Software Interface Specification (SIS) for the Lunar Prospector Spectrometer Planetary Data System Files, Version V002

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This document is an addendum to the SIS document for the Version V001 submission of the Lunar Prospector spectrometer data (Los Alamos report LAUR-99-2753). This data submission contains gamma-ray spectrometer (GRS) data from Jan. 16, 1998 to Dec. 19, 1998 and neutron spectrometer (NS) data from Jan. 16, 1998 to October 5, 1998. This document describes changes that have been made to the data processing since the V001 submission. Detailed descriptions are given where changes have been made to the data and/or processing. For headings where changes have not been made, the reader is referred to the version V001 document.

Spacecraft Spin Flip: One major change between the V001 and V002 submissions is that the V002 submission is being divided up into two different time-ordered data sets. This is because the LP spacecraft executed a 180° flip of the spin axis on October 5, 1998 which continued until October 7, 1998. Since the response functions of both the GRS and NS vary according to latitude and spacecraft orientation, the pre-flip and post-flip data is being handled separately. For the GRS, both pre- and post-flip data are being submitted. For the NS, only pre-flip data is being submitted at this time. An addendum to the V002 submission will include the post-flip NS data. The exact times of the spin flip maneuvers are being included in the V002 submission in the *Auxiliary_V002.txt* data file.

Leonid Meteor Shower: For five days in November 1998 (Nov. 15 - Nov. 19), the spin orientation of the LP spacecraft was changed to minimize damage by particles from the Leonid meteor shower. Since the spin axis was not parallel to the Moon's spin axis at this time, data from this period are not being included in the V002 submission. The times for this maneuver are listed in the *Auxiliary_V002.txt* data file.

1. Gamma-Ray Spectrometer (GRS)

1.1 Introduction

The GRS data now contains four primary data files: the pre-flip files are: *GRS_spectra_high1_V002.cdf* and *GRS_ThK_high1_V002.cdf*; the post-flip files are *GRS_spectra_high2_V002.cdf* and *GRS_ThK_high2_V002.cdf*. These files have the same format and description as the similar V001 data files. The file: *Auxiliary_V002.txt* contains the times of the spin flip maneuvers.

1.2 GRS Data Contents: Integrated Spectra

Same as the V001 submission.

1.3 GRS Data Contents: Thorium and Potassium Counting Rates
Same as the V001 submission.

1.4 GRS Data Processing: Integrated Spectra
The following processing steps have been done to create the GRS integrated spectra.

Deadtime: Same as the V001 submission.

Gain Corrections: Same as the V001 submission. Updates of the GRS HV gain change times are included in an auxiliary file.

Solar Energetic Particle (SEP) Events: Same as the V001 submission. Updates of the SEP times are included in an auxiliary file.

Galactic Cosmic Ray (GCR) Effects: The correction for the GCR variations has been modified in the following way. Instead of smoothing the 6.13 MeV gamma-ray counting rate data over two hours, the 6.13 MeV gamma-ray counting data is now averaged only for latitudes poleward of ±80°. This is being done to minimize composition effects that may have been included in the previous GCR correction.

Binning of Data: Same as the V001 submission.

Standard Deviation: Same as the V001 submission.

Height/Solid Angle Correction: A correction is now being made to the data to correct for variations in the Moon's solid angle seen by the detector due to height variations. This correction is carried out by assuming that the Moon is a sphere and calculating the fraction of a half solid angle seen by the detector. This fractional solid angle is:

$$\Omega = \frac{\theta}{2\pi},$$

where,

$$\theta = -2\pi \cos(\alpha - 1),$$

and,

$$\alpha = \sin^{-1}\left(\frac{R}{R+h}\right).$$

Here, R = the mean lunar radius which is 1738 km, and h = the spacecraft height above the mean lunar surface. All data is corrected to a spacecraft height of 100 km.

1.5 GRS Data Processing: Thorium and Potassium Counts
The following processing steps have been done to create the GRS thorium and potassium counting rate data.

Data Selection: Same as the V001 submission.

Latitude Correction: The latitude correction is now a 6th polynomial in sin(latitude):

$$f(x) = 1 + a_1 \sin(\lambda) + a_2 \sin^2(\lambda) + a_3 \sin^3(\lambda) + a_4 \sin^4(\lambda) + a_5 \sin^5(\lambda) + a_6 \sin^6(\lambda)$$

where the a_i coefficients are different for the thorium and potassium corrections.

Binning of Data: Same as the V001 submission.

Standard Deviation: Same as the V001 submission.

Height/Solid Angle Correction: The same height/solid angle correction described in Section 1.4 was also carried out for the thorium and potassium counting rate data.

1.6 GRS Auxiliary Data File
In addition to the counting rate data, the GRS data set contains an auxiliary file in ASCII format: *Auxiliary_V002.txt*. The auxiliary file contains two items for the GRS: times of solar energetic particle events which have been omitted from the data; times of high voltage changes for the GRS detector.

2. Neutron Spectrometer (NS)

2.1 Introduction
The NS data contains one primary data file: *NS_high1_V001.cdf*. The NS data file contains counting rate data for thermal and epithermal neutrons from Jan. 16, 1998 to October 5, 1998. This file contains only pre-flip NS data. This file has the same format and description as the similar V001 data file.

2.2 NS Data Contents
Same as the V001 submission.

2.3 NS Data Processing
The following steps have been done to create the NS neutron counting rate data.

Spacecraft Processing: Same as the V001 submission.

SEP Events: Same as the V001 submission. Updates of the SEP times are included in an auxiliary file.

Galactic Cosmic Ray (GCR) Effects: The correction for the GCR variations has been modified in the following way. Instead of smoothing the 6.13 MeV gamma-ray counting rate data over two hours, the 6.13 MeV gamma-ray counting data is now averaged only for latitudes poleward of ±80°. This is being done to minimize composition effects that may have been included in the previous GCR correction.

Latitude Correction: Same as the V001 submission.

Height/Solid Angle Correction: The same height/solid angle correction described in Section 1.4 was also carried out for the thermal and epithermal neutron counting rate data.

Binning of Data: Same as the V001 submission.

Standard Deviation: Same as the V001 submission.

2.4 NS Auxiliary Data File
Auxiliary data for the NS data is included in the file: *Auxiliary_V002.txt*.

3. Alpha Particle Spectrometer (APS)
The APS data will be included as an addendum to the V002 submission.

4. Common Data Format
The V002 data is again being submitted in Common Data Format (CDF). Future submissions may also include data in a raw binary format.

5. References
There are no new references for the V002 submission.