Summary of the Lunar Prospector Spectrometers Gamma-ray and Neutron Time-series Submission to the Planetary Data System

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1. Introduction

This document summarizes the submission of gamma-ray and neutron time-series data from the Lunar Prospector mission. Specifically, these data consist of fully corrected 32-second data accumulations from the Lunar Prospector Gamma-ray and Neutron Spectrometers (LP-NS, LP-GRS). Full descriptions of these data products and reduction procedures are given by *Lawrence et al.* [2003] and *Maurice et al.* [2003]. A detailed instrument description for the Lunar Prospector Spectrometers is given by *Feldman et al.*, [2003]. The remaining portion of this document describes the file structure and contents of the submitted data.

2. LP-GRS Data Products

2.1 Naming Convention for LP-GRS Files

Data from the LP-GRS are separated into files containing one day's worth of data. The datafiles contain binary data and are named with the following convention: *yyyy_doy*_grs.bin, where

- *yyyy* gives the year the data was taken (either 1998 or 1999)
- *doy* gives the day of year the data was taken (values from 001 to 365 are valid).

For example, gamma-ray data collected on February 1, 1998 will be in the file named 1998_032_grs.bin. Auxiliary files, named *yyyy_doy*_grs.txt, contain supplementary information about the files such as the date and time the data were processed and written into binary files.

2.2. Contents of LP-GRS Files

The reduction of LP-GRS time-series data are described in *Lawrence et al*., [2003] and does not need to be repeated here. Table 1 lists the contents of each daily file and how these data are formatted. The first four bytes are a value of type *long* that give the total number of samples, named *num*, in each file. Following the first four bytes are nine data products. The first two products are the 512 element accepted and rejected gamma-ray spectra. Following the spectra are the measured deadtime, overload, and LP-GRS temperature. Finally, the spacecraft time, height, latitude, and longitude are given. This sequence of eight data products repeats *num* times until the end of the file. The total size of each file should be *num**(2*512 + 7)*4 + 4 = *num**4124+4 bytes.

Product name	Variable name[a]	Data type	Total bytes	Total items	Start byte
Number of samples	*num*	long	4	1	1
Accepted spectra	acc_1[512]	float	2048	512	5
Rejected spectra	rej_1[512]	float	2048	512	2053
Deadtime	$deadtime_1$	float	4	1	4101
Overload	$overload_1$	float	4	1	4105
GRS Temperature	$grstemp_1$	float	4	1	4109
Earth receive time	ert_1	float	4	1	4113
Spacecraft height	hgt_1	float	4	1	4117
Spacecraft latitude	lat_1	float	4	1	4121
Spacecraft longitude	lon_1	float	4	1	4125
Accepted spectra	acc_2[512]	float	2048	512	4129
Rejected spectra	rej_2[512]	float	2048	512	6177
Deadtime	$deadtime_2$	float	4	1	8225
Overload	$overload_2$	float	4	1	8229
GRS Temperature	$grstemp_2$	float	4	1	8233
Earth receive time	ert_2	float	4	1	8237
Spacecraft height	hgt_2	float	4	1	8241
Spacecraft latitude	lat_2	float	4	1	8245
Spacecraft longitude	lon_2	float	4	1	8249
↓	↓	↓	↓	↓	↓
Accepted spectra	acc_{num}[512]	float	2048	512	filesize-4124
Rejected spectra	rej_{num}[512]	float	2048	512	filesize-2076
Deadtime	$deadtime_{num}$	float	4	1	filesize-28
Overload	$overload_{num}$	float	4	1	filesize-24
GRS Temperature	$grstemp_{num}$	float	4	1	filesize-20
Earth receive time	ert_{num}	float	4	1	filesize-16
Spacecraft height	hgt_{num}	float	4	1	filesize-12
Spacecraft latitude	lat_{num}	float	4	1	filesize-8
Spacecraft longitude	lon_{num}	float	4	1	filesize-4

[a]The notation for variable names is the following: 1) A subscript after the variable name indicates a particular element of an array. For example, the first element of the array lat is designated lat_1. 2) An entire array is designated by a square brackets. For example, the first 512-element accepted array is designated acc_1[512]. This same variable naming convention holds true for the other tables in this document.

Table 1: Contents of the LP-GRS binary timeseries files.

3. LP-NS Data Products

3.1 Naming Convention for LP-NS Files

The neutron data has eleven different types of neutron data products. These include thermal and epithermal neutrons from high and low altitude. Each of the thermal and epithermal neutron datasets has data taken over 8 and 32 second sample periods. There are two fast neutron datasets of high and low altitude. Finally, there is one dataset of low

altitude moderated neutrons. The file naming convention for the binary files is the following: *type*_neutron_*xxxy*sec.bin, where

- *type* gives the type of neutron and can be either *thermal*, *epithermal*, *fast* or *moderated*.
- *xxx* tells whether the dataset is *high* or *low* altitude.
- *y* tells whether the dataset is 8 or 32 second sample period.

There are eight additional binary files that contain position information and are named position_*xxxy*sec.bin, where the *xxx* and *y* carry the same information as above. Auxiliary files, named *type*_neutron_*xxxy*sec.txt, contain supplementary information about the files such as the date and time the data were processed and written into binary files.

3.2. Contents of LP-NS Files

The reduction of LP-NS time-series data are described in *Maurice et al*., [2003] and does not need to be repeated here. Table 2 lists the contents of the files containing 32 second period data, except for the 32-second moderated neutrons (see Table 4). The first four bytes in each file are a value of type *long* that give the total number of samples, named *num*, in each file. Following the first four bytes are the data values. For the *type*_neutron_*xxx*32sec.bin files, these data are a single array containing *num* elements. For the position_*xxx*32sec.bin files, there are the four products of latitude, longitude, spacecraft height, and Earth receive time.

Table 3 lists the contents of the files containing 8-second period data. The first four bytes in each file are a value of type *long* that give the total number of samples, named *num*, in each file. Following the first four bytes are the data values. For the *type*_neutron_*xxx8*sec.bin files, these data are a single array containing *num* elements. For the position_*xxx8*sec.bin files, there are the two products of latitude and longitude.

Finally, Table 4 lists the contents of the file moderated_neutron_low32sec.bin. This file contains both the low altitude moderated neutron data and position information for these data.

File name	Product name	variable name	Data type	Total bytes	Total items	Start byte
thermal_neutron_ *xxx*32sec.bin	number of samples	*num*	long	4	1	1
	thermal neutrons	*therms*[num]	float	4**num*	1	5
epithermal_neutron_ *xxx*32sec.bin	number of samples	*num*	long	4	1	1
	epithermal neutrons	*epis*[*num*]	float	4**num*	1	5
fast_neutron_*xxx*32sec.bin	number of samples	*num*	long	4	1	1
	fast neutrons	*fast*[*num*]	float	4**num*	1	5
position_*xxx*32sec.bin	number of samples	*num*	long	4	1	1
	latitude	*lat*[*num*]	float	4**num*	1	5
	longitude	*lon*[*num*]	float	4**num*	1	5 + 4**num*
	height	*hgt*[*num*]	float	4**num*	1	5 + 8**num*
	earth receive time	*ert*[*num*]	float	4**num*	1	5 + 12**num*

Table 2: Contents of 32 second neutron and position files.

File name	Product name	variable name	Data type	Total bytes	Total items	Start byte
thermal_neutron_ *xxx*8sec.bin	number of samples	*num*	long	4	1	1
	thermal neutrons	*therms*[num]	float	4**num*	1	5
epithermal_neutron_ *xxx*8sec.bin	number of samples	*num*	long	4	1	1
	epithermal neutrons	*epis*[*num*]	float	4**num*	1	5
position_*xxx*8sec.bin	number of samples	*num*	long	4	1	1
	latitude	*lat*[*num*]	float	4**num*	1	5
	longitude	*lon*[*num*]	float	4**num*	1	5 + 4**num*

Table 3: Contents of 8 second neutron and position files.

File name	Product name	variable name	Data type	Total bytes	Total items	Start byte
moderated_neutron_ low32sec.bin	number of samples	*num*	long	4	1	1
	moderated neutrons	*moderated*[num]	float	4**num*	1	5
	latitude	*lat*[*num*]	float	4**num*	1	5 + 4**num*
	longitude	*lon*[*num*]	float	4**num*	1	5 + 8**num*
	height	*hgt*[*num*]	float	4**num*	1	5 + 12**num*
	earth receive time	*ert*[*num*]	float	4**num*	1	5 + 16**num*

Table 4: Contents of 32 second moderated neutron file.

4. References

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