GECAM 科学数据产品格式和组织说明

GECAM 科学应用系统

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目录

1 GECAM 试用数据内容简介

本文档为方便参加《第二届 GECAM 科学研讨会》参会人员使用数据编写，详细数据格式说明文档将会另行发布。本文档内容与正式发布版本不一致时请以发布版本为准。

本次试用数据为 1 级数据，包括连续、触发和暴发数据，目录结构如下：

```
|-- daily
    |-- GECAM_A
        gag_evt_yymmdd_hh_v00.fits
        …
    |-- GECAM_B
        gbg_evt_yymmdd_hh_v00.fits
        …
|-- triggers
   |-- tnyymmdd_hhmmss_pp
      …
|-- bursts
    |-- bnyymmdd_hhmmss
        |-- GECAM_A
            …
        |-- GECAM_B
            …
```

试用数据下载链接：**http://gecamweb.ihep.ac.cn/mnsj.jhtml**

1.1 GECAM 数据分级

图 1-1 简要描述了 GECAM 各级数据生成流程及各产品之间的相互关系，蓝色方框内部分为数传科学数据的标定处理过程。

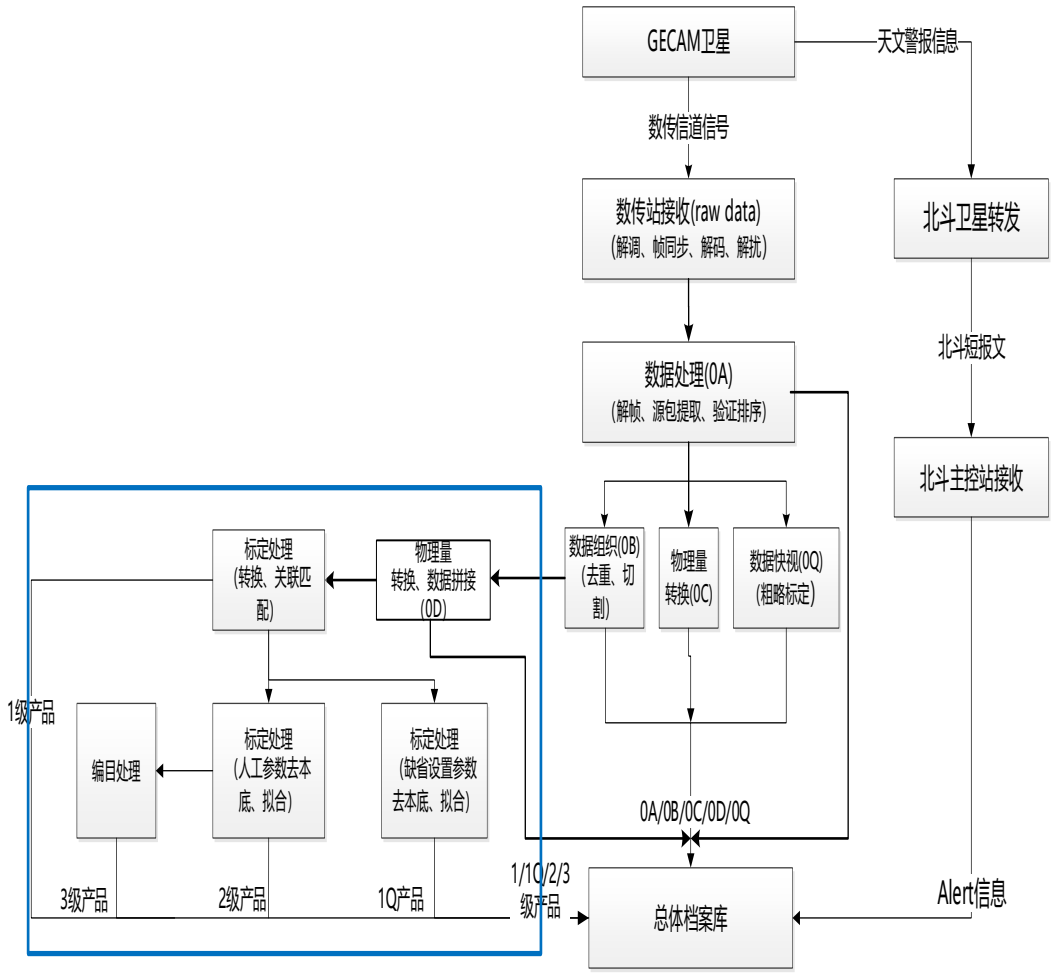

图 1-1 各级数据产品生成示意

1.2 1 级数据内容

1/级数据是 0D 级数据处理的结果。数据处理过程在 GECAM 科学应用系统完成，数据处理的结果作为 1 级数据会向科学用户公开，作为 GECAM 科学数据分析及研究的基础。

1 级数据产品生产从 0D 级数据产品出发，完成数据分解、内容重组、标定等处理，自动生成 1 级数据产品并输出数据质量报告。数据按照内容组织不同划分为触发/暴发和连续数据，其中触发/暴发数据由连续数据切割而成；连续数据又可区分为并道数据和事例数据。GRD 的并道数据有两种类型，分别为 BTIME 和 BSPEC；CPD 只有一种 BTIME 并道数据。此外，部分 GRD 触发可能为同一暴发现象，GECAM 由于是双星，对同一暴发现象很可能在双星数据中同时有触发。对于同一暴发现象的双星匹配数据最后会放到同一暴发目录。

2 数据通用约定

2.1 文件类型

1 级数据文件全部为 FITS 格式。

2.2 时间系统

数据文件中使用的时间有：

1. Mission Elapsed Time (MET)，参考时间定义为 2019 年 1 月 1 日 0 时（0h:0m:0s）（UTC 时间）；
2. TT 时间, 数据文件命名和开始、结束时间及数据单元中使用。

2.3 卫星轨道文件

轨道数据文件中分别提供 WGS-84 和 J2000 坐标系下的 GECAM 双星位置、速度参数。

2.4 文件命名

1. 文件命名规则统一、在全部文件系统中保持唯一。文件版本变化体现在文件命名规则里，数据生成过程中的算法变化，标定文件的更新等对相同的输入数据处理都会生成更高版本的文件，版本变化对应于文件名的变化，并且各种变化和更新的细节在文件里面有关键字标记；
2. 文件命名使用的字符为 a-z，数字为 0-9，分隔符使用“_”；
3. 文件命名以字符 g 开始，代表 GECAM 卫星，其它字符意义如下：
   a) 字符“a”和“b”表示 GECAM 两个卫星；
   b) 字符“g”或“c”表示 GRD 或 CPD；
   c) 载荷连续数据文件中“evt”表示事例文件；“btime”和“bspec”分别表示并道数据文件，连续数据文件每天每种类型 24 个；
   d) 触发数据名中的触发编号 tnyymmdd_hhmmss_pp，tn 是 trigger number 的简称，后面字符表示年、月、日、时、分和秒。pp 表示触发类型有 fa：星上 a 星触发；fb：星上 b 星触发；ga：地面搜索 a 星触发；gb：地面搜索 b 星触发；gj：地面双星联合搜索触发；
   e) 暴发数据名中的暴发编号 bnyymmdd_hhmmss[X]，bn 是 burst number 的简称，后面字符表示年、月、日、时、分和秒。如果为

相同暴发编号的第一个事例 X 为空，第二个以后的暴发事例以字母 B 开始顺序增加；

f) 文件版本序号从 v00 开始顺序增加。

按照以上命名规则的 GRD 连续事例文件命名如下：

g[a/b]g_evt_yymmdd_hh_v00.fits

2.5 FITS 头文件关键字

此处列出各种数据类型文件共用的头文件关键字定义：

表 2-1 各种数据类型文件共用的头文件关键字定义

关键字 Keyword	取值 Value	注释 Comment	参数说明
CREATOR	字符串	Software and version	软件名和版本
DATE	YYYY-MM-DDThh:mm:ss	File creation date	文件生成时间
FILETYPE	FITS	Type of this file	文件格式
FMAT_VER	整形	Version of the format for this filetype	FITS 文件格式版本号
MISSION	GECAM	Name of the mission	项目名称
TELESCOP	字符串	Name of the telescope	卫星名称
INSTRUM	字符串	Name of the instrument	探头名称
WORKMODE	字符串 (full, half)	Work mode of the instrument	探头工作模式，可能为全组份或半组份
OBSERVER	XIONG	Name of instrument PI	PI 名称
ORIGIN	GSDC	The origin of file creation	生产文件的分系统名称
DATE_OBS	YYYY-MM-DDThh:mm: ss.sss	Time of start of observation	文件开始时间
DATE_END	YYYY-MM-DDThh:mm: ss.sss	Time of end of observation	文件结束时间
DATE_REF	2019-01-01T00:00:00.000	Reference date for GECAM	GECAM 参考时间
TSTART		[GECAM MET] Observation start time	文件开始的 MET 时间
TSTOP		[GECAM MET] Observation stop time	文件结束的 MET 时间

续表 3-1

TIMESYS	TT	Time system used in time keywords	时间系统
TIMEUNIT	S	Time since MJDREF, used both in TSTART and STOP	时间单位
MJDREFI	整数	MJD of GECAM reference epoch, integer part	GECAM 参考时间的整数部分（MJD）
MJDREFF	小数	MJD of GECAM reference epoch, fractional part	GECAM 参考时间的小数部分（MJD）
CHECKSUM		Checksum for entireHDU	HDU 校验
DATASUM		Checksum for data table	数据校验

3 1 级数据文件描述

3.1 1 级连续数据文件列表

表 3-1 GECAM 1 级连续数据文件列表

GECAM 连续数据类型				
序号	数据产品	产品描述	文件长度	产品级别
1	GRD 载荷连续事例数据	25 个探头在一个文件，按事例组织数据，能量按照 PI 道为 498 道输出。	每星每小时一个文件	1
2	GRD 载荷 BTIME 并道数据	25 个探头在一个文件，每 50ms 给出一组能谱数据（高、低增益各 7 道）和死时间。	每星每小时一个文件	1
3	GRD 载荷 BSPEC 并道数据	25 个探头在一个文件，每秒给出一组能谱数据（高、低增益各 129 道）和死时间。	每星每小时一个文件	1
4	CPD 载荷事例数据	8 个探头在一个文件，按事例组织数据.	每星每小时一个文件	1
5	CPD 载荷并道数据	8 个探头在一个文件，每 50 毫秒给出一组能谱数据（3 道）和死时间。	每星每小时一个文件	1
6	GRD 与 CPD 同时粒子数据	同一时间包括 GRD 和 CPD 的 33 个探头中任意 2 个及以上有计数时输出各探头的具体计数情况。	每星每小时一个文件	1
7	卫星轨道姿态数据	卫星轨道参数在 WGS-84 和 J2000 坐标系下的值，卫星姿态四元数。	每星每小时一个文件	1
8	日月星地数据	各天体在载荷坐标系的极角，方位角和卫星星下点经、纬度等数据。	每星每小时一个文件	1

3.2 1 级触发数据文件列表

表 3-2 GECAM 1 级触发数据文件列表

GECAM 触发数据类型				
序号	数据产品	产品描述	文件长度	产品级别
1	GRD 触发事例数据	按照触发时间范围从连续事例数据中切割。25 个探头在一个文件，按事例组织数据，能量按照 PI 道为 498 道输出。	触发时间范围	1
2	CPD 事例数据	按照触发时间范围从连续事例数据中切割。8 个探头在一个文件，按照事例组织数据。	触发时间范围	1
3	卫星轨道姿态数据	按照触发时间范围从连续数据中切割。卫星轨道参数在 WGS-84 和 J2000 坐标系下的值，卫星姿态数据四元数。	触发时间范围	1
4	日月星地数据	按照触发时间范围从连续数据中切割。各天体在载荷坐标系的极角、方位角，以及卫星星下点经、纬度。	触发时间范围	1

3.3 1 级暴发数据文件列表

表 3-3 GECAM 1 级暴发数据文件列表

GECAM 暴发数据类型				
序号	数据产品	产品描述	文件长度	产品级别
1	GRD 暴发事例数据	按照暴发时间范围从双星连续事例数据中切割。25 个探头在一个文件，按事例组织数据，能量按照 PI 道为 498 道输出。	暴发时间范围	1
2	CPD 事例数据	按照暴发时间范围从双星连续事例数据中切割。8 个探头在一个文件，按事例组织数据.	暴发时间范围	1
3	GRD 载荷 BTIME 并道数据	按照暴发时间范围从双星连续数据中切割。25 个探头在一个文件，每 50ms 给出一组能谱数据（高、低增益各 7 道）。	暴发时间范围	1

序号	数据产品	产品描述	文件长度	产品级别
4	GRD 载荷 BSPEC 并道数据	按照暴发时间范围从双星连续数据中切割。25 个探头在一个文件，每秒给出一组能谱数据（高、低增益各 129 道）。	暴发时间范围	1
5	CPD 载荷并道数据	按照暴发时间范围从双星连续数据中切割。8 个探头在一个文件，每 50 毫秒给出一组能谱数据（3 道）。	暴发时间范围	1
6	GRD 与 CPD 同时粒子数据	按照暴发时间范围从双星连续数据中切割。同一时间包括 GRD 和 CPD 的 33 个探头中任意 2 个及以上有计数时输出各探头的具体计数情况。	暴发时间范围	1
7	卫星轨道姿态数据	按照暴发时间范围从双星连续数据中切割。卫星轨道参数在 WGS-84 和 J2000 坐标系下的值，卫星姿态数据四元数。	暴发时间范围	1
8	日月星地数据	按照暴发时间范围从双星连续数据中切割。各天体在载荷坐标系的极角、方位角，以及卫星星下点经、纬度等数据。	暴发时间范围	1

4 GECAM 1 级数据

4.1 GRD 连续事例数据：

产品描述：

连续事例文件按照每小时每星一个文件，每个文件包含上一小时最后 100 秒时间数据；每个文件包含单颗卫星 25 个 GRD 探头数据；事例数据按照探测时间和能道数据记录（暂定 498 PI 道）。

文件命名：g[a/b]g_evt_yymmdd_hh_v00.fits

4.1.1 HDU LIST

No.	Name	Ver	Type	Cards	Dimensions	Format
0	PRIMARY	1	PrimaryHDU	28	()	
1	EBOUNDS	1	BinTableHDU	49	498R x 3C	[I, E, E]
2	GTI	1	BinTableHDU	34	MR x 2C	[D, D]
3	EVENTS01	1	BinTableHDU	56	NR x 7C	[D, I, X, B, B, B, 2X]
4	EVENTS02	1	BinTableHDU	56	NR x 7C	[D, I, X, B, B, B, 2X]
5	EVENTS03	1	BinTableHDU	56	NR x 7C	[D, I, X, B, B, B, 2X]
6	EVENTS04	1	BinTableHDU	56	NR x 7C	[D, I, X, B, B, B, 2X]
7	EVENTS05	1	BinTableHDU	56	NR x 7C	[D, I, X, B, B, B, 2X]
8	EVENTS06	1	BinTableHDU	56	NR x 7C	[D, I, X, B, B, B, 2X]
9	EVENTS07	1	BinTableHDU	56	NR x 7C	[D, I, X, B, B, B, 2X]
10	EVENTS08	1	BinTableHDU	56	NR x 7C	[D, I, X, B, B, B, 2X]
11	EVENTS09	1	BinTableHDU	56	NR x 7C	[D, I, X, B, B, B, 2X]
12	EVENTS10	1	BinTableHDU	56	NR x 7C	[D, I, X, B, B, B, 2X]
13	EVENTS11	1	BinTableHDU	56	NR x 7C	[D, I, X, B, B, B, 2X]
14	EVENTS12	1	BinTableHDU	56	NR x 7C	[D, I, X, B, B, B, 2X]
15	EVENTS13	1	BinTableHDU	56	NR x 7C	[D, I, X, B, B, B, 2X]
16	EVENTS14	1	BinTableHDU	56	NR x 7C	[D, I, X, B, B, B, 2X]
17	EVENTS15	1	BinTableHDU	56	NR x 7C	[D, I, X, B, B, B, 2X]
18	EVENTS16	1	BinTableHDU	56	NR x 7C	[D, I, X, B, B, B, 2X]
19	EVENTS17	1	BinTableHDU	56	NR x 7C	[D, I, X, B, B, B, 2X]
20	EVENTS18	1	BinTableHDU	56	NR x 7C	[D, I, X, B, B, B, 2X]
21	EVENTS19	1	BinTableHDU	56	NR x 7C	[D, I, X, B, B, B, 2X]
22	EVENTS20	1	BinTableHDU	56	NR x 7C	[D, I, X, B, B, B, 2X]
23	EVENTS21	1	BinTableHDU	56	NR x 7C	[D, I, X, B, B, B, 2X]
24	EVENTS22	1	BinTableHDU	56	NR x 7C	[D, I, X, B, B, B, 2X]
25	EVENTS23	1	BinTableHDU	56	NR x 7C	[D, I, X, B, B, B, 2X]
26	EVENTS24	1	BinTableHDU	56	NR x 7C	[D, I, X, B, B, B, 2X]
27	EVENTS25	1	BinTableHDU	56	NR x 7C	[D, I, X, B, B, B, 2X]

4.1.2 Primary Header Keywords

FITS Keyword	Value	Purpose
SIMPLE	T	conforms to FITS standard
BITPIX	8	array data type
NAXIS	0	number of array dimensions
EXTEND	T	
CREATOR	'DailyData v1.0'	Software and version
DATE	'YYYY-MM-DDThh:mm:ss'	File creation date
FILETYPE	'GECAM PHOTON LIST'	Name for this type of FITS file
FILE_VER	'1.0.0 '	Version of the format for this filetype
MISSION	'GECAM'	Name of mission
TELESCOP	'GECAM-[A/B] '	Name of satellite
INSTRUME	'GRD '	Instrument used for observation of gamma photon
OBSERVER	'XIONG '	GECAM P.I.
ORIGIN	'GSDC '	Name of organization making file
DATE_OBS	'YYYY-MM-DDThh:mm: ss.sss'	Time of start of observation
DATE_END	'YYYY-MM-DDThh:mm: ss.sss'	Time of end of observation
DATE_REF	'2019-01-01T00:00:00.000'	Reference date for GECAM
TSTART		[GECAM MET] Observation start time
TSTOP		[GECAM MET] Observation stop time
TIMESYS	'TT '	Time system used in time keywords
TIMEUNIT	's '	Time since MJDREF, used both in TSTART and STOP
MJDREFI	58484	MJD of GECAM reference epoch, integer part
MJDREFF	0.00080074074	MJD of GECAM reference epoch, fractional part
FILENAME	'g[a/b]g_evt_yymmdd_hh_v00.fits'	Name of this file
DATATYPE	'EVT '	Name of the primary datatype making up this file
INFILE01	'gecam_a_xxx.fits'	Level 0D input data file
INFILE02	'cal_a_xxx.fits'	Calibration data file
CHECKSUM		Checksum for entireHDU
DATASUM		Checksum for data table
END		

4.1.3 Extension Header 1: EBOUNDS

FITS Keyword	Value	Purpose
XTENSION	'BINTABLE'	Binary table extension
BITPIX	8	Array data type
NAXIS	2	Number of array dimensions

NAXIS1	10	Length of dimension 1
NAXIS2	498	Length of dimension 2
PCOUNT	0	Number of group parameters
GCOUNT	1	Number of groups
TFIELDS	3	Number of table fields
TTYPE1	'CHANNEL '	
TFORM1	'I '	
TTYPE2	'E_MIN '	
TFORM2	'E '	
TTYPE3	'E_MAX '	
TFORM3	'E '	
TLMIN1	'0 '	Lower limit of energy channel
TLMAX1	497	Upper limit of energy channel
TUNIT1	'none '	Physical unit of field
TLMIN2	2	Lowest energy
TLMAX2	'10000	Highest energy
TUNIT2	'keV '	Physical unit of field
TLMIN3	2	Lowest energy
TLMAX3	10000	Highest energy
TUNIT3	'keV '	Physical unit of field
DATE	'YYYY-MM-DDThh:mm:ss'	File creation date
MISSION	'GECAM'	Name of mission
TELESCOP	'GECAM-[A/B] '	Name of satellite
INSTRUME	'GRD '	Instrument used for observation of gamma photon
OBSERVER	'XIONG '	GECAM P.I.
ORIGIN	'GSDC '	Name of organization making file
DATE_OBS	'YYYY-MM-DDThh:mm: ss.sss'	Time of start of observation
DATE_END	'YYYY-MM-DDThh:mm: ss.sss'	Time of end of observation
DATE_REF	'2019-01-01T00:00:00.000'	Reference date for GECAM
TSTART		[GECAM MET] Observation start time
TSTOP		[GECAM MET] Observation stop time
TIMESYS	'TT '	Time system used in time keywords
TIMEUNIT	's '	Time since MJDREF, used both in TSTART and STOP
MJDREFI	58484	MJD of GECAM reference epoch, integer part
MJDREFF	0.00080074074	MJD of GECAM reference epoch, fractional part
EXTNAME	'EBOUNDS '	Name of this binary table extension
EXTVER	'1 '	Version of this extension format
CHANTYPE	'PI '	Transformation from PHA to PI has been applied
DETCHANS	498	Total number of channels in each rate
HDUCLASS	'OGIP '	OGIP standard
HDUVERS	'1.0.0 '	Version of format in use
HDUCLAS1	'EBOUNDS '	From calibration file
CH2E_VER	'CH2E 1.0'	ADC channel to dep_E conversion scheme used

CAL_VER	'E2PI 1.0 '	Dep_E to PI channel conversion version used
CHECKSUM		HDU checksum
DATASUM		data unit checksum
END		

数组存储形式：

['CHANNEL', 'E_MIN', 'E_MAX']

I E E

498 行*3 列

4.1.4 Extension Header 2 : GTI

FITS Keyword	Value	Purpose
XTENSION	'BINTABLE'	binary table extension
BITPIX	8	array data type
NAXIS	2	number of array dimensions
NAXIS1	16	length of dimension 1
NAXIS2	1	length of dimension 2
PCOUNT	0	number of group parameters
GCOUNT	1	number of groups
TFIELDS	2	number of table fields
TTYPE1	'START '	
TFORM1	'D '	
TTYPE2	'STOP '	
TFORM2	'D '	
DATE	'YYYY-MM-DDThh:mm:ss'	File creation date
MISSION	'GECAM'	Name of mission
TELESCOP	'GECAM-[A/B] '	Name of satellite
INSTRUME	'GRD '	Instrument used for observation of gamma photon
OBSERVER	'XIONG '	GECAM P.I.
ORIGIN	'GSDC '	Name of organization making file
DATE_OBS	'YYYY-MM-DDThh:mm: ss.sss'	Time of start of observation
DATE_END	'YYYY-MM-DDThh:mm: ss.sss'	Time of end of observation
DATE_REF	'2019-01-01T00:00:00.000'	Reference date for GECAM
TSTART		[GECAM MET] Observation start time
TSTOP		[GECAM MET] Observation stop time
TIMESYS	'TT '	Time system used in time keywords
TIMEUNIT	's '	Time since MJDREF, used both in TSTART and STOP
MJDREFI	58484	MJD of GECAM reference epoch, integer part
MJDREFF	0.00080074074	MJD of GECAM reference epoch, fractional part
EXTNAME	'GTI '	Name of the extension

EXTVER	'1 '	Version of this extension format
HDUCLASS	‘OGIP’	OGIP standard
HDUVERS	'1.0.0 '	Version of format in use
HDUCLAS1	'GTI '	Extension contains Events
CHECKSUM		HDU checksum
DATASUM		data unit checksum
END		

数组存储形式：

['START', 'STOP']（好时间段，进、出异常区之外时间段数据，关机时间段之外数据等）

D D

n 行*2 列

4.1.5 Extension Header 3 : EVENTS01

FITS Keyword	Value	Purpose
XTENSION	'BINTABLE'	binary table extension
BITPIX	8	array data type
NAXIS	2	number of array dimensions
NAXIS1	15	length of dimension 1
NAXIS2		length of dimension 2
PCOUNT	0	number of group parameters
GCOUNT	1	number of groups
TFIELDS	7	number of table fields
TTYPE1	'TIME '	
TFORM1	'D '	
TUNIT1	's '	
TTYPE2	'PI '	
TFORM2	'I '	
TTYPE3	'GAIN_TYPE'	0: high, 1: low
TFORM3	'X '	
TTYPE4	'DEAD_TIME '	dead time
TFORM4	'B '	
TUNIT4	'μs '	
TSCAL4	0.8	
TTYPE5	'EVT_TYPE '	event type
TFORM5	'B '	
TTYPE6	'FLAG'	
TFORM6	'B'	
TTYPE7	'EVT_PAIR'	
TFORM7	'2X'	
DATE	'YYYY-MM-DDThh:mm:ss'	File creation date
MISSION	'GECAM'	Name of mission
TELESCOP	'GECAM-[A/B] '	Name of satellite

INSTRUME	'GRD '	Instrument used for observation of gamma photon
OBSERVER	'XIONG '	GECAM P.I.
ORIGIN	'GSDC '	Name of organization making file
DATE_OBS	'YYYY-MM-DDThh:mm: ss.sss'	Time of start of observation
DATE_END	'YYYY-MM-DDThh:mm: ss.sss'	Time of end of observation
DATE_REF	'2019-01-01T00:00:00.000'	Reference date for GECAM
TSTART		[GECAM MET] Observation start time
TSTOP		[GECAM MET] Observation stop time
TIMESYS	'TT '	Time system used in time keywords
TIMEUNIT	's '	Time since MJDREF, used both in TSTART and STOP
MJDREFI	58484	MJD of GECAM reference epoch, integer part
MJDREFF	0.00080074074	MJD of GECAM reference epoch, fractional part
EXTNAME	'EVENTS01'	Name of this binary table extension
EXTVER	'1 '	Version of this extension format
DETNAM	'GRD_01 '	Individual detector name of GRD
DAQMODE	'X '	DAQ mode
IBLINE	'X '	
WORKMODE	'FULL/HALF '	Working mode of the sensor.
EVT_DEAD	'E '	[s] Deadtime per event
EVTDEDHI	'E '	[s] Deadtime per overflow channel event
DETCHANS	498	Total number of channels in each rate
HDUCLASS	‘OGIP’	OGIP standard
HDUVERS	'1.0.0 '	Version of format in use
HDUCLAS1	'EVENTS '	Extension contains Events
CH2E_VER	'CH2E 1.0'	ADC chan to dep_E conversion scheme used
CAL_VER	'E2PI 1.0 '	Dep_E to PI channel conversion version used
CHECKSUM		HDU checksum
DATASUM		data unit checksum
END		

数组存储形式：

['TIME',	'PI,	'GAIN_TYPE',	'DEAD_TIME',	'EVT_TYPE',	'FLAG',	'EVT_PAIR']
（ D	I	X	B	B	B	2X ）

粒子个数（行）*7 列

PI:498 道；

GAIN_TYPE:增益类型， 0：高增益；1：低增益；

DEAD_TIME：死时间，正常事例：4 微秒；

EVT_TYPE:事例类型，1：正常事例；2：超高事例；3：超宽事例；

FLAG：时间解算准确性和同时粒子推荐标记；

EVT_PAIR：星上和地面判断同时粒子标记；

4.2 GRD 的触发数据：

产品描述：

与连续事例数据内容一致，数据时间覆盖触发前 50 秒和后 250 秒数据。每个文件包含单颗卫星 GRD25 个探头数据；事例数据按照探测时间和能道数据记录（暂定 498 PI 道）。

触发文件命名：g[a/b]g_evt_tnyymmdd_hhmmss_pp_v00.fits

4.2.1 HDU LIST

No.	Name	Ver	Type	Cards	Dimensions	Format
0	PRIMARY	1	PrimaryHDU	40	()	
1	EBOUNDS	1	BinTableHDU	61	498R x 3C	[I, E, E]
2	GTI	1	BinTableHDU	47	MR x 2C	[D, D]
3	EVENTS01	1	BinTableHDU	68	NR x 7C	[D, I, X, B, B, B, 2X]
4	EVENTS02	1	BinTableHDU	68	NR x 7C	[D, I, X, B, B, B, 2X]
5	EVENTS03	1	BinTableHDU	68	NR x 7C	[D, I, X, B, B, B, 2X]
6	EVENTS04	1	BinTableHDU	68	NR x 7C	[D, I, X, B, B, B, 2X]
7	EVENTS05	1	BinTableHDU	68	NR x 7C	[D, I, X, B, B, B, 2X]
8	EVENTS06	1	BinTableHDU	68	NR x 7C	[D, I, X, B, B, B, 2X]
9	EVENTS07	1	BinTableHDU	68	NR x 7C	[D, I, X, B, B, B, 2X]
10	EVENTS08	1	BinTableHDU	68	NR x 7C	[D, I, X, B, B, B, 2X]
11	EVENTS09	1	BinTableHDU	68	NR x 7C	[D, I, X, B, B, B, 2X]
12	EVENTS10	1	BinTableHDU	68	NR x 7C	[D, I, X, B, B, B, 2X]
13	EVENTS11	1	BinTableHDU	68	NR x 7C	[D, I, X, B, B, B, 2X]
14	EVENTS12	1	BinTableHDU	68	NR x 7C	[D, I, X, B, B, B, 2X]
15	EVENTS13	1	BinTableHDU	68	NR x 7C	[D, I, X, B, B, B, 2X]
16	EVENTS14	1	BinTableHDU	68	NR x 7C	[D, I, X, B, B, B, 2X]
17	EVENTS15	1	BinTableHDU	68	NR x 7C	[D, I, X, B, B, B, 2X]
18	EVENTS16	1	BinTableHDU	68	NR x 7C	[D, I, X, B, B, B, 2X]
19	EVENTS17	1	BinTableHDU	68	NR x 7C	[D, I, X, B, B, B, 2X]
20	EVENTS18	1	BinTableHDU	68	NR x 7C	[D, I, X, B, B, B, 2X]
21	EVENTS19	1	BinTableHDU	68	NR x 7C	[D, I, X, B, B, B, 2X]
22	EVENTS20	1	BinTableHDU	68	NR x 7C	[D, I, X, B, B, B, 2X]
23	EVENTS21	1	BinTableHDU	68	NR x 7C	[D, I, X, B, B, B, 2X]
24	EVENTS22	1	BinTableHDU	68	NR x 7C	[D, I, X, B, B, B, 2X]
25	EVENTS23	1	BinTableHDU	68	NR x 7C	[D, I, X, B, B, B, 2X]
26	EVENTS24	1	BinTableHDU	68	NR x 7C	[D, I, X, B, B, B, 2X]

27 EVENTS25 1 BinTableHDU 68 NR x 7C [D, I, X, B, B, B, 2X]

4.2.2 Primary Header Keywords

FITS Keyword	Value	Purpose
SIMPLE	T	conforms to FITS standard
BITPIX	8	array data type
NAXIS	0	number of array dimensions
EXTEND	T	
CREATOR	'DailyData v1.0'	Software and version
DATE	'YYYY-MM-DDThh:mm:ss'	File creation date
FILETYPE	'GECAM PHOTON LIST'	Name for this type of FITS file
FILE_VER	'1.0.0 '	Version of the format for this filetype
MISSION	'GECAM'	Name of mission
TELESCOP	'GECAM-[A/B] '	Name of satellite
INSTRUME	'GRD '	Instrument used for observation of gamma photon
OBSERVER	'XIONG '	GECAM P.I.
ORIGIN	'GSDC '	Name of organization making file
DATE_OBS	'YYYY-MM-DDThh:mm: ss.sss'	Time of start of observation
DATE_END	'YYYY-MM-DDThh:mm: ss.sss'	Time of end of observation
DATE_REF	'2019-01-01T00:00:00.000'	Reference date for GECAM
TSTART		[GECAM MET] Observation start time
TSTOP		[GECAM MET] Observation stop time
TIMESYS	'TT '	Time system used in time keywords
TIMEUNIT	's '	Time since MJDREF, used both in TSTART and STOP
MJDREFI	58484	MJD of GECAM reference epoch, integer part
MJDREFF	0.00080074074	MJD of GECAM reference epoch, fractional Part
TRIGTIME	'D '	Trigger time relative to MJDREF, double precision
TRIGTYPE	[fa,fb,ga,gb,gj,tj] '	Trigger type
TRIG_ORI	'GECAM_[a/b/j] '	GECAM_a(b, j) or other satellites
TRIG_VER	'TRIGGER_SOFTVER v1.0'	Software and version
TRIG_ID	'tnyymmdd_hhmmss_pp'	Trigger name in standard format
FILENAME	'gag_evt_tnyymmdd_hhmmss_pp_ v00.fits'	Name of this file
DATATYPE	'EVT '	Name of the primary datatype making up this file
COMMENTS: Initial location		
LOC_ORI	'GECAM_[a/b/j] '	GECAM_a(b, j) or other satellites
RADECSYS	'FK5 '	Stellar reference frame
EQUINOX	'2000.0 '	Equinox for RA and Dec
RA_OBJ	'D '	RA of trigger

DEC_OBJ	'D '	Dec of trigger
ERR_RAD	'D '	Location Error Radius
INFILE01	'gecam_a_xxx.fits'	Level 0D input data file
INFILE02	'cal_a_xxx.fits'	Calibration data file
CHECKSUM		HDU checksum
DATASUM		data unit checksum
END		

4.2.3 Extension Header 1 : EBOUNDS

FITS Keyword	Value	Purpose
XTENSION	'BINTABLE'	binary table extension
BITPIX	8	array data type
NAXIS	2	number of array dimensions
NAXIS1	10	length of dimension 1
NAXIS2	498	length of dimension 2
PCOUNT	0	number of group parameters
GCOUNT	1	number of groups
TFIELDS	3	number of table fields
TTYPE1	'CHANNEL '	
TFORM1	'I '	
TTYPE2	'E_MIN '	
TFORM2	'E '	
TTYPE3	'E_MAX '	
TFORM3	'E '	
TLMIN1	'0 '	Lower limit of energy channel
TLMAX1	'497 '	Upper limit of energy channel
TUNIT1	'none '	Physical unit of field
TLMIN2	'5 '	Lowest energy
TLMAX2	'6000 '	Highest energy
TUNIT2	'keV '	Physical unit of field
TLMIN3	'5 '	Lowest energy
TLMAX3	'6000 '	Highest energy
TUNIT3	'keV '	Physical unit of field
DATE	'YYYY-MM-DDThh:mm:ss'	File creation date
MISSION	'GECAM'	Name of mission
TELESCOP	'GECAM-[A/B] '	Name of satellite
INSTRUME	'GRD '	Instrument used for observation of gamma photon
OBSERVER	'XIONG '	GECAM P.I.
ORIGIN	'GSDC '	Name of organization making file
DATE_OBS	'YYYY-MM-DDThh:mm: ss.sss'	Time of start of observation
DATE_END	'YYYY-MM-DDThh:mm: ss.sss'	Time of end of observation
DATE_REF	'2019-01-01T00:00:00.000'	Reference date for GECAM

TSTART		[GECAM MET] Observation start time
TSTOP		[GECAM MET] Observation stop time
TIMESYS	'TT '	Time system used in time keywords
TIMEUNIT	's '	Time since MJDREF, used both in TSTART and STOP
MJDREFI	58484	MJD of GECAM reference epoch, integer part
MJDREFF	0.00080074074	MJD of GECAM reference epoch, fractional Part
TRIGTIME	'D '	Trigger time relative to MJDREF, double precision
TRIGTYPE	'[fa,fb,ga,gb,gj,tj] '	Trigger type
TRIG_ORI	'GECAM_[a/b/j] '	GECAM_a(b, j) or other satellites
TRIG_VER	'TRIGGER_SOFTVER v1.0'	Software and version
TRIG_ID	'tnyymmdd_hhmmss_pp'	Trigger name in standard format
COMMENTS: Initial location		
LOC_ORI	'GECAM_[a/b/j] '	GECAM_a(b, j) or other satellites
RADECSYS	'FK5 '	Stellar reference frame
EQUINOX	'2000.0 '	Equinox for RA and Dec
RA_OBJ	'D '	RA of trigger
DEC_OBJ	'D '	Dec of trigger
ERR_RAD	'D '	Location Error Radius
EXTNAME	'EBOUNDS '	Name of this binary table extension
EXTVER	'1 '	Version of this extension format
CHANTYPE	'PI '	Transformation from PHA to PI has been applied
DETCHANS	498	Total number of channels in each rate
HDUCLASS	'OGIP '	
HDUVERS	'1.0.0 '	Version of format in use
HDUCLAS1	'EBOUNDS '	From calibration file
CH2E_VER	'CH2E 1.0'	ADC channel to dep_E conversion scheme used
CAL_VER	'E2PI 1.0 '	Dep_E to PI channel conversion version used
CHECKSUM		HDU checksum
DATASUM		data unit checksum
END		

数组存储形式：

['CHANNEL', 'E_MIN', 'E_MAX']

I E E

498 行*3 列

4.2.4 Extension Header 2 : GTI

FITS Keyword	Value	Purpose
XTENSION	'BINTABLE'	binary table extension

BITPIX	8	array data type
NAXIS	2	number of array dimensions
NAXIS1	16	length of dimension 1
NAXIS2	1	length of dimension 2
PCOUNT	0	number of group parameters
GCOUNT	1	number of groups
TFIELDS	2	number of table fields
TTYPE1	'START '	
TFORM1	'D '	
TTYPE2	'STOP '	
TFORM2	'D '	
DATE	'YYYY-MM-DDThh:mm:ss'	File creation date
MISSION	'GECAM'	Name of mission
TELESCOP	'GECAM-[A/B] '	Name of satellite
INSTRUME	'GRD '	Instrument used for observation of gamma photon
OBSERVER	'XIONG '	GECAM P.I.
ORIGIN	'GSDC '	Name of organization making file
DATE_OBS	'YYYY-MM-DDThh:mm: ss.sss'	Time of start of observation
DATE_END	'YYYY-MM-DDThh:mm: ss.sss'	Time of end of observation
DATE_REF	'2019-01-01T00:00:00.000'	Reference date for GECAM
TSTART		[GECAM MET] Observation start time
TSTOP		[GECAM MET] Observation stop time
TIMESYS	'TT '	Time system used in time keywords
TIMEUNIT	's '	Time since MJDREF, used both in TSTART and STOP
MJDREFI	58484	MJD of GECAM reference epoch, integer part
MJDREFF	0.00080074074	MJD of GECAM reference epoch, fractional part
TRIGTIME	'D '	Trigger time relative to MJDREF, double precision
TRIGTYPE	'[fa,fb,ga,gb,gj,tj] '	Trigger type
TRIG_ORI	'GECAM_[a/b/j] '	GECAM_a(b, j) or other satellites
TRIG_VER	'TRIGGER_SOFTVER v1.0'	Software and version
TRIG_ID	'tnyymmdd_hhmmss_pp'	Trigger name in standard format
COMMENTS: Initial location		
LOC_ORI	'GECAM_[a/b/j] '	GECAM_a(b, j) or other satellites
RADECSYS	'FK5 '	Stellar reference frame
EQUINOX	'2000.0 '	Equinox for RA and Dec
RA_OBJ	'D '	RA of trigger
DEC_OBJ	'D '	Dec of trigger
ERR_RAD	'D '	Location Error Radius
EXTNAME	'GTI '	Name of the extension
EXTVER	'1 '	Version of this extension format
HDUCLASS	'OGIP'	OGIP standard
HDUVERS	'1.0.0 '	Version of format in use

HDUCLAS1	'GTI '	Extension contains Events
CHECKSUM		HDU checksum
DATASUM		data unit checksum
END		

4.2.5 Extension Header 3 : EVENTS01

FITS Keyword	Value	Purpose
XTENSION	'BINTABLE'	binary table extension
BITPIX	8	array data type
NAXIS	2	number of array dimensions
NAXIS1	15	length of dimension 1
NAXIS2		length of dimension 2
PCOUNT	0	number of group parameters
GCOUNT	1	number of groups
TFIELDS	7	number of table fields
TTYPE1	'TIME '	
TFORM1	'D '	
TUNIT1	's '	
TTYPE2	'PI '	
TFORM2	'I '	
TTYPE3	'GAIN_TYPE'	0: high, 1: low
TFORM3	'X '	
TTYPE4	'DEAD_TIME '	
TFORM4	'B '	
TUNIT4	'μs '	
TSCAL4	0.8	
TTYPE5	'EVT_TYPE '	
TFORM5	'B '	
TTYPE6	'FLAG'	
TFORM6	'B'	
TTYPE7	'EVT_PAIR'	
TFORM7	'2X'	
DATE	'YYYY-MM-DDThh:mm:ss'	File creation date
MISSION	'GECAM'	Name of mission
TELESCOP	'GECAM-[A/B] '	Name of satellite
INSTRUME	'GRD '	Instrument used for observation of gamma photon
OBSERVER	'XIONG '	GECAM P.I.
ORIGIN	'GSDC '	Name of organization making file
DATE_OBS	'YYYY-MM-DDThh:mm: ss.sss'	Time of start of observation
DATE_END	'YYYY-MM-DDThh:mm: ss.sss'	Time of end of observation
DATE_REF	'2019-01-01T00:00:00.000'	Reference date for GECAM

TSTART		[GECAM MET] Observation start time
TSTOP		[GECAM MET] Observation stop time
TIMESYS	'TT '	Time system used in time keywords
TIMEUNIT	's '	Time since MJDREF, used both in TSTART and STOP
MJDREFI	58484	MJD of GECAM reference epoch, integer part
MJDREFF	0.00080074074	MJD of GECAM reference epoch, fractional part
TRIGTIME	'D '	Trigger time relative to MJDREF, double precision
TRIGTYPE	'[fa,fb,ga,gb,gj,tj] '	Trigger type
TRIG_ORI	'GECAM_[a/b/j] '	GECAM_a(b, j) or other satellites
TRIG_VER	'TRIGGER_SOFTVER v1.0'	Software and version
TRIG_ID	'tnyymmdd_hhmmss_pp'	Trigger name in standard format
COMMENTS: Initial location		
LOC_ORI	'GECAM_[a/b/j] '	GECAM_a(b, j) or other satellites
RADECSYS	'FK5 '	Stellar reference frame
EQUINOX	'2000.0 '	Equinox for RA and Dec
RA_OBJ	'D '	RA of trigger
DEC_OBJ	'D '	Dec of trigger
ERR_RAD	'D '	Location Error Radius
EXTNAME	'EVENTS01'	Name of this binary table extension
EXTVER	'1 '	Version of this extension format
DETNAM	'GRD_01 '	Individual detector name of GRD
DAQMODE	'X '	DAQ mode
IBLINE	'X '	
WORKMODE	'FULL/HALF '	Working mode of the sensor
EVT_DEAD	'E '	[s] Deadtime per event
EVTDEDHI	'E '	[s] Deadtime per overflow channel event
.		
DETCHANS	498	Total number of channels in each rate
HDUCLASS	‘OGIP’	OGIP standard
HDUVERS	'1.0.0 '	Version of format in use
HDUCLAS1	'EVENTS '	Extension contains Events
CHECKSUM		HDU checksum updated 2019-04-04T13:42:44
DATASUM		data unit checksum updated 2019-04-04T13:42:44
END		

数组存储形式：

['TIME',	'PI,	'GAIN_TYPE',	'DEAD_TIME',	'EVT_TYPE',	'FLAG',	'EVT_PAIR']
（ D	I	X	B	B	B	2X ）

粒子个数（行）*7 列

4.3 GRD 的暴发数据：

产品描述：

内容与连续事例数据内容一致，数据时间大致范围与具体暴发事件有关。包括 GECAM_A 和 GECAM_B 双星 GRD 事例数据文件，每个文件包含单颗卫星 GRD25 个探头数据；事例数据按照探测时间和能道数据记录（暂定 498 道）。

暴发文件命名：g[a/b]g_evt_bnyymmdd_hhmmss[X]_v00.fits

4.3.1 HDU LIST

No.	Name	Ver	Type	Cards	Dimensions	Format
0	PRIMARY	1	PrimaryHDU	41	()	
1	EBOUNDS	1	BinTableHDU	62	498R x 3C	[I, E, E]
2	GTI	1	BinTableHDU	47	MR x 2C	[D, D]
3	EVENTS01	1	BinTableHDU	69	NR x 7C	[D, I, X, B, B, B, 2X]
4	EVENTS02	1	BinTableHDU	69	NR x 7C	[D, I, X, B, B, B, 2X]
5	EVENTS03	1	BinTableHDU	69	NR x 7C	[D, I, X, B, B, B, 2X]
6	EVENTS04	1	BinTableHDU	69	NR x 7C	[D, I, X, B, B, B, 2X]
7	EVENTS05	1	BinTableHDU	69	NR x 7C	[D, I, X, B, B, B, 2X]
8	EVENTS06	1	BinTableHDU	69	NR x 7C	[D, I, X, B, B, B, 2X]
9	EVENTS07	1	BinTableHDU	69	NR x 7C	[D, I, X, B, B, B, 2X]
10	EVENTS08	1	BinTableHDU	69	NR x 7C	[D, I, X, B, B, B, 2X]
11	EVENTS09	1	BinTableHDU	69	NR x 7C	[D, I, X, B, B, B, 2X]
12	EVENTS10	1	BinTableHDU	69	NR x 7C	[D, I, X, B, B, B, 2X]
13	EVENTS11	1	BinTableHDU	69	NR x 7C	[D, I, X, B, B, B, 2X]
14	EVENTS12	1	BinTableHDU	69	NR x 7C	[D, I, X, B, B, B, 2X]
15	EVENTS13	1	BinTableHDU	69	NR x 7C	[D, I, X, B, B, B, 2X]
16	EVENTS14	1	BinTableHDU	69	NR x 7C	[D, I, X, B, B, B, 2X]
17	EVENTS15	1	BinTableHDU	69	NR x 7C	[D, I, X, B, B, B, 2X]
18	EVENTS16	1	BinTableHDU	69	NR x 7C	[D, I, X, B, B, B, 2X]
19	EVENTS17	1	BinTableHDU	69	NR x 7C	[D, I, X, B, B, B, 2X]
20	EVENTS18	1	BinTableHDU	69	NR x 7C	[D, I, X, B, B, B, 2X]
21	EVENTS19	1	BinTableHDU	69	NR x 7C	[D, I, X, B, B, B, 2X]
22	EVENTS20	1	BinTableHDU	69	NR x 7C	[D, I, X, B, B, B, 2X]
23	EVENTS21	1	BinTableHDU	69	NR x 7C	[D, I, X, B, B, B, 2X]
24	EVENTS22	1	BinTableHDU	69	NR x 7C	[D, I, X, B, B, B, 2X]
25	EVENTS23	1	BinTableHDU	69	NR x 7C	[D, I, X, B, B, B, 2X]
26	EVENTS24	1	BinTableHDU	69	NR x 7C	[D, I, X, B, B, B, 2X]
27	EVENTS25	1	BinTableHDU	69	NR x 7C	[D, I, X, B, B, B, 2X]

4.3.2 Primary Header Keywords

FITS Keyword	Value	Purpose
SIMPLE	T	conforms to FITS standard
BITPIX	8	array data type
NAXIS	0	number of array dimensions
EXTEND	T	
CREATOR	'DailyData v1.0'	Software and version
DATE	'YYYY-MM-DDThh:mm:ss'	File creation date
FILETYPE	'GECAM PHOTON LIST'	Name for this type of FITS file
FILE_VER	'1.0.0 '	Version of the format for this filetype
MISSION	'GECAM'	Name of mission
TELESCOP	'GECAM-[A/B] '	Name of satellite
INSTRUME	'GRD '	Instrument used for observation of gamma photon
OBSERVER	'XIONG '	GECAM P.I.
ORIGIN	'GSDC '	Name of organization making file
DATE_OBS	'YYYY-MM-DDThh:mm: ss.sss'	Time of start of observation
DATE_END	'YYYY-MM-DDThh:mm: ss.sss'	Time of end of observation
DATE_REF	'2019-01-01T00:00:00.000'	Reference date for GECAM
TSTART		[GECAM MET] Observation start time
TSTOP		[GECAM MET] Observation stop time
TIMESYS	'TT '	Time system used in time keywords
TIMEUNIT	's '	Time since MJDREF, used both in TSTART and STOP
MJDREFI	58484	MJD of GECAM reference epoch, integer part
MJDREFF	0.00080074074	MJD of GECAM reference epoch, fractional Part
BURST_ID	'bnyymmdd_hhmmss[X]'	
BST_TIME	= 'D '	Burst time relative to MJDREF
CLASS	= ' '	Classfication of burst
CLASPROB	= 'D '	
BST_NAME	= ' '	
FILENAME	= 'gag_evt_bnyymmdd_hhmmss[X]_ v00.fits'	Name of this file
DATATYPE	'EVT '	Name of the primary datatype making up this file
COMMENTS	Initial location	
LOC_ORI	'GECAM_[a/b/j] '	GECAM_a(b, j) or other satellites
RADECSYS	'FK5 '	Stellar reference frame
EQUINOX	'2000.0 '	Equinox for RA and Dec
RA_OBJ	'D '	RA of trigger
DEC_OBJ	'D '	Dec of trigger
ERR_RAD	'D '	Location Error Radius
INFILE01	'gecam_a_xxx.fits'	Level 0D input data file
CHECKSUM		HDU checksum updated 2019-04-04T13:42:44

DATASUM data unit checksum updated 2019-04-04T13:42:44
END

4.3.3 Extension Header 1 : EBOUNDS

FITS Keyword	Value	Purpose
XTENSION	'BINTABLE'	binary table extension
BITPIX	8	array data type
NAXIS	2	number of array dimensions
NAXIS1	10	length of dimension 1
NAXIS2	498	length of dimension 2
PCOUNT	0	number of group parameters
GCOUNT	1	number of groups
TFIELDS	3	number of table fields
TTYPE1	'CHANNEL '	
TFORM1	'I '	
TTYPE2	'E_MIN '	
TFORM2	'E '	
TTYPE3	'E_MAX '	
TFORM3	'E '	
TLMIN1	'0 '	Lower limit of energy channel
TLMAX1	'497 '	Upper limit of energy channel
TUNIT1	'none '	Physical unit of field
TLMIN2	'5 '	Lowest energy
TLMAX2	'6000 '	Highest energy
TUNIT2	'keV '	Physical unit of field
TLMIN3	'5 '	Lowest energy
TLMAX3	'6000 '	Highest energy
TUNIT3	'keV '	Physical unit of field
DATE	'YYYY-MM-DDThh:mm:ss'	File creation date
MISSION	'GECAM'	Name of mission
TELESCOP	'GECAM-[A/B] '	Name of satellite
INSTRUME	'GRD '	Instrument used for observation of gamma photon
OBSERVER	'XIONG '	GECAM P.I.
ORIGIN	'GSDC '	Name of organization making file
DATE_OBS	'YYYY-MM-DDThh:mm: ss.sss'	Time of start of observation
DATE_END	'YYYY-MM-DDThh:mm: ss.sss'	Time of end of observation
DATE_REF	'2019-01-01T00:00:00.000'	Reference date for GECAM
TSTART		[GECAM MET] Observation start time
TSTOP		[GECAM MET] Observation stop time
TIMESYS	'TT '	Time system used in time keywords
TIMEUNIT	's '	Time since MJDREF, used both in TSTART and STOP

MJDREFI	58484	MJD of GECAM reference epoch, integer part
MJDREFF	0.00080074074	MJD of GECAM reference epoch, fractional Part
BURST_ID	'bnyymmdd_hhmmss[X]'	Burst name in standard format
BST_TIME	'D '	Burst time relative to MJDREF
CLASS = ' '		Classfication of burst
CLASPROB	'D '	
BST_NAME	' '	
LOC_ORI	'GECAM_[a/b/j] '	GECAM_a(b, j) or other satellites
RADECSYS	'FK5 '	Stellar reference frame
EQUINOX	'2000.0 '	Equinox for RA and Dec
RA_OBJ	'D '	RA of trigger
DEC_OBJ	'D '	Dec of trigger
ERR_RAD	'D '	Location Error Radius
EXTNAME	'EBOUNDS '	Name of this binary table extension
EXTVER	'1 '	Version of this extension format
CHANTYPE	'PI '	Transformation from PHA to PI has been applied
DETCHANS	498	Total number of channels in each rate
HDUCLASS	'OGIP '	
HDUVERS	'1.0.0 '	Version of format in use
HDUCLAS1	'EBOUNDS '	From calibration file
CH2E_VER	'CH2E 1.0'	ADC channel to dep_E conversion scheme used
CAL_VER	'E2PI 1.0 '	Dep_E to PI channel conversion version used
CHECKSUM		HDU checksum
DATASUM		data unit checksum
END		

数组存储形式：

['CHANNEL', 'E_MIN', 'E_MAX']

I E E

498 行*3 列

4.3.4 Extension Header 2 : GTI

FITS Keyword	Value	Purpose
XTENSION	'BINTABLE'	binary table extension
BITPIX	8	array data type
NAXIS	2	number of array dimensions
NAXIS1	16	length of dimension 1
NAXIS2	1	length of dimension 2
PCOUNT	0	number of group parameters
GCOUNT	1	number of groups

TFIELDS	2	number of table fields
TTYPE1	'START '	
TFORM1	'D '	
TTYPE2	'STOP '	
TFORM2	'D '	
DATE	'YYYY-MM-DDThh:mm:ss'	File creation date
MISSION	'GECAM'	Name of mission
TELESCOP	'GECAM-[A/B] '	Name of satellite
INSTRUME	'GRD '	Instrument used for observation of gamma photon
OBSERVER	'XIONG '	GECAM P.I.
ORIGIN	'GSDC '	Name of organization making file
DATE_OBS	'YYYY-MM-DDThh:mm: ss.sss'	Time of start of observation
DATE_END	'YYYY-MM-DDThh:mm: ss.sss'	Time of end of observation
DATE_REF	'2019-01-01T00:00:00.000'	Reference date for GECAM
TSTART		[GECAM MET] Observation start time
TSTOP		[GECAM MET] Observation stop time
TIMESYS	'TT '	Time system used in time keywords
TIMEUNIT	's '	Time since MJDREF, used both in TSTART and STOP
MJDREFI	58484	MJD of GECAM reference epoch, integer part
MJDREFF	0.00080074074	MJD of GECAM reference epoch, fractional part
BURST_ID	'bnyymmdd_hhmmss[X]'	Burst name in standard format
BST_TIME	'D '	Burst time relative to MJDREF
CLASS = '	'	Classfication of burst
CLASPROB	'D '	
BST_NAME	' '	
LOC_ORI	'GECAM_[a/b/j] '	GECAM_a(b, j) or other satellites
RADECSYS	'FK5 '	Stellar reference frame
EQUINOX	'2000.0 '	Equinox for RA and Dec
RA_OBJ	'D '	RA of trigger
DEC_OBJ	'D '	Dec of trigger
ERR_RAD	'D '	Location Error Radius
EXTNAME	'GTI '	Name of the extension
EXTVER	'1 '	Version of this extension format
HDUCLASS = ‘OGIP’		OGIP standard
HDUVERS = '1.0.0 '		Version of format in use
HDUCLAS1= 'GTI '		Extension contains Events
CHECKSUM		HDU checksum
DATASUM		data unit checksum
END		

数组存储形式：

['START', 'STOP']

D D
n 行*2 列

4.3.5 Extension Header 3 : EVENTS01

FITS Keyword	Value	Purpose
XTENSION	'BINTABLE'	binary table extension
BITPIX	8	array data type
NAXIS	2	number of array dimensions
NAXIS1	15	length of dimension 1
NAXIS2		length of dimension 2
PCOUNT	0	number of group parameters
GCOUNT	1	number of groups
TFIELDS	7	number of table fields
TTYPE1	'TIME '	
TFORM1	'D '	
TUNIT1	's '	
TTYPE2	'PI '	
TFORM2	'I '	
TTYPE3	'GAIN_TYPE'	0: high, 1: low
TFORM3	'X '	
TTYPE4	'DEAD_TIME '	
TFORM4	'B '	
TUNIT4	'μs '	
TSCAL4	0.8	
TTYPE5	'EVT_TYPE '	
TFORM5	'B '	
TTYPE6	'FLAG'	
TFORM6	'B'	
TTYPE7	'EVT_PAIR'	
TFORM7	'2X'	
DATE	'YYYY-MM-DDThh:mm:ss'	File creation date
MISSION	'GECAM'	Name of mission
TELESCOP	'GECAM-[A/B] '	Name of satellite
INSTRUME	'GRD '	Instrument used for observation of gamma photon
OBSERVER	'XIONG '	GECAM P.I.
ORIGIN	'GSDC '	Name of organization making file
DATE_OBS	'YYYY-MM-DDThh:mm: ss.sss'	Time of start of observation
DATE_END	'YYYY-MM-DDThh:mm: ss.sss'	Time of end of observation
DATE_REF	'2019-01-01T00:00:00.000'	Reference date for GECAM
TSTART		[GECAM MET] Observation start time
TSTOP		[GECAM MET] Observation stop time

TIMESYS	'TT '	Time system used in time keywords
TIMEUNIT	's '	Time since MJDREF, used both in TSTART and STOP
MJDREFI	58484	MJD of GECAM reference epoch, integer part
MJDREFF	0.00080074074	MJD of GECAM reference epoch, fractional part
BURST_ID	'bnyymmdd_hhmmss[X]'	Burst name in standard format
BST_TIME	'D '	Burst time relative to MJDREF
CLASS	' '	Classfication of burst
CLASPROB	'D '	
BST_NAME	' '	
LOC_ORI	'GECAM_[a/b/j] '	GECAM_a(b, j) or other satellites
RADECSYS	'FK5 '	Stellar reference frame
EQUINOX	'2000.0 '	Equinox for RA and Dec
RA_OBJ	'D '	RA of trigger
DEC_OBJ	'D '	Dec of trigger
ERR_RAD	'D '	Location Error Radius
EXTNAME	'EVENTS01'	Name of this binary table extension
EXTVER	'1 '	Version of this extension format
DETNAM	'GRD_01 '	Individual detector name of GRD
DAQMODE	'X '	DAQ mode
IBLINE	'X '	
WORKMODE	'FULL/HALF '	Working mode of the sensor.
EVT_DEAD	'E '	[s] Deadtime per event
EVTDEDHI	'E '	[s] Deadtime per overflow channel event
DETCHANS	498	Total number of channels in each rate
HDUCLASS	= ‘OGIP’	OGIP standard
HDUVERS	'1.0.0 '	Version of format in use
HDUCLAS1=	'EVENTS '	Extension contains Events
CHECKSUM		HDU checksum
DATASUM		data unit checksum
END		

数组存储形式：

['TIME', 'PI, 'GAIN_TYPE', 'DEAD_TIME', 'EVT_TYPE', 'FLAG', 'EVT_PAIR']

（ D I X B B B 2X ）

粒子个数（行）*7 列

4.4 GRD 的 BTIME 数据：

产品描述：

BTIME 文件按照每小时一个文件，每个文件包含上一小时最后 100 秒时间数据；每个文件包含单颗卫星 GRD25 个探头数据；BTIME 按照每

50ms 给出一组能谱数据（高、低增益各 7 道），以及高低增益的死时间。

文件命名：g[a/b]g_btime_yymmdd_hh_v00.fits

4.4.1 HDU LIST

No.	Name	Ver	Type	Cards	Dimensions	Format
0	PRIMARY	1	PrimaryHDU	26	()	
1	EBOUNDS	1	BinTableHDU	29	14R x 2C	[3E, 3E]
2	GTI	1	BinTableHDU	16	MR x 2C	[D, D]
3	SPECTRUM01	1	BinTableHDU	34	NR x 5C	[D, D, 14I, 2E, 2X]
4	SPECTRUM02	1	BinTableHDU	34	NR x 5C	[D, D, 14I, 2E, 2X]
5	SPECTRUM03	1	BinTableHDU	34	NR x 5C	[D, D, 14I, 2E, 2X]
6	SPECTRUM04	1	BinTableHDU	34	NR x 5C	[D, D, 14I, 2E, 2X]
7	SPECTRUM05	1	BinTableHDU	34	NR x 5C	[D, D, 14I, 2E, 2X]
8	SPECTRUM06	1	BinTableHDU	34	NR x 5C	[D, D, 14I, 2E, 2X]
9	SPECTRUM07	1	BinTableHDU	34	NR x 5C	[D, D, 14I, 2E, 2X]
10	SPECTRUM08	1	BinTableHDU	34	NR x 5C	[D, D, 14I, 2E, 2X]
11	SPECTRUM09	1	BinTableHDU	34	NR x 5C	[D, D, 14I, 2E, 2X]
12	SPECTRUM10	1	BinTableHDU	34	NR x 5C	[D, D, 14I, 2E, 2X]
13	SPECTRUM11	1	BinTableHDU	34	NR x 5C	[D, D, 14I, 2E, 2X]
14	SPECTRUM12	1	BinTableHDU	34	NR x 5C	[D, D, 14I, 2E, 2X]
15	SPECTRUM13	1	BinTableHDU	34	NR x 5C	[D, D, 14I, 2E, 2X]
16	SPECTRUM14	1	BinTableHDU	34	NR x 5C	[D, D, 14I, 2E, 2X]
17	SPECTRUM15	1	BinTableHDU	34	NR x 5C	[D, D, 14I, 2E, 2X]
18	SPECTRUM16	1	BinTableHDU	34	NR x 5C	[D, D, 14I, 2E, 2X]
19	SPECTRUM17	1	BinTableHDU	34	NR x 5C	[D, D, 14I, 2E, 2X]
20	SPECTRUM18	1	BinTableHDU	34	NR x 5C	[D, D, 14I, 2E, 2X]
21	SPECTRUM19	1	BinTableHDU	34	NR x 5C	[D, D, 14I, 2E, 2X]
22	SPECTRUM20	1	BinTableHDU	34	NR x 5C	[D, D, 14I, 2E, 2X]
23	SPECTRUM21	1	BinTableHDU	34	NR x 5C	[D, D, 14I, 2E, 2X]
24	SPECTRUM22	1	BinTableHDU	34	NR x 5C	[D, D, 14I, 2E, 2X]
25	SPECTRUM23	1	BinTableHDU	34	NR x 5C	[D, D, 14I, 2E, 2X]
26	SPECTRUM24	1	BinTableHDU	34	NR x 5C	[D, D, 14I, 2E, 2X]
27	SPECTRUM25	1	BinTableHDU	34	NR x 5C	[D, D, 14I, 2E, 2B]

4.4.2 Primary Header Keywords

FITS Keyword	Value	Purpose
SIMPLE	T	conforms to FITS standard
BITPIX	8	array data type

NAXIS	0	number of array dimensions
EXTEND	T	
CREATOR	'DailyData v1.0'	Software and version
DATE	'YYYY-MM-DDThh:mm:ss'	File creation date
FILETYPE	'GECAM BTIME SPECTRUM'	Name for this type of FITS file
FILE-VER	'1.0.0 '	Version of the format for this filetype
MISSION	'GECAM'	Name of mission
TELESCOP	'GECAM-[A/B] '	Name of satellite
INSTRUME	'GRD '	Instrument used for observation of gamma photon
OBSERVER	'XIONG '	GECAM P.I.
ORIGIN	'GSDC '	Name of organization making file
DATE_OBS	'YYYY-MM-DDThh:mm: ss.sss'	Time of start of observation
DATE_END	'YYYY-MM-DDThh:mm: ss.sss'	Time of end of observation
DATE_REF	'2019-01-01T00:00:00.000'	Reference date for GECAM
TSTART		[GECAM MET] Observation start time
TSTOP		[GECAM MET] Observation stop time
TIMESYS	'TT '	Time system used in time keywords
TIMEUNIT	's '	Time since MJDREF, used both in TSTART and STOP
MJDREFI	58484	MJD of GECAM reference epoch, integer part
MJDREFF	0.00080074074	MJD of GECAM reference epoch, fractional Part
FILENAME	'g[a/b]g_btime_yymmdd_hh_v00.fits'	Name of this file
DATATYPE	'BTIME '	Name of the primary datatype making up this file
INFILE01	'gecam_a_xxx.fits'	Level 0D input data file
INFILE02	'cal_a_xxx.fits'	Calibration data file
CHECKSUM		HDU checksum
DATASUM		data unit checksum
END		

4.4.3 Extension Header 1 : EBOUNDS

FITS Keyword	Value	Purpose
COMMENTS		Initial ebounds
XTENSION	'BINTABLE'	binary table extension
BITPIX	8	array data type
NAXIS	2	number of array dimensions
NAXIS1	24	length of dimension 1
NAXIS2	14	length of dimension 2
PCOUNT	0	number of group parameters
GCOUNT	1	number of groups

TFIELDS 2 number of table fields
TTYPE1 'EBOUNDS0 '
TFORM1 '3E '
TTYPE2 'EBOUNDS1 '
TFORM2 '3E '
TLMIN1 '0 ' Lower limit of energy channel
TLMAX1 '6 ' Upper limit of energy channel
TUNIT1 'none ' Physical unit of field
TLMIN2 '5 ' Lowest energy
TLMAX2 '6000 ' Highest energy
TUNIT2 'keV ' Physical unit of field
TLMIN3 '5 ' Lowest energy
TLMAX3 '6000 ' Highest energy
TUNIT3 'keV ' Physical unit of field
DATE 'YYYY-MM-DDThh:mm:ss' File creation date
MISSION 'GECAM' Name of mission
TELESCOP 'GECAM-[A/B] ' Name of satellite
INSTRUME 'GRD ' Instrument used for observation of gamma photon
OBSERVER 'XIONG ' GECAM P.I.
ORIGIN 'GSDC ' Name of organization making file
DATE_OBS 'YYYY-MM-DDThh:mm: ss.sss' Time of start of observation
DATE_END 'YYYY-MM-DDThh:mm: ss.sss' Time of end of observation
DATE_REF '2019-01-01T00:00:00.000' Reference date for GECAM
TSTART [GECAM MET] Observation start time
TSTOP [GECAM MET] Observation stop time
TIMESYS 'TT ' Time system used in time keywords
TIMEUNIT 's ' Time since MJDREF, used both in TSTART and STOP
MJDREFI 58484 MJD of GECAM reference epoch, integer part
MJDREFF 0.00080074074 MJD of GECAM reference epoch, fractional Part
EXTNAME 'EBOUNDS ' Name of this binary table extension
EXTVER '1 ' Version of this extension format
CHANTYPE 'CHANNEL ' ADC channel
DETCHANS '7 ' Total number of channels in each rate
HDUCLASS 'OGIP '
HDUVERS '1.0.0 ' Version of format in use
HDUCLAS1 'EBOUNDS ' From calibration file
CH2E_VER 'CH2E 1.0' Channel to energy conversion scheme used
CHECKSUM HDU checksum
DATASUM data unit checksum
END

数组存储形式：
['CHANNEL', 'E_MIN', 'E_MAX']

I E E
25*14*3 列

4.4.4 Extension Header 2 : GTI

FITS Keyword	Value	Purpose
XTENSION	'BINTABLE'	binary table extension
BITPIX	8	array data type
NAXIS	2	number of array dimensions
NAXIS1	16	length of dimension 1
NAXIS2	1	length of dimension 2
PCOUNT	0	number of group parameters
GCOUNT	1	number of groups
TFIELDS	2	number of table fields
TTYPE1	'START '	
TFORM1	'D '	
TTYPE2	'STOP '	
TFORM2	'D '	
DATE	'YYYY-MM-DDThh:mm:ss'	File creation date
MISSION	'GECAM'	Name of mission
TELESCOP	'GECAM-[A/B] '	Name of satellite
INSTRUME	'GRD '	Instrument used for observation of gamma photon
OBSERVER	'XIONG '	GECAM P.I.
ORIGIN	'GSDC '	Name of organization making file
DATE_OBS	'YYYY-MM-DDThh:mm: ss.sss'	Time of start of observation
DATE_END	'YYYY-MM-DDThh:mm: ss.sss'	Time of end of observation
DATE_REF	'2019-01-01T00:00:00.000'	Reference date for GECAM
TSTART		[GECAM MET] Observation start time
TSTOP		[GECAM MET] Observation stop time
TIMESYS	'TT '	Time system used in time keywords
TIMEUNIT	's '	Time since MJDREF, used both in TSTART and STOP
MJDREFI	58484	MJD of GECAM reference epoch, integer part
MJDREFF	0.00080074074	MJD of GECAM reference epoch, fractional part
EXTNAME	'GTI '	Name of the extension
EXTVER	'1 '	Version of this extension format
HDUCLASS	‘OGIP’	OGIP standard
HDUVERS	'1.0.0 '	Version of format in use
HDUCLAS1	'GTI '	Extension contains Events
CHECKSUM		HDU checksum

DATASUM	data unit checksum
END	

数组存储形式：

['START', 'STOP']

D D

n 行*2 列

4.4.5 Extension Header3 : SPECTRUM01

FITS Keyword	Value	Purpose
XTENSION	'BINTABLE'	binary table extension
BITPIX	8	array data type
NAXIS	2	number of array dimensions
NAXIS1	54	length of dimension 1
NAXIS2		length of dimension 2
PCOUNT	0	number of group parameters
GCOUNT	1	number of groups
TFIELDS	5	number of table fields
TTYPE1	'STARTTIME'	
TFORM1	'D '	
TTYPE2	'ENDTIME '	
TFORM2	'D '	
TTYPE3	'BTIME '	
TFORM3	'14I '	
TTYPE4	'EXPOSURE'	
TFORM4	'2E '	
TUNIT4	's'	
TTYPE5	'QUALITY '	
TFORM5	'2X '	
DATE	'YYYY-MM-DDThh:mm:ss'	File creation date
MISSION	'GECAM'	Name of mission
TELESCOP	'GECAM-[A/B] '	Name of satellite
INSTRUME	'GRD '	Instrument used for observation of gamma photon
OBSERVER	'XIONG '	GECAM P.I.
ORIGIN	'GSDC '	Name of organization making file
DATE_OBS	'YYYY-MM-DDThh:mm: ss.sss'	Time of start of observation
DATE_END	'YYYY-MM-DDThh:mm: ss.sss'	Time of end of observation
DATE_REF	'2019-01-01T00:00:00.000'	Reference date for GECAM
TSTART		[GECAM MET] Observation start time
TSTOP		[GECAM MET] Observation stop time
TIMESYS	'TT '	Time system used in time keywords

TIMEUNIT	's '	Time since MJDREF, used both in TSTART and STOP
MJDREFI	58484	MJD of GECAM reference epoch, integer part
MJDREFF	0.00080074074	MJD of GECAM reference epoch, fractional
EXTNAME	'SPECTRUM01'	Name of this binary table extension
EXTVER	'1 '	Version of this extension format
FILTER	'none '	No instrument filter used
AREASCAL	'I '	No special scaling of effective area by channel
BACKFILE	'none '	Spectra are not linked to a background file
BACKSCAL	'I '	No scaling of background
CORRFILE	'none '	Spectra are not linked to a correction file
CORRSCAL	'I '	Correction scaling file
RESPFILE	'none '	Spectra are not linked to an RMF file
ANCRFILE	'none '	Spectra are not linked to an ARF file
SYS_ERR	'I '	No systematic errors
POISSERR	'T '	Assume Poisson Errors
DETNAM	'GRD_01 '	Individual detector name of GRD
DAQMODE	'X '	DAQ mode
IBLINE	'X '	
WORKMODE	'FULL/HALF '	Working mode of the sensor.
HDUCLASS	‘OGIP’	
HDUCLAS1	'SPECTRUM'	Extension contains Spectrum
CHECKSUM		HDU checksum
DATASUM		data unit checksum
END		

数组存储形式：

['STARTTIME', 'ENDTIME', 'COUNTS', 'EXPOSURE', 'QUALITY']

(D D 14J 2E 2X)

每 50ms（行）*5 列

4.5 GRD 的 BSPEC 数据：

产品描述：

BSPEC 文件按照每小时一个文件，每个文件包含上一小时最后 100 秒时间数据；每个文件包含单颗卫星 GRD25 个探头数据；BSPEC 按照每 1s 给出能谱数据（高、低增益各 129 道），以及高低增益的死时间。

文件命名：g[a/b]g_bspec_yyyymmdd_hh_v00.fits

4.5.1 HDU LIST

No.	Name	Ver	Type	Cards	Dimensions	Format
0	PRIMARY	1	PrimaryHDU	26	()	
1	EBOUNDS	1	BinTableHDU	29	256R x 2C	[3E, 3E]
2	GTI	1	BinTableHDU	16	1R x 2C	[D, D]
3	SPECTRUM01	1	BinTableHDU	36	NR x 6C	[D, D, 256I, 2E, 2I, 2X]
4	SPECTRUM02	1	BinTableHDU	36	NR x 6C	[D, D, 256I, 2E, 2I, 2X]
5	SPECTRUM03	1	BinTableHDU	36	NR x 6C	[D, D, 256I, 2E, 2I, 2X]
6	SPECTRUM04	1	BinTableHDU	36	NR x 6C	[D, D, 256I, 2E, 2I, 2X]
7	SPECTRUM05	1	BinTableHDU	36	NR x 6C	[D, D, 256I, 2E, 2I, 2X]
8	SPECTRUM06	1	BinTableHDU	36	NR x 6C	[D, D, 256I, 2E, 2I, 2X]
9	SPECTRUM07	1	BinTableHDU	36	NR x 6C	[D, D, 256I, 2E, 2I, 2X]
10	SPECTRUM08	1	BinTableHDU	36	NR x 6C	[D, D, 256I, 2E, 2I, 2X]
11	SPECTRUM09	1	BinTableHDU	36	NR x 6C	[D, D, 256I, 2E, 2I, 2X]
12	SPECTRUM10	1	BinTableHDU	36	NR x 6C	[D, D, 256I, 2E, 2I, 2X]
13	SPECTRUM11	1	BinTableHDU	36	NR x 6C	[D, D, 256I, 2E, 2I, 2X]
14	SPECTRUM12	1	BinTableHDU	36	NR x 6C	[D, D, 256I, 2E, 2I, 2X]
15	SPECTRUM13	1	BinTableHDU	36	NR x 6C	[D, D, 256I, 2E, 2I, 2X]
16	SPECTRUM14	1	BinTableHDU	36	NR x 6C	[D, D, 256I, 2E, 2I, 2X]
17	SPECTRUM15	1	BinTableHDU	36	NR x 6C	[D, D, 256I, 2E, 2I, 2X]
18	SPECTRUM16	1	BinTableHDU	36	NR x 6C	[D, D, 256I, 2E, 2I, 2X]
19	SPECTRUM17	1	BinTableHDU	36	NR x 6C	[D, D, 256I, 2E, 2I, 2X]
20	SPECTRUM18	1	BinTableHDU	36	NR x 6C	[D, D, 256I, 2E, 2I, 2X]
21	SPECTRUM19	1	BinTableHDU	36	NR x 6C	[D, D, 256I, 2E, 2I, 2X]
22	SPECTRUM20	1	BinTableHDU	36	NR x 6C	[D, D, 256I, 2E, 2I, 2X]
23	SPECTRUM21	1	BinTableHDU	36	NR x 6C	[D, D, 256I, 2E, 2I, 2X]
24	SPECTRUM22	1	BinTableHDU	36	NR x 6C	[D, D, 256I, 2E, 2I, 2X]
25	SPECTRUM23	1	BinTableHDU	36	NR x 6C	[D, D, 256I, 2E, 2I, 2X]
26	SPECTRUM24	1	BinTableHDU	36	NR x 6C	[D, D, 256I, 2E, 2I, 2X]
27	SPECTRUM25	1	BinTableHDU	21	NR x 6C	[D, D, 256I, 2E, 2I, 2X]

4.5.2 Primary Header Keywords

FITS Keyword	Value	Purpose
SIMPLE	T	conforms to FITS standard
BITPIX	8	array data type
NAXIS	0	number of array dimensions
EXTEND	T	
CREATOR	'DailyData v1.0'	Software and version
DATE	'YYYY-MM-DDThh:mm:ss'	File creation date
FILETYPE	'GECAM BSPEC SPECTRUM'	Name for this type of FITS file

FILE-VER	'1.0.0 '	Version of the format for this filetype
MISSION	'GECAM'	Name of mission
TELESCOP	'GECAM-[A/B] '	Name of satellite
INSTRUME	'GRD '	Instrument used for observation of gamma photon
OBSERVER	'XIONG '	GECAM P.I.
ORIGIN	'GSDC '	Name of organization making file
DATE_OBS	'YYYY-MM-DDThh:mm: ss.sss'	Time of start of observation
DATE_END	'YYYY-MM-DDThh:mm: ss.sss'	Time of end of observation
DATE_REF	'2019-01-01T00:00:00.000'	Reference date for GECAM
TSTART		[GECAM MET] Observation start time
TSTOP		[GECAM MET] Observation stop time
TIMESYS	'TT '	Time system used in time keywords
TIMEUNIT	's '	Time since MJDREF, used both in TSTART and STOP
MJDREFI	58484	MJD of GECAM reference epoch, integer part
MJDREFF	0.00080074074	MJD of GECAM reference epoch, fractional Part
FILENAME	'g[a/b]g_bspec_yymmdd_hh_v00.fits'	Name of this file
DATATYPE	'BSPEC '	Name of the primary datatype making up this file
INFILE01	'gecam_a_xxx.fits'	Level 0D input data file
INFILE02	'cal_a_xxx.fits'	Calibration data file
CHECKSUM		HDU checksum
DATASUM		data unit checksum
END		

4.5.3 Extension Header 1 : EBOUNDS

FITS Keyword	Value	Purpose
COMMENTS		Initial ebounds
XTENSION	'BINTABLE'	binary table extension
BITPIX	8	array data type
NAXIS	2	number of array dimensions
NAXIS1	3072	length of dimension 1
NAXIS2	25	length of dimension 2
PCOUNT	0	number of group parameters
GCOUNT	1	number of groups
TFIELDS	1	number of table fields
TTYPE1	'EBOUNDS '	
TFORM1	'768E '	
TLMIN1	'0 '	Lower limit of energy channel
TLMAX1	'127 '	Upper limit of energy channel

TUNIT1	'none '	Physical unit of field
TLMIN2	'5 '	Lowest energy
TLMAX2	'6000 '	Highest energy
TUNIT2	'keV '	Physical unit of field
TLMIN3	'5 '	Lowest energy
TLMAX3	'6000 '	Highest energy
TUNIT3	'keV '	Physical unit of field
DATE	'YYYY-MM-DDThh:mm:ss'	File creation date
MISSION	'GECAM'	Name of mission
TELESCOP	'GECAM-[A/B] '	Name of satellite
INSTRUME	'GRD '	Instrument used for observation of gamma photon
OBSERVER	'XIONG '	GECAM P.I.
ORIGIN	'GSDC '	Name of organization making file
DATE_OBS	'YYYY-MM-DDThh:mm: ss.sss'	Time of start of observation
DATE_END	'YYYY-MM-DDThh:mm: ss.sss'	Time of end of observation
DATE_REF	'2019-01-01T00:00:00.000'	Reference date for GECAM
TSTART		[GECAM MET] Observation start time
TSTOP		[GECAM MET] Observation stop time
TIMESYS	'TT '	Time system used in time keywords
TIMEUNIT	's '	Time since MJDREF, used both in TSTART and STOP
MJDREFI	58484	MJD of GECAM reference epoch, integer part
MJDREFF	0.00080074074	MJD of GECAM reference epoch, fractional part
EXTNAME	'EBOUNDS '	Name of this binary table extension
EXTVER	'1 '	Version of this extension format
CHANTYPE	'CHANNEL '	ADC channel
DETCHANS	'128 '	Total number of channels in each rate
HDUCLASS	'OGIP '	
HDUVERS	'1.0.0 '	Version of format in use
HDUCLAS1	'EBOUNDS '	From calibration file
CH2E_VER	'CH2E 1.0'	Channel to energy conversion scheme used
CHECKSUM		HDU checksum
DATASUM		data unit checksum
END		

数组存储形式：

['CHANNEL', 'E_MIN', 'E_MAX']

I E E

25*256*3 列

4.5.1 Extension Header 2: GTI

FITS Keyword	Value	Purpose

XTENSION	'BINTABLE'	binary table extension
BITPIX	8	array data type
NAXIS	2	number of array dimensions
NAXIS1	16	length of dimension 1
NAXIS2	1	length of dimension 2
PCOUNT	0	number of group parameters
GCOUNT	1	number of groups
TFIELDS	2	number of table fields
TTYPE1	'START '	
TFORM1	'D '	
TTYPE2	'STOP '	
TFORM2	'D '	
DATE	'YYYY-MM-DDThh:mm:ss'	File creation date
MISSION	'GECAM'	Name of mission
TELESCOP	'GECAM-[A/B] '	Name of satellite
INSTRUME	'GRD '	Instrument used for observation of gamma photon
OBSERVER	'XIONG '	GECAM P.I.
ORIGIN	'GSDC '	Name of organization making file
DATE_OBS	'YYYY-MM-DDThh:mm: ss.sss'	Time of start of observation
DATE_END	'YYYY-MM-DDThh:mm: ss.sss'	Time of end of observation
DATE_REF	'2019-01-01T00:00:00.000'	Reference date for GECAM
TSTART		[GECAM MET] Observation start time
TSTOP		[GECAM MET] Observation stop time
TIMESYS	'TT '	Time system used in time keywords
TIMEUNIT	's '	Time since MJDREF, used both in TSTART and STOP
MJDREFI	58484	MJD of GECAM reference epoch, integer part
MJDREFF	0.0	MJD of GECAM reference epoch, fractional part
EXTNAME	'GTI '	Name of the extension
EXTVER	'1 '	Version of this extension format
HDUCLASS	‘OGIP’	OGIP standard
HDUVERS	'1.0.0 '	Version of format in use
HDUCLAS1	'GTI '	Extension contains Events
CHECKSUM		HDU checksum
DATASUM		data unit checksum
END		

数组存储形式：

['START', 'STOP']

D D

n 行*2 列

4.5.2 Extension Header 3 : SPECTRUM01

FITS Keyword	Value	Purpose
XTENSION	'BINTABLE'	binary table extension
BITPIX	8	array data type
NAXIS	2	number of array dimensions
NAXIS1	542	length of dimension 1
NAXIS2		length of dimension 2
PCOUNT	0	number of group parameters
GCOUNT	1	number of groups
TFIELDS	6	number of table fields
TTYPE1	'STARTTIME'	
TFORM1	'D '	
TTYPE2	'ENDTIME '	
TFORM2	'D '	
TTYPE3	'COUNTS '	
TFORM3	'256I '	
TTYPE4	'EXPOSURE'	
TFORM4	'2E '	
TUNIT4	's'	
TTYPE5	'WCOUNTS '	
TFORM5	'2I '	
TTYPE6	'QUALITY '	
TFORM6	'2X '	
DATE	'YYYY-MM-DDThh:mm:ss'	File creation date
MISSION	'GECAM'	Name of mission
TELESCOP	'GECAM-[A/B] '	Name of satellite
INSTRUME	'GRD '	Instrument used for observation of gamma photon
OBSERVER	'XIONG '	GECAM P.I.
ORIGIN	'GSDC '	Name of organization making file
DATE_OBS	'YYYY-MM-DDThh:mm: ss.sss'	Time of start of observation
DATE_END	'YYYY-MM-DDThh:mm: ss.sss'	Time of end of observation
DATE_REF	'2019-01-01T00:00:00.000'	Reference date for GECAM
TSTART		[GECAM MET] Observation start time
TSTOP		[GECAM MET] Observation stop time
TIMESYS	'TT '	Time system used in time keywords
TIMEUNIT	's '	Time since MJDREF, used both in TSTART and STOP
MJDREFI	58484	MJD of GECAM reference epoch, integer part
MJDREFF	0.00080074074	MJD of GECAM reference epoch, fractional part
EXTNAME	'SPECTRUM01'	Name of this binary table extension

EXTVER '1 ' Version of this extension format
FILTER 'none ' No instrument filter used
AREASCAL 'I ' No special scaling of effective area by channel
BACKFILE 'none ' Spectra are not linked to a background file
BACKSCAL 'I ' No scaling of background
CORRFILE 'none ' Spectra are not linked to a correction file
CORRSCAL 'I ' Correction scaling file
RESPFILE 'none ' Spectra are not linked to an RMF file
ANCRFILE 'none ' Spectra are not linked to an ARF file
SYS_ERR 'I ' No systematic errors
POISSERR 'T ' Assume Poisson Errors
DETNAM 'GRD_01 ' Individual detector name of GRD
DAQMODE 'X ' DAQ mode
IBLINE 'X '
WORKMODE 'FULL/HALF ' Working mode of the sensor.
HDUCLASS ‘OGIP’
HDUCLAS1 'SPECTRUM' Extension contains Spectrum
CHECKSUM HDU checksum updated 2019-04-04T15:26:38
DATASUM data unit checksum updated 2019-04-04T15:26:38
END

数组存储形式：

['STARTTIME', 'ENDTIME', 'COUNTS', 'EXPOSURE', ‘WCOUNTS’, 'QUALITY']
(D D 256I 2E 2I 2X)
每秒（行）*6 列

4.6 CPD 连续事例数据：

产品描述：

事例文件按照每小时一个文件，每个文件包含上一小时最后 100 秒时间数据；每个文件包含单颗卫星 CPD 8 个探头数据；事例数据按照探测时间和能道数据记录（全部 PI 456 道，原始 4096 道；300keV-5MeV）。

文件命名：g[a/b]c_evt_yymmdd_hh_v00.fits

4.6.1 HDU LIST

No. Name Ver Type Cards Dimensions Format
0 PRIMARY 1 PrimaryHDU 28 ()

1	EBOUNDS	1	BinTableHDU	49	456R x 3C [I, E, E]
2	GTI	1	BinTableHDU	34	1R x 2C [D, D]
3	EVENTS01	1	BinTableHDU	49	NR x 5C [D, I, B, B, B]
4	EVENTS02	1	BinTableHDU	49	NR x 5C [D, I, B, B, B]
5	EVENTS03	1	BinTableHDU	49	NR x 5C [D, I, B, B, B]
6	EVENTS04	1	BinTableHDU	49	NR x 5C [D, I, B, B, B]
7	EVENTS05	1	BinTableHDU	49	NR x 5C [D, I, B, B, B]
8	EVENTS06	1	BinTableHDU	49	NR x 5C [D, I, B, B, B]
9	EVENTS07	1	BinTableHDU	49	NR x 5C [D, I, B, B, B]
10	EVENTS08	1	BinTableHDU	49	NR x 5C [D, I, B, B, B]

4.6.2 Primary Header Keywords

FITS Keyword	Value	Purpose
SIMPLE	T	conforms to FITS standard
BITPIX	8	array data type
NAXIS	0	number of array dimensions
EXTEND	T	
CREATOR	'DailyData v1.0'	Software and version
DATE	'YYYY-MM-DDThh:mm:ss'	File creation date
FILETYPE	'GECAM EVENTS LIST'	Name for this type of FITS file
FILE_VER	'1.0.0 '	Version of the format for this filetype
MISSION	'GECAM'	Name of mission
TELESCOP	'GECAM-[A/B] '	Name of satellite
INSTRUME	'CPD '	Instrument used for observation of particle
OBSERVER	'XIONG '	GECAM P.I.
ORIGIN	'GSDC '	Name of organization making file
DATE_OBS	'YYYY-MM-DDThh:mm: ss.sss'	Time of start of observation
DATE_END	'YYYY-MM-DDThh:mm: ss.sss'	Time of end of observation
DATE_REF	'2019-01-01T00:00:00.000'	Reference date for GECAM
TSTART		[GECAM MET] Observation start time
TSTOP		[GECAM MET] Observation stop time
TIMESYS	'TT '	Time system used in time keywords
TIMEUNIT	's '	Time since MJDREF, used both in TSTART and STOP
MJDREFI	58484	MJD of GECAM reference epoch, integer part
MJDREFF	0.00080074074	MJD of GECAM reference epoch, fractional part
FILENAME	'g[a/b]c_evt_yymmdd_hh_v00.fits'	Name of this file
DATATYPE	'EVT '	Name of the primary datatype making up this file
INFILE01	'gecam_a_xxx.fits'	Level 0D input data file
INFILE02	'cal_a_xxx.fits'	Calibration data file
CHECKSUM		Checksum for entireHDU
DATASUM		Checksum for data table
END		

4.6.3 Extension Header 1 : EBOUNDS

FITS Keyword	Value	Purpose
XTENSION	'BINTABLE'	Binary table extension
BITPIX	8	Array data type
NAXIS	2	Number of array dimensions
NAXIS1	10	Length of dimension 1
NAXIS2	456	Length of dimension 2
PCOUNT	0	Number of group parameters
GCOUNT	1	Number of groups
TFIELDS	3	Number of table fields
TTYPE1	'CHANNEL '	
TFORM1	'I '	
TTYPE2	'E_MIN '	
TFORM2	'E '	
TTYPE3	'E_MAX '	
TFORM3	'E '	
TLMIN1	'0 '	Lower limit of energy channel
TLMAX1	'455 '	Upper limit of energy channel
TUNIT1	'none '	Physical unit of field
TLMIN2	'300 '	Lowest energy
TLMAX2	'5000 '	Highest energy
TUNIT2	'keV '	Physical unit of field
TLMIN3	'300 '	Lowest energy
TLMAX3	'5000 '	Highest energy
TUNIT3	'keV '	Physical unit of field
DATE	'YYYY-MM-DDThh:mm:ss'	File creation date
MISSION	'GECAM'	Name of mission
TELESCOP	'GECAM-[A/B] '	Name of satellite
INSTRUME	'CPD '	Instrument used for observation of particle
OBSERVER	'XIONG '	GECAM P.I.
ORIGIN	'GSDC '	Name of organization making file
DATE_OBS	'YYYY-MM-DDThh:mm: ss.sss'	Time of start of observation
DATE_END	'YYYY-MM-DDThh:mm: ss.sss'	Time of end of observation
DATE_REF	'2019-01-01T00:00:00.000'	Reference date for GECAM
TSTART		[GECAM MET] Observation start time
TSTOP		[GECAM MET] Observation stop time
TIMESYS	'TT '	Time system used in time keywords
TIMEUNIT	's '	Time since MJDREF, used both in TSTART and STOP
MJDREFI	58484	MJD of GECAM reference epoch, integer part
MJDREFF	0.00080074074	MJD of GECAM reference epoch, fractional part

EXTNAME	'EBOUNDS '	Name of this binary table extension
EXTVER	'1 '	Version of this extension format
CHANTYPE	'PI '	Transformation from PHA to PI has been applied
DETCHANS	456	Total number of channels in each rate
HDUCLASS	'OGIP '	OGIP standard
HDUVERS	'1.0.0 '	Version of format in use
HDUCLAS1	'EBOUNDS '	From calibration file
CH2E_VER	'CH2E 1.0'	ADC channel to dep_E conversion scheme used
CAL_VER	'E2PI 1.0 '	Dep_E to PI channel conversion version used
CHECKSUM		HDU checksum
DATASUM		data unit checksum
END		

数组存储形式：

['CHANNEL', 'E_MIN', 'E_MAX']

I E E

456 行*3 列

4.6.4 Extension Header 2 : GTI

FITS Keyword	Value	Purpose
XTENSION	'BINTABLE'	binary table extension
BITPIX	8	array data type
NAXIS	2	number of array dimensions
NAXIS1	16	length of dimension 1
NAXIS2	1	length of dimension 2
PCOUNT	0	number of group parameters
GCOUNT	1	number of groups
TFIELDS	2	number of table fields
TTYPE1	'START '	
TFORM1	'D '	
TTYPE2	'STOP '	
TFORM2	'D '	
DATE	'YYYY-MM-DDThh:mm:ss'	File creation date
MISSION	'GECAM'	Name of mission
TELESCOP	'GECAM-[A/B] '	Name of satellite
INSTRUME	'CPD '	Instrument used for observation of particle
OBSERVER	'XIONG '	GECAM P.I.
ORIGIN	'GSDC '	Name of organization making file
DATE_OBS	'YYYY-MM-DDThh:mm: ss.sss'	Time of start of observation
DATE_END	'YYYY-MM-DDThh:mm: ss.sss'	Time of end of observation
DATE_REF	'2019-01-01T00:00:00.000'	Reference date for GECAM

TSTART		[GECAM MET] Observation start time
TSTOP		[GECAM MET] Observation stop time
TIMESYS	'TT '	Time system used in time keywords
TIMEUNIT	's '	Time since MJDREF, used both in TSTART and STOP
MJDREFI	58484	MJD of GECAM reference epoch, integer part
MJDREFF	0.00080074074	MJD of GECAM reference epoch, fractional part
EXTNAME	'GTI '	Name of the extension
EXTVER	'1 '	Version of this extension format
HDUCLASS	‘OGIP’	OGIP standard
HDUVERS	'1.0.0 '	Version of format in use
HDUCLAS1	'GTI '	Extension contains Events
CHECKSUM		HDU checksum
DATASUM		data unit checksum
END		

数组存储形式**:**

['START', 'STOP']
D D
n 行*2 列

4.6.5 Extension Header 3: EVENTS01

FITS Keyword	**Value**	**Purpose**
XTENSION	'BINTABLE'	binary table extension
BITPIX	8	array data type
NAXIS	2	number of array dimensions
NAXIS1	13	length of dimension 1
NAXIS2		length of dimension 2
PCOUNT	0	number of group parameters
GCOUNT	1	number of groups
TFIELDS	5	number of table fields
TTYPE1	'TIME '	
TFORM1	'D '	
TUNIT1	's '	
TTYPE2	'PI '	
TFORM2	'I '	
TTYPE3 =	'DEAD_TIME'	
TFORM3 =	'B '	
TUNIT3	'μs '	
TSCAL3	0.8	

TTYPE4	'EVT_TYPE '	
TFORM4	'B '	
TTYPE5 =	' FLAG '	
TFORM5 =	'B '	
DATE	'YYYY-MM-DDThh:mm:ss'	File creation date
MISSION	'GECAM'	Name of mission
TELESCOP	'GECAM-[A/B] '	Name of satellite
INSTRUME	'CPD '	Instrument used for observation of particle
OBSERVER	'XIONG '	GECAM P.I.
ORIGIN	'GSDC '	Name of organization making file
DATE_OBS	'YYYY-MM-DDThh:mm: ss.sss'	Time of start of observation
DATE_END	'YYYY-MM-DDThh:mm: ss.sss'	Time of end of observation
DATE_REF	'2019-01-01T00:00:00.000'	Reference date for GECAM
TSTART		[GECAM MET] Observation start time
TSTOP		[GECAM MET] Observation stop time
TIMESYS	'TT '	Time system used in time keywords
TIMEUNIT	's '	Time since MJDREF, used both in TSTART and STOP
MJDREFI	58484	MJD of GECAM reference epoch, integer part
MJDREFF	0.00080074074	MJD of GECAM reference epoch, fractional part
EXTNAME	'EVENTS01'	Name of this binary table extension
EXTVER	'1 '	Version of this extension format
DETNAM	'CPD_01 '	Individual detector name of CPD
DAQMODE	'X '	DAQ mode
IBLINE	'X '	
WORKMODE	'FULL/HALF '	Working mode of the sensor.
EVT_DEAD	'E '	[s] Deadtime per event
EVTDEDHI	'E '	[s] Deadtime per overflow channel event
DETCHANS	456	Total number of channels in each rate
HDUCLASS	‘OGIP’	OGIP standard
HDUVERS	'1.0.0 '	Version of format in use
HDUCLAS1	'EVENTS '	Extension contains Events
CH2E_VER	'CH2E 1.0'	ADC chan to dep_E conversion scheme used
CAL_VER	'E2PI 1.0 '	Dep_E to PI channel conversion version used
CHECKSUM		HDU checksum
DATASUM		data unit checksum
END		

数组存储形式：

['TIME', 'PI ', 'DEAD_TIME', 'EVT_TYPE'，'FLAG']

（ D I B B B ）

粒子个数（行）*5 列

4.7 CPD 的 BTIME 数据：

产品描述：

BSPEC 文件按照每小时一个文件，每个文件包含上一小时最后 100 秒时间数据；每个文件包含单颗卫星 CPD 8 个探头数据；CPD 的 BTIME 数据按照每 50m 秒给出能谱数据（3 道）和死时间。

文件命名：g[a/b]c_btime_yyyymmdd_hh_v00.fits

4.7.1 HDU LIST

No.	Name	Ver	Type	Cards	Dimensions	Format
0	PRIMARY	1	PrimaryHDU	30	()	
1	EBOUNDS	1	BinTableHDU	31	8R x 3C	[9E]
2	GTI	1	BinTableHDU	18	1R x 2C	[D, D]
3	SPECTRUM01	1	BinTableHDU	24	NR x 5C	[D, D, 3I, E, X]
4	SPECTRUM02	1	BinTableHDU	24	NR x 5C	[D, D, 3I, E, X]
5	SPECTRUM03	1	BinTableHDU	24	NR x 5C	[D, D, 3I, E, X]
6	SPECTRUM04	1	BinTableHDU	24	NR x 5C	[D, D, 3I, E, X]
7	SPECTRUM05	1	BinTableHDU	24	NR x 5C	[D, D, 3I, E, X]
8	SPECTRUM06	1	BinTableHDU	24	NR x 5C	[D, D, 3I, E, X]
9	SPECTRUM07	1	BinTableHDU	24	NR x 5C	[D, D, 3I, E, X]
10	SPECTRUM08	1	BinTableHDU	24	NR x 5C	[D, D, 3I, E, X]

4.7.2 Primary Header Keywords

FITS Keyword	**Value**	**Purpose**
SIMPLE	T	conforms to FITS standard
BITPIX	8	array data type
NAXIS	0	number of array dimensions
EXTEND	T	
CREATOR	'DailyData v1.0'	Software and version
DATE	'YYYY-MM-DDThh:mm:ss'	File creation date
FILETYPE	'GECAM BTIME SPECTRUM'	Name for this type of FITS file
FILE-VER	'1.0.0 '	Version of the format for this filetype
MISSION	'GECAM'	Name of mission
TELESCOP	'GECAM-[A/B] '	Name of satellite
INSTRUME	'CPD '	Instrument used for observation of particle
OBSERVER	'XIONG '	GECAM P.I.
ORIGIN	'GSDC '	Name of organization making file
DATE_OBS	'YYYY-MM-DDThh:mm: ss.sss'	Time of start of observation

DATE_END	'YYYY-MM-DDThh:mm: ss.sss'	Time of end of observation
DATE_REF	'2019-01-01T00:00:00.000'	Reference date for GECAM
TSTART		[GECAM MET] Observation start time
TSTOP		[GECAM MET] Observation stop time
TIMESYS	'TT '	Time system used in time keywords
TIMEUNIT	's '	Time since MJDREF, used both in TSTART and STOP
MJDREFI	58484	MJD of GECAM reference epoch, integer part
MJDREFF	0.00080074074	MJD of GECAM reference epoch, fractional Part
FILENAME	'g[a/b]c_btime_yymmdd_hh_v00.fits'	Name of this file
DATATYPE	BTIME '	Name of the primary datatype making up this file
INFILE01	'gecam_a_xxx.fits'	Level 0D input data file
INFILE02	'cal_a_xxx.fits'	Calibration data file
CHECKSUM		HDU checksum
DATASUM		data unit checksum
END		

4.7.3 Extension Header 1 : EBOUNDS

FITS Keyword	Value	Purpose
COMMENTS		Initial ebounds
XTENSION	'BINTABLE'	binary table extension
BITPIX	8	array data type
NAXIS	2	number of array dimensions
NAXIS1		length of dimension 1
NAXIS2	4	length of dimension 2
PCOUNT	0	number of group parameters
GCOUNT	1	number of groups
TFIELDS	1	number of table fields
TTYPE1	'EBOUNDS '	
TFORM1	'9E '	
TLMIN1	'0 '	Lower limit of energy channel
TLMAX1	'2 '	Upper limit of energy channel
TUNIT1	'none '	Physical unit of field
TLMIN2	'300 '	Lowest energy
TLMAX2	'5000 '	Highest energy
TUNIT2	'keV '	Physical unit of field
TLMIN3	'300 '	Lowest energy
TLMAX3	'5000 '	Highest energy
TUNIT3	'keV '	Physical unit of field
DATE	'YYYY-MM-DDThh:mm:ss'	File creation date

MISSION	'GECAM'	Name of mission
TELESCOP	'GECAM-[A/B] '	Name of satellite
INSTRUME	'CPD '	Instrument used for observation of particle
OBSERVER	'XIONG '	GECAM P.I.
ORIGIN	'GSDC '	Name of organization making file
DATE_OBS	'YYYY-MM-DDThh:mm: ss.sss'	Time of start of observation
DATE_END	'YYYY-MM-DDThh:mm: ss.sss'	Time of end of observation
DATE_REF	'2019-01-01T00:00:00.000'	Reference date for GECAM
TSTART		[GECAM MET] Observation start time
TSTOP		[GECAM MET] Observation stop time
TIMESYS	'TT '	Time system used in time keywords
TIMEUNIT	's '	Time since MJDREF, used both in TSTART and STOP
MJDREFI	58484	MJD of GECAM reference epoch, integer part
MJDREFF	0.00080074074	MJD of GECAM reference epoch, fractional Part
EXTNAME	'EBOUNDS '	Name of this binary table extension
EXTVER	'1 '	Version of this extension format
CHANTYPE	'CHANNEL '	ADC channel
DETCHANS	'3 '	Total number of channels in each rate
HDUCLASS	'OGIP '	
HDUVERS	'1.0.0 '	Version of format in use
HDUCLAS1	'EBOUNDS '	From calibration file
CH2E_VER	'CH2E 1.0'	Channel to energy conversion scheme used
CHECKSUM		HDU checksum
DATASUM		data unit checksum
END		

数组存储形式：

['CHANNEL', 'E_MIN', 'E_MAX']

I E E

8*3*3 列

4.7.4 Extension Header 2 : GTI

FITS Keyword	Value	Purpose
XTENSION	'BINTABLE'	binary table extension
BITPIX	8	array data type
NAXIS	2	number of array dimensions
NAXIS1	16	length of dimension 1
NAXIS2	1	length of dimension 2
PCOUNT	0	number of group parameters
GCOUNT	1	number of groups

TFIELDS	2	number of table fields
TTYPE1	'START '	
TFORM1	'D '	
TTYPE2	'STOP '	
TFORM2	'D '	
DATE	'YYYY-MM-DDThh:mm:ss'	File creation date
MISSION	'GECAM'	Name of mission
TELESCOP	'GECAM-[A/B] '	Name of satellite
INSTRUME	'CPD '	Instrument used for observation of particle
OBSERVER	'XIONG '	GECAM P.I.
ORIGIN	'GSDC '	Name of organization making file
DATE_OBS	'YYYY-MM-DDThh:mm: ss.sss'	Time of start of observation
DATE_END	'YYYY-MM-DDThh:mm: ss.sss'	Time of end of observation
DATE_REF	'2019-01-01T00:00:00.000'	Reference date for GECAM
TSTART		[GECAM MET] Observation start time
TSTOP		[GECAM MET] Observation stop time
TIMESYS	'TT '	Time system used in time keywords
TIMEUNIT	's '	Time since MJDREF, used both in TSTART and STOP
MJDREFI	58484	MJD of GECAM reference epoch, integer part
MJDREFF	0.00080074074	MJD of GECAM reference epoch, fractional part
EXTNAME	'GTI '	Name of the extension
EXTVER	'1 '	Version of this extension format
HDUCLASS	‘OGIP’	OGIP standard
HDUVERS	'1.0.0 '	Version of format in use
HDUCLAS1	'GTI '	Extension contains Events
CHECKSUM		HDU checksum
DATASUM		data unit checksum
END		

数组存储形式：

['START', 'STOP']
D D
n 行*2 列

4.7.5 Extension Header 3 : SPECTRUM01

FITS Keyword	Value	Purpose
XTENSION	'BINTABLE'	binary table extension
BITPIX	8	array data type
NAXIS	2	number of array dimensions

NAXIS1		length of dimension 1
NAXIS2		length of dimension 2
PCOUNT	0	number of group parameters
GCOUNT	1	number of groups
TFIELDS	5	number of table fields
TTYPE1	'STARTTIME'	
TFORM1	'D '	
TTYPE2	' ENDTIME '	
TFORM2	'D '	
TTYPE3	'COUNTS '	
TFORM3	'3I '	
TTYPE4	' EXPOSURE '	
TFORM4	'E '	
TUNIT4	's '	
TTYPE5	' QUALITY '	
TFORM5	'X '	
DATE	'YYYY-MM-DDThh:mm:ss'	File creation date
MISSION	'GECAM'	Name of mission
TELESCOP	'GECAM-[A/B] '	Name of satellite
INSTRUME	'CPD '	Instrument used for observation of particle
OBSERVER	'XIONG '	GECAM P.I.
ORIGIN	'GSDC '	Name of organization making file
DATE_OBS	'YYYY-MM-DDThh:mm: ss.sss'	Time of start of observation
DATE_END	'YYYY-MM-DDThh:mm: ss.sss'	Time of end of observation
DATE_REF	'2019-01-01T00:00:00.000'	Reference date for GECAM
TSTART		[GECAM MET] Observation start time
TSTOP		[GECAM MET] Observation stop time
TIMESYS	'TT '	Time system used in time keywords
TIMEUNIT	's '	Time since MJDREF, used both in TSTART and STOP
MJDREFI	58484	MJD of GECAM reference epoch, integer part
MJDREFF	0.00080074074	MJD of GECAM reference epoch, fractional part
EXTNAME	'SPECTRUM01'	Name of this binary table extension
EXTVER	'1 '	Version of this extension format
FILTER	'none '	No instrument filter used
AREASCAL	'I '	No special scaling of effective area by channel
BACKFILE	'none '	Spectra are not linked to a background file
BACKSCAL	'I '	No scaling of background
CORRFILE	'none '	Spectra are not linked to a correction file
CORRSCAL	'I '	Correction scaling file
RESPFILE	'none '	Spectra are not linked to an RMF file
ANCRFILE	'none '	Spectra are not linked to an ARF file
SYS_ERR	'I '	No systematic errors
POISSERR	'T '	Assume Poisson Errors

DETNAM	'CPD_01 '	Individual detector name of CPD
DAQMODE	'X '	DAQ mode
IBLINE	'X '	
WORKMODE	'FULL/HALF '	Working mode of the sensor.
HDUCLASS	‘OGIP’	
HDUCLAS1	'SPECTRUM'	Extension contains Spectrum
CHECKSUM		HDU checksum
DATASUM		data unit checksum
END		

数组存储形式：

['STARTTIME',	'ENDTIME' ,	'COUNTS',	'EXPOSURE',	'QUALITY']
(D	D	3I	E	X)

每 50ms（行）*5 列

4.8 GECAM 卫星轨道和姿态等数据：

产品描述：

文件按照每小时一个文件，每个文件包含上一小时最后 100 秒时间数据，包含卫星坐标变换所需全部信息，具体有 GECAM 卫星时间，位置，速度，卫星姿态数据。本文件每月合并一次为一个较大文件。

文件命名示意如下：g[a/b]_posatt_yymmdd_hh_v00.fits

4.8.1 HDU LIST

No.	Name	Ver	Type	Cards	Dimensions	Format
0	PRIMARY	1	PrimaryHDU	24	()	
1	Orbit_Attitude	1	BinTableHDU	68	NR x 22C	[D, E, E, E, E, E, E, E, B, E, E, E, E, E, E, E, E, E, E, B]

4.8.2 Primary Header Keywords

FITS Keyword	Value	Purpose
SIMPLE	T	conforms to FITS standard
BITPIX	8	array data type
NAXIS	0	number of array dimensions
EXTEND	T	
SOURFILE		Level 0D input data file
MISSION	'GECAM '	Name of mission

TELESCOP	'GECAM-[A/B]'	Name of satellite
DATATYPE	'ENG '	Type of the data
DATE_REF	'2019-01-01T00:00:00.000'	Refrence date for GECAM
DATE_OBS	'YYYY-MM-DDThh:mm:ss.fff'	Date of start of observation
DATE_END	'YYYY-MM-DDThh:mm:ss.fff'	Date of end of observation
TSTART	'E '	[GECAM MET] Observation start time
TSTOP	'E '	[GECAM MET] Observation stop time
TIMESYS	'TT '	Time system used in time keywords
TIMEUNIT	's '	Time since MJDREF, used in TSTART and STOP
MJDREFI	58484.0	MJD of GECAM reference epoch, integer part
MJDREFF	0.0	MJD of GECAM reference epoch, fractional part
CREATIME	'YYYY-MM-DDThh:mm:ss'	File creation date TT
ORIGIN	'NSSDC '	National Space Science Data Center
SOFTWARE	'GECAM_PREPROCESS_V1.0'	Software and version
CONTACT	'National Space Science Data Center, nssdc@nsc.ac.cn'	
CHECKSUM	' '	HDU checksum updated
DATASUM	' '	data unit checksum updated
COMMENT	COMMENT	
END		

4.8.3 Extension Header 1 : Orbit Attitude

FITS Keyword	Value	Purpose
XTENSION	'BINTABLE'	binary table extension
BITPIX	8	array data type
NAXIS	2	number of array dimensions
NAXIS1	80	length of dimension 1
NAXIS2		length of dimension 2
PCOUNT	0	number of group parameters
GCOUNT	1	number of groups
TFIELDS	22	number of table fields
TTYPE1	'TIME '	
TFORM1	'D '	
TUNIT1	's '	
TTYPE2	'Q1 '	
TFORM2	'E '	
TTYPE3	'Q2 '	
TFORM3	'E '	
TTYPE4	'Q3 '	
TFORM4	'E '	
TTYPE5	'Q4'	
TFORM5	'E '	
TTYPE6	'wx'	

TFORM6 'E '
TUNIT6 'rad/s '
TTYPE7 'wy'
TFORM7 'E '
TUNIT7 'rad/s '
TTYPE8 'wz '
TFORM8 'E '
TUNIT8 'rad/s '
TTYPE9 'Orb_Type '
TFORM9 'B '
TTYPE10 'X_J2000 '
TFORM10 'E '
TUNIT10 'm '
TTYPE11 'Y_J2000'
TFORM11 'E '
TUNIT11 'm '
TTYPE12 'Z_J2000'
TFORM12 'E '
TUNIT12 'km/s '
TTYPE13 'VX_J2000'
TFORM13 'E '
TUNIT13 'm/s '
TTYPE14 'VY_J2000 '
TFORM14 'E '
TUNIT14 'm/s '
TTYPE15 'VZ_J2000 '
TFORM15 'E '
TUNIT15 'm/s '
TTYPE16 'X_WGS84 '
TFORM16 'E '
TUNIT16 'm '
TTYPE17 ' Y_WGS84 '
TFORM17 'E '
TUNIT17 'm '
TTYPE18 ' Z_WGS84 '
TFORM18 'E '
TUNIT18 'm '
TTYPE19 'VX_WGS84 '
TFORM19 'E '
TUNIT19 'm/s '
TTYPE20 ' VY_WGS84 '
TFORM20 'E '
TUNIT20 'm/s '
TTYPE21 ' VZ_WGS84 '

TFORM21 'E '
TUNIT21 'm/s '
TTYPE22 ' TIME_Quality '
TFORM21 'B '
EXTNAME 'Orbit_Attitude' Name of the extension
DATE_OBS 'YYYY-MM-DDThh:mm:ss.fff' Date of start of observation
DATE_END 'YYYY-MM-DDThh:mm:ss.fff' Date of end of observation
TSTART 'E ' [GECAM MET] Observation start time
TSTOP 'E ' [GECAM MET] Observation stop time
CHECKSUM ' ' HDU checksum updated
DATASUM ' ' data unit checksum updated
END

数组存储形式：

['TIME' 'Q1' 'Q2' 'Q3' 'Q4' 'wx' 'wy' 'wz' 'Orb_Type' 'X_J2000' 'Y_ J2000' 'Z_ J2000' 'VX_ J2000' 'VY_ J2000' 'VZ_ J2000' 'X_WGS84' 'Y_WGS84' 'Z_WGS84' 'VX_WGS84' 'VY_WGS84' 'VZ_WGS84' 'TIME_Quality']

[D E E E E E E E B E E E E
E E E E E E E
E B]

4.9 日月地空间信息数据：

产品描述：

文件按照每小时一个文件，包含前一个文件 100 秒数据，包含太阳、月亮和地球在探测器坐标系的极角和方位角。

文件命名示意如下：g[a/b]_aux_yymmdd_hh_v00.fits

4.9.1 HDU LIST

No.	Name	Ver	Type	Cards	Dimensions	Format
0	PRIMARY	1	PrimaryHDU	24	()	
1	SME	1	BinTableHDU	41	NR x 9C	[D, 2D, 2D, 2D, 2D, D, D, 2D, 2D]

4.9.2 Primary Header Keywords

FITS Keyword	Value	Purpose
SIMPLE	T	conforms to FITS standard
BITPIX	8	array data type

NAXIS	0	number of array dimensions
EXTEND	T	
SOURFILE	' '	Level 0D input data file
MISSION	'GECAM '	Name of mission
TELESCOP	'GECAM-[A/B]'	Name of satellite
DATATYPE	'AUX '	Type of the data
DATE_REF	'2019-01-01T00:00:00.000'	Refrence date for GECAM
DATE_OBS	'YYYY-MM-DDThh:mm:ss.fff'	Date of start of observation
DATE_END	'YYYY-MM-DDThh:mm:ss.fff'	Date of end of observation
TSTART	'E '	[GECAM MET] Observation start time
TSTOP	'E '	[GECAM MET] Observation stop time
TIMESYS	'TT '	Time system used in time keywords
TIMEUNIT	's '	Time since MJDREF, used in TSTART and STOP
MJDREFI	58484.0	MJD of GECAM reference epoch, integer part
MJDREFF	0.0	MJD of GECAM reference epoch, fractional part
CREATIME	'YYYY-MM-DDThh:mm:ss'	File creation date TT
ORIGIN	'NSSDC '	National Space Science Data Center
SOFTWARE	'GECAM_SME_V1.0'	Software and version
CONTACT	'National Space Science Data Center, nssdc@nsc.ac.cn'	
CHECKSUM	' '	HDU checksum updated
DATASUM	' '	data unit checksum updated
COMMENT	COMMENT	
END		

4.9.3 Extension Header 1 : SME

FITS Keyword	Value	Purpose
XTENSION	'BINTABLE'	binary table extension
BITPIX	8	array data type
NAXIS	2	number of array dimensions
NAXIS1	120	length of dimension 1
NAXIS2		length of dimension 2
PCOUNT	0	number of group parameters
GCOUNT	1	number of groups
TFIELDS	9	number of table fields
TTYPE1	'TIME '	
TFORM1	'D '	
TUNIT1	's '	
TTYPE2	'SUN_ANGLE'	
TFORM2	'2D '	
TUNIT2	'deg '	
TTYPE3	'MOON_ANGLE'	
TFORM3	'2D '	

TUNIT3 'deg '
TTYPE4 'EARTH_ANGLE'
TFORM4 '2D '
TUNIT4 'deg '
TTYPE5 'LONLAT '
TFORM5 '2D '
TUNIT5 'deg '
TTYPE6 'ALT '
TFORM6 'D '
TUNIT6 'km '
TTYPE7 'LOCAL_SOLAR_TIME'
TFORM7 'D '
TTYPE8 'Z_J2000 '
TFORM8 '2D '
TUNIT8 'deg '
TTYPE9 'X_J2000 '
TFORM9 '2D '
TUNIT9 'deg '
EXTNAME 'SME' Name of the extension
DATE_OBS 'YYYY-MM-DDThh:mm:ss.fff' Date of start of observation
DATE_END 'YYYY-MM-DDThh:mm:ss.fff' Date of end of observation
TSTART 'E ' [GECAM MET] Observation start time
TSTOP 'E ' [GECAM MET] Observation stop time
CHECKSUM ' ' HDU checksum updated 2020-01-02T11:10:36
DATASUM ' ' data unit checksum updated 2020-01-02T11:10:36
END

数组存储形式：

［'TIME' 'SUN_ANGLE' 'MOON_ANGLE' 'EARTH_ANGLE' 'LONLAT' 'ALT' ' LOCAL_SOLAR_TIME ' 'Z_J2000' 'X_J2000']

[D 2D 2D 2D 2D D D 2D 2D]

4.10 GECAM 卫星的 GRD 和 CPD 同时粒子数据

产品描述：

文件按照每小时一个文件，每个文件包含上一小时最后 100 秒时间数据。数据内容包括同一时间包括 GRD 和 CPD 的 33 个探头中任意 2 个及以上有计数时各探头的具体计数情况。

文件命名：g[a/b]gc_simevt_yymmdd_hh_v00.fits

4.10.1 HDU LIST

No.	Name	Ver	Type	Cards	Dimensions	Format
0	PRIMARY	1	PrimaryHDU	26	()	
1	SIMEVT	1	BinTableHDU	34	NR x 3C	[D, B, 33B]

4.10.2 Primary Header Keywords

FITS Keyword	Value	Purpose
SIMPLE	T	conforms to FITS standard
BITPIX	8	array data type
NAXIS	0	number of array dimensions
EXTEND	T	
CREATOR	'DailyData v1.0'	Software and version
DATE	'YYYY-MM-DDThh:mm:ss'	File creation date
FILETYPE=	'GECAM SIMEVT'	Name for this type of FITS file
FILE-VER	'1.0.0 '	Version of the format for this filetype
MISSION	'GECAM'	Name of mission
TELESCOP	'GECAM-[A/B] '	Name of satellite
INSTRUME	'ALL '	All instruments of one satellite
OBSERVER	'XIONG '	GECAM P.I.
ORIGIN	'GSDC '	Name of organization making file
DATE_OBS	'YYYY-MM-DDThh:mm: ss.sss'	Time of start of observation
DATE_END	'YYYY-MM-DDThh:mm: ss.sss'	Time of end of observation
DATE_REF	'2019-01-01T00:00:00.000'	Reference date for GECAM
TSTART		[GECAM MET] Observation start time
TSTOP		[GECAM MET] Observation stop time
TIMESYS	'TT '	Time system used in time keywords
TIMEUNIT	's '	Time since MJDREF, used both in TSTART and STOP
MJDREFI	58484	MJD of GECAM reference epoch, integer part
MJDREFF	0.00080074074	MJD of GECAM reference epoch, fractional part
FILENAME	'g[a/b]gc_simevt_yymmdd_hh_v00.fits'	Name of this file
INFILE01	'gecam_a_xxx.fits'	Level 0D input data file
CHECKSUM		HDU checksum
DATASUM	'	data unit checksum
END		

4.10.3 Extension Header 1 : SIMEVT

FITS Keyword	Value	Purpose
XTENSION	'BINTABLE'	binary table extension
BITPIX	8	array data type
NAXIS	2	number of array dimensions
NAXIS1	72	length of dimension 1
NAXIS2		length of dimension 2
PCOUNT	0	number of group parameters
GCOUNT	1	number of groups
TFIELDS	3	number of table fields
TTYPE1	'TIME '	
TFORM1	'D '	
TUNIT1	's '	
TTYPE2	'NUM_SIM '	
TFORM2	'B '	
TTYPE3	'GRD_CPD '	
TFORM3	'33B '	
DATE	'YYYY-MM-DDThh:mm:ss'	File creation date
MISSION	'GECAM'	Name of mission
TELESCOP	'GECAM-[A/B] '	Name of satellite
INSTRUME	'ALL '	All instruments of one satellite
OBSERVER	'XIONG '	GECAM P.I.
ORIGIN	'GSDC '	Name of organization making file
DATE_OBS	'YYYY-MM-DDThh:mm: ss.sss'	Time of start of observation
DATE_END	'YYYY-MM-DDThh:mm: ss.sss'	Time of end of observation
DATE_REF	'2019-01-01T00:00:00.000'	Reference date for GECAM
TSTART		[GECAM MET] Observation start time
TSTOP		[GECAM MET] Observation stop time
TIMESYS	'TT '	Time system used in time keywords
TIMEUNIT	's '	Time since MJDREF, used both in TSTART and STOP
MJDREFI	58484	MJD of GECAM reference epoch, integer part
MJDREFF	0.00080074074	MJD of GECAM reference epoch, fractional part
EXTNAME	'SIMEVT '	Name of the extension
EXTVER	'1 '	Version of this extension format
CHECKSUM		HDU checksum
DATASUM		data unit checksum
END		

数组存储形式：

['TIME' ' NUM_SIM' 'GRD01' … 'GRD25' 'CPD01' … 'CPD08']

[D B B … B … B … B]