
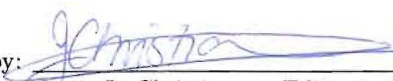


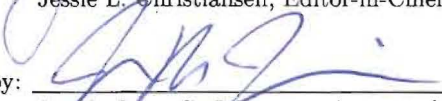
Kepler Data Release 20 Notes

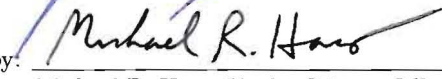
Q15

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1 Introduction

These Data Release Notes provide information specific to the release of Q15 data, processed with SOC Pipeline 9.0. These Notes contain the summary figures and tables for this quarter. The Kepler Data Characteristics Handbook (Christiansen et al., 2012) discusses most of the known phenomena found in the Kepler data in more detail.

1.1 Dates and Cadence Numbers for Q15

Contents of Data Release 20–Cadence Data

Q.m		First Cadence MJD midTime	Last Cadence MJD midTime	First Cadence UT midTime	Last Cadence UT midTime	Num CINs	Start CIN	End CIN
15	LC	56205.9855	56303.6377	05-Oct-2012 23:39:07	11-Jan-2013 15:18:15	4780	61886	66665
15.1	SCM1	56205.9756	56236.8093	05-Oct-2012 23:24:53	05-Nov-2012 19:25:19	45270	1845040	1890309
15.2	SCM2	56237.7703	56267.8887	06-Nov-2012 18:29:14	06-Dec-2012 21:19:47	44220	1891720	1935939
15.3	SCM3	56268.7272	56303.6476	07-Dec-2012 17:27:10	11-Jan-2013 15:32:29	51270	1937170	1988439

Contents of Data Release 20–Full Frame Images

Q	Class	Flannel	UT Start	UT End
Q15	FFI	KPLR2012310200152	2012-11-05 19:32:27	2012-11-05 20:01:52
Q15	FFI	KPLR2012341215621	2012-12-06 21:26:56	2012-12-06 21:56:21
Q15	FFI	KPLR2013011160902	2013-01-11 15:39:37	2013-01-11 16:09:02

1.2 The SOC Pipeline for Q15

Data Release 20 was processed with the SOC Pipeline 9.0. For details on how Kepler processes the data through the front-end of the pipeline (modules CAL, PA, PDC), please see the Data Processing Handbook (Fanelli et al., 2011). Notable changes and improvements to the pipeline in 9.0 include the following:

- The light curve files contain new keywords in the first data extension to inform the user about how PDC performed on the individual target. First, the PDCMETHOD keyword indicates whether the light curve in the PDCSAP_FLUX column of the FITS files was computed using regular MAP or the msMAP algorithm. Second, the goodness metrics used by PDC now includes an earth point goodness metric. As with all the goodness metrics, both the value and the percentile compared with targets on the same channel is reported in the FITS headers. Third, the headers describe the number of Sudden Pixel Sensitivity Dropouts (SPSDs) detected and corrected using the keywords NSPSDET and NSPSDCOR. For more details on these keywords, see the Archive Manual (Thompson & Fraquelli, 2012).
- The exporter module now correctly reports all barycentric times in the data products in TDB (terrestrial dynamic time). See section 3.1 for more details.

1.3 Kepler Mission Timeline to Date

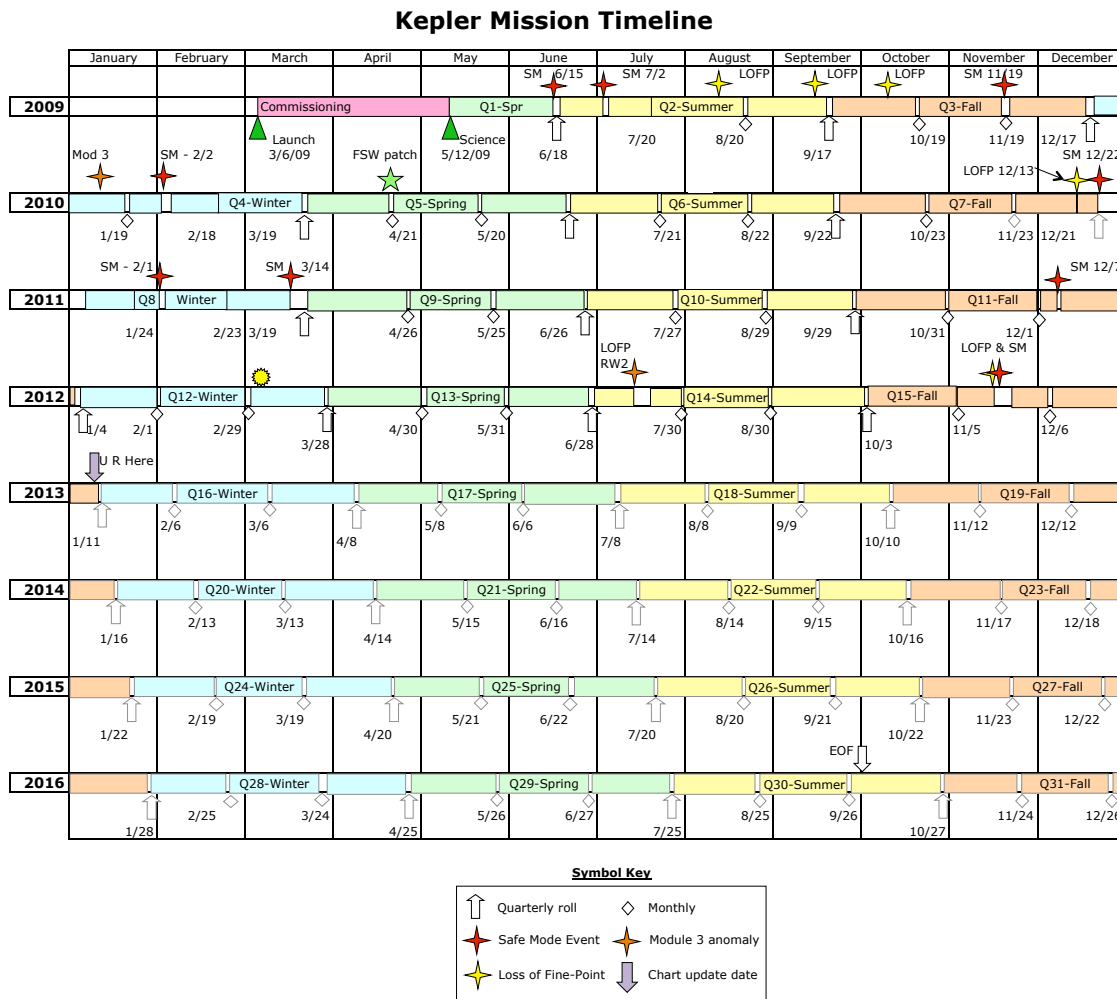


Figure 1: Kepler Mission Timeline as of the end of Q15. All future dates are tentative and subject to change.

2 Data Quality in Q15

2.1 Evaluation of CDDP

To understand the overall performance of the pipeline, we show the Temporal Median (TM) of the CDDP time series as calculated by the TPS pipeline for different versions of the SOC pipeline (Figure 2). We also provide the CDDP statistics for Q15 binned by magnitude in Table 1. The algorithm to calculate CDDP changed in Q13, generally causing slightly lower values of CDDP (see Data Release Notes 19).

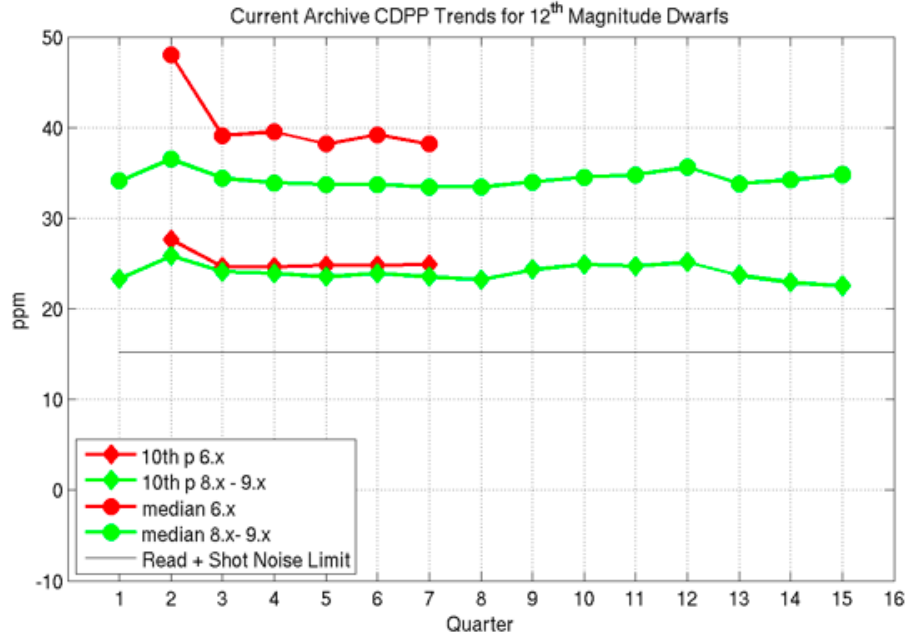


Figure 2: 6.5-h Temporal Median of the CDDP time series. The median (circles) and 10th percentile value (diamonds) are given for all dwarf stars between $Kp=11.75-12.25$. The 6-h TMCDDPs have been divided by $\sqrt{13/12} = 1.041$ to approximate 6.5-h TMCDDPs. A detailed discussion of the CDDP values is given in the Kepler Data Characteristics Handbook. The 6.x, 8.x, and 9.x labels, given in the legend, refer to the version of the SOC pipeline used.

Table 1: Aggregate statistics for the TMCDPPs by magnitude. Column Definitions: (1) Kepler Magnitude at the center of the 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 the bin. (3) 10th percentile TMCDPP for dwarfs in the bin. (4) Median TMCDPP for dwarfs in the bin. (5) Number of all stars in the bin. (6) 10th percentile TMCDPP of all observed stars in the bin. (7) Median TMCDPP for all stars in the bin. (8) Simplified noise model CDPP.

Kp mag	No. dwarfs	10th prctile	Median	No. stars	10th prctile	Median	Noise model
9.0	50	8.3	17.8	181	9.5	42.6	3.8
10.0	161	11.6	29.5	572	12.5	54.7	6.0
11.0	601	16.6	29.7	1706	18.5	64.5	9.5
12.0	2156	22.5	34.8	4178	23.8	53.1	15.2
13.0	6826	32.6	44.2	9826	33.7	51.9	24.4
14.0	14143	50.2	65.0	16394	50.8	67.2	40.1
15.0	27944	87.6	114.4	27948	87.7	114.4	68.8
16.0	14487	158.6	204.3	14487	158.6	204.3	127.8

2.2 Summary of Data Anomalies

Certain cadences are flagged to indicate a possible reduction of quality. See the `QUALITY` and `SAP_QUALITY` columns of the target pixel and light curve files, respectively. Cadences with data anomalies that affect the entire focal plane are shown in Figure 3. The meaning of the flags are explained in the Data Characteristics Handbook (Christiansen et al., 2012) and Archive Manual (Thompson & Fraquelli, 2012).

A few notable anomalies occurred during Q15. One safe mode occurred during Q15 following a loss of fine point. The lack of zero crossing events during Q15 is a result of an operational change that prevents the reaction wheels from having a speed near zero. The earth point that occurred before month three of Q15 was inadvertently not flagged for this data release. The cadence range of this earth point is 64916–64956. The earth point will be flagged in future releases of the Q15 data.

Clarifications on select flags in Figure 3 are listed here:

- `ARGABRIGHTENING` refers to cadences where the multiple-channel Argabrightening flag (flag 0x07, decimal value 64) was set. The single channel Argabrightening flag (0x0D, decimal value 4096) is not represented on this plot.
- `COARSE_POINT` refers to cadences where the pointing of the telescope drifted by more than 0.5 millipixels from the nominal value. `NOT_FINE_POINT` refers to cadences where the telescope’s fine guidance sensor reported that the telescope was not in fine point mode. These flags are combined as flag 0x03 (decimal value 4) in the FITS files.
- `LDE_FLAG` refers to flags set by the Spacecraft when a error was detected in the Local Detector Electronics (LDE) or the on-board memory. The pipeline does not process these cadences; only raw pixels are available.

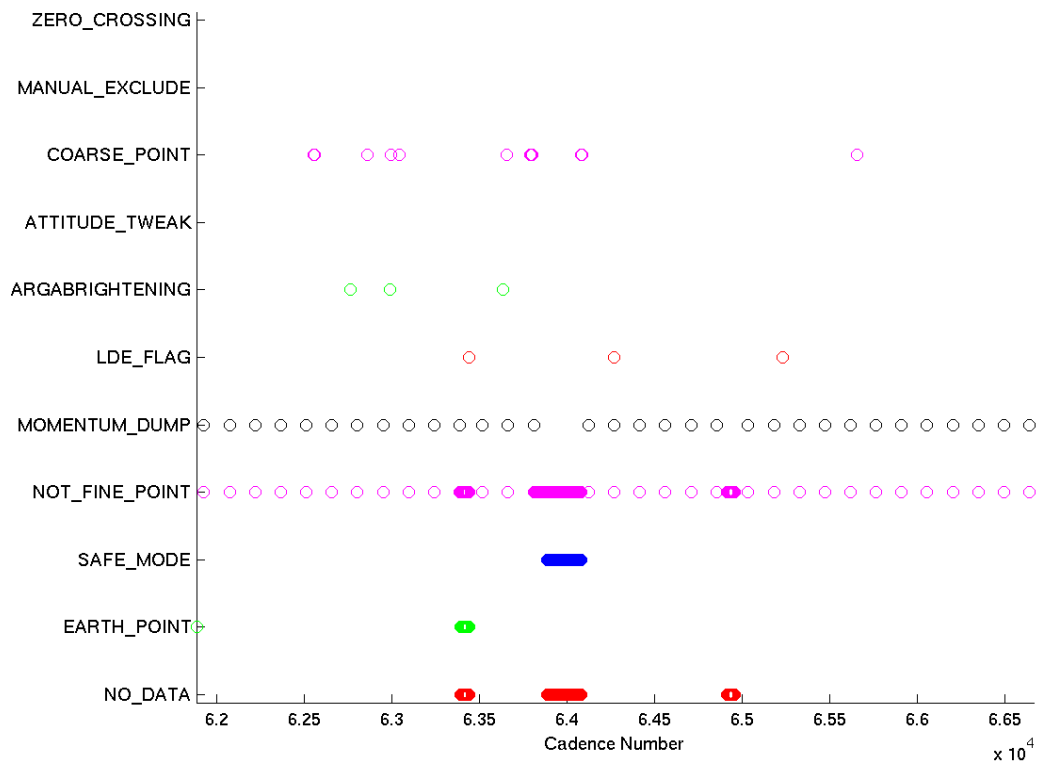


Figure 3: An overview of the location of the data anomalies flagged in Q15. “No_Data” is not an anomaly flag and simply indicates those cadences with no data collected (e.g., during Earth-point or Safe Mode events).

3 Notable Features of the Q15 Data

In this section we discuss features of the data that occurred during collection or processing that are either new to Q15, significantly different than previous quarters, or not discussed in the Data Characteristics Handbook (Christiansen et al., 2012). A more complete listing of events that are known to affect the data are discussed in the Data Characteristics Handbook.

3.1 Time and Time Stamps

Unlike previous data releases, the barycentric times in Q15 have been correctly reported in terrestrial dynamic time (TDB). Previous data releases reported times in UTC (a ~ 66 second offset from TDB). For a more detailed description of the issue, please see Data Release Notes 19. From Q15 onward, all data products will have barycentric times reported in the TDB time system.

The FITS light curve files for Q0–Q14, with barycentric times reported in TDB, will be released immediately after the ingest of the Q15 data at MAST. Once ingest of data release 21 is complete, all light curve files and FFIs at the MAST will have barycentric times reported in the same time system (TDB).

WARNING: While the barycentric times in the Q15 target pixel files are in TDB, **the Q0–Q14 target pixel files are not and will not be re-exported as part of data release 21.** As such, there will be a discontinuity in the barycentric times reported in the target pixel files (between Q14 and Q15). Users of the target pixel files are encouraged to use the time stamps from the light curve files until the correction can be made to these remaining data products.

3.2 Missing Earth Point Flag

Cadences between 64916 and 64956 are not marked as an earth point. Besides missing in the QUALITY column of the FITS files, this has an impact on one of the PDC metrics. The PDC module uses the earth point flag to determine which cadences to include in the calculation of the earth point goodness metric. It does not use the flag to decide how to correct the earth point thermal recoveries. Therefore, the earth point goodness metric in Q15 may not be as accurate a metric as it would have been if these cadences were appropriately flagged. The earth point will be correctly flagged for the next reprocessing of the Q15 data.

References

- Christiansen, J. L., Van Cleve, J. E., Jenkins, J. M., Caldwell, D. A., Barclay, T., Bryson, S., Burke, C. J., Twicken, J. D., & Uddin, A. K. (2012). Kepler Data Characteristics Handbook. *KSCI-19040-004*.
- Fanelli, M. N., Jenkins, J. M., Bryson, S. T., Quintana, E. V., Twicken, J. D., Wu, H. W., Tenenbaum, P., Allen, C. L., Caldwell, D. A., Chandrasekaran, H., Christiansen, B. D., & Uddin, A. K. (2011). Kepler Data Processing Handbook. *KSCI-19081-001*.
- Thompson, S. E., & Fraquelli, D. (2012). Kepler Archive Manual. *KDMC-10008-005*.