NASA/CR-97- 207336

AEROSPACE REPORT NO.
ATR-97(7400)-1

Data Recovery From SCATHA Satellite

15 September 1997

Prepared by

J. F. FENNELL, G. M. BOYD, M. T. REDDING,
and M. C. McNAB
Space and Environment Technology Center
Technology Operations

Prepared for

European Space Research and Technology Centre
Noordwijk, The Netherlands

Contract No. 11006/94/NL/CC

National Aeronautics and Space Administration
Washington, DC 20546

Grant No. NAGW-4141

Engineering and Technology Group

THE AEROSPACE CORPORATION
El Segundo, California

TECHNOLOGY OPERATIONS

The Aerospace Corporation functions as an "architect-engineer" for national security programs, specializing in advanced military space systems. The Corporation's Technology Operations supports the effective and timely development and operation of national security systems through scientific research and the application of advanced technology. Vital to the success of the Corporation is the technical staff's wide-ranging expertise and its ability to stay abreast of new technological developments and program support issues associated with rapidly evolving space systems. Contributing capabilities are provided by these individual Technology Centers:

Electronics Technology Center: Microelectronics, VLSI reliability, failure analysis, solid-state device physics, compound semiconductors, radiation effects, infrared and CCD detector devices, Micro-Electro-Mechanical Systems (MEMS), and data storage and display technologies; lasers and electro-optics, solid state laser design, micro-optics, optical communications, and fiber optic sensors; atomic frequency standards, applied laser spectroscopy, laser chemistry, atmospheric propagation and beam control, LIDAR/LADAR remote sensing; solar cell and array testing and evaluation, battery electrochemistry, battery testing and evaluation.

Mechanics and Materials Technology Center: Evaluation and characterization of new materials: metals, alloys, ceramics, polymers and composites; development and analysis of advanced materials processing and deposition techniques; nondestructive evaluation, component failure analysis and reliability; fracture mechanics and stress corrosion; analysis and evaluation of materials at cryogenic and elevated temperatures; launch vehicle fluid mechanics, heat transfer and flight dynamics; aerothermodynamics; chemical and electric propulsion; environmental chemistry; combustion processes; spacecraft structural mechanics, space environment effects on materials, hardening and vulnerability assessment; contamination, thermal and structural control; lubrication and surface phenomena; microengineering technology and microinstrument development.

Space and Environment Technology Center: Magnetospheric, auroral and cosmic ray physics, wave-particle interactions, magnetospheric plasma waves; atmospheric and ionospheric physics, density and composition of the upper atmosphere, remote sensing using atmospheric radiation; solar physics, infrared astronomy, infrared signature analysis; effects of solar activity, magnetic storms and nuclear explosions on the earth's atmosphere, ionosphere and magnetosphere; effects of electromagnetic and particulate radiations on space systems; space instrumentation; propellant chemistry, chemical dynamics, environmental chemistry, trace detection; atmospheric chemical reactions, atmospheric optics, light scattering, state-specific chemical reactions and radiative signatures of missile plumes, and sensor out-of-field-of-view rejection.

AEROSPACE REPORT NO.
ATR-97(7400)-1

DATA RECOVERY FROM SCATHA SATELLITE

Prepared by

J. F. FENNELL, G. M. BOYD, M. T. REDDING,
and M. C. McNAB
Space and Environment Technology Center
Technology Operations

15 September 1997

Engineering and Technology Group
THE AEROSPACE CORPORATION
El Segundo, CA 90245-4691

Prepared for

European Space Research and Technology Centre
Noordwijk, The Netherlands

Contract No. 11006/94/NL/CC

National Aeronautics and Space Administration
Washington, DC 20546

Grant No. NAGW-4141

AEROSPACE REPORT NO.
ATR-97(7400)-1

DATA RECOVERY FROM SCATHA SATELLITE

Prepared

J. F. Fennell
Space Sciences Department

J. F. Fennell for G. M. Boyd

G. M. Boyd
Space Sciences Department

M. T. Redding
Space Sciences Department

M. C. McNab
Space Sciences Department

Approved

J. B. Blake, Director
Space Sciences Department
Space and Environment Technology Center

A. B. Christensen, Principal Director
Space and Environment Technology Center
Technology Operations

Abstract

This document gives a brief description of the SCATHA (P78-2) satellite and consolidates into one location information relevant to the generation of the SCATHA Summary Data parameters for the European Space Agency (ESA), under ESTEC Contract No. 11006/94/NL/CC, and the National Aeronautics and Space Administration (NASA), under Grant No. NAGW-4141. Included are descriptions of the instruments from which the Summary Data parameters are generated, their derivation, and archival.

Any questions pertaining to the Summary Data parameters should be directed to Dr. Joseph Fennell.

Preface

This report fulfills two separate purposes. First, it is the final report for both the ESA Contract (No. 110006/94/NL/CC) and the NASA Grant (NAGW-4141) that enabled the SCATHA data to be recovered from decaying storage media and archived in a more permanent form; the funds also made it possible to put the data into a more accessible form. For example, all the recovered data are now archived as Common Data Format (CDF) files. Second, the summary or key parameter-type data generated for the whole dataset are available in CDF form and can be viewed via the Internet at the Uniform Resource Locator (URL): http://uss-enterprise.bu.edu/BUSPACE/SCATHA/scatha.html. (The Internet site was set up at Boston University and funded under a separate grant.)

This report is also intended as a reference document for the archived SCATHA dataset. The intent was to gather, in one place, all information available to The Aerospace Corporation concerning the measurements and the conversion of the data to physical units.

Acknowledgment

We would like to acknowledge Dr. Harlan Spence, who started the negotiations for this project prior to transferring to Boston University. Harlan also took the lead in establishing the SCATHA summary data web site at Boston University and provided many useful insights during the data recovery effort. We would also like to thank Drs. Alan Roux of CNET/CETP, Rudi Schmidt at ESTEC, Jim Willett at NASA, and David Siebek of Applied Physics Laboratory. They provided useful comments and significant support to the data recovery effort.

Contents

Figures

Tables

1. Introduction

1.1 Background

The Cluster mission comprises four spacecraft forming a tetrahedron in space. The spacecraft will fly in formation through key plasma regions in geospace, thereby providing, for the first time ever, true three-dimensional measurements of the most important plasma parameters.

The Cluster dataset will be used to remove ambiguities between spatial and temporal variations of the plasma environment, to resolve three-dimensional structures, and to characterize plasma turbulence. In order to achieve these goals, it is necessary to design new diagnostic tools to analyze the four spacecraft's data and to test these tools with data from existing satellites with appropriate orbits and instrumentation. An early attempt to compile a multi-spacecraft dataset for simulation purposes will also be important to the smooth operations of the Cluster mission because there is only a limited amount of fuel to actively maintain the Cluster configuration.

For these reasons, it is essential to build a multi-spacecraft database from GEOS-2, ISEE, AMPTE, and SCATHA (Spacecraft Charging AT High Attitudes). This set would include, for certain periods, data from three to four spacecraft. GEOS, ISEE, and AMPTE data are publicly available in Europe. SCATHA data, however, are not presently available in properly decommutated and scientific units. A database of summary parameters utilizing outputs from selected SCATHA sensors will be created for delivery to the European Space Agency (ESA).

Separately, NASA has had an ongoing program to maintain, archive, and make universally available important science datasets. The SCATHA dataset was one that the science community felt had made important contributions and that was scientifically very valuable because of the completeness and quality of the science instrumentation it carried. Much new science could be and was being performed at a low level with the SCATHA dataset. The main impediment to using the dataset was that a complete dataset was not available from a single source. Most of the principal investigators retained copies only of data pertaining to their own instrument. The Aerospace Corporation had the most complete set of SCATHA data. However, the data was stored on decaying tapes that were in a little-used CDC 60-bit word format that was not easily read on the most common computers. The Aerospace tapes basically contained the unprocessed raw telemetry data. The science data was not broken out nor was it in physical units. The science community wanted the data to be salvaged but in a more usable form. Thus, Aerospace was chosen to perform the data recovery and to put the SCATHA data into science units and in an easily accessible form for today's computers.

The NASA data recovery program and the ESA/Cluster mission needs fit together. The two agencies agreed to jointly fund the SCATHA data recovery program. Below, we describe the SCATHA data, the processing that was done, and the output formats for the recovered data.

1.2 Satellite Overview

SCATHA (P78-2) was a NASA/Air Force satellite launched in early 1979. It was placed in a near-synchronous, near-equatorial earth orbit with ~5.3 Re perigee, ~8.2 Re apogee, and an inclination of ~8.5°. The mission lasted about 10 years. However, the data coverage was not 100%, and only a small fraction of data were fully analyzed. Over the mission life, approximately 1,300 days of data were accumulated. The article, "Description of P78-2 (SCATHA) Satellite and Experiments" [Fennell, 1982] describes the satellite and reflects the functional status of the experiments after the first two years. The SCATHA (P78-2) spacecraft was spin-stabilized with the spin axis in the orbit plane and maintained nearly perpendicular to the satellite-sun line for the first ~9 years. In the fall of 1987, the spin axis was adjusted to be nearly perpendicular to the ecliptic for the remainder of the mission. The body of the spacecraft was of cylindrical shape approximately 1.75 m in both length and diameter. Five experiment booms were deployed on orbit. The boom experiments were SC1, SC2, SC6, SC10, and SC11. The other experiments were SC3, SC4, SC5, SC7, SC8, SC9, and ML12. Figure 1.1, Figure 1.2, and Figure 1.3 show the locations on the satellite of the twelve experiments.

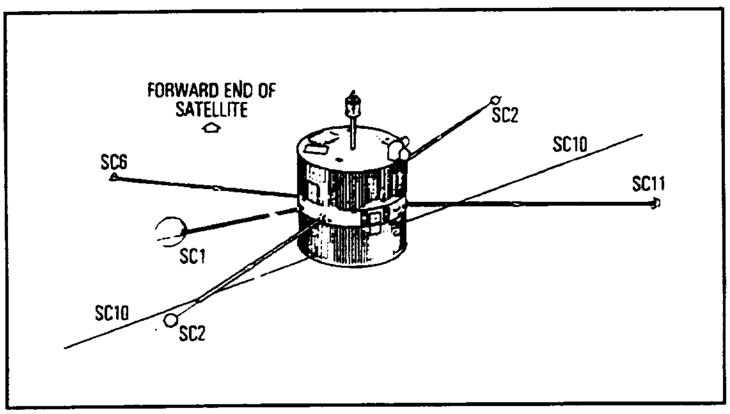

Figure 1.1. P78-2 space vehicle.

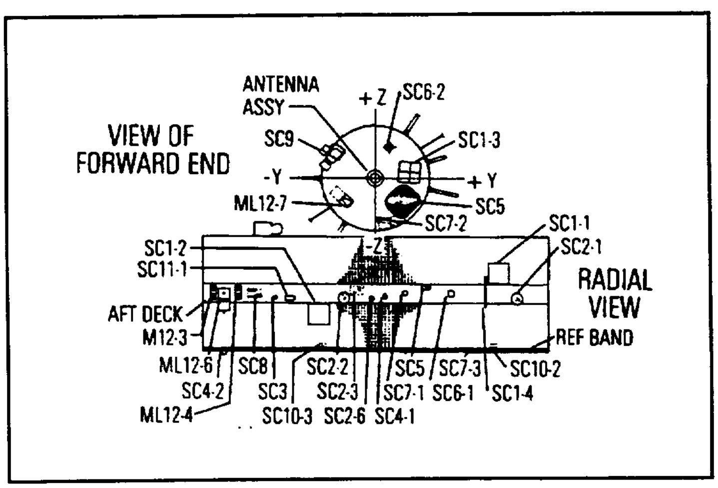

Figure 1.2. Payload locations—side and forward end views.

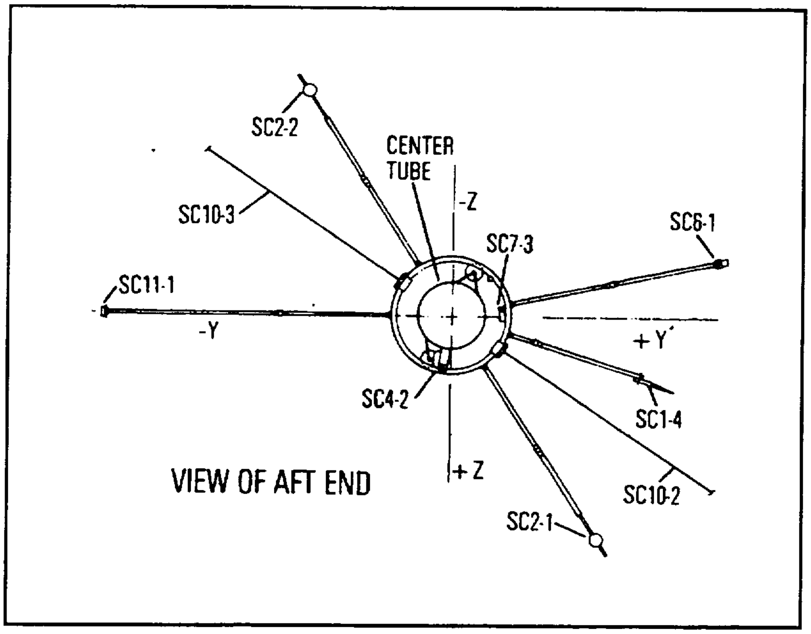

Figure 1.3. Payload Locations—aft end view.

Data from the SCATHA spacecraft were obtained for both science and engineering purposes. On the engineering side, the data from the instruments were used to validate satellite-environment interaction models. These included models of sheath/charging and EMI coupling. The space environment and science analyses drew upon the data from the various electron and ion particle sensors on the spacecraft. These covered an energy range from one eV to several million eV as shown in Table 1.1. Particles with energies in the keV regime were the most important to the charging problem. Several satellite/environment interaction models could be validated using correlations of data from several experiments. The measurements came from particle sensors, electrical potential monitors, field measurements, and transient detectors.

In addition, particular payloads had objectives that extended beyond the scope of spacecraft charging investigations. Specifically, investigations of plasma interaction phenomena were supported by several payloads—charged particles from the SC9, SC5 and SC2 experiments, energetic ions from the SC8 and SC2-3 energetic ion composition experiments, light ions from the SC7 light ion mass spectrometer, and the data from the SC3 high-energy particle spectrometer.

Table 1.1 Particle Detector Characteristics

Species/ Number	Energy Min–Max	ΔE/E	Δt (s)	Geometric Factors (cm^2-sr)	Comments
Electrons					
SC6	1–100 eV		0.1	~ 0.4	
SC9	0.2 eV–1.55 keV	0.2	0.25, 0.04, or 0.0005	1.6×10^{-4}	Programmable Resolution
SC5	0.05–1.7 keV	0.8	0.2	10^{-4}	
SC2	6 eV–18 keV	0.07	0.1	1.7×10^{-4}	
SC9	1 eV–81 keV	0.2	0.25, 0.04, or 0.0005	1.6×10^{-4}	Programmable Resolution
SC5	1.7–60 keV	0.8	0.2	10^{-4}	
SC3	0.05–5.1 MeV	0.1–1	0.5	3×10^{-3}	Programmable Resolution
SC3	5.1–10.0 MeV	Integral	0.5	3×10^{-3}	Programmable Resolution
Protons					
SC9	0.2 eV–1.55 keV	0.2	0.25, 0.04, or 0.0005	3.2×10^{-4}	Programmable Resolution
SC5	0.05–1.7 keV	0.8	0.2	10^{-2}	
SC2	5 eV–14 keV	0.1	0.1	6.7×10^{-4}	
SC9	1 eV–81 keV	0.2	0.25, 0.04, or 0.0005	3.2×10^{-4}	Programmable Resolution
SC5	1.7–60 keV	0.8	0.2	10^{-2}	
SC5	70–725 keV	0.5	0.1 or 0.2	10^{-2}	
SC2	17–>3300 keV		1	2×10^{-3}	
SC5	0.725–35 MeV	0.5–0.9	0.1 or 0.25	2×10^{-2}	
SC3	1–200 MeV	0.003–0.3	0.5	3×10^{-3}	Programmable Resolution
Ions					
SC6	1–100 eV		0.1	~ 0.4	
SC7	1–100 eV	0.2	0.06	2×10^{-3}	H^+, ${}_4He^+$, ${}_{16}O^+$
SC8	0.1–32 keV	0.05	32	10^{-3}	Δm/m mass dependent 1–160 AMU
SC2	≥ 90 keV/AMU	Integral	1.0 or 0.25	3.6×10^{-4}	
SC3	6–60 MeV	0.01–0.2	0.5	3×10^{-3}	Programmable Resolution

1.3 Purpose

This document describes the SCATHA Summary Parameter data for the multi-spacecraft database, for the CLUSTER mission, and for general use. The description of the parameters in the archival high-resolution dataset (used to get the summary parameters) is found in the listing of the High-Resolution CDF Skeleton table (Appendix F). Limited amounts of the high-resolution data will be made available to interested investigators. (The high-resolution dataset is very large, and it would be too expensive to make it routinely available.) This document includes a description of the sensor data selected for recovery and archival. It describes the measurement details and the methods used to decommutate, calibrate, and calculate the physical parameters. The satellite and experiment descriptions and scientific objectives, measuring techniques, and operational aspects included below have been extracted from a pre-launch document for the SCATHA program entitled, "Description of the Space Test Program P78-2 Spacecraft and Payloads" by J. R. Stevens and A. L. Vampola (1978). In addition to restating the pre-flight intentions and expectations for the hardware, data acquisition, and data analysis found in that document, where possible, the descriptions here have been revised to reflect actual satellite flight hardware and testing that took place during the lifetime of the mission.

1.4 SCATHA Data Selection

1.4.1 Archival of Raw Data

The raw data from all the SCATHA experiments is archived at The Aerospace Corporation on magneto-optical disks in a compressed format using the NASA Science Internet Network Information Center's (NSINIC) data compression utility. These data are the undecoded telemetry bytes for most of the experiments. This is not a 100% dataset, but is an image of what was contained on the Aerospace "Agency Tapes." For example, the data from the following experiments were not on the Aerospace tapes and will not be discussed further.

SC4	Electron and Ion Beam System (particle source for charging SCATHA Cohen et al., 1981)
SC5	High Time Resolution Plasma and Energetic Particle Measurements (Stevens and Vampola, 1978; Hanser, et al., 1979; Mullen and. Gussenhoven, 1983)
SC6	Thermal Plasma Analyzer (failed during checkout; Stevens and Vampola, 1978)

Data from the SC8 [Energetic ion composition (Johnson et al., 1983; Strangeway and Johnson, 1984)] and SC9 [Plasma electrons and protons (Olsen, R. C., 1982, Mauk and Meng, 1983)] experiments will not be routinely processed or made available due to immediate lack of familiarity with it. Aerospace was unable to obtain the necessary documentation and/or software that would have allowed us to decode the raw telemetry bytes and to process the data into science units. The data resides in our raw data archive and can be processed in the future if the appropriate information becomes available. Most likely, Aerospace would not perform the processing but would make copies of the raw data available to those interested in attempting to recover these data.

The SC8 electron data does exist in the High-Resolution CDF and is of high quality. The SC9 data does not exists for the full mission life of SCATHA. The instrument suffered a failure during the second year of operation. However, there is more than one year of high-quality data from this experiment. One caveat exists for the SC9—it is possible that some critical housekeeping data is missing from the SC9 telemetry stored on the Aerospace tapes. We were unable to extract useful SC9 data from the Aerospace tapes because we could not get the proper documentation or software for this instrument.

Data from the following engineering and science experiments are not available and not part of the Summary Data due to early experiment failure, measurement redundancy, unknown quality of measurement, lack of relevance to magnetospheric science, or insufficient documentation:

SC1	Engineering, non-science data (all but SC1-8A; Koons, et al., 1980; Koons, 1982, Mizera, 1983)
SC7	Light ion mass spectrometer (failed early in mission; Reasoner, et al., 1983; Fennell, 1982ß)
ML12	Satellite engineering data – thermal control material experiment (Hall and Fote, 1984)

All of the above are described in the references by Stevens and Vampola (1978) and Fennell (1982) and will not be discussed further in this document.

1.4.2 Summary and High-Resolution Datasets

The High-Resolution and Summary dataset will consist of data from the following primary experiments. (The SC8 exists in the High-Resolution dataset only). These experiments are discussed in greater detail in Section 2 and in the references.

SC1–8A	VLF magnetic and electric field wave instrument (Koons, 1981; Fennell, 1982; Koons and Fennell, 1983)
SC2	Suprathermal plasma and energetic proton experiment (Fennell et al., 1981; Blake and Fennell, 1981; Fennell, 1982)
SC3	High energy electron spectrometer (Regan et al., 1980; 1981; Fennell, 1982)
SC8	Energetic ion composition experiment-electrons channels only (Stevens and Vampola 1978; Fennell, 1982)
SC10	Electric field detector (Stevens and Vampola, 1978)
SC11	Magnetic field monitor (Stevens and Vampola, 1978; Fennell, 1982; Croley et al., 1986)

The High-Resolution Dataset contains the highest time resolution measurements from these experiments. The measurements have been converted to physical units, if possible, and written onto magneto-optical disks in CDF format. The measurements available and the format of the High-Resolution data files are summarized in Appendix B. The skeleton table for the High-Resolution CDF files is in Appendix F.

The High-Resolution Dataset is further processed to obtain Summary data at exactly 1-min intervals. For most of the Summary data, this amounts to taking averages or moments of the measurements. The Summary data processing is described in detail in Section 3, and the skeleton table for the SUMMARY CDF is in Appendix E. It is these Summary data that will be made readily available from alternate sources and on the Internet. ESA has plans to create CD ROMs of the SCATHA Summary data, and simple line plots are being made available at the Boston University Internet site (Internet address = http://uss-enterprise.bu.edu/BUSPACE/SCATHA/scatha.html as of March 1997). It is expected that NASA Goddard Space Flight Center's Data Center will have a complete copy of the SCATHA Summary data, probably on CD ROM. Of the 1,300 days of data available, only the contractual days are listed in Appendix D.

2. Experiment Descriptions

2.1 SC1-8A Very Low Frequency Wave Analyzer

2.1.1 Scientific Objectives

The primary scientific objective of this experiment was to measure the intensity and spectra of electromagnetic and electrostatic emissions by the energetic particles in the magnetosphere outside of the plasmasphere. These data were to be used to model the dynamics of the radiation belt particles in this region of the magnetosphere. The secondary scientific objective was to investigate wave-particle interaction and whistler-mode propagation in the outer magnetosphere. Science results from this experiment can be found in the SC1-8A references noted above.

2.1.2 Measurement Technique

The experiment employed two antennas to detect the electromagnetic and electrostatic emissions. An air-core loop antenna (designated SC1-4, see Figure 1.3) detected the magnetic component of the waves, and a 100-m tip-to-tip dipole antenna (designated SC10-2, 3; see Figure 1.3 and description in Section 2.5) detected the electric component. The overall sensitivity of the electric-field receiver was 5×10^{-7} V/m Hz$^{1/2}$ at 1.3 kHz and 10^{-7} V/m Hz$^{1/2}$ at 10.5 kHz.

The air-core loop was electrostatically shielded and had an effective area of 575 m^2 at 1.3 kHz. It was constructed of 1,530 turns of 36 AWG copper wire on a form 50 cm in diameter. The antenna was a boom-mounted loop 2 m from the spacecraft. The overall sensitivity of the receiver was $3 \times 10^{-6}\gamma$/ Hz$^{1/2}$ at 1.3 kHz. The dynamic range was 60 dB.

2.1.3 Operational Aspects

The VLF Analyzer had eight pulsed commands to control the operation of the experiment as follows:

(1) Selection of the broadband output mode—OFF/ 3 kHz/ 5 kHz (see SC1-8A ref.)

(2) Selection of the antenna signal to be analyzed—
ELECTRIC/MAGNETIC/AUTOMATIC SWITCHING

(3) Selection of the calibrate mode—ON/OFF

(4) Selection of the narrowband filter mode—ON/OFF

The primary on-orbit operation was to be the narrowband filter mode providing tape-recorded data with the antennas automatically switching.

2.2 SC2 Plasma Sensors

2.2.1 Scientific Objectives

This experiment was intended to provide the electron and ion distribution functions over a limited energy range. The experiment also measured the floating potential of the graphite-coated spherical probes relative to the spacecraft ground. The spherical probes could be biased relative to the spacecraft upon ground command. The current to one of the biased probes was also measured. The biased probes modified the particle distributions measured at the probe and in their vicinity. The aims of the experiment were (1) to obtain insight into the characteristics of spacecraft sheath fields, (2) to observe the effects of particles that comprise the energetic plasma near a spacecraft, (3) to observe the potential that a relatively simple geometrical shape (a sphere) attains in the plasma environment, and (4) to monitor the influence that the spacecraft itself has on the final potential that such simple objects attain. These observations were to be compared with the results of other more comprehensive plasma measurements aboard the spacecraft to obtain new insights concerning the plasma sheaths that form around objects in hot, dilute plasmas both in the presence and absence of photo-illumination. The observations were also used as test data for the validation of spacecraft-plasma interaction models that were developed.

2.2.2 Measurement Technique

The plasma sensors consisted of three miniature electrostatic analyzers that measured the fluxes of electrons and ions over a limited range of energies, as shown in Table 2.2.1. Two of the analyzers were enclosed within boom-mounted spherical probes, and the third was mounted behind the center band on the spacecraft. The booms were 180° apart and were mounted near the

Table 2.2.1 SC2 Electrostatic Analyzer Energies

Program	Step	Approximate Energy (eV/Charge) Electrons	Ions
1	0	190	150
	1	450	350
	2	1060	830
	3	2530	1980
	4	4480	3510
	5	10500	8200
	6	18600	14500
	7	Return to zero	Return to zero
2	0	0 -- 5	0 -- 4
	1	90	70
	2	330	260
	3	800	630
	4	1890	1480
	5	5960	4660
	6	14000	11000
	7	Return to zero	Return to zero
3	0	6–13	5–10
	1	20–24	15–20
	2	45	36
	3	600	470
	4	1410	1110
	5	3380	2650
	6	7850	6150
	7	Return to zero	Return to zero

centerline of the vehicle. The relative geometry of the spacecraft and booms are shown schematically in Figures 1.2, 1.3, and 2.2.1. The fields of view of the analyzers were parallel to each other and to the fields of view of the energetic ion sensors. Plasma data from the SC2-3 sensor, which was mounted on the satellite body, are included in the Summary Data. The spherical probe data, which made primarily engineering measurements, are not included in any of the recovered data.

Each SC2 electrostatic analyzer consisted of three concentric cylindrical plates that deflected the particles of proper energy per charge through 127° onto SPIRALTRON channel electron multipliers where they were detected. The center analyzer plate was biased from 0.0 to −1600 V by a programmer, as shown schematically in Figure 2.2.2. The ions were post accelerated by −1600 V before impinging on the ion detector to increase the detection efficiency. The electrons were not post accelerated. The analyzer collimator and serrated plates were coated with "gold black" to reduce the ultraviolet response of the system. (As far as could be determined, the units did not respond to sun light at all.) The three units were as nearly identical as possible mechanically and electrically. The angular response of the units (FW at 10% maximum response) were approximately 9° by 7° for the electrons and 16° by 9° for the ions in planes parallel and perpendicular, respectively, to the spacecraft spin axis. They had geometric factors of $\sim 1.7 \times 10^{-4}$ cm^2 sr for electrons and $\sim 6.7 \times 10^{-4}$ cm^2 sr for ions. The energy resolutions were $\Delta E/E = 0.14$ for ions, and $\Delta E/E = 0.09$ for electrons.

There were four independent high-voltage supplies and one low-voltage supply provided for each ESA. The voltages from all supplies were monitored continuously. The detector supply voltages could be changed by command to one of four levels. These were utilized to boost detector gain on orbit as the need arose and to monitor detector efficiency (in a limited way; see Appendix C).

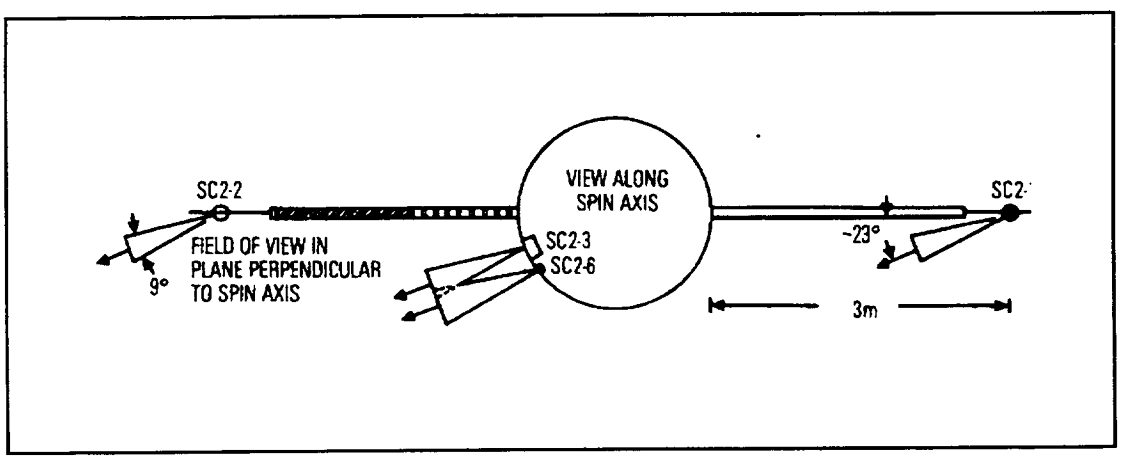

Figure 2.2.1. Spacecraft and boom geometry.

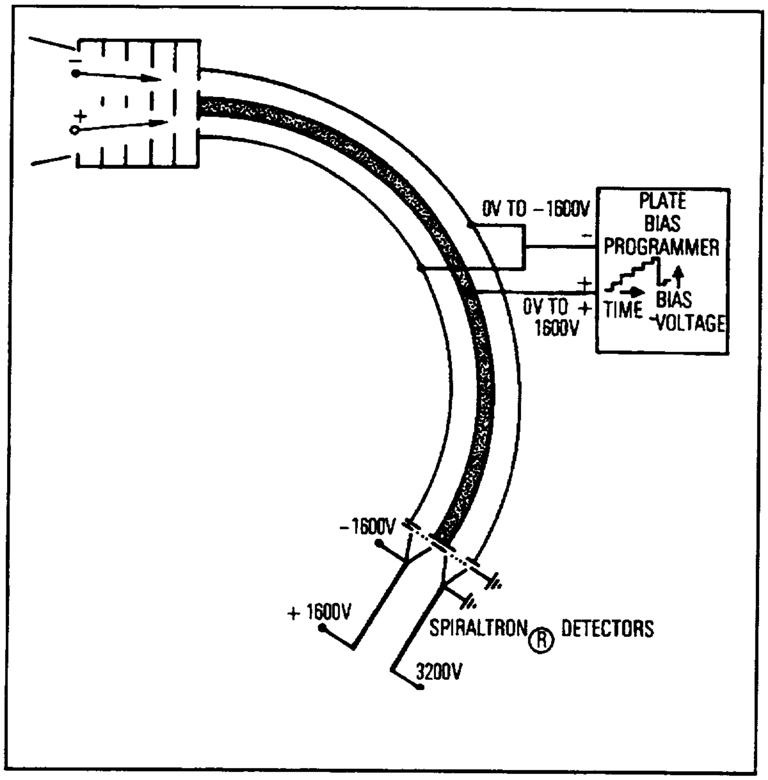

Figure 2.2.2. Schematic diagram of ESA.

2.2.3 Operational Aspects

The ESAs were controlled by the SC2 data system. When the ESA was powered up, it responded to the 32-bit command that was in its storage register at that time. The 32-bit ESA command word was sent by the data system to the ESAs eight times a second in bursts ~125 μs long (clock rate ~260 kHz). When the data system was first turned on, it immediately started sending a predetermined program to the ESAs. If a different ESA command was not transmitted to the data system by the spacecraft, the ESAs continually executed this default program. Twenty-two bits controlled the ESA plate biases, two controlled the detector biases, and eight controlled the housekeeping data multiplexer in each ESA. There were a total of 14 ESA operational programs that were used to increase or decrease the number of energies measured and that changed the time taken to obtain a complete spectrum. A crude spectrum could be obtained in one second. A complete spectrum could be obtained in as little as three seconds. If good angular resolution was required, the energies could be scanned slowly (64 s per energy) with fluxes obtained at eight samples per second. In this mode, a complete spectrum was obtained in 512 s, but the angular resolution was on the order of 1°. The SC2-1 and SC2-2 ESAs were driven by the same command generator in the data system and thus always measured the same energies. The SC2-3 ESA commands were generated separately. The outputs from the ESA detectors were accumulated for 101.5 ms each 125 ms in 12-bit compressed scalars. The scalar contents were multiplexed into the TM stream by the data system. The scalars were inhibited for ~23 ms after each 32-bit command was sent to allow the ESA plate voltages to stabilize before accumulating a new sample.

2.3 Energetic Proton (SC2-6) and Ion Plus Background Detectors (SC2-3B)

2.3.1 Scientific Objectives

The SC2-6 and SC2-3B sensors measured protons, alphas, carbon, nitrogen, and oxygen ions, with emphasis on pitch angle coverage with good resolution. The proton measurements covered the energy range 17 keV to 3.3 MeV. The heavy-ion measurements were integral, covering energies ≥ 96 keV/nucleon. The background contribution for protons and ions penetrating > 0.3 cm of brass and having >3 MeV of energy remaining was also measured. Details of the energies measured are shown in Table 2.3.1. The SC2-6 proton energy range was chosen to overlap that of the SC9 University of California at San Diego (UCSD) charged-particle experiment on the low end and to extend up to energies covered by the SC3 high-energy particle spectrometer described in Section 2.4. The experiment measured the temporal, spatial, and directional variations in positive ion fluxes. The solid-state particle detection technique made it possible to obtain instantaneous energy spectra for each one-second interval (~6° angular sampling).

Table 2.3.1. SC2-6 Energies

Protons Channel	Energy[1] (MeV)
A1[2]	0.017_0.29
A2	0.029–0.054
A3	0.054–0.104
A4	0.104–0.189
A5	0.189–0.363
A6	0.363–0.717
A7	> 0.717
A8	> 3.3

$G_p \sim 2 \times 10^{-3}$ cm^2 sr

2.3.2 Measurement Technique

The proton detection system (SC2-6) is shown in Figure 2.3.1. The proton telescope consisted of a front and a rear solid-state detector behind a collimator-magnet assembly. The particles entering the collimator passed through a uniform magnetic field that kept electrons from being detected and contaminating the proton measurement. The protons and heavy ion trajectories were unaffected by the magnetic field. The front detector was energy analyzed while the rear detector eliminated penetrating particles from the analysis and provided necessary background information. The proton analysis produced differential flux measurements in six energy windows and two integral flux channels, as shown in Table 2.3.1. The instrument had a geometric factor of 2×10^{-3} cm^2 sr.

The heavy-ion detection system SC2-3B was similar to the SC2-6 proton detector. The heavy-ion detector is shown schematically in Figure 2.3.2. The instrument was a two-element, solid-state telescope that was highly collimated, and the detectors were heavily shielded in all directions except the field of view. The electron rejection magnet was well separated from the detectors and deflected out of the incident beam all electrons with energies ≤ 1.7 MeV. The energetic ions were not affected by this "broom magnet." The SC2-3B heavy-ion telescope had a geometric factor of 3.6×10^{-4} cm^2 sr.

[1] Defined at half response points for 20°C. The thresholds were temperature sensitive.
[2] The efficiency of this channel is ≤ 90%.

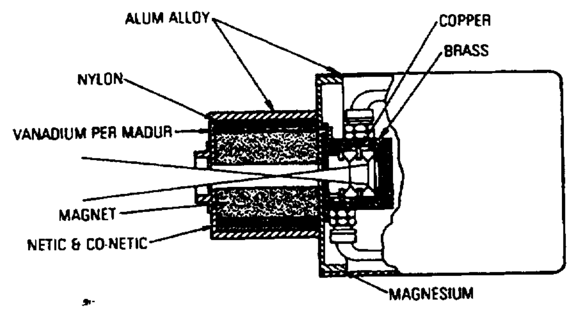

Figure 2.3.1. Energetic proton detector.

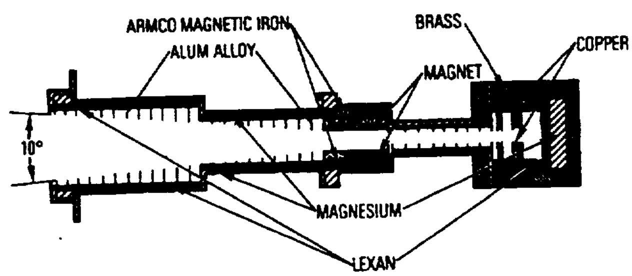

Figure 2.3.2. Energetic ion plus background detector.

The SC2-3B ion telescope had a very thin (2.3 μm, 10 mm^2) front detector and a thicker (42.1 μm, 25 mm^2) rear detector . The output from the front detector was energy-analyzed while the rear detector was used to reject penetrating particles. The ions were differentiated by the energy required for them to penetrate the front detector. Ions with energies ≥ 90 keV/nucleon were detected. A high threshold was also used on the rear detector to measure particles that penetrated the brass shield or front detector and still deposit large amounts of energy. The shielding stopped < 45 MeV protons and < 5 MeV electrons.

2.3.3 Operational Aspects

The SC2-6 operated independently of the data system. The data system accumulated the output pulses into 12-bit compressed scalars and multiplexed the resultant bytes into the TM stream at the proper times. The accumulation interval for all SC2-6 outputs was one second. Some of the SC2-6 data channels were shared with other measurements. This was determined by the command state of the experiment. The SC2-3B functioned partially independent of the data system and partially under its control. Some of the outputs were accumulated in 8-bit scalars within the detector and shifted out directly into the TM stream by the data system. The remaining outputs were accumulated within the data system into 8-bit scalars or 12-bit compressed scalars and then multiplexed into the TM stream. The sample rates for the SC2-3B outputs were 0.5, 1, and 4 samples per second.

2.4 SC3 High-Energy Particle Spectrometer

2.4.1 Scientific Objectives

The goals of the SC3 payload were to make energetic electron and proton measurements that met the objectives of the spacecraft charging program. The energetic electron fluxes at near-synchronous altitudes exhibit pronounced pitch-angle, diurnal, and solar rotation dependencies, and are highly dynamic. The energetic electrons behave differently from the low-energy electrons, and, therefore, measurements obtained by the SC3 spectrometer complemented the measurements made at lower energies by other experiments on the SCATHA mission. One application to the Spacecraft Charging mission was the measurement of flux intensities of penetrating energetic electrons to determine whether anomalous charging of coaxial cables in spacecraft was a source of system noise.

A knowledge of the fluxes, spectra, and pitch-angle distributions of the energetic electron at near-equatorial geosynchronous altitudes is essential to an understanding of environmental effects on ELF and VLF communications. These communications are affected by naturally occurring and artificially induced wave-particle interactions through transfer of wave energy to particle energy. Perturbation of the particle energy or pitch-angle distribution as a result of such interactions enhances particle precipitation into the ionosphere, which subsequently adversely affects long-wavelength communication systems. Payloads on the SCATHA mission simultaneously measured, in detail, the energetic electron population, the cold plasma environment, and the electric and magnetic field environment at near-synchronous equatorial altitudes for all local times and under a variety of naturally occurring wave conditions. The SC3 spectrometer, in conjunction with low-energy electron observations by the SC2, SC5, and SC9 payloads, measured the trapped electron environment that interacted with the wave environment measured by the electric and magnetic field payloads, SC1, SC10, and SC11, under well-defined cold plasma conditions that were measured by the SC6 and SC7 payloads. The knowledge obtained from these simultaneous data led to a better understanding of both natural and man-made ELF and VLF wave interactions with trapped particles in the magnetosphere and to the subsequent effects of such interactions on the ionosphere.

The SC3 payload measured the electron environment with good energy resolution at the time of solar maximum conditions. The energetic electrons constituted a potential hazard to the electronic components used in both the payloads and the spacecraft. Outputs from the SC3 payload were used to determine the environment and radiation dose acquired by the spacecraft behind various shielding thickness. These data were also used for the SCATHA mission degradation calculations and to improve the radiation models for subsequent missions.

At the times of solar particle events, energetic solar protons, electrons, and alpha particles typically have efficient access to the near-geosynchronous orbit. There, they may significantly alter the energetic plasma composition. The SC3 spectrometer measured these energetic solar particles and their contributions to the backgrounds and radiation dose for other components of the SCATHA mission. The SC3 instrument measured the fluxes, spectra, and pitch-angle distribution of the energetic particles in the energy range 50 keV to 5100 keV and the integral fluxes between 5100 keV and 10,000 keV. In addition, SC3 measured the proton environment at energies 1–200 MeV and the alpha particle environment at 6–60 MeV. The measurements are made with a pitch-angle resolution of 3° (full-width-at-half-maximum). The energy spectra were obtained with a 12-channel pulse height analyzer that was programmed to cover either a narrow or wide energy range. In this manner, both complete survey data and high-resolution spectral data were obtained.

2.4.2 Measurement Technique

The basic measurement technique used a solid-state particle spectrometer consisting of four sensor elements. A line drawing of the spectrometer is shown in Figure 2.4.1. Various logic combinations of the four sensors in the instrument were used to determine the particle types and energy ranges. The various particle types and energy ranges were measured in several time-multiplexed modes by command.

The D-detector (200-µm-thick intrinsic Si) was used to measure both the rate of energy loss of the energetic particles and to directly stop and measure the lower-energy particles. The E-detector (which consisted of five 2-mm-thick detectors in parallel) was located behind the D-detector to stop the higher-energy particles and to measure their total energy loss. The E'-detector (1000 µm thick) was located behind the E-detector and was used as an active collimator. Behind the E'-detector was a tungsten absorber that set the upper energy limit for analysis. All of these detectors were fabricated of surface-barrier silicon and were stacked together in a telescope configuration. The entire stack was surrounded by the A-detector, which consists of a plastic scintillator viewed by a photomultiplier tube. The purpose of the A-anticoincidence detector was to sense and reject energetic particles and bremsstrahlung that penetrate either the outer shielding walls of aluminum and tungsten or the silicon detector stack and absorber. The sensor stack was located behind a long, narrow collimator that defined the 3° field of view.

2.4.3 Operational Aspects

The SC3 instrument utilized three discrete commands to power (1) the instrument (5003), (2) the anticoincidence system (5002), and (3) the memory system (5006). A LOAD command (5008) preceded each memory loading operation, and a RUN command (5004) preceded the sending of an instruction (INST). There were 256 INST commands available (5101 through 5356). The SC3 calibration system could be disabled via a discrete command (5005). The SC3 memory was

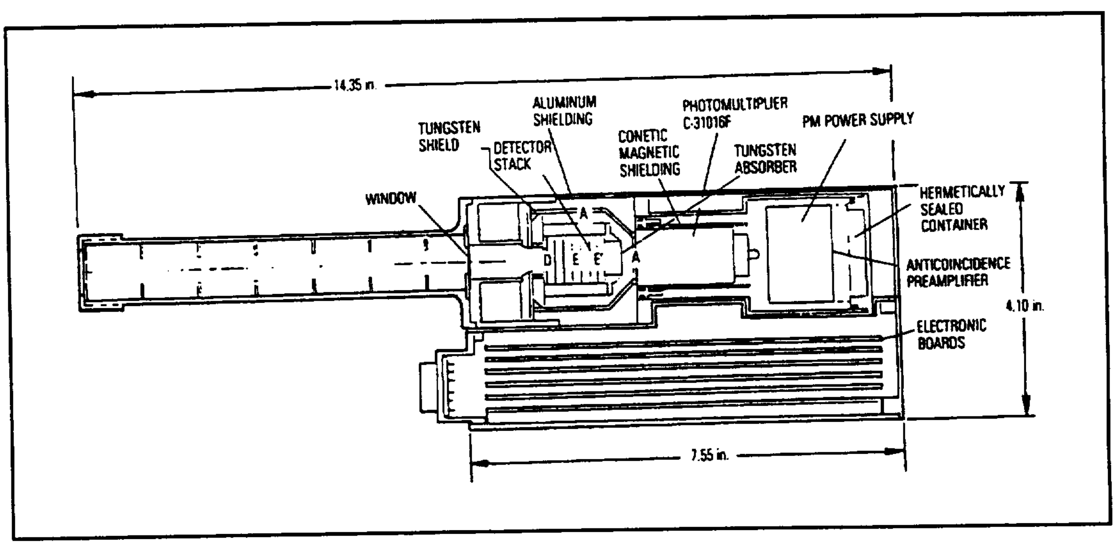

Figure 2.4.1. High-energy particle spectrometer.

loaded at the earliest opportunity after launch and remained active for the duration of the mission. This was accomplished by sending 256 combinations of data and address words. Changes to the memory were accomplished by automatic blocks of serial binary commands (9-bit) or by individual serial commands (9-bit). Threshold changes to select different energy ranges were the most frequently sent commands after payload initialization.

The SC3 instrument was operational at all times during the SCATHA mission. The primary mode of operation measured electrons, and the instrument operated alternately between the mid- and high-energy electron ranges from a PAGE of memory. At the times of solar particle events, operation was commanded from a preselected PAGE in memory to obtain the proton spectrum and its contribution to radiation dose.

Since magnetic attitude of the SC3 was essential to its measurements, it was always operated with the SC11 instrument. Special alignment calibrations between the two instruments were performed on-orbit.

2.5 SC10 Electric Field Detector

2.5.1 Scientific Objectives

One of the primary goals of the SC10 electric field detector measurements was the observation of the steady-state convection electric fields that existed at the planned orbital altitude of the P78-2 satellite. The existence of these fields had been inferred from the extrapolation of convection plasma velocities in the high-latitude ionosphere to synchronous altitude and from earlier observations by the IMP VI satellite data of high-amplitude transient electric fields in the midnight meridian during the onset phase of auroral substorm events.

Another goal of SC10 was to measure electric fields from transient events such as electrostatic discharges on selected spacecraft insulating surfaces. The SC10 antenna, along with three SC1 antennas, was used to characterize electromagnetic interference in the vicinity of the spacecraft. The common mode signal of SC10 related electric fields in the undisturbed ambient medium of the plasma.

Common mode data from the electric field experiment on the IMP VI satellite had been shown to correspond to spacecraft charging events. The common mode part of SC10 electric field detector proved useful in understanding spacecraft charging (1) because of the very good temporal resolution available from this measurement, (2) because of the possibility of extrapolating the SCATHA spacecraft results to lower and higher satellite altitudes, (3) because of the sensitivity of this experiment to active charging events provided by the SC4 experiment, and (4) because of the ease of folding these events into morphological studies of charging events as a function of orbital position, local time, and auroral activity.

2.5.2 Measurement Techniques

The SC10 electric field experiment was a NASA-supplied, double floating probe ensemble that measured DC electric fields in the ambient plasma and also spacecraft charging events. The experiment consisted of three payload packages. The SC10-2 and SC10-3 units (Ref. Figures 1.1 and 1.3) were unfurlable antennas. The deployed antennas formed a 100-m tip-to-tip dipole. The SC10-1 electronics packages contained high input impedance amplifiers, high-precision differential amplifiers, and a low-frequency spectrum analyzer (see Figure 3.5.1). The experimental objectives were twofold. The differential signal on the dipole antenna yielded direct measurement of the ambient convection electric fields in the plasma. Also, the common mode signal of a single antenna monitored spacecraft charging events. The SC10-2 and SC10-3 dipole antennas were used as double floating probes. The inner 30-m sections of these 50-m, 1/4-inch-diameter antennas were coated with Kapton insulation to move the outer 20-m active probe areas away from the measurement-contaminating plasma sheath of the satellite.

The SC10 100-m dipole antenna was shared with the SC1-7 and SC1-8 HF and VLF experiments. An electrical interface ran between the SC10-2 and SC10-3 antenna packages and the SC1 preamplifiers via a 10-kΩ resistor in-line with the low-frequency preamplifiers.

In addition to this cross-coupling to the SC1 experiment, one of the 0.2 to 200 Hz rms analyzers in the SC10-1 electronics package could be commanded to detect the output of the X-axis of the SC11 magnetometer (Ref. Figure 2.5.1). When operating in the magnetic-field mode, this portion of the SC10 experiment provided morphological data relative to the ELF E and B noise at the orbit of the satellite.

2.5.3 Operational Aspects

The SC10 antennas were deployed shortly after spacecraft orbit insertion. The antennas deployed in three stages to three different lengths to study the probe characteristics with varying degrees of overlap from the satellite sheath. The final antenna lengths were kept at 100 m tip-to-tip for the duration of the spacecraft lifetime.

The gain functions of the SC10 electronic package could be calibrated with internal AC and DC voltage sources. This calibration was activated by ground command. The data from SC10 was acquired during all normal data transmission. Wideband electric field data were transmitted on a time-shared basis. Wideband data from this experiment were hardwired in the satellite data processor and transmitted simultaneously with wideband data from the SC11 and SC9 experiments.

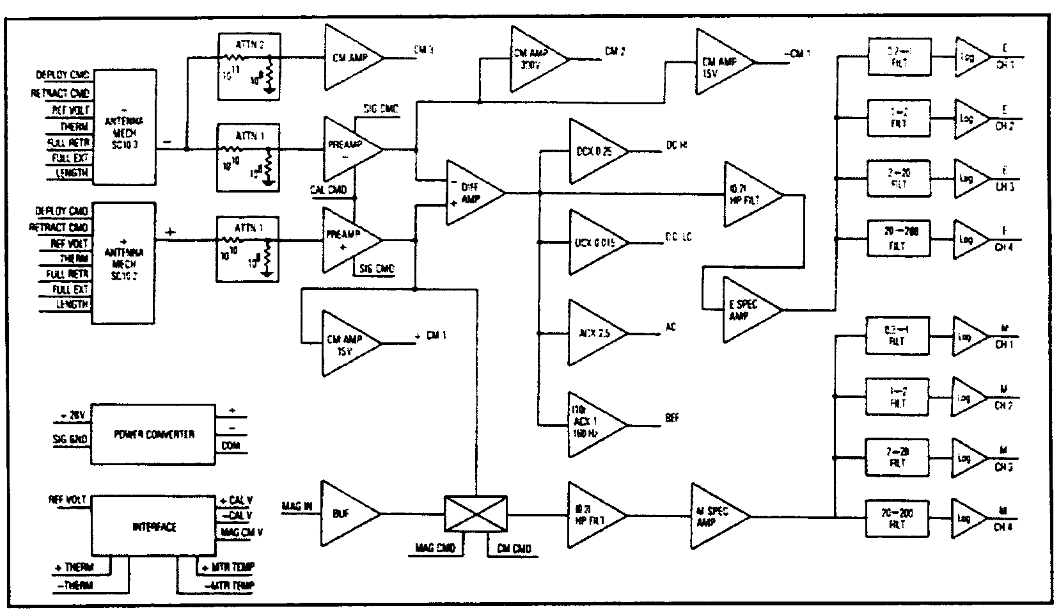

Figure 2.5.1. SC10 electric field experiment block diagram.

2.6 SC11 Magnetic Field Monitor

2.6.1 Scientific Objectives

Data from the magnetic field monitor were used to analyze the field-aligned and distributed current systems in the low-latitude regions around synchronous altitude. Magnetopause crossings were expected, and the magnetic field measurements simultaneous with wideband SC10 electric field and SC9 particle measurements were used in wave-particle interaction investigations. These data contributed to a better understanding of magnetosphere dynamics as it affects spacecraft charging. The magnetic field data were also used in spacecraft charging models to compute local particle trajectories and for environmental modeling.

2.6.2 Measurement Techniques

The SC11 instrument was a triaxial fluxgate magnetometer and associated electronics. Each axis had a range of approximately $\pm 500\gamma$ ($1\gamma = 1$ nT). To reduce absolute errors in the magnetic field measurements, a magnetics control program was implemented on SCATHA. It included prelaunch subsystem and system level stray field measurements. In addition, the magnetometer sensor was located at the end of a 4-m boom (SC11-1, see Figures 1.1 and 1.3). The sensor axes, X, Y, and Z, were accurately aligned with the corresponding spacecraft axes (see Figures 1.2 and 1.3). An error analysis performed by the spacecraft manufacturer estimated that the absolute accuracy measurements of the ambient magnetic field component along the space vehicle's X-axis would be better than 1γ at 1σ confidence level. Errors in the other two axes would be less than in the X-axis. The spacecraft's maneuvers and spin provided in-flight information about the magnetometer zero levels and the spacecraft magnetic field components along those two axes.

2.6.3 Functional Block Diagram

A block diagram of the SC11 Magnetic Field Monitor is shown in Figure 2.6.1. The 0–5 V analog output of each axis is processed by a 4-bit subtractor. The residual voltage is then amplified. The amplified signals and the state of the 4-bit subtractors are fed to the satellite's analog-to-digital converter on the lines marked "X FINE," "X COARSE," etc. The ground calibrations of the 4-bit subtractor are used to reconstruct the analog output from each axis from the telemetered FINE and COARSE signals. The resolution of the measurement is ~ 0.3 nT. The fluxgate signals are filtered by a low-pass filter with a pole at 2 Hz to reduce aliasing of the sampled data.

The signals from the spin axis aligned fluxgate (X-axis) are fed directly without filtering to spectrometer in the SC10 experiment. The bandwidth of the magnetic signal passed to the spectrometer is about 100 Hz. These signals are used to generate the ELF B-field data discussed in Section 3.3.3 below.

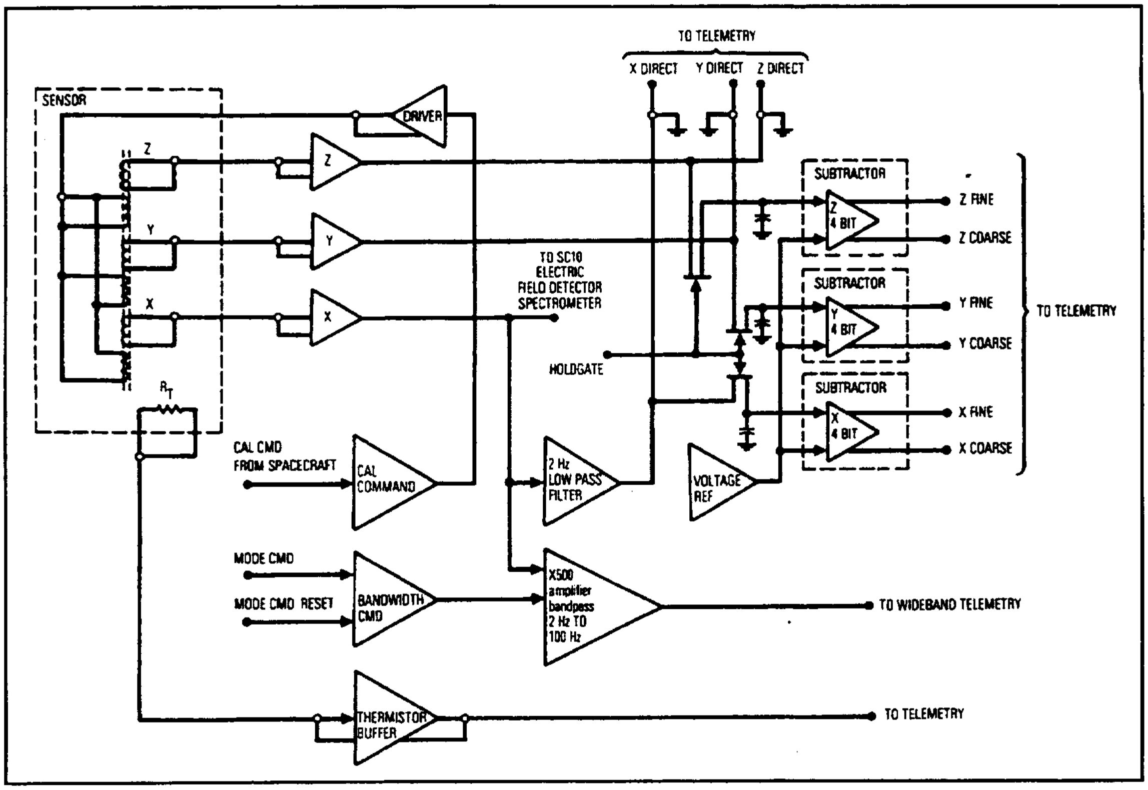

Figure 2.6.1. Magnetic field monitor block diagram.

2.6.4 Operational Aspects

After initial on-orbit operations, the real-time data were used to measure instrument zero levels and spacecraft fields in the spin plane. A calibration pulse, which indicated the sensitivity of all three axes, was sent during real-time data intervals. The SC11 vector magnetometer data were acquired during all normal data transmissions. Broadband magnetometer data were transmitted on a time-shared basis.

3. Summary Data Parameter Description

3.1 Parameter Types

The Summary Data has a one-minute time resolution and includes the following processed data products:

- Average electron fluxes[3] perpendicular and parallel to the magnetic field
- Average ion fluxes[3] perpendicular and parallel to the magnetic field
- Moments[4] of the electron velocity phase space distribution
- Moments[5] of the ion velocity phase space distribution
- Average magnetic field vectors – (B_x, B_y, B_z in GSM)
- Average and peak AC electric and magnetic field wave amplitudes[6]
- Spacecraft ephemeris and ancillary data

The Summary Data[7] were extracted and derived from the high-resolution dataset.[8]

3.2 Definitions

One-minute arithmetic average:

To get the average, we defined the half-open time interval $[T_0, T_1)$ with midpoint time T_m such that $T_1 - T_0 = 60$ s. Then we selected all (N) data values X_i whose corresponding times T_i were

[3] Differential flux at seven plasma energy channels and three high energy channels plus integral number and energy flux

[4] Combined thermal and superthermal plasma moment integrals including number density, bulk speed, pressure, and average energy from ~90 eV <E <~20 keV

[5] Combined thermal and superthermal plasma moment integrals including number density, bulk speed, pressure, and average energy from ~70 eV <E <~130 keV

[6] Includes twelve wave channels from SC1-8A (8 electric, 4 magnetic) and eight from SC10 (4 electric, 4 magnetic) in addition to DC E-field and satellite potential.

[7] See Appendix A

[8] See Appendix B

within the interval, i.e. $\{ X_i \mid T_0 \leq T_i < T_1 \}$. We calculated the arithmetic average X_{ave} of these data as:

$$X_{ave} = (\sum X_i)/N$$

Statistical Error (Standard Deviation):

Standard deviation σ of the sample was determined using:

$$\sigma = \sqrt{\frac{\sum (X_i - X_{ave})^2}{N-1}}$$

Root Mean Square (RMS):

$$RMS = \sqrt{\frac{\sum X_i^2}{N}}$$

If the number of samples in the interval was less than 2, then defined fill values were used instead for the average and error parameters and stored with other summary values corresponding to the interval midpoint time, T_m.

Statistical Fractional Error

$$X_{sum} = \sum X_i. \qquad (X_i = \text{counts/sample})$$

The statistical fractional error for the flux is $1/(X_{sum}^{1/2})$, independent of the number of samples.

ECI (Earth-Centered Inertial) Coordinates

The ECI coordinate system, also referred to as GCI, Geocentric Celestial Inertial, is earth centered, with the X-axis pointing from the Earth towards the first point of Aries (the position of the Sun at vernal equinox). This direction is the intersection of the Earth's equatorial plane and the ecliptic plane—thus the X-axis lies in both planes. The Z-axis is parallel to the rotation axis of the Earth, and the Y-axis completes a right-handed orthogonal coordinate system. The X-axis is the direction of the mean vernal equinox of J2000.[9]

GSM (Geocentric Solar Magnetospheric) Coordinates

The GSM coordinate system is Earth centered and has its X-axis pointing from the Earth towards the Sun. The positive Z-axis is perpendicular to the X-axis and parallel to the projection of the

---

[9] Ref. Mish, W. H., December, 1992 *International Solar-Terrestrial Physics (ISTP) Key Parameter Generation Software (KPGS) Standards & Conventions*

GSM (Geocentric Solar Magnetospheric) Coordinates

The GSM coordinate system is Earth centered and has its X-axis pointing from the Earth towards the Sun. The positive Z-axis is perpendicular to the X-axis and parallel to the projection of the negative dipole moment on a plane perpendicular to the X-axis (the northern magnetic pole is in the same hemisphere as the tail of the magnetic moment vector). This is a right-handed orthogonal coordinate system.9

Interpolation:

Interpolation was performed using the IDL function NR_SPLINE, which is based on the routine spline in Section 3.3 of *Numerical Recipes in C: The Art of Scientific Computing.*

Integration:

The procedure used integrates a tabulated set of data $\{x_i, f_i\}$ on the closed interval [min(x),max(x)] utilizing trapezoid integration over an unequally spaced abscissa.

$$\int_{x_1}^{x_n} f(x)dx = \frac{h_1}{2}(f_1 + f_2) + \frac{h_2}{2}(f_2 + f_3) + \ldots + \frac{h_{n-1}}{2}(f_{n-1} + f_n)$$

$$h_i = x_{i+1} - x_i$$

Moments:

Density: $$n = 4\pi \cdot 10^{-15} \cdot \int_a^b v^2 f(v)dv \ \text{cm}^{-3}$$

Average Velocity: $$\langle v \rangle = \frac{\int_a^b v^2 f(v)dv}{\int_a^b v f(v)dv} \ \text{km / sec}$$

Average Energy: $$\langle E \rangle = \frac{10^3}{1.6 \times 10^{-19}} \cdot \frac{\int_a^b \frac{1}{2} m v^4 f(v)dv}{\int_a^b v^2 f(v)dv} \ \text{keV}$$

Pressure: $P = nkT$ (where kT is the average Maxwellian temperature in keV)

$$= 1.602 n\langle E \rangle \ \eta\text{dynes} \cdot \text{cm}^{-2}$$

where,

Nominal Distribution Function:

$$f(v) = \frac{J}{m^2 v^2}$$

$$= \frac{J}{2mE} = \begin{cases} 1.616 \times 10^{-7} J / E \sec^3 \text{km}^{-6}, \text{ for electrons} \\ 5.44094 \times 10^{-1} J / E \sec^3 \text{km}^{-6}, \text{ for protons} \end{cases}$$

Velocity:

$$v(E) = c \cdot \sqrt{\frac{\left(\frac{E}{E_0}\right)^2 + 2\left(\frac{E}{E_0}\right)}{\left(\frac{E}{E_0} + 1\right)^2}} \text{ km / sec}$$

where,

Rest Energy:

$$E_0 = \begin{cases} 511.0 \text{ keV for electrons} \\ 938259.2 \text{ keV for protons} \end{cases}$$

Flux:

$$J = \frac{\text{particles}}{\text{cm}^2 \cdot \text{sec} \cdot \text{sr} \cdot \text{keV}}$$

Energy: E = keV

3.3 Derivation Methods For Summary Data

3.3.1 Average Magnetic Field Vector and Sigma

Summary Data Parameters (2–7)

The source data for these parameters were acquired by the SC11 Magnetic Field Monitor at four samples per second, and stored in GSM coordinates in units of nT. One-minute averaging was performed on this data to obtain parameters 2–4. Corresponding statistical errors were calculated and stored in parameters 5–7.

3.3.2 Average and Peak Field Wave Amplitudes (VLF)

Summary Data Parameters (8–31)

Source data for these parameters (AC electric and magnetic fields) were acquired by the SC1-8A instrument at a sample rate of 1 sample per second, alternating between the electric and magnetic antennas every (normally) 16 s. Electric and magnetic field output data were converted to science units of dBV and dBnT, respectively. Electric field values were converted to units of dBV/m assuming an effective antenna length of 50 m. Averages for 16-s blocks of E-field (excluding points occurring either 1 s before a switch to the magnetic antenna or 1 s after a switch to the electric antenna), and B-field values were calculated for each sampled frequency. One-minute summary averages were then obtained by interpolating the computed 16-s average values to the midpoint of the interval. Peak values were obtained by selecting the maximum E-field and B-field value within each one-minute time interval.

3.3.3 Average and Peak Field Wave Amplitudes (ELF)

Summary Data Parameters (32–34)

Spacecraft common mode potentials for ranges ±15, ± 300, and ± 5000 V were averaged over the time interval. Source data were acquired by the SC10 experiment at 2 samples per second.

Summary Data Parameters (35–37)

DC electric field data, using low and high gains of SC10, acquired at 2 samples per second were averaged over each summary time interval. Average AC values were also calculated within each summary time interval. Each interval's average AC value was then used as an instrument bias (or offset) for the data found in the interval. This offset was subtracted from the data values to obtain corrected AC values. The summary rms value for the interval was then calculated using the resulting corrected AC values.

Summary Data Parameters (38–41)

SC10 E-Field telemetry voltages at four ELF frequencies were obtained by averaging the 1 sample per second source data with each summary time interval.[10]

Summary Data Parameters (42–45)

SC10 E-Field peak telemetry voltages at four ELF frequencies were obtained by selecting the maximum 1-sample-per-second E-field value in each summary time interval.[10]

Summary Data Parameters (46–49)

SC11 B-Field telemetry voltages at four ELF frequencies were obtained by averaging the 1-sample per second source data within each summary time interval.[10]

Summary Data Parameters (50–53)

SC11 B-Field peak telemetry voltages at four ELF frequencies were obtained by selecting the maximum 1-sample-per-second B-field value in each summary time interval.[10]

[10] Calibration/conversion to science units is TBD.

3.3.4 Average Electron Fluxes

Summary Data Parameters (54 - 97)

The SC2-3 ESA and SC3 electron detector angular distributions were obtained at selected energies during the averaging interval (see Table 3.3.1). Differential number fluxes were calculated for those samples with pitch-angles of 90° ± 20°. These were averaged and stored as Summary Data Parameters 54–63. The corresponding statistical errors (Counting Rate Errors—parameters 64–73) were determined for each energy. In the same way, the electron differential number fluxes approximately parallel to B (180° ± 30° and 0° ± 30°) and their corresponding statistical errors were stored as Summary Data Parameters 74–93.

Integral energy and number flux values of electrons perpendicular to B (parameters 94 and 95) were calculated by using the average differential flux values from all available SC2-3 energies. A spectrum was formed from the available data.. This set of fluxes was "filled-out," where necessary, via interpolation, to give values corresponding to 21 energies, and was then integrated over the range 0.20 to 20 keV to obtain the electron integral number flux perpendicular to B. The differential number fluxes were also converted to energy fluxes. The electron integral energy flux over the range 0.20–20 keV was obtained by converting the differential number fluxes to energy flux and integrating. Parameters 96 and 97 (electron integral energy and number flux approximately parallel to B over the 0.20 to 20 keV range) were calculated similarly.

3.3.5 Average Proton Fluxes

Summary Data Parameters (98–141)

The proton differential and integral flux values were calculated from the proton data in the same way as were the electron flux values. Proton differential number fluxes perpendicular to B (parameters 98–107) and parallel to B (parameters 118–127) and their corresponding statistical errors (parameters 108–117 and 128–137, respectively) were derived from proton data acquired by the SC2-3 and SC3 instruments (Ref. Table 3.3.1). The summary proton data were acquired at 10 energies, seven from SC2-3 and the 19, 36, 71, and 133 keV SC2-6 energy channels. For the

Table 3.3.1 Energies for Average Summary Data

Sensor	Electrons (keV)	Protons (keV)
SC2-3	0.187	0.154
	0.446	0.360
	1.090	0.880
	2.580	2.060
	4.520	3.600
	10.95	8.800
	19.40	15.60
SC3* &	57	19
SC2-6†	98	36
	140	71
		133

* Electrons
† Protons

proton fluxes, "perpendicular" data are those having pitch-angles of 90° ± 20° for the SC2-3 measurements and 90° ± 10° for the SC2-6 measurements; "parallel" data have pitch-angles of 0° ± 30° or 180° ± 30°. SC2-6 data are not used if sun contaminated. As with the electron integral fluxes, proton integral fluxes are calculated using data at SC2-3 step program #1 energies and program #2 and #3 energies where available during the averaging interval.

3.3.6 Moments of the Electron Phase Space Distribution

Summary Data Parameters (142–145)

The density, average velocity, average energy, and pressure for electrons were calculated using the formulas defined in Section 3.2. This was done using electron data points in the energy range 0.04–20 keV having a pitch angle in the range of 90° ± 20°. The calculation required the use of SC2-3 step program #1 average differential number fluxes and, where available, average differential number fluxes for programs #2 and #3 (see Appendix C).

3.3.7 Moments of the Proton Phase Space Distribution

Summary Data Parameters (146–149)

The density, average velocity, average energy, and pressure for protons were calculated using the formulas defined in Section 3.2. For average velocity, this is done using proton data points in the energy range 0.15–15 keV having a pitch angle in the range of 90° ± 20°. The calculation requires the use of SC2-3 step program #1 average differential number fluxes and, where available, average differential number fluxes for programs #2 and #3 (see Appendix C). For density, average energy and pressure, the calculations were performed using the same data as for average velocity supplemented with the 36, 71, and 133 keV data from SC2-6 with a pitch angle of 90° ± 20° giving a total energy range of .15–133 keV. When 133 keV data are not available (because of telemetry sharing), the calculation was done over the 0.15–71 keV range, and the status character for the proton moment parameters was set to reflect the reduced range.

3.3.8 Spacecraft Ephemeris and Ancillary Data

Summary Data Parameters (150–166)

These data were retrieved from the SCATHA ephemeris file. An interpolation was made to the midpoint of each one-minute interval for each of the following ephemeris parameters:

Spacecraft geocentric east longitude (0°–360°)

Spacecraft geocentric latitude (± 90°)

Spacecraft geocentric radius (km)

Spacecraft x-position ECI (km)

Spacecraft y-position ECI (km)

Spacecraft z-position ECI (km)

Spacecraft velocity_x ECI (km/s)

Spacecraft velocity_y ECI (km/s)

Spacecraft velocity_z ECI (km/s)

Magnetic local time at the magnetic equator (hours)

Magnetic Latitude

B_equator_model (nT) (from IGRF 1965.0 + Olsen Pfitzer model)

L value (Earth radii) (from IGRF1965.0 + Olsen Pfitzer model)

arccos$< \mathbf{b} \bullet \mathbf{s} >$ (Angle between B-field direction (**b**) and spacecraft spin axis (**s**) using measured B-field and attitude data)

Bx_model (nT) - GSM (from IGRF 1965.0 + Olsen Pfitzer model)

By_model (nT) - GSM (from IGRF 1965.0 + Olsen Pfitzer model)

Bz_model (nT) - GSM (from IGRF 1965.0 + Olsen Pfitzer model)

<u>Summary Data Parameter (167)</u>

The ion/electron gun operation flag is set to indicate the "ON" status during each of the one-minute summary time intervals.

0 $\Rightarrow$ both electron and ion guns OFF

1 $\Rightarrow$ only electron gun ON

2 $\Rightarrow$ only ion gun ON

3 $\Rightarrow$ both electron and ion guns ON

Summary Data Parameter (168)

Variable Data Quality Indicator

Character position	Definition	
		Global characters: O - OK C - Use with caution M - Not supplied B - Bad data Special characters
0	System CDF quality	0 - Bad data 1 - Use with caution 2 - OK F - Not supplied
1	B-field quality	
2	VLF quality	VLF antenna switching 1 - E normal M abnormal 2 - E abnormal M normal 3 - E abnormal M abnormal
3	S/C Common Mode quality	
4	ELF quality	
5	Electron Flux quality	
6	Electron Moment quality	
7	Proton Flux quality	
8	Proton Moment quality	1 - Uses energies $\leq$ 71 keV
9	Ephemeris quality	
10	Ion Gun/electron gun quality	

References

Blake, J. B. and J. F. Fennell, "Heavy Ion Measurements in the Synchronous Region," *Planet. Sp. Sci., 29*, 1205, 1981.

Boyd, G. B., J. F. Fennell, and M. T. Redding, "SCATHA Data Summary Description," *ESTEC 11006/94/NL/CC* and *NASA NAGW-4141*, 1995.

Cohen, H. A., R. C. Adamo, T. Aggson, A. L. Chesley, D. M. Clark, S. A. Damron, D. E. Delorey, J. F. Fennell, M. 5. Gussenhoven, F. A. Hanser, D. Hall, D. A. Hardy, W. B. Huber, I. Katz, H. C. Koons, 5. T. Lai, B. Ledley, P. F. Mizera, E. G. Mullen, J. E. Nanevicz, R. C. Olsen, A. G. Rubin, G. W. Schnuelle, N. A. Saflekos, M. F. Tautz, and E. C. Whipple, "P78-2 Satellite and Payload Responses to Electron Beam Operations on March 30, 1979," in *Spacecraft Charging Technology 1980*, p. 509, *NASA CP2182* and *AFGL-TR-81-0270*, 1981.

Croley, D. R., Jr., J. F. Fennell, and B. G. Ledley, "Observations of Reconnection Phenomena at Synchronous Orbit," *J. Geophys. Res., 91*, 4321, 1986.

Fennell, J. F., "Description of P78-2 (SCATHA) Satellite and Experiments," in *The IMS Source Book*, Russell and Southwood Ed., 65-81, American Geophysical Union, Washington, DC, 1982.

Fennell, J. F., D. R. Croley, Jr., and S. M. Kaye, "Low-Energy Ion Pitch-Angle Distributions in the Outer Magnetosphere: Ion Zipper Distributions," *J. Geophys. Res., 86*, 3375, 1981.

Hall, D. F. and A. A. Fote, "α_S/ε_H Measurements of Thermal Control Coatings over Four Years at Geosynchronous Altitude," in *Spacecraft Contamination: Sources and Prevention*, Roux and McCay, ed., Vol 91 of Progress in Astronautics and Aeronautics, 1984.

Hanser, F. A., D. A. Hardy, and B. Sellers, "Calibration of the Rapid Scan Particle Detector Mounted in the SCATHA Satellite," *AFGL-TR-79-0167*, 1979.

Johnson, R. G., R. J. Strangeway, E. G. Shelley, J. M. Quinn, and S. M. Kaye, "Hot Plasma Composition Results form the SCATHA Spacecraft," in *Energetic Ion Composition in The Earth's Magnetosphere*, edited by R. G. Johnson, p. 287, Terra Scientific, Tokyo, 1983.

Koons, H. C., P. F. Mizera, J. F. Fennell, and D. F. Hall, "Spacecraft Charging—Results from the SCATHA Satellite," *Astronautics and Astronautics, 18*, 44, 1980.

Koons, H. C., "The Role of Hiss in Magnetospheric Chorus Emissions," 6745, 1981.

Koons, H. C., "Summary of Environmentally Induced Electrical Discharges on the P78-2 (SCATHA) Satellite," *AIAA-82-0264*, Orlando, FL, Jan. 1982.

Koons, H. C. and J. F. Fennell, "Particle and Wave Dynamics During Plasma Injections," *J. Geophys. Res., 88*, 6221, 1983.

Mauk, B. H. and C. I. Meng, "Dynamical Injections as the Source of Near Geostationary Quiet Time Particle Spatial Boundaries," *J. Geophys. Res., 88*, 10011, 1983.

Mizera, P. F., "A Summary of Spacecraft Charging Results," *J. Spacecraft and Rockets*, 20, 438, 1981.

Mullen, E. G. and M. S. Gussenhoven, "SCATHA Environmental Atlas," *AFGL-TR-83-0002*, 1983.

Olsen, R. C., "The Hidden Ion Population of the Magnetosphere," *J. Geophys. Res, 87,* 3481, 1982.

Reagan, J. B., R. W. Nightingale, E. E. Gaines, W. L. Imhof, and E. G. Stassinopoulos, "Outer zone energetic electron spectral measurements," *Proceedings of the AIAA 18th Aerospace Sciences Meeting, AIAA-80-0390*, Pasadena, CA, 1980.

Reagan, J. B., R. W. Nightingale, E. E. Gaines, R. E. Meyerott, and W. L. Imhof, "The role of energetic particles in the charging/discharging of spacecraft dielectrics," in *Proceedings of the Spacecraft Charging Technology 1980*, N. J. Stevens, ed., *NASA Conf. Pub. 2182* and *AFGL-TR-81-0270*, 1981.

Reasoner, D. L., P. D. Craven, and C. R. Chappell, "Characteristics of Low-Energy Plasma in the Plasmasphere and Plasma Trough," *J. Geophys. Res, 88,* 7913, 1983.

Stevens, J. R. and A. L. Vampola eds., "Description of the Space Test Program P78-2 Spacecraft and Payloads," SAMSO TR-78-24, The Aerospace Corp., El Segundo, CA, 1978.

Strangeway, R. J. and R. G. Johnson, "Energetic Ion Mass Composition as Observed at Near-Geosynchronous and Low Altitudes During the Storm Period of February 21 and 22, 1979," *J. Geophys. Res., 89*, 8919, 1984.

Appendix A—Summary Data Structure

Each record is separated in time by one minute.

Item	Description		Bytes	Source
1	NSSDC Standard Time (Epoch)		8	N/A
2	<Bx> - GSM		4	SC11
3	<By> - GSM		4	"
4	<Bz> - GSM		4	"
5	sigma <Bx> (standard deviation)		4	"
6	sigma <By> (standard deviation)		4	"
7	sigma <Bz> (standard deviation)		4	"
8	<E-field> VLF wave amplitude	(0.4 kHz)	4	SC1-8A
9	"	(1.3 kHz)	4	"
10	"	(2.3 kHz)	4	"
11	"	(3.0 kHz)	4	"
12	"	(10.5 kHz)	4	"
13	"	(30 kHz)	4	"
14	"	(100 kHz)	4	"
15	"	(300 kHz)	4	"
16	Peak E-field VLF wave amplitude	(0.4 kHz)	4	"
17	"	(1.3 kHz)	4	"
18	"	(2.3 kHz)	4	"
19	"	(3.0 kHz)	4	"
20	"	(10.5 kHz)	4	"
21	"	(30 kHz)	4	"
22	"	(100 kHz)	4	"
23	"	(300 kHz)	4	"
24	<B-field> VLF wave amplitude	(0.4 kHz)	4	"
25	"	(1.3 kHz)	4	"
26	"	(2.3 kHz)	4	"
27	"	(3.0 kHz)	4	"
28	Peak B-field VLF wave amplitude	(0.4 kHz)	4	"
29	"	(1.3 kHz)	4	"
30	"	(2.3 kHz)	4	"
31	"	(3.0 kHz)	4	"
32	<Common mode s/c potential>	(±15 volts)	4	SC10
33	"	(±300 volts)	4	"
34	"	(±5000 volts)	4	"
35	<DC E-field magnitude>	(x 0.025)	4	"
36	"	(x 0.25)	4	"
37	< E-field RMS magnitude>	(x 2.5)	4	"
38	<E-field> ELF telemetry volts	(0.1-1.0 Hz)	4	"
39	"	(1-2 Hz)	4	"
40	"	(2-20 Hz)	4	"
41	"	(20-200 Hz)	4	"
42	Peak E-field ELF telemetry volts	(0.1-1.0 Hz)	4	"
43	"	(1-2 Hz)	4	"

Item	Description		Bytes	Source
44	"	(2-20 Hz)	4	"
45	"	(20-200 Hz)	4	"
46	<B-field> ELF telemetry volts	(0.1-1.0 Hz)	4	"
47	"	(1-2 Hz)	4	"
48	"	(2-20 Hz)	4	"
49	"	(20-200 Hz)	4	"
50	Peak B-field ELF telemetry volts	(0.1-1.0 Hz)	4	"
51	"	(1-2 Hz)	4	"
52	"	(2-20 Hz)	4	"
53	"	(20-200 Hz)	4	"
54	< Differential e- flux (perp to B) >	(187eV)	4	SC2-3
55	"	(446 eV)	4	"
56	"	(1090 eV)	4	"
57	"	(2580 eV)	4	"
58	"	(4520 eV)	4	"
59	"	(10.95 keV)	4	"
60	"	(19.40 keV)	4	"
61	"	(57 keV)	4	SC3
62	"	(98 keV)	4	"
63	"	(140 keV)	4	"
64	Statistical error in differential e-flux (perp to B)	(187eV)	4	SC2-3
65	"	(446 eV)	4	"
66	"	(1090 eV)	4	"
67	"	(2580 eV)	4	"
68	"	(4520 eV)	4	"
69	"	(10.95 keV)	4	"
70	"	(19.40 keV)	4	"
71	"	(57 keV)	4	SC3
72	"	(98 keV)	4	"
73	"	(140 keV)	4	"
74	< Differential e- flux (parl to B) >	(187eV)	4	SC2-3
75	"	(446 eV)	4	"
76	"	(1090 eV)	4	"
77	"	(2580 eV)	4	"
78	"	(4520 eV)	4	"
79	"	(10.95 keV)	4	"
80	"	(19.40 keV)	4	"
81	"	(57 keV)	4	SC3
82	"	(98 keV)	4	"
83	"	(140 keV)	4	"
84	Statistical error in differential e-flux (parl to B)	(187eV)	4	SC2-3
85	"	(446 eV)	4	"
86	"	(1090 eV)	4	"
87	"	(2580 eV)	4	"
88	"	(4520 eV)	4	"
89	"	(10.95 keV)	4	"
90	"	(19.40 keV)	4	"
91	"	(57 keV)	4	SC3
92	"	(98 keV)	4	"
93	"	(140 keV)	4	"
94	Total e-_perp energy flux	(.20 - 20keV)	4	SC2-3
95	Total e-_perp number flux	"	4	"

Item	Description		Bytes	Source
96	Total e-_parl energy flux	(.20 - 20keV)	4	SC2-3
97	Total e-_parl number flux	"	4	"
98	< Differential p+ flux (perp to B) >	(154 eV)	4	SC2-3
99	"	(360 eV)	4	"
100	"	(880 eV)	4	"
101	"	(2060 eV)	4	"
102	"	(3600 eV)	4	"
103	"	(8800 eV)	4	"
104	"	(15.60 keV)	4	"
105	"	(36 keV)	4	SC2-6
106	"	(71 keV)	4	"
107	"	133keV	4	"
108	Statistical error in differential p-flux perp to B	(154eV)	4	SC2-3
109	"	(360 eV)	4	"
110	"	(880 eV)	4	"
111	"	(2060 eV)	4	"
112	"	(3600 eV)	4	"
113	"	(8800 eV)	4	"
114	"	(15.60 keV)	4	"
115	"	(36 keV)	4	SC2-6
116	"	(71 keV)	4	"
117	"	133keV	4	"
118	< Differential p+ flux (parl to B) >	(154 eV)	4	SC2-3
119	"	(360 eV)	4	"
120	"	(880 eV)	4	"
121	"	(2060 eV)	4	"
122	"	(3600 eV)	4	"
123	"	(8800 eV)	4	"
124	"	(15.60 keV)	4	"
125	"	(36 keV)	4	SC2-6
126	"	(71 keV)	4	"
127	"	(133 keV)	4	"
128	Statistical error in differential p-flux parl to B	(154eV)	4	SC2-3
129	"	(360 eV)	4	"
130	"	(880 eV)	4	"
131	"	(2060 eV)	4	"
132	"	(3600 eV)	4	"
133	"	(8800 eV)	4	"
134	"	(15.60 keV)	4	"
135	"	(36 keV)	4	SC2-6
136	"	(71 keV)	4	"
137	"	(133 keV)	4	"
138	Total p+_perp energy flux	(.15 - 15keV)	4	SC2-3
139	Total p+_perp number flux	"	4	"
140	Total p+_parl energy flux >	(.15 - 15keV)	4	SC2-3
141	Total p+_parl number flux >	"	4	"
142	< n e- > (cm-3)	(.1 - 20keV)	4	SC2-3
143	< lv e-l > (km/s)	"	4	"
144	< P e- > ndynes/cm^2	"	4	"
145	< E e- > (keV)	"	4	"
146	< n p+ > (cm-3)	(.1 - 133keV)	4	SC2-3,-6
147	< lv p+ > (km/s)	(.1 - 15keV)	4	SC2-3

Item	Description		Bytes	Source
148	< P p+ > ndynes/cm^2	(.1 - 133keV)	4	SC2-3,-6
149	< E p+ > (keV)	▪	4	SC2-3,-6
150	s/c geo. longitude (degrees)		4	Ephemeris
151	s/c geo. latitude (degrees)		4	▪
152	s/c geocentric radius (km)		4	▪
153	s/c x-position (ECI)		4	▪
154	s/c y-position (ECI)		4	▪
155	s/c z-position (ECI		4	▪
156	s/c velocity_x(ECI) (km/s)		4	▪
157	s/c velocity_y(ECI) (km/s)		4	▪
158	s/c velocity_z(ECI) (km/s)		4	▪
159	MLT @ mag equator (hours)		4	▪
160	Magnetic Latitude		4	▪
161	B_equator_model (nT)		4	▪
162	L shell		4	▪
163	arccos< b_hat . s_hat > (degrees)		4	▪
164	Bx_model (nT) - GSM		4	▪
165	By_model (nT) - GSM		4	▪
166	Bz_model (nT) - GSM		4	▪
167	Ion/electron gun operation flag		1	SC4
168	Variable Data Quality Indicator		11	

Appendix B—High-Resolution Data Parameters

Item	Description		Source
1	NSSDC Standard Time (epoch)		N/A
2	Record Status		"
3	Bx (1st 1/4-sec sample)	S/C coords	SC11
4	By "	"	"
5	Bz "	"	"
6	Bx (2nd 1/4-sec sample)	"	"
7	By "	"	"
8	Bz "	"	"
9	Bx (3rd 1/4-sec sample)	"	"
10	By "	"	"
11	Bz "	"	"
12	Bx (4th 1/4-sec sample)	"	"
13	By "	"	"
14	Bz "	"	"
15	Bx (1st 1/4-sec sample)	ECI coords	"
16	By "	"	"
17	Bz "	"	"
18	Bx (2nd 1/4-sec sample)	"	"
19	By "	"	"
20	Bz "	"	"
21	Bx (3rd 1/4-sec sample)	"	"
22	By "	"	"
23	Bz "	"	"
24	Bx (4th 1/4-sec sample)	"	"
25	By "	"	"
26	Bz "	"	"
27	Bx (1st 1/4-sec sample)	GSM coords	"
28	By "	"	"
29	Bz "	"	"
30	Bx (2nd 1/4-sec sample)	"	"
31	By "	"	"
32	Bz "	"	"
33	Bx (3rd 1/4-sec sample)	"	"
34	By "	"	"
35	Bz "	"	"
36	Bx (4th 1/4-sec sample)	"	"
37	By "	"	"
38	Bz "	"	"
39	E- field VLF wave amplitude	(0.4 kHz)	SC1-8A
40	"	(1.3 kHz)	"
41	"	(2.3 kHz)	"
42	"	(3.0 kHz)	"
43	"	(10.5 kHz)	"
44	"	(30 kHz)	"
45	"	(100 kHz)	"
46	"	(300 kHz)	"

Item	Description		Source
47	B- field VLF wave amplitude	(0.4 kHz)	"
48	"	(1.3 kHz)	"
49	"	(2.3 kHz)	"
50	"	(3.0 kHz)	"
51	"	(10.5 kHz)	"
52	"	(30 kHz)	"
53	"	(100 kHz)	"
54	"	(300 kHz)	"
55	SC1-8A antenna mode (E or B)		"
56	Electric antenna look-angle		"
57	Magnetic antenna look-angle		"
58	Common mode S/C potential positive		SC10
59	Common mode S/C potential	(±15 volts)	
60	"	(±300 volts)	"
61	"	(±5000 volts)	"
62	DC E-field magnitude>	(x 0.025)	"
63	"	(x 0.25)	"
64	AC E-field RMS magnitude	(x 2.5)	"
65	E-field ELF wave amplitude	(0.1-1.0 Hz)	"
66	"	(1-2 Hz)	"
67	"	(2-20 Hz)	"
68	"	(20-200 Hz)	"
69	B-field ELF wave amplitude	(0.1-1.0 Hz)	"
70	"	(1-2 Hz)	"
71	"	(2-20 Hz)	"
72	"	(20-200 Hz)	"
73	SC2 ESA status		SC2,1,2,3
74	SC2-1 Pitch angle	PA(0)	SC2-1
75	"	PA(1)	"
76	"	PA(2)	"
77	"	PA(3)	"
78	"	PA(4)	"
79	"	PA(5)	"
80	"	PA(6)	"
81	SC2-1 Sun angle	S(0)	"
82	"	S(1)	"
83	"	S(2)	"
84	"	S(3)	"
85	"	S(4)	"
86	"	S(5)	"
87	"	S(6)	"
88	SC2-1 Probe voltage		"
89	SC2-1 Detector bias boost status		"
90	SC2-1 Differential electron plasma flux	e(0)	"
91	"	e(1)	"
92	"	e(2)	"
93	"	e(3)	"
94	"	e(4)	"
95	"	e(5)	"
96	"	e(6)	"
97	SC2-1 Differential proton plasma flux	p(0)	"
98	"	p(1)	"

Item	Description		Source
99	"	p(2)	"
100	"	p(3)	"
101	"	p(4)	"
102	"	p(5)	"
103	"	p(6)	"
104	SC2 -1 Program ID	0	"
105	"	1	"
106	"	2	"
107	"	3	"
108	"	4	"
109	"	5	"
110	"	6	"
111	SC2 -1 Mode (program sequence)		"
112	SC2-1 Step (energy step indicator)	step 0	"
113	"	step 1	"
114	"	step 2	"
115	"	step 3	"
116	"	step 4	"
117	"	step 5	"
118	"	step 6	"
119	SC2-1 Step0/Step4 indicator		"
120	SC2-2 Pitch angle	PA(0)	SC2-2
121	"	PA(1)	"
122	"	PA(2)	"
123	"	PA(3)	"
124	"	PA(4)	"
125	"	PA(5)	"
126	"	PA(6)	"
127	SC2-2 Sun angle	S(0)	"
128	"	S(1)	"
129	"	S(2)	"
130	"	S(3)	"
131	"	S(4)	"
132	"	S(5)	"
133		S(6)	"
134	SC2-2 Probe voltage		"
135	SC2-2 Detector bias boost status		"
136	SC2-2 Differential electron plasma flux	e(0)	"
137	"	e(1)	"
138	"	e(2)	"
139	"	e(3)	"
140	"	e(4)	"
141	"	e(5)	"
142	"	e(6)	"
143	SC2-2 Differential proton plasma flux	p(0)	"
144	"	p(1)	"
145	"	p(2)	"
146	"	p(3)	"
147	"	p(4)	"
148	"	p(5)	"
149	"	p(6)	"
150	SC2-2 Program ID	0	"

Item	Description		Source
151	"	1	"
152	"	2	"
153	"	3	"
154	"	4	"
155	"	5	"
156	"	6	"
157	SC2-2 Mode (program sequence)		"
158	SC2-2Step (energy step indicator)	step 0	"
159	"	step 1	"
160	"	step 2	"
161	"	step 3	"
162	"	step 4	"
163	"	step 5	"
164	"	step 6	"
165	SC2-2 Step0/Step4 indicator		"
166	SC2-3 Pitch angle	PA(0)	SC2-3
167	"	PA(1)	"
168	"	PA(2)	"
169	"	PA(3)	"
170	"	PA(4)	"
171	"	PA(5)	"
172	"	PA(6)	"
173	SC2-3 Sun angle	S(0)	"
174	"	S(1)	"
175	"	S(2)	"
176	"	S(3)	"
177	"	S(4)	"
178	"	S(5)	"
179	"	S(6)	"
180	SC2-3 Detector bias boost status		"
181	SC2-3 Differential electron plasma flux	e(0)	"
182	"	e(1)	"
183	"	e(2)	"
184	"	e(3)	"
185	"	e(4)	"
186	"	e(5)	"
187	"	e(6)	"
188	SC2-3 Differential proton plasma flux	p(0)	"
189	"	p(1)	"
190	"	p(2)	"
191	"	p(3)	"
192	"	p(4)	"
193	"	p(5)	"
194	"	p(6)	"
195	SC2 -3 Program ID	0	"
196	"	1	"
197	"	2	"
198	"	3	"
199	"	4	"
200	"	5	"
201	"	6	"
202	SC2-3 Mode (program sequence)		"

Item	Description		Source
203	SC2-3 Step (energy step indicator)	step 0	"
204	"	step 1	"
205	"	step 2	"
206	"	step 3	"
207	"	step 4	"
208	"	step 5	"
209	"	step 6	"
210	SC2-3 Step0/Step4 indicator		"
211	SC2-3B E_p> 126 keV		SC2-3B
212	SC2-3B E_p > 390 keV		"
213	SC2-3B $E_\alpha \geq$ 3.8 MeV		"
214	SC2-3B 392 < E_α < 960 keV		"
215	SC2-3B 549 < E_α < 960 keV		"
216	SC2-3B 1.21 < E_{cno} < 2.7		"
217	SC2-3B $E_{m>16}$ > 5.4 MeV		"
218	SC2-3B pitch angle		"
219	SC2-6 Differential proton energetic particle flux	14≤ep≤24keV	SC2-6
220	"	24≤ep≤48keV	"
221	"	48≤ep≤94keV	"
222	"	94≤ep≤1724keV	"
223	"	172≤ep≤3524keV	"
224	"	352≤ep≤700keV	"
225	"	700≤ep≤3300keV	"
226	"	33004keV<ep	"
227	SC2-6 pitch angle		"
228	SC2-6 sun angle		"
229	SC3 Instrument Status		SC3
230	SC3 Energetic Electron raw particle count	CH01-Ee(0)	"
231	"	CH02-Ee(1)	"
232	"	CH03-Ee(2)	"
233	"	CH04-Ee(3)	"
234	"	CH05-Ee(4)	"
235	"	CH06-Ee(5)	"
236	"	CH07-Ee(6)	"
237	"	CH08-Ee(7)	"
238	"	CH09-Ee(8)	"
239	"	CH10-Ee(9)	"
240	"	CH11-Ee(10)	"
241	"	CH12-Ee(11)	"
242	"	DINT-Ee(12)	"
243	"	EINT-Ee(13)	"
244	"	EINT-Ee(14)	"
245	"	AINT-Ee(15)	"
246	SC3 pitch angle		"
247	SC8 Instrument Status		SC8
248	SC8 E ~0.18 keV (average of 2 samples/sec)		"
249	SC8 E ~0.81 keV "		"
250	SC8 E ~3.69 keV "		"

Item	Description	Source
251	SC8 E ~17.53 keV "	"
252	SC8 Pitch angle	"
253	Angle between the electric antenna and B	SC10
254	Angle between the magnetic antenna and B	"
255	SC10 Instrument Status	"
256	SC10 Sun Angle (electric antenna)	"
257	Ion/electron gun operation flag	SC4

Notes:

Each record contains one second of data.
Items58-68 include periods only when E-field booms are not shadowed.
Items 211-217 and 219-226 are sun-edited to eliminate saturation sun response.

Appendix C—Scatha Science Units Conversions

C.1 Conversion for SC1-8A Instrument

Calibration curves shown in Figure C1 were used to convert the SC1-8A VLF wave data to science units. Given the raw telemetry value, Figures C1(a and b) are used to convert the electric channel data to units of dBV. Figure C1(c) is used to convert the raw magnetic channel data to units of dBnT. The data are stored in these units in the High Resolution CDF files (see Appendices B and F). The electric channel wave amplitudes, which are written to the SUMMARY CDF, have been converted to units of dBV/m assuming an effective length of 50 m for the SC10 antenna.

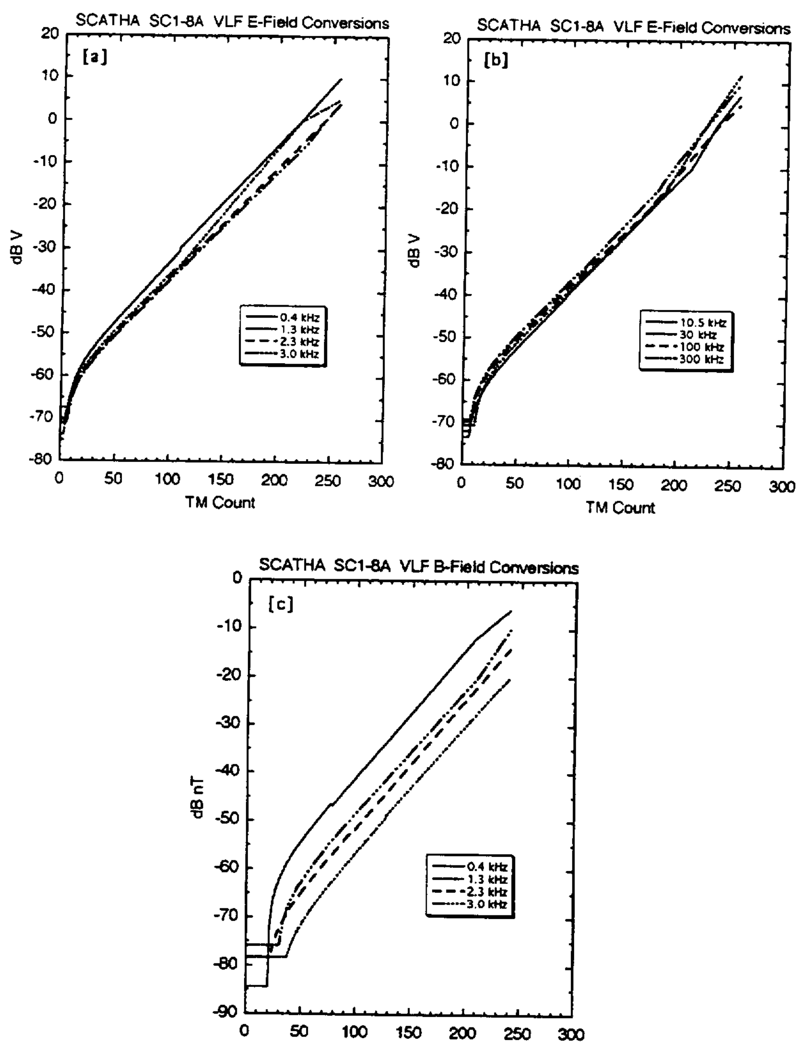

Figure C1. SC1-8A calibration curves.

C.2 Conversion for SC2 Instrument

The raw data for this instrument are stored as compressed values. After decompression, the data are converted to science units and stored in the High Resolution CDF (see Appendices B and F). Selected channels from SC2 -3 and SC2-6 are stored in the SUMMARY CDF. The conversion to physical units is described below, starting with the construction of a table used to decompress the raw telemetry values.

Calculation of decompression table:

a = [1, 2, 4, 16, 64, 256, 1024, 4096] (slopes)
b = [0, 512, 1536, 3584, 11776, 44544, 175104, 696832] (constants)

For values of i from 1 to 4096:

$nl_i = ((i - 1) / 512) + 1$

$table_i = a(nl_i) * (i - 1 - (nl_i - 1) * 512) + b(nl_i)$

$table_{i = 3073} = 175616$

$table_{i = 3585} = 699392$

The table with decompressed values are used to get observed counts/second, C_o.

SC2-1, SC2-2, and SC2-3 ESA

$C_o = 10 * (\text{decompressed value} - 1)$

SC2-3B and SC2-6

$C_o = \text{decompressed value} - 1$

(One is subtracted because the measurements from the SC2 sensors have a one count preset.)

SC2-1 and SC2-2 Probe

$C_o = \text{decompressed value}$

Science units calculation for SC2-1, SC2-2, and SC2-3 (ESA)

To get to science units for the ESA sensors, Tables C1 (ESA electrons) and C2 (ESA protons) are used to convert counts/sec to SC2-3 differential number flux. Figures C2 and C3 show the curves used to correct the SC2-3 ESA data to counts/sec from observed counts/sec (C_o). This is necessary because the Spiraltron channel electron multiplier efficiencies degraded with time on orbit. Figures C2 and C3 represent our best estimate of the efficiency reductions for the electron and proton detectors, respectively. The coefficients of third-order polynomials used to interpolate these efficiencies for use in the HR and Summary data production programs are also given. It should be noted that beyond about day 2,000 the electron efficiency is not well determined. The different curves correspond to the ratio of counting rates obtained by increasing the detector bias. N indicates NO bias increase. B1 indicates the bias was increased to BOOST-1 level and B2 indicates the bias was increased to BOOST-2 level. The ratios N/B1, N/B2, and B1/B2 indicates how the detector rate increased with bias voltage increase. If the detectors were operating in "pulse saturation" mode, the curves would have been flat with relative efficiency of unity. The fact that they are not flat indicates that efficiency correction is required. Since B2 was the highest bias level available, a relative efficiency of unity was arbitrarily assigned to the data taken at B2 bias. Similar operations were performed on the SC2-1 and SC2-2 ESA data that are only included in the High Resolution CDF.

Table C1. SCATHA SC2-3 ESA Multipliers for Electron Differential Number Flux At Mission Start

Prgm No.	Step No.	Energy (keV)	Multiplier Flux = cps*mulitiplier	Flux Units
1	0	0.187	6.60E+4	Electrons /(cm^2 s sr keV)
	1	0.446	4.07E+4	Electrons /(cm^2 s sr keV)
	2	1.09	1.53E+4	Electrons /(cm^2 s sr keV)
	3	2.58	8.25E+3	Electrons /(cm^2 s sr keV)
	4	4.52	5.69E+3	Electrons /(cm^2 s sr keV)
	5	10.95	3.76E+3	Electrons /(cm^2 s sr keV)
	6	19.4	2.45E+3	Electrons /(cm^2 s sr keV)
2	0	~0	NA	NA
	1	0.087	1.69E+5	Electrons /(cm^2 s sr keV)
	2	0.316	4.88E+4	Electrons /(cm^2 s sr keV)
	3	0.815	2.10E+4	Electrons /(cm^2 s sr keV)
	4	1.94	1.03E+4	Electrons /(cm^2 s sr keV)
	5	5.9	4.55E+3	Electrons /(cm^2 s sr keV)
	6	14.4	3.06E+3	Electrons /(cm^2 s sr keV)
3	0	~0	NA	NA
	1	0.017	7.26E+5	Electrons /(cm^2 s sr keV)
	2	0.04	2.41E+5	Electrons /(cm^2 s sr keV)
	3	0.612	3.36E+4	Electrons /(cm^2 s sr keV)
	4	1.44	1.30E+4	Electrons /(cm^2 s sr keV)
	5	3.41	6.96E+3	Electrons /(cm^2 s sr keV)
	6	8.2	3.76E+3	Electrons /(cm^2 s sr keV)

Nominal Geometric Factor = 1.62×10^{-4} cm^2 sr$\Delta E/E$

Prior to efficiency correction $\Delta E/E$ ~7%

eESA has analyzer constant = 5.9 (x Vpp)

Sample period at each step is ~100 msec

Table C2. SCATHA SC2-3 ESA Multipliers for Proton Differential Number Flux at Mission Start

Prgm No.	Step No.	Energy (keV)	Multiplier Flux = cps*mulitiplier	Flux Units
1	0	0.154	1.03E+4	Protons/(cm^2 s sr keV)
	1	0.360	4.41E+3	Protons/(cm^2 s sr keV)
	2	0.880	1.80E+3	Protons/(cm^2 s sr keV)
	3	2.060	7.71E+2	Protons/(cm^2 s sr keV)
	4	3.600	4.41E+2	Protons/(cm^2 s sr keV)
	5	8.800	1.80E+2	Protons/(cm^2 s sr keV)
	6	15.600	1.02E+2	Protons/(cm^2 s sr keV)
2	0	-0	NA	NA
	1	0.074	2.15E+4	Protons/(cm^2 s sr keV)
	2	0.255	6.22E+3	Protons/(cm^2 s sr keV)
	3	0.655	2.42E+3	Protons/(cm^2 s sr keV)
	4	1.550	1.02E+3	Protons/(cm^2 s sr keV)
	5	4.800	3.31E+2	Protons/(cm^2 s sr keV)
	6	11.600	1.37E+2	Protons/(cm^2 s sr keV)
3	0	-0	NA	NA
	1	0.018	8.82E+4	Protons/(cm^2 s sr keV)
	2	0.037	4.29E+4	Protons/(cm^2 s sr keV)
	3	0.490	3.24E+3	Protons/(cm^2 s sr keV)
	4	1.165	1.36E+3	Protons/(cm^2 s sr keV)
	5	2.700	5.88E+2	Protons/(cm^2 s sr keV)
	6	6.650	2.39E+2	Protons/(cm^2 s sr keV)

Nominal Geometric Factor = 6.3×10^{-4} cm^2 sr $\Delta E/E$
Prior to efficiency correction $\Delta E/E$ ~8%
pESA has analyzer constant = 4.33 (x Vpp)

Table C3. SCATHA SC2-6 Multipliers for Proton Differential Number Flux at Mission Start

Channel Energy	Midpoint Energy (keV)	Multiplier Flux = cps*multiplier	Flux Units
$14 \le E_p \le 24$ keV	19	5.00E+1	Protons /(cm^2 s sr keV)
$24 \le E_p \le 48$ keV	36	2.08E+1	Protons /(cm^2 s sr keV)
$48 \le E_p \le 94$ keV	71	1.09E+1	Protons /(cm^2 s sr keV)
$94 \le E_p \le 172$ keV	133	6.41E+0	Protons /(cm^2 s sr keV)
$172 \le E_p \le 352$ keV	262	2.78E+0	Protons /(cm^2 s sr keV)
$352 \le E_p \le 700$ keV	526	1.44E+0	Protons /(cm^2 s sr keV)
$700 \le E_p \le 3300$ keV	2000	1.92E-1	Protons /(cm^2 s sr keV)
3300 keV $\le E_p$		500.	Protons/(2.0×10^{-3} cm^2 sr)

Nominal Geometric Factor ~ 2.0×10^{-3} cm^2 sr
Angular Response ~ 9° FWHM

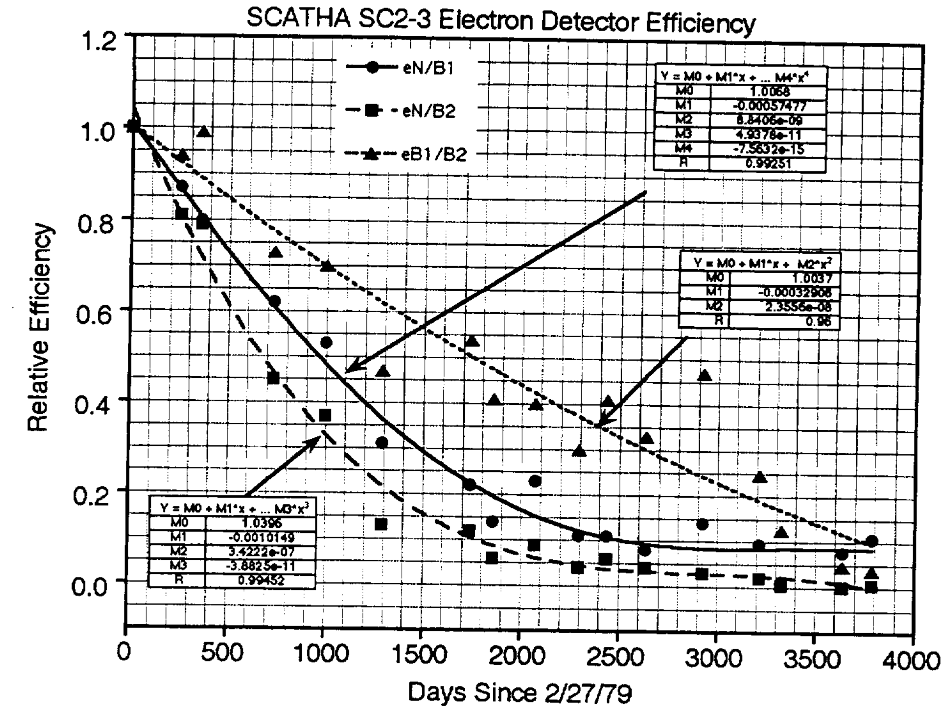

Figure C2. SC2-3 ESA electron detector efficiency.

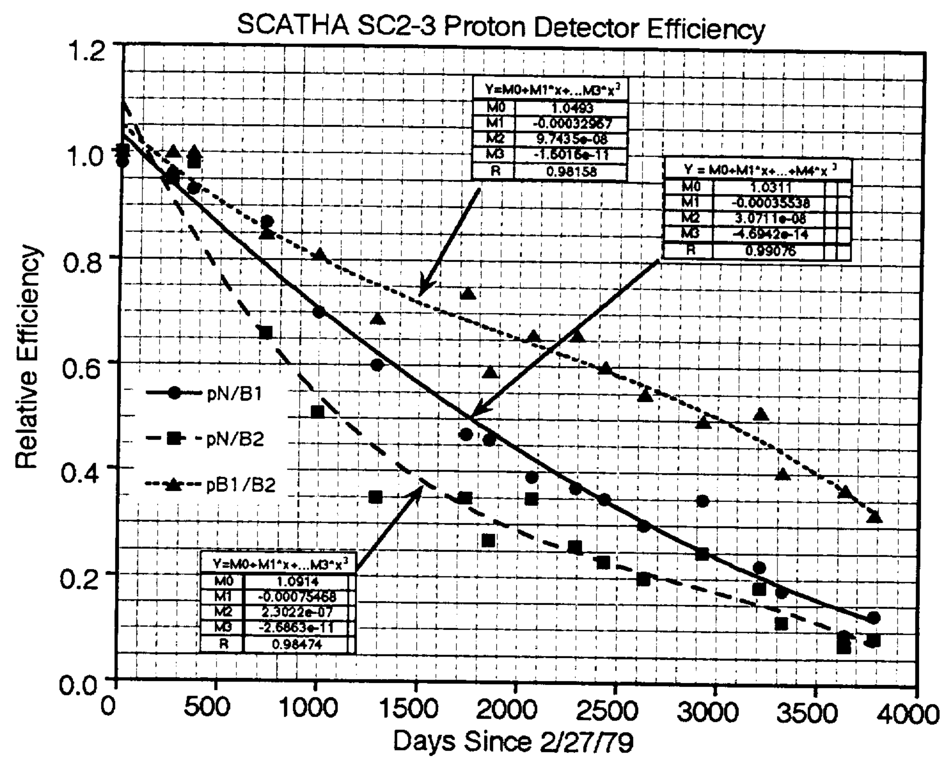

Figure C3. SC2-3 ESA proton detector efficiency.

Science units calculation for SC2-6 and SC2-3b:

Table C4 is used to convert the SC2-6 proton data from C_0 to differential number flux; while Table C5 is used for conversion of the SC2-3B C_0 data.

Science units calculation for SC2-1 and SC2-2 Probes:

The least significant bit of C_0 determines the range, 0 = low, 1 = high and the most significant bit of C_0 determines the sign.

If the most significant bit is 0:

$$SC2\text{-}1_V = (1111 * C_0 - 1124) / 1.0e{+}06 \text{—if range} = 0$$
$$SC2\text{-}1_V = (1150 * C_0 - 22400) / 1.0e{+}04 \text{—if range} = 1$$
$$SC2\text{-}2_V = (1160 * C_0 + 820) / 1.0e{+}06 \text{—if range} = 0$$
$$SC2\text{-}2_V = (1191 * C_0 + 21277) / 1.0e{+}04 \text{—if range} = 1$$

If the most significant bit is 1:

$$SC2\text{-}1_V = (1156 * C_0 + 6098) / 1.0e{+}06 \text{—if range} = 0$$
$$SC2\text{-}1_V = (1150 * C_0 + 14390) / 1.0e{+}04 \text{—if range} = 1$$
$$SC2\text{-}2_V = (1149 * C_0 + 583) / 1.0e{+}06 \text{—if range} = 0$$
$$SC2\text{-}2_V = (1188 * C_0 -6390) / 1.0e{+}04 \text{—if range} = 1$$

Table C4. SCATHA SC2-3B Ion Detector Multipliers for Conversion to Ion Differential Number Flux at Mission Start

Channel ID	Channel Energy Range	Multiplier Flux = cps*multiplier	Flux Units
BP1S	$E_P > 126$ keV	2.78×10^3	number/(cm^2 s sr)
	$E_{>P} < 390$ keV	"	number/(cm^2 s sr)
BP2S	$E_P > 390$ keV	2.78×10^3	number/(cm^2 s sr)
	$E_\alpha > 960$ keV	"	number/(cm^2 s sr)
	$E_{CNO} > 2.7$ MeV	"	number/(cm^2 s sr)
2B	$E_\alpha \geq 3.8$ MeV	2.78×10^3	number/(cm^2 s sr)
	$E_{CNO} \geq 6.5$ MeV	"	number/(cm^2 s sr)
α_1	$392 \leq E_\alpha \leq 960$ keV	4.89	number/(cm^2 s sr keV)
α_2	$549 \leq E_\alpha \leq 960$ keV	6.76	number/(cm^2 s sr keV)
CNO1	$1.21 \leq E_{CNO} \leq 2.7$ MeV	1.86	number/(cm^2 s sr keV)
CNO2	$1.48 \leq E_{CNO} \leq 2.7$ MeV	2.28	number/(cm^2 s sr keV)
CNO3	$1.48 \leq E_{CNO} \leq 2.7$ MeV	3	number/(cm^2 s sr keV)
>CNO	$E_{>CNO} \geq 5.5$ MeV	2.78×10^3	number/(cm^2 s sr)

Nominal Geometric Factor ~ 3.6×10^{-4} cm^2 sr
Angular Response ~ 4° FWHM
Sample Period = 1 sec except for B10 and B11 which have 0.25 sec samples

C.3 Conversion for SC3 Instrument

The SC3 instrument telemetry contained either data from high- or low-energy electron channels. The data are decompressed, and the observed counts are stored in the HIGH RESOLUTION CDF (see Appendix G). The SUMMARY CDF contains the data for three of the low-energy channels (italicized channels) converted to fluxes.

CH 1 E119	***CH 2 E98***	CH 3 E77
CH 4 E57	CH 5 E203	CH 6 E182
CH 7 E161	***CH 8 E140***	CH 9 E288
CH 10 E267	CH 11 E245	CH 12 E224
CH 13 DINT	CH 14 EINT	CH 15 ELINT
CH 16 AINT		

DINT = Integral channel for low-energy channels
EINT = Integral channel for high-energy channels
ELINT = The 3rd detector in the stack

AINT = The shield around the whole stack of 3 detectors

To decompress the 8-bit data for the **high** or the **low** electron channels and get observed counts, the following was used:

$$\text{8-bit compressed data } \mathbf{IZ} = \overset{\text{MSB}}{Y_4}\, Y_3\, Y_2\, Y_1\, X_4\, X_3\, \overset{\text{LSB}}{X_2}\, X_1 \text{ where....}$$

$$\mathbf{IY} = Y_4 Y_3 Y_2 Y_1 \quad \text{and} \quad \mathbf{IX} = X_4 X_3 X_2 X_1$$

$$\text{If } \mathbf{IZ} \leq 31 \quad \text{counts}_{obs} = \mathbf{IZ}$$
$$\text{If } \mathbf{IZ} > 31 \quad \text{counts}_{obs} = (\mathbf{IX} + 16) * 2^{(IY-1)} + 2^{(IY-2)}$$

The observed counts for the **low** electron energy channels were converted to true counts using the following equation:

$$\text{Counts}_{true} = (\text{counts}_{obs}/0.496) * \text{obs\_factor}$$

$$\text{obs\_factor} = 1.0 + (0.0000194 * \text{DINT} / 0.496) \,/\, (1.0 - (0.000006 * \text{DINT} / 0.496))$$

DINT is the value from the integral channel.
Data are accumulated for 0.496 seconds each half second.

The flux calculation was done by multiplying Counts_{true} by its appropriate multiplier (see Table C5).

Table C5. SCATHA SC3 Electron Detector - Multipliers for Differential number flux at mission start

Channel Energy	Midpoint Energy (keV)	Multiplier Flux = cps * multiplier	Flux Units
$46 \le E_e \le$ 66 keV	57	8.98E+1	Electrons/(cm^2 s sr keV)
$66 \le E_e \le$ 87 keV	77	5.36E+1	Electrons/(cm^2 s sr keV)
$87 \le E_e \le$ 108 keV	98	4.38E+1	Electrons/(cm^2 s sr keV)
$108 \le E_e \le$ 129 keV	119	3.75E+1	Electrons/(cm^2 s sr keV)
$129 \le E_e \le$ 150 keV	140	3.43E+1	Electrons/(cm^2 s sr keV)
$150 \le E_e \le$ 171 keV	161	3.15E+1	Electrons/(cm^2 s sr keV)
$171 \le E_e \le$ 192 keV	182	2.98E+1	Electrons/(cm^2 s sr keV)
$192 \le E_e \le$ 214 keV	203	2.74E+1	Electrons/(cm^2 s sr keV)
$214 \le E_e \le$ 235 keV	224	2.82E+1	Electrons/(cm^2 s sr keV)
$235 \le E_e \le$ 256 keV	245	3.15E+1	Electrons/(cm^2 s sr keV)
$256 \le E_e \le$ 278 keV	267	3.50E+1	Electrons/(cm^2 s sr keV)
$278 \le E_e \le$ 299 keV	288	4.38E+1	Electrons/(cm^2 s sr keV)

C.4 Conversion for SC8 Instrument

There are four channels of SC8 electron data. These data, decompressed and converted to science units, are included in the High Resolution CDF but are not part of the SUMMARY CDF. The raw telemetry is compressed. Table C6 is used to convert the decompressed value to science units.

Decompression:

$$\text{8-bit compressed data } \mathbf{IZ} = \overset{\text{MSB}}{Y_4} Y_3 Y_2 Y_1 X_4 X_3 X_2 \overset{\text{LSB}}{X_1} \text{ where....}$$

$$\mathbf{IY} = Y_4 Y_3 Y_2 Y_1 \quad \text{and} \quad \mathbf{IX} = X_4 X_3 X_2 X_1$$

If $\mathbf{IZ} \le 31$ $\quad cts_{obs} = \mathbf{IZ} / 2$

If $\mathbf{IZ} > 31$ $\quad cts_{obs} = (\mathbf{IZ} - 1) / 2$ for $\mathbf{IY} \le 1$

If $\mathbf{IZ} > 31$ $\quad cts_{obs} = ((\mathbf{IX} + 16) * 2^{(IY-1)} + 2^{(IY-2)} - 1) / 2$ for $IY > 1$

Table C6. SCATHA SC8 Electron Detector—Flux Multipliers

Channel Energy	Midpoint Energy (keV)	Multiplier Flux = cts_{obs} · multiplier	Flux Units
.09 - 0.27	0.18	414594.	Electrons/(cm^2 s sr keV)
0.39 - 1.23	0.81	160333.	Electrons/(cm^2 s sr keV)
1.76 - 5.62	3.69	38715.	Electrons/(cm^2 s sr keV)
8.3 - 26.7	17.53	13054.	Electrons/(cm^2 s sr keV)

C.5 Conversion for SC10 Instrument

The SC10 data conversion starts by dividing the raw telemetry (8 bits) by 50 to get voltages.

Electric and Magnetic field low-frequency wave conversions:

The four channels each of the SC10 electric field wave amplitudes and SC11 magnetic field wave amplitudes were not converted to science units because the conversion information is not known. Only voltage values are stored in the High Resolution and the SUMMARY CDFs for these parameters.

Common Mode potential conversions:

cm1scpot = ((8-bit value) / 50.) - 2.5) * 6.	(range = ±15 volts)
cm2scpot = ((8-bit value) / 50.) - 2.5) * 120.	(range = ±300 volts)
cm3scpot = ((8-bit value) / 50.) - 2.5) * 2000.	(range = ±5000 volts)

DC Electric field conversions:

edclo = ((8-bit value) / 50.) - 2.5) * 49.	(gain = 0.025)
edchi = ((8-bit value) / 50.) - 2.5) * 4.9	(gain = 0.25)
eac = ((8-bit value) / 50.) - 2.5) * 817.	(gain = 2.5)

C.6 Conversion for SC11 Instrument

The outputs of this instrument are biased by 2.5 V and range from 0 V corresponding to a component of –700 gamma (= –700 nanotesla) up to 5 V corresponding to +700 gamma. The basic frequency response of this instrument is approximately that of a low-pass filter with a single pole at 100 Hz. The data are stored in the High Resolution CDF files in three different coordinate systems: satellite, ECI, and GSM. The SUMMARY CDF includes only data in the GSM coordinate system. The experiment provides two types of data useful for aspect calculations:

Type 1: The sample rate is one sample per eight seconds of each axis output. These signals were supplied to the spacecraft analog telemetry system through low pass filters with a 2 Hz bandwidth.

Type 2: The sample rate is four two-word samples per second of each axis output. For this data, the signal from each axis is filtered with a 2 Hz low pass filter and then processed by a 4-bit subtractor. An analog representation of the 4-bit word is encoded by the spacecraft's telemetry system as the first of the two words assigned to each sample. A subtracted remainder is then amplified by sixteen and is encoded by the spacecraft's telemetry system as the second word. Because of the 2 Hz filters (used to eliminate aliasing in the 4 sample/second data) and the satellite spin rate of 1 rpm, it will be necessary to correct for the phase shift of the components in the spin plane.

Algorithms:

For data of Type 1 above:

$B_i = a_i(V_i - VO_i) + C_i$ (i = 1,2,3 for the three axes)

where

B_i is the ambient field component in the direction of the i sensor.

V_i is a Type 1 data word.

VO_i is the axis bias value (= V_i in zero ambient field).

C_i is a correction for the spacecraft field.

a_i is a constant.

For data of Type 2 above (The majority of SCATHA data was Type 2.):

$B_i = A_i'(F(V_i') + ((V_i'' - VF_i)/G_i) - VO_i) + C_i + CK_{i=2}$

where definitions are as above and

$A_1 = 192.58$
$A_2 = 192.37$
$A_3 = 3192.72$

$X_v = 0.02$ (conversion factor from 8-bit telemetry to 0-5.0 volts)

$VF_1 = 0.473$
$VF_2 = 0.479$
$VF_3 = 0.477$

$VO_1 = 2.491$
$VO_2 = 2.513$
$VO_3 = 2.499$

V_i' and V_i'' refer to words 1 and 2 for each sample.
V_i' = the 8-bit value * X_v word 1
V_i'' = the 8-bit value * X_v word 2

G is a constant.
$G_1 = 12.991$
$G_2 = 12.991$
$G_3 = 12.991$

$C_1 = 0.0$
$C_2 = 0.0$
$C_3 = 0.5$

$F(V_i')$ is obtained from a 16 point look-up table for each component.

TEMP = 8-bit value * X_v
CK is a temperature correction factor utilizing the CAY function listed below. The temperature correction factor, ($CK_{i=2}$) is given once every 16 seconds and as noted the correction is for i = 2 only.
If TEMP < 3.7 then CAY(TEMP) = 0.0
If TEMP ≥ 3.7 then CAY(TEMP) = (TEMP - 3.7) * .727272727272

Table C7. SCATHA SC11 Voltage Look-up Table

8-bit value	X = 1	Y = 2	Z = 3
000 - 007	-0.0014	-0.0016	-0.0014
008 - 023	0.3111	0.3109	0.3111
024 - 038	0.6235	0.6235	0.6233
039 - 054	0.9362	0.9362	0.9360
055 - 070	1.2486	1.2483	1.2491
071 - 085	1.5613	1.5610	1.5618
086 - 101	1.8738	1.8737	1.8741
102 - 117	2.1865	2.1864	2.1869
118 - 132	2.5001	2.4995	2.4994
133 - 148	2.8128	2.8122	2.8121
149 - 164	3.1253	3.1250	3.1244
165 - 179	3.4380	3.4377	3.4372
180 - 195	3.7505	3.7498	3.7503
196 - 210	4.0632	4.0625	4.0631
211 - 226	4.3758	4.3754	4.3754
227 - 255	4.6886	4.6882	4.6882

Appendix D—SCATHA Days for ESA-Required Data Only

1063 03/04/79
1065 03/06/79
1066 03/07/79
1067 03/08/79
1068 03/09/79
1069 03/10/79
1070 03/11/79
1071 03/12/79

1084 03/25/79
1085 03/26/79
1086 03/27/79
1087 03/28/79
1088 03/29/79
1090 03/31/79
1091 04/01/79
1092 04/02/79
1093 04/03/79

1134 05/14/79
1135 05/15/79
1136 05/16/79
1137 05/17/79
1138 05/18/79
1139 05/19/79
1140 05/20/79
1141 05/21/79
1142 05/22/79

1205 07/24/79
1206 07/25/79
1207 07/26/79
1208 07/27/79
1209 07/28/79
1210 07/29/79
1211 07/30/79
1212 07/31/79
1213 08/01/79

1276 10/03/79
1277 10/04/79
1278 10/05/79
1279 10/06/79
1280 10/07/79
1281 10/08/79
1282 10/09/79
1283 10/10/79

1284 10/11/79
1347 12/13/79
1348 12/14/79
1349 12/15/79
1350 12/16/79
1351 12/17/79
1352 12/18/79
1353 12/19/79
1354 12/20/79

2053 02/22/80
2054 02/23/80
2055 02/24/80
2056 02/25/80
2057 02/26/80
2058 02/27/80
2059 02/28/80
2060 02/29/80
2061 03/01/80
2062 03/02/80
2063 03/03/80
2065 03/05/80
2066 03/06/80
2067 03/07/80
2068 03/08/80
2069 03/09/80
2071 03/11/80
2073 03/13/80
2074 03/14/80
2076 03/16/80
2077 03/17/80
2078 03/18/80
2079 03/19/80
2080 03/20/80
2081 03/21/80
2082 03/22/80
2083 03/23/80
2084 03/24/80

6245 09/01/84
6246 09/02/84
6247 09/03/84
6248 09/04/84
6249 09/05/84
6250 09/06/84
6251 09/07/84
6252 09/08/84
6253 09/09/84
6254 09/10/84
6255 09/11/84
6256 09/12/84
6257 09/13/84
6258 09/14/84
6259 09/15/84
6260 09/16/84
6261 09/17/84
6262 09/18/84
6263 09/19/84
6264 09/20/84
6265 09/21/84
6266 09/22/84
6267 09/23/84
6268 09/24/84
6269 09/25/84
6270 09/26/84
6271 09/27/84
6272 09/28/84
6273 09/29/84
6274 09/30/84
6278 10/04/84
6279 10/05/84
6280 10/06/84
6281 10/07/84
6292 10/18/84
6293 10/19/84
6294 10/20/84
6295 10/21/84
6296 10/22/84
6297 10/23/84
6298 10/24/84
6299 10/25/84
6300 10/26/84
6301 10/27/84
6302 10/28/84
6303 10/29/84
6304 10/30/84

6305 10/31/84

7008 01/08/85
7009 01/09/85
7010 01/10/85
7011 01/11/85
7012 01/12/85

7022 01/22/85
7023 01/23/85
7024 01/24/85
7025 01/25/85

7060 03/01/85
7061 03/02/85
7062 03/03/85
7063 03/04/85
7064 03/05/85
7065 03/06/85
7066 03/07/85
7067 03/08/85
7070 03/11/85
7071 03/12/85
7072 03/13/85
7073 03/14/85
7074 03/15/85
7075 03/16/85
7076 03/17/85
7077 03/18/85
7078 03/19/85
7079 03/20/85
7080 03/21/85
7081 03/22/85
7082 03/23/85
7083 03/24/85
7084 03/25/85
7085 03/26/85
7086 03/27/85
7087 03/28/85
7088 03/29/85
7089 03/30/85
7090 03/31/85
7091 04/01/85
7092 04/02/85
7093 04/03/85
7094 04/04/85
7095 04/05/85
7096 04/06/85

7097 04/07/85
7098 04/08/85
7099 04/09/85
7100 04/10/85
7101 04/11/85
7102 04/12/85
7103 04/13/85
7108 04/18/85
7109 04/19/85
7110 04/20/85
7111 04/21/85
7112 04/22/85
7113 04/23/85
7114 04/24/85
7115 04/25/85
7116 04/26/85
7117 04/27/85
7118 04/28/85
7119 04/29/85
7120 04/30/85

8088 03/29/86
8089 03/30/86
8090 03/31/86
8091 04/01/86
8092 04/02/86
8093 04/03/86
8094 04/04/86
8095 04/05/86
8096 04/06/86
8097 04/07/86
8098 04/08/86
8099 04/09/86
8100 04/10/86
8101 04/11/86
8102 04/12/86
8103 04/13/86
8104 04/14/86
8105 04/15/86
8106 04/16/86
8107 04/17/86
8108 04/18/86
8109 04/19/86
8110 04/20/86
8111 04/21/86
8112 04/22/86
8113 04/23/86
8114 04/24/86
8115 04/25/86
8116 04/26/86
8117 04/27/86

8118 04/28/86
8119 04/29/86
8120 04/30/86
8121 05/01/86
8122 05/02/86
8123 05/03/86
8124 05/04/86
8125 05/05/86
8126 05/06/86
8127 05/07/86
8128 05/08/86
8129 05/09/86
8130 05/10/86
8131 05/11/86
8132 05/12/86
8133 05/13/86
8135 05/15/86
8136 05/16/86
8137 05/17/86
8138 05/18/86
8139 05/19/86
8140 05/20/86
8141 05/21/86
8142 05/22/86
8143 05/23/86
8144 05/24/86
8145 05/25/86
8146 05/26/86
8147 05/27/86
8148 05/28/86
8149 05/29/86
8150 05/30/86
8151 05/31/86
8152 06/01/86
8153 06/02/86
8154 06/03/86
8155 06/04/86
8156 06/05/86
8157 06/06/86
8158 06/07/86
8159 06/08/86
8160 06/09/86
8161 06/10/86
8162 06/11/86
8163 06/12/86
8164 06/13/86
8165 06/14/86
8166 06/15/86
8167 06/16/86

Appendix E—SCATHA Direction Cosines

Sensor	X_1	X_2	X_3
SC1-8A (magnetic)	0.00000	-0.03032	0.9529
SC1-8A (electric)	0.00000	0.8290	0.5590
SC2-1	-0.9852966	0.1706885	0.0074855
SC2-2	-0.9857497	0.1682058	-0.0020601
SC2-3	-0.9812992	0.1924831	0.0014539
SC2-3B	-0.9812992	0.1924831	0.0014539
SC2-6	-0.9816268	0.1908089	-0.0008639
SC3	.258819045	.965925826	0.0000000
SC8	.548918955	.813805817	.19808996
SC10 (electric)	0.00000	0.8290	0.5590

Appendix F—SCATHA Attitude File Reconstruction

1. Introduction

This appendix documents the structure and content of SCATHA Attitude Data Files (ADFs) and summarizes recently completed modifications to the associated software. The differing attitude file formats are described, compared, and contrasted. In addition, difficulties in using early orbit attitude files for current processing efforts are identified and resolved. In this appendix, the term *attitude processing software* refers to that software that takes as input the ADFs produced from the SCATHA telemetry stream. It does not refer to the code that *created* these attitude files. The software description consists of separate sections covering the *unpacking* component, the *compatibility* component, and the *analysis* component. The unpacking component includes those modules that read attitude files from tape and convert the bit patterns from one binary format to another. The compatibility component consists of code that applies adjustments to the attitude data based on the input file type. The analysis component contains routines that construct and make use of high-level attitude products such as coordinate transformation matrices and estimates of spin rate and phase. Note that the choice of terminology employed in this appendix is guided by the original algorithms and code; little effort has been made to improve or modernize the discussion. For more information concerning the SCATHA project, spacecraft, instruments, sensor data, and processing software, refer to the following reports:

- Boyd, G. M., J. F. Fennell, and M. Redding, SCATHA Summary Data Description, 1994
- Fennell, J. F., Description of P78-2 (SCATHA) Satellite and Experiments, *IMS Source Book*, 1982
- Stevens, J. R. and A. L. Vampola, Description of the Space Test Program P78-2 Spacecraft and Payloads, SAMSO TR-78-24, 1978.

2. Attitude Data File Structure and Content

Original ADFs for orbits earlier than day 150 in 1979 have a different structure and less content than attitude files for later orbits. In this appendix, the early file type is referred to as *Version 1* and the later file type as *Version 2*. The specific format for Version 1 files is described in section 2.1 and for Version 2 in section 2.2. Currently available SCATHA attitude processing software cannot operate directly with Version 1 files. Fortunately, some years ago, reprocessing was carried out for 33 early days of SCATHA telemetry (between day 47 and day 150 of 1979), and thus there are available Version 2 attitude files for these dates. This information can be employed, in conjunction with appropriately modified software, to allow *indirect* processing of Version 1 files. The details of this process are described in sections 3.2 and 3.3.

2.1 Version 1 File Format

A Version 1 attitude file is stored in CDC (Control Data Corporation) Cyber binary format and consists of records containing 1,024 fields of 60-bit floating-point data. The individual fields are identified in Table 2.1. See sections 3.3.1 and 3.3.2 for more information about field contents. Note that R_{ECIANG} is simply the matrix transpose of R_{ANGECI}.

Table 2.1

Fields	Item	Description
1 – 9	R_{ANGECI}	Rotation Matrix ECI ⇨ ANG
10 – 18	R_{ECIANG}	Rotation Matrix ANG ⇨ ECI
19 – 36	<Not Used>	
37 – 38	t_1 and t_2	Endpoints of valid time segment for fitting (UT seconds)
39 – 42	c_0, c_1, c_2, c_3	Cubic fit coefficients for spin phase
43 – 1024	<Not Used>	

2.2 Version 2 File Format

A Version 2 attitude file is stored in CDC Cyber binary format and consists of records containing 2,048 fields of 60-bit floating-point data. The file is structured to allow for three prologue fields followed by up to 48 sets of pointing parameters segmented with respect to UT. Each set consists of 42 fields. Although the file structure is designed for 48 such sets, in practice there never appear to be more than 24. Table 2.2 reflects this fact and also identifies the individual fields. See Subsections 3.3.1 and 3.3.2 for more information about field contents. Note that R_{ECIANG} is the matrix transpose of R_{ANGECI}; R_{PRISAT} is the matrix transpose of R_{SATPRI}.

Table 2.2

Fields	Item	Description
1 – 2	Year and Day Number	Year in 4-digit form; $1 \leq \text{Day} \leq 366$
3	Number of Segments	Number of matrix/coefficient sets
4 – 5	t_1 and t_2	Endpoints of valid time segment for fitting (UT seconds)
6 – 9	c_0, c_1, c_2, c_3	Cubic fit coefficients for spin phase
10 – 18	R_{ANGECI}	Rotation Matrix ECI ⇨ ANG
19 – 27	R_{ECIANG}	Rotation Matrix ANG ⇨ ECI
28 – 36	R_{SATPRI}	Rotation Matrix PRI ⇨ SAT
37 – 45	R_{PRISAT}	Rotation Matrix SAT ⇨ PRI
46 – 87	<See Description>	Same as fields 4–45, but for segment 2
88 – 129	<See Description>	Same as fields 4–45, but for segment 3
etc.	. . .	. . .
971 – 1011	<See Description>	Same as fields 4–45, but for segment 24
1012 – 2048	<Not Used>	

3. Attitude Software Modifications

The attitude processing software consists of an unpacking component, a compatibility component, and an analysis component, as described earlier in this appendix. With respect to software developed prior to, and during the months following, launch of the SCATHA spacecraft, the first two components are entirely new; the third is a modified version of the original. The following sections expand upon the previous description.

3.1 Unpacking Component

Processing of SCATHA attitude files is presently performed on VAX machines; however, the files were originally created on CDC systems. Therefore, conversion from CDC 60-bit floating-point format to VAX 64-bit floating-point format is required. This unpacking task is performed on a word-by-word basis and thus is not dependent upon the attitude file format. The following paragraphs describe the conversion process in detail.

The CDC 60-bit floating point format consists of a sign/exponent portion (12 bits) and a mantissa portion (48 bits) and is interpreted as follows. If $o_0, o_1, \ldots, o_{19}$ denote the octal digits (from least to most significant) equivalent to the bit pattern representing a floating point number f, then

$$f = 2^n s \sum_{i=0}^{15} o_i 8^i ,$$

where s is the mantissa sign as determined from Table 3.1, and n is the exponent as determined from Table 3.2. Note that in Table 3.2 the quantity r is the integer whose octal representation is $o_{19}\, o_{18}\, o_{17}\, o_{16}$. Also, note that in the CDC format specification a value of 1777 for r indicates that the address contains an indefinite (i.e., uninitialized) value.

Table 3.1

Value of Digit o_{19}	Exponent Sign, s_e	Mantissa Sign, s
0 *or* 1	Negative	Positive
2 *or* 3	Positive	Positive
4 *or* 5	Positive	Negative
6 *or* 7	Negative	Negative

Table 3.2

r	Exponent Value, n
0 to 1776	r − 1777
2000 to 3777	r − 1777
4000 to 5777	5777 − r
6000 to 7777	6000 − r

To accomplish the conversion from CDC format to VAX format, the attitude file is read into a byte array, and each set of 60 bits is packed into five 12-bit portions. Each of these portions is then stored into a VAX integer*2 (16-bit) word. Let these five words be denoted a_1, a_2, a_3, a_4, and a_5 (from least to most significant). Then the floating point value can be recovered as follows:

$$f = 2^n s \sum_{i=1}^{4} a_i 4096^{(i-1)} ,$$

where n and s are derived from a_5 using Tables 3.1 and 3.2 (i.e., substitute a_5 for r when referencing the tables).

3.2 Compatibility Component

Once the contents of a Version 2 attitude file have been converted from CDC to VAX format, they are stored into elements of common block ATT and are then available for use by the attitude analysis routines (see section 3.3). The task of the compatibility component is to produce an equivalent ATT block for the case in which a Version 1 file is being processed. Common block ATT is structured identically to a Version 2 attitude file. Therefore, the compatibility component must *create* the appropriate missing entries (i.e., those that are not available in a Version 1 file). In effect, this will give the appearance that the information contained in ATT originated in a Version 2 file. The procedure is straightforward for all quantities except matrix R_{SATPRI}. Creating an entry for this matrix requires special methods that are described later in this section. To summarize, the particular compatibility steps carried out for orbits having Version 1 attitude files are as follows:

- Entries are created for Year, Day, and Segment Count (the created Segment Count is given a value of zero, which is appropriate given the non-segmented structure of Version 1 files[11]),
- Segment endpoint times and spin phase cubic fit coefficients are reordered to conform to Version 2 usage,
- Matrix R_{SATPRI} and its transpose are created by evaluating a predetermined fitting function (described in the next paragraph).

The methods by which R_{SATPRI} matrices were generated for Version 2 attitude files are unknown. Thus, some reasonable substitute must be employed to create such matrices for Version 1 file processing. If no information relevant to this task could be located, then the only approach possible would be to use identity matrices. This would have some justification given the fact that known R_{SATPRI} matrices appearing in Version 2 files are "close to" the identity matrix (see Subsection 3.3.1). However, as mentioned earlier in this appendix, relevant information *has* been discovered: 33 cases of reprocessed early orbit data. For these cases, the reprocessing has resulted in Version 1 attitude files being replaced by Version 2 files. Thus, 33 R_{SATPRI} matrices from the early mission period are avail-

[11] This also matches the value originally appearing in all known Version 2 attitude files. However, in the course of the current attitude analysis effort, these Version 2 files have been updated to contain correct Segment Counts.

able. These matrices can be used to produce a fitting function that can then be evaluated as described earlier to create appropriate entries for the missing R_{SATPRI} matrices.

The 33 values for each matrix element exhibit significant scatter, and since no cyclical component appears to dominate, the straightforward choice is to fit each matrix element with a linear function, thus adequately tracking the trend variation. The 33 "data points" reflect two distinct patterns, and thus two separate linear fits have been generated: one for the day number range [47, 83], one for the range [84, 150]. Numerical details of this process are available in source code files maintained by the authors.

3.3 Analysis Component

For purposes of this appendix, the attitude analysis software component can be identified with subroutine OMH. The following subsections briefly discuss the overall algorithms and their specific implementations in OMH.

3.3.1 Transformation Algorithms

Four coordinate frames are employed in SCATHA attitude processing: geocentric equatorial inertial (ECI), despun spacecraft (ANG), principal axis (PRI), and spacecraft geometrical (SAT). The transformation of primary interest, connecting the ECI and SAT frames, is composed of three subsidiary rotations, and, therefore, the overall transformation matrix is the product of the three rotation matrices:

$$R_{\mathrm{ECISAT}} = R_{\mathrm{ECIANG}} \; R_{\mathrm{ANGPRI}} \; R_{\mathrm{PRISAT}}$$

The inverse transformation is given, of course, by the reverse-ordered product of the transposed matrices. The ANG and PRI frames are related by a rotation about z equal to the spin phase angle. As one would expect, the PRI and SAT frames are nearly identical—the off-diagonal elements of R_{PRISAT} typically having magnitudes of 10^{-3} to 10^{-6}.

3.3.2 Module OMH

Fortran subroutine OMH was originally written by Henry Hilton in 1979. It was subsequently modified by Don Croley, and later, by the authors of this appendix (particularly, G. M. Boyd). OMH accesses the attitude data array stored in common block ATT and employs the information to form the ECI-to-SAT transformation matrix. As a byproduct, it also produces an estimate of the spacecraft spin rate (this quantity is available internally, it is not stored in a passed parameter). OMH uses the four calling parameters defined in Table 3.3 (note that the second parameter is simply the matrix transpose of the first).

Table 3.3

Name	Type	Structure	Input/Output	Description
RSATECI	real*8	(3, 3)	output	Rotation Matrix ECI ⇨ SAT
RECISAT	real*8	(3, 3)	output	Rotation Matrix SAT ⇨ ECI
MOUT	integer*4	scalar	output	Fit Segment Employed
UT	real*8	scalar	input	Universal Time (sec)

As a brief functional summary, note the following steps performed by OMH:

1. Locate the fit segment that brackets the input UT[12].

2. If the segment differs from that employed in the previous call, then obtain the new matrices, R_{ECIANG} and R_{PRISAT}, and the new spin phase cubic fit coefficients.

3. Modify local variables t_1 and t_2 to reflect the new segment.

4. Generate an estimate for the spin rate using the linear term coefficient.

5. Determine matrix R_{ANGPRI} using the spin phase resulting from evaluating the fit function.

6. Form the overall rotation matrix, R_{ECISAT}, and its transpose. Return these as RECISAT and RSATECI, respectively.

7. Return the segment number as MOUT.

[12] Note that in all known cases only the *first* segment is used because, inexplicably, the Segment Count is zero.

Appendix G—Summary CDF Skeleton Table

```
#header

!       CDF SKELETON TABLE FOR SCATHA SUMMARY PARAMETER DATA
!
!                                                    31 October 1994

                      CDF NAME:  SCTHSUM
                 DATA ENCODING:  NETWORK
                      MAJORITY:  COLUMN
                        FORMAT:  SINGLE

! Variables  G. Attributes  V.Attributes  Records  Dims  Sizes
! ---------  -------------  ------------  -------  ----  ---------------
     73/0          16             20          0/z    4     3  4  8  10


#GLOBALattributes

!   Attribute       Entry   Data              Value
!   Name            Number  Type
!   ---------       ------  ----    --------------------------------------
  "TITLE"             1:   CDF_CHAR  { "SCATHA Science Summary Data" }.

  "Discipline"        1:   CDF_CHAR  { "Space Physics>Magnetospheric Science" }.

  "Source_name"       1:   CDF_CHAR  { "SCATHA>SC1 - Engineering and Plasma " -
                                       "Wave Experiments " }
                      2:   CDF_CHAR  { "SCATHA>SC2 - Plasma (0.1 - 20keV) " -
                                       "and Energetic Ions (20 - 1200keV)" }
                      3:   CDF_CHAR  { "SCATHA>SC3 - High Energy Electrons " -
                                       ">= 50keV" }
                      4:   CDF_CHAR  { "SCATHA>SC4 - Satellite Electron and " -
                                       "Positive Ion Beam System" }
                      5:   CDF_CHAR  { "SCATHA>SC10 - Electric Field Detector " -
                                       "and ULF Waves" }
                      6:   CDF_CHAR  { "SCATHA>SC11 - Magnetic Field Monitor " -
                                       "and ULF Waves" }.

!
  "Data_version"      1:   CDF_CHAR  { "01" }.

! The SFDU identifier - following SFDU registration
  "ADID_ref"          1:   CDF_CHAR  { "XXXXXXXXXX" }.

! First and Last record number for each continuous data period
  "Data_intervals"    1:   CDF_INT4  { 0, 0 }.

  "Data_type"         1:   CDF_CHAR  { "Summary Parameter" }.

  "Descriptor"        1:   CDF_CHAR  { "Scatha satelite summary data" }.

  "Generated_by"      1:   CDF_CHAR  { "The Aerospace Corporation" }.
```

```
! Date stamps the creation of the CDF file - To be generated during processing
   "Generation_date"    1:   CDF_CHAR  { "yyyy-mm-ddThh:mm:ss.wwwZ" }.

! Identical to the CDF file name - To be generated during processing
   "Logical_file_id"    1:   CDF_CHAR  { "SC_SP_all_yyyymmdd_Vmm" }.

   "Rules_of_use"       1:   CDF_CHAR  { "refer to CSDS for rules of use" }.

   "Skeleton_version"   1:   CDF_CHAR  { "SCATHA_Summary_V4.0" }.

! Identifies the processing software - To be revised during processing
   "Software_version"   1:   CDF_CHAR  { "SCATHA_Summary_V1.0" }.

   "Status_key"         1:   CDF_CHAR  { "Status[0]='0'=Bad data" }
                        2:   CDF_CHAR  { "Status[0]='1'=Use with caution" }
                        3:   CDF_CHAR  { "Status[0]='2'=OK" }
                        4:   CDF_CHAR  { "Status[0]='F'=Not Supplied" }

                        5:   CDF_CHAR  { "Status[1]='O'=B-field - OK" }
                        6:   CDF_CHAR  { "Status[1]='C'=B-field - Use with caution" }
                        7:   CDF_CHAR  { "Status[1]='M'=B-field - Not Supplied" }
                        8:   CDF_CHAR  { "Status[1]='B'=B-field - Bad data" }

                        9:   CDF_CHAR  { "Status[2]='O'=VLF - OK" }
                       10:   CDF_CHAR  { "Status[2]='C'=VLF - Use with caution" }
                       11:   CDF_CHAR  { "Status[2]='M'=VLF - Not Supplied" }
                       12:   CDF_CHAR  { "Status[2]='B'=VLF - Bad data" }
                       13:   CDF_CHAR  { "Status[2]='1'=VLF - Mag OK; partial Ele" }
                       14:   CDF_CHAR  { "Status[2]='2'=VLF - Ele OK; partial Mag" }
                       15:   CDF_CHAR  { "Status[2]='3'=VLF - partial Ele; partial Mag" }

                       16:   CDF_CHAR  { "Status[3]='O'=SC Common - OK" }
                       17:   CDF_CHAR  { "Status[3]='C'=SC Common - Use with caution" }
                       18:   CDF_CHAR  { "Status[3]='M'=SC Common - Not Supplied" }
                       19:   CDF_CHAR  { "Status[3]='B'=SC Common - Bad data" }

                       20:   CDF_CHAR  { "Status[4]='O'=ELF - OK" }
                       21:   CDF_CHAR  { "Status[4]='C'=ELF - Use with caution" }
                       22:   CDF_CHAR  { "Status[4]='M'=ELF - Not Supplied" }
                       23:   CDF_CHAR  { "Status[4]='B'=ELF - Bad Data" }

                       24:   CDF_CHAR  { "Status[5]='O'=E-Flux - OK" }
                       25:   CDF_CHAR  { "Status[5]='C'=E-Flux - Use with caution" }
                       26:   CDF_CHAR  { "Status[5]='M'=E-Flux - Not Supplied" }
                       27:   CDF_CHAR  { "Status[5]='B'=E-Flux - Bad data" }

                       28:   CDF_CHAR  { "Status[6]='O'=E-Moment - OK" }
                       29:   CDF_CHAR  { "Status[6]='C'=E-Moment - Use with caution" }
                       30:   CDF_CHAR  { "Status[6]='M'=E-Moment - Not Supplied" }
                       31:   CDF_CHAR  { "Status[6]='B'=E-Moment - Bad data" }

                       32:   CDF_CHAR  { "Status[7]='O'=P-Flux - OK" }
                       33:   CDF_CHAR  { "Status[7]='C'=P-Flux - Use with caution" }
                       34:   CDF_CHAR  { "Status[7]='M'=P-Flux - Not Supplied" }
                       35:   CDF_CHAR  { "Status[7]='B'=P-Flux - Bad data" }

                       36:   CDF_CHAR  { "Status[8]='O'=P-Moment - OK" }
                       37:   CDF_CHAR  { "Status[8]='C'=P-Moment - Use with caution" }
                       38:   CDF_CHAR  { "Status[8]='M'=P-Moment - Not Supplied" }
                       39:   CDF_CHAR  { "Status[8]='B'=P-Moment - Bad data" }
```

```
                40:   CDF_CHAR  { "Status[8]='1'=P-Moment - Uses flux LE 71.0 keV" }

                41:   CDF_CHAR  { "Status[9]='O'=Ephemeris - OK" }
                42:   CDF_CHAR  { "Status[9]='C'=Ephemeris - Use with caution" }
                43:   CDF_CHAR  { "Status[9]='M'=Ephemeris - Not Supplied" }
                44:   CDF_CHAR  { "Status[9]='B'=Ephemeris - Bad data" }

                45:   CDF_CHAR  { "Status[10]='O'=Gun - OK" }
                46:   CDF_CHAR  { "Status[10]='C'=Gun - Use with caution" }
                47:   CDF_CHAR  { "Status[10]='M'=Gun - Not Supplied" }
                48:   CDF_CHAR  { "Status[10]='B'=Gun - Bad data" }.

"TEXT"           1:   CDF_CHAR  { "SATELLITE DESCRIPTION:               "}
                 2:             { "The P78-2 (SCATHA - Spacecraft "       }
                 3:             { "Charging AT High Altitude) was "       }
                 4:             { "placed into a near synchronous orbit "}
                 5:             { "in early February 1979.  The "         }
                 6:             { "objectives of the satellite were "     }
                 7:             { "twofold; one was to obtain "           }
                 8:             { "environmental and engineering "        }
                 9:             { "information so as to provide design " }
                10:             { "criteria, materials, techniques, "     }
                11:             { "tests and analytical methods to "      }
                12:             { "ensure control of the charging of"     }
                13:             { "satellite surfaces.  The second "      }
                14:             { "objective was to collect scientific " }
                15:             { "data of interest to each experiment " }
                16:             { "sponsor and the scientific "           }
                17:             { "community.  Key ares of scientific "  }
                18:             { "investigation include understanding " }
                19:             { "plasma-wave interactions, substorm "  }
                20:             { "studies and further studies of the "  }
                21:             { "energetic ring current."               }
                22:             { "The satellite has its spin axis "      }
                23:             { "approximately parallel to the orbit " }
                24:             { "plane and perpendicular to he sun "   }
                25:             { "line for 1979-1987 period and "        }
                26:             { "perpendicular to ecliptic from 1988 " }
                27:             { "to end of life.  This allows good "   }
                28:             { "pitch angle coverage by the "          }
                29:             { "particle experiments.  The "           }
                30:             { "experiment complement consists of a " }
                31:             { "complete set of plasma, energetic "   }
                32:             { "particle, composition, field and "    }
                33:             { "wave experiments."}

                34:             { "INSTRUMENT DESCRIPTION:              "}
                35:             { "SC1 - Engineering and Wave Experiment"}
                36:             { "Pricipal Investigator: "               }
                37:             { "H. C. Koons "                          }
                38:             { "The Aerospace Corporation "            }
                39:             { "The primary SC1 science experiment "  }
                40:             { "is the VLF wave experiment.  The "    }
                41:             { "experiment employs two antennas, an " }
                42:             { "air-core loop and the 100 m "          }
                43:             { "tip-to-tip dipole from the SC10 "      }
                44:             { "experiment.  The electric field "      }
                45:             { "receiver has a sensitivity of "        }
                46:             { "5 x 10**-7 V/(mHz**.5) at 1.3 kHz "   }
                47:             { "and 10**-7 V/(mHz**.5) at 10.5 kHz.  "}
                48:             { "The magnetic loop is "                 }
```

```
{ "electrostatically shielded, has an "  }
{ "effective area of 575 m**2 at 1.3 "   }
{ "kHz, and is mounted on a two-meter "  }
{ "boom.  The sensitivity of the "       }
{ "magnetic receiver is "                }
{ "3 x 10**-6 gamma/Hz**.5 at 1.3 kHz "  }
{ "and has a 60 dB dynamic range.  "     }
{ "There are eight narrow band filter "  }
{ "(bandwidth +/- 7.5%) outputs at 0.4, "}
{ "1.3, 2.3, 3.0, 10.5, 30.0, 100.0 "    }
{ "and 300.0 kHz and a broadband mode "  }
{ "(0 to 5 kHz).  The broadband data "   }
{ "is taken for one to two hours per "   }
{ "day."                                 }

{ "SC2 - Plasma and Energetic Ion "      }
{ "Pricipal Investigator: "              }
{ "J. F. Fennel "                        }
{ "The Aerospace Corporation "           }
{ "Experiment"                           }
{ "The SC2 experiment has both science " }
{ "and engineering applications.  The "  }
{ "electrostatic analyzers measure "     }
{ "ions and electrons with energies "    }
{ "from a few 10's of eV to ~20 keV, "   }
{ "perpendicular to the spin axis.  "    }
{ "SC2 also measures 20 keV ions with "  }
{ "a temporal resolution of 250 msec "   }
{ "for He and the CNO group "            }
{ "(>150keV/AMU) and one sec for "       }
{ "protons."                             }

{ "SC3 - High Energy Particle "          }
{ "Pricipal Investigator: "              }
{ "J. B. Reagan "                        }
{ "Lockheed Palo Alto Research Lab "     }
{ "Spectrometer"                         }
{ "The SC3 eperiment measures the "      }
{ "energetic electron distributions "    }
{ "with good energy and angular "        }
{ "resolution (three degree "            }
{ "full-width-at-half-maxim).  The "     }
{ "primary emphasis is on the electron " }
{ "measurements in the 47 to 4970 keV "  }
{ "range."                               }

{ "SC4 - Electron and Ion Beam Emission "}
{ "Pricipal Investigator: "              }
{ "H. A. Cohen "                         }
{ "Air Force Geophysics Lab "            }
{ "System"                               }
{ "The SC4 experiment was to provide "   }
{ "current sources for charging and "    }
{ "discharging the satellite."           }

{ "SC10 - Electric Field Detector "      }
{ "Pricipal Investigator: "              }
{ "T. L. Aggson "                        }
{ "NASA Goddar Space Flight Center "     }
{ "The SC10 experiment measures the DC " }
{ "electric field and the satellite "    }
```

```
{ "potential.  The sensor is a 100 m "    }
{ "tip-to-tip (50 m per side) "           }
{ "cylindrical (0.64cm diameter) dipole "}
{ "that is used as a double floating "    }
{ "probe.  The two halves of the "        }
{ "antenna are extended perpendicular "   }
{ "to the spin axis.  The inner 30 m of "}
{ "each 50 m segment is coated with "     }
{ "Kapton insulation.  The primary "      }
{ "emphasis of the experiment is on "     }
{ "electric fields from DC to 200 Hz.  " }
{ "The antenna is also used by SC1 in "   }
{ "the HF and VLF experiments. "          }

{ "SC11 - Magnetometer "                  }
{ "Pricipal Investigator: "               }
{ "B. G. Ledley "                         }
{ "NASA Goddard Space Flight Center "     }
{ "The SC11 experiment is a triaxial "    }
{ "fluxgate magnetometer.  Each axis "    }
{ "has a reange of 0 to +/- 500 nT.  "    }
{ "The sensor is mounted on a 4 m boom " }
{ "extended perpendicular to the spin "   }
{ "axis.  The field vector is measured " }
{ "four times per second.  The output "   }
{ "from the spin axis aligned sensor is "}
{ "also fed to a set of SC10 filter "     }
{ "channels to provide the same "         }
{ "frequency band outputs.  The "         }
{ "bandwidth of this magnetometer "       }
{ "output is ~100 Hz.  The same axis "    }
{ "can be placed on a brodband channel. "}
{ "The filter output from SC10 provides "}
{ "a sensitivity of 10**-1 nT in the 20 "}
{ "to 200 Hz channel while the "          }
{ "broadband output provides a "          }
{ "sensitivity of 0.2 nT/V."}

{ "INSTRUMENT REFERENCES:                "}
{ "Refer to: "                            }
{ "Stevens, J. R. and A. L. Vampola, "    }
{ "Description of the space test "        }
{ "program P78-2 spacecraft and "         }
{ "payloads, Air Force Space and "        }
{ "Missile Systems organization report " }
{ "SAMSO TR-78-24, 1978.  - Referred to "}
{ "as the 'Blue Book'."                   }
{ "Fennell, J. F., Description of "       }
{ "P78-2 (SCATHA) Satellite and "         }
{ "Experiments, IMS SOURCE BOOK, 1982."   }

{ "SUMMARY PARAMETER OVERVIEW: "          }
{ " "                                     }
{ " "                                     }
{ " "                                     }
{ " "                                     }
{ " "                                     }
{ "SUMMARY PARAMETERS DESCRIPTION:       "}

{ "Epoch - NSSDC Standard Time "          }
{ " "                                     }
```

```
{ " "                                        }

{ "AveInt - Averaging time interval "        }
{ " "                                        }
{ " "                                        }

{ "Except where noted, the following "       }
{ "parameters are averages of the "          }
{ "high resolution data available from "     }
{ "the corresponding measurement over "      }
{ "the period of length 'AVEINT' with "      }
{ "midpoint at time 'EPOCH'.  "              }

{ "B_GSM - x-, y- and z- GSM Magnetic "      }
{ "- field coordinate - From 4 sps SC11 "    }
{ "values averaged over AveInt time "        }
{ "interval centered at Epoch time.  "       }

{ "BSigma_GSM - "                            }
{ " - Count Rate error of corresponding "    }
{ "x-, y- and z- fields of B_GSM - "         }
{ "SQRT( Sum of counts ). "                  }

{ "EVLFAmp - Electric field VLF "            }
{ "wave amplitudes at 8 frequencies - "      }
{ "From  SC1-8A data acquired over 16 "      }
{ "second period - Converted to science "    }
{ "units using calibration data - "          }
{ "Averaged over 16 seconds then "           }
{ "interpolated to the time in Epoch.  "     }

{ "EVLFPAmp - Electric field VLF "           }
{ "peak wave amplitudes at each of 8 "       }
{ "frequencies during AveInt time "          }
{ "interval around the time in Epoch - "     }
{ "Converted to science units using "        }
{ "calibration values.  "                    }

{ "EVLFFrq - NRV - 8 Electric field "        }
{ "VLF frequency range center values "       }
{ "for values stored in EVLFAmp and "        }
{ "EVLFPAmp.  "                              }

{ "EVLFFHi - NRV - 8 Electric field "        }
{ "VLF frequency range maximum values "      }
{ "for values stored in EVLFAmp and "        }
{ "EVLFPAmp.  "                              }

{ "EVLFFLo - NRV - 8 Electric field "        }
{ "VLF frequency range minimum values "      }
{ "for values stored in EVLFAmp and "        }
{ "EVLFPAmp.  "                              }

{ "BVLFAmp - Magnetic field VLF "            }
{ "wave amplitudes at 4 frequencies - "      }
{ "From  SC1-8A data acquired over 16 "      }
{ "second period - Converted to science "    }
{ "units using calibration data - "          }
{ "Averaged over 16 seconds then "           }
{ "interpolated to the time in Epoch.  "     }
```

```
{ "BVLFPAmp - Magnetic field VLF "        }
{ "peak wave amplitudes at each of 4 "    }
{ "frequencies during AveInt time "       }
{ "interval around the time in Epoch - "  }
{ "Converted to science units using "     }
{ "calibration values.  "                 }

{ "BVLFFrq - NRV - 4 Magnetic field "     }
{ "VLF frequency range center values "    }
{ "for values stored in BVLFAmp and "     }
{ "BVLFPAmp.  "                           }

{ "BVLFFHi - NRV - 4 Magnetic field "     }
{ "VLF frequency range maximum values "   }
{ "for values stored in BVLFAmp and "     }
{ "BVLFPAmp.  "                           }

{ "BVLFFLo - NRV - 4 Magnetic field "     }
{ "VLF frequency range minimum values "   }
{ "for values stored in BVLFAmp and "     }
{ "BVLFPAmp.  "                           }

{ "CM1SCPot - Common mode S/C "           }
{ "potential, +/-15 volts - From SC10 "   }

{ "CM2SCPot - Common mode S/C "           }
{ "potential, +/-300 volts - From "       }
{ "SC10.  "                               }

{ "CM3SCPot - Common mode S/C "           }
{ "potential, +/-5000 volts - From "      }
{ "SC10.  "                               }

{ "EDCLo - DC Electric field "            }
{ "magnitude low gain range "             }
{ "(gain = 0.025) - From SC10.  "         }

{ "EAC - DC Electric field "              }
{ "magnitude AC range (gain = 2.5) - "    }
{ "From SC10.  "                          }

{ "EDCHi - DC Electric field "            }
{ "magnitude high gain range "            }
{ "(gain = 0.25) - From SC10.  "          }

{ "EELFAmp - Average Electric field "     }
{ "ELF wave amplitudes in 4 frequency    "}
{ "ranges - From SC10.  "                 }

{ "EELFPAmp - Peak Electric field "       }
{ "wave amplitudes in 4 ELF frequency "   }
{ "ranges - From SC10.  "                 }

{ "EELFFHi - NRV - Maximum "              }
{ "frequency values for Electric field "  }
{ "ELF frequency range(s) - for values "  }
{ "stored in EELFAmp and EELFPAmp.  "     }

{ "EELFFLo - NRV - Minimum "              }
{ "frequency values for Electric field "  }
{ "ELF frequency range(s) - for values "  }
```

```
{ "stored in EELFAmp and EELFPAmp.  "     }

{ "BELFAmp - Average Magnetic field "     }
{ "wave amplitudes in 4 ELF frequency "   }
{ "ranges - From SC10.  "                 }

{ "BELFPAmp - Peak Magnetic field "       }
{ "wave amplitudes in 4 ELF frequency "   }
{ "ranges - From SC10.  "                 }

{ "BELFFHi - NRV - Maximum "              }
{ "frequency values for Magnetic field " }
{ "ELF frequency range(s) - for values " }
{ "stored in BELFAmp and BELFPAmp.  "     }

{ "BELFFLo - NRV - Minimum "              }
{ "frequency values for Magnetic field " }
{ "ELF frequency range(s) - for values " }
{ "stored in BELFAmp and BELFPAmp.  "     }

{ "EPpDfFlx - Differential electron "     }
{ "number flux perpendicular to B in 10 "}
{ "energy ranges - Calculated pitch "     }
{ "angles are 90 +/- 20 deg to the "      }
{ "magnetic field - Data acquired by "    }
{ "SC2-3 using program #1 energy "        }
{ "steps (7 steps from .20 - 20keV) and "}
{ "SC3 at energies 57, 98 and 140keV.  " }

{ "EEPpDfFlx - E-perp differential flux "}
{ "fractional error - 10 count rate "     }
{ "errors of values stored in EPpDfFlx " }
{ "= 1 / SQRT( SUM( counts ) ).  "        }

{ "EPlDfFlx - Differential electron "     }
{ "number flux parallel to B in 10 "      }
{ "energy ranges - Calculated pitch "     }
{ "angles are 0 +/- 30 deg or 180 "       }
{ "+/- 30 deg to the magnetic field - "   }
{ "Data acquired by SC2-3 using "         }
{ "program #1 energy steps (7 steps "     }
{ "from .20 - 20keV) and SC3 at "         }
{ "energies 57, 98 and 140keV.  "         }

{ "EEPlDfFlx - E-parl differential flux "}
{ "fractional error - 10 count rate "     }
{ "errors of values stored in EPlDfFlx " }
{ "= 1 / SQRT( SUM( counts ) ).  "        }

{ "EDfFlxEn - NRV - Differential "        }
{ "electron flux center energy - 10 "     }
{ "reference energies associated with "   }
{ "variables EPpDfFlx, EEPpDfFlx, "       }
{ "EPlDfFlx and EEPlDfFlx.  "             }

{ "EPpEnFlx - Electron energy flux "      }
{ "perpendicular to B over .20-20keV "    }
{ "energy range - uses 60 second "        }
{ "average differential energy fluxes "   }
{ "from SC2-3 step program #1 (energies "}
{ "defined by variable EDfFlxEn) and "    }
```

```
{ "programs #2 and #3 if available - "   }
{ "otherwise interpolations to those "   }
{ "energies are done.  "                 }

{ "EPpNmFlx - Electron number flux "     }
{ "perpendicular to B over .20-20keV "   }
{ "energy range - uses 60 second "       }
{ "average differential fluxes from "    }
{ "SC2-3 step program #1 (energies "     }
{ "defined by variable EDfFlxEn) and "   }
{ "programs #2 and #3 if available - "   }
{ "otherwise interpolations to those "   }
{ "energies are done.  "                 }

{ "EPlEnFlx - Electron energy flux "     }
{ "parallel to B over .20-20keV "        }
{ "energy range - uses 60 second "       }
{ "average differential energy fluxes "  }
{ "from SC2-3 step program #1 (energies "}
{ "defined by variable EDfFlxEn) and "   }
{ "programs #2 and #3 if available - "   }
{ "otherwise interpolations to those "   }
{ "energies are done.  "                 }

{ "EPlNmFlx - Electron number flux "     }
{ "paralel to B over .20-20keV "         }
{ "energy range - uses 60 second "       }
{ "average differential fluxes from "    }
{ "SC2-3 step program #1 (energies "     }
{ "defined by variable EDfFlxEn) and "   }
{ "programs #2 and #3 if available - "   }
{ "otherwise interpolations to those "   }
{ "energies are done.  "                 }

{ "PPpDfFlx - Differential proton "      }
{ "number flux perpendicular to B in 10 "}
{ "energy ranges - Calculated pitch "    }
{ "angles are 90 +/- 20 deg (SC2-3) and "}
{ "90 +/- 10 deg (SC2-6) to the "        }

{ "Magnetic field - Data acquired by "   }
{ "SC2-3 using program #1 energy "       }
{ "steps (7 steps from .15 - 15keV) and "}
{ "SC2-6 at energies 36, 71 and "        }
{ "133keV.  "                            }

{ "EPPpDfFlx - P-perp differential flux "}
{ "fractional error - 8 count rate "     }
{ "errors of values stored in PPpDfFlx " }
{ "= 1 / SQRT( SUM( counts ) ).  "       }

{ "PPlDfFlx - Differential proton "      }
{ "number flux parallel to B in 8 "      }
{ "energy ranges - Calculated pitch "    }
{ "angles are 0 +/- 30 deg or 180 "      }
{ "+/- 30 deg to the magnetic field - "  }
{ "Data acquired by SC2-3 using "        }
{ "program #1 energy steps (7 steps "    }
{ "from .15 - 15keV) and SC2-6 at "      }
{ "energies 36, 71 and 133keV.  "        }
```

```
{ "EPPlDfFlx - P-parl differential flux "}
{ "fractional error - 10 count rate "    }
{ "errors of values stored in PPlDfFlx " }
{ "= 1 / SQRT( SUM( counts ) ).  "       }

{ "PDfFlxEn - NRV - Differential "       }
{ "electron flux center energy - 10 "    }
{ "reference energies associated with "  }
{ "variables PPpDfFlx, PEPpDfFlx, "      }
{ "PPlDfFlx and PEPlDfFlx.  "            }

{ "PPpEnFlx - Proton energy flux "       }
{ "perpendicular to B over .15-15keV "   }
{ "energy range - uses 60 second "       }
{ "average differential energy fluxes "  }
{ "from SC2-3 step program #1 (energies "}
{ "defined by variable PDfFlxEn) and "   }
{ "programs #2 and #3 if available - "   }
{ "otherwise interpolations to those "   }
{ "energies are done.  "                 }

{ "PPpNmFlx - Proton number flux "       }
{ "perpendicular to B over .15-15keV "   }
{ "energy range - uses 60 second "       }
{ "average differential fluxes from "    }
{ "SC2-3 step program #1 (energies "     }
{ "defined by variable PDfFlxEn) and "   }
{ "programs #2 and #3 if available - "   }
{ "otherwise interpolations to those "   }
{ "energies are done.  "                 }

{ "PPlEnFlx - Proton energy flux "       }
{ "parallel to B over .15-15keV "        }
{ "energy range - uses 60 second "       }
{ "average differential energy fluxes "  }
{ "from SC2-3 step program #1 (energies "}
{ "defined by variable PDfFlxEn) and "   }
{ "programs #2 and #3 if available - "   }
{ "otherwise interpolations to those "   }
{ "energies are done.  "                 }

{ "PPlNmFlx - Proton number flux "       }
{ "paralel to B over .15-15keV "         }
{ "energy range - uses 60 second "       }
{ "average differential fluxes from "    }
{ "SC2-3 step program #1 (energies "     }
{ "defined by variable PDfFlxEn) and "   }
{ "programs #2 and #3 if available - "   }
{ "otherwise interpolations to those "   }
{ "energies are done.  "                 }

{ "EDensity - Electron density in "      }
{ "energy range .1-20keV - From SC2-3 "  }
{ "using average differential number "   }
{ "fluxes in the time interval from "    }
{ "step program #1 (see EDfFlxEn) and "  }
{ "step programs #2 and/or #3 to create "}
{ "the integration energy range 87eV to "}
{ "19.4keV."                             }

{ "EPpDrfVel - Electron drift "          }
```

```
{ "velocity perpendicular to B of "      }
{ "electrons in the energy range "       }
{ ".1-20keV and having a pitch angle "   }
{ "of 90 +/- 20 deg to the magnetic "    }
{ "field - (see EDensity for "           }
{ "description of source.  "             }

{ "EPress - Electron pressure in "       }
{ "range .1-20keV of electrons in the "  }
{ "energy range .04-20keV and having a " }
{ "pitch angle of 90 +/- 20 deg to the " }
{ "magnetic field - (see EDensity for "  }
{ "description of source.  "             }

{ "EAveEn - Electron average energy "    }
{ "Calculated from differential number " }
{ "flux values derived from SC2-3 "      }
{ "energy step programs #1 and from "    }
{ "programs #2 and/or #3 - same source " }
{ "as for EDensity.  "                   }

{ "PDensity - Proton density in "        }
{ "energy range .1-133eV - From SC2-3 "  }
{ "step program #1 (see PDfFlxEn) and"   }
{ "#2 and/or #3 (integration range "     }
{ "SC2-3 is .1 - 15.6keV) and from "     }
{ "SC2-6 36, 71 and 133keV channel data "}
{ "if available.  Integration is done "  }
{ "over just the SC2-3 range "           }
{ "(.1-15.6keV) if SC2-6 133keV data is "}
{ "not available - see character 8 in "  }
{ "variable Status%SC_SP."               }

{ "PPpDrfVel - xxxProton drift "             }
{ "velocity perpendicular to B of "      }
{ "electrons in the energy range "       }
{ ".1-15.6keV and having a pitch angle " }
{ "of 90 +/- 20 deg ( 90 +/- 10 deg for "}
{ "SC2-6 data) to the magnetic field - " }
{ "(see PDensity for description of "    }
{ "source.  "                            }

{ "PPress - Proton pressure in energy "  }
{ "range .1-133keV (or .1-15.6keV if "   }
{ "SC2-6 133keV data is not available - "}
{ "check character 8 of variable "       }
{ "Status%SC_SP) of protons in the time "}
{ "interval and having a pitch angle of "}
{ "90 +/- 20 deg ( 90 +/- 10 deg for "   }
{ "SC2-6 data) to the magnetic field - " }
{ "(see PDensity for description of "    }
{ "source.  "                            }

{ "PAveEn - Proton average energy in "   }
{ "energy range .1-133keV (or "          }
{ ".1-15.6keV if SC2-6 133keV data is "  }
{ "not available check character 8 of "  }
{ "variable Status%SC_SP) - same source "}
{ "as for PDensity. "                    }

{ "SCGeoLon - Spacecraft "               }
```

```
{ "Geographic Longitude (0-360 deg E.) " }
{ "- Interpolated at interval midpoint " }
{ "time EPOCH using Ephemeris data.  "   }

{ "SCGeoLat - Spacecraft "               }
{ "Geographic Latitude (+/- 90 deg - "   }
{ "Interpolated at interval midpoint "   }
{ "time EPOCH using Ephemeris data.  "   }

{ "SCGeoRad - Spacecraft "               }
{ "Geocentric Radius (km) - "            }
{ "Interpolated at interval midpoint "   }
{ "time EPOCH using Ephemeris data.  "   }

{ "SCECIPos - Spacecraft location "      }
{ "x-, y- and z-position (km) in ECI "   }
{ " coordinate system - "                }
{ "Interpolated at interval midpoint "   }
{ "time EPOCH using Ephemeris data.  "   }

{ "SCECIVel - Spacecraft x-, y- and "    }
{ "z- velocity (km/s) in ECI coordinate "}
{ "system - "                            }
{ "Interpolated at interval midpoint "   }
{ "time EPOCH using Ephemeris data.  "   }

{ "MLT - Magnetic local time at "        }
{ "equator (hrs) - "                     }
{ "Interpolated at interval midpoint "   }
{ "time EPOCH using Ephemeris data.  "   }

{ "MagLat - Magnetic latitude "          }
{ "(degs) - "                            }
{ "Interpolated at interval midpoint "   }
{ "time EPOCH using Ephemeris data.  "   }

{ "LShell - L-shell value "              }
{ "Interpolated at interval midpoint "   }
{ "time EPOCH using Ephemeris data.  "   }

{ "BEqModl - B equator from IGRF "       }
{ "1965.0 / Olsen-Pfitzer model - "      }
{ "Interpolated at interval midpoint "   }
{ "time EPOCH using Ephemeris data.  "   }

{ "BF2Spin - Angle between B-field "     }
{ "and S/C spin axis using "             }
{ "Model B-field and S/C attitude data " }
{ "interpolated to the midpoint time "   }
{ "EPOCH using Ephemeris data.  "        }

{ "BModl - Bx, By and Bz from IGRF "     }
{ "1965.0 / Olsen-Pfitzer model - "      }
{ "Interpolated at interval midpoint "   }
{ "time EPOCH using Ephemeris data.  "   }
{ "4GunStat"                             }

{ "Ion/Electron gun operation flag - "   }
{ "bit 0 (electron gun) 0/1 => OFF/ON, " }
{ "bit 1 (ion gun) 0/1 => OFF/ON.  "     }
```

```
522:                { "Variable quality indicator - "         }
523:                { "(see global attribute Status_key)"     }.
```

#VARIABLEattributes

```
"FIELDNAM"
"VALIDMIN"
"VALIDMAX"
"SCALEMIN"
"SCALEMAX"
"FILLVAL"
"MONOTON"
"UNITS"
"LABLAXIS"
"FORMAT"
"VAR_TYPE"
"DEPEND_0"
"DICT_KEY"
"SCALETYP"
"SC_id"
"Sig_digits"
"DELTA_PLUS_VAR"
"DELTA_MINUS_VAR"
"DEPEND_1"
"LABL_PTR_1"
```

```
#variables

!------------------------------------------------------------
!   Variable          Data          Number     Record     Dim
!   Name              Type          Elements   Variance   Variance
!   -------           ----          --------   --------   --------
  "Epoch"            CDF_EPOCH      1          T          F F F F

! Attribute   Data          Value
! Name        Type
!-----------  -----         ------
  "FIELDNAM"  CDF_CHAR      { "NSSDC Standard Time" }
  "VALIDMIN"  CDF_EPOCH     { 01-Jan-1979 00:00:00.000 }
  "VALIDMAX"  CDF_EPOCH     { 21-May-1990 23:59:59.000 }
  "SCALEMIN"  CDF_EPOCH     { 01-Jan-1979 00:00:00.000 }
  "SCALEMAX"  CDF_EPOCH     { 21-May-1990 23:59:59.000 }
  "UNITS"     CDF_CHAR      { "ms" }
  "LABLAXIS"  CDF_CHAR      { "Epoch" }
  "MONOTON"   CDF_CHAR      { "INCREASE" }
  "FILLVAL"   CDF_REAL8     { -1.0e31 }
  "VAR_TYPE"  CDF_CHAR      { "data" }
  "DICT_KEY"  CDF_CHAR      { "XXX" }
  "LABLAXIS"  CDF_CHAR      { "Epoch" }
  "SCALETYP"  CDF_CHAR      { "linear" }
  "SC_id"     CDF_CHAR      { "SCATHA" }
  "Sig_digits"CDF_CHAR      { "14" }.
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable          Data          Number     Record     Dim
!   Name              Type          Elements   Variance   Variance
!   -------           ----          --------   --------   --------
  "AveInt"           CDF_REAL8      1          F          F F F F

! Attribute   Data          Value
! Name        Type
!-----------  -----         ------
  "FIELDNAM"  CDF_CHAR      { "Averaging time interval" }
  "VALIDMIN"  CDF_REAL8     { 1.0 }
  "VALIDMAX"  CDF_REAL8     { 1.e8 }
  "SCALEMIN"  CDF_REAL8     { 1.0 }
  "SCALEMAX"  CDF_REAL8     { 1.e8 }
  "UNITS"     CDF_CHAR      { "ms" }
  "LABLAXIS"  CDF_CHAR      { "Ave. Interval" }
  "FORMAT"    CDF_CHAR      { "e14.6" }
  "FILLVAL"   CDF_REAL8     { -1.0e31 }
  "VAR_TYPE"  CDF_CHAR      { "data" }
  "DEPEND_0"  CDF_CHAR      { "Epoch" }
  "DICT_KEY"  CDF_CHAR      { "XXX" }
  "SCALETYP"  CDF_CHAR      { "logarithmic" }
  "SC_id"     CDF_CHAR      { "SCATHA" }
  "Sig_digits"CDF_CHAR      { "7" }.
!------------------------------------------------------------
```

```
!------------------------------------------------------------
!   Variable                Data          Number     Record     Dim
!   Name                    Type          Elements   Variance   Variance
!   -------                 ----          --------   --------   --------
   "B_GSM"                  CDF_REAL4     1          T          T F F F

!  Attribute    Data          Value
!  Name         Type
!-----------    -----         ------
  "FIELDNAM"    CDF_CHAR      { "Mag. field in GSM coordinates" }
  "VALIDMIN"    CDF_REAL4     { -300.  }
  "VALIDMAX"    CDF_REAL4     {  300.0 }
  "SCALEMIN"    CDF_REAL4     { -300.0 }
  "SCALEMAX"    CDF_REAL4     {  300.0 }
  "UNITS"       CDF_CHAR      {  "nT" }
  "LABL_PTR_1"CDF_CHAR        { "Lbl_B_GSM" }
  "FORMAT"      CDF_CHAR      { "F8.2" }
  "FILLVAL"     CDF_REAL4     { -999.99 }
  "VAR_TYPE"    CDF_CHAR      { "data" }
  "DEPEND_0"    CDF_CHAR      { "Epoch" }
  "DEPEND_1"    CDF_CHAR      { "cartesian" }
  "DICT_KEY"    CDF_CHAR      { "XXX" }
  "SCALETYP"    CDF_CHAR      { "linear" }
  "SC_id"       CDF_CHAR      { "SCATHA" }
  "Sig_digits"CDF_CHAR        { "5" }.
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable                Data          Number     Record     Dim
!   Name                    Type          Elements   Variance   Variance
!   -------                 ----          --------   --------   --------
   "Lbl_B_GSM"              CDF_CHAR      8          F          T F F F

!  Attribute    Data          Value
!  Name         Type
!-----------    -----         ------
  "FIELDNAM"    CDF_CHAR      { "Label for B_GSM" }
  "VAR_TYPE"    CDF_CHAR      { "metadata" }
  "DICT_KEY"    CDF_CHAR      { "XXX" }.

! NRV values follow

     [1,1,1,1] = { "Bx (GSM)" }
     [2,1,1,1] = { "By (GSM)" }
     [3,1,1,1] = { "Bz (GSM)" }
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable                Data          Number     Record     Dim
!   Name                    Type          Elements   Variance   Variance
!   -------                 ----          --------   --------   --------
   "cartesian"              CDF_CHAR      11         F          T F F F

!  Attribute    Data          Value
!  Name         Type
!-----------    -----         ------
  "FIELDNAM"    CDF_CHAR      { "Dimension label" }
  "VAR_TYPE"    CDF_CHAR      { "metadata" }
  "DICT_KEY"    CDF_CHAR      { "ISPT>vector>cartesian" }.
```

```
! NRV values follow

      [1,1,1,1] = { "x-component" }
      [2,1,1,1] = { "y-component" }
      [3,1,1,1] = { "z-component" }
!--------------------------------------------------------------

!--------------------------------------------------------------
!   Variable            Data             Number      Record      Dim
!   Name                Type             Elements    Variance    Variance
!   -------             ----             --------    --------    --------
   "BSigma_GSM"         CDF_REAL4        1           T           T F F F

!  Attribute    Data           Value
!  Name         Type
!-----------    -----          ------
  "FIELDNAM"   CDF_CHAR       { "Count rate error of averaged B-field  coordinates" }
  "VALIDMIN"   CDF_REAL4      { -300.0 }
  "VALIDMAX"   CDF_REAL4      {  300.0 }
  "SCALEMIN"   CDF_REAL4      { -300.0 }
  "SCALEMAX"   CDF_REAL4      {  300.0 }
  "UNITS"      CDF_CHAR       {  " " }
  "LABL_PTR_1"CDF_CHAR        { "LBL_BSigma_GSM" }
  "FORMAT"     CDF_CHAR       { "F8.2" }
  "FILLVAL"    CDF_REAL4      { -999.99 }
  "VAR_TYPE"   CDF_CHAR       { "data" }
  "DEPEND_0"   CDF_CHAR       { "Epoch" }
  "DEPEND_1"   CDF_CHAR       { "cartesian" }
  "DICT_KEY"   CDF_CHAR       { "XXX" }
  "SCALETYP"   CDF_CHAR       { "linear" }
  "SC_id"      CDF_CHAR       { "SCATHA" }
  "Sig_digits"CDF_CHAR        { "5" }.
!--------------------------------------------------------------

!--------------------------------------------------------------
!   Variable            Data             Number      Record      Dim
!   Name                Type             Elements    Variance    Variance
!   -------             ----             --------    --------    --------
   "Lbl_BSigma_GSM"     CDF_CHAR         14          F           T F F F

!  Attribute    Data           Value
!  Name         Type
!-----------    -----          ------
  "FIELDNAM"   CDF_CHAR       { "Label for BSigma_GSM" }
  "VAR_TYPE"   CDF_CHAR       { "metadata" }
  "DICT_KEY"   CDF_CHAR       { "XXX" }.

! NRV values follow

      [1,1,1,1] = { "Bx-sigma (GSM)" }
      [2,1,1,1] = { "By-sigma (GSM)" }
      [3,1,1,1] = { "Bz-sigma (GSM)" }
!--------------------------------------------------------------
```

```
!-------------------------------------------------------------
!  Variable            Data          Number      Record      Dim
!  Name                Type          Elements    Variance    Variance
!  -------             ----          --------    --------    --------
  "EVLFAmp"            CDF_REAL4     1           T           F F T F

! Attribute    Data          Value
! Name         Type
!-----------   -----         ------
  "FIELDNAM"   CDF_CHAR      { "E-field VLF wave amplitude" }
  "VALIDMIN"   CDF_REAL4     {  -82.0 }
  "VALIDMAX"   CDF_REAL4     {  -32.0 }
  "SCALEMIN"   CDF_REAL4     {  -82.0 }
  "SCALEMAX"   CDF_REAL4     {  -32.0 }
  "UNITS"      CDF_CHAR      { "dBV/m" }
  "LABLAXIS"   CDF_CHAR      { "E-field VLF amp" }
  "FORMAT"     CDF_CHAR      { "F8.3" }
  "FILLVAL"    CDF_REAL4     { -99.999 }
  "VAR_TYPE"   CDF_CHAR      { "data" }
  "DEPEND_0"   CDF_CHAR      { "Epoch" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }
  "SCALETYP"   CDF_CHAR      { "linear" }
  "SC_id"      CDF_CHAR      { "SCATHA" }
  "Sig_digits"CDF_CHAR       { "5" }
  "DEPEND_1"   CDF_CHAR      { "EVLFFrq" }.
!-------------------------------------------------------------

!-------------------------------------------------------------
!  Variable            Data          Number      Record      Dim
!  Name                Type          Elements    Variance    Variance
!  -------             ----          --------    --------    --------
  "EVLFPAmp"           CDF_REAL4     1           T           F F T F

! Attribute    Data          Value
! Name         Type
!-----------   -----         ------
  "FIELDNAM"   CDF_CHAR      { "E-field VLF peak wave amplitude" }
  "VALIDMIN"   CDF_REAL4     {  -82.0 }
  "VALIDMAX"   CDF_REAL4     {  -32.0 }
  "SCALEMIN"   CDF_REAL4     {  -82.0 }
  "SCALEMAX"   CDF_REAL4     {  -32.0 }
  "UNITS"      CDF_CHAR      { "dBV/m" }
  "LABLAXIS"   CDF_CHAR      { "Peak E-field VLF amp" }
  "FORMAT"     CDF_CHAR      { "F8.3" }
  "FILLVAL"    CDF_REAL4     { -99.999 }
  "VAR_TYPE"   CDF_CHAR      { "data" }
  "DEPEND_0"   CDF_CHAR      { "Epoch" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }
  "SCALETYP"   CDF_CHAR      { "linear" }
  "SC_id"      CDF_CHAR      { "SCATHA" }
  "Sig_digits"CDF_CHAR       { "5" }
  "DEPEND_1"   CDF_CHAR      { "EVLFFrq" }.

!-------------------------------------------------------------
```

```
!------------------------------------------------------------
!   Variable            Data            Number     Record      Dim
!   Name                Type            Elements   Variance    Variance
!   -------             ----            --------   --------    --------
   "EVLFFrq"           CDF_REAL4       1          F           F F T F

!  Attribute    Data          Value
!  Name         Type
!-----------    -----         ------
  "FIELDNAM"   CDF_CHAR      { "E-field VLF center frequency" }
  "VALIDMIN"   CDF_REAL4     {   0.4 }
  "VALIDMAX"   CDF_REAL4     { 300.0 }
  "SCALEMIN"   CDF_REAL4     {   0.4 }
  "SCALEMAX"   CDF_REAL4     { 300.0 }
  "UNITS"      CDF_CHAR      { "kHz" }
  "LABLAXIS"   CDF_CHAR      { "E-field VLF freq" }
  "FORMAT"     CDF_CHAR      { "F7.1" }
  "FILLVAL"    CDF_REAL4     { -999.9 }
  "VAR_TYPE"   CDF_CHAR      { "data" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }
  "SCALETYP"   CDF_CHAR      { "logarithmic" }
  "SC_id"      CDF_CHAR      { "SCATHA" }
  "Sig_digits"CDF_CHAR       { "5" }
  "DELTA_PLUS_VAR"CDF_CHAR   { "EVLFFHi" }
  "DELTA_MINUS_VAR"CDF_CHAR  { "EVLFFLo" }.

! NRV values follow

      [1,1,1,1] = 0.4
      [1,1,2,1] = 1.3
      [1,1,3,1] = 2.3
      [1,1,4,1] = 3.0
      [1,1,5,1] = 10.5
      [1,1,6,1] = 30.0
      [1,1,7,1] = 100.0
      [1,1,8,1] = 300.0
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable            Data            Number     Record      Dim
!   Name                Type            Elements   Variance    Variance
!   -------             ----            --------   --------    --------
   "EVLFFHi"           CDF_REAL4       1          F           F F T F

!  Attribute    Data          Value
!  Name         Type
!-----------    -----         ------
  "FIELDNAM"   CDF_CHAR      { "E-field VLF upper frequency range value" }
  "VALIDMIN"   CDF_REAL4     {   0.0 }
  "VALIDMAX"   CDF_REAL4     {  300.0  }
  "SCALEMIN"   CDF_REAL4     {   0.0 }
  "SCALEMAX"   CDF_REAL4     {  300.0  }
  "UNITS"      CDF_CHAR      { "kHz" }
  "LABLAXIS"   CDF_CHAR      { "E-Field VLF Hi" }
  "FORMAT"     CDF_CHAR      { "F8.2" }
  "FILLVAL"    CDF_REAL4     { -999.99 }
  "VAR_TYPE"   CDF_CHAR      { "data" }
  "DICT_KEY"   CDF_CHAR      { "ISTP>range>absolute" }
  "SCALETYP"   CDF_CHAR      { "logarithmic" }
  "SC_id"      CDF_CHAR      { "SCATHA" }
  "Sig_digits"CDF_CHAR       { "6" }.
```

```
! NRV values follow

      [1,1,1,1] = 0.43
      [1,1,2,1] = 1.4
      [1,1,3,1] = 2.5
      [1,1,4,1] = 3.2
      [1,1,5,1] = 11.3
      [1,1,6,1] = 32.25
      [1,1,7,1] = 108.0
      [1,1,8,1] = 323.0
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable            Data          Number     Record     Dim
!   Name                Type          Elements   Variance   Variance
!   -------             ----          --------   --------   --------
  "EVLFFLo"             CDF_REAL4     1          F          F F T F

!  Attribute    Data         Value
!  Name         Type
!-----------    -----        ------
  "FIELDNAM"    CDF_CHAR     { "E-field VLF lower frequency range value" }
  "VALIDMIN"    CDF_REAL4    {   0.0 }
  "VALIDMAX"    CDF_REAL4    {  300.0  }
  "SCALEMIN"    CDF_REAL4    {   0.0 }
  "SCALEMAX"    CDF_REAL4    {  300.0  }
  "UNITS"       CDF_CHAR     { "kHz" }
  "LABLAXIS"    CDF_CHAR     { "E-Field VLF Lo" }
  "FORMAT"      CDF_CHAR     { "F8.2" }
  "FILLVAL"     CDF_REAL4    { -999.99 }
  "VAR_TYPE"    CDF_CHAR     { "data" }
  "DICT_KEY"    CDF_CHAR     { "ISTP>range>absolute" }
  "SCALETYP"    CDF_CHAR     { "logarithmic" }
  "SC_id"       CDF_CHAR     { "SCATHA" }
  "Sig_digits"CDF_CHAR       { "6" }.

! NRV values follow

      [1,1,1,1] = 0.37
      [1,1,2,1] = 1.2
      [1,1,3,1] = 2.1
      [1,1,4,1] = 2.8
      [1,1,5,1] = 9.71
      [1,1,6,1] = 28.0
      [1,1,7,1] = 93.0
      [1,1,8,1] = 278.0
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable            Data          Number     Record     Dim
!   Name                Type          Elements   Variance   Variance
!   -------             ----          --------   --------   --------
  "BVLFAmp"             CDF_REAL4     1          T          F T F F

!  Attribute    Data         Value
!  Name         Type
!-----------    -----        ------
  "FIELDNAM"    CDF_CHAR     { "B-field VLF wave amplitude" }
  "VALIDMIN"    CDF_REAL4    {  -80.0 }
  "VALIDMAX"    CDF_REAL4    {  -30.0 }
```

```
 "SCALEMIN"  CDF_REAL4      {  -80.0 }
 "SCALEMAX"  CDF_REAL4      {  -30.0 }
 "UNITS"     CDF_CHAR       { "dBnT" }
 "LABLAXIS"  CDF_CHAR       { "B-field VLF amp" }
 "FORMAT"    CDF_CHAR       { "F8.3" }
 "FILLVAL"   CDF_REAL4      { -99.999 }
 "VAR_TYPE"  CDF_CHAR       { "data" }
 "DEPEND_0"  CDF_CHAR       { "Epoch" }
 "DICT_KEY"  CDF_CHAR       { "XXX" }
 "SCALETYP"  CDF_CHAR       { "linear" }
 "SC_id"     CDF_CHAR       { "SCATHA" }
 "Sig_digits"CDF_CHAR       { "5" }
 "DEPEND_1"  CDF_CHAR       { "BVLFFrq" }.
!-------------------------------------------------------------
!  Variable          Data           Number     Record     Dim
!  Name              Type           Elements   Variance   Variance
!  -------           ----           --------   --------   --------
   "BVLFPAmp"        CDF_REAL4      1          T          F T F F

! Attribute   Data          Value
! Name        Type
!-----------  -----         ------
 "FIELDNAM"  CDF_CHAR       { "Peak B-field VLF peak wave amplitude" }
 "VALIDMIN"  CDF_REAL4      {  -80.0 }
 "VALIDMAX"  CDF_REAL4      {  -30.0 }
 "SCALEMIN"  CDF_REAL4      {  -80.0 }
 "SCALEMAX"  CDF_REAL4      {  -30.0 }
 "UNITS"     CDF_CHAR       { "dBnT" }
 "LABLAXIS"  CDF_CHAR       { "Peak B-field VLF amp" }
 "FORMAT"    CDF_CHAR       { "F8.3" }
 "FILLVAL"   CDF_REAL4      { -99.999 }
 "VAR_TYPE"  CDF_CHAR       { "data" }
 "DEPEND_0"  CDF_CHAR       { "Epoch" }
 "DICT_KEY"  CDF_CHAR       { "XXX" }
 "SCALETYP"  CDF_CHAR       { "linear" }
 "SC_id"     CDF_CHAR       { "SCATHA" }
 "Sig_digits"CDF_CHAR       { "5" }
 "DEPEND_1"  CDF_CHAR       { "BVLFFrq" }.
!-------------------------------------------------------------

!-------------------------------------------------------------
!  Variable          Data           Number     Record     Dim
!  Name              Type           Elements   Variance   Variance
!  -------           ----           --------   --------   --------
   "BVLFFrq"         CDF_REAL4      1          F          F T F F

! Attribute   Data          Value
! Name        Type
!-----------  -----         ------
 "FIELDNAM"  CDF_CHAR       { "B-field VLF center frequency" }
 "VALIDMIN"  CDF_REAL4      {   0.4 }
 "VALIDMAX"  CDF_REAL4      {   3.0 }
 "SCALEMIN"  CDF_REAL4      {   0.4 }
 "SCALEMAX"  CDF_REAL4      {   3.0 }
 "UNITS"     CDF_CHAR       { "kHz" }
 "LABLAXIS"  CDF_CHAR       { "B-field VLF freq" }
 "FORMAT"    CDF_CHAR       { "F5.1" }
 "FILLVAL"   CDF_REAL4      { -9.9 }
 "VAR_TYPE"  CDF_CHAR       { "data" }
 "DICT_KEY"  CDF_CHAR       { "XXX" }
 "SCALETYP"  CDF_CHAR       { "linear" }
```

```
   "SC_id"      CDF_CHAR        { "SCATHA" }
   "Sig_digits"CDF_CHAR         { "3" }
   "DELTA_PLUS_VAR"CDF_CHAR  { "BVLFFHi" }
   "DELTA_MINUS_VAR"CDF_CHAR { "BVLFFLo" }.

! NRV values follow

       [1,1,1,1] = 0.4
       [1,2,1,1] = 1.3
       [1,3,1,1] = 2.3
       [1,4,1,1] = 3.0
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable            Data          Number     Record     Dim
!   Name                Type          Elements   Variance   Variance
!   -------             ----          --------   --------   --------
   "BVLFFHi"            CDF_REAL4     1          F          F T F F

! Attribute    Data        Value
! Name         Type
!-----------   -----       ------
  "FIELDNAM"   CDF_CHAR    { "B-field VLF upper frequency range value" }
  "VALIDMIN"   CDF_REAL4   {   0.43 }
  "VALIDMAX"   CDF_REAL4   {   3.2  }
  "SCALEMIN"   CDF_REAL4   {   0.43 }
  "SCALEMAX"   CDF_REAL4   {   3.2  }
  "UNITS"      CDF_CHAR    { "kHz" }
  "LABLAXIS"   CDF_CHAR    { "B-Field VLF Hi" }
  "FORMAT"     CDF_CHAR    { "F6.2" }
  "FILLVAL"    CDF_REAL4   { -9.99 }
  "VAR_TYPE"   CDF_CHAR    { "data" }
  "DICT_KEY"   CDF_CHAR    { "ISTP>range>absolute" }
  "SCALETYP"   CDF_CHAR    { "linear" }
  "SC_id"      CDF_CHAR    { "SCATHA" }
  "Sig_digits"CDF_CHAR     { "4" }.

! NRV values follow

       [1,1,1,1] = 0.43
       [1,2,1,1] = 1.4
       [1,3,1,1] = 2.5
       [1,4,1,1] = 3.2
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable            Data          Number     Record     Dim
!   Name                Type          Elements   Variance   Variance
!   -------             ----          --------   --------   --------
   "BVLFFLo"            CDF_REAL4     1          F          F T F F

! Attribute    Data        Value
! Name         Type
!-----------   -----       ------
  "FIELDNAM"   CDF_CHAR    { "B-field VLF lower frequency range value" }
  "VALIDMIN"   CDF_REAL4   {  0.37 }
  "VALIDMAX"   CDF_REAL4   {  2.8  }
  "SCALEMIN"   CDF_REAL4   {  0.37 }
  "SCALEMAX"   CDF_REAL4   {  2.8  }
  "UNITS"      CDF_CHAR    { "kHz" }
  "LABLAXIS"   CDF_CHAR    { "B-Field VLF Hi" }
```

```
  "FORMAT"     CDF_CHAR        { "F6.2" }
  "FILLVAL"    CDF_REAL4       { -9.99 }
  "VAR_TYPE"   CDF_CHAR        { "data" }
  "DICT_KEY"   CDF_CHAR        { "ISTP>range>absolute" }
  "SCALETYP"   CDF_CHAR        { "linear" }
  "SC_id"      CDF_CHAR        { "SCATHA" }
  "Sig_digits"CDF_CHAR         { "4" }.

! NRV values follow

     [1,1,1,1] = 0.37
     [1,2,1,1] = 1.2
     [1,3,1,1] = 2.1
     [1,4,1,1] = 2.8
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable            Data          Number      Record      Dim
!   Name                Type          Elements    Variance    Variance
!   -------             ----          --------    --------    --------
   "CM1SCPot"           CDF_REAL4     1           T           F F F F

!  Attribute   Data          Value
!  Name        Type
!-----------   -----         ------
  "FIELDNAM"   CDF_CHAR      { "Common mode S/C potential, +/-15 volts" }
  "VALIDMIN"   CDF_REAL4     { -15.0 }
  "VALIDMAX"   CDF_REAL4     {  15.0 }
  "SCALEMIN"   CDF_REAL4     { -15.0 }
  "SCALEMAX"   CDF_REAL4     {  15.0 }
  "UNITS"      CDF_CHAR      { "V" }
  "LABLAXIS"   CDF_CHAR      { "S/C Common potential low range" }
  "FORMAT"     CDF_CHAR      { "F8.3" }
  "FILLVAL"    CDF_REAL4     { -99.999 }
  "VAR_TYPE"   CDF_CHAR      { "data" }
  "DEPEND_0"   CDF_CHAR      { "Epoch" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }
  "SCALETYP"   CDF_CHAR      { "linear" }
  "SC_id"      CDF_CHAR      { "SCATHA" }
  "Sig_digits"CDF_CHAR       { "5" }.
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable            Data          Number      Record      Dim
!   Name                Type          Elements    Variance    Variance
!   -------             ----          --------    --------    --------
   "CM2SCPot"           CDF_REAL4     1           T           F F F F

!  Attribute   Data          Value
!  Name        Type
!-----------   -----         ------
  "FIELDNAM"   CDF_CHAR      { "Common mode S/C potential, +/-300 volts" }
  "VALIDMIN"   CDF_REAL4     { -300.0 }
  "VALIDMAX"   CDF_REAL4     {  300.0 }
  "SCALEMIN"   CDF_REAL4     { -300.0 }
  "SCALEMAX"   CDF_REAL4     {  300.0 }
  "UNITS"      CDF_CHAR      { "V" }
  "LABLAXIS"   CDF_CHAR      { "S/C Common potential mid range" }
  "FORMAT"     CDF_CHAR      { "F8.2" }
  "FILLVAL"    CDF_REAL4     { -999.99 }
  "VAR_TYPE"   CDF_CHAR      { "data" }
```

```
  "DEPEND_0"  CDF_CHAR      { "Epoch" }
  "DICT_KEY"  CDF_CHAR      { "XXX" }
  "SCALETYP"  CDF_CHAR      { "linear" }
  "SC_id"     CDF_CHAR      { "SCATHA" }
  "Sig_digits"CDF_CHAR      { "5" }.
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable            Data            Number     Record     Dim
!   Name                Type            Elements   Variance   Variance
!   -------             ----            --------   --------   --------
   "CM3SCPot"           CDF_REAL4       1          T          F F F F

!  Attribute   Data         Value
!  Name        Type
!-----------   -----        ------
  "FIELDNAM"  CDF_CHAR      { "Common mode S/C potential, +/-5000 volts" }
  "VALIDMIN"  CDF_REAL4     { -5000.0 }
  "VALIDMAX"  CDF_REAL4     {  5000.0 }
  "SCALEMIN"  CDF_REAL4     { -5000.0 }
  "SCALEMAX"  CDF_REAL4     {  5000.0 }
  "UNITS"     CDF_CHAR      { "V" }
  "LABLAXIS"  CDF_CHAR      { "S/C Common potential high range" }
  "FORMAT"    CDF_CHAR      { "F8.1" }
  "FILLVAL"   CDF_REAL4     { -9999.9 }
  "VAR_TYPE"  CDF_CHAR      { "data" }
  "DEPEND_0"  CDF_CHAR      { "Epoch" }
  "DICT_KEY"  CDF_CHAR      { "XXX" }
  "SCALETYP"  CDF_CHAR      { "linear" }
  "SC_id"     CDF_CHAR      { "SCATHA" }
  "Sig_digits"CDF_CHAR      { "5" }.
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable            Data            Number     Record     Dim
!   Name                Type            Elements   Variance   Variance
!   -------             ----            --------   --------   --------
   "EDCLo"              CDF_REAL4       1          T          F F F F

!  Attribute   Data         Value
!  Name        Type
!-----------   -----        ------
  "FIELDNAM"  CDF_CHAR      { "DC E-field magnitude low gain (gain = 0.025" }
  "VALIDMIN"  CDF_REAL4     {  -3000.0 }
  "VALIDMAX"  CDF_REAL4     {   3000.0 }
  "SCALEMIN"  CDF_REAL4     {  -3000.0 }
  "SCALEMAX"  CDF_REAL4     {   3000.0 }
  "UNITS"     CDF_CHAR      { "mV/m" }
  "LABLAXIS"  CDF_CHAR      { "E-field DC low" }
  "FORMAT"    CDF_CHAR      { "F8.1" }
  "FILLVAL"   CDF_REAL4     { -9999.9 }
  "VAR_TYPE"  CDF_CHAR      { "data" }
  "DEPEND_0"  CDF_CHAR      { "Epoch" }
  "DICT_KEY"  CDF_CHAR      { "XXX" }
  "SCALETYP"  CDF_CHAR      { "linear" }
  "SC_id"     CDF_CHAR      { "SCATHA" }
  "Sig_digits"CDF_CHAR      { "5" }.
!------------------------------------------------------------
```

```
!------------------------------------------------------------
!   Variable            Data          Number     Record     Dim
!   Name                Type          Elements   Variance   Variance
!   -------             ----          --------   --------   --------
  "EAC"                 CDF_REAL4     1          T          F F F F

!  Attribute    Data          Value
!  Name         Type
!-----------   -----         ------
  "FIELDNAM"   CDF_CHAR      { "DC E-field magnitude AC range (gain = 2.5" }
  "VALIDMIN"   CDF_REAL4     {  -15.0 }
  "VALIDMAX"   CDF_REAL4     {   15.0 }
  "SCALEMIN"   CDF_REAL4     {  -15.0 }
  "SCALEMAX"   CDF_REAL4     {   15.0 }
  "UNITS"      CDF_CHAR      { "mV/m" }
  "LABLAXIS"   CDF_CHAR      { "E-field DC mid" }
  "FORMAT"     CDF_CHAR      { "F8.3" }
  "FILLVAL"    CDF_REAL4     { -99.999 }
  "VAR_TYPE"   CDF_CHAR      { "data" }
  "DEPEND_0"   CDF_CHAR      { "Epoch" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }
  "SCALETYP"   CDF_CHAR      { "linear" }
  "SC_id"      CDF_CHAR      { "SCATHA" }
  "Sig_digits"CDF_CHAR       { "5" }.
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable            Data          Number     Record     Dim
!   Name                Type          Elements   Variance   Variance
!   -------             ----          --------   --------   --------
  "EDCHi"               CDF_REAL4     1          T          F F F F

!  Attribute    Data          Value
!  Name         Type
!-----------   -----         ------
  "FIELDNAM"   CDF_CHAR      { "DC E-field magnitude high gain (gain = 0.25" }
  "VALIDMIN"   CDF_REAL4     {  -150.0 }
  "VALIDMAX"   CDF_REAL4     {   150.0 }
  "SCALEMIN"   CDF_REAL4     {  -150.0 }
  "SCALEMAX"   CDF_REAL4     {   150.0 }
  "UNITS"      CDF_CHAR      { "mV/m" }
  "LABLAXIS"   CDF_CHAR      { "E-field DC high" }
  "FORMAT"     CDF_CHAR      { "F8.2" }
  "FILLVAL"    CDF_REAL4     { -999.99 }
  "VAR_TYPE"   CDF_CHAR      { "data" }
  "DEPEND_0"   CDF_CHAR      { "Epoch" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }
  "SCALETYP"   CDF_CHAR      { "linear" }
  "SC_id"      CDF_CHAR      { "SCATHA" }
  "Sig_digits"CDF_CHAR       { "4" }.
!------------------------------------------------------------
```

```
!---------------------------------------------------------------
!   Variable              Data          Number     Record      Dim
!   Name                  Type          Elements   Variance    Variance
!   -------               ----          --------   --------    --------
   "EELFAmp"              CDF_REAL4     1          T           F T F F

!  Attribute    Data         Value
!  Name         Type
!-----------    -----        ------
   "FIELDNAM"   CDF_CHAR     { "E-field ELF wave amplitude" }
   "VALIDMIN"   CDF_REAL4    {  0.0 }
   "VALIDMAX"   CDF_REAL4    {  5.0 }
   "SCALEMIN"   CDF_REAL4    {  0.0 }
   "SCALEMAX"   CDF_REAL4    {  5.0 }
   "UNITS"      CDF_CHAR     { "TM V" }
   "LABLAXIS"   CDF_CHAR     { "E-field ELF amp" }
   "FORMAT"     CDF_CHAR     { "F8.4" }
   "FILLVAL"    CDF_REAL4    { -9.9999 }
   "VAR_TYPE"   CDF_CHAR     { "data" }
   "DEPEND_0"   CDF_CHAR     { "Epoch" }
   "DICT_KEY"   CDF_CHAR     { "XXX" }
   "SCALETYP"   CDF_CHAR     { "linear" }
   "SC_id"      CDF_CHAR     { "SCATHA" }
   "Sig_digits"CDF_CHAR      { "6" }
   "DEPEND_1"   CDF_CHAR     { "EELFFLo" }.
!---------------------------------------------------------------

!---------------------------------------------------------------
!   Variable              Data          Number     Record      Dim
!   Name                  Type          Elements   Variance    Variance
!   -------               ----          --------   --------    --------
   "EELFPAmp"             CDF_REAL4     1          T           F T F F

!  Attribute    Data         Value
!  Name         Type
!-----------    -----        ------
   "FIELDNAM"   CDF_CHAR     { "Peak E-field ELF wave amplitude" }
   "VALIDMIN"   CDF_REAL4    {  0.0 }
   "VALIDMAX"   CDF_REAL4    {  5.0 }
   "SCALEMIN"   CDF_REAL4    {  0.0 }
   "SCALEMAX"   CDF_REAL4    {  5.0 }
   "UNITS"      CDF_CHAR     { "TM V" }
   "LABLAXIS"   CDF_CHAR     { "Peak E-field ELF amp" }
   "FORMAT"     CDF_CHAR     { "F8.4" }
   "FILLVAL"    CDF_REAL4    { -9.9999 }
   "VAR_TYPE"   CDF_CHAR     { "data" }
   "DEPEND_0"   CDF_CHAR     { "Epoch" }
   "DICT_KEY"   CDF_CHAR     { "XXX" }
   "SCALETYP"   CDF_CHAR     { "linear" }
   "SC_id"      CDF_CHAR     { "SCATHA" }
   "Sig_digits"CDF_CHAR      { "6" }
   "DEPEND_1"   CDF_CHAR     { "EELFFLo" }.
!---------------------------------------------------------------
```

```
!------------------------------------------------------------
!   Variable              Data            Number     Record     Dim
!   Name                  Type            Elements   Variance   Variance
!   -------               ----            --------   --------   --------
   "EELFFHi"              CDF_REAL4       1          F          F T F F

!  Attribute    Data          Value
!  Name         Type
!-----------    -----         ------
  "FIELDNAM"   CDF_CHAR      { "E-field ELF upper frequency range value" }
  "VALIDMIN"   CDF_REAL4     {  1.0 }
  "VALIDMAX"   CDF_REAL4     {  200.0 }
  "SCALEMIN"   CDF_REAL4     {  1.0 }
  "SCALEMAX"   CDF_REAL4     {  200.0 }
  "UNITS"      CDF_CHAR      {   "Hz"   }
  "LABLAXIS"   CDF_CHAR      { "E-Field ELF freq Hi" }
  "FORMAT"     CDF_CHAR      { "F6.1" }
  "FILLVAL"    CDF_REAL4     { -999.9 }
  "VAR_TYPE"   CDF_CHAR      { "data" }
  "DICT_KEY"   CDF_CHAR      { "ISTP>range>absolute" }
  "SCALETYP"   CDF_CHAR      { "logarithmic" }
  "SC_id"      CDF_CHAR      { "SCATHA" }
  "Sig_digits"CDF_CHAR       { "4" }.

! NRV values follow

     [1,1,1,1] =   1.0
     [1,2,1,1] =   2.0
     [1,3,1,1] =  20.0
     [1,4,1,1] = 200.0
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable              Data            Number     Record     Dim
!   Name                  Type            Elements   Variance   Variance
!   -------               ----            --------   --------   --------
   "EELFFLo"              CDF_REAL4       1          F          F T F F

!  Attribute    Data          Value
!  Name         Type
!-----------    -----         ------
  "FIELDNAM"   CDF_CHAR      { "E-field ELF lower frquency range value" }
  "VALIDMIN"   CDF_REAL4     {     0.1 }
  "VALIDMAX"   CDF_REAL4     {    20.0 }
  "SCALEMIN"   CDF_REAL4     {     0.1 }
  "SCALEMAX"   CDF_REAL4     {    20.0 }
  "UNITS"      CDF_CHAR      { "Hz" }
  "LABLAXIS"   CDF_CHAR      { "E-Field ELF freq Lo" }
  "FORMAT"     CDF_CHAR      { "F6.1" }
  "FILLVAL"    CDF_REAL4     { -99.9 }
  "VAR_TYPE"   CDF_CHAR      { "data" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }
  "SCALETYP"   CDF_CHAR      { "logarithmic" }
  "SC_id"      CDF_CHAR      { "SCATHA" }
  "Sig_digits"CDF_CHAR       { "4" }
  "DELTA_PLUS_VAR"CDF_CHAR   { "EELFFHi" }.

! NRV values follow

     [1,1,1,1] =   0.1
     [1,2,1,1] =   1.0
```

```
      [1,3,1,1] =   2.0
      [1,4,1,1] =  20.0
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable             Data          Number     Record      Dim
!   Name                 Type          Elements   Variance    Variance
!   -------              ----          --------   --------    --------
  "BELFAmp"              CDF_REAL4     1          T           F T F F

!  Attribute    Data        Value
!  Name         Type
!-----------    -----       ------
  "FIELDNAM"   CDF_CHAR     { "B-field ELF wave amplitude" }
  "VALIDMIN"   CDF_REAL4    {  0.0 }
  "VALIDMAX"   CDF_REAL4    {  5.0 }
  "SCALEMIN"   CDF_REAL4    {  0.0 }
  "SCALEMAX"   CDF_REAL4    {  5.0 }
  "UNITS"      CDF_CHAR     { "TM V" }
  "LABLAXIS"   CDF_CHAR     { "B-field ELF wave amp" }
  "FORMAT"     CDF_CHAR     { "F8.4" }
  "FILLVAL"    CDF_REAL4    { -9.9999 }
  "VAR_TYPE"   CDF_CHAR     { "data" }
  "DEPEND_0"   CDF_CHAR     { "Epoch" }
  "DICT_KEY"   CDF_CHAR     { "XXX" }
  "SCALETYP"   CDF_CHAR     { "linear" }
  "SC_id"      CDF_CHAR     { "SCATHA" }
  "Sig_digits"CDF_CHAR      { "6" }
  "DEPEND_1"   CDF_CHAR     { "BELFFLo" }.
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable             Data          Number     Record      Dim
!   Name                 Type          Elements   Variance    Variance
!   -------              ----          --------   --------    --------
  "BELFPAmp"             CDF_REAL4     1          T           F T F F

!  Attribute    Data        Value
!  Name         Type
!-----------    -----       ------
  "FIELDNAM"   CDF_CHAR     { "Peak B-field ELF wave amplitude" }
  "VALIDMIN"   CDF_REAL4    {  0.0 }
  "VALIDMAX"   CDF_REAL4    {  5.0 }
  "SCALEMIN"   CDF_REAL4    {  0.0 }
  "SCALEMAX"   CDF_REAL4    {  5.0 }
  "UNITS"      CDF_CHAR     { "TM V" }
  "LABLAXIS"   CDF_CHAR     { "Peak B-field ELF wave amp" }
  "FORMAT"     CDF_CHAR     { "F8.4" }
  "FILLVAL"    CDF_REAL4    { -9.9999 }
  "VAR_TYPE"   CDF_CHAR     { "data" }
  "DEPEND_0"   CDF_CHAR     { "Epoch" }
  "DICT_KEY"   CDF_CHAR     { "XXX" }
  "SCALETYP"   CDF_CHAR     { "linear" }
  "SC_id"      CDF_CHAR     { "SCATHA" }
  "Sig_digits"CDF_CHAR      { "6" }
  "DEPEND_1"   CDF_CHAR     { "BELFFLo" }.
!------------------------------------------------------------
```

```
!-------------------------------------------------------------
!  Variable             Data          Number     Record     Dim
!  Name                 Type          Elements   Variance   Variance
!  -------              ----          --------   --------   --------
  "BELFFHi"             CDF_REAL4     1          F          F T F F

! Attribute   Data           Value
! Name        Type
!-----------  -----          ------
  "FIELDNAM"  CDF_CHAR       { "B-field ELF upper frequency range value" }
  "VALIDMIN"  CDF_REAL4      {    1.0 }
  "VALIDMAX"  CDF_REAL4      {  200.0 }
  "SCALEMIN"  CDF_REAL4      {    1.0 }
  "SCALEMAX"  CDF_REAL4      {  200.0 }
  "UNITS"     CDF_CHAR       {   "Hz"  }
  "LABLAXIS"  CDF_CHAR       { "B-Field ELF freq Hi" }
  "FORMAT"    CDF_CHAR       { "F7.1" }
  "FILLVAL"   CDF_REAL4      { -999.9 }
  "VAR_TYPE"  CDF_CHAR       { "data" }
  "DICT_KEY"  CDF_CHAR       { "ISTP>range>absolute" }
  "SCALETYP"  CDF_CHAR       { "logarithmic" }
  "SC_id"     CDF_CHAR       { "SCATHA" }
  "Sig_digits"CDF_CHAR       { "5" }.

! NRV values follow

      [1,1,1,1] =   1.0
      [1,2,1,1] =   2.0
      [1,3,1,1] =  20.0
      [1,4,1,1] = 200.0
!-------------------------------------------------------------

!-------------------------------------------------------------
!  Variable             Data          Number     Record     Dim
!  Name                 Type          Elements   Variance   Variance
!  -------              ----          --------   --------   --------
  "BELFFLo"             CDF_REAL4     1          F          F T F F

! Attribute   Data           Value
! Name        Type
!-----------  -----          ------
  "FIELDNAM"  CDF_CHAR       { "B-field ELF lower frequency range value" }
  "VALIDMIN"  CDF_REAL4      {   0.0 }
  "VALIDMAX"  CDF_REAL4      {  20.0 }
  "SCALEMIN"  CDF_REAL4      {   0.0 }
  "SCALEMAX"  CDF_REAL4      {  20.0 }
  "UNITS"     CDF_CHAR       { "Hz" }
  "LABLAXIS"  CDF_CHAR       { "B-Field ELF freq Lo" }
  "FORMAT"    CDF_CHAR       { "F6.1" }
  "FILLVAL"   CDF_REAL4      { -99.9 }
  "VAR_TYPE"  CDF_CHAR       { "data" }
  "DICT_KEY"  CDF_CHAR       { "XXX" }
  "SCALETYP"  CDF_CHAR       { "logarithmic" }
  "SC_id"     CDF_CHAR       { "SCATHA" }
  "Sig_digits"CDF_CHAR       { "4" }
  "DELTA_PLUS_VAR"CDF_CHAR   { "BELFFHi" }.

! NRV values follow

      [1,1,1,1] =   0.1
      [1,2,1,1] =   1.0
```

```
      [1,3,1,1] =   2.0
      [1,4,1,1] =  20.0
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable            Data             Number     Record      Dim
!   Name                Type             Elements   Variance    Variance
!   -------             ----             --------   --------    --------
  "EPpDfFlx"            CDF_REAL4        1          T           F F F T

! Attribute   Data        Value
! Name        Type
!-----------  -----       ------
  "FIELDNAM"  CDF_CHAR    { "Differential electron flux perpendicular to B" }
  "VALIDMIN"  CDF_REAL4   {   0.0 }
  "VALIDMAX"  CDF_REAL4   {   1.0E10 }
  "SCALEMIN"  CDF_REAL4   {   0.0 }
  "SCALEMAX"  CDF_REAL4   {   1.0E10 }
  "UNITS"     CDF_CHAR    { "electrons/(cm^2 sec str keV)" }
  "LABLAXIS"  CDF_CHAR    { "E-perp differential flux" }
  "FORMAT"    CDF_CHAR    { "E10.2" }
  "FILLVAL"   CDF_REAL4   { -1.0e31 }
  "VAR_TYPE"  CDF_CHAR    { "data" }
  "DEPEND_0"  CDF_CHAR    { "Epoch" }
  "DICT_KEY"  CDF_CHAR    { "XXX" }
  "SCALETYP"  CDF_CHAR    { "logarithmic" }
  "SC_id"     CDF_CHAR    { "SCATHA" }
  "Sig_digits"CDF_CHAR    { "3" }
  "DEPEND_1"  CDF_CHAR    { "EDfFlxEn" }.
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable            Data             Number     Record      Dim
!   Name                Type             Elements   Variance    Variance
!   -------             ----             --------   --------    --------
  "EEPpDfFlx"           CDF_REAL4        1          T           F F F T

! Attribute   Data        Value
! Name        Type
!-----------  -----       ------
  "FIELDNAM"  CDF_CHAR    { "E-perp differential flux fractional error" }
  "VALIDMIN"  CDF_REAL4   {   0.0 }
  "VALIDMAX"  CDF_REAL4   {   1.0E10 }
  "SCALEMIN"  CDF_REAL4   {   0.0 }
  "SCALEMAX"  CDF_REAL4   {   1.0E10 }
  "UNITS"     CDF_CHAR    { " " }
  "LABLAXIS"  CDF_CHAR    { "E-perp flux err" }
  "FORMAT"    CDF_CHAR    { "E10.2" }
  "FILLVAL"   CDF_REAL4   { -1.0e31 }
  "VAR_TYPE"  CDF_CHAR    { "data" }
  "DEPEND_0"  CDF_CHAR    { "Epoch" }
  "DICT_KEY"  CDF_CHAR    { "XXX" }
  "SCALETYP"  CDF_CHAR    { "logarithmic" }
  "SC_id"     CDF_CHAR    { "SCATHA" }
  "Sig_digits"CDF_CHAR    { "3" }
  "DEPEND_1"  CDF_CHAR    { "EDfFlxEn" }.
!------------------------------------------------------------
```

```
!------------------------------------------------------------
!   Variable            Data          Number    Record    Dim
!   Name                Type          Elements  Variance  Variance
!   -------             ----          --------  --------  --------
   "EPlDfFlx"           CDF_REAL4     1         T         F F F T

!  Attribute    Data         Value
!  Name         Type
!-----------    -----        ------
  "FIELDNAM"    CDF_CHAR     { "Differential electron flux parallel to B" }
  "VALIDMIN"    CDF_REAL4    {   0.0 }
  "VALIDMAX"    CDF_REAL4    {   1.0E10 }
  "SCALEMIN"    CDF_REAL4    {   0.0 }
  "SCALEMAX"    CDF_REAL4    {   1.0E10 }
  "UNITS"       CDF_CHAR     { "electrons/(cm^2 sec str keV)" }
  "LABLAXIS"    CDF_CHAR     { "E-parl differential flux" }
  "FORMAT"      CDF_CHAR     { "E10.2" }
  "FILLVAL"     CDF_REAL4    { -1.0e31 }
  "VAR_TYPE"    CDF_CHAR     { "data" }
  "DEPEND_0"    CDF_CHAR     { "Epoch" }
  "DICT_KEY"    CDF_CHAR     { "XXX" }
  "SCALETYP"    CDF_CHAR     { "logarithmic" }
  "SC_id"       CDF_CHAR     { "SCATHA" }
  "Sig_digits"CDF_CHAR       { "3" }
  "DEPEND_1"    CDF_CHAR     { "EDfFlxEn" }.
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable            Data          Number    Record    Dim
!   Name                Type          Elements  Variance  Variance
!   -------             ----          --------  --------  --------
   "EEPlDfFlx"          CDF_REAL4     1         T         F F F T

!  Attribute    Data         Value
!  Name         Type
!-----------    -----        ------
  "FIELDNAM"    CDF_CHAR     { "E-parl differential flux fractional error" }
  "VALIDMIN"    CDF_REAL4    {   0.0 }
  "VALIDMAX"    CDF_REAL4    {   1.0E10 }
  "SCALEMIN"    CDF_REAL4    {   0.0 }
  "SCALEMAX"    CDF_REAL4    {   1.0E10 }
  "UNITS"       CDF_CHAR     { " " }
  "LABLAXIS"    CDF_CHAR     { "E-parl flux err" }
  "FORMAT"      CDF_CHAR     { "E12.4" }
  "FILLVAL"     CDF_REAL4    { -1.0e31 }
  "VAR_TYPE"    CDF_CHAR     { "data" }
  "DEPEND_0"    CDF_CHAR     { "Epoch" }
  "DICT_KEY"    CDF_CHAR     { "XXX" }
  "SCALETYP"    CDF_CHAR     { "logarithmic" }
  "SC_id"       CDF_CHAR     { "SCATHA" }
  "Sig_digits"CDF_CHAR       { "5" }
  "DEPEND_1"    CDF_CHAR     { "EDfFlxEn" }.
!------------------------------------------------------------
```

```
!-----------------------------------------------------------
!   Variable             Data        Number      Record      Dim
!   Name                 Type        Elements    Variance    Variance
!   -------              ----        --------    --------    --------
  "EDfFlxEn"             CDF_REAL4   1           F           F F F T

! Attribute   Data          Value
! Name        Type
!-----------  -----         ------
  "FIELDNAM"  CDF_CHAR      { "Differential electron flux center energy" }
  "VALIDMIN"  CDF_REAL4     {      187.0 }
  "VALIDMAX"  CDF_REAL4     {   140000.0 }
  "SCALEMIN"  CDF_REAL4     {      187.0 }
  "SCALEMAX"  CDF_REAL4     {   140000.0 }
  "UNITS"     CDF_CHAR      { "keV" }
  "LABLAXIS"  CDF_CHAR      { "E-perp differential flux" }
  "FORMAT"    CDF_CHAR      { "F9.0" }
  "FILLVAL"   CDF_REAL4     { -999999. }
  "VAR_TYPE"  CDF_CHAR      { "data" }
  "DICT_KEY"  CDF_CHAR      { "XXX" }
  "SCALETYP"  CDF_CHAR      { "logarithmic" }
  "SC_id"     CDF_CHAR      { "SCATHA" }
  "Sig_digits"CDF_CHAR      { "6" }.

! NRV values follow

      [1,1,1,1]  =      187.0
      [1,1,1,2]  =      446.0
      [1,1,1,3]  =     1090.0
      [1,1,1,4]  =     2580.0
      [1,1,1,5]  =     4520.0
      [1,1,1,6]  =    10950.0
      [1,1,1,7]  =    19400.0
      [1,1,1,8]  =    57000.0
      [1,1,1,9]  =    98000.0
      [1,1,1,10] =   140000.0
!-----------------------------------------------------------

!-----------------------------------------------------------
!   Variable             Data        Number      Record      Dim
!   Name                 Type        Elements    Variance    Variance
!   -------              ----        --------    --------    --------
  "EPpEnFlx"             CDF_REAL4   1           T           F F F F

! Attribute   Data          Value
! Name        Type
!-----------  -----         ------
  "FIELDNAM"  CDF_CHAR      { "Electron energy flux perpendicular to B" }
  "VALIDMIN"  CDF_REAL4     {   0.0 }
  "VALIDMAX"  CDF_REAL4     {   1.0E10 }
  "SCALEMIN"  CDF_REAL4     {   0.0 }
  "SCALEMAX"  CDF_REAL4     {   1.0E10 }
  "UNITS"     CDF_CHAR      { "keV/(cm^2 sec str)" }
  "LABLAXIS"  CDF_CHAR      { "E-perp energy flux" }
  "FORMAT"    CDF_CHAR      { "E10.2" }
  "FILLVAL"   CDF_REAL4     { -1.0e31 }
  "VAR_TYPE"  CDF_CHAR      { "data" }
  "DEPEND_0"  CDF_CHAR      { "Epoch" }
  "DICT_KEY"  CDF_CHAR      { "XXX" }
  "SCALETYP"  CDF_CHAR      { "logarithmic" }
  "SC_id"     CDF_CHAR      { "SCATHA" }
```

```
  "Sig_digits"CDF_CHAR      { "3" }.
!--------------------------------------------------------------

!--------------------------------------------------------------
!   Variable             Data          Number    Record     Dim
!   Name                 Type          Elements  Variance   Variance
!   --------             ----          --------  --------   --------
    "EPpNmFlx"           CDF_REAL4     1         T          F F F F

! Attribute    Data          Value
! Name         Type
!-----------   -----         ------
  "FIELDNAM"   CDF_CHAR     { "Electron number flux perpendicular to B" }
  "VALIDMIN"   CDF_REAL4    {   0.0 }
  "VALIDMAX"   CDF_REAL4    {   1.0E10 }
  "SCALEMIN"   CDF_REAL4    {   0.0 }
  "SCALEMAX"   CDF_REAL4    {   1.0E10 }
  "UNITS"      CDF_CHAR     { "electrons/(cm^2 sec str)" }
  "LABLAXIS"   CDF_CHAR     { "E-perp number flux" }
  "FORMAT"     CDF_CHAR     { "E10.2" }
  "FILLVAL"    CDF_REAL4    { -1.0e31 }
  "VAR_TYPE"   CDF_CHAR     { "data" }
  "DEPEND_0"   CDF_CHAR     { "Epoch" }
  "DICT_KEY"   CDF_CHAR     { "XXX" }
  "SCALETYP"   CDF_CHAR     { "logarithmic" }
  "SC_id"      CDF_CHAR     { "SCATHA" }
  "Sig_digits"CDF_CHAR      { "3" }.
!--------------------------------------------------------------

!--------------------------------------------------------------
!   Variable             Data          Number    Record     Dim
!   Name                 Type          Elements  Variance   Variance
!   --------             ----          --------  --------   --------
    "EPlEnFlx"           CDF_REAL4     1         T          F F F F

! Attribute    Data          Value
! Name         Type
!-----------   -----         ------
  "FIELDNAM"   CDF_CHAR     { "Electron energy flux parallel to B" }
  "VALIDMIN"   CDF_REAL4    {   0.0 }
  "VALIDMAX"   CDF_REAL4    {   1.0E10 }
  "SCALEMIN"   CDF_REAL4    {   0.0 }
  "SCALEMAX"   CDF_REAL4    {   1.0E10 }
  "UNITS"      CDF_CHAR     { "keV/(cm^2 sec str)" }
  "LABLAXIS"   CDF_CHAR     { "E-parl energy flux" }
  "FORMAT"     CDF_CHAR     { "E10.2" }
  "FILLVAL"    CDF_REAL4    { -1.0e31 }
  "VAR_TYPE"   CDF_CHAR     { "data" }
  "DEPEND_0"   CDF_CHAR     { "Epoch" }
  "DICT_KEY"   CDF_CHAR     { "XXX" }
  "SCALETYP"   CDF_CHAR     { "logarithmic" }
  "SC_id"      CDF_CHAR     { "SCATHA" }
  "Sig_digits"CDF_CHAR      { "3" }.
!--------------------------------------------------------------
```

```
!------------------------------------------------------------
!   Variable              Data           Number     Record      Dim
!   Name                  Type           Elements   Variance    Variance
!   -------               ----           --------   --------    --------
  "EPlNmFlx"              CDF_REAL4      1          T           F F F F

! Attribute   Data        Value
! Name        Type
!-----------  -----       ------
  "FIELDNAM"  CDF_CHAR    { "Electron number flux perpendicular to B" }
  "FIELDNAM"  CDF_CHAR    { "Differential electron flux perpendicular to B" }
  "VALIDMIN"  CDF_REAL4   {   0.0 }
  "VALIDMAX"  CDF_REAL4   {   1.0E10 }
  "SCALEMIN"  CDF_REAL4   {   0.0 }
  "SCALEMAX"  CDF_REAL4   {   1.0E10 }
  "UNITS"     CDF_CHAR    { "electrons/(cm^2 sec str)" }
  "LABLAXIS"  CDF_CHAR    { "E-parl number flux" }
  "FORMAT"    CDF_CHAR    { "E10.2" }
  "FILLVAL"   CDF_REAL4   { -1.0e31 }
  "VAR_TYPE"  CDF_CHAR    { "data" }
  "DEPEND_0"  CDF_CHAR    { "Epoch" }
  "DICT_KEY"  CDF_CHAR    { "XXX" }
  "SCALETYP"  CDF_CHAR    { "logarithmic" }
  "SC_id"     CDF_CHAR    { "SCATHA" }
  "Sig_digits"CDF_CHAR    { "3" }.
!------------------------------------------------------------
```

```
!------------------------------------------------------------
!   Variable              Data           Number     Record      Dim
!   Name                  Type           Elements   Variance    Variance
!   -------               ----           --------   --------    --------
  "PPpDfFlx"              CDF_REAL4      1          T           F F F T

! Attribute   Data        Value
! Name        Type
!-----------  -----       ------
  "FIELDNAM"  CDF_CHAR    { "Differential proton flux perpendicular to B" }
  "VALIDMIN"  CDF_REAL4   {   0.0 }
  "VALIDMAX"  CDF_REAL4   {   1.0E10 }
  "SCALEMIN"  CDF_REAL4   {   0.0 }
  "SCALEMAX"  CDF_REAL4   {   1.0E10 }
  "UNITS"     CDF_CHAR    { "protons/(cm^2 sec str keV)" }
  "LABLAXIS"  CDF_CHAR    { "P-perp differential flux" }
  "FORMAT"    CDF_CHAR    { "E10.2" }
  "FILLVAL"   CDF_REAL4   { -1.0e31 }
  "VAR_TYPE"  CDF_CHAR    { "data" }
  "DEPEND_0"  CDF_CHAR    { "Epoch" }
  "DICT_KEY"  CDF_CHAR    { "XXX" }
  "SCALETYP"  CDF_CHAR    { "logarithmic" }
  "SC_id"     CDF_CHAR    { "SCATHA" }
  "Sig_digits"CDF_CHAR    { "3" }
  "DEPEND_1"  CDF_CHAR    { "EDfFlxEn" }.
!------------------------------------------------------------
```

```
!----------------------------------------------------------------
!   Variable              Data            Number      Record      Dim
!   Name                  Type            Elements    Variance    Variance
!   -------               ----            --------    --------    --------
  "EPPpDfFlx"            CDF_REAL4        1           T           F F F T

!  Attribute     Data           Value
!  Name          Type
!-----------    -----          ------
  "FIELDNAM"    CDF_CHAR       { "P-perp differential flux fractional error" }
  "VALIDMIN"    CDF_REAL4      {   0.0 }
  "VALIDMAX"    CDF_REAL4      {   1.0E10 }
  "SCALEMIN"    CDF_REAL4      {   0.0 }
  "SCALEMAX"    CDF_REAL4      {   1.0E10 }
  "UNITS"       CDF_CHAR       { " " }
  "LABLAXIS"    CDF_CHAR       { "P-perp flux err" }
  "FORMAT"      CDF_CHAR       { "E10.2" }
  "FILLVAL"     CDF_REAL4      { -1.0e31 }
  "VAR_TYPE"    CDF_CHAR       { "data" }
  "DEPEND_0"    CDF_CHAR       { "Epoch" }
  "DICT_KEY"    CDF_CHAR       { "XXX" }
  "SCALETYP"    CDF_CHAR       { "logarithmic" }
  "SC_id"       CDF_CHAR       { "SCATHA" }
  "Sig_digits"CDF_CHAR         { "3" }
  "DEPEND_1"    CDF_CHAR       { "EDfFlxEn" }.
!----------------------------------------------------------------
```

```
!----------------------------------------------------------------
!   Variable              Data            Number      Record      Dim
!   Name                  Type            Elements    Variance    Variance
!   -------               ----            --------    --------    --------
  "PPlDfFlx"             CDF_REAL4        1           T           F F F T

!  Attribute     Data           Value
!  Name          Type
!-----------    -----          ------
  "FIELDNAM"    CDF_CHAR       { "Differential proton flux parallel to B" }
  "VALIDMIN"    CDF_REAL4      {   0.0 }
  "VALIDMAX"    CDF_REAL4      {   1.0E10 }
  "SCALEMIN"    CDF_REAL4      {   0.0 }
  "SCALEMAX"    CDF_REAL4      {   1.0E10 }
  "UNITS"       CDF_CHAR       { "protons/(cm^2 sec str keV)" }
  "LABLAXIS"    CDF_CHAR       { "P-parl differential flux" }
  "FORMAT"      CDF_CHAR       { "E10.2" }
  "FILLVAL"     CDF_REAL4      { -1.0e31 }
  "VAR_TYPE"    CDF_CHAR       { "data" }
  "DEPEND_0"    CDF_CHAR       { "Epoch" }
  "DICT_KEY"    CDF_CHAR       { "XXX" }
  "SCALETYP"    CDF_CHAR       { "logarithmic" }
  "SC_id"       CDF_CHAR       { "SCATHA" }
  "Sig_digits"CDF_CHAR         { "3" }
  "DEPEND_1"    CDF_CHAR       { "EDfFlxEn" }.
!----------------------------------------------------------------
```

```
!-----------------------------------------------------------
!   Variable             Data        Number     Record     Dim
!   Name                 Type        Elements   Variance   Variance
!   -------              ----        --------   --------   --------
  "EPPlDfFlx"            CDF_REAL4   1          T          F F F T

! Attribute   Data        Value
! Name        Type
!-----------  -----       ------
  "FIELDNAM"  CDF_CHAR    { "P-parl differential flux fractional error" }
  "VALIDMIN"  CDF_REAL4   {   0.0 }
  "VALIDMAX"  CDF_REAL4   {   1.0E10 }
  "SCALEMIN"  CDF_REAL4   {   0.0 }
  "SCALEMAX"  CDF_REAL4   {   1.0E10 }
  "UNITS"     CDF_CHAR    { " " }
  "LABLAXIS"  CDF_CHAR    { "P-parl flux err" }
  "FORMAT"    CDF_CHAR    { "E10.2" }
  "FILLVAL"   CDF_REAL4   { -1.0e31 }
  "VAR_TYPE"  CDF_CHAR    { "data" }
  "DEPEND_0"  CDF_CHAR    { "Epoch" }
  "DICT_KEY"  CDF_CHAR    { "XXX" }
  "SCALETYP"  CDF_CHAR    { "logarithmic" }
  "SC_id"     CDF_CHAR    { "SCATHA" }
  "Sig_digits"CDF_CHAR    { "3" }
  "DEPEND_1"  CDF_CHAR    { "EDfFlxEn" }.
!-----------------------------------------------------------

!-----------------------------------------------------------
!   Variable             Data        Number     Record     Dim
!   Name                 Type        Elements   Variance   Variance
!   -------              ----        --------   --------   --------
  "PDfFlxEn"             CDF_REAL4   1          F          F F F T

! Attribute   Data        Value
! Name        Type
!-----------  -----       ------
  "FIELDNAM"  CDF_CHAR    { "Differential proton flux center energy" }
  "VALIDMIN"  CDF_REAL4   {      154.0 }
  "VALIDMAX"  CDF_REAL4   {   133000.0 }
  "SCALEMIN"  CDF_REAL4   {      154.0 }
  "SCALEMAX"  CDF_REAL4   {   133000.0 }
  "UNITS"     CDF_CHAR    { "keV" }
  "LABLAXIS"  CDF_CHAR    { "E-perp differential flux" }
  "FORMAT"    CDF_CHAR    { "F9.0" }
  "FILLVAL"   CDF_REAL4   { -999999. }
  "VAR_TYPE"  CDF_CHAR    { "data" }
  "DICT_KEY"  CDF_CHAR    { "XXX" }
  "SCALETYP"  CDF_CHAR    { "logarithmic" }
  "SC_id"     CDF_CHAR    { "SCATHA" }
  "Sig_digits"CDF_CHAR    { "6" }.

! NRV values follow

     [1,1,1,1]  =     154.0
     [1,1,1,2]  =     360.0
     [1,1,1,3]  =     880.0
     [1,1,1,4]  =    2060.0
     [1,1,1,5]  =    3600.0
     [1,1,1,6]  =    8800.0
     [1,1,1,7]  =   15600.0
     [1,1,1,8]  =   36000.0
```

```
    [1,1,1,9]  =    71000.0
    [1,1,1,10] =   133000.0
!--------------------------------------------------------------

!--------------------------------------------------------------
!   Variable            Data              Number     Record       Dim
!   Name                Type              Elements   Variance     Variance
!   -------             ----              --------   --------     --------
   "PPpEnFlx"           CDF_REAL4         1          T            F F F F

!  Attribute    Data          Value
!  Name         Type
!-----------   -----          ------
  "FIELDNAM"   CDF_CHAR      { "Proton energy flux perpendicular to B" }
  "VALIDMIN"   CDF_REAL4     {   0.0 }
  "VALIDMAX"   CDF_REAL4     {   1.0E10 }
  "SCALEMIN"   CDF_REAL4     {   0.0 }
  "SCALEMAX"   CDF_REAL4     {   1.0E10 }
  "UNITS"      CDF_CHAR      { "keV/(cm^2 sec str)" }
  "LABLAXIS"   CDF_CHAR      { "P-perp energy flux" }
  "FORMAT"     CDF_CHAR      { "E10.2" }
  "FILLVAL"    CDF_REAL4     { -1.0e31 }
  "VAR_TYPE"   CDF_CHAR      { "data" }
  "DEPEND_0"   CDF_CHAR      { "Epoch" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }
  "SCALETYP"   CDF_CHAR      { "logarithmic" }
  "SC_id"      CDF_CHAR      { "SCATHA" }
  "Sig_digits"CDF_CHAR       { "3" }.
!--------------------------------------------------------------

!--------------------------------------------------------------
!   Variable            Data              Number     Record       Dim
!   Name                Type              Elements   Variance     Variance
!   -------             ----              --------   --------     --------
   "PPpNmFlx"           CDF_REAL4         1          T            F F F F

!  Attribute    Data          Value
!  Name         Type
!-----------   -----          ------
  "FIELDNAM"   CDF_CHAR      { "Proton number flux perpendicular to B" }
  "VALIDMIN"   CDF_REAL4     {   0.0 }
  "VALIDMAX"   CDF_REAL4     {   1.0E10 }
  "SCALEMIN"   CDF_REAL4     {   0.0 }
  "SCALEMAX"   CDF_REAL4     {   1.0E10 }
  "UNITS"      CDF_CHAR      { "protons/(cm^2 sec str)" }
  "LABLAXIS"   CDF_CHAR      { "P-perp number flux" }
  "FORMAT"     CDF_CHAR      { "E10.2" }
  "FILLVAL"    CDF_REAL4     { -1.0e31 }
  "VAR_TYPE"   CDF_CHAR      { "data" }
  "DEPEND_0"   CDF_CHAR      { "Epoch" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }
  "SCALETYP"   CDF_CHAR      { "logarithmic" }
  "SC_id"      CDF_CHAR      { "SCATHA" }
  "Sig_digits"CDF_CHAR       { "3" }.
!--------------------------------------------------------------
```

```
!-------------------------------------------------------------
!   Variable             Data          Number      Record      Dim
!   Name                 Type          Elements    Variance    Variance
!   -------              ----          --------    --------    --------
   "PPlEnFlx"            CDF_REAL4     1           T           F F F F

!  Attribute     Data          Value
!  Name          Type
!-----------     -----         ------
  "FIELDNAM"    CDF_CHAR     { "Proton energy flux parallel to B" }
  "VALIDMIN"    CDF_REAL4    {   0.0 }
  "VALIDMAX"    CDF_REAL4    {   1.0E10 }
  "SCALEMIN"    CDF_REAL4    {   0.0 }
  "SCALEMAX"    CDF_REAL4    {   1.0E10 }
  "UNITS"       CDF_CHAR     { "keV/(cm^2 sec str)" }
  "LABLAXIS"    CDF_CHAR     { "P-parl energy flux" }
  "FORMAT"      CDF_CHAR     { "E10.2" }
  "FILLVAL"     CDF_REAL4    { -1.0e31 }
  "VAR_TYPE"    CDF_CHAR     { "data" }
  "DEPEND_0"    CDF_CHAR     { "Epoch" }
  "DICT_KEY"    CDF_CHAR     { "XXX" }
  "SCALETYP"    CDF_CHAR     { "logarithmic" }
  "SC_id"       CDF_CHAR     { "SCATHA" }
  "Sig_digits"CDF_CHAR       { "3" }.
!-------------------------------------------------------------

!-------------------------------------------------------------
!   Variable             Data          Number      Record      Dim
!   Name                 Type          Elements    Variance    Variance
!   -------              ----          --------    --------    --------
   "PPlNmFlx"            CDF_REAL4     1           T           F F F F

!  Attribute     Data          Value
!  Name          Type
!-----------     -----         ------
  "FIELDNAM"    CDF_CHAR     { "Proton number flux perpendicular to B" }
  "VALIDMIN"    CDF_REAL4    {   0.0 }
  "VALIDMAX"    CDF_REAL4    {   1.0E10 }
  "SCALEMIN"    CDF_REAL4    {   0.0 }
  "SCALEMAX"    CDF_REAL4    {   1.0E10 }
  "UNITS"       CDF_CHAR     { "protons/(cm^2 sec str)" }
  "LABLAXIS"    CDF_CHAR     { "P-parl number flux" }
  "FORMAT"      CDF_CHAR     { "E10.2" }
  "FILLVAL"     CDF_REAL4    { -1.0e31 }
  "VAR_TYPE"    CDF_CHAR     { "data" }
  "DEPEND_0"    CDF_CHAR     { "Epoch" }
  "DICT_KEY"    CDF_CHAR     { "XXX" }
  "SCALETYP"    CDF_CHAR     { "logarithmic" }
  "SC_id"       CDF_CHAR     { "SCATHA" }
  "Sig_digits"CDF_CHAR       { "3" }.
!-------------------------------------------------------------
```

```
!------------------------------------------------------------
!   Variable              Data          Number     Record     Dim
!   Name                  Type          Elements   Variance   Variance
!   -------               ----          --------   --------   --------
  "EDensity"              CDF_REAL4     1          T          F F F F

!  Attribute    Data           Value
!  Name         Type
!-----------   -----          ------
  "FIELDNAM"   CDF_CHAR       { "Electron density (.1-20keV)" }
  "VALIDMIN"   CDF_REAL4      {    0.0 }
  "VALIDMAX"   CDF_REAL4      {  100.0 }
  "SCALEMIN"   CDF_REAL4      {    0.0 }
  "SCALEMAX"   CDF_REAL4      {  100.0 }
  "UNITS"      CDF_CHAR       { "cm-3" }
  "LABLAXIS"   CDF_CHAR       { "n_e" }
  "FORMAT"     CDF_CHAR       { "F10.4" }
  "FILLVAL"    CDF_REAL4      { -999.9999 }
  "VAR_TYPE"   CDF_CHAR       { "data" }
  "DEPEND_0"   CDF_CHAR       { "Epoch" }
  "DICT_KEY"   CDF_CHAR       { "XXX" }
  "SCALETYP"   CDF_CHAR       { "linear" }
  "SC_id"      CDF_CHAR       { "SCATHA" }
  "Sig_digits"CDF_CHAR        { "7" }.
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable              Data          Number     Record     Dim
!   Name                  Type          Elements   Variance   Variance
!   -------               ----          --------   --------   --------
  "EPpDrfVel"             CDF_REAL4     1          T          F F F F

!  Attribute    Data           Value
!  Name         Type
!-----------   -----          ------
  "FIELDNAM"   CDF_CHAR       { "Electron (.1-20keV) drift velocity perpendicular to B" }
  "VALIDMIN"   CDF_REAL4      {  -1.0e10 }
  "VALIDMAX"   CDF_REAL4      {   1.0e10 }
  "SCALEMIN"   CDF_REAL4      {  -1.0e10 }
  "SCALEMAX"   CDF_REAL4      {   1.0e10 }
  "UNITS"      CDF_CHAR       { "km/s" }
  "LABLAXIS"   CDF_CHAR       { "v_e" }
  "FORMAT"     CDF_CHAR       { "E12.4" }
  "FILLVAL"    CDF_REAL4      { -1.0e31 }
  "VAR_TYPE"   CDF_CHAR       { "data" }
  "DEPEND_0"   CDF_CHAR       { "Epoch" }
  "DICT_KEY"   CDF_CHAR       { "XXX" }
  "SCALETYP"   CDF_CHAR       { "logarithmic" }
  "SC_id"      CDF_CHAR       { "SCATHA" }
  "Sig_digits"CDF_CHAR        { "5" }.
!------------------------------------------------------------
```

```
!------------------------------------------------------------
!   Variable            Data            Number     Record     Dim
!   Name                Type            Elements   Variance   Variance
!   -------             ----            --------   --------   --------
  "EPress"              CDF_REAL4       1          T          F F F F

! Attribute    Data         Value
! Name         Type
!-----------   -----        ------
  "FIELDNAM"   CDF_CHAR     { "Electron pressure (.1-20keV)" }
  "VALIDMIN"   CDF_REAL4    {   0.0 }
  "VALIDMAX"   CDF_REAL4    {   1.0e10 }
  "SCALEMIN"   CDF_REAL4    {   0.0 }
  "SCALEMAX"   CDF_REAL4    {   1.0e10 }
  "UNITS"      CDF_CHAR     { "ndynes/cm2" }
  "LABLAXIS"   CDF_CHAR     { "P_e" }
  "FORMAT"     CDF_CHAR     { "E12.4" }
  "FILLVAL"    CDF_REAL4    { -1.0e31 }
  "VAR_TYPE"   CDF_CHAR     { "data" }
  "DEPEND_0"   CDF_CHAR     { "Epoch" }
  "DICT_KEY"   CDF_CHAR     { "XXX" }
  "SCALETYP"   CDF_CHAR     { "logarithmic" }
  "SC_id"      CDF_CHAR     { "SCATHA" }
  "Sig_digits"CDF_CHAR      { "5" }.
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable            Data            Number     Record     Dim
!   Name                Type            Elements   Variance   Variance
!   -------             ----            --------   --------   --------
  "EAveEn"              CDF_REAL4       1          T          F F F F

! Attribute    Data         Value
! Name         Type
!-----------   -----        ------
  "FIELDNAM"   CDF_CHAR     { "Electron average energy (.1-20keV)" }
  "VALIDMIN"   CDF_REAL4    {   0.0 }
  "VALIDMAX"   CDF_REAL4    {   20.0 }
  "SCALEMIN"   CDF_REAL4    {   0.0 }
  "SCALEMAX"   CDF_REAL4    {   20.0 }
  "UNITS"      CDF_CHAR     { "keV" }
  "LABLAXIS"   CDF_CHAR     { "E_e" }
  "FORMAT"     CDF_CHAR     { "F10.5" }
  "FILLVAL"    CDF_REAL4    { -99.99999 }
  "VAR_TYPE"   CDF_CHAR     { "data" }
  "DEPEND_0"   CDF_CHAR     { "Epoch" }
  "DICT_KEY"   CDF_CHAR     { "XXX" }
  "SCALETYP"   CDF_CHAR     { "linear" }
  "SC_id"      CDF_CHAR     { "SCATHA" }
  "Sig_digits"CDF_CHAR      { "7" }.
!------------------------------------------------------------
```

```
!-------------------------------------------------------------
!   Variable              Data         Number     Record     Dim
!   Name                  Type         Elements   Variance   Variance
!   -------               ----         --------   --------   --------
   "PDensity"             CDF_REAL4    1          T          F F F F

!  Attribute    Data         Value
!  Name         Type
!-----------    -----        ------
  "FIELDNAM"   CDF_CHAR     { "Proton density (.1-133keV)" }
  "VALIDMIN"   CDF_REAL4    {    0.0 }
  "VALIDMAX"   CDF_REAL4    {  100.0 }
  "SCALEMIN"   CDF_REAL4    {    0.0 }
  "SCALEMAX"   CDF_REAL4    {  100.0 }
  "UNITS"      CDF_CHAR     { "cm-3" }
  "LABLAXIS"   CDF_CHAR     { "n_p" }
  "FORMAT"     CDF_CHAR     { "F10.4" }
  "FILLVAL"    CDF_REAL4    { -999.9999 }
  "VAR_TYPE"   CDF_CHAR     { "data" }
  "DEPEND_0"   CDF_CHAR     { "Epoch" }
  "DICT_KEY"   CDF_CHAR     { "XXX" }
  "SCALETYP"   CDF_CHAR     { "linear" }
  "SC_id"      CDF_CHAR     { "SCATHA" }
  "Sig_digits"CDF_CHAR      { "7" }.
!-------------------------------------------------------------

!-------------------------------------------------------------
!   Variable              Data         Number     Record     Dim
!   Name                  Type         Elements   Variance   Variance
!   -------               ----         --------   --------   --------
   "PPpDrfVel"            CDF_REAL4    1          T          F F F F

!  Attribute    Data         Value
!  Name         Type
!-----------    -----        ------
  "FIELDNAM"   CDF_CHAR     { "Proton (.1-15keV) drift velocity perpendicular to B" }
  "VALIDMIN"   CDF_REAL4    {  -1.0e10 }
  "VALIDMAX"   CDF_REAL4    {   1.0e10 }
  "SCALEMIN"   CDF_REAL4    {  -1.0e10 }
  "SCALEMAX"   CDF_REAL4    {   1.0e10 }
  "UNITS"      CDF_CHAR     { "km/s" }
  "LABLAXIS"   CDF_CHAR     { "v_p" }
  "FORMAT"     CDF_CHAR     { "E12.4" }
  "FILLVAL"    CDF_REAL4    { -1.0e31 }
  "VAR_TYPE"   CDF_CHAR     { "data" }
  "DEPEND_0"   CDF_CHAR     { "Epoch" }
  "DICT_KEY"   CDF_CHAR     { "XXX" }
  "SCALETYP"   CDF_CHAR     { "logarithmic" }
  "SC_id"      CDF_CHAR     { "SCATHA" }
  "Sig_digits"CDF_CHAR      { "5" }.
!-------------------------------------------------------------
```

```
!-----------------------------------------------------------------
!  Variable             Data              Number     Record      Dim
!  Name                 Type              Elements   Variance    Variance
!  -------              ----              --------   --------    --------
   "PPress"             CDF_REAL4         1          T           F F F F

! Attribute   Data          Value
! Name        Type
!-----------  -----         ------
  "FIELDNAM"  CDF_CHAR      { "Proton pressure (.1-133keV)" }
  "VALIDMIN"  CDF_REAL4     {   0.0 }
  "VALIDMAX"  CDF_REAL4     {   1.0e10 }
  "SCALEMIN"  CDF_REAL4     {   0.0 }
  "SCALEMAX"  CDF_REAL4     {   1.0e10 }
  "UNITS"     CDF_CHAR      { "ndynes/cm2" }
  "LABLAXIS"  CDF_CHAR      { "P_p" }
  "FORMAT"    CDF_CHAR      { "E12.4" }
  "FILLVAL"   CDF_REAL4     { -1.0e31 }
  "VAR_TYPE"  CDF_CHAR      { "data" }
  "DEPEND_0"  CDF_CHAR      { "Epoch" }
  "DICT_KEY"  CDF_CHAR      { "XXX" }
  "SCALETYP"  CDF_CHAR      { "logarithmic" }
  "SC_id"     CDF_CHAR      { "SCATHA" }
  "Sig_digits"CDF_CHAR      { "5" }.
!-----------------------------------------------------------------

!-----------------------------------------------------------------
!  Variable             Data              Number     Record      Dim
!  Name                 Type              Elements   Variance    Variance
!  -------              ----              --------   --------    --------
   "PAveEn"             CDF_REAL4         1          T           F F F F

! Attribute   Data          Value
! Name        Type
!-----------  -----         ------
  "FIELDNAM"  CDF_CHAR      { "Proton average energy (.1-133keV)" }
  "VALIDMIN"  CDF_REAL4     {   0.0 }
  "VALIDMAX"  CDF_REAL4     {   20.0 }
  "SCALEMIN"  CDF_REAL4     {   0.0 }
  "SCALEMAX"  CDF_REAL4     {   20.0 }
  "UNITS"     CDF_CHAR      { "keV" }
  "LABLAXIS"  CDF_CHAR      { "E_p" }
  "FORMAT"    CDF_CHAR      { "F10.5" }
  "FILLVAL"   CDF_REAL4     { -99.99999 }
  "VAR_TYPE"  CDF_CHAR      { "data" }
  "DEPEND_0"  CDF_CHAR      { "Epoch" }
  "DICT_KEY"  CDF_CHAR      { "XXX" }
  "SCALETYP"  CDF_CHAR      { "linear" }
  "SC_id"     CDF_CHAR      { "SCATHA" }
  "Sig_digits"CDF_CHAR      { "7" }.
!-----------------------------------------------------------------
```

```
!------------------------------------------------------------
!   Variable             Data           Number     Record      Dim
!   Name                 Type           Elements   Variance    Variance
!   -------              ----           --------   --------    --------
   "SCGeoLon"            CDF_REAL4      1          T           F F F F

! Attribute   Data        Value
! Name        Type
!-----------  -----       ------
  "FIELDNAM"  CDF_CHAR    { "S/C geographic longitude" }
  "VALIDMIN"  CDF_REAL4   {   0.0 }
  "VALIDMAX"  CDF_REAL4   { 360.0 }
  "SCALEMIN"  CDF_REAL4   {   0.0 }
  "SCALEMAX"  CDF_REAL4   { 360.0 }
  "UNITS"     CDF_CHAR    { "deg E" }
  "LABLAXIS"  CDF_CHAR    { "lon" }
  "FORMAT"    CDF_CHAR    { "F8.2" }
  "FILLVAL"   CDF_REAL4   { -999.99 }
  "VAR_TYPE"  CDF_CHAR    { "data" }
  "DEPEND_0"  CDF_CHAR    { "Epoch" }
  "DICT_KEY"  CDF_CHAR    { "XXX" }
  "SCALETYP"  CDF_CHAR    { "logarithmic" }
  "SC_id"     CDF_CHAR    { "SCATHA" }
  "Sig_digits"CDF_CHAR    { "5" }.
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable             Data           Number     Record      Dim
!   Name                 Type           Elements   Variance    Variance
!   -------              ----           --------   --------    --------
   "SCGeoLat"            CDF_REAL4      1          T           F F F F

! Attribute   Data        Value
! Name        Type
!-----------  -----       ------
  "FIELDNAM"  CDF_CHAR    { "S/C geographic latitude" }
  "VALIDMIN"  CDF_REAL4   {  -90.0 }
  "VALIDMAX"  CDF_REAL4   {   90.0 }
  "SCALEMIN"  CDF_REAL4   {  -90.0 }
  "SCALEMAX"  CDF_REAL4   {   90.0 }
  "UNITS"     CDF_CHAR    { "deg" }
  "LABLAXIS"  CDF_CHAR    { "lat" }
  "FORMAT"    CDF_CHAR    { "F7.2" }
  "FILLVAL"   CDF_REAL4   { -99.99 }
  "VAR_TYPE"  CDF_CHAR    { "data" }
  "DEPEND_0"  CDF_CHAR    { "Epoch" }
  "DICT_KEY"  CDF_CHAR    { "XXX" }
  "SCALETYP"  CDF_CHAR    { "linear" }
  "SC_id"     CDF_CHAR    { "SCATHA" }
  "Sig_digits"CDF_CHAR    { "4" }.
!------------------------------------------------------------
```

```
!------------------------------------------------------------
!   Variable            Data          Number     Record     Dim
!   Name                Type          Elements   Variance   Variance
!   -------             ----          --------   --------   --------
   "SCGeoRad"          CDF_REAL4     1          T          F F F F

!  Attribute   Data          Value
!  Name        Type
!-----------   -----         ------
  "FIELDNAM"   CDF_CHAR      { "S/C geocentric radius" }
  "VALIDMIN"   CDF_REAL4     {  0.0 }
  "VALIDMAX"   CDF_REAL4     {  1.0e6 }
  "SCALEMIN"   CDF_REAL4     {  0.0 }
  "SCALEMAX"   CDF_REAL4     {  1.0e6 }
  "UNITS"      CDF_CHAR      { "km" }
  "LABLAXIS"   CDF_CHAR      { "radius" }
  "FORMAT"     CDF_CHAR      { "F9.1" }
  "FILLVAL"    CDF_REAL4     { -99999.9 }
  "VAR_TYPE"   CDF_CHAR      { "data" }
  "DEPEND_0"   CDF_CHAR      { "Epoch" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }
  "SCALETYP"   CDF_CHAR      { "linear" }
  "SC_id"      CDF_CHAR      { "SCATHA" }
  "Sig_digits"CDF_CHAR       { "6" }.
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable            Data          Number     Record     Dim
!   Name                Type          Elements   Variance   Variance
!   -------             ----          --------   --------   --------
   "SCECIPos"          CDF_REAL4     1          T          T F F F

!  Attribute   Data          Value
!  Name        Type
!-----------   -----         ------
  "FIELDNAM"   CDF_CHAR      { "S/C position  (ECI coordinates)" }
  "VALIDMIN"   CDF_REAL4     {  -1.0e10 }
  "VALIDMAX"   CDF_REAL4     {   1.0e10 }
  "SCALEMIN"   CDF_REAL4     {  -1.0e10 }
  "SCALEMAX"   CDF_REAL4     {   1.0e10 }
  "UNITS"      CDF_CHAR      { "km" }
  "LABL_PTR_1"CDF_CHAR       { "Lbl_ECIPos" }
  "FORMAT"     CDF_CHAR      { "E16.8" }
  "FILLVAL"    CDF_REAL4     { -1.0e31 }
  "VAR_TYPE"   CDF_CHAR      { "data" }
  "DEPEND_0"   CDF_CHAR      { "Epoch" }
  "DEPEND_1"   CDF_CHAR      { "cartesian" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }
  "SCALETYP"   CDF_CHAR      { "linear" }
  "SC_id"      CDF_CHAR      { "SCATHA" }
  "Sig_digits"CDF_CHAR       { "9" }.
!------------------------------------------------------------
```

```
!------------------------------------------------------------
!   Variable              Data          Number     Record      Dim
!   Name                  Type          Elements   Variance    Variance
!   -------               ----          --------   --------    --------
   "Lbl_ECIPos"           CDF_CHAR      7          F           T F F F

!  Attribute    Data          Value
!  Name         Type
!-----------    -----         ------
  "FIELDNAM"   CDF_CHAR      { "Label for ECI position" }
  "VAR_TYPE"   CDF_CHAR      { "metadata" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }.

! NRV values follow

      [1,1,1,1] = { "x (ECI)" }
      [2,1,1,1] = { "y (ECI)" }
      [3,1,1,1] = { "z (ECI)" }
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable              Data          Number     Record      Dim
!   Name                  Type          Elements   Variance    Variance
!   -------               ----          --------   --------    --------
   "SCECIVel"             CDF_REAL4     1          T           T F F F

!  Attribute    Data          Value
!  Name         Type
!-----------    -----         ------
  "FIELDNAM"   CDF_CHAR      { "S/C velocity (ECI coordinates)" }
  "VALIDMIN"   CDF_REAL4     {  -1.0e10 }
  "VALIDMAX"   CDF_REAL4     {   1.0e10 }
  "SCALEMIN"   CDF_REAL4     {  -1.0e10 }
  "SCALEMAX"   CDF_REAL4     {   1.0e10 }
  "UNITS"      CDF_CHAR      { "km/s" }
  "LABL_PTR_1"CDF_CHAR       { "Lbl_ECIVel" }
  "FORMAT"     CDF_CHAR      { "E16.8" }
  "FILLVAL"    CDF_REAL4     { -1.0e31 }
  "VAR_TYPE"   CDF_CHAR      { "data" }
  "DEPEND_0"   CDF_CHAR      { "Epoch" }
  "DEPEND_1"   CDF_CHAR      { "cartesian" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }
  "SCALETYP"   CDF_CHAR      { "linear" }
  "SC_id"      CDF_CHAR      { "SCATHA" }
  "Sig_digits"CDF_CHAR       { "9" }.
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable              Data          Number     Record      Dim
!   Name                  Type          Elements   Variance    Variance
!   -------               ----          --------   --------    --------
   "Lbl_ECIVel"           CDF_CHAR      8          F           T F F F

!  Attribute    Data          Value
!  Name         Type
!-----------    -----         ------
  "FIELDNAM"   CDF_CHAR      { "Label for ECI velocity" }
  "VAR_TYPE"   CDF_CHAR      { "metadata" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }.
```

```
! NRV values follow

      [1,1,1,1] = { "vx (ECI)" }
      [2,1,1,1] = { "vy (ECI)" }
      [3,1,1,1] = { "vz (ECI)" }
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable            Data            Number     Record     Dim
!   Name                Type            Elements   Variance   Variance
!   -------             ----            --------   --------   --------
  "MLT"                 CDF_REAL4       1          T          F F F F

! Attribute    Data          Value
! Name         Type
!-----------   -----         ------
  "FIELDNAM"   CDF_CHAR     * { "Magnetic local time at equator" }
  "VALIDMIN"   CDF_REAL4      {  0.0 }
  "VALIDMAX"   CDF_REAL4      {  24.0 }
  "SCALEMIN"   CDF_REAL4      {  0.0 }
  "SCALEMAX"   CDF_REAL4      {  24.0 }
  "UNITS"      CDF_CHAR       { "hours" }
  "LABLAXIS"   CDF_CHAR       { "MLT" }
  "FORMAT"     CDF_CHAR       { "F8.2" }
  "FILLVAL"    CDF_REAL4      { -99.999 }
  "VAR_TYPE"   CDF_CHAR       { "data" }
  "DEPEND_0"   CDF_CHAR       { "Epoch" }
  "DICT_KEY"   CDF_CHAR       { "XXX" }
  "SCALETYP"   CDF_CHAR       { "linear" }
  "SC_id"      CDF_CHAR       { "SCATHA" }
  "Sig_digits"CDF_CHAR        { "5" }.
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable            Data            Number     Record     Dim
!   Name                Type            Elements   Variance   Variance
!   -------             ----            --------   --------   --------
  "MagLat"              CDF_REAL4       1          T          F F F F

! Attribute    Data          Value
! Name         Type
!-----------   -----         ------
  "FIELDNAM"   CDF_CHAR      { "Magnetic latitude" }
  "VALIDMIN"   CDF_REAL4     {  -90.0 }
  "VALIDMAX"   CDF_REAL4     {   90.0 }
  "SCALEMIN"   CDF_REAL4     {  -90.0 }
  "SCALEMAX"   CDF_REAL4     {   90.0 }
  "UNITS"      CDF_CHAR      { "deg" }
  "LABLAXIS"   CDF_CHAR      { "Mlat" }
  "FORMAT"     CDF_CHAR      { "F8.2" }
  "FILLVAL"    CDF_REAL4     { -99.99 }
  "VAR_TYPE"   CDF_CHAR      { "data" }
  "DEPEND_0"   CDF_CHAR      { "Epoch" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }
  "SCALETYP"   CDF_CHAR      { "linear" }
  "SC_id"      CDF_CHAR      { "SCATHA" }
  "Sig_digits"CDF_CHAR       { "4" }.
!------------------------------------------------------------
```

```
!--------------------------------------------------------------
!   Variable              Data           Number     Record      Dim
!   Name                  Type           Elements   Variance    Variance
!   -------               ----           --------   --------    --------
  "LShell"                CDF_REAL4      1          T           F F F F

!  Attribute    Data          Value
!  Name         Type
!-----------    -----         ------
  "FIELDNAM"    CDF_CHAR      { "L - shell" }
  "VALIDMIN"    CDF_REAL4     {  0.0 }
  "VALIDMAX"    CDF_REAL4     {  1000.0 }
  "SCALEMIN"    CDF_REAL4     {  0.0 }
  "SCALEMAX"    CDF_REAL4     {  1000.0 }
  "UNITS"       CDF_CHAR      { " " }
  "LABLAXIS"    CDF_CHAR      { "L" }
  "FORMAT"      CDF_CHAR      { "F8.2" }
  "FILLVAL"     CDF_REAL4     { -999.99 }
  "VAR_TYPE"    CDF_CHAR      { "data" }
  "DEPEND_0"    CDF_CHAR      { "Epoch" }
  "DICT_KEY"    CDF_CHAR      { "XXX" }
  "SCALETYP"    CDF_CHAR      { "linear" }
  "SC_id"       CDF_CHAR      { "SCATHA" }
  "Sig_digits"CDF_CHAR        { "5" }.
!--------------------------------------------------------------

!--------------------------------------------------------------
!   Variable              Data           Number     Record      Dim
!   Name                  Type           Elements   Variance    Variance
!   -------               ----           --------   --------    --------
  "BEqModl"               CDF_REAL4      1          T           F F F F

!  Attribute    Data          Value
!  Name         Type
!-----------    -----         ------
  "FIELDNAM"    CDF_CHAR      { "B equator model" }
  "VALIDMIN"    CDF_REAL4     {  -500.0 }
  "VALIDMAX"    CDF_REAL4     {   500.0 }
  "SCALEMIN"    CDF_REAL4     {  -500.0 }
  "SCALEMAX"    CDF_REAL4     {   500.0 }
  "UNITS"       CDF_CHAR      { "nT" }
  "LABLAXIS"    CDF_CHAR      { "B_eq_mod" }
  "FORMAT"      CDF_CHAR      { "F8.2" }
  "FILLVAL"     CDF_REAL4     { -999.99 }
  "VAR_TYPE"    CDF_CHAR      { "data" }
  "DEPEND_0"    CDF_CHAR      { "Epoch" }
  "DICT_KEY"    CDF_CHAR      { "XXX" }
  "SCALETYP"    CDF_CHAR      { "linear" }
  "SC_id"       CDF_CHAR      { "SCATHA" }
  "Sig_digits"CDF_CHAR        { "5" }.
!--------------------------------------------------------------
```

```
!------------------------------------------------------------
!   Variable              Data              Number      Record       Dim
!   Name                  Type              Elements    Variance     Variance
!   -------               ----              --------    --------     --------
  "BF2Spin"              CDF_REAL4          1           T            F F F F

!  Attribute   Data          Value
!  Name        Type
!-----------   -----         ------
  "FIELDNAM"  CDF_CHAR      { "Angle between B-field and S/C spin axis" }
  "VALIDMIN"  CDF_REAL4     {  -90.0 }
  "VALIDMAX"  CDF_REAL4     {   90.0 }
  "SCALEMIN"  CDF_REAL4     {  -90.0 }
  "SCALEMAX"  CDF_REAL4     {   90.0 }
  "UNITS"     CDF_CHAR      { "deg" }
  "LABLAXIS"  CDF_CHAR      { "Ang BF to S" }
  "FORMAT"    CDF_CHAR      { "F8.2" }
  "FILLVAL"   CDF_REAL4     { -999.99 }
  "VAR_TYPE"  CDF_CHAR      { "data" }
  "DEPEND_0"  CDF_CHAR      { "Epoch" }
  "DICT_KEY"  CDF_CHAR      { "XXX" }
  "SCALETYP"  CDF_CHAR      { "linear" }
  "SC_id"     CDF_CHAR      { "SCATHA" }
  "Sig_digits"CDF_CHAR      { "5" }.
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable              Data              Number      Record       Dim
!   Name                  Type              Elements    Variance     Variance
!   -------               ----              --------    --------     --------
  "BModl"                CDF_REAL4          1           T            T F F F

!  Attribute   Data          Value
!  Name        Type
!-----------   -----         ------
  "FIELDNAM"  CDF_CHAR      { "Model mag. field coordinates" }
  "VALIDMIN"  CDF_REAL4     { -500.  }
  "VALIDMAX"  CDF_REAL4     {  500.0 }
  "SCALEMIN"  CDF_REAL4     { -500.0 }
  "SCALEMAX"  CDF_REAL4     {  500.0 }
  "UNITS"     CDF_CHAR      {  "nT" }
  "LABL_PTR_1"CDF_CHAR      { "Lbl_BModl" }
  "FORMAT"    CDF_CHAR      { "F8.2" }
  "FILLVAL"   CDF_REAL4     { -999.99 }
  "VAR_TYPE"  CDF_CHAR      { "data" }
  "DEPEND_0"  CDF_CHAR      { "Epoch" }
  "DEPEND_1"  CDF_CHAR      { "cartesian" }
  "DICT_KEY"  CDF_CHAR      { "XXX" }
  "SCALETYP"  CDF_CHAR      { "linear" }
  "SC_id"     CDF_CHAR      { "SCATHA" }
  "Sig_digits"CDF_CHAR      { "5" }.
!------------------------------------------------------------
```

```
!-------------------------------------------------------------
!   Variable            Data          Number     Record     Dim
!   Name                Type          Elements   Variance   Variance
!   -------             ----          --------   --------   --------
   "Lbl_BModl"          CDF_CHAR      10         F          T F F F

! Attribute   Data         Value
! Name        Type
!-----------  -----        ------
  "FIELDNAM"  CDF_CHAR     { "Label for BModl" }
  "VAR_TYPE"  CDF_CHAR     { "metadata" }
  "DICT_KEY"  CDF_CHAR     { "XXX" }.

! NRV values follow

      [1,1,1,1] = { "Bx (model)" }
      [2,1,1,1] = { "By (model)" }
      [3,1,1,1] = { "Bz (model)" }
!-------------------------------------------------------------

!-------------------------------------------------------------
!   Variable            Data          Number     Record     Dim
!   Name                Type          Elements   Variance   Variance
!   -------             ----          --------   --------   --------
   "GunStat"            CDF_INT1      1          T          F F F F

! Attribute   Data         Value
! Name        Type
!-----------  -----        ------
  "FIELDNAM"  CDF_CHAR     { "Ion/Electron gun operation flag" }
  "VALIDMIN"  CDF_REAL4    { -128 }
  "VALIDMAX"  CDF_REAL4    {  127 }
  "SCALEMIN"  CDF_REAL4    { -128 }
  "SCALEMAX"  CDF_REAL4    {  127 }
  "UNITS"     CDF_CHAR     {  " " }
  "LABLAXIS"  CDF_CHAR     { "Gun stat" }
  "FORMAT"    CDF_CHAR     { "I5" }
  "FILLVAL"   CDF_REAL4    { -128 }
  "VAR_TYPE"  CDF_CHAR     { "data" }
  "DEPEND_0"  CDF_CHAR     { "Epoch" }
  "DICT_KEY"  CDF_CHAR     { "XXX" }
  "SCALETYP"  CDF_CHAR     { "linear" }
  "SC_id"     CDF_CHAR     { "SCATHA" }
  "Sig_digits"CDF_CHAR     { "3" }.
!-------------------------------------------------------------

!-------------------------------------------------------------
!   Variable            Data          Number     Record     Dim
!   Name                Type          Elements   Variance   Variance
!   -------             ----          --------   --------   --------
   "Status%SC_SP"       CDF_CHAR      11         T          F F F F

! Attribute   Data         Value
! Name        Type
!-----------  -----        ------
  "FIELDNAM"  CDF_CHAR     { "Variable quality indicator" }
  "FORMAT"    CDF_CHAR     { "A11" }
  "FILLVAL"   CDF_CHAR     { "FFFFFFFFFFF" }
  "VAR_TYPE"  CDF_CHAR     { "data" }
  "DEPEND_0"  CDF_CHAR     { "Epoch" }
  "DICT_KEY"  CDF_CHAR     { "XXX" }
```

```
  "SC_id"      CDF_CHAR       { "SCATHA" }.
!---------------------------------------------------------------
```

```
#zVariables

! No zVariables.

#end
```

Appendix H—High-Resolution CDF Skeleton Table

```
#header

!       CDF SKELETON TABLE FOR SCATHA PRIME PARAMETER DATA
!
!                              6 September 1995

                     CDF NAME:  SCATHAP2
                DATA ENCODING:  NETWORK
                     MAJORITY:  COLUMN
                       FORMAT:  SINGLE

! Variables  G. Attributes  V.Attributes  Records  Dims  Sizes
! ---------  -------------  ------------  -------  ----  ---------------
    0/117         16             25         0/z      0


#GLOBALattributes

!  Attribute        Entry   Data              Value
!  Name             Number  Type
!  ---------        ------  ----    ---------------------------------------
  "Project"           1:    CDF_CHAR  { "SCATHA>Spacecraft Charging AT High " -
                                        "Altitude" }.

  "TITLE"             1:    CDF_CHAR  { "SCATHA Science Full Resolution Data" }.

  "MODS"              1:    CDF_CHAR  { "version 1.0" }
                      2:              { "version 1.1 - Increased size of " }
                      3:              { "Sat_per_Epoch and Sat_period from 8 to 48. " }
                      4:              { "version 1.2 - added Rec_Status variable and "}
                      5:              { "Rec_Status_key to indicate the quality of " }
                      6:              { "each record's (corresponding to Epoch) " }
                      7:              { "data. " }
                      8:              { "version 1.3 - SC2StatBits bit 1 meaning " }
                      9:              { "with 'SC2-1 power' and used the previously "}
                     10:              { "bit 15 with 'SC2-2 power' " }
                     11:              { "version 1.4 - revised NRV value declarations "}
                     12:              { "for variables Btd, VLFTd, EELFTd, BELFTd, " }
                     13:              { "SC23BTd, SC26Td and SC8ETd - same values, " }
                     14:              { "slightly different syntax" }
                     15:              { "version 1.5 - deleted SC2-3e and SC2-3p H.V. "}
                     16:              { "status bits from SC2StatBits " }
                     17:              { "version 1.6 - corrected description of bit "}
```

```
                  18:               { "7 - fast/slow in SC2ModeCheckKey " }.

  "Discipline"        1:    CDF_CHAR  { "Space Physics>Magnetospheric Science" }.

  "Source_name"       1:    CDF_CHAR  { "SCATHA>SC1 - Engineering and Plasma " -
                                        "Wave Experiments " }
                      2:    CDF_CHAR  { "SCATHA>SC2 - Plasma (0.1 - 20keV) " -
                                        "and Energetic Ions (20 - 1200keV)" }
                      3:    CDF_CHAR  { "SCATHA>SC3 - High Energy Electrons " -
                                        ">= 50keV" }
                      4:    CDF_CHAR  { "SCATHA>SC4 - Satellite Electron and " -
                                        "Positive Ion Beam System" }
                      5:    CDF_CHAR  { "SCATHA>SC10 - Electric Field Detector " -
                                        "and ULF Waves" }
                      6:    CDF_CHAR  { "SCATHA>SC11 - Magnetic Field Monitor " -
                                        "and ULF Waves" }.

!
  "Data_version"      1:    CDF_CHAR  { "01" }.

! The SFDU identifier - following SFDU registration
  "ADID_ref"          1:    CDF_CHAR  { "XXXXXXXXXX" }.

! First and Last record number for each continuous data period
  "Data_intervals"    1:    CDF_INT4  { 0, 0 }.

  "Data_type"         1:    CDF_CHAR  { "Prime Parameter" }.

  "Descriptor"        1:    CDF_CHAR  { "Scatha satelite primary data" }.

  "Generated_by"      1:    CDF_CHAR  { "The Aerospace Corporation" }.

! Date stamps the creation of the CDF file - To be generated during processing
  "Generation_date"   1:    CDF_CHAR  { "yyyy-mm-ddThh:mm:ss.wwwZ" }.

! Identical to the CDF file name - To be generated during processing
  "Logical_file_id"   1:    CDF_CHAR  { "SC_PP_all_yyyymmdd_Vmm" }.

  "Rules_of_use"      1:    CDF_CHAR  { "refer to The Aerospace Corporation" }.

  "Skeleton_version"  1:    CDF_CHAR  { "SCATHA_Primary_V1.6" }.

! Identifies the processing software - To be revised during processing
  "Software_version"  1:    CDF_CHAR  { "SCATHA_Primary_V1.0" }.

  "Status_key"        1:    CDF_CHAR  { "Status[0]='0'=Bad data" }
                      2:    CDF_CHAR  { "Status[0]='1'=Use with caution" }
                      3:    CDF_CHAR  { "Status[0]='2'=OK" }
                      4:    CDF_CHAR  { "Status[0]='F'=Not Supplied" }.
```

```
"TEXT"          1:  CDF_CHAR  { "SATELLITE DESCRIPTION:               "}
                2:            { "The P78-2 (SCATHA - Spacecraft "      }
                3:            { "Charging AT High Altitude) was "      }
                4:            { "placed into a near synchronous orbit "}
                5:            { "in early February 1979.  The "        }
                6:            { "objectives of the satellite were "    }
                7:            { "twofold; one was to obtain "          }
                8:            { "environmental and engineering "       }
                9:            { "information so as to provide design " }
               10:            { "criteria, materials, techniques, "    }
               11:            { "tests and analytical methods to "     }
               12:            { "ensure control of the charging of"    }
               13:            { "satellite surfaces.  The second "     }
               14:            { "objective was to collect scientific " }
               15:            { "data of interest to each experiment " }
               16:            { "sponsor and the scientific "          }
               17:            { "community.  Key.ares of scientific "  }
               18:            { "investigation include understanding " }
               19:            { "plasma-wave interactions, substorm "  }
               20:            { "studies and further studies of the "  }
               21:            { "energetic ring current."              }
               22:            { "The satellite has its spin axis "     }
               23:            { "approximately parallel to the orbit " }
               24:            { "plane and perpendicular to he sun "   }
               25:            { "line for 1979-1987 period and "       }
               26:            { "perpendicular to ecliptic from 1988 " }
               27:            { "to end of life.  This allows good "   }
               28:            { "pitch angle coverage by the "         }
               29:            { "particle experiments.  The "          }
               30:            { "experiment complement consists of a " }
               31:            { "complete set of plasma, energetic "   }
               32:            { "particle, composition, field and "    }
               33:            { "wave experiments.")
               34:            { "INSTRUMENT DESCRIPTION:              "}
               35:            { "SC1 - Engineering and Wave Experiment"}
               36:            { "Pricipal Investigator: "              }
               37:            { "H. C. Koons "                         }
               38:            { "The Aerospace Corporation "           }
               39:            { "The primary SC1 science experiment "  }
               40:            { "is the VLF wave experiment.  The "    }
               41:            { "experiment employs two antennas, an " }
               42:            { "air-core loop and the 100 m "         }
               43:            { "tip-to-tip dipole from the SC10 "     }
               44:            { "experiment.  The electric field "     }
               45:            { "receiver has a sensitivity of "       }
               46:            { "5 x 10**-7 V/(mHz**.5) at 1.3 kHz "   }
               47:            { "and 10**-7 V/(mHz**.5) at 10.5 kHz.  "}
               48:            { "The magnetic loop is "                }
               49:            { "electrostatically shielded, has an "  }
               50:            { "effective area of 575 m**2 at 1.3 "   }
               51:            { "kHz, and is mounted on a two-meter "  }
```

```
{ "boom.  The sensitivity of the "        }
{ "magnetic receiver is "                 }
{ "3 x 10**-6 gamma/Hz**.5 at 1.3 kHz "   }
{ "and has a 60 dB dynamic range.  "      }
{ "There are eight narrow band filter "   }
{ "(bandwidth +/- 7.5%) outputs at 0.4, "}
{ "1.3, 2.3, 3.0, 10.5, 30.0, 100.0 "     }
{ "and 300.0 kHz and a broadband mode "   }
{ "(0 to 5 kHz).  The broadband data "    }
{ "is taken for one to two hours per "    }
{ "day."}
{ "SC2 - Plasma and Energetic Ion "       }
{ "Pricipal Investigator: "               }
{ "J. F. Fennel "                         }
{ "The Aerospace Corporation "            }
{ "Experiment"                            }
{ "The SC2 experiment has both science "  }
{ "and engineering applications.  The "   }
{ "electrostatic analyzers measure "      }
{ "ions and electrons with energies "     }
{ "from a few 10's of eV to ~20 keV, "    }
{ "perpendicular to the spin axis.  "     }
{ "SC2 also measures 20 keV ions with "   }
{ "a temporal resolution of 250 msec "    }
{ "for He and the CNO group "             }
{ "(>150keV/AMU) and one sec for "        }
{ "protons."}
{ "SC3 - High Energy Particle "           }
{ "Pricipal Investigator: "               }
{ "J. B. Reagan "                         }
{ "Lockheed Palo Alto Research Lab "      }
{ "Spectrometer"                          }
{ "The SC3 eperiment measures the "       }
{ "energetic electron distributions "     }
{ "with good energy and angular "         }
{ "resolution (three degree "             }
{ "full-width-at-half-maxim).  The "      }
{ "primary emphasis is on the electron "  }
{ "measurements in the 47 to 4970 keV "   }
{ "range."}
{ "SC4 - Electron and Ion Beam Emission "}
{ "Pricipal Investigator: "               }
{ "H. A. Cohen "                          }
{ "Air Force Geophysics Lab "             }
{ "System"}
{ "The SC4 experiment was to provide "    }
{ "current sources for charging and "     }
{ "discharging the satellite."}
{ "SC10 - Electric Field Detector "       }
{ "Pricipal Investigator: "               }
{ "T. L. Aggson "                         }
```

```
{ "NASA Goddar Space Flight Center "      }
{ "The SC10 experiment measures the DC " }
{ "electric field and the satellite "     }
{ "potential.  The sensor is a 100 m "    }
{ "tip-to-tip (50 m per side) "           }
{ "cylindrical (0.64cm diameter) dipole "}
{ "that is used as a double floating "    }
{ "probe.  The two halves of the "        }
{ "antenna are extended perpendicular "   }
{ "to the spin axis.  The inner 30 m of "}
{ "each 50 m segment is coated with "     }
{ "Kapton insulation.  The primary "      }
{ "emphasis of the experiment is on "     }
{ "electric fields from DC to 200 Hz.  " }
{ "The antenna is also used by SC1 in "   }
{ "the HF and VLF experiments. "          }
{ "SC11 - Magnetometer "                  }
{ "Pricipal Investigator: "               }
{ "B. G. Ledley "                         }
{ "NASA Goddard Space Flight Center "     }
{ "The SC11 experiment is a triaxial "    }
{ "fluxgate magnetometer.  Each axis "    }
{ "has a reange of 0 to +/- 500 nT.  "    }
{ "The sensor is mounted on a 4 m boom " }
{ "extended perpendicular to the spin "   }
{ "axis.  The field vector is measured " }
{ "four times per second.  The output "   }
{ "from the spin axis aligned sensor is "}
{ "also fed to a set of SC10 filter "     }
{ "channels to provide the same "         }
{ "frequency band outputs.  The "         }
{ "bandwidth of this magnetometer "       }
{ "output is ~100 Hz.  The same axis "    }
{ "can be placed on a brodband channel. "}
{ "The filter output from SC10 provides "}
{ "a sensitivity of 10**-1 nT in the 20 "}
{ "to 200 Hz channel while the "          }
{ "broadband output provides a "          }
{ "sensitivity of 0.2 nT/V."}
{ "INSTRUMENT REFERENCES:               "}
{ "Refer to: "                            }
{ "Stevens, J. R. and A. L. Vampola, "    }
{ "Description of the space test "        }
{ "program P78-2 spacecraft and "         }
{ "payloads, Air Force Space and "        }
{ "Missile Systems organization report " }
{ "SAMSO TR-78-24, 1978.  - Referred to "}
{ "as the 'Blue Book'."                   }
{ "Fennell, J. F., Description of "       }
{ "P78-2 (SCATHA) Satellite and "         }
{ "Experiments, IMS SOURCE BOOK, 1982."  }
```

```
                    154:        { "PRIMARY PARAMETER OVERVIEW: "        }
                    155:        { " "}
                    156:        { " "}
                    157:        { " "}
                    158:        { " "}
                    159:        { " "}
                    160:        { "PRIMARY PARAMETERS DESCRIPTION:      "}
                    161:        { " 1. Epoch - NSSDC Standard Time "     }
                    162:        { " "}
                    163:        { " 2. Rec_Status - Data quality indicator " }
                    164:        { "    see 'SCATHA Attitude Files and Associated " }
                    165:        { " Software: 1995 Update' by M. C. McNab and " }
                    166:        { " G. M. Boyd, The Aerospace Corporation, for " }
                    167:        { " more information about attitude-dependent " }
                    168:        { " status values. " }.

#VARIABLEattributes

      "FIELDNAM"
      "VALIDMIN"
      "VALIDMAX"
      "SCALEMIN"
      "SCALEMAX"
      "FILLVAL"
      "MONOTON"
      "UNITS"
      "LABLAXIS"
      "FORMAT"
      "VAR_TYPE"
      "DEPEND_0"
      "DICT_KEY"
      "SCALETYP"
      "SC_id"
      "Sig_digits"
      "DELTA_PLUS_VAR"
      "DELTA_MINUS_VAR"
      "LABL_PTR_1"
      "DEPEND_1"
      "DEPEND_2"
      "OFFSET_0"
      "DEPEND_BIT"
      "TRANS_KEY"
      "UNIT_PTR"


#variables

! No rVariables.

!--------------------------------------------------------------
```

```
#zVariables
!------------------------------------------------------------------
!   Variable         Data        Number                    Record        Dimension
!   Name             Type        Elements    Dims   Sizes   Variance     Variancees
!   --------         ----        --------    ----   -----   --------     ----------
    "Epoch"        CDF_EPOCH        1         0               T

!  Attribute    Data          Value
!  Name         Type
!-----------    -----         ------
  "FIELDNAM"   CDF_CHAR      { "NSSDC Standard Time" }
  "VALIDMIN"   CDF_EPOCH     { 01-Jan-1979 00:00:00.000 }
  "VALIDMAX"   CDF_EPOCH     { 21-May-1990 23:59:59.000 }
  "SCALEMIN"   CDF_EPOCH     { 01-Jan-1979 00:00:00.000 }
  "SCALEMAX"   CDF_EPOCH     { 21-May-1990 23:59:59.000 }
  "UNITS"      CDF_CHAR      { "ms" }
  "LABLAXIS"   CDF_CHAR      { "Epoch" }
  "MONOTON"    CDF_CHAR      { "INCREASE" }
  "FILLVAL"    CDF_REAL8     { -1.0e31 }
  "VAR_TYPE"   CDF_CHAR      { "data" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }
  "SCALETYP"   CDF_CHAR      { "linear" } /
  "SC_id"      CDF_CHAR      { "SCATHA" }
  "Sig_digits" CDF_CHAR      { "14" }.
!------------------------------------------------------------------
!------------------------------------------------------------------
!   Variable         Data        Number                    Record        Dimension
!   Name             Type        Elements    Dims   Sizes   Variance     Variancees
!   --------         ----        --------    ----   -----   --------     ----------
    "Rec_Status"   CDF_UINT1        1         0               T

!  Attribute    Data          Value
!  Name         Type
!-----------    -----         ------
  "FIELDNAM"   CDF_CHAR      { "Data quality/status indicator" }
  "VALIDMIN"   CDF_UINT1     { 0 }
  "VALIDMAX"   CDF_UINT1     { 255 }
  "SCALEMIN"   CDF_UINT1     { 0 }
  "SCALEMAX"   CDF_UINT1     { 255 }
  "UNITS"      CDF_CHAR      { " " }
  "LABLAXIS"   CDF_CHAR      { "Status" }
  "FILLVAL"    CDF_UINT1     { 255 }
  "VAR_TYPE"   CDF_CHAR      { "data" }
  "FORMAT"     CDF_CHAR      { "I4" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }
  "DEPEND_0"   CDF_CHAR      { "Epoch" }
  "TRANS_KEY"  CDF_CHAR      { "Rec_Status_key" }
  "SCALETYP"   CDF_CHAR      { "linear" }
  "SC_id"      CDF_CHAR      { "SCATHA" }
  "Sig_digits" CDF_CHAR      { "3" }.
!------------------------------------------------------------------
```

```
!-------------------------------------------------------------
!   Variable          Data        Number                      Record      Dimension
!   Name              Type        Elements   Dims    Sizes    Variance    Variances
!   --------          ----        --------   ----    -----    --------    ----------
    "Rec_Status_key" CDF_CHAR       63        1       256        F            T

!  Attribute    Data          Value
!  Name         Type
!-----------   -----         ------
  "FIELDNAM"   CDF_CHAR      { "Rec_Status value definition" }
  "VAR_TYPE"   CDF_CHAR      { "metadata" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }.

! NRV values follow
    [  1] = { "    0 - Good                                                      " }
    [  2] = { "    1 - Caution - Epoch not in defined attitude segment range     " }
    [  3] = { "    2 - Caution - Attitude result of interpolation                " }
    [  4] = { "    3 - Caution - Epoch not in attitude range; interpolated att   " }
    [  5] = { "    4 - Caution - No attitude data available                      " }
    [  6] = { "    5 - NA                                                        " }
    [  7] = { "    6 - NA                                                        " }
    [  8] = { "    7 - NA                                                        " }
    [  9] = { "    8 - NA                                                        " }
    [ 10] = { "    9 - NA                                                        " }
    [ 11] = { "   10 - NA                                                        " }
    [ 12] = { "   11 - NA                                                        " }
    [ 13] = { "   12 - NA                                                        " }
    [ 14] = { "   13 - NA                                                        " }
    [ 15] = { "   14 - NA                                                        " }
    [ 16] = { "   15 - NA                                                        " }
    [ 17] = { "   16 - NA                                                        " }
    [ 18] = { "   17 - NA                                                        " }
    [ 19] = { "   18 - NA                                                        " }
    [ 20] = { "   19 - NA                                                        " }
    [ 21] = { "   20 - NA                                                        " }
    [ 22] = { "   21 - NA                                                        " }
    [ 23] = { "   22 - NA                                                        " }
    [ 24] = { "   23 - NA                                                        " }
    [ 25] = { "   24 - NA                                                        " }
    [ 26] = { "   25 - NA                                                        " }
    [ 27] = { "   26 - NA                                                        " }
    [ 28] = { "   27 - NA                                                        " }
    [ 29] = { "   28 - NA                                                        " }
    [ 30] = { "   29 - NA                                                        " }
    [ 31] = { "   30 - NA                                                        " }
    [ 32] = { "   31 - NA                                                        " }
    [ 33] = { "   32 - NA                                                        " }
    [ 34] = { "   33 - NA                                                        " }
    [ 35] = { "   34 - NA                                                        " }
    [ 36] = { "   35 - NA                                                        " }
    [ 37] = { "   36 - NA                                                        " }
```

```
[ 38] = { "  37 - NA                                                     " }
[ 39] = { "  38 - NA                                                     " }
[ 40] = { "  39 - NA                                                     " }
[ 41] = { "  40 - NA                                                     " }
[ 42] = { "  41 - NA                                                     " }
[ 43] = { "  42 - NA                                                     " }
[ 44] = { "  43 - NA                                                     " }
[ 45] = { "  44 - NA                                                     " }
[ 46] = { "  45 - NA                                                     " }
[ 47] = { "  46 - NA                                                     " }
[ 48] = { "  47 - NA                                                     " }
[ 49] = { "  48 - NA                                                     " }
[ 50] = { "  49 - NA                                                     " }
[ 51] = { "  50 - NA                                                     " }
[ 52] = { "  51 - NA                                                     " }
[ 53] = { "  52 - NA                                                     " }
[ 54] = { "  53 - NA                                                     " }
[ 55] = { "  54 - NA                                                     " }
[ 56] = { "  55 - NA                                                     " }
[ 57] = { "  56 - NA                                                     " }
[ 58] = { "  57 - NA                                                     " }
[ 59] = { "  58 - NA                                                     " }
[ 60] = { "  59 - NA                                                     " }
[ 61] = { "  60 - NA                                                     " }
[ 62] = { "  61 - NA                                                     " }
[ 63] = { "  62 - NA                                                     " }
[ 64] = { "  63 - NA                                                     " }
[ 65] = { "  64 - NA                                                     " }
[ 66] = { "  65 - NA                                                     " }
[ 67] = { "  66 - NA                                                     " }
[ 68] = { "  67 - NA                                                     " }
[ 69] = { "  68 - NA                                                     " }
[ 70] = { "  69 - NA                                                     " }
[ 71] = { "  70 - NA                                                     " }
[ 72] = { "  71 - NA                                                     " }
[ 73] = { "  72 - NA                                                     " }
[ 74] = { "  73 - NA                                                     " }
[ 75] = { "  74 - NA                                                     " }
[ 76] = { "  75 - NA                                                     " }
[ 77] = { "  76 - NA                                                     " }
[ 78] = { "  77 - NA                                                     " }
[ 79] = { "  78 - NA                                                     " }
[ 80] = { "  79 - NA                                                     " }
[ 81] = { "  80 - NA                                                     " }
[ 82] = { "  81 - NA                                                     " }
[ 83] = { "  82 - NA                                                     " }
[ 84] = { "  83 - NA                                                     " }
[ 85] = { "  84 - NA                                                     " }
[ 86] = { "  85 - NA                                                     " }
[ 87] = { "  86 - NA                                                     " }
[ 88] = { "  87 - NA                                                     " }
```

```
[ 89] = { "  88 - NA          " }
[ 90] = { "  89 - NA          " }
[ 91] = { "  80 - NA          " }
[ 92] = { "  91 - NA          " }
[ 93] = { "  92 - NA          " }
[ 94] = { "  93 - NA          " }
[ 95] = { "  94 - NA          " }
[ 96] = { "  95 - NA          " }
[ 97] = { "  96 - NA          " }
[ 98] = { "  97 - NA          " }
[ 99] = { "  98 - NA          " }
[100] = { "  99 - NA          " }
[101] = { " 100 - NA          " }
[102] = { " 101 - NA          " }
[103] = { " 102 - NA          " }
[104] = { " 103 - NA          " }
[105] = { " 104 - NA          " }
[106] = { " 105 - NA          " }
[107] = { " 106 - NA          " }
[108] = { " 107 - NA          " }
[109] = { " 108 - NA          " }
[110] = { " 109 - NA          " }
[111] = { " 110 - NA          " }
[112] = { " 111 - NA          " }
[113] = { " 112 - NA          " }
[114] = { " 113 - NA          " }
[115] = { " 114 - NA          " }
[116] = { " 115 - NA          " }
[117] = { " 116 - NA          " }
[118] = { " 117 - NA          " }
[119] = { " 118 - NA          " }
[120] = { " 119 - NA          " }
[121] = { " 120 - NA          " }
[122] = { " 121 - NA          " }
[123] = { " 122 - NA          " }
[124] = { " 123 - NA          " }
[125] = { " 124 - NA          " }
[126] = { " 125 - NA          " }
[127] = { " 126 - NA          " }
[128] = { " 127 - NA          " }
[129] = { " 128 - NA          " }
[130] = { " 129 - NA          " }
[131] = { " 130 - NA          " }
[132] = { " 131 - NA          " }
[133] = { " 132 - NA          " }
[134] = { " 133 - NA          " }
[135] = { " 134 - NA          " }
[136] = { " 135 - NA          " }
[137] = { " 136 - NA          " }
[138] = { " 137 - NA          " }
[139] = { " 138 - NA          " }
```

```
[140] = { " 139 - NA                                                                    " }
[141] = { " 140 - NA                                                                    " }
[142] = { " 141 - NA                                                                    " }
[143] = { " 142 - NA                                                                    " }
[144] = { " 143 - NA                                                                    " }
[145] = { " 144 - NA                                                                    " }
[146] = { " 145 - NA                                                                    " }
[147] = { " 146 - NA                                                                    " }
[148] = { " 147 - NA                                                                    " }
[149] = { " 148 - NA                                                                    " }
[150] = { " 149 - NA                                                                    " }
[151] = { " 150 - NA                                                                    " }
[152] = { " 151 - NA                                                                    " }
[153] = { " 152 - NA                                                                    " }
[154] = { " 153 - NA                                                                    " }
[155] = { " 154 - NA                                                                    " }
[156] = { " 155 - NA                                                                    " }
[157] = { " 156 - NA                                                                    " }
[158] = { " 157 - NA                                                                    " }
[159] = { " 158 - NA                                                                    " }
[160] = { " 159 - NA                                                                    " }
[161] = { " 160 - NA                                                                    " }
[162] = { " 161 - NA                                                                    " }
[163] = { " 162 - NA                                                                    " }
[164] = { " 163 - NA                                                                    " }
[165] = { " 164 - NA                                                                    " }
[166] = { " 165 - NA                                                                    " }
[167] = { " 166 - NA                                                                    " }
[168] = { " 167 - NA                                                                    " }
[169] = { " 168 - NA                                                                    " }
[170] = { " 169 - NA                                                                    " }
[171] = { " 170 - NA                                                                    " }
[172] = { " 171 - NA                                                                    " }
[173] = { " 172 - NA                                                                    " }
[174] = { " 173 - NA                                                                    " }
[175] = { " 174 - NA                                                                    " }
[176] = { " 175 - NA                                                                    " }
[177] = { " 176 - NA                                                                    " }
[178] = { " 177 - NA                                                                    " }
[179] = { " 178 - NA                                                                    " }
[180] = { " 179 - NA                                                                    " }
[181] = { " 180 - NA                                                                    " }
[182] = { " 181 - NA                                                                    " }
[183] = { " 182 - NA                                                                    " }
[184] = { " 183 - NA                                                                    " }
[185] = { " 184 - NA                                                                    " }
[186] = { " 185 - NA                                                                    " }
[187] = { " 186 - NA                                                                    " }
[188] = { " 187 - NA                                                                    " }
[189] = { " 188 - NA                                                                    " }
[190] = { " 189 - NA                                                                    " }
```

```
[191] = { " 190 - NA                                                    " }
[192] = { " 191 - NA                                                    " }
[193] = { " 192 - NA                                                    " }
[194] = { " 193 - NA                                                    " }
[195] = { " 194 - NA                                                    " }
[196] = { " 195 - NA                                                    " }
[197] = { " 196 - NA                                                    " }
[198] = { " 197 - NA                                                    " }
[199] = { " 198 - NA                                                    " }
[200] = { " 199 - NA                                                    " }
[201] = { " 200 - NA                                                    " }
[202] = { " 201 - NA                                                    " }
[203] = { " 202 - NA                                                    " }
[204] = { " 203 - NA                                                    " }
[205] = { " 204 - NA                                                    " }
[206] = { " 205 - NA                                                    " }
[207] = { " 206 - NA                                                    " }
[208] = { " 207 - NA                                                    " }
[209] = { " 208 - NA                                                    " }
[210] = { " 209 - NA                                                    " }
[211] = { " 210 - NA                                                    " }
[212] = { " 211 - NA                                                    " }
[213] = { " 212 - NA                                                    " }
[214] = { " 213 - NA                                                    " }
[215] = { " 214 - NA                                                    " }
[216] = { " 215 - NA                                                    " }
[217] = { " 216 - NA                                                    " }
[218] = { " 217 - NA                                                    " }
[219] = { " 218 - NA                                                    " }
[220] = { " 219 - NA                                                    " }
[221] = { " 220 - NA                                                    " }
[222] = { " 221 - NA                                                    " }
[223] = { " 222 - NA                                                    " }
[224] = { " 223 - NA                                                    " }
[225] = { " 224 - NA                                                    " }
[226] = { " 225 - NA                                                    " }
[227] = { " 226 - NA                                                    " }
[228] = { " 227 - NA                                                    " }
[229] = { " 228 - NA                                                    " }
[230] = { " 229 - NA                                                    " }
[231] = { " 230 - NA                                                    " }
[232] = { " 231 - NA                                                    " }
[233] = { " 232 - NA                                                    " }
[234] = { " 233 - NA                                                    " }
[235] = { " 234 - NA                                                    " }
[236] = { " 235 - NA                                                    " }
[237] = { " 236 - NA                                                    " }
[238] = { " 237 - NA                                                    " }
[239] = { " 238 - NA                                                    " }
[240] = { " 239 - NA                                                    " }
[241] = { " 240 - NA                                                    " }
```

```
    [242] = { " 241 - NA                                                         " }
    [243] = { " 242 - NA                                                         " }
    [244] = { " 243 - NA                                                         " }
    [245] = { " 244 - NA                                                         " }
    [246] = { " 245 - NA                                                         " }
    [247] = { " 246 - NA                                                         " }
    [248] = { " 247 - NA                                                         " }
    [249] = { " 248 - NA                                                         " }
    [250] = { " 249 - NA                                                         " }
    [251] = { " 250 - NA                                                         " }
    [252] = { " 251 - NA                                                         " }
    [253] = { " 252 - NA                                                         " }
    [254] = { " 253 - NA                                                         " }
    [255] = { " 254 - NA                                                         " }
    [256] = { " 255 - NA                                                         " }
!------------------------------------------------------------
!   Variable         Data        Number                      Record      Dimension
!   Name             Type        Elements    Dims   Sizes    Variance    Variancees
!   --------         ----        --------    ----   -----    --------    ----------
    "Sat_per_Epoch" CDF_EPOCH       1          1     48         F            T

!  Attribute    Data          Value
!  Name         Type
!-----------    -----         ------
  "FIELDNAM"   CDF_CHAR      { "Satelite period associated time" }
  "VALIDMIN"   CDF_EPOCH     { 01-Jan-1979 00:00:00.000 }
  "VALIDMAX"   CDF_EPOCH     { 21-May-1990 23:59:59.000 }
  "SCALEMIN"   CDF_EPOCH     { 01-Jan-1979 00:00:00.000 }
  "SCALEMAX"   CDF_EPOCH     { 21-May-1990 23:59:59.000 }
  "UNITS"      CDF_CHAR      { "ms" }
  "LABLAXIS"   CDF_CHAR      { "Epoch" }
  "FILLVAL"    CDF_REAL8     { -1.0e31 }
  "VAR_TYPE"   CDF_CHAR      { "data" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }
  "SCALETYP"   CDF_CHAR      { "linear" }
  "SC_id"      CDF_CHAR      { "SCATHA" }
  "Sig_digits" CDF_CHAR      { "14" }.
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable         Data        Number                      Record      Dimension
!   Name             Type        Elements    Dims   Sizes    Variance    Variancees
!   --------         ----        --------    ----   -----    --------    ----------
    "Sat_period"    CDF_REAL8       1          1     48         F            T

!  Attribute    Data          Value
!  Name         Type
!-----------    -----         ------
  "FIELDNAM"   CDF_CHAR      { "Satelite period" }
  "VALIDMIN"   CDF_REAL8     {   0.0 }
  "VALIDMAX"   CDF_REAL8     { 100.0 }
```

```
 "SCALEMIN"  CDF_REAL8      {   0.0 }
 "SCALEMAX"  CDF_REAL8      { 100.0 }
 "UNITS"     CDF_CHAR       { "s/spin" }
 "LABLAXIS"  CDF_CHAR       { "Period" }
 "FILLVAL"   CDF_REAL8      { -1.0e31 }
 "FORMAT"    CDF_CHAR       { "E14.6" }
 "VAR_TYPE"  CDF_CHAR       { "data" }
 "DEPEND_1"  CDF_CHAR       { "Sat_per_Epoch" }
 "DICT_KEY"  CDF_CHAR       { "XXX" }
 "SCALETYP"  CDF_CHAR       { "linear" }
 "SC_id"     CDF_CHAR       { "SCATHA" }
 "Sig_digits" CDF_CHAR      { "7" }.
!-------------------------------------------------------------

!-------------------------------------------------------------
!  Variable        Data        Number                    Record      Dimension
!  Name            Type        Elements   Dims   Sizes   Variance    Variancees
!  --------        ----        --------   ----   -----   --------    ----------
   "B_Sat"       CDF_REAL4        1         2     3 4       T           T T

!  Attribute   Data          Value
!  Name        Type
!-----------   -----         ------
  "FIELDNAM"   CDF_CHAR      { "Mag. Field in Cartesian Spacecraft coordinates" }
  "VALIDMIN"   CDF_REAL4     { -300.  }
  "VALIDMAX"   CDF_REAL4     {  300.0 }
  "SCALEMIN"   CDF_REAL4     { -300.0 }
  "SCALEMAX"   CDF_REAL4     {  300.0 }
  "UNITS"      CDF_CHAR      {  "nT" }
  "LABL_PTR_1" CDF_CHAR      { "label_B_Sat" }
  "FORMAT"     CDF_CHAR      { "F8.2" }
  "FILLVAL"    CDF_REAL4     { -999.99 }
  "VAR_TYPE"   CDF_CHAR      { "data" }
  "DEPEND_0"   CDF_CHAR      { "Epoch" }
  "DEPEND_1"   CDF_CHAR      { "label_B_Sat" }
  "DEPEND_2"   CDF_CHAR      { "Quarter_sec" }
  "OFFSET_0"   CDF_CHAR      { "BTd" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }
  "SCALETYP"   CDF_CHAR      { "linear" }
  "SC_id"      CDF_CHAR      { "SCATHA" }
  "Sig_digits" CDF_CHAR      { "5" }.
!-------------------------------------------------------------

!-------------------------------------------------------------
!  Variable        Data        Number                    Record      Dimension
!  Name            Type        Elements   Dims   Sizes   Variance    Variancees
!  --------        ----        --------   ----   -----   --------    ----------
   "label_B_Sat" CDF_CHAR         8         1     3         F           T

!  Attribute   Data          Value
!  Name        Type
```

```
!-----------    -----          ------
  "FIELDNAM"  CDF_CHAR       { "Label for B_Sat" }
  "VAR_TYPE"  CDF_CHAR       { "metadata" }
  "DICT_KEY"  CDF_CHAR       { "XXX" }.

! NRV values follow

      [ 1 ] = { "Bx (Sat)" }
      [ 2 ] = { "By (Sat)" }
      [ 3 ] = { "Bz (Sat)" }
!------------------------------------------------------------
!------------------------------------------------------------
!   Variable        Data       Number                       Record      Dimension
!   Name            Type       Elements   Dims    Sizes    Variance    Variancees
!   --------        ----       --------   ----    -----    --------    ----------
    "B_ECI"       CDF_REAL4      1          2      3 4        T           T T

!  Attribute    Data           Value
!  Name         Type
!-----------    -----          ------
  "FIELDNAM"  CDF_CHAR       { "Mag. Field in Cartesian Spacecraft coordinates" }
  "VALIDMIN"  CDF_REAL4      { -300.  }
  "VALIDMAX"  CDF_REAL4      {  300.0 }
  "SCALEMIN"  CDF_REAL4      { -300.0 }
  "SCALEMAX"  CDF_REAL4      {  300.0 }
  "UNITS"     CDF_CHAR       {  "nT" }
  "LABL_PTR_1" CDF_CHAR      { "label_B_ECI" }
  "FORMAT"    CDF_CHAR       { "F8.2" }
  "FILLVAL"   CDF_REAL4      { -999.99 }
  "VAR_TYPE"  CDF_CHAR       { "data" }
  "DEPEND_0"  CDF_CHAR       { "Epoch" }
  "DEPEND_1"  CDF_CHAR       { "label_B_ECI" }
  "DEPEND_2"  CDF_CHAR       { "Quarter_sec" }
  "OFFSET_0"  CDF_CHAR       { "BTd" }
  "DICT_KEY"  CDF_CHAR       { "XXX" }
  "SCALETYP"  CDF_CHAR       { "linear" }
  "SC_id"     CDF_CHAR       { "SCATHA" }
  "Sig_digits" CDF_CHAR      { "5" }.
!------------------------------------------------------------
!------------------------------------------------------------
!   Variable        Data       Number                       Record      Dimension
!   Name            Type       Elements   Dims    Sizes    Variance    Variancees
!   --------        ----       --------   ----    -----    --------    ----------
    "label_B_ECI" CDF_CHAR       8          1       3         F           T

!  Attribute    Data           Value
!  Name         Type
!-----------    -----          ------
  "FIELDNAM"  CDF_CHAR       { "Label for B_ECI" }
  "VAR_TYPE"  CDF_CHAR       { "metadata" }
  "DICT_KEY"  CDF_CHAR       { "XXX" }.
```

```
! NRV values follow

      [ 1 ] = { "Bx (ECI)" }
      [ 2 ] = { "By (ECI)" }
      [ 3 ] = { "Bz (ECI)" }
!-------------------------------------------------------------

!-------------------------------------------------------------
!   Variable         Data         Number                       Record       Dimension
!   Name             Type         Elements   Dims    Sizes     Variance     Variancees
!   --------         ----         --------   ----    -----     --------     ----------
    "B_GSM"        CDF_REAL4        1         2       3 4         T            T T

!  Attribute     Data            Value
!  Name          Type
!-----------     -----           ------
  "FIELDNAM"    CDF_CHAR        { "Mag. Field in Cartesian Spacecraft coordinates" }
  "VALIDMIN"    CDF_REAL4       { -300.  }
  "VALIDMAX"    CDF_REAL4       {  300.0 }
  "SCALEMIN"    CDF_REAL4       { -300.0 }
  "SCALEMAX"    CDF_REAL4       {  300.0 }
  "UNITS"       CDF_CHAR        {  "nT" }
  "LABL_PTR_1" CDF_CHAR        { "label_B_GSM" }
  "FORMAT"      CDF_CHAR        { "F8.2" }
  "FILLVAL"     CDF_REAL4       { -999.99 }
  "VAR_TYPE"    CDF_CHAR        { "data" }
  "DEPEND_0"    CDF_CHAR        { "Epoch" }
  "DEPEND_1"    CDF_CHAR        { "label_B_GSM" }
  "DEPEND_2"    CDF_CHAR        { "Quarter_sec" }
  "OFFSET_0"    CDF_CHAR        { "BTd" }
  "DICT_KEY"    CDF_CHAR        { "XXX" }
  "SCALETYP"    CDF_CHAR        { "linear" }
  "SC_id"       CDF_CHAR        { "SCATHA" }
  "Sig_digits" CDF_CHAR        { "5" }.
!-------------------------------------------------------------

!-------------------------------------------------------------
!   Variable         Data         Number                       Record       Dimension
!   Name             Type         Elements   Dims    Sizes     Variance     Variancees
!   --------         ----         --------   ----    -----     --------     ----------
    "label_B_GSM" CDF_CHAR          8         1       3           F            T

!  Attribute     Data            Value
!  Name          Type
!-----------     -----           ------
  "FIELDNAM"    CDF_CHAR        { "Label for B_GSM" }
  "VAR_TYPE"    CDF_CHAR        { "metadata" }
  "DICT_KEY"    CDF_CHAR        { "XXX" }.
```

```
! NRV values follow

      [ 1 ] = { "Bx (GSM)" }
      [ 2 ] = { "By (GSM)" }
      [ 3 ] = { "Bz (GSM)" }
!------------------------------------------------------------

!------------------------------------------------------------
!  Variable        Data        Number                        Record      Dimension
!  Name            Type        Elements    Dims    Sizes     Variance    Variancees
!  --------        ----        --------    ----    -----     --------    ----------
   "BTd"          CDF_REAL4       1          1       4          F            T

! Attribute    Data          Value
! Name         Type
!-----------   -----         ------
  "FIELDNAM"   CDF_CHAR      { "B-Time offset" }
  "UNITS"      CDF_CHAR      { "ms" }
  "VAR_TYPE"   CDF_CHAR      { "metadata" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }.

! NRV values follow

      [ 1 ] =  61.523438
      [ 2 ] = 311.523438
      [ 3 ] = 561.523438
      [ 4 ] = 811.523438
!------------------------------------------------------------

!------------------------------------------------------------
!  Variable        Data        Number                        Record      Dimension
!  Name            Type        Elements    Dims    Sizes     Variance    Variancees
!  --------        ----        --------    ----    -----     --------    ----------
   "Quarter_sec" CDF_CHAR      18          1       4          F            T

! Attribute    Data          Value
! Name         Type
!-----------   -----         ------
  "FIELDNAM"   CDF_CHAR      { "Dimension labels for quarter seconds" }
  "VAR_TYPE"   CDF_CHAR      { "metadata" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }.

! NRV values follow

      [ 1 ] =  { "1st quarter second" }
      [ 2 ] =  { "2nd quarter second" }
      [ 3 ] =  { "3rd quarter second" }
      [ 4 ] =  { "4th quarter second" }
!------------------------------------------------------------
```

```
!-----------------------------------------------------------
!  Variable        Data         Number                     Record        Dimension
!  Name            Type        Elements   Dims   Sizes    Variance      Variancees
!  --------        ----        --------   ----   -----    --------      ----------
   "Half_sec"    CDF_CHAR         15        1      2          F              T

!  Attribute    Data          Value
!  Name         Type
!-----------    -----         ------
  "FIELDNAM"   CDF_CHAR      { "Dimension labels for half seconds" }
  "VAR_TYPE"   CDF_CHAR      { "metadata" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }.

! NRV values follow

      [ 1 ] =  { "1st half second" }
      [ 2 ] =  { "2nd half second" }
!-----------------------------------------------------------

!-----------------------------------------------------------
!  Variable        Data         Number                     Record        Dimension
!  Name            Type        Elements   Dims   Sizes    Variance      Variancees
!  --------        ----        --------   ----   -----    --------      ----------
   "EVLFAmp"     CDF_REAL4        1         2     8 2         T            T  T

!  Attribute    Data          Value
!  Name         Type
!-----------    -----         ------
  "FIELDNAM"   CDF_CHAR      { "E-field VLF wave amplitude" }
  "VALIDMIN"   CDF_REAL4     {  -240.0 }
  "VALIDMAX"   CDF_REAL4     {   20.0 }
  "SCALEMIN"   CDF_REAL4     {  -82.0 }
  "SCALEMAX"   CDF_REAL4     {  -32.0 }
  "UNITS"      CDF_CHAR      { "dBV" }
  "LABL_PTR_1" CDF_CHAR      { "label_VLF_frq" }
  "FORMAT"     CDF_CHAR      { "F9.3" }
  "FILLVAL"    CDF_REAL4     { -999.999 }
  "VAR_TYPE"   CDF_CHAR      { "data" }
  "DEPEND_0"   CDF_CHAR      { "Epoch" }
  "DEPEND_1"   CDF_CHAR      { "VLFFrq" }
  "DEPEND_2"   CDF_CHAR      { "Half_sec" }
  "OFFSET_0"   CDF_CHAR      { "VLFTd" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }
  "SCALETYP"   CDF_CHAR      { "linear" }
  "SC_id"      CDF_CHAR      { "SCATHA" }
  "Sig_digits" CDF_CHAR      { "five" }.
!-----------------------------------------------------------
```

```
!-------------------------------------------------------------
!   Variable          Data       Number                     Record      Dimension
!   Name              Type       Elements   Dims   Sizes    Variance    Variancees
!   --------          ----       --------   ----   -----    --------    ----------
    "BVLFAmp"      CDF_REAL4        1         2     4 2        T           T  T

!  Attribute    Data           Value
!  Name         Type
!-----------    -----          ------
  "FIELDNAM"  CDF_CHAR      { "B-field VLF wave amplitude" }
  "VALIDMIN"  CDF_REAL4     {  -240.0 }
  "VALIDMAX"  CDF_REAL4     {    20.0 }
  "SCALEMIN"  CDF_REAL4     {   -82.0 }
  "SCALEMAX"  CDF_REAL4     {   -32.0 }
  "UNITS"     CDF_CHAR      { "dBnT" }
  "LABL_PTR_1" CDF_CHAR     { "label_VLF_frq" }
  "FORMAT"    CDF_CHAR      { "F9.3" }
  "FILLVAL"   CDF_REAL4     { -999.999 }
  "VAR_TYPE"  CDF_CHAR      { "data" }
  "DEPEND_0"  CDF_CHAR      { "Epoch" }
  "DEPEND_1"  CDF_CHAR      { "VLFFrq" }
  "DEPEND_2"  CDF_CHAR      { "Half_sec" }
  "OFFSET_0"  CDF_CHAR      { "VLFTd" }
  "DICT_KEY"  CDF_CHAR      { "XXX" }
  "SCALETYP"  CDF_CHAR      { "linear" }
  "SC_id"     CDF_CHAR      { "SCATHA" }
  "Sig_digits" CDF_CHAR     { "five" }.
!-------------------------------------------------------------
!-------------------------------------------------------------
!   Variable          Data       Number                     Record      Dimension
!   Name              Type       Elements   Dims   Sizes    Variance    Variancees
!   --------          ----       --------   ----   -----    --------    ----------
   "label_VLF_frq" CDF_CHAR         8         1      8         F            T

!  Attribute    Data           Value
!  Name         Type
!-----------    -----          ------
  "FIELDNAM"  CDF_CHAR      { "Label for VLF frequency channel" }
  "VAR_TYPE"  CDF_CHAR      { "metadata" }
  "DICT_KEY"  CDF_CHAR      { "XXX" }.

! NRV values follow
[ 1 ] =  { "   0.4kHz" }
      [ 2 ] =  { "   1.3kHz" }
      [ 3 ] =  { "   2.3kHz" }
      [ 4 ] =  { "   3.0kHz" }
      [ 5 ] =  { "  10.5kHz" }
      [ 6 ] =  { "  30.5kHz" }
      [ 7 ] =  { "100.0kHz" }
      [ 8 ] =  { "300.0kHz" }
!-------------------------------------------------------------
```

```
!-------------------------------------------------------------
!  Variable          Data       Number                         Record      Dimension
!  Name              Type       Elements   Dims    Sizes       Variance    Variancees
!  --------          ----       --------   ----    -----       --------    ----------
   "VLFFrq"          CDF_REAL4      1        1       8            F            T

!  Attribute    Data          Value
!  Name         Type
!-----------    -----         ------
  "FIELDNAM"    CDF_CHAR      { "E-field VLF center frequency" }
  "UNITS"       CDF_CHAR      { "kHz" }
  "VAR_TYPE"    CDF_CHAR      { "metadata" }
  "DELTA_PLUS_VAR"  CDF_CHAR  { "VLFFHi" }
  "DELTA_MINUS_VAR" CDF_CHAR  { "VLFFLo" }
  "DICT_KEY"    CDF_CHAR      { "XXX" }.

! NRV values follow
[1] = 0.4
      [2] = 1.3
      [3] = 2.3
      [4] = 3.0
      [5] = 10.5
      [6] = 30.0
      [7] = 100.0
      [8] = 300.0
!-------------------------------------------------------------
!-------------------------------------------------------------
!  Variable          Data       Number                         Record      Dimension
!  Name              Type       Elements   Dims    Sizes       Variance    Variancees
!  --------          ----       --------   ----    -----       --------    ----------
   "VLFFHi"          CDF_REAL4      1        1       8            F            T

!  Attribute    Data          Value
!  Name         Type
!-----------    -----         ------
  "FIELDNAM"    CDF_CHAR      { "E-field VLF upper frequency range value" }
  "UNITS"       CDF_CHAR      { "kHz" }
  "VAR_TYPE"    CDF_CHAR      { "metadata" }
  "DICT_KEY"    CDF_CHAR      { "ISTP>range>absolute" }.

! NRV values follow

      [1] = 0.43
      [2] = 1.4
      [3] = 2.5
      [4] = 3.2
      [5] = 11.3
      [6] = 32.25
      [7] = 108.0
      [8] = 323.0
!-------------------------------------------------------------
```

```
!------------------------------------------------------------
!   Variable          Data         Number                          Record        Dimension
!   Name              Type         Elements    Dims    Sizes    Variance      Variancees
!   --------          ----         --------    ----    -----    --------      ----------
    "VLFFLo"        CDF_REAL4          1          1       8          F              T

!  Attribute      Data            Value
!  Name           Type
!-----------      -----           ------
  "FIELDNAM"    CDF_CHAR        { "E-field VLF lower frequency range value" }
  "UNITS"       CDF_CHAR        { "kHz" }
  "VAR_TYPE"    CDF_CHAR        { "metadata" }
  "DICT_KEY"    CDF_CHAR        { "ISTP>range>absolute" }.

! NRV values follow

      [1] = 0.37
      [2] = 1.2
      [3] = 2.1
      [4] = 2.8
      [5] = 9.71
      [6] = 28.0
      [7] = 93.0
      [8] = 278.0
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable          Data         Number                          Record        Dimension
!   Name              Type         Elements    Dims    Sizes    Variance      Variancees
!   --------          ----         --------    ----    -----    --------      ----------
    "VLFTd"         CDF_REAL4          1          1       2          F              T

!  Attribute      Data            Value
!  Name           Type
!-----------      -----           ------
  "FIELDNAM"    CDF_CHAR        { "VLF Time offset" }
  "UNITS"       CDF_CHAR        { "ms" }
  "VAR_TYPE"    CDF_CHAR        { "metadata" }
  "DEPEND_0"    CDF_CHAR        { "Epoch" }
  "DEPEND_1"    CDF_CHAR        { "VLFFrq" }
  "DEPEND_2"    CDF_CHAR        { "Half_sec" }
  "DICT_KEY"    CDF_CHAR        { "XXX" }.

! NRV values follow

      [1] = 0.0
      [2] = 500.0
!------------------------------------------------------------
```

```
!-------------------------------------------------------------
!  Variable         Data          Number                             Record        Dimension
!  Name             Type          Elements    Dims     Sizes         Variance      Variancees
!  --------         ----          --------    ----     -----         --------      ----------
   "AntMode"        CDF_CHAR         1          0                       T

!  Attribute     Data         Value
!  Name          Type
!-----------     -----        ------
  "FIELDNAM"     CDF_CHAR     { "Antenna mode - 'E'/'M'" }
  "LABLAXIS"     CDF_CHAR     { "Ant. mode" }
  "FORMAT"       CDF_CHAR     { "A" }
  "FILLVAL"      CDF_CHAR     { " " }
  "VAR_TYPE"     CDF_CHAR     { "data" }
  "DEPEND_0"     CDF_CHAR     { "Epoch" }
  "DICT_KEY"     CDF_CHAR     { "XXX" }
  "SC_id"        CDF_CHAR     { "SCATHA" }.
!-------------------------------------------------------------

!-------------------------------------------------------------
!  Variable         Data          Number                             Record        Dimension
!  Name             Type          Elements    Dims     Sizes         Variance      Variancees
!  --------         ----          --------    ----     -----         --------      ----------
   "AntELA"         CDF_REAL4        1          0                       T

!  Attribute     Data         Value
!  Name          Type
!-----------     -----        ------
  "FIELDNAM"     CDF_CHAR     { "Ele. Antenna look angle for VLF exp. (old calc)" }
  "VALIDMIN"     CDF_REAL4    {   0.0 }
  "VALIDMAX"     CDF_REAL4    { 360.0 }
  "SCALEMIN"     CDF_REAL4    {   0.0 }
  "SCALEMAX"     CDF_REAL4    { 360.0 }
  "UNITS"        CDF_CHAR     { "deg" }
  "LABLAXIS"     CDF_CHAR     { "E-Ant. LA" }
  "FORMAT"       CDF_CHAR     { "F8.2" }
  "FILLVAL"      CDF_REAL4    { -999.99 }
  "VAR_TYPE"     CDF_CHAR     { "data" }
  "DEPEND_0"     CDF_CHAR     { "Epoch" }
  "DICT_KEY"     CDF_CHAR     { "XXX" }
  "SCALETYP"     CDF_CHAR     { "linear" }
  "SC_id"        CDF_CHAR     { "SCATHA" }
  "Sig_digits"   CDF_CHAR     { "5" }.
!-------------------------------------------------------------
```

```
!------------------------------------------------------------
!   Variable        Data        Number                       Record      Dimension
!   Name            Type        Elements   Dims   Sizes      Variance    Variancees
!   --------        ----        --------   ----   -----      --------    ----------
    "AntMLA"      CDF_REAL4       1         0                   T

!  Attribute    Data          Value
!  Name         Type
!-----------   -----         ------
  "FIELDNAM"   CDF_CHAR      { "Mag. Antenna look angle (SC1-8a)" }
  "VALIDMIN"   CDF_REAL4     {   0.0 }
  "VALIDMAX"   CDF_REAL4     { 360.0 }
  "SCALEMIN"   CDF_REAL4     {   0.0 }
  "SCALEMAX"   CDF_REAL4     { 360.0 }
  "UNITS"      CDF_CHAR      { "deg" }
  "LABLAXIS"   CDF_CHAR      { "M-Ant. PA" }
  "FORMAT"     CDF_CHAR      { "F8.2" }
  "FILLVAL"    CDF_REAL4     { -999.99 }
  "VAR_TYPE"   CDF_CHAR      { "data" }
  "DEPEND_0"   CDF_CHAR      { "Epoch" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }
  "SCALETYP"   CDF_CHAR      { "linear" }
  "SC_id"      CDF_CHAR      { "SCATHA" }
  "Sig_digits" CDF_CHAR      { "5" }.
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable        Data        Number                       Record      Dimension
!   Name            Type        Elements   Dims   Sizes      Variance    Variancees
!   --------        ----        --------   ----   -----      --------    ----------
    "CMPSCPot"    CDF_INT1        1         0                   T

!  Attribute    Data          Value
!  Name         Type
!-----------   -----         ------
  "FIELDNAM"   CDF_CHAR      { "Common mode S/C postive potential - unconverted" }
  "VALIDMIN"   CDF_REAL4     { -128 }
  "VALIDMAX"   CDF_REAL4     {  127 }
  "SCALEMIN"   CDF_REAL4     { -128 }
  "SCALEMAX"   CDF_REAL4     {  127 }
  "UNITS"      CDF_CHAR      { " " }
  "LABLAXIS"   CDF_CHAR      { "S/C Common potential positive" }
  "FORMAT"     CDF_CHAR      { "I5" }
  "FILLVAL"    CDF_REAL4     { -128 }
  "VAR_TYPE"   CDF_CHAR      { "data" }
  "DEPEND_0"   CDF_CHAR      { "Epoch" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }
  "SCALETYP"   CDF_CHAR      { "linear" }
  "SC_id"      CDF_CHAR      { "SCATHA" }
  "Sig_digits" CDF_CHAR      { "3" }.
!------------------------------------------------------------
```

```
!------------------------------------------------------------
!   Variable        Data        Number                      Record      Dimension
!   Name            Type        Elements   Dims   Sizes    Variance    Variancees
!   --------        ----        --------   ----   -----    --------    ----------
    "CM1SCPot"    CDF_REAL4       1          1      2         T            T

!  Attribute    Data          Value
!  Name         Type
!-----------    -----         ------
  "FIELDNAM"   CDF_CHAR       { "Common mode S/C potential, +/-15 volts" }
  "VALIDMIN"   CDF_REAL4      { -15.0 }
  "VALIDMAX"   CDF_REAL4      {  15.0 }
  "SCALEMIN"   CDF_REAL4      { -15.0 }
  "SCALEMAX"   CDF_REAL4      {  15.0 }
  "UNITS"      CDF_CHAR       { "V" }
  "LABLAXIS"   CDF_CHAR       { "S/C Common potential low range" }
  "FORMAT"     CDF_CHAR       { "F8.3" }
  "FILLVAL"    CDF_REAL4      { -99.999 }
  "VAR_TYPE"   CDF_CHAR       { "data" }
  "DEPEND_0"   CDF_CHAR       { "Epoch" }
  "DEPEND_1"   CDF_CHAR       { "Half_sec" }
  "OFFSET_0"   CDF_CHAR       { "CMTd" }
  "DICT_KEY"   CDF_CHAR       { "XXX" }
  "SCALETYP"   CDF_CHAR       { "linear" }
  "SC_id"      CDF_CHAR       { "SCATHA" }
  "Sig_digits" CDF_CHAR       { "5" }.
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable        Data        Number                      Record      Dimension
!   Name            Type        Elements   Dims   Sizes    Variance    Variancees
!   --------        ----        --------   ----   -----    --------    ----------
    "CM2SCPot"    CDF_REAL4       1          1      2         T            T

!  Attribute    Data          Value
!  Name         Type
!-----------    -----         ------
  "FIELDNAM"   CDF_CHAR       { "Common mode S/C potential, +/-300 volts" }
  "VALIDMIN"   CDF_REAL4      { -300.0 }
  "VALIDMAX"   CDF_REAL4      {  300.0 }
  "SCALEMIN"   CDF_REAL4      { -300.0 }
  "SCALEMAX"   CDF_REAL4      {  300.0 }
  "UNITS"      CDF_CHAR       { "V" }
  "LABLAXIS"   CDF_CHAR       { "S/C Common potential mid range" }
  "FORMAT"     CDF_CHAR       { "F8.2" }
  "FILLVAL"    CDF_REAL4      { -999.99 }
  "VAR_TYPE"   CDF_CHAR       { "data" }
  "DEPEND_0"   CDF_CHAR       { "Epoch" }
  "DEPEND_1"   CDF_CHAR       { "Half_sec" }
  "OFFSET_0"   CDF_CHAR       { "CMTd" }
  "DICT_KEY"   CDF_CHAR       { "XXX" }
```

```
  "SCALETYP"  CDF_CHAR       { "linear" }
  "SC_id"     CDF_CHAR       { "SCATHA" }
  "Sig_digits" CDF_CHAR      { "5" }.
!------------------------------------------------------------
!  Variable         Data       Number                       Record      Dimension
!  Name             Type       Elements   Dims    Sizes     Variance    Variancees
!  --------         ----       --------   ----    -----     --------    ----------
   "CM3SCPot"    CDF_REAL4        1         1       2          T            T
! Attribute   Data          Value
! Name        Type
!-----------  -----         ------
  "FIELDNAM"  CDF_CHAR      { "Common mode S/C potential, +/-5000 volts" }
  "VALIDMIN"  CDF_REAL4     { -5000.0 }
  "VALIDMAX"  CDF_REAL4     {  5000.0 }
  "SCALEMIN"  CDF_REAL4     { -5000.0 }
  "SCALEMAX"  CDF_REAL4     {  5000.0 }
  "UNITS"     CDF_CHAR      { "V" }
  "LABLAXIS"  CDF_CHAR      { "S/C Common potential high range" }
  "FORMAT"    CDF_CHAR      { "F8.1" }
  "FILLVAL"   CDF_REAL4     { -9999.9 }
  "VAR_TYPE"  CDF_CHAR      { "data" }
  "DEPEND_0"  CDF_CHAR      { "Epoch" }
  "DEPEND_1"  CDF_CHAR      { "Half_sec" }
  "OFFSET_0"  CDF_CHAR      { "CMTd" }
  "DICT_KEY"  CDF_CHAR      { "XXX" }
  "SCALETYP"  CDF_CHAR      { "linear" }
  "SC_id"     CDF_CHAR      { "SCATHA" }
  "Sig_digits" CDF_CHAR     { "5" }.
!------------------------------------------------------------
!  Variable         Data       Number                       Record      Dimension
!  Name             Type       Elements   Dims    Sizes     Variance    Variancees
!  --------         ----       --------   ----    -----     --------    ----------
   "CMTd"        CDF_REAL4        1         1       2          F            T

! Attribute   Data          Value
! Name        Type
!-----------  -----         ------
  "FIELDNAM"  CDF_CHAR      { "Common mode time offset" }
  "UNITS"     CDF_CHAR      { "ms" }
  "VAR_TYPE"  CDF_CHAR      { "metadata" }
  "DEPEND_1"  CDF_CHAR      { "Half_sec" }
  "DICT_KEY"  CDF_CHAR      { "XXX" }.

! NRV values follow

     [1] =   0.0
     [2] = 500.0
!------------------------------------------------------------
```

```
!-----------------------------------------------------------------
!   Variable          Data          Number                          Record       Dimension
!   Name              Type          Elements    Dims    Sizes      Variance     Variancees
!   --------          ----          --------    ----    -----      --------     ----------
    "EDCLo"           CDF_REAL4        1          1       2           T             T

!  Attribute     Data           Value
!  Name          Type
!-----------     -----          ------
  "FIELDNAM"    CDF_CHAR       { "DC E-field magnitude low gain (gain = 0.025" }
  "VALIDMIN"    CDF_REAL4      {   -1000.0 }
  "VALIDMAX"    CDF_REAL4      {    1000.0 }
  "SCALEMIN"    CDF_REAL4      {   -1000.0 }
  "SCALEMAX"    CDF_REAL4      {    1000.0 }
  "UNITS"       CDF_CHAR       { "mV/m" }
  "LABLAXIS"    CDF_CHAR       { "E-field DC high" }
  "FORMAT"      CDF_CHAR       { "F8.1" }
  "FILLVAL"     CDF_REAL4      { -9999.9 }
  "VAR_TYPE"    CDF_CHAR       { "data" }
  "DEPEND_0"    CDF_CHAR       { "Epoch" }
  "DEPEND_1"    CDF_CHAR       { "Half_sec" }
  "OFFSET_0"    CDF_CHAR       { "EDCLoTd" }
  "DICT_KEY"    CDF_CHAR       { "XXX" }
  "SCALETYP"    CDF_CHAR       { "linear" }
  "SC_id"       CDF_CHAR       { "SCATHA" }
  "Sig_digits" CDF_CHAR        { "5" }.
!-----------------------------------------------------------------


!-----------------------------------------------------------------
!   Variable          Data          Number                          Record       Dimension
!   Name              Type          Elements    Dims    Sizes      Variance     Variances
!   --------          ----          --------    ----    -----      --------     ----------
    "EDCLoTd"         CDF_REAL4        1          1       2           F             T

!  Attribute     Data           Value
!  Name          Type
!-----------     -----          ------
  "FIELDNAM"    CDF_CHAR       { "E-field DCLo time offset" }
  "UNITS"       CDF_CHAR       { "ms" }
  "VAR_TYPE"    CDF_CHAR       { "metadata" }
  "DEPEND_1"    CDF_CHAR       { "Half_sec" }
  "DICT_KEY"    CDF_CHAR       { "XXX" }.

! NRV values follow

      [1] =   0.0
      [2] = 500.0
!-----------------------------------------------------------------
```

```
!------------------------------------------------------------
!   Variable        Data       Number                       Record      Dimension
!   Name            Type       Elements   Dims    Sizes     Variance    Variancees
!   --------        ----       --------   ----    -----     --------    ----------
    "EAC"          CDF_REAL4      1         1       2          T            T

!  Attribute   Data          Value
!  Name        Type
!-----------   -----         ------
  "FIELDNAM"  CDF_CHAR     { "DC E-field magnitude AC range (gain = 2.5" }
  "VALIDMIN"  CDF_REAL4    {  -100.0 }
  "VALIDMAX"  CDF_REAL4    {   100.0 }
  "SCALEMIN"  CDF_REAL4    {  -100.0 }
  "SCALEMAX"  CDF_REAL4    {   100.0 }
  "UNITS"     CDF_CHAR     { "mV/m" }
  "LABLAXIS"  CDF_CHAR     { "E-field DC mid" }
  "FORMAT"    CDF_CHAR     { "F8.2" }
  "FILLVAL"   CDF_REAL4    { -999.99 }
  "VAR_TYPE"  CDF_CHAR     { "data" }
  "DEPEND_0"  CDF_CHAR     { "Epoch" }
  "DEPEND_1"  CDF_CHAR     { "Half_sec" }
  "OFFSET_0"  CDF_CHAR     { "EACTd" }
  "DICT_KEY"  CDF_CHAR     { "XXX" }
  "SCALETYP"  CDF_CHAR     { "linear" }
  "SC_id"     CDF_CHAR     { "SCATHA" }
  "Sig_digits" CDF_CHAR    { "5" }.
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable        Data       Number                       Record      Dimension
!   Name            Type       Elements   Dims    Sizes     Variance    Variances
!   --------        ----       --------   ----    -----     --------    ----------
    "EACTd"        CDF_REAL4      1         1       2          F            T

!  Attribute   Data          Value
!  Name        Type
!-----------   -----         ------
  "FIELDNAM"  CDF_CHAR     { "E-field AC time offset" }
  "UNITS"     CDF_CHAR     { "ms" }
  "VAR_TYPE"  CDF_CHAR     { "metadata" }
  "DEPEND_1"  CDF_CHAR     { "Half_sec" }
  "DICT_KEY"  CDF_CHAR     { "XXX" }.

! NRV values follow

      [1] =    0.0
      [2] = 500.0
!------------------------------------------------------------
```

```
!------------------------------------------------------------
!   Variable         Data        Number                      Record      Dimension
!   Name             Type        Elements   Dims   Sizes     Variance    Variances
!   --------         ----        --------   ----   -----     --------    ----------
    "EDCHi"          CDF_REAL4      1         1      2          T            T

!  Attribute     Data         Value
!  Name          Type
!-----------     -----        ------
  "FIELDNAM"    CDF_CHAR     { "DC E-field magnitude high gain (gain = 0.25" }
  "VALIDMIN"    CDF_REAL4    {  -10.0 }
  "VALIDMAX"    CDF_REAL4    {   10.0 }
  "SCALEMIN"    CDF_REAL4    {  -10.0 }
  "SCALEMAX"    CDF_REAL4    {   10.0 }
  "UNITS"       CDF_CHAR     { "mV/m" }
  "LABLAXIS"    CDF_CHAR     { "E-field DC low" }
  "FORMAT"      CDF_CHAR     { "F7.2" }
  "FILLVAL"     CDF_REAL4    { -99.99 }
  "VAR_TYPE"    CDF_CHAR     { "data" }
  "DEPEND_0"    CDF_CHAR     { "Epoch" }
  "DEPEND_1"    CDF_CHAR     { "Half_sec" }
  "OFFSET_0"    CDF_CHAR     { "EDCHiTd" }
  "DICT_KEY"    CDF_CHAR     { "XXX" }
  "SCALETYP"    CDF_CHAR     { "linear" }
  "SC_id"       CDF_CHAR     { "SCATHA" }
  "Sig_digits" CDF_CHAR      { "4" }.
!------------------------------------------------------------
!------------------------------------------------------------
!   Variable         Data        Number                      Record      Dimension
!   Name             Type        Elements   Dims   Sizes     Variance    Variances
!   --------         ----        --------   ----   -----     --------    ----------
    "EDCHiTd"        CDF_REAL4      1         1      2          F            T

!  Attribute     Data         Value
!  Name          Type
!-----------     -----        ------
  "FIELDNAM"    CDF_CHAR     { "E-field DCHi time offset" }
  "UNITS"       CDF_CHAR     { "ms" }
  "VAR_TYPE"    CDF_CHAR     { "metadata" }
  "DEPEND_1"    CDF_CHAR     { "Half_sec" }
  "DICT_KEY"    CDF_CHAR     { "XXX" }.

! NRV values follow

      [1] =    0.0
      [2] = 500.0
!------------------------------------------------------------
```

```
!------------------------------------------------------------
!   Variable        Data       Number                      Record     Dimension
!   Name            Type       Elements   Dims   Sizes    Variance   Variances
!   --------        ----       --------   ----   -----    --------   ----------
    "EELFAmp"     CDF_REAL4       1         1      4          T          T

!  Attribute    Data          Value
!  Name         Type
!-----------    -----         ------
  "FIELDNAM"   CDF_CHAR      { "E-field ELF wave amplitude" }
  "VALIDMIN"   CDF_REAL4     {  0.0 }
  "VALIDMAX"   CDF_REAL4     {  5.0 }
  "SCALEMIN"   CDF_REAL4     {  0.0 }
  "SCALEMAX"   CDF_REAL4     {  5.0 }
  "UNITS"      CDF_CHAR      { "TM V" }
  "LABLAXIS"   CDF_CHAR      { "E-field ELF amp" }
  "FORMAT"     CDF_CHAR      { "F8.4" }
  "FILLVAL"    CDF_REAL4     { -9.9999 }
  "VAR_TYPE"   CDF_CHAR      { "data" }
  "DEPEND_0"   CDF_CHAR      { "Epoch" }
  "DEPEND_1"   CDF_CHAR      { "EELFFrq" }
  "OFFSET_0"   CDF_CHAR      { "EELFTd" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }
  "SCALETYP"   CDF_CHAR      { "linear" }
  "SC_id"      CDF_CHAR      { "SCATHA" }
  "Sig_digits" CDF_CHAR      { "7" }.
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable        Data       Number                      Record     Dimension
!   Name            Type       Elements   Dims   Sizes    Variance   Variances
!   --------        ----       --------   ----   -----    --------   ----------
    "EELFFrq"     CDF_REAL4       1         1      4          F          T

!  Attribute    Data          Value
!  Name         Type
!-----------    -----         ------
  "FIELDNAM"   CDF_CHAR      { "E-Field ELF center frequency" }
  "UNITS"      CDF_CHAR      { "Hz" }
  "VAR_TYPE"   CDF_CHAR      { "metadata" }
  "DELTA_PLUS_VAR" CDF_CHAR  { "EELFFHi" }
  "DELTA_MINUS_VAR" CDF_CHAR { "EELFFLo" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }.

! NRV values follow

      [1] =   1.316
      [2] =   1.414
      [3] =   6.3
      [4] =  63.
!------------------------------------------------------------
```

```
!------------------------------------------------------------
!   Variable          Data        Number                      Record     Dimension
!   Name              Type        Elements   Dims   Sizes    Variance   Variances
!   --------          ----        --------   ----   -----    --------   ----------
    "EELFFHi"       CDF_REAL4       1          1      4         F           T

!  Attribute    Data            Value
!  Name         Type
!-----------    -----           ------
  "FIELDNAM"   CDF_CHAR       { "E-field ELF upper frequency range value" }
  "UNITS"      CDF_CHAR       { "Hz"   }
  "VAR_TYPE"   CDF_CHAR       { "metadata" }
  "DICT_KEY"   CDF_CHAR       { "ISTP>range>absolute" }.

! NRV values follow

      [1] =    1.0
      [2] =    2.0
      [3] =   20.0
      [4] =  200.0
!------------------------------------------------------------
```

```
!------------------------------------------------------------
!   Variable          Data        Number                      Record     Dimension
!   Name              Type        Elements   Dims   Sizes    Variance   Variances
!   --------          ----        --------   ----   -----    --------   ----------
    "EELFFLo"       CDF_REAL4       1          1      4         F           T

!  Attribute    Data            Value
!  Name         Type
!-----------    -----           ------
  "FIELDNAM"   CDF_CHAR       { "E-field ELF lower frquency range value" }
  "UNITS"      CDF_CHAR       { "Hz" }
  "LABLAXIS"   CDF_CHAR       { "E-Field ELF freq Lo" }
  "VAR_TYPE"   CDF_CHAR       { "metadata" }
  "DICT_KEY"   CDF_CHAR       { "ISTP>range>absolute" }.

! NRV values follow

      [1] =    0.1
      [2] =    1.0
      [3] =    2.0
      [4] =   20.0
!------------------------------------------------------------
```

```
!------------------------------------------------------------
!   Variable         Data       Number                        Record      Dimension
!   Name             Type       Elements    Dims    Sizes     Variance    Variances
!   --------         ----       --------    ----    -----     --------    ----------
    "EELFTd"       CDF_REAL4       1          0                  F

!  Attribute    Data          Value
!  Name         Type
!-----------    -----         ------
  "FIELDNAM"   CDF_CHAR      { "E-field ELF time offset" }
  "UNITS"      CDF_CHAR      { "ms" }
  "VAR_TYPE"   CDF_CHAR      { "metadata" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }.

! NRV values follow

      [ ] =    0.0
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable         Data       Number                        Record      Dimension
!   Name             Type       Elements    Dims    Sizes     Variance    Variances
!   --------         ----       --------    ----    -----     --------    ----------
    "BELFAmp"     CDF_REAL4       1          1       4           T            T

!  Attribute    Data          Value
!  Name         Type
!-----------    -----         ------
  "FIELDNAM"   CDF_CHAR      { "B-field ELF wave amplitude" }
  "VALIDMIN"   CDF_REAL4     {  0.0 }
  "VALIDMAX"   CDF_REAL4     {  5.0 }
  "SCALEMIN"   CDF_REAL4     {  0.0 }
  "SCALEMAX"   CDF_REAL4     {  5.0 }
  "UNITS"      CDF_CHAR      { "TM V" }
  "LABLAXIS"   CDF_CHAR      { "B-field ELF wave amp" }
  "FORMAT"     CDF_CHAR      { "F8.4" }
  "FILLVAL"    CDF_REAL4     { -9.9999 }
  "VAR_TYPE"   CDF_CHAR      { "data" }
  "DEPEND_0"   CDF_CHAR      { "Epoch" }
  "DEPEND_1"   CDF_CHAR      { "BELFFrq" }
  "OFFSET_0"   CDF_CHAR      { "BELFTd" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }
  "SCALETYP"   CDF_CHAR      { "linear" }
  "SC_id"      CDF_CHAR      { "SCATHA" }
  "Sig_digits" CDF_CHAR      { "5" }.
!------------------------------------------------------------
```

```
!------------------------------------------------------------
!   Variable         Data        Number                        Record       Dimension
!   Name             Type        Elements   Dims   Sizes       Variance     Variances
!   --------         ----        --------   ----   -----       --------     ----------
    "BELFTd"      CDF_REAL4         1         0                   F

! Attribute      Data             Value
! Name           Type
!-----------      -----            ------
  "FIELDNAM"   CDF_CHAR      { "Peak B-field time offset" }
  "UNITS"      CDF_CHAR      { "ms" }
  "VAR_TYPE"   CDF_CHAR      { "metadata" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }.

! NRV values follow

      [ ] =   0.0
!------------------------------------------------------------


!------------------------------------------------------------
!   Variable         Data        Number                        Record       Dimension
!   Name             Type        Elements   Dims   Sizes       Variance     Variances
!   --------         ----        --------   ----   -----       --------     ----------
    "BELFFrq"     CDF_REAL4         1         1      4            F             T

! Attribute      Data             Value
! Name           Type
!-----------      -----            ------
  "FIELDNAM"   CDF_CHAR      { "B-Field ELF center frequency" }
  "UNITS"      CDF_CHAR      { "Hz" }
  "VAR_TYPE"   CDF_CHAR      { "metadata" }
  "DELTA_PLUS_VAR" CDF_CHAR  { "BELFFHi" }
  "DELTA_MINUS_VAR" CDF_CHAR { "BELFFLo" }
  "DICT_KEY"   CDF_CHAR      { "ISTP>range>absolute" }.

! NRV values follow

      [1] =   1.316
      [2] =   1.414
      [3] =   6.3
      [4] =  63.
!------------------------------------------------------------
```

```
!-----------------------------------------------------------
!   Variable        Data        Number                           Record      Dimension
!   Name            Type        Elements    Dims    Sizes        Variance    Variances
!   --------        ----        --------    ----    -----        --------    ----------
    "BELFFHi"       CDF_REAL4      1          1       4             F             T

! Attribute    Data          Value
! Name         Type
!-----------   -----         ------
  "FIELDNAM"   CDF_CHAR      { "B-field ELF upper frequency range value" }
  "UNITS"      CDF_CHAR      { "ms"  }
  "VAR_TYPE"   CDF_CHAR      { "metadata" }
  "DICT_KEY"   CDF_CHAR      { "ISTP>range>absolute" }.

! NRV values follow

      [1] =   1.0
      [2] =   2.0
      [3] =  20.0
      [4] = 200.0
!-----------------------------------------------------------


!-----------------------------------------------------------
!   Variable        Data        Number                           Record      Dimension
!   Name            Type        Elements    Dims    Sizes        Variance    Variances
!   --------        ----        --------    ----    -----        --------    ----------
    "BELFFLo"       CDF_REAL4      1          1       4             F             T

! Attribute    Data          Value
! Name         Type
!-----------   -----         ------
  "FIELDNAM"   CDF_CHAR      { "B-field ELF lower frequency range value" }
  "UNITS"      CDF_CHAR      { "ms" }
  "VAR_TYPE"   CDF_CHAR      { "metadata" }
  "DICT_KEY"   CDF_CHAR      { "ISTP>range>absolute" }.

! NRV values follow

      [1] =   0.1
      [2] =   1.0
      [3] =   2.0
      [4] =  20.0
!-----------------------------------------------------------
```

```
!-------------------------------------------------------------
!   Variable         Data       Number                        Record      Dimension
!   Name             Type       Elements   Dims    Sizes     Variance    Variances
!   --------         ----       --------   ----    -----     --------    ----------
   "SC2_acq_frame" CDF_CHAR        7          1       7          F            T

! Attribute    Data          Value
! Name         Type
!-----------   -----         ------
  "FIELDNAM"   CDF_CHAR     { "SC2 acquisition frame number" }
  "VAR_TYPE"   CDF_CHAR     { "metadata" }
  "DICT_KEY"   CDF_CHAR     { "XXX" }.

! NRV values follow

      [1] = { "frame 0" }
      [2] = { "frame 1" }
      [3] = { "frame 2" }
      [4] = { "frame 3" }
      [5] = { "frame 4" }
      [6] = { "frame 5" }
      [7] = { "frame 6" }
!-------------------------------------------------------------


!-------------------------------------------------------------
!   Variable         Data       Number                        Record      Dimension
!   Name             Type       Elements   Dims    Sizes     Variance    Variances
!   --------         ----       --------   ----    -----     --------    ----------
   "SC2_Prog"      CDF_CHAR        9          1       3          F            T

! Attribute    Data          Value
! Name         Type
!-----------   -----         ------
  "FIELDNAM"   CDF_CHAR     { "SC2 ESA Step Progam Identifier" }
  "VAR_TYPE"   CDF_CHAR     { "metadata" }
  "DICT_KEY"   CDF_CHAR     { "XXX" }.

! NRV values follow

      [1] = { "Program 1" }
      [2] = { "Program 2" }
      [3] = { "Program 3" }
!-------------------------------------------------------------
```

```
!------------------------------------------------------------
!   Variable        Data        Number                         Record       Dimension
!   Name            Type        Elements   Dims    Sizes       Variance     Variances
!   --------        ----        --------   ----    -----       --------     ----------
    "SC2Stat"      CDF_UINT2       1        0                     T

! Attribute     Data            Value
! Name          Type
!-----------    -----           ------
  "FIELDNAM"   CDF_CHAR       { "SC2-1,-2, -3 status bit word" }
  "VALIDMIN"   CDF_REAL4      {      0 }
  "VALIDMAX"   CDF_REAL4      {  65535 }
  "SCALEMIN"   CDF_REAL4      {      0 }
  "SCALEMAX"   CDF_REAL4      {  65535 }
  "UNITS"      CDF_CHAR       { " " }
  "LABLAXIS"   CDF_CHAR       { "SC2 status" }
  "FORMAT"     CDF_CHAR       { "I6" }
  "FILLVAL"    CDF_REAL4      { -128 }
  "VAR_TYPE"   CDF_CHAR       { "data" }
  "DEPEND_BIT"CDF_CHAR        { "SC2StatBits" }
  "DEPEND_0"   CDF_CHAR       { "Epoch" }
  "DICT_KEY"   CDF_CHAR       { "XXX" }
  "SCALETYP"   CDF_CHAR       { "linear" }
  "SC_id"      CDF_CHAR       { "SCATHA" }
  "Sig_digits" CDF_CHAR       { "5" }.
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable        Data        Number                         Record       Dimension
!   Name            Type        Elements   Dims    Sizes       Variance     Variances
!   --------        ----        --------   ----    -----       --------     ----------
    "SC2StatBits" CDF_CHAR        52        1       16            F             T

! Attribute     Data            Value
! Name          Type
!-----------    -----           ------
  "FIELDNAM"   CDF_CHAR       { "SC2 Status word bit definition" }
  "VAR_TYPE"   CDF_CHAR       { "metadata" }
  "DICT_KEY"   CDF_CHAR       { "XXX" }.

! NRV values follow

      [1] = { "B4001 SC2-3 ESA power monitor 0=OFF/1=ON          " }
      [2] = { "B4002 SC2-1 power supply 0=OFF/1=ON               " }
      [3] = { "B4003 SC2-4a power supply 0=OFF/1=ON              " }
      [4] = { "B4004 SC2-4b power supply 0=OFF/1=ON              " }
      [5] = { "B4006 SC2-3B power supply 0=OFF/1=ON              " }
      [6] = { "B4007 SC2-6 power supply 0=OFF/1=ON               " }
      [7] = { "spare                                             " }
      [8] = { "spare                                             " }
      [9] = { "B4656 SC2-1 e detector H.V. bias (1EHV) 0=OFF/1=ON " }
```

```
    [10] = { "B4658 SC2-1 p detector +H.V. bias (1PHV) 0=OFF/1=ON" }
    [11] = { "B4660 SC2-1 p detector -H.V. bias (1-HV) 0=OFF/1=ON" }
    [12] = { "B4752 SC2-2 e detector H.V. bias (2EHV) 0=OFF/1=ON " }
    [13] = { "B4754 SC2-2 p detector +H.V. bias (2PHV) 0=OFF/1=ON" }
    [14] = { "B4756 SC2-2 p detector -H.V. bias (2-HV) 0=OFF/1=ON" }
    [15] = { "Probe Shunt state: 0=Open, 1=Closed                 " }
    [16] = { "B4002 SC2-2 power supply 0=OFF/1=ON                 " }
!------------------------------------------------------------

!------------------------------------------------------------
!  Variable      Data        Number                  Record     Dimension
!  Name          Type        Elements  Dims  Sizes   Variance   Variances
!  --------      ----        --------  ----  -----   --------   ----------
   "SC21PA"      CDF_REAL4   1         1     7       T          T

! Attribute    Data        Value
! Name         Type
!-----------   -----       ------
  "FIELDNAM"   CDF_CHAR    { "SC2-1 pitch angle" }
  "VALIDMIN"   CDF_REAL4   {   0.0 }
  "VALIDMAX"   CDF_REAL4   { 360.0 }
  "SCALEMIN"   CDF_REAL4   {   0.0 }
  "SCALEMAX"   CDF_REAL4   { 360.0 }
  "UNITS"      CDF_CHAR    { "deg" }
  "LABLAXIS"   CDF_CHAR    { "SC2-1 PA" }
  "FORMAT"     CDF_CHAR    { "F8.2" }
  "FILLVAL"    CDF_REAL4   { -999.99 }
  "VAR_TYPE"   CDF_CHAR    { "data" }
  "DEPEND_0"   CDF_CHAR    { "Epoch" }
  "DEPEND_1"   CDF_CHAR    { "SC2_acq_frame" }
  "OFFSET_0"   CDF_CHAR    { "SC21Td" }
  "DICT_KEY"   CDF_CHAR    { "XXX" }
  "SCALETYP"   CDF_CHAR    { "linear" }
  "SC_id"      CDF_CHAR    { "SCATHA" }
  "Sig_digits" CDF_CHAR    { "5" }.
!------------------------------------------------------------

!------------------------------------------------------------
!  Variable      Data        Number                  Record     Dimension
!  Name          Type        Elements  Dims  Sizes   Variance   Variances
!  --------      ----        --------  ----  -----   --------   ----------
   "SC21SA"      CDF_REAL4   1         1     7       T          T
! Attribute    Data        Value
! Name         Type
!-----------   -----       ------
  "FIELDNAM"   CDF_CHAR    { "SC2-1 sun angle" }
  "VALIDMIN"   CDF_REAL4   {   0.0 }
  "VALIDMAX"   CDF_REAL4   { 360.0 }
  "SCALEMIN"   CDF_REAL4   {   0.0 }
  "SCALEMAX"   CDF_REAL4   { 360.0 }
  "UNITS"      CDF_CHAR    { "deg" }
```

```
  "LABLAXIS"  CDF_CHAR     { "SC2-1 SA" }
  "FORMAT"    CDF_CHAR     { "F8.2" }
  "FILLVAL"   CDF_REAL4    { -999.99 }
  "VAR_TYPE"  CDF_CHAR     { "data" }
  "DEPEND_0"  CDF_CHAR     { "Epoch" }
  "DEPEND_1"  CDF_CHAR     { "SC2_acq_frame" }
  "OFFSET_0"  CDF_CHAR     { "SC21Td" }
  "DICT_KEY"  CDF_CHAR     { "XXX" }
  "SCALETYP"  CDF_CHAR     { "linear" }
  "SC_id"     CDF_CHAR     { "SCATHA" }
  "Sig_digits" CDF_CHAR    { "5" }.
!------------------------------------------------------------
!------------------------------------------------------------
!  Variable         Data      Number                      Record     Dimension
!  Name             Type      Elements   Dims   Sizes     Variance   Variances
!  --------         ----      --------   ----   -----     --------   ----------
   "SC2PV1"       CDF_REAL4      1         0                 T

! Attribute   Data          Value
! Name        Type
!-----------  -----         ------
  "FIELDNAM"  CDF_CHAR     { "SC2-1 probe voltage" }
  "VALIDMIN"  CDF_REAL4    { -1000.0 }
  "VALIDMAX"  CDF_REAL4    {  1000.0 }
  "SCALEMIN"  CDF_REAL4    { -1000.0 }
  "SCALEMAX"  CDF_REAL4    {  1000.0 }
  "UNITS"     CDF_CHAR     { "V" }
  "LABLAXIS"  CDF_CHAR     { "PV1" }
  "FORMAT"    CDF_CHAR     { "F8.1" }
  "FILLVAL"   CDF_REAL4    { -9999.9 }
  "VAR_TYPE"  CDF_CHAR     { "data" }
  "DEPEND_0"  CDF_CHAR     { "Epoch" }
  "DICT_KEY"  CDF_CHAR     { "XXX" }
  "SCALETYP"  CDF_CHAR     { "linear" }
  "SC_id"     CDF_CHAR     { "SCATHA" }
  "Sig_digits" CDF_CHAR    { "5" }.
!------------------------------------------------------------
!------------------------------------------------------------
!  Variable         Data      Number                      Record     Dimension
!  Name             Type      Elements   Dims   Sizes     Variance   Variances
!  --------         ----      --------   ----   -----     --------   ----------
   "SC2DetBiasKey" CDF_CHAR     14        1      3          F           T

! Attribute   Data          Value
! Name        Type
!-----------  -----         ------
  "FIELDNAM"  CDF_CHAR     { "SC2 detector bias boost indicator key" }
  "VAR_TYPE"  CDF_CHAR     { "metadata" }
  "DICT_KEY"  CDF_CHAR     { "XXX" }.
```

```
! NRV values follow

      [1] = { "0 = boost OFF" }
      [2] = { "1 = No. 1 ON " }
      [3] = { "2 = No. 2 ON " }
!-------------------------------------------------------------

!-------------------------------------------------------------
!   Variable          Data        Number                      Record       Dimension
!   Name              Type        Elements   Dims   Sizes     Variance     Variances
!   --------          ----        --------   ----   -----     --------     ----------
    "SC21DBias"    CDF_INT1          1         0                 T

! Attribute      Data            Value
! Name           Type
!-----------     -----           ------
  "FIELDNAM"   CDF_CHAR        { "SC2-1,-2 detector bias boost indicator" }
  "VALIDMIN"   CDF_REAL4       { 0 }
  "VALIDMAX"   CDF_REAL4       { 2 }
  "SCALEMIN"   CDF_REAL4       { 0 }
  "SCALEMAX"   CDF_REAL4       { 2 }
  "UNITS"      CDF_CHAR        { " " }
  "LABLAXIS"   CDF_CHAR        { "SC2-1 D Bias" }
  "FORMAT"     CDF_CHAR        { "I3" }
  "FILLVAL"    CDF_REAL4       { -9 }
  "VAR_TYPE"   CDF_CHAR        { "data" }
  "DEPEND_0"   CDF_CHAR        { "Epoch" }
  "TRANS_KEY"  CDF_CHAR        { "SC2DetBiasKey" }
  "DICT_KEY"   CDF_CHAR        { "XXX" }
  "SCALETYP"   CDF_CHAR        { "linear" }
  "SC_id"      CDF_CHAR        { "SCATHA" }
  "Sig_digits" CDF_CHAR        { "1" }.
!-------------------------------------------------------------

!-------------------------------------------------------------
!   Variable          Data        Number                      Record       Dimension
!   Name              Type        Elements   Dims   Sizes     Variance     Variances
!   --------          ----        --------   ----   -----     --------     ----------
    "SC21EFlx"     CDF_REAL4         1         1      7          T              T

! Attribute      Data            Value
! Name           Type
!-----------     -----           ------
  "FIELDNAM"   CDF_CHAR        { "SC2-1 Differential Electron Plasma Flux" }
  "VALIDMIN"   CDF_REAL4       {   0.0 }
  "VALIDMAX"   CDF_REAL4       {   1.0E10 }
  "SCALEMIN"   CDF_REAL4       {   0.0 }
  "SCALEMAX"   CDF_REAL4       {   1.0E10 }
  "UNITS"      CDF_CHAR        { "electrons/(cm^2 sec str keV)" }
  "LABLAXIS"   CDF_CHAR        { "SC2-1 e- flux" }
  "FORMAT"     CDF_CHAR        { "E10.2" }
```

```
  "FILLVAL"     CDF_REAL4      { -1.0e31 }
  "VAR_TYPE"    CDF_CHAR       { "data" }
  "DEPEND_0"    CDF_CHAR       { "Epoch" }
  "DEPEND_1"    CDF_CHAR       { "SC2_acq_frame" }
  "OFFSET_0"    CDF_CHAR       { "SC21Td" }
  "DICT_KEY"    CDF_CHAR       { "XXX" }
  "SCALETYP"    CDF_CHAR       { "logarithmic" }
  "SC_id"       CDF_CHAR       { "SCATHA" }
  "Sig_digits"  CDF_CHAR       { "3" }.
!-------------------------------------------------------------
!-------------------------------------------------------------
!   Variable       Data        Number                          Record       Dimension
!   Name           Type        Elements    Dims    Sizes      Variance     Variances
!   --------       ----        --------    ----    -----      --------     ----------
    "SC21EEn"      CDF_REAL4      1          2      7 3          F            T  T

!  Attribute    Data          Value
!  Name         Type
!-----------    -----         ------
  "FIELDNAM"    CDF_CHAR      { "SC2-1 electron flux center energy" }
  "UNITS"       CDF_CHAR      { "keV" }
  "VAR_TYPE"    CDF_CHAR      { "metadata" }
  "DEPEND_1"    CDF_CHAR      { "SC2_acq_frame" }
  "DEPEND_2"    CDF_CHAR      { "SC2_Prog" }
  "DICT_KEY"    CDF_CHAR      { "XXX" }.

! NRV values follow
      [1,1]  =   174.
      [2,1]  =   400.
      [3,1]  =  1040.
      [4,1]  =  2500.
      [5,1]  =  4350.
      [6,1]  = 10500.
      [7,1]  = 18400.
      [1,2]  =     4.
      [2,2]  =    85.
      [3,2]  =   310.
      [4,2]  =   772.
      [5,2]  =  1870.
      [6,2]  =  5600.
      [7,2]  = 13850.
      [1,3]  =     6.
      [2,3]  =    18.
      [3,3]  =    41.
      [4,3]  =   573.
      [5,3]  =  1390.
      [6,3]  =  3280.
      [7,3]  =  7800.
!-------------------------------------------------------------
```

```
!--------------------------------------------------------------
!   Variable        Data        Number                          Record      Dimension
!   Name            Type        Elements    Dims    Sizes       Variance    Variances
!   --------        ----        --------    ----    -----       --------    ----------
    "SC21PFlx"      CDF_REAL4       1         1       7            T             T

!  Attribute    Data            Value
!  Name         Type
!-----------    -----           ------
  "FIELDNAM"    CDF_CHAR       { "SC2-1 Differential Proton Plasma Flux" }
  "VALIDMIN"    CDF_REAL4      {   0.0 }
  "VALIDMAX"    CDF_REAL4      {   1.0E10 }
  "SCALEMIN"    CDF_REAL4      {   0.0 }
  "SCALEMAX"    CDF_REAL4      {   1.0E10 }
  "UNITS"       CDF_CHAR       { "protons/(cm^2 sec str keV)" }
  "LABLAXIS"    CDF_CHAR       { "SC2-1 p+ flux" }
  "FORMAT"      CDF_CHAR       { "E10.2" }
  "FILLVAL"     CDF_REAL4      { -1.0e31 }
  "VAR_TYPE"    CDF_CHAR       { "data" }
  "DEPEND_0"    CDF_CHAR       { "Epoch" }
  "DEPEND_1"    CDF_CHAR       { "SC2_acq_frame" }
  "OFFSET_0"    CDF_CHAR       { "SC21Td" }
  "DICT_KEY"    CDF_CHAR       { "XXX" }
  "SCALETYP"    CDF_CHAR       { "logarithmic" }
  "SC_id"       CDF_CHAR       { "SCATHA" }
  "Sig_digits" CDF_CHAR        { "3" }.
!--------------------------------------------------------------
!--------------------------------------------------------------
!   Variable        Data        Number                          Record      Dimension
!   Name            Type        Elements    Dims    Sizes       Variance    Variances
!   --------        ----        --------    ----    -----       --------    ----------
    "SC21PEn"       CDF_REAL4       1         2      7 3           F           T  T

!  Attribute    Data            Value
!  Name         Type
!-----------    -----           ------
  "FIELDNAM"    CDF_CHAR       { "SC2-1 proton flux center energy" }
  "UNITS"       CDF_CHAR       { "keV" }
  "VAR_TYPE"    CDF_CHAR       { "metadata" }
  "DEPEND_1"    CDF_CHAR       { "SC2_acq_frame" }
  "DEPEND_2"    CDF_CHAR       { "SC2_Prog" }
  "DICT_KEY"    CDF_CHAR       { "XXX" }.

! NRV values follow

      [1,1]  =   154.
      [2,1]  =   355.
      [3,1]  =   920.
      [4,1]  =  2200.
      [5,1]  =  3800.
      [6,1]  =  9400.
```

```
     [7,1]  = 16300.
     [1,2]  =     3.2
     [2,2]  =    79.
     [3,2]  =   264.
     [4,2]  =   685.
     [5,2]  =  1640.
     [6,2]  =  5000.
     [7,2]  = 12400.
     [1,3]  =     5.
     [2,3]  =    15.
     [3,3]  =    36.
     [4,3]  =   510.
     [5,3]  =  1230.
     [6,3]  =  2900.
     [7,3]  =  6950.
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable        Data          Number                          Record        Dimension
!   Name            Type          Elements    Dims    Sizes      Variance      Variances
!   --------        ----          --------    ----    -----      --------      ----------
    "SC21Td"      CDF_REAL4          1          1       7           F              T

!  Attribute     Data            Value
!  Name          Type
!-----------     -----           ------
   "FIELDNAM"   CDF_CHAR       { "SC2-1 electron data time offset" }
   "UNITS"      CDF_CHAR       { "ms" }
   "DEPEND_1"   CDF_CHAR       { "SC2_acq_frame" }
   "VAR_TYPE"   CDF_CHAR       { "metadata" }
   "DICT_KEY"   CDF_CHAR       { "XXX" }.
! NRV values follow
     [1]   =   74.25
     [2]   =  199.25
     [3]   =  324.25
     [4]   =  449.25
     [5]   =  574.25
     [6]   =  699.25
     [7]   =  824.25
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable        Data          Number                          Record        Dimension
!   Name            Type          Elements    Dims    Sizes      Variance      Variances
!   --------        ----          --------    ----    -----      --------      ----------
    "SC21Prog"    CDF_INT1           1          1       7           T              T

!  Attribute     Data            Value
!  Name          Type
!-----------     -----           ------
   "FIELDNAM"   CDF_CHAR       { "SC2-1 program id" }
```

```
 "VALIDMIN"  CDF_REAL4      {  1 }
 "VALIDMAX"  CDF_REAL4      {  3 }
 "SCALEMIN"  CDF_REAL4      {  1 }
 "SCALEMAX"  CDF_REAL4      {  3 }
 "UNITS"     CDF_CHAR       { " " }
 "LABLAXIS"  CDF_CHAR       { "SC2-1 program" }
 "FORMAT"    CDF_CHAR       { "I3" }
 "FILLVAL"   CDF_REAL4      { -9 }
 "VAR_TYPE"  CDF_CHAR       { "data" }
 "DEPEND_0"  CDF_CHAR       { "Epoch" }
 "DEPEND_1"  CDF_CHAR       { "SC2_acq_frame" }
 "OFFSET_0"  CDF_CHAR       { "SC21Td" }
 "DICT_KEY"  CDF_CHAR       { "XXX" }
 "SCALETYP"  CDF_CHAR       { "linear" }
 "SC_id"     CDF_CHAR       { "SCATHA" }
 "Sig_digits" CDF_CHAR      { "1" }.
!-------------------------------------------------------------
!-------------------------------------------------------------
!   Variable        Data      Number                  Record     Dimension
!   Name            Type      Elements  Dims  Sizes   Variance   Variances
!   --------        ----      --------  ----  -----   --------   ----------
    "SC21Mode"   CDF_INT1        1        0              T

!  Attribute    Data       Value
!  Name         Type
!-----------   -----      ------
  "FIELDNAM"   CDF_CHAR    { "SC2-1 mode" }
  "VALIDMIN"   CDF_REAL4   {  0 }
  "VALIDMAX"   CDF_REAL4   { 63 }
  "SCALEMIN"   CDF_REAL4   {  0 }
  "SCALEMAX"   CDF_REAL4   { 63 }
  "UNITS"      CDF_CHAR    { " " }
  "LABLAXIS"   CDF_CHAR    { "SC2-1 mode" }
  "FORMAT"     CDF_CHAR    { "I4" }
  "FILLVAL"    CDF_REAL4   { -99 }
  "VAR_TYPE"   CDF_CHAR    { "data" }
  "DEPEND_0"   CDF_CHAR    { "Epoch" }
!  "OFFSET_0"  CDF_CHAR     { "SC21Td" }
  "DICT_KEY"   CDF_CHAR    { "XXX" }
  "SCALETYP"   CDF_CHAR    { "linear" }
  "SC_id"      CDF_CHAR    { "SCATHA" }
  "Sig_digits" CDF_CHAR    { "1" }
  "TRANS_KEY"  CDF_CHAR    { "SC2ModeKey" }.
!-------------------------------------------------------------
```

```
!---------------------------------------------------------------
!   Variable          Data       Number                        Record      Dimension
!   Name              Type       Elements   Dims   Sizes      Variance    Variances
!   --------          ----       --------   ----   -----      --------    ----------
    "SC2ModeKey"   CDF_CHAR        49        1      14           F            T

!  Attribute    Data          Value
!  Name         Type
!-----------    -----         ------
  "FIELDNAM"   CDF_CHAR      { "SC2 4-bit mode word definition" }
  "VAR_TYPE"   CDF_CHAR      { "metadata" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }.

! NRV values follow

      [1] = { "bits 0-2; 0 = Program sequence - 1,2,3,1,2,3,1,2 " }
      [2] = { "bits 0-2; 1 = Program sequence - 1,1,1,1,1,1,1,1 " }
      [3] = { "bits 0-2; 2 = Program sequence - 2,2,2,2,2,2,2,2 " }
      [4] = { "bits 0-2; 3 = Program sequence - 1,2,1,2,1,2,1,2 " }
      [5] = { "bits 0-2; 4 = Program sequence - 3,3,3,3,3,3,3,3 " }
      [6] = { "bits 0-2; 5 = Program sequence - 1,3,1,3,1,3,1,3 " }
      [7] = { "bits 0-2; 6 = Program sequence - 2,3,2,3,2,3,2,3 " }
      [8] = { "bits 0-2; 7 = not used                          " }
      [9] = { "bit 3;    0 = Fast mode                         " }
     [10] = { "bit 3;    1 = Slow mode                         " }
     [11] = { "bit 4;    1 = detector bias boost #1 ON         " }
     [12] = { "bit 5;    1 = detector bias boost #2 ON         " }
     [13] = { "bit 6;    not used                              " }
     [14] = { "bit 7;    not used                              " }
!---------------------------------------------------------------

!---------------------------------------------------------------
!   Variable          Data       Number                        Record      Dimension
!   Name              Type       Elements   Dims   Sizes      Variance    Variances
!   --------          ----       --------   ----   -----      --------    ----------
    "SC2ModeCheckKey" CDF_CHAR     51        1       4           F            T

!  Attribute    Data          Value
!  Name         Type
!-----------    -----         ------
  "FIELDNAM"   CDF_CHAR      { "SC2 8-bit mode-step word definition" }
  "VAR_TYPE"   CDF_CHAR      { "metadata" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }.

! NRV values follow

      [1] = { "bits 0-2; ESA0 - energy step at acquisition frame 0" }
      [2] = { "bits 3-5; ESA4 - energy step at acquisition frame 4" }
      [3] = { "bit  6;   Fill value bit - 1 = fill, 0 = mode-step " }
      [4] = { "bit  7;   Fast/Slow indicator - 0 = fast, 1 = slow " }
!---------------------------------------------------------------
```

```
!------------------------------------------------------------
!   Variable          Data        Number                        Record      Dimension
!   Name              Type        Elements   Dims   Sizes   Variance    Variances
!   --------          ----        --------   ----   -----   --------    ----------
    "SC21Step"   CDF_INT1           1          1       7        T            T
!  Attribute      Data            Value
!  Name           Type
!-----------      -----           ------
  "FIELDNAM"   CDF_CHAR       { "SC2-1 energy step number" }
  "VALIDMIN"   CDF_REAL4      {  1 }
  "VALIDMAX"   CDF_REAL4      {  7 }
  "SCALEMIN"   CDF_REAL4      {  1 }
  "SCALEMAX"   CDF_REAL4      {  7 }
  "UNITS"      CDF_CHAR       { " " }
  "LABLAXIS"   CDF_CHAR       { "SC2-1 step" }
  "FORMAT"     CDF_CHAR       { "I3" }
  "FILLVAL"    CDF_REAL4      { -9 }
  "VAR_TYPE"   CDF_CHAR       { "data" }
  "DEPEND_0"   CDF_CHAR       { "Epoch" }
  "DEPEND_1"   CDF_CHAR       { "SC2_acq_frame" }
  "OFFSET_0"   CDF_CHAR       { "SC21Td" }
  "DICT_KEY"   CDF_CHAR       { "XXX" }
  "SCALETYP"   CDF_CHAR       { "linear" }
  "SC_id"      CDF_CHAR       { "SCATHA" }
  "Sig_digits" CDF_CHAR       { "1" }.
!------------------------------------------------------------
!------------------------------------------------------------
!   Variable          Data        Number                        Record      Dimension
!   Name              Type        Elements   Dims   Sizes   Variance    Variances
!   --------          ----        --------   ----   -----   --------    ----------
    "SC21ModeCheck"CDF_INT1         1          0                T
!  Attribute      Data            Value
!  Name           Type
!-----------      -----           ------
  "FIELDNAM"   CDF_CHAR       { "SC2-1 mode/step0/step4 identifier" }
  "VALIDMIN"   CDF_REAL4      { -128 }
  "VALIDMAX"   CDF_REAL4      {   63 }
  "SCALEMIN"   CDF_REAL4      { -128 }
  "SCALEMAX"   CDF_REAL4      {   63 }
  "UNITS"      CDF_CHAR       { " " }
  "LABLAXIS"   CDF_CHAR       { "SC2-1 mode-step" }
  "FORMAT"     CDF_CHAR       { "I4" }
  "FILLVAL"    CDF_REAL4      {  64 }
  "VAR_TYPE"   CDF_CHAR       { "data" }
  "DEPEND_0"   CDF_CHAR       { "Epoch" }
  "DICT_KEY"   CDF_CHAR       { "XXX" }
  "SCALETYP"   CDF_CHAR       { "linear" }
  "SC_id"      CDF_CHAR       { "SCATHA" }
  "Sig_digits" CDF_CHAR       { "3" }
  "TRANS_KEY"  CDF_CHAR       { "SC2ModeCheckKey" }.
```

```
!------------------------------------------------------------
!   Variable        Data        Number                          Record      Dimension
!   Name            Type        Elements   Dims    Sizes        Variance    Variances
!   --------        ----        --------   ----    -----        --------    ----------
    "SC22PA"        CDF_REAL4   1          1       7            T           T

!  Attribute    Data         Value
!  Name         Type
!-----------    -----        ------
   "FIELDNAM"   CDF_CHAR     { "SC2-2 pitch angle" }
   "VALIDMIN"   CDF_REAL4    {   0.0 }
   "VALIDMAX"   CDF_REAL4    { 360.0 }
   "SCALEMIN"   CDF_REAL4    {   0.0 }
   "SCALEMAX"   CDF_REAL4    { 360.0 }
   "UNITS"      CDF_CHAR     { "deg" }
   "LABLAXIS"   CDF_CHAR     { "SC2-2 PA" }
   "FORMAT"     CDF_CHAR     { "F8.2" }
   "FILLVAL"    CDF_REAL4    { -999.99 }
   "VAR_TYPE"   CDF_CHAR     { "data" }
   "DEPEND_0"   CDF_CHAR     { "Epoch" }
   "DEPEND_1"   CDF_CHAR     { "SC2_acq_frame" }
   "OFFSET_0"   CDF_CHAR     { "SC22Td" }
   "DICT_KEY"   CDF_CHAR     { "XXX" }
   "SCALETYP"   CDF_CHAR     { "linear" }
   "SC_id"      CDF_CHAR     { "SCATHA" }
   "Sig_digits" CDF_CHAR     { "5" }.
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable        Data        Number                          Record      Dimension
!   Name            Type        Elements   Dims    Sizes        Variance    Variances
!   --------        ----        --------   ----    -----        --------    ----------
    "SC22SA"        CDF_REAL4   1          1       7            T           T

!  Attribute    Data         Value
!  Name         Type
!-----------    -----        ------
   "FIELDNAM"   CDF_CHAR     { "SC2-2 sun angle" }
   "VALIDMIN"   CDF_REAL4    {   0.0 }
   "VALIDMAX"   CDF_REAL4    { 360.0 }
   "SCALEMIN"   CDF_REAL4    {   0.0 }
   "SCALEMAX"   CDF_REAL4    { 360.0 }
   "UNITS"      CDF_CHAR     { "deg" }
   "LABLAXIS"   CDF_CHAR     { "SC2-2 SA" }
   "FORMAT"     CDF_CHAR     { "F8.2" }
   "FILLVAL"    CDF_REAL4    { -999.99 }
   "VAR_TYPE"   CDF_CHAR     { "data" }
   "DEPEND_0"   CDF_CHAR     { "Epoch" }
   "DEPEND_1"   CDF_CHAR     { "SC2_acq_frame" }
   "OFFSET_0"   CDF_CHAR     { "SC22Td" }
   "DICT_KEY"   CDF_CHAR     { "XXX" }
```

```
  "SCALETYP"  CDF_CHAR      { "linear" }
  "SC_id"     CDF_CHAR      { "SCATHA" }
  "Sig_digits" CDF_CHAR     { "5" }.
!------------------------------------------------------------
!   Variable        Data       Number                    Record     Dimension
!   Name            Type       Elements   Dims   Sizes   Variance   Variances
!   --------        ----       --------   ----   -----   --------   ----------
    "SC2PV2"      CDF_REAL4       1         0               T

! Attribute   Data          Value
! Name        Type
!----------- -----         ------
  "FIELDNAM"  CDF_CHAR      { "SC2-2 probe voltage" }
  "VALIDMIN"  CDF_REAL4     { -1000.0 }
  "VALIDMAX"  CDF_REAL4     {  1000.0 }
  "SCALEMIN"  CDF_REAL4     { -1000.0 }
  "SCALEMAX"  CDF_REAL4     {  1000.0 }
  "UNITS"     CDF_CHAR      { "V" }
  "LABLAXIS"  CDF_CHAR      { "PV2" }
  "FORMAT"    CDF_CHAR      { "F8.1" }
  "FILLVAL"   CDF_REAL4     { -9999.9 }
  "VAR_TYPE"  CDF_CHAR      { "data" }
  "DEPEND_0"  CDF_CHAR      { "Epoch" }
  "DICT_KEY"  CDF_CHAR      { "XXX" }
  "SCALETYP"  CDF_CHAR      { "linear" }
  "SC_id"     CDF_CHAR      { "SCATHA" }
  "Sig_digits" CDF_CHAR     { "5" }.
!------------------------------------------------------------
!------------------------------------------------------------
!   Variable        Data       Number                    Record     Dimension
!   Name            Type       Elements   Dims   Sizes   Variance   Variances
!   --------        ----       --------   ----   -----   --------   ----------
    "SC22DBias"   CDF_INT1        1         0               T
! Attribute   Data          Value
! Name        Type
!----------- -----         ------
  "FIELDNAM"  CDF_CHAR      { "SC2-1,-2 detector bias boost indicator" }
  "VALIDMIN"  CDF_REAL4     { 0 }
  "VALIDMAX"  CDF_REAL4     { 2 }
  "SCALEMIN"  CDF_REAL4     { 0 }
  "SCALEMAX"  CDF_REAL4     { 2 }
  "UNITS"     CDF_CHAR      { " " }
  "LABLAXIS"  CDF_CHAR      { "SC2-2 D Bias" }
  "FORMAT"    CDF_CHAR      { "I3" }
  "FILLVAL"   CDF_REAL4     { -9 }
  "VAR_TYPE"  CDF_CHAR      { "data" }
  "DEPEND_0"  CDF_CHAR      { "Epoch" }
  "TRANS_KEY" CDF_CHAR      { "SC2DetBiasKey" }
  "DICT_KEY"  CDF_CHAR      { "XXX" }
  "SCALETYP"  CDF_CHAR      { "linear" }
  "SC_id"     CDF_CHAR      { "SCATHA" }
```

```
  "Sig_digits" CDF_CHAR     { "1" }.
!------------------------------------------------------------
!------------------------------------------------------------
!   Variable         Data       Number                      Record      Dimension
!   Name             Type       Elements   Dims   Sizes     Variance    Variances
!   --------         ----       --------   ----   -----     --------    ----------
    "SC22EFlx"    CDF_REAL4      1          1       7         T            T
!  Attribute    Data          Value
!  Name         Type
!-----------    -----         ------
  "FIELDNAM"  CDF_CHAR      { "SC2-2 Differential Electron Plasma Flux" }
  "VALIDMIN"  CDF_REAL4     {   0.0 }
  "VALIDMAX"  CDF_REAL4     {   1.0E10 }
  "SCALEMIN"  CDF_REAL4     {   0.0 }
  "SCALEMAX"  CDF_REAL4     {   1.0E10 }
  "UNITS"     CDF_CHAR      { "electrons/(cm^2 sec str keV)" }
  "LABLAXIS"  CDF_CHAR      { "SC2-2 e- flux" }
  "FORMAT"    CDF_CHAR      { "E10.2" }
  "FILLVAL"   CDF_REAL4     { -1.0e31 }
  "VAR_TYPE"  CDF_CHAR      { "data" }
  "DEPEND_0"  CDF_CHAR      { "Epoch" }
  "DEPEND_1"  CDF_CHAR      { "SC2_acq_frame" }
  "OFFSET_0"  CDF_CHAR      { "SC22Td" }
  "DICT_KEY"  CDF_CHAR      { "XXX" }
  "SCALETYP"  CDF_CHAR      { "logarithmic" }
  "SC_id"     CDF_CHAR      { "SCATHA" }
  "Sig_digits" CDF_CHAR     { "3" }.
!------------------------------------------------------------
!------------------------------------------------------------
!   Variable         Data       Number                      Record      Dimension
!   Name             Type       Elements   Dims   Sizes     Variance    Variances
!   --------         ----       --------   ----   -----     --------    ----------
    "SC22EEn"     CDF_REAL4      1          2      7 3        F           T  T
!  Attribute    Data          Value
!  Name         Type
!-----------    -----         ------
  "FIELDNAM"  CDF_CHAR      { "SC2-2 electron flux center energy" }
  "UNITS"     CDF_CHAR      { "keV" }
  "VAR_TYPE"  CDF_CHAR      { "metadata" }
  "DEPEND_1"  CDF_CHAR      { "SC2_acq_frame" }
  "OFFSET_0"  CDF_CHAR      { "SC22Td" }
  "DICT_KEY"  CDF_CHAR      { "XXX" }.
! NRV values follow
      [1,1]  =   188.
      [2,1]  =   428.
      [3,1]  =  1065.
      [4,1]  =  2500.
      [5,1]  =  4400.
      [6,1]  = 10500.
      [7,1]  = 18500.
      [1,2]  =     1.
```

```
      [2,2]  =    92.
      [3,2]  =   314.
      [4,2]  =   775.
      [5,2]  =  1890.
      [6,2]  =  5650.
      [7,2]  = 14000.
      [1,3]  =    13.5
      [2,3]  =    25.
      [3,3]  =    48.5
      [4,3]  =   585.
      [5,3]  =  1420.
      [6,3]  =  3350.
      [7,3]  =  7900.
!-------------------------------------------------------------
!-------------------------------------------------------------
!   Variable        Data       Number                  Record     Dimension
!   Name            Type       Elements  Dims  Sizes  Variance   Variances
!   --------        ----       --------  ----  -----  --------   ----------
    "SC22PFlx"    CDF_REAL4       1        1     7       T           T

!  Attribute    Data           Value
!  Name         Type
!-----------    -----          ------
  "FIELDNAM"  CDF_CHAR      { "SC2-2 Differential Proton Plasma Flux" }
  "VALIDMIN"  CDF_REAL4     {   0.0 }
  "VALIDMAX"  CDF_REAL4     {   1.0E10 }
  "SCALEMIN"  CDF_REAL4     {   0.0 }
  "SCALEMAX"  CDF_REAL4     {   1.0E10 }
  "UNITS"     CDF_CHAR      { "protons/(cm^2 sec str keV)" }
  "LABLAXIS"  CDF_CHAR      { "SC2-2 p+ flux" }
  "FORMAT"    CDF_CHAR      { "E10.2" }
  "FILLVAL"   CDF_REAL4     { -1.0e31 }
  "VAR_TYPE"  CDF_CHAR      { "data" }
  "DEPEND_0"  CDF_CHAR      { "Epoch" }
  "DEPEND_1"  CDF_CHAR      { "SC2_acq_frame" }
  "OFFSET_0"  CDF_CHAR      { "SC22Td" }
  "DICT_KEY"  CDF_CHAR      { "XXX" }
  "SCALETYP"  CDF_CHAR      { "logarithmic" }
  "SC_id"     CDF_CHAR      { "SCATHA" }
  "Sig_digits" CDF_CHAR     { "3" }.
!-------------------------------------------------------------
```

```
!-------------------------------------------------------------
!   Variable          Data        Number                        Record       Dimension
!   Name              Type        Elements    Dims    Sizes     Variance     Variances
!   --------          ----        --------    ----    -----     --------     ----------
    "SC22PEn"       CDF_REAL4       1          2      7 3          F            T  T

!  Attribute    Data          Value
!  Name         Type
!-----------    -----         ------
  "FIELDNAM"   CDF_CHAR      { "SC2-2 proton flux center energy" }
  "UNITS"      CDF_CHAR      { "keV" }
  "VAR_TYPE"   CDF_CHAR      { "metadata" }
  "DEPEND_1"   CDF_CHAR      { "SC2_acq_frame" }
  "OFFSET_0"   CDF_CHAR      { "SC22Td" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }.

! NRV values follow
      [1,1]  =    158.
      [2,1]  =    360.
      [3,1]  =    900.
      [4,1]  =   2080.
      [5,1]  =   3690.
      [6,1]  =   8800.
      [7,1]  =  15500.
      [1,2]  =       .8
      [2,2]  =     79.
      [3,2]  =    265.
      [4,2]  =    660.
      [5,2]  =   1580.
      [6,2]  =   4750.
      [7,2]  =  11700.
      [1,3]  =     11.3
      [2,3]  =     24.
      [3,3]  =     42.5
      [4,3]  =    500.
      [5,3]  =   1200.
      [6,3]  =   2760.
      [7,3]  =   6600.
!-------------------------------------------------------------

!-------------------------------------------------------------
!   Variable          Data        Number                        Record       Dimension
!   Name              Type        Elements    Dims    Sizes     Variance     Variances
!   --------          ----        --------    ----    -----     --------     ----------
    "SC22Td"        CDF_REAL4       1          1       7           F            T

!  Attribute    Data          Value
!  Name         Type
!-----------    -----         ------
  "FIELDNAM"   CDF_CHAR      { "SC2-2 electron data time offset" }
  "UNITS"      CDF_CHAR      { "ms" }
```

```
  "VAR_TYPE"  CDF_CHAR       { "metadata" }
  "DEPEND_1"  CDF_CHAR       { "SC2_acq_frame" }
  "DICT_KEY"  CDF_CHAR       { "XXX" }.

! NRV values follow
      [1]  =   74.25
      [2]  =  199.25
      [3]  =  324.25
      [4]  =  449.25
      [5]  =  574.25
      [6]  =  699.25
      [7]  =  824.25
!-------------------------------------------------------------
!-------------------------------------------------------------
!   Variable        Data       Number                     Record      Dimension
!   Name            Type       Elements   Dims   Sizes    Variance    Variances
!   --------        ----       --------   ----   -----    --------    ----------
    "SC22Prog"   CDF_INT1         1         1      7         T            T

!  Attribute   Data          Value
!  Name        Type
!-----------   -----         ------
  "FIELDNAM"  CDF_CHAR       { "SC2-2 program id" }
  "VALIDMIN"  CDF_REAL4      {  1 }
  "VALIDMAX"  CDF_REAL4      {  3 }
  "SCALEMIN"  CDF_REAL4      {  1 }
  "SCALEMAX"  CDF_REAL4      {  3 }
  "UNITS"     CDF_CHAR       { " " }
  "LABLAXIS"  CDF_CHAR       { "SC2-2 program" }
  "FORMAT"    CDF_CHAR       { "I3" }
  "FILLVAL"   CDF_REAL4      { -9 }
  "VAR_TYPE"  CDF_CHAR       { "data" }
  "DEPEND_0"  CDF_CHAR       { "Epoch" }
  "DEPEND_1"  CDF_CHAR       { "SC2_acq_frame" }
  "OFFSET_0"  CDF_CHAR       { "SC22Td" }
  "DICT_KEY"  CDF_CHAR       { "XXX" }
  "SCALETYP"  CDF_CHAR       { "linear" }
  "SC_id"     CDF_CHAR       { "SCATHA" }
  "Sig_digits" CDF_CHAR      { "1" }.
!-------------------------------------------------------------
!-------------------------------------------------------------
!   Variable        Data       Number                     Record      Dimension
!   Name            Type       Elements   Dims   Sizes    Variance    Variances
!   --------        ----       --------   ----   -----    --------    ----------
    "SC22Mode"   CDF_INT1         1         0                T
!  Attribute   Data          Value
!  Name        Type
!-----------   -----         ------
  "FIELDNAM"  CDF_CHAR       { "SC2-2 mode" }
  "VALIDMIN"  CDF_REAL4      {  0 }
  "VALIDMAX"  CDF_REAL4      { 63 }
```

```
  "SCALEMIN"  CDF_REAL4     {  0 }
  "SCALEMAX"  CDF_REAL4     { 63 }
  "UNITS"     CDF_CHAR      { " " }
  "LABLAXIS"  CDF_CHAR      { "SC2-2 mode" }
  "FORMAT"    CDF_CHAR      { "I4" }
  "FILLVAL"   CDF_REAL4     { -99 }
  "VAR_TYPE"  CDF_CHAR      { "data" }
  "DEPEND_0"  CDF_CHAR      { "Epoch" }
  "DICT_KEY"  CDF_CHAR      { "XXX" }
  "SCALETYP"  CDF_CHAR      { "linear" }
  "SC_id"     CDF_CHAR      { "SCATHA" }
  "Sig_digits" CDF_CHAR     { "1" }
  "TRANS_KEY" CDF_CHAR      { "SC2ModeKey" }.
!------------------------------------------------------------
!------------------------------------------------------------
!   Variable        Data       Number                  Record     Dimension
!   Name            Type       Elements   Dims  Sizes  Variance   Variances
!   --------        ----       --------   ----  -----  --------   ----------
    "SC22Step"   CDF_INT1        1         1      7       T            T
!  Attribute   Data          Value
!  Name        Type
!-----------   -----         ------
  "FIELDNAM"  CDF_CHAR      { "SC2-2 energy step number" }
  "VALIDMIN"  CDF_REAL4     {  1 }
  "VALIDMAX"  CDF_REAL4     {  7 }
  "SCALEMIN"  CDF_REAL4     {  1 }
  "SCALEMAX"  CDF_REAL4     {  7 }
  "UNITS"     CDF_CHAR      { " " }
  "LABLAXIS"  CDF_CHAR      { "SC2-2 step" }
  "FORMAT"    CDF_CHAR      { "I3" }
  "FILLVAL"   CDF_REAL4     { -9 }
  "VAR_TYPE"  CDF_CHAR      { "data" }
  "DEPEND_0"  CDF_CHAR      { "Epoch" }
  "DEPEND_1"  CDF_CHAR      { "SC2_acq_frame" }
  "OFFSET_0"  CDF_CHAR      { "SC22Td" }
  "DICT_KEY"  CDF_CHAR      { "XXX" }
  "SCALETYP"  CDF_CHAR      { "linear" }
  "SC_id"     CDF_CHAR      { "SCATHA" }
  "Sig_digits" CDF_CHAR     { "1" }.
!------------------------------------------------------------
!------------------------------------------------------------
!   Variable        Data       Number                  Record     Dimension
!   Name            Type       Elements   Dims  Sizes  Variance   Variances
!   --------        ----       --------   ----  -----  --------   ----------
    "SC22ModeCheck"CDF_INT1      1         0              T
!  Attribute   Data          Value
!  Name        Type
!-----------   -----         ------
  "FIELDNAM"  CDF_CHAR      { "SC2-2 mode/step0/step4 identifier" }
  "VALIDMIN"  CDF_REAL4     { -128 }
  "VALIDMAX"  CDF_REAL4     {   63 }
```

```
 "SCALEMIN"  CDF_REAL4       { -128 }
 "SCALEMAX"  CDF_REAL4       {   63 }
 "UNITS"     CDF_CHAR        { " " }
 "LABLAXIS"  CDF_CHAR        { "SC2-2 mode-step" }
 "FORMAT"    CDF_CHAR        { "I4" }
 "FILLVAL"   CDF_REAL4       {  64 }
 "VAR_TYPE"  CDF_CHAR        { "data" }
 "DEPEND_0"  CDF_CHAR        { "Epoch" }
 "DICT_KEY"  CDF_CHAR        { "XXX" }
 "SCALETYP"  CDF_CHAR        { "linear" }
 "SC_id"     CDF_CHAR        { "SCATHA" }
 "Sig_digits" CDF_CHAR       { "3" }
 "TRANS_KEY" CDF_CHAR        { "SC2ModeCheckKey" }.

!-----------------------------------------------------------------
!  Variable        Data       Number                    Record     Dimension
!  Name            Type       Elements   Dims   Sizes   Variance   Variances
!  --------        ----       --------   ----   -----   --------   ----------
   "SC23PA"     CDF_REAL4       1          1      7        T           T
! Attribute    Data         Value
! Name         Type
!-----------   -----        ------
  "FIELDNAM"  CDF_CHAR      { "SC2-3 pitch angle" }
  "VALIDMIN"  CDF_REAL4     {   0.0 }
  "VALIDMAX"  CDF_REAL4     { 360.0 }
  "SCALEMIN"  CDF_REAL4     {   0.0 }
  "SCALEMAX"  CDF_REAL4     { 360.0 }
  "UNITS"     CDF_CHAR      { "deg" }
  "LABLAXIS"  CDF_CHAR      { "SC2-3 PA" }
  "FORMAT"    CDF_CHAR      { "F8.2" }
  "FILLVAL"   CDF_REAL4     { -999.99 }
  "VAR_TYPE"  CDF_CHAR      { "data" }
  "DEPEND_0"  CDF_CHAR      { "Epoch" }
  "DEPEND_1"  CDF_CHAR      { "SC2_acq_frame" }
  "OFFSET_0"  CDF_CHAR      { "SC23Td" }
  "DICT_KEY"  CDF_CHAR      { "XXX" }
  "SCALETYP"  CDF_CHAR      { "linear" }
  "SC_id"     CDF_CHAR      { "SCATHA" }
  "Sig_digits" CDF_CHAR     { "5" }.
!-----------------------------------------------------------------
!-----------------------------------------------------------------
!  Variable        Data       Number                    Record     Dimension
!  Name            Type       Elements   Dims   Sizes   Variance   Variances
!  --------        ----       --------   ----   -----   --------   ----------
   "SC23SA"     CDF_REAL4       1          1      7        T           T
! Attribute    Data         Value
! Name         Type
!-----------   -----        ------
  "FIELDNAM"  CDF_CHAR      { "SC2-3 sun angle" }
  "VALIDMIN"  CDF_REAL4     {   0.0 }
  "VALIDMAX"  CDF_REAL4     { 360.0 }
```

```
  "SCALEMIN"  CDF_REAL4     {   0.0 }
  "SCALEMAX"  CDF_REAL4     { 360.0 }
  "UNITS"     CDF_CHAR      { "deg" }
  "LABLAXIS"  CDF_CHAR      { "SC2-3 SA" }
  "FORMAT"    CDF_CHAR      { "F8.2" }
  "FILLVAL"   CDF_REAL4     { -999.99 }
  "VAR_TYPE"  CDF_CHAR      { "data" }
  "DEPEND_0"  CDF_CHAR      { "Epoch" }
  "DEPEND_1"  CDF_CHAR      { "SC2_acq_frame" }
  "OFFSET_0"  CDF_CHAR      { "SC23Td" }
  "DICT_KEY"  CDF_CHAR      { "XXX" }
  "SCALETYP"  CDF_CHAR      { "linear" }
  "SC_id"     CDF_CHAR      { "SCATHA" }
  "Sig_digits" CDF_CHAR     { "5" }.
!-------------------------------------------------------------
!-------------------------------------------------------------
!  Variable        Data      Number                     Record     Dimension
!  Name            Type      Elements   Dims   Sizes   Variance   Variances
!  --------        ----      --------   ----   -----   --------   ----------
   "SC23DBias"   CDF_INT1       1         0               T
! Attribute   Data          Value
! Name        Type
!-----------  -----         ------
  "FIELDNAM"  CDF_CHAR      { "SC2-3 detector bias boost indicator" }
  "VALIDMIN"  CDF_REAL4     { 0 }
  "VALIDMAX"  CDF_REAL4     { 2 }
  "SCALEMIN"  CDF_REAL4     { 0 }
  "SCALEMAX"  CDF_REAL4     { 2 }
  "UNITS"     CDF_CHAR      { " " }
  "LABLAXIS"  CDF_CHAR      { "SC2-3 D Bias" }
  "FORMAT"    CDF_CHAR      { "I3" }
  "FILLVAL"   CDF_REAL4     { -9 }
  "VAR_TYPE"  CDF_CHAR      { "data" }
  "DEPEND_0"  CDF_CHAR      { "Epoch" }
  "TRANS_KEY" CDF_CHAR      { "SC2DetBiasKey" }
  "DICT_KEY"  CDF_CHAR      { "XXX" }
  "SCALETYP"  CDF_CHAR      { "linear" }
  "SC_id"     CDF_CHAR      { "SCATHA" }
  "Sig_digits" CDF_CHAR     { "1" }.
!-------------------------------------------------------------
!-------------------------------------------------------------
!  Variable        Data      Number                     Record     Dimension
!  Name            Type      Elements   Dims   Sizes   Variance   Variances
!  --------        ----      --------   ----   -----   --------   ----------
   "SC23EFlx"    CDF_REAL4      1         1      7        T           T

! Attribute   Data          Value
! Name        Type
!-----------  -----         ------
  "FIELDNAM"  CDF_CHAR      { "SC2-3 Differential Electron Plasma Flux" }
  "VALIDMIN"  CDF_REAL4     {   0.0 }
```

```
  "VALIDMAX"  CDF_REAL4     {   1.0E10 }
  "SCALEMIN"  CDF_REAL4     {   0.0 }
  "SCALEMAX"  CDF_REAL4     {   1.0E10 }
  "UNITS"     CDF_CHAR      { "electrons/(cm^2 sec str keV)" }
  "LABLAXIS"  CDF_CHAR      { "SC2-3 e- flux" }
  "FORMAT"    CDF_CHAR      { "E10.2" }
  "FILLVAL"   CDF_REAL4     { -1.0e31 }
  "VAR_TYPE"  CDF_CHAR      { "data" }
  "DEPEND_0"  CDF_CHAR      { "Epoch" }
  "DEPEND_1"  CDF_CHAR      { "SC2_acq_frame" }
  "OFFSET_0"  CDF_CHAR      { "SC23Td" }
  "DICT_KEY"  CDF_CHAR      { "XXX" }
  "SCALETYP"  CDF_CHAR      { "logarithmic" }
  "SC_id"     CDF_CHAR      { "SCATHA" }
  "Sig_digits" CDF_CHAR     { "3" }.
!------------------------------------------------------------
!------------------------------------------------------------
!   Variable      Data     Number                    Record     Dimension
!   Name          Type     Elements   Dims   Sizes   Variance   Variances
!   --------      ----     --------   ----   -----   --------   ----------
    "SC23EEn"    CDF_REAL4    1        2     7 3       F          T  T

!  Attribute    Data         Value
!  Name         Type
!-----------    -----        ------
  "FIELDNAM"   CDF_CHAR      { "SC2-3 electron flux center energy" }
  "UNITS"      CDF_CHAR      { "keV" }
  "VAR_TYPE"   CDF_CHAR      { "metadata" }
  "DEPEND_1"   CDF_CHAR      { "SC2_acq_frame" }
  "DEPEND_2"   CDF_CHAR      { "SC2_Prog" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }.

! NRV values follow
      [1,1]  =   187.
      [2,1]  =   446.
      [3,1]  =  1090.
      [4,1]  =  2580.
      [5,1]  =  4520.
      [6,1]  = 10950.
      [7,1]  = 19400.
      [1,2]  =     5.
      [2,2]  =    87.
      [3,2]  =   316.
      [4,2]  =   815.
      [5,2]  =  1940.
      [6,2]  =  5900.
      [7,2]  = 14400.
      [1,3]  =     6.
      [2,3]  =    17.
      [3,3]  =    40.
      [4,3]  =   612.
```

```
     [5,3]  =  1440.
     [6,3]  =  3410.
     [7,3]  =  8200.
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable        Data        Number                      Record      Dimension
!   Name            Type        Elements   Dims   Sizes     Variance    Variances
!   --------        ----        --------   ----   -----     --------    ----------
    "SC23PFlx"    CDF_REAL4       1         1      7          T             T

!  Attribute    Data           Value
!  Name         Type
!-----------    -----          ------
  "FIELDNAM"  CDF_CHAR       { "SC2-3 Differentail Proton Plasma Flux" }
  "VALIDMIN"  CDF_REAL4      {   0.0 }
  "VALIDMAX"  CDF_REAL4      {   1.0E10 }
  "SCALEMIN"  CDF_REAL4      {   0.0 }
  "SCALEMAX"  CDF_REAL4      {   1.0E10 }
  "UNITS"     CDF_CHAR       { "protons/(cm^2 sec str keV)" }
  "LABLAXIS"  CDF_CHAR       { "SC2-3 p+ flux" }
  "FORMAT"    CDF_CHAR       { "E10.2" }
  "FILLVAL"   CDF_REAL4      { -1.0e31 }
  "VAR_TYPE"  CDF_CHAR       { "data" }
  "DEPEND_0"  CDF_CHAR       { "Epoch" }
  "DEPEND_1"  CDF_CHAR       { "SC2_acq_frame" }
  "OFFSET_0"  CDF_CHAR       { "SC23Td" }
  "DICT_KEY"  CDF_CHAR       { "XXX" }
  "SCALETYP"  CDF_CHAR       { "logarithmic" }
  "SC_id"     CDF_CHAR       { "SCATHA" }
  "Sig_digits" CDF_CHAR      { "3" }.
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable        Data        Number                      Record      Dimension
!   Name            Type        Elements   Dims   Sizes     Variance    Variances
!   --------        ----        --------   ----   -----     --------    ----------
    "SC23PEn"     CDF_REAL4       1         2      7 3        F            T  T

!  Attribute    Data           Value
!  Name         Type
!-----------    -----          ------
  "FIELDNAM"  CDF_CHAR       { "SC2-3 Proton flux center energy" }
  "UNITS"     CDF_CHAR       { "keV" }
  "VAR_TYPE"  CDF_CHAR       { "metadata" }
  "DEPEND_1"  CDF_CHAR       { "SC2_acq_frame" }
  "DICT_KEY"  CDF_CHAR       { "XXX" }.

! NRV values follow
     [1,1]  =   154.
     [2,1]  =   360.
```

```
      [3,1]  =   880.
      [4,1]  =  2060.
      [5,1]  =  3600.
      [6,1]  =  8800.
      [7,1]  = 15600.
      [1,2]  =     4.
      [2,2]  =    74.
      [3,2]  =   255.
      [4,2]  =   655.
      [5,2]  =  1550.
      [6,2]  =  4800.
      [7,2]  = 11600.
      [1,3]  =     4.
      [2,3]  =    18.
      [3,3]  =    37.
      [4,3]  =   490.
      [5,3]  =  1165.
      [6,3]  =  2700.
      [7,3]  =  6650.
!------------------------------------------------------------
!------------------------------------------------------------
!   Variable       Data        Number                    Record     Dimension
!   Name           Type        Elements   Dims   Sizes   Variance   Variances
!   --------       ----        --------   ----   -----   --------   ----------
    "SC23Td"     CDF_REAL4        1         1      7        F           T

!  Attribute    Data          Value
!  Name         Type
!-----------    -----         ------
  "FIELDNAM"   CDF_CHAR      { "SC2-3 electron data time offset" }
  "UNITS"      CDF_CHAR      { "ms" }
  "VAR_TYPE"   CDF_CHAR      { "metadata" }
  "DEPEND_1"   CDF_CHAR      { "SC2_acq_frame" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }.

! NRV values follow
      [1]  =   74.25
      [2]  =  199.25
      [3]  =  324.25
      [4]  =  449.25
      [5]  =  574.25
      [6]  =  699.25
      [7]  =  824.25
!------------------------------------------------------------
```

```
!------------------------------------------------------------
!  Variable        Data       Number                    Record      Dimension
!  Name            Type       Elements   Dims   Sizes   Variance    Variances
!  --------        ----       --------   ----   -----   --------    ----------
  "SC23Prog"   CDF_INT1          1        1      7         T            T

! Attribute    Data           Value
! Name         Type
!-----------   -----          ------
  "FIELDNAM"  CDF_CHAR       { "SC2-3 program id" }
  "VALIDMIN"  CDF_REAL4      {  1 }
  "VALIDMAX"  CDF_REAL4      {  3 }
  "SCALEMIN"  CDF_REAL4      {  1 }
  "SCALEMAX"  CDF_REAL4      {  3 }
  "UNITS"     CDF_CHAR       { " " }
  "LABLAXIS"  CDF_CHAR       { "SC2-3 program" }
  "FORMAT"    CDF_CHAR       { "I3" }
  "FILLVAL"   CDF_REAL4      { -9 }
  "VAR_TYPE"  CDF_CHAR       { "data" }
  "DEPEND_0"  CDF_CHAR       { "Epoch" }
  "DEPEND_1"  CDF_CHAR       { "SC2_acq_frame" }
  "OFFSET_0"  CDF_CHAR       { "SC23Td" }
  "DICT_KEY"  CDF_CHAR       { "XXX" }
  "SCALETYP"  CDF_CHAR       { "linear" }
  "SC_id"     CDF_CHAR       { "SCATHA" }
  "Sig_digits" CDF_CHAR      { "1" }.
!------------------------------------------------------------
!------------------------------------------------------------
!  Variable        Data       Number                    Record      Dimension
!  Name            Type       Elements   Dims   Sizes   Variance    Variances
!  --------        ----       --------   ----   -----   --------    ----------
  "SC23Mode"   CDF_INT1          1        0                T
! Attribute    Data           Value
! Name         Type
!-----------   -----          ------
  "FIELDNAM"  CDF_CHAR       { "SC2-3 mode" }
  "VALIDMIN"  CDF_REAL4      {  0 }
  "VALIDMAX"  CDF_REAL4      { 63 }
  "SCALEMIN"  CDF_REAL4      {  0 }
  "SCALEMAX"  CDF_REAL4      { 63 }
  "UNITS"     CDF_CHAR       { " " }
  "LABLAXIS"  CDF_CHAR       { "SC2-3 mode" }
  "FORMAT"    CDF_CHAR       { "I4" }
  "FILLVAL"   CDF_REAL4      { -99 }
  "VAR_TYPE"  CDF_CHAR       { "data" }
  "DEPEND_0"  CDF_CHAR       { "Epoch" }
  "DICT_KEY"  CDF_CHAR       { "XXX" }
  "SCALETYP"  CDF_CHAR       { "linear" }
  "SC_id"     CDF_CHAR       { "SCATHA" }
  "Sig_digits" CDF_CHAR      { "1" }
  "TRANS_KEY" CDF_CHAR       { "SC2ModeKey" }.
```

```
!------------------------------------------------------------
!------------------------------------------------------------
!   Variable         Data        Number                       Record      Dimension
!   Name             Type       Elements   Dims    Sizes      Variance    Variances
!   --------         ----       --------   ----    -----      --------    ----------
   "SC23Step"   CDF_INT1           1         1       7          T            T
!  Attribute      Data         Value
!  Name           Type
!-----------      -----        ------
  "FIELDNAM"   CDF_CHAR      { "SC2-3 energy step" }
  "VALIDMIN"   CDF_REAL4     {  1 }
  "VALIDMAX"   CDF_REAL4     {  7 }
  "SCALEMIN"   CDF_REAL4     {  1 }
  "SCALEMAX"   CDF_REAL4     {  7 }
  "UNITS"      CDF_CHAR      { " " }
  "LABLAXIS"   CDF_CHAR      { "SC2-3 energy step" }
  "FORMAT"     CDF_CHAR      { "I3" }
  "FILLVAL"    CDF_REAL4     { -9 }
  "VAR_TYPE"   CDF_CHAR      { "data" }
  "DEPEND_0"   CDF_CHAR      { "Epoch" }
  "DEPEND_1"   CDF_CHAR      { "SC2_acq_frame" }
  "OFFSET_0"   CDF_CHAR      { "SC23Td" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }
  "SCALETYP"   CDF_CHAR      { "linear" }
  "SC_id"      CDF_CHAR      { "SCATHA" }
  "Sig_digits" CDF_CHAR      { "1" }.
!------------------------------------------------------------
!------------------------------------------------------------
!   Variable         Data        Number                       Record      Dimension
!   Name             Type       Elements   Dims    Sizes      Variance    Variances
!   --------         ----       --------   ----    -----      --------    ----------
   "SC23ModeCheck"CDF_INT1         1         0                  T
!  Attribute      Data         Value
!  Name           Type
!-----------      -----        ------
  "FIELDNAM"   CDF_CHAR      { "SC2-3 mode/step0/step4 identifier" }
  "VALIDMIN"   CDF_REAL4     { -128 }
  "VALIDMAX"   CDF_REAL4     {   63 }
  "SCALEMIN"   CDF_REAL4     { -128 }
  "SCALEMAX"   CDF_REAL4     {   63 }
  "UNITS"      CDF_CHAR      { " " }
  "LABLAXIS"   CDF_CHAR      { "SC2-3 mode-step" }
  "FORMAT"     CDF_CHAR      { "I4" }
  "FILLVAL"    CDF_REAL4     {  64 }
  "VAR_TYPE"   CDF_CHAR      { "data" }
  "DEPEND_0"   CDF_CHAR      { "Epoch" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }
  "SCALETYP"   CDF_CHAR      { "linear" }
  "SC_id"      CDF_CHAR      { "SCATHA" }
  "Sig_digits" CDF_CHAR      { "3" }
  "TRANS_KEY"  CDF_CHAR      { "SC2ModeCheckKey" }.
```

```
!----------------------------------------------------------
!----------------------------------------------------------
!   Variable        Data       Number                       Record      Dimension
!   Name            Type       Elements   Dims   Sizes      Variance    Variances
!   --------        ----       --------   ----   -----      --------    ----------
    "SC23BPFlx"   CDF_REAL4       1        1       7          T            T
!  Attribute     Data          Value
!  Name          Type
!-----------     -----         ------
  "FIELDNAM"   CDF_CHAR      { "SC23B Heavier Ion Particle Flux" }
  "VALIDMIN"   CDF_REAL4     {   0.0 }
  "VALIDMAX"   CDF_REAL4     {   1.0E10 }
  "SCALEMIN"   CDF_REAL4     {   0.0 }
  "SCALEMAX"   CDF_REAL4     {   1.0E10 }
  "UNITS"      CDF_CHAR      { "ions/(cm^2 sec str keV)" }
  "LABL_PTR_1" CDF_CHAR      { "SC23B_channel" }
  "FORMAT"     CDF_CHAR      { "E10.2" }
  "FILLVAL"    CDF_REAL4     { -1.0e31 }
  "VAR_TYPE"   CDF_CHAR      { "data" }
  "DEPEND_0"   CDF_CHAR      { "Epoch" }
  "DEPEND_1"   CDF_CHAR      { "SC23B_channel" }
  "OFFSET_0"   CDF_CHAR      { "SC23BTd" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }
  "SCALETYP"   CDF_CHAR      { "logarithmic" }
  "SC_id"      CDF_CHAR      { "SCATHA" }
  "Sig_digits" CDF_CHAR      { "3" }.
!----------------------------------------------------------
!   Variable        Data       Number                       Record      Dimension
!   Name            Type       Elements   Dims   Sizes      Variance    Variances
!   --------        ----       --------   ----   -----      --------    ----------
    "SC23B_channel" CDF_CHAR     31        1       7          F            T

!  Attribute     Data          Value
!  Name          Type
!-----------     -----         ------
  "FIELDNAM"   CDF_CHAR      { "Dimension label for SC23B energy channel" }
  "VAR_TYPE"   CDF_CHAR      { "metadata" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }.

! NRV values follow
      [1]  =  { "BP1s:    Ep > 126 keV             " }
      [2]  =  { "BP2s:    Ep > 390 keV             " }
      [3]  =  { "2B:      E_alpha > 3.8 MeV        " }
      [4]  =  { "ALPHA1:  392 < E_alpha < 960 keV" }
      [5]  =  { "ALPHA2:  549 < E_alpha < 960 keV" }
      [6]  =  { "CNOs:    1.21 < E_CNO < 2.7 MeV " }
      [7]  =  { ">CNO:    E_Mg > 5.4 MeV           " }
!----------------------------------------------------------
```

```
!-------------------------------------------------------------
!   Variable          Data        Number                      Record       Dimension
!   Name              Type        Elements   Dims   Sizes     Variance     Variances
!   --------          ----        --------   ----   -----     --------     ----------
!    "SC23BPEn"    CDF_REAL4         1          1      7          F             T
!
!  Attribute     Data            Value
!  Name          Type
!-----------    -----            ------
!  "FIELDNAM"   CDF_CHAR         { "SC23B ion flux center energy" }
!  "UNITS"      CDF_CHAR         { "keV" }
!  "VAR_TYPE"   CDF_CHAR         { "metadata" }
!  "DEPEND_1"   CDF_CHAR         { "SC23B_channel" }
!  "DICT_KEY"   CDF_CHAR         { "XXX" }.
!
! NRV values follow
!         [ 1]  = 0.0
!         [ 2]  = 0.0
!         [ 3]  = 0.0
!         [ 4]  = 0.0
!         [ 5]  = 0.0
!         [ 6]  = 0.0
!         [ 7]  = 0.0
!-------------------------------------------------------------

!-------------------------------------------------------------
!   Variable          Data        Number                      Record       Dimension
!   Name              Type        Elements   Dims   Sizes     Variance     Variances
!   --------          ----        --------   ----   -----     --------     ----------
    "SC23BTd"      CDF_REAL4         1          0                 F

!  Attribute     Data            Value
!  Name          Type
!-----------    -----            ------
   "FIELDNAM"   CDF_CHAR         { "SC23B ion data time offset" }
   "UNITS"      CDF_CHAR         { "ms" }
   "VAR_TYPE"   CDF_CHAR         { "metadata" }
   "DICT_KEY"   CDF_CHAR         { "XXX" }.

! NRV values follow
        [ ]  = -500.0
!-------------------------------------------------------------
```

```
!------------------------------------------------------------
!   Variable        Data       Number                     Record      Dimension
!   Name            Type       Elements   Dims   Sizes    Variance    Variances
!   --------        ----       --------   ----   -----    --------    ----------
    "SC23BPA"     CDF_REAL4       1         0                T

!  Attribute     Data            Value
!  Name          Type
!-----------     -----           ------
  "FIELDNAM"    CDF_CHAR       { "SC2-3B ion pitch angle" }
  "VALIDMIN"    CDF_REAL4      {   0.0 }
  "VALIDMAX"    CDF_REAL4      { 360.0 }
  "SCALEMIN"    CDF_REAL4      {   0.0 }
  "SCALEMAX"    CDF_REAL4      { 360.0 }
  "UNITS"       CDF_CHAR       { "deg" }
  "LABLAXIS"    CDF_CHAR       { "SC2-3B ion PA" }
  "FORMAT"      CDF_CHAR       { "F8.2" }
  "FILLVAL"     CDF_REAL4      { -999.99 }
  "VAR_TYPE"    CDF_CHAR       { "data" }
  "DEPEND_0"    CDF_CHAR       { "Epoch" }
  "OFFSET_0"    CDF_CHAR       { "SC23BTd" }
  "DICT_KEY"    CDF_CHAR       { "XXX" }
  "SCALETYP"    CDF_CHAR       { "linear" }
  "SC_id"       CDF_CHAR       { "SCATHA" }
  "Sig_digits"  CDF_CHAR       { "5" }.
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable        Data       Number                     Record      Dimension
!   Name            Type       Elements   Dims   Sizes    Variance    Variances
!   --------        ----       --------   ----   -----    --------    ----------
    "SC26PFlx"    CDF_REAL4       1         1      8         T            T

!  Attribute     Data            Value
!  Name          Type
!-----------     -----           ------
  "FIELDNAM"    CDF_CHAR       { "SC26 Differential Proton Particle Flux" }
  "VALIDMIN"    CDF_REAL4      {   0.0 }
  "VALIDMAX"    CDF_REAL4      {   1.0E10 }
  "SCALEMIN"    CDF_REAL4      {   0.0 }
  "SCALEMAX"    CDF_REAL4      {   1.0E10 }
  "UNIT_PTR"    CDF_CHAR       { "SC26PFlxUnits" }
  "LABL_PTR_1"  CDF_CHAR       { "SC26_energy" }
  "FORMAT"      CDF_CHAR       { "E10.2" }
  "FILLVAL"     CDF_REAL4      { -1.0e31 }
  "VAR_TYPE"    CDF_CHAR       { "data" }
  "DEPEND_0"    CDF_CHAR       { "Epoch" }
  "DEPEND_1"    CDF_CHAR       { "SC26_energy" }
  "OFFSET_0"    CDF_CHAR       { "SC26Td" }
  "DICT_KEY"    CDF_CHAR       { "XXX" }
  "SCALETYP"    CDF_CHAR       { "logarithmic" }
```

```
 "SC_id"      CDF_CHAR        { "SCATHA" }
 "Sig_digits" CDF_CHAR        { "3" }.
!------------------------------------------------------------
!------------------------------------------------------------
!  Variable          Data         Number                    Record      Dimension
!  Name              Type         Elements   Dims   Sizes   Variance    Variances
!  --------          ----         --------   ----   -----   --------    ----------
   "SC26PFlxUnits"CDF_CHAR          26        1       8        F             T
! Attribute    Data          Value
! Name         Type
!-----------    -----         ------
 "FIELDNAM"   CDF_CHAR       { "Dimension units for SC26PFlx" }
 "LABL_PTR_1" CDF_CHAR       { "SC26_energy" }
 "VAR_TYPE"   CDF_CHAR       { "metadata" }
 "DEPEND_1"   CDF_CHAR       { "SC26_energy" }.

! NRV values follow

      [1]  =  { "protons/(cm^2 sec str keV)" }
      [2]  =  { "protons/(cm^2 sec str keV)" }
      [3]  =  { "protons/(cm^2 sec str keV)" }
      [4]  =  { "protons/(cm^2 sec str keV)" }
      [5]  =  { "protons/(cm^2 sec str keV)" }
      [6]  =  { "protons/(cm^2 sec str keV)" }
      [7]  =  { "protons/(cm^2 sec str keV)" }
      [8]  =  { "protons/(cm^2 sec str)     " }
!------------------------------------------------------------
!------------------------------------------------------------
!  Variable          Data         Number                    Record      Dimension
!  Name              Type         Elements   Dims   Sizes   Variance    Variances
!  --------          ----         --------   ----   -----   --------    ----------
   "SC26_energy" CDF_CHAR           19        1       8        F             T

! Attribute    Data          Value
! Name         Type
!-----------    -----         ------
 "FIELDNAM"   CDF_CHAR       { "Dimension label for SC26 energy ranges" }
 "VAR_TYPE"   CDF_CHAR       { "metadata" }
 "DICT_KEY"   CDF_CHAR       { "XXX" }.

! NRV values follow
      [1]  = { "14 < Ep < 24 keV    " }
      [2]  = { "24 < Ep < 48 keV    " }
      [3]  = { "48 < Ep < 94 keV    " }
      [4]  = { "94 < Ep < 172 keV   " }
      [5]  = { "172 < Ep < 352 keV  " }
      [6]  = { "352 < Ep < 700 keV  " }
      [7]  = { "700 < Ep < 3300 keV" }
      [8]  = { "3300 keV < Ep       " }
!------------------------------------------------------------
```

```
!------------------------------------------------------------
!  Variable        Data      Number                          Record      Dimension
!  Name            Type      Elements   Dims   Sizes         Variance    Variances
!  --------        ----      --------   ----   -----         --------    ----------
   "SC26PEn"       CDF_REAL4    1         1      8              F            T

! Attribute    Data          Value
! Name         Type
!-----------   -----         ------
  "FIELDNAM"   CDF_CHAR      { "SC26 proton flux center energy" }
  "UNITS"      CDF_CHAR      { "keV" }
  "VAR_TYPE"   CDF_CHAR      { "metadata" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }.

! NRV values follow
      [ 1]  =   19.
      [ 2]  =   36.
      [ 3]  =   71.
      [ 4]  =  133.
      [ 5]  =  262.
      [ 6]  =  526.
      [ 7]  = 2000.
      [ 8]  = 3300.
!------------------------------------------------------------

!------------------------------------------------------------
!  Variable        Data      Number                          Record      Dimension
!  Name            Type      Elements   Dims   Sizes         Variance    Variances
!  --------        ----      --------   ----   -----         --------    ----------
   "SC26Td"        CDF_REAL4    1         0                     F

! Attribute    Data          Value
! Name         Type
!-----------   -----         ------
  "FIELDNAM"   CDF_CHAR      { "SC26 proton data time offset" }
  "UNITS"      CDF_CHAR      { "ms" }
  "VAR_TYPE"   CDF_CHAR      { "metadata" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }.

! NRV values follow
      [ ]  = -500.
!------------------------------------------------------------
```

```
!------------------------------------------------------------
!  Variable       Data      Number                      Record      Dimension
!  Name           Type      Elements  Dims   Sizes      Variance    Variances
!  --------       ----      --------  ----   -----      --------    ----------
   "SC26PA"     CDF_REAL4     1        0                   T

!  Attribute    Data        Value
!  Name         Type
!-----------   -----       ------
  "FIELDNAM"  CDF_CHAR     { "SC26 pitch angle" }
  "VALIDMIN"  CDF_REAL4    {      0.0 }
  "VALIDMAX"  CDF_REAL4    {    360.0 }
  "SCALEMIN"  CDF_REAL4    {      0.0 }
  "SCALEMAX"  CDF_REAL4    {    360.0 }
  "UNITS"     CDF_CHAR     { "deg" }
  "LABLAXIS"  CDF_CHAR     { "SC26 PA" }
  "FORMAT"    CDF_CHAR     { "F8.2" }
  "FILLVAL"   CDF_REAL4    { -999.99 }
  "VAR_TYPE"  CDF_CHAR     { "data" }
  "DEPEND_0"  CDF_CHAR     { "Epoch" }
  "OFFSET_0"  CDF_CHAR     { "SC26Td" }
  "DICT_KEY"  CDF_CHAR     { "XXX" }
  "SCALETYP"  CDF_CHAR     { "linear" }
  "SC_id"     CDF_CHAR     { "SCATHA" }
  "Sig_digits" CDF_CHAR    { "5" }.
!------------------------------------------------------------
!------------------------------------------------------------
!  Variable       Data      Number                      Record      Dimension
!  Name           Type      Elements  Dims   Sizes      Variance    Variances
!  --------       ----      --------  ----   -----      --------    ----------
   "SC26SA"     CDF_REAL4     1        0                   T
!  Attribute    Data        Value
!  Name         Type
!-----------   -----       ------
  "FIELDNAM"  CDF_CHAR     { "SC26 sun angle" }
  "VALIDMIN"  CDF_REAL4    {      0.0 }
  "VALIDMAX"  CDF_REAL4    {    360.0 }
  "SCALEMIN"  CDF_REAL4    {      0.0 }
  "SCALEMAX"  CDF_REAL4    {    360.0 }
  "UNITS"     CDF_CHAR     { "deg" }
  "LABLAXIS"  CDF_CHAR     { "SC26 SA" }
  "FORMAT"    CDF_CHAR     { "F8.2" }
  "FILLVAL"   CDF_REAL4    { -999.99 }
  "VAR_TYPE"  CDF_CHAR     { "data" }
  "DEPEND_0"  CDF_CHAR     { "Epoch" }
  "OFFSET_0"  CDF_CHAR     { "SC26Td" }
  "DICT_KEY"  CDF_CHAR     { "XXX" }
  "SCALETYP"  CDF_CHAR     { "linear" }
  "SC_id"     CDF_CHAR     { "SCATHA" }
  "Sig_digits" CDF_CHAR    { "5" }.
!------------------------------------------------------------
```

```
!-----------------------------------------------------------
!  Variable        Data        Number                       Record     Dimension
!  Name            Type        Elements   Dims   Sizes      Variance   Variances
!  --------        ----        --------   ----   -----      --------   ----------
   "SC3Stat"      CDF_UINT2        1        1      2           T            T
! Attribute    Data          Value
! Name         Type
!-----------    -----        ------
  "FIELDNAM"  CDF_CHAR      { "SC3 status bit word" }
  "VALIDMIN"  CDF_REAL4     {      0 }
  "VALIDMAX"  CDF_REAL4     {  65535 }
  "SCALEMIN"  CDF_REAL4     {      0 }
  "SCALEMAX"  CDF_REAL4     {  65535 }
  "UNITS"     CDF_CHAR      { " " }
  "LABLAXIS"  CDF_CHAR      { "SC3 status" }
  "FORMAT"    CDF_CHAR      { "I5" }
  "FILLVAL"   CDF_REAL4     {  0 }
  "VAR_TYPE"  CDF_CHAR      { "data" }
  "DEPEND_BIT"CDF_CHAR      { "SC3StatBits" }
  "DEPEND_0"  CDF_CHAR      { "Epoch" }
  "DEPEND_2"  CDF_CHAR      { "Half_sec" }
  "DICT_KEY"  CDF_CHAR      { "XXX" }
  "SCALETYP"  CDF_CHAR      { "linear" }
  "SC_id"     CDF_CHAR      { "SCATHA" }
  "Sig_digits" CDF_CHAR     { "5" }.
!-----------------------------------------------------------
!-----------------------------------------------------------
!  Variable        Data        Number                       Record     Dimension
!  Name            Type        Elements   Dims   Sizes      Variance   Variances
!  --------        ----        --------   ----   -----      --------   ----------
   "SC3StatBits" CDF_CHAR         40        1      16          F            T

! Attribute    Data          Value
! Name         Type
!-----------    -----        ------
  "FIELDNAM"  CDF_CHAR      { "SC3 Status word bit definition" }
  "VAR_TYPE"  CDF_CHAR      { "metadata" }
  "DICT_KEY"  CDF_CHAR      { "XXX" }.

! NRV values follow

      [1] = { "bit 0: Low mode flag - 1=Low; (0=High ?)" }
      [2] = { "bit 1: LSB of status telemetry byte     " }
      [3] = { "bit 2: bit 1 of status telemetry byte   " }
      [4] = { "bit 3: bit 2 of status telemetry byte   " }
      [5] = { "bit 4: bit 3 of status telemetry byte   " }
      [6] = { "bit 5: bit 4 of status telemetry byte   " }
      [7] = { "bit 6: bit 5 of status telemetry byte   " }
      [8] = { "bit 7: bit 6 of status telemetry byte   " }
      [9] = { "bit 8: MSB of status telemetry byte     " }
     [10] = { "bits 9 - 12: Second of original TM frame" }
```

```
    [11] = { "spare                                          " }
    [12] = { "spare                                          " }
    [13] = { "spare                                          " }
    [14] = { "spare                                          " }
    [15] = { "spare                                          " }
    [16] = { "spare                                          " }
!--------------------------------------------------------------
!--------------------------------------------------------------
!   Variable       Data        Number                   Record     Dimension
!   Name           Type        Elements   Dims   Sizes  Variance   Variances
!   --------       ----        --------   ----   -----  --------   ----------
    "SC3ECnts"   CDF_REAL4       1         2     16 2      T          T T

!  Attribute    Data          Value
!  Name         Type
!-----------    -----         ------
  "FIELDNAM"   CDF_CHAR      { "SC3 Differential Electron raw particle count" }
  "VALIDMIN"   CDF_REAL4     {   0.0 }
  "VALIDMAX"   CDF_REAL4     {   1.0E10 }
  "SCALEMIN"   CDF_REAL4     {   0.0 }
  "SCALEMAX"   CDF_REAL4     {   1.0E10 }
  "UNITS"      CDF_CHAR      { "counts" }
  "LABL_PTR_1"CDF_CHAR       { "label_SC3ECnts" }
  "FORMAT"     CDF_CHAR      { "E10.2" }
  "FILLVAL"    CDF_REAL4     { -1.0e31 }
  "VAR_TYPE"   CDF_CHAR      { "data" }
  "DEPEND_0"   CDF_CHAR      { "Epoch" }
  "DEPEND_1"   CDF_CHAR      { "label_SC3ECnts" }
  "DEPEND_2"   CDF_CHAR      { "Half_sec" }
  "OFFSET_0"   CDF_CHAR      { "SC3CntsTd" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }
  "SCALETYP"   CDF_CHAR      { "logarithmic" }
  "SC_id"      CDF_CHAR      { "SCATHA" }
  "Sig_digits" CDF_CHAR      { "5" }.
!--------------------------------------------------------------

!--------------------------------------------------------------
!   Variable       Data        Number                   Record     Dimension
!   Name           Type        Elements   Dims   Sizes  Variance   Variances
!   --------       ----        --------   ----   -----  --------   ----------
    "label_SC3ECnts"CDF_CHAR     10        1      16       F          T

!  Attribute    Data          Value
!  Name         Type
!-----------    -----         ------
  "FIELDNAM"   CDF_CHAR      { "Label for SC3ECnts" }
  "VAR_TYPE"   CDF_CHAR      { "metadata" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }.
```

```
! NRV values follow

        [1] = { "Channel 1 " }
        [2] = { "Channel 2 " }
        [3] = { "Channel 3 " }
        [4] = { "Channel 4 " }
        [5] = { "Channel 5 " }
        [6] = { "Channel 6 " }
        [7] = { "Channel 7 " }
        [8] = { "Channel 8 " }
        [9] = { "Channel 9 " }
       [10] = { "Channel 10" }
       [11] = { "Channel 11" }
       [12] = { "Channel 12" }
       [13] = { "DINT      " }
       [14] = { "EINT      " }
       [15] = { "E1INT     " }
       [16] = { "AINT      " }
!------------------------------------------------------------

!------------------------------------------------------------
!  Variable        Data      Number                      Record     Dimension
!  Name            Type      Elements   Dims   Sizes     Variance   Variances
!  --------        ----      --------   ----   -----     --------   ----------
   "SC3EEnLo"    CDF_REAL4     1         1      12          F          T

!  Attribute    Data         Value
!  Name         Type
!-----------    -----        ------
  "FIELDNAM"   CDF_CHAR     { "SC3 electron channel center energy - low mode" }
  "UNITS"      CDF_CHAR     { "keV" }
  "VAR_TYPE"   CDF_CHAR     { "metadata" }
  "DICT_KEY"   CDF_CHAR     { "XXX" }.

! NRV values follow
      [ 1]  =  56.7
      [ 2]  =  76.7
      [ 3]  =  97.5
      [ 4]  = 118.5
      [ 5]  = 139.5
      [ 6]  = 160.5
      [ 7]  = 181.5
      [ 8]  = 203.
      [ 9]  = 224.5
      [10]  = 245.5
      [11]  = 267.
      [12]  = 288.5
!------------------------------------------------------------
```

```
!-------------------------------------------------------------
!   Variable          Data        Number                       Record      Dimension
!   Name              Type        Elements   Dims   Sizes      Variance    Variances
!   --------          ----        --------   ----   -----      --------    ----------
    "SC3EEnHi"     CDF_REAL4        1         1      12           F            T

!  Attribute     Data           Value
!  Name          Type
!-----------     -----          ------
  "FIELDNAM"    CDF_CHAR       { "SC3 electron channel center energy - high mode" }
  "UNITS"       CDF_CHAR       { "keV" }
  "VAR_TYPE"    CDF_CHAR       { "metadata" }
  "DICT_KEY"    CDF_CHAR       { "XXX" }.

! NRV values follow
       [ 1]  =  448.5
       [ 2]  =  830.
       [ 3]  = 1222.5
       [ 4]  = 1616.5
       [ 5]  = 2011.
       [ 6]  = 2405.5
       [ 7]  = 2800.
       [ 8]  = 3195.
       [ 9]  = 3590.
       [10]  = 3904.
       [11]  = 4378.
       [12]  = 4772.5
!-------------------------------------------------------------
!-------------------------------------------------------------
!   Variable          Data        Number                       Record      Dimension
!   Name              Type        Elements   Dims   Sizes      Variance    Variances
!   --------          ----        --------   ----   -----      --------    ----------
    "SC3PA"        CDF_REAL4        1         1       2           T            T

!  Attribute     Data           Value
!  Name          Type
!-----------     -----          ------
  "FIELDNAM"    CDF_CHAR       { "SC3 pitch angle" }
  "VALIDMIN"    CDF_REAL4      {      0.0 }
  "VALIDMAX"    CDF_REAL4      {    360.0 }
  "SCALEMIN"    CDF_REAL4      {      0.0 }
  "SCALEMAX"    CDF_REAL4      {    360.0 }
  "UNITS"       CDF_CHAR       { "deg" }
  "LABLAXIS"    CDF_CHAR       { "SC3 PA" }
  "FORMAT"      CDF_CHAR       { "F8.2" }
  "FILLVAL"     CDF_REAL4      { -999.99 }
  "VAR_TYPE"    CDF_CHAR       { "data" }
  "DEPEND_0"    CDF_CHAR       { "Epoch" }
  "DEPEND_1"    CDF_CHAR       { "Half_sec" }
  "OFFSET_0"    CDF_CHAR       { "SC3PATd" }
  "DICT_KEY"    CDF_CHAR       { "XXX" }
```

```
  "SCALETYP"  CDF_CHAR      { "linear" }
  "SC_id"     CDF_CHAR      { "SCATHA" }
  "Sig_digits" CDF_CHAR     { "5" }.
!------------------------------------------------------------
!   Variable         Data        Number                    Record      Dimension
!   Name             Type        Elements   Dims   Sizes   Variance    Variances
!   --------         ----        --------   ----   -----   --------    ----------
    "SC3CntsTd"    CDF_REAL4       1          2     16 2       F           F T

!  Attribute    Data          Value
!  Name         Type
!-----------    -----         ------
  "FIELDNAM"  CDF_CHAR      { "SC3 electron counts data time offset" }
  "UNITS"     CDF_CHAR      { "ms" }
  "VAR_TYPE"  CDF_CHAR      { "metadata" }
  "DEPEND_1"  CDF_CHAR      { "SC3EEn" }
  "DEPEND_2"  CDF_CHAR      { "Half_sec" }
  "DICT_KEY"  CDF_CHAR      { "XXX" }.

! NRV values follow
      [1,1]  = -248.
      [1,2]  =  252.
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable         Data        Number                    Record      Dimension
!   Name             Type        Elements   Dims   Sizes   Variance    Variances
!   --------         ----        --------   ----   -----   --------    ----------
    "SC3PATd"      CDF_REAL4       1          1      2         F           T

!  Attribute    Data          Value
!  Name         Type
!-----------    -----         ------
  "FIELDNAM"  CDF_CHAR      { "SC3 electron pitch angle data time offset" }
  "UNITS"     CDF_CHAR      { "ms" }
  "VAR_TYPE"  CDF_CHAR      { "metadata" }
  "DEPEND_1"  CDF_CHAR      { "Half_sec" }
  "DICT_KEY"  CDF_CHAR      { "XXX" }.

! NRV values follow
      [ 1]  = -248.
      [ 2]  =  252.
!------------------------------------------------------------
```

```
!------------------------------------------------------------
!   Variable         Data        Number                      Record      Dimension
!   Name             Type        Elements   Dims    Sizes    Variance    Variances
!   --------         ----        --------   ----    -----    --------    ----------
    "SC8Stat"      CDF_UINT2        1         0                 T

!  Attribute    Data            Value
!  Name         Type
!-----------    -----           ------
  "FIELDNAM"   CDF_CHAR       { "SC8 status bit word" }
  "VALIDMIN"   CDF_REAL4      {       0 }
  "VALIDMAX"   CDF_REAL4      {   65535 }
  "SCALEMIN"   CDF_REAL4      {       0 }
  "SCALEMAX"   CDF_REAL4      {   65535 }
  "UNITS"      CDF_CHAR       { " " }
  "LABLAXIS"   CDF_CHAR       { "SC8 status" }
  "FORMAT"     CDF_CHAR       { "I6" }
  "FILLVAL"    CDF_REAL4      {  0 }
  "VAR_TYPE"   CDF_CHAR       { "data" }
  "DEPEND_BIT"CDF_CHAR        { "SC8StatBits" }
  "DEPEND_0"   CDF_CHAR       { "Epoch" }
  "DICT_KEY"   CDF_CHAR       { "XXX" }
  "SCALETYP"   CDF_CHAR       { "linear" }
  "SC_id"      CDF_CHAR       { "SCATHA" }
  "Sig_digits" CDF_CHAR       { "5" }.
!------------------------------------------------------------
!------------------------------------------------------------
!   Variable         Data        Number                      Record      Dimension
!   Name             Type        Elements   Dims    Sizes    Variance    Variances
!   --------         ----        --------   ----    -----    --------    ----------
    "SC8StatBits" CDF_CHAR         38        1       16         F            T

!  Attribute    Data            Value
!  Name         Type
!-----------    -----           ------
  "FIELDNAM"   CDF_CHAR       { "SC8 Status word bit definition" }
  "VAR_TYPE"   CDF_CHAR       { "metadata" }
  "DICT_KEY"   CDF_CHAR       { "XXX" }.

! NRV values follow
[1] = { "H2002 SC8-1 High voltage monitor      " }
      [2] = { "H2002 SC8-1 Calibration enable monitor" }
      [3] = { "H2003 SC8-1 Bias ON monitor           " }
      [4] = { "H2004 SC8-1 Mode 1 monitor            " }
      [5] = { "H2005 SC8-1 Mode 2 monitor            " }
      [6] = { "H2006 SC8-1 Light/heavy monitor       " }
      [7] = { "H2007 SC8-1 Boost 1 monitor           " }
      [8] = { "H2008 SC8-1 Boost 2 monitor           " }
      [9] = { "H2009 SC8-1 Background/mass lock      " }
     [10] = { "H2010 SC8-1 Mass lock counter 1       " }
     [11] = { "H2011 SC8-1 Mass lock counter 2       " }
```

```
     [12] = { "H2012 SC8-1 E-step counter 1          " }
     [13] = { "H2013 SC8-1 E-step counter 2          " }
     [14] = { "H2014 SC8-1 E-step counter 3          " }
     [15] = { "H2015 SC8-1 Multi-level counter 1     " }
     [16] = { "H2016 SC8-1 Multi-level counter 2     " }
!------------------------------------------------------------
!------------------------------------------------------------
!   Variable        Data        Number                  Record      Dimension
!   Name            Type        Elements   Dims  Sizes  Variance    Variances
!   --------        ----        --------   ----  -----  --------    ----------
    "SC8EFlx"     CDF_REAL4       1         1      4       T            T

!  Attribute    Data          Value
!  Name         Type
!-----------    -----         ------
  "FIELDNAM"   CDF_CHAR      { "SC8 electron flux" }
  "VALIDMIN"   CDF_REAL4     {   0.0 }
  "VALIDMAX"   CDF_REAL4     {   1.0E10 }
  "SCALEMIN"   CDF_REAL4     {   0.0 }
  "SCALEMAX"   CDF_REAL4     {   1.0E10 }
  "UNITS"      CDF_CHAR      { "electrons/(cm^2 sec str keV)" }
  "LABL_PTR_1" CDF_CHAR      { "SC8_energy" }
  "FORMAT"     CDF_CHAR      { "E10.2" }
  "FILLVAL"    CDF_REAL4     { -1.0e31 }
  "VAR_TYPE"   CDF_CHAR      { "data" }
  "DEPEND_0"   CDF_CHAR      { "Epoch" }
  "DEPEND_1"   CDF_CHAR      { "SC8_energy" }
  "OFFSET_0"   CDF_CHAR      { "SC8ETd" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }
  "SCALETYP"   CDF_CHAR      { "logarithmic" }
  "SC_id"      CDF_CHAR      { "SCATHA" }
  "Sig_digits" CDF_CHAR      { "3" }.
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable        Data        Number                  Record      Dimension
!   Name            Type        Elements   Dims  Sizes  Variance    Variances
!   --------        ----        --------   ----  -----  --------    ----------
    "SC8EEn"      CDF_REAL4       1         1      4       F            T

!  Attribute    Data          Value
!  Name         Type
!-----------    -----         ------
  "FIELDNAM"   CDF_CHAR      { "SC8 electron flux center energy" }
  "UNITS"      CDF_CHAR      { "keV" }
  "VAR_TYPE"   CDF_CHAR      { "metadata" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }.

! NRV values follow
     [ 1]  =    .18
     [ 2]  =    .81
```

```
     [ 3]  =  3.69
     [ 4]  = 17.53
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable        Data        Number                    Record      Dimension
!   Name            Type        Elements   Dims   Sizes   Variance    Variances
!   --------        ----        --------   ----   -----   --------    ----------
    "SC8ETd"     CDF_REAL4         1         0                F

! Attribute    Data          Value
! Name         Type
!-----------   -----         ------
  "FIELDNAM"   CDF_CHAR     { "SC8 electron time offset" }
  "UNITS"      CDF_CHAR     { "ms" }
  "VAR_TYPE"   CDF_CHAR     { "metadata" }
  "DICT_KEY"   CDF_CHAR     { "XXX" }.

! NRV values follow
     [ ]   = 1000.0
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable        Data        Number                    Record      Dimension
!   Name            Type        Elements   Dims   Sizes   Variance    Variances
!   --------        ----        --------   ----   -----   --------    ----------
    "SC8EPA"     CDF_REAL4         1         0                T

! Attribute    Data          Value
! Name         Type
!-----------   -----         ------
  "FIELDNAM"   CDF_CHAR     { "SC8 electron pitch angle" }
  "VALIDMIN"   CDF_REAL4    {   0.0 }
  "VALIDMAX"   CDF_REAL4    { 360.0 }
  "SCALEMIN"   CDF_REAL4    {   0.0 }
  "SCALEMAX"   CDF_REAL4    { 360.0 }
  "UNITS"      CDF_CHAR     { "deg" }
  "LABLAXIS"   CDF_CHAR     { "SC8 PA" }
  "FORMAT"     CDF_CHAR     { "F8.2" }
  "FILLVAL"    CDF_REAL4    { -999.99 }
  "VAR_TYPE"   CDF_CHAR     { "data" }
  "DEPEND_0"   CDF_CHAR     { "Epoch" }
  "OFFSET_0"   CDF_CHAR     { "SC8ETd" }
  "DICT_KEY"   CDF_CHAR     { "XXX" }
  "SCALETYP"   CDF_CHAR     { "linear" }
  "SC_id"      CDF_CHAR     { "SCATHA" }
  "Sig_digits" CDF_CHAR     { "5" }.
!------------------------------------------------------------
```

```
!------------------------------------------------------------
!   Variable        Data        Number                      Record      Dimension
!   Name            Type        Elements    Dims   Sizes    Variance    Variancees
!   --------        ----        --------    ----   -----    --------    ----------
    "SC10ELA"     CDF_REAL4       1          0                 T

!  Attribute    Data          Value
!  Name         Type
!-----------    -----         ------
  "FIELDNAM"   CDF_CHAR      { "SC10 electric antenna look angle (new calc)" }
  "VALIDMIN"   CDF_REAL4     {   0.0 }
  "VALIDMAX"   CDF_REAL4     { 360.0 }
  "SCALEMIN"   CDF_REAL4     {   0.0 }
  "SCALEMAX"   CDF_REAL4     { 360.0 }
  "UNITS"      CDF_CHAR      { "deg" }
  "LABLAXIS"   CDF_CHAR      { "E-Ant. LA" }
  "FORMAT"     CDF_CHAR      { "F8.2" }
  "FILLVAL"    CDF_REAL4     { -999.99 }
  "VAR_TYPE"   CDF_CHAR      { "data" }
  "DEPEND_0"   CDF_CHAR      { "Epoch" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }
  "SCALETYP"   CDF_CHAR      { "linear" }
  "SC_id"      CDF_CHAR      { "SCATHA" }
  "Sig_digits" CDF_CHAR      { "5" }.
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable        Data        Number                      Record      Dimension
!   Name            Type        Elements    Dims   Sizes    Variance    Variancees
!   --------        ----        --------    ----   -----    --------    ----------
    "SC10MLA"     CDF_REAL4       1          0                 T

!  Attribute    Data          Value
!  Name         Type
!-----------    -----         ------
  "FIELDNAM"   CDF_CHAR      { "SC10 magnetic antenna look angle (new calc)" }
  "VALIDMIN"   CDF_REAL4     {   0.0 }
  "VALIDMAX"   CDF_REAL4     { 360.0 }
  "SCALEMIN"   CDF_REAL4     {   0.0 }
  "SCALEMAX"   CDF_REAL4     { 360.0 }
  "UNITS"      CDF_CHAR      { "deg" }
  "LABLAXIS"   CDF_CHAR      { "M-Ant. LA" }
  "FORMAT"     CDF_CHAR      { "F8.2" }
  "FILLVAL"    CDF_REAL4     { -999.99 }
  "VAR_TYPE"   CDF_CHAR      { "data" }
  "DEPEND_0"   CDF_CHAR      { "Epoch" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }
  "SCALETYP"   CDF_CHAR      { "linear" }
  "SC_id"      CDF_CHAR      { "SCATHA" }
  "Sig_digits" CDF_CHAR      { "5" }.
!------------------------------------------------------------
```

```
!------------------------------------------------------------
!   Variable          Data        Number                         Record        Dimension
!   Name              Type        Elements    Dims    Sizes      Variance      Variancees
!   --------          ----        --------    ----    -----      --------      ----------
    "SC10SA"        CDF_REAL4        1         0                    T

!  Attribute     Data           Value
!  Name          Type
!-----------    -----          ------
  "FIELDNAM"    CDF_CHAR       { "SC10 electric antenna sun angle" }
  "VALIDMIN"    CDF_REAL4      {    0.0 }
  "VALIDMAX"    CDF_REAL4      { 360.0 }
  "SCALEMIN"    CDF_REAL4      {    0.0 }
  "SCALEMAX"    CDF_REAL4      { 360.0 }
  "UNITS"       CDF_CHAR       { "deg" }
  "LABLAXIS"    CDF_CHAR       { "E-Ant. SA" }
  "FORMAT"      CDF_CHAR       { "F8.2" }
  "FILLVAL"     CDF_REAL4      { -999.99 }
  "VAR_TYPE"    CDF_CHAR       { "data" }
  "DEPEND_0"    CDF_CHAR       { "Epoch" }
  "DICT_KEY"    CDF_CHAR       { "XXX" }
  "SCALETYP"    CDF_CHAR       { "linear" }
  "SC_id"       CDF_CHAR       { "SCATHA" }
  "Sig_digits" CDF_CHAR        { "5" }.
!------------------------------------------------------------

!------------------------------------------------------------
!   Variable          Data        Number                         Record        Dimension
!   Name              Type        Elements    Dims    Sizes      Variance      Variancees
!   --------          ----        --------    ----    -----      --------      ----------
    "SC10Stat"      CDF_INT1         1         0                    T
!  Attribute     Data           Value
!  Name          Type
!-----------    -----          ------
  "FIELDNAM"    CDF_CHAR       { "SC10 instrument status byte" }
  "VALIDMIN"    CDF_REAL4      { -128 }
  "VALIDMAX"    CDF_REAL4      {  127 }
  "SCALEMIN"    CDF_REAL4      { -128 }
  "SCALEMAX"    CDF_REAL4      {  127 }
  "UNITS"       CDF_CHAR       { " " }
  "LABLAXIS"    CDF_CHAR       { "SC10 status" }
  "FORMAT"      CDF_CHAR       { "I5" }
  "FILLVAL"     CDF_REAL4      { -128 }
  "VAR_TYPE"    CDF_CHAR       { "data" }
  "DEPEND_0"    CDF_CHAR       { "Epoch" }
  "DEPEND_BIT"CDF_CHAR         { "SC10StatBits" }
  "DICT_KEY"    CDF_CHAR       { "XXX" }
  "SCALETYP"    CDF_CHAR       { "linear" }
  "SC_id"       CDF_CHAR       { "SCATHA" }
  "Sig_digits" CDF_CHAR        { "3" }.
!------------------------------------------------------------
```

```
!-------------------------------------------------------------
!   Variable         Data        Number                          Record      Dimension
!   Name             Type        Elements    Dims    Sizes      Variance    Variances
!   --------         ----        --------    ----    -----      --------    ----------
    "SC10StatBits" CDF_CHAR         46         1       8           F            T

!  Attribute    Data          Value
!  Name         Type
!-----------    -----         ------
  "FIELDNAM"   CDF_CHAR      { "SC10 Status word bit definition" }
  "VAR_TYPE"   CDF_CHAR      { "metadata" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }.

! NRV values follow

      [1] = { "L2001 SC10 Broadband filter setting            " }
      [2] = { "K2004 SC10 Mode 0=OFF;1=ON                      " }
      [3] = { "K2003 SC10 Common mode verification 0=cm;1=mag" }
      [4] = { "K2002 SC10 Calib verification (-) 0=sig;1=cal " }
      [5] = { "K2001 SC10 Calib verification (+) 0=sig;1=cal " }
      [6] = { "spare                                          " }
      [7] = { "spare                                          " }
      [8] = { "spare                                          " }
!-------------------------------------------------------------


!-------------------------------------------------------------
!   Variable         Data        Number                          Record      Dimension
!   Name             Type        Elements    Dims    Sizes      Variance    Variances
!   --------         ----        --------    ----    -----      --------    ----------
    "GunStat"      CDF_INT1        1          0                    T

!  Attribute    Data          Value
!  Name         Type
!-----------    -----         ------
  "FIELDNAM"   CDF_CHAR      { "Ion/Electron gun operation flag" }
  "VALIDMIN"   CDF_REAL4     { -128 }
  "VALIDMAX"   CDF_REAL4     {  127 }
  "SCALEMIN"   CDF_REAL4     { -128 }
  "SCALEMAX"   CDF_REAL4     {  127 }
  "UNITS"      CDF_CHAR      {  " " }
  "LABLAXIS"   CDF_CHAR      { "Gun stat" }
  "FORMAT"     CDF_CHAR      { "I5" }
  "FILLVAL"    CDF_REAL4     { -128 }
  "VAR_TYPE"   CDF_CHAR      { "data" }
  "DEPEND_0"   CDF_CHAR      { "Epoch" }
  "DICT_KEY"   CDF_CHAR      { "XXX" }
  "SCALETYP"   CDF_CHAR      { "linear" }
  "SC_id"      CDF_CHAR      { "SCATHA" }
  "Sig_digits" CDF_CHAR      { "3" }.
      #end
```