Mars Science Laboratory (MSL)
Software Interface Specification
DAN Reduced Data Record (RDR)

Version 1.0
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2/15/12	All	Remaining questions from PDS	Draft
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TBD ITEMS

SECTION/PAGE	TBD ITEM	RESPONSIBILITY

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ACRONYMS AND ABBREVIATIONS

ASCII	American Standard Code for Information Interchange
CODMAC	Committee on Data Management and Computation
CETN	Counts of Epithermal Neutrons
CTN	Counts of Thermal Neutrons
DAN	Dynamic Albedo of Neutrons
DE	DAN Electronics
EDR	Experiment Data Record
FDD	Functional Design Document
FEI	File Exchange Interface
GDS	Ground Data System
IOT	Instrument Operations Team
JPL	Jet Propulsion Laboratory
LPL	Lunar and Planetary Laboratory
MER	Mars Exploration Rovers
MIPL	Multi-mission image Processing Laboratory
MSL	Mars Science Laboratory
NAIF	Navigation and Ancillary Information Facility
NASA	National Aeronautics and Space Administration
ODL	Object Description Language
ODS	MSL's Operations Data Store
OPGS	Operations Products Generation Sub-system
PDS	Planetary Data System
PHX	Mars Phoenix Lander
PNG	Pulsing Neutron Generator
RDR	Reduced Data Record
RMC	Rover Motion Counter
RTO	Real Time Operations (MSL terminology)
SCLK	Spacecraft Clock
SIS	Software Interface Specification
TBD	To Be Defined/Determined

1. INTRODUCTION

1.1 Purpose and Scope

The purpose of this Software Interface Specification (SIS) is to provide suppliers and consumers of the Mars Science Lander's (MSL) Dynamic Albedo of Neutrons (DAN) instrument with a detailed description of DAN's Reduced Data Records (RDR). It does not cover any lower-level products, which are collectively known as Experimental Data Records (EDR). They will be covered by a separate SIS, provided by the OPGS (JPL).

This SIS includes descriptions of higher order DAN science and the special engineering data products.

The users for whom this SIS is intended for are the scientists who will analyze the data, including those associated with the MSL Project, DAN instrument engineers, and other users in the general planetary science community.

1.2 Contents

This SIS provides a very high level description of how DAN works/operates. It also describes, at high level, how the DAN data product is acquired by the instrument and how it is processed, formatted, labeled, and uniquely identified on the ground.

The document discusses standards used in generating the product and software tools which may be used to access the information. The data product structure and organization is described in sufficient detail to enable a user to read the product. Finally, an example of the product's PDS label is provided.

1.3 Applicable Documents and Constraints

This Data Product SIS is responsive to the following MSL documents:

1. Mars Exploration Program Data Management Plan, Arvidson et al., Rev. 4.0, June 15, 2011.
2. Mars Science Laboratory Archive Generation, Validation and Transfer Plan, Joy Crisp, JPL D-35281, May 28, 2010.
3. Planetary Data System Standards Reference, JPL D-7669 part 2, version 3.8, February 27, 2009.
4. Planetary Archive Preparation Guide, JPL D-31224, Version 1.4, April 1, 2010, http://pds.jpl.nasa.gov/tools/archiving.html.
5. DAN FDD, JPL D-34220, MSL 375-1230
6. Mars Science Laboratory Software Interface Specification DAN Experiment Data Record, JPL D-38113, SIS-SCI1014-MSL, to be completed.
7. Mars Exploration Program Data Management Plan, Arvidson et al., Rev. 4.0, June 15, 2011.
8. MSL DAN Science Team and PDS Geosciences Node Interface Control Document (ICD), Susan Slavney and Alberto Behar, Version 3.0, July 26, 2010.

9. Mars Science Laboratory Dynamic Albedo of Neutrons RDR Archive Volume Software Interface Specification, Karl Harshman, September 28, 2011.

10. The Dynamic Albedo of Neutrons (DAN) Experiment for NASA's 2009 Mars Science Laboratory Litvak et al., 2008

This SIS is meant to be consistent with the contract negotiated between the MSL Project and the Instrument Principal Investigator (PI) in which reduced data records (RDR) and documentation (SIS) are explicitly defined as deliverable products.

1.4 Relationships with Other Interfaces

Changes to this DAN SIS document will affect the following products, software, and/or documents.

Table 1: Product and Software Interfaces to this SIS

Name	Type P-product S-software D-document	Owner
DAN RDRs	P	U of A
DAN_RDR_gen	S	U of A
DAN UA database schema	P	U of A
Other DAN Programs/Products/Documents	P/S/D	DAN Science Team

2. DATA PRODUCT CHARACTERISTICS AND ENVIRONMENT

2.1 Instrument Overview

The Dynamic Albedo of Neutrons (DAN) is an active/passive neutron spectrometer that measures the abundance and depth distribution of H- and OH-bearing materials (e.g., adsorbed water, hydrated minerals) in a shallow layer (~1 m) of Mars' subsurface along the path of the MSL rover. In active mode, DAN measures the time decay curve (the "dynamic albedo") of the neutron flux from the subsurface induced by its pulsing 14 MeV neutron source (Figure 1 shows an example). A detailed description of the DAN instrument and scientific investigation can be found in Litvak et al. (2008). The experiment is contributed by the Federal Space Agency of Russia.

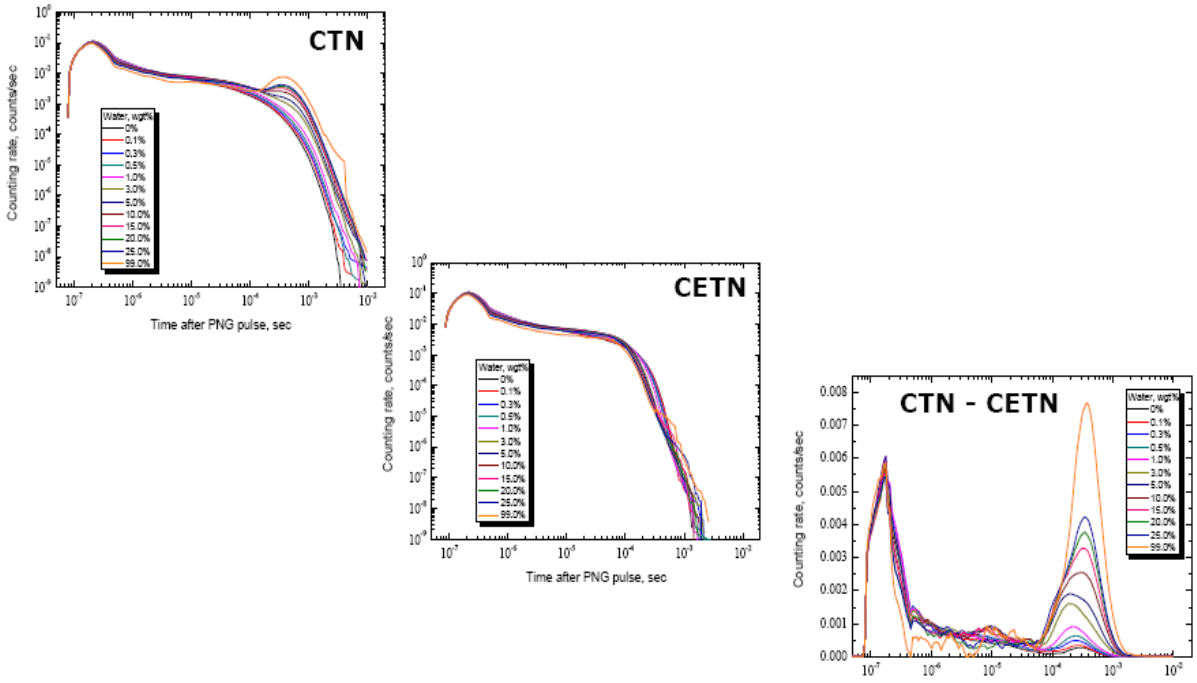


Figure 1: Numerical simulations of the neutron count rate versus time (i.e., die-away curve) for the unshielded (left, CTN) and shielded (middle CETN) detectors as a function of water abundance. The right panel shows the difference between the two count rates.

The science objectives of the DAN instrument are as follows: 1) Detect and provide a quantitative estimation of the hydrogen in the subsurface throughout the surface mission; 2) Investigate the upper <0.5 m of the subsurface and determine the possible layering structure of hydrogen-bearing materials in the subsurface; 3) Track the variability of hydrogen content in the upper soil layer (~1 m) during the mission by periodic analysis; and 4) Track the variability of neutron radiation background (neutrons with energy < 100 keV) during the mission by periodic analysis.

The DAN instrument is expected to be used during rover traverses (e.g., during short stops at ~1 m intervals) and while the rover is parked. Short-duration (< 2 min) measurements will provide a rough estimate of the water-equivalent hydrogen distribution with an accuracy of ~1% by weight. Longer-duration (~30 min) measurements are necessary to derive the vertical distribution of water-equivalent hydrogen with an accuracy of 0.1-0.3% by weight.
DAN performs layering structure analyses of the Martian sub-surface, to measure the distribution of H- and OH-bearing materials, with a vertical resolution of < 1 m and horizontal resolutions of 0.5 - 100 m along the path of the rover.

DAN has three different modes of operations: Standby, Passive, and Active.

- STANDBY: Low voltage electronics are on, no science observations.
- PASSIVE: Background observations collected
- ACTIVE: Neutron pulses are produced and science observations collected.

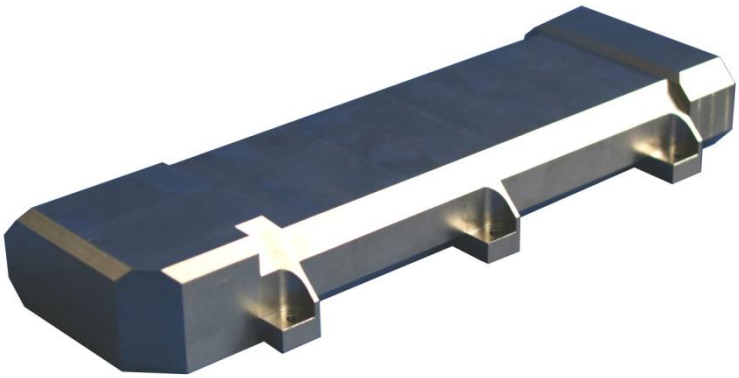


Figure 2: DAN PNG, Pulsing Neutron Generator

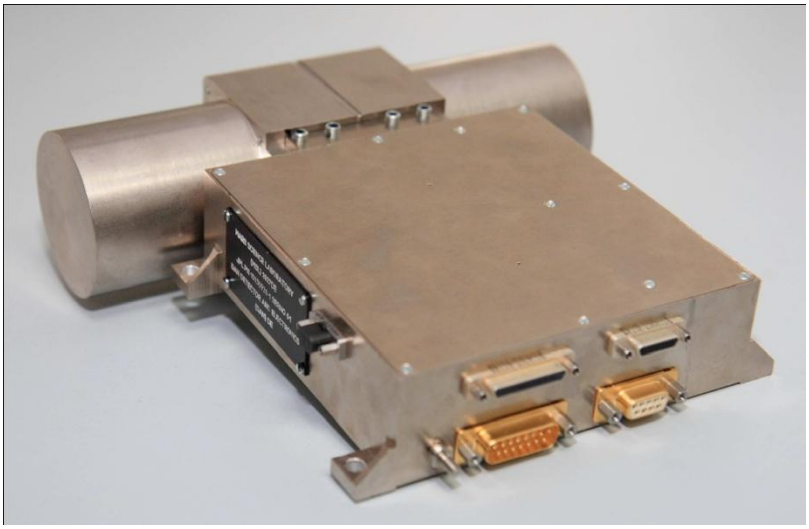


Figure 3: DE, DAN Detector

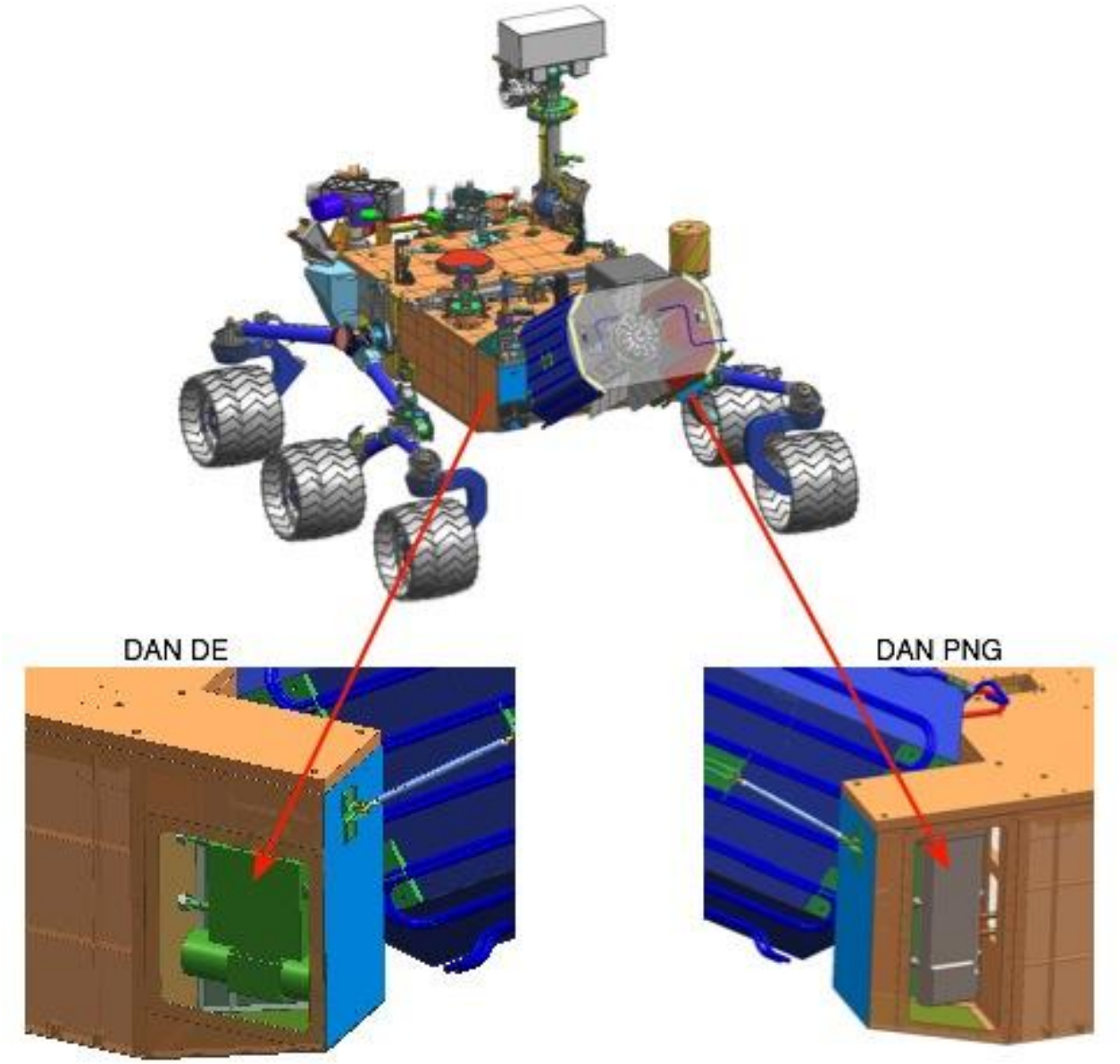


Figure 4: Location of DAN DE and PNG on rover

2.2 Data Product Overview

DAN's Reduced Data Records (RDR), NASA Level 1-A and 1B products, are generated by the DAN Team from the EDR data products, which are produced by OPGS at JPL.

DAN RDRs consist of clusters of calibrated data records, time-ordered, and grouped together. Each RDR will have a unique PDS label file, also known as a PDS detached label, which provides all the Meta and Ancillary data for each DAN data product. The pair of files, DAN binary data, and its PDS label, is collectively referred to as an RDR. In other words, an RDR is always made up of two files, named identically with only different file extensions, ".DAT" and ".LBL".

As part of the RDR generation, older RDRs are replaced by newer and better calibrated versions. Since RDRs are generated from EDRs, if new EDRs become available RDRs may need to be regenerated. A regenerated version is identified in the product's PDS label by an incremented product version ID and a later product generation time.

2.3 Data Processing

2.3.1 Data Processing Level

The DAN RDR data set is assigned the PDS Data Set ID "MSL-M-DAN-3/4-RDR-V1.0". The processing level numbers are from the "Committee on Data Management and Computation (CODMAC) data level numbering system (Table 2).

Table 2: Processing Levels for Science Data Sets

NASA	CODMAC	Description
Packet data	Raw - Level 1	Telemetry data stream as received at the ground station, with science and engineering data embedded.
Level-0	Edited - Level 2	Instrument science data (e.g., raw voltages, counts) at full resolution, time ordered, with duplicates and transmission errors removed.
Level 1-A	Calibrated - Level 3	Level 0 data that have been located in space and may have been transformed (e.g., calibrated, rearranged) in a reversible manner and packaged with needed ancillary and auxiliary data (e.g., radiances with the calibration equations applied).
Level 1-B	Resampled - Level 4	Irreversibly transformed (e.g., resampled, remapped, calibrated) values of the instrument measurements (e.g., radiances, magnetic field strength).
Level 1-C	Derived - Level 5	Level 1A or 1B data that have been resampled and mapped onto uniform space-time grids. The data are calibrated (i.e., radiometrically corrected) and may have additional corrections applied (e.g., terrain correction).
Level 2	Derived - Level 5	Geophysical parameters, generally derived from Level 1 data, and located in space and time

NASA	CODMAC	Description
		commensurate with instrument location, pointing, and sampling.
Level 3	Derived - Level 5	Geophysical parameters mapped onto uniform space-time grids.

2.3.2 Data Product Generation

The DAN RDR data products will be generated by the University of Arizona using the data processing software, DAN_RDR_gen. The RDR data products will be calibrated data derived from EDR data products and formatted according to this RDR SIS.

Data derived using SPICE kernels will be included in the RDR data products

2.3.3 Data Flow

The DAN RDR data products generated by the U of A will be created from EDR products provided from OPGS through MIPL's File Exchange Interface (FEI) system and data derived using SPICE kernels acquired from NAIF. After a data validation period, the DAN RDR data products will be delivered to the Planetary Data System on a pre-determined schedule.

The DAN RDRs will be generated at least one month prior to the scheduled delivery date. The DAN RDR data will be reprocessed if new EDR data are received or if better calibrations are available.

The total estimated volume of the RDRs over the course of the MSL mission is 1 Gigabyte.

2.3.4 Labeling and Identification

There is a file-naming scheme adopted for the MSL image and non-image data products. The scheme applies to the EDR and RDR data products. The file naming schemes adhere to the Level II 36.3 filename convention approved by PDS in 2009.

The primary attributes of the filename nomenclature are:

a) Uniqueness - It must be unique unto itself without the file system's directory path. This protects against product overwrite as files are copied/moved within the file system and external to the file system, if managed correctly.

b) Metadata - It should be comprised of metadata fields that keep file bookkeeping and sorting intuitive to the human user. Even though autonomous file processing will be managed via databases, there will always be a human-in-the-loop that puts a premium on filename intuition. Secondly, the metadata fields should be smartly selected based on their value to ground processing tools, as it is less CPU-intensive to extract information from the filename than from the label.

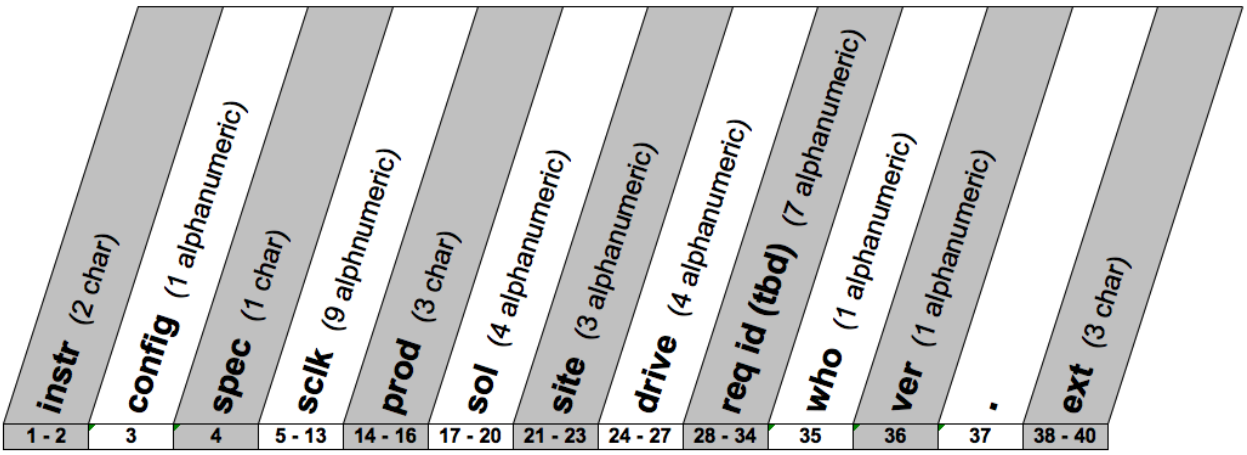
NOTE: The metadata information in the filename also resides in the product label.

The metadata fields have been selected based on MER and PHX lessons learned. In general, the metadata fields are arranged to achieve:

a) Sortability - At the beginning of the filename resides a primary time oriented field such as Spacecraft Clock Start Count (SCLK). This allows for sorting of files on the MSL file system by spacecraft data acquisition time as events occurred on Mars.

b) Readability - An effort is made to alternate integer fields with ASCII character fields to optimize differentiation of field boundaries for the human user.

Each DAN product has a detached PDS label associated with the DAN data file. The file-naming scheme for the DAN data products is:



where,

Instr = (2 alpha character) Instrument ID, denoting the source MSL science or engineering instrument that acquired the data.

Valid values for Instrument ID's are:

"DN" - DAN

Config = (1 alphanumeric) Instrument Configuration, an operational attribute of the Instrument that assists in characterizing the data.

Valid values:

Instrument	Configuration	
	Values	Description
DAN ("DN")	it is being set to either "**A**" or "**B**"	A-side configuration, B-side configuration

spec = (1 character) Special Processing flag, applicable to RDRs on a case-by-case basis.

Special Processing	EDR Value	RDR Value
None know	"_"	"_"
Special method types A - Z	n/a	"**A**" - "**Z**"

sclk = (9 alphanumeric) Spacecraft Clock Start Count, in units of seconds.

Which specific SCLK is used depends on the instrument but is generally expected to be the time the data was acquired. For the DAN EDRs the SCLK provided in the .emd (Data product metadata file) file will be used.

The valid values, in their progression, are as follows (non-Hex):

Range 000000000 thru 999999999 - "**000000000**", "**000000001**", **…** "**999999999**"
Range 1000000000 thru 1099999999 - "**A00000000**", "**A00000001**", **…** "**A99999999**"
Range 1100000000 thru 1199999999 - "**B00000000**", **"B00000001**", **…** **"B99999999**"

•
•
•

Range 3500000000 thru 3599999999 - "**Z00000000**", "**Z00000001**", **…** "**Z99999999**"

prod = (3 char) Product Type identifier.

This field has the following rule-of-thumb:

Beginning **"E"** - Type of **E**DR, which is a raw data product.
Beginning "**R**" - Type of **R**DR, which is a reduced product.

Valid values for DAN Product identifiers are listed below:

Product Type Description	Value
Active EDR	"**EAC**"
Passive EDR	"**EPA**"
Standby EDR	"**EST**"
Derived Engineering RDR	**"REN"**
Derived Passive RDR	"**RPA**"
Derived Active RDR	"**RAC**"
Averaged Passive RDR	"**RAP**"
Averaged Active RDR	"**RAA**"

sol = (4 alphanumeric) Sol, or Mars Solar Day. It is converted from the SCLK using LMST

(Local Mean Solar Time).

NOTE: If the first character is an underscore ("_") then the remaining 3 characters denote the day of year (DOY). This format will be used during cruise.

The valid values, in their progression, are as follows (non-Hex):

Range 0000 thru 9999 - "**0000**", "**0001**", **…** "**9999**"
Range 10000 thru 10999 - "**A000**", "**A001**", **…** "**A999**"
Range 11000 thru 11999 - "**B000**", **"B001"**, **… "B999"**
•
•
•
Range 35000 thru 35999 - "**Z000**", "**Z001**", **…** "**Z999**"

site = (3 alphanumeric) Site location count, from the RMC.

This field has the following rules-of-thumb:

If value is any 3 alphanumeric characters then content represents Site index extracted from RMC, or 3 underscores (denoting value is out-of-range),.

The valid Site values, in their progression, are as follows (non-Hex):

Range 000 thru 999 - "**000**", "**001**", **…** "**999**"
Range 1000 thru 1099 - "**A00**", "**A01**", **…** "**A99**"
Range 1100 thru 1199 - "**B00**", **"B01"**, **…** "**B99**"
•
•
•
Range 3500 thru 3599 - "**Z00**", "**Z01**", **…** "**Z99**"

drive = (4 alphanumeric) Drive (position-within-Site) location count, from the Rover Motion Counter (RMC).

This field has the following rules-of-thumb:

If value is any 4 alphanumeric charactersthen content represents Drive index extracted from RMC, or 4 underscores (denoting value is out-of-range),.

The valid Drive values, in their progression, are as follows (non-Hex):

Range 0000 thru 9999 - "**0000**", "**0001**", **…** "**9999**"
Range 10000 thru 10999 - "**A000**", "**A001**", **…** "**A999**"
Range 11000 thru 11999 - "**B000**", **"B001"**, **… "B999"**
•
•
•
Range 35000 thru 35999 - "**Z000**", "**Z001**", **…** "**Z999**"
Range 36000 thru 36099 - "**AA00**", "**AA01**", **…** "**AA99**"
Range 36100 thru 36199 - "**AB00**", "**AB01**", **…** "**AB99**"
•
•
•
Range 38500 thru 38599 - "**AZ00**", "**AZ01**", **…** "**AZ99**"
Range 38600 thru 38699 - "**BA00**", "**BA01**", **…** "**BA99**"
Range 38700 thru 38799 - "**BB00**", "**BB01**", **…** "**BB99**"

•
•
•

Range 41100 thru 41199 - "**BZ00**", "**BZ01**", **…** "**BZ99**"
Range 41200 thru 41299 - "**CA00**", "**CA01**", **…** "**CA99**"

•
•
•

Range 65400 thru 65499 - "**LI00**", "**LI01**", **…** "**LI99**"
Range 65500 thru 65535 - "**LJ00**", "**LJ01**", **…** "**LJ35**"

req id = (7 alphanumeric) - Request ID

In the case of DAN this files is currently not being used, and therefore it will always have a value of all underscores ("_____"). It is maintained as a placeholder, and to maintain consistency with MSL file-naming nomenclature.

Valid values:

"_____" – N/A.

a)

who = (1 alpha character) Product Producer ID identifies the institution that generated the product.

This field has the following rules-of-thumb:

Producer - If value is "**P**" (for Flight) or "**Y**" (for Engineering), the provider of the product is the Principal Investigator. Except for MIPL as the provider ("**M**" for Flight or "**Z**" for Engineering), the remaining characters are assigned to Co-investigator providers at the discretion of the P.I. and will be identified in due time. Within the instrument of the P.I., characters are unique. Across instruments, characters are reusable.

See the following table of valid values:

Venue		**by Producer**
Flight Model	Eng. Model	
"**M**"	"**Z**"	**M**IPL (OPGS at JPL)
"**P**"	"**Y**"	**P**rincipal Investigator of Instrument … Instrument — Principal Investigator SAM — GSFC (Goddard, MD) REMS — Ministry of Education & Science (Spain) DAN — Federal Space Agency (Russia) RAD — SwRI (Boulder, CO) CheMin — Ames Research Center (Mountain View, CA) APXS — Max-Planck Institute (Germany) SA/SPaH — JPL
"**A**" - "**L**"	"**Q**" - "**X**"	Co-Investigators (to be identified by P.I. per instrument) A for UA generated.

ver = (1 alphanumeric) Version identifier.

The valid values, in their progression, are as follows (non-Hex):

Range 1 thru 10 - "**1**", "**2**", **…** "**9**", "**0**"

Range 11 thru 36 - "**A**", "**B**", **…** "**Z**"
Range 37 and higher - "**_**" (underscore)

The Version number increments by one whenever an otherwise-identical filename would be produced. Note that not every version need exist, e.g. versions 1, 2 and 4 may exist but not 3. In general, the highest-numbered Version represents the "best" version of that product.

NOTE: To be clear, this field increments independently of all fields, including the Special Processing field.

ext = (2 to 3 alpha characters) Product type extension.

Valid values for nominal operations data products:

"**DAT**" - Non-imaging binary instrument data
"**LBL**" - Detached label in PDS format

Example #1: DNA_351797691RPA_0550000000_____P1.DAT

Where,

instr	=	"**DN**"	=	DAN
config	=	"**A**"	=	TBD (Instrument configuration for now)
spec	=	"**_**"	=	TBD
sclk	=	"**_**"	=	Spacecraft Clock Start Count of 351797691 sec.
prod	=	"**RPA**"	=	"R"-RDR, "PA"-Passive
sol	=	"**_055**"	=	Day-of-Year 55 (Cruise)
site	=	"**000**"	=	Site 0
drive	=	"**0000**"	=	Position (Drive) 0
reqestID	=	"**_____**"	=	unused
who	=	"**P**"	=	Produced by **LPL** at the University of Arizona
ver	=	"**1**"	=	Version 1
ext	=	"**DAT**"	=	Indicates this file contains data, and not label info (LBL).

2.4 Standards Used in Generating Data Products

2.4.5 PDS Standards

The DAN data product complies with PDS standards for file formats and labels, as specified in the PDS Standards Reference .(Applicable Document 3)

2.4.6 Time Standards

The following time standards and conventions are used throughout this document, as well as the MSL project for planning activities and identification of events.

Time Format	*Definition*
SCET	Spacecraft event time. This is the time when an event occurred on-board the spacecraft, in UTC. It is usually derived from SCLK.
SCLK	Spacecraft Clock. This is an on-board 64-bit counter, in units of nano-seconds and increments once every 100 milliseconds. Time zero corresponds to midnight on 1-Jan-1980.
ERT	Earth Received Time. This is the time when the first bit of the packet containing the current data was received at the Deep Space (DSN) station. Recorded in UTC format.
Local Solar Time	Local Solar Time (LST). This is the local solar time defined by the local solar days (sols) from the landing date using a 24 "hour" clock within the current local solar day (HR:MN:SC). Since the Mars day is 24h 37m 22s long, each unit of LST is slightly longer than the corresponding Earth unit. LST is computed using positions of the Sun and the landing site from SPICE kernels. If a landing date is unknown to the program (e.g. for calibration data acquired on Earth) then no sol number will be provided on output LST examples: SOL 12 12:00:01 SOL 132 01:22:32.498 SOL 29
RCT	Record Creation Time. This is the time when the first telemetry packet, containing a give data, set was created on the ground. Recorded in UTC format.
True Local Solar Time	This is related to LST, which is also known as the mean solar time. It is the time of day based on the position of the Sun, rather than the measure of time based on midnight to midnight "day". TLST is used in all MIPL/OPGS generated products.
SOL	Solar Day Number, also known as PLANET DAY NUMBER in PDS label. This is the number of complete solar days on Mars since landing. The landing day therefore is SOL zero.

2.4.7 Coordinate Systems

The following coordinate systems are used within the project to refer to the position of the Rover and its instruments.

Coordinate System	*Origin*	*Orientation*
Local Level	Same as payload frame, and it moves with the	+X North +Z down along gravity vector

	Rover	+Y East
Payload Frame	At the shoulder of the Robotic Arm. Attached and moves with the Rover	+X along Rover –X (point out into the work space) +Z down along Rover (vertical axis) +Y along Rover -Y
Site Frame	Same as payload frame when first defined and never moves relative to Mars. Possible to define multiple site frames in case the Rover moves/slips.	Same as local level
Rover Frame	Attached to Rover	Attached to Rover

2.4.8 Data Storage Conventions

DAN RDR products will be stored as binary files containing IEEE floating-point values, big-endian integers and ASCII character strings. For every DAN RDR there will be a detached PDS label file. The detached PDS labels for DAN RDRs are stored as ASCII text, with each keyword definition terminated by ASCII carriage-return and line-feed characters. The RDR products are defined in section 5. The PDS label keywords are described in Appendix-A.

Each DAN RDRs will contain fixed length records but the length can differ depending on the type of RDR. When necessary, records will be padded with extra bytes of 0x00. Label keywords will provide necessary information to determine the size and organization of the binary records.

2.5 Data Validation

The DAN RDRs, as with all other MSL RDRs, are subject to PDS peer review.

Validation of DAN RDR products during production will be performed according to specifications in the MSL Archive Plan. The DAN Team will validate the science content of the data products, and the PDS Geosciences Node will validate the products for compliance with PDS standards and for conformance with the design specified in this SIS.

Validation of the MSL RDRs will fall into two primary categories: automated and manual. Automated validation will be performed on every RDR product produced for the mission. Manual validation will only be performed on a subset.

Validation of DAN RDRs will be performed by the DAN Team as a part of the archiving process, and will be done simultaneously with the archive volume validation. Validations performed will include such things as verification that the checksum in the label matches a calculated checksum for the data product (i.e., that the data product included in the archive is identical to that produced by the real-time process), a validation of the PDS syntax of the label, a check of the label values against the database and against the index tables included on the

archive volume, and checks for internal consistency of the label items. The latter include such things as verifying that the product creation date is later than the earth received time. As problems are discovered and/or new possibilities identified for automated verification, they will be added to the validation procedure.

Manual validation of the data will be performed both as spot-checking of data throughout the life of the mission, and comprehensive validation of a subset of the data (for example, a couple of days' worth of data). A human will view these products. The DAN Team will validate the science content of the data products, and the PDS Geosciences Node will validate the products for compliance with PDS standards and for conformance with the design specified in this SIS.

3. DETAILED DATA PRODUCT SPECIFICATIONS

When powered, the DAN instrument is in one of three states: STANDBY, PASSIVE, or ACTIVE. Onboard, the DAN instruments can generate different data packets depending on the state of the instrument.

Five RDR products will be produced, DERIVED_ENG, DERIVED_PASSIV, DERIVED_ACTIVE, AVERAGED_PASSIV and AVERAGED_ACTIVE Each is defined in the following sections. The DAN RDR file naming convention will uniquely identify each data product. See Section 2.3.4 for detail description of the DAN file naming convention.

The structure of the DAN RDR consists of a detached ASCII PDS label and a binary data file as shown in Figure 3.1.

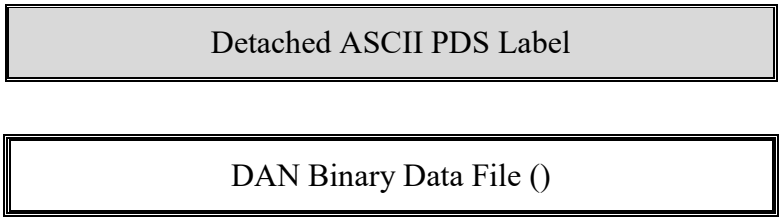


Figure 3.1: The DAN RDR consists of two files.

3.1 Data Format Descriptions

Appendix A includes the table for binary data column definitions to the byte level.

3.1.1 DERIVED_ENGINEERING

Derived Engineering are the raw DN values from the 6 temperature sensors converted to Celsius. Each EDR record contains these temperatures and therefore a time series dataset can be constructed over the entire time DAN is operating. This data product also contains the states of the two high voltages for the detectors and also the two discriminator values for each of the two detectors (CTN and CETN).

3.1.2 DERIVED_PASSIVE

The Derived Passive data products are in a one to one correspondence with the EDR Passive data products. Each data product has counts for each detector summed over channels 1 to 16 and background counts for the collection period as well as location and time information.

3.1.3 DERIVED ACTIVE

The Derived Active data set is in a one to one correspondence with the EDR Active data set. This data set has the detector counts summed over channels 1 to 16 for each of the 64 spectra in the EDR set. It also contains the background counts for each of the 64 spectra as well as location and time information.

3.1.4 AVERAGED PASSIVE

An Averaged Passive data product contains the average counts over some time period of passive measurements. Derived Passive data products are used to calculate the average of the given time period. The time periods will coincide with passive measurements during a travser from location A to location B. This data product also contains the background counts for the given time period as well as an error and normalization factor. It also contains spatial and temporal information over which the data was taken.

3.1.5 AVERAGED ACTIVE

An Averaged Active data product contains the average counts over some time period of active measurements. The Derived Active data products are used to calculate the average of the given time period. The time periods will coincide with active measurements during a time the rover is stopped. This data product also contains the background counts for the given time period as well as an error and normalization factor. It also contains spatial and temporal information over which the data was taken.

3.2 Label and Header Descriptions

3.2.6 PDS Label

DAN products have detached PDS labels. A PDS label is object-oriented and describes the objects in the data file. The PDS label contains keywords for product identification and for table object definitions. The label also contains descriptive information needed to interpret or process the data objects in the file.

PDS labels are written in Object Description Language (ODL). PDS label statements have the form of "keyword = value". Each label statement is terminated with a carriage return character (ASCII 13) and a line feed character (ASCII 10) sequence to allow the label to be read by many

operating systems. Pointer statements with the following format are used to indicate the location of data objects in the file:

^Object = location

where the carat character (^, also called a pointer) is followed by the name of the specific data object. The location is the starting record number for the data object within the file.

Each PDS keyword defined for the DAN label will always be included in the label. If a keyword does not have a value, a value of N/A will be given as the keyword value.

Per PDS rules, "N/A" is used when a keyword exists, but it does not apply to a particular data, and "UNKNOWN" or UNK is used when a value of an applicable keyword cannot be determined at the time the PDS label was generated.

3.2.7 PDS Table Object

The TABLE object is a uniform collection of rows containing ASCII or binary values stored in columns. The INTERCHANGE_FORMAT keyword is used to distinguish between TABLEs containing only ASCII columns and those containing binary data. DAN RDR products are stored as binary tables. Each field is defined as a fixed-width COLUMN object; the value of the COLUMNS keyword is the total number of COLUMN objects defined in the label. All TABLE objects must have fixed-width records.

4. APPLICABLE SOFTWARE

4.1 Utility Programs

None

4.2 Applicable PDS Software Tools

PDS-labeled images and tables can be viewed, but not manipulated with the program NASAView, developed by the PDS Engineering Node, and are available for a variety of computer platforms. They can be obtained directly from the PDS at http://pds.nasa.gov/tools/nasa-view.shtml.

5. DATA

5.1 DAN RDR Data Columns

This table lists the columns in all DAN RDR data files in alphabetical order. The format of each type of data file, including column positions, sizes, data types, units, and full descriptions, can be found in the format files (*.FMT) in the LABEL directory.

Column Name	Data Type	Length in bytes	Description	Appears In
BEGIN_LATITUDE	IEEE_REAL	4	"Latitude in Mars fixed coordinates at the beginning of the frame."	DP, AP, AA
BEGIN_LONGITUDE	IEEE_REAL	4	"Longitude in Mars fixed coordinates at the beginning of the frame."	DP, AP, AA
CETN_AVERAGE	IEEE_REAL	4	"Average counts for CETN detector over collection duration."	AP, AA
CETN_BKGD	IEEE_REAL	4	"Background counts for CETN detector (counts)."	DP, DA, AP, AA
CETN_COUNTS	IEEE_REAL	4	"Counts gathered in CETN detector during frame interval."	DP, DA
CETN_ERROR	IEEE_REAL	4	"Error in counts in CETN detector over collection duration."	AP, AA

Column Name	Data Type	Length in bytes	Description	Appears In
CETN_NORM	IEEE_REAL	4	"Normalization in counts for CETN detector for collection duration."	AP, AA
COLLECTION_DURATION	MSB_UNSIGNED_INTEGER	4	"Value of collection time in seconds."	DP, AA, AP, DA
CTN_AVERAGE	IEEE_REAL	4	"Average Counts in CTN detector over duration."	AP, AA
CTN_BKGD	IEEE_REAL	4	"Background counts for CTN detector (counts)."	DP, DA, AP, AA
CTN_COUNTS	IEEE_REAL	4	"Counts gathered in CTN detector during frame interval."	DP, DA
CTN_ERROR	IEEE_REAL	4	"Error in counts in CTN detector over duration."	AP, AA
CTN_NORM	IEEE_REAL	4	"Normalization in counts for CTN detector over duration."	AP, AA
DAN_TIME	MSB_UNSIGNED_INTEGER	4	"DAN instrument time in milliseconds since last power up."	DP, DE
DSC_LEVEL_CETN	MSB_UNSIGNED_INTEGER	1	"The CETN Discriminator level 0 = low, 1 = high."	DE

Column Name	Data Type	Length in bytes	Description	Appears In
DSC_LEVEL_CTN	MSB_UNSIGNED_INTEGER	1	"The CTN Discriminator level 0 = low, 1 = high."	DE
END_DAN_TIME	MSB_UNSIGNED_INTEGER	4	"DAN time at end of collection in milliseconds."	DA, AP, AA
END_LATITUDE	IEEE_REAL	4	" Planetocentric Latitude in Mars fixed coordinates at the end of the frame."	DP, AA, AP
END_LONGITUDE	IEEE_REAL	4	" Planetocentric east Longitude in Mars fixed coordinates at the end of the frame."	DP, AP, AA
END_UTC	CHARACTER	23	"UTC time at the end of the collection interval, stored as yyyy-mm-ddThh:mm:ss.sss."	DP, DA, AP, AA
HV_LEVEL_CETN	MSB_UNSIGNED_INTEGER	1	"The CETN HV level 0 = off, 2 = high, 3 = low."	DE
HV_LEVEL_CTN	MSB_UNSIGNED_INTEGER	1	"The CTN HV level 0 = off, 2 = high, 3 = low."	DE
LATITUDE	IEEE_REAL	4	" Planetocentric Latitude in Mars fixed coordinates."	DA
LONGITUDE	IEEE_REAL	4	" Planetocentric east Longitude in Mars fixed coordinates."	DA

Column Name	Data Type	Length in bytes	Description	Appears In
NUM_PNG_PULSES	IEEE_REAL	4	"Number of PNG pulses during data collection interval."	DA, AA
PNG_FREQUENCY	MSB_UNSIGNED_INTEGER	1	"Pulsing Neutron Generator frequency of pulsing in counts."	DA, AA
START_DAN_TIME	MSB_UNSIGNED_INTEGER	4	"DAN time at beginning of interval in milliseconds."	DA, AP, AA
START_UTC	CHARACTER	23	"UTC time at the start of the collection interval, stored as yyyy-mm-ddThh:mm:ss.sss."	DP, DA, AP, AA
TEMP1	IEEE_REAL	4	"PNG temperature in Celsius."	DE
TEMP2	IEEE_REAL	4	" High voltage board temperature in Celsius."	DE
TEMP3	IEEE_REAL	4	" FPGA temperature in Celsius."	DE
TEMP4	IEEE_REAL	4	" Analog board #1 temperature in Celsius."	DE
TEMP5	IEEE_REAL	4	" Analog board #2 temperature in Celsius."	DE

Column Name	Data Type	Length in bytes	Description	Appears In
TEMP6	IEEE_REAL	4	" Case temperature in Celsius."	DE
TIME_BIN_DURATION	IEEE_REAL	4	"Duration in microseconds for each time bin."	DA, AA
TIME_BIN_START	IEEE_REAL	4	"Start time in microseconds for each time bin."	DA, AA
UTC	CHARACTER	23	"UTC time at the start of the collection interval, stored as yyyy-mm-ddThh:mm:ss.sss."	DE

6. EXAMPLES OF DAN RDR PDS LABELS

6.1 Derived Engineering Label

```
PDS_VERSION_ID                  = PDS3

/* FILE DATA ELEMENTS */
RECORD_TYPE                     = FIXED_LENGTH
RECORD_BYTES                    = 5663
FILE_RECORDS                    = 21

/* IDENTIFICATION DATA ELEMENTS */
DATA_SET_ID                     = "MSL-M-DAN-3/4-RDR-V1.0"
COMMAND_SEQUENCE_NUMBER         = 0
INSTRUMENT_HOST_ID              = MSL
INSTRUMENT_HOST_NAME            = "MARS SCIENCE LABORATORY"
INSTRUMENT_NAME                 = "DYNAMIC ALBEDO OF NEUTRONS"
MSL:REQUEST_ID                  = 4932
PLANET_DAY_NUMBER               = "42"
PRODUCT_CREATION_TIME           = 2010-10-27T22:19:47.000
PRODUCT_ID                      =
"DNA_351797691REN_0550000000_______P1.DAT"
PRODUCT_TYPE                    = DAN_RDR_EN
PRODUCT_VERSION_ID              = "1.0"
RELEASE_ID                      = "1"
ROVER_MOTION_COUNTER            = (0,0,0,0,0,0,0,0)
ROVER_MOTION_COUNTER_NAME       = (SITE, DRIVE, POSE, ARM, CHIMRA,
                                  DRILL, RSM, HGA)
SEQUENCE_ID                     = "1036288"
SEQUENCE_VERSION_ID             = "0"
SPACECRAFT_CLOCK_START_COUNT    = "340477575.18840"
SPACECRAFT_CLOCK_STOP_COUNT     =  "340563425.23451"
START_TIME                      = 2012-289T05:10:16.868
STOP_TIME                       = 2012-289T06:04:10.232
TARGET_NAME                     = MARS
^TABLE                          = "DNA_351797691REN_0550000000_______P1
.DAT"

OBJECT                          = TABLE
   COLUMNS                      = 1213
   INTERCHANGE_FORMAT           = BINARY
   ROW_BYTES                    = 5663
   ROWS                         = 21
   DESCRIPTION                  = "
    This table contains converted engineering data
    as observed by the Mars Science Laboratory (MSL) Dynamic Albedo of
    Neutron Detector (DAN).

    Detailed descriptions for the parameters defined below are
```

```
    contained in the DAN RDR SIS document .

    The complete column definitions are contained in the following
external
    file found in the LABEL directory of the archive volume.
    "
   ^STRUCTURE                    = "DAN_RDR_DERIVED_ENG.FMT"
END_OBJECT                       = TABLE
END
```

6.1.1 Derived Engineering FORMAT FILE ("DAN_RDR_DERIVED_ENG.FMT")

```
OBJECT = COLUMN
   COLUMN_NUMBER = 1
   NAME = DAN_TIME
   DATA_TYPE = MSB_UNSIGNED_INTEGER
   BYTES = 4
   START_BYTE = 1
   UNIT = MILLISECONDS
   DESCRIPTION = "DAN instrument time in milliseconds since last power
up."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 2
   NAME = UTC
   DATA_TYPE = CHARACTER
   BYTES = 23
   START_BYTE = 5
   DESCRIPTION = "UTC time at the start of the collection interval,
   stored as yyyy-mm-ddThh:mm:ss.sss."
END_OBJECT = COLUMN

OBJECT = COLUMN
   NAME = TEMP1
   COLUMN_NUMBER = 3
   BYTES = 4
   DATA_TYPE = IEEE_REAL
   START_BYTE = 28
```

```
   UNIT = "DEGREES CELSIUS"
   DESCRIPTION = "PNG temperature in Celsius."
END_OBJECT = COLUMN

OBJECT = COLUMN
   NAME = TEMP2
   COLUMN_NUMBER = 4
   BYTES = 4
   DATA_TYPE = IEEE_REAL
   START_BYTE = 32
   UNIT = "DEGREES CELSIUS"
   DESCRIPTION = "High voltage board temperature in Celsius."
END_OBJECT = COLUMN

OBJECT = COLUMN
   NAME = TEMP3
   COLUMN_NUMBER = 5
   BYTES = 4
   DATA_TYPE = IEEE_REAL
   START_BYTE = 36
   UNIT = "DEGREES CELSIUS"
   DESCRIPTION = "FPGA temperature in Celsius.."
END_OBJECT = COLUMN

OBJECT = COLUMN
   NAME = TEMP4
   COLUMN_NUMBER = 6
   BYTES = 4
   DATA_TYPE = IEEE_REAL
   START_BYTE = 40
   UNIT = "DEGREES CELSIUS"
   DESCRIPTION = "Analog board #1 temperature in Celsius."
END_OBJECT = COLUMN

OBJECT = COLUMN
   NAME = TEMP5
```

```
   COLUMN_NUMBER = 7
   BYTES = 4
   DATA_TYPE = IEEE_REAL
   START_BYTE = 44
   UNIT = "DEGREES CELSIUS"
   DESCRIPTION = "Analog board #2 temperature in Celsius."
END_OBJECT = COLUMN

OBJECT = COLUMN
   NAME = TEMP6
   COLUMN_NUMBER = 8
   BYTES = 4
   DATA_TYPE = IEEE_REAL
   START_BYTE = 48
   UNIT = "DEGREES CELSIUS"
   DESCRIPTION = "Case temperature in Celsius."
END_OBJECT = COLUMN

OBJECT = COLUMN
   NAME = HV_LEVEL_CTN
   COLUMN_NUMBER = 9
   BYTES = 1
   DATA_TYPE = MSB_UNSIGNED_INTEGER
   START_BYTE = 52
   DESCRIPTION = "The CTN HV level 0 = off, 2 = high, 3 = low"
END_OBJECT = COLUMN

OBJECT = COLUMN
   NAME = HV_LEVEL_CETN
   COLUMN_NUMBER = 10
   BYTES = 1
   DATA_TYPE = MSB_UNSIGNED_INTEGER
   START_BYTE = 53
   DESCRIPTION = "The CETN HV level 0 = off, 2 = high, 3 = low"
END_OBJECT = COLUMN
```

```
OBJECT = COLUMN
   NAME = DSC_LEVEL_CTN
   COLUMN_NUMBER = 11
   BYTES = 1
   DATA_TYPE = MSB_UNSIGNED_INTEGER
   START_BYTE = 54
   DESCRIPTION = "The CTN Discriminator level 0 = low, 1 = high."
END_OBJECT = COLUMN

OBJECT = COLUMN
   NAME = DSC_LEVEL_CETN
   COLUMN_NUMBER = 12
   BYTES = 1
   DATA_TYPE = MSB_UNSIGNED_INTEGER
   START_BYTE = 55
   DESCRIPTION = "The CETN Discriminator level 0 = low, 1 = high."
END_OBJECT = COLUMN

OBJECT = COLUMN
   NAME = LST
   COLUMN_NUMBER = 13
   BYTES = 8
   DATA_TYPE = CHARACTER
   START_BYTE = 56
   DESCRIPTION = "Local solar time at start of period, 'hh:mm:ss'."
END_OBJECT = COLUMN
```

6.2 Derived Passive Label

```
PDS_VERSION_ID                  = PDS3

/* FILE DATA ELEMENTS */
RECORD_TYPE                     = FIXED_LENGTH
RECORD_BYTES                    = 8671
FILE_RECORDS                    = 21

/* IDENTIFICATION DATA ELEMENTS */
DATA_SET_ID                     = "MSL-M-DAN-3/4-RDR-V1.0"
COMMAND_SEQUENCE_NUMBER         = 0
INSTRUMENT_HOST_ID              = MSL
INSTRUMENT_HOST_NAME            = "MARS SCIENCE LABORATORY"
INSTRUMENT_NAME                 = "DYNAMIC ALBEDO OF NEUTRONS"
```

```
MSL:REQUEST_ID                  = 324
PLANET_DAY_NUMBER               = "42"
PRODUCT_CREATION_TIME           = 2010-10-27T22:19:47.000
PRODUCT_ID                      =
"DNA_351797691RPA_0550000000_____P1.DAT"
PRODUCT_TYPE                    = DAN_RDR_PA
PRODUCT_VERSION_ID              = "1.0"
RELEASE_ID                      = "1"
ROVER_MOTION_COUNTER            = (0,0,0,0,0,0,0,0)
ROVER_MOTION_COUNTER_NAME       = (SITE, DRIVE, POSE, ARM, CHIMRA,
                                  DRILL, RSM, HGA)
SEQUENCE_ID                     = "1036288"
SEQUENCE_VERSION_ID             = "0"
SPACECRAFT_CLOCK_START_COUNT    = "340477575.18840"
SPACECRAFT_CLOCK_STOP_COUNT     = "340492323.21101"
START_TIME                      = 2012-289T05:10:16.868
STOP_TIME                       = 2012-289T06:05:11:21.545
TARGET_NAME                     = MARS
^TABLE                          =
"DNA_351797691RPA_0550000000_____P1.DAT"

OBJECT                          = TABLE
   COLUMNS                      = 1212
   INTERCHANGE_FORMAT           = BINARY
   ROW_BYTES                    = 8671
   ROWS                         = 21
   DESCRIPTION                  = "
    This table contains converted neutron count data
    as observed by the Mars Science Laboratory (MSL) Dynamic Albedo of
    Neutron Detector (DAN).

    Detailed descriptions for the parameters defined below are
    contained in the DAN RDR SIS document.

    The complete column definitions are contained in an external file
    found in the LABEL directory of the archive volume.
    "
   ^STRUCTURE                    = "DAN_RDR_DERIVED_PASSIV.FMT"
END_OBJECT                       = TABLE
END
```

6.2.1 Derived Passive FORMAT FILE

```
OBJECT = COLUMN
   COLUMN_NUMBER = 1
   NAME = DAN_TIME
   DATA_TYPE = MSB_UNSIGNED_INTEGER
```

```
   BYTES = 4
   START_BYTE = 1
   DESCRIPTION = "DAN instrument time in milliseconds since last
                  power up."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 2
   NAME = UTC_TIMESTAMP
   DATA_TYPE = CHARACTER
   BYTES = 23
   START_BYTE = 5
   DESCRIPTION = "UTC time at the start of the collection interval,
   stored as yyyy-mm-ddThh:mm:ss.sss."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 3
   NAME = BEGIN_LATITUDE
   DATA_TYPE = IEEE_REAL
   BYTES = 4
   START_BYTE = 28
   UNIT = DEGREE
   DESCRIPTION = "Latitude in Mars fixed coordinates at the beginning
   of the frame, in degrees."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 4
   NAME = BEGIN_LONGITUDE
   DATA_TYPE = IEEE_REAL
   BYTES = 4
   START_BYTE = 32
   UNIT = DEGREE
   DESCRIPTION = "Easting Longitude in Mars fixed coordinates at the
beginning
```

```
   of the frame, in degrees."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 5
   NAME = END_LATITUDE
   DATA_TYPE = IEEE_REAL
   BYTES = 4
   START_BYTE = 36
   UNIT = DEGREE
   DESCRIPTION = "Latitude in Mars fixed coordinates at the end
   of the frame, in degrees."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 6
   NAME = END_LONGITUDE
   DATA_TYPE = IEEE_REAL
   BYTES = 4
   START_BYTE = 40
   UNIT = DEGREE
   DESCRIPTION = "Easting Longitude in Mars fixed coordinates at the end
   of the frame, in degrees."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 7
   NAME = COLLECTION_DURATION
   DATA_TYPE = IEEE_REAL
   BYTES = 4
   START_BYTE = 44
   UNIT = SECOND
   DESCRIPTION = "Value of collection time register, length of time
   in seconds."
END_OBJECT = COLUMN
```

```
OBJECT = COLUMN
   COLUMN_NUMBER = 8
   NAME = CTN_BKGD
   DATA_TYPE = IEEE_REAL
   BYTES = 4
   START_BYTE = 48
   UNIT = COUNT
   DESCRIPTION = "Background counts for CTN detector (counts)."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 9
   NAME = CTN_COUNTS
   DATA_TYPE = IEEE_REAL
   BYTES = 4
   START_BYTE = 52
   UNIT = COUNT
   DESCRIPTION = "Sum of Counts gathered in CTN detector during frame
   interval."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 10
   NAME = CETN_BKGD
   DATA_TYPE = IEEE_REAL
   BYTES = 4
   START_BYTE = 56
   UNIT = COUNT
   DESCRIPTION = "Background counts for CETN detector (counts)."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 11
   NAME = CETN_COUNTS
   DATA_TYPE = IEEE_REAL
   BYTES = 4
```

```
   START_BYTE = 60
   UNIT = COUNT
   DESCRIPTION = "Sum of Counts gathered in CETN detector during frame
   interval."
END_OBJECT = COLUMN

OBJECT = COLUMN
   NAME = LST
   COLUMN_NUMBER = 12
   BYTES = 8
   DATA_TYPE = CHARACTER
   START_BYTE = 64
   DESCRIPTION = "Local solar time at start of period, 'hh:mm:ss'."
END_OBJECT = COLUMN
```

6.3 Derived Active Label

```
PDS_VERSION_ID                  = PDS3

/* FILE DATA ELEMENTS */
RECORD_TYPE                     = FIXED_LENGTH
RECORD_BYTES                    = 13551336
FILE_RECORDS                    = 21

/* IDENTIFICATION DATA ELEMENTS */
DATA_SET_ID                     = "MSL-M-DAN-3/4-RDR-V1.0"
COMMAND_SEQUENCE_NUMBER         = 0
INSTRUMENT_HOST_ID              = MSL
INSTRUMENT_HOST_NAME            = "MARS SCIENCE LABORATORY"
INSTRUMENT_NAME                 = "DYNAMIC ALBEDO OF NEUTRONS"
MSL:REQUEST_ID                  = 5213
PLANET_DAY_NUMBER               = "42"
PRODUCT_CREATION_TIME           = 2010-10-27T22:19:47.000
PRODUCT_ID                      =
"DNA_351797691RAC_0550000000_______P1.DAT"
PRODUCT_TYPE                    = DAN_RDR_AC
PRODUCT_VERSION_ID              = "1.0"
RELEASE_ID                      = "1"
ROVER_MOTION_COUNTER            = (0,0,0,0,0,0,0,0)
ROVER_MOTION_COUNTER_NAME       = (SITE, DRIVE, POSE, ARM, CHIMRA,
                                  DRILL, RSM, HGA)
SEQUENCE_ID                     = "1036288"
SEQUENCE_VERSION_ID             = "0"
SPACECRAFT_CLOCK_START_COUNT    = "340477575.18840"
SPACECRAFT_CLOCK_STOP_COUNT     = "340479563.22311"
START_TIME                      = 2012-289T05:10:16.868
STOP_TIME                       = 2012-289T05:21:11.454
TARGET_NAME                     = MARS
```

```
^TABLE                          =
"DNA_351797691RAC_0550000000_______P1.DAT"

OBJECT                          = TABLE
   COLUMNS                      = 1514
   INTERCHANGE_FORMAT           = BINARY
   ROW_BYTES                    = 13551336
   ROWS                         = 21
   DESCRIPTION                  = "
    This table contains converted neutron count data during neutron
pulsing
    as observed by the Mars Science Laboratory (MSL) Dynamic Albedo of
    Neutron Detector (DAN).

    Detailed descriptions for the parameters defined below are
    contained in the DAN RDR SIS document.

    The complete column definitions are contained in an external file
    found in the LABEL directory of the archive volume.
    "
   ^STRUCTURE                    = "DAN_RDR_DERIVED_ACTIV.FMT"
END_OBJECT                      = TABLE
END
```

6.3.1 Derived Active FORMAT FILE

```
OBJECT = COLUMN
   COLUMN_NUMBER = 1
   NAME = DAN_TIME
   DATA_TYPE = MSB_UNSIGNED_INTEGER
   BYTES = 4
   START_BYTE = 1
   UNIT = MILLISECONDS
   DESCRIPTION = "DAN time at beginning of interval."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 2
   NAME = UTC_TIMESTAMP
   DATA_TYPE = CHARACTER
   BYTES = 23
   START_BYTE = 5
```

```
   DESCRIPTION = "UTC time at the start of the collection interval,
   stored as yyyy-mm-ddThh:mm:ss.sss."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 3
   NAME = LATITUDE
   DATA_TYPE = IEEE_REAL
   BYTES = 4
   START_BYTE = 28
   UNIT = DEGREE
   DESCRIPTION = "Latitude in Mars fixed coordinates."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 4
   NAME = LONGITUDE
   DATA_TYPE = IEEE_REAL
   BYTES = 4
   START_BYTE = 32
   UNIT = DEGREE
   DESCRIPTION = "Easting Longitude in Mars fixed coordinates."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 5
   NAME = COLLECTION_DURATION
   DATA_TYPE = MSB_UNSIGNED_INTEGER
   BYTES = 4
   START_BYTE = 36
   UNIT = SECOND
   DESCRIPTION = "Value of collection time register, length of time
   in seconds."
END_OBJECT = COLUMN

OBJECT = COLUMN
```

```
   COLUMN_NUMBER = 6
   NAME = NUM_PNG_PULSES
   DATA_TYPE = MSB_UNSIGNED_INTEGER
   BYTES = 4
   START_BYTE = 40
   UNIT = COUNT
   DESCRIPTION = "number of PNG pulses during data collection interval."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 7
   NAME = PNG_FREQUENCY
   DATA_TYPE = MSB_UNSIGNED_INTEGER
   BYTES = 1
   START_BYTE = 44
   UNIT = COUNT
   DESCRIPTION = "Pulsing Neutron Generator frequency of pulsing."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 8
   NAME = TIME_BIN_DURATION
   DATA_TYPE = MSB_UNSIGNED_INTEGER
   BYTES = 4
   START_BYTE = 45
   UNIT = MICROSECOND
   DESCRIPTION = "duration in microseconds for each time bin."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 9
   NAME = TIME_BIN_START
   DATA_TYPE = MSB_UNSIGNED_INTEGER
   BYTES = 256
   START_BYTE = 49
   ITEMS = 64
```

```
   ITEM_BYTES = 4
   UNIT = MICROSECOND
   DESCRIPTION = "start time in microseconds for each time bin."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 10
   NAME = CTN_BKGD
   DATA_TYPE = IEEE_REAL
   BYTES = 256
   START_BYTE = 305
   ITEMS = 64
   ITEM_BYTES = 4
   UNIT = COUNTS
   DESCRIPTION = "Background counts for each of 64 CTN detector spectra
   (counts)."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 11
   NAME = CTN_COUNTS
   DATA_TYPE = IEEE_REAL
   BYTES = 256
   START_BYTE = 561
   ITEMS = 64
   ITEM_BYTES = 4
   UNIT = COUNTS
   DESCRIPTION = "Counts gathered in CTN detector for each of the 64
   spectra during frame interval."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 12
   NAME = CETN_BKGD
   DATA_TYPE = IEEE_REAL
   BYTES = 256
```

```
   ITEMS = 64
   ITEM_BYTES = 4
   START_BYTE = 817
   UNIT = COUNTS
   DESCRIPTION = "Background counts for each of the 64 CETN detector
   (counts)."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 13
   NAME = CETN_COUNTS
   DATA_TYPE = IEEE_REAL
   BYTES = 256
   ITEMS = 64
   ITEM_BYTES = 4
   START_BYTE = 1073
   UNIT = COUNTS
   DESCRIPTION = "Counts gathered in CETN detector for each of the 64
   specta during frame interval."
END_OBJECT = COLUMN

OBJECT = COLUMN
   NAME = LST
   COLUMN_NUMBER = 14
   BYTES = 8
   DATA_TYPE = CHARACTER
   START_BYTE = 1329
   DESCRIPTION = "Local solar time at the start of interval, 'hh:mm:ss'."
END_OBJECT = COLUMN
```

6.4 Averaged Passive Label

```
PDS_VERSION_ID                  = PDS3

/* FILE DATA ELEMENTS */
RECORD_TYPE                     = FIXED_LENGTH
RECORD_BYTES                    = 106122
```

```
FILE_RECORDS                    = 21

/* IDENTIFICATION DATA ELEMENTS */
DATA_SET_ID                     = "MSL-M-DAN-3/4-RDR-V1.0"
COMMAND_SEQUENCE_NUMBER         = 0
INSTRUMENT_HOST_ID              = MSL
INSTRUMENT_HOST_NAME            = "MARS SCIENCE LABORATORY"
INSTRUMENT_NAME                 = "DYNAMIC ALBEDO OF NEUTRONS"
MSL:REQUEST_ID                  = 2131
PLANET_DAY_NUMBER               = "42"
PRODUCT_CREATION_TIME           = 2010-10-27T22:19:47.000
PRODUCT_ID                      =
"DNA_351797691RAP_0550000000_______P1.DAT"
PRODUCT_TYPE                    = DAN_RDR_AP
PRODUCT_VERSION_ID              = "1.0"
RELEASE_ID                      = "1"
ROVER_MOTION_COUNTER            = (0,0,0,0,0,0,0,0)
ROVER_MOTION_COUNTER_NAME       = (SITE, DRIVE, POSE, ARM, CHIMRA,
                                  DRILL, RSM, HGA)
SEQUENCE_ID                     = "1036288"
SEQUENCE_VERSION_ID             = "0"
SPACECRAFT_CLOCK_START_COUNT    = "340477575.18840"
SPACECRAFT_CLOCK_STOP_COUNT     = "340470323.23321"
START_TIME                      = 2010-289T05:10:16.868"
STOP_TIME                       = 2012-289T05:12:17.121
TARGET_NAME                     = MARS
^TABLE                          =
"DNA_351797691RAP_0550000000_______P1.DAT"

OBJECT                          = TABLE
   COLUMNS                      = 1719
   INTERCHANGE_FORMAT           = BINARY
   ROW_BYTES                    = 106122
   ROWS                         = 21
   DESCRIPTION                  = "
    This table contains converted neutron averaged counts data during
    neutron passive operations as observed by the Mars Science
    Laboratory (MSL) Dynamic Albedo of Neutron Detector (DAN).

    Detailed descriptions for the parameters defined below are
    contained in the DAN RDR SIS document.

    The complete column definitions are contained in an external file
    found in the LABEL directory of the archive volume.
    "
   ^STRUCTURE                    = "DAN_RDR_AVERAGE_PASSIV.FMT"
END_OBJECT                      = TABLE
END
```

5.3.1 Averaged Passive FORMAT FILE

```
OBJECT = COLUMN
   COLUMN_NUMBER = 1
   NAME = START_DAN_TIME
   DATA_TYPE = MSB_UNSIGNED_INTEGER
   BYTES = 4
   START_BYTE = 1
   UNIT = MILLISECONDS
   DESCRIPTION = "DAN time at beginning of average interval."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 2
   NAME = END_DAN_TIME
   DATA_TYPE = MSB_UNSIGNED_INTEGER
   BYTES = 4
   START_BYTE = 5
   UNIT = MILLISECONDS
   DESCRIPTION = "DAN time at end of average interval."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 3
   NAME = START_UTC
   DATA_TYPE = CHARACTER
   BYTES = 23
   START_BYTE = 9
   DESCRIPTION = "UTC time at the start of the collection interval,
   stored as yyyy-mm-ddThh:mm:ss.sss."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 4
   NAME = END_UTC
   DATA_TYPE = CHARACTER
   BYTES = 23
   START_BYTE = 32
   DESCRIPTION = "UTC time at the end of the collection interval,
```

```
   stored as yyyy-mm-ddThh:mm:ss.sss."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 5
   NAME = BEGIN_LATITUDE
   DATA_TYPE = IEEE_REAL
   BYTES = 4
   START_BYTE = 55
   UNIT = DEGREE
   DESCRIPTION = "Latitude in Mars fixed coordinates at the beginning
   of the frame, in degrees."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 6
   NAME = BEGIN_LONGITUDE
   DATA_TYPE = IEEE_REAL
   BYTES = 4
   START_BYTE = 59
   UNIT = DEGREE
   DESCRIPTION = "Easting Longitude in Mars fixed coordinates at the
beginning
   of the frame, in degrees."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 7
   NAME = END_LATITUDE
   DATA_TYPE = IEEE_REAL
   BYTES = 4
   START_BYTE = 63
   UNIT = DEGREE
   DESCRIPTION = "Latitude in Mars fixed coordinates at the end
   of the frame, in degrees."
END_OBJECT = COLUMN

OBJECT = COLUMN
```

```
   COLUMN_NUMBER = 8
   NAME = END_LONGITUDE
   DATA_TYPE = IEEE_REAL
   BYTES = 4
   START_BYTE = 67
   UNIT = DEGREE
   DESCRIPTION = "Easting Longitude in Mars fixed coordinates at the end
   of the frame, in degrees."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 9
   NAME = COLLECTION_DURATION
   DATA_TYPE = MSB_UNSIGNED_INTEGER
   BYTES = 4
   START_BYTE = 71
   UNIT = SECOND
   DESCRIPTION = "Value of collection time register, length of time
   in seconds."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 10
   NAME = CTN_AVERAGE
   DATA_TYPE = IEEE_REAL
   BYTES = 4
   START_BYTE = 75
   UNIT = COUNT
   DESCRIPTION = "Average Counts in CTN detector over duration."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 11
   NAME = CTN_BKGD
   DATA_TYPE = IEEE_REAL
   BYTES = 4
   START_BYTE = 79
```

```
   UNIT = COUNT
   DESCRIPTION = "Background counts for CTN detector (counts)."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 12
   NAME = CTN_ERROR
   DATA_TYPE = IEEE_REAL
   BYTES = 4
   START_BYTE = 83
   UNIT = COUNT
   DESCRIPTION = "Error in CTN detector over duration."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 13
   NAME = CTN_NORM
   DATA_TYPE = IEEE_REAL
   BYTES = 4
   START_BYTE = 87
   UNIT = COUNT
   DESCRIPTION = "Normalization for CTN detector over duration."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 14
   NAME = CETN_AVERAGE
   DATA_TYPE = IEEE_REAL
   BYTES = 4
   START_BYTE = 91
   UNIT = COUNT
   DESCRIPTION = "Average counts for CETN detector over duration."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 15
   NAME = CETN_BKGD
```

```
   DATA_TYPE = IEEE_REAL
   BYTES = 4
   START_BYTE = 95
   UNIT = COUNT
   DESCRIPTION = "Background counts for CETN detector (counts)."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 16
   NAME = CETN_ERROR
   DATA_TYPE = IEEE_REAL
   BYTES = 4
   START_BYTE = 99
   UNIT = COUNT
   DESCRIPTION = "Error in CETN detector over duration."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 17
   NAME = CETN_NORM
   DATA_TYPE = IEEE_REAL
   BYTES = 4
   START_BYTE = 103
   UNIT = COUNT
   DESCRIPTION = "Normalization for CETN detector for duration."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 18
   NAME = START_LST
   DATA_TYPE = CHARACTER
   BYTES = 8
   START_BYTE = 107
   DESCRIPTION = "Local solar time at start of period, 'hh:mm:ss'."
END_OBJECT = COLUMN

OBJECT = COLUMN
```

```
   COLUMN_NUMBER = 19
   NAME = END_LST
   DATA_TYPE = CHARACTER
   BYTES = 8
   START_BYTE = 115
   DESCRIPTION = "Local solar time at end of period, 'hh:mm:ss'."
END_OBJECT = COLUMN
```

6.5 Averaged Active Label

```
PDS_VERSION_ID                  = PDS3

/* FILE DATA ELEMENTS */
RECORD_TYPE                     = FIXED_LENGTH
RECORD_BYTES                    = 119135
FILE_RECORDS                    = 21

/* IDENTIFICATION DATA ELEMENTS */
DATA_SET_ID                     = "MSL-M-DAN-3/4-RDR-V1.0"
COMMAND_SEQUENCE_NUMBER         = 0
INSTRUMENT_HOST_ID              = MSL
INSTRUMENT_HOST_NAME            = "MARS SCIENCE LABORATORY"
INSTRUMENT_NAME                 = "DYNAMIC ALBEDO OF NEUTRONS"
MSL:REQUEST_ID                  = 3321
PLANET_DAY_NUMBER               = "42"
PRODUCT_CREATION_TIME           = 2010-10-27T22:19:47.000
PRODUCT_ID                      =
"DNA_351797691RAA_0550000000_______P1.DAT"
PRODUCT_TYPE                    = DAN_RDR_AA
PRODUCT_VERSION_ID              = "1.0"
RELEASE_ID                      = "1"
ROVER_MOTION_COUNTER            = (0,0,0,0,0,0,0,0)
ROVER_MOTION_COUNTER_NAME       = (SITE, DRIVE, POSE, ARM, CHIMRA,
SEQUENCE_ID                     = "1036288"
SEQUENCE_VERSION_ID             = "0"
SPACECRAFT_CLOCK_START_COUNT    = "340477575.18840"
SPACECRAFT_CLOCK_STOP_COUNT     = "340481123.22311"
START_TIME                      = 2012-289T05:10:16.868
STOP_TIME                       = 2012-289T05:12:22:213
TARGET_NAME                     = MARS
^TABLE                          =
"DNA_351797691RAA_0550000000_______P1.DAT"

OBJECT                          = TABLE
   COLUMNS                      = 2123
   INTERCHANGE_FORMAT           = BINARY
   ROW_BYTES                    = 119135
   ROWS                         = 21
```

```
   DESCRIPTION                  = "
    This table contains converted neutron count data during neutron
pulsing
    as observed by the Mars Science Laboratory (MSL) Dynamic Albedo of
    Neutron Detector (DAN).

    Detailed descriptions for the parameters defined below are
    contained in the DAN RDR SIS document.

    The complete column definitions are contained in an external file
    found in the LABEL directory of the archive volume.
    "
   ^STRUCTURE                   = "DAN_RDR_AVERAGE_ACTIV.FMT"
END_OBJECT                      = TABLE
END
```

5.3.1 Averaged Active FORMAT FILE

```
OBJECT = COLUMN
   COLUMN_NUMBER = 1
   NAME = START_DAN_TIME
   DATA_TYPE = MSB_UNSIGNED_INTEGER
   BYTES = 4
   START_BYTE = 1
   UNIT = MILLISECONDS
   DESCRIPTION = "DAN time at beginning of average."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 2
   NAME = END_DAN_TIME
   DATA_TYPE = MSB_UNSIGNED_INTEGER
   BYTES = 4
   START_BYTE = 5
   UNIT = MILLISECONDS
   DESCRIPTION = "DAN time at end of averaging interval."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 3
   NAME = START_UTC
   DATA_TYPE = CHARACTER
```

```
   BYTES = 23
   START_BYTE = 9
   DESCRIPTION = "UTC time at the start of the averaging interval,
   stored as yyyy-mm-ddThh:mm:ss.sss."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 4
   NAME = END_UTC
   DATA_TYPE = CHARACTER
   BYTES = 23
   START_BYTE = 32
   DESCRIPTION = "UTC time at the end of the averaging interval,
   stored as yyyy-mm-ddThh:mm:ss.sss."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 5
   NAME = BEGIN_LATITUDE
   DATA_TYPE = IEEE_REAL
   BYTES = 4
   START_BYTE = 55
   UNIT = DEGREE
   DESCRIPTION = "Latitude in Mars fixed coordinates at the beginning
   of the frame, in degrees."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 6
   NAME = BEGIN_LONGITUDE
   DATA_TYPE = IEEE_REAL
   BYTES = 4
   START_BYTE = 59
   UNIT = DEGREE
   DESCRIPTION = "Easting Longitude in Mars fixed coordinates at the
beginning
   of the frame, in degrees."
END_OBJECT = COLUMN
```

```
OBJECT = COLUMN
   COLUMN_NUMBER = 7
   NAME = END_LATITUDE
   DATA_TYPE = IEEE_REAL
   BYTES = 4
   START_BYTE = 63
   UNIT = DEGREE
   DESCRIPTION = "Latitude in Mars fixed coordinates at the end
   of the frame, in degrees."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 8
   NAME = END_LONGITUDE
   DATA_TYPE = IEEE_REAL
   BYTES = 4
   START_BYTE = 67
   UNIT = DEGREE
   DESCRIPTION = "Easting Longitude in Mars fixed coordinates at the end
   of the frame, in degrees."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 9
   NAME = COLLECTION_DURATION
   DATA_TYPE = MSB_UNSIGNED_INTEGER
   BYTES = 4
   START_BYTE = 71
   UNIT = SECOND
   DESCRIPTION = "Value of collection time register, length of time
   in seconds."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 10
   NAME = NUM_PNG_PULSES
```

```
   DATA_TYPE = MSB_UNSIGNED_INTEGER
   BYTES = 4
   START_BYTE = 75
   UNIT = COUNT
   DESCRIPTION = "number of PNG pulses during data collection interval."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 11
   NAME = PNG_FREQUENCY
   DATA_TYPE = MSB_UNSIGNED_INTEGER
   BYTES = 1
   START_BYTE = 79
   UNIT = COUNT
   DESCRIPTION = "Pulsing Neutron Generator frequency of pulsing."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 12
   NAME = TIME_BIN_DURATION
   DATA_TYPE = IEEE_REAL
   BYTES = 4
   START_BYTE = 80
   UNIT = MICROSECONDS
   DESCRIPTION = "duration in microseconds for each time bin."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 13
   NAME = TIME_BIN_START
   DATA_TYPE = IEEE_REAL
   BYTES = 4
   START_BYTE = 84
   UNIT = MICROSECONDS
   DESCRIPTION = "start time after the pulse in microseconds for
   each time bin."
END_OBJECT = COLUMN
```

```
OBJECT = COLUMN
   COLUMN_NUMBER = 14
   NAME = CTN_AVERAGE
   DATA_TYPE = IEEE_REAL
   BYTES = 4
   START_BYTE = 88
   UNIT = COUNT
   DESCRIPTION = "Average Counts in CTN detector over duration."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 15
   NAME = CTN_BKGD
   DATA_TYPE = IEEE_REAL
   BYTES = 4
   START_BYTE = 92
   UNIT = COUNT
   DESCRIPTION = "Background counts for CTN detector (counts)."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 16
   NAME = CTN_ERROR
   DATA_TYPE = IEEE_REAL
   BYTES = 4
   START_BYTE = 96
   UNIT = COUNT
   DESCRIPTION = "Average Error in CTN detector over interval."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 17
   NAME = CTN_NORM
   DATA_TYPE = IEEE_REAL
   BYTES = 4
   START_BYTE = 100
```

```
   UNIT = COUNT
   DESCRIPTION = "Normalization for CTN detector over duration."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 18
   NAME = CETN_AVERAGE
   DATA_TYPE = IEEE_REAL
   BYTES = 4
   START_BYTE = 104
   UNIT = COUNT
   DESCRIPTION = "Average counts for CETN detector over duration."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 19
   NAME = CETN_BKGD
   DATA_TYPE = IEEE_REAL
   BYTES = 4
   START_BYTE = 108
   UNIT = COUNT
   DESCRIPTION = "Background counts for CETN detector (counts)."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 20
   NAME = CETN_ERROR
   DATA_TYPE = IEEE_REAL
   BYTES = 4
   START_BYTE = 112
   UNIT = COUNT
   DESCRIPTION = "Error in CETN detector over duration."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 21
   NAME = CETN_NORM
```

```
   DATA_TYPE = IEEE_REAL
   BYTES = 4
   START_BYTE = 116
   UNIT = COUNT
   DESCRIPTION = "Normalization for CETN detector for duration."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 22
   NAME = START_LST
   DATA_TYPE = CHARACTER
   BYTES = 8
   START_BYTE = 120
   DESCRIPTION = "Local solar time at start of period, 'hh:mm:ss'."
END_OBJECT = COLUMN

OBJECT = COLUMN
   COLUMN_NUMBER = 23
   NAME = END_LST
   DATA_TYPE = CHARACTER
   BYTES = 8
   START_BYTE = 128
   DESCRIPTION = "Local solar time at end of period, 'hh:mm:ss'."
END_OBJECT = COLUMN
```

7. APPENDIX – A

Keyword Name	Definition	Type
PDS_VERSION_ID	Specifies the version number of the PDS standards document that is valid when a data product label is created. Values for the PDS_version_id are formed by appending the integer for the latest version number to the letters 'PDS'.	String
/* FILE DATA ELEMENTS */	Comment	
RECORD_TYPE	Specifies the record format of a file, such as FIXED_LENGTH. Note: In the PDS, when RECORD_TYPE is used in a detached label file, it always describes its corresponding detached data file and not the label file itself. The use of RECORD_TYPE along with other file-related data elements is fully described in the PDS Standards Reference.	String
RECORD_BYTES	Specifies the number of bytes in a physical file record, including record terminators and separators. Note: In the PDS, the use of record_bytes, along with other file-related data elements is fully described in the Standards Reference.	integer
FILE_RECORDS	Specifies the number of physical file records, including both label records and data records. Note: In the PDS the use of FILE_RECORDS along with other file-related data elements is fully described in the Standards Reference.	integer
/* IDENTIFICATION DATA ELEMENTS */	Comment	

Keyword Name	Definition	Type
DATA_SET_ID	A unique alphanumeric identifier for a data set or a data product. The DATA_SET_ID value for a given data set or product is constructed according to flight project naming conventions. In most cases the DATA_SET_ID is an abbreviation of the DATA_SET_NAME. Note: In the PDS, the values for both DATA_SET_ID and DATA_SET_NAME are constructed according to standards outlined in the Standards Reference.	string(40)
COMMAND_SEQUENCE_NUMBER	Specifies a numeric identifier for a sequence of commands sent to a spacecraft or instrument. Note: For MSL, this is the command number that identifies the specific generating command within the specified sequence.	String
INSTRUMENT_HOST_ID	Specifies a unique identifier for the host where an instrument is located. This host can be either a spacecraft or an earth base (e.g., and observatory or laboratory on the earth). Thus, INSTRUMENT_HOST_ID can contain values, which are either SPACECRAFT_ID values or EARTH_BASE_ID values.	String
INSTRUMENT_HOST_NAME	The full name of the host on which this instrument is based	String
INSTRUMENT_NAME	Name of the instrument, free format, enclosed in double quotes. See example labels for various names used for MECA non-imaging products	String
INTERCHANGE_FORMAT	Set to BINARY for DAN RDRs	String
PLANET_DAY	Mars Sol starting from Sol 0 at Landing	Integer
PRODUCT_CREATION_TIME	Defines the UTC system format time when a product was created.	String
PRODUCT_ID	Represents a permanent, unique identifier assigned to a data product by its producer. See also: source_product_id. Note: In the PDS, the value assigned to product_id must be unique within its data set. Additional note: The product_id can describe the lowest-level data object that has a PDS label.	String(40)
PRODUCT_TYPE	Either EDR or RDR	String

Keyword Name	Definition	Type
MSL:REQUEST_ID	Specifies the Request ID value associated with the Data Product generation command. Unsigned integer.	
ROVER_MOTION_COUNTER	Specifies a set of integers which describe a (potentially) unique location (position/orientation) for a rover. Each time something happens that moves, or could potentially move, the rover, a new motion counter value is created. This includes intentional motion due to drive commands, as well as potential motion due to other articulating devices, such as arms or antennae. This motion counter (or part of it) is used as a reference to define instances of coordinate systems which can move such as SITE or ROVER frames. The motion counter is defined in a mission-specific manner. Although the original intent was to have incrementing indices (e.g. MER), the motion counter could also contain any integer values which conform to the above definition, such as time or spacecraft clock values. For MSL, the motion counter consists of eight values. In order, they are Site, Drive, Pose, Arm, Chimra, Drill, RSM and HGA. The Site value increments whenever a new major Site frame is declared. The Drive value increments any time intentional driving is done. Each of those resets all later indices to 0 when they increment.	
ROVER_MOTION_COUNTER_NAME	Specifies an array that provides the formal names identifiying each integer in ROVER_MOTION_COUNTER.	
SEQUENCE_ID	Specifies an identification of the spacecraft sequence associated with the given product. This element replaces the older seq_id, which should no longer be used.	
SEQUENCE_VERSION_ID	Specifies the version identifier for a particular observation sequence used during planning or data processing.	
SPACECRAFT_CLOCK_START	Starting SCLK, smallest, value of all the records contained in the EDR.	string(30)
START_TIME	SPACECRAFT_CLOCK_START_COUNT converted and represented in UTC	string
STOP_TIME	SPACECRAFT_CLOCK_STOP converted and represented in UTC	string

Keyword Name	Definition	Type
TARGET_NAME	Identifies a target. The target may be a planet, satellite, ring, region, feature, asteroid or comet. See TARGET_TYPE. This is based on mission phase.	string(30)
^TABLE	The name of the data file	string
COLUMNS	The number of columns in the data file	Integer
ROW_BYTES	The number of bytes per row in the data file	Integer
ROWS	The number of rows in the data file	Integer
^STRUCTURE	A pointer to the Format file the contains information about each column in the data file	String