

STEREO

SEP High Energy Telescope (HET)

Level 1 Data Format

HET-Level1DataFormatA.doc
Version A – 10/03/2002

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Document Revision Record

Rev.	Date	Description of Change	Approved By
A	2002-Oct-03	First Draft	-

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1. Introduction

This document defines the format of the Level 1 data for the SEP High Energy Telescope (HET) sensors, to be delivered by GSFC to UCB on a regular schedule during the STEREO mission. Per the STEREO Phase A Report, “Level 1 data are also referred to as high (time) resolution data, and contain all of the measurements made by the IMPACT instruments in physical units.”

The document describes the data that will be included in HET Level 1 data files, the physical units of the data, the coordinate systems used, the format of the data files, and the predicted size of the files. Example fragments of data files are included.

HET calibration data and software for generating HET Level 1 data are not described, since these data and software will not be delivered by Goddard to UCB (at least until after the early shakedown phase of the mission).

1.1. Document Conventions

In this document, **TBD** (To Be Determined) means that no information currently exists. **TBR** (To Be Resolved) means that a statement is preliminary. In either case, the acronym is typically followed by the initials of those responsible for providing the information, or the responsible institution.

1.2. Applicable Documents

Some of these documents can be found on the Berkeley STEREO/IMPACT website: <http://sprg.ssl.berkeley.edu/impact/dwc/>. Others are currently available from GSFC.

1. Phase A Report/PAIP (Performance Assurance Implementation Plan)
2. HET Science Data Frame Format Specification
3. IMPACT Performance Requirements
4. IMPACT Requirements Verification / Validation Plan

1.3. Acronyms

GSFC	Goddard Space Flight Center
HET	High Energy Telescope
IMPACT	In situ Measurements of Particles and CME Transients
SEP	Solar Energetic Particles
SIT	Suprathermal Ion Telescope
SEPT	Solar Electron Proton Telescope
SRL	Caltech Space Radiation Laboratory

2. HET Level 1 Data Description

2.1. General Description

Level 1 data for the two HET sensors (one sensor in each of the ahead and behind spacecraft) consist of intensities of solar energetic particles for various species. For each species, intensities for a number of energy intervals within an energy range are provided. These energy ranges and intervals are not necessarily the same for each species; however there are a large number of energy intervals that are common to most of the species provided. The intensities are provided as time-series, with one-minute averages.

The intensities referred to above are calculated using the full geometry factor of the HET instrument. For a subset of the species referred to above, intensities for a number of more narrowly defined look-directions (sectors) are also provided. The energy intervals over which sectorized data are provided are similar to the energy intervals provided for data calculated using the full geometry factor, but some energy intervals are combined in order to increase statistics and to conserve telemetry bandwidth.

2.2. Physical Units and Coordinate Systems

Particle intensities are provided in units of Particles/(cm² s sr MeV) for protons, and Particles/(cm² s sr MeV/nucleon) for species with $Z \geq 2$.

2.3. Data Quantities Included

Intensities for the following species will be provided: electrons, H, ³He, ⁴He, C, O, Ne, Mg, Si, Fe.

Exact energy ranges and exact boundaries for energy intervals for each species are TBD. The following table is derived from the performance requirements, and shows some examples:

Species	Number of Intervals	Energy Range (MeV/nuc.)
H	10	13 – 40
He ⁴	10	13 – 40
O	8	30 – 87
Fe	8	52 – 163

2.4. Data Files and Formats

The following specifications apply to all HET Level 1 data files:

- Data files will be in ASCII format.
- The two-character <CR><LF> sequence will define the record delimiter.
- Fields within records will be space-delimited.

- Each file will begin with a header section that describes the data and provides version and creation-date information, etc. in readable English.
- The header section will be separated from the data records by a standard character sequence (see below).
- Each data file will cover a period of 1 day.
- Each data record will cover a one-minute interval.
- Each data record will contain a timestamp that will refer to the beginning of the one-minute interval during which the data were accumulated by the sensor.
- There may be data gaps in data files. One-minute records for which no data are available will be absent in the data files. Fill-data within a record will be denoted as –1.

2.4.1. File Format

Within each data file, the header section at the beginning of the file is defined as follows:

Line 1: Short descriptive label

Line 2: Either “Ahead” or “Behind”, indicating which STEREO spacecraft the data comes from

Line 3: Institution label

Line 4: File creation date

Line 5: Software version

Line 6 to end of header section: description of data. For each species, define the energy intervals. Define the format of the data records.

Last line of the header will contain the following: # End

The following, in italics, is an example of the beginning of a HET Level 1 data file:

HET Level 1 Data

Ahead

Goddard Space Flight Center

File created: Tue Aug 27 16:24

Software version: 1.0

This file contains solar energetic particle intensities in one-minute averages for the following species: H, 3He, 4He, C, O, Ne, Mg, Si, Fe.

Energy intervals for each species are as follows:

H ...TBD

3He ...TBD

4He...TBD

C...TBD

O...TBD

Ne...TBD

Mg...TBD

Si...TBD

Fe ...TBD

For each intensity, a value and error are listed.

Within each data record below, the following fields are defined:

Field 1: Timestamp – Year, a 4-digit integer, e.g. 2005.

Field 2: Timestamp – UT Day-of-year, integer.

Field 3: Timestamp – UT Hour-of-day and minute-of-day combined into a four-digit integer, e.g. 0215 for 2:15am.

Field 4: A character string that defines the species. Characters A-Z, a-z, 0-9, _ and - are allowed. No spaces, tabs, non-printing characters, etc. are allowed. Example: Fe

Field 5: A positive integer N defining the number of intensity fields following in the record. N = the number of energy intervals defined above for the species, in format “%2d”.

Fields 6, 8, ... 2N+4: N intensities, in format “% 10.3g”. Example: 1.23e-04 or 12.3

Fields 7, 9, ... 2N+5: N error in intensity, in format “% 10.3g”.

Intensity or count values of –1. indicate bad or missing data.

#End

```
2005 100 0000 H 6 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05
2005 100 0000 3He 4 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05
2005 100 0000 4He 6 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05
2005 100 0000 C 6 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05
2005 100 0000 O 6 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05
2005 100 0000 Ne 6 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05
2005 100 0000 Mg 6 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05
2005 100 0000 Si 6 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05
2005 100 0000 Fe 6 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05
2005 100 0001 H 6 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05
2005 100 0001 3He 4 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05
2005 100 0001 4He 6 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05
2005 100 0001 C 6 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05
2005 100 0001 O 6 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05
2005 100 0001 Ne 6 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05
2005 100 0001 Mg 6 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05
2005 100 0001 Si 6 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05
2005 100 0001 Fe 6 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05 1.23e-04 1.23e-05
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2.4.2. File Sizes

Daily file sizes will be ~ 2.8 megabytes/day.