
| -INDEX-
| -LABEL-

```

| -VOLDESC.CAT

Remark : The name of Root Directory is 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

Calibration information can be found in the file ROMAP_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 is 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 :

| 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 |

3.4.3.5 Geometry Directory

TBD

3.4.3.6 Software Directory

There is no software directory.

3.4.3.7 Gazetteer Directory

There is no Gazetteer directory.

3.4.3.8 Label Directory

The label directory contains include files (.FMT files with label definitions) referenced by data files on the data set. The following files are included in the index directory :

| File Name | Contents |
|---------------------------|---|
| LABINFO.TXT | A description of the contents of this directory (.FMT files) |
| ROMAP_RAWHK.FMT | Edited (raw) HK data |
| ROMAP_CALHK.FMT | Calibrated HK data |
| ROMAP_MAG_RAWSC.FMT | Edited (raw) Science data |
| ROMAP_MAG_CALSCA.FMT | Draft Calibrated Data, Instrument coordinates |
| ROMAP_MAG_CALSCB.FMT | Draft Calibrated Data, Lander coordinates |
| ROMAP_MAG_CALSCC.FMT | Draft Calibrated Data, Orbiter coordinates |
| ROMAP_MAG_CALSCD.FMT | Draft Calibrated Data, ECLIP J2000 coordinates |
| ROMAP_MAG_CALSCE.FMT | Final Calibrated Data, Instrument coordinates |
| ROMAP_MAG_CALSCF.FMT | Final Calibrated Data, Lander coordinates |
| ROMAP_MAG_CALSCG.FMT | Final Calibrated Data, Orbiter coordinates |
| ROMAP_MAG_CALSCH.FMT | Final Calibrated Data, ECLIP J2000 coordinates |
| ROMAP_SPM_RAW_ION_CN.FMT | raw mode Ion spectrum definition (counts-energy-angle distribution, channels 1 or 2) ; Level 2 |
| ROMAP_SPM_RAW_ION_CR.FMT | raw mode Ion spectrum definition (current-energy- angle), (channels 1 or 2) ; Level 2 |
| ROMAP_SPM_PAR_ION_CNE.FMT | parameter mode Ion spectrum definition (counts-energy distribution), (channels 1 or 2) ; Level 2 |
| ROMAP_SPM_PAR_ION_CRE.FMT | parameter mode Ion spectrum definition (current-energy distribution), (channels 1 or 2) ; Level 2 |

| | |
|-----------------------------|--|
| ROMAP_SPM_PAR_ION_CNA.FMT | parameter mode Ion spectrum definition (counts-angle distribution), (channels 1 or 2) ; Level 2 |
| ROMAP_SPM_PAR_ION_CRA.FMT | parameter mode Ion spectrum definition (current-angle), (channels 1 or 2) ; Level 2 |
| ROMAP_SPM_FC.FMT | Faraday cup current-energy distribution ; Level 2 |
| ROMAP_SPM_ELEC.FMT | Electron spectrum (count-energy distribution) Level 2 |
| ROMAP_SPM_RAWC_ION_CN.FMT | raw mode Ion spectrum definition (counts-energy-angle distribution), (channels 1 or 2) ; Level 3 |
| ROMAP_SPM_RAWC_ION_CR.FMT | raw mode Ion spectrum definition (current-energy-angle), (channels 1 or 2) ; Level 3 |
| ROMAP_SPM_PARC_ICNT_CNE.FMT | parameter mode Ion spectrum definition (counts-energy distribution), (channels 1 or 2) ; Level 3 |
| ROMAP_SPM_PARC_ION_CRE.FMT | parameter mode Ion spectrum definition (current-energy distribution), (channels 1 or 2) ; Level 3 angles |
| ROMAP_SPM_PARC_ION_CNA.FMT | parameter mode Ion spectrum definition (counts-angle distribution), (channels 1 or 2) ; Level 3 |
| ROMAP_SPM_PARC_ION_CRA.FMT | parameter mode Ion spectrum definition (current-angle), (channels 1 or 2) ; Level 3 |
| ROMAP_SPM_FCC.FMT | Faraday cup current-energy distribution ; Level 3 |
| ROMAP_SPM_ELECC.FMT | Electron spectrum (count-energy distribution) Level 3 |

3.4.3.9 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 |
| RO-LRO-DP-300002-UA.PDF | ROMAP FM2 ADP |
| RO-LRO-DP-300002-UA.LBL | PDS label for file RO-LRO-DP-300002-UA |
| EAICD_ROMAP.PDF | This document |
| EAICD_ROMAP.LBL | PDS label for file EAICD_ROMAP.PDF |
| ROMAP_CALIBRATION_DESC.TXT | Description of the calibration of MAG and SPM |
| ROMAP_CALIBRATION_DESC.LBL | PDS label for ROMAP_CALIBRATION_DESC.TXT |
| TIMELINE_ph.TXT | Timeline Ascii file with the PDS label attached for phase <i>ph</i> |
| TIMELINE_ph_DESC.TXT | Description of the timeline file for phase <i>ph</i> |
| TIMELINE_ph_obty.PNG | Timeline Image file for phase <i>ph</i> and observation type <i>obty</i> |
| TIMELINE_ph_obty.LBL | PDS label for image TIMELINE_ph_obty.PNG |

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 ROMAP MAG and SPM data are archived in a separate data sets on the basis mission phase relative to the production of the data. The ROMAP MAG DATA directory contains subdirectories with preliminary and final calibrated data.

4.2 Data Sets, Definition and Content

The following table gives the definition of the name and id of the ROMAP data sets :

| Data Set ID | Data Set Name |
|------------------------------|--|
| RL-CAL-ROMAP-2-GRND-MAG-V1.0 | ROSETTA-LANDER CAL ROMAP 2 GRND MAG V1.0 |
| RL-CAL-ROMAP-2-CVP-MAG-V1.0 | ROSETTA-LANDER CAL ROMAP 2 CVP MAG V1.0 |
| RL-CAL-ROMAP-2-CR2-MAG-V1.0 | ROSETTA-LANDER CAL ROMAP 2 CR2 MAG V1.0 |
| RL-CAL-ROMAP-2-CR4A-MAG-V1.0 | ROSETTA-LANDER CAL ROMAP 2 CR4A MAG V1.0 |
| RL-CAL-ROMAP-2-CR4B-MAG-V1.0 | ROSETTA-LANDER CAL ROMAP 2 CR4B MAG V1.0 |
| RL-CAL-ROMAP-2-CR5-MAG-V1.0 | ROSETTA-LANDER CAL ROMAP 2 CR5 MAG V1.0 |
| RL-CAL-ROMAP-2-CR6-MAG-V1.0 | ROSETTA-LANDER CAL ROMAP 2 CR6 MAG V1.0 |
| RL-CAL-ROMAP-2-RMV1-MAG-V1.0 | ROSETTA-LANDER CAL ROMAP 2 RMV1 MAG V1.0 |
| RL-CAL-ROMAP-2-RMV2-MAG-V1.0 | ROSETTA-LANDER CAL ROMAP 2 RMV2 MAG V1.0 |
| RL-CAL-ROMAP-3-CR2-MAG-V1.0 | ROSETTA-LANDER CAL ROMAP 3 CR2 MAG V1.0 |
| RL-CAL-ROMAP-3-CR4A-MAG-V1.0 | ROSETTA-LANDER CAL ROMAP 3 CR4A MAG V1.0 |
| RL-CAL-ROMAP-3-CR4B-MAG-V1.0 | ROSETTA-LANDER CAL ROMAP 3 CR4B MAG V1.0 |
| RL-CAL-ROMAP-3-CR5-MAG-V1.0 | ROSETTA-LANDER CAL ROMAP 3 CR5 MAG V1.0 |
| RL-CAL-ROMAP-3-CR6-MAG-V1.0 | ROSETTA-LANDER CAL ROMAP 3 CR6 MAG V1.0 |
| RL-CAL-ROMAP-3-RMV1-MAG-V1.0 | ROSETTA-LANDER CAL ROMAP 3 RMV1 MAG V1.0 |
| RL-CAL-ROMAP-3-RMV2-MAG-V1.0 | ROSETTA-LANDER CAL ROMAP 3 RMV2 MAG V1.0 |
| RL-E-ROMAP-2-EAR1-MAG-V1.0 | ROSETTA-LANDER EARTH ROMAP 2 EAR1 MAG V1.0 |
| RL-E-ROMAP-2-EAR2-MAG-V1.0 | ROSETTA-LANDER EARTH ROMAP 2 EAR2 MAG V1.0 |
| RL-E-ROMAP-2-EAR3-MAG-V1.0 | ROSETTA-LANDER EARTH ROMAP 2 EAR3 MAG V1.0 |
| RL-E-ROMAP-3-EAR1-MAG-V1.0 | ROSETTA-LANDER EARTH ROMAP 3 EAR1 MAG V1.0 |
| RL-E-ROMAP-3-EAR2-MAG-V1.0 | ROSETTA-LANDER EARTH ROMAP 3 EAR2 MAG V1.0 |
| RL-E-ROMAP-3-EAR3-MAG-V1.0 | ROSETTA-LANDER EARTH ROMAP 3 EAR3 MAG V1.0 |
| RL-M-ROMAP-2-MARS-MAG-V1.0 | ROSETTA-LANDER MARS ROMAP 2 MARS MAG V1.0 |
| RL-M-ROMAP-3-MARS-MAG-V1.0 | ROSETTA-LANDER MARS ROMAP 3 MARS MAG V1.0 |
| RL-M-ROMAP-5-MARS-MAG-V1.0 | ROSETTA-LANDER MARS ROMAP 5 MARS MAG V1.0 |
| RL-A-ROMAP-2-AST1-MAG-V1.0 | ROSETTA-LANDER STEINS ROMAP 2 AST1 MAG V1.0 |
| RL-A-ROMAP-3-AST1-MAG-V1.0 | ROSETTA-LANDER STEINS ROMAP 3 AST1 MAG V1.0 |
| RL-A-ROMAP-5-AST1-MAG-V1.0 | ROSETTA-LANDER STEINS ROMAP 5 AST1 MAG V1.0 |
| RL-A-ROMAP-2-AST2-MAG-V1.0 | ROSETTA-LANDER LUTETIA ROMAP 2 AST2 MAG V1.0 |
| RL-A-ROMAP-3-AST2-MAG-V1.0 | ROSETTA-LANDER LUTETIA ROMAP 3 AST2 MAG V1.0 |
| RL-C-ROMAP-2-COM-MAG-V1.0 | ROSETTA-LANDER 67P ROMAP 2 COM MAG V1.0 |
| RL-C-ROMAP-3-COM-MAG-V1.0 | ROSETTA-LANDER 67P ROMAP 3 COM MAG V1.0 |
| RL-C-ROMAP-5-COM-MAG-V1.0 | ROSETTA-LANDER 67P ROMAP 5 COM MAG V1.0 |
| | |
| RL-CAL-ROMAP-2-CVP-SPM-V1.0 | ROSETTA-LANDER CAL ROMAP 2 CVP SPM V1.0 |
| RL-CAL-ROMAP-2-CR2-SPM-V1.0 | ROSETTA-LANDER CAL ROMAP 2 CR2 SPM V1.0 |
| RL-CAL-ROMAP-2-CR4A-SPM-V1.0 | ROSETTA-LANDER CAL ROMAP 2 CR4A SPM V1.0 |

| | |
|------------------------------|--|
| RL-CAL-ROMAP-2-CR4B-SPM-V1.0 | ROSETTA-LANDER CAL ROMAP 2 CR4B SPM V1.0 |
| RL-CAL-ROMAP-2-CR5-SPM-V1.0 | ROSETTA-LANDER CAL ROMAP 2 CR5 SPM V1.0 |
| RL-CAL-ROMAP-2-CR6-SPM-V1.0 | ROSETTA-LANDER CAL ROMAP 2 CR6 SPM V1.0 |
| RL-CAL-ROMAP-2-RMV1-SPM-V1.0 | ROSETTA-LANDER CAL ROMAP 3 RMV1 SPM V1.0 |
| RL-CAL-ROMAP-2-RMV2-SPM-V1.0 | ROSETTA-LANDER CAL ROMAP 3 RMV2 SPM V1.0 |
| RL-CAL-ROMAP-3-CR2-SPM-V1.0 | ROSETTA-LANDER CAL ROMAP 3 CR2 SPM V1.0 |
| RL-CAL-ROMAP-3-CR4A-SPM-V1.0 | ROSETTA-LANDER CAL ROMAP 3 CR4A SPM V1.0 |
| RL-CAL-ROMAP-3-CR4B-SPM-V1.0 | ROSETTA-LANDER CAL ROMAP 3 CR4B SPM V1.0 |
| RL-CAL-ROMAP-3-CR5-SPM-V1.0 | ROSETTA-LANDER CAL ROMAP 3 CR5 SPM V1.0 |
| RL-CAL-ROMAP-3-CR6-SPM-V1.0 | ROSETTA-LANDER CAL ROMAP 3 CR6 SPM V1.0 |
| RL-CAL-ROMAP-3-RMV1-SPM-V1.0 | ROSETTA-LANDER CAL ROMAP 3 RMV1 SPM V1.0 |
| RL-CAL-ROMAP-3-RMV2-SPM-V1.0 | ROSETTA-LANDER CAL ROMAP 3 RMV2 SPM V1.0 |
| RL-E-ROMAP-2-EAR1-SPM-V1.0 | ROSETTA-LANDER EARTH ROMAP 2 EAR1 SPM V1.0 |
| RL-E-ROMAP-2-EAR2-SPM-V1.0 | ROSETTA-LANDER EARTH ROMAP 2 EAR2 SPM V1.0 |
| RL-E-ROMAP-2-EAR3-SPM-V1.0 | ROSETTA-LANDER EARTH ROMAP 2 EAR3 SPM V1.0 |
| RL-E-ROMAP-3-EAR1-SPM-V1.0 | ROSETTA-LANDER EARTH ROMAP 3 EAR1 SPM V1.0 |
| RL-E-ROMAP-3-EAR2-SPM-V1.0 | ROSETTA-LANDER EARTH ROMAP 3 EAR2 SPM V1.0 |
| RL-E-ROMAP-3-EAR3-SPM-V1.0 | ROSETTA-LANDER EARTH ROMAP 3 EAR3 SPM V1.0 |
| RL-M-ROMAP-2-MARS-SPM-V1.0 | ROSETTA-LANDER MARS ROMAP 2 MARS SPM V1.0 |
| RL-M-ROMAP-3-MARS-SPM-V1.0 | ROSETTA-LANDER MARS ROMAP 3 MARS SPM V1.0 |
| RL-A-ROMAP-2-AST1-SPM-V1.0 | ROSETTA-LANDER STEINS ROMAP 2 AST1 SPM V1.0 |
| RL-A-ROMAP-3-AST1-SPM-V1.0 | ROSETTA-LANDER STEINS ROMAP 3 AST1 SPM V1.0 |
| RL-A-ROMAP-2-AST2-SPM-V1.0 | ROSETTA-LANDER LUTETIA ROMAP 2 AST2 SPM V1.0 |
| RL-A-ROMAP-3-AST2-SPM-V1.0 | ROSETTA-LANDER LUTETIA ROMAP 3 AST2 SPM V1.0 |
| RL-C-ROMAP-2-COM-SPM-V1.0 | ROSETTA-LANDER 67P ROMAP 2 COM SPM V1.0 |
| RL-C-ROMAP-3-COM-SPM-V1.0 | ROSETTA-LANDER 67P ROMAP 3 COM SPM V1.0 |
| RL-C-ROMAP-5-COM-SPM-V1.0 | ROSETTA-LANDER 67P ROMAP 5 COM SPM V1.0 |

The contents of the ROMAP data sets is as follows:

RL-CAL-ROMAP-x-CVP-xxx-Vx.x contains data from commissioning (2004)
 RL-CAL-ROMAP-x-CRx-xxx-Vx.x contains data from cruise phases 1 to 6 (2004-2014)
 RL-E-ROMAP-x-EARx-xxx-Vx.x contains data from the 3 Earth swing-by (03/2005, 11/2007, 11/2009)
 RL-M-ROMAP-x-MARS-xxx-Vx.x contains data from the Mars swing-by (02/2007)
 RL-A-ROMAP-x-AST1-xxx-Vx.x contains data from asteroid Steins fly by (2008)
 RL-A-ROMAP-x-AST2-xxx-Vx.x contains data from asteroid Lutetia fly by (2010)
 RL-C-ROMAP-x-COM-xxx-Vx.x contains data from comet phase (2014-2015).

4.3 Data Product Design

The following types of data products are defined for ROMAP:

- Magnetometer data products: edited data (CODMAC level 2) in ADC units, preliminary calibrated data (CODMAC level 3) and final calibrated data (CODMAC level 5).
- Simple plasma monitor data products: edited data (CODMAC level 2), preliminary calibrated and final calibrated (CODMAC level 3), derived data (CODMAC level 5 **TBD**)
- Housekeeping data. The HK data are common for MAG and SPM and include the pressure values.

All ROMAP data products have PDS detached labels.

4.3.1 Magnetometer Science Edited Data Product Design (Level 2)

A ROMAP edited Science file contains magnetic field vectors time stamped in UTC and ROMAP on board time.

4.3.1.1 File Characteristics Data Elements

The PDS file characteristic data elements for ROMAP MAG edited science data (level 2) are:

```
RECORD_TYPE      = FIXED_LENGTH
RECORD_BYTES
FILE_RECORDS
LABEL_RECORDS
```

4.3.1.2 Data Object Pointers Identification Data Elements

The ROMAP SC edited data are organized as ASCII tables. The data object pointers (^TABLE) reference TAB files.

4.3.1.3 Instrument and Detector Descriptive Data Elements

The following data identification elements provide additional information about the ROMAP-MAG data products.

```
INSTRUMENT_HOST_NAME      = "ROSETTA-LANDER"
INSTRUMENT_HOST_ID        = RL
INSTRUMENT_ID              = ROMAP
INSTRUMENT_NAME            = "ROSETTA LANDER MAGNETOMETER AND PLASMA MONITOR"
INSTRUMENT_TYPE            = { "FLUXGATE MAGNETOMETER", "ELECTROSTATIC ANALYZER",
                               "FARADAY CUP" }
DETECTOR_ID                = MAG
INSTRUMENT_MODE_ID         = "N/A"
INSTRUMENT_MODE_DESC       = "N/A"
```

4.3.1.4 Data Object Definition

Each TAB file contains a five columns table with the raw magnetic field in Instrument frame and in ADC units: UTC, OBT, Bx, By, Bz.

```
OBJECT              = TABLE
NAME                 = "ROMAP_MAG_RAWSC_TABLE"
INTERCHANGE_FORMAT  = ASCII
ROWS                 =
COLUMNS              = 5
ROW_BYTES            = 65
^STRUCTURE           = "ROMAP_MAG_RAWSC.FMT"
END_OBJECT           = TABLE
```

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

```
/* Contents of format file "ROMAP_MAG_RAWSC.FMT" (Edited Science data) */

OBJECT              = COLUMN
NAME                 = "UTC"
DATA_TYPE            = TIME
START_BYTE           = 1
BYTES                = 23
DESCRIPTION           = "This column represents the UTC
                          Of the magnetic field vector in PDS standard format
                          YYYY-MM-DDThh:mm:ss.sss"
END_OBJECT           = COLUMN

OBJECT              = COLUMN
NAME                 = "OBT"
DATA_TYPE            = ASCII_REAL
START_BYTE           = 25
BYTES                = 15
UNIT                 = SECOND
FORMAT               = "F15.5"
```

```

DESCRIPTION      = "ROMAP 4 bytes counter representing the measurement
                    time synchronized with Lander On Board Time.
                    The time resolution is 0.03125 s"
END_OBJECT       = COLUMN

OBJECT           = COLUMN
  NAME           = "BX"
  DATA_TYPE     = ASCII_INTEGER
  START_BYTE     = 41
  BYTES          = 7
  FORMAT         = "I7"
  UNIT           = "ADC_COUNTS"
  DESCRIPTION    = "Magnetic field X component,
                    Uncalibrated raw data in instrument coordinates"
END_OBJECT       = COLUMN

OBJECT           = COLUMN
  NAME           = "BY"
  DATA_TYPE     = ASCII_INTEGER
  START_BYTE     = 49
  BYTES          = 7
  FORMAT         = "I7"
  UNIT           = "ADC_COUNTS"
  DESCRIPTION    = "Magnetic field Y component,
                    Uncalibrated raw data in instrument coordinates"
END_OBJECT       = COLUMN

OBJECT           = COLUMN
  NAME           = "BZ"
  DATA_TYPE     = ASCII_INTEGER
  START_BYTE     = 57
  BYTES          = 7
  FORMAT         = "I7"
  UNIT           = "ADC_COUNTS"
  DESCRIPTION    = "Magnetic field Z component,
                    Uncalibrated raw data in instrument coordinates"
END_OBJECT       = COLUMN

```

4.3.1.5 Description of Instrument

The description of the instrument is done in above and as a brief overview in the INST.CAT catalog file.

4.3.2 Simple Plasma Monitor Science Edited Data Product Design (Level 2)

A ROMAP SPM edited science file contains data for several measurement cycles.

One cycle contains the following data (in raw or parameter modes):

Raw mode

SPM header:

- UTC,
- OBT,
- Status of SPM (from HK parameters in SC data frame)

16 (for different angles) energy distributions (counts and current) for Ion1 and Ion2 sensors,
1 energy distribution (current) for Faraday Cup sensors,
1 energy distribution (counts) for Electron sensors

Parameter mode

SPM header (same as for raw mode)

1 energy distribution (counts and currents) for Ion1 and Ion2 sensors,
1 angle distributions (counts and currents) for Ion1 and Ion2 sensors,
1 energy distribution (current) for Faraday Cup sensors (same format as for raw mode),

1 energy distribution (counts) for Electron sensors (same format as for raw mode)

Each measurement cycle is described by a "combined detached label" (.LBL) containing pointers to corresponding data files (.TAB).

Examples:

Raw mode:

SPM_FS2_041007004354_RAW.LBL
 SPMR_FS2_041007004354_CN.TAB (ion energy-angle distribution, counts)
 SPMR_FS2_041007004354_CR.TAB (ion energy-angle distribution, current)
 SPMF_FS2_041007004354.TAB (Faraday cup energy distribution, current)
 SPME_FS2_041007004354.TAB (electron energy distribution, counts)

Param mode:

SPM_FS2_040514013124_PAR.LBL
 SPMP_FS2_040514013124_CNA.TAB (ion angle distribution, counts)
 SPMP_FS2_040514013124_CNE.TAB (ion energy distribution, counts)
 SPMP_FS2_040514013124_CRA.TAB (ion angle distribution, current)
 SPMP_FS2_040514013124_CRE.TAB (ion energy distribution, current)
 SPMF_FS2_040514013124.TAB (Faraday cup energy distribution, current)
 SPME_FS2_040514013124.TAB (electron energy distribution, counts)

The table objects corresponding to the distributions are detailed in the following paragraphs.

4.3.2.1 File Characteristics Data Elements

The PDS file characteristic data elements for ROMAP SPM edited science data (level 2) are:

```
RECORD_TYPE = FIXED_LENGTH
RECORD_BYTES
FILE_RECORDS
LABEL_RECORDS
```

4.3.2.2 Data Object Pointers Identification Data Elements

The ROMAP SPM SC edited data are organized as ASCII tables. The data object pointers (^TABLE) reference TAB files.

4.3.2.3 Instrument and Detector Descriptive Data Elements

The following data identification elements provide additional information about the ROMAP-SPM data products.

```
INSTRUMENT_HOST_NAME = "ROSETTA-LANDER"
INSTRUMENT_HOST_ID = RL
INSTRUMENT_ID = ROMAP
INSTRUMENT_NAME = "ROSETTA LANDER MAGNETOMETER AND PLASMA MONITOR"
INSTRUMENT_TYPE = {"FLUXGATE MAGNETOMETER", "ELECTROSTATIC ANALYZER",
                   "FARADAY CUP"}
DETECTOR_ID = SPM
INSTRUMENT_MODE_ID = "N/A"
INSTRUMENT_MODE_DESC = "N/A"
```

4.3.2.4 Data Object Definition

Each TAB file contains a header describing the Instrument status and the energy and angle distributions.

4.3.2.4.1 Ion spectrum definition (counts-energy-angle distribution), raw mode (channels 1 or 2)

```
OBJECT = ROMAP_SPM_RAW_ION_CN_TABLE
```

```

NAME = ROMAP_SPM_RAW_ION_CN
INTERCHANGE_FORMAT = ASCII
ROWS = 256
^STRUCTURE = "ROMAP_SPM_RAW_ION_CN.FMT"
COLUMNS = 28
ROW_BYTES = 232
END_OBJECT = ROMAP_SPM_RAW_ION_CN_TABLE

```

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

```

/*          Contents of format file "ROMAP_SPM_RAW_ION_CN.FMT"          */
/*          Ion spectrum definition      (Level 3)                       */
/*          (I1CNT or I2CNT),   raw mode (channels 1 or 2)              */
/*          */
/* ***** */
/* Include the HEADER at the beginning of each measurement            */
/* ***** */

OBJECT      = COLUMN
  NAME      = "UTC"
  DATA_TYPE = TIME
  START_BYTE = 1
  BYTES     = 23
  DESCRIPTION = "This column represents the UTC
                Of the SPM spectrum in PDS standard format
                YYYY-MM-DDThh:mm:ss.sss"
END_OBJECT = COLUMN

OBJECT      = COLUMN
  NAME      = "OBT"
  DATA_TYPE = ASCII_REAL
  START_BYTE = 25
  BYTES     = 15
  UNIT      = SECOND
  FORMAT    = "F15.5"
  DESCRIPTION = "ROMAP 4 bytes counter representing the measurement
                time synchronized with Lander On Board Time.
                The time resolution is 0.03125 s"
END_OBJECT = COLUMN

OBJECT      = COLUMN
  NAME      = "MODE"
  DATA_TYPE = CHARACTER
  START_BYTE = 42
  BYTES     = 9
  FORMAT    = "N/A"
  UNIT      = "N/A"
  DESCRIPTION = "SPM mode:
                raw or parameter"
END_OBJECT = COLUMN

OBJECT      = COLUMN
  NAME      = "EXPOSITION_TIME"
  DATA_TYPE = CHARACTER
  START_BYTE = 54
  BYTES     = 5
  FORMAT    = "N/A"
  UNIT      = "N/A"
  DESCRIPTION = "SPM exposition time setting:
                short or long"
END_OBJECT = COLUMN

OBJECT      = COLUMN
  NAME      = "CALIBRATION"
  DATA_TYPE = CHARACTER
  START_BYTE = 62
  BYTES     = 8

```

```

FORMAT          = "N/A"
UNIT            = "N/A"
DESCRIPTION     = "SPM calibration status:
                  active or inactive"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
NAME           = "CEM_SUPPLY"
DATA_TYPE      = ASCII_INTEGER
START_BYTE     = 72
BYTES         = 1
FORMAT        = "I1"
UNIT          = "N/A"
DESCRIPTION   = "SPM CEM supply setting:
                  step number from 1 to 5"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
NAME           = "RESOLUTION"
DATA_TYPE      = CHARACTER
START_BYTE     = 75
BYTES         = 4
FORMAT        = "N/A"
UNIT          = "N/A"
DESCRIPTION   = "SPM resolution setting:
                  low or high"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
NAME           = "ION_CHANNEL"
DATA_TYPE      = CHARACTER
START_BYTE     = 82
BYTES         = 8
FORMAT        = "N/A"
UNIT          = "N/A"
DESCRIPTION   = "Ion channel status:
                  Both_off
                  Ion1
                  Ion2
                  Both_on"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
NAME           = "EVEN_ODD"
DATA_TYPE      = CHARACTER
START_BYTE     = 93
BYTES         = 8
FORMAT        = "N/A"
UNIT          = "N/A"
DESCRIPTION   = "Indicates whether all energies
                  are transmitted (64 for full resolution and
                  32 for low resolution) or even/odd energies
                  alternatively. Takes the values:
                  even_odd or full"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
NAME           = "I1_X_ECLIPJ2000"
DATA_TYPE      = ASCII_REAL
START_BYTE     = 103
BYTES         = 6
FORMAT        = "F6.3"
UNIT          = "N/A"
DESCRIPTION   = "X component of unit vector aligned with Ion 1 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT     = COLUMN

```

```

OBJECT          = COLUMN
  NAME          = "I1_Y_ECLIPJ2000"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 110
  BYTES         = 6
  FORMAT        = "F6.3"
  UNIT          = "N/A"
  DESCRIPTION   = "Y component of unit vector aligned with Ion 1 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
  NAME          = "I1_Z_ECLIPJ2000"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 117
  BYTES         = 6
  FORMAT        = "F6.3"
  UNIT          = "N/A"
  DESCRIPTION   = "Z component of unit vector aligned with Ion 1 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
  NAME          = "I2_X_ECLIPJ2000"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 124
  BYTES         = 6
  FORMAT        = "F6.3"
  UNIT          = "N/A"
  DESCRIPTION   = "X component of unit vector aligned with Ion 2 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
  NAME          = "I2_Y_ECLIPJ2000"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 131
  BYTES         = 6
  FORMAT        = "F6.3"
  UNIT          = "N/A"
  DESCRIPTION   = "Y component of unit vector aligned with Ion 2 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
  NAME          = "I2_Z_ECLIPJ2000"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 138
  BYTES         = 6
  FORMAT        = "F6.3"
  UNIT          = "N/A"
  DESCRIPTION   = "Z component of unit vector aligned with Ion 2 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
  NAME          = "EL_X_ECLIPJ2000"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 145
  BYTES         = 6
  FORMAT        = "F6.3"
  UNIT          = "N/A"
  DESCRIPTION   = "X component of unit vector aligned with electron
                  detector in ECLIPJ2000 coordinates"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
  
```

```

NAME                = "EL_Y_ECLIPJ2000"
DATA_TYPE           = ASCII_REAL
START_BYTE         = 152
BYTES              = 6
FORMAT             = "F6.3"
UNIT               = "N/A"
DESCRIPTION        = "Y component of unit vector aligned with electron
                    detector in ECLIPJ2000 coordinates"
END_OBJECT         = COLUMN

OBJECT             = COLUMN
NAME              = "EL_Z_ECLIPJ2000"
DATA_TYPE        = ASCII_REAL
START_BYTE      = 159
BYTES          = 6
FORMAT        = "F6.3"
UNIT          = "N/A"
DESCRIPTION   = "Z component of unit vector aligned with electron
                    detector in ECLIPJ2000 coordinates"
END_OBJECT   = COLUMN

OBJECT             = COLUMN
NAME              = "FC_X_ECLIPJ2000"
DATA_TYPE        = ASCII_REAL
START_BYTE      = 166
BYTES          = 6
FORMAT        = "F6.3"
UNIT          = "N/A"
DESCRIPTION   = "X component of unit vector aligned with Faraday cup
                    in ECLIPJ2000 coordinates"
END_OBJECT   = COLUMN

OBJECT             = COLUMN
NAME              = "FC_Y_ECLIPJ2000"
DATA_TYPE        = ASCII_REAL
START_BYTE      = 173
BYTES          = 6
FORMAT        = "F6.3"
UNIT          = "N/A"
DESCRIPTION   = "Y component of unit vector aligned with Faraday cup
                    in ECLIPJ2000 coordinates"
END_OBJECT   = COLUMN

OBJECT             = COLUMN
NAME              = "FC_Z_ECLIPJ2000"
DATA_TYPE        = ASCII_REAL
START_BYTE      = 180
BYTES          = 6
FORMAT        = "F6.3"
UNIT          = "N/A"
DESCRIPTION   = "Z component of unit vector aligned with Faraday cup
                    in ECLIPJ2000 coordinates"
END_OBJECT   = COLUMN

/* ***** */
/* Add index and type columns */
/* Index column : measurement number */
/* Type column : measurement type (I1CNT or I2CNT) */
/* ***** */

OBJECT             = COLUMN
NAME              = "INDEX"
DATA_TYPE        = INTEGER
START_BYTE      = 187
BYTES          = 5
FORMAT        = "I5"
UNIT          = "N/A"
  
```

```

    DESCRIPTION      = "Measurement index"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
  NAME               = "TYPE"
  DATA_TYPE         = CHARACTER
  START_BYTE        = 194
  BYTES              = 5
  FORMAT             = "N/A"
  UNIT               = "N/A"
  DESCRIPTION        = "Measurement type (I1CNT or I2CNT)"
END_OBJECT          = COLUMN

/* ***** */

OBJECT              = COLUMN
  NAME               = "ENERGY"
  DATA_TYPE         = ASCII_REAL
  START_BYTE        = 201
  BYTES              = 7
  FORMAT             = "F7.2"
  UNIT               = "ELECTRONVOLT"
  DESCRIPTION        = "Energy step"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
  NAME               = "COUNTS_ELEVATION_1"
  DATA_TYPE         = ASCII_REAL
  START_BYTE        = 209
  BYTES              = 8
  FORMAT             = "F8.2"
  UNIT               = "CM**-2*S**-1"
  DESCRIPTION        = "counts for elevation step 1"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
  NAME               = "COUNTS_ELEVATION_2"
  DATA_TYPE         = ASCII_REAL
  START_BYTE        = 218
  BYTES              = 8
  FORMAT             = "F8.2"
  UNIT               = "CM**-2*S**-1"
  DESCRIPTION        = "counts for elevation step 2"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
  NAME               = "COUNTS_ELEVATION_3"
  DATA_TYPE         = ASCII_REAL
  START_BYTE        = 227
  BYTES              = 8
  FORMAT             = "F8.2"
  UNIT               = "CM**-2*S**-1"
  DESCRIPTION        = "counts for elevation step 3"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
  NAME               = "COUNTS_ELEVATION_4"
  DATA_TYPE         = ASCII_REAL
  START_BYTE        = 236
  BYTES              = 8
  FORMAT             = "F8.2"
  UNIT               = "CM**-2*S**-1"
  DESCRIPTION        = "counts for elevation step 4"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
  NAME               = "COUNTS_ELEVATION_5"

```

```

DATA_TYPE      = ASCII_REAL
START_BYTE     = 245
BYTES          = 8
FORMAT        = "F8.2"
UNIT          = "CM**-2*S**-1"
DESCRIPTION    = "counts for elevation step 5"
END_OBJECT    = COLUMN

OBJECT         = COLUMN
NAME          = "COUNTS_ELEVATION_6"
DATA_TYPE     = ASCII_REAL
START_BYTE    = 254
BYTES         = 8
FORMAT       = "F8.2"
UNIT        = "CM**-2*S**-1"
DESCRIPTION = "counts for elevation step 6 "
END_OBJECT  = COLUMN

OBJECT         = COLUMN
NAME          = "COUNTS_ELEVATION_7"
DATA_TYPE     = ASCII_REAL
START_BYTE    = 263
BYTES         = 8
FORMAT       = "F8.2"
UNIT        = "CM**-2*S**-1"
DESCRIPTION = "counts for elevation step 7 "
END_OBJECT  = COLUMN

OBJECT         = COLUMN
NAME          = "COUNTS_ELEVATION_8"
DATA_TYPE     = ASCII_REAL
START_BYTE    = 272
BYTES         = 8
FORMAT       = "F8.2"
UNIT        = "CM**-2*S**-1"
DESCRIPTION = "counts for elevation step 8 "
END_OBJECT  = COLUMN

OBJECT         = COLUMN
NAME          = "COUNTS_ELEVATION_9"
DATA_TYPE     = ASCII_REAL
START_BYTE    = 281
BYTES         = 8
FORMAT       = "F8.2"
UNIT        = "CM**-2*S**-1"
DESCRIPTION = "counts for elevation step 9 "
END_OBJECT  = COLUMN

OBJECT         = COLUMN
NAME          = "COUNTS_ELEVATION_10"
DATA_TYPE     = ASCII_REAL
START_BYTE    = 290
BYTES         = 8
FORMAT       = "F8.2"
UNIT        = "CM**-2*S**-1"
DESCRIPTION = "counts for elevation step 10 "
END_OBJECT  = COLUMN

OBJECT         = COLUMN
NAME          = "COUNTS_ELEVATION_11"
DATA_TYPE     = ASCII_REAL
START_BYTE    = 299
BYTES         = 8
FORMAT       = "F8.2"
UNIT        = "CM**-2*S**-1"
DESCRIPTION = "counts for elevation step 11 "
END_OBJECT  = COLUMN

```

```
OBJECT                = COLUMN
  NAME                = "COUNTS_ELEVATION_12"
  DATA_TYPE          = ASCII_REAL
  START_BYTE          = 308
  BYTES               = 8
  FORMAT              = "F8.2"
  UNIT                = "CM**-2*S**-1"
  DESCRIPTION         = "counts for elevation step 12 "
END_OBJECT            = COLUMN
```

```
OBJECT                = COLUMN
  NAME                = "COUNTS_ELEVATION_13"
  DATA_TYPE          = ASCII_REAL
  START_BYTE          = 317
  BYTES               = 8
  FORMAT              = "F8.2"
  UNIT                = "CM**-2*S**-1"
  DESCRIPTION         = "counts for elevation step 13 "
END_OBJECT            = COLUMN
```

```
OBJECT                = COLUMN
  NAME                = "COUNTS_ELEVATION_14"
  DATA_TYPE          = ASCII_REAL
  START_BYTE          = 326
  BYTES               = 8
  FORMAT              = "F8.2"
  UNIT                = "CM**-2*S**-1"
  DESCRIPTION         = "counts for elevation step 14 "
END_OBJECT            = COLUMN
```

```
OBJECT                = COLUMN
  NAME                = "COUNTS_ELEVATION_15"
  DATA_TYPE          = ASCII_REAL
  START_BYTE          = 335
  BYTES               = 8
  FORMAT              = "F8.2"
  UNIT                = "CM**-2*S**-1"
  DESCRIPTION         = "counts for elevation step 15 "
END_OBJECT            = COLUMN
```

```
OBJECT                = COLUMN
  NAME                = "COUNTS_ELEVATION_16"
  DATA_TYPE          = ASCII_REAL
  START_BYTE          = 344
  BYTES               = 8
  FORMAT              = "F8.2"
  UNIT                = "CM**-2*S**-1"
  DESCRIPTION         = "counts for elevation step 16"
END_OBJECT            = COLUMN
```

4.3.2.4.2 Ion spectrum definition (current-energy-angle), raw mode (channels 1 or 2)

```
OBJECT                = ROMAP_SPM_RAW_ION_CR_TABLE
  NAME                = ROMAP_SPM_RAW_ION_CR
  INTERCHANGE_FORMAT = ASCII
  ROWS                = 96
  ^STRUCTURE          = "ROMAP_SPM_RAW_ION_CR.FMT"
  COLUMNS            = 28
  ROW_BYTES           = 200
END_OBJECT            = ROMAP_SPM_RAW_ION_CR_TABLE
```

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

```
/*                Contents of format file "ROMAP_SPM_RAW_ION_CR.FMT"                */
/*                Ion spectrum definition                (Level 2)                */
```

```

/*      (I1CRT or I2CRT),      raw mode (channels 1 or 2)      */

/* ***** */
/* Include the HEADER at the beginning of each measurement      */
/* ***** */

OBJECT      = COLUMN
  NAME      = "UTC"
  DATA_TYPE = TIME
  START_BYTE = 1
  BYTES     = 23
  DESCRIPTION = "This column represents the UTC
                Of the SPM spectrum in PDS standard format
                YYYY-MM-DDThh:mm:ss.sss"
END_OBJECT  = COLUMN

OBJECT      = COLUMN
  NAME      = "OBT"
  DATA_TYPE = ASCII_REAL
  START_BYTE = 25
  BYTES     = 15
  UNIT      = SECOND
  FORMAT    = "F15.5"
  DESCRIPTION = "ROMAP 4 bytes counter representing the measurement
                time synchronized with Lander On Board Time.
                The time resolution is 0.03125 s"
END_OBJECT  = COLUMN

OBJECT      = COLUMN
  NAME      = "MODE"
  DATA_TYPE = CHARACTER
  START_BYTE = 42
  BYTES     = 9
  FORMAT    = "N/A"
  UNIT      = "N/A"
  DESCRIPTION = "SPM mode:
                raw or parameter"
END_OBJECT  = COLUMN

OBJECT      = COLUMN
  NAME      = "EXPOSITION_TIME"
  DATA_TYPE = CHARACTER
  START_BYTE = 54
  BYTES     = 5
  FORMAT    = "N/A"
  UNIT      = "N/A"
  DESCRIPTION = "SPM exposition time setting:
                short or long"
END_OBJECT  = COLUMN

OBJECT      = COLUMN
  NAME      = "CALIBRATION"
  DATA_TYPE = CHARACTER
  START_BYTE = 62
  BYTES     = 8
  FORMAT    = "N/A"
  UNIT      = "N/A"
  DESCRIPTION = "SPM calibration status:
                active or inactive"
END_OBJECT  = COLUMN

OBJECT      = COLUMN
  NAME      = "CEM_SUPPLY"
  DATA_TYPE = ASCII_INTEGER
  START_BYTE = 72
  BYTES     = 1
  FORMAT    = "I1"

```

```

UNIT = "N/A"
DESCRIPTION = "SPM CEM supply setting:
step number from 1 to 5"
END_OBJECT = COLUMN

OBJECT = COLUMN
NAME = "RESOLUTION"
DATA_TYPE = CHARACTER
START_BYTE = 75
BYTES = 4
FORMAT = "N/A"
UNIT = "N/A"
DESCRIPTION = "SPM resolution setting:
low or high"
END_OBJECT = COLUMN

OBJECT = COLUMN
NAME = "ION_CHANNEL"
DATA_TYPE = CHARACTER
START_BYTE = 82
BYTES = 8
FORMAT = "N/A"
UNIT = "N/A"
DESCRIPTION = "Ion channel status:
Both_off
Ion1
Ion2
Both_on"
END_OBJECT = COLUMN

OBJECT = COLUMN
NAME = "EVEN_ODD"
DATA_TYPE = CHARACTER
START_BYTE = 93
BYTES = 8
FORMAT = "N/A"
UNIT = "N/A"
DESCRIPTION = "Indicates whether all energies
are transmitted (64 for full resolution and
32 for low resolution) or even/odd energies
alternatively. Takes the values:
even_odd or full"
END_OBJECT = COLUMN

/* ***** */
/* Add index and type columns */
/* Index column : measurement number */
/* Type column : measurement type (CNT or CRT) */
/* ***** */

OBJECT = COLUMN
NAME = "INDEX"
DATA_TYPE = INTEGER
START_BYTE = 103
BYTES = 5
FORMAT = "I5"
UNIT = "N/A"
DESCRIPTION = "Measurement index"
END_OBJECT = COLUMN

OBJECT = COLUMN
NAME = "TYPE"
DATA_TYPE = CHARACTER
START_BYTE = 110
BYTES = 5
FORMAT = "N/A"
UNIT = "N/A"

```

```

    DESCRIPTION      = "Measurement type (I1CRT or I2CRT)"
END_OBJECT          = COLUMN

/* ***** */

OBJECT              = COLUMN
  NAME               = "ENERGY_BIN"
  DATA_TYPE         = INTEGER
  START_BYTE         = 117
  BYTES              = 2
  FORMAT             = "I2"
  UNIT               = "N/A"
  DESCRIPTION        = "Energy bin number"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
  NAME               = "CURRENT_ELEVATION_1"
  DATA_TYPE         = INTEGER
  START_BYTE         = 120
  BYTES              = 4
  FORMAT             = "I4"
  UNIT               = "ADC_UNITS"
  DESCRIPTION        = "Current for elevation step 1"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
  NAME               = "CURRENT_ELEVATION_2"
  DATA_TYPE         = INTEGER
  START_BYTE         = 125
  BYTES              = 4
  FORMAT             = "I4"
  UNIT               = "ADC_UNITS"
  DESCRIPTION        = "Current for elevation step 2"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
  NAME               = "CURRENT_ELEVATION_3"
  DATA_TYPE         = INTEGER
  START_BYTE         = 130
  BYTES              = 4
  FORMAT             = "I4"
  UNIT               = "ADC_UNITS"
  DESCRIPTION        = "Current for elevation step 3"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
  NAME               = "CURRENT_ELEVATION_4"
  DATA_TYPE         = INTEGER
  START_BYTE         = 135
  BYTES              = 4
  FORMAT             = "I4"
  UNIT               = "ADC_UNITS"
  DESCRIPTION        = "Current for elevation step 4"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
  NAME               = "CURRENT_ELEVATION_5"
  DATA_TYPE         = INTEGER
  START_BYTE         = 140
  BYTES              = 4
  FORMAT             = "I4"
  UNIT               = "ADC_UNITS"
  DESCRIPTION        = "Current for elevation step 5"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
  NAME               = "CURRENT_ELEVATION_6"

```

```

DATA_TYPE      = INTEGER
START_BYTE     = 145
BYTES          = 4
FORMAT         = "I4"
UNIT           = "ADC_UNITS"
DESCRIPTION    = "Current for elevation step 6 "
END_OBJECT     = COLUMN

OBJECT         = COLUMN
NAME           = "CURRENT_ELEVATION_7"
DATA_TYPE     = INTEGER
START_BYTE    = 150
BYTES         = 4
FORMAT        = "I4"
UNIT          = "ADC_UNITS"
DESCRIPTION   = "Current for elevation step 7 "
END_OBJECT    = COLUMN

OBJECT         = COLUMN
NAME           = "CURRENT_ELEVATION_8"
DATA_TYPE     = INTEGER
START_BYTE    = 155
BYTES         = 4
FORMAT        = "I4"
UNIT          = "ADC_UNITS"
DESCRIPTION   = "Current for elevation step 8 "
END_OBJECT    = COLUMN

OBJECT         = COLUMN
NAME           = "CURRENT_ELEVATION_9"
DATA_TYPE     = INTEGER
START_BYTE    = 160
BYTES         = 4
FORMAT        = "I4"
UNIT          = "ADC_UNITS"
DESCRIPTION   = "Current for elevation step 9 "
END_OBJECT    = COLUMN

OBJECT         = COLUMN
NAME           = "CURRENT_ELEVATION_10"
DATA_TYPE     = INTEGER
START_BYTE    = 165
BYTES         = 4
FORMAT        = "I4"
UNIT          = "ADC_UNITS"
DESCRIPTION   = "Current for elevation step 10 "
END_OBJECT    = COLUMN

OBJECT         = COLUMN
NAME           = "CURRENT_ELEVATION_11"
DATA_TYPE     = INTEGER
START_BYTE    = 170
BYTES         = 4
FORMAT        = "I4"
UNIT          = "ADC_UNITS"
DESCRIPTION   = "Current for elevation step 11 "
END_OBJECT    = COLUMN

OBJECT         = COLUMN
NAME           = "CURRENT_ELEVATION_12"
DATA_TYPE     = INTEGER
START_BYTE    = 175
BYTES         = 4
FORMAT        = "I4"
UNIT          = "ADC_UNITS"
DESCRIPTION   = "Current for elevation step 12 "
END_OBJECT    = COLUMN

```

```
OBJECT                = COLUMN
  NAME                = "CURRENT_ELEVATION_13"
  DATA_TYPE          = INTEGER
  START_BYTE         = 180
  BYTES               = 4
  FORMAT              = "I4"
  UNIT                = "ADC_UNITS"
  DESCRIPTION         = "Current for elevation step 13 "
END_OBJECT           = COLUMN
```

```
OBJECT                = COLUMN
  NAME                = "CURRENT_ELEVATION_14"
  DATA_TYPE          = INTEGER
  START_BYTE         = 185
  BYTES               = 4
  FORMAT              = "I4"
  UNIT                = "ADC_UNITS"
  DESCRIPTION         = "Current for elevation step 14 "
END_OBJECT           = COLUMN
```

```
OBJECT                = COLUMN
  NAME                = "CURRENT_ELEVATION_15"
  DATA_TYPE          = INTEGER
  START_BYTE         = 190
  BYTES               = 4
  FORMAT              = "I4"
  UNIT                = "ADC_UNITS"
  DESCRIPTION         = "Current for elevation step 15 "
END_OBJECT           = COLUMN
```

```
OBJECT                = COLUMN
  NAME                = "CURRENT_ELEVATION_16"
  DATA_TYPE          = INTEGER
  START_BYTE         = 195
  BYTES               = 4
  FORMAT              = "I4"
  UNIT                = "ADC_UNITS"
  DESCRIPTION         = "Current for elevation step 16 "
END_OBJECT           = COLUMN
```

4.3.2.4.3 Ion spectrum definition (counts-energy distribution), parameter mode (channels 1 or 2)

```
OBJECT                = ROMAP_SPM_PAR_ION_CNE_TABLE
  NAME                = ROMAP_SPM_PAR_ION_CNE
  INTERCHANGE_FORMAT = ASCII
  ROWS                = 192
  ^STRUCTURE          = "ROMAP_SPM_PAR_ION_CNE.FMT"
  COLUMNS            = 14
  ROW_BYTES           = 148
END_OBJECT           = ROMAP_SPM_PAR_ION_CNE_TABLE
```

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

```
/*          Contents of format file " ROMAP_SPM_PAR_ION_CNE.FMT" */
/*          Ion spectrum definition      (Level 2)                */
/*          (I1CNTE or I2CNTE), parameter mode (channels 1 or 2) */

/* ***** */
/* Include the HEADER at the beginning of each measurement      */
/* ***** */

OBJECT                = COLUMN
  NAME                = "UTC"
  DATA_TYPE          = TIME
  START_BYTE         = 1
```

```

    BYTES = 23
    DESCRIPTION = "This column represents the UTC
                  Of the SPM spectrum in PDS standard format
                  YYYY-MM-DDThh:mm:ss.sss"
  END_OBJECT = COLUMN

  OBJECT = COLUMN
  NAME = "OBT"
  DATA_TYPE = ASCII_REAL
  START_BYTE = 25
  BYTES = 15
  UNIT = SECOND
  FORMAT = "F15.5"
  DESCRIPTION = "ROMAP 4 bytes counter representing the measurement
                 time synchronized with Lander On Board Time.
                 The time resolution is 0.03125 s"
  END_OBJECT = COLUMN

  OBJECT = COLUMN
  NAME = "MODE"
  DATA_TYPE = CHARACTER
  START_BYTE = 42
  BYTES = 9
  FORMAT = "N/A"
  UNIT = "N/A"
  DESCRIPTION = "SPM mode:
                 raw or parameter"
  END_OBJECT = COLUMN

  OBJECT = COLUMN
  NAME = "EXPOSITION_TIME"
  DATA_TYPE = CHARACTER
  START_BYTE = 54
  BYTES = 5
  FORMAT = "N/A"
  UNIT = "N/A"
  DESCRIPTION = "SPM exposition time setting:
                 short or long"
  END_OBJECT = COLUMN

  OBJECT = COLUMN
  NAME = "CALIBRATION"
  DATA_TYPE = CHARACTER
  START_BYTE = 62
  BYTES = 8
  FORMAT = "N/A"
  UNIT = "N/A"
  DESCRIPTION = "SPM calibration status:
                 active or inactive"
  END_OBJECT = COLUMN

  OBJECT = COLUMN
  NAME = "CEM_SUPPLY"
  DATA_TYPE = ASCII_INTEGER
  START_BYTE = 72
  BYTES = 1
  FORMAT = "I1"
  UNIT = "N/A"
  DESCRIPTION = "SPM CEM supply setting:
                 step number from 1 to 5"
  END_OBJECT = COLUMN

  OBJECT = COLUMN
  NAME = "RESOLUTION"
  DATA_TYPE = CHARACTER
  START_BYTE = 75
  BYTES = 4
  
```

```

    FORMAT          = "N/A"
    UNIT            = "N/A"
    DESCRIPTION     = "SPM resolution setting:
                    low or high"
  END_OBJECT      = COLUMN

  OBJECT          = COLUMN
  NAME            = "ION_CHANNEL"
  DATA_TYPE      = CHARACTER
  START_BYTE      = 82
  BYTES           = 8
  FORMAT          = "N/A"
  UNIT            = "N/A"
  DESCRIPTION     = "Ion channel status:
                    Both_off
                    Ion1
                    Ion2
                    Both_on"
  END_OBJECT      = COLUMN

  OBJECT          = COLUMN
  NAME            = "EVEN_ODD"
  DATA_TYPE      = CHARACTER
  START_BYTE      = 93
  BYTES           = 8
  FORMAT          = "N/A"
  UNIT            = "N/A"
  DESCRIPTION     = "Indicates whether all energies
                    are transmitted (64 for full resolution and
                    32 for low resolution) or even/odd energies
                    alternatively. Takes the values:
                    even_odd or full"
  END_OBJECT      = COLUMN

/* ***** */
/* Add index and type columns */
/*      Index column : measurement number */
/*      Type column : measurement type (I1CNTE or I2CNTE) */
/* ***** */

  OBJECT          = COLUMN
  NAME            = "INDEX"
  DATA_TYPE      = INTEGER
  START_BYTE      = 103
  BYTES           = 5
  FORMAT          = "I5"
  UNIT            = "N/A"
  DESCRIPTION     = "Measurement index"
  END_OBJECT      = COLUMN

  OBJECT          = COLUMN
  NAME            = "TYPE"
  DATA_TYPE      = CHARACTER
  START_BYTE      = 110
  BYTES           = 6
  FORMAT          = "N/A"
  UNIT            = "N/A"
  DESCRIPTION     = "Measurement type (I1CNTE or I2CNTE)"
  END_OBJECT      = COLUMN

/* ***** */

  OBJECT          = COLUMN
  NAME            = "ENERGY_BIN"
  DATA_TYPE      = INTEGER
  START_BYTE      = 118
  BYTES           = 2

```

```

FORMAT          = "I2"
UNIT            = "N/A"
DESCRIPTION     = "Energy bin number"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
NAME           = "COUNTS"
DATA_TYPE      = INTEGER
START_BYTE     = 121
BYTES          = 8
FORMAT         = "I8"
UNIT           = "ADC_UNITS"
DESCRIPTION    = "Sum of counts for elevation steps 1 to 16"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
NAME           = "OVERFLOW FLAG"
DATA_TYPE      = CHARACTER
START_BYTE     = 131
BYTES          = 16
FORMAT         = "N/A"
UNIT           = "N/A"
DESCRIPTION    = "String of 16 characters ; each character corresponds
                  to an elevation step and may take one of the following
                  values :
                      0 : No overflow
                      1 : Overflow"
END_OBJECT     = COLUMN

```

4.3.2.4.4 Ion spectrum definition (current-energy distribution), parameter mode (channels 1 or 2)

```

OBJECT          = ROMAP_SPM_PAR_ION_CRE_TABLE
NAME           = ROMAP_SPM_PAR_ION_CRE
INTERCHANGE_FORMAT = ASCII
ROWS           = 192
^STRUCTURE     = "ROMAP_SPM_PAR_ION_CRE.FMT"
COLUMNS       = 14
ROW_BYTES      = 145
END_OBJECT     = ROMAP_SPM_PAR_ION_CRE_TABLE

```

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

```

/*          Contents of format file "ROMAP_SPM_PAR_ION_CRE.FMT"          */
/*          Ion spectrum definition (Level 2)                            */
/*          (I1CRTE or I2CRTE), parameter mode (channels 1 or 2)        */

/* ***** */
/* Include the HEADER at the beginning of each measurement             */
/* ***** */

OBJECT          = COLUMN
NAME           = "UTC"
DATA_TYPE      = TIME
START_BYTE     = 1
BYTES          = 23
DESCRIPTION    = "This column represents the UTC
                  Of the SPM spectrum in PDS standard format
                  YYYY-MM-DDThh:mm:ss.sss"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
NAME           = "OBT"
DATA_TYPE      = ASCII_REAL
START_BYTE     = 25
BYTES          = 15
UNIT           = SECOND

```

```

    FORMAT          = "F15.5"
    DESCRIPTION     = "ROMAP 4 bytes counter representing the measurement
                    time synchronized with Lander On Board Time.
                    The time resolution is 0.03125 s"
  END_OBJECT      = COLUMN

  OBJECT          = COLUMN
  NAME            = "MODE"
  DATA_TYPE     = CHARACTER
  START_BYTE     = 42
  BYTES          = 9
  FORMAT         = "N/A"
  UNIT           = "N/A"
  DESCRIPTION    = "SPM mode:
                    raw or parameter"
  END_OBJECT      = COLUMN

  OBJECT          = COLUMN
  NAME            = "EXPOSITION_TIME"
  DATA_TYPE     = CHARACTER
  START_BYTE     = 54
  BYTES          = 5
  FORMAT         = "N/A"
  UNIT           = "N/A"
  DESCRIPTION    = "SPM exposition time setting:
                    short or long"
  END_OBJECT      = COLUMN

  OBJECT          = COLUMN
  NAME            = "CALIBRATION"
  DATA_TYPE     = CHARACTER
  START_BYTE     = 62
  BYTES          = 8
  FORMAT         = "N/A"
  UNIT           = "N/A"
  DESCRIPTION    = "SPM calibration status:
                    active or inactive"
  END_OBJECT      = COLUMN

  OBJECT          = COLUMN
  NAME            = "CEM_SUPPLY"
  DATA_TYPE     = ASCII_INTEGER
  START_BYTE     = 72
  BYTES          = 1
  FORMAT         = "I1"
  UNIT           = "N/A"
  DESCRIPTION    = "SPM CEM supply setting:
                    step number from 1 to 5"
  END_OBJECT      = COLUMN

  OBJECT          = COLUMN
  NAME            = "RESOLUTION"
  DATA_TYPE     = CHARACTER
  START_BYTE     = 75
  BYTES          = 4
  FORMAT         = "N/A"
  UNIT           = "N/A"
  DESCRIPTION    = "SPM resolution setting:
                    low or high"
  END_OBJECT      = COLUMN

  OBJECT          = COLUMN
  NAME            = "ION_CHANNEL"
  DATA_TYPE     = CHARACTER
  START_BYTE     = 82
  BYTES          = 8
  FORMAT         = "N/A"

```

```

UNIT = "N/A"
DESCRIPTION = "Ion channel status:
                Both_off
                Ion1
                Ion2
                Both_on"
END_OBJECT = COLUMN

OBJECT = COLUMN
NAME = "EVEN_ODD"
DATA_TYPE = CHARACTER
START_BYTE = 93
BYTES = 8
FORMAT = "N/A"
UNIT = "N/A"
DESCRIPTION = "Indicates whether all energies
                are transmitted (64 for full resolution and
                32 for low resolution) or even/odd energies
                alternatively. Takes the values:
                even_odd or full"
END_OBJECT = COLUMN

/* ***** */
/* Add index and type columns */
/* Index column : measurement number */
/* Type column : measurement type (I1CRTE or I2CRTE) */
/* ***** */

OBJECT = COLUMN
NAME = "INDEX"
DATA_TYPE = INTEGER
START_BYTE = 103
BYTES = 5
FORMAT = "I5"
UNIT = "N/A"
DESCRIPTION = "Measurement index"
END_OBJECT = COLUMN

OBJECT = COLUMN
NAME = "TYPE"
DATA_TYPE = CHARACTER
START_BYTE = 110
BYTES = 6
FORMAT = "N/A"
UNIT = "N/A"
DESCRIPTION = "Measurement type (I1CRTE or I2CRTE)"
END_OBJECT = COLUMN

/* ***** */

OBJECT = COLUMN
NAME = "ENERGY_BIN"
DATA_TYPE = INTEGER
START_BYTE = 118
BYTES = 2
FORMAT = "I2"
UNIT = "N/A"
DESCRIPTION = "Energy bin number"
END_OBJECT = COLUMN

OBJECT = COLUMN
NAME = "CURRENT"
DATA_TYPE = INTEGER
START_BYTE = 121
BYTES = 5
FORMAT = "I5"
UNIT = "ADC_UNITS"

```

```

DESCRIPTION      = "Sum of currents for elevation steps 1 to 16"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "OVERFLOW FLAG"
  DATA_TYPE    = CHARACTER
  START_BYTE    = 128
  BYTES         = 16
  FORMAT        = "N/A"
  UNIT          = "N/A"
  DESCRIPTION   = "String of 16 characters ; each character corresponds
                  to an elevation step and may take one of the following
                  values :
                    0 : No overflow
                    1 : Overflow"
END_OBJECT      = COLUMN

```

4.3.2.4.5 Ion spectrum definition (counts-angle distribution), parameter mode (channels 1 or 2)

```

OBJECT          = ROMAP_SPM_PAR_ION_CNA_TABLE
  NAME          = ROMAP_SPM_PAR_ION_CNA
  INTERCHANGE_FORMAT = ASCII
  ROWS          = 96
  ^STRUCTURE    = "ROMAP_SPM_PAR_ION_CNA.FMT"
  COLUMNS      = 14
  ROW_BYTES     = 196
END_OBJECT      = ROMAP_SPM_PAR_ION_CNA_TABLE

```

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

```

/*          Contents of format file " ROMAP_SPM_PAR_ION_CNA.FMT" */
/*          Ion spectrum definition (Level 2) */
/*          (I1CNTA or I2CNTA), parameter mode (channels 1 or 2) */

/* ***** */
/* Include the HEADER at the beginning of each measurement */
/* ***** */

OBJECT          = COLUMN
  NAME          = "UTC"
  DATA_TYPE    = TIME
  START_BYTE    = 1
  BYTES         = 23
  DESCRIPTION   = "This column represents the UTC
                  Of the SPM spectrum in PDS standard format
                  YYYY-MM-DDThh:mm:ss.sss"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "OBT"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 25
  BYTES         = 15
  UNIT          = SECOND
  FORMAT        = "F15.5"
  DESCRIPTION   = "ROMAP 4 bytes counter representing the measurement
                  time synchronized with Lander On Board Time.
                  The time resolution is 0.03125 s"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "MODE"
  DATA_TYPE    = CHARACTER
  START_BYTE    = 42
  BYTES         = 9
  FORMAT        = "N/A"
  UNIT          = "N/A"

```

```

DESCRIPTION      = "SPM mode:
                   raw or parameter"
END_OBJECT       = COLUMN

OBJECT           = COLUMN
  NAME           = "EXPOSITION_TIME"
  DATA_TYPE     = CHARACTER
  START_BYTE     = 54
  BYTES          = 5
  FORMAT         = "N/A"
  UNIT           = "N/A"
  DESCRIPTION    = "SPM exposition time setting:
                   short or long"
END_OBJECT       = COLUMN

OBJECT           = COLUMN
  NAME           = "CALIBRATION"
  DATA_TYPE     = CHARACTER
  START_BYTE     = 62
  BYTES          = 8
  FORMAT         = "N/A"
  UNIT           = "N/A"
  DESCRIPTION    = "SPM calibration status:
                   active or inactive"
END_OBJECT       = COLUMN

OBJECT           = COLUMN
  NAME           = "CEM_SUPPLY"
  DATA_TYPE     = ASCII_INTEGER
  START_BYTE     = 72
  BYTES          = 1
  FORMAT         = "I1"
  UNIT           = "N/A"
  DESCRIPTION    = "SPM CEM supply setting:
                   step number from 1 to 5"
END_OBJECT       = COLUMN

OBJECT           = COLUMN
  NAME           = "RESOLUTION"
  DATA_TYPE     = CHARACTER
  START_BYTE     = 75
  BYTES          = 4
  FORMAT         = "N/A"
  UNIT           = "N/A"
  DESCRIPTION    = "SPM resolution setting:
                   low or high"
END_OBJECT       = COLUMN

OBJECT           = COLUMN
  NAME           = "ION_CHANNEL"
  DATA_TYPE     = CHARACTER
  START_BYTE     = 82
  BYTES          = 8
  FORMAT         = "N/A"
  UNIT           = "N/A"
  DESCRIPTION    = "Ion channel status:
                   Both_off
                   Ion1
                   Ion2
                   Both_on"
END_OBJECT       = COLUMN

OBJECT           = COLUMN
  NAME           = "EVEN_ODD"
  DATA_TYPE     = CHARACTER
  START_BYTE     = 93
  BYTES          = 8

```

```

FORMAT          = "N/A"
UNIT            = "N/A"
DESCRIPTION     = "Indicates whether all energies
                  are transmitted (64 for full resolution and
                  32 for low resolution) or even/odd energies
                  alternatively. Takes the values:
                  even_odd or full"
END_OBJECT      = COLUMN

/* ***** */
/* Add index and type columns */
/* Index column : measurement number */
/* Type column : measurement type (I1CNTA or I2CNTA) */
/* ***** */

OBJECT          = COLUMN
  NAME          = "INDEX"
  DATA_TYPE    = INTEGER
  START_BYTE    = 103
  BYTES         = 5
  FORMAT        = "I5"
  UNIT          = "N/A"
  DESCRIPTION   = "Measurement index"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "TYPE"
  DATA_TYPE    = CHARACTER
  START_BYTE    = 110
  BYTES         = 6
  FORMAT        = "N/A"
  UNIT          = "N/A"
  DESCRIPTION   = "Measurement type (I1CNTA or I2CNTA)"
END_OBJECT      = COLUMN

/* ***** */

OBJECT          = COLUMN
  NAME          = "ANGLE_BIN"
  DATA_TYPE    = INTEGER
  START_BYTE    = 118
  BYTES         = 2
  FORMAT        = "I2"
  UNIT          = "N/A"
  DESCRIPTION   = "Elevation step"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "COUNTS"
  DATA_TYPE    = INTEGER
  START_BYTE    = 121
  BYTES         = 8
  FORMAT        = "I8"
  UNIT          = "N/A"
  DESCRIPTION   = "Sum of counts for energy steps 0 to 31
                  Or 0 to 63"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "OVERFLOW FLAG"
  DATA_TYPE    = CHARACTER
  START_BYTE    = 131
  BYTES         = 64
  FORMAT        = "N/A"
  UNIT          = "N/A"
  DESCRIPTION   = "String of 64 characters ; each character corresponds
                  to a step of energy and may take one of the following
  
```

```

values :
    0 : No overflow
    1 : Overflow
In low resolution the 32 last characters are unused
and set to blank "

```

END_OBJECT

= COLUMN

4.3.2.4.6 Ion spectrum definition (current-angle), parameter mode (channels 1 or 2)

```

OBJECT          = ROMAP_SPM_PAR_ION_CRA_TABLE
NAME            = ROMAP_SPM_PAR_ION_CRA
INTERCHANGE_FORMAT = ASCII
ROWS           = 96
^STRUCTURE     = "ROMAP_SPM_PAR_ION_CRA.FMT"
COLUMNS       = 14
ROW_BYTES      = 194
END_OBJECT     = ROMAP_SPM_PAR_ION_CRA_TABLE

```

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

```

/*          Contents of format file "ROMAP_SPM_PAR_ION_CRA.FMT"          */
/*          Ion spectrum definition (Level 2)                          */
/*          (I1CRTA or I2CRTA), parameter mode (channels 1 or 2)      */

```

```

/* ***** */
/* Include the HEADER at the beginning of each measurement          */
/* ***** */

```

```

OBJECT          = COLUMN
NAME            = "UTC"
DATA_TYPE       = TIME
START_BYTE     = 1
BYTES          = 23
DESCRIPTION     = "This column represents the UTC
                  Of the SPM spectrum in PDS standard format
                  YYYY-MM-DDThh:mm:ss.sss"
END_OBJECT     = COLUMN

```

```

OBJECT          = COLUMN
NAME            = "OBT"
DATA_TYPE       = ASCII_REAL
START_BYTE     = 25
BYTES          = 15
UNIT           = SECOND
FORMAT         = "F15.5"
DESCRIPTION     = "ROMAP 4 bytes counter representing the measurement
                  time synchronized with Lander On Board Time.
                  The time resolution is 0.03125 s"
END_OBJECT     = COLUMN

```

```

OBJECT          = COLUMN
NAME            = "MODE"
DATA_TYPE       = CHARACTER
START_BYTE     = 42
BYTES          = 9
FORMAT         = "N/A"
UNIT           = "N/A"
DESCRIPTION     = "SPM mode:
                  raw or parameter"
END_OBJECT     = COLUMN

```

```

OBJECT          = COLUMN
NAME            = "EXPOSITION_TIME"
DATA_TYPE       = CHARACTER
START_BYTE     = 54
BYTES          = 5
FORMAT         = "N/A"

```

```

UNIT = "N/A"
DESCRIPTION = "SPM exposition time setting:
short or long"
END_OBJECT = COLUMN

OBJECT = COLUMN
NAME = "CALIBRATION"
DATA_TYPE = CHARACTER
START_BYTE = 62
BYTES = 8
FORMAT = "N/A"
UNIT = "N/A"
DESCRIPTION = "SPM calibration status:
active or inactive"
END_OBJECT = COLUMN

OBJECT = COLUMN
NAME = "CEM_SUPPLY"
DATA_TYPE = ASCII_INTEGER
START_BYTE = 72
BYTES = 1
FORMAT = "I1"
UNIT = "N/A"
DESCRIPTION = "SPM CEM supply setting:
step number from 1 to 5"
END_OBJECT = COLUMN

OBJECT = COLUMN
NAME = "RESOLUTION"
DATA_TYPE = CHARACTER
START_BYTE = 75
BYTES = 4
FORMAT = "N/A"
UNIT = "N/A"
DESCRIPTION = "SPM resolution setting:
low or high"
END_OBJECT = COLUMN

OBJECT = COLUMN
NAME = "ION_CHANNEL"
DATA_TYPE = CHARACTER
START_BYTE = 82
BYTES = 8
FORMAT = "N/A"
UNIT = "N/A"
DESCRIPTION = "Ion channel status:
Both_off
Ion1
Ion2
Both_on"
END_OBJECT = COLUMN

OBJECT = COLUMN
NAME = "EVEN_ODD"
DATA_TYPE = CHARACTER
START_BYTE = 93
BYTES = 8
FORMAT = "N/A"
UNIT = "N/A"
DESCRIPTION = "Indicates whether all energies
are transmitted (64 for full resolution and
32 for low resolution) or even/odd energies
alternatively. Takes the values:
even_odd or full"
END_OBJECT = COLUMN

```

```

/* Add index and type columns */
/* Index column : measurement number */
/* Type column : measurement type (I1CRTA or I2CRTA) */
/* ***** */

```

```

OBJECT = COLUMN
NAME = "INDEX"
DATA_TYPE = INTEGER
START_BYTE = 103
BYTES = 5
FORMAT = "I5"
UNIT = "N/A"
DESCRIPTION = "Measurement index"
END_OBJECT = COLUMN

```

```

OBJECT = COLUMN
NAME = "TYPE"
DATA_TYPE = CHARACTER
START_BYTE = 110
BYTES = 6
FORMAT = "N/A"
UNIT = "N/A"
DESCRIPTION = "Measurement type (I1CRTA or I2CRTA)"
END_OBJECT = COLUMN

```

```

/* ***** */

```

```

OBJECT = COLUMN
NAME = "ANGLE_BIN"
DATA_TYPE = INTEGER
START_BYTE = 118
BYTES = 2
FORMAT = "I2"
UNIT = "N/A"
DESCRIPTION = "Elevation step number"
END_OBJECT = COLUMN

```

```

OBJECT = COLUMN
NAME = "CURRENT"
DATA_TYPE = INTEGER
START_BYTE = 121
BYTES = 6
FORMAT = "I6"
UNIT = "N/A"
DESCRIPTION = "Sum of currents for energy steps 0 to 31
Or 0 to 63"
END_OBJECT = COLUMN

```

```

OBJECT = COLUMN
NAME = "OVERFLOW FLAG"
DATA_TYPE = CHARACTER
START_BYTE = 129
BYTES = 64
FORMAT = "N/A"
UNIT = "N/A"
DESCRIPTION = "String of 64 characters ; each character corresponds
to a step of energy and may take one of the following
values :
0 : No overflow
1 : Overflow
In low resolution the 32 last characters are unused
and set to blank "
END_OBJECT = COLUMN

```

4.3.2.4.7 Faraday cup current-energy distribution

FC TABLE object for PAR mode

```
OBJECT          = ROMAP_SPM_PAR_FC_TABLE
NAME            = ROMAP_SPM_PAR_FC
INTERCHANGE_FORMAT = ASCII
ROWS           = 54
COLUMNS       = 12
ROW_BYTES      = 119
^STRUCTURE     = "ROMAP_SPM_FC.FMT"
END_OBJECT     = ROMAP_SPM_PAR_FC_TABLE
```

FC TABLE object for RAW mode

```
OBJECT          = ROMAP_SPM_RAW_FC_TABLE
NAME            = ROMAP_SPM_RAW_FC
INTERCHANGE_FORMAT = ASCII
ROWS           = 272
COLUMNS       = 12
ROW_BYTES      = 119
^STRUCTURE     = "ROMAP_SPM_FC.FMT"
END_OBJECT     = ROMAP_SPM_RAW_FC_TABLE
```

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

```
/*          Contents of format file "ROMAP_SPM_FC.FMT"          */
/* Faraday cup current-energy distribution (Level 2)             */

/* ***** */
/* Include the HEADER at the beginning of each measurement    */
/* ***** */

OBJECT          = COLUMN
NAME            = "UTC"
DATA_TYPE       = TIME
START_BYTE     = 1
BYTES          = 23
DESCRIPTION     = "This column represents the UTC
                  Of the SPM spectrum in PDS standard format
                  YYYY-MM-DDThh:mm:ss.sss"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
NAME            = "OBT"
DATA_TYPE       = ASCII_REAL
START_BYTE     = 25
BYTES          = 15
UNIT           = SECOND
FORMAT         = "F15.5"
DESCRIPTION     = "ROMAP 4 bytes counter representing the measurement
                  time synchronized with Lander On Board Time.
                  The time resolution is 0.03125 s"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
NAME            = "MODE"
DATA_TYPE       = CHARACTER
START_BYTE     = 42
BYTES          = 9
FORMAT         = "N/A"
UNIT           = "N/A"
DESCRIPTION     = "SPM mode:
                  raw or parameter"
END_OBJECT     = COLUMN
```

```

OBJECT          = COLUMN
  NAME          = "EXPOSITION_TIME"
  DATA_TYPE    = CHARACTER
  START_BYTE    = 54
  BYTES         = 5
  FORMAT        = "N/A"
  UNIT          = "N/A"
  DESCRIPTION    = "SPM exposition time setting:
                  short or long"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "CALIBRATION"
  DATA_TYPE    = CHARACTER
  START_BYTE    = 62
  BYTES         = 8
  FORMAT        = "N/A"
  UNIT          = "N/A"
  DESCRIPTION    = "SPM calibration status:
                  active or inactive"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "CEM_SUPPLY"
  DATA_TYPE    = ASCII_INTEGER
  START_BYTE    = 72
  BYTES         = 1
  FORMAT        = "I1"
  UNIT          = "N/A"
  DESCRIPTION    = "SPM CEM supply setting:
                  step number from 1 to 5"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "RESOLUTION"
  DATA_TYPE    = CHARACTER
  START_BYTE    = 75
  BYTES         = 4
  FORMAT        = "N/A"
  UNIT          = "N/A"
  DESCRIPTION    = "SPM resolution setting:
                  low or high"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "ION_CHANNEL"
  DATA_TYPE    = CHARACTER
  START_BYTE    = 82
  BYTES         = 8
  FORMAT        = "N/A"
  UNIT          = "N/A"
  DESCRIPTION    = "Ion channel status:
                  Both_off
                  Ion1
                  Ion2
                  Both_on"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "EVEN_ODD"
  DATA_TYPE    = CHARACTER
  START_BYTE    = 93
  BYTES         = 8
  FORMAT        = "N/A"
  UNIT          = "N/A"
  DESCRIPTION    = "Indicates whether all energies
                  are transmitted (64 for full resolution and
  
```

```

32 for low resolution) or even/odd energies
alternatively. Takes the values:
    even_odd or full"
END_OBJECT          = COLUMN

/* ***** */
/* Add index column                                     */
/*      Index column : measurement number              */
/* ***** */

OBJECT              = COLUMN
  NAME               = "INDEX"
  DATA_TYPE        = INTEGER
  START_BYTE        = 103
  BYTES              = 5
  FORMAT             = "I5"
  UNIT               = "N/A"
  DESCRIPTION        = "Measurement index"
END_OBJECT          = COLUMN

/* ***** */

OBJECT              = COLUMN
  NAME               = "ENERGY_BIN"
  DATA_TYPE        = INTEGER
  START_BYTE        = 109
  BYTES              = 2
  FORMAT             = "I2"
  UNIT               = "N/A"
  DESCRIPTION        = "Energy bin number"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
  NAME               = "CURRENT"
  DATA_TYPE        = INTEGER
  START_BYTE        = 112
  BYTES              = 6
  FORMAT             = "I6"
  UNIT               = "ADC_UNITS"
  DESCRIPTION        = "Faraday cup Current "
END_OBJECT          = COLUMN

```

4.3.2.4.8 Electron spectrum (count-energy distribution)

Electron spectrum TABLE object for PAR mode.

```

OBJECT              = ROMAP_SPM_PAR_ELEC_TABLE
  NAME               = ROMAP_SPM_PAR_ELEC
  INTERCHANGE_FORMAT = ASCII
  ROWS                = 96
  COLUMNS            = 12
  ROW_BYTES           = 119
  ^STRUCTURE          = "ROMAP_SPM_ELEC.FMT"
END_OBJECT          = ROMAP_SPM_PAR_ELEC_TABLE

```

Electron spectrum TABLE object for RAW mode.

```

OBJECT              = ROMAP_SPM_RAW_ELEC_TABLE
  NAME               = ROMAP_SPM_RAW_ELEC
  INTERCHANGE_FORMAT = ASCII
  ROWS                = 256
  COLUMNS            = 12
  ROW_BYTES           = 119
  ^STRUCTURE          = "ROMAP_SPM_ELEC.FMT"
END_OBJECT          = ROMAP_SPM_RAW_ELEC_TABLE

```

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

```

/*          Contents of format file "ROMAP_SPM_ELEC.FMT"          */
/*          Electron spectrum (count-energy distribution) (Level 2)  */

/* ***** */
/* Include the HEADER at the beginning of each measurement      */
/* ***** */

OBJECT          = COLUMN
  NAME          = "UTC"
  DATA_TYPE    = TIME
  START_BYTE    = 1
  BYTES         = 23
  DESCRIPTION   = "This column represents the UTC
                  Of the SPM spectrum in PDS standard format
                  YYYY-MM-DDThh:mm:ss.sss"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
  NAME          = "OBT"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 25
  BYTES         = 15
  UNIT          = SECOND
  FORMAT        = "F15.5"
  DESCRIPTION   = "ROMAP 4 bytes counter representing the measurement
                  time synchronized with Lander On Board Time.
                  The time resolution is 0.03125 s"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
  NAME          = "MODE"
  DATA_TYPE    = CHARACTER
  START_BYTE    = 42
  BYTES         = 9
  FORMAT        = "N/A"
  UNIT          = "N/A"
  DESCRIPTION   = "SPM mode:
                  raw or parameter"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
  NAME          = "EXPOSITION_TIME"
  DATA_TYPE    = CHARACTER
  START_BYTE    = 54
  BYTES         = 5
  FORMAT        = "N/A"
  UNIT          = "N/A"
  DESCRIPTION   = "SPM exposition time setting:
                  short or long"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
  NAME          = "CALIBRATION"
  DATA_TYPE    = CHARACTER
  START_BYTE    = 62
  BYTES         = 8
  FORMAT        = "N/A"
  UNIT          = "N/A"
  DESCRIPTION   = "SPM calibration status:
                  active or inactive"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
  NAME          = "CEM_SUPPLY"
  DATA_TYPE    = ASCII_INTEGER
  START_BYTE    = 72

```

```

    BYTES                = 1
    FORMAT               = "I1"
    UNIT                 = "N/A"
    DESCRIPTION          = "SPM CEM supply setting:
                          step number from 1 to 5"
END_OBJECT             = COLUMN

OBJECT                 = COLUMN
  NAME                  = "RESOLUTION"
  DATA_TYPE            = CHARACTER
  START_BYTE           = 75
  BYTES                 = 4
  FORMAT               = "N/A"
  UNIT                 = "N/A"
  DESCRIPTION          = "SPM resolution setting:
                          low or high"
END_OBJECT             = COLUMN

OBJECT                 = COLUMN
  NAME                  = "ION_CHANNEL"
  DATA_TYPE            = CHARACTER
  START_BYTE           = 82
  BYTES                 = 8
  FORMAT               = "N/A"
  UNIT                 = "N/A"
  DESCRIPTION          = "Ion channel status:
                          Both_off
                          Ion1
                          Ion2
                          Both_on"
END_OBJECT             = COLUMN

OBJECT                 = COLUMN
  NAME                  = "EVEN_ODD"
  DATA_TYPE            = CHARACTER
  START_BYTE           = 93
  BYTES                 = 8
  FORMAT               = "N/A"
  UNIT                 = "N/A"
  DESCRIPTION          = "Indicates whether all energies
                          are transmitted (64 for full resolution and
                          32 for low resolution) or even/odd energies
                          alternatively. Takes the values:
                          even_odd or full"
END_OBJECT             = COLUMN

/* ***** */
/* Add index column */
/*   Index column : measurement number */
/* ***** */

OBJECT                 = COLUMN
  NAME                  = "INDEX"
  DATA_TYPE            = INTEGER
  START_BYTE           = 103
  BYTES                 = 5
  FORMAT               = "I5"
  UNIT                 = "N/A"
  DESCRIPTION          = "Measurement index"
END_OBJECT             = COLUMN

/* ***** */

OBJECT                 = COLUMN
  NAME                  = "ENERGY_BIN"
  DATA_TYPE            = INTEGER
  START_BYTE           = 109
  
```

```

    BYTES           = 2
    FORMAT          = "I2"
    UNIT           = "N/A"
    DESCRIPTION     = "Energy bin number"
END_OBJECT        = COLUMN

OBJECT            = COLUMN
    NAME           = "COUNTS"
    DATA_TYPE     = INTEGER
    START_BYTE     = 112
    BYTES          = 6
    FORMAT         = "I6"
    UNIT           = "ADC_UNITS"
    DESCRIPTION     = "Electron counts"
END_OBJECT        = COLUMN

```

4.3.2.5 Description of Instrument

The description of the instrument is done in above and as a brief overview in the INST.CAT catalog file.

4.3.3 Housekeeping Edited Data Product Design (Level 2)

4.3.3.1 File Characteristics Data Elements

The PDS file characteristic data elements for ROMAP HK edited data (level 2) are:

```

RECORD_TYPE      = FIXED_LENGTH
RECORD_BYTES
FILE_RECORDS
LABEL_RECORDS

```

4.3.3.2 Data Object Pointers Identification Data Elements

The ROMAP HK edited 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             = ROMAP
INSTRUMENT_NAME           = "ROSETTA LANDER MAGNETOMETER AND PLASMA MONITOR"
INSTRUMENT_TYPE           = { "FLUXGATE MAGNETOMETER", "ELECTROSTATIC ANALYZER",
                              "FARADAY CUP" }
INSTRUMENT_MODE_ID       = "N/A"
INSTRUMENT_MODE_DESC     = "N/A"

```

4.3.3.4 Data Object Definition

Each TAB file contains a 16 columns table with the uncalibrated HK data (ADC units).

```

OBJECT            = TABLE
    NAME           = "ROMAP_RAWHK_TABLE"
    INTERCHANGE_FORMAT = ASCII
    ROWS           =
    COLUMNS       = 8
    ROW_BYTES     = 153
    ^STRUCTURE     = "ROMAP_RAWHK.FMT"
END_OBJECT        = TABLE

```

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

```

/* Contents of format file "ROMAP_RAWHK.FMT" (Uncalibrated HK data) */

```

OBJECT = COLUMN
 NAME = "UTC"
 DATA_TYPE = TIME
 START_BYTE = 1
 BYTES = 23
 DESCRIPTION = "This column represents the UTC
 Of the HK parameters set in PDS standard format
 YYYY-MM-DDThh:mm:ss.sss"
 END_OBJECT = COLUMN

OBJECT = COLUMN
 NAME = "OBT"
 DATA_TYPE = ASCII_REAL
 START_BYTE = 25
 BYTES = 15
 UNIT = SECOND
 FORMAT = "F15.5"
 DESCRIPTION = "ROMAP 4 bytes counter representing the measurement
 time synchronized with Lander On Board Time.
 The time resolution is 0.03125 s"
 END_OBJECT = COLUMN

OBJECT = COLUMN
 NAME = "CONTROLLER STATUS"
 DATA_TYPE = CHARACTER
 START_BYTE = 42
 BYTES = 4
 FORMAT = "N/A"
 UNIT = "N/A"
 DESCRIPTION = " Controller Status Bits in Hexadecimal Format :

| Bit | Description |
|--------|---|
| 0 | Status flag : Instrument Mode was loaded at power-up from TC-Buffer |
| 1 | Status flag : MAG setting was loaded from TC-Buffer |
| 3 | Error flag : read TC-Buffer error at power-up |
| 4 | Error flag : write BRAM error; cleared after successfully writing BRAM |
| 5 | Error flag : TC-Buffer content error (illegal checksum) |
| 6 | Error flag : SPM Ion 1 counter overflow occurred (cleared after displaying SPM overflow error flag in HK data) |
| 7 | Error flag : SPM Ion 2 counter overflow occurred (cleared after displaying SPM overflow errorflag in HK data) |
| 8 | Error flag : SPM Electron counter overflow occurred (cleared after displaying SPM overflow error flag in HK data) |
| 9 | Status flag : Penning pressure sensor on/off |
| 10 | Status flag : Pirani pressure sensor on/off |
| 11 | Status flag : DUMMY FPGA output on/off |
| 12..13 | Not used |
| 14..15 | Status flags: I0, I1 identify instrument mode |

If one of the bits 0 .. 5 is set once, it stays active until the instrument is switched off."

END_OBJECT = COLUMN

OBJECT = COLUMN
 NAME = "LAST RECEIVED TC (WORD 1)"
 DATA_TYPE = CHARACTER
 START_BYTE = 49
 BYTES = 4

FORMAT = "N/A"
 UNIT = "N/A"
 DESCRIPTION = "Last received TC (word 1) in Hexadecimal Format"
 END_OBJECT = COLUMN

OBJECT = COLUMN
 NAME = "LAST RECEIVED TC (WORD 2)"
 DATA_TYPE = CHARACTER
 START_BYTE = 56
 BYTES = 4
 FORMAT = "N/A"
 UNIT = "N/A"
 DESCRIPTION = "Last received TC (word 2)in Hexadecimal Format"
 END_OBJECT = COLUMN

OBJECT = COLUMN
 NAME = "POWER CONSUMPTION"
 DATA_TYPE = ASCII_INTEGER
 START_BYTE = 62
 BYTES = 6
 FORMAT = "I6"
 UNIT = "ADC_COUNTS"
 DESCRIPTION = "Overall instrument power consumption
 $P = N * 76.3E-3 * 4 \text{ [mW]}$ "
 END_OBJECT = COLUMN

OBJECT = COLUMN
 NAME = "+5V CURRENT"
 DATA_TYPE = ASCII_INTEGER
 START_BYTE = 69
 BYTES = 6
 FORMAT = "I6"
 UNIT = "ADC_COUNTS"
 DESCRIPTION = "+5V current
 $I = N * 76.3E-3 * 0.5 \text{ [mA]}$ "
 END_OBJECT = COLUMN

OBJECT = COLUMN
 NAME = "-5V CURRENT"
 DATA_TYPE = ASCII_INTEGER
 START_BYTE = 76
 BYTES = 6
 FORMAT = "I6"
 UNIT = "ADC_COUNTS"
 DESCRIPTION = "-5V current
 $I = N * 76.3E-3 * 0.05 \text{ [mA]}$ "
 END_OBJECT = COLUMN

OBJECT = COLUMN
 NAME = "ELECTRONICS TEMPERATURE"
 DATA_TYPE = ASCII_INTEGER
 START_BYTE = 83
 BYTES = 6
 FORMAT = "I6"
 UNIT = "ADC_COUNTS"
 DESCRIPTION = "electronics temperature
 $T = (N * 76.3E-6 - 0.535) * 472.9 \text{ [°C]}$ "
 END_OBJECT = COLUMN

OBJECT = COLUMN
 NAME = "+28V CURRENT"
 DATA_TYPE = ASCII_INTEGER
 START_BYTE = 90
 BYTES = 6
 FORMAT = "I6"
 UNIT = "ADC_COUNTS"
 DESCRIPTION = "+28V current"

```

      I = N * 76.3E-3 * 0.025 [mA]"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "SPM HV STATUS 1"
  DATA_TYPE    = CHARACTER
  START_BYTE    = 98
  BYTES         = 4
  FORMAT        = "N/A"
  UNIT          = "N/A"
  DESCRIPTION   = "SPM HV status 1 in Hexadecimal Format"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "SPM HV STATUS 2"
  DATA_TYPE    = CHARACTER
  START_BYTE    = 105
  BYTES         = 4
  FORMAT        = "N/A"
  UNIT          = "N/A"
  DESCRIPTION   = "SPM HV status 2 in Hexadecimal Format"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "SPM HV STATUS 3"
  DATA_TYPE    = CHARACTER
  START_BYTE    = 112
  BYTES         = 4
  FORMAT        = "N/A"
  UNIT          = "N/A"
  DESCRIPTION   = "SPM HV status 3 in Hexadecimal Format"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "SPM HV STATUS 4"
  DATA_TYPE    = CHARACTER
  START_BYTE    = 119
  BYTES         = 4
  FORMAT        = "N/A"
  UNIT          = "N/A"
  DESCRIPTION   = "SPM HV status 4 in Hexadecimal Format"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "PENNING PRESSURE"
  DATA_TYPE    = ASCII_INTEGER
  START_BYTE    = 125
  BYTES         = 6
  FORMAT        = "I6"
  UNIT          = "ADC_COUNTS"
  DESCRIPTION   = "Penning pressure"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "PIRANI PRESSURE"
  DATA_TYPE    = ASCII_INTEGER
  START_BYTE    = 132
  BYTES         = 6
  FORMAT        = "I6"
  UNIT          = "ADC_COUNTS"
  DESCRIPTION   = "Pirani pressure"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "PROM CHECKSUM"
  DATA_TYPE    = CHARACTER

```

```

START_BYTE      = 140
BYTES           = 4
FORMAT          = "N/A"
UNIT            = "N/A"
DESCRIPTION     = "PROM checksum (computed at power-up)
                  in Hexadecimal Format"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME            = "INSTRUMENT ERROR FLAGS"
DATA_TYPE       = CHARACTER
START_BYTE      = 147
BYTES           = 4
FORMAT          = "N/A"
UNIT            = "N/A"
DESCRIPTION     = " Instrument Error Flags in Hexadecimal Format :
```

| Bit | Description |
|-----|---|
| 0 | Command overflow (a TC was received before the former was processed) |
| 1 | CDMS illegal word count |
| 2 | CDMS message error |
| 3 | General CDMS receiving error |
| 4 | General CDMS transmission error |
| 5 | Wrong telecommand received |
| 6 | CDMS request overflow (a CDMS request occurs before the former was processed) |
| 7 | Frame buffer overflow |
| 8 | MAG vector sampling overflow |
| 9 | CDMS error code word received |
| 10 | CDMS checksum error |
| 11 | checksum error in received CDMS SST word |
| 12 | SPM counter overflow |
| 13 | ADC sampling overflow |
| 14 | SPM transmission overflow |
| 15 | SPM setup error" |

```

END_OBJECT      = COLUMN
```

4.3.3.5 Description of Instrument

The description of the instrument is done in above and as a brief overview in the INST.CAT catalog file.

4.3.4 Magnetometer Science calibrated Data Product Design (Level 3)

There are two kinds of calibrated science data for the ROMAP MAG instrument, draft calibrated and calibrated. The draft calibration refers to that data are in physical units (like nanoTesla), scaled, rotated into different coordinates and preliminary offsets subtracted. The different frames are Magnetometer, Lander, Orbiter and Ecliptic J2000. Level 3 contains draft calibrated MAG data.

4.3.4.1 File Characteristics Data Elements

The PDS file characteristic data elements for ROMAP MAG science calibrated data are:

```

RECORD_TYPE     = FIXED_LENGTH
RECORD_BYTES    = 119
FILE_RECORDS    =
LABEL_RECORDS   =
```

4.3.4.2 Data Object Pointers Identification Data Elements

The ROMAP MAG SC calibrated data are organized as ASCII tables. The data object pointers (^TABLE) reference TAB files.

4.3.4.3 Instrument and Detector Descriptive Data Elements

The following data identification elements provide additional information about the ROMAP-MAG data products.

```

INSTRUMENT_HOST_NAME      = "ROSETTA-LANDER"
INSTRUMENT_HOST_ID       = RL
INSTRUMENT_ID            = ROMAP
INSTRUMENT_NAME          = "ROSETTA LANDER  MAGNETOMETER AND PLASMA MONITOR"
INSTRUMENT_TYPE          = { "FLUXGATE MAGNETOMETER", "ELECTROSTATIC ANALYZER",
                             "FARADAY CUP" }
DETECTOR_ID              = MAG
INSTRUMENT_MODE_ID       = "N/A"
INSTRUMENT_MODE_DESC     = "N/A"

```

4.3.4.4 Data Object Definition

4.3.4.4.1 Level A data object definition (draft calibrated in instrument coordinates)

Each TAB file contains an eight columns table with the magnetic field and the spacecraft position.

```

OBJECT          = TABLE
NAME            = "ROMAP_MAG_CALSCA_TABLE"
INTERCHANGE_FORMAT = ASCII
ROWS           =
COLUMNS       = 8
ROW_BYTES      = 119
^STRUCTURE     = "ROMAP_MAG_CALSCA.FMT"
END_OBJECT     = TABLE

```

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

```

/*          Contents of format file  "ROMAP_MAG_CALSCA.FMT"          */
/*  Level A data object definition  :          */
/*  draft calibrated in instrument coordinates          */

```

```

OBJECT          = COLUMN
NAME            = "UTC"
DATA_TYPE       = TIME
START_BYTE      = 1
BYTES           = 23
DESCRIPTION     = "This column represents the UTC
                  Of the magnetic field vector in PDS standard format
                  YYYY-MM-DDThh:mm:ss.sss"
END_OBJECT     = COLUMN

```

```

OBJECT          = COLUMN
NAME            = "OBT"
DATA_TYPE       = ASCII_REAL
START_BYTE      = 25
BYTES           = 15
UNIT            = SECOND
FORMAT          = "F15.5"
DESCRIPTION     = "ROMAP 4 bytes counter representing the measurement
                  time synchronized with Lander On Board Time.
                  The time resolution is 0.03125 s"
END_OBJECT     = COLUMN

```

```

OBJECT          = COLUMN
NAME            = "POS_X"
DATA_TYPE       = ASCII_REAL
START_BYTE      = 41
BYTES           = 16

```

```

FORMAT          = "F16.3"
UNIT            = KILOMETER
DESCRIPTION     = "X component of the Spacecraft (Lander) position,
                  ECLIPJ2000 coordinates"
END_OBJECT     = COLUMN

OBJECT         = COLUMN
NAME          = "POS_Y"
DATA_TYPE     = ASCII_REAL
START_BYTE    = 58
BYTES        = 16
FORMAT       = "F16.3"
UNIT        = KILOMETER
DESCRIPTION = "Y component of the Spacecraft (Lander) position,
                  ECLIPJ2000 coordinates"
END_OBJECT   = COLUMN

OBJECT         = COLUMN
NAME          = "POS_Z"
DATA_TYPE     = ASCII_REAL
START_BYTE    = 75
BYTES        = 16
FORMAT       = "F16.3"
UNIT        = KILOMETER
DESCRIPTION = "Z component of the Spacecraft (Lander) position,
                  ECLIPJ2000 coordinates"
END_OBJECT     = COLUMN

OBJECT         = COLUMN
NAME          = "BX"
DATA_TYPE     = ASCII_REAL
START_BYTE    = 92
BYTES        = 8
FORMAT       = "F8.2"
UNIT        = NANOTESLA
DESCRIPTION = "Magnetic field X component,
                  draft calibrated, instrument coordinates"
END_OBJECT     = COLUMN

OBJECT         = COLUMN
NAME          = "BY"
DATA_TYPE     = ASCII_REAL
START_BYTE    = 101
BYTES        = 8
FORMAT       = "F8.2"
UNIT        = NANOTESLA
DESCRIPTION = "Magnetic field Y component,
                  draft calibrated, instrument coordinates"
END_OBJECT     = COLUMN

OBJECT         = COLUMN
NAME          = "BZ"
DATA_TYPE     = ASCII_REAL
START_BYTE    = 110
BYTES        = 8
FORMAT       = "F8.2"
UNIT        = NANOTESLA
DESCRIPTION = "Magnetic field Z component,
                  draft calibrated, instrument coordinates"
END_OBJECT     = COLUMN

```

4.3.4.4.2 Level B data object definition (draft calibrated in Lander coordinates)

Each TAB file contains an eight columns table with the magnetic field and the spacecraft position.

```

OBJECT          = TABLE
NAME           = "ROMAP_MAG_CALSCB_TABLE"

```

```

INTERCHANGE_FORMAT = ASCII
ROWS =
COLUMNS = 8
ROW_BYTES = 119
^STRUCTURE = "ROMAP_MAG_CALSCB.FMT"
END_OBJECT = TABLE

```

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

```

/*          Contents of format file  "ROMAP_MAG_CALSCB.FMT"          */
/*  Level B data object definition  :                               */
/*  draft calibrated in Lander coordinates                          */
/*                                                                 */

OBJECT = COLUMN
  NAME = "UTC"
  DATA_TYPE = TIME
  START_BYTE = 1
  BYTES = 23
  DESCRIPTION = "This column represents the UTC
                Of the magnetic field vector in PDS standard format
                YYYY-MM-DDThh:mm:ss.sss"
END_OBJECT = COLUMN

OBJECT = COLUMN
  NAME = "OBT"
  DATA_TYPE = ASCII_REAL
  START_BYTE = 25
  BYTES = 15
  UNIT = SECOND
  FORMAT = "F15.5"
  DESCRIPTION = "ROMAP 4 bytes counter representing the measurement
                time synchronized with Lander On Board Time.
                The time resolution is 0.03125 s"
END_OBJECT = COLUMN

OBJECT = COLUMN
  NAME = "POS_X"
  DATA_TYPE = ASCII_REAL
  START_BYTE = 41
  BYTES = 16
  FORMAT = "F16.3"
  UNIT = KILOMETER
  DESCRIPTION = "X component of the Spacecraft (Lander) position,
                ECLIPJ2000 coordinates"
END_OBJECT = COLUMN

OBJECT = COLUMN
  NAME = "POS_Y"
  DATA_TYPE = ASCII_REAL
  START_BYTE = 58
  BYTES = 16
  FORMAT = "F16.3"
  UNIT = KILOMETER
  DESCRIPTION = "Y component of the Spacecraft (Lander) position,
                ECLIPJ2000 coordinates"
END_OBJECT = COLUMN

OBJECT = COLUMN
  NAME = "POS_Z"
  DATA_TYPE = ASCII_REAL
  START_BYTE = 75
  BYTES = 16
  FORMAT = "F16.3"
  UNIT = KILOMETER
  DESCRIPTION = "Z component of the Spacecraft (Lander) position,
                ECLIPJ2000 coordinates"

```

```

END_OBJECT          = COLUMN

OBJECT              = COLUMN
  NAME              = "BX"
  DATA_TYPE        = ASCII_REAL
  START_BYTE        = 92
  BYTES             = 8
  FORMAT            = "F8.2"
  UNIT              = NANOTESLA
  DESCRIPTION        = "Magnetic field X component,
                        draft calibrated, Lander coordinates"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
  NAME              = "BY"
  DATA_TYPE        = ASCII_REAL
  START_BYTE        = 101
  BYTES             = 8
  FORMAT            = "F8.2"
  UNIT              = NANOTESLA
  DESCRIPTION        = "Magnetic field Y component,
                        draft calibrated, Lander coordinates"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
  NAME              = "BZ"
  DATA_TYPE        = ASCII_REAL
  START_BYTE        = 110
  BYTES             = 8
  FORMAT            = "F8.2"
  UNIT              = NANOTESLA
  DESCRIPTION        = "Magnetic field Z component,
                        draft calibrated, Lander coordinates"
END_OBJECT          = COLUMN

```

4.3.4.4.3 Level C data object definition (draft calibrated in Orbiter coordinates)

Each TAB file contains an eight columns table with the magnetic field and the spacecraft position.

```

OBJECT              = TABLE
  NAME              = "ROMAP_MAG_CALSCC_TABLE"
  INTERCHANGE_FORMAT = ASCII
  ROWS              =
  COLUMNS          = 8
  ROW_BYTES         = 119
  ^STRUCTURE        = "ROMAP_MAG_CALSCC.FMT"
END_OBJECT          = TABLE

```

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

```

/*          Contents of format file  "ROMAP_MAG_CALSCC.FMT"          */
/*  Level C data object definition  :                               */
/*  draft calibrated in Orbiter  coordinates                         */

OBJECT              = COLUMN
  NAME              = "UTC"
  DATA_TYPE        = TIME
  START_BYTE        = 1
  BYTES             = 23
  DESCRIPTION        = "This column represents the UTC
                        Of the magnetic field vector in PDS standard format
                        YYYY-MM-DDThh:mm:ss.sss"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
  NAME              = "OBT"

```

```

DATA_TYPE      = ASCII_REAL
START_BYTE     = 25
BYTES          = 15
UNIT           = SECOND
FORMAT         = "F15.5"
DESCRIPTION    = "ROMAP 4 bytes counter representing the measurement
                  time synchronized with Lander On Board Time.
                  The time resolution is 0.03125 s"
END_OBJECT     = COLUMN

OBJECT         = COLUMN
NAME           = "POS_X"
DATA_TYPE     = ASCII_REAL
START_BYTE    = 41
BYTES         = 16
FORMAT       = "F16.3"
UNIT         = KILOMETER
DESCRIPTION  = "X component of the Spacecraft (Lander) position,
                  ECLIPJ2000 coordinates"
END_OBJECT   = COLUMN

OBJECT         = COLUMN
NAME           = "POS_Y"
DATA_TYPE     = ASCII_REAL
START_BYTE    = 58
BYTES         = 16
FORMAT       = "F16.3"
UNIT         = KILOMETER
DESCRIPTION  = "Y component of the Spacecraft (Lander) position,
                  ECLIPJ2000 coordinates"
END_OBJECT   = COLUMN

OBJECT         = COLUMN
NAME           = "POS_Z"
DATA_TYPE     = ASCII_REAL
START_BYTE    = 75
BYTES         = 16
FORMAT       = "F16.3"
UNIT         = KILOMETER
DESCRIPTION  = "Z component of the Spacecraft (Lander) position,
                  ECLIPJ2000 coordinates"
END_OBJECT   = COLUMN

OBJECT         = COLUMN
NAME           = "BX"
DATA_TYPE     = ASCII_REAL
START_BYTE    = 92
BYTES         = 8
FORMAT       = "F8.2"
UNIT         = NANOTESLA
DESCRIPTION  = "Magnetic field X component,
                  draft calibrated, Orbiter coordinates"
END_OBJECT   = COLUMN

OBJECT         = COLUMN
NAME           = "BY"
DATA_TYPE     = ASCII_REAL
START_BYTE    = 101
BYTES         = 8
FORMAT       = "F8.2"
UNIT         = NANOTESLA
DESCRIPTION  = "Magnetic field Y component,
                  draft calibrated, Orbiter coordinates"
END_OBJECT   = COLUMN

OBJECT         = COLUMN
NAME           = "BZ"

```

```

DATA_TYPE      = ASCII_REAL
START_BYTE     = 110
BYTES          = 8
FORMAT         = "F8.2"
UNIT           = NANOTESLA
DESCRIPTION    = "Magnetic field Z component,
draft calibrated, Orbiter coordinates"
END_OBJECT     = COLUMN

```

4.3.4.4.4 Level D data object definition (draft calibrated in ECLIP J2000 coordinates)

Each TAB file contains an eight columns table with the magnetic field and the spacecraft position.

```

OBJECT         = TABLE
NAME           = "ROMAP_MAG_CALSCD_TABLE"
INTERCHANGE_FORMAT = ASCII
ROWS          =
COLUMNS      = 8
ROW_BYTES     = 119
^STRUCTURE   = "ROMAP_MAG_CALSCD.FMT"
END_OBJECT    = TABLE

```

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

```

/*           Contents of format file  "ROMAP_MAG_CALSCD.FMT"           */
/*   Level D data object definition  :                               */
/*   draft calibrated in ECLIP J2000 coordinates                     */

OBJECT      = COLUMN
NAME        = "UTC"
DATA_TYPE   = TIME
START_BYTE  = 1
BYTES       = 23
DESCRIPTION = "This column represents the UTC
              Of the magnetic field vector in PDS standard format
              YYYY-MM-DDThh:mm:ss.sss"
END_OBJECT  = COLUMN

OBJECT      = COLUMN
NAME        = "OBT"
DATA_TYPE   = ASCII_REAL
START_BYTE  = 25
BYTES       = 15
UNIT        = SECOND
FORMAT      = "F15.5"
DESCRIPTION = "ROMAP 4 bytes counter representing the measurement
              time synchronized with Lander On Board Time.
              The time resolution is 0.03125 s"
END_OBJECT  = COLUMN

OBJECT      = COLUMN
NAME        = "POS_X"
DATA_TYPE   = ASCII_REAL
START_BYTE  = 41
BYTES       = 16
FORMAT      = "F16.3"
UNIT        = KILOMETER
DESCRIPTION = "X component of the Spacecraft (Lander) position,
              ECLIPJ2000 coordinates"
END_OBJECT  = COLUMN

OBJECT      = COLUMN
NAME        = "POS_Y"
DATA_TYPE   = ASCII_REAL
START_BYTE  = 58
BYTES       = 16

```

```

FORMAT          = "F16.3"
UNIT            = KILOMETER
DESCRIPTION     = "Y component of the Spacecraft (Lander) position,
                  ECLIPJ2000 coordinates"
END_OBJECT     = COLUMN

OBJECT         = COLUMN
NAME          = "POS_Z"
DATA_TYPE     = ASCII_REAL
START_BYTE    = 75
BYTES        = 16
FORMAT       = "F16.3"
UNIT        = KILOMETER
DESCRIPTION = "Z component of the Spacecraft (Lander) position,
                  ECLIPJ2000 coordinates"
END_OBJECT  = COLUMN

OBJECT         = COLUMN
NAME          = "BX"
DATA_TYPE     = ASCII_REAL
START_BYTE    = 92
BYTES        = 8
FORMAT       = "F8.2"
UNIT        = NANOTESLA
DESCRIPTION = "Magnetic field X component,
                  draft calibrated, ECLIPJ2000 coordinates"
END_OBJECT  = COLUMN

OBJECT         = COLUMN
NAME          = "BY"
DATA_TYPE     = ASCII_REAL
START_BYTE    = 101
BYTES        = 8
FORMAT       = "F8.2"
UNIT        = NANOTESLA
DESCRIPTION = "Magnetic field Y component,
                  draft calibrated, ECLIPJ2000 coordinates"
END_OBJECT  = COLUMN

OBJECT         = COLUMN
NAME          = "BZ"
DATA_TYPE     = ASCII_REAL
START_BYTE    = 110
BYTES        = 8
FORMAT       = "F8.2"
UNIT        = NANOTESLA
DESCRIPTION = "Magnetic field Z component,
                  draft calibrated, ECLIPJ2000 coordinates"
END_OBJECT  = COLUMN

```

4.3.4.5 Description of Instrument

The description of the instrument is done in above and as a brief overview in the INST.CAT catalog file.

4.3.5 Simple Plasma Monitor Science Draft Calibrated Data Product Design (Level 3)

We understand by draft calibrated data energy and angle distributions in $\text{cm}^{-2}\text{s}^{-1}$, ion currents in ADC units (signed 16 integers, no physical values since the CEM amplifications are not clear), Faraday cup currents in cm^{-2} , energy in eV and angle (elevation) in degrees. The energy tables and the correspondences between step numbers and energy and between step numbers and angle (elevation) is given in the following tables (Table 4-1, Table 4-2).

| Step No | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|--------------|-----|-----|-----|-----|-----|-----|-----|-----|----|---|----|----|----|----|----|----|
| Ion1/2 (deg) | -52 | -47 | -41 | -34 | -27 | -21 | -16 | -11 | -6 | 0 | 5 | 10 | 15 | 20 | 25 | 31 |

Table 4-1 Correspondence between step number and elevation

| | | | | | | | | | | | | |
|---------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Step No "64" | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| Step No "32" | | 0 | | 1 | | 2 | | 3 | | 4 | | 5 |
| Ion1/2 (eV) | 38.6 | 42.6 | 46.6 | 50.6 | 54.6 | 59.9 | 65.3 | 70.6 | 77.3 | 83.9 | 90.6 | 98.6 |
| Electron (eV) | 0.35 | 0.42 | 0.49 | 0.56 | 0.63 | 0.7 | 0.84 | 0.98 | 1.12 | 1.3 | 1.47 | 1.75 |

| | | | | | | | | | | | | |
|---------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Step No "64" | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| Step No "32" | | 6 | | 7 | | 8 | | 9 | | 10 | | 11 |
| Ion1/2 (eV) | 107 | 117 | 127 | 138 | 150 | 163 | 178 | 194 | 211 | 230 | 250 | 271 |
| Electron (eV) | 2.03 | 2.38 | 2.74 | 3.16 | 3.72 | 4.28 | 4.98 | 5.82 | 6.73 | 7.79 | 9.05 | 10.5 |

| | | | | | | | | | | | | |
|---------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Step No "64" | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 |
| Step No "32" | | 12 | | 13 | | 14 | | 15 | | 16 | | 17 |
| Ion1/2 (eV) | 295 | 321 | 350 | 381 | 414 | 450 | 490 | 533 | 580 | 640 | 700 | 760 |
| Electron (eV) | 12.3 | 14.2 | 16.5 | 19.2 | 22.3 | 25.9 | 30.1 | 34.9 | 41.0 | 47.4 | 54.7 | 63.1 |

| | | | | | | | | | | | | |
|---------------|------|------|-----|------|------|------|------|------|------|------|------|------|
| Step No "64" | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 |
| Step No "32" | | 18 | | 19 | | 20 | | 21 | | 22 | | 23 |
| Ion1/2 (eV) | 820 | 900 | 980 | 1060 | 1160 | 1260 | 1360 | 1480 | 1620 | 1760 | 1920 | 2080 |
| Electron (eV) | 73.7 | 86.3 | 100 | 116 | 135 | 156 | 181 | 211 | 245 | 284 | 330 | 383 |

| | | | | | | | | | | | | |
|---------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Step No "64" | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 |
| Step No "32" | | 24 | | 25 | | 26 | | 27 | | 28 | | 29 |
| Ion1/2 (eV) | 2260 | 2460 | 2680 | 2920 | 3180 | 3460 | 3760 | 4080 | 4440 | 4820 | 5260 | 5720 |
| Electron (eV) | 445 | 517 | 600 | 695 | 810 | 937 | 1095 | 1274 | 1474 | 1716 | 1989 | 2316 |

| | | | | |
|---------------|------|------|------|------|
| Step No "64" | 60 | 61 | 62 | 63 |
| Step No "32" | | 30 | | 31 |
| Ion1/2 (eV) | 6220 | 6760 | 7360 | 8000 |
| Electron (eV) | 2684 | 3115 | 3621 | 4210 |

| | | | | | | | | | | | |
|----------------------------|---|------|------|----|------|------|------|------|------|------|------|
| Step No "64" | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
| Step No "32" | | 0 | | 1 | | 2 | | 3 | | 4 | |
| Far.Cup - "Ions" (eV) | | 10.7 | 12.7 | 15 | 17.6 | 20.8 | 24.6 | 29.2 | 34.6 | 40.8 | 48.6 |
| Far.Cup - "Electrons" (eV) | | 1 | 2 | | | | | | | | |

| | | | | | | | | | | | |
|-----------------------|----|------|------|------|------|-----|-----|-----|-----|-----|-----|
| Step No "64" | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | |
| Step No "32" | | 5 | | 6 | | 7 | | 8 | | 9 | |
| Far.Cup - "Ions" (eV) | | 57.6 | 67.8 | 80.2 | 95.2 | 113 | 133 | 160 | 190 | 224 | 264 |

| | | | | | | | | | | | |
|-----------------------|----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| Step No "64" | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | |
| Step No "32" | | 10 | | 11 | | 12 | | 13 | | 14 | |
| Far.Cup - "Ions" (eV) | | 314 | 370 | 440 | 520 | 614 | 730 | 864 | 1020 | 1204 | 1430 |

| | | |
|-----------------------|------|------|
| Step No "64" | 30 | 31 |
| Step No "32" | | 15 |
| Far.Cup - "Ions" (eV) | 1690 | 2000 |

Table 4-2 Correspondence between step number and energy

The ROMAP SPM draft calibrated science files have a format similar to the edited (level 2) data, i.e; each file contains data from several measurement cycles. The level 3 files contain in addition detectors orientation in ECLIP J2000 frame.

One cycle contains the following data (in raw or parameter modes):

Raw mode

SPM header:

- UTC,
- OBT,
- Status of SPM (from HK parameters in SC data frame)
- Orientation of detectors in ECLIPJ2000 (see §2.2.1 for the orientation of sensors relative to S/C)

16 (for different angles) energy distributions ($\text{cm}^{-2}\text{s}^{-1}$ and current in nA) for Ion1 and Ion2 sensors,
1 energy distribution (current in nA) for Faraday Cup sensors,
1 energy distribution ($\text{cm}^{-2}\text{s}^{-1}$) for Electron sensors

Parameter mode

SPM header (same as for raw mode)

1 energy distribution ($\text{cm}^{-2}\text{s}^{-1}$ and currents in nA) for Ion1 and Ion2 sensors,
1 angle distributions ($\text{cm}^{-2}\text{s}^{-1}$ and currents in nA) for Ion1 and Ion2 sensors,
1 energy distribution (current in nA) for Faraday Cup sensors (same format as raw mode),
1 energy distribution ($\text{cm}^{-2}\text{s}^{-1}$) for Electron sensors (same format as raw mode)

The table objects corresponding to the distributions are detailed in the following paragraphs.

4.3.5.1 File Characteristics Data Elements

The PDS file characteristic data elements for ROMAP SPM draft calibrated science data (level 3) are:

```
RECORD_TYPE = FIXED_LENGTH
RECORD_BYTES
FILE_RECORDS
LABEL_RECORDS
```

4.3.5.2 Data Object Pointers Identification Data Elements

The ROMAP SPM SC draft calibrated data are organized as ASCII tables. The data object pointers (^TABLE) reference TAB files.

4.3.5.3 Instrument and Detector Descriptive Data Elements

The following data identification elements provide additional information about the ROMAP-SPM data products.

```
INSTRUMENT_HOST_NAME = "ROSETTA-LANDER"
INSTRUMENT_HOST_ID = RL
INSTRUMENT_ID = ROMAP
INSTRUMENT_NAME = "ROSETTA LANDER MAGNETOMETER AND PLASMA MONITOR"
INSTRUMENT_TYPE = {"FLUXGATE MAGNETOMETER", "ELECTROSTATIC ANALYZER",
                  "FARADAY CUP"}
DETECTOR_ID = SPM
INSTRUMENT_MODE_ID = "N/A"
INSTRUMENT_MODE_DESC = "N/A"
```

4.3.5.4 Data Object Definition

Each TAB file contains a header describing the Instrument status and detectors orientation followed by the energy and angle distributions.

4.3.5.4.1 Ion spectrum definition (counts-energy-angle distribution), raw mode (channels 1 or 2)

```
OBJECT = ROMAP_SPM_RAW_ION_CN_TABLE
NAME = ROMAP_SPM_RAW_ION_CN
```

```

INTERCHANGE_FORMAT = ASCII
ROWS                = 32
^STRUCTURE          = "ROMAP_SPM_RAWC_ION_CN.FMT"
COLUMNS            = 40
ROW_BYTES           = 353
END_OBJECT          = ROMAP_SPM_RAW_ION_CN_TABLE

```

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

```

/*          Contents of format file "ROMAP_SPM_RAWC_ION_CN.FMT"          */
/*          Ion spectrum definition (Level 3)                          */
/*          (I1CNT or I2CNT), raw mode (channels 1 or 2)                */
/*          */
/* ***** */
/* Include the HEADER at the beginning of each measurement            */
/* ***** */

OBJECT      = COLUMN
NAME        = "UTC"
DATA_TYPE   = TIME
START_BYTE  = 1
BYTES       = 23
DESCRIPTION = "This column represents the UTC
              Of the SPM spectrum in PDS standard format
              YYYY-MM-DDThh:mm:ss.sss"
END_OBJECT  = COLUMN

OBJECT      = COLUMN
NAME        = "OBT"
DATA_TYPE   = ASCII_REAL
START_BYTE  = 25
BYTES       = 15
UNIT        = SECOND
FORMAT      = "F15.5"
DESCRIPTION = "ROMAP 4 bytes counter representing the measurement
              time synchronized with Lander On Board Time.
              The time resolution is 0.03125 s"
END_OBJECT  = COLUMN

OBJECT      = COLUMN
NAME        = "MODE"
DATA_TYPE   = CHARACTER
START_BYTE  = 42
BYTES       = 9
FORMAT      = "N/A"
UNIT        = "N/A"
DESCRIPTION = "SPM mode:
              raw or parameter"
END_OBJECT  = COLUMN

OBJECT      = COLUMN
NAME        = "EXPOSITION_TIME"
DATA_TYPE   = CHARACTER
START_BYTE  = 54
BYTES       = 5
FORMAT      = "N/A"
UNIT        = "N/A"
DESCRIPTION = "SPM exposition time setting:
              short or long"
END_OBJECT  = COLUMN

OBJECT      = COLUMN
NAME        = "CALIBRATION"
DATA_TYPE   = CHARACTER
START_BYTE  = 62
BYTES       = 8
FORMAT      = "N/A"

```

```

UNIT = "N/A"
DESCRIPTION = "SPM calibration status:
              active or inactive"
END_OBJECT = COLUMN

OBJECT = COLUMN
NAME = "CEM_SUPPLY"
DATA_TYPE = ASCII_INTEGER
START_BYTE = 72
BYTES = 1
FORMAT = "I1"
UNIT = "N/A"
DESCRIPTION = "SPM CEM supply setting:
              step number from 1 to 5"
END_OBJECT = COLUMN

OBJECT = COLUMN
NAME = "RESOLUTION"
DATA_TYPE = CHARACTER
START_BYTE = 75
BYTES = 4
FORMAT = "N/A"
UNIT = "N/A"
DESCRIPTION = "SPM resolution setting:
              low or high"
END_OBJECT = COLUMN

OBJECT = COLUMN
NAME = "ION_CHANNEL"
DATA_TYPE = CHARACTER
START_BYTE = 82
BYTES = 8
FORMAT = "N/A"
UNIT = "N/A"
DESCRIPTION = "Ion channel status:
              Both_off
              Ion1
              Ion2
              Both_on"
END_OBJECT = COLUMN

OBJECT = COLUMN
NAME = "EVEN_ODD"
DATA_TYPE = CHARACTER
START_BYTE = 93
BYTES = 8
FORMAT = "N/A"
UNIT = "N/A"
DESCRIPTION = "Indicates whether all energies
              are transmitted (64 for full resolution and
              32 for low resolution) or even/odd energies
              alternatively. Takes the values:
              even_odd or full"
END_OBJECT = COLUMN

OBJECT = COLUMN
NAME = "I1_X_ECLIPJ2000"
DATA_TYPE = ASCII_REAL
START_BYTE = 103
BYTES = 6
FORMAT = "F6.3"
UNIT = "N/A"
DESCRIPTION = "X component of unit vector aligned with Ion 1 detector
              in ECLIPJ2000 coordinates"
END_OBJECT = COLUMN

OBJECT = COLUMN

```

```

NAME           = "I1_Y_ECLIPJ2000"
DATA_TYPE      = ASCII_REAL
START_BYTE     = 110
BYTES          = 6
FORMAT         = "F6.3"
UNIT           = "N/A"
DESCRIPTION    = "Y component of unit vector aligned with Ion 1 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT     = COLUMN

OBJECT         = COLUMN
NAME           = "I1_Z_ECLIPJ2000"
DATA_TYPE      = ASCII_REAL
START_BYTE     = 117
BYTES          = 6
FORMAT         = "F6.3"
UNIT           = "N/A"
DESCRIPTION    = "Z component of unit vector aligned with Ion 1 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT     = COLUMN

OBJECT         = COLUMN
NAME           = "I2_X_ECLIPJ2000"
DATA_TYPE      = ASCII_REAL
START_BYTE     = 124
BYTES          = 6
FORMAT         = "F6.3"
UNIT           = "N/A"
DESCRIPTION    = "X component of unit vector aligned with Ion 2 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT     = COLUMN

OBJECT         = COLUMN
NAME           = "I2_Y_ECLIPJ2000"
DATA_TYPE      = ASCII_REAL
START_BYTE     = 131
BYTES          = 6
FORMAT         = "F6.3"
UNIT           = "N/A"
DESCRIPTION    = "Y component of unit vector aligned with Ion 2 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT     = COLUMN

OBJECT         = COLUMN
NAME           = "I2_Z_ECLIPJ2000"
DATA_TYPE      = ASCII_REAL
START_BYTE     = 138
BYTES          = 6
FORMAT         = "F6.3"
UNIT           = "N/A"
DESCRIPTION    = "Z component of unit vector aligned with Ion 2 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT     = COLUMN

OBJECT         = COLUMN
NAME           = "EL_X_ECLIPJ2000"
DATA_TYPE      = ASCII_REAL
START_BYTE     = 145
BYTES          = 6
FORMAT         = "F6.3"
UNIT           = "N/A"
DESCRIPTION    = "X component of unit vector aligned with electron
                  detector in ECLIPJ2000 coordinates"
END_OBJECT     = COLUMN

OBJECT         = COLUMN
NAME           = "EL_Y_ECLIPJ2000"
DATA_TYPE      = ASCII_REAL
  
```

```

START_BYTE      = 152
BYTES           = 6
FORMAT          = "F6.3"
UNIT            = "N/A"
DESCRIPTION     = "Y component of unit vector aligned with electron
                  detector in ECLIPJ2000 coordinates"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
NAME            = "EL_Z_ECLIPJ2000"
DATA_TYPE      = ASCII_REAL
START_BYTE     = 159
BYTES         = 6
FORMAT        = "F6.3"
UNIT          = "N/A"
DESCRIPTION   = "Z component of unit vector aligned with electron
                  detector in ECLIPJ2000 coordinates"
END_OBJECT    = COLUMN

OBJECT          = COLUMN
NAME            = "FC_X_ECLIPJ2000"
DATA_TYPE      = ASCII_REAL
START_BYTE     = 166
BYTES         = 6
FORMAT        = "F6.3"
UNIT          = "N/A"
DESCRIPTION   = "X component of unit vector aligned with Faraday cup
                  in ECLIPJ2000 coordinates"
END_OBJECT    = COLUMN

OBJECT          = COLUMN
NAME            = "FC_Y_ECLIPJ2000"
DATA_TYPE      = ASCII_REAL
START_BYTE     = 173
BYTES         = 6
FORMAT        = "F6.3"
UNIT          = "N/A"
DESCRIPTION   = "Y component of unit vector aligned with Faraday cup
                  in ECLIPJ2000 coordinates"
END_OBJECT    = COLUMN

OBJECT          = COLUMN
NAME            = "FC_Z_ECLIPJ2000"
DATA_TYPE      = ASCII_REAL
START_BYTE     = 180
BYTES         = 6
FORMAT        = "F6.3"
UNIT          = "N/A"
DESCRIPTION   = "Z component of unit vector aligned with Faraday cup
                  in ECLIPJ2000 coordinates"
END_OBJECT    = COLUMN

/* ***** */
/* Add index and type columns */
/*      Index column : measurement number */
/*      Type column : measurement type (I1CNT or I2CNT) */
/* ***** */

OBJECT          = COLUMN
NAME            = "INDEX"
DATA_TYPE      = INTEGER
START_BYTE     = 187
BYTES         = 5
FORMAT        = "I5"
UNIT          = "N/A"
DESCRIPTION   = "Measurement index"
END_OBJECT    = COLUMN

```

```
OBJECT          = COLUMN
  NAME          = "TYPE"
  DATA_TYPE    = CHARACTER
  START_BYTE    = 194
  BYTES         = 5
  FORMAT        = "N/A"
  UNIT          = "N/A"
  DESCRIPTION   = "Measurement type (I1CNT or I2CNT)"
END_OBJECT      = COLUMN
```

/* ***** */

```
OBJECT          = COLUMN
  NAME          = "ENERGY"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 201
  BYTES         = 7
  FORMAT        = "F7.2"
  UNIT          = "ELECTRONVOLT"
  DESCRIPTION   = "Energy step"
END_OBJECT      = COLUMN
```

```
OBJECT          = COLUMN
  NAME          = "COUNTS_ELEVATION_1"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 209
  BYTES         = 8
  FORMAT        = "F8.2"
  UNIT          = "CM**-2*S**-1"
  DESCRIPTION   = "counts for elevation step 1"
END_OBJECT      = COLUMN
```

```
OBJECT          = COLUMN
  NAME          = "COUNTS_ELEVATION_2"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 218
  BYTES         = 8
  FORMAT        = "F8.2"
  UNIT          = "CM**-2*S**-1"
  DESCRIPTION   = "counts for elevation step 2"
END_OBJECT      = COLUMN
```

```
OBJECT          = COLUMN
  NAME          = "COUNTS_ELEVATION_3"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 227
  BYTES         = 8
  FORMAT        = "F8.2"
  UNIT          = "CM**-2*S**-1"
  DESCRIPTION   = "counts for elevation step 3"
END_OBJECT      = COLUMN
```

```
OBJECT          = COLUMN
  NAME          = "COUNTS_ELEVATION_4"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 236
  BYTES         = 8
  FORMAT        = "F8.2"
  UNIT          = "CM**-2*S**-1"
  DESCRIPTION   = "counts for elevation step 4"
END_OBJECT      = COLUMN
```

```
OBJECT          = COLUMN
  NAME          = "COUNTS_ELEVATION_5"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 245
```

```

    BYTES                = 8
    FORMAT               = "F8.2"
    UNIT                 = "CM**-2*S**-1"
    DESCRIPTION          = "counts for elevation step 5"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
    NAME                 = "COUNTS_ELEVATION_6"
    DATA_TYPE           = ASCII_REAL
    START_BYTE           = 254
    BYTES                = 8
    FORMAT               = "F8.2"
    UNIT                 = "CM**-2*S**-1"
    DESCRIPTION          = "counts for elevation step 6 "
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
    NAME                 = "COUNTS_ELEVATION_7"
    DATA_TYPE           = ASCII_REAL
    START_BYTE           = 263
    BYTES                = 8
    FORMAT               = "F8.2"
    UNIT                 = "CM**-2*S**-1"
    DESCRIPTION          = "counts for elevation step 7 "
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
    NAME                 = "COUNTS_ELEVATION_8"
    DATA_TYPE           = ASCII_REAL
    START_BYTE           = 272
    BYTES                = 8
    FORMAT               = "F8.2"
    UNIT                 = "CM**-2*S**-1"
    DESCRIPTION          = "counts for elevation step 8 "
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
    NAME                 = "COUNTS_ELEVATION_9"
    DATA_TYPE           = ASCII_REAL
    START_BYTE           = 281
    BYTES                = 8
    FORMAT               = "F8.2"
    UNIT                 = "CM**-2*S**-1"
    DESCRIPTION          = "counts for elevation step 9 "
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
    NAME                 = "COUNTS_ELEVATION_10"
    DATA_TYPE           = ASCII_REAL
    START_BYTE           = 290
    BYTES                = 8
    FORMAT               = "F8.2"
    UNIT                 = "CM**-2*S**-1"
    DESCRIPTION          = "counts for elevation step 10 "
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
    NAME                 = "COUNTS_ELEVATION_11"
    DATA_TYPE           = ASCII_REAL
    START_BYTE           = 299
    BYTES                = 8
    FORMAT               = "F8.2"
    UNIT                 = "CM**-2*S**-1"
    DESCRIPTION          = "counts for elevation step 11 "
END_OBJECT              = COLUMN

OBJECT                  = COLUMN

```

```

NAME           = "COUNTS_ELEVATION_12"
DATA_TYPE      = ASCII_REAL
START_BYTE     = 308
BYTES          = 8
FORMAT         = "F8.2"
UNIT           = "CM**-2*S**-1"
DESCRIPTION    = "counts for elevation step 12 "
END_OBJECT     = COLUMN

OBJECT         = COLUMN
NAME           = "COUNTS_ELEVATION_13"
DATA_TYPE      = ASCII_REAL
START_BYTE     = 317
BYTES          = 8
FORMAT         = "F8.2"
UNIT           = "CM**-2*S**-1"
DESCRIPTION    = "counts for elevation step 13 "
END_OBJECT     = COLUMN

OBJECT         = COLUMN
NAME           = "COUNTS_ELEVATION_14"
DATA_TYPE      = ASCII_REAL
START_BYTE     = 326
BYTES          = 8
FORMAT         = "F8.2"
UNIT           = "CM**-2*S**-1"
DESCRIPTION    = "counts for elevation step 14 "
END_OBJECT     = COLUMN

OBJECT         = COLUMN
NAME           = "COUNTS_ELEVATION_15"
DATA_TYPE      = ASCII_REAL
START_BYTE     = 335
BYTES          = 8
FORMAT         = "F8.2"
UNIT           = "CM**-2*S**-1"
DESCRIPTION    = "counts for elevation step 15 "
END_OBJECT     = COLUMN

OBJECT         = COLUMN
NAME           = "COUNTS_ELEVATION_16"
DATA_TYPE      = ASCII_REAL
START_BYTE     = 344
BYTES          = 8
FORMAT         = "F8.2"
UNIT           = "CM**-2*S**-1"
DESCRIPTION    = "counts for elevation step 16"
END_OBJECT     = COLUMN

```

4.3.5.4.2 Ion spectrum definition (current-energy-angle), raw mode (channels 1 or 2)

```

OBJECT         = ROMAP_SPM_RAW_ION_CR_TABLE
NAME           = ROMAP_SPM_RAW_ION_CR
INTERCHANGE_FORMAT = ASCII
ROWS          = 32
^STRUCTURE     = "ROMAP_SPM_RAWC_ION_CR.FMT"
COLUMNS       = 40
ROW_BYTES     = 321
END_OBJECT     = ROMAP_SPM_RAW_ION_CR_TABLE

```

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

```

/*           Contents of format file "ROMAP_SPM_RAWC_ION_CR.FMT"           */
/*           Ion spectrum definition           (Level 3)                   */
/*           (I1CRT or I2CRT), raw mode (channels 1 or 2)                 */

```

```

/* ***** */
/* Include the HEADER at the beginning of each measurement */
/* ***** */

OBJECT          = COLUMN
  NAME          = "UTC"
  DATA_TYPE    = TIME
  START_BYTE    = 1
  BYTES         = 23
  DESCRIPTION   = "This column represents the UTC
                  Of the SPM spectrum in PDS standard format
                  YYYY-MM-DDThh:mm:ss.sss"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
  NAME          = "OBT"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 25
  BYTES         = 15
  UNIT          = SECOND
  FORMAT        = "F15.5"
  DESCRIPTION   = "ROMAP 4 bytes counter representing the measurement
                  time synchronized with Lander On Board Time.
                  The time resolution is 0.03125 s"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
  NAME          = "MODE"
  DATA_TYPE    = CHARACTER
  START_BYTE    = 42
  BYTES         = 9
  FORMAT        = "N/A"
  UNIT          = "N/A"
  DESCRIPTION   = "SPM mode:
                  raw or parameter"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
  NAME          = "EXPOSITION_TIME"
  DATA_TYPE    = CHARACTER
  START_BYTE    = 54
  BYTES         = 5
  FORMAT        = "N/A"
  UNIT          = "N/A"
  DESCRIPTION   = "SPM exposition time setting:
                  short or long"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
  NAME          = "CALIBRATION"
  DATA_TYPE    = CHARACTER
  START_BYTE    = 62
  BYTES         = 8
  FORMAT        = "N/A"
  UNIT          = "N/A"
  DESCRIPTION   = "SPM calibration status:
                  active or inactive"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
  NAME          = "CEM_SUPPLY"
  DATA_TYPE    = ASCII_INTEGER
  START_BYTE    = 72
  BYTES         = 1
  FORMAT        = "I1"
  UNIT          = "N/A"
  DESCRIPTION   = "SPM CEM supply setting:

```

```

        step number from 1 to 5"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "RESOLUTION"
  DATA_TYPE    = CHARACTER
  START_BYTE    = 75
  BYTES         = 4
  FORMAT        = "N/A"
  UNIT          = "N/A"
  DESCRIPTION   = "SPM resolution setting:
                  low or high"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "ION_CHANNEL"
  DATA_TYPE    = CHARACTER
  START_BYTE    = 82
  BYTES         = 8
  FORMAT        = "N/A"
  UNIT          = "N/A"
  DESCRIPTION   = "Ion channel status:
                  Both_off
                  Ion1
                  Ion2
                  Both_on"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "EVEN_ODD"
  DATA_TYPE    = CHARACTER
  START_BYTE    = 93
  BYTES         = 8
  FORMAT        = "N/A"
  UNIT          = "N/A"
  DESCRIPTION   = "Indicates whether all energies
                  are transmitted (64 for full resolution and
                  32 for low resolution) or even/odd energies
                  alternatively. Takes the values:
                  even_odd or full"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "I1_X_ECLIPJ2000"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 103
  BYTES         = 6
  FORMAT        = "F6.3"
  UNIT          = "N/A"
  DESCRIPTION   = "X component of unit vector aligned with Ion 1 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "I1_Y_ECLIPJ2000"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 110
  BYTES         = 6
  FORMAT        = "F6.3"
  UNIT          = "N/A"
  DESCRIPTION   = "Y component of unit vector aligned with Ion 1 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "I1_Z_ECLIPJ2000"
  DATA_TYPE    = ASCII_REAL

```

```

START_BYTE      = 117
BYTES           = 6
FORMAT          = "F6.3"
UNIT            = "N/A"
DESCRIPTION     = "Z component of unit vector aligned with Ion 1 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT     = COLUMN
OBJECT          = COLUMN
  NAME          = "I2_X_ECLIPJ2000"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 124
  BYTES         = 6
  FORMAT        = "F6.3"
  UNIT          = "N/A"
  DESCRIPTION   = "X component of unit vector aligned with Ion 2 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT     = COLUMN
OBJECT          = COLUMN
  NAME          = "I2_Y_ECLIPJ2000"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 131
  BYTES         = 6
  FORMAT        = "F6.3"
  UNIT          = "N/A"
  DESCRIPTION   = "Y component of unit vector aligned with Ion 2 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT     = COLUMN
OBJECT          = COLUMN
  NAME          = "I2_Z_ECLIPJ2000"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 138
  BYTES         = 6
  FORMAT        = "F6.3"
  UNIT          = "N/A"
  DESCRIPTION   = "Z component of unit vector aligned with Ion 2 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT     = COLUMN
OBJECT          = COLUMN
  NAME          = "EL_X_ECLIPJ2000"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 145
  BYTES         = 6
  FORMAT        = "F6.3"
  UNIT          = "N/A"
  DESCRIPTION   = "X component of unit vector aligned with electron
                  detector in ECLIPJ2000 coordinates"
END_OBJECT     = COLUMN
OBJECT          = COLUMN
  NAME          = "EL_Y_ECLIPJ2000"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 152
  BYTES         = 6
  FORMAT        = "F6.3"
  UNIT          = "N/A"
  DESCRIPTION   = "Y component of unit vector aligned with electron
                  detector in ECLIPJ2000 coordinates"
END_OBJECT     = COLUMN
OBJECT          = COLUMN
  NAME          = "EL_Z_ECLIPJ2000"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 159
  BYTES         = 6

```

```

    FORMAT          = "F6.3"
    UNIT            = "N/A"
    DESCRIPTION     = "Z component of unit vector aligned with electron
                    detector in ECLIPJ2000 coordinates"
  END_OBJECT      = COLUMN

  OBJECT          = COLUMN
    NAME          = "FC_X_ECLIPJ2000"
    DATA_TYPE    = ASCII_REAL
    START_BYTE    = 166
    BYTES         = 6
    FORMAT        = "F6.3"
    UNIT          = "N/A"
    DESCRIPTION   = "X component of unit vector aligned with Faraday cup
                    in ECLIPJ2000 coordinates"
  END_OBJECT      = COLUMN

  OBJECT          = COLUMN
    NAME          = "FC_Y_ECLIPJ2000"
    DATA_TYPE    = ASCII_REAL
    START_BYTE    = 173
    BYTES         = 6
    FORMAT        = "F6.3"
    UNIT          = "N/A"
    DESCRIPTION   = "Y component of unit vector aligned with Faraday cup
                    in ECLIPJ2000 coordinates"
  END_OBJECT      = COLUMN

  OBJECT          = COLUMN
    NAME          = "FC_Z_ECLIPJ2000"
    DATA_TYPE    = ASCII_REAL
    START_BYTE    = 180
    BYTES         = 6
    FORMAT        = "F6.3"
    UNIT          = "N/A"
    DESCRIPTION   = "Z component of unit vector aligned with Faraday cup
                    in ECLIPJ2000 coordinates"
  END_OBJECT      = COLUMN

/* ***** */
/* Add index and type columns */
/* Index column : measurement number */
/* Type column : measurement type (I1CRT or I2CRT) */
/* ***** */
  OBJECT          = COLUMN
    NAME          = "INDEX"
    DATA_TYPE    = INTEGER
    START_BYTE    = 187
    BYTES         = 5
    FORMAT        = "I5"
    UNIT          = "N/A"
    DESCRIPTION   = "Measurement index"
  END_OBJECT      = COLUMN

  OBJECT          = COLUMN
    NAME          = "TYPE"
    DATA_TYPE    = CHARACTER
    START_BYTE    = 194
    BYTES         = 5
    FORMAT        = "N/A"
    UNIT          = "N/A"
    DESCRIPTION   = "Measurement type (I1CRT or I2CRT)"
  END_OBJECT      = COLUMN

/* ***** */

  OBJECT          = COLUMN

```

```

NAME = "ENERGY"
DATA_TYPE = ASCII_REAL
START_BYTE = 201
BYTES = 7
FORMAT = "F7.2"
UNIT = "ELECTRONVOLT"
DESCRIPTION = "Energy step"
END_OBJECT = COLUMN

OBJECT = COLUMN
NAME = "CURRENT_ELEVATION_1"
DATA_TYPE = ASCII_REAL
START_BYTE = 209
BYTES = 6
FORMAT = "F6.3"
UNIT = "MICROAMPERE"
DESCRIPTION = "Current for elevation step 1 (-31 deg)"
END_OBJECT = COLUMN

OBJECT = COLUMN
NAME = "CURRENT_ELEVATION_2"
DATA_TYPE = ASCII_REAL
START_BYTE = 216
BYTES = 6
FORMAT = "F6.3"
UNIT = "MICROAMPERE"
DESCRIPTION = "Current for elevation step 2"
END_OBJECT = COLUMN

OBJECT = COLUMN
NAME = "CURRENT_ELEVATION_3"
DATA_TYPE = ASCII_REAL
START_BYTE = 223
BYTES = 6
FORMAT = "F6.3"
UNIT = "MICROAMPERE"
DESCRIPTION = "Current for elevation step 3"
END_OBJECT = COLUMN

OBJECT = COLUMN
NAME = "CURRENT_ELEVATION_4"
DATA_TYPE = ASCII_REAL
START_BYTE = 230
BYTES = 6
FORMAT = "F6.3"
UNIT = "MICROAMPERE"
DESCRIPTION = "Current for elevation step 4"
END_OBJECT = COLUMN

OBJECT = COLUMN
NAME = "CURRENT_ELEVATION_5"
DATA_TYPE = ASCII_REAL
START_BYTE = 237
BYTES = 6
FORMAT = "F6.3"
UNIT = "MICROAMPERE"
DESCRIPTION = "Current for elevation step 5"
END_OBJECT = COLUMN

OBJECT = COLUMN
NAME = "CURRENT_ELEVATION_6"
DATA_TYPE = ASCII_REAL
START_BYTE = 244
BYTES = 6
FORMAT = "F6.3"
UNIT = "MICROAMPERE"

```

DESCRIPTION = "Current for elevation step 6 "
 END_OBJECT = COLUMN

OBJECT = COLUMN
 NAME = "CURRENT_ELEVATION_7"
 DATA_TYPE = ASCII_REAL
 START_BYTE = 251
 BYTES = 6
 FORMAT = "F6.3"
 UNIT = "MICROAMPERE"
 DESCRIPTION = "Current for elevation step 7 "
 END_OBJECT = COLUMN

OBJECT = COLUMN
 NAME = "CURRENT_ELEVATION_8"
 DATA_TYPE = ASCII_REAL
 START_BYTE = 258
 BYTES = 6
 FORMAT = "F6.3"
 UNIT = "MICROAMPERE"
 DESCRIPTION = "Current for elevation step 8 "
 END_OBJECT = COLUMN

OBJECT = COLUMN
 NAME = "CURRENT_ELEVATION_9"
 DATA_TYPE = ASCII_REAL
 START_BYTE = 265
 BYTES = 6
 FORMAT = "F6.3"
 UNIT = "MICROAMPERE"
 DESCRIPTION = "Current for elevation step 9 "
 END_OBJECT = COLUMN

OBJECT = COLUMN
 NAME = "CURRENT_ELEVATION_10"
 DATA_TYPE = ASCII_REAL
 START_BYTE = 272
 BYTES = 6
 FORMAT = "F6.3"
 UNIT = "MICROAMPERE"
 DESCRIPTION = "Current for elevation step 10 "
 END_OBJECT = COLUMN

OBJECT = COLUMN
 NAME = "CURRENT_ELEVATION_11"
 DATA_TYPE = ASCII_REAL
 START_BYTE = 279
 BYTES = 6
 FORMAT = "F6.3"
 UNIT = "MICROAMPERE"
 DESCRIPTION = "Current for elevation step 11 "
 END_OBJECT = COLUMN

OBJECT = COLUMN
 NAME = "CURRENT_ELEVATION_12"
 DATA_TYPE = ASCII_REAL
 START_BYTE = 286
 BYTES = 6
 FORMAT = "F6.3"
 UNIT = "MICROAMPERE"
 DESCRIPTION = "Current for elevation step 12 "
 END_OBJECT = COLUMN

OBJECT = COLUMN
 NAME = "CURRENT_ELEVATION_13"
 DATA_TYPE = ASCII_REAL
 START_BYTE = 293

```

    BYTES           = 6
    FORMAT          = "F6.3"
    UNIT            = "MICROAMPERE"
    DESCRIPTION     = "Current for elevation step 13 "
END_OBJECT        = COLUMN

```

```

OBJECT            = COLUMN
  NAME            = "CURRENT_ELEVATION_14"
  DATA_TYPE      = ASCII_REAL
  START_BYTE      = 300
  BYTES           = 6
  FORMAT          = "F6.3"
  UNIT            = "MICROAMPERE"
  DESCRIPTION     = "Current for elevation step 14 "
END_OBJECT        = COLUMN

```

```

OBJECT            = COLUMN
  NAME            = "CURRENT_ELEVATION_15"
  DATA_TYPE      = ASCII_REAL
  START_BYTE      = 307
  BYTES           = 6
  FORMAT          = "F6.3"
  UNIT            = "MICROAMPERE"
  DESCRIPTION     = "Current for elevation step 15 "
END_OBJECT        = COLUMN

```

```

OBJECT            = COLUMN
  NAME            = "CURRENT_ELEVATION_16"
  DATA_TYPE      = ASCII_REAL
  START_BYTE      = 314
  BYTES           = 6
  FORMAT          = "F6.3"
  UNIT            = "MICROAMPERE"
  DESCRIPTION     = "Current for elevation step 16"
END_OBJECT        = COLUMN

```

4.3.5.4.3 Ion spectrum definition (counts-energy distribution), parameter mode (channels 1 or 2)

```

OBJECT            = ROMAP_SPM_PAR_ION_CNE_TABLE
  NAME            = ROMAP_SPM_PAR_ION_CNE
  INTERCHANGE_FORMAT = ASCII
  ROWS            = 640
  ^STRUCTURE      = "ROMAP_SPM_PARC_ION_CNE.FMT"
  COLUMNS        = 26
  ROW_BYTES       = 239
END_OBJECT        = ROMAP_SPM_PAR_ION_CNE_TABLE

```

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

```

/*          Contents of format file "ROMAP_SPM_PARC_ION_CNE.FMT"          */
/*          Ion spectrum definition (Level 3)                             */
/*          (I1CNTE, I2CNTE), parameter mode (channels 1 or 2)          */
/*          */
/* ***** */
/* Include the HEADER at the beginning of each measurement             */
/* ***** */

OBJECT            = COLUMN
  NAME            = "UTC"
  DATA_TYPE      = TIME
  START_BYTE      = 1
  BYTES           = 23
  DESCRIPTION     = "This column represents the UTC
                    Of the SPM spectrum in PDS standard format
                    YYYY-MM-DDThh:mm:ss.sss"
END_OBJECT        = COLUMN

```

```

OBJECT          = COLUMN
  NAME          = "OBT"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 25
  BYTES         = 15
  UNIT          = SECOND
  FORMAT        = "F15.5"
  DESCRIPTION   = "ROMAP 4 bytes counter representing the measurement
                  time synchronized with Lander On Board Time.
                  The time resolution is 0.03125 s"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "MODE"
  DATA_TYPE    = CHARACTER
  START_BYTE    = 42
  BYTES         = 9
  FORMAT        = "N/A"
  UNIT          = "N/A"
  DESCRIPTION   = "SPM mode:
                  raw or parameter"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "EXPOSITION_TIME"
  DATA_TYPE    = CHARACTER
  START_BYTE    = 54
  BYTES         = 5
  FORMAT        = "N/A"
  UNIT          = "N/A"
  DESCRIPTION   = "SPM exposition time setting:
                  short or long"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "CALIBRATION"
  DATA_TYPE    = CHARACTER
  START_BYTE    = 62
  BYTES         = 8
  FORMAT        = "N/A"
  UNIT          = "N/A"
  DESCRIPTION   = "SPM calibration status:
                  active or inactive"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "CEM_SUPPLY"
  DATA_TYPE    = ASCII_INTEGER
  START_BYTE    = 72
  BYTES         = 1
  FORMAT        = "I1"
  UNIT          = "N/A"
  DESCRIPTION   = "SPM CEM supply setting:
                  step number from 1 to 5"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "RESOLUTION"
  DATA_TYPE    = CHARACTER
  START_BYTE    = 75
  BYTES         = 4
  FORMAT        = "N/A"
  UNIT          = "N/A"
  DESCRIPTION   = "SPM resolution setting:
                  low or high"
END_OBJECT      = COLUMN
  
```

```

OBJECT          = COLUMN
  NAME          = "ION_CHANNEL"
  DATA_TYPE    = CHARACTER
  START_BYTE    = 82
  BYTES         = 8
  FORMAT        = "N/A"
  UNIT          = "N/A"
  DESCRIPTION   = "Ion channel status:
                  Both_off
                  Ion1
                  Ion2
                  Both_on"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
  NAME          = "EVEN_ODD"
  DATA_TYPE    = CHARACTER
  START_BYTE    = 93
  BYTES         = 8
  FORMAT        = "N/A"
  UNIT          = "N/A"
  DESCRIPTION   = "Indicates whether all energies
                  are transmitted (64 for full resolution and
                  32 for low resolution) or even/odd energies
                  alternatively. Takes the values:
                  even_odd or full"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
  NAME          = "I1_X_ECLIPJ2000"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 103
  BYTES         = 6
  FORMAT        = "F6.3"
  UNIT          = "N/A"
  DESCRIPTION   = "X component of unit vector aligned with Ion 1 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
  NAME          = "I1_Y_ECLIPJ2000"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 110
  BYTES         = 6
  FORMAT        = "F6.3"
  UNIT          = "N/A"
  DESCRIPTION   = "Y component of unit vector aligned with Ion 1 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
  NAME          = "I1_Z_ECLIPJ2000"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 117
  BYTES         = 6
  FORMAT        = "F6.3"
  UNIT          = "N/A"
  DESCRIPTION   = "Z component of unit vector aligned with Ion 1 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
  NAME          = "I2_X_ECLIPJ2000"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 124
  BYTES         = 6
  
```

```

FORMAT          = "F6.3"
UNIT            = "N/A"
DESCRIPTION     = "X component of unit vector aligned with Ion 2 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
NAME           = "I2_Y_ECLIPJ2000"
DATA_TYPE     = ASCII_REAL
START_BYTE    = 131
BYTES         = 6
FORMAT       = "F6.3"
UNIT        = "N/A"
DESCRIPTION = "Y component of unit vector aligned with Ion 2 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT  = COLUMN

OBJECT          = COLUMN
NAME           = "I2_Z_ECLIPJ2000"
DATA_TYPE     = ASCII_REAL
START_BYTE    = 138
BYTES         = 6
FORMAT       = "F6.3"
UNIT        = "N/A"
DESCRIPTION = "Z component of unit vector aligned with Ion 2 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT  = COLUMN

OBJECT          = COLUMN
NAME           = "EL_X_ECLIPJ2000"
DATA_TYPE     = ASCII_REAL
START_BYTE    = 145
BYTES         = 6
FORMAT       = "F6.3"
UNIT        = "N/A"
DESCRIPTION = "X component of unit vector aligned with electron
                  detector in ECLIPJ2000 coordinates"
END_OBJECT  = COLUMN

OBJECT          = COLUMN
NAME           = "EL_Y_ECLIPJ2000"
DATA_TYPE     = ASCII_REAL
START_BYTE    = 152
BYTES         = 6
FORMAT       = "F6.3"
UNIT        = "N/A"
DESCRIPTION = "Y component of unit vector aligned with electron
                  detector in ECLIPJ2000 coordinates"
END_OBJECT  = COLUMN

OBJECT          = COLUMN
NAME           = "EL_Z_ECLIPJ2000"
DATA_TYPE     = ASCII_REAL
START_BYTE    = 159
BYTES         = 6
FORMAT       = "F6.3"
UNIT        = "N/A"
DESCRIPTION = "Z component of unit vector aligned with electron
                  detector in ECLIPJ2000 coordinates"
END_OBJECT  = COLUMN

OBJECT          = COLUMN
NAME           = "FC_X_ECLIPJ2000"
DATA_TYPE     = ASCII_REAL
START_BYTE    = 166
BYTES         = 6
FORMAT       = "F6.3"

```

```

UNIT = "N/A"
DESCRIPTION = "X component of unit vector aligned with Faraday cup
              in ECLIPJ2000 coordinates"
END_OBJECT = COLUMN

OBJECT = COLUMN
NAME = "FC_Y_ECLIPJ2000"
DATA_TYPE = ASCII_REAL
START_BYTE = 173
BYTES = 6
FORMAT = "F6.3"
UNIT = "N/A"
DESCRIPTION = "Y component of unit vector aligned with Faraday cup
              in ECLIPJ2000 coordinates"
END_OBJECT = COLUMN

OBJECT = COLUMN
NAME = "FC_Z_ECLIPJ2000"
DATA_TYPE = ASCII_REAL
START_BYTE = 180
BYTES = 6
FORMAT = "F6.3"
UNIT = "N/A"
DESCRIPTION = "Z component of unit vector aligned with Faraday cup
              in ECLIPJ2000 coordinates"
END_OBJECT = COLUMN

/* ***** */
/* Add index and type columns */
/* Index column : measurement number */
/* Type column : measurement type (I1CNTE, I2CNTE) */
/* ***** */

OBJECT = COLUMN
NAME = "INDEX"
DATA_TYPE = INTEGER
START_BYTE = 187
BYTES = 5
FORMAT = "I5"
UNIT = "N/A"
DESCRIPTION = "Measurement index"
END_OBJECT = COLUMN

OBJECT = COLUMN
NAME = "TYPE"
DATA_TYPE = CHARACTER
START_BYTE = 194
BYTES = 6
FORMAT = "N/A"
UNIT = "N/A"
DESCRIPTION = "Measurement type (I1CNTE, I2CNTE)"
END_OBJECT = COLUMN

/* ***** */

OBJECT = COLUMN
NAME = "ENERGY"
DATA_TYPE = ASCII_REAL
START_BYTE = 202
BYTES = 7
FORMAT = "F7.2"
UNIT = "ELECTRONVOLT"
DESCRIPTION = "Energy step"
END_OBJECT = COLUMN

OBJECT = COLUMN
NAME = "COUNTS"

```

```

DATA_TYPE      = ASCII_REAL
START_BYTE     = 210
BYTES          = 10
FORMAT         = "F10.2"
UNIT           = "CM**-2*S**-1"
DESCRIPTION    = "Sum of counts for elevation steps 1 to 16"
END_OBJECT     = COLUMN

OBJECT         = COLUMN
NAME           = "OVERFLOW FLAG"
DATA_TYPE     = CHARACTER
START_BYTE    = 222
BYTES         = 16
FORMAT        = "N/A"
UNIT          = "N/A"
DESCRIPTION   = "String of 16 characters ; each character corresponds
                to an elevation step and may take one of the following
                values :
                0 : No overflow
                1 : Overflow"
END_OBJECT     = COLUMN

```

4.3.5.4.4 Ion spectrum definition (current-energy distribution), parameter mode (channels 1 or 2)

```

OBJECT         = ROMAP_SPM_PAR_ION_CRE_TABLE
NAME           = ROMAP_SPM_PAR_ION_CRE
INTERCHANGE_FORMAT = ASCII
ROWS           = 640
^STRUCTURE     = "ROMAP_SPM_PARC_ION_CRE.FMT"
COLUMNS       = 26
ROW_BYTES      = 235
END_OBJECT     = ROMAP_SPM_PAR_ION_CRE_TABLE

```

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

```

/*          Contents of format file "ROMAP_SPM_PARC_ION_CRE.FMT"          */
/*          Ion spectrum definition (Level 3)                             */
/*          (I1CRTE, I2CRTE), parameter mode (channels 1 or 2)           */
/*          ********************************************************** */
/* Include the HEADER at the beginning of each measurement              */
/*          ********************************************************** */

OBJECT         = COLUMN
NAME           = "UTC"
DATA_TYPE     = TIME
START_BYTE    = 1
BYTES         = 23
DESCRIPTION   = "This column represents the UTC
                Of the SPM spectrum in PDS standard format
                YYYY-MM-DDThh:mm:ss.sss"
END_OBJECT     = COLUMN

OBJECT         = COLUMN
NAME           = "OBT"
DATA_TYPE     = ASCII_REAL
START_BYTE    = 25
BYTES         = 15
UNIT          = SECOND
FORMAT        = "F15.5"
DESCRIPTION   = "ROMAP 4 bytes counter representing the measurement
                time synchronized with Lander On Board Time.
                The time resolution is 0.03125 s"
END_OBJECT     = COLUMN

OBJECT         = COLUMN

```

```

NAME                = "MODE"
DATA_TYPE           = CHARACTER
START_BYTE          = 42
BYTES               = 9
FORMAT              = "N/A"
UNIT                = "N/A"
DESCRIPTION         = "SPM mode:
                    raw or parameter"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = "EXPOSITION_TIME"
DATA_TYPE           = CHARACTER
START_BYTE          = 54
BYTES               = 5
FORMAT              = "N/A"
UNIT                = "N/A"
DESCRIPTION         = "SPM exposition time setting:
                    short or long"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = "CALIBRATION"
DATA_TYPE           = CHARACTER
START_BYTE          = 62
BYTES               = 8
FORMAT              = "N/A"
UNIT                = "N/A"
DESCRIPTION         = "SPM calibration status:
                    active or inactive"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = "CEM_SUPPLY"
DATA_TYPE           = ASCII_INTEGER
START_BYTE          = 72
BYTES               = 1
FORMAT              = "I1"
UNIT                = "N/A"
DESCRIPTION         = "SPM CEM supply setting:
                    step number from 1 to 5"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = "RESOLUTION"
DATA_TYPE           = CHARACTER
START_BYTE          = 75
BYTES               = 4
FORMAT              = "N/A"
UNIT                = "N/A"
DESCRIPTION         = "SPM resolution setting:
                    low or high"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = "ION_CHANNEL"
DATA_TYPE           = CHARACTER
START_BYTE          = 82
BYTES               = 8
FORMAT              = "N/A"
UNIT                = "N/A"
DESCRIPTION         = "Ion channel status:
                    Both_off
                    Ion1
                    Ion2
                    Both_on"
END_OBJECT          = COLUMN

```

```

OBJECT          = COLUMN
  NAME          = "EVEN_ODD"
  DATA_TYPE    = CHARACTER
  START_BYTE    = 93
  BYTES         = 8
  FORMAT        = "N/A"
  UNIT          = "N/A"
  DESCRIPTION   = "Indicates whether all energies
                  are transmitted (64 for full resolution and
                  32 for low resolution) or even/odd energies
                  alternatively. Takes the values:
                  even_odd or full"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "I1_X_ECLIPJ2000"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 103
  BYTES         = 6
  FORMAT        = "F6.3"
  UNIT          = "N/A"
  DESCRIPTION   = "X component of unit vector aligned with Ion 1 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "I1_Y_ECLIPJ2000"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 110
  BYTES         = 6
  FORMAT        = "F6.3"
  UNIT          = "N/A"
  DESCRIPTION   = "Y component of unit vector aligned with Ion 1 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "I1_Z_ECLIPJ2000"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 117
  BYTES         = 6
  FORMAT        = "F6.3"
  UNIT          = "N/A"
  DESCRIPTION   = "Z component of unit vector aligned with Ion 1 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "I2_X_ECLIPJ2000"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 124
  BYTES         = 6
  FORMAT        = "F6.3"
  UNIT          = "N/A"
  DESCRIPTION   = "X component of unit vector aligned with Ion 2 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "I2_Y_ECLIPJ2000"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 131
  BYTES         = 6
  FORMAT        = "F6.3"
  UNIT          = "N/A"
  DESCRIPTION   = "Y component of unit vector aligned with Ion 2 detector
                  in ECLIPJ2000 coordinates"

```

```

END_OBJECT          = COLUMN

OBJECT              = COLUMN
  NAME               = "I2_Z_ECLIPJ2000"
  DATA_TYPE         = ASCII_REAL
  START_BYTE         = 138
  BYTES              = 6
  FORMAT             = "F6.3"
  UNIT               = "N/A"
  DESCRIPTION        = "Z component of unit vector aligned with Ion 2 detector
                      in ECLIPJ2000 coordinates"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
  NAME               = "EL_X_ECLIPJ2000"
  DATA_TYPE         = ASCII_REAL
  START_BYTE         = 145
  BYTES              = 6
  FORMAT             = "F6.3"
  UNIT               = "N/A"
  DESCRIPTION        = "X component of unit vector aligned with electron
                      detector in ECLIPJ2000 coordinates"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
  NAME               = "EL_Y_ECLIPJ2000"
  DATA_TYPE         = ASCII_REAL
  START_BYTE         = 152
  BYTES              = 6
  FORMAT             = "F6.3"
  UNIT               = "N/A"
  DESCRIPTION        = "Y component of unit vector aligned with electron
                      detector in ECLIPJ2000 coordinates"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
  NAME               = "EL_Z_ECLIPJ2000"
  DATA_TYPE         = ASCII_REAL
  START_BYTE         = 159
  BYTES              = 6
  FORMAT             = "F6.3"
  UNIT               = "N/A"
  DESCRIPTION        = "Z component of unit vector aligned with electron
                      detector in ECLIPJ2000 coordinates"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
  NAME               = "FC_X_ECLIPJ2000"
  DATA_TYPE         = ASCII_REAL
  START_BYTE         = 166
  BYTES              = 6
  FORMAT             = "F6.3"
  UNIT               = "N/A"
  DESCRIPTION        = "X component of unit vector aligned with Faraday cup
                      in ECLIPJ2000 coordinates"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
  NAME               = "FC_Y_ECLIPJ2000"
  DATA_TYPE         = ASCII_REAL
  START_BYTE         = 173
  BYTES              = 6
  FORMAT             = "F6.3"
  UNIT               = "N/A"
  DESCRIPTION        = "Y component of unit vector aligned with Faraday cup
                      in ECLIPJ2000 coordinates"
END_OBJECT          = COLUMN
  
```

```

OBJECT          = COLUMN
  NAME          = "FC_Z_ECLIPJ2000"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 180
  BYTES         = 6
  FORMAT        = "F6.3"
  UNIT          = "N/A"
  DESCRIPTION   = "Z component of unit vector aligned with Faraday cup
                  in ECLIPJ2000 coordinates"
END_OBJECT      = COLUMN
  
```

```

/* ***** */
/* Add index and type columns */
/*   Index column : measurement number */
/*   Type column : measurement type (I1CRTE, I2CRTE) */
/* ***** */
  
```

```

OBJECT          = COLUMN
  NAME          = "INDEX"
  DATA_TYPE    = INTEGER
  START_BYTE    = 187
  BYTES         = 5
  FORMAT        = "I5"
  UNIT          = "N/A"
  DESCRIPTION   = "Measurement index"
END_OBJECT      = COLUMN
  
```

```

OBJECT          = COLUMN
  NAME          = "TYPE"
  DATA_TYPE    = CHARACTER
  START_BYTE    = 194
  BYTES         = 6
  FORMAT        = "N/A"
  UNIT          = "N/A"
  DESCRIPTION   = "Measurement type (I1CRTE, I2CRTE)"
END_OBJECT      = COLUMN
  
```

```

/* ***** */
  
```

```

OBJECT          = COLUMN
  NAME          = "ENERGY"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 202
  BYTES         = 7
  FORMAT        = "F7.2"
  UNIT          = "ELECTRONVOLT"
  DESCRIPTION   = "Energy bin number"
END_OBJECT      = COLUMN
  
```

```

OBJECT          = COLUMN
  NAME          = "CURRENT"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 210
  BYTES         = 6
  FORMAT        = "F6.3"
  UNIT          = "MICROAMPERE"
  DESCRIPTION   = "Sum of currents for elevation steps 1 to 16"
END_OBJECT      = COLUMN
  
```

```

OBJECT          = COLUMN
  NAME          = "OVERFLOW FLAG"
  DATA_TYPE    = CHARACTER
  START_BYTE    = 218
  BYTES         = 16
  FORMAT        = "N/A"
  UNIT          = "N/A"
  
```

DESCRIPTION = "String of 16 characters ; each character corresponds to an elevation step and may take one of the following values :

0 : No overflow
1 : Overflow"

END_OBJECT = COLUMN

4.3.5.4.5 Ion spectrum definition (counts-angle distribution), parameter mode (channels 1 or 2)

OBJECT = ROMAP_SPM_PAR_ION_CNA_TABLE
NAME = ROMAP_SPM_PAR_ION_CNA
INTERCHANGE_FORMAT = ASCII
ROWS = 320
^STRUCTURE = "ROMAP_SPM_PARC_ION_CNA.FMT"
COLUMNS = 26
ROW_BYTES = 287
END_OBJECT = ROMAP_SPM_PAR_ION_CNA_TABLE

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

```
/*          Contents of format file "ROMAP_SPM_PARC_ION_CNA.FMT"          */
/*          Ion spectrum definition (Level 3)                             */
/*          (I1CNTA, I2CNTA), parameter mode (channels 1 or 2)           */
/*          */
/* ***** */
/* Include the HEADER at the beginning of each measurement             */
/* ***** */
```

OBJECT = COLUMN
NAME = "UTC"
DATA_TYPE = TIME
START_BYTE = 1
BYTES = 23
DESCRIPTION = "This column represents the UTC
Of the SPM spectrum in PDS standard format
YYYY-MM-DDThh:mm:ss.sss"
END_OBJECT = COLUMN

OBJECT = COLUMN
NAME = "OBT"
DATA_TYPE = ASCII_REAL
START_BYTE = 25
BYTES = 15
UNIT = SECOND
FORMAT = "F15.5"
DESCRIPTION = "ROMAP 4 bytes counter representing the measurement
time synchronized with Lander On Board Time.
The time resolution is 0.03125 s"
END_OBJECT = COLUMN

OBJECT = COLUMN
NAME = "MODE"
DATA_TYPE = CHARACTER
START_BYTE = 42
BYTES = 9
FORMAT = "N/A"
UNIT = "N/A"
DESCRIPTION = "SPM mode:
raw or parameter"
END_OBJECT = COLUMN

OBJECT = COLUMN
NAME = "EXPOSITION_TIME"
DATA_TYPE = CHARACTER
START_BYTE = 54
BYTES = 5

```

FORMAT          = "N/A"
UNIT            = "N/A"
DESCRIPTION     = "SPM exposition time setting:
                  short or long"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME           = "CALIBRATION"
DATA_TYPE      = CHARACTER
START_BYTE     = 62
BYTES          = 8
FORMAT         = "N/A"
UNIT           = "N/A"
DESCRIPTION    = "SPM calibration status:
                  active or inactive"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME           = "CEM_SUPPLY"
DATA_TYPE      = ASCII_INTEGER
START_BYTE     = 72
BYTES          = 1
FORMAT         = "I1"
UNIT           = "N/A"
DESCRIPTION    = "SPM CEM supply setting:
                  step number from 1 to 5"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME           = "RESOLUTION"
DATA_TYPE      = CHARACTER
START_BYTE     = 75
BYTES          = 4
FORMAT         = "N/A"
UNIT           = "N/A"
DESCRIPTION    = "SPM resolution setting:
                  low or high"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME           = "ION_CHANNEL"
DATA_TYPE      = CHARACTER
START_BYTE     = 82
BYTES          = 8
FORMAT         = "N/A"
UNIT           = "N/A"
DESCRIPTION    = "Ion channel status:
                  Both_off
                  Ion1
                  Ion2
                  Both_on"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME           = "EVEN_ODD"
DATA_TYPE      = CHARACTER
START_BYTE     = 93
BYTES          = 8
FORMAT         = "N/A"
UNIT           = "N/A"
DESCRIPTION    = "Indicates whether all energies
                  are transmitted (64 for full resolution and
                  32 for low resolution) or even/odd energies
                  alternatively. Takes the values:
                  even_odd or full"
END_OBJECT      = COLUMN

```

```

OBJECT          = COLUMN
  NAME          = "I1_X_ECLIPJ2000"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 103
  BYTES         = 6
  FORMAT        = "F6.3"
  UNIT          = "N/A"
  DESCRIPTION   = "X component of unit vector aligned with Ion 1 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "I1_Y_ECLIPJ2000"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 110
  BYTES         = 6
  FORMAT        = "F6.3"
  UNIT          = "N/A"
  DESCRIPTION   = "Y component of unit vector aligned with Ion 1 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "I1_Z_ECLIPJ2000"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 117
  BYTES         = 6
  FORMAT        = "F6.3"
  UNIT          = "N/A"
  DESCRIPTION   = "Z component of unit vector aligned with Ion 1 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "I2_X_ECLIPJ2000"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 124
  BYTES         = 6
  FORMAT        = "F6.3"
  UNIT          = "N/A"
  DESCRIPTION   = "X component of unit vector aligned with Ion 2 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "I2_Y_ECLIPJ2000"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 131
  BYTES         = 6
  FORMAT        = "F6.3"
  UNIT          = "N/A"
  DESCRIPTION   = "Y component of unit vector aligned with Ion 2 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "I2_Z_ECLIPJ2000"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 138
  BYTES         = 6
  FORMAT        = "F6.3"
  UNIT          = "N/A"
  DESCRIPTION   = "Z component of unit vector aligned with Ion 2 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  
```

```

NAME                = "EL_X_ECLIPJ2000"
DATA_TYPE           = ASCII_REAL
START_BYTE          = 145
BYTES               = 6
FORMAT              = "F6.3"
UNIT                = "N/A"
DESCRIPTION         = "X component of unit vector aligned with electron
                      detector in ECLIPJ2000 coordinates"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = "EL_Y_ECLIPJ2000"
DATA_TYPE           = ASCII_REAL
START_BYTE          = 152
BYTES               = 6
FORMAT              = "F6.3"
UNIT                = "N/A"
DESCRIPTION         = "Y component of unit vector aligned with electron
                      detector in ECLIPJ2000 coordinates"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = "EL_Z_ECLIPJ2000"
DATA_TYPE           = ASCII_REAL
START_BYTE          = 159
BYTES               = 6
FORMAT              = "F6.3"
UNIT                = "N/A"
DESCRIPTION         = "Z component of unit vector aligned with electron
                      detector in ECLIPJ2000 coordinates"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = "FC_X_ECLIPJ2000"
DATA_TYPE           = ASCII_REAL
START_BYTE          = 166
BYTES               = 6
FORMAT              = "F6.3"
UNIT                = "N/A"
DESCRIPTION         = "X component of unit vector aligned with Faraday cup
                      in ECLIPJ2000 coordinates"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = "FC_Y_ECLIPJ2000"
DATA_TYPE           = ASCII_REAL
START_BYTE          = 173
BYTES               = 6
FORMAT              = "F6.3"
UNIT                = "N/A"
DESCRIPTION         = "Y component of unit vector aligned with Faraday cup
                      in ECLIPJ2000 coordinates"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
NAME                = "FC_Z_ECLIPJ2000"
DATA_TYPE           = ASCII_REAL
START_BYTE          = 180
BYTES               = 6
FORMAT              = "F6.3"
UNIT                = "N/A"
DESCRIPTION         = "Z component of unit vector aligned with Faraday cup
                      in ECLIPJ2000 coordinates"
END_OBJECT          = COLUMN

/* ***** */
/* Add index and type columns */

```

```

/*      Index column : measurement number      */
/*      Type column : measurement type (I1CNTA or I2CNTA)      */
/*      *****      */

```

```

OBJECT      = COLUMN
  NAME      = "INDEX"
  DATA_TYPE = INTEGER
  START_BYTE = 187
  BYTES     = 5
  FORMAT    = "I5"
  UNIT      = "N/A"
  DESCRIPTION = "Measurement index"
END_OBJECT  = COLUMN

```

```

OBJECT      = COLUMN
  NAME      = "TYPE"
  DATA_TYPE = CHARACTER
  START_BYTE = 194
  BYTES     = 6
  FORMAT    = "N/A"
  UNIT      = "N/A"
  DESCRIPTION = "Measurement type (I1CNTA or I2CNTA)"
END_OBJECT  = COLUMN

```

```

/*      *****      */

```

```

OBJECT      = COLUMN
  NAME      = "ANGLE "
  DATA_TYPE = ASCII_REAL
  START_BYTE = 202
  BYTES     = 7
  FORMAT    = "F7.2"
  UNIT      = "DEGREE"
  DESCRIPTION = "Elevation step"
END_OBJECT  = COLUMN

```

```

OBJECT      = COLUMN
  NAME      = "COUNTS"
  DATA_TYPE = ASCII_REAL
  START_BYTE = 210
  BYTES     = 10
  FORMAT    = "F10.2"
  UNIT      = "CM**-2*S**-1"
  DESCRIPTION = "Sum of counts for energy steps 0 to 31
                Or 0 to 63"
END_OBJECT  = COLUMN

```

```

OBJECT      = COLUMN
  NAME      = "OVERFLOW FLAG"
  DATA_TYPE = CHARACTER
  START_BYTE = 222
  BYTES     = 64
  FORMAT    = "N/A"
  UNIT      = "N/A"
  DESCRIPTION = "String of 64 characters ; each character corresponds
                to a step of energy and may take one of the following
                values :
                    0 : No overflow
                    1 : Overflow
                In low resolution the 32 last characters are unused
                and set to blank "
END_OBJECT  = COLUMN

```

4.3.5.4.6 Ion spectrum definition (current-angle), parameter mode (channels 1 or 2)

```

OBJECT      = ROMAP_SPM_PAR_ION_CRA_TABLE
  NAME      = ROMAP_SPM_PAR_ION_CRA
  INTERCHANGE_FORMAT = ASCII

```

```

ROWS = 320
^STRUCTURE = "ROMAP_SPM_PARC_ION_CRA.FMT"
COLUMNS = 26
ROW_BYTES = 283
END_OBJECT = ROMAP_SPM_PAR_ION_CRA_TABLE

```

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

```

/* Contents of format file "ROMAP_SPM_PARC_ION_CRA.FMT" */
/* Ion spectrum definition (Level 3) */
/* (I1CRTA, I2CRTA), parameter mode (channels 1 or 2) */

```

```

/* ***** */
/* Include the HEADER at the beginning of each measurement */
/* ***** */

```

```

OBJECT = COLUMN
NAME = "UTC"
DATA_TYPE = TIME
START_BYTE = 1
BYTES = 23
DESCRIPTION = "This column represents the UTC
Of the SPM spectrum in PDS standard format
YYYY-MM-DDThh:mm:ss.sss"
END_OBJECT = COLUMN

```

```

OBJECT = COLUMN
NAME = "OBT"
DATA_TYPE = ASCII_REAL
START_BYTE = 25
BYTES = 15
UNIT = SECOND
FORMAT = "F15.5"
DESCRIPTION = "ROMAP 4 bytes counter representing the measurement
time synchronized with Lander On Board Time.
The time resolution is 0.03125 s"
END_OBJECT = COLUMN

```

```

OBJECT = COLUMN
NAME = "MODE"
DATA_TYPE = CHARACTER
START_BYTE = 42
BYTES = 9
FORMAT = "N/A"
UNIT = "N/A"
DESCRIPTION = "SPM mode:
raw or parameter"
END_OBJECT = COLUMN

```

```

OBJECT = COLUMN
NAME = "EXPOSITION_TIME"
DATA_TYPE = CHARACTER
START_BYTE = 54
BYTES = 5
FORMAT = "N/A"
UNIT = "N/A"
DESCRIPTION = "SPM exposition time setting:
short or long"
END_OBJECT = COLUMN

```

```

OBJECT = COLUMN
NAME = "CALIBRATION"
DATA_TYPE = CHARACTER
START_BYTE = 62
BYTES = 8
FORMAT = "N/A"
UNIT = "N/A"

```

```

DESCRIPTION      = "SPM calibration status:
                   active or inactive"
END_OBJECT       = COLUMN

OBJECT           = COLUMN
  NAME           = "CEM_SUPPLY"
  DATA_TYPE     = ASCII_INTEGER
  START_BYTE     = 72
  BYTES         = 1
  FORMAT         = "I1"
  UNIT           = "N/A"
  DESCRIPTION    = "SPM CEM supply setting:
                   step number from 1 to 5"
END_OBJECT       = COLUMN

OBJECT           = COLUMN
  NAME           = "RESOLUTION"
  DATA_TYPE     = CHARACTER
  START_BYTE     = 75
  BYTES         = 4
  FORMAT         = "N/A"
  UNIT           = "N/A"
  DESCRIPTION    = "SPM resolution setting:
                   low or high"
END_OBJECT       = COLUMN

OBJECT           = COLUMN
  NAME           = "ION_CHANNEL"
  DATA_TYPE     = CHARACTER
  START_BYTE     = 82
  BYTES         = 8
  FORMAT         = "N/A"
  UNIT           = "N/A"
  DESCRIPTION    = "Ion channel status:
                   Both_off
                   Ion1
                   Ion2
                   Both_on"
END_OBJECT       = COLUMN

OBJECT           = COLUMN
  NAME           = "EVEN_ODD"
  DATA_TYPE     = CHARACTER
  START_BYTE     = 93
  BYTES         = 8
  FORMAT         = "N/A"
  UNIT           = "N/A"
  DESCRIPTION    = "Indicates whether all energies
                   are transmitted (64 for full resolution and
                   32 for low resolution) or even/odd energies
                   alternatively. Takes the values:
                   even_odd or full"
END_OBJECT       = COLUMN

OBJECT           = COLUMN
  NAME           = "I1_X_ECLIPJ2000"
  DATA_TYPE     = ASCII_REAL
  START_BYTE     = 103
  BYTES         = 6
  FORMAT         = "F6.3"
  UNIT           = "N/A"
  DESCRIPTION    = "X component of unit vector aligned with Ion 1 detector
                   in ECLIPJ2000 coordinates"
END_OBJECT       = COLUMN

OBJECT           = COLUMN
  NAME           = "I1_Y_ECLIPJ2000"

```

```

DATA_TYPE      = ASCII_REAL
START_BYTE     = 110
BYTES          = 6
FORMAT         = "F6.3"
UNIT           = "N/A"
DESCRIPTION    = "Y component of unit vector aligned with Ion 1 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT     = COLUMN

OBJECT         = COLUMN
NAME           = "I1_Z_ECLIPJ2000"
DATA_TYPE     = ASCII_REAL
START_BYTE    = 117
BYTES         = 6
FORMAT        = "F6.3"
UNIT          = "N/A"
DESCRIPTION   = "Z component of unit vector aligned with Ion 1 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT    = COLUMN

OBJECT         = COLUMN
NAME           = "I2_X_ECLIPJ2000"
DATA_TYPE     = ASCII_REAL
START_BYTE    = 124
BYTES         = 6
FORMAT        = "F6.3"
UNIT          = "N/A"
DESCRIPTION   = "X component of unit vector aligned with Ion 2 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT    = COLUMN

OBJECT         = COLUMN
NAME           = "I2_Y_ECLIPJ2000"
DATA_TYPE     = ASCII_REAL
START_BYTE    = 131
BYTES         = 6
FORMAT        = "F6.3"
UNIT          = "N/A"
DESCRIPTION   = "Y component of unit vector aligned with Ion 2 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT    = COLUMN

OBJECT         = COLUMN
NAME           = "I2_Z_ECLIPJ2000"
DATA_TYPE     = ASCII_REAL
START_BYTE    = 138
BYTES         = 6
FORMAT        = "F6.3"
UNIT          = "N/A"
DESCRIPTION   = "Z component of unit vector aligned with Ion 2 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT    = COLUMN

OBJECT         = COLUMN
NAME           = "EL_X_ECLIPJ2000"
DATA_TYPE     = ASCII_REAL
START_BYTE    = 145
BYTES         = 6
FORMAT        = "F6.3"
UNIT          = "N/A"
DESCRIPTION   = "X component of unit vector aligned with electron
                  detector in ECLIPJ2000 coordinates"
END_OBJECT    = COLUMN

OBJECT         = COLUMN
NAME           = "EL_Y_ECLIPJ2000"
DATA_TYPE     = ASCII_REAL
START_BYTE    = 152

```

```

    BYTES           = 6
    FORMAT          = "F6.3"
    UNIT            = "N/A"
    DESCRIPTION     = "Y component of unit vector aligned with electron
                      detector in ECLIPJ2000 coordinates"
END_OBJECT        = COLUMN

OBJECT            = COLUMN
  NAME             = "EL_Z_ECLIPJ2000"
  DATA_TYPE       = ASCII_REAL
  START_BYTE       = 159
  BYTES            = 6
  FORMAT           = "F6.3"
  UNIT             = "N/A"
  DESCRIPTION      = "Z component of unit vector aligned with electron
                      detector in ECLIPJ2000 coordinates"
END_OBJECT        = COLUMN

OBJECT            = COLUMN
  NAME             = "FC_X_ECLIPJ2000"
  DATA_TYPE       = ASCII_REAL
  START_BYTE       = 166
  BYTES            = 6
  FORMAT           = "F6.3"
  UNIT             = "N/A"
  DESCRIPTION      = "X component of unit vector aligned with Faraday cup
                      in ECLIPJ2000 coordinates"
END_OBJECT        = COLUMN

OBJECT            = COLUMN
  NAME             = "FC_Y_ECLIPJ2000"
  DATA_TYPE       = ASCII_REAL
  START_BYTE       = 173
  BYTES            = 6
  FORMAT           = "F6.3"
  UNIT             = "N/A"
  DESCRIPTION      = "Y component of unit vector aligned with Faraday cup
                      in ECLIPJ2000 coordinates"
END_OBJECT        = COLUMN

OBJECT            = COLUMN
  NAME             = "FC_Z_ECLIPJ2000"
  DATA_TYPE       = ASCII_REAL
  START_BYTE       = 180
  BYTES            = 6
  FORMAT           = "F6.3"
  UNIT             = "N/A"
  DESCRIPTION      = "Z component of unit vector aligned with Faraday cup
                      in ECLIPJ2000 coordinates"
END_OBJECT        = COLUMN

/* ***** */
/* Add index and type columns */
/*   Index column : measurement number */
/*   Type column  : measurement type (I1CRTA, I2CRTA) */
/* ***** */

OBJECT            = COLUMN
  NAME             = "INDEX"
  DATA_TYPE       = INTEGER
  START_BYTE       = 187
  BYTES            = 5
  FORMAT           = "I5"
  UNIT             = "N/A"
  DESCRIPTION      = "Measurement index"
END_OBJECT        = COLUMN

```

```
OBJECT          = COLUMN
  NAME          = "TYPE"
  DATA_TYPE    = CHARACTER
  START_BYTE    = 194
  BYTES         = 6
  FORMAT        = "N/A"
  UNIT          = "N/A"
  DESCRIPTION   = "Measurement type (I1CRTA, I2CRTA)"
END_OBJECT     = COLUMN
```

/* ***** */

```
OBJECT          = COLUMN
  NAME          = "ANGLE"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 202
  BYTES         = 7
  FORMAT        = "F7.2"
  UNIT          = "DEGREE"
  DESCRIPTION   = "Elevation step"
END_OBJECT     = COLUMN
```

```
OBJECT          = COLUMN
  NAME          = "CURRENT"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 210
  BYTES         = 6
  FORMAT        = "F6.3"
  UNIT          = "MICROAMPERE"
  DESCRIPTION   = "Sum of currents for energy steps 0 to 31
                  Or 0 to 63"
END_OBJECT     = COLUMN
```

```
OBJECT          = COLUMN
  NAME          = "OVERFLOW_FLAG"
  DATA_TYPE    = CHARACTER
  START_BYTE    = 218
  BYTES         = 64
  FORMAT        = "N/A"
  UNIT          = "N/A"
  DESCRIPTION   = "String of 64 characters ; each character corresponds
                  to a step of energy and may take one of the following
                  values :
                    0 : No overflow
                    1 : Overflow
                  In low resolution the 32 last characters are unused
                  and set to blank "
END_OBJECT     = COLUMN
```

4.3.5.4.7 Faraday cup current-energy distribution

FC TABLE object for PAR mode

```
OBJECT          = ROMAP_SPM_PAR_FC_TABLE
  NAME          = ROMAP_SPM_PAR_FC
  INTERCHANGE_FORMAT = ASCII
  ROWS          = 180
  COLUMNS      = 24
  ROW_BYTES     = 212
  ^STRUCTURE    = "ROMAP_SPM_FCC.FMT"
END_OBJECT     = ROMAP_SPM_PAR_FC_TABLE
```

FC TABLE object for RAW mode

```
OBJECT          = ROMAP_SPM_RAW_FC_TABLE
  NAME          = ROMAP_SPM_RAW_FC
  INTERCHANGE_FORMAT = ASCII
```

```

ROWS                = 34
COLUMNS            = 24
ROW_BYTES           = 212
^STRUCTURE          = "ROMAP_SPM_FCC.FMT"
END_OBJECT          = ROMAP_SPM_RAW_FC_TABLE

```

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

```

/*                Contents of format file  "ROMAP_SPM_FCC.FMT"                */
/*  Faraday cup current-energy distribution  (Level 3)                          */

/* ***** */
/* Include the HEADER at the beginning of each measurement                    */
/* ***** */

OBJECT            = COLUMN
  NAME            = "UTC"
  DATA_TYPE      = TIME
  START_BYTE      = 1
  BYTES           = 23
  DESCRIPTION     = "This column represents the UTC
                    Of the SPM spectrum in PDS standard format
                    YYYY-MM-DDThh:mm:ss.sss"
END_OBJECT        = COLUMN

OBJECT            = COLUMN
  NAME            = "OBT"
  DATA_TYPE      = ASCII_REAL
  START_BYTE      = 25
  BYTES           = 15
  UNIT            = SECOND
  FORMAT          = "F15.5"
  DESCRIPTION     = "ROMAP 4 bytes counter representing the measurement
                    time synchronized with Lander On Board Time.
                    The time resolution is 0.03125 s"
END_OBJECT        = COLUMN

OBJECT            = COLUMN
  NAME            = "MODE"
  DATA_TYPE      = CHARACTER
  START_BYTE      = 42
  BYTES           = 9
  FORMAT          = "N/A"
  UNIT            = "N/A"
  DESCRIPTION     = "SPM mode:
                    raw or parameter"
END_OBJECT        = COLUMN

OBJECT            = COLUMN
  NAME            = "EXPOSITION_TIME"
  DATA_TYPE      = CHARACTER
  START_BYTE      = 54
  BYTES           = 5
  FORMAT          = "N/A"
  UNIT            = "N/A"
  DESCRIPTION     = "SPM exposition time setting:
                    short or long"
END_OBJECT        = COLUMN

OBJECT            = COLUMN
  NAME            = "CALIBRATION"
  DATA_TYPE      = CHARACTER
  START_BYTE      = 62
  BYTES           = 8
  FORMAT          = "N/A"
  UNIT            = "N/A"
  DESCRIPTION     = "SPM calibration status:

```

```

      active or inactive"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "CEM_SUPPLY"
  DATA_TYPE    = ASCII_INTEGER
  START_BYTE    = 72
  BYTES         = 1
  FORMAT        = "I1"
  UNIT          = "N/A"
  DESCRIPTION   = "SPM CEM supply setting:
                  step number from 1 to 5"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "RESOLUTION"
  DATA_TYPE    = CHARACTER
  START_BYTE    = 75
  BYTES         = 4
  FORMAT        = "N/A"
  UNIT          = "N/A"
  DESCRIPTION   = "SPM resolution setting:
                  low or high"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "ION_CHANNEL"
  DATA_TYPE    = CHARACTER
  START_BYTE    = 82
  BYTES         = 8
  FORMAT        = "N/A"
  UNIT          = "N/A"
  DESCRIPTION   = "Ion channel status:
                  Both_off
                  Ion1
                  Ion2
                  Both_on"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "EVEN_ODD"
  DATA_TYPE    = CHARACTER
  START_BYTE    = 93
  BYTES         = 8
  FORMAT        = "N/A"
  UNIT          = "N/A"
  DESCRIPTION   = "Indicates whether all energies
                  are transmitted (64 for full resolution and
                  32 for low resolution) or even/odd energies
                  alternatively. Takes the values:
                  even_odd or full"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "I1_X_ECLIPJ2000"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 103
  BYTES         = 6
  FORMAT        = "F6.3"
  UNIT          = "N/A"
  DESCRIPTION   = "X component of unit vector aligned with Ion 1 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "I1_Y_ECLIPJ2000"
  DATA_TYPE    = ASCII_REAL

```

```

START_BYTE      = 110
BYTES           = 6
FORMAT          = "F6.3"
UNIT            = "N/A"
DESCRIPTION     = "Y component of unit vector aligned with Ion 1 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME            = "I1_Z_ECLIPJ2000"
DATA_TYPE       = ASCII_REAL
START_BYTE      = 117
BYTES           = 6
FORMAT          = "F6.3"
UNIT            = "N/A"
DESCRIPTION     = "Z component of unit vector aligned with Ion 1 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT      = COLUMN
OBJECT          = COLUMN
NAME            = "I2_X_ECLIPJ2000"
DATA_TYPE       = ASCII_REAL
START_BYTE      = 124
BYTES           = 6
FORMAT          = "F6.3"
UNIT            = "N/A"
DESCRIPTION     = "X component of unit vector aligned with Ion 2 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME            = "I2_Y_ECLIPJ2000"
DATA_TYPE       = ASCII_REAL
START_BYTE      = 131
BYTES           = 6
FORMAT          = "F6.3"
UNIT            = "N/A"
DESCRIPTION     = "Y component of unit vector aligned with Ion 2 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME            = "I2_Z_ECLIPJ2000"
DATA_TYPE       = ASCII_REAL
START_BYTE      = 138
BYTES           = 6
FORMAT          = "F6.3"
UNIT            = "N/A"
DESCRIPTION     = "Z component of unit vector aligned with Ion 2 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME            = "EL_X_ECLIPJ2000"
DATA_TYPE       = ASCII_REAL
START_BYTE      = 145
BYTES           = 6
FORMAT          = "F6.3"
UNIT            = "N/A"
DESCRIPTION     = "X component of unit vector aligned with electron
                  detector in ECLIPJ2000 coordinates"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME            = "EL_Y_ECLIPJ2000"
DATA_TYPE       = ASCII_REAL
START_BYTE      = 152
BYTES           = 6

```

```

    FORMAT          = "F6.3"
    UNIT            = "N/A"
    DESCRIPTION     = "Y component of unit vector aligned with electron
                    detector in ECLIPJ2000 coordinates"
END_OBJECT        = COLUMN

OBJECT            = COLUMN
  NAME            = "EL_Z_ECLIPJ2000"
  DATA_TYPE     = ASCII_REAL
  START_BYTE     = 159
  BYTES          = 6
  FORMAT         = "F6.3"
  UNIT           = "N/A"
  DESCRIPTION    = "Z component of unit vector aligned with electron
                    detector in ECLIPJ2000 coordinates"
END_OBJECT        = COLUMN

OBJECT            = COLUMN
  NAME            = "FC_X_ECLIPJ2000"
  DATA_TYPE     = ASCII_REAL
  START_BYTE     = 166
  BYTES          = 6
  FORMAT         = "F6.3"
  UNIT           = "N/A"
  DESCRIPTION    = "X component of unit vector aligned with Faraday cup
                    in ECLIPJ2000 coordinates"
END_OBJECT        = COLUMN

OBJECT            = COLUMN
  NAME            = "FC_Y_ECLIPJ2000"
  DATA_TYPE     = ASCII_REAL
  START_BYTE     = 173
  BYTES          = 6
  FORMAT         = "F6.3"
  UNIT           = "N/A"
  DESCRIPTION    = "Y component of unit vector aligned with Faraday cup
                    in ECLIPJ2000 coordinates"
END_OBJECT        = COLUMN

OBJECT            = COLUMN
  NAME            = "FC_Z_ECLIPJ2000"
  DATA_TYPE     = ASCII_REAL
  START_BYTE     = 180
  BYTES          = 6
  FORMAT         = "F6.3"
  UNIT           = "N/A"
  DESCRIPTION    = "Z component of unit vector aligned with Faraday cup
                    in ECLIPJ2000 coordinates"
END_OBJECT        = COLUMN

/* ***** */
/* Add index column */
/*      Index column : measurement number */
/* ***** */

OBJECT            = COLUMN
  NAME            = "INDEX"
  DATA_TYPE     = INTEGER
  START_BYTE     = 187
  BYTES          = 5
  FORMAT         = "I5"
  UNIT           = "N/A"
  DESCRIPTION    = "Measurement index"
END_OBJECT        = COLUMN

/* ***** */

```

```
OBJECT          = COLUMN
  NAME          = "ENERGY"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 193
  BYTES         = 7
  FORMAT        = "F7.2"
  UNIT          = "ELECTRONVOLT"
  DESCRIPTION   = "Energy step"
END_OBJECT      = COLUMN
```

```
OBJECT          = COLUMN
  NAME          = "CURRENT"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 201
  BYTES         = 10
  FORMAT        = "F10.2"
  UNIT          = "NANOAMPERE"
  DESCRIPTION   = "Faraday cup Current "
END_OBJECT      = COLUMN
```

4.3.5.4.8 Electron spectrum (count-energy distribution)

Electron spectrum TABLE object for PAR mode

```
OBJECT          = ROMAP_SPM_PAR_ELEC_TABLE
  NAME          = ROMAP_SPM_PAR_ELEC
  INTERCHANGE_FORMAT = ASCII
  ROWS          = 320
  COLUMNS      = 24
  ROW_BYTES     = 210
  ^STRUCTURE    = "ROMAP_SPM_ELECC.FMT"
END_OBJECT      = ROMAP_SPM_PAR_ELEC_TABLE
```

Electron spectrum TABLE object for RAW mode

```
OBJECT          = ROMAP_SPM_RAW_ELEC_TABLE
  NAME          = ROMAP_SPM_RAW_ELEC
  INTERCHANGE_FORMAT = ASCII
  ROWS          = 32
  COLUMNS      = 24
  ROW_BYTES     = 210
  ^STRUCTURE    = "ROMAP_SPM_ELECC.FMT"
END_OBJECT      = ROMAP_SPM_RAW_ELEC_TABLE
```

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

```
/*          Contents of format file "ROMAP_SPM_ELECC.FMT"          */
/*          Electron spectrum (count-energy distribution) (Level 3)  */

/* ***** */
/* Include the HEADER at the beginning of each measurement        */
/* ***** */
```

```
OBJECT          = COLUMN
  NAME          = "UTC"
  DATA_TYPE    = TIME
  START_BYTE    = 1
  BYTES         = 23
  DESCRIPTION   = "This column represents the UTC
                  Of the SPM spectrum in PDS standard format
                  YYYY-MM-DDThh:mm:ss.sss"
END_OBJECT      = COLUMN
```

```

OBJECT          = COLUMN
  NAME          = "OBT"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 25
  BYTES         = 15
  UNIT          = SECOND
  FORMAT        = "F15.5"
  DESCRIPTION   = "ROMAP 4 bytes counter representing the measurement
                  time synchronized with Lander On Board Time.
                  The time resolution is 0.03125 s"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
  NAME          = "MODE"
  DATA_TYPE    = CHARACTER
  START_BYTE    = 42
  BYTES         = 9
  FORMAT        = "N/A"
  UNIT          = "N/A"
  DESCRIPTION   = "SPM mode:
                  raw or parameter"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
  NAME          = "EXPOSITION_TIME"
  DATA_TYPE    = CHARACTER
  START_BYTE    = 54
  BYTES         = 5
  FORMAT        = "N/A"
  UNIT          = "N/A"
  DESCRIPTION   = "SPM exposition time setting:
                  short or long"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
  NAME          = "CALIBRATION"
  DATA_TYPE    = CHARACTER
  START_BYTE    = 62
  BYTES         = 8
  FORMAT        = "N/A"
  UNIT          = "N/A"
  DESCRIPTION   = "SPM calibration status:
                  active or inactive"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
  NAME          = "CEM_SUPPLY"
  DATA_TYPE    = ASCII_INTEGER
  START_BYTE    = 72
  BYTES         = 1
  FORMAT        = "I1"
  UNIT          = "N/A"
  DESCRIPTION   = "SPM CEM supply setting:
                  step number from 1 to 5"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
  NAME          = "RESOLUTION"
  DATA_TYPE    = CHARACTER
  START_BYTE    = 75
  BYTES         = 4
  FORMAT        = "N/A"
  UNIT          = "N/A"
  DESCRIPTION   = "SPM resolution setting:
                  low or high"
END_OBJECT     = COLUMN
  
```

```

OBJECT          = COLUMN
  NAME          = "ION_CHANNEL"
  DATA_TYPE    = CHARACTER
  START_BYTE    = 82
  BYTES         = 8
  FORMAT        = "N/A"
  UNIT          = "N/A"
  DESCRIPTION    = "Ion channel status:
                  Both_off
                  Ion1
                  Ion2
                  Both_on"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "EVEN_ODD"
  DATA_TYPE    = CHARACTER
  START_BYTE    = 93
  BYTES         = 8
  FORMAT        = "N/A"
  UNIT          = "N/A"
  DESCRIPTION    = "Indicates whether all energies
                  are transmitted (64 for full resolution and
                  32 for low resolution) or even/odd energies
                  alternatively. Takes the values:
                  even_odd or full"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "I1_X_ECLIPJ2000"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 103
  BYTES         = 6
  FORMAT        = "F6.3"
  UNIT          = "N/A"
  DESCRIPTION    = "X component of unit vector aligned with Ion 1 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "I1_Y_ECLIPJ2000"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 110
  BYTES         = 6
  FORMAT        = "F6.3"
  UNIT          = "N/A"
  DESCRIPTION    = "Y component of unit vector aligned with Ion 1 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "I1_Z_ECLIPJ2000"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 117
  BYTES         = 6
  FORMAT        = "F6.3"
  UNIT          = "N/A"
  DESCRIPTION    = "Z component of unit vector aligned with Ion 1 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "I2_X_ECLIPJ2000"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 124
  BYTES         = 6
  
```

```

FORMAT          = "F6.3"
UNIT            = "N/A"
DESCRIPTION     = "X component of unit vector aligned with Ion 2 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME           = "I2_Y_ECLIPJ2000"
DATA_TYPE      = ASCII_REAL
START_BYTE     = 131
BYTES          = 6
FORMAT         = "F6.3"
UNIT           = "N/A"
DESCRIPTION    = "Y component of unit vector aligned with Ion 2 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME           = "I2_Z_ECLIPJ2000"
DATA_TYPE      = ASCII_REAL
START_BYTE     = 138
BYTES          = 6
FORMAT         = "F6.3"
UNIT           = "N/A"
DESCRIPTION    = "Z component of unit vector aligned with Ion 2 detector
                  in ECLIPJ2000 coordinates"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME           = "EL_X_ECLIPJ2000"
DATA_TYPE      = ASCII_REAL
START_BYTE     = 145
BYTES          = 6
FORMAT         = "F6.3"
UNIT           = "N/A"
DESCRIPTION    = "X component of unit vector aligned with electron
                  detector in ECLIPJ2000 coordinates"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME           = "EL_Y_ECLIPJ2000"
DATA_TYPE      = ASCII_REAL
START_BYTE     = 152
BYTES          = 6
FORMAT         = "F6.3"
UNIT           = "N/A"

DESCRIPTION    = "Y component of unit vector aligned with electron
                  detector in ECLIPJ2000 coordinates"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME           = "EL_Z_ECLIPJ2000"
DATA_TYPE      = ASCII_REAL
START_BYTE     = 159
BYTES          = 6
FORMAT         = "F6.3"
UNIT           = "N/A"
DESCRIPTION    = "Z component of unit vector aligned with electron
                  detector in ECLIPJ2000 coordinates"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME           = "FC_X_ECLIPJ2000"
DATA_TYPE      = ASCII_REAL
START_BYTE     = 166
BYTES          = 6

```

```

    FORMAT          = "F6.3"
    UNIT            = "N/A"
    DESCRIPTION     = "X component of unit vector aligned with Faraday cup
                     in ECLIPJ2000 coordinates"
  END_OBJECT      = COLUMN

  OBJECT          = COLUMN
    NAME          = "FC_Y_ECLIPJ2000"
    DATA_TYPE    = ASCII_REAL
    START_BYTE    = 173
    BYTES         = 6
    FORMAT        = "F6.3"
    UNIT          = "N/A"
    DESCRIPTION   = "Y component of unit vector aligned with Faraday cup
                     in ECLIPJ2000 coordinates"
  END_OBJECT      = COLUMN

  OBJECT          = COLUMN
    NAME          = "FC_Z_ECLIPJ2000"
    DATA_TYPE    = ASCII_REAL
    START_BYTE    = 180
    BYTES         = 6
    FORMAT        = "F6.3"
    UNIT          = "N/A"
    DESCRIPTION   = "Z component of unit vector aligned with Faraday cup
                     in ECLIPJ2000 coordinates"
  END_OBJECT      = COLUMN

/* ***** */
/* Add index column */
/* Index column : measurement number */
/* ***** */

  OBJECT          = COLUMN
    NAME          = "INDEX"
    DATA_TYPE    = INTEGER
    START_BYTE    = 187
    BYTES         = 5
    FORMAT        = "I5"
    UNIT          = "N/A"
    DESCRIPTION   = "Measurement index"
  END_OBJECT      = COLUMN

/* ***** */

  OBJECT          = COLUMN
    NAME          = "ENERGY"
    DATA_TYPE    = ASCII_REAL
    START_BYTE    = 193
    BYTES         = 7
    FORMAT        = "F7.2"
    UNIT          = "ELECTRONVOLT"
    DESCRIPTION   = "Energy step"
  END_OBJECT      = COLUMN

  OBJECT          = COLUMN
    NAME          = "COUNTS"
    DATA_TYPE    = ASCII_REAL
    START_BYTE    = 201
    BYTES         = 8
    FORMAT        = "F8.2"
    UNIT          = "CM**-2*S**-1"
    DESCRIPTION   = "Electron counts"
  END_OBJECT      = COLUMN

```

4.3.5.5 Description of Instrument

The description of the instrument is done in above and as a brief overview in the INST.CAT catalog file.

4.3.5.6 Mission Specific Keywords

There is no mission specific keywords for ROMAP.

4.3.6 Housekeeping Calibrated Data Product Design (Level 3)

4.3.6.1 File Characteristics Data Elements

The PDS file characteristic data elements for ROMAP HK calibrated data (level 3) are:

```
RECORD_TYPE      = FIXED_LENGTH
RECORD_BYTES     = 165
FILE_RECORDS
LABEL_RECORDS
```

4.3.6.2 Data Object Pointers Identification Data Elements

The ROMAP HK calibrated data are organized as ASCII tables. The data object pointers (^TABLE) reference TAB files.

4.3.6.3 Instrument and Detector Descriptive Data Elements

```
INSTRUMENT_HOST_NAME      = "ROSETTA-LANDER"
INSTRUMENT_HOST_ID       = RL
INSTRUMENT_ID             = ROMAP
INSTRUMENT_NAME           = "ROSETTA LANDER MAGNETOMETER AND PLASMA MONITOR"
INSTRUMENT_TYPE           = { "FLUXGATE MAGNETOMETER", "ELECTROSTATIC ANALYZER",
                              "FARADAY CUP" }
INSTRUMENT_MODE_ID       = "N/A"
INSTRUMENT_MODE_DESC     = "N/A"
```

4.3.6.4 Data Object Definition

Each TAB file contains a 18 columns table with the calibrated HK data (ADC units).

```
OBJECT              = TABLE
NAME                = "ROMAP_CALHK_TABLE"
INTERCHANGE_FORMAT = ASCII
ROWS                =
COLUMNS            = 18
ROW_BYTES           = 165
^STRUCTURE          = "ROMAP_CALHK.FMT"
END_OBJECT          = TABLE
```

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

```
/* Contents of format file "ROMAP_CALHK.FMT" (Calibrated HK data) */

OBJECT              = COLUMN
NAME                = "UTC"
DATA_TYPE           = TIME
START_BYTE          = 1
BYTES               = 23
DESCRIPTION         = "This column represents the UTC
                       Of the HK parameters set in PDS standard format"
```

```

      YYYY-MM-DDThh:mm:ss.sss"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "OBT"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 25
  BYTES         = 15
  UNIT          = SECOND
  FORMAT        = "F15.5"
  DESCRIPTION   = "ROMAP 4 bytes counter representing the measurement
                  time synchronized with Lander On Board Time.
                  The time resolution is 0.03125 s"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "CONTROLLER STATUS"
  DATA_TYPE    = CHARACTER
  START_BYTE    = 42
  BYTES         = 4
  FORMAT        = "Hexadecimal Format"
  UNIT          = "N/A"
  DESCRIPTION   = " Controller Status Bits :

                  Bit                Description

                  0      Status flag : Instrument Mode was loaded
                           at power-up from TC-Buffer
                  1      Status flag : MAG setting was loaded from
                           TC-Buffer
                  3      Error flag : read TC-Buffer error at power-up
                  4      Error flag : write BRAM error; cleared after
                           successfully writing BRAM
                  5      Error flag : TC-Buffer content error
                           (illegal checksum)
                  6      Error flag : SPM Ion 1 counter overflow occurred
                           (cleared after displaying SPM
                           overflow error flag in HK data)
                  7      Error flag : SPM Ion 2 counter overflow occurred
                           (cleared after displaying SPM
                           overflow errorflag in HK data)
                  8      Error flag : SPM Electron counter overflow
                           occurred (cleared after displaying
                           SPM overflow error flag in HK data)
                  9      Status flag : Penning pressure sensor on/off
                  10     Status flag : Pirani pressure sensor on/off
                  11     Status flag : DUMMY FPGA output on/off
                  12..13 Not used
                  14..15 Status flags: I0, I1 identify instrument mode

                  If one of the bits 0 .. 5 is set once, it stays active
                  until the instrument is switched off."
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "LAST RECEIVED TC (WORD 1)"
  DATA_TYPE    = CHARACTER
  START_BYTE    = 49
  BYTES         = 4
  FORMAT        = "N/A"
  UNIT          = "N/A"
  DESCRIPTION   = "Last received TC (word 1)in Hexadecimal Format"
END_OBJECT      = COLUMN

OBJECT          = COLUMN
  NAME          = "LAST RECEIVED TC (WORD 2)"
  DATA_TYPE    = CHARACTER

```

```

START_BYTE      = 56
BYTES           = 4
FORMAT          = "N/A"
UNIT            = "N/A"
DESCRIPTION     = "Last received TC (word 2 ) in Hexadecimal Format"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
NAME            = "POWER CONSUMPTION"
DATA_TYPE      = ASCII_REAL
START_BYTE     = 62
BYTES          = 8
FORMAT         = "F8.2"
UNIT           = MILLIWATT
DESCRIPTION    = "Overall instrument power consumption
                  P = N * 76.3E-3 * 4 [mW]"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
NAME            = "+5V CURRENT"
DATA_TYPE      = ASCII_REAL
START_BYTE     = 71
BYTES          = 7
FORMAT         = "F7.2"
UNIT           = VOLT
DESCRIPTION    = "+5V current
                  I = N * 76.3E-3 * 0.5 [mA]"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
NAME            = "-5V CURRENT"
DATA_TYPE      = ASCII_REAL
START_BYTE     = 79
BYTES          = 7
FORMAT         = "F7.2"
UNIT           = VOLT
DESCRIPTION    = "-5V current
                  I = N * 76.3E-3 * 0.05 [mA]"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
NAME            = "ELECTRONICS TEMPERATURE"
DATA_TYPE      = ASCII_REAL
START_BYTE     = 87
BYTES          = 6
FORMAT         = "F6.2"
UNIT           = KELVIN
DESCRIPTION    = "electronics temperature
                  T = (N * 76.3E-6 - 0.535) * 472.9 [°C]"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
NAME            = "+28V CURRENT"
DATA_TYPE      = ASCII_REAL
START_BYTE     = 94
BYTES          = 7
FORMAT         = "F7.2"
UNIT           = MILLIAMPERE
DESCRIPTION    = "+28V current
                  I = N * 76.3E-3 * 0.025 [mA]"
END_OBJECT     = COLUMN

OBJECT          = COLUMN
NAME            = "SPM HV STATUS 1"
DATA_TYPE      = ASCII_REAL
START_BYTE     = 102
BYTES          = 5
  
```

```

    FORMAT          = "F5.2"
    UNIT            = VOLT
    DESCRIPTION     = "SPM HV status 1"
END_OBJECT        = COLUMN

OBJECT            = COLUMN
  NAME             = "SPM HV STATUS 2"
  DATA_TYPE       = ASCII_REAL
  START_BYTE       = 108
  BYTES            = 8
  FORMAT           = "F8.4"
  UNIT             = VOLT
  DESCRIPTION     = "SPM HV status 2"
END_OBJECT        = COLUMN

OBJECT            = COLUMN
  NAME             = "SPM HV STATUS 3"
  DATA_TYPE       = ASCII_REAL
  START_BYTE       = 117
  BYTES            = 8
  FORMAT           = "F8.4"
  UNIT             = VOLT
  DESCRIPTION     = "SPM HV status 3"
END_OBJECT        = COLUMN

OBJECT            = COLUMN
  NAME             = "SPM HV STATUS 4"
  DATA_TYPE       = ASCII_REAL
  START_BYTE       = 126
  BYTES            = 8
  FORMAT           = "F8.4"
  UNIT             = VOLT
  DESCRIPTION     = "SPM HV status 4"
END_OBJECT        = COLUMN

OBJECT            = COLUMN
  NAME             = "PENNING PRESSURE"
  DATA_TYPE       = ASCII_INTEGER
  START_BYTE       = 135
  BYTES            = 7
  FORMAT           = "I7"
  UNIT             = PASCAL
  DESCRIPTION     = "Penning pressure"
END_OBJECT        = COLUMN

OBJECT            = COLUMN
  NAME             = "PIRANI PRESSURE"
  DATA_TYPE       = ASCII_INTEGER
  START_BYTE       = 143
  BYTES            = 7
  FORMAT           = "I7"
  UNIT             = PASCAL
  DESCRIPTION     = "Pirani pressure"
END_OBJECT        = COLUMN

OBJECT            = COLUMN
  NAME             = "PROM CHECKSUM"
  DATA_TYPE       = CHARACTER
  START_BYTE       = 152
  BYTES            = 4
  FORMAT           = "N/A"
  UNIT             = "N/A"
  DESCRIPTION     = "PROM checksum (computed at power-up)
                    in Hexadecimal Format"
END_OBJECT        = COLUMN

OBJECT            = COLUMN
  
```

NAME = "INSTRUMENT ERROR FLAGS"
 DATA_TYPE = CHARACTER
 START_BYTE = 159
 BYTES = 4
 FORMAT = "N/A"
 UNIT = "N/A"
 DESCRIPTION = " Instrument Error Flags in Hexadecimal Format :

| Bit | Description |
|-----|---|
| 0 | Command overflow (a TC was received before the former was processed) |
| 1 | CDMS illegal word count |
| 2 | CDMS message error |
| 3 | General CDMS receiving error |
| 4 | General CDMS transmission error |
| 5 | Wrong telecommand received |
| 6 | CDMS request overflow (a CDMS request occurs before the former was processed) |
| 7 | Frame buffer overflow |
| 8 | MAG vector sampling overflow |
| 9 | CDMS error code word received |
| 10 | CDMS checksum error |
| 11 | checksum error in received CDMS SST word |
| 12 | SPM counter overflow |
| 13 | ADC sampling overflow |
| 14 | SPM transmission overflow |
| 15 | SPM setup error" |

END_OBJECT = COLUMN

4.3.7 Magnetometer Science calibrated Data Product Design (Level 5)

There are two kinds of calibrated science data for the ROMAP MAG instrument, draft calibrated and calibrated. The level 5 contains calibrated data. The calibration includes removal of spacecraft influence, of all kinds of AC disturbances and taking into account of temperature dependency of magnets. Both data products (draft calibrated and calibrated) have the same format, i.e. the UTC, the OBT, the spacecraft position (X, Y, Z) and the magnetic field (Bx, By, Bz) in Instrument, Lander, Orbiter and ECLIP J2000 coordinates.

4.3.7.1 File Characteristics Data Elements

The PDS file characteristic data elements for ROMAP MAG science calibrated data are:

RECORD_TYPE = FIXED_LENGTH
 RECORD_BYTES = 119
 FILE_RECORDS
 LABEL_RECORDS

4.3.7.2 Data Object Pointers Identification Data Elements

The ROMAP MAG SC calibrated data are organized as ASCII tables. The data object pointers (^TABLE) reference TAB files.

4.3.7.3 Instrument and Detector Descriptive Data Elements

The following data identification elements provide additional information about the ROMAP-MAG data products.

INSTRUMENT_HOST_NAME = "ROSETTA-LANDER"
 INSTRUMENT_HOST_ID = RL
 INSTRUMENT_ID = ROMAP
 INSTRUMENT_NAME = "ROSETTA LANDER MAGNETOMETER AND PLASMA MONITOR"

```

INSTRUMENT_TYPE      = { "FLUXGATE MAGNETOMETER" , "ELECTROSTATIC ANALYZER" ,
                          "FARADAY CUP" }
DETECTOR_ID          = MAG
INSTRUMENT_MODE_ID   = "N/A"
INSTRUMENT_MODE_DESC = "N/A"

```

4.3.7.4 Data Object Definition

4.3.7.4.1 Level E data object definition (calibrated in instrument coordinates)

Each TAB file contains an eight columns table with the magnetic field and the spacecraft position.

```

OBJECT      = TABLE
NAME        = "ROMAP_MAG_CALSCE_TABLE"
INTERCHANGE_FORMAT = ASCII
ROWS       =
COLUMNS   = 8
ROW_BYTES  = 119
^STRUCTURE = "ROMAP_MAG_CALSCE.FMT"
END_OBJECT  = TABLE

```

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

```

/*          Contents of format file  "ROMAP_MAG_CALSCE.FMT"          */
/*  Level E data object definition  :                               */
/*  calibrated in instrument coordinates                             */
/*
OBJECT      = COLUMN
NAME        = "UTC"
DATA_TYPE   = TIME
START_BYTE  = 1
BYTES       = 23
DESCRIPTION = "This column represents the UTC
              Of the magnetic field vector in PDS standard format
              YYYY-MM-DDThh:mm:ss.sss"
END_OBJECT  = COLUMN

OBJECT      = COLUMN
NAME        = "OBT"
DATA_TYPE   = ASCII_REAL
START_BYTE  = 25
BYTES       = 15
UNIT        = SECOND
FORMAT      = "F15.5"
DESCRIPTION = "ROMAP 4 bytes counter representing the measurement
              time synchronized with Lander On Board Time.
              The time resolution is 0.03125 s"
END_OBJECT  = COLUMN

OBJECT      = COLUMN
NAME        = "POS_X"
DATA_TYPE   = ASCII_REAL
START_BYTE  = 41
BYTES       = 16
FORMAT      = "F16.3"
UNIT        = KILOMETER
DESCRIPTION = "X component of the Spacecraft (Lander) position,
              ECLIPJ2000 coordinates"
END_OBJECT  = COLUMN

OBJECT      = COLUMN
NAME        = "POS_Y"
DATA_TYPE   = ASCII_REAL
START_BYTE  = 58

```

```

    BYTES                = 16
    FORMAT               = "F16.3"
    UNIT                 = KILOMETER
    DESCRIPTION          = "Y component of the Spacecraft (Lander) position,
                          ECLIPJ2000 coordinates"
END_OBJECT             = COLUMN

OBJECT                 = COLUMN
  NAME                  = "POS_Z"
  DATA_TYPE            = ASCII_REAL
  START_BYTE            = 75
  BYTES                 = 16
  FORMAT                = "F16.3"
  UNIT                  = KILOMETER
  DESCRIPTION           = "Z component of the Spacecraft (Lander) position,
                          ECLIPJ2000 coordinates"
END_OBJECT             = COLUMN

OBJECT                 = COLUMN
  NAME                  = "BX"
  DATA_TYPE            = ASCII_REAL
  START_BYTE            = 92
  BYTES                 = 8
  FORMAT                = "F8.2"
  UNIT                  = NANOTESLA
  DESCRIPTION           = "Magnetic field X component,
                          calibrated, instrument coordinates"
END_OBJECT             = COLUMN

OBJECT                 = COLUMN
  NAME                  = "BY"
  DATA_TYPE            = ASCII_REAL
  START_BYTE            = 101
  BYTES                 = 8
  FORMAT                = "F8.2"
  UNIT                  = NANOTESLA
  DESCRIPTION           = "Magnetic field Y component,
                          calibrated, instrument coordinates"
END_OBJECT             = COLUMN

OBJECT                 = COLUMN
  NAME                  = "BZ"
  DATA_TYPE            = ASCII_REAL
  START_BYTE            = 110
  BYTES                 = 8
  FORMAT                = "F8.2"
  UNIT                  = NANOTESLA
  DESCRIPTION           = "Magnetic field Z component,
                          calibrated, instrument coordinates"
END_OBJECT             = COLUMN

```

4.3.7.4.2 Level F data object definition (calibrated in Lander coordinates)

Each TAB file contains an eight columns table with the magnetic field and the spacecraft position.

```

OBJECT                 = TABLE
  NAME                  = "ROMAP_MAG_CALSCF_TABLE"
  INTERCHANGE_FORMAT   = ASCII
  ROWS                  =
  COLUMNS              = 8
  ROW_BYTES             = 119
  ^STRUCTURE           = "ROMAP_MAG_CALSCF.FMT"
END_OBJECT             = TABLE

```

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

```

/*          Contents of format file  "ROMAP_MAG_CALSCF.FMT"          */
/*  Level F data object definition :                                */
/*  calibrated in Lander coordinates                                */

```

```

OBJECT          = COLUMN
  NAME          = "UTC"
  DATA_TYPE    = TIME
  START_BYTE    = 1
  BYTES        = 23
  DESCRIPTION   = "This column represents the UTC
                  Of the magnetic field vector in PDS standard format
                  YYYY-MM-DDThh:mm:ss.sss"
END_OBJECT     = COLUMN

```

```

OBJECT          = COLUMN
  NAME          = "OBT"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 25
  BYTES        = 15
  UNIT         = SECOND
  FORMAT       = "F15.5"
  DESCRIPTION   = "ROMAP 4 bytes counter representing the measurement
                  time synchronized with Lander On Board Time.
                  The time resolution is 0.03125 s"
END_OBJECT     = COLUMN

```

```

OBJECT          = COLUMN
  NAME          = "POS_X"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 41
  BYTES        = 16
  FORMAT       = "F16.3"
  UNIT         = KILOMETER
  DESCRIPTION   = "X component of the Spacecraft (Lander) position,
                  ECLIPJ2000 coordinates"
END_OBJECT     = COLUMN

```

```

OBJECT          = COLUMN
  NAME          = "POS_Y"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 58
  BYTES        = 16
  FORMAT       = "F16.3"
  UNIT         = KILOMETER
  DESCRIPTION   = "Y component of the Spacecraft (Lander) position,
                  ECLIPJ2000 coordinates"
END_OBJECT     = COLUMN

```

```

OBJECT          = COLUMN
  NAME          = "POS_Z"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 75
  BYTES        = 16
  FORMAT       = "F16.3"
  UNIT         = KILOMETER
  DESCRIPTION   = "Z component of the Spacecraft (Lander) position,
                  ECLIPJ2000 coordinates"
END_OBJECT     = COLUMN

```

```

OBJECT          = COLUMN
  NAME          = "BX"
  DATA_TYPE    = ASCII_REAL
  START_BYTE    = 92
  BYTES        = 8
  FORMAT       = "F8.2"
  UNIT         = NANOTESLA

```



```

END_OBJECT          = COLUMN

OBJECT              = COLUMN
  NAME              = "POS_X"
  DATA_TYPE        = ASCII_REAL
  START_BYTE        = 41
  BYTES              = 16
  FORMAT            = "F16.3"
  UNIT              = KILOMETER
  DESCRIPTION        = "X component of the Spacecraft (Lander) position,
                        ECLIPJ2000 coordinates"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
  NAME              = "POS_Y"
  DATA_TYPE        = ASCII_REAL
  START_BYTE        = 58
  BYTES              = 16
  FORMAT            = "F16.3"
  UNIT              = KILOMETER
  DESCRIPTION        = "Y component of the Spacecraft (Lander) position,
                        ECLIPJ2000 coordinates"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
  NAME              = "POS_Z"
  DATA_TYPE        = ASCII_REAL
  START_BYTE        = 75
  BYTES              = 16
  FORMAT            = "F16.3"
  UNIT              = KILOMETER
  DESCRIPTION        = "Z component of the Spacecraft (Lander) position,
                        ECLIPJ2000 coordinates"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
  NAME              = "BX"
  DATA_TYPE        = ASCII_REAL
  START_BYTE        = 92
  BYTES              = 8
  FORMAT            = "F8.2"
  UNIT              = NANOTESLA
  DESCRIPTION        = "Magnetic field X component,
                        calibrated, Orbiter coordinates"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
  NAME              = "BY"
  DATA_TYPE        = ASCII_REAL
  START_BYTE        = 101
  BYTES              = 8
  FORMAT            = "F8.2"
  UNIT              = NANOTESLA
  DESCRIPTION        = "Magnetic field Y component,
                        calibrated, Orbiter coordinates"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
  NAME              = "BZ"
  DATA_TYPE        = ASCII_REAL
  START_BYTE        = 110
  BYTES              = 8
  FORMAT            = "F8.2"
  UNIT              = NANOTESLA
  DESCRIPTION        = "Magnetic field Z component,
                        calibrated, Orbiter coordinates"
END_OBJECT          = COLUMN

```

4.3.7.4.4 Level H data object definition (calibrated in ECLIP J2000 coordinates)

Each TAB file contains an eight columns table with the magnetic field and the spacecraft position.

```
OBJECT          = TABLE
NAME            = "ROMAP_MAG_CALSCH_TABLE"
INTERCHANGE_FORMAT = ASCII
ROWS           =
COLUMNNS       = 8
ROW_BYTES      = 119
^STRUCTURE     = "ROMAP_MAG_CALSCH.FMT"
END_OBJECT     = TABLE
```

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

```
/*          Contents of format file "ROMAP_MAG_CALSCH.FMT"          */
/* Level F data object definition :                                  */
/* calibrated in ECLIP J2000 coordinates                             */
```

```
OBJECT          = COLUMN
NAME            = "UTC"
DATA_TYPE       = TIME
START_BYTE      = 1
BYTES           = 23
DESCRIPTION     = "This column represents the UTC
                  Of the magnetic field vector in PDS standard format
                  YYYY-MM-DDThh:mm:ss.sss"
END_OBJECT     = COLUMN
```

```
OBJECT          = COLUMN
NAME            = "OBT"
DATA_TYPE       = ASCII_REAL
START_BYTE      = 25
BYTES           = 15
UNIT            = SECOND
FORMAT          = "F15.5"
DESCRIPTION     = "ROMAP 4 bytes counter representing the measurement
                  time synchronized with Lander On Board Time.
                  The time resolution is 0.03125 s"
END_OBJECT     = COLUMN
```

```
OBJECT          = COLUMN
NAME            = "POS_X"
DATA_TYPE       = ASCII_REAL
START_BYTE      = 41
BYTES           = 16
FORMAT          = "F16.3"
UNIT            = KILOMETER
DESCRIPTION     = "X component of the Spacecraft (Lander) position,
                  ECLIPJ2000 coordinates"
END_OBJECT     = COLUMN
```

```
OBJECT          = COLUMN
NAME            = "POS_Y"
DATA_TYPE       = ASCII_REAL
START_BYTE      = 58
BYTES           = 16
FORMAT          = "F16.3"
UNIT            = KILOMETER
DESCRIPTION     = "Y component of the Spacecraft (Lander) position,
                  ECLIPJ2000 coordinates"
END_OBJECT     = COLUMN
```

```
OBJECT          = COLUMN
```

```

NAME                = "POS_Z"
DATA_TYPE           = ASCII_REAL
START_BYTE         = 75
BYTES              = 16
FORMAT             = "F16.3"
UNIT               = KILOMETER
DESCRIPTION        = "Z component of the Spacecraft (Lander) position,
                    ECLIPJ2000 coordinates"
END_OBJECT         = COLUMN

OBJECT              = COLUMN
NAME               = "BX"
DATA_TYPE         = ASCII_REAL
START_BYTE       = 92
BYTES           = 8
FORMAT         = "F8.2"
UNIT          = NANOTESLA
DESCRIPTION   = "Magnetic field X component,
                calibrated, ECLIPJ2000 coordinates"
END_OBJECT   = COLUMN

OBJECT              = COLUMN
NAME               = "BY"
DATA_TYPE         = ASCII_REAL
START_BYTE       = 101
BYTES           = 8
FORMAT         = "F8.2"
UNIT          = NANOTESLA
DESCRIPTION   = "Magnetic field Y component,
                calibrated, ECLIPJ2000 coordinates"
END_OBJECT   = COLUMN

OBJECT              = COLUMN
NAME               = "BZ"
DATA_TYPE         = ASCII_REAL
START_BYTE       = 110
BYTES           = 8
FORMAT         = "F8.2"
UNIT          = NANOTESLA
DESCRIPTION   = "Magnetic field Z component,
                calibrated, ECLIPJ2000 coordinates"
END_OBJECT   = COLUMN

```

4.3.7.5 Description of Instrument

The description of the instrument is done in above and as a brief overview in the INST.CAT catalog file.

5 Appendix: 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: Example of PDS detached label for ROMAP MAG level 2 data product

PDS_VERSION_ID = PDS3

```

LABEL_REVISION_NOTE = "2007-07-16, SONC, version 1.0"

/* PVV version 3.0 */
/* Edited Science data */

/* FILE CHARACTERISTIC DATA ELEMENTS */

RECORD_TYPE          = FIXED_LENGTH
FILE_RECORDS         = 18990
RECORD_BYTES         = 65
FILE_NAME            = "MAG_FS2_070225015459_00004.TAB"

/* DATA OBJECT POINTERS */

^ROMAP_MAG_RAWSC_TABLE = ("MAG_FS2_070225015459_00004.TAB",1 <BYTES>)

DATA_SET_ID          = "RL-CAL-ROMAP-2-MARS-MAG-V1.0"
DATA_SET_NAME        = "ROSETTA-LANDER MARS ROMAP 2 MARS MAG V1.0"
PRODUCT_ID           = "MAG_FS2_070225015459_00004"
PRODUCT_CREATION_TIME = 2008-03-17T10:20:01
MISSION_NAME         = "INTERNATIONAL ROSETTA MISSION"
MISSION_PHASE_NAME   = "MARS SWING-BY"
MISSION_ID           = ROSETTA
INSTRUMENT_HOST_NAME = "ROSETTA-LANDER"
INSTRUMENT_HOST_ID   = RL

PRODUCT_TYPE         = EDR
START_TIME           = 2007-02-25T01:54:59.194
STOP_TIME            = 2007-02-25T01:59:55.303
SPACECRAFT_CLOCK_START_COUNT = "1/130989270.09"
SPACECRAFT_CLOCK_STOP_COUNT = "1/130989566.12"

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

INSTRUMENT_ID        = ROMAP
INSTRUMENT_NAME      = UNK
INSTRUMENT_TYPE      = {"FLUXGATE MAGNETOMETER","ELECTROSTATIC ANALYZER",
                        "FARADAY CUP"}
DETECTOR_ID          = MAG
DETECTOR_DESC        = "Magnetometer"

INSTRUMENT_MODE_ID   = "N/A"
INSTRUMENT_MODE_DESC = "N/A"
TARGET_NAME          = "MARS"
TARGET_TYPE          = "PLANET"

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

/* GEOMETRY PARAMETERS */

/* SPACECRAFT LOCATION: Position <km> */
SC_SUN_POSITION_VECTOR = ( -18553289.9, 195616341.6, 90223877.3)
/* TARGET PARAMETERS: Position <km>, Velocity <km/s> */
SC_TARGET_POSITION_VECTOR = ( -153787159.6, 250943772.8, 114210041.1)
SC_TARGET_VELOCITY_VECTOR = ( -35.3, -20.1, -8.6)
/* SPACECRAFT POSITION WITH RESPECT TO CENTRAL BODY */
SPACECRAFT_ALTITUDE = 315694750.8 <km>
SUB_SPACECRAFT_LATITUDE = -21.06 <deg>
SUB_SPACECRAFT_LONGITUDE = 122.76 <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>"

/* DATA OBJECT DEFINITION */

```
OBJECT           = ROMAP_MAG_RAWSC_TABLE
NAME            = "ROMAP_MAG EDITED SCIENCE DATA"
INTERCHANGE_FORMAT = ASCII
ROWS           = 18990
COLUMNS       = 5
ROW_BYTES      = 65
^STRUCTURE     = "ROMAP_MAG_RAWSC.FMT"
END_OBJECT      = ROMAP_MAG_RAWSC_TABLE
```

END

7 Appendix: Example of PDS combined detached label for ROMAP SPM level 2 data product

```
PDS_VERSION_ID           = PDS3
LABEL_REVISION_NOTE     = "2009-03-16, SONC, version 1.0"
/* PVV version 3.0 */

/*           Edited Science data (Level 2)           */

DATA_SET_ID              = "RL-CAL-ROMAP-2-CVP-SPM-V1.0"
DATA_SET_NAME            = "ROSETTA-LANDER CAL ROMAP 2 CVP SPM V1.0"
PRODUCT_ID               = "SPM_FS2_040514013124"
PRODUCT_CREATION_TIME    = 2009-03-11T08:29:37
MISSION_NAME             = "INTERNATIONAL ROSETTA MISSION"
MISSION_PHASE_NAME       = "COMMISSIONING"
MISSION_ID               = ROSETTA
INSTRUMENT_HOST_NAME     = "ROSETTA-LANDER"
INSTRUMENT_HOST_ID      = RL

PRODUCT_TYPE             = EDR
START_TIME               = 2004-05-14T01:31:24.815
STOP_TIME                = 2004-05-14T01:34:17.627
SPACECRAFT_CLOCK_START_COUNT = "031312529.93750"
SPACECRAFT_CLOCK_STOP_COUNT  = "042637969.93750"

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

INSTRUMENT_ID            = ROMAP
INSTRUMENT_NAME          = "N/A"
INSTRUMENT_TYPE          = {"FLUXGATE MAGNETOMETER", "ELECTROSTATIC ANALYZER",
                           "FARADAY CUP"}
DETECTOR_ID              = SPM
DETECTOR_DESC            = "Simple Plasma Monitor"

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 = (58256145.8, 110046457.3, 46674031.2)

/* TARGET PARAMETERS: Position <km>, Velocity <km/s> */

SC_TARGET_POSITION_VECTOR = (-31604133.9, -1530439.7, -1698850.3)

SC_TARGET_VELOCITY_VECTOR = (-6.8, -3.6, -1.6)

/* SPACECRAFT POSITION WITH RESPECT TO CENTRAL BODY */

SPACECRAFT_ALTITUDE = 31680363.9 <km>

SUB_SPACECRAFT_LATITUDE = 3.08 <deg>

SUB_SPACECRAFT_LONGITUDE = 108.33 <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>"

/* DATA OBJECT DEFINITION */

OBJECT = FILE
 RECORD_TYPE = FIXED_LENGTH
 FILE_RECORDS = 96
 RECORD_BYTES = 196
 ^ROMAP_SPM_PAR_ION_CNA_TABLE = "SPMP_FS2_040514013124_CNA.TAB"
 OBJECT = ROMAP_SPM_PAR_ION_CNA_TABLE
 NAME = ROMAP_SPM_PAR_ION_CNA
 INTERCHANGE_FORMAT = ASCII
 ROWS = 96
 ^STRUCTURE = "ROMAP_SPM_PAR_ION_CNA.FMT"
 COLUMNS = 14
 ROW_BYTES = 196
 END_OBJECT = ROMAP_SPM_PAR_ION_CNA_TABLE
 END_OBJECT = FILE

OBJECT = FILE
 RECORD_TYPE = FIXED_LENGTH
 FILE_RECORDS = 192
 RECORD_BYTES = 148
 ^ROMAP_SPM_PAR_ION_CNE_TABLE = "SPMP_FS2_040514013124_CNE.TAB"
 OBJECT = ROMAP_SPM_PAR_ION_CNE_TABLE
 NAME = ROMAP_SPM_PAR_ION_CNE
 INTERCHANGE_FORMAT = ASCII
 ROWS = 192
 ^STRUCTURE = "ROMAP_SPM_PAR_ION_CNE.FMT"
 COLUMNS = 14
 ROW_BYTES = 148
 END_OBJECT = ROMAP_SPM_PAR_ION_CNE_TABLE
 END_OBJECT = FILE

OBJECT = FILE
 RECORD_TYPE = FIXED_LENGTH
 FILE_RECORDS = 96
 RECORD_BYTES = 194
 ^ROMAP_SPM_PAR_ION_CRA_TABLE = "SPMP_FS2_040514013124_CRA.TAB"
 OBJECT = ROMAP_SPM_PAR_ION_CRA_TABLE
 NAME = ROMAP_SPM_PAR_ION_CRA
 INTERCHANGE_FORMAT = ASCII
 ROWS = 96
 ^STRUCTURE = "ROMAP_SPM_PAR_ION_CRA.FMT"
 COLUMNS = 14
 ROW_BYTES = 194
 END_OBJECT = ROMAP_SPM_PAR_ION_CRA_TABLE
 END_OBJECT = FILE

| | | |
|--|-----------------------------------|---|
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| <p> -RL-CAL-ROMAP-2-CVP-SPM-V1.0-</p> | <p>-DATA-----</p> <p>-SC-----</p> | <ul style="list-style-type: none"> -SPMP_FS2_041007004502_CNE.TAB -SPMP_FS2_041007004502_CRA.TAB -SPMP_FS2_041007004502_CRE.TAB -SPMP_FS2_041009001425_CNA.TAB -SPMP_FS2_041009001425_CNE.TAB -SPMP_FS2_041009001425_CRA.TAB -SPMP_FS2_041009001425_CRE.TAB -SPMR_FS2_041007004354_CN.TAB -SPMR_FS2_041007004354_CR.TAB -SPMR_FS2_041009001317_CN.TAB -SPMR_FS2_041009001317_CR.TAB -SPM_FS2_040514013124_PAR.LBL -SPM_FS2_041007004354_RAW.LBL -SPM_FS2_041007004502_PAR.LBL -SPM_FS2_041009001317_RAW.LBL -SPM_FS2_041009001425_PAR.LBL |
| | <p>-DOCUMENT-----</p> | <ul style="list-style-type: none"> -DOCINFO.TXT -EAICD_ROMAP.DOC -EAICD_ROMAP.LBL -RO-LRO-DP-300002-UA.LBL -RO-LRO-DP-300002-UA.PDF -ROMAP_CALIBRATION_DESC.TXT -ROMAP_CALIBRATION_DESC.LBL -TIMELINE_CVP.TXT -TIMELINE_CVP_DESC.TXT -TIMELINE_CVP_PART1.LBL -TIMELINE_CVP_PART1.PNG -TIMELINE_CVP_PART2.LBL -TIMELINE_CVP_PART2.PNG |
| | <p>-INDEX-----</p> | <ul style="list-style-type: none"> -INDXINFO.TXT -INDEX.LBL -INDEX.TAB |
| | <p>-LABEL-----</p> | <ul style="list-style-type: none"> -LABINFO.TXT -ROMAP_RAWHK.FMT -ROMAP_SPM_ELEC.FMT -ROMAP_SPM_FC.FMT -ROMAP_SPM_PAR_ION_CNA.FMT -ROMAP_SPM_PAR_ION_CNE.FMT -ROMAP_SPM_PAR_ION_CRA.FMT -ROMAP_SPM_PAR_ION_CRE.FMT -ROMAP_SPM_RAW_ION_CN.FMT -ROMAP_SPM_RAW_ION_CR.FMT |
| | <p>-VOLDESC.CAT</p> | |