



Kepler Data Release 9 Notes

KSCI-19049-001

Data Analysis Working Group (DAWG)

Jessie Christiansen (Editor)

Pavel Machalek (Editor)

Data Release 9 for Quarter Q6

Q.m		First Cadence MJD midTime	Last Cadence MJD midTime	First Cadence UT midTime	Last Cadence UT midTime	Num CINs	Start CIN	End CIN
6	LC	55371.9473	55461.7939	06/24/10 22:44	09/22/10 19:03	4397	21069	25466
6.1	SC	55371.9375	55399.0317	06/24/10 22:29	07/22/10 00:45	39779	620530	660309
6.2	SC	55399.8702	55430.7855	07/22/10 20:53	08/22/10 18:51	45389	661540	706929
6.3	SC	55431.6853	55461.8037	08/23/10 16:26	09/22/10 19:17	44219	708250	752469

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Prepared by: J. Christian Date 1/20/2011
Jessie Christiansen, Kepler Science Office, for the DAWG (next page)

Prepared by: Pavel Machalek Date 1-20-2011
Pavel Machalek, Kepler Science Office, for the DAWG (next page)

Approved by: Jeffrey E. Van Cleve Date 1/20/2011
Jeffrey Van Cleve, Editor-in-Chief

Approved by: Douglas Alkhwell for JJ Date 1/20/2011
Jon Jenkins, Co-I for Data Analysis & DAWG Lead

Approved by: Michael R. Haas Date 1/20/11
Michael R. Haas, Science Office Director

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Michael R. Haas
Kepler Science Office Director
MS 244-30
NASA Ames Research Center
Moffett Field, CA 94035-1000
Michael.R.Haas@nasa.gov

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The Data Characteristics Handbook is the collective effort of the Data Analysis Working Group (DAWG), composed of Science Office (SO), Science Operations Center (SOC), Guest Observer Office (GO), and Science Team (ST) members as listed below:

Jon Jenkins*, Chair

Doug Caldwell*, Co-Chair

Allen, Christopher L.
Bryson, Stephen T.
Christiansen, Jessie L.
Clarke, Bruce D.
Cote, Miles T.
Fanelli, Michael N.
Gilliland*, Ron (STSci)
Girouard, Forrest
Haas, Michael R.
Hall, Jennifer
Ibrahim, Khadeejah
Kinemuchi, Karen
Klaus, Todd
Kolodziejczak, Jeff (MSFC)
Li, Jie
Machalek, Pavel
McCauliff, Sean D.
Middour, Christopher K.
Morris, Rob
Mullally, Fergal
Quintana, Elisa V.
Rowe, Jason
Seader, Shawn
Smith, Jeffrey Claiborne
Still, Martin
Tenenbaum, Peter G.
Thompson, Susan E.
Twicken, Joe
Uddin, Akm Kamal
Van Cleve, Jeffrey
Wohler, Bill

*Science Team

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Prefatory Admonition to Users

The corrected light-curve product generated by the PDC (Pre-search Data Conditioning) pipeline module is designed to enable the Kepler planetary transit search. Although significant effort has been expended to preserve the natural variability of targets in the corrected light curves in order to enable astrophysical exploitation of the Kepler data, it is not possible to perfectly preserve general stellar variability on long timescales with amplitudes comparable to or smaller than the instrumental systematics, and PDC currently is known to remove or distort astrophysical features in a subset of the corrected light curves. In those cases where PDC fails, or where the requirements of an astrophysical investigation are in conflict with those for transit planet search, the investigator should use the ‘raw’ light-curve product, for which basic calibration has been performed but correction for instrumental systematics has not, instead of the PDC (‘corrected’) light-curve product. Where appropriate, the investigator can then use the ancillary engineering data and image motion time series provided in the relevant Data Release Notes Supplement/s for systematic error correction. Investigators are strongly encouraged to study the Data Characteristics Handbook and Data Release Notes for any data sets they intend to use. The Science Office advises against publication of results based on Kepler light curves without careful consideration and due diligence by the end user, and dialog with the Science Office or Guest Observer Office where appropriate. Users are encouraged to notice and document artifacts, either in the raw or processed data, and report them to the Science Office at kepler-scienceoffice@lists.nasa.gov.



Users who neglect this Admonition risk seeing their works crumble into ruin before their time.

1. Introduction

These Data Release Notes provide information specific to the quarter of data currently being released. They have been drastically shortened relative to previous versions. The companion text has been moved to the Kepler Data Characterization Handbook (KSCI-19040). The section numbers and titles are identical in these Notes and that Handbook to assist the reader.

1.1 Dates, Cadence numbers, and units

Table 1: Contents of Release 9. CIN is the cadence interval number. All Release 9 cadence data were processed under KSOP-652 with SOC Pipeline 6.2, revision number r40414.

Q.m		First Cadence MJD midTime	Last Cadence MJD midTime	First Cadence UT midTime	Last Cadence UT midTime	Num CINs	Start CIN	End CIN
6	LC	55371.9473	55461.7939	06/24/10 22:44	09/22/10 19:03	4397	21069	25466
6.1	SC	55371.9375	55399.0317	06/24/10 22:29	07/22/10 00:45	39779	620530	660309
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6.3	SC	55431.6853	55461.8037	08/23/10 16:26	09/22/10 19:17	44219	708250	752469

2. Release Description

No changes from the Data Characteristics Handbook.

3. Evaluation of Performance

3.1 Overall

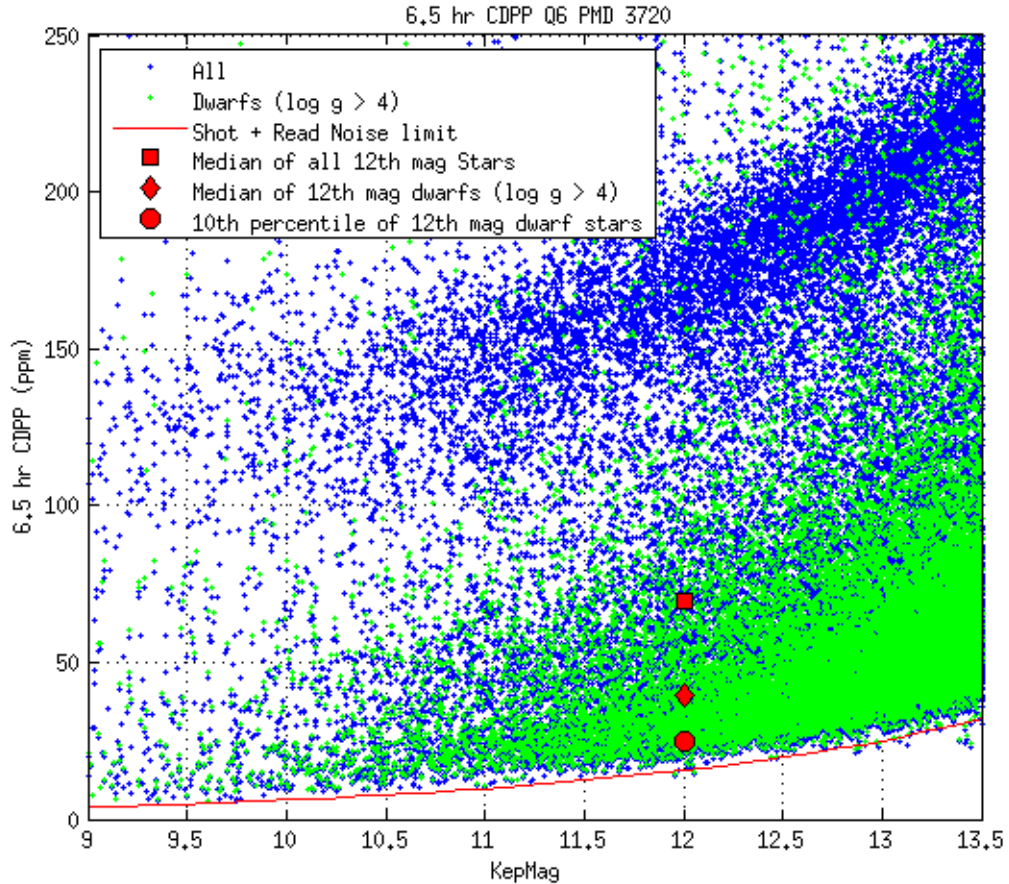


Figure 1: 6.5 hr Temporal Median (TM) of the Quarter 6 CDPP time series calculated by the TPS pipeline module for stars between 9th and 13.5th magnitude. The 6 hr TMCDDPs have been divided by $\sqrt{13/12} = 1.041$ to approximate 6.5 hr TMCDDPs. Stars on the planetary target list with Kepler Magnitude < 13.5 and $\log g > 4$, which are almost certainly dwarf stars, are shown as green '+'s; other stars are marked with blue '+'s.

Table 2: Aggregate Statistics for the TMCDDPs plotted in Figure 1: 6.5 hr Temporal Median (TM) of the Quarter 6 CDPP time series calculated by the TPS pipeline module for stars between 9th and 13.5th magnitude. The 6 hr TMCDDPs have been divided by $\sqrt{13/12} = 1.041$ to approximate 6.5 hr TMCDDPs. Stars on the planetary target list with Kepler Magnitude < 13.5 and $\log g > 4$, which are almost certainly dwarf stars, are shown as green '+'s; other stars are marked with blue '+'s.. Column Definitions: (1) Kepler Magnitude at center of bin. Bins are ± 0.25 mag, for a bin of width 0.5 mag centered on this value. (2) Number of dwarfs ($\log g > 4$) in bin. (3) 10th percentile TMCDDP for dwarfs in bin. (4) Median TMCDDP for dwarfs in bin. (5) Number of all stars in bin. (6) 10th percentile TMCDDP of all observed stars in bin. (7) Median TMCDDP for all stars in bin. (8) Simplified noise model CDPP.

Kepler mag at bin center	Number of dwarfs in bin	10 th percentile CDPP, dwarfs	Median CDPP, dwarfs	Number of all stars in bin	10 th percentile CDPP, all stars	Median CDPP, all stars	Lower envelope of model CDPP
9	31	9.8	37	180	13.2	89.5	3.8
10	160	12.1	34.6	567	14.7	100.3	6
11	607	18.5	33.8	1707	21.4	94.2	9.5
12	2169	24.9	39.2	4385	27	69.5	15.2
13	6767	36.4	50.9	10645	38.2	64.7	24.4

4. Historical Events

In this Section, we discuss cadences that may be lost to high-precision photometry due to planned or unplanned spacecraft events.

4.1 Kepler mission timeline to date

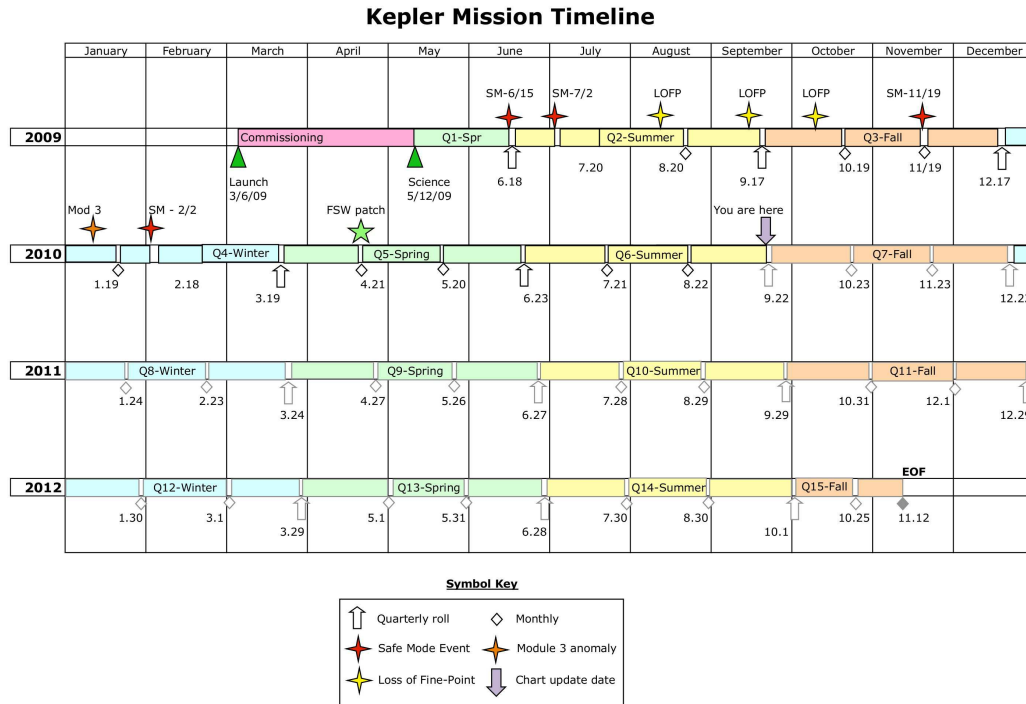


Figure 2: Kepler Mission Timeline as of end of Q6.

4.2 Safe Mode

No changes from the Data Characteristics Handbook.

4.3 Loss of Fine Point

No changes from the Data Characteristics Handbook.

4.4 Attitude Tweaks

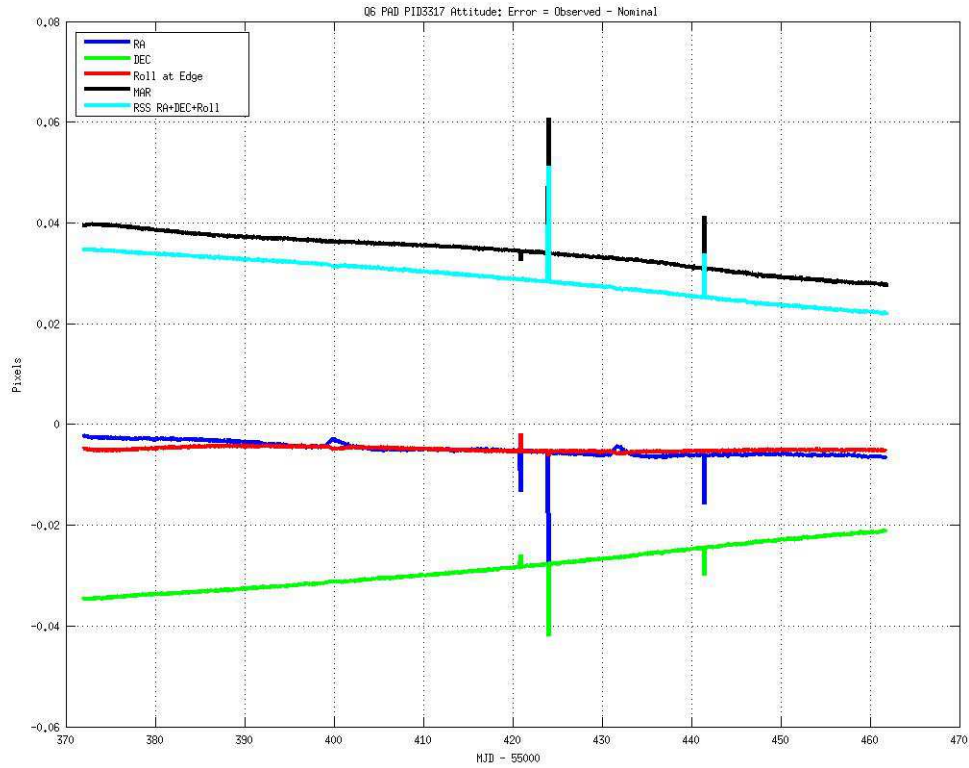


Figure 3: Attitude Error in Quarter 6, calculated by PAD using Long Cadence data.

4.5 Variable FGS Guide Stars

No changes from the Data Characteristics Handbook.

4.6 Module 3 Failure

No changes from the Data Characteristics Handbook.

5. Ongoing Phenomena

5.1 Image Motion

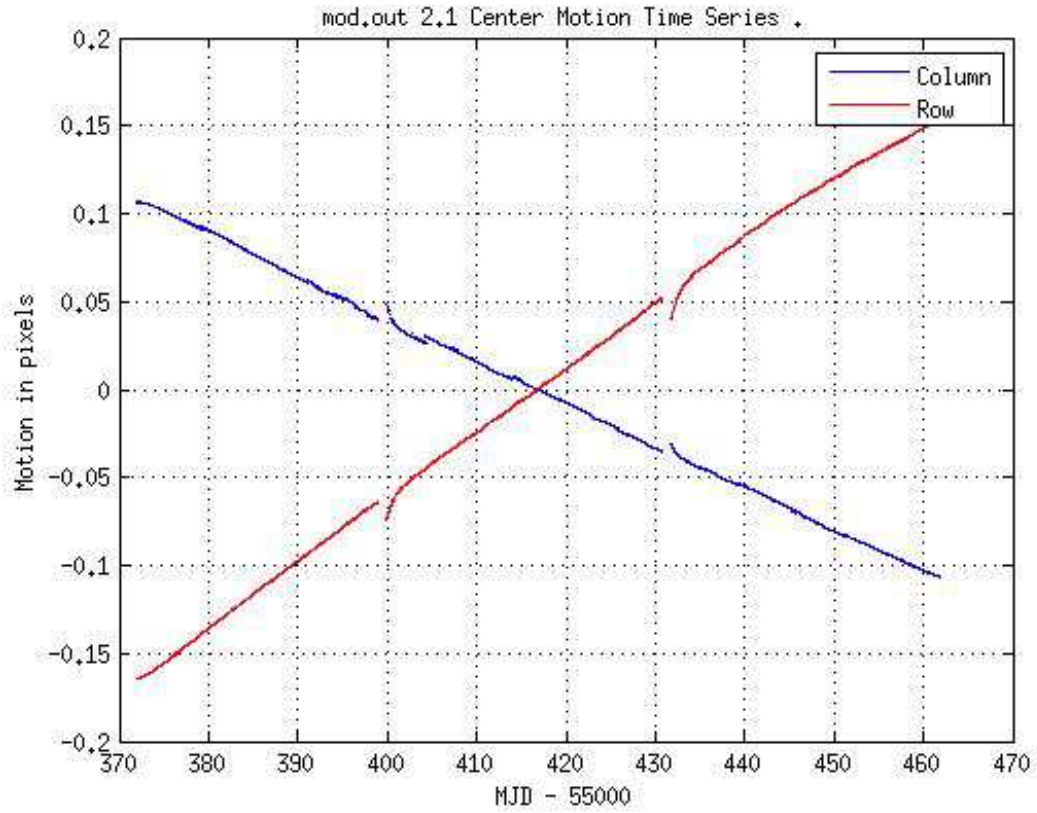


Figure 4: Mod out 2.1 Center motion time series. The gaps are monthly Earth contacts.

5.2 Focus Drift and Jitter

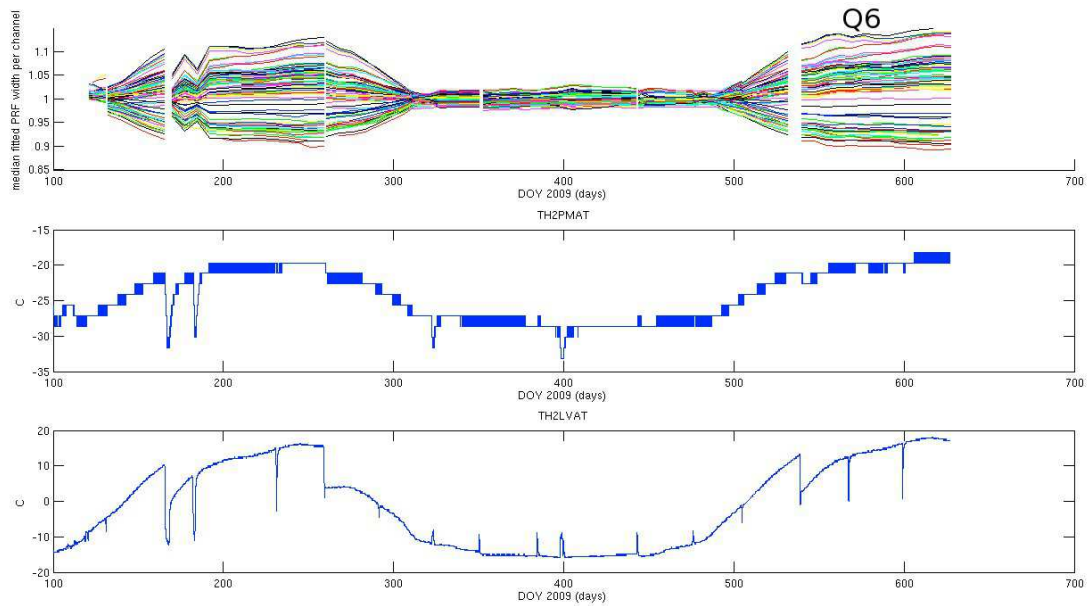


Figure 5: Correlation of variation in PRF width with various spacecraft temperatures, demonstrating the seasonal nature of focus and PRF changes.

5.3 Momentum Desaturation

Table 3: Momentum dumps in Q6 and the corresponding Long and Short Cadences. CIN = cadence interval number, RCI = relative cadence index.

LC	CIN	RCI	Date (MJD)
	21150	82	55373.60245
	21296	228	55376.58576
	21442	374	55379.56906
	21588	520	55382.55237
	21734	666	55385.53567
	21880	812	55388.51898
	22026	958	55391.50229
	22172	1104	55394.48559
	22318	1250	55397.46890
	22393	1325	55399.00142
	22538	1470	55401.96429
	22684	1616	55404.94760
	22830	1762	55407.93090
	22976	1908	55410.91421
	23122	2054	55413.89752
	23268	2200	55416.88082

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23414	2346	55419.86413
23560	2492	55422.84743
23706	2638	55425.83074
23852	2784	55428.81405
23947	2879	55430.75524
24093	3025	55433.73852
24239	3171	55436.72183
24385	3317	55439.70514
24531	3463	55442.68844
24677	3609	55445.67175
24822	3754	55448.63462
24968	3900	55451.61793
25114	4046	55454.60123
25260	4192	55457.58454
25406	4338	55460.56784
25465	4397	55461.77343

SC
CIN RCI Date(MJD)

(Month 1)

622970	2441	55373.59938
622971	2442	55373.60007
627350	6821	55376.58269
627351	6822	55376.58337
631730	11201	55379.56600
631731	11202	55379.56668
636110	15581	55382.54930
636111	15582	55382.54998
640490	19961	55385.53261
640491	19962	55385.53329
644870	24341	55388.51592
644871	24342	55388.51660
649250	28721	55391.49922
653630	33101	55394.48253
658010	37481	55397.46583
660260	39731	55398.99835

(Month 2)

664610	3071	55401.96123
668990	7451	55404.94453
673370	11831	55407.92784
677750	16211	55410.91115
682130	20591	55413.89445
686510	24971	55416.87776
690890	29351	55419.86106
695270	33731	55422.84437
699650	38111	55425.82768
704030	42491	55428.81098
706880	45341	55430.75217

(Month 3)

711260	3011	55433.73546
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```

715640 7391 55436.71876
720020 11771 55439.70207
720021 11772 55439.70275
724400 16151 55442.68538
728780 20531 55445.66868
733130 24881 55448.63156
733131 24882 55448.63224
737510 29261 55451.61486
737511 29262 55451.61554
741890 33641 55454.59817
741891 33642 55454.59885
746270 38021 55457.58147
746271 38022 55457.58215
750650 42401 55460.56478
750651 42402 55460.56546
752420 44171 55461.77036
    
```

5.4 *Reaction Wheel Zero Crossings*

Table 4: Zero crossing events in Q6, defined as the time from first to last zero crossing in the event, rounded to the nearest Cadence. The corresponding cadence numbers for SC are in the supplement.

Event #	MJD Start	MJD End	CIN Start	CIN End	RCI Start	RCI End	NumTLM Samp
1	55379.569	55379.957	21442	21461	374	393	280
2	55382.552	55382.695	21588	21595	520	527	103
3	55388.499	55388.601	21879	21884	811	816	55
4	55397.469	55397.510	22318	22320	1250	1252	29
5	55410.894	55410.935	22975	22977	1907	1909	16

5.5 *Downlink Earth Point*

No changes from the Data Characteristics Handbook.

5.6 *Manually Excluded Cadences*

No changes from the Data Characteristics Handbook.

5.7 *Incomplete Apertures Give Flux and Feature Discontinuities at Quarter Boundaries*

No changes from the Data Characteristics Handbook.

5.8 Argabrightening

Table 5: Q6 LC Argabrightening Events with amplitude $T_{MAD} > 10$, and occurring on a number of channels $T_{MCE} > 10$. The columns are (1) CIN = Cadence Interval Number for Argabrightening cadences, (2) RCI = relative cadence index for Argabrightening cadences, (3) Date = Arg cadence mid-Times, MJD, (4) Mean Argabrightening statistic over Channels of Arg Event $\langle S_{Arg} \rangle_{FPA}$ (5) N_{chan} = Channels exceeding threshold in Arg cadence, (6) N_{pipe} = Channels exceeding default (pipeline) threshold in Arg cadence. MAD is calculated on a channel-by-channel basis.

CIN	RCI	Mid-Times (MJD)	$\langle S_{Arg} \rangle$	N_{chan}	N_{pipe}
21601	533	55382.81801	17.4	68	0
21724	656	55385.33134	7.2	18	0
21836	768	55387.61990	7.6	19	0
22014	946	55391.25708	8.5	26	0
22169	1101	55394.42429	8.2	23	0
22296	1228	55397.01936	7.8	21	0
23130	2062	55414.06099	8.3	27	0
23465	2397	55420.90624	62.4	69	13
23466	2398	55420.92668	15.4	27	1
23616	2548	55423.99172	100.0	80	36
23944	2876	55430.69394	4.9	11	0
23945	2877	55430.71437	7.4	18	0
23946	2878	55430.73481	10.5	30	0
23948	2880	55430.77567	18.9	59	0
24061	2993	55433.08465	14.0	56	0
24386	3318	55439.72557	7.8	16	0
24427	3359	55440.56335	36.9	79	0
24470	3402	55441.44199	66.3	80	13
24640	3572	55444.91570	6.8	22	0
24796	3728	55448.10335	3.3	13	0
24994	3926	55452.14920	7.4	12	0
25111	4043	55454.53993	10.0	34	0
25334	4266	55459.09662	18.2	67	0

Table 6: Q6 SC Argabrightening Events with amplitude $T_{MAD} > 10$, and occurring on a number of channels $T_{MCE} > 10$. The columns have the same meanings as Table 5: Q6 LC Argabrightening Events with amplitude $T_{MAD} > 10$, and occurring on a number of channels $T_{MCE} > 10$. The columns are (1) CIN = Cadence Interval Number for Argabrightening cadences, (2) RCI = relative cadence index for Argabrightening cadences, (3) Date = Arg cadence mid-Times, MJD, (4) Mean Argabrightening statistic over Channels of Arg Event $\langle S_{Arg} \rangle_{FPA}$ (5) N_chan = Channels exceeding threshold in Arg cadence, (6) N_pipe = Channels exceeding default (pipeline) threshold in Arg cadence. MAD is calculated on a channel-by-channel basis. Note consecutive detections of the largest events. A horizontal line separates the 3 Months of the Quarter. The relative cadence index (RCI) is reset at the start of each Month.

CIN	RCI	Mid-Times (MJD)	$\langle S_{Arg} \rangle$	N_chan	N_pipe
636501	15972	55382.81562	17.6	69	0
640187	19658	55385.32623	8.4	23	0
648880	28351	55391.24721	9.3	30	0
665777	4238	55402.75609	7.1	15	0
692439	30900	55420.91612	71.1	66	42
692440	30901	55420.91680	15.7	22	6
696948	35409	55423.98729	44.0	76	16
696949	35410	55423.98797	66.0	69	37
710291	2042	55433.07545	8.3	21	0
720044	11795	55439.71842	6.0	12	2
721281	13032	55440.56096	33.8	77	3
722571	14322	55441.43961	12.7	43	0
722572	14323	55441.44029	17.2	56	1
722573	14324	55441.44097	29.3	73	4
727678	19429	55444.91809	6.3	20	0
748502	40253	55459.10173	9.7	32	0

5.9 Background Time Series

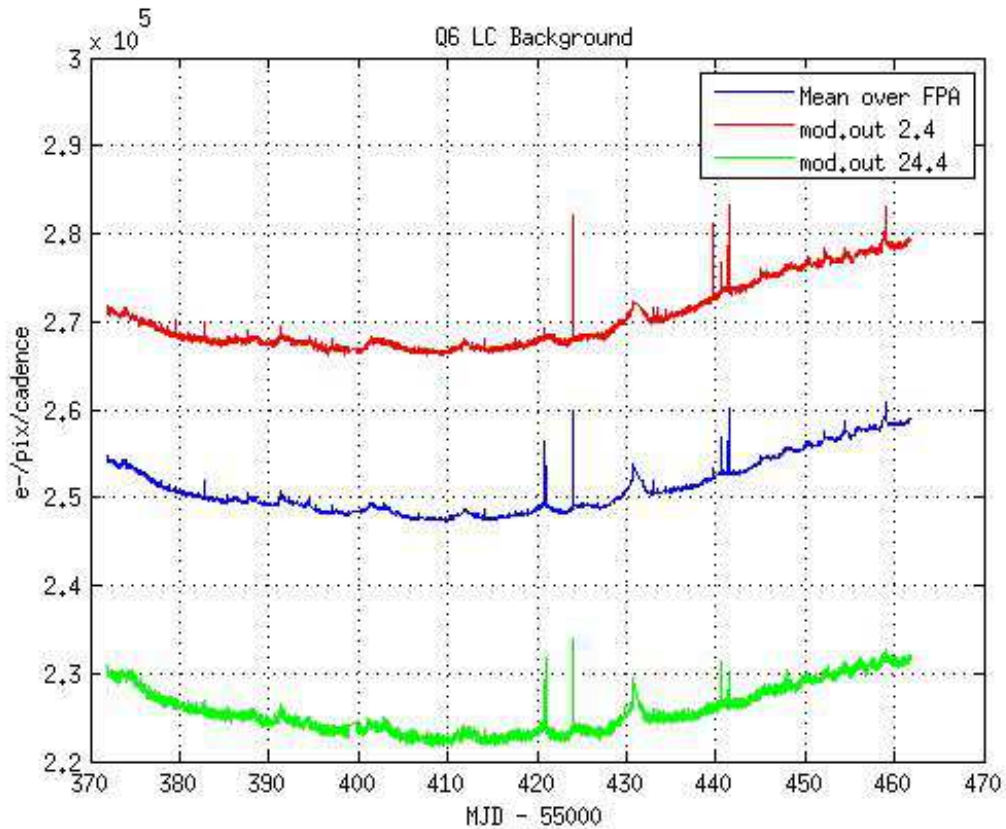


Figure 6: Background time series for Q6 showing the average over all the modules, and the modules furthest from (2.4) and nearest to (24.4) the Galactic plane. The narrow spikes are Argabrightening events.

5.10 Pixel Sensitivity Dropouts

No changes from the Data Characteristics Handbook.

5.11 Short Cadence Requantization Gaps

No changes from the Data Characteristics Handbook.

5.12 Spurious Frequencies in SC Data

No changes from the Data Characteristics Handbook.

5.13 Anomaly Summary Table

Machine readable CINs for the anomalies below are in the Data Supplement.

Table 7: Anomaly Summary Table for Long and Short Cadences

LC CIN			
Start	End	Anomaly Type	Note
21069	21069	EARTH POINT	Monthly science data downlink
22395	22436	EARTH POINT	Monthly science data downlink
23949	23992	EARTH POINT	Monthly science data downlink
23465	23466	ARGABRIGHTENING	See Section 5.8.
23616	23616	ARGABRIGHTENING	
24470	24470	ARGABRIGHTENING	

SC CIN			
Start	End	Anomaly Type	Note
622969	622980	COARSE POINT	See Section 5.3 for Momentum desaturations.
627349	627360	COARSE POINT	
631729	631740	COARSE POINT	
636109	636120	COARSE POINT	
640489	640500	COARSE POINT	
644869	644880	COARSE POINT	
649249	649260	COARSE POINT	
653629	653640	COARSE POINT	
658009	658020	COARSE POINT	
660259	660270	COARSE POINT	
664609	664620	COARSE POINT	
668989	669000	COARSE POINT	
673369	673380	COARSE POINT	
677749	677760	COARSE POINT	
682129	682140	COARSE POINT	
686509	686520	COARSE POINT	
690889	690900	COARSE POINT	
695269	695280	COARSE POINT	
696949	696949	COARSE POINT	
699649	699660	COARSE POINT	
704029	704040	COARSE POINT	
706879	706890	COARSE POINT	
692439	692440	ARGABRIGHTENING	See Section 5.8
696948	696949	ARGABRIGHTENING	
711259	711270	COARSE POINT	See Section 5.3 for Momentum desaturations.
715639	715650	COARSE POINT	
720019	720030	COARSE POINT	
724399	724410	COARSE POINT	
728779	728790	COARSE POINT	
733129	733140	COARSE POINT	
737509	737520	COARSE POINT	
741889	741900	COARSE POINT	
746269	746280	COARSE POINT	

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750649	750660	COARSE POINT	
750970	751029	COARSE POINT	
752419	752430	COARSE POINT	

6. Time and Time Stamps

No changes from the Data Characteristics Handbook.

7. Contents of Supplement

The Supplement is available as a full package (DataReleaseNotes_09_SupplementFull.tar), which contains the files described below.

Pipeline Instance Detail Reports

Q6_LC_r6.2_ksop652_PA_+PDC_with_mpe_asrun_Pipeline_Instance_Detail_Report_110104.txt
Q6_SCM1_r6.2_ksop652_with_mpe_as-run_Pipeline_Instance_Detail_Report_110104.txt
Q6_SCM2_r6.2_ksop652_with_mpe_as-run_Pipeline_Instance_Detail_Report_110104.txt
Q6_SCM3_r6.2_ksop652_with_mpe_as-run_Pipeline_Instance_Detail_Report_110104.txt

Data Anomaly Types

DataAnomalyTypes_Q6_LC_PID3197_Summary.txt
DataAnomalyTypes_Q6M1_SC_PID3217_Summary.txt
DataAnomalyTypes_Q6M2_SC_PID3237_Summary.txt
DataAnomalyTypes_Q6M3_SC_PID3277_Summary.txt

Mod.out Central Motion

Q6_central_row_motion.txt
Q6_central_column_motion.txt

Average LDE board Temperature

Q6_LDE_averageBoardTemp.txt
Q6_TH12LVAT_MJD_gap.txt
Q6_TH1RW34T_MJD_gap.txt

Background Time Series

Q6_SCM1_background.txt
Q6_SCM2_background.txt
Q6_SCM3_background.txt
Q6_LC_background.txt

Flight System Events

Argabrightening Detections

ArgAgg_Q6_LC_PID3197_MADT010_MCT10_Summary.txt
ArgAgg_Q6M1_SC_PID3557_MADT010_MCT10_Summary.txt
ArgAgg_Q6M2_SC_PID3577_MADT010_MCT10_Summary.txt
ArgAgg_Q6M3_SC_PID3597_MADT010_MCT10_Summary.txt

Out of Fine Point Cadence Lists

Q6M1_SC_isNotFinePoint.txt
Q6M2_SC_isNotFinePoint.txt
Q6M3_SC_isNotFinePoint.txt
Q6_LC_isNotFinePoint.txt

Zero Crossing Events

Q6_Dec21_SC_ZeroCrossings.txt
Q6_Dec21_LC_ZeroCrossings.txt

Short Supplement Package

The Supplement also contains a short package suitable for emailing (DataReleaseNotes_09_SupplementSmall.tar). The small package does not contain the following files:

13Dec_SC_Q6M1_background.txt
13Dec_SC_Q6M2_background.txt
13Dec_SC_Q6M3_background.txt
Dec13_LC_Q6_background.txt

13Dec_Q6_LC_central_row_motion.txt
13Dec_Q6_LC_central_column_motion.txt
Q6_TH12LVAT_MJD_gap.txt
Q6_TH1RW34T_MJD_gap.txt

8. References

No changes from Data Characteristics Handbook.