SUMMARY TAPE

The Summary tape is a labelled tape. The data section has many logical record, each logical record is made up of a header plus one or more subsections as diagrammed below.

```
/*COMMENT ALL TAPE REQUESTS FROM MIT (CSPR) CART
/*SETUP UNIT=T6250,ID=(GS5P03,NORING,SAVE,SL),                    X
/*C='SLOT  PT0247'
//GO.FT12F001    DD  UNIT=(T6250),LABEL=(,SL),DISP=(OLD,PASS),
//   DCB=(RECFM=VBS,LRECL=4224,BLKSIZE=18260),
//   DSN=VOYAGER.CONJOINT.MAG.PLS,
//   VOL=SER=GS5P03
```

ENG - ENGINEERING	
Header 32 words	SELECTED ENGINEERING DATA 2-240 words

LFM - MAGNETOMETER		
Header 32 words	MAG DATA 496 words	SEDR 50 words

M - PROTON MODE			
Header 32 words	OUTPUT DATA 150 words	SEDR 50 words	RAW DATA 256 words

L - PROTON MODE			
Header 32 words	OUTPUT DATA 150 words	SEDR 50 words	RAW DATA 32 words

E1/E2 - ELECTRON MODE			
Header 32 words	OUTPUT DATA 80 words	SEDR 50 words	RAW DATA 8 words

Note that the records are of variable length and that there is a word in the HEADER that allows these records to be read by a Fortran read without error. Fortran can also read these records by reading into a large array and accepting the end of record error (this is usually faster).

This block is the first block in all SUMMARY tape records.

HEADER to SUMMARY TAPE RECORDS

WORD	NAME	TYPE	MEANING
1	ID	A4	Data identifier i.e. 'ENG ', 'LFM ', 'M ', 'L ', 'E1 ', E2 ', 'HDR1', 'HDR2', 'HDR3'
2	TELFMT	A4	Telemetry format
3	SCID	A4	Spacecraft ID, 'FLT1', 'FLT2'
4	IYR	I2	Year of data (time tag at beginning of data block)
	IDAY	I2	Day of year (Jan 1 = 1)
5	IHR	I2	Hour of day (0-23)
	MIN	I2	Minute of hour (0-59)
6	ISEC	I2	Second of minute (0-59)
	MSEC	I2	Millisecond (0-999)
7-8	DDAY	R8	Decimal day of year of data (Jan 1 = 0)
9-10	EPICDAY	R8	Decimal day count since 20 Aug. 1977
11	TYPE	A4	Type of time, SCET or ERT.
12	BLOCKTIM	R8	Time period of this data block in seconds.
13	COUNT16	I2	2**16 seq counter of data at time of telemetry readout (increments once in 48 min)
	MOD60		Modulo 60 seq counter of data readout (increments once in 48 sec)
14	LINECNT	I2	Line counter of data readout (1-800) (increments once in 60 ms)
			Spare
15	STATUS	Z4	Status word
16	COMMAND	Z4	Command
17	ID2	I2	Data identifier LFM=1, HFM=2, M=3, E1=4, L=5, E2=6, ENG=7, HDR1=8, HDR3=10
	MODE	I2	Data telemetry mode GS-3=0, CR-1=1, CR-2=2, CR-3=3, CR-4=4, CR-5A=5, CR-6A=6, CR-6B=7, CR-5B=8, CR-7S=9, CR-7L=10, GS-5S=11, GS-5L=12
18			SPARE
19-20	MEDDLE	A8	A character
21-22			SPARE
30-31			
32	NREC	I2	Record number on tape
	NWORD	I2	Number of words remaining in logical record.

ANSWER ARRAY M & L

DESCRIPTION OF ANSWER (ANS) ARRAY

WORD	QUANTITY	MNEMONIC	TYPE	DEFINITION	UNITS	SET BY
1 a)			I2	number of words in ANS array		many
b)		NTALLY		tally of the calls to PLSANL		PLSANL
2 a)		IPK (4)	I2	peak channel number sensor A		KNTCUR
b)			I2	B		
3 a)			I2	C		
b)			I2	D		
4			R4	delta time from start of mode to peak	sec	KNTCUR
5	Bx	BX	R4	components of B field in spacecraft coordinates (x,y,z)	q	GETFLD
6	By	BY				
7	Bz	BZ				
8		BMAG	R4	square root of sum of squared average components	q	GETFLD
9		F2	R4	average of $(B_x^2 + B_y^2 + B_z^2)^{1/2}$	q	GETFLD
10		RMS (3)	R4	vector RMS of B field, spacecraft coordinates	q	GETFLD
11						
12						
13		NA	I4	number of MAG samples in this average (0 if bad data)		GETFLD
14			R4	delta time from peak to mag field average	sec	GETFLD
15			R4	time period of field average	sec	GETFLD

---------- Moment Calculations ----------

Moments usually taken over 8 channels above peak and 12 below. Stopped at 3 times noise level or saturation see items 16 through 19.

DESCRIPTION OF ANSWER (ANS) ARRAY (cont)

WORD	QUANTITY	MNEMONIC	TYPE	DEFINITION	UNITS	SET BY
16	$J_{A_{mom}}$	JACUPMOM	R4	number of channels used in moment calculation, cup A		PRANAL
17	$J_{B_{mom}}$	JBCUPMOM		B		
18	$J_{C_{mom}}$	JCCUPMOM		C		
19	$J_{D_{mom}}$	JDCUPMOM		D		
20	ρ_A	NACUP	R4	density from moments, for each cup	#/cc	MPMENT
21	ρ_B	NBCUP				
22	ρ_C	NCCUP				
23	ρ_D	NDCUP				
24	V_{A_n}	VACUPN	R4	velocity component along normal of each cup	km/sec	PRANAL MOMENT
25	V_{B_n}	VBCUPN				
26	V_{C_n}	VCCUPN				
27	V_{D_n}	VDCUPN				
28	$V_{x_{mom}}$	VXMOM	R4	velocity from moments, spacecraft coordinates x,y,z (i.e. no aberration correction)	km/sec	PRANAL
29	$V_{y_{mom}}$	VYMOM				
30	$V_{z_{mom}}$	VZMOM				
31	V	VMAG	R4	velocity from moments, spacecraft R, r, d	km/sec	PRANAL
32	θ_{mom}	THETAMOM				
33	ϕ_{mom}	PHIMOM				
34	W_{A_n}	WACUPN	R4	thermal speed from moments, for each cup	km/sec	PRANAL MOMENT
35	W_{B_n}	WBCUPN				

36	W_{C_n}	WCCUPN				
37	W_{D_n}	WDCUPN				
38	δ_{mom}	NBARMOM	R4	average density from moments		
39	w_n	DN	R4	density criterion (no transparency correction)		
40	W_{mom}	WMOM	R4	thermal speed from moment (reconstructed using field)	km/sec	PRANAL MOMENT
41	A	A1P	R4	anisotropy of proton thermal speed (moments), Wpar/Wperp		PRANAL
42	X_w^2	CHI2W	R4	cost function (normalized square of residuals) for thermal speed fit by PARPER		PRANAL/ (PARPER)
43	q_A	QACUPMOM	R4	heat flux from moments for each cup	km/sec	PRANAL MOMENT
44	q_B	QBCUPMOM				
45	q_C	QCCUPMOM				
46	q_D	QDCUPMOM				
47	$Q_{\parallel}+5*Q_{\perp}$	QPAR	R4	Q parallel + 5*Q perpendicular again reconstructed and unreliable		PARPER/ PRANAL
48	X_q^2	CHI2Q	R4	normalized square residuals for heat flux		PRANAL

---------- Fit Calculations ----------

There are several fitting options; the default is an anisotropic proton and an isotropic alpha maxwellian. Items 49 through 63 summarize the results of the fitting procedure. The quantities are averages over the appropriate peaks weighted by the number density of the peaks.

DESCRIPTION OF ANSWER (ANS) ARRAY (cont)

WORD	QUANTITY	MNEMONIC	TYPE	DEFINITION	UNITS	SET BY
49	$V_{x_{fit}}$	VXBARPFT	R4	velocity of protons from fit routine spacecraft coordinates x,y,z	km/sec	PRANAL/ MJSFIT
50	$V_{y_{fit}}$	VYBARPFT				
51	$V_{z_{fit}}$	VZBARPFT				
52	ρ_{fit}	NBARPFT	R4	density of protons from fit		MJSFIT
53	W_{fit}	WBARPFT	R4	thermal width of protons from fit, averaged	km/sec	PRANAL/ MJSFIT
54	A_{fit}	ABARPFT	R4	anisotropy of protons from fit		PRANAL/ MJSFIT
55	q_{fit}	QBARPFT	R4	heat flux of protons from fit, normalized		PRANAL/ MJSFIT
56	$V_{x_{fit}}$	VXBARAFT	R4	velocity of alphas from fit, spacecraft x,y,z	km/sec	PRANAL/
57	$V_{y_{fit}}$	VYBARAFT				
58	$V_{z_{fit}}$	VZBARAFT				
59	n_{fit}	NBARAFT	R4	density of alphas from fit		MJSFIT
60	W_{fit}	WBARAFT	R4	thermal width of alphas from fit	km/sec	PRANAL/ MJSFIT
61	A_{fit}	ABARAFT	R4	anisotropy of alphas from fit		PRANAL/ MJSFIT
62	q_{fit}	QBARAFT	R4	heat flux of alphas from fit, normalized		PRANAL/ MJSFIT
63	$V_\alpha - V_p$	DVAMPFT	R4	delta velocity between alphas and protons from fit	km/sec	PRANAL/ MJSFIT

---------- fit, information on first peak ----------

DESCRIPTION OF ANSWER (ANS) ARRAY (cont)

WORD	QUANTITY	MNEMONIC	TYPE	DEFINITION	UNITS	SET BY
64	$V_{x_{1p}}$	VS1P	R4	velocity of first proton peak, spacecraft x,y,z	km/sec	PRANAL MJ[IT]
65	$V_{y_{1p}}$	VY1P				
66	$V_{z_{1p}}$	VZ1P				
67	ρ_{1p}	N1P	R4	density of first proton peak		MJSFIT
68	$W_{\parallel_{1p}}$	WPAR1P	R4	thermal width parallel to B field for first proton bi-maxwellian	km/sec	PRANAL/ MJSFIT
69	$W_{\perp_{1p}}$	WPER1P	R4	thermal width perpendicular to B field for first proton bi-maxwellian	km/sec	PRANAL/ MJSFIT

---------- fit, information on second peak ----------

DESCRIPTION OF ANSWER (ANS) ARRAY (cont)

WORD	QUANTITY	MNEMONIC	TYPE	DEFINITION	UNITS	SET BY
70	V_{1p}-V_{2p}	DV2P	R4	difference in bulk velocity between first and second proton (along B required)	km/sec	PRANAL/ MJSFIT
71	ρ_{2p}	N2P	R4	density of second proton fit		MJSFIT
72	W_{2p}	WPAR2P	R4	thermal width of second proton maxwellian parallel to B field	km/sec	PRANAL/ MJSFIT
73	W_{2p}	WPER2P	R4	thermal width of second proton; maxwellian; perpendicular to B field	km/sec	PRANAL/ MJSFIT

---------- fit, information on first alpha peak ----------

DESCRIPTION OF ANSWER (ANS) ARRAY (cont)

WORD	QUANTITY	MNEMONIC	TYPE	DEFINITION	UNITS	SET BY
74	$V_{1\alpha}$-V_{1p}	DV1A	R4	velocity difference between first proton and first alpha,	km/sec	PRANAL/ MJSFIT
75	$\rho_{1\alpha}$	N1A	R4	density of first alpha,		MJSFIT
76	$W_{\parallel_{1\alpha}}$	WPAR1A	R4	thermal width of first alpha, parallel to B	km/sec	PRANAL/ MJSFIT
77	$W_{\perp_{1\alpha}}$	WPER1A	R4	thermal width of first alpha, perpendicular to B	km/sec	PRANAL/ MJSFIT

----------fit information on second alpha peak ----------

DESCRIPTION OF ANSWER (ANS) ARRAY (cont)

WORD	QUANTITY	MNEMONIC	TYPE	DEFINITION	UNITS	SET BY
78	$V_{2\alpha}$-V_{1p}	DV2A	R4	velocity difference between second alpha and first proton,	km/sec	PRANAL/ MJSFIT
79	$\rho_{2\alpha}$	N2A	R4	density of second alpha		MJSFIT
80	$W_{\parallel_{2\alpha}}$	W2a	R4	thermal width of second alpha parallel to B field	km/sec	PRANAL/ MJSFIT
81	$W_{\perp_{2\alpha}}$	WPER2A	R4	thermal width of second alpha perpendicular to B field	km/sec	
82	$Log_{10}X^2$	LOGHI2	R4	log10 of cost function (sum of squares of residuals)		

----------general information ----------

DESCRIPTION OF ANSWER (ANS) ARRAY (cont)

WORD	QUANTITY	MNEMONIC	TYPE	DEFINITION	UNITS	SET BY
83	$Log_{10}X^2$ ext	LOGCHI2E	R4	log10 of cost function (sum of squares of residuals over all data)		
84	ICALL	ICALL	R4	number of iterations performed by fit routine		
85	IQUAL	IQUAL	R4	related to reason for termination of fit procedure		
86	$J_{A_{fit}}$	JACUPFT	R4	number of channels from each cup used in fit		
87	$J_{B_{fit}}$	JBCUPFT				
88	$J_{C_{fit}}$	JCCUPFT				
89	IXCEL	IXCEL	R4	number of saturated channels		
90	t1	T1	R4	transparency correction (due to angle) for each main cup		PRANAL
91	t2	T2				
92	t3	T3				

----------summary of analysis with aberration corrections made to velocities----------

DESCRIPTION OF ANSWER (ANS) ARRAY (cont)

WORD	QUANTITY	MNEMONIC	TYPE	DEFINITION	UNITS	SET BY
93	$\rho_{1_{cor}}$	N1COR	R4	moment densities corrected for trasparencies		
94	$\rho_{2_{cor}}$	N2COR				
95	$\rho_{3_{cor}}$	N3COR				
96	B_R	BR	R4	B field in RTN coordinates	q	
97	B_T	BT				
98	B_N	BN				
99	$V_{R_{mom}}$	VRMOM	R4	moment proton velocities in RTN coordinates	km/sec	
100	$V_{T_{mom}}$	VTMOM				
101	$V_{N_{mom}}$	VNMOM				
102	V_{mom}	VMAGMOM	R4	moment proton speed	km/sec	
103	$NS<)_{mom}$	NSANMOM		North-South angle of flow = ATAN2 (VN/SQRT(VR2 + VT2))	degrees	
104	$EW<)_{mom}$	EWANMOM		East-West angle of flow = -ATAN2 (VT,VR)	degrees	
105	$V_{R_{fit}}$	VRPFT	R4	proton velocity in RTN coordinates, fit	km/sec	
106	$V_{T_{fit}}$	VTPFT				
107	$V_{N_{fit}}$	VNPFT				
108	fit	VMAGPFT	R4	proton speed, fit	km/sec	
109	$NS<)_{fit}$	NSANPFT		flow angles, fit (defined as above)	degrees	
110	$EW<)_{fit}$	EWANPFT				
111	$V_{R_{fit}}$	VRAFT	R4	alpha velocity in RTN coordinates, fit	degrees	
112	$V_{T_{fit}}$	VTAFT				
113	$V_{N_{fit}}$	VNAFT				

114	fit	VMAGAFT	R4	alpha speed, fit	km/sec
115	NS<)$_{fit}$	NSANAFT		alpha flow angles, fit	
116	EW<)$_{fit}$	EWANAFT			
117	$\rho_{\alpha_{mom}}$	NAMOM		alpha number density, moments	
118	$W_{\alpha_{mon}}$	WAMOM		alpha thermal speed, moments	km/sec
119	$V_{x_{\alpha_{mom}}}$	VXAMOM		alpha velocity, moments, s/c coord ¬ abberation correction)	km/sec
120	$V_{y_{\alpha_{mom}}}$	VYAMOM			
121	$V_{z_{\alpha_{mom}}}$	VZAMOM			
122	IPAa	IPACUPA		pk channel for alpha in each cup (estimated-not useful)	
123	IPBa	IPBCUPA			
124	IPCa	IPBCUPA			
125	NCHANp	NESTCHP		estimate of of channels from peak to 1/e of peak. derived from moment calculation	
126	NCHANa	NESTCHA		ditto for alphas	
127	V_α-V_{mom}	VAMPMOM		speed difference, not necessarily along B, moments	km/sec
128	<) (V_α-V_p,B)	ANVAMPB		angle to B field	degrees
129	wna	DNA		density criterion for alphas	
130	cos(B:,n:A)	COSBACUP		cosines of angles between BT and cup normals	
131	cos(B:,n:B)	COSBBCUP			
132	cos(B:,n:C)	COSBCCUP			
133	$W_{p_{mom}}$	WBARPMOM		estimate of thermal speed	km/sec
				from moments: (WA2 + WB2 + WC2)1/2	

This is the answer array for all electron data.

ANSWER ARRAY Electron data.

WORD	NAME	TYPE	MEANING
1		I2	Number of words in this block
		I2	Tally of number of calls to PLSANL
2		I2	Peak channel number sensor cup A
		I2	" B
3		I2	" C
		I2	" D
4		R4	Δ time from mode start to peak.
5	XA	R4	B_x ambient field in spacecraft coordinates.
6	YA	R4	B_y
7	ZA	R4	B_z
8	F1	R4	$\sum_i^N \frac{\lvert\vec{B_i}\rvert}{N}$
9	F2	R4	$\sqrt{\bar{B}_x^2+\bar{B}_y^2+\bar{B}_z^2}$
10-12	RMS	R4	Vector rms of B field
13	NA	I4	Number of MAG samples in average
14		R4	Δ time from peak to MAG average.
15		R4	Time period of Mag average.
16		R4	Flux #/cm^2 /sec
17		R4	Temperature degrees Kelvin
18-33		R4	Distribution #/V^3/cm^3
23-80			SPARE

This is the answer array for protons using IDCANL.

ANSWER ARRAY IDCANL.

WORD	NAME	TYPE	MEANING
1		I2	Number of words in this block
		I2	Tally of number of calls to PLSANL
2		I2	Peak channel number sensor cup A
		I2	" B
3		I2	" C
		I2	" D
4		R4	Δ time from mode start to peak.
5	XA	R4	B_x ambient field in spacecraft coordinates.
6	YA	R4	B_y
7	ZA	R4	B_z
8	F1	R4	$\sum_i^N \frac{\lvert\vec{B}_i\rvert}{N}$
9	F2	R4	$\sqrt{\overline{B_x}^2+\overline{B_y}^2+\overline{B_z}^2}$
10-12	RMS	R4	Vector rms of B field
13	NA	I4	Number of MAG samples in average
14		R4	Δ time from peak to MAG average.
15		R4	Time period of Mag average.
16	DEN	R4	Density num/cc
17	VEL	R4	Velocity km/sec
18		R4	Thermal velocity km/sec
19		R4	Third monent km/sec
20	IQUAL	I4	number of channels above noise. If negative MOMENT failed

This is variable length block of engineering data

ENGINEERING DATA

WORD	NAME	TYPE	MEANING
1	IDECK	I2	Deck (ENG code) 620=672
	IENG	I2	Value of ENG
2	ITIME	R4	"Read out" time of data in sec last time in header.

* repeat for new set
*
*

This block gives the spacecraft state vector and rotation matrices
for conversion between coordinate systems.
Note that the coordinate systems change with the type of tape.

SEDR DATA

WORD	NAME	TYPE	MEANING
1-2	TN	R8	EPIC day of navigation block.
3-4	TP	R8	EPIC day of pointing vector block.
5-10	SPV	R4	Spacecraft relative position vector and velocity vector in HG: Inertial Sun Equator System (AU, km/sec) S3: Jupiter System III Cartesian (Jupiter radii, Km/sec)
11	RANGE	R4	Spacecraft distance from HG: Sun in AU. S3: Jupiter in Jupiter radii.
12-13	ANG	R4	Spacecraft relative Longitude and Lattitude in radians HG: Inertial Sun Equatorial System. S3: Jupiter latitude and longitude :hp1.Note: :ehp1. $0 \leq \text{longitude} < 2\pi$ $-\pi/2 < \text{latitude} \leq +\pi/2$
14-22	TTB	R4	HG: Matrix to rotate data from Inertial Sum Equatorial System to Inertial Heliographic System. S3: Matrix to rotate data from Jupiter System III to Jupiter system III spherical
23-31	TTB5	R4	HG: Matrix to rotate data from Inertial Heliographic System to Earth-Orbit-True System. S3: Matrix to rotate data from payload to Jupiter System III Cartesian.
32-40	THG	R4	HG: Matrix to rotate data from payload to Inertial Heliographic System. S3: Matrix to rotate data from Payload to Jupiter System III spherical.
41-50			SPARE