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Description of Average Tapes of Experiment-4 Data of He-1 and -2 (Search-Coil Magnetometer Experiment)

A) Structure of Tapes

1) 9 track, ~~1600~~ 6250 BPI, binary
2) Files: one tape includes one file
3) Records: they have variable length. The maximal length is 800 words. The first record in a tape is a header-record. The next record is a day label. Additional day labels precede every change of day in a tape. The other records are science data records. In average tapes two types of science data records are possible:

   Mean value records (Mean)
   peak value records (Max)

   The time sequence is as follows:

   Mean (T1), Max (T1), Mean (T1 + 0.5 × Tstep),
   Mean (T1 + 2 × Tstep), Max (T1 + 2 × Tstep),
   Mean (T1 + 1.5 × Tstep),
   a.s.o.
   with: T1 - any start time
   Tstep - time intervall for one Max

4) words:
   The wordlength is 16 bits.
   The content of records is counted in words.
   For detailed description of words in a record see 'E4 adr Tape Records' (enc.)

   character representation : 8-bit Ascii code
   bits 1-8 first character
   bits 9-16 second character

integer representation: 1 word, two's complement
real representation: 2 words
bit 1: sign
bits 2-10: exponent (biased+256)
bits 11-32: positive fraction
long representation: 4 words
bits 1-10: same as real
bits 11-64: positive fraction

B) Science Data Records:

1) Data processing: For detailed description of the search-coil magnetometer experiment (E4) see Neubauer et al. (1977), Dehmel et al. (1975).

The experiment consists of 3 orthogonal search-coil sensors with Z-axis parallel to the spin-axis and the X- and Y-axis in the equatorial plane.
The Z-component and one of the X- or Y-component is processed by a spectrum analyser. It consists of 8 band-pass filters spaced logarithmically in frequency.

frequency range [Hz]	center freq. [Hz]	channels
4.7 - 10	6.8	X1, Z1
10 - 22	14.7	X2, Z2
22 - 47	31.6	X3, Z3
47 - 100	68	X4, Z4
100 - 220	147	X5, Z5
220 - 470	316	X6, Z6
470 - 1000	681	X7, Z7
1000 - 2200	1470	X8, Z8
		(or instead of X : Y)

A set of X1, Z1, ... , X8, Z8 is called a vector.

Mean vaules:

The filter outputs are squared and averaged by a digital mean-value-computer on board of Helios. The time intervalls are:

1.125, 2.25, 4.5, 18, 36, 72, 144, 288, 576, 1152 seconds depending on the operational mode of the S/C telemetry system.

Peak values:

For the same time interval the peak reading from each filter output is transmitted in addition to the mean values. The peak values are scaled such that for a monochromatic signal they are above the mean values by a factor of $\sqrt{2}$. No peak values exist for distribution mode 0.

8sec average tapes:

The data records consist of experimental output voltages with respect to an amplification factor. For average intervals less than 4.5 seconds the mean values are compressed to 8-sec-averages.

2) Time information:

The number of days is counted from the day of year at launch.

He 1: launched December 10, 1974
number of day: 344

He 2: launched January 15, 1976
number of day: 15

Attention: No reset of day number was made when the year changes.

The fraction of day is the current time of that day.

e.g.: He-1, February 1, 1975 at 12.00
number of days: 397
fraction of days: 0.5

The number and fraction of day provide the event time of the first vector in a data record. The vector step time is the time between two vectors in fraction of day.

3) Conversion of data:

To convert the sensor output voltages into spectral densities measured in $\gamma/\sqrt{Hz}$ (= nT · $\sqrt{sec}$) one has to apply a conversion factor conv(f) and the amplification factor Amp to each channel.
Amp is 10. throughout the missions of He1 and 2.

conv(f)	channel X,Y,Z
$2.07 \cdot 10^{-6}$	8
$6.58 \cdot 10^{-6}$	7
$2.11 \cdot 10^{-5}$	6
$6.65 \cdot 10^{-5}$	5
$2.11 \cdot 10^{-4}$	4
$6.60 \cdot 10^{-4}$	3
$2.09 \cdot 10^{-3}$	2
$6.59 \cdot 10^{-3}$	1

e.g.: Value of sensor 2, 1st vector, channel 8
value [$\gamma/\sqrt{Hz}$] = real (word 87,88) × conv(8)/Amp

4) Noise:

There are some rare cases showing only background noise in all frequency channels. But in most of the time channel 1 and 2 (frequency 4.7 - 22 Hz) show signals well above the noise levels.
The occurence of signals above the noise decrease with increasing frequency and increase with approach to the sun.

Lit.: Neubauer, F.M., Beinroth, H.J., Barnstorf, H., Dehmel, G.: Initial results from the Helios-1 search-coil magnetometer experiment. J.Geophys.Res., 42, 599-614, 1977.

Dehmel, G., Neubauer, F.M., Lukoschus, D., Wawretzko, J., Lammers, E.: Das Induktionsspulen-Magnetometer-Experiment (E4). Raumfahrtforschung, 19, 241-244, 1975.

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E4ADR TAPE RECORDS FILE: "E4FORMAT.GBEIN"
05.03.81

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1. TAPE HEADER

WORDNUMBER	TYPE		CONTENT
1	INTEGER	100	LABEL
2	INTEGER		LENGTH OF RECORD IN WORDS
3	CHARACTER		"**** E4ADR TAPE HEADER/HELIOS A ****"
			"**** E4ADR TAPE HEADER/HELIOS B ****"
21	INTEGER		NUMBER OF TAPE
22	INTEGER		NUMBER OF SERIES
23	INTEGER		YEAR OF GENERATION
24	INTEGER		MONTH "
25	INTEGER		DAY "
26	INTEGER		HOUR "
27	INTEGER		MINUTE "
28	INTEGER		MAX. LENGTH OF DATA RECORD IN WOR
29	INTEGER		OUTPUT DEVICE
30	INTEGER		RPI
31	INTEGER		AVERAGE TIME OF TAPE IN SECONDS
32-60			FREE

2. DAY LABEL

1	INTEGER	99	LABEL
2	INTEGER	12	- LENGTH OF RECORD IN WORDS
3	INTEGER		NUMBER OF DAYS SINCE LAUNCH
4	CHARACTER		"****DAY LABEL*****"

3. SCIENCE DATA

1	INTEGER	11	- MEANVALUES
		12	- MAXIMALVALUES
		13	- WAVEFORMVALUES
2	INTEGER		LENGTH OF RECORDS IN WORDS
3	INTEGER		NUMBER OF DAYS SINCE LAUNCH
4-7	LONG		FRACTION OF DAY (DECIMAL)
8-9			FREE
10	INTEGER		NUMBER OF VECTORS IN RECORD
11			FREE
12	INTEGER		FORMAT
13	INTEGER		BIT RATE
14	INTEGER		DISTRIBUTION MODE
15-18	LONG		VECTOR STEP TIME IN FRACTION OF D
19-21			FREE

22	INTEGER	90	- HELIOS 1
		91	- HELIOS 2
23-24	REAL		ECLIPT. LAT. OF SPIN AXIS (RAD)
25,26	REAL		ECLIPT. LONG. OF SPIN AXIS (RAD)
27,28			FREE
29-30	REAL		ECLIPT. LONG. OF HELIOS POS.(RAD)
31-32	REAL		DISTANCE FROM SUN (AU)
33-34	REAL		FREE
35,36			HELIOGRAPH. LAT. OF HEL. POS.(RAD
37,38	REAL		ANGLE HELIOS-SUN-EARTH (RAD)
39,40			FREE
41,42	REAL		SAMPLING RATE IN ORIG. DATA
			(ONLY AVERAGE TAPES)
43-46	LONG		VECTOR STEP TIME " "
			(ONLY AVERAGE TAPES)
47-66			FREE
67-70	LONG		TRIP LIGHT TIME IN FRACTION OF DA
71-74	LONG		SPIN PERIOD IN FRACTION OF DAY
74-80			FREE

DATA PART OF REC

81	INTEGER	0	- GOOD QUALITY
		1-7	- BAD QUALITY
82	INTEGER	0	- Y - SENSOR
		1	- X - SENSOR
83	INTEGER		AMPLIFICATION FACTOR
			(0 - .4, 1 - .08
			2 - 10., 3 - 2.)
84	INTEGER		FACTOR, ONLY IN AVERAGE TAPES
85-86	REAL		SAMPLING RATE (IN AVERAGE TAPES
			NUMBER OF GOOD VECTORS FOUND
			IN THIS AVERAGE INTERVALL,
			SEE WORD 41,42)
87-118	REAL		16 WORDS, 8X,8Z,7X,7Z,...,1X,1Z
			FOR MEAN VALUES
87-102	INTEGER		16 WORDS, 8X,8Z,7X,7Z,...,1X,1Z
			FOR MAXIMAL VALUES

REPETITIONS FOR N MORE VECTORS AS SPECIFIED IN WORD 10

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100 **

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LINES = 60
POLL = TRUE  (I.E. BATCH = FALSE)
REAR = TRUE (I.E. FRONT = FALSE)
DELTA =       1
CURRENT DEPTH = 0, THE DEPTH LIMIT = 10
RIGHT =72
LENGTH = 72
LONG = TRUE (I.E. SHORT = FALSE)
TIME = 50
TOTAL NUMBER OF CURRENT LINES = 100
FROM =        1
LEFT =  1
FIXED = TRUE (I.E. VARIABLE = FALSE)
SIZE = 0
DISPLAY = TRUE (I.E. QUIET = FALSE)
FORMAT=DEFAULT
NO TABS USED
FILES:
    WORK: K0641640
    KEEP:
    TEXT: E4FORMAT.GBEIN.E4          THU, MAR  5, 1981,  4:40 PM
    JOIN:
```