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# THEMIS

## PARTICLES L1 Data files Variable Name Definition

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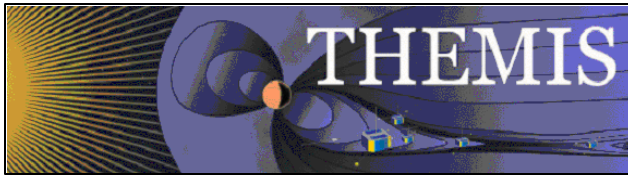
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## Document Revision Record

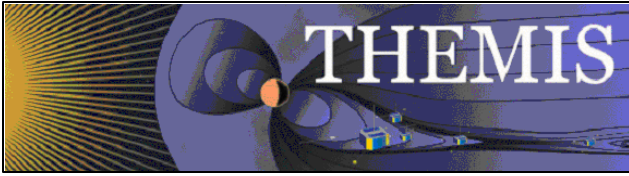
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		Added Ludlam in signature list; Added ESA Modes Table	

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Identifier	Description
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# 1. Introduction

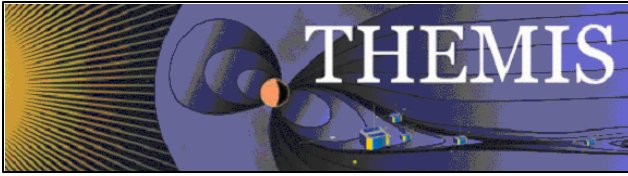
## 1.1 Purpose and Scope.

THEMIS data are transmitted to the ground as Virtual Channel (VC), Application Identifier (APID) packets, each containing packets of a specific instrument data type from a specific IDPU instrument APID. Time-ordering of individual APID packet files, time-tagging, decompression of the IDPU post-recording compression, a small re-arrangement of quantities and possible trivial processing of raw quantities results in L0 file data. These files (herein termed APID\_LODAT.pkt) contain APID data in daily files. The APIDs are described in: thm\_fsw\_003\_ctm\_v4.013.xls (and previous versions), and are also listed below:

### THEMIS IDPU APPLICATION IDENTIFIERS

APID(Hex)	Description of Packet
410	IDPU SPIN FIT PACKET (EFI & FGM)
411	spare
412	spare
440	DIGITAL FIELDS BOARD FILTERS
441	DIGITAL FIELDS BOARD Fast Survey (A) V1-V6
442	DIGITAL FIELDS BOARD Fast Survey (B) V1-V6
443	DIGITAL FIELDS BOARD Fast Survey E12DC, E34DC, E56DC at 2 to 256 Hz
444	DIGITAL FIELDS BOARD Fast Survey SCM1, SCM2, SCM3 at 2 to 256 Hz
445	DIGITAL FIELDS BOARD Particle Burst (A) V1-V6 at 2 to 256 Hz
446	DIGITAL FIELDS BOARD Particle Burst (B) V1-V6 at 2 to 256 Hz
447	DIGITAL FIELDS BOARD Particle Burst E12DC, E34DC, E56DC at 2 to 256 Hz
448	DIGITAL FIELDS BOARD Particle Burst SCM1, SCM2, SCM3 at 2 to 256 Hz
449	DIGITAL FIELDS BOARD Wave Burst (A) V1-V6 at 512 to 8192 Hz
44A	DIGITAL FIELDS BOARD Wave Burst (B) V1-V6 at 512 to 8192 Hz
44B	DIGITAL FIELDS BOARD Wave Burst E12DC, E34DC, E56DC at 512 to 16384 Hz
44C	DIGITAL FIELDS BOARD Wave Burst SCM1, SCM2, SCM3 at 512 to 16384 Hz
44D	DIGITAL FIELDS BOARD Particle Burst Spectra 1 to 4 16-64 pts @1/4-8 Hz
44E	DIGITAL FIELDS BOARD Wave Burst Spectra 1 to 4 16-64 pts @1/4-8 Hz
44F	spare
450	spare
451	Trigger Data
452	SST Engineering Data
453	ESA and SST Moments [212 bytes/spin]
454	iESA FDF Survey Ion 88x32 Angle*Energies
455	iESA RDF Survey Ion 6x16 Angle*Energies
456	iESA FDF Burst Ion 88x32 Angle*Energies
457	eESA FDF Survey Electron 88x32 Angle*Energies
458	eESA RDF Survey Electron 6x16 Angle*Energies
459	eESA FDF Burst Electron 88x32 Angle*Energies
45A	iSST FDF Survey Ion 64x16 Angle*Energies
45B	iSST RDF Survey Ion 6x8 Angle*Energies
45C	iSST FDF Burst Ion 64x16 Angle*Energies
45D	eSST FDF Survey Electron 64x16 Angle*Energies
45E	eSST RDF Survey Electron 6x8 Angle*Energies
45F	eSST FDF Burst Electron 64x16 Angle*Energies
460	FGM LOW RATE DATA (TML)
461	FGM HIGH RATE DATA (TMH)

THEMIS Level 1 probe data (herein termed L1DAT.cdf), shall be CDF files containing the above L0 data, in principle as close to their L0 format as feasible, but with addition of metadata and time stamps that facilitate interpretation and access by the scientific community. It is anticipated that L1 files will originally



contain data stemming from their individual APID files, but will eventually be merged into a single daily multi-instrument file, containing all the science APIDs for a single probe.

Generation of physical quantities from such L1DAT.cdf files shall proceed, in principle, by use of two additional files and a piece of code: A calibration file (herein termed CAL.cdf), a probe STATE file (herein termed STATE.cdf) and a piece of IDL code that reads the three files, calibrates and transforms the data into the proper coordinate system and produces physical quantities.

The purpose of this document is to define the EFI, SCM and FGM instrument L1 data file quantities and names. The overarching principle is to create short and unique mnemonics that facilitate easy understanding of the data quantities they carry, while preserving, if possible, the efficiency (and compactness) of the L0 and APID data representation.

## 1.2 Applicable Documents.

1. THM_SYS_012_PDMP	THEMIS Project Data Management Plan
2. THM_SOC_101_TIME	THEMIS TIME Definition
3. THM_SOC_105_FIELDS_L1_VARNAAMES	THEMIS FIELDS Variable Name Def's
4. THM_SOC_108_GMAG_L1_VARNAAMES	THEMIS GMAG Variable Name Def's
5. THM_SOC_109_ASI_L1_VARNAAMES	THEMIS ASI Variable Name Definitions
6. THM_SOC_110_COORDINATES	THEMIS Coordinate Systems Definitions
7. THM_SOC_111_SUNSENSPROC	THEMIS SUN SENSOR Science Processing
8. THM_SOC_112_ATTPAIPROC	THEMIS Science ATT & Inertia Determ.
9. THM_SOC_113_FGM_CALPROC	THEMIS FGM CAL File and Processing
10. THM_SOC_114_SCM_CALPROC	THEMIS SCM CAL File and Processing
11. THM_SOC_115_EFI_CALPROC	THEMIS EFI CAL File and Processing
12. THM_SOC_116_ESA_CALPROC	THEMIS ESA CAL File and Processing
13. THM_SOC_117_SST_CALPROC	THEMIS SST CAL File and Processing

## 2. General L1DAT File Variable Naming Conventions

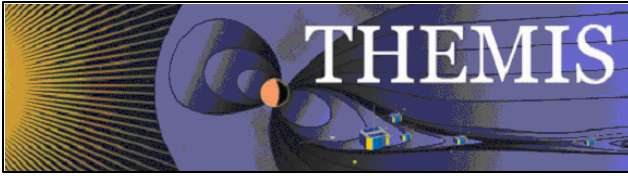
### 2.1 Construct of PARTICLES VARNAAMES: TH[A-E]\_XYZ\_nnnn

Following an overall principle of naming THEMIS variables using more general to less general descriptors, separated by the underscore character “\_”, the ESA and SST variables shall be named: TH[A-E]\_XYZ, where: A-E is the probe letter – identifier, and “XYZ” is a descriptive ESA or SST distribution quantity identifier.

This construct works well with data products from most distribution functions and when further specificity is required in order to ensure optimal file size, such as in the number of spectral angle-energy quantities, additional descriptors \_nnnn are utilized. Those unique identifiers can be letters or numbers.

### 2.2 Packet HEADERS: TH[A-E]\_XYZ\_HED; TH[A-E]\_XYZ\_nnnn\_HED

Packet header information and packet time (but not packet data) shall be included in the L1 files. Such headers shall be named by appending the 3 letters “HED” to the variable name. When multiple variables were extracted from the same L0 packets, a more generic name for the packet variable shall be used, e.g., TH[A-E]\_MOM\_HED would describe headers for all ESA and SST moments.



### 3. Specific PARTICLES Quantities

#### 3.1 Distribution Functions (APIDs 454-45F): TH[A-E]\_XYZ\_nnnn

ESA and SST distribution functions are transmitted in various angle-energy combinations depending on mode (survey, burst) and region (magnetospheric, shocked solar wind, and pristine solar wind). The naming convention shall be: TH[A-E]\_XYZ\_nnnn, where:

X ∈ {E, S} for ESA or SST

Y ∈ {I, E} for Ions or Electrons

Z ∈ {F,R,B} for Full, Reduced or Burst distributions

nnnn is a unique identifier of the angle-energy ranges for the SST and ESA shown in **Tables 1 and 2.**

#### 3.2 Moments (APID 453)

ESA and SST moments are transmitted together in APID 453, along with the spacecraft potential. The spacecraft potential is used in the ESA moment computation for removing electron contamination.

The variable representing the moment data products shall be named: TH[A-E]\_MOM and shall be a 4x13 array where:

\_MOM.dat(0,\*) shall be the ion ESA moments

\_MOM.dat(1,\*) shall be the electron ESA moments

\_MOM.dat(2,\*) shall be the ion SST moments and

\_MOM.dat(3,\*) shall be the electron SST moments.

The variable representing the spacecraft potential that was used for the moment computation shall be in variable: \_MOM\_POT, a time-varying quantity of type R\*4

The variable representing the status shall be \_MOM\_QF, a 1 dimension, 2 BYTE array, representing the SST data valid (\_MOM\_QF.dat(0); bit=1) and ESA data valid (\_MOM\_QF.dat(0); bit=0).

Moment Format (etcreq1.6)	
0	Density
1-3	Flux1-3
4-9	P[1-6]
10-12	Q[1-3]

All quantities are 4 bytes, signed, and big-endian

#### 3.3 SST Engineering data (APID 452)

Data shall be contained in a variable named: \_SST\_ENG which will represent a time varying, 1 dimensional, 256 BYTE array. Header information shall be contained in \_SST\_ENG\_HED and header time shall be in \_SST\_ENG\_HED\_TIME