2013 Cassini/CAPS

**Cassini Plasma Spectrometer**

**CAPS STANDARD DATA PRODUCTS**

**AND ARCHIVE VOLUME**

**SOFTWARE INTERFACE SPECIFICATION**

**(CAPS Archive Volumes SIS)**

**SIS ID: IO-AR-017**

Version 3.0

rev. June 24, 2013

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Approved:

J. H. Waite Date

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[1. Preface 4](#_Toc359834375)

[1.1. Distribution List 4](#_Toc359834376)

[1.2. Document Change Log 4](#_Toc359834377)

[1.3. TBD Items 5](#_Toc359834378)

[1.4. Acronyms and Abbreviations 5](#_Toc359834379)

[1.5. Glossary 6](#_Toc359834380)

[2. Introduction 7](#_Toc359834381)

[2.1. Content Overview 7](#_Toc359834382)

[2.2. Scope 8](#_Toc359834383)

[2.3. Applicable Documents 8](#_Toc359834384)

[2.4. Audience 9](#_Toc359834385)

[3. Archive Volume Generation 10](#_Toc359834386)

[3.1. Data Production and Transfer Methods 10](#_Toc359834387)

[3.2. Archive Volume Creation and Validation Methods 11](#_Toc359834388)

[3.3. Labeling and Identification 11](#_Toc359834389)

[4. Archive Volume Contents 14](#_Toc359834390)

[4.1. Root Directory Contents 14](#_Toc359834391)

[4.2. INDEX Directory Contents 14](#_Toc359834392)

[4.3. DOCUMENT Directory Contents 15](#_Toc359834393)

[4.4. CATALOG Directory Contents 16](#_Toc359834394)

[4.5. DATA (Standard Products) Directory Contents and Naming Conventions 17](#_Toc359834395)

[4.5.1. Required Files 17](#_Toc359834396)

[4.5.2. File Naming Conventions 18](#_Toc359834397)

[4.5.3. DATA/UNCALIBRATED/YYYYDDD Directory Contents 19](#_Toc359834398)

[4.5.4. DATA/HIGHERORDER/SCPOT/YYYY Directory Contents 20](#_Toc359834399)

[4.5.5. DATA/HIGHERORDER/ELEMOMT/YYYY Directory Contents 21](#_Toc359834400)

[4.5.6. DATA/HIGHERORDER/IONMOMT/YYYY Directory Contents 21](#_Toc359834401)

[4.5.7. DATA/CALIBRATED Directory Contents 22](#_Toc359834402)

[4.6. CALIB Directory Contents 22](#_Toc359834403)

[4.6.1. CALIB/SAMPLE\_DATA Directory Contents 24](#_Toc359834404)

[4.7. EXTRAS Directory Contents 24](#_Toc359834405)

[4.8. BROWSE Directory Contents 24](#_Toc359834406)

[5. Archive Volume Format 26](#_Toc359834407)

[5.1. File Formats 26](#_Toc359834408)

[5.1.1. Document File Formats 26](#_Toc359834409)

[5.1.2. Catalog File Formats 26](#_Toc359834410)

[5.1.3. PDS Label File Formats 26](#_Toc359834411)

[5.1.4. DATA/UNCALIBRATED File Formats – Binary Tables 27](#_Toc359834412)

[5.1.5. DATA/HIGHERORDER File Formats – Tab Delimited 28](#_Toc359834413)

[5.2. CAPS Standard UNCALIBRATED Data Product Descriptions 28](#_Toc359834414)

[5.2.1. CAPS ELS Data Product Format 28](#_Toc359834415)

[5.2.2. CAPS IBS Data Product Format 29](#_Toc359834416)

[5.2.3. CAPS IMS ION Data Product Format 30](#_Toc359834417)

[5.2.4. CAPS IMS SNG Data Product Format 32](#_Toc359834418)

[5.2.5. CAPS IMS LOG Data Product Format 33](#_Toc359834419)

[5.2.6. CAPS IMS TOF Data Product Format 34](#_Toc359834420)

[5.2.7. CAPS ACT Data Product Format 36](#_Toc359834421)

[5.2.8. CAPS ANC Data Product Format 37](#_Toc359834422)

[5.2.9. CAPS EVN Data Product Format 41](#_Toc359834423)

[5.3. CAPS Standard HIGHERORDER Data Product Descriptions 42](#_Toc359834424)

[5.3.1. CAPS ELS Electron Moment Data Product Format 42](#_Toc359834425)

[5.3.2. CAPS ELS Spacecraft Potential Data Product Format 44](#_Toc359834426)

[5.3.3. CAPS Ion Moments Data Format 45](#_Toc359834427)

[6. Support Staff and Cognizant Persons 48](#_Toc359834428)

[Appendix A. Directory Structure for Archive Volume, COCAPS\_1nnn 42](#_Toc359834429)

[Appendix B. PDS Labels & Format Files for Standard UNCALIBRATED Data Products 44](#_Toc359834430)

[Appendix C. PDS Labels & Format Files for Standard HIGHERORDER Data Products 87](#_Toc359834431)

**List Of Tables:**

[Table 1: Distribution List 4](#_Toc359834432)

[Table 2: Document Change History 4](#_Toc359834433)

[Table 3: TBD Items 5](#_Toc359834434)

[Table 4: Acronyms and Abbreviations 5](#_Toc359834435)

[Table 5: Spacecraft Science Data Products in CAPS Data Sets 7](#_Toc359834436)

[Table 6: Relationship Between Data Sets, Standard Data Product Types, and Archive Volumes 12](#_Toc359834437)

[Table 7: Root Directory Contents 14](#_Toc359834438)

[Table 8: Index Directory Contents 15](#_Toc359834439)

[Table 9: Document Directory Contents 15](#_Toc359834440)

[Table 10: Document/CAPS\_SIS Directory Contents 16](#_Toc359834441)

[Table 11: Document/CAPS\_CALIB Directory Contents 16](#_Toc359834442)

[Table 12: Catalog Directory Contents 17](#_Toc359834443)

[Table 13: YYYYDDD UNCALIBRATED Data Directory Contents 19](#_Toc359834444)

[Table 14: HIGHERORDER/SCPOT/YYYY Data Directory Contents 20](#_Toc359834445)

[Table 15: HIGHERORDER/ELEMOMT/YYYY Data Directory Contents 21](#_Toc359834446)

[Table 16: HIGHERORDER/IONMOMT/YYYY Data Directory Contents 21](#_Toc359834447)

[Table 17: DATA/CALIBRATED Directory Contents 22](#_Toc359834448)

[Table 18: CALIB Directory Contents 22](#_Toc359834449)

[Table 19: YYYYDDD BROWSE Directory Contents 24](#_Toc359834450)

[Table 20: CAPS ELS UNCALIBRATED Data File Contents and Structure 28](#_Toc359834451)

[Table 21: CAPS IBS UNCALIBRATED Data File Contents and Structure 29](#_Toc359834452)

[Table 22: CAPS UNCALIBRATED IMS ION Data File Contents and Structure 30](#_Toc359834453)

[Table 23: CAPS UNCALIBRATED IMS Singles Data File Contents and Structure 32](#_Toc359834454)

[Table 24: CAPS IMS Logicals UNCALIBRATED Data File Contents and Structure 33](#_Toc359834455)

[Table 25: CAPS IMS TOF UNCALIBRATED Data File Contents and Structure 34](#_Toc359834456)

[Table 26: CAPS ACT Data File Contents and Structure (both Calibrated & Un-calibrated) 36](#_Toc359834457)

[Table 27: CAPS ANC UNCALIBRATED Data File Contents and Structure 37](#_Toc359834458)

[Table 28: CAPS EVN UNCALIBRATED Data File Contents and Structure 41](#_Toc359834459)

[Table 29: CAPS ELS Electron Moment HIGHERORDER Data File Contents and Structure 42](#_Toc359834460)

[Table 30: CAPS ELS Spacecraft Potential HIGHERORDER Data File Contents and Structure 44](#_Toc359834461)

[Table 31: CAPS Ion Moments HIGHERORDER Data File Contents and Structure 45](#_Toc359834462)

[Table 32: CAPS Archive Collection Support Staff 48](#_Toc359834463)

# Preface

This document describes the contents and types of volumes belonging to all of the CAPS data sets.

## Distribution List

| Table : Distribution List | |
| --- | --- |
| **Name** | **Email** |
| Steve Joy | [sjoy@igpp](mailto:sjoy@igpp).ucla.edu |
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| Earl Maize | Earl.Maize@jpl.nasa.gov |
| Shiela Chatterjee | sheila.b.chatterjee@jpl.nasa.gov |

## Document Change Log

| Table : Document Change History | | |
| --- | --- | --- |
| **Change** | **Date** | **Affected Portions** |
| Update version 1.17 | 05/2010 | All |
| Updates include Missing Constant values and a change to TOF format. | 05/2010 | All |
| Included Higher Order Data Products. Updated sections for missing constants, etc | 3/2013 |  |

## 

## TBD Items

Items that are currently still to be specified:

| Table : TBD Items | | |
| --- | --- | --- |
| **Item** | **Section** | **Page(s)** |
| Resubmission of higher order files | Section 2.1 | 7 |
| Description of calibrated data set | Section 2.1 | 7 |
| Size & type of calibrated data | Table 5 in Section 2.1 | 7/8 |
| Description of calibrated data | Section 3.1 | 10 |
| Types & names of calibrated data | Table 6 in Section 3.3 | 12/13 |
| Directory structure | Section 4.5 | 17 |
| Detached FMT or not? | Section 4.5.1 | 17/18 |
| File naming convention | Section 4.5.2 | 18 |

## Acronyms and Abbreviations

| Table : Acronyms and Abbreviations | |
| --- | --- |
| Acronym | Definition |
| ASCII | American Standard Code for Information Interchange |
| CAPS | CAssini Plasma Spectrometer |
| CD-R | Compact Disc - Recordable Media |
| CD-ROM | Compact Disc - Read-Only Memory |
| DVD | Digital Versatile Disc |
| ELS | Electron Spectrometer |
| ELS 3DMOMT | Electron Moment |
| EVT | Ion Mass Spectrometer Event Mode Data Product |
| GB | Gigabyte(s) |
| IBS | Ion Beam Spectrometer |
| ION MOMT | Ion Moment – made from Singles Data (SNG) |
| IMS | Ion Mass Spectrometer |
| ISO | International Standards Organization |
| JPL | Jet Propulsion Laboratory |
| LOG | Ion Mass Spectrometer’s Logical Data Product |
| MB | Megabyte(s) |
| NSSDC | National Space Science Data Center |
| PDB | Project Database |
| PDS | Planetary Data System |
| PNG | Portable Network Graphic. A bit-mapped graphics format |
| PPI | Planetary Data System, Planetary Plasma Interactions Node |
| SCPOT | Electron Spectrometer Spacecraft Potential |
| SDVT | Science Data Validation Team |
| SNG | Ion Mass Spectrometer Singles Data Product |
| SIS | Software Interface Specification |
| TBD | To Be Determined |
| TOF – LEF | Time of Flight – Linear Electric Field |
| TOF – ST | Time of Flight – Straight Through |

## 

## Glossary

**Archive** – An archive consists of one or more Data Sets along with all the documentation and ancillary information needed to understand and use the data. An archive is a logical construct independent of the medium on which it is stored.

**Archive Volume** - An Archive Volume is a single physical media (CDROM, DVD, 9-track tape, etc.) used to permanently store files within the PDS archive. Archive Volumes may only be created on media approved by the PDS as meeting archive quality standards.

**Archive Volume Set** – A collection of one or more Archive Volumes used to store a single Data Set or collection of related Data Sets.

**Catalog Information** – High-level descriptive information about a Data Set (e.g., mission description, spacecraft description, instrument description), expressed in Object Description Language (ODL), which is suitable for loading into a PDS catalog.

**Data Product** – A labeled grouping of data resulting from a scientific observation, usually stored in one file. A product label identifies, describes, and defines the structure of the data. An example of a Data Product is a planetary image, a spectral table, or a time series table.

**Data Set –** A Data Set is a collection of Data Products from a single instrument that have a common data processing level, together with supporting documentation and ancillary files.

**Standard Data Product** – A Data Product generated in a predefined way using well-understood procedures, processed in "pipeline" fashion. Data Products that are generated in a non­standard way are sometimes called *special Data Products*.

# Introduction

## Content Overview

The Cassini Plasma Spectrometer (CAPS) aboard the Cassini spacecraft is an instrument comprised of three different sensors: the Electron Spectrometer (ELS), the Ion Mass Spectrometer (IMS), and the Ion Beam Spectrometer (IBS). The primary focus of CAPS’s mission is Saturn science, but data was taken at Earth and Jupiter as well as interplanetary space.

The CAPS instrument is a complex instrument that produces large amounts of data. We archive un-calibrated, calibrated, and higher order data files to the PDS.

CAPS is archiving three data sets: un-calibrated, calibrated, and higher-order. Each data set is archived on a separate volume. The un-calibrated data set is archived with some very basic calibration procedures. These procedures may be updated, but the higher order data volume and files contain the very latest in calibration information. There are several different types of data products in each data set. The ELS and IBS sensors each produce their own data product. The IMS sensor generates several different data products including Event Mode (EVN), two Time of Flight data products that are archived in the same file (TOF), a singles data product (SNG), a logicals data product (LOG), and an ion data product (ION). In addition, we have an actuator data product (ACT) and an ancillary data product (ANC). The calibrated data set is currently being defined, but will include calibrated files for the electron spectrometer and the ion neutral mass spectrometer. Full details of the contents of volume and individual descriptions of the file types will be included TBD (soon). Higher order data are derived quantities from the electron spectrometer and the IMS sensor singles and TOF data products. These products are electron and ion moments and spacecraft potential.

Most CAPS data products are collected on 32-second cycles (called A-cycles). IMS Time-of-Flight (TOF) data products are a collection of A-cycles (called B-cycles). Each B-cycle represents one-full time of flight – energy spectrum. The number of A-cycles per B-cycle varies depending upon the data rate of the instrument, due to data volume limitations. In version 4.0 (and later) of CAPS flight software, the IBS sensor data are collected on a fixed 8 A-cycle collection period (called a C-cycle). One goal with our archive format is for the differences in data rate and flight software version to be transparent to the end user.

The data products mentioned are briefly described in below, including the data set in which they are included and the maximum data volume of each different data type (per day). Each sensor’s data is written to a separate file, and the format of each file will be discussed in detail in section , and Table 20 through Table 28.

| Table : Spacecraft Science Data Products in CAPS Data Sets | | | |
| --- | --- | --- | --- |
| **Sensor** | **Data Set Type** | **Maximum (MB / Day)** | **Sensor Total (MB / Day)** |
| ELS | Un-calibrated | 103.821 | 106.321 |
| Calibrated | TBD |
| Higher Order (3DMOMT) | 0.4 |
| Higher Order (SCPOT) | 2.1 |
| IBS | Un-calibrated | 315.170 | 315.170 |
| IMS TOF | Un-calibrated | 1.32544 | 1.32544 |
| Calibrated | TBD |
| IMS ION | Un-calibrated | 381.541 | 381.541 |
| Calibrated | TBD |
| IMS SNG | Un-calibrated | 51.9104 | 51.9104 |
| Calibrated | TBD |
| ACT | Un-calibrated | 0.360489 | 0.360489 |
| ANC | Un-calibrated | 0.37594 | 0.37594 |
| IMS LOG | Un-calibrated | 46.7194 | 46.7194 |
| EVN | Un-calibrated | 12.198 | 12.198 |
| IMS SNG & IMS TOF | Higher Order (ION\_MOMT) | 0.2 | 0.2 |

## Scope

This specification applies to all archive volumes containing CAPS data products for the duration of its mission.

## Applicable Documents

*Planetary Science Data Dictionary Document*, August 28, 2002, Planetary Data System, JPL D-7116, Rev. E.

*Planetary Data System Data Preparation Workbook*, February 1995, JPL D-7669, Part 1, Version 3.1.

*Planetary Data System Standards Reference,* August 1, 2003, JPL D-7669, Part 2, Version 3.6.

*Cassini/Huygens Program Archive Plan for Science Data*, PD 699-068, JPL D-159576

Young, David T., et al., *Cassini Plasma Spectrometer Investigation*, *Space Science Reviews*, **114**, 1-112 (2004).

## Audience

This specification is intended for researchers and analysts who wish to understand the format and content of the CAPS PDS data product archive collection. Typically, these individuals would be software engineers, data analysts, or planetary scientists.

# Archive Volume Generation

## Data Production and Transfer Methods

The CAPS standard product archive collections are produced by the CAPS instrument team in cooperation with the PDS Planetary Plasma Interactions (PPI) Node at the University of California, Los Angeles (UCLA). The CAPS team is funded by NASA through the Cassini Project office and the PPI activities are funded by the NASA Planetary Data System.

The CAPS team has produced the individual data files and the associated detached PDS labels for each of the standard data products defined in section above. For the un-calibrated data, there are up to 4 files per product, per day. The files are split into 6 hour periods, with full B-cycles appearing in the file in which the B-cycle starts. This implies that a few A-cycles at the start of each file may be in the previous 6-hour block file. However, this implies multi-sensor analysis by assuring that all the data obtained at a given time is in the file with the same time stamp. The A and B cycle numbers are the same for all data products, i.e. if an A-cycle of ELS data is missing, the A-cycle numbers in the ELS file will skip the appropriate number. Additionally, if there are no A-cycles for a given time period then there is **not** a gap in the A-cycle number count.

Un-calibrated data files are flat, binary data files, with a fixed series of values repeated as many times as necessary. The files contain data taken at all rates during the period. If data are collapsed in elevation, counts are given for the lowest elevation of the collapsed sample and all other elevations contain fill values. The fill values as specified in the label files are different for the data products due to differences in maximum values. If the data are collapsed in energy or azimuth, this are indicated by the first and last energy step and azimuth values. This implies that an A-cycle of data contains a variable number of rows, depending on the data rate. The format of the data can be found in section , and Table 20 through Table 28.

Data are ftp’d to an agreed to location within the PDS ftp system. PPI assembles the data products into archive volumes so that each volume contains the interval of data from each data set in multiples of 5 day periods (or only 1 day if 5 days will not fit). The CAPS team delivers data to PDS/PPI on a quarterly basis.

Higher Order data consists of electron and ion moments, each in separate files. Each file has a corresponding detached label, which contains the format of the data. Additionally, a separate file is submitted for spacecraft potential that has been generated from the Cassini CAPS ELS sensor. Data is delivered in separate folders within the higher order directory. Higher Order data files are fixed length ASCII files. Electron moments and spacecraft potential are supplied at a 32 second cadence, which is the cadence of an instrument cycle (called an A-cycle). Ion moment data is supplied on a B-cycle cadence (either 256, 512, or 1024 seconds – predefined multiples of a single instrument cycle). The format of the higher order data can be found in section 5.3, and Table 29 through Table 31.

Calibrated data will consist of electron spectrometer and ion mass spectrometer files. Additional information regarding the volume and its contents will be supplied within TBD.

## Archive Volume Creation and Validation Methods

The archive validation procedure described in this section applies to volumes generated during all phases of the mission. PPI collects the data files and labels provided by the CAPS team onto archive volumes. Each archive volume contains all CAPS data available (either un-calibrated or higher order) for the time interval covered by the archive volume. Once all of the data files, labels, and ancillary data files are organized onto an archive volume, PPI adds all of the PDS required files (AAREADME, INDEX, ERRATA, etc.) and produces the physical media, which are then validated.

Data is validated using the PDS peer review process. The peer review panel consists of members of the instrument team, the PPI and Central Nodes of the PDS, and at least two outside scientists actively working in the field of magnetospheric physics, especially those working with low energy ion and electron measurements. The PDS personnel are responsible for validating that the archive volume(s) are fully compliant with PDS standards. The instrument team and outside science reviewers are responsible for verifying the content of the data set, the completeness of the documentation, and the usability of the data in its archive format. Because of the large volume of the CAPS data, the peer review panel seeks to validate the process by which the data products are produced rather than the data products themselves. This is accomplished in two phases. First, a specimen volume is created and manually reviewed for proper structure and completeness of documentation along with the current reference volume. Once the specimen volume is validated, PPI develops software to validate that subsequent data volumes comply with PDS standards. After the volume creation software is complete, a volume created by this process is reviewed again, this time considering all facets of volume usefulness. Any deficiencies in the archive volume are recorded as liens against the product by the review panel. After all liens placed against the product or the product generation software are resolved, automated production and validation can begin. Peer review is performed on both CAPS archive volumes.

All of the archive files contained on these volumes are verified through the use of the data by the instrument team. Archive un-calibrated data products are used on a daily basis to generate browse spectrograms. In addition, selected periods in all modes are examined in depth by the science team as part of science and research activities. If an error is found, the response will depend on the source of the error. If the error is in the automation software that produced the data product, the error will be fixed and the data product will be reproduced. If there is a correctable error in a data file, the file will be replaced and a new archive volume will be created. If an error in a data file is uncorrectable (i.e., an error in the downlink data file) the error will be described in the cumulative errata file that is included on each volume in the volume set.

## Labeling and Identification

Each CAPS standard data product archive volume bears a unique volume identifier (volume\_id) of the form COCAPS\_1nnn for CAPS un-calibrated data with calibration information, COCAPS\_2kkk for CAPS calibrated data, and COCAPS\_5mmm for CAPS higher order data where CO identifies the spacecraft (Cassini Orbiter), CAPS identifies the instrument, and kkkk, nnn, and mmm are sequential numbers assigned to each volume. The volume\_id is used as the label for the physical medium on which the data are stored.

CAPS PDS data set names will conform to the format: CASSINI ORBITER EARTH/JUP/SAT/SW CAPS UNCALIBRATED V<major version>.<minor version> for un-calibrated data. For calibrated data, the data set name will be CASSINI ORBITER EARTH/JUP/SAT/SW CAPS CALIBRATED V<major version>.<minor version>. For higher order data the data set name for ion moments will be CASSINI ORBITER SAT/SW CAPS DERIVED ION MOMENTS V<major version>.<minor version>, for electron moments it will be CASSINI ORBITER SAT/SW CAPS DERIVED ELECTRON MOMENTS V<major version>.<minor version>, and for spacecraft potential it will be CASSINI ORBITER SAT/SW CAPS DERIVED SC POTENTIAL V<major version>.<minor version>.

PDS data set identifiers (dsid) are abbreviated versions of the data set names formed according to the PDS formation rule for the DATA\_SET\_ID keyword (see Section 6 of the PDS Standards Reference). For example, the dsids for the 1.0 version of the CAPS data sets are CO-E/J/S/SW-CAPS-2-UNCALIBRATED-V1.0, CO-E/J/S/SW-CAPS-3-CALIBRATED-V1.0,

CO-S/SW-CAPS-5-DDR-ION-MOMENTS-V1.0,

CO-S/SW-CAPS-5-DDR-ELE-MOMENTS-V1.0,

and

CO-S/SW-CAPS-5-DDR-SC-POTENTIAL-V1.0.

|  |  |  |
| --- | --- | --- |
| Table 6: Relationship Between Data Sets, Standard Data Product Types, and Archive Volumes | | |
| **Data Set ID** | **Product Type** | **Product Volume Files** |
| CO-E/J/S/SW-2-UNCALIBRATED-V1.0 | ELS | ELS\_199923000\_U1.DAT |
| IBS | IBS\_199923000\_U1.DAT |
| IMS Ions (ION) | ION\_199923000\_U1.DAT |
| IMS Singles (SNG) | SNG\_199923000\_U1.DAT |
| IMS Logicals (LOG) | LOG\_199923000\_U1.DAT |
| IMS TOF (TOF) | TOF\_199923000\_U1.DAT |
| Actuator (ACT) | ACT\_199923000\_1.DAT |
| Ancillary (ANC) | ANC\_199923000\_U1.DAT |
| IMS Event Mode (EVN) | EVN\_199923000\_U1.DAT |
| CO-E/J/S/SW-3-CALIBRATED-V1.0 | ELS | TBD |
| IMS TOF | TBD |
| IMS Singles | TBD |
| TBD | TBD |
| CO-S/SW-CAPS-5-DDR-ELE-MOMENTS-V1.0 | ELS Electron Moments | ELS\_3DMOMT\_YYYYDOY\_00.TAB |
| CO-S/SW-CAPS-5-DDR-SC-POTENTIAL-V1.0 | ELS Spacecraft Potential | ELS\_SCPOT\_YYYYDOY\_00.TAB |
| CO-S/SW-CAPS-5-DDR-ION-MOMENTS-V1.0 | Singles Ion Moments | ION\_MOMT\_YYYYDOY\_01.TAB |

# Archive Volume Contents

This section describes the contents of the CAPS standard product archive collection volumes, including the file names, file contents, file types, and organizations responsible for providing the files. The complete directory structure is shown in Appendix A. All the ancillary files described herein appear on each CAPS archive volume, except where noted. Based on the type of archive volume, the DATA contents will be contain either un-calibrated data, calibrated data, or higher order data. All other directory contents will remain the same, though the higher order data volume will have the most up-to-date calibration documentation and will not contain the ancillary data.

## Root Directory Contents

The following files are contained in the root directory (for either volume), and are produced by the PPI Node at UCLA. With the exception of the hypertext file and its label, all of these files are required by the PDS Archive Volume organization standards.

| Table : Root Directory Contents | | |
| --- | --- | --- |
| **File Name** | **File Contents** | **Provided By** |
| AAREADME.TXT | This file completely describes the Volume organization and contents (PDS label attached). | PPI |
| AAREADME.HTM | Hypertext version of AAREADME.TXT (top level of HTML interface to the Archive Volume). | PPI |
| AAREADME.LBL | A PDS detached label that describes AAREADME.HTM. | PPI |
| ERRATA.TXT | A cumulative listing of comments and updates concerning all CAPS Standard Data Products on all CAPS Volumes in the Volume set published to date. | PPI |
| VOLDESC.CAT | A description of the contents of this Volume in a PDS format readable by both humans and computers. | PPI |

## INDEX Directory Contents

The following files are contained in the INDEX directory and are produced by the PDS PPI Node. The INDEX.TAB file contains a listing of all data products on the archive volume. In addition, there is a cumulative index file (CUMINDEX.TAB) file that lists all data products in the CAPS archive volume set to date. The index and index information (INDXINFO.TXT) files are required by the PDS volume standards. The index tables include both required and optional columns. The cumulative index file is also a PDS requirement; however, this file may not be reproduced on each data volume if its size grows so large as to affect where volume boundaries lie. An online and web accessible cumulative index file will be maintained at the PPI Node while archive volumes are being produced.

| Table : Index Directory Contents | | |
| --- | --- | --- |
| **File Name** | **File Contents** | **Provided By** |
| INDXINFO.TXT | A description of the contents of this directory | PPI |
| INDEX.TAB | A table listing all CAPS Data Products on this Volume | PPI |
| INDEX.LBL | A PDS detached label that describes INDEX.TAB | PPI |

## DOCUMENT Directory Contents

The document directory contains documentation that is considered to be either necessary or simply useful for users to understand the archive data set. These documents are not necessarily appropriate for inclusion in the PDS catalog. Documents may be included in multiple forms (ASCII, PDF, MS Word, HTML with image file pointers, etc.). PDS standards require that any documentation deemed required for use of the data be available in some ASCII format. HTML and PostScript are acceptable as ASCII formats in addition to plain text.

There is a separate directory for each document that is to be archived. Each of the document directories includes the document in hypertext (ASCII) and the document in another format (i.e. .DOC or .PDF). There is also a single label file that describes all the different formats of the included documents.

The following files are contained in the DOCUMENT directory and are produced or collected by the PPI Node.

|  |  |  |
| --- | --- | --- |
| Table : Document Directory Contents | | |
| **File Name** | **File Contents** | **Provided By** |
| DOCINFO.TXT | A description of the contents of this directory and all subdirectories. | PPI |
| CAPS\_SIS | Directory containing the CAPS archive SIS | CAPS |
| CAPS\_CALIB | Directory containing information regarding calibration | CAPS |
| Other Documents | Additional documents describing data processing, etc. | CAPS, PPI |
| Other Document labels | Detached PDS labels for any additional documents | CAPS, PPI |

The following files are contained in the DOCUMENT/CAPS\_SIS directory.

|  |  |  |
| --- | --- | --- |
| Table : Document/CAPS\_SIS Directory Contents | | |
| **File Name** | **File Contents** | **Provided By** |
| CAPS\_ARCHIVE\_SIS.HTM | The Archive Volume SIS (this document) as hypertext | CAPS, PPI |
| CAPS\_ARCHIVE\_SIS.DOC | The Archive Volume SIS (this document) in Microsoft Word format | CAPS |
| CAPS\_ARCHIVE\_SIS.ASC | The Archive Volume SIS (this document) in ASCII format | CAPS, PPI |
| CAPS\_ARCHIVE\_SIS.LBL | A PDS detached label that describes VOLSIS.ASC, VOLSIS.HTM and VOLSIS.DOC. | CAPS, PPI |

The following files are contained in the DOCUMENT/CAPS\_CALIB directory.

|  |  |  |
| --- | --- | --- |
| Table : Document/CAPS\_CALIB Directory Contents | | |
| **File Name** | **File Contents** | **Provided By** |
| CAPS\_BASIC\_CALIB\_PROCEDURES.HTM | The CAPS Basic Calibration Procedures document as hypertext | CAPS, PPI |
| CAPS\_BASIC\_CALIB\_PROCEDURES.DOC | The CAPS Basic Calibration Procedures document in Microsoft Word format | CAPS |
| CAPS\_BASIC\_CALIB\_PROCEDURES.ASC | The CAPS Basic Calibration Procedures document in ASCII format | CAPS, PPI |
| CAPS\_BASIC\_CALIB\_PROCEDURES.LBL | A PDS detached label that describes VOLSIS.ASC, VOLSIS.HTM and VOLSIS.DOC. | CAPS, PPI |

## CATALOG Directory Contents

The completed PDS templates in the CATALOG directory provide a top-level understanding of the Cassini/CAPS mission and its data products. The information necessary to create the files is provided by the CAPS team and formatted into standard template formats by the PPI Node. The files in this directory are coordinated with PDS data engineers at both the PPI and the PDS Central Nodes.

| Table : Catalog Directory Contents | | |
| --- | --- | --- |
| **File Name** | **File Contents** | **Provided By** |
| CATINFO.TXT | A description of the contents of this directory | PPI |
| CO\_CAPS\_UNCALIBRATED\_DS.CAT | PDS Data Set catalog description of all the CAPS un-calibrated level 2 data files | CAPS |
| CO\_CAPS\_CALIBRATED\_DS.CAT | PDS Data Set catalog description of all the CAPS calibrated level 3 data files | CAPS |
| CO\_CAPS\_DERIVED\_DS.CAT | PDS Data Set catalog description of all the CAPS higher order level 5 data files | CAPS |
| INSTHOST.CAT | PDS instrument host (spacecraft) catalog description of the Cassini spacecraft | Cassini Project |
| CO\_CAPS\_INST.CAT | PDS instrument catalog description of the CAPS instrument | CAPS |
| MISSION.CAT | PDS mission catalog description of the Cassini mission | Cassini Project |
| CO\_CAPS\_PERS.CAT | PDS personnel catalog description of CAPS Team members and other persons involved with generation of CAPS Data Products | CAPS |
| CO\_CAPS\_REF.CAT | CAPS-related references mentioned in other \*.CAT files | CAPS |
| PROJREF.CAT | Mission-related references mentioned in other \*.CAT files | Cassini Project |

## DATA (Standard Products) Directory Contents and Naming Conventions

The DATA directory contains the following sub-directories, based upon the archive volume: UNCALIBRATED, CALIBRATED, or HIGHERORDER. For un-calibrated data products, there are sub-directories of the form YYYYDDD. Each YYYYDDD subdirectory contains 1 day of data, for all data types. For higher order data products, the HIGHERORDER directory contains three (3) subdirectories, one for each type of data: SCPOT, ELEMOMT, and IONMOMT. In each of these subdirectories, data are broken down into YYYY directories. For calibrated data products, the directory structure is still TBD.

### Required Files

The DATA directory contains a file named DATAINFO.TXT that is an ASCII text description of the directory and subdirectory contents. Every file in the DATA path of an Archive Volume must be described by a PDS label, hence all files in the DATA directory have external (detached) labels. Detached PDS label files have the same root name as the file they describe but have the suffix ".LBL". In the UNCALIBRATED/YYYYDDD subdirectories, an external format file (.FMT) is included for each data type. In the HIGHERORDER/YYYY subdirectories, the format information is contained within the detached label file itself. In the CALIBRATED subdirectories, it has not yet been decided if there will be an attached or detached labels.

### File Naming Conventions

Un-calibrated data products have names of the following form:

<sensor>\_YYYYDDDHH\_<DataType><V>.DAT

where

YYYYDDDHH is the start year, day of year, and hour of the data

sensor is the 3 letter code chosen from the following list:

ELS, IBS, ION, SNG, TOF, LOG, ACT, EVN, and ANC

DataType is a one (1) letter descriptor for the type of data, where C = calibrated and U = un-calibrated.

V is the data version number of the data product.

HH has valid values of 00, 06, 12, and 18, as data files are 6 hours in duration.

There is one exception to the un-calibrated data naming convention listed above. Given that the actuator (ACT) data product is both calibrated and un-calibrated, the <DataType> identifier is dropped. Actuator files conform to the following naming convention: ACT\_YYYYDDDHHH\_<V>.DAT.

Not every combination of sensor and DataType is a valid filename. Valid combinations can be determined by using the information contained in Table 5.

When data is updated within a specific type of format the data version number is incremented. When more than nine versions are required, the characters a-z are used to represent further versions.

Higher order data files have the following form:

<ProductType>\_YYYYDOY\_<vv>.TAB

where

YYYYDOY is the start year and day of year of the data

ProductType is ELS\_3DMOMT, ELS\_SCPOT, or ION\_MOMT, and

vv is the version number.

The naming convention for calibrated data products is still TBD.

### DATA/UNCALIBRATED/YYYYDDD Directory Contents

Un-calibrated data files starting on YYYYDDD from all sensors are stored in the DATA/UNCALIBRATED/YYYYDDD directory. Each directory will contain one day of data. Each sensor can have up to 4 files for the day and each sensor file can contain up to 6 hours of data. The file naming convention is described in Section . Every data file in the directory has a detached PDS label with the same root name as the file they describe but have the suffix “.LBL”. In addition, there is a brief ASCII text file (INFO.TXT) that describes the DATA/UNCALIBRATED/YYYYDDD directory contents, which are listed in . In addition, each YYYYDDD directory has its own set of format files. NOTE: Files are only be available if data from of the appropriate type (during the 6 hour block in question) is available. Also, we do not take very much event mode data (EVN), so these files are not available very frequently.

|  |  |  |
| --- | --- | --- |
| Table : YYYYDDD UNCALIBRATED Data Directory Contents | | |
| **File Name** | **File Contents** | **Provided By** |
| DATAINFO.TXT | Brief description of directory contents and naming conventions. | PPI |
| ELS\*.DAT | ELS sensor data files. | CAPS |
| ELS\*.LBL | PDS label for ELS sensor files of same base name. | CAPS |
| IBS\*.DAT | IBS sensor data files. | CAPS |
| IBS\*.LBL | PDS label for IBS sensor files of same base name. | CAPS |
| SNG\*.DAT | IMS Singles (SNG) sensor data files. | CAPS |
| SNG\*.LBL | PDS label for SNG files of same base name. | CAPS |
| LOG\*.DAT | IMS Logicals (LOG) data files. | CAPS |
| LOG\*.LBL | PDS label for LOG files of same base name. | CAPS |
| ION\*.DAT | IMS Ions (ION) data files. | CAPS |
| ION\*.LBL | PDS label for ION files of same base name. | CAPS |
| TOF\*.DAT | IMS Time of Flight (TOF) data files. | CAPS |
| TOF\*.LBL | PDS label for TOF files of same base name. | CAPS |
| ACT\*.DAT | Actuator (ACT) data files. | CAPS |
| ACT\*.LBL | PDS label for ACT files of same base name. | CAPS |
| ANC\*.DAT | Ancillary (ANC) data files. | CAPS |
| ANC\*.LBL | PDS label for ANC files of same base name. | CAPS |
| EVN\*.DAT | Event Mode (EVN) data files. | CAPS |
| EVN\*.LBL | PDS label for EVN files of same base name. | CAPS |
| ELS\_U3.FMT | PDS format file containing the data file structure for the ELS file format. | CAPS |
| IBS\_U3.FMT | PDS format file containing the data file structure for the IBS file format. | CAPS |
| SNG\_U3.FMT | PDS format file containing the data file structure for the SNG file format. | CAPS |
| LOG\_U3.FMT | PDS format file containing the data file structure for the LOG file format. | CAPS |
| ION\_U3.FMT | PDS format file containing the data file structure for the ION file format. | CAPS |
| TOF\_U3.FMT | PDS format file containing the data file structure for the TOF file format. | CAPS |
| ACT\_3.FMT | PDS format file containing the data file structure for the ACT file format. | CAPS |
| ANC\_U3.FMT | PDS format file containing the data file structure for the ANC file format. | CAPS |
| EVN\_U3.FMT | PDS format file containing the data file structure for the EVN file format. | CAPS |

### DATA/HIGHERORDER/SCPOT/YYYY Directory Contents

Higher order data files for spacecraft potential starting within the year, YYYY, are stored in the DATA/HIGHERORDER/SCPOT/YYYY directory. Each directory contains one year of data. Each type of higher order file can have only 1 file for a given day and can contain up to 24 hours of data. The file naming convention is described in Section . Every data file in the directory has a detached PDS label with the same root name as the file they describe but have the suffix “.LBL”. The detached label file includes the format of the file. In addition, there is a brief ASCII text file (DATAINFO.TXT) that describes the DATA/HIGHERORDER/SCPOT/YYYY directory contents, which are briefly listed in Table 14.

|  |  |  |
| --- | --- | --- |
| Table : HIGHERORDER/SCPOT/YYYY Data Directory Contents | | |
| **File Name** | **File Contents** | **Provided By** |
| DATAINFO.TXT | Brief description of directory contents and naming conventions. | PPI |
| ELS\_SCPOT\*.TAB | ELS spacecraft potential files. | CAPS |
| ELS\_SCPOT\*.LBL | PDS label for ELS spacecraft potential files of same base name. | CAPS |

### DATA/HIGHERORDER/ELEMOMT/YYYY Directory Contents

Higher order data files for ELS moments starting within the year, YYYY, are stored in the DATA/HIGHERORDER/ELEMOMT/YYYY directory. Each directory contains one year of data. Each type of higher order file can have only 1 file for a given day and can contain up to 24 hours of data. The file naming convention is described in Section . Every data file in the directory has a detached PDS label with the same root name as the file they describe but have the suffix “.LBL”. The detached label file includes the format of the file. In addition, there is a brief ASCII text file (INFO.TXT) that describes the DATA/HIGHERORDER/ELEMOMT/YYYY directory contents, which are briefly listed in Table 15.

|  |  |  |
| --- | --- | --- |
| Table : HIGHERORDER/ELEMOMT/YYYY Data Directory Contents | | |
| **File Name** | **File Contents** | **Provided By** |
| DATAINFO.TXT | Brief description of directory contents and naming conventions. | PPI |
| ELS\_3DMOMT\*.TAB | ELS Moments files. | CAPS |
| ELS\_3DMOMT\*.LBL | PDS label for ELS Moments files of same base name. | CAPS |

### DATA/HIGHERORDER/IONMOMT/YYYY Directory Contents

Higher order data files for ion moments starting within the year, YYYY, are stored in the DATA/HIGHERORDER/IONMOMT/YYYY directory. Each directory contains one year of data. Each type of higher order file can have only 1 file for a given day and can contain up to 24 hours of data. The file naming convention is described in Section . Every data file in the directory has a detached PDS label with the same root name as the file they describe but have the suffix “.LBL”. The detached label file includes the format of the file. In addition, there is a brief ASCII text file (INFO.TXT) that describes the DATA/HIGHERORDER/IONMOMT/YYYY directory contents, which are briefly listed in Table 16.

|  |  |  |
| --- | --- | --- |
| Table : HIGHERORDER/IONMOMT/YYYY Data Directory Contents | | |
| **File Name** | **File Contents** | **Provided By** |
| DATAINFO.TXT | Brief description of directory contents and naming conventions. | PPI |
| ION\_MOMT\*.TAB | IMS Singles ion moment files. | CAPS |
| ION\_MOMT\*.LBL | PDS label for IMS Singles ion moment files of same base name. | CAPS |

### DATA/CALIBRATED Directory Contents

The DATA/CALIBRATED directory contents are still TBD, but will include calibrated data products, their label files, and a DATAINFO.TXT file.

|  |  |  |
| --- | --- | --- |
| Table 17: DATA/CALIBRATED Directory Contents | | |
| **File Name** | **File Contents** | **Provided By** |
| DATAINFO.TXT | Brief description of directory contents and naming conventions. | PPI |
| \*.DAT or \*.TAB | Calibrated Data Products. | CAPS |
| \*.LBL | Label files for Calibrated Data Products. | CAPS |

## CALIB Directory Contents

Given that we are archiving data to 2 different volumes, the contents of the CALIB directory include the following information for the un-calibrated archive volume. Please note that the documentation for CAPS basic calibration procedures can be found in the DOCUMENT/CAPS\_CALIB directory.

|  |  |  |
| --- | --- | --- |
| Table : CALIB Directory Contents | | |
| **File Name** | **File Contents** | **Provided By** |
| CALINFO.TXT | A description of the contents of this directory and all subdirectories. | PPI |
| SAMPLE\_DATA | A directory that contains a sample input data file, additional files needed for the calibration process, and a sample output file. | CAPS |
| ELS\_ENERGY\_ARRAY.TAB | The ELS Sweep Table calibration data | CAPS |
| ELS\_ENERGY\_ARRAY.LBL | A PDS detached label that describes ELS\_ENERGY\_ARRAY.TAB | CAPS |
| ELS\_GEOM\_FACTOR.TAB | The ELS Geometric Factor matrix (see label for full description) | CAPS |
| ELS\_GEOM\_FACTOR.LBL | A PDS detached label that describes ELS\_GEOM\_FACTOR.TAB | CAPS |
| ELS\_SWEEP\_TABLE\_ALL\_VER.TAB | The ELS Sweep Table for all CAPS data | CAPS |
| ELS\_SWEEP\_TABLE\_ALL\_VER.LBL | A PDS detached label that describes ELS\_SWEEP\_TABLE\_ALL\_VER.TAB | CAPS |
| IBS\_SWEEP\_V0\_V1\_V2.TAB | The IBS Sweep Table for versions 0, 1, and 2 of the CAPS data | CAPS |
| IBS\_SWEEP\_V0\_V1\_V2.LBL | A PDS detached label that describes IBS\_SWEEP\_V0\_V1\_V2.TAB | CAPS |
| IBS\_SWEEP\_V3.TAB | The IBS Sweep Table for version 3 of the CAPS data | CAPS |
| IBS\_SWEEP\_V3.LBL | A PDS detached label that describes IBS\_SWEEP\_V3.TAB | CAPS |
| IMS\_SWEEP\_TABLE\_0\_V0\_V1\_V2.TAB | The IMS Sweep Table number 0 for versions 0, 1, and 2 of the CAPS data | CAPS |
| IMS\_SWEEP\_TABLE\_0\_V0\_V1\_V2.LBL | A PDS detached label that describes IMS\_SWEEP\_TABLE\_0\_V0\_V1\_V 2.TAB | CAPS |
| IMS\_SWEEP\_TABLE\_16.TAB | The IMS Sweep Table number 16 for all versions of CAPS data. The sweep table has been used for calibrations. | CAPS |
| IMS\_SWEEP\_TABLE\_16.LBL | A PDS detached label that describes IMS\_SWEEP\_TABLE\_16.TAB | CAPS |
| IMS\_SWEEP\_TABLE\_15.TAB | The IMS Sweep Table number 15 for all versions of CAPS data. This sweep table is used only during some Titan flyby periods (less than 1400km) | CAPS |
| IMS\_SWEEP\_TABLE\_15.LBL | A PDS detached label that describes IMS\_SWEEP\_TABLE\_15.TAB | CAPS |
| IMS\_SWEEP\_TABLE\_255.TAB | The IMS Sweep Table number 255 for all versions of CAPS data. This sweep table was used only once, and has been replaced by #15. | CAPS |
| IMS\_SWEEP\_TABLE\_255.LBL | A PDS detached label that describes IMS\_SWEEP\_TABLE\_255.TAB | CAPS |
| ION\_AND\_GROUPTABLE\_NAMING.DOC | Contains the definitions of the group table naming and ion naming in Microsoft Word format | CAPS |
| ION\_AND\_GROUPTABLE\_NAMING.PDF | Contains the definitions of the group table naming and ion naming in Adobe Acrobat format | CAPS |
| ION\_AND\_GROUPTABLE\_NAMING.LBL | A PDS detached label that describes the documents ION\_AND\_GROUPTABLE\_NAMING.\* | CAPS |

### CALIB/SAMPLE\_DATA Directory Contents

This directory contains a sample input file, any additional files necessary for the calibration process, and a sample output file. The goal of files in this directory is to provide data users an example against which to test their calibration routines, which were developed according to the CAPS BASIC CALIB PROCEDURES document (which can be found in DOCUMENT/CAPS\_CALIB). Please note that the output includes first order calibration, and not the second order corrections that are currently being worked.

## EXTRAS Directory Contents

The EXTRAS directory contains an EXTRINFO.TXT file that contains a description of the contents of this directory. Additional files include example software to read the CAPS un-calibrated data files, open the necessary calibration files, calibrate the data, and write them out. Example software for generating the CAPS browse spectrograms is also provided.

## BROWSE Directory Contents

The BROWSE directory contains browse spectrogram plots that are not intended for publication. Browse spectrograms starting on YYYYDDD from all sensors are stored in the BROWSE/YYYYDDD directory. Each directory contains one day of data. Each sensor can have up to 4 spectrograms for the day and can contain up to 6 hours of data. The file naming convention is described in Section , with a .PNG extension to specify the file format. Every data file in the directory has a detached PDS label with the same root name as the file they describe but have the suffix “.LBL”. In addition, there is a brief ASCII text file (INFO.TXT) that describes the BROWSE/YYYYDDD directory contents, which are listed in Table 19: YYYYDDD BROWSE Directory Contents. NOTE: Files are only available if data from the appropriate type (during the 6 hour block in question) is available. We do not plot ancillary data.

|  |  |  |
| --- | --- | --- |
| Table : YYYYDDD BROWSE Directory Contents | | |
| **File Name** | **File Contents** | **Provided By** |
| DATAINFO.TXT | Brief description of directory contents and naming conventions. | PPI |
| ACT\*.PNG | Actuator plot in PNG format | CAPS |
| ACT\*.LBL | PDS label for actuator PNG formatted file of same base name | PPI |
| ELS\*.PNG | ELS plot in PNG format | CAPS |
| ELS\*.LBL | PDS label for ELS PNG formatted file of same base name | PPI |
| IBS\*.PNG | IBS plots in PNG format | CAPS |
| IBS\*.LBL | PDS label for IBS PNG formatted file of same base name | PPI |
| ION\*.PNG | IMS ION plots in PNG format | CAPS |
| ION\*.LBL | PDS label for IMS ION PNG formatted file of same base name | PPI |
| LOG\*.PNG | IMS logicals plot in PNG format | CAPS |
| LOG\*.LBL | PDS label for IMS Logicals PNG formatted file of same base name | PPI |
| SNG\*.PNG | IMS singles plot in PNG format | CAPS |
| SNG\*.LBL | PDS label for IMS Singles PNG formatted file of same base name | PPI |
| TOF\*.PNG | IMS TOF plot in PNG format | CAPS |
| TOF\*.LBL | PDS label for IMS TOF PNG formatted file of same base name | PPI |

Since we will archive our calibrated files on a separate volume, the UNCALIBRATED volume does not contain a DATA/CALIBRATED directory. When ready, the calibration data will be available in the DATA/CALIBRATED directory. On the calibrated archive volume, the CALIB directory contains files that are used in the calibration process. The files include only text files and tables. Any other calibration files are included in the DOCUMENT/CAPS\_CALIB directory. Contents are still TBD and will be specified under Section 4.5.7 when the calibration volume is ready.

# Archive Volume Format

This section describes the format of CAPS standard product archive volumes. Data that comprise the CAPS standard product archives are formatted in accordance with Planetary Data System specifications [Planetary Science Data Dictionary, 2002; PDS Data Preparation Workbook, 1995; PDS Standards Reference, 2002].

## File Formats

The following section describes file formats for the kinds of files contained on Archive Volumes. For more information, see the PDS Standards Reference.

### Document File Formats

Document files with the .TXT suffix exist in all directories. They are ASCII files with embedded PDS labels. All document files contain variable-length, 80-byte maximum records, with a carriage return character (ASCII 13) in the 79th byte and a line feed character (ASCII 10) in the 80th byte. This allows the files to be read by the MacOS, DOS, Windows, UNIX, OS2, and VMS operating systems.

However, the documents in the reference volume contain formatting and figures that cannot be rendered as pure ASCII text. These documents are provided in formats that support graphics, such as HTML, MS Word, PDF, etc.  The PDS requirement that all documentation critical to the understanding of the data set be provided in ASCII text form is met by the inclusion of HTML formatted documents.

### Catalog File Formats

Catalog files (suffix .CAT) exist in the Root and Catalog directories. They are formatted in an object-oriented structure consisting of sets of 'keyword = value' declarations. All files are ASCII and conform to the same structure standards (line length, line terminator) as the PDS label files described in the previous section.

### PDS Label File Formats

All data files in the CAPS Standard Product Archive Collection have PDS labels [Planetary Science Data Dictionary; PDS Standards Reference]. These labels are all detached from the data files (same file name prefix, .LBL suffix).

A PDS label, whether embedded or detached from its associated file, provides descriptive information about the associated file. The PDS label is an object-oriented structure consisting of sets of 'keyword = value' declarations. The object that the label refers to (e.g., TABLE, STRUCTURE, etc.) is denoted by a statement of the form:

^object = location

in which the carat character (^, also called a pointer in this context) indicates where to find the object. In a PDS label, the location denotes the name of the file containing the object, along with the starting record or byte number, if there is more than one object in the file. For example:

^HEADER = ("98118.TAB",1)

^TABLE = ("98118.TAB",1025 <BYTES>)

indicates that the HEADER object begins at record 1 and that the TABLE object begins at byte 1025 of the file 98118.TAB. The file 98118.TAB must be located in the same directory as the detached label file.

Below is a list of the possible formats for the ^object definition in labels in this product.

^object = n

^object = n <BYTES>

^object = "filename.ext"

^object = ("filename.ext", n)

^object = ("filename.ext", n <BYTES>)

where

**n** is the starting record or byte offset of the object, counting from the beginning of the file (record 1,  
byte 1),

**<BYTES>** indicates that the number given is in units of bytes (the default is records),

**filename** is the up-to-8-character, alphanumeric upper‑case file name,

**ext** is the up-to-3-character upper‑case file extension.

All CAPS detached labels conform to the requirement of less than 80-byte per line, including the carriage return character (ASCII 13) and the line feed character (ASCII 10). The RECORD\_TYPE of all the labels is STREAM.

### DATA/UNCALIBRATED File Formats – Binary Tables

All of the un-calibrated data files for CAPS are binary tables of data (.DAT suffix). Data files can be found in the YYYYDDD directories, which are located in DATA/UNCALIBRATED. Missing data are filled with appropriate (and documented) fill values. The table format for each sensor is described by a detached PDS label of the same base name as the file, but with an .LBL extension. A description of the data file contents and structure for the standard data set data products can be found Section 5.2. The format for the detached labels and format files can be found in Appendix B. PDS Labels & Format Files for Standard UNCALIBRATED Data Products.

### DATA/HIGHERORDER File Formats – Fixed Field ASCII

All of the HIGHERORDER data files for CAPS are fixed-field ASCII files with a .TAB suffix. Data files can be found in the YYYY directories, which are located in DATA/HIGHERORDER/ELEMOMT, DATA/HIGHERORDER/IONMOMT, or DATA/HIGHERODRER/SCPPT. Missing data are filled with appropriate (and documented) fill values. The table format for each higher order product is described by a detached PDS label of the same base name as the file, but with an .LBL extension. The format file for each type of higher order product is included in the detached label. A description of the data file contents and structure for the standard data set data products can be found in Section 5.3. The format for the detached label and format file can be found in Appendix C. PDS Labels & Format Files for Standard HIGHERORDER Data Products.

## CAPS Standard UNCALIBRATED Data Product Descriptions

The following sections describe the content and structure of each of the standard data products within the UNCALIBRATED level 2 CAPS data set.

### CAPS ELS Data Product Format

The data product format for ELS is listed in below. The fill value for ELS data is 65535 (hex value FFFF).

| Table : CAPS ELS UNCALIBRATED Data File Contents and Structure | | | | |
| --- | --- | --- | --- | --- |
| **Column Name** | **Type** | **Length (bytes)** | **Range** | **Description** |
| B cycle number | Unsigned Integer | 2 | [1,340] | B cycle number from the start of day, a value of 65535 indicates no B-cycle data is available |
| A cycle number | Unsigned Integer | 2 | [1,2732] | A cycle number from the start of day.  Fill Value: 65535 |
| Time | Float | 8 | [-7.1x107, 1.5x109] | Start time of A cycle, sec. from J2000 (barycentric dynamic time). Fill Value: 10x109 |
| Telemetry mode | Unsigned Integer | 1 | [1,136] | Logical telemetry rate and mode:  1 = 250bps, 2 = 500bps, 4 = 1kbps, 8 = 2kbps, 16 = 4kbps, 32 = 8kbps, 64 = 16kbps, 130 = 500bps solar wind, 132 = 1 kbps solar wind, 136 = 2kbps solar wind. Fill Value: 255 |
| Collapse flag | Unsigned Integer | 1 | [0,131] | Collapse flag indicates collapse by average (0), sum (1), average with in-flight dead-time correction (2), sum with in-flight dead-time correction (3), or snapshot portion (4). For snapshot, full collapse information is gained by adding to 4 (so snapshot portion can be 4, 5, 6, or 7 depending upon the collapse). If the most significant bit is 1 (giving a starting value of 128), it will indicate no HK was available. Fill Value: 255 |
| Offset time | Unsigned Integer | 2 | [0,32000] | Milliseconds from start of A cycle. Fill Value: 65535 |
| First Energy Step | Unsigned Integer | 2 | [1,63] | Min energy step in collapsed data  Fill Value: 65535 |
| Last Energy Step | Unsigned Integer | 2 | [1,63] | Max energy step in collapsed data  Fill Value: 65535 |
| First Azimuth Value | Unsigned Integer | 2 | [1,16] | Min azimuth value in collapsed data  Fill Value: 65535 |
| Last Azimuth Value | Unsigned Integer | 2 | [1,16] | Max azimuth value in collapsed data  Fill Value: 65535 |
| Data, Elevation 1 | Unsigned Integer | 2 | [0,65504] | Counts in elevation 1: Fill: 65535 |
| Data, Elevation 2 | Unsigned Integer | 2 | [0,65504] | Counts in elevation 2: Fill: 65535 |
| Data, Elevation 3 | Unsigned Integer | 2 | [0,65504] | Counts in elevation 3: Fill: 65535 |
| Data, Elevation 4 | Unsigned Integer | 2 | [0,65504] | Counts in elevation 4: Fill: 65535 |
| Data, Elevation 5 | Unsigned Integer | 2 | [0,65504] | Counts in elevation 5: Fill: 65535 |
| Data, Elevation 6 | Unsigned Integer | 2 | [0,65504] | Counts in elevation 6: Fill: 65535 |
| Data, Elevation 7 | Unsigned Integer | 2 | [0,65504] | Counts in elevation 7: Fill: 65535 |
| Data, Elevation 8 | Unsigned Integer | 2 | [0,65504] | Counts in elevation 8: Fill: 65535 |

### CAPS IBS Data Product Format

The data product format for CAPS IBS is listed in below. The fill value for IBS data is 65535 (hex value FFFF).

| Table : CAPS IBS UNCALIBRATED Data File Contents and Structure | | | | |
| --- | --- | --- | --- | --- |
| **Column Name** | **Type** | **Length (bytes)** | **Range** | **Description** |
| B cycle number | Unsigned Integer | 2 | [1,340] | B cycle number from start of day, a value of 65535 indicates no B-cycle data is available |
| A cycle number | Unsigned Integer | 2 | [1,2732] | A cycle number from the start of day.  Fill: 65535 |
| Time | Float | 8 | [-7.1x107, 1.5x109] | Start time of C cycle, sec. from J2000 (barycentric dynamic time).  Fill: 10x109 |
| Telemetry mode | Unsigned Integer | 1 | [1,136] | Logical telemetry rate and mode:  1 = 250bps, 2 = 500bps, 4 = 1kbps, 8 = 2kbps, 16 = 4kbps, 32 = 8kbps, 64 = 16kbps, 130 = 500bps solar wind, 132 = 1 kbps solar wind, 136 = 2kbps solar wind. Fill: 255 |
| IBS mode/submode | Unsigned Integer | 1 | [0,254] | IBS mode and submode flag:  0 = Standard Sweep Collapse, 1 = Standard Sweep Snapshot, 2 = Solar Wind Search, 3 = Solar Wind Track, 4 = Magnetosphere Search, 5 = Magnetosphere Survey, 6 = Calibration Mode, 7-255 = spare.  Fill: 255 |
| Offset time | Unsigned Integer | 4 | [1,256000] | Milliseconds from start of C cycle  Fill: 400000 |
| First Energy Step | Unsigned Integer | 2 | [1,852] | Min energy step in collapsed data (index into the energy table)  Fill: 65535 |
| Last Energy Step | Unsigned Integer | 2 | [1,852] | Max energy step in collapsed data (index into the energy table)  Fill: 65535 |
| First Azimuth Value | Unsigned Integer | 2 | [1,128] | Min azimuth value in collapsed data  Fill: 65535 |
| Last Azimuth Value | Unsigned Integer | 2 | [1,128] | Max azimuth value in collapsed data  Fill: 65535 |
| Data, Fan 1 | Unsigned Integer | 2 | [1,65504] | Counts in fan 1. Fill: 65535 |
| Data, Fan 2 | Unsigned Integer | 2 | [1,65504] | Counts in fan 2. Fill: 65535 |
| Data, Fan 3 | Unsigned Integer | 2 | [1,65504] | Counts in fan 3. Fill: 65535 |

### CAPS IMS ION Data Product Format

The data product format for CAPS IMS ION is listed in below. The fill value for IMS Ion data is 28671 (hex value 6FFF).

| Table : CAPS UNCALIBRATED IMS ION Data File Contents and Structure | | | | |
| --- | --- | --- | --- | --- |
| **Column Name** | **Type** | **Length (bytes)** | **Range** | **Description** |
| B cycle number | Unsigned Integer | 2 | [1,340] | B cycle number from start of day, a value of 65535 indicates no B-cycle data is available |
| A cycle number | Unsigned Integer | 2 | [1,2732] | A cycle number from the start of day, a value of 65535 indicates that no A-cycle header information was available |
| Time | Float | 8 | [-7.1x107, 1.5x109] | Start time of A cycle, sec. from J2000 (barycentric dynamic time)  Fill: 10x109 |
| Telemetry mode | Unsigned Integer | 1 | [1,136] | Logical telemetry rate and mode:  1 = 250bps, 2 = 500bps, 4 = 1kbps, 8 = 2kbps, 16 = 4kbps, 32 = 8kbps, 64 = 16kbps, 130 = 500bps solar wind, 132 = 1 kbps solar wind, 136 = 2kbps solar wind. Fill: 255 |
| Spare | Unsigned Integer | 1 | 0 | Spare bits to keep on even byte boundaries. Fill: 0 |
| Offset time | Unsigned Integer | 2 | [1,32000] | Milliseconds from start of A cycle  Fill: 65535 |
| First Energy Step | Unsigned Integer | 2 | [1,63] | Min energy step in collapsed data  Fill: 65535 |
| Last Energy Step | Unsigned Integer | 2 | [1,63] | Max energy step in collapsed data  Fill: 65535 |
| First Azimuth Value | Unsigned Integer | 2 | [1,8] | Min azimuth value in collapsed data  Fill: 65535 |
| Last Azimuth Value | Unsigned Integer | 2 | [1,8] | Max azimuth value in collapsed data  Fill: 65535 |
| Sam Ion number | Unsigned Integer | 2 | [0,65534] | SAM ion number[[1]](#footnote-1). Fill: 65535 |
| Data, Elevation 1 | Integer | 2 | [-32,27650] | Counts in elevation 1 (\*\*):Fill 28671 |
| Data, Elevation 2 | Integer | 2 | [-32,27650] | Counts in elevation 2 (\*\*):Fill 28671 |
| Data, Elevation 3 | Integer | 2 | [-32,27650] | Counts in elevation 3 (\*\*):Fill 28671 |
| Data, Elevation 4 | Integer | 2 | [-32,27650] | Counts in elevation 4 (\*\*):Fill 28671 |
| Data, Elevation 5 | Integer | 2 | [-32,27650] | Counts in elevation 5 (\*\*):Fill 28671 |
| Data, Elevation 6 | Integer | 2 | [-32,27650] | Counts in elevation 6 (\*\*):Fill 28671 |
| Data, Elevation 7 | Integer | 2 | [-32,27650] | Counts in elevation 7 (\*\*):Fill 28671 |
| Data, Elevation 8 | Integer | 2 | [-32,27650] | Counts in elevation 8 (\*\*):Fill 28671 |

(\*\*): Note that due to on-board spacecraft de-convolution routines used to estimate the number of counts from a particular species, a combination of low counts and background noise can cause the de-convolution routine to give negative numbers.

### CAPS IMS SNG Data Product Format

The data product format for CAPS IMS Singles (SNG) is listed in below. The fill value for Singles data is 65535 (hex value FFFF).

| Table : CAPS UNCALIBRATED IMS Singles Data File Contents and Structure | | | | |
| --- | --- | --- | --- | --- |
| **Column Name** | **Type** | **Length (bytes)** | **Range** | **Description** |
| B cycle number | Unsigned Integer | 2 | [1,340] | B cycle number from the start of day, a value of 65535 indicates no B-cycle data is available |
| A cycle number | Unsigned Integer | 2 | [1,2732] | A cycle number from the start of day, a value of 65535 indicates that no A-cycle header information was available |
| Time | Float | 8 | [-7.1x107, 1.5x109] | Start time of A cycle, sec. from J2000 (barycentric dynamic time)  Fill: 10x109 |
| Telemetry mode | Unsigned Integer | 1 | [1,136] | Logical telemetry rate and mode:  1 = 250bps, 2 = 500bps, 4 = 1kbps, 8 = 2kbps, 16 = 4kbps, 32 = 8kbps, 64 = 16kbps, 130 = 500bps solar wind, 132 = 1 kbps solar wind, 136 = 2kbps solar wind. Fill: 255 |
| Spare | Unsigned Integer | 1 | 0 | Spare byte to have even byte boundaries. Fill: 0 |
| Offset time | Unsigned Integer | 2 | [1,32000] | Milliseconds from start of A cycle  Fill: 65535 |
| First Energy Step | Unsigned Integer | 2 | [1,63] | Min energy step in collapsed data  Fill: 65535 |
| Last Energy Step | Unsigned Integer | 2 | [1,63] | Max energy step in collapsed data  Fill: 65535 |
| First Azimuth Value | Unsigned Integer | 2 | [1,8] | Min azimuth value in collapsed data  Fill: 65535 |
| Last Azimuth Value | Unsigned Integer | 2 | [1,8] | Max azimuth value in collapsed data  Fill: 65535 |
| Data, Elevation 1 | Unsigned Integer | 2 | [0,27500] | Counts in elevation 1. Fill 65535 |
| Data, Elevation 2 | Unsigned Integer | 2 | [0,27500] | Counts in elevation 2. Fill 65535 |
| Data, Elevation 3 | Unsigned Integer | 2 | [0,27500] | Counts in elevation 3. Fill 65535 |
| Data, Elevation 4 | Unsigned Integer | 2 | [0,27500] | Counts in elevation 4. Fill 65535 |
| Data, Elevation 5 | Unsigned Integer | 2 | [0,27500] | Counts in elevation 5. Fill 65535 |
| Data, Elevation 6 | Unsigned Integer | 2 | [0,27500] | Counts in elevation 6. Fill 65535 |
| Data, Elevation 7 | Unsigned Integer | 2 | [0,27500] | Counts in elevation 7. Fill 65535 |
| Data, Elevation 8 | Unsigned Integer | 2 | [0,27500] | Counts in elevation 8. Fill 65535 |

### CAPS IMS LOG Data Product Format

The data product format for CAPS IMS Logicals (LOG) is listed in below. The fill value for Logical Data is 65535 (hex FFFF).

| Table : CAPS IMS Logicals UNCALIBRATED Data File Contents and Structure | | | | |
| --- | --- | --- | --- | --- |
| **Column Name** | **Type** | **Length (bytes)** | **Range** | **Description** |
| B cycle number | Unsigned Integer | 2 | [1,340] | B cycle number from the start of day, a value of 65535 indicates no B-cycle data is available |
| A cycle number | Unsigned Integer | 2 | [1,2732] | A cycle number from the start of day, a value of 65535 indicates that no A-cycle header information was available |
| Time | Float | 8 | [-7.1x107, 1.5x109] | Start time of A cycle, sec. from J2000 (barycentric dynamic time)  Fill: 10x109 |
| Telemetry mode | Unsigned Integer | 1 | [1,136] | Logical telemetry rate and mode:  1 = 250bps, 2 = 500bps, 4 = 1kbps, 8 = 2kbps, 16 = 4kbps, 32 = 8kbps, 64 = 16kbps, 130 = 500bps solar wind, 132 = 1 kbps solar wind, 136 = 2kbps solar wind. Fill: 255 |
| TDC log selection | Unsigned Integer | 1 | [0,3] | TDC selectable logical definition  0 = (Logical 13: Start CFD Singles, Logical 14: Stop CFD Singles), 1 = (Logical 13: Acquisition, Logical 14: Deadtimes), 2 = (Logical 13: Single TOF events, Logical 14: Double TOF events), 3 = (Logical 13: Data strobes, Logical 14: Resets). Fill: 255 |
| Offset time | Unsigned Integer | 2 | [1,32000] | Milliseconds from start of A cycle  Fill: 65535 |
| First Energy Step | Unsigned Integer | 2 | [1,63] | Min energy step in collapsed data  Fill: 65535 |
| Last Energy Step | Unsigned Integer | 2 | [1,63] | Max energy step in collapsed data  Fill: 65535 |
| First Azimuth Value | Unsigned Integer | 2 | [1,8] | Min azimuth value in collapsed data  Fill: 65535 |
| Last Azimuth Value | Unsigned Integer | 2 | [1,8] | Max azimuth value in collapsed data  Fill: 65535 |
| LEF Stops | Unsigned Integer | 2 | [0,27500] | LEF stop counts: Fill: 65535 |
| ST Stops | Unsigned Integer | 2 | [0,27500] | ST stop counts: Fill: 65535 |
| Timeouts | Unsigned Integer | 2 | [0,27500] | Timeout events: Fill: 65535 |
| Total Events | Unsigned Integer | 2 | [0,27500] | Total events (generated by SAM for dead time). Fill: 65535 |
| Logical 13 | Unsigned Integer | 2 | [0,27500] | TDC selectable logical 13. Fill: 65535 |
| Logical 14 | Unsigned Integer | 2 | [0,27500] | TDC selectable logical 14. Fill: 65535 |

### CAPS IMS TOF Data Product Format

The data product format for CAPS IMS Time of flight (TOF) is listed in below. The fill value for IMS TOF and ST data is 4294967295 (hex value FFFFFFFF).

| Table : CAPS IMS TOF UNCALIBRATED Data File Contents and Structure | | | | |
| --- | --- | --- | --- | --- |
| **Column Name** | **Type** | **Length (bytes)** | **Range** | **Description** |
| B cycle number | Unsigned Integer | 2 | [1,340] | B cycle number from the start of day |
| Time | Float | 8 | [-7.1x107, 1.5x109] | Start time of B cycle, sec. from J2000 (barycentric dynamic time)  Fill: 10x109 |
| Telemetry mode | Unsigned Integer | 1 | [1,136] | Logical telemetry rate and mode:  1 = 250bps, 2 = 500bps, 4 = 1kbps, 8 = 2kbps, 16 = 4kbps, 32 = 8kbps, 64 = 16kbps, 130 = 500bps solar wind, 132 = 1 kbps solar wind, 136 = 2kbps solar wind. Fill: 255 |
| Collapse Flag | Unsigned Integer | 1 | [0,5] | Flags indicating collapse and Bcycle Duration. 0=average, 256s duration; 1=sum, 256s duration; 2=average, 512s duration; 3=sum, 512s duration; 4=average, 1024s duration, 5=sum, 1024s duration. Fill: 255 |
| ST start channel | Unsigned Integer | 2 | [0,1535] | Start ST TOF channel  Fill value: 2048 |
| ST interval | Unsigned Integer | 1 | [1,4] | ST TOF bin interval  1 = each word is taken starting at the Start channel. 2 = Every other word is taken starting at the Start channel. 4 = Every fourth word is taken starting at the Start Channel. 0 = Fill Value implying housekeeping is not available |
| ST energy collapse | Unsigned Integer | 1 | [0,3] | ST energy collapse option  0 = sum adjacent energies, 1 = take even energies, 2 = take odd energies, 3 = TBA. Fill: 255 |
| LEF start channel | Unsigned Integer | 2 | [0,1535] | Start LEF TOF channel  Fill value: 2048 |
| LEF interval | Unsigned Integer | 1 | [1,4] | LEF TOF bin interval  1 = each word is taken starting at the Start channel. 2 = Every other word is taken starting at the Start channel. 4 = Every fourth word is taken starting at the Start Channel. 0 = Fill Value implying housekeeping is not available |
| LEF energy collapse | Unsigned Integer | 1 | [0,3] | LEF energy collapse option  0 = sum adjacent energies, 1 = take even energies, 2 = take odd energies, 3 = TBA. Fill: 255 |
| Energy Step | Unsigned Integer | 2 | [1,32] | Energy step in collapsed data  Fill: 65535 |
| Data, ST TOF bin 1 | Unsigned Integer | 4 | [0, 3268027] | Counts in ST TOF bin 1.  Fill 4294967295 |
| Data, ST TOF bin 2 | Unsigned Integer | 4 | [0, 3268027] | Counts in ST TOF bin 2  Fill 4294967295 |
| … | Unsigned Integer | 4x509 | [0, 3268027] | Counts in ST TOF bins 3 – 511  Fill 4294967295 |
| Data, ST TOF bin 512 | Unsigned Integer | 4 | [0, 3268027] | Counts in ST TOF bin 512  Fill 4294967295 |
| Data, LEF TOF bin 1 | Unsigned Integer | 4 | [0, 3268027] | Counts in LEF TOF bin 1  Fill 4294967295 |
| Data, LEF TOF bin 2 | Unsigned Integer | 4 | [0, 3268027] | Counts in LEF TOF bin 2  Fill 4294967295 |
| … | Unsigned Integer | 4x509 | [0, 3268027] | Counts in LEF TOF bins 3 – 511  Fill 4294967295 |
| Data, LEF TOF bin 512 | Unsigned Integer | 4 | [0, 3268027] | Counts in LEF TOF bin 512  Fill 4294967295 |

### CAPS ACT Data Product Format

The data product format for the CAPS actuator is listed in below. The fill value for actuator data is –999.0. Actuator data products are considered to be both calibrated and un-calibrated data products. In order to accommodate this, we lose the <DataType> in the filename (as described in section 4.5.2).

| Table : CAPS ACT Data File Contents and Structure (both Calibrated & Un-calibrated) | | | | |
| --- | --- | --- | --- | --- |
| **Column Name** | **Type** | **Length (bytes)** | **Range** | **Description** |
| B cycle number | Unsigned Integer | 2 | [1,340] | B cycle number from the start of day, a value of 65535 indicates no B-cycle data is available |
| A cycle number | Unsigned Integer | 2 | [1,2732] | A cycle number from the start of day  Fill: 65535 |
| Time | Float | 8 | [-7.1x107, 1.5x109] | Start time of A cycle, sec. from J2000 (barycentric dynamic time)  Fill: 10x109 |
| Data, Actuator angle 1 | Float | 4 | [-115,115] | Actuator angle at time + 0 sec  Fill: -999 |
| Data, Actuator angle 2 | Float | 4 | [-115,115] | Actuator angle at time + 1 sec  Fill: -999 |
| … | Float | 4x29 | [-115,115] | Actuator angle (offset times of 2 – 30 sec) Fill: -999 |
| Data, Actuator angle 32 | Float | 4 | [-115,115] | Actuator angle at time + 31 sec  Fill: -999 |

### CAPS ANC Data Product Format

The data product format for the ancillary data product is listed in Table 27 below. There are no standard fill values for these items.

| Table : CAPS ANC UNCALIBRATED Data File Contents and Structure | | | | |
| --- | --- | --- | --- | --- |
| **Column Name** | **Type** | **Length (bytes)** | **Range** | **Description** |
| B cycle number | Unsigned Integer | 2 | [1,340] | B cycle number from the start of day, a value of 65535 indicates no B-cycle data is available |
| A cycle number | Unsigned Integer | 2 | [1,2732] | A cycle number from the start of day  Fill: 65535 |
| Time | Float | 8 | [-7.1x107, 1.5x109] | Start time of A cycle, sec. from J2000 (barycentric dynamic time)  Fill: 10x109 |
| SCLK | Unsigned Integer | 4 | [0,3.0x109] | Start time of A cycle, spacecraft clock  Fill: 10x109 |
| Spacecraft/Saturn position [x] | Float | 4 | [-9.46x1012, 9.46x1012] | J2000 [km]: Saturn-centered  Fill: 10x1012 |
| Spacecraft/Saturn position [y] | Float | 4 | [-9.46x1012, 9.46x1012] | J2000 [km]: Saturn-centered  Fill: 10x1012 |
| Spacecraft/Saturn position [z] | Float | 4 | [-9.46x1012, 9.46x1012] | J2000 [km]: Saturn-centered  Fill: 10x1012 |
| Spacecraft/Saturn velocity vx | Float | 4 | [-3x105, 3x105] | J2000 [km/s]: relative to Saturn  Fill: 5x105 |
| Spacecraft/Saturn velocity vy | Float | 4 | [-3x105, 3x105] | J2000 [km/s]: relative to Saturn  Fill: 5x105 |
| Spacecraft/Saturn velocity vz | Float | 4 | [-3x105, 3x105] | J2000 [km/s]: relative to Saturn  Fill: 5x105 |
| Spacecraft/Sun position [x] | Float | 4 | [-9.46x1012, 9.46x1012] | J2000 [km]: Sun-centered  Fill: 10x1012 |
| Spacecraft/Sun position [y] | Float | 4 | [-9.46x1012, 9.46x1012] | J2000 [km]: Sun-centered.  Fill: 10x1012 |
| Spacecraft/Sun position [z] | Float | 4 | [-9.46x1012, 9.46x1012] | J2000 [km]: Sun-centered  Fill: 10x1012 |
| Spacecraft/Sun velocity vx | Float | 4 | [-3x105, 3x105] | J2000 [km/s]: Relative to the Sun  Fill: 5x105 |
| Spacecraft/Sun velocity vy | Float | 4 | [-3x105, 3x105] | J2000 [km/s]: Relative to the Sun  Fill: 5x105 |
| Spacecraft/Sun velocity vz | Float | 4 | [-3x105, 3x105] | J2000 [km/s]: Relative to the Sun  Fill: 5x105 |
| Spacecraft orientation [xx] | Float | 4 | [-1,1] | Component of rotation matrix to J2000. Fill value = 2. |
| Spacecraft orientation [xy] | Float | 4 | [-1,1] | Component of rotation matrix to J2000. Fill value = 2. |
| Spacecraft orientation [xz] | Float | 4 | [-1,1] | Component of rotation matrix to J2000. Fill value = 2. |
| Spacecraft orientation [yx] | Float | 4 | [-1,1] | Component of rotation matrix to J2000. Fill value = 2. |
| Spacecraft orientation [yy] | Float | 4 | [-1,1] | Component of rotation matrix to J2000. Fill value = 2. |
| Spacecraft orientation [yz] | Float | 4 | [-1,1] | Component of rotation matrix to J2000. Fill value = 2. |
| Spacecraft orientation [zx] | Float | 4 | [-1,1] | Component of rotation matrix to J2000. Fill value = 2. |
| Spacecraft orientation [zy] | Float | 4 | [-1,1] | Component of rotation matrix to J2000. Fill value = 2. |
| Spacecraft orientation [zz] | Float | 4 | [-1,1] | Component of rotation matrix to J2000. Fill value = 2. |
| ELS quality flag | Unsigned Integer | 1 | [0,7] | Missing data and good/bad checksum  0=Everything OK, 1 = Missing Data, 2 = Bad Checksum, 3 = Missing Data & Bad Checksum, 7 = No Data (4,5,6 not valid) |
| IBS quality flag | Unsigned Integer | 1 | [0,7] | Missing data and good/bad checksum  0=Everything OK, 1 = Missing Data, 2 = Bad Checksum, 3 = Missing Data & Bad Checksum, 7 = No Data (4,5,6 not valid) |
| IMS Ion quality flag | Unsigned Integer | 1 | [0,7] | Missing data and good/bad checksum  0=Everything OK, 1 = Missing Data, 2 = Bad Checksum, 3 = Missing Data & Bad Checksum, 7 = No Data (4,5,6 not valid) |
| IMS TOF LEF quality flag | Unsigned Integer | 1 | [0,7] | Missing data and good/bad checksum  0=Everything OK, 1 = Missing Data, 2 = Bad Checksum, 3 = Missing Data & Bad Checksum, 7 = No Data (4,5,6 not valid) |
| IMS TOF ST quality flag | Unsigned Integer | 1 | [0,7] | Missing data and good/bad checksum  0=Everything OK, 1 = Missing Data, 2 = Bad Checksum, 3 = Missing Data & Bad Checksum, 7 = No Data (4,5,6 not valid) |
| IMS Logicals quality flag | Unsigned Integer | 1 | [0,7] | Missing data and good/bad checksum  0=Everything OK, 1 = Missing Data, 2 = Bad Checksum, 3 = Missing Data & Bad Checksum, 7 = No Data (4,5,6 not valid) |
| IMS Singles quality flag | Unsigned Integer | 1 | [0,7] | Missing data and good/bad checksum  0=Everything OK, 1 = Missing Data, 2 = Bad Checksum, 3 = Missing Data & Bad Checksum, 7 = No Data (4,5,6 not valid) |
| Actuator quality flag | Unsigned Integer | 1 | [0,7] | Missing data and good/bad checksum  0=Everything OK, 1 = Missing Data, 2 = Bad Checksum, 3 = Missing Data & Bad Checksum, 7 = No Data (4,5,6 not valid) |
| Actuator Status Bits (all 32 of them) | Unsigned Integer | 32 | [0,8] | Status bits for the actuator data product. These are represented as 32 bytes with the following values:  0 = Everything is OK  4 = Limit Switch has been hit at +108 degrees  8 = Limit Switch has been hit at -108 degrees  16 = Data not available (data is only available in 16, 8, 4, and 2 kbps modes) |
| TLM Version | Unsigned Integer | 1 | [0,15] | Telemetry Mode version number  Fill: 255 |
| FSW Major version | Unsigned Integer | 1 | [0,255] | To build the flight software version number:  Major.SubMajor.Minor.SubMinor. For example: 3.1.0.2. Fill: 255 |
| FSW Sub-Major version | Unsigned Integer | 1 | [0,255] | See description for FSW Major version  Fill: 255 |
| FSW Minor version | Unsigned Integer | 1 | [0,255] | See description for FSW Major version  Fill: 255 |
| FSW Sub-Minor version | Unsigned Integer | 1 | [0,255] | See description for FSW Major version  Fill: 255 |
| Spacecraft pointing type | Unsigned Integer | 1 | [0,2] | 0 = no pointing available, 1 = pointing based on predicts, 2 = pointing based on reconstructs |
| Telemetry rate and mode | Unsigned Integer | 1 | [1,136] | Logical telemetry rate and mode:  1 = 250bps, 2 = 500bps, 4 = 1kbps, 8 = 2kbps, 16 = 4kbps, 32 = 8kbps, 64 = 16kbps, 130 = 500bps solar wind, 132 = 1 kbps solar wind, 136 = 2kbps solar wind. Fill: 255 |
| IBS Sweep Table & Index Table Numbers | Unsigned Integer | 1 | [0,250] | The upper 4 bits are the IBS index table, and the lower 4 bits are the IBS sweep table number. (fill 0xFF) |
| IBS Background, Fan 1 | Unsigned Integer | 2 | [0,60000] | IBS Background counts in fan 1 (fill 0xFFFF) |
| IBS Background, Fan 2 | Unsigned Integer | 2 | [0,60000] | IBS Background counts in fan 2 (fill 0xFFFF) |
| IBS Background, Fan 3 | Unsigned Integer | 2 | [0,60000] | IBS Background counts in fan 3 (fill 0xFFFF) |
| IBS starting energy | Unsigned Integer | 2 | [1,852] | IBS starting energy step number (fill 0xFFFF) |
| IBS Subcycle | Unsigned Integer | 1 | [0,7] | IBS subcycle counter (A cycle in C cycle) (fill 0xFF) |
| IBS compression ratio | Unsigned Integer | 1 | [1,32] | Uncompressed/compressed length. This ratio is calculated on the ground from information in the IBS header and rounded down to the nearest integer. (fill 0x0) |
| IBS Peak Fan | Unsigned Integer | 1 | [1,3] | Fan containing the IBS peak (1st in the C cycle). (fill 0x4) |
| IBS Peak A cycle | Unsigned Integer | 1 | [1,8] | A cycle number (1st in the C cycle). (fill 0x9) |
| IBS Peak Sweep | Unsigned Integer | 1 | [1,16] | IBS peak energy sweep or azimuth (1st in the C cycle). (fill 0x0) |
| IBS Peak Energy Step | Unsigned Integer | 1 | [0,255] | IBS peak energy step (1st in the C cycle). (fill 0x0) |
| IBS Threshold Run Length | Unsigned Integer | 2 | [0,255] | Run length compression threshold (fill 0xFFFF) |
| IMS sweep table number | Unsigned Integer | 1 | [0,255] | IMS Sweep table number  Fill: 240 |
| TDC Single Select | Unsigned Integer | 1 | [0,3] | Determines how singles 13 and 14 are set (these are also Logical 13 and Logical 14):  **Value: Single 13 Single 14**  0 Start CFD Stop CFD  1 Acquisition Error Deadtimes  2 Single TOF’s Double TOF’s  3 Data Strobes Resets  Fill: 255 |
| IMS logicals selection | Unsigned Integer | 2 | [4096,27416] | The TDC logicals selection is a bitmap:  Bits 15-13: IMS Logical 1  Bits 12-10: IMS Logical 2  Bits 9-7: IMS Logical 3  Bits 6-4: IMS Logical 4 Bits 3-0: Unused  Logical selection decoder:  0 = Unused  1 = LEF Stop  2 = ST Stop  3 = Timeouts  4 = Total Events (As used in SAM dead time correction)  5 = Logical 13  6 = Logical 14  7 = Unused  NOTE: Logical 13 and 14 are set with 82TDC\_ENG\_SING. See previous column. Fill: 65535 |
| SAM/CPU2 status flags | Unsigned Integer | 1 | [0,255] | Bitmap: Bit 7 is most significant bit.  7 = CPU2/SAM mode change  6 = Background data  5 = Ion deadtime compensation  4 = SAM LEF enable  3 = SAM molecule enable  2 = SW/HW binning  1-0 = HW binning LUT index. |
| SAM Ion selection index | Unsigned Integer | 1 | [0,255] | SAM ion selection index |
| SAM Ion group table | Unsigned Integer | 2 | [0,65534] | SAM group table ID number  Fill or missing: 65535 |
| ELS\_MCP\_ADJ | Float | 4 | [0.0,3700.0] | ELS High voltage adjust (Volts). FILL value is –1.0 |
| IBS\_CEM\_DAC | Float | 4 | [-4000.0,0.0] | IBS CEM High Voltage Digital to Analog Converter (Volts). FILL value is 1.0 |
| HVU1\_RET\_DAC | Float | 4 | [0,16.0] | HVU1 Retarding High Voltage Digital to Analog Converter (kVolts). FILL is –1.0 |
| HVU1\_ACC\_DAC | Float | 4 | [-16.0,0.0] | HVU1 Accelerating High Voltage Digital to Analog Converter (kVolts). FILL is 1.0 |
| HVU2\_ST\_DAC | Float | 4 | [-3600.0,0.0] | HVU2 ST MCP Digital to Analog Converter (Volts). FILL is 1.0 |
| HVU2\_LEF\_DAC | Float | 4 | [-2400.0,0.0] | HVU2 LEF MCP Digital to Analog Converter (Volts). FILL is 1.0 |

### CAPS EVN Data Product Format

The data product format for the CAPS IMS event mode data is listed in Table 28 below. No fill values are necessary. Data rows exist only if data are present.

| Table : CAPS EVN UNCALIBRATED Data File Contents and Structure | | | | |
| --- | --- | --- | --- | --- |
| **Column Name** | **Type** | **Length (bytes)** | **Range** | **Description** |
| B cycle number | Unsigned Integer | 2 | [1,340] | B cycle number from the start of day, a value of 65535 indicates no B-cycle data is available |
| A cycle number | Unsigned Integer | 2 | [1,2732] | A cycle number from the start of day  Fill: 65535 |
| Time | Float | 8 | [-7.1x107, 1.5x109] | Start time of B cycle, sec. from J2000 (barycentric dynamic time)  Fill: 10x109 |
| Offset time | Unsigned Integer | 2 | [0,32000] | Milliseconds from start of A cycle  Fill: 65535 |
| Energy Step | Unsigned Integer | 2 | [1,63] | Energy Step. Fill: 65535 |
| Azimuth Value | Unsigned Integer | 2 | 1 | Azimuth Value. In this case, the value is always 1 (CPU2 samples the first sweep of every other A cycle. Included here for clarity and useful when used in combination with ION data). Fill: 65535 |
| Elevation | Unsigned Integer | 1 | [1,8] | Elevation or Sector ID.  Fill: 255 |
| TOF type | Unsigned Integer | 1 | [0,254] | ST/LEF and single/dual event flag  0 = ST, first or single event  1 = LEF, first or single event  2 = ST, second event of a dual event  3 = LEF, second event of a dual event  4 – 254 = Spare  Fill: 255 |
| TOF | Unsigned Integer | 2 | [1,2048] | Event’s Time of Flight. The particle’s TOF channel. Fill: 65535 |

## CAPS Standard HIGHERORDER Data Product Descriptions

The following sections describe the content and structure of each of the standard data products within the HIGHERORDER level 5 CAPS data set. The format of each different type of higher order data product is included in the following sections.

### CAPS ELS Electron Moment Data Product Format

The data product format for the ELS electron moment data is listed in Table 29 below. There are no standard fill values for these items, however, fill values are listed for each value. Data are in fixed field, ascii format.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Table 29: CAPS ELS Electron Moment HIGHERORDER Data File Contents and Structure | | | | |
| **Column Name** | **Type** | **Length (bytes)** | **Range** | **Description** |
| Start\_Time | Time | 17 | [1997-228T10:43:00, 2025-001T00:00:00] | Start of the sampling period, spacecraft event time, UTC, in ISOD format to second resolution. ISOD format is: YYYY-DOYTHH:MM:SS. Fill is 2030-001T00:00:00. |
| End\_Time | Time | 17 | [1997-228T10:43:00, 2025-001T00:00:00] | End of the sampling period, spacecraft event time, UTC, in ISOD format to second resolution. ISOD format is: YYYY-DOYTHH:MM:SS. Fill is 2030-001T00:00:00. |
| Anode\_Used | Integer | 1 | [1,9] | Anode used to calculate moments. A value of 9 implies multiple anodes were used. Fill value is 0. |
| Signal\_to\_Noise | Real | 5 | [0.00, 10.00] | Signal to noise ratio threshold. Only data values above this threshold go into the moments calculation. Fill is -9.99. |
| SC\_Potential | Real | 7 | [-100.00, 100.00] | Spacecraft potential (V) during the time period given. The fill value is -999.99. |
| Density | Real | 13 | [1.000000E+03, 1.000000E+10] | Density in units of electrons/m3, summed over all energies. The fill value used is -9.000000E+00. |
| Temperature | Real | 12 | [1.000000, 99999.999999] | Temperature (eV), summed over all energies. Fill value used is -9999.000000. |
| Quality\_Factor | Real | 7 | [0.000, 100.000] | The number of standard deviations, assuming Poisson counting statistics, that the peak of the Maxwellian corresponding to the determined moments lies above the ELS one-count level. The larger the value, the better. The fill value used is -99.000. |
| SC\_Charge\_State | Integer | 1 | [0, 1] | Indicates whether the data is likely to be from a region in which the spacecraft is negatively charged.  0: likely positively charged  1: likely negatively charged  Fill is 9. |
| Penetrating\_Radiation | Integer | 1 | [0,1] | Indicates whether the data is probably from a region in which there is penetrating radiation present.  0: not likely to be present  1: likely to be present  Fill is 9. |
| Density with Penetrating Radiation removed | Real | 13 | [1.000000E+03, 1.000000E+10] | Density in units of electrons/m3, summed over all energies, but with penetrating radiation subtracted from the data before moments calculations were made. Fill is -9.000000E+00. |
| Temperature with Penetrating Radiation removed | Real | 12 | [1.000000, 99999.999999] | Temperature (eV), summed over all energies, but with penetrating radiation subtracted from the data before moments calculations were made. Fill value used is -9999.000000. |
| Quality factor with penetrating radiation removed | Real | 7 | [0.000, 100.000] | The number of standard deviations, assuming Poisson counting statistics, that the peak of the Maxwellian corresponding to the determined moments lies above the ELS one-count level, but with penetrating radiation subtracted from the data before moments calculations were made. The larger the value, the better. The fill is -99.000. |

### CAPS ELS Spacecraft Potential Data Product Format

The data product format for the ELS spacecraft potential data is listed in Table 30 below. There are no standard fill values for these items, however, fill values are assigned for each variable. Data are in fixed field, ascii format.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Table 30: CAPS ELS Spacecraft Potential HIGHERORDER Data File Contents and Structure | | | | |
| **Column Name** | **Type** | **Length (bytes)** | **Range** | **Description** |
| Start\_Time | Time | 17 | [1997-228T10:43:00, 2025-001T00:00:00] | Start of the sampling period, spacecraft event time, UTC, in ISOD format to second resolution. ISOD format is: YYYY-DOYTHH:MM:SS. Fill is 2030-001T00:00:00. |
| End\_Time | Time | 17 | [1997-228T10:43:00, 2025-001T00:00:00] | End of the sampling period, spacecraft event time, UTC, in ISOD format to second resolution. ISOD format is: YYYY-DOYTHH:MM:SS. Fill is 2030-001T00:00:00. |
| Anode\_Used | Integer | 1 | [1,8] | Anode used to assign potential. Fill value is 0. |
| SC\_Potential | Real | 7 | [-100.0, 100.0] | Spacecraft potential (V) during the time period given. Fill value is -999.99. |
| Accuracy\_Flag | Integer | 2 | [0,2] | 0 = Accurate value derived from ELS data. Value will be accurate to +/- 8.5% as the dE/E of ELS is 17%.  1 = Potential below ELS lowest energy, therefore estimated, use with care.  2 = Accurate value derived from non-ELS data, ie. RPWS at periapsis or PE at moon encounters. |

### CAPS Ion Moments Data Format

The data product format for the ion moments is listed in Table 31 below. There are no standard fill values for these items, however, fill values are assigned for each item. Data are in fixed field, ascii format.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Table 31: CAPS Ion Moments HIGHERORDER Data File Contents and Structure | | | | |
| **Column Name** | **Type** | **Length (bytes)** | **Range** | **Description** |
| Time | Time | 17 | [1997-228T10:43:00, 2025-001T00:00:00] | Start of the sampling period, spacecraft event time, UTC, in ISOD format to second resolution. ISOD format is: YYYY-DOYTHH:MM:SS. Fill is 2030-001T00:00:00. |
| ION\_Method\_Flag | Integer | 2 | [1,4] | Ion Method Flag for calculation of numerical ion moments. Value: meaning  1 : SNG data, TOF-based partition  2 : SNG data, E-based partition  3 : SNG data, hard-wired partition  4 : ION data  Fill value is -1. |
| H+ Density | Real | 8 | [0.000, 999.9999] | H+ density (ions/cm3). Please note the difference between a value of 0.000 and -1. The 0.000 corresponds to a valid determination that is just extremely low (and there is no confidence in the actual quantitative value, other than that it is very low), whereas the fill value corresponds to an invalid determination, usually caused by problems in the integration process. |
| H+ Temperature | Real | 9 | [0, 99999.999] | H+ temperature (eV). Fill value is -1. |
| H2+ Density | Real | 8 | [0.000, 999.9999] | H2+ density (ions/cm3). Please note the difference between a value of 0.000 and -1. The 0.000 corresponds to a valid determination that is just extremely low (and there is no confidence in the actual quantitative value, other than that it is very low), whereas the fill value corresponds to an invalid determination, usually caused by problems in the integration process. |
| H2+ Temperature | Real | 9 | [0, 99999.999] | H2+ temperature (eV). Fill value is -1. |
| W+ Density | Real | 8 | [0.000, 999.9999] | W+ density (ions/cm3). Water-group ions, W+, includes O+, OH+, H2O+, and H3O+. Please note the difference between a value of 0.000 and -1. The 0.000 corresponds to a valid determination that is just extremely low (and there is no confidence in the actual quantitative value, other than that it is very low), whereas the fill value corresponds to an invalid determination, usually caused by problems in the integration process. |
| W+ Temperature | Real | 9 | [0, 99999.999] | W+ temperature (eV). Fill value is -1. |
| Ave Vr | Real | 9 | [-3000.000, 3000.000] | Weighted average flow velocity (km/s), r component, in Saturn centered spherical coordinates. Fill is -9999.999 |
| Ave VΦ | Real | 9 | [-3000.000, 3000.000] | Weighted average flow velocity (km/s), phi component, in Saturn centered spherical coordinates. Fill is -9999.999 |
| Ave Vθ | Real | 9 | [-3000.000, 3000.000] | Weighted average flow velocity (km/s), theta component, in Saturn centered spherical coordinates. Fill is -9999.999 |
| Average Flow Speed | Real | 9 | [0, 3000.000] | Weighted average flow speed. Fill is -9999.999. |
| Quality\_Flag | Integer | 2 | [0, 2] | Value: meaning  0: Not-bad; corotation direction is in the Field of View (FOV)  1: Not-bad; corotation direction not in FOV  2: Bad (the spacecraft is rolling and/or CAPS is not actuating) |

## CAPS Standard CALIBRATED Data Product Descriptions

The following section will describe the content and structure of each of the standard data products within the CALIBRATED level 3 CAPS data set. The format of the calibrated data set is currently TBD.

# Support Staff and Cognizant Persons

Table : CAPS Archive Collection Support Staff

|  |  |  |  |
| --- | --- | --- | --- |
| ***CAPS Team*** | | | |
| **Judith D Furman** | Southwest Research Institute  6220 Culebra Road  San Antonio, TX 78228 | 210-522-6040 | jfurman@swri.edu |
| **Frank Crary** | University of Colorado at Boulder  Laboratory for Atmospheric and Space Science, Boulder, CO | 303-735-2120 | frank.crary@lasp.colorado.edu |
| **Rob Wilson** | University of Colorado at Boulder  Laboratory for Atmospheric and Space Science, Boulder, CO | 303-492-5476 | rob.wilson@lasp.colorado.edu |
| **Michelle Thomsen** | Los Alamos National Laboratory  Los Alamos, NM 87545 | 505-667-1210 | mthomsen@lanl.gov |
| **UCLA** | | | |
| **Mr. Steven P. Joy** PPI Operations Manager | UCLA-IGPP 405 Hilgard Ave Los Angeles, CA 90095-1567 | 310-825-3506 | sjoy@igpp.ucla.edu |
|  |  |  |  |

# Appendix A. Directory Structure for Archive Volume, COCAPS\_1nnn

CATALOG

INDEX

EXTRAS

DOCUMENT

BROWSE

CALIB

CAPS\_CALIB

SAMPLE\_DATA

TBD

CAPS\_SIS

DATA

UNCALIBRATED

YYYYDDD1

YYYYDDD2

File list as specified in

File list as specified in

Directory Structure for Archive Volume, COCAPS\_5mmm

CATALOG

INDEX

EXTRAS

DOCUMENT

File list as specified in

HIGHERORDER

CAPS\_CALIB

TBD

CAPS\_SIS

SAMPLE\_DATA

BROWSE

CALIB

DATA

SCPOT

ELEMOMT

IONMOMT

File list as specified in

File list as specified in

File list as specified in

File list as specified in

File list as specified in

YYYY2

YYYY1

YYYY2

YYYY1

YYYY2

YYYY1

# Appendix B. PDS Labels & Format Files for Standard UNCALIBRATED Data Products

|  |
| --- |
| ELS\_U3.FMT File |
| /\* ELS\_U3.FMT \*/  /\* Description of the electron spectrometer data table \*/  OBJECT = COLUMN  NAME = B\_CYCLE\_NUMBER  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 1  BYTES = 2  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 340  MISSING\_CONSTANT = 65535  DESCRIPTION = "B cycle number from the start of the day,  a value of 65535 indicates no B-cycle data  is available"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = A\_CYCLE\_NUMBER  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 3  BYTES = 2  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 2732  MISSING\_CONSTANT = 65535  DESCRIPTION = "A cycle number from the start of day"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = TIME  DATA\_TYPE = IEEE\_REAL  START\_BYTE = 5  BYTES = 8  VALID\_MINIMUM = -7.1x10^7  VALID\_MAXIMUM = 1.5x10^9  MISSING\_CONSTANT = 10x10^9  UNIT = SECOND  DESCRIPTION = "Start time of the A cycle, seconds from J2000  (barycentric dynamic time). An A-cycle is the  32 second instrument collection cycle."  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = TELEMETRY\_MODE  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 13  BYTES = 1  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 136  MISSING\_CONSTANT = 255  DESCRIPTION = "Logical telemetry rate and mode:  1 = 250 bps  2 = 500 bps  4 = 1 kbps  8 = 2 kbps  16 = 4 kbps  32 = 8 kbps  64 = 16 kbps  130 = 500 bps solar wind  132 = 1 kbps solar wind  136 = 2 kbps solar wind"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = COLLAPSE\_FLAG  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 14  BYTES = 1  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 131  MISSING\_CONSTANT = 255  DESCRIPTION = "Flag indicating how data is collapsed:  0: average  1: sum  2: average with in-flight deadtime correction  3: sum with in-flight deadtime correction  4: snapshot portion  NOTE: For snapshot, full collapse information is  gained by adding 4 (so snapshot portion can be  4, 5, 6, or 7 depending upon the collapse.  The upper bit will be set to 1 when  housekeeping is missing."  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = OFFSET\_TIME  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 15  BYTES = 2  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 32000  MISSING\_CONSTANT = 65535  UNIT = MILLISECOND  DESCRIPTION = "Milliseconds from start of A cycle"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = FIRST\_ENERGY\_STEP  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 17  BYTES = 2  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 63  MISSING\_CONSTANT = 65535  DESCRIPTION = "Minimum energy step in collapsed data"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = LAST\_ENERGY\_STEP  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 19  BYTES = 2  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 63  MISSING\_CONSTANT = 65535  DESCRIPTION = "Maximum energy step in collapsed data"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = FIRST\_AZIMUTH\_VALUE  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 21  BYTES = 2  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 16  MISSING\_CONSTANT = 65535  DESCRIPTION = "Minimum azimuth value in collapsed data"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = LAST\_AZIMUTH\_VALUE  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 23  BYTES = 2  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 16  MISSING\_CONSTANT = 65535  DESCRIPTION = "Maximum azimuth value in collapsed data"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = DATA  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 25  UNIT = COUNTS  ITEMS = 8  ITEM\_BYTES = 2  BYTES = 16  MISSING\_CONSTANT = 65535  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 65504  DESCRIPTION = "Counts in elevations 1 through 8"  END\_OBJECT = COLUMN |

|  |
| --- |
| Sample ELS Label File: ELS\_YYYYDDDHH\_U3.LBL |
| PDS\_VERSION\_ID = PDS3  DATA\_SET\_ID = "CO-E/J/S/SW-CAPS-2-UNCALIBRATED-V1.1"    STANDARD\_DATA\_PRODUCT\_ID = "ELS UNCALIBRATED"  PRODUCT\_ID = "ELS\_201001000\_U3"  PRODUCT\_TYPE = "DATA"  PRODUCT\_CREATION\_TIME = 2010-141T20:48    RECORD\_TYPE = FIXED\_LENGTH  RECORD\_BYTES = 40  FILE\_RECORDS = 113664    START\_TIME = 2010-010T00:08:07  STOP\_TIME = 2010-010T06:05:59  SPACECRAFT\_CLOCK\_START\_COUNT = "1/1641775909.000"  SPACECRAFT\_CLOCK\_STOP\_COUNT = "1/1641797381.000"    INSTRUMENT\_HOST\_NAME = "CASSINI ORBITER"  INSTRUMENT\_HOST\_ID = "CO"  TARGET\_NAME = {"SATURN"}  INSTRUMENT\_NAME = "CASSINI PLASMA SPECTROMETER"  INSTRUMENT\_ID = "CAPS"  DESCRIPTION = "  This file contains Cassini CAPS data from the ELS sensor  acquired at SATURN between  2010-010T00:08:07.000 and 2010-010T06:05:59.000 (orbit 124)."    MD5\_CHECKSUM = "94d3f6a361ea4712658758b776aac2ca"    NOTE = "  The end around carry checksum, with seed 0x55AA,  of this file is 0x5A20"    ^TABLE = "ELS\_201001000\_U3.DAT"  OBJECT = TABLE  INTERCHANGE\_FORMAT = "BINARY"  ROWS = 113664  COLUMNS = 11  ROW\_BYTES = 40  ^STRUCTURE = "ELS\_U3.FMT"  DESCRIPTION = "  The file ELS\_U3.FMT describes the column structure and content  of the data file."  END\_OBJECT = TABLE  END |

|  |
| --- |
| IBS\_U3.FMT File |
| /\* IBS\_U3.FMT \*/  /\* describes the structure of the IBS Data Table\*/  OBJECT = COLUMN  NAME = B\_CYCLE\_NUMBER  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 1  BYTES = 2  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 340  MISSING\_CONSTANT = 65535  DESCRIPTION = "B cycle number from the start of the day,  a value of 65535 indicates no B-cycle data  is available"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = A\_CYCLE\_NUMBER  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 3  BYTES = 2  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 2732  MISSING\_CONSTANT = 65535  DESCRIPTION = "A cycle number from the start of day"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = TIME  DATA\_TYPE = IEEE\_REAL  START\_BYTE = 5  BYTES = 8  UNIT = SECOND  VALID\_MINIMUM = -7.1x10^7  VALID\_MAXIMUM = 1.5x10^9  MISSING\_CONSTANT = 10x10^9  DESCRIPTION = "Start time of the A cycle, seconds from J2000  (barycentric dynamic time). An A-cycle is the  32 second instrument collection cycle."  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = TELEMETRY\_MODE  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 13  BYTES = 1  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 136  MISSING\_CONSTANT = 255  DESCRIPTION = "Logical telemetry rate and mode:  1 = 250 bps  2 = 500 bps  4 = 1 kbps  8 = 2 kbps  16 = 4 kbps  32 = 8 kbps  64 = 16 kbps  130 = 500 bps solar wind  132 = 1 kbps solar wind  136 = 2 kbps solar wind"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = IBS\_MODE\_SUBMODE  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 14  BYTES = 1  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 254  MISSING\_CONSTANT = 255  DESCRIPTION = "IBS mode and submode flag:  0 = Standard Sweep Collapse  1 = Standard Sweep Snapshot  2 = Solar Wind Search  3 = Solar Wind Track  4 = Magnetosphere Search  5 = Magnetosphere Survey  6 = Calibration Mode  7-254 = spare  255 = Fill"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = OFFSET\_TIME  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 15  BYTES = 4  UNIT = MILLISECOND  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 256000  MISSING\_CONSTANT = 400000  DESCRIPTION = "Milliseconds from start of the IBS collection cycle.  An IBS data product is constructed from 16 to 128  azimuths of data, with each azimuth representing 2  seconds of instrument data collection."  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = FIRST\_ENERGY\_STEP  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 19  BYTES = 2  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 852  MISSING\_CONSTANT = 65535  DESCRIPTION = "Minimum energy step in collapsed data.  This is an index into the energy table."  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = LAST\_ENERGY\_STEP  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 21  BYTES = 2  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 852  MISSING\_CONSTANT = 65535  DESCRIPTION = "Maximum energy step in collapsed data  This is an index into the energy table."  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = FIRST\_AZIMUTH\_VALUE  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 23  BYTES = 2  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 128  MISSING\_CONSTANT = 65535  DESCRIPTION = "Minimum azimuth value in collapsed data"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = LAST\_AZIMUTH\_VALUE  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 25  BYTES = 2  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 128  MISSING\_CONSTANT = 65535  DESCRIPTION = "Maximum azimuth value in collapsed data"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = DATA  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 27  UNIT = COUNTS  ITEMS = 3  ITEM\_BYTES = 2  BYTES = 6  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 65504  MISSING\_CONSTANT = 65535  DESCRIPTION = "Counts in fans 1 through 3"  END\_OBJECT = COLUMN |

|  |
| --- |
| Sample IBS Label File: IBS\_YYYYDDDHH\_U3.LBL |
| PDS\_VERSION\_ID = PDS3  DATA\_SET\_ID = "CO-E/J/S/SW-CAPS-2-UNCALIBRATED-V1.1"    STANDARD\_DATA\_PRODUCT\_ID = "IBS UNCALIBRATED"  PRODUCT\_ID = "IBS\_201001000\_U3"  PRODUCT\_TYPE = "DATA"  PRODUCT\_CREATION\_TIME = 2010-141T20:48    RECORD\_TYPE = FIXED\_LENGTH  RECORD\_BYTES = 32  FILE\_RECORDS = 224145    START\_TIME = 2010-010T00:08:07  STOP\_TIME = 2010-010T05:57:59  SPACECRAFT\_CLOCK\_START\_COUNT = "1/1641775909.000"  SPACECRAFT\_CLOCK\_STOP\_COUNT = "1/1641796901.000"    INSTRUMENT\_HOST\_NAME = "CASSINI ORBITER"  INSTRUMENT\_HOST\_ID = "CO"  TARGET\_NAME = {"SATURN"}  INSTRUMENT\_NAME = "CASSINI PLASMA SPECTROMETER"  INSTRUMENT\_ID = "CAPS"  DESCRIPTION = "  This file contains Cassini CAPS data from the IBS sensor  acquired at SATURN between  2010-010T00:08:07.000 and 2010-010T05:57:59.000 (orbit 124)."    MD5\_CHECKSUM = "d009ac30bdfda29b1d361fd4937ea863"    NOTE = "  The end around carry checksum, with seed 0x55AA,  of this file is 0x2A46"    ^TABLE = "IBS\_201001000\_U3.DAT"  OBJECT = TABLE  INTERCHANGE\_FORMAT = "BINARY"  ROWS = 224145  COLUMNS = 11  ROW\_BYTES = 32  ^STRUCTURE = "IBS\_U3.FMT"  DESCRIPTION = "  The file IBS\_U3.FMT describes the column structure and content  of the data file."  END\_OBJECT = TABLE  END |

|  |
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| ION\_U3.FMT File |
| /\* ION\_U3.FMT \*/  /\* describes the structure of the IMS ION Data Table\*/  OBJECT = COLUMN  NAME = B\_CYCLE\_NUMBER  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 1  BYTES = 2  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 340  MISSING\_CONSTANT = 65535  DESCRIPTION = "B cycle number from the start of the day,  a value of 65535 indicates no B-cycle data  is available"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = A\_CYCLE\_NUMBER  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 3  BYTES = 2  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 2732  MISSING\_CONSTANT = 65535  DESCRIPTION = "A cycle number from the start of day,  a value of 65535 indicates that no A-cycle  header information is available"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = TIME  DATA\_TYPE = IEEE\_REAL  START\_BYTE = 5  BYTES = 8  UNIT = SECOND  VALID\_MINIMUM = -7.1x10^7  VALID\_MAXIMUM = 1.5x10^9  MISSING\_CONSTANT = 10x10^9  DESCRIPTION = "Start time of the A cycle, seconds from J2000  (barycentric dynamic time). An A-cycle is the  32 second instrument collection cycle."  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = TELEMETRY\_MODE  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 13  BYTES = 1  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 136  MISSING\_CONSTANT = 255  DESCRIPTION = "Logical telemetry rate and mode:  1 = 250 bps  2 = 500 bps  4 = 1 kbps  8 = 2 kbps  16 = 4 kbps  32 = 8 kbps  64 = 16 kbps  130 = 500 bps solar wind  132 = 1 kbps solar wind  136 = 2 kbps solar wind"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = SPARE  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 14  BYTES = 1  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 0  MISSING\_CONSTANT = 0  DESCRIPTION = "Will contains zeroes"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = OFFSET\_TIME  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 15  BYTES = 2  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 32000  MISSING\_CONSTANT = 65535  UNIT = MILLISECOND  DESCRIPTION = "Milliseconds from start of A cycle"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = FIRST\_ENERGY\_STEP  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 17  BYTES = 2  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 63  MISSING\_CONSTANT = 65535  DESCRIPTION = "Minimum energy step in collapsed data"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = LAST\_ENERGY\_STEP  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 19  BYTES = 2  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 63  MISSING\_CONSTANT = 65535  DESCRIPTION = "Maximum energy step in collapsed data"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = FIRST\_AZIMUTH\_VALUE  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 21  BYTES = 2  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 8  MISSING\_CONSTANT = 65535  DESCRIPTION = "Minimum azimuth value in collapsed data"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = LAST\_AZIMUTH\_VALUE  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 23  BYTES = 2  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 8  MISSING\_CONSTANT = 65535  DESCRIPTION = "Maximum azimuth value in collapsed data"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = SAM\_ION\_NUMBER  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 25  BYTES = 2  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 65535  DESCRIPTION = "SAM ion number (identifies ion and group  table)"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = DATA  DATA\_TYPE = MSB\_INTEGER  START\_BYTE = 27  UNIT = COUNTS  ITEMS = 8  ITEM\_BYTES = 2  BYTES = 16  VALID\_MINIMUM = -32  VALID\_MAXIMUM = 27650  MISSING\_CONSTANT = 28671  DESCRIPTION = "Counts in elevations 1 through 8 (signed  value)"  END\_OBJECT = COLUMN |

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| Sample IMS ION Label File: ION\_YYYYDDDHH\_U3.LBL |
| PDS\_VERSION\_ID = PDS3  DATA\_SET\_ID = "CO-E/J/S/SW-CAPS-2-UNCALIBRATED-V1.1"    STANDARD\_DATA\_PRODUCT\_ID = "ION UNCALIBRATED"  PRODUCT\_ID = "ION\_201001000\_U3"  PRODUCT\_TYPE = "DATA"  PRODUCT\_CREATION\_TIME = 2010-141T20:49    RECORD\_TYPE = FIXED\_LENGTH  RECORD\_BYTES = 42  FILE\_RECORDS = 42336    START\_TIME = 2010-010T00:08:07  STOP\_TIME = 2010-010T06:05:59  SPACECRAFT\_CLOCK\_START\_COUNT = "1/1641775909.000"  SPACECRAFT\_CLOCK\_STOP\_COUNT = "1/1641797381.000"    INSTRUMENT\_HOST\_NAME = "CASSINI ORBITER"  INSTRUMENT\_HOST\_ID = "CO"  TARGET\_NAME = {"SATURN"}  INSTRUMENT\_NAME = "CASSINI PLASMA SPECTROMETER"  INSTRUMENT\_ID = "CAPS"  DESCRIPTION = "  This file contains Cassini CAPS Ion data from the IMS sensor  acquired at SATURN between  2010-010T00:08:07.000 and 2010-010T06:05:59.000 (orbit 124)."    MD5\_CHECKSUM = "c91403bfde0888687e420949f56e2a30"    NOTE = "  The end around carry checksum, with seed 0x55AA,  of this file is 0x7DAC"    ^TABLE = "ION\_201001000\_U3.DAT"  OBJECT = TABLE  INTERCHANGE\_FORMAT = "BINARY"  ROWS = 42336  COLUMNS = 12  ROW\_BYTES = 42  ^STRUCTURE = "ION\_U3.FMT"  DESCRIPTION = "  The file ION\_U3.FMT describes the column structure and content  of the data file."  END\_OBJECT = TABLE  END |

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| SNG\_U3.FMT File |
| /\* SNG\_U3.FMT \*/  /\* describes the structure of the IMS Singles (SNG) Data Table\*/  OBJECT = COLUMN  NAME = B\_CYCLE\_NUMBER  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 1  BYTES = 2  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 340  MISSING\_CONSTANT = 65535  DESCRIPTION = "B cycle number from the start of the day,  a value of 65535 indicates no B-cycle data  is available"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = A\_CYCLE\_NUMBER  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 3  BYTES = 2  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 2732  MISSING\_CONSTANT = 65535  DESCRIPTION = "A cycle number from the start of day,  a value of 65535 indicates that no A-cycle  header information is available"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = TIME  DATA\_TYPE = IEEE\_REAL  START\_BYTE = 5  BYTES = 8  UNIT = SECOND  VALID\_MINIMUM = -7.1x10^7  VALID\_MAXIMUM = 1.5x10^9  MISSING\_CONSTANT = 10x10^9  DESCRIPTION = "Start time of the A cycle, seconds from J2000  (barycentric dynamic time). An A-cycle is the  32 second instrument collection cycle."  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = TELEMETRY\_MODE  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 13  BYTES = 1  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 136  MISSING\_CONSTANT = 255  DESCRIPTION = "Logical telemetry rate and mode:  1 = 250 bps  2 = 500 bps  4 = 1 kbps  8 = 2 kbps  16 = 4 kbps  32 = 8 kbps  64 = 16 kbps  130 = 500 bps solar wind  132 = 1 kbps solar wind  136 = 2 kbps solar wind"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = SPARE  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 14  BYTES = 1  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 0  MISSING\_CONSTANT = 0  DESCRIPTION = "Contains zeroes"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = OFFSET\_TIME  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 15  BYTES = 2  UNIT = MILLISECOND  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 32000  MISSING\_CONSTANT = 65535  DESCRIPTION = "Milliseconds from start of A cycle"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = FIRST\_ENERGY\_STEP  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 17  BYTES = 2  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 63  MISSING\_CONSTANT = 65535  DESCRIPTION = "Minimum energy step in collapsed data"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = LAST\_ENERGY\_STEP  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 19  BYTES = 2  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 63  MISSING\_CONSTANT = 65535  DESCRIPTION = "Maximum energy step in collapsed data"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = FIRST\_AZIMUTH\_VALUE  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 21  BYTES = 2  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 8  MISSING\_CONSTANT = 65535  DESCRIPTION = "Minimum azimuth value in collapsed data"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = LAST\_AZIMUTH\_VALUE  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 23  BYTES = 2  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 8  MISSING\_CONSTANT = 65535  DESCRIPTION = "Maximum azimuth value in collapsed data"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = DATA  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 25  UNIT = COUNTS  ITEMS = 8  ITEM\_BYTES = 2  BYTES = 16  MISSING\_CONSTANT = 65535  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 27500  DESCRIPTION = "Counts in elevations 1 through 8"  END\_OBJECT = COLUMN |

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| Sample IMS Singles (SNG) Label File: SNG\_YYYYDDDHH\_U3.LBL |
| PDS\_VERSION\_ID = PDS3  DATA\_SET\_ID = "CO-E/J/S/SW-CAPS-2-UNCALIBRATED-V1.1"    STANDARD\_DATA\_PRODUCT\_ID = "SNG UNCALIBRATED"  PRODUCT\_ID = "SNG\_201001000\_U3"  PRODUCT\_TYPE = "DATA"  PRODUCT\_CREATION\_TIME = 2010-141T20:49    RECORD\_TYPE = FIXED\_LENGTH  RECORD\_BYTES = 40  FILE\_RECORDS = 42273    START\_TIME = 2010-010T00:08:07  STOP\_TIME = 2010-010T06:05:59  SPACECRAFT\_CLOCK\_START\_COUNT = "1/1641775909.000"  SPACECRAFT\_CLOCK\_STOP\_COUNT = "1/1641797381.000"    INSTRUMENT\_HOST\_NAME = "CASSINI ORBITER"  INSTRUMENT\_HOST\_ID = "CO"  TARGET\_NAME = {"SATURN"}  INSTRUMENT\_NAME = "CASSINI PLASMA SPECTROMETER"  INSTRUMENT\_ID = "CAPS"  DESCRIPTION = "  This file contains Cassini CAPS Singles data from the IMS sensor  acquired at SATURN between  2010-010T00:08:07.000 and 2010-010T06:05:59.000 (orbit 124)."    MD5\_CHECKSUM = "df02aa1879e3237b51ef412f960d05b5"    NOTE = "  The end around carry checksum, with seed 0x55AA,  of this file is 0xA5FA"    ^TABLE = "SNG\_201001000\_U3.DAT"  OBJECT = TABLE  INTERCHANGE\_FORMAT = "BINARY"  ROWS = 42273  COLUMNS = 11  ROW\_BYTES = 40  ^STRUCTURE = "SNG\_U3.FMT"  DESCRIPTION = "  The file SNG\_U3.FMT describes the column structure and content  of the data file."  END\_OBJECT = TABLE  END |

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| LOG\_U3.FMT File |
| /\* LOG\_U3.FMT \*/  /\* describes the structure of the IMS Logicals (LOG) Data Table\*/  OBJECT = COLUMN  NAME = B\_CYCLE\_NUMBER  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 1  BYTES = 2  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 340  MISSING\_CONSTANT = 65535  DESCRIPTION = "B cycle number from the start of the day,  a value of 65535 indicates no B-cycle data  is available"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = A\_CYCLE\_NUMBER  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 3  BYTES = 2  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 2732  MISSING\_CONSTANT = 65535  DESCRIPTION = "A cycle number from the start of day,  a value of 65535 indicates that no A-cycle  header information is available"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = TIME  DATA\_TYPE = IEEE\_REAL  START\_BYTE = 5  BYTES = 8  UNIT = SECOND  VALID\_MINIMUM = -7.1x10^7  VALID\_MAXIMUM = 1.5x10^9  MISSING\_CONSTANT = 10x10^9  DESCRIPTION = "Start time of the A cycle, seconds from J2000  (barycentric dynamic time). An A-cycle is the  32 second instrument collection cycle."  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = TELEMETRY\_MODE  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 13  BYTES = 1  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 136  MISSING\_CONSTANT = 255  DESCRIPTION = "Logical telemetry rate and mode:  1 = 250 bps  2 = 500 bps  4 = 1 kbps  8 = 2 kbps  16 = 4 kbps  32 = 8 kbps  64 = 16 kbps  130 = 500 bps solar wind  132 = 1 kbps solar wind  136 = 2 kbps solar wind"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = TDC\_LOG\_SELECTION  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 14  BYTES = 1  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 3  MISSING\_CONSTANT = 255  DESCRIPTION = "TDC selectable logical definition, where  Value: Logical 13: Logical 14:  0 Start CFD singles Stop CFD Singles  1 Acquisition Errors Deadtimes  2 Single TOF events Double TOF events  3 Data strobes Resets"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = OFFSET\_TIME  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 15  BYTES = 2  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 32000  MISSING\_CONSTANT = 65535  UNIT = MILLISECOND  DESCRIPTION = "Milliseconds from start of A cycle"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = FIRST\_ENERGY\_STEP  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 17  BYTES = 2  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 63  MISSING\_CONSTANT = 65535  DESCRIPTION = "Minimum energy step in collapsed data"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = LAST\_ENERGY\_STEP  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 19  BYTES = 2  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 63  MISSING\_CONSTANT = 65535  DESCRIPTION = "Maximum energy step in collapsed data"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = FIRST\_AZIMUTH\_VALUE  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 21  BYTES = 2  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 8  MISSING\_CONSTANT = 65535  DESCRIPTION = "Minimum azimuth value in collapsed data"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = LAST\_AZIMUTH\_VALUE  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 23  BYTES = 2  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 8  MISSING\_CONSTANT = 65535  DESCRIPTION = "Maximum azimuth value in collapsed data"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = LEF\_STOPS  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 25  UNIT = COUNTS  BYTES = 2  MISSING\_CONSTANT = 65535  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 27500  DESCRIPTION = "LEF stop counts"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = ST\_STOPS  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 27  UNIT = COUNTS  BYTES = 2  MISSING\_CONSTANT = 65535  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 27500  DESCRIPTION = "ST stop counts"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = TIMEOUTS  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 29  UNIT = COUNTS  BYTES = 2  MISSING\_CONSTANT = 65535  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 27500  DESCRIPTION = "Timeout events"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = TOTAL\_EVENTS  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 31  UNIT = COUNTS  BYTES = 2  MISSING\_CONSTANT = 65535  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 27500  DESCRIPTION = "Total events (generated by SAM for dead time)"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = LOGICAL\_13  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 33  UNIT = COUNTS  BYTES = 2  MISSING\_CONSTANT = 65535  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 27500  DESCRIPTION = "TDC selectable logical 13, see variable,  TDC\_LOG\_SELECTION to determine which logical  is represented in the data."  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = LOGICAL\_14  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 35  UNIT = COUNTS  BYTES = 2  MISSING\_CONSTANT = 65535  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 27500  DESCRIPTION = "TDC selectable logical 14, see variable,  TDC\_LOG\_SELECTION to determine which logical  is represented in the data."  END\_OBJECT = COLUMN |

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| Sample IMS Logicals (LOG) Label File: LOG\_YYYYDDDHH\_U3.LBL |
| PDS\_VERSION\_ID = PDS3  DATA\_SET\_ID = "CO-E/J/S/SW-CAPS-2-UNCALIBRATED-V1.1"    STANDARD\_DATA\_PRODUCT\_ID = "LOG UNCALIBRATED"  PRODUCT\_ID = "LOG\_201001000\_U3"  PRODUCT\_TYPE = "DATA"  PRODUCT\_CREATION\_TIME = 2010-141T20:49    RECORD\_TYPE = FIXED\_LENGTH  RECORD\_BYTES = 36  FILE\_RECORDS = 141057    START\_TIME = 2010-010T00:08:07  STOP\_TIME = 2010-010T06:05:59  SPACECRAFT\_CLOCK\_START\_COUNT = "1/1641775909.000"  SPACECRAFT\_CLOCK\_STOP\_COUNT = "1/1641797381.000"    INSTRUMENT\_HOST\_NAME = "CASSINI ORBITER"  INSTRUMENT\_HOST\_ID = "CO"  TARGET\_NAME = {"SATURN"}  INSTRUMENT\_NAME = "CASSINI PLASMA SPECTROMETER"  INSTRUMENT\_ID = "CAPS"  DESCRIPTION = "  This file contains Cassini CAPS Logicals data from the IMS sensor  acquired at SATURN between  2010-010T00:08:07.000 and 2010-010T06:05:59.000 (orbit 124)."    MD5\_CHECKSUM = "c5074119ad07eb2d59c77daf3e1681c8"    NOTE = "  The end around carry checksum, with seed 0x55AA,  of this file is 0x0571"    ^TABLE = "LOG\_201001000\_U3.DAT"  OBJECT = TABLE  INTERCHANGE\_FORMAT = "BINARY"  ROWS = 141057  COLUMNS = 16  ROW\_BYTES = 36  ^STRUCTURE = "LOG\_U3.FMT"  DESCRIPTION = "  The file LOG\_U3.FMT describes the column structure and content  of the data file."  END\_OBJECT = TABLE  END |

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| TOF\_U3.FMT File |
| /\* TOF\_U3.FMT \*/  /\* describes the structure of the IMS TOF Data Table\*/  OBJECT = COLUMN  NAME = B\_CYCLE\_NUMBER  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 1  BYTES = 2  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 340  MISSING\_CONSTANT = 65535  DESCRIPTION = "B cycle number from the start of the day,  a value of 65535 indicates that there is  a problem with archive generation"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = TIME  DATA\_TYPE = IEEE\_REAL  START\_BYTE = 3  BYTES = 8  VALID\_MINIMUM = -7.1x10^7  VALID\_MAXIMUM = 1.5x10^9  MISSING\_CONSTANT = 10x10^9  UNIT = SECOND  DESCRIPTION = "Start time of the B cycle, seconds from J2000  (barycentric dynamic time). A B-cycle is the  collection cycle of the Time of Flight data.  The duration of the collection cycle is dependant  upon the flight software version. A collection  is 256 seconds, 512 seconds, or 1024 seconds.  During each 32 second instrument cycle, data is  transmitted and then recombined on the ground.  For more information, please see the  CO\_CAPS\_UNCALIBRATED\_DS.CAT in the CATALOG  directory."  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = TELEMETRY\_MODE  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 11  BYTES = 1  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 136  MISSING\_CONSTANT = 255  DESCRIPTION = "Logical telemetry rate and mode:  Telemetry mode when data was downlinked. Gives  information regarding how data is currently  collapsed.  1 = 250 bps  2 = 500 bps  4 = 1 kbps  8 = 2 kbps  16 = 4 kbps  32 = 8 kbps  64 = 16 kbps  130 = 500 bps solar wind  132 = 1 kbps solar wind  136 = 2 kbps solar wind"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = COLLAPSE\_FLAG  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 12  BYTES = 1  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 1  MISSING\_CONSTANT = 255  DESCRIPTION = "Flag indicating collapse in TOF:  0: average, 256s Bcycle duration  1: sum, 256s Bcycle duration  2: average, 512s Bcycle duration  3: sum, 512s Bcycle duration  4: average, 1024s Bcycle duration  5: sum, 1024s Bcycle duration"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = ST\_START\_CHANNEL  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 13  BYTES = 2  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 1535  MISSING\_CONSTANT = 2047  DESCRIPTION = "Start ST TOF Channel. NOTE: There are a total  of 2048 channels in flight."  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = ST\_INTERVAL  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 15  BYTES = 1  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 4  MISSING\_CONSTANT = 0  DESCRIPTION = "ST TOF bin interval:  0 = FILL value implying housekeping information  is unavailable. Check previous of following  Bcycle for this information.  1 = every word taken starting at the  ST\_START\_CHANNEL  2 = every other word is taken starting at the  ST\_START\_CHANNEL  4 = every 4th word is taken starting at the  ST\_START\_CHANNEL"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = ST\_ENERGY\_COLLAPSE  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 16  BYTES = 1  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 3  MISSING\_CONSTANT = 255  DESCRIPTION = "ST energy collapse option:  0 = sum adjacent energies  1 = take even energies  2 = take odd energies  3 = TBA (to be assigned)"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = LEF\_START\_CHANNEL  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 17  BYTES = 2  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 1535  MISSING\_CONSTANT = 2047  DESCRIPTION = "Start LEF TOF Channel. NOTE: There are a total  of 2048 channels in flight."  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = LEF\_INTERVAL  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 19  BYTES = 1  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 4  MISSING\_CONSTANT = 0  DESCRIPTION = "LEF TOF bin interval:  0 = FILL value implying housekeping information  is unavailable. Check previous of following  Bcycle for this information.  1 = every word taken starting at the  LEF\_START\_CHANNEL  2 = every other word is taken starting at the  LEF\_START\_CHANNEL  4 = every 4th word is taken starting at the  LEF\_START\_CHANNEL"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = LEF\_ENERGY\_COLLAPSE  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 20  BYTES = 1  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 3  MISSING\_CONSTANT = 255  DESCRIPTION = "LEF energy collapse option:  0 = sum adjacent energies  1 = take even energies  2 = take odd energies  3 = TBA (to be assigned)"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = ENERGY\_STEP  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 21  BYTES = 2  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 32  MISSING\_CONSTANT = 65535  DESCRIPTION = "Energy step in collapsed data"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = DATA\_ST  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 23  ITEMS = 512  ITEM\_BYTES = 4  BYTES = 2048  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 3268027  MISSING\_CONSTANT = 4294967295  UNIT = COUNTS  DESCRIPTION = "Counts in ST TOF bins 1 through 512"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = DATA\_LEF  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 2071  ITEMS = 512  ITEM\_BYTES = 4  BYTES = 2048  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 3268027  MISSING\_CONSTANT = 4294967295  UNIT = COUNTS  DESCRIPTION = "Counts in LEF TOF bins 1 through 512"  END\_OBJECT = COLUMN |

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| Sample IMS TOF Label File: TOF\_YYYYDDDHH\_U3.LBL |
| PDS\_VERSION\_ID = PDS3  DATA\_SET\_ID = "CO-E/J/S/SW-CAPS-2-UNCALIBRATED-V1.1"    STANDARD\_DATA\_PRODUCT\_ID = "TOF UNCALIBRATED"  PRODUCT\_ID = "TOF\_201001000\_U3"  PRODUCT\_TYPE = "DATA"  PRODUCT\_CREATION\_TIME = 2010-141T20:49    RECORD\_TYPE = FIXED\_LENGTH  RECORD\_BYTES = 4118  FILE\_RECORDS = 448    START\_TIME = 2010-010T00:25:10  STOP\_TIME = 2010-010T05:57:58  SPACECRAFT\_CLOCK\_START\_COUNT = "1/1641776932.000"  SPACECRAFT\_CLOCK\_STOP\_COUNT = "1/1641796900.000"    INSTRUMENT\_HOST\_NAME = "CASSINI ORBITER"  INSTRUMENT\_HOST\_ID = "CO"  TARGET\_NAME = {"SATURN"}  INSTRUMENT\_NAME = "CASSINI PLASMA SPECTROMETER"  INSTRUMENT\_ID = "CAPS"  DESCRIPTION = "  This file contains Cassini CAPS Time of Flight data from the IMS sensor  acquired at SATURN between  2010-010T00:25:10.000 and 2010-010T05:57:58.000 (orbit 124)."    MD5\_CHECKSUM = "d4016b866ca45e497c893392fe6261c8"    NOTE = "  The end around carry checksum, with seed 0x55AA,  of this file is 0xEE70"    ^TABLE = "TOF\_201001000\_U3.DAT"  OBJECT = TABLE  INTERCHANGE\_FORMAT = "BINARY"  ROWS = 448  COLUMNS = 13  ROW\_BYTES = 4118  ^STRUCTURE = "TOF\_U3.FMT"  DESCRIPTION = "  The file TOF\_U3.FMT describes the column structure and content  of the data file."  END\_OBJECT = TABLE  END |
| ACT\_3.FMT File |
| /\* ACT\_3.FMT \*/  /\* describes the structure of the Actuator Data Table\*/  OBJECT = COLUMN  NAME = B\_CYCLE\_NUMBER  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 1  BYTES = 2  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 340  MISSING\_CONSTANT = 65535  DESCRIPTION = "B cycle number from the start of the day,  a value of 65535 indicates no B-cycle data  is available"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = A\_CYCLE\_NUMBER  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 3  BYTES = 2  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 2372  MISSING\_CONSTANT = 65535  DESCRIPTION = "A cycle number from the start of day"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = TIME  DATA\_TYPE = IEEE\_REAL  START\_BYTE = 5  BYTES = 8  VALID\_MINIMUM = -7.1x10^7  VALID\_MAXIMUM = 1.5x10^9  MISSING\_CONSTANT = 10x10^9  UNIT = SECOND  DESCRIPTION = "Start time of the A cycle, seconds from J2000  (barycentric dynamic time). An A-cycle is the  32 second instrument collection cycle"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = DATA  DATA\_TYPE = IEEE\_REAL  START\_BYTE = 13  UNIT = ANGLE  ITEMS = 32  ITEM\_BYTES = 4  BYTES = 128  MISSING\_CONSTANT = -999  VALID\_MINIMUM = -115  VALID\_MAXIMUM = 115  DESCRIPTION = "Actuator angle at start + (item #) seconds,  where item # is between 0 and 31.  TIME"  END\_OBJECT = COLUMN |

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| Sample Actuator (ACT) Label File: ACT\_YYYYDDDHH\_3.LBL |
| PDS\_VERSION\_ID = PDS3  DATA\_SET\_ID = {"CO-E/J/S/SW-CAPS-2-UNCALIBRATED-V1.1",  "CO-E/J/S/SW-CAPS-3-CALIBRATED-V1.1"}  STANDARD\_DATA\_PRODUCT\_ID = "ACT"  PRODUCT\_ID = "ACT\_201001000\_3"  PRODUCT\_TYPE = "DATA"  PRODUCT\_CREATION\_TIME = 2010-141T20:48    RECORD\_TYPE = FIXED\_LENGTH  RECORD\_BYTES = 140  FILE\_RECORDS = 671    START\_TIME = 2010-010T00:08:07  STOP\_TIME = 2010-010T06:05:59  SPACECRAFT\_CLOCK\_START\_COUNT = "1/1641775909.000"  SPACECRAFT\_CLOCK\_STOP\_COUNT = "1/1641797381.000"    INSTRUMENT\_HOST\_NAME = "CASSINI ORBITER"  INSTRUMENT\_HOST\_ID = "CO"  TARGET\_NAME = {"SATURN"}  INSTRUMENT\_NAME = "CASSINI PLASMA SPECTROMETER"  INSTRUMENT\_ID = "CAPS"  DESCRIPTION = "  This file contains Cassini CAPS actuator data  acquired at SATURN between  2010-010T00:08:07.000 and 2010-010T06:05:59.000 (orbit 124)."    MD5\_CHECKSUM = "b0d1329c7a43c48fd3b1fb32ff411264"    NOTE = "  The end around carry checksum, with seed 0x55AA,  of this file is 0x2E7E"    ^TABLE = "ACT\_201001000\_3.DAT"  OBJECT = TABLE  INTERCHANGE\_FORMAT = "BINARY"  ROWS = 671  COLUMNS = 4  ROW\_BYTES = 140  ^STRUCTURE = "ACT\_3.FMT"  DESCRIPTION = "  The file ACT\_3.FMT describes the column structure and content  of the data file."  END\_OBJECT = TABLE  END |

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| EVN\_U3.FMT File |
| /\* EVN\_U3.FMT \*/  /\* describes the structure of the Event Mode Data Table\*/  OBJECT = COLUMN  NAME = B\_CYCLE\_NUMBER  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  FORMAT = I2  START\_BYTE = 1  BYTES = 2  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 340  MISSING\_CONSTANT = 65535  DESCRIPTION = "B cycle number from the start of the day,  a value of 65535 indicates no B-cycle data  is available"  END\_OBJECT = COLUMN  OBJECT = COLUMN  NAME = A\_CYCLE\_NUMBER  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  FORMAT = I2  START\_BYTE = 3  BYTES = 2  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 2732  MISSING\_CONSTANT = 65535  DESCRIPTION = "A cycle number from the start of day,  a value of 65535 indicates that no A-cycle  header information is available"  END\_OBJECT = COLUMN  OBJECT = COLUMN  NAME = TIME  DATA\_TYPE = IEEE\_REAL  FORMAT = F8  START\_BYTE = 5  BYTES = 8  VALID\_MINIMUM = -7.1x10^7  VALID\_MAXIMUM = 1.5x10^9  MISSING\_CONSTANT = 10x10^9  UNIT = SECOND  DESCRIPTION = "Start time of the A cycle, seconds from J2000  (barycentric dynamic time). An A-cycle is the  32 second instrument collection cycle."  END\_OBJECT = COLUMN  OBJECT = COLUMN  NAME = OFFSET\_TIME  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  FORMAT = I2  START\_BYTE = 13  BYTES = 2  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 32000  MISSING\_CONSTANT = 65535  UNIT = MILLISECOND  DESCRIPTION = "Milliseconds from start of A cycle"  END\_OBJECT = COLUMN  OBJECT = COLUMN  NAME = ENERGY\_STEP  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  FORMAT = I2  START\_BYTE = 15  BYTES = 2  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 63  MISSING\_CONSTANT = 65535  DESCRIPTION = "Energy step"  END\_OBJECT = COLUMN  OBJECT = COLUMN  NAME = AZIMUTH\_VALUE  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  FORMAT = I2  START\_BYTE = 17  BYTES = 2  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 1  MISSING\_CONSTANT = 1  DESCRIPTION = "Azimuth value (always 1)"  END\_OBJECT = COLUMN  OBJECT = COLUMN  NAME = ELEVATION  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  FORMAT = I1  START\_BYTE = 19  BYTES = 1  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 8  MISSING\_CONSTANT = 255  DESCRIPTION = "Elevation"  END\_OBJECT = COLUMN  OBJECT = COLUMN  NAME = TOF\_TYPE  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  FORMAT = I1  START\_BYTE = 20  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 254  MISSING\_CONSTANT = 255  BYTES = 1  DESCRIPTION = "ST/LEF and single/dual event flag  0 = ST, first or single event  1 = LEF, first or single event  2 = ST, second event of a dual event  3 = LEF, second event of a dual event  4 - 255 = spare"  END\_OBJECT = COLUMN  OBJECT = COLUMN  NAME = TOF  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  FORMAT = I2  START\_BYTE = 21  BYTES = 2  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 2048  MISSING\_CONSTANT = 65535  DESCRIPTION = "Event's Time of Flight Data.  The particle's TOF channel."  END\_OBJECT = COLUMN |

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| Sample EVN Label File: EVN\_YYYYDDDHH\_U3.LBL |
| NOT AVAILABLE YET, AS NO FILES EXIST |

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| ANC\_U3.FMT File |
| /\* ANC\_U3.FMT \*/  /\* describes the structure of the Ancillary Data Table\*/  OBJECT = COLUMN  NAME = B\_CYCLE\_NUMBER  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 1  BYTES = 2  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 340  MISSING\_CONSTANT = 65535  DESCRIPTION = "B cycle number from the start of the day,  a value of 65535 indicates no B-cycle data  is available"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = A\_CYCLE\_NUMBER  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 3  BYTES = 2  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 2732  MISSING\_CONSTANT = 65535  DESCRIPTION = "A cycle number from the start of day"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = TIME  DATA\_TYPE = IEEE\_REAL  START\_BYTE = 5  BYTES = 8  VALID\_MINIMUM = -7.1x10^7  VALID\_MAXIMUM = 1.5x10^9  MISSING\_CONSTANT = 10x10^9  UNIT = SECOND  DESCRIPTION = "Start time of the A cycle, seconds from J2000  (barycentric dynamic time). An A-cycle is the  32 second instrument collection cycle."  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = TIME\_SCLK  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 13  BYTES = 4  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 3.0x10^9  MISSING\_CONSTANT = 10x10^9  UNIT = SECOND  DESCRIPTION = "Start time of the A cycle, spacecraft clock"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = SC\_SATURN\_POS\_X  DATA\_TYPE = IEEE\_REAL  START\_BYTE = 17  BYTES = 4  VALID\_MINIMUM = -9.46x10^12  VALID\_MAXIMUM = 9.46x10^12  MISSING\_CONSTANT = 10x10^12  UNIT = KILOMETER  DESCRIPTION = "J2000[km]: Saturn-centered Spacecraft X Position"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = SC\_SATURN\_POS\_Y  DATA\_TYPE = IEEE\_REAL  START\_BYTE = 21  BYTES = 4  VALID\_MINIMUM = -9.46x10^12  VALID\_MAXIMUM = 9.46x10^12  MISSING\_CONSTANT = 10x10^12  UNIT = KILOMETER  DESCRIPTION = "J2000[km]: Saturn-centered Spacecraft Y Position"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = SC\_SATURN\_POS\_Z  DATA\_TYPE = IEEE\_REAL  START\_BYTE = 25  BYTES = 4  VALID\_MINIMUM = -9.46x10^12  VALID\_MAXIMUM = 9.46x10^12  MISSING\_CONSTANT = 10x10^12  UNIT = KILOMETER  DESCRIPTION = "J2000[km]: Saturn-centered Spacecraft Z Position"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = SC\_SATURN\_VELOCITY\_VX  DATA\_TYPE = IEEE\_REAL  START\_BYTE = 29  BYTES = 4  VALID\_MINIMUM = -3x10^5  VALID\_MAXIMUM = 3x10^5  MISSING\_CONSTANT = 5x10^5  DESCRIPTION = "J2000 [km/s]: Relative to Saturn"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = SC\_SATURN\_VELOCITY\_VY  DATA\_TYPE = IEEE\_REAL  START\_BYTE = 33  BYTES = 4  VALID\_MINIMUM = -3x10^5  VALID\_MAXIMUM = 3x10^5  MISSING\_CONSTANT = 5x10^5  DESCRIPTION = "J2000 [km/s]: Relative to Saturn"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = SC\_SATURN\_VELOCITY\_VZ  DATA\_TYPE = IEEE\_REAL  START\_BYTE = 37  BYTES = 4  VALID\_MINIMUM = -3x10^5  VALID\_MAXIMUM = 3x10^5  MISSING\_CONSTANT = 5x10^5  DESCRIPTION = "J2000 [km/s]: Relative to Saturn"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = SC\_SUN\_POS\_X  DATA\_TYPE = IEEE\_REAL  START\_BYTE = 41  BYTES = 4  VALID\_MINIMUM = -9.46x10^12  VALID\_MAXIMUM = 9.46x10^12  MISSING\_CONSTANT = 10x10^12  UNIT = KILOMETER  DESCRIPTION = "J2000[km]: Sun-centered Spacecraft X Position."  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = SC\_SUN\_POS\_Y  DATA\_TYPE = IEEE\_REAL  START\_BYTE = 45  BYTES = 4  VALID\_MINIMUM = -9.46x10^12  VALID\_MAXIMUM = 9.46x10^12  MISSING\_CONSTANT = 10x10^12  UNIT = KILOMETER  DESCRIPTION = "J2000[km]: Sun-centered Spacecraft Y Position."  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = SC\_SUN\_POS\_Z  DATA\_TYPE = IEEE\_REAL  START\_BYTE = 49  BYTES = 4  VALID\_MINIMUM = -9.46x10^12  VALID\_MAXIMUM = 9.46x10^12  MISSING\_CONSTANT = 10x10^12  UNIT = KILOMETER  DESCRIPTION = "J2000[km]: Sun-centered Spacecraft Z Position."  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = SC\_SUN\_VELOCITY\_VX  DATA\_TYPE = IEEE\_REAL  START\_BYTE = 53  BYTES = 4  VALID\_MINIMUM = -3x10^5  VALID\_MAXIMUM = 3x10^5  MISSING\_CONSTANT = 5x10^5  DESCRIPTION = "J2000 [km/s]: Relative to the Sun"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = SC\_SUN\_VELOCITY\_VY  DATA\_TYPE = IEEE\_REAL  START\_BYTE = 57  BYTES = 4  VALID\_MINIMUM = -3x10^5  VALID\_MAXIMUM = 3x10^5  MISSING\_CONSTANT = 5x10^5  DESCRIPTION = "J2000 [km/s]: Relative to the Sun"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = SC\_SUN\_VELOCITY\_VZ  DATA\_TYPE = IEEE\_REAL  START\_BYTE = 61  BYTES = 4  VALID\_MINIMUM = -3x10^5  VALID\_MAXIMUM = 3x10^5  MISSING\_CONSTANT = 5x10^5  DESCRIPTION = "J2000 [km/s]: Relative to the Sun"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = SC\_ORIENT\_XX  DATA\_TYPE = IEEE\_REAL  START\_BYTE = 65  BYTES = 4  VALID\_MINIMUM = -1  VALID\_MAXIMUM = 1  MISSING\_CONSTANT = 2  DESCRIPTION = "XX component of rotation matrix to J2000"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = SC\_ORIENT\_XY  DATA\_TYPE = IEEE\_REAL  START\_BYTE = 69  BYTES = 4  VALID\_MINIMUM = -1  VALID\_MAXIMUM = 1  MISSING\_CONSTANT = 2  DESCRIPTION = "XY component of rotation matrix to J2000"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = SC\_ORIENT\_XZ  DATA\_TYPE = IEEE\_REAL  START\_BYTE = 73  BYTES = 4  VALID\_MINIMUM = -1  VALID\_MAXIMUM = 1  MISSING\_CONSTANT = 2  DESCRIPTION = "XZ component of rotation matrix to J2000"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = SC\_ORIENT\_YX  DATA\_TYPE = IEEE\_REAL  START\_BYTE = 77  BYTES = 4  VALID\_MINIMUM = -1  VALID\_MAXIMUM = 1  MISSING\_CONSTANT = 2  DESCRIPTION = "YX component of rotation matrix to J2000"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = SC\_ORIENT\_YY  DATA\_TYPE = IEEE\_REAL  START\_BYTE = 81  BYTES = 4  VALID\_MINIMUM = -1  VALID\_MAXIMUM = 1  MISSING\_CONSTANT = 2  DESCRIPTION = "YY component of rotation matrix to J2000"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = SC\_ORIENT\_YZ  DATA\_TYPE = IEEE\_REAL  START\_BYTE = 85  BYTES = 4  VALID\_MINIMUM = -1  VALID\_MAXIMUM = 1  MISSING\_CONSTANT = 2  DESCRIPTION = "YZ component of rotation matrix to J2000"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = SC\_ORIENT\_ZX  DATA\_TYPE = IEEE\_REAL  START\_BYTE = 89  BYTES = 4  VALID\_MINIMUM = -1  VALID\_MAXIMUM = 1  MISSING\_CONSTANT = 2  DESCRIPTION = "ZX component of rotation matrix to J2000"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = SC\_ORIENT\_ZY  DATA\_TYPE = IEEE\_REAL  START\_BYTE = 93  BYTES = 4  VALID\_MINIMUM = -1  VALID\_MAXIMUM = 1  MISSING\_CONSTANT = 2  DESCRIPTION = "ZY component of rotation matrix to J2000"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = SC\_ORIENT\_ZZ  DATA\_TYPE = IEEE\_REAL  START\_BYTE = 97  BYTES = 4  VALID\_MINIMUM = -1  VALID\_MAXIMUM = 1  MISSING\_CONSTANT = 2  DESCRIPTION = "ZZ component of rotation matrix to J2000"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = ELS\_QUALITY\_FLAG  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 101  BYTES = 1  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 6  MISSING\_CONSTANT = 7  DESCRIPTION = "Missing data and good/bad checksum  0 = Everything is OK  1 = Missing Data  2 = Bad Checksum  3 = Both Missing Data & Bad Checksum  4,5,6 = Not used  7 = No Data"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = IBS\_QUALITY\_FLAG  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 102  BYTES = 1  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 6  MISSING\_CONSTANT = 7  DESCRIPTION = "Missing data and good/bad checksum  0 = Everything is OK  1 = Missing Data  2 = Bad Checksum  3 = Both Missing Data & Bad Checksum  4,5,6 = Not used  7 = No Data"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = ION\_QUALITY\_FLAG  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 103  BYTES = 1  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 6  MISSING\_CONSTANT = 7  DESCRIPTION = "Missing data and good/bad checksum  0 = Everything is OK  1 = Missing Data  2 = Bad Checksum  3 = Both Missing Data & Bad Checksum  4,5,6 = Not used  7 = No Data"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = TOF\_LEF\_QUALITY\_FLAG  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 104  BYTES = 1  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 6  MISSING\_CONSTANT = 7  DESCRIPTION = "Missing data and good/bad checksum  0 = Everything is OK  1 = Missing Data  2 = Bad Checksum  3 = Both Missing Data & Bad Checksum  4,5,6 = Not used  7 = No Data"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = TOF\_ST\_QUALITY\_FLAG  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 105  BYTES = 1  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 6  MISSING\_CONSTANT = 7  DESCRIPTION = "Missing data and good/bad checksum  0 = Everything is OK  1 = Missing Data  2 = Bad Checksum  3 = Both Missing Data & Bad Checksum  4,5,6 = Not used  7 = No Data"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = LOG\_QUALITY\_FLAG  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 106  BYTES = 1  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 6  MISSING\_CONSTANT = 7  DESCRIPTION = "Missing data and good/bad checksum  0 = Everything is OK  1 = Missing Data  2 = Bad Checksum  3 = Both Missing Data & Bad Checksum  4,5,6 = Not used  7 = No Data"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = SNG\_QUALITY\_FLAG  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 107  BYTES = 1  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 6  MISSING\_CONSTANT = 7  DESCRIPTION = "Missing data and good/bad checksum  0 = Everything is OK  1 = Missing Data  2 = Bad Checksum  3 = Both Missing Data & Bad Checksum  4,5,6 = Not used  7 = No Data"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = ACT\_QUALITY\_FLAG  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 108  BYTES = 1  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 6  MISSING\_CONSTANT = 7  DESCRIPTION = "Missing data and good/bad checksum  0 = Everything is OK  1 = Missing Data  2 = Bad Checksum  3 = Both Missing Data & Bad Checksum  4,5,6 = Not used  7 = No Data"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = ACT\_STATUS\_BITS  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 109  ITEMS = 32  ITEM\_BYTES = 1  BYTES = 32  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 8  MISSING\_CONSTANT = 16  DESCRIPTION = "Actuator Status Bits:  0 = Everything is OK  4 = Hit the Limit Switch at +108  8 = Hit the Limit Switch at -108  16 = Data Not Available"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = TLM\_VERSION  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 141  BYTES = 1  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 3  MISSING\_CONSTANT = 255  DESCRIPTION = "Telemetry mode version number"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = FSW\_MAJOR\_VERSION  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 142  BYTES = 1  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 4  MISSING\_CONSTANT = 255  DESCRIPTION = "Flight software major version number.  To build the full flight software version:  Major.SubMajor.Minor.SubMinor  For example: 3.1.0.2"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = FSW\_SUBMAJOR\_VERSION  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 143  BYTES = 1  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 16  MISSING\_CONSTANT = 255  DESCRIPTION = "Flight software sub-major version number.  To build the full flight software version:  Major.SubMajor.Minor.SubMinor  For example: 3.1.0.2"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = FSW\_MINOR\_VERSION  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 144  BYTES = 1  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 16  MISSING\_CONSTANT = 255  DESCRIPTION = "Flight software minor version number.  To build the full flight software version:  Major.SubMajor.Minor.SubMinor  For example: 3.1.0.2"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = FSW\_SUBMINOR\_VERSION  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 145  BYTES = 1  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 16  MISSING\_CONSTANT = 255  DESCRIPTION = "Flight software sub-minor version number.  To build the full flight software version:  Major.SubMajor.Minor.SubMinor  For example: 3.1.0.2"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = POINTING\_TYPE  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 146  BYTES = 1  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 2  MISSING\_CONSTANT = 0  DESCRIPTION = "Describes the type of pointing we have:  0 = no pointing available  1 = pointing based on predicts  2 = pointing based on reconstructs."  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = TELEMETRY\_MODE  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 147  BYTES = 1  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 136  MISSING\_CONSTANT = 255  DESCRIPTION = "Logical telemetry rate and mode:  1 = 250 bps  2 = 500 bps  4 = 1 kbps  8 = 2 kbps  16 = 4 kbps  32 = 8 kbps  64 = 16 kbps  130 = 500 bps solar wind  132 = 1 kbps solar wind  136 = 2 kbps solar wind"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = IBS\_SWEEP\_TABLE\_NUMBER  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 148  BYTES = 1  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 240  MISSING\_CONSTANT = 255  DESCRIPTION = "IBS sweep table and index table numbers:  Upper 4 bits are the IBS index table  Lower 4 bits are the IBS sweep table number  Fill: 0xFF"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = DATA\_IBS\_BKGD  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 149  UNIT = COUNTS  ITEMS = 3  ITEM\_BYTES = 2  BYTES = 6  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 65534  MISSING\_CONSTANT = 65535  DESCRIPTION = "IBS background counts in fans 1 through 3.  Fill is 0xFFFF"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = IBS\_STARTING\_ENERGY  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 155  BYTES = 2  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 852  MISSING\_CONSTANT = 65535  DESCRIPTION = "IBS starting energy step number.  Fill is 0xFFFF"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = IBS\_SUBCYCLE  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 157  BYTES = 1  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 7  MISSING\_CONSTANT = 255  DESCRIPTION = "IBS subcycle counter.  Fill is 0xFF"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = IBS\_COMPRESSION\_RATIO  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 158  BYTES = 1  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 32  MISSING\_CONSTANT = 0  DESCRIPTION = "ratio: (uncompressed length/compressed length).  Calculated on ground from info in the IBS header  and rounded down to the nearest integer.  Fill is 0"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = IBS\_PEAK\_FAN  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 159  BYTES = 1  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 3  MISSING\_CONSTANT = 4  DESCRIPTION = "Fan containing the IBS peak.  Fill is 4"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = IBS\_PEAK\_ACYCLE  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 160  BYTES = 1  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 8  MISSING\_CONSTANT = 9  DESCRIPTION = "A cycle number containing the IBS peak  Fill is 9"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = IBS\_PEAK\_SWEEP  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 161  BYTES = 1  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 16  MISSING\_CONSTANT = 0  DESCRIPTION = "IBS peak energy sweep.  Fill is 0"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = IBS\_PEAK\_STEP  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 162  BYTES = 1  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 255  MISSING\_CONSTANT = 0  DESCRIPTION = "IBS peak energy step.  Fill is 0"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = IBS\_THRESHOLD\_RL  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 163  BYTES = 2  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 255  MISSING\_CONSTANT = 65535  DESCRIPTION = "IBS Run length compression threshold.  Fill is 0xFFFF"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = IMS\_SWEEP\_TABLE\_NUMBER  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 165  BYTES = 1  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 255  MISSING\_CONSTANT = 240  DESCRIPTION = "IMS sweep table number.  Number 240 will be reserved as a fill value"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = TDC\_SINGLE\_SELECT  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 166  BYTES = 1  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 3  MISSING\_CONSTANT = 255  DESCRIPTION = "TDC Singles Selection:  Value: Single 13 Single 14  0 Start CFD Stop CFD  1 Acquisition Error Deadtimes  2 Single TOF's Double TOF's  3 Data Strobes Resets"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = IMS\_LOGICALS\_SELECTION  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 167  BYTES = 2  VALID\_MINIMUM = 4096  VALID\_MAXIMUM = 27416  MISSING\_CONSTANT = 65535  DESCRIPTION = "TDC logicals selection:  Bits 15-13: IMS Logical 1  Bits 12-10: IMS Logical 2  Bits 9-7: IMS Logical 3  Bits 6-4: IMS Logical 4  Bits 3-0: Unused    Logical selection decoder:  0 = Unused  1 = LEF Stop  2 = ST Stop  3 = Timeouts  4 = Total Events (As used in SAM deadtime correction)  5 = Logical 13  6 = Logical 14  7 = Unused  NOTE: Logical 13 and 14 are set with 82TDC\_ENG\_SING.  See OBJECT name TDC\_SINGLE\_SELECT."  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = SAM\_CPU2\_STATUS\_FLAGS  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 169  BYTES = 1  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 255  DESCRIPTION = "Bit 7 = CPU2/SAM mode change  6 = Background data  5 = Ion deadtime compensation  4 = SAM LEF enable  3 = SAM molecule enable  2 = SW/HW binning  1-0 = HW binning LUT index"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = SAM\_ION\_SELECTION\_INDEX  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 170  BYTES = 1  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 255  DESCRIPTION = "SAM Ion selection index number"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = SAM\_ION\_GROUP\_TABLE  DATA\_TYPE = MSB\_UNSIGNED\_INTEGER  START\_BYTE = 171  BYTES = 2  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 65534  MISSING\_CONSTANT = 65535  DESCRIPTION = "SAM group table ID number"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = ELS\_MCP\_ADJ  DATA\_TYPE = IEEE\_REAL  START\_BYTE = 173  BYTES = 4  UNIT = VOLTS  VALID\_MINIMUM = 0.0  VALID\_MAXIMUM = 3700.0  MISSING\_CONSTANT = -1.0  DESCRIPTION = "ELS High Voltage Adjust. converted using:  V = DAC \* 58.73. Where DAC is the digital to  analog value transmitted by the instrument in  housekeeping."  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = IBS\_CEM\_DAC  DATA\_TYPE = IEEE\_REAL  START\_BYTE = 177  BYTES = 4  UNIT = VOLTS  VALID\_MINIMUM = -4000.0  VALID\_MAXIMUM = 0.0  MISSING\_CONSTANT = 1.0  DESCRIPTION = "IBS CEM (channel-electron multiplier) High Voltage.  Converted using: V = DAC \* (-15.68627451). DAC is  the digital to analog value transmitted by the  instrument in housekeeping."  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = HVU1\_RET\_DAC  DATA\_TYPE = IEEE\_REAL  START\_BYTE = 181  BYTES = 4  UNIT = KILOVOLTS  VALID\_MINIMUM = 0.0  VALID\_MAXIMUM = 16.0  MISSING\_CONSTANT = -1.0  DESCRIPTION = "HVU1 (high voltage unit 1) Retarding High Voltage,  converted using: kV = DAC \* 0.0627451  Where DAC is the digital to analog value transmitted  by the instrument in housekeeping."  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = HVU1\_ACC\_DAC  DATA\_TYPE = IEEE\_REAL  START\_BYTE = 185  BYTES = 4  UNIT = KILOVOLTS  VALID\_MINIMUM = -16.0  VALID\_MAXIMUM = 0.0  MISSING\_CONSTANT = 1.0  DESCRIPTION = "HVU1 (high voltage unit 1) Accelerating High Voltage,  converted using: kV = DAC \* -0.0627451  Where DAC is the digital to analog value transmitted  by the instrument in housekeeping."  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = HVU2\_ST\_DAC  DATA\_TYPE = IEEE\_REAL  START\_BYTE = 189  BYTES = 4  UNIT = VOLTS  VALID\_MINIMUM = -3600.0  VALID\_MAXIMUM = 0.0  MISSING\_CONSTANT = 1.0  DESCRIPTION = "HVU2 (high voltage unit 2) Straight Through MCP  (multichannel plate), converted using:  V = DAC \* -14.1176  Where DAC is the digital to analog value transmitted  by the instrument in housekeeping."  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = HVU2\_LEF\_DAC  DATA\_TYPE = IEEE\_REAL  START\_BYTE = 193  BYTES = 4  UNIT = VOLTS  VALID\_MINIMUM = -2400.0  VALID\_MAXIMUM = 0.0  MISSING\_CONSTANT = 1.0  DESCRIPTION = "HVU2 (high voltage unit 2) Linear Electric Field MCP  (multichannel plate), converted using:  V = DAC \* -9.4118  Where DAC is the digital to analog value transmitted  by the instrument in housekeeping."  END\_OBJECT = COLUMN |

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| Sample Ancillary (ANC) Label File: ANC\_YYYYDDDHH\_U3.LBL |
| PDS\_VERSION\_ID = PDS3  DATA\_SET\_ID = "CO-E/J/S/SW-CAPS-2-UNCALIBRATED-V1.1"    STANDARD\_DATA\_PRODUCT\_ID = "ANC UNCALIBRATED"  PRODUCT\_ID = "ANC\_201001000\_U3"  PRODUCT\_TYPE = "DATA"  PRODUCT\_CREATION\_TIME = 2010-141T20:48    RECORD\_TYPE = FIXED\_LENGTH  RECORD\_BYTES = 196  FILE\_RECORDS = 671    START\_TIME = 2010-010T00:08:07  STOP\_TIME = 2010-010T06:05:59  SPACECRAFT\_CLOCK\_START\_COUNT = "1/1641775909.000"  SPACECRAFT\_CLOCK\_STOP\_COUNT = "1/1641797381.000"    INSTRUMENT\_HOST\_NAME = "CASSINI ORBITER"  INSTRUMENT\_HOST\_ID = "CO"  TARGET\_NAME = {"SATURN"}  INSTRUMENT\_NAME = "CASSINI PLASMA SPECTROMETER"  INSTRUMENT\_ID = "CAPS"  DESCRIPTION = "  This file contains Cassini CAPS ancillary data and some  spacececraft pointing information  acquired at SATURN between  2010-010T00:08:07.000 and 2010-010T06:05:59.000 (orbit 124)."  MD5\_CHECKSUM = "120bd2983382c76702046cccf611869f"    NOTE = "  The end around carry checksum, with seed 0x55AA,  of this file is 0xB62E"  SPICE\_FILE\_NAME = {"SPK: 100209R\_SCPSE\_10003\_10021.bsp",  "00: 10006\_10011ra.bc",  "06: 10006\_10011ra.bc",  "12: 10006\_10011ra.bc",  "18: 10011\_10016ra.bc",  "18: 10006\_10011ra.bc"}    ^TABLE = "ANC\_201001000\_U3.DAT"  OBJECT = TABLE  INTERCHANGE\_FORMAT = "BINARY"  ROWS = 671  COLUMNS = 63  ROW\_BYTES = 196  ^STRUCTURE = "ANC\_U3.FMT"  DESCRIPTION = "  The file ANC\_U3.FMT describes the column structure and content  of the data file."  END\_OBJECT = TABLE  END |

# Appendix C. PDS Labels & Format Files for Standard HIGHERORDER Data Products

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| Sample ELS Moment (ELS\_3DMOMT) Format & Label File: ELS\_3DMOMT\_YYYYDDD\_VV.LBL |
| PDS\_VERSION\_ID = PDS3  DATA\_SET\_ID = "CO-S/SW-CAPS-5-DDR-ELE-MOMENTS-V1.0"    STANDARD\_DATA\_PRODUCT\_ID = "ELECTRON MOMENTS"  PRODUCT\_ID = "ELS\_3DMOMT\_2005283\_00"  PRODUCT\_TYPE = "DATA"  PRODUCT\_CREATION\_TIME = 2013-079T22:12  PRODUCT\_VERSION\_ID = "1"    RECORD\_TYPE = "FIXED\_LENGTH"  RECORD\_BYTES = 127  FILE\_RECORDS = 2695  COLUMNS = 13    START\_TIME = 2005-283T00:00:20  STOP\_TIME = 2005-283T23:59:47  SPACECRAFT\_CLOCK\_START\_COUNT = "1/1507595334.252"  SPACECRAFT\_CLOCK\_STOP\_COUNT = "1/1507681702.137"    INSTRUMENT\_HOST\_NAME = "CASSINI ORBITER"  INSTRUMENT\_HOST\_ID = "CO"  TARGET\_NAME = {"SATURN"}  INSTRUMENT\_NAME = "CASSINI PLASMA SPECTROMETER"  INSTRUMENT\_ID = "CAPS"  DESCRIPTION = "  This file contains Cassini CAPS electron moments data,  acquired at SATURN between  2005-283T00:00:20.000 and 2005-283T23:59:47.000 (orbit 016)."    MD5\_CHECKSUM = "c0bbc8061d86617ec607f0dfebdf62cb"    ^TABLE = "ELS\_3DMOMT\_2005283\_00.TAB"    OBJECT = TABLE  INTERCHANGE\_FORMAT = "ASCII"  ROWS = 2695  COLUMNS = 13  ROW\_BYTES = 127  DESCRIPTION = "Electron Moments. A description of how  moments are generated can be found in the  archive SIS."    /\* Description of the electron moment data \*/  OBJECT = COLUMN  NAME = "START\_TIME"  DATA\_TYPE = "TIME"  START\_BYTE = 1  BYTES = 17  VALID\_MINIMUM = 1997-288T10:43:00  VALID\_MAXIMUM = 2025-001T00:00:00  MISSING\_CONSTANT = 2030-001T00:00:00  UNIT = "N/A"  DESCRIPTION = "Start of the sampling period, spacecraft event time,  UTC, in ISOD format to second resolution. ISOD  format is as follows: YYYY-DOYTHH:MM:SS"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = "END\_TIME"  DATA\_TYPE = "TIME"  START\_BYTE = 19  BYTES = 17  VALID\_MINIMUM = 1997-288T10:43:00  VALID\_MAXIMUM = 2025-001T00:00:00  MISSING\_CONSTANT = 2030-001T00:00:00  UNIT = "N/A"  DESCRIPTION = "End of the sampling period, spacecraft event time,  UTC, in ISOD format to second resolution. ISOD  format is as follows: YYYY-DOYTHH:MM:SS"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = "ANODE\_USED"  DATA\_TYPE = "ASCII\_INTEGER"  START\_BYTE = 37  BYTES = 1  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 9  MISSING\_CONSTANT = 0  DESCRIPTION = "Anode used to calculate moments. A value of 9  implies that multiple anodes were used."  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = "SIGNAL\_TO\_NOISE"  DATA\_TYPE = "ASCII\_REAL"  START\_BYTE = 39  BYTES = 5  VALID\_MINIMUM = 0.00  VALID\_MAXIMUM = 10.00  MISSING\_CONSTANT = -9.99  UNIT = "N/A"  DESCRIPTION = "Signal to noise ratio threshold. Only data values  above this threshold go into the moments  calculation."  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = "SC\_POTENTIAL"  DATA\_TYPE = "ASCII\_REAL"  START\_BYTE = 45  BYTES = 7  VALID\_MINIMUM = -100.00  VALID\_MAXIMUM = 100.00  MISSING\_CONSTANT = -999.99  UNIT = "V"  DESCRIPTION = "Spacecraft potential during the time period given"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = "DENSITY"  DATA\_TYPE = "ASCII\_REAL"  START\_BYTE = 53  BYTES = 13  VALID\_MINIMUM = 1.000000E+03  VALID\_MAXIMUM = 1.000000E+10  MISSING\_CONSTANT = -9.000000E+00  UNIT = "ELECTRONS/M^3"  DESCRIPTION = "Density, summed over all energies."  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = "TEMPERATURE"  DATA\_TYPE = "ASCII\_REAL"  START\_BYTE = 67  BYTES = 12  VALID\_MINIMUM = 1.000000  VALID\_MAXIMUM = 99999.999999  MISSING\_CONSTANT = -9999.000000  UNIT = "eV"  DESCRIPTION = "Temperature, summed over all energies"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = "QUALITY\_FACTOR"  DATA\_TYPE = "ASCII\_REAL"  START\_BYTE = 80  BYTES = 7  VALID\_MINIMUM = 0.000  VALID\_MAXIMUM = 100.000  MISSING\_CONSTANT = -99.000  UNIT = "N/A"  DESCRIPTION = "The number of standard deviations, assuming Poisson  counting statistics, that the peak of the Maxwellian  corresponding to the determined moments lies above  the ELS one-count level. The larger the value, the  better."  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = "SC\_CHARGE\_STATE"  DATA\_TYPE = "ASCII\_INTEGER"  START\_BYTE = 88  BYTES = 1  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 1  MISSING\_CONSTANT = 9  UNIT = "N/A"  DESCRIPTION = "Indicates whether the data is likely to be from a  region in which the spacecraft is negatively  charged.  0: likely positively charged  1: likely negatively charged"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = "PENETRATING\_RADIATION"  DATA\_TYPE = "ASCII\_INTEGER"  START\_BYTE = 90  BYTES = 1  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 1  MISSING\_CONSTANT = 9  UNIT = "N/A"  DESCRIPTION = "Indicates whether the data is probably from a  region in which there is penetrating radiation  present.  0: not likely to be present  1: likely to be present"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = "DENSITY\_WITH\_PEN\_RAD"  DATA\_TYPE = "ASCII\_REAL"  START\_BYTE = 92  BYTES = 13  VALID\_MINIMUM = 1.000000E+03  VALID\_MAXIMUM = 1.000000E+10  MISSING\_CONSTANT = -9.000000E+00  UNIT = "ELECTRONS/M^3"  DESCRIPTION = "Density, summed over all energies, but with  penetrating radiation subtracted from the data  before moments calculations were made."  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = "TEMPERATURE\_WITH\_PEN\_RAD"  DATA\_TYPE = "ASCII\_REAL"  START\_BYTE = 106  BYTES = 12  VALID\_MINIMUM = 1.000000  VALID\_MAXIMUM = 99999.999999  MISSING\_CONSTANT = -9999.000000  UNIT = "eV"  DESCRIPTION = "Temperature, summed over all energies, but with  penetrating radiation subtracted from the data  before moments calculations were made."  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = "QUALITY\_FACTOR\_WITH\_PEN\_RAD"  DATA\_TYPE = "ASCII\_REAL"  START\_BYTE = 119  BYTES = 7  VALID\_MINIMUM = 0.000  VALID\_MAXIMUM = 100.000  MISSING\_CONSTANT = -99.000  UNIT = "N/A"  DESCRIPTION = "The number of standard deviations, assuming Poisson  counting statistics, that the peak of the Maxwellian  corresponding to the determined moments lies above  the ELS one-count level, but with penetrating  radiation subtracted from the data before moments  calculations were made. The larger the value, the  better."  END\_OBJECT = COLUMN  END\_OBJECT = TABLE  END |

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| Sample ELS Spacecraft Potential (ELS\_SCPOT) Format & Label File: ELS\_SCPOT\_YYYYDDD\_VV.LBL |
| PDS\_VERSION\_ID = PDS3  DATA\_SET\_ID = "CO-S/SW-CAPS-5-DDR-SC-POTENTIAL-V1.0"    STANDARD\_DATA\_PRODUCT\_ID = "SPACECRAFT POTENTIAL"  PRODUCT\_ID = "ELS\_SCPOT\_2005283\_00"  PRODUCT\_TYPE = "DATA"  PRODUCT\_CREATION\_TIME = 2013-079T22:13  PRODUCT\_VERSION\_ID = "1"    RECORD\_TYPE = "FIXED\_LENGTH"  RECORD\_BYTES = 50  FILE\_RECORDS = 12099  COLUMNS = 5    START\_TIME = 2005-283T00:00:00  STOP\_TIME = 2005-284T00:00:03  SPACECRAFT\_CLOCK\_START\_COUNT = "1/1507595314.252"  SPACECRAFT\_CLOCK\_STOP\_COUNT = "1/1507681718.137"    INSTRUMENT\_HOST\_NAME = "CASSINI ORBITER"  INSTRUMENT\_HOST\_ID = "CO"  TARGET\_NAME = {"SATURN"}  INSTRUMENT\_NAME = "CASSINI PLASMA SPECTROMETER"  INSTRUMENT\_ID = "CAPS"  DESCRIPTION = "  This file contains Cassini CAPS spacecraft potential data,  acquired at SATURN between  2005-283T00:00:00.000 and 2005-284T00:00:03.000 (orbit 016)."    MD5\_CHECKSUM = "7c28c977775314f5a45167a7d62d016d"    ^TABLE = "ELS\_SCPOT\_2005283\_00.TAB"    OBJECT = TABLE  INTERCHANGE\_FORMAT = "ASCII"  ROWS = 12099  COLUMNS = 5  ROW\_BYTES = 50  DESCRIPTION = "Spacecraft Potential. A description of how  spacecraft potentials are generated by CAPS  can be found in our archived SIS."    /\* Description of the CAPS-ELS spacecraft potential data \*/  OBJECT = COLUMN  NAME = "START\_TIME"  DATA\_TYPE = "TIME"  START\_BYTE = 1  BYTES = 17  VALID\_MINIMUM = 1997-288T10:43:00  VALID\_MAXIMUM = 2025-001T00:00:00  MISSING\_CONSTANT = 2030-001T00:00:00  UNIT = "N/A"  DESCRIPTION = "Start of the sampling period, spacecraft event time,  UTC, in ISOD format to second resolution. ISOD  format is as follows: YYYY-DOYTHH:MM:SS"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = "END\_TIME"  DATA\_TYPE = "TIME"  START\_BYTE = 19  BYTES = 17  VALID\_MINIMUM = 1997-288T10:43:00  VALID\_MAXIMUM = 2025-001T00:00:00  MISSING\_CONSTANT = 2030-001T00:00:00  UNIT = "N/A"  DESCRIPTION = "End of the sampling period, spacecraft event time,  UTC, in ISOD format to second resolution. ISOD  format is as follows: YYYY-DOYTHH:MM:SS"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = "ANODE\_USED"  DATA\_TYPE = "ASCII\_INTEGER"  START\_BYTE = 37  BYTES = 1  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 8  MISSING\_CONSTANT = 0  DESCRIPTION = "Anode used to assign potential."  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = "SC\_POTENTIAL"  DATA\_TYPE = "ASCII\_REAL"  START\_BYTE = 39  BYTES = 7  VALID\_MINIMUM = -100.00  VALID\_MAXIMUM = 100.00  MISSING\_CONSTANT = -999.99  UNIT = "V"  DESCRIPTION = "Spacecraft potential during the time period given"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = "ACCURACY\_FLAG"  DATA\_TYPE = "ASCII\_INTEGER"  START\_BYTE = 47  BYTES = 2  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 2  MISSING\_CONSTANT = -1  UNIT = "N/A"  DESCRIPTION = "0 = Accurate value derived from ELS data.  Value will be accurate to +/- 8.5% as the dE/E  of ELS is 17%.  1 = Potential below ELS lowest energy, therefore  estimated, use with care.  2 = Accurate value derived from non-ELS data, ie.  RPWS at periapsis or PE at moon encounters."  END\_OBJECT = COLUMN  END\_OBJECT = TABLE  END |

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| Sample ION Moment (ION\_MOMT) Format & Label File: ION\_MOMT\_YYYYDDD\_VV.LBL |
| PDS\_VERSION\_ID = PDS3  DATA\_SET\_ID = "CO-S/SW-CAPS-5-DDR-ION-MOMENTS-V1.0"    STANDARD\_DATA\_PRODUCT\_ID = "ION MOMENTS"  PRODUCT\_ID = "ION\_MOMT\_2005283\_01"  PRODUCT\_TYPE = "DATA"  PRODUCT\_CREATION\_TIME = 2013-079T22:00  PRODUCT\_VERSION\_ID = "1"    RECORD\_TYPE = "FIXED\_LENGTH"  FILE\_RECORDS = 189  RECORD\_BYTES = 122  COLUMNS = 13  ROW\_BYTES = 122    START\_TIME = 2005-283T00:03:00  STOP\_TIME = 2005-283T23:48:03  SPACECRAFT\_CLOCK\_START\_COUNT = "1/1507595494.252"  SPACECRAFT\_CLOCK\_STOP\_COUNT = "1/1507680998.136"    INSTRUMENT\_HOST\_NAME = "CASSINI ORBITER"  INSTRUMENT\_HOST\_ID = "CO"  TARGET\_NAME = {"SATURN"}  INSTRUMENT\_NAME = "CASSINI PLASMA SPECTROMETER"  INSTRUMENT\_ID = "CAPS"  DESCRIPTION = "  This file contains Cassini CAPS ion moments data,  acquired at SATURN between  2005-283T00:03:00.000 and 2005-283T23:48:03.000 (orbit 016)."    MD5\_CHECKSUM = "270041152131aff72b4326796c64461a"    ^TABLE = "ION\_MOMT\_2005283\_01.TAB"    OBJECT = TABLE  INTERCHANGE\_FORMAT = "ASCII"  ROWS = 189  COLUMNS = 13  ROW\_BYTES = 122  DESCRIPTION = "  Moments are generated from Cassini CAPS data and are partially  described in the CAPS guide for users found at the PDS web site:  http://ppi.pds.nasa.gov/search/view/?f=yes&id=pds://PPI/COCAPS\_1SAT/DOCUMENT  A brief description of the columns follows."    /\* Description of the ion moment data \*/  OBJECT = COLUMN  NAME = "TIME"  DATA\_TYPE = "TIME"  START\_BYTE = 1  BYTES = 17  VALID\_MINIMUM = 1997-288T10:43:00  VALID\_MAXIMUM = 2025-001T00:00:00  MISSING\_CONSTANT = 2030-001T00:00:00  UNIT = "N/A"  DESCRIPTION = "Time, spacecraft event time, UTC, in ISOD format  to second resolution. ISOD format is as follows:  YYYY-DOYTHH:MM:SS"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = "ION\_METHOD\_FLAG"  DATA\_TYPE = "ASCII\_INTEGER"  START\_BYTE = 19  BYTES = 2  VALID\_MINIMUM = 1  VALID\_MAXIMUM = 4  MISSING\_CONSTANT = -1  DESCRIPTION = "Ion Method Flag for calculation of numerical ion  moments. Value: meaning  1 : SNG data, TOF-based partition  2 : SNG data, E-based partition  3 : SNG data, hard-wired partition  4 : ION data"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = "H+\_DENSITY"  DATA\_TYPE = "ASCII\_REAL"  START\_BYTE = 22  BYTES = 8  VALID\_MINIMUM = 0.000  VALID\_MAXIMUM = 999.9999  MISSING\_CONSTANT = -1  UNIT = "IONS/CM^3"  DESCRIPTION = "H+ density. Please note the difference between a  value of 0.000 and -1. The 0.000 corresponds to a  valid determination that is just extremely low (and  there is no confidence in the actual quantitative  value, other than that it is very low), whereas the  fill value corresponds to an invalid determination,  usually caused by problems in the integration  process."  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = "H+\_TEMP"  DATA\_TYPE = "ASCII\_REAL"  START\_BYTE = 31  BYTES = 9  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 99999.999  MISSING\_CONSTANT = -1  UNIT = "eV"  DESCRIPTION = "H+ temperature"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = "H2+\_DENSITY"  DATA\_TYPE = "ASCII\_REAL"  START\_BYTE = 41  BYTES = 8  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 999.9999  MISSING\_CONSTANT = -1  UNIT = "IONS/CM^3"  DESCRIPTION = "H2+ density. Please note the difference between a  value of 0.000 and -1. The 0.000 corresponds to a  valid determination that is just extremely low (and  there is no confidence in the actual quantitative  value, other than that is is very low), whereas the  fill value corresponds to an invalid determination,  usually caused by problems in the integration  process."  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = "H2+\_TEMP"  DATA\_TYPE = "ASCII\_REAL"  START\_BYTE = 50  BYTES = 9  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 99999.999  MISSING\_CONSTANT = -1  UNIT = "eV"  DESCRIPTION = "H2+ temperature"  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = "W+\_DENSITY"  DATA\_TYPE = "ASCII\_REAL"  START\_BYTE = 60  BYTES = 8  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 999.9999  MISSING\_CONSTANT = -1  UNIT = "IONS/CM^3"  DESCRIPTION = "W+ density. Water-group ions, W+, includes O+, OH+,  H2O+, and H3O+ (where the 2 and 3 are subscripts).  Please note the difference between a value of 0.000  and -1. The 0.000 corresponds to a valid  determination that is just extremely low (and there  is no confidence in the actual quantitative value,  other than that is is very low), whereas the fill  value corresponds to an invalid determination,  usually caused by problems in the integration  process."  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = "W+\_TEMP"  DATA\_TYPE = "ASCII\_REAL"  START\_BYTE = 69  BYTES = 9  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 99999.999  MISSING\_CONSTANT = -1  UNIT = "eV"  DESCRIPTION = "W+ temperature, where W+ are water group ions.  W+ includes ions: O+, OH+, H2O+, and H3O+."  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = "AVE\_V\_R"  DATA\_TYPE = "ASCII\_REAL"  START\_BYTE = 79  BYTES = 9  VALID\_MINIMUM = -3000.000  VALID\_MAXIMUM = 3000.000  MISSING\_CONSTANT = -9999.999  UNIT = "KILOMETER/SECOND"  DESCRIPTION = "Weighted average flow velocity, r component, in  Saturn centered spherical coordinates."  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = "AVE\_V\_PHI"  DATA\_TYPE = "ASCII\_REAL"  START\_BYTE = 89  BYTES = 9  VALID\_MINIMUM = -3000.000  VALID\_MAXIMUM = 3000.000  MISSING\_CONSTANT = -9999.999  UNIT = "KILOMETER/SECOND"  DESCRIPTION = "Weighted average flow velocity, phi component, in  Saturn centered spherical coordinates."  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = "AVE\_V\_THETA"  DATA\_TYPE = "ASCII\_REAL"  START\_BYTE = 99  BYTES = 9  VALID\_MINIMUM = -3000.000  VALID\_MAXIMUM = 3000.000  MISSING\_CONSTANT = -9999.999  UNIT = "KILOMETER/SECOND"  DESCRIPTION = "Weighted average flow velocity, theta component, in  Saturn centered spherical coordinates."  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = "AVE\_FLOW\_SPEED"  DATA\_TYPE = "ASCII\_REAL"  START\_BYTE = 109  BYTES = 9  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 3000.000  MISSING\_CONSTANT = -9999.999  UNIT = "KILOMETER/SECOND"  DESCRIPTION = "Weighted average flow speed."  END\_OBJECT = COLUMN    OBJECT = COLUMN  NAME = "QUALITY\_FLAG"  DATA\_TYPE = "ASCII\_INTEGER"  START\_BYTE = 119  BYTES = 2  VALID\_MINIMUM = 0  VALID\_MAXIMUM = 2  MISSING\_CONSTANT = -1  DESCRIPTION = "Value: meaning  0: Not-bad; corotation direction is in the Field of  View (FOV)  1: Not-bad; corotation direction not in FOV  2: Bad (the spacecraft is rolling and/or CAPS is not  actuating)"  END\_OBJECT = COLUMN  END\_OBJECT = TABLE  END |

1. The SAM Ion number shall uniquely identify the ion and the group table used by SAM. This shall be based on a table generated and kept on the ground, and will not be the ion number used inside SAM software (which represents different species in different group tables) nor the ion number in the current CDF files (which represents the order in which ions are selected and passed on by CPU2, and which depends on the group table and ion selection index.) [↑](#footnote-ref-1)