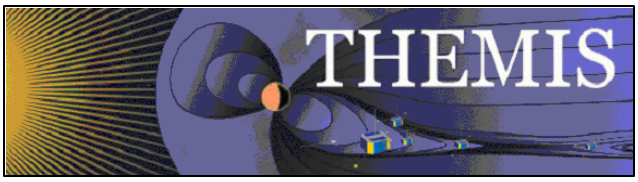


1. Fit Module (FIT.A)

The FIT module calculates the E-Field and B-Field vectors by taking 32 points at equal angles and fitting a sine wave least squares fit to the data. The best fit of the data is defined by the formula: A + B*cos() + C*sin(). The module calculates the standard deviation of the fit called Sigma, and the number of points remaining in the curve called N.

In addition, the FIT module averages the Z-axis data (E and B) and provides in the telemetry.

1.1 Initialization.

At turn-on, the FIT_INIT routine sets the initial statistical parameters of the FIT at Alpha 1.4 and Beta 0.4. These determine the basic rejection criteria for points as the Nth fit rejection criteria is Alpha+N*Beta.

1.2 Operation.

Data is obtained by the FIT_SAMP routine getting called at one of 32 sectors in the spin. At each sector call, the FIT_SAMP shall call the EFI and FGM modules to obtain samples of E and B, respectively. Since EFI and FGM operate from a variety of time-based sampling frequencies, both sets of electronics have been designed to produce an ever-present 128 Hz signal. EFI and FGM have access to this data and will return the data upon request from FIT.

Given a spin rate of 3 seconds, the use of 128 Hz data for spin fitting puts an apparent phase shift of 360/(3*128) or roughly 0.9 degrees into the results. While this meets the 1.0 degree requirement, the phase shift correction can be determined on the ground using the spin pulse time data relative to the 1Hz tick which is the basis of the 128 Hz data.

1.3 Commands.

The FIT module provides a single command for enabling/disabling the E or B data production, and whether to use V12 or V34, or BX or BY.

1.4 Synchronization.

The FIT_SYNC routine identifies the start of the spin and thus reset the data buffering.

1.5 Sampling.

The FIT_SAMP routine shall collect data into two 32-point arrays (E & B) and shall provide an indication that data is ready for fitting. Each data point in the array is 16-bit, 2's complement, Least Significant Byte first.

Based upon numerous missions of data, the type of Electric Field sensors THEMIS is using will likely experience an apparent sunward-aligned signal. This error signal is due to the electron population shifting between probe and spacecraft bodies. In addition, any shadowing of the electric field sensor from the spacecraft body will cause a voltage spike, whose width is roughly 2 * arcsin (0.7/25) meters or about 3 degrees. Both issues point out that the Spin Fit data points shall be be taken at consistent points through the spin. It has been tradition to make the first point the sunward aligned point, and let it be rejected immediately in the SPIN procedure.

1.6 Calculation

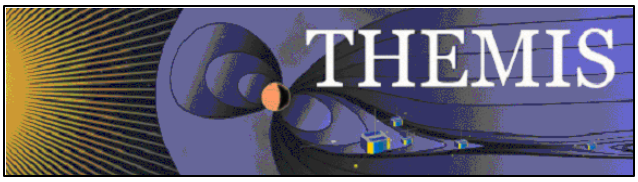
The FIT_EXEC routine shall detect when there is a full spin of data, and shall call the SPIN module with the 32-point array to get a result vector as detailed below. The Spin Fit calculations themselves are presented in thm_fsw_218_spin.doc and will not be described herein.

Byte	Result Vector
0	A [Exponent]
1	A [MS Mantissa]
2	A [LS Mantissa]
3	B [Exponent]
4	B [MS Mantissa]
5	B [LS Mantissa]
6	C [Exponent]
7	C [MS Mantissa]
8	C [LS Mantissa]
9	S [Exponent]
10	S [MS Mantissa]
11	S [LS Mantissa]
12	N (Unsigned byte)

Each three byte floating point value shall be formatted as follows:

Exponent	MS Byte	LS Byte
SEEEEEEE	HHHHHHHH	LLLLLLLL

Where s = 1 for negative values, e is the binary exponent in excess 64 format, and [hl] are the 16-bit mantissa. There shall be no hidden bit in this format. Example: 1.0 is 41,80,00, 1.5 is 41,C0,00, 2 is 42,80,00.



1.6.1 Data Reduction

In the Cluster II project, the FIT results described above were further reduced to the following vector presented to telemetry. The Offset A was tossed out (not useful) and the engineering quantity N also tossed. The Floating Point results were truncated to 8-bit mantissas in order to further reduce the data set.

Byte	Result Vector
0	B [Exponent]
1	B [MS Mantissa]
2	C [Exponent]
3	C [MS Mantissa]
4	S [Exponent]
5	S [MS Mantissa]

1.6.2 Packet Generation

Spin Fit results are encoded with a header byte to distinguish E and B fits, then stored in a fit packet which when filled, is transferred to the Survey segment. See the Command and Telemetry document APID 410.

Due to the extreme period represented by APID 410, the FIT module should not request a memory packet until ready to transfer to the SSR. It should use a temporary area in SRAM, and transfer completed packets when finished.