KAGUYA (SELENE)

Product Format Description

- Laser Altimeter (LALT) -

Version 1.0

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1. Introduction

1.1 Purpose

This document describes the format[*2] used for the catalog and product files for the Laser Altimeter [*1](LALT) that was board KAGUYA (SELENE). These files provided by Japan Aerospace Exploration Agency (JAXA).

*1 : Refer to the following "Project Homepage of KAGUYA" and "Image Gallery of KAGUYA" used for the LALT mission.

- ✓ Project Homepage for KAGUYA
  http://www.kaguya.jaxa.jp/en/equipment/lalt_e.htm
- ✓ Image Gallery for KAGUYA
  http://wms.selene.jaxa.jp/selene_viewer/en/observation_mission/lalt/

*2 : The data format used for SELENE is based on the PDS (Planetary Data System) by NASA. However, the data format is not fully compliant with the PDS format.

1.2 The composition of this format description

Table 1-1 shows the composition of this format description.

Table 1-1 the composition of this format description

No.	INDEX	Title	Description content
1	Section 1.3	Table 1-2 LALT Products List	The name of the product, the object form, and the composition of the product are described as a product list illustrated by this description.
		Table 1-3 Product Description	Concerning each product shown in the No1 product list, the content included in data and the description of the observation method are illustrated.
2	Chapter X	" Product Name"	Concerning the product shown in the No1 product list, rules used for file naming, label format, data object format and catalog information file format are described.
3	Section X.1	Rules used for File naming	Concerning the product shown in No2, the rules of file nomenclature is described.
4	Section X.2	Label Format	Concerning the product shown in No2, the label format is described.
5	Section X.3	Data Object Format	Concerning the product shown in No2, the data format of the data object is described. (The extension of the data file is unique in each product. Therefore, refer to the file nomenclature in No3.)
6	Section X.4	Catalog Information File Format	Concerning the product shown in No2, the format of the catalog information file (extension: .ctg) of the product is described.
7	Chapter X+1		
		Same as above	

1.3 Data Set

The Data Set refers to a set consisting of: Product, Catalog Information, and Thumbnail Image (JPEG format), which are tar-archived. This set is referred to as the "L2 Data Set". The file extension is "SL2". However, the thumbnail image may be omitted at the by composer's judgment.

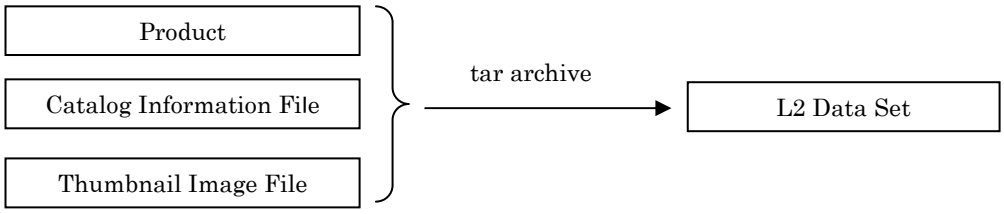

Figure 1-1 composition of the L2 Data Set

1.3.1 Product

For product composition, two possible options are available. Product Composition – Attached consists of label information and data information in a single data file. Product Composition – detached consists of separate files for the label file and data file.

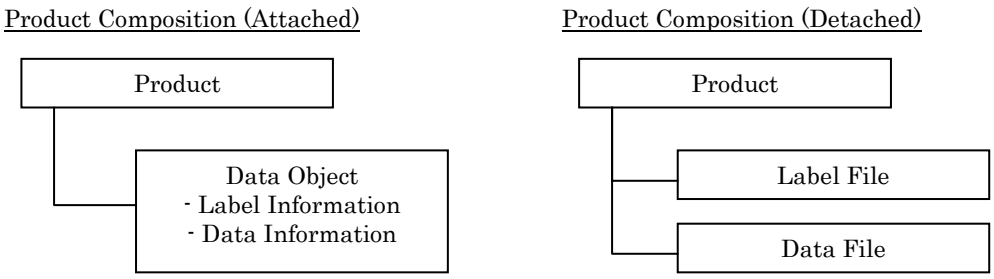

Figure 1-2 Product Composition : Attached and Detached

(1) Label File (Data Object (Label Information)

The Label File (Label Information) is storing as text format the information that identifies the Data File (Data Information).

(2) Data File (Data Object (Data Information))

The data File (Data Object (Data Information)) of the product are classified into the following four data types.

a) IMAGE : image data
An IMAGE is a two-dimensional array of values, all of the same type, each of which is referred to as a sample. IMAGE are normally processed with special display tools to produce a visual representation of the samples by assigning brightness levels or display colors to the values. An IMAGE consists of a series of lines, each containing the same number of samples.
*Refer to the PDS Standard Reference V3.8 Appendix A.20 "IMAGE".

b) TABLE : tabular form data
TABLEs are a natural storage format for collections of data from many instruments. The TABLE is a uniform collection of rows containing ASCII or binary values stored in columns.
*Refer to the PDS Standard Reference V3.8 Appendix A.29 "TABLE".

c) SERIES : time series data
The SERIES is a sub-class of the TABLE. It is used for storing a sequence of measurements organized in a specific way. The sampling parameter keywords in the SERIES represent the variation between the ROWS of data.
*Refer to the PDS Standard Reference V3.8 Appendix A.24 "SERIES"

d) TEXT : text data
The TEXT describes a file which contains plain text.
*Refer to the PDS Standard Reference V3.8 Appendix A.30 "TEXT".

1.3.2 Catalog Information File

Catalog Information File is the information file attached to explain the general of the product and is used to search for the product from L2DB subsystem.

1.3.3 Thumbnail Image File

Thumbnail Image File is the reduced image of the data object, and is the JPEG format image. However, the thumbnail image may be omitted at the by composer's judgment.

1.4 LALT Products

The list of LALT products, which this document describes, is shown in Table 1-2. In addition, the description for each product is shown in Table 1-3.

Table 1-2 LALT Products List

Level*1	Product Name	Product ID	Data Type	Product Format*2
Standard	LALT Range Data	LALT_RD	TABLE	A
Standard	Lunar Global Topographic Data as Time Series	LALT_LGT_TS	TABLE	A
Higher Level	Global Grid Topographic Data of the Moon	LALT_GGT_NUM	TABLE	A
Higher Level	Global Topographic MAP of the Moon	LALT_GGT_MAP	IMAGE	A
Higher Level	Grid Topographic Data of the Lunar North Pole	LALT_GT_NP_NUM	TABLE	A
Higher Level	Topographic Image of the Lunar North Pole	LALT_GT_NP_IMG	IMAGE	A
Higher Level	Grid Topographic Data of the Lunar South Pole	LALT_GT_SP_NUM	TABLE	A
Higher Level	Topographic Image of the Lunar South Pole	LALT_GT_SP_IMG	IMAGE	A
Higher Level	Spherical Harmonics Coefficients of the Lunar Topography	LALT_SH	TABLE	A

:Map product

*1 : Data obtained by equipments is not clear as it is, therefore various processings and correction treatment are necessary by the ground system. According to the difference in the process of processing and correction treatment, they can be classified to the standard processing and higher-level processing. The higher-level processing refers to the standard processing data to which various processing and correction treatment are conducted according to the research purpose et cetra.

*2 : Product Format : A - Attached, D - Detached

Table 1-3 Product Description

Product Name	Product ID
LALT Range Data	Time series range data of LALT to the lunar surface. Thermal error of the internal clock is corrected. Range precision is within +/- 5m.
Lunar Global Topographic Data as Time Series	Lunar global topographic data calculated from the main orbiter's position, attitude, and LALT ranging data corrected by peak height data. Time stamp is converted from TI to UT. Used ancillary data are also included.
Global Grid Topographic Data of the Moon	Gridded lunar global topography obtained from the interpolation of elevation data in [Lunar Global Topographic Data as Time Series].
Global Topographic MAP of the Moon	Map data of lunar global topography obtained from the interpolation of elevation data in [Lunar Global Topographic Data as Time Series]..
Grid Topographic Data of the Lunar North Pole	Numerical topographic data centered on Lunar north pole and 10 degrees in radius obtained from the interpolation of elevation data in [Lunar Global Topographic Data as Time Series].
Topographic Image of the Lunar North Pole	Topographic image centered on Lunar north pole and 10 degrees in radius obtained from the interpolation of elevation data in [Lunar Global Topographic Data as Time Series].
Grid Topographic Data of the Lunar South Pole	Numerical topographic data centered on Lunar south pole and 10 degrees in radius obtained from the interpolation of elevation data in [Lunar Global Topographic Data as Time Series].
Topographic Image of the Lunar South Pole	Topographic image centered on Lunar south pole and 10 degrees in radius obtained from the interpolation of elevation data in [Lunar Global Topographic Data as Time Series].
Spherical Harmonics Coefficients of the Lunar Topography	Spherical harmonic coefficients of Lunar global topography obtained from the analysis of elevation data in [Lunar Global Topographic Data as Time Series]. Maximum degree is 360.

:Map product

2. LALT Range Data (Product ID : LALT_RD)

2.1 Rules used for File naming

The nomenclature used for Label, Data Object and Catalog Information File the product files are described below. In addition, the file name is case-independent.

LALT_RD_YYYYMMDD.ext

- LALT_RD : Product (STATIC)
- YYYYMMDD : Observation Date (UTC)
- ext : File Extension
  - ✓ TAB : Label and Data Object File
  - ✓ ctg : Catalog Information File

<Example of Name >

LALT_RD_20080125.TAB

2.2 Label Format

The Label Format for the TABLE object used for the LALT Range Data product is shown in Table 2-1.

Table 2-1 Label Format

No	Items	Elements	Types	Values
Standard Item				
1	PDS version number	PDS_VERSION_ID = %s	char	PDS3 [STATIC]
2	Record format of the file	RECORD_TYPE = %s	char	FIXED_LENGTH [STATIC]
3	Byte count of the file records	RECORD_BYTE = %s	int	XXX
4	Count of the file records	FILE_RECORDS = %s	int	XXX
5	Count of the label records	LABEL_RECORDS = %s	int	XXX
6	File name	FILE_NAME = %s	char	See Section 2.1 “Rules used for File naming”.
7	Name of the mission	MISSION_NAME = %s	char	SELENE [STATIC]
8	Name of the spacecraft	SPACECRAFT_NAME = %s	char	SELENE-M [STATIC]
9	Name of the instrument	INSTRUMENT_NAME = %s	char	"LALT" [STATIC]
10	Product ID	PRODUCT_TYPE = %s	char	See Table 1-2 “Product_ID”.
11	Version number of the product	PRODUCT_VERSION_ID = %s	char	yyyymmdd
12	Target name	TARGET_NAME = %s	char	MOON [STATIC]
13	Starting position of the HEADER object	^HEADER = %d <BYTES>	int	XXX <BYTES>
14	Starting position of the TABLE object	^TABLE = %d <BYTES>	int	XXX <BYTES>
Header Object Description Part				
		OBJECT = HEADER		
1	Byte count of the data	BYTE = %s	int	XXX
2	Header format	HEADER_TYPE = %s	char	“XXX”
3	Description	DESCRIPTION = “%s”	char	“XXXXXXXXXX”
		END_OBJECT = HEADER		

TABLE Object Description Part				
		OBJECT = TABLE		
1	Number of lines of data	ROWS = %s	int	Count of the observation number
2	Number of columns of data	COLUMS = "%s"	int	11 [STATIC]
3	Byte count of data line	ROW_BYTES = %s	int	162 [STATIC]
4	Format	INTERCHANGE_FORMAT = %s	char	ASCI I [STATIC]
5	Description	DESCRIPTION = "%s"	char	See the following example. [STATIC]
COLIMN Object Description Part (11 column)				
		OBJECT = COLUMN		
1	Name	NAME = "%s"	char	See the following example. [STATIC]
2	Type of the data	DATA_TYPE = %s	char	See the following example. [STATIC]
3	Starting byte of the data	START_BYTES = %s	int	See the following example. [STATIC]
4	Byte count of the data	BYTE = %s	int	See the following example. [STATIC]
5	Format	FORMAT = %s	char	See the following example. [STATIC]
6	Unit of the data	UNIT = "%s"	char	See the following example. [STATIC]
7	Description	DESCRIPTION = "%s"	char	See the following example. [STATIC]
		END_OBJECT = COLUMN		
		END_OBJECT = TABLE		
END statement				
		END		

<Example of Label : LALT Range Data>

```
PDS_VERSION_ID                = PDS3
RECORD_TYPE                   = FIXED_LENGTH
RECORD_BYTES                  = 162
FILE_RECORDS                  = 12161
LABEL_RECORDS                 = 158

FILE_NAME                     = "LALT_RD_20080105.TAB"
MISSION_NAME                  = SELENE
SPACECRAFT_NAME               = "SELENE-M"
INSTRUMENT_NAME               = "LALT"
PRODUCT_TYPE                  = LALT_RD
PRODUCT_VERSION_ID            = 20091028
TARGET_NAME                   = MOON

^HEADER                       = 159
OBJECT                        = HEADER
  BYTES                       = 162
  HEADER_TYPE                 = "TEXT"
  DESCRIPTION                 = "The header gives the names of the
                                data columns."
END_OBJECT                    = HEADER

^TABLE = 25759 <BYTES>

/*TABLE*/
OBJECT                        = TABLE

ROWS                          = 12002
COLUMNS                       = 11
ROW_BYTES                     = 162
INTERCHANGE_FORMAT            = ASCII
DESCRIPTION                   = "
  LALT_RD is the time series range data set from LALT to the lunar surface
  where the laser pulses hit, which also contains the output power and peak
  height data of the returned pulses. The range data are corrected for the
```

thermal variation of the counting rate of the time interval counter. Time tags are due to the internal clock counting of Kaguya main orbiter (TI). Some other telemetry data or parameters are also included. One file is for one day (UTC).

PI: Dr. Hiroshi ARAKI (arakih@miz.nao.ac.jp)."

```
OBJECT                  = COLUMN
  NAME                    = "TI"
  DATA_TYPE               = ASCII_INTEGER
  START_BYTE              = 1
  BYTES                   = 10
  FORMAT                  = "I10"
  UNIT                    = "N/A"
  DESCRIPTION             = "Internal timing data of the
                            SELENE main orbiter when the
                            laser is fired from LALT."
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                    = "LALT_ALTITUDE"
  DATA_TYPE               = ASCII_REAL
  START_BYTE              = 11
  BYTES                   = 9
  FORMAT                  = "F9.1"
  UNIT                    = "M"
  DESCRIPTION             = "The distance between LALT and the ranged lunar surface."
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                    = "LALT_DETECT_PEAK"
  DATA_TYPE               = ASCII_REAL
  START_BYTE              = 20
  BYTES                   = 6
  FORMAT                  = "F6.1"
  UNIT                    = "mV"
  DESCRIPTION             = "The peak height of the returned pulses."
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                    = "LALT_OUTPUT_POWER"
  DATA_TYPE               = ASCII_REAL
  START_BYTE              = 26
  BYTES                   = 6
  FORMAT                  = "F6.1"
  UNIT                    = "mJ"
  DESCRIPTION             = "The output power of the laser pulses."
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                    = "LALT_HV_MON_APD"
  DATA_TYPE               = ASCII_REAL
  START_BYTE              = 32
  BYTES                   = 6
  FORMAT                  = "F6.1"
  UNIT                    = "V"
  DESCRIPTION             = "The high voltage applied to APD sensor."
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                    = "LALT_TEMP_MON_4"
  DATA_TYPE               = ASCII_REAL
  START_BYTE              = 38
  BYTES                   = 6
  FORMAT                  = "F6.1"
  UNIT                    = "Degrees Celsius"
  DESCRIPTION             = "Temperature around the analog signal processing unit."
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
```

```
      NAME                        = "LALT_TEMP_MON_6"
      DATA_TYPE                   = ASCII_REAL
      START_BYTE                  = 44
      BYTES                       = 6
      FORMAT                      = "F6.1"
      UNIT                        = "Degrees Celsius"
      DESCRIPTION                 = "Temperature around the clock unit in the time interval counter."
    END_OBJECT                    = COLUMN

    OBJECT                        = COLUMN
      NAME                        = "LALT_TEMP_MON_8"
      DATA_TYPE                   = ASCII_REAL
      START_BYTE                  = 50
      BYTES                       = 6
      FORMAT                      = "F6.1"
      UNIT                        = "Degrees Celsius"
      DESCRIPTION                 = "Temperature data by the thermometer in APD."
    END_OBJECT                    = COLUMN

    OBJECT                        = COLUMN
      NAME                        = "LALT_ALTERNATIVE_PPS"
      DATA_TYPE                   = ASCII_TEXT
      START_BYTE                  = 56
      BYTES                       = 4
      FORMAT                      = "N/A"
      UNIT                        = "N/A"
      DESCRIPTION                 = "Whether pseudo 1 pps signal is used or not (NON)."
    END_OBJECT                    = COLUMN

    OBJECT                        = COLUMN
      NAME                        = "LALT_START_MODE"
      DATA_TYPE                   = ASCII_REAL
      START_BYTE                  = 60
      BYTES                       = 4
      FORMAT                      = "N/A"
      UNIT                        = "N/A"
      DESCRIPTION                 = "Whether the start of the clock counting is normal (NML) or not."
    END_OBJECT                    = COLUMN

    OBJECT                        = COLUMN
      NAME                        = "LALT_THRESHOLD_LEVEL"
      DATA_TYPE                   = ASCII_REAL
      START_BYTE                  = 64
      BYTES                       = 4
      FORMAT                      = "N/A"
      UNIT                        = "N/A"
      DESCRIPTION                 = "The detection threshold on the returned pulses is low (LO; 5mV) or
high (HI; 25mV)."
    END_OBJECT                    = COLUMN

  END_OBJECT = TABLE

  END
```

2.3 Data Object Format

Ranging data, as a time series, from the LALT verge of opening to the surface of the Moon. The data is described in a TABLE format. Table 2-2 shows the format of the LALT ranging data. The data for 11 items are included.

Table 2-2 Data Object Format

Byte position	Byte count	Item	Data type	Format	Unit	Substance
1	10	TI*1	ASCII_REAL	I10	N/A	Satellite time
11	9	LALT_ALTITUDE	ASCII_REAL	F9.1	M	Ranging data
20	6	LALT_DETECT_PEAK	ASCII_REAL	F6.1	mV	Reception signal level peak value
26	6	LALT_OUTPUT_POWER	ASCII_REAL	F6.1	mJ	Transmission (Emission) energy value
32	6	LALT_HV_MON_APD	ASCII_REAL	F6.1	V	High-voltage power supply monitor value
38	6	LALT_TEMP_MON_4	ASCII_REAL	F6.1	Centigrade	Thermal monitor ch4 (analog signal processor)
44	6	LALT_TEMP_MON_7	ASCII_REAL	F6.1	Centigrade	Thermal monitor ch7 (start pulse sensing station)
50	6	LALT_TEMP_MON_8	ASCII_REAL	F6.1	Centigrade	Thermal monitor ch8 (APD)
56	4	LALT_ALTERNATIVE_PPS	ASCII	N/A	N/A	accrued status of quasi-1pps
60	4	LALT_START_MODE	ASCII	N/A	N/A	Start pulse mode
64	4	LALT_THRESHOLD_LEVEL	ASCII	N/A	N/A	Threshold mode
68	92	(blank)	-	N/A	N/A	N/A
160	2	<CR><LF> statement	-	N/A	N/A	<0x0D><0x0A>

*1 : The internal time of the laser fire of SELENE main satellite for that point in the orbit.

2.4 Catalog Information File Format

The Catalog Information File Format is shown in Table 2-3.

Table 2-3 Catalog Information File Format

Item Name	Elements	Format of Value	Range of Value	Values
Name of the data file (*1)	DataFileName	AAAA….AAAA (Up to 31 digits)	alphanumeric characters	dependent on the product (See Section 2.1 "Rules used for File naming".)
Size of the data file	DataFileSize	NNNNNNNNNNN (Up to 12 digits)	unit:<byte>	dependent on the product
File format of the data file	DataFileFormat	AAAA….AAAA (Up to 16 digits)	character strings	PDS3 [STATIC]
Name of the instrument	InstrumentName	AAAA….AAAA (Up to 16 digits)	character strings	LALT [STATIC]
Processing level	ProcessingLevel	AAAA….AAAA (Up to 16 digits)	character strings	dependent on the product (See Table 1-2 "Level".)
Product ID	ProductID	AAAA….AAAA (Up to 30 digits)	character strings	dependent on the product (See Table 1-2 "Product_ID".)
Version number of the product	ProductVersion	AAAA….AAAA (Up to 16 digits)	character strings	X
Access level	AccessLevel	N	values of 0-4	N/A
Comment information	CommentInfo	AAAA….AAAA (Up to 4000 digits)	character strings	dependent on the product

(*1) "DataFileName" is the stored file name of the product. For the detached format, this is the stored file name.

<Example of Catalog Information>

DataFileName = LALT_RD_20080105.TAB
DataFileSize = 1970082
DataFileFormat = PDS
InstrumentName = LALT
ProcessingLevel = Standard
ProductID = LALT_RD
ProductVersion = 1.0
AccessLevel = 4
CommentInfo = LALT_RD processed by H. NODA (noda@miz.nao.ac.jp).

3. Lunar Global Topographic Data as Time Series (Product ID: LALT_LGT_TS)

3.1 Rules used for File naming

The nomenclature used for Label, Data Object and Catalog Information File the product files are described below. In addition, the file name is case-independent.

LALT_LGT_TS _YYYYMMDD.ext

- LALT_LGT_TS : Product (STATIC)
- YYYYMMDD : Observation Date (UTC)
- ext : File Extension
  - ✓ TAB : Label and Data Object File
  - ✓ ctg : Catalog Information File

< Example of Name >

LALT_LGT_TS_20071230.TAB

3.2 Label Format

The Label Format for the TABLE object used for the Lunar Global Topographic Data as Time Series product is shown in Table 3-1.

Table 3-1 Label Format

No	Items	Elements	Types	Values
Standard Item				
1	PDS version number	PDS_VERSION_ID = %s	char	PDS3 [STATIC]
2	Record format of the file	RECORD_TYPE = %s	char	FIXED_LENGTH [STATIC]
3	Byte count of the file records	RECORD_BYTE = %s	int	XXX
4	Count of the file records	FILE_RECORDS = %s	int	XXX
5	Count of the label records	LABEL_RECORDS = %s	int	XXX
6	File name	FILE_NAME = %s	char	See Section 3.1 “Rules used for File naming”.
7	Name of the mission	MISSION_NAME = %s	char	SELENE [STATIC]
8	Name of the spacecraft	SPACECRAFT_NAME = %s	char	SELENE-M [STATIC]
9	Name of the instrument	INSTRUMENT_NAME = %s	char	"LALT" [STATIC]
10	Product ID	PRODUCT_TYPE = %s	char	See Table 1-2 “Product_ID”.
11	Version number of the product	PRODUCT_VERSION_ID = %s	char	"YYYYMMDD gravity model = XXX, orbit data = filename"
12	Target name	TARGET_NAME = %s	char	MOON [STATIC]
13	Starting position of the HEADER object	^HEADER = %d <BYTES>	int	XXX <BYTES>
14	Starting position of the TABLE object	^TABLE = %d <BYTES>	int	XXX <BYTES>
Header Object Description Part				
		OBJECT = HEADER		
1	Byte count of the data	BYTE = %s	int	XXX
2	Header format	HEADER_TYPE = %s	char	“XXX”
3	Description	DESCRIPTION = “%s”	char	“XXXXXXXXXX”
		END_OBJECT = HEADER		

TABLE Object Description Part				
		OBJECT = TABLE		
1	Number of lines of data	ROWS = %s	int	Count of the observation number
2	Number of columns of data	COLUMS = "%s"	int	13 [STATIC]
3	Byte count of data line	ROW_BYTES = %s	int	162 [STATIC]
4	Format	INTERCHANGE_FORMAT = %s	char	ASCI I [STATIC]
5	Description	DESCRIPTION = "%s"	char	See the following example. [STATIC]
COLUMN Object Description Part (13 column)				
		OBJECT = COLUMN		
1	Name	NAME = "%s"	char	See the following example. [STATIC]
2	Type of the data	DATA_TYPE = %s	char	See the following example. [STATIC]
3	Starting byte of the data	START_BYTES = %s	int	See the following example. [STATIC]
4	Byte count of the data	BYTE = %s	int	See the following example. [STATIC]
5	Format	FORMAT = %s	char	See the following example. [STATIC]
6	Unit of the data	UNIT = "%s"	char	See the following example. [STATIC]
7	Description	DESCRIPTION = "%s"	char	See the following example. [STATIC]
		END_OBJECT = COLUMN		
		END_OBJECT = TABLE		
END statement				
		END		

<Example of Label : Lunar Global Topographic Data as Time Series >

```
PDS_VERSION_ID                = PDS3
RECORD_TYPE                   = FIXED_LENGTH
RECORD_BYTES                  = 162
FILE_RECORDS                  = 12194
LABEL_RECORDS                 = 191

FILE_NAME                     = "LALT_LGT_TS_20080105.TAB"
MISSION_NAME                  = SELENE
SPACECRAFT_NAME               = "SELENE-M"
INSTRUMENT_NAME               = "LALT"
PRODUCT_TYPE                  = LALT_LGT_TS
PRODUCT_VERSION_ID            = "20091028 gravity model = SGM100g, orbit data =
NAOJ_RISE_MAIN_ORBIT_SGM100g_20071020_0000-20081029_1338.bsp"
TARGET_NAME                   = MOON

^HEADER                       = 192
OBJECT                        = HEADER
  BYTES                       = 162
  HEADER_TYPE                 = "TEXT"
  DESCRIPTION                 = "The header gives the names of the
                                data columns."
END_OBJECT                    = HEADER

^TABLE = 31105 <BYTES>

/*TABLE*/
OBJECT                        = TABLE

ROWS                          = 12002
COLUMNS                       = 13
ROW_BYTES                     = 162
INTERCHANGE_FORMAT            = ASCII
DESCRIPTION                   = "
  LALT_LGT_TS     is lunar global topography calculated by the SPICE toolkit
  software of Navigation and Ancillary Information Facility using LALT range
```

data, the main orbiter's position / attitude data and the ephemeris DE421.
Time stamp is in UTC (transmit time). Reference surface is a sphere whose radius is 1737.4 km and the center is on the gravity center. The coordinate system is Mean Earth/Polar Axis (ME) system in which z axis is mean rotational axis and x axes is defined as the direction of the intersection of equator and prime meridian (mean sub-Earth point)."

```
OBJECT                          = COLUMN
  NAME                            = "TI"
  DATA_TYPE                       = ASCII_INTEGER
  START_BYTE                      = 1
  BYTES                           = 10
  FORMAT                          = "I10"
  UNIT                            = "N/A"
  DESCRIPTION                     = "Internal timing data of the
                                    SELENE main orbiter when the
                                    laser is fired from LALT."
END_OBJECT                      = COLUMN

OBJECT                          = COLUMN
  NAME                            = "UT"
  DATA_TYPE                       = TIME
  START_BYTE                      = 11
  BYTES                           = 24
  FORMAT                          = "N/A"
  UNIT                            = "N/A"
  DESCRIPTION                     = "Timing data when the laser is
                                    fired from LALT in Coordinated
                                    Universal Time (UTC)."
END_OBJECT                      = COLUMN

OBJECT                          = COLUMN
  NAME                            = "LONGITUDE"
  DATA_TYPE                       = ASCII_REAL
  START_BYTE                      = 35
  BYTES                           = 12
  FORMAT                          = "F12.6"
  UNIT                            = "DEGREE"
  POSITIVE_LONGITUDE_DIRECTION = "EAST"
  DESCRIPTION                     = "The longitude of the laser bounce point,
                                    in the ME body-fixed coordinates."
END_OBJECT                      = COLUMN

OBJECT                          = COLUMN
  NAME                            = "LATITUDE"
  DATA_TYPE                       = ASCII_REAL
  START_BYTE                      = 47
  BYTES                           = 12
  FORMAT                          = "F12.6"
  UNIT                            = "DEGREE"
  DESCRIPTION                     = "The latitude of the laser bounce point,
                                    in the ME body-fixed coordinates."
END_OBJECT                      = COLUMN

OBJECT                          = COLUMN
  NAME                            = "ELEVATION"
  DATA_TYPE                       = ASCII_REAL
  START_BYTE                      = 59
  BYTES                           =  9
  FORMAT                          = "F9.3"
  UNIT                            = "KM"
  DESCRIPTION                     = "The elevation of the point on a reference
                                    sphere whose radius is 1737.4 km and the
                                    center is on the gravity center."
END_OBJECT                      = COLUMN

OBJECT                          = COLUMN
  NAME                            = "S/C Position X"
  DATA_TYPE                       = ASCII_REAL
  START_BYTE                      = 68
```

```
  BYTES                          = 13
  FORMAT                          = "F13.3"
  UNIT                           = "KM"
  POSITIVE_LONGITUDE_DIRECTION = "EAST"
  DESCRIPTION                     = "The X component of the S/C position in
                                  in the ME body-fixed coordinates."
END_OBJECT                     = COLUMN

OBJECT                         = COLUMN
  NAME                           = "S/C Position Y"
  DATA_TYPE                       = ASCII_REAL
  START_BYTE                      = 81
  BYTES                          = 11
  FORMAT                          = "F11.3"
  UNIT                           = "KM"
  DESCRIPTION                     = "The Y component of the S/C position in
                                  in the ME body-fixed coordinates."
END_OBJECT                     = COLUMN

OBJECT                         = COLUMN
  NAME                           = "S/C Position Z"
  DATA_TYPE                       = ASCII_REAL
  START_BYTE                      = 92
  BYTES                          = 11
  FORMAT                          = "F11.3"
  UNIT                           = "KM"
  DESCRIPTION                     = "The Z component of the S/C position in
                                  in the ME body-fixed coordinates."
END_OBJECT                     = COLUMN

OBJECT                         = COLUMN
  NAME                           = "X component of the S/C direction cosine"
  DATA_TYPE                       = ASCII_REAL
  START_BYTE                      = 103
  BYTES                          = 14
  FORMAT                          = "F14.3"
  UNIT                           = "N/A"
  DESCRIPTION                     = "X component of the S/C direction cosine
                                  in the ME body-fixed coordinates."
END_OBJECT                     = COLUMN

OBJECT                         = COLUMN
  NAME                           = "Y component of the LALT direction cosine"
  DATA_TYPE                       = ASCII_REAL
  START_BYTE                      = 117
  BYTES                          = 11
  FORMAT                          = "F11.3"
  UNIT                           = "N/A"
  DESCRIPTION                     = "Y component of the S/C direction cosine
                                  in the ME body-fixed coordinates."
END_OBJECT                     = COLUMN

OBJECT                         = COLUMN
  NAME                           = "Z component of the LALT direction cosine"
  DATA_TYPE                       = ASCII_REAL
  START_BYTE                      = 128
  BYTES                          = 11
  FORMAT                          = "F11.3"
  UNIT                           = "N/A"
  DESCRIPTION                     = "Z component of the S/C direction cosine
                                  in the ME body-fixed coordinates."
END_OBJECT                     = COLUMN

OBJECT                         = COLUMN
  NAME                           = "LALT range data"
  DATA_TYPE                       = ASCII_REAL
  START_BYTE                      = 139
  BYTES                          = 11
  FORMAT                          = "F11.4"
  UNIT                           = "KM"
```

```
    DESCRIPTION                = "LALT range data in KM."
  END_OBJECT                 = COLUMN

  OBJECT                     = COLUMN
    NAME                       = "Range data correction"
    DATA_TYPE                  = ASCII_REAL
    START_BYTE                 = 150
    BYTES                      = 11
    FORMAT                     = "F11.1"
    UNIT                       = "M"
    DESCRIPTION                = "Range correction data of LALT in meters."
  END_OBJECT                 = COLUMN

END_OBJECT = TABLE

END
```

3.3 Data Object Format

Moon configuration data as a time series, from the measurement arc of the LALT. This data is described in a TABLE format. Table 3-2 shows the format of the Lunar Global Topographic Data as a Time Series.

Table 3-2 Data Object Format

Column	Byte Position	Byte Count	Item	Data Type	Format	Unit	Substance
1	1	10	TI	ASCII_INTEGER	I10	N/A	Satellite time
2	11	24	UT	TIME	N/A	N/A	Universal Time
3	35	12	LONGITUDE	ASCII_REAL	F12.6	degree	longitude *1
4	47	12	LATITUDE	ASCII_REAL	F12.6	degree	latitude *1
5	59	9	ELEVATION	ASCII_REAL	F9.3	km	Altitude *2
6	68	13	S/C position X	ASCII_REAL	F13.3	km	Satellite position (X) *1
7	81	11	S/C position Y	ASCII_REAL	F11.3	km	Satellite position (Y) *1
8	92	11	S/C position Z	ASCII_REAL	F11.3	km	Satellite position (Z) *1
9	103	14	X component of the LALT direction cosine	ASCII_REAL	F14.3	N/A	Direction of cosine for ranging (X) *1
10	117	11	Y component of the LALT direction cosine	ASCII_REAL	F11.3	N/A	Direction of cosine for ranging (Y) *1
11	128	11	Z component of the LALT direction cosine	ASCII_REAL	F11.3	N/A	Direction of cosine for ranging (Z) *1
12	139	11	LALT range data	ASCII_REAL	F11.4	km	Ranging data
13	150	11	Range data correction	ASCII_REAL	F11.1	m	Correction of the ranging data
-	161	2	<CR><LF>statement	-	N/A	N/A	<0x0D><0x0A>

*1 : ME body-fixed coordinates
*2 : The elevation of the grid point on the sphere whose radius is 1737.4 km referenced to the gravity center of the Mean Earth/Polar Axis body-fixed coordinates.

3.4 Catalog Information File Format

The Catalog Information File Format is shown in Table 3-3.

Table 3-3 Catalog Information File Format

Item Name	Elements	Format of Value	Range of Value	Values
Name of the data file (*1)	DataFileName	AAAA….AAAA (Up to 31 digits)	alphanumeric characters	dependent on the product (See Section 3.1 "Rules used for File naming".)
Size of the data file	DataFileSize	NNNNNNNNNNNN (Up to 12 digits)	unit:<byte>	dependent on the product
File format of the data file	DataFileFormat	AAAA….AAAA (Up to 16 digits)	character strings	PDS [STATIC]
Name of the instrument	InstrumentName	AAAA….AAAA (Up to 16 digits)	character strings	LALT [STATIC]
Processing level	ProcessingLevel	AAAA….AAAA (Up to 16 digits)	character strings	dependent on the product (See Table 1-2 "Level".)
Product ID	ProductID	AAAA….AAAA (Up to 30 digits)	character strings	dependent on the product (See Table 1-2 "Product_ID".)
Version number of the product	ProductVersion	AAAA….AAAA (Up to 16 digits)	character strings	X
Access level	AccessLevel	N	values of 0-4	N/A
Start time	StartDateTime	yyyy- mmddT hh: mm: ss.sssZ	DATE & TIME	dependent on the product
Stop time	EndDateTime	yyyy- mmddT hh: mm: ss.sssZ	DATE & TIME	dependent on the product
Comment information	CommentInfo	AAAA….AAAA (Up to 4000 digits)	character strings	dependent on the product

(*1) "DataFileName" is the stored file name of the product. For the detached format, this is the stored file name.

<Example of Catalog Information>

DataFileName = LALT_LGT_TS_20080626.TAB
DataFileSize = 40602
DataFileFormat = PDS
InstrumentName = LALT
ProcessingLevel = Standard
ProductID = LALT_LGT_TS
ProductVersion = 1.0
AccessLevel = 4
StartDateTime = 2008-06-26T00:00:00.733Z
EndDateTime = 2008-06-26T00:00:59.733Z
CommentInfo = LALT_LGT_TS processed by H. NODA (noda@miz.nao.ac.jp).

4. Global Grid Topographic Data of the Moon (Product ID: LALT_GGT_NUM)

4.1 Rules used for File naming

The nomenclature used for Label, Data Object and Catalog Information File the product files are described below. In addition, the file name is case-independent.

LALT_GGT_NUM.ext

- LALT_GGT_NUM : Product (STATIC)
- ext : File Extension
  - ✓ TAB : Label and Data Object File
  - ✓ jpg : Thumbnail JPEG Image File
  - ✓ ctg : Catalog Information File

<Example of Name >
LALT_GGT_NUM.TAB

4.2 Label Format

The Label Format for the TABLE object used for the Global Grid Topographic Data of the Moon product is shown in Table 4-1.

Table 4-1 Label Format

No	Items	Elements	Types	Values
Standard Item				
1	PDS version number	PDS_VERSION_ID = %s	char	PDS3 [STATIC]
2	Record format of the file	RECORD_TYPE = %s	char	UNDEFINED [STATIC]
3	File name	FILE_NAME = %s	char	See Section 4.1 “Rules used for File naming”.
4	Name of the mission	MISSION_NAME = %s	char	SELENE [STATIC]
5	Name of the spacecraft	SPACECRAFT_NAME = %s	char	SELENE-M [STATIC]
6	Name of the instrument	INSTRUMENT_NAME = %s	char	"LALT" [STATIC]
7	Product ID	PRODUCT_SET_ID = %s	char	See Table 1-2 “Product_ID”.
8	Version number of the product	PRODUCT_VERSION_ID = %s	char	yyyymmdd
9	Target name	TARGET_NAME = %s	char	MOON [STATIC]
10	Comment	COMMENT_TEXT = "%s"	char	See the following example. [STATIC]
11	Starting position of the TABLE object	^TABLE = %d <BYTES>	int	XXXXX <BYTES>
TABLE Object Format Description Part				
		OBJECT = TABLE		
	Format	INTERCHANGE_FORMAT = %s	char	ASCI I [STATIC]
	Number of lines of data	ROWS = %s	int	XXXXXXXX [STATIC]
	Number of columns of data	COLUMNS = %s	int	3 [STATIC]
	Byte count of data line	ROW_BYTES = %s	int	30 [STATIC]
Data format of the 1 row		OBJECT = COLUMN		
	Name	NAME = "%s"	char	"LONGITUDE" [STATIC]
	Type of the data	DATA_TYPE = %s	char	ASCII_REAL [STATIC]
	Starting byte of the data	START_BYTES = %s	int	1 [STATIC]
	Byte count of the data	BYTE = %s	int	9 [STATIC]
	Format	FORMAT = %s	char	"F9.5" [STATIC]

	Unit of the data	UNIT = "%s"	char	"DEGREE" [STATIC]
	Direction of positive longitude	POSITIVE_LONGITUDE_DIRECTION = “%s”	char	"EAST" [STATIC]
	Description	DESCRIPTION = "%s"	char	See the following example. [STATIC]
		END_OBJECT = COLUMN		
Data format of the 2 row		OBJECT = COLUMN		
	Name	NAME = "%s"	char	"LATITUDE" [STATIC]
	Type of the data	DATA_TYPE = %s	char	ASCII_REAL [STATIC]
	Starting byte of the data	START_BYTES = %s	int	10 [STATIC]
	Byte count of the data	BYTE = %s	int	11 [STATIC]
	Format	FORMAT = %s	char	"F11.5" [STATIC]
	Unit of the data	UNIT = "%s"	char	"DEGREE" [STATIC]
	Description	DESCRIPTION = "%s"	char	See the following example. [STATIC]
		END_OBJECT = COLUMN		
Data format of the 1 row		OBJECT = COLUMN		
	Name	NAME = "%s"	char	" ELEVATION " [STATIC]
	Type of the data	DATA_TYPE = %s	char	ASCII_REAL [STATIC]
	Starting byte of the data	START_BYTES = %s	int	22 [STATIC]
	Byte count of the data	BYTE = %s	int	9 [STATIC]
	Format	FORMAT = %s	char	"F9.3" [STATIC]
	Unit of the data	UNIT = "%s"	char	"KM" [STATIC]
	Description	DESCRIPTION = "%s"	char	See the following example. [STATIC]
		END_OBJECT = COLUMN		
		END_OBJECT = TABLE		
END statement				
		END		

<Example of Label : Global Grid Topographic Data of the Moon >

```
/* BASICS */
PDS_VERSION_ID                = PDS3
RECORD_TYPE                   = UNDEFINED
FILE_NAME                     = LALT_GGT_NUM.TAB
MISSION_NAME                  = SELENE
SPACECRAFT_NAME               = SELENE-M
INSTRUMENT_NAME               = "LALT"
PRODUCT_SET_ID                = LALT_GGT_NUM
PRODUCT_VERSION_ID            = 20091002
TARGET_NAME                   = MOON
COMMENT_TEXT                  = "LALT_GGT_NUM is a global grid topographic data set created from
                                the LALT_LGT_TS using 'surface' command in Generic Mapping Tool
                                (Wessel and Smith, 1991). Altitude values were rounded off to
                                the third decimal place. Data are ordered from +89.96875 to
                                -89.96875 degrees in latitude and from +0.03125 to +359.96875
                                degrees in longitude. They are referenced to the sphere of
                              1737.4km radius based on the gravity center of the Mean Earth/Polar Axis
                              body-fixed coordinates of the Moon. Grid resolution is 0.0625 (1/16) degree.
                                PI: Dr. Hiroshi ARAKI (arakih@miz.nao.ac.jp)."

^TABLE =    11179

/* TABLE */
OBJECT                        = TABLE

ROWS                          = 16588800
COLUMNS                       = 3
ROW_BYTES                     = 30
INTERCHANGE_FORMAT                = ASCII

  OBJECT                      = COLUMN
    NAME                          = "LONGITUDE"
    DATA_TYPE                     = ASCII_REAL
```

```
    START_BYTE                    = 1
    BYTES                         = 9
    FORMAT                        = "F9.5"
    UNIT                          = "DEGREE"
    POSITIVE_LONGITUDE_DIRECTION = "EAST"
    DESCRIPTION                   = "The longitude of the grid point
                                    in the Mean Earth/Polar Axis body-fixed coordinates."
  END_OBJECT                      = COLUMN

  OBJECT                          = COLUMN
    NAME                          = "LATITUDE"
    DATA_TYPE                     = ASCII_REAL
    START_BYTE                    = 10
    BYTES                         = 11
    FORMAT                        = "F11.5"
    UNIT                          = "DEGREE"
    DESCRIPTION                   = "The latitude of the grid point
                                    in the Mean Earth/Polar Axis body-fixed coordinates."
  END_OBJECT                      = COLUMN

  OBJECT                          = COLUMN
    NAME                          = "ELEVATION"
    DATA_TYPE                     = ASCII_REAL
    START_BYTE                    = 21
    BYTES                         = 9
    FORMAT                        = "F9.3"
    UNIT                          = "KM"
    DESCRIPTION                   = "The elevation of the grid point on the sphere
                                    whose radius is 1737.4 km referenced to the
                                    gravity center of the Mean Earth/Polar Axis
                                    body-fixed coordinates."
  END_OBJECT                      = COLUMN

END_OBJECT = TABLE

END
```

4.3 Data Object Format

The altitude data for the Moon was measured from the 1737.4 km sphere centered at the center of the mass of the Moon as the starting point for establishing the latitude and longitude.

- Format summary (ASCII)
  - ✓ Data range: Global. Longitude from +0.03125 degrees to +359.96875 degrees.
    Latitude from +89.96875 degrees to -89.96875 degrees.
  - ✓ POSITIVE LONGITUDE DIRECTION : EAST

Table 4-2 Data Object Format

Column	1	2	3	
Item	LONGITUDE	LATITUDE	ELEVATION	<LF>statement
Byte position	1	10	21	30
Byte count	9	11	9	1
Data type	ASCII_REAL	ASCII_REAL	ASCII_REAL	-
Format	F9.5	F11.5	F9.3	N/A
Unit	degree	degree	km	N/A
Substance	Moon's surface longitude *1	Moon's surface latitude *1	Altitude *2	<0x0A>

*1 : Mean Earth/Polar Axis body-fixed coordinates
*2 : The elevation of the grid point on a reference sphere whose radius and center is 1737.4 km based on the gravity center in the Mean Earth/Polar Axis body-fixed coordinates.

4.4 Catalog Information File Format

The Catalog Information File Format is shown in Table 4-3.

Table 4-3 Catalog Information File Format

Item Name	Elements	Format of Value	Range of Value	Values
Name of the data file (*1)	DataFileName	AAAA….AAAA (Up to 31 digits)	alphanumeric characters	dependent on the product (See Section 4.1 "Rules used for File naming".)
Size of the data file	DataFileSize	NNNNNNNNNNNN (Up to 12 digits)	unit:<byte>	dependent on the product
File format of the data file	DataFileFormat	AAAA….AAAA (Up to 16 digits)	character strings	PDS [STATIC]
Name of the thumbnail file	ThumbnailFileName	AAAA….AAAA (Up to 31 digits)	alphanumeric characters	dependent on the product (See Section 4.1 "Rules used for File naming".)
Size of the thumbnail file	ThumbnailFileSize	NNNNNNNNNNNN (Up to 12 digits)	unit:<byte>	dependent on the product
File format of the thumbnail file	ThumbnailFileFormat	AAAA (Up to 4 digits)	JPEG Format	JPEG [STATIC]
Name of the instrument	InstrumentName	AAAA….AAAA (Up to 16 digits)	character strings	LALT [STATIC]
Processing level	ProcessingLevel	AAAA….AAAA (Up to 16 digits)	character strings	dependent on the product (See Table 1-2 "Level".)
Product ID	ProductID	AAAA….AAAA (Up to 30 digits)	character strings	dependent on the product (See Table 1-2 "Product_ID".)
Version number of the product	ProductVersion	AAAA….AAAA (Up to 16 digits)	character strings	X
Access level	AccessLevel	N	values of 0-4	N/A
Start time	StartDateTime	yyyy- mmddT hh: mm: ss.sssZ	DATE & TIME	dependent on the product
Stop time	EndDateTime	yyyy- mmddT hh: mm: ss.sssZ	DATE & TIME	dependent on the product
Comment information	CommentInfo	AAAA….AAAA (Up to 4000 digits)	character strings	dependent on the product

(*1) "DataFileName" is the stored file name of the product. For the detached format, this is the stored file name.

<Example of Catalog Information>

DataFileName = LALT_GGT_NUM.TAB
DataFileSize = 497675247
DataFileFormat = PDS3
ThumbnailFileName = LALT_GGT_NUM.jpg
ThumbnailFileSize = 11598
ThumbnailFileFormat = JPEG
InstrumentName = LALT
ProcessingLevel = Higher Level
ProductID = LALT_GGT_NUM
ProductVersion = 1.0
AccessLevel = 4
StartDateTime = 2007-12-30T17:19:20.245Z
EndDateTime = 2008-10-27T09:39:31.161Z
CommentInfo = LALT_GGT_NUM.lonlatalt processed by Y. ISHIHARA (ishihara@miz.nao.ac.jp).

5. Global Topographic MAP of the Moon (Product ID: LALT_GGT_MAP)

5.1 Rules used for File naming

The nomenclature used for Label, Data Object and Catalog Information File the product files are described below. In addition, the file name is case-independent.

LALT_GGT_MAP.ext

- LALT_GGT_MAP : Product (STATIC)
- ext : File Extension
  - ✓ IMG : Label and Data Object File
  - ✓ jpg : Thumbnail JPEG Image File
  - ✓ ctg : Catalog Information File

<Example of Name >
LALT_GGT_MAP.IMG

5.2 Label Format

The Label Format for the IMAGE object used for the Global Topographic MAP of the Moon product is shown in Table 5-1. The Label for the IMAGE object includes: Standard Item, Image Data Object Format Description Part and IMAGE_MAP_PROJECTION Object Description Part.

Table 5-1 Label Format

No	Items	Elements	Types	Values
Standard Item (/* BASIC */)				
1	PDS version number	PDS_VERSION_ID = %s	char	PDS3 [STATIC]
2	Record format of the file	RECORD_TYPE = %s	char	UNDEFINED [STATIC]
3	File name	FILE_NAME = %s	char	See Section 5.1 “Rules used for File naming”.
4	Name of the mission	MISSION_NAME = %s	char	SELENE [STATIC]
5	Name of the spacecraft	SPACECRAFT_NAME = %s	char	SELENE-M [STATIC]
6	Name of the instrument	INSTRUMENT_NAME = %s	char	LALT [STATIC]
7	Product ID	PRODUCT_SET_ID = %s	char	See Table 1-2 “Product_ID”.
8	Product version number	PRODUCT_VERSION_ID = %s	char	yyyymmdd
9	Target name	TARGET_NAME = %s	char	MOON [STATIC]
10	Comment	COMMENT_TEXT = "%s"	char	See the following example.[STATIC]
11	Starting position of the image object	^IMAGE = %d <BYTES>	int	XXXX<BYTES>
Image Data Object Format Description Part(/* IMAGE */)				
		OBJECT = IMAGE		
1	Band storage type	BAND_STORAGE_TYPE = %s	char	BAND_SEQUENTIAL [STATIC] *Refer to the PDS Standard Reference V3.5 Appendix A.19 “IMAGE”.
2	Number of bands	BANDS = %d	smallint	1 [STATIC]
3	Compression class and encoding type	ENCODING_TYPE = %s	char	N/A [STATIC]
4	Alternative value outside assumption	INVALID_CONSTANT = %s	int	0 [STATIC]

5	Horizontal pixel count of image	LINE_SAMPLES = %d	int	5760 [STATIC]
6	Vertical pixel count of image	LINES = %d	int	2880 [STATIC]
7	Dummy data	DUMMY_DATA = %f	float	xx.xxx
8	Offset	OFFSET = %f	float	0.0000 [STATIC]
9	Pixel bit length	SAMPLE_BITS = %d	int	32 [STATIC]
10	Scaling factor	SCALING_FACTOR = %d	int	1 [STATIC]
11	Pixel type	SAMPLE_TYPE = %s	char	4BYTE_FLOAT [STATIC]
12	Unit of the data	UNIT = %s	char	km
13	Stretched Flag	STRETCHED_FLAG = %s	char	FALSE [STATIC]
		END_OBJECT = IMAGE		
IMAGE_MAP_PROJECTION Object Description Part(/* IMAGE_MAP_PROJECTION */)				
		OBJECT = IMAGE_MAP_PROJECTION		
1	Semi-major axis of the ellipsoidal body	A_AXIS_RADIUS = %f<KM>	float	1737.400<km> [STATIC]
2	medial axis of ellipsoidal body	B_AXIS_RADIUS = %f<KM>	float	1737.400<km> [STATIC]
3	Semi-minor axis of ellipsoidal body	C_AXIS_RADIUS = %f<KM>	float	1737.400<km> [STATIC]
4	Name of coordinate system	COORDINATE_SYSTEM_NAME = "%s"	char	"PLANETOCENTRIC " [STATIC]
5	Type of coordinate system	COORDINATE_SYSTEM_TYPE = "%s"	char	"BODY-FIXED ROTATING" [STATIC]
6	Easternmost longitude	EASTERNMOST_LONGITUDE = %f	float	+359.96875 [STATIC]
7	Westernmost longitude	WESTERNMOST_LONGITUDE = %f	float	+0.03125 [STATIC]
8	Maximum latitude	MAXIMUM_LATITUDE = %f	float	+89.96875 [STATIC]
9	Minimum latitude	MINIMUM_LATITUDE = %f	float	-89.96875 [STATIC]
10	Map projection type	MAP_PROJECTION_TYPE = "%s"	char	MERCATO R [STATIC]
11	Resolution	MAP_RESOLUTION = %d<PIXEL/DEGREE>	int	16 <PIXEL/DEGREE>
		END_OBJECT = IMAGE_MAP_PROJECTION		
END statement				
		END		

<Example of Label : Global Topographic MAP of the Moon >

```
/* BASICS */
PDS_VERSION_ID                = PDS3
RECORD_TYPE                   = UNDEFINED
FILE_NAME                     = LALT_GGT_MAP.IMG
MISSION_NAME                  = SELENE
SPACECRAFT_NAME               = SELENE-M
INSTRUMENT_NAME               = "LALT"
PRODUCT_SET_ID                = LALT_GGT_MAP
PRODUCT_VERSION_ID            = 20091002
TARGET_NAME                   = MOON
COMMENT_TEXT                  = "LALT GGT_MAP is a lunar global topographic MAP data extracted
                                from LALT_GGT_NUM that is created from the LALT_LGT_TS created
                                by 'surface' command in Generic Mapping Tool (Wessel and Smith, 1991).
                                Altitude values were rounded off to the third decimal place.
                                Data are ordered from +89.96875 to -89.96875 degrees in latitude
                                and from +0.03125 to +359.96875 degrees in longitude. They are
                                referenced to the sphere of 1737.4km radius based on the gravity
                                center of the Mean Earth/Polar Axis body-fixed coordinates of the Moon.
Grid resolution is 0.0625 (1/16) degree.
                                PI: Dr. Hiroshi ARAKI (arakih@miz.nao.ac.jp)."

^IMAGE = 9618 <BYTES>

/* IMAGE */
OBJECT                        = IMAGE

  BAND_STORAGE_TYPE           = BAND_SEQUENTIAL
```

```
  BANDS                          = 1
  ENCODING_TYPE                    = N/A
  INVALID_CONSTANT                 = 0
  LINE_SAMPLES                   = 5760
  LINES                        = 2880
  DUMMY_DATA                       = 99.999
  OFFSET                         = 0.0000
  SAMPLE_BITS                    = 32
  SCALING_FACTOR                   = 1
  SAMPLE_TYPE                    = 4BYTE_FLOAT
  UNIT                         = KM
  STRETCHED_FLAG                   = FALSE

END_OBJECT                       = IMAGE

/* IMAGE_MAP_PROJECTION */
OBJECT                         = IMAGE_MAP_PROJECTION

  A_AXIS_RADIUS                  = 1737.400<km>
  B_AXIS_RADIUS                  = 1737.400<km>
  C_AXIS_RADIUS                  = 1737.400<km>
  COORDINATE_SYSTEM_NAME           = PLANETOCENTRIC
  COORDINATE_SYSTEM_TYPE         = BODY-FIXED ROTATING
  EASTERNMOST_LONGITUDE            = +359.96875
  WESTERNMOST_LONGITUDE            =    +0.03125
  MAXIMUM_LATITUDE               =   +89.96875
  MINIMUM_LATITUDE               =   -89.96875
  MAP_PROJECTION_TYPE              = MERCATOR
  MAP_RESOLUTION                 = 16 <PIXEL/DEGREE>

END_OBJECT                       = IMAGE_MAP_PROJECTION

END
```

5.3 Data Object Format

The altitude data for the Moon was measured from the 1737.4 km sphere centered at the center of the mass of the Moon as the starting point for establishing the latitude and longitude.

The format summary is shown below.

- ✓ BAND_SEQUENTIAL
- ✓ 5760 columns per one line. 2880 lines.
- ✓ Optical resolution Δ = 1/16 degrees (0.0625 degrees).
- ✓ See Figure 3-2 for a summary of the rows and columns.
- ✓ See Figure 3-3 for a summary of the data units and a description of the columns.
- ✓ Data unit is float type (4 bytes used for the actual number)
- ✓ Unit of measure: km.

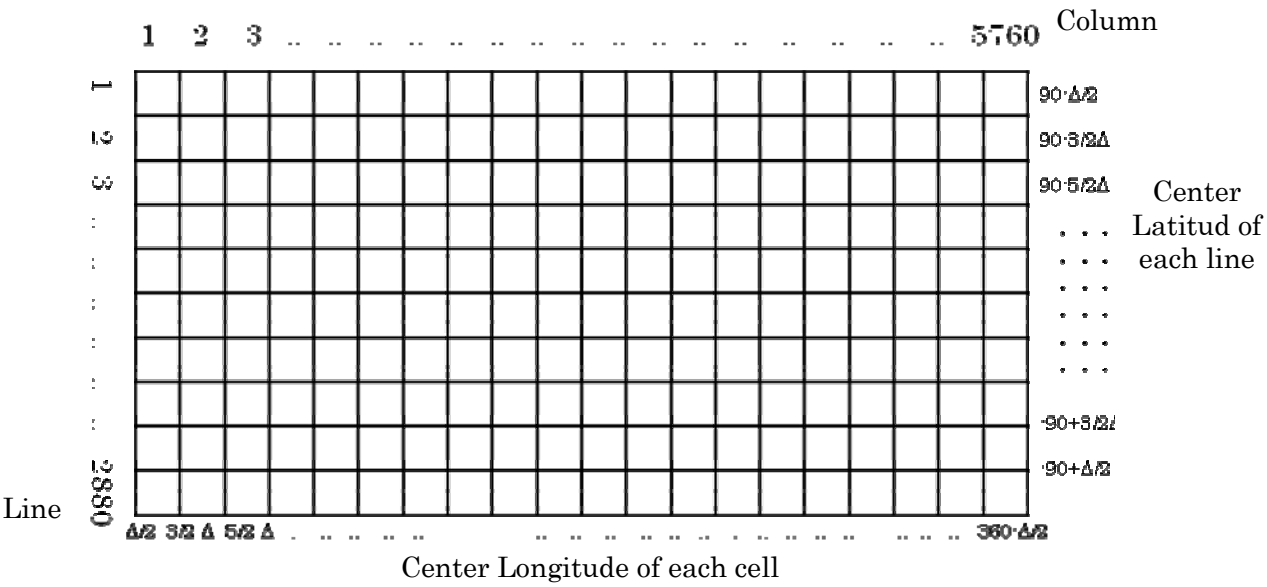

Figure 5-1 Relationship and data format between the Center Latitude of each line and the Center Longitude of each cell, Δ=1/16 (degree)

	Byte Position			Column	Description	Data Type
Line 1	0	-	3	1	Altitude	float×1
	4	-	7	2	Altitude	float×1
	8	-	11	3	Altitude	float×1
				.....		
	23036	-	23039	5760	Altitude	float×1
Line 2	23040	-	23043	1	Altitude	float×1
				.....		
	46076	-	46079	5760	Altitude	float×1
.....				.....		
				.....		
Line 2880	66332160	-	66332163	1	Altitude	float×1
				.....		
	66355196	-	66355199	5760	Altitude	float×1

Figure 5-2 Format of Map data object

5.4 Catalog Information File Format

The Catalog Information File Format is shown in Table 5-2.

Table 5-2 Catalog Information File Format

Item Name	Elements	Format of Value	Range of Value	Values
Name of the data file (*1)	DataFileName	AAAA….AAAA (Up to 31 digits)	alphanumeric characters	dependent on the product (See Section 5.1 “Rules used for File naming”.)
Size of the data file	DataFileSize	NNNNNNNNNNN (Up to 12 digits)	unit:<byte>	dependent on the product
File format of the data file	DataFileFormat	AAAA….AAAA (Up to 16 digits)	character strings	PDS3 [STATIC]
Name of the thumbnail file	ThumbnailFileName	AAAA….AAAA (Up to 31 digits)	alphanumeric characters	dependent on the product (See Section 5.1 “Rules used for File naming”.)
Size of the thumbnail file	ThumbnailFileSize	NNNNNNNNNNN (Up to 12 digits)	unit:<byte>	dependent on the product
File format of the thumbnail file	ThumbnailFileFormat	AAAA (Up to 4 digits)	JPEG Format	JPEG [STATIC]
Name of the instrument	InstrumentName	AAAA….AAAA (Up to 16 digits)	character strings	LALT [STATIC]
Processing level	ProcessingLevel	AAAA….AAAA (Up to 16 digits)	character strings	dependent on the product (See Table 1-2 “Level”.)
Product ID	ProductID	AAAA….AAAA (Up to 30 digits)	character strings	dependent on the product (See Table 1-2 “Product_ID”.)

Version number of the product	ProductVersion	AAAA….AAAA (Up to 16 digits)	character strings	X
Access level	AccessLevel	N	values of 0-4	N/A
Start time	StartDateTime	yyyy- mmddT hh: mm: ss.sssZ	DATE & TIME	dependent on the product
Stop time	EndDateTime	yyyy- mmddT hh: mm: ss.sssZ	DATE & TIME	dependent on the product
Upper left latitude of the scene	UpperLeftLatitude	SNN.NNNNNN	-90-90	90.0 [STATIC]
Upper left longitude of the scene	UpperLeftLongitude	NNN.NNNNNN	0-360	0.0 [STATIC]
Upper right latitude of the scene	UpperRightLatitude	SNN.NNNNNN	-90-90	90.0 [STATIC]
Upper right longitude of the scene	UpperRightLongitude	NNN.NNNNNN	0-360	360.0 [STATIC]
Lower left latitude of the scene	LowerLeftLatitude	SNN.NNNNNN	-90-90	-90.0 [STATIC]
Lower left longitude of the scene	LowerLeftLongitude	NNN.NNNNNN	0-360	0.0 [STATIC]
Lower right latitude of the scene	LowerRightLatitude	SNN.NNNNNN	-90-90	-90.0 [STATIC]
Lower right longitude of the scene	LowerRightLongitude	NNN.NNNNNN	0-360	360.0 [STATIC]
Comment information	CommentInfo	AAAA….AAAA (Up to 4000 digits)	character strings	dependent on the product

(*1) "DataFileName" is the stored file name of the product. For the detached format, this is the stored file name.

<Example of Catalog Information>

DataFileName = LALT_GGT_MAP.IMG
DataFileSize = 66364817
DataFileFormat = PDS3
ThumbnailFileName = LALT_GGT_MAP.jpg
ThumbnailFileSize = 11918
ThumbnailFileFormat = JPEG
InstrumentName = LALT
ProcessingLevel = Higher Level
ProductID = LALT_GGT_MAP
ProductVersion = 1.0
AccessLevel = 4
StartDateTime = 2007-12-30T17:19:20.245Z
EndDateTime = 2008-10-27T09:39:31.161Z
CommentInfo = LALT_GGT_MAP.IMG processed by Y. ISHIHARA (ishihara@miz.nao.ac.jp) & H. ARAKI (arakih@miz.nao.ac.jp)..

6. Grid Topographic Data of the Lunar North Pole (Product ID:LALT_GT_NP_NUM)

6.1 Rules used for File naming

The nomenclature used for Label, Data Object and Catalog Information File the product files are described below. In addition, the file name is case-independent.

LALT_GT_NP_NUM.ext

- LALT_GT_NP_NUM : Product (STATIC)
- ext : File Extension
  - ✓ TAB : Label and Data Object File
  - ✓ jpg : Thumbnail JPEG Image File
  - ✓ ctg : Catalog Information File

<Example of Name >
LALT_GT_NP_NUM.TAB

6.2 Label Format

The Label Format for the TABLE object used for the Grid Topographic Data of the Lunar North Pole product is shown in Table 6-1.

Table 6-1 Label Format

No	Items	Elements	Types	Values
Standard Item (/* BASIC */)				
1	PDS version number	PDS_VERSION_ID = %s	char	PDS3 [STATIC]
2	Record format of the file	RECORD_TYPE = %s	char	UNDEFINED [STATIC]
3	File name	FILE_NAME = %s	char	See Section 6.1 “Rules used for File naming”.
4	Name of the mission	MISSION_NAME = %s	char	SELENE [STATIC]
5	Name of the spacecraft	SPACECRAFT_NAME = %s	char	SELENE-M [STATIC]
6	Name of the instrument	INSTRUMENT_NAME = %s	char	"LALT" [STATIC]
7	Product ID	PRODUCT_SET_ID = %s	char	See Table 1-2 “Product_ID”.
8	Version number of the product	PRODUCT_VERSION_ID = %s	char	yyyymmdd
9	Target name	TARGET_NAME = %s	char	MOON [STATIC]
10	Comment	COMMENT_TEXT = "%s"	char	See the following example.[STATIC]
11	Starting position of the TABLE object	^TABLE = %d <BYTES>	int	XXXXX <BYTES>
TABLE Object Format Description Part				
		OBJECT = TABLE		
	Format	INTERCHANGE_FORMAT = %s	char	ASCI I [STATIC]
	Number of lines of data	ROWS = %s	int	XXXXXXXX [STATIC]
	Number of columns of data	COLUMNS = %s	int	3 [STATIC]
	Byte count of data line	ROW_BYTES = %s	int	31 [STATIC]
COLUMN Object Description Part (3 column)				
		OBJECT = COLUMN		
1	Name	NAME = "%s"	char	See the following example. [STATIC]

2	Type of the data	DATA_TYPE = %s	char	See the following example. [STATIC]
3	Starting byte of the data	START_BYTES = %s	int	See the following example. [STATIC]
4	Byte count of the data	BYTE = %s	int	See the following example. [STATIC]
5	Format	FORMAT = %s	char	See the following example. [STATIC]
6	Unit of the data	UNIT = "%s"	char	See the following example. [STATIC]
7	Direction of positive longitude	POSITIVE_LONGITUDE_DIRECTION = %s	char	"EAST" [STATIC] *Only the first column
8	Description	DESCRIPTION = "%s"	char	See the following example. [STATIC]
		END_OBJECT = COLUMN		
	END_OBJECT = TABLE			
END statement				
		END		

<Example of Label : Grid Topographic Data of the Lunar North Pole >

```
/* BASICS */
PDS_VERSION_ID                = PDS3
RECORD_TYPE                   = UNDEFINED
FILE_NAME                     = LALT_GT_NP_NUM.TAB
MISSION_NAME                  = SELENE
SPACECRAFT_NAME               = SELENE-M
INSTRUMENT_NAME               = "LALT"
PRODUCT_SET_ID                = LALT_GT_NP_NUM
PRODUCT_VERSION_ID            = 20091002
TARGET_NAME                   = MOON
COMMENT_TEXT                  = "LALT_GT_NP_NUM is a grid topographic data set around the lunar
                                north pole derived from the LALT_LGT_TS using the 'nearneighbor'
                                command in the Generic Mapping Tool (Wessel and Smith, 1991).
                                Altitude values were rounded off to the third decimal place.
                                Data are ordered from +89.99609375 to +80.00390625 degrees in
                                latitude and from +0.015625 to +359.984375 degrees in longitude.
                                They are referenced to the sphere of 1737.4 km radius based on
                                the gravity center of the Moon. Grid resolution along latitude
                                is 0.0078125 (1/128) degree and for longitude is 0.03125 (1/32)
                                degree. 99.999 on the elevation column is a dummy datum.
                                PI: Dr. Hiroshi ARAKI (arakih@miz.nao.ac.jp)."

^TABLE =    11503

/* TABLE */
OBJECT                        = TABLE

ROWS                          = 14745600
COLUMNS                       = 3
ROW_BYTES                     = 31
INTERCHANGE_FORMAT                = ASCII

  OBJECT                      = COLUMN
    NAME                          = "LONGITUDE"
    DATA_TYPE                     = ASCII_REAL
    START_BYTE                    = 1
    BYTES                         = 10
    FORMAT                        = "F10.6"
    UNIT                          = "DEGREE"
    POSITIVE_LONGITUDE_DIRECTION = "EAST"
    DESCRIPTION                       = "The longitude of the grid point
                                      on the Mean Earth/Polar Axis body-fixed coordinates."
  END_OBJECT                  = COLUMN

  OBJECT                      = COLUMN
    NAME                          = "LATITUDE"
    DATA_TYPE                     = ASCII_REAL
    START_BYTE                    = 11
```

```
    BYTES                       = 13
    FORMAT                      = "F13.8"
    UNIT                        = "DEGREE"
    DESCRIPTION                 = "The latitude of the grid point
                                  on the Mean Earth/Polar Axis body-fixed coordinates."
  END_OBJECT                    = COLUMN

  OBJECT                        = COLUMN
    NAME                        = "ELEVATION"
    DATA_TYPE                   = ASCII_REAL
    START_BYTE                  = 24
    BYTES                       = 7
    FORMAT                      = "F7.3"
    UNIT                        = "KM"
    DESCRIPTION                 = "The elevation of the grid point on the sphere
                                  whose radius is 1737.4 km referenced to the gravity center
                                  of the Mean Earth/Polar Axis body-fixed coordinates.
                                  99.999 is a dummy datum."
  END_OBJECT                    = COLUMN

END_OBJECT = TABLE

END
```

6.3 Data Object Format

The Grid Topographic Data of the Lunar North Pole is the altitude data for the Moon north of 80 degree N Latitude based on the 1737.4 km phere centered at the center of the mass of the Moon as the starting point.

The resolution of latitude direction is 1/128 degrees and the resolution of longitude direction is 1/32 degrees.

- Format summary (ASCII)
  - ✓ Data range: Moon's surface latitude = +89.99609375° - +80.00390625°
    Moon's surface longitude = +0.015625° - +359.984375°
  - ✓ POSITIVE LONGITUDE DIRECTION : EAST

Table 6-2 Data Object Format

Column	1	2	3	
Item	LONGITUDE	LATITUDE	ELEVATION	<LF>statement
Byte position	1	11	24	31
Byte count	10	13	7	1
Data type	ASCII_REAL	ASCII_REAL	ASCII_REAL	-
Format	F10.6	F13.8	F7.3	N/A
Unit	degree	degree	km	N/A
Substance	Moon's surface longitude *1	Moon's surface latitude *1	Altitude *2	<0x0A>

*1 : Mean Earth/Polar Axis body-fixed coordinates
*2 : The elevation of the grid point on a reference sphere whose radius and center is 1737.4 km based on the gravity center in the Mean Earth/Polar Axis body-fixed coordinates.

6.4 Catalog Information File Format

The Catalog Information File Format is shown in Table 6-3.

Table 6-3 Catalog Information File Format

Item Name	Elements	Format of Value	Range of Value	Values
Name of the data file (*1)	DataFileName	AAAA….AAAA (Up to 31 digits)	alphanumeric characters	dependent on the product (See Section 6.1 "Rules used for File naming".)
Size of the data file	DataFileSize	NNNNNNNNNNNN (Up to 12 digits)	unit:<byte>	dependent on the product
File format of the data file	DataFileFormat	AAAA….AAAA (Up to 16 digits)	character strings	PDS [STATIC]
Name of the thumbnail file	ThumbnailFileName	AAAA….AAAA (Up to 31 digits)	alphanumeric characters	dependent on the product (See Section 6.1 "Rules used for File naming".)
Size of the thumbnail file	ThumbnailFileSize	NNNNNNNNNNNN (Up to 12 digits)	unit:<byte>	dependent on the product
File format of the thumbnail file	ThumbnailFileFormat	AAAA (Up to 4 digits)	JPEG Format	JPEG [STATIC]
Name of the instrument	InstrumentName	AAAA….AAAA (Up to 16 digits)	character strings	LALT [STATIC]
Processing level	ProcessingLevel	AAAA….AAAA (Up to 16 digits)	character strings	dependent on the product (See Table 1-2 "Level".)
Product ID	ProductID	AAAA….AAAA (Up to 30 digits)	character strings	dependent on the product (See Table 1-2 "Product_ID".)
Version number of the product	ProductVersion	AAAA….AAAA (Up to 16 digits)	character strings	X
Access level	AccessLevel	N	values of 0-4	N/A
Start time	StartDateTime	yyyy- mmddT hh: mm: ss.sssZ	DATE & TIME	dependent on the product
Stop time	EndDateTime	yyyy- mmddT hh: mm: ss.sssZ	DATE & TIME	dependent on the product
Comment information	CommentInfo	AAAA….AAAA (Up to 4000 digits)	character strings	dependent on the product

(*1) "DataFileName" is the stored file name of the product. For the detached format, this is the stored file name.

<Example of Catalog Information>

DataFileName = LALT_GT_NP_NUM.TAB
DataFileSize = 457125173
DataFileFormat = PDS3
ThumbnailFileName = LALT_GT_NP_NUM.jpg
ThumbnailFileSize = 11809
ThumbnailFileFormat = JPEG
InstrumentName = LALT
ProcessingLevel = Higher Level
ProductID = LALT_GT_NP_NUM
ProductVersion = 1.0
AccessLevel = 4
StartDateTime = 2007-12-30T17:19:20.245Z
EndDateTime = 2008-10-27T09:39:31.161Z
CommentInfo = LALT_GT_NP_NUM.TAB processed by Y. ISHIHARA (ishihara@miz.nao.ac.jp).

7. Topographic Image of the Lunar North Pole (Product ID: LALT_GT_NP_IMG)

7.1 Rules used for File naming

The nomenclature used for Label, Data Object and Catalog Information File the product files are described below. In addition, the file name is case-independent.

LALT_GT_NP_IMG.ext

- LALT_GT_NP_IMG : Product (STATIC)
- ext : File Extension
  - ✓ IMG : Label and Data Object File
  - ✓ jpg : Thumbnail JPEG Image File
  - ✓ ctg : Catalog Information File

<Example of Name >

LALT_GT_NP_IMG.IMG

7.2 Label Format

The Label Format for the IMAGE object used for the Topographic Image of the Lunar North Pole product is shown in Table 7-1. The Label for the IMAGE object includes: Standard Item, Image Data Object Format Description Part and IMAGE_MAP_PROJECTION Object Description Part.

Table 7-1 Label Format

No	Items	Elements	Types	Values
Standard Item (/* BASIC */)				
1	PDS version number	PDS_VERSION_ID = %s	char	PDS3 [STATIC]
2	Record format of the file	RECORD_TYPE = %s	char	UNDEFINED [STATIC]
3	File name	FILE_NAME = %s	char	See Section 7.1 "Rules used for File naming".
4	Name of the mission	MISSION_NAME = %s	char	SELENE [STATIC]
5	Name of the spacecraft	SPACECRAFT_NAME = %s	char	SELENE-M [STATIC]
6	Name of the instrument	INSTRUMENT_NAME = %s	char	LALT [STATIC]
7	Product ID	PRODUCT_SET_ID = %s	char	See Table 1-2 "Product_ID".
8	Product version number	PRODUCT_VERSION_ID = %s	char	yyyymmdd
9	Target name	TARGET_NAME = %s	char	MOON [STATIC]
10	Comment	COMMENT_TEXT = "%s"	char	See the following example.[STATIC]
11	Starting position of the image object	^IMAGE = %d <BYTES>	int	XXXX <BYTES>
Image Data Object Format Description Part(/* IMAGE */)				
		OBJECT = IMAGE		
1	Band storage type	BAND_STORAGE_TYPE = %s	char	BAND_SEQUENTIAL [STATIC] *Refer to the PDS Standard Reference V3.5 Appendix A.19 "IMAGE".
2	Number of bands	BANDS = %d	smallint	1 [STATIC]
3	Compression class and encoding type	ENCODING_TYPE = %s	char	N/A [STATIC]
4	Alternative value outside assumption	INVALID_CONSTANT = %s	int	0 [STATIC]

5	Horizontal pixel count of image	LINE_SAMPLES = %d	int	11520 [STATIC]
6	Vertical pixel count of image	LINES = %d	int	1280 [STATIC]
7	Dummy data	DUMMY_DATA = %f	float	xx.xxx
8	Offset	OFFSET = %f	float	0.0000 [STATIC]
9	Pixel bit length	SAMPLE_BITS = %d	int	32 [STATIC]
10	Scaling factor	SCALING_FACTOR = %d	int	1 [STATIC]
11	Pixel type	SAMPLE_TYPE = %s	char	4BYTE_FLOAT [STATIC]
12	Stretched Flag	STRETCHED_FLAG = %s	char	FALSE [STATIC]
		END_OBJECT = IMAGE		
IMAGE_MAP_PROJECTION Object Description Part(/* IMAGE_MAP_PROJECTION */)				
		OBJECT = IMAGE_MAP_PROJECTION		
1	Semi-major axis of the ellipsoidal body	A_AXIS_RADIUS = %f<KM>	float	1737.400<km> [STATIC]
2	medial axis of ellipsoidal body	B_AXIS_RADIUS = %f<KM>	float	1737.400<km> [STATIC]
3	Semi-minor axis of ellipsoidal body	C_AXIS_RADIUS = %f<KM>	float	1737.400<km> [STATIC]
4	Name of coordinate system	COORDINATE_SYSTEM_NAME = "%s"	char	"PLANETOCENTRIC " [STATIC]
5	Type of coordinate system	COORDINATE_SYSTEM_TYPE = "%s"	char	"BODY-FIXED ROTATING" [STATIC]
6	Easternmost longitude	EASTERNMOST_LONGITUDE = %s	float	+359.984375 [STATIC]
7	Westernmost longitude	WESTERNMOST_LONGITUDE = %s	float	+0.015625 [STATIC]
8	Resolution (Longitude)	MAP_RESOLUTION_LONGITUDE = %d	int	32 <PIXEL/DEGREE>
9	Maximum latitude	MAXIMUM_LATITUDE = %f	float	+89.99609375 [STATIC]
10	Minimum latitude	MINIMUM_LATITUDE = %f	float	+80.00390625 [STATIC]
11	Resolution (Latitude)	MAP_RESOLUTION_LATITUDE = %d	int	128 <PIXEL/DEGREE>
12	Map projection type	MAP_PROJECTION_TYPE = "%s"	char	POLAR STEREOGRAPHIC [STATIC]
		END_OBJECT = IMAGE_MAP_PROJECTION		
END statement				
		END		

<Example of Label : Topographic Image of the Lunar North Pole >

```
/* BASICS */
PDS_VERSION_ID                = PDS3
RECORD_TYPE                    = UNDEFINED
FILE_NAME                     = LALT_GT_NP_IMG.IMG
MISSION_NAME                   = SELENE
SPACECRAFT_NAME                  = SELENE-M
INSTRUMENT_NAME                  = "LALT"
PRODUCT_SET_ID                 = LALT_GT_NP_IMG
PRODUCT_VERSION_ID               = 20091002
TARGET_NAME                    = MOON
COMMENT_TEXT                     = "LALT_GT_NP_IMG is a grid topographic data set around the lunar
                                  north pole extracted from LALT_GT_NP_NUM that is created by
                                  'nearneighbor' command in the Generic Mapping Tool (Wessel and Smith,
                                  1991).
                                  Altitude values were rounded off to the third decimal place. Data
                                  are ordered from 89.99609375 to 80.00390625 degrees in latitude
                                  and from 0.015625 to 359.984375 degrees in longitude. They are
                                  referenced to the sphere of 1737.4 km radius based on the gravity
                                  center of the Moon. Grid resolution along latitude is 0.0078125
                                  (1/128) degree and for longitude is 0.03125 (1/32) degree. 99.999
                                  on the elevation column is a dummy datum.
                                  PI: Dr. Hiroshi ARAKI (arakih@miz.nao.ac.jp)."

^IMAGE =    9944

/* IMAGE */
OBJECT                        = IMAGE

  BAND_STORAGE_TYPE                = BAND_SEQUENTIAL
  BANDS                         = 1
  ENCODING_TYPE                    = N/A
```

```
   INVALID_CONSTANT                = 0
   LINE_SAMPLES                    = 11520
   LINES                           = 1280
   DUMMY_DATA                      = 99.999
   OFFSET                          = 0.0000
   SAMPLE_BITS                     = 32
   SCALING_FACTOR                  = 1
   SAMPLE_TYPE                     = 4BYTE_FLOAT
   STRETCHED_FLAG                  = FALSE

/* IMAGE_MAP_PROJECTION */
OBJECT                             = IMAGE_MAP_PROJECTION

   A_AXIS_RADIUS                   = 1737.400<km>
   B_AXIS_RADIUS                   = 1737.400<km>
   C_AXIS_RADIUS                   = 1737.400<km>
   COORDINATE_SYSTEM_NAME          = PLANETOCENTRIC
   COORDINATE_SYSTEM_TYPE          = BODY-FIXED ROTATING
   EASTERNMOST_LONGITUDE           = +359.984375
   WESTERNMOST_LONGITUDE           = +0.015625
   MAP_RESOLUTION_LONGITUDE        = 32 <PIXEL/DEGREE>
   MAXIMUM_LATITUDE                = +89.99609375
   MINIMUM_LATITUDE                = +80.00390625
   MAP_RESOLUTION_LATITUDE         = 128 <PIXEL/DEGREE>
   MAP_PROJECTION_TYPE             = POLAR STEREOGRAPHIC

END_OBJECT                         = IMAGE_MAP_PROJECTION

END_OBJECT                         = IMAGE

END
```

7.3 Data Object Format

Topographic Image of the Lunar North Pole based on the 1737.4 km sphere centered at the center of the mass of the Moon as the starting point. The format summary is shown below.

- ✓ BAND_SEQUENTIAL
- ✓ 11520 columns per one line. 1280 lines.
- ✓ Optical resolution of the longitude direction Δ_1 = 1/32 degrees (0.03125 degrees).
- ✓ Optical resolution of the latitude direction Δ_2 = 1/128 degrees (0.0078125 degrees).
- ✓ See Figure 3-5 for a summary of the rows and columns.
- ✓ See Figure 3-6 for a summary of the data units and a description of the columns.
- ✓ The data unit is float type (4 bytes used for the actual number)
- ✓ Unit of measure: km.

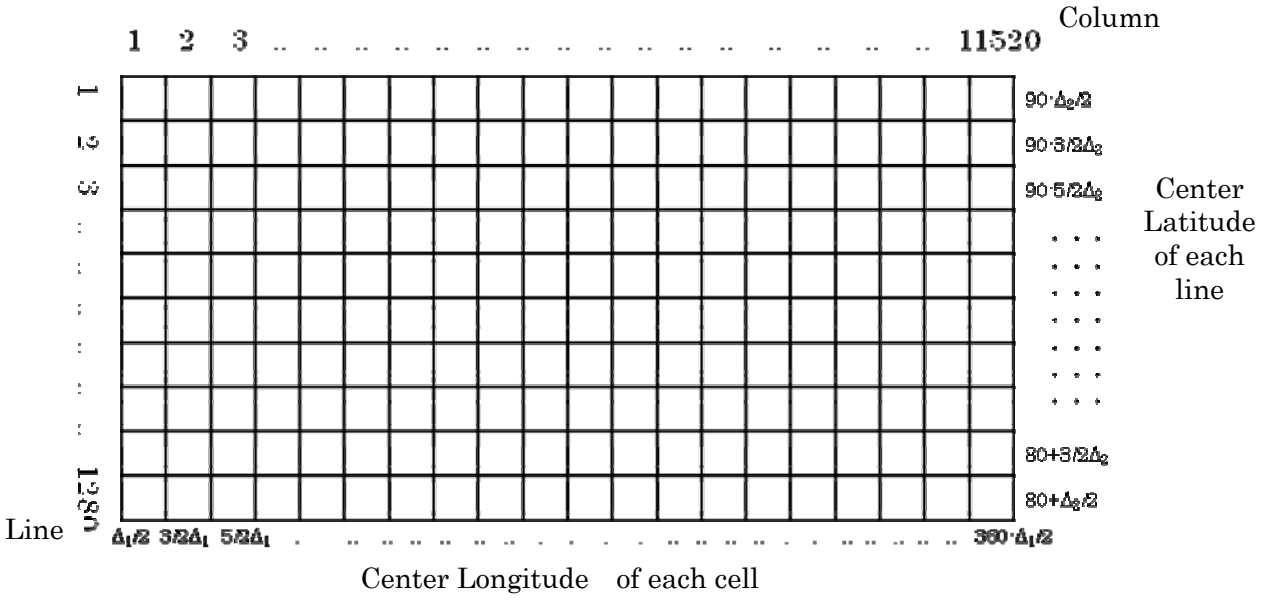

Figure 7-1 Relationship and data format between the Center Latitude of each line and the Center Longitude of each cell. Optical resolution of the longitude direction Δ_1 = 1/32 degrees. Optical resolution of latitude direction Δ_2 = 1/128 degrees.

	Byte Position			Column	Description	Data Type
Line 1	0	-	3	1	Altitude	float×1
	4	-	7	2	Altitude	float×1
	8	-	11	3	Altitude	float×1
				.....		
	46076	-	46079	11520	Altitude	float×1
Line 2	46080	-	46083	1	Altitude	float×1
				.....		
	92156	-	92159	11520	Altitude	float×1
.....				.....		
				.....		
Line 1280	58936320	-	58936323	1	Altitude	float×1
				.....		
	58989396	-	58989399	11520	Altitude	float×1

Figure 7-2 Format of data object

7.4 Catalog Information File Format

The Catalog Information File Format is shown in Table 7-2.

Table 7-2 Catalog Information File Format

Item Name	Elements	Format of Value	Range of Value	Values
Name of the data file (*1)	DataFileName	AAAA….AAAA (Up to 31 digits)	alphanumeric characters	dependent on the product (See Section 7.1 "Rules used for File naming".)
Size of the data file	DataFileSize	NNNNNNNNNNNN (Up to 12 digits)	unit:<byte>	dependent on the product
File format of the data file	DataFileFormat	AAAA….AAAA (Up to 16 digits)	character strings	PDS3 [STATIC]
Name of the thumbnail file	ThumbnailFileName	AAAA….AAAA (Up to 31 digits)	alphanumeric characters	dependent on the product (See Section 7.1 "Rules used for File naming".)
Size of the thumbnail file	ThumbnailFileSize	NNNNNNNNNNNN (Up to 12 digits)	unit:<byte>	dependent on the product
File format of the thumbnail file	ThumbnailFileFormat	AAAA (Up to 4 digits)	JPEG Format	JPEG [STATIC]
Name of the instrument	InstrumentName	AAAA….AAAA (Up to 16 digits)	character strings	LALT [STATIC]
Processing level	ProcessingLevel	AAAA….AAAA (Up to 16 digits)	character strings	dependent on the product (See Table 1-2 "Level".)
Product ID	ProductID	AAAA….AAAA (Up to 30 digits)	character strings	dependent on the product (See Table 1-2 "Product_ID".)
Version number of the product	ProductVersion	AAAA….AAAA (Up to 16 digits)	character strings	X
Access level	AccessLevel	N	values of 0-4	N/A
Start time	StartDateTime	yyyy- mmddT hh: mm: ss.sssZ	DATE & TIME	dependent on the product
Stop time	EndDateTime	yyyy- mmddT hh: mm: ss.sssZ	DATE & TIME	dependent on the product
Comment information	CommentInfo	AAAA….AAAA (Up to 4000 digits)	character strings	dependent on the product

(*1) "DataFileName" is the stored file name of the product. For the detached format, this is the stored file name.

<Example of Catalog Information>

DataFileName = LALT_GT_NP_IMG.IMG
DataFileSize = 58992343
DataFileFormat = PDS3
ThumbnailFileName = LALT_GT_NP_IMG.jpg
ThumbnailFileSize = 13018
ThumbnailFileFormat = JPEG
InstrumentName = LALT
ProcessingLevel = Higher Level
ProductID = LALT_GT_NP_IMG
ProductVersion = 1.0
AccessLevel = 4
StartDateTime = 2007-12-30T17:19:20.245Z
EndDateTime = 2008-10-27T09:39:31.161Z
CommentInfo = LALT_GT_NP_IMG.IMG processed by Y. ISHIHARA (ishihara@miz.nao.ac.jp) & H. ARAKI (arakih@miz.nao.ac.jp).

8. Grid Topographic Data of the Lunar South Pole (Product ID:LALT_GT_SP_NUM)

8.1 Rules used for File naming

The nomenclature used for Label, Data Object and Catalog Information File the product files are described below. In addition, the file name is case-independent.

LALT_GT_SP_NUM.ext

- LALT_GT_SP_NUM : Product (STATIC)
- ext : File Extension
  - ✓ TAB : Label and Data Object File
  - ✓ jpg : Thumbnail JPEG Image File
  - ✓ ctg : Catalog Information File

<Example of Name >
LALT_GT_SP_NUM.TAB

8.2 Label Format

The Label Format for the TABLE object used for the Grid Topographic Data of the Lunar South Pole product is shown in Table 8-1.

Table 8-1 Label Format

No	Items	Elements	Types	Values
Standard Item (/* BASIC */)				
1	PDS version number	PDS_VERSION_ID = %s	char	PDS3 [STATIC]
2	Record format of the file	RECORD_TYPE = %s	char	UNDEFINED [STATIC]
3	File name	FILE_NAME = %s	char	See Section 8.1 “Rules used for File naming”.
4	Name of the mission	MISSION_NAME = %s	char	SELENE [STATIC]
5	Name of the spacecraft	SPACECRAFT_NAME = %s	char	SELENE-M [STATIC]
6	Name of the instrument	INSTRUMENT_NAME = %s	char	"LALT" [STATIC]
7	Product ID	PRODUCT_SET_ID = %s	char	See Table 1-2 “Product_ID”.
8	Version number of the product	PRODUCT_VERSION_ID = %s	char	yyyymmdd
9	Target name	TARGET_NAME = %s	char	MOON [STATIC]
10	Comment	COMMENT_TEXT = "%s"	char	See the following example. [STATIC]
11	Starting position of the TABLE object	^TABLE = %d <BYTES>	int	XXXXX <BYTES>
TABLE Object Format Description Part				
		OBJECT = TABLE		
	Format	INTERCHANGE_FORMAT = %s	char	ASCI I [STATIC]
	Number of lines of data	ROWS = %s	int	XXXXXXXX [STATIC]
	Number of columns of data	COLUMNS = %s	int	3 [STATIC]
	Byte count of data line	ROW_BYTES = %s	int	31 [STATIC]
COLUMN Object Format Description Part (3 column)				
		OBJECT = COLUMN		
1	Name	NAME = "%s"	char	See the following example. [STATIC]
2	Type of the data	DATA_TYPE = %s	char	See the following example.

				[STATIC]
3	Starting byte of the data	START_BYTES = %s	int	See the following example. [STATIC]
4	Byte count of the data	BYTE = %s	int	See the following example. [STATIC]
5	Format	FORMAT = %s	char	See the following example. [STATIC]
6	Unit of the data	UNIT = "%s"	char	See the following example. [STATIC]
7	Direction of positive longitude	POSITIVE_LONGITUDE_DIRECTION = %s	char	"EAST" [STATIC] *Only the first column
8	Description	DESCRIPTION = "%s"	char	See the following example. [STATIC]
		END_OBJECT = COLUMN		
	END_OBJECT = TABLE			
END statement				
		END		

<Example of Label : Grid Topographic Data of the Lunar South Pole >

```
/* BASICS */
PDS_VERSION_ID                = PDS3
RECORD_TYPE                   = UNDEFINED
FILE_NAME                     = LALT_GT_SP_NUM.TAB
MISSION_NAME                  = SELENE
SPACECRAFT_NAME               = SELENE-M
INSTRUMENT_NAME               = "LALT"
PRODUCT_SET_ID                = LALT_GT_SP_NUM
PRODUCT_VERSION_ID            = 20091002
TARGET_NAME                   = MOON
COMMENT_TEXT                  = "LALT_GT_SP_NUM is a grid topographic data set around the lunar
                                north pole derived from the LALT_LGT_TS using the 'nearneighbor'
                                command in the Generic Mapping Tool (Wessel and Smith, 1991).
                                Altitude values were rounded off to the third decimal place.
                                Data are ordered from -80.00390625 to -89.99609375 degrees in
                                latitude and from 0.015625 to 359.984375 degrees in longitude.
                                They are referenced to the sphere of 1737.4 km radius based on
                                the gravity center of the Moon. Grid resolution along latitude
                                is 0.0078125 (1/128) degree and for longitude is 0.03125 (1/32)
                                degree. 99.999 on the elevation column is a dummy datum.
                                PI: Dr. Hiroshi ARAKI (arakih@miz.nao.ac.jp)."

^TABLE =    11503

/* TABLE */
OBJECT                        = TABLE

ROWS                          = 14745600
COLUMNS                       = 3
ROW_BYTES                     = 31
INTERCHANGE_FORMAT                = ASCII

  OBJECT                      = COLUMN
    NAME                          = "LONGITUDE"
    DATA_TYPE                     = ASCII_REAL
    START_BYTE                    = 1
    BYTES                         = 10
    FORMAT                        = "F10.6"
    UNIT                          = "DEGREE"
    POSITIVE_LONGITUDE_DIRECTION = "EAST"
    DESCRIPTION                       = "The longitude of the grid point
                                      on the Mean Earth/Polar Axis body-fixed coordinates."
  END_OBJECT                  = COLUMN

  OBJECT                      = COLUMN
    NAME                          = "LATITUDE"
    DATA_TYPE                     = ASCII_REAL
    START_BYTE                    = 11
    BYTES                         = 13
```

```
    FORMAT                      = "F13.8"
    UNIT                      = "DEGREE"
    DESCRIPTION                 = "The latitude of the grid point
                                on the Mean Earth/Polar Axis body-fixed coordinates."
  END_OBJECT                  = COLUMN

  OBJECT                    = COLUMN
    NAME                      = "ELEVATION"
    DATA_TYPE                 = ASCII_REAL
    START_BYTE                = 24
    BYTES                     = 7
    FORMAT                    = "F7.3"
    UNIT                      = "KM"
    DESCRIPTION                 = "The elevation of the grid point on a shphere
                                whose radius is 1737.4 km referenced to the
                                gravity center of the Mean Earth/Polar Axis
                                body-fixed coordinates. 99.999 is a dummy datum."
  END_OBJECT                  = COLUMN

END_OBJECT = TABLE

END
```

8.3 Data Object Format

The Grid Topographic Data of the Lunar South Pole is the altitude data for the Moon south of 80 degree S Latitude based on the 1737.4 km sphere centered at the center of the mass of the Moon as the starting point.

The resolution of latitude direction is 1/128 degrees and the resolution of longitude direction is 1/32 degrees.

- Format summary (ASCII)
  - ✓ Data range: Moon's surface latitude = -80.00390625° - -89.99609375°
    Moon's surface longitude = +0.015625° - +359.984375°
  - ✓ POSITIVE LONGITUDE DIRECTION : EAST

Table 8-2 Data Object Format

Column	1	2	3	
Item	LONGITUDE	LATITUDE	ELEVATION	<LF>statement
Byte position	1	11	24	31
Byte count	10	13	7	1
Data Type	ASCII_REAL	ASCII_REAL	ASCII_REAL	-
Format	F10.6	F13.8	F7.3	N/A
Unit	degree	degree	km	N/A
Substance	Moon's surface longitude *1	Moon's surface latitude *1	Altitude *2	<0x0A>

*1 : Mean Earth/Polar Axis body-fixed coordinates
*2 : The elevation of the grid point on a reference sphere whose radius and center is 1737.4 km based on the gravity center in the Mean Earth/Polar Axis body-fixed coordinates.

8.4 Catalog Information File Format

The Catalog Information File Format is shown in Table 8-3.

Table 8-3 Catalog Information File Format

Item Name	Elements	Format of Value	Range of Value	Values
Name of the data file (*1)	DataFileName	AAAA….AAAA (Up to 31 digits)	alphanumeric characters	dependent on the product (See Section 8.1 "Rules used for File naming".)
Size of the data file	DataFileSize	NNNNNNNNNNN (Up to 12 digits)	unit:<byte>	dependent on the product
File format of the data file	DataFileFormat	AAAA….AAAA (Up to 16 digits)	character strings	PDS [STATIC]
Name of the thumbnail file	ThumbnailFileName	AAAA….AAAA (Up to 31 digits)	alphanumeric characters	dependent on the product (See Section 8.1 "Rules used for File naming".)
Size of the thumbnail file	ThumbnailFileSize	NNNNNNNNNNN (Up to 12 digits)	unit:<byte>	dependent on the product

File format of the thumbnail file	ThumbnailFileFormat	AAAA (Up to 4 digits)	JPEG Format	JPEG [STATIC]
Name of the instrument	InstrumentName	AAAA….AAAA (Up to 16 digits)	character strings	LALT [STATIC]
Processing level	ProcessingLevel	AAAA….AAAA (Up to 16 digits)	character strings	dependent on the product (See Table 1-2 "Level".)
Product ID	ProductID	AAAA….AAAA (Up to 30 digits)	character strings	dependent on the product (See Table 1-2 "Product_ID".)
Version number of the product	ProductVersion	AAAA….AAAA (Up to 16 digits)	character strings	X
Access level	AccessLevel	N	values of 0-4	N/A
Start time	StartDateTime	yyyy- mmddT hh: mm: ss.sssZ	DATE & TIME	dependent on the product
Stop time	EndDateTime	yyyy- mmddT hh: mm: ss.sssZ	DATE & TIME	dependent on the product
Comment information	CommentInfo	AAAA….AAAA (Up to 4000 digits)	character strings	dependent on the product

(*1) "DataFileName" is the stored file name of the product. For the detached format, this is the stored file name.

<Example of Catalog Information>

DataFileName = LALT_GT_SP_NUM.TAB
DataFileSize = 457125173
DataFileFormat = PDS3
ThumbnailFileName = LALT_GT_SP_NUM.jpg
ThumbnailFileSize = 11906
ThumbnailFileFormat = JPEG
InstrumentName = LALT
ProcessingLevel = Higher Level
ProductID = LALT_GT_SP_NUM
ProductVersion = 1.0
AccessLevel = 4
StartDateTime = 2007-12-30T17:19:20.245Z
EndDateTime = 2008-10-27T09:39:31.161Z
CommentInfo = LALT_GT_SP_NUM.TAB processed by Y. ISHIHARA (ishihara@miz.nao.ac.jp).

9. Topographic Image of the Lunar South Pole (Product ID: LALT_GT_SP_IMG)

9.1 Rules used for File naming

The nomenclature used for Label, Data Object and Catalog Information File the product files are described below. In addition, the file name is case-independent.

LALT_GT_SP_IMG.ext

- LALT_GT_SP_IMG : Product (STATIC)
- ext : File Extension
  - ✓ IMG : Label and Data Object File
  - ✓ jpg : Thumbnail JPEG Image File
  - ✓ ctg : Catalog Information File

<Example of Name >
LALT_GT_SP_IMG.IMG

9.2 Label Format

The Label Format for the IMAGE object used for the Topographic Image of the Lunar South Pole product is shown in Table 9-1. The Label for the IMAGE object includes: Standard Item, Image Data Object Format Description Part and IMAGE_MAP_PROJECTION Object Description Part.

Table 9-1 Label Format

No	Items	Elements	Types	Values
Standard Item (/* BASIC */)				
1	PDS version number	PDS_VERSION_ID = %s	char	PDS3 [STATIC]
2	Record format of the file	RECORD_TYPE = %s	char	UNDEFINED [STATIC]
3	File name	FILE_NAME = %s	char	See Section 9.1 “Rules used for File naming”.
4	Name of the mission	MISSION_NAME = %s	char	SELENE [STATIC]
5	Name of the spacecraft	SPACECRAFT_NAME = %s	char	SELENE-M [STATIC]
6	Name of the instrument	INSTRUMENT_NAME = %s	char	LALT [STATIC]
7	Product ID	PRODUCT_SET_ID = %s	char	See Table 1-2 “Product_ID”.
8	Product version number	PRODUCT_VERSION_ID = %s	char	yyyymmdd
9	Target name	TARGET_NAME = %s	char	MOON [STATIC]
10	Comment	COMMENT_TEXT = "%s"	char	See the following example.[STATIC]
11	Starting position of the image object	^IMAGE = %d <BYTES>	int	XXXX <BYTES>
Image Data Object Format Description Part(/* IMAGE */)				
		OBJECT = IMAGE		
1	Band storage type	BAND_STORAGE_TYPE = %s	char	BAND_SEQUENTIAL [STATIC] *Refer to the PDS Standard Reference V3.5 Appendix A.19 “IMAGE”.
2	Number of bands	BANDS = %d	smallint	1 [STATIC]
3	Compression class and encoding type	ENCODING_TYPE = %s	char	N/A [STATIC]
4	Alternative value outside assumption	INVALID_CONSTANT = %s	int	0 [STATIC]

5	Horizontal pixel count of image	LINE_SAMPLES = %d	int	11520 [STATIC]
6	Vertical pixel count of image	LINES = %d	int	1280 [STATIC]
7	Dummy data	DUMMY_DATA = %f	float	xx.xxx
8	Offset	OFFSET = %f	float	0.0000 [STATIC]
9	Pixel bit length	SAMPLE_BITS = %d	int	32 [STATIC]
10	Scaling factor	SCALING_FACTOR = %d	int	1 [STATIC]
11	Pixel type	SAMPLE_TYPE = %s	char	4BYTE_FLOAT [STATIC]
12	Stretched Flag	STRETCHED_FLAG = %s	char	FALSE [STATIC]
		END_OBJECT = IMAGE		
IMAGE_MAP_PROJECTION Object Description Part(/* IMAGE_MAP_PROJECTION */)				
		OBJECT = IMAGE_MAP_PROJECTION		
1	Semi-major axis of the ellipsoidal body	A_AXIS_RADIUS = %f<KM>	float	1737.400<km> [STATIC]
2	medial axis of ellipsoidal body	B_AXIS_RADIUS = %f<KM>	float	1737.400<km> [STATIC]
3	Semi-minor axis of ellipsoidal body	C_AXIS_RADIUS = %f<KM>	float	1737.400<km> [STATIC]
4	Name of coordinate system	COORDINATE_SYSTEM_NAME = "%s"	char	"PLANETOCENTRIC " [STATIC]
5	Type of coordinate system	COORDINATE_SYSTEM_TYPE = "%s"	char	"BODY-FIXED ROTATING" [STATIC]
6	Easternmost longitude	EASTERNMOST_LONGITUDE = %f	float	+359.984375 [STATIC]
7	Westernmost longitude	WESTERNMOST_LONGITUDE = %f	float	+0.015625 [STATIC]
8	Resolution (longitude)	MAP_RESOLUTION_LONGITUDE = %d	int	32 <PIXEL/DEGREE>
9	Maximum latitude	MAXIMUM_LATITUDE = %f	float	-80.00390625 [STATIC]
10	Minimum latitude	MINIMUM_LATITUDE = %f	float	-89.99609375 [STATIC]
11	Resolution (latitude)	MAP_RESOLUTION_LATITUDE = %d	int	128 <PIXEL/DEGREE>
12	Map projection type	MAP_PROJECTION_TYPE = "%s"	char	POLAR STEREOGRAPHIC [STATIC]
		END_OBJECT = IMAGE_MAP_PROJECTION		
END statement				
		END		

<Example of Label : Topographic Image of the Lunar South Pole >

```
/* BASICS */
PDS_VERSION_ID                = PDS3
RECORD_TYPE                    = UNDEFINED
FILE_NAME                     = LALT_GT_SP_IMG.IMG
MISSION_NAME                   = SELENE
SPACECRAFT_NAME                  = SELENE-M
INSTRUMENT_NAME                  = "LALT"
PRODUCT_SET_ID                 = LALT_GT_SP_IMG
PRODUCT_VERSION_ID               = 20091002
TARGET_NAME                    = MOON
COMMENT_TEXT                     = "LALT_GT_SP_IMG is a grid topographic data set around the lunar
                                  south pole extracted from LALT_GT_SP_NUM that is created by
                                  'nearneighbor' command in the Generic Mapping Tool (Wessel and Smith,
1911).

                                  Altitude values were rounded off to the third decimal place. Data
                                  are ordered from -80.00390625 to -89.99609375 degrees in latitude
                                  and from +0.015625 to +359.984375 degrees in longitude. They are
                                  referenced to the sphere of 1737.4 km radius based on the gravity
                                  center of the Moon. Grid resolution along latitude is 0.0078125
                                  (1/128) degree and for longitude is 0.03125 (1/32) degree. 99.999
                                  on the elevation column is a dummy datum.
                                  PI: Dr. Hiroshi ARAKI (arakih@miz.nao.ac.jp)."

^IMAGE =    9944
```

```
/* IMAGE */
OBJECT                          = IMAGE

   BAND_STORAGE_TYPE               = BAND_SEQUENTIAL
   BANDS                        = 1
   ENCODING_TYPE                  = N/A
   INVALID_CONSTANT               = 0
   LINE_SAMPLES                   = 11520
   LINES                       = 1280
   DUMMY_DATA                     = 99.999
   OFFSET                      = 0.0000
   SAMPLE_BITS                    = 32
   SCALING_FACTOR                 = 1
   SAMPLE_TYPE                    = 4BYTE_FLOAT
   STRETCHED_FLAG                  = FALSE

/* IMAGE_MAP_PROJECTION */
OBJECT                          = IMAGE_MAP_PROJECTION

   A_AXIS_RADIUS                  = 1737.400<km>
   B_AXIS_RADIUS                  = 1737.400<km>
   C_AXIS_RADIUS                  = 1737.400<km>
   COORDINATE_SYSTEM_NAME            = PLANETOCENTRIC
   COORDINATE_SYSTEM_TYPE           = BODY-FIXED ROTATING
   EASTERNMOST_LONGITUDE            = +359.984375
   WESTERNMOST_LONGITUDE             = +0.015625
   MAP_RESOLUTION_LONGITUDE          = 32 <PIXEL/DEGREE>
   MAXIMUM_LATITUDE                = -80.00390625
   MINIMUM_LATITUDE                = -89.99609375
   MAP_RESOLUTION_LATITUDE           = 128 <PIXEL/DEGREE>
   MAP_PROJECTION_TYPE              = POLAR STEREOGRAPHIC

END_OBJECT                      = IMAGE_MAP_PROJECTION

END_OBJECT                      = IMAGE

END
```

9.3 Data Object Format

Topographic Image of the Lunar South Pole based on the 1737.4 km sphere centered at the center of the mass of the Moon as the starting point. The format summary is shown below.

- ✓ BAND_SEQUENTIAL
- ✓ 11520 columns per one line. 1280 lines.
- ✓ Optical resolution of the longitude direction Δ_1 = 1/32 degrees (0.03125 degrees).
- ✓ Optical resolution of the latitude direction Δ_2 = 1/128 degrees (0.0078125 degrees).
- ✓ See Figure 3-8 for a summary of the rows and columns.
- ✓ See Figure 3-9 for a summary of the data units and a description of the columns.
- ✓ Data unit is float type (4 bytes used for the actual number)
- ✓ Unit of measure: km.

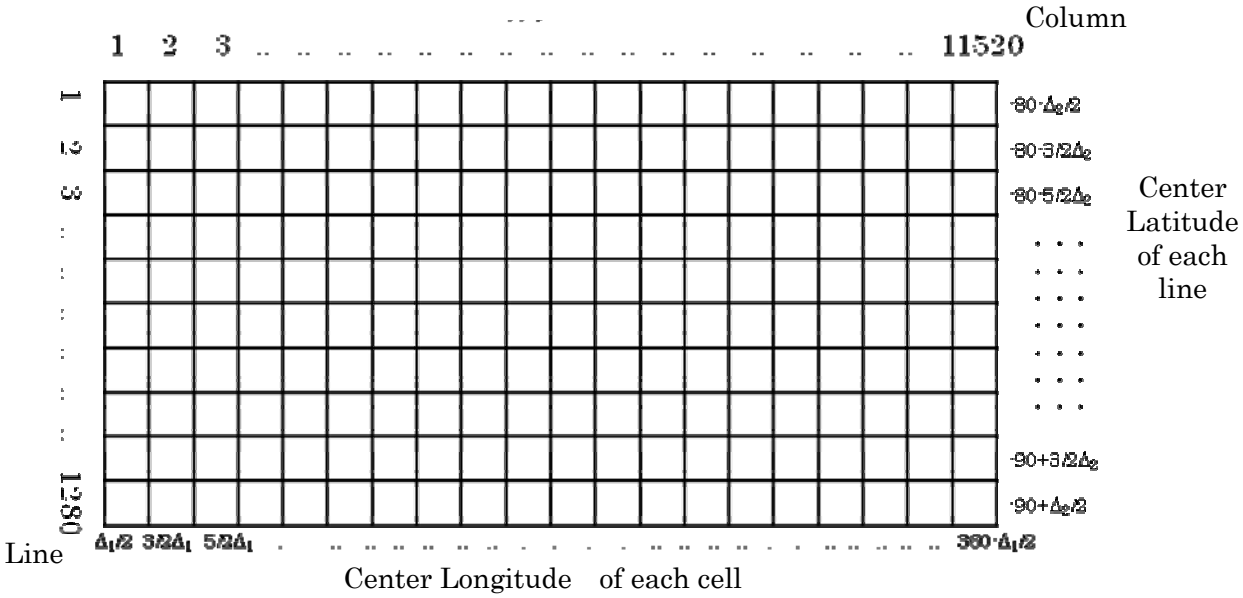

Figure 9-1 Relationship and data format between the Center Latitude of each line and the Center Longitude of each cell. Optical resolution of the longitude direction Δ_1 = 1/32 degrees. Optical resolution of the latitude direction Δ_2 = 1/128 degrees.

	Byte Position			Column	Description	Data Type
Line 1	0	-	3	1	Altitude	float×1
	4	-	7	2	Altitude	float×1
	8	-	11	3	Altitude	float×1
				.....		
	46076	-	46079	11520	Altitude	float×1
Line 2	46080	-	46083	1	Altitude	float×1
				.....		
	92156	-	92159	11520	Altitude	float×1
.....				.....		
				.....		
Line 1280	58936320	-	58936323	1	Altitude	float×1
				.....		
	58989396	-	58989399	11520	Altitude	float×1

Figure 9-2 Format of data object

9.4 Catalog Information File Format

The Catalog Information File Format is shown in Table 9-2.

Table 9-2 Catalog Information File Format

Item Name	Elements	Format of Value	Range of Value	Values
Name of the data file (*1)	DataFileName	AAAA….AAAA (Up to 31 digits)	alphanumeric characters	dependent on the product (See Section 9.1 "Rules used for File naming".)
Size of the data file	DataFileSize	NNNNNNNNNNNN (Up to 12 digits)	unit:<byte>	dependent on the product
File format of the data file	DataFileFormat	AAAA….AAAA (Up to 16 digits)	character strings	PDS3 [STATIC]
Name of the thumbnail file	ThumbnailFileName	AAAA….AAAA (Up to 31 digits)	alphanumeric characters	dependent on the product (See Section 9.1 "Rules used for File naming".)
Size of the thumbnail file	ThumbnailFileSize	NNNNNNNNNNNN (Up to 12 digits)	unit:<byte>	dependent on the product
File format of the thumbnail file	ThumbnailFileFormat	AAAA (Up to 4 digits)	JPEG Format	JPEG [STATIC]
Name of the instrument	InstrumentName	AAAA….AAAA (Up to 16 digits)	character strings	LALT [STATIC]
Processing level	ProcessingLevel	AAAA….AAAA (Up to 16 digits)	character strings	dependent on the product (See Table 1-2 "Level".)
Product ID	ProductID	AAAA….AAAA (Up to 30 digits)	character strings	dependent on the product (See Table 1-2 "Product_ID".)
Version number of the product	ProductVersion	AAAA….AAAA (Up to 16 digits)	character strings	X
Access level	AccessLevel	N	values of 0-4	N/A
Start time	StartDateTime	yyyy- mmddT hh: mm: ss.sssZ	DATE & TIME	dependent on the product
Stop time	EndDateTime	yyyy- mmddT hh: mm: ss.sssZ	DATE & TIME	dependent on the product
Comment information	CommentInfo	AAAA….AAAA (Up to 4000 digits)	character strings	dependent on the product

(*1) "DataFileName" is the stored file name of the product. For the detached format, this is the stored file name.

<Example of Catalog Information>

DataFileName = LALT_GT_SP_IMG.IMG
DataFileSize = 58992343
DataFileFormat = PDS3
ThumbnailFileName = LALT_GT_SP_IMG.jpg
ThumbnailFileSize = 13523
ThumbnailFileFormat = JPEG
InstrumentName = LALT
ProcessingLevel = Higher Level
ProductID = LALT_GT_SP_IMG
ProductVersion = 1.0
AccessLevel = 4
StartDateTime = 2007-12-30T17:19:20.245Z
EndDateTime = 2008-10-27T09:39:31.161Z
CommentInfo = LALT_GT_SP_IMG.IMG processed by Y. ISHIHARA (ishihara@miz.nao.ac.jp) & H. ARAKI (arakih@miz.nao.ac.jp).

10. Spherical Harmonics Coefficients of the Lunar Topography (Product ID: LALT_SH)

10.1 Rules used for File naming

The nomenclature used for Label, Data Object and Catalog Information File the product files are described below. In addition, the file name is case-independent.

LALT_SH.ext

- LALT_SH : Product (STATIC)
- ext : File Extension
  - ✓ TAB : Label and Data Object File
  - ✓ jpg : Thumbnail JPEG Image File
  - ✓ ctg : Catalog Information File

<Example of Name >
LALT_SH.TAB

10.2 Label Format

The Label Format for the TABLE object used for the Spherical Harmonics Coefficients of the Lunar Topography product is shown in Table 10-1.

Table 10-1 Label Format

No	Items	Elements	Types	Values
Standard Item (/* BASIC */)				
1	PDS version number	PDS_VERSION_ID = %s	char	PDS3 [STATIC]
2	Record format of the file	RECORD_TYPE = %s	char	UNDEFINED [STATIC]
3	File name	FILE_NAME = %s	char	See Section 10.1 “Rules used for File naming”.
4	Name of the mission	MISSION_NAME = %s	char	SELENE [STATIC]
5	Name of the spacecraft	SPACECRAFT_NAME = %s	char	SELENE-M [STATIC]
6	Name of the instrument	INSTRUMENT_NAME = %s	char	"LALT" [STATIC]
7	Product ID	PRODUCT_SET_ID = %s	char	See Table 1-2 “Product_ID”.
8	Version number of the product	PRODUCT_VERSION_ID = %s	char	yyyymmdd
9	Target name	TARGET_NAME = %s	char	MOON [STATIC]
10	Comment	COMMENT_TEXT = "%s"	char	See the following example.[STATIC]
11	Starting position of the TABLE object	^TABLE = %d <BYTES>	int	XXXXX <BYTES>
TABLE Object Format Description Part				
		OBJECT = TABLE		
	Format	INTERCHANGE_FORMAT = %s	char	ASCI I [STATIC]
	Number of lines of data	ROWS = %s	int	XXXXX [STATIC]
	Number of columns of data	COLUMNS = %s	int	4 [STATIC]
	Byte count of data line	ROW_BYTES = %s	int	73 [STATIC]
COLUMN Object Description Part (4 column)				
		OBJECT = COLUMN		
1	Name	NAME = "%s"	char	See the following example. [STATIC]
2	Type of the data	DATA_TYPE = %s	char	See the following example. [STATIC]

3	Starting byte of the data	START_BYTES = %s	int	See the following example. [STATIC]
4	Byte count of the data	BYTE = %s	int	See the following example. [STATIC]
5	Format	FORMAT = %s	char	See the following example. [STATIC]
6	Unit of the data	UNIT = "%s"	char	See the following example. [STATIC]
		END_OBJECT = COLUMN		
		END_OBJECT = TABLE		
END statement				
		END		

<Example of Label : Spherical Harmonics Coefficients of the Lunar Topography >

```
/* BASICS */
PDS_VERSION_ID                = PDS3
RECORD_TYPE                   = UNDEFINED
FILE_NAME                     = LALT_SH.TAB
MISSION_NAME                  = SELENE
SPACECRAFT_NAME               = SELENE-M
INSTRUMENT_NAME               = "LALT"
PRODUCT_SET_ID                = LALT_SH
PRODUCT_VERSION_ID            = 20091002
TARGET_NAME                   = MOON
COMMENT_TEXT                  = "LALT_SH is a data set of spherical harmonic expansion coefficients
                                derived from the LALT_GGT_NUM using SHExpandDH routine in
SHTOOLS

                                on Prof. M. Wieczorec's Web site
                                (www.ipgp.fr/~wieczor/SHTOOLS/SHTOOLS.html)
                                PI: Dr. Hiroshi ARAKI (arakih@miz.nao.ac.jp)."

^TABLE =    10596

/* TABLE */
OBJECT                        = TABLE

ROWS                          = 64980
COLUMNS                       = 4
ROW_BYTES                     = 73
INTERCHANGE_FORMAT            = ASCII

  OBJECT                      = COLUMN
    NAME                      = "DEGREE"
    DATA_TYPE                 = ASCII_INTEGER
    START_BYTE                = 1
    BYTES                     = 12
    FORMAT                    = "I12"
    UNIT                      = "N/A"
  END_OBJECT                  = COLUMN

  OBJECT                      = COLUMN
    NAME                      = "ORDER"
    DATA_TYPE                 = ASCII_INTEGER
    START_BYTE                = 13
    BYTES                     = 12
    FORMAT                    = "I12"
    UNIT                      = "N/A"
  END_OBJECT                  = COLUMN

  OBJECT                      = COLUMN
    NAME                      = "COSINE CODFFICIENTS"
    DATA_TYPE                 = ASCII_REAL
    START_BYTE                = 25
    BYTES                     = 24
    FORMAT                    = "E24.15"
    UNIT                      = "M"
  END_OBJECT                  = COLUMN
```

```
  OBJECT                        = COLUMN
    NAME                          = "SINE CODFFICIENTS"
    DATA_TYPE                      = ASCII_REAL
    START_BYTE                     = 49
    BYTES                         = 24
    FORMAT                         = "E24.15"
    UNIT                          = "M"
  END_OBJECT                     = COLUMN

END_OBJECT = TABLE

END
```

10.3 Data Object Format

The Spherical Harmonics Coefficients of the Lunar Topography data is generated based on the LALT_LGT_TS. The Spherical Harmonics Coefficients are incremented up to and including 359 and described in a TABLE format.

- Format summary
  - ✓ A sample is shown below. The example's format is 'I12, I12, E24.15, and E24.15'. For the 359 increment, the calculation used is as follows: (360 multiplied by 361) / 2 = 64980.

n	m	Cnm	Snm
0	0	1737155.82805134	0.00000000000000

...

Table 10-2 Data Format

Column	1	2	3	4	
Item	n	m	Cnm	Snm	<LF>statement
Byte position	1	13	25	49	73
Byte count	12	12	24	24	1
Data Type	ASCII_INTEGER	ASCII_INTEGER	ASCII_REAL	ASCII_REAL	-
Format	I12	I12	E24.15	E24.15	N/A
Unit	N/A	N/A	M	M	N/A
Sample	0	0	1737155.82805134	0.00000000000000	N/A
Substance	order	ordinal	cosine coefficient	sine coefficient	<0x0A>

10.4 Catalog Information File Format

The Catalog Information File Format is shown in Table 10-3.

Table 10-3 Catalog Information File Format

Item Name	Elements	Format of Value	Range of Value	Values
Name of the data file (*1)	DataFileName	AAAA….AAAA (Up to 31 digits)	alphanumeric characters	dependent on the product (See Section 10.1 "Rules used for File naming".)
Size of the data file	DataFileSize	NNNNNNNNNNNN (Up to 12 digits)	unit:<byte>	dependent on the product
File format of the data file	DataFileFormat	AAAA….AAAA (Up to 16 digits)	character strings	PDS [STATIC]
Name of the thumbnail file	ThumbnailFileName	AAAA….AAAA (Up to 31 digits)	alphanumeric characters	dependent on the product (See Section 10.1 "Rules used for File naming".)
Size of the thumbnail file	ThumbnailFileSize	NNNNNNNNNNNN (Up to 12 digits)	unit:<byte>	dependent on the product
File format of the thumbnail file	ThumbnailFileFormat	AAAA (Up to 4 digits)	JPEG Format	JPEG [STATIC]
Name of the instrument	InstrumentName	AAAA….AAAA (Up to 16 digits)	character strings	LALT [STATIC]
Processing level	ProcessingLevel	AAAA….AAAA (Up to 16 digits)	character strings	dependent on the product (See Table 1-2 "Level".)
Product ID	ProductID	AAAA….AAAA (Up to 30 digits)	character strings	dependent on the product (See Table 1-2 "Product_ID".)
Version number of the product	ProductVersion	AAAA….AAAA (Up to 16 digits)	character strings	X
Access level	AccessLevel	N	values of 0-4	N/A
Start time	StartDateTime	yyyy- mmddT hh: mm: ss.sssZ	DATE & TIME	dependent on the product
Stop time	EndDateTime	yyyy- mmddT hh: mm: ss.sssZ	DATE & TIME	dependent on the product
Comment information	CommentInfo	AAAA….AAAA (Up to 4000 digits)	character strings	dependent on the product

(*1) "DataFileName" is the stored file name of the product. For the detached format, this is the stored file name.

<Example of Catalog Information>

DataFileName = LALT_SH.TAB
DataFileSize = 4754135
DataFileFormat = PDS3
ThumbnailFileName = LALT_SH.jpg
ThumbnailFileSize = 11007
ThumbnailFileFormat = JPEG
InstrumentName = LALT
ProcessingLevel = Higher Level
ProductID = LALT_SH
ProductVersion = 1.0
AccessLevel = 4
StartDateTime = 2007-12-30T17:19:20.245Z
EndDateTime = 2008-10-27T09:39:31.161Z
CommentInfo = LALT_SH.TAB processed by Y. ISHIHARA (ishihara@miz.nao.ac.jp).