European Space Agency

Research and Science Support Department
Planetary Missions Division

Huygens-DISR

NASA PDS and ESA PSA Interface Control Document

[HP-DISR-EAICD-1]

Version 1.1

Prepared by: Charles (Chuck) See

Instrument PI: Martin Tomasko

PDS Interface: Lyle Huber

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1. Introduction

1.1 Purpose and Scope

The EAICD (Experimenter to Archive Interface Control Document) describes the data and documentation from the Descent Imager and Spectral Radiometer (DISR) instrument (aboard the Huygens Probe) that was submitted to the European Space Agency (ESA) Planetary Science Archive (PSA) and the National Aeronautics and Space Agency (NASA) Planetary Data System (PSA) archive.

1.2 Contents

This document describes the archived data volume and data flow of the DISR instrument on the Huygens Probe. It includes information on how data were processed, formatted, labeled and uniquely identified. The document discusses general naming schemes for data volumes, data sets, data and label files. Standards used to generate the product are explained.

1.3 Intended Readership

The staff of archiving authority (Planetary Data System for NASA, Planetary Science Archive for ESA) design team and any potential user of the DISR data.

1.4 Applicable Documents

The DISR archive has been generated under PDS version: PDS3, and the Planetary Science Data Dictionary used was the Online database: PSDCAT1R90, Generated Tue Jul 9 11:07:03 2013, Version: OPS.

1.5 Relationships to Other Interfaces

This document completely describes the DISR data and documentation as submitted to the NASA PDS and ESA PSA. In the event that there is any conflict between this document and any other Cassini or Huygens data archiving document regarding the DISR archive volume, this document will take precedence.

1.6 Acronyms and Abbreviations

ASCII = American Standard Code for Information Interchange
DCT = Discrete Cosine Transformation
DDB = Descent Data Broadcast
DISR = Descent Imager/Spectral Radiometer
DLIS = Downward-looking Infrared Spectrometer
DLV = Downward-looking Violet Photometer
DLVS = Downward-looking Visible Spectrometer
DTWG = Descent Trajectory Working Group
EAICD = Experimenter to Archive Interface Control Document
ESA = European Space Agency
ESOC = European Space Operation Center
HRI = High Resolution Imager
IR = Infrared Wavelengths
ITAR = International Traffic and Arms Regulations
JPL = Jet Propulsion Laboratory
MRI = Medium Resolution Imager
NASA = National Aeronautics and Space Administration
N/A = not applicable or not available
PDF = Adobe Acrobat Format Documents
PDS = Planetary Data System
PNG = Portable Network Graphics
PSA = Planetary Science Archive
SLI = Side-Looking Imager
SSL = Surface Science Lamp
T0 = time in the mission when pyros fire and the DDB is reset to 0
ULIS = Upward-looking Infrared Spectrometer
ULV = Upward-looking Violet Photometer
ULVS = Upward-looking Visible Spectrometer
XDR = External Data Representation Standard

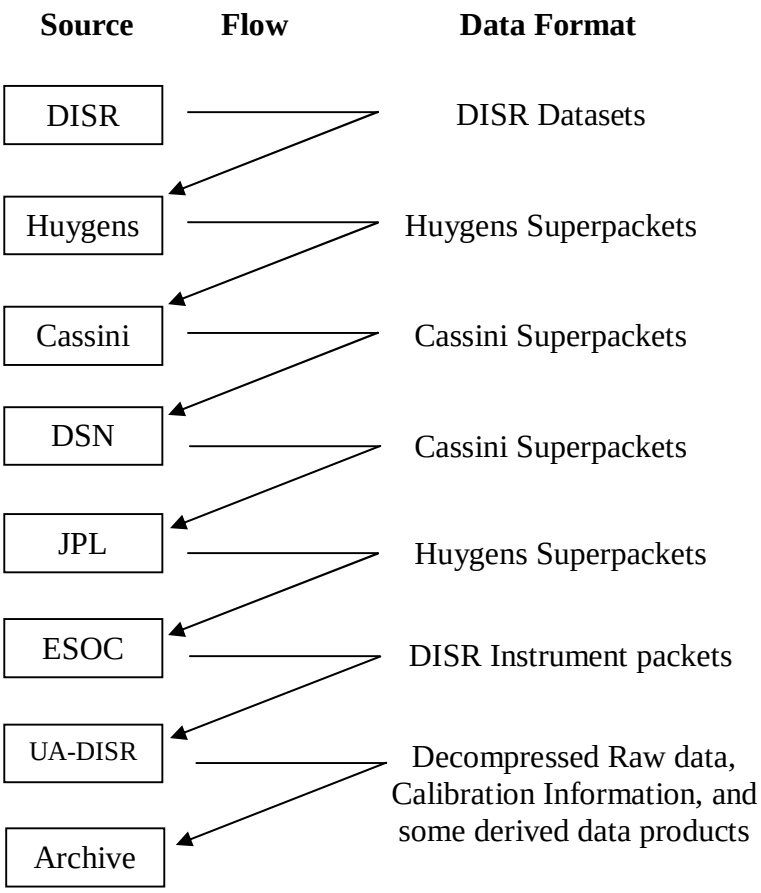
1.7 Contact Names and Addresses

Name	Affiliation	Phone	Email Address
Marty Tomasko	DISR	+1 520 621-6969	mtomasko2@gmail.com
Lyn Doose	DISR	+1 520 621-2127	ldoose@lpl.arizona.edu
Chuck See	DISR	+1 520 621-1097	csee@lpl.arizona.edu
Lyle Huber	PDS	+1 505 646-1862	lhuber@nmsu.edu
Sheila Chatterjee	JPL	+1 818 393-0924	sheila.chatterjee@jpl.nasa.gov
Nicolas Altobelli	ESA	+34 91 813 1201	nicolas.altobelli@sciops.esa.int
Jean-Pierre Lebreton	ESA	+31 71 565-3600	Jean-Pierre.Lebreton@rssd.esa.int

2. Overview of Process and Product Generation

The following chart describes the data flow from the Cassini spacecraft to the archive.

DISR Data Flow



DISR data was first processed on-board by the flight software. Various operations were performed (depending on the source of the data) to group the data into DISR data sets. This is explained in greater detail in the Experiment Users Manual (in the DOCUMENT folder called EXP_USERS_MANUAL_REV_C.PDF). For more information see also SP1177.PDF (in the DOCUMENTS folder) and Space Science Reviews 104: 469-551, 2002.

A data set is a single exposure of a single data product (data products are as defined in this document). A data cycle is a grouping of a set of measurements associated with a science goal. Thus, a group of data sets comprises a data cycle, which constitutes an organized group of measurements in close proximity of time and altitude (also called a Descent Cycle). These sets were

formatted into telemetry packets and delivered to the probe for transmission on one or both of the Huygens Probe's telemetry streams.

The Huygens Probe transmitted the data to the Cassini Orbiter, which relayed the data to the ground (via the DSN). The combined telemetry streams were delivered to ESOC, where they were distributed to the DISR team at the University of Arizona.
At the University of Arizona the telemetry was processed to reconstruct DISR data sets, which are expressed as data numbers.

The data provided is at the 1b level, defined 'as data that have been sorted by instrument data types and instrument modes. Data are in scientifically useful form, such as images or individual spectra. These data are still uncalibrated'. DISR includes the raw data from the data stream converted into ASCII files when appropriate, some data converted to physical units, and data interpretation documentation (calibration documents, users guides, white papers, etc.).

Thus, the archive contains the decompressed data numbers and calibration information. The calibration reports contain all information necessary to obtain calibrated physical data. For detailed information see also SP1177.PDF (in the DOCUMENTS folder) and Space Science Reviews 104: 469-551, 2002.

Individuals involved in the generation of DISR data products are listed below, along with their responsibilities and office numbers in the Kuiper Space Sciences Building (#92) at the University of Arizona, Tucson Arizona.

Name	Room #	Responsibility
Marty Tomasko	233	PI
Lyn Doose	239	Co-I
Bashar Rizk	213	Co-I
Chuck See	214	Engineering Operations
Mike Bushroe	235C	Telemetry Processing
Lisa McFarlane	235D	Analysis and Documentation
Steffi Engel	212	Data Analysis
Andrew Eibl	219	Data Analysis
Mike Prout	237	Management

2.1 Pre-Flight Data Products

The DISR raw calibration data is included in the EXTRAS section of the archive as: HIGHER_ORDER_PRODUCTS\DISR3_CALIBRATION_DATA. The volume includes all the flight unit (DISR 03) lab calibration data from 1996, plus a couple of additional tests run on flight spare optics in 2001. A companion document which further describes the data is in the same directory as: "DISR Lab Calibration Data Archive Companion Document".

For the most part all pre-flight data is stored in External Data Representation (XDR) formatted files.

2.2 Sub-System Tests

All relevant Sub-System Test data appear in the calibration reports or white paper summaries. No additional Sub-system data are included. Instrument level tests which target subsystem performance are included in the calibration (see section 2.1) and In-flight test data described in section 2.5.

2.3 Instrument Calibrations

The DISR PI will deliver calibration documents that clearly describe how to calibrate the raw data, approximately one per major instrument system. There is a calibration document for each major system listed below:

1) Imagers
2) Infrared Spectrometers
3) Solar Aureole
4) Sun Sensor
5) Surface Science Lamp
6) Violet Photometers
7) Visible Spectrometers and,
8) Calibration Standard

The instrument's calibration data is discussed in section 2.1

2.4 Other Files written during Calibration

The calibration reports and white paper summaries will contain all information necessary to obtain calibrated data. See section 2.1 for discussion of the calibration data.

2.5 In-Flight Data Products

The EXTRAS directory contains "In-Flight" test data collected from the time the instrument was installed on the Huygens Probe (October 1996) until the Titan Encounter (January 2005). There is also a companion document which describes this data ("DISR In-Flight Test Data Archive Companion Document"), which is co-located with the data. The relevant archive directory is: EXTRA\HIGHER_ORDER_PRODUCTS\DISR_IN-FLIGHT_DATA.

For the most part all pre-flight data is stored in External Data Representation (XDR) formatted files.

2.6 Titan Encounter Data Products

Encounter Data is organized as per the following categories and converted to ASCII, with the exception of the images. The images are available in 8 bit PNG format (in the BROWSE directory), and as 16 bit TIFF and XDR images in the DATA directory. Also available in the DATA directory are ASCII tables containing the pixel intensities for each DISR image. The BROWSE PNG images are enlarged (x2), rotated and stretched for easier general viewing and access.

Data Product	Type	Comments
BROWSE	Image object	Portable Network Graphic (PNG) representations of the individual descent images
CCD_DARK_DATA	Text object	Dark (covered column) CCD exposures for each data cycle, used to determine the measurement offset.
DERIVED_DATA_PRODUCTS	Multiple Table objects	Tables of the spectrum measured during the descent in physical units [W/(sqm-u-sr)], with certain prescribed assumptions.
DESCENT_CYCLES	Text object	Header information for an entire cycle that is found nowhere else.
HIGHER_LEVEL_DATA	Image object	Panoramic mosaics of the descent created from the DISR images.
HOUSEKEEPING	Text object	Engineering data describing the internal function of the instrument and provide temperatures that are needed for calibration.
IMAGERS	Image object & Table object	Contains images of three main different types and sizes (High Resolution HRI: 160 by 256, Medium Resolution MRI: 176 by 256, Side Looking SLI: 128 by 256)
IR_SPECTROMETER	Multiple Table objects	Infrared spectra (either the uplooking ULIS, downlooking DLIS or both in one)
LAMP	Text object	Information about the internal calibration lamps and the surface science lamp (SSL).
SLI_STRIP	Table object	A vertical strip from the right and left side of the side looking Imager (2 by 254).
SOLAR_AUREOLE	Table object	Solar Aureole data (24 or 4 by 50) divided into 4 channels (blue and red polarized horizontally and vertically)
SUN_SENSOR	Table object	Sun Sensor data (three time pulses and an amplitude, to determine spin rate, solar azimuth and solar zenith angles).
TIME	Table object	Clock values (2 by 20) comparing probe mission time to DISR internal time.

VIOLET_PHOTOMETER	Table object	Violet Photometer (either uplooking ULV or downlooking DLV). A single number.
VISIBLE_EXTRA_COLUMNS	Table object	Reference measurements of stray light used with the visible data (always 2 by 200)
VISIBLE_SPECTROMETER	Table object	Visible Spectra (either uplooking ULVS: always 2 by 200; or downlooking DLVS: variable by 200)

2.7 Software

No special software is needed since the data is provided in ASCII form or in industry standard TIFF or PNG files and the calibration documents do not require software. All information that is necessary to obtain calibrated data are provided in the calibration reports or white paper summaries. No special software is required to use the calibration documents or white paper summaries.

The DISR instrument calibration reports contain complete descriptions of each instrument detector system, the calibration data, methods, and algorithms for converting the instrument data numbers into physical units and intensities into data numbers.

Reduced mean intensities over the field of view (FOV) are provided for the spectrometers. However for the broad band instruments (imagers, SA camera) the mean intensity over the FOV is not a useful number since the spectral variation is important, and the bandpass changes significantly during the descent. It is felt that the best scientific approach is to create models which reproduce data numbers rather than mean intensities.

In general generic calibration software is not available. Some lines of code exist as examples in the calibration reports. A collection of Interactive Data Language (IDL) source code that was used by the DISR team to interpret the data has been added to the EXTRAS directory as:

EXTRAS\HIGHER_ORDER_PRODUCTS\IDL_PROGRAMS

Also in included in this directory are a companion document ("DISR Data Software Companion Document") and additional support documentation.

Interpretation of the DISR data is model dependent and selection of the model parameters (i.e. atmospheric composition, intensity spectrum, surface reflectance, variation over the field of view) is key in deciphering the data. The scientist is encouraged to develop their own software to explore the physical interpretations of the DISR data.

2.8 Documentation

The calibration reports or white paper summaries contain all information necessary to obtain calibrated data. Calibration reports for each major DISR system are provided in Adobe Acrobat PDF format with incorporated tables and figures as follows: 1) Imagers; 2) Solar Aureole; 3) Sun Sensor; 4) Surface Science Lamp; 5) Calibration Standard. White paper summaries will be provided in Adobe Acrobat PDF format with incorporated tables and figures for the following: 1) Infrared; 2) Violet; 3) Violet flux; 4) Visible. Most of the documents are also available in MS-Word and ASCII format.

The folder CALIBRATION_STANDARD contains the following three reports:

1) CALIBRATION_STANDARD_REVIEW, deals primarily with the monochrometer used in the absolute calibration of the DISR;
2) DARK_CURRENT, explains the method for determining dark current at a given time;
3) INTEGRATING_SPHERE_HOMOGENEITY, explores the uniformity of the light used for calibration.

Other helpful documents include:
DOCINFO.TXT: Describes all the documents in this section;
EAICD.PDF: This document;
EXP_USERS_MANUAL_REV_C.PDF: Provides a detailed description of the DISR instrument (including, e.g., Science Overview, Instrument Overview, Operations, Instrument Commands, Software Architecture, Buffer Allocations, Bit Numbering, Telemetry Formats, etc. This document also provides an explanation of housekeeping information, e.g., ccd_flag, proc_flag, etc);
HEADER_DESCRIPTION.PDF: Provides a description of the information that is associated with each data file in the header of the data;
IR_SW_AND_DATA_COLLECTION.DOC: Provides a detailed explanation of the organization of the infrared data (including locations of shutter time, sample time, operation time, region, rotation, etc.).
The DISR_DATA_USERS_GUIDE is a top level guide for using the archived DISR data, and should be a first read for anyone using the volume.

The structure of the document section is shown below, and later in this document.

| - DOCUMENT
| - BIBLIOGRAPHY
| - DISR_CALIBRATION_DOCUMENTS
| - CALIBRATION_STANDARD
| - CALIBRATION_STANDARD_REVIEW
| - DARK_CURRENT
| - INTEGRATING_SPHERE_HOMOGENEITY
| - IMAGERS
| - INFRARED_SPECTROMETERS
| - IR_SPECTROMETER_CAL_DOC
| - IR_SPECTROMETER_CAL_NOTES
| - SLI_STRIPS
| - SOLAR_AUREOLE
| - SUN_SENSOR
| - SURFACE_SCIENCE_LAMP
| - VIOLET_PHOTOMETERS
| -VIOLET_FLUX_DETERMINATION
| -VIOLET_PHOTOMETER_CAL_DOC
| - VISIBLE_SPECTROMETERS
| -VISIBLE_SPECTROMETER_CALDOC
| -VISIBLE_SPECTROMETER_CAL_NOTES
| - DISR SUPPORTING DOCUMENTS
| - DISR_DATA_USERS_GUIDE
| - EAICD
| - ESA_SP1177
| - DISR_INSTRUMENT
| - SUNLIGHT_PENETRATION_MODEL
| - EXPERIMENT_USERS_MANUAL
| - HEADER_DESCRIPTION
| - SPACE_SCIENCE_REVIEW
| - DOCINFO.TXT

2.9 Derived and other Data Products

The DATA/DERIVED_DATA_PRODUCTS directory contains the average intensity over the field of view (in Watts/(m2-u-sr)) for the violet, visible and infrared systems, both upward looking, and downward looking.

The DATA/HIGHER_LEVEL_DATA directory contains mosaic presentations of the DISR images provided as posters.

Derived data products and schedules in support of the Descent Trajectory Working Group are presented in the DTWG archive.

3. Archive Format and Content

3.1 Format and Conventions

3.1.1 Deliveries and Archive Volume Format

The original DISR data was released to the archive on 15 July 2006. The proprietary period extended for 18 months after the descent, and thus expired on 14 July 2007.

The first major revision to the DISR data archive is being submitted to the NASA PDS (with copy to the ESA PSA) in January 2014. It includes updated image files, and substantial improvement in documentation. Also, many minor format and syntax errors were corrected.

DISR delivers the data to the PDS archive in electronic form and the archiving authority writes the physical volumes.

3.1.2 Data Set ID Formation

HP-SSA-DISR-2/3-EDR/RDR-V1.1

<Huygens Probe>-<Saturn Satellite>-<Descent Imager Spectral Radiometer>-<Level 2 is raw data>-<Experiment Data Record>-<version 1.1>

We provide Level 2 data as defined in the table below:

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

3.1.3 Data Directory Naming Convention

The subdirectories will be named according to the data product. Data products are listed in section 2.5 of this document.

3.1.4 File Naming Convention

The DISR archive data filenames are made up of a 6 character (or less) file type descriptor (i.e. IMAGE), followed by 4 numerical digits containing the sequential dataset sequence number, followed by a 5 digit number containing the mission time in seconds after T0, followed by the letter 'S' to denote 'seconds', followed by either a 3 digit number conveying the starting altitude of the observation in kilometers (followed by _KM) for observations above 10 km, or a 4 digit number corresponding to the altitude in meters (followed by _M) for observations below 10 km, all followed by the appropriate 3 character file extension as described below. Here are some examples of DISR filenames (for each data type).

```
1) DARK_0001_00191_S_140_KM.TAB
2) DCYCLE_0058_07063_S_8116_M.TXT
3) HKEEPN_0060_08811_S_0269_M.TXT
4A) IMAGE_0402_05765_S_017_KM.TAB
4B) IMAGE_0402_05765_S_017_KM.TIF
4C) IMAGE_0402_05765_S_017_KM.XDR
5) IR_0109_06738_S_011_KM.TAB
6) LAMP_0030_01985_S_060_KM.TXT
7) SOLAR_0100_06530_S_012_KM.TAB
8) STRIP_0173_04090_S_030_KM.TAB
9) SUN_0001_00265_S_137_KM.TAB
10) TIME_0099_04022_S_030_KM.TAB
11) VIOLET_0446_08872_S_0000_M.TAB
12) VIS_EX_0001_00143_S_143_KM.TAB
13) VISIBL_0001_00143_S_143_KM.TAB      (26.3)

In browse:  PNGIMG_0002_00144_S_143_KM.PNG
```

<data type>_<sequence number>_<mission time in sec>_S_<altitude in km or m>_<M or KM>.<ext>

For the file extensions .TAB refers to a table, .TXT refers to ASCII text, .PNG refers to portable network graphics, .TIF refers to Tagged Image File format and .XDR is a eXternal Data Representation file. The maximum length for a DISR dataset is 30 characters (26+'.'+3).

3.2 Standards Used in Data Product Generation

3.2.1 PDS Standards

We intend to comply with the PDS standards to the extent as defined in this document.

3.2.2 Time Standards

All start times are referenced to the probe on-board software mission time, T0. DISR mission time is synchronized to the Huygens probe mission timer T0.
An exception to this is for the first couple of message data products (which are generated before synchronization and are relative to when DISR was turned on. These first few messages are time stamped, and the offset is later measured. Mission time is measured to one ten-thousandth of a second (0.1 ms).

3.2.3 Reference Systems

DISR derives azimuth information from the Sun Sensor instrument subsystem. The azimuth is measured relative to the sun in the instantaneous plane of the probe and is thus labeled an apparent solar azimuth angle. Positive spin (or azimuth) is Counterclockwise as viewed from above (Zenith).

All angles are measured within a right-handed system aligned to the Huygens Probe system, which is defined in the EID, Part A. Quoting from Issue 1, Rev 0, Sect. 3.1, page 3: "The Probe axes form a right-handed orthogonal system Xp, Yp, Zp that is fixed relative to the Probe geometry. The Probe Reference Frame has the same orientation as the Orbiter Reference Frame (i.e., no tilt angle). The -Xp axis is pointing along the Probe centerline towards the nose of the Probe. The –Zp axis is pointing in the direction of the top SED strut. The origin of the Probe Reference Frame is on the lower side of the experiment platform (i.e., the side facing the Probe nose)." See the DISR Archive Users' Guide for further information.

The DISR mechanical system within which the apparent solar azimuth angle above is measured, is aligned to the Huygens Probe system described above but the origin of the DISR system is displaced from that of the Huygens system.

3.2.4 Other Applicable Standards

N/A

3.3 Data Validation

The internal validation of the scientific content will be performed by the science team. All DISR packets include Cyclic Redundancy Check codes. Packets with invalid codes are discarded. We will ensure data values are in the expected range and are valid numbers.
We agree to a peer review of the EAICD by a committee chaired by the Project Scientist and the PSA manager and consisting of the members of the HSWT, members of the DISR team and PSA and PDS personnel and to abide by their recommendations within the resources available.

3.4 Content

3.4.1 Volume Set

The DISR data set will be part of the Huygens Volume Set.

3.4.2 Data Set

All of the raw DISR data products (listed in section 2.5 of this document) will be combined to form one data set.

3.4.3 Directories

ROOT

| - BROWSE
|| - PNG
| - CATALOG
|| - CATINFO.TXT
|| - DATASET.CAT
|| - DISRINST.CAT
|| - INST_HOST.CAT
|| - MISSION.CAT
|| - PERSON.CAT
|| - REF.CAT
|| - (SOFT.CAT)
|| - (TARGET.CAT)

| - DATA
|| - CCD_DARK_DATA
|| - DERIVED_DATA_PRODUCTS
||| - DLIS
||| - DLV
||| - DLVS
||| - ULIS
||| - ULV
||| - ULVS
|| - DESCENT_CYCLES
|| - HIGHER_LEVEL_DATA
||| - POSTERS
|| - HOUSEKEEPING
|| - IMAGER
||| - TABLE_FORMAT
||| - TIFF_FORMAT
||| - XDR_FORMAT
|| - IR_SPECTROMETER
|| - LAMP
|| - SLI_STRIP
|| - SOLAR_AUREOLE
|| - SUN_SENSOR
|| - TIME
|| - VIOLET_PHOTOMETER
|| - VISIBLE_EXTRA_COLUMNS
|| - VISIBLE_SPECTROMETER

| - DOCUMENT
|| - BIBLIOGRAPHY
|| - DISR_CALIBRATION_DOCUMENTS
||| - CALIBRATION_STANDARD
|||| - CALIBRATION_STANDARD_REVIEW
|||| - DARK_CURRENT
|||| - INTEGRATING_SPHERE_HOMOGENEITY
||| - IMAGERS
||| - INFRARED_SPECTROMETERS
|||| - IR_SPECTROMETER_CAL_DOC
|||| - IR_SPECTROMETER_CAL_NOTES
||| - SLI_STRIPS
||| - SOLAR_AUREOLE
||| - SUN_SENSOR
||| - SURFACE_SCIENCE_LAMP
||| - VIOLET_PHOTOMETERS
|||| -VIOLET_FLUX_DETERMINATION
|||| -VIOLET_PHOTOMETER_CAL_DOC
||| - VISIBLE_SPECTROMETERS
|||| -VISIBLE_SPECTROMETER_CALDOC
|||| -VISIBLE_SPECTROMETER_NOTES
|| - DISR SUPPORTING DOCUMENTS
||| - DISR_DATA_USERS_GUIDE
||| - EAICD
||| - ESA_SP_1177
|||| - DISR_INSTRUMENT
|||| - SUNLIGHT_PENETRATION_MODEL
||| - EXPERIMENT_USERS_MANUAL
||| - HEADER_DESCRIPTION
||| - SPACE_SCIENCE_REVIEW
|| - DOCINFO.TXT

| - EXTRAS
|| - HIGHER_ORDER_PRODUCTS
||| - DISR3_CALIBRATION_DATA
|||| - DISR3_CAL
|||| - DISR_LAB_CAL_DATA_DOC
||| - DISR_IN-FLIGHT_DATA
|||| - DF3
|||| - DISR_IN-FLIGHT_TEST_DOC
||| - DISR_XDR_DATA
|||| - 14JAN05
|||| - DISR_XDR_DATA_DOC
||| - IDL_PROGRAMS
|||| - SOFTWARE_SUPPORT_DOCUMENTS
|||| - SOURCE_CODE
|||| - DISR_IDL_CODE_DOC
|| - IMAGE_ELEMENTS
||| - DARK_CURRENT_IMAGES
|||| - PGM
|||| - TABLE_FORMAT
||| - IMPROVED_FLAT_FIELDS
|||| - PGM
|||| - TABLE_FORMAT
||| - ON-BOARD_FLAT_FIELDS
||| - RAW_IMAGES
|||| - PGM
|||| - TABLE_FORMAT
||| - SQRT_TABLES
|| - MOSAICS
||| - MOSAICS_PNG
||| - MOSAICS_PPM
|| - MOVIES
||| - NARRATION_SCRIPTS
||| - TECH_MOVIE
||| - TITAN_DESCENT_MOVIE
|| - POSTERS
|| - PROBE_ATTITUDE
||| - DATA_AT_SOLAR_CROSSING
||| - HUYGENS_DESCENT_PARAMETERS
|| - PROCESSED IMAGES
||| - DISRSOFT_E_IMAGES
||| - DISRSOFT_G_IMAGES
||| - UNSMOOTHED_IMAGES
|| - RENDERINGS

| - INDEX
|| - INDEXINFO.TXT
|| - INDEX.LBL
|| - INDEX.TAB
| - AAREADME.TXT
| - ERRATA.TXT
| - VOLDESC.CAT

3.4.3.1 Root Directory

AAREADME.TXT	Volume Contents and format info in ASCII text format.
ERRATA.TXT	Cumulative listing of updates for all DISR volumes published thus far.
VOLDESC.CAT	Description of volume contents in a PDS format.

3.4.3.2 Calibration Directory

There is no Calibration Directory. All of the calibration information is contained in the DOCUMENT directory. There detailed calibration reports are provided for all the DISR Science sub=instruments, and calibration standard as follows: 1) Imagers; 2) Side Looking Imager Strips, 3) Infrared Spectrometers; 4) Solar Aureole Camera; 5) Sun Sensor; 6) Surface Science Lamp; 7) Violet Photometer; 8) Visible Spectrometers and; 9) Calibration Standard.

3.4.3.3 Catalog Directory

CATINFO.TXT	ASCII description of the contents of this directory.
DATASET.CAT	Data set catalog object.
DISRINST.CAT	Instrument catalog object.
INST_HOST.CAT	Space craft catalog object (to be provided by ESA)
MISSION.CAT	Mission catalog object (to be provided by the Cassini Project)
PERSON.CAT	Listing of personnel involved in data production.
REF.CAT	References (published literature) catalog object.
SOFT.CAT	Information about the DISR software.
TARGET.CAT	For Titan, provided by the NASA PDS

3.4.3.4 Index Directory

Index table of all label files this archive.

3.4.3.5 Browse Directory and Browse Files

We provide Thumbnails of all images in slightly modified raw form, in PNG format. The files are same images as are in the Image directory, but converted to 8 bit PNG format, enlarged by a factor of two and stretched for easy viewing. The directory contains about 600 images.

3.4.3.6 Geometry Directory

There is no Geometry Directory. Geometry data is included in the instrument calibration reports.

3.4.3.7 Software Directory

N/A - There is no Software Directory in the DISR archive. No generic calibration software is available, although there are samples of Interactive Data Language (IDL) source code that was used by the DISR team to interpret the data added to the EXTRAS directory.

3.4.3.8 Gazetteer Directory

N/A - There are no named features at this time.

3.4.3.9 Label Directory

There is no Label Directory. Label files are located with their targets in the DATA and DOCUMENT directories. The Index table shows the location of all label files.

3.4.3.10 Document Directory

Documents are provided in Adobe PDF format. In most cases MS Word and ASCII files are also available. The Calibration Reports are located in the Document directory. Other documents included in this directory are the DISR EAICD, Header Description, Users Manual, mission description documents and Bibliography.

3.4.3.11 Extras Directory

The Extras Directory contains eight subdirectories:

1) HIGHER_ORDER_PRODUCTS: Contains calibration and In-Flight cruise data from the instrument, along with the raw Titan descent data in its original eXternal Data Representation (XDR) form, plus some of the Interactive Data Language (IDL) source code that was used by the DISR team to interpret the data . Companion documents are supplied that explain the contents of each directory.
2) IMAGE_ELEMENTS: A collection of the DISR images, and supporting elements (dark current model, flat fields, square root compression tables, etc) created by Erich Karkoschka as an improvement on the original reconstruction of the images. All elements are in PDS format.
3) MOSAICS: Assemblages of the DISR images to create views of Titan's surface. Filenames with numbers represent the resolution in meters/pixel (i.e. 4.png is a mosaic with 4 m/pixel resolution). These depictions were made using FORTRAN by Erich Karkoschka. The other 3 files (HIGH..., MEDIUM..., & TITAN.PNG) are earlier, hand made mosaics.
4) MOVIES: Two types of movies inhabit this directory. The Titan Descent Movies are an extension of Erich's mosaic work. There are sequenced frames of mosaics at increasingly higher resolution (starting out with frames which orient the viewer from the Mees Solar Observatory). A detailed description exists in the TITAN_DESCENT_MOVIE directory (TITAN_DESCENT_MOVIE.TXT). The Narration Scripts also describe these movies. The Tech Movie combines all of the DISR data into one graphic dynamic display (with sound). A detailed description exists in the TECH_MOVIE directory as DESCRIPTION_OF_TECH_MOVIE.TXT.
5) POSTERS: This directory contains a variety of views of Titans surface as seen by the Huygens probe during the descent. Various projections at distinct altitudes are presented. There is more detailed description in the file TITAN_POSTERS_DESCRIPTION.
6) PROBE_ATTITUDE: Measurements of the sun's position, and movement of features on Titan's surface allowed us to make of estimates of the Huygens probe's attitude and position during the descent. This information is provided in tabular form in this directory.
7) PROCESSED_IMAGES: The individual images taken by the DISR are presented in this directory with 3 levels of processing. The most basic (Unsmoothed Images) just have camera defects removed. The next step (E-Images) includes compressor artifact removal and some smoothing, while the G-Images also have geometric distortions removed and are photometrically normalized.
8) RENDERINGS: Movies of stereographic renderings of Titan's surface created by USGS using the DISR images.

3.4.3.12 Data Directory

The data directory will is organized according to the directory levels as listed in section 2.5 of this document.

4. Detailed Interface Specifications

4.1 Structure and Organization Overview

See preceding section.

4.2 Data Product Design

The data products will be in ASCII format, with the exception of the Image and Image_Display which will be in TIFF & PNG format. Software will not be provided. There are often several types of data files within each data product type (such as with a different number of columns). The following lists each data product type, followed by a brief description, with dimensions shown in parentheses where appropriate. For more specific details see the disrinst.cat, the Experiment Users Manual or the Space Science Reviews paper listed in the Bibliography.

1) Dark: Dark exposures for each data cycle (2 by 256) are from 4 adjacent columns on the CCD covered by an opaque coating. The first dark column is DN values for columns 7 and 8 summed, and the second dark column is DN values for columns 9 and 10 summed.
2) Descent: Header information for an entire cycle that is found nowhere else. Lists cycle types, start times, etc. The predicted_altitude entry is from real-time data and is not necessarily correct. See section 4.8 for discussion of the available altitude information.
3) Hkeeping: Engineering data to check the internal function of the instrument. This is the only place where some types of temperature data exist (e.g. Electronics Assembly (EA) or Optics temperature specifically).
4) Image: Contains images of three main different types and sizes (HRI: 160 by 256 pixels, MRI: 176 by 256, SLI: 128 by 256). In addition, some images can be half this size, that is the number of columns by 128 (or half of 256 rows). The top and bottom row are copies of adjacent rows as the total number of rows needed to be a multiple of 16 to work with the data compressor. These will be provided in TIFF and ASCII table format. Data will be in DN and will include exposure time.
5) Ir: Infrared spectra, either the ULIS (2 by 150), DLIS (2 by 150) or IR combined (24 by 150). Data will be a table of DN and will include sufficient information to compute effective exposure times.
6) Lamp: Current and Voltage Information about the internal calibration lamps and the SSL.
7) Solar: Solar Aureole data (24 or 4 by 50) divided into 4 channels (blue and red horizontal and vertical). The 4 by 50 array is summed within each of the 4 channels. Data will be in DN and will include exposure time.
8) Strip: A vertical strip from the right and left side of the SLI Imager (2 by 254). Data will be in DN and will include exposure time.
9) Sun: Sun Sensor data (three time pulses and an amplitude). Pulse time is in seconds, amplitude is in DN. There are three slits in the Sun Sensor, and so as the image of the sun crosses the slit, one pulse per slit. This data is used to determine the azimuth and rotation rate of the probe, as well as the zenith angle of the sun. There are a variable number of measurements in a file.
10) Time: Time values (2 by 20) comparing probe mission time to DISR internal time. It is used to record the correlation between mission time from the probe that is sent to DISR in the probe

broadcast messages and the master time which is kept by a hardware clock. Broadcast time is mission time from the DDB in 0.0001 second increments from the beginning of the mission. The master time corresponds to mission time and is also in 0.0001 second increments. Since the DISR is powered-on post T0, the broadcast time from the probe is always the larger value.

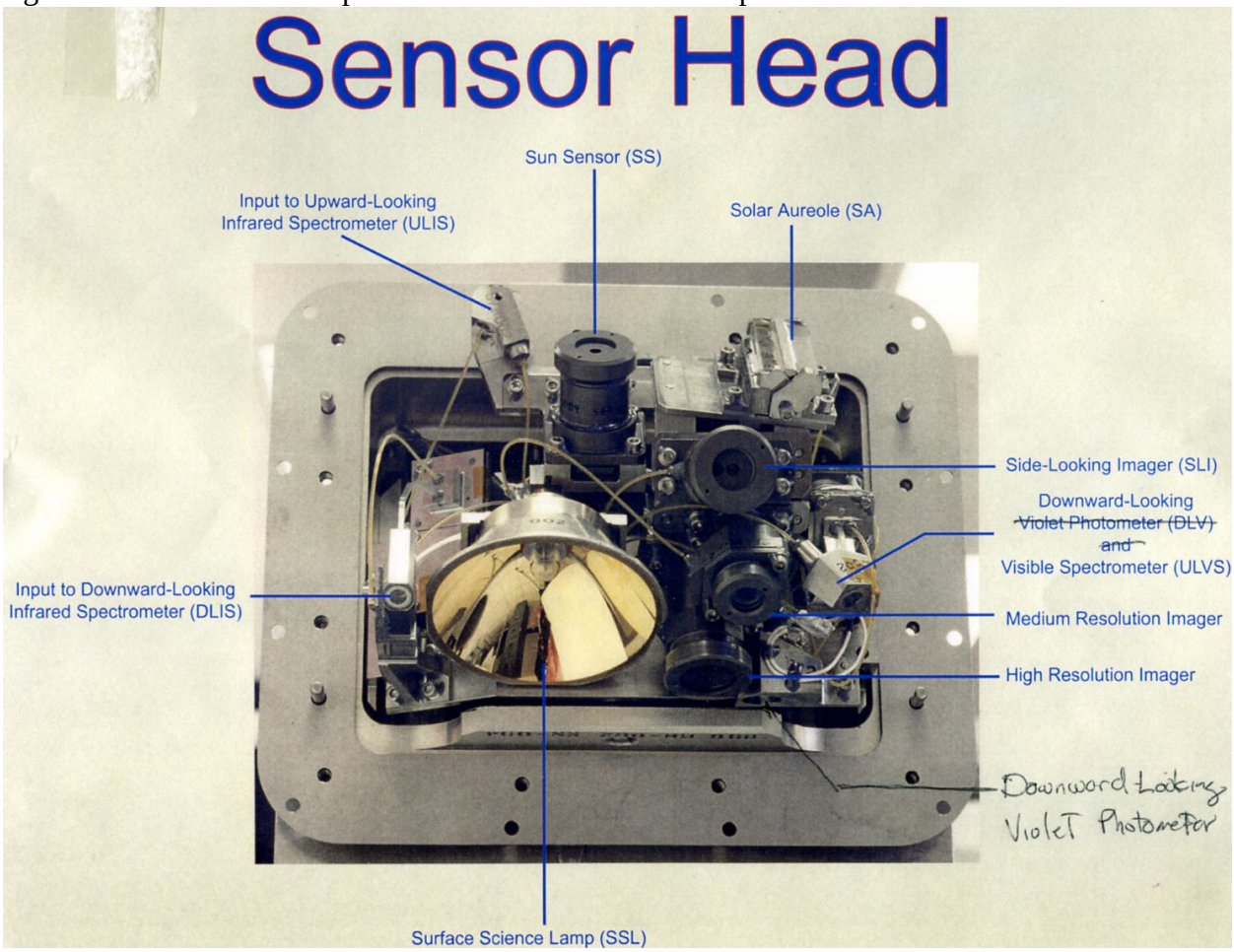
11) Violet: Violet Photometer (either ULV or DLV). A single number. data will be in DN. The violet photometers are instruments that are reading continuously, so there is no exposure time or integration time.
12) Visible: Visible Spectra (either ULVS: always 2 by 200; or DLVS: 2, 5, 10 or 20 by 200). For DLVS, the 20 by 200 is unsummed. Otherwise, 10, 5 and 2 adjacent columns are summed for arrays with 2, 5 and 10 DLVS columns. Data will be in DN and will include exposure time.
13) Visible_Ext: Reference measurements of scattered light used with the visible data. This measures instrument crosstalk. This uses otherwise unused columns between the ULVS/DLVS and DLVS/Imagers. The dimensions are always 2 by 200. Data will be in DN and will include exposure time.

In the Browse directory: Image_Display contains the same files as the Image directory, but converted to 8 bit PNG format enlarged (x2) and stretched.

Two other DATA subdirectories contain derived data products as describe in section 2.9, above.

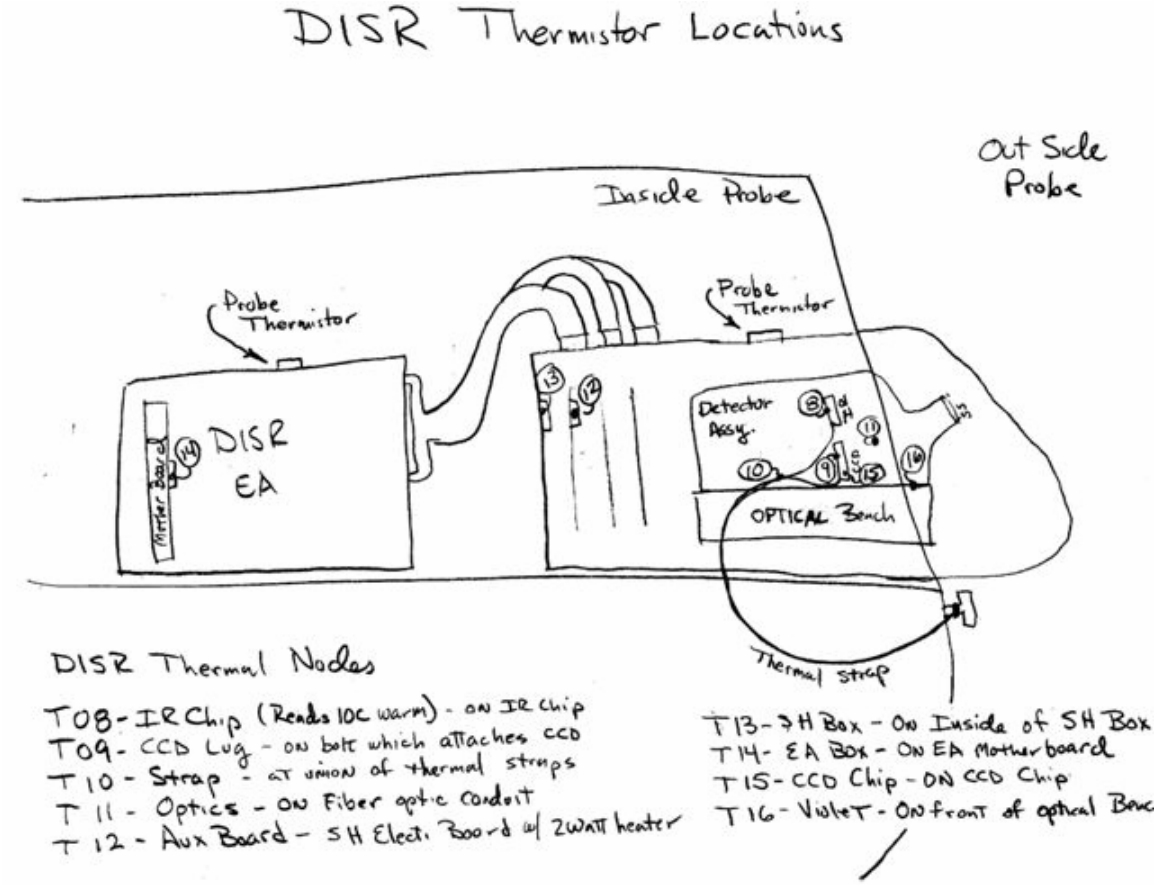
4.3 Location of DISR Sub-Instruments

The picture below shows the location of the optics for the DISR sub-instruments. In general the signal is carried from the optics to the detectors via fiber optics.



4.4 Instrument Temperature (Thermistor Reading) Description

Some of the labels include a temperature array, referred to as the keyword INSTRUMENT_TEMPERATURE. The following is a description of each of the positions within this array, referred to as INSTRUMENT_TEMPERATURE_POINT. Location of the temperature sensors is shown below:



ccd_t1	CCD Chip - On edge of CCD chip (part of the chip).
ref_t2	Near CCD chip - MPAE reference.
irb_t3	IR Chip, beginning - Near the thermal strap to detector lug (biased +10C)*
ire_t4	IR Chip, ending - Near the thermal strap to detector lug (biased +10C)*
ccdlug_t5	CCD Lug - Where the thermal strap meets the CCD.
strap_t6	Strap - At strap split (IR/CCD), near DISR Strap Heater (not powered).
optics_t7	Optics - On fiber optic conduit, about 1/3 way from CCD to Optics.
violet_t8	Violet - Towards the Front of the optical bench, near cover (cooler).
sh_aux_t9	Aux Board - On SH Aux. Circuit Card, near heater (not powered).
sh_box_t10	SH Box - On Sensor Head (SH) back cover (facing EA), warm part of SH.
ea_box_t11	EA Box - In Electronics Ass'y (EA), on Motherboard (warm, lags housing)

* The IR temperatures (thermistor readings) in this keyword is too high by +10 K because of the sensor bias. Note that these are all thermistor readings and **not** calibrated temperatures.

4.5 Solar Aureole Columns, Rows, Filters, and Polarization

For DISR#3 the correspondence between columns and rows in a Solar Aureole data set and a Full data set are as follows:

Rows 0:49 in a Solar Aureole data set correspond to rows 204:253 in a Full data set.

SA data set columns	0:5	6:11	12:17	18:23
Full data set columns *	40:45	31:36	23:28	14:19
Filter	Blue	Blue	Red	Red
Polarization	Horizontal	Vertical	Vertical	Horizontal

* refers to full CCD output used during calibration; not applicable to Titan descent

4.6 Description of Possible values for DETECTOR_ID keyword

Keyword DETECTOR_ID is used to distinguish between sub-instrument detectors (or readout formats) when they co-exist in a data directory. Below is a list of the possible values for this keyword for DISR.

```
"UHH":      The Upper Half of the High resolution imager.
"UHM":      The Upper Half of the Medium resolution imager.
"UHS":      The Upper Half of the Side-looking imager.
"LHH":      The Lower Half of the High resolution imager.
"LHM":      The Lower Half of the Medium resolution imager.
"LHS":      The Lower Half of the Side-looking imager.
"DLV":      The Downward Looking Violet photometer.
"ULV":      The Upward Looking Violet photometer.
"DLIS":     The Downward Looking Infrared Spectrometer.
"ULIS":     The Upward Looking Infrared Spectrometer.
"IR_COMB":  The InfraRed spectrometers Combined, up and down in one dataset.
"IR_LONG":  The InfraRed spectrometers with LONG integration time.
"STRIP":    The side looking imager STRIP measurement.
"SA":       The Solar Aureole camera.
"NS_DLVS":  The Near Surface Downward Looking Visible Spectrometer format.
"DLVS":     Downward Looking Visible Spectrometer.
"ULVS":     Upward Looking Visible Spectrometer.
"DARK"      CCD covered pixel DARK current data.
"MRI":      Medium Resolution Imager, (176 by 256 pixels).
"SLI":      Side-Looking Imager, (128 by 256 pixels).
"HRI":      High Resolution Imager (160 by 256 pixels).
"DLVS_EX":  EXtra columns from the Downward Looking Visible Spectrometer.
"ULVS_EX":  EXtra columns from the Upward Looking Visible  Spectrometer.
```

See also MEASUREMENT_TYPE

4.7 Description of Possible values for DESCENT_CYCLE_NAME

DESCENT_CYCLE_NAME is found in the Descent dataset labels. It is also known as Cycle Type. It is an indicator of the type of measurement set that the dataset belongs to. Descent Cycles are time and altitude based groupings of measurements aimed to a set science goal.

Cycle Type #	Descent Cycle Name
1	STANDARD_NON-IMAGE
2	STANDARD_IMAGE
3	FLAT_FIELD
4	CAL_CYCLE_A
5	CAL_CYCLE_B
6	CAL_CYCLE_C
7	UNDEFINED
8	DARK_CURRENT_ONLY
9	SPECTROPHOTOMETRIC
10	DRAIN_CYCLE
11	HIGH_NEAR_SURFACE
12	MEDIUM_NEAR_SURFACE
13	LOW_NEAR_SURFACE
14	VERY_LOW_NEAR_SURFACE
15	SURFACE_A
16	SURFACE_B
17	SURFACE_C
18	SURFACE_D

4.8 Other Label Elements or Keywords

4.8.1 PRODUCT_ID

In general the product id for each DISR dataset follows the form:

*type_number*_MTIME_*mission time*_DISR, where

type_number is the dataset type, such as SOLAR or IMG, and *mission time* is the mission time at the start of the observation in hours_minutes_seconds_ten thousandths of a second. For example: "IMG_01033_MTIME_03_12_14_7773_DISR" is image #1033, taken at mission time 3 hours, 12 minutes and 14.7773 seconds after T0.

4.8.2 SEQUENCE_NUMBER

The sequence number is a unique sequential integer number given to a dataset when it is generated. Thus the first dataset (of each type) generated after power is applied to the instrument is 0001 (i.e. the first Image taken is IMAGE_0001, the second is IMAGE_0002, etc). The dataset's sequence number is reported in the Label file as a 4 digit integer (i.e. 0001).

4.8.3 SPACECRAFT_CLOCK_START_COUNT & ..._STOP_COUNT

Observations are time tagged using the DISR clock, which is referenced to the Huygens probe timer. Offsets are recorded in the DISR time datasets (\DATA\TIME). The times presented in this keyword are the beginning of the observation exposure and the end of the observation exposure. The Descent Data Broadcast (DDB) time is in seconds after the Huygens parachute deployment (aka T0).

4.8.4 EXPOSURE_DURATION

Exposure duration for the CCD instruments (Imagers, Solar Aureole and Visible Spectrometers) is the time (in milliseconds) between the time the CCD is 'cleared' until the charge is transferred to the memory zone (i.e. the amount of time charge is allowed to accumulate on the CCD image area). It is analogous to the shutter open time on a standard camera.

For the IR spectrometer the exposure time is azimuth based and must be determined from the data tables, as described in the Users' guide (see Section 1.4).

4.8.5 EXPOSURE_TYPE

Depending on the epoch, during the descent (mission time, altitude, descent cycle, etc.) exposure times are either manually selected (i.e. preprogrammed into the flight software) or automatically (dynamically) selected by the flight software (automatic).

In general observation exposures are automatically determined based on the data accumulation rate (i.e. DN/second) experienced by prior exposures at the same azimuth relative to the Sun for the same type of observation (image, SA, Ir, etc). For the CCD instruments (Imagers, Visible Spectrometer, Solar Aureole Camera) the software targets the mean exposure to be half of the saturation limit, while simultaneously limiting the number of pixels that are saturated (to less than a few percent). For the IR system the collection of samples into azimuth bins relative to the Sun are optimized in the auto-exposure case. Only for a few descent cycles (calibration, etc) are the exposures fixed.

The EXPOSURE_TYPE element conveys whether the data exposure times are dynamically determined (AUTO) or pre-set in the flight software (MANUAL).

4.8.6 SPACECRAFT_ALTITUDE_START & SPACECRAFT_ALTITUDE_END

These keywords report the probe's altitude in kilometers above the Huygens landing site (assuming a 2575 km spherical body), at the beginning of the observation and at the end of the observation. These values are based on the Descent Trajectory Working Group's (DTWG) reconstruction from June of 2011.

4.8.7 PREDICTED_ALTITUDE

The real-time altitude (km) as predicted by the Huygens probe and relayed to the instrument via the Descent Data Broadcast (DDB). It is off by more than 10 km at some altitudes (see section 4.8.6), but was the information used by the DISR flight software to make observation decisions.

4.8.8 AZIMUTH_START & AZIMUTH_END

The direction the instrument is viewing relative to the sun's position in the sky at the beginning and end of the observation. The angle is defined as the direction of the instrument's bore-sight vector (i.e. the direction it is looking) relative to the vector from the sub-instrument point to the sun, with both vectors projected on a plane tangent to the surface at the sub-instrument point. The angle is counter clockwise positive, viewed from above (from zenith), in keeping with the intended rotation direction of the Huygens probe. These values are from the descent reconstruction performed by Erich Karkoschka in March 2013, and are similar to 1% of the values published in PSS in 2007 (Karkoschka).

4.8.9 AZIMUTH_NORTH_START & AZIMUTH_NORTH_END

The direction the instrument is viewing relative to North at the beginning and end of the observation. This angle is defined as the direction of the instrument's bore-sight vector (i.e. the direction it is looking) relative to the planets positive spin vector (RHR), with both vectors projected on a plane tangent to the surface at the sub-instrument point. It is positive clockwise, viewed from above, as in a compass heading. Same source as 4.8.8.

4.8.10 SPIN_RATE

The approximate average spin rate over the time of the observation, in Revolutions Per Minute (RPM). It is derived from a functional fit of the instantaneous spin rate, calculated from changes in azimuth (from the same source as 4.8.8). The sense of the rotation is counterclockwise (CCW), positive (viewed from above) in keeping with the original spin intention of the probe. The spin rate is important in deciphering the sense of the azimuth change (and thus viewing direction) during the observation.

4.8.11 ROTATIONS

The number of probe rotations during the observation is based on the average spin rate (see 4.8.10). It is important for observations with long exposure times (such as the IR measurements) in order to trace the azimuth history. Its direction is the same as the spin, CCW positive as viewed from Zenith. One rotation (or revolution) is 360 degs or 2π radians.

4.8.12 SPIN_RATE_START & SPIN_RATE_END

In contrast with the SPIN_RATE described in section 4.8.10, these keywords contain our best reconstructed values for the instantaneous spin rate at the start and end of the observation (in RPM), derived from the azimuth information described in section 4.8.8. The sense is CCW positive as viewed from above. This information is valuable in determining azimuthal smear of the observation.

4.8.13 HYUGENS:EW_TILT_ANGLE_START and ..._END

The tilt of the Huygens probe spin axis at the start and end of the observation in the east/west direction. The tilt is measured relative to the Zenith vector in the east/west, latitudinal plane in degrees. Positive tilt is defined as the spin vector being East of Zenith (i.e. the parachute being east of the probe).

4.8.14 LAMP_STATE

The DISR instrument has 3 on-board incandescent calibration lamps (used to check the detectors), and one 20 watt external lamp (designed to observe Titan's surface). The LAMP_STATE keyword conveys the state (on vs. off) for each of these 4 lamps. The four characters presented are binary indicators, one for each lamp in the order: Cal#1, Cal#2, Cal#3, & SSL (Surface Science Lamp).

The calibration lamps are all used together during the 4 calibration cycles executed during the descent. The LAMP_STATE when the 3 calibration lamp are on (and the SSL off) is: "1110". The SSL is turned on when the probe altitude is below about 600 meters. When the SSL is on (and the calibration lamps are off) the LAMP_STATE is "0001".

4.8.15 NULL_PIXEL_2 & NULL_PIXEL_3

Readout of covered pixels on the CCD chip which are needed to determine the dark current offset for the observation. During the observation, the flight software averages the values of covered CCD columns 2 & 3, multiplies the result by 4 and transmits that as the values for NULL_PIXEL_2 & NULL_PIXEL_3. Their use in determining the dark current offset is described in section 5.7 of the DISR Archive Users' Guide (in the DOCUMENTS section of the archive).

4.8.16 NATIVE_START_TIME & NATIVE_STOP_TIME

These are the same as the SPACECRAFT_CLOCK_START_COUNT and SPACECRAFT_CLOCK_STOP_COUNT. See section 4.8.3.

4.8.17 MEASUREMENT_TYPE

MEASUREMENT_TYPE distinguishes between directional view, and readout formats for the DISR's sub-instruments. Below is a list of the possible values for this keyword. See the Users' Guide for more details.

```
"UHH":      The Upper Half of the High resolution imager.
"UHM":      The Upper Half of the Medium resolution imager.
"UHS":      The Upper Half of the Side-looking imager.
"LHH":      The Lower Half of the High resolution imager.
"LHM":      The Lower Half of the Medium resolution imager.
"LHS":      The Lower Half of the Side-looking imager.
"DLV":      The Downward Looking Violet photometer.
"ULV":      The Upward Looking Violet photometer.
"DLIS":     The Downward Looking Infrared Spectrometer.
"ULIS":     The Upward Looking Infrared Spectrometer.
"IR_COMB":  The InfraRed spectrometers Combined, up and down in one dataset.
"IR_LONG":  The InfraRed spectrometers with LONG integration time.
"STRIP":    The side looking imager STRIP measurement.
"SA":       The Solar Aureole camera.
"NS_DLVS":  The Near Surface Downward Looking Visible Spectrometer format.
"DLVS":     Downward Looking Visible Spectrometer.
"ULVS":     Upward Looking Visible Spectrometer.
"DARK"      CCD covered pixel DARK current data.
"MRI":      Medium Resolution Imager, (176 by 256 pixels).
"SLI":      Side-Looking Imager, (128 by 256 pixels).
"HRI":      High Resolution Imager (160 by 256 pixels).
"DLVS_EX":  EXtra columns from the Downward Looking Visible Spectrometer.
"ULVS_EX":  EXtra columns from the Upward Looking Visible  Spectrometer.
```

5.0 Sample Labels

5.1 DARK LABEL

```
PDS_VERSION_ID                = PDS3
LABEL_REVISION_NOTE           = "Thu Jan 09 23:28:28 2014 <UTC>, C. See"

RECORD_TYPE                   = FIXED_LENGTH
RECORD_BYTES                  = 25
FILE_RECORDS                  = 257

^HEADER                       = ("DARK_0001_00191_S_140_KM.TAB",1)
^TABLE                        = ("DARK_0001_00191_S_140_KM.TAB",2)

DATA_SET_ID                   = "HP-SSA-DISR-2/3-EDR/RDR-V1.1"
PRODUCT_ID                    = "DARK_0001_MTIME_00_03_10_5941_DISR"
SEQUENCE_NUMBER               = 0001
PRODUCT_CREATION_TIME         = 2014-01-09T23:28:28 /*UTC*/

MISSION_NAME                  = "CASSINI-HUYGENS"
INSTRUMENT_HOST_NAME          = "HUYGENS PROBE"
INSTRUMENT_HOST_ID            = HP
TARGET_NAME                   = TITAN
MISSION_PHASE_NAME            = DESCENT
INSTRUMENT_ID                 = DISR
INSTRUMENT_NAME               = "DESCENT IMAGER SPECTRAL RADIOMETER"
INSTRUMENT_TYPE               = {"IMAGER","RADIOMETER","SPECTROMETER"}
PRODUCER_ID                   = DISR
PRODUCER_INSTITUTION_NAME     = "UNIVERSITY OF ARIZONA"
PRODUCER_FULL_NAME            = "CHARLES (CHUCK) SEE"
PRODUCT_TYPE                  = EDR

START_TIME                    = 2005-01-14T09:13:31.594 /*UTC*/
STOP_TIME                     = 2005-01-14T09:13:31.604 /*UTC*/
SPACECRAFT_CLOCK_START_COUNT  = 190.594    /* DDB time in seconds.fff */
SPACECRAFT_CLOCK_STOP_COUNT   = 190.604    /* DDB time in seconds.fff */

FILE_NAME                     = "DARK_0001_00191_S_140_KM.TAB"

EXPOSURE_DURATION             = 10.0000 <MILLISECONDS>
EXPOSURE_TYPE                 = MANUAL
SPACECRAFT_ALTITUDE_START     = 140.343 <KM> /* Reconstruction, Note 1 */
SPACECRAFT_ALTITUDE_END       = 140.343 <KM>

AZIMUTH_START                 =  33.39 <DEGREES> /* CCW From Sun, Note 3 */
AZIMUTH_END                   =  33.66 <DEGREES>
AZIMUTH_NORTH_START           =  79.39 <DEGREES> /* CW From North, Note 4 */
AZIMUTH_NORTH_END             =  79.12 <DEGREES>

HUYGENS:EW_TILT_ANGLE_START   =   3.54 <DEGREES> /* + for East tip, Note 6 */
HUYGENS:EW_TILT_ANGLE_END     =   3.54 <DEGREES>
```

```
INSTRUMENT_TEMPERATURE        = (259.06,  "UNK", 270.37,
                                 270.89, 266.92, 258.72,
                                 264.13, 269.44, 275.59,
                                 274.38, 286.88)
                                 /* KELVIN */
INSTRUMENT_TEMPERATURE_POINT  = ("CCD_T1","REF_T2","IRB_T3",
                                 "IRE_T4","CCDLUG_T5","STRAP_T6",
                                 "OPTICS_T7","VIOLET_T8","SH_AUX_T9",
                                 "SH_BOX_T10","EA_BOX_T11")

LAMP_STATE                    = 0000
NULL_PIXEL_2                  = 86.0000 <DN>
NULL_PIXEL_3                  = 81.0000 <DN>

NATIVE_START_TIME             = 190.5941   <SECONDS>
NATIVE_STOP_TIME              = 190.6041   <SECONDS>

DESCRIPTION = "
These are the counts in the covered (dark) CCD columns during the Titan
descent.  The datasets contain two numbers per row: 1) the sum of CCD
columns 7 & 8, and 2) the sum of CCD columns 9 & 10.  This data is used
to determine the CCD dark current rate (DN/sec.) vs. mission time (and ergo
Temperature). Typically one dataset is taken on each descent cycle (see
section 5.7 of the DISR Users Guide). A summary of the Dark datasets is
presented in Guide appendix 24.

Notes:
1) The altitudes are from the DTWG release in June of 2011.
2) The probe azimuth & tilt are updated to the March 2013 Karkoschka analysis.
3) AZIMUTH... is degrees counter clockwise from the Sun, viewed from Nadir.
4) AZIMUTH_NORTH... is degrees clockwise from North, as viewed from Nadir.
5) These data are from ESOC stream 524(b).
6) Positive tilt is parachute East of probe (spin axis tipped East)
7) Temperatures are reported at the mid point (in time) of the observation.

A list of the header entries from the source XDR format file are shown
below for reference.  The official label data (above) takes precedence over
any conflicting information presented below (i.e. azimuths, temps., etc):

filename_pre: C:\df3\15Jan05\Log\524B\DB2\Dark\
filename: V_00001K_MMX_00%03%10_5941_Drk
dimensions:      2
num_cols:        2
num_rows:      256
data_type:     2,  16 bit integer
date_replayed: Wed Feb 09 11:08:33 2005
set_name:      Dark
ccd_t1:        259.10
detector:      CCD
CCD_id_no:       93.00 ms
exp_time:        10.00 ms
coord_x col2:  10
coord_y col2:   0
coord_x col1:   8
coord_y col1:   0
gse_ver:        Windows_GSE
test_log:       C:\df3\15Jan05\ESOC_Files
```

```
units:          C:\df3\15Jan05\ESOC_Files\o524sd__.1h_
set_id:           14  (DARK)
seq_num:           1
m_time:          190.59 seconds
cycle_num:         1
dataset type:         18  (DARK)
DDB altitude:   148.852 km
target azimuth:      180.000 deg
predicted azimuth:    89.910 deg
lamp states:        0000
ccd_stat:          0
ccd_flag:       1110
proc_flag:    111000
 bad_pixels:        replaced
 summing:           summed
 S/W Compression:   compressed
 Square Root Proc:  not square rooted
 H/W Compression:   not compressed
 Exposure Control:  manual
cols_sent:       2
null_col2:     86
null_col3:     81
thermistor_I:   0.0
ccdlug_t5:    261.6
strap_t:      258.9
optics_t:     264.2
violet_t:     263.9
SH_aux_t:     275.7
SH_box_t:     274.2
EA_box_t:     287.1
Aux_volt:      11.9
cpu_volt:       5.0
adc_offset:     0.0
disp_q_size:      6
alarm_q_size:    10
tlm_q_size:       0
sci_pro_q:        5
stack_size:    1471
comp_ratio:       4
disr_model:   DISR3
Pixel min, max & mean (0 to 8190):     25,    168,     101.81
"

OBJECT                      = HEADER
  HEADER_TYPE                 = TEXT
  BYTES                       = 25
  ROW_BYTES                   = 25
  RECORDS                     = 1
  INTERCHANGE_FORMAT          = ASCII
  DESCRIPTION                 = "The first line of the file contains titles
                                for the table columns: Row Number, Sum of CCD
                                columns 7 & 8, and Sum of CCD columns 9 & 10"
END_OBJECT                  = HEADER


OBJECT                         = TABLE
```

```
  INTERCHANGE_FORMAT            = ASCII
  COLUMNS                       = 3
  ROWS                          = 256
  ROW_BYTES                     = 25
  DESCRIPTION                   = "TWO SUMMED COLUMNS OF DARK VALUES
                                   FROM THE CCD"

  OBJECT                        = COLUMN
    NAME                        = "ROW"
    COLUMN_NUMBER               = 1
    UNIT                        = "N/A"
    DATA_TYPE                   = INTEGER
    START_BYTE                  = 1
    BYTES                       = 4
    FORMAT                      = "I4"
    DESCRIPTION                 = "ROW NUMBER"
  END_OBJECT                    = COLUMN

  OBJECT                        = COLUMN
    NAME                        = "DARK1"
    COLUMN_NUMBER               = 2
    UNIT                        = "DN"
    DATA_TYPE                   = INTEGER
    START_BYTE                  = 5
    BYTES                       = 10
    FORMAT                      = "I10"
    DESCRIPTION                 = "THE SUM OF CCD COLUMNS 7 & 8"
  END_OBJECT                    = COLUMN

  OBJECT                        = COLUMN
    NAME                        = "DARK2"
    COLUMN_NUMBER               = 3
    UNIT                        = "DN"
    DATA_TYPE                   = INTEGER
    START_BYTE                  = 15
    BYTES                       = 10
    FORMAT                      = "I10"
    DESCRIPTION                 = "THE SUM OF CCD COLUMNS 9 & 10"
  END_OBJECT                    = COLUMN

END_OBJECT                    = TABLE

END
```

SAMPLE DARK DATA PRINTOUT...

Row	Col 7+8	Col 9+10
1	27	25
2	35	32
3	36	33
4	36	35
5	37	36
6	40	36
7	40	38
8	40	37
9	41	37

to row: 256

5.2 DESCENT LABEL

```
PDS_VERSION_ID                = PDS3
LABEL_REVISION_NOTE           = "Thu Jan 02 04:34:17 2014 <UTC>, C. See"

RECORD_TYPE                   = STREAM
RECORD_BYTES                  = 70
FILE_RECORDS                  = 32

^TEXT                         = "DCYCLE_0100_08852_S_0078_M.TXT"

DATA_SET_ID                   = "HP-SSA-DISR-2/3-EDR/RDR-V1.1"
PRODUCT_ID                    = "DESCENT_0100_MTIME_02_27_31_8075_DISR"
SEQUENCE_NUMBER               = 0100
PRODUCT_CREATION_TIME         = 2014-01-02T04:34:17 /*UTC*/

MISSION_NAME                  = "CASSINI-HUYGENS"
INSTRUMENT_HOST_NAME          = "HUYGENS PROBE"
INSTRUMENT_HOST_ID            = HP
TARGET_NAME                   = TITAN
MISSION_PHASE_NAME            = DESCENT
INSTRUMENT_ID                 = DISR
INSTRUMENT_NAME               = "DESCENT IMAGER SPECTRAL RADIOMETER"
INSTRUMENT_TYPE               = {"IMAGER","RADIOMETER","SPECTROMETER"}
PRODUCER_ID                   = DISR
PRODUCER_INSTITUTION_NAME     = "UNIVERSITY OF ARIZONA"
PRODUCER_FULL_NAME            = "CHARLES (CHUCK) SEE"
PRODUCT_TYPE                  = EDR

START_TIME                    = 2005-01-14T11:37:52.808 /*UTC*/
STOP_TIME                     = 2005-01-14T11:37:54.519 /*UTC*/
SPACECRAFT_CLOCK_START_COUNT  = 8851.808   /* DDB time in seconds.fff */
SPACECRAFT_CLOCK_STOP_COUNT   = 8853.519   /* DDB time in seconds.fff */

FILE_NAME                     = "DCYCLE_0100_08852_S_0078_M.TXT"

DESCENT_CYCLE_NAME            = VERY_LOW_NEAR_SURFACE
SPACECRAFT_ALTITUDE_START     =   0.081 <KM> /* Reconstruction, Note 1 */
SPACECRAFT_ALTITUDE_END       =   0.074 <KM>
AZIMUTH_START                 =  27.53 <DEGREES> /* CCW From Sun, Note 3 */
AZIMUTH_END                   =  16.74 <DEGREES>
AZIMUTH_NORTH_START           =  87.51 <DEGREES> /* CW From North, Note 4 */
AZIMUTH_NORTH_END             =  98.30 <DEGREES>
SPIN_RATE_START               =  -1.09 <RPM> /* CCW Positive, Note 8 */
SPIN_RATE_END                 =  -1.09 <RPM> /* CCW Positive, Note 8 */
ROTATIONS                     =  -0.03 <REVOLUTIONS> /* CCW +, Note 8 */

INSTRUMENT_TEMPERATURE        = (170.30,  "UNK", 189.55,
                                 189.57, 173.30, 172.19,
                                 165.79, 153.45, 234.04,
                                 204.59, 288.13)
                                 /* KELVIN */
INSTRUMENT_TEMPERATURE_POINT  = ("CCD_T1","REF_T2","IRB_T3",
                                 "IRE_T4","CCDLUG_T5","STRAP_T6",
```

```
                                "OPTICS_T7","VIOLET_T8","SH_AUX_T9",
                                "SH_BOX_T10","EA_BOX_T11")

NATIVE_START_TIME             = 8851.8076  <SECONDS>
NATIVE_STOP_TIME              = 8853.5186  <SECONDS>

DESCRIPTION = "
The descent cycles datasets contain information about the descent data
cycle being executed.  Dynamic parameters (altitude, spin, & azimuth)
are recorded at the start of the cycle, and are reported in the archive
as estimates (i.e. Estimated_Spin) in contrast to the post-encounter
reconstructed information, which is also reported (i.e. Starting_Spin).
The parameters actually reported in the descent dataset are: Cycle_Number,
Start_Time, Estimated_Azimuth, Estimated_Altitude, Estimated_Spin,
Scenario_Step, Cycle_Type, SPM_Flag, CCD_Measurements, IR_Measurements
and Violet_Measurements.

Notes:
1) The altitudes are from the DTWG release in June of 2011.
2) The probe azimuth & tilt are updated to the March 2013 Karkoschka analysis.
3) AZIMUTH... is degrees counter clockwise from the Sun, viewed from Nadir.
4) AZIMUTH_NORTH... is degrees clockwise from North, as viewed from Nadir.
5) These data are from ESOC stream 524(b).
6) Positive tilt is parachute East of probe (spin axis tipped East)
7) Temperatures are reported at the mid point (in time) of the observation.
8) ROTATIONS are approximate & are based on the local average spin rate.

A list of the header entries from the source XDR format file are shown
below for reference.  The official label data (above) takes precedence over
any conflicting information presented below (i.e. azimuths, temps., etc):

filename_pre:  C:\df3\15Jan05\Log\524B\DB2\Descent\
filename:      V_00100D_MMX_02%27%31_8075_Dst
dimensions:      0
num_cols:        0
num_rows:        0
data_type:       0  (null)
date_replayed:   Wed Feb 09 11:08:33 2005
engineer:        Chuck See
set_name:        Descent
ccd_t1:          170.20
CCD_id_no:        93
gse_ver:        Windows_GSE
test_log:       C:\df3\15Jan05\ESOC_Files
units:          C:\df3\15Jan05\ESOC_Files\o524sd__.1h_
set_id:            8
seq_num:         100
m_time:         8851.81 seconds
Cycle type:       14  (Very low near surface)
cycle_num:       100
scen_step:        24
spm_flag:          0
CCD_set_no:       11
IR_set_no:         5
VIOLET_set_no:     4
cycle start az:       45.700 deg CCW of sun
DDB altitude:          0.110 km
```

```
thermistor_current: 0.002046 amps

ccdlug_t5:    173.2 deg. K
strap_t:      172.2 deg. K
optics_t:     165.8 deg. K
violet_t:     153.4 deg. K
SH_aux_t:     234.0 deg. K
SH_box_t:     204.6 deg. K
EA_box_t:     288.1 deg. K
Aux_volt:      11.9 volts
cpu_volt:       4.9 volts
adc_offset:     0.0 volts
disp_q_size:      8
alarm_q_size:    11
tlm_q_size:       0
sci_pro_q:        5
stack_size:    1217
disr_model:   DISR3
"


  OBJECT                       = TEXT
    RECORD_BYTES                 = 70
    FILE_RECORDS                 = 32
    NOTE                         = "DISR DESCENT DATASET"
    PUBLICATION_DATE             = 2014-01-02
    INTERCHANGE_FORMAT           = ASCII
  END_OBJECT                   = TEXT

END
```

SAMPLE DESCENT DATA PRINTOUT...

```
Stream:            524B\DB2
Original_Filename: V_00100D_MMX_02%27%31_8075_Dst
Date_Taken:        2005-01-14T11:37:52.808
Cycle_Number:       100
Cycle_Type:          14 (Very low near surface)

Start_Time:          8851.81 seconds after T0
End_Time*:           8853.52 seconds after T0
Cycle_Length*:          1.71 seconds
Scenario_Step:        24 (from cycle criteria table)
SPM_flag:              0 (Spectrophotometric cycle flag)

Predicted_Altitude:    0.110 (Kilometers)
Starting_Altitude*:    0.081 (Kilometers)
Ending_Altitude*:      0.074 (Kilometers)

Predicted_Azimuth:      45.7 (Deg CCW from Sun)
Starting_Azimuth*:      27.5 (Deg CCW from Sun)
Ending_Azimuth*:        16.7 (Deg CCW from Sun)
Starting_Compass*:      87.5 (Deg CW from North)
Ending_Compass*:        98.3 (Deg CW from North)

Predicted_Spin:          1.5 (RPM)
Starting_Spin*:         -1.1 (RPM)
Ending_Spin*:           -1.1 (RPM)
Revolutions_Approx*:    -0.0 (Revs)

CCD_Measurement       11 (ID number of CCD measurement set)
IR_Measurement         5 (ID number of IR measurement set)
Violet_Measurement     4 (ID number of Violet measurement set)

*=post mission reconstruction
```

5.3 HOUSEKEEPING LABEL

```
PDS_VERSION_ID                = PDS3
LABEL_REVISION_NOTE           = "Sat Dec 28 22:15:39 2013 <UTC>, C. See"

RECORD_TYPE                   = STREAM
RECORD_BYTES                  = 70
FILE_RECORDS                  = 32

^TEXT                         = "HKEEPN_0001_00282_S_136_KM.TXT"

DATA_SET_ID                   = "HP-SSA-DISR-2/3-EDR/RDR-V1.1"
PRODUCT_ID                    = "HKEEPN_0001_MTIME_00_04_42_0074_DISR"
SEQUENCE_NUMBER               = 0001
PRODUCT_CREATION_TIME         = 2013-12-28T22:15:39 /*UTC*/

MISSION_NAME                  = "CASSINI-HUYGENS"
INSTRUMENT_HOST_NAME          = "HUYGENS PROBE"
INSTRUMENT_HOST_ID            = HP
TARGET_NAME                   = TITAN
MISSION_PHASE_NAME            = DESCENT
INSTRUMENT_ID                 = DISR
INSTRUMENT_NAME               = "DESCENT IMAGER SPECTRAL RADIOMETER"
INSTRUMENT_TYPE               = {"IMAGER","RADIOMETER","SPECTROMETER"}
PRODUCER_ID                   = DISR
PRODUCER_INSTITUTION_NAME     = "UNIVERSITY OF ARIZONA"
PRODUCER_FULL_NAME            = "CHARLES (CHUCK) SEE"
PRODUCT_TYPE                  = EDR

START_TIME                    = 2005-01-14T09:15:03.007 /*UTC*/
STOP_TIME                     = 2005-01-14T09:15:03.007 /*UTC*/
SPACECRAFT_CLOCK_START_COUNT  = 282.007    /* DDB time in seconds.fff */
SPACECRAFT_CLOCK_STOP_COUNT   = 282.007    /* DDB time in seconds.fff */

FILE_NAME                     = "HKEEPN_0001_00282_S_136_KM.TXT"

SPACECRAFT_ALTITUDE_START     = 135.934 <KM>
SPACECRAFT_ALTITUDE_END       = 135.934 <KM>
AZIMUTH_START                 = 340.53 <DEGREES> /* CCW From Sun, Note 3 */
AZIMUTH_END                   = 340.53 <DEGREES>
AZIMUTH_NORTH_START           = 132.31 <DEGREES> /* CW From North, Note 4 */
AZIMUTH_NORTH_END             = 132.31 <DEGREES>
HUYGENS:EW_TILT_ANGLE_START   =   0.00 <DEGREES> /* + for East tip, Note 6 */
HUYGENS:EW_TILT_ANGLE_END     =   0.00 <DEGREES>
SPIN_RATE_START               =   2.98 <RPM> /* CCW Positive, Note 7 */
SPIN_RATE_END                 =   2.98 <RPM> /* CCW Positive, Note 7 */

INSTRUMENT_TEMPERATURE        = (259.59,  "UNK", 271.14,
                                 271.47, 261.81, 259.02,
                                 264.19, 263.79, 275.71,
                                 274.02, 287.24)
                                 /* KELVIN */
INSTRUMENT_TEMPERATURE_POINT  = ("CCD_T1","REF_T2","IRB_T3",
                                 "IRE_T4","CCDLUG_T5","STRAP_T6",
                                 "OPTICS_T7","VIOLET_T8","SH_AUX_T9",
```

```
                                "SH_BOX_T10","EA_BOX_T11")

NATIVE_START_TIME             = 282.0074   <SECONDS>
NATIVE_STOP_TIME              = 282.0074   <SECONDS>

DESCRIPTION = "
The housekeeping cycles datasets contain temperature, voltage and software
information about the DISR instrument.  Housekeeping data is collected at
the start of each descent cycle.

Notes:
1) The altitudes are from the DTWG release in June of 2011.
2) The probe azimuth & tilt are updated to the March 2013 Karkoschka analysis.
3) AZIMUTH... is degrees counter clockwise from the Sun, viewed from Nadir.
4) AZIMUTH_NORTH... is degrees clockwise from North, as viewed from Nadir.
5) These data are from ESOC stream 524(b).
6) Positive tilt is parachute East of probe (spin axis tipped East)
7) Probe SPIN_RATE is the local average spin rate at the start of the cycle.

A list of the header entries from the source XDR format file are shown
below for reference.  The official label data (above) takes precedence over
any conflicting information presented below (i.e. azimuths, temps., etc):

filename_pre:    C:\df3\15Jan05\Log\524B\DB2\HKeeping\
filename:        V_00001H_MMX_00%04%42_0074_Hkp
dimensions:      0
num_cols:        0
num_rows:        0
data_type:       0  (null)
date_replayed:   Wed Feb 09 11:08:33 2005
engineer:        Chuck See
set_name:        HKeeping
ccd_t1:          259.50
detector:        AUX
CCD_id_no:       93
gse_ver:         Windows_GSE
test_log:        C:\df3\15Jan05\ESOC_Files
units:           C:\df3\15Jan05\ESOC_Files\o524sd__.1h_
set_id:          06
seq_num:         0001
m_time:          282.01 seconds
thermistor_current: 0.002046 amps

ccdlug_t5:    261.8 deg. K
strap_t:      259.0 deg. K
optics_t:     264.2 deg. K
violet_t:     263.8 deg. K
SH_aux_t:     275.7 deg. K
SH_box_t:     274.0 deg. K
EA_box_t:     287.2 deg. K
Aux_volt:      11.9 volts
cpu_volt:       5.0 volts
adc_offset:     0.0 volts
disp_q_size:      6
alarm_q_size:    10
tlm_q_size:       0
sci_pro_q:        5
```

```
stack_size:    1471
disr_model:   DISR3
"


 OBJECT                       = TEXT
  RECORD_TYPE                   = FIXED_LENGTH
  RECORD_BYTES                  = 80
  FILE_RECORDS                  = 27
  NOTE                          = "DISR HOUSEKEEPING DATASET"
  PUBLICATION_DATE              = 2013-12-28
  INTERCHANGE_FORMAT            = ASCII
 END_OBJECT                   = TEXT

END
```

SAMPLE HKEEPING DATA PRINTOUT...

```
Stream:            524B\DB2
Original_Filename: V_00001H_MMX_00%04%42_0074_Hkp
Date_Taken:        2005-01-14T09:15:03.007
Set_Name:          HKeeping
GSE_Version:       Windows_GSE
Sequence_No.:      0001
Mission_Time:         282.01 seconds after T0

Thermistor_Current: 0.002046 (amps)
CCD_Temp_t1:          259.50 degK
CCD_Lug_Temp_t5:      261.80 degK
Thermal_Strap_t6:     259.02 degK
Optical_Bench_t7:     264.19 degK
Violet_Detector_t8:   263.79 degK
Sensor_Head_Aux_t9:   275.71 degK
Sensor_Head_Box_t10   274.02 degK
Electronics_Box_t11   287.24 degK

Aux_Board_Voltage:   11.9311 volts
CPU_Board_Voltage:    4.9651 volts
ADC_Offset:         0.002440 volts

Display_Queue_size:       6
Alarm_Queue_size:        10
Telemetry_Queue_siz       0
Sci_Processing_Q_si       5
Stack_size:            1471
```

5.4 IMAGE TABLE LABEL

```
PDS_VERSION_ID                = PDS3
LABEL_REVISION_NOTE           = "Sat Jan 11 00:05:25 2014 <UTC>, C. See"

RECORD_TYPE                   = FIXED_LENGTH
RECORD_BYTES                  = 1029
FILE_RECORDS                  = 259

^HEADER                       = ("IMAGE_0002_00144_S_143_KM.TAB",1)
^TABLE                        = ("IMAGE_0002_00144_S_143_KM.TAB",4)

DATA_SET_ID                   = "HP-SSA-DISR-2/3-EDR/RDR-V1.1"
PRODUCT_ID                    = "IMAGE_0002_MTIME_00_02_23_5790_DISR"
SEQUENCE_NUMBER               = 0002
IMAGE_ID                      = SLI
PRODUCT_CREATION_TIME         = 2014-01-11T00:05:25 /*UTC*/

MISSION_NAME                  = "CASSINI-HUYGENS"
INSTRUMENT_HOST_NAME          = "HUYGENS PROBE"
INSTRUMENT_HOST_ID            = HP
TARGET_NAME                   = TITAN
MISSION_PHASE_NAME            = DESCENT
INSTRUMENT_ID                 = DISR
INSTRUMENT_NAME               = "DESCENT IMAGER SPECTRAL RADIOMETER"
INSTRUMENT_TYPE               = {"IMAGER","RADIOMETER","SPECTROMETER"}
PRODUCER_ID                   = DISR
PRODUCER_INSTITUTION_NAME     = "UNIVERSITY OF ARIZONA"
PRODUCER_FULL_NAME            = "CHARLES (CHUCK) SEE"
PRODUCT_TYPE                  = EDR

START_TIME                    = 2005-01-14T09:12:44.579 /*UTC*/
STOP_TIME                     = 2005-01-14T09:12:44.586 /*UTC*/
SPACECRAFT_CLOCK_START_COUNT  = 143.579    /* DDB time in seconds.fff */
SPACECRAFT_CLOCK_STOP_COUNT   = 143.586    /* DDB time in seconds.fff */

FILE_NAME                     = "IMAGE_0002_00144_S_143_KM.TAB"

EXPOSURE_DURATION             = 7.00000 <MILLISECONDS>
EXPOSURE_TYPE                 = AUTO
PREDICTED_ALTITUDE            = 152.669 <KM> /* Real-Time from DDB */
SPACECRAFT_ALTITUDE_START     = 142.775 <KM> /* Reconstruction, Note 1 */
SPACECRAFT_ALTITUDE_END       = 142.775 <KM>

AZIMUTH_START                 = 157.44 <DEGREES> /* CCW From Sun, Note 3 */
AZIMUTH_END                   = 157.65 <DEGREES>
AZIMUTH_NORTH_START           = 315.31 <DEGREES> /* CW From North, Note 4 */
AZIMUTH_NORTH_END             = 315.10 <DEGREES>
HUYGENS:EW_TILT_ANGLE_START   =   9.76 <DEGREES> /* + for East tip, Note 6 */
HUYGENS:EW_TILT_ANGLE_END     =   9.76 <DEGREES>
SPIN_RATE                     =   5.04 <RPM> /* CCW Positive, Note 8 */

INSTRUMENT_TEMPERATURE        = (258.81,  "UNK", 269.98,
                                 270.59, 266.12, 258.56,
                                 264.10, 269.57, 275.53,
```

```
                                  274.56, 286.70)
                                  /* KELVIN */
INSTRUMENT_TEMPERATURE_POINT  = ("CCD_T1","REF_T2","IRB_T3",
                                  "IRE_T4","CCDLUG_T5","STRAP_T6",
                                  "OPTICS_T7","VIOLET_T8","SH_AUX_T9",
                                  "SH_BOX_T10","EA_BOX_T11")

LAMP_STATE                    = 0000
NULL_PIXEL_2                  = 79.0000 <DN>
NULL_PIXEL_3                  = 76.0000 <DN>

NATIVE_START_TIME             = 143.5790   <SECONDS>
NATIVE_STOP_TIME              = 143.5860   <SECONDS>

DESCRIPTION = "
This is data from the DISR imagers.  Three imagers take simultaneous
exposures. The Side Looking Imager (SLI) views from 96 down to 45 deg from
Nadir. The Medium Resolution Imager (MRI) views from 45 to 16 deg from Nadir.
And, the High Resolution Imager (HRI) views from 21 to 6 deg Nadir.  The
composite image covers ~25 deg of azimuth. The tables are rotated 180 deg
relative to the observed scene (top is most nadir & left is right).

The tables present the per-pixel photometric reading reconstructed from the
Discrete Cosine Transform (DCT) coefficients that were transmitted to Earth.
The values are scaled from zero to 519,168 DN (~12 bits *128)

A few of the images taken on Titans surface have saturated or missing pixels.
Saturated pixels have a value of 519,168 DN.  Missing pixels have a value of
zero, and are usually in contiguous 16 x 16 pixel blocks (missing packets).
Pixel values can be found in the corresponding image table under:
DATA/IMAGE/TABLE_FORMAT.

The MRIs exhibit a changed responsivity on the top rows of the image,
due to an error in the on-board flat field (see Users Guide, sect. 5.8).

Notes:
1) The altitudes are from the DTWG release in June of 2011.
2) The probe azimuth & tilt are updated to the March 2013 Karkoschka analysis.
3) AZIMUTH... is degrees counter clockwise from the Sun, viewed from Nadir.
4) AZIMUTH_NORTH... is degrees clockwise from North, as viewed from Nadir.
5) These data are from ESOC stream 524(b).
6) Positive tilt is parachute East of probe (spin axis tipped East)
7) Temperatures are reported at the mid point (in time) of the observation.
8) SPIN_RATE is approximate & based on the local average spin rate, CCW postiv.

A list of the header entries from the source XDR format file are shown
below for reference.  The official label data (above) takes precedence over
any conflicting information presented below (i.e. azimuths, temps., etc):

filename_pre:       C:\df3\15Jan05\Log\524B\DB2\Image15\
original_filename:  V_00002I_MMX_00%02%23_5790_Img
dimensions:           2
num_cols:           128
num_rows:           256
data_type:            3,  32 bit integer
date_replayed:      Wed Feb 09 11:08:33 2005
engineer:           Chuck See
```

```
set_name:           Image
ccd_t1:             258.70 Kelvin
detector:           CCD
CCD_id_no:          93
exp_time:              7.00 ms
coord_x col1:       361
gse_ver:            Windows_GSE
test_log:           stream_524b\DB2\Image15
ESOC_File:          C:\df3\15Jan05\ESOC_Files\o524sd__.1h_
set_id:               11  (IMAGE)
seq_num:               2
m_time:              143.58 seconds after T0
cycle_num:             1
dataset type:         22 (SLI)
DDB altitude:         152.669 km
target azimuth:       152.000 deg CCW Sun
predicted azimuth:    151.070 deg CCW Sun
lamp states:          0000  (C1 C2 C3 SSL),cr                       ;(h,102)
ccd_stat:           0
dcs_stat:           1
ccd_flag:        1110
proc_flag:     100111
 bad_pixels:        replaced
 summing:           unsummed
 S/W Compression:   not compressed
 Square Root Proc:  square rooted
 H/W Compression:   compressed
 Exposure Control:  automatic
cols_sent:      128
null_col2:      79 DN
null_col3:      76 DN
ccd_tgt_pct:    60
ccd_prctile:    97
thermistor_I: 2.0460 mA
ccdlug_t5:     261.6 Kelvin
strap_t:       258.9 Kelvin
optics_t:      264.2 Kelvin
violet_t:      264.0 Kelvin
SH_aux_t:      275.7 Kelvin
SH_box_t:      274.2 Kelvin
EA_box_t:      287.1 Kelvin
Aux_volt:       11.9 Volts
cpu_volt:        5.0 Volts
adc_offset:      2.4 mV
disp_q_size:       6
alarm_q_size:     10
tlm_q_size:        0
sci_pro_q:         5
stack_size:     1471
comp_ratio:       29 (Words in dataset)/(# Pixels*2)
disr_model:    DISR3
sqrt_min (12 bit):   286 DN
sqrt_max (12 bit):  1738 DN
Pixel min, max & mean (range: 0 to 519,168 DN):   3364, 196529,  147881.08
"

OBJECT                      = HEADER
```

```
  HEADER_TYPE               = TEXT
  BYTES                     = 1029
  RECORDS                   = 3
  INTERCHANGE_FORMAT        = ASCII
  DESCRIPTION               = "The first 3 lines of the file contain info
                               about the measurement and the table layout."
END_OBJECT                  = HEADER


OBJECT                      = TABLE

  INTERCHANGE_FORMAT        = ASCII
  COLUMNS                   = 129
  ROWS                      = 256
  ROW_BYTES                 = 1029
  DESCRIPTION               = "Table of pixel values from the DISR camera
                               image taken during the Titan Descent. In raw DN.
                               Scaled from min=0 to max=519,168.  Inverted (up
                               vs. down) relative to Descent Attitude.
                               SLI Imager."

  OBJECT                    = COLUMN
    NAME                    = "ROW"
    COLUMN_NUMBER           = 1
    UNIT                    = "N/A"
    DATA_TYPE               = INTEGER
    START_BYTE              = 1
    BYTES                   = 4
    FORMAT                  = "I4"
    DESCRIPTION             = "ROW NUMBERS"
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    NAME                    = "DATA COLUMN 0"
    COLUMN_NUMBER           = 2
    UNIT                    = "DN"
    DATA_TYPE               = INTEGER
    START_BYTE              = 5
    BYTES                   = 8
    FORMAT                  = "I8"
    DESCRIPTION             = "Imager pixel reading in range 0 TO 519,168 DN"
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    NAME                    = "DATA COLUMN 1"
    COLUMN_NUMBER           = 3
    UNIT                    = "DN"
    DATA_TYPE               = INTEGER
    START_BYTE              = 13
    BYTES                   = 8
    FORMAT                  = "I8"
    DESCRIPTION             = "Imager pixel reading in range 0 TO 519,168 DN"
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    NAME                    = "DATA COLUMN 2"
    COLUMN_NUMBER           = 4
```

```
    UNIT                    = "DN"
    DATA_TYPE               = INTEGER
    START_BYTE              = 21
    BYTES                   = 8
    FORMAT                  = "I8"
    DESCRIPTION             = "Imager pixel reading in range 0 TO 519,168 DN"
  END_OBJECT                = COLUMN

      .                       .
      .                       .
      .                       .

  OBJECT                    = COLUMN
    NAME                    = "DATA COLUMN 126"
    COLUMN_NUMBER           = 128
    UNIT                    = "DN"
    DATA_TYPE               = INTEGER
    START_BYTE              = 1013
    BYTES                   = 8
    FORMAT                  = "I8"
    DESCRIPTION             = "Imager pixel reading in range 0 TO 519,168 DN"
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    NAME                    = "DATA COLUMN 127"
    COLUMN_NUMBER           = 129
    UNIT                    = "DN"
    DATA_TYPE               = INTEGER
    START_BYTE              = 1021
    BYTES                   = 8
    FORMAT                  = "I8"
    DESCRIPTION             = "Imager pixel reading in range 0 TO 519,168 DN"
  END_OBJECT                = COLUMN

END_OBJECT                = TABLE

END
```

SAMPLE IMAGE TABLE DATA PRINTOUT...

Table of DISR image pixel data (DN) for SLI image number: 2

ROW	COLUMNS... 1	2	3	4	5	6	7	8	9	...
1	3750	3406	3511	3364	3595	3655	3406	4050	3832	...
2	62634	63330	63576	63876	63444	63012	63024	63948	63762	...
3	70485	70275	69862	70282	69729	70191	70275	69785	69911	
4	72968	73168	72872	72976	72984	73080	72584	72904	72840	
5	73808	74124	73728	74152	73792	73328	73536	73920	74558	
6	74890	74264	74047	75220	74970	75155	76545	78737	79295	
7	77208	76328	77840	80573	82643	85628	85058	85178	85618	
8	76342	77952	83558	86778	86638	86868	86838	87438	88228	
9	78872	85038	88198	87288	87158	87328	88618	88088	88818	
10	87038	89778	90488	89738	88248	88068	89848	90318	89628	
11	90858	91739	91158	90258	89828	92201	90318	89828	90968	
12	91268	91168	91408	93188	91588	91458	90748	91618	92229	
13	90628	92089	91746	92964	92215	91753	92229	91178	91208	
14	92901	92495	92313	93602	94367	92271	92432	93674	93181	
15	93926	93593	94286	93512	94502	94652	93503	95240	94583	
16	94652	96344	97988	95744	95444	97220	95492	97184	94880	
17	95816	95996	96224	96344	96236	95936	95552	95288	95252	
18	96224	96392	96620	96752	96680	96392	96056	95804	95780	
19	96968	97136	97364	97508	97460	97232	96944	96740	96740	
20	97916	98084	98300	98456	98456	98300	98072	97928	97952	
21	98948	99092	99308	99476	99512	99416	99272	99176	99212	
22	99956	100076	100256	100412	100484	100460	100376	100340	100376	
23	100868	100952	101096	101228	101312	101336	101324	101312	101336	
24	101684	101744	101828	101924	101996	102056	102092	102104	102116	
25	102493	102506	102519	102571	102636	102727	102805	102844	102831	
26	103390	103338	103286	103260	103312	103416	103520	103585	103546	
27	104365	104274	104144	104053	104066	104183	104326	104417	104365	
.	.	.	.	.	.	.	.	.	.	
.	.	.	.	.	.	.	.	.	.	
.	.	.	.	.	.	.	.	.	.	

5.4b IMAGE DISPLAY LABEL

```
PDS_VERSION_ID                = PDS3
LABEL_REVISION_NOTE           = "Fri Dec 20 02:54:12 2013 <UTC>, C. See"

RECORD_TYPE                   = UNDEFINED

^PNG_DOCUMENT                 = "PNGIMG_1051_11751_S_0000_M.PNG"

DATA_SET_ID                   = "HP-SSA-DISR-2/3-EDR/RDR-V1.1"
PRODUCT_ID                    = "PNGIMG_1051_MTIME_03_15_51_2490_DISR"
SOURCE_PRODUCT_ID             = "IMAGE_1051_MTIME_03_15_51_2490_DISR"
SEQUENCE_NUMBER               = 1051
IMAGE_ID                      = SLI
PRODUCT_CREATION_TIME         = 2013-12-20T02:54:12 /*UTC*/

MISSION_NAME                  = "CASSINI-HUYGENS"
INSTRUMENT_HOST_NAME          = "HUYGENS PROBE"
INSTRUMENT_HOST_ID            = HP
TARGET_NAME                   = TITAN
MISSION_PHASE_NAME            = DESCENT
INSTRUMENT_ID                 = DISR
INSTRUMENT_NAME               = "DESCENT IMAGER SPECTRAL RADIOMETER"
INSTRUMENT_TYPE               = {"IMAGER","RADIOMETER","SPECTROMETER"}
PRODUCER_ID                   = DISR
PRODUCER_INSTITUTION_NAME     = "UNIVERSITY OF ARIZONA"
PRODUCER_FULL_NAME            = "CHARLES (CHUCK) SEE"
PRODUCT_TYPE                  = EDR

START_TIME                    = 2005-01-14T12:26:12.249 /*UTC*/
STOP_TIME                     = 2005-01-14T12:26:12.254 /*UTC*/
SPACECRAFT_CLOCK_START_COUNT  = 11751.249  /* DDB time in seconds.fff */
SPACECRAFT_CLOCK_STOP_COUNT   = 11751.254  /* DDB time in seconds.fff */

FILE_NAME                     = "PNGIMG_1051_11751_S_0000_M.PNG"
EXPOSURE_DURATION             = 5.00000 <MILLISECONDS>
EXPOSURE_TYPE                 = AUTO
SPACECRAFT_ALTITUDE_START     =   0.000 <KM>
SPACECRAFT_ALTITUDE_END       =   0.000 <KM>
AZIMUTH_START                 = 295.35 <DEGREES> /* CCW From Sun, Note 3 */
AZIMUTH_END                   = 295.35 <DEGREES>
AZIMUTH_NORTH_START           = 180.00 <DEGREES> /* CW From North, Note 4 */
AZIMUTH_NORTH_END             = 180.00 <DEGREES>
HUYGENS:EW_TILT_ANGLE_START   =   0.00 <DEGREES> /* + for East tip, Note 6 */
HUYGENS:EW_TILT_ANGLE_END     =   0.00 <DEGREES>
INSTRUMENT_TEMPERATURE        = (181.13,  "UNK", 199.60,
                                 199.87, 181.10, 175.33,
                                 187.67, 184.35, 245.44,
                                 217.73, 285.15)
                                 /* KELVIN */
INSTRUMENT_TEMPERATURE_POINT  = ("CCD_T1","REF_T2","IRB_T3",
                                 "IRE_T4","CCDLUG_T5","STRAP_T6",
                                 "OPTICS_T7","VIOLET_T8","SH_AUX_T9",
                                 "SH_BOX_T10","EA_BOX_T11")
LAMP_STATE                    = 0001
NULL_PIXEL_2                  = 242.000 <DN>
```

```
NULL_PIXEL_3                  = 238.000 <DN>

NATIVE_START_TIME             = 11751.2490 <SECONDS>
NATIVE_STOP_TIME              = 11751.2540 <SECONDS>

DESCRIPTION = "
This is data from the DISR imagers.  Three imagers take simultaneous
exposures. The Side Looking Imager (SLI) views from 96 down to 45 deg from
Nadir. The Medium Resolution Imager (MRI) views from 45 to 16 deg from Nadir.
And, the High Resolution Imager (HRI) views from 21 to 6 deg Nadir.  The
composite image covers ~25 deg of azimuth.

The BROWSE (PNG) images are re-binned to twice their original size (2X & 2Y).
They also are photometrically limited to 5 sigma below their mean value (if
greater than 0), and to 4 sigma above their mean value (if less than the
maximum), to remove dead or hot pixels.

A few of the images taken on Titans surface have saturated or missing pixels.
Saturated pixels have a value of 519,168 DN.  Missing pixels have a value of
zero, and are usually in contiguous 16 x 16 pixel blocks (missing packets).
Pixel values can be found in the corresponding image table under:
DATA/IMAGE/TABLE_FORMAT.

The MRIs exhibit a changed responsivity on the top rows of the image,
due to an error in the on-board flat field (see Users Guide, sect. 5.8).

Notes:
1) The altitudes are from the DTWG release in June of 2011.
2) The probe azimuth & tilt are updated to the March 2013 Karkoschka analysis.
3) AZIMUTH... is degrees counter clockwise from the Sun, viewed from Nadir.
4) AZIMUTH_NORTH... is degrees clockwise from North, as viewed from Nadir.
5) These data are from ESOC stream 524(b).
6) Positive tilt is parachute East of probe (spin axis tipped East)
7) Temperatures are reported at the mid point (in time) of the observation.

A list of the header entries from the source XDR format file are shown
below for reference.  The official label data (above) takes precedence over
any conflicting information presented below (i.e. azimuths, temps., etc):

filename_pre:       C:\df3\15Jan05\Log\524B\DB2\Image15\
original_filename:  V_01051I_MMX_03%15%51_2490_Img
dimensions:           2
num_cols:           128
num_rows:           256
data_type:            3,  32 bit integer
date_replayed:      Wed Feb 09 11:08:33 2005
engineer:           Chuck See
set_name:           Image
ccd_t1:             181.10
detector:           CCD
CCD_id_no:            93.00 ms
exp_time:              5.00 ms
coord_x col1:       361
gse_ver:            Windows_GSE
test_log:           stream_524b\DB2\Image15
ESOC_File:          C:\df3\15Jan05\ESOC_Files\o524sd__.1h_
set_id:                11
```

```
seq_num:             1051
m_time:             11751.25
cycle_num:            161
dataset type:        22 (SLI)
predicted altitude:    0.000 km
target azimuth:        2.000
predicted azimuth:     0.820
lamp states:        0001
ccd_stat:          0
dcs_stat:          1
ccd_flag:       1110
proc_flag:    100111
cols_sent:     128
null_col2:    242
null_col3:    238
ccd_tgt_pct:   60
ccd_prctile:   97
thermistor_I:   0.0
ccdlug_t5:    181.2
strap_t:      175.4
optics_t:     187.7
violet_t:     184.5
SH_aux_t:     245.5
SH_box_t:     217.8
EA_box_t:     285.2
Aux_volt:      11.9
cpu_volt:       4.9
adc_offset:     0.0
disp_q_size:      7
alarm_q_size:    12
tlm_q_size:       0
sci_pro_q:        4
stack_size:    1280
comp_ratio:      14
disr_model:   DISR3
sqrt_min (12 bit):    50
sqrt_max (12 bit):   358
Pixel min, max & mean (19 bit, 0 to 519,168):   4044,  81014,   24155.84
"

OBJECT                      = PNG_DOCUMENT
  DOCUMENT_NAME               = "DISR Huygens Descent PNG Image"
  PUBLICATION_DATE            = 2013-12-20
  DOCUMENT_TOPIC_TYPE         = "MISSION RESULTS"
  FILES                       = 1
  DOCUMENT_FORMAT             = PNG
  ENCODING_TYPE               = "PNG1.0"
  INTERCHANGE_FORMAT          = BINARY
  SAMPLE_TYPE                 = UNSIGNED_INTEGER
  SAMPLE_BITS                 = 16
  DESCRIPTION                 = "Portable Network Graphics (PNG) representation
    of DISR camera image taken during the Titan Descent. Scaled from min=0
    to max=65535. Displayed as DISR sees the world.
    SLI - 128 by 256 pixels.
    PNG 1.0, 16 bit Unsigned, No Compression"
END_OBJECT                  = PNG_DOCUMENT
```

END

SAMPLE IMAGE DATA ...

5.5 IR LABEL

```
PDS_VERSION_ID                = PDS3
LABEL_REVISION_NOTE           = "Mon Dec 30 21:18:29 2013 <UTC>, C. See"

RECORD_TYPE                   = FIXED_LENGTH
RECORD_BYTES                  = 173
FILE_RECORDS                  = 251

^DATA_HEADER                  = "IR_0001_00143_S_141_KM.TAB"
^DATA_TABLE                   = ("IR_0001_00143_S_141_KM.TAB",2)
^REGIONS_HEADER               = ("IR_0001_00143_S_141_KM.TAB",154)
^REGIONS_TABLE                = ("IR_0001_00143_S_141_KM.TAB",156)
^READING_HEADER               = ("IR_0001_00143_S_141_KM.TAB",165)
^READING_TABLE                = ("IR_0001_00143_S_141_KM.TAB",168)
^BINS_HEADER                  = ("IR_0001_00143_S_141_KM.TAB",225)
^BINS_TABLE                   = ("IR_0001_00143_S_141_KM.TAB",228)

DATA_SET_ID                   = "HP-SSA-DISR-2/3-EDR/RDR-V1.1"
PRODUCT_ID                    = "IR_0001_MTIME_00_02_23_1725_DISR"
SEQUENCE_NUMBER               = 0001
MEASUREMENT_TYPE              = IR_COMB
PRODUCT_CREATION_TIME         = 2013-12-30T21:18:29 /*UTC*/

MISSION_NAME                  = "CASSINI-HUYGENS"
INSTRUMENT_HOST_NAME          = "HUYGENS PROBE"
INSTRUMENT_HOST_ID            = HP
TARGET_NAME                   = TITAN
MISSION_PHASE_NAME            = DESCENT
INSTRUMENT_ID                 = DISR
INSTRUMENT_NAME               = "DESCENT IMAGER SPECTRAL RADIOMETER"
INSTRUMENT_TYPE               = {"IMAGER","RADIOMETER","SPECTROMETER"}
PRODUCER_ID                   = DISR
PRODUCER_INSTITUTION_NAME     = "UNIVERSITY OF ARIZONA"
PRODUCER_FULL_NAME            = "CHARLES (CHUCK) SEE"
PRODUCT_TYPE                  = EDR

START_TIME                    = 2005-01-14T09:12:44.173 /*UTC*/
STOP_TIME                     = 2005-01-14T09:13:54.529 /*UTC*/
SPACECRAFT_CLOCK_START_COUNT  = 143.173    /* DDB time in seconds.fff */
SPACECRAFT_CLOCK_STOP_COUNT   = 213.529    /* DDB time in seconds.fff */

FILE_NAME                     = "IR_0001_00143_S_141_KM.TAB"

INTEGRATION_DURATION          = 70.3567 <SECONDS> /* Total Collection Time */
EXPOSURE_DURATION             = "N/A"
EXPOSURE_TYPE                 = AUTO
SPACECRAFT_ALTITUDE_START     = 142.794 <KM>
SPACECRAFT_ALTITUDE_END       = 139.241 <KM>

AZIMUTH_START                 = 145.38 <DEGREES> /* CCW From Sun, Note 3 */
AZIMUTH_END                   = 257.87 <DEGREES>
AZIMUTH_NORTH_START           = 327.38 <DEGREES> /* CW From North, Note 4 */
AZIMUTH_NORTH_END             = 214.93 <DEGREES>
HUYGENS:EW_TILT_ANGLE_START   =   9.82 <DEGREES> /* + for East tip, Note 6 */
```

```
HUYGENS:EW_TILT_ANGLE_END     =   1.45 <DEGREES>
PREDICTED_SPIN_RATE           =   6.69 <RPM> /* Always Positive, Note 9 */
SPIN_RATE_START               =   5.05 <RPM> /* CCW Positive, Note 8 */
SPIN_RATE_END                 =   3.93 <RPM>
ROTATIONS                     =   5.26 <REVS>    /* CCW Positive, Note 8 */

INSTRUMENT_TEMPERATURE        = (258.95,  "UNK", 270.27,
                                 270.81, 266.78, 258.68,
                                 264.12, 269.48, 275.57,
                                 274.42, 286.84)
                                 /* KELVIN */
INSTRUMENT_TEMPERATURE_POINT  = ("CCD_T1","REF_T2","IRB_T3",
                                 "IRE_T4","CCDLUG_T5","STRAP_T6",
                                 "OPTICS_T7","VIOLET_T8","SH_AUX_T9",
                                 "SH_BOX_T10","EA_BOX_T11")

LAMP_STATE                    = 0000

NATIVE_START_TIME             = 143.1725   <SECONDS>
NATIVE_STOP_TIME              = 213.5292   <SECONDS>
DETECTOR_ID                   = "IR_COMB"
COLUMNS                       = 24
ROWS                          = 150

DESCRIPTION = "
This is data from the DISR IR spectrometers.  There are two, one looking
upward (~2 Pi steradians), and one looking downward (from 15.5 to 24.5 deg
Nadir, & ~3 deg in azimuth).  Both have 132 spectral pixels, from about
870 to 1700 nm. The data are binned in regions symmetric about the sun
vector. See DISR Users Guide, section 5.11.

The IR data is presented in 4 tables.  The DATA_TABLE presents the photometric
readings for each pixel.  The REGIONS_TABLE provides information on the bin
orientation. The READING_TABLE lists the measurements in chronological order.
And, the BINS_TABLE presents the total exposure time for each bin.

The photometric values are inverted.  60,000 DN is dark, and below 3500 DN are
typically saturated pixels.  See DISR Users Guide, section 5.11 for details.

Notes:
1) The altitudes are from the DTWG release in June of 2011.
2) The probe azimuth & tilt are updated to the March 2013 Karkoschka analysis.
3) AZIMUTH... is degrees counter clockwise from the Sun, viewed from Nadir.
4) AZIMUTH_NORTH... is degrees clockwise from North, as viewed from Nadir.
5) These data are from ESOC stream 524(b).
6) Positive tilt is parachute East of probe (spin axis tipped East)
7) Temperatures are reported at the mid point (in time) of the observation.
8) ROTATIONS are approximate & are based on the local average spin rate.
9) PREDICTED_SPIN_RATE is an inaccurate real-time estimate from DDB & Sun
    Sensor. It is the value the instrument used to plan the observation.

A list of the header entries from the source XDR format file are shown
below for reference.  The official label data (above) takes precedence over
any conflicting information presented below (i.e. azimuths, temps., etc):

filename_pre:       C:\df3\15Jan05\Log\524B\DB\Ir\
original_filename:  V_00001R_MMX_00%02%23_1725_Ir
```

```
replay_time:        Wed Feb 09 11:14:08 2005
dimensions:           2
num_cols:           150
num_rows:            24
data_type:            3   (32 bit integer)
date_replayed:      Wed Feb 09 11:08:33 2005
engineer:           Chuck See
observation_site:   ESOC
set_name:           Ir
ccd_t1:             259.40
detector:           IR
Sensor_id_no:         93.00
gse_ver:            Windows_GSE
test_log:           stream_524b\DB2\Image15
ESOC_File:          C:\df3\15Jan05\ESOC_Files\o524sd__.1h_
set_id:               16
seq_num:               1
m_time:              143.17
cycle_num:             1
dataset type:         10 (IR_COMB)
predicted altitude:  141.000 km
predicted azimuth:     0.000 deg CCW Sun
lamp states:        0000
ir_hardware_status:   0
ir_flags:             11      optimum & compression
ir_chip_temp_start:  269.980 deg K
ir_chip_temp_end:    270.592 deg K
precharge_voltage: 12592.000 mv
IR_collection_time:   70.357 seconds
num_bins:             56.000 bins (typ 1, or 8 per rotation)
num_regions:           8.000 regions
ulis_dc_offset:     9522.000 mv
dlis_dc_offset:     9105.000 mv
target_%_ulis:        50.000 %
target_%_dlis:        50.000 %
%_point_ulis:          7.000 %
%_point_dlis:          7.000 %
thermistor_I:          2.046 mA
ccdlug_t5:    261.6
strap_t:      258.9
optics_t:     264.2
violet_t:     263.9
SH_aux_t:     275.7
SH_box_t:     274.2
EA_box_t:     287.1
Aux_volt:      11.9
cpu_volt:       5.0
adc_offset:     0.0
disp_q_size:      6
alarm_q_size:    10
tlm_q_size:       0
sci_pro_q:        5
stack_size:    1471
num_bins:        24
disr_model:   DISR3
Pixel min, max & mean (16 bit, 0 to 65,535):   3272,  53227,   49290.17
"
```

```
OBJECT                       = DATA_HEADER
  HEADER_TYPE                  = TEXT
  BYTES                        = 173
  RECORDS                      = 2
  INTERCHANGE_FORMAT           = ASCII
  DESCRIPTION                  = "The first 2 lines of the file contain the
                                  table title and column headers."
END_OBJECT                   = DATA_HEADER


OBJECT                       = DATA_TABLE

  INTERCHANGE_FORMAT         = ASCII
  COLUMNS                    = 25
  ROWS                       = 150
  ROW_BYTES                  = 173
  DESCRIPTION                = "AN ARRAY OF IR MEASUREMENTS
                                150 BY 24 FROM THE IR SPECTROMETER."

  OBJECT                       = COLUMN
    NAME                       = "ROW"
    COLUMN_NUMBER              = 1
    UNIT                       = "N/A"
    DATA_TYPE                  = INTEGER
    START_BYTE                 = 1
    BYTES                      = 4
    FORMAT                     = "I4"
    DESCRIPTION                = "THE ROW #, EACH CORRESPONDS TO AN IR PIXEL.
                                  SHORT WL AT TOP (1), REDDER AT BOTTOM (150)"
  END_OBJECT                   = COLUMN

  OBJECT                       = COLUMN
    NAME                       = "DLIS SHUTTER OPEN COL1"
    COLUMN_NUMBER              = 2
    UNIT                       = "DN"
    DATA_TYPE                  = INTEGER
    START_BYTE                 = 5
    BYTES                      = 7
    FORMAT                     = "I7"
    DESCRIPTION                = "IR_COMB COUNTS WHILE SHUTTER IS OPEN"
  END_OBJECT                   = COLUMN

  OBJECT                       = COLUMN
    NAME                       = "DLIS SHUTTER OPEN COL2"
    COLUMN_NUMBER              = 3
    UNIT                       = "DN"
    DATA_TYPE                  = INTEGER
    START_BYTE                 = 12
    BYTES                      = 7
    FORMAT                     = "I7"
    DESCRIPTION                = "IR_COMB COUNTS WHILE SHUTTER IS OPEN"
  END_OBJECT                   = COLUMN

      .                            .
      .                            .
      .                            .
```

```
  OBJECT                      = COLUMN
    NAME                      = "ULIS SHUTTER CLOSED COL4"
    COLUMN_NUMBER             = 25
    UNIT                      = "DN"
    DATA_TYPE                 = INTEGER
    START_BYTE                = 166
    BYTES                     = 7
    FORMAT                    = "I7"
    DESCRIPTION               = "IR_COMB COUNTS WHILE SHUTTER IS CLOSED"
  END_OBJECT                  = COLUMN
END_OBJECT                  = DATA_TABLE



OBJECT                      = REGIONS_HEADER
  HEADER_TYPE               = TEXT
  BYTES                     = 38
  RECORDS                   = 2
  INTERCHANGE_FORMAT        = ASCII
  DESCRIPTION               = "The first 2 lines contain the
                               table title and column headers."
END_OBJECT                  = REGIONS_HEADER


OBJECT                      = REGIONS_TABLE

  INTERCHANGE_FORMAT        = ASCII
  ROWS                      = 8
  COLUMNS                   = 5
  ROW_BYTES                 = 37
  DESCRIPTION               = "Definition of the start & end azimuths for each
                               region and their associated bin designation."

  OBJECT                      = COLUMN
    NAME                      = "REGION NUMBER"
    COLUMN_NUMBER             = 1
    UNIT                      = "N/A"
    DATA_TYPE                 = INTEGER
    START_BYTE                = 1
    BYTES                     = 4
    FORMAT                    = "I4"
    DESCRIPTION               = "NUMBER OF THE REGION"
  END_OBJECT                  = COLUMN

  OBJECT                      = COLUMN
    NAME                      = "STARTING AZIMUTH"
    COLUMN_NUMBER             = 2
    UNIT                      = "CENTI-DEGREES"
    DATA_TYPE                 = INTEGER
    START_BYTE                = 5
    BYTES                     = 8
    FORMAT                    = "I8"
    DESCRIPTION               = "OFFSET FROM START AZIMUTH TO THE BEGINNING"
                                 OF THE BIN IN DEG (*100) CCW "
  END_OBJECT                  = COLUMN
```

```
  OBJECT                    = COLUMN
    NAME                    = "ENDING AZIMUTH"
    COLUMN_NUMBER           = 3
    UNIT                    = "CENTI-DEGREES"
    DATA_TYPE               = INTEGER
    START_BYTE              = 13
    BYTES                   = 8
    FORMAT                  = "I8"
    DESCRIPTION             = "OFFSET FROM START AZIMUTH TO THE END"
                               OF THE BIN IN DEG (*100) CCW "
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    NAME                    = "UP BIN INDEX"
    COLUMN_NUMBER           = 4
    UNIT                    = "N/A"
    DATA_TYPE               = INTEGER
    START_BYTE              = 21
    BYTES                   = 8
    FORMAT                  = "I8"
    DESCRIPTION             = "TELLS PART OF ARRAY (BIN) IN WHICH THE
                               ULIS SUM IS ACCUMULATED"
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    NAME                    = "DOWN BIN INDEX"
    COLUMN_NUMBER           = 5
    UNIT                    = "N/A"
    DATA_TYPE               = INTEGER
    START_BYTE              = 29
    BYTES                   = 8
    FORMAT                  = "I8"
    DESCRIPTION             = "TELLS PART OF ARRAY (BIN) IN WHICH THE
                               DLIS SUM IS ACCUMULATED."
  END_OBJECT                = COLUMN

END_OBJECT                  = REGIONS_TABLE



OBJECT                      = READING_HEADER
  HEADER_TYPE               = TEXT
  BYTES                     = 46
  RECORDS                   = 3
  INTERCHANGE_FORMAT        = ASCII
  DESCRIPTION               = "The first 3 lines contain the
                               table title and column headers."
END_OBJECT                  = READING_HEADER


OBJECT                      = READING_TABLE

  INTERCHANGE_FORMAT        = ASCII
  ROWS                      = 56
  COLUMNS                   = 6
  ROW_BYTES                 = 45
  DESCRIPTION               = "A CHRONOLOGICAL LISTING OF THE DATA COLLECTION,
```

```
                          SHOWING THE COLLECTION TIME, SHUTTER TIME AND
                          SAMPLE TIME (IN 8.064 ms STEPS) FOR EACH REGION."

  OBJECT                  = COLUMN
    NAME                  = "ROTATION NUMBER"
    COLUMN_NUMBER         = 1
    UNIT                  = "N/A"
    DATA_TYPE             = INTEGER
    START_BYTE            = 1
    BYTES                 = 3
    FORMAT                = "I3"
    DESCRIPTION           = "ROTATION NUMBER"
  END_OBJECT              = COLUMN

  OBJECT                  = COLUMN
    NAME                  = "REGION"
    COLUMN_NUMBER         = 2
    UNIT                  = "N/A"
    DATA_TYPE             = INTEGER
    START_BYTE            = 4
    BYTES                 = 5
    FORMAT                = "I5"
    DESCRIPTION           = "REGION OF ROTATION USED"
  END_OBJECT              = COLUMN

  OBJECT                  = COLUMN
    NAME                  = "MISSION TIME START"
    COLUMN_NUMBER         = 3
    UNIT                  = "SECONDS*10E-4"
    DATA_TYPE             = INTEGER
    START_BYTE            = 9
    BYTES                 = 12
    FORMAT                = "I12"
    DESCRIPTION           = "MISSION TIME AT START OF ROTATION IN SEC X 1E4"
  END_OBJECT              = COLUMN

  OBJECT                  = COLUMN
    NAME                  = "IR DURATION"
    COLUMN_NUMBER         = 4
    UNIT                  = "8.064 MILLISECOND STEPS"
    DATA_TYPE             = INTEGER
    START_BYTE            = 21
    BYTES                 = 8
    FORMAT                = "I8"
    DESCRIPTION           = "COLLECTION TIME FOR THIS ROTATION REGION
                             IN UNITS OF 8.064 MILLISECOND STEPS"
  END_OBJECT              = COLUMN

  OBJECT                  = COLUMN
    NAME                  = "IR SHUTTER TIME"
    COLUMN_NUMBER         = 5
    UNIT                  = 8.064 MILLISECOND PERIODS
    DATA_TYPE             = INTEGER
    START_BYTE            = 29
    BYTES                 = 8
    FORMAT                = "I8"
    DESCRIPTION           = "TIME THE SHUTTER IS OPEN PER CYCLE IN UNITS OF
```

```
                                   8.064 MILLISECOND STEPS (N*SAMPLE TIME)"
  END_OBJECT                     = COLUMN

  OBJECT                         = COLUMN
    NAME                         = "IR SAMPLE TIME"
    COLUMN_NUMBER                = 6
    UNIT                         = 8.064 MILLISECOND STEPS
    DATA_TYPE                    = INTEGER
    START_BYTE                   = 37
    BYTES                        = 8
    FORMAT                       = "I8"
    DESCRIPTION                  = "TIME BETWEEN READS IN UNITS OF 8.064
                                    MILLISECOND INCREMENTS (I.E. EXPOSURE TIME)"
  END_OBJECT                     = COLUMN

END_OBJECT                       = READING_TABLE



OBJECT                           = BINS_HEADER
  HEADER_TYPE                    = TEXT
  BYTES                          = 56
  RECORDS                        = 3
  INTERCHANGE_FORMAT             = ASCII
  DESCRIPTION                    = "The first 3 lines contain the
                                    table title and column headers."
END_OBJECT                       = BINS_HEADER


OBJECT                           = BINS_TABLE

  INTERCHANGE_FORMAT             = ASCII
  ROWS                           = 24
  COLUMNS                        = 6
  ROW_BYTES                      = 53
  DESCRIPTION                    = "Information on the direction (up vs. down),
                                    the shutter state (open vs. closed), the
                                    total accumulated shutter time, number
                                    of samples, and corresponding Data Table
                                    column number for the data in each bin. "

  OBJECT                         = COLUMN
    NAME                         = "BIN NUMBER"
    COLUMN_NUMBER                = 1
    UNIT                         = "N/A"
    DATA_TYPE                    = INTEGER
    START_BYTE                   = 1
    BYTES                        = 4
    FORMAT                       = "I4"
    DESCRIPTION                  = "THE NUMBER OF THE BIN "
  END_OBJECT                     = COLUMN

  OBJECT                         = COLUMN
    NAME                         = "DLIS OR ULIS"
    COLUMN_NUMBER                = 2
    UNIT                         = "N/A"
    DATA_TYPE                    = INTEGER
```

```
    START_BYTE              = 5
    BYTES                   = 8
    FORMAT                  = "I8"
    DESCRIPTION             = "IDENTIFIES THE DOWN (0) OR UP (1)
                               LOOKING INSTRUMENT"
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    NAME                    = "SHUTTER STATE"
    COLUMN_NUMBER           = 3
    UNIT                    = "N/A"
    DATA_TYPE               = INTEGER
    START_BYTE              = 13
    BYTES                   = 8
    FORMAT                  = "I8"
    DESCRIPTION             = "TELLS IF THE SHUTTER IS OPEN (0) OR
                               CLOSED (1) FOR THE DATA IN THIS BIN."
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    NAME                    = "SHUTTER INTEGRATION TIME"
    COLUMN_NUMBER           = 4
    UNIT                    = "SECONDS*10**-4"
    DATA_TYPE               = INTEGER
    START_BYTE              = 21
    BYTES                   = 14
    FORMAT                  = "I14"
    DESCRIPTION             = "INTEGRATION OF SHUTTER ACTUATION TIME (OPEN
                               OR CLOSED) FOR THIS BIN IN SECONDS*E-4."
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    NAME                    = "NUMBER SAMPLES TAKEN"
    COLUMN_NUMBER           = 5
    UNIT                    = "SECONDS*10**-4"
    DATA_TYPE               = INTEGER
    START_BYTE              = 35
    BYTES                   = 10
    FORMAT                  = "I10"
    DESCRIPTION             = "TOTAL NUMBER OF SAMPLES TAKEN WITH THE
                               SHUTTER OPEN (OR CLOSED) FOR THIS BIN."
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    NAME                    = "DATA ROW FOR BIN"
    COLUMN_NUMBER           = 6
    UNIT                    = "SECONDS*10**-4"
    DATA_TYPE               = INTEGER
    START_BYTE              = 45
    BYTES                   = 8
    FORMAT                  = "I8"
    DESCRIPTION             = "ROW OF THE PIXEL ARRAY (DATA TABLE) THAT
                               CORRESPONDS TO THIS BIN"
  END_OBJECT                = COLUMN

END_OBJECT                = BINS_TABLE
```

```
END
```

SAMPLE IR DATA PRINTOUT...

```
DATA_TABLE...
 PIX  D O 1  D O 2  D O 3  D O 4  D O 5  D O 6  D O 7  D O 8  D C 1  D C 2  D C 3 ...
   1  49175  49172  49171  49178  49177  49175  49174  49176  49170  49168  49166 ...
   2  49073  49073  49074  49081  49078  49077  49078  49078  49069  49070  49071 ...
   3  48344  48341  48337  48348  48349  48347  48345  48345  48345  48343  48339 ...
   4  48379  48379  48379  48390  48386  48383  48384  48385  48381  48379  48381 ...
   5  48206  48205  48203  48216  48214  48212  48211  48208  48208  48207  48205 ...
   6  44267  44266  44259  44287  44271  44271  44255  44258  44280  44278  44271 ...
   7  48374  48370  48370  48381  48379  48379  48376  48376  48375  48372  48371 ...
   8  48276  48276  48277  48289  48285  48282  48281  48282  48321  48321  48322 ...
   9  38574  38627  38587  38678  38626  38567  38590  38643  38642  38689  38665 ...
  10  47682  47680  47683  47694  47691  47691  47689  47689  47735  47734  47735 ...
  11  48479  48475  48474  48484  48483  48480  48478  48479  48527  48524  48523 ...
  12  46828  46824  46819  46835  46833  46828  46833  46829  46878  46875  46870 ...
  13  48335  48334  48337  48344  48343  48340  48339  48342  48384  48381  48384 ...
  14  48224  48225  48225  48235  48232  48229  48229  48229  48269  48269  48269 ...
to row:   150


REGIONS_TABLE...
REGION  AZ_S    AZ_E  UP-BIN  DWN-BIN
   1       0    4500      11        1
   2    4500    7000      12        2
   3    9000   13500      13        3
   4   13500   18000      14        4
   5   18000   22500      14        5
   6   22500   27000      13        6
   7   29000   31500      12        7
   8   31500   36000      11        8

READING_TABLE...
ROT  REGION  M_TIME_S  COLL_T  SHUT_T  SAMP_T
 NO   NO     SEC*E4    *8.064  *8.064  *8.064
  1    4     1432437     122      10       1
  1    5     1443484     122      10       1
  1    6     1454693     122      10       1
  1    7     1470337      74      10       1
  .    .        .          .       .       .
  .    .        .          .       .       .
  .    .        .          .       .       .
  7    1     2093202     146      10       1
  7    2     2107877      86      12       1
  7    3     2121425     170      10       1

BINS_TABLE...
 BIN   UP-DOWN  OPEN-CLOSE  OPEN_TIME  NO_SAMPS  COL_NO
 NO    0=D 1=U   0=O 1=C     SEC*E-4
   1       0       0         33062       410       0
   2       0       0         18869       234       1
   3       0       0         34675       430       2
   4       0       0         33062       410       3
   5       0       0         33062       410       4
   6       0       0         33062       410       5
```

7	0	0	18385	228	6
8	0	0	33062	410	7
1	0	1	33062	410	8
2	0	1	18869	234	9
3	0	1	34675	430	10
4	0	1	33062	410	11
5	0	1	33062	410	12
6	0	1	33062	410	13
7	0	1	18385	228	14
8	0	1	33062	410	15
11	1	0	66124	820	16
12	1	0	37255	462	17
13	1	0	67737	840	18
14	1	0	66124	820	19
11	1	1	66124	820	20
12	1	1	37255	462	21
13	1	1	67737	840	22
14	1	1	66124	820	23

5.6 LAMP LABEL

```
PDS_VERSION_ID                = PDS3
LABEL_REVISION_NOTE           = "Wed Jan 01 02:47:21 2014 <UTC>, C. See"

RECORD_TYPE                   = FIXED_LENGTH
RECORD_BYTES                  = 70
FILE_RECORDS                  = 44

^TEXT                         = "LAMP_0001_00702_S_118_KM.TXT"

DATA_SET_ID                   = "HP-SSA-DISR-2/3-EDR/RDR-V1.1"
PRODUCT_ID                    = "LAMP_0001_MTIME_00_11_41_7062_DISR"
SEQUENCE_NUMBER               = 0001
PRODUCT_CREATION_TIME         = 2014-01-01T02:47:21 /*UTC*/

MISSION_NAME                  = "CASSINI-HUYGENS"
INSTRUMENT_HOST_NAME          = "HUYGENS PROBE"
INSTRUMENT_HOST_ID            = HP
TARGET_NAME                   = TITAN
MISSION_PHASE_NAME            = DESCENT
INSTRUMENT_ID                 = DISR
INSTRUMENT_NAME               = "DESCENT IMAGER SPECTRAL RADIOMETER"
INSTRUMENT_TYPE               = {"IMAGER","RADIOMETER","SPECTROMETER"}
PRODUCER_ID                   = DISR
PRODUCER_INSTITUTION_NAME     = "UNIVERSITY OF ARIZONA"
PRODUCER_FULL_NAME            = "CHARLES (CHUCK) SEE"
PRODUCT_TYPE                  = EDR

START_TIME                    = 2005-01-14T09:22:02.706 /*UTC*/
STOP_TIME                     = 2005-01-14T09:22:02.706 /*UTC*/
SPACECRAFT_CLOCK_START_COUNT  = 701.706    /* DDB time in seconds.fff */
SPACECRAFT_CLOCK_STOP_COUNT   = 701.706    /* DDB time in seconds.fff */

FILE_NAME                     = "LAMP_0001_00702_S_118_KM.TXT"

PREDICTED_ALTITUDE            = 120.727 <KM> /* Real-Time from DDB */
SPACECRAFT_ALTITUDE_START     = 118.329 <KM>
SPACECRAFT_ALTITUDE_END       = 118.329 <KM>
AZIMUTH_START                 = 204.54 <DEGREES> /* CCW From Sun, Note 3 */
AZIMUTH_END                   = 204.54 <DEGREES>
AZIMUTH_NORTH_START           = 268.58 <DEGREES> /* CW From North, Note 4 */
AZIMUTH_NORTH_END             = 268.58 <DEGREES>
HUYGENS:EW_TILT_ANGLE_START   =  -7.60 <DEGREES> /* + for East tip, Note 6 */
HUYGENS:EW_TILT_ANGLE_END     =  -7.60 <DEGREES>
SPIN_RATE_START               =  -1.27 <RPM> /* CCW Positive, Note 7 */
SPIN_RATE_END                 =  -1.27 <RPM> /* CCW Positive, Note 7 */

INSTRUMENT_TEMPERATURE        = (260.58,  "UNK", 272.62,
                                 272.64, 262.33, 259.12,
                                 264.39, 261.70, 276.01,
                                 272.43, 289.03)
                                 /* KELVIN */
INSTRUMENT_TEMPERATURE_POINT  = ("CCD_T1","REF_T2","IRB_T3",
                                 "IRE_T4","CCDLUG_T5","STRAP_T6",
```

```
                                "OPTICS_T7","VIOLET_T8","SH_AUX_T9",
                                "SH_BOX_T10","EA_BOX_T11")

NATIVE_START_TIME             = 701.7062   <SECONDS>
NATIVE_STOP_TIME              = 701.7062   <SECONDS>

DESCRIPTION = "
The Lamp datasets contain information about the voltage and current being
drawn from the DISR calibration and Surface Science lamps while they are on.
These datasets are generated at the rate of about one every 5 seconds when
the lamps are energized.

Notes:
1) The altitudes are from the DTWG release in June of 2011.
2) The probe azimuth & tilt are updated to the March 2013 Karkoschka analysis.
3) AZIMUTH... is degrees counter clockwise from the Sun, viewed from Nadir.
4) AZIMUTH_NORTH... is degrees clockwise from North, as viewed from Nadir.
5) These data are from ESOC stream 524(b).
6) Positive tilt is parachute East of probe (spin axis tipped East)
7) Probe SPIN_RATE is the local average spin rate at the time of the dataset.

A list of the header entries from the source XDR format file are shown
below for reference.  The official label data (above) takes precedence over
any conflicting information presented below (i.e. azimuths, temps., etc):

filename_pre:    C:\df3\15Jan05\Log\524B\DB2\Lamp\
filename:        V_00001L_MMX_00%11%41_7062_Lmp
dimensions:      0
num_cols:        0
num_rows:        0
data_type:       0  (null)
date_replayed:   Wed Feb 09 11:08:33 2005
engineer:        Chuck See
set_name:        Lamp
ccd_t1:          260.50
detector:        AUX
CCD_id_no:       93
gse_ver:         Windows_GSE
test_log:        C:\df3\15Jan05\ESOC_Files
units:           C:\df3\15Jan05\ESOC_Files\o524sd__.1h_
set_id:          07
seq_num:         0001
m_time:          701.71 seconds
DDB altitude:        120.727 km
lamp states:        1110
thermistor_current: 0.002046 amps

ccdlug_t5:    262.3 deg. K
strap_t:      259.1 deg. K
optics_t:     264.4 deg. K
violet_t:     261.7 deg. K
SH_aux_t:     276.0 deg. K
SH_box_t:     272.4 deg. K
EA_box_t:     289.0 deg. K
Aux_volt:      11.9 volts
cpu_volt:       5.0 volts
adc_offset:     0.0 volts
```

```
disp_q_size:      8
alarm_q_size:    11
tlm_q_size:       0
sci_pro_q:        1
stack_size:    1159
cal1_volt:     4.9849 volts
cal1_curr:     0.1145 amps
cal2_volt:     4.8971 volts
cal2_curr:     0.1099 amps
cal3_volt:     4.9117 volts
cal3_curr:     0.1167 amps
ssl_volt:      0.0000 volts
ssl_curr:      0.0000 amps
disr_model:   DISR3
"


 OBJECT                       = TEXT
  RECORD_TYPE                   = FIXED_LENGTH
  RECORD_BYTES                  = 70
  FILE_RECORDS                  = 44
  NOTE                          = "DISR LAMP DATASET"
  PUBLICATION_DATE              = 2014-01-01
  INTERCHANGE_FORMAT            = ASCII
 END_OBJECT                    = TEXT

END
```

SAMPLE LAMP DATA PRINTOUT...

```
Stream:            524B\DB2
Original_Filename: V_00001L_MMX_00%11%41_7062_Lmp
Date_Taken:        2005-01-14T09:22:02.706
Set_Name:          Lamp
GSE_Version:       Windows_GSE
Sequence_No.:      0001

Mission_Time:         701.71 seconds after T0
Predicted_Altitude:  120.727 (Kilometers)
Actual_Altitude*:    118.329 (Kilometers)

Lamp_State:        1110  (C1,C2,C3,SSL)

Cal_Lamp1_Voltage:    4.9849 volts
Cal_Lamp1_Current:    0.1145 amps
Cal_Lamp2_Voltage:    4.8971 volts
Cal_Lamp2_Current:    0.1099 amps
Cal_Lamp3_Voltage:    4.9117 volts
Cal_Lamp3_Current:    0.1167 amps

Surface_Science_Lamp_Vol   0.0000 volts
Surface_Science_Lamp_Cur   0.0000 amps

Thermistor_Current: 0.002046 (amps)
CCD_Temp_t1:          260.50 degK
CCD_Lug_Temp_t5:      262.30 degK
Thermal_Strap_t6:     259.12 degK
Optical_Bench_t7:     264.39 degK
Violet_Detector_t8:   261.70 degK
Sensor_Head_Aux_t9:   276.01 degK
Sensor_Head_Box_t10   272.43 degK
Electronics_Box_t11   289.03 degK

Aux_Board_Voltage:   11.9311 volts
CPU_Board_Voltage:    4.9789 volts
ADC_Offset:         0.002440 volts

Display_Queue_size:            8
Alarm_Queue_size:             11
Telemetry_Queue_size:          0
Sci_Processing_Q_size:         1
Stack_size:                 1159

*=Post mission reconstructed information.
```

5.7 SOLAR LABEL

```
PDS_VERSION_ID                = PDS3
LABEL_REVISION_NOTE           = "Sat Jan 11 01:47:50 2014 <UTC>, C. See"

RECORD_TYPE                   = FIXED_LENGTH
RECORD_BYTES                  = 173
FILE_RECORDS                  = 52

^HEADER                       = ("SOLAR_0001_00168_S_142_KM.TAB",1)
^TABLE                        = ("SOLAR_0001_00168_S_142_KM.TAB",3)

DATA_SET_ID                   = "HP-SSA-DISR-2/3-EDR/RDR-V1.1"
PRODUCT_ID                    = "SOLAR_0001_MTIME_00_02_47_9261_DISR"
SEQUENCE_NUMBER               = 0001
PRODUCT_CREATION_TIME         = 2014-01-11T01:47:50 /*UTC*/

MISSION_NAME                  = "CASSINI-HUYGENS"
INSTRUMENT_HOST_NAME          = "HUYGENS PROBE"
INSTRUMENT_HOST_ID            = HP
TARGET_NAME                   = TITAN
MISSION_PHASE_NAME            = DESCENT
INSTRUMENT_ID                 = DISR
INSTRUMENT_NAME               = "DESCENT IMAGER SPECTRAL RADIOMETER"
INSTRUMENT_TYPE               = {"IMAGER","RADIOMETER","SPECTROMETER"}
PRODUCER_ID                   = DISR
PRODUCER_INSTITUTION_NAME     = "UNIVERSITY OF ARIZONA"
PRODUCER_FULL_NAME            = "CHARLES (CHUCK) SEE"
PRODUCT_TYPE                  = EDR

START_TIME                    = 2005-01-14T09:13:08.926 /*UTC*/
STOP_TIME                     = 2005-01-14T09:13:08.986 /*UTC*/
SPACECRAFT_CLOCK_START_COUNT  = 167.926    /* DDB time in seconds.fff */
SPACECRAFT_CLOCK_STOP_COUNT   = 167.986    /* DDB time in seconds.fff */

FILE_NAME                     = "SOLAR_0001_00168_S_142_KM.TAB"

EXPOSURE_DURATION             = 60.0000 <MILLISECONDS>
EXPOSURE_TYPE                 = AUTO
PREDICTED_ALTITUDE            = 150.693 <KM> /* Real-Time from DDB */
SPACECRAFT_ALTITUDE_START     = 141.538 <KM> /* Reconstruction, Note 1 */
SPACECRAFT_ALTITUDE_END       = 141.534 <KM>

DESIRED_AZIMUTH               =   2.50 <DEGREES> /* CCW From Sun, Note 3 */
PREDICTED_AZIMUTH             =   3.29 <DEGREES>
AZIMUTH_START                 = 137.98 <DEGREES> /* CCW From Sun, Note 3 */
AZIMUTH_END                   = 139.65 <DEGREES>
AZIMUTH_NORTH_START           = 334.79 <DEGREES> /* CW From North, Note 4 */
AZIMUTH_NORTH_END             = 333.11 <DEGREES>
SPIN_RATE                     =   4.63 <RPM>     /* CCW Positive, Note 8 */
ROTATIONS                     =   0.00 <REVOLUTIONS> /* CCW +, Note 8 */

HUYGENS:EW_TILT_ANGLE_START   =   6.61 <DEGREES> /* + for East tip, Note 6 */
HUYGENS:EW_TILT_ANGLE_END     =   6.60 <DEGREES>
```

```
INSTRUMENT_TEMPERATURE        = (258.88,  "UNK", 270.19,
                                 270.75, 266.55, 258.64,
                                 264.11, 269.51, 275.56,
                                 274.46, 286.79)
                                 /* KELVIN */
INSTRUMENT_TEMPERATURE_POINT  = ("CCD_T1","REF_T2","IRB_T3",
                                 "IRE_T4","CCDLUG_T5","STRAP_T6",
                                 "OPTICS_T7","VIOLET_T8","SH_AUX_T9",
                                 "SH_BOX_T10","EA_BOX_T11")

LAMP_STATE                    = 0000
NULL_PIXEL_2                  = 66.0000 <DN>
NULL_PIXEL_3                  = 55.0000 <DN>

NATIVE_START_TIME             = 167.9261   <SECONDS>
NATIVE_STOP_TIME              = 167.9861   <SECONDS>

DESCRIPTION = "
This is data from the DISR Solar Aureole Cameras.  Four imagers take
simultaneous exposures. The 4 cameras cover two wavelengths (500 & 935 nm)
and two polarization states (horizontal & vertical). All the cameras cover
an azimuth range of 6 degrees, and zenith range from 25 to 75 degrees.  The
intent was to take exposures near the sun, but due to pointing errors the
strips on the sky were generally observed at random locations.

The imagers each occupy 6 x 50 pixels on the CCD.  The data is collected in
two modes, 1) raw 12 bit photometric data (24 columns, 0 to 4096 DN), or
2) Four columns of data, row summed, by imager (0 to 24575 DN).

Notes:
1) The altitudes are from the DTWG release in June of 2011.
2) The probe azimuth & tilt are updated to the March 2013 Karkoschka analysis.
3) AZIMUTH... is degrees counter clockwise from the Sun, viewed from Nadir.
4) AZIMUTH_NORTH... is degrees clockwise from North, as viewed from Nadir.
5) These data are from ESOC stream 524(b).
6) Positive tilt is parachute East of probe (spin axis tipped East)
7) Temperatures are reported at the mid point (in time) of the observation.
8) SPIN_RATE is approximate & based on the local average spin rate, CCW postiv.

A list of the header entries from the source XDR format file are shown
below for reference.  The official label data (above) takes precedence over
any conflicting information presented below (i.e. azimuths, temps., etc):

filename_pre:         C:\df3\15Jan05\Log\524B\DB2\Solar\
original_filename:    V_00001A_MMX_00%02%47_9261_Slr
date_of_data_replay:  Wed Feb 09 11:13:54 2005
dimensions:           2
num_cols:            24
num_rows:            50
data_type:            2,  16 bit integer
date_replayed:      Wed Feb 09 11:08:33 2005
engineer:           Chuck See
set_name:           Solar
ccd_t1:             258.80 Kelvin
detector:           CCD
CCD_id_no:          93
exp_time:             60.00 ms
```

```
coord_x col2:        19
coord_y col2:       203
coord_x col3:        36
coord_y col3:       203
coord_x col4:        45
coord_y col4:       203
coord_x col1:        28
coord_y col1:       203
gse_ver:            Windows_GSE
test_log:           C:\df3\14Jan05\Log\stream_524b\DB2\Solar
ESOC_File:          C:\df3\15Jan05\ESOC_Files\o524sd__.1h_
set_id:               13  (SA)
seq_num:               1
m_time:              167.93 seconds after T0
cycle_num:             1
dataset type:          14 (SA)
DDB altitude:        150.693 km
target azimuth:        2.500 deg CCW Sun
predicted azimuth:     3.290 deg CCW Sun
lamp states:        0000  (C1 C2 C3 SSL)
ccd_stat:          0
ccd_flag:       1110
proc_flag:    101001
 bad_pixels:        replaced
 summing:           unsummed
 S/W Compression:   compressed
 Square Root Proc:  not square rooted
 H/W Compression:   not compressed
 Exposure Control:  automatic
cols_sent:     24
null_col2:     66 DN
null_col3:     55 DN
ccd_tgt_pct:   50
ccd_prctile:   97
thermistor_I:   2.0460 mA
ccdlug_t5:    261.6 Kelvin
strap_t:      258.9 Kelvin
optics_t:     264.2 Kelvin
violet_t:     264.0 Kelvin
SH_aux_t:     275.7 Kelvin
SH_box_t:     274.2 Kelvin
EA_box_t:     287.1 Kelvin
Aux_volt:      11.9 Volts
cpu_volt:       5.0 Volts
adc_offset:     2.4 mV
disp_q_size:      6
alarm_q_size:    10
tlm_q_size:       0
sci_pro_q:        5
stack_size:    1471
comp_ratio:    2.18
disr_model:   DISR3
Pixel min, max & mean (Range: 0 to 4095 DN):     23,    541,     270.85
"

OBJECT                      = HEADER
  HEADER_TYPE                 = TEXT
```

```
  BYTES                    = 173
  RECORDS                  = 2
  INTERCHANGE_FORMAT       = ASCII
  DESCRIPTION              = "The first 2 lines of the file contain info
                             about the measurement and the table layout."
END_OBJECT                 = HEADER


OBJECT                     = TABLE

  INTERCHANGE_FORMAT       = ASCII
  COLUMNS                  = 25
  ROWS                     = 50
  ROW_BYTES                = 173
  DESCRIPTION              = "A 24 BY 50 ARRAY OF PIXEL VALUES
                              FROM THE SOLAR AUREOLE CAMERA."

  OBJECT                   = COLUMN
    NAME                   = "ROW"
    COLUMN_NUMBER          = 1
    UNIT                   = "N/A"
    DATA_TYPE              = INTEGER
    START_BYTE             = 1
    BYTES                  = 4
    FORMAT                 = "I4"
    DESCRIPTION            = "ROW - AND VERTICAL PIXEL NUMBER."
  END_OBJECT               = COLUMN

  OBJECT                   = COLUMN
    NAME                   = "SA_COL_0-BLUE_HORIZONTAL_1"
    COLUMN_NUMBER          = 2
    UNIT                   = "DN"
    DATA_TYPE              = INTEGER
    START_BYTE             = 5
    BYTES                  = 7
    FORMAT                 = "I7"
    DESCRIPTION            = "500 NM HORIZONTAL POLARIZED COLUMN 1"
  END_OBJECT               = COLUMN

  OBJECT                   = COLUMN
    NAME                   = "SA_COL_1-BLUE_HORIZONTAL_2"
    COLUMN_NUMBER          = 3
    UNIT                   = "DN"
    DATA_TYPE              = INTEGER
    START_BYTE             = 12
    BYTES                  = 7
    FORMAT                 = "I7"
    DESCRIPTION            = "500 NM HORIZONTAL POLARIZED COLUMN 2"
  END_OBJECT               = COLUMN

      .                        .
      .                        .
      .                        .

  OBJECT                   = COLUMN
    NAME                   = "SA_COL_22-RED_HORIZONTAL_5"
    COLUMN_NUMBER          = 24
```

```
    UNIT                    = "DN"
    DATA_TYPE               = INTEGER
    START_BYTE              = 159
    BYTES                   = 7
    FORMAT                  = "I7"
    DESCRIPTION             = "935 NM HORIZONTAL POLARIZED COLUMN 5"
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    NAME                    = "SA_COL_23-RED_HORIZONTAL_6"
    COLUMN_NUMBER           = 25
    UNIT                    = "DN"
    DATA_TYPE               = INTEGER
    START_BYTE              = 166
    BYTES                   = 7
    FORMAT                  = "I7"
    DESCRIPTION             = "935 NM HORIZONTAL POLARIZED COLUMN 6"
  END_OBJECT                = COLUMN

END_OBJECT                = TABLE


END
```

SAMPLE SOLAR DATA PRINTOUT...

Solar Aureole Summed Data from Dataset: 1

PIX	B-H-1	B-H-2	B-H-3	B-H-4	B-H-5	B-H-6	B-V-1	B-V-2	B-V-3	B-V-4	B-V-5 ...
1	150	165	156	156	128	123	23	43	42	39	35 ...
2	381	415	426	419	410	400	108	185	182	170	142 ...
3	421	454	463	465	478	449	144	216	211	206	187 ...
4	430	472	463	474	478	449	151	217	208	203	196 ...
5	435	485	484	486	487	360	147	219	214	202	188 ...
6	453	492	482	494	483	260	146	212	205	202	188 ...
7	425	475	491	504	493	209	153	218	207	201	188 ...
8	427	475	485	494	479	349	125	200	200	193	183 ...
9	462	506	506	506	497	473	126	197	193	192	183 ...
10	479	499	520	506	508	497	157	197	197	180	185 ...
11	478	484	523	513	505	502	159	205	196	186	179 ...
12	482	521	517	527	523	512	157	199	196	188	176 ...
13	485	514	522	526	522	518	151	189	193	192	172 ...
14	496	519	533	523	524	508	148	197	188	187	173 ...
15	465	502	501	521	513	480	142	193	188	183	166 ...
16	467	516	513	518	520	396	143	191	186	184	170 ...
17	493	528	517	531	534	333	155	194	195	181	166 ...
18	494	515	534	541	525	250	165	203	192	184	176 ...

etc, on to row 50

5.8 STRIP LABEL

```
PDS_VERSION_ID                = PDS3
LABEL_REVISION_NOTE           = "Wed Jan 01 05:36:15 2014 <UTC>, C. See"

RECORD_TYPE                   = FIXED_LENGTH
RECORD_BYTES                  = 50
FILE_RECORDS                  = 257

^HEADER                       = "(STRIP_0001_00433_S_129_KM.TAB",1)
^TABLE                        = "(STRIP_0001_00433_S_129_KM.TAB",4)

DATA_SET_ID                   = "HP-SSA-DISR-2/3-EDR/RDR-V1.1"
PRODUCT_ID                    = "STRIP_0001_MTIME_00_07_13_2492_DISR"
SEQUENCE_NUMBER               = 0001
PRODUCT_CREATION_TIME         = 2014-01-01T05:36:15 /*UTC*/

MISSION_NAME                  = "CASSINI-HUYGENS"
INSTRUMENT_HOST_NAME          = "HUYGENS PROBE"
INSTRUMENT_HOST_ID            = HP
TARGET_NAME                   = TITAN
MISSION_PHASE_NAME            = DESCENT
INSTRUMENT_ID                 = DISR
INSTRUMENT_NAME               = "DESCENT IMAGER SPECTRAL RADIOMETER"
INSTRUMENT_TYPE               = {"IMAGER","RADIOMETER","SPECTROMETER"}
PRODUCER_ID                   = DISR
PRODUCER_INSTITUTION_NAME     = "UNIVERSITY OF ARIZONA"
PRODUCER_FULL_NAME            = "CHARLES (CHUCK) SEE"
PRODUCT_TYPE                  = EDR

START_TIME                    = 2005-01-14T09:17:34.249 /*UTC*/
STOP_TIME                     = 2005-01-14T09:17:34.252 /*UTC*/
SPACECRAFT_CLOCK_START_COUNT  = 433.249    /* DDB time in seconds.fff */
SPACECRAFT_CLOCK_STOP_COUNT   = 433.252    /* DDB time in seconds.fff */

FILE_NAME                     = "STRIP_0001_00433_S_129_KM.TAB"

EXPOSURE_DURATION             = 2.50000 <MILLISECONDS>
EXPOSURE_TYPE                 = AUTO
PREDICTED_ALTITUDE            = 132.506 <KM> /* Real-Time from DDB */
SPACECRAFT_ALTITUDE_START     = 129.102 <KM> /* Reconstruction, Note 1 */
SPACECRAFT_ALTITUDE_END       = 129.102 <KM>

DESIRED_AZIMUTH               = 315.00 <DEGREES> /* CCW From Sun, Note 3 */
PREDICTED_AZIMUTH             = 314.25 <DEGREES>
AZIMUTH_START                 = 191.37 <DEGREES> /* CCW From Sun, Note 3 */
AZIMUTH_END                   = 191.39 <DEGREES>
AZIMUTH_NORTH_START           = 281.56 <DEGREES> /* CW From North, Note 4 */
AZIMUTH_NORTH_END             = 281.54 <DEGREES>

HUYGENS:EW_TILT_ANGLE_START   =   0.86 <DEGREES> /* + for East tip, Note 6 */
HUYGENS:EW_TILT_ANGLE_END     =   0.86 <DEGREES>

INSTRUMENT_TEMPERATURE        = (260.21,  "UNK", 271.97,
                                 272.24, 262.30, 259.52,
```

```
                                  264.29, 263.10, 275.91,
                                  273.43, 287.83)
                                  /* KELVIN */
INSTRUMENT_TEMPERATURE_POINT  = ("CCD_T1","REF_T2","IRB_T3",
                                  "IRE_T4","CCDLUG_T5","STRAP_T6",
                                  "OPTICS_T7","VIOLET_T8","SH_AUX_T9",
                                  "SH_BOX_T10","EA_BOX_T11")

LAMP_STATE                    = 0000
NULL_PIXEL_2                  = 71.0000 <DN>
NULL_PIXEL_3                  = 69.0000 <DN>

NATIVE_START_TIME             = 433.2492   <SECONDS>
NATIVE_STOP_TIME              = 433.2517   <SECONDS>

DESCRIPTION = "
This is data from the DISR Side Looking Imager (SLI).  This data consists
of the sum of two strips, one near each edge of the imager.  The left column
is the sum of SLI columns 6 through 18, and the right dataset column is the
sum of SLI columns 109 through 121.  Both sums are 13 columns wide (~0.2 deg)
and 254 rows vertically (~45 to 96 deg Nadir).

Notes:
1) The altitudes are from the DTWG release in June of 2011.
2) The probe azimuth & tilt are updated to the March 2013 Karkoschka analysis.
3) AZIMUTH... is degrees counter clockwise from the Sun, viewed from Nadir.
4) AZIMUTH_NORTH... is degrees clockwise from North, as viewed from Nadir.
5) These data are from ESOC stream 524(b).
6) Positive tilt is parachute East of probe (spin axis tipped East)
7) Temperatures are reported at the mid point (in time) of the observation.

A list of the header entries from the source XDR format file are shown
below for reference.  The official label data (above) takes precedence over
any conflicting information presented below (i.e. azimuths, temps., etc):

filename_pre:         C:\df3\15Jan05\Log\524B\DB2\Strip\
original_filename:    V_00001P_MMX_00%07%13_2492_Stp
date_of_data_replay:  Wed Feb 09 11:14:01 2005
dimensions:           2
num_cols:             2
num_rows:           254
data_type:            2,  16 bit integer
date_replayed:      Wed Feb 09 11:08:33 2005
engineer:           Chuck See
set_name:           Strip
ccd_t1:             260.20
detector:           CCD
CCD_id_no:          93
exp_time:              2.50 ms
coord_x col1:       234
coord_y col1:         1
gse_ver:            Windows_GSE
test_log:           stream_524b\DB2\Image15
ESOC_File:          C:\df3\15Jan05\ESOC_Files\o524sd__.1h_
set_id:               12  (Strip)
seq_num:               1
m_time:             433.25
```

```
cycle_num:              3
dataset type:        12 (STRIP)
DDB altitude:        132.506 km
target azimuth:      315.000 deg CCW Sun
predicted azimuth:   314.250 deg CCW Sun
lamp states:        0000
ccd_stat:          0
ccd_flag:       1110
proc_flag:    111001
cols_sent:       2
null_col2:     71
null_col3:     69
ccd_tgt_pct:   60
ccd_prctile:   97
strp_cnt_col:       232
first_col_strp:     240
thermistor_I:   0.0
ccdlug_t5:    262.3
strap_t:      259.5
optics_t:     264.3
violet_t:     263.1
SH_aux_t:     275.9
SH_box_t:     273.4
EA_box_t:     287.8
Aux_volt:      11.9
cpu_volt:       5.0
adc_offset:     0.0
disp_q_size:      9
alarm_q_size:    11
tlm_q_size:       0
sci_pro_q:        4
stack_size:    1282
comp_ratio:       1
disr_model:   DISR3
Pixel min, max & mean (0 to 53,235):      0,   7764,    6320.26
"

OBJECT                       = HEADER
  HEADER_TYPE                  = TEXT
  BYTES                        = 50
  RECORDS                      = 3
  INTERCHANGE_FORMAT           = ASCII
  DESCRIPTION                  = "The first 3 lines of the file contain info
                                    about the measurement and the table layout."
END_OBJECT                   = HEADER


OBJECT                       = TABLE

  INTERCHANGE_FORMAT         = ASCII
  COLUMNS                    = 3
  ROWS                       = 254
  ROW_BYTES                  = 21
  DESCRIPTION                = "SUM OF PIXEL VALUES FOR 13 COLUMNS
                                 NEAR EACH SIDE OF THE SLI"

  OBJECT                       = COLUMN
```

```
    NAME                    = "ROW"
    COLUMN_NUMBER           = 1
    UNIT                    = "N/A"
    DATA_TYPE               = INTEGER
    START_BYTE              = 1
    BYTES                   = 4
    FORMAT                  = "I4"
    DESCRIPTION             = "ROW NUMBER - VERTICAL DIMENSION"
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    NAME                    = "DN"
    COLUMN_NUMBER           = 2
    UNIT                    = "DN"
    DATA_TYPE               = INTEGER
    START_BYTE              = 5
    BYTES                   = 8
    FORMAT                  = "I8"
    DESCRIPTION             = "SUM OF PIXEL VALUES FOR 13 COLUMNS
                               (COLUMN 6 THRU COLUMN 18) NEAR THE
                               LEFT EDGE OF THE SLI"
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    NAME                    = "DN"
    COLUMN_NUMBER           = 3
    UNIT                    = "DN"
    DATA_TYPE               = INTEGER
    START_BYTE              = 13
    BYTES                   = 8
    FORMAT                  = "I8"
    DESCRIPTION             = "SUM OF PIXEL VALUES FOR 13 COLUMNS
                               (COLUMN 109 THRU COLUMN 121) NEAR THE
                               RIGHT EDGE OF THE SLI"
  END_OBJECT                = COLUMN

END_OBJECT                 = TABLE


END
```

SAMPLE STRIP DATA PRINTOUT...

```
SLI Strip Data from Dataset: 1
Sum of SLI Columns 6 thru 18 and 109 thru 121.
 ROW    LEFT   RIGHT
   1       0       0
   2       0    2444
   3    2258    3096
   4    3106    3189
   5    3013    3233
   6    3466    3268
   7    3565    3314
   8    3561    3321
   9    3644    3411
etc to row 254
```

5.9 SUN LABEL

```
PDS_VERSION_ID                = PDS3
LABEL_REVISION_NOTE           = "Sat Jan 11 20:47:10 2014 <UTC>, C. See"

RECORD_TYPE                   = FIXED_LENGTH
RECORD_BYTES                  = 60
FILE_RECORDS                  = 7

^HEADER                       = ("SUN_0010_01321_S_083_KM.TAB",1)
^TABLE                        = ("SUN_0010_01321_S_083_KM.TAB",3)

DATA_SET_ID                   = "HP-SSA-DISR-2/3-EDR/RDR-V1.1"
PRODUCT_ID                    = "SUN_0010_MTIME_00_22_00_7354_DISR"
SEQUENCE_NUMBER               = 0010
PRODUCT_CREATION_TIME         = 2014-01-11T20:47:10 /*UTC*/

MISSION_NAME                  = "CASSINI-HUYGENS"
INSTRUMENT_HOST_NAME          = "HUYGENS PROBE"
INSTRUMENT_HOST_ID            = HP
TARGET_NAME                   = TITAN
MISSION_PHASE_NAME            = DESCENT
INSTRUMENT_ID                 = DISR
INSTRUMENT_NAME               = "DESCENT IMAGER SPECTRAL RADIOMETER"
INSTRUMENT_TYPE               = {"IMAGER","RADIOMETER","SPECTROMETER"}
PRODUCER_ID                   = DISR
PRODUCER_INSTITUTION_NAME     = "UNIVERSITY OF ARIZONA"
PRODUCER_FULL_NAME            = "CHARLES (CHUCK) SEE"
PRODUCT_TYPE                  = EDR

START_TIME                    = 2005-01-14T09:32:21.735 /*UTC*/
STOP_TIME                     = 2005-01-14T09:33:44.131 /*UTC*/
SPACECRAFT_CLOCK_START_COUNT  = 1320.735   /* DDB time in seconds.fff */
SPACECRAFT_CLOCK_STOP_COUNT   = 1403.131   /* DDB time in seconds.fff */

FILE_NAME                     = "SUN_0010_01321_S_083_KM.TAB"

PREDICTED_ALTITUDE            =  84.103 <KM> /* Real-Time from DDB */
SPACECRAFT_ALTITUDE_START     =  84.769 <KM> /* Reconstruction, Note 1 */
SPACECRAFT_ALTITUDE_END       =  80.539 <KM>

AZIMUTH_START                 =   6.98 <DEGREES> /* CCW From Sun, Note 3 */
AZIMUTH_END                   = 345.52 <DEGREES>
AZIMUTH_NORTH_START           = 106.58 <DEGREES> /* CW From North, Note 4 */
AZIMUTH_NORTH_END             = 128.08 <DEGREES>
SPIN_RATE                     =  -8.56 <RPM>     /* CCW POSITIVE, Notes 2, 8 */
ROTATIONS                     = -11.75 <REVOLUTIONS> /* CCW +, Note 8 */

HUYGENS:EW_TILT_ANGLE_START   =  -6.50 <DEGREES> /* + for East tip, Note 6 */
HUYGENS:EW_TILT_ANGLE_END     =  -5.30 <DEGREES>

INSTRUMENT_TEMPERATURE        = (258.44,  "UNK", 271.35,
                                 270.94, 258.85, 253.87,
                                 263.30, 255.97, 275.02,
```

```
                                  268.52, 291.86)
                                  /* KELVIN */
INSTRUMENT_TEMPERATURE_POINT  = ("CCD_T1","REF_T2","IRB_T3",
                                  "IRE_T4","CCDLUG_T5","STRAP_T6",
                                  "OPTICS_T7","VIOLET_T8","SH_AUX_T9",
                                  "SH_BOX_T10","EA_BOX_T11")


NATIVE_START_TIME             = 1320.7354  <SECONDS>
NATIVE_STOP_TIME              = 1403.1315  <SECONDS>

DESCRIPTION = "
This is data from the DISR Sun Sensor.  The Sun Sensor is a narrow band IR
(936 nm) detector behind a double V shaped slit which produces 3 pulses for
each encounter with the sun.  If the set is deemed valid, the mission time for
each pulse, and the amplitude of the signal are recorded.  Variations in the
period plus the pulse spacing allow the user to calculate the spin rate and
tip in the direction of the sun. However, consecutive pulse readings are not
necessarily consecutive probe rotations.  Many sun crossings are missing.

The Sun Sensors FOV covers 25 to 75 degs Zenith angle, but the on-board
filtering designed to eliminate glints and errant pulses kept the sensor
from recording each sun crossing due to excessive swinging of the probe.

Notes:
1) The altitudes are from the DTWG release in June of 2011.
2) The probe azimuth & tilt are updated to the March 2013 Karkoschka analysis.
3) AZIMUTH... is degrees counter clockwise from the Sun, viewed from Nadir.
4) AZIMUTH_NORTH... is degrees clockwise from North, as viewed from Nadir.
5) These data are from ESOC stream 524(b).
6) Positive tilt is parachute East of probe (spin axis tipped East)
7) Temperatures are reported at the mid point (in time) of the observation.
8) ROTATIONS are approximate & are based on the local average spin rate.

A list of the header entries from the source XDR format file are shown
below for reference.  The official label data (above) takes precedence over
any conflicting information presented below (i.e. azimuths, temps., etc):

filename_pre:         C:\df3\15Jan05\Log\524B\DB2\Sun\
original_filename:    V_00010S_MMX_00%22%00_7354_Sun
date_of_data_replay:  Wed Feb 09 11:09:06 2005
dimensions:           2
num_cols:             4
num_rows:             5
data_type:            3,  32 bit integer
date_replayed:      Wed Feb 09 11:08:33 2005
engineer:           Chuck See
set_name:           Sun
ccd_t1:             258.70 Kelvin
detector_type:      SUN
CCD_id_no:          93
gse_ver:            Windows_GSE
test_log:           C:\df3\14Jan05\Log\stream_524b\DB2\Sun
ESOC_File:          C:\df3\15Jan05\ESOC_Files\o524sd__.1h_
set_id:                3  (SUN_SENSOR)
seq_num:              10
m_time:             1320.7354 seconds
```

```
DDB altitude:         84.103 km
thermistor_I: 2.0460 mA
ccdlug_t5:    259.0 Kelvin
strap_t:      254.6 Kelvin
optics_t:     263.5 Kelvin
violet_t:     256.6 Kelvin
SH_aux_t:     275.0 Kelvin
SH_box_t:     268.9 Kelvin
EA_box_t:     291.7 Kelvin
Aux_volt:      11.9 Volts
cpu_volt:       5.0 Volts
adc_offset:     3.677 mV
disp_q_size:      9
alarm_q_size:    10
tlm_q_size:       0
sci_pro_q:        1
stack_size:    1181
num_triplets:     5
disr_model:   DISR3
"

OBJECT                      = HEADER
  HEADER_TYPE               = TEXT
  BYTES                     = 60
  RECORDS                   = 2
  INTERCHANGE_FORMAT        = ASCII
  DESCRIPTION               = "The first 2 lines of the file contain info
                               about the measurement and the column headers."
END_OBJECT                  = HEADER


OBJECT                      = TABLE

  INTERCHANGE_FORMAT        = ASCII
  COLUMNS                   = 5
  ROWS                      = 5
  ROW_BYTES                 = 46
    DESCRIPTION             = "THE TIME OF THE THREE SUN SENSOR PULSES
                               AND THE AMPLITUDE FROM THE SUN SENSOR."

  OBJECT                    = COLUMN
    NAME                    = "SET"
    COLUMN_NUMBER           = 1
    UNIT                    = "N/A"
    DATA_TYPE               = INTEGER
    START_BYTE              = 1
    BYTES                   = 4
    FORMAT                  = "I4"
    DESCRIPTION             = "EACH SET CORRESPONDS TO A SUN DETECTION."
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    NAME                    = "TIME 1"
    COLUMN_NUMBER           = 2
    UNIT                    = "SECOND*10**-4"
    DATA_TYPE               = INTEGER
    START_BYTE              = 5
```

```
    BYTES                   = 11
    FORMAT                  = "I11"
    DESCRIPTION             = "MISSION TIME OF FIRST SUN PULSE."
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    NAME                    = "TIME 2"
    COLUMN_NUMBER           = 3
    UNIT                    = "SECOND*10**-4"
    DATA_TYPE               = INTEGER
    START_BYTE              = 16
    BYTES                   = 11
    FORMAT                  = "I11"
    DESCRIPTION             = "MISSION TIME OF SECOND SUN PULSE."
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    NAME                    = "TIME 3"
    COLUMN_NUMBER           = 4
    UNIT                    = "SECOND*10**-4"
    DATA_TYPE               = INTEGER
    START_BYTE              = 27
    BYTES                   = 11
    FORMAT                  = "I11"
    DESCRIPTION             = "MISSION TIME OF THIRD SUN PULSE."
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    NAME                    = "DN"
    COLUMN_NUMBER           = 5
    UNIT                    = "DN"
    DATA_TYPE               = INTEGER
    START_BYTE              = 38
    BYTES                   = 8
    FORMAT                  = "I8"
    DESCRIPTION             = "SUN SENSOR DETECTOR AMPLITUDE"
  END_OBJECT                = COLUMN

END_OBJECT                = TABLE


END
```

SAMPLE SUN DATA PRINTOUT...

```
DISR SUN SENSOR PULSE TIMES (SEC*E-4) & AMPLITUDE (DN)
 SET     TIME_1     TIME_2     TIME_3  AMPLITUDE
   1   13207354   13209090   13210890     255
   2   13271220   13272619   13274226     260
   3   13879616   13882097   13884151     230
   4   13953052   13954216   13955572     234
   5   14024419   14028125   14031315     209
```

5.10 TIME LABEL

```
PDS_VERSION_ID               = PDS3
LABEL_REVISION_NOTE          = "Sat Jan 11 21:12:55 2014 <UTC>, C. See"

RECORD_TYPE                  = FIXED_LENGTH
RECORD_BYTES                 = 40
FILE_RECORDS                 = 22

^HEADER                      = ("TIME_0001_00102_S_144_KM.TAB",1)
^TABLE                       = ("TIME_0001_00102_S_144_KM.TAB",3)

DATA_SET_ID                  = "HP-SSA-DISR-2/3-EDR/RDR-V1.1"
PRODUCT_ID                   = "TIME_0001_MTIME_00_01_42_0000_DISR"
SEQUENCE_NUMBER              = 0001
PRODUCT_CREATION_TIME        = 2014-01-11T21:12:55 /*UTC*/

MISSION_NAME                 = "CASSINI-HUYGENS"
INSTRUMENT_HOST_NAME         = "HUYGENS PROBE"
INSTRUMENT_HOST_ID           = HP
TARGET_NAME                  = TITAN
MISSION_PHASE_NAME           = DESCENT
INSTRUMENT_ID                = DISR
INSTRUMENT_NAME              = "DESCENT IMAGER SPECTRAL RADIOMETER"
INSTRUMENT_TYPE              = {"IMAGER","RADIOMETER","SPECTROMETER"}
PRODUCER_ID                  = DISR
PRODUCER_INSTITUTION_NAME    = "UNIVERSITY OF ARIZONA"
PRODUCER_FULL_NAME           = "CHARLES (CHUCK) SEE"
PRODUCT_TYPE                 = EDR

START_TIME                   = 2005-01-14T09:12:03.000 /*UTC*/
STOP_TIME                    = 2005-01-14T09:12:41.000 /*UTC*/
SPACECRAFT_CLOCK_START_COUNT = 102.000    /* DDB time in seconds.fff */
SPACECRAFT_CLOCK_STOP_COUNT  = 140.000    /* DDB time in seconds.fff */

FILE_NAME                    = "TIME_0001_00102_S_144_KM.TAB"

PREDICTED_ALTITUDE           = 158.799 <KM> /* Real-Time from DDB */
SPACECRAFT_ALTITUDE_START    = 144.978 <KM> /* Reconstruction, Note 1 */
SPACECRAFT_ALTITUDE_END      = 142.940 <KM>

AZIMUTH_START                = 290.23 <DEGREES> /* CCW From Sun, Note 3 */
AZIMUTH_END                  =  50.72 <DEGREES>
AZIMUTH_NORTH_START          = 182.49 <DEGREES> /* CW From North, Note 4 */
AZIMUTH_NORTH_END            =  62.02 <DEGREES>
SPIN_RATE                    =   5.44 <RPM>     /* CCW POSITIVE, Noted 2,8 */
ROTATIONS                    =   3.45 <REVOLUTIONS> /* CCW +, Note 8 */

HUYGENS:EW_TILT_ANGLE_START  =  13.50 <DEGREES> /* + for East tip, Note 6 */
HUYGENS:EW_TILT_ANGLE_END    =  10.20 <DEGREES>

INSTRUMENT_TEMPERATURE       = (259.06,  "UNK", 269.80,
                                270.45, 266.07, 258.49,
                                264.08, 269.57, 275.50,
                                274.65, 286.61)
```

```
                                  /* KELVIN */
INSTRUMENT_TEMPERATURE_POINT  = ("CCD_T1","REF_T2","IRB_T3",
                                 "IRE_T4","CCDLUG_T5","STRAP_T6",
                                 "OPTICS_T7","VIOLET_T8","SH_AUX_T9",
                                 "SH_BOX_T10","EA_BOX_T11")


NATIVE_START_TIME             = 102.0000   <SECONDS>
NATIVE_STOP_TIME              = 140.0000   <SECONDS>

DESCRIPTION = "
This is data from the DISR Time datasets.  The time datasets record the Huygens
Descent Data Broadcast (DDB) time and corresponding DISR internal clock time
at each DDB (2 seconds). Since the clocks start at different times, there is
always an offset. If the offset changes significantly (due to drift etc) the
instrument may make small (0.0002 second) time corrections, which can effect
time based measurements, such as the spin rate.

Notes:
1) The altitudes are from the DTWG release in June of 2011.
2) The probe azimuth & tilt are updated to the March 2013 Karkoschka analysis.
3) AZIMUTH... is degrees counter clockwise from the Sun, viewed from Nadir.
4) AZIMUTH_NORTH... is degrees clockwise from North, as viewed from Nadir.
5) These data are from ESOC stream 524(b).
6) Positive tilt is parachute East of probe (spin axis tipped East)
7) Temperatures are reported at the mid point (in time) of the observation.
8) ROTATIONS are approximate & are based on the local average spin rate.

A list of the header entries from the source XDR format file are shown
below for reference.  The official label data (above) takes precedence over
any conflicting information presented below (i.e. azimuths, temps., etc):

filename_pre:         C:\df3\15Jan05\Log\524B\DB2\Time\
original_filename:    V_00001T_MMX_00%01%42_0000_Tme
date_of_data_replay:  Wed Feb 09 11:08:58 2005
dimensions:           2
num_cols:             2
num_rows:            20
data_type:            3,  32 bit integer
date_replayed:      Wed Feb 09 11:08:33 2005
engineer:           Chuck See
set_name:           Time
ccd_t1:             259.40 Kelvin
CCD_id_no:          93
gse_ver:            Windows_GSE
test_log:           C:\df3\14Jan05\Log\stream_524b\DB2\Time
ESOC_File:          C:\df3\15Jan05\ESOC_Files\o524sd__.1h_
set_id:                 2  (TIME)
seq_num:                1
m_time:              102.0000 seconds
DDB altitude:        158.799 km
thermistor_I:          2.0460 mA
ccdlug_t5:    261.6 Kelvin
strap_t:      258.9 Kelvin
optics_t:     264.2 Kelvin
violet_t:     263.9 Kelvin
SH_aux_t:     275.7 Kelvin
```

```
SH_box_t:     274.2 Kelvin
EA_box_t:     287.1 Kelvin
Aux_volt:      11.9 Volts
cpu_volt:       5.0 Volts
adc_offset:     2.440 mV
disp_q_size:      6
alarm_q_size:    10
tlm_q_size:       0
sci_pro_q:        5
stack_size:    1471
num_time_pairs:  20
disr_model:   DISR3
"

OBJECT                      = HEADER
  HEADER_TYPE               = TEXT
  BYTES                     = 40
  RECORDS                   = 2
  INTERCHANGE_FORMAT        = ASCII
  DESCRIPTION               = "The first 2 lines of the file contain the
                               column headers."
END_OBJECT                  = HEADER


OBJECT                    = TABLE

  INTERCHANGE_FORMAT      = ASCII
  COLUMNS                 = 3
  ROWS                    = 20
  ROW_BYTES               = 25
  DESCRIPTION             = "TABLE COMPARING PROBE DDB TIME TO
                             DISR INTERNAL CLOCK TIME."

  OBJECT                  = COLUMN
    NAME                  = "ROW"
    COLUMN_NUMBER         = 1
    UNIT                  = "N/A"
    DATA_TYPE             = INTEGER
    START_BYTE            = 1
    BYTES                 = 4
    FORMAT                = "I4"
    DESCRIPTION           = "ROW NUMBER "
  END_OBJECT              = COLUMN

  OBJECT                  = COLUMN
    NAME                  = "TIME 1"
    COLUMN_NUMBER         = 2
    UNIT                  = "SECOND*10**-4"
    DATA_TYPE             = INTEGER
    START_BYTE            = 5
    BYTES                 = 10
    FORMAT                = "I10"
    DESCRIPTION           = "HUYGENS PROBE DDB TIME"
  END_OBJECT              = COLUMN

  OBJECT                  = COLUMN
    NAME                  = "TIME 2"
```

```
    COLUMN_NUMBER            = 3
    UNIT                     = "SECOND*10**-4"
    DATA_TYPE                = INTEGER
    START_BYTE               = 15
    BYTES                    = 10
    FORMAT                   = "I10"
    DESCRIPTION              = "INTERNAL DISR CLOCK TIME"
  END_OBJECT                 = COLUMN

END_OBJECT                 = TABLE


END
```

SAMPLE TIME DATA PRINTOUT...

EPOCH	DDB_TIME SEC*E-4	DISR_CLOCK SEC*E-4
1	1020000	217956
2	1040000	237956
3	1060000	257956
4	1080000	277957
5	1100000	297957
6	1120000	317957
7	1140000	337957
8	1160000	357958
9	1180000	377958
10	1200000	397958
11	1220000	417958
12	1240000	437959
13	1260000	457959
14	1280000	477959
15	1300000	497959
16	1320000	517960
17	1340000	537960
18	1360000	557960
19	1380000	577960
20	1400000	597961

5.11 VIOLET LABEL

```
PDS_VERSION_ID               = PDS3
LABEL_REVISION_NOTE          = "Sat Jan 11 22:11:56 2014 <UTC>, C. See"

RECORD_TYPE                  = FIXED_LENGTH
RECORD_BYTES                 = 10
FILE_RECORDS                 = 2

^HEADER                      = ("VIOLET_0001_00144_S_143_KM.TAB",1)
^TABLE                       = ("VIOLET_0001_00144_S_143_KM.TAB",2)

DATA_SET_ID                  = "HP-SSA-DISR-2/3-EDR/RDR-V1.1"
PRODUCT_ID                   = "VIOLET_0001_MTIME_00_02_24_2528_DISR"
SEQUENCE_NUMBER              = 0001
MEASUREMENT_TYPE             = DLV
PRODUCT_CREATION_TIME        = 2014-01-11T22:11:56 /*UTC*/

MISSION_NAME                 = "CASSINI-HUYGENS"
INSTRUMENT_HOST_NAME         = "HUYGENS PROBE"
INSTRUMENT_HOST_ID           = HP
TARGET_NAME                  = TITAN
MISSION_PHASE_NAME           = DESCENT
INSTRUMENT_ID                = DISR
INSTRUMENT_NAME              = "DESCENT IMAGER SPECTRAL RADIOMETER"
INSTRUMENT_TYPE              = {"IMAGER","RADIOMETER","SPECTROMETER"}
PRODUCER_ID                  = DISR
PRODUCER_INSTITUTION_NAME    = "UNIVERSITY OF ARIZONA"
PRODUCER_FULL_NAME           = "CHARLES (CHUCK) SEE"
PRODUCT_TYPE                 = EDR

START_TIME                   = 2005-01-14T09:12:45.253 /*UTC*/
STOP_TIME                    = 2005-01-14T09:12:45.253 /*UTC*/
SPACECRAFT_CLOCK_START_COUNT = 144.253    /* DDB time in seconds.fff */
SPACECRAFT_CLOCK_STOP_COUNT  = 144.253    /* DDB time in seconds.fff */

FILE_NAME                    = "VIOLET_0001_00144_S_143_KM.TAB"

PREDICTED_ALTITUDE           = 152.615 <KM> /* Real-Time from DDB */
SPACECRAFT_ALTITUDE_START    = 142.744 <KM> /* Reconstruction, Note 1 */
SPACECRAFT_ALTITUDE_END      = 142.744 <KM>

DESIRED_AZIMUTH              = 180.00 <DEGREES> /* CCW From Sun, Note 3 */
PREDICTED_AZIMUTH            = 177.97 <DEGREES>
AZIMUTH_START                = 177.41 <DEGREES> /* CCW From Sun, Note 3 */
AZIMUTH_END                  = 177.41 <DEGREES>
AZIMUTH_NORTH_START          = 295.34 <DEGREES> /* CW From North, Note 4 */
AZIMUTH_NORTH_END            = 295.34 <DEGREES>
SPIN_RATE_AVERAGE            =   4.95 <RPM>     /* CCW POSITIVE, Notes 2, 8 */

HUYGENS:EW_TILT_ANGLE_START  =   9.67 <DEGREES> /* + for East tip, Note 6 */
HUYGENS:EW_TILT_ANGLE_END    =   9.67 <DEGREES>

INSTRUMENT_TEMPERATURE       = (258.80,  "UNK", 269.99,
                                270.60, 266.12, 258.56,
```

```
                                 264.10, 269.57, 275.53,
                                 274.56, 286.70)
                                 /* KELVIN */
INSTRUMENT_TEMPERATURE_POINT  = ("CCD_T1","REF_T2","IRB_T3",
                                 "IRE_T4","CCDLUG_T5","STRAP_T6",
                                 "OPTICS_T7","VIOLET_T8","SH_AUX_T9",
                                 "SH_BOX_T10","EA_BOX_T11")

LAMP_STATE                    = 0000

NATIVE_START_TIME             = 144.2528   <SECONDS>
NATIVE_STOP_TIME              = 144.2528   <SECONDS>

DESCRIPTION = "
This is data from the DISR Violet Photometers.  Two filterd Si detectors
record the up or down looking radiance over the band from 350 to 480 nm.
The photometers observe nearly pi stradians (170 deg azimuth, and from 5 to
88 degs from Nadir and Zenith).

Notes:
1) The altitudes are from the DTWG release in June of 2011.
2) The probe azimuth & tilt are updated to the March 2013 Karkoschka analysis.
3) AZIMUTH... is degrees counter clockwise from the Sun, viewed from Nadir.
4) AZIMUTH_NORTH... is degrees clockwise from North, as viewed from Nadir.
5) These data are from ESOC stream 524(b).
6) Positive tilt is parachute East of probe (spin axis tipped East)
7) Temperatures are reported at the mid point (in time) of the observation.
8) SPIN_RATE is approximate & based on the local average spin rate, CCW postiv.

A list of the header entries from the source XDR format file are shown
below for reference.  The official label data (above) takes precedence over
any conflicting information presented below (i.e. azimuths, temps., etc):

filename_pre:         C:\df3\15Jan05\Log\524B\DB2\Violet\
original_filename:    V_00001V_MMX_00%02%24_2528_Vlt
date_of_data_replay:  Wed Feb 09 11:09:30 2005
dimensions:           0
num_cols:             1
num_rows:             0
data_type:            2,  16 bit integer
date_replayed:      Wed Feb 09 11:08:33 2005
engineer:           Chuck See
set_name:           Violet
ccd_t1:             259.40 Kelvin
detector:           VIOLET
CCD_id_no:          93
gse_ver:            Windows_GSE
test_log:           C:\df3\14Jan05\Log\stream_524b\DB2\Violet
ESOC_File:          C:\df3\15Jan05\ESOC_Files\o524sd__.1h_
set_id:               17  (VIOLET)
seq_num:               1
m_time:              144.25 seconds after T0
cycle_num:             1
dataset type:         6 (DLV)
DDB altitude:        152.615 km
target azimuth:      180.000 deg CCW Sun
predicted azimuth:   177.970 deg CCW Sun
```

```
lamp states:        0000
thermistor_I:          2.046 mA
ccdlug_t5:    261.6 Kelvin
strap_t:      258.9 Kelvin
optics_t:     264.2 Kelvin
violet_t:     264.0 Kelvin
SH_aux_t:     275.7 Kelvin
SH_box_t:     274.2 Kelvin
EA_box_t:     287.1 Kelvin
Aux_volt:      11.9 Volts
cpu_volt:       5.0 Volts
adc_offset:     2.4 mV
disp_q_size:      6
alarm_q_size:    10
tlm_q_size:       0
sci_pro_q:        5
stack_size:    1471
disr_model:   DISR3
photometer_reading:      379
"

OBJECT                       = HEADER
  HEADER_TYPE                  = TEXT
  BYTES                        = 10
  RECORDS                      = 1
  INTERCHANGE_FORMAT           = ASCII
  DESCRIPTION                  = "The first line of the file contains the
                                    measurement type (ULV or DLV)."
END_OBJECT                   = HEADER


OBJECT                        = TABLE
  INTERCHANGE_FORMAT          = ASCII
  ROWS                        = 1
  COLUMNS                     = 1
  ROW_BYTES                   = 10
  DESCRIPTION                 = "A SINGLE MEASUREMENT FROM THE VIOLET PHOTOMETER"

  OBJECT                        = COLUMN
    NAME                        = "DN"
    COLUMN_NUMBER               = 1
    UNIT                        = "N/A"
    DATA_TYPE                   = INTEGER
    START_BYTE                  = 1
    BYTES                       = 10
    DESCRIPTION                 = "A SINGLE READING FROM THE DLV PHOTOMETER"
  END_OBJECT                    = COLUMN
END_OBJECT                    = TABLE


END
```

SAMPLE VIOLET DATA PRINTOUT...

```
      DLV
      379
```

5.12 VISIBLE LABEL

```
PDS_VERSION_ID               = PDS3
LABEL_REVISION_NOTE          = "Sat Jan 11 23:40:20 2014 <UTC>, C. See"

RECORD_TYPE                  = FIXED_LENGTH
RECORD_BYTES                 = 85
FILE_RECORDS                 = 202

^HEADER                      = ("VISIBL_0001_00143_S_143_KM.TAB",1)
^TABLE                       = ("VISIBL_0001_00143_S_143_KM.TAB",3)

DATA_SET_ID                  = "HP-SSA-DISR-2/3-EDR/RDR-V1.1"
PRODUCT_ID                   = "VISIBLE_0001_MTIME_00_02_23_0117_DISR"
SEQUENCE_NUMBER              = 0001
MEASUREMENT_TYPE             = DLVS
COLUMNS                      = 10
PRODUCT_CREATION_TIME        = 2014-01-11T23:40:20 /*UTC*/

MISSION_NAME                 = "CASSINI-HUYGENS"
INSTRUMENT_HOST_NAME         = "HUYGENS PROBE"
INSTRUMENT_HOST_ID           = HP
TARGET_NAME                  = TITAN
MISSION_PHASE_NAME           = DESCENT
INSTRUMENT_ID                = DISR
INSTRUMENT_NAME              = "DESCENT IMAGER SPECTRAL RADIOMETER"
INSTRUMENT_TYPE              = {"IMAGER","RADIOMETER","SPECTROMETER"}
PRODUCER_ID                  = DISR
PRODUCER_INSTITUTION_NAME    = "UNIVERSITY OF ARIZONA"
PRODUCER_FULL_NAME           = "CHARLES (CHUCK) SEE"
PRODUCT_TYPE                 = EDR

START_TIME                   = 2005-01-14T09:12:44.012 /*UTC*/
STOP_TIME                    = 2005-01-14T09:12:44.310 /*UTC*/
SPACECRAFT_CLOCK_START_COUNT = 143.012    /* DDB time in seconds.fff */
SPACECRAFT_CLOCK_STOP_COUNT  = 143.310    /* DDB time in seconds.fff */

FILE_NAME                    = "VISIBL_0001_00143_S_143_KM.TAB"

EXPOSURE_DURATION            = 298.500 <MILLISECONDS>
EXPOSURE_TYPE                = AUTO
PREDICTED_ALTITUDE           = 152.715 <KM> /* Real-Time from DDB */
SPACECRAFT_ALTITUDE_START    = 142.801 <KM> /* Reconstruction, Note 1 */
SPACECRAFT_ALTITUDE_END      = 142.787 <KM>

DESIRED_AZIMUTH              = 152.00 <DEGREES> /* CCW From Sun, Note 3 */
PREDICTED_AZIMUTH            = 128.24 <DEGREES>
AZIMUTH_START                = 140.60 <DEGREES> /* CCW From Sun, Note 3 */
AZIMUTH_END                  = 149.46 <DEGREES>
AZIMUTH_NORTH_START          = 332.15 <DEGREES> /* CW From North, Note 4 */
AZIMUTH_NORTH_END            = 323.29 <DEGREES>
SPIN_RATE                    =   5.05 <RPM>     /* CCW POSITIVE, Notes 2,8 */
ROTATIONS                    =   0.03 <REVOLUTIONS> /* CCW +, Note 8 */

HUYGENS:EW_TILT_ANGLE_START  =   9.85 <DEGREES> /* + for East tip, Note 6 */
HUYGENS:EW_TILT_ANGLE_END    =   9.80 <DEGREES>
```

```
INSTRUMENT_TEMPERATURE        = (258.81,  "UNK", 269.98,
                                 270.59, 266.12, 258.56,
                                 264.10, 269.57, 275.53,
                                 274.56, 286.70)
                                 /* KELVIN */
INSTRUMENT_TEMPERATURE_POINT  = ("CCD_T1","REF_T2","IRB_T3",
                                 "IRE_T4","CCDLUG_T5","STRAP_T6",
                                 "OPTICS_T7","VIOLET_T8","SH_AUX_T9",
                                 "SH_BOX_T10","EA_BOX_T11")

LAMP_STATE                    = 0000
NULL_PIXEL_2                  = 66.0000 <DN>
NULL_PIXEL_3                  = 55.0000 <DN>

NATIVE_START_TIME             = 143.0117   <SECONDS>
NATIVE_STOP_TIME              = 143.3102   <SECONDS>

DESCRIPTION = "
This is data from the DISR visible wavelength spectrometers.  The DISR
contains two: the Upward Looking Visible Spectrometer (ULVS) and the
Downward Looking Visible Spectrometer (DLVS).  Both have 200 spectral
elements covering the wavelength range from 480 to 960 nm.  The ULVS observes
basically Pi stradians (170 deg azimuth and 5 to 88 deg Zenith angle).  The
DLVS observes a spot centered on the SSL (4 deg azimuth by 10 to 50 deg Nadir).

The ULVS occupies 8 x 200 pixels on the CCD.  The data is row summed by 4s
resulting in 2 rows of data, right and left half of the sky. The DLVS is 20 x
200 pixels and relayed either raw or summed in 10, 5 or 2 columns depending on
the data collection mode (descent cycle).

Notes:
1) The altitudes are from the DTWG release in June of 2011.
2) The probe azimuth & tilt are updated to the March 2013 Karkoschka analysis.
3) AZIMUTH... is degrees counter clockwise from the Sun, viewed from Nadir.
4) AZIMUTH_NORTH... is degrees clockwise from North, as viewed from Nadir.
5) These data are from ESOC stream 524(b).
6) Positive tilt is parachute East of probe (spin axis tipped East)
7) Temperatures are reported at the mid point (in time) of the observation.
8) ROTATIONS are approximate & are based on the local average spin rate.

A list of the header entries from the source XDR format file are shown
below for reference.  The official label data (above) takes precedence over
any conflicting information presented below (i.e. azimuths, temps., etc):

filename_pre:         C:\df3\15Jan05\Log\524B\DB2\Visible\
original_filename:    V_00001B_MMX_00%02%23_0117_Vis
date_of_data_replay:  Wed Feb 09 11:12:13 2005
dimensions:           2
num_cols:            10
num_rows:           200
data_type:            2,  16 bit integer
date_replayed:      Wed Feb 09 11:08:33 2005
engineer:           Chuck See
set_name:           Visible
ccd_t1:             258.60 Kelvin
detector:           CCD
```

```
CCD_id_no:          93
exp_time:            298.50 ms
coord_x col1:        33
coord_y col1:         1
gse_ver:            Windows_GSE
test_log:           C:\df3\14Jan05\Log\stream_524b\DB2\Visible
ESOC_File:          C:\df3\15Jan05\ESOC_Files\o524sd__.1h_
set_id:                10  (VISIBLE)
seq_num:               1
m_time:              143.01 seconds after T0
cycle_num:             1
dataset type:        16 (DLVS)
DDB altitude:        152.715 km
target azimuth:      152.000 deg CCW Sun
predicted azimuth:   128.240 deg CCW Sun
lamp states:        0000
ccd_stat:          0
ccd_flag:       1110
proc_flag:    111001
 bad_pixels:        replaced
 summing:           summed
 S/W Compression:   compressed
 Square Root Proc:  not square rooted
 H/W Compression:   not compressed
 Exposure Control:  automatic
cols_sent:      10
null_col2:     66 DN
null_col3:     55 DN
ccd_tgt_pct:   50
ccd_prctile:   97
thermistor_I: 2.0460 mA
ccdlug_t5:    261.6 Kelvin
strap_t:      258.9 Kelvin
optics_t:     264.2 Kelvin
violet_t:     263.9 Kelvin
SH_aux_t:     275.7 Kelvin
SH_box_t:     274.2 Kelvin
EA_box_t:     287.1 Kelvin
Aux_volt:      11.9 Volts
cpu_volt:       5.0 Volts
adc_offset:     2.4 mV
disp_q_size:      6
alarm_q_size:    10
tlm_q_size:       0
sci_pro_q:        5
stack_size:    1471
comp_ratio:     1.830
disr_model:   DISR3
Pixel min, max & mean (Range: 0 to 8190):     44,   2158,     957.84
"

OBJECT                      = HEADER
  HEADER_TYPE               = TEXT
  BYTES                     = 85
  RECORDS                   = 2
  INTERCHANGE_FORMAT        = ASCII
  DESCRIPTION               = "The first 2 lines of the file contain info
```

```
                                about the measurement and the column headers."
END_OBJECT                  = HEADER


OBJECT                      = TABLE

  INTERCHANGE_FORMAT        = ASCII
  COLUMNS                   = 11
  ROWS                      = 200
  ROW_BYTES                 = 85
    DESCRIPTION             = "DLVS DATA SUMMED INTO TEN COLUMNS"

  OBJECT                      = COLUMN
    NAME                      = "ROW"
    COLUMN_NUMBER             = 1
    UNIT                      = "N/A"
    DATA_TYPE                 = INTEGER
    START_BYTE                = 1
    BYTES                     = 4
    FORMAT                    = "I4"
    DESCRIPTION               = "ROW NUMBER - SPECTRAL DIMENSION"
  END_OBJECT                  = COLUMN

  OBJECT                      = COLUMN
    NAME                      = "DLVS_COLM_1_OF_10"
    COLUMN_NUMBER             = 2
    UNIT                      = "DN"
    DATA_TYPE                 = INTEGER
    START_BYTE                = 5
    BYTES                     = 8
    FORMAT                    = "I8"
    DESCRIPTION               = "SUM OF CCD COLS 14 & 15"
  END_OBJECT                  = COLUMN

  OBJECT                      = COLUMN
    NAME                      = "DLVS_COLM_2_OF_10"
    COLUMN_NUMBER             = 3
    UNIT                      = "DN"
    DATA_TYPE                 = INTEGER
    START_BYTE                = 13
    BYTES                     = 8
    FORMAT                    = "I8"
    DESCRIPTION               = "SUM OF CCD COLS 16 & 17"
  END_OBJECT                  = COLUMN

  OBJECT                      = COLUMN
    NAME                      = "DLVS_COLM_3_OF_10"
    COLUMN_NUMBER             = 4
    UNIT                      = "DN"
    DATA_TYPE                 = INTEGER
    START_BYTE                = 21
    BYTES                     = 8
    FORMAT                    = "I8"
    DESCRIPTION               = "SUM OF CCD COLS 18 & 19"
  END_OBJECT                  = COLUMN

  OBJECT                      = COLUMN
```

```
    NAME                    = "DLVS_COLM_4_OF_10"
    COLUMN_NUMBER           = 5
    UNIT                    = "DN"
    DATA_TYPE               = INTEGER
    START_BYTE              = 29
    BYTES                   = 8
    FORMAT                  = "I8"
    DESCRIPTION             = "SUM OF CCD COLS 20 & 21"
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    NAME                    = "DLVS_COLM_5_OF_10"
    COLUMN_NUMBER           = 6
    UNIT                    = "DN"
    DATA_TYPE               = INTEGER
    START_BYTE              = 37
    BYTES                   = 8
    FORMAT                  = "I8"
    DESCRIPTION             = "SUM OF CCD COLS 22 & 23"
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    NAME                    = "DLVS_COLM_6_OF_10"
    COLUMN_NUMBER           = 7
    UNIT                    = "DN"
    DATA_TYPE               = INTEGER
    START_BYTE              = 45
    BYTES                   = 8
    FORMAT                  = "I8"
    DESCRIPTION             = "SUM OF CCD COLS 24 & 25"
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    NAME                    = "DLVS_COLM_7_OF_10"
    COLUMN_NUMBER           = 8
    UNIT                    = "DN"
    DATA_TYPE               = INTEGER
    START_BYTE              = 53
    BYTES                   = 8
    FORMAT                  = "I8"
    DESCRIPTION             = "SUM OF CCD COLS 26 & 27"
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    NAME                    = "DLVS_COLM_8_OF_10"
    COLUMN_NUMBER           = 9
    UNIT                    = "DN"
    DATA_TYPE               = INTEGER
    START_BYTE              = 61
    BYTES                   = 8
    FORMAT                  = "I8"
    DESCRIPTION             = "SUM OF CCD COLS 28 & 29"
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    NAME                    = "DLVS_COLM_9_OF_10"
    COLUMN_NUMBER           = 10
```

```
    UNIT                    = "DN"
    DATA_TYPE               = INTEGER
    START_BYTE              = 69
    BYTES                   = 8
    FORMAT                  = "I8"
    DESCRIPTION             = "SUM OF CCD COLS 30 & 31"
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    NAME                    = "DLVS_COLM_10_OF_10"
    COLUMN_NUMBER           = 11
    UNIT                    = "DN"
    DATA_TYPE               = INTEGER
    START_BYTE              = 77
    BYTES                   = 8
    FORMAT                  = "I8"
    DESCRIPTION             = "SUM OF CCD COLS 32 & 33"
  END_OBJECT                = COLUMN

END_OBJECT                = TABLE

END
```

SAMPLE VISIBLE DATA PRINTOUT...

DISR DOWN LOOKING VISIBLE SPECTROMETER (DLVS) SUMMED TWO TO A COLUMN. SET: 1

ROW	C14+15	C16+17	C18+19	C20+21	C22+23	C24+25	C26+27	C28+29	C30+31	C32+33
1	44	62	56	50	64	60	58	62	63	66
2	47	53	57	59	61	67	69	64	66	72
3	52	56	79	66	67	60	81	65	67	79
4	69	78	55	65	58	77	68	70	70	89
5	54	60	68	62	68	62	71	87	70	66
6	58	71	66	70	76	72	72	69	70	77
7	73	66	70	87	83	84	77	87	76	77
8	62	70	76	88	75	80	78	90	80	94
9	63	82	85	78	87	86	89	93	95	94
10	68	102	90	98	124	96	101	107	108	115
11	89	104	87	93	100	100	105	105	105	125
12	94	100	111	101	107	112	118	121	114	128
13	89	122	110	112	133	115	128	119	123	132
14	87	109	163	122	136	147	130	129	125	138
15	97	143	129	136	131	144	143	140	143	145
16	101	148	139	157	149	150	156	156	159	151

to row: 200

5.13 VISIBLE_EX LABEL

```
PDS_VERSION_ID                = PDS3
LABEL_REVISION_NOTE           = "Sat Jan 11 22:55:39 2014 <UTC>, C. See"

RECORD_TYPE                   = FIXED_LENGTH
RECORD_BYTES                  = 21
FILE_RECORDS                  = 202

^HEADER                       = ("VIS_EX_0001_00143_S_143_KM.TAB",1)
^TABLE                        = ("VIS_EX_0001_00143_S_143_KM.TAB",3)

DATA_SET_ID                   = "HP-SSA-DISR-2/3-EDR/RDR-V1.1"
PRODUCT_ID                    = "VIS_EX_0001_MTIME_00_02_23_0117_DISR"
SEQUENCE_NUMBER               = 0001
MEASUREMENT_TYPE              = DLVS_EXT
PRODUCT_CREATION_TIME         = 2014-01-11T22:55:39 /*UTC*/

MISSION_NAME                  = "CASSINI-HUYGENS"
INSTRUMENT_HOST_NAME          = "HUYGENS PROBE"
INSTRUMENT_HOST_ID            = HP
TARGET_NAME                   = TITAN
MISSION_PHASE_NAME            = DESCENT
INSTRUMENT_ID                 = DISR
INSTRUMENT_NAME               = "DESCENT IMAGER SPECTRAL RADIOMETER"
INSTRUMENT_TYPE               = {"IMAGER","RADIOMETER","SPECTROMETER"}
PRODUCER_ID                   = DISR
PRODUCER_INSTITUTION_NAME     = "UNIVERSITY OF ARIZONA"
PRODUCER_FULL_NAME            = "CHARLES (CHUCK) SEE"
PRODUCT_TYPE                  = EDR

START_TIME                    = 2005-01-14T09:12:44.012 /*UTC*/
STOP_TIME                     = 2005-01-14T09:12:44.310 /*UTC*/
SPACECRAFT_CLOCK_START_COUNT  = 143.012    /* DDB time in seconds.fff */
SPACECRAFT_CLOCK_STOP_COUNT   = 143.310    /* DDB time in seconds.fff */

FILE_NAME                     = "VIS_EX_0001_00143_S_143_KM.TAB"

EXPOSURE_DURATION             = 298.500 <MILLISECONDS>
EXPOSURE_TYPE                 = MANUAL
PREDICTED_ALTITUDE            = 152.715 <KM> /* Real-Time from DDB */
SPACECRAFT_ALTITUDE_START     = 142.801 <KM> /* Reconstruction, Note 1 */
SPACECRAFT_ALTITUDE_END       = 142.787 <KM>

DESIRED_AZIMUTH               = 152.00 <DEGREES> /* CCW From Sun, Note 3 */
PREDICTED_AZIMUTH             = 128.24 <DEGREES>
AZIMUTH_START                 = 140.60 <DEGREES> /* CCW From Sun, Note 3 */
AZIMUTH_END                   = 149.46 <DEGREES>
AZIMUTH_NORTH_START           = 332.15 <DEGREES> /* CW From North, Note 4 */
AZIMUTH_NORTH_END             = 323.29 <DEGREES>
SPIN_RATE_AVERAGE             =   5.05 <RPM>     /* CCW POSITIVE, Notes 2, 8 */
ROTATIONS                     =   0.03 <REVOLUTIONS> /* CCW +, Note 8 */

HUYGENS:EW_TILT_ANGLE_START   =   9.85 <DEGREES> /* + for East tip, Note 6 */
HUYGENS:EW_TILT_ANGLE_END     =   9.80 <DEGREES>
```

```
INSTRUMENT_TEMPERATURE        = (258.81,  "UNK", 269.98,
                                 270.59, 266.12, 258.56,
                                 264.10, 269.57, 275.53,
                                 274.56, 286.70)
                                 /* KELVIN */
INSTRUMENT_TEMPERATURE_POINT  = ("CCD_T1","REF_T2","IRB_T3",
                                 "IRE_T4","CCDLUG_T5","STRAP_T6",
                                 "OPTICS_T7","VIOLET_T8","SH_AUX_T9",
                                 "SH_BOX_T10","EA_BOX_T11")

LAMP_STATE                    = 0000
NULL_PIXEL_2                  = 66.0000 <DN>
NULL_PIXEL_3                  = 55.0000 <DN>

NATIVE_START_TIME             = 143.0117   <SECONDS>
NATIVE_STOP_TIME              = 143.3102   <SECONDS>

DESCRIPTION = "
This is data from the DISR visible wavelength spectrometer extra columns.
The VIS_EX columns are dark pixels that lie outside of the visible
spectrometer columns on the DISR CCD. They are read at the same time as their
corresponding spectrometer (ULVS or DLVS) during observations, and used to
eliminate stray light.  See DISR Users Guide section 5.10 for details.

The ULVS_EX datasets record CCD columns 31 & 49. The DLVS_EX datasets record
CCD columns 39 & 49. (both are 2 by 200 pixels).

Notes:
1) The altitudes are from the DTWG release in June of 2011.
2) The probe azimuth & tilt are updated to the March 2013 Karkoschka analysis.
3) AZIMUTH... is degrees counter clockwise from the Sun, viewed from Nadir.
4) AZIMUTH_NORTH... is degrees clockwise from North, as viewed from Nadir.
5) These data are from ESOC stream 524(b).
6) Positive tilt is parachute East of probe (spin axis tipped East)
7) Temperatures are reported at the mid point (in time) of the observation.
8) ROTATIONS are approximate & are based on the local average spin rate.

A list of the header entries from the source XDR format file are shown
below for reference.  The official label data (above) takes precedence over
any conflicting information presented below (i.e. azimuths, temps., etc):

filename_pre:         C:\df3\15Jan05\Log\524B\DB2\Visible_Ext\
original_filename:    V_00001O_MMX_00%02%23_0117_Vex
date_of_data_replay:  Wed Feb 09 11:13:26 2005
dimensions:           2
num_cols:             2
num_rows:           200
data_type:            2,  16 bit integer
date_replayed:      Wed Feb 09 11:08:33 2005
engineer:           Chuck See
set_name:           Visible_Ext
ccd_t1:             258.60 Kelvin
detector:           CCD
CCD_id_no:          93
exp_time:            298.50 ms
coord_x col1:         2
```

```
gse_ver:            Windows_GSE
test_log:           C:\df3\14Jan05\Log\stream_524b\DB2\Visible_Ext
ESOC_File:          C:\df3\15Jan05\ESOC_Files\o524sd__.1h_
set_id:                19  (VIS_EX)
seq_num:                1
m_time:               143.01 seconds after T0
cycle_num:              1
dataset type:         30 (DLVS_EXT)
DDB altitude:         152.715 km
target azimuth:       152.000 deg CCW Sun
predicted azimuth:    128.240 deg CCW Sun
lamp states:          0000
ccd_stat:            0
ccd_flag:        1110
proc_flag:       1000
 bad_pixels:          not replaced
 summing:             unsummed
 S/W Compression:     compressed
 Square Root Proc:    not square rooted
 H/W Compression:     not compressed
 Exposure Control:    manual
cols_sent:         2
null_col2:      66 DN
null_col3:      55 DN
ccd_tgt_pct:     0
ccd_prctile:     0
thermistor_I: 2.0460 mA
ccdlug_t5:     261.6 Kelvin
strap_t:       258.9 Kelvin
optics_t:      264.2 Kelvin
violet_t:      263.9 Kelvin
SH_aux_t:      275.7 Kelvin
SH_box_t:      274.2 Kelvin
EA_box_t:      287.1 Kelvin
Aux_volt:       11.9 Volts
cpu_volt:        5.0 Volts
adc_offset:      2.4 mV
disp_q_size:       6
alarm_q_size:     10
tlm_q_size:        0
sci_pro_q:         5
stack_size:     1471
comp_ratio:        3
disr_model:    DISR3
Pixel min, max & mean (Range: 0 to 4095):     21,    190,      82.16
"

OBJECT                      = HEADER
  HEADER_TYPE               = TEXT
  BYTES                     = 21
  RECORDS                   = 2
  INTERCHANGE_FORMAT        = ASCII
  DESCRIPTION               = "The first 2 lines of the file contain info
                               about the measurement and the column headers."
END_OBJECT                  = HEADER
```

```
OBJECT                      = TABLE

  INTERCHANGE_FORMAT        = ASCII
  COLUMNS                   = 3
  ROWS                      = 200
  ROW_BYTES                 = 21
  DESCRIPTION               = "CCD COLUMNS TO BE USED FOR BLEED-THRU
                               COMPENSATION FOR DLVS COLUMNS"

  OBJECT                    = COLUMN
    NAME                      = "ROW_NO"
    COLUMN_NUMBER             = 1
    UNIT                      = "N/A"
    DATA_TYPE                 = INTEGER
    START_BYTE                = 1
    BYTES                     = 4
    FORMAT                    = "I4"
    DESCRIPTION               = "SPECTROMETER ROW NUMBER"
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    NAME                      = "COLUMN1"
    COLUMN_NUMBER             = 2
    UNIT                      = "DN"
    DATA_TYPE                 = INTEGER
    START_BYTE                = 5
    BYTES                     = 8
    FORMAT                    = "I8"
    DESCRIPTION               = "CCD READINGS IN COLUMN 39"
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    NAME                      = "COLUMN2"
    COLUMN_NUMBER             = 3
    UNIT                      = "DN"
    DATA_TYPE                 = INTEGER
    START_BYTE                = 13
    BYTES                     = 8
    FORMAT                    = "I8"
    DESCRIPTION               = "CCD READINGS IN COLUMN 49"
  END_OBJECT                = COLUMN

END_OBJECT                  = TABLE

END
```

SAMPLE VISIBLE_EX DATA PRINTOUT...

DLVS EXTRA COLUMNS.

ROW	COL-39	COL-49
1	26	68
2	28	70
3	46	76
4	29	78
5	25	80
6	24	85
7	29	93
8	24	93
9	21	101
10	24	89
11	26	90

to row: 200

6. Revisions to Earlier Data Volumes

Corrections made to earlier data volumes...

Revised Dataset: HP-SSA-DISR-2/3-EDR/RDR-V1.0

Data Changes...
No errors were found in the archived data; however a more photometrically accurate method of processing the Image data has been found, and the improved images have been added in the EXTRAS\IMAGE_ELEMENTS directory. Many improvements have been made to the supporting information contained in the label files.

* A detailed list of the data changes...

1) Image elements with improved photometry have been added to the volume under: EXTRAS\IMAGE_ELEMENTS. Besides the raw imaged, improved flat fields, the dark current parameters, and the square-root compression tables have been added along with information on how to process the images.

2) Altitudes reported in the label files have been updated to reflect the newer Descent Trajectory Working Group (DTWG) release from June of 2011.

3) Label file values for Azimuth, Spin Rate, & E/W tilt are updated to be in line with the March 2013 Karkoschka analysis.

4) The probe Azimuth, Altitude & Tilt are reported at both the beginning and end of the observation (previously reported only at the beginning).

5) Added 'SPIN_RATE' keyword to most label files to allow the user to determine the direction of the azimuth progression.

6) The DISR temperature array has been expanded to include all available instrument measured temperatures (in Label Files), not just selected values as before, as some analyses have shown additional temperature dependencies.

7) Temperatures are reported at the mid-point (in time) of the measurement, rather than at the beginning. This allows more accuracy for long exposure measurements.

8) A better explanation of the azimuth definition is included in the DESCRIPTION elements.

9) The DESCRIPTION fields have been expanded to provide a more complete explanation of the dataset.

10) Where appropriate the 'EXPOSURE_TYPE' keyword was added to describe if the observation was automatically or manually exposed to help distinguish the calibration measurements.

11) The 'NULL_PIXEL' keywords were added to CCD measurements to allow determination of the dark-current offset.

12) A more complete data re-play that includes partial datasets was used.

13) Filenames and Product ID's have been revised to include more information.

14) Added reconstructed altitude, azimuth and spin information to DESCENT datasets to juxtapose real-time software values to the actuals.

15) Added XDR formatted images to the DATA/IMAGERS directory.

16) Replaced NASAView formatted (IMG) images with more generic TIFF images.

17) Added IMAGE_ID keyword to image labels to help user determine the format (MRI, SLI, HRI) of the dataset.

18) Added note to image labels pointing out the error in the on-board flat fields for the Medium Resolution Imagers (MRI).

19) Added 'MEASUREMENT_TYPE' keyword to IR spectrometer labels to help user determine the type of IR measurement (ULIS, DLIS, IR_COMB, IR,LONG, etc).

20) Added "ROTATIONS' keyword to the IR spectrometer labels to help the user determine the spectrometer pointing history.

21) Added table column headers to make the data more understandable.

22) Added 'COLUMNS' keyword to the Visible Spectrometer label files to allow the user to determine the amount of column summing used.

23) Corrected many small errors including the syntax and offset for the pointers in the label files.

* New Keywords Added...

1) SPACECRAFT_ALTITUDE_START = The reconstructed altitude of the probe at the start of the measurement.

2) SPACECRAFT_ALTITUDE_END = The reconstructed altitude of the probe at the end of the measurement.

3) PREDICTED_ALTITUDE = The real-time altitude (km) as predicted by the Huygens probe and relayed to the instrument via the Descent Data Broadcast (DDB).

4) AZIMUTH_START = The reconstructed pointing direction of the DISR instrument at the start of the observation. The angle is defined as being in a plane perpendicular to the Nadir vector (i.e. horizontal), measured in degrees Counterclockwise (CCW) from the vector to the Sun, as viewed from above.

5) AZIMUTH_END = The reconstructed pointing direction of the DISR instrument at the end of the observation. The angle is defined as being in a plane perpendicular to the Nadir vector (i.e. horizontal), measured in degrees Counterclockwise (CCW) from the vector to the Sun, as viewed from above.

6) AZIMUTH_NORTH_START = The same as AZIMUTH_START, except measured in degrees Clockwise (CW) from true North (Titan's spin vector) viewed from above, as

one would for standard compass directions.

7) AZIMUTH_NORTH_START = The same as AZIMUTH_END, except measured in degrees Clockwise (CW) from true North (Titan's spin vector), viewed from above, as one would for standard compass directions.

8) SPIN_RATE = The approximate average spin rate (in RPM) of the Huygens probe during the measurement as determined by a polynomial fit to the local spin-rate observations. The sense is CCW positive in keeping with the original intended spin direction of the probe.

9) ROTATIONS = The number (or fraction) of spin revolutions the probe makes during the observation, CCW from above defined as positive.

10) SPIN_RATE_START = The instantaneous, re-constructed spin rate (in RPM) at the start of the observation, CCW from above defined as positive.

11) SPIN_RATE_END = The instantaneous, re-constructed spin rate (in RPM) at the end of the observation, CCW from above defined as positive.

12) HUYGENS:EW_TILT_ANGLE_START = The tilt of the Huygens probe spin axis at the start of the observation. The tilt is measured relative to the Zenith vector in the East/West direction. Positive tilt is defined as the spin vector being East of Zenith (i.e. the parachute being east of the probe).

13) HUYGENS:EW_TILT_ANGLE_END = The tilt of the Huygens probe spin axis at the end of the observation. The tilt is measured relative to the Zenith vector in the East/West direction. Positive tilt is defined as the spin vector being East of Zenith (i.e. the parachute being east of the probe).

14) DESCENT_CYCLE_NAME = The name of the descent cycle (Image, Non-Image, etc) that the observation was in. This can often effect data collection externalities such as azimuth timing, exposure time, column summing, etc.

15) NULL_PIXEL_2 & NULL_PIXEL_3 = Readout of covered pixels on the CCD chip which are needed to determine the dark current offset for the observation.

16) MEASUREMENT_TYPE = Distinguishes between sub-types within the DISR sub-instruments, such as Upward Looking vs. Downward Looking for the Visible Spectrometer.

17) IMAGE_ID = Distinguishes type of image dataset; Medium Resolution, High Resolution, or Side Looking.

18) EXPOSURE_TYPE = Distinguishes between Auto-exposed observations and pre-planned, fixed exposure observations. Can be used to identify calibration exposures.

* Documentation Revisions...

1) The EAICD has been substantially revised.

2) Added the Visible Spectrometer Calibration Document (\DOCUMENT\ DISR_CALIBRATION_DOCUMENTS\VISIBLE_SPECTROMETERS\VISIBLE_SPECTROMETER_CALDOC), which contains all the details about how the Visible Spectrometers were calibrated.

3) Added the Infra-Red Spectrometer Calibration Document (\DOCUMENT\
DISR_CALIBRATION_DOCUMENTS\INFRARED_SPECTROMETERS\IR_SPECTROMETER_CAL_DOC),
which contains all the details about how the Infra-Red Spectrometers were
calibrated.

4) Added clarification to section 2.1 of VISIBLE_SPECTROMETER_CAL_NOTES,
(\DOCUMENT\DISR_CALIBRATION_DOCUMENTS\VISIBLE_SPECTROMETERS\
VISIBLE_SPECTROMETER_CAL_NOTES).

5) Fixed an error in the IR spectrometer calibration notes
(IR_SPECTROMETER_CAL_NOTES) section 2, equation f, and in section 3, the DLIS
FWHM equation.

6) Corrected figure 8 of the SUN_SENSOR_CALIBRATION_DOC.

7) Incorporated DISR Archive Users' Guide in DOCUMENTS section of archive.