#476

IMP H + J

SUMMARY DATA TAPES

72-073A 03C
73-078A-03C

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 This inventory information is now no longer maintained in the DSCs, but is now managed in the inventory part of the NSSDC information system.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

IMP-J

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Two additional magnetic tapes have been added to this data set. The tapes are 9-track, 6250 BPI, written in Binary. The C tapes are 3480 cartridges. The D and C numbers, number of files and time span are as follows:

D#	C#	FILES	TIME SPAN
D-108697	C-032791	1	04/04/95 - 09/28/95
D-108698	C-032792	1	09/28/95 - 03/20/96

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SUMMARY DATA TAPES

This data set has been restored. These data were originally on 11 9-track, 1600 BPI, Binary magnetic tapes. They have been stacked onto 3 9-Track, 6250 BPI tapes. The original tapes were created on an IBM 360 computer. The DR and DS numbers along with the total number of files and time span are as follows:

DR#	DS#	FILES	TIME
DR02592	DS02592	4	09/25/72 - 10/07/74
DR02593	DS02593	4	10/07/74 - 10/16/76
DR02594	DS02594	3	10/16/76 - 06/06/78

Previous tape #'s are as follows
DD41576-41586
DC21261-21271

IMP-J

SUMMARY DATA TAPES

73-078A-03C SPHE-00215

THIS DATA SET HAS BEEN RESTORED. THERE WERE ORIGINALLY 50 9-TRACK, 1600 BPI TAPES WRITTEN IN BINARY. THERE ARE 13 RESTORED TAPES. THE DR TAPES ARE 3480 CARTRIDGES AND THE DS TAPES ARE 9-TRACK, 6250 BPI. THE ORIGINAL TAPES WERE CREATED ON AN IBM 360 COMPUTER AND WERE RESTORED ON AN IBM 9021 COMPUTER. THE DR AND DS NUMBERS ALONG WITH THE CORRESPONDING D NUMBERS AND TIME SPANS ARE AS FOLLOWS:

DR#	DS#	D#	FILES	TIME SPAN
DR004239	DS004239	D041562	1	10/30/73 - 04/07/74
		D041563	2	04/08/74 - 08/23/74
		D041564	3	08/23/74 - 12/28/74
		D041565	4	12/28/74 - 06/19/75
DR004240	DS004240	D041566	1	06/19/75 - 12/11/75
		D041567	2	12/11/75 - 05/07/76
		D041568	3	05/09/76 - 10/30/76
		D041569	4	10/30/76 - 04/25/77
DR004241	DS004241	D041570	1	04/25/75 - 09/22/77
		D041571	2	09/22/75 - 02/09/78
		D041572	3	02/09/78 - 06/26/78
		D041573	4	06/26/78 - 01/01/79
DR004242	DS004242	D041574	1	01/02/79 - 07/08/79
		D041575	2	07/08/79 - 12/30/79
		D056280	3	12/30/79 - 06/24/80
		D056281	4	06/24/80 - 12/16/80
DR004243	DS004243	D056282	1	12/16/80 - 06/12/81
		D058889	2	06/12/81 - 12/04/81
		D058890	3	12/04/81 - 04/22/82
		D060608	4	05/30/82 - 01/11/83
DR004244	DS004244	D060609	1	12/30/82 - 07/07/83
		D064478	2	07/08/83 - 01/12/84
		D064479	3	12/31/83 - 03/01/84
		D065440	4	02/25/84 - 07/06/84

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DR#	DS#	D#	FILES	TIME SPAN
DR004245	DS004245	D066497	1	06/24/84 - 11/10/84
		D074220	2	04/22/85 - 10/03/85
		D074222	3	12/30/85 - 06/11/86
		D078926	4	05/30/86 - 11/10/86
		D076064	5	10/28/86 - 04/03/87
DR004246	DS004246	D078026	1	03/29/87 - 09/07/87
		D066797	2	08/26/87 - 01/12/88
		D078932	3	12/31/87 - 08/13/88
DR004247	DS004247	D076063	1	07/19/88 - 01/12/89
		D074221	2	07/19/88 - 01/12/89
		D066498	3	12/30/88 - 06/11/89
DR004248	DS004248	D084349	1	05/30/89 - 09/07/89
		D084350	2	08/26/89 - 12/04/89
		D084351	3	11/22/89 - 03/03/90
		D084352	4	02/18/90 - 06/11/90
DR004249	DS004249	D084353	1	05/30/90 - 09/07/90
		D084354	2	08/26/90 - 01/11/91
		D084355	3	12/30/90 - 05/04/91
		D084531	4	04/23/91 - 10/15/91
DR005990	DS005990	D107675	1	10/15/91 - 05/16/92
		D107676	2	05/16/92 - 12/04/92
		D107677	3	12/04/92 - 06/10/93
		D107678	4	06/10/93 - 12/15/93
DR006197	DS006197	D108019	1	12/15/93 - 06/08/94
		D108020	2	06/08/94 - 12/02/94
		D108162	3	12/03/94 - 04/04/95
DR006377	DS006377	D108697	1	04/04/95 - 09/28/95
		D108698	2	09/28/95 - 03/21/96
		D108844	3	03/21/96 - 09/14/96
		D108845	4	09/14/96 - 03/08/97
		D108999	5	03/08/97 - 08/30/97
DR006378	DS006378	D109135	5	08/31/97 - 01/26/00
DR006379	DS006379	D109587	6	07/21/00 - 07/19/01

IMP-H

SUMMARY DATA TAPES

72-073A-03C SPHE-00516

THIS DATA SET HAS BEEN RESTORED. ORIGINALLY THERE WERE 11 9-TRACK, 1600 BPI TAPES, WRITTEN IN BINARY. THERE ARE 3 RESTORED TAPES. THE DR AND DS TAPES ARE 9-TRACK, 6250 BPI. THE ORIGINAL TAPES WERE CREATED ON AN IBM 360 COMPUTER. THE DR AND DS NUMBERS ALONG WITH THE CORRESPONDING D NUMBERS AND TIME SPANS ARE AS FOLLOWS:

DR#	DS#	D#	FILES	TIME SPAN
DR002592	DS002592	D041576	1	09/25/72 - 03/18/73
		D041577	2	03/18/73 - 09/23/73
		D041578	3	09/24/73 - 04/01/74
		D041579	4	04/01/74 - 10/07/74
DR002593	DS002593	D041580	1	10/07/74 - 04/15/75
		D041581	2	04/14/75 - 10/20/75
		D041582	3	10/21/75 - 05/10/76
		D041583	4	05/10/76 - 10/16/76
DR002594	DS002594	D041584	1	10/16/76 - 05/23/77
		D041585	2	05/23/77 - 11/28/77
		D041586	3	11/29/77 - 06/06/78

REQ. AGENT	RAND NO.	ACQ. AGENT
BER	V0235	RWP
DAD		

IMP H & J

SUMMARY DATA TAPES

72-073A-03C

73-078A-03C

This data set catalog consists of 11 IMP-H and 46 IMP-J data tapes. There are two logical records - Summary records and ULET event records. The tapes are 1600 BPI, 9 track, binary and contain 1 file of data. The tapes were created in the IBM 360 computer.

The time spans are as follows:

IMP-H 72-073A-03C

D#	C#	TIME SPAN
D-41576	C-21266	09/25/72 - 03/18/73
D-41577	C-21267	03/18/73 - 09/23/73
D-41578	C-21261	09/24/73 - 04/01/74
D-41579	C-21262	04/01/74 - 10/07/74
D-41580	C-21263	10/07/74 - 04/15/75
D-41581	C-21268	04/14/75 - 10/20/75
D-41582	C-21264	10/21/75 - 05/10/76
D-41583	C-21269	05/10/76 - 10/16/76
D-41584	C-21270	10/16/76 - 05/23/77
D-41585	C-21271	05/23/77 - 11/28/77
D-41586	C-21265	11/29/77 - 06/06/78

IMP J 73-078A-03C

D#	C#	TIME SPAN
D-41562	C-21226	10/30/73 - 04/07/74
D-41563	C-21227	04/08/74 - 08/23/74
D-41564	C-21228	08/23/74 - 12/28/74
D-41565	C-21229	12/28/74 - 06/19/75
D-41566	C-21230	06/19/75 - 12/11/75
D-41567	C-21231	12/11/75 - 05/07/76
D-41568	C-21232	05/09/76 - 10/30/76
D-41569	C-21233	10/30/76 - 04/25/77
D-41570	C-21234	04/25/77 - 09/22/77
D-41571	C-21235	09/22/77 - 02/09/78
D-41572	C-21236	02/09/78 - 06/26/78
D-41573	C-21237	06/26/78 - 01/01/79
D-41574	C-21238	01/02/79 - 07/08/79
D-41575	C-21239	07/08/79 - 12/30/79
D-56280	C-23056	12/30/79 - 06/24/80
D-56281	C-23057	06/24/80 - 12/16/80
D-56282	C-23058	12/16/80 - 06/12/81
D-58889	C-23245	06/12/81 - 12/04/81
D-58890	C-23246	12/04/81 - 04/22/82
D-60608	C-23691	05/30/82 - 01/11/83
D-60609	C-23692	12/30/82 - 07/07/83
D-64478	C-24288	07/08/83 - 01/12/84
D-64479	C-24289	12/31/83 - 03/14/84
D-65440	C-24676	02/25/84 - 07/06/84
D-66497	C-24884	06/24/84 - 11/10/84
D-66498	C-24885	~~10/28/84 - 01/23/85~~ 12/30/88 - 06/11/89
D-66797 (see note)	C-25058	~~10/28/84 - 05/12/85~~ 5/26/87 - 1/12/88

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D#	C#	TIME SPANS
D-74220	C-26707	04/22/85 - 10/03/85
D-74221	C-26708	07/20/88 - 01/12/89
D-74222	C-26709	12/30/85 - 06/11/86
D-78926	C-26875	05/30/86 - 11/10/86
D-76064	C-26705	10/28/86 - 04/03/87
D-78026	C-26737	03/29/87 - 09/07/87
D-78932	C-27517	12/31/87 - 08/12/88
D-76063	C-26704	8/26/85 - 01/11/86 ~~07/19/88 - 01/[illegible]/89~~ correct
D-84349	C-28852	05/30/89 - 09/07/89
D-84350	C-28853	08/26/89 - 12/04/89
D-84351	C-28854	11/22/89 - 03/03/90
D-84352	C-28855	02/18/90 - 06/11/90
D-84353	C-28856	05/30/90 - 09/07/90
D-84354	C-28857	08/26/90 - 01/11/91
D-84355	C-28858	12/30/90 - 05/04/91
D-84531	C-28859	04/23/91 - 10/16/91
	C-27853 tape missing no D tape?	12/31/87 - 08/12/88

IMP-J

73-078A-03C

Linda

Gloeckler/Hovestadt

IMP/8

PRELIMINARY TAPE FORMAT FOR

IMP-J SUMMARY TAPES

IMP-J Summary tapes will contain summaries of rates for 8-album periods (about 10.908 minutes at the 1600 BPS bit rate, 43.632 minutes at the 400 BPS bit rate) and a listing of all ULET events occuring in those periods. The tapes will be single-filed, 9 track, 1600 BPI. Records will be fixed-blocked, with a logical record length of 1440 bytes (360 words) and a physical record length of 8640 bytes (blocking factor of 6 logical records per physical record). Summary tape logical records will be of two types: Summary records and ULET Event records. Each Summary record will contain start and stop times, spacecraft position, performance parameter, data quality, rate and PHA summaries along with a maximum of 60 ULET events for an 8-album summary period. If more than 60 ULET events occurred in the 8 albums, the remaining events will be contained in as many ULET event records as necessary (240 events per record) immediately following the Summary record for that period.

Each 8-album summary period will begin when the album number modulo 8 (as determined by the spacecraft clock) is zero. Since the spacecraft clock increments every sequence, the low-order 6 bits are zero at the start of an album. When the album number modulo 8 is zero, the next low-order 3 bits are zero. Therefore, each 8-album summary periods begins when the low-order 9 bits of the spacecraft clock are zero. Since the ULET threshold changes when the low-order 13 bits are zero, summary periods will never span threshold changes.

Each summary tape will be generated from an integral number of Encyclopedia tapes. It is expected that 6 Encyclopedia tapes may be summarized on one Summary tape. Since Encyclopedia tapes will not in general begin and end on the 8-album boundaries defined above, the last Summary record/ULET Event record(s) set on a given Summary tape may belong to the same 8-album period as the first set on the next Summary tape in time sequence. Therefore, when multiple Summary tapes are processed, the data in the last set of records on a Summary tape may have to be merged with the data on the first set of records in the next tape processed. This will be necessary when the first words of the two Summary records involved are equal.

A detailed description of the IMP-J Summary tape record formats follows. "Word" and "halfword" refer to IBM 360 32-bit words and 16 bit halfwords, respectively. Format I*4 refers to a 4-byte (fullword) integer, I*2 refers to a 2-byte (halfword) integer, and R*4 refers to a 4-byte floating-point number; all in IBM 360 format.

Ultra Low Energy Telescope

73-078A-03C

S-1

IMP-J SUMMARY TAPE

SUMMARY RECORD FORMAT

WORD	HALFWORD	FORMAT	CONTENTS	
1		I*4	S/C clock for start album of summary period (low-order 9 bits zero)	
2		"	S/C clock for first album of summary period summarized in this record	
3		"	S/C clock for last album of summary period summarized in this record.	
4	1	I*2	Year	Start time of summary period
	2	"	Day of Year	
5	1	"	Month	
	2	"	Day of Month	
6		I*4	Milliseconds of Day	
7	1	I*2	Year	Stop time of Summary period
	2	"	Day of Year	
8	1	"	Month	
	2	"	Day of Month	
9		I*4	Milliseconds of Day	
10	1	I*2	Year	Time of first album processed in summary period
	2	"	Day of Year	
11	1	"	Month	
	2	"	Day of Month	
12		I*4	Milliseconds of Day	
13	1	I*2	Year	Time of last album processed in summary period
	2	"	Day of Year	
14	1	"	Month	
	2	"	Day of Month	
15		I*4	Milliseconds of Day	
16		"	Sequence number of Encyclopedia tape containing first album summarized in this period.	
17		R*4	Altitude (km)	
18		"	GSE_X (km)	From first album processed in summary period
19		"	GSE_Y "	
20		"	GSE_Z "	
21		"	SEV angle (degrees)	
22		"	THETA (degrees)	
23		"	Altitude (km)	
24		"	GSE_X (km)	From last album processed in summary period
25		"	GSE_Y "	
26		"	GSE_Z "	
27		"	SEV angle (degrees)	
28		"	THETA (degrees)	

J-2

WORD	HALFWORD	FORMAT	CONTENTS
29	1	I*2	Number of albums process in this summary period (1-8).
	2	"	Number of albums at 1600 BPS
30	1	I*2	Number of albums at 400 BPS
	2	"	Number of albums in Tm Slave Mode
31		R*4	Spin Period (seconds)
32		"	Mean Temperature (degress C) (-1000.0 if no readouts of temperature available)
33	1	I*2	Number of albums ULET off
	2	"	Number of albums ULET on
34	1	"	Number of albums with Sun Gate off
	2	"	" on
35	1	"	" change
	2	"	" undetermined
36		R*4	High voltage APP-mean for even albums (-1000.0 if no readouts)
37		"	High voltage APP-mean for odd albums (-1000.0 if no readouts)
38		"	ULET parameter-mean for even albums (-1000.0 if no readouts)
39		"	ULET parameter-mean for odd albums (-1000.0 if no readouts)
40	1	I*2	No. of sequences analyzed-MAE
	2	"	" -ULET
41	1	"	No. of non-zero sequences-MAE-PHA 1
	2	"	" " -PHA 2
42	1	"	" -ULET
	2	"	No. of zero sequences-MAE-PHA 1
43	1	"	" " -PHA 2
	2	"	" -ULET
44	1	"	No. of calibrate sequences-MAE
	2	"	" -ULET
45	1	"	No. of sequences with only channel padded-MAE
	2	"	" -ULET
46	1	"	No. of sequences with only ID padded-MAE
	2	"	" -ULET
47	1	"	No. of sequences with both padded-MAE
	2	"	" -ULET
48	1	"	No. of illegal events-MAE-PHA 1
	2	"	" " -PHA 2
49	1 — 97	"	" -ULET
	2	"	No. of unidentified multiplexed rate readouts -R4 (A1/B)
50	1	"	-S1 (P5/P7/P6/P3)
	2	"	-S4 (D1/D2)
51			Last 8 bits represented as $B_1B_2B_3B_4B_5B_6B_7B_8$ indicate the inclusion or exclusion of the 8 albums from the summary: B_2 = 1 if the 2th album was included; = 0 if the 2th album was excluded

S-3

Rate Summary:

Non-sectored:

WORD	HALFWORD	FORMAT	CONTENTS	
52	1	I*2	No. of good readouts	P4 (R1)
	2	"	" " bad "	
53		R*4	Total counts	
54		"	$\sum(\text{counts})^2$	
55		"	Accumulation time (seconds)	
56-59			Same as words 52-55 for P7' (R2)	
60-63			Same as words 52-55 for P2" (R3)	
64-67			Same as words 52-55 for A1 (R4)	
68-71			Same as words 52-55 for A2 (R4)	
72-75			Same as words 52-55 for B (R4)	

Sectored:

WORD	HALFWORD	FORMAT		CONTENTS	
76	1	I*2		No. of good readouts	
	2	"		" " bad "	
77		R*4		Total counts (all readouts, all sectors)	
78		"		$\sum(\text{total counts for 4 sectors, each readout})^2$	P5 (S1)
79		"	151	Total accumulation time per sector (secs.)	
80		"	152	Total counts - sector 1	
81		"	153	" " - sector 2	
82		"	154	" " - sector 3	
83		"	155	" " - sector 4	
84-91				Same as words 76-83 for P7 (S1)	
92-99				" P6 (S1)	
100-107				" P3 (S1)	
108-115				" P6' (S2)	
116-123				" N (S3)	
124-131				" D1 (S4)	
132-139				" D2 (S4)	
140-147				" P8 (S5)	
148-155				" D1D2 (S6) ←	
156-163				" P2 (S7)	
164-171				" P1 (S8)	

PHA Summary:

WORD	HALFWORD	FORMAT	CONTENTS	
172	1	I*2	No. of legal events	
	2	"	" " illegal "	
173	1	"	No. of events - sector 0	
	2	"	" - " 1	
174	1	"	" - " 2	P1
	2	"	" - " 3	
175	1	"	" - " 4	
	2	"	" - " 5	
176	1	"	" - " 6	
	2	"	" - " 7	

WORD	HALFWORD	FORMAT	CONTENTS
177-181			Same as words 172-176 for P2
182-186			" P2"
187-191			" P3
192-196			" P4
197-201			" P5
202-206			" P6
207-211			" P7
212-216			" P7'
217-221			" P8

PHA Charge Group Summary - Number of events vs. charge group and event type

WORD	HALFWORD	FORMAT	EVENT TYPE	CHARGE GROUP*	CHANNELS
222	1	I*2	P1	5-8	15-34
	2	"		>13	40-120
223	1	"		BG-Low	<15
	2	"		BG-High	>120
224	1	"	P2	2	7-14
	2	"		BG-Low	<7
225	1	"	P2"	5-8	19-54
	2	"		13	60-170
226	1	"		BG-High	>170
	2	"	P3	1	7-17
227	1	"		2	20-33
	2	"		5-8	40-140
228	1	"		BG-High	>140
	2	"	P4	1	10-22
229	1	"		2	24-39
	2	"		5-8	54-170
230	1	"		BG-High	>170
	2	"	P5	BG-Low	<30
231	1	"		BG-High	≥30
	2	"	P6	1	19-36
232	1	"		2	38-70
	2	"		5-8	86-270
233	1	"		BG-Low	7-16
	2	"		BG-High	>270
234	1	"	P7	1	15-42
	2	"	P7'	2	48-90
235	1	"		5-8	100-300
	2	"		BG-High	>300
236	1	"	P8	1	21-40
	2	"		2	46-80
237	1	"		5-8	90-300
	2	"		BG-Low	5-19
238	1	"		BG-High	>300
	2	"	Spare		
239	1	"	Number of ULET events contained in this record (≤ 60)		
	2	"	Number of ULET events contained in following ULET Event records		

*BG = background

WORD	HALFWORD	FORMAT	CONTENTS
240	1	I*2	Number of ULET Event records following this record
	2	"	Spare
241	1	"	No. of temperature readouts used in computation of word 32
	2	"	No. of readouts used in computation of word 36
242	1		" 37
	2		" 38
243	1		" 39
	2		" 244
244		R*4	Mean Detector Bias (APP#46) (volts)
245-270			Spares [See Modifications on Next Page.]
271-360			ULET Events (number given in Halfword 1 of Word 239): 60 sets of 3 halfwords each: Halfword 1: OA sector number (0-7) If event occurred in calibrate mode, this is set to - (OA sector no. + 1) Halfword 2: D1 PHA Channel Halfword 3: D2 PHA Channel Unused halfwords are set to - 1.

Modifications to Summary Record Format

WORD	HALFWORD	FORMAT	CONTENTS
245	1	1*2	LI
	2	"	IP
246	1	"	Kp (3 hour)
	2	"	Kp (daily)
247	1	"	Ap (3 hour)
	2	"	Ap (daily)
248	1	"	Solar Rotation Number
	2	"	Sun Cycle Day Number
249	1	"	Daily Character Figure CQ
	2	"	Zurich Sunspot #
250		R*4	Cp
251		R*4	10.7 cm Flux
252		"	Flux Code 0=Normal 1=adjusted for burst 2=Burst in Progress 3=No Value
253		"	81 day average of 10.7 cm Flux

ULET Event Record Format (360 words)

If more than 60 ULET events occurred during the 8-album period, the remaining events (number given in Halfword 2 of word 239 of the Summary record) are contained in ULET Event records immediately following the Summary record for that period. The number of Event records following is contained in Halfword 1 of word 240 of the Summary record. Each ULET Event record will contain up to 240 events (only the last record for each period may contain less than 240 events), with each event consisting of 3 halfwords as described for words 271-360 of the Summary record. Unused halfwords are set to - 1.

Explanatory Notes

WORD	HALFWORD	EXPLANATION
16		Sequence number of Encyclopedia Tape containing first album summarized in this period - as each encyclopedia tape is generated, it will be assigned a number JPXXX where J indicates IMP-J, P indicates Production (as opposed to T for a Test tape), XXX is a 3-digit index number starting at 001 for the tape generated from the first data received. This index number will be contained here.
18-20 and 24-26		GSE_X, GSE_Y, GSE_Z - This is the spacecraft position in Geocentric Solar-Ecliptic coordinates (see figure).
21, 27		SEV angle - This angle (from 0° to 360°) is the angle between the projection of the earth - S/C line in the ecliptic plane and the earth-sun line and is positive counter-clockwise (see figure).
22, 28		THETA - This angle (from -90° to $+90^{\circ}$) is the angle between the Earth-S/C line and the ecliptic plane, with the positive direction towards the North-ecliptic pole.
30	2	Number of albums in TM Slave Mode - In case of Optical Aspect sensor failure, the encoder may be commanded into Telemetry (TM) Slave Mode in which case sectoring is driven by the spacecraft clock and not by sensing the sun. This condition is indicated by digital performance parameter DP#a_3-19 having a value of 1. This halfword counts the albums in the summary period for which DP#a_3-19 reads 1 at any time in the album.

WORD	HALFWORD	EXPLANATION
33	1,2	ULET on/off determination - Digital performance parameter DP#a_3-18 reads 1 when ULET is on, 0 when off. If any non-padded readout of DP#a_3-18 is 1 in an album, that album is considered to have ULET on. If all non-pad readouts are 0, ULET is off in the album. If all readouts are padded, ULET status is undetermined. The number of albums in which this occurs is given by Number of albums processed (Word 29, Halfword 1) - (Word 33, Halfword 1 + Word 33, Halfword 2)
34, 35	1,2	Sun Gate (SG) Mode Determination - Sun Gate Mode status is readout every sequence. Status for an album is determined as follows: Examine the first 4 and last 4 non-padded SG readouts of the album: a) If 8 non-padded readouts are not found <u>or</u> if the first 4 are not identical (four 0's or four 1's) <u>or</u> if the last 4 are not identical, SG status is UNDETERMINED. Otherwise, b) If the first 4 and the last 4 are all 0's, SG status is OFF. Otherwise, c) If the first 4 and the last 4 are all 1's, SG status is ON. Otherwise, d) If the first 4 are 0's and the last 4 are 1's or vice versa, SG status is CHANGE.
40 to 49	1 1	PHA Data Statistics - Since PHA ID's lag their corresponding pulse height channel numbers by one telemetry sequence and since padding is done on a sequence basis, an ID may be padded while the channel number is not and vice versa. When the ID is not padded, information as to calibrate mode status and occurrence of an event - either valid or illegal - may be obtained whether or not the channel number is padded. "No. of sequences analyzed" refers to the total number of sequences processed. The number for MAE + the number for ULET should in general equal the number of albums processed x 64. The exception to this may be understood in light of the method of ULET mode determination: The experiment is considered to be in ULET mode during pages 0, 1, and 2 if SG mode is ON and during page 3 if SG mode is OFF. If SG mode is CHANGE or UNDETERMINED, the mode of the last album processed for which the mode was ON or OFF is used. If no previous mode of ON or OFF was encountered, the PHA data in the album is not processed. Note: Any sequence in which a D1D2 event is readout (D1D2 in PHA 1, D2 in PHA 2) is counted as being in ULET mode. Also, if the first sequence of ULET mode does not contain a

WORD	HALFWORD	EXPLANATION
40 to 49 (continued)	1 to 1	D1D2 event, it is counted as MAE mode (not ULET). "No. of non-zero sequences" refers to the following: MAE - number of non-calibrate sequences where the specified PHA ID is not padded and greater than 0 and is a legal event (P2, P2", P4, P6, or P8 for PHA 1; P1, P3, P5, P7, or P7' for PHA 2). ULET - number of non-calibrate sequences where the PHA ID's are not padded, are non-zero, and specify a D1·D2 event. "No. of zero sequences" refers to the number of non-calibrate sequences where the specified PHA ID was 0. For ULET mode, both the PHA 1 ID's and PHA 2 ID's must be zero. "No. of calibrate sequences" refers to the number of sequences with the calibrate bit on. ULET mode determination in this case is performed by only checking the SG mode and page number, not by examining the event type. "No. of illegal events" refers to the number of non-calibrate sequences where the PHA ID is not padded and the following applies: MAE - PHA 1 - not zero and not one of the following events: P2, P2", P4, P6, P8. MAE - PHA 2 - not zero and not one of the following events: P1, P3, P5, P7, P7'. ULET - PHA 1 ID not zero and not D1D2 and PHA 2 ID not zero and not D2.
49	2	No. of unidentified A1/B (R4) readouts - Since the A1/B readouts alternate every album, the first non-pad readout of A1/B of each album is compared to the first non-pad readouts of an even and an odd album. If the readout being tested is less than the mean of the other two, it is labelled B; otherwise it is labelled A1. If all A1/B readouts are are padded in an album or if odd and even album readouts are not available, then then A1/B readout is undetermined for that album.
50	1	No. of unidentified S1 (P5/P7/P6/P3) readouts - The S1 multiplex cycle requires 4 albums to complete and is dependent on the SG mode. Identification of S1 requires finding a unique zero readout in the cycle. If this readout cannot be found, S1 cannot be identified. Also, a change in SG mode changes readout positions in the multiplex sequence. In order to avoid any ambiguities, all readouts of S1 in albums for which SG mode is CHANGE or for which the previous album had SG mode CHANGE are discarded as unidentified.

WORD	HALFWORD	EXPLANATION
50	2	No. of unidentified S4 (D1/D2) readouts - The S4 multiplex cycle requires one album to complete and is dependent on the SG mode. As for S1, S4 readouts in an album are "unidentified" if that album or the previous album had SG mode CHANGE.
52-75		Non-sectored rate summary: - "BAD" readouts are those that are padded or are unusually large (> 200,000) - Mean counts per readout may be found by $\frac{\text{"Total counts"}}{\text{"No. of good readouts"}}$ - Mean counts per second may be found by $\frac{\text{"Total counts"}}{\text{"Accumulation Time"}}$
76-171		Sectored rate summary: - "BAD" readouts are those that are padded or for which any one sector is greater than 200,000.
172-238		PHA Summaries - only events for which both the PHA ID and channel numbers are not padded are included in these summaries.

72-073A-~~05B~~/ 03C
73-078A-~~03B~~

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II. INSTRUMENTATION

The University of Maryland experiment on board the IMP-8 spacecraft is fully described in Appendix A. The characteristics are briefly repeated here for the convenience of the reader. The experiment is an electrostatic deflection sensor. An ion entering the instrument has its entrance trajectory defined by a collimator (see figure A-1). The particle then enters one of three electrostatic field regions where its path is deflected by an amount inversely proportional to its kinetic energy per charge. On exit from the deflection cavity, the ion strikes one of an array of rectangular solid state detectors, each of which covers a well-defined deflection, and hence energy per charge, range. Pulse-height analysis of the detector signal allows a direct measurement of the particle's total kinetic energy, from which its charge may be determined. In addition, by using multiple energy thresholds on signals of several detectors, counting rates having well-defined energy limits and hence charge responses are generated with time resolutions as short as five seconds. Several of these rates are sectored into four directional quandrants in the ecliptic plane, providing data on particle anisotropies. A plastic scintillator anticoincidence cup and an array of solid-state anticoincidence detectors placed behind the detector array prevent analysis of penetrating particles.

Background correction of a detector's pulse-height histogram is performed by subtracting a normalized histogram obtained from the same detector during quiet times, when the counting rates are at their lowest values. During these quiet times, analysis of pulse-height histograms indicates that the detectors respond primarily to the secondary electron background produced in the spacecraft.

The relative abundance of individual charge states may be determined by fitting computed instrument response curves to the observed pulse-height distributions, as described in Appendix C. A full description of the instrument response characteristics is given in Appendix B. The sensor is capable of fully resolving ionic charge states 1 to 4 for elements up to oxygen. In addition, charge states 5 to 8 are separated sufficiently so that, by means of a simple iteration procedure, abundances of these individual states may also be determined. (For example, the charge-state resolution of detector P3 is plotted in figure 2-1.) Complete charge state identification for carbon and oxygen down to about 40 keV per charge is thus obtained. Of course, the individual elements may not be resolved in this manner since only the ionic charge (as opposed to nuclear charge) is determined. In many cases, however, the ions may be completely identified (i.e., ionic charge and nuclear charge) by using the simultaneous nuclear abundance information provided by the Ultra Low Energy Telescope (ULET) [Hovestadt and Vollmer, 1971] of the Maryland/Max-Planck-Institut experiment at somewhat higher energies.

ULET is a dE/dx vs total energy telescope with a geometrical factor of .53 cm^2 sterad. The sensor is pictured in figure 2-2. The front, ΔE element (D1) is a thin-window flow-through proportional counter, with a total mass of ~ 300 $\mu gm/cm^2$. The rear, E element (D2) is a silicon surface barrier detector. A plastic scintillator anticoincidence cup (A) surrounds the detector assembly. The low mass of the ΔE element allows two parameter analysis of incoming particles down to $\lesssim 100$ keV per nucleon for iron. Different elemental tracks can be reliably (i.e., automatically) separated down to about 600 keV per nucleon. Every three hours ULET changes its analysis threshold, so that it alternately analyzes all incoming particles, and only those particles heavier than helium. ULET shares the electrostatic energy-charge analyzer's pulse height analyzers and telemetry on a $\frac{3}{4}$ - $\frac{1}{4}$ basis, and both instruments are contained in the same spacecraft module.

IMP-8 (Explorer 50) was launched from Cape Canaveral, Florida on 1973 October 26 at 0226 GMT. The spacecraft achieved an elliptical orbit (shown in figure 2-3) with a mean apogee of about 45 earth radii and a perigee of ~ 28 RE, inclined 29° to the ecliptic. The University of Maryland experiment was turned on on October 30 and has operated normally since that time.

- APPENDIX A -

THE UNIVERSITY OF MARYLAND ELECTROSTATIC ENERGY-CHARGE ANALYZER EXPERIMENT

The measurements of the energy and charge spectra of low energy interplanetary particles requires two parameter analysis from which the particle's total energy and charge can both be determined.

A technique commonly used consists of measurement of the energy loss and total energy for particles using a combination of thin and thick detector elements respectively. Telescopes employing the so-called "dE/dx vs E" method have achieved excellent chemical and isotopic resolution by using low noise silicon detectors as the sensitive elements of the sensors. In the past the low energy limit for two-dimensional dE/dx vs E analysis could not be extended below several MeV per nucleon because of lack of suitably thin dE/dx elements.

The usefulness of the dE/dx vs E analysis technique has been extended to energies below 60 keV per nucleon for iron by using a thin-window proportional counter as the dE/dx detector element. The Ultra Low Energy Telescope (ULET), included as part of the University of Maryland Experiment on the IMP 7 and 8 spacecraft uses a low mass ($\sim$330 μgm/cm^2) total thickness gas proportional counter as the energy loss rate, or dE/dx, detector and thus has a low energy limit for two dimensional analysis of 300 keV per nucleon for protons and 200 keV per nucleon for alpha particles.

To extend the range to even lower energies, and to determine the particle's ionic charge requires a different technique. The Electrostatic Energy-Charge Analyzer is the main sensor of the University of Maryland IMP 8 experiment. This device uses electrostatic deflection vs total energy measurements to determine the ionization state and energy of particles in the range of 37 to 1250 keV per charge (for charge $Q \geq 2$ particles). The sensor is similar in principles of operation to the instrument flown on IMP 7 [Fan et al, 1971], but is primarily designed to investigate positively charged ions and has a lower energy limit--a factor of three below that of the IMP 7 experiment. In this appendix the sensor and the electronics used for signal processing and data handling are described.

The Deflection System

The deflection d of an ion travelling through an approximately transverse electrostatic field generated by a potential V is related to the particle's kinetic energy T and its ionic charge Q through [Spiker, 1970]

$$d = \frac{2\gamma\ g\ VQ}{(\gamma+1)\ T} \qquad \text{(A-1)}$$

where g is a constant dependent on the deflector geometry and γ is the relativistic factor. Thus, by measuring simultaneously a particle's deflection in a known electrostatic field and its total kinetic energy one determines its ionic charge Q.

In the IMP instrument the deflection fields are created by applying voltages to two flat non-parallel magnesium plates, mounted on stand-off insulators inside a ground cavity (Figure A-1). One plate is maintained at a potential of + 14.5 kV relative to the ground plate, the other at + 3.5 kV. Three field regions are thus created in the deflection cavity with potential differences of 14.5 kV (top), 11 kV (center), and 3.5 kV (bottom), corresponding to fields at the front edge of deflection plates of 7.25 kV/cm, 11 kV/cm and 1.75 kV/cm. These fields decrease as one moves away from the front edge due to the increased separation of the plates. However, this does not significantly affect the validity to first order of the expression (A-1) above. A passive collimator at the entrance of the cavity defines the arrival directions of incoming particles.

A charged particle entering the sensor is deflected in one of these three field regions. Its deflection is determined by the location of that one solid state detector in the array of eight which is triggered as the particle strikes its surface after exiting the deflection cavity. Simultaneously, pulse-height analysis of the triggered detector's output signal determines the particle's total energy. The differential energy range per charge of each detector is defined by its position and width (figure A-2) and does not depend on electronic threshold levels. Using eight discrete detectors we obtain eight differential energy channel analyzers (seven for positive ions and one for electrons) simply counting the number of particles which trigger each of the eight detectors. The charge and finer energy resolution within each of the 7 positive ion channels is achieved by pulse height analysis of the signals of that detector.

The Detector Array

The front of the detector array (Figure A-3) consists of seven thin (100 μ) silicon surface barrier detectors designated P1 to P4 and P6 to P8 in order of increasing energy of the particles able to reach them. In addition, a thick (1000 μ) Li drifted Si [Si(Li)] detector (called N) is included in the array at a position to intersect electrons. The signal from the N detector is not pulse-height analyzed--it serves only as a rate trigger. Detector P5 is covered with an aluminum foil just thick enough to stop protons deflected to it. This detector is identical to P2 and P6 and its purpose is to measure the shape of the background energy spectrum and the background rate. Continuous monitoring of the background spectrum and rate are essential because the background spectral shape was found to change during solar flare events. The detector energy per charge ranges and geometrical factors are listed in Table A-I.

Behind this front layer is an array of six thick Si(Li) detectors, positioned so that particles which penetrate one of the front detectors must also strike one of these. All back detectors are connected in parallel and are referred to as B. The requirement for pulse-height analysis of a given P detector P_i is $P_i \cdot \overline{B}$, since positive ions reaching these P detectors will be stopped in them. High priority for analysis is given to heavy ion events in certain detectors. The N rate requires N·B coincidence reflecting the high probability that electrons reaching N will penetrate and trigger B. The coincidence requirement assures identification of electrons unambiguously and serves to reduce background. The B anticoincidence for pulse-height analysis also helps in reducing background due to penetrating particles.

A plastic anticoincidence scintillator surrounds the detectors, preventing analysis of high energy penetrating particles and further reducing background. In addition, the scintillator counting rate is a measure of the integral proton flux above about 18 MeV, with a large geometrical factor (about 1100 cm^2 sterad).

The Collimator

The collimator at the entrance of the sensor cavity overcomes one fo the major disadvantages of the electrostatic deflection method, namely the inherently small geometrical factor. For deflection measurements to be meaningful the entrance angles of the entering particles must be severely restricted. This entails very strict collimation, with the result that such sensors usually have very small geometrical factors. We have overcome this problem to some extent by using a collimator with a large open area and many slits.

The 40 mm thick collimator consists of a total of 270 thin (0.144 mm) aluminum plates stacked together and rigidly attached to either side of a magnesium frame (Figure A-4). Aluminum was chosen because of low atomic number and moderate density, yielding a collimation thickness of approximately 5.4 gm/cm^2 for particles with skew trajectories. The curved frame (inside radius 270 mm) has 150 plates on the convex front side and the remaining 120 on the back. Each stack is secured to the frame by screws.

Each aluminum plate has 1521 slotted openings chemically milled through its surface (Figure A-5). These slots are 0.254 mm wide and vary in length from 12.37 to 14.25 mm. Proceeding from the outermost to innermost plate the slots become shorter and the row spacings narrower. A total of 27 different plate types are used. Stacking these plates creates a series of vertically and radially converging tunnels through which particles may pass. The upper and lower collimator sections have a vertical acceptance angle of 6.10° while the center section has a convergence angle of 2.47°. The horizontal acceptance angle (in the ecliptic plane) is $\sim$ 60°. "Focusing" of particles is achieved by the combined vertical and horizontal convergence of the tunnels. The points of convergence lie along three separate arcs, one for each electric field region, 188.5 mm behind the collimator. The dispersion of particles on this arc represent the geometrical resolution of the focused collimator. This resolution depends on slot width, focal length, collimator thickness and stacking accuracy. Resolution of this collimator ranged from 1.6 to 1.7 mm (FWHM). The geometrical factors, a function of both acceptance angle and detector area, were calculated for the various detectors using a Monte-Carlo method and are listed in Table A-I, above.

To alleviate small angle scattering of both light and energetic particles in the collimator 30% of the plates were replaced with spacers to form "light traps". Three spacers were included with the 10 plates of each type for all 27 different types.

The Electronics

A simplified block diagram of the electronics is shown in Figure A-6. The electronics serves to count the number of particles which strike the various solid state detectors and to measure the energy lost in the detectors. It also interfaces with the spacecraft, transfers the data to spacecraft for telemetry and monitors the performance of the instrument.

Each detector has a set of linear circuits consisting of a charge sensitive amplifier, pulse shaping amplifier and at least one amplitude discriminator. The output from these circuits is a logic pulse from an amplitude discriminator indicating that a pulse exceeding threshold has occurred, and a voltage pulse suitable for pulse height analysis whose amplitude is a function of the charge deposited on a detector. The amplifier noise level is $\leq$ 50 keV (FWHM).

There are two pulse height analyzers (PHA) in the instrument. Each PHA contains a delay line, linear gate, pulse height to pulse width converter and a gated clock. The maximum PHA channel number, determined by the saturation of the amplifiers, is about 1150. The spacecraft telemetry limits the analysis rate to one event, consisting of 2 PHA's, every 1.28 seconds. The two PHA's analyze either coincident pulses from ULET detectors or two single pulses from EECA detectors.

Since there are a total of ten detectors whose outputs are pulse height analyzed, an increase in the noise level of one detector to a point where noise pulses are analyzed will seriously reduce the amount of PHA data obtained from other detectors. To minimize this possibility the PHA's are multiplexed between ULET and EECA so that only ULET pulses are analyzed for a specified fixed time period and EECA pulses are analyzed the rest of the time. Either sensor can be selected by a ground command to have 75% (48 sequences out of 64) of the PHA time. As a further protection against individual detector failure, there are threshold rate meters monitoring the pulse rates from amplitude discriminators. Whenever the pulse rate from a discriminator exceed the threshold rate, pulses from the detector associated with the particular discriminator are no longer pulse height analyzed and therefore have no adverse affect on the dead times of other, operational detectors. All detectors, except the anticoincidence scintillator PM tubes, have such rate meters. The rate thresholds are set at $\sim$ 50 khz for both ULET detectors and the low energy EECA detector. All other rate thresholds are at 10 khz.

The logic circuits generate the event counting rates and determine when and which pulses are to be pulse height analyzed. The event counting rates are summarized in Table A-II. The basic requirement for positively charged particle counting rates is that the front detector produce a pulse and that neither the B detector nor the anticoincidence cup (A1) produces a pulse. The basic requirement for the electron rate is that both the front detector and the back detector have coincident pulses with no pulse from the anticoincidence cup. (The nominal requirement to record a coincidence or anticoincidence is that the pulses are within 0.6 μsec). Most rates are sectored into four quadrants, according to aspect angle of the rotating spacecraft with respect to the sun, thus providing anisotropy information. The spacecraft spin rate of 22.9 RPM gives a short time scale for these measurements. For the University of Maryland experiment 12 rates are available, 8 sectored into four quadrants each (SR) and 4 unsectored rates (R). Since a total of 18 rates had to be telemetered some rates are multiplexed as shown in Table A-II.

The PHA requirements for the EECA detector analysis are the same as for positive ion rates with the additional requirements that the analyzer is not busy, the data from registers are not being telemetered, no other detector using the same PHA has a pulse, the PHA is in the EECA instead of ULET mode, the threshold rate from the detector has not been exceeded, and that no high priority event is stored in the register. High priority is assigned to analyses of charge $Q \geq 4$ from P2 detector in one PHA and to analyses of charge $Q \geq 2$ from P7 in the other PHA. When these analyses occur a flag is set and the PHA is inhibited from analyzing other events until the data is telementered. If the priority flag is not set, pulses are analyzed until $\sim$ 2.5 msec before telemetry and the result of last analysis is transmitted. The priority scheme was implemented to obtain PHA data for heavier particles during times of high fluxes. With each PHA event a code identifying which detector produced the pulse and the angular position of spacecraft, to the nearest 45°, at the time the event occurred is also recorded.

To verify the proper operation and to detect any significant drifts in gain or thresholds an in-flight calibrate system is used. For a period of $\sim$ 82 seconds every $\sim$ 3 hours the instrument is commanded by the spacecraft into a calibrate mode. During this time pulses are applied to the test inputs of each of the charge sensitive amplifiers in turn. The amplitude of these pulses is stepped through a predetermined sequence. For each linear channel pulses of appropriate amplitude are generated so that the overall gain from charge input to channel number output is checked at at least two points. To avoid particle data from interfering with calibration the PHA input is enabled only for $\sim$ 40 μsec and the calibrate input pulse is generated during this time.

Analog voltages which monitor performance of some subsystems are also periodically read out. The temperature at the EECA detector cup and the detector bias voltage are measured once every $\sim$ 82 seconds. The + 3.5 kV supply, the 14.5 kV power supply, ULET proportional counter pressure and the temperature of the thermal valve controlling ULET pressure are monitored every 164 seconds.

Extensive calibrations were performed on the EECA, using both sources and accelerator beams. The first calibrations and design verification have been reported by Spiker [1970]. Additional source calibrations and resolution measurements were reported by Fan <u>et</u> <u>al</u> [1971]. Electron, proton, helium, and nitrogen beams were used to calibrate the IMP-8 experiment, both at the University of Maryland and Goddard Space Flight Center accelerators.

- APPENDIX B -

INSTRUMENT RESPONSE

In order to make full use of the PHA histograms, it is necessary to understand how the instrument responds to a incident spectrum of particles, and to deconvolve the effects of detector and electronic noise, deflection dispersion, electronic thresholds, energy defect, etc.

We first define:

a) $\varepsilon(E)$ = detection efficiency: the probability that a particle incident with energy E strikes the detector active area.

We note that a particle of incident energy E does not, in general, deposit its full energy in the detector, because of non-ionizing nuclear collisions [Campbell and Lin, 1973; Linhard et al, 1963]. The deposited energy E' is related to E by

$$E' = \delta(Z,A,E) \cdot E$$

where δ is the nuclear defect and $\delta \leq 1$. An empirical formula for δ has been derived and used in this analysis:

$$\delta(Z,A,E) = 1 - \{[1-5.12\times10^{-3}(Z+10)\sin(\frac{Z-2}{14}\pi)] \times .03737\sqrt{\frac{Z\ell nZ}{E}}\}$$

with E measured in MeV.

b) $D(E',h)\,dh$ = probability that deposition of an energy E' in the detector gives a pulse height between h and h+dh. This is ideally a Gaussian function of the electronics noise with σ_E:

$$D(E',h) = \frac{1}{\sqrt{2\pi}\,\sigma_E} e^{-(E'-h)^2/2\sigma_E^2}$$

c) $P_t(h)$ = probability that the detector signal h triggers the threshold discriminator, allowing pulse height analysis to take place.

$= P(\frac{h-t}{\sigma_E})$, where t is the threshold and P(x) is the normal probability integral

$$P(x) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{x} e^{-u^2/2}\,du$$

We can now define a detector response function [Berger et al, 1969]

$$R(E,h)dh = \varepsilon(E)\; D(\delta\cdot E,h)\; P_t(h)\; dh$$

= probability that an incident particle with energy E is detected and gives rise to an analyzed pulse height between h and h+dh.

If the incident flux of particles is j(E) (particles/cm^2-sr-sec-MeV), we then obtain a pulse height distribution H(h) (particles/sec-MeV),

$$H(h)\;dh = G \int_0^\infty j(E)\;R(E,h)\;dE \cdot dh$$

where G = geometrical factor (cm^2 sterad)

H(h) dh = # of particles detected/second with pulse height between h and h+dh

$$= G \int_0^\infty j(E)\ \varepsilon(E)\ D(\delta\cdot E,h)\ P_t(h)\ dE \cdot dh$$

Going to the discrete case, for pulse height channel n we define

$$H_n \equiv \frac{1}{h_{n+1}-h_n} \int_{h_n}^{h_{n+1}} H(h)\ dh$$

= particles/sec-MeV in channel n with h_n and h_{n+1} the lower and upper energy limits of channel n, respectively.

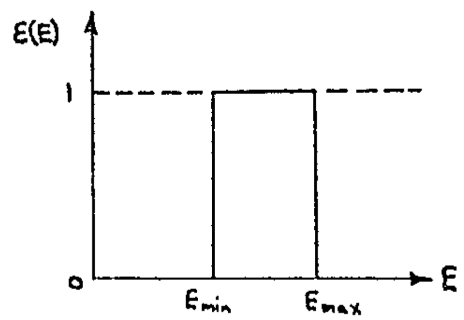
$$H_n = \frac{1}{h_{n+1}-h_n} \int_{h_n}^{h_{n+1}} dh\ G \int_0^\infty j(E)\ \varepsilon(E)\ D(E\delta,h)\ P_t(h)\ dE$$

$$= \frac{G}{h_{n+1}-h_n} \int_0^\infty dE\ j(E)\ \varepsilon(E) \int_{h_n}^{h_{n+1}} \frac{1}{\sqrt{2\pi}\ \sigma_E}\ e^{-(E\delta-h)^2/2\sigma_E^2}\ P(\frac{h-t}{\sigma_E})\ dh$$

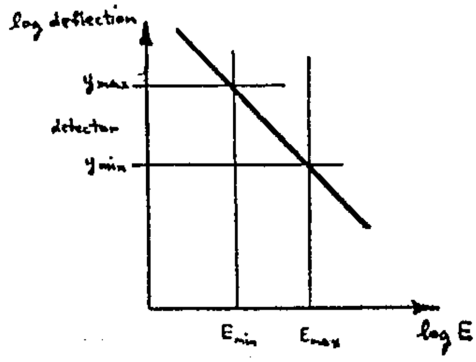
$$= \sum_{m=1}^{\infty} \frac{G}{h_{n+1}-h_n} \int_{E_m}^{E_{m+1}} dE\ j(E)\varepsilon(E) \int_{h_n}^{h_{n+1}} \frac{1}{\sqrt{2\pi}\ \sigma_E}\ e^{-(E\delta-h)^2/2\sigma_E^2}\ P(\frac{h-t}{\sigma_E})\ dh$$

$$\text{or } H_n \approx \sum_{m=1}^{N} \frac{G}{h_{n+1}-h_n} \int_{E_m}^{E_{m+1}} dE\ j(E)\ \varepsilon(E)\ [\,P(\frac{E\delta-h_n}{\sigma_E}) - P(\frac{E\delta-h_{n+1}}{\sigma_E})] \cdot P(\frac{h_n-t}{\sigma_E})$$

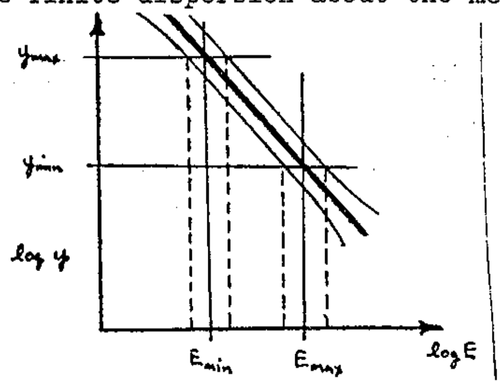
Recall that $\varepsilon(E)$ = detection efficiency for incident energy E, or the probability that a particle with incident energy E will strike the detector. For a perfect electrostatic deflection sensor, $\varepsilon(E)$ should be a rectangular window:



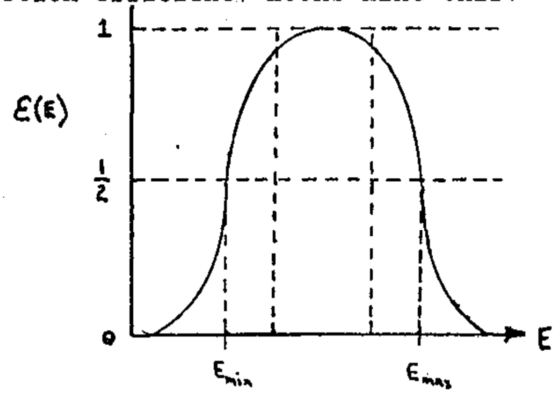
where E_{min} and E_{max} are determined by detector size and position, and particle deflection y:



However, in a real sensor, particles of energy E_o are deflected with some finite dispersion about the mean position



and thus the detection efficiency looks like this:



Numerically

$$\varepsilon(E_o) = \int_{y_{min}}^{y_{max}} \frac{1}{\sqrt{2\pi}\,\sigma_D} e^{-(y_o-y)^2/2\sigma_D^2} dy$$

where $y_o = \frac{kQ}{E_o}$ and $\sigma_D = (.43281 + .00081\ y^2)^{1/2}$ mm [Fan <u>et</u> <u>al</u>, 1971] is the deflection dispersion.

Thus

$$\varepsilon(E_o) = P\left(\frac{y_o-y_{min}}{\sigma_D}\right) - P\left(\frac{y_o-y_{max}}{\sigma_D}\right)$$

$$\text{or} \qquad \varepsilon(E) = P\left(\frac{\frac{kQ}{E} - y_{min}}{\sigma_D}\right) - P\left(\frac{\frac{kQ}{E} - y_{max}}{\sigma_D}\right)$$

So the pulse height histogram becomes

$$H_n = \sum_{m=1}^{N} \frac{G}{h_{n+1}-h_n} \int_{E_m}^{E_{m+1}} j(E)\left[P\left(\frac{E\delta-h_n}{\sigma_E}\right) - P\left(\frac{E\delta-h_{n+1}}{\sigma_E}\right)\right]$$

$$\left[P\left(\frac{\frac{kQ}{E} - y_{min}}{\sigma_D}\right) - P\left(\frac{\frac{kQ}{E} - y_{max}}{\sigma_D}\right)\right] \; P\left(\frac{h_n-t}{\sigma_E}\right)\, dE$$

particles/(sec MeV) in channel n

If we assume that over the energy interval (E_m, E_{m+1}), $j(E)$ is a constant j_m (a good approximation for small channel widths $E_{m+1} - E_m$)

$$j_m(\bar{E}_m) = \frac{1}{E_{m+1}-E_m} \int_{E_m}^{E_{m+1}} j(E)\, dE \qquad \text{(B-1)}$$

then,

$$H_n = \frac{G}{h_{n+1}-h_n} \sum_{m=1}^{N} j_m \int_{E_m}^{E_{m+1}} \left[P\left(\frac{E\delta-h_n}{\sigma_E}\right) - P\left(\frac{E\delta-h_{n+1}}{\sigma_E}\right)\right]$$

$$\left[P\left(\frac{\frac{kQ}{E} - y_{min}}{\sigma_D}\right) - P\left(\frac{\frac{kQ}{E} - y_{max}}{\sigma_E}\right)\right] P\left(\frac{h_n-t}{\sigma_E}\right)\, dE$$

$$\text{or} \qquad H_n = \sum_{m=1}^{N} R_{nm}\, j_m$$

where

$$R_{nm} \equiv \frac{G}{h_{n+1}-h_n} \int_{E_m}^{E_{m+1}} \left[P\left(\frac{E\delta-h_n}{\sigma_E}\right) - P\left(\frac{E\delta-h_{n+1}}{\sigma_E}\right)\right] \left[P\left(\frac{\frac{kQ}{E} - y_{min}}{\sigma_D}\right) - \right.$$

$$\left. - P\left(\frac{\frac{kQ}{E} - y_{max}}{\sigma_D}\right)\right] P\left(\frac{h_{n-t}}{\sigma_E}\right)\, dE \qquad \text{(B-2)}$$

Thus

$$\vec{H} = \underset{\sim}{R}\vec{j} \tag{B-3}$$

where $\vec{H}$ and $\vec{j}$ are N-dimensional column vectors and $\underset{\sim}{R}$ is an NxN matrix.

TABLE A-1

Detector Energy-Charge Ranges

Detector[a]	Charge Threshold	Energy Range	Geometrical Factor (cm^2 sr)
P1	$Q \geq 6$	37-55 keV/Q	.02
P2	$Q \geq 2$	65-100 keV/Q	.03
P2'[b]	$Q \geq 4$	65-100 keV/Q	.03
P3	$Q \geq 1$	130-210 keV/Q	.03
P4	$Q \geq 1$	160-230 keV/Q	.02
P5	$Q \geq 1$	background $\gtrsim$ 160 keV	---
P6	$Q \geq 1$	390-600 keV/Q	.018
P6'[c]	$Q \geq 4$	390-600 keV/Q	.018
P7	$Q \geq 1$	550-900 keV/Q	.03
P7'[b,c]	$Q \geq 2$	550-900 keV/Q	.03
P8	$Q \geq 1$	740-1200 keV/Q	.018
N·B	electrons	600-860 keV	.018
A1	protons	$\gtrsim$ 18 MeV	1100.
A2	protons	$\gtrsim$ 6 MeV	675.

[a]Discriminator rates for all detectors are generated and read out through telemetry. In addition, all detector signals except N·B and A1 and A2 are pulse height analyzed.

[b]Denotes pulse height analysis priority event.

[c]For detectors listed twice the prime indicates a higher threshold for rate or pulse height analysis.

TABLE A-II

Event Counting Rates

Rate	Multiplex Step	Time in Mux Step (sec)	Logical Equation	Accumulation time/ readout (sec).	Period between readouts (sec)
R1			$P4\cdot(\overline{B}+BRD)\cdot\overline{A1}$	5.12	5.12
R2			$P7'\cdot(\overline{B}+BRD)\cdot\overline{A1}$	5.12	5.12
R3			$P2'\cdot(\overline{B}+BRD)\cdot\overline{A1}$	5.12	5.12
R4	0	61.44	A1	10.24	10.24
	1	20.48	A2	10.24	10.24
	2	61.44	B	10.24	10.24
	3	20.48	A2	10.24	10.24
SR1	0	61.44	No rate (sync)	--	20.48
	1	20.48	$P5\cdot(\overline{B}+BRD)\cdot\overline{A1}$	4.59/sector	20.48
	2	81.92	$P7\cdot(\overline{B}+BRD)\cdot\overline{A1}$	4.59/sector	20.48
	3	81.92	$P6\cdot(\overline{B}+BRD)\cdot\overline{A1}$	4.59/sector	20.48
	4	81.92	$P3\cdot(\overline{B}+BRD)\cdot\overline{A1}$	4.59/sector	20.48
SR2			$P6'\cdot(\overline{B}+BRD)\cdot\overline{A1}$	4.59/sector	20.48
SR3			$N\cdot(\overline{B}+BRD)\cdot\overline{A1}$	4.59/sector	20.48
SR4	0	61.44	$D2\cdot\overline{A2}$	4.59/sector	20.48
	1	20.48	$D1\cdot\overline{A2}$	4.59/sector	20.48
SR5			$P8(\overline{B}+BRD)\cdot\overline{A1}$	4.59/sector	20.48
SR6			$D1\cdot D2\cdot\overline{A2}$	4.59/sector	20.48
SR7			$P2(\overline{B}+BRD)\overline{A1}$	4.59/sector	20.48
SR8			$P1(\overline{B}+BRD)\overline{A1}$	4.59/sector	20.48

NOTE: BRD true when B threshold rate is exceeded.

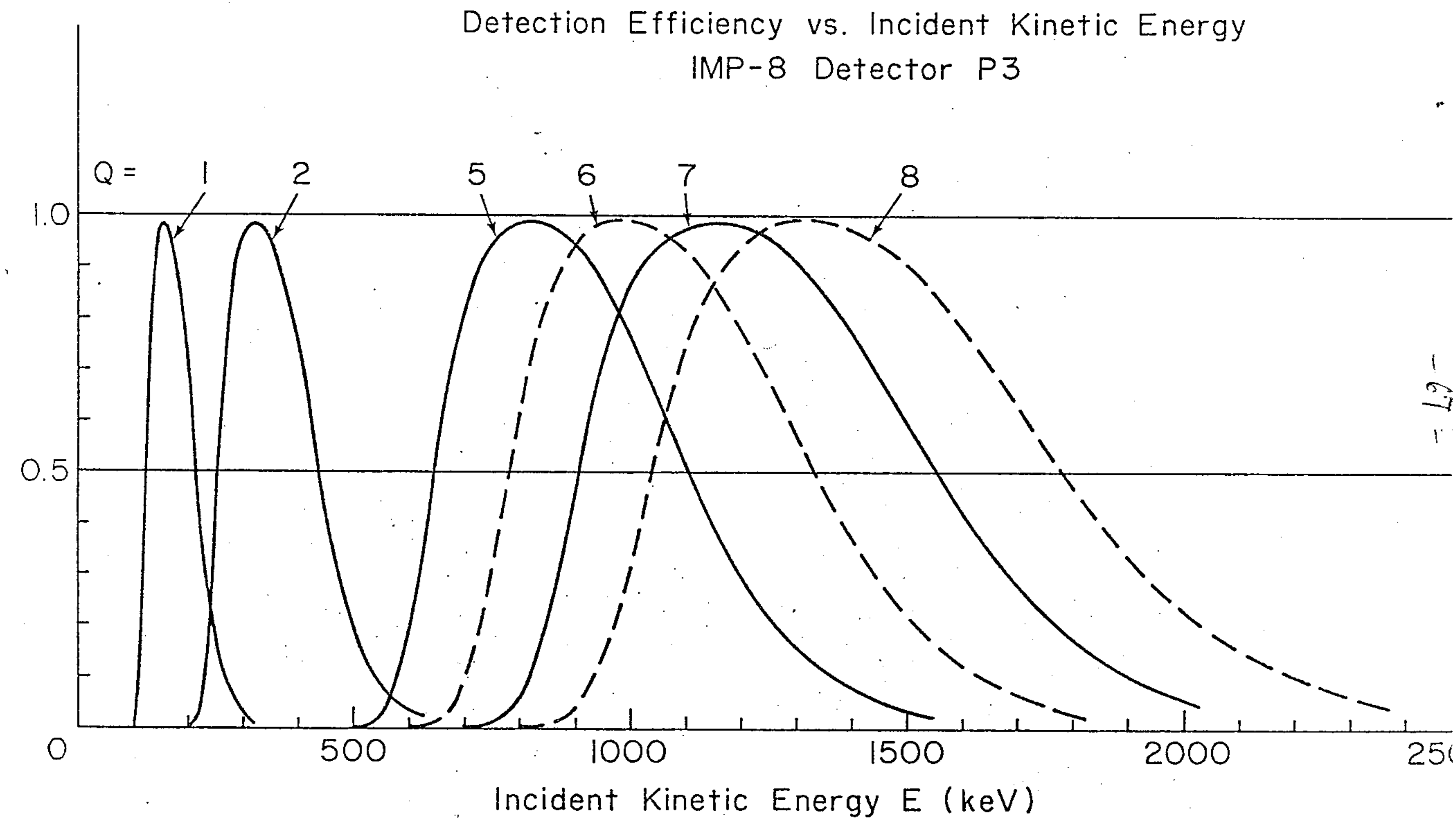

Detection Efficiency vs. Incident Kinetic Energy
IMP-8 Detector P3
Q = 1 2 5 6 7 8
1.0
0.5
0
500
1000
1500
2000
250
Incident Kinetic Energy E (keV)

FIGURE 2-1

```
FAST ANALYSIS OF TAPE AND RECOVERY -- FATAR   VER 4.3.5   -- INNOVATION DATA PROCESSING  AUTHORIZED   6/27/96   PAGE   1
FATS070 CONTROL CARD TABLE SIZE IS   4096 BYTES
FATAR CONTROL CARDS
   1--    ANALYZE BLP,LABELS=NO,PRTLEN=200,VERIFY                    C-03J971
   2--      PRINT LF=1,B=1-2,HEX
   3--      PRINT LF=1,B=2482-2483,HEX
FATS071 TAPE BUFFER SIZE IS 65535 BYTES

                                          CHARACTERISTICS OF THE TAPE TO BE ANALYZED
                                                 UNIT   SERIAL   DEN   TRTCH
                                                 5B5   CMS11    38000

                                                      FATAR DETAIL REPORT
 BLOCK  LNGTH/  MESSAGE/                  1...5...10...15...20...25...30...35...40...45...50...55...60...65...70...75...80
 NUMBER DISPL  BLOCK TYPE                          (COLUMN GRID IS VALID ONLY FOR CHARACTER FORMATTED DATA)

* * * * * * *  START FILE      1
                                                        1995  day 94
      1  8640  PRINT REQUESTED            00D82C00 40D82C00 C0D92C00 CB075E00  04000400 14BF3D04 CB075E00 04000400
        +00033                            14BB4704 CB075E00 04000400 94FE3E04  CB075E00 04000400 F57B4604 99250000
        +00065                            38493090 823D6CB7 E0C2EF50 19C2354B  87442304 96C237EB 384924AC 3645C492
        +00097                            2EC9E4DC 6DC88988 8744E01D 96C2FB0E  07000700 00000000 2A41D0CB 8642E041
        +00129                            07000000 07000000 00000000 4E416766  95419A99 D4BD00FE 4C40C8CC 50017000
        +00161                            86008A00 0000C000 BC006C00 01000100  05000000 05000000 06000000 00000000
        +00193                            01000000 00000000

      2  8640  PRINT REQUESTED            00722D00 00722D00 C0732D00 CB075F00  04000500 17561802 CB075F00 04000500
        +00033                            17522202 CB075F00 04000500 17561802  CB075F00 04000500 09132102 99250000
        +00065                            45495C36 2142814D EDC2F4D9 83C14181  9044865D EEC14AA5 4549B05F 7E485E08
        +00097                            39C9002D C9C78448 90440177 EAC1425C  08000800 00000000 2A4160CE 89421C9F
        +00129                            08000000 08000000 00000000 4E416566  95419A99 D4BD00FE 4C40C8CC 80018000
        +00161                            AA00A000 0000D900 E3007D00 00000000  00000000 00000000 00000000 00000000
        +00193                            00000000 00000000

   2482  8640  PRINT REQUESTED            008E2200 008E2200 C08F2200 CB070E01  09001B00 F4830705 CB070E01 09001B00
        +00033                            F47F1105 CB070E01 09001B00 F4830705  CB070E01 09001B00 E6401005 A6250000
        +00065                            7049F844 DDC0E4E8 11C331F2 46424562  8544C1A3 95429AFE 7049C834 24C7A069
        +00097                            63C90454 994878D2 8544AEB4 9542EC64  08000800 00000000 2A4140B2 8242A8E4
        +00129                            08000000 08000000 00000000 4E416566  9441CFCC D4BD00FE 4C40C8CC 80018000
        +00161                            A100B200 0000E200 D1007B00 00000000  00000100 00000100 00000100 00000000
        +00193                            00000000 00000000
                                                        1995 , day 271
   2483  8640  PRINT REQUESTED            009A2200 009A2200 C09B2200 CB070F01  09001C00 00131D00 CB070F01 09001C00
        +00033                            000F2700 CB070F01 09001C00 00131D00  CB070F01 09001C00 F2CF2500 A6250000
        +00065                            6F49D4CE 90C02250 12C39639 4042A571  8644D91D 914226A2 6F496CBC CEC6981F
        +00097                            63C994C1 9548F81D 86449B30 904214F5  08000800 00000000 2A41B0AF 8242A8E4
        +00129                            08000000 08000000 00000000 4E416566  9441CFCC D4BD00FE 4C40C8CC 80018000
        +00161                            A300AD00 0000E200 D8007A00 00000000  00000000 00000000 00000000 00000000
        +00193                            01000000 00000000
* * * * * * *  END OF FILE      1  -- FILE CONTAINED    2483 BLOCKS
* * * * * * *  START FILE      2
```

DUMP OF TAPE BOUT15

Imp-H
D-41576

INPUT TAPE BOUT15 ON MT1
DATA INPUT H9 FL 1 1 1

YR=72 DAY=9/25

9/25/72 - 3/18/73

FILE 1 RECORD 1 LENGTH 8640BYTES

(0)	00341400	00341480	003415C0	07B4010D	00090019	04E89155	07B4010D	00090019	04F28E31	07B4010D
(40)	00090019	04EB108C	07B4010D	00090019	04F14E95	00002329	453A9850	4223EBBE	C03F9474	C1B35AD5
(80)	431679A7	C21154B9	453A9729	4537F299	C347696F	C511656D	43167B6C	C21145AF	00060006	00000000
(120)	4129EB85	418F134A	00060000	00060000	00000000	3C100000	3C100000	3C100000	3C100000	01200060
(160)	00000000	00000000	00000000	00000000	00000000	01190060	00070000	00000000	00000000	00000000
(200)	0000003F	005E0002	00000000	00000000	431E0AE4	005F0001	00000000	00000000	431E5CB5	005F0001
(240)	00000000	00000000	431E5CB5	00240000	00000000	00000000	431702FA	000B0001	00000000	00000000
(280)	42708074	00240000	00000000	00000000	431702FA	00170001	00000000	00000000	42697470	00000000
(320)	00000000	00000000	00000000	00170001	00000000	00000000	42697470	00000000	00000000	00000000
(360)	00000000	00170001	00000000	00000000	42697470	00000000	00000000	00000000	00000000	00170001
(400)	00000000	00000000	42697470	00000000	00000000	00000000	00000000	00170001	00000000	00000000
(440)	42697470	00000000	00000000	00000000	00000000	00170001	00000000	00000000	42697470	00000000
(480)	00000000	00000000	00000000	00170001	00000000	00000000	42697470	00000000	00000000	00000000
(520)	00000000	00170001	00000000	00000000	42697470	00000000	00000000	00000000	00000000	00180000
(560)	00000000	00000000	426E0A32	00000000	00000000	00000000	00000000	00180000	00000000	00000000
(600)	426E0A32	00000000	00000000	00000000	00000000	00180000	00000000	00000000	426E0A32	00000000
(640)	00000000	00000000	00000000	00180000	00000000	00000000	426E0A32	00000000	00000000	00000000
(680)	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
(720)	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
(760)	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
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(840)	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
(880)	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
(920)	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
(960)	000C0009	00090003	0003000C	BF6A7F00	FFF80001	0014007B	00070006	00000000	00010052	404CCCCC
(1000)	427DB333	41100000	42778000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
(1040)	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
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(1120)	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF
(1160)	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF
(1200)	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF
(1240)	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF
(1280)	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF
(1320)	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF
(1360)	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF
(1400)	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF
(1440)	00341600	00341600	003417C0	07B4010D	00090019	04F28E30	07B4010D	00090019	04FC8B0C	07B4010D
(1480)	00090019	04F28E30	07B4010D	00090019	04FB4B6E	00002329	453A96FF	4223EE68	C02B5460	C1B2AA4E
(1520)	43167BAC	C2114388	453A9582	4537F7AE	C31FFDC0	C5114FE9	43167DF2	C2113027	00080008	00000000
(1560)	4129EB85	418D7630	00080000	00080000	00000000	BE8DF000	BF237EFE	3C100000	BF1A9F00	01800080
(1600)	00000000	00000000	00000000	00000000	00000000	01800080	00000000	00000000	00000000	00000000
(1640)	000000FF	00800000	00000000	00000000	4328E8A6	00800000	00000000	00000000	4328E8A6	00800000
(1680)	00000000	00000000	4328E8A6	00300000	00000000	00000000	431EAE9E	00100000	00000000	00000000
(1720)	42A3A391	00300000	00000000	00000000	431EAE9E	00200000	00000000	00000000	4292B842	00000000
(1760)	00000000	00000000	00000000	00200000	00000000	00000000	4292B842	00000000	00000000	00000000
(1800)	00000000	00200000	00000000	00000000	4292B842	00000000	00000000	00000000	00000000	00200000
(1840)	00000000	00000000	4292B842	00000000	00000000	00000000	00000000	00200000	00000000	00000000
(1880)	4292B842	00000000	00000000	00000000	00000000	00200000	00000000	00000000	4292B842	00000000
(1920)	00000000	00000000	00000000	00200000	00000000	00000000	4292B842	00000000	00000000	00000000
(1960)	00000000	00200000	00000000	00000000	4292B842	00000000	00000000	00000000	00000000	00200000
(2000)	00000000	00000000	4292B842	00000000	00000000	00000000	00000000	00200000	00000000	00000000
(2040)	4292B842	00000000	00000000	00000000	00000000	00200000	00000000	00000000	4292B842	00000000
(2080)	00000000	00000000	00000000	00200000	00000000	00000000	4292B842	00000000	00000000	00000000
(2120)	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
(2160)	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
(2200)	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
(2240)	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
(2280)	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000

(4160)	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF
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(4240)	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF
(4280)	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF
(4320)	0027FF00	0027FF00	0027FF00	07B5004F	00030013	02256A33	07B5004E	00030013	022F6704	07B5004E
(4360)	00030013	02256A33	07B5004E	00030013	022E276E	00002336	453A492E	C0349DC8	C220440B	4212F946
(4400)	4310DA27	421E74FA	453A4641	C32A50C9	C53237A3	451D90B1	4310DCF9	421E7CB2	00080008	00000000
(4440)	41299A6F	41B50BC0	00080000	00080000	00000000	4144CCC2	413E0000	40B999A0	3C100000	01800080
(4480)	01060131	00000003	00170075	00000000	00010000	00000001	00000000	00780040	00020000	00000000
(4520)	000000FF	00800000	00000000	00000000	4328E896	00800000	43315000	44174900	4328E896	00800000
(4560)	43567800	443FAF00	4328E896	00300000	452C1400	48287E60	431EAE78	00100000	44904000	47515200
(4600)	42A3A2F0	00300000	452C1400	48287E60	431EAE78	001F0001	43127000	43C79000	428D0F9C	42470000
(4640)	42400000	42530000	42400000	001F0001	43127000	43C79000	428D0F9C	42470000	424D0000	42530000
(4680)	42400000	001F0001	43127000	43C79000	428D0F9C	42470000	424D0000	42530000	42400000	001F0001
(4720)	43127000	43C79000	428D0F9C	42470000	424D0000	42530000	42400000	001F0001	43127000	43C79000
(4760)	428D0F9C	42470000	424D0000	42530000	42400000	00200000	43135000	43CB3000	42919C80	424D0000
(4800)	42500000	42490000	424F0000	00200000	431AD000	4417D300	42919C80	42600000	426B0000	42740000
(4840)	426E0000	00200000	431AD000	4417D300	42919C80	42600000	426B0000	42740000	426E0000	00200000
(4880)	423A0000	42A60000	42919C80	41E00000	41E00000	41B00000	42130000	00200000	00000000	00000000
(4920)	42919C80	00000000	00000000	00000000	00000000	00200000	431CA000	441B0600	42919C80	42630000
(4960)	42800000	42790000	426E0000	00200000	42400000	42BC0000	42919C80	41F00000	41C00000	41E00000
(5000)	42170000	006A0002	000A0009	00100017	000F000A	000B000C	00410001	00090006	00080007	000E0007
(5040)	00060006	006F0000	0000000D	000A0012	0010000A	000E0011	00380003	00070005	00050006	000A0008
(5080)	00060009	001E000E	00020006	00040003	00030007	00040001	003F000C	00070004	000A0004	00090009
(5120)	000F0005	00210000	00030004	00040001	00050007	00030006	002F0006	00060004	00070003	00060009
(5160)	00060006	00210003	00030004	00010007	00040004	00060004	00180055	00080004	00010003	00030002
(5200)	00030003	00240016	00270008	00190000	0010002C	001E0017	000D0006	0003000D	00020003	00030012
(5240)	00200008	000B0005	00000005	001D0000	0010000F	00080003	0001000E	00000000	00000000	00000000
(5280)	0010000C	000C0004	00040010	4128CCC8	FFF90001	004301C9	006F0052	00000000	00070022	411CCCCC
(5320)	42619999	41100000	42659999	00000000	00000000	00000000	00000000	00000000	00000000	00000000
(5360)	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
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(5640)	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF
(5680)	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF
(5720)	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF	FFFFFFFF

FILE	INPUT RECS.	DATA RECORDS INPUT	MAX. SIZE	READ ERROR SUMMARY PERM	ZERO B	SHORT	UNDEF.	INPUT RETRIES #RECS.	TOTAL#
1	3748	3749	8640	0	96	0	0	96	98

EOJ DUMP STOPPED AFTER FILE 1 # OF PERMANENT READ ERRORS 0

START TIME 01/09/81 13:49:31 STOP TIME 01/09/81 13:53:16

dmp-J
D-6060
May 30, 198
Jan. 11, 1983

DUMP OF TAPE DOUTA

INPUT TAPE DOUTA ON MT4
DATA INPUT H9 FL 1 1 1

year 1982 Day 150 5/30

FILE 1 RECORD 1 LENGTH 8640BYTES

(0)	00157E00	00157EC0	00157FC0	07BE0096	0005001E	040E08E3	07BE0096	0005001E	04180562	07BE0096
(40)	0005001E	0411C792	07BE0096	0005001E	0416C5D4	00002423	45373E81	3F1F9CBD	C22350F2	C1362FC9
(80)	4310E032	C157A47C	45373A1A	431BD9BF	C536FAE0	C4537496	4310E1CF	C156B5FC	00050005	00000000
(120)	412B5E3D	41EADF60	00050000	00050000	00000000	41340000	414B3330	BF6A7F00	40C66670	00F00050
(160)	00D100D2	00000023	0022004A	00000000	00000001	00000001	00000000	00000000	00010000	00000000
(200)	0000001F	00500000	42F70000	434A5000	43199089	004F0001	41D00000	41D00000	43193EBB	004F0001
(240)	4312A000	4371C000	43193EBB	00120000	44B08000	476C3480	42B81166	000A0000	44346000	471126A0
(280)	4266428E	000C0000	441B3000	463DB700	427AB644	00010000	41100000	41100000	414BE4EA	00000000
(320)	00000000	41100000	00000000	00050000	41400000	41A00000	4217B788	00000000	00000000	41200000
(360)	41200000	00070000	41E00000	42360000	42213424	41600000	41400000	41100000	41300000	00040000
(400)	42770000	43EB1000	4212F93A	41D00000	41400000	42540000	42120000	00140000	41400000	41400000
(440)	425EDE1A	41100000	00000000	41100000	41200000	00140000	42200000	42460000	425EDE1A	41500000
(480)	41A00000	41800000	41900000	00050000	00000000	00000000	4217B788	00000000	00000000	00000000
(520)	00000000	000F0000	436FB000	45380590	42472694	43181000	43254000	431CD000	43159000	00140000
(560)	421A0000	42320000	425EDE1A	41700000	41800000	41600000	41500000	00140000	00000000	00000000
(600)	425EDE1A	00000000	00000000	00000000	00000000	00140000	436D3000	4534BA30	425EDE1A	42CC0000
(640)	42DA0000	433ED000	43140000	00140000	42D00000	43B6E000	425EDE1A	42290000	421B0000	425E0000
(680)	422E0000	00320000	00090008	00040002	00050008	000A0004	00480000	00050010	00060000	0009000B
(720)	000F000A	006B0000	00050013	00090001	001A0023	000A0002	00780000	0009000F	000F0003	00070023
(760)	001E0006	00120000	00010004	00020001	00010004	00020003	000A0000	00010001	00040001	00010000
(800)	00000002	00080000	00020001	00020001	00000001	00000001	00130000	00040005	00020003	00010000
(840)	00020002	000B0000	00010001	00010001	00020002	00000003	00040000	00000001	00010001	00000000
(880)	00000001	001C0003	00120000	00430005	00330002	00000059	00100004	0000000D	00000003	00010007
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(1520)	4310E213	C1568E37	45373206	43494546	C536F523	C451C475	4310E4C4	C1550027	00080008	00000000
(1560)	412B5E3D	41EADF60	00080000	00080000	00000000	41340000	414B3330	BF6A7F00	40C66670	01800080
(1600)	00E200F2	00000074	00640069	002F000B	00000000	00000000	00000000	00000000	00010000	00000000
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(1680)	4315C000	43A3A000	4328E729	00180000	44E94000	478DBA00	42F56C88	00100000	44550000	471C3D00
(1720)	42A39DB0	00180000	44360000	4679B600	42F56C88	00020000	00000000	00000000	4197C9D4	00000000
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(1800)	41600000	00080000	42150000	42530000	4225FE31	41500000	41600000	41400000	41600000	00080000
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(1920)	41900000	41A00000	41600000	00080000	41700000	42310000	4225F65C	41200000	41100000	41300000
(1960)	41100000	00180000	442EB000	465B5D90	4271E310	438D5000	43D90000	43D6E000	43ADD000	00200000
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(2200)	001A000B	001E0000	00030003	00040004	00020007	00030004	00190000	00040007	00050001	00020002
(2240)	00020002	00180000	00060005	00030001	00000003	00030003	001A0000	00070001	00020003	00030002
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(7760)	42360000	427C0000	4297D8DA	41B00000	42130000	41F00000	41900000	00200000	00000000	00000000
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(7880)	421B0000	003E0000	0001000D	000D0007	00040007	000D0004	00580000	0004000B	001B0006	00060015
(7920)	00080005	004E0000	0000000E	00180008	0009000B	00060006	00830000	000C0012	00150010	00110014
(7960)	000E000D	00370000	00050004	00020008	0007000A	0009000A	000E0000	00020002	00020003	00000003
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(8040)	00040003	00150000	00030002	00050002	00040004	00000001	001A0000	00020003	00070003	00040004
(8080)	00010002	001B0001	00200002	00520006	00280005	00040066	00110003	00010021	000F0002	0000000C
(8120)	0002000E	00010000	00090001	00270008	00030000	00130005	00000001	00000000	00000000	00000000
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FILE 1 RECORD 2702 LENGTH 2880BYTES

(0)	003EA000	003EA000	003EA1C0	07BF000B	0001000B	046123B3	07BF000B	0001000B	046B2032	07BF000B
(40)	0001000B	046123B3	07BF000B	0001000B	0469E0A5	00002435	4538656E	C04CEA70	C2212051	C1EA3AB8
(80)	4310D7AD	C217D74B	453869D8	C34B7C42	C533934D	C516DAFC	4310DAC0	C217E664	00080008	00000000
(120)	412B57D9	42119F89	00080000	00080000	00000000	41340000	414B3330	3C100000	40D33340	01800080
(160)	009C00AE	000000B4	00A20060	002D000A	00010005	00030004	0004000D	00000000	00000000	00000000
(200)	000000FF	00790007	42910000	43157000	4326AA87	007A0006	41800000	42160000	4326FC55	007A0006
(240)	42290000	423B0000	4326FC55	00180000	449D4000	47407680	42F56C88	00100000	443DD000	46EF2780
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(720)	00010002	00170000	00050001	00020003	00010003	00060002	007B0000	000A000B	000D0013	00130017
(760)	000F000D	00470000	00060009	0008000A	0010000A	00080004	00100000	00020004	00010000	00010003
(800)	00020003	001E0000	00010004	00060003	00030006	00010006	00040000	00000001	00020000	00000000
(840)	00010000	00000000	00000000	00000000	00000000	00000000	00030000	00000000	00000002	00000001
(880)	00000000	00080002	00140001	001A0003	000A0002	0001006B	00070000	00000040	00020002	0001000C
(920)	00040013	00040000	00060000	00040000	00000000	00010000	00010001	00000000	00010000	00000000
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(1440)	003EA200	003EA200	003EA3C0	07BF000B	0001000B	046B2034	07BF000B	0001000B	04751CB3	07BF000B
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