Standard file format guidelines for particle fluxes

S. Bourdarie (ONERA - France)
B. Blake (Aerospace Corporation – USA)
J.B. Cao (CSSAR – China)
R. Friedel (LANL – USA)
Y. Miyoshi (STELAB – Japan)
M. Panasyuk (MSU – Russia)
C. Underwood (U. Of Surrey – UK)

Panel on Radiation Belt Environment Modeling (PRBEM)

Standard file format guidelines V1.2

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I. Introduction

The purpose of this document is to provide guidelines to produce standard radiation belt files to facilitate data exchange between different groups involved in the field and tools development that will use these data sets.
Data acquired in different countries/institutes/agencies are usually stored in various format (cdf, hdf, ascii, binary, idl saveset, ...) more or less exotic with no standard header, information, description ... This current status makes life difficult to cross-compare different data sets (it is always necessary to develop dedicated routines usually done several times throughout the world, ...).
Guidelines is needed from the worldwide community of developers of space radiation data bases to permit standardization of data file format and therefore minimise efforts for data user's.

II. File format

An easy to use and flexible file format must be selected. To include data as well as relevant informations attached to the data, self described file format are the most convenient. One widely used by now is cdf (Common Data File). We then strongly suggest to follow ISTP/IACG guidelines (http://cdf.gsfc.nasa.gov/). In this section we recall what those guidelines are and we add one more layer to ensure that any cdf file produced will be done along the same philosophy. We concentrate here only on particles measurements in space. Note that all text in italic originates from the NASA ISTP web site: .

where authors and curators are
Mona Kessel, mona.kessel@gsfc.nasa.gov, (301)286-6595
Code 632, NASA Goddard Space Flight Center
Greenbelt, MD 20771, USA

A CDF data set using ISTP/IACG guidelines, by definition forms a logically complete and self-sufficient whole (data and descriptions). The goal is to make the resulting CDF data set correctly and independently usable by the science community. These guidelines have been adopted by a wide SEC community (http://pwg.gsfc.nasa.gov/istp/collaborating/).

A CDF file is composed of global attributes which provide descriptions of the whole data set. Then variables have to be defined as well as their attributes.

II.1 File naming convention

The ISTP file naming convention is the following:

- One file per day is generated
- The file name has to be like:
  SPACECRAFT_**_INSTRUMENT_yyyymmdd_V++.cdf where:
  - SPACECRAFT is the name of the spacecraft in capital letters
  - ** can either be *"Hn>High Resolution data" for certified data of higher resolution than Key Parameters. n can run from 0 to 9 to allow for more than one kind of data product. For Cluster/CSDS this can either be "SP>Summary Parameter" or "PP>Prime Parameter". Other possible data types may be defined in future. If any of these data sets are modified or used to produce derived products, the data type should be, e.g., "Mn>Modified Data n", where n is from 0 to 9.*
  - INSTRUMENT is the name of the instrument in capital letters
  - yyyy being the year
  - mm being two digit month (integer)
  - dd being two digit day of month
  - ++ indicates the file version number (two digits) and can run from 00 to 99!

II.2 Global attributes

Global attributes are used to provide information about the data set as an entity. Together with variables and variable attributes, the global attributes make the data correctly and independently usable by someone not connected with the instrument team, and hence, a good archive product. The global attributes can also be used by any software, one popular example being the CDAWeb Display and Retrieval system (http://cdaweb.gsfc.nasa.gov/cdaweb/).
A list of global attributes is provided below, note that it is not limited, one can decide to add more global attributes if needed for his own applications.

"Data_type"	required
"Data_version"	required
"Descriptor"	required
"Discipline"	required
"Instrument_type"	required
"Logical_file_id"	required
"Logical_source"	required
"Logical_source_description"	required
"Mission_group"	required
"PI_affiliation"	required
"PI_name"	required
"Project"	required
"Source_name"	required
"TEXT"	required
"Time_resolution"	required
"Acknowledgement"	recommended
"ADID_ref"	recommended
"Generated_by"	recommended
"Generated_with_software"	recommended

"Generation_date"	recommended
"LINK_TEXT"	recommended
"LINK_TITLE"	recommended
"HTTP_LINK"	recommended
"MODS"	recommended
"Planet"	recommended
"Rules_of_use"	recommended
"Parents"	optional
"Skeleton_version"	optional
"Sofware_version"	optional
"TITLE"	optional
"Validate"	optional

*Some required Global Attributes are listed here with example values. Note that CDF attributes are case-sensitive and must **exactly** follow what is shown here.*

```
     ATTRIBUTE                                  EXAMPLE VALUE
-------------------------------------------------------------------------

 "Project"                       { "ISTP>International " -
                                       "Solar-Terrestrial Physics" }.
 "Source_name"                   { "GEOTAIL>Geomagnetic Tail" }.
 "Discipline"                    { "Space Physics>Magnetospheric Science" }.
 "Data_type"                     { "H0>High time resolution" }.
 "Descriptor"                    { "EPI>Energetic Particles" -
                                       " and Ion Composition" }.
 "Data_version"                  { "1" }.
 "Logical_file_id"               { "GE_H0_EPI_19920908_V01" }.
 "PI_name"                       { "D. Williams" }.
 "PI_affiliation"                { "JHU/APL" }.
 "TEXT"                          { "reference to journal article, URL
                                    address" }.
 "Instrument_type"               { "Magnetic Fields (space)" }.
 "Mission_group"                 { "Geotail" }.
 "Logical_source"                { "GE_H0_EPI" }.
 "Logical_source_description"  { "Geotail Magnetic Field Key Parameters" }.
-------------------------------------------------------------------------
```

The Global Attribute Definitions are provided below in alphabetical order

Acknowledgement--- recommended
Text string at PI disposal allowing for information on expected acknowledgment if data is citable.

ADID_ref --- recommended
This attribute stores the control authority identifier associated with the detached SFDU label. If no control authority identifier has been assigned, then the identifier associated with the ISTP/IACG Guidelines (NSSD0241) or with CDF (NSSD0110) can be used.

Data_type --- required
This attribute identifies the data type of the CDF data set. Both a long name and a short name are given. For ISTP exchangeable data products the values are "Kn>Key Parameter" for approximately minute averaged survey data, and "Hn>High Resolution data" for certified data of higher resolution than Key Parameters.n can run from 0 to 9 to allow for more than one kind of data product. For Cluster/CSDS this can either be "SP>Summary Parameter" or "PP>Prime Parameter". Other possible data types may be defined in future. If any of these data sets are modified or used to produce derived products, the data type should be, e.g., "Mn>Modified Data n", where n is from 0 to 9.

Data_version --- required
This attribute identifies the version of a particular CDF data file for a given date, e.g., the file POLAR_H0_CEPPAD_19960923_V01 is the first version of data for 1996 September 23. ***Each time*** *this particular data file is reproduced - for recalibration or other reasons - the Data_version is incremented by 1. Data_version always starts at `1'.*

Descriptor --- required
This attribute identifies the name of the instrument or sensor that collected the data. Both a long name and a short name are given. An example for ISTP is "EPI>Energetic Particles and Ion Composition". The short name should be limited to from 2 to 4 characters for consistency with ISTP. This attribute should be single valued.

Discipline --- required
This attribute describes both the science discipline and subdiscipline. More than one entry is allowed. The list for space physics is:

- *"Space Physics>Magnetospheric Science"*
- *"Space Physics>Interplanetary Studies"*

Generated_by --- recommended
This attribute allows for the generating data center/group to be identified.

Generated_with_software – recommended
This attribute describes the software and its version being used for processing the data as well as the library and its version for computing magnetic coordinates (e.g. IRBEM-SVN 231)

Generation_date --- recommended
Date stamps the creation of the file using the syntax yyyymmdd, e.g., "19920923". This is distinct from the date in "validate" below which records the times of later validation processes.

HTTP_LINK , LINK_TEXT and LINK_TITLE --- recommended
This attribute stores the URL for the PI or CoI web site holding on-line data. This attribute is used in conjunction with "LINK_TEXT" and "LINK_TITLE". There can be up to 5 entries for each - there MUST be a corresponding entry of "LINK_TEXT" and "LINK_TITLE" for each "HTTP_LINK" entry. As an example CDAWeb will then link to the URL given by "HTTP_LINK" using the "LINK_TITLE" and the description in "LINK_TEXT", on the CDAWeb Data Explorer page. For example

- *"LINK_TEXT" = 3-sec MGF magnetic field 1 Sep 1993 through 30 Sep 1997 available at*
- *"LINK_TITLE" = ISAS DARTS*
- *"HTTP_LINK" = http://www.darts.isas.ac.jp/spdb/index.html*

will give the following link:
3-sec MGF magnetic field 1 Sep 1993 through 30 Sep 1997 available at ISAS DARTS

Instrument_type --- required
This attribute is used to facilitate making choices of instrument type. More than one entry is allowed. The following list contains the valid values.

- *Particles (space)*
- *Plasma and Solar Wind*

Logical_file_id --- required
This attribute stores the name of the CDF file using the ISTP naming convention (source_name / data_type / descriptor / date / data_version), e.g., POLAR_H0_CEPPAD_19960923_V01. This attribute is required (1) to allow storage of the full name on IBM PCs, and (2) to avoid loss of the original source in the case of accidental (or intentional) renaming. For CDFs created on the ISTP CDHF, the correct Logical_file_id will be filled in by an ICSS support routine.

Logical_source --- required
This attribute carries source_name, data_type, and descriptor information.

Logical_source_description --- required
This attribute writes out the full words associated with the encrypted Logical_source above, e.g., "POLAR CEPPAD High resolution particle data".

Mission_group --- required
This attribute has a single value and is used to facilitate making choices of source. Valid values include (but are not restricted to) :

- *Geotail*
- *IMP8*
- *Wind*
- *Geosynchronous Investigations*

MODS --- recommended
This attribute is an NSSDC standard global attribute which is used to denote the history of modifications made to the CDF data set. The MODS attribute should contain a description of all significant changes to the data set. This attribute is not directly tied to Data_version, but each version produced will contain the relevant modifications. This attribute can have as many entries as necessary to contain the desired information.

Parents --- optional
This attribute lists the parent CDF(S) for files of derived and merged data sets. Subsequent entry values are used for multiple parents. The syntax for a CDF parent would be e.g. "CDF>logical_file_id".

PI_affiliation --- required
This attribute value should include a recognizable abbreviation.

PI_name --- required
This attribute value should include first initial and last name.

Planet --- recommended
This attribute value indicate from which planet the data are (e.g. "Earth" or "Jupiter").

Project --- required
This attribute identifies the name of the project and indicates ownership. For ISTP missions and investigations, the value used is "ISTP>International Solar-Terrestrial Physics". For the Cluster mission, the value is "STSP Cluster>Solar Terrestrial Science Programmes, Cluster".

Rules_of_use --- recommended
Text containing information on, e.g. citability and PI access restrictions. This may point to a World Wide Web page specifying the rules of use.

Skeleton_version --- optional
This is a text attribute containing the skeleton file version number. This is a required attribute for Cluster, but for IACG purposes it exists if experimenters want to track it.

Software_version --- optional
This is a required attribute for Cluster, but for IACG purposes it exists if experimenters want to track it.

Source_name --- required
This attribute identifies the mission or investigation that contains the sensors. For ISTP, this is the mission name for spacecraft missions or the investigation name for ground-based or theory investigations. Both a long name and a short name are provided. This attribute should be single valued. Examples:

- *"GEOTAIL>Geomagnetic Tail"*
- *"WIND>Wind Interplanetary Plasma Laboratory"*
- *"GOES_7>Geostationary Operational Environmental Satellite 7"*
- *"IMP-8>Interplanetary Monitoring Platform"*
- *"LANL1989_046>Los Alamos National Laboratory 1989"*
- *"C1>Cluster Satellite No 1".*

TEXT --- required
This attribute is an NSSDC standard global attribute which is a text description of the experiment whose data is included in the CDF. A reference to a journal article(s) or to a World Wide Web page describing the experiment is essential, and constitutes the minimum requirement. A written description of the data set is also desirable. This attribute can have as many entries as necessary to contain the desired information.

Time_resolution --- required
specifies time resolution of the file in seconds, e.g., "3 seconds".

TITLE --- optional
This attribute is an NSSDC standard global attribute which is a title for the data set, e.g., " POLAR CEPPAD High Resolution Data".

Validate --- optional
Details to be specified. This attribute is written by software for automatic validation of features such as the structure of the CDF file on a simple pass/fail criterion. The software will test that all expected attributes are present and, where possible, have reasonable values. The syntax is likely to be of the form "test>result>where-done>date". It is not the same as data validation.

II.3 Variables

In this section we *define data variables, support_data variables, and metadata variables including their dimensionality and what is needed for their correct display.* The list of variables is provided below, note that it is not limited to, one can decide to add more variables if needed for his own applications (e.g. housekeeking).

We have identified three types of variables to be included in ISTP/IACG CDF files: ***data*** *variables of primary importance (e.g., particle_flux),* ***support_data*** *variables of secondary importance (e.g., time, energy_bands associated with particle_flux) and* ***metadata*** *variables (e.g., a variable holding "xGEO,yGEO,xGEO" to label spacecraft position). Variables are defined with CDF specifications and required attributes. Data variables also have attached variables for time and dependencies (support_data) and labels (metadata). The support_data variables can be attached to data variables via DEPEND_i variable attributes. Metadata variables can be attached to data variables via LABL_PTR_i variable attributes (see below).*

NOTE: *ISTP/IACG now encourages the use of zVariables which carry their own dimensionality.*

The complete variable description is provided next.

II.3.1 Data

These are variables of primary importance (e.g., particle_flux). Data variables are completely defined with the combination of CDF specifications, variable attributes, and attached variables such as time and dependencies (support_data) and labels (metadata).
One of the goal of these guidelines is to use the same variable names accross spacecraft/instruments to ease data exhange and software development. Note that having the same data type throughout all spacecraft/instrument is highly recommended, i.e. all real variables are CDF_REAL4 and all integer variables are CDF_INT2. This variable types guaranty enough precision for the quantities stored in the cdf files.

The following CDF variable specifications are required.

Data is always either Real or Integer type. Data is always time (record) varying, but can be of any dimensionality. Real or Integer data are always defined as having one element. In order to not make huge files, requiring large data space or large memory we suggest to use only REAL4 and INT2 data type. This provides enough precision for particle measurements and associated geographic and magnetic parameters.
The following variable attributes are required. See section II.3 for more details.

- *AVG_TYPE*
- *CATDESC*
- *DEPEND_0 = Epoch*
- *DEPEND_i*
- *DICT_KEY*
- *DISPLAY_TYPE (time_series, spectrogram, stack_plot,image)*
- *FIELDNAM*
- *FILLVAL*
- *FORMAT/FORM_PTR*
- *LABLAXIS/LABL_PTR_i*
- *QUALITY_VAR*
- *UNITS/UNIT_PTR*
- *SI_conversion*
- *VALIDMIN*
- *VALIDMAX*
- *VAR_TYPE = data*

The need for DEPEND_i (other than DEPEND_0) and either LABLAXIS or LABL_PTR_i depends on the data itself and how it will be displayed.

The following variable attributes are recommended:

- *SCALETYP (linear or log)*
- *VAR_NOTES*

The list of variables that must be present in cdf files is the following:

- Position: Position is a three-dimentional variable which provide spacecraft position in geographic cartesian coordinates – Units: km. Var type = CDF_REAL4

- B_Calc: Calculated magnetic field strength where the internal field being DGRF/IGRF and the external field being Olson-Pfitzer quiet magnetic field models – Units: nT. Var type = CDF_REAL4

- B_Eq: Calculated magnetic field strength at magnetic equator where the internal field being DGRF/IGRF and the external field being Olson-Pfitzer quiet magnetic field models – Units: nT. Var type = CDF_REAL4

- L: Calculated L McIlwain's L parameter where the internal field being DGRF/IGRF and the external field being Olson-Pfitzer quiet magnetic field models. Var type = CDF_REAL4

- L_star: Calculated Roederer's L* parameter where the internal field being DGRF/IGRF and the external field being Olson-Pfitzer quiet magnetic field models. Var type = CDF_REAL4
- I: Calculated adiabatic invariant (second invariant) where the internal field being DGRF/IGRF and the external field being Olson-Pfitzer quiet magnetic field models. Full definition of I can be found in Roederer, J. G., Dynamics of the geomagnetically trapped radiation, Springer New York, pp. 48, 1970. Var type = CDF_REAL4
- MLT: Calculated Magnetic Local Time – Units: hours. Var type = CDF_REAL4
- Alpha: Local pitch angle the instrument is looking at (often assume to be 90° for large viewing angle – omni-directional instrument) – Units: degrees. Var type = CDF_REAL4
- Alpha_Eq: Computed equatorial pitch angle the instrument is looking from Alpha, B_Calc and B_Eq – Units: degrees. Var type = CDF_REAL4

Now depending on what the instrument is measuring the following variables described next have to be present. Note that if directional fluxes are available omni-directional fluxes should be added and computed from directional fluxes: $J = \frac{\int_0^{pi} j \cdot \sin\alpha \cdot d\alpha}{\int_0^{pi} \sin\alpha \cdot d\alpha}$, the resulting omni-flux being per-steradian to ease inter-comparisons with others instruments which have different field of view.

	Var name	Description	Unit	Var type	Dependence to support data
Omni-directional differential channels	FPDO	Omni-directional Differential Proton Flux	MeV^{-1} cm^{-2} s^{-1} sr^{-1}	CDF_REAL4	DEPEND_0=Epoch DEPEND_1=FPDO_Energy
	FEDO	Omni-directional Differential Electron Flux	MeV^{-1} cm^{-2} s^{-1} sr^{-1}	CDF_REAL4	DEPEND_0=Epoch DEPEND_1=FEDO_Energy
	FADO	Omni-directional Differential Alpha Flux	MeV^{-1} cm^{-2} s^{-1} sr^{-1}	CDF_REAL4	DEPEND_0=Epoch DEPEND_1=FADO_Energy
	FIDO	Omni-directional Differential Heavy Ion Flux (to be used when the	MeV^{-1} cm^{-2} s^{-1} sr^{-1}	CDF_REAL4	DEPEND_0=Epoch DEPEND_1=FIDO_Energy

		specie is not resolved)			
	FHeDO	Flux helium differential omni-directional (to be used if the charge state is unknown)	MeV^{-1} cm^{-2} s^{-1} sr^{-1}	CDF_REAL4	DEPEND_0=Epoch DEPEND_1=FHeDO_Energy
	FHe1DO	Flux helium differential omni-directional if its charge state +1	MeV^{-1} cm^{-2} s^{-1} sr^{-1}	CDF_REAL4	DEPEND_0=Epoch DEPEND_1=FHe1DO_Energy
	FHe2DO	Flux helium differential omni-directional if its charge state +2 (same as FADO)	MeV^{-1} cm^{-2} s^{-1} sr^{-1}	CDF_REAL4	DEPEND_0=Epoch DEPEND_1=FHe2DO_Energy
	F*#DO	Omni-directional flux for specie=* and charge state=#. * is the element symbol (e.g. C,N, O, Fe)	MeV^{-1} cm^{-2} s^{-1} sr^{-1}	CDF_REAL4	DEPEND_0=Epoch DEPEND_1=F*#DO_Energy
Omni-directional integral channels	FPIO	Omni-directional Integral Proton Flux	cm^{-2} s^{-1} sr^{-1}	CDF_REAL4	DEPEND_0=Epoch DEPEND_1=FPIO_Energy
	FEIO	Omni-directional Integral Electron Flux	cm^{-2} s^{-1} sr^{-1}	CDF_REAL4	DEPEND_0=Epoch DEPEND_1=FEIO_Energy
	FAIO	Omni-directional Integral Alpha Flux	cm^{-2} s^{-1} sr^{-1}	CDF_REAL4	DEPEND_0=Epoch DEPEND_1=FAIO_Energy
	FIIO	Omni-directional Integral Heavy Ion Flux (to be used when the specie is not	cm^{-2} s^{-1} sr^{-1}	CDF_REAL4	DEPEND_0=Epoch DEPEND_1=FIIO_Energy

		resolved)			
	FHeIO	Flux helium Integral omni-directional (to be used if the charge state is unknown)	$cm^{-2}\ s^{-1}\ sr^{-1}$	CDF_REAL4	DEPEND_0=Epoch DEPEND_1=FHeIO_Energy
	FHe1IO	Flux helium Integral omni-directional if its charge state +1	$cm^{-2}\ s^{-1}\ sr^{-1}$	CDF_REAL4	DEPEND_0=Epoch DEPEND_1=FHe1IO_Energy
	FHe2IO	Flux helium Integral omni-directional if its charge state +2 (same as FADO)	$cm^{-2}\ s^{-1}\ sr^{-1}$	CDF_REAL4	DEPEND_0=Epoch DEPEND_1=FHe2IO_Energy
	F*#IO	Omni-directional Integral flux for specie=* and charge state=#. * is the element symbol (e.g. C,N, O, Fe)	$cm^{-2}\ s^{-1}\ sr^{-1}$	CDF_REAL4	DEPEND_0=Epoch DEPEND_1=F*#IO_Energy
Directional differential channels	FPDU	Directional Differential Proton Flux	$MeV^{-1}\ cm^{-2}\ s^{-1}\ sr^{-1}$	CDF_REAL4	DEPEND_0=Epoch DEPEND_1=FPDU_Energy DEPEND_2=FPDU_Alpha
	FEDU	Directional Differential Electron Flux	$MeV^{-1}\ cm^{-2}\ s^{-1}\ sr^{-1}$	CDF_REAL4	DEPEND_0=Epoch DEPEND_1=FEDU_Energy DEPEND_2=FEDU_Alpha
	FADU	Directional Differential Alpha Flux	$MeV^{-1}\ cm^{-2}\ s^{-1}\ sr^{-1}$	CDF_REAL4	DEPEND_0=Epoch DEPEND_1=FADU_Energy DEPEND_2=FADU_Alpha
	FIDU	Directional Differential Heavy Ion Flux (to be used when the specie is not resolved)	$MeV^{-1}\ cm^{-2}\ s^{-1}\ sr^{-1}$	CDF_REAL4	DEPEND_0=Epoch DEPEND_1=FIDU_Energy DEPEND_2=FIDU_Alpha
	FHeDU	Flux helium differential directional (to be used if the	$MeV^{-1}\ cm^{-2}\ s^{-1}\ sr^{-1}$	CDF_REAL4	DEPEND_0=Epoch DEPEND_1=FHeDU_Energy DEPEND_2=FHeDU_Alpha

		charge state is unknown)			
	FHe1DU	Flux helium differential directional if its charge state +1	MeV^{-1} cm^{-2} s^{-1} sr^{-1}	CDF_REAL4	DEPEND_0=Epoch DEPEND_1=FHe1DU_Energy DEPEND_2=FHe1DU_Alpha
	FHe2DU	Flux helium differential directional if its charge state +2 (same as FADO)	MeV^{-1} cm^{-2} s^{-1} sr^{-1}	CDF_REAL4	DEPEND_0=Epoch DEPEND_1=FHe2DU_Energy DEPEND_2=FHe2DU_Alpha
	F*#DU	Directional flux for specie=* and charge state=#. * is the element symbol (e.g. C,N, O, Fe)	MeV^{-1} cm^{-2} s^{-1} sr^{-1}	CDF_REAL4	DEPEND_0=Epoch DEPEND_1=F*#DU_Energy DEPEND_2=F*#DU_Alpha
Omni-directional integral channels	FPIU	Directional Integral Proton Flux	cm^{-2} s^{-1} sr^{-1}	CDF_REAL4	DEPEND_0=Epoch DEPEND_1=FPIU_Energy DEPEND_2=FPIU_Alpha
	FEIU	Directional Integral Electron Flux	cm^{-2} s^{-1} sr^{-1}	CDF_REAL4	DEPEND_0=Epoch DEPEND_1=FEIU_Energy DEPEND_2=FEIU_Alpha
	FAIU	Directional Integral Alpha Flux	cm^{-2} s^{-1} sr^{-1}	CDF_REAL4	DEPEND_0=Epoch DEPEND_1=FAIU_Energy DEPEND_2=FAIU_Alpha
	FIIU	Directional Integral Heavy Ion Flux (to be used when the specie is not resolved)	cm^{-2} s^{-1} sr^{-1}	CDF_REAL4	DEPEND_0=Epoch DEPEND_1=FIIU_Energy DEPEND_2=FIIU_Alpha
	FHeIU	Flux helium Integral directional (to be used if the charge state is unknown)	cm^{-2} s^{-1} sr^{-1}	CDF_REAL4	DEPEND_0=Epoch DEPEND_1=FHeIU_Energy DEPEND_2=FHeIU_Alpha
	FHe1IU	Flux helium Integral directional if its charge state +1	cm^{-2} s^{-1} sr^{-1}	CDF_REAL4	DEPEND_0=Epoch DEPEND_1=FHe1IU_Energy DEPEND_2=FHe1IU_Alpha
	FHe2IU	Flux helium	cm^{-2} s^{-1}	CDF_REAL4	DEPEND_0=Epoch

		Integral directional if its charge state +2 (same as FADO)	sr^{-1}		DEPEND_1=FHe2IU_Energy DEPEND_2=FHe2IU_Alpha
	F*#IU	Directional Integral flux for specie=* and charge state=#. * is the element symbol (e.g. C,N, O, Fe)	$cm^{-2}\ s^{-1}\ sr^{-1}$	CDF_REAL4	DEPEND_0=Epoch DEPEND_1=F*#U_Energy DEPEND_2=F*#U_Alpha

To make thinks even more general, flux for any measurements can be provided from a fit function which can depend on several parameters. Then the logic to store such measurements into common cdf file format is only composed of metadata and support data. So in this case the coresponding guidelines are provided in the support data and metadata sections.

II.3.2 Support_Data

These are variables of secondary importance (e.g., time, energy, energy_bands, pitch-angle, pitch-angle band associated with particle_flux, Quality_flags) .

The following CDF variable specifications are required.
Support_data is always either Real or Integer type. Support_data is usually time invariant, but can be time varying.
If a support_data variable is attached to a data variable via DEPEND_i, then it must be of the same size as the dimension i. Real or Integer support data are always defined as having one element.
The following variable attributes are required:

- *CATDESC*
- *DICT_KEY*
- *DEPEND_0 = Epoch (if time varying)*
- *FIELDNAM*
- *FILLVAL (if time varying)*
- *FORMAT/FORM_PTR*
- *LABLAXIS/LABL_PTR_i*
- *SI_conversion*
- *UNITS/UNIT_PTR*
- *VALIDMIN (if time varying)*
- *VALIDMAX (if time varying)*
- *VAR_TYPE = support_data*

The following variable attributes are recommended:

- *VAR_NOTES*

The list of support data that must be present in cdf files is the following (other support data may be added is needed):

- Epoch: *"Epoch" should be the first variable in each CDF data set. All time varying variables in the CDF data set will depend on the "Epoch" variable (or on a CDF_EPOCH type variable) - more than one CDF_EPOCH type variable is allowed in a data set to allow for more than one time resolution. For ISTP the time value of a record refers to the center of the accumulation period for the record if the measurement is not an instantaneous one. Epoch allows for a scalar representation of time which provides for seamless crossings of day and year boundaries. Epoch time is simply the time in milliseconds A.D. CDF toolkit programs will display and expect CDF_EPOCH values in the format dd-mmm-yyyy hh:mm:ss.ccc where dd is the day of the month, mmm is the month, yyyy is the year, hh is the hour, mm is the minute, ss is the second and ccc is the millisecond (e.g., 01-Aug-1992 10:30:05.025). "Epoch" will be monotonically increasing so that the attribute MONOTON should be defined as "INCREASE". (Note: All CDF data sets using the Epoch variable should use the subroutines provided in the CDF toolkit for making the conversion between this value and year, month, day, etc. These routines are available as black boxes from NSSDC. To determine Epoch time it is only necessary to call the subroutine compute_Epoch(year, month, day, hour, minute, second, msec, Epoch) with arguments as shown.for making the conversion between this value and year, month, day, etc. This ensures that all users use the same conversion when generating their CDF data sets and will therefore have the same view of the effects of the various calendar changes that have occurred over the last two thousand years.)* . Var type = CDF_EPOCH

- Position_Quality: Position Quality Flag – time dependent (0 means highest quality, 1 means bad quality) . Var type = CDF_INT2

- Support data for omnidirectional flux (F*#$0), where *=specie, #=charge state and $=D for differential channels or $=I for integral channels.

    - F*#$O_Energy: Energy levels for F*#$O fluxes – Units: MeV. Var type = CDF_REAL4. Must be a 1D array, time independent because F*#$O depend on F*#$O_Energy. So the central energy is given here ($E = \sqrt{E_{\min} * E_{\max}}$). If energy band is known then it is recommended to add another support data described next, in order to not loose details of measurement.

    - F*#DO_EnergyRange: Energy range levels for F*#DO fluxes – Units: MeV. Var type = CDF_REAL4. Must be a 2D variable [2, number of channels]. This support data does not apply for integral channels.

    - F*#$O_Quality: Quality Flag for F*#$O fluxes – time dependent (0 denotes highest quality, 1 denotes problem with time resolution, 2 denotes contamination, 3 denotes saturation, 4 denotes any other problem, 5

denotes background and 10 is the default values while data have not been yet filtered). Var type = CDF_INT2

- F*#$O_Crosscalib: Intercalibration values for F*#$O fluxes. Var type = CDF_REAL4
- Example for omnidirectional differental proton channels: FPDO_Energy, FPDO_EnergyRange, FPDO_Quality and FPDO_Crosscalib

- Support data for directional flux (F*#$U), where *=specie, #=charge state and $=D for differential channels or $=I for integral channels.
  - F*#$U_Energy: Energy levels for F*#$U fluxes – Units: MeV. Var type = CDF_REAL4. Must be a 1D array, time independent because F*#$U depend on F*#$U_Energy. So the central energy is given here ($E = \sqrt{E_{\min} * E_{\max}}$). If energy band is known then it is recommended to add another support data described next, in order to not loose details of measurement.
  - F*#DU_EnergyRange: Energy range levels for F*#DU fluxes – Units: MeV. Var type = CDF_REAL4. Must be a 2D array [2, number of channels]. This support data does not apply for integral channels.
  - F*#$U_Alpha: Local pitch-angles for F*#$U fluxes – Units: Degree. Var type = CDF_REAL4. Must be a 1D array, time independent because F*#$U depend on F*#$U_Alpha. So the central pitch-angle is given here. If pitch-angle band is known then it is recommended to add another support data described next, in order to not loose details of measurement.
  - F*#$U_AlphaRange: Local pitch-angles range for F*#$U fluxes – Units: Degree. Var type = CDF_REAL4. Must be a 2D array [2, number of pitch-angle channels].
  - F*#$U_Alpha_Eq: Equatorial pitch-angles for F*#$U fluxes – Units: Degree. Var type = CDF_REAL4. Must be a 1D array + time dependent. So it corresponds to the central local pitch-angle described above.
  - F*#$U_Quality: Quality Flag for F*#$U fluxes – time dependent (0 denotes highest quality, 1 denotes problem with time resolution, 2 denotes contamination, 3 denotes saturation, 4 denotes any other problem, 5 denotes background and 10 is the default values while data have not been yet filtered). Var type = CDF_INT2
  - F*#$U_Crosscalib: Intercalibration values for F*#$U fluxes. Var type = CDF_REAL4
  - Example for directional differental proton channels: FPDU_Energy, FPDU_EnergyRange, FPDU_Alpha, FPDU_AlphaRange, FPDU_Quality and FPDU_Crosscalib

The list of support data that are recomended in cdf files is the following:

- Optional support data for omnidirectional flux (F*#$0), where *=specie, #=charge state and $=D for differential channels or $=I for integral channels.
    - F*#$O_Crosscalib_RMSE: RMS error of the natural log of the flux for each channel, from calibration against a gold standard and/or counts-to-flux inversion for F*#$O fluxes. Var type = CDF_REAL4
- Optional support data for directional flux (F*#$U), where *=specie, #=charge state and $=D for differential channels or $=I for integral channels.
    - F*#$U_Crosscalib_RMSE: RMS error of the natural log of the flux for each channel, from calibration against a gold standard and/or counts-to-flux inversion for F*#$U fluxes. Var type = CDF_REAL4

When flux for any measurements are computed from a fit function which can depend on several parameters the following support data must be present (note that FFEDO stands for Omnidirectional Differential Electron Flux Fit, FFEIO stands for Omnidirectional Integral Electron Flux Fit, FFPDO stands for Omnidirectional Differential Proton Flux Fit, FFPIO stands for Omnidirectional Integral Proton Flux Fit):

- FFEDO_Energy_Range: Energy range within which the fit function (provided in the metadata FFEDO) can be evaluated – Units: MeV. Var type = CDF_REAL4
- FFEDO_Parameter: Parameters to evaluate the fit function FFEDO – time dependent (this is an array where the number of dimension as the size of the number of input parameters for the fit function). Var type = CDF_REAL4
- FFEDO_Quality: Quality flag for the fit function FFEDO. The use of the quality flag must be precised in the VAR_NOTES attribute. Var type = CDF_REAL4
- FFEIO_Energy_Range: Energy range within which the fit function (provided in the metadata FFEIO) can be evaluated – Units: MeV. Var type = CDF_REAL4
- FFEIO_Parameter: Parameters to evaluate the fit function FFEIO – time dependent (this is an array where the number of dimension as the size of the number of input parameters for the fit function). Var type = CDF_REAL4
- FFEIO_Quality: Quality flag for the fit function FFEIO. The use of the quality flag must be precised in the VAR_NOTES attribute. Var type = CDF_REAL4
- FFPDO_Energy_Range: Energy range within which the fit function (provided in the metadata FFPDO) can be evaluated – Units: MeV. Var type = CDF_REAL4
- FFPDO_Parameter: Parameters to evaluate the fit function FFPDO – time dependent (this is an array where the number of dimension as the size of the number of input parameters for the fit function) . Var type = CDF_REAL4

- FFPDO_Quality: Quality flag for the fit function FFPDO. The use of the quality flag must be precised in the VAR_NOTES attribute. Var type = CDF_REAL4
- FFPIO_Energy_Range: Energy range within which the fit function (provided in the metadata FFPIO) can be evaluated – Units: MeV. Var type = CDF_REAL4
- FFPIO_Parameter: Parameters to evaluate the fit function FFPIO – time dependent (this is an array where the number of dimension as the size of the number of input parameters for the fit function) . Var type = CDF_REAL4
- FFPIO_Quality: Quality flag for the fit function FFPIO. The use of the quality flag must be precised in the VAR_NOTES attribute. Var type = CDF_REAL4

II.3.3 Metadata

These are variables of secondary importance e.g., a variable holding "xGEO,yGEO,zGEO" to label spacecraft position.
The following CDF variable specifications are required.
Metadata is always character type. Metadata is always time invariant if it is used to label a data variable. Metadata can be time varying if it is NOT used as a label.
If a metadata variable is attached to a data variable via LABL_PTR_i, then it must be of the same size as the dimension i.
Character metadata must define the number of elements to be the same as the number of characters used in its value.
The following variable attributes are required.

- *CATDESC*
- *DICT_KEY*
- *FIELDNAM*
- *FORMAT/FORM_PTR*
- *VAR_TYPE = metadata*

The list of metadata that must be present in cdf files is the following:

- Position_LABL_1: Position variable labels. Var type = CDF_CHAR
- Metadata for flux data:
  - F*#$O_LABL_1: Energy labels for F*#$O fluxes. Var type = CDF_CHAR or F*#$U_LABL_1 in case of directional fluxes.
  - F*#$U_LABL_2: Local pitch-angle labels for F*#$U fluxes. Var type = CDF_CHAR. This metadta only apply for directional fluxes.

When flux for any measurements are computed from a fit function which can depend on several parameters the following metadata must be present (note that FFEDO stands for Omnidirectional Differential Electron Flux Fit, FFEIO stands for Omnidirectional Integral

Electron Flux Fit, FFPDO stands for Omnidirectional Differential Proton Flux Fit, FFPIO stands for Omnidirectional Integral Proton Flux Fit), (The variable names can be extended to any specie and charge state following the nomenclature used before in this document):

- FFEDO: Omnidirectional Differential Electron Flux Fit. This metadata has the string type and describe in IDL language the fit function. The use in the formula of Ek for the kinetic energy in MeV is highly recommended and also the variable name FFEDO_Parameter(0), FFEDO_Parameter(1), ... Note that the flux unit should be provided in #/(MeV cm^2 s sr). Var type = CDF_CHAR

- FFEIO: Omnidirectional Integral Electron Flux Fit. This metadata has the string type and describe in IDL language the fit function. The use in the formula of Ek for the kinetic energy in MeV is highly recommended and also the variable name FFEIO_Parameter(0), FFEIO_Parameter(1), ... Note that the flux unit should be provided in #/(cm^2 s sr) . Var type = CDF_CHAR

- FFPDO: Omnidirectional Differential Proton Flux Fit. This metadata has the string type and describe in IDL language the fit function. The use in the formula of Ek for the kinetic energy in MeV is highly recommended and also the variable name FFPDO_Parameter(0), FFPDO_Parameter(1), ... Note that the flux unit should be provided in #/(MeV cm^2 s sr) . Var type = CDF_CHAR

- FFPIO: Omnidirectional Integral Proton Flux Fit. This metadata has the string type and describe in IDL language the fit function. The use in the formula of Ek for the kinetic energy in MeV is highly recommended and also the variable name FFPIO_Parameter(0), FFPIO_Parameter(1), ... Note that the flux unit should be provided in #/(cm^2 s sr) . Var type = CDF_CHAR

III. Reading the cdf files

In this section, the logic to read the cdf files, and to take advantages of all information in there is provided. The logic is provided here for Omni-directional Differential Electron Flux but it can be easily extented to any type of flux provided in the files.

1- Retrieve FEDO flux variables. This variable should contain original data provided by the PI and should not have been modified at all. This guaranty that anyone can re-plot the data as he has provided them without any extra modification. Retrieve the UNITS attribute for FEDO will provide the flux units.
2- Retrieve FEDO_Energy. This support_data should contain the energy ranges for all channels provided in FEDO. Retrieve the UNITS attribute for FEDO_Energy will provide the energy units.
3- Retrieve FEDO_LABL_1. This metadata should contain the energy labels provided as strings.
4- Retrieve FEDO_Quality. This support_data should contain quality information for the data (FEDO) and allows any future user to filter the data according to the data quality he wants. Note that the safer being to filter the data when FEDO_Quality is set to 0.

5- Retrieve FEDO_Crosscalib. This support_data should contain inter-calibration factor to apply to each FEDO in order to ensure that all data accross all spacecraft/instrument are consistent. Flux=FEDO*FEDO_Crosscalib.

Now the logic is provided for Omni-directional Differential Electron Flux Fit (FFEDO) but it can be easily extented to any type of flux fit provided in the files.

1- Retrieve FFEDO flux fit function. This metadata should contain the IDL fit function. Retrieve the UNITS attribute for FFEDO will provide the flux units.
2- Retrieve FFEDO_Energy_Range. This support_data should contain the energy ranges within which the fit function can be evaluated. Retrieve the UNITS attribute for FFEDO_Energy_Range will provide the energy units.
3- Retrieve FFEDO_Parameter. This support_data should contain the parameters needed to evaluate the fit function. It is recommended to retrieve this support data under the name FFEDO_Parameter as it should appear in the FFEDO formula.
4- Retrieve FFEDO_Quality. This support_data should contain information on how far can we believe in the fit function. This support_data should allow to filter only times when the fit is accurate and therefore ensure a good use of the evaluated flux.
5- If step 1 to 4 have been followed properly then it should be straiforward to evaluate FFEDO fit function with IDL just setting an array of energy at which the fluxes have to be computed (Ek).

IV. Exemple

In this exemple we provide a skeleton table for POLAR CEPPAD data where there are electron and proton data, omni-directional and directional data.

```
! Skeleton table for the "POLAR_H0_CEPPAD_20070312_V02.cdf" CDF.
! Generated: Monday, 9-Jan-2012 16:43:40
! CDF created/modified by CDF V3.2.1
! Skeleton table created by CDF V3.3.0

#header

                     CDF NAME: POLAR_H0_CEPPAD_20070312_V02.cdf
                 DATA ENCODING: NETWORK
                     MAJORITY: ROW
                       FORMAT: SINGLE

! Variables  G.Attributes  V.Attributes  Records  Dims  Sizes
! ---------  ------------  ------------  -------  ----  -----
    0/48          27            25         0/z      0


#GLOBALattributes

! Attribute         Entry       Data
! Name              Number      Type        Value
! ---------         ------      ----        -----

  "Project"             1:    CDF_UCHAR    { "ISTP>International " -
                                             "Solar-Terrestrial Physics" }
.

  "Source_name"         1:    CDF_UCHAR    { "POLAR>Polar" } .
```

```
  "Discipline"          1:    CDF_UCHAR    { "Space " -
                                             "Physics>Magnetospheric " -
                                             "Physics" } .

  "Data_type"           1:    CDF_UCHAR    { "H0>High Time Resolution" } .

  "Descriptor"          1:    CDF_UCHAR    { "CEPPAD>Comprehensive " -
                                             "Energetic Particle and " -
                                             "Pitch Angle Distribution" } .

  "Data_version"        1:    CDF_CHAR     { "02" } .

  "PI_name"             1:    CDF_UCHAR    { "J. Bernard Blake " -
                                             "(JBernard.Blake@aero.org)" }
.
  "PI_affiliation"      1:    CDF_UCHAR    { "The Aerospace Corporation" }
.
  "TEXT"                1:    CDF_UCHAR    { "CEPPAD is the energetic " -
                                             "particle suite flown on " -
                                             "the NASA POLAR satellite " -
                                             "consiting of the IES, IPS " -
                                             "and HIST detectors, " -
                                             "covering electrons and " -
                                             "protons from 10s of Kev to" -
                                             " several MEV. Details are " -
                                             "given in  J. B Blake et " -
                                             "al., CEPPAD: Comprehensive" -
                                             " energetic particle and " -
                                             "pitch angle distribution " -
                                             "experiment on Polar. Space" -
                                             " Sci. Rev., 71, 531-562, " -
                                             "1995. The instruments are " -
                                             "Solid State Energetic " -
                                             "Particle Telescopes " -
                                             "(space)" } .

  "Instrument_type"     1:    CDF_UCHAR    { "Particles (space)" } .

  "Mission_group"       1:    CDF_UCHAR    { "POLAR" } .

  "Logical_source"      1:    CDF_UCHAR    { "POLAR_H0_CEPPAD" } .

  "Logical_file_id"     1:    CDF_CHAR     { "POLAR_H0_CEPPAD_20070312_V02"
} .

  "Logical_source_description"
                        1:    CDF_UCHAR    { "High resolution energetic " -
                                             "particle data from the " -
                                             "CEPPAD instrument onboard " -
                                             "the NASA Polar satellite" } .

  "Time_resolution"     1:    CDF_UCHAR    { "24 seconds" } .

  "Rules_of_use"        1:    CDF_UCHAR    { "Distribute freely." } .

  "Generated_by"        1:    CDF_UCHAR    { "LANL" } .

  "Generation_date"     1:    CDF_UCHAR    { "20071207" } .

  "Acknowledgement"     1:    CDF_UCHAR    { "acknowledge PAPCO and " -
                                             "ONERA/DESP Mag Library " -
                                             "(Reiner Friedel, Josef " -
                                             "Koller at LANL; Sebastien " -
```

```
                                                    "Bourdarie at ONER) and " -
                                                    "original PI. Please " -
                                                    "contact PI before any " -
                                                    "publication or " -
                                                    "presentation of data." } .

  "MODS"                  1:    CDF_UCHAR     { "20071207 Automatic " -
                                                  "generation" }
                          2:    CDF_CHAR      { "20100329 file modifed to " -
                                                  "make it fully ISTP " -
                                                  "compliant" }
                          3:    CDF_CHAR      { "20110120 Lstar corrected" } .

  "ADID_ref"              1:    CDF_UCHAR     { "NSSD0110" } .

  "LINK_TEXT"             1:    CDF_UCHAR     { "Cammice, Ceppad and Rapid " -
                                                  "Web Page" } .

  "LINK_TITLE"            1:    CDF_UCHAR     { "CCR Home Page" } .

  "HTTP_LINK"             1:    CDF_UCHAR     { "http://leadbelly.lanl.gov/" -
                                                  "ccr/" } .

  "Parents"               1:    CDF_UCHAR     { "none" } .

  "Planet"                1:    CDF_CHAR      { "Earth" } .

  "Generated_with_software"
                          1:    CDF_CHAR      { "IRBEM-lib release 0295" } .

#VARIABLEattributes

  "AVG_TYPE"
  "CATDESC"
  "DEPEND_0"
  "DEPEND_1"
  "DEPEND_2"
  "DICT_KEY"
  "DISPLAY_TYPE"
  "V_PARENT"
  "FIELDNAM"
  "FILLVAL"
  "FORM_PTR"
  "FORMAT"
  "LABLAXIS"
  "LABL_PTR_1"
  "QUALITY_VAR"
  "SCAL_PTR"
  "SCALETYP"
  "SI_conversion"
  "UNITS"
  "UNIT_PTR"
  "VALIDMIN"
  "VALIDMAX"
  "VAR_TYPE"
  "VAR_NOTES"
  "LABL_PTR_2"


#variables

! No rVariables.


#zVariables
```

```
! Variable          Data      Number                  Record   Dimension
! Name              Type     Elements  Dims  Sizes  Variance  Variances
! --------          ----     --------  ----  -----  --------  ---------

  "Epoch"         CDF_EPOCH      1       0             T

  ! Attribute       Data
  ! Name            Type       Value
  ! --------        ----       -----

    "CATDESC"     CDF_UCHAR    { "Default time" }
    "DICT_KEY"    CDF_CHAR     { "time>Epoch" }
    "FIELDNAM"    CDF_UCHAR    { "Epoch" }
    "FILLVAL"     CDF_EPOCH    { 31-Dec-9999 23:59:59.999 }
    "SCALETYP"    CDF_UCHAR    { "linear" }
    "SI_conversion"
                  CDF_UCHAR    { "1.0e3>s" }
    "UNITS"       CDF_UCHAR    { "ms" }
    "VALIDMIN"    CDF_EPOCH    { 01-Jan-1950 00:00:00.000 }
    "VALIDMAX"    CDF_EPOCH    { 31-Dec-2100 23:59:59.999 }
    "VAR_TYPE"    CDF_UCHAR    { "support_data" }
    "VAR_NOTES"   CDF_UCHAR    { "Epoch, UT" } .

  ! RV values were not requested.


! Variable          Data      Number                  Record   Dimension
! Name              Type     Elements  Dims  Sizes  Variance  Variances
! --------          ----     --------  ----  -----  --------  ---------

  "Position"      CDF_REAL4      1       1     3        T         T

  ! Attribute       Data
  ! Name            Type       Value
  ! --------        ----       -----

    "AVG_TYPE"    CDF_UCHAR    { "standard" }
    "CATDESC"     CDF_CHAR     { "Position of the satellite in " -
                                 "geographic coordinates" }
    "DEPEND_0"    CDF_UCHAR    { "Epoch" }
    "DICT_KEY"    CDF_CHAR     { "position>geographic_cartesian_vector" }
    "DISPLAY_TYPE"
                  CDF_UCHAR    { "time_series" }
    "FIELDNAM"    CDF_UCHAR    { "Satellite position (GEO)" }
    "FILLVAL"     CDF_FLOAT    { -1.0e+31 }
    "FORMAT"      CDF_UCHAR    { "F6.3" }
    "LABL_PTR_1"  CDF_UCHAR    { "Position_LABL_1" }
    "SCALETYP"    CDF_UCHAR    { "linear" }
    "SI_conversion"
                  CDF_UCHAR    { "1.0e-3>m" }
    "UNITS"       CDF_UCHAR    { "km" }
    "VALIDMIN"    CDF_FLOAT    { -1.0e+31 }
    "VALIDMAX"    CDF_FLOAT    { 1.0e+31 }
    "VAR_TYPE"    CDF_UCHAR    { "data" }
    "VAR_NOTES"   CDF_UCHAR    { "Origin = Earths center of mass. X = " -
                                 "Intersection of Greenwich meridian and" -
                                 " geographic equator. Z = Geographic " -
                                 "North Pole. Y = completes a " -
                                 "right-handed Cartesian triad" } .

  ! RV values were not requested.


! Variable          Data      Number                  Record   Dimension
! Name              Type     Elements  Dims  Sizes  Variance  Variances
```

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

  "Position_LABL_1"
                    CDF_CHAR       4       1     3        F         T

  ! Attribute       Data
  ! Name            Type       Value
  ! --------        ----       -----

    "CATDESC"       CDF_UCHAR    { "Position labels" }
    "DICT_KEY"      CDF_CHAR     { "label>position" }
    "FIELDNAM"      CDF_UCHAR    { "Position_LABL_1" }
    "FORMAT"        CDF_UCHAR    { "A4" }
    "VAR_TYPE"      CDF_UCHAR    { "metadata" } .

  ! NRV values follow...

    [1] = { "Xgeo" }
    [2] = { "Ygeo" }
    [3] = { "Zgeo" }


! Variable          Data      Number                  Record   Dimension
! Name              Type     Elements  Dims  Sizes  Variance  Variances
! --------          ----     --------  ----  -----  --------  ---------

  "Position_Quality"
                    CDF_INT2       1       0              T

  ! Attribute       Data
  ! Name            Type       Value
  ! --------        ----       -----

    "CATDESC"       CDF_UCHAR    { "Position Quality flag" }
    "DEPEND_0"      CDF_UCHAR    { "Epoch" }
    "DICT_KEY"      CDF_UCHAR    { "flag>quality" }
    "FIELDNAM"      CDF_UCHAR    { "Position_Quality" }
    "FILLVAL"       CDF_INT2     { -32768 }
    "FORMAT"        CDF_UCHAR    { "I11" }
    "LABLAXIS"      CDF_UCHAR    { "Quality" }
    "UNITS"         CDF_UCHAR    { "none" }
    "VALIDMIN"      CDF_INT2     { 0 }
    "VALIDMAX"      CDF_INT2     { 1 }
    "VAR_TYPE"      CDF_UCHAR    { "support_data" }
    "VAR_NOTES"     CDF_UCHAR    { "0 denotes highest quality." } .

  ! RV values were not requested.


! Variable          Data      Number                  Record   Dimension
! Name              Type     Elements  Dims  Sizes  Variance  Variances
! --------          ----     --------  ----  -----  --------  ---------

  "B_Calc"          CDF_REAL4      1       0              T

  ! Attribute       Data
  ! Name            Type       Value
  ! --------        ----       -----

    "AVG_TYPE"      CDF_CHAR     { "standard" }
    "CATDESC"       CDF_UCHAR    { "Calculated magnetic field strength" }
    "DEPEND_0"      CDF_UCHAR    { "Epoch" }
    "DICT_KEY"      CDF_UCHAR    { "magnetic_field>amplitude" }
    "DISPLAY_TYPE"
                    CDF_UCHAR    { "time_series" }
    "FIELDNAM"      CDF_UCHAR    { "Magnetic field strength" }
```

```
    "FILLVAL"      CDF_FLOAT     { -1.0e+31 }
    "FORMAT"       CDF_UCHAR     { "E10.3" }
    "LABLAXIS"     CDF_UCHAR     { "B" }
    "SCALETYP"     CDF_UCHAR     { "linear" }
    "SI_conversion"
                   CDF_UCHAR     { "1.0e9>T" }
    "UNITS"        CDF_UCHAR     { "nT" }
    "VALIDMIN"     CDF_FLOAT     { 0.0 }
    "VALIDMAX"     CDF_FLOAT     { 1.0e+31 }
    "VAR_TYPE"     CDF_UCHAR     { "data" }
    "VAR_NOTES"    CDF_UCHAR     { "Calculated using ONERA-DESP library " -
                                   "Internal field: DGRF/IGRF External " -
                                   "field: Olson & Pfitzer quiet" } .

  ! RV values were not requested.


! Variable           Data       Number                    Record   Dimension
! Name               Type      Elements  Dims  Sizes    Variance  Variances
! --------           ----      --------  ----  -----    --------  ---------

  "B_Eq"           CDF_REAL4       1       0               T

  ! Attribute       Data
  ! Name            Type        Value
  ! --------        ----        -----

    "AVG_TYPE"     CDF_CHAR      { "standard" }
    "CATDESC"      CDF_UCHAR     { "Calculated magnetic field strength at " -
                                   "magnetic equator" }
    "DEPEND_0"     CDF_UCHAR     { "Epoch" }
    "DICT_KEY"     CDF_UCHAR     { "magnetic_field>amplitude" }
    "DISPLAY_TYPE"
                   CDF_UCHAR     { "time_series" }
    "FIELDNAM"     CDF_UCHAR     { "Equatorial magnetic field strength" }
    "FILLVAL"      CDF_FLOAT     { -1.0e+31 }
    "FORMAT"       CDF_UCHAR     { "E10.3" }
    "LABLAXIS"     CDF_UCHAR     { "B_Eq" }
    "SCALETYP"     CDF_UCHAR     { "linear" }
    "SI_conversion"
                   CDF_UCHAR     { "1.0e9>T" }
    "UNITS"        CDF_UCHAR     { "nT" }
    "VALIDMIN"     CDF_FLOAT     { 0.0 }
    "VALIDMAX"     CDF_FLOAT     { 1.0e+31 }
    "VAR_TYPE"     CDF_UCHAR     { "data" }
    "VAR_NOTES"    CDF_UCHAR     { "Calculated using ONERA-DESP library " -
                                   "Internal field: DGRF/IGRF External " -
                                   "field: Olson & Pfitzer quiet" } .

  ! RV values were not requested.


! Variable           Data       Number                    Record   Dimension
! Name               Type      Elements  Dims  Sizes    Variance  Variances
! --------           ----      --------  ----  -----    --------  ---------

  "L"              CDF_REAL4       1       0               T

  ! Attribute       Data
  ! Name            Type        Value
  ! --------        ----        -----

    "AVG_TYPE"     CDF_CHAR      { "standard" }
    "CATDESC"      CDF_UCHAR     { "Calculated McIlwains L parameter " -
                                   "(Earths radii)" }
    "DEPEND_0"     CDF_UCHAR     { "Epoch" }
```

```
    "DICT_KEY"     CDF_CHAR     { "magnetic_field>derived" }
    "DISPLAY_TYPE"
                   CDF_UCHAR    { "time_series" }
    "FIELDNAM"     CDF_UCHAR    { "McIlwains L parameter" }
    "FILLVAL"      CDF_FLOAT    { -1.0e+31 }
    "FORMAT"       CDF_UCHAR    { "E10.3" }
    "LABLAXIS"     CDF_UCHAR    { "L" }
    "SCALETYP"     CDF_UCHAR    { "linear" }
    "SI_conversion"
                   CDF_UCHAR    { "1.5696e-7>m" }
    "UNITS"        CDF_UCHAR    { "R_E" }
    "VALIDMIN"     CDF_FLOAT    { 0.0 }
    "VALIDMAX"     CDF_FLOAT    { 1.0e+31 }
    "VAR_TYPE"     CDF_UCHAR    { "data" }
    "VAR_NOTES"    CDF_UCHAR    { "Calculated using ONERA-DESP library " -
                                  "Internal field: DGRF/IGRF External " -
                                  "field: Olson & Pfitzer quiet" } .

  ! RV values were not requested.


! Variable          Data      Number                    Record   Dimension
! Name              Type     Elements  Dims  Sizes  Variance  Variances
! --------          ----     --------  ----  -----  --------  ---------

  "L_star"         CDF_REAL4      1       0              T

  ! Attribute       Data
  ! Name            Type       Value
  ! --------        ----       -----

    "AVG_TYPE"     CDF_CHAR     { "standard" }
    "CATDESC"      CDF_UCHAR    { "Calculated Roederers L* parameter " -
                                  "(Earths radii)" }
    "DEPEND_0"     CDF_UCHAR    { "Epoch" }
    "DICT_KEY"     CDF_CHAR     { "magnetic_field>derived" }
    "DISPLAY_TYPE"
                   CDF_UCHAR    { "time_series" }
    "FIELDNAM"     CDF_UCHAR    { "Roederers L* parameter" }
    "FILLVAL"      CDF_FLOAT    { -1.0e+31 }
    "FORMAT"       CDF_UCHAR    { "E10.3" }
    "LABLAXIS"     CDF_UCHAR    { "L*" }
    "SCALETYP"     CDF_UCHAR    { "linear" }
    "SI_conversion"
                   CDF_UCHAR    { "1.5696e-7>m" }
    "UNITS"        CDF_UCHAR    { "R_E" }
    "VALIDMIN"     CDF_FLOAT    { 0.0 }
    "VALIDMAX"     CDF_FLOAT    { 1.0e+31 }
    "VAR_TYPE"     CDF_UCHAR    { "data" }
    "VAR_NOTES"    CDF_UCHAR    { "Calculated using ONERA-DESP library " -
                                  "Internal field: DGRF/IGRF External " -
                                  "field: Olson & Pfitzer quiet" } .

  ! RV values were not requested.


! Variable          Data      Number                    Record   Dimension
! Name              Type     Elements  Dims  Sizes  Variance  Variances
! --------          ----     --------  ----  -----  --------  ---------

  "I"              CDF_REAL4      1       0              T

  ! Attribute       Data
  ! Name            Type       Value
  ! --------        ----       -----
```

```
    "AVG_TYPE"     CDF_CHAR     { "standard" }
    "CATDESC"      CDF_UCHAR    { "Adiabatic invariant (bounce)" }
    "DEPEND_0"     CDF_UCHAR    { "Epoch" }
    "DICT_KEY"     CDF_CHAR     { "magnetic_field>derived" }
    "DISPLAY_TYPE"
                   CDF_UCHAR    { "time_series" }
    "FIELDNAM"     CDF_UCHAR    { "Adiabatic invariant (bounce)" }
    "FILLVAL"      CDF_FLOAT    { -1.0e+31 }
    "FORMAT"       CDF_UCHAR    { "E10.3" }
    "LABLAXIS"     CDF_UCHAR    { "I" }
    "SCALETYP"     CDF_UCHAR    { "linear" }
    "SI_conversion"
                   CDF_UCHAR    { "none" }
    "UNITS"        CDF_UCHAR    { "none" }
    "VALIDMIN"     CDF_FLOAT    { 0.0 }
    "VALIDMAX"     CDF_FLOAT    { 1.0e+31 }
    "VAR_TYPE"     CDF_UCHAR    { "data" }
    "VAR_NOTES"    CDF_UCHAR    { "Calculated using ONERA-DESP library " -
                                  "Internal field: DGRF/IGRF External " -
                                  "field: Olson & Pfitzer quiet" } .

  ! RV values were not requested.


! Variable          Data      Number                  Record   Dimension
! Name              Type     Elements  Dims  Sizes  Variance  Variances
! --------          ----     --------  ----  -----  --------  ---------

  "MLT"           CDF_REAL4      1       0             T

  ! Attribute       Data
  ! Name            Type       Value
  ! --------        ----       -----

    "AVG_TYPE"     CDF_CHAR     { "angle_hour" }
    "CATDESC"      CDF_UCHAR    { "Calculated Magnetic Local Time (hours)" }
    "DEPEND_0"     CDF_UCHAR    { "Epoch" }
    "DICT_KEY"     CDF_CHAR     { "time>magnetic_local_hour" }
    "DISPLAY_TYPE"
                   CDF_UCHAR    { "time_series" }
    "FIELDNAM"     CDF_UCHAR    { "Magnetic Local Time" }
    "FILLVAL"      CDF_FLOAT    { -1.0e+31 }
    "FORMAT"       CDF_UCHAR    { "E10.3" }
    "LABLAXIS"     CDF_UCHAR    { "MLT" }
    "SCALETYP"     CDF_UCHAR    { "linear" }
    "SI_conversion"
                   CDF_UCHAR    { "2.778e-4>s" }
    "UNITS"        CDF_UCHAR    { "h" }
    "VALIDMIN"     CDF_FLOAT    { 0.0 }
    "VALIDMAX"     CDF_FLOAT    { 24.0 }
    "VAR_TYPE"     CDF_UCHAR    { "data" }
    "VAR_NOTES"    CDF_UCHAR    { "Calculated using ONERA-DESP library " -
                                  "Internal field: DGRF/IGRF External " -
                                  "field: Olson & Pfitzer quiet" } .

  ! RV values were not requested.


! Variable          Data      Number                  Record   Dimension
! Name              Type     Elements  Dims  Sizes  Variance  Variances
! --------          ----     --------  ----  -----  --------  ---------

  "Alpha"         CDF_REAL4      1       0             T

  ! Attribute       Data
  ! Name            Type       Value
```

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

    "AVG_TYPE"     CDF_CHAR      { "standard" }
    "CATDESC"      CDF_UCHAR     { "Pitch angle" }
    "DEPEND_0"     CDF_UCHAR     { "Epoch" }
    "DICT_KEY"     CDF_UCHAR     { "angle>pitch" }
    "DISPLAY_TYPE"
                   CDF_UCHAR     { "time_series" }
    "FIELDNAM"     CDF_UCHAR     { "Pitch angle" }
    "FILLVAL"      CDF_FLOAT     { -1.0e+31 }
    "FORMAT"       CDF_UCHAR     { "E10.3" }
    "LABLAXIS"     CDF_UCHAR     { "Alpha" }
    "SCALETYP"     CDF_UCHAR     { "linear" }
    "SI_conversion"
                   CDF_UCHAR     { "57.296>rad" }
    "UNITS"        CDF_UCHAR     { "degrees" }
    "VALIDMIN"     CDF_FLOAT     { 0.0 }
    "VALIDMAX"     CDF_FLOAT     { 180.0 }
    "VAR_TYPE"     CDF_UCHAR     { "data" }
    "VAR_NOTES"    CDF_UCHAR     { "Calculated using ONERA-DESP library " -
                                   "Internal field: DGRF/IGRF External " -
                                   "field: Olson & Pfitzer quiet" } .

  ! RV values were not requested.


! Variable           Data       Number                    Record   Dimension
! Name               Type      Elements  Dims  Sizes    Variance  Variances
! --------           ----      --------  ----  -----    --------  ---------

  "Alpha_Eq"       CDF_REAL4       1        0               T

  ! Attribute        Data
  ! Name             Type        Value
  ! --------         ----        -----

    "AVG_TYPE"     CDF_CHAR      { "standard" }
    "CATDESC"      CDF_UCHAR     { "Equatorial pitch angle" }
    "DEPEND_0"     CDF_UCHAR     { "Epoch" }
    "DICT_KEY"     CDF_UCHAR     { "angle>pitch" }
    "DISPLAY_TYPE"
                   CDF_UCHAR     { "time_series" }
    "FIELDNAM"     CDF_UCHAR     { "Equat. Pitch angle" }
    "FILLVAL"      CDF_FLOAT     { -1.0e+31 }
    "FORMAT"       CDF_UCHAR     { "E10.3" }
    "LABLAXIS"     CDF_UCHAR     { "Alpha(Eq)" }
    "SCALETYP"     CDF_UCHAR     { "linear" }
    "SI_conversion"
                   CDF_UCHAR     { "57.296>rad" }
    "UNITS"        CDF_UCHAR     { "degrees" }
    "VALIDMIN"     CDF_FLOAT     { 0.0 }
    "VALIDMAX"     CDF_FLOAT     { 180.0 }
    "VAR_TYPE"     CDF_UCHAR     { "data" }
    "VAR_NOTES"    CDF_UCHAR     { "Calculated using ONERA-DESP library " -
                                   "Internal field: DGRF/IGRF External " -
                                   "field: Olson & Pfitzer quiet" } .

  ! RV values were not requested.


! Variable           Data       Number                    Record   Dimension
! Name               Type      Elements  Dims  Sizes    Variance  Variances
! --------           ----      --------  ----  -----    --------  ---------

  "FPDO"           CDF_REAL4       1        1     32         T         T
```

```
  ! Attribute       Data
  ! Name            Type        Value
  ! --------        ----        -----

    "AVG_TYPE"     CDF_CHAR     { "log" }
    "CATDESC"      CDF_UCHAR    { "Omnidirectional Differential Proton Flux"
}
    "DEPEND_0"     CDF_UCHAR    { "Epoch" }
    "DEPEND_1"     CDF_UCHAR    { "FPDO_Energy" }
    "DICT_KEY"     CDF_CHAR     { "particle_flux>proton_differential_omni" -
                                  "-directional" }
    "DISPLAY_TYPE"
                   CDF_CHAR     { "time_series" }
    "V_PARENT"     CDF_UCHAR    { "FPDU" }
    "FIELDNAM"     CDF_UCHAR    { "FPDO" }
    "FILLVAL"      CDF_FLOAT    { -1.0e+31 }
    "FORMAT"       CDF_UCHAR    { "E10.3" }
    "LABL_PTR_1"   CDF_UCHAR    { "FPDO_LABL_1" }
    "QUALITY_VAR"
                   CDF_UCHAR    { "FPDO_Quality" }
    "SCALETYP"     CDF_CHAR     { "log" }
    "SI_conversion"
                   CDF_UCHAR    { "1.602e-17>m^-2 s^-1 sr^-1 J^-1" }
    "UNITS"        CDF_UCHAR    { "cm^-2 s^-1 sr^-1 MeV^-1" }
    "VALIDMIN"     CDF_FLOAT    { -1.0e+31 }
    "VALIDMAX"     CDF_FLOAT    { 1.0e+31 }
    "VAR_TYPE"     CDF_UCHAR    { "data" }
    "VAR_NOTES"    CDF_UCHAR    { "Dimension 1 holds channels." } .

  ! RV values were not requested.


! Variable          Data      Number                  Record   Dimension
! Name              Type     Elements  Dims  Sizes  Variance  Variances
! --------          ----     --------  ----  -----  --------  ---------

  "FPDO_EnergyRange"
                   CDF_REAL4      1       2    32 2      F        T T

  ! Attribute       Data
  ! Name            Type        Value
  ! --------        ----        -----

    "CATDESC"      CDF_UCHAR    { "Energy levels for FPDO" }
    "DICT_KEY"     CDF_CHAR     { "energy>band" }
    "FIELDNAM"     CDF_UCHAR    { "FPDO Energy" }
    "FILLVAL"      CDF_FLOAT    { -1.0e+31 }
    "FORMAT"       CDF_UCHAR    { "F8.3" }
    "LABLAXIS"     CDF_UCHAR    { "Energy" }
    "SCALETYP"     CDF_CHAR     { "log" }
    "SI_conversion"
                   CDF_UCHAR    { "6.242e12>J" }
    "UNITS"        CDF_UCHAR    { "MeV" }
    "VALIDMIN"     CDF_FLOAT    { 0.0 }
    "VALIDMAX"     CDF_FLOAT    { 1.0e+31 }
    "VAR_TYPE"     CDF_UCHAR    { "support_data" }
    "VAR_NOTES"    CDF_UCHAR    { "Energy levels are a combination of IPS" -
                                  " and HISTp" } .

  ! NRV values follow...

    [1,1] =    0.017
    [1,2] =    0.021
    [2,1] =    0.021
    [2,2] =    0.028
    [3,1] =    0.028
```

```
    [3,2] =    0.037
    [4,1] =    0.037
    [4,2] =    0.050
    [5,1] =    0.050
    [5,2] =    0.066
    [6,1] =    0.066
    [6,2] =    0.088
    [7,1] =    0.088
    [7,2] =    0.118
    [8,1] =    0.118
    [8,2] =    0.161
    [9,1] =    0.161
    [9,2] =    0.221
    [10,1] =    0.221
    [10,2] =    0.303
    [11,1] =    0.303
    [11,2] =    0.417
    [12,1] =    0.417
    [12,2] =    0.574
    [13,1] =    0.574
    [13,2] =    0.791
    [14,1] =    0.791
    [14,2] =    1.091
    [15,1] =    1.091
    [15,2] =    1.505
    [16,1] =    1.505
    [16,2] =    2.000
    [17,1] =    1.000
    [17,2] =    3.000
    [18,1] =    3.000
    [18,2] =    3.740
    [19,1] =    3.740
    [19,2] =    4.650
    [20,1] =    4.650
    [20,2] =    5.790
    [21,1] =    5.790
    [21,2] =    7.210
    [22,1] =    7.210
    [22,2] =    8.970
    [23,1] =    8.970
    [23,2] =   11.170
    [24,1] =   11.170
    [24,2] =   13.910
    [25,1] =   13.910
    [25,2] =   17.320
    [26,1] =   17.320
    [26,2] =   21.560
    [27,1] =   21.560
    [27,2] =   26.850
    [28,1] =   26.850
    [28,2] =   33.430
    [29,1] =   33.430
    [29,2] =   41.620
    [30,1] =   41.620
    [30,2] =   51.820
    [31,1] =   51.820
    [31,2] =   64.510
    [32,1] =   64.510
    [32,2] =   80.320

! Variable          Data      Number                    Record   Dimension
! Name              Type     Elements  Dims   Sizes   Variance  Variances
! --------          ----     --------  ----   -----   --------  ---------

  "FPDO_Quality"
```

```
                  CDF_INT2       1       1     32       T         T

  ! Attribute       Data
  ! Name            Type        Value
  ! --------        ----        -----

    "CATDESC"     CDF_UCHAR    { "FPDO Quality flag" }
    "DEPEND_0"    CDF_UCHAR    { "Epoch" }
    "DEPEND_1"    CDF_UCHAR    { "FPDO_Energy" }
    "DICT_KEY"    CDF_UCHAR    { "flag>quality" }
    "FIELDNAM"    CDF_UCHAR    { "FPDO_Quality" }
    "FILLVAL"     CDF_INT2     { -32768 }
    "FORMAT"      CDF_UCHAR    { "I11" }
    "LABLAXIS"    CDF_UCHAR    { "Quality" }
    "LABL_PTR_1"  CDF_UCHAR    { "FPDO_LABL_1" }
    "UNITS"       CDF_UCHAR    { "none" }
    "VALIDMIN"    CDF_INT2     { 0 }
    "VALIDMAX"    CDF_INT2     { 10 }
    "VAR_TYPE"    CDF_UCHAR    { "support_data" }
    "VAR_NOTES"   CDF_UCHAR    { "0 denotes highest quality. 1 denotes " -
                                 "problem with time resolution. 2 " -
                                 "denotes possible contamination. 3 " -
                                 "denotes saturation.  4 denotes any " -
                                 "other problem and 10 denotes that data" -
                                 " have not been qualified" } .

  ! RV values were not requested.


! Variable          Data      Number                  Record   Dimension
! Name              Type     Elements  Dims  Sizes  Variance  Variances
! --------          ----     --------  ----  -----  --------  ---------

  "FPDO_Crosscalib"
                  CDF_REAL4      1       1     32       F         T

  ! Attribute       Data
  ! Name            Type        Value
  ! --------        ----        -----

    "CATDESC"     CDF_UCHAR    { "Crosscalibration factors for FPDO" }
    "DEPEND_0"    CDF_CHAR     { "FPDO_Energy" }
    "DICT_KEY"    CDF_CHAR     { "ratio>particle_flux" }
    "FIELDNAM"    CDF_UCHAR    { "FPDO Crosscalib" }
    "FILLVAL"     CDF_FLOAT    { -1.0e+31 }
    "FORMAT"      CDF_UCHAR    { "F5" }
    "LABLAXIS"    CDF_UCHAR    { "Crosscalibration factors" }
    "SI_conversion"
                  CDF_UCHAR    { "none" }
    "UNITS"       CDF_UCHAR    { "none" }
    "VALIDMIN"    CDF_FLOAT    { 0.0 }
    "VALIDMAX"    CDF_FLOAT    { 1.0e+31 }
    "VAR_TYPE"    CDF_UCHAR    { "support_data" }
    "VAR_NOTES"   CDF_UCHAR    { "none" } .

  ! NRV values follow...

    [1] = 1.0
    [2] = 1.0
    [3] = 1.0
    [4] = 1.0
    [5] = 1.0
    [6] = 1.0
    [7] = 1.0
    [8] = 1.0
    [9] = 1.0
```

```
    [10] = 1.0
    [11] = 1.0
    [12] = 1.0
    [13] = 1.0
    [14] = 1.0
    [15] = 1.0
    [16] = 1.0
    [17] = 1.0
    [18] = 1.0
    [19] = 1.0
    [20] = 1.0
    [21] = 1.0
    [22] = 1.0
    [23] = 1.0
    [24] = 1.0
    [25] = 1.0
    [26] = 1.0
    [27] = 1.0
    [28] = 1.0
    [29] = 1.0
    [30] = 1.0
    [31] = 1.0
    [32] = 1.0


! Variable           Data       Number                    Record   Dimension
! Name               Type      Elements  Dims  Sizes    Variance  Variances
! --------           ----      --------  ----  -----    --------  ---------

  "FPDU_EnergyRange"
                     CDF_REAL4      1       2    32 2       F         T T

  ! Attribute        Data
  ! Name             Type         Value
  ! --------         ----         -----

    "CATDESC"        CDF_UCHAR    { "Energy levels for FPDU" }
    "DICT_KEY"       CDF_CHAR     { "energy>band" }
    "FIELDNAM"       CDF_UCHAR    { "FPDU Energy" }
    "FILLVAL"        CDF_FLOAT    { -1.0e+31 }
    "FORMAT"         CDF_UCHAR    { "F8.3" }
    "LABLAXIS"       CDF_UCHAR    { "Energy" }
    "SCALETYP"       CDF_CHAR     { "log" }
    "SI_conversion"
                     CDF_UCHAR    { "6.242e12>J" }
    "UNITS"          CDF_UCHAR    { "MeV" }
    "VALIDMIN"       CDF_FLOAT    { 0.0 }
    "VALIDMAX"       CDF_FLOAT    { 1.0e+31 }
    "VAR_TYPE"       CDF_UCHAR    { "support_data" }
    "VAR_NOTES"      CDF_UCHAR    { "Energy levels are a combination of IPS" -
                                    " and HISTp" } .

  ! NRV values follow...

    [1,1] =    0.017
    [1,2] =    0.021
    [2,1] =    0.021
    [2,2] =    0.028
    [3,1] =    0.028
    [3,2] =    0.037
    [4,1] =    0.037
    [4,2] =    0.050
    [5,1] =    0.050
    [5,2] =    0.066
    [6,1] =    0.066
    [6,2] =    0.088
```

```
    [7,1] =    0.088
    [7,2] =    0.118
    [8,1] =    0.118
    [8,2] =    0.161
    [9,1] =    0.161
    [9,2] =    0.221
    [10,1] =    0.221
    [10,2] =    0.303
    [11,1] =    0.303
    [11,2] =    0.417
    [12,1] =    0.417
    [12,2] =    0.574
    [13,1] =    0.574
    [13,2] =    0.791
    [14,1] =    0.791
    [14,2] =    1.091
    [15,1] =    1.091
    [15,2] =    1.505
    [16,1] =    1.505
    [16,2] =    2.000
    [17,1] =    1.000
    [17,2] =    3.000
    [18,1] =    3.000
    [18,2] =    3.740
    [19,1] =    3.740
    [19,2] =    4.650
    [20,1] =    4.650
    [20,2] =    5.790
    [21,1] =    5.790
    [21,2] =    7.210
    [22,1] =    7.210
    [22,2] =    8.970
    [23,1] =    8.970
    [23,2] =   11.170
    [24,1] =   11.170
    [24,2] =   13.910
    [25,1] =   13.910
    [25,2] =   17.320
    [26,1] =   17.320
    [26,2] =   21.560
    [27,1] =   21.560
    [27,2] =   26.850
    [28,1] =   26.850
    [28,2] =   33.430
    [29,1] =   33.430
    [29,2] =   41.620
    [30,1] =   41.620
    [30,2] =   51.820
    [31,1] =   51.820
    [31,2] =   64.510
    [32,1] =   64.510
    [32,2] =   80.320


! Variable          Data      Number                    Record   Dimension
! Name              Type     Elements  Dims  Sizes  Variance  Variances
! --------          ----     --------  ----  -----  --------  ---------

  "FPDU_AlphaRange"
                   CDF_REAL4      1       2    9 2       F        T T

  ! Attribute       Data
  ! Name            Type       Value
  ! --------        ----       -----

    "CATDESC"     CDF_UCHAR    { "Local pitch angle bins for FPDU" }
```

```
    "DICT_KEY"     CDF_CHAR     { "angle>pitch_interval" }
    "FIELDNAM"     CDF_UCHAR    { "FPDU Alpha" }
    "FILLVAL"      CDF_FLOAT    { -1.0e+31 }
    "FORMAT"       CDF_UCHAR    { "F5" }
    "LABLAXIS"     CDF_CHAR     { "Local pitch-angle" }
    "SCALETYP"     CDF_CHAR     { "linear" }
    "SI_conversion"
                   CDF_UCHAR    { "0.0174533>rad" }
    "UNITS"        CDF_UCHAR    { "degrees" }
    "VALIDMIN"     CDF_FLOAT    { 0.0 }
    "VALIDMAX"     CDF_FLOAT    { 180.0 }
    "VAR_TYPE"     CDF_UCHAR    { "support_data" }
    "VAR_NOTES"    CDF_UCHAR    { "10 degree pitch angle bins based on " -
                                  "the assumption of gyrotropy." } .

  ! NRV values follow...

    [1,1] = 0.0
    [1,2] = 20.0
    [2,1] = 20.0
    [2,2] = 40.0
    [3,1] = 40.0
    [3,2] = 60.0
    [4,1] = 60.0
    [4,2] = 80.0
    [5,1] = 80.0
    [5,2] = 100.0
    [6,1] = 100.0
    [6,2] = 120.0
    [7,1] = 120.0
    [7,2] = 140.0
    [8,1] = 140.0
    [8,2] = 160.0
    [9,1] = 160.0
    [9,2] = 180.0


! Variable          Data      Number                    Record   Dimension
! Name              Type     Elements  Dims  Sizes    Variance  Variances
! --------          ----     --------  ----  -----    --------  ---------

  "FPDU_Alpha_EqRange"
                   CDF_REAL4      1       2    9 2       T        T T

  ! Attribute       Data
  ! Name            Type       Value
  ! --------        ----       -----

    "CATDESC"      CDF_UCHAR    { "Equaorial pitch angle bins for FPDU" }
    "DEPEND_0"     CDF_UCHAR    { "Epoch" }
    "DEPEND_1"     CDF_CHAR     { "FPDU_Alpha" }
    "DEPEND_2"     CDF_CHAR     { "channel_bound" }
    "DICT_KEY"     CDF_CHAR     { "angle>pitch" }
    "DISPLAY_TYPE"
                   CDF_CHAR     { "time_series" }
    "FIELDNAM"     CDF_UCHAR    { "FPDU Alpha Eq" }
    "FILLVAL"      CDF_FLOAT    { -1.0e+31 }
    "FORMAT"       CDF_UCHAR    { "F5" }
    "LABLAXIS"     CDF_UCHAR    { "Equatorial pitch angle" }
    "LABL_PTR_1"   CDF_CHAR     { "FPDU_LABL_2" }
    "SCALETYP"     CDF_CHAR     { "linear" }
    "SI_conversion"
                   CDF_UCHAR    { "0.0174533>rad" }
    "UNITS"        CDF_UCHAR    { "degrees" }
    "VALIDMIN"     CDF_FLOAT    { 0.0 }
    "VALIDMAX"     CDF_FLOAT    { 180.0 }
```

```
    "VAR_TYPE"     CDF_CHAR      { "data" }
    "VAR_NOTES"    CDF_UCHAR     { "10 degree pitch angle bins based on " -
                                   "the assumption of gyrotropy." }
    "LABL_PTR_2"   CDF_CHAR      { "channel_bound_LABL" } .

  ! RV values were not requested.


! Variable           Data       Number                    Record   Dimension
! Name               Type      Elements  Dims  Sizes     Variance  Variances
! --------           ----      --------  ----  -----     --------  ---------

  "FPDU_Crosscalib"
                   CDF_REAL4       1       1     32        F         T

  ! Attribute        Data
  ! Name             Type        Value
  ! --------         ----        -----

    "CATDESC"      CDF_UCHAR     { "Crosscalibration factors for FPDO" }
    "DEPEND_0"     CDF_CHAR      { "FPDU_Energy" }
    "DICT_KEY"     CDF_CHAR      { "ratio>particle_flux" }
    "FIELDNAM"     CDF_UCHAR     { "FPDU Crosscalib" }
    "FILLVAL"      CDF_FLOAT     { -1.0e+31 }
    "FORMAT"       CDF_UCHAR     { "F5" }
    "LABLAXIS"     CDF_UCHAR     { "Crosscalibration factors" }
    "SI_conversion"
                   CDF_UCHAR     { "none" }
    "UNITS"        CDF_UCHAR     { "none" }
    "VALIDMIN"     CDF_FLOAT     { 0.0 }
    "VALIDMAX"     CDF_FLOAT     { 1.0e+31 }
    "VAR_TYPE"     CDF_UCHAR     { "support_data" }
    "VAR_NOTES"    CDF_UCHAR     { "none" } .

  ! NRV values follow...

    [1] = 1.0
    [2] = 1.0
    [3] = 1.0
    [4] = 1.0
    [5] = 1.0
    [6] = 1.0
    [7] = 1.0
    [8] = 1.0
    [9] = 1.0
    [10] = 1.0
    [11] = 1.0
    [12] = 1.0
    [13] = 1.0
    [14] = 1.0
    [15] = 1.0
    [16] = 1.0
    [17] = 1.0
    [18] = 1.0
    [19] = 1.0
    [20] = 1.0
    [21] = 1.0
    [22] = 1.0
    [23] = 1.0
    [24] = 1.0
    [25] = 1.0
    [26] = 1.0
    [27] = 1.0
    [28] = 1.0
    [29] = 1.0
    [30] = 1.0
```

```
    [31] = 1.0
    [32] = 1.0


! Variable          Data      Number                    Record   Dimension
! Name              Type     Elements  Dims  Sizes  Variance  Variances
! --------          ----     --------  ----  -----  --------  ---------

  "FEDO"           CDF_REAL4      1       1     24       T         T

  ! Attribute       Data
  ! Name            Type       Value
  ! --------        ----       -----

    "AVG_TYPE"     CDF_CHAR     { "log" }
    "CATDESC"      CDF_UCHAR    { "Omnidirectional Differential Electron " -
                                  "Flux" }
    "DEPEND_0"     CDF_UCHAR    { "Epoch" }
    "DEPEND_1"     CDF_UCHAR    { "FEDO_Energy" }
    "DICT_KEY"     CDF_CHAR     { "particle_flux>electron_differential_om" -
                                  "ni-directional" }
    "DISPLAY_TYPE"
                   CDF_CHAR     { "time_series" }
    "V_PARENT"     CDF_UCHAR    { "FEDU" }
    "FIELDNAM"     CDF_UCHAR    { "FEDO" }
    "FILLVAL"      CDF_FLOAT    { -1.0e+31 }
    "FORMAT"       CDF_UCHAR    { "E10.3" }
    "LABL_PTR_1"   CDF_UCHAR    { "FEDO_LABL_1" }
    "QUALITY_VAR"
                   CDF_UCHAR    { "FEDO_Quality" }
    "SCALETYP"     CDF_CHAR     { "log" }
    "SI_conversion"
                   CDF_UCHAR    { "1.602e-17>m^-2 s^-1 sr^-1 J^-1" }
    "UNITS"        CDF_UCHAR    { "cm^-2 s^-1 sr^-1 MeV^-1" }
    "VALIDMIN"     CDF_FLOAT    { -1.0e+31 }
    "VALIDMAX"     CDF_FLOAT    { 1.0e+31 }
    "VAR_TYPE"     CDF_UCHAR    { "data" }
    "VAR_NOTES"    CDF_UCHAR    { "FEDO, Dimension 1 holds channels." } .

  ! RV values were not requested.


! Variable          Data      Number                    Record   Dimension
! Name              Type     Elements  Dims  Sizes  Variance  Variances
! --------          ----     --------  ----  -----  --------  ---------

  "FEDO_EnergyRange"
                   CDF_REAL4      1       2    24 2      F        T T

  ! Attribute       Data
  ! Name            Type       Value
  ! --------        ----       -----

    "CATDESC"      CDF_UCHAR    { "Energy levels for FEDO" }
    "DICT_KEY"     CDF_CHAR     { "energy>band" }
    "FIELDNAM"     CDF_UCHAR    { "FEDO Energy" }
    "FILLVAL"      CDF_FLOAT    { -1.0e+31 }
    "FORMAT"       CDF_UCHAR    { "F5" }
    "LABLAXIS"     CDF_UCHAR    { "Energy" }
    "SCALETYP"     CDF_CHAR     { "log" }
    "SI_conversion"
                   CDF_UCHAR    { "6.242e12>J" }
    "UNITS"        CDF_UCHAR    { "MeV" }
    "VALIDMIN"     CDF_FLOAT    { 0.0 }
    "VALIDMAX"     CDF_FLOAT    { 1.0e+31 }
    "VAR_TYPE"     CDF_UCHAR    { "support_data" }
```

```
    "VAR_NOTES"    CDF_UCHAR     { "Energy levels are a combination of IES" -
                                   " and HISTe" } .

  ! NRV values follow...

    [1,1] = 0.0185
    [1,2] = 0.0305
    [2,1] = 0.0305
    [2,2] = 0.0425
    [3,1] = 0.0425
    [3,2] = 0.0585
    [4,1] = 0.0585
    [4,2] = 0.0805
    [5,1] = 0.0805
    [5,2] = 0.1105
    [6,1] = 0.1105
    [6,2] = 0.1525
    [7,1] = 0.1525
    [7,2] = 0.2125
    [8,1] = 0.2125
    [8,2] = 0.2945
    [9,1] = 0.2945
    [9,2] = 0.4065
    [10,1] = 0.4065
    [10,2] = 0.4265
    [11,1] = 0.656734
    [11,2] = 0.700186
    [12,1] = 0.700186
    [12,2] = 0.743639
    [13,1] = 0.743639
    [13,2] = 0.980042
    [14,1] = 0.980042
    [14,2] = 1.15826
    [15,1] = 1.15826
    [15,2] = 1.42174
    [16,1] = 1.42174
    [16,2] = 1.69826
    [17,1] = 1.69826
    [17,2] = 2.10174
    [18,1] = 2.10174
    [18,2] = 2.77826
    [19,1] = 2.77826
    [19,2] = 3.48174
    [20,1] = 3.48174
    [20,2] = 4.57826
    [21,1] = 4.57826
    [21,2] = 5.68174
    [22,1] = 5.68174
    [22,2] = 7.17826
    [23,1] = 7.17826
    [23,2] = 8.94174
    [24,1] = 8.94174
    [24,2] = 11.2783

! Variable          Data      Number                    Record   Dimension
! Name              Type     Elements  Dims  Sizes  Variance  Variances
! --------          ----     --------  ----  -----  --------  ---------

  "FEDO_Quality"
                   CDF_INT2       1       1     24       T         T

  ! Attribute       Data
  ! Name            Type       Value
  ! --------        ----       -----
```

```
    "CATDESC"      CDF_UCHAR    { "FEDO Quality flag" }
    "DEPEND_0"     CDF_UCHAR    { "Epoch" }
    "DEPEND_1"     CDF_UCHAR    { "FEDO_Energy" }
    "DICT_KEY"     CDF_UCHAR    { "flag>quality" }
    "FIELDNAM"     CDF_UCHAR    { "FEDO_Quality" }
    "FILLVAL"      CDF_INT2     { -32768 }
    "FORMAT"       CDF_UCHAR    { "I11" }
    "LABLAXIS"     CDF_UCHAR    { "Quality" }
    "LABL_PTR_1"   CDF_UCHAR    { "FEDO_LABL_1" }
    "UNITS"        CDF_UCHAR    { "none" }
    "VALIDMIN"     CDF_INT2     { 0 }
    "VALIDMAX"     CDF_INT2     { 10 }
    "VAR_TYPE"     CDF_UCHAR    { "support_data" }
    "VAR_NOTES"    CDF_UCHAR    { "0 denotes highest quality. 1 denotes " -
                                  "problem with time resolution. 2 " -
                                  "denotes possible contamination. 3 " -
                                  "denotes saturation.  4 denotes any " -
                                  "other problem and 10 denotes that data" -
                                  " have not been qualified" } .

  ! RV values were not requested.


! Variable           Data       Number                    Record   Dimension
! Name               Type      Elements  Dims  Sizes     Variance  Variances
! --------           ----      --------  ----  -----     --------  ---------

  "FEDO_Crosscalib"
                   CDF_REAL4      1       1     24         F         T

  ! Attribute        Data
  ! Name             Type        Value
  ! --------         ----        -----

    "CATDESC"      CDF_UCHAR    { "Crosscalibration factors for FEDO" }
    "DEPEND_0"     CDF_CHAR     { "FEDO_Energy" }
    "DICT_KEY"     CDF_CHAR     { "ratio>particle_flux" }
    "FIELDNAM"     CDF_UCHAR    { "FEDO Crosscalib" }
    "FILLVAL"      CDF_FLOAT    { -1.0e+31 }
    "FORMAT"       CDF_UCHAR    { "F5" }
    "LABLAXIS"     CDF_UCHAR    { "Crosscalibration factors" }
    "SI_conversion"
                   CDF_UCHAR    { "none" }
    "UNITS"        CDF_UCHAR    { "none" }
    "VALIDMIN"     CDF_FLOAT    { 0.0 }
    "VALIDMAX"     CDF_FLOAT    { 1.0e+31 }
    "VAR_TYPE"     CDF_UCHAR    { "support_data" }
    "VAR_NOTES"    CDF_UCHAR    { "none" } .

  ! NRV values follow...

    [1] = 1.0
    [2] = 2.65
    [3] = 2.86
    [4] = 4.28
    [5] = 4.87
    [6] = 3.62
    [7] = 1.97
    [8] = 1.3
    [9] = 0.71
    [10] = 1.0
    [11] = 1.0
    [12] = 1.0
    [13] = 1.0
    [14] = 1.0
    [15] = 1.0
```

```
    [16] = 1.0
    [17] = 1.0
    [18] = 1.0
    [19] = 1.0
    [20] = 1.0
    [21] = 1.0
    [22] = 1.0
    [23] = 1.0
    [24] = 1.0


! Variable          Data      Number                    Record   Dimension
! Name              Type     Elements  Dims  Sizes  Variance  Variances
! --------          ----     --------  ----  -----  --------  ---------

  "FEDU_EnergyRange"
                  CDF_REAL4      1       2    24 2      F        T T

  ! Attribute       Data
  ! Name            Type       Value
  ! --------        ----       -----

    "CATDESC"     CDF_UCHAR    { "Energy levels for FEDU" }
    "DICT_KEY"    CDF_CHAR     { "energy>band" }
    "FIELDNAM"    CDF_UCHAR    { "FEDU Energy" }
    "FILLVAL"     CDF_FLOAT    { -1.0e+31 }
    "FORMAT"      CDF_UCHAR    { "F5" }
    "LABLAXIS"    CDF_UCHAR    { "Energy" }
    "SCALETYP"    CDF_CHAR     { "log" }
    "SI_conversion"
                  CDF_UCHAR    { "6.242e12>J" }
    "UNITS"       CDF_UCHAR    { "MeV" }
    "VALIDMIN"    CDF_FLOAT    { 0.0 }
    "VALIDMAX"    CDF_FLOAT    { 1.0e+31 }
    "VAR_TYPE"    CDF_UCHAR    { "support_data" }
    "VAR_NOTES"   CDF_UCHAR    { "Energy levels are a combination of IES" -
                                 " and HISTe" } .

  ! NRV values follow...

    [1,1] = 0.0185
    [1,2] = 0.0305
    [2,1] = 0.0305
    [2,2] = 0.0425
    [3,1] = 0.0425
    [3,2] = 0.0585
    [4,1] = 0.0585
    [4,2] = 0.0805
    [5,1] = 0.0805
    [5,2] = 0.1105
    [6,1] = 0.1105
    [6,2] = 0.1525
    [7,1] = 0.1525
    [7,2] = 0.2125
    [8,1] = 0.2125
    [8,2] = 0.2945
    [9,1] = 0.2945
    [9,2] = 0.4065
    [10,1] = 0.4065
    [10,2] = 0.4265
    [11,1] = 0.656734
    [11,2] = 0.700186
    [12,1] = 0.700186
    [12,2] = 0.743639
    [13,1] = 0.743639
    [13,2] = 0.980042
```

```
    [14,1] = 0.980042
    [14,2] = 1.15826
    [15,1] = 1.15826
    [15,2] = 1.42174
    [16,1] = 1.42174
    [16,2] = 1.69826
    [17,1] = 1.69826
    [17,2] = 2.10174
    [18,1] = 2.10174
    [18,2] = 2.77826
    [19,1] = 2.77826
    [19,2] = 3.48174
    [20,1] = 3.48174
    [20,2] = 4.57826
    [21,1] = 4.57826
    [21,2] = 5.68174
    [22,1] = 5.68174
    [22,2] = 7.17826
    [23,1] = 7.17826
    [23,2] = 8.94174
    [24,1] = 8.94174
    [24,2] = 11.2783


! Variable           Data       Number                    Record   Dimension
! Name               Type      Elements  Dims  Sizes    Variance  Variances
! --------           ----      --------  ----  -----    --------  ---------

  "FEDU_AlphaRange"
                     CDF_REAL4      1       2    9 2        F         T T

  ! Attribute        Data
  ! Name             Type        Value
  ! --------         ----        -----

    "CATDESC"        CDF_UCHAR    { "Local pitch angle bins for FEDU" }
    "DICT_KEY"       CDF_CHAR     { "angle>pitch_interval" }
    "FIELDNAM"       CDF_UCHAR    { "FEDU Alpha" }
    "FILLVAL"        CDF_FLOAT    { -1.0e+31 }
    "FORMAT"         CDF_UCHAR    { "F5" }
    "LABLAXIS"       CDF_CHAR     { "Local pitch-angle" }
    "SCALETYP"       CDF_CHAR     { "linear" }
    "SI_conversion"
                     CDF_UCHAR    { "0.0174533>rad" }
    "UNITS"          CDF_UCHAR    { "degrees" }
    "VALIDMIN"       CDF_FLOAT    { 0.0 }
    "VALIDMAX"       CDF_FLOAT    { 180.0 }
    "VAR_TYPE"       CDF_UCHAR    { "support_data" }
    "VAR_NOTES"      CDF_UCHAR    { "10 degree pitch angle bins based on " -
                                    "the assumption of gyrotropy." } .

  ! NRV values follow...

    [1,1] = 0.0
    [1,2] = 20.0
    [2,1] = 20.0
    [2,2] = 40.0
    [3,1] = 40.0
    [3,2] = 60.0
    [4,1] = 60.0
    [4,2] = 80.0
    [5,1] = 80.0
    [5,2] = 100.0
    [6,1] = 100.0
    [6,2] = 120.0
    [7,1] = 120.0
```

```
    [7,2] = 140.0
    [8,1] = 140.0
    [8,2] = 160.0
    [9,1] = 160.0
    [9,2] = 180.0


! Variable          Data      Number                    Record   Dimension
! Name              Type     Elements  Dims  Sizes  Variance  Variances
! --------          ----     --------  ----  -----  --------  ---------

  "FEDU_Alpha_EqRange"
                  CDF_REAL4      1       2    9 2       T        T T

  ! Attribute       Data
  ! Name            Type       Value
  ! --------        ----       -----

    "CATDESC"     CDF_UCHAR    { "Equatorial pitch angle bins for FEDU" }
    "DEPEND_0"    CDF_UCHAR    { "Epoch" }
    "DEPEND_1"    CDF_CHAR     { "FEDU_Alpha" }
    "DEPEND_2"    CDF_CHAR     { "channel_bound" }
    "DICT_KEY"    CDF_CHAR     { "angle>pitch" }
    "DISPLAY_TYPE"
                  CDF_CHAR     { "time_series" }
    "FIELDNAM"    CDF_UCHAR    { "FEDU Alpha Eq" }
    "FILLVAL"     CDF_FLOAT    { -1.0e+31 }
    "FORMAT"      CDF_UCHAR    { "F5" }
    "LABLAXIS"    CDF_UCHAR    { "Equatorial pitch angle" }
    "LABL_PTR_1"  CDF_CHAR     { "FEDU_LABL_2" }
    "SCALETYP"    CDF_CHAR     { "linear" }
    "SI_conversion"
                  CDF_UCHAR    { "0.0174533>rad" }
    "UNITS"       CDF_UCHAR    { "degrees" }
    "VALIDMIN"    CDF_FLOAT    { 0.0 }
    "VALIDMAX"    CDF_FLOAT    { 180.0 }
    "VAR_TYPE"    CDF_CHAR     { "data" }
    "VAR_NOTES"   CDF_UCHAR    { "10 degree pitch angle bins based on " -
                                 "the assumption of gyrotropy." }
    "LABL_PTR_2"  CDF_CHAR     { "channel_bound_LABL" } .

  ! RV values were not requested.


! Variable          Data      Number                    Record   Dimension
! Name              Type     Elements  Dims  Sizes  Variance  Variances
! --------          ----     --------  ----  -----  --------  ---------

  "FEDU_Crosscalib"
                  CDF_REAL4      1       1     24       F         T

  ! Attribute       Data
  ! Name            Type       Value
  ! --------        ----       -----

    "CATDESC"     CDF_UCHAR    { "Crosscalibration factors for FEDU" }
    "DEPEND_0"    CDF_CHAR     { "FEDU_Energy" }
    "DICT_KEY"    CDF_CHAR     { "ratio>particle_flux" }
    "FIELDNAM"    CDF_UCHAR    { "FEDU Crosscalib" }
    "FILLVAL"     CDF_FLOAT    { -1.0e+31 }
    "FORMAT"      CDF_UCHAR    { "F5" }
    "LABLAXIS"    CDF_UCHAR    { "Crosscalibration factors" }
    "SI_conversion"
                  CDF_UCHAR    { "none" }
    "UNITS"       CDF_UCHAR    { "none" }
    "VALIDMIN"    CDF_FLOAT    { 0.0 }
```

```
    "VALIDMAX"     CDF_FLOAT     { 1.0e+31 }
    "VAR_TYPE"     CDF_UCHAR     { "support_data" }
    "VAR_NOTES"    CDF_UCHAR     { "none" } .

  ! NRV values follow...

    [1] = 1.0
    [2] = 2.65
    [3] = 2.86
    [4] = 4.28
    [5] = 4.87
    [6] = 3.62
    [7] = 1.97
    [8] = 1.3
    [9] = 0.71
    [10] = 1.0
    [11] = 1.0
    [12] = 1.0
    [13] = 1.0
    [14] = 1.0
    [15] = 1.0
    [16] = 1.0
    [17] = 1.0
    [18] = 1.0
    [19] = 1.0
    [20] = 1.0
    [21] = 1.0
    [22] = 1.0
    [23] = 1.0
    [24] = 1.0


! Variable           Data       Number                    Record    Dimension
! Name               Type      Elements  Dims   Sizes   Variance  Variances
! --------           ----      --------  ----   -----   --------  ---------

  "FPDO_Energy"    CDF_REAL4       1        1     32        F          T

  ! Attribute        Data
  ! Name             Type        Value
  ! --------         ----        -----

    "CATDESC"      CDF_CHAR      { "Energy levels for FPDO" }
    "DICT_KEY"     CDF_CHAR      { "energy>band" }
    "FIELDNAM"     CDF_CHAR      { "FPDO Energy" }
    "FILLVAL"      CDF_FLOAT     { -1.0e+31 }
    "FORMAT"       CDF_CHAR      { "F5" }
    "LABLAXIS"     CDF_CHAR      { "Energy" }
    "SI_conversion"
                   CDF_CHAR      { "6.242e12>J" }
    "UNITS"        CDF_CHAR      { "MeV" }
    "VALIDMIN"     CDF_FLOAT     { 0.0 }
    "VALIDMAX"     CDF_FLOAT     { 1.0e+31 }
    "VAR_TYPE"     CDF_CHAR      { "support_data" }
    "VAR_NOTES"    CDF_CHAR      { "Energy levels are a combination of IPS" -
                                   " and HISTp" } .

  ! NRV values follow...

    [1] = 0.0188722
    [2] = 0.0243204
    [3] = 0.0323458
    [4] = 0.0431277
    [5] = 0.057172
    [6] = 0.0760226
    [7] = 0.101728
```

```
    [8] = 0.137833
    [9] = 0.188629
    [10] = 0.258772
    [11] = 0.355459
    [12] = 0.489242
    [13] = 0.67382
    [14] = 0.928968
    [15] = 1.28139
    [16] = 1.73494
    [17] = 1.73205
    [18] = 3.34963
    [19] = 4.17025
    [20] = 5.18879
    [21] = 6.46111
    [22] = 8.042
    [23] = 10.0097
    [24] = 12.4649
    [25] = 15.5216
    [26] = 19.3241
    [27] = 24.06
    [28] = 29.9599
    [29] = 37.3009
    [30] = 46.4408
    [31] = 57.8179
    [32] = 71.9822


! Variable          Data      Number                    Record   Dimension
! Name              Type     Elements  Dims  Sizes  Variance  Variances
! --------          ----     --------  ----  -----  --------  ---------

  "FPDO_LABL_1"   CDF_CHAR      19       1     32       F         T

  ! Attribute       Data
  ! Name            Type       Value
  ! --------        ----       -----

    "CATDESC"     CDF_CHAR     { "FPDO_LABL_1" }
    "DICT_KEY"    CDF_CHAR     { "label" }
    "FIELDNAM"    CDF_CHAR     { "FPDO_LABL_1" }
    "FORMAT"      CDF_CHAR     { "A19" }
    "VAR_TYPE"    CDF_CHAR     { "metadata" } .

  ! NRV values follow...

    [1] = { "  0.017 - 0.021 MeV" }
    [2] = { "  0.021 - 0.028 MeV" }
    [3] = { "  0.028 - 0.037 MeV" }
    [4] = { "  0.037 - 0.050 MeV" }
    [5] = { "  0.050 - 0.066 MeV" }
    [6] = { "  0.066 - 0.088 MeV" }
    [7] = { "  0.088 - 0.118 MeV" }
    [8] = { "  0.118 - 0.161 MeV" }
    [9] = { "  0.161 - 0.221 MeV" }
    [10] = { "  0.221 - 0.303 MeV" }
    [11] = { "  0.303 - 0.417 MeV" }
    [12] = { "  0.417 - 0.574 MeV" }
    [13] = { "  0.574 - 0.791 MeV" }
    [14] = { "  0.791 - 1.091 MeV" }
    [15] = { "  1.091 - 1.505 MeV" }
    [16] = { "  1.505 - 2.000 MeV" }
    [17] = { "  1.000 - 3.000 MeV" }
    [18] = { "  3.000 - 3.740 MeV" }
    [19] = { "  3.740 - 4.650 MeV" }
    [20] = { "  4.650 - 5.790 MeV" }
    [21] = { "  5.790 - 7.210 MeV" }
```

```
    [22] = { "  7.210 - 8.970 MeV" }
    [23] = { " 8.970 - 11.170 MeV" }
    [24] = { "11.170 - 13.910 MeV" }
    [25] = { "13.910 - 17.320 MeV" }
    [26] = { "17.320 - 21.560 MeV" }
    [27] = { "21.560 - 26.850 MeV" }
    [28] = { "26.850 - 33.430 MeV" }
    [29] = { "33.430 - 41.620 MeV" }
    [30] = { "41.620 - 51.820 MeV" }
    [31] = { "51.820 - 64.510 MeV" }
    [32] = { "64.510 - 80.320 MeV" }


! Variable          Data      Number                    Record   Dimension
! Name              Type     Elements  Dims  Sizes  Variance  Variances
! --------          ----     --------  ----  -----  --------  ---------

  "FEDO_Energy"   CDF_REAL4      1       1     24       F         T

  ! Attribute       Data
  ! Name            Type       Value
  ! --------        ----       -----

    "CATDESC"     CDF_CHAR     { "Energy levels for FEDO" }
    "DICT_KEY"    CDF_CHAR     { "energy>band" }
    "FIELDNAM"    CDF_CHAR     { "FEDO Energy" }
    "FILLVAL"     CDF_FLOAT    { -1.0e+31 }
    "FORMAT"      CDF_CHAR     { "F5" }
    "LABLAXIS"    CDF_CHAR     { "Energy" }
    "SI_conversion"
                  CDF_CHAR     { "6.242e12>J" }
    "UNITS"       CDF_CHAR     { "MeV" }
    "VALIDMIN"    CDF_FLOAT    { 0.0 }
    "VALIDMAX"    CDF_FLOAT    { 1.0e+31 }
    "VAR_TYPE"    CDF_CHAR     { "support_data" }
    "VAR_NOTES"   CDF_CHAR     { "Energy levels are a combination of IES" -
                                 " and HISTe" } .

  ! NRV values follow...

    [1] = 0.0237539
    [2] = 0.0360035
    [3] = 0.0498623
    [4] = 0.068624
    [5] = 0.0943146
    [6] = 0.129812
    [7] = 0.180017
    [8] = 0.250162
    [9] = 0.345997
    [10] = 0.41638
    [11] = 0.678112
    [12] = 0.721586
    [13] = 0.853697
    [14] = 1.06543
    [15] = 1.28326
    [16] = 1.55386
    [17] = 1.88926
    [18] = 2.41644
    [19] = 3.11017
    [20] = 3.99253
    [21] = 5.10024
    [22] = 6.38631
    [23] = 8.01162
    [24] = 10.0423
```

```
! Variable          Data      Number                  Record   Dimension
! Name              Type      Elements  Dims  Sizes   Variance  Variances
! --------          ----      --------  ----  -----   --------  ---------

  "FEDO_LABL_1"   CDF_CHAR      18       1     24        F         T

  ! Attribute       Data
  ! Name            Type       Value
  ! --------        ----       -----

    "CATDESC"     CDF_CHAR     { "FEDO_LABL_1" }
    "DICT_KEY"    CDF_CHAR     { "label" }
    "FIELDNAM"    CDF_CHAR     { "FEDO_LABL_1" }
    "FORMAT"      CDF_CHAR     { "A18" }
    "VAR_TYPE"    CDF_CHAR     { "metadata" } .

  ! NRV values follow...

    [1] = { " 0.019 - 0.031 MeV" }
    [2] = { " 0.031 - 0.042 MeV" }
    [3] = { " 0.042 - 0.059 MeV" }
    [4] = { " 0.059 - 0.080 MeV" }
    [5] = { " 0.080 - 0.111 MeV" }
    [6] = { " 0.111 - 0.152 MeV" }
    [7] = { " 0.152 - 0.212 MeV" }
    [8] = { " 0.212 - 0.295 MeV" }
    [9] = { " 0.295 - 0.406 MeV" }
    [10] = { " 0.406 - 0.426 MeV" }
    [11] = { " 0.657 - 0.700 MeV" }
    [12] = { " 0.700 - 0.744 MeV" }
    [13] = { " 0.744 - 0.980 MeV" }
    [14] = { " 0.980 - 1.158 MeV" }
    [15] = { " 1.158 - 1.422 MeV" }
    [16] = { " 1.422 - 1.698 MeV" }
    [17] = { " 1.698 - 2.102 MeV" }
    [18] = { " 2.102 - 2.778 MeV" }
    [19] = { " 2.778 - 3.482 MeV" }
    [20] = { " 3.482 - 4.578 MeV" }
    [21] = { " 4.578 - 5.682 MeV" }
    [22] = { " 5.682 - 7.178 MeV" }
    [23] = { " 7.178 - 8.942 MeV" }
    [24] = { "8.942 - 11.278 MeV" }

! Variable          Data      Number                  Record   Dimension
! Name              Type      Elements  Dims  Sizes   Variance  Variances
! --------          ----      --------  ----  -----   --------  ---------

  "FPDU_Energy"   CDF_REAL4     1       1     32        F         T

  ! Attribute       Data
  ! Name            Type       Value
  ! --------        ----       -----

    "CATDESC"     CDF_CHAR     { "Energy levels for FPDU" }
    "DICT_KEY"    CDF_CHAR     { "energy>band" }
    "FIELDNAM"    CDF_CHAR     { "FPDU Energy" }
    "FILLVAL"     CDF_FLOAT    { -1.0e+31 }
    "FORMAT"      CDF_CHAR     { "F5" }
    "LABLAXIS"    CDF_CHAR     { "Energy" }
    "SI_conversion"
                  CDF_CHAR     { "6.242e12>J" }
    "UNITS"       CDF_CHAR     { "MeV" }
    "VALIDMIN"    CDF_FLOAT    { 0.0 }
    "VALIDMAX"    CDF_FLOAT    { 1.0e+31 }
    "VAR_TYPE"    CDF_CHAR     { "support_data" }
```

```
    "VAR_NOTES"    CDF_CHAR      { "Energy levels are a combination of IPS" -
                                   " and HISTp" } .

  ! NRV values follow...

    [1] = 0.0188722
    [2] = 0.0243204
    [3] = 0.0323458
    [4] = 0.0431277
    [5] = 0.057172
    [6] = 0.0760226
    [7] = 0.101728
    [8] = 0.137833
    [9] = 0.188629
    [10] = 0.258772
    [11] = 0.355459
    [12] = 0.489242
    [13] = 0.67382
    [14] = 0.928968
    [15] = 1.28139
    [16] = 1.73494
    [17] = 1.73205
    [18] = 3.34963
    [19] = 4.17025
    [20] = 5.18879
    [21] = 6.46111
    [22] = 8.042
    [23] = 10.0097
    [24] = 12.4649
    [25] = 15.5216
    [26] = 19.3241
    [27] = 24.06
    [28] = 29.9599
    [29] = 37.3009
    [30] = 46.4408
    [31] = 57.8179
    [32] = 71.9822


! Variable           Data       Number                    Record    Dimension
! Name               Type      Elements  Dims  Sizes    Variance   Variances
! --------           ----      --------  ----  -----    --------   ---------

  "channel_bound"
                   CDF_REAL4       1       1     2         F          T

  ! Attribute        Data
  ! Name             Type        Value
  ! --------         ----        -----

    "CATDESC"      CDF_CHAR      { "Channel bound" }
    "DICT_KEY"     CDF_CHAR      { "angle>pitch" }
    "FIELDNAM"     CDF_CHAR      { "channel bound" }
    "FILLVAL"      CDF_FLOAT     { -1.0e+31 }
    "FORMAT"       CDF_CHAR      { "F5" }
    "LABLAXIS"     CDF_CHAR      { "Channel bound" }
    "SI_conversion"
                   CDF_CHAR      { " " }
    "UNITS"        CDF_CHAR      { " " }
    "VALIDMIN"     CDF_FLOAT     { 0.0 }
    "VALIDMAX"     CDF_FLOAT     { 1.0 }
    "VAR_TYPE"     CDF_CHAR      { "support_data" }
    "VAR_NOTES"    CDF_CHAR      { "0 denotes min value and 1 denotes max " -
                                   "value" } .

  ! NRV values follow...
```

```
    [1] = 0.0
    [2] = 1.0


! Variable          Data      Number                  Record   Dimension
! Name              Type     Elements  Dims  Sizes  Variance  Variances
! --------          ----     --------  ----  -----  --------  ---------

  "channel_bound_LABL"
                   CDF_CHAR       3       1     2        F         T

  ! Attribute       Data
  ! Name            Type       Value
  ! --------        ----       -----

    "CATDESC"      CDF_CHAR     { "channel_bound_LABL" }
    "DICT_KEY"     CDF_CHAR     { "label" }
    "FIELDNAM"     CDF_CHAR     { "channel bound LABL" }
    "FORMAT"       CDF_CHAR     { "A3" }
    "VAR_TYPE"     CDF_CHAR     { "metadata" } .

  ! NRV values follow...

    [1] = { "min" }
    [2] = { "max" }


! Variable          Data      Number                  Record   Dimension
! Name              Type     Elements  Dims  Sizes  Variance  Variances
! --------          ----     --------  ----  -----  --------  ---------

  "FPDU_Alpha_Eq"
                   CDF_REAL4      1       1     9        T         T

  ! Attribute       Data
  ! Name            Type       Value
  ! --------        ----       -----

    "AVG_TYPE"     CDF_CHAR     { "standard" }
    "CATDESC"      CDF_CHAR     { "Mean equatorial pitch-angle for FPDU" }
    "DEPEND_0"     CDF_CHAR     { "Epoch" }
    "DEPEND_1"     CDF_CHAR     { "FPDU_Alpha" }
    "DICT_KEY"     CDF_CHAR     { "angle>pitch" }
    "DISPLAY_TYPE"
                   CDF_CHAR     { "time_series" }
    "FIELDNAM"     CDF_CHAR     { "FPDU Alpha Eq" }
    "FILLVAL"      CDF_FLOAT    { -1.0e+31 }
    "FORMAT"       CDF_CHAR     { "F5" }
    "LABL_PTR_1"   CDF_CHAR     { "FPDU_LABL_2" }
    "SCALETYP"     CDF_CHAR     { "linear" }
    "SI_conversion"
                   CDF_CHAR     { "0.0174533>rad" }
    "UNITS"        CDF_CHAR     { "degrees" }
    "VALIDMIN"     CDF_FLOAT    { 0.0 }
    "VALIDMAX"     CDF_FLOAT    { 180.0 }
    "VAR_TYPE"     CDF_CHAR     { "data" }
    "VAR_NOTES"    CDF_CHAR     { "Mean equatorial pitch-angle" } .

  ! RV values were not requested.


! Variable          Data      Number                  Record   Dimension
! Name              Type     Elements  Dims  Sizes  Variance  Variances
! --------          ----     --------  ----  -----  --------  ---------
```

```
  "FPDU_Alpha"    CDF_REAL4      1       1     9        F         T

  ! Attribute       Data
  ! Name            Type       Value
  ! --------        ----       -----

    "CATDESC"     CDF_CHAR     { "Local pitch angle for FPDU" }
    "DICT_KEY"    CDF_CHAR     { "angle>pitch" }
    "FIELDNAM"    CDF_CHAR     { "FPDU Alpha" }
    "FILLVAL"     CDF_FLOAT    { -1.0e+31 }
    "FORMAT"      CDF_CHAR     { "F5" }
    "LABLAXIS"    CDF_CHAR     { "Local pitch angle" }
    "SI_conversion"
                  CDF_CHAR     { "0.0174533>rad" }
    "UNITS"       CDF_CHAR     { "degrees" }
    "VALIDMIN"    CDF_FLOAT    { 0.0 }
    "VALIDMAX"    CDF_FLOAT    { 180.0 }
    "VAR_TYPE"    CDF_CHAR     { "support_data" }
    "VAR_NOTES"   CDF_CHAR     { "10 degree pitch angle bins based on " -
                                 "the assumption of gyrotropy." } .

  ! NRV values follow...

    [1] = 10.0
    [2] = 30.0
    [3] = 50.0
    [4] = 70.0
    [5] = 90.0
    [6] = 110.0
    [7] = 130.0
    [8] = 150.0
    [9] = 170.0


! Variable          Data      Number                  Record   Dimension
! Name              Type     Elements  Dims  Sizes  Variance  Variances
! --------          ----     --------  ----  -----  --------  ---------

  "FPDU"          CDF_REAL4      1       2    32 9      T        T T

  ! Attribute       Data
  ! Name            Type       Value
  ! --------        ----       -----

    "AVG_TYPE"    CDF_CHAR     { "log" }
    "CATDESC"     CDF_CHAR     { "Unidirectional Differential Proton Flux"
}
    "DEPEND_0"    CDF_CHAR     { "Epoch" }
    "DEPEND_1"    CDF_CHAR     { "FPDU_Energy" }
    "DEPEND_2"    CDF_CHAR     { "FPDU_Alpha" }
    "DICT_KEY"    CDF_CHAR     { "particle_flux>proton_differential_dire" -
                                 "ctional" }
    "DISPLAY_TYPE"
                  CDF_CHAR     { "time_series" }
    "FIELDNAM"    CDF_CHAR     { "FPDU" }
    "FILLVAL"     CDF_FLOAT    { -1.0e+31 }
    "FORMAT"      CDF_CHAR     { "E10.3" }
    "LABL_PTR_1"  CDF_CHAR     { "FPDU_LABL_1" }
    "QUALITY_VAR"
                  CDF_CHAR     { "FPDU_Quality" }
    "SCALETYP"    CDF_CHAR     { "log" }
    "SI_conversion"
                  CDF_CHAR     { "1.602e-17>m^-2 s^-1 sr^-1 J^-1" }
    "UNITS"       CDF_CHAR     { "cm^-2 s^-1 sr^-1 MeV^-1" }
    "VALIDMIN"    CDF_FLOAT    { -1.0e+31 }
    "VALIDMAX"    CDF_FLOAT    { 1.0e+31 }
```

```
    "VAR_TYPE"     CDF_CHAR      { "data" }
    "VAR_NOTES"    CDF_CHAR      { "Dimension 1 holds channels." }
    "LABL_PTR_2"   CDF_CHAR      { "FPDU_LABL_2" } .

  ! RV values were not requested.


! Variable           Data       Number                    Record   Dimension
! Name               Type      Elements  Dims  Sizes    Variance  Variances
! --------           ----      --------  ----  -----    --------  ---------

  "FPDU_Quality"
                   CDF_INT2        1       2    32 9       T         T T

  ! Attribute        Data
  ! Name             Type        Value
  ! --------         ----        -----

    "CATDESC"      CDF_CHAR      { "FPDU Quality flag" }
    "DEPEND_0"     CDF_CHAR      { "Epoch" }
    "DEPEND_1"     CDF_CHAR      { "FPDU_Energy" }
    "DEPEND_2"     CDF_CHAR      { "FPDU_Alpha" }
    "DICT_KEY"     CDF_CHAR      { "flag>quality" }
    "FIELDNAM"     CDF_CHAR      { "FPDU_Quality" }
    "FILLVAL"      CDF_INT2      { -32768 }
    "FORMAT"       CDF_CHAR      { "I11" }
    "LABL_PTR_1"   CDF_CHAR      { "FPDU_LABL_1" }
    "UNITS"        CDF_CHAR      { "none" }
    "VALIDMIN"     CDF_INT2      { 0 }
    "VALIDMAX"     CDF_INT2      { 10 }
    "VAR_TYPE"     CDF_CHAR      { "support_data" }
    "VAR_NOTES"    CDF_CHAR      { "0 denotes highest quality. 1 denotes " -
                                   "problem with time resolution. 2 " -
                                   "denotes possible contamination. 3 " -
                                   "denotes saturation.  4 denotes any " -
                                   "other problem and 10 denotes that data" -
                                   " have not been qualified" }
    "LABL_PTR_2"   CDF_CHAR      { "FPDU_LABL_2" } .

  ! RV values were not requested.


! Variable           Data       Number                    Record   Dimension
! Name               Type      Elements  Dims  Sizes    Variance  Variances
! --------           ----      --------  ----  -----    --------  ---------

  "FPDU_LABL_1"    CDF_CHAR       20       1     32        F         T

  ! Attribute        Data
  ! Name             Type        Value
  ! --------         ----        -----

    "CATDESC"      CDF_CHAR      { "FPDU_LABL_1" }
    "DICT_KEY"     CDF_CHAR      { "label>energy" }
    "FIELDNAM"     CDF_CHAR      { "FPDU_LABL_1" }
    "FORMAT"       CDF_CHAR      { "A20" }
    "VAR_TYPE"     CDF_CHAR      { "metadata" } .

  ! NRV values follow...

    [1] = { " 0.017 -   0.021 MeV" }
    [2] = { " 0.021 -   0.028 MeV" }
    [3] = { " 0.028 -   0.037 MeV" }
    [4] = { " 0.037 -   0.050 MeV" }
    [5] = { " 0.050 -   0.066 MeV" }
    [6] = { " 0.066 -   0.088 MeV" }
```

```
    [7] = { " 0.088 -   0.118 MeV" }
    [8] = { " 0.118 -   0.161 MeV" }
    [9] = { " 0.161 -   0.221 MeV" }
    [10] = { " 0.221 -   0.303 MeV" }
    [11] = { " 0.303 -   0.417 MeV" }
    [12] = { " 0.417 -   0.574 MeV" }
    [13] = { " 0.574 -   0.791 MeV" }
    [14] = { " 0.791 -   1.091 MeV" }
    [15] = { " 1.091 -   1.505 MeV" }
    [16] = { " 1.505 -   2.000 MeV" }
    [17] = { " 1.000 -   3.000 MeV" }
    [18] = { " 3.000 -   3.740 MeV" }
    [19] = { " 3.740 -   4.650 MeV" }
    [20] = { " 4.650 -   5.790 MeV" }
    [21] = { " 5.790 -   7.210 MeV" }
    [22] = { " 7.210 -   8.970 MeV" }
    [23] = { " 8.970 -  11.170 MeV" }
    [24] = { "11.170 -  13.910 MeV" }
    [25] = { "13.910 -  17.320 MeV" }
    [26] = { "17.320 -  21.560 MeV" }
    [27] = { "21.560 -  26.850 MeV" }
    [28] = { "26.850 -  33.430 MeV" }
    [29] = { "33.430 -  41.620 MeV" }
    [30] = { "41.620 -  51.820 MeV" }
    [31] = { "51.820 -  64.510 MeV" }
    [32] = { "64.510 -  80.320 MeV" }

! Variable          Data      Number                  Record   Dimension
! Name              Type     Elements  Dims  Sizes  Variance  Variances
! --------          ----     --------  ----  -----  --------  ---------

  "FPDU_LABL_2"   CDF_CHAR      17       1     9        F         T

  ! Attribute       Data
  ! Name            Type       Value
  ! --------        ----       -----

    "CATDESC"     CDF_CHAR     { "FPDU_LABL_2" }
    "DICT_KEY"    CDF_CHAR     { "label>pitch_angle" }
    "FIELDNAM"    CDF_CHAR     { "FPDU_LABL_2" }
    "FORMAT"      CDF_CHAR     { "A17" }
    "VAR_TYPE"    CDF_CHAR     { "metadata" } .

  ! NRV values follow...

    [1] = { "   0.-20. degrees" }
    [2] = { "  20.-40. degrees" }
    [3] = { "  40.-60. degrees" }
    [4] = { "  60.-80. degrees" }
    [5] = { " 80.-100. degrees" }
    [6] = { "100.-120. degrees" }
    [7] = { "120.-140. degrees" }
    [8] = { "140.-160. degrees" }
    [9] = { "160.-180. degrees" }

! Variable          Data      Number                  Record   Dimension
! Name              Type     Elements  Dims  Sizes  Variance  Variances
! --------          ----     --------  ----  -----  --------  ---------

  "FEDU_Energy"   CDF_REAL4      1       1     24       F         T

  ! Attribute       Data
  ! Name            Type       Value
  ! --------        ----       -----
```

```
    "CATDESC"      CDF_CHAR     { "Energy levels for FEDU" }
    "DICT_KEY"     CDF_CHAR     { "energy>band" }
    "FIELDNAM"     CDF_CHAR     { "FEDU Energy" }
    "FILLVAL"      CDF_FLOAT    { -1.0e+31 }
    "FORMAT"       CDF_CHAR     { "F5" }
    "LABLAXIS"     CDF_CHAR     { "Energy" }
    "SI_conversion"
                   CDF_CHAR     { "6.242e12>J" }
    "UNITS"        CDF_CHAR     { "MeV" }
    "VALIDMIN"     CDF_FLOAT    { 0.0 }
    "VALIDMAX"     CDF_FLOAT    { 1.0e+31 }
    "VAR_TYPE"     CDF_CHAR     { "support_data" }
    "VAR_NOTES"    CDF_CHAR     { "Energy levels are a combination of IES" -
                                  " and HISTe" } .

  ! NRV values follow...

    [1] = 0.0237539
    [2] = 0.0360035
    [3] = 0.0498623
    [4] = 0.068624
    [5] = 0.0943146
    [6] = 0.129812
    [7] = 0.180017
    [8] = 0.250162
    [9] = 0.345997
    [10] = 0.41638
    [11] = 0.678112
    [12] = 0.721586
    [13] = 0.853697
    [14] = 1.06543
    [15] = 1.28326
    [16] = 1.55386
    [17] = 1.88926
    [18] = 2.41644
    [19] = 3.11017
    [20] = 3.99253
    [21] = 5.10024
    [22] = 6.38631
    [23] = 8.01162
    [24] = 10.0423


! Variable          Data      Number                  Record   Dimension
! Name              Type     Elements  Dims  Sizes  Variance  Variances
! --------          ----     --------  ----  -----  --------  ---------

  "FEDU_Alpha_Eq"
                  CDF_REAL4      1       1     9        T         T

  ! Attribute       Data
  ! Name            Type       Value
  ! --------        ----       -----

    "AVG_TYPE"     CDF_CHAR     { "standard" }
    "CATDESC"      CDF_CHAR     { "Mean equatorial pitch-angle for FEDU" }
    "DEPEND_0"     CDF_CHAR     { "Epoch" }
    "DEPEND_1"     CDF_CHAR     { "FEDU_Alpha" }
    "DICT_KEY"     CDF_CHAR     { "angle>pitch" }
    "DISPLAY_TYPE"
                   CDF_CHAR     { "time_series" }
    "FIELDNAM"     CDF_CHAR     { "FEDU Alpha Eq" }
    "FILLVAL"      CDF_FLOAT    { -1.0e+31 }
    "FORMAT"       CDF_CHAR     { "F5" }
    "LABL_PTR_1"   CDF_CHAR     { "FEDU_LABL_2" }
```

```
    "SCALETYP"    CDF_CHAR     { "linear" }
    "SI_conversion"
                  CDF_CHAR     { "0.0174533>rad" }
    "UNITS"       CDF_CHAR     { "degrees" }
    "VALIDMIN"    CDF_FLOAT    { 0.0 }
    "VALIDMAX"    CDF_FLOAT    { 180.0 }
    "VAR_TYPE"    CDF_CHAR     { "data" }
    "VAR_NOTES"   CDF_CHAR     { "Mean equatorial pitch-angle" } .

  ! RV values were not requested.


! Variable          Data      Number                  Record   Dimension
! Name              Type     Elements  Dims  Sizes  Variance  Variances
! --------          ----     --------  ----  -----  --------  ---------

  "FEDU_Alpha"    CDF_REAL4      1       1     9        F         T

  ! Attribute       Data
  ! Name            Type       Value
  ! --------        ----       -----

    "CATDESC"     CDF_CHAR     { "Local pitch angle for FEDU" }
    "DICT_KEY"    CDF_CHAR     { "angle>pitch" }
    "FIELDNAM"    CDF_CHAR     { "FEDU Alpha" }
    "FILLVAL"     CDF_FLOAT    { -1.0e+31 }
    "FORMAT"      CDF_CHAR     { "F5" }
    "LABLAXIS"    CDF_CHAR     { "Local pitch angle" }
    "SI_conversion"
                  CDF_CHAR     { "0.0174533>rad" }
    "UNITS"       CDF_CHAR     { "degrees" }
    "VALIDMIN"    CDF_FLOAT    { 0.0 }
    "VALIDMAX"    CDF_FLOAT    { 180.0 }
    "VAR_TYPE"    CDF_CHAR     { "support_data" }
    "VAR_NOTES"   CDF_CHAR     { "10 degree pitch angle bins based on " -
                                 "the assumption of gyrotropy." } .

  ! NRV values follow...

    [1] = 10.0
    [2] = 30.0
    [3] = 50.0
    [4] = 70.0
    [5] = 90.0
    [6] = 110.0
    [7] = 130.0
    [8] = 150.0
    [9] = 170.0


! Variable          Data      Number                  Record   Dimension
! Name              Type     Elements  Dims  Sizes  Variance  Variances
! --------          ----     --------  ----  -----  --------  ---------

  "FEDU"          CDF_REAL4      1       2    24 9      T        T T

  ! Attribute       Data
  ! Name            Type       Value
  ! --------        ----       -----

    "AVG_TYPE"    CDF_CHAR     { "log" }
    "CATDESC"     CDF_CHAR     { "Unidirectional Differential Electron " -
                                 "Flux" }
    "DEPEND_0"    CDF_CHAR     { "Epoch" }
    "DEPEND_1"    CDF_CHAR     { "FEDU_Energy" }
    "DEPEND_2"    CDF_CHAR     { "FEDU_Alpha" }
```

```
    "DICT_KEY"     CDF_CHAR     { "particle_flux>electron_differential_di" -
                                  "rectional" }
    "DISPLAY_TYPE"
                   CDF_CHAR     { "time_series" }
    "FIELDNAM"     CDF_CHAR     { "FEDU" }
    "FILLVAL"      CDF_FLOAT    { -1.0e+31 }
    "FORMAT"       CDF_CHAR     { "E10.3" }
    "LABL_PTR_1"   CDF_CHAR     { "FEDU_LABL_1" }
    "QUALITY_VAR"
                   CDF_CHAR     { "FEDU_Quality" }
    "SCALETYP"     CDF_CHAR     { "log" }
    "SI_conversion"
                   CDF_CHAR     { "1.602e-17>m^-2 s^-1 sr^-1 J^-1" }
    "UNITS"        CDF_CHAR     { "cm^-2 s^-1 sr^-1 MeV^-1" }
    "VALIDMIN"     CDF_FLOAT    { -1.0e+31 }
    "VALIDMAX"     CDF_FLOAT    { 1.0e+31 }
    "VAR_TYPE"     CDF_CHAR     { "data" }
    "VAR_NOTES"    CDF_CHAR     { "FEDU, Dimension 1 holds channels, " -
                                  "Dimension 2 holds pitch angles." }
    "LABL_PTR_2"   CDF_CHAR     { "FEDU_LABL_2" } .

  ! RV values were not requested.


! Variable           Data      Number                    Record   Dimension
! Name               Type     Elements  Dims  Sizes   Variance  Variances
! --------           ----     --------  ----  -----   --------  ---------

  "FEDU_Quality"
                   CDF_INT2       1       2    24 9      T        T T

  ! Attribute        Data
  ! Name             Type        Value
  ! --------         ----        -----

    "CATDESC"      CDF_CHAR     { "FEDU Quality flag" }
    "DEPEND_0"     CDF_CHAR     { "Epoch" }
    "DEPEND_1"     CDF_CHAR     { "FEDU_Energy" }
    "DEPEND_2"     CDF_CHAR     { "FEDU_Alpha" }
    "DICT_KEY"     CDF_CHAR     { "flag>quality" }
    "FIELDNAM"     CDF_CHAR     { "FEDU_Quality" }
    "FILLVAL"      CDF_INT2     { -32768 }
    "FORMAT"       CDF_CHAR     { "I11" }
    "LABL_PTR_1"   CDF_CHAR     { "FEDU_LABL_1" }
    "UNITS"        CDF_CHAR     { "none" }
    "VALIDMIN"     CDF_INT2     { 0 }
    "VALIDMAX"     CDF_INT2     { 10 }
    "VAR_TYPE"     CDF_CHAR     { "support_data" }
    "VAR_NOTES"    CDF_CHAR     { "0 denotes highest quality. 1 denotes " -
                                  "problem with time resolution. 2 " -
                                  "denotes possible contamination. 3 " -
                                  "denotes saturation.  4 denotes any " -
                                  "other problem and 10 denotes that data" -
                                  " have not been qualified" }
    "LABL_PTR_2"   CDF_CHAR     { "FEDU_LABL_2" } .

  ! RV values were not requested.


! Variable           Data      Number                    Record   Dimension
! Name               Type     Elements  Dims  Sizes   Variance  Variances
! --------           ----     --------  ----  -----   --------  ---------

  "FEDU_LABL_1"    CDF_CHAR      19       1     24        F         T

  ! Attribute        Data
```

```
  ! Name             Type        Value
  ! --------         ----        -----

    "CATDESC"      CDF_CHAR      { "FEDU_LABL_1" }
    "DICT_KEY"     CDF_CHAR      { "label>energy" }
    "FIELDNAM"     CDF_CHAR      { "FEDU_LABL_1" }
    "FORMAT"       CDF_CHAR      { "A19" }
    "VAR_TYPE"     CDF_CHAR      { "metadata" } .

  ! NRV values follow...

    [1] = { "0.019 -   0.031 MeV" }
    [2] = { "0.031 -   0.042 MeV" }
    [3] = { "0.042 -   0.059 MeV" }
    [4] = { "0.059 -   0.080 MeV" }
    [5] = { "0.080 -   0.111 MeV" }
    [6] = { "0.111 -   0.152 MeV" }
    [7] = { "0.152 -   0.212 MeV" }
    [8] = { "0.212 -   0.295 MeV" }
    [9] = { "0.295 -   0.406 MeV" }
    [10] = { "0.406 -   0.426 MeV" }
    [11] = { "0.657 -   0.700 MeV" }
    [12] = { "0.700 -   0.744 MeV" }
    [13] = { "0.744 -   0.980 MeV" }
    [14] = { "0.980 -   1.158 MeV" }
    [15] = { "1.158 -   1.422 MeV" }
    [16] = { "1.422 -   1.698 MeV" }
    [17] = { "1.698 -   2.102 MeV" }
    [18] = { "2.102 -   2.778 MeV" }
    [19] = { "2.778 -   3.482 MeV" }
    [20] = { "3.482 -   4.578 MeV" }
    [21] = { "4.578 -   5.682 MeV" }
    [22] = { "5.682 -   7.178 MeV" }
    [23] = { "7.178 -   8.942 MeV" }
    [24] = { "8.942 -  11.278 MeV" }

! Variable          Data      Number                    Record   Dimension
! Name              Type     Elements  Dims  Sizes  Variance  Variances
! --------          ----     --------  ----  -----  --------  ---------

  "FEDU_LABL_2"   CDF_CHAR      17       1     9        F         T

  ! Attribute       Data
  ! Name            Type        Value
  ! --------        ----        -----

    "CATDESC"      CDF_CHAR      { "FEDU_LABL_2" }
    "DICT_KEY"     CDF_CHAR      { "label>pitch_angle" }
    "FIELDNAM"     CDF_CHAR      { "FEDU_LABL_2" }
    "FORMAT"       CDF_CHAR      { "A17" }
    "VAR_TYPE"     CDF_CHAR      { "metadata" } .

  ! NRV values follow...

    [1] = { "   0.-20. degrees" }
    [2] = { "  20.-40. degrees" }
    [3] = { "  40.-60. degrees" }
    [4] = { "  60.-80. degrees" }
    [5] = { " 80.-100. degrees" }
    [6] = { "100.-120. degrees" }
    [7] = { "120.-140. degrees" }
    [8] = { "140.-160. degrees" }
    [9] = { "160.-180. degrees" }
```

```
#end
```