

LAXPC10 anomaly on 26 March 2018

16 April 2021

Around 05:36 UT on 26 March 2018 during orbit 13470 ($T = 259738560$ s) the count rate in LAXPC10 showed a strong burst with dead-time corrected peak count rate of about 40000 s^{-1} . After that the counts and spectrum were erratic. Although, the cause of anomaly is not known, as a matter of precaution against possible corona it was decided to reduce the high-voltage by about 200 V and the HV adjustment command was implemented at 9:20 UT on 29 March 2018 during orbit 13517 ($T = 260011200$ s). Since the counts were stable after this adjustment, the HV was increased by about 100 V and the LLD threshold of A6 and A7 were also raised to avoid low channel spikes. These changes were implemented at 08:00 UT on 30 March 2018 during orbit 13531 ($T = 260092800$ s). After reducing the voltage the count rate was not totally stable, there were periods when it showed abnormal counts. These periods can be distinguished by a dip in ULD count rate. The time intervals with ULD count rate below 450 s^{-1} can be treated as bad time interval.

The HV was again reduced by about 100 V at 10:52 UT on 2 April 2018 during orbit 13577 ($T = 260362320$ s). After that no anomaly was observed and the ULD and K-threshold were adjusted at 6:27 UT on 4 April 2018 during orbit 13604 ($T = 260519220$ s). Since then a few abnormal count rate intervals have been observed. These can again be identified by a dip in ULD count rate below 750 s^{-1} . These rejection criterion has been implemented in the software. In order to control these instances some LLD thresholds were raised at 8:55 UT on 6 April 2018 during orbit 13625 ($T = 260700900$ s) but these intermittent bursts continue.

The HV was reduced by another 200 V at 08:20 UT on 27 April 2018 during orbit 13945 ($T = 262513200$ s). After that the detector was stable but the LLD threshold was around 10 keV and the counts from the sources were not clearly seen. The detector was switched off at 08:00 UT on 1 May 2018 during orbit 14004 ($T = 262857600$ s) and was switched on at 10:18 UT on 2 May 2018 during orbit 14020 ($T = 262952280$ s) with HV set to be about 200 V below the nominal operating HV. After that the detector was stable and the HV was increased by about 100 V at 08:47 UT on 7 May 2018 during orbit 14093 ($T = 263378820$ s). The counts were not stable at this HV and hence the HV was reduced by about 100 V back to the old value at 07:20 UT on 8 May 2018 during orbit 14107 ($T = 263460000$ s), but the counts were not stable. As a result the detector was switched off for 2 orbits on 9 May 2018, from 09:27 UT during orbit 14124 ($T = 263554020$ s) to 13:00 UT during orbit 14126 ($T = 263566800$ s). After that also the count rate was not stable. However, on 17 May 2018 from orbit 14241 ($T = 264229000$ s) the counts suddenly became stable without any intervention. Since then the counts were stable in LAXPC10 until about 8:30 UT on 2 June 2018 during orbit 14479. After that the data loss due to intermittent burst is very high.

The detector was switched off around 08:25 UT on 7 June 2018 during orbit 14552 ($T = 266055840$ s). It was switched on around 07:02 UT on 8 June 2018 during orbit 14566 ($T = 266137320$ s). Since the counts were not stable the HV was reduced by about 100 V at around 08:03 UT on 15 June 2018 during orbit 14670 ($T = 266745780$ s). After the HV reduction the counts are stable. With this HV the LLD threshold is about 8 keV and ULD threshold is about 115 keV. As a result the total background counts are higher. On 16 July 2018, the counts again became unstable and there was 80% data loss due to bursts. Hence the HV was reduced by about 100 V at around 11:25 UT on 30 July 2018 during orbit 15340 ($T = 270645900$ s). After this the counts are stable. With this HV the LLD threshold is about 11 keV and ULD threshold is about 190 keV.

On 11 October 2018 the count rate again became unstable and there was over 90% data loss due to bursts. Hence the HV was reduced by about 100 V at around 09:43 UT on 15 October 2018 during orbit 16477 ($T = 277292580$ s). After this also the counts were unstable and data loss of about 80%

Summary of all events in LAXPC10 after 26 March 2018

Time (s)	Orbit ObsID	Event	Comments	Background	Response
05:36 26Mar18 259738560	13470 1988	Erratic counts	Data not useful		
09:20 29Mar18 260011200	13517 1990	HV down by ~ 200 V	Counts stable use only single events	earth occult	cshm141SEv1.1
08:00 30Mar18 260092800	13531 1992	HV up by ~ 100 V LLD of A6, A7 raised	Intermittent burst use only single events reject time with ULD < 450 s $^{-1}$	earth occult apr18	cshm81SEv2.0
09:52 02Apr18 260362320	13577 2002	HV down by ~ 100 V	Counts stable use only single events	earth occult	cshm141SEv2.0
06:27 04Apr18 260519220	13604 2008	ULD and K-limits adjusted	Intermittent bursts reject time with ULD < 750 s $^{-1}$	earth occult aps18	cshm141v2.1
08:55 06Apr18 260700900	13625 2018	LLD of A6–A9 adjusted	Intermittent bursts reject time with ULD < 750 s $^{-1}$	earth occult aps18	cshm141v2.2
08:20 27Apr18 262513200	13945 2060	HV down by ~ 200 V	Counts stable	earth occult	cshm193SEv2.2
08:00 01May18 262857600	14004 2068	Switch off	No data	No Data	
10:18 02May18 262952280	14020 2070	Switch on HV up by ~ 200 V	Counts Stable	earth occult aps18	cshm141v2.2
08:47 07May18 263378820	14093 2078	HV up by ~ 100 V	Intermittent burst use only single events reject time with ULD < 450 s $^{-1}$	earth occult apr18	cshm81SEv2.0
07:20 08May18 263460000	14107 2080	HV down by ~ 100 V	Intermittent bursts reject time with ULD < 750 s $^{-1}$	earth occult aps18	cshm141v2.2
09:27 09May18 263554020	14124 2082	detector off	No data		
13:00 09May18 263566800	14126 2082	detector on	Intermittent bursts reject time with ULD < 750 s $^{-1}$	earth occult aps18	cshm141v2.2
08:25 07Jun18 266055840	14552 2144	Switch off	No data		No Data
07:02 08Jun18 266137320	14566 2146	Switch on	Intermittent bursts reject time with ULD < 750 s $^{-1}$	earth occult jun18	cshm141v2.2
08:03 15Jun18 266745780	14670 2170	HV down by ~ 100 V	Counts stable use only single events reject time with ULD < 450 s $^{-1}$	earth occult jul18	cshm175SEv2.2
11:25 30Jul18 270645900	15340 2260	HV down by ~ 100 V	Counts stable use only single events reject time with ULD < 300 s $^{-1}$	earth occult aug18,sep18	cshm197SEv2.2
09:43 15Oct18 277292580	16477 2438	HV down by ~ 100 V	Intermittent bursts use only single events reject time with ULD < 200 s $^{-1}$	earth occult oct18–mar19	cshm212SEv2.2
05:24 22Oct18 277881840	16578 2444	Switch off	No data		No Data
07:34 23Oct18 277976040	16594 2446	Switch on	Counts stable use only single events reject time with ULD < 200 s $^{-1}$	earth occult oct18–mar19	cshm212SEv2.2
07:23 17Apr19 293181780	19199 2838	HV down by ~ 100 V	Intermittent bursts use only single events reject time with ULD < 130 s $^{-1}$	earth occult apr19	cshm220SEv2.2

persisted. As a result the detector was switched off for one day at 05:24 UT on 22 October 2018 during orbit 16578 ($T = 277881840$ s). The detector was switched on at 07:34 UT on 23 October 2018 during orbit 16594 ($T = 277976040$ s). At this HV the LLD threshold is about 15 keV and the ULD threshold is about 310 keV.

During orbit 19080 on 9 April 2019, LAXPC10 again started showing erratic counts. During the six months since the last HV adjustment the gain had increased by about 1/3 of the reduction on 15 October 2018. During the last one year since the problem started the HV has been reduced by five steps of about 100 V, while gain shift during this period has compensated for about one of this step. Since the spectrum continued to be erratic the HV was lowered by about 100 V at 07:23 UT on 17 April 2019 during orbit 19199 ($T = 293181780$ s). After this some intermittent burst in ULD counts continued, but since 20 April 2019 the counts are stable. At this HV the LLD threshold is about 30 keV and ULD threshold is about 400 keV. With this gain it is difficult to estimate the position of peaks in A8 as it is close to the LLD threshold of A8 and hence is difficult to get any reliable measure of the gain shift. As a result the data may not be useful.

During orbit 24705 on 23 April 2020, LAXPC10 again started showing erratic counts and the spectrum is erratic, though the total count rates are close to normal. On 27 April 2020 the burst in SGR 1935+2154 was still detected in LAXPC10. We are keeping watch on its performance. On 3 May 2020 during orbit 24870, the erratic counts stopped and LAXPC10 counts and spectrum were at the state before 23 April 2020.

During orbit 29830 on 4 April 2021, LAXPC10 again started showing erratic counts and the spectrum is erratic, though the total count rates are close to normal. On 14 April 2021 during orbit 29979, the erratic counts stopped and LAXPC10 counts and spectrum were at the state before 4 April 2021. The data obtained during this period should be rejected. With the drift in gain, the LLD threshold of LAXPC10 as on 16 April 2021 is about 20 keV, while the ULD is around 230 keV.

Table 1 lists all events and adjustments made Table 1 lists all events and adjustments made and recommendation for background and response files. The comments apply to time interval starting from the event time till the next event.

Rejection of events based on ULD threshold is implemented in the software. However, this may not be perfect, so some adjustment may be needed in gti file after looking at the light curve. During the time when adjustments were being made it is best to use background spectrum and counts from observation during Earth Occultation. Some background observation is available for all values of HV, but there could be some variations.

Before the K-thresholds were adjusted on 4 April 2018, it is necessary to use only single events as the logic for double events will not be correctly implemented. This option is available in new version of software ($iev = -1$ or 1). Considering the unpredictable nature of detector no adjustment of ULD and K-threshold is planned at the HV values used after 15 June 2018, and hence it is advisable to use only single events.

The responses listed are indicative, neighbouring responses may also be tried, if available. The program backshiftv3.f may not work for the time covered by this table as appropriate background may not be available. For the times where the response file v2.2 is recommended the latest version of backshiftv3 may be able to calculate the shift and recommend appropriate response. During these period the peak channel at 30 keV has shifted at a rate that is comparable to that before April 2018.

The LLD threshold was around 10 keV during the period before 15 October 2018. As a result, the count rates for the source is reduced. This has reduced even further after reduction in HV. Latest version of the software would be required for analysing these data.