University of Michigan
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TIDI Data Processing Software **Background Spectra File Format**	CAGE No. 0TK63 Drawing No. 055-4174 Project TIDI Contract No. NASW-5-5049 Page 1 of 1

REVISION RECORD			
Rev	Description	Date	Author
C	• Added Table 4 detailing the p_status variable in the background file.	27-Oct-2008	M. L. Cooper
B	• Added 'type' of variable to Table 3.	17-Jan-2007	M. L. Cooper
A	• Add model coefficients • Remove Approval block	27-Jan-2004	D. A. Gell
	Initial Release	08-Apr-2002	

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1. References

1. Gell, David "Downlink Software Development Plan", SPRL File 055-3439, 29 July 1997

2. Russ Rew, Glen Davis, Steve Emmerson, and Harvey Davies, *NetCDF User's Guide for C, Version 3*, Unidata Program Center, June 1997

3. APL, *TIMED General Instrument Interface Specification (GIIS),* APL File 7363-9050, 1 Oct 1997

4. Gell, David, "File Naming Convention Summary", SPRL File 055-3545, 3 Feb 1998

5. Wolfe, E., "GETBACKGROUND Requirements Specification", SPRL File 055-4176.

2. Introduction

The TIDI Background Spectra Data File contains the results of the background collection program, GETBACKGROUND, for use in the program RETRIEVE, (reference 1). This program consumes level 0 TM packets and produces this level 1 file. The data will consist of entire level 0 packets for which background was measured (see ref. 5). During flight operations the level 0 data from which this file is produced will be formed from recorder playback data. During algorithm development, the level 0 data may be produced by simulators or emulators.

BACKGROUND files will generally contain data for a 24 hour period beginning at 00h01 UTC. However, simulated and test data may be produced for shorter periods starting at arbitrary times.

3. File Organization and Content

Background Data will be stored in netCDF (ref. 2) files. These files are organized as if they contained a series of arrays, one array for each data item. In addition to the data, a netCDF file contains attributes. These attributes may be attached to a data item or they may be global, applying to the entire file. The minimum set of global attributes to be specified for the file is defined in an Appendix of the GIIS (ref. 3). The global attributes for this file are specified in section, 3.1 below

Attributes attached to each data item will include units, long name (description), maximum valid value, minimum valid value and missing value, as appropriate. The attributes and their definitions are specified in Table 1.

Table 1, Data Item Attributes

attribute name	description
`Units`	a string containing the SI standard abbreviations for the units associated with the data item
`long_name`	a string containing a description of the data item, sufficiently detailed that a knowledgeable outsider can interpret the description
`valid_min`	the minimum value ever expected of the data item
`valid_max`	the maximum value ever expected of the data item
`missing_value`	a value either greater than valid_max or less than valid_min used to fill the data item in the absence of valid data

These files consist of two logical segments, a "header" consisting of the global attributes and the data records. The minimum contents of the header are specified in an Appendix of the GIIS (ref.3). The data section consists of the collected data records.

3.1. File Header

The global attributes which constitute the header of the background file are listed in Table 2 , below. These attributes include those required by the GIIS and some TIDI unique items. The column labeled "Attribute Name" specifies the exact name to be used for the global attribute. The column labeled "Type" specifies whether the attribute is a character string, an integer number or a floating point number. In this column, items labeled Rev ID are a string consisting of a major revision number and a minor revision number separated by a decimal point. In the column labeled "Description", items in **`bold courier`** type are the exact constant value to be assigned to the attribute.

Table 2, Global Attributes

Attribute Name	Type	Description
Title	String	text description of the data file
data_product_type	String	**`ROUTINE, LEVEL1`**
Mission	String	**`TIMED`**
Source	String	**`TIDI_POC`**
data_product_version	Rev ID	Version of the data product contained in the file
product_format_version	Rev ID	Version of the file format. Major format is incremented when a change in the reading software is required. Minor version is incremented when changes are implemented that do not require access software changes.
software_version	Rev ID	Major and Minor version numbers of the software used to produce the file
software_name	String	**`GETBACKGROUND`**
calibration_version	Rev ID	Major and Minor version numbers of the calibration data used in the production of this file
filename	String	The name assigned to this file at the time of its creation.
input_file	String	The name of the TM Packet (level 0) file processed to create this file.
date_created	String	yyyydoyhhmmss

The date created field contains the time that the file was created, expressed in the TIMED standard ASCII format with fraction seconds omitted.

3.2. Data Segment

The data segment consists of a set of spectral records described in section 3.2.1.

3.2.1. Spectral Data Records

The spectral data consists of one logical record for each spectra. The record contains ancillary data partially describing the state of the instrument at the time of the measurement. The spectra are unconverted.

The spectral data is stored as a series of parallel arrays. The first dimension of each array is the record dimension. The spectra are denoted in the table as having a dimension greater than 1 and are implemented as 2 dimensional netCDF arrays with dimension (unlimited,n) where n is the value in the column labeled dim. Scalar items, such as time, are denoted in the table as having a dimension of 1 and are one dimensional netCDF arrays with an unlimited dimension.

The spectral record contents are described in Table 3. The short name is to be used as the variable name for the data item. The description is the string to be used as the netCDF `long_name` attribute. The units column specifies the string to be used as the netCDF `units` attribute. The dimension column contains the second dimension of each array. The range column defines a range of valid values for each item. These values shall be used as the `valid_min` and `valid_max` netCDF attributes. The value for the `missing_value` attribute shall be outside of the valid range.

Table 3, Background Spectral Record Contents

short name	Description	units	type	dim.	range
time	date and time of the measurement (mission time)	s since epoch[‡]	I4	1	x > 0
ms_time	fractional second of the measurement	ms	I2	1	0 ≤ x ≤ 999
rec_index	location of this record in file	—	I4	1	x ≥ 1
lamp_status	status of calibration lamps	—	I1	1	0,1,2,3,4
sc_warn	spacecraft master warning flag	—	C1	1	"T" | "F"
in_saa	True if in the south Atlantic anomaly	—	C1	1	"T" | "F"
fw_error	filter wheel position error	—	C1	1	"T" | "F"
elev_error	telescope elevation error	—	C1	1	"T" | "F"
data_ok	True if data is OK, False if data is contaminated	—	C1	1	"T" | "F"
fw_pos_errors	filter wheel position errors: (1,2)	—	C1	2	"T" | "F"
fw_positions	filter wheel positions: (1, 2)	—	I1	2	1, 2, … 8
sun_avoid	Sun avoidance	—	C1	1	"T" | "F"
tel_time_err	telescope timing error	—	C1	1	"T" | "F"
fw_time_err	filter wheel timing error	—	C1	1	"T" | "F"
shut_time_err	shutter timing error	—	C1	1	"T" | "F"
shut_positions	shutter position for each telescope: (1,2,3,4)	—	C1	4	"O" | "C"
table_id	identifier of the scan table controlling the measurement	—	I4	1	0≤ x ≤ 65535
exp_count	CCD exposures since start of scan table	—	I4	1	0≤ x ≤ 65535
elevations	telescope elevations for azimuths 45, 135, 225, 315	deg	R4	4	10 ≤ x ≤ 31
binningtab	CCD binning table identifier: .id in the .btab file	—	I4	1	0≤ x ≤ 65535
int_period	CCD integration duration	S	R4	1	0 ≤ x ≤ 40.95
spectra	detector counts	counts	I2	255	0 ≤ x ≤ 4095
gain	CCD gain index	—	I1	1	1 ≤ x ≤ 4
p_status	processing status value	—	I4	1	0=OK
coefs	model coefficients for reconstructing background	—	R4	8	$-1\cdot10^{8}\le x\le1\cdot10^{8}$
cr_cnt	number of contaminated spectral channels	—	I4	1	0≤x≤256
norder	number of coefficients used in spectral model	—	I4	1	1≤x≤8

[‡] epoch is the GPS epoch, 0h00 UTC, 6 January 1980

3.2.2. Description of processing status settings (p_status)

The p_status is saved within the BGD file created by the getbackground program. However, one setting, bit one of p_status, is carried out in the read_bckgrnd subroutine called by RETRIEVE.

Table 4, P_status settings

bit #	bit mask	description
0	0001	the number of cr_contam greater than or equal to max_bad (=50) ← no longer in the background file… this is now a test in the read_bckgrnd.c routine
1	0002	saturated spectra ← **not implemented in versions before D005**
2	0004	filter wheel changed from previous setting
3	0008	previous record had a filter wheel error

4. Naming Convention

According to the convention specified in reference 4, file names consist of a file description string and a file type string separated by the period "." character. TIDI background spectra files have the same names as the level0 files they consume, with the file type string "TL0" replaced by ".BGD".