SAMPEX

Level 2 Data Products NSSDC Submission Description

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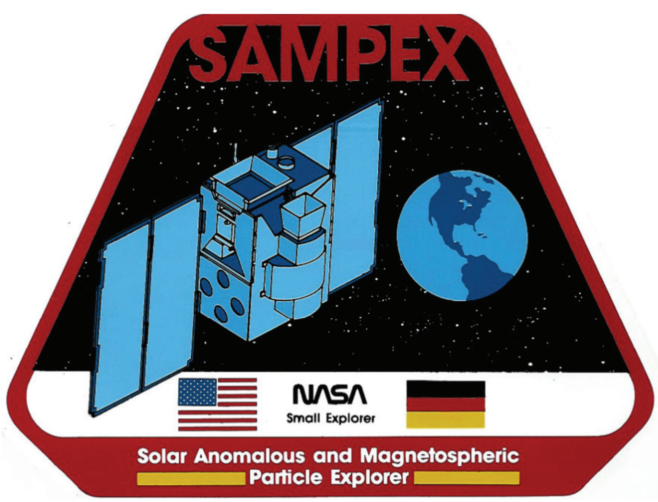

Version 1.3
15 August 2007

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Document Revision History

Version #	Date	Modifications
1.0	26 Feb 1996	Original document
1.1	27 Apr 1999	Update citations to web pages & contacts for instrument information Correct typo in table A-7.1 for MAST 2 count rate
1.2	5 May 2000	Update instrument contact information Add Appendix 2.5.4 and Table A-2.1 summarizing point modes during mission Add notes to tables A-5.1, and A-7.1 to document effects of loss of MAST D7 detector
1.3	15 Aug 2007	Corrections found in comparison with SAMPEX data center products: 1) Table A-5.1 (MAST) subcoms for rates 62 and 70 2) Table A-6.1 (PET) repeat of rate 16 documented. 3) Misc typos previously noted

Scope

This document describes the four Level 2 data sets delivered to the National Space Science Data Center by the SAMPEX Science Working Group. The one Level 1 data set, consisting of Master Data Files (MDFs), is described in the SAMPEX Master Data File Description (see Reference Documents). The Level 2 data sets described here are supplied as formatted ASCII files. The remainder of this document describes the contents of the Level 2 files.

Reference Documents are in Appendix 13. A complete description of the SAMPEX mission and instrumentation was published in *IEEE Trans. Remote Sensing, 31,* 1993.

SAMPEX information on World Wide Web:

In addition to the reference documents, there is a SAMPEX home page on the world-wide-web at:

http://lepsam.gsfc.nasa.gov/www/sampex.html

The WWW contains the instrument and mission papers from the *IEEE* issue cited above, plus data and other information.

Introduction

The Solar, Anomalous, and Magnetospheric Particle Explorer (SAMPEX) was launched on 3 July 1992 into an 82° inclination 520 x 670 km orbit. SAMPEX carries four energetic particle instruments:

- HILT, the Heavy Ion Large Telescope, was constructed by the Max-Planck-Institut, Garching, Germany, and the Aerospace Corporation, Los Angeles. HILT is a highly sensitive *dE/dx* vs residual energy telescope that used a flow through gas proportional counter, silicon solid state detectors, and a CsI crystal to identify particle type, energy, and arrival direction.

- LICA, the Low Energy Ion Composition Telescope, was constructed by the University of Maryland. LICA is a time-of-flight mass spectrometer that identifies particle type, energy, and arrival direction by their time-of-flight over a ~0.5 m flight path, along with their residual energy.

- MAST, the Mass Spectrometer Telescope, was constructed by the California Institute of Technology and Goddard Space Flight Center. MAST is an ultra-high mass resolution spectrometer that identifies particle type, energy, and arrival direction by multiple *dE/dx* vs. residual energy measurements, along with position sensing detectors that allow determination of the particle arrival direction and trajectory within the telescope.

- PET, the Proton Electron Telescope, was constructed by the California Institute of Technology and Goddard Space Flight Center. PET detects electrons, protons, and helium nuclei by the *dE/dx* vs. residual energy method.

A complete description of the SAMPEX mission and instrumentation was published in *IEEE Trans. Remote Sensing, 31,* 1993.

For further information about the instrumentation, contact:

MAST or PET	LICA	HILT
Dr. R. A. Mewaldt Space Radiation Lab. 220-47 Caltech Pasadena, CA 91125	Dr. J. E. Mazur Aerospace Corp. Space Sciences Dep't 15049 Conf. Ctr. Dr CH3/210 Chantilly, VA 20515	Dr. B. Klecker Max Planck Institut D-85740 Garching Germany
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1.0 Submission Contents

The SAMPEX Level 2 data products NSSDC submission contains four data sets:

Data set:	Contents	Portion of Orbit covered	Time resolution
1	all counting rates	entire orbit	30 s
2	selected fluxes	entire orbit	30 s
3	all counting rates	polar cap	1 point per polar cap pass
4	selected fluxes	polar cap	1 point per polar cap pass

Fluxes: are in units of particles/sec cm^2 sr MeV/nucleon

Polar cap: is defined as that portion of the orbit above 70° invariant latitude. *Note: the spacecraft does not reach or exceed 70° on every orbit, so some polar passes are not present.*

Files with 30 s time resolution are organized on a 1 file per day (midnight-midnight UT) basis. Files containing averages over the polar caps are organized on longer (~1 year) runs of data.

General Description

File format: flux and count rate files all follow the general format shown in Figure 1. A variable number of ASCII **header records** at the start of the file contains run-time information and history for the generation of this file -- this information is for internal documentation only and can be ignored by the user. Following the header records is a single **column** header record with comma-delimited names of each data column. This is intended for use in reading the flatfile into commercial programs such as Kaleidagraph. Immediately following the column header records are the data records (variable number) described below.

Data record format: each group of 30-second averaged counting rates and the selected fluxes derived from them are accompanied by position, attitude and model magnetic field parameters obtained from the PS set of the Master Data File. These parameters are described in Appendix 2. The PS set closest to the start of the 30 second averaging interval is selected. Each group of 30-second rates contains a live time variable for each counting rate, sigma values calculated for each flux value, and data quality flags.

Each group of polar cap averaged counting rates and the selected fluxes derived from them are accompanied by a start and end time of the polar cap pass, a flag indicating North or South polar region, a live time variable for each counting rate, sigma values calculated for each flux value, and data quality flags.

The counting rates and live times are obtained from the "browse files". The live time variable is the number of seconds the instrument was measuring a particular counting rate. Two additional time variables, SAMPEX time and ISO time, obtained from the browse files, are included to indicated the actual beginning time of the rate averaging interval.

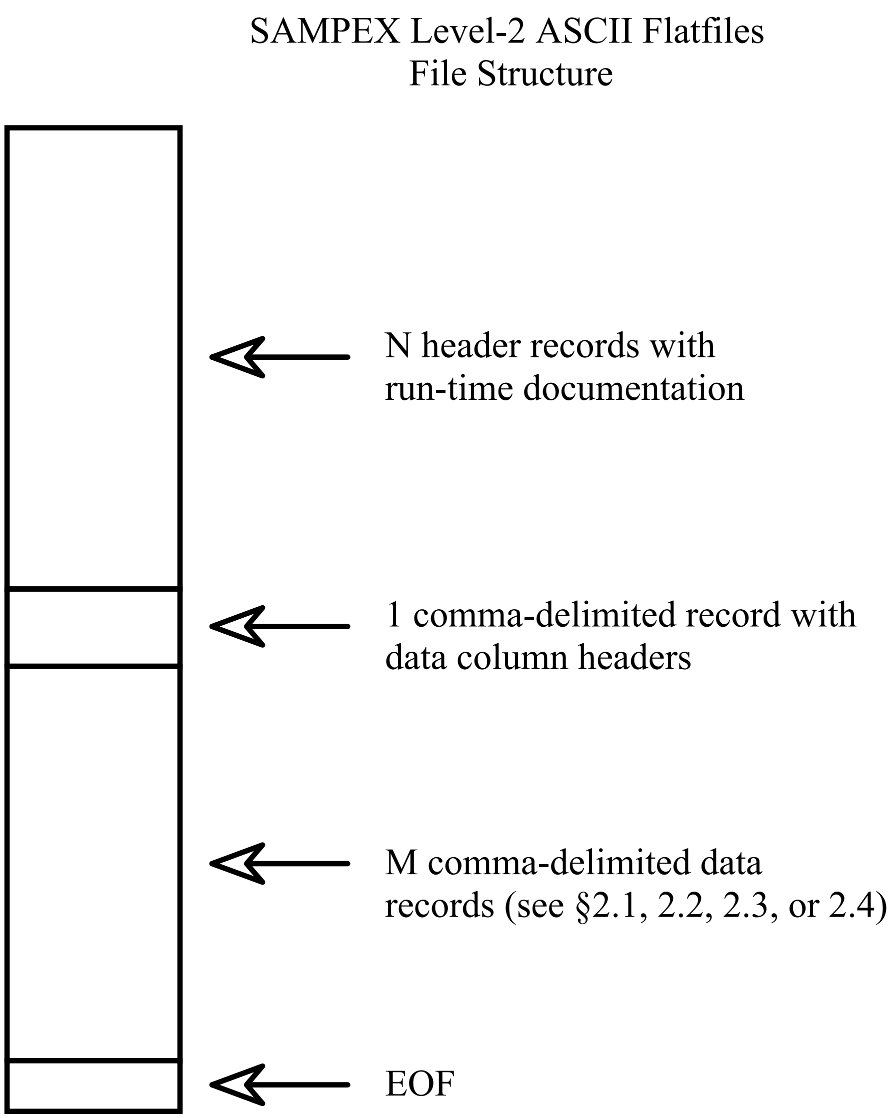

Fig. 1. Flatfile file structure

2.0 Data Record Format Descriptions

2.1 30 second count rate data records

The content of each ASCII data record of the 30 second count rate files for each orbit is as given in the table 2.1. Each record contains items for a single 30-second interval. The table includes references to appendices that contain further detail on each item.

Table 2.1
Record Format for 30 Second Count Rate files

Item #	Format	Description	Reference
1	I10,x	SAMPEX time	Appendix 1
2	A24,x	ISO time	Appendix 1
3	A18,x	MM/DD/YY HH:MM:SS	Appendix 1
4	I8,x	SAMPEX Orbit #	Appendix 1
5	3(I3,x)	Program version #s	Appendix 1
6	65(1PE11.3,x),I3,x,2(1PE11.3,x),I2,x,1PE11.3,x	Position and magnetic field data	Appendix 2
7	12(I10,x,I3,x) 6(I3,x)	LICA: 12 count & live time pairs & 6 data quality flags	Appendix 3 Appendix 9
8	24(I10,x,I3,x) 7(I3,x)	HILT 24 count and live time pairs & 7 data quality flags	Appendix 4 Appendix 10
9	78(I10,x, I3,x) 4(I3,x)	MAST 78 count and live time pairs, & 4 data quality flags	Appendix 5 Appendix 11
10	33(I10,x, I3,x) 4(I3,x)	PET count and live time pairs, & 4 data quality flags	Appendix 6 Appendix 12
11	I3	SAA flag	Appendix 2

Notes:

1) "x" in above formats marks the location of comma separators of data items
2) total number of comma delimited items in one data record:
$$7 + 70 + 24 + 6 + 48 + 7 + 156 + 4 + 66 + 4 + 1 = 393$$
3) "counts" means the sum of accumulator counts
4) "live times" are in seconds for each accumulator
5) Each file contains data for a single 24 hour period (midnight-midnight UT).
6) ISTP standard fill values for count data: -2147483648

2.2 30 second flux data records

The content of each ASCII data record of the 30 second flux file is as given in the table 2.2. Each record contains items for a single 30-second interval. The table includes references to appendices that contain further detail on each item.

Table 2.2
Record Format for 30 Second Flux files

Item #	Format	Description	Reference
1	I10,x	SAMPEX time	Appendix 1
2	A24,x	ISO time	Appendix 1
3	A18,x	MM/DD/YY HH:MM:SS	Appendix 1
4	I8,x	SAMPEX Orbit #	Appendix 1
5	3(I3,x)	Program version #s	Appendix 1
6	65(1PE11.3,x),I3 ,x,2(1PE11.3,x),I 2,x,1PE11.3,x	Position and magnetic field data	Appendix 2
7	3(1PE11.3,x), 3(1PE11.3,x), 6(I3,x)	LICA fluxes (3), sigmas(3) & data quality flags (6)	Appendix 7 Appendix 9
8	4(1PE11.3,x), 4(1PE11.3,x), 7(I3,x)	HILT fluxes (4), sigmas (4) & data quality flags (7)	Appendix 7 Appendix 10
9	8(1PE11.3,x), 8(1PE11.3,x) 4(I3,x)	MAST fluxes (8), sigmas (8), & data quality flags (4)	Appendix 7 Appendix 11
10	3(1PE11.3,x), 3(1PE11.3,x), 4(I3,x)	PET fluxes (3), sigmas (3), & data quality flags (4)	Appendix 7 Appendix 12
11	I3	SAA flag	Appendix 2

Notes:

1) "x" in above formats marks the location of comma separators of data items
2) total number of comma delimited items in one data record:

   7 + 70 + 3 + 3 + 4 + 4 + 4 + 6 + 8 + 8 + 3 + 3 + 3 + 3 + 1 = 127

3) "fluxes" are in units of particles/sec cm^2 sr MeV/n
4) "sigmas" are 1-standard deviation uncertainties based on counting statistics *only.*
5) Each file contains data for a single 24 hour period (midnight-midnight UT).
6) ISTP standard fill value for flux data: -1.000000E+31

2.3 polar cap count rate data records

The content of each ASCII data record of the polar cap count rate files for each orbit is as given in the table 2.3. Each record in the file corresponds to a single polar cap crossing, where the polar cap is defined as times when the spacecraft is at an invariant latitude >70°. *Note: the spacecraft does not reach or exceed 70° on every orbit, so some polar passes are not present.* The table includes references to appendices that contain further detail on each item.

Table 2.3
Record Format for Polar Cap Count Rate files

Item #	Format	Description	Reference
1	I10,x	SAMPEX time at start of entry	Appendix 1
2	A24,x	ISO time at start of cap entry	Appendix 1
3	A18,x	MM/DD/YY HH:MM:SS	Appendix 1
4	I10,x	SAMPEX time at cap exit	Appendix 1
5	A24,x	ISO time at cap exit	Appendix 1
6	A18,x	MM/DD/YY HH:MM:SS	Appendix 1
7	I3,x	N/S polar cap flag	see below
8	12(I10,x,I3,x) 4(I3,x)	LICA: 12 count & live time pairs & 4 data quality flags	Appendix 3 Appendix 9
9	24(I10,x,I3,x) 6(I3,x)	HILT 24 count and live time pairs & 6 data quality flags	Appendix 4 Appendix 10
10	78(I10,x, I3,x) 3(I3,x)	MAST 78 count and live time pairs, & 3 data quality flags	Appendix 5 Appendix 11
11	33(I10,x, I3,x) 3(I3,x)	PET count and live time pairs, & 3 data quality flags	Appendix 6 Appendix 12

Notes:

1) "x" in above formats marks the location of comma separators of data items
2) total number of comma delimited items in one data record:
   7 + 24 + 4 + 48 + 6 + 156 + 3 + 66 + 3 = 317
3) "count" means the sum of accumulator counts
4) "live time" is in seconds for each accumulator
5) Polar cap flag: 1 = North Polar Cap; 0 = South Polar Cap.
6) ISTP standard fill values for count data: -2147483648

2.4 polar cap flux data records

The content of each ASCII data record of the Polar Cap flux file is as given in the table 2.2. Each record in the file corresponds to a single polar cap crossing, where the polar cap is defined as times when the spacecraft is at an invariant latitude >70°. *Note: the spacecraft does not reach or exceed 70° on every orbit, so some polar passes are not present.* The table includes references to appendices that contain further detail on each item.

Table 2.4
Record Format for Polar Cap Flux files

Item #	Format	Description	Reference
1	I10,x	SAMPEX time at start of entry	Appendix 1
2	A24,x	ISO time at start of cap entry	Appendix 1
3	A18,x	MM/DD/YY HH:MM:SS	Appendix 1
4	I10,x	SAMPEX time at cap exit	Appendix 1
5	A24,x	ISO time at cap exit	Appendix 1
6	A18,x	MM/DD/YY HH:MM:SS	Appendix 1
7	I3,x	N/S polar cap flag	see below
8	3(1PE11.3,x), 3(1PE11.3,x), 4(I3,x)	LICA fluxes (3), sigmas(3) & data quality flags (4)	Appendix 7 Appendix 9
9	4(1PE11.3,x), 4(1PE11.3,x), 6(I3,x)	HILT fluxes (4), sigmas (4) & data quality flags (6)	Appendix 7 Appendix 10
10	8(1PE11.3,x), 8(1PE11.3,x) 3(I3,x)	MAST fluxes (8), sigmas (8), & data quality flags (3)	Appendix 7 Appendix 11
11	3(1PE11.3,x), 3(1PE11.3,x), 3(I3,x)	PET fluxes (3), sigmas (3), & data quality flags (3)	Appendix 7 Appendix 12

Notes:

1) "x" in above formats marks the location of comma separators of data items
2) total number of comma delimited items in one data record:
    7 + 3 + 3 + 4 + 4 + 4 + 6 + 8 + 8 + 3 + 3 + 3 + 3 = 59
3) "fluxes" are in units of particles/sec cm^2 sr MeV/n
4) "sigmas" are 1-standard deviation uncertainties based on counting statistics *only.*
5) Polar cap flag: 1 = North Polar Cap; 0 = South Polar Cap.
6) ISTP standard fill value for flux data: -1.000000E+31

Appendix 1 - TIME formats

The files use 3 different time formats, which are useful for different applications.

1) SAMPEX time:

SAMPEX time is: seconds since 01 JAN 1992 00:00:00 (UT)

2) ISO time;

ISO time is a 24 character string with format: yyyy-mm-ddThh:mm:ssbbbbb
where: T = tab; b = blank

Variation A, ISO 8601, Reference:

CCSDS 301.0-B-2 (Blue Book), Issue 2, April 1990
Consultative Committee for Space Data Systems
Communications and Data Systems Division (Code OS)
National Aeronautics and Space Administration
Washington, DC 20546

3) MM/DD/YY HH:MM:SS format

This format is recognized by commercial software packages such as Excel 4, Excel 98, and Kaleidagraph 3.5.

Appendix 2 - Position and Magnetic Field Data

The Position and Magnetic Field Data section contains spacecraft position and velocity in inertial coordinates, position in geographic and magnetic coordinates, spacecraft attitude, zenith and azimuth look angles, and model magnetic field parameters. All magnetic field data is calculated from a model (see below). Calculated parameters correspond to the start time of each bin.

Appendix 2.1 Models

The IGRF 1990 Model is used. Values are calculated with a subroutine BL_IGRF written by: Mike NcNab of the Aerospace Corporation. This same subroutine is used in the SAMPEX Level-1 (MDF) files.

Appendix 2.2 Dynamic Integration Step Size

The integration step size used in the magnetic field model numerical integration routine is dynamically adjustable as a function of the L-shell parameter. For L-shell values of 10 or greater the step size is 500. For L-shell values less than 10, the step size is 100. The purpose of this is to achieve good accuracy for $L < 10$ while reducing calculation time for $L \geq 10$ where the model is less accurate.

Appendix 2.3 Detailed Point Descriptions

Table A-2.3 - Detailed Position/Mag Field Data Description

Item	Format	Name	Description
1	I10,x	SAMPEX Time	Time (seconds since 01Jan92 00:00:00) of current 6-second MDF bin.
2	A24,x	ISO time	ISO time, Variation A, ISO 8601 (yyyy-mm-ddThh:mm:ssbbbbb)
3	A18,x	MM/DD/YY HH:MM:SS	Date and time in a form usable by commercial packages such as Kaleidagraph
4	I8,x	Orbit #	Current orbit number. Launch into orbit 1. Orbit 2 starts at first ascending node through geographic equatorial plane.
5	I3,x	MDF_sw_no	Software version number for MDF Generator.
6	I3,x	BL_IGRF_sw_no	Software version number for routine BL_IGRF (does magnetic field calculations)
7	I3,x	Mag_Eph_sw_no	Software version number for magnetic ephemeris library.
8	3(1PE11.3,x)	GEO_POS	Geographic position; range (km), longitude (0° to 360°), latitude (-90° to +90°)
9	1PE11.3,x	GEO_ALT	Geographic altitude (km).
10	3(1PE11.3,x)	GEI_POS	X,Y,Z of spacecraft (km) in Geocentric Equatorial Inertial coordinates (identical to ECI coordinates).

11	3(1PE11.3,x)	GEI_VEL	VX,VY,VZ velocities (km/s) in GEI coordinates

continued

Table A-2.3 - Detailed Position/Mag Field Data Description
(continued)

Item	Format	Point Name	Description
12	9(1PE11.3,x)	Direction Cosine Array	9-element direction cosine array for rotating from GEI coordinates to body fixed coordinates. Z-axis in body fixed is along instrument bore sights. Order of elements is A(1,1), A(2,1), A(3,1), A(1,2), A(2,2), A(3,2), A(1,3), A(2,3), A(3,3).
13	1PE11.3,x	Exo_temp	Exospheric temperature (Kelvin) used in orbit propagation code.
14	1PE11.3,x	Drag	Drag scaling factor used in orbit propagation; Drag factor = (1+drag)*2.2
15	1PE11.3,x	Geomag_index	Geomagnetic activity index used in orbit propagation.
16	3(1PE11.3,x)	ECD_pos	Eccentric Dipole (offset tilted dipole) range (km), longitude (0° to 360°), latitude (-90° to +90°) of spacecraft.
17	1PE11.3,x	ECD_LT	Local time in ECD (hr).
18	1PE11.3,x	L	L-shell parameter
19	1PE11.3,x	Bmag	Model field magnitude (gauss)
20	1PE11.3,x	MLT	Local time at magnetic equator (hr) ECD
21	1PE11.3,x	Invlat	Invariant latitude (degrees)

continued

Table A-2.3 - Detailed Position/Mag Field Data Description
(continued)

Item	Format	Point Name	Description
22	1PE11.3,x	Pitch	Pitch angle of particle entering on instrument center line (angle between B and spacecraft minus Z direction) (degrees)
23	1PE11.3,x	Losscone1	Loss cone 1/2 angle (degrees) for particles mirroring below 100 km in same hemisphere as spacecraft.
24	1PE11.3,x	Losscone2	Smaller of the two loss cone 1/2 angles (degrees) for particles mirroring below 100 km in either hemisphere.
25	3(1PE11.3,x)	Bvec_GEI	Magnetic field vector, Cartesian GEI coordinates.
26	3(1PE11.3,x)	Bvec_GEO	Magnetic field vector, spherical geographic coordinates (r, theta, phi).
27	3(1PE11.3,x)	Dipole_moment	Dipole moment vector. Cartesian geographic coordinates.
28	3(1PE11.3,x)	Displacement	Dipole moment displacement vector (km). Cartesian geographic coordinates.
29	1PE11.3,x	Declination	Magnetic declination (degrees).
30	1PE11.3,x	Dip	Magnetic dip angle (degrees)
31	1PE11.3,x	MagRad	Algebraic magnetic radial distance (km). Note A.

32	1PE11.3,x	MagLat	Algebraic magnetic latitude (degrees) Note A.

continued

Table A-2.3 - Detailed Position/Mag Field Data Description
(continued)

Item	Format	Point Name	Description
33	3(1PE11.3,x)	Mirror	Geographic altitude (km), longitude (degrees), latitude (degrees) of mirror point (where B is same as B at spacecraft).
34	4(1PE11.3,x)	Equatorial	Magnitude of field (gauss) and GEO altitude (km), longitude (degrees), latitude (degrees) at magnetic equator.
35	4(1PE11.3,x)	North100	Magnitude of field (gauss) and GEO altitude (km), longitude (degrees), latitude (degrees) at north 100 km point. Note B.
36	4(1PE11.3,x)	South100	Magnitude of field (gauss) and GEO altitude (km), longitude (degrees), latitude (degrees) at south 100 km point. Note B.
37	1PE11.3,x	Cutoff	Nominal vertical cutoff (1980) at 20 km altitude at subsatellite location (GV). (Shea and Smart, 1983, Bangalore ICRC, Paper MG10-3).
38	I3,x	SAAF	South Atlantic Anomaly Flag. 0=not in SAA 1=within SAA
39	1PE11.3,x	Zenith	Angle (0° to 180°) between zenith and spacecraft z-axis (instrument bore sight).

40	1PE11.3,x	Azimuth	Direction of projection of spacecraft z-axis in plane perpendicular to radial direction. 0=east, 90=north, 180=west, 270=south

Table A-2.3 - Detailed Position/Mag Field Data Description (continued)

Item	Format	Point Name	Description
41	I2,x	Control mode	ACS control mode indicator. 0=SUNPOINT 1=MAGCAL 2=ORBIT ROTATION (normal mode) 3=COAST (see **MDF** document, page 47)
42	1PE11.3,x,	Inertial Dot Product	Inertial dot product between unit sun vector and unit B-vector.

<u>Note A:</u> Algebraic radius and latitude are computed using the dipole relationship between B, L, and latitude but with values for B and L generated from the IGRF model.

<u>Note B:</u> The 100-km points are the locations where the magnetic field line going through the spacecraft reaches an altitude of 100 km (a typical altitude for particle loss). These points are determined numerically, not analytically, so the computed values are step-size dependent. The altitude is included with the longitude and latitude to provide the user with a measure of how close the computed position is to the ideal.

Appendix 2.4 SAA FLAG

The SAA flag is set = 1 when SAMPEX is on or within the ellipse defined below. This area is centered approximately on the South Atlantic Anomaly.

The flag is set = 0 when SAMPEX is outside this ellipse.

Equation of ellipse:

$$((lat-a)/c)^2+((long-b)/d)^2 = 1$$

Where:

a = -27.5°
b = -22.5°
c = 32.5°
d = 70.0°
lat = geographic latitude (-90° to +90°)
long = east geographic longitude (-180° to +180°)

Parameters a,b,c,d are chosen to approximately fit the contour of >3 MeV protons at 10 cm^{-2} s^{-1} at 600 km altitude as specified in NASA SP 3054 (1970).

Appendix 2.5 Spacecraft Pointing Programs

The SAMPEX spacecraft is three-axis stabilized. Pointing is under control of the on-board attitude control system, as described in more detail in An Overview of the Solar, Anomalous, and Magnetospheric Particle Explorer (SAMPEX) Mission, D. N. Baker, G. M. Mason, O. Figueroa, G. Colon, J. G. Watzin, and R. M. Aleman, IEEE Transactions on Geoscience and Remote Sensing, Vol. 31, No., 3, May 1993, p 531. (see also SAMPEX WWW page).

The pointing program was modifiable, and could be changed to optimize different science studies. As of this writing (Feb. 1996), the bulk of the mission has been spend in two modes, described in Appendices 2.5.1 and 2.5.2. A third pointing program was under test in February 1996 and may be used in the future. Other programs might be developed for new studies.

2.5.1 Original Pointing Program

This program was in use from launch (7/3/92) until 5/26/94 13:46:28 UT, and is denoted original ORR (Orbit Rate Rotation) in the Table A-2.1

- Pitch axis (normal to solar panels) points directly at sun always
- Yaw axis (detector boresight direction) rotates once per orbit, and points north over the north pole, south over the south pole; parallel to equator at equatorial plane crossings.
- Yaw axis pointing avoids ram direction to protect sensor thin windows.

2.5.2 Trapped ACR Optimized Pointing Program

This program was put into use on 5/26/94 13:46:28 UT. It is a modification of the original program that optimizes observations of trapped particles near the equator. In Table A-2.1 it is denoted "modified ORR".

- Pitch axis (normal to solar panels) points directly at sun always
- Yaw axis (detector boresight direction) points as close as allowed by other constraints:
  - (a) parallel to magnetic field for B > 0.3 gauss;
  - (b) perpendicular to magnetic field for B < 0.3 gauss.
- Yaw axis (detector boresight direction) rotates once per orbit, and points north over the north pole, south over the south pole; parallel to equator at equatorial plane crossings.
- Yaw axis pointing avoids ram direction to protect sensor thin windows.

2.5.3 1 RPM Pointing Program

1 RPM program description (called 1 RPM in table A-2.1):

- Pitch axis (normal to solar panels) points directly at sun always
- Yaw axis (detector boresight direction) rotates at 1 RPM about pitch axis (solar direction)

2.5.4 Summary of Pointing Program Modes

Table A-2.1 Summary of pointing modes
(through July 1, 2004)

Date / time	Pointing program in place
July 1992	original ORR
5/26/94 13:46:28	modified ORR
6/1/94 18:41:01	original ORR after warm restart
6/2/94 14:52:07	modified ORR
8/10/94 15:40:17	original ORR after warm restart
8/10/94 22:40	modified ORR
4/30/95 12:22:51	original ORR after warm restart
5/1/95 13:07:01	modified ORR
10/24/95 13:41	original ORR after safehold
10/27/95 18:26	modified ORR
2/1/96 15:07:12	1 RPM mode (test)
2/1/96 19:15	modified ORR
2/13/96 13:45:32	1 RPM mode (test)
2/14/96 19:30	modified ORR
2/14/96 20:30:50	1 RPM mode
2/16/96 18:00:00	modified ORR
3/5/96 15:25:08	1 RPM mode
3/8/96 17:45:00	modified ORR
5/8/96 13:33:00	1 RPM mode
8/22/96 09:53	modified ORR after safehold
8/23/96	ram avoidance turned off
8/24/96 03:57	modified ORR mode
8/26/96 08:53	1 RPM mode
11/6/97 23:10:56	modified ORR mode
11/17/97 13:26:20	1 RPM mode
12/18/97 13:08:01	modified ORR mode

1/14/98 12:45	1 RPM mode
4/21/98 15:08:01	modified ORR mode
4/28/98 16:08:45	1 RPM mode
5/7/98 14:05:09	modified ORR mode
12/17/99 20:10	1 RPM mode -- support Antarctic balloon
2/2/00 20:05	modified ORR mode
1/16/02 14:29:31	ORR mode
1/17/02 18:45:00	Modified ORR mode
this table last updated August 15, 2007	

for additional details, see the document "SAMPEX_pointing_history" at the SAMPEX data center web site.

Appendix 3 - LICA count rates

The 12 LICA Count Rates are described in Table A-3.1. The rates are all unmultiplexed, and all read out to the DPU every 6 seconds.

Table A-3.1 LICA Rates

Rate #	*Rate Acronym*	*Rate Description*	*Live time %*
1	D1	All ions & e-, >800 keV H; >600 e-	100%
2	D2	All ions & e-, >800 keV H; >600 e-	"
3	D3	All ions & e-, >800 keV H; >600 e-	"
4	D4	All ions & e-, >800 keV H; >600 e-	"
5	Triples (VSE)	All ions, 0.8-6.0 MeV H	"
6	Doubles (VS)	All ions, >250 keV H	"
7	START	All ions & e-, >250 keV H; >30 keV e-	"
8	STOP	All ions & e-, >250 keV H; >30 keV e-	"
9	IFC	In flight calibrator (not a particle rate)	"
10	Lo Priority	He, 0.5-6.6 MeV/nuc	"
11	Hi Priority	Z>2 ions, 0.49-8.3 MeV/nuc	"
12	Protons	H, 0.8-6 MeV	"

Note: “e-” denotes electrons

Appendix 4 - HILT count rates

The 24 HILT Count Rates are described in Table A-4.1.

Table A-4.1 HILT Count Rates

Rate #	*Rate Acronym*	*Rate Description*	*Live time %*
1	HE1	4.3 - 9 MeV/nuc He	100
2	HE2	9.0 - 30 MeV/nuc He	"
3	HZ1	Z≥6, 8.2 - 42 MeV/nuc for Oxygen	"
4	HZ2	42 - 220 MeV/nuc Z≥6	"
5	SSD1	>5 MeV/nuc Z≥1	25%
6	SSD2	>5 MeV/nuc Z≥1	"
7	SSD3	>5 MeV/nuc Z≥1	"
8	SSD4	>5 MeV/nuc Z≥1	"
9	STROBE	Z≥1 (>2.5 MeV for H)	12.5%
10	PCFE	Front proportional counter Z≥1 (>2.5 MeV for H)	"
11	IK	Z≥2 (>3 MeV/nuc for He)	"
12	CSI	Cesium Iodide Z≥1 (>22 MeV for H)	"
13	PCRE	Rear proportional counter	"
14	NO	diagnostic engineering rate	"
15	PILEUP	sensor diagnostic rate	"
16	INVARR	Invalid array - (sensor diagnostic)	"
17	IDLEHI	Idle high (live time)	100
18	IDLELO	Idle low (live time)	"
19	*varies*	*see Tables A4.2 (a. b, and c) below*	"
20	"	"	"
21	"	"	"
22	"	"	"
23	"	"	"
24	"	"	"

IMPORTANT NOTE: The accumulator totals for rates 1-2 (HE1, HE2, HZ1, HZ2) are corrected to reflect deadtime, proportional counter gain changes, and background level. With this correction made, the HILT Rates 1-4 accumulator totals in the Count Rate files are then used directly to calculate the HILT fluxes taking account of time coverage, energy range, and geometrical factors.

The HILT high resolution rate accumulators are assigned by the DPU, and can be changed by modifying the DPU bootlist. In Table A-4.1, the high resolution rates are identified only by slot number. The contents of the slots are given below in Table A-4.2(a-c) below. Dates for which each table applies are listed in each case. For additional details of the operation, contact Dr. J. B. Blake, Aerospace Corporation, El Segundo, CA (JBernard.Blake@aero.org).

Table A-4.2(a) HILT high resolution count rates
DPU - original (launch) configuration; for the period
Launch through 3/25/94 19:09:59 (day 84)

Rate #	*Rate Acronym*	*Rate Description*	*frequency*
19	HSSD1	>5 MeV/nuc Z≥1	100 ms
20	HSSD2	>5 MeV/nuc Z≥1	"
21	HSSD3	>5 MeV/nuc Z≥1	"
22	HSSD4	>5 MeV/nuc Z≥1	"
23	HIK	predominantly 3-9 MeV/nuc He	"
24	HPCRE	Rear proportional counter	"

Table A-4.2(b) HILT high resolution count rates
DPU version 2.2; for the period
3/25/94 19:09:59 (day 84) to 8/25/94 21:00:34 (day 327)

Rate #	*Rate Acronym*	*Rate Description*	*frequency*
19	HSSD1	>5 MeV/nuc Z≥1	20ms
20	HSSD1	>5 MeV/nuc Z≥1	"
21	HSSD1	>5 MeV/nuc Z≥1	"
22	HSSD4	>5 MeV/nuc Z≥1	100 ms
23	HSSD1	>5 MeV/nuc Z≥1	20 ms
24	HSSD1	>5 MeV/nuc Z≥1	"

Table A-4.2(c) HILT high resolution count rates
DPU version 2.3; for the period
8/25/94 21:00:34 (day 327) to 11/15/95 21:49:29 (day 319)

Rate #	*Rate Acronym*	*Rate Description*	*frequency*
19	HSSD1	>5 MeV/nuc Z≥1	30 ms
20	HPCRE	Rear proportional counter	"
21	HSSD1	>5 MeV/nuc Z≥1	"
22	HPCRE	Rear proportional counter	"
23	HPCRE	Rear proportional counter	"
24	HSSD1	>5 MeV/nuc Z≥1	"

Note: the last HILT in-calibration data before running out of proportional counter gas was on 11/15/1995 21:49:29. All NSSDC HILT data after this time is out of calibration and is set to "fill".

Appendix 5 - MAST count rates

The 78 MAST count rates are described in Table A-5.1.

Table A-5.1 MAST Rates

Rate #	*Rate Acronym*	*Rate Description*	*Subcom*
1	Z1SEC	OR of Z1R0, R1, R2 (almost all proton chance coincidences)	All
2	ADCOR	Trigger of any ADC; protons >~3 MeV, detector noise	All
3	LIVE	Live time pulser; 732 counts/6 seconds = 99.7%	All
4	PEN	Mostly CNO > ~150 MeV/nuc	All **
5	Z1	Almost all proton chance coincidences	All
6	Z2	He 8-15 MeV/nuc (5-15 in some periods)	All
7	HIZR0	Z ≥ 6, 17-19.5 MeV/nuc for O (14.5-19.5 for some periods)	All
8	HIZR1	Z ≥ 6, 19.5 - 23 MeV/n Oxygen 12.5 cm^2 sr	All
9	HIZR2	Z ≥ 6, 23 - 31.1 MeV/n Oxygen 12.5 cm^2 sr	All
10	HIZR3	Z ≥ 6, 31.1 - 51.9 MeV/n Oxygen 12.2 cm^2 sr	All
11	HIZR4	Z ≥ 6, 51.9 - 76.5 MeV/n Oxygen 11.7 cm^2 sr	All
12	HIZR5	Z ≥ 6, 76.5 - 113 MeV/n Oxygen 10.2 cm^2 sr	All
13	HIZR6	Z ≥ 6, 113 - 156 MeV/n Oxygen 8.1 cm^2 sr	All **
14	Rate 17	M1XSA: M1 Z2-level discriminator	6
15	Rate 17	M1XSB: M1 HIZ level discriminator	7
16	Rate 17	M2YSA: M2 Z2-level discriminator	8
17	Rate 17	M2YSB: M2 HIZ level discriminator	9
18	Rate 17	M3XSA: M3 Z2-level discriminator	10
19	Rate 17	M3XSB: M3 HIZ level discriminator	11
20	Rate 17	M4YSA: M4 Z2-level discriminator	12
21	Rate 17	M4YSB: M4 HIZ level discriminator	13
22	Rate 17	D1A: D1 Z2-level discriminator	14
23	Rate 17	D1B: D1 HIZ level discriminator	15
24	Rate 17	D2A: D2 Z2-level discriminator	16
25	Rate 17	D2B: D2 HIZ level discriminator	17
26	Rate 17	D3A: D3 Z2-level discriminator	18
27	Rate 17	D3B: D3 HIZ level discriminator	19
28	Rate 17	D4A: D4 Z2-level discriminator	20
29	Rate 17	D4B: D4 HIZ level discriminator	21

30	Rate 16	M1X1: M1 position ADC trigger	6
31	Rate 16	M1XS: M1 ADC trigger	7
32	Rate 16	M2Y1: M2 position ADC trigger	8
33	Rate 16	M2YS: M2 ADC trigger	9
34	Rate 16	M3X1: M3 position ADC trigger	10
35	Rate 16	M3XS: M3 ADC trigger	11
36	Rate 16	M4Y1: M4 position ADC trigger	12
37	Rate 16	M4YS: M4 ADC trigger	13
38	Rate 16	D1: D1 ADC trigger	14
39	Rate 16	D2: D2 ADC trigger	15
40	Rate 16	D3: D3 ADC trigger	16
41	Rate 16	D4: D4 ADC trigger	17
42	Rate 16	D5: D5 ADC trigger	18
43	Rate 16	D6: D6 ADC trigger	19
44	Rate 16	G1: Low-level anticoincidence guard	20
45	Rate 16	G2: High-level anticoincidence guard	21
46	Rate 18	D7: D7 discriminator	6 **
47	Rate 18	G35L: LL anticoincidence guard D3 or D5	7
48	Rate 18	G35H: HL anticoincidence guard D3 or D5	8
49	Rate 18	G47L: LL anticoincidence guard D4 or D7	9
50	Rate 18	G47H: HL anticoincidence guard D4 or D7	10
51	Rate 18	G6L: LL anticoincidence guard D6	11
52	Rate 18	G6H: HL anticoincidence guard D6	12
53	Rate 18	HAZ: ADC trigger close to previous ADC trigger	13
54	Rate 18	D5A: D5 Z2-level discriminator	14
55	Rate 18	D5B: D5 HIZ-level discriminator	15
56	Rate 18	D6A: D6 Z2-level discriminator	16
57	Rate 18	D6B: D6 HIZ-level discriminator	17
58	Rate 18	M12: Logical AND of M1 & M2	18
59	Rate 18	M34: AND of M3 & M4 (=M3 in certain periods)	19
60	Rate 18	L: OR of Z2-level discriminators	20
61	Rate 18	H: OR of HIZ-level discriminators	21
62	Z1R	Z1R0: Nominal stop in M4 (or M3 in certain periods) -- see also R69 for add'l readouts	6,14
63	Z1R	Z1R1: Nominal proton stop in D1 (mostly chance coinc.)	7,15
64	Z1R	Z1R2: Nominal proton stop in D2 (mostly chance coinc.)	8,16
65	Z1R	Z1R3: Nominal proton stop in D3 (mostly chance coinc.)	9,17

66	Z1R	Z1R4: Nominal proton stop in D4 (mostly chance coinc.)	10,18
67	Z1R	Z1R5: Nominal proton stop in D5 (mostly chance coinc.)	11,19
68	Z1R	Z1R6: Nominal proton stop in D6 (mostly chance coinc.)	12,20 **
69	Z1R	Z1R0: Nominal stop in M4 (or M3 in certain periods)	13,21
70	Z2R	Z2R0: Prob. He stop in M4 (or M3 in certain periods) -- see also R77 for add'l readouts	6,14
71	Z2R	Z2R1: Probable He stop in D1	7,15
72	Z2R	Z2R2: Probable He stop in D2	8,16
73	Z2R	Z2R3: Probable He stop in D3	9,17
74	Z2R	Z2R4: Nominal He stop in D4 (mostly chance coinc.)	10,18
75	Z2R	Z2R5: Nominal He stop in D5 (mostly chance coinc.)	11,19
76	Z2R	Z2R6: Nominal He stop in D6 (mostly chance coinc.)	12,20 **
77	Z2R	Z2R0: Prob. He stop in M4 (or M3 in certain periods)	13,21
78	HIZSUM	OR of HIZRx	All **

** Note: Rates marked above by shading (#4, 13, 46, 68, 76, and 78) are affected by the failure of the D7 detector around 21:51 UT on March 1, 2000 (day 61). After this time, PEN (#4) and D7 (#46) are identically 0. The remaining rates all increase since the anti-coincidence condition is removed, thus increasing the energy window.

8/15/07: Subcoms for rates 62 and 70 corrected

Appendix 6 - PET count rates

The 33 PET count rates are described in Table A-6.1

Table A-6.1 PET Count Rates

Rate #	*Rate Acronym*	*Rate Description*	*Subcom*
1	PHI	Protons 28-60 MeV (sometimes no upper limit) 1.5 cm^2 sr	All
2	EHI	Electrons 4-15 MeV (sometimes no upper limit) 1.5 cm^2 sr	All
3	PLO	Protons 19-28 MeV (some periods = P1A) 1.65 cm^2 sr	All
4	ELO	Electrons 2-6 MeV (some periods = P1ADC) 1.65 cm^2 sr	All
5	EWG	Electrons wide geometry 4-30 MeV (sometimes no upper limit)	All
6	LIVE	Live time pulser 732/6 seconds = 99.7%	All
7	PEN	Protons > 85 MeV, Electrons > 30 MeV 0.25 cm^2 sr	All
8	RNG	Protons > 60 MeV, electrons > 15 MeV 0.4 cm^2 sr	All
9	MUX1	P1ADC: electrons > 400 keV, protons > ~2 MeV	6, 14
10	MUX1	ADC OR: Any ADC trigger, electrons > 400 keV, protons > ~2 MeV	7,1 5
11	MUX1	P2ADC: electrons > ~800 keV, protons > ~25 MeV	8, 16
12	MUX1	AL: low level anticoincidence trigger	9, 17
13	MUX1	P3ADC: Electrons > ~3 MeV, protons > ~25 MeV	10, 18
14	MUX1	AH: High-level anticoincidence trigger	11, 19
15	MUX1	P47ADC: He ~75-90 MeV/nuc	12, 20
16	MUX1	HAZ: ADC trigger close to previous ADC trigger	13, 21
17	MUX1	HAZ: ADC trigger close to previous ADC trigger NOTE REPEATED RATE!	13, 21
18	MUX2	P4 discriminator, Electrons > 15 MeV, H, He > 60 MeV/nuc	6

19	MUX2	P5 discriminator, Electrons > 18 MeV, H, He > 64 MeV/nuc	7
20	MUX2	P6 discriminator, Electrons > 22 MeV, H, He > 70 MeV/nuc	8
21	MUX2	P7 discriminator, Electrons > 26 MeV, H, He > 77 MeV/nuc	9
22	MUX1	P8 discriminator, Electrons > 30 MeV, H, He > 85 MeV/nuc	10
23	MUX1	A3L: Low-level anticoincidence guard on P3	11
24	MUX1	A3H: High-level anticoincidence guard on P3	12
25	MUX1	A4L: Low-level anticoincidence guard on P4	13
26	MUX1	A4H: High-level anticoincidence guard on P4	14
27	MUX1	A57L: Low-level anticoincidence guard on P5 or P7	15
28	MUX1	A57H: High-level anticoincidence guard on P5 or P7	16
29	MUX1	A68L: Low-level anticoincidence guard on P6 or P8	17
30	MUX1	A68H: High-level anticoincidence guard on P6 or P8	18
31	MUX1	P1A: Proton-level disc. on P1; H, He, some electrons > 4 MeV	19
32	MUX1	P3A: P3 low-level discriminator	20
33	RLEHE	Ratio of ELO to EHI fluxes	All

Missing rate due to repeat of #16 (8/15/07)

	MUX1	P3B: P3 high-level discriminator	21

Appendix 7 - Fluxes (LICA, HILT, MAST, PET)

The fluxes from all instruments are described in Table A-7.1.

Table A-7.1 Fluxes

Flux item	*Rate*	*Energy Range*	*Dominant Particle*	*Geom. Factor (cm^2sr)*	*Saturation Flag*
LICA 1	SSD	>0.8 MeV >0.6 MeV	Ions and e-	0.64	SSD sum > 10^4 /s
LICA 2	LoPriority	0.5-6.6 MeV/n	Z ≥ 1 (Mainly Helium)	0.58	Start MCP > 10^4 /s
LICA 3	HiPriority	0.49-8.3 MeV/n	Z ≥ 6	0.58	Stop MCP > 10^4 /s
HILT 1	HE2	4-9 MeV/n	Helium	60.0	See notes
HILT 2	HE1	9-38 MeV/n	Helium	60.0	"
HILT 3	HZ2	8.2-42 MeV/n	Z ≥ 6	60.0	"
HILT 4	HZ2	41-220 MeV/n	Z ≥ 6	60.0	"
MAST 1	M12	5-12 MeV	Z ≥ 1 (Mainly Protons)	6.6	ADC > 1 x10^4 /s
MAST 2	Z2	8-15 MeV/n	Helium	10	"
MAST 3	HIZR1	19.3-22.8 MeV/n	Z ≥ 6	12.5	"
MAST 4	HIZR1	22.8-31.0 MeV/n	Z ≥ 6	12.5	"
MAST 5	HIZR3	31.0-51.7 MeV/n	Z ≥ 6	12.2	"
MAST 6	HIZR4	51.7-76.2 MeV/n	Z ≥ 6	11.7	"
MAST 7	HIZR5	76.2-113 MeV/n	Z ≥ 6	10.1	"
MAST 8	HIZR6	113-156 MeV/n	Z ≥ 6	8.1	" **
PET 1	ELO	1.5-6.0 MeV	e-	1.0	P1HI > 10^4 /s
PET 2	EHI	2.5-14 MeV	e-	0.8	"
PET 3	PLO	19-27 MeV/n	Z ≥ 1 (Mainly Protons)	1.8	"

Notes: Z>1 energy ranges are for oxygen.

Flux 1-σ standard uncertainties due to statistics (*1/sqrt(N)*) *only*.

** Note: The rate MAST 8 (shaded row above) is affected by the failure of the D7 detector around 21:51 UT on March 1, 2000 (day 61). After this time the rate increases since the anti-coincidence condition is removed, thus increasing the energy window from 113-156 MeV/nucleon to >113 MeV/nucleon

Saturation Corrections and Efficiency Corrections for fluxes:

The HILT, MAST, and PET instruments include instrument livetime counters that are used to correct the fluxes due to instrument deadtime. These corrections can have the effect of correcting the rate by more than a factor of 10 under high count rate conditions. When deadtime corrections are important, the saturation Data Quality Flag is raised to indicate that the fluxes are out of calibration.

The 4 HILT fluxes are also affected by drift in the proportional counter and background effects. The HILT proportional counter gain decreased with time during the mission, as is typical for this type of device. The gain decrease modifies the energy range for the HILT fluxes, and this has been corrected for in the flux calculation. In addition, HILT fluxes are subject to background under very quiet conditions, and this background has been taken into account in the flux calculation.

The LICA instrument has triggering efficiencies for electrons, H, and He that are substantially less than 1.

> For the **LICA 1 flux**, the overall correction depends on the mix of species triggering the SSDs, and so the calculation of calibrated flux of ions or electrons is not possible. Rather, the LICA 1 flux should be considered a qualitative measure of low energy ions and electrons only.
>
> The **LICA 2 flux** is primarily Helium, that had an average triggering efficiency of about 6% at launch. After that time, the efficiency for Helium varied as the microchannel plates aged due to repeated exposure to the radiation belts. To counteract that, the LICA MCP bias was adjusted periodically throughout the mission, but nevertheless the LICA 2 triggering efficiency varied with time. The overall efficiency at any given time was determined from the MCP gain settings, along with comparison with prelaunch data and spectral comparisons with the HILT sensor. For the flux calculation here, the efficiency was calculated as a function of time and used to correct the flux.

Appendix 8 - Data Quality Flag Overview

Appendices 9, 10, 11, and 12 define the data quality flags for the count rate files and flux files. Data quality flags are interpreted as follows:

1) if ALL quality flags for an instrument = 0 (good), then the data is in calibration.
2) if ANY quality flag = 1 (bad), then there are two possibilities:
   a) data (counts or fluxes) set to FILL (ISTP standard used)
   b) data is included but is not in calibration
3) if several quality flags are set = 1, then the data will be set to FILL unless the only flags set are those that are associated with out-of calibration conditions.

The tables in the following appendices list the flags and conditions for setting the flags for each instrument for both flux and count rate data files.

Most of the flags are self explanatory; however, a general flag has been included called the "*significant event*" flag. This refers to periods when the instrument data is out of calibration for miscellaneous reasons not covered in the other flags, which refer mostly to routine events on the spacecraft. Examples of significant event flags are:

- spacecraft safehold operation (all instruments affected)
- times when the spacecraft attitude control system memory allocation in the spacecraft data system was filled (all instruments affected)
- times when the HILT closable cover was being cycled; times when the HILT isobutane system was being tested, or was turned off to conserve expendables (HILT affected), or after the HILT isobutane supply was exhausted. *NOTE: the HILT isobutane supply was exhausted on November `15, 1995.*
- times when the MAST or PET logic was commanded into special operating states which affected the calibration temporarily; or when the MAST/PET low voltage power supply was operating out of regulation (either MAST and/or PET affected)

ISTP Standard Fill Values

INT*4	-2147483648

REAL*4	-1.000000E+31

Appendix 9 - LICA data quality flags

There are two categories of data quality flags for each instrument, those associated with 30-second averaged counts and fluxes and those associated with polar averaged counts and fluxes.

	LICA 30 Second Average Data quality flags		
No.	**Data quality flag Name**	**Flagging Conditions**	**Action taken if flag = 1**
1	LICA_OFF	Set = 1 when LICA is off during any portion of the 30 second averaging interval; Set = 0 when LICA is on for the entire 30 second averaging interval.	Counts and fluxes are set to FILL.
2	LICA_IFC	Set = 1 when LICA IFC is active during any portion of the 30 second averaging interval; Set = 0 when LICA IFC is inactive for the entire 30 second averaging interval.	Counts and fluxes are set to FILL.
3	LICA_BHV	Set = 1 when LICA HV is out of calibration at any time during 30 second averaging interval as indicated in the file LEICA_BAD_HV.DAT; Set = 0 otherwise.	Counts and fluxes are set to FILL.
4	LICA_SSD_SAT	Set = 1 when (SSD1+SSD1+SSD3+SSD4) > 1.0E4/sec at any time during 30 second averaging interval; Set = 0 otherwise.	Data have been included but are out of calibration.
5	LICA_MCP_SAT	Set = 1 when START MCP rate > 1.0E4/sec at any time during 30 second averaging interval; Set = 0 otherwise.	Data have been included but are out of calibration.
6	LICA_SIG	Set = 1 when LICA is affected by significant event at any time during 30 second averaging interval; Set = 0 otherwise.	Counts and fluxes are set to FILL.

	LICA Polar Cap Data quality flags		
No.	**Data quality flag Name**	**Flagging Conditions**	**Action taken if flag = 1**
1	POLE_SSD_SAT	Set = 1 if *any* 30 second averaged (SSD1+SSD1+SSD3+SSD4) count during polar pass interval has its associated saturation flag set; Set = 0 otherwise.	Data have been included but are out of calibration.
1	POLE_MCP_SAT	Set = 1 if *any* 30 second averaged START count during polar pass interval has its associated saturation flag set; Set = 0 otherwise.	Data have been included but are out of calibration.
3	LICA_PARTIAL	Set = 1 if *any* of LICA_OFF, LICA_IFC, LICA_SIG or LICA_BHV flags were set during part, but not all of the polar pass accumulation period. Set = 0 otherwise.	Data are in calibration, but some data were excluded.
4	LICA_BAD	Set = 1 if *any* combination of LICA_OFF, LICA_IFC, LICA_SIG or LICA_BHV flags being set caused no accumulation of data during the entire polar pass interval. Set = 0 otherwise.	Counts and fluxes are set to FILL.

–

Appendix 10 - HILT data quality flags

There are two categories of data quality flags for each instrument, those associated with 30-second averaged counts and fluxes and those associated with polar averaged counts and fluxes.

	HILT 30 Second Average Data quality flags		
No.	**Data quality flag Name**	**Flagging Conditions**	**Action taken if flag = 1**
1	HILT_OFF	Set = 1 when HILT is off at any time during 30 second averaging interval. Set = 0 when HILT is on for the entire 30 second averaging interval.	Counts and fluxes are set to FILL.
1	HILT_IFC	Set = 1 when HILT IFC is active at any time during 30 second averaging interval, Set = 0 when HILT IFC is inactive for the entire 30 second averaging interval.	Counts and fluxes are set to FILL.
3	HILT_HE1_SAT	Set = 1 when HILT HE1 rate deadtime is >90% or if background or calibration uncertainties are large; Set = 0 otherwise.	Data have been included but are out of calibration.
4	HILT_HE2_SAT	Set = 1 when HILT HE1 rate deadtime is >90% or if background or calibration uncertainties are large; Set = 0 otherwise.	Data have been included but are out of calibration.
5	HILT_HZ1_SAT	Set = 1 when HILT HZ1 rate deadtime is >90% or if background or calibration uncertainties are large; Set = 0 otherwise.	Data have been included but are out of calibration.
6	HILT_HZ1_SAT	Set = 1 when HILT HZ2 rate deadtime is >90% or if background or calibration uncertainties are large; Set = 0 otherwise.	Data have been included but are out of calibration.

7	HILT_SIG	Set = 1 when HILT is affected by significant event at any time during 30 second averaging interval; Set 0 otherwise.	Counts and fluxes are set to FILL.

	HILT Polar Cap Data quality flags		
No.	**Data quality flag Name**	**Flagging Conditions**	**Action taken if flag = 1**
1	POLE_HE1_SAT	Set = 1 if *any* 30 second averaged HE1 count during polar pass interval has its associated saturation flag set; Set = 0 otherwise.	Data have been included but are out of calibration.
1	POLE_HE1_SAT	Set = 1 if *any* 30 second averaged HE1 count during polar pass interval has its associated saturation flag set; Set = 0 otherwise.	Data have been included but are out of calibration.
3	POLE_HZ1_SAT	Set = 1 if *any* 30 second averaged HZ1 count during polar pass interval has its associated saturation flag set; Set = 0 otherwise.	Data have been included but are out of calibration.
4	POLE_HZ1_SAT	Set = 1 if *any* 30 second averaged HZ1 count during polar pass interval has its associated saturation flag set; Set = 0 otherwise.	Data have been included but are out of calibration.
5	HILT_PARTIAL	Set = 1 if *any* of HILT_OFF, HILT_IFC or HILT_SIG flags were set during part, but not all of the polar pass accumulation period. Set = 0 otherwise.	Data are in calibration, but some data were excluded.
6	HILT_BAD	Set = 1 if *any* combination of HILT_OFF, HILT_IFC or HILT_SIG flags being set caused no accumulation of data during the entire polar pass interval. Set = 0 otherwise.	Counts and fluxes are set to FILL.

Appendix 11 - MAST data quality flags

There are two categories of data quality flags for each instrument, those associated with 30-second averaged counts and fluxes and those associated with polar averaged counts and fluxes.

	MAST 30 Second Average Data quality flags		
No.	**Data quality flag Name**	**Flagging Conditions**	**Action taken if flag = 1**
1	MAST_OFF	Set = 1 if is off during any portion of the 30 second averaging interval; Set = 0 when is on for the entire 30 second averaging interval.	Counts and fluxes are set to FILL.
1	MAST_IFC	Set = 1 if IFC is active during any portion of the 30 second averaging interval; Set = 0 when IFC is inactive for the entire 30 second averaging interval.	Counts and fluxes are set to FILL.
3	MAST_SIG	Set = 1 when is affected by significant event at any time during 30 second averaging interval; Set = 0 otherwise.	Counts and fluxes are set to FILL.
4	MAST_ADC_SAT	Set = 1 when ADCOR rate > 1.0E4/sec at any time during 30 second averaging interval; Set = 0 otherwise.	Data have been included but are out of calibration.

	MAST Polar Cap Data quality flags		
No.	**Data quality flag Name**	**Flagging Conditions**	**Action taken if flag = 1**
1	POLE_ADC_SAT	Set = 1 if *any* 30 second averaged ADCOR count during polar pass interval has its associated saturation flag set; Set = 0 otherwise.	Data have been included but are out of calibration.
1	MAST_PARTIAL	Set = 1 if *any* of MAST_OFF, MAST_IFC, or MAST_SIG flags were set during part, but not all of the polar pass accumulation period. Set = 0 otherwise.	Data are in calibration, but some data were excluded.
3	MAST_BAD	Set = 1 if *any* combination of MAST_OFF, MAST_IFC or MAST_SIG flags being set caused no accumulation of data during the entire polar pass interval. Set = 0 otherwise.	Counts and fluxes are set to FILL.

Appendix 12 - PET data quality flags

There are two categories of data quality flags for each instrument, those associated with 30-second averaged counts and fluxes and those associated with polar averaged counts and fluxes.

	PET 30 Second Average Data quality flags		
No.	**Data quality flag Name**	**Flagging Conditions**	**Action taken if flag = 1**
1	PET_OFF	Set = 1 if PET is off during any portion of the 30 second averaging interval; Set = 0 when PET is on for the entire 30 second averaging interval.	Counts and fluxes are set to FILL.
1	PET_IFC	Set = 1 if PET IFC is active during any portion of the 30 second averaging interval; Set = 0 when PET IFC is inactive for the entire 30 second averaging interval.	Counts and fluxes are set to FILL.
3	PET_SIG	Set = 1 when PET is affected by significant event at any time during the 30 second averaging interval; Set = 0 otherwise.	Counts and fluxes are set to FILL.
4	PET_P1HI_SAT	Set = 1 when PET P1HI rate > 1.0E4/sec at any time during the 30 second averaging interval; Set = 0 otherwise.	Data have been included but are out of calibration.

	PET Polar Cap Data quality flags		
No.	**Data quality flag Name**	**Flagging Conditions**	**Action taken if flag = 1**
1	POLE_P1HI_SAT	Set = 1 if *any* 30 second averaged P1HI count during polar pass interval has its associated saturation flag set; Set = 0 otherwise.	Data have been included but are out of calibration.
1	PET_PARTIAL	Set = 1 if *any* of PET_OFF, PET_IFC, or PET_SIG flags were set during part, but not all of the polar pass accumulation period. Set = 0 otherwise.	Data are in calibration, but some data were excluded.
3	PET_BAD	Set = 1 if *any* combination of PET_OFF, PET_IFC or PET_SIG flags being set caused no accumulation of data during the entire polar pass interval. Set = 0 otherwise.	Counts and fluxes are set to FILL.

Appendix 13 - Reference Documents

SAMPEX Master Data File Description Document # PP94 - 116, Version 1.0, 6 April 1994 Department of Physics, Space Physics Group_University of Maryland College Park, MD 10741

Telemetry Packet Description for the SAMPEX Data Processing Unit (DPU), prepared by Space Science Laboratory, the Aerospace Corporation, 26 August 1991, document SAM-1-O-08195 Rev C.

Small Explorer Project Data Management Plan for Solar Anomalous and Magnetospheric Explorer. SAMPEX-MGMT-018, 18 March 1994 Goddard Space Flight Center Greenbelt, MD

An Overview of the Solar, Anomalous, and Magnetospheric Particle Explorer (SAMPEX) Mission, D. N. Baker, G. M. Mason, O. Figueroa, G. Colon, J. G. Watzin, and R. M. Aleman, IEEE Transactions on Geoscience and Remote Sensing, Vol. 31, No., 3, May 1993, p 531.

HILT: A Heavy Ion Large Area Proportional Counter Telescope for Solar and Anomalous Cosmic Rays. B. Klecker, et al. IEEE Transactions on Geoscience and Remote Sensing, Vol. 31, No. 3, May 1993, p. 542.

LEICA: A Low Energy Ion Composition Analyzer for the Study of Solar and Magnetospheric Heavy Ions. G. M. Mason, et al. IEEE Transactions on Geoscience and Remote Sensing, Vol. 31, No. 3, May 1993, p. 549.

MAST: A Mass Spectrometer Telescope for Studies of the Isotopic Composition of Solar, Anomalous, and Galactic Cosmic Ray Nuclei. W. R. Cook, et al. IEEE Transactions on Geoscience and Remote Sensing, Vol. 31, No. 3, May 1993, p. 557.

PET: A Proton/Electron Telescope for Studies of Magnetospheric, Solar, and Galactic Particles. W. R. Cook, et al. IEEE Transactions on Geoscience and Remote Sensing, Vol. 31, No. 3, May 1993, p. 565.

The SAMPEX Data Processing Unit, D. J. Mabry, S. J. Hansel, and J. B. Blake, IEEE Transactions on Geoscience and Remote Sensing, Vol. 31, No. 3, May 1993, p. 572.

NSSDC CDF User's Guide Version 1.4, February 15, 1994 National Space Science Data Center Goddard Space Flight Center Greenbelt, MD

International Solar-Terrestrial Physics (ISTP) Key Parameter Generation Software (KPGS) Standards and Conventions W. H. Mish Version 1.3, March, 1994 Goddard Space Flight Center Greenbelt, MD__