746

PIONEER 11

15-MIN INTERPLANETARY DATA, SFDU

73-019A-02D

Table of Contents

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1. INTRODUCTION:

The documentation for this data set was originally on paper, kept in NSSDC's Data Set Catalogs (DSCs). The paper documentation in the Data Set Catalogs have been made into digital images, and then collected into a single PDF file for each Data Set Catalog. The inventory information in these DSCs is current as of July 1, 2004. This inventory information is now no longer maintained in the DSCs, but is now managed in the inventory part of the NSSDC information system. The information existing in the DSCs is now not needed for locating the data files, but we did not remove that inventory information.

The offline tape datasets have now been migrated from the original magnetic tape to Archival Information Packages (AIP's).

A prior restoration may have been done on data sets, if a requestor of this data set has questions; they should send an inquiry to the request office to see if additional information exists.

2. ERRATA/CHANGE LOG:

NOTE: Changes are made in a text box, and will show up that way when displayed on screen with a PDF reader.

When printing, special settings may be required to make the text box appear on the printed output.

Version	Date	Person	Page	Description of Change
01				
02				

3 LINKS TO RELEVANT INFORMATION IN THE ONLINE NSSDC INFORMATION SYSTEM:

http://nssdc.gsfc.nasa.gov/nmc/

[NOTE: This link will take you to the main page of the NSSDC Master Catalog. There you will be able to perform searches to find additional information]

4. CATALOG MATERIALS:

a. Associated Documents   To find associated documents you will need to know the document ID number and then click here.
http://nssdcftp.gsfc.nasa.gov/miscellaneous/documents/

b. Core Catalog Materials

REQ. AGENT	ACQ. AGENT
CMW	JFC

PIONEER 11

15-MIN INTERPLANETARY DATA, SFDU

73-019A-02D SPHE-00482

This data set consists of 2 magnetic tapes. The tapes were written on 9-track, 6250 bpi, in SFDU format, and can be read with the VAX COPY command in VMS directory format. The tapes are not labeled. The first two files on each tape contains the volume description and the file formats. These are followed by the data files. All data records are of the same length, 32256 ASCII characters or bytes per physical record. Each physical record contains 96 logical records of length 336 bytes. The D and C numbers and time span are as follows:

D#	C#	FILES HEADER/DATA	TIME SPAN
D-100501	C-031394	1-2/3-24	04/06/73 - 12/31/83
D-100502	C-031395	1-2/3-20	01/01/84 - 11/28/92

CMW031 DUPE OF D-100501/P11CP1

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START TIME = 1973/096	BLOCK 1	RECORD 12
STOP TIME = 1973/181	BLOCK 86	RECORD 96
START TIME = 1973/182	BLOCK 1	RECORD 1
STOP TIME = 1973/365	BLOCK 184	RECORD 93
START TIME = 1974/001	BLOCK 1	RECORD 1
STOP TIME = 1974/181	BLOCK 181	RECORD 96
START TIME = 1974/182	BLOCK 1	RECORD 1
STOP TIME = 1974/365	BLOCK 184	RECORD 95
START TIME = 1975/001	BLOCK 1	RECORD 1
STOP TIME = 1975/181	BLOCK 181	RECORD 96
START TIME = 1975/182	BLOCK 1	RECORD 1
STOP TIME = 1975/365	BLOCK 184	RECORD 83
START TIME = 1976/001	BLOCK 1	RECORD 20
STOP TIME = 1976/182	BLOCK 182	RECORD 69
START TIME = 1976/183	BLOCK 1	RECORD 50
STOP TIME = 1976/366	BLOCK 184	RECORD 30
START TIME = 1977/001	BLOCK 1	RECORD 72
STOP TIME = 1977/181	BLOCK 181	RECORD 96
START TIME = 1977/182	BLOCK 1	RECORD 1
STOP TIME = 1977/365	BLOCK 184	RECORD 74
START TIME = 1978/001	BLOCK 1	RECORD 78
STOP TIME = 1978/181	BLOCK 181	RECORD 52
START TIME = 1978/182	BLOCK 1	RECORD 29
STOP TIME = 1978/365	BLOCK 184	RECORD 39
START TIME = 1979/001	BLOCK 1	RECORD 23
STOP TIME = 1979/181	BLOCK 181	RECORD 96
START TIME = 1979/182	BLOCK 1	RECORD 1
STOP TIME = 1979/365	BLOCK 184	RECORD 64
START TIME = 1980/001	BLOCK 1	RECORD 29
STOP TIME = 1980/182	BLOCK 182	RECORD 96
START TIME = 1980/183	BLOCK 1	RECORD 1
STOP TIME = 1980/366	BLOCK 184	RECORD 77
START TIME = 1981/001	BLOCK 1	RECORD 1
STOP TIME = 1981/181	BLOCK 181	RECORD 96
START TIME = 1981/182	BLOCK 1	RECORD 1
STOP TIME = 1981/365	BLOCK 184	RECORD 94
START TIME = 1982/001	BLOCK 1	RECORD 6
STOP TIME = 1982/181	BLOCK 181	RECORD 90
START TIME = 1982/182	BLOCK 1	RECORD 19
STOP TIME = 1982/365	BLOCK 184	RECORD 84
START TIME = 1983/001	BLOCK 1	RECORD 9
STOP TIME = 1983/181	BLOCK 181	RECORD 88
START TIME = 1983/183	BLOCK 2	RECORD 34
STOP TIME = 1983/365	BLOCK 184	RECORD 50

F11CP2 = DUPE OF D-100502
========================

START TIME = 1984/001 BLOCK 1 RECORD 74
STOP TIME = 1984/182 BLOCK 182 RECORD 69 ♀ F3

START TIME = 1984/183 BLOCK 1 RECORD 66
STOP TIME = 1984/366 BLOCK 184 RECORD 95

START TIME = 1985/001 BLOCK 1 RECORD 13
STOP TIME = 1985/181 BLOCK 181 RECORD 48

START TIME = 1985/182 BLOCK 1 RECORD 26
STOP TIME = 1985/365 BLOCK 184 RECORD 59

START TIME = 1986/002 BLOCK 2 RECORD 43
STOP TIME = 1986/180 BLOCK 180 RECORD 56

START TIME = 1986/182 BLOCK 1 RECORD 3
STOP TIME = 1986/365 BLOCK 184 RECORD 77

START TIME = 1987/003 BLOCK 3 RECORD 51
STOP TIME = 1987/181 BLOCK 181 RECORD 95

START TIME = 1987/183 BLOCK 2 RECORD 92
STOP TIME = 1987/365 BLOCK 184 RECORD 95

START TIME = 1988/001 BLOCK 1 RECORD 1
STOP TIME = 1988/181 BLOCK 181 RECORD 92

START TIME = 1988/184 BLOCK 2 RECORD 21
STOP TIME = 1988/364 BLOCK 182 RECORD 77

START TIME = 1989/001 BLOCK 1 RECORD 66
STOP TIME = 1989/181 BLOCK 181 RECORD 94

START TIME = 1989/184 BLOCK 3 RECORD 23
STOP TIME = 1989/365 BLOCK 184 RECORD 95

START TIME = 1990/001 BLOCK 1 RECORD 1
STOP TIME = 1990/178 BLOCK 178 RECORD 39

START TIME = 1990/184 BLOCK 3 RECORD 35
STOP TIME = 1990/365 BLOCK 184 RECORD 31

START TIME = 1991/001 BLOCK 1 RECORD 62
STOP TIME = 1991/181 BLOCK 181 RECORD 53

START TIME = 1991/182 BLOCK 1 RECORD 2
STOP TIME = 1991/305 BLOCK 124 RECORD 19

START TIME = 1992/154 BLOCK 154 RECORD 20
STOP TIME = 1992/182 BLOCK 182 RECORD 86

START TIME = 1992/215 BLOCK 33 RECORD 17 ♀ F20
STOP TIME = 1992/<u>333</u> BLOCK 151 RECORD 58

<u>November, 28th</u>

The University of Chicago
Laboratory for Astrophysics and Space Research

933 E. 56th Street
Chicago IL 60637

Tel: (312)702-7836
FAX: (312)702-6645
Email: lentz@odysseus.uchicago.edu

Date: April 1, 1993

Dr John Cooper
S. T. Systems Corp.
7601 Ora Glenn Drive
Greenbelt MD 20771

Dear John;

I am sending you today two (2) magnetic tapes containing the University of Chicago Pioneer-11 Charged Particle Instrument archive data from launch through 1992. This completes the initial submission of the Cruise-Mode Archive Data for this instrument as agreed by the Pioneer Principal Investigators. Additions to this dataset will be made approximately annually as new data becomes available.

The two tape volumes are identified as follows; for the first volume:

Vol_Ident: USA_NASA_NSSD_P11B_0001
Data_Set_Name: Pioneer 11 CPI Cruise Data Archive
Data_Source: Pioneer 11 Charged Particle Instrument
Vol_Time_Coverage: 1973-04-06 to 1983-12-31

and for the second volume:

Vol_Ident: USA_NASA_NSSD_P11B_0002
Data_Set_Name: Pioneer 11 CPI Cruise Data Archive
Data_Source: Pioneer 11 Charged Particle Instrument
Vol_Time_Coverage: 1984-01-01 to 1992-12-31

Sincerely

Gordon A. Lentz
Manager, Data Systems

Cc: J. Simpson
C. Lopate
C. Sethuramen

DSC # 146

73-019A-02D

CCSD3ZF0000100000001CCSD3VS00002MRK**001

l_Ident: USA_NASA_NSSD_P11B_0001

Vol_Creation_Date: 1993-03-29

Medium_Description: 1/2 inch, 9 track, 6250 bpi magnetic tape, unlabeled

Technical_Contact:

Gordon A. Lentz
University of Chicago
Enrico Fermi Institute
Laboratory for Astrophysics and Space Research
933 E. 56th Street
Chicago, IL 60637
Telephone: (312) 702-7836
E-Mail: (NSI/DECnet) LASR::LENTZ
: (Internet) lentz@odysseus.uchicago.edu

Prev_Vols: none

CCSD$$MARKERMRK**001CCSD3SS00002MRK**002

Data_Set_Name: Pioneer 11 CPI Cruise Data Archive

Data_Source: Pioneer 11 Charged Particle Instrument

Scientific_Contact:

Prof. John A. Simpson
University of Chicago
Enrico Fermi Institute
Laboratory for Astrophysics and Space Research
933 E. 56th Street
Chicago, IL 60637
Telephone: (312) 702-7670

Spacecraft_Characteristics: The Pioneer 10 and 11 spacecraft are near-twin
spacecraft which were launched toward Jupiter about a year apart with differen'
closest-approach radii at the respective encounters, and differing post-
encounter trajectories. Pioneer 10 was launched on March 3, 1972, and
encountered Jupiter in December, 1973. Since the encounter, it has been on an
escape trajectory from the solar system, and at the end of 1991 it was at a
distance of about 53 AU from the sun, a celestial latitude of +3 degrees, and
celestial longitude (measured eastward from the vernal equinox) of 73 degrees.
Pioneer 11 was launched April 5, 1973 and encountered Jupiter in December 1974
Its post-encounter trajectory was chosen so that it would encounter Saturn som
5 years later; this encounter took place successfully in August-September 1979
At the end of 1991 Pioneer 11 was at a radial distance of 35 AU, a celestial
latitude of +17 degrees and a celestial longitude of -95 degrees. Both
spacecraft were instrumented with a full suite of instruments for fields and
particles, including magnetometer, plasma sensors, and four energetic particle
and cosmic ray instruments. Other instruments included an ultraviolet
photometer, infrared photometer, imaging photopolarimeter, and micrometeoroid
detector. The spacecraft are spin stabilized, with the spin axis oriented
toward the earth.

(More from the data set)

DSC #746
73-019A-02D

CCSD3ZF0000100000001CCSD3VS00002MRK**001

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Vol_Creation_Date: 1993-03-29

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University of Chicago
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Laboratory for Astrophysics and Space Research
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Chicago, IL 60637
Telephone: (312) 702-7836
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Prev_Vols: none

CCSD$$MARKERMRK**001CCSD3SS00002MRK**002

Data_Set_Name: Pioneer 11 CPI Cruise Data Archive

Data_Source: Pioneer 11 Charged Particle Instrument

Scientific_Contact:

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Investigation_Objectives: The basic scientific objectives of the University of Chicago Charged Particle Instrument (CPI) on Pioneer 10/11 are divided into two categories: (a) those concerned with studies of the magnetospheric environments of Jupiter (Pioneer 10/11) and Saturn (Pioneer 11 only), and (b) those concerned with investigations in the interplanetary medium. The objectives in the study of the planetary magnetospheres are described in NSSDC documents elsewhere. The interplanetary objectives are directed towards studies of transient and long-term solar modulation of galactic cosmic rays, towards studies of acceleration mechanisms for cosmic rays in interplanetary space, and towards studies of propagation and storage of energetic solar particles, in what can be considered to be three regimes of interplanetary space. These are (1) the inner solar system between one and five A.U. from the Sun, (2) the extended region of the solar cavity beyond the orbit of Jupiter to a predicted terminal shock in the solar wind at 50-150 A.U., and (3) the region between the solar wind termination shock and the 'modulation boundary' at several hundred A.U., expected to be characterized by some kind of transition to the local interstellar medium. The basic interplanetary objectives can be summarized as follows:

(1) The measurement of the variation of the differential energy spectra and flux level of energetic charged particles (protons, helium, some heavy nuclei and electrons) with heliographic radius, longitude and latitude, and time. Time variations in the radial and latitudinal gradients are of specific interest for studies of long-term solar modulation of galactic cosmic rays, and the origin of the anomalous components of cosmic rays. The latter is thought to arise from acceleration of cold, singly ionized interstellar atoms at the termination shock of the solar wind. Radial and longitudinal variations are of interest for the study of the propagation of Jovian electrons in the inner heliosphere, where electron acceleration in and leakage from the Jovian magnetosphere is the dominant source, and for the study of cosmic ray particle propagation, acceleration, and transient modulation by traveling shocks and corotating interaction regions.

(2) Investigation of the radial and longitudinal dependence of the energy spectra, composition, and time-intensity behavior for energetic particles from solar flares and solar active regions in both the inner and outer heliospheres. Measurements of spatial gradients can be used to determine parameters for energetic particle diffusion parallel and perpendicular to the interplanetary magnetic field, while composition measurements yield information on acceleration and propagation of flare ions within the solar atmosphere and corona.

Cruise data are useful for the following reasons in planetary studies:

(1) The state of the interplanetary energetic particles can be assessed before the planetary flybys to determine if large solar flare events or effects of interplanetary shock acceleration may inject new particles into the magnetosphere prior to or doing passage through the magnetosphere.

(2) Leakage of particles (e.g., Jovian electrons) can be studied as a function of temporal phase with respect to the planetary rotation period to allow inference of the particle source mechanism.

In order to meet the interplanetary objectives, continuous measurements of the fluxes, energy spectra, and chemical and isotopic composition of energetic charged particles in the interplanetary medium in the inner and outer heliosphere are required. In particular, for nuclei which stop in the sensors (energy range 0.5 - 67 MeV for protons)the instrument separately identifies individual nuclei including protons, helium and higher Z nuclei up to oxygen, and measures the energy and differential flux of these particles. The integral flux of nuclei which completely penetrate the sensors (energy >67 MeV for protons) is also measured. Electron spectra are measured from ~3 to ~30 MeV.

Instrument_Attributes:

A. Sensor Characteristics: The Pioneer 10 and 11 CPI instruments consist of four separate sensors, which are the Main Telescope (MT), the Low Energy Subsystem Telescope (LET), the Electron Current Detector (ECD or "Egg"), and the Fission Cell Detector. Detailed descriptions of these sensors are given in Simpson et al. (1974a,b; 1980). For cruise data analysis only the MT and LET telescopes are utilized.

1. The Main Telescope. The major portion of the instrument response is provided by a 7-element solid state telescope utilizing Li-drifted silicon detectors, a CsI scintillator viewed by a photo-diode, and a cylindrical plastic scintillator guard detector viewed by a photomultiplier tube. This detector telescope satisfies the response capability required for the interplanetary objectives given above except as supplemented by the LET sensor described below. Coincidence-anticoincidence requirements on various combinations of detectors define particle range intervals in which counting rates are measured. In addition, the amount of energy lost in each of three detectors by individual particles passing through the telescope is measured using three pulse height analyzers, thus providing information for particle identification and measurement of energy.

The seven detector elements are identified as D1 through D7, where D1, D2, D3, D4, and D6 are Li-drifted silicon detectors. D5 is composed of a CsI scintillator crystal, shaped in the form of a truncated cone, viewed through its bottom face by a Li-drifted silicon photodiode, and D7 is the plastic scintillator. Detectors D1 and D2 are formed as spherical segments in the Pioneer 11 instrument in order to improve resolution. Pioneer 10 had one flat and one curved detector. The so-called "large geometry" of telescope acceptance for incident events is formed by the D1 and D2 detectors which define an acceptance cone of half angle 32 degrees, for which D3 provides a range measurement in this geometry. The "small geometry" is formed by D1 and D4 with a cone half angle of 23 degrees, for which D5 and D6 provide two additional range measurements. The D7 plastic scintillator is used to reject all particles penetrating the configuration from other directions than those defined by the large and small geometries.

Coincidence and anticoincidence requirements on combinations of detectors triggered by penetration of a charged particle define particle range intervals (also called range ID's) in which counting rates are measured. In addition to these requirements a restriction requiring the total amount of energy deposited in D1 and D2 to total at least 3 MeV for low-energy counting rates is incorporated in the form of the "slant" or "S" discriminator. This condition eliminates background from gamma rays from 200 keV to 3 MeV produced by the Radio-isotope Thermoelectric Generators (RTG's) which produce power for the spacecraft. Since the sensor electronics are optimized for low flux environments in interplanetary space, the MT coincidence rates are overwhelmed by accidental coincidences in high flux environments, and caution is required in the interpretation of data from such periods (e.g., in Jupiter's magnetosphere or in very large solar flare particle events such as occurred in August 1972).

Multiparameter pulse-height analysis is performed using D1, D2, and D5. Energy losses due to charged particle ionization are measured in these three detectors by using multiple-ramp linear post amplifiers in conjunction with 256 channel pulse height analyzers. Hence there are 2 independent streams of digital information: (1) particle event counting rates in the range intervals or ID's, and (2) multiparameter pulse height analysis for each analyzed particle event. The first provides a continuous measure of particle flux, while the second provides information for identifying particle type and energy for a random sample of particles entering the telescope.

2. The Low Energy Telescope. The LET consists of three silicon detectors: a thin (36.3 micron) detector identified as L1, an annular detector, and a flat detector, the last two being coupled together electronically and identified as L2. Passive shielding defines a front aperture of conical half-angle 38 degrees which is further protected by a thin titanium window (0.84 mg/sq-cm) and which points perpendicular to the spacecraft spin axis. The passive shield excludes protons and heavier nuclei below about 45 MeV/amu from penetration to the active detectors from the sides. Protons entering through the aperture trigger only the L1 detector at incident energies of 0.54-1.8 MeV/amu and will trigger both L1 and L2 for energies in the range of 1.8-8.8 MeV/amu. The helium response extends to 50 MeV/amu for L1.L2 events but no heavier ions can be identified. Thirty-two channel pulse height analysis is performed for energy deposition in the L1 detector, which has a 350-keV discriminator threshold. For each L1 event the state of the L2 discriminator is also recorded to identify L1.L2 events, but the L2 pulse height is not recorded. The same discriminator that controls the pulse height analysis is used to increment the counting rate accumulators corresponding to L1.(NOT L2) and L1.L2 events.

3. Electron Current Detector. The ECD was developed especially for the extremely high fluxes of electrons with energies >3 MeV in the inner Jovian magnetosphere. It consists of a shielded, single solid state detector which operates in current mode at temperatures below -40 degrees (C). Current flow due to formation of electron-hole pairs produced by incident charged particles is linear for electron fluxes up to at least 10**11 electrons/cm**2 sr. Current flow is measured by a logarithmic amplifier which has no significant response to single electron events, so the use of the ECD is restricted to high flux environments. Beryllium shielding absorbs protons and ions below 35 MeV/amu in energy while allowing electrons at energies >= 3.4 MeV to penetrate. The light metallic element Be was chosen to minimize Bremsstrahlung and electron range scattering. The external mount and surface treatment of the ECD cool it to temperatures in the nominal range where the leakage current is 5x(10**(-11)) Ampere. Flux measurements with the ECD have accuracies of approximately a factor two or three, primarily as a result of variations in sensitivity with spectral form and direction of incidence.

4. The fission cell was designed to detect and measure a high-energy proton component in the presence of intense fluxes of high energy electrons. The technique used is to measure the fission fragments resulting from proton-induced fission in the isotope Th-232, since the ratio of cross sections for nucleon-induced fission to electron-induced fission is 10**3 to 10**5, depending on electron energy. In order to measure the fission fragment spectrum, two electrically connected curved silicon surface-barrier detectors surround a 5-mil fission foil of Th-232. The detectors are curved to minimize the possibility of confusing a proton-induced fission event with a high-energy particle having a pathlength long enough to produce a larger signal. The threshold energy of the fission cell, 35 MeV, is determined by the Th-232 coulomb barrier and the minimum amount of 1 gm/cm**2 shielding material. Two counting rates, F1 and F2, are obtained by setting the detector discriminator levels at 30 and 50 MeV, respectively. In this way a ratio F1/F2 is gained which is useful for determination of species or energy spectra of incident particles, the response being significantly different for light and heavy ions. The fission cell was used primarily in the Jovian and Saturnian magnetospheres.

B. Data_Channel_Identifiers:

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Detector Combination	ID Code	Species	Energies	Geometry Factor (sqcm-ster.) Pion-10	Pion-11
D1.S.NOT(D2 or D7)	1	P, He	3-10 MeV/amu	~7	~7
	1	CNO	5-20 MeV/amu	~7	~7
D1.D2.S.NOT(D3 or D7)	2	P, He	11-20 MeV/amu	1.30	1.27
	2	C	18-35 MeV/amu	1.30	1.27
	2	N	20-40 MeV/amu	1.30	1.27
	2	O	22-45 MeV/amu	1.30	1.27
D1.D2.S.D3.NOT(D4 or D7)*	3	P, He	20-24 MeV/emu	1.35	1.27
	3	C	35-42 MeV/amu	1.35	1.27
	3	N	40-47 MeV/amu	1.35	1.27
	3	O	45-52 MeV/amu	1.35	1.27
D1.D2.D4.NOT(D5 or D7)	4	P, He	24-29 MeV/amu	0.388	0.419
	4	C	42-50 MeV/amu	0.388	0.419
	4	N	47-55 MeV/amu	0.388	0.419
	4	O	52-60 MeV/amu	0.388	0.419
	4	e-	2- 7 MeV	0.388	0.419
D1.D2.D4.D5.NOT(D6 or D7)	5	P, He	29-67 MeV/amu	0.388	0.419
	5	C	50-125 MeV/amu	0.388	0.419
	5	N	55-140 MeV/amu	0.388	0.419
	5	O	60-185 MeV/amu	0.388	0.419
	5	e-	6-28 MeV	0.388	0.419
D1.D2.D4.D5.D6.NOT(D7)	7	P, He	>67 MeV/amu	~2	~2
	7	C	>125 MeV/amu	~2	~2
	7	N	>140 MeV/amu	~2	~2
	7	O	>185 MeV/amu	~2	~2
L1.NOT(L2)		P	0.5-1.85 MeV	0.486	0.486
		He	0.3-1.82 MeV/amu	0.486	0.486
L1.L2		P	1.85-8.80 MeV	0.486	0.486
		He	1.82-50 MeV/amu	0.486	0.486

*Note: This logic is correct for the Pioneer 10 instrument only; for the Pioneer-11 this logic was changed to:
D1.D2.S.D3.NOT(D4 or D5 or D6 or D7)
Because of the difference in the ID3 logic between the Pioneer 10 and Pioneer 11 instruments, rates and fluxes for this ID should not be combined or added from the two instruments.

****

C. Data_Readout: The CPI instrument readout of high priority rate and pulse height (PHA) information utilizes a four-frame cycle, where 33 bits are allotted to CPI in each main frame word, consisting of 192 data bits. The cycle proceeds as rate 1 word, PHA word, rate 2 word, and PHA word, where a rate 1 word includes the counting rates defined by the detector coincidences D1.S.NOT(D2 or D3 or D7) and L1.NOT(L2). A rate 2 word contains the counting rates defined by D1.D2.S.NOT(D3 or D4 or D7) and D1.D2.D4.D5.NOT(D6 or D7). Every other mainframe word is devoted to the pulse-height analysis of a single particle event.

Also included in each main frame PHA word is information concerning the event range ID and the octant with respect to the solar direction in which the telescope was pointing at the instant the event was detected. Read out concurrently with the main frame is a science subcommutator word of 6 bits. One science subcom frame requires 64 main frame readouts for completion. Lower priority MT rates as well as the analog and digital information provided by the other three sensors in the instrument package are sequentially read out in this way. Consequently, the subcom information is read out only 1/16 as often as any one of the main frame rates defined above. The analog rates "D7" and "Analog Current" are averages over the few sampling points taken during the time interval presented. The analog rates are calculated identically to all the other rates. The units for the D7 rate is counts/sec and the units for the ECD rate is amperes.

Data_Set_Parameters: The parameters in this dataset provide information to allow computation of average counting rates and of fluxes of protons, electrons, helium and CNO-group nuclei in selected energy ranges as identified by the pulse height analysis (see the PHINT-tape description, below).

Note: a 'FORMAT' of 'in' means the item is an ASCII integer of 'n' characters and should be read with a FORTRAN FORMAT specification of 'In' -- e.g. 'I6'. Time is referenced to Spacecraft Event Time

WORD	CONTENTS	RANGE	FORMAT
01	S/C identification Number	10 or 11	i3
02	10*Seconds of Day at interval start time	0 - 864000	i7
03	Day of Year (Jan. 1 = 1)	0 - 366	i4
04	Year from 1970	2 - 32	i3
05	Coverage (seconds) for Rate #1 : L1N2	0 - 900	i4
06	Counts for Rate #1 : L1N2	0 - 2147483392	i10
07	Coverage (seconds) for Rate #2 : D1SN237	0 - 900	i4
08	Counts for Rate #2 : D1SN237	0 - 612000	i7
09	Coverage (seconds) for Rate #3 : D12SN37	0 - 900	i4
10	Counts for Rate #3 : D12SN37	0 - 157284000	i9
11	Coverage (seconds) for Rate #4 : D1245N67	0 - 900	i4
12	Counts for Rate #4 : D1245N67	0 - 78642000	i8
13	Coverage (seconds) for Rate #5 : D2456N7	0 - 1536	i5
14	Counts for Rate #5 (Subcom Digital) : D2456N7	0 - 18900	i6
15	Coverage (seconds) for Rate #6 D12NS37	0 - 1536	i5
16	Counts for Rate #6 : (Subcom Digital) : D12NS37	0 - 18900	i6
17	Coverage (seconds) for Rate #7 : L12	0 - 1536	i5
18	Counts for Rate #7 (Subcom Digital) : L12	0 - 18900	i6
19	Coverage (seconds) for Fission 1 Rate: FISS1	0 - 1536	i5
20	Counts for Fission 1 Rate (Subcom Digital) : FISS1	0 - 261888	i6
21	Coverage (seconds) for Fission 2 Rate: FISS2	0 - 1536	i5

22	Counts for Fission 2 Rate (Subcom Digital) : FISS2	0 - 65280	i6
23	Coverage (seconds) for ECD Current-seconds : ECD	0 - 1536	i5
24	Counts for ECD Current-seconds (Subcom Analog) : ECD (ECD*1.00E+9)	0 - 49610	i6
25	Coverage (seconds) for subcom rate: D7	0 - 1536	i5
26	Counts for the subcom rate (Subcom Analog) : D7	0 - 17503272	i9
27	Total number of PH events for ID1	0 - 4800	i5
28	Total number of PH events for ID2	0 - 4800	i5
29	Total number of PH events for ID5	0 - 4800	i5
30	Total number of PH events for ID7 + ID13	0 - 4800	i5
31	Total number of PH events for ID13	0 - 4800	i5
32	Counts for PH Box #01: ID1 Protons (3 - 10 MeV)	0 - 4800	i5
33	Counts for PH Box #02: ID1 Helium (3 - 10 MeV/amu)	0 - 4800	i5
34	Counts for PH Box #03: ID1 CNO	0 - 4800	i5
35	Counts for PH Box #04: ID2 Protons (11 - 20 MeV)	0 - 4800	i5
36	Counts for PH Box #05: ID2 Protons (11.00 - 13.25 MeV)	0 - 4800	i5
37	Counts for PH Box #06: ID2 Protons (13.25 - 15.50 MeV	0 - 4800	i5
38	Counts for PH Box #07:: ID2 Protons ((15.50 - 17.75 MeV)	0 - 4800	i5
39	Counts for PH Box #08:: ID2 Protons (17.75 - 20.00 MeV)	0 - 4800	i5
40	Counts for PH Box #09:: ID2 Helium (11 - 20 MeV/amu)	0 - 4800	i5
41	Counts for PH Box #10: ID3 Protons (20 - 24 MeV)	0 - 4800	i5
42	Counts for PH Box #11: ID3 Helium (20 - 24 MeV/amu)	0 - 4800	i5
43	Counts for PH Box #12: ID4 Electrons	0 - 4800	i5
44	Counts for PH Box #13: ID4 Protons (24 - 29 MeV)	0 - 4800	i5
45	Counts for PH Box #14: ID4 Helium (24 - 29 MeV/amu)	0 - 4800	i5
46	Counts for PH Box #15: ID4 Z > 2	0 - 4800	i5
47	Counts for PH Box #16: ID5 Electrons	0 - 4800	i5
48	Counts for PH Box #17: ID5 Electrons (2 x min. ion.)	0 - 4800	i5
49	Counts for PH Box #18: ID5 Protons (29 - 67 MeV)	0 - 4800	i5
50	Counts for PH Box #19: ID5 Protons (29 - 42 MeV)	0 - 4800	i5
51	Counts for PH Box #20: ID5 Protons (42 - 54 MeV)	0 - 4800	i5
52	Counts for PH Box #21: ID5 Protons (54 - 67 MeV)	0 - 4800	i5
53	Counts for PH Box #22: ID5 Helium (29 - 67 MeV/amu)	0 - 4800	i5
54	Counts for PH Box #23: ID5 Z>2	0 - 4800	i4
55	Counts for PH Box #24: ID7 Z>5	0 - 4800	i4
56	Counts for PH Box #25: ID9 Electrons	0 - 4800	i4
57	Counts for PH Box #26: ID10 Electrons	0 - 4800	i4
58	Counts for PH Box #27:	0 - 4800	i5

ID7 + ID13 (> 67 MeV/amu)

59	100*S/C longitude (Heliographic coord.)	-18000 - 18000	i7
60	100*S/C latitude (Heliographic coord.)	-9000 - 9000	i6
61	100*Radial Distance of s/c from the sun	100 - 8000	i5
62	S/C Telemetry rate (bps)	16 - 2048	i5
63	Effective bit rate (bps)	0 - 2048	i5
64	S/C Spin Rate (rpm x 1000)	4000 - 9000	i5

Data_Set_Quality: Most erroneous data has been removed from the dataset. A few 15-minute data-logical-records (see "Data_Organization", below) contain data which is of dubious quality; these logical-records are flagged by setting the first data-item (item #01, "Spacecraft Identification Number") to the value 000 (zero). In addition, any logical record for which there was no telemetry coverage has this data item set to zero (see "Data_Organization"); thus, any logical record which has a zero in the first data-item should be ignored. This check must be made before any other data or time checks are made. In cases where there were errors in the computation of any "Counts", the reported value will be set to "-1". Except when an entire 15-minute block is filled (Item #01 = 0), all other values will always be present (will not be filled.

Data reported during the first few weeks after turn on should not be used in rate calculations. The instrument logic and electronics were being tested during this period. The counts reported include readings from a mixture of settings, and it is not possible to normalize them to a useful rate.

As stated earlier, this is primarily a "Cruise-Science" dataset. Jupiter and Saturn encounter data are included at the same resolution as the rest of the dataset for pruposes of completeness. The "Counts" data for the periods near the planets will be accurate, even if the time-resolution in this dataset reduces their usefulness; however, the position and attitude data during these periods will not be accurate due to the rapidly changing trajectory of the spacecraft. During the closest-approach to Jupiter some of our counting rates overflowed the allowed telemetry storage, so 15-minute rates should be viewed with some suspicion.

Data_Processing_Overview:

A. Experimenter Data Records (EDR):

The basic experiment data from the CPI is supplied by the Ames Research Center (ARC) in EDR format. Each EDR contains the data from a 24-hour period and contains four physical files. The first of these is a BCD file containing general information about the spacecraft operations and about the ARC processing for this period. The second file is also BCD and contains a record of all commands sent to the spacecraft during the period of the EDR. The third file is in 24-bit binary words and contains the latest 31 observations of celestial latitude, longitude, clock angle of the Sun, and clock angle of Canopus. The fourth file presents the CPI data for the period in physical records consisting of a 24-bit-word binary header (34 words) and then the CPI data in 256 24-bit binary words, as extracted from 128 spacecraft data frames. The CPI Rate-scaler values in the EDR are in log-compressed form as described in the document below.

The contents of the UC-CPI EDR are documented in a NASA document,

Pioneer Off-line Data Processing System
Experimenter Tape Formats
October, 1966
Prepared for Ames Research Center, Moffett Field, CA,

by Computer Sciences Corporation.

and in an internal University of Chicago-LASR document,

JUPRO
Primary Processing Program
for Pioneer 10/11 CPI Data
12/12/72

B. Primary Processing of CPI Data:

The basic processing program for the CPI data accepts the EDR-format data files as described above and produces the "Summary Tape" and "CAL/MRO" datasets described below. This processor provides (1) time validation and time conversion from ground-received time to spacecraft-transmitted time, (2) rejection or flagging of invalid data, (3) rejection of null-pulse-height readouts, (4) computation of sectors (look direction) for both counting rates and valid pulse-height analyses. Since these output data products between them contain all the significant data from the EDR, the EDR is typically recycled after the summary tapes are found to be valid, typically after about 1-2 years.

Additional programs are provided to produce, from the Summary Tape, two further data products -- the "Pulse-Height" and "Rate" tapes. These products are the ones which have been the basis of the UC-CPI data submission to the NSSDC for all data from 1972 to the present. The format and content of these datasets are well documented in Simpson et al. [1974b] which is available from the Technical Reference File at NSSDC. Brief descriptions of these datasets are given below.

C. The Summary Tape:

A complete description of the format of the Summary Tape, Rate tape and Pulse Height tape and of every parameter therein is given in Simpson et al [1974b].

The summary tape contains the bulk of the scientific data from the CPI. These tapes are written in binary mode and 24-bit words (see the above document for a description of these "H800" word formats) and the records are 825 words long. The logical-record structure within these physical records is complex; therefore, these summary tapes are not suitable for distribution. The detailed format of the Summary Tape is documented in the JUPRO document referenced above. A brief description of the contents of the summary tape are given below. No Summary-Tape-format data is included in the dataset being documented here.

The summary tape record contains all the significant (i.e., non-fill) rate and (i.e., non-zero) PHA data for all the CPI sensors (MT, LET, ECD, and Fission Cell) at the finest available time resolution and also includes:

(1) basic spacecraft and instrument support data - S/C mode, format, frame counter, platform and instrument temperatures, DC bus voltages and current, analog calibration values, instrument on/off status, S/C status words, bit-rate and data-quality indicators.

(2) timing data given as the UT year, day-of-year, and milli-second-of-day of the first non-fill frame in the record.

(3) calculated angle in the spin plane of the axis of the MT (Main Telescope) for MT pulse-height-analyzed values and rates.

Each logical record contains the information from one "engineering-subcom sequence" which includes 128 spacecraft minor frames.

D. The Calibrate-Data/Memory-Readout-Data (CAL/MRO) Dataset.

The CAL/MRO dataset contains any CPI calibrate-mode or S/C-memory-readout data found during the 24-hour data-day contained in the EDR from which the above-described summary-tape data was derived. In addition, files 1-3 of the CAL/MRO tape will contain copies of the first three files of the EDR as described in paragraph (A) above.

If any calibrate-mode or MRO data is found, the fourth file of the CAL/MRO tape contains this data in the same format as the data recorded in a summary-tape logical records as described in paragraph (C) above.

E. The Pulse-Height Tape

A logical pulse-height record contains all the valid, non-zero pulse-height-analyzed (PHA) data from the MT and LET for a 15-minute period. The logical record (LR) is made up of at least two physical records,

(1) header-record (HR) containing

- spacecraft-status and instrument-status descriptors
- beginning time of the LR in UT
- bookkeeping and attitude parameters
- "livetime" for the MT during the LR
- count of valid MT events
- number of filled LET and MT events during the LR
- a selection of averaged counting rates correlative with PHA's
- livetimes for the correlative counting rates

These HR records are expressed in 60, 48-bit floating point (Harris H-800) words.

(2) at least one physical record (may be more, depending on the number of analyzed events during the 15-minute period) which contains the PHA values (counts) for each non-zero MT (D1, D2, and D5) and LET (L1) detector, together with range of the analyzed particle through the telescope and the sector (octant of S/C rotation) in which the MT event was detected.

These PHA records are expressed in 24-bit integer form.

F. The Rate Tape

This tape is written in a mixture of 24-bit integer and 48-bit floating-point word (H800) formats. All of the valid, non-fill, rate-scaler values from all CPI detectors are averaged over an rigid five-minute intervals and recorded in this dataset, expressed as average counts/second and associated seconds-of-coverage. For the MT, sectored (octant) rates as well as omnidirectional rates are given; sectoring is to be ignored if the S/C bit rate falls below about 256 bps. Supporting information included in the format is:

- beginning/end times of the accumulation interval
- S/C status (spin rate, etc.)

G. Secondary Processing of CPI Data

The secondary processing scheme uses as input the Pulse-Height and Rate tapes described above to determine counting rates and fluxes of various cosmic ray species. The programs involved (1) eliminate bad quality data 2) remove single 5-minute 'spike' events (3) accumulate the good data over fixed time intervals and (4) average over all sectored information. Because the individual time and sector information for each event is lost in the accumulation procedure the Pulse-Height and Rate tapes will continue to be submitted to the NSSDC in case special analysis is desired.

H. PHINT-Tape Datasets

This is the dataset which is included in the archive in this volume.

The PHINT tape (Pulse-Height INTegrated tape) contains all the information necessary to get a basic set of counting rates and fluxes of cosmic rays for various species in selected energy ranges measured with the CPI. The tape is created by processing Pulse-Height tapes and Rate tapes (see E and F above). The standard PHINT tape computes counts during rigid 15-minute intervals in Universal Time at the spacecraft. All 15-minute intervals will be included in the PHINT tape, with times of fill represented by records in which the 1st word (s/c ID number) set to zero. All records should be checked to see if the 1st word is zero before any averaging is done with that record. The PHINT tape has 64 ASCII data-items comprising 336 characters in the format:
(I3,I7,I4,I3,I4,I10,I4,I7,I4,I9,I4,I8,6(I5,I6),I5,I9,27I5,4I4,I5,I7,I6,4I5)
in each logical (15-minute) record, giving a total record length of 32,256 ASCII characters.

Housekeeping information and two types of data are stored in the PHINT tape.

(1) The housekeeping information includes the spacecraft identifier, the start time for each accumulation interval and spacecraft operation information, the telemetry bit rate, spin rate, radial distance from the Sun, heliographic latitude and longitude is also included.

(2) Twenty-seven 'boxes' are defined. Each 'box' contains the total number (counts) in the time interval of a specific charged particle species in a specific energy range. Every non-zero, good Pulse-Height event is analyzed to determine its energy and charge, and then added to the appropriate 'box'. No consistency check is made for the charge determination. Thus during periods of high solar activity many 'boxes' may contain significant numbers of background counts, due to pulse pile-up, electronic noise or nuclear interactions occurring in the various detectors.

There is also included the total number of pulse-height events in 5 ID's, which can be used as normalization in order to determine fluxes.

N.B. There was radiation damage to some of the Pioneer 10 detectors during the passage through the Jovian magnetosphere. The damage has resulted in a slowly varying change in the calculated channel for a given energy deposit in the detectors, most especially D1 and D2. This variation has been corrected for in the 'boxes' on the PHINT tapes.

(3) In addition to the 'boxes', eleven important, non-pulse-height analyzed counting rates (counts) are computed. Along with each set of counts is the associated livetime (seconds). With this information counting rates can be calculated.

N.B. The spacecraft telemetry bit rate for data transmission is often such that our data readouts do not divide evenly into 15-minutes (900 seconds) For this reason, coverages during some "15-minute intervals" occasionally will be greater than the nominal time interval of 900 seconds. This is not a cause for concern, but is merely an artifact of the averaging procedure. The not used in the computation for this box, since there is not enough information to know what to do.

(b) If both idcnt = 0 and rtcnt = 0, you should assume that all events are analyzed. However, since the Pioneer instruments cannot analyze events while a Pulse-Height frame is being read out, there is never 100% analysis. The following table gives the fractional live-times:

fractional livetime for main telescope	fractional livetime for low energy telescope
0.9141	0.9995

Then if f = fractional livetime, the pseudo-count is defined as:

pcnt = bxcnt/f

At the end of the averaging interval the mean flux is calculated as follows:

<flux> = Sum(pcnt) / Sum(rtcvg)

The University of Chicago has a recommended set of normalizations for each of the 27 'boxes'. The reason for the difference in normalization between Pioneer 10 and Pioneer 11 is that the D4 detector failed on Pioneer 11 in mid-1980 and no ID5 Pulse-Height events or D1245N6 rate events have been recorded since then.

For Pioneer 10:

Boxes #01 (ID1 H), #02 (ID1 He), #03 (ID1 CNO), #24 (ID7 Z>5), #25 (ID9 e-), #26 (ID10 e-), and #27 (ID7+ID13 >67MeV/AMU):

  use the Pulse-Height #1, ID1 to normalize and use the associated rate #2, D1SN2.

All other boxes (#04-#23):

  use the Pulse-Height #3, ID5 to normalize and use the associated rate #4, D1245N6.

For Pioneer 11:

Boxes #01 (ID1 H), #02 (ID1 He), #03 (ID1 CNO), #24 (ID7 Z>5), #25 (ID9 e-), #26 (ID10 e-), and #27 (ID7+ID13 >67MeV/AMU) :

  use the Pulse-Height #1, ID1 to normalize and use the associated rate #2, D1SN2.

All other boxes (#04-#23):

  use the Pulse-Height #2, ID2 to normalize and use the associated rate #3, D12SN3.

(2) Old method (om) This is the old standard method of normalization. The bxcnts, rtcnts, idcnts, and rtcvgs are summed for the entire averaging interval.

Then:

```
               Sum( bxcnt ) * Sum( rtcnt )
  <flux> =  ---------------------------------
               Sum( idcnt ) * Sum( rtcvg )
```

If less than 100% of the events are being pulse height analyzed, this method breaks down when the normalizing rate varies significantly during an averaging interval. Thus it works poorly during flare periods, when large transients, such as shocks, pass the spacecraft, and near planetary encounter periods.

(3) Pulse-Height-Livetime method (phlt). This method sums bxcnts and phlts for the whole averaging interval.

The pulse height livetime for each ID is calculated by dividing the ID counts for a sub-interval by the value of the corresponding rate averaged over that sub-interval. That is, the counters: idcnt, rtcnt, and rtcvg are accumulated during an interval and then

phlt = idcnt * rtcvg / rtcnt

(see pcm method above for the recommended normalizing ID and associated rate).

The counts in a 'box' and the phlts for the sub-intervals are summed to get a phlt for the entire averaging interval. The average flux is calculated as:

```
     <flux> = Sum( bxcnt )  /  Sum( phlt )
```

This method breaks down when the normalizing rate is so low that few or no counts are accumulated during a 15-minute interval.

Data_Organization: A CPI PHINT-tape logical record contains the data (with content and datum-size as specified in the "Data_Set_Parameters" section above and, in the "FORMAT.SFD" file, in the "Record_Syntax" section) for a 15-minute period of time synchronized with hour boundaries. It has a size of 336 ASCII characters (bytes). A physical tape record will consist of a concatenation of 96 logical records, have a size of 32,256 bytes and contain the data from one day. A year of CPI-PHINT data consists of either 365 or 366 such physical records (a total of 11,773,440 or 11,805,696 bytes). A year of data will be contained in two separate data files, each containing not more than six months of data.

In the case of missing data:

(1) if no coverage-time is available for any 15-minute logical record or series of logical records, such logical records have every one of the 64 data-items in them set to zero values; this is a "zero-logical-record". In such records, the "Spacecraft Identification Number" will be zero and the logical-record can be ignored by an initial check on that item (see also, "Data_Set_Quality" above).

(2) if no coverage was obtained for an entire day, the physical record for that day will exist but will consist of 96 zero-logical-records as defined above. This is done to preserve the overall structure so that (for example) FORTRAN 'READs' based on multiple-day FORMAT specifications are easily possible.

File_Class_Relationships: N/A

Lit_References:

Simpson, J. A., T. S. Bastian, D. L. Chenette, R. B. McKibben, and K. R. Pyle, The trapped radiations of Saturn and their absorption by satellites and rings, J. Geophys. Res., 85, 5731, 1980.

Simpson, J. A., D. C. Hamliton, R. B. McKibben, A. Mogro-Campero, K. R. Pyle, and A. J. Tuzzolino, The protons and electrons trapped in the Jovian dipole magnetic field and their interaction with Io, J. Geophys. Res., 79, 3522, 1974a.

Simpson, J. A., G. A. Lentz, R. B. McKibben, J. J. O'Gallagher, W. Schroeder, and A. J. Tuzzolino, Preliminary documentation for the University of Chicago charged particle instrument from the Pioneer 10/11 spacecraft, NSSDC Tech. Ref. File B21970, Goddard Space Flight Center, Greenbelt, MD, 1974b.

CCSD$$MARKERMRK**002CCSD3KS00002MRK**003

Vol_Time_Coverage: 1973-04-06 to 1983-12-31

File_Naming_Convention: CPI files are named according to the start time of the data contained in the file, using the form CPI_PXX_YYH.DAT where:

PXX can be either P10 or P11

YY stands for the last two digits of the year

H can be "A", meaning "first half of the calendar year, i.e., January/01 through June/30" or
"B", meaning "second half of the calendar year, i.e., July/01 through December/31."

Note that files on the current data volume are referenced below by file sequence number, since there are no file labels on the tape. These sequence numbers are then mapped to the actual file name in the "REFERENCE=" keywords.

File_Time_Coverage:

CPI_P11_73A.DAT	73/04/06 thru 73/06/30
CPI_P11_73B.DAT	73/07/01 thru 73/12/31
CPI_P11_74A.DAT	74/01/01 thru 74/12/31
CPI_P11_74B.DAT	74/07/01 thru 74/12/31
CPI_P11_75A.DAT	75/01/01 thru 75/12/31
CPI_P11_75B.DAT	75/07/01 thru 75/12/31
CPI_P11_76A.DAT	76/01/01 thru 76/12/31
CPI_P11_76B.DAT	76/07/01 thru 76/12/31
CPI_P11_77A.DAT	77/01/01 thru 77/12/31
CPI_P11_77B.DAT	77/07/01 thru 77/12/31
CPI_P11_78A.DAT	78/01/01 thru 78/12/31
CPI_P11_78B.DAT	78/07/01 thru 78/12/31
CPI_P11_79A.DAT	79/01/01 thru 79/12/31
CPI_P11_79B.DAT	79/07/01 thru 79/12/31
CPI_P11_80A.DAT	80/01/01 thru 80/12/31
CPI_P11_80B.DAT	80/07/01 thru 80/12/31
CPI_P11_81A.DAT	81/01/01 thru 81/12/31
CPI_P11_81B.DAT	81/07/01 thru 81/12/31
CPI_P11_82A.DAT	82/01/01 thru 82/12/31
CPI_P11_82B.DAT	82/07/01 thru 82/12/31
CPI_P11_83A.DAT	83/01/01 thru 83/12/31
CPI_P11_83B.DAT	83/07/01 thru 83/12/31

```
CCSD$$MARKERMRK**003NSSD3RF001400000001

REFERENCETYPE = $SEQUENCE;

LABEL=ATTACHED;
REFERENCE = "$2 = FORMAT.SFD,  $5 = 2";

LABEL = NSSD3IF001320000000l;

REFERENCE = "$2 = CPI_P11_73A.DAT, $5 = 3";
REFERENCE = "$2 = CPI_P11_73B.DAT, $5 = 4";

REFERENCE = "$2 = CPI_P11_74A.DAT, $5 = 5";
REFERENCE = "$2 = CPI_P11_74B.DAT, $5 = 6";

REFERENCE = "$2 = CPI_P11_75A.DAT, $5 = 7";
REFERENCE = "$2 = CPI_P11_75B.DAT, $5 = 8";

REFERENCE = "$2 = CPI_P11_76A.DAT, $5 = 9";
REFERENCE = "$2 = CPI_P11_76B.DAT, $5 = 10";

REFERENCE = "$2 = CPI_P11_77A.DAT, $5 = 11";
REFERENCE = "$2 = CPI_P11_77B.DAT, $5 = 12";

REFERENCE = "$2 = CPI_P11_78A.DAT, $5 = 13";
REFERENCE = "$2 = CPI_P11_78B.DAT, $5 = 14";

REFERENCE = "$2 = CPI_P11_79A.DAT, $5 = 15";
REFERENCE = "$2 = CPI_P11_79B.DAT, $5 = 16";

REFERENCE = "$2 = CPI_P11_80A.DAT, $5 = 17";
REFERENCE = "$2 = CPI_P11_80B.DAT, $5 = 18";

REFERENCE = "$2 = CPI_P11_81A.DAT, $5 = 19";
REFERENCE = "$2 = CPI_P11_81B.DAT, $5 = 20";

REFERENCE = "$2 = CPI_P11_82A.DAT, $5 = 21";
REFERENCE = "$2 = CPI_P11_82B.DAT, $5 = 22";

REFERENCE = "$2 = CPI_P11_83A.DAT, $5 = 23";
REFERENCE = "$2 = CPI_P11_83B.DAT, $5 = 24";
```

```
CCSD3FF0000500000001CCSD3CS00004MRK**001
ADIDNAME=NSSD0132;
CCSD$$MARKERMRK**001CCSD3KS00002MRK**002
```

Subm_Name: Gordon A. Lentz

Subm_Addr:

Gordon A. Lentz
University of Chicago
Enrico Fermi Institute
Laboratory for Astrophysics and Space Research
933 E. 56th Street
Chicago, IL 60637
Telephone: (312) 702-7836
E-Mail: (NSI/DECnet) LASR::LENTZ
      :   (Internet) lentz@odysseus.uchicago.edu

Subm_Date: 1993-03-29

Title: Format for Pioneer 11 CPI Cruise Data Archive Data Set

Descr: Format description of the Pioneer 11 Charged Particle Instrument's cruise phase archive data set, March, 1972 through December, 1992

Rel_Date: 1993-03-29

```
CCSD$$MARKERMRK**002CCSD3DF0000200000001
```

File_Class_Name: UC CPI Interplanetary Cruise ASCII Archive

Record_Type_Name: Fifteen-minute PHINT tape

Algorithms: See VOLDESC.SFD file, Data_Usage section. All algorithms used in the interpretation of the CPI data are given in detail there.

File_Class_Syntax: All records in the UC CPI interplanetary cruise ASCII archive files are of the same type, size, and format.

File_Class_Field_Relationships: N/A

File_Class_Misc: See Record and Field specifications.

Record_Name: Fifteen-minute PHINT tape records

Record_Structure: All data records are of the same length.

Record_Length: 32,256 ASCII characters or bytes per physical record. Each physical record contains 96 logical records of length 336 bytes.

Record_Field_Names:

SCID,ISTIM,DOY,YEAR70,TL1NL2,CL1NL2,TD1SN237,CD1SN237,TD1S2N37,CD1S2N37,
TD1245N6,CD1245N6,TD2456N7,CD2456N7,TD12NS37,CD12NS37,TL1L2,CL1L2,TFISS1,
CFISS1,TFISS2,CFISS2,TECD,CECD,TD7,CD7,NPHID1,NPHID2,NPHID5,NPHID713,NPHID13,

NID1P,NID1HE,NID1CNO,NID2P1,NID2P2,NID2P3,NID2P4,NID2P5,NID2HE,NID3P,NID3HE,
NID4E,NID4P,NID4HE,NID4ZG2,NID5E1,NID5E2,NID5P1,NID5P2,NID5P3,NID5P4,NID5HE,
NID5ZG2,NID7ZG5,NID9E,NID10E,NID7+13,HEGLONG,HEGLAT,HEGRAD,TELBRATE,EFFBRATE,
SPINRATE

FORMAT:
(I3,I7,I4,I3,I4,I10,I4,I7,I4,I9,I4,I8,6(I5,I6),I5,I9,27I5,4I4,I5,I7,I6,4I5)

Record_Syntax: (See the note preceding the "Data_Set_Parameters" Table.)

WORD	MNEMONIC	CONTENTS	RANGE	FORMAT
01	SCID	S/C identification Number	10 or 11	i3
02	ISTIM	10*Seconds of Day at interval start time	0 - 864000	i7
03	DOY	Day of Year (Jan. 1 = 1)	0 - 366	i4
04	YEAR70	Year from 1970	2 - 32	i3
05	TL1NL2	Coverage (seconds) for Rate #1 : L1N2	0 - 900	i4
06	CL1NL2	Counts for Rate #1 : L1N2	0 - 2147483392	i10
07	TD1SN237	Coverage (seconds) for Rate #2 : D1SN237	0 - 900	i4
08	CD1SN237	Counts for Rate #2 : D1SN237	0 - 612000	i7
09	TD1S2N37	Coverage (seconds) for Rate #3 : D1S2N37	0 - 900	i4
10	CD1S2N37	Counts for Rate #3 : D1S2N37	0 - 157284000	i9
11	TD1245N6	Coverage (seconds) for Rate #4 : D1245N67	0 - 900	i4
12	CD1245N6	Counts for Rate #4 : D1245N67	0 - 78642000	i8
13	TD2456N7	Coverage (seconds) for Rate #5 : D2456N7	0 - 1536	i5
14	CD2456N7	Counts for Rate #5 (Subcom Digital) : D2456N7	0 - 18900	i6
15	TD12NS37	Coverage (seconds) for Rate #6 : D12NS37	0 - 1536	i5
16	CD12NS37	Counts for Rate #6 (Subcom Digital) : D12NS37	0 - 18900	i6
17	TL1L2	Coverage (seconds) for Rate #7 : L12	0 - 1536	i5
18	CL1L2	Counts for Rate #7 (Subcom Digital) : L12	0 - 18900	i6
19	TFISS1	Coverage (seconds) for Fission 1 Rate: FISS1	0 - 1536	i5
20	CFISS1	Counts for Fission 1 Rate (Subcom Digital) : FISS1	0 - 261888	i6
21	TFISS2	Coverage (seconds) for Fission 2 Rate: FISS2	0 - 1536	i5
22	CFISS2	Counts for Fission 2 Rate (Subcom Digital) : FISS2	0 - 65280	i6
23	TECD	Coverage (seconds) for ECD Current : ECD	0 - 1536	i5
24	CECD	Counts for ECD Current (Subcom Analog) : (ECD x 1.00e+9)	0 - 49610	i6
25	TD7	Coverage (seconds) for the subcom rate: D7	0 - 1536	i5
26	CD7	Counts for the subcom rate (Subcom Analog) : D7	0 - 175030272	i9
27	NPHID1	Total number of PH events for ID1	0 - 4800	i5
28	NPHID2	Total number of PH events for ID2	0 - 4800	i5
29	NPHID5	Total number of PH events for ID5	0 - 4800	i5
30	NPHID713	Total number of PH events for ID7 + ID13	0 - 4800	i5
31	NPHID13	Total number of PH events for ID13	0 - 4800	i5
32	NID1P	Counts for PH Box #01: D1 Protons (3 - 10 MeV)	0 - 4800	i5
33	NID1HE	Counts for PH Box #02: ID1 Helium (3 - 10 MeV/amu)	0 - 4800	i5
34	NID1CNO	Counts for PH Box #03: ID1 CNO	0 - 4800	i5
35	NID2P1	Counts for PH Box #04:	0 - 4800	i5

		ID2 Protons (11 - 20 MeV)		
36	NID2P2	Counts for PH Box #05: ID2 Protons (11.00 - 13.25 MeV)	0 - 4800	i5
37	NID2P3	Counts for PH Box #06: ID2 Protons (13.25 - 15.50 MeV)	0 - 4800	i5
38	NID2P4	Counts for PH Box #07: ID2 Protons (15.50 - 17.75 MeV)	0 - 4800	i5
39	NID2P5	Counts for PH Box #08: ID2 Protons (17.75 - 20.00 MeV)	0 - 4800	i5
40	NID2HE	Counts for PH Box #09: ID2 Helium (11 - 20 MeV/amu)	0 - 4800	i5
41	NID3P	Counts for PH Box #10: ID3 Protons (20 - 24 MeV)	0 - 4800	i5
42	NID3HE	Counts for PH Box #11: ID3 Helium (20 - 24 MeV/amu)	0 - 4800	i5
43	NID4E	Counts for PH Box #12: ID4 Electrons	0 - 4800	i5
44	NID4P	Counts for PH Box #13: ID4 Protons (24 - 29 MeV)	0 - 4800	i5
45	NID4HE	Counts for PH Box #14: ID4 Helium (24 - 29 MeV/amu)	0 - 4800	i5
46	NID4ZG2	Counts for PH Box #15: ID4 Z > 2	0 - 4800	i5
47	NID5E1	Counts for PH Box #16: ID5 Electrons	0 - 4800	i5
48	NID5E2	Counts for PH Box #17: ID5 Electrons (2 x min. ion.)	0 - 4800	i5
49	NID5P1	Counts for PH Box #18: ID5 Protons (29 - 67 MeV)	0 - 4800	i5
50	NID5P2	Counts for PH Box #19: ID5 Protons (29 - 42 MeV)	0 - 4800	i5
51	NID5P3	Counts for PH Box #20: ID5 Protons (42 - 54 MeV)	0 - 4800	i5
52	NID5P4	Counts for PH Box #21: ID5 Protons (54 - 67 MeV)	0 - 4800	i5
53	NID5HE	Counts for PH Box #22: ID5 Helium (29 - 67 MeV/amu)	0 - 4800	i5
54	NID5ZG2	Counts for PH Box #23: ID5 Z>2	0 - 4800	i4
55	NID7ZG5	Counts for PH Box #24: ID7 Z>5	0 - 4800	i4
56	NID9E	Counts for PH Box #25: ID9 Electrons	0 - 4800	i4
57	NID10E	Counts for PH Box #26: ID10 Electrons	0 - 4800	i4
58	NID7+13	Counts for PH Box #27: ID7 + ID13 (> 67 MeV/amu)	0 - 4800	i5
59	HEGLONG	100*S/C longitude (Heliographic coord.)	-18000 - 18000	i7
60	HEGLAT	100*S/C latitude (Heliographic coord.)	-9000 - 9000	i6
61	HEGRAD	100*Radial Distance of s/c from the su	100 - 8000	i5
62	TELBRATE	S/C Telemetry rate (bps)	16 - 2048	i5
63	EFFBRATE	Effective bit rate (bps)	0 - 2048	i5
64	SPINRATE	S/C Spin Rate (rpm x 1000)	4000 - 9000	i5

Field_Name: S/C identification number
Field_Mnemonic: SCID
Field_Units: ASCII characters
Field_Resolution: N/A
Field_Range: 10 - 11
Field_Description: S/C identification number (10= P10, 11= P11)
Field_Representation: 3 ASCII CHARACTERS (I3)

Field_Name: Start time for 15-min interval
Field_Mnemonic: ISTIM
Field_Units: 10*Seconds of Day
Field_Resolution: N/A
Field_Range: 0 - 864000

```
Field_Description: 10*Seconds of Day at interval start time
Field_Representation: 7 ASCII characters (I7)

Field_Name: Day of Year
Field_Mnemonic: DOY
Field_Units: Day of year
Field_Resolution:  1 day
Field_Range: 1-366
Field_Description: Day of Year (Jan. 1 = 1)
Field_Representation: 4 ASCII characters (I4)

Field_Name: Years from 1970
Field_Mnemonic: YEAR70
Field_Units: year
Field_Resolution: 1 year
Field_Range: 2-32
Field_Description: Year from 1970 (2 = year 1972)
Field_Representation: 3 ASCII characters (I3)

Field_Name:  L1NL2 time coverage
Field_Mnemonic: TL1NL2
Field_Units:  seconds
Field_Resolution: 1
Field_Range: 0-900
Field_Description: Coverage (seconds) for Rate #1 : L1NL2
Field_Representation: 4 ASCII characters (I4)

Field_Name:  L1NL2 counts
Field_Mnemonic: CL1NL2
Field_Units:  counts
Field_Resolution: 1
Field_Range: 0-2147483392
Field_Description: Counts for Rate #1: L1NL2
Field_Representation: 10 ASCII characters (I10)

Field_Name: D1SN2 Time Coverage
Field_Mnemonic: TD1SN237
Field_Units: seconds
Field_Resolution: 1
Field_Range: 0-900
Field_Description: Coverage for Rate #2: D1SN2
Field_Representation: 4 ASCII characters (I4)

Field_Name: D1SN2 Counts
Field_Mnemonic: CD1SN237
Field_Units: counts
Field_Resolution: 1
Field_Range: 0-612000
Field_Description: Counts for Rate #2: D1SN2
Field_Representation: 7 ASCII characters (I7)

Field_Name: D12SN3 Time Coverage
Field_Mnemonic: TD12SN37
Field_Units: seconds
Field_Resolution: 1
Field_Range: 0-900
Field_Description: Coverage for Rate #3: D12SN3
Field_Representation: 4 ASCII characters (I4)

Field_Name: D12SN3 Counts
```

Field_Mnemonic: CD12SN37
Field_Units: counts
Field_Resolution: 1
Field_Range: 0-157284000
Field_Description: Counts for Rate #3
Field_Representation: 9 ASCII characters (I9)

Field_Name: D1245N6 Coverage
Field_Mnemonic: TD1245N6
Field_Units: seconds
Field_Resolution: 1
Field_Range: 0-900
Field_Description: Coverage for Rate #4: D1245N6
Field_Representation: 4 ASCII characters (I4)

Field_Name: D1245N6 Counts
Field_Mnemonic: CD1245N6
Field_Units: counts
Field_Resolution: 1
Field_Range: 0-78642000
Field_Description: Counts for Rate #4: D1245N6
Field_Representation: 8 ASCII characters (I8)

Field_Name: D2456N7 Coverage
Field_Mnemonic: TD2456N7
Field_Units: seconds
Field_Resolution: 1
Field_Range: 0-1536
Field_Description: Coverage for Rate #5: D2456N7
Field_Representation: 5 ASCII characters (I5)

Field_Name: D2456N7 Counts
Field_Mnemonic: CD2456N7
Field_Units: counts
Field_Resolution: 1
Field_Range: 0-18900
Field_Description: Counts for Rate #5: D2456N7
Field_Representation: 6 ASCII characters (I6)

Field_Name: D12NS Coverage
Field_Mnemonic: TD12NS37
Field_Units: seconds
Field_Resolution: 1
Field_Range: 0-1536
Field_Description: Coverage for Rate #6: D12NS
Field_Representation: 5 ASCII characters (I5)

Field_Name: D12NS Counts
Field_Mnemonic: CD12NS37
Field_Units: counts
Field_Resolution: 1
Field_Range: 0-18900
Field_Description: Counts for Rate #6: D12NS
Field_Representation: 6 ASCII characters (I6)

Field_Name: L1L2 Coverage
Field_Mnemonic: TL1L2
Field_Units: seconds
Field_Resolution: 1
Field_Range: 0-1536

```
Field_Description: Coverage for Rate #7: L1L2
Field_Representation: 5 ASCII characters (I5)

Field_Name: L1L2 Counts
Field_Mnemonic: CL1L2
Field_Units: counts
Field_Resolution: 1
Field_Range: 0-18900
Field_Description: Counts for Rate #7: L1L2
Field_Representation: 6 ASCII characters (I6)

Field_Name: Fission 1 Coverage
Field_Mnemonic: TFISS1
Field_Units:  seconds
Field_Resolution: 1
Field_Range: 0-1536
Field_Description: Coverage for Fission 1 Rate: FISS1
Field_Representation: 5 ASCII characters (I5)

Field_Name: Fission 1 Counts
Field_Mnemonic: CFISS1
Field_Units: counts
Field_Resolution: 1
Field_Range: 0-261888
Field_Description: Counts for Fission 1 Rate: FISS1
Field_Representation: 6 ASCII characters (I6)

Field_Name: Fission 2 Coverage
Field_Mnemonic: TFISS2
Field_Units:  seconds
Field_Resolution: 1
Field_Range: 0-1536
Field_Description: Coverage for Fission 2 Rate: FISS2
Field_Representation: 5 ASCII characters (I5)

Field_Name: Fission 2 Counts
Field_Mnemonic: CFISS2
Field_Units:  counts
Field_Resolution: 1
Field_Range: 0-65280
Field_Description: Counts for Fission 2 Rate: FISS2
Field_Representation: 6 ASCII characters (I6)

Field_Name: Electron Current Detector Rate (ECD) Coverage
Field_Mnemonic: TECD
Field_Units:  seconds
Field_Resolution: 1
Field_Range: 0-1536
Field_Description: Coverage for ECD Current: ECD
Field_Representation: 5 ASCII characters (I5)

Field_Name: Electron Current Detector Current (ECD) Current
Field_Mnemonic: CECD
Field_Units:  ampere-second * (1.00E+9)
Field_Resolution: 1
Field_Range: 0-49610
Field_Description: Ampere-seconds for ECD Current: ECD
Field_Representation: 6 ASCII characters (I6)

Field_Name: D7 Coverage
```

```
Field_Mnemonic: TD7
Field_Units:  seconds
Field_Resolution: 1
Field_Range: 0-1536
Field_Description: Coverage for D7 subcom rate
Field_Representation: 5 ASCII characters (I5)

Field_Name: D7 Counts
Field_Mnemonic: CD7
Field_Units: counts
Field_Resolution: 1
Field_Range: 0-175030272
Field_Description: Counts for the D7 subcom rate
Field_Representation: 9 ASCII characters (I9)

Field_Name: ID1 PH Events
Field_Mnemonic: NPHID1
Field_Units: events
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: Total number of PH events for ID1
Field_Representation: 5 ASCII characters (I5)

Field_Name: ID2 PH events
Field_Mnemonic: NPHID2
Field_Units: events
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: Total number of PH events for ID2
Field_Representation: 5 ASCII characters (I5)

Field_Name: ID5 PH events
Field_Mnemonic: NPHID5
Field_Units: events
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: Total number of PH events for ID5
Field_Representation: 5 ASCII characters (I5)

Field_Name: ID7+ID13 PH Events
Field_Mnemonic: NPHID713
Field_Units:  events
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: Total number of PH events for ID7+ID13
Field_Representation: 5 ASCII characters (I5)

Field_Name: ID13 PH Events
Field_Mnemonic: NPHID13
Field_Units:  events
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: Total PH Events for ID13
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 1 Counts
Field_Mnemonic: NID1P
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
```

```
Field_Description: ID1 Protons (3-10 MeV)
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 2 Counts
Field_Mnemonic: NID1HE
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID1 Helium (3 - 10 MeV/amu)
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 3 Counts
Field_Mnemonic: NID1CNO
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID1 CNO
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 4 Counts
Field_Mnemonic: NID2P1
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID2 Protons (11 - 20 MeV)
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 5 Counts
Field_Mnemonic: NID2P2
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID2 Protons (11.00-13.25 MeV)
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 6 Counts
Field_Mnemonic: NID2P3
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID2 Protons (13.25-15.50 MeV)
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 7 Counts
Field_Mnemonic: NID2P4
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID2 Protons (15.50-17.75 MeV)
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 8 Counts
Field_Mnemonic: NID2P5
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID2 Protons (17.75-20.00 MeV)
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 9 Counts
```

```
Field_Mnemonic: NID2HE
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID2 Helium (11 - 20 MeV/amu)
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 10 Counts
Field_Mnemonic: NID3P
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID3 Protons (20 - 24 MeV)
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 11 Counts
Field_Mnemonic: NID3HE
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID3 Helium (20 - 24 MeV/amu)
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 12 Counts
Field_Mnemonic: NID4E
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID4 Electrons
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 13 Counts
Field_Mnemonic: NID4P
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID4 Protons (24 - 29 MeV)
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 14 Counts
Field_Mnemonic: NID4HE
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID4 Helium (24 - 29 MeV/amu)
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 15 Counts
Field_Mnemonic: NID4ZG2
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID4 Z > 2
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 16 Counts
Field_Mnemonic: NID5E1
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
```

```
Field_Description: ID5 Electrons
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 17 Counts
Field_Mnemonic: NID5E2
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID5 Electrons (2 x Min.Ion.)
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 18 Counts
Field_Mnemonic: NID5P1
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID5 Protons (29 - 67 MeV)
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 19 Counts
Field_Mnemonic: NID5P2
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID5 Protons (29 - 42 MeV)
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 20 Counts
Field_Mnemonic: NID5P3
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID5 Protons (42 - 54 MeV)
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 21 Counts
Field_Mnemonic: NID5P4
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID5 Protons (54 - 67 MeV)
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 22 Counts
Field_Mnemonic: NID5HE
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID5 Helium (29 - 67 MeV/amu)
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 23 Counts
Field_Mnemonic: NID5ZG2
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID5   Z > 2
Field_Representation: 4 ASCII characters (I4)

Field_Name: PH Box 24 Counts
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Field_Mnemonic: NID7ZG5
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID7   Z > 5
Field_Representation: 4 ASCII characters (I4)

Field_Name: PH Box 25 Counts
Field_Mnemonic: NID9E
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID9 Electrons
Field_Representation: 4 ASCII characters (I4)

Field_Name: PH Box 26 Counts
Field_Mnemonic: NID10E
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID10 Electrons
Field_Representation: 4 ASCII characters (I4)

Field_Name: PH Box 27 Counts
Field_Mnemonic: NID7+13
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-2000
Field_Description: ID7 + ID13 (>67 MeV/amu)
Field_Representation: 5 ASCII characters (I5)

Field_Name:S/C Heliographic Longitude
Field_Mnemonic: HEGLONG
Field_Units: 100*degrees
Field_Resolution: .01 degrees
Field_Range:-18,000 -- 18,000
Field_Description: Heliographic Longitude of S/C in 0.01-degrees
Field_Representation: 7 ASCII Characters (I7)

Field_Name: S/C Heliographic Latitude
Field_Mnemonic: HEGLAT
Field_Units: 100*degrees
Field_Resolution: 0.01 degrees
Field_Range: -9,000 -- 9,000
Field_Description: Heliographic Latitude of S/C in 0.01-degree
Field_Representation: 6 ASCII Characters (I6)

Field_Name: Radial Distance of S/C from Sun
Field_Mnemonic: HEGRAD
Field_Units: 100*AU
Field_Resolution: .01AU
Field_Range: 100 -- 8000
Field_Description: Radial distance of the Spacecraft from the Sun in 0.01AU
Field_Representation: 5 ASCII Characters (I5)

Field_Name: S/C telemetry rate
Field_Mnemonic: TELBRATE
Field_Units: bits-per-second
Field_Resolution: 1 bps
Field_Range: 16-2048

```
Field_Description: S/C Telemetry rate (bps)
Field_Representation: 5 ASCII characters (I5)

Field_Name:  Effective bit rate
Field_Mnemonic: EFFBRATE
Field_Units: bits-per-second
Field_Resolution: 1 bps
Field_Range:  8-2048
Field_Description: Effective bit rate
Field_Representation: 5 ASCII characters (I5)

Field_Name:  S/C spin rate
Field_Mnemonic: SPINRATE
Field_Units: rpm x 1000
Field_Resolution: 1
Field_Range: 4000-9000
Field_Description: S/C Spin Rate
Field_Representation: 5 ASCII characters (I5)
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CCSD3ZF0000100000001CCSD3VS00002MRK**001

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Technical_Contact:

Gordon A. Lentz
University of Chicago
Enrico Fermi Institute
Laboratory for Astrophysics and Space Research
933 E. 56th Street
Chicago, IL 60637
Telephone: (312) 702-7836
E-Mail: (NSI/DECnet) LASR::LENTZ
: (Internet) lentz@odysseus.uchicago.edu

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Data_Source: Pioneer 11 Charged Particle Instrument

Scientific_Contact:

Prof. John A. Simpson
University of Chicago
Enrico Fermi Institute
Laboratory for Astrophysics and Space Research
933 E. 56th Street
Chicago, IL 60637
Telephone: (312) 702-7670

Spacecraft_Characteristics: The Pioneer 10 and 11 spacecraft are near-twin spacecraft which were launched toward Jupiter about a year apart with different closest-approach radii at the respective encounters, and differing post-encounter trajectories. Pioneer 10 was launched on March 3, 1972, and encountered Jupiter in December, 1973. Since the encounter, it has been on an escape trajectory from the solar system, and at the end of 1991 it was at a distance of about 53 AU from the sun, a celestial latitude of +3 degrees, and a celestial longitude (measured eastward from the vernal equinox) of 73 degrees. Pioneer 11 was launched April 5, 1973 and encountered Jupiter in December 1974. Its post-encounter trajectory was chosen so that it would encounter Saturn some 5 years later; this encounter took place successfully in August-September 1979. At the end of 1991 Pioneer 11 was at a radial distance of 35 AU, a celestial latitude of +17 degrees and a celestial longitude of -95 degrees. Both spacecraft were instrumented with a full suite of instruments for fields and particles, including magnetometer, plasma sensors, and four energetic particle and cosmic ray instruments. Other instruments included an ultraviolet photometer, infrared photometer, imaging photopolarimeter, and micrometeoroid detector. The spacecraft are spin stabilized, with the spin axis oriented toward the earth.

Investigation_Objectives: The basic scientific objectives of the University of Chicago Charged Particle Instrument (CPI) on Pioneer 10/11 are divided into two categories: (a) those concerned with studies of the magnetospheric environments of Jupiter (Pioneer 10/11) and Saturn (Pioneer 11 only), and (b) those concerned with investigations in the interplanetary medium. The objectives in the study of the planetary magnetospheres are described in NSSDC documents elsewhere. The interplanetary objectives are directed towards studies of transient and long-term solar modulation of galactic cosmic rays, towards studies of acceleration mechanisms for cosmic rays in interplanetary space, and towards studies of propagation and storage of energetic solar particles, in what can be considered to be three regimes of interplanetary space. These are (1) the inner solar system between one and five A.U. from the Sun, (2) the extended region of the solar cavity beyond the orbit of Jupiter to a predicted terminal shock in the solar wind at 50-150 A.U., and (3) the region between the solar wind termination shock and the 'modulation boundary' at several hundred A.U., expected to be characterized by some kind of transition to the local interstellar medium. The basic interplanetary objectives can be summarized as follows:

(1) The measurement of the variation of the differential energy spectra and flux level of energetic charged particles (protons, helium, some heavy nuclei and electrons) with heliographic radius, longitude and latitude, and time. Time variations in the radial and latitudinal gradients are of specific interest for studies of long-term solar modulation of galactic cosmic rays, and the origin of the anomalous components of cosmic rays. The latter is thought to arise from acceleration of cold, singly ionized interstellar atoms at the termination shock of the solar wind. Radial and longitudinal variations are of interest for the study of the propagation of Jovian electrons in the inner heliosphere, where electron acceleration in and leakage from the Jovian magnetosphere is the dominant source, and for the study of cosmic ray particle propagation, acceleration, and transient modulation by traveling shocks and corotating interaction regions.

(2) Investigation of the radial and longitudinal dependence of the energy spectra, composition, and time-intensity behavior for energetic particles from solar flares and solar active regions in both the inner and outer heliospheres. Measurements of spatial gradients can be used to determine parameters for energetic particle diffusion parallel and perpendicular to the interplanetary magnetic field, while composition measurements yield information on acceleration and propagation of flare ions within the solar atmosphere and corona.

Cruise data are useful for the following reasons in planetary studies:

(1) The state of the interplanetary energetic particles can be assessed before the planetary flybys to determine if large solar flare events or effects of interplanetary shock acceleration may inject new particles into the magnetosphere prior to or doing passage through the magnetosphere.

(2) Leakage of particles (e.g., Jovian electrons) can be studied as a function of temporal phase with respect to the planetary rotation period to allow inference of the particle source mechanism.

In order to meet the interplanetary objectives, continuous measurements of the fluxes, energy spectra, and chemical and isotopic composition of energetic charged particles in the interplanetary medium in the inner and outer heliosphere are required. In particular, for nuclei which stop in the sensors (energy range 0.5 - 67 MeV for protons)the instrument separately identifies individual nuclei including protons, helium and higher Z nuclei up to oxygen, and measures the energy and differential flux of these particles. The integral flux of nuclei which completely penetrate the sensors (energy >67 MeV for protons) is also measured. Electron spectra are measured from ~3 to ~30 MeV.

Instrument_Attributes:

A. Sensor Characteristics: The Pioneer 10 and 11 CPI instruments consist of four separate sensors, which are the Main Telescope (MT), the Low Energy Subsystem Telescope (LET), the Electron Current Detector (ECD or "Egg"), and the Fission Cell Detector. Detailed descriptions of these sensors are given in Simpson et al. (1974a,b; 1980). For cruise data analysis only the MT and LET telescopes are utilized.

1. The Main Telescope. The major portion of the instrument response is provided by a 7-element solid state telescope utilizing Li-drifted silicon detectors, a CsI scintillator viewed by a photo-diode, and a cylindrical plastic scintillator guard detector viewed by a photomultiplier tube. This detector telescope satisfies the response capability required for the interplanetary objectives given above except as supplemented by the LET sensor described below. Coincidence-anticoincidence requirements on various combinations of detectors define particle range intervals in which counting rates are measured. In addition, the amount of energy lost in each of three detectors by individual particles passing through the telescope is measured using three pulse height analyzers, thus providing information for particle identification and measurement of energy.

The seven detector elements are identified as D1 through D7, where D1, D2, D3, D4, and D6 are Li-drifted silicon detectors, D5 is composed of a CsI scintillator crystal, shaped in the form of a truncated cone, viewed through its bottom face by a Li-drifted silicon photodiode, and D7 is the plastic scintillator. Detectors D1 and D2 are formed as spherical segments in the Pioneer 11 instrument in order to improve resolution. Pioneer 10 had one flat and one curved detector. The so-called "large geometry" of telescope acceptance for incident events is formed by the D1 and D2 detectors which define an acceptance cone of half angle 32 degrees, for which D3 provides a range measurement in this geometry. The "small geometry" is formed by D1 and D4 with a cone half angle of 23 degrees, for which D5 and D6 provide two additional range measurements. The D7 plastic scintillator is used to reject all particles penetrating the configuration from other directions than those defined by the large and small geometries.

Coincidence and anticoincidence requirements on combinations of detectors triggered by penetration of a charged particle define particle range intervals (also called range ID's) in which counting rates are measured. In addition to these requirements a restriction requiring the total amount of energy deposited in D1 and D2 to total at least 3 MeV for low-energy counting rates is incorporated in the form of the "slant" or "S" discriminator. This condition eliminates background from gamma rays from 200 keV to 3 MeV produced by the Radio-isotope Thermoelectric Generators (RTG's) which produce power for the spacecraft. Since the sensor electronics are optimized for low flux environments in interplanetary space, the MT coincidence rates are overwhelmed by accidental coincidences in high flux environments, and caution is required in the interpretation of data from such periods (e.g., in Jupiter's magnetosphere or in very large solar flare particle events such as occurred in August 1972).

Multiparameter pulse-height analysis is performed using D1, D2, and D5. Energy losses due to charged particle ionization are measured in these three detectors by using multiple-ramp linear post amplifiers in conjunction with 256 channel pulse height analyzers. Hence there are 2 independent streams of digital information: (1) particle event counting rates in the range intervals or ID's, and (2) multiparameter pulse height analysis for each analyzed particle event. The first provides a continuous measure of particle flux, while the second provides information for identifying particle type and energy for a random sample of particles entering the telescope.

2. The Low Energy Telescope. The LET consists of three silicon detectors: a thin (36.3 micron) detector identified as L1, an annular detector, and a flat detector, the last two being coupled together electronically and identified as L2. Passive shielding defines a front aperture of conical half-angle 38 degrees which is further protected by a thin titanium window (0.84 mg/sq-cm) and which points perpendicular to the spacecraft spin axis. The passive shield excludes protons and heavier nuclei below about 45 MeV/amu from penetration to the active detectors from the sides. Protons entering through the aperture trigger only the L1 detector at incident energies of 0.54-1.8 MeV/amu and will trigger both L1 and L2 for energies in the range of 1.8-8.8 MeV/amu. The helium response extends to 50 MeV/amu for L1.L2 events but no heavier ions can be identified. Thirty-two channel pulse height analysis is performed for energy deposition in the L1 detector, which has a 350-keV discriminator threshold. For each L1 event the state of the L2 discriminator is also recorded to identify L1.L2 events, but the L2 pulse height is not recorded. The same discriminator that controls the pulse height analysis is used to increment the counting rate accumulators corresponding to L1.(NOT L2) and L1.L2 events.

3. Electron Current Detector. The ECD was developed especially for the extremely high fluxes of electrons with energies >3 MeV in the inner Jovian magnetosphere. It consists of a shielded, single solid state detector which operates in current mode at temperatures below -40 degrees (C). Current flow due to formation of electron-hole pairs produced by incident charged particles is linear for electron fluxes up to at least 10**11 electrons/cm**2 sr. Current flow is measured by a logarithmic amplifier which has no significant response to single electron events, so the use of the ECD is restricted to high flux environments. Beryllium shielding absorbs protons and ions below 35 MeV/amu in energy while allowing electrons at energies >= 3.4 MeV to penetrate. The light metallic element Be was chosen to minimize Bremsstrahlung and electron range scattering. The external mount and surface treatment of the ECD cool it to temperatures in the nominal range where the leakage current is 5x(10**(-11)) Ampere. Flux measurements with the ECD have accuracies of approximately a factor two or three, primarily as a result of variations in sensitivity with spectral form and direction of incidence.

4. The fission cell was designed to detect and measure a high-energy proton component in the presence of intense fluxes of high energy electrons. The technique used is to measure the fission fragments resulting from proton-induced fission in the isotope Th-232, since the ratio of cross sections for nucleon-induced fission to electron-induced fission is 10**3 to 10**5, depending on electron energy. In order to measure the fission fragment spectrum, two electrically connected curved silicon surface-barrier detectors surround a 5-mil fission foil of Th-232. The detectors are curved to minimize the possibility of confusing a proton-induced fission event with a high-energy particle having a pathlength long enough to produce a larger signal. The threshold energy of the fission cell, 35 MeV, is determined by the Th-232 coulomb barrier and the minimum amount of 1 gm/cm**2 shielding material. Two counting rates, F1 and F2, are obtained by setting the detector discriminator levels at 30 and 50 MeV, respectively. In this way a ratio F1/F2 is gained which is useful for determination of species or energy spectra of incident particles, the response being significantly different for light and heavy ions. The fission cell was used primarily in the Jovian and Saturnian magnetospheres.

B. Data_Channel_Identifiers:

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Detector Combination	ID Code	Species	Energies	Geometry Factor (sqcm-ster.) Pion-10	Pion-11
D1.S.NOT(D2 or D7)	1	P, He	3-10 MeV/amu	~7	~7
	1	CNO	5-20 MeV/amu	~7	~7
D1.D2.S.NOT(D3 or D7)	2	P, He	11-20 MeV/amu	1.30	1.27
	2	C	18-35 MeV/amu	1.30	1.27
	2	N	20-40 MeV/amu	1.30	1.27
	2	O	22-45 MeV/amu	1.30	1.27
D1.D2.S.D3.NOT(D4 or D7)*	3	P, He	20-24 MeV/emu	1.35	1.27
	3	C	35-42 MeV/amu	1.35	1.27
	3	N	40-47 MeV/amu	1.35	1.27
	3	O	45-52 MeV/amu	1.35	1.27
D1.D2.D4.NOT(D5 or D7)	4	P, He	24-29 MeV/amu	0.388	0.419
	4	C	42-50 MeV/amu	0.388	0.419
	4	N	47-55 MeV/amu	0.388	0.419
	4	O	52-60 MeV/amu	0.388	0.419
	4	e-	2- 7 MeV	0.388	0.419
D1.D2.D4.D5.NOT(D6 or D7)	5	P, He	29-67 MeV/amu	0.388	0.419
	5	C	50-125 MeV/amu	0.388	0.419
	5	N	55-140 MeV/amu	0.388	0.419
	5	O	60-185 MeV/amu	0.388	0.419
	5	e-	6-28 MeV	0.388	0.419
D1.D2.D4.D5.D6.NOT(D7)	7	P, He	>67 MeV/amu	~2	~2
	7	C	>125 MeV/amu	~2	~2
	7	N	>140 MeV/amu	~2	~2
	7	O	>185 MeV/amu	~2	~2
L1.NOT(L2)		P	0.5-1.85 MeV	0.486	0.486
		He	0.3-1.82 MeV/amu	0.486	0.486
L1.L2		P	1.85-8.80 MeV	0.486	0.486
		He	1.82-50 MeV/amu	0.486	0.486

*Note: This logic is correct for the Pioneer 10 instrument only; for the Pioneer-11 this logic was changed to:

D1.D2.S.D3.NOT(D4 or D5 or D6 or D7)

Because of the difference in the ID3 logic between the Pioneer 10 and Pioneer 11 instruments, rates and fluxes for this ID should not be combined or added from the two instruments.

****

C. Data_Readout: The CPI instrument readout of high priority rate and pulse height (PHA) information utilizes a four-frame cycle, where 33 bits are allotted to CPI in each main frame word, consisting of 192 data bits. The cycle proceeds as rate 1 word, PHA word, rate 2 word, and PHA word, where a rate 1 word includes the counting rates defined by the detector coincidences D1.S.NOT(D2 or D3 or D7) and L1.NOT(L2). A rate 2 word contains the counting rates defined by D1.D2.S.NOT(D3 or D4 or D7) and D1.D2.D4.D5.NOT(D6 or D7). Every other mainframe word is devoted to the pulse-height analysis of a single particle event.

Also included in each main frame PHA word is information concerning the event range ID and the octant with respect to the solar direction in which the telescope was pointing at the instant the event was detected. Read out concurrently with the main frame is a science subcommutator word of 6 bits. One science subcom frame requires 64 main frame readouts for completion. Lower priority MT rates as well as the analog and digital information provided by the other three sensors in the instrument package are sequentially read out in this way. Consequently, the subcom information is read out only 1/16 as often as any one of the main frame rates defined above. The analog rates "D7" and "Analog Current" are averages over the few sampling points taken during the time interval presented. The analog rates are calculated identically to all the other rates. The units for the D7 rate is counts/sec and the units for the ECD rate is amperes.

Data_Set_Parameters: The parameters in this dataset provide information to allow computation of average counting rates and of fluxes of protons, electrons, helium and CNO-group nuclei in selected energy ranges as identified by the pulse height analysis (see the PHINT-tape description, below).

Note: a 'FORMAT' of 'in' means the item is an ASCII integer of 'n' characters and should be read with a FORTRAN FORMAT specification of 'In' -- e.g. 'I6'. Time is referenced to Spacecraft Event Time

WORD	CONTENTS	RANGE	FORMAT
01	S/C identification Number	10 or 11	i3
02	10*Seconds of Day at interval start time	0 - 864000	i7
03	Day of Year (Jan. 1 = 1)	0 - 366	i4
04	Year from 1970	2 - 32	i3
05	Coverage (seconds) for Rate #1 : L1N2	0 - 900	i4
06	Counts for Rate #1 : L1N2	0 - 2147483392	i10
07	Coverage (seconds) for Rate #2 : D1SN237	0 - 900	i4
08	Counts for Rate #2 : D1SN237	0 - 612000	i7
09	Coverage (seconds) for Rate #3 : D12SN37	0 - 900	i4
10	Counts for Rate #3 : D12SN37	0 - 157284000	i9
11	Coverage (seconds) for Rate #4 : D1245N67	0 - 900	i4
12	Counts for Rate #4 : D1245N67	0 - 78642000	i8
13	Coverage (seconds) for Rate #5 : D2456N7	0 - 1536	i5
14	Counts for Rate #5 (Subcom Digital) : D2456N7	0 - 18900	i6
15	Coverage (seconds) for Rate #6 D12NS37	0 - 1536	i5
16	Counts for Rate #6 : (Subcom Digital) : D12NS37	0 - 18900	i6
17	Coverage (seconds) for Rate #7 : L12	0 - 1536	i5
18	Counts for Rate #7 (Subcom Digital) : L12	0 - 18900	i6
19	Coverage (seconds) for Fission 1 Rate: FISS1	0 - 1536	i5
20	Counts for Fission 1 Rate (Subcom Digital) : FISS1	0 - 261888	i6
21	Coverage (seconds) for Fission 2 Rate: FISS2	0 - 1536	i5

22	Counts for Fission 2 Rate (Subcom Digital) : FISS2	0 - 65280	i6
23	Coverage (seconds) for ECD Current-seconds : ECD	0 - 1536	i5
24	Counts for ECD Current-seconds (Subcom Analog) : ECD (ECD*1.00E+9)	0 - 49610	i6
25	Coverage (seconds) for subcom rate: D7	0 - 1536	i5
26	Counts for the subcom rate (Subcom Analog) : D7	0 - 17503272	i9
27	Total number of PH events for ID1	0 - 4800	i5
28	Total number of PH events for ID2	0 - 4800	i5
29	Total number of PH events for ID5	0 - 4800	i5
30	Total number of PH events for ID7 + ID13	0 - 4800	i5
31	Total number of PH events for ID13	0 - 4800	i5
32	Counts for PH Box #01: ID1 Protons (3 - 10 MeV)	0 - 4800	i5
33	Counts for PH Box #02: ID1 Helium (3 - 10 MeV/amu)	0 - 4800	i5
34	Counts for PH Box #03: ID1 CNO	0 - 4800	i5
35	Counts for PH Box #04: ID2 Protons (11 - 20 MeV)	0 - 4800	i5
36	Counts for PH Box #05: ID2 Protons (11.00 - 13.25 MeV)	0 - 4800	i5
37	Counts for PH Box #06: ID2 Protons (13.25 - 15.50 MeV	0 - 4800	i5
38	Counts for PH Box #07:: ID2 Protons ((15.50 - 17.75 MeV)	0 - 4800	i5
39	Counts for PH Box #08:: ID2 Protons (17.75 - 20.00 MeV)	0 - 4800	i5
40	Counts for PH Box #09:: ID2 Helium (11 - 20 MeV/amu)	0 - 4800	i5
41	Counts for PH Box #10: ID3 Protons (20 - 24 MeV)	0 - 4800	i5
42	Counts for PH Box #11: ID3 Helium (20 - 24 MeV/amu)	0 - 4800	i5
43	Counts for PH Box #12: ID4 Electrons	0 - 4800	i5
44	Counts for PH Box #13: ID4 Protons (24 - 29 MeV)	0 - 4800	i5
45	Counts for PH Box #14: ID4 Helium (24 - 29 MeV/amu)	0 - 4800	i5
46	Counts for PH Box #15: ID4 Z > 2	0 - 4800	i5
47	Counts for PH Box #16: ID5 Electrons	0 - 4800	i5
48	Counts for PH Box #17: ID5 Electrons (2 x min. ion.)	0 - 4800	i5
49	Counts for PH Box #18: ID5 Protons (29 - 67 MeV)	0 - 4800	i5
50	Counts for PH Box #19: ID5 Protons (29 - 42 MeV)	0 - 4800	i5
51	Counts for PH Box #20: ID5 Protons (42 - 54 MeV)	0 - 4800	i5
52	Counts for PH Box #21: ID5 Protons (54 - 67 MeV)	0 - 4800	i5
53	Counts for PH Box #22: ID5 Helium (29 - 67 MeV/amu)	0 - 4800	i5
54	Counts for PH Box #23: ID5 Z>2	0 - 4800	i4
55	Counts for PH Box #24: ID7 Z>5	0 - 4800	i4
56	Counts for PH Box #25: ID9 Electrons	0 - 4800	i4
57	Counts for PH Box #26: ID10 Electrons	0 - 4800	i4
58	Counts for PH Box #27:	0 - 4800	i5

	ID7 + ID13 (> 67 MeV/amu)		
59	100*S/C longitude (Heliographic coord.)	-18000 - 18000	i7
60	100*S/C latitude (Heliographic coord.)	-9000 - 9000	i6
61	100*Radial Distance of s/c from the sun	100 - 8000	i5
62	S/C Telemetry rate (bps)	16 - 2048	i5
63	Effective bit rate (bps)	0 - 2048	i5
64	S/C Spin Rate (rpm x 1000)	4000 - 9000	i5

Data_Set_Quality: Most erroneous data has been removed from the dataset. A few 15-minute data-logical-records (see "Data_Organization", below) contain data which is of dubious quality; these logical-records are flagged by setting the first data-item (item #01, "Spacecraft Identification Number") to the value 000 (zero). In addition, any logical record for which there was no telemetry coverage has this data item set to zero (see "Data_Organization"); thus, any logical record which has a zero in the first data-item should be ignored. This check must be made before any other data or time checks are made. In cases where there were errors in the computation of any "Counts", the reported value will be set to "-1". Except when an entire 15-minute block is filled (Item #01 = 0), all other values will always be present (will not be filled.

Data reported during the first few weeks after turn on should not be used in rate calculations. The instrument logic and electronics were being tested during this period. The counts reported include readings from a mixture of settings, and it is not possible to normalize them to a useful rate.

As stated earlier, this is primarily a "Cruise-Science" dataset. Jupiter and Saturn encounter data are included at the same resolution as the rest of the dataset for pruposes of completeness. The "Counts" data for the periods near the planets will be accurate, even if the time-resolution in this dataset reduces their usefulness; however, the position and attitude data during these periods will not be accurate due to the rapidly changing trajectory of the spacecraft. During the closest-approach to Jupiter some of our counting rates overflowed the allowed telemetry storage, so 15-minute rates should be viewed with some suspicion.

Data_Processing_Overview:

A. Experimenter Data Records (EDR):

The basic experiment data from the CPI is supplied by the Ames Research Center (ARC) in EDR format. Each EDR contains the data from a 24-hour period and contains four physical files. The first of these is a BCD file containing general information about the spacecraft operations and about the ARC processing for this period. The second file is also BCD and contains a record of all commands sent to the spacecraft during the period of the EDR. The third file is in 24-bit binary words and contains the latest 31 observations of celestial latitude, longitude, clock angle of the Sun, and clock angle of Canopus. The fourth file presents the CPI data for the period in physical records consisting of a 24-bit-word binary header (34 words) and then the CPI data in 256 24-bit binary words, as extracted from 128 spacecraft data frames. The CPI Rate-scaler values in the EDR are in log-compressed form as described in the document below.

The contents of the UC-CPI EDR are documented in a NASA document,

Pioneer Off-line Data Processing System
Experimenter Tape Formats
October, 1966
Prepared for Ames Research Center, Moffett Field, CA,

by Computer Sciences Corporation.

and in an internal University of Chicago-LASR document,

JUPRO
Primary Processing Program
for Pioneer 10/11 CPI Data
12/12/72

B. Primary Processing of CPI Data:

The basic processing program for the CPI data accepts the EDR-format data files as described above and produces the "Summary Tape" and "CAL/MRO" datasets described below. This processor provides (1) time validation and time conversion from ground-received time to spacecraft-transmitted time, (2) rejection or flagging of invalid data, (3) rejection of null-pulse-height readouts, (4) computation of sectors (look direction) for both counting rates and valid pulse-height analyses. Since these output data products between them contain all the significant data from the EDR, the EDR is typically recycled after the summary tapes are found to be valid, typically after about 1-2 years.

Additional programs are provided to produce, from the Summary Tape, two further data products -- the "Pulse-Height" and "Rate" tapes. These products are the ones which have been the basis of the UC-CPI data submission to the NSSDC for all data from 1972 to the present. The format and content of these datasets are well documented in Simpson et al. [1974b] which is available from the Technical Reference File at NSSDC. Brief descriptions of these datasets are given below.

C. The Summary Tape:

A complete description of the format of the Summary Tape, Rate tape and Pulse Height tape and of every parameter therein is given in Simpson et al [1974b].

The summary tape contains the bulk of the scientific data from the CPI. These tapes are written in binary mode and 24-bit words (see the above document for a description of these "H800" word formats) and the records are 825 words long. The logical-record structure within these physical records is complex; therefore, these summary tapes are not suitable for distribution. The detailed format of the Summary Tape is documented in the JUPRO document referenced above. A brief description of the contents of the summary tape are given below. No Summary-Tape-format data is included in the dataset being documented here.

The summary tape record contains all the significant (i.e., non-fill) rate and (i.e., non-zero) PHA data for all the CPI sensors (MT, LET, ECD, and Fission Cell) at the finest available time resolution and also includes:

(1) basic spacecraft and instrument support data - S/C mode, format, frame counter, platform and instrument temperatures, DC bus voltages and current, analog calibration values, instrument on/off status, S/C status words, bit-rate and data-quality indicators.

(2) timing data given as the UT year, day-of-year, and milli-second-of-day of the first non-fill frame in the record.

(3) calculated angle in the spin plane of the axis of the MT (Main Telescope) for MT pulse-height-analyzed values and rates.

Each logical record contains the information from one "engineering-subcom sequence" which includes 128 spacecraft minor frames.

D. The Calibrate-Data/Memory-Readout-Data (CAL/MRO) Dataset.

The CAL/MRO dataset contains any CPI calibrate-mode or S/C-memory-readout data found during the 24-hour data-day contained in the EDR from which the above-described summary-tape data was derived. In addition, files 1-3 of the CAL/MRO tape will contain copies of the first three files of the EDR as described in paragraph (A) above.

If any calibrate-mode or MRO data is found, the fourth file of the CAL/MRO tape contains this data in the same format as the data recorded in a summary-tape logical records as described in paragraph (C) above.

E. The Pulse-Height Tape

A logical pulse-height record contains all the valid, non-zero pulse-height-analyzed (PHA) data from the MT and LET for a 15-minute period. The logical record (LR) is made up of at least two physical records,

(1) header-record (HR) containing

- spacecraft-status and instrument-status descriptors
- beginning time of the LR in UT
- bookkeeping and attitude parameters
- "livetime" for the MT during the LR
- count of valid MT events
- number of filled LET and MT events during the LR
- a selection of averaged counting rates correlative with PHA's
- livetimes for the correlative counting rates

These HR records are expressed in 60, 48-bit floating point (Harris H-800) words.

(2) at least one physical record (may be more, depending on the number of analyzed events during the 15-minute period) which contains the PHA values (counts) for each non-zero MT (D1, D2, and D5) and LET (L1) detector, together with range of the analyzed particle through the telescope and the sector (octant of S/C rotation) in which the MT event was detected.

These PHA records are expressed in 24-bit integer form.

F. The Rate Tape

This tape is written in a mixture of 24-bit integer and 48-bit floating-point word (H800) formats. All of the valid, non-fill, rate-scaler values from all CPI detectors are averaged over an rigid five-minute intervals and recorded in this dataset, expressed as average counts/second and associated seconds-of-coverage. For the MT, sectored (octant) rates as well as omnidirectional rates are given; sectoring is to be ignored if the S/C bit rate falls below about 256 bps. Supporting information included in the format is:

- beginning/end times of the accumulation interval
- S/C status (spin rate, etc.)

G. Secondary Processing of CPI Data

The secondary processing scheme uses as input the Pulse-Height and Rate tapes described above to determine counting rates and fluxes of various cosmic ray species. The programs involved (1) eliminate bad quality data 2) remove single 5-minute 'spike' events (3) accumulate the good data over fixed time intervals and (4) average over all sectored information. Because the individual time and sector information for each event is lost in the accumulation procedure the Pulse-Height and Rate tapes will continue to be submitted to the NSSDC in case special analysis is desired.

H. PHINT-Tape Datasets

This is the dataset which is included in the archive in this volume.

The PHINT tape (Pulse-Height INTegrated tape) contains all the information necessary to get a basic set of counting rates and fluxes of cosmic rays for various species in selected energy ranges measured with the CPI. The tape is created by processing Pulse-Height tapes and Rate tapes (see E and F above). The standard PHINT tape computes counts during rigid 15-minute intervals in Universal Time at the spacecraft. All 15-minute intervals will be included in the PHINT tape, with times of fill represented by records in which the 1st word (s/c ID number) set to zero. All records should be checked to see if the 1st word is zero before any averaging is done with that record. The PHINT tape has 64 ASCII data-items comprising 336 characters in the format:
(I3,I7,I4,I3,I4,I10,I4,I7,I4,I9,I4,I8,6(I5,I6),I5,I9,27I5,4I4,I5,I7,I6,4I5)
in each logical (15-minute) record, giving a total record length of 32,256 ASCII characters.

Housekeeping information and two types of data are stored in the PHINT tape.

(1) The housekeeping information includes the spacecraft identifier, the start time for each accumulation interval and spacecraft operation information, the telemetry bit rate, spin rate, radial distance from the Sun, heliographic latitude and longitude is also included.

(2) Twenty-seven 'boxes' are defined. Each 'box' contains the total number (counts) in the time interval of a specific charged particle species in a specific energy range. Every non-zero, good Pulse-Height event is analyzed to determine its energy and charge, and then added to the appropriate 'box'. No consistency check is made for the charge determination. Thus during periods of high solar activity many 'boxes' may contain significant numbers of background counts, due to pulse pile-up, electronic noise or nuclear interactions occurring in the various detectors.

There is also included the total number of pulse-height events in 5 ID's, which can be used as normalization in order to determine fluxes.

N.B. There was radiation damage to some of the Pioneer 10 detectors during the passage through the Jovian magnetosphere. The damage has resulted in a slowly varying change in the calculated channel for a given energy deposit in the detectors, most especially D1 and D2. This variation has been corrected for in the 'boxes' on the PHINT tapes.

(3) In addition to the 'boxes', eleven important, non-pulse-height analyzed counting rates (counts) are computed. Along with each set of counts is the associated livetime (seconds). With this information counting rates can be calculated.

N.B. The spacecraft telemetry bit rate for data transmission is often such that our data readouts do not divide evenly into 15-minutes (900 seconds) For this reason, coverages during some "15-minute intervals" occasionally will be greater than the nominal time interval of 900 seconds. This is not a cause for concern, but is merely an artifact of the averaging procedure. The coverages in the dataset are the correct times and should be used in all cases.

Data_Usage:

A. Non-Pulse-Height analyzed rates:

The eleven non-pulse-height analyzed counts and coverages can be used to make counting rates for any desired time interval. The user should accumulate the counts and coverages for the desired averaging period, then calculate the rate as:

<rate> = Sum(counts) / Sum(coverage)

This method should be used for all rates, including the two subcom analog rates D7 (counts/second) and ECD (amperes), as mentioned earlier in section C.

N.B. To avoid biasing, sums of counts and coverage should be kept for the entire averaging interval. For example, if you wish to compute 24-hour fluxes, do not calculate fluxes for 1 hour periods and then average the 24 1-hour periods, but instead use the PHINT tape to compute true 24-hour sums of both counts and coverage before calculating a counting rate.

B. Pulse-Height analyzed rates and fluxes from the 27 'boxes':

The user may choose from three possible normalization methods for calculating counting rates for the 27 'boxes' of cosmic rays.

If a true flux (particles/cm^2 s sr MeV/n) is desired, you should divide the counting rate by the geometrical factor and the energy interval.

(1) Pseudo-count method (pcm) This is the recommended method for calculating counting rates and fluxes. It must be used for accurate values when the counting rates are so low that few or no events are accumulated during a 15-minute interval. It is less accurate during times of high, variable fluxes, but is never grossly incorrect.

When the pcm normalization is used, the number of box counts which would have been observed if all incident particles were analyzed is estimated for each 15-minute PHINT tape interval, and these 'pseudo-counts' are summed for the entire averaging period. The pseudo-count total is divided by the appropriate rate coverage total to determine the counting rate.

For each 15-minute interval read the four values bxcnt, rtcnt, idcnt and rtcvg from the PHINT tape and calculate the value pcnt as:

pcnt = bxcnt * rtcnt / idcnt

where

```
bxcnt   = number of counts in a matrix 'box'
rtcnt   = number of counts in the rate scalar associated
          with the normalizing ID
idcnt   = number of counts in the normalizing ID
rtcvg   = seconds of coverage for the rate scalar associated
          with the normalizing ID
pcnt    = number of pseudo-counts
```

There are two special cases, in the computation of pcnt, to be considered:

(a) If idcnt<>0 and rtcnt=0 for a 15-minute interval, that interval should not used in the computation for this box, since there is not enough information to know what to do.

(b) If both idcnt = 0 and rtcnt = 0, you should assume that all events are analyzed. However, since the Pioneer instruments cannot analyze events while a Pulse-Height frame is being read out, there is never 100% analysis. The following table gives the fractional live-times:

fractional livetime for main telescope	fractional livetime for low energy telescope
0.9141	0.9995

Then if f = fractional livetime, the pseudo-count is defined as:

pcnt = bxcnt/f

At the end of the averaging interval the mean flux is calculated as follows:

<flux> = Sum(pcnt) / Sum(rtcvg)

The University of Chicago has a recommended set of normalizations for each of the 27 'boxes'. The reason for the difference in normalization between Pioneer 10 and Pioneer 11 is that the D4 detector failed on Pioneer 11 in mid-1980 and no ID5 Pulse-Height events or D1245N6 rate events have been recorded since then.

For Pioneer 10:

Boxes #01 (ID1 H), #02 (ID1 He), #03 (ID1 CNO), #24 (ID7 Z>5), #25 (ID9 e-), #26 (ID10 e-), and #27 (ID7+ID13 >67MeV/AMU):

use the Pulse-Height #1, ID1 to normalize and use the associated rate #2, D1SN2.

All other boxes (#04-#23):

use the Pulse-Height #3, ID5 to normalize and use the associated rate #4, D1245N6.

For Pioneer 11:

Boxes #01 (ID1 H), #02 (ID1 He), #03 (ID1 CNO), #24 (ID7 Z>5), #25 (ID9 e-), #26 (ID10 e-), and #27 (ID7+ID13 >67MeV/AMU) :

use the Pulse-Height #1, ID1 to normalize and use the associated rate #2, D1SN2.

All other boxes (#04-#23):

use the Pulse-Height #2, ID2 to normalize and use the associated rate #3, D12SN3.

(2) Old method (om) This is the old standard method of normalization. The bxcnts, rtcnts, idcnts, and rtcvgs are summed for the entire averaging interval.

Then:

```
               Sum( bxcnt ) * Sum( rtcnt )
  <flux> =  ---------------------------------
               Sum( idcnt ) * Sum( rtcvg )
```

If less than 100% of the events are being pulse height analyzed, this method breaks down when the normalizing rate varies significantly during an averaging interval. Thus it works poorly during flare periods, when large transients, such as shocks, pass the spacecraft, and near planetary encounter periods.

(3) Pulse-Height-Livetime method (phlt). This method sums bxcnts and phlts for the whole averaging interval.

The pulse height livetime for each ID is calculated by dividing the ID counts for a sub-interval by the value of the corresponding rate averaged over that sub-interval. That is, the counters: idcnt, rtcnt, and rtcvg are accumulated during an interval and then

```
phlt = idcnt * rtcvg / rtcnt
```

(see pcm method above for the recommended normalizing ID and associated rate).

The counts in a 'box' and the phlts for the sub-intervals are summed to get a phlt for the entire averaging interval. The average flux is calculated as:

```
     <flux> = Sum( bxcnt )  /  Sum( phlt )
```

This method breaks down when the normalizing rate is so low that few or no counts are accumulated during a 15-minute interval.

Data_Organization: A CPI PHINT-tape logical record contains the data (with content and datum-size as specified in the "Data_Set_Parameters" section above and, in the "FORMAT.SFD" file, in the "Record_Syntax" section) for a 15-minute period of time synchronized with hour boundaries. It has a size of 336 ASCII characters (bytes). A physical tape record will consist of a concatenation of 96 logical records, have a size of 32,256 bytes and contain the data from one day. A year of CPI-PHINT data consists of either 365 or 366 such physical records (a total of 11,773,440 or 11,805,696 bytes). A year of data will be contained in two separate data files, each containing not more than six months of data.

In the case of missing data:

(1) if no coverage-time is available for any 15-minute logical record or series of logical records, such logical records have every one of the 64 data-items in them set to zero values; this is a "zero-logical-record". In such records, the "Spacecraft Identification Number" will be zero and the logical-record can be ignored by an initial check on that item (see also, "Data_Set_Quality" above).

(2) if no coverage was obtained for an entire day, the physical record for that day will exist but will consist of 96 zero-logical-records as defined above. This is done to preserve the overall structure so that (for example) FORTRAN 'READs' based on multiple-day FORMAT specifications are easily possible.

File_Class_Relationships: N/A

Lit_References:

Simpson, J. A., T. S. Bastian, D. L. Chenette, R. B. McKibben, and K. R. Pyle, The trapped radiations of Saturn and their absorption by satellites and rings, J. Geophys. Res., 85, 5731, 1980.

Simpson, J. A., D. C. Hamliton, R. B. McKibben, A. Mogro-Campero, K. R. Pyle, and A. J. Tuzzolino, The protons and electrons trapped in the Jovian dipole magnetic field and their interaction with Io, J. Geophys. Res., 79, 3522, 1974a.

Simpson, J. A., G. A. Lentz, R. B. McKibben, J. J. O'Gallagher, W. Schroeder, and A. J. Tuzzolino, Preliminary documentation for the University of Chicago charged particle instrument from the Pioneer 10/11 spacecraft, NSSDC Tech. Ref. File B21970, Goddard Space Flight Center, Greenbelt, MD, 1974b.

CCSD$$MARKERMRK**002CCSD3KS00002MRK**003

Vol_Time_Coverage: 1984-01-01 to 1992-12-31

File_Naming_Convention: CPI files are named according to the start time of the data contained in the file, using the form CPI_PXX_YYH.DAT where:

PXX can be either P10 or P11

YY stands for the last two digits of the year

H can be "A", meaning "first half of the calendar year, i.e., January/01 through June/30" or
"B", meaning "second half of the calendar year, i.e., July/01 through December/31."

Note that files on the current data volume are referenced below by file sequence number, since there are no file labels on the tape. These sequence numbers are then mapped to the actual file name in the "REFERENCE=" keywords.

File_Time_Coverage:

CPI_P11_84A.DAT	84/01/01 thru 84/06/30
CPI_P11_84B.DAT	84/07/01 thru 84/12/31
CPI_P11_85A.DAT	85/01/01 thru 85/12/31
CPI_P11_85B.DAT	85/07/01 thru 85/12/31
CPI_P11_86A.DAT	86/01/01 thru 86/12/31
CPI_P11_86B.DAT	86/07/01 thru 86/12/31
CPI_P11_87A.DAT	87/01/01 thru 87/12/31
CPI_P11_87B.DAT	87/07/01 thru 87/12/31
CPI_P11_88A.DAT	88/01/01 thru 88/12/31
CPI_P11_88B.DAT	88/07/01 thru 88/12/31
CPI_P11_89A.DAT	89/01/01 thru 89/12/31
CPI_P11_89B.DAT	89/07/01 thru 89/12/31
CPI_P11_90A.DAT	90/01/01 thru 90/12/31
CPI_P11_90B.DAT	90/07/01 thru 90/12/31
CPI_P11_91A.DAT	91/01/01 thru 91/12/31
CPI_P11_91B.DAT	91/07/01 thru 91/12/31
CPI_P11_92A.DAT	92/01/01 thru 92/12/31
CPI_P11_92B.DAT	92/07/01 thru 92/12/31

CCSD$$MARKERMRK**003NSSD3RF0014000000001

REFERENCETYPE = $SEQUENCE;

```
LABEL=ATTACHED;
REFERENCE = "$2 = FORMAT.SFD,  $5 = 2";

LABEL = NSSD3IF0013200000001;

REFERENCE = "$2 = CPI_P11_84A.DAT, $5 = 3";
REFERENCE = "$2 = CPI_P11_84B.DAT, $5 = 4";

REFERENCE = "$2 = CPI_P11_85A.DAT, $5 = 5";
REFERENCE = "$2 = CPI_P11_85B.DAT, $5 = 6";

REFERENCE = "$2 = CPI_P11_86A.DAT, $5 = 7";
REFERENCE = "$2 = CPI_P11_86B.DAT, $5 = 8";

REFERENCE = "$2 = CPI_P11_87A.DAT, $5 = 9";
REFERENCE = "$2 = CPI_P11_87B.DAT, $5 = 10";

REFERENCE = "$2 = CPI_P11_88A.DAT, $5 = 11";
REFERENCE = "$2 = CPI_P11_88B.DAT, $5 = 12";

REFERENCE = "$2 = CPI_P11_89A.DAT, $5 = 13";
REFERENCE = "$2 = CPI_P11_89B.DAT, $5 = 14";

REFERENCE = "$2 = CPI_P11_90A.DAT, $5 = 15";
REFERENCE = "$2 = CPI_P11_90B.DAT, $5 = 16";

REFERENCE = "$2 = CPI_P11_91A.DAT, $5 = 17";
REFERENCE = "$2 = CPI_P11_91B.DAT, $5 = 18";

REFERENCE = "$2 = CPI_P11_92A.DAT, $5 = 19";
REFERENCE = "$2 = CPI_P11_92B.DAT, $5 = 20";
```

```
CCSD3FF0000500000001CCSD3CS00004MRK**001
ADIDNAME=NSSD0132;
CCSD$$MARKERMRK**001CCSD3KS00002MRK**002
```

Subm_Name: Gordon A. Lentz

Subm_Addr:

Gordon A. Lentz
University of Chicago
Enrico Fermi Institute
Laboratory for Astrophysics and Space Research
933 E. 56th Street
Chicago, IL 60637
Telephone: (312) 702-7836
E-Mail: (NSI/DECnet) LASR::LENTZ
      :   (Internet) lentz@odysseus.uchicago.edu

Subm_Date: 1993-03-22

Title: Format for Pioneer 11 CPI Cruise Data Archive Data Set

Descr: Format description of the Pioneer 11 Charged Particle Instrument's cruise phase archive data set, March, 1972 through December, 1992

Rel_Date: 1993-03-22

```
CCSD$$MARKERMRK**002CCSD3DF0000200000001
```

File_Class_Name: UC CPI Interplanetary Cruise ASCII Archive

Record_Type_Name: Fifteen-minute PHINT tape

Algorithms: See VOLDESC.SFD file, Data_Usage section. All algorithms used in the interpretation of the CPI data are given in detail there.

File_Class_Syntax: All records in the UC CPI interplanetary cruise ASCII archive files are of the same type, size, and format.

File_Class_Field_Relationships: N/A

File_Class_Misc: See Record and Field specifications.

Record_Name: Fifteen-minute PHINT tape records

Record_Structure: All data records are of the same length.

Record_Length: 32,256 ASCII characters or bytes per physical record. Each physical record contains 96 logical records of length 336 bytes.

Record_Field_Names:

SCID,ISTIM,DOY,YEAR70,TL1NL2,CL1NL2,TD1SN237,CD1SN237,TD1S2N37,CD1S2N37,
TD1245N6,CD1245N6,TD2456N7,CD2456N7,TD12NS37,CD12NS37,TL1L2,CL1L2,TFISS1,
CFISS1,TFISS2,CFISS2,TECD,CECD,TD7,CD7,NPHID1,NPHID2,NPHID5,NPHID713,NPHID13,

NID1P,NID1HE,NID1CNO,NID2P1,NID2P2,NID2P3,NID2P4,NID2P5,NID2HE,NID3P,NID3HE,
NID4E,NID4P,NID4HE,NID4ZG2,NID5E1,NID5E2,NID5P1,NID5P2,NID5P3,NID5P4,NID5HE,
NID5ZG2,NID7ZG5,NID9E,NID10E,NID7+13,HEGLONG,HEGLAT,HEGRAD,TELBRATE,EFFBRATE,
SPINRATE

FORMAT:
(I3,I7,I4,I3,I4,I10,I4,I7,I4,I9,I4,I8,6(I5,I6),I5,I9,27I5,4I4,I5,I7,I6,4I5)

Record_Syntax: (See the note preceding the "Data_Set_Parameters" Table.)

WORD	MNEMONIC	CONTENTS	RANGE	FORMAT
01	SCID	S/C identification Number	10 or 11	i3
02	ISTIM	10*Seconds of Day at interval start time	0 - 864000	i7
03	DOY	Day of Year (Jan. 1 = 1)	0 - 366	i4
04	YEAR70	Year from 1970	2 - 32	i3
05	TL1NL2	Coverage (seconds) for Rate #1 : L1N2	0 - 900	i4
06	CL1NL2	Counts for Rate #1 : L1N2	0 - 2147483392	i10
07	TD1SN237	Coverage (seconds) for Rate #2 : D1SN237	0 - 900	i4
08	CD1SN237	Counts for Rate #2 : D1SN237	0 - 612000	i7
09	TD1S2N37	Coverage (seconds) for Rate #3 : D1S2N37	0 - 900	i4
10	CD1S2N37	Counts for Rate #3 : D1S2N37	0 - 157284000	i9
11	TD1245N6	Coverage (seconds) for Rate #4 : D1245N67	0 - 900	i4
12	CD1245N6	Counts for Rate #4 : D1245N67	0 - 78642000	i8
13	TD2456N7	Coverage (seconds) for Rate #5 : D2456N7	0 - 1536	i5
14	CD2456N7	Counts for Rate #5 (Subcom Digital) : D2456N7	0 - 18900	i6
15	TD12NS37	Coverage (seconds) for Rate #6 : D12NS37	0 - 1536	i5
16	CD12NS37	Counts for Rate #6 (Subcom Digital) : D12NS37	0 - 18900	i6
17	TL1L2	Coverage (seconds) for Rate #7 : L12	0 - 1536	i5
18	CL1L2	Counts for Rate #7 (Subcom Digital) : L12	0 - 18900	i6
19	TFISS1	Coverage (seconds) for Fission 1 Rate: FISS1	0 - 1536	i5
20	CFISS1	Counts for Fission 1 Rate (Subcom Digital) : FISS1	0 - 261888	i6
21	TFISS2	Coverage (seconds) for Fission 2 Rate: FISS2	0 - 1536	i5
22	CFISS2	Counts for Fission 2 Rate (Subcom Digital) : FISS2	0 - 65280	i6
23	TECD	Coverage (seconds) for ECD Current : ECD	0 - 1536	i5
24	CECD	Counts for ECD Current (Subcom Analog) : (ECD x 1.00e+9)	0 - 49610	i6
25	TD7	Coverage (seconds) for the subcom rate: D7	0 - 1536	i5
26	CD7	Counts for the subcom rate (Subcom Analog) : D7	0 - 175030272	i9
27	NPHID1	Total number of PH events for ID1	0 - 4800	i5
28	NPHID2	Total number of PH events for ID2	0 - 4800	i5
29	NPHID5	Total number of PH events for ID5	0 - 4800	i5
30	NPHID713	Total number of PH events for ID7 + ID13	0 - 4800	i5
31	NPHID13	Total number of PH events for ID13	0 - 4800	i5
32	NID1P	Counts for PH Box #01: D1 Protons (3 - 10 MeV)	0 - 4800	i5
33	NID1HE	Counts for PH Box #02: ID1 Helium (3 - 10 MeV/amu)	0 - 4800	i5
34	NID1CNO	Counts for PH Box #03: ID1 CNO	0 - 4800	i5
35	NID2P1	Counts for PH Box #04:	0 - 4800	i5

```
                    ID2 Protons  (11 - 20 MeV)
36   NID2P2   Counts for PH Box #05:                    0 - 4800       i5
                    ID2 Protons  (11.00 - 13.25 MeV)
37   NID2P3   Counts for PH Box #06:                    0 - 4800       i5
                    ID2 Protons  (13.25 - 15.50 MeV)
38   NID2P4   Counts for PH Box #07:                    0 - 4800       i5
                    ID2 Protons  (15.50 - 17.75 MeV)
39   NID2P5   Counts for PH Box #08:                    0 - 4800       i5
                    ID2 Protons  (17.75 - 20.00 MeV)
40   NID2HE   Counts for PH Box #09:                    0 - 4800       i5
                    ID2 Helium  (11 - 20 MeV/amu)
41   NID3P    Counts for PH Box #10:                    0 - 4800       i5
                    ID3 Protons  (20 - 24 MeV)
42   NID3HE   Counts for PH Box #11:                    0 - 4800       i5
                    ID3 Helium  (20 - 24 MeV/amu)
43   NID4E    Counts for PH Box #12:  ID4 Electrons     0 - 4800       i5
44   NID4P    Counts for PH Box #13:                    0 - 4800       i5
                    ID4 Protons  (24 - 29 MeV)
45   NID4HE   Counts for PH Box #14:                    0 - 4800       i5
                    ID4 Helium  (24 - 29 MeV/amu)
46   NID4ZG2  Counts for PH Box #15:  ID4 Z > 2         0 - 4800       i5
47   NID5E1   Counts for PH Box #16:  ID5 Electrons     0 - 4800       i5
48   NID5E2   Counts for PH Box #17:                    0 - 4800       i5
                    ID5 Electrons (2 x min. ion.)
49   NID5P1   Counts for PH Box #18:                    0 - 4800       i5
                    ID5 Protons  (29 - 67 MeV)
50   NID5P2   Counts for PH Box #19:                    0 - 4800       i5
                    ID5 Protons  (29 - 42 MeV)
51   NID5P3   Counts for PH Box #20:                    0 - 4800       i5
                    ID5 Protons  (42 - 54 MeV)
52   NID5P4   Counts for PH Box #21:                    0 - 4800       i5
                    ID5 Protons  (54 - 67 MeV)
53   NID5HE   Counts for PH Box #22:                    0 - 4800       i5
                    ID5 Helium  (29 - 67 MeV/amu)
54   NID5ZG2  Counts for PH Box #23:  ID5 Z>2           0 - 4800       i4
55   NID7ZG5  Counts for PH Box #24:  ID7 Z>5           0 - 4800       i4
56   NID9E    Counts for PH Box #25:  ID9 Electrons     0 - 4800       i4
57   NID10E   Counts for PH Box #26:  ID10 Electrons    0 - 4800       i4
58   NID7+13  Counts for PH Box #27:                    0 - 4800       i5
                    ID7 + ID13  (> 67 MeV/amu)
59   HEGLONG  100*S/C longitude (Heliographic coord.) -18000 - 18000   i7
60   HEGLAT   100*S/C latitude (Heliographic coord.)    -9000 - 9000   i6
61   HEGRAD   100*Radial Distance of s/c from the su    100 - 8000     i5
62   TELBRATE S/C Telemetry rate (bps)                  16 - 2048      i5
63   EFFBRATE Effective bit rate (bps)                   0 - 2048      i5
64   SPINRATE S/C Spin Rate (rpm  x 1000)               4000 - 9000    i5
```

Field_Name: S/C identification number
Field_Mnemonic: SCID
Field_Units: ASCII characters
Field_Resolution: N/A
Field_Range: 10 - 11
Field_Description: S/C identification number (10= P10, 11= P11)
Field_Representation: 3 ASCII CHARACTERS (I3)

Field_Name: Start time for 15-min interval
Field_Mnemonic: ISTIM
Field_Units: 10*Seconds of Day
Field_Resolution: N/A
Field_Range: 0 - 864000

```
Field_Description: 10*Seconds of Day at interval start time
Field_Representation: 7 ASCII characters (I7)

Field_Name: Day of Year
Field_Mnemonic: DOY
Field_Units: Day of year
Field_Resolution:  1 day
Field_Range: 1-366
Field_Description: Day of Year (Jan. 1 = 1)
Field_Representation: 4 ASCII characters (I4)

Field_Name: Years from 1970
Field_Mnemonic: YEAR70
Field_Units: year
Field_Resolution: 1 year
Field_Range: 2-32
Field_Description: Year from 1970 (2 = year 1972)
Field_Representation: 3 ASCII characters (I3)

Field_Name:  L1NL2 time coverage
Field_Mnemonic: TL1NL2
Field_Units:  seconds
Field_Resolution: 1
Field_Range: 0-900
Field_Description: Coverage (seconds) for Rate #1 : L1NL2
Field_Representation: 4 ASCII characters (I4)

Field_Name:  L1NL2 counts
Field_Mnemonic: CL1NL2
Field_Units:  counts
Field_Resolution: 1
Field_Range: 0-2147483392
Field_Description: Counts for Rate #1: L1NL2
Field_Representation: 10 ASCII characters (I10)

Field_Name: D1SN2 Time Coverage
Field_Mnemonic: TD1SN237
Field_Units: seconds
Field_Resolution: 1
Field_Range: 0-900
Field_Description: Coverage for Rate #2: D1SN2
Field_Representation: 4 ASCII characters (I4)

Field_Name: D1SN2 Counts
Field_Mnemonic: CD1SN237
Field_Units: counts
Field_Resolution: 1
Field_Range: 0-612000
Field_Description: Counts for Rate #2: D1SN2
Field_Representation: 7 ASCII characters (I7)

Field_Name: D12SN3 Time Coverage
Field_Mnemonic: TD12SN37
Field_Units: seconds
Field_Resolution: 1
Field_Range: 0-900
Field_Description: Coverage for Rate #3: D12SN3
Field_Representation: 4 ASCII characters (I4)

Field_Name: D12SN3 Counts
```

```
Field_Mnemonic: CD12SN37
Field_Units: counts
Field_Resolution: 1
Field_Range: 0-157284000
Field_Description: Counts for Rate #3
Field_Representation: 9 ASCII characters (I9)

Field_Name: D1245N6 Coverage
Field_Mnemonic: TD1245N6
Field_Units:  seconds
Field_Resolution: 1
Field_Range: 0-900
Field_Description: Coverage for Rate #4: D1245N6
Field_Representation: 4 ASCII characters (I4)

Field_Name: D1245N6 Counts
Field_Mnemonic: CD1245N6
Field_Units: counts
Field_Resolution: 1
Field_Range: 0-78642000
Field_Description: Counts for Rate #4: D1245N6
Field_Representation: 8 ASCII characters (I8)

Field_Name:  D2456N7 Coverage
Field_Mnemonic: TD2456N7
Field_Units: seconds
Field_Resolution: 1
Field_Range: 0-1536
Field_Description: Coverage for Rate #5: D2456N7
Field_Representation: 5 ASCII characters (I5)

Field_Name: D2456N7 Counts
Field_Mnemonic: CD2456N7
Field_Units: counts
Field_Resolution: 1
Field_Range: 0-18900
Field_Description: Counts for Rate #5: D2456N7
Field_Representation: 6 ASCII characters (I6)

Field_Name: D12NS Coverage
Field_Mnemonic: TD12NS37
Field_Units: seconds
Field_Resolution: 1
Field_Range: 0-1536
Field_Description:  Coverage for Rate #6: D12NS
Field_Representation: 5 ASCII characters (I5)

Field_Name: D12NS Counts
Field_Mnemonic: CD12NS37
Field_Units: counts
Field_Resolution: 1
Field_Range: 0-18900
Field_Description: Counts for Rate #6: D12NS
Field_Representation: 6 ASCII characters (I6)

Field_Name: L1L2 Coverage
Field_Mnemonic: TL1L2
Field_Units: seconds
Field_Resolution: 1
Field_Range: 0-1536
```

```
Field_Description: Coverage for Rate #7: L1L2
Field_Representation: 5 ASCII characters (I5)

Field_Name: L1L2 Counts
Field_Mnemonic: CL1L2
Field_Units: counts
Field_Resolution: 1
Field_Range: 0-18900
Field_Description: Counts for Rate #7: L1L2
Field_Representation: 6 ASCII characters (I6)

Field_Name: Fission 1 Coverage
Field_Mnemonic: TFISS1
Field_Units:  seconds
Field_Resolution: 1
Field_Range: 0-1536
Field_Description: Coverage for Fission 1 Rate: FISS1
Field_Representation: 5 ASCII characters (I5)

Field_Name: Fission 1 Counts
Field_Mnemonic: CFISS1
Field_Units: counts
Field_Resolution: 1
Field_Range: 0-261888
Field_Description: Counts for Fission 1 Rate: FISS1
Field_Representation: 6 ASCII characters (I6)

Field_Name: Fission 2 Coverage
Field_Mnemonic: TFISS2
Field_Units:  seconds
Field_Resolution: 1
Field_Range: 0-1536
Field_Description: Coverage for Fission 2 Rate: FISS2
Field_Representation: 5 ASCII characters (I5)

Field_Name: Fission 2 Counts
Field_Mnemonic: CFISS2
Field_Units:  counts
Field_Resolution: 1
Field_Range: 0-65280
Field_Description: Counts for Fission 2 Rate: FISS2
Field_Representation: 6 ASCII characters (I6)

Field_Name: Electron Current Detector Rate (ECD) Coverage
Field_Mnemonic: TECD
Field_Units:  seconds
Field_Resolution: 1
Field_Range: 0-1536
Field_Description: Coverage for ECD Current: ECD
Field_Representation: 5 ASCII characters (I5)

Field_Name: Electron Current Detector Current (ECD) Current
Field_Mnemonic: CECD
Field_Units:  ampere-second * (1.00E+9)
Field_Resolution: 1
Field_Range: 0-49610
Field_Description: Ampere-seconds for ECD Current: ECD
Field_Representation: 6 ASCII characters (I6)

Field_Name: D7 Coverage
```

```
Field_Mnemonic: TD7
Field_Units:  seconds
Field_Resolution: 1
Field_Range: 0-1536
Field_Description: Coverage for D7 subcom rate
Field_Representation: 5 ASCII characters (I5)

Field_Name: D7 Counts
Field_Mnemonic: CD7
Field_Units: counts
Field_Resolution: 1
Field_Range: 0-175030272
Field_Description: Counts for the D7 subcom rate
Field_Representation: 9 ASCII characters (I9)

Field_Name: ID1 PH Events
Field_Mnemonic: NPHID1
Field_Units: events
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: Total number of PH events for ID1
Field_Representation: 5 ASCII characters (I5)

Field_Name: ID2 PH events
Field_Mnemonic: NPHID2
Field_Units: events
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: Total number of PH events for ID2
Field_Representation: 5 ASCII characters (I5)

Field_Name: ID5 PH events
Field_Mnemonic: NPHID5
Field_Units: events
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: Total number of PH events for ID5
Field_Representation: 5 ASCII characters (I5)

Field_Name: ID7+ID13 PH Events
Field_Mnemonic: NPHID713
Field_Units:  events
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: Total number of PH events for ID7+ID13
Field_Representation: 5 ASCII characters (I5)

Field_Name: ID13 PH Events
Field_Mnemonic: NPHID13
Field_Units:  events
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: Total PH Events for ID13
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 1 Counts
Field_Mnemonic: NID1P
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
```

Field_Description: ID1 Protons (3-10 MeV)
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 2 Counts
Field_Mnemonic: NID1HE
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID1 Helium (3 - 10 MeV/amu)
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 3 Counts
Field_Mnemonic: NID1CNO
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID1 CNO
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 4 Counts
Field_Mnemonic: NID2P1
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID2 Protons (11 - 20 MeV)
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 5 Counts
Field_Mnemonic: NID2P2
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID2 Protons (11.00-13.25 MeV)
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 6 Counts
Field_Mnemonic: NID2P3
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID2 Protons (13.25-15.50 MeV)
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 7 Counts
Field_Mnemonic: NID2P4
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID2 Protons (15.50-17.75 MeV)
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 8 Counts
Field_Mnemonic: NID2P5
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID2 Protons (17.75-20.00 MeV)
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 9 Counts

```
Field_Mnemonic: NID2HE
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID2 Helium (11 - 20 MeV/amu)
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 10 Counts
Field_Mnemonic: NID3P
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID3 Protons (20 - 24 MeV)
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 11 Counts
Field_Mnemonic: NID3HE
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID3 Helium (20 - 24 MeV/amu)
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 12 Counts
Field_Mnemonic: NID4E
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID4 Electrons
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 13 Counts
Field_Mnemonic: NID4P
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID4 Protons (24 - 29 MeV)
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 14 Counts
Field_Mnemonic: NID4HE
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID4 Helium (24 - 29 MeV/amu)
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 15 Counts
Field_Mnemonic: NID4ZG2
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID4 Z > 2
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 16 Counts
Field_Mnemonic: NID5E1
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
```

Field_Description: ID5 Electrons
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 17 Counts
Field_Mnemonic: NID5E2
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID5 Electrons (2 x Min.Ion.)
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 18 Counts
Field_Mnemonic: NID5P1
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID5 Protons (29 - 67 MeV)
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 19 Counts
Field_Mnemonic: NID5P2
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID5 Protons (29 - 42 MeV)
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 20 Counts
Field_Mnemonic: NID5P3
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID5 Protons (42 - 54 MeV)
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 21 Counts
Field_Mnemonic: NID5P4
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID5 Protons (54 - 67 MeV)
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 22 Counts
Field_Mnemonic: NID5HE
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID5 Helium (29 - 67 MeV/amu)
Field_Representation: 5 ASCII characters (I5)

Field_Name: PH Box 23 Counts
Field_Mnemonic: NID5ZG2
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID5 Z > 2
Field_Representation: 4 ASCII characters (I4)

Field_Name: PH Box 24 Counts

```
Field_Mnemonic: NID7ZG5
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID7   Z > 5
Field_Representation: 4 ASCII characters (I4)

Field_Name: PH Box 25 Counts
Field_Mnemonic: NID9E
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID9 Electrons
Field_Representation: 4 ASCII characters (I4)

Field_Name: PH Box 26 Counts
Field_Mnemonic: NID10E
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-4800
Field_Description: ID10 Electrons
Field_Representation: 4 ASCII characters (I4)

Field_Name: PH Box 27 Counts
Field_Mnemonic: NID7+13
Field_Units: Counts
Field_Resolution: 1
Field_Range: 0-2000
Field_Description: ID7 + ID13 (>67 MeV/amu)
Field_Representation: 5 ASCII characters (I5)

Field_Name:S/C Heliographic Longitude
Field_Mnemonic: HEGLONG
Field_Units: 100*degrees
Field_Resolution: .01 degrees
Field_Range:-18,000 -- 18,000
Field_Description: Heliographic Longitude of S/C in 0.01-degrees
Field_Representation: 7 ASCII Characters (I7)

Field_Name: S/C Heliographic Latitude
Field_Mnemonic: HEGLAT
Field_Units: 100*degrees
Field_Resolution: 0.01 degrees
Field_Range: -9,000 -- 9,000
Field_Description: Heliographic Latitude of S/C in 0.01-degree
Field_Representation: 6 ASCII Characters (I6)

Field_Name: Radial Distance of S/C from Sun
Field_Mnemonic: HEGRAD
Field_Units: 100*AU
Field_Resolution: .01AU
Field_Range: 100 -- 8000
Field_Description: Radial distance of the Spacecraft from the Sun in 0.01AU
Field_Representation: 5 ASCII Characters (I5)

Field_Name:  S/C telemetry rate
Field_Mnemonic:  TELBRATE
Field_Units:  bits-per-second
Field_Resolution: 1 bps
Field_Range: 16-2048
```

```
Field_Description: S/C Telemetry rate (bps)
Field_Representation: 5 ASCII characters (I5)

Field_Name:  Effective bit rate
Field_Mnemonic: EFFBRATE
Field_Units: bits-per-second
Field_Resolution: 1 bps
Field_Range:  8-2048
Field_Description: Effective bit rate
Field_Representation: 5 ASCII characters (I5)

Field_Name:  S/C spin rate
Field_Mnemonic: SPINRATE
Field_Units: rpm x 1000
Field_Resolution: 1
Field_Range: 4000-9000
Field_Description: S/C Spin Rate
Field_Representation: 5 ASCII characters (I5)
```

ASCII LIST OF CPI_P11_92B.DAT

File: 20
D-100502

RECORD 151   32256 BYTES


```
 11      0 333 22 912       18 912     20 888       0 888      0  768     0  768    52  768    32  768    15  768    63  768     3
3  768    300616   17     0     0     0     0    12     4     2     0     0     0     0     0     0     0     0     0     0     0     0     0
  0     0     0     0     0     0     0     0     0  -9342   1728 3707    32    32 8129 11    9000 333 22 888        12 888      12 912        0 912
      0 1152      0 1152     33 1152     47 1152      9 1152     0 1152     50 1152    388768    13     0     0     0     0     8     3     0     0
    0     0     0     0     0     0     1     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0  -9342   1728 3707
32    31 8129 11   18000 333 22 912         14 912       24 888          1 888        0  768      0  768     9  768     25  768    16  768
63  768     33  768    238464    14     2     0     0     0     7     7     3     1     1     0     0     0     0     0     0     0     0     0     0
   0     0     0     0     0     0     0     0     0     0     0  -9342   1728 3707    32    32 8129 11   27000 333 22 888        16 888      16 912
      6 912       0  768      0  768     23  768     35  768     10  768      0  768     33  768    300616    10     3     0     0     0     6
 3     1     1     0     1     0     0     1     0     1     0     0     0     0     0     0     0     0     0     0     0     0     0     0  -9342
1728 3707    32    31 8129 11   36000 333 22 912         21 912       24 888          1 888        0 1152      0 1152     81 1152     55 1152
 22 1152     63 1152     50 1152    326613    16     2     0     0     0    12     3     2     0     0     0     0     0     1     0     1     0     0
 0     0     0     0     0     0     0     0     0     0     0     0     0     0  -9342   1728 3707    32    32 8129 11   45000 333 22 840        19 840
    12 864        3 864       0  384     0  384    19  384    11  768    11  768     0  384    16  384    150307    12     1     0     0
  0     6     6     3     0     0     0     0     0     1     0     1     0     0     0     0     0     0     0     0     0     0     0     0     0
  0  -9342   1728 3707    32    29 8129  0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
  0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
  0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
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 0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
   0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
 0  0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
  0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
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  0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
  0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
  0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
   0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
 0     0     0  0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
 0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
   0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
 0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
  0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
  0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
 0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0 11 144000 333 22  48         1  48
    0  24        0  24        0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
  0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
  0  -9342   1728 3707    32     1 8129 11 153000 333 22 864          14 864        8 864         1 864       0  768     0  768     70  768
 33  768     13  768     63  768     33  768    238460    14     1     0     0     0     6     7     3     1     0     1     0     0     0     1     2
  0     0     0     0     0     0     0     0     0     0     0     0     0     0  -9342   1728 3707    32    30 8129 11 162000 333 22 912
    14 912      16 888          1 888       0  768      0  768     70  768     29  768     6  768      0  768     33  768    238460     9
1     0     0     0     5     3     1     0     0     0     0     0     0     0     1     0     0     0     0     0     0     0     0     0     0
 0     0     0     0  -9342   1728 3707    32    32 8129 11 171000 333 22 888         17 888      16 912         1 912       0 1152      0 1152
  160 1152     62 1152     25 1152     63 1152     50 1152     450924    12     1     0     0     0     9     1     1     0     0     0     0     0
1     0     1     0     0     0     0     0     0     0     0     0     0     0     0     0     0  -9342   1728 3707    32    31 8129 11 180000 3
33 22 912       16 912      24 888         1 888       0  768      0  768     14  768     29  768     13  768      0  768     33  768    176
304    20     0     0     0     0    17     2     1     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
0     0     0     0     0     0     0  -9342   1728 3707    32    32 8129 11 189000 333 22 888         14 888      24 912        0 912       0  768
     0  768    116  768     42  768     20  768     63  768     33  768    176304    19     0     0     0     0    11     6     2     0     0     0
```

```
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 -9342 1728 3707 32 31 8129
11 198000 333 22 912 16 912 20 888 1 888 0 1152 0 1152 78 1152 49 1152 15 1152 0 1152 5
0 1152 450925 17 1 0 0 0 13 3 1 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 -9342 1728 3707 32 32 8129 11 207000 333 22 888 14 888 16 912 0 912
0 768 0 768 40 768 26 768 20 768 63 768 33 768 304042 10 0 0 0 0 7 3 2 0
0 0 0 0 0 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 -9342 1728 3707
32 31 8129 11 216000 333 22 912 8 912 16 888 2 888 0 768 0 768 21 768 35 768 10 768
0 768 33 768 238460 11 2 0 0 0 9 1 1 1 1 0 0 0 1 1 1 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 -9342 1728 3707 32 32 8129 11 225000 333 22 888 21 888 16 912
3 912 0 1152 0 1152 25 1152 37 1152 21 1152 63 1152 50 1152 388768 14 3 0 0 0 8
5 2 2 2 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 -9342
1728 3707 32 31 8129 11 234000 333 22 912 13 912 16 888 0 888 0 768 0 768 112 768 44 768
8 768 0 768 33 768 238460 14 0 0 0 0 10 2 1 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 -9342 1728 3707 32 32 8129 11 243000 333 22 888 19 888
8 912 1 912 0 768 0 768 45 768 35 768 12 768 63 768 33 768 238460 7 1 0 0
0 7 0 0 0 0 0 0 0 0 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 -9342 1728 3707 32 31 8129 11 252000 333 22 912 12 912 24 888 1 888 0 1152 0 1152 49 1152
45 1152 22 1152 63 1152 50 1152 326613 20 1 0 0 0 17 1 0 0 0 0 0 1 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 -9342 1728 3707 32 32 8129 11 261000 333 22 888
7 888 16 912 1 912 0 768 1 768 125 768 46 768 14 768 0 768 33 768 238460 12
2 0 1 0 9 3 1 0 0 0 0 0 1 1 0 0 0 0 0 0 0 0 0 0 0 0
1 0 0 1 -9342 1728 3707 32 31 8129 11 270000 333 22 912 21 912 20 888 1 888 0 768 0 768
17 768 34 768 14 768 63 768 33 768 238460 15 0 0 0 0 13 2 0 0 0 0 0 0
0 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 -9342 1728 3707 32 32 8129 11 279000 3
33 22 888 10 888 20 912 2 912 0 1152 0 1152 127 1152 51 1152 17 1152 0 1152 50 1152 388
768 15 1 0 0 0 12 3 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0
0 0 0 0 0 0 0 -9342 1728 3707 32 31 8129 11 288000 333 22 912 16 912 24 888 1 888 0 768
0 768 14 768 47 768 11 768 63 768 33 768 238460 18 1 0 0 0 16 1 1 0 0 0
0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 -9342 1728 3707 32 32 8129
11 297000 333 22 888 16 888 12 912 1 912 0 1152 0 1152 59 1152 42 1152 13 1152 0 1152 5
0 1152 326613 9 1 0 0 0 7 1 1 0 0 0 0 1 1 0 0 0 0 0 0 0
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0 768 0 768 61 768 38 768 18 768 63 768 33 768 238460 10 1 0 0 0 8 2 1 0
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32 32 8129 11 315000 333 22 840 19 840 20 888 0 888 0 768 0 768 12 768 41 768 9 768
0 768 33 768 238460 17 1 0 0 0 12 2 0 0 0 0 0 0 0 0 0 0 0 0
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2 888 0 1152 0 1152 52 1152 50 1152 17 1152 63 1152 50 1152 388768 18 1 0 0 0 13
3 0 1 1 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 -9342
1728 3707 32 32 8129 11 333000 333 22 888 13 888 24 912 0 912 0 768 0 768 110 768 34 768
11 768 0 768 33 768 300616 16 0 0 0 0 12 3 0 0 0 0 0 0 0 3 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 -9342 1728 3707 32 31 8129 11 342000 333 22 912 13 912
16 888 0 888 0 768 0 768 22 768 44 768 25 768 63 768 33 768 238464 14 0 0 0
0 13 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0
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72 1152 21 1152 63 1152 50 1152 450925 11 2 0 0 0 7 2 0 0 0 0 0 0 2 0 1
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14 888 24 840 0 840 0 768 0 768 70 768 33 768 15 768 0 768 33 768 238460 19
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76 768 35 768 5 768 0 768 33 768 238460 17 0 0 0 0 14 3 1 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 -9342 1728 3707 32 31 8129 11 378000 3
33 22 912 9 912 20 888 0 888 0 1152 0 1152 83 1152 41 1152 16 1152 63 1152 50 1152 326
612 17 0 0 0 0 12 3 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 -9342 1728 3707 32 32 8129 11 387000 333 22 888 11 888 16 912 2 912 0 768
0 768 9 768 45 768 9 768 0 768 33 768 238460 14 2 0 0 0 12 2 2 1 0 0
1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 -9342 1728 3707 32 31 8129
11 396000 333 22 864 16 864 20 864 0 864 0 768 1 768 27 768 30 768 12 768 63 768 3
3 768 300616 14 0 0 1 0 10 3 1 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 1 0 0 1 -9342 1728 3707 32 30 8129 11 405000 333 22 888 7 888 12 912 2 912
```

```
      0 1152      0 1152     31 1152     49 1152     24 1152      0 1152     50 1152    326613    10     2     0     0     0     8     0     0     0
    0     0     0     0     1     1     1     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0  -9342   1728 3707
32    31 8129 11 414000 333 22 768          13 768        16 744          0 744         0  768      0  768     83  768     29  768      9  768
63  768    33  768    238462   13     0     0     0     0     7     4     1     0     0     0     0     0     0     0     1     0     0     0     0     0
    0     0     0     0     0     0     0     0     0     0     0  -9342   1728 3707    32    27 8129 11 423000 333 22 864           9 864         8 864
      1 864        0  768      0  768     21  768     40  768     16  768      0  768     33  768    176304     8     1     0     0     0     5
  2     1     1     0     1     0     0     0     0     2     0     0     0     0     0     0     0     0     0     0     0     0     0     0  -9342
1728 3707    32    30 8129 11 432000 333 22 912          15 912        16 888          0 888        0 1152      0 1152     45 1152     56 1152
 17 1152    63 1152    50 1152    264457    10     1     0     0     0     6     4     2     0     0     0     0     0     0     0     1     0     0
  0     0     0     0     0     0     0     0     0     0     0     0     0     0  -9342   1728 3707    32    32 8129 11 441000 333 22 888          14 888
     24 912        3 912        0  768      0  768     27  768     38  768     14  768      0  768     33  768    176304    16     2     0     0
    0     9     5     4     0     0     0     0     0     1     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
  0  -9342   1728 3707    32    31 8129 11 450000 333 22 911          21 911        20 887         2 887        0  767      0  767     61  767
 31  767    17  767    63  767    33  767    176302    14     2     0     0     0     9     5     3     0     0     0     0     0     0     0     1
    0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0  -9342   1728 3707    32    32 8129 11 459000 333 22 888
     11 888       16 912        2 912        0 1152      0 1152     12 1152     58 1152     27 1152      0 1152     50 1152    326613     9
2     0     0     0     7     2     1     0     0     0     0     0     2     0     2     0     0     0     0     0     0     0     0     0     0     0
  0     0     0     0  -9342   1728 3707    32    31 8129 11 468000 333 22 912          12 912        12 888          0 888        0  768      0  768
    22  768    34  768    12  768    63  768    33  768    176304    11     0     0     0     0     7     2     1     0     0     0     0     0
0     0     3     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0  -9342   1728 3707    32    32 8129 11 477000 3
33 22 888          13 888        12 912         2 912        0  768      0  768     63  768     46  768     11  768      0  768     33  768    238
460    10     1     0     0     0     4     6     3     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
0     0     0     0     0     0     0  -9342   1728 3707    32    31 8129 11 486000 333 22 912          12 912        16 888          0 888        0 1152
      0 1152    71 1152    49 1152    19 1152    63 1152    50 1152    388768    11     0     0     0     0     9     1     1     0     0     0
  0     0     0     0     1     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0  -9342   1728 3707    32    32 8129
 11 495000 333 22 888          11 888        16 912         1 912        0  768      0  768     57  768     37  768     11  768      0  768     3
3  768    238460    10     1     0     0     0     9     1     0     0     0     0     0     0     0     1     2     0     0     0     0     0     0     0
  0     0     0     0     0     0     0     0     0  -9342   1728 3707    32    31 8129 11 504000 333 22 912          11 912        24 888          2 888
      0  768      0  768     23  768     46  768     11  768     63  768     33  768    176304    15     1     0     0     0    10     4     1     0
    0     0     0     0     1     0     2     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0  -9342   1728 3707
32    32 8129 11 513000 333 22 888          14 888        16 912         1 912        0 1152      0 1152    104 1152     60 1152     26 1152
 0 1152    50 1152    450925    12     0     0     0     0     9     3     2     0     0     0     0     0     0     0     1     0     0     0     0     0
    0     0     0     0     0     0     0     0     0     0     0  -9342   1728 3707    32     0 8129     0     0     0     0     0     0     0     0
      0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
  0     0     0     0     0   [illegible]   0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
    0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
    0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
  0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
      0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
    0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
    0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
    0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
    0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
      0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
  0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
  0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
    0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
      0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
  0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
  0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
  0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
      0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
    0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
  0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
  0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0     0
```