mult-four1

THE MULTI-SATELLITE FOURIER ANALYSIS PROGRAM

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I. INTRODUCTION

The Multi-satellite Fourier Analysis Program is a system of subroutines that may be divided into two sets:

A. The satellite independent modules (SI)
B. The satellite dependent modules (SD)

The system is organized such that any satellite data can link into the SI modules by supplying the correct SD modules. It then receives Fourier analyzed data in the form of listings and/or plots. This saves design, coding, and testing time for all analysis, listing, and plotting routines.

It should be noted that there are two subroutines that simply return after being called. One, SUB1, is called directly before Fourier analysis, and the other, SUB2, is called immediately following analysis. This allows either subroutine to be substituted for by linking in the new load module before the SI load modules, thereby substituting in special data manipulation functions prior to or after analysis. Section 8 contains those SUB1 and SUB2 routines already devised for special uses.

This document defines all the satellite data systems developed to date: the internal code description, a user's gide, and sample JCL for running the program. The next page lists the data sets used in this system, the source, JCL, and LOAD data sets. The source will be spooled to tape.

A. Source

1. Source for satellite independent and dependent modules is in file 'SB#PR.FOURIER.SOURCE' with the partition names as:

   a. SATINDEP - The satellite independent code
   b. IMP8 - IMP 8 sectored rates
   c. ISEE3 - ISEE 3 Cosmic Ray sectored rates
   d. HELIOS - HELIOS A,B sectored data
   e. PIONEER - PIONEER 10,11 sectored data
   f. PIOPHA - PIONEER 10,11 PHA data
   g. IMP7 - IMP 7 sectored rates

2. Source for the SUB1 custom modules is held in file 'SB#PR.FOURIER.SUB1' with partition name as:

   a. DIFRNTL - Creates rate differences, substitutes for rates

3. Source for the SUB2 custom modules is held in file 'SB#PR.FOURIER.SUB2' with partition name as:

   a. ANICHK - Ensures anisotropy is within 2 * it's deviation

* Note that the LOAD modules will be permanently on disk, but the SOURCE and JCL files may be archived by the system.

B. JCL

SB#PR.MULTISAT.FOURIER.SOURCE ?

1. The JCL is held in file '~~SB#PR.FOURIER.JCL~~' with partition name as:

~~a. JCL~~		~~- This contains general JCL~~
$RUN PION b.	PIOJCL	- This contains PIONEER JCL
PHJCL, PHIJCL b.	PHAJCL	- This contains PIONEER PHA JCL
$RUN HELI c.	HELJCL	- This contains HELIOS JCL
$RUN IMP8 d.	IMP8JCL	- This contains IMP-8 JCL
$RUN ISEE e.	ISEE3JCL	- This contains ISEE-3 Cosmic Ray JCL
$RUN IMP7 f.	IMP7JCL	- This contains IMP-7 JCL

C. LOAD Modules

1. The LOAD modules are held in the userid of the satellite:

a.	'SB#PR.FOURSI.LOAD'	- Satellite independent module
b.	'SB#PR.FOURPIO.LOAD'	- PIONEER sectored rates
c.	'SB#PR.FOURPHA.LOAD'	- PIONEER PHA rates
d.	'SB#PR.FOURDIF.LOAD'	- PIONEER differential rates custom SUB1
e.	'SB#PR.FOURCHK.LOAD'	- PIONEER check on anisotropy values custom SUB2
SB#IM f.	'~~SEIMP.~~FOURIMP8.LOAD'	- IMP-8 sectored rates
g.	'~~SDHEL.~~FOURHEL.LOAD'	- HELIOS sectored rates
SB#HL h.	'~~SEICC.FOURICC~~.LOAD'	- ISEE-3 Cosmic Ray sectored rates
i.	'SB#PR.FOURDIF.LOAD'	- Differential rates custom SUB1
j.	'SB#PR.FOURCHK.LOAD'	- Anisotropy value check custom SUB2
SB#IC.FOURISE k.	'~~SEIMP.~~FOURIMP7.LOAD'	- IMP-7 sectored rates

~~(SB#PR.FOURIER.SOURCE SAVE)~~

SB#IM

II. Multi-Satellite Fourier Analysis Program System Documentation

A. Overview

1. Description

The Fourier Analysis Program analyzes sectored data from any satellite according to the article "Limitations of the COS Approximation as Applied to the Cosmic-Ray Anisotropy," Nuclear Instruments and Methods, #138 (1976) pages 191-199, R.D. Zwickl and W.R. Webber. This analysis calculates the first three harmonics from counts data divided into eight 45^{0} sectors.

The following outputs may be generated:

a. Fourier listing of flux, a "flow parameter", the anisotropies and angles, and the sectored counts. The listing may also include angle corrections to the sectors and magnetic field values.

b. Flux plots of flux vs. time.

c. Anisotropy double plots of the anisotropy values vs. time plotted above the anisotropy angles vs. time.

d. Cam plots of the sectored counts and, if desired, magnetic field cam histograms of the north-sourth and planar directions with an arrow on the rates cam plots indicating direction of field.

e. Output tape of the sector counts for use with other programs.

f. Output tape of the Fourier results for use with other programs.

g. PC-Fourier tape in PC format

All plots may be sent to either the SD4060 plotter or the Calcomp plotter.

The Fourier Analysis Program is essentially two sections:

1. Satellite-independent (SI)
2. Satellite-dependent (SD)

Thus, to incorporate a new satellite into the system, only a small subset of coding is necessary which reads in extra user parameters, validates the data, and reads in the sectored counts. How to code this is included later in "Adapting the Fourier Program to a New Data Source".

Another feature of flexibility in this program is the use of two subroutines which are called immediately prior to and after the Fourier analysis formula are used. This allows the data to be manipulated in any way before being output. The default routines simply return. To involk changes in this way, a routine by the same name is created in load form and JCL links it in before the Fourier program modules. Thus, these routines are used in place of the dummy routines.

2. Formulae

a. Fourier formulae:

The following expression for the rate is used:

$$C_i = A_o[1 + \sum_{n=1}^{3} \zeta_n \cos n(\phi_i - \phi_n)]$$

where

$$A_o = \frac{1}{8G} \sum_{i=1}^{8} C_i,$$

C_i = sector rate,

$$\zeta_n = A_n/A_o,$$

$$A_n = (a_n^2 + b_n^2)^{1/2},$$

$$a_n = \frac{W_n}{4} \sum_{i=1}^{8} C_i \cos(n\theta_i),$$

$$b_n = \frac{W_n}{4} \sum_{i=1}^{8} C_i \sin(n\theta_i),$$

θ_o = reference direction measured counter-clockwise from the reference direction to the center f sector 0

θ_i = angle in direction of Sector i,

$$\theta_n = \frac{1}{n} \tan^{-1}(b_n/a_n) + \theta_o,$$

n = harmonic number,

i = sector number,
W_n = given weight factor, predetermined, and
G = geometric factor of counter (cm^2ster).

For 8 sectors, θ_i is a multiple of 45^o, so the values for cos $n\theta_i$ and sin $n\theta_i$ may be predetermined, saving CPU time. The result is then rotated through the angle θ_o so that the final answer is with respect to the north reference direction (usually the sun).

The following formulae for standard deviation is used:

$$\sigma_{A_o} = (A_o/8G)^{1/2}$$

$$\sigma_{\zeta_n} = W_n([1+D_n]/4A_o)^{1/2}$$

$$\sigma_{\phi_n} = W_n([1-D_n]/(4n^2\zeta_n^2 A_o])^{1/2}$$

$$D_n = (W_n^2/8A_o^3\zeta_n^2)\left(\sum_{i=1}^{8} [(a_n^2-b_n^2)\cos 2n\theta_i + 2a_n b_n \sin 2n\theta_i]C_i\right)$$

$-1 < D < 1$

$$\text{flow} = (a_1+a_3*\cos(3*\theta_i-\theta_3))/(a_1+a_2\cos(2*\theta_1-\theta_2))$$

b. Magnetic Field:

Phi: lies in the ecliptic plane and the sectors progress counter-clockwise when viewed from above the plane (north). (24 sectors)

Theta: lies perpendicular to the ecliptic plane, with sectors progressing from $+90^o$ to -90^o, measuring distance from the plane. (12 sectors) (measured counter-clockwise)

$+\hat{Z}$ = North
$+\hat{x}$ = From Sun to S/C
$+Y = ZX_X$
ϕ = Phi = $\tan^{-1}(y/x)$
θ = Theta = $90-\cos^{-1}(Z)$
$\Delta B = (\langle|B|^2\rangle-\langle|B|\rangle^2)^{1/2}$

$$\Delta\phi,\Delta\theta = \left(\frac{\sum_{i=o}^{n} N_i \phi_i^2}{\sum_{i=o}^{n} N_i} - \left(\frac{\sum_{i=o}^{n} N_i \phi_i}{\sum_{i=o}^{n} N_i}\right)\right)^{2\ 1/2}$$

where n=23 for ϕ, 11 for θ

($\Delta\phi$ is calculated using the sector with the most counts as the center of the distribution).

3. Timing System

The times input by the user or from input data are in year, month, day, hour, minute, seconds. The Fourier Plot Program converts all times into one number, the "Modified Julian Time" which is in units of average intervals since January 1 of the epoch year hardcoded by the programmer. Arrays with the days for each succeeding year and days since January 1 are used in the conversion

(See TIMJUL and JULTIM). For this reason, the epoch year must be a leap year -1, or the count of days will be off by 1. The formula used is:

Modified Julian time = $A*B + \frac{C}{D}$

where,

A = days since epoch year, Jan. 1 of epoch year = Ø
B = average intervals/day
C = seconds of day
D = seconds/average interval

Thus, January 10, 1^h 30^m 0^s 1973, epoch year = 1971, average interval = 900 seconds is converted to $376*96 + \frac{5400}{900} = 36102$

4. Input Required

a. Input sectored data set:

This is entirely dependent on which satellite's data is processed.

b. Magnetic field tape (optional):

This tape is described in the document "Magnetic Field Processing for the Fourier Program". The programmer may wish to use a different format and alter the MAGADV routine.

c. User namelists:

These namelists are described in the document "Multi-Satellite Fourier Analysis Program, User's Guide".

5. Output Generated

a. Fourier analysis listing containing:

(1) Flow parameter (see Formulae, Section IB)
(2) Flux, deviation
(3) Anisotropies, deviations
(4) Anisotropy angles, deviations
(5) Sector counts
(6) Accumulation time
(7) Magnetic field values
(8) Correction angles to sector Ø offset.

b. Flux plots of flux vs. time

c. Anisotropy plots of anisotropy values vs. time plotted above anisotropy angles vs. time

d. Cam plots of the sector counts containing:

(1) Cam plots
(2) Listing of Fourier parameters
(3) Average counts
(4) Magnetic field cam plots
(5) Magnetic field direction arrow overlaid on the counts cam plots
(6) Timing
(7) Direction arrow and line for the first & second order anisotrophy overlaid on the cam plot
(8) Rates label for each cam plot

e. Output tapes:

(1) There are two input tapes available from this program:

(a) Fourier parameters tape containing the results of the analysis
(b) Counts tape containing the sectored counts input to the Fourier routines

They both are IBM variable blocked record format, 1600 BPI. This means that four bytes are present at the start of the first record of each file, the first two of which indicate the file length in bytes (including the length words). Each record has four bytes preceeding it, the first two of which indicate the length of the record in bytes. Consult the IBM tape format manual for more detailed information.

Each input namelist set creates a new file on the tapes.

(2) Header record format for both tapes:

(If the JCL for a program reading this tape does not declare the tape as VB, then there is an additional four bytes for each file and 4 bytes for each record specifying the length in bytes of the file or record.)

Bytes	Type	Description
1-16	A16	Satellite ID, EBCDIC
17-64	6*A8	Rate ID's of the run. Blanks are fill.
65-136	9*A8	Fourier parameters of the run. Blanks are fill.
137-140	I4	Number of rates processed this run. (later called i)
141-144	I4	Number of Fourier parameters stored this run. (later called j)
145-148	I4	Averaging interval in seconds.
149-200	--	Spare

(3) Record structure for the Fourier parameters tape:

k=j if 'MAG' was not a FPARMS parameter. Otherwise, k=j-1

k1=i*k*2 = total R4 values; (parameter, deviation for k parameters in i rates)

Bytes	Type	Description
1-12	6*I2	Year,month,day,hour,minute,second of start of interval
next K1*4	R4 each	List of parameters,deviation values: i * (k * (parameter,deviation))
next 24	R4 each	Magnetic field data:

Bytes
1-8 = Magnitude of field
9-16 = planar direction, deviation of field
17-24 = polar direction, deviation of field

(4) Record structure for the Counts tape:

K=10*i = total # of counts data words

Bytes	Type	Description
1-12	6*I2	Year,month,day,hour,minute,second of start of interval
next K*4	R4 each	List of the counts data for each rate: i * (accummulation time,8 counts,sum)

(5) JCL

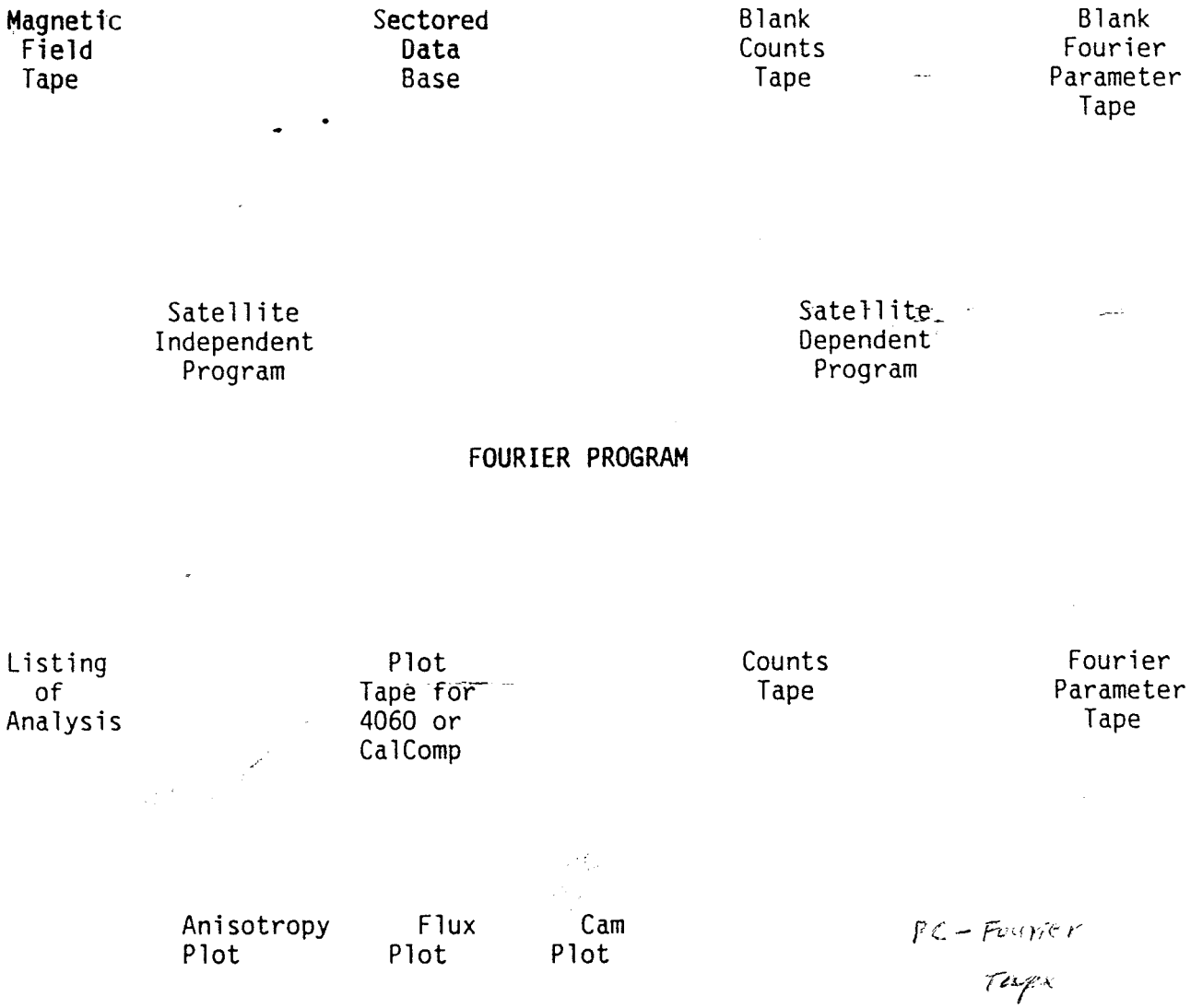
DCB = (BLKSIZE=7294,RECFM=VB)

6. Miscellaneous Notes and Highlights

a. All plots for a run are written to the same plot tape.
b. Any rate with a total count of 20 or less is not Fourier analyzed. A -1.0 is used on the listing to indicate this condition.
c. The satellite dependent modules may use any negative number as fill for any of the Fourier values. The system will ignore plotting these values.
d. The FPARMS parameter in the namelist INPUT affects only plots and output tapes.
e. All rates specified in one namelist set are plotted on the same plot using different symbols.
f. Multiple namelist sets may be specified in one run, no limit.
g. Only 6 or less rates are allowed per namelist set.
h. The maximum plot density is 4 points per centimeter, 24 centimeters per

plot.

7. System Configuration



8. Module Definition

Subroutine	Function
ANISOT	Plots the anisotropies and the PHI angles
DATFIL	Fills the counts and accumulation time arrays for the rates
DEVBAR	Plots the error bars for anisotropy and rate plots
FOURIE	Performs fourier analysis, returning results in common
INITL (SD)	Initializes the label, weight, phi0, geometric factor arrays
JULTIM	Converts Julian date into yr, mon, dy, hr, mn, sc
MAGADV(SD)	Advances the magnetic field tape, reads record
MAGPRO	Fills the magnetic field common and writes to disk
MAIN	Program driver
PAGE	Called from PRINTF to write the page headers
POLER	Plots counts vs. sector on a polar plot, has magnetic field option
PRINTF	Prints the fourier series coefficient results
RATDAT(SD)	initialize the common blocks
RATES	Plots the rates vs. time
READIN	Reads the input namelists, performs data checks
RECADV (SD)	Reads in a new average for pioneer flux tape
RTAPE	Creates a tape containing the Fourier results
SEGMNT	Plots a line segment, arrow head, or whole arrow
SETPLT	Sets the scaling up for polar plots
STAPE	Creates a sector counts tape
SUB1,SUB2	Dummy subroutines, substituted for by user JCL if desired
TIMJUL	Converts yr, mon, dy, hr, mn, sc to modified Julian time
TIMJL2	Converts year, day of year, second of day to Julian time
TIMLAB	Labels the time axis for anisotropy and rates plots
VALID (SD)	Validates the user input data

9. Program Structure

a. Block Diagram

*Note: All modules followed by an asterist * are satellite-dependent (SD) codes

MAIN

A B

A:

ANISOT	FOURIE	PRINTF	POLER	RATES	READIN	
DEVBAR		JULTIM	JULTIM	DEVBAR	INITL*	VALID*
JULTIM		PAGE	SEGMNT	JULTIM		
TIMLAB			SETPLT	TIMLAB	TIMJUL	

B:

RECADV*	RTAPE	SUB1*	SUB2*	STAPE
MAGADV * MAGPRO	JULTIM			JULTIM
TIMJL2				

b. Program Algorithm

The program may be divided into four main steps:

(1) Read in a user namelist set, validating its parameters. If there is no complete namelist set, end.

(2) Initialize all required I/O devices (tapes, plotter) for this namelist set.

(3) Loop, processing the following steps until data has been processed for this namelist set:

(a) Read in one average interval of sectored data.
(b) Read in magnetic field data to match the interval if required.
(c) Fourier analyze the data.
(d) Print it if desired.
(e) Output to counts or parameters tapes, if desired.
(f) Store on disk if any plots are desired until one full plot of data is collected. Then plot appropriate plots.

(4) Go back for another namelist set.

c. Error Handling

The FORTRAN STOP N statements are used when an error occurs to stop the program with a non-zero return code. These return codes are accompanied by a printed message, but the return code number itself defines the general error as follows:

Return Code

1	The namelist parameters are checked to ensure typing errors were not introduced. The program stop will return code of 1 if any parameters are not valid.
-	If there is an I/O error while creating the anisotropy plots, the message: 'RECORD # OF HARMONIC # SKIPPED, I/O DISK ERR.'
7	If there is a timing problem the message: 'JULTIM HAS BAD TIMES' is issued and the program stops with a return code of 7. Consult person who maintains the program.
-	When an I/O error is encountered while creating polar plots, the message:

Return Code

'DISK READ ERROR IN POLAR ROUTINE'

is used and the program continues. Some data will be missing.

When an I/O error is encountered while creating flux plots, the message:

'RECORD # SKIPPED DUE TO I/O ERROR FROM DISK'

is issued, and the program continues. Some data will be missing on the flux plot.

10. Common Block Definition

a. /RATDAT/COUNTS(9,6),ACCUM(6),AO(6),DEVAO(6),PHIO(6),AN(3,6),DEVAN(3,6),PHI(3,6),DEPHI(3,6),JTIME(2)

Variable	Type	Initial Value	Description
COUNTS	R*4	0	8 sector counts + 1 sum of 8 counts, for each of 6 possible rates.
ACCUM	R*4	0	Accumulation time in seconds of each rate for a time interval.
AO	R*4	0	Adjusted flux: AO= avg cnts/(time* geometric factor for each rate
DEVAO	R*4	0	Deviation of AO(6)
PHIO	R*4	0	Angles between north and sector 0 for each rate, corrected each interval for data dependent correction angles.
AN	R*4	0	Three harmonics of the anisotropy for each rate from Fourier analysis, in %.
DEVAN	R*4	0	Deviation of AN(3,6)
PHI	R*4	0	Anisotropy angle for 3 harmonics of each rate, in degrees from Fourier analysis.

Variable	Type	Initial Value	Description
DEPHI	R*4	0	Deviation on above angles.
JTIME	I*4	0	Modified Julian time for start (jtime(1)) and end (jtime(2)) of the current interval.

b. COMMON/INPARM/NUMRAT,NUMAVG,NUMPLT,QRATS(20),QPARM(9)

Variable	Type	Initial Value	Description
NUMRAT	I*4	0	The number of rates being processed.
NUMAVG	I*4	1	Number of flux intervals to sum, corresponds with the Modified Julian data.
NUMPLT	I*4		Number of plots of any type created so far.
QPARM	L*1	F	T=parameter is to be plotted or written to tape. F=parameter is not to be plotted or written to tape.

QRATS	L*1	F	T=rate # is to be processed.
			F=rate # is not to be processed, for 20 possible Helios and Pioneer rates.
			
			Rate 1-4 = SR1A-SR1D
			Rate 5-12 = SR2A-SR2H
			Rate 13-20 = SR3A-SR3H

c. COMMON/PLOTS/CSIZE,FHI,FLO,XHI,XLOW,AOHI,ICNT,QBARR

Variable	Type	Initial Value	Description
CSIZE	R*4	1.0	Plotter character size factor.
FHI	R*4	0.0	Flux plot maximum in counts per cm^2 sec ster.

Variable	Type	Initial Value	Description
FLO	R*4	0.0	Flux plot minimum in counts/cm^{2}sec ster.
XHI	R*4	0.0	X axis end plot time in modified Julian date.
XLOW	R*4	0.0	X axis start plot time in modified Julian date.
AOHI	R*4	0.0	Flux plot Y axis maximum.
ICNT	I*4	0	Point for the number of data points collected.
QBARR	L*1	F	T=draw error bars

d. COMMON /FLAGS/QPRINT,QPLOTS,QTAPES,QRATPL,QANIPL,QPOLPL,QHARM2,QRTAPE, QSTAPE,QHIST,QMAGNT

Variable	Type	Initial Value	Description
QPRINT	L*1	F	T=Print Fourier analysis results
QPLOTS	L*1	F	T=Create polar plots, flux plots and/or anisotropy plots
QTAPES	L*1	F	T=Create Fourier tape and/or counts tape
QRATPL	L*1	F	T=Flux plot desired
QANIPL	L*1	F	T=Anisotropy plots desired
QPOLPL	L*1	F	T=Polar plots desired
QHARM2	L*1	F	T=Draw in second harmonic on polar plot
QRTAPE	L*1	F	T=Create Fourier tape
QSTAPE	L*1	F	T=Create counts tape
QMAGNT	L*1	F	T=Process magnetic field data

e. COMMONS /TIMES/IBTIME,IETIME,IEPOCH,INTSEC,INTMS,RDYCN,RHRCN,RMNCN

Variable	Type	Initial Value	Description
IBTIME	I*4	0	Beginning time of run in modified Julian time.
IETIME	I*4	0	Ending time of run in modified Juluan time.
IEPOCH	I*4	71	Earliest leap year -1 of the satellites data.
INTSEC	I*4	900	Seconds per interval.
INTMS	I*4	900000	Milliseconds per interval.
RDYCN	R*4	96	Days per interval.
RHRCN	R*4	4	Hours per interval.
RMNCM	R*4	.067	Minutes per interval.

f. COMMON /FACTRS/WGHT(3,6),PHIKEP(6),GEOM(6)

Variable	Type	Initial Value	Description
WGHT	R*4	0	Weighted correction factors for Fourier analysis.
PHIKEP	R*4	0	Angle between reference direction and sector 0.
GEOM	R*4	0	Geometric correction factor for Fourier analysis.

g. COMMON /THEADR/SATID(16),RATES(6),FPARMS(9),NUMS(3),QSPARE(52)

Variable	Type	Initial Value	Description
SATID	L*1	blanks	Contains the satellite id.
RATES	R*8	blanks	Rate ID's, EBCDIC
FPARMS	R*8	blanks	Fourier parameters to process, EBCDIC.
NUMS	I*4	0	(1)=number of rates processed. (2)=number of Fourier parameters. (3)=averaging interval in seconds.

Variable	Type	Initial Value	Description
QSPARE	L*1	0	Spare bytes.

h. COMMON /PRINT/IPRINT,LOST,IREJEC(6),IROLL,SOLR,NSOLR

Variable	Type	Initial Value	Description
IPRINT	I*4	0	Printer option: 1=print Fourier parameters only 2=Print sector counts and Fourier parameters
LOST	I*4	0	Seconds of data not present in the interval.
IREJEC	I*4	0	Number of 15 minute intervals reject due to bad sector times.
IROLL	I*4	0	Roll factor of space-craft either 0 or 180 degrees.
NROLL	I*4	0	Number of times the roll factor changed in the interval.
SOLR	R*4	0.0	Solar angle correction for spacecraft, degrees.
NSOLR	I*4	0	Number of input records rejected in the average due to too large of a solar correction angle.

i. COMMONS /NAMES/QSATID(16),ZLABEL(4,20)

Variable	Type	Initial Value	Description
QSATID	L*1	blanks	The satellite's name.
ZLABEL	R*8	blanks	The sectored rates labels, up to 20 rates with 32 bytes each.

j. COMMON /MAGFLD/BMAG,DELB,BPHI,DELPH,BTHETA,DELTH,QPSECT(24), QTSECT(12),COSIN(3),BSQR,MAGCNT,IZFILE

Variable	Type	Initial Value	Description
BMAG	R*4	0.0	Magnetic field flux.
DELB	R*4	0.0	Deviation in BMAG.
BPHI	R*4	0.0	The phi angle value of the magnetic field.
DELPHA	R*4	0.0	Deviation in BPHI.
BTHETA	R*4	0.0	The theta angle value of the magnetic field.
DELTH	R*4	0	
QPSECT	L*1	0	Phi sector counts.
QTSECT	L*1	0	Theta sector counts.
COSIN	R*4	0	The direction cosines.
BSQR	R*4	0	The average of the squares of the magnetic field.
MAGCNT	I*4	0	Number of magnetic field records included in the average.
IZFILE	I*4	1	File number of the magnetic field tape.

k. COMMON /USER/FROM(6),TO(6),DEVICE,INTSEC

Variable	Type	Initial Value	Description
FROM	I*4	0	User-input start time (yr,mon,day,hr,min,sec)
TO	I*4	0	User-input end time (yr,mon,day,hr,min,sec)
DEVICE	I*4	2	User-input plotter device choice: 1=SD4060 plotter 2=Calcomp plotter 3=printer (debug)
INTSEC	I*4	900	User-input average interval of input sectored data.

11. Common Block Cross Reference

Common Name and Function	Module Occurrence	Input/Output
1. RATDAT - Contains the sector count data and the Fourier results.	MAIN	I,O
	ANISOT	I,O
	POLER	I,O
	PRINTF	I
	RATES	I,O
	RECADV	I,O
	RTAPE	I
	STAPE	I
	PCOPTN	I
2. INPARM - Contains the user-input parameters needed for analysis.	MAIN	I
	ANISOT	I,O
	INITL	I
	PAGE	I
	POLER	I,O
	RATES	I,O
	READIN	O
	RECADV	I
	RTAPE	I
	VALID	I,O
	PCOPTN	I
3. PLOTS - Contains axis values plot flags, and numbers needed to produce the plots.	MAIN	I,O
	ANISOT	I
	RATES	I
	READIN	O
4. FLAGS - Contains user option flags	MAIN	I
	INITL	I
	READIN	O
5. TIMES - Contains timing information	MAIN	I,O
	INITL	I,O
	JULTIM	I
	RECADV	I,O
	TIMJUL	I
6. FACTRS - Contains correction factors to the sectored data	MAIN	I
	INITL	O
		RECADVI
7. THEADR - Contains header information for the rates and counts output tapes	READIN	O
	RTAPE	I
	STAPE	I
	VALID	I,O
	PCOPTN	I
8. PRINT - Contains information which appears in the listing, and the listing option.	PRINTF	I
	READIN	O
	RECADV	O

Common Name and Function	Occurrence	Input/Output
9. NAMES - Contains EBCDIC names of the satellite, data base source, and Rate ID's.	ANISOT	I
	INITL	I,O
	PAGE	I
	POLER	I
	RATES	I
	PCOPTN	I
10. MAGFLD - Contains the magnetic field data used for lisings and plots	MAIN	O
	MAGADV	I,O
	MAGPRO	I,O
	POLER	I,O
	PRINTF	I,O
	READIN	O
	RTAPE	I
	PCOPTN	I
11. USER - Contains some input user namelist values.	READIN	O
	INITL	I
	VALID	I
	PCOPTN	I

12. Recurring Argument Dictionary (RAD)

Variable	Type	Initial Value	Description
QNEW	L*1	T	T=First time through the code for the current namelist set.

13. Recurring Argument Cross Reference

Module Argument	Occurrence	Input/Output
QNEW	RTAPE,STAPE,MAGADV	I

14. Individual Module Documentation

NOTE: All modules were designed, coded, and debugged by Jenny Jacques, Code 664. Various additions and re-structuring were completed February 1980.

First the satellite-independent modules are described, then the satellite-dependent structure is described.

a. Satellite-Independent Modules

(1) **MAIN - Main controller.** This routine controls the program flow.

(a) Calling sequence: None

(b) Module cross reference:
Called by: none
Calls: ANISOT,FOURIE,POLER,PRINTF,RATES,READIN, RECADV,RTAPE,SUB1,SUB2,STAPE

(c) Common use:

Common	Variable(s)	I,O
FACTRS	all	I
FLAGS	all but QHIST and QHARM2	I
INPARM	NUMRAT,NUMAVG,NUMPLT	I
RATDAT	COUNTS,ACCUM,PHIO,AN, DEVAN,PHI,DEPHI,AO,DEVAO	I,O
TIMES	IBTIME	I
MAGFLD	all	O

(d) Significant local variables:

*See RAD for definitions of QNEW.

Name	Type	Description
IJK	I*4	0=First time through AOHI-finding code, initialize AOHI. 1=Not 0
QENDPL	L*1	T=At least one plot was made this run.
MAXPTS	I*4	Number of points (intervals) per plot frame.
QEND	L*1	T=End of the program, no more namelist sets.
QFILL	L*1	T=All fill data in the interval.
IPLDEN	I*4	Plot point density in points/cm.

(e) Logic:

There are two logical loops in MAIN. The outer-most loop processes new namelist sets. The second loop

processes all data within the definition of a namelist set. In this loop, the data is processed interval by interval for listing and creating the output tapes. If any plots are to be made, each interval is then written to a temporary disk file until enough data for a plot is collected. At this point, the plot routines are involked and the disk file is accessed. The file is used from the top for succeeding plots. When the second (inner) loop is finished, i.e., all the data for the time period desired is processed,the outer loop reads in a new namelist set and ends the program if no set is found. All plots created are written on one tape. All other output tapes contain one file per namelist set.

(2) **ANISOT** - Anisotropy plot routine. This subroutine creates a plot of A_n/A_0 vs time above ϕ vs time for - n=1,2,3, where each n is plotted on one plot frame. All rates specified are plotted on one plot for each n. Any anisotropies less than or equal to zero and their corresponding phi points are not plotted.

(a) Calling sequence: Subroutine ANISOT

(b) Module cross reference:
Called by: MAIN
Calls: JULTIM,TIMLAB

(c) Common use:

Common	Variable(s)	I,O
INPARM	a. NUMRAT,QRATES,QPARM	I
	b. NUMPLT	O

(d) Significant local variables:

Name	Type	Description
QPL	L*1	T=Good data, plot point.
ERR1,ERR2	R*4	Errors for Phi and Theta
P25,P75	R*4	Location of tic marks for Phi plot.
IPTS	I*4	Number of rates to plot *-1.
TERM	R*4	Ordinate of start of tick mark.
XPOS,YPOS	R*4	Coordinates of the labels for Rate ID's.

Name	Type	Description
YHI2	R*4	Upper scale factor of A_n/A_0 plot.
QCHAR(6)	L*1	EBCDIC plot character, 1 per rate.
PLOTY1,PLOTY2	R*4	Anisotropy and Phi values.

(e) Logic:

There is one overall loop to create one plot for each harmonic. Within this loop, the scaling, grid, and labels for the A_n/A_0 plot are created, then for the Phi plot. Plot heading labels are next created. Then there is a loop to read in all plot records, process them, and plot them. The plotting of this data involves setting the scale for first the A_n/A_0 plot and plotting the data, then likewise, for the phi plot. After the plots are created, the plot frame ends and the next harmonic is processed.

(3) DEVBAR - Deviation bars. This subroutine draws error bars for a set of points passed to it.

(a) Calling sequence: Subroutine DEVBAR(RMAX,RMIN,XPOS,YPOS,DEV,NUM)

Name	Type	I/O	Description
RMAX	R*4	I	Plot maximum value.
RMIN	R*4	I	Plot minimum value.
XPOS(num)	R*4	I	Abscissa value of points.
YPOS(num)	R*4	I	Ordinate value of points.
DEV(num)	R*4	I	Deviation values of points.
NUM	I*4	I	Number of points.

(b) Module cross reference:
Called by: ANISOT,RATES
Calls: none

(c) Common usage: none

(d) Significant local variables:

Name	Type	Description
XLIM(2)	R*4	Endpoints of the error bar, abscissa values.
YLIM(2)	R*4	Endpoints of the error bar, ordinate values.

(e) Logic:

There is one loop which processes NUM error bars. Inside the loop, the coordinates for the error bar are determined, clipping at the edges of the plot. Then the bar is drawn.

(4) FOURIE - Fourier analysis. This subroutine performs the fourier analysis on the sectored rates.

(a) Calling sequence:

Subroutine FOURIE(AO,DEVAO,AN,DEVAN,PHI,DEVPHI,C,PHIO,WGHT)

Name	Type	I/O	Description
AO	R*4	O	The average of the sectored counts.
DEVAO	R*4	O	Square root of AO/8.
AN(3)	R*4	O	Anisotropies
DEVAN(3)	R*4	O	Deviation of the anisotropies
PHI(3)	R*4	O	Direction angle of anisotropy.
DEVPHI(3)	R*4	O	Deviation of the direction angle.
C(9)	R*4	I	Eight sectored counts plus a ninth which is their sum.
PHIO	R*4	I	Correction angle between reference direction and sector 0.
WGHT(3)	R*4	I	Weight factors applied to analysis.

(b) Module cross reference:
Called by: MAIN

Calls: none

(c) Common usage: none

(d) Significant local variables

Name	Type	Description
RA(3)	R*4	Fourier coefficients a_1,a_2,a_3
RB(3)	R*4	Fourier coefficients b_1,b_2,b_3
ZANG	R*8	Cos ($\pi/4$) in radians
DEGRAD	R*4	Conversion factor for radians to degrees.

(e) Logic:

The flux AO is calculated and then used to find the Fourier coefficients. The anisotropies are calculated with these coefficients (3 harmonics), and then the anisotropy angles are calculated, along with deviations for both the anisotropies and the angles.

(f) Formulas used:

(See Overview section I.B.1.)

(5) JULTIM - Julian to time. This subroutine performs a conversion from the modified Julian time to year, month, day, hour, minute, second.

(a) Calling sequence:

Subroutine JULTIM(ITIME,JTIME)

Name	Type	I/O	Description
ITIME(6)	I*4	O	Year,month,day,hour,minute, and second.
JTIME	I*4	I	Modified Julian date to be converted.

(b) Module cross reference:
Called by: ANISOT,PRINTF,POLER,RATES,RTAPE,STAPE
Calls: none

(c) Common usage:

Common	Variables	I/O
TIMES	all	I

(d) Significant local variables:

Name	Type	Description
IDAY	I*4	Days since Jan. 1 of current year.
JDAY	I*4	Number of days since Jan. 1, of the epoch year.
LEAP	I*4	1=not leap year, 2=leap year.
IDAYS(16)	I*4	The number of days since epoch year for up to 16 years.
JAVGS	I*4	Number of average intervals in the day.
MONTH(13,2)	I*4	Number of days, since Jan. 1 for each month for both leap years and non-leap years.

(e) Logic:

The number of days since epoch year and the number of intervals in the day are derived. Then loops are used to match these numbers with the MONTH and IDAYS arrays to identify the month and time of day. The epoch year must be a leap year for the IDAYS array to be true.

(6) **MAGPRO - Magnetic field processing.** This routine processes the magnetic field data, storing it in common.

(a) Calling sequence: Subroutine MAGPRO

(b) Module cross reference:
Called by: RECADV
Calls: none

(c) Common usage:

Common	Variables	I/O
MAGFLD	all	I,O

(d) Significant local variables:

Name	Type	Description
SUMP,SUMT	R*4	Used to efficiently obtain the PHI and THETA deviations.
PHI,THETA	R*4	Angle used to calculte the PHI and THETA deviation.

IP	I*4	Sector number of the maxmium counts for PHI.

(e) Logic:

The sums of magnetic field records are averaged by dividing by the # of records. Then the phi theta angles of the magnetic field are calculated. Finally, the phi, theta deviations are calculated, where phi's deviation is calculated with respect to the sector with maximum counts. (See Section I.B.2)

(7) **PAGE - Page header.** This routine pages the Fourier printout, writing the header.

(a) Calling sequence: Subroutine PAGE(LINCNT)

Name	Type	I/O	Description
LINCNT	I*4	O	Number of lines written on the page.

(b) Module cross reference:
Called by: PRINTF
Calls: none

(c) Common usage:

Common	Variables	I/O
INPARM	NUMRAT,QRATS	I
NAMES	all	I

(d) Significant local variables: none

(e) Logic:

The line counter is set to 3 + numrat to account for the heading. Then a loop is used to print out the rate's names as part of the header.

(8) **POLER - Polar plots.** This routine creates the polar or cam plots with or without magnetic field indications.

(a) Calling sequence:

Subroutine POLER(CSIZE,ICNT,QHARM2,QMAGNT,QHIST)

Name	Type	I/O	Description
CSIZE	R*4	I	Character size in inches, differs for the Calcomp and the SD4060.
ICNT	I*4	I	Number of intervals to

plot from disk.

Name	Type	I/O	Description
QHARM2	L*1	I	T=plot the second harmonic dash line.
QMAGNT	L*1	I	T=produce magnetic field output of some sort.
QHIST	L*1	I	T=create phi, theta histograms.

(b) Module cross reference:
Called by: MAIN
Calls: SETPLT,SEGMNT,JULTIM

(c) Common usage:

Common	Variables	I/O
INPARM	NUMRAT,QRATS	I
	NUMPLT	I,O
RATDAT	all	I,O
MAGFLD	BMAG,DELB,BPHI,DELPH, BTHETA,DELTH,QPSECT, QTSECT	I,O

(d) Significant local variables:

Name	Type	Description
ROALT	R*4	.16" beyond the cam radius.
ROALT2	R*4	.25" beound the cam radius.
ARWR(2), ARWA(2)	R*4	Endpoints of a plot sugment in polar coordinates r,θ. This array is used to create dashed lines.
LPOS(6)	I*4	Position of the rate label in the label array for each rate to be plotted.
QMAG	L*1	Contains labels for the Phi and Theta cam plots.
CHSIZ	R*4	.2* CSIZE, used for proper label positioning.
ITIM1(6),	I*4	Start, end times of each cam plot,

Name	Type	Description
ITIM2(6)		year, month, day, hour, minute, and second.
NUMRT2	I*4	The number of cam plots per average interval, including magnetic field plots.
J	I*4	Loop variable for the major loop that cycles through each rate for each interval.
NAVG	I*4	Number of average intervals to plot per line.
RAVG	R*4	Average counts for each cam plot.
ANGLE	R*4	Angle increment for drawing a dash circle, dependent on the maximum counts so that the sector length is constant, independent of PMAX.
CONV2	R*4	ROALT2 in the cam plot scale.
XLPOS,YLPOS YLPOS	R*4	Lable positions for rate labels and satellite ID.
IBEGIN, IEND	I*4	Start stop times of plot frame.
SECTOR(49)	R*4	Sector angle positions for the Phi and Theta plots of 15^{o} sectors. Each is repeated twice to create a histogram, plus the end position to connect with the first position.
CNTS(49)	R*4	Magnetic field counts (radius) to match SECTOR angles for the histogram cam plots of the magnetic field.
NCNT	I*4	Counter for the number of average intervals processed per call to POLER.
PMAX	R*4	Counts in the sector with the most counts, calculated for each cam plot.

Name	Type	Description
XPOS(12,6) YPOS(12,6)	R*4	Positions for the labels above each cam plot. Up to 12 cam plots may be on a frame, and the position depends on the number of rates there are in the run. (See Logic section)
BANGS(49)	R*4	Same as SECTOR, for use with SETPLT.
NPLOT	I*4	Number of cam plots per line including magnetic field plots.
NPLT	I*4	Number of cam plots per line of rates only, no magnetic field plots.
QCHAR(80)	L*1	Label array for drawing assorted labels.
QTIME(28)	L*1	Label array for drawing times.
QFIRST	L*1	T=first time through the code for each call to POLER.
RO	R*4	Radius in inches of the cam plots,currently .7".
BMAX	R*4	Same as PMAX, except for magnetic field data.
CONV	R*4	ROALT, scaled to the current cam plot.
QAVG	L*1	Label array to draw the counts average for each cam plot.
BCNTS(24)	R*4	Magnetic field counts for each sector.
RLABY	R*4	Vertical position for the Fourier parameter table labels.

Name	Type	Description
A45DEG(17)	R*4	Angles which are at midpoints of the 45^{o} sectors, repeated to create a histogram with the end angle equal to the state $+360^{o}$ to connect the first and last points. This array is used to create another array which may be rotated through any angle. (i.e., point Sector 0 to north)

(e) Logic:

This subroutine logic may be divided into seven sections:

1. Counter and POLER constant initialization. (CHSIZ,ROALT,ROALT2,NUMRT2,NAVG,LPOS)
2. Data - independent labels (SATID,RATE ID's)
3. Outer loop for one plot frame based on the number of averaging intervals per frame to plot.
4. First inner loop to label Fourier parameters table.
5. Second inner loop to plot the rates cam plots.
6. Third inner loop to plot the magnetic field cam plots.
7. After outer loop to label time range on the plot and end the frame.

The placing of cam plots is based on the number of rates which are to be processed as follows:

# Rates in the Run	# Averages/Line (2 lines)
1	6
2	3
3	2
4	1
5	1
6	1

If magnetic field cam plots are desired, add 2 to the number of rates per run to determine how many average intervals will be placed on each line.

Because the labels must be smaller for the SD4060, the placement of label lines are adjusted with CHSIZ according to the plotter used.

The outer loop reads in a new average from the disk. The position arrays XPOS and YPOS take care of positioning the cam plots for each plot of the frame. Because the plots are polar plots, the labels must be done first before polar mode in WOLFPLOT is initiated for the cam plots. Once the labels for each plot are drawn, polar mode is declared and the second inner loop is done by searching for the maximum counts in the sectors and setting the scaling for the cam (SETPLT). The counts are drawn, then the average counts circle is dashed in. A dash arrow for the magnetic field direction may be drawn, and the first anisotropy may be drawn with a dashed line. Then the third inner loop is initialized, creating the magnetic field cam plots if desired. Finally, the frame is ended, and the entire sequence is repeated until the data is exhausted on the disk.

Several things must be remembered when working with WOLFPLOT:

1. All angles for WOLFPLOT are measured clockwise. Thus, the angles plotted had to be subtracted from 360 before calling WOLFPLOT routines, because they proceed counter-clockwise.
2. No coordinate of 0.0 can be given to a polar mode plotting routine, it must be made .00001.
3. Polar mode plots are drawn as a subset of the plot frame. Thus, each cam plot must have its scaling set properly to position the origin at the appropriate spot on the page.
4. All straight lines must be drawn after polar mode has been cancelled.

(9) **PRINTF** - Print Fourier listing. This routine prints the results of the Fourier analysis if desired for one interval.

(a) Calling sequence: Subroutine
PRINTF(NUMRAT,QFILL,QMAGNT)

Name	Type	I/O	Description
NUMRAT	I*4	I	Number of rates to printout.
QFILL	L*1	I	T=Fill data, all zero's print the times only.
QMAGNT	L*1	I	T=Magnetic field data are to be printed.

(b) Module cross reference:
Called by: MAIN
Calls: PAGE,JULTIM

(c) Common usage:

Common	Variables	I/O
PRINT	all	I
RATDAT	all	I
MAGFLD	BMAG,DELB,BPHI, DELPH,BTHETA,DELTH	I

(d) Significant local variables:

Name	Type	Description
ITIME(6) ITIME2(6)	I*4	Time range of the interval year, month, day, hour, minute,second.
FLOW	R*4	Flow parameter (see Formulas, Section II).
RMISS	R*4	Seconds of last time of the average.
LINCNT	I*4	Line counter, for printing page headings.

(e) Logic:

The line counter is incremented according to how many rates there are, thus lines printed. If needed, a new page heading is printed. Then the time range is converted to year, month, day, hour, minute, second, and printed. If the correction angles are non-zero, they are printed. If magnetic field is processed, magnetic field parameters are listed. Then the Fourier parameters are printed followed by the counts and accumulations if requested (IPRINT=2).

(10) **RATES** - Rate plots. This routine plots the rate, or flux, of the counts.

(a) Calling sequence: Subroutine RATES

(b) Module cross reference:
Called by: MAIN
Calls: DEVBAR,TIMLAB

(c) Common usage:

Common	Variable	I/O
INPARM	NUMRAT,QRATS, NUMPLT	I I,O
NAMES	all	I
PLOTS	all	I
RATDAT	all	I

(d) Significant local variables:

Name	Type	Description
XPOS,YPOS	R*4	Label plotting positions.
QPL	L*1	T=Plot the point, good data
RINC	R*4	Y value of decade, for tick marks.
YTIC	R*4	Y value of each tick mark.
QCHAR(6)	L*1	Possible plot characters.
IPTS	I*2	-1*NUMRAT to indicate character plots.

(e) Logic:

The first part of the routine makes sure the scales are in order. If there are more than four decades, adjust the low scale to be four decades from the high scale value. The logarithmic the marks are drawn next on each side of the plot, and the plot is labeled. A loop is set up to read in the data, plotting NUMRAT points at a time.

(11) **READIN** - Read in user namelists. This routine reads in the satellite independent namelists, verifies them, and initializes the I/O devices and commons.

(a) Calling sequence: Subroutine READIN(IPLDEN,QEND)

Name	Type	Description
IPLDEN	I*4	Plot density in points/cm.
QEND	L*1	T=end of user data, no more namelist sets.

(b) Module cross reference:
Called by: MAIN
Calls: INITL,VALID

(c) Common usage:

Common	Variables	I/O
MAGFLD	IZFILE	0
USER	all	0
THEADR	all	0
FLAGS	all	0
INPARM	NUMAVG	0
PLOTS	FLMAX,FLMIN,QBARR	0
PRINT	IPRINT	0

(d) Significant local variables:

Name	Type	Description
ZRVOL	R*8	EBCDIC tape name of the output Fourier parameter tape if any.
ZSVOL	R*8	EBCDIC tape name of the output counts tape if any.
IRFILE	I*4	File number of the Fourier parameter tape.
ISFILE	I*4	File number of the counts tape.
ZMVOL	R*8	EBCDIC tape name of the magnetic field tape if any.

(e) Logic:

The namelists are organized in sets with the initial namelist (INPUT) defining which namelists must follow it. For example, if plots are desired, the INPUT namelist would set the QPLOTS flag to true which signals READIN to read the PLOTS namelist.

One namelist set is read in, then its validity is checked (VALID). If all is good,then the I/O devices are initialized, satellite dependent namelists read in, and some commons are filled (INITL).

(12) RTAPE - Rates tape. This routine creates the Fourier parameters tape of all Fourier analysis results.

(a) Calling sequence: Subroutine RTAPE(QNEW)
(See RAD for QNEW)

(b) Module cross reference:
Called by: MAIN
Calls: JULTIM

(c) Common usage:

Common	Variables	I/O
INPARM	NUMRAT,QPARM	I
RATDAT	all	I
THEADR	all	I

(d) Significant local variables:

Name	Type	Description
ROUT(45)	R*4	Used to collect the real Fourier parameter numbers for output.
HOUT(90)	I*2	Used to collect the integer*2 output parameters.
ITIM(6)	I*4	Time of start of interval.

(e) Logic:

Each part of the output record is filled with the appropriate numbers in the order: time, flux, anisotropy., and angle.

(13) SEGMNT - Segment draw. This routine draws line segments in solid or dash, with option of an arrowhead, from the origin to RMAX.

(a) Calling sequence: Subroutine SEGMNT(MODE,ANGLE,RMAX)

Name	Type	I/O	Description
MODE	I*4	I	1=solid line, 2=solid arrow, 3=dash line, 4=dash arrow
ANGLE	R*4	I	Angle from north of the segment, measured clockwise.
RMAX	R*4	I	Radius of the maximum of the segment.

(b) Module cross reference:
Called by: POLER
Calls: none

(c) Common usage: none

(d) Significant local variables:

Name	Type	Description
R(3)	R*4	Radius array of the segment.
THETA(3)	R*4	Angle array of the segment.
RINC	R*4	Increment length of the dashes for dash modes.

(e) Logic:

There are three sections of code: solid line, dash line, and arrow head. Depending on the mode, the coordinates are loaded in R and THETA and the lines are drawn with WOLFPLOT's PLOT.

(14) SETPLT - Set plot scales. This routine sets the plot scaling for polar cam plots.

(a) Calling sequence:

Subroutine SETPLT(NUM,CNTS,SECT,ANGLS,COR,DAT,XPOS,YPOS,RAD,PMAX)

Name	Type	I/O	Description
NUM	I*4	I	Number of sectors.
CNTS(2*NUM+1)	R*4	O	Histogram array for the sectors counts.
SECT(2*NUM+1)	R*4	O	Histogram array for the sector angles, adjusted by COR.
ANGLS(2*NUM+1)	R*4	I	Histogram array for the Sector angles before adjustment by COR.
COR	R*4	I	Offset in degrees of the sector angle positions from north.
DAT(NUM)	R*4	I	Sector counts data.
XPOS,YPOS	R*4	I	Coordinates of the origin on the frame in inches.

Name	Type	I/O	Description
RAD	R*4	I	Radius of cam in inches.
PMAX	R*4	O	Radius of cam in scaled coordinates; maximum counts of all sectors.

(b) Module cross reference:
Called by: POLER
Calls: none

(c) Common usage: none

(d) Significant local variables:

Name	Type	Description
MAX	I*4	NUM*2+1=number of points needed to plot a historgram of NUM sectors.

(e) Logic:

The polar mode is set and the window of the cam plot on the plot frame is defined. (PSTGRD). Then a search for the sector with maximum counts is made (PMAX). The plot arrays are filled with counts, angles coordinates for histogram, and then the user scaling for the cam in the window is defined (SCALE), such that RAD (inches) = PMAX (counts). Note that to draw a histogram, the counts and angles array are doubled and staggered by 1 element.

Ex: C(1)=A, C(2)=A, C(3)=B, C(4)=B
A(1)=M, A(2)=N, A(3)=N, A(4)=O, etc.

And the last coordinates are equal to the first coordinates so the histogram is closed.

(15) **STAPE - Sectored counts tape.** This routine copies the sector count data onto a tape.

(a) Calling sequence: Subroutine STAPE(QNEW)

(See RAD for QNEW)

(b) Module cross reference:
Called by: MAIN
Calls: JULTIM

(c) Common usage:

Common	Variables	I/O
THEADR	all	I
RATDAT	all	I

(d) Significant local variables:

Name	Type	Description
HOUT(126)	I*2	Integer*2 output array, equivalenced to ROUT.
ROUT(63)	R*4	Real*4 output array, written to tape.
ITIM(6)	I*4	Interval start time.

(e) Logic:

Write the header information to tape and then fill the output data array. Set the length variable for the record and output the record.

(16) SUB1,SUB2 - Subroutines 1 and 2. These routines are called before FOURIE and after FOURIE to allow data manipulation. They only return, unless JCL swaps in SUB1 and SUB2 with user-defined code.

(17) TIMJUL - Time to Julian. This routine converts year, month, day, hour, minute, second to the modified Julian time.

(a) Calling sequence: Subroutine TIMJUL(ITIME,JTIME)

Name	Type	I/O	Description
ITIME(6)	I*4	I	Input times.
JTIME	I*4	O	Modified Julian time.

(b) Module cross reference:
Called by: INITL,RECADV
Calls: none

(c) Common usage:

Common	Variables	I/O
TIMES	all but IBTIME,IETIME	I

(d) Significant local variables:

Name	Type	Description
IDAYS(15)	I*4	The number of days since epoch year for up to 16 years.
MONTH(13,2)	I*4	Number of days ince Jan. 1 for each month for both leap years and non-leap years.
LEAP	I*4	1=not leap year, 2=leap year

(e) Alternate entry point: TIMJL2

TIMJL2 uses year, day of year, and seconds of day instead of year, month, day, hour, minute, second. Otherwise, it is identical.

Entry TIMJL2(IYR,IDAY,ISC,JTIME)

Name	Type	I/O	Description
IYR,IDAY,ISC	I*4	I	Year, day of year, seconds of day to be converted.
JTIME	I*4	O	Modified Julian time.

(f) Logic:

The MONTH and IDAYS arrays are used to directly convert the times into the modified Julian time. (See Section I.C.)

(18) TIMLAB - Time labels. This routine labels the time axis for the anisotropy plots and the flux plot.

(a) Calling sequence: Subroutine TIMLAB(XLOW,XHI)

Name	Type	I/O	Description
XLOW	R*4	I	Beginning time of frame, in modified Julian time.
XHI	R*4	I	Ending time of frame in modified Julian time.

(b) Module cross reference:
Called by: ANISOT,RATES
Calls: JULTIM

(c) Common usage: none

(A)

(19) PCOPTN – PC-Fourier tape. This routine writes the PC-Fourier type of sector notes data, magnetic field data in PC format.

(a) Calling sequence = Subroutine PCOPTN (QNEW)
(see RAD for QNEW)

(b) Module cross reference:
Called by: MAIN
Calls: PCCONC, GTANGL, ASCII

(c) Common usage:

Common	Variables	I/O
INPARM	NUMRAT, NUMANG, QPARM	I
NAMES	ZLABEL	I
RATDAT	PHIP, DEPHI	I
THEADR	FPARM, NUMS	I

(d) Significant local variables:

Name	Type	Description
QOUT(20000)	L*1	Output array

(e) Logic:

Write the header information on tape and then fill the output data array. Write the filled output array on tape.

(d) Significant local variables:

Name	Type	Description
JTIME	I*4	Modified Julian time of the grid mark.
IDIV	I*4	Number of average intervals er grid division.
XPOS	R*4	Position ininches of each horizontal grid division.
YPOS(6)	R*4	Position in inches of each time label: year, month, day, hour, minute, second.
ITIME(6)	I*4	Holds time for the labels at each grid mark.
ITIM1(6)	I*4	Holds previous grid mark time.
ISTRT,ISTOP	I*4	Start, stop times of plot frame, same as XLOW, XHI, except integer for the loop.

(e) Logic:

There is one loop which starts at the start time of the plot and loops by the grid division to the end time. The loop variable is converted to year,month, day, hour, minute, second, and compared with the previous grid times to see whether a new time is printed. If a time is different from the previous grid time, it is labeled.

b. Satellite Dependent Structure

The satellite-dependent (SD) routines which are called from the satellite-independent routines are INITL,MAGADV,RECADV, and VALID, as outlined in the block diagram of Section IV.A. They each have a fixed calling sequence, common blocks, and purpose, but are tailored to accomplish the purpose for a particular satellite or data source. Section X. describes in detail what this entails. This section will define the framework for each routine, i.e. the minimum contents of the modules. The code for the framework is in SEJSS.MULTISAT.FOURIER(FRAMWRK).

(1) INITL - Initializer. This routine initializes all I/O devices, reads in SD namelists, and initialized the common block TIMES.

(a) Calling sequence:

Subroutine INITL(ZRVOL,ZSVOL,ZMVOL,CSIZE,
IRFILE,ISFILE,IZFILE)

Name	Type	I/O	Description
ZRVOL	R*8	I	Tape name (EBCDIC) of the output Fourier parameters tape.
ZSVOL	R*8	I	Tape name of the counts output tape.
ZMVOL	R*8	I	Tape name of the input magnetic field tape.
CSIZE	R*4	O	Character size in inches, if plotting.
IRFILE	I*4	I	Start file for ZRVOL.
ISFILE	I*4	I	Start file for ZSVOL.
IZFILE	I*4	I	Start file for ZMVOL.

(b) Module cross reference:
Called by: READIN
Calls: (SD routines), TIMJUL

(c) Common usage:

Common	Variables	I/O
USER	all	I
NAMES	all	O
TIMES	all	O
THEADR	NUMS QSAT	O I
FLAGS	QPRINT,QPLOTS, QTAPES,QRTAPE, QSTAPE,QMAGNT	I
INPARM	NUMRAT,QRATS	I
FACTRS	all	O

(d) Significant local variables: *=SD dimension

Name	Type	Description
IROLD	I*4	File number of the Fourier parameter tape output from the previous namelist set, if any.
ISOLD	I*4	Same as IROLD, except for the counts tape.
PHIOO(*)	R*4	The angle of sector 0 measured counter-clockwise from north.
WGHTO(*,3)	R*4	The weight factors for all three harmonics.
GEOM(*)	R*4	The geometric factor.
QRNEW	L*1	T=first time the Fourier parameters tape was requested this run.
QSNEW	L*1	Same as QRNEW except for counts tape.
QAGAIN	L*1	T=Plotters already initialized from previous namelist sets.

(e) Logic:

The satellite dependent input is usually processed first. Then the weight, geometric factor, and label arrays are filled. The initialization of the I/O devices, etc. proceeds in the following order:

1. Input sectored rated device
2. Output tapes
3. Plotter
4. Timing common: TIMES
5. Theader common: THEADR

(2) MAGADV - Magnetic field data advance. This routine reads in magnetic field data for one interval and stores it in the common MAGFLG.

(a) Calling sequence: Subroutine MAGADV(INTSEC,INTRVL,QNEW)

Name	Type	I/O	Description
INTSEC	I*4	I	Averaging interval in seconds of the input date tape.

Name	Type	I/O	Description
INTRV(2)	I*4	I	Time range to collect the data over, in modified Julian time.

(b) Module cross reference:
Called by: RECADV
Calls: TIMJL2,JULTIM

(c) Common usage:

Common	Variables	I/O
MAGFLD	BMAG,QPSECT,QTSECT, COSIN,BSQR,MAGCNT, IZFILE	I,O
MAGIN	all	O

(d) Significant local variables:

Name	Type	Description
MTIME	I*4	Modified Julian time (MJT) from magnetic field tape.
QWAIT	L*1	T=Interval on tape is later than current time range.
QEOF	L*1	T=And end of file mark was detected on the magnetic field tape.
IEND	I*4	Ending of time range (MJT) to process.

(e) Logic:

Check to see if the last time left a record not used yet in the buffer (QWAIT=T). If so, skip around the FREAD. Otherwise, read in a record from the magnetic field tape. Loop, summing as many records as necessary to complete the time range. If an EOF occurs, continue to the next file. If an EOV occurs, set QOFF to true and end the magnetic field tape processing. (Further calls to MAGADV simply return.)

(3) RECADV - Record advance. This routine collects the sectored rates data for one averaging interval, storing it in common RATDAT.

(a) Calling sequence: Subroutine RECADV(QNEW,QDONE,QMAGNT)

(See RAD for QNEW)

Name	Type	I/O	Description
QDONE	L*1	O	T=finished with the sectored rates by eiher end of data, or end of time range.
QMAGNT	L*1	I	T=magnetic field processing desired.

(b) Module cross reference:
Called by: MAIN
Calls: MAGADV,MAGPRO,TIMJUL

(c) Common usage:

Common	Variables	I/O
FACTRS	PHIKEP	I
INPARM	NUMRAT,NUMAVG,QRATS	I
PRINT	all but IPRINT	O
TIMES	IBTIME,IETIME,INTSEC	I
RATDAT	all	O

(d) Significant local variables: dependent

(e) Logic:

The structure is simple, in two parts:

1. Read in and collect sectored rates for the average interval.
2. Collect magnetic field data for the same interval.

The correction angle and S/C roll counters were built in for PIONEER,to be printed on the Fourier analysis listing. They may be used, or left as zero, in which case they are ignored by PRINTF.

(4) VALID - Validate. This routine validates the satellite independent user input variables and initializes the INPARM common block.

(a) Calling sequence: SubroutineVALID(IPRINT,IPLDN, FLMIN,FLMAX,QPLT)

(These are the namelist parameters as defined in READIN) All are input to VALID.

(b) Module cross reference:
Called by: READIN
Calls: none

(c) Common usage:

Common	Variables	I/O
USER	IFROM,IDEV,ITO	I
THEADR	QSATID,FPARMS,RATES	I
	NUMS	O
INPARM	NUMRAT,QRATS,QPARM	O

(d) Local variables:

Name	Type	Description
NPOSS	I*4	Number of rates for the satellite, max = 20.
ZCHAR(8)	R*8	Used to print an error message for the variable in error.
ZINPUT(9)	R*8	Contains valid input names to the FPARMS array.
ZRATES(*)	R*8	*=NPOSS. This array contains valid rate names to process for the run.

(e) Logic:

The variables are validated in the following order:

1. Integer variables
2. Time variables
3. Rate names
4. Flux min and max
5. Fourier parameter names
6. Plotter device requested

15. Adapting the Fourier Program to a New Data Source

a. Overview

The Fourier satellite-independent (SI) routines are designed such that any data set may be used to create the output if it conforms to the following criteria:

(1) There are no more than 6 different sectored rates processed per namelist set. There may be as many as 20 rates from which to choose these six.
(2) Each rate is composed of 8 sectored counts (45^{o} sectors) and all sectors have one accumulation time.
(3) The time span of one run may not exceed fifteen years.
(4) The plots are 24 centimeters long, with point density of 1, 2, 3, or 4 points/cm.

The satellite-dependent (SD) routines must be written to connect with the SI routines. A framework for these SD routines is located in SEJSS.MULTISAT.FOURIER(FRAMWRK), and contains suggested format for each routine.

b. Functions of SD Modules

The SD set of routines consists of INITL, MAGADV, RECADV, and VALID, but the analyst may certainly include others if they are called from the above SD modules. A BLOCK DATA must also be included for both SI and SD commons. The modules must accomplish the following tasks:

(1) INITL - Initialize arrays and I/O devices

  (a) Fill the NAMES common with the labels for the rates chosen in a run.
  (b) Fill the FACTRS array with weight, geometric factor, and PHIO values for the rates chosen in a run.
  (c) Read in and validate any SD extra namelist parameters.
  (d) Fill the TIMES common with the proper values. The epoch year may be changed each run by making it an SD namelist parameter. This will accomodate satellites with data spans exceeding 15 years.
  (e) Mount or open the sectored rates input data base.
  (f) Mount the output tapes (or write an end of file on them after each namelist set) if required.
  (g) Initialize the plotter if being used for the first time in the run.
  (h) Mount the magnetic field tape if required.
  (i) Assign the THEADR common array NUMS(3)=INTSEC*NUMAVG.

(2) RECADV - Collect one averaging interval of data

  (a) Fill the RATDAT common with the average interval's data.
  (b) Fill the PRINT common with the correction information. If left as zeros, it is ignored.

(c) Fill the MAGFLD common by calling two routines: MAGADV and MAGPRO.
(d) Set QDONE=.true. when the processing is to stop.

(3) VALID - Validates namelist input

(a) Check the INPUT namelist parameters: FROM,TO to be in bounds; and RATES, FPARMS to be valid names.
(b) Check the PRINT namelist parameter: IPRINT to be 1 or 2.
(c) Check the PLOTS namelist parameters; IPLDEN to be less than five but greater than zero; FLMIN,FLMAX to be greater or equal to 0.0; ensure that DEVICE (plotter device) is a 1, 2, or 3.
(d) Set QRATS and QPARMS flag arrays.
(e) Set the THEADR common array:
NUMS(1) = NUMRAT and
NUMS(2) = # of FPARMS options were .true.
(f) Set NUMRAT to be the number of sectored rates to process this run.

(4) BLOCK DATA - Initialize the common blocks to their default values.

c. Explicit Changes

If one is using the framework code to create the SD routines, the following changes are suggested for each module:

(1) INITL

There are 6 basic changes to this routine:
(a) Define NPOSS as the number of data types the satellite will ever need processed by this program.
(b) Dimension the geometric factor array GEOMO(NPOSS) and initialize it's element. (Used to define GEOM(6) in common FACTRS).
(c) Dimension the weight factor array WGHTO (NPOSS,3) and initialize its elements.
(d) Dimension the phi0 array PHIOO(NPOSS) and initialize its elements. (Used to define PHIKEP in common FACTRS)
(e) Dimension the data labels array ZLABO(4,NPOSS) and initialize its elements. (Used to define ALABL(4,20) in common NAMES)
(f) Include any namelists and their READ statements.

(2) RECADV

This routine requires two changes:

(a) Method of reading and storing the sectored data for one average interval.
(b) Filling the PHIO array.

RECADV is set up with the following structure:

1 Common definitions, dimensions, etc.

2 Time, flag, array, and common initialization

3 Read in the sector data for one averaging period, sorting it into the proper commons.

4 Collect the magnetic field data for one avaraging period by successive calls to MAGADV, if magnetic field data is to be processed.

5 Store the magnetic field data in common by one call to MAGPRO.

6 Initialize the PHIO array from PHIKEP array as PHIO=PHIKEP+correction angle.

The substructure #3 may require mounting a new tape if the end of volume was encountered, or end of file and error handling.

(3) VALID

There are two changes to this routine:

(a) Define NPOSS as the number of data types the satellite will ever need processed by this program.

(b) Dimension the data labels array ZRATES(NPOSS) and initialize its elements. These names will be the ones input by the user in the RATES parameter in namelist INPUT.

16. System Performance, Restrictions

a. Space

The core required to execute the Fourier Plot Program is dependent on how many output devices are to be used. Generally, for listings and plots with no magnetic field, the LOADER region is 250K. With the magnetic field, it becomes 270K.

b. Source Code

The source code is in FORTRANH, using the WOLFPLOT plotting package on the IBM 360. Either the 360/75 or the 360/91 may be used.

c. Time

The execution time is dependent on how many output options are asked for. Generally, a listing and all plots may be run for 1000 averaging intervals in a H00001 on the 360/91. This time may be increased if the desired data is far into the input tape.

Multisatellite Fourier Analysis Program
User's Guide

B. Overview

The Fourier Program is divided into two groups:

1. Satellite independent code (SI) which performs the analysis.
2. Satellite dependent code (SD) which reads in alluser and satellite data and prepares it for the SI code.

The SI load modules are contained in 'SB#PR.FOURSI.LOAD' and the SD load modules are located according to their name as follows:

Satellite		SI Load Module
PIONEER F,G (sectored)		'SB#PR.FOURPIO.LOAD'
PIONEER F,G (PHA)		'SB#PR.FOURPHA.LOAD'
ISEE 3		'~~SEICC.FOURICC.~~LOAD' SB#IC. FOURISE
IMP8	SB#IM	'~~SEIMP~~.FOURIMP8.LOAD'
HELIOS A,B	SB#HL	'~~SDHEL~~.FOURHEL.LOAD'
IMP7	SB#IM	'~~SEIMP~~.FOURIMP7.LOAD'

Both the SI and SD load modules are specified in the JCL as described later in this document. Documentation for user input, output, error handling, and JCL in the SD routines is documented separately for each satellite.

1. Input Required

a. Namelist parameters for ~~five~~ six namelists as follows:

(2) Namelist: INPUT

Name	Type	Default	Description
FROM(6)	I4	0	Beginning time for analysis in year (1978=78), month, day, hour, minute, second.
TO(6)	I4	0	Ending time for analysis in year (1978=78), month, day, hour, minute, second.
NUMAVG	I4	1	The number of input intervals (volumes) to average into one point.
-------			nes for the rates to be ocessed.

(1) Namelist: PC

Name	Type	Default	Description
QPCOPT	L1		T= produce PC-Fourier tape

Name	Type	Default	Description
FPARMS(9)	A8	blanks	The run parameters which specify those Fourier parameters to output on plots or tapes. Choices are: 'A0'=flux 'A1','A2','A3'=anisotropy harmonics 1-3 'PHI1','PHI2','PHI3'=Angle PHI for harmonics 1-3 'FLOW'=flow parameter 'MAG'=magnetic field data

**The plots are determined by A0,A1,A2, and A3, A0=do flux plot, A1,A2,A3=anisotropy plots for the first, second, and third harmonics. All other FPARMS parameters are used for the tape option.

SATID	A16	blanks	EBCDIC satellite name.
INTSEC	I4	900	Number of seconds per input interval.
QPRINT	L1	F	T=print FOURIER results.
QPLOTS	L1	F	T=there will be plots made.
QTAPES	L1	F	T=there will be tapes created.
QMAGNT	L1	F	T=process magnetic field data.

(3) Namelist: PRINT

Name	Type	Default	Description
IPRINT	I4	1	1=print only Fourier results 2=print counts and accumulation times in addition to Fourier results.

(4) Namelist: PLOTS

Name	Type	Default	Description
DEVICE	I4	1	1=Create SD4060 plot tape. 2=Create CalComp plot tape. 3 = printer
PLTDEN	I4	4	Plot point density in points/sm. The plot is 24 cm long.
QRATPL	L1	F	Create a rate (flux) plot.
QANIPL	L1	F	Create an anisotropy and angle plot.
QPOLPL	L1	F	Create polar (cm) plots.
QBARR	L1	F	Include error bars on the flux or anisotropy plots if they are being created.
IHARMS	I4	0	0 = Do no anisotropy arrows on cam plots 1 = do first anisotropy dash arrow only 2 = do second anisotropy solid line only 3 = do both 1 and 2
FLMIN	R4	data adjusted	Flux plot minimum if automatic scaling not desired.
FLMAX	R4	data adjusted	Flux plot maximum if automatic scaling is not desired.

(5) Namelist: TAPES

This must be used if and only if QTAPES=T in the INPUT namelist.

Name	Type	Default	Description
QRTAPE	L1	F	Create a tape of Fourier parameters.
IRFILE	I4	1	Start file number of Fourier tape.
ZRVOL	A8	blank	Volume-serial name of the tape to be used for Fourier output.

Name	Type	Default	Description
QSTAPE	L1	F	Create a tape of counts and accumulation time.
ISFILE	I4	1	Start file number of counts tape.
ZSVOL	A8	blank	Volume-serial names of the tape to be used for counts output.

(5) Namelist: MAGNT

This must be used if and only if QMAGNT=T in the INPUT namelist.

Name	Type	Default	Description
IHISTS	I4	0	0 = do no magnetic field histograms 1 = do the phi histogram only 2 = do the theta histogram only 3 = do both phi and theta histograms
ZMVOL	A8	blank	Magnetic field data base tape name.
IZFILE	I4	I	Start file number on magnetic field data base tape.

----NOTE----

The INPUT determines which of the other four namelists are to be used. These other four namelist must appear in the order listed. The set of namelist describing the characteristics of the job run may be repeated any number of times with varying parameters. This allows several plots with different rate combinations. All parameters except SATID, RATES, and FPARMS default to the last value used in the previous namelist set.

b. Tape input is required as follows:

(1) Plot Tape

This is a 7-track 556 BPI tape to be used for SD4060 of Calcomp plots if desired.

(2) Rates Input Data

This is satellite dependent (SD).

(3) Fourier Tape — output tape ?

This is a tape used for Fourier parameter output if QTAPES=T in the INPUT namelist and QRTAPE=T in the TAPES namelist,, device **unit 10** is used for this tape.

(4) Counts Tape

This is a tape for the counts and accumulation time output, only when QTAPES=T in the INPUT namelist and QSTAPE=T in the TAPES namelists. Device **until 11** is used for this tape.

(5) **Magnetic Field Data Base Tape** unit = ?

This is a tape created for the Fourier program which contains the magnetic field data as described in documentation on the Fourier MAGDBG documentation.

(6)

c. Subroutine Substitution

There are two positions one may insert any subroutine by JCL methods:

1. SUB1 - This subroutine is called before the Fourier routine so that the data may be altered before Fourier analysis.

2. SUB2 - This subroutine is called after Fourier analysis so that the data may be altered before being output in some form.

If a SYSLIB card pointing to an object module with SUB1 and/or SUB2 as members are inserted before the SYSLIB card pointing to the Fourier program object modules, then the program will accept the new SUB1, SUB2 routines. If this card is not inserted, then the dummy SUB1, SUB2 routines, which merely return control, are used

(6) PC - Fourier tape

This is an output tape containing sector rates data, magnetic field data in PC format. Device unit 14 is used for this tape.

Ex:

No Substitution:

```
//SYSLIB  DD  DSN=SB#PR.FOURSI.LOAD
//        DD  DSN=SYS1.FORTLIB,DISP=SHR
//        DD  DSN=SYS2.FORTLIB,DISP=SHR
//        DD  DSN=SYS2.WOLFPLOT,DISP=SHR
```

Substitution: (USRID.PROG.LOAD has member SUB1)

```
//SYSLIB  DD  DSN=USRID.PROG.LOAD,DISP=SHR
//        DD  DSN=SEJSS.FOURIER.SI.LOAD,DISP=SHR
//        DD  DSN=SYS1.FORTLIB,DISP=SHR
//        DD  DSN=SYS2,FORTLIB,DISP=SHR
//        DD  DSN=SYS2.WOLFPLOT,DISP=SHR
```

2. Output Generated

Automatic Output

a. The input namelist data is printed.

b. A summary of how many plot tape files were created is printed.

User Option Output

Output	Namelist:	option flag
1. Fourier Parameter Printout	INPUT:	QPRINT=T
	PRINT:	IPRINT=1
2. Fourier Parameter and Counts Printout	INPUT:	QPRINT=T
	PRINT:	IPRINT=2
3. Flux or Rates	INPUT:	QPLOTS=T
	PLOTS:	QRATPL=T
4. Anisotropy Plots	INPUT:	QPLOTS=T
	PLOTS:	QANIPL=T
5. Polar or Cam Plots	INPUT:	QPLOTS=T
	PLOTS:	QPOLPL=T
6. Tape of Fourier Parameters	INPUT:	QTAPES=T
	TAPES:	QRTAPE=T
7. Tape of Counts and Accumulation Time	INPUT:	QTAPES=T
	TAPES:	QSTAPE=T
8. PC-Fourier tape	PC :	QPCOPT=T

3. Running the Program

The following steps must be done to submit a run.

Step 1

Hang all required tapes in the slots and determine the namelist parameters to be used.

Step 2

Edit the TSO file which contains the JCL and namelists to run the job. Change:

1. The JOBCARD
2. Plot tapes VOL=SER names
3. Namelist parameters to suit the desired input and output.
4. All SD unit DD card specifications as required by the particular satellite.
5. PC-Fourier tape volume name

Step 3

Submit the job using:

1. 'SUB^*' if still in edit mode.
2. 'SUB^name' if the file has been renamed and saved under a new file name.

---If still in edit and the file is not renamed, end the edit session with END^N command.---

4. Error Handling

Return Code

1 The namelist parameters are checked to ensure typing errors were not introduced. The program stop will return code of 1 if any parameters are not valid.

- If there is an I/O error while creating the anisotropy plots, the message:

'RECORD # OF HARMONIC # SKIPPED, I/O DISK ERR.'

7 If there is a timing problem the message:

'JULTIM HAS BAD TIMES'

is issued and the program stops with a return code of 7. Consult person who maintains the program.

Return Code

- When an I/O error is encountered while creating polar plots, the message:

  'DISK READ ERROR IN POLAR ROUTINE'

  is used and the program continues. Some data will be missing.

- When an I/O error is encountered while creating flux plots, the message:

  'RECORD # SKIPPED DUE TO I/O ERROR FROM DISK'

  is issued, and the program continues. Some data will be missing on the flux plot.

C. JCL Required

The JCL is contained in the file '~~SB#PR.LIB.CNTL(AFOURJCL)~~ 'SB#PR.MULTIDAT.FOURIER.SOURCE(SATINDEP)'. This file contains ~~only~~ that JCL required for the SI routines. ~~Comment cards indicate where SD JCL is to be included.~~

~~Sample JCL -- Satellite independent module~~

FT09

III. Multisatellite Fourier Analysis Program PIONEER System Documentation

A. Overview

The satellite-dependent (SD) PIONEER routines allow the PIONEER 10 and 11 data to be processed through the Fourier program's analysis and output procedures. The satellite-independent (SI) routines are contained in separate source and load modules from all SD code, and thus, any satellite may be linked via JCL.

This document describes the SD internal code description for PIONEER Fourier analysis. The main document containing the SI description must be reviewed prior to this one.

1. Input Required

a. Satellite independent namelist INPUT

(1) The RATES parameter may have the following values:

RATES Parameter	Rate Signified
SR1A	A1 A2 B CI CIII
SR1B	A2 B K1 CIII
SR1C	DI DII F
SR1D	DI DII E1 F
SR2A	SI5 SII SIIA SIII
SR2B	SI6 SII SIIA SIII
SR2C	SI7 SII SIIA SIII
SR2D	SI8 SII SIIA SIII
SR2E	SI SII5 SIIA SIII
SR2F	SI SII6 SIIA SIII
SR2G	SI SII7 SIIA SIII
SR2H	SI SII8 SIIA SIII

(2) The parameter SATID must be 'PIONEER-F', 'PIONEER-G', 'PIONEER-S', or any valid PIONEER flux catalog name.

b. PIONEER namelist PIO

&PIO INTAPE,SRCE,ZVOL

This namelist must appear after each namelist set of the SI routines.

Name	Type	Default	Description
INTAPE	I*4	2	1=user-input flux tape 2=search catalog for flux tape with user-specified times

Name	Type	Default	Description
SRCE	A4	blank	The flux catalog source name
ZVOL	A8	blank	Volume-serial name of the user-input flux tape if INTAPE=1

c. Flux Tape

This is a standard label, variable length record tape in the PIONEER flux tape format.[1] It is either user provided or provided by the flux catalog. The tape uses unit 9, with DSN = PIOFLUX.

4. Flux Catalog

The flux catalog[1] is used only if INTAPE=T in the INPUT namelist. The catalog file name must be entered in the JCL for unit 30. Currently, PIONEER catalog is in:

'SB#PR.FLUXCAT.DATA'

2. Output Generated

(See Fourier Plot Program SI Documentation)

3. Module Documentation

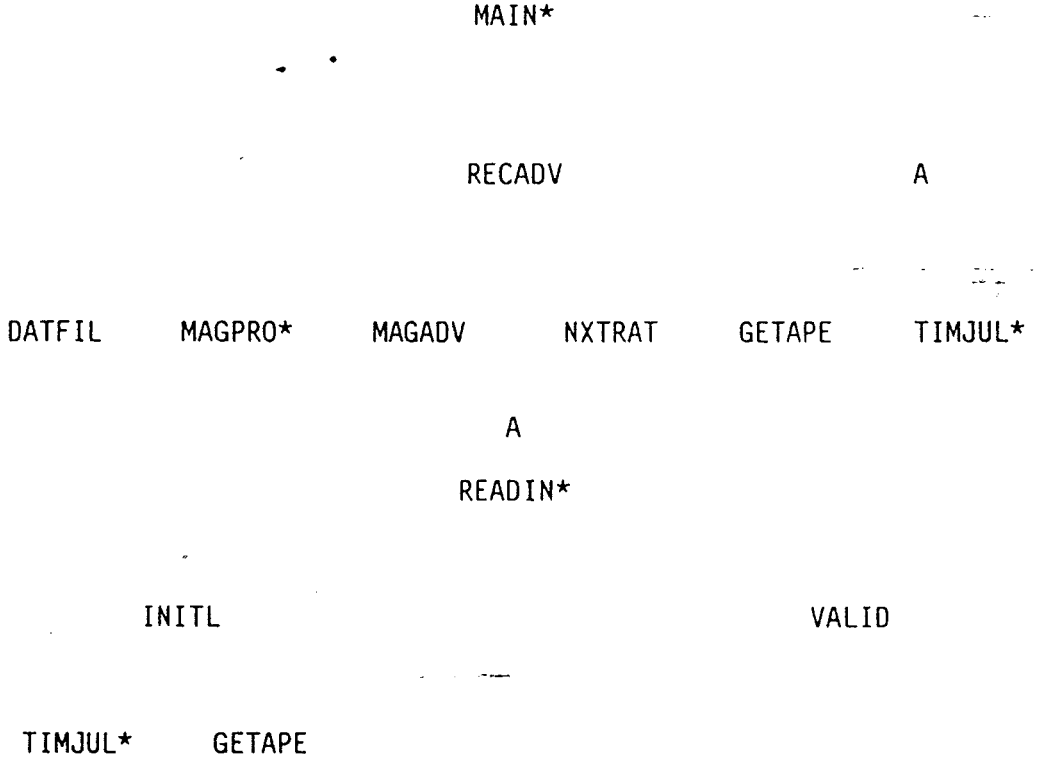
Module	Description
DATFIL	Fills the counts and time arrays, checking for valid data
GETAPE	Finds and mounts a flux tape
INITL	Initialized I/O devices, common blocks, and reads in the SD namelist PIO
NXTRAT	Skips seven records on the flux tape so the next one read is a rates record
MAGADV	Reads an averaging interval of magnetic field data
RECADV	Reads in one rate and magnetic field data average into the RATDAT and MAGFLD commons
VALID	Validates the input namelist data for the SI READIN module

[1]"PIONEER/HELIOS, Flux Data Base Generator (FLXDBG) Maintenance Programmer's Introduction", CSC Document, 1978.

4. Program Structure

a. Block Diagram

*=Satellite independent module



b. Algorithm

The SI module READIN reads the SI namelist and calls VALID to validate them. Then it calls INITL to read in the SD namelist PIO and initialize the I/O devices. Control is returned to MAIN which succesively calls RECADV to accummulate one average point of sector counts and if desired, magnetic field data. RECADV reads in a flux record, stores it (DATFIL), and collects magnetic field data if desired (MAGPRO, MAGADV). Before reading the next rates record, six non-rates records are skipped. (NXTRAT).

c. Error Handling

The following return codes and messages may be printed:

Return Code	Description
-	'I/O ERROR WHILE SPACING TO NEXT RECORD'
	This flags a tape read error on the flux tape.
2	'CAN NOT FIND THE SPACECRAFT ID IN CATALOG'
	Check the spelling of the S/C ID and make sure the catalog is the correct one for PIONEER.
3	'DATA SET COUNT EXCEEDS 4 IN SEARCH FOR SOURCE: Satellite ID SRCE=name user entered'
	Check the SRCE parameter in the INPUT namelist.
4	The user-defined average interval does not match the catalog source name's interval.
-	'NO TAPES IN CURRENT TIME RANGE'
	The flux catalog does not contain the full time range of flux tapes as required by the user.
5	'ERROR FROM DREAD IN CATALOG: STOP.
	An I/O error was discovered in the flux catalog. Rerun the job, and if persistent, the catalog must be replaced.
-	'INPUT TAPE READ ERROR,SKIP THIS RATE'
	A tape read error on the flux tape caused a volume to be skipped.

5. Common Block Definitions

There is only one SD common block, used to read in one flux tape rates record in RECADV:

```
Common: /PSUMRC/HTIME(6),H11,HMDAYC,MSECC,MSTIME,ISR1(9,4),ISR2(9,8),IUR(49
        ),SSCOM1(4),ISCOM2(6),TSR7(9,4),TSR2(9,8),TUR(49),HSCOM(10),HROLL,H
        FLG,SANG
```

SEE "PIONEER/HELIOS Flux Data Base Generator (FLXDBG) Maintenance Programmer's Introduction", CSC, 1978, page 7 for the definition of the rates record values.

6. Individual Module Documentation

All modules were designed, coded, and tested by Jenny S. Jacques, Code 664, 1979-1980.

a. (1) Module: DATFIL - Fills the data arrays with counts and time.

(2) Calling sequence:

Subroutine DATFIL(K,NUM,NOFF,ISR,TSR,IREJEC,QUSED,QRATS)

Name	Type	I/O	Description
K	I*4	I,O	Pointer to the counts array, increments with each rate stored
NUM	I*4	I	Number of rates to process
NOFF	I*4	I	NOFF + NUM is the rate number in the input arrays to process
ISR(9,NUM)	I*4	I	Input counts array
TSR(9,NUM)	R*4	I	Input time array
IREJEC(6)	I*4	O	Number of averages rejected for each rate due to differing sector times
QUSED(6)	L*1	O	T = data has been included in the arrays for the rate
QRATS(20)	L*1	I	T = this rate is being used

(3) Called by: RECADV
Calls: none

(4) Common usage:

Common	Variables	I/O
RATDAT	COUNTS,ACCUM	O

(5) Local variables: none

(6) Logic:

A main loop is set up that loops through the input data rates. If one is being processed this run, a check to ensure all sectors are collected over the same time is done. If they are, the counts and time are summed into the output arrays and QUSED (rate #) = T. Otherwise, nothing is summed for that rate.

b. (1) Module: GETAPE -Finds and mounts a flux tape onto unit 9

(2) Calling sequence: Subroutine GETAPE(SRCE,ZSLOT,INTAPE,QDONE)

Name	Type	I/O	Description
SRCE	A4	I	Flux catalog source name
ZSLOT	A8	I,O	Volume - serial name of the flux tape, input if user-provided output if obtained from the catalog
INTAPE	I*4	I 2 = T =	1 = User-provided flux tape Fetch flux tape from the catalog No flux tape in the time range was found in the catalog

(3) Called by: INITL
Calls: none

(4) Common usage:

Common	Variables	I,O
NAMES	ZSAT,ASAT	I
TIMES	IBTIME,IETIME,INTSEC	I

(5) Local variables:

Name	Type	Description
WORD(272)	R*4	These arrays are all equivalenced

I*4 and are used to read in the flux
I*4 catalog records. They are
I*2 different modes to interpret
various byte fields according
to the number type in the field.

W(2)	R*4	These variables are equivalenced
ZTEST	R*8	in order to extract the satellite

ID's first 8 characters and
compare with ZSAT.

IVOL(2)	I*4	These variables are equivalenced
ZVOLUM	R*8	in order to extract the volume

name from the catalog and call
MOUNT with it.

OSRCE	A4	Records the catalog source name,
OZSLOT	A8	volume name, and flux tape option

GETAPE from RECADV or INITL.

ZVOLD	A8	Records the previous flux tape volume name to compare with the present one. If they are the same, the tape is rewound. If not the same, the old one is unloaded and the new one mounted.
NDFILE	I*4	Record number of the catalog where desired source catalog begins.
NEXTRA	I*4	Word number in the catalog of the source names. Used to locate the correct source.
NFIRST	I*4	Word number in the catalog of the spacecraft ID's, used to locate the correct spacecraft ID.
NUMTPS	I*4	The number of used flux tapes for a particular Satellite and source.
QSTART	L*1	T = firts to,e through GETAPE for the run.

(6) Logic:

If the user provides a tape, it is simply mounted and GETAPE returns (INTAPE = 1). If the flux catalog is used (INTAPE = 2), it must be searched for the correct satellite, then the correct source for tht satellite, then the correct time range to process. A tape volume name is thus fetched with the correct Satellite ID, source, and times, and it is mounted. Then GETAPE returns.

In both cases of INTAPE, there may have been a flux tape previously used in this run with another namelist set. If so, the tape is not unloaded and mounted again, but is simply rewounded to the beginning.

c. (1) Module: INITL - Initializes the I/O devices, common blocks, and reads in the PIO namelist.

(See the "Fourier Plot Program Satellite Independent System Documentation" for a basic description of .INITL. The differences of additions/deletions are described below.)

Differences or Additions/Deletions

1. There are 12 possible rates
2. A namelist PIO is read in
3. GETAPE is called to fetch and mount the flux tape

d. (1) Module: NXTRAT - Advances flux tape 7 records

(2) Calling sequence: Subroutine NXTRAT(*)
* is the return if an end of file is read

(3) Called by: RECADV
Calls: none

(4) Common usage: none

(5) Local variables: none

(6) Logic:

A loop to read seven records is done. If an I/O error occurs, the record is skipped. If an end of file occurs, the routine returns to a statement number in REDADV. (The FREAD statements use a negative unit number to prevent the input buffer from being transferred twice. See the IBM FTIO booklet.)

e. (1) Module: MAGADV - Magentic field tape advance - This routine collects the magnetic field data, within the time range passed, from the fourier magnetic field data base tape.

(2) Calling Sequence:

SUBROUTINE MAGADV (INTSEC,INTRVL,QNEW)

Name	Type	I,O	Description
INTSEC	I*4	I	Averaging interval in seconds of the input data tape

INTRVL(2)	I*4	I	Time range to collect the data over, in modified Julian time

(3) Module Cross Reference:

Called by: RECADV
Calls: TIMJL2,JULTIM

(4) Common Usage:

Common	Variables	I/O
MAGFLD	BMAG,QPSECT,QTSECT, COSIN,BSQR,MAGCNT,IZFILE	I,O
MAGIN	all	O

(5) Significant Local Variables:

Name	Type	Description
MTIME	I*4	Modified Julian time (MJT) from magnetic field tape
QWAIT	L*1	T = Interval on tape is later than current time range
QEOF	L*1	T = And end of file mark was detected on the magnetic field tape
IEND	L*1	Ending of time range (MJT) to process

(6) Logic:

Check to see if the last time left a record not used yet in the buffer (QWAIT=T). If so, skip around the FREAD. Otherwise, read in a record from the magnetic field tape. Loop, summing as many records as necessary to complete the time range. If an EOF occurs, continue to the next file. If an EOV occurs, set QOFF to true and end the magnetic field tape processing. (Further calls to MAGADV simply return)

f. (1) Module: RECADV - Reads in one average of sectored counts data and, if desired, magnetic field data.

(See the "Fourier Plot Program Satellite Independent System Documentation" for a basic description or additions/deletions are described below.)

Differences or Additions/Deletions

1. PSUMRC is used to contain the flux tape rates data records.
2. DATFIL is called to sum the flux tape rates data into the counts and times arrays.
3. The length of the record determines whether a solar correction angle must be added to PHIO array.
4. GETAPE is called to fetch a new tape if the current one ends with time still left to process.

g. (1) Module: VALID - Validates the input satellite independent namelist values.

(See the "Fourier Plot Program Satellite Independent System Documentation" for a basic description of VALID. The differences/additions/deletions are listed below.)

Differences on Additions/Deletions

1. There are 12 possible rate ID's.
2. The rate ID's to validate are unique to PIONEER 10 and 11.

7. Program Assumptions and Restrictions

a. The flux tape requires 32K core if BUFNO = 1 in the DCB is specified.
b. The flux tape must be of the standard format for flux tapes for PIONEER 10 and 11.
c. The catalog must be the flux tape catalog named in Section II. 3.

Multisatellite Fourier Analysis Program
PIONEER User's Guide

B. Overview

The satellite-dependent (SD) PIONEER routines allow the PIONEER 10 and 11 data to be processed through the Fourier program's analysis and output procedures. The satelljte-independent (SI) routines are contained in separate source and load modules from all SD code, and thus, any satellite may be linked via JCL.

This document describes the SD internal code description for PIONEER Fourier analysis. The main document containing the SI description must be reviewed prior to this one.

1. Input Required

a. Satellite independent namelist INPUT

(1) The RATES parameter may have the following values:

RATES Parameter	Rate Signified
SR1A	A1 A2 B CI CIII
SR1B	A2 B K1 CIII
SR1C	DI DII F
SR1D	DI DII E1 F
SR2A	SI5 SII SIIA SIII
SR2B	SI6 SII SIIA SIII
SR2C	SI7 SII SIIA SIII
SR2D	SI8 SII SIIA SIII
SR2E	SI SII5 SIIA SIII
SR2F	SI SII6 SIIA SIII
SR2G	SI SII7 SIIA SIII
SR2H	SI SII8 SIIA SIII

(2) The parameter SATID must be either 'PIONEER-F, 'PIONEER-G', 'PIONEER-S', or any valid PIONEER flux catalog name.

b. PIONEER namelist PIO

&PIO INTAPE,SRCE,ZVOL

This namelist must appear after each namelist set of the SI routines.

Name	Type	Default	Description
INTAPE	I*4	2	1=user-input flux tape 2=search catalog for flux tape with user-specified times
SRCE = 625 pioneer-6A4		blank	The flux catalog source name
Name = PENC Pioneer-F	Type	Default	Description

ZVOL	A8	blank	Volume-serial name of the user-input flux tape if INTAPE=1

c. Flux Tape

This is a standard label, variable length record tape in the PIONEER flux tape format.[1] It is either user provided or provided by the flux catalog. The tape uses unit 9, with DSN = PIOFLUX.

d. Flux Catalog

The flux catalog[1] is used only if INTAPE=T in the INPUT namelist. The catalog file name must be entered in the JCL for unit 30. Currently, PIONEER catalog is in:

'SB#PR.FLUXCAT.DATA'

2. Error Handling

The following return codes and messages may be printed:

Return Code	Description
-	'I/O ERROR WHILE SPACING TO NEXT RECORD'
	This flags a tape read error on the flux tape.
2	'CAN NOT FIND THE SPACECRAFT ID IN CATALOG'
	Check the spelling of the S/C ID and make sure the catalog is the correct one for PIONEER.
3	'DATA SET COUNT EXCEEDS 4 IN SEARCH FOR SOURCE: Satellite ID SRCE=name user entered'
	Check the SRCE parameter in the INPUT namelist.
4	The user-defined average interval does not match the catalog source name's interval.

Return Code	Description
-	'NO TAPES IN CURRENT TIME RANGE

The flux catalog does not contain the full time range of

[1]"PIONEER/HELIOS, Flux Data Base Generator (FLXDBG) Maintenance Programmer's Introduction", CSC Document, 1978.

flux tapes as required by the user.

5 'ERROR FROM DREAD IN CATALOG: STOP.

An I/O error was discovered in the flux catalog. Rerun the job, and if persistent, - the catalog must be replaced.

- 'INPUT TAPE READ ERROR,SKIP THIS RATE'

A tape read error on the flux tape caused a volume to be skipped.

9 The parameter SATID contained an invalid name. See Section II.b.

3. JCL Required

1. Load module to link with SI routines:
'SB#PR.FOURPIO.LOAD' , 'SB#PR.PLOPTN.LOAD'

2. Flux catalog, unit 30:
'SB#PR.FLUXCAT.DATA'

3. &PIO namelist for each namelist set.

4. Unit 9 defined as:

```
//FT09F001 DD DSN=PIOFLUX,DISP=SHR,LABEL=(,SL),UNIT=(~~1600~~ 6250,,DEFER),
//    VOL=SER=DUM1,DCB=BUFNO=1
```

5. Unit 14 defined as

```
//FT14F001 DD UNIT=(6250,,DEFER),DISP=(NEW,KEEP),LABEL=(1,NL,,OUT),
//    DCB=(RECFM=U,BLKSIZE=20000,DEN=3),VOL=SER=PCTAPE
```

```
//XRHHLPIO JOB (SBO16,350,10),PIONEER.F,TIME=(0,10),CLASS=A,
//    MSGCLASS=X,NOTIFY=XRHHL
/*JOBPARM LINES=100
//*
//* PIONEER FOURIER
//*
// EXEC OLOADERH,REGION=1200K,PARM='SIZE=260K,EP=MAIN'
//SYSLIB DD DSN=SB#PR.FOURSI.LOAD,DISP=SHR
//       DD DSN=SB#PR.FOURPIO.LOAD,DISP=SHR
//       DD
//       DD
//       DD DSN=SYS2.WOLFPLOT,DISP=SHR
//       DD DSN=SB#PR.PCOPTN.LOAD,DISP=SHR
//       DD DSN=SB#IM.ADDTOLIB.LOAD,DISP=SHR
//SYSLIN DD DSN=SB#PR.FOURSI.LOAD(MAIN),DISP=SHR
//       DD DSN=SB#PR.FOURPIO.LOAD(RATDAT),DISP=SHR
//FT06F001 DD SYSOUT=X,DCB=(RECFM=VBA,LRECL=137,BLKSIZE=141)
//FT09F001 DD DSN=PIOFLUX,DISP=SHR,LABEL=(,SL),UNIT=(6250,,DEFER),
//    VOL=SER=DUM1,DCB=BUFNO=1
//FT14F001 DD UNIT=(6250,,DEFER),DISP=(NEW,KEEP),LABEL=(1,NL,,OUT),
//   DCB=(RECFM=U,BLKSIZE=20000,DEN=3),VOL=SER=PCTAPE
//FT15F001 DD UNIT=SYSDA,SPACE=(TRK,(15,10)),DISP=(NEW,DELETE),
//    DCB=(RECFM=FB,LRECL=608,BLKSIZE=6688,BUFNO=2)
//FT16F001 DD UNIT=SYSDA,SPACE=(TRK,(15,10)),DISP=(NEW,DELETE),
//    DCB=(RECFM=FB,LRECL=60,BLKSIZE=7260,BUFNO=2)
//*PLOTTAPE DD DCB=(DEN=1,BUFNO=2),LABEL=(,BLP,,OUT),
//*   DSN=NULLFILE,VOL=SER=CALCXX,UNIT=(7TRACK,,DEFER)
//PLOTTAPE DD DUMMY
//*WOLF4060 DD UNIT=(6250,,DEFER),LABEL=(1,NL),DISP=(NEW,KEEP),
//*   DCB=(DEN=3,BUFNO=2),DSN=NULLFILE,VOL=SER=PI009
//WOLF4060 DD DUMMY
//FT30F001 DD DSN=SB#PR.FLUXCAT.DATA,DISP=SHR
//*     THE FOLLOWING IS A COMPLETE LIST OF ALL POSSIBLE
//*     NAMELISTS AND THEIR PARAMETERS. FOR THEIR PROPER USEAGE,
//*     SEE DOCUMENTATION ON THE FOURIER PROGRAM.
//*&INPUT FROM,TO,NUMAVG,RATES,FPARMS,SATID,INTSEC,QPRINT,
//*       QTAPES,QPLOTS,QMAGNT
//*&PRINT IPRINT
//*&PLOTS DEVICE,PLTDEN,QRATPL,QANIPL,QPOLPL,QBARR,IHARMS,FLMIN,FLMAX
//*&TAPES QRTAPE,IRFILE,ZRVOL,QSTAPE,ISFILE,ZSVOL
//*&MAGNT IHISTS,ZMVOL,IZFILE
//*&(SATLITE NAMELISTS)
//DATA5 DD *
 &PC QPCOPT=T, &END
 &INPUT FROM=86,05,18,00,00,TO=86,05,18,03,00,INTSEC=900,NUMAVG=4,
   RATES='SR1B','SR1C','SR1D','SR2B','SR2C','SR2D',
   FPARMS='A0','A1','A2','A3','PHI1','PHI2','PHI3',
   SATID='PIONEER-F',QPRINT=T, &END
 &PRINT IPRINT=2,    &END
 &PIO SRCE='PENC',INTAPE=2,    &END
//   EXEC NTSO
```

6 rates max in job

IV. Multisatellite Fourier Analysis Program
PIONEER PHA System Guide

A. Overview

The satellite-dependent (SD) PIONEER PHA routines allow the PIONEER 10 and 11 PHA data to be processed through the Fourier program's analysis and output procedures. The satellite-independent (SI) routines are contained in separate source and load modules from all SD code, and thus, any satellite may be linked via JCL. The PHA data are considered a separate satellite from the other PIONEER sectored rates data.

This document describes the SD user input required for PIONEER Fourier analysis. The main document containing the SI user input must be reviewed prior to this one.

1. Input Required

a. Satellite independent namelist INPUT'S RATES parameter and SATID are left blank.

b. Sectored PHA Data Base

This data base resides on disk. It is created specifically for this program by someone desiring a particular set of energies to be analyzed. The data set is created by running the PIONEER fluxplot program, using the BS (bin sectors) card. Section I of the PIONEER F&G User's Guide describes the bin card. Instead of a 'B' in column 1, put a BS in columns 1 and 2. The data set must be allocated prior to submitting the fluxplot run.

2. Output Generated

(See Fourier Plot Program SI Documentation)

3. Module Documentation

Module	Description
DATFIL	Fills the counts and time arrays, checking for valid data
APHDR	Initializes the input data file, retrieving rate labels and analysis values.
INITL	Initialized I/O devices, common blocks, and reads in the SD namelist PIO
MAGADV	Reads an averaging interval of magnetic field data
RECADV	Reads in one rate and magnetic field data average into the RATDAT and MAGFLD commons

Module	Description
VALID module	Validates the input namelist data for the SI READIN
APDATA	Reads in the counts data from the data file.

4. Program Structure .

a. Block Diagram

*=Satellite independent module

MAIN*

A

RECADV

DATFIL MAGPRO* MAGADV NXTRAT APDATA TIMJUL*

A

READIN*

INITL VALID

TIMJUL* APHDR

b. Algorithm

The SI module READIN reads the SI namelist and calls VALID to validate them. Then it calls INITL to initialize the I/O devices. Control is returned to MAIN which succesively calls RECADV to accummulate one average point of sector counts and if desired, magnetic field data. RECADV reads in a flux record, stores it (DATFIL), and collects magnetic field data if desired (MAGPRO, MAGADV).

c. Error Handling

The following return codes and messages may be printed:

Return Code	Description
-'INPUT DISK READ ERROR,SKIP THIS RATE'	A disk read error on the input file caused a volume to be skipped.

5. Common Block Definitions

There are no SD common blocks.

6. Individual Module Documentation

All modules except APHDR and APDATA were designed, coded, and tested by Jenny S. Jacques, Code 664, 1980. APHDR and APDATA were created by Nand Lal, CSC.

a. (1) Module: DATFIL - Fills the data arrays with counts and time.

(2) Calling sequence:

Subroutine DATFIL(K,NUM,NOFF,ISR,TSR,IREJEC,QUSED,QRATS)

Name	Type	I/O	Description
K	I*4	I,O	Pointer to the counts array, increments with each rate stored
NUM	I*4	I	Number of rates to process
NOFF	I*4	I	NOFF + NUM is the rate number in the input arrays to process
ISR(9,NUM)	I*4	I	Input counts array
TSR(9,NUM)	R*4	I	Input time array
IREJEC(6)	I*4	O	Number of averages rejected for each rate due to differing sector times
QUSED(6)	L*1	O	T =data has been included in the arrays for the rate
QRATS(20)	L*1	I	T =this rate is being used

(3) Called by: RECADV

Calls: none

(4) Common usage:

Common	Variables	I/O
RATDAT	COUNTS,ACCUM	O

(5) Local variables: none

(6) Logic:

A main loop is set up that loops through the input data rates. If one is being processed this run, a check to ensure all sectors are collected over the same time is done. If they are, the counts and time are summed into the output arrays and QUSED (rate #) = T. Otherwise, nothing is summed for that rate.

b. (1) Module: INITL - Initializes the I/O devices, common blocks, and reads in the PIO namelist.

(See the "Fourier Plot Program Satellite Independent System Documentation" for a basic description of .INITL. The differences of additions/deletions are described below.)

Differences or Additions/Deletions

1. There are an infinite number of possible rates, as defined by the data file.
2. APHDR initializes the geometric factors, the weight factors, and the rate labels.

c. (1) Module: MAGADV - Magnetic field tape advance - This routine collects the magnetic field data, within the time range passed, from the fourier magnetic field data base tape.

(2) Calling Sequence:

SUBROUTINE MAGADV (INTSEC,INTRVL,QNEW)

Name	Type	I,O	Description
INTSEC	I*4	I	Averaging interval in seconds of the input data tape
INTRVL(2)	I*4	I	Time range to collect the data over, in modified Julian time

(3) Module Cross Reference:

Called by: RECADV

Calls: TIMJL2,JULTIM

(4) Common Usage:

Common	Variables	I/O
MAGFLD	BMAG,QPSECT,QTSECT, COSIN,BSQR,MAGCNT,IZFILE	I,O
MAGIN	all	O

(5) Significant Local Variables:

Name	Type	Description
MTIME	I*4	Modified Julian time (MJT) from magnetic field tape
QWAIT	L*1	T = Interval on tape is later than current time range
QEOF	L*1	T = And end of file mark was detected on the magnetic field tape
IEND	L*1	Ending of time range (MJT) to process

(6) Logic:

Check to see if the last time left a record not used yet in the buffer (QWAIT=T). If so, skip around the FREAD. Otherwise, read in a record from the magnetic field tape. Loop, summing as many records as necessary to complete the time range. If an EOF occurs, continue to the next file. If an EOV occurs, set QOFF to true and end the magnetic field tape processing. (Further calls to MAGADV simply return)

d. (1) Module: RECADV - Reads in one average of sectored counts data and, if desired, magnetic field data.

(See the "Fourier Plot Program Satellite Independent System Documentation" for a basic description or additions/deletions are described below.)

Differences or Additions/Deletions

1. DATFIL is called to sum the flux tape rates data into the counts and times arrays.
2. The return variable from APDATA determines whether a solar correction angle must be added to PHIO array.

e. (1) Module: VALID - Validates the input satellite independent namelist values.

(See the "Fourier Plot Program Satellite Independent System Documentation" for a basic description of VALID. The differences/additions/deletions are listed below.)

Differences on Additions/Deletions

1. There are an infinite number possible rate ID's, as determined by the data file.

7. Program Assumptions and Restrictions

1. The input data file must be created by the FLUXPLOT program as described in Section II.2.

Multisatellite Fourier Analysis Program
PIONEER PHA User's Guide

B. Overview

The satellite-dependent (SD) PIONEER PHA routines allow the PIONEER 10 and 11 PHA data to be processed through the Fourier program's analysis and output procedures. The satellite-independent (SI) routines are contained in separate source and load modules from all SD code, and thus, any satellite may be linked via JCL. The PHA data are considered a separate satellite from the other PIONEER sectored rates data.

This document describes the SD user input required for PIONEER Fourier analysis. The main document containing the SI user input must be reviewed prior to this one.

1. Input Required

a. Satellite independent namelist INPUT'S RATES parameter and SATID are left blank.

b. Sectored PHA Data Base

This data base resides on disk. It is created specifically for this program by someone desiring a particular set of energies to be analyzed. The data set is created by running the PIONEER fluxplot program, using the BS (bin sectors) card. Section I of the PIONEER F&G User's Guide describes the bin card. Instead of a 'B' in column 1, put a BS in columns 1 and 2. The data set must be allocated prior to submitting the fluxplot run.

2. Error Handling

The following return codes and messages may be printed:

Return Code	Description
-	'INPUT DISK READ ERROR,SKIP THIS RATE'

A disk file read error on the input file caused a volume to be skipped.

3. JCL Required

a. Load module to link with SI routines:
'SB#PR.FOURPHA.LOAD'

b. Unit 49 defined as the input Sectored PHA disk file name.

C. Sample JCL - PIONEER PHA

V. Multi-Satellite Fourier Program HELIOS System Documentation

A. Overview

The satellite-dependent (SD) HELIOS routines allow the HELIOS A and B data to be processed through the Fourier program's analysis and output procedures. The satellite-independent (SI) routines are contained in separate source and load modules from all SD code, and thus, any satellite may be linked via JCL.

This document describes the SD internal code description for HELIOS Fourier analysis. The main document containing the SI description must be reviewed prior to this one.

1. Input Required

a. Satellite independent namelist INPUT

(1) The RATES parameter may have the following values:

RATES Parameter	Rate Signified
SR1A	A1 A2 B CI CIII
SR1B	A2 B K1 CIII
SR1C	DI DII F
SR1D	DI DII E1 F
SR2A	SI5 SII SIIA SIII
SR2B	SI6 SII SIIA SIII
SR2C	SI7 SII SIIA SIII
SR2D	SI8 SII SIIA SIII
SR2E	SI SII5 SIIA SIII
SR2F	SI SII6 SIIA SIII
SR2G	SI SII7 SIIA SIII
SR2H	SI SII8 SIIA SIII
SR3A	SI5 SII SIIA SIII
SR3B	SI6 SII SIIA SIII
SR3C	SI7 SII SIIA SIII
SR3D	SI8 SII SIIA SIII
SR3E	SI SII5 SIIA SIII
SR3F	SI SII6 SIIA SIII
SR3G	SI SII7 SIIA SIII
SR3H	SI SII8 SIIA SIII

(2) The parameter SATID must be one of the following: 'HELIOS-A', 'HELIOS-B', 'HELIOS-1', or HELIOS-2'.

b. HELIOS namelist HEL

&HEL INTAPE,SRCE,ZVOL

This namelist must appear after each namelist set of the SI routines.

Name	Type	Default	Description
INTAPE	I*4	2	1=user-input flux tape 2=search catalog for flux tape with user-specified times
SRCE	A4	blank	The flux catalog source name
ZVOL	A8	blank	Volume-serial name of the user-input flux tape if INTAPE=1

c. Flux Tape

This is a standard label, variable length record tape in the HELIOS flux tape format.[1] It is either user provided or provided by the flux catalog. The tape uses unit 9, with DSN = HELFLUX.

d. Flux Catalog

The flux catalog[1] is used only if INTAPE=2 in the INPUT namelist. The catalog file name must be entered in the JCL for unit 30. Currently, HELIOS catalog is in:

'SDHEL.FLUXCAT.DATA'

2. Output Generated

(See Fourier Plot Program SI Documentation)

3. Module Documentation

Module	Description
DATFIL	Fills the counts and time arrays, checking for valid data
GETAPE	Finds and mounts a flux tape
INITL	Initialized I/O devices, common blocks, and reads in the SD namelist HEL

Module Description

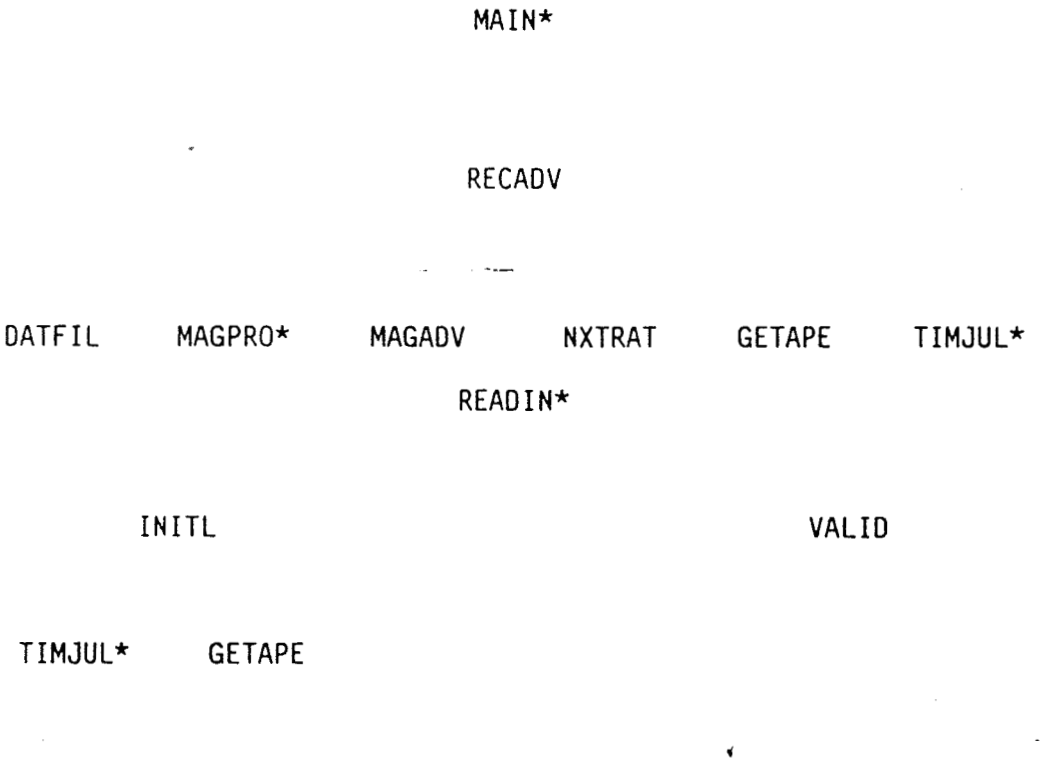
[1]"PIONEER/HELIOS, Flux Data Base Generator (FLXDBG) Maintenance Programmer's Introduction", CSC Document, 1978.

NXTRAT	Skips seven records on the flux tape so the next one read is a rates record
MAGADV	Reads an averaging interval of magnetic field data
RECADV	Reads in one rate and magnetic field data average into the RATDAT and MAGFLD commons
VALID	Validates the input namelist data for the SI READIN module

4. Program Structure

a. Block Diagram

*=Satellite independent module



b. Algorithm

The SI module READIN reads the SI namelist and calls VALID to validate them. Then it calls INITL to read in the SD namelist HEL and initialize the I/O devices. Control is returned to MAIN which succesively calls RECADV to accummulate one average point of sector counts and if desired, magnetic field data. RECADV reads in a flux record, stores it (DATFIL), and collects magnetic field data if desired (MAGPRO, MAGADV). Before reading the next rates record, six non-rates records are skipped. (NXTRAT).

c. Error Handling

The following return codes and messages may be printed:

Return Code	Description
-	'I/O ERROR WHILE SPACING TO NEXT RECORD' This flags a tape read error on the flux tape.
2	'CAN NOT FIND THE SPACECRAFT ID IN CATALOG' Check the spelling of the S/C ID and make sure the catalog is the correct one for HELIOS.
3	'DATA SET COUNT EXCEEDS 4 IN SEARCH FOR SOURCE: Satellite ID SRCE=name user entered' Check the SRCE parameter in the INPUT namelist.
4	The user-defined average interval does not match the catalog source name's interval.
-	'NO TAPES IN CURRENT TIME RANGE' The flux catalog does not contain the full time range of flux tapes as required by the user.
5	'ERROR FROM DREAD IN CATALOG: STOP. An I/O error was discovered in the flux catalog. Rerun the job, and if persistent, the catalog must be replaced.
-	'INPUT TAPE READ ERROR,SKIP THIS RATE' A tape read error on the flux tape caused a volume to be skipped.
9	The parameter SATID contained an invalid name. See Section II.b.

5. Common Block Definitions

There is only one SD common block, used to read in one flux tape rates record in RECADV:

```
Common:       /HYRC,HMONC,HDAYC,HHRC,HMINC,HSECC,H11,HMDAYC,MSECC,MSTIME,I
       SR1(9,5),ISR2(9,8),ISR3(9,8)ISRXY(9),IUR(64),TSRI(9,5),TSR2(9,8),TSR3(9
       ,8),TSXY(9),TUR(64),ISCOM(16),HRCOM(16)
```

SEE "PIONEER/HELIOS Flux Data Base Generator (FLXDBG) Maintenance Programmer's Introduction", CSC, 1978, page 7 for the definition of the rates record values.

6. Individual Module Documentation

All modules were designed, coded, and tested by Jenny S. Jacques, Code 664, 1979-1980.

a. (1) Module: DATFIL - Fills the data arrays with counts and time.

(2) Calling sequence:

```
Subroutine DATFIL(K,NUM,NOFF,ISR,TSR,IREJEC,QUSED,QRATS)
```

Name	Type	I/O	Description
K	I*4	I,O	Pointer to the counts array, increments with each rate stored
NUM	I*4	I	Number of rates to process
NOFF	I*4	I	NOFF + NUM is the rate number in the input arrays to process
ISR(9,NUM)	I*4	I	Input counts array
TSR(9,NUM)	R*4	I	Input time array
IREJEC(6)	I*4	O	Number of averages rejected for each rate due to differing sector times
QUSED(6)	L*1	O	T = data has been included in the arrays for the rate
QRATS(20)	L*1	I	T = this rate is being used

(3) Called by: RECADV
Calls: none

(4) Common usage:

Common	Variables	I/O
RATDAT	COUNTS,ACCUM	O

(5) Local variables: none

(6) Logic:

A main loop is set up that loops through the input data rates. If one is being processed this run, a check to ensure all sectors are collected over the same time is done. If they are, the counts and time are summed into the output arrays and QUSED (rate #) = T. Otherwise, nothing is summed for that rate.

b. (1) Module: GETAPE - Finds and mounts a flux tape onto unit 9

(2) Calling sequence: Subroutine GETAPE(SRCE,ZSLOT,INTAPE,QDONE)

Name	Type	I/O	Description
SRCE	A4	I	Flux catalog source name
ZSLOT	A8	I,O	Volume - serial name of the flux tape, input if user-provided output if obtained from the catalog
INTAPE	I*4	I	1 = User-provided flux tape 2 = Fetch flux tape from the catalog T = No flux tape in the time range was found in the catalog

(3) Called by: INITL
Calls: none

(4) Common usage:

Common	Variables	I/O
NAMES	ZSAT,ASAT	I
TIMES	IBTIME,IETIME,INTSEC	I

(5) Local variables:

Name	Type	Description
WORD(272)	R*4 I*4 I*4 I*2	These arrays are all equivalenced and are used to read in the flux catalog records. They are different modes to interpret various byte fields according to the number type in the field.
W(2)	R*4	These variables are equivalenced
ZTEST	R*8	in order to extract the satellite ID's first 8 characters and compare with ZSAT.
IVOL(2)	I*4	These variables are equivalenced
ZVOLUM	R*8	in order to extract the volume name from the catalog and call MOUNT with it.
OSRCE OZSLOT KINTAP	A4 A8 I*4	Records the catalog source name, volume name, and flux tape option for written calls to GETAPE from RECADV or INITL.
ZVOLD	A8	Records the previous flux tape volume name to compare with the present one. If they are the same, the tape is rewound. If not the same, the old one is unloaded and the new one mounted.
NDFILE	I*4	Record number of the catalog where desired source catalog begins.
NEXTRA	I*4	Word number in the catalog of the source names. Used to locate the correct source.
NFIRST	I*4	Word number in the catalog of the spacecraft ID's, used to locate the correct spacecraft ID.

Name	Type	Description
NUMTPS	I*4	The number of used flux tapes for a particular Satellite and source.
QSTART	L*1	T = first time through GETAPE for the run.

(6) Logic:

If the user provides a tape, it is simply mounted and GETAPE returns (INTAPE = 1). If the flux catalog is used (INTAPE = 2), it must be searched for the correct satellite, then the correct source for tht satellite, then the correct time range to process. A tape volume name is thus fetched with the correct Satellite ID, source, and times, and it is mounted. Then GETAPE returns.

In both cases of INTAPE, there may have been a flux tape previously used in this run with another namelist set. If so, the tape is not unloaded and mounted again, but is simply rewounded to the beginning.

c. (1) Module: INITL - Initializes the I/O devices, common blocks, and reads in the HEL namelist.

(See the "Fourier Plot Program Satellite Independent System Documentation" for a basic description of .INITL. The differences of additions/deletions are described below.)

Differences or Additions/Deletions

1. There are 12 possible rates
2. A namelist HEL is read in
3. GETAPE is called to fetch and mount the flux tape

d. (1) Module: NXTRAT - Advances flux tape 7 records

(2) Calling sequence: Subroutine NXTRAT(*)
* is the return if an end of file is read

(3) Called by: RECADV
Calls: none

(4) Common usage: none

(5) Local variables: none

(6) Logic:

A loop to read seven records is done. If an I/O error occurs, the record is skipped. If an end of file occurs, the routine returns to a statement number in REDADV. (The FREAD statements use a negative unit number to prevent the input buffer from being transferred twice. See the IBM FTIO booklet.)

e. (1) Module: MAGADV - Magentic field tape advance - This routine collects the magnetic field data, within the time range passed, from the fourier magnetic field data base tape.

(2) Calling Sequence:

SUBROUTINE MAGADV (INTSEC,INTRVL,QNEW)

Name	Type	I,O	Description
INTSEC	I*4	I	Averaging interval in seconds of the input data tape
INTRVL(2)	I*2	I	Time range to collect the data over, in modified Julian time

(3) Module Cross Reference:

Called by: RECADV
Calls: TIMJL2,JULTIM

(4) Common Usage:

Common	Variables	I,O
MAFGLD	BMAG,QPSECT,QTSECT, COSIN,BSQR,MAGCNT,IZFILE	I,O
MAGIN	all	O

(5) Significant Local Variables:

Name	Type	Description
MTIME	I*4	Modified Julian time (MJT) from magnetic field tape
QWAIT	L*1	T = Interval on tape is later than current time range
QEOF	L*1	T = And end of file mark was detected on the magnetic field tape

IEND	L*1	Ending of time range (MJT) to process

(6) Logic:

Check to see if the last time left a record not used yet in the buffer (QWAIT=T). If so, skip around the FREAD. Otherwise, read in a record from the magnetic field tape. Loop, summing as many records as necessary to complete the time range. If an EOF occurs, continue to the next file. If an EOV occurs, set QOFF to true and end the magnetic field tape processing. (Further calls to MAGADV simply return)

f. (1) Module: RECADV - Reads in one average of sectored counts data and, if desired, magnetic field data.

(See the "Fourier Plot Program Satellite Independent System Documentation" for a basic description or additions/deletions are described below.)

Differences or Additions/Deletions

1. PSUMRC is used to contain the flux tape rates data records.
2. DATFIL is called to sum the flux tape rates data into the counts and times arrays.
3. The length of the record determines whether a solar correction angle must be added to PHIO array.
4. GETAPE is called to fetch a new tape if the current one ends with time still left to process.

g. (1) Module: VALID - Validates the input satellite independent namelist values.

(See the "Fourier Plot Program Satellite Independent System Documentation" for a basic description of VALID. The differences/additions/deletions are listed below.)

Differences or Additions/Deletions

1. There are 12 possible rate ID's.
2. The rate ID's to validate are unique to HELIOS A and B.

7. Program Assumptions and Restrictions

1. The flux tape requires 32K core if BUFNO = 1 in the DCB is specified.
2. The flux tape must be of the standard format for flux tapes for HELIOS A and B.
3. The catalog must be the flux tape catalog named in Section II. 3.

Multisatellite Fourier Analysis Program
HELIOS User's Guide

B. Overview

The satellite-dependent (SD) HELIOS routines allow the HELIOS 1 and 2 data to be processed through the Fourier program's analysis and output procedures. The satellite-independent (SI) routines are contained in separate source and load modules from all SD code, and thus, any satellite may be linked via JCL.

This document describes the SD user input required for HELIOS Fourier analysis. The main document containing the SI user input must be reviewed prior to this one.

1. Input Required

a. Satellite independent namelist INPUT

(1) The RATES parameter may have the following values:

RATES Parameter	Rate Signified
SR1A	A1 A2 B CI CIII
SR1B	A2 B K1 CIII
SR1C	DI DII F
SR1D	DI DII E1 F
SR2A	SI5 SIII SIIA SIII
SR2B	SI6 SII SIIA SII
SR2C	SI7 SII SIIA SII
SR2D	SI8 SII SIIA SII
SR2E	SI SII5 SIIA SIII
SR2F	SI SII6 SIIA SIII
SR2G	SI SII7 SIIA SIII
SR2H	SI SII8 SIIA SIII
SR3A	SI5 SII SIIA SIII
SR3B	SI6 SII SIIA SIII
SR3C	SI7 SII SIIA SIII
SR3D	SI8 SII SIIA SIII
SR3E	SI SII5 SIIA SIII
SR3F	SI SII6 SIIA SIII
SR3G	SI SII7 SIIA SIII
SR3H	SI SII8 SIIA SIII

(2) The parameter SATID must be one of the following: 'HELIOS-A', 'HELIOS-B', 'HELIOS-1', or 'HELIOS-2'.

b. HELIOS namelist HEL

&HEL INTAPE,SRCE,ZVOL

This namelist must appear after each namelist set of the SI routines.

Name	Type	Default	Description

INTAPE	I*4	2	1=user-input flux tape 2=search catalog for flux tape with user-specified times
SRCE	A4	blank	The flux catalog source name
ZVOL	A8	blank	Volume-serial name of the user-input flux tape if INTAPE=1

c. Flux Tape

This is a standard label, variable length record tape in the HELIOS flux tape format. It is either user provided or provided by the flux catalog. The tape uses unit 9, with DSN = HELFLUX.

d. Flux Catalog

The flux catalog is used only if INTAPE=T in the INPUT namelist. The catalog file name must be entered in the JCL for unit 30. Currently, HELIOS catalog is in:

SB#HL
'SDHEL.FLUXCAT2.DATA'
SB#HL

2. Error Handling

The following return codes and messages may be printed:

Return Code	Description
-	'I/O ERROR WHILE SPACING TO NEXT RECORD' This flags a tape read error on the flux tape.
2	'CAN NOT FIND THE SPACECRAFT ID IN CATALOG' Check the spelling of the S/C ID and make sure the catalog is the correct one for HELIOS.
3	'DATA SET COUNT EXCEEDS 4 IN SEARCH FOR SOURCE: Satellite ID SRCE=name user entered' Check the SRCE parameter in the INPUT namelist.
4	The user-defined average interval does not match the catalog source name's interval.

Return Code	Description
-	'NO TAPES IN CURRENT TIME RANGE

The flux catalog does not contain the full time range of flux tapes as required by the user.

5 'ERROR FROM DREAD IN CATALOG: STOP.

An I/O error was discovered in the flux catalog. Rerun the job, and if persistent, - the catalog must be replaced.

- 'INPUT TAPE READ ERROR,SKIP THIS RATE'

A tape read error on the flux tape caused a volume to be skipped.

9 The parameter SATID contained an invalid name. See Section II.b.

3. JCL Required

1. Load module to link with SI routines:
'~~SDHEL~~.FOURHEL.LOAD' 'SBHPR.PLOPTN.LOAD'
SBHHL
2. Flux catalog, unit 30:
'SDHEL.FLUXCAT2.DATA'

3. &HEL namelist for each namelist set.

4. Unit 9 defined as: 3480
```
//FT09F001 DD DSN=HELFLUX,DISP=SHR,LABEL=(,SL),UNIT=(~~1600~~,,DEFER),
//    VOL=SER=DUM1,DCB=BUFNO=1
```

5. Unit 14 defined as:

```
//FT14F001 DD UNIT=(6250,,DEFER),DISP=(NEW,KEEP),LABEL=(1,NL,,OUT),
//    DCB=(RECFM=U,BLKSIZE=20000,DEN=3),VOL=SER=PCTAPE
```

```
//XRHHLHEA JOB (SB016,350,05),HELIOS-A.FOURIER,TIME=(0,05),CLASS=A,
//      MSGCLASS=X,NOTIFY=XRHHL
/*JOBPARM LINES=100
//*
//* HELIOS FOURIER
//*
// EXEC OLOADERH,REGION=1500K,PARM='SIZE=260K,EP=MAIN'
//SYSLIB DD DSN=SB#PR.FOURSI.LOAD,DISP=SHR
//        DD DSN=SB#HL.FOURHEL.LOAD,DISP=SHR
//        DD
//        DD
//        DD DSN=SYS2.WOLFPLOT,DISP=SHR
//        DD DSN=SB#PR.PCOPTN.LOAD,DISP=SHR
//        DD DSN=SB#IM.ADDTOLIB.LOAD,DISP=SHR
//SYSLIN DD DSN=SB#PR.FOURSI.LOAD(MAIN),DISP=SHR
//        DD DSN=SB#HL.FOURHEL.LOAD(RATDAT),DISP=SHR
//FT06F001 DD SYSOUT=X
//FT09F001 DD DSN=HELFLUX,DISP=SHR,LABEL=(,SL),UNIT=(3480,,DEFER),
//     VOL=SER=DUM1,DCB=BUFNO=1
//FT10F001 DD LABEL=(,NL),UNIT=(6250,,DEFER),VOL=SER=DUM2,
//      DCB=(BLKSIZE=7294,RECFM=VB,BUFNO=1),DSN=NULLFILE
//FT11F001 DD LABEL=(,NL),UNIT=(6250,,DEFER),VOL=SER=DUM3,
//      DCB=(BLKSIZE=7294,RECFM=VB,BUFNO=1),DSN=NULLFILE
//FT14F001 DD UNIT=(6250,,DEFER),DISP=(NEW,KEEP),
//    DCB=(RECFM=U,BLKSIZE=20000),LABEL=(1,NL,,OUT),
//    VOL=SER=PCTAPE
//FT15F001 DD UNIT=SYSDA,SPACE=(TRK,(500,10)),DISP=(NEW,DELETE),
//     DCB=(RECFM=FB,LRECL=608,BLKSIZE=6688)
//FT30F001 DD DSN=SB#HL.FLUXCAT2.DATA,DISP=SHR
//*PLOTTAPE DD LABEL=(1,NL,,OUT),UNIT=(9TRACK,,DEFER),
//     DCB=(BUFNO=1,DEN=3),DSN=NULLFILE
//*WOLF4060 DD LABEL=(,BLP,,OUT),UNIT=(7TRACK,,DEFER),
//*     DCB=(BUFNO=1,DEN=1,TRTCH=C),DSN=NULLFILE,VOL=SER=CALC08
//PLOTTAPE DD DUMMY
//WOLF4060 DD DUMMY
//*  THE FOLLOWING ARE THE POSSIBLE NAMELISTS AND THEIR PARAMETERS:
//*&INPUT FROM,TO,NUMAVG,RATES,FPARMS,INTAPE,VOLSER,SATID,SRCE,
//*       QPRINT,QPLOTS,QTAPES
//*&PRINTR IPRINT
//*&PLOTS DEVICE,FHI,FLO,PLTDEN,QRATPL,QANIPL,QPOLPL,QBARR,QHARM2
//*&TAPES QRTAPE,IRFILE,ZRVOL,QSTAPE,ISFILE,ZSVOL
//* IF QPRINT=T,&PRINTR MUST BE SPECIFIED.IF QPLOTS=T,&PLOTS MUST
//* BE SPECIFIED. IF QTAPES=T, &TAPES MUST BE SPECIFED. IN THAT ORDER
//DATA5 DD *
 &PC QPCOPT=T, &END
 &INPUT FROM=82,01,03,00,00,TO=82,01,04,00,00,NUMAVG=04,INTSEC=900,
    RATES='SR1B','SR1C','SR1D','SR2E',
    FPARMS='A0','A1','A2','A3','PHI1','PHI2','PHI3',
    QPRINT=T,QMAGNT=F,QTAPES=F,QPLOTS=F,
    SATID='HELIOS-A',    &END
 &PRINT IPRINT=2,  &END
 &HEL SRCE='6250',INTAPE=2,                &END
// EXEC NTSO
```

VI. Multisatellite Fourier Analysis Program
ISEE3 System Documentation

A. Overview

The satellite-dependent (SD) ISEE routines allow the ISEE 3 data** to be processed through the Fourier program's analysis and output procedures. The satellite-independent (SI) routines are contained in separate source and load modules from all SD code, and thus, any satellite may be linked via JCL.

This document describes the SD user input required for ISEE Fourier analysis. The main document containing the SI user input must be reviewed prior to this one.

1. Input Required

a. Satellite independent namelist INPUT

(1) The RATES parameter may have the following values:

RATES Parameter	Rate Signified	Detector	Label
H1AS	A1A2\C4\G1\G2	HET1A	AS
H1BSP1	B1B2SB\C1\G1\G2	HET1B	BSP
H1BSP2	B1B2C4SB\C1\G1\G2	HET1B	BSP
H1BSE	B1B2C4\C1\SB\G1\G2	HET1B	BSE
H1ASZ3	A1A2SAC4\G3	HET1A	ASZ3
H1BSZ2	B1B2SB\C1\G2	HET1B	BSZ2
H2AS	A1A2\C4\G1\G2	HET2A	AS
H2BSP1	B1B2SB\C1\G1\G2	HET2B	BSP
H2BSP2	B1B2C4SB\C1\G1\G2	HET2B	BSP
H2BSE	B1B2C4\C1\SB\G1\G2	HET2B	BSE
H2ASZ3	A1A2SAC4\G3	HET2A	ASZ3
H2BSZ2	B1B2SB\C1\G2	HET2B	BSZ2
L1D\I	D1D2\F(SIG1)	LET1	D\I
L1D	D1D2\F	LET1	D
L2D\I	D1D2\F(SIG1)	LET2	D\I
L2D	D1D2\F	LET2	D

(2) The parameter SATID must be: 'ISEE-3'.

b. ISEE namelist ISEE3

&ISEE3 ~~QTREND,ITYPE~~ ITYPE, ISRCE, MTYPE, MSRCE, QTREND

This namelist must appear after each namelist set of the SI routines.

&ISEE3 ITYPE, ISRCE, MTYPE, MSRCE, QTREND

Name	Type	Default	Description
QTREND	L*1	F	T=use only trend checked data
ITYPE	A1	'E'	The data base tape type: 'E'=encyclopedia tape 'W'=work tape

see next page

c. Input Data Tape

There are two types of tapes in the ISEE-3 data base. Both have identical JCL and tape structure. However, the "work" tape is created for a specific time period usually used to test a new data extraction technique. The "Encyclopedia" tapes are the final data base, a merge of all work tapes into a full data base. The tape type is specified in the SD namelist.

d. Data Base Catalog

This catalog is used to retrieve the desired tape volume name according to the input time range. Unit 25 is used for the catalog, whose name is:

~~'SEICG.LOG.DATA'~~ SBFIC.COG.DATA

2. Output Generated

(See Fourier Plot Program SI Documentation)

3. Module Documentation

Module	Description
DATFIL	Fills the counts and time arrays, checking for valid data
INITL	Initialized I/O devices, common blocks, and reads in the SD namelist PIO
MAGADV	Reads an averaging interval of magnetic field data
RECADV	Reads in one rate and magnetic field data average into the RATDAT and MAGFLD commons
SKPVOL	Skips over other chapters of the same time period
TAPEIC	Finds and mounts the proper tape, given the time desired
VALID	Validates the input namelist data for the SI

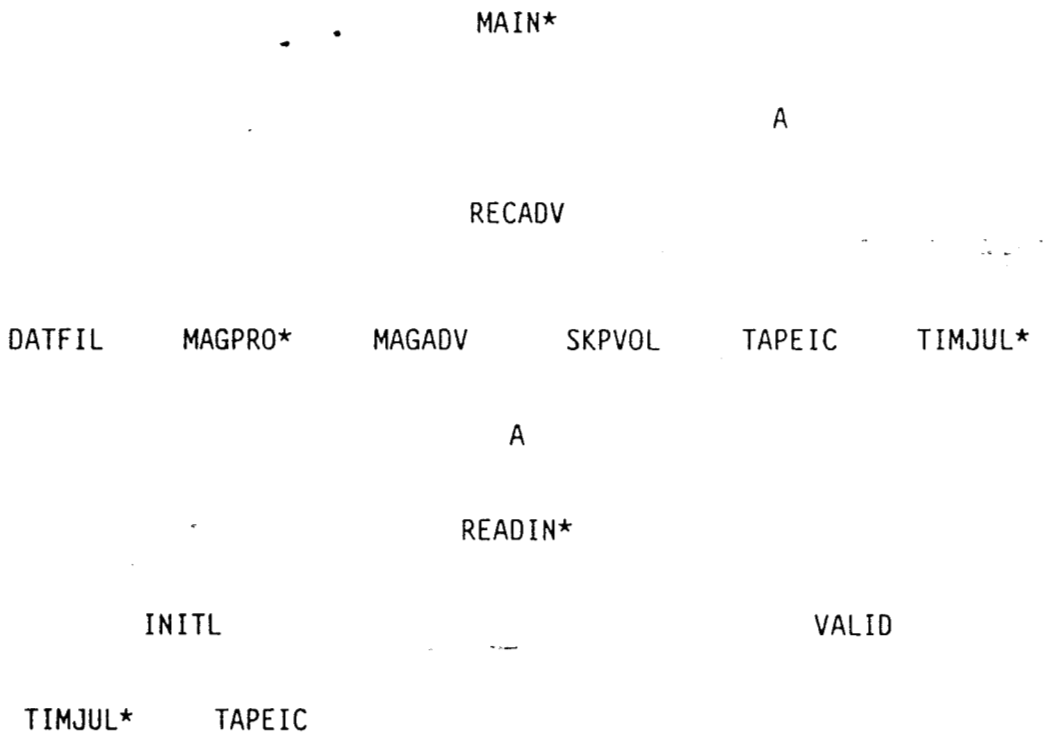
Name	Type	Default	Description
ITYPE	A1	'E'	data base tape type: 'E' = encyclopedia tape 'W' = work tape
ISRCE	I*4		catalog source name
MTYPE	A1		data base tape type: 'E' = encyclopedia tape. 'W' = work tape
MSRCE	I*4		catalog source name
QTREND	L1	F	trend checked data flag

READIN module

4. Program Structure

a. Block Diagram

*=Satellite independent module



b. Algorithm

The SI module READIN reads the SI namelist and calls VALID to validate them. Then it calls INITL to read in the SD namelist ISEE3 and initialize the I/O devices. Control is returned to MAIN which succesively calls RECADV to accummulate one average point of sector counts and if desired, magnetic field data. RECADV reads in a flux record, stores it (DATFIL), and collects magnetic field data if desired (MAGPRO, MAGADV). Before reading the next volume, the remaining chapters in the volume are skipped. (SKPVOL).

c. Error Handling

The following return codes and messages may be printed:

Return Code	Description
1	Some input namelist parameter was not valid. Of the SD input, the following may happen:
	a. Tape type is neither 'E' nor 'W'.
	b. The catalog routine has an error and returns with a code printed:
	4=Satellite ID 'ISEE-3' could not be found. 8=I/O error on the catalog.
11	Error reading the data tape volume.
12	Error reading the data tape chapter.

5. Common Block Definitions

a. /ISEE/ICVOL,ITYPE,IUNIT,QTREND

Name	Type	Description
ICVOL	I*4	Volume number of the beginning of the time range desired
ITYPE	I*4	'E'=encyclopedia tape, 'W'=work tape
IUNIT	I*4	Data base tape unit=9
QTREND	L*1	T=use trend checked data

b. /RECORD/INREC(7500),LENGTH

Name	Type	Description
INREC	I*4	Input record buffer for data base tape
LENGTH	I*4	Length of data record from data base tape

c. /FERMSG/IMES(26)

(See IBM FTTO documentation)

6. Individual Module Documentation

All modules except TAPEIC and SKPVOL were designed, coded, and tested by Jenny S. Jacques, Code 664, March 1980. TAPEIC and SKPVOL were created by Ed Ronish, CSC.

a. (1) Module: DATFIL - Fills the data arrays with counts and time.

(2) Calling sequence:

Subroutine DATFIL(K,NUM,NOFF,ISR,TSR,IREJEC,QUSED,QRATS)

Name	Type	I/O	Description
K	I*4	I,O	Pointer to the counts array, increments with each rate stored
NUM	I*4	I	Number of rates to process
NOFF	I*4	I	NOFF + NUM is the rate number in the input arrays to process
ISR(9,NUM)	I*4	I	Input counts array
TSR(9,NUM)	R*4	I	Input time array
IREJEC(6)	I*4	O	Number of averages rejected for each rate due to differing sector times
QUSED(6)	L*1	O	T =data has been included in the arrays for the rate
QRATS(20)	L*1	I	T =this rate is being used

(3) Called by: RECADV
Calls: none

(4) Common usage:

Common	Variables	I,O
RATDAT	COUNTS,ACCUM	O

(5) Local variables: none

(6) Logic:

A main loop is set up that loops through the input data rates. If one is being processed this run, a check to ensure all sectors are collected over the same time is done. If they are, the counts and time are summed into the output arrays and QUSED (rate #) = T. Otherwise, nothing is summed for that rate.

b. (1) Module: INITL - Initializes the I/O devices, common blocks, and reads in the ISEE3 namelist.

(See the "Fourier Plot Program Satellite Independent System Documentation" for a basic description of .INITL. The differences of additions/deletions are described below.)

Differences or Additions/Deletions

1. There are 16 possible rates
2. A namelist ISEE3 is read in
3. TAPEIC is called to fetch and mount the data tape

c. (1) Module: MAGADV - Magentic field tape advance - This routine collects the magnetic field data, within the time range passed, from the fourier magnetic field data base tape.

(2) Calling Sequence:

SUBROUTINE MAGADV (INTSEC,INTRVL,QNEW)

Name	Type	I,O	Description
INTSEC	I*4	I	Averaging interval in seconds of the input data tape
INTRVL(2)	I*4	I	Time range to collect the data over, in modified Julian time

(3) Module Cross Reference:

Called by: RECADV
Calls: TIMJL2,JULTIM

(4) Common Usage:

Common	Variables	I,O
MAGFLD	BMAG,QPSECT,QTSECT, COSIN,BSQR,MAGCNT,IZFILE	I,O

MAGIN	all	0

(5) Significant Local Variables:

Name	Type	Description
MTIME	I*4	Modified Julian time (MJT) from magnetic field tape
QWAIT	L*1	T = Interval on tape is later than current time range
QEOF	L*1	T = And end of file mark was detected on the magnetic field tape
IEND	L*1	Ending of time range (MJT) to process

(6) Logic:

Check to see if the last time left a record not used yet in the buffer (QWAIT=T). If so, skip around the FREAD. Otherwise, read in a record from the magnetic field tape. Loop, summing as many records as necessary to complete the time range. If an EOF occurs, continue to the next file. If an EOV occurs, set QOFF to true and end the magnetic field tape processing. (Further calls to MAGADV simply return)

d. (1) Module: RECADV - Reads in one average of sectored counts data and, if desired, magnetic field data.

(See the "Fourier Plot Program Satellite Independent System Documentation" for a basic description or additions/deletions are described below.)

Differences or Additions/Deletions

1. RECORD is used to contain the data records.
2. DATFIL is called to sum the data into the counts and times arrays.
3. TAPEIC is called to fetch a new tape if the current one ends with time still left to process.

e. (1) Module: SKPVOL - advances data tape to next counts volume

(2) Calling Sequence:

Subroutine SKPVOL(IUNIT)

Name	Type	I,O	Description
IUNIT	I*4	I	Encyclopedia tape unit

(3) Module Cross Reference:

Called by: RECADV
Calls: None

(4) Common Usage:

Common	Variables	I,O
RECORD	all	I

(5) Significant Local Variables: None

(6) Logic:

Skip over the volumes, then chapters, then verses according to the values in the common.

f. (1) Module: TAPEIC - Mounts data tape with correct volume.

(2) Calling Sequence:

Subroutine TAPEIC(IVOL,ITYPE,IVOLST,IVOLEN,ICODE)

Name	Type	I,O	Description
IVOL	I*4	I	Volume sought
ITYPE	I*4	I	Type of tape to mount
IVOLST	I*4	O	Start volume of tape
IVOLEN	I*4	O	End volume of tape
ICODE	I*4	O	Return code

(3) Module Cross Reference:
Called by: RECADV
Calls: DIRSAT,LREAD (ISEE System Routines)

(4) Common Usage:

Common	Variables	I,O	
FERMSG	all	O	(FTTO common)

(5) Significant Local Variables: See FORTRAN routine header.

(6) Logic:

If a previous tape is mounted, dismount it. Read the directory block, then satellite block, then work blocks till the one with the right time (volume) is found. Extract tape name and return.

g. (1) Module: VALID - Validates the input satellite independent namelist values.

(See the "Fourier Plot Program Satellite Independent System Documentation" for a basic description of VALID. The differences/additions/deletions are listed below.)

Differences on Additions/Deletions

1. There are 16 possible rate ID's.
2. The rate ID's to validate are unique to ISEE-3.

7. Program Assumptions and Restrictions

a. The input data tape requires 32K core if BUFNO = 1 in the DCB is specified.
b. The data tape must be of the standard format for encyclopedia tapes ISEE-3 Cosmic Ray experiment.
c. The catalog must be the catalog named in Section II. 3.

Multisatellite Fourier Analysis Program
ISEE User's Guide

B. Overview

The satellite-dependent (SD) ISEE routines allow the ISEE 3 data to be processed through the Fourier program's analysis and output procedures. The satellite-independent (SI) routines are contained in separate source and load modules from all SD code, and thus, any satellite may be linked via JCL.

This document describes the SD user input required for ISEE Fourier analysis. The main document containing the SI user input must be reviewed prior to this one.

1. Input Required

a. Satellite independent namelist INPUT

(1) The RATES parameter may have the following values:

RATES Parameter	Rate Signified	Detector	Label
H1AS	A1A2 C4 G1 G2	HET1A	AS
H1BSP1	B1B2SB C1 G1 G2	HET1B	BSP
H1BSP2	B1B2C4SB C1 G1 G2	HET1B	BSP
H1BSE	B1B2C4 C1 SB G1 G2	HET1B	BSE
H1ASZ3	A1A2SAC4 G3	HET1A	ASZ3
H1BSZ2	B1B2SB C1 G2	HET1B	BSZ2
H2AS	A1A2 C4 G1 G2	HET2A	AS
H2BSP1	B1B2SB C1 G1 G2	HET2B	BSP
H2BSP2	B1B2C4SB C1 G1 G2	HET2B	BSP
H2BSE	B1B2C4 C1 SB G1 G2	HET2B	BSE
H2ASZ3	A1A2SAC4 G3	HET2A	ASZ3
H2BSZ2	B1B2SB C1 G2	HET2B	BSZ2
L1D I	D1D2 F(SIG1)	LET1	D I
L1D	D1D2 F	LET1	D
L2D I	D1D2 F(SIG1)	LET2	D I
L2D	D1D2 F	LET2	D

(2) The parameter SATID must be: 'ISEE-3'.

b. ISEE namelist ISEE3

&ISEE3 ~~QTREND,ITYPE~~ ITYPE, ISRCE, MTYPE, MSRCE, QTREND

This namelist must appear after each namelist set of the SI routines.

Name	Type	Default	Description
QTREND	L*1	F	T=use only trend checked data
ITYPE	A1	'E'	The data base tape type: 'E'=encyclopedia tape 'W'=work tape

see next page

Name	Type	Default	Description
ITYPE	A1	'E'	data base tape type: 'E' = encyclopedia tape 'W' = work tape
ISRCE	I*4		catalog source name
MTYPE	A1		data base tape type: 'E' = encyclopedia tape 'W' = work tape
MSRCE	I*4		catalog source name
QTREND	L1	F	trend checked data flag

c. Input Data Tape

There are two types of tapes in the ISEE-3 data base. Both have identical JCL and tape structure. However, the "work" tape is created for a specific time period usually used to test a new data extraction technique. The "Encyclopedia" tapes are the final data base, a merge of all work tapes into a full data base. The tape type is specified in the SD namelist.

d. Data Base Catalog

This catalog is used to retrieve the desired tape volume name according to the input time range. Unit 25 is used for the catalog, whose name is:

'~~SEICC.LOG.DATA~~' SBFIC.LOG.DATA

2. Error Handling

The following return codes and messages may be printed:

Return Code	Description
1	Some input namelist parameter was not valid. Of the SD input, the following may happen: a. Tape type is neither 'E' nor 'W'. b. The catalog routine has an error and returns with a code printed: 4=Satellite ID 'ISEE-3' could not be found. 8=I/O error on the catalog.
11	Error reading the data tape volume.
12	Error reading the data tape chapter.

3. JCL Required

1. Load module to link with SI routines:
'~~SEICC.FOURICC.LOAD~~' 'SBFIC.FOURISE.LOAD', 'SBFIR.PCOPIN.LOAD'

2. Flux catalog, unit 25:
'~~SEICC.LOG.DATA~~' SBFIC.LOG.DATA

DCB=(RECFM=FB,LRECL=7232,BLKSIZE=7232,BUFNO=1)

~~4.~~ &ISEE3 namelist for each namelist set.

~~5.~~ Unit 9 defined as:

3. catalog, unit 26:

'SBFIC.DPLOG.DATA'

DP.MASTER.ENCY

```
//FT09F001 DD DSN=ISEEDUM,DISP=SHR,LABEL=(,SL),UNIT=(6250,,DEFER),
//    VOL=SER=DUM1,DCB=(LRECL=32008,BLKSIZE=32012,RECFM=VBA,BUFNO=1)
```

3480

6. Unit 14 defined as:

```
//FT14F001 DD UNIT=(6250,,DEFER),DISP=(NEW,KEEP),LABEL=(1,NL,,OUT),
//    DCB=(RECFM=U,BLKSIZE=20000,DEN=3),VOL=SER=PCTAPE
```

C. Sample JCL - ISEE-3

```
//XRHHLISE JOB (SB016,350,15),NEWISEE3,TIME=(00,25),CLASS=A,
//    MSGCLASS=X
/*JOBPARM LINES=500
//*
//*ISEE3FOURIER
//*
// EXEC OLOADERH,REGION=500K,PARM='SIZE=480K,EP=MAIN'
//SYSLIB DD DSN=SB#PR.FOURSI.LOAD,DISP=SHR
//       DD DSN=SB#IC.FOURISE.LOAD,DISP=SHR
//       DD DSN=SYS2.WOLFPLOT,DISP=SHR
//       DD DSN=SYS1.FORTLIB,DISP=SHR
//       DD DSN=SYS2.FORTLIB,DISP=SHR
//       DD DSN=SB#PR.PCOPTN.LOAD,DISP=SHR
//SYSLIN DD DSN=SB#PR.FOURSI.LOAD(MAIN),DISP=SHR
//       DD DSN=SB#IC.FOURISE.LOAD(RATDAT),DISP=SHR
//FT06F001 DD SYSOUT=X,DCB=(RECFM=VBA,LRECL=137,BLKSIZE=141)
//*FT06F001 DD DUMMY
//FT08F001 DD SYSOUT=X
//FT09F001 DD DSN=DP.MASTER.ENCY,DISP=SHR,LABEL=(,SL,,IN),
//    UNIT=(3480,,DEFER),VOL=SER=ICTAPE,DCB=BUFNO=1
//FT10F001 DD DSN=PDP.FOURIER.OUT,DISP=(NEW,KEEP),UNIT=(3480,,DEFER),
//    LABEL=(,NL,,OUT),DCB=(RECFM=VB,BLKSIZE=7294,BUFNO=1,DEN=3),
//    VOL=SER=PDPTPE
//*FT11F001 DD DUMMY
//*T11F001 DD DSN=COUNTS.OUT,DISP=(NEW,KEEP),UNIT=(3480,,DEFER),
//*   LABEL=(,NL,,OUT),DCB=(RECFM=VB,BLKSIZE=7294,BUFNO=1,DEN=3),
//*VOL=SER=DUM11
//FT12F001 DD DSN=DP.MASTER.ENCY,LABEL=(1,SL),
//    UNIT=(3480,,DEFER),
//    DCB=(BLKSIZE=32008,LRECL=32000,RECFM=VB,DEN=4,BUFNO=1),
//    DISP=SHR,VOL=SER=DUM12
//* ADD UNIT 14 FOR TESTING PC OUTPUT
//FT14F001 DD DUMMY
//*FT14F001 DD DSN=XRHHL.PC.ISEE3.DATA,DISP=SHR
//*FT14F001 DD UNIT=(6250,,DEFER),DISP=(NEW,KEEP),LABEL=(1,NL,,OUT),
//*  DCB=(RECFM=U,BLKSIZE=20000),VOL=SER=PCTAPE
//FT15F001 DD UNIT=SYSDA,SPACE=(TRK,(15,10)),DISP=(NEW,DELETE),
//    DCB=(RECFM=FB,LRECL=608,BLKSIZE=6688)
//FT16F001 DD UNIT=SYSDA,SPACE=(TRK,(15,10)),DISP=(NEW,DELETE),
//    DCB=(RECFM=FB,LRECL=60,BLKSIZE=7260)
//*PLOTTAPE DD LABEL=(1,NL,,OUT),UNIT=(3480,,DEFER),
//*   DCB=(BUFNO=1,DEN=3),DISP=(NEW,KEEP),
//*   DSN=CALCOMP,VOL=SER=ICCPL2
//WOLF4060 DD UNIT=(3480,,DEFER),LABEL=(1,NL,,OUT),DISP=(NEW,KEEP),
//   DCB=(BUFNO=1,DEN=3),DSN=WOLF4060,VOL=SER=ICCPL2
//FT25F001 DD DSN=SB#IC.LOG.DATA,DISP=SHR,
//  DCB=(BLKSIZE=7232,LRECL=7232,RECFM=FB,BUFNO=1)
//FT26F001 DD DSN=SB#IC.DPLOG.DATA,DISP=SHR,
//   DCB=(BLKSIZE=7232,LRECL=7232,RECFM=FB,BUFNO=1)
//SYSUDUMP DD SYSOUT=X
//*     THE FOLLOWING IS A COMPLETE LIST OF ALL POSSIBLE
//*     NAMELISTS AND THEIR PARAMETERS. FOR THEIR PROPER USEAGE,
//*     SEE DOCUMENTATION ON THE FOURIER PROGRAM.
//*&INPUT FROM,TO,NUMAVG,RATES,FPARMS,SATID,INTSEC,QPRINT,
//*       QTAPES,QPLOTS,QMAGNT
//*&PRINT IPRINT
//*&PLOTS DEVICE,PLTDEN,QRATPL,QANIPL,QPOLPL,QBARR,IHARMS,FLMIN,FLMAX
//*&TAPES QRTAPE,IRFILE,ZRVOL,QSTAPE,ISFILE,ZSVOL
```

```
//*&MAGNT IHISTS,ZMVOL,IZFILE
//*&(SATLITE NAMELISTS)
//*&TAPES QRTAPE=T,ZRVOL='ICCPL4',IRFILE=6, &END
//*&PLOTS QPOLPL=T, &END
//DATA5 DD *
 &PC QPCOPT=T, &END
 &INPUT FROM= 85,10,29,12,00, TO=85,10,29,12,30, RATES='L1D^I','L1D',
    'H2AS','H2ASZ3',NUMAVG=1,INTSEC=900,SATID='ISEE3',QPRINT=T,
      QMAGNT=T,QTAPES=F,QPLOTS=F,
      FPARMS='A0','A1','A2','A3','PHI1','PHI2','PHI3','MAG', &END
 &PRINT IPRINT=2,&END
 &MAGNT IHISTS=3, &END
 &ISEE3 ITYPE='E',&END
// EXEC NOTIFYTS
```

VII. Multisatellite Fourier Analysis Program
IMP-8 System Documentation

A. Overview

The satellite-dependent (SD) IMP routines allow the IMP 8 data to be processed through the Fourier program's analysis and output procedures. The satellite-independent (SI) routines are contained in separate source and load modules from all SD code, and thus, any satellite may be linked via JCL. Also a PSEUDO FTIO version for IMP-8 to built.

This document describes the SD user input required for IMP Fourier analysis. The main document containing the SI user input must be reviewed prior to this one.

1. Input Required

a. Satellite independent namelist INPUT

(1) The RATES parameter may have the following values:

RATES Parameter	Rate Signified
MED1	DI E F G
MED2	DI D2 E F G
MED3	(DI+EI)1 E F G
MED4	DI (DI+EI)1 E F G
LED1	A1 B C
LED2	A1 B C
VLET1	DI DII F
VLET2	DI DII (SUM)1D F

(2) The parameter SATID must be 'IMP-8'.

b. IMP namelist IMP

&IMP ZMAG,QLED

This namelist must appear after each namelist set of the SI routines.

Name	Type	Default	Description
ZMAG(8)	A8	blanks	List of magnetic field tape names in order
QLED	L*1	T	T=use corrected LED rates data

c. Counts Tape

This is a standard label, fixed, blocked tape in the IMP counts tape format. It is provided by the tape catalog.

d. Tape Catalog

The catalog file name must be entered in the JCL for unit 25. The IMP catalog is in:

'~~SEIMP~~SBEM.DEX52CAT,DATA'

2. Output Generated

(See Fourier Plot Program SI Documentation)

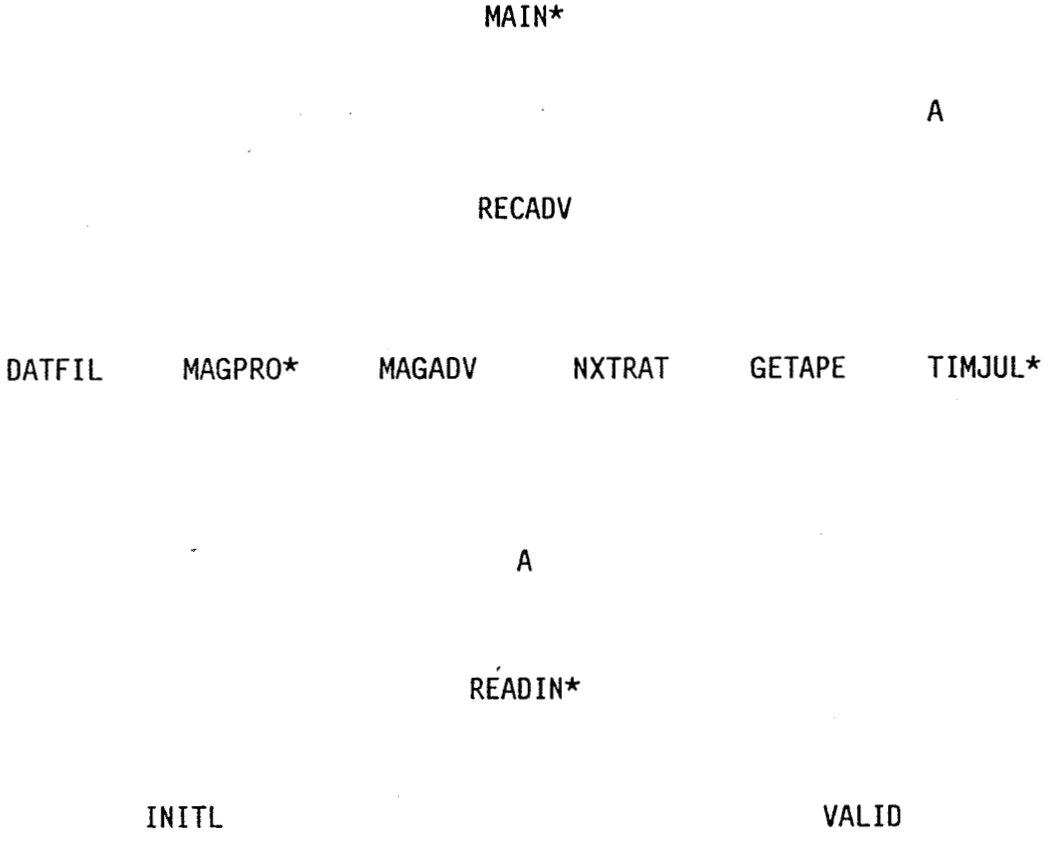
3. Module Documentation

Module	Description
INITL	Initialized I/O devices, common blocks, and reads in the SD namelist PIO
MAGADV	Reads an averaging interval of magnetic field data
RECADV	Reads in one rate and magnetic field data average into the RATDAT and MAGFLD commons
VALID	Validates the input namelist data for the SI READIN module
CATLOG	Retrieves a tape name from the IMP-8 catalog. This is an IMP-8 system routine.

4. Program Structure

a. Block Diagram

*=Satellite independent module



b. Algorithm

The SI module READIN reads the SI namelist and calls VALID to validate them. Then it calls INITL to read in the SD namelist IMP and initialize the I/O devices. Control is returned to MAIN which succesively calls RECADV to accummulate one average point of sector counts and if desired, magnetic field data. RECADV reads in a flux record, stores it, and collects magnetic field data if desired (MAGPRO, MAGADV).

c. Error Handling

The following return codes and messages may be printed:
(See SI System Documentation for other handling.)

Return Code	Description
-	'INPUT TAPE READ ERROR, SKIP THIS RATE'
	A tape read error on the input tape caused a volume to be skipped.

5. Common Block Definitions

a. Common: /IMPUSR/ZMAG(8),QLED

Name	Type	Description
ZMAG	A8	A list of up to 8 magnetic field tapes in chronological order of use.
ZTAPE	A8	Counts tape
QLED	L*1	T=use only corrected LED rates.

b. Common: /RECORD/IBUFF(615)

Name	Type	Description
IBUFF	I*4	This buffer is used to store the input tape record. For detail on its contents see IMP-8(J) EXP52 Counts Tape Format document in the IMP-8 documentation set.

6. Individual Module Documentation

All modules were designed, coded, and tested by Jenny S. Jacques, Code 664, 1980.

a. (1) Module: INITL - Initializes the I/O devices, common blocks, and reads in the IMP namelist.

(See the "Fourier Plot Program Satellite Independent System Documentation" for a basic description of .INITL. The differences of additions/deletions are described below.)

Differences or Additions/Deletions

1. There are 8 possible rates
2. A namelist IMP is read in
3. CATLOG is called to fetch input tape name.

b. (1) Module: MAGADV - Magnetic field tape advance - This routine collects the magnetic field data, within the time range passed, from the fourier magnetic field data base tape.

(2) Calling Sequence:

SUBROUTINE MAGADV (INTSEC,INTRVL,QNEW)

Name	Type	I,O	Description
INTSEC	I*4	I	Averaging interval in seconds of the input data tape
INTRVL(2)	I*4	I	Time range to collect the data over, in modified Julian time

(3) Module Cross Reference:

Called by: RECADV
Calls: TIMJL2,JULTIM

(4) Common Usage:

Common	Variables	I,O
MAGFLD	BMAG,QPSECT,QTSECT, COSIN,BSQR,MAGCNT,IZFILE	I,O
MAGIN	all	O
IMPUSR	ZMAG	I

(5) Significant Local Variables:

Name	Type	Description
MTIME	I*4	Modified Julian time (MJT) from magnetic field tape
QWAIT	L*1	T = Interval on tape is later than current time range
QEOF	L*1	T = And end of file mark was detected on the magnetic field tape

Name	Type	Description
IEND	L*1	Ending of time range (MJT) to process
ITAPE	I*4	Counter to the ZMAG tape namelist.

(6) Logic:

Check to see if the last time left a record not used yet in the buffer (QWAIT=T). If so, skip around the FREAD. Otherwise, read in a record from the magnetic field tape. Loop, summing as many records as necessary to complete the time range. If an EOF occurs, continue to the next file. If an EOV occurs, look for the next tape name in ZMAG. If none are available, set QOFF to .true., causing further calls to simply return.

c. (1) Module: RECADV - Reads in one average of sectored counts data and, if desired, magnetic field data.

(See the "Fourier Plot Program Satellite Independent System Documentation" for a basic description or additions/deletions are described below.)

Differences or Additions/Deletions

1. RECORD is used to contain the input tape rates data records.
2. CATLOG is called to fetch a new tape name if the current one ends with time still left to process.

d. (1) Module: VALID - Validates the input satellite independent namelist values.

(See the "Fourier Plot Program Satellite Independent System Documentation" for a basic description of VALID. The differences/additions/deletions are listed below.)

Differences on Additions/Deletions

1. There are 8 possible rate ID's.
2. The rate ID's to validate are unique to IMP-8.

7. Program Assumptions and Restrictions

1. The flux tape requires 32K core if BUFNO = 1 in the DCB is specified.
2. The flux tape must be of the standard format for flux tapes for IMP-8.
3. The input tape catalog must be the tape catalog named in Section II. 3.

Multisatellite Fourier Analysis Program
~~IMP~~ User's Guide

IMP-8

B. Overview

The satellite-dependent (SD) IMP routines allow the IMP 8 data to be processed through the Fourier program's analysis and output procedures. The satellite-independent (SI) routines are contained in separate source and load modules from all SD code, and thus, any satellite may be linked via JCL.

This document describes the SD user input required for IMP Fourier analysis. The main document containing the SI user input must be reviewed prior to this one.

1. Input Required

a. Satellite independent namelist INPUT

(1) The RATES parameter may have the following values:

RATES Parameter	Rate Signified
MED1	DI E F G
MED2	DI D2 E F G
MED3	(DI+EI)1 E F G
MED4	DI (DI+EI)1 E F G
LED1	A1 B C
LED2	A1 B C
VLET1	DI DII F
VLET2	DI DII (SUM)1D F

(2) The parameter SATID must be 'IMP-8'.

b. IMP namelist IMP

&IMP ZMAG,QLED

This namelist must appear after each namelist set of the SI routines.

Name	Type	Default	Description
ZMAG(8)	A8	blanks	List of magnetic field tape names in order
QLED	L*1	T	T=use corrected LED rates data

c. Counts Tape

This is a standard label, fixed, blocked tape in the IMP counts tape format. It is provided by the tape catalog.

d. Tape Catalog

The catalog file name must be entered in the JCL for unit 25. The IMP catalog is in:

'~~SEIMP~~.DEX52CAT.DATA'

SB#IM

2. Error Handling

Only the satellite independent errors will terminate the program. See Section IV in the document: Multisatellite Fourier Analysis Program User's Guide.

3. JCL Required

1. Load module to link with SI routines:
   ~~'SEIMP.FOURIMP.LOAD'~~ 'SB#IM.FOURIMP8.LOAD' , 'SB#PR.PLOPTN.LOAD'
2. Flux catalog, unit 25:
   '~~SEIMP~~.DEX52CAT.DATA'
   SB#IM
3. &IMP namelist for each namelist set.
4. Unit 9 defined as:
   3480
   ```
   //FT09F001 DD DSN=IMPJ~~DUM~~,DISP=SHR,UNIT=(~~1600~~,,DEFER),
   //    VOL=SER=DUM1,DCB=BUFNO=1
   ```
5. Unit 14 defined as:

```
//FT14F001 DD UNIT=(6250,,DEFER),DISP=(NEW,KEEP),LABEL=(1,NL,,OUT),
//    DCB=(RECFM=U,BLKSIZE=20000,DEN=3),VOL=SER=PCTAPE
```

4. JCL to build PSEUDO FTIO version

```
//XRHHLIM8 JOB (SB016,350,8),'FOURIER O&N',TIME=(0,10),CLASS=0,          00000010
//   MSGCLASS=X,NOTIFY=XRHHL
//*************************************************************          00000060
//*
//*THIS BUILD JCL IS TO CREATE FOURIER PSEUDO FTIO LOAD MODULE FOR IMP-8
//*
//STEP1  EXEC OLINKH,PARM='DCBS'                                         00000070
//LINK.SYSLIB DD DSN=SB#PR.FOURSI.LOAD,DISP=SHR                          00000100
//            DD DSN=SB#PR.PCOPTN.LOAD,DISP=SHR                          00000110
//            DD DSN=SYS2.WOLFPLOT,DISP=SHR                              00000120
//            DD DSN=SYS1.FORTLIB,DISP=SHR                               00000130
//            DD DSN=SYS2.FORTLIB,DISP=SHR                               00000140
//            DD DSN=SB#IM.ADDTOLIB.LOAD,DISP=SHR
//            DD DSN=SB#IM.FOURIMP8.LOAD,DISP=SHR                        00000110
//LINK.SYSLMOD DD DSN=SB#PR.FOURSI.LOAD,DISP=SHR                         00000160
//LINK.SYSLIN DD *                                                       00000180
     INCLUDE SYS(MAIN)                                                  00000190
     INCLUDE SYSA(RATDAT)                                               00000200
     ENTRY MAIN                                                         00000220
     NAME FOUR8(R)                                                      00000230
//SYS DD DSN=SB#PR.FOURSI.LOAD,DISP=SHR                                  00000240
//SYSA DD DSN=SB#IM.FOURIMP8.LOAD,DISP=SHR                               00000250
//*************************************************************          00000270
//* STEP2 - BUILD THE PSEUDO FTIO VERSION OF FOURIER8 PGM. *             00000280
//*************************************************************          00000290
//STEP2  EXEC OFORTH                                                     00000300
//SYSIN DD DSN=SB#IM.READCT.FORT(READCT),DISP=SHR                        00000310
//       DD DSN=SB#IM.READCT.FORT(OLDIMP),DISP=SHR                       00000320
//       DD DSN=SB#IM.READCT.FORT(KATXXX),DISP=SHR                       00000330
// EXEC OASMG,PARM='CMS',LIB3='SYS1.AMODGEN',                            00000340
//            LIB1='SYS2.MACLIB',LIB2='SYS1.MACLIB'                      00000350
//SYSIN DD DSN=SB#IM.PSEUDO.CNTL(NEW$$MOU),DISP=SHR                      00000360
// EXEC OLINKH,PARM='XREF'                                               00000370
//SYSLMOD DD DSN=SB#PR.FOURSI.LOAD,UNIT=SYSDA,DISP=OLD                   00000380
//LINK.OBJECT DD *                                                      00000390
 REPLACE MOUNT($$MOUNT),FREAD($$FREAD),FWRITE($$FWRITE),               X00000400
               REWIND($$REWIND),UNLOAD($$UNLOAD),                      X00000410
               LEAVE($$LEAVE),MEMBER($$MEMBER),                        X00000420
               POSN($$POSN),FREADB($$FREADB)                            00000430
 INCLUDE SYSLMOD(FOUR8)                                                 00000440
  ENTRY MAIN                                                            00000450
  NAME PFOUR8(R)                                                        00000460
//SYSUDUMP DD SYSOUT=A                                                  00000470
// EXEC NOTIFYTS                                                        00000480
```

C. Sample JCL - IMP-8

```
//XRHHLIM8 JOB (SB016,350,10),IMP8,TIME=(0,15),CLASS=A,
//     MSGCLASS=X
/*JOBPARM LINES=100
//*
//*IMP8 FOURIER
//*
//*   WHEN YOU CHOOSE MAGNETIC FIELD DATA,
//*   ITOT = NUMRAT + (QHIST+1)/2  =< 6
//*
//    EXEC PGM=PFOUR8,REGION=1600K
//STEPLIB DD DSN=SB#PR.FOURSI.LOAD,DISP=SHR
//FT06F001 DD SYSOUT=X
//FT09F001 DD DSN=IMPJ,UNIT=(3480,,DEFER),DISP=(OLD,KEEP),
//    VOL=SER=DUM1,DCB=BUFNO=1,LABEL=(,SL,,IN)
//FT10F001 DD DSN=PDP.FOURIER.OUT,DISP=(NEW,KEEP),UNIT=(3480,,DEFER),
//     LABEL=(,NL,,OUT),DCB=(RECFM=VB,BLKSIZE=7294,BUFNO=1,DEN=3),
//     VOL=SER=PDPTPE
//FT11F001 DD DSN=COUNTS.OUT,DISP=(NEW,KEEP),UNIT=(3480,,DEFER),
//     LABEL=(,NL,,OUT),DCB=(RECFM=VB,BLKSIZE=7294,BUFNO=1,DEN=3),
// VOL=SER=DUM11
//*
//*     ADD UNIT 12 FOR MAGNETIC FIELD  ON 11/1/89
//*
//*FT12F001 DD DSN=IMPJ.SUMMARY,LABEL=(1,NL,,IN),UNIT=(6250,,DEFER),
//FT12F001 DD DSN=IMPJ.SUMMARY,UNIT=(6250,,DEFER),
//    DCB=(RECFM=VBS,LRECL=276,BLKSIZE=16564,DEN=4),
//    VOL=SER=DUM12,DISP=(OLD,KEEP),LABEL=(1,SL,,IN)
//*FT14F001 DD UNIT=(6250,,DEFER),DISP=(NEW,KEEP),LABEL=(1,NL,,OUT),
//*     DCB=(RECFM=U,BLKSIZE=20000),VOL=SER=PCTAPE
//FT14F001 DD DSN=XRHHL.PC.FOURIER.IMP8.DATA,DISP=SHR
//FT15F001 DD UNIT=SYSDA,SPACE=(TRK,(15,10)),DISP=(NEW,DELETE),
//     DCB=(RECFM=FB,LRECL=608,BLKSIZE=6688)
//FT16F001 DD UNIT=SYSDA,SPACE=(TRK,(15,10)),DISP=(NEW,DELETE),
//     DCB=(RECFM=FB,LRECL=60,BLKSIZE=7260)
//PLOTTAPE DD LABEL=(1,NL,,OUT),UNIT=(3480,,DEFER),
//    DCB=(BUFNO=1,DEN=3),DISP=(NEW,KEEP),
//    DSN=CALCOMP,VOL=SER=ICCPL2
//WOLF4060 DD UNIT=(3480,,DEFER),LABEL=(1,NL,,OUT),DISP=(NEW,KEEP),
//    DCB=(BUFNO=1,DEN=3),DSN=WOLF4060,VOL=SER=ICCPL2
//FT25F001 DD DSN=SB#IM.DEX52CAT.DATA,DISP=SHR
//FT02F001 DD DSN=SB#IM.CORRCAT8,DISP=SHR
//*
//*      THE FOLLOWING IS A COMPLETE LIST OF ALL POSSIBLE
//*      NAMELISTS AND THEIR PARAMETERS. FOR THEIR PROPER USEAGE,
//*      SEE DOCUMENTATION ON THE FOURIER PROGRAM.
//*&INPUT FROM,TO,NUMAVG,RATES,FPARMS,SATID,INTSEC,QPRINT,
//*        QTAPES,QPLOTS,QMAGNT
//*&PRINT IPRINT
//*&PLOTS DEVICE,PLTDEN,QRATPL,QANIPL,QPOLPL,QBARR,IHARMS,FLMIN,FLMAX
//*&TAPES QRTAPE,IRFILE,ZRVOL,QSTAPE,ISFILE,ZSVOL
//*&MAGNT IHISTS,ZMVOL,IZFILE
//*&(SATLITE NAMELISTS)
//*&TAPES QRTAPE=T,ZRVOL='ICCPL4',IRFILE=6, &END
//*&PLOTS QPOLPL=T, &END
//FT05F001 DD *
 &PC QPCOPT=T, &END
 &INPUT FROM= 77,05,01,00, TO=77,05,02,20,INTSEC=1800,NUMAVG=1,
  RATES='MED2','MED4','VLET1','VLET2',
```

```
  SATID='IMP8',
   QPRINT=T,QMAGNT=T,QTAPES=F,QPLOTS=F,
      FPARMS='AO','A1','A2','A3','PHI1','PHI2','PHI3', &END
 &PRINT IPRINT=2,&END
 &TAPES QRTAPE=F,ZRVOL='ICCPL4',IRFILE=6, &END
 &MAGNT IHISTS=3,ZMVOL='XXXXXX',IZFILE=1, &END
 &IMP ZMAG='HLOOO2',QLED=F,&END
// EXEC NOTIFYTS
```

VIII. Multisatellite Fourier Analysis Program Differential Rates Routine

A. Overview

The Multisatellite Fourier Analysis Program (MFAP) has an option to change the data before it goes into Fourier analysis. This is done via a subroutine called SUB1. (See the MFAP System Documentation Sections I.A. and IX.A.16. for a further description.) This document describes a SUB1 routine which subtracts one set of sectored counts from the next and stores this differential as a new set of counts. These counts then undergo the same analysis as before. SUB1 also changes the labels appropriately. If a succeeding rate does not exist (always the case for the last rate) or is not acceptable for analysis, the differential value can not be computed. In this case, a -2.0 is placed as a flag in the accumulation time, and the value is ignored by plotting routines.

To involk this process, SUB1 for differential rates is compiled into a load module and linked as the first SYSLIB data set. This causes the new SUB1 to override the dummy (simply returns) SUB1 in the Fourier load module, and thus be used to create differential sectored rates.

1. JCL Required

a. SYSLIB DD DSN=SB#PR.FOURDIF.LOAD,DISP=SHR as the first SYSLIB data set.

b. Same JCL as for the sectored rates.

Multisatellite Fourier Analysis Program
Anisotropy Check Routine

B. Overview

The Multisatellite Fourier Analysis Program (MFAP) has an option to alter the data after Fourier analysis. This is done via a subroutine called SUB2. (See the MFAP System Documentation Sections I.A. and IX.A.16. for a further description.) This document describes a SUB2 routine which performs a check on the Fourier analysis anisotropy values. If a value is less than twice its deviation, it is negated. This flags the plotting routines to ignore the value, and the listing shows the negative anisotropy.

1. JCL Required

a. SYSLIB DD DSN=SB#PR.FOURCHK.LOAD,DISP=SHR as the first SYSLIB data set.

b. Same JCL as for the sectored rates.

C. Sample JCL - SUB1, SUB2

This example is for PIONNER. The SUB1 routine to be used is the file 'SEJSS.FOURIER.DIFFRNTL.LOAD'

IX

~~VII.~~ Multisatellite Fourier Analysis Program
IMP-8 System Documentation

7

A. Overview

The satellite-dependent (SD) IMP routines allow the IMP-~~8~~ 7 data to be processed through the Fourier program's analysis and output procedures. The satellite-independent (SI) routines are contained in separate source and load modules from all SD code, and thus, any satellite may be linked via JCL. Also a PSEUDO FTIO version for IMP-7 is built

This document describes the SD user input required for IMP Fourier analysis. The main document containing the SI user input must be reviewed prior to this one.

1. Input Required

a. Satellite independent namelist INPUT

(1) The RATES parameter may have the following values:

RATES Parameter	Rate Signified
MED	DI D2 E F G
MED	(DI&EI)1 E F G
MED	DI (DI&EI)1 E F G
MED	DI E F G
LED	A B C
LED	A B C
LET-II	(SI)5 SII ANTI
LET-II	SI (SII)7 ANTI
LET-II	SI (SII)6 ANTI
LET-II	SI (SII)5 ANTI
LET-II	(SI)7 SII ANTI
LET-II	(SI)6 SII ANTI
LET-II	(SI)5 SII ANTI (F)
LET-II	SI (SII)7 ANTI (F)
LET-II	SI (SII)6 ANTI (F)
LET-II	SI (SII)5 ANTI (F)
LET-II	(SI)7 SII ANTI (F)
LET-II	(SI)6 SII ANTI (F)

~~MAG~~(8)	A8	blanks	List of magnetic field tape names in order
~~QLED~~ QTRANS	L*1	T	T=use corrected LED rates data

c. Counts Tape

This is a standard label, fixed, blocked tape in the IMP counts tape format. It is provided by the tape catalog.

d. Tape Catalog

The catalog file name must be entered in the JCL for unit 25. The IMP catalog is in:

'~~SEIMP~~.DEX~~52~~CAT,DATA'
SBFIM 32

2. Output Generated

(See Fourier Plot Program SI Documentation)

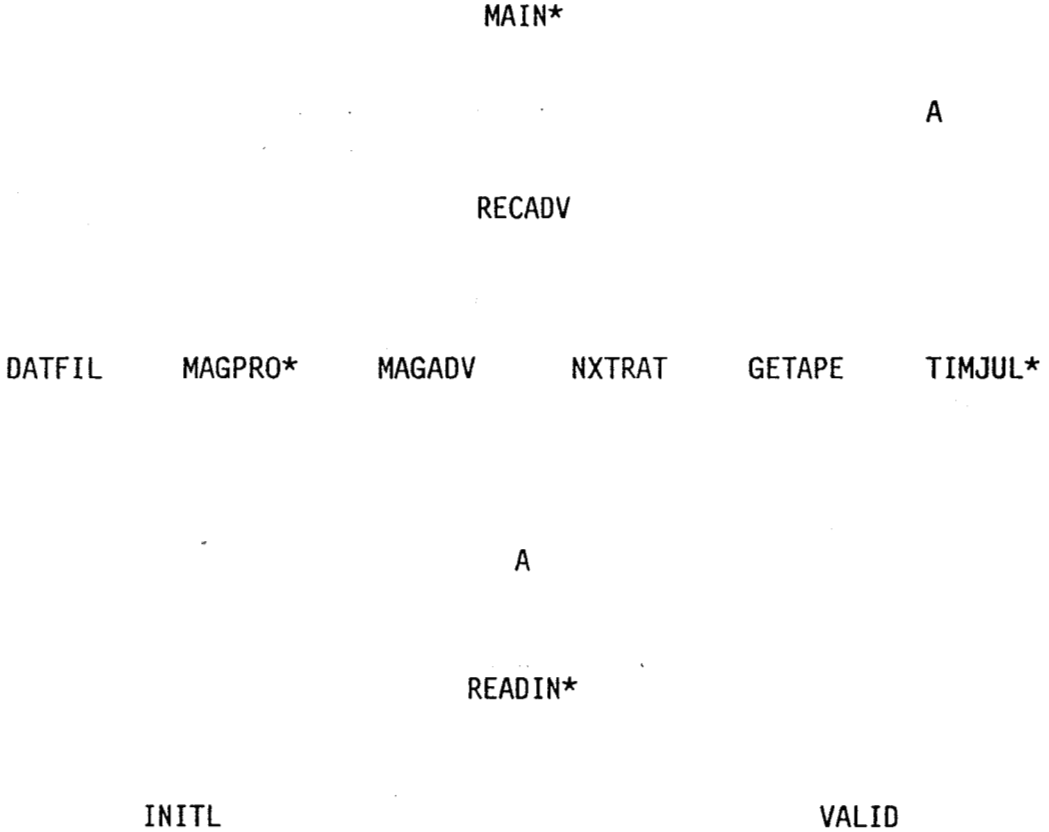
3. Module Documentation

Module	Description
INITL	Initialized I/O devices, common blocks, and reads in the SD namelist PIO
MAGADV	Reads an averaging interval of magnetic field data
RECADV	Reads in one rate and magnetic field data average into the RATDAT and MAGFLD commons
VALID	Validates the input namelist data for the SI READIN module
CATLOG	Retrieves a tape name from the IMP-8 catalog. This is an IMP-8 system routine.

4. Program Structure

a. Block Diagram

*=Satellite independent module



b. Algorithm

The SI module READIN reads the SI namelist and calls VALID to validate them. Then it calls INITL to read in the SD namelist IMP and initialize the I/O devices. Control is returned to MAIN which succesively calls RECADV to accummulate one average point of sector counts and if desired, magnetic field data. RECADV reads in a flux record, stores it, and collects magnetic field data if desired (MAGPRO, MAGADV).

c. Error Handling

The following return codes and messages may be printed:
(See SI System Documentation for other handling.)

Return Code	Description
-	'INPUT TAPE READ ERROR, SKIP THIS RATE' A tape read error on the input tape caused a volume to be skipped.

5. Common Block Definitions

a. Common: /IMPUSR/ZMAG(8),QLED

Name	Type	Description
ZMAG	A8	A list of up to 8 magnetic field tapes in chronological order of use.
ZTAPE	A8	count tape
~~QLED~~	L*1	T=use only corrected LED rates.
QTRANS		

b. Common: /RECORD/IBUFF(615)

Name	Type	Description
IBUFF	I*4	This buffer is used to store the input tape record. For detail on its contents see IMP-8(J) EXP32 Counts Tape Format document in the IMP-8 documentation set.

6. Individual Module Documentation

All modules were designed, coded, and tested by Jenny S. Jacques, Code 664, 1980.

a. (1) Module: INITL - Initializes the I/O devices, common blocks, and reads in the IMP namelist.

(See the "Fourier Plot Program Satellite Independent System Documentation" for a basic description of .INITL. The differences of additions/deletions are described below.)

Differences or Additions/Deletions

1. There are 18 possible rates
2. A namelist IMP is read in
3. CATLOG is called to fetch input tape name.

b. (1) Module: MAGADV - Magnetic field tape advance - This routine collects the magnetic field data, within the time range passed, from the fourier magnetic field data base tape.

(2) Calling Sequence:

SUBROUTINE MAGADV (INTSEC,INTRVL,QNEW)

Name	Type	I,O	Description
INTSEC	I*4	I	Averaging interval in seconds of the input data tape
INTRVL(2)	I*4	I	Time range to collect the data over, in modified Julian time

(3) Module Cross Reference:

Called by: RECADV
Calls: TIMJL2,JULTIM

(4) Common Usage:

Common	Variables	I,O
MAGFLD	BMAG,QPSECT,QTSECT, COSIN,BSQR,MAGCNT,IZFILE	I,O
MAGIN	all	O
IMPUSR	ZMAG	I

(5) Significant Local Variables:

Name	Type	Description
MTIME	I*4	Modified Julian time (MJT) from magnetic field tape
QWAIT	L*1	T = Interval on tape is later than current time range
QEOF	L*1	T = And end of file mark was detected on the magnetic field tape

Name	Type	Description
IEND	L*1	Ending of time range (MJT) to process
ITAPE	I*4	Counter to the ZMAG tape namelist.

(6) Logic:

Check to see if the last time left a record not used yet in the buffer (QWAIT=T). If so, skip around the FREAD. Otherwise, read in a record from the magnetic field tape. Loop, summing as many records as necessary to complete the time range. If an EOF occurs, continue to the next file. If an EOV occurs, look for the next tape name in ZMAG. If none are available, set QOFF to .true., causing further calls to simply return.

c. (1) Module: RECADV - Reads in one average of sectored counts data and, if desired, magnetic field data.

(See the "Fourier Plot Program Satellite Independent System Documentation" for a basic description or additions/deletions are described below.)

Differences or Additions/Deletions

1. RECORD is used to contain the input tape rates data records.
2. CATLOG is called to fetch a new tape name if the current one ends with time still left to process.

d. (1) Module: VALID - Validates the input satellite independent namelist values.

(See the "Fourier Plot Program Satellite Independent System Documentation" for a basic description of VALID. The differences/additions/deletions are listed below.)

Differences on Additions/Deletions

1. There are 8 possible rate ID's.
2. The rate ID's to validate are unique to IMP-8.

7. Program Assumptions and Restrictions

1. The flux tape requires 32K core if BUFNO = 1 in the DCB is specified.
2. The flux tape must be of the standard format for flux tapes for IMP-8.
3. The input tape catalog must be the tape catalog named in Section II. 3.

Multisatellite Fourier Analysis Program
~~IMP~~ User's Guide
IMP-7

B. Overview

The satellite-dependent (SD) IMP routines allow the IMP-~~8~~ data to be processed through the Fourier program's analysis and output procedures. The satellite-independent (SI) routines are contained in separate source and load modules from all SD code, and thus, any satellite may be linked via JCL. Also a PSEUDO FTIO version for IMP-7 is built.

This document describes the SD user input required for IMP Fourier analysis. The main document containing the SI user input must be reviewed prior to this one.

1. Input Required

a. Satellite independent namelist INPUT

(1) The RATES parameter may have the following values:

RATES Parameter	Rate Signified
MED	DI D2 E F G
MED	(DI&EI)1 E F G
MED	DI (DI&EI)1 E F G
MED	DI E F G
LED	A B C
LED	A B C
LET-II	(SI)5 SII ANTI
LET-II	SI (SII)7 ANTI
LET-II	SI (SII)6 ANTI
LET-II	SI (SII)5 ANTI
LET-II	(SI)7 SII ANTI
LET-II	(SI)6 SII ANTI
LET-II	(SI)5 SII ANTI (F)
LET-II	SI (SII)7 ANTI (F)
LET-II	SI (SII)6 ANTI (F)
LET-II	SI (SII)5 ANTI (F)
LET-II	(SI)7 SII ANTI (F)
LET-II	(SI)6 SII ANTI (F)

Name	Type	Default	Description
ZMAG(8)	A8	blanks	List of magnetic field tape names in order
~~QLED~~ QTRANS	L*1	T	T=use corrected LED rates data

c. Counts Tape

This is a standard label, fixed, blocked tape in the IMP counts tape format. It is provided by the tape catalog.

d. Tape Catalog

The catalog file name must be entered in the JCL for unit 25. The IMP catalog is in:

'~~SEIMP~~.DEX52CAT.DATA'

SBIM 3

2. Error Handling

Only the satellite independent errors will terminate the program. See Section IV in the document: Multisatellite Fourier Analysis Program User's Guide.

3. JCL Required

1. Load module to link with SI routines:
'~~SEIMP.FOURIMP.LOAD~~' 'SBIM.FOURIMP7.LOAD' , 'SBIPR.PCOPTN.LOAD'

2. Flux catalog, unit 25:
'~~SEIMP~~.DEX52CAT.DATA'
SBIM 3

3. &IMP namelist for each namelist set.

4. Unit 9 defined as: H 3490
```
//FT09F001 DD DSN=IMP~~JDUM~~,DISP=SHR,UNIT=(~~1600~~,,DEFER),
//    VOL=SER=DUM1,DCB=BUFNO=1
```

5. Unit 14 defined as:

```
//FT14F001 DD UNIT=(6250,,DEFER),DISP=(NEW,KEEP),LABEL=(1,NL,,OUT),
//    DCB=(RECFM=U,BLKSIZE=20000,DEN=3),VOL=SER=PCTAPE
```

```
//XRHHLIM7 JOB (SBO16,350,8),'FOURIER IMP7',TIME=(0,10),CLASS=0,        00000010
//   MSGCLASS=X,NOTIFY=XRHHL
//*************************************************************        00000060
//*
//*THIS BUILD JCL IS TO CREATE FOURIER PSEUDO FTIO LOAD MODULE FOR IMP-7
//*
//STEP1  EXEC OLINKH,PARM='DCBS'                                       00000070
//LINK.SYSLIB DD DSN=SB#PR.FOURSI.LOAD,DISP=SHR                        00000100
//            DD DSN=SB#PR.PCOPTN.LOAD,DISP=SHR                        00000110
//            DD DSN=SYS2.WOLFPLOT,DISP=SHR                            00000120
//            DD DSN=SYS1.FORTLIB,DISP=SHR                             00000130
//            DD DSN=SYS2.FORTLIB,DISP=SHR                             00000140
//            DD DSN=SB#IM.ADDTOLIB.LOAD,DISP=SHR
//            DD DSN=SB#IM.FOURIMP7.LOAD,DISP=SHR                      00000110
//LINK.SYSLMOD DD DSN=SB#PR.FOURSI.LOAD,DISP=SHR                       00000160
//LINK.SYSLIN DD *                                                     00000180
     INCLUDE SYS(MAIN)                                               00000190
     INCLUDE SYSA(RATDAT)                                            00000200
     ENTRY MAIN                                                      00000220
     NAME FOUR7(R)                                                   00000230
//SYS DD DSN=SB#PR.FOURSI.LOAD,DISP=SHR                              00000240
//SYSA DD DSN=SB#IM.FOURIMP7.LOAD,DISP=SHR                           00000250
//*************************************************************       00000270
//* STEP2 - BUILD THE PSEUDO FTIO VERSION OF FOURIER8 PGM. *          00000280
//*************************************************************       00000290
//STEP2  EXEC OFORTH                                                 00000300
//SYSIN DD DSN=SB#IM.READCT.FORT(READCT),DISP=SHR                    00000310
//       DD DSN=SB#IM.READCT.FORT(OLDIMP),DISP=SHR                   00000320
//       DD DSN=SB#IM.READCT.FORT(KATXXX),DISP=SHR                   00000330
// EXEC OASMG,PARM='CMS',LIB3='SYS1.AMODGEN',                        00000340
//            LIB1='SYS2.MACLIB',LIB2='SYS1.MACLIB'                  00000350
//SYSIN DD DSN=SB#IM.PSEUDO.CNTL(NEW$$MOU),DISP=SHR                  00000360
// EXEC OLINKH,PARM='XREF'                                           00000370
//SYSLMOD DD DSN=SB#PR.FOURSI.LOAD,UNIT=SYSDA,DISP=OLD               00000380
//LINK.OBJECT DD *                                                  00000390
 REPLACE MOUNT($$MOUNT),FREAD($$FREAD),FWRITE($$FWRITE),           X00000400
               REWIND($$REWIND),UNLOAD($$UNLOAD),                  X00000410
               LEAVE($$LEAVE),MEMBER($$MEMBER),                    X00000420
               POSN($$POSN),FREADB($$FREADB)                        00000430
 INCLUDE SYSLMOD(FOUR7)                                            00000440
  ENTRY MAIN                                                       00000450
  NAME PFOUR7(R)                                                   00000460
//SYSUDUMP DD SYSOUT=A                                             00000470
// EXEC NOTIFYTS                                                   00000480
```

C. Sample JCL - IMP-7

```
//XRHHLIM7 JOB (SBO16,350,01),IMP7,TIME=(0,05),CLASS=A,
//    MSGCLASS=X,NOTIFY=XRHHL
/*JOBPARM LINES=100
//*
//*IMP7 FOURIER
//*
//   EXEC PGM=PFOUR7,REGION=1600K
//STEPLIB DD DSN=SB#PR.FOURSI.LOAD,DISP=SHR
//FT06F001 DD SYSOUT=X
//FT09F001 DD DSN=IMPH,UNIT=(3480,,DEFER),DISP=(OLD,KEEP),
//   VOL=SER=DUM1,DCB=BUFNO=1,LABEL=(,SL,,IN)
//FT10F001 DD DUMMY
//FT12F001 DD DUMMY
//FT14F001 DD DSN=IMP7.FOURPC.DATA,DISP=(SHR,KEEP),
//    UNIT=(6250,,DEFER),LABEL=(1,NL,,OUT),
//    DCB=(RECFM=U,BLKSIZE=20000),VOL=SER=PCTAPE
//FT15F001 DD UNIT=SYSDA,SPACE=(TRK,(15,10)),DISP=(NEW,DELETE),
//    DCB=(RECFM=FB,LRECL=608,BLKSIZE=6688)
//FT16F001 DD UNIT=SYSDA,SPACE=(TRK,(15,10)),DISP=(NEW,DELETE),
//    DCB=(RECFM=FB,LRECL=60,BLKSIZE=7260)
//WOLF4060 DD DUMMY
//FT25F001 DD DSN=SB#IM.DEX32CAT.DATA,DISP=SHR
//FT02F001 DD DSN=SB#IM.CORRCAT7,DISP=SHR
//*
//*     THE FOLLOWING IS A COMPLETE LIST OF ALL POSSIBLE
//*     NAMELISTS AND THEIR PARAMETERS. FOR THEIR PROPER USEAGE,
//*     SEE DOCUMENTATION ON THE FOURIER PROGRAM.
//*&INPUT FROM,TO,NUMAVG,RATES,FPARMS,SATID,INTSEC,QPRINT,
//*       QTAPES,QPLOTS,QMAGNT
//*&PRINT IPRINT
//*&PLOTS DEVICE,PLTDEN,QRATPL,QANIPL,QPOLPL,QBARR,IHARMS,FLMIN,FLMAX
//*&TAPES QRTAPE,IRFILE,ZRVOL,QSTAPE,ISFILE,ZSVOL
//*&MAGNT IHISTS,ZMVOL,IZFILE
//*&(SATLITE NAMELISTS)
//*&TAPES QRTAPE=T,ZRVOL='ICCPL4',IRFILE=6, &END
//*&PLOTS QPOLPL=T, &END
//FT05F001 DD *
 &PC QPCOPT=T, &END
 &INPUT FROM=77,11,22,09,0,0,TO=77,11,22,18,0,0,NUMAVG=1,
       RATES='D-D2.E-F','DE1.E-F','D1-DE1.E','D1.E.F-G',FPARMS='AO',
        'A1','A2','A3','PHI1','PHI2','PHI3','FLOW',SATID='IMP7',
        INTSEC=600,QPRINT=T,&END
 &PRINT IPRINT=2,&END
 &IMP QTRANS=T,&END
 //   EXEC NTSO
```

X. MEMO

To : E. Eng
N. Lal
N. Laubenthal
B. McGuire
D. Reames
T. Von Rosenvinge

From : Henry Lo

Copies : S. Reddy
P. Schuster
K. Wortman

Subject : Modification of routine FOURIE in MULTISATELLITE FOURIER ANALYSIS PROGRAM

The software problem in routine FOURIE was that a variable D will be used to calculate the standard deviation on anisotropy, and the standard deviation on the direction angle of anisotropy. If the value of D is less than and equal to -1, or greater than and equal to 1, then the calculation of above standard deviations will fail.

The routine FOURIE was modified that if the value of variable D is greater than -1 and less than 1, we calculate the standard deviation on anisotropy, and the standard deviation on the direction angle of anisotropy, otherwise both standard deviations are set to 0.0.

To : E. Eng
N. Lal
N. Laubenthal
B. McGuire
D. Reames
T. Von Rosenvinge

From : Henry Lo

Copies : S. Reddy
P. Schuster
K. Wortman

Subject : Modification of routine MAGPRO in MULTISATELLITE FOURIER ANALYSIS PROGRAM

The software problem in routine MAGPRO was that if the number of magnetic field records included in the average time interval is less than 2, then the calculation of the standard deviation of magnetic field flux will fail.

The routine MAGPRO was modified that if the number of magnetic field records included in the average time interval is less than 2, we pass the step to calculate the standard deviation of magnetic field flux and set to 0.0.