MAVEN
Mars Atmosphere and Volatile Evolution Mission
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Mars Atmosphere and Volatile Evolution (MAVEN) Mission

Extreme Ultraviolet Monitor (EUV)

PDS Archive

Software Interface Specification

[Rev. 5.1, 15 February 2019]

Prepared by

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1 Introduction

This software interface specification (SIS) describes the format and content of the Extreme Ultraviolet monitor (EUV) Planetary Data System (PDS) data archive. It includes descriptions of the data products and associated metadata, and the archive format, content, and generation pipeline.

1.1 Distribution List

Table 1: Distribution list

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1.2 Document Change Log

Table 2: Document change log

Version	Change	Date	Affected portion
0.0	Initial template	2012-Aug-24	All
0.1	Updated template	2013-Feb-13	All
0.2	Updated template	2013-Apr-03	All
0.3	Updated template	2014-Jan-30	All
0.4	First draft	2014-Apr-28	All
0.5	Second draft	2014-Jun-12	All
1.0	Release for Signatures	2014-Jun-17	All
2.0	Updated for final review of L2	2015-May-08	Primarily Section 6, minor fixes elsewhere
3.0	Updated for review of L3	2016-Apr-12	Section 6
4.0	Updated in response to reviews	2016-Aug-11	Section 6
5.0	Updated for changes to L2 product	2017-Aug-01	Sections 5 and 6
5.1	Final peer review lien resolution	2019-Feb-15	Primarily Appendices C-G, minor fixes elsewhere

1.3   **TBD Items**

Table 3 lists items that are not yet finalized.

Table 3: List of TBD items

Item	Section(s)	Page(s)

1.4   **Abbreviations**

Table 4: Abbreviations and their meaning

Abbreviation	Meaning
ASCII	American Standard Code for Information Interchange
Atmos	PDS Atmospheres Node (NMSU, Las Cruces, NM)
CCSDS	Consultative Committee for Space Data Systems
CDR	Calibrated Data Record
CFDP	CCSDS File Delivery Protocol
CK	C-matrix Kernel (NAIF orientation data)
CODMAC	Committee on Data Management, Archiving, and Computing
CRC	Cyclic Redundancy Check
CU	University of Colorado (Boulder, CO)
DAP	Data Analysis Product
DDR	Derived Data Record
DMAS	Data Management and Storage
DPF	Data Processing Facility
E&PO	Education and Public Outreach
EDR	Experiment Data Record
EUV	Extreme Ultraviolet; also used for the EUV Monitor, part of LPW (SSL)
FEI	File Exchange Interface
FOV	Field of View
FTP	File Transfer Protocol
GB	Gigabyte(s)
GSFC	Goddard Space Flight Center (Greenbelt, MD)
HK	Housekeeping

Abbreviation	Meaning
HTML	Hypertext Markup Language
ICD	Interface Control Document
IM	Information Model
ISO	International Standards Organization
ITF	Instrument Team Facility
IUVS	Imaging Ultraviolet Spectrograph (LASP)
JPL	Jet Propulsion Laboratory (Pasadena, CA)
LASP	Laboratory for Atmosphere and Space Physics (CU)
LID	Logical Identifier
LIDVID	Versioned Logical Identifer
LPW	Langmuir Probe and Waves instrument (SSL)
MAG	Magnetometer instrument (GSFC)
MAVEN	Mars Atmosphere and Volatile EvolutioN
MB	Megabyte(s)
MD5	Message-Digest Algorithm 5
MOI	Mars Orbit Insertion
MOS	Mission Operations System
MSA	Mission Support Area
NAIF	Navigation and Ancillary Information Facility (JPL)
NASA	National Aeronautics and Space Administration
NGIMS	Neutral Gas and Ion Mass Spectrometer (GSFC)
NMSU	New Mexico State University (Las Cruces, NM)
NSSDC	National Space Science Data Center (GSFC)
PCK	Planetary Constants Kernel (NAIF)
PDS	Planetary Data System
PDS4	Planetary Data System Version 4
PF	Particles and Fields (instruments)
PPI	PDS Planetary Plasma Interactions Node (UCLA)
RS	Remote Sensing (instruments)
SCET	Spacecraft Event Time

Abbreviation	Meaning
SDC	Science Data Center (LASP)
SCLK	Spacecraft Clock
SEP	Solar Energetic Particle instrument (SSL)
SIS	Software Interface Specification
SOC	Science Operations Center (LASP)
SPE	Solar Particle Event
SPICE	Spacecraft, Planet, Instrument, C-matrix, and Events (NAIF data format)
SPK	Spacecraft and Planetary ephemeris Kernel (NAIF)
SSL	Space Sciences Laboratory (UCB)
STATIC	Supra-Thermal And Thermal Ion Composition instrument (SSL)
SWEA	Solar Wind Electron Analyzer (SSL)
SWIA	Solar Wind Ion Analyzer (SSL)
TBC	To Be Confirmed
TBD	To Be Determined
UCB	University of California, Berkeley
UCLA	University of California, Los Angeles
URN	Uniform Resource Name
UV	Ultraviolet
XML	eXtensible Markup Language

1.5 Glossary

Archive – A place in which public records or historical documents are preserved; also the material preserved – often used in plural. The term may be capitalized when referring to all of PDS holdings – the PDS Archive.

Basic Product – The simplest product in PDS4; one or more data objects (and their description objects), which constitute (typically) a single observation, document, etc. The only PDS4 products that are *not* basic products are collection and bundle products.

Bundle Product – A list of related collections. For example, a bundle could list a collection of raw data obtained by an instrument during its mission lifetime, a collection of the calibration products associated with the instrument, and a collection of all documentation relevant to the first two collections.

Class – The set of attributes (including a name and identifier) which describes an item defined in the PDS Information Model. A class is generic – a template from which individual items may be constructed.

Collection Product – A list of closely related basic products of a single type (e.g. observational data, browse, documents, etc.). A collection is itself a product (because it is simply a list, with its label), but it is not a *basic* product.

Data Object – A generic term for an object that is described by a description object. Data objects include both digital and non-digital objects.

Description Object – An object that describes another object. As appropriate, it will have structural and descriptive components. In PDS4 a 'description object' is a digital object – a string of bits with a predefined structure.

Digital Object – An object which consists of real electronically stored (digital) data.

Identifier – A unique character string by which a product, object, or other entity may be identified and located. Identifiers can be global, in which case they are unique across all of PDS (and its federation partners). A local identifier must be unique within a label.

Label – The aggregation of one or more description objects such that the aggregation describes a single PDS product. In the PDS4 implementation, labels are constructed using XML.

Logical Identifier (**LID**) – An identifier which identifies the set of all versions of a product.

Versioned Logical Identifier (LIDVID) – The concatenation of a logical identifier with a version identifier, providing a unique identifier for each version of product.

Manifest - A list of contents.

Metadata – Data about data – for example, a 'description object' contains information (metadata) about an 'object.'

Non-Digital Object – An object which does not consist of digital data. Non-digital objects include both physical objects like instruments, spacecraft, and planets, and non-physical objects like missions, and institutions. Non-digital objects are labeled in PDS in order to define a unique identifier (LID) by which they may be referenced across the system.

Object – A single instance of a class defined in the PDS Information Model.

PDS Information Model – The set of rules governing the structure and content of PDS metadata. While the Information Model (IM) has been implemented in XML for PDS4, the model itself is implementation independent.

Product – One or more tagged objects (digital, non-digital, or both) grouped together and having a single PDS-unique identifier. In the PDS4 implementation, the descriptions are combined into a single XML label. Although it may be possible to locate individual objects within PDS (and to

find specific bit strings within digital objects), PDS4 defines 'products' to be the smallest granular unit of addressable data within its complete holdings.

Tagged Object – An entity categorized by the PDS Information Model, and described by a PDS label.

Registry – A database that provides services for sharing content and metadata.

Repository – A place, room, or container where something is deposited or stored (often for safety).

XML – eXtensible Markup Language.

XML schema – The definition of an XML document, specifying required and optional XML elements, their order, and parent-child relationships.

1.6   MAVEN Mission Overview

The MAVEN mission is scheduled to launch on an Atlas V between November 18 and December 7, 2013. After a ten-month ballistic cruise phase, Mars orbit insertion will occur on or after September 22, 2014. Following a 5-week transition phase, the spacecraft will orbit Mars at a 75° inclination, with a 4.5 hour period and periapsis altitude of 140-170 km (density corridor of 0.05-0.15 kg/km^3). Over a one-Earth-year period, periapsis will precess over a wide range of latitude and local time, while MAVEN obtains detailed measurements of the upper atmosphere, ionosphere, planetary corona, solar wind, interplanetary/Mars magnetic fields, solar EUV and solar energetic particles, thus defining the interactions between the Sun and Mars. MAVEN will explore down to the homopause during a series of five 5-day "deep dip" campaigns for which periapsis will be lowered to an atmospheric density of 2 kg/km^3 (~125 km altitude) in order to sample the transition from the collisional lower atmosphere to the collisionless upper atmosphere. These five campaigns will be interspersed though the mission to sample the subsolar region, the dawn and dusk terminators, the anti-solar region, and the north pole.

1.6.1 Mission Objectives

The primary science objectives of the MAVEN project will be to provide a comprehensive picture of the present state of the upper atmosphere and ionosphere of Mars and the processes controlling them and to determine how loss of volatiles to outer space in the present epoch varies with changing solar conditions. Knowing how these processes respond to the Sun's energy inputs will enable scientists, for the first time, to reliably project processes backward in time to study atmosphere and volatile evolution. MAVEN will deliver definitive answers to high-priority science questions about atmospheric loss (including water) to space that will greatly enhance our understanding of the climate history of Mars. Measurements made by MAVEN will allow us to determine the role that escape to space has played in the evolution of the Mars atmosphere, an essential component of the quest to "follow the water" on Mars. MAVEN will accomplish this by achieving science objectives that answer three key science questions:

- What is the current state of the upper atmosphere and what processes control it?

- What is the escape rate at the present epoch and how does it relate to the controlling processes?

- What has the total loss to space been through time?

MAVEN will achieve these objectives by measuring the structure, composition, and variability of the Martian upper atmosphere, and it will separate the roles of different loss mechanisms for both neutrals and ions. MAVEN will sample all relevant regions of the Martian atmosphere/ionosphere system—from the termination of the well-mixed portion of the atmosphere (the "homopause"), through the diffusive region and main ionosphere layer, up into the collisionless exosphere, and through the magnetosphere and into the solar wind and downstream tail of the planet where loss of neutrals and ionization occurs to space—at all relevant latitudes and local solar times. To allow a meaningful projection of escape back in time, measurements of escaping species will be made simultaneously with measurements of the energy drivers and the controlling magnetic field over a range of solar conditions. Together with measurements of the isotope ratios of major species, which constrain the net loss to space over time, this approach will allow thorough identification of the role that atmospheric escape plays today and to extrapolate to earlier epochs.

1.6.2 Payload

MAVEN will use the following science instruments to measure the Martian upper atmospheric and ionospheric properties, the magnetic field environment, the solar wind, and solar radiation and particle inputs:

- NGIMS Package:
  - Neutral Gas and Ion Mass Spectrometer (NGIMS) measures the composition, isotope ratios, and scale heights of thermal ions and neutrals.
- RS Package:

  - Imaging Ultraviolet Spectrograph (IUVS) remotely measures UV spectra in four modes: limb scans, planetary mapping, coronal mapping and stellar occultations. These measurements provide the global composition, isotope ratios, and structure of the upper atmosphere, ionosphere, and corona.
- PF Package:

  - Supra-Thermal and Thermal Ion Composition (STATIC) instrument measures the velocity distributions and mass composition of thermal and suprathermal ions from below escape energy to pickup ion energies.
  - Solar Energetic Particle (SEP) instrument measures the energy spectrum and angular distribution of solar energetic electrons (30 keV – 1 MeV) and ions (30 keV – 12 MeV).
  - Solar Wind Ion Analyzer (SWIA) measures solar wind and magnetosheath ion density, temperature, and bulk flow velocity. These measurements are used to determine the charge exchange rate and the solar wind dynamic pressure.
  - Solar Wind Electron Analyzer (SWEA) measures energy and angular distributions of 5 eV to 5 keV solar wind, magnetosheath, and auroral electrons, as well as ionospheric photoelectrons. These measurements are used to constrain

> the plasma environment, magnetic field topology and electron impact ionization rate.
>
> o Langmuir Probe and Waves (LPW) instrument measures the electron density and temperature and electric field in the Mars environment. The instrument includes an EUV Monitor that measures the EUV input into Mars atmosphere in three broadband energy channels.
>
> o Magnetometer (MAG) measures the vector magnetic field in all regions traversed by MAVEN in its orbit.

1.7 SIS Content Overview

Section 2 describes the EUV instrument. Section 3 gives an overview of data organization and data flow. Section 4 describes data archive generation, delivery, and validation. Section 5 describes the archive structure and archive production responsibilities. Section 6 describes the file formats used in the archive, including the data product record structures. Individuals involved with generating the archive volumes are listed in Appendix A. Appendix B contains a description of the MAVEN science data file naming conventions. Appendix C, Appendix D, and Appendix E contain sample PDS product labels. Appendix F describes EUV archive product PDS deliveries formats and conventions.

1.8 Scope of this document

The specifications in this SIS apply to all EUV products submitted for archive to the Planetary Data System (PDS), for all phases of the MAVEN mission. This document includes descriptions of archive products that are produced by both the EUV team and by PDS. Note that the EUV is part of the LPW instrument. As such, the EUV raw data is part of the LPW data stream. The LPW SIS describes the raw data and L0 archival for the LPW-EUV data combined. This document only describes the higher level EUV specific data products to be archived at the PDS.

1.9 Applicable Documents

[1] Planetary Data System Data Provider's Handbook, Version 1.4.1, February 23, 2016.

[2] Planetary Data System Standards Reference, Version 1.4.0, September 22, 2015.

[3] PDS4 Data Dictionary, – Abridged, Version 1.4.0.0, 30 March 2015.

[4] Planetary Data System (PDS) PDS4 Information Model Specification, Version 1.4.0.0.

[5] Mars Atmosphere and Volatile Evolution (MAVEN) Science Data Management Plan, Rev. C, doc. no.MAVEN-SOPS-PLAN-0068.

[6] Archive of MAVEN CDF in PDS4, Version 3, T. King and J. Mafi, March 13, 2014.

1.10 Audience

This document serves both as a SIS and Interface Control Document (ICD). It describes both the archiving procedure and responsibilities, and data archive conventions and format. It is designed

to be used both by the instrument teams in generating the archive, and by those wishing to understand the format and content of the EUV PDS data product archive collection. Typically, these individuals would include scientists, data analysts, and software engineers.

2   EUV Instrument Description

The EUV monitor is designed to measure the solar irradiance in three broad bands in the soft x-ray and extreme ultraviolet wavelength range. It consists of three filter radiometers that each have a limiting aperture, bandpass limiting filter, silicon photodiode detector, and an electrometer to measure the current in the detector. A fourth detector-electrometer combination that is blocked from receiving any light input is used as a "dark" detector to monitor changes in the thermal and radiation induced background signals. A temperature diode is also included in the EUV instrument. There is also a mechanism to place or remove additional fused silica windows in front of the three science apertures. These filters block the EUV and X-ray sunlight, but still allow longer wavelength light (primarily visible) through into the radiometers. This allows for a measurement of the out-of-band contribution to the signals from the science channels. Figure 1 shows the block diagram as context for how the EUV monitor is incorporated into the LPW-EUV instrument. The EUV instrument and its calibration are described in more detail in *Eparvier, et al. [2014]*.
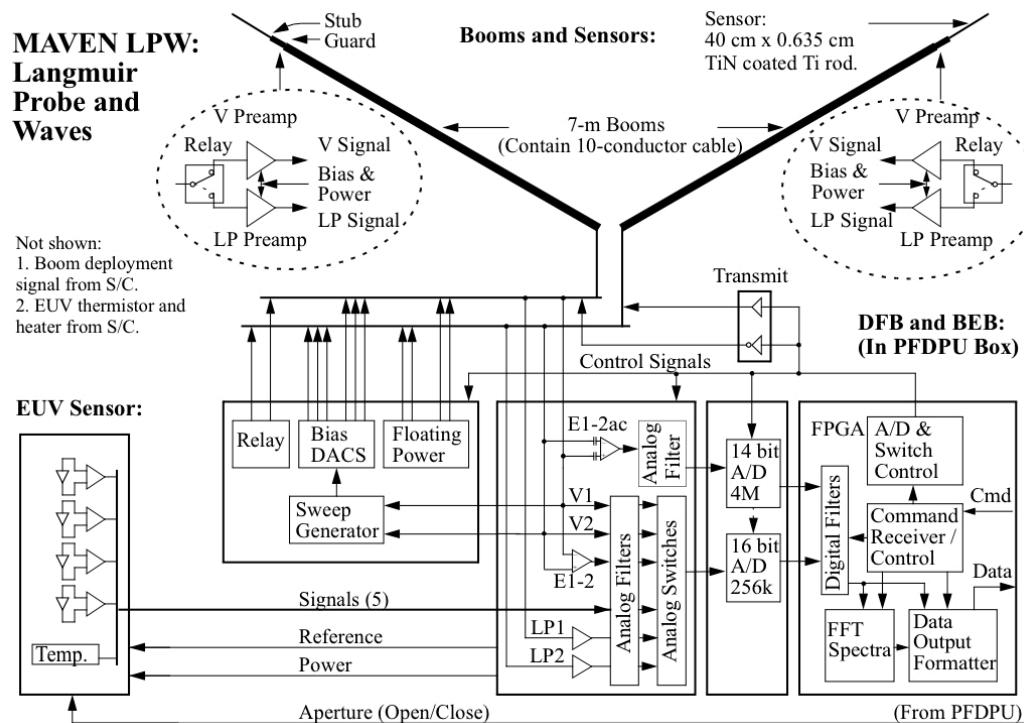

Figure 1: Block diagram of LPW instrument (including EUV)

2.1   Science Objectives

The science objective of the EUV monitor is to provide the solar extreme ultraviolet irradiance of aeronomical importance at Mars for the MAVEN mission. Through a combination of

measurements (on MAVEN and in Earth orbit) and empirical proxy models, the EUV monitor produces the spectral irradiance from 0-194 nm in 1-nm wavelength bins at a time cadence of 1-minute (L3 product). The EUV measurements (L2 product) on MAVEN consist of three bands (0.1-7 nm, 17-22 nm, and 121-122 nm) at a cadence of 1-second. A modified version of the Flare Irradiance Spectral Model (FISM) uses the EUV monitor measurements as proxy inputs, along with other solar proxies interpolated in time and space from Earth to Mars) to generate the full spectral irradiance.

2.2 Operational Modes

The EUV monitor has a single mode. When the LPW is powered ON, the EUV detectors and temperature monitor are producing data at a nominal cadence of 1-sec (this is configurable, but only in rare cases will it be changed). When the LPW is powered OFF, no EUV data is produced. Within the power ON mode, there are different possible states that affect the science usefulness of the data from the EUV. If the instrument boresight is pointed at the Sun, then the EUV is able to take solar measurements. If the EUV is not pointed at the Sun, then the data is considered "dark" data and is useful for detector noise and background measurements, but not for solar observations.

2.3 Ground Calibration

The calibration of the electronics for the EUV monitor was performed at the University of Colorado's Laboratory for Atmospheric and Space Physics. The radiometric calibration was performed at the National Institute of Standards and Technology (NIST) Synchrotron Ultraviolet Radiation Facility (SURF) III in Gaithersburg, MD. The EUV monitor was calibrated over a range of field of view angles. The EUV instrument and its calibration are described in more detail in *Eparvier, et al. [2015].*

2.4 Inflight Calibration

During cruise phase while on the way to Mars, the EUV observed the same face of the Sun as several Earth-orbit based solar EUV irradiance instruments (SDO-EVE, TIMED-SEE, and SORCE). This provided a benchmark for any changes in radiometric performance between NIST-SURF calibrations and launch. A cruiform maneuver, moving the Sun through the extremes of the EUV field of view, was performed to check for boresight shifts and changes in the field of view response. This maneuver, plus a smaller raster scan of the center of the field of view will be repeated during the MAVEN transition phase and once again before the end of the primary mission. A SPICE kernel for the EUV boresight relative to the spacecraft pointing is produced from the cruiform maneuver data. Weekly visible light contribution measurements will be made during the science phase of the mission utilizing the EUV aperture mechanism. Dark data through the cruise phase and serendipitous dark data (during off-pointing from the Sun) in science phase will be used to track changes in the relationship between the dark channel and the detector noise and background signal in the science channels.

3 Data Overview

This section provides a high level description of archive organization under the PDS4 Information Model (IM) as well as the flow of the data from the spacecraft through delivery to PDS. Unless specified elsewhere in this document, the MAVEN EUV archive conforms with version 1.1.0.1 of the PDS4 IM [4] and version 1.0 of the MAVEN mission schema. A list of the XML Schema and Schematron documents associated with this archive are provided in Table 5 below.

Table 5: MAVEN EUV Archive Schema and Schematron

XML Document	Steward	Product LID
PDS Master Schema, v. 1.1.0.1	PDS	urn:nasa:pds:system_bundle:xml_schema:pds-xml_schema
PDS Master Schematron, v. 1.1.0.1	PDS	urn:nasa:pds:system_bundle:xml_schema:pds-xml_schema
MAVEN Mission Schema, v. 1.0	MAVEN	
MAVEN Mission Schematron, v. 1.0	MAVEN	

3.1 Data Processing Levels

A number of different systems may be used to describe data processing level. This document refers to data by their PDS4 processing level. Table 6 provides a description of these levels along with the equivalent designations used in other systems.

Table 6: Data processing level designations

PDS4 processing level	PDS4 processing level description	MAVEN Processing Level	CODMAC Level	NASA Level
Raw	Original data from an instrument. If compression, reformatting, packetization, or other translation has been applied to facilitate data transmission or storage, those processes are reversed so that the archived data are in a PDS approved archive format.	0	2	1A
Reduced	Data that have been processed beyond the raw stage but which are not yet entirely independent of the instrument.	1	2	1A
Calibrated	Data converted to physical units entirely independent of the instrument.	2	3	1B

PDS4 processing level	PDS4 processing level description	MAVEN Processing Level	CODMAC Level	NASA Level
Derived	Results that have been distilled from one or more calibrated data products (for example, maps, gravity or magnetic fields, or ring particle size distributions). Supplementary data, such as calibration tables or tables of viewing geometry, used to interpret observational data should also be classified as 'derived' data if not easily matched to one of the other three categories.	3+	4+	2+

3.2   **Products**

A PDS product consists of one or more digital and/or non-digital objects, and an accompanying PDS label file. Labeled digital objects are data products (i.e. electronically stored files). Labeled non-digital objects are physical and conceptual entities which have been described by a PDS label. PDS labels provide identification and description information for labeled objects. The PDS label defines a Logical Identifier (LID) by which any PDS labeled product is referenced throughout the system. In PDS4 labels are XML formatted ASCII files. More information on the formatting of PDS labels is provided in Section 6.3. More information on the usage of LIDs and the formation of MAVEN LIDs is provided in Section 5.1.

3.3   **Product Organization**

The highest level of organization for PDS archive is the bundle. A bundle is a list of one or more related collection products which may be of different types. A collection is a list of one or more related basic products which are all of the same type. Figure 2 below illustrates these relationships.
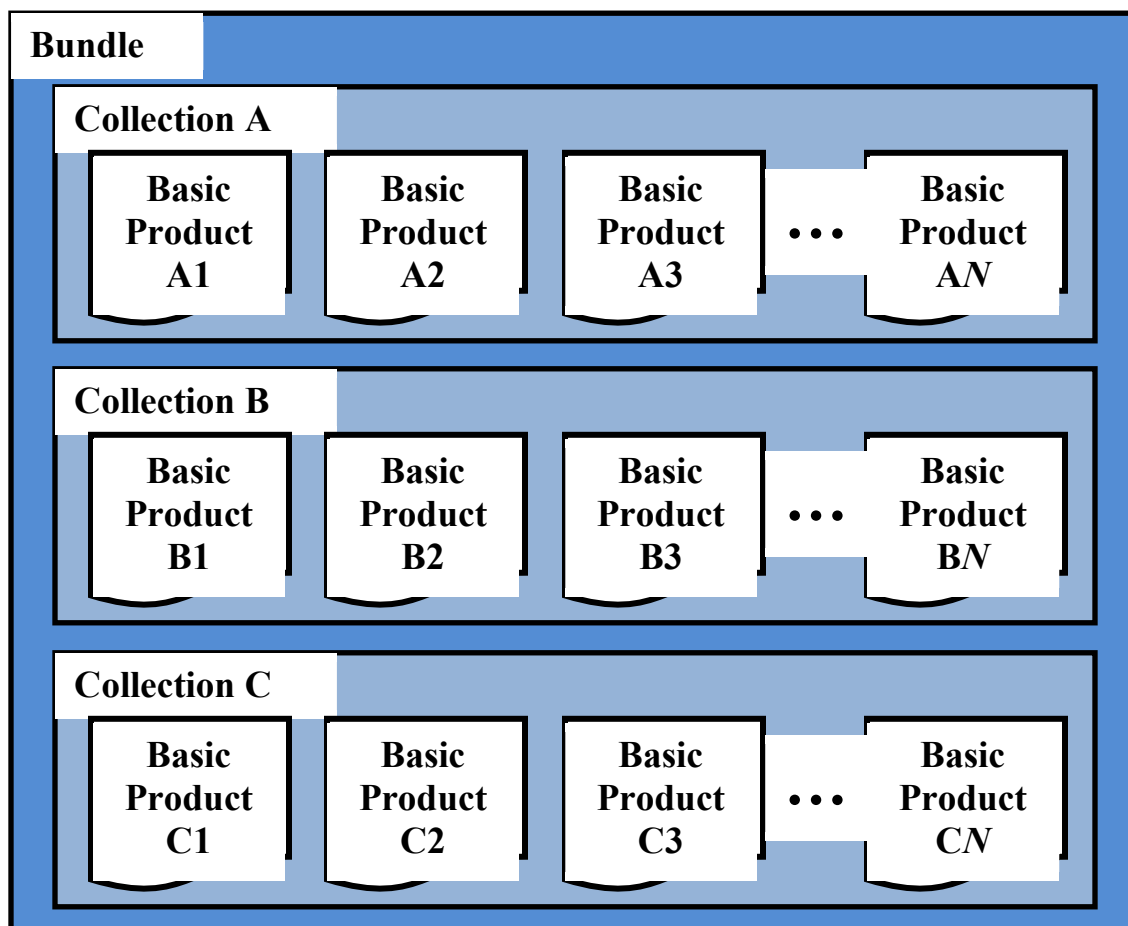
Figure 2: A graphical depiction of the relationship among bundles, collections, and basic products.

Bundles and collections are logical structures, not necessarily tied to any physical directory structure or organization. Bundle and collection membership is established by a member inventory list. Bundle member inventory lists are provided in the bundle product labels themselves. Collection member inventory lists are provided in separate collection inventory table files. Sample bundle and collection labels are provided in Appendix C and Appendix D, respectively.

3.3.1 Collection and Basic Product Types

Collections are limited to a single type of basic products. The types of archive collections that are defined in PDS4 are listed in Table 7.

Table 7: Collection product types

Collection Type	Description
Browse	Contains products intended for data characterization, search, and viewing, and not for scientific research or publication.

Calibration	Contains data and files necessary for the calibration of basic products.
Context	Contains products which provide for the unique identification of objects which form the context for scientific observations (*e.g.* spacecraft, observatories, instruments, targets, etc.).
Document	Contains electronic document products which are part of the PDS Archive.
Data	Contains scientific data products intended for research and publication.
SPICE	Contains NAIF SPICE kernels.
XML_Schema	Contains XML schemas and related products which may be used for generating and validating PDS4 labels.

3.4   **Bundle Products**

The EUV data archive is organized into 5 bundles, although two of these bundles are actually PF and LPW bundles (described in the LPW SIS). A description of each bundle is provided in Table 8. A more detailed description of the contents and format of each of the three EUV specific bundles controlled by the EUV ITF is provided in Section 5.2.

Table 8: EUV Bundles

Bundle Logical Identifier	PDS4 Reduction Level	Description	Data Provider
TBD	Raw	PF packets – all packets together, describe in separate document (LPW SIS) . This is the Level 0 data.	SDC
urn:nasa:pds:maven.lpw.raw	Raw	LPW packets in separate CDF files. This is the Level 0b data. (See LPW SIS for description)	TBD
urn:nasa:pds:maven.euv.calibrated	Calibrated	Fully calibrated: solar irradiances at MAVEN in three instrument bandpasses. Provided by the EUV team in CDF files. This is the EUV Level 2 Data Product.	ITF
urn:nasa:pds:maven.euv.modelled	Modelled	Modelled full EUV spectral irradiances at MAVEN based on EUV and other measurements (per minute and one daily average at 1-nm resolution). Provided by the EUV team in CDF files. This is the EUV Level 3 Data Product.	ITF
urn:nasa:pds:maven.euv	N/A	EUV Documentation	ITF

3.5 Data Flow

This section describes only those portions of the MAVEN data flow that are directly connected to archiving. A full description of MAVEN data flow is provided in the MAVEN Science Data Management Plan [5]. A graphical representation of the full MAVEN data flow is provided in Figure 3 below.

Reduced (MAVEN level 1) data will be produced by RS and NGIMS as an intermediate processing product, and are delivered to the SDC for archiving at the PDS, but will not be used by the MAVEN team.

All ITFs will produce calibrated products. Following an initial 2-month period at the beginning of the mapping phase, the ITFs will routinely deliver preliminary calibrated data products to the SDC for use by the entire MAVEN team within two weeks of ITF receipt of all data needed to generate those products. The SOC will maintain an active archive of all MAVEN science data, and will provide the MAVEN science team with direct access through the life of the MAVEN mission. After the end of the MAVEN project, PDS will be the sole long-term archive for all public MAVEN data.

Updates to calibrations, algorithms, and/or processing software are expected to occur regularly, resulting in appropriate production system updates followed by reprocessing of science data products by ITFs for delivery to SDC. Systems at the SOC, ITFs and PDS are designed to handle these periodic version changes.

Data bundles intended for the archive are identified in Table 8.
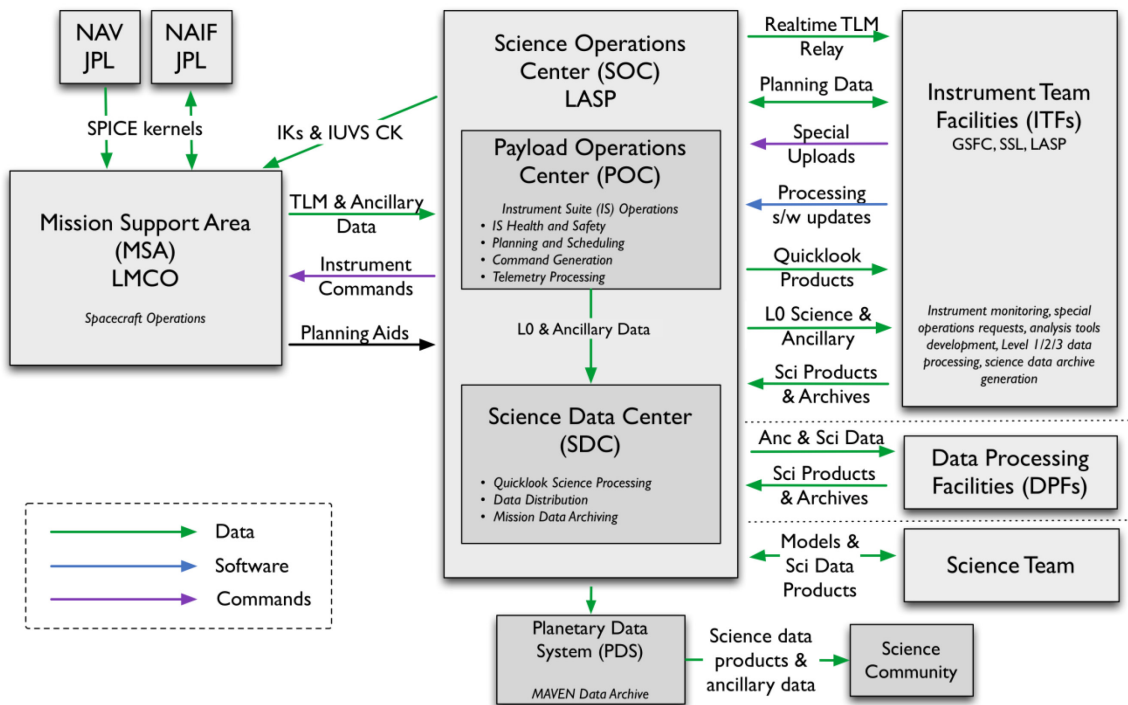
Figure 3: MAVEN Ground Data System responsibilities and data flow. Note that this figure includes portions of the MAVEN GDS which are not directly connected with archiving, and are therefore not described in Section 3.5 above.

4 Archive Generation

The EUV archive products are produced by the EUV instrument team in cooperation with the SDC, and with the support of the PDS, Planetary Plasma Interactions (PPI) Node at the University of California, Los Angeles (UCLA). The archive volume creation process described in this section sets out the roles and responsibilities of each of these groups. The assignment of tasks have been agreed upon by all parties. Archived data received by the PPI Node from the EUV team are made available to PDS users electronically as soon as practicable but no later two weeks after the delivery and validation of the data.

4.1 Data Processing and Production Pipeline

The following sections describe the process by which data products in each of the EUV specific bundles listed in *Table 8* are produced. The PF and LPW bundles also mentioned in that table are described in the LPW SIS.

4.1.1 Raw Data Production Pipeline

The LPW team uses a dedicated decomutator to extract the LPW packets from the MAVEN PF L-0 packets. The data from the individual instrument packets is then extracted and saved as separate CDF files for PDS archiving urn:nasa:pds:maven.lpw.raw. The decomutator software will be archived at PDS as a reference manual for the future in the Document bundle.

4.1.2 Calibrated Data Production Pipeline

The EUV team uses a dedicated decomutator to extract the EUV packets from the MAVEN PF L-0 packets. The raw EUV data is then calibrated with the calibration information derived from ground testing in the instrument constants routine provided in the Document bundle. The raw EUV can also be found in the L0b file urn:nasa:pds:maven.lpw.raw:euv.

After the individual packets are calibrated using the ground testing data from different packets it is merged together with ancillary data and evaluated to create the Level 2 and Level 3 science data products (urn:nasa:pds:maven.euv.calibrated and urn:nasa:pds:maven.euv.modelled respectively). This software is archived as documentation of the process in the Document bundle.

4.2 Data Validation

4.2.1 Instrument Team Validation

Since the quality of the EUV is sensitive to SC attitude and solar conditions, etc., the data will be evaluated by a scientist through overview plots and spot-checking. At interesting/active periods the production of the data can be manually optimized. The EUV team will use confidence flags to indicate when the SC attitude (or other reasons) degrades the instrument measure quality. The EUV data products will be compared with Earth-based measurements and models of solar

irradiance to determine if the EUV results at Mars are reasonable in both absolute value and relative variability.

4.2.2 MAVEN Science Team Validation

The calibrated and modeled files will be used by the MAVEN Science team. This will provide a second validation of the science data. The LPW team will use the EUV data to help determine the photocurrent contribution to their signals. The Remote Sensing (RS) team and various interdisciplinary scientists will use the EUV data as input to atmospheric and dayglow models to better understand their data and the atmospheric response to changes in various energy inputs. The use of EUV data in by these other team members will serve to partially validate the EUV data products.

4.2.3 PDS Peer Review

The PPI node will conduct a full peer review of all of the data types that the LPW team intends to archive. The review data will consist of fully formed bundles populated with candidate final versions of the data and other products and the associated metadata.

Table 9: MAVEN PDS review schedule

4.3 Date	4.4 Activity	4.5 Responsible Team
2014-Mar-24	Signed SIS deadline	ITF
2014-Apr-18	Sample data products due	ITF
2014-May to 2014-Aug	Preliminary PDS peer review (SIS, sample data files)	PDS
2015-Mar-02	Release #1: Data due to PDS	ITF/SDC
2015-Mar to 2015-May	Release #1: Data PDS peer review	PDS
2015-May-15	Release #1: Public release	PDS

Reviews will include a preliminary delivery of sample products for validation and comment by PDS PPI and Engineering node personnel. The data provider will then address the comments coming out of the preliminary review, and generate a full archive delivery to be used for the peer review.

Reviewers will include MAVEN Project and EUV team representatives, researchers from outside of the MAVEN project, and PDS personnel from the Engineering and PPI nodes. Reviewers will examine the sample data products to determine whether the data meet the stated science objectives of the instrument and the needs of the scientific community and to verify that the accompanying metadata are accurate and complete. The peer review committee will identify any liens on the data that must be resolved before the data can be 'certified' by PDS, a process by which data are made public as minor errors are corrected.

In addition to verifying the validity of the review data, this review will be used to verify that the data production pipeline by which the archive products are generated is robust. Additional deliveries made using this same pipeline will be validated at the PPI node, but will not require additional external review.

As expertise with the instrument and data develops the EUV team may decide that changes to the structure or content of its archive products are warranted. Any changes to the archive products or to the data production pipeline will require an additional round of review to verify that the revised products still meet the original scientific and archival requirements or whether those criteria have been appropriately modified. Whether subsequent reviews require external reviewers will be decided on a case-by-case basis and will depend upon the nature of the changes. A comprehensive record of modifications to the archive structure and content is kept in the Modification_History element of the collection and bundle products.

The instrument team and other researchers are encouraged to archive additional EUV products that cover specific observations or data-taking activities. The schedule and structure of any additional archives are not covered by this document and should be worked out with the PPI node.

4.6   Data Transfer Methods and Delivery Schedule

The SOC is responsible for delivering data products to the PDS for long-term archiving. While ITFs are primarily responsible for the design and generation of calibrated and derived data archives, the archival process is managed by the SOC. The SOC (in coordination with the ITFs) will also be primarily responsible for the design and generation of the raw data archive. The first PDS delivery will take place within 6 months of the start of science operations. Additional deliveries will occur every following 3 months and one final delivery will be made after the end of the mission. Science data are delivered to the PDS within 6 months of its collection. If it becomes necessary to reprocess data which have already been delivered to the archive, the ITFs will reprocess the data and deliver them to the SDC for inclusion in the next archive delivery. A summary of this schedule is provided in Table 10 below.

Table 10: Archive bundle delivery schedule for EUV specific bundles.

Bundle Logical Identifier	First Delivery to PDS	Delivery Schedule	Estimated Delivery Size
urn:nasa:pds:maven.euv.calibrated	Represent L2 data. No later than 6 months	Every 3 months	

	after the start of science operations		
urn:nasa:pds:maven.euv.modelled	Represent L3 data. 3 months after all input information is available.	Every 3 months	

Each delivery will comprise both data and ancillary data files organized into directory structures consistent with the archive design described in Section 5, and combined into a deliverable file(s) using file archive and compression software. When these files are unpacked at the PPI Node in the appropriate location, the constituent files will be organized into the archive structure.

Archive deliveries are made in the form of a "delivery package". Delivery packages include all of the data being transferred along with a transfer manifest, which helps to identify all of the products included in the delivery, and a checksum manifest which helps to insure that integrity of the data is maintained through the delivery. The format of these files is described in Section 6.4.

Data are transferred electronically (using the *ssh* protocol) from the SOC to an agreed upon location within the PPI file system. PPI will provide the SOC a user account for this purpose. Each delivery package is made in the form of a compressed *tar* or *zip* archive. Only those files that have changed since the last delivery are included. The PPI operator will decompress the data, and verify that the archive is complete using the transfer and MD5 checksum manifests that were included in the delivery package. Archive delivery status will be tracked using a system defined by the PPI node.

Following receipt of a data delivery, PPI will reorganize the data into its PDS archive structure within its online data system. PPI will also update any of the required files associated with a PDS archive as necessitated by the data reorganization. Newly delivered data are made available publicly through the PPI online system once accompanying labels and other documentation have been validated. It is anticipated that this validation process will require no more than fourteen working days from receipt of the data by PPI. However, the first few data deliveries may require more time for the PPI Node to process before the data are made publicly available.

The MAVEN prime mission begins approximately 5 weeks following MOI and lasts for 1 Earth-year. Table 10 shows the data delivery schedule for the entire mission.

4.7   **Data Product and Archive Volume Size Estimates**

EUV data products consist of files that span 24 hours, breaking at 0h UTC SCET. The break point depends on the time tag of the instrument packets, not when the individual measurement was made. The combined EUV Level 2 (calibrated) and Level 3 (modelled) data products are expected to be ~7 MB per week.

4.8   **Data Validation**

Routine data deliveries to the PDS are validated at the PPI node to ensure that the delivery meets PDS standards, and that the data conform to the SIS as approved in the peer review. As long as there are no changes to the data product formats, or data production pipeline, no additional external review will be conducted.

4.9   **Backups and duplicates**

The PPI Node keeps three copies of each archive product. One copy is the primary online archive copy, another is an onsite backup copy, and the final copy is an off-site backup copy. Once the archive products are fully validated and approved for inclusion in the archive, copies of the products are sent to the National Space Science Data Center (NSSDC) for long-term archive in a NASA-approved deep-storage facility. The PPI Node may maintain additional copies of the archive products, either on or off-site as deemed necessary. The process for the dissemination and preservation of EUV data is illustrated in Figure 4.
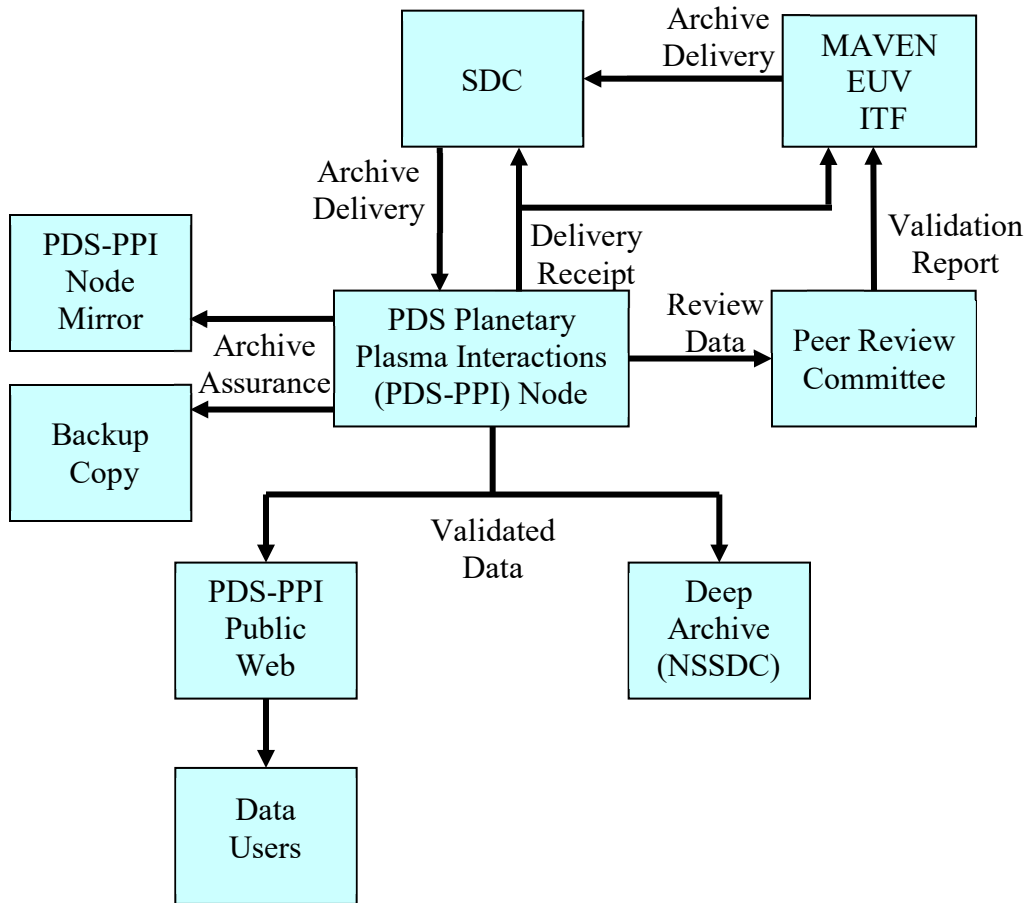
Figure 4: Duplication and dissemination of EUV archive products at PDS/PPI.

5   Archive organization and naming

This section describes the basic organization of an EUV bundle, and the naming conventions used for the product logical identifiers, and bundle, collection, and basic product filenames.

5.1   Logical Identifiers

Every product in PDS is assigned an identifier which allows it to be uniquely identified across the system. This identifier is referred to as a Logical Identifier or LID. A LIDVID (Versioned Logical Identifier) includes product version information, and allows different versions of a specific product to be referenced uniquely. A product's LID and VID are defined as separate attributes in the product label. LIDs and VIDs are assigned by the entity generating the labels and are formed according to the conventions described in sections 5.1.1 and 5.1.2 below. The uniqueness of a product's LIDVID may be verified using the PDS Registry and Harvest tools.

5.1.1 LID Formation

LIDs take the form of a Uniform Resource Name (URN). LIDs are restricted to ASCII lower case letters, digits, dash, underscore, and period. Colons are also used, but only to separate prescribed components of the LID. Within one of these prescribed components dash, underscore, or period are used as separators. LIDs are limited in length to 255 characters.

MAVEN EUV LIDs are formed according to the following conventions:

- Bundle LIDs are formed by appending a bundle specific ID to the MAVEN EUV base ID:

    urn:nasa:pds:maven.euv.<bundle ID>

  Since all PDS bundle LIDs are constructed this way, the combination of maven.euv.bundle must be unique across all products archived with the PDS.

- Collection LIDs are formed by appending a collection specific ID to the collection's parent bundle LID:

    urn:nasa:pds:maven.euv.<bundle ID>:<collection ID>

  Since the collection LID is based on the bundle LID, which is unique across PDS, the only additional condition is that the collection ID must be unique across the bundle. Collection IDs correspond to the collection type (e.g. "browse", "data", "document", etc.). Additional descriptive information may be appended to the collection type (e.g. "data.raw", "data.calibrated", etc.) to insure that multiple collections of the same type within a single bundle have unique LIDs.

- Basic product LIDs are formed by appending a product specific ID to the product's parent collection LID:

    urn:nasa:pds:maven.euv.<bundle ID>:<collection ID>:<product ID>

  Since the product LID is based on the collection LID, which is unique across PDS, the only additional condition is that the product ID must be unique across the collection.

A list of EUV bundle LIDs is provided in Table 8. (Note that the table includes two LPW bundles that are described in the separate LPW SIS.) Collection LIDs are listed in Table 11 and Table 12..

5.1.2 VID Formation

Product version ID's consist of major and minor components separated by a "." (M.n). Both components of the VID are integer values. The major component is initialized to a value of "1", and the minor component is initialized to a value of "0". The minor component resets to "0" when the major component is incremented.

All produced CDF-filed from the EUV instrument will contain one version number and one revision number in the file name. The version number will reflect if the structure of the CDF-file has changed. The revision number will reflect if the EUV team has reprocessed the data that already were submitted to the SOC.

5.2   **EUV Archive Contents**

The EUV archive from the EUV team includes the 3 bundles listed in Table 8 that are specific to the EUV monitor. The following sections describe the contents of each of these bundles in greater detail. See the LPW SIS for the description of the raw data bundles that contain the full PF and LPW raw data including the EUV raw data.

5.2.1 EUV calibrated

This bundle of products is science quality data that directly is produced by the EUV instrument. It comprises the Level 2 data product for the EUV instrument. In the production process information such as spacecraft attitude has been considered. There is only one collection/product in the EUV calibrated bundle. This collection/product is described briefly in Table 11. The following sections describe the products in more detail. The production and validation is of EUV ITF's responsibility.

Table 11: EUV calibrated collection/product

Collection LID	Description
euv.calibrated:data.bands	These are the L2 calibrated irradiances at MAVEN in each of the three instrument bandpasses (Watts/m^2)

5.2.1.1 euv.calibrated:data.bands

The product is the solar irradiance at MAVEN in the three instrument bandpasses. The raw data numbers (DN) from the three EUV science channels are corrected for background signal (using a scaling of the dark channel), out-of-band signal (using contributions measured during periodic window-closed calibration observations), temperature effects, normalized gain, and field-of-view variations. Then the resultant corrected signals are multiplied by a responsivity factor for each channel that is determined from ground calibrations and comparisons with Earh-orbit based observations by similar instruments, converting the DN to Watts/m^2 in each channel's bandpass. Irradiances are produced for each 1-second measurement in the

L0 raw data in which the spacecraft attitude and the position of the EUV aperture mechanism allow for a solar measurement. In addition, a measurement uncertainty and a total combined uncertainty for each irradiance is provided. The MAVEN to Sun distance (in km) for each measurement is also included. If there is no good measurement available (such as when the EUV aperture is closed, or the EUV is pointed off the Sun), the data is still included in the products but flagged as unusable for science.. For each measurement a flag is provided with the value of: 0=Good solar, 1=Occultation, 2=No pointing info, 3=Sun NOT fully In FOV, 4=Sun NOT In FOV, 5=Windowed, 6=Eclipse, 7=spare (for future use). As of Version 9 of the data product (released in August, 2017), the corrected count rates prior to conversion to irradiance units for each of the three science channels have been added (in units of counts/sec).

The EUV ITF will produce this products, with one file per UT day, with the naming convention mvn_euv_l2_bands_<yyyy><mm><dd>_v<xx>_r<yy>.cdf

5.2.2 EUV modelled

The EUV modelled bundles comprise the Level 3 data product for the EUV instrument. Information from the EUV calibrated data products (Level 2) and from Earth-based solar indices and measurements as input to a solar irradiance proxy model which generates solar irradiance spectra at MAVEN in 1-nm bins from 0-190 nm. The proxy model is the Flare Irradiance Spectral Model – Mars (FISM-M) and is described in *Eparvier, et al. [2015]*. Explanation of the modelled collections is given in Table 12 and the modelled products are presented in Table 13. The EUV ITF is responcible for the production and verification of these products.

Table 12: EUV modelled collections

Collection LID	Description
euv.modelled:data.daily	These are data products are the daily averaged modelled irradiance spectra at MAVEN.
euv.modelled:data.minute	These are data products are the minute averaged modelled irradiance spectra at MAVEN.

Table 13: EUV modelled products

Collection LID	Description
euv.modelled:data.daily.spectra	Daily averaged irradiance spectrum ($W/m^2/nm$) at MAVEN from the FISM-M model using the EUV calibrated band irradiance and interpolated Earth-based indices as proxies. There are 190 elements in each spectrum. There is one spectrum per day. The uncertainty (in %) and central wavelength (in nm) for each element is also provided.

Collection LID	Description
euv.modelled:data.minute.spectra	Minute averaged irradiance spectrum (W/m^2/nm) at MAVEN from the FISM-M model using the EUV calibrated band irradiance and interpolated Earth-based indices as proxies. There are 190 elements in each spectrum and one spectrum for each minute in the day when the EUV instrument is making valid solar measurements. The uncertainty (in %) and central wavelength (in nm) for each element is also provided.

5.2.2.1 euv.modelled:data.daily.spectra

When the EUV instrument is making valid solar observations (EUV is pointed at the Sun and aperture mechanism in the OPEN position) then the EUV calibrated bands product can be used as proxies in the FISM-M model along with properly time and location interpolated (to the MAVEN location) Earth-based solar indices. The EUV bands product and the Earth-based proxies are averaged over the day and the FISM-M model is run in the daily mode to produce an irradiance spectrum. The daily spectra product is the output of the FISM-M model and is Watts/m^2/nm for each of the 1-nm bins from 0-190 nm.

The FISM-M daily model provides an uncertainty for the irradiance spectrum. Two uncertainties (in %) are provided for each of the 1-nm bins in the daily spectra product, an uncertainty of the model (based on the variance of the model from the training dataset) and a total combined uncertainty (combining model and driving proxy uncertainties).

The wavelength (in nm) for the center of each of the 1-nm bins in the daily spectra product is also included. This wavelength scale is currently static but is repeated every day for completeness. The MAVEN to Sun distance (in km) for the middle of the UT day is also included.

A data flag is also included based on the quality of the model drivers for that day, having the values: 0=uses best MAVEN proxies, 1=uses lower quality or partial MAVEN proxies, 2: uses no MAVEN proxies but best extrapolated Earth proxies 3: uses no MAVEN proxies AND poor quality Earth proxies.

The EUV ITF will produce this products, with one file per UT day, with the naming convention mvn_euv_l3_daily_<yyyy><mm><dd>_v<xx>_r<yy>.cdf

5.2.2.2 euv.modelled:data.minute.spectra

When the EUV instrument is making valid solar observations (EUV is pointed at the Sun and aperture mechanism in the OPEN position) then the EUV calibrated bands product can be used as proxies in the FISM-M model along with properly time and location interpolated Earth-based solar indices. The EUV bands product and the Earth-based proxies are averaged over each minute of the day corresponding to valid EUV solar measurements and the FISM-M model is run in the minutely mode to produce irradiance spectra for that minute. The minute spectra product is the output of the FISM-M model and is Watts/m^2/nm for each of the 1-nm bins from 0-190 nm. There are 1440 spectra in each minute spectra file, one for each minute of the day. For minutes where EUV data is not available, or not of high enough quality to make the high time cadence modelled product, the spectra for those minutes are filled with the daily average spectral product for that day.

The modelled minute product includes uncertainty estimates. Two uncertainties (in %) are provided for each of the 1-nm bins in the daily spectra product, an uncertainty of the model (based on the variance of

the model from the training dataset) and a total combined uncertainty (combining model and driving proxy uncertainties).

The wavelength (in nm) for the center of each of the 1-nm bins in the minute spectra product is also included. This wavelength scale is currently static but is repeated every day for completeness. Only one wavelength scale is included for each day. The MAVEN to Sun distance (in km) for each minute is also included.

A data flag is also included based on the quality of the model drivers for that day, having the values: 0=uses best MAVEN proxies, 1=uses lower quality or partial MAVEN proxies, 2: uses no MAVEN proxies but best extrapolated Earth proxies 3: uses no MAVEN proxies AND poor quality Earth proxies.

 The EUV ITF will produce this products, with one file per UT day, with the naming convention mvn_euv_l3_minute *<yyyy><mm><dd>*_v<xx>_r<yy>.cdf

5.2.3 EUV documentation

The information of the archived data is presented in this archived SIS document. Additional documents archived are the production software algorithm. The software algorithm is commented as the documentation. The archived products are presented in Table 14. Other documentation important to EUV is presented in Table 15.

Table 14: Documentation collections

Collection LID	Description
SIS	This document
Process	The IDL programs in ASCII files and calibration files

Table 15: Key Documentation associated with EUV

Document Name	LID	Responsiblility
MAVEN Science Data Management Plan	urn:nasa:pds:maven:document:sdmp	MAVEN Project
MAVEN Mission Description	urn:nasa:pds:maven:document:mission.description	MAVEN Project
MAVEN Spacecraft Description	urn:nasa:pds:maven:document:spacecraft.description	MAVEN Project
MAVEN EUV Archive SIS	urn:nasa:pds:maven:document.euv:sis	EUV Team
EUV Software Description	urn:nasa:pds:maven:document.euv:process	EUV Team

MAVEN Science Data Management Plan – describes the data requirements for the MAVEN mission and the plan by which the MAVEN data system will meet those requirements

MAVEN Mission Description – describes the MAVEN mission.

MAVEN Spacecraft Description – describes the MAVEN spacecraft.

MAVEN EUV Archive SIS – describes the format and content of the EUV PDS data archive, including descriptions of the data products and associated metadata, and the archive format, content, and generation pipeline (this document)

EUV Software Description – the commented software describes how the data is processed.

The commented IDL software provides information how the maven.euv.calibrated, and maven.euv.modelled products are generated. The calibration files used by the IDL software are also included. These are provided as a number of ascii files.

6 Archive product formats

Data that comprise the EUV archives are formatted in accordance with PDS specifications [see *Planetary Science Data Dictionary* [4], *PDS Data Provider's Handbook* [2], and *PDS Standards Reference* [3]. This section provides details on the formats used for each of the products included in the archive.

6.1 Data File Formats

This section describes the format and record structure of each of the data file types.

EUV data files will be archived with PDS as Common Data Format (CDF). In order to allow the archival CDF files to be described by PDS metadata a number of requirements have been agreed to between the EUV ITF and the PDS-PPI node. These requirements are detailed in the document *Archive of MAVEN CDF in PDS4* (T. King and J. Mafi, July 16, 2013). These CDF files will be the same one's used and distributed by the EUV ITF internally. The contents of the EUV CDF files are described in the tables below.

The EUV CDF data product files have also been constructed to be compatible with an existing suite of Interactive Data Language (IDL, see www.exelisvis.com/IDL) software for reading, plotting, and manipulating particles and fields data called "tplot" which originated at the Space Sciences Lab (SSL) at the University of California at Berkeley. Widely used in the space plasma community, tplot is a constantly being updated and added to by that community and is not under strict revision control. (See the following websites for information about tplot routines and for contact information regarding tplot issues: http://lists.ssl.berkeley.edu/mailman/listinfo/tplot, http://www.faculty.jacobs-universit.de/jvogt/cospar/cbw3/efield/software/source/idl/general/tplot/help.html .)

6.1.1 Calibrated data file structure

EUV calibrated data files (Level 2 product) will be archived with PDS as Common Data Format (CDF). The CDF Global Attributes, and Variable Attributes of the Level 2 EUV CDF files are described in Table 16. Note that some of the generic fields that are required for tplot are not used in the product, but filled with "NA" or equivalent. Also, some attributes are required by the PDS, but are not used in tplot. In the table the "No." column uses the designation "A*n*" for Global Attribute *n*, "V*i*" for Variable *i*, and "V*i*A*j*" for Attribute *j* of Variable *i*.

For PDS label attributes, please refer to Appendix E.

Table 16: Contents for euv.calibrated:data.bands data file.

No.	Field Name	Type	Entry/Description
A1	Product_name	CDF_CHAR	"MAVEN LPW EUV Calibrated Irradiance in units of W/m^2, level: L2"
A2	Project	CDF_CHAR	"MAVEN>Mars Atmosphere and Volatile EvolutioN Mission"

A3	Discipline	CDF_CHAR	"Planetary Physics>Particles and fields"
A4	Data_type	CDF_CHAR	"CAL>calibrated"
A5	Descriptor	CDF_CHAR	"EUV>Extreme Ultraviolet"
A6	Data_version	CDF_CHAR	Version and Revision in vv.rr format: e.g. "05.04"
A7	Instrument_type	CDF_CHAR	"Gamma and X-Rays"
A8	Mission_group	CDF_CHAR	"MAVEN"
A9	PI_name	CDF_CHAR	"Data production PI: F. Eparvier, LASP/CU"
A10	PI_affiliation	CDF_CHAR	"LASP University of Colorado"
A11	Text	CDF_CHAR	"Extreme Ultraviolet (EUV) monitor calibrated irradiances in three bandpasses: 17-22 nm, 0-7 nm, and 121-122 nm. See Eparvier et al, Space Research, 195, 203-301 2015, doi:10-1007/s 111214-015-0195-2."
A12	Source_name	CDF_CHAR	"MAVEN>Mars Atmosphere and Volatile EvolutioN mission"
A13	Generated_by	CDF_CHAR	"LASP/CU - EUV Team"
A14	Generation_date	CDF_CHAR	Date of file generation, e.g. "Mon Mar 21 22:28:33 2016"
A15	Rules_of_use	CDF_CHAR	http://lasp.colorado.edu/home/maven/science/
A16	Acknowledgement	CDF_CHAR	"Eparvier et al, Space Research, 195, 203-301 2015, doi:10-1007/s 111214-015-0195-2"
A17	Leapseconds_kernel	CDF_CHAR	Leap seconds kernel in SPICE, e.g. "naif0011.tls"
A18	Spacecraft_clock_kernel	CDF_CHAR	Spacecraft Clock kernel, e.g. "MVN_SCLKSCET.00022.tsc"
A19	PDS_start_time	CDF_CHAR	Time of first data record in file, e.g. "2015-11-04T00:00:06.488Z"
A20	PDS_stop_time	CDF_CHAR	Time of last data record in file, e.g. "2015-11-05T00:00:04.872Z"
A21	PDS_sclk_start_count	CDF_CHAR	Spacecraft Clock start in file, e.g. "0499867061"
A22	PDS_sclk_stop_count	CDF_CHAR	Spacecraft Clock end in file, e.g. "0499953459"
A23	SPICE_kernel_version	CDF_CHAR	SPICE kernel version used, e.g. "anc_clocks_spice_ver V2.0"

A24	SPICE_kernel_flag	CDF_CHAR	"SPICE used" or "SPICE not used"
V1	**data**	**CDF_FLOAT**	**Irradiance (W/m2) in each bandpass, three elements per time step. (Note, also called "y" in tplot parlance.)**
V1A1	SI_CONVERSION	CDF_CHAR	"NA"
V1A2	SIG_DIGITS	CDF_CHAR	"NA"
V1A3	DERIVN	CDF_CHAR	"NA"
V1A4	TIME_FIELD	CDF_CHAR	"mission_elapsed_time (SPICE sclk format)::UTC_time (yyyymmddhhmmss.ms)::ephermeris_time (ET)::julian_date (JD)::UNIX_time::CDF TT2000 Time::leapseconds::(Reconstructed)"
V1A5	TIME_END	CDF_CHAR	"2015-11-05T00:00:04.872Z"
V1A6	TIME_START	CDF_CHAR	"2015-11-04T00:00:06.488Z"
V1A7	LABLAXIS	CDF_CHAR	"Irradiance Watts/m^2"
V1A8	LABL_PTR_1	CDF_CHAR	"Irradiance"
V1A9	NO_INTERP	CDF_FLOAT	0.0
V1A10	PSYM	CDF_FLOAT	4.0
V1A11	NOERRORBARS	CDF_FLOAT	1.0
V1A12	LABFLAG	CDF_FLOAT	0.0
V1A13	COLORS	CDF_CHAR	" 0"
V1A14	LABELS	CDF_CHAR	"NA"
V1A15	ZRANGE	CDF_FLOAT	0.0, 0.1
V1A16	ZTITLE	CDF_CHAR	"NA"
V1A17	YRANGE	CDF_FLOAT	0.0, 0.001
V1A18	YTITLE	CDF_CHAR	"Irradiance Watts/m^2"
V1A19	XTITLE	CDF_CHAR	"Time (UNIX) (Reconstructed)"
V1A20	CHAR_SIZE	CDF_FLOAT	1.2
V1A21	ZLOG	CDF_FLOAT	0.0
V1A22	CAL_V_CONST2	CDF_CHAR	"NA"
V1A23	CAL_V_CONST1	CDF_CHAR	"NA"
V1A24	YLOG	CDF_FLOAT	1.0
V1A25	SPEC	CDF_FLOAT	0.0
V1A26	ZSUBTITLE	CDF_CHAR	"NA"

V1A27	YSUBTITLE	CDF_CHAR	"(Watts/m^2) "
V1A28	XSUBTITLE	CDF_CHAR	"(sec) "
V1A29	FLAG_SOURCE	CDF_CHAR	"NA"
V1A30	FLAG_INFO	CDF_CHAR	"NA "
V1A31	CAL_SOURCE	CDF_CHAR	"NA "
V1A32	CAL_DATAFILE	CDF_CHAR	"NA"
V1A33	CAL_Y_CONST2	CDF_CHAR	"NA"
V1A34	CAL_Y_CONST1	CDF_CHAR	"Used: 1.00000 # 1.00000 # 1.00000 # 1.00000"
V1A35	CAL_VERS	CDF_CHAR	"Constant_ver 2.0 # Pkt_euv_ver 2.0 "
V1A36	L0_DATAFILE	CDF_CHAR	"mvn_pfp_all_l0_20151105_v003.dat"
V1A37	T_EPOCH	CDF_DOUBLE	9.46728E+08
V1A38	FLAG_VAR_NOTES	CDF_CHAR	"Data flag: 0=Good solar, 1=Occultation, 2=No pointing info, 3=Sun NOT fully In FOV, 4=Sun NOT In FOV, 5=Windowed, 6=Eclipse, 7=spare "
V1A39	DV_VAR_NOTES	CDF_CHAR	"TOTAL combined uncertainty (accuracy) OF y values In % "
V1A40	V_VAR_NOTES	CDF_CHAR	"Center wavelength (nm) OF each bin, repeated FOR each observation "
V1A41	Y_VAR_NOTES	CDF_CHAR	"Calibrated EUV irradiances FOR Channels A (17-22 nm), B (0-7 nm), and C (121-122 nm) "
V1A42	X_VAR_NOTES	CDF_CHAR	"UNIX time: Number OF seconds elapsed since 1970-01-01/00:00:00. "
V1A43	VAR_NOTES	CDF_CHAR	"Calibrated EUV irradiances FOR Channels A (17-22 nm), B (0-7 nm), and C (121-122 nm) "
V1A44	VAR_TYPE	CDF_CHAR	"data"
V1A45	VALIDMAX	CDF_FLOAT	0.1
V1A46	VALIDMIN	CDF_FLOAT	0
V1A47	UNITS	CDF_CHAR	"(Watts/m^2) "
V1A48	SCALEMAX	CDF_FLOAT	0.005
V1A49	SCALEMIN	CDF_FLOAT	0.0
V1A50	MONOTON	CDF_CHAR	"INCREASE"
V1A51	FORMAT	CDF_CHAR	"F12.10"

V1A52	FILLVAL	CDF_FLOAT	-1.0E+31
V1A53	FLAGFIELDNAM	CDF_CHAR	"flag: Data Useability "
V1A54	DVFIELDNAM	CDF_CHAR	"dv: TOTAL Combined Uncertainty "
V1A55	VFIELDNAM	CDF_CHAR	"v: Wavelength "
V1A56	YFIELDNAM	CDF_CHAR	"y: Irradiance "
V1A57	XFIELDNAM	CDF_CHAR	"x: Unix Time "
V1A58	FIELDNAM	CDF_CHAR	"y: Irradiance "
V1A59	DISPLAY_TYPE	CDF_CHAR	"time_series"
V1A60	DEPEND_0	CDF_CHAR	"epoch"
V1A61	FLAG_CATDESC	CDF_CHAR	"Data useability flag "
V1A62	DV_CATDESC	CDF_CHAR	"Total combined uncertainty "
V1A63	DY_CATDESC	CDF_CHAR	"Measurement uncertainty "
V1A64	V_CATDESC	CDF_CHAR	"Wavelength, in nm "
V1A65	Y_CATDESC	CDF_CHAR	"Solar Irradiances, in W/m^2 "
V1A66	X_CATDESC	CDF_CHAR	"Timestamps for each data point, in UNIX time. "
V1A67	CATDESC	CDF_CHAR	"Solar Irradiances, in W/m^2 "
V1A68	TPLOT_NAME	CDF_CHAR	"mvn_euv_calib_bands"
V2	**ddata**	**CDF_FLOAT**	**Measurement Uncertainty (precision) in %, same number of elements as data (y). (Note, also called "dy" in tplot parlance.)**
V2A1	LABLAXIS	CDF_CHAR	"Measurement Uncertainty (precision) OF y values In % "
V2A2	VAR_NOTES	CDF_CHAR	"Measurement Uncertainty (precision) OF y values In % "
V2A3	VAR_TYPE	CDF_CHAR	"Support_data"
V2A4	VALIDMAX	CDF_FLOAT	1000.0
V2A5	VALIDMIN	CDF_FLOAT	0.0
V2A6	UNITS	CDF_CHAR	"percent"
V2A7	SCALEMAX	CDF_FLOAT	100.0
V2A8	SCALEMIN	CDF_FLOAT	0.0
V2A9	MONOTON	CDF_CHAR	"INCREASE"
V2A10	FORMAT	CDF_CHAR	"F12.10"
V2A11	FILLVAL	CDF_FLOAT	-1.0E+31

V2A12	FIELDNAM	CDF_CHAR	"dy: Measurement Uncertainty "
V2A13	DISPLAY_TYPE	CDF_CHAR	"time_series "
V2A14	DEPEND_0	CDF_CHAR	"epoch"
V2A15	CATDESC	CDF_CHAR	"Measurement uncertainty "
V3	**dfreq**	**CDF_FLOAT**	**Total Combined Uncertainty (accuracy) in %, same number of elements as data (y). (Note, also called "dv" in tplot parlance.)**
V3A1	LABLAXIS	CDF_CHAR	"TOTAL combined uncertainty(%) "
V3A2	VAR_NOTES	CDF_CHAR	"TOTAL combined uncertainty (accuracy) OF y values In % "
V3A3	VAR_TYPE	CDF_CHAR	"support_data"
V3A4	VALIDMAX	CDF_FLOAT	1000.0
V3A5	VALIDMIN	CDF_FLOAT	0.0
V3A6	UNITS	CDF_CHAR	"Percent"
V3A7	SCALEMAX	CDF_FLOAT	100.0
V3A8	SCALEMIN	CDF_FLOAT	0.0
V3A9	MONOTON	CDF_CHAR	"INCREASE"
V3A10	FORMAT	CDF_CHAR	"F12.10"
V3A11	FILLVAL	CDF_FLOAT	-1.0E+31
V3A12	FIELDNAM	CDF_CHAR	"dv: TOTAL Combined Uncertainty "
V3A13	DISPLAY_TYPE	CDF_CHAR	"time_series "
V3A14	DEPEND_0	CDF_CHAR	"epoch"
V3A15	CATDESC	CDF_CHAR	"TOTAL combined uncertainty "
V4	**flag**	**CDF_INT2**	**Flags for data useability, one for each time step. (0=Good solar, 1=Occultation, 2=No pointing info, 3=Sun NOT fully In FOV, 4=Sun NOT In FOV, 5=Windowed, 6=Eclipse, 7=spare)**
V4A1	LABLAXIS	CDF_CHAR	"flags"
V4A2	VAR_NOTES	CDF_CHAR	"Data flag: 0=Good solar, 1=Occultation, 2=No pointing info, 3=Sun NOT fully In FOV, 4=Sun NOT In FOV, 5=Windowed, 6=Eclipse, 7=spare "
V4A3	VAR_TYPE	CDF_CHAR	"support_data"

V4A4	VALIDMAX	CDF_INT2	7
V4A5	VALIDMIN	CDF_INT2	0
V4A6	UNITS	CDF_CHAR	"flag 0-7"
V4A7	SCALEMAX	CDF_INT2	8
V4A8	SCALEMIN	CDF_INT2	0
V4A9	MONOTON	CDF_CHAR	"INCREASE"
V4A10	FORMAT	CDF_CHAR	"B1"
V4A11	FILLVAL	CDF_INT2	-32768
V4A12	FIELDNAM	CDF_CHAR	"flag: Data Useability "
V4A13	DISPLAY_TYPE	CDF_CHAR	"time_series "
V4A14	DEPEND_0	CDF_CHAR	"epoch"
V4A15	CATDESC	CDF_CHAR	"Data useability flag "
V5	**time_unix**	**CDF_DOUBLE**	**Unix time for each time step, same number of elements as data (y). (Note, also called "x" in tplot parlance.)**
V5A1	LABLAXIS	CDF_CHAR	"UNIX Time [secs]"
V5A2	VAR_NOTES	CDF_CHAR	"UNIX time: Number OF seconds elapsed since 1970-01-01/00:00:00. "
V5A3	VAR_TYPE	CDF_CHAR	"support_data"
V5A4	VALIDMAX	CDF_DOUBLE	2.0E+09
V5A5	VALIDMIN	CDF_DOUBLE	1.0E+09
V5A6	UNITS	CDF_CHAR	"[secs]"
V5A7	SCALEMAX	CDF_CHAR	"2015-11-05T00:00:04.872Z"
V5A8	SCALEMIN	CDF_CHAR	"2015-11-04T00:00:06.488Z"
V5A9	MONOTON	CDF_CHAR	"INCREASE"
V5A10	FORMAT	CDF_CHAR	"F25.6"
V5A11	FILLVAL	CDF_DOUBLE	-1.0E+31
V5A12	FIELDNAM	CDF_CHAR	"x: Unix Time "
V5A13	DISPLAY_TYPE	CDF_CHAR	"time_series"
V5A14	DEPEND_0	CDF_CHAR	"epoch"
V5A15	CATDESC	CDF_CHAR	"Timestamps for each data point, in UNIX time. "
V6	**epoch**	**CDF_TT2000**	**CDF TT2000 Time (sec) for each time step, same number of elements as data (y).**

V6A1	LABLAXIS	CDF_CHAR	"cdf TT2000 Time [secs]"
V6A2	T_EPOCH	CDF_FLOAT	1.0
V6A3	VAR_NOTES	CDF_CHAR	"Calculated using Berkeley SSL IDL tplot package."
V6A4	VAR_TYPE	CDF_CHAR	"Support_data"
V6A5	VALIDMAX	CDF_TT2000	"2014-10-01T00:00:00.000000000"
V6A6	VALIDMIN	CDF_TT2000	"2018-12-31T23:59:59.000000000"
V6A7	UNITS	CDF_CHAR	"[ns]"
V6A8	SCALEMAX	CDF_TT2000	"2015-11-04T23:59:59.000000000"
V6A9	SCALEMIN	CDF_TT2000	"2015-11-04T00:00:06.000000000"
V6A10	MONOTON	CDF_CHAR	"INCREASE"
V6A11	FORMAT	CDF_CHAR	"I22"
V6A12	FILLVAL	CDF_TT2000	"9999-12-31T23:59:59.999999999"
V6A13	FIELDNAM	CDF_CHAR	"Epoch Time"
V6A14	DISPLAY_TYPE	CDF_CHAR	"time_series"
V6A15	DEPEND_0	CDF_CHAR	"epoch"
V6A16	CATDESC	CDF_CHAR	"CDF TT2000 time."
V6A17	TIME_BASE	CDF_CHAR	"J2000"
V7	**maven_sun_distance**	**CDF_DOUBLE**	**The distance between MAVEN and the Sun (km) for each time step, same number of elements as data (y).**
V7A1	LABLAXIS	CDF_CHAR	"Sun distance from MAVEN"
V7A2	VAR_NOTES	CDF_CHAR	"Sun distance from MAVEN (km)"
V7A3	VAR_TYPE	CDF_CHAR	"support_data"
V7A4	VALIDMAX	CDF_DOUBLE	2.5E+08
V7A5	VALIDMIN	CDF_DOUBLE	2.06E+08
V7A6	UNITS	CDF_CHAR	"kilometers"
V7A7	SCALEMAX	CDF_DOUBLE	2.5E+08
V7A8	SCALEMIN	CDF_DOUBLE	2.06E+08
V7A9	FORMAT	CDF_CHAR	"F12.2"
V7A10	FILLVAL	CDF_DOUBLE	-1.0E+31
V7A11	FIELDNAM	CDF_CHAR	"Sun distance "
V7A12	DISPLAY_TYPE	CDF_CHAR	"time_series"
V7A13	DEPEND_0	CDF_CHAR	"epoch"

V7A14	CATDESC	CDF_CHAR	"Sun distance from MAVEN"
V8	**counts**	**CDF_FLOAT**	**Corrected count rates for each bandpass (counts/sec), three elements per time step.**
V8A1	LABLAXIS	CDF_CHAR	"Counts per Second"
V8A2	VAR_NOTES	CDF_CHAR	"Count rate with corrections applied for visible light, dark offset, temperature, normalized gain, and field-of-view, in counts per second"
V8A3	VAR_TYPE	CDF_CHAR	"support_data"
V8A4	VALIDMAX	CDF_FLOAT	200000.0
V8A5	VALIDMIN	CDF_FLOAT	0.0
V8A6	UNITS	CDF_CHAR	"Counts per second"
V8A7	SCALEMAX	CDF_DOUBLE	200000.0
V8A8	SCALEMIN	CDF_DOUBLE	0.0
V8A9	FORMAT	CDF_CHAR	"F12.2"
V8A10	FILLVAL	CDF_FLOAT	-1.0E+31
V8A11	FIELDNAM	CDF_CHAR	"Counts "
V8A12	DISPLAY_TYPE	CDF_CHAR	"time_series"
V8A13	DEPEND_0	CDF_CHAR	"epoch"
V8A14	CATDESC	CDF_CHAR	"Counts"

6.1.2 Modelled data file structure

EUV modelled data files (Level 3 products daily and minute), will be archived with PDS as Common Data Format (CDF). The CDF Global Attributes, and Variable Attributes of the EUV Level 3 CDF files are described in Table 17 for the daily spectra and Table 18 for the minute spectra. Note that some of the generic fields that are required for tplot are not used in the products, but filled with "NA" or equivalent. Also, some attributes are required by the PDS, but are not used in tplot. In the table the "No." column uses the designation "A*n*" for Global Attribute *n*, "V*i*" for Variable *i*, and "V*i*A*j*" for Attribute *j* of Variable *i*.

For PDS label attributes, please refer to Appendix E.

Table 17: Contents for euv.modelled:data.daily.spectra data files.

No.	Field Name	Type	Entry/Description

A1	Product_name	CDF_CHAR	"MAVEN LPW EUV Modeled Daily Irradiance in units of Watts/m^2/nm, level: L3"
A2	Project	CDF_CHAR	"MAVEN>Mars Atmosphere and Volatile EvolutioN Mission"
A3	Discipline	CDF_CHAR	"Planetary Physics>Particles and fields"
A4	Data_type	CDF_CHAR	"CAL>calibrated"
A5	Descriptor	CDF_CHAR	"EUV>Extreme Ultraviolet"
A6	Data_version	CDF_CHAR	Version and Revision in vv.rr format: e.g. "05.04"
A7	Instrument_type	CDF_CHAR	"Gamma and X-Rays"
A8	Mission_group	CDF_CHAR	"MAVEN"
A9	PI_name	CDF_CHAR	"Data production PI: F. Eparvier, LASP/CU"
A10	PI_affiliation	CDF_CHAR	"LASP University of Colorado"
A11	Text	CDF_CHAR	"Extreme UltraViolet (EUV) modeled daily averaged irradiances in 1-nm bins from 0-190 nm. See Eparvier et al, Space Research, 195, 203-301 2015, doi:10-1007/s 111214-015-0195-2"
A12	Source_name	CDF_CHAR	"MAVEN>Mars Atmosphere and Volatile EvolutioN mission"
A13	Generated_by	CDF_CHAR	"LASP/CU - EUV Team"
A14	Generation_date	CDF_CHAR	Date of file generation, e.g. "Mon Mar 21 22:28:33 2016"
A15	Rules_of_use	CDF_CHAR	http://lasp.colorado.edu/home/maven/science/
A16	Acknowledgement	CDF_CHAR	"Eparvier et al, Space Research, 195, 203-301 2015, doi:10-1007/s 111214-015-0195-2"
A17	Leapseconds_kernel	CDF_CHAR	Leap seconds kernel in SPICE, e.g. "naif0011.tls"
A18	Spacecraft_clock_kernel	CDF_CHAR	Spacecraft Clock kernel, e.g. "MVN_SCLKSCET.00022.tsc"
A19	PDS_start_time	CDF_CHAR	Time of first data record in file, e.g. "2015-11-04T00:00:06.488Z"
A20	PDS_stop_time	CDF_CHAR	Time of last data record in file, e.g. "2015-11-05T00:00:04.872Z"
A21	PDS_sclk_start_count	CDF_CHAR	Spacecraft Clock start in file, e.g. "0499867061"

A22	PDS_sclk_stop_count	CDF_CHAR	Spacecraft Clock end in file, e.g. "0499953459"
A23	SPICE_kernel_version	CDF_CHAR	SPICE kernel version used, e.g. "anc_clocks_spice_ver V2.0"
A24	SPICE_kernel_flag	CDF_CHAR	"SPICE used" or "SPICE not used"
V1	**flag**	**CDF_INT2**	**Data useability flag (0:uses best MAVEN proxies, 1: uses lower quality or partial MAVEN proxies, 2: uses no MAVEN proxies but best extrapolated Earth proxies 3: uses no MAVEN proxies AND poor quality Earth proxies.)**
V1A1	FIELDNAME	CDF_CHAR	"flag: Data Useability"
V1A2	VAR_NOTES	CDF_CHAR	"Data flag: 0:uses best MAVEN proxies, 1: uses lower quality or partial MAVEN proxies, 2: uses no MAVEN proxies but best extrapolated Earth proxies 3: uses no MAVEN proxies AND poor quality Earth proxies."
V1A3	CATDESC	CDF_CHAR	"Data useability flag"
V1A4	VALIDMAX	CDF_INT2	7
V1A5	VALIDMIN	CDF_INT2	0
V1A6	SCALEMAX	CDF_INT2	3
V1A7	SCALEMIN	CDF_INT2	0
V1A8	LABLAXIS	CDF_CHAR	"flags"
V1A9	FILLVAL	CDF_INT2	-32768
V1A10	SOURCE	CDF_CHAR	"NA"
V1A11	INFO	CDF_CHAR	"NA"
V1A12	DEPEND_0	CDF_CHAR	"epoch"
V1A13	FORMAT	CDF_CHAR	"I1"
V1A14	DISPLAY_TYPE	CDF_CHAR	"time_series"
V1A15	VAR_TYPE	CDF_CHAR	"support_data"
V2	**epoch**	**CDF_TT2000**	**CDF TT2000 Time (sec)**
V2A1	FIELDNAM	CDF_CHAR	"Epoch Time"
V2A2	VAR_NOTES	CDF_CHAR	"Derived from SPICE"
V2A3	CATDESC	CDF_CHAR	"CDF TT2000 time "
V2A4	VALIDMAX	CDF_TT2000	2018-12-31T23:59:59.000000000

V2A5	VALIDMIN	CDF_TT2000	2014-10-01T00:00:00.000000000
V2A6	SCALEMAX	CDF_TT2000	2015-11-04T23:59:59.000000000
V2A7	SCALEMIN	CDF_TT2000	2015-11-04T00:00:06.000000000
V2A8	LABLAXIS	CDF_CHAR	"cdf TT2000 Time [secs]"
V2A9	FILLVAL	CDF_TT2000	9999-12-31T23:59:59.999999999
V2A10	DEPEND_0	CDF_CHAR	"epoch"
V2A11	FORMAT	CDF_CHAR	"I22"
V2A12	DISPLAY_TYPE	CDF_CHAR	"time_series"
V2A13	VAR_TYPE	CDF_CHAR	"support_data"
V2A14	UNITS	CDF_CHAR	"[ns]"
V2A15	TIME_BASE	CDF_CHAR	"J2000"
V2A16	MONOTON	CDF_CHAR	"INCREASE"
V2A17	LABL_PTR_1	CDF_CHAR	"time"
V3	**x**	**CDF_DOUBLE**	**Timestamp for center of day, in UNIX time.**
V3A1	FIELDNAM	CDF_CHAR	"x: Unix Time"
V3A2	VAR_NOTES	CDF_CHAR	"UNIX time: Number of seconds elapsed since 1970-01-01/00:00:00."
V3A3	CATDESC	CDF_CHAR	"Timestamps FOR each day, center of day, in UNIX time."
V3A4	VALIDMAX	CDF_DOUBLE	e.g. 1.45809e+09
V3A5	VALIDMIN	CDF_DOUBLE	e.g. 1.458e+09
V3A6	FILLVAL	CDF_DOUBLE	-1.0e+31
V3A7	DEPEND_0	CDF_CHAR	"epoch"
V3A8	FORMAT	CDF_CHAR	"F22.3"
V3A9	DISPLAY_TYPE	CDF_CHAR	"Time_series"
V3A10	VAR_TYPE	CDF_CHAR	"support_data"
V3A11	MONOTON	CDF_CHAR	"INCREASE"
V3A12	LABL_PTR_1	CDF_CHAR	"time"
V3A13	TIME_FIELD	CDF_CHAR	"mission_elapsed_time (SPICE sclk format) UTC_time (yyyymmddhhmmss.ms) ephermeris_time (ET) julian_date (JD) UNIX_time CDF TT2000 Time leapseconds (Reconstructed)"

V3A14	TIME_START	CDF_DOUBLE	Start time of file in formats of TIME_FIELD, e.g "4.99867e+08, 2.01511e+13, 4.99867e+08, 2.45733e+06, 1.4466e+09, 4.99867e+17, 36.0"
V3A15	TIME_END	CDF_DOUBLE	End time of file in formats of TIME_FIELD, e.g. "4.99954e+08, 2.01511e+13, 4.99954e+08, 2.45733e+06, 1.44668e+09, 4.99954e+17, 36.0"
V4	**y**	**CDF_FLOAT**	**Modeled EUV irradiances in Watt/m^2/nm for each wavelength bin, 190 elements.**
V4A1	FIELDNAM	CDF_CHAR	"y: Irradiance"
V4A2	VAR_NOTES	CDF_CHAR	"Modeled EUV irradiances for each wavelength bin"
V4A3	CATDESC	CDF_CHAR	"Solar Irradiances, in W/m^2/nm"
V4A4	VALIDMAX	CDF_FLOAT	0.00278269
V4A5	VALIDMIN	CDF_FLOAT	1.3419e-7
V4A6	SCALEMAX	CDF_FLOAT	0.005
V4A7	SCALEMIN	CDF_FLOAT	0.0
V4A8	LABLAXIS	CDF_CHAR	"Irradiance"
V4A9	FILLVAL	CDF_FLOAT	-1.0e+31
V4A10	DEPEND_0	CDF_CHAR	"epoch"
V4A11	FORMAT	CDF_CHAR	"F18.10"
V4A12	DISPLAY_TYPE	CDF_CHAR	"spectrogram
V4A13	VAR_TYPE	CDF_CHAR	"data"
V4A14	MONOTON	CDF_CHAR	"INCREASE"
V4A15	DEPEND_1	CDF_CHAR	"v"
V5	**v**	**CDF_FLOAT**	**The wavelength (nm) of the center of each bin in the spectrum, 190 elements**
V5A1	FIELDNAM	CDF_CHAR	"v: Wavelength"
V5A2	VAR_NOTES	CDF_CHAR	"Center wavelength (nm) of each 1-nm bin from 0-190 nm"
V5A3	CATDESC	CDF_CHAR	"Wavelength, in nm"
V5A4	VALIDMAX	CDF_FLOAT	189.5
V5A5	VALIDMIN	CDF_FLOAT	0.5

V5A6	LABLAXIS	CDF_CHAR	"Wavelength"
V5A7	FILLVAL	CDF_FLOAT	-1.0e+31
V5A8	DEPEND_0	CDF_CHAR	"epoch"
V5A9	FORMAT	CDF_CHAR	"F18.10"
V5A10	DISPLAY_TYPE	CDF_CHAR	"Time_series"
V5A11	VAR_TYPE	CDF_CHAR	"support_data"
V5A12	LABL_PTR_1	CDF_CHAR	"Wavelength"
V6	**dy**	**CDF_FLOAT**	**The model uncertainty (%), 190 elements**
V6A1	FIELDNAME	CDF_CHAR	"dy: Model Irradiance Uncertainty"
V6A2	VAR_NOTES	CDF_CHAR	"Model Uncertainty (precision) of y values In %"
V6A3	CATDESC	CDF_CHAR	"Model uncertainty"
V6A4	VALIDMAX	CDF_FLOAT	200.0
V6A5	VALIDMIN	CDF_FLOAT	0.0
V6A6	LABLAXIS	CDF_CHAR	"Model Uncert."
V6A7	FILLVAL	CDF_FLOAT	-1.0e+31
V6A8	DEPEND_0	CDF_CHAR	"epoch"
V6A9	FORMAT	CDF_CHAR	"F18.10"
V6A10	DISPLAY_TYPE	CDF_CHAR	"Time_series"
V6A11	VAR_TYPE	CDF_CHAR	"support_data"
V6A12	LABL_PTR_1	CDF_CHAR	"Model Uncert."
V7	**dv**	**CDF_FLOAT**	**The total combined uncertainty (%) of model and proxies used, 190 elements**
V7A1	FIELDNAM	CDF_CHAR	"dv: Total Combined Uncertainty"
V7A2	VAR_NOTES	CDF_CHAR	"Total combined uncertainty (accuracy) of y values In %"
V7A3	CATDESC	CDF_CHAR	"Total combined uncertainty"
V7A4	VALIDMAX	CDF_FLOAT	532.38
V7A5	VALIDMIN	CDF_FLOAT	3.84494
V7A6	LABLAXIS	CDF_CHAR	"Total Uncert."
V7A7	FILLVAL	CDF_FLOAT	-1.0e+31
V7A8	DEPEND_0	CDF_CHAR	"epoch"
V7A9	FORMAT	CDF_CHAR	"F18.10"

V7A10	DISPLAY_TYPE	CDF_CHAR	"Time_series"
V7A11	VAR_TYPE	CDF_CHAR	"support_data"
V7A12	LABL_PTR_1	CDF_CHAR	"Total Uncert."
V8	**maven_sun_distance**	**CDF_DOUBLE**	**The mean distance between MAVEN and the Sun (km) for the day.**
V8A1	FIELDNAM	CDF_CHAR	"Sun distance"
V8A2	VAR_NOTES	CDF_CHAR	"Sun distance from MAVEN (km)
V8A3	CATDESC	CDF_CHAR	"Sun distance from MAVEN"
V8A4	VALIDMAX	CDF_DOUBLE	2.5e+08
V8A5	VALIDMIN	CDF_DOUBLE	2.06e+08
V8A6	SCALEMAX	CDF_DOUBLE	2.5e+08
V8A7	SCALEMIN	CDF_DOUBLE	2.06e+08
V8A8	LABLAXIS	CDF_CHAR	"Sun distance from MAVEN"
V8A9	FILLVAL	CDF_DOUBLE	-1.0e+31
V8A10	DEPEND_0	CDF_CHAR	"epoch"
V8A11	FORMAT	CDF_CHAR	"F12.2"
V8A12	DISPLAY_TYPE	CDF_CHAR	"time_series"
V8A13	VAR_TYPE	CDF_CHAR	"support_data"
V8A14	UNITS	CDF_CHAR	"kilometers"

Table 18: Contents for euv.modelled:data.minute.spectra data files.

No.	Field Name	Type	Entry/Description
A1	Product_name	CDF_CHAR	"MAVEN LPW EUV Modeled Minutely Irradiance in units of Watts/m^2/nm, level: L3"
A2	Project	CDF_CHAR	"MAVEN>Mars Atmosphere and Volatile EvolutioN Mission"
A3	Discipline	CDF_CHAR	"Planetary Physics>Particles and fields"
A4	Data_type	CDF_CHAR	"CAL>calibrated"
A5	Descriptor	CDF_CHAR	"EUV>Extreme Ultraviolet"

A6	Data_version	CDF_CHAR	Version and Revision in vv.rr format: e.g. "05.04"
A7	Instrument_type	CDF_CHAR	"Gamma and X-Rays"
A8	Mission_group	CDF_CHAR	"MAVEN"
A9	PI_name	CDF_CHAR	"Data production PI: F. Eparvier, LASP/CU"
A10	PI_affiliation	CDF_CHAR	"LASP University of Colorado"
A11	Text	CDF_CHAR	"Extreme UltraViolet (EUV) modeled 1 minute irradiances in 1-nm bins from 0-190 nm. See Eparvier et al, Space Research, 195, 203-301 2015, doi:10-1007/s 111214-015-0195-2"
A12	Source_name	CDF_CHAR	"MAVEN>Mars Atmosphere and Volatile EvolutioN mission"
A13	Generated_by	CDF_CHAR	"LASP/CU - EUV Team"
A14	Generation_date	CDF_CHAR	Date of file generation, e.g. "Mon Mar 21 22:28:33 2016"
A15	Rules_of_use	CDF_CHAR	http://lasp.colorado.edu/home/maven/science/
A16	Acknowledgement	CDF_CHAR	"Eparvier et al, Space Research, 195, 203-301 2015, doi:10-1007/s 111214-015-0195-2"
A17	Leapseconds_kernel	CDF_CHAR	Leap seconds kernel in SPICE, e.g. "naif0011.tls"
A18	Spacecraft_clock_kernel	CDF_CHAR	Spacecraft Clock kernel, e.g. "MVN_SCLKSCET.00022.tsc"
A19	PDS_start_time	CDF_CHAR	Time of first data record in file, e.g. "2015-11-04T00:00:06.488Z"
A20	PDS_stop_time	CDF_CHAR	Time of last data record in file, e.g. "2015-11-05T00:00:04.872Z"
A21	PDS_sclk_start_count	CDF_CHAR	Spacecraft Clock start in file, e.g. "0499867061"
A22	PDS_sclk_stop_count	CDF_CHAR	Spacecraft Clock end in file, e.g. "0499953459"
A23	SPICE_kernel_version	CDF_CHAR	SPICE kernel version used, e.g. "anc_clocks_spice_ver V2.0"
A24	SPICE_kernel_flag	CDF_CHAR	"SPICE used" or "SPICE not used"

V1	flag	CDF_INT2	**Data useability flag for each minute (0:uses best MAVEN proxies, 1: uses lower quality or partial MAVEN proxies, 2: uses no MAVEN proxies but best extrapolated Earth proxies 3: uses no MAVEN proxies AND poor quality Earth proxies), 1440 records**
V1A1	FIELDNAM	CDF_CHAR	"flag: Data Useability"
V1A2	VAR_NOTES	CDF_CHAR	"Data flag: 0:uses best MAVEN proxies, 1: uses lower quality or partial MAVEN proxies, 2: uses no MAVEN proxies but best extrapolated Earth proxies 3: uses no MAVEN proxies AND poor quality Earth proxies."
V1A3	CATDESC	CDF_CHAR	"Data useability flag"
V1A4	VALIDMAX	CDF_INT2	7
V1A5	VALIDMIN	CDF_INT2	0
V1A6	SCALEMAX	CDF_INT2	3
V1A7	SCALEMIN	CDF_INT2	0
V1A8	LABLAXIS	CDF_CHAR	"flags"
V1A9	FILLVAL	CDF_INT2	-32768
V1A10	SOURCE	CDF_CHAR	"NA"
V1A11	INFO	CDF_CHAR	"NA"
V1A12	DEPEND_0	CDF_CHAR	"epoch"
V1A13	FORMAT	CDF_CHAR	"I1"
V1A14	DISPLAY_TYPE	CDF_CHAR	"time_series"
V1A15	VAR_TYPE	CDF_CHAR	"support_data"
V1A16	LABL_PTR_1	CDF_CHAR	"flag"
V2	**epoch**	**CDF_TT2000**	**CDF TT2000 Time (sec), 1440 records**
V2A1	FIELDNAM	CDF_CHAR	"epoch"
V2A2	VAR_NOTES	CDF_CHAR	"Derived from SPICE"
V2A3	CATDESC	CDF_CHAR	"CDF TT2000 time "
V2A4	VALIDMAX	CDF_TT2000	e.g. 2015-10-09T23:59:59.093000000
V2A5	VALIDMIN	CDF_TT2000	e.g. 2015-10-09T00:00:09.072000000
V2A6	SCALEMAX	CDF_TT2000	e.g. 2015-10-09T23:59:59.093000000
V2A7	SCALEMIN	CDF_TT2000	e.g. 2015-10-09T00:00:09.072000000
V2A8	LABLAXIS	CDF_CHAR	"cdf TT2000 Time [secs]"

V2A9	FILLVAL	CDF_TT2000	9999-12-31T23:59:59.999999999
V2A10	DEPEND_0	CDF_CHAR	"epoch"
V2A11	FORMAT	CDF_CHAR	"I22"
V2A12	DISPLAY_TYPE	CDF_CHAR	"time_series"
V2A13	VAR_TYPE	CDF_CHAR	"support_data"
V2A14	LABL_PTR_1	CDF_CHAR	"time"
V2A15	UNITS	CDF_CHAR	"[ns]"
V2A16	TIME_BASE	CDF_CHAR	"J2000"
V2A17	MONOTON	CDF_CHAR	"INCREASE"
V3	**x**	**CDF_DOUBLE**	**Timestamp for center each minute of the day, in UNIX time, 1440 records.**
V3A1	FIELDNAME	CDF_CHAR	"x: Unix Time"
V3A2	VAR_NOTES	CDF_CHAR	"UNIX time: Number of seconds elapsed since 1970-01-01/00:00:00."
V3A3	CATDESC	CDF_CHAR	"Timestamps for each minute of day, center of minute, in UNIX time."
V3A4	VALIDMAX	CDF_DOUBLE	e.g. 1.45809e+09
V3A5	VALIDMIN	CDF_DOUBLE	e.g. 1.458e+09
V3A6	FILLVAL	CDF_DOUBLE	-1.0e+31
V3A7	DEPEND_0	CDF_CHAR	"epoch"
V3A8	FORMAT	CDF_CHAR	"F22.10"
V3A9	DISPLAY_TYPE	CDF_CHAR	"Time_series"
V3A10	VAR_TYPE	CDF_CHAR	"support_data"
V3A11	LABL_PTR_1	CDF_CHAR	"time"
V3A12	MONOTON	CDF_CHAR	"INCREASE"
V3A13	TIME_FIELD	CDF_CHAR	"mission_elapsed_time (SPICE sclk format) UTC_time (yyyymmddhhmmss.ms) ephermeris_time (ET) julian_date (JD) UNIX_time CDF TT2000 Time leapseconds (Reconstructed)"
V3A14	TIME_START	CDF_DOUBLE	Start time of file in formats of TIME_FIELD, e.g "4.99867e+08, 2.01511e+13, 4.99867e+08, 2.45733e+06, 1.4466e+09, 4.99867e+17, 36.0"

V3A15	TIME_END	CDF_DOUBLE	End time of file in formats of TIME_FIELD, e.g. "4.99954e+08, 2.01511e+13, 4.99954e+08, 2.45733e+06, 1.44668e+09, 4.99954e+17, 36.0"
V4	**y**	**CDF_FLOAT**	**Modeled EUV irradiances in Watt/m^2/nm for each minute of the day for each wavelength bin, 1440 records, 190 elements.**
V4A1	FIELDNAM	CDF_CHAR	"y: Irradiance"
V4A2	VAR_NOTES	CDF_CHAR	"Modeled EUV irradiances FOR each wavelength bin, for each minute"
V4A3	CATDESC	CDF_CHAR	"Solar Irradiances, in W/m^2/nm"
V4A4	VALIDMAX	CDF_FLOAT	e.g. 0.00279047
V4A5	VALIDMIN	CDF_FLOAT	e.g. 1.27086e-07
V4A6	SCALEMAX	CDF_FLOAT	0.005
V4A7	SCALEMIN	CDF_FLOAT	0.0
V4A8	LABLAXIS	CDF_CHAR	"Irradiance"
V4A9	FILLVAL	CDF_FLOAT	-1.0e+31
V4A10	DEPEND_0	CDF_CHAR	"epoch"
V4A11	FORMAT	CDF_CHAR	"F12.10"
V4A12	DISPLAY_TYPE	CDF_CHAR	"spectrogram"
V4A13	VAR_TYPE	CDF_CHAR	"data"
V4A14	LAB_PTR_1	CDF_CHAR	"Irradiance"
V4A15	MONOTON	CDF_CHAR	"INCREASE"
V4A16	DEPEND_1	CDF_CHAR	"v"
V5	**v**	**CDF_FLOAT**	**The wavelength (nm) of the center of each bin in the spectrum, 190 elements**
V5A1	FIELDNAM	CDF_CHAR	"v: Wavelength"
V5A2	VAR_NOTES	CDF_CHAR	"Center wavelength (nm) of each 1-nm bin from 0-190 nm"
V5A3	CATDESC	CDF_CHAR	"Wavelength, in nm"
V5A4	VALIDMAX	CDF_FLOAT	189.5
V5A5	VALIDMIN	CDF_FLOAT	0.5
V5A6	FILLVAL	CDF_FLOAT	-1.0e+31
V5A7	DEPEND_0	CDF_CHAR	"epoch"
V5A8	FORMAT	CDF_CHAR	"F18.10"

V5A9	DISPLAY_TYPE	CDF_CHAR	"time_series"
V5A10	VAR_TYPE	CDF_CHAR	"support_data"
V5A11	LAB_PTR_1	CDF_CHAR	"Wavelength"
V6	**dy**	**CDF_FLOAT**	**The model uncertainty (%), 1440 records, 190 elements**
V6A1	FIELDNAM	CDF_CHAR	"dy: Model Irradiance Uncertainty"
V6A2	VAR_NOTES	CDF_CHAR	"Model Uncertainty (precision) of y values In %"
V6A3	CATDESC	CDF_CHAR	"Model uncertainty"
V6A4	VALIDMAX	CDF_FLOAT	e.g. 2984.54
V6A5	VALIDMIN	CDF_FLOAT	e.g. 0.803156
V6A6	FILLVAL	CDF_FLOAT	-1.0e+31
V6A7	DEPEND_0	CDF_CHAR	"epoch"
V6A8	FORMAT	CDF_CHAR	"F18.10"
V6A9	DISPLAY_TYPE	CDF_CHAR	"Time_series"
V6A10	VAR_TYPE	CDF_CHAR	"support_data"
V6A11	LABL_PTR_1	CDF_CHAR	"Model Uncert."
V7	**dv**	**CDF_FLOAT**	**The total combined uncertainty (%) of model and proxies used, 1440 records, 190 elements**
V7A1	FIELDNAM	CDF_CHAR	"dv: Total Combined Uncertainty"
V7A2	VAR_NOTES	CDF_CHAR	"Total combined uncertainty (accuracy) of y values In %"
V7A3	CATDESC	CDF_CHAR	"Total combined uncertainty"
V7A4	VALIDMAX	CDF_FLOAT	e.g. 2984.55
V7A5	VALIDMIN	CDF_FLOAT	e.g. 3.84162
V7A6	FILLVAL	CDF_FLOAT	-1.0e+31
V7A7	DEPEND_0	CDF_CHAR	"epoch"
V7A8	FORMAT	CDF_CHAR	"F18.10"
V7A9	DISPLAY_TYPE	CDF_CHAR	"Time_series"
V7A10	VAR_TYPE	CDF_CHAR	"support_data"
V7A11	LABL_PTR_1	CDF_CHAR	"Total Uncert."
V8	**maven_sun_distance**	**CDF_DOUBLE**	**The mean distance between MAVEN and the Sun (km) for each minute, 1440 records.**

V8A1	FIELDNAM	CDF_CHAR	"Sun distance"
V8A2	VAR_NOTES	CDF_CHAR	"Sun distance from MAVEN (km)
V8A3	CATDESC	CDF_CHAR	"Sun distance from MAVEN"
V8A4	VALIDMAX	CDF_DOUBLE	2.5e+08
V8A5	VALIDMIN	CDF_DOUBLE	2.06e+08
V8A6	SCALEMAX	CDF_DOUBLE	2.5e+08
V8A7	SCALEMIN	CDF_DOUBLE	2.06e+08
V8A8	LABLAXIS	CDF_CHAR	"Sun distance from MAVEN"
V8A9	FILLVAL	CDF_DOUBLE	-1.0e+31
V8A10	DEPEND_0	CDF_CHAR	"epoch"
V8A11	FORMAT	CDF_CHAR	"F12.2"
V8A12	DISPLAY_TYPE	CDF_CHAR	"time_series"
V8A13	VAR_TYPE	CDF_CHAR	"support_data"
V8A14	UNITS	CDF_CHAR	"kilometers"

6.2   Document Product File Formats

EUV will provide the calibrated and modelled data in CDF formats. The processing from raw to calibrated/modelled is documented with the archiving ASCII files with the IDL program scripts. The SIS document (this document) will be archived in Portable Document Format (PDF).

6.3   PDS Labels

PDS labels are ASCII text files written, in the eXtensible Markup Language (XML). All product labels are detached from the digital files (if any) containing the data objects they describe (except Product_Bundle). There is one label for every product. Each product, however, may contain one or more data objects. The data objects of a given product may all reside in a single file, or they may be stored in multiple separate files. PDS4 label files must end with the file extension ".xml".

The structure of PDS label files is governed by the XML documents described in Section 6.3.1.

6.3.1 XML Documents

For the MAVEN mission PDS labels will conform to the PDS master schema based upon the 1.1.0.1 version of the PDS Information Model for structure, and the 1.1.0.1 version of the PDS schematron for content. By use of an XML editor these documents may be used to validate the structure and content of the product labels.

The PDS master schema and schematron documents are produced, managed, and supplied to MAVEN by the PDS. In addition to these documents, the MAVEN mission has produced additional XML documents which govern the products in this archive. These documents contain

attribute and parameter definitions specific to the MAVEN mission.. A list of the XML documents associated with this archive is included in this document in the XML_Schema collection section for each bundle.

Examples of PDS labels required for the EUV archive are shown in Appendix C (bundle products), Appendix D (collection products), and Appendix E (basic products).

6.4   **Delivery Package**

Data transfers, whether from data providers to PDS or from PDS to data users or to the deep archive, are accomplished using delivery packages. Delivery packages include the following required elements:

1. The package which consists of a compressed bundle of the products being transferred.

2. A transfer manifest which maps each product's LIDVID to the physical location of the product label in the package after uncompression.

3. A checksum manifest which lists the MD5 checksum of each file included in the package after uncompression.

EUV archive delivery packages (including the transfer and checksum manifests) for delivery to PDS are produced at the MAVEN SDC.

6.4.1 The Package

The directory structure used in for the delivery package is described in the Appendix in Section F.1. Delivery packages are compressed using either [zip, or tar/gzip – SDC text] and are transferred electronically using the ssh protocol.

6.4.2 Transfer Manifest

The "transfer manifest" is a file provided with each transfer to, from, or within PDS. The transfer manifest is external to the delivery package. It contains an entry for each label file in the package, and maps the product LIDVID to the file specification name for the associated product's label file. Details of the structure of the transfer manifest are provided in Section F.2.

The transfer manifest is external to the delivery package, and is not an archive product. As a result, it does not require a PDS label.

6.4.3 Checksum Manifest

The checksum manifest contains an MD5 checksum for every file included as part of the delivery package. This includes both the PDS product labels and the files containing the digital objects which they describe. The format used for a checksum manifest is the standard output generated by the md5deep utility. Details of the structure of the checksum manifest are provided in section F.3.

The checksum manifest is external to the delivery package, and is not an archive product. As a result, it does not require a PDS label.

Appendix A   Support staff and cognizant persons

Table 19: Archive support staff

EUV team			
Name	**Address**	**Phone**	**Email**
Dr. Francis G. Eparvier	LASP/Univ. Colorado, 3665 Discovery Drive, Bouder, CO 80303	303-492-4546	eparvier@colorado.edu
Dr. Laila Andersson	LASP/Univ. Colorado, 3665 Discovery Drive, Boulder, CO 80303	303 492 1689	Laila.andersson@lasp.colorado.edu

UCLA			
Name	**Address**	**Phone**	6.5 **Email**
Dr. Steven Joy PPI Operations Manager	IGPP, University of California 405 Hilgard Avenue Los Angeles, CA 90095-1567 USA	+001 310 825 3506	sjoy@igpp.ucla.edu
Mr. Joseph Mafi PPI Data Engineer	IGPP, University of California 405 Hilgard Avenue Los Angeles, CA 90095-1567 USA	+001 310 206 6073	jmafi@igpp.ucla.edu

Appendix B   Naming conventions for MAVEN science data files

This section describes the naming convention used for science data files for the MAVEN mission.

Raw (MAVEN Level 0):

mvn_<inst>_<grouping>_l0_< yyyy><mm><dd>_v<xxx>.dat

Level 1, 2, 3+:

mvn_<inst>_<level>_<descriptor>_<yyyy><mm><dd>T<hh><mm><ss>_v<xx>_r<yy>.<ext>

Code	Description
<inst>	3-letter instrument ID (see table below)
<grouping>	Three-letter code: options are all, svy, and arc for all data, survey data, and archive data respectively. Primarily for PF to divide their survey and archive data at Level 0. (Not used for EUV)
<yyyy>	4-digit year
<mm>	2-digit month, *e.g.* 01, 12
<dd>	2-digit day of month, *e.g.* 02, 31
<hh>	2-digit hour, separated from the date by T. OPTIONAL. (Not used for EUV)
<mm>	2-digit minute. OPTIONAL. (Not used for EUV)
<ss>	2-digit second. OPTIONAL. (Not used for EUV)
v<xx>	2-digit data file version: For the EUV monitor, the version number will reflect if the structure of the CDF-file has changed.
r<yy>	2-digit data revision: For the EUV monitor, the revision number will reflect if the EUV team has reprocessed the data that already were submitted to the SOC.
<descriptor>	A description of the data. Defined by the creator of the dataset. There are no underscores in the value.
.<ext>	File type extension: .fits, .txt, .cdf, .png (EUV will use cdf)
<level>	A code indicating the MAVEN processing level of the data, EUV will use l2 for the calibrated data and l3 for the modelled

Instrument name	<instrument>
EUV	euv
IUVS	iuv
NGIMS	ngi
LPW	lpw
MAG	mag
SEP	sep
SWIA	swi
SWEA	swe
STATIC	sta
PF package	pfp

Appendix C   Sample Bundle Product Label

This section provides a sample bundle product label. The example provided here is for the maven.euv.calibrated bundle.

```
<?xml version="1.0" encoding="UTF-8"?>
<?xml-model href="http://pds.nasa.gov/pds4/pds/v1/PDS4_PDS_1400.sch"
   schematypens="http://purl.oclc.org/dsdl/schematron"?>
<?xml-model href="http://pds.nasa.gov/pds4/mission/mvn/v1/PDS4_MVN_1040.sch"
   schematypens="http://purl.oclc.org/dsdl/schematron"?>
<Product_Bundle
   xmlns="http://pds.nasa.gov/pds4/pds/v1"
   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
   xmlns:mvn="http://pds.nasa.gov/pds4/mission/mvn/v1"
   xsi:schemaLocation="
      http://pds.nasa.gov/pds4/pds/v1
      http://pds.nasa.gov/pds4/pds/v1/PDS4_PDS_1400.xsd

      http://pds.nasa.gov/pds4/mission/mvn/v1
      http://pds.nasa.gov/pds4/mission/mvn/v1/PDS4_MVN_1040.xsd
   ">
   <Identification_Area>

<logical_identifier>urn:nasa:pds:maven.euv.calibrated</logical_identifier>
      <version_id>13.1</version_id>
      <title>MAVEN EUV Calibrated Data Bundle</title>
      <information_model_version>1.4.0.0</information_model_version>
      <product_class>Product_Bundle</product_class>
      <Citation_Information>
         <publication_year>2018</publication_year>
         <keyword>MAVEN EUV Calibrated</keyword>
         <description>
            This    bundle    contains    fully    calibrated    MAVEN    EUV    solar
irradiances in three instrument
            bandpasses. Provided by the EUV team in CDF files.
         </description>
      </Citation_Information>
      <Modification_History>
         <Modification_Detail>
            <modification_date>2019-02-15</modification_date>
            <version_id>13.1</version_id>
            <description>
               MAVEN    Release    16    (2019-02-15):    This    version    is    an
incremental release of the
               MAVEN  EUV  calibrated  data  bundle,  including  the  inital
release of the data
               covering 2018-08-15 through 2018-11-14. This version also
includes updates to
               the label files contents, and a revised version of the SIS.
            </description>
         </Modification_Detail>
         <Modification_Detail>
            <modification_date>2018-11-15</modification_date>
            <version_id>13.0</version_id>
            <description>
               MAVEN Release 15 (2018-11-15): This version includes a full
redelivery of the
```

```
                MAVEN EUV calibrated data bundle, including the initial
release of the data
                covering 2018-05-15 through 2018-08-14. Full coverage is
2014-10-18 to 2018-05-14.
                These data have been generated using the most recent
calibration.
            </description>
        </Modification_Detail>
        <Modification_Detail>
            <modification_date>2018-08-13</modification_date>
            <version_id>12.0</version_id>
            <description>
                MAVEN Release 14 (2018-08-15): This version includes a full
redelivery of the
                MAVEN EUV calibrated data bundle, including the initial
release of the data
                covering 2018-02-15 through 2018-05-14. Full coverage is
2014-10-18 to 2018-05-14.
            </description>
        </Modification_Detail>
        <Modification_Detail>
            <modification_date>2018-05-08</modification_date>
            <version_id>11.0</version_id>
            <description>
                MAVEN Release 13 (2018-05-15): This version includes a full
redelivery of the MAVEN
                EUV calibrated data bundle, including the initial release
of the data covering
                2017-11-15 through 2018-02-14. With revision 02 of version
11, an error in the
                flags has been corrected. In the previous revision data
during rapid slews of the
                spacecraft were incorrectly labelled as 'good solar data'
resulting in large spikes
                in the data during those slews. A rate of slew limit has
been incorporated in the
                flag criteria, correcting the problem. In addition, a
citation to the paper
                describing the EUV spectral model has been included in the
attributes. Full
                coverage is 2014-10-18 to 2018-02-14.
            </description>
        </Modification_Detail>
        <Modification_Detail>
            <modification_date>2018-02-15</modification_date>
            <version_id>10.0</version_id>
            <description>
                MAVEN Release 12 (2018-02-15): This version includes a full
redelivery of the MAVEN
                EUV calibrated data bundle, including the initial release
of the data covering
                2017-08-15 through 2017-11-14. Full coverage is 2014-10-18
to 2017-11-14.
            </description>
        </Modification_Detail>
        <Modification_Detail>
            <modification_date>2017-11-16</modification_date>
```

55

```
                <version_id>9.0</version_id>
                <description>
                    MAVEN  Release  11.  This  release  consists  of  the  initial
release of 2017-05-15 to
                    2017-08-14, plus the re-release of all previously released
data. These data have
                    be processed using new field-of-view, temperature-gain, and
degradation corrections.
                    The new FOV correction is based on a new technique of using
all off-points in addition
                    to  the  planned  FOV  map  maneuvers  to  determine  the  FOV
variability. This has allowed the
                    expansion of the useable pointing range so that some data
formerly flagged as "bad" for
                    pointing  reasons  are  now  flagged  as  "good"  data.  The
temperature-gain and degradation
                    correction  updates  are  improved  fits  to  the  calibration
changes tracked throughout the
                    mission.
                </description>
            </Modification_Detail>
            <Modification_Detail>
                <modification_date>2017-08-11</modification_date>
                <version_id>8.0</version_id>
                <description>
                    MAVEN Release 10 (2017-08-15): This version of the bundle
includes the following:
                    - the addition of corrected count rates
                    - the correction of a 1 second timing error associated with
the leap second at
                      2016-12-31T23:59:60
                    - correction of errors in the leap second and spacecraft
clock SPICE kernels
                      listed in the CDF headers and PDS labels
                    This release consists of a full re-release of the data from
2014-10-18 to
                    2017-02-04 and the initial release of 2017-02-15 to 2017-
05-14.
                </description>
            </Modification_Detail>
            <Modification_Detail>
                <modification_date>2017-05-12</modification_date>
                <version_id>7.0</version_id>
                <description>
                    MAVEN  Release  9  (2017-05-15):  These  data  have  been
regenerated to correct a CDF
                    leap  second  issue  that  appeared  in  the  2017  data.  This
includes a full redelivery
                    of  data  from  2014-10-18  to  2016-11-14  and  the  initial
delivery of 2016-11-15 to
                    2017-02-14.
                </description>
            </Modification_Detail>
            <Modification_Detail>
                <modification_date>2017-02-15</modification_date>
                <version_id>6.0</version_id>
                <description>
```

```
                        MAVEN   Release   8   (2017-02-15):   These   data   have   been
regenerated using an updated
                        calibration  including  a  new  correction  for  responsivity
variations due to
                        pointing within the instrument field-of-view, an improved
temperature-gain
                        correction,   and   an   improved   long-term   degradation
correction.
                </description>
            </Modification_Detail>
            <Modification_Detail>
                <modification_date>2016-11-15</modification_date>
                <version_id>5.0</version_id>
                <description>
                    MAVEN Release 7 (2016-11-15): This version includes a full
redelivery of the MAVEN
                    EUV calibrated data collection. In this version the data
files include an additional
                    field indicated the Sun to MAVEN distance.
                </description>
            </Modification_Detail>
            <Modification_Detail>
                <modification_date>2016-08-15</modification_date>
                <version_id>4.0</version_id>
                <description>
                    MAVEN Release 6 (2016-08-15): This version includes a full
redelivery of the MAVEN
                    EUV calibrated data collection. In this version the data
files include an additional
                    field indicated the Sun to MAVEN distance.
                </description>
            </Modification_Detail>
            <Modification_Detail>
                <modification_date>2016-05-11</modification_date>
                <version_id>3.0</version_id>
                <description>
                    MAVEN Release 5. This version includes a full redelivery of
the MAVEN EUV
                    Calibrated data collection which was generated using a new
version of the
                    EUV data generation software.
                </description>
            </Modification_Detail>
            <Modification_Detail>
                <modification_date>2016-02-16</modification_date>
                <version_id>2.0</version_id>
                <description>MAVEN Release 4</description>
            </Modification_Detail>
            <Modification_Detail>
                <modification_date>2015-11-06</modification_date>
                <version_id>1.2</version_id>
                <description>MAVEN Release 3</description>
            </Modification_Detail>
            <Modification_Detail>
                <modification_date>2015-08-17</modification_date>
                <version_id>1.1</version_id>
                <description>MAVEN Release 2</description>
```

```
            </Modification_Detail>
            <Modification_Detail>
                <modification_date>2015-05-15</modification_date>
                <version_id>1.0</version_id>
                <description>MAVEN Release 1</description>
            </Modification_Detail>
        </Modification_History>
    </Identification_Area>
    <Context_Area>
        <Time_Coordinates>
            <start_date_time>2014-10-18T00:00:00.000Z</start_date_time>
            <stop_date_time>2018-11-14T23:59:59.999Z</stop_date_time>
        </Time_Coordinates>
        <Primary_Result_Summary>
            <purpose>Science</purpose>
            <processing_level>Calibrated</processing_level>
            <Science_Facets>
                <domain>Magnetosphere</domain>
                <discipline_name>Flux Measurements</discipline_name>
            </Science_Facets>
        </Primary_Result_Summary>
        <Investigation_Area>
            <name>Mars Atmosphere and Volatile EvolutioN Mission</name>
            <type>Mission</type>
            <Internal_Reference>

<lid_reference>urn:nasa:pds:context:investigation:mission.maven</lid_referenc
e>
                <reference_type>bundle_to_investigation</reference_type>
            </Internal_Reference>
        </Investigation_Area>
        <Observing_System>
            <Observing_System_Component>
                <name>MAVEN</name>
                <type>Spacecraft</type>
                <Internal_Reference>

<lid_reference>urn:nasa:pds:context:instrument_host:spacecraft.maven</lid_ref
erence>
                    <reference_type>is_instrument_host</reference_type>
                </Internal_Reference>
            </Observing_System_Component>
          <Observing_System_Component>
                <name>Extreme Ultraviolet Monitor</name>
                <type>Instrument</type>
                <Internal_Reference>

<lid_reference>urn:nasa:pds:context:instrument:euv.maven</lid_reference>
                    <reference_type>is_instrument</reference_type>
                </Internal_Reference>
            </Observing_System_Component>
        </Observing_System>
        <Target_Identification>
                <name>Mars</name>
                <type>Planet</type>
                <Internal_Reference>
```

```
<lid_reference>urn:nasa:pds:context:target:planet.mars</lid_reference>

<reference_type>collection_to_target</reference_type>
                    </Internal_Reference>
            </Target_Identification>
             <Mission_Area>
                    <MAVEN xmlns="http://pds.nasa.gov/pds4/mission/mvn/v1">
                            <mission_phase_name>Transition</mission_phase_name>
                            <mission_phase_name>Prime
Mission</mission_phase_name>
                            <mission_phase_name>EM-1</mission_phase_name>
                            <mission_phase_name>EM-2</mission_phase_name>
                            <mission_phase_name>EM-3</mission_phase_name>
                    </MAVEN>
            </Mission_Area>
    </Context_Area>
    <Reference_List>
    </Reference_List>
    <Bundle>
        <bundle_type>Archive</bundle_type>
        <description>MAVEN EUV Calibrated Data Bundle</description>
    </Bundle>
   <File_Area_Text>
      <File>
          <file_name>readme_maven_euv_calibrated_13.1.txt</file_name>
          <local_identifier>Readme</local_identifier>
          <creation_date_time>2019-02-14T23:38:18</creation_date_time>
          <md5_checksum>53d8f857012f2503171d0cf9f7c7fe4e</md5_checksum>
             <comment>
                  This  file  contains  a  brief  overview  of  the  MAVEN  EUV
Calibrated Data bundle.
             </comment>
      </File>
      <Stream_Text>
          <name>readme_maven_euv_calibrated_13.1.txt</name>
          <local_identifier>Readme</local_identifier>
          <offset unit="byte">0</offset>
          <object_length unit="byte">10730</object_length>
          <parsing_standard_id>7-Bit ASCII Text</parsing_standard_id>
          <description>
             This file contains a brief overview of the MAVEN EUV Calibrated
Data bundle.
          </description>
          <record_delimiter>Carriage-Return Line-Feed</record_delimiter>
      </Stream_Text>
    </File_Area_Text>
    <Bundle_Member_Entry>

<lidvid_reference>urn:nasa:pds:maven.euv.calibrated:data.bands::13.1</lidvid_
reference>
        <member_status>Primary</member_status>
        <reference_type>bundle_has_data_collection</reference_type>
    </Bundle_Member_Entry>
    <Bundle_Member_Entry>

<lidvid_reference>urn:nasa:pds:maven.euv:document::1.4</lidvid_reference>
```

```
            <member_status>Secondary</member_status>
            <reference_type>bundle_has_document_collection</reference_type>
        </Bundle_Member_Entry>
</Product_Bundle>
```

Appendix D   Sample Collection Product Label

This section provides a sample collection product label. The example provided here is for the maven.euv.calibrated:data.bands collection.

```
<?xml version="1.0" encoding="UTF-8"?>
<?xml-model href="http://pds.nasa.gov/pds4/pds/v1/PDS4_PDS_1400.sch"
    schematypens="http://purl.oclc.org/dsdl/schematron"?>
<?xml-model href="http://pds.nasa.gov/pds4/mission/mvn/v1/PDS4_MVN_1040.sch"
    schematypens="http://purl.oclc.org/dsdl/schematron"?>
<Product_Collection
    xmlns="http://pds.nasa.gov/pds4/pds/v1"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xmlns:mvn="http://pds.nasa.gov/pds4/mission/mvn/v1"
    xsi:schemaLocation="
      http://pds.nasa.gov/pds4/pds/v1
      http://pds.nasa.gov/pds4/pds/v1/PDS4_PDS_1400.xsd

      http://pds.nasa.gov/pds4/mission/mvn/v1
      http://pds.nasa.gov/pds4/mission/mvn/v1/PDS4_MVN_1040.xsd
     ">
    <Identification_Area>

<logical_identifier>urn:nasa:pds:maven.euv.calibrated:data.bands</logical_ide
ntifier>
      <version_id>13.1</version_id>
      <title>MAVEN EUV calibrated irradiances Data Collection</title>
      <information_model_version>1.4.0.0</information_model_version>
      <product_class>Product_Collection</product_class>
      <Citation_Information>
         <publication_year>2018</publication_year>
         <description>
           MAVEN EUV calibrated irradiances in each of the three instrument
bandpasses (Watts/m**2)
         </description>
      </Citation_Information>
      <Modification_History>
         <Modification_Detail>
            <modification_date>2019-02-15</modification_date>
            <version_id>13.1</version_id>
            <description>MAVEN Release 16</description>
         </Modification_Detail>
      </Modification_History>
   </Identification_Area>
   <Context_Area>
      <Time_Coordinates>
         <start_date_time>2014-10-18T00:00:00.000Z</start_date_time>
         <stop_date_time>2018-11-14T23:59:59.999Z</stop_date_time>
      </Time_Coordinates>
      <Primary_Result_Summary>
         <purpose>Science</purpose>
         <processing_level>Calibrated</processing_level>
         <Science_Facets>
            <domain>Magnetosphere</domain>
            <discipline_name>Flux Measurements</discipline_name>
         </Science_Facets>
      </Primary_Result_Summary>
```

```
    <Investigation_Area>
        <name>Mars Atmosphere and Volatile EvolutioN Mission</name>
        <type>Mission</type>
        <Internal_Reference>

<lid_reference>urn:nasa:pds:context:investigation:mission.maven</lid_referenc
e>
            <reference_type>collection_to_investigation</reference_type>
        </Internal_Reference>
    </Investigation_Area>
    <Observing_System>
        <Observing_System_Component>
            <name>MAVEN</name>
            <type>Spacecraft</type>
            <Internal_Reference>

<lid_reference>urn:nasa:pds:context:instrument_host:spacecraft.maven</lid_ref
erence>
                <reference_type>is_instrument_host</reference_type>
            </Internal_Reference>
        </Observing_System_Component>
        <Observing_System_Component>
            <name>Extreme Ultraviolet Monitor</name>
            <type>Instrument</type>
            <Internal_Reference>

<lid_reference>urn:nasa:pds:context:instrument:euv.maven</lid_reference>
                <reference_type>is_instrument</reference_type>
            </Internal_Reference>
        </Observing_System_Component>
    </Observing_System>
    <Target_Identification>
        <name>Mars</name>
        <type>Planet</type>
        <Internal_Reference>

<lid_reference>urn:nasa:pds:context:target:planet.mars</lid_reference>
            <reference_type>collection_to_target</reference_type>
        </Internal_Reference>
    </Target_Identification>
    <Mission_Area>
        <MAVEN xmlns="http://pds.nasa.gov/pds4/mission/mvn/v1">
            <mission_phase_name>Transition</mission_phase_name>
            <mission_phase_name>Prime Mission</mission_phase_name>
            <mission_phase_name>EM-1</mission_phase_name>
            <mission_phase_name>EM-2</mission_phase_name>
            <mission_phase_name>EM-3</mission_phase_name>
        </MAVEN>
    </Mission_Area>
</Context_Area>
<Reference_List>

</Reference_List>
<Collection>
    <collection_type>Data</collection_type>
    <description>
```

```
            MAVEN EUV calibrated irradiances in each of the three instrument
bandpasses (Watts/m**2)
        </description>
    </Collection>
    <File_Area_Inventory>
        <File>
            <file_name>collection_data_l2_bands_13.1.csv</file_name>
            <creation_date_time>2019-02-15T06:06:29</creation_date_time>
            <file_size unit="byte">116526</file_size>
            <md5_checksum>57944f6d56c6e58a9332538c7352f36e</md5_checksum>
        </File>
        <Inventory>
            <offset unit="byte">0</offset>
            <parsing_standard_id>PDS DSV 1</parsing_standard_id>
            <records>1468</records>
            <record_delimiter>Carriage-Return Line-Feed</record_delimiter>
            <field_delimiter>Comma</field_delimiter>
            <Record_Delimited>
                <fields>2</fields>
                <groups>0</groups>
                <maximum_record_length unit="byte">257</maximum_record_length>
                <Field_Delimited>
                    <name>Member_Status</name>
                    <field_number>1</field_number>
                    <data_type>ASCII_String</data_type>
                    <maximum_field_length unit="byte">1</maximum_field_length>
                </Field_Delimited>
                <Field_Delimited>
                    <name>LIDVID_LID</name>
                    <field_number>2</field_number>
                    <data_type>ASCII_LIDVID_LID</data_type>
                    <maximum_field_length unit="byte">255</maximum_field_length>
                </Field_Delimited>
            </Record_Delimited>
            <reference_type>inventory_has_member_product</reference_type>
        </Inventory>
    </File_Area_Inventory>
</Product_Collection>
```

Appendix E   Sample Data Product Labels

This section provides sample product labels for the various data types described in this document.
The example provided here is from the maven.euv.calibrated:data.bands collection.

```
<?xml version="1.0" encoding="UTF-8"?>
<?xml-model href="http://pds.nasa.gov/pds4/pds/v1/PDS4_PDS_1400.sch"
     schematypens="http://purl.oclc.org/dsdl/schematron"?>
<?xml-model href="http://pds.nasa.gov/pds4/alt/v1/PDS4_ALT_1000.sch"
   schematypens="http://purl.oclc.org/dsdl/schematron"?>
<?xml-model href="http://pds.nasa.gov/pds4/particle/v1/PDS4_PARTICLE_1100.sch"
   schematypens="http://purl.oclc.org/dsdl/schematron"?>
<?xml-model href="http://pds.nasa.gov/pds4/mission/mvn/v1/PDS4_MVN_1040.sch"
   schematypens="http://purl.oclc.org/dsdl/schematron"?>
<Product_Observational
   xmlns="http://pds.nasa.gov/pds4/pds/v1"
   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
   xmlns:alt="http://pds.nasa.gov/pds4/alt/v1"
   xmlns:particle="http://pds.nasa.gov/pds4/particle/v1"
   xmlns:mvn="http://pds.nasa.gov/pds4/mission/mvn/v1"
   xsi:schemaLocation="
      http://pds.nasa.gov/pds4/pds/v1
      http://pds.nasa.gov/pds4/pds/v1/PDS4_PDS_1400.xsd

      http://pds.nasa.gov/pds4/alt/v1
      http://pds.nasa.gov/pds4/alt/v1/PDS4_ALT_1000.xsd

      http://pds.nasa.gov/pds4/particle/v1
      http://pds.nasa.gov/pds4/particle/v1/PDS4_PARTICLE_1100.xsd

      http://pds.nasa.gov/pds4/mission/mvn/v1
      http://pds.nasa.gov/pds4/mission/mvn/v1/PDS4_MVN_1040.xsd
 ">
   <Identification_Area>

<logical_identifier>urn:nasa:pds:maven.euv.calibrated:data.bands:mvn_euv_l2_b
ands_20181025</logical_identifier>
      <version_id>1.0</version_id>
      <title>MAVEN EUV calibrated irradiances</title>
      <information_model_version>1.4.0.0</information_model_version>
      <product_class>Product_Observational</product_class>
      <Citation_Information>
         <author_list>Eparvier, F. G.</author_list>
         <publication_year>2019</publication_year>
         <description>
            Extreme Ultraviolet (EUV) monitor calibrated irradiances in three
bandpasses: 17-22 nm,
            0-7 nm, and 121-122 nm  for 2018-10-25.
         </description>
      </Citation_Information>
      <Modification_History>
         <Modification_Detail>
            <modification_date>2019-02-05</modification_date>
            <version_id>1.0</version_id>
            <description>
               Initial version
            </description>
```

```
            </Modification_Detail>
        </Modification_History>
    </Identification_Area>
    <Observation_Area>
        <Time_Coordinates>
            <start_date_time>2018-10-25T00:00:00.000Z</start_date_time>
            <stop_date_time>2018-10-25T23:59:59.999Z</stop_date_time>
        </Time_Coordinates>
        <Primary_Result_Summary>
            <purpose>Science</purpose>
            <processing_level>Calibrated</processing_level>
            <Science_Facets>
                <domain>Magnetosphere</domain>
                <discipline_name>Flux Measurements</discipline_name>
            </Science_Facets>
        </Primary_Result_Summary>
        <Investigation_Area>
            <name>Mars Atmosphere and Volatile EvolutioN Mission</name>
            <type>Mission</type>
            <Internal_Reference>

<lid_reference>urn:nasa:pds:context:investigation:mission.maven</lid_referenc
e>
                <reference_type>data_to_investigation</reference_type>
            </Internal_Reference>
        </Investigation_Area>
        <Observing_System>
            <Observing_System_Component>
                <name>Mars Atmosphere and Volatile EvolutioN Mission</name>
                <type>Spacecraft</type>
                <Internal_Reference>

<lid_reference>urn:nasa:pds:context:instrument_host:spacecraft.maven</lid_ref
erence>
                    <reference_type>is_instrument_host</reference_type>
                </Internal_Reference>
            </Observing_System_Component>
            <Observing_System_Component>
                <name>Extreme Ultraviolet Monitor</name>
                <type>Instrument</type>
                <Internal_Reference>

<lid_reference>urn:nasa:pds:context:instrument:euv.maven</lid_reference>
                    <reference_type>is_instrument</reference_type>
                </Internal_Reference>
            </Observing_System_Component>
        </Observing_System>
        <Target_Identification>
            <name>Mars</name>
            <type>Planet</type>
            <Internal_Reference>

<lid_reference>urn:nasa:pds:context:target:planet.mars</lid_reference>
                <reference_type>data_to_target</reference_type>
            </Internal_Reference>
        </Target_Identification>
        <Mission_Area>
```

```
            <MAVEN xmlns="http://pds.nasa.gov/pds4/mission/mvn/v1">
                <mission_phase_name>EM-3</mission_phase_name>

<spacecraft_clock_start_count>0593697307</spacecraft_clock_start_count>

<spacecraft_clock_stop_count>0593783706</spacecraft_clock_stop_count>
            </MAVEN>
        </Mission_Area>
        <Discipline_Area>
            <Particle_Observation xmlns="http://pds.nasa.gov/pds4/particle/v1">
                <name>y: Irradiance</name>
                <description>Solar Irradiances, in W/m^2 Calibrated EUV irradiances
FOR Channels A (17-22 nm), B (0-7 nm), and C (121-122 nm)</description>
                <Primary_Values>
                    <Local_Internal_Reference>

<local_identifier_reference>data</local_identifier_reference>

<local_reference_type>particle_observation_to_observation_values</local_refer
ence_type>
                    </Local_Internal_Reference>
                </Primary_Values>
                <Axis_Values>
                    <Local_Internal_Reference>

<local_identifier_reference>epoch</local_identifier_reference>

<local_reference_type>particle_observation_to_axis_values</local_reference_ty
pe>
                    </Local_Internal_Reference>
                    <axis_number>1</axis_number>
                </Axis_Values>
                <Aligned_Values>
                    <Local_Internal_Reference>

<local_identifier_reference>ddata</local_identifier_reference>

<local_reference_type>particle_observation_to_aligned_values</local_reference
_type>
                    </Local_Internal_Reference>
                </Aligned_Values>
                <Aligned_Values>
                    <Local_Internal_Reference>

<local_identifier_reference>dfreq</local_identifier_reference>

<local_reference_type>particle_observation_to_aligned_values</local_reference
_type>
                    </Local_Internal_Reference>
                </Aligned_Values>
            </Particle_Observation>
            <Alternate_Values xmlns="http://pds.nasa.gov/pds4/alt/v1">
                <name>time values</name>
                <Data_Values>
                    <Local_Internal_Reference>

<local_identifier_reference>epoch</local_identifier_reference>
```

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```
<local_reference_type>data_values_to_data_values</local_reference_type>
            </Local_Internal_Reference>
          </Data_Values>
          <Data_Values>
            <Local_Internal_Reference>

<local_identifier_reference>time_unix</local_identifier_reference>

<local_reference_type>data_values_to_data_values</local_reference_type>
            </Local_Internal_Reference>
          </Data_Values>
        </Alternate_Values>
      </Discipline_Area>
    </Observation_Area>
    <Reference_List>
      <Internal_Reference>

<lidvid_reference>urn:nasa:pds:maven.spice:spice_kernels:lsk_naif0012.tls::1.
0</lidvid_reference>
        <reference_type>data_to_spice_kernel</reference_type>
        <comment>
          This data file was processed using the SPICE leapsecond kernel:
naif0012.tls.
        </comment>
      </Internal_Reference>
      <Internal_Reference>

<lidvid_reference>urn:nasa:pds:maven.spice:spice_kernels:sclk_mvn_sclkscet_00
063.tsc::1.0</lidvid_reference>
        <reference_type>data_to_spice_kernel</reference_type>
        <comment>
          This data file was processed using the SPICE MAVEN SCLK kernel:
MVN_SCLKSCET.00063.tsc.
        </comment>
      </Internal_Reference>
      <External_Reference>
        <doi>doi:10-1007/s 111214-015-0195-2</doi>
        <reference_text>
          Eparvier, F.G., Chamberlin, P.C., Woods, T.N. et al. Space Sci Rev
(2015) 195:293.
          doi:10.1007/s11214-015-0195-2
        </reference_text>
      </External_Reference>
      <External_Reference>
        <doi>doi:10.1002/2016JA023512</doi>
        <reference_text>
          Thiemann, E. M. B., P. C. Chamberlin, F. G. Eparvier, B. Templeman,
T. N.
          Woods, S. W. Bougher, B. M. Jakosky (2017), The MAVEN EUVM model of
solar
          spectral irradiance variability at Mars: Algorithms and results, J.
Geophys.
          Res. Space Physics, 122, doi:10.1002/2016JA023512.
        </reference_text>
      </External_Reference>
    </Reference_List>
```

```
    <File_Area_Observational>
      <File>
         <file_name>mvn_euv_l2_bands_20181025_v11_r04.cdf</file_name>
         <creation_date_time>2019-02-05T20:05:49</creation_date_time>
         <file_size unit="byte">6442999</file_size>
         <md5_checksum>b19be08445695036d2cdbc2ab5d0ab2a</md5_checksum>
      </File>
      <Header>
         <name>CDF Header</name>
         <offset unit="byte">0</offset>
         <object_length unit="byte">404</object_length>
         <parsing_standard_id>CDF 3.4 ISTP/IACG</parsing_standard_id>
      </Header>
      <Array>
         <name>y: Irradiance</name>
         <local_identifier>data</local_identifier>
         <offset unit="byte">10978</offset>
         <axes>2</axes>
         <axis_index_order>Last Index Fastest</axis_index_order>
         <description>Solar Irradiances, in W/m^2 Calibrated EUV irradiances
FOR Channels A (17-22 nm), B (0-7 nm), and C (121-122 nm) </description>
         <Element_Array>
            <data_type>IEEE754MSBSingle</data_type>
         </Element_Array>
          <Axis_Array>
            <axis_name>epoch</axis_name>
            <elements>86399</elements>
            <sequence_number>1</sequence_number>
         </Axis_Array>
          <Axis_Array>
            <axis_name>Channel</axis_name>
            <elements>3</elements>
            <sequence_number>2</sequence_number>
         </Axis_Array>
         <Special_Constants>
            <error_constant>-1.0E31</error_constant>
            <valid_maximum>1.0</valid_maximum>
            <valid_minimum>0.0</valid_minimum>
         </Special_Constants>
      </Array>
      <Array>
         <name>dy: Measurement Uncertainty</name>
         <local_identifier>ddata</local_identifier>
         <offset unit="byte">1075500</offset>
         <axes>2</axes>
         <axis_index_order>Last Index Fastest</axis_index_order>
         <description>Measurement    uncertainty    Measurement    Uncertainty
(precision) OF y values In % </description>
         <Element_Array>
            <data_type>IEEE754MSBSingle</data_type>
         </Element_Array>
          <Axis_Array>
            <axis_name>epoch</axis_name>
            <elements>86399</elements>
            <sequence_number>1</sequence_number>
         </Axis_Array>
          <Axis_Array>
```

```
            <axis_name>Channel</axis_name>
            <elements>3</elements>
            <sequence_number>2</sequence_number>
        </Axis_Array>
        <Special_Constants>
            <error_constant>-1.0E31</error_constant>
            <valid_maximum>1000.0</valid_maximum>
            <valid_minimum>0.0</valid_minimum>
        </Special_Constants>
    </Array>
    <Array>
        <name>dv: TOTAL Combined Uncertainty</name>
        <local_identifier>dfreq</local_identifier>
        <offset unit="byte">2113863</offset>
        <axes>2</axes>
        <axis_index_order>Last Index Fastest</axis_index_order>
        <description>TOTAL combined uncertainty TOTAL combined uncertainty
(accuracy) OF y values In % </description>
        <Element_Array>
            <data_type>IEEE754MSBSingle</data_type>
        </Element_Array>
         <Axis_Array>
            <axis_name>epoch</axis_name>
            <elements>86399</elements>
            <sequence_number>1</sequence_number>
        </Axis_Array>
         <Axis_Array>
            <axis_name>Channel</axis_name>
            <elements>3</elements>
            <sequence_number>2</sequence_number>
        </Axis_Array>
        <Special_Constants>
            <error_constant>-1.0E31</error_constant>
            <valid_maximum>1000.0</valid_maximum>
            <valid_minimum>0.0</valid_minimum>
        </Special_Constants>
    </Array>
    <Array>
        <name>flag: Data Useability</name>
        <local_identifier>flag</local_identifier>
        <offset unit="byte">3152203</offset>
        <axes>1</axes>
        <axis_index_order>Last Index Fastest</axis_index_order>
        <description>Data useability flag Data flag: 0=Good solar,
1=Occultation, 2=No pointing info, 3=Sun NOT fully In FOV, 4=Sun NOT In FOV,
5=Windowed, 6=Eclipse, 7=spare </description>
        <Element_Array>
            <data_type>SignedMSB2</data_type>
        </Element_Array>
         <Axis_Array>
            <axis_name>epoch</axis_name>
            <elements>86399</elements>
            <sequence_number>1</sequence_number>
        </Axis_Array>
        <Special_Constants>
            <error_constant>-32768</error_constant>
            <valid_maximum>7</valid_maximum>
```

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```
                <valid_minimum>0</valid_minimum>
            </Special_Constants>
        </Array>
        <Array>
            <name>x: Unix Time</name>
            <local_identifier>time_unix</local_identifier>
            <offset unit="byte">3326583</offset>
            <axes>1</axes>
            <axis_index_order>Last Index Fastest</axis_index_order>
            <description>Timestamps for each data point, in UNIX time UNIX time:
Number OF seconds elapsed since 1970-01-01/00:00:00 </description>
            <Element_Array>
                <data_type>IEEE754MSBDouble</data_type>
            </Element_Array>
             <Axis_Array>
                <axis_name>epoch</axis_name>
                <elements>86399</elements>
                <sequence_number>1</sequence_number>
            </Axis_Array>
            <Special_Constants>
                <error_constant>-1.0E31</error_constant>
                <valid_maximum>2.0E9</valid_maximum>
                <valid_minimum>1.0E9</valid_minimum>
            </Special_Constants>
        </Array>
        <Array>
            <name>Epoch Time</name>
            <local_identifier>epoch</local_identifier>
            <offset unit="byte">4019375</offset>
            <axes>1</axes>
            <axis_index_order>Last Index Fastest</axis_index_order>
            <description>CDF TT2000 time. Calculated using Berkeley SSL IDL tplot
package </description>
            <Element_Array>
                <data_type>SignedMSB8</data_type>
            </Element_Array>
             <Axis_Array>
                <axis_name>epoch</axis_name>
                <elements>86399</elements>
                <sequence_number>1</sequence_number>
            </Axis_Array>
            <Special_Constants>
                <error_constant>-0.0</error_constant>
                <valid_maximum>1.3712600958419273E-268</valid_maximum>
                <valid_minimum>1.509766378456986E-277</valid_minimum>
            </Special_Constants>
        </Array>
        <Array>
            <name>Sun distance</name>
            <local_identifier>maven_sun_distance</local_identifier>
            <offset unit="byte">4712534</offset>
            <axes>1</axes>
            <axis_index_order>Last Index Fastest</axis_index_order>
            <description>Sun distance from MAVEN Sun distance from MAVEN (km)
</description>
            <Element_Array>
                <data_type>IEEE754MSBDouble</data_type>
```

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```
            </Element_Array>
             <Axis_Array>
                <axis_name>epoch</axis_name>
                <elements>86399</elements>
                <sequence_number>1</sequence_number>
            </Axis_Array>
            <Special_Constants>
                <error_constant>-1.0E31</error_constant>
                <valid_maximum>2.5E8</valid_maximum>
                <valid_minimum>2.06E8</valid_minimum>
            </Special_Constants>
        </Array>
        <Array>
            <name>Counts</name>
            <local_identifier>counts</local_identifier>
            <offset unit="byte">5405189</offset>
            <axes>2</axes>
            <axis_index_order>Last Index Fastest</axis_index_order>
            <description>Counts Count rate with corrections applied for visible
light, dark offset, temperature, normalized gain, and field-of-view, in counts
per second </description>
            <Element_Array>
                <data_type>IEEE754MSBSingle</data_type>
            </Element_Array>
             <Axis_Array>
                <axis_name>epoch</axis_name>
                <elements>86399</elements>
                <sequence_number>1</sequence_number>
            </Axis_Array>
             <Axis_Array>
                <axis_name>Channel</axis_name>
                <elements>3</elements>
                <sequence_number>2</sequence_number>
            </Axis_Array>
            <Special_Constants>
                <error_constant>-1.0E31</error_constant>
                <valid_maximum>200000.0</valid_maximum>
                <valid_minimum>0.0</valid_minimum>
            </Special_Constants>
        </Array>
    </File_Area_Observational>
</Product_Observational>
```

Appendix F   PDS Delivery Package Manifest File Record Structures

The delivery package includes two manifest files: a transfer manifest, and MD5 checksum manifest. When delivered as part of a data delivery, these two files are not PDS archive products, and do not require PDS labels files. The format of each of these files is described below.

F.1   Transfer Package Directory Structure

Tar/gzip file directory structure will follow that used by the MAVEN SDC.

F.2   Checksum Manifest Record Structure

The checksum manifest consists of two fields: a 32 character hexadecimal (using lowercase letters) MD5, and a file specification from the root directory of the unzipped delivery package to every file included in the package. The file specification uses forward slashes ("/") as path delimiters. The two fields are separated by two spaces. Manifest records may be of variable length. This is the standard output format for a variety of MD5 checksum tools (*e.g.* md5deep, etc.).

Appendix G   PDS4 Labels for SEP CDF Data Files

This appendix describes the way that the metadata provided in the EUV PDS4 label files may be used to understand the internal physical and logical structure of the EUV data files, and how those labels may be used to access the data directly.

G.1 CDF Formatted Data Files

Common Data Format (CDF) is a self-describing data format for the storage of scalar and multidimensional data in a platform- and discipline-independent way. It has both library and toolkit support for the most commonly used platforms and programming languages. For the PDS archive, CDF files are required meet CDF-A specification with the PDS extensions [CDF-A]. In addition, the MAVEN mission includes other attributes in the CDF file as defined in the MAVEN archive CDF document [MAVEN CDF].

G.2   CDF and PDS4 Metadata

The PDS4 product label is an XML file that accompanies the CDF file. The PDS4 labels are designed to enable data users to read the CDF files without the use of a CDF reader or any awareness that the data are stored in a CDF file. Since the data consist of multiple data parameters (arrays) which have very specific relationships, the label describes both the physical structure of the data file, as well as the logical relationships between data parameters. This section describes the approach used to document both the physical structure and logical relationships.

G.2.1 PDS4 Label Structure

The PDS label is subdivided into a series of separate sections or "areas". Metadata describing the data parameters and their relationships are located in different areas of the label. Data parameters in the label are assigned a "local_identifier" and this identifier is referenced in the descriptions of the logical structure. A complete PDS4 label contains many areas. In this section we concentrate only on the areas which describe the physical structure and the logical relationships.

G.2.1.1   PDS Label Physical Structure Description

The physical structure of the data files are described in the "File_Area_Observational" portion of the label. Each data parameter is described using an "Array" object. The Array object contains location, data type, size, and descriptive information for each parameter. An "Axis_Array" object is provided for each axis of an array. Axis_Array includes an "axis_name" which is either set to the name of the CDF value associated with the axis or to the value "index" if the parameter is itself an independent variable. For each Array the "name" is the name assigned to the parameter ("variable" in CDF terms) in the CDF file. This is also assigned to "local_identifier" since a variable name is unique within a CDF. Figure 5 contains sample Array objects.

```
<Array>
   <name>y: Irradiance</name>
   <local_identifier>data</local_identifier>
   <offset unit="byte">10978</offset>
   <axes>2</axes>
   <axis_index_order>Last Index Fastest</axis_index_order>
   <description>Solar  Irradiances,  in  W/m^2  Calibrated  EUV  irradiances  FOR
Channels A (17-22 nm), B (0-7 nm), and C (121-122 nm) </description>
   <Element_Array>
      <data_type>IEEE754MSBSingle</data_type>
   </Element_Array>
   <Axis_Array>
      <axis_name>epoch</axis_name>
      <elements>86399</elements>
      <sequence_number>1</sequence_number>
   </Axis_Array>
   <Axis_Array>
      <axis_name>Channel</axis_name>
      <elements>3</elements>
      <sequence_number>2</sequence_number>
   </Axis_Array>
</Array>


.
.
.

<Array>
   <name>Epoch Time</name>
   <local_identifier>epoch</local_identifier>
   <offset unit="byte">4019375</offset>
   <axes>1</axes>
   <axis_index_order>Last Index Fastest</axis_index_order>
   <description>CDF TT2000 time. Calculated using Berkeley SSL IDL tplot package
</description>
   <Element_Array>
      <data_type>SignedMSB8</data_type>
   </Element_Array>
   <Axis_Array>
      <axis_name>epoch</axis_name>
      <elements>86399</elements>
      <sequence_number>1</sequence_number>
   </Axis_Array>
</Array>
```

Figure 5. Sample PDS4 Array objects.

G.2.1.1.2   Parameter Logical Relationships

The Discipline_Area may contain objects which are specific to a discipline. The logical relationships of parameters is often specific to the types of observations, so is described in the Discipline_Area.

The Alternate_Values object is used to indicate arrays which are functionally interchangeable. Note that this does not mean that the arrays are equivalent, only that they serve the same function. For example, this object may be used to associate multiple time arrays included in a data file. An Alternate_Values object contains a series of Data_Values objects which reference arrays by Local_Internal_Reference. Each of the Data_Values array within a single Alternate_Values must have the same dimensions. Figure 6 contains a sample Alternate_Values object. The Alternate_Values object is defined in the "alt" discipline schema (LID = urn:nasa:pds:system_bundle:xml_schema:alt-xml_schema).

```
<Alternate_Values xmlns="http://pds.nasa.gov/pds4/alt/v1">
   <name>time values</name>
   <Data_Values>
      <Local_Internal_Reference>
         <local_identifier_reference>epoch</local_identifier_reference>
         <local_reference_type>data_values_to_data_values</local_reference_type>
      </Local_Internal_Reference>
   </Data_Values>
   <Data_Values>
      <Local_Internal_Reference>
         <local_identifier_reference>time_unix</local_identifier_reference>
         <local_reference_type>data_values_to_data_values</local_reference_type>
      </Local_Internal_Reference>
   </Data_Values>
</Alternate_Values>
```

Figure 6. Sample Alternate_Values object

The Particle_Observation class describes the relationship between (typically multi-dimensional) data arrays and other arrays that are associated with an axis or axes of the data array. The Primary_Values object identifies the primary data array. The Axis_Values object associates an array with a single axes of the primary data array. The Aligned_Values object associates two arrays of the same dimensionality and axis definitions. Each "primary", "axis", and "aligned" array is referenced using the local_identifier attribute of a Local_Internal_Reference. Figure 19 contains a sample Particle_Observation object. The schema for the Particle_Observation object is defined in the "particle" discipline schema (LID =
urn:nasa:pds:system_bundle:xml_schema:particle-xml_schema).

```
<Particle_Observation xmlns="http://pds.nasa.gov/pds4/particle/v1">
   <name>y: Irradiance</name>
   <description>Solar Irradiances, in W/m^2 Calibrated EUV irradiances FOR Channels
A (17-22 nm), B (0-7 nm), and C (121-122 nm)</description>
   <Primary_Values>
      <Local_Internal_Reference>
         <local_identifier_reference>data</local_identifier_reference>

<local_reference_type>particle_observation_to_observation_values</local_reference_ty
pe>
      </Local_Internal_Reference>
   </Primary_Values>
   <Axis_Values>
      <Local_Internal_Reference>
         <local_identifier_reference>epoch</local_identifier_reference>

<local_reference_type>particle_observation_to_axis_values</local_reference_type>
      </Local_Internal_Reference>
      <axis_number>1</axis_number>
   </Axis_Values>
   <Aligned_Values>
      <Local_Internal_Reference>
         <local_identifier_reference>ddata</local_identifier_reference>

<local_reference_type>particle_observation_to_aligned_values</local_reference_type>
      </Local_Internal_Reference>
   </Aligned_Values>
   <Aligned_Values>
      <Local_Internal_Reference>
         <local_identifier_reference>dfreq</local_identifier_reference>

<local_reference_type>particle_observation_to_aligned_values</local_reference_type>
      </Local_Internal_Reference>
   </Aligned_Values>
</Particle_Observation>
```

Figure 7. Sample Particle_Observation object