Title: BAT Global Bad Times and Quality Maps

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Version:	9
Document:	SWIFT-BAT-CALDB-BTI-V9

1. Summary

This document is meant as a summary of all the "bad times" for BAT science analysis.

In particular, it is meant to document problems with the instrument which are not readily available by scanning the telemetry. There are two tables: one which gives global bad times where the entire array may be unusable; and bad "regions" where only a part of the array (block, DM, etc) had problems.

2. Component Files

BAT Good/Bad Times

File Name	Valid Date	Release Date	Version	Description
swbbadtimes20041120v001.gti	2004-11-20	2006-10-14	1	BAT good/bad science time intervals **OBSOLETE**
swbbadtimes20041120v002.gti	2004-11-20	2007-03-22	2	BAT good/bad science time intervals **OBSOLETE**
swbbadtimes20041120v003.gti	2004-11-20	2008-02-14	3	BAT good/bad science time intervals **OBSOLETE**
swbbadtimes20041120v004.gti	2004-11-20	2008-10-26	4	BAT good/bad science time intervals **OBSOLETE**
swbbadtimes20041120v005.gti	2004-11-20	2009-01-30	5	BAT good/bad science time intervals **OBSOLETE**
swbbadtimes20041120v006.gti	2004-11-20	2010-06-21	6	BAT good/bad science time intervals **OBSOLETE**
swbbadtimes20041120v007.gti	2004-11-20	2013-01-17	7	BAT good/bad science time intervals **OBSOLETE**

| swbbadtimes20041120v008.gti | 2004-11-20 | 2017-10-16 | 8 | BAT good/bad science time intervals **OBSOLETE** |
| swbbadtimes20041120v009.gti | 2004-11-20 | 2023-06-07 | 9 | BAT good/bad science time intervals |

BAT Global Quality Maps

File Name	Valid Date	Release Date	Version	Description
swbbadpix20041120v001.fits.gz	2004-11-20	2007-10-14	1	BAT global quality map **OBSOLETE**
swbbadpix20041120v002.fits.gz	2004-11-20	2007-03-22	2	BAT global quality map **OBSOLETE**
swbbadpix20041120v003.fits.gz	2004-11-20	2008-03-06	3	BAT global quality map **OBSOLETE**
swbbadpix20041120v004.fits.gz	2004-11-20	2008-10-26	4	BAT global quality map **OBSOLETE**
swbbadpix20041120v005.fits.gz	2004-11-20	2009-08-28	5	BAT global quality map **OBSOLETE**
swbbadpix20041120v006.fits.gz	2004-11-20	2010-06-21	6	BAT global quality map **OBSOLETE**
swbbadpix20041120v007.fits.gz	2004-11-20	2013-01-17	7	BAT global quality map **OBSOLETE**
swbbadpix20041120v008.fits.gz	2004-11-20	2017-10-16	8	BAT global quality map **OBSOLETE**
swbbadpix20041120v008.fits.gz	2004-11-20	2023-06-07	9	BAT global quality map

3. Scope of Document

This document relates to gross time and detector quality filtering for sensitive survey analysis.

4. Reason for Update

Version 4 incorporates changes after the BAT reboot of October 2008. Specifically, the times of reboot and recovery are noted, and threshold changes after the reboot are flagged.

The 'bad times' file version 5 incorporates a correction to the MJDREF keyword, to make it consistent with the Swift mission epoch.

Version 9 has updated information through May 2023.

5. Discussion

Analysis of any data involves proper quality filtering. In the case of BAT, it is especially important to remove detectors with known problems or issues because each enabled detector contributes to flux estimates of a large solid angle on the sky. Aberrant detectors can contribute noise to image and flux estimates.

These calibration files, swbbadtimes* and swbbadpix*, provide the times and positions of known problems or issues with the entire array, and with individual regions of the array.

There are two BAT ground software tasks to retrieve the data from CALDB.

- batglobalgti retrieves a good time interval file which can be used to time-filter the data
- batdetmask retrieves a detector quality map which can be used to spatially filter the data

Important Note: the user is still responsible for doing generic quality filtering of data (i.e. removing times where the spacecraft star tracker was out of lock, or removing noisy detectors using 'bathotpix'). These files provide only high-level information about known instrumental issues.

6. swbbadtimes*: Global Good/Bad Time File

The swbbadtimes* file is a standard good time interval (GTI) file which contains global good and bad time intervals for BAT science analysis. The user should use this file conjunction with the task 'batglobalgti' to chose the desired quality level. The meanings of the QUALITY column are described below.

QUALITY	Description
0	No known issues; data OK
1	Something non-routine occurred, but it had no known impact
2	Bad data, with some possible good data; user must proceed with extreme caution
3	Bad data, with little to no good data

There is also a text comment which describes the issue, if any.

7. swbbadpix*: Global Quality Maps

The swbbadpix* file is a series of maps which are formatted according to the "BADPIX" OGIP convention (i.e. a series of BAT detector quality maps). They are crude mission-level quality maps which indicate which detectors were known to have issues or problems which affect science analysis. The file is formatted as series of FITS extensions, one for each time interval with constant quality information.

Also,

- Following the OGIP QUALITY convention, zero means "good"
- These maps provide only crude, mission-level information. The user must still screen individual detector images for problems (for example noisy detectors).

Each map has a REASON keyword which describes why a new map was created at that particular validity time. In cases where a problem was corrected, i.e. more detectors are enabled, the REASON keyword will be prefixed with "RESOLVED".

The 'batdetmask' task can extract the correct map for a given observation.

8. Reasons for Bad Times

Tables 1 and 2 in the next section provide a listing of known issues, which is meant to be identical to the content of the FITS files. The problems and issues are described more fully in this section.

High voltage reduced - the detector bias voltage was typically reduced during critical BAT or spacecraft procedures as a precautionary measure. The gamma-ray energy scale is not correct during these intervals.

IP reboot - the BAT Instrument Processor (IP) has been rebooted several times. In some cases rebooting was an intended consequence of a flight software upgrade. In other cases a reboot was required to recover the BAT from an anomalous condition.

Gain/offset values equilibrate - after an IP reboot, the automatic calibration system typically requires several hours to reach equilibrium. During that time, the gain scale may be incorrect.

Detector gain jump - it has been noted that some detectors have experienced sudden gain shifts. Most of these gain shifts are associated with power cycling of specific detector hardware during the period of the "block communication problem" (blocks 6 & 13). While most of these anomalies appear after launch, for the sake of prudence we are marking them as bad since launch. There are about 80 detectors which show such behavior.

Loop heat pipe #1 shut down - the loop heat pipes are part of the instrument thermal system, used to regulate the temperatures of the detectors and instrumental electronics. For one episode in 2005, loop heat pipe #1 shut down due to a sensor anomaly. Loop heat pipe #2 still functioned, and provided adequate, although slightly reduced, thermal control until loop heat pipe #1 was restored.

Calibration task stopped - the automatic calibration task performs periodic electronics calibrations. During this interval, the calibration task was stopped, which caused the electronics (gain/offset) calibration to be frozen. Since the on-board electronics calibration appears to be quite stable, the BAT team believes this data is usable for science analysis. After an IP reboot, the calibration task was restored.

Block communications anomaly - During two episodes in 2006, the communication link between the IP and some BAT detector blocks did not function properly for unknown reasons. In the first instance (day 2006:055), the recovery process took several days. In the second case, the instrument functioned properly after a short recovery procedure, but two detector blocks remained disabled for about three weeks.

DM LLD threshold incorrect - for unknown reasons, some DM lower level discriminator threshold settings increased during SAA. Thus, the energy response for these modules was changed (low energy gamma-rays were ignored). The threshold values were reset periodically by ground command.

Spacecraft gyro anomaly (Fall 2007) - on 10 August 2007, the Swift spacecraft experienced a gyro anomaly. This anomaly, and the ensuing events, cause the BAT to be powered off. BAT operations were recovered in two stages: first, the BAT detector array was powered on; next, the flight software was updated from the launch version to the version used before the gyro anomaly (on 07 Sep 2007). For the time period 07 Sep 2007 through 18 Oct 2007, the spacecraft had limited maneuvering capability due to the gyro anomaly. During this period, observers should be watchful for periods of bad spacecraft attitude, but the BAT data should be nominal. After that 18 Oct 2007, full maneuvering capability was restored.

BAT on-board misalignment matrix is incorrect (Oct 2008) - The knowledge of the BAT instrument orientation with respect to the spacecraft boresite is kept on-board in matrix form. After a BAT reboot in Oct 2008, this matrix was incorrect for a short time. BAT positions computed on-board were incorrect by about 8 arcminutes. Two triggers were incorrectly classified as gamma-ray bursts when they were actually known galactic sources (triggers 330074 and 330083). BAT "image status packets" have incorrect positions and fluxes during this interval. Data processed on the ground from event data or DPHs should be unaffected by the on-board misalignment matrix setting.

BAT tick overflow anomaly (Sep 2009) - On 2009-09-17, an internal 64 msec tick counter within the BAT flight software overflowed. This caused several tasks to stop responding and/or producing data. Although data production was restored temporarily on 2009-09-20, the BAT IP was rebooted in order to reset the system to a known consistent state. After this anomaly, block number 12 experienced the "lost communication" problem until the next reboot in January 2010.

BAT spontaneous reboot (Jan 2010) - On 2009-01-22, and again on 2009-01-27, the BAT IP spontaneously transitioned to "BOOT" mode. The reasons for these spontaneous occurrences, and the fact that they are close together in time, has not be completely explained. After recovery from the first reboot, block numbers 1 and 8 experienced the "lost communication" problem. After recovery from the second reboot, all blocks communicated properly.

BAT Loop heat pipe #0 controller failure (Apr 2010) - On 2010-03-31, BAT loop heat pipe #0 experienced a temperature anomaly, which was eventually identified as a thermal controller failure. During part of the time, BAT triggering was disabled, and high voltage was lowered, until corrective action could be taken. A redundant controller was used after the failure.

BAT DM high voltage lowering - Lower high voltage in detector module in order to reduce persistent high leakage current.

BAT truncated DPH (20-bins) (2012 and later) - in June 2012 and December 2012 - Feb 2013, the primary ground station for Swift experienced reliability problems, and it was not possible to downlink all data being generated on board. As a stop-gap measure to reduce the data volume, BAT survey data was reduced from 80 energy bins (14-200 keV) to 20 energy bins (14-50 keV). Because the data generated during these times has reduced numbers of energy bins, the energy bins and energy coverage are not compatible with the standard 80-bin DPH binning using during most of the Swift mission. Analyzing these data will require special care. The available data is correct, but it may not be easily processed with standard software. This time period is set to QUALITY level 1 (indicating an unusual situation).

BAT strip/segment shift (2019 and later) - after a spontaneous reboot in October 2019, four DM sandwiches in block 8 experienced a shift in the strip and segment coefficients. These coefficients are used by the DM digital electronics to determine which detector received a count, and the coefficient shift indicates change in the XA1 pulse driver. After 2023, and new strip and segment solution was estimated and made operational.

9. Bad Time Table

Tables 1 and 2 provide a listing of the known problems and issues.

Definition of the columns:

START
>   start time of the time interval in MET NNNNNNNNNN or YYYY:DDDD:hh:mm:ss format.

STOP
>   stop time of the time interval. Use "*" to indicate an unresolved problem.

B,D,S,d

The block, DM, sandwich, and/or detectors. Use "*" for "all."

Q = QUALITY
data quality

0

No known problems (may be omitted);

1

Known issue, but no known ill effects;

2

Known problem, some good and some bad data; care must be taken to analyze properly;

3

Known problem, all data bad.

COMMENT
Text comment describing the issue or problem. Use the same phrase if the same problem appears multiple times.

START	STOP	B	D	S	d	Q	COMMENT
							2004
2004:325:17:16:00	2004:346:10:00:00	*	*	*	*	2	S/C launch and BAT initial activation sequence
2004:346:10:00:00	2004:347:09:28:00	*	*	*	*	2	BAT high voltage reduced
2004:347:09:28:00	2004:350:02:03:41	*	*	*	*	2	S/C boresite quaternion adjustments
2004:354:21:33:00	2004:355:02:45:00	*	*	*	*	2	BAT high voltage reduced; S/C battery software change
							2005
2005:068:22:02:00	2005:070:18:11:00	*	*	*	*	2	BAT high voltage reduced; IP reboot
2005:070:18:11:00	2005:071:00:00:00	*	*	*	*	2	BAT gain/offset values equilibrate (estimated)
2005:091:07:30:00	2005:098:14:45:00	*	*	*	*	1	BAT loop heat pipe #1 shut down; DM temperatures less regulated
2005:158:13:38:00	2005:158:15:43:00	*	*	*	*	2	BAT high voltage reduced; IP reboot
2005:158:15:43:00	2005:159:00:00:00	*	*	*	*	2	BAT gain/offset values equilibrate
2005:331:14:45:00	2005:333:14:11:00	*	*	*	*	1	BAT calibration task stopped; electronic calibration frozen

2005:333:14:11:00	2005:333:17:43:32	*	*	*	*	2	BAT high voltage reduced; IP reboot
2005:333:17:43:32	2005:335:00:00:00	*	*	*	*	2	BAT gain/offset values equilibrate
2006							
2006:046:18:17:00	2006:046:20:46:00	*	*	*	*	2	BAT high voltage reduced; FSW upgrade; IP reboot
2006:046:20:46:00	2006:047:14:01:00	*	*	*	*	3	BAT instrument in SAA mode
2006:047:14:01:00	2006:047:18:23:00	*	*	*	*	2	BAT high voltage reduced
2006:047:18:23:00	2006:047:20:12:00	*	*	*	*	2	BAT reconfigure triggers
2006:047:20:12:00	2006:048:00:00:00	*	*	*	*	2	BAT gain/offset values equilibrate
2006:048:00:00:00	2006:055:21:07:00	*	*	*	*	1	BAT noisy detectors not disabled on-board; block 11 disabled
2006:055:21:07:00	2006:058:12:48:00	*	*	*	*	3	BAT block communication anomaly; recovery procedures
2006:058:12:48:00	2006:058:15:14:00	*	*	*	*	2	BAT high voltage reduced; IP reboot
2006:058:15:14:00	2006:058:18:03:00	*	*	*	*	3	BAT reconfigure instrument parameters
2006:058:18:03:00	2006:059:15:53:44	*	*	*	*	3	BAT science timestamps are not correct (derived from FSW)
2006:059:15:53:44	2006:060:00:00:00	*	*	*	*	2	BAT gain/offset values equilibrate
2006:166:13:00:00	2006:166:21:00:00	*	*	*	*	3	BAT block communication anomaly
2006:346:01:00:00	2006:347:18:00:00	*	*	*	*	3	BAT IP reboot and recovery
2007							
2007:072:15:16:00	2007:072:18:00:00	*	*	*	*	3	BAT high voltage reduced; FSW upgrade; IP reboot
2007:072:18:00:00	2007:073:00:00:00	*	*	*	*	2	BAT gain/offset values equilibrate
2007:073:15:25:00	2007:073:17:30:00	*	*	*	*	2	BAT DSP software upgrade and reboot
2007:222:20:37:00	2007:223:06:00:00	*	*	*	*	2	S/C gyro anomaly onset
2007:223:06:00:00	2007:230:22:41:24	*	*	*	*	3	BAT powered off during S/C anomaly
2007:230:22:41:24	2007:241:13:35:00	*	*	*	*	3	BAT power-on, initialization, re-enable triggers
2007:241:13:35:00	2007:242:00:00:00	*	*	*	*	2	BAT gain/offset values equilibrate

2007:241:13:35:00	2007:247:18:47:00	*	*	*	*	1	BAT functioning with old FSW
2007:247:18:47:00	2007:247:20:31:00	*	*	*	*	3	S/C attitude anomaly
2007:247:20:31:00	2007:250:15:21:14	*	*	*	*	1	BAT functioning with old FSW
2007:250:15:21:14	2007:250:18:46:40	*	*	*	*	3	BAT FSW update; IP reboot
2007:250:18:46:40	2007:251:00:00:00	*	*	*	*	2	BAT gain/offset values equilibrate
2007:251:00:00:00	2007:291:14:04:00	*	*	*	*	1	S/C has limited maneuvering (check for bad attitude)
2008							
2008:275:19:50:00	2008:275:23:00:00	*	*	*	*	3	BAT FSW update; IP reboot
2008:275:23:00:00	2008:276:09:00:00	*	*	*	*	2	BAT gain/offset values equilibrate
2008:276:09:00:00	2008:276:18:00:00	*	*	*	*	1	BAT on-board misalignment matrix is incorrect
2009							
2009:260:10:15:00	2009:263:17:49:00	*	*	*	*	3	BAT tick overflow anomaly (FSW not responding)
2009:263:17:49:00	2009:264:11:01:00	*	*	*	*	2	BAT temporary anomaly recovery
2009:264:11:01:00	2009:265:16:17:00	*	*	*	*	3	BAT reboot to recover from anomaly
2009:265:16:17:00	2009:266:00:00:00	*	*	*	*	2	BAT gain/offset values equilibrate
2010							
2010:022:04:29:31	2010:023:00:04:00	*	*	*	*	3	BAT spontaneous reboot and troubleshooting
2010:023:00:04:00	2010:025:22:37:00	*	*	*	*	3	BAT IP reboot and recovery
2010:027:12:14:00	2010:028:14:19:00	*	*	*	*	3	BAT spontaneous reboot and troubleshooting
2010:028:14:19:00	2010:028:19:32:00	*	*	*	*	3	BAT IP reboot and recovery
2010:028:19:32:00	2010:029:00:00:00	*	*	*	*	2	BAT gain/offset values equilibrate
2010:090:14:59:00	2010:092:02:05:00	*	*	*	*	1	BAT Loop heat pipe #0 controller failure; DM temperatures less regulated
2010:092:02:05:00	2010:093:14:27:00	*	*	*	*	2	BAT high voltage reduced; trouble-shoot loop heat pipe #0 anomaly

2010:093:14:27:00	2010:093:18:00:00	*	*	*	*	1	BAT DM temperature equilibration

2011	

| 2011:222:13:12:00 | 2011:223:13:21:00 | * | * | * | * | 3 | BAT FSW update; IP reboot; gain/offset values equilibrate |

2012	

2012:180:14:02:00	2012:184:16:36:00	*	*	*	*	1	BAT truncated DPH (20-bins)
2012:187:14:13:00	2012:192:13:01:00	*	*	*	*	1	BAT truncated DPH (20-bins)
2012:361:18:14:00	2013:015:15:53:50	*	*	*	*	1	BAT truncated DPH (20-bins)

2013	

2013:024:15:32:00	2013:039:13:15:00	*	*	*	*	1	BAT truncated DPH (20-bins) - intermittant
2013:237:21:00:00	2013:238:17:00:00	*	*	*	*	3	BAT IP reboot and recovery
2013:238:17:00:00	2013:238:23:00:00	*	*	*	*	2	BAT gain/offset values equilibrate

2015	

| 2015:304:14:00:00 | 2015:315:00:00:00 | * | * | * | * | 2 | BAT Loop heat pipe failure; loss of temperature regulation |

2016	

| 2016:168:14:00:00 | 2016:169:20:00:00 | * | * | * | * | 3 | BAT block #15 comm failure; IP reboot and recovery |
| 2016:169:20:00:00 | 2016:170:04:00:00 | * | * | * | * | 2 | gain/offset values equilibrate |

2018	

2018:154:19:57:00	2018:165:17:31:00	*	*	*	*	3	BAT clock rollover reboot and recovery
2018:165:17:31:00	2018:165:21:20:00	*	*	*	*	2	BAT gain/offset values equilibrate
2018:252:18:00:00	2018:257:16:36:00	*	*	*	*	3	BAT spontaneous reboot and recovery
2018:257:16:36:00	2018:257:22:00:00	*	*	*	*	2	BAT gain/offset values equilibrate
2018:261:04:27:33	2018:263:18:18:42	*	*	*	*	3	BAT comm failure; IP reboot and recovery
2018:263:18:18:42	2018:264:00:00:00	*	*	*	*	2	BAT gain/offset values equilibrate

2019	

2019:253:13:00:00	2019:259:14:05:00	*	*	*	*	3	BAT spontaneous reboot and recovery
2019:259:14:05:00	2019:259:20:00:00	*	*	*	*	2	BAT gain/offset values equilibrate
2019:312:10:20:00	2019:315:15:50:21	*	*	*	*	3	BAT spontaneous reboot and recovery
2019:315:15:50:21	2019:315:21:00:00	*	*	*	*	2	BAT gain/offset values equilibrate
2019:319:16:19:20	2019:324:15:39:27	*	*	*	*	1	BAT truncated DPH (20-bins)
2019:327:20:50:00	2019:329:16:28:25	*	*	*	*	3	BAT spontaneous reboot and recovery
2019:329:16:28:25	2019:329:22:00:00	*	*	*	*	2	BAT gain/offset values equilibrate
2019:329:22:00:00	2019:333:16:00:00	*	*	*	*	1	BAT truncated DPH (20-bins)
2020							
2020:022:11:00:00	2020:024:13:00:41	*	*	*	*	3	BAT spontaneous reboots and recovery
2020:024:13:00:41	2020:024:18:00:00	*	*	*	*	2	BAT gain/offset values equilibrate
2020:027:13:52:01	2020:030:14:52:38	*	*	*	*	1	BAT truncated DPH (20-bins)
2020:032:04:00:00	2020:035:14:10:29	*	*	*	*	3	BAT spontaneous reboots and recovery
2020:035:14:10:29	2020:035:20:00:00	*	*	*	*	2	BAT gain/offset values equilibrate
2020:035:20:00:00	2020:036:17:27:22	*	*	*	*	1	BAT truncated DPH (20-bins)
2020:231:15:48:07	2020:240:16:00:00	*	*	*	*	1	BAT truncated DPH (20-bins)
2021							
2021:027:15:19:00	2021:033:21:45:54	*	*	*	*	3	BAT reboot to recover blocks 4,5,10
2021:033:21:45:54	2021:034:15:48:00	*	*	*	*	2	BAT gain/offset values equilibrate
2021:228:16:00:00	2021:231:14:00:00	*	*	*	*	1	BAT truncated DPH (20-bins)
2022							
2022:284:14:00:00	2022:285:20:35:00	*	*	*	*	3	BAT clock rollover reboot and reboot to recover non-comm blocks
2022:285:20:35:00	2022:286:02:00:00	*	*	*	*	2	BAT gain/offset values equilibrate
2022:300:21:09:48	2022:301:20:04:38	*	*	*	*	3	BAT array latchup / SAA mode

START	STOP						COMMENT
2022:319:12:10:17	2022:321:15:15:22	*	*	*	*	3	BAT reboot to recover non-comm blocks
2022:321:15:15:22	2022:321:21:00:00	*	*	*	*	2	BAT gain/offset values equilibrate
2023							
2023:072:15:10:22	2023:072:18:36:47	*	*	*	*	3	BAT recover communication to non-comm blocks
2023:122:14:51:02	2023:122:15:46:02	*	*	*	*	3	BAT recover communication to non-comm blocks
2023:128:14:27:46	2023:128:15:24:53	*	*	*	*	3	BAT recover communication to non-comm blocks
2023:144:17:08:53	2023:144:20:00:00	*	*	*	*	3	BAT block #15 comm recovery (lower LLD)
2023:145:15:00:22	2023:145:20:00:00	*	*	*	*	3	BAT block #10 comm recovery (lower LLD)
2023:150:18:17:15	2023:150:23:30:00	*	*	*	*	3	BAT blocks #9 & #7 comm recovery (lower LLD)
2023:151:16:53:43	2023:152:00:00:00	*	*	*	*	3	BAT blocks #11 & #4 comm recovery (lower LLD)

Table 3. Global Bad Time Listing

START	STOP	B	D	S	d	Q	COMMENT
Anomalous Detectors							
2004:325:00:00:00	*	1	2	1	92	2	Detector gain jump
2004:325:00:00:00	*	3	2	0	0	2	Detector gain jump
2004:325:00:00:00	*	4	0	1	98	2	Detector gain jump
2004:325:00:00:00	*	4	0	1	105	2	Detector gain jump
2004:325:00:00:00	*	4	1	1	51	2	Detector gain jump
2004:325:00:00:00	*	4	1	1	55	2	Detector gain jump
2004:325:00:00:00	*	4	4	0	26	2	Detector gain jump
2004:325:00:00:00	*	5	1	1	122	2	Detector gain jump
2004:325:00:00:00	*	5	4	1	4	2	Detector gain jump
2004:325:00:00:00	*	5	5	1	2	2	Detector gain jump

2004:325:00:00:00	*	5	5	1	51	2	Detector gain jump
2004:325:00:00:00	*	6	0	0	7	2	Detector gain jump
2004:325:00:00:00	*	6	0	0	20	2	Detector gain jump
2004:325:00:00:00	*	6	0	0	41	2	Detector gain jump
2004:325:00:00:00	*	6	0	1	95	2	Detector gain jump
2004:325:00:00:00	*	6	1	0	3	2	Detector gain jump
2004:325:00:00:00	*	6	1	1	25	2	Detector gain jump
2004:325:00:00:00	*	6	1	1	42	2	Detector gain jump
2004:325:00:00:00	*	6	1	1	104	2	Detector gain jump
2004:325:00:00:00	*	6	2	1	50	2	Detector gain jump
2004:325:00:00:00	*	6	2	1	67	2	Detector gain jump
2004:325:00:00:00	*	6	2	1	78	2	Detector gain jump
2004:325:00:00:00	*	6	2	1	124	2	Detector gain jump
2004:325:00:00:00	*	6	3	0	105	2	Detector gain jump
2004:325:00:00:00	*	6	3	1	19	2	Detector gain jump
2004:325:00:00:00	*	6	4	0	60	2	Detector gain jump
2004:325:00:00:00	*	6	4	0	61	2	Detector gain jump
2004:325:00:00:00	*	6	4	0	119	2	Detector gain jump
2004:325:00:00:00	*	6	5	1	91	2	Detector gain jump
2004:325:00:00:00	*	6	5	1	105	2	Detector gain jump
2004:325:00:00:00	*	6	6	0	1	2	Detector gain jump
2004:325:00:00:00	*	6	7	0	2	2	Detector gain jump
2004:325:00:00:00	*	6	7	0	21	2	Detector gain jump
2004:325:00:00:00	*	6	7	0	68	2	Detector gain jump

2004:325:00:00:00	*	6	7	0	77	2	Detector gain jump
2004:325:00:00:00	*	6	7	1	106	2	Detector gain jump
2004:325:00:00:00	*	7	0	0	127	2	Detector gain jump
2004:325:00:00:00	*	7	4	1	78	2	Detector gain jump
2004:325:00:00:00	*	7	7	0	123	2	Detector gain jump
2004:325:00:00:00	*	8	2	0	23	2	Detector gain jump
2004:325:00:00:00	*	8	4	0	104	2	Detector gain jump
2004:325:00:00:00	*	9	3	1	117	2	Detector gain jump
2004:325:00:00:00	*	9	6	0	0	2	Detector gain jump
2004:325:00:00:00	*	9	6	0	10	2	Detector gain jump
2004:325:00:00:00	*	9	6	0	18	2	Detector gain jump
2004:325:00:00:00	*	9	6	0	40	2	Detector gain jump
2004:325:00:00:00	*	9	6	0	48	2	Detector gain jump
2004:325:00:00:00	*	9	6	0	81	2	Detector gain jump
2004:325:00:00:00	*	9	6	0	116	2	Detector gain jump
2004:325:00:00:00	*	10	2	1	81	2	Detector gain jump
2004:325:00:00:00	*	11	2	0	86	2	Detector gain jump
2004:325:00:00:00	*	11	5	1	83	2	Detector gain jump
2004:325:00:00:00	*	13	0	0	7	2	Detector gain jump
2004:325:00:00:00	*	13	0	0	70	2	Detector gain jump
2004:325:00:00:00	*	13	0	1	76	2	Detector gain jump
2004:325:00:00:00	*	13	0	1	86	2	Detector gain jump
2004:325:00:00:00	*	13	1	0	33	2	Detector gain jump
2004:325:00:00:00	*	13	1	1	6	2	Detector gain jump

2004:325:00:00:00	*	13	2	0	23	2	Detector gain jump
2004:325:00:00:00	*	13	2	1	15	2	Detector gain jump
2004:325:00:00:00	*	13	2	1	88	2	Detector gain jump
2004:325:00:00:00	*	13	2	1	110	2	Detector gain jump
2004:325:00:00:00	*	13	3	0	10	2	Detector gain jump
2004:325:00:00:00	*	13	3	1	50	2	Detector gain jump
2004:325:00:00:00	*	13	3	1	57	2	Detector gain jump
2004:325:00:00:00	*	13	3	1	95	2	Detector gain jump
2004:325:00:00:00	*	13	3	1	109	2	Detector gain jump
2004:325:00:00:00	*	13	4	0	0	2	Detector gain jump
2004:325:00:00:00	*	13	4	0	27	2	Detector gain jump
2004:325:00:00:00	*	13	4	1	27	2	Detector gain jump
2004:325:00:00:00	*	13	4	1	33	2	Detector gain jump
2004:325:00:00:00	*	13	5	0	85	2	Detector gain jump
2004:325:00:00:00	*	13	5	0	109	2	Detector gain jump
2004:325:00:00:00	*	13	5	1	26	2	Detector gain jump
2004:325:00:00:00	*	13	5	1	35	2	Detector gain jump
2004:325:00:00:00	*	13	6	1	28	2	Detector gain jump
2004:325:00:00:00	*	13	6	1	57	2	Detector gain jump
2004:325:00:00:00	*	13	6	1	67	2	Detector gain jump
2004:325:00:00:00	*	13	6	1	70	2	Detector gain jump
2004:325:00:00:00	*	13	6	1	72	2	Detector gain jump
2004:325:00:00:00	*	13	6	1	92	2	Detector gain jump
2004:325:00:00:00	*	13	6	1	100	2	Detector gain jump

2004:325:00:00:00	*	13	7	1	23	2	Detector gain jump
2004:325:00:00:00	*	13	7	1	66	2	Detector gain jump
2004:325:00:00:00	*	13	7	1	71	2	Detector gain jump
2004:325:00:00:00	*	15	5	0	9	2	Detector gain jump
2004:325:00:00:00	*	15	5	0	31	2	Detector gain jump
2004:325:00:00:00	*	15	5	0	46	2	Detector gain jump
2004:325:00:00:00	*	15	5	0	48	2	Detector gain jump
2004:325:00:00:00	*	15	5	0	69	2	Detector gain jump
2004							
2004:346:10:00:00	2005:074:16:00:00	1	2	*	*	2	BAT DM LLD threshold incorrect
2005							
2005:070:16:08:52	2005:076:13:48:18	4	0	*	*	2	BAT DM LLD threshold incorrect
2005:078:13:43:52	2005:083:19:52:50	13	1	*	*	2	BAT DM LLD threshold incorrect
2005:080:08:43:52	2005:083:19:52:50	6	5	*	*	2	BAT DM LLD threshold incorrect
2005:080:08:48:52	2005:083:19:52:50	4	5	*	*	2	BAT DM LLD threshold incorrect
2005:080:10:23:52	2005:083:19:52:50	14	6	*	*	2	BAT DM LLD threshold incorrect
2005:087:06:13:52	2005:091:19:07:50	13	6	*	*	2	BAT DM LLD threshold incorrect
2005:089:04:48:54	2005:091:19:07:50	7	0	*	*	2	BAT DM LLD threshold incorrect
2005:089:17:43:52	2005:091:19:07:50	7	4	*	*	2	BAT DM LLD threshold incorrect
2005:091:06:38:52	2005:096:14:43:36	12	4	*	*	2	BAT DM LLD threshold incorrect
2005:094:09:28:52	2005:096:14:43:36	5	7	*	*	2	BAT DM LLD threshold incorrect
2005:104:01:18:52	2005:112:16:32:45	2	3	*	*	2	BAT DM LLD threshold incorrect
2005:104:16:59:30	2005:112:16:32:45	12	1	*	*	2	BAT DM LLD threshold incorrect
2005:108:22:33:52	2005:112:16:32:45	14	0	*	*	2	BAT DM LLD threshold incorrect

2005:113:18:03:52	2005:126:14:52:53	4	6	*	*	2	BAT DM LLD threshold incorrect
2005:114:18:13:52	2005:126:14:52:53	11	0	*	*	2	BAT DM LLD threshold incorrect
2005:116:11:48:52	2005:126:14:52:53	9	5	*	*	2	BAT DM LLD threshold incorrect
2005:117:18:28:52	2005:126:14:52:53	12	3	*	*	2	BAT DM LLD threshold incorrect
2005:118:11:53:52	2005:126:14:52:53	11	5	*	*	2	BAT DM LLD threshold incorrect
2005:119:15:18:55	2005:126:14:52:53	13	3	*	*	2	BAT DM LLD threshold incorrect
2005:121:15:33:55	2005:126:14:52:53	3	1	*	*	2	BAT DM LLD threshold incorrect
2005:122:15:38:55	2005:129:18:42:53	1	7	*	*	2	BAT DM LLD threshold incorrect
2005:125:09:13:55	2005:129:18:42:53	1	4	*	*	2	BAT DM LLD threshold incorrect
2005:125:10:58:55	2005:129:18:42:53	4	7	*	*	2	BAT DM LLD threshold incorrect
2005:126:09:23:55	2005:129:18:42:53	12	5	*	*	2	BAT DM LLD threshold incorrect
2005:128:07:53:55	2005:129:18:42:53	10	2	*	*	2	BAT DM LLD threshold incorrect
2005:129:09:34:40	2005:129:18:42:53	9	4	*	*	2	BAT DM LLD threshold incorrect
2005:147:12:22:00	2005:333:17:43:32	3	1	*	*	3	BAT DM leakage current too high; disabled
2006							
2006:166:13:00:00	2006:186:17:32:00	5	*	*	*	3	BAT block communication anomaly
2006:166:13:00:00	2006:186:17:32:00	15	*	*	*	3	BAT block communication anomaly
2006:345:15:00:00	2006:353:14:30:00	9	4	1	*	2	BAT DM LLD threshold incorrect
2006:348:08:00:00	2006:353:14:30:00	9	0	*	*	2	BAT DM LLD threshold incorrect
2006:348:08:00:00	2006:353:14:30:00	12	0	*	*	2	BAT DM LLD threshold incorrect
2006:349:11:30:00	2006:353:14:30:00	14	6	*	*	2	BAT DM LLD threshold incorrect
2006:350:11:30:00	2006:353:14:30:00	6	7	*	*	2	BAT DM LLD threshold incorrect
2007							
2007:072:15:16:00	2007:073:17:30:00	12	1	*	*	2	BAT DM latch-up (not reported in enable/disable map)

2007:255:16:00:00	2007:267:22:00:00	12	1	*	*	2	BAT DM LLD threshold incorrect
2007:256:11:00:00	2007:267:22:00:00	7	4	*	*	2	BAT DM LLD threshold incorrect
2007:256:14:00:00	2007:267:22:00:00	1	1	*	*	2	BAT DM LLD threshold incorrect
2007:256:14:00:00	2007:267:22:00:00	3	3	*	*	2	BAT DM LLD threshold incorrect
2007:256:19:00:00	2007:267:22:00:00	9	6	*	*	2	BAT DM LLD threshold incorrect
2007:257:12:00:00	2007:267:22:00:00	0	2	*	*	2	BAT DM LLD threshold incorrect
2007:257:12:00:00	2007:267:22:00:00	2	4	*	*	2	BAT DM LLD threshold incorrect
2007:257:13:00:00	2007:267:22:00:00	6	1	*	*	2	BAT DM LLD threshold incorrect
2007:262:11:00:00	2007:267:22:00:00	0	7	*	*	2	BAT DM LLD threshold incorrect
2007:264:12:00:00	2007:267:22:00:00	9	0	*	*	2	BAT DM LLD threshold incorrect
2007:266:14:00:00	2007:267:22:00:00	2	1	*	*	2	BAT DM LLD threshold incorrect
2008						
2008:277:07:00:00	2008:279:05:30:00	6	5	*	*	2	BAT DM LLD threshold incorrect
2008:278:08:00:00	2008:279:05:30:00	7	7	*	*	2	BAT DM LLD threshold incorrect
2008:275:05:00:00	2008:279:05:30:00	11	3	*	*	2	BAT DM LLD threshold incorrect
2008:277:07:00:00	2008:279:05:30:00	15	0	*	*	2	BAT DM LLD threshold incorrect
2009						
2009:266:00:00:00	2009:268:13:13:00	1	3	*	*	3	BAT DM latch-up (not reported in enable/disable map)
2009:266:00:00:00	2009:268:13:13:00	4	4	*	*	3	BAT DM latch-up (not reported in enable/disable map)
2009:266:00:00:00	2010:022:04:29:31	12	*	*	*	3	BAT block communication anomaly
2010						
2010:025:22:37:00	2010:027:12:14:00	1	*	*	*	3	BAT block communication anomaly
2010:025:22:37:00	2010:027:12:14:00	8	*	*	*	3	BAT block communication anomaly
2010:225:14:00:00	2011:038:17:00:00	15	4	*	*	3	BAT DM high voltage lowering

			2011			
2011:019:14:00:00	2011:032:23:59:00	5	3	*	*	3	BAT DM latch-up (not reported in enable/disable map)
2011:021:16:00:00	2011:032:23:59:00	3	3	*	*	3	BAT DM latch-up (not reported in enable/disable map)
			2016			
2016:168:14:00:00	2019:261:00:00:00	15	*	*	*	3	BAT block #15 comm failure & recovery
			2019			
2019:260:12:55:03	2019:264:00:00:00	11	*	*	*	3	BAT block #11 comm failure recovery
2019:261:12:47:18	2019:264:00:00:00	5	*	*	*	3	BAT block #5 comm failure recovery
2019:261:17:37:08	2019:264:00:00:00	3	*	*	*	3	BAT block #3 comm failure recovery
2019:262:12:41:13	2019:264:00:00:00	6	*	*	*	3	BAT block #6 comm failure recovery
2019:262:17:31:29	2019:264:00:00:00	7	*	*	*	3	BAT block #7 comm failure recovery
2019:312:10:22:47	2023:180:00:00:00	8	2	*	*	3	BAT block #8 strip/segment shift
2019:312:10:22:47	2023:180:00:00:00	8	5	1	*	3	BAT block #8 strip/segment shift
2019:312:10:22:47	2023:180:00:00:00	8	7	1	*	3	BAT block #8 strip/segment shift
			2021			
2021:021:12:00:00	2022:071:00:00:00	5	*	*	*	3	BAT block #5 comm failure
2021:023:05:00:00	2022:071:00:00:00	10	*	*	*	3	BAT block #10 comm failure
2021:026:02:00:00	2022:071:00:00:00	4	*	*	*	3	BAT block #4 comm failure
			2022			
2022:286:16:10:00	2022:321:21:00:00	11	*	*	*	3	BAT block #11 comm failure
2022:288:00:45:00	2022:321:21:00:00	9	*	*	*	3	BAT block #9 comm failure
2022:294:06:49:33	2022:321:21:00:00	7	*	*	*	3	BAT block #7 comm failure
2022:319:12:10:17	2023:160:00:00:00	2	6	*	*	3	Latched up DM
2022:319:12:10:17	2023:160:00:00:00	5	7	*	*	3	Latched up DM

2023						
2023:145:00:00:00	2023:160:00:00:00	0	5	*	*	3	Latched up DM

Table 4. Global Bad Regions Listing

10. Caveat Emptor

As noted above, the user is still responsible for performing generic quality filtering using the data at hand (i.e. searching for noisy detectors, etc).

11. Expected Updates

This file will be updated when major events occur, or when new issues are discovered. The expected update frequency is approximately 3-6 months.

12. Version History

12.1. Update VERSION 1 (2006-11-07)

Initial release.

12.2. Update VERSION 2 (2007-03-22)

- 01 Jan 2007 - add reboot of mid Dec 2006; add threshold changes of mid Dec 2006
- 22 Mar 2007 - add reboot and flight software upgrade of Mar 2007

12.3. Update VERSION 3 (2008-02-14)

- 14 Feb 2008 - add events of 2007, including spacecraft gyro anomaly and recovery.

12.4. Update VERSION 4 (2008-10-03)

- 06 Mar 2008 - add DM threshold changes after the anomaly recovery.
- 26 Oct 2008 - add reboot and flight software upgrade of Oct 2008, and subsequent DM threshold changes.

12.5. Update VERSION 5 (2009-01-30)

- 29 Jan 2009 - fix to MJDREF keyword in 'bad times' file

12.6. Update VERSION 6 (2010-06-21)

- 26 Jun 2009 - add detectors with anomalous gain jumps
- 12 Mar 2010 - add spontaneous reboot anomalies of Sep 2009 and Jan 2010
- 04 Apr 2010 - add loop heat pipe anomaly of Apr 2010

12.7. Update VERSION 7 (2013-01-17)

- 16 Jan 2013 - add 20-bin survey intervals during Malindi ground station problems (mid 2012 & late 2012 into early 2013)

12.8. Update VERSION 8 (2017-10-16)

- 27 Mar 2017 - update through March 2017: BAT IP reboot 2013; loop heat pipe problems 2015; block #15 communication problems 2015

12.9. Update VERSION 9 (2023-06-07)

- 07 Jun 2023 - update through May 2023: various communication problems, reboots and recoveries