VOYAGER

Meeting of Field- and Particle-P.I.'s : Jupiter Encounter Preparation

8/14/78

Agenda:

THE FOLLOWING IS A SUGGESTED AGENDA FOR THE 14 AUGUST 78 GSFC MEETING ON VOYAGER-ENCOUNTER DATA PRODUCTS, POTENTIAL SCIENCE OBJECTIVES AND RELATED TECHNICAL ISSUES. 10:00AM-INTRODUCTORY REMARKS (N.F.NESS). 10:10-DESCRIPTION OF EACH EXPERIMENT'S DATA PRODUCTS FOR APPROX 20 MIN/EXP (ORDER: MAG,PLS,LECP,CRS,PWS,PRA) PLUS 20 MIN INTERACTION. 12:30 - LUNCH. EXAMPLE OF MAG'S CONTRIBUTION TO THE MORNING MEETING: (1) DATA CONTENT FROM BOTH NERT FILE AND THOSE AVAILABLE AT GSFC (AND AT JPL VIA RAPIFAX), I.E. MAGNITUDE, ANGLES,TYPES OF COMPONENTS, AND RMS"S, (2) COORDINATE SYSTEMS, SUCH AS PAYLOAD, HELIOGRAPHIC, AND PLANTOCENTRIC, (3) FORMATS, INCLUDING SCALES AND PHYSICAL SIZES, TYPE OF AVERAGES, TIME INTERVALS, ETC. (4) GENERAL COMMENTS ON TENTATIVE TEAM PLANS ON EAST-WEST COAST COORDINATION FOR, AT LEAST, CRUCIAL NEAR-ENCOUNTER PERIOD (I.E. WHO WILL BE WHERE AND WHEN FOR JUPITER 1). PLEASE BE PREPARED TO DISCUSS YOUR DATA PRODUCTS IN SIMILAR MANNER (WHERE BY ANALOGY TO OUR RMS DISCUSSION, IS YOUR FLUX MEASURED "OMNI" OR IS THERE DIRECTIONAL DEPENDENCE?, FOR EXAMPLE) ALSO PLEASE BRING 20 COPIES OF HANDOUTS DESCRIBING YOUR DATA PRODUCTS AND ANY OTHER USEFUL INFORMATION. AT 01:30PM PROJECT SCIENTIST DISCUSSES PROJECT NEEDS AND DESIRES. AT 01:50 PROGRAM SCIENTIST DISCUSSES PROGRAM CONCERNS. AT 2:15 A DUSCUSSION OF CURRENT STATUS OF VOYAGER DATA TAPES (EDRS) AND PROBLEMS. AT APPROXIMATELY 02:45 MEETING ASSUMES AN OPEN FORMAT WHERE POTENTIAL ENCOUNTER SCIENTIFIC TOPICS ARE ADDRESSED; SOME SUGGESTIONS ARE: IO FLUX TUBE, JOVIAN ELECTRONS, UPSTREAM WAVES, DECAMETRIC DATA, JUPITER "FLOPPY DISC" CORRELATION OF V1 AND V2 DATA DURING ENCOUNTER ETC. IF TIME PERMITS SOME DISCUSSION ON TECHNICAL OR GENERAL ISSUES MIGHT BE APPROPRIATE, E.G. PLANS FOR USE OF NON-ENCOUNTER VOYAGER DATA FOR SUPPORT; DATA COPYING AND TRANSFER (E.G. RAPIFAX); REASONABLE SHARING OF REMOTE-NORT LINE, WHERE RELEVANT; REASONABLE PRE-REQUEST PI-TO-PI TO EXPIDITE OPERATIONS; CAN JPL HANDLE Q.L.-EDR REQUESTS IN EVENT OF R-NORT FAILURE? CAN WE AVOID DUPLICATIVE EFFORTS IN PRODUCING ANY SUPPORT DATA? HOW ABOUT USE OF IMP (EARTH) AND ISEE DATA FOR ENCOUNTER SUPPORT? AT APPROX 4:00PM MEETING ADJOURNS TO SEEK LIQUIDITY.

MAG DATA CONTENT, PRODUCTS, AND TYPE (AVE)

- Basic sample rate of LFM's is 16 2/3 samples/sec (60 msec)
  [This is available in CR-1 and GS-3]

- Production data:
  - Summary tapes – 1.92, 9.6, and 48 sec aves.
  - Hourly ave tapes and plots (0.8 cm/day)
  - Daily ave tapes and plots.
  - Microfilm plots of 9.6 sec aves. (3 HRS/frame)
  - Microfiche P.O. of 9.6 sec. aves.

- Encounter data:
  - Production data products available via Remote-NORT generated Q.L. tapes
  - NERT (JPL level II): 48 sec ave. plots and P.O.; plot examples to be shown.
  - R-NORT (GSFC) Q.L.: 9.6 sec. ave plots and P.O.; plot example to be shown. Also Q.L. hourly ave cards.

MAG DATA CONTENT

- Production 9.6 sec plots: B_N, F, λ, δ, RMS.
- Production 9.6 sec P.O.: F, λ, δ, B_R, B_T, B_N, RMS, N (no. pts in ave.)

  — where $RMS = \sqrt{RMS_R^2 + RMS_T^2 + RMS_N^2}$
- Summary tapes: Production P.O. quantities plus component RMS's
- Hourly ave plots: F, λ, δ, RMS. (Also various RMS's on tape)
- NERT 4.8 sec (level II): Choice of either
  - Plots { F, Long., Lat., RMS (nominal set) or F, Component RMS's, RMS (Inner or Outer)
  - P.O. { Complete set of quantities.
- Remote NORT Q.L.: Same as Production plot and P.O. quantities

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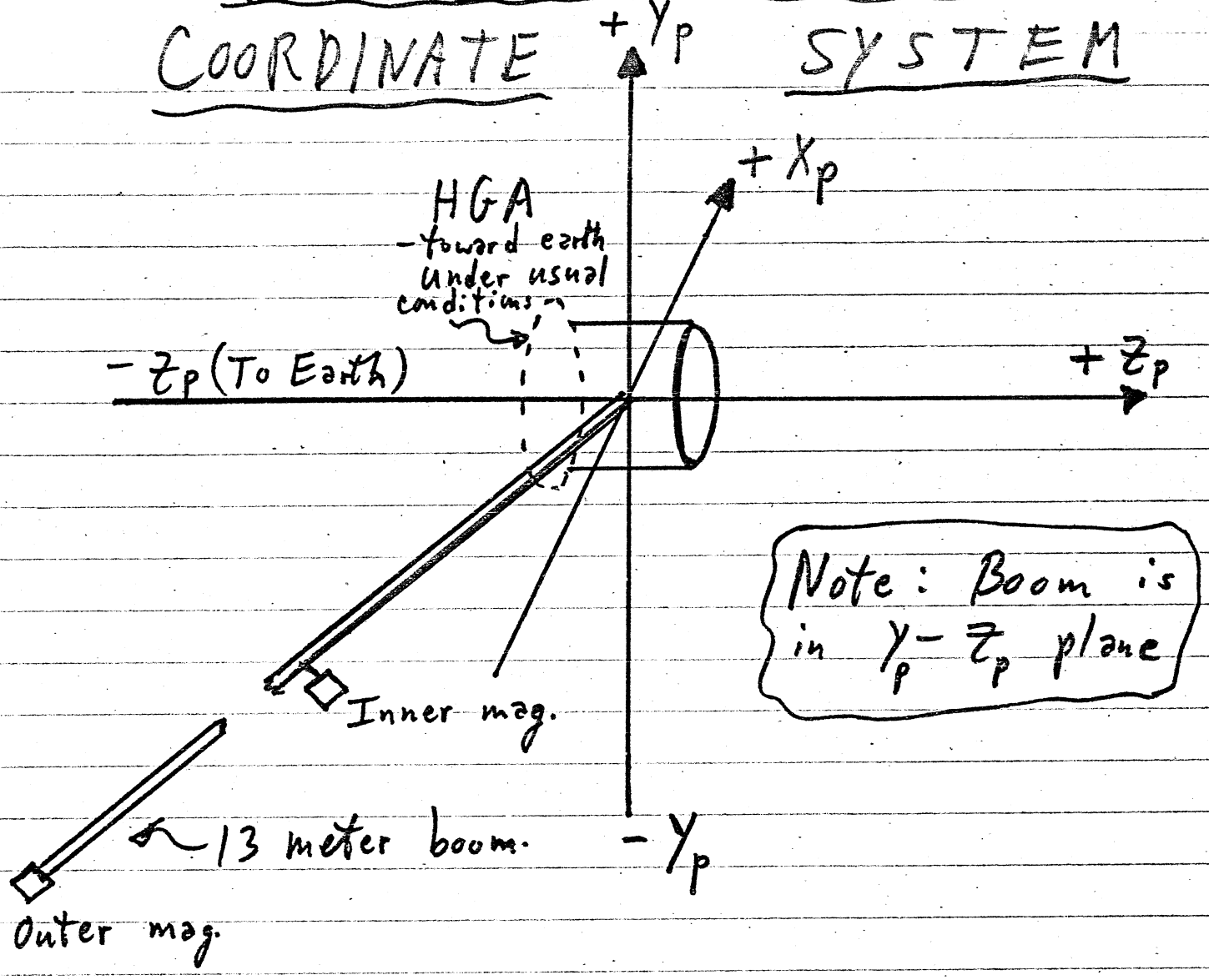
Special Request Item: Detail tape, plot, and/or P.O. (i.e. 60 msec at encounter).

COORDINATE SYSTEMS

- Inertial Heliographic (IHG) for S/C position, esp. for cruise.
- Payload (essentially same as MAG sensor coords.).
- Heliographic (HG) or $\hat{R}, \hat{T}, \hat{N}$ system.
- Jupiter System III (1965) at encounter when SEDR is available.
- Jupiter Centered $\hat{S}, \hat{J}$ System (Smith et al.) a possibility; similar to Earth's GSM system.

VOYAGER PAYLOAD COORDINATE SYSTEM

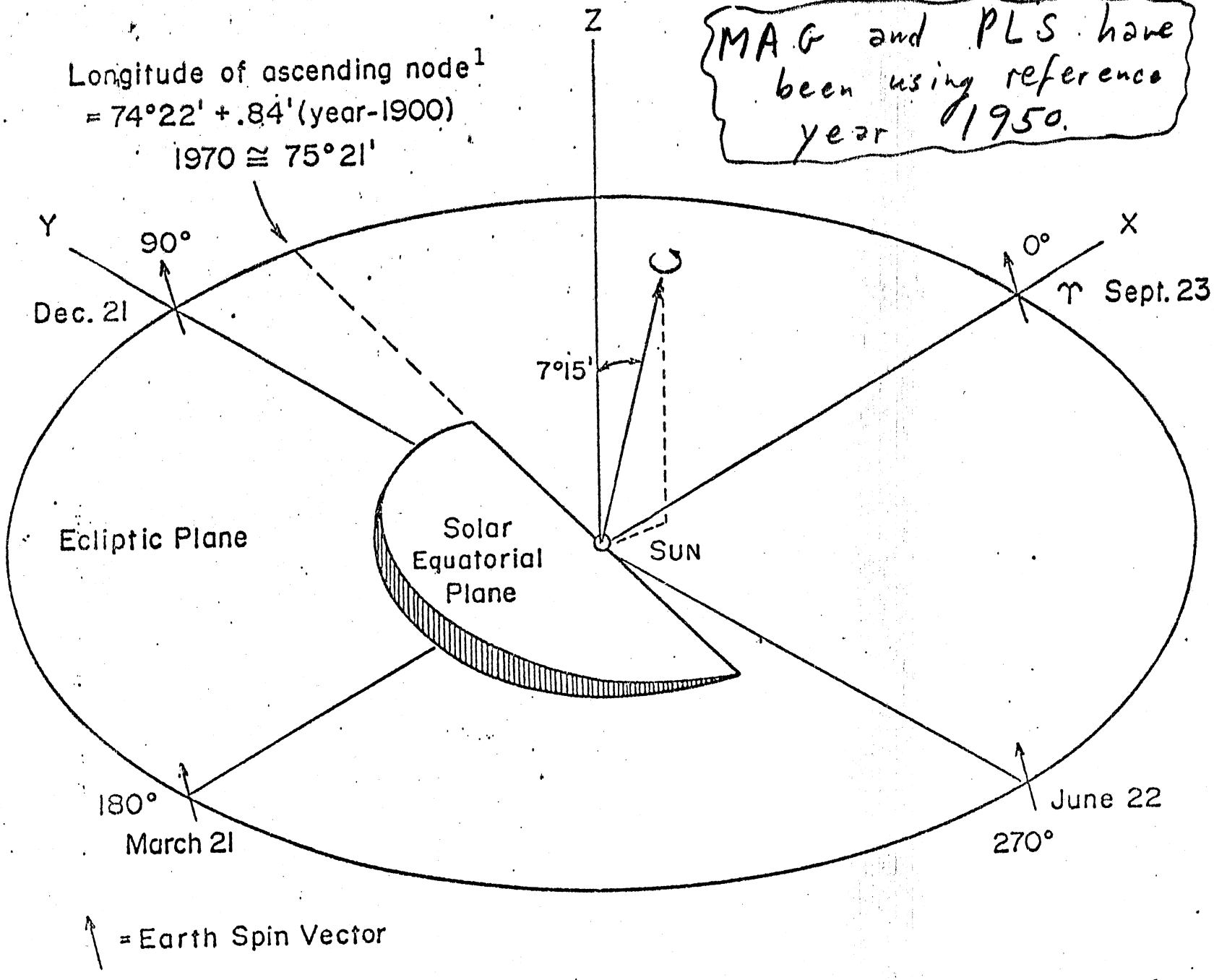


Note: Boom is in $Y_p - Z_p$ plane

Mag sensor axes are aligned with spacecraft (payload) axes.

RELATIONSHIP BETWEEN SUN CENTERED ECLIPTIC AND INERTIAL HELIOGRAPHIC COORDINATES

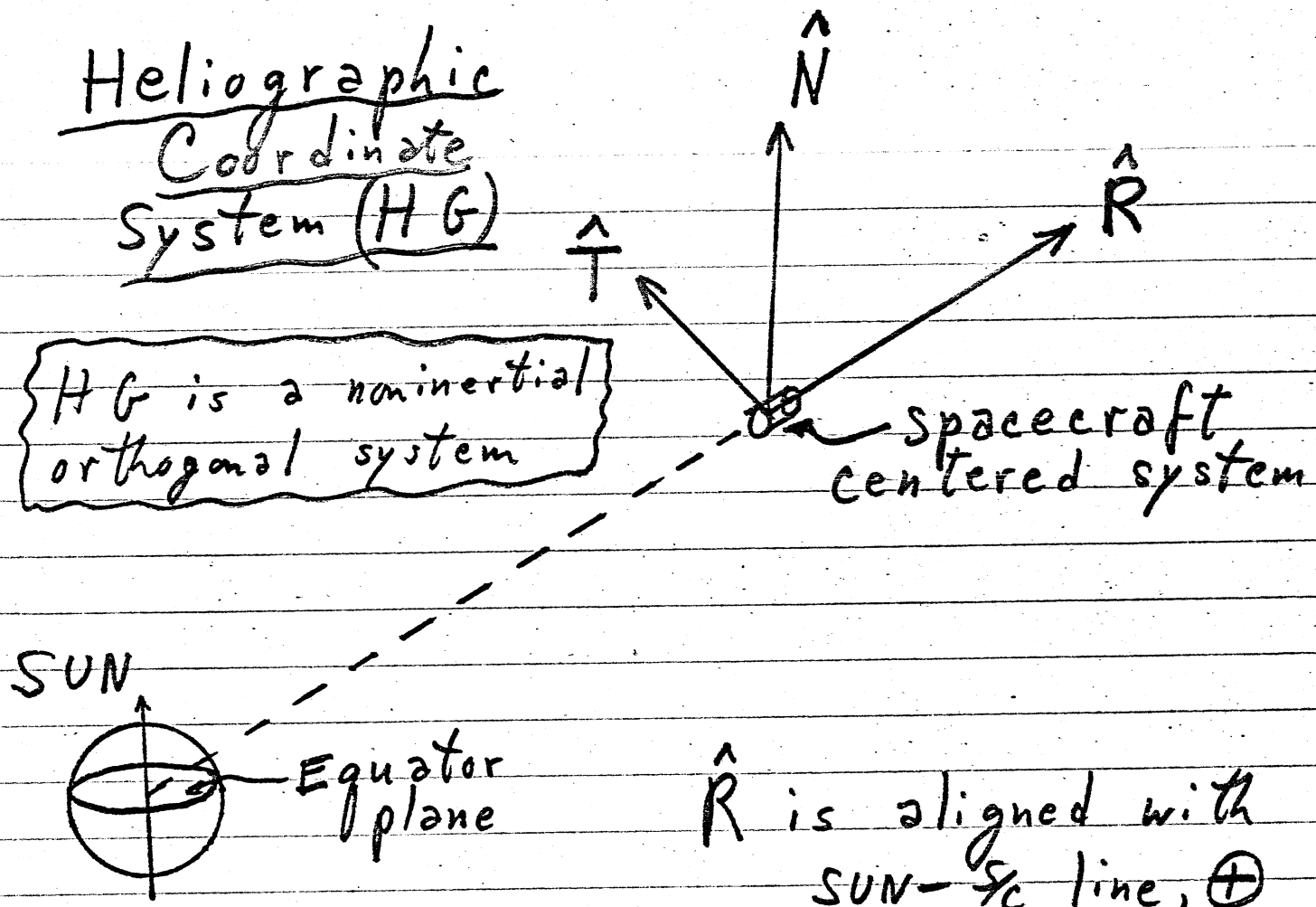
MAG and PLS have been using reference year 1950.



1 "Explanatory Supplement to the Astronomical Ephemeris and the American Ephemeries and Nautical Almanac", Her Majesty's Stationary Office, London, 1962. See p. 489 and p. 307

Production Data Coords: MAG and PLS

Heliographic Coordinate System (HG)



HG is a noninertial orthogonal system

$\hat{R}$ is aligned with SUN–S/C line, ⊕ away from SUN.

$\hat{T}$ is ⊥ to $\hat{R}$ and lies in a plane parallel to the SUN's Equator plane, ⊕ in direction of SUN's rotation.

$$\hat{N} = \hat{R} \times \hat{T}$$

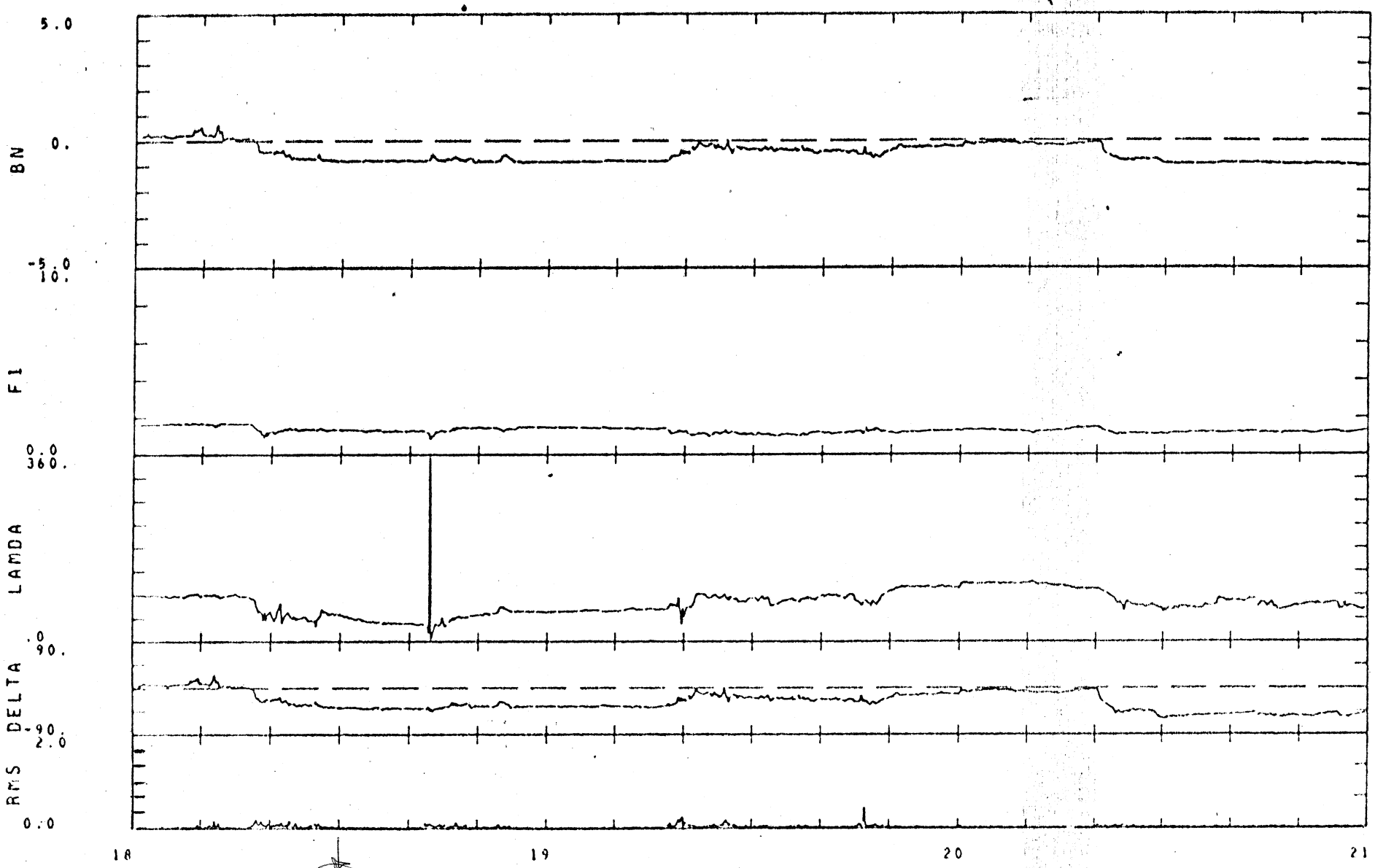
Also $B = \sqrt{B_R^2 + B_T^2 + B_N^2}$

$$\lambda = \tan^{-1}\left(B_T / B_R\right)$$

$$\delta = \sin^{-1}\left(B_N / B\right)$$

VOYAGER 2 HG COORD 9.6 SEC AVG DATE 78/91/18

(1 April '78, HR = 18)



INC(R,TH,PH) 2.66 0.40 0.01

OB S/C FIELD 0.0 0.0 0.0
STAT/CMD CR-2 86A080

FRAME 42
RUN 21.04.30.23 07/26/78

PLOT TIMES 223.75000 223.87500
NOPTS/TAPES 5600 676 452 677 M20153

6/8/78

Probably best to put all labeling inside boxes, eg: time F δ, V, N. as well as A, B, C, D, E 1,2.

5"

1 F

2 δ or φ

3 δ or θ

4 RMS

N.B. Histograms of upper 2 blocks will have equal spaced bars. Lower (A,B,C,D,E) will be unequal.

Mag 9.6 sec Avgs

4 sub panels histograms

Preliminary

Drawing To Scale

0.5" = 1.0"

5"

N

V

Flow Angles

Temps.

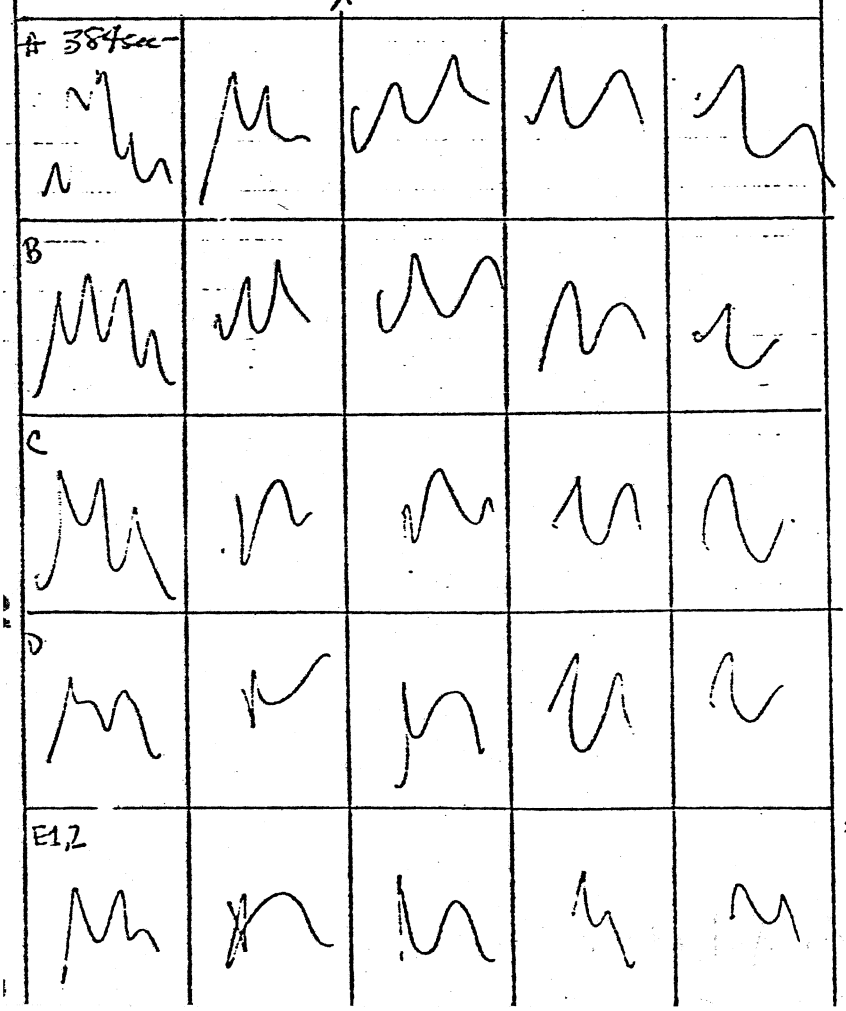
Plasma 384 sec points, histo

5 sub-panels

Bottom sub panel dual tr

1920

8" = 1920 sec (i.e. 32 min)



128 pt histograms dual trace

"

"

"

16 & 32 pt histograms single trace.

MAG Digital Plot Processing

At the end of each processing cycle in mode 1a, the eleven parameters to be plotted are calculated. If the effect of missing data is such that a parameter value cannot be computed for a particular period, then this shall be indicated by plotting a blank for the affected parameter.

Plot Characteristics

The capability of using a logarithmic or linear horizontal axis scale is required. There shall be 3 types of plotting page formats and associated parameters:

		Horizontal Spacing
(A)	Ambient Field Magnitude (F)	4 inches
	Outboard LFM RMS(X)	1 inch
	Outboard LFM RMS(Y)	1 inch
	Outboard LFM RMS(Z)	1 inch
	Outboard Pythagorean Mean RMS	1 inch
		8 inches

(B) Exactly as Type (A), however using Inboard components.

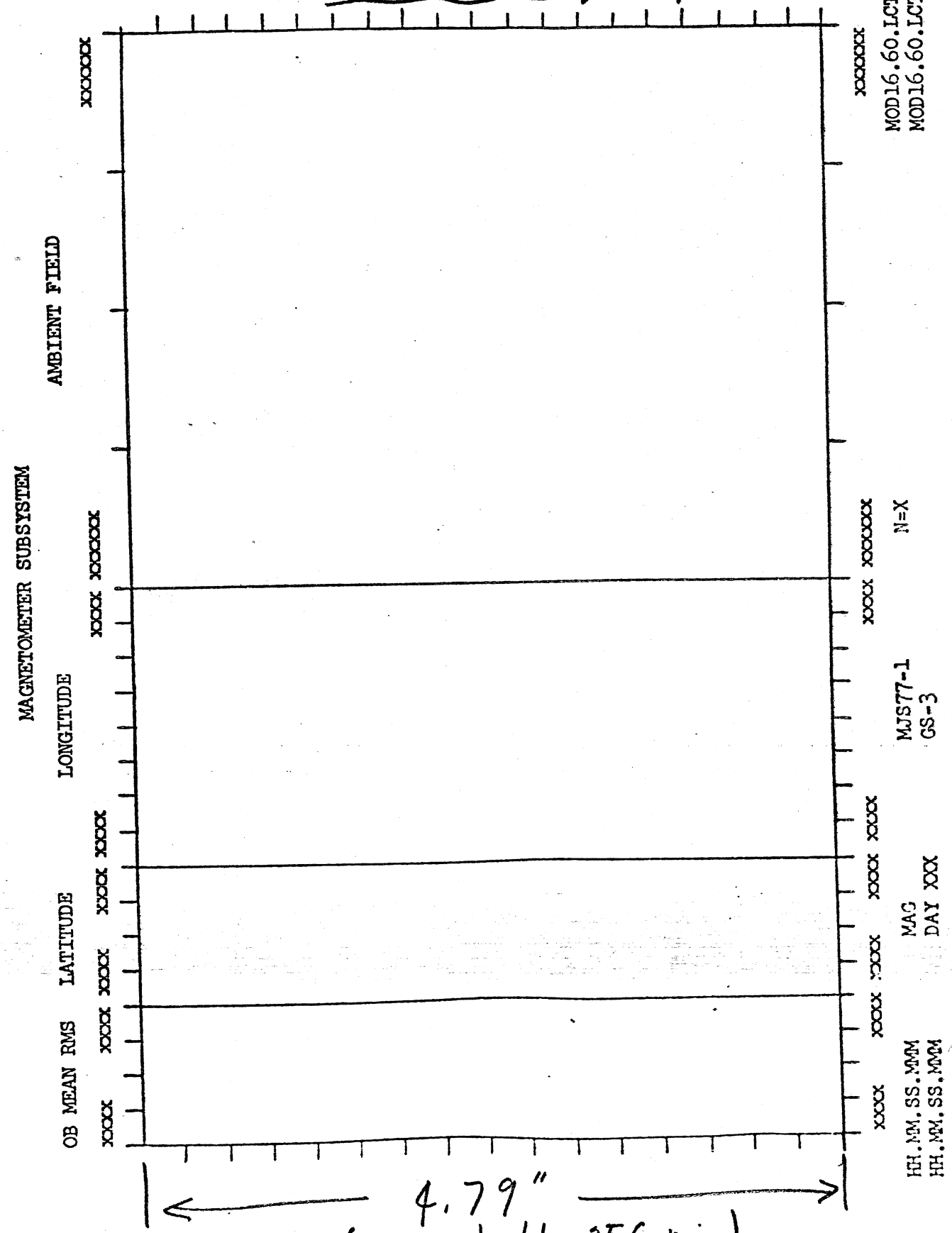
Ambient Field Magnitude (F)	4 inches
Inboard LFM RMS(X)	1 inch
Inboard LFM RMS(Y)	1 inch
Inboard LFM RMS(Z)	1 inch
Inboard Pythagorean Mean RMS	1 inch
	8 inches

(C)	Ambient Field Magnitude (F)	4 inches
	Latitude	1 ~~2~~ inches
	Longitude	2 ~~1~~ inch
	Outboard Pythagorean Mean RMS	1 inch
		8 inches

Scaling mode and scaling factors are user input. (Scaling mode = LOG or LIN)
Two - raster wide vertical line shall separate the individual fields.

Figure 2c. Type C Plot Framework

48 sec. averages plotted

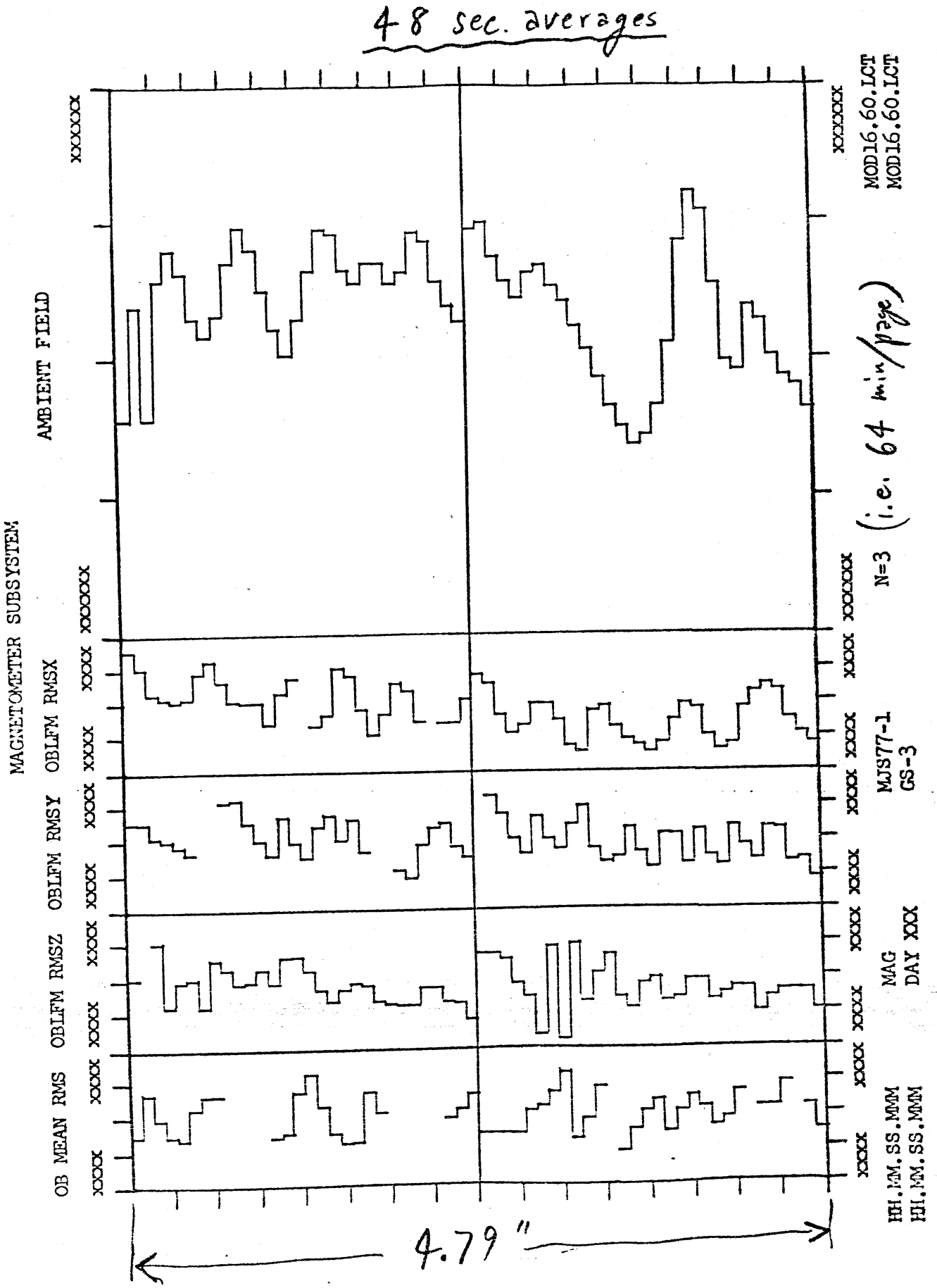


4.79"

(in probably 256 min.)

Possibilities: $\Delta t = (16\ m) \times 2^N$ $(N=0,\ldots,5)$

Figure 3. Sample MAG Plot



Hourly Ave tapes keep card format.

VOYAGER 1,2 CRUISE HOURLY AVG CARD FORMAT

FORMAT	EXPLANATION OF QUANTITIES
A1	'1' Voyager 1 or '2' Voyager 2
A2	Coordinate System (HG)
I4,3I5	R, X, Y, Z Spacecraft Position in Inertial HG Coords. For R<10 A.U., quantities are multiplied by 1,000 (i.e., to use, divide value on cards by the factor 1,000 to give A.U.) For R ≥ 10 A.U., factor becomes 100.
I2	Year
I3	Day (Calendar); Jan 1=1
I2	Hour
F5.2	$F1 = (\sum_{i=1}^{N} F_i)/N$, Ambient Field in γ's.
F5.1	δ, in degrees.
F5.1	λ, in degrees.
I2	N, Count of 48 second averaged data included in the hourly average.
F6.3	$\sigma_c = \sqrt{RMS_R^2 + RMS_T^2 + RMS_N^2}$
F5.3	σ_{F1}
3F6.3	$RMS_{R,\ T,\ N}$
F5.2	$F2 = \sqrt{\bar{B}_R^{\,2} + \bar{B}_T^{\,2} + \bar{B}_N^{\,2}}$

} in γ's.

NOTE: For encounter this will be either blank or replaced with a Jupiter system. Also all quantities in γ's will have the decimal point shifted to the right as appropriate.

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2HG.  0    0    0    07726510 6.42 48.9241.675 2.0970.276  0.94  1.21  1.44 8.14
C
STATEMENT NUMBER        FORTRAN STATEMENT                                  IDENTIFICATION
```

This is page 2.6-1 of GSFC X-doc: X-694-76-242, Rev. June 1978. "Commonly Used Digital Tape, Disk And Card Formats."

- MAG TEAM -

WHO WILL BE WHERE AND WHEN: JUPITER 1

AT JPL:

Norm Ness, C.A. ± ?

Mario Acuña, approx. 2 weeks.

Fritz Neubauer, approx 2 weeks.

AT GSFC:

Ken Behannon, ≈ 1 March onward.

Len Burlaga } For entire
Ron Lepping } encounter period.

Communication of data and figures between GSFC ⇄ JPL via RAPIFAX over telephone lines.