2005 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 1.14

rev. August 16, 2005

J. Furman & F. Crary
Southwest Research Institute
San Antonio, TX 78238
and
S. Joy
University of California, Los Angeles
Los Angeles, CA 90095-1567

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Approved:

D. T. Young — Date
Principal Investigator

Diane Conner — Date
Cassini Archive Data Engineer

Ray Walker — Date
PDS Discipline Node Manager

List Of Tables:

1. Preface

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

1.1. Distribution List

Table 1: Distribution List

Name	Email
Steve Joy	sjoy@igpp.ucla.edu
Joe Mafi	jmafi@igpp.ucla.edu
David T. Young	dyoung@swri.edu
Frank Crary	fcrary@swri.edu
Judith Furman	jfurman@swri.edu
CAPS Team	caps_team@swri.edu
Scott Bolton	sbolton@swri.edu
Ray Walker	rwalker@igpp.ucla.edu
Diane Conner	Diane.Conner@jpl.nasa.gov
Robert Mitchell	Robert.Mitchell@jpl.nasa.gov

1.2. Document Change Log

Table 2: Document Change History

Change	Date	Affected Portions
Initial Draft	03/2003	All
Updated Items with comments made by Steve Joy	03/24/2003	All
Updates by J. Furman in response to Steve Joy & continued updates to all sections	04/2003	All
Updates by J. Furman in response to action items from archive review and updates needed for the team. Also, updated the directory structure (issues with too many files in the same directory)	06/2003	Contents of Data Products
Update to ACT name & some issues with the format itself (min, max, etc)	7/28/2003	
Update instrument tables & description	11/2003	All

Table 2: Document Change History		
Change	**Date**	**Affected Portions**
Make sure all tables are up-to-date	3/9/2004	
Modified the ANC data format. Added position relative to the Sun & Saturn at all times	4/28/2004	5.3.8
Updated IBS data format. Increased the size of the offset time to 4 bytes, and also changed a few definitions	6/25/2004	Table 18
Added in format files and sample labels files	6/25/2004	Appendix B. PDS Labels & Format Files for Standard UNCALIBRATED Data Products
Made changes to B-cycle & A-cycle number descriptions	1/25/2005	Table 17 through Table 25
Update ancillary data product	3/30/2005	ANC table
Updated some of the TBD items. Added in sections to indicate that we now have 2 separate volumes. Added a few additional tables for new directories that were added as a result of peer review. Updated format files & label files included in this document.	8/1/2005	Scattered throughout the document

1.3. TBD Items

Items that are currently still to be specified:

Table 3: TBD Items		
Item	**Section**	**Page(s)**
Resubmission of calibrated files	Section 2.1	8
Size of calibrated data	Table 5	8
Data product format for all the calibrated data files	Section 5.4	38

1.4. Acronyms and Abbreviations

Table 4: 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

Table 4: Acronyms and Abbreviations	
Acronym	Definition
ELS	Electron Spectrometer
EVT	Ion Mass Spectrometer Event Mode Data Product
GB	Gigabyte(s)
IBS	Ion Beam Spectrometer
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
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

1.5. 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 non-standard way are sometimes called *special Data Products*.

2. Introduction

2.1. 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 we will take data at Earth and Jupiter as well as interplanetary science.

The CAPS instrument is a complex instrument that produces large amounts of data. We intend to archive both un-calibrated and calibrated data files to the PDS. Due to the complexity of calibrations, we will resubmit calibrated data files on a TBD basis. Also, we will be archiving a set of special (higher order) data products on a limited basis.

CAPS will be archiving two data sets: un-calibrated and calibrated. Each data set will be archived on a separate volume. The un-calibrated data set will be archived with some very basic calibration procedures. These procedures may be updated, but the calibrated data volume and files will contain the very latest in calibration information. There are several different types of data products per 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 will be 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).

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 will be 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 Table 5 below, including the data set in which they will be included and the maximum data volume of each different data type (per day). Each sensor's data will be written to a separate file, and the format of each file will be discussed in detail in section 5.3, and Table 17 through Table 25.

Table 5: Spacecraft Science Data Products in CAPS Data Sets

Sensor	Data Set Type	Maximum (MB / Day)	Sensor Total (MB / Day)
ELS	Un-calibrated	103.821	
	Calibrated	TBD	
IBS	Un-calibrated	315.170	

Table 5: Spacecraft Science Data Products in CAPS Data Sets			
Sensor	**Data Set Type**	**Maximum (MB / Day)**	**Sensor Total (MB / Day)**
	Calibrated	TBD	
IMS TOF	Un-calibrated	1.32544	
	Calibrated	TBD	
IMS ION	Un-calibrated	381.541	
	Calibrated	TBD	
IMS SNG	Un-calibrated	51.9104	
	Calibrated	TBD	
ACT	Un-calibrated	0.360489	
	Calibrated	TBD	
ANC	Un-calibrated	0.37594	
	Calibrated	TBD	
IMS LOG	Un-calibrated	46.7194	46.7194
EVN	Un-calibrated	12.198	12.198

2.2. Scope

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

2.3. 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

2.4. Audience

This specification is useful to those 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.

3. Archive Volume Generation

3.1. Data Production and Transfer Methods

The CAPS standard product archive collections will be 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 will produce the individual data files and the associated detached PDS labels for each of the standard data products defined in section 2.1 above. There will be up to 4 files per product, per day. The files will be 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 will be 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 will **not** be a gap in the A-cycle number count.

Data files will be flat, binary data files, with a fixed series of values repeated as many times as necessary. The files will contain data taken at all rates during the period. If data are collapsed in elevation, counts will be given for the lowest elevation of the collapsed sample and all other elevations will 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 will be 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 5.3, and Table 17 through Table 25.

Data will be written to DVD media in a format compatible with PDS standards. PPI will assemble the data products into archive volumes so that each volume will contain 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 will deliver data DVDs to PDS/PPI on a quarterly basis. Initially only un-calibrated volumes will be available. CAPS calibrated data volumes will follow shortly.

3.2. 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 will collect the data files and labels provided by the CAPS team onto archive volumes. Each archive volume will contain all CAPS data available (either un-calibrated or calibrated) 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 will add all of the PDS required files (AAREADME, INDEX, ERRATA, etc.) and produce the physical media, which will then be validated.

Data will be validated using the PDS peer review process. The peer review panel will consist 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 low energy ion and electron measurements. The PDS personnel will be responsible for validating that the archive volume(s) are fully compliant with PDS standards. The instrument team and outside science reviewers will be 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 will seek to validate the process by which the data products are produced rather than the data products themselves. This will be accomplished in two phases. First, a specimen volume will be created and manually reviewed for proper structure and completeness of documentation along with the current reference volume. Once the specimen volume is validated, PPI will develop software to validate that subsequent data volumes comply with PDS standards. After the volume creation software is complete, a volume created by this process will be reviewed again, this time considering all facets of volume usefulness. Any deficiencies in the archive volume will be 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 will need to be done 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 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.

3.3. Labeling and Identification

Each CAPS standard data product archive volume will bear a unique volume identifier (volume_id) of the form COCAPS_1nnn for CAPS un-calibrated data with calibration information and COCAPS_2mmm for CAPS calibrated data where CO identifies the spacecraft (Cassini Orbiter), CAPS identifies the instrument, and 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 E/J/S/SW CAPS UNCALIBRATED V<major version>.<minor version> for un-calibrated data and CASSINI E/J/S/SW CAPS CALIBRATED V<major version>.<minor version> for calibrated data.

PDS data set identifiers (dsid) will be 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 will be CO-E/J/S/SW-CAPS-2-UNCALIBRATED-V1.0, CO-E/J/S/SW-CAPS-3-CALIBRATED-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-CAPS-3-CALIBRATED-V1.0	ELS	ELS_199923000_C1.DAT
	IBS	IBS_199923000_C1.DAT
	IMS ION	ION_199923000_C1.DAT
	IMS SNG	SNG_199923000_C1.DAT
	IMS TOF	TOF_199923000_C1.DAT
	Actuator	ACT_199923000_1.DAT
	Ancillary	ANC_199923000_C1.DAT

4. 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 or calibrated data. All other directory contents will remain the same, though the calibration volume will have the most up-to-date calibration documentation.

4.1. 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 7: 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

4.2. 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 8: 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

4.3. 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 will be a separate directory for each document that is to be archived. Each of the document directories will include the document in hypertext (ASCII) and the document in another format (i.e. .DOC or .PDF). There will also be 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 9: 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 10: 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 11: 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

4.4. 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 12: 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
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

4.5. DATA (Standard Products) Directory Contents and Naming Conventions

The DATA directory will contain of the following sub-directories, based upon the archive volume: CALIBRATED or UNCALIBRATED. Data Products produced by the CAPS team are located in subdirectories of either of these two sub-directories in the DATA subdirectory and are of the form YYYYDDD. Each subdirectory will contain 1 day of data, for all data types. Multiple YYYYDDD will be written to the disk (in multiples of 5 days), up to the space limitation of the DVD.

4.5.1. **Required Files**

The DATA directory will contain 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 will have external (detached) labels. Detached PDS label files have the same root name as the file they describe but have the suffix ".LBL". In directories where there are numerous data files with the same internal table structure, the table column description is included in a single format file (.FMT) that is referenced by a pointer within each PDS label file. This eliminates repetition of information that is not changing within the PDS label files.

4.5.2. **File Naming Conventions**

Data products will 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.

There is one exception to the naming convention listed above. Since the actuator (ACT) data product is both calibrated and un-calibrated, we will drop the <DataType> identifier. Actuator files will have the naming convention of ACT_YYYYDDDHHH_<V>.DAT.

Since the data files are 6 hour files, HH will only have the valid values of 00, 06, 12, and 18.

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 will be incremented. When more than nine versions are required, the characters a-z are used to represent further versions.

4.5.3. **DATA/UNCALIBRATED/YYYYDDD Directory Contents**

Un-calibrated data files starting on YYYYDDD from all sensors will be 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 4.5.2. Every data file in the directory will have a detached PDS label with the same root name as the file they describe but have the suffix ".LBL". In addition, there will be a brief ASCII text file (INFO.TXT) that describes the DATA/UNCALIBRATED/YYYYDDD directory contents, which are listed in Table 13. In addition, each YYYYDDD directory will have its own set of format files. NOTE: Files will 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 13: 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_U1.FMT	PDS format file containing the data file structure for the ELS file format.	CAPS
IBS_U2.FMT	PDS format file containing the data file structure for the IBS file format.	CAPS
SNG_U1.FMT	PDS format file containing the data file structure for the SNG file format.	CAPS
LOG_U1.FMT	PDS format file containing the data file structure for the LOG file format.	CAPS
ION_U1.FMT	PDS format file containing the data file structure for the ION file format.	CAPS

TOF_U1.FMT	PDS format file containing the data file structure for the TOF file format.	CAPS
ACT_1.FMT	PDS format file containing the data file structure for the ACT file format.	CAPS
ANC_U1.FMT	PDS format file containing the data file structure for the ANC file format.	CAPS
EVN_U1.FMT	PDS format file containing the data file structure for the EVN file format.	CAPS

4.5.4. **DATA/CALIBRATED/YYYYDDD Directory Contents**

Calibrated data files starting on YYYYDD from all sensors will be stored in the DATA/CALIBRATED/YYYYDDD directory. Each directory will contain one day of data. Each type of calibrated file can have up to 4 files for the day and can contain up to 6 hours of data. The file naming convention is described in Section 4.5.2. Every data file in the directory will have a detached PDS label with the same root name as the file they describe but have the suffix ".LBL". In addition, there will be a brief ASCII text file (INFO.TXT) that describes the DATA/CALIBRATED/YYYYDDD directory contents, which are briefly listed in Table 14. Each YYYYDDD directory will contain a set of its own format files.

In the label file for calibrated data, there will be pointers to the file containing the appropriate algorithms and parameters for the CALIBRATED data. When calibration changes, the pointers in the labels will be updated to include the correct links.

Table 14: YYYYDDD CALIBRATED Data Directory Contents

File Name	File Contents	Provided By
DATAINFO.TXT	Brief description of directory contents and naming conventions.	PPI
ELS*.DAT	ELS Calibrated data files.	CAPS
ELS*.LBL	PDS label for ELS calibrated data files of same base name.	CAPS
IBS*.DAT	IBS Calibrated data files.	CAPS
IBS*.LBL	PDS label for IBS calibrated data files of same base name.	CAPS
SNG*.DAT	IMS SNG Calibrated data files.	CAPS
SNG*.LBL	PDS label for IMS SNG calibrated data files of same base name.	CAPS
ION*.DAT	IMS ION Calibrated data files.	CAPS

ION*.LBL	PDS label for IMS ION calibrated data files of same base name.	CAPS
TOF*.DAT	IMS TOF Calibrated data files.	CAPS
TOF*.LBL	PDS label for IMS TOF calibrated data files of same base name.	CAPS
ANC*.DAT	Ancillary Calibrated data files.	CAPS
ANC*.LBL	PDS label for Ancillary calibrated data files of same base name.	CAPS
ELS_CAL_U0.FMT	PDS format file containing the data file structure for the ELS calibrated data file format.	CAPS
IBS_CAL_U0.FMT	PDS format file containing the data file structure for the IBS calibrated data file format.	CAPS
SNG_CAL_U0.FMT	PDS format file containing the data file structure for the IMS SNG calibrated data file format.	CAPS
ION_CAL_U0.FMT	PDS format file containing the data file structure for the IMS ION calibrated data file format.	CAPS
TOF_CAL_U0.FMT	PDS format file containing the data file structure for the IMS ION calibrated data file format.	CAPS
ANC_CAL_U0.FMT	PDS format file containing the data file structure for the Ancillary calibrated data file format.	CAPS

4.6. CALIB Directory Contents

Given that we will be archiving data to 2 different volumes, the contents of the CALIB directory will 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 15: 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

4.6.1. **CALIB/SAMPLE_DATA Directory Contents**

This directory will contain 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 will only include first order calibration, and not the second order corrections that are currently being worked.

4.7. EXTRAS Directory Contents

The EXTRAS directory will contain an EXTRINFO.TXT file that contains a description of the contents of this directory. Additional files will 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 will also be provided.

4.8. BROWSE Directory Contents

The BROWSE directory will contain browse spectrogram plots that are not intended for publication. Browse spectrograms starting on YYYYDDD from all sensors will be stored in the BROWSE/YYYYDDD directory. Each directory will contain 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 4.5.2, with a .PNG extension to specify the file format. Every data file in the directory will have a detached PDS label with the same root name as the file they describe but have the suffix ".LBL". In addition, there will be a brief ASCII text file (INFO.TXT) that describes the BROWSE/YYYYDDD directory contents, which are listed in Table 16: YYYYDDD BROWSE Directory Contents. NOTE: Files will only be available if data from of the appropriate type (during the 6 hour block in question) is available. We do not plot ancillary data.

Table 16: 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	CAPS
ELS*.PNG	ELS plot in PNG format	CAPS
ELS*.LBL	PDS label for ELS PNG formatted file of same base name	CAPS
IBS*.PNG	IBS plots in PNG format	CAPS
IBS*.LBL	PDS label for IBS PNG formatted file of same base name	CAPS
ION*.PNG	IMS ION plots in PNG format	CAPS
ION*.LBL	PDS label for IMS ION PNG formatted file of same base name	CAPS
LOG*.PNG	IMS logicals plot in PNG format	CAPS
LOG*.LBL	PDS label for IMS Logicals PNG formatted file of same base name	CAPS
SNG*.PNG	IMS singles plot in PNG format	CAPS
SNG*.LBL	PDS label for IMS Singles PNG formatted file of same base name	CAPS
TOF*.PNG	IMS TOF plot in PNG format	CAPS
TOF*.LBL	PDS label for IMS TOF PNG formatted file of same base name	CAPS

Since we will be archiving our calibrated files on a separate volume, this volume will 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 will contain files that are used in the calibration process. The files will include only text files and tables. Any other calibration files will be included in the DOCUMENT/CAPS_CALIB directory. Contents are still TBD and will be specified when the calibration volume is ready.

5. Archive Volume Format

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

5.1. Disk Format

Disk formats for the archive volumes will conform to the PDS standard for the applicable media. At present, the plan is to archive CAPS data on DVD-R media. The PDS standard for DVD-R media disk format is UDF-Bridge.

5.2. 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.

5.2.1. **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 will be 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 will be met by the inclusion of HTML formatted documents.

5.2.2. **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.

5.2.3. **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 will 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.

5.2.4. **Data File Formats – Binary Tables**

All of the 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/CALIBRATED and 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 in the following sections: 5.3 and 5.4. The format for the detached labels and format files can be found in Appendix B. PDS Labels & Format Files for Standard UNCALIBRATED Data Products.

5.3. 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.

5.3.1. **CAPS ELS Data Product Format**

The data product format for ELS is listed in Table 17 below. The fill value for ELS data is 65535 (hex value FFFF).

Table 17: 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
Time	Float	8	[-7.1×10^7, 1.5×10^9]	Start time of A cycle, sec. from J2000 (barycentric dynamic time)
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.
Collapse flag	Unsigned Integer	1	[0,131]	Collapse flag indicates collapse by average (0), sum (1), average with in-flight dead-time correction (2), or sum with in-flight dead-time correction (3). If the most significant bit is 1, it will indicate no HK was available.
Offset time	Unsigned Integer	2	[0,32000]	Milliseconds from start of A cycle
First Energy Step	Unsigned Integer	2	[1,63]	Min energy step in collapsed data

Table 17: CAPS ELS UNCALIBRATED Data File Contents and Structure				
Last Energy Step	Unsigned Integer	2	[1,63]	Max energy step in collapsed data
First Azimuth Value	Unsigned Integer	2	[1,16]	Min azimuth value in collapsed data
Last Azimuth Value	Unsigned Integer	2	[1,16]	Max azimuth value in collapsed data
Data, Elevation 1	Unsigned Integer	2	[0,65504]	Counts in elevation 1
Data, Elevation 2	Unsigned Integer	2	[0,65504]	Counts in elevation 2
Data, Elevation 3	Unsigned Integer	2	[0,65504]	Counts in elevation 3
Data, Elevation 4	Unsigned Integer	2	[0,65504]	Counts in elevation 4
Data, Elevation 5	Unsigned Integer	2	[0,65504]	Counts in elevation 5
Data, Elevation 6	Unsigned Integer	2	[0,65504]	Counts in elevation 6
Data, Elevation 7	Unsigned Integer	2	[0,65504]	Counts in elevation 7
Data, Elevation 8	Unsigned Integer	2	[0,65504]	Counts in elevation 8

5.3.2. **CAPS IBS Data Product Format**

The data product format for CAPS IBS is listed in Table 18 below. The fill value for IBS data is 65535 (hex value FFFF).

Table 18: 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
Time	Float	8	[-7.1×10^7, 1.5×10^9]	Start time of C cycle, sec. from J2000 (barycentric dynamic time)
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.
IBS mode/submode	Unsigned Integer	1	[0,255]	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.
Offset time	Unsigned Integer	4	[1,256000]	Milliseconds from start of C cycle
First Energy Step	Unsigned Integer	2	[1,852]	Min energy step in collapsed data

Table 18: CAPS IBS UNCALIBRATED Data File Contents and Structure				
Column Name	**Type**	**Length (bytes)**	**Range**	**Description**
				(index into the energy table)
Last Energy Step	Unsigned Integer	2	[1,852]	Max energy step in collapsed data (index into the energy table)
First Azimuth Value	Unsigned Integer	2	[1,128]	Min azimuth value in collapsed data
Last Azimuth Value	Unsigned Integer	2	[1,128]	Max azimuth value in collapsed data
Data, Fan 1	Unsigned Integer	2	[1,65504]	Counts in fan 1
Data, Fan 2	Unsigned Integer	2	[1,65504]	Counts in fan 2
Data, Fan 3	Unsigned Integer	2	[1,65504]	Counts in fan 3

5.3.3. **CAPS IMS ION Data Product Format**

The data product format for CAPS IMS ION is listed in Table 19 below. The fill value for IMS Ion data is 28671 (hex value 6FFF).

Table 19: 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	[-7.1×10^7, 1.5×10^9]	Start time of A cycle, sec. from J2000 (barycentric dynamic time)
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.
Spare	Unsigned Integer	1	0	Spare bits to keep on even byte boundaries
Offset time	Unsigned Integer	2	[1,32000]	Milliseconds from start of A cycle
First Energy Step	Unsigned Integer	2	[1,63]	Min energy step in collapsed data
Last Energy Step	Unsigned Integer	2	[1,63]	Max energy step in collapsed data
First Azimuth Value	Unsigned Integer	2	[1,8]	Min azimuth value in collapsed data
Last Azimuth Value	Unsigned Integer	2	[1,8]	Max azimuth value in collapsed data

Table 19: CAPS UNCALIBRATED IMS ION Data File Contents and Structure				
Column Name	**Type**	**Length (bytes)**	**Range**	**Description**
Sam Ion number	Unsigned Integer	2	[0,65535]	SAM ion number[1]
Data, Elevation 1	Integer	2	[-32,27650]	Counts in elevation 1 (**)
Data, Elevation 2	Integer	2	[-32,27650]	Counts in elevation 2 (**)
Data, Elevation 3	Integer	2	[-32,27650]	Counts in elevation 3 (**)
Data, Elevation 4	Integer	2	[-32,27650]	Counts in elevation 4 (**)
Data, Elevation 5	Integer	2	[-32,27650]	Counts in elevation 5 (**)
Data, Elevation 6	Integer	2	[-32,27650]	Counts in elevation 6 (**)
Data, Elevation 7	Integer	2	[-32,27650]	Counts in elevation 7 (**)
Data, Elevation 8	Integer	2	[-32,27650]	Counts in elevation 8 (**)

(**): 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.

5.3.4. **CAPS IMS SNG Data Product Format**

The data product format for CAPS IMS Singles (SNG) is listed in Table 20 below. The fill value for Singles data is 65535 (hex value FFFF).

Table 20: 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	[-7.1×10^7, 1.5×10^9]	Start time of A cycle, sec. from J2000 (barycentric dynamic time)
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,

[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.)

Table 20: CAPS UNCALIBRATED IMS Singles Data File Contents and Structure				
				132 = 1 kbps solar wind, 136 = 2kbps solar wind.
Spare	Unsigned Integer	1	0	Spare byte to have even byte boundaries
Offset time	Unsigned Integer	2	[1,32000]	Milliseconds from start of A cycle
First Energy Step	Unsigned Integer	2	[1,63]	Min energy step in collapsed data
Last Energy Step	Unsigned Integer	2	[1,63]	Max energy step in collapsed data
First Azimuth Value	Unsigned Integer	2	[1,8]	Min azimuth value in collapsed data
Last Azimuth Value	Unsigned Integer	2	[1,8]	Max azimuth value in collapsed data
Data, Elevation 1	Unsigned Integer	2	[0,27500]	Counts in elevation 1
Data, Elevation 2	Unsigned Integer	2	[0,27500]	Counts in elevation 2
Data, Elevation 3	Unsigned Integer	2	[0,27500]	Counts in elevation 3
Data, Elevation 4	Unsigned Integer	2	[0,27500]	Counts in elevation 4
Data, Elevation 5	Unsigned Integer	2	[0,27500]	Counts in elevation 5
Data, Elevation 6	Unsigned Integer	2	[0,27500]	Counts in elevation 6
Data, Elevation 7	Unsigned Integer	2	[0,27500]	Counts in elevation 7
Data, Elevation 8	Unsigned Integer	2	[0,27500]	Counts in elevation 8

5.3.5. **CAPS IMS LOG Data Product Format**

The data product format for CAPS IMS Logicals (LOG) is listed in Table 21 below. The fill value for Logical Data is 65535 (hex FFFF).

Table 21: 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	[-7.1×10^7, 1.5×10^9]	Start time of A cycle, sec. from J2000 (barycentric dynamic time)
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.
TDC log selection	Unsigned Integer	1	[0,3]	TDC selectable logical definition

Table 21: CAPS IMS Logicals UNCALIBRATED Data File Contents and Structure				
				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)
Offset time	Unsigned Integer	2	[1,32000]	Milliseconds from start of A cycle
First Energy Step	Unsigned Integer	2	[1,63]	Min energy step in collapsed data
Last Energy Step	Unsigned Integer	2	[1,63]	Max energy step in collapsed data
First Azimuth Value	Unsigned Integer	2	[1,8]	Min azimuth value in collapsed data
Last Azimuth Value	Unsigned Integer	2	[1,8]	Max azimuth value in collapsed data
LEF Stops	Unsigned Integer	2	[0,27500]	LEF stop counts
ST Stops	Unsigned Integer	2	[0,27500]	ST stop counts
Timeouts	Unsigned Integer	2	[0,27500]	Timeout events
Total Events	Unsigned Integer	2	[0,27500]	Total events (generated by SAM for dead time)
Logical 13	Unsigned Integer	2	[0,27500]	TDC selectable logical 13
Logical 14	Unsigned Integer	2	[0,27500]	TDC selectable logical 14

5.3.6. **CAPS IMS TOF Data Product Format**

The data product format for CAPS IMS Time of flight (TOF) is listed in Table 22 below. The fill value for IMS TOF and ST data is 4294967295 (hex value FFFFFFFF).

Table 22: 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	[-7.1×10^7, 1.5×10^9]	Start time of B cycle, sec. from J2000 (barycentric dynamic time)
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.
Collapse Flag	Unsigned Integer	1	[0,1]	Flags indicating collapse by average (0) or sum (1)
ST start channel	Unsigned Integer	2	[1,2048]	Start ST TOF channel
ST interval	Unsigned Integer	1	[1,4]	ST TOF bin interval 1 = each word is taken starting at the

Table 22: CAPS IMS TOF UNCALIBRATED Data File Contents and Structure				
				Start channel. 2 = Every other word is taken starting at the Start channel. 4 = Every fourth word is taken starting at the Start Channel
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 (to be assigned).
LEF start channel	Unsigned Integer	2	[1,2048]	Start LEF TOF channel
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
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.
Energy Step	Unsigned Integer	2	[1,32]	Energy step in collapsed data
Data, ST TOF bin 1	Unsigned Integer	4	[0, 3268027]	Counts in ST TOF bin 1
Data, ST TOF bin 2	Unsigned Integer	4	[0, 3268027]	Counts in ST TOF bin 2
…	Unsigned Integer	4x509	[0, 3268027]	Counts in ST TOF bins 3 - 511
Data, ST TOF bin 512	Unsigned Integer	4	[0, 3268027]	Counts in ST TOF bin 512
Data, LEF TOF bin 1	Unsigned Integer	4	[0, 3268027]	Counts in LEF TOF bin 1
Data, LEF TOF bin 2	Unsigned Integer	4	[0, 3268027]	Counts in LEF TOF bin 2
…	Unsigned Integer	4x509	[0, 3268027]	Counts in LEF TOF bins 3 - 511
Data, LEF TOF bin 512	Unsigned Integer	4	[0, 3268027]	Counts in LEF TOF bin 512

5.3.7. **CAPS ACT Data Product Format**

The data product format for the CAPS actuator is listed in Table 23 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 23: 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
Time	Float	8	[-7.1×10^7, 1.5×10^9]	Start time of A cycle, sec. from J2000 (barycentric dynamic time)
Data, Actuator angle 1	Float	4	[-115,115]	Actuator angle at time + 0 sec
Data, Actuator angle 2	Float	4	[-115,115]	Actuator angle at time + 1 sec
…	Float	4x29	[-115,115]	Actuator angle (offset times of 2 – 30 sec)
Data, Actuator angle 32	Float	4	[-115,115]	Actuator angle at time + 31 sec

5.3.8. **CAPS ANC Data Product Format**

The data product format for the ancillary data product is listed in Table 24 below. There are no standard fill values for these items.

Table 24: 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
Time	Float	8	[-7.1×10^7, 1.5×10^9]	Start time of A cycle, sec. from J2000 (barycentric dynamic time)
SCLK	Unsigned Integer	4	[0,3.0×10^9]	Start time of A cycle, spacecraft clock
Spacecraft/Saturn position [x]	Float	4	[-9.46×10^{12}, 9.46×10^{12}]	J2000 [km]: Saturn-centered
Spacecraft/Saturn position [y]	Float	4	[-9.46×10^{12}, 9.46×10^{12}]	J2000 [km]: Saturn-centered
Spacecraft/Saturn position [z]	Float	4	[-9.46×10^{12}, 9.46×10^{12}]	J2000 [km]: Saturn-centered
Spacecraft/Saturn velocity v_x	Float	4	[-3×10^5, 3×10^5]	J2000 [km/s]: relative to Saturn

Table 24: CAPS ANC UNCALIBRATED Data File Contents and Structure				
Spacecraft/Saturn velocity v_y	Float	4	[$-3x10^5$, $3x10^5$]	J2000 [km/s]: relative to Saturn
Spacecraft/Saturn velocity v_z	Float	4	[$-3x10^5$, $3x10^5$]	J2000 [km/s]: relative to Saturn
Spacecraft/Sun position [x]	Float	4	[$-9.46x10^{12}$, $9.46x10^{12}$]	J2000 [km]: Sun-centered
Spacecraft/Sun position [y]	Float	4	[$-9.46x10^{12}$, $9.46x10^{12}$]	J2000 [km]: Sun-centered.
Spacecraft/Sun position [z]	Float	4	[$-9.46x10^{12}$, $9.46x10^{12}$]	J2000 [km]: Sun-centered
Spacecraft/Sun velocity v_x	Float	4	[$-3x10^5$, $3x10^5$]	J2000 [km/s]: Relative to the Sun
Spacecraft/Sun velocity v_y	Float	4	[$-3x10^5$, $3x10^5$]	J2000 [km/s]: Relative to the Sun
Spacecraft/Sun velocity v_z	Float	4	[$-3x10^5$, $3x10^5$]	J2000 [km/s]: Relative to the Sun
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

Table 24: CAPS ANC UNCALIBRATED Data File Contents and Structure				
				= 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
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
FSW Sub-Major version	Unsigned Integer	1	[0,255]	See description for FSW Major version
FSW Minor version	Unsigned Integer	1	[0,255]	See description for FSW Major version
FSW Sub-Minor version	Unsigned Integer	1	[0,255]	See description for FSW Major version

Table 24: CAPS ANC UNCALIBRATED Data File Contents and Structure

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.
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		IMS Sweep table number
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
IMS logicals selection	Unsigned Integer	2	[4096,27416]	The TDC logicals selection is a bitmap: Bits 15-13: IMS Logical 1

Table 24: CAPS ANC UNCALIBRATED Data File Contents and Structure				
				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.
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	[0,65535]	SAM group table ID number
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

5.3.9. **CAPS EVN Data Product Format**

The data product format for the CAPS IMS event mode data is listed in Table 25 below. No fill values are necessary. Data rows exist only if data are present.

Table 25: 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
Time	Float	8	[-7.1×10^7, 1.5×10^9]	Start time of B cycle, sec. from J2000 (barycentric dynamic time)
Offset time	Unsigned Integer	2	[0,32000]	Milliseconds from start of A cycle
Energy Step	Unsigned Integer	2	[1,63]	Energy Step
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).
Elevation	Unsigned Integer	1	[1,8]	Elevation or Sector ID.
TOF type	Unsigned Integer	1	[0,255]	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
TOF	Unsigned Integer	2	[1,2048]	Event's Time of Flight. The particle's TOF channel.

5.4. CAPS Standard CALIBRATED Data Product Descriptions

The following sections describe the content and structure of each of the standard data products within the CALIBRATED level 3 CAPS data set. The format will be similar to the un-calibrated data product format, BUT the counts will be converted to either flux or phase space densities. In addition, there will be a variance on each measurement. Also, instead of having just an energy step or an azimuth number, we will have the actual energy value and the azimuth angle. The size of the files will quadruple.

5.4.1. **CAPS ELS Data Product Format**

The data product format for ELS is TBD.

5.4.2. **CAPS IBS Data Product Format**

The data product format for CAPS IBS is TBD.

5.4.3. **CAPS IMS ION Data Product Format**

The data product format for CAPS IMS ION is TBD.

5.4.4. **CAPS IMS SNG Data Product Format**

The data product format for CAPS IMS Singles (SNG) is TBD.

5.4.5. **CAPS IMS TOF Data Product Format**

The data product format for CAPS IMS Time of flight (TOF) is TBD.

5.4.6. **CAPS ANC Data Product Format**

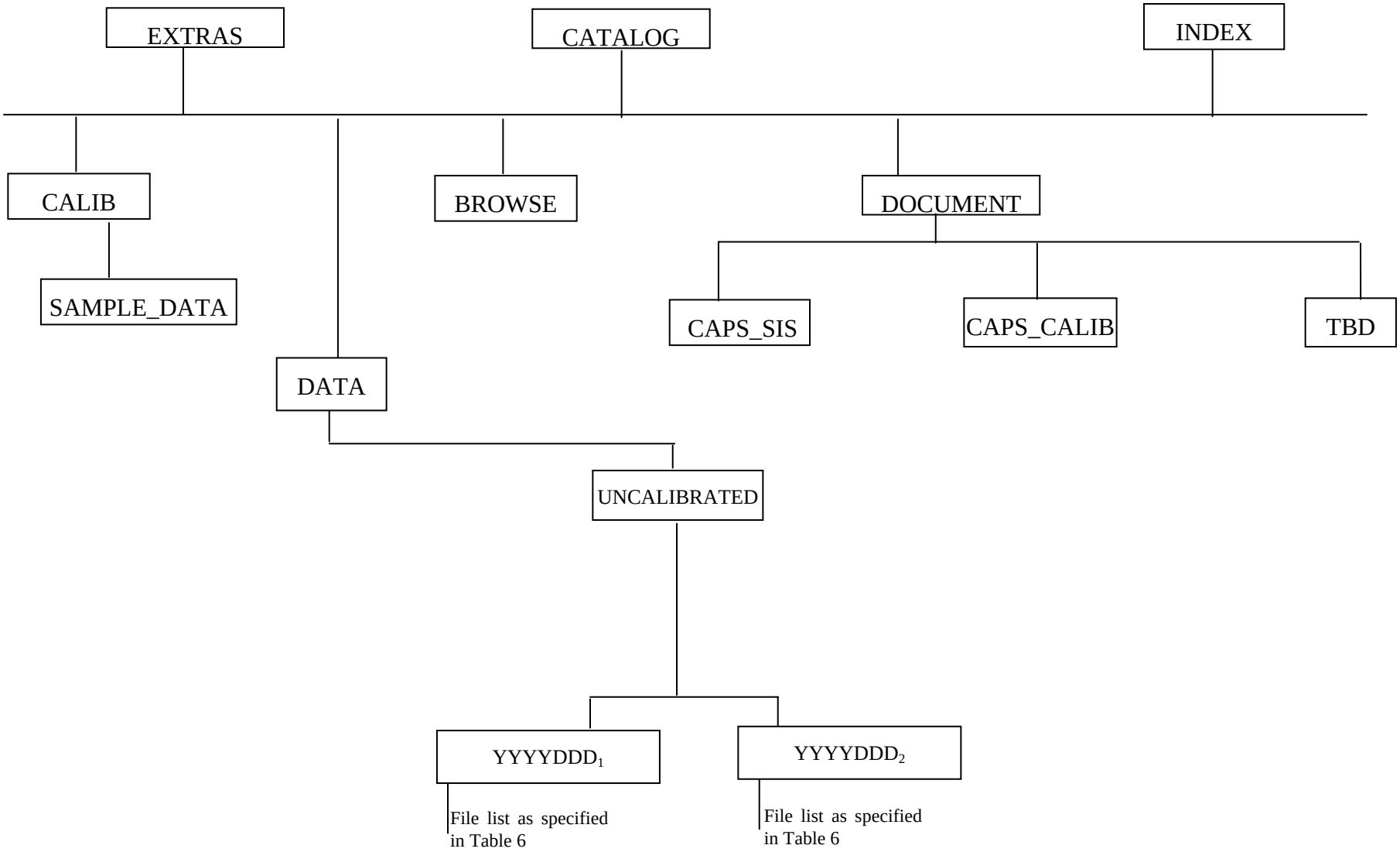
The data product format for the ancillary data product is TBD. This structure will include variables for use with the calibrated files. In addition, the file will include multiple coordinate systems, which are more relevant to our data than the J2000 coordinate system.

6. Support Staff and Cognizant Persons

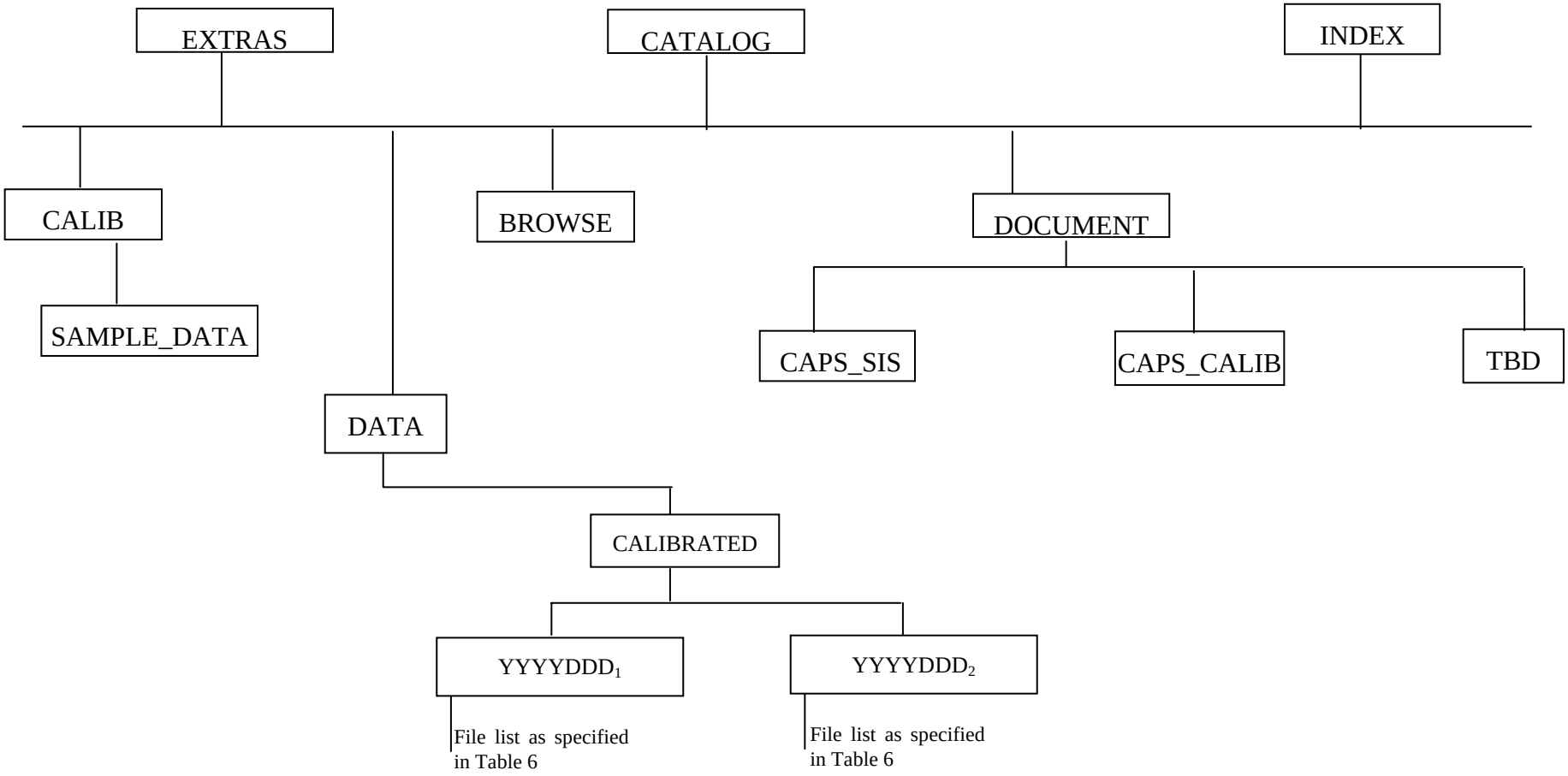
Table 26: CAPS Archive Collection Support Staff

CAPS Team			
Judith D Furman	Southwest Research Institute 6220 Culebra Road San Antonio, TX 78228	210-522-6040	jfurman@swri.edu
Charles Zinsmeyer	Southwest Research Institute 6220 Culebra Road San Antonio, TX 78228	210-522-5018	czinsmeyer@swri.edu
Dr. Frank Crary	Southwest Research Institute 6220 Culebra Road San Antonio, TX 78228	210-522-6043	fcrary@swri.edu
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



Directory Structure for Archive Volume, COCAPS_2mmm



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

ELS_U1.FMT File

```
/* ELS_U1.FMT */
/* Description of the electron spectrometer data table */
OBJECT              = COLUMN
   NAME             = B_CYCLE_NUMBER
   DATA_TYPE        = MSB_UNSIGNED_INTEGER
   START_BYTE       = 1
   BYTES            = 2
   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
   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
   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
   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
   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
                NOTE:  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
   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
   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
   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
   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
   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_U1.LBL

```
PDS_VERSION_ID              = PDS3
DATA_SET_ID                 = "CO-E/J/S/SW-CAPS-2-UNCALIBRATED-V1.0"

STANDARD_DATA_PRODUCT_ID    = "ELS UNCALIBRATED"
PRODUCT_ID                  = "ELS_200522400_U1"
PRODUCT_TYPE                = "DATA"
PRODUCT_CREATION_TIME       = 2005-228T19:58

RECORD_TYPE                 = FIXED_LENGTH
RECORD_BYTES                = 40
FILE_RECORDS                = 122496

START_TIME                  = 2005-224T00:00:21
STOP_TIME                   = 2005-224T05:59:48
SPACECRAFT_CLOCK_START_COUNT  = "1/1502497703.000"
SPACECRAFT_CLOCK_STOP_COUNT   = "1/1502519271.000"

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
   2005-224T00:00:21.000 and 2005-224T05:59:48.000 (orbit 013)."

MD5_CHECKSUM                = "dca0087dc4ee3c3e5abc68f372d20320"

NOTE                        = "
   The end around carry checksum, with seed 0x55AA,
   of this file is 0xFE38"

^TABLE                      = "ELS_200522400_U1.DAT"
OBJECT                      = TABLE
  INTERCHANGE_FORMAT        = "BINARY"
  ROWS                      = 122496
  COLUMNS                   = 11
  ROW_BYTES                 = 40
  ^STRUCTURE                = "ELS_U1.FMT"
  DESCRIPTION               = "
    The file ELS_U1.FMT describes the column structure and content
    of the data file."
END_OBJECT                  = TABLE
END
```

IBS_U1.FMT File

```
/* IBS_U1.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
   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
   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
   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
   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
   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
                7-255 = spare"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
  NAME              = OFFSET_TIME
  DATA_TYPE         = MSB_UNSIGNED_INTEGER
  START_BYTE        = 15
  BYTES             = 4
  UNIT              = MILLISECOND
  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
  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
  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
  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
  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
  MISSING_CONSTANT  = 65535
  VALID_MINIMUM     = 1
  VALID_MAXIMUM     = 65504
  DESCRIPTION       = "Counts in fans 1 through 3"
END_OBJECT          = COLUMN
```

Sample IBS Label File: IBS_YYYYDDDHH_U1.LBL

```
PDS_VERSION_ID              = PDS3
DATA_SET_ID                 = "CO-E/J/S/SW-CAPS-2-UNCALIBRATED-V1.0"

STANDARD_DATA_PRODUCT_ID    = "IBS UNCALIBRATED"
PRODUCT_ID                  = "IBS_200522400_U1"
PRODUCT_TYPE                = "DATA"
PRODUCT_CREATION_TIME       = 2005-228T19:58

RECORD_TYPE                 = FIXED_LENGTH
RECORD_BYTES                = 32
FILE_RECORDS                = 538815

START_TIME                  = 2005-223T23:56:37
STOP_TIME                   = 2005-224T05:55:00
SPACECRAFT_CLOCK_START_COUNT  = "1/1502497479.000"
SPACECRAFT_CLOCK_STOP_COUNT   = "1/1502518983.000"

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
   2005-223T23:56:37.000 and 2005-224T05:55:00.000 (orbit 013)."

MD5_CHECKSUM                = "e7e5905adba35ede16ef2245b34c39d3"

NOTE                        = "
   The end around carry checksum, with seed 0x55AA,
   of this file is 0x0229"

^TABLE                      = "IBS_200522400_U1.DAT"
OBJECT                      = TABLE
  INTERCHANGE_FORMAT        = "BINARY"
  ROWS                      = 538815
  COLUMNS                   = 11
  ROW_BYTES                 = 32
  ^STRUCTURE                = "IBS_U1.FMT"
  DESCRIPTION               = "
    The file IBS_U1.FMT describes the column structure and content
    of the data file."
END_OBJECT                  = TABLE
END
```

ION_U1.FMT File

```
/* ION_U1.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
   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
   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
   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
   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
   DESCRIPTION    = "Will contains zeroes"
END_OBJECT        = COLUMN

OBJECT            = COLUMN
   NAME           = OFFSET_TIME
   DATA_TYPE      = MSB_UNSIGNED_INTEGER
   START_BYTE     = 15
   BYTES          = 2
   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
   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
   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
   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
   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
   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
     MISSING_CONSTANT  = 28671
     VALID_MINIMUM     = -32
    VALID_MAXIMUM     = 27650
     DESCRIPTION       = "Counts in elevations 1 through 8 (signed
                  value)"
 END_OBJECT          = COLUMN
```

Sample IMS ION Label File: ION_YYYYDDDHH_U1.LBL

```
PDS_VERSION_ID              = PDS3
DATA_SET_ID                 = "CO-E/J/S/SW-CAPS-2-UNCALIBRATED-V1.0"

STANDARD_DATA_PRODUCT_ID    = "ION UNCALIBRATED"
PRODUCT_ID                  = "ION_200522400_U1"
PRODUCT_TYPE                = "DATA"
PRODUCT_CREATION_TIME       = 2005-228T19:58

RECORD_TYPE                 = FIXED_LENGTH
RECORD_BYTES                = 42
FILE_RECORDS                = 36288

START_TIME                  = 2005-224T00:08:53
STOP_TIME                   = 2005-224T05:41:08
SPACECRAFT_CLOCK_START_COUNT  = "1/1502498215.000"
SPACECRAFT_CLOCK_STOP_COUNT   = "1/1502518151.000"

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
   2005-224T00:08:53.000 and 2005-224T05:41:08.000 (orbit 013)."

MD5_CHECKSUM                = "eacab590197d3ac2dcfdaba4f6bac6ad"

NOTE                        = "
   The end around carry checksum, with seed 0x55AA,
   of this file is 0x019A"

^TABLE                      = "ION_200522400_U1.DAT"
OBJECT                      = TABLE
 INTERCHANGE_FORMAT         = "BINARY"
 ROWS                       = 36288
 COLUMNS                    = 12
 ROW_BYTES                  = 42
 ^STRUCTURE                 = "ION_U1.FMT"
 DESCRIPTION                = "
   The file ION_U1.FMT describes the column structure and content
   of the data file."
END_OBJECT                  = TABLE
END
```

SNG_U1.FMT File

```
/* SNG_U1.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
   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
   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
   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
   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
    DESCRIPTION    = "Contains zeroes"
END_OBJECT         = COLUMN

OBJECT             = COLUMN
    NAME           = OFFSET_TIME
    DATA_TYPE      = MSB_UNSIGNED_INTEGER
    START_BYTE     = 15
    BYTES          = 2
    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
    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
    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
    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
    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
```

Sample IMS Singles (SNG) Label File: SNG_YYYYDDDHH_U1.LBL

```
PDS_VERSION_ID              = PDS3
DATA_SET_ID                 = "CO-E/J/S/SW-CAPS-2-UNCALIBRATED-V1.0"

STANDARD_DATA_PRODUCT_ID    = "SNG UNCALIBRATED"
PRODUCT_ID                  = "SNG_200522400_U1"
PRODUCT_TYPE                = "DATA"
PRODUCT_CREATION_TIME       = 2005-228T19:58

RECORD_TYPE                 = FIXED_LENGTH
RECORD_BYTES                = 40
FILE_RECORDS                = 48573

START_TIME                  = 2005-224T00:00:21
STOP_TIME                   = 2005-224T05:59:48
SPACECRAFT_CLOCK_START_COUNT  = "1/1502497703.000"
SPACECRAFT_CLOCK_STOP_COUNT   = "1/1502519271.000"

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
   2005-224T00:00:21.000 and 2005-224T05:59:48.000 (orbit 013)."

MD5_CHECKSUM                = "006c7e1177dc6dbfa1a167d7e84a4639"

NOTE                        = "
   The end around carry checksum, with seed 0x55AA,
   of this file is 0x2645"

^TABLE                      = "SNG_200522400_U1.DAT"
OBJECT                      = TABLE
  INTERCHANGE_FORMAT        = "BINARY"
  ROWS                      = 48573
  COLUMNS                   = 11
  ROW_BYTES                 = 40
  ^STRUCTURE                = "SNG_U1.FMT"
  DESCRIPTION               = "
    The file SNG_U1.FMT describes the column structure and content
    of the data file."
END_OBJECT                  = TABLE
END
```

LOG_U1.FMT File

```
/* LOG_U1.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
   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
   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
   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
   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
   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
   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
   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
   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
   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
   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
```

Sample IMS Logicals (LOG) Label File: LOG_YYYYDDDHH_U1.LBL

```
PDS_VERSION_ID              = PDS3
DATA_SET_ID                 = "CO-E/J/S/SW-CAPS-2-UNCALIBRATED-V1.0"

STANDARD_DATA_PRODUCT_ID    = "LOG UNCALIBRATED"
PRODUCT_ID                  = "LOG_200522400_U1"
PRODUCT_TYPE                = "DATA"
PRODUCT_CREATION_TIME       = 2005-228T19:58

RECORD_TYPE                 = FIXED_LENGTH
RECORD_BYTES                = 36
FILE_RECORDS                = 84861

START_TIME                  = 2005-224T00:00:21
STOP_TIME                   = 2005-224T05:59:48
SPACECRAFT_CLOCK_START_COUNT  = "1/1502497703.000"
SPACECRAFT_CLOCK_STOP_COUNT   = "1/1502519271.000"

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
   2005-224T00:00:21.000 and 2005-224T05:59:48.000 (orbit 013)."

MD5_CHECKSUM                = "6dd05c1fb3105d5394c325c92fce99e3"

NOTE                        = "
   The end around carry checksum, with seed 0x55AA,
   of this file is 0x0CFB"

^TABLE                      = "LOG_200522400_U1.DAT"
OBJECT                      = TABLE
  INTERCHANGE_FORMAT        = "BINARY"
  ROWS                      = 84861
  COLUMNS                   = 16
  ROW_BYTES                 = 36
  ^STRUCTURE                = "LOG_U1.FMT"
  DESCRIPTION               = "
    The file LOG_U1.FMT describes the column structure and content
```

```
   of the data file."
END_OBJECT                = TABLE
END
```

TOF_U1.FMT File

```
/* TOF_U1.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
   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
   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
   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      = 12
   BYTES           = 1
   DESCRIPTION     = "Flag indicating collapse in TOF:
                     0: average
                     1: sum"
END_OBJECT         = COLUMN
```

```
OBJECT              = COLUMN
  NAME              = ST_START_CHANNEL
  DATA_TYPE         = MSB_UNSIGNED_INTEGER
  START_BYTE        = 13
  BYTES             = 2
  VALID_MINIMUM     = 0
  VALID_MAXIMUM     = 2048
  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
  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
  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     = 0
  VALID_MAXIMUM     = 2048
  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
  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
  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
  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
  MISSING_CONSTANT  = 4294967295
  VALID_MINIMUM     = 0
  VALID_MAXIMUM     = 3268027
  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
  MISSING_CONSTANT  = 4294967295
  VALID_MINIMUM     = 0
  VALID_MAXIMUM     = 3268027
  UNIT              = COUNTS
  DESCRIPTION       = "Counts in LEF TOF bins 1 through 512"
END_OBJECT          = COLUMN
```

Sample IMS TOF Label File: TOF_YYYYDDDHH_U1.LBL

```
PDS_VERSION_ID              = PDS3
DATA_SET_ID                 = "CO-E/J/S/SW-CAPS-2-UNCALIBRATED-V1.0"

STANDARD_DATA_PRODUCT_ID    = "TOF UNCALIBRATED"
PRODUCT_ID                  = "TOF_200500100_U1"
PRODUCT_TYPE                = "DATA"
PRODUCT_CREATION_TIME       = 2005-201T15:01

RECORD_TYPE                 = FIXED_LENGTH
RECORD_BYTES                = 4118
FILE_RECORDS                = 384

START_TIME                  = 2005-001T00:15:29
STOP_TIME                   = 2005-001T05:42:57
SPACECRAFT_CLOCK_START_COUNT  = "1/1483231288.000"
SPACECRAFT_CLOCK_STOP_COUNT   = "1/1483250936.000"

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
   2005-001T00:15:29.000 and 2005-001T05:42:57.000 (orbit 00C)."

NOTE                        = "
   The end around carry checksum, with seed 0x55AA,
   of this file is 0x8E6C"

^TABLE                      = "TOF_200500100_U1.DAT"
OBJECT                      = TABLE
  INTERCHANGE_FORMAT        = "BINARY"
  ROWS                      = 384
  COLUMNS                   = 13
  ROW_BYTES                 = 4118
  ^STRUCTURE                = "TOF_U1.FMT"
  DESCRIPTION               = "
    The file TOF_U1.FMT describes the column structure and content
    of the data file."
END_OBJECT                  = TABLE
END
```

ACT_1.FMT File

```
/* ACT_1.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
   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
   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
   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
```

Sample Actuator (ACT) Label File: ACT_YYYYDDDHH_1.LBL

```
PDS_VERSION_ID              = PDS3
DATA_SET_ID                 = {"CO-E/J/S/SW-CAPS-2-UNCALIBRATED-V1.0",
                               "CO-E/J/S/SW-CAPS-3-CALIBRATED-V1.0"}
STANDARD_DATA_PRODUCT_ID    = {"ACT UNCALIBRATED", "ACT CALIBRATED"}
PRODUCT_ID                  = "ACT_200522400_1"
PRODUCT_TYPE                = "DATA"
PRODUCT_CREATION_TIME       = 2005-228T19:58

RECORD_TYPE                 = FIXED_LENGTH
RECORD_BYTES                = 140
FILE_RECORDS                = 675

START_TIME                  = 2005-224T00:00:21
STOP_TIME                   = 2005-224T05:59:48
SPACECRAFT_CLOCK_START_COUNT  = "1/1502497703.000"
SPACECRAFT_CLOCK_STOP_COUNT   = "1/1502519271.000"

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
   2005-224T00:00:21.000 and 2005-224T05:59:48.000 (orbit 013)."

MD5_CHECKSUM                = "1d2450f06e28196c9bbc031b5ce66f3d"

NOTE                        = "
   The end around carry checksum, with seed 0x55AA,
   of this file is 0xDCB2"

^TABLE                      = "ACT_200522400_1.DAT"
OBJECT                      = TABLE
  INTERCHANGE_FORMAT        = "BINARY"
  ROWS                      = 675
  COLUMNS                   = 4
  ROW_BYTES                 = 140
  ^STRUCTURE                = "ACT_1.FMT"
  DESCRIPTION               = "
    The file ACT_1.FMT describes the column structure and content
    of the data file."
END_OBJECT                  = TABLE
END
```

EVN_U1.FMT File

```
/* EVN_U1.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
   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
   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
   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
   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
   DESCRIPTION      = "Energy step"
```

```
END_OBJECT          = COLUMN

OBJECT              = COLUMN
  NAME              = AZIMUTH_VALUE
  DATA_TYPE         = MSB_UNSIGNED_INTEGER
  FORMAT            = I2
  START_BYTE        = 17
  BYTES             = 2
  DESCRIPTION       = "Azimuth value (always 1)"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
  NAME              = ELEVATION
  DATA_TYPE         = MSB_UNSIGNED_INTEGER
  FORMAT            = I1
  START_BYTE        = 19
  BYTES             = 1
  DESCRIPTION       = "Elevation"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
  NAME              = TOF_TYPE
  DATA_TYPE         = MSB_UNSIGNED_INTEGER
  FORMAT            = I1
  START_BYTE        = 20
  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
  DESCRIPTION       = "Event's Time of Flight Data.
                     The particle's TOF channel."
END_OBJECT          = COLUMN
```

Sample EVN Label File: EVN_YYYYDDDHH_U1.LBL

NOT AVAILABLE YET

ANC_U1.FMT File

```
/* ANC_U1.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
   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
   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
   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
   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
   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
   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
   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
   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
   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
   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
   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
   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
```

```
   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
   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
   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
   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
   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
   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
   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
   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
   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
   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
   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
   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
   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
   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
   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
   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
   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
   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
   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
   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
   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  = 4
   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
   DESCRIPTION    = "Telemetry mode version number"
END_OBJECT        = COLUMN

OBJECT            = COLUMN
   NAME           = FSW_MAJOR_VERSION
   DATA_TYPE      = MSB_UNSIGNED_INTEGER
   START_BYTE     = 142
   BYTES          = 1
   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
   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
   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
   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
   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
   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
   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
   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
   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
   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
   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
   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
   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
   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
   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
   DESCRIPTION      = "IMS sweep table number"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
   NAME             = TDC_SINGLE_SELECT
   DATA_TYPE        = MSB_UNSIGNED_INTEGER
   START_BYTE       = 166
   BYTES            = 1
   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
   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
   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
   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
   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
```

Sample Ancillary (ANC) Label File: ANC_YYYYDDDHH_U1.LBL

```
PDS_VERSION_ID              = PDS3
DATA_SET_ID                 = "CO-E/J/S/SW-CAPS-2-UNCALIBRATED-V1.0"

STANDARD_DATA_PRODUCT_ID    = "ANC UNCALIBRATED"
PRODUCT_ID                  = "ANC_200522400_U1"
PRODUCT_TYPE                = "DATA"
PRODUCT_CREATION_TIME       = 2005-228T19:58

RECORD_TYPE                 = FIXED_LENGTH
RECORD_BYTES                = 196
FILE_RECORDS                = 675

START_TIME                  = 2005-224T00:00:21
STOP_TIME                   = 2005-224T05:59:48
SPACECRAFT_CLOCK_START_COUNT  = "1/1502497703.000"
SPACECRAFT_CLOCK_STOP_COUNT   = "1/1502519271.000"

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
   2005-224T00:00:21.000 and 2005-224T05:59:48.000 (orbit 013)."
MD5_CHECKSUM                = "d991a15bbf9572cb5ab9f9e7dbfc1ff5"

NOTE                        = "
   The end around carry checksum, with seed 0x55AA,
   of this file is 0x54A7"
SPICE_FILE_NAME             = {"SPK: 050505AP_SCPSE_05119_08222.bsp",
                           "00: 05212_05242pk_fsiv.bc",
                           "06: 05212_05242pk_fsiv.bc",
                           "12: 05212_05242pk_fsiv.bc",
                           "18: 05212_05242pk_fsiv.bc"}

^TABLE                      = "ANC_200522400_U1.DAT"
OBJECT                      = TABLE
 INTERCHANGE_FORMAT         = "BINARY"
 ROWS                       = 675
 COLUMNS                    = 65
 ROW_BYTES                  = 196
```

```
  ^STRUCTURE                = "ANC_U1.FMT"
  DESCRIPTION               = "
    The file ANC_U1.FMT describes the column structure and content
    of the data file."
END_OBJECT                  = TABLE
END
```