SUBROUTINES

MAIN

The main routine for VGRANL. RUNBEG is called to initialize commons. It reads the time card from FT01F001 (see :hdref refid=FT01.). Only those times included on the time card are processed. If no time card is present, all times are processed. VGRANL loops using NXTMOD to read in the next data record, and then processes the data specified by the time cards in the subroutines.

ALTCP (IAP, I, ANS, VAR, ITYPE)

A dummy routine that allows for an alternate copying of the ANS array into the proto HA array.

ARG	DEFINITION
IAP	Source of ANS data, see :hdref refid=CDOCP..
I	Inxdex to IAP.
ANS	Answer array, see :hdref refid=STDCALL..
VAR	Proto HA array, see :hdref refid=HA..
ITYPE	Input data source, see :hdref refid=NXTMOD..

ANSPRT (ANS, JTB, JDAT, JNE, LSTAT, JTLMOD, JCLK, TEMP, IDSRN)

Prints out the answer array on Fortran unit IDSRN. If IDSRN > 0, a formatted output is given. If IDSRN < 0, the answer array is just printed in G format. ANSMAG is a version of ANSPRT for use with NXTMAG when the detailed magnetic field is wanted from SUMMARY tapes. Note that the ANS array is different in this case as is documented in the NXTMAG code.

ARG	DEFINITION	
ANS-TEMP	:hdref refid=STDCALL..	
IDSRN	I4	Control for printing.

BKGDCR (ANS, JTB, JDAT, JNE, LSTAT, JTLMOD, JCLK, TEMP, CURRNT)

Dummy routine that can process DC returns.

ARG	DEFINITION
ANS-TEMP	:hdref refid=STDCALL..
CURRNT(512)	Currents in femtoamps.

CAVE (ANS, JTB, CUR, KSTAT, LSTAT, JTLMOD, NNS, FL, CURL)

Cave averages NNS spectra together. It keeps the four modes separate and will start a new average if it detects a change in the status word.

ARG	DEFINITION	
ANS(150)	R4	ANS array.
JTB(6)	I2	Time array
CUR(512)	R4	Curents in femptoamps to be averaged.
KSTAT	I2	Assumed status word.
LSTAT	L4	Official status word.
JTLMOD	I2	Type of mode.
NNS	I4	Number of spectra to be averaged.
FL	I4	Flag indicates if average is being returned.
		0 Use average.
		1 Do not use spectra.
CURL	R4	Current levels for 0, 128, 255 digital levels. RMARK in KNTCUR.

CORRCT (ANS, JTB, JDATA, JNE, LSTAT, JTLMOD, JCLK, TEMP, IEOD, TYPE)

CORRCT allows for correction to the data. As programmed, it corrects for known errors in the integration times. Both ANS and JCLK are corrected.

The method used is an array: JL(4,2,10,2) stores the start/stop time (first index), 1 or 2 (second index), number of error interval (third index), and spacecraft type (fourth index). If the time is in the known window and JCLK does not agree with the known integration time, then JCLK and ANS are corrected.

ARG	DEFINITION	
ANS-TEMP	See :hdref refid=STDCALL..	
IEOD	I4	End of file flag.
TYPE	A4	Type of input tape, e.g. SUM, EDR.

CURCAL (ANS, JTB, JDAT, JNE, LSTAT, JTLMOD, JCLK, TEMP, CURRNT)

Dummy routine to do the current calibration analysis. Does call VOYPRT.

ARG	DEFINITION
ANS-TEMP	:hdref refid=STDCALL..
CURRNT	Current in femptoamps.

CURPLT (ANS, JTB, JDATA, JNE, LSTAT, JTLMOD, JCLK, TEMP, IKINDS, YDEC, XLG, YLG, NDEC, MINDEX CUF, CUR, KSTAT, IXCEL, CNOISE, CUR128)

Plots out oddplots, and spectral plots. See SPECTRAL PLOT write up.

ARG	DEFINITION
ANS-TEMP	:hdref refid=STDCALL.

DOCALT (ANS, JTB, JDATA, JNE, LSTAT, JTLMOD, JCLK)

Puts out a calibration record, also known as a spectral tape. (See :hdref refid=SPECTRA.). Long or short form is determined by 'IUNIT' and 'LDMP' which can be set from the input deck. (See also :hdref refid=FT02.).

COMMON BLOCK	USE and reference.
CCA	GSFC control common :hdref refid=CCA..
CMODE	NXTMOD common :hdref refid=CMODE..

ARG	DEFINITION
ANS	ANS array.
JTB(6)	Time array.
JDATA(512)	Array of digital data.
JNE	Number of samples taken per cup for one mode.
LSTAT	Status word.
JTLMOD	Indicator of type of mode.
JCLK	Index showing integration time being used.

DOCP (ANS, VAR, ITYPE)

Copies the answer array into a proto Hourly Average array. :hdref refid=HA. describes the default. Copying can be controlled via input: cf. :hdref refid=FT02..

ARG	DEFINITION
ANS	ANS array, :hdref refid=ANSWER..
VAR	Proto Hourly Average array. :hdref refid=HA..
ITYPE	Type of input data.

DOCN (ANS, JTB, JDATA, JNE, LSTAT, IEOD)

Dummy routine to allow for a user defined tape.

ARG	DEFINITION
ANS-TEMP	:hdref refid=STDCALL.. (not yet)

DODP (VAR, IEOD)

DODP produces the day plot or the N-day plots. It has its own writeup.

ARG	DEFINITION
VAR	Proto Hourly average array. See :hdref refid=HA..
IEOD	End of data flag.

DOHA (VAR, IEOD, ANS, IPTYPE)

DOHA computes the hourly averages, Average value, Standard deviation & Number of accepted points for each value in the proto Hourly Average array. For every change in the hour, the Hourly Average record is written out.

ARG	DEFINITION
VAR	Proto HA array.
IEOD	End of data flag.
ANS	ANS array.
IPTYPE	Type of input data.

ELANAL (ANS, JNE, JTLMOD, CURRNT, IXCEL, CNOISE, RMARK)

Processes normal electron data. Computes electron temperature (in degrees Kelvin) and the distribution function.

ARG	DEFINITION
ANS	ANS array. :hdref refid=STDCALL..
JNE	Number of energy levels.
JTLMOD	Type of Mode.
CURRNT	The measured currents in femptoamps. A negative value means that the current has been filtered out, or -1. suspect, or -2. not received.
KSTAT	Our best guess at the status word.
IXCEL	Quality flag. +1 = OK. Otherwise a count +1 of the number of suspect channels. (JDAT = -1). If negative, some channels are saturated.
CNOISE	The noise level for this instrument setting.
RMARK(3)	The current level for digital counts of 0, 128, 255.

FNCDRV (LX, Y, WEIGHT, NCOL, NTERMS, NCOMP, A, NFREE, VLIM, CHISQR, ALPHA, BETA)

Computes the current in each cup and channel for a given bimaxwellian. Also computes the derivatives.

ARG	DEFINITION
LX	!
Y	!
WEIGHT	!
NCOL	!
NTERMS	!
NCOMP	!
A	!
NFREE	!
VLIM	!
CHISQR	!
ALPHA	!
BETA	!

GETFLD (ANS, JTB)

Gets the Magnetic field and put it in the answer array. At GSFC this is a GSFC routine. At MIT this either picks it off the data tape, or puts in a dummy one (0.707, 0.0, 0.707). In either case it can be overwritten. See :hdref refid=FT03..

ARG		
ANS	R4	ANS array.
JTB(6)	I2	Time array.

IDCANL (ANS, JTB, JDAT, JNE, LSTAT, JTLMOD, ICLK, TEMP, CURRNT, IMODON, IXCEL, CNOISE, RMARK)

Does a short moment analysis of the DC return. See "ANSWER ARRAY IDCANL" :hdref refid=ANSIDC..

ARG	DEFINITION
ANS-TEMP	:hdref refid=STDCALL..
CURRNT(512)	Current in femptoamps.
IMODON	!
IXCEL	!
CNOISE	!
RMARK	The currents associated with the 0, 128, 255 digital level in the cups.

JC (JNE, A, B, T, F)

Computes currents from fit parameters.

ARG.DEFINITION

JNE	Number of energy levels.
A(3)	X, Y, Z velocities.
B(3)	X, Y, Z B field.
T(4)	!
F( )	Current in femptoamps.

KNTCUR (ANS, JTB, JDAT, JNE, LSTAT, JTLMOD, JCLK, TEMP , CURRNT, KSTAT, IXCEL, CNOISE, RMARK)

Converts the digital currents into femptoamps. It is also able to average together many spectra using CAVE, and/or filter the spectra to decrease the effects of the noise.

ARG	DEFINITION
ANS-TEMP	:hdref refid=STDCALL..
CURRNT	The measured currents in femptoamps. A negative value means that the current has been filtered out, or -1. suspect, or -2. not received.
KSTAT	Our best guess at the status word.
IXCEL	Quality flag. +1 = OK. Otherwise a count +1 of the number of suspect channels. (JDAT = -1). If negative, some channels are saturated.
CNOISE	The noise level for this instrument setting.
RMARK(3)	The current level for digital counts of 0, 128, 255.

If LPLS(25) is .FALSE. then a filter is used to pick the peak current in L & M modes.

VGRLOG (ANS, JTB, JDATA, JNE, LSTAT, JTLMOD, JCLK, TEMP, IEOD, ICU3, ICU4)

VGRLOG prints out a Log of the input tape. It can also produce a plot of the missing data.

ARG	DEFINITION
ANS-TEMP	:hdref refid=STDCALL..
IEOD	End of data flag.
ICU3	Fortran unit number for log.
ICU4	Fortran unit number for Spectral histograms.

MJSFIT (LX, Y, WEIGHT, NCOL, NTERMS, NCOMP, ICHI, A, SIGMAA, FLAMDA, CHISQR, VLIM, ICALL, IQUAL, IPRT, EPS, IEND)

Does nonlinear fit for plasma parameters.

ARG	DEFINITION
LX	!
Y	!
WEIGHT	!
NCOL	!
NTERMS	!
NCOMP	!
A	!
SIGMAA	!
FLAMDA	!
CHISQR	!
VLIM	!
ICALL	!
IQUAL	!
IPRT	!
EPS	!
IEND	!

MJSINV (ARRAY, NORDER, DET)

Inverts a symmetric matrix, and computes its determinant.

ARG	DEFINITION
ARRAY	Matrix for both input and output.
NORDER	Order of determinant.
DETT	Determinant.

MODCAL (ANS, JTB, JDAT, JNE, LSTAT, JTLMOD, JCLK, TEMP, CURRNT)

Dummy routine to allow for analysis of voltage modulator calibrations. Calls VOYPRT.

ARG	DEFINITION
ANS-TEMP	:hdref refid=STDCALL..
CURRNT(512)	Current in femtoamps.

MOMENT (L1, L2, V, R, RMM1, RM0, RM1, RM2, FM1, F0, F1, F2, XCRIT, IQUALY)

Computes the first three moments of the ion distribution.

ARG	DEFINITION
L1	Minium channel to be included.
L2	Maximum channel to be included.
V	Velocity of channel at middle of channel.
R	Current in fempto amps.
RMM1	Density in Cm**-3
RM0	Vel of plasma relative to cup normat in km/s.
RM1	Thermal speed in (km/Sec)**2
RM2	Third moment divided by density, Heat Flux (km/s)**3
FM1	!
F0	!
F1	!
F2	!
XCRIT	!
IQUALY	!

NXTMOD (ANS, JTB, JDATA, JNE, LSTAT, JTLMOD, JCLK, TEMP, IEOD, IL, IDTYPE)

NXTMOD exists in many forms to read the many different VGR data tapes. To the user there is a minimum of differences. These routines also return results that are almost the same as what we receive from GSFC through the standard calling sequence which is the first part of NXTMOD's calling sequence (see below). The common block CMODE (:hdref refid=CMODE.) is not available at GSFC and should be avoided if possible.

ARG	DEFINITION
ANS-TEMP	:hdref refid=STDCALL..
IEOD	End of data flag.
	0 Normal return.
	-1 End of data.
	-2 Error.
IL	Fortran unit number for detailed printout (debugging).
IDTYPE	A4 Type of input medium being read: SUM, EDR, SPL. (Not always implemented)

Note that different versions may invoke different subroutines and common blocks.

SETBFL (IBLL)

Of use only in NXTMAG. It sets the integration time to be picked for the B field.

ARG	DEFINITION
IBLL	Flag for integration time. (default 1)
	1 48.00 seconds
	2 9.60 seconds
	3 1.92 seconds

ODDPLT (ANS, JTB, JDATA, JNE, LSTAT, JTLMOD, JCLK, TEMP, IEOD)

Picks out the 'oddest' reasonable plot in every given interval of data, and does a spectral plot of it along with its fit currents.

ARG	DEFINITION
ANS-TEMP	:hdref refid=STDCALL..
IEOD	End of data flag.

ORDER (A, O, P, B, BMAG)

ARG	DEFINITION
A	!
O	!
P	!
B	!
BMAG	!

OUTMOD (ANS, JTB, JDATA, JNE, LSTAT, IEOD, IPTYPE, LUSE)

OUTMOD controls most of the output for VGRANL. Actual output is done in the called subroutines.

ARG	DEFINITION
ANS	ANS array.
JTB(6)	Time array.
JDATA(512)	Digital current array.
JNE	Number of measurement per cup.
LSTAT	Status word.
IEOD	End of data flag.
IPTYPE	Type of input tape.
LUSE	Use flag.

PARPER (A, B, C, PAR, PER, CHI2, DET)

Calculates the parallel and perpendicular components of the ellipse of the input data. Usually the cups thermal width.

PARPW (A, B, C, PAR, PER, CHI2, DET)

!

PARPQ (A, B, C, PAR, PER, CHI2, DET)

PERDIF (PDN, IH, ANS)

Computes histogram of percentage differences of fit and moment densities.

ARG	DEFINITION
PDF	percentage difference ρ_{mon} and ρ_{fit}
IH(10)	Histogram of differences.
ANS(150)	Answer array.

PLSANL (ANS, JTB, JDAT, JNE, LSTAT, JTLMOD, JCLK, TEMP)

Main plasma analysis routine used at GSFC. Mostly a big switch which decides what type of data it is and then calls the appropriate processing routines.

ARG	DEFINITION
ANS-TEMP	:hdref refid=STDCALL..

PLSEDM (JTBH, IEODC)

PLSEDM functions differently according to its environment. For EDR tapes, it computes a state vector for the spacecraft and the coordinate conversion matrices by reading the SEDR tape. For Summary tapes, this data is read from the SUMMARY tape. At GSFC it is furnished by a subroutine call from GSFC's code before PLSANL is called.

ARG	TYPE	DEFINITION
JTBH(6)	I4	Time of the data.
IEODC	I4	End of data flag.

PLSBEG

PLSBEG initializes many of the variables used in the plasma analysis. Note that many of the variables can be changed using &PLSNT (:hdref refid=FT02.) which is read in by RUNBEG (:hdref refid=RUNBEG.). At GSFC, the GSFC code reads in &PLSNT in the same manner as RUNBEG. The block data associated with the plasma analysis is also loaded with PLSBEG. Still, PLSBEG must be executed before any plasma analysis is done.

PRANAL (ANS, JNE, JTLMOD, CURRNT, IXCEL, CNOISE, RMARK)

Processes normal electron data. Does both the moment and fit positive ion parameters.

ARG	DEFINITION
ANS	ANS array.
JNE	Number of energy levels.
JTLMOD	Type of Mode.
CURRNT	The measured currents in femptoamps. A negative value means that the current has been filtered out, or -1. suspect, or -2. not received.
KSTAT	Our best guess at the status word.
IXCEL	Quality flag. +1 = OK. Otherwise a count +1 of the number of suspect channels. (JDAT = -1). If negative, some channels are saturated.
CNOISE	The noise level for this instrument setting.
RMARK(3)	The current level for digital counts of 0, 128, 255.

RUNBEG

RUNBEG loads the BLOCK DATA for:

PLCONS	:hdref refid=PLCONS..
CDODP	:hdref refid=CDOCP..
PSTUFF	:hdref refid=PSTUFF..
NDYCOM	:hdref refid=NDYCOM..

Note that many of these are needed for the processing of subroutines that may be used independently of VGRANL. RUNBEG is also the approved way of loading and changing these variables. RUNBEG reads all of its input off FT02F001, &PLSNT, &RUNNT and LPLS. See :hdref refid=FT02.. RUNBEG should be called only once.

SELECT (ANS, JTB, JDATA, JNE, LSTAT, JTLMOD, JCLK, TEMP, LUSE)

SELECT is normally a dummy routine which is set to allow the user to select which data is to be processed. In the case of Summary tape production, there is a version SELSUM which does monitor the processing.

ARG	DEFINITION	
ANS-TEMP	:hdref refid=STDCALL..	
LUSE	L4	TRUE if the data is to be used, FALSE if the data is to be ignored.

SELPRT

Prints out a summary of the selection at the end of the job.

SETJTL (JTLMO, JTLOFF, KSTAT, JTB, JTLMOD, JCLK)

Set the offset for JTLMOD in GS-5. Must be called befort GETJTL. Uses special data from NXTMOD.

ARG	TYPE	DEFINITION
JTLMO	I2	Modified JTLMOD
	1	L , long in GS-5
	2	M
	3	E1, long in GS-5
	4	E2, long in GS-5
	5	L , short in GS-5
	6	M , not used
	7	E1, short in GS-5
	8	E2, short in GS-5
JTLOFF	I2	Offset for JTLMOD. JTLMO - JTLMOD
KSTAT	I2	Best guess at status word.
JTLMOD	I2	Type of mode.
	1	L
	2	M
	3	E1
	4	E2
JCLK	I2	Index for integration time of instrument.

GETJTL (JTLMO, JTLOFF, KSTAT)

Returns the arguments calculated by the last call to SETJTL.

SPLOT (KNS, KTB, KDATA, KNE, KSTAT, KTLMOD, KCLK, KEMP, KXCEL, KKINDS, KINDEX, KKSTAT, IH)

Write out Numbers on oddplots, and plots real and computed currents using CURPLT.

ARG	DEFINITION
KNS	!
KTB	!
KDATA	!
KNE	!
KSTAT	!
KTLMOD	!
KCLK	!
KEMP	!
KXEL	!
KKINDS	!
KINDEX	!
KKSTAT	!
IH	!

STDANL (ANS, JTB, JDAT, JNE, LSTAT, JTLMOD, JCLK, TEMP , CURRNT, IXCEL, CNOISE, RMARK)

STDANL processes all of the standard plasma measurements, using the subroutines PRANAL and ELANAL.

ARG	DEFINITION
ANS-TEMP	:hdref refid=STDCALL..
CURRNT	The measured currents in femptoamps. A negative value means that the current has been filtered out, or -1. suspect, or -2. not received.
KSTAT	Our best guess at the status word.
IXCEL	Quality flag. +1 = OK. Otherwise a count +1 of the number of suspect channels. (JDAT = -1) If negative, some channels are saturated.
CNOISE	The noise level for this instrument setting.
RMARK(3)	The current level for digital counts of 0, 128, 255.

STEP (NUMCHN)

Computes the average velocity, and velocity width for each modulator step

ARG	DEFINITION
NUMCHN(2)	Number of channels in L, and M modes.

VOYPRT (ANS, JTB, JDAT, JNE, LSTAT, JTLMOD, JCLK, TEMP, IDSRN)

Voyprt prints out the digital currents.

ARG	DEFINITION
ANS-TEMP	:hdref refid=STDCALL..
IDSRN	Fortran unit number to print on. If 0, no print.