

# KIC 007038096

## Q1-17 DR25 TCE Parameters

TCE	Run Type	KOI?	Period (Days)	Epoch (BKJD)	Depth (ppm)	Duration (Hours)	MES	SNR	$R_{\star}$ ( $R_{\odot}$ )	$T_{\star}$ (K)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
007038096-01	OBS	4020.01	1.133569	131.815272	93.8	1.263	9.5	14.1	1.10	6147	1.26	3016.41
007038096-02	OBS	No	0.566809	131.796211	110.0	1.534	16.0	18.2	1.10	6147	1.36	7600.43

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
007038096-01	OBS	FP	0.00	0	1	0	1	MOD_SEC_DV—MOD_SEC_ALT—HAS_SEC_TCE—CENT_FEW_DIFFS—EPHEM_MATCH
007038096-02	OBS	FP	0.00	1	1	0	1	IS_SEC_TCE—EPHEM_MATCH

**Notes:** OBS = Observed. INJ = Injected. INV = Inverted. SCR = Scrambled.

N = Not Transit-Like. S = Stellar Eclipse. C = Centroid Offset. E = Ephemeris Match.

See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 007038096-01

TCE (1)	KIC	Parent (2)	Parent KIC	$P_1:P_2$	Dist ( $\mu$ )	$\Delta$ Row	$\Delta$ Col	$m_2$	$m_1$	$D_2/D_1$	Mechanism	Flag	$\sigma_P$	$\sigma_T$
007038096-01	7038096	RR-Lyr-pri	7198959	2:1	4900.3	836	-1	7.86	14.65	6630.80	Col-Anomaly	0	1.38	0.97

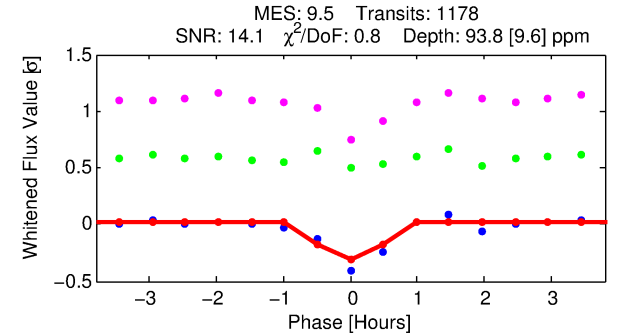
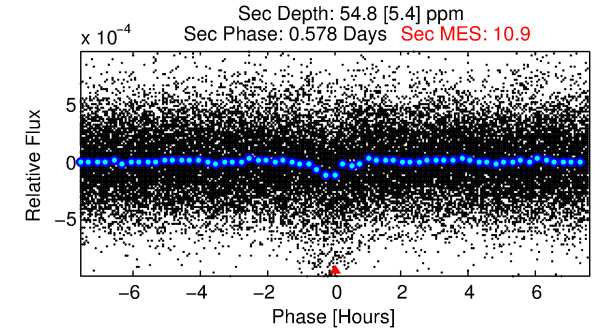
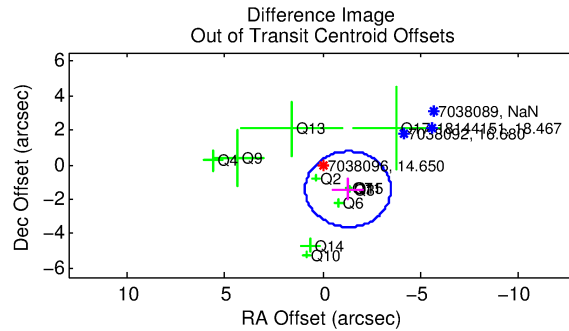
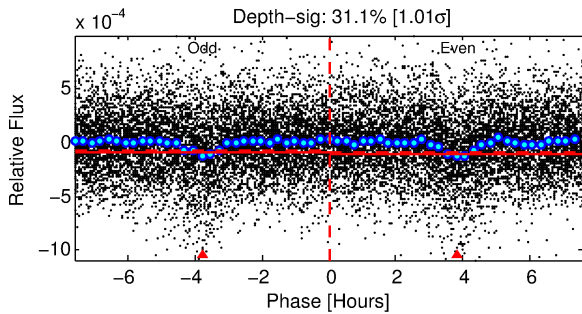
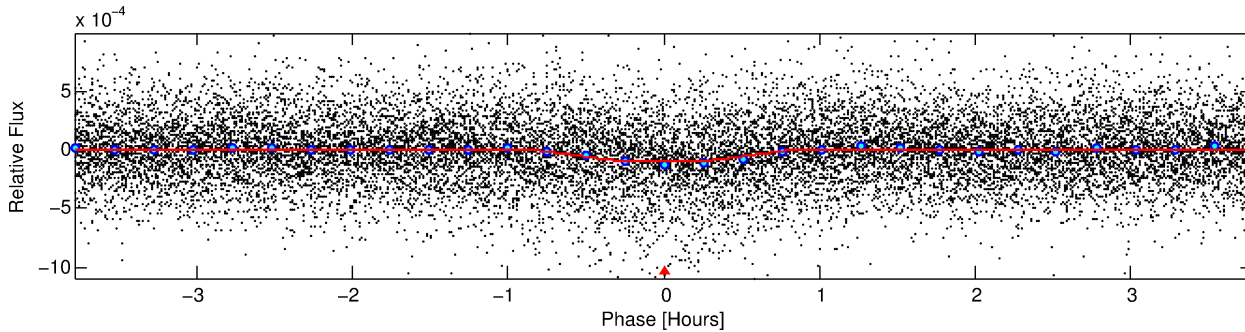
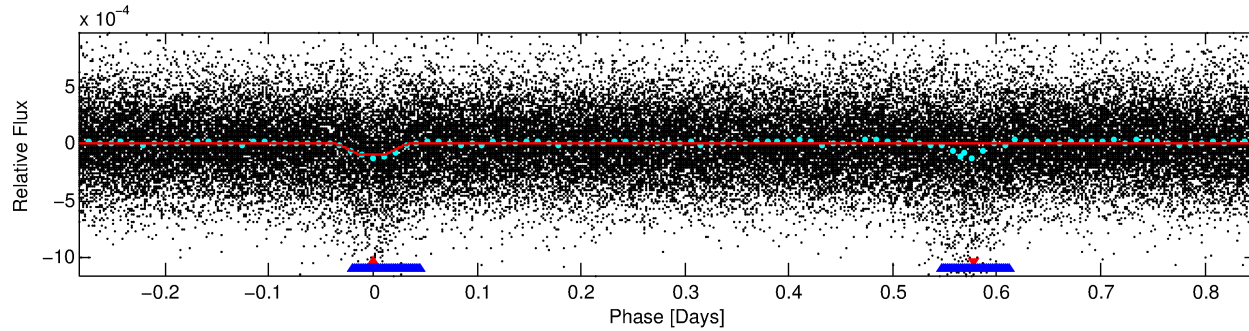
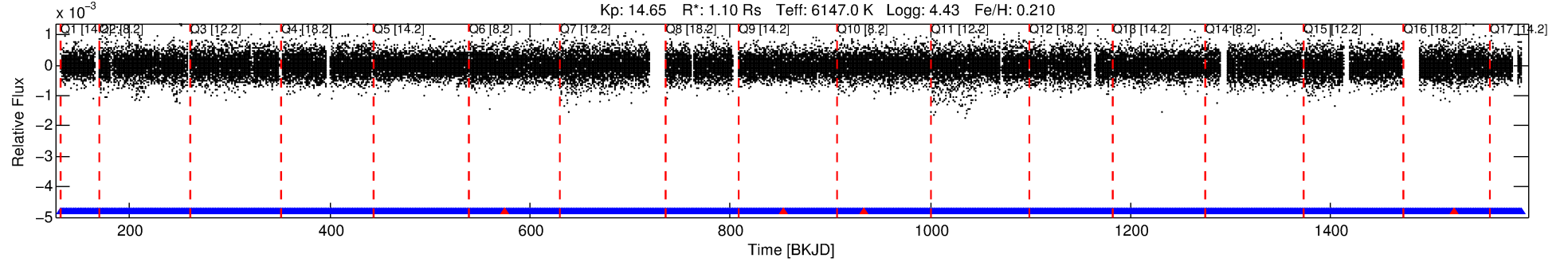
**Notes:**  $P_1:P_2$  is the period ratio. Dist is the distance in arcseconds.  $\Delta$ Row and  $\Delta$ Col are the number of pixels apart in row and column.  $m_2$  and  $m_1$  are the magnitudes of the parent and child.  $D_2/D_1$  is the parent's transit depth divided by the child's.  $\sigma_P$  and  $\sigma_T$  are the significance of the match in period and epoch. For a match to be considered significant  $\sigma_P < 5.0$  and  $\sigma_T < 5.0$ . Matches which have  $\sigma_P$  and  $\sigma_T$  very close to this cutoff should receive extra scrutiny, especially if the period ratio is very large.

# DV One-Page Summary

KIC: 7038096 Candidate: 1 of 2 Period: 1.134 d

KOI: K04020 Corr: No Ephemeris Match

Kp: 14.65 R\*: 1.10 Rs Teff: 6147.0 K Logg: 4.43 Fe/H: 0.210



## DV Fit Results:

Period = 1.13357 [0.00001] d  
Epoch = 131.8153 [0.0014] BKJD  
Rp/R\* = 0.0106 [0.0058]  
a/R\* = 3.25 [8.30]  
b = 0.90 [0.59]  
Seff = 3016.41 [1128.48]  
Teff = 1890 [177] K  
Rp = 1.26 [0.78] Re  
a = 0.0226 [0.0053] AU  
Ag = 9.62 [11.14] [0.77σ]  
Teffp = 5145 [1433] K [2.25σ]

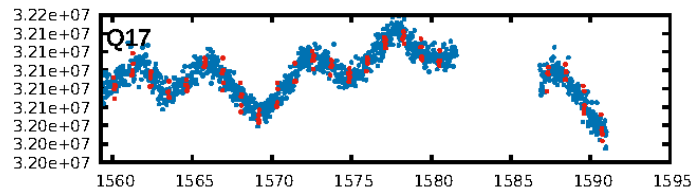
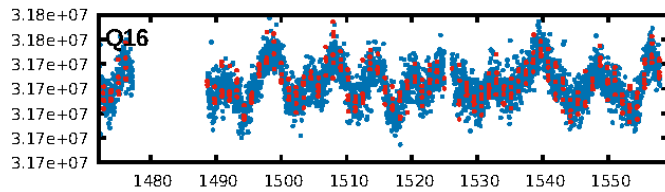
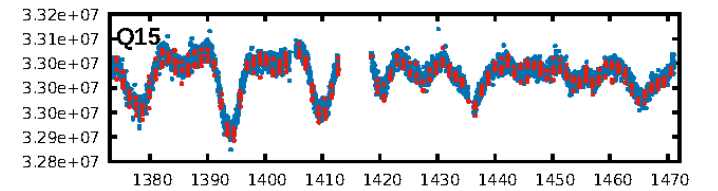
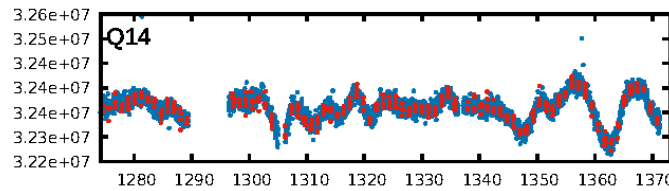
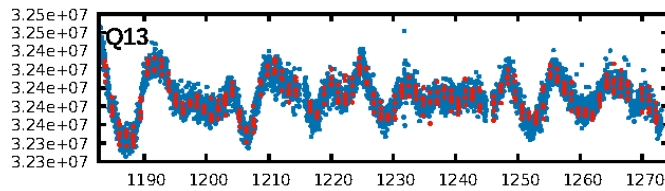
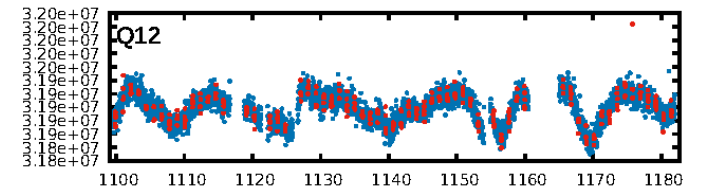
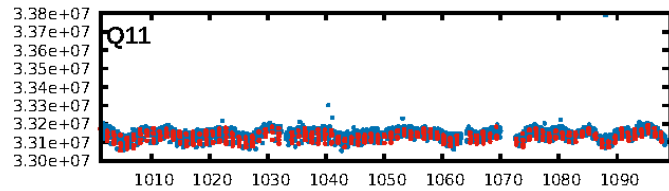
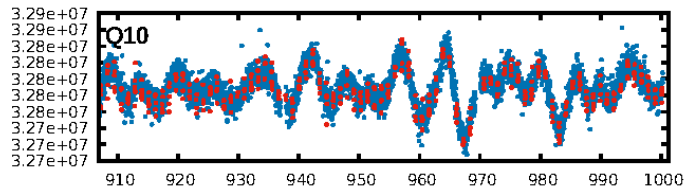
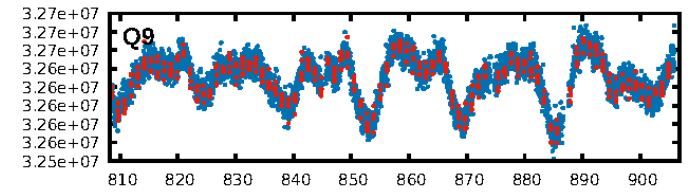
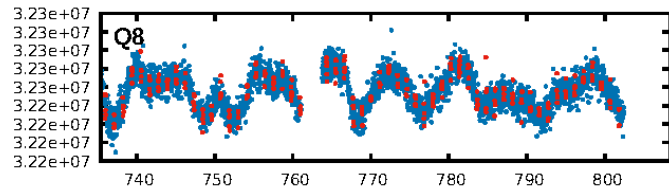
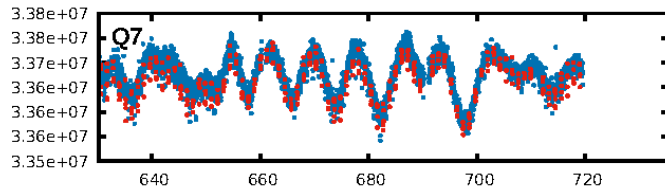
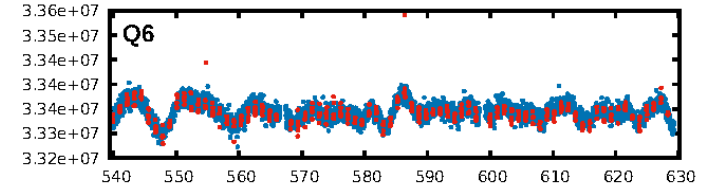
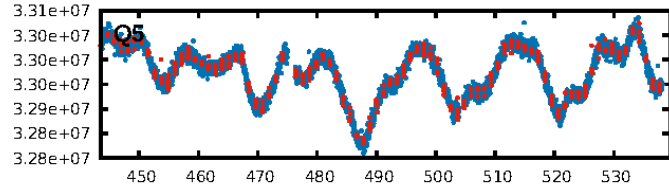
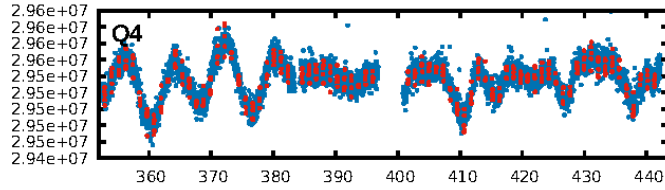
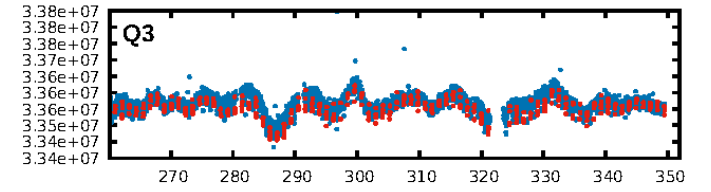
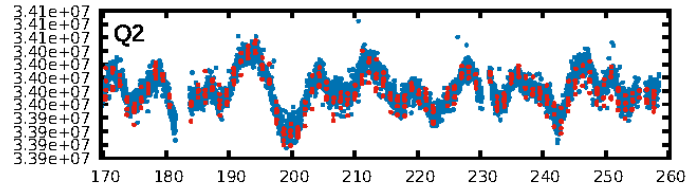
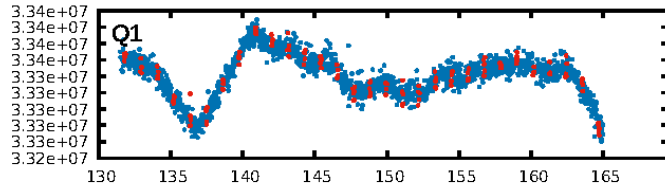
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [6.85σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: 8.46e-23  
RollingBand-fgt: 1.00 [1121/1125]  
GhostDiagnostic-chr: 0.3195  
Centroid-sig: 40.3%  
Centroid-so: 0.729 arcsec [0.80σ]  
OotOffset-rm: 1.920 arcsec [2.63σ]  
OotOffset-st: 4/4/1/3 [12]  
KicOffset-rm: 2.090 arcsec [3.24σ]  
KicOffset-st: 4/4/1/3 [12]  
DiffImageQuality-fgm: 0.17 [2/12]  
DiffImageOverlap-fno: 0.00 [0/17]

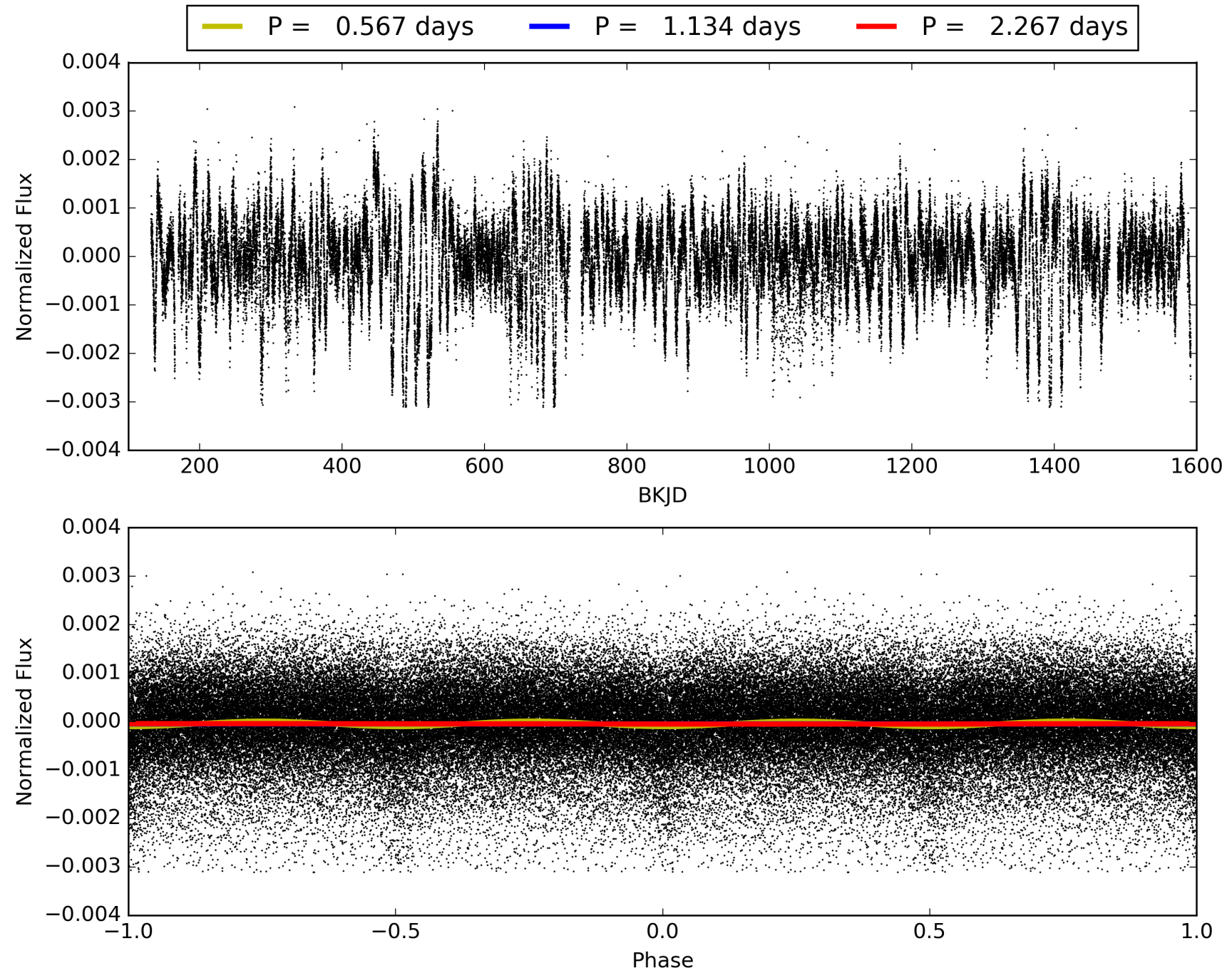
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 23:24:32 Z

This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 007038096-01, PDC Light Curves

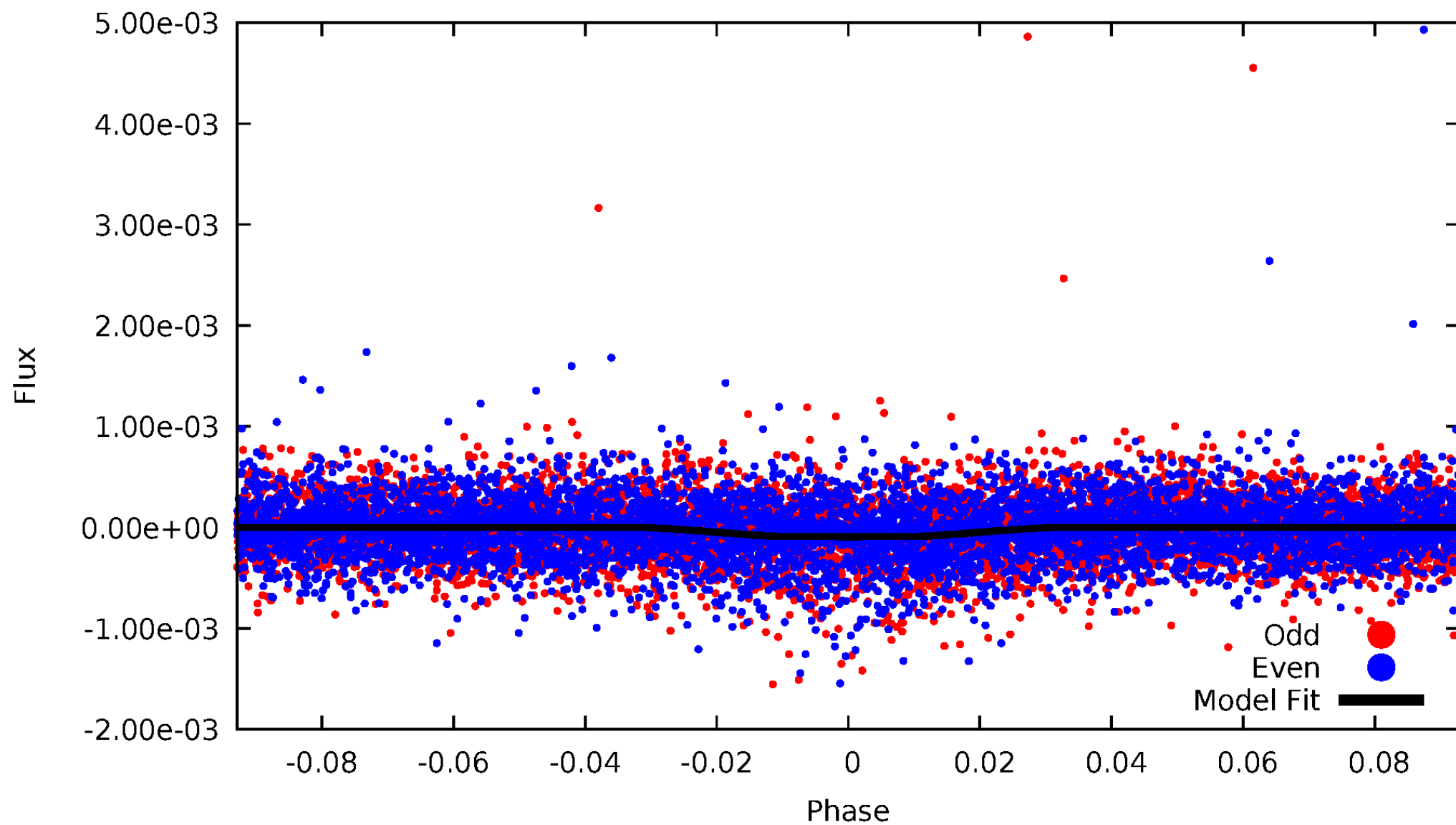


TCE 007038096-01



# DV Odd/Even

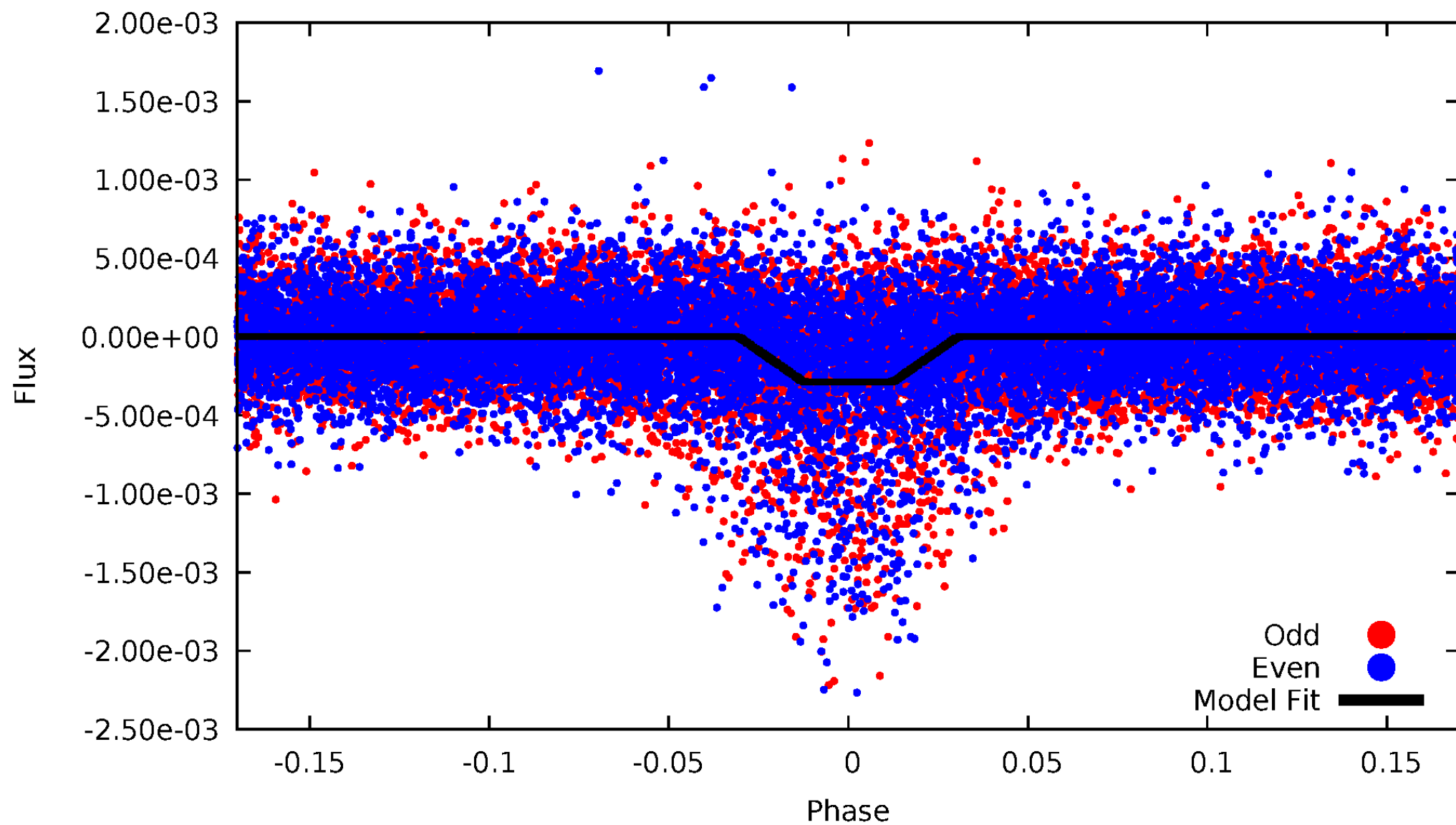
TCE 007038096-01





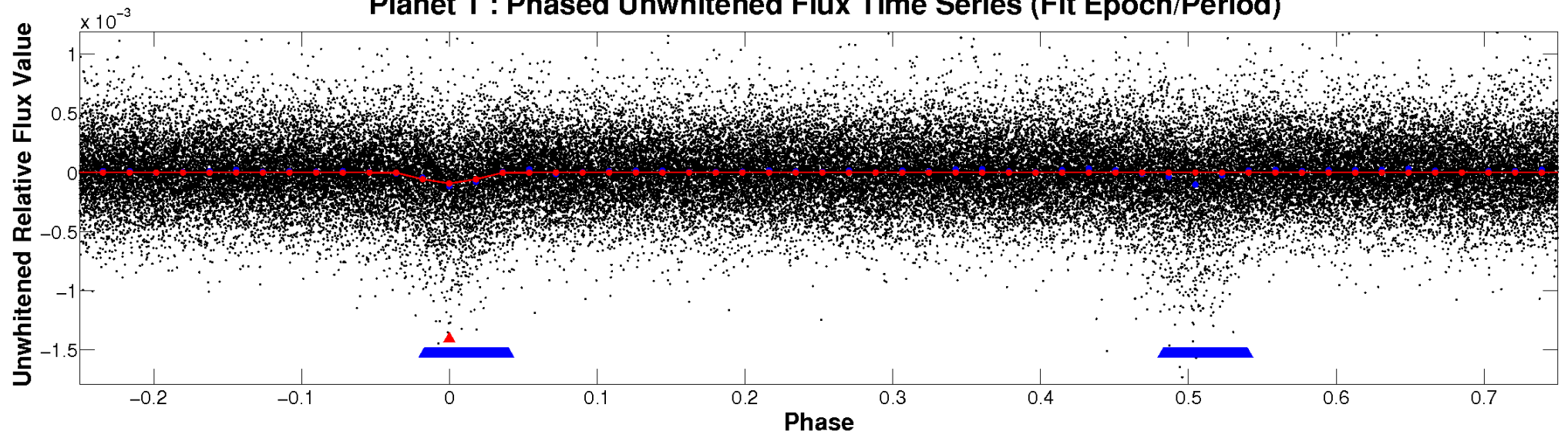
# ALT Odd/Even

TCE 007038096-01

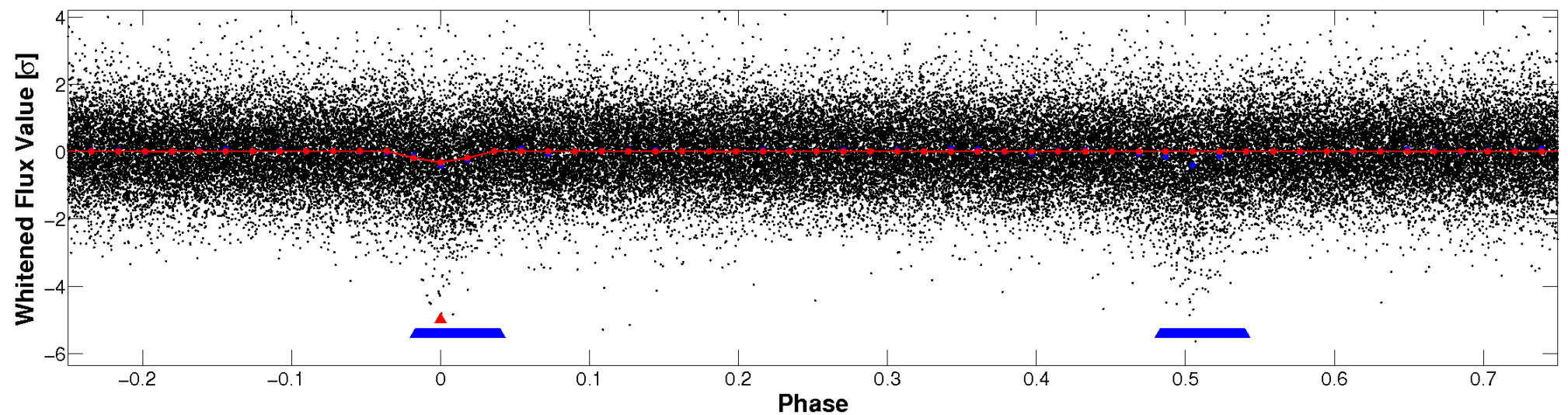


# Non-Whitened Vs. Whitened Light Curve

**Planet 1 : Phased Unwhitened Flux Time Series (Fit Epoch/Period)**

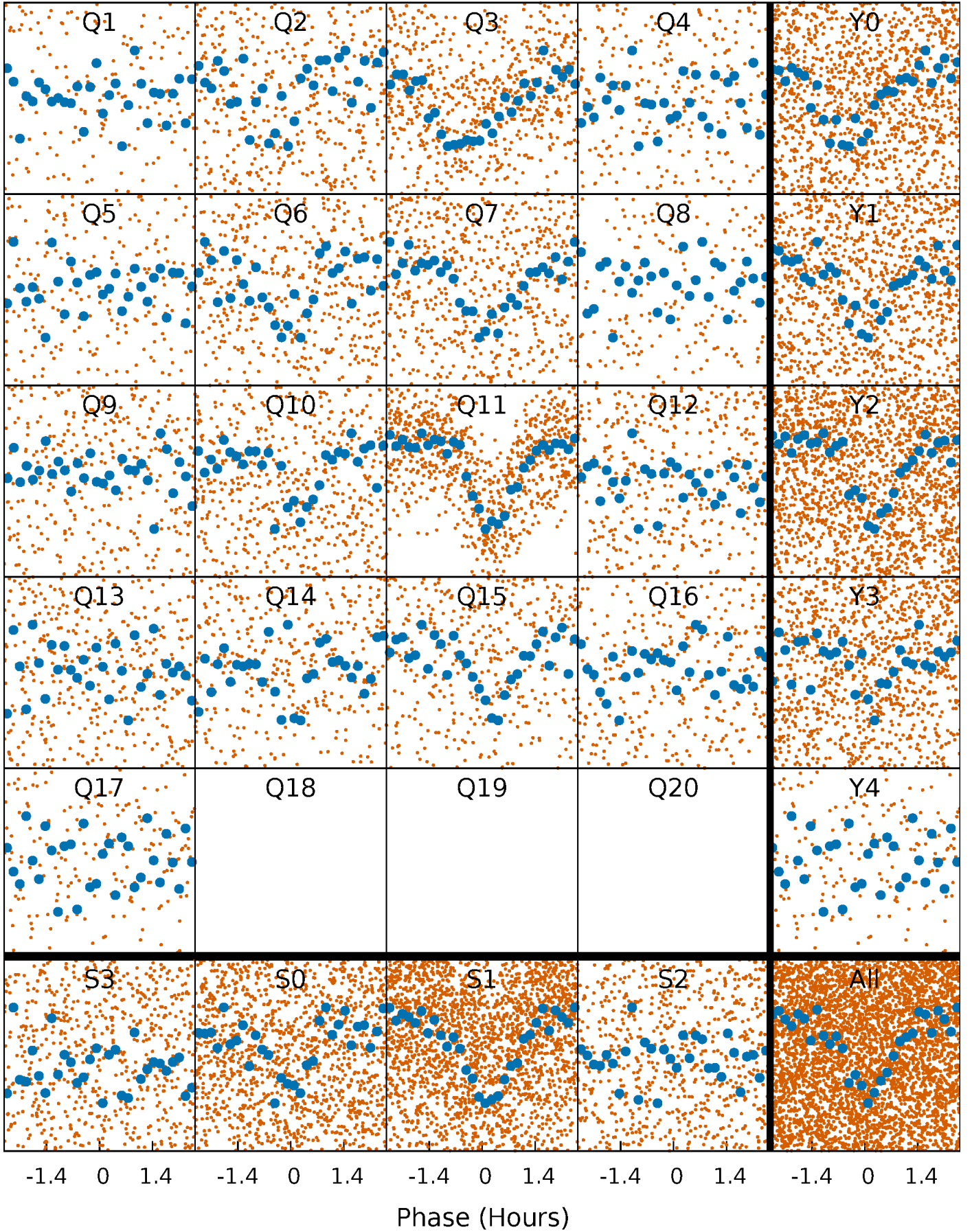


**Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



# PDC Quarter-Phased Transit Curves

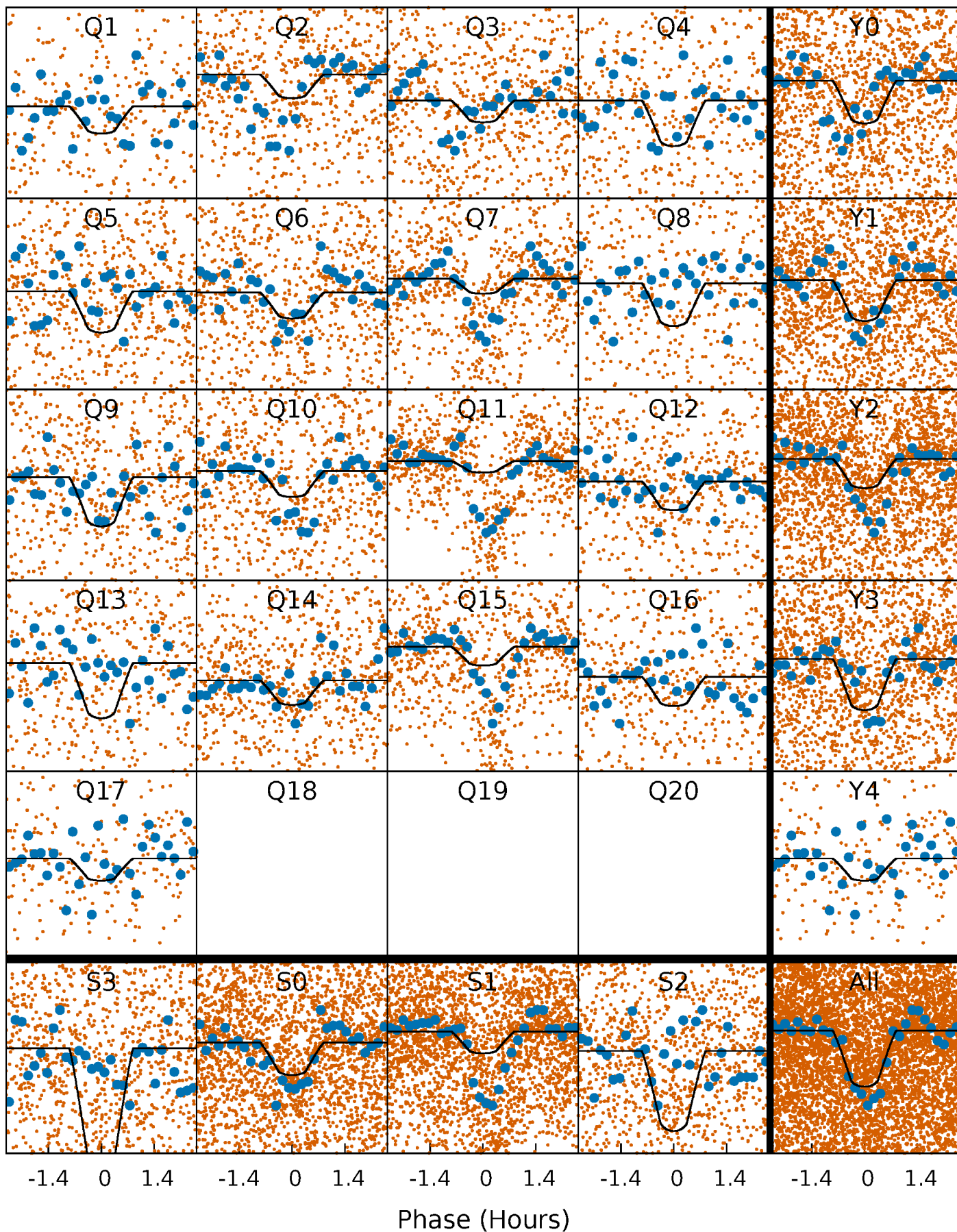
TCE 007038096-01 P= 1.133569 Days  $T_0=131.815272$  (BKJD)





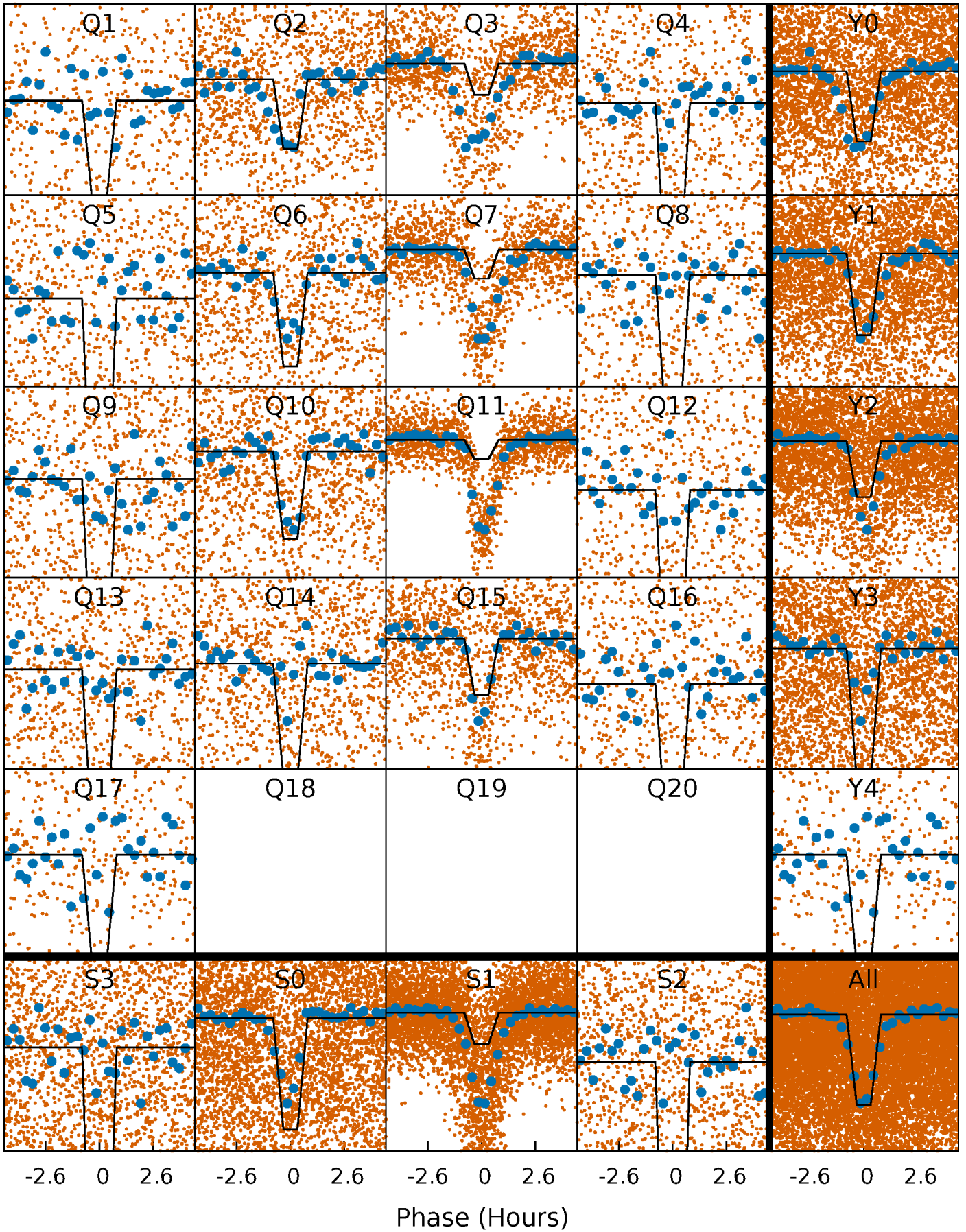
# DV Quarter-Phased Transit Curves

TCE 007038096-01 P= 1.133569 Days  $T_0=131.815272$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

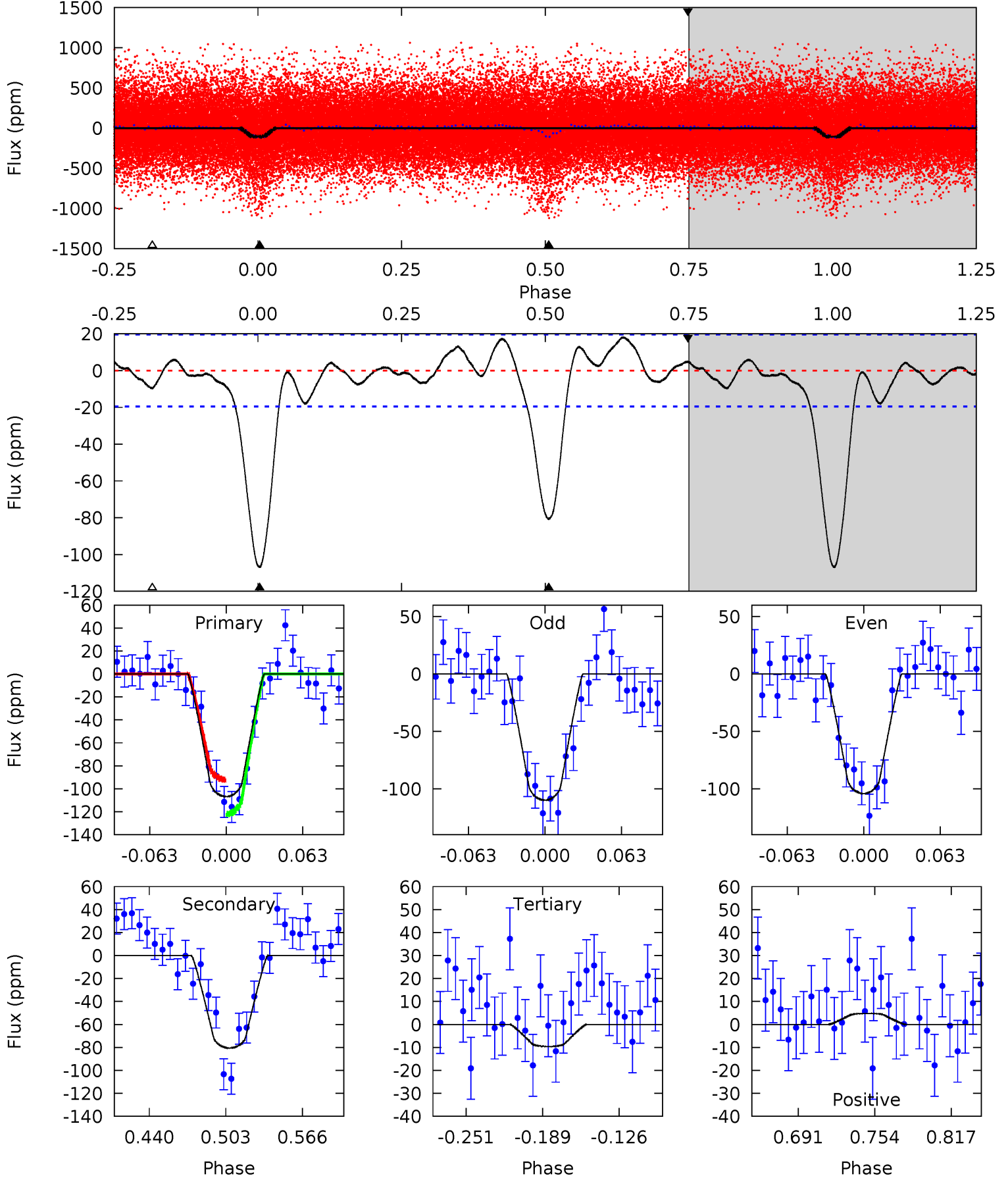
TCE 007038096-01 P= 1.133588 Days  $T_0=131.806363$  (BKJD)



# DV Model-Shift Uniqueness Test

007038096-01, P = 1.133569 Days, E = 130.681703 Days

Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
25.5	19.2	2.30	1.14	4.66	1.86	1.74	23.2	24.3	16.9	18.1	0.69	1.46	0.14	3.58

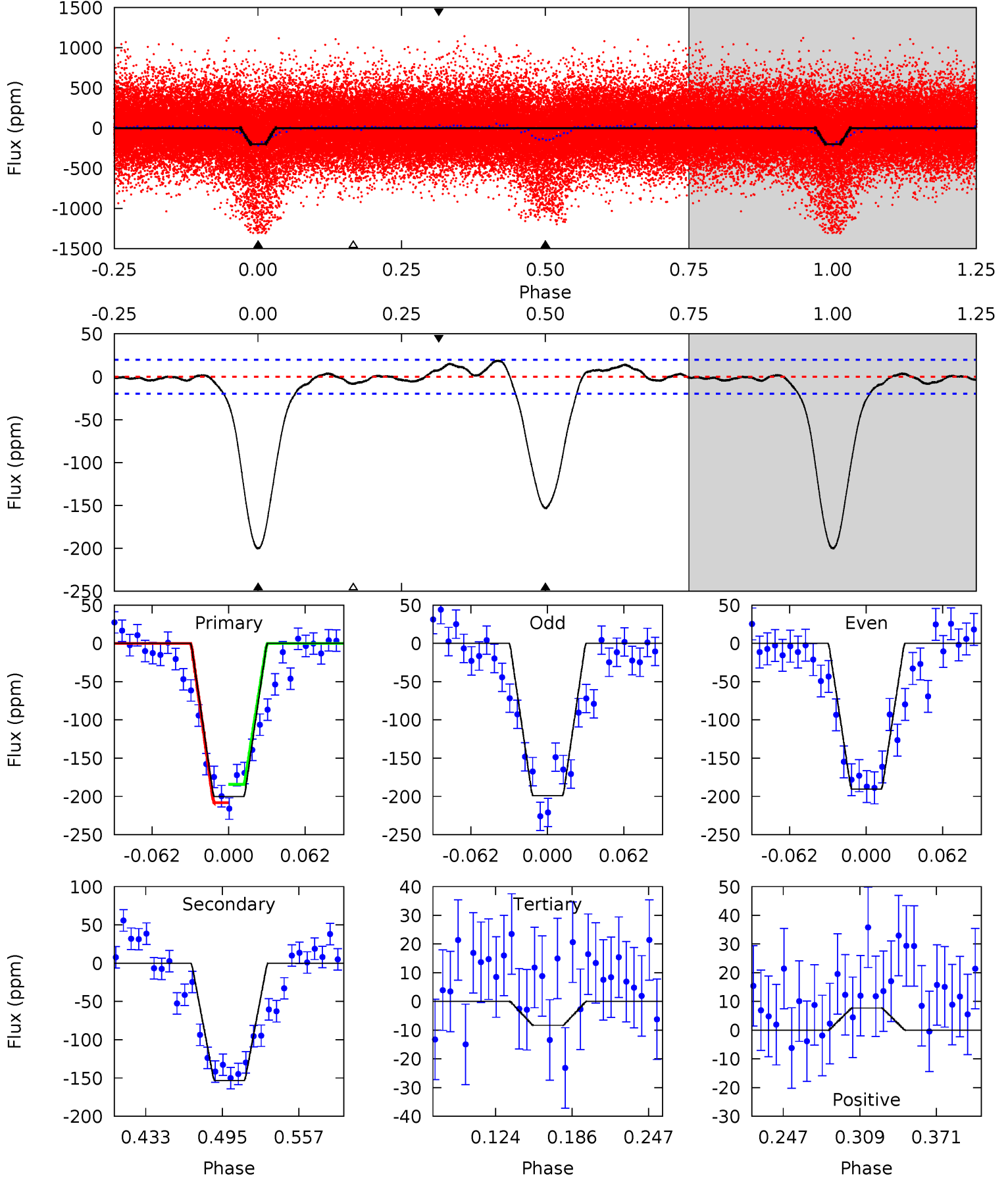




# Alt Model-Shift Uniqueness Test

007038096-01, P = 1.133588 Days, E = 130.672775 Days

Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
46.9	35.9	1.94	1.80	4.66	1.87	1.63	45.0	45.1	34.0	34.1	1.00	2.02	0.09	2.80





### Stellar Parameters For KIC 007038096

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6147^{+172}_{-215}$	$4.435^{+0.048}_{-0.192}$	$0.210^{+0.200}_{-0.350}$	$1.096^{+0.301}_{-0.129}$	$1.193^{+0.127}_{-0.170}$	$1.275^{+0.326}_{-0.627}$
	+3%/-3%	+1%/-4%	+95%/-167%	+27%/-12%	+11%/-14%	+26%/-49%
Source	PHO1	KIC0	KIC0	DSEP		

KIC = Kepler Input Catalog; PHO = Photometry; SPE = Spectroscopy; AST = Asteroseismology  
 TRA = Transits; DESP = Dartmouth Models; MULT = Multiple Models

### Secondary Eclipse Parameters for KIC 007038096-01 / KOI 4020.01

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	-81±4	$1.39^{+0.76}_{-0.68}$	$2702^{+205}_{-134}$	$5530^{+2353}_{-946}$	$12^{+32}_{-7}$
Alt.	-153±4	$2.09^{+0.76}_{-0.70}$	$2702^{+173}_{-138}$	$5262^{+1086}_{-642}$	$9.434^{+11.724}_{-4.345}$

$T_{\text{max}}$  = Theoretical Maximum Planetary Temperature

$T_{\text{obs}}$  = Observed Planetary Temperature (Assuming A=0.3)

$A_{\text{obs}}$  = Observed Albedo (Assuming T=0)

If a secondary eclipse is present, the system is likely an EB if  $T_{\text{obs}} \gg T_{\text{max}}$  AND  $A_{\text{obs}} \gg 1.0$

## DV Centroid Data

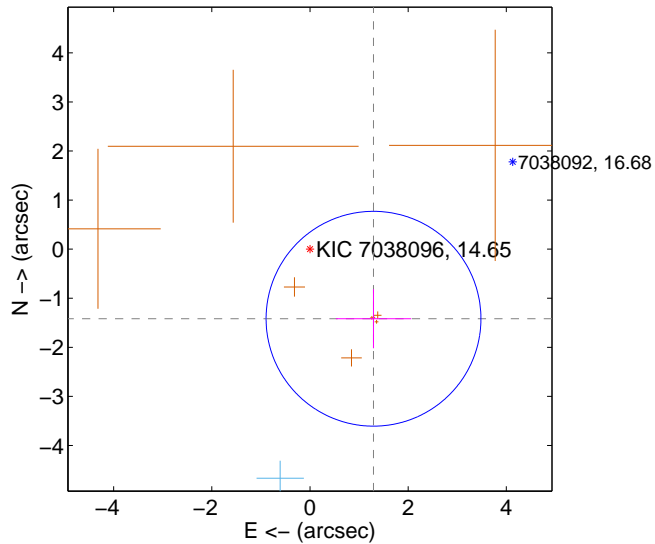
Supplemental centroid analysis for 007038096-01. Kepler magnitude: 14.65. Transit SNR 14.12

There are 2 quarters with good PRF difference image offsets

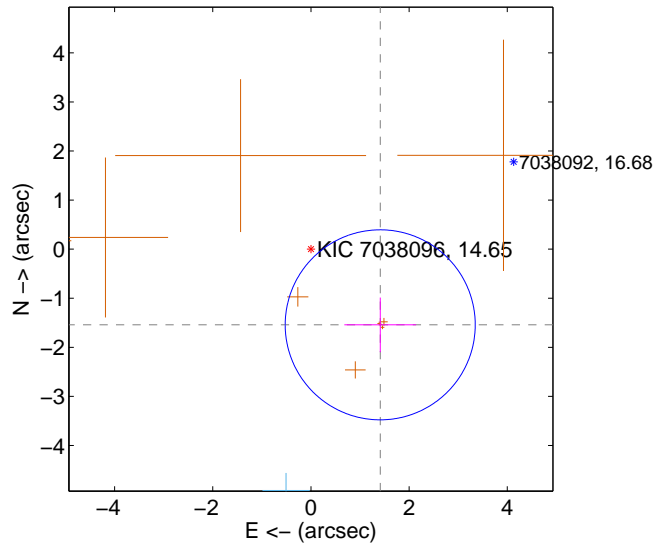
The direct PRF centroid is offset from the target star catalog position by about 0.25 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.920 \pm 0.730$	2.63	$-1.294 \pm 0.767$	$-1.418 \pm 0.601$
PRF-fit source offset from KIC position	$2.090 \pm 0.645$	3.24	$-1.412 \pm 0.731$	$-1.542 \pm 0.557$
photometric centroid source offset	$0.73 \pm 0.91$	0.80	$-0.54 \pm 0.95$	$-0.49 \pm 0.86$

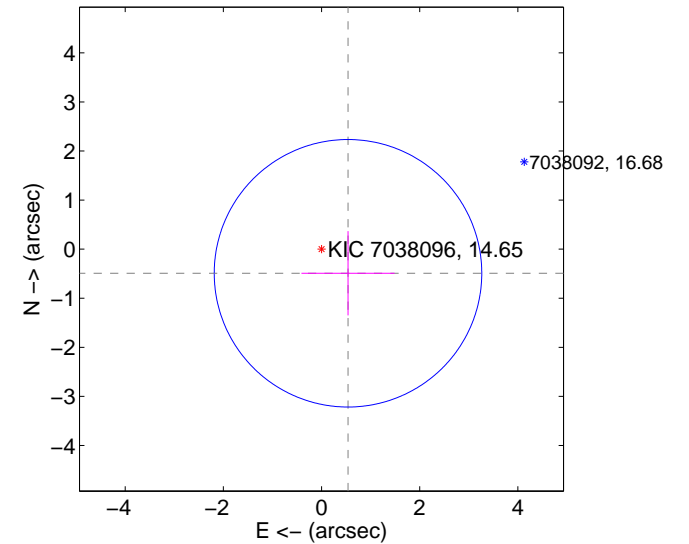
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

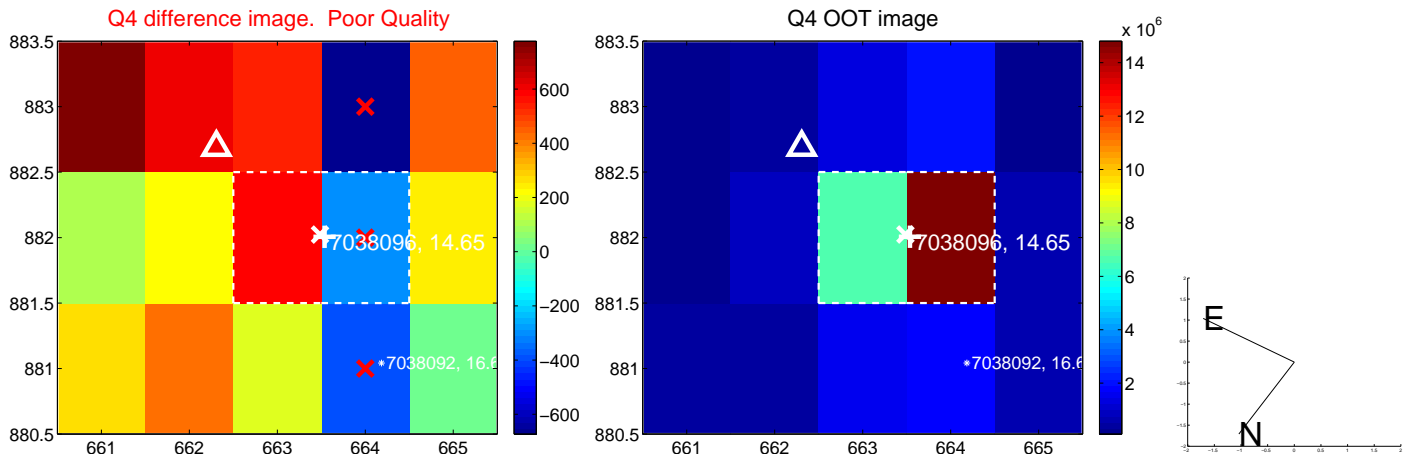
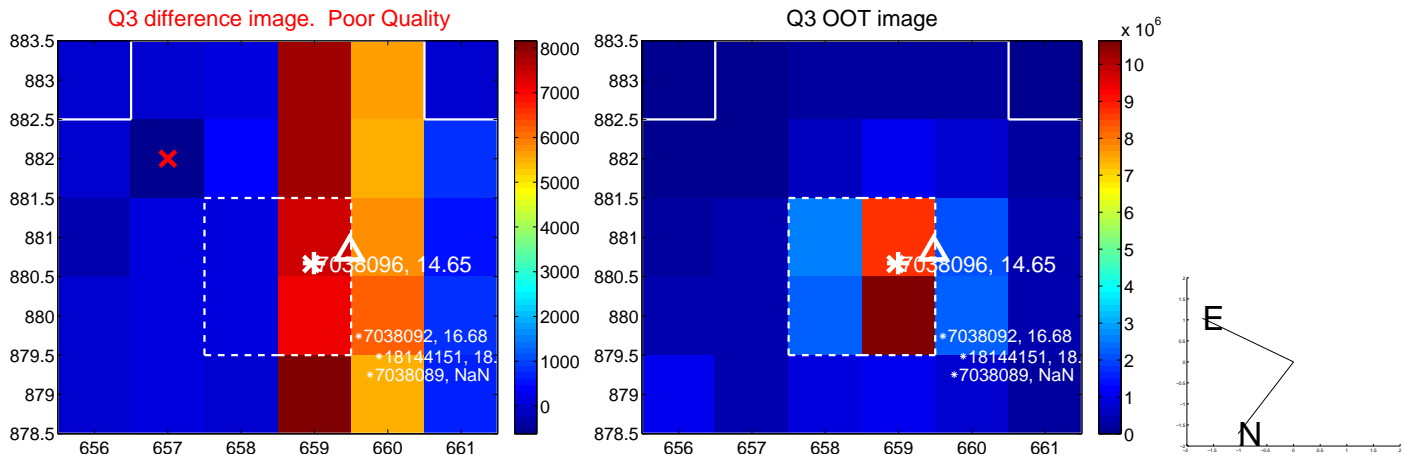
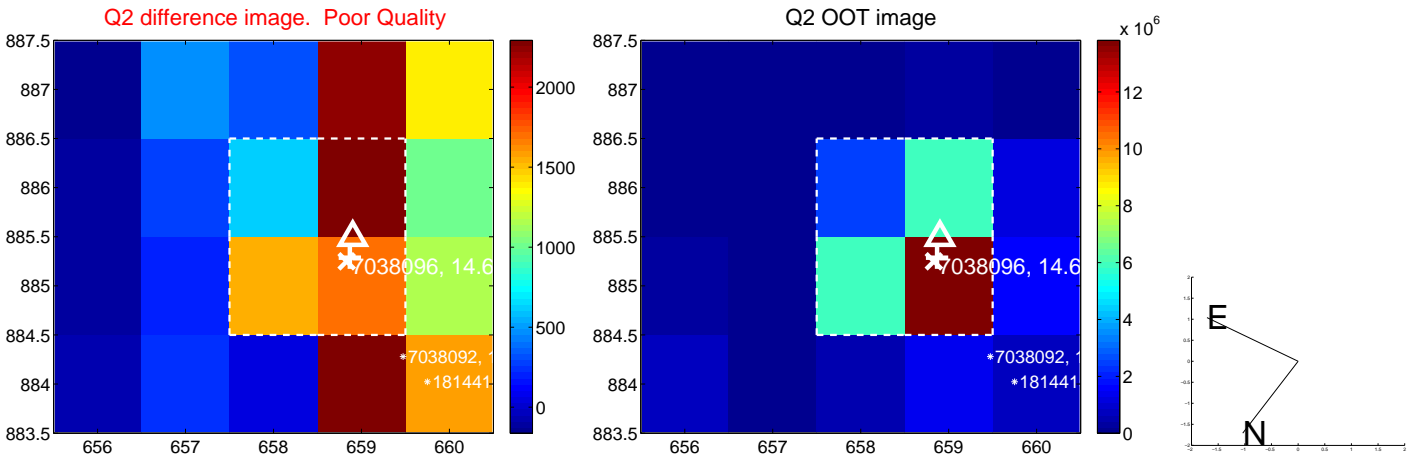
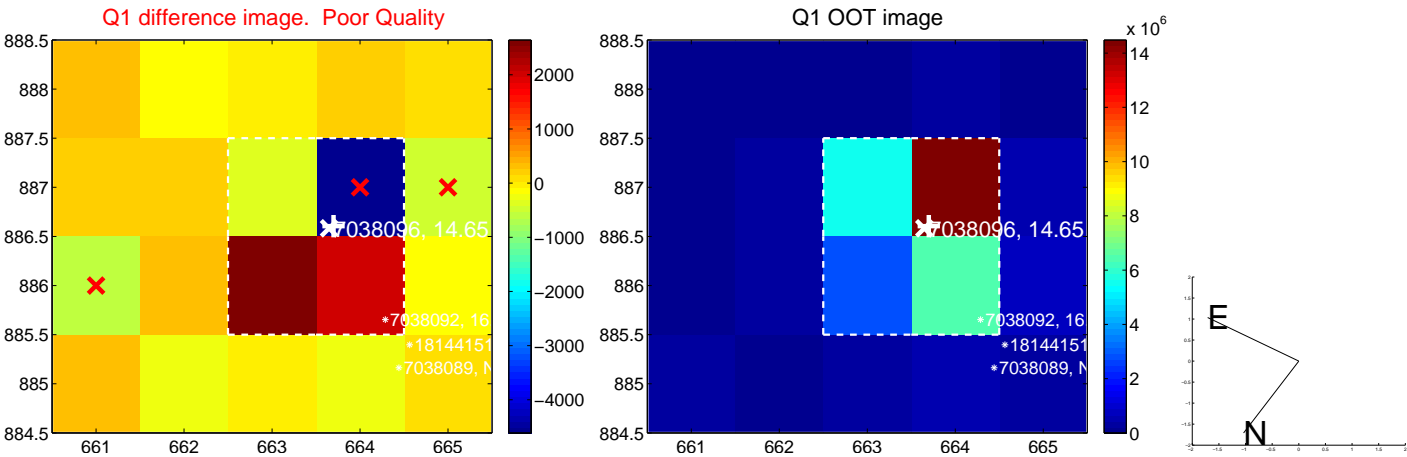


offset from photometric centroids

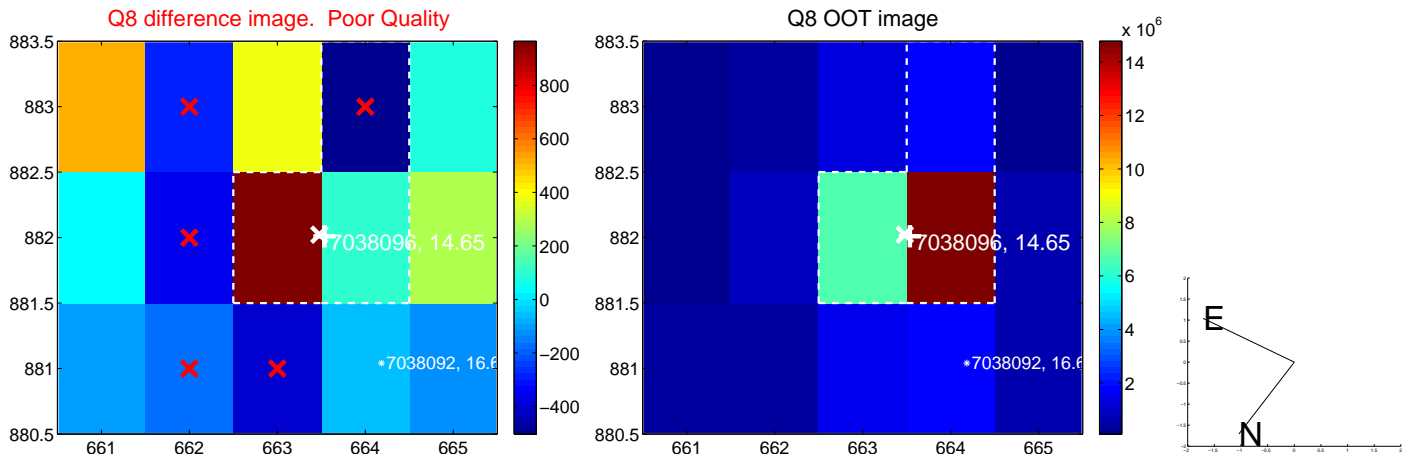
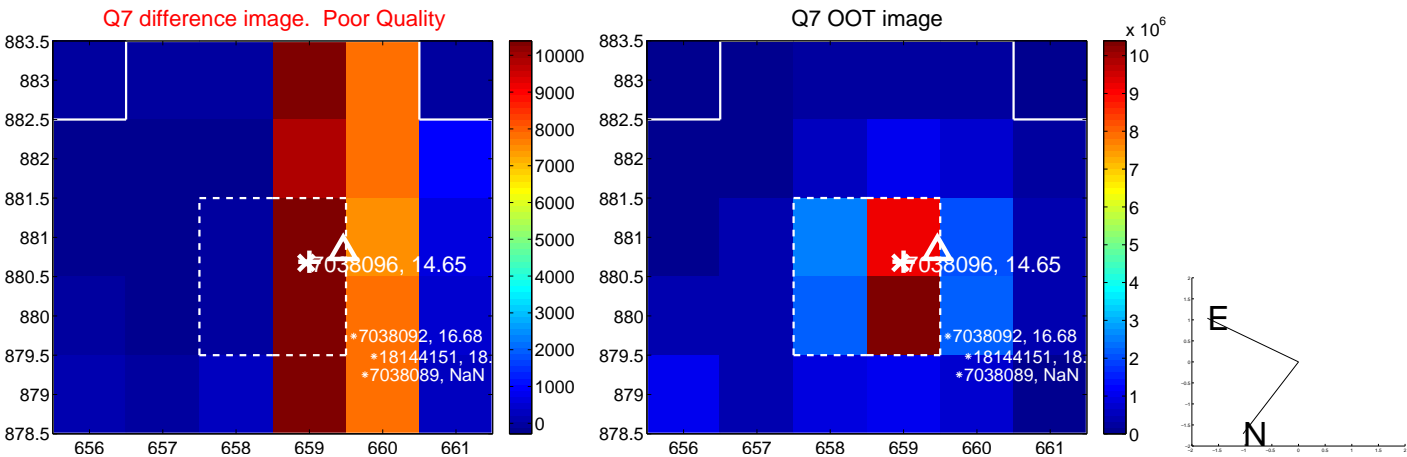
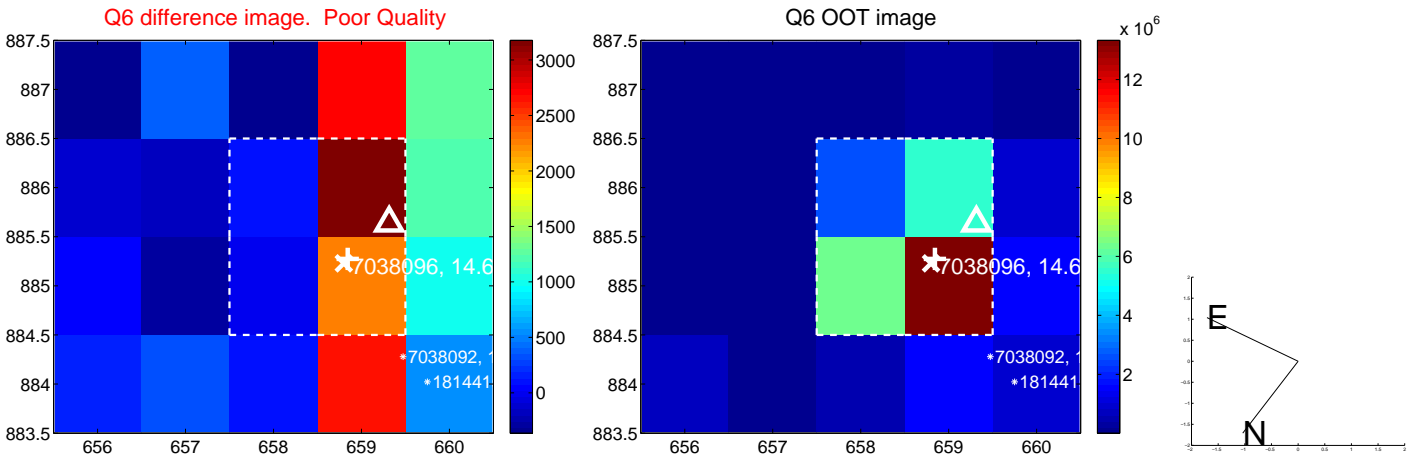
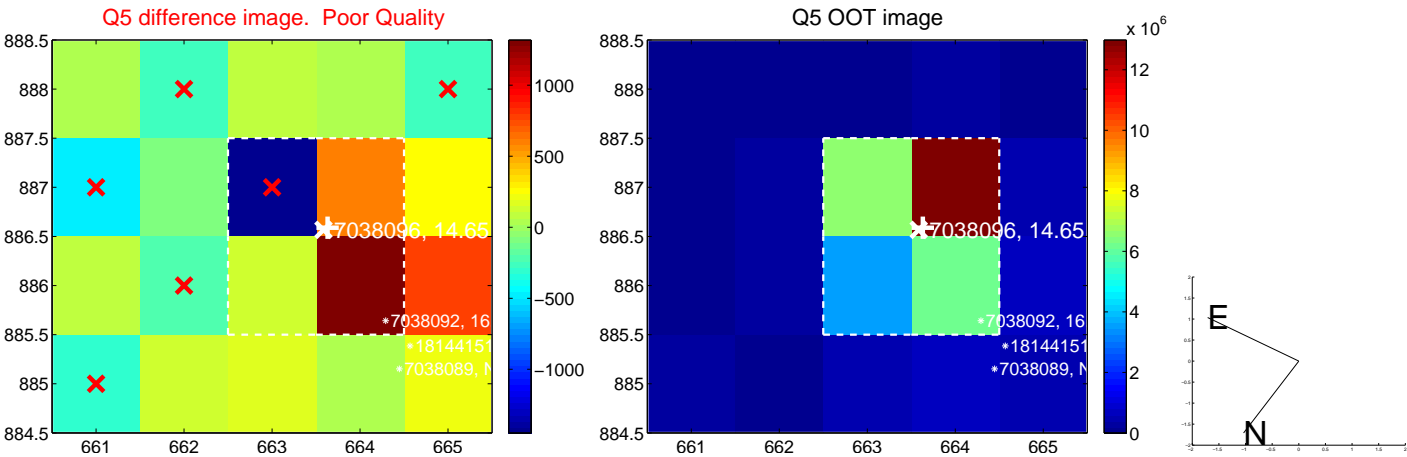


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three- $\sigma$ . Red \*: target star. Blue \*: Other stars. Text next to a star gives its KIC ID and kepmag. KIC IDs > 15,000,000 are from the UKIRT catalog.

white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

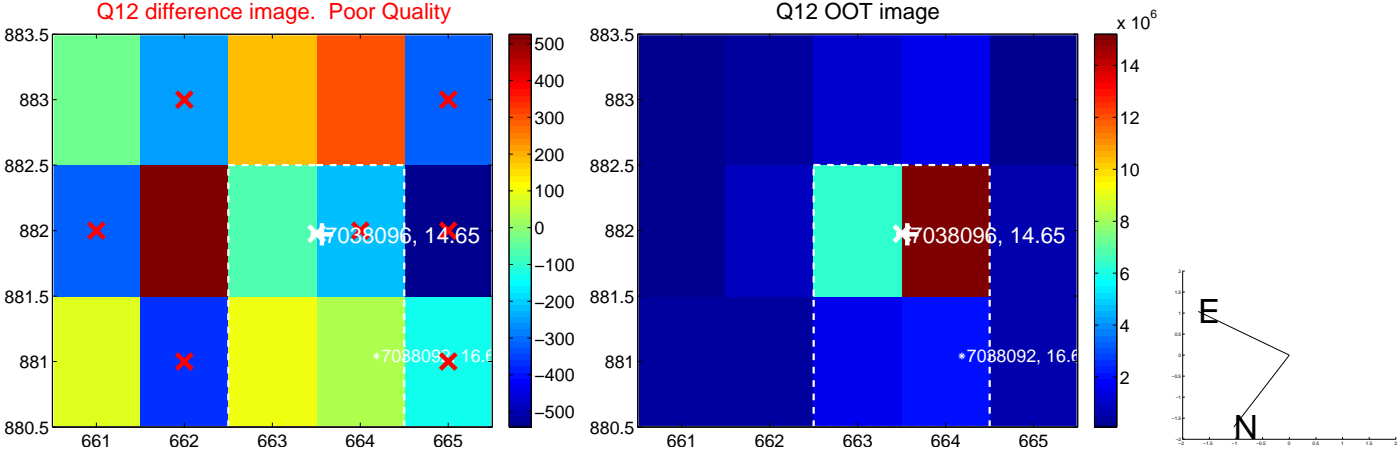
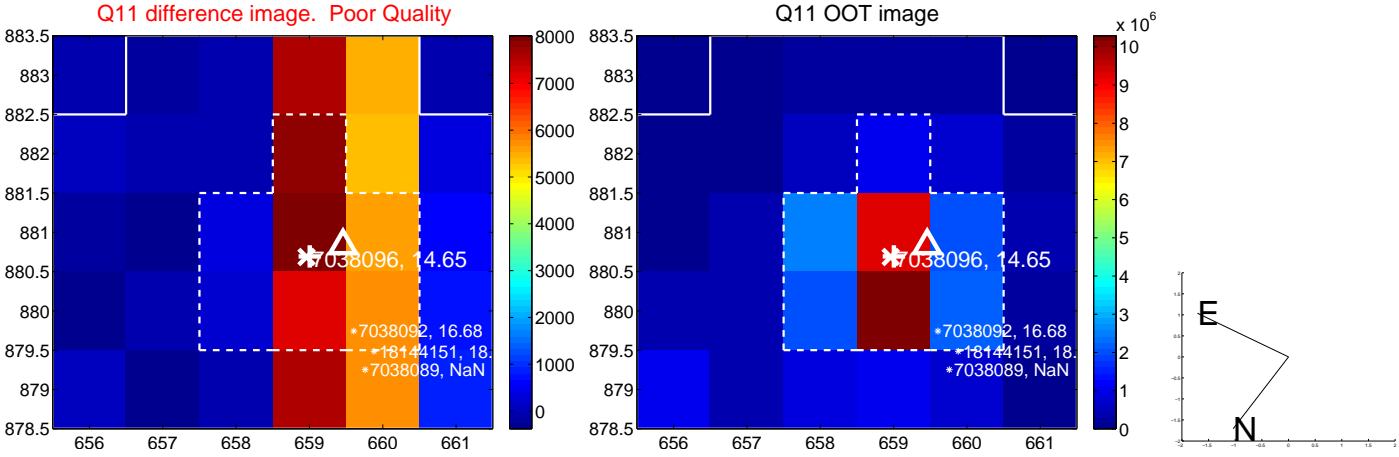
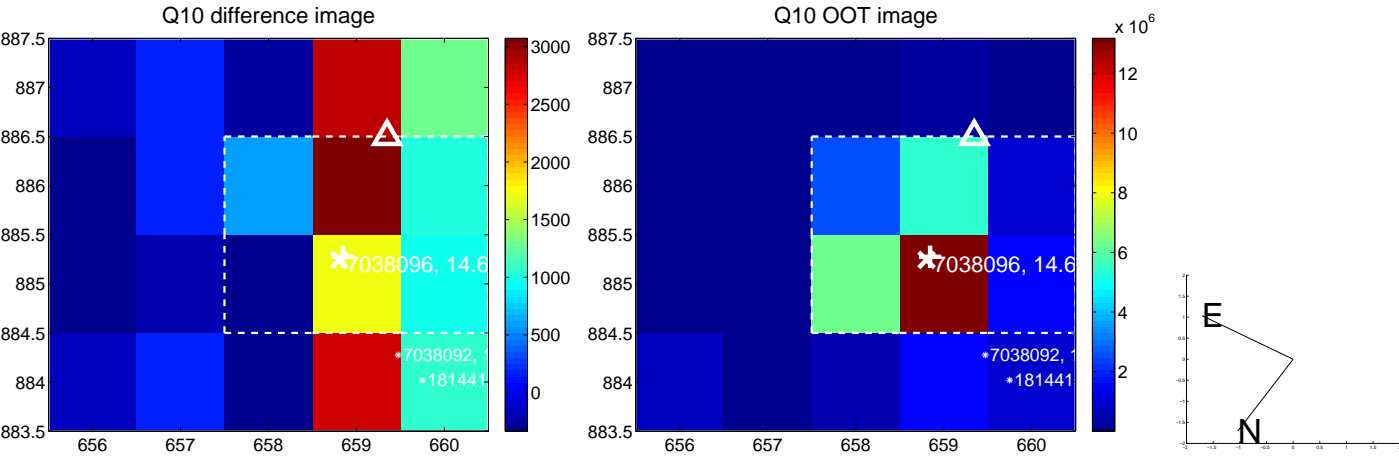
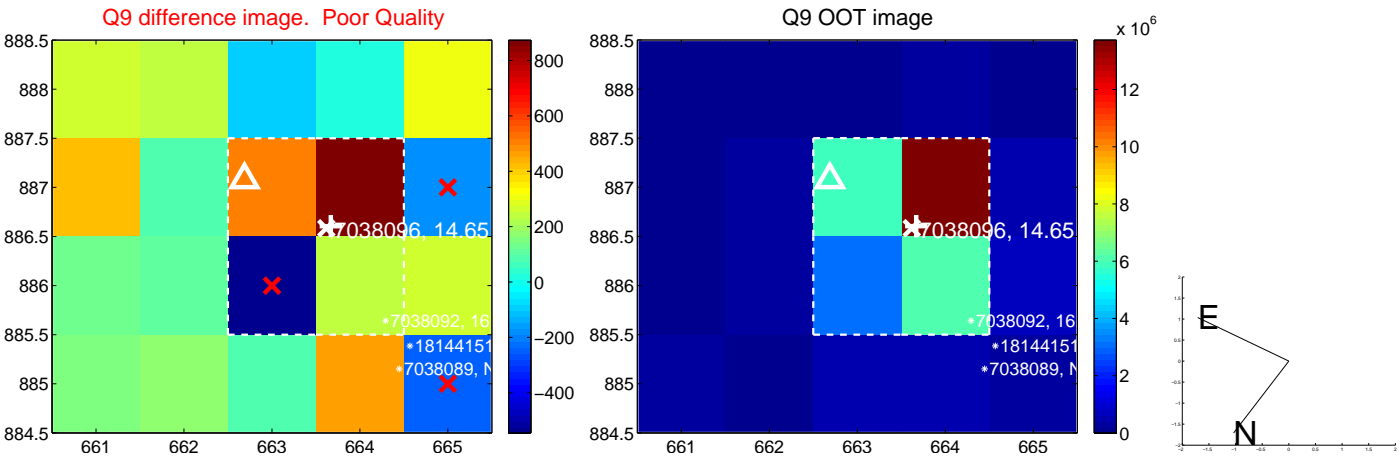


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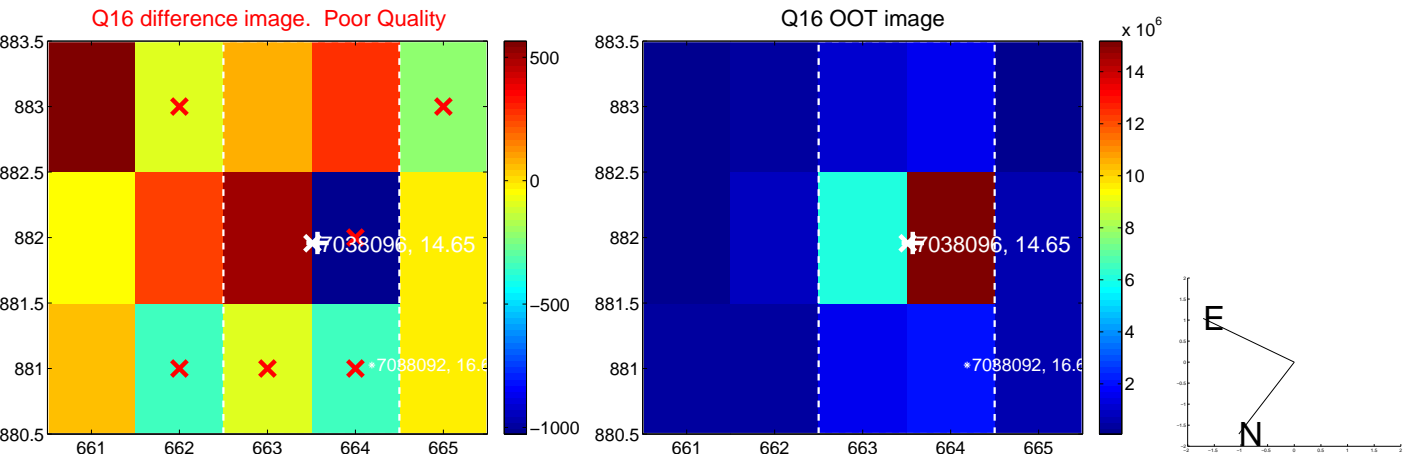
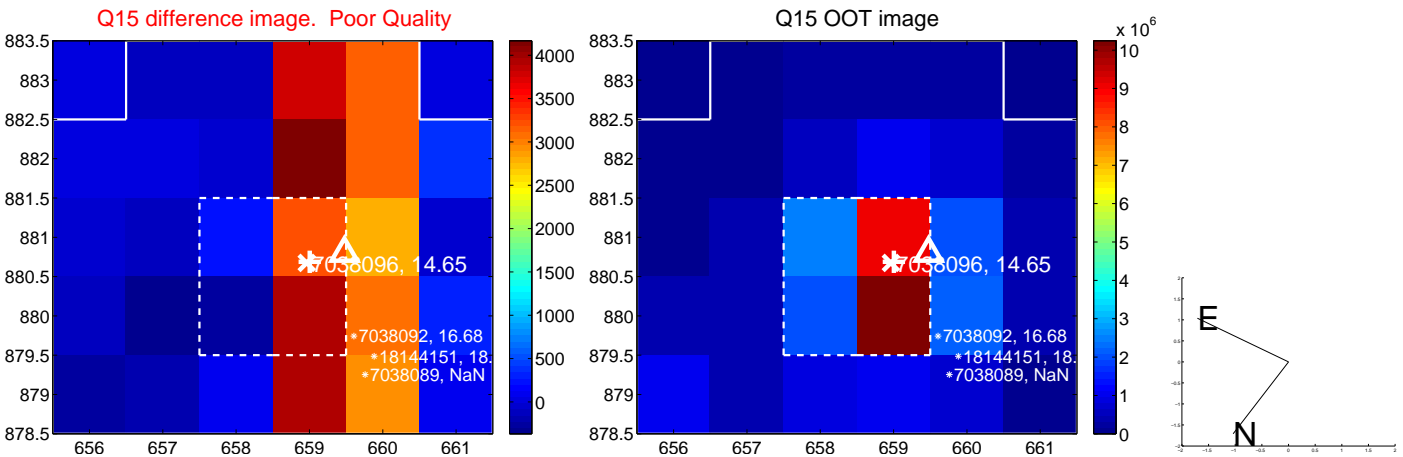
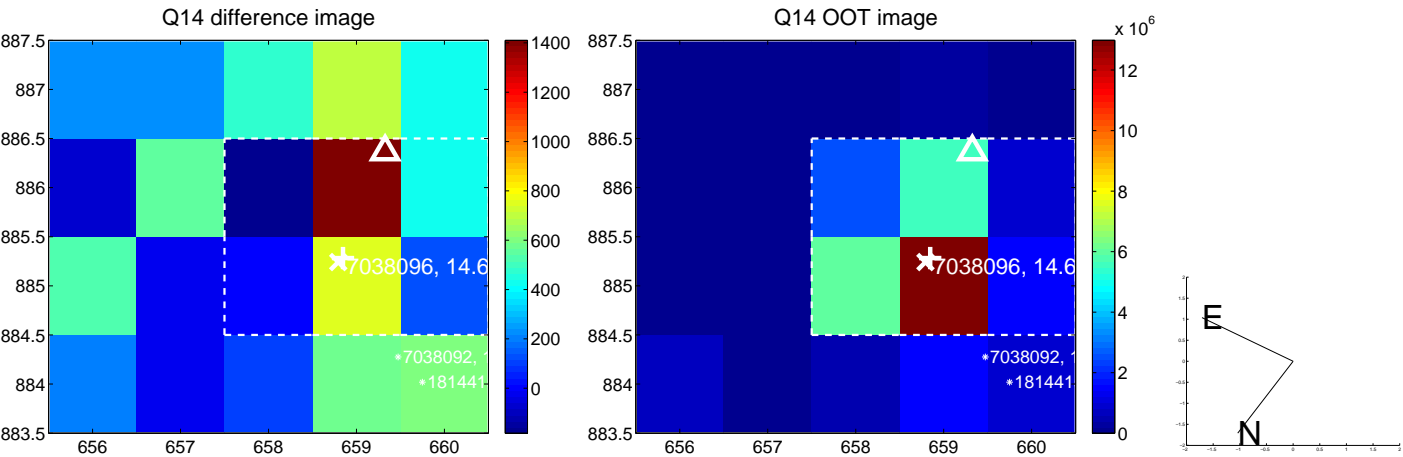
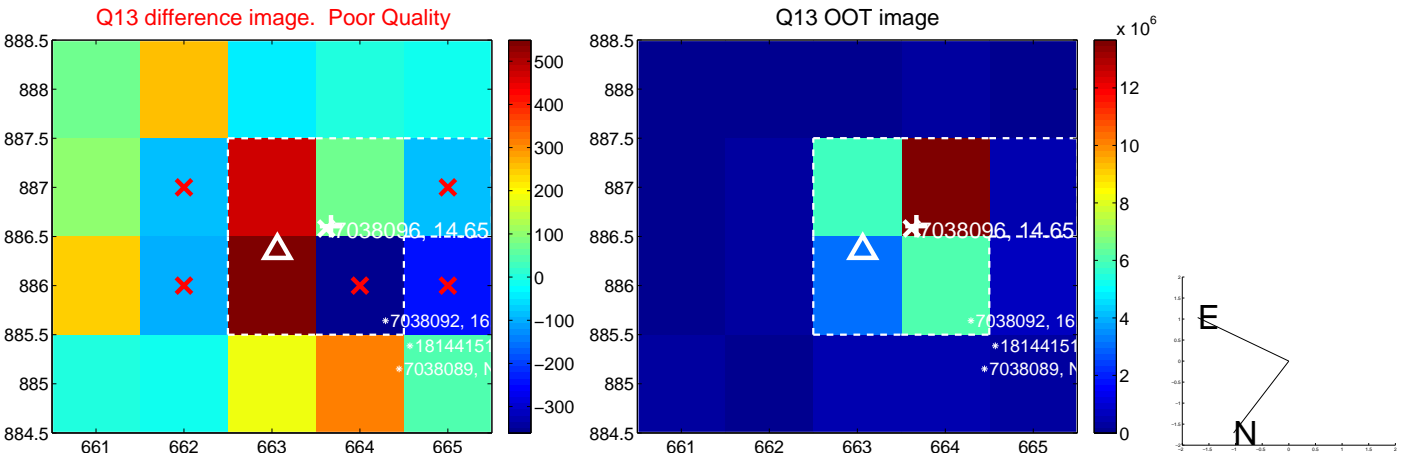




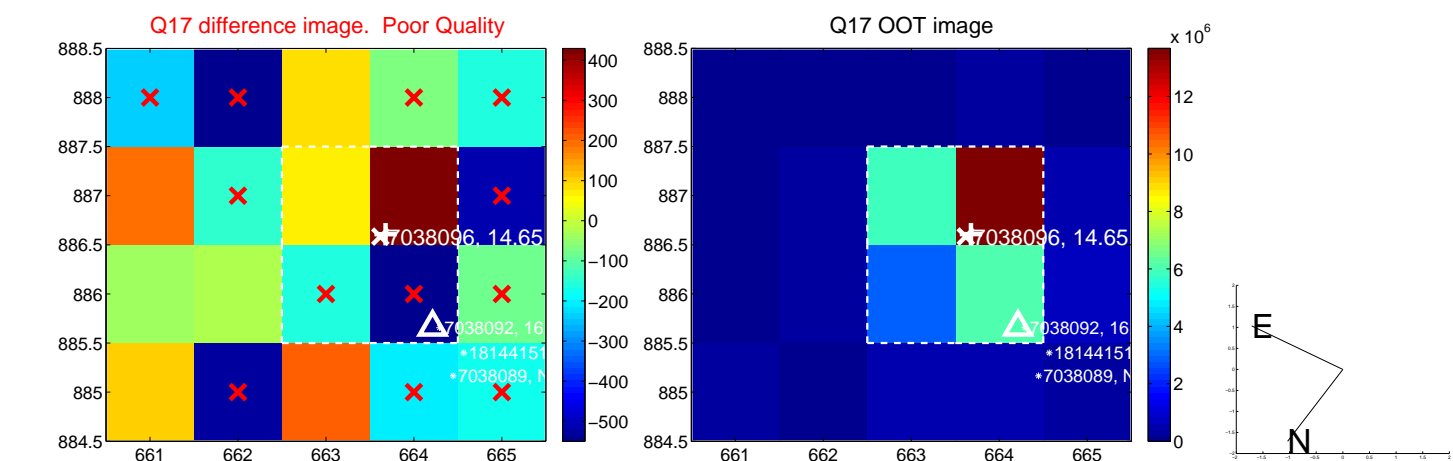
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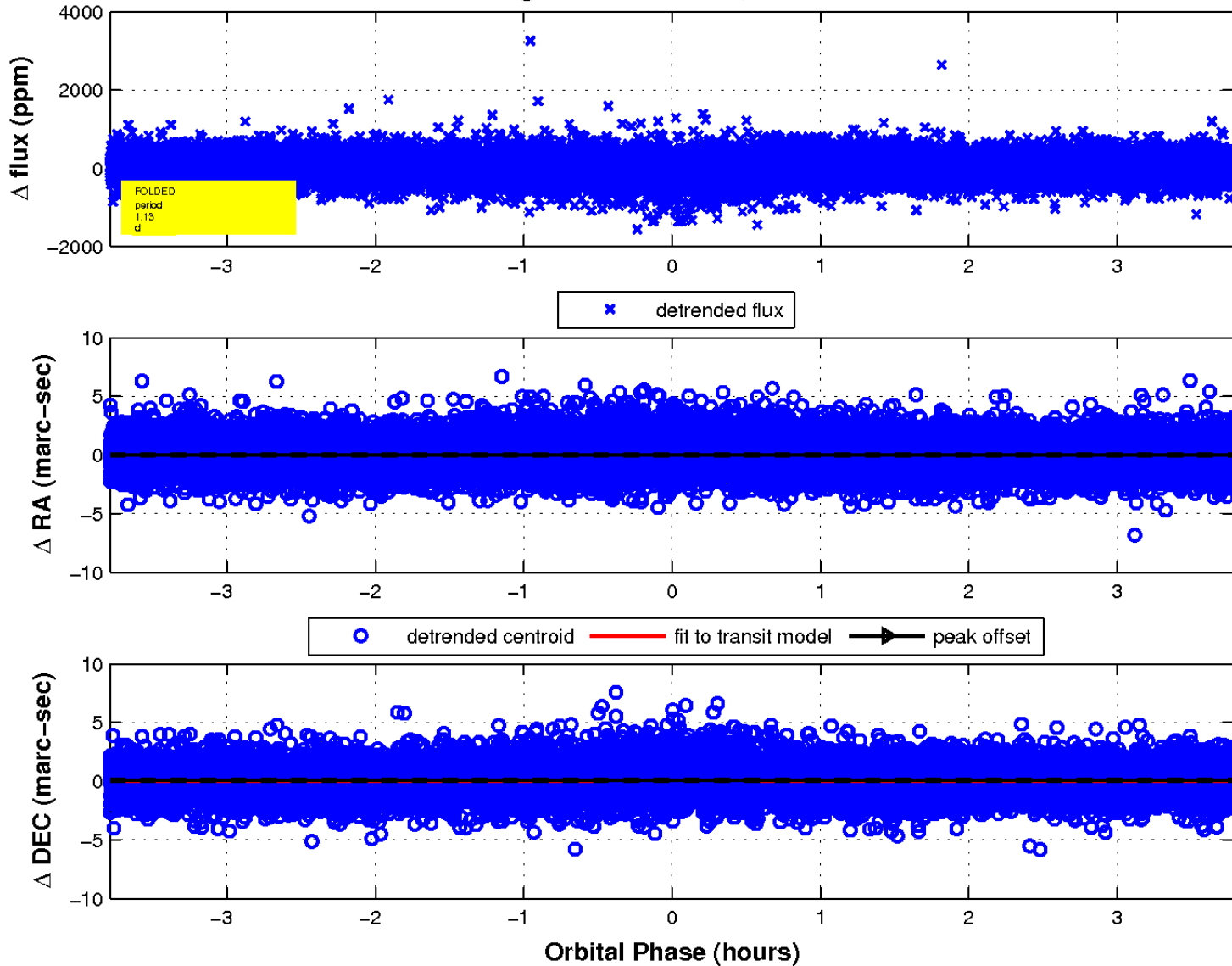
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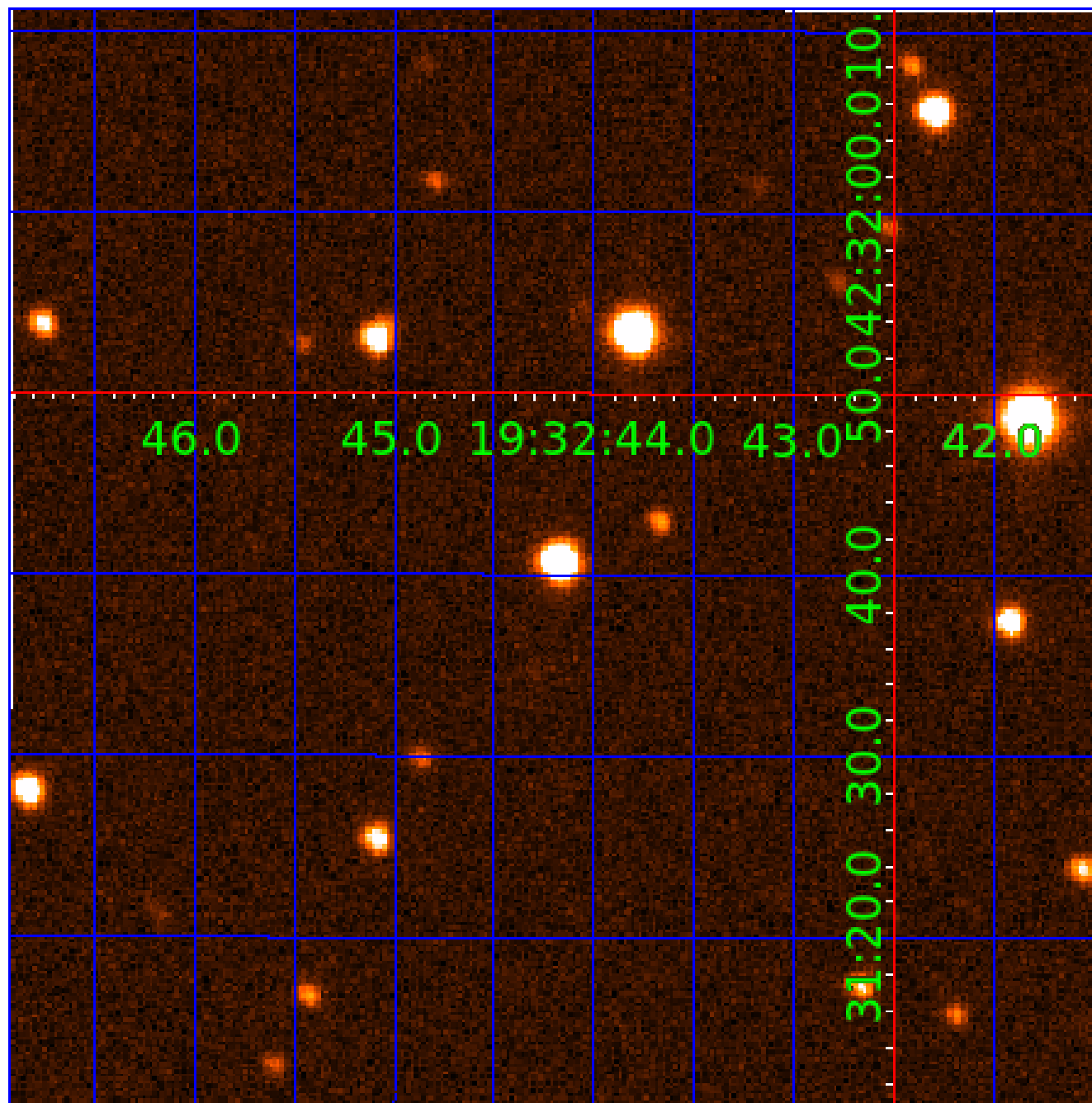


fluxWeightedCentroids, Planet 1 of 2



# UKIRT Image

Declination





# KIC 007038096

## Q1-17 DR25 TCE Parameters

TCE	Run Type	KOI?	Period (Days)	Epoch (BKJD)	Depth (ppm)	Duration (Hours)	MES	SNR	$R_{\star}$ ( $R_{\odot}$ )	$T_{\star}$ (K)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
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## Robovetter Results

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**Notes:** OBS = Observed. INJ = Injected. INV = Inverted. SCR = Scrambled.

N = Not Transit-Like. S = Stellar Eclipse. C = Centroid Offset. E = Ephemeris Match.

See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

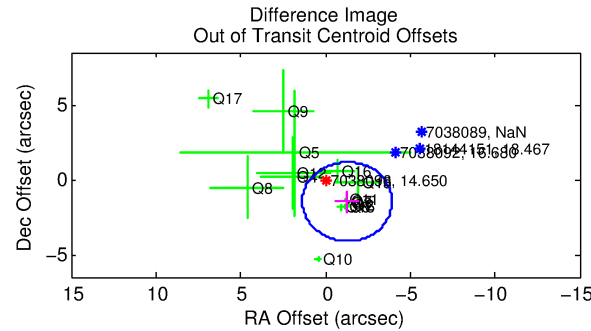
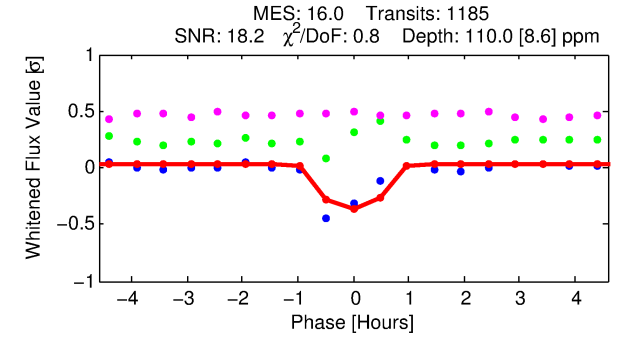
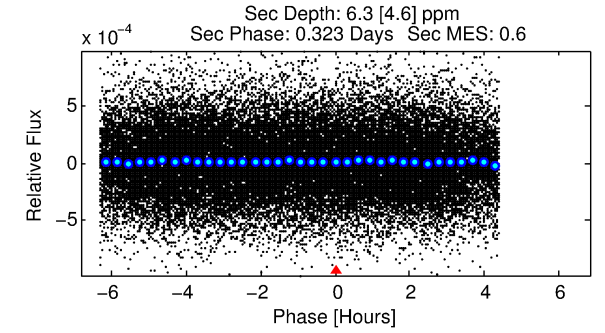
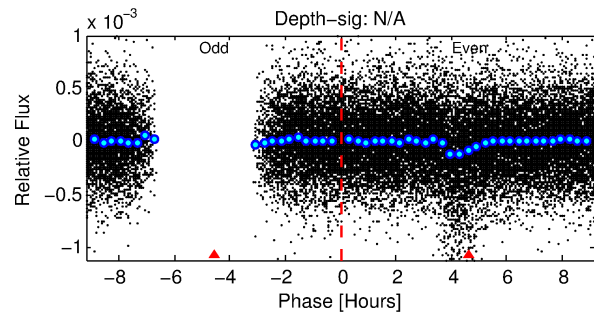
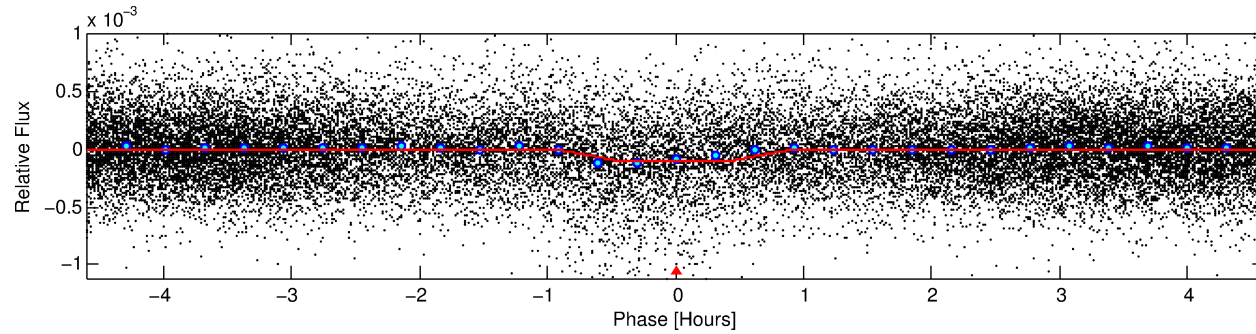
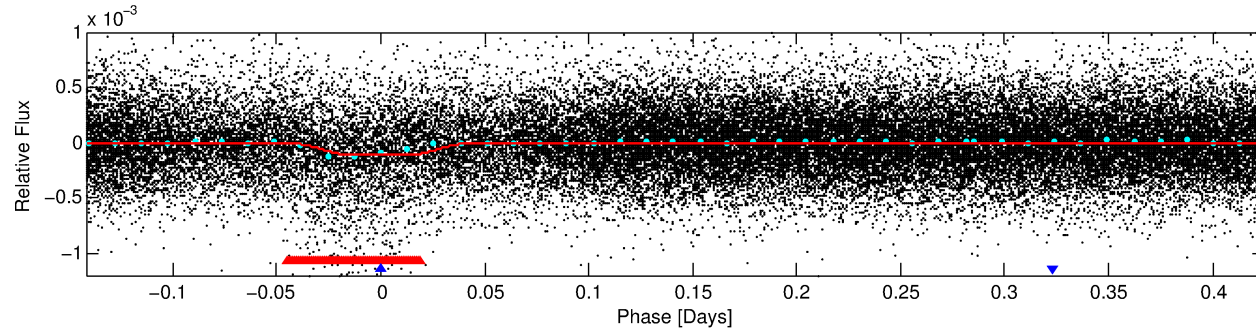
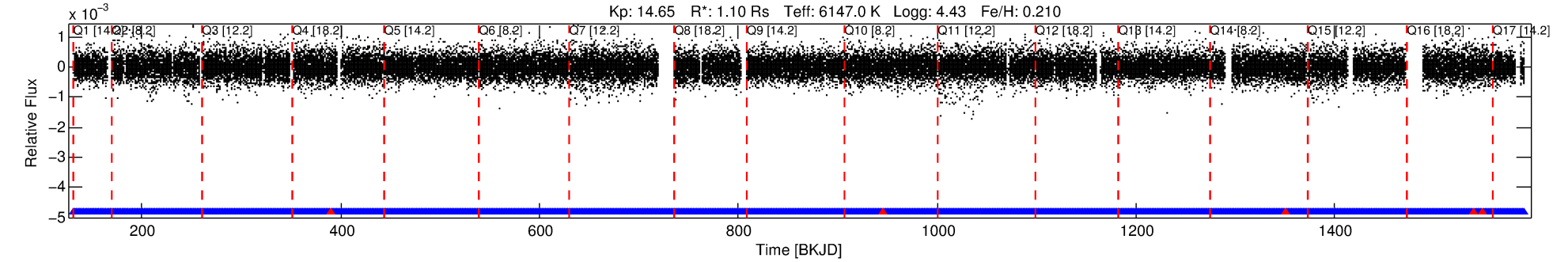
## Ephemeris Match Information For 007038096-02

TCE (1)	KIC	Parent (2)	Parent KIC	$P_1:P_2$	Dist ( $''$ )	$\Delta$ Row	$\Delta$ Col	$m_2$	$m_1$	$D_2/D_1$	Mechanism	Flag	$\sigma_P$	$\sigma_T$
007038096-02	7038096	RR-Lyr-pri	7198959	1:1	4900.3	836	-1	7.86	14.65	5666.30	Col-Anomaly	0	3.73	22.93

**Notes:**  $P_1:P_2$  is the period ratio. Dist is the distance in arcseconds.  $\Delta$ Row and  $\Delta$ Col are the number of pixels apart in row and column.  $m_2$  and  $m_1$  are the magnitudes of the parent and child.  $D_2/D_1$  is the parent's transit depth divided by the child's.  $\sigma_P$  and  $\sigma_T$  are the significance of the match in period and epoch. For a match to be considered significant  $\sigma_P < 5.0$  and  $\sigma_T < 5.0$ . Matches which have  $\sigma_P$  and  $\sigma_T$  very close to this cutoff should receive extra scrutiny, especially if the period ratio is very large.

# DV One-Page Summary

KIC: 7038096 Candidate: 2 of 2 Period: 0.567 d  
KOI: K04020.01 Corr: 0.863



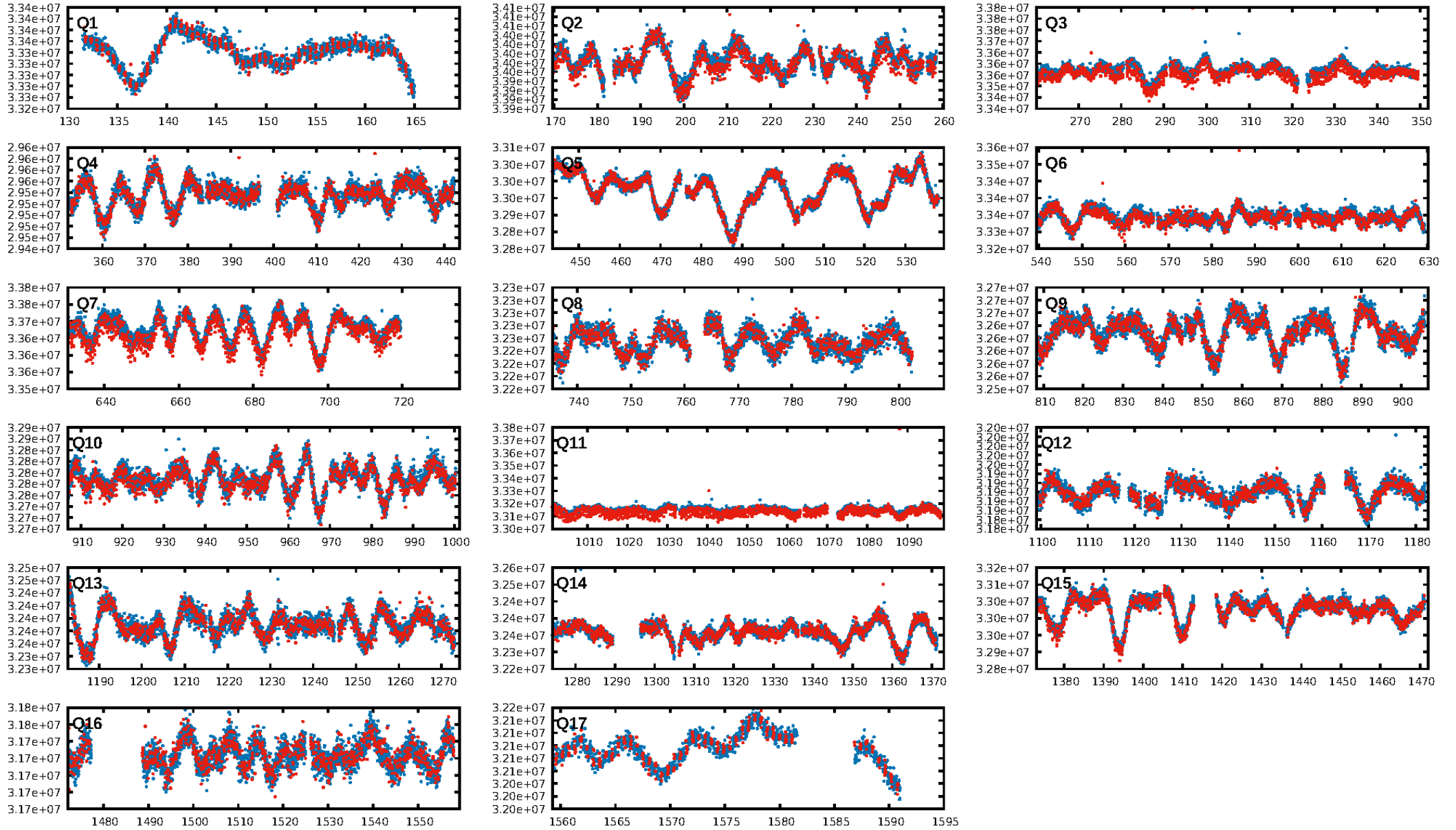
## DV Fit Results:

Period = 0.56681 [0.00001] d  
Epoch = 131.7962 [0.0012] BKJD  
Rp/R\* = 0.0114 [0.0040]  
a/R\* = 1.61 [1.74]  
b = 0.90 [0.38]  
Seff = 7600.43 [2843.43]  
Teff = 2381 [223] K  
Rp = 1.36 [0.60] Re  
a = 0.0142 [0.0033] AU  
Ag = 0.38 [0.40] [-1.55σ]  
Teffp = 2887 [731] K [0.66σ]

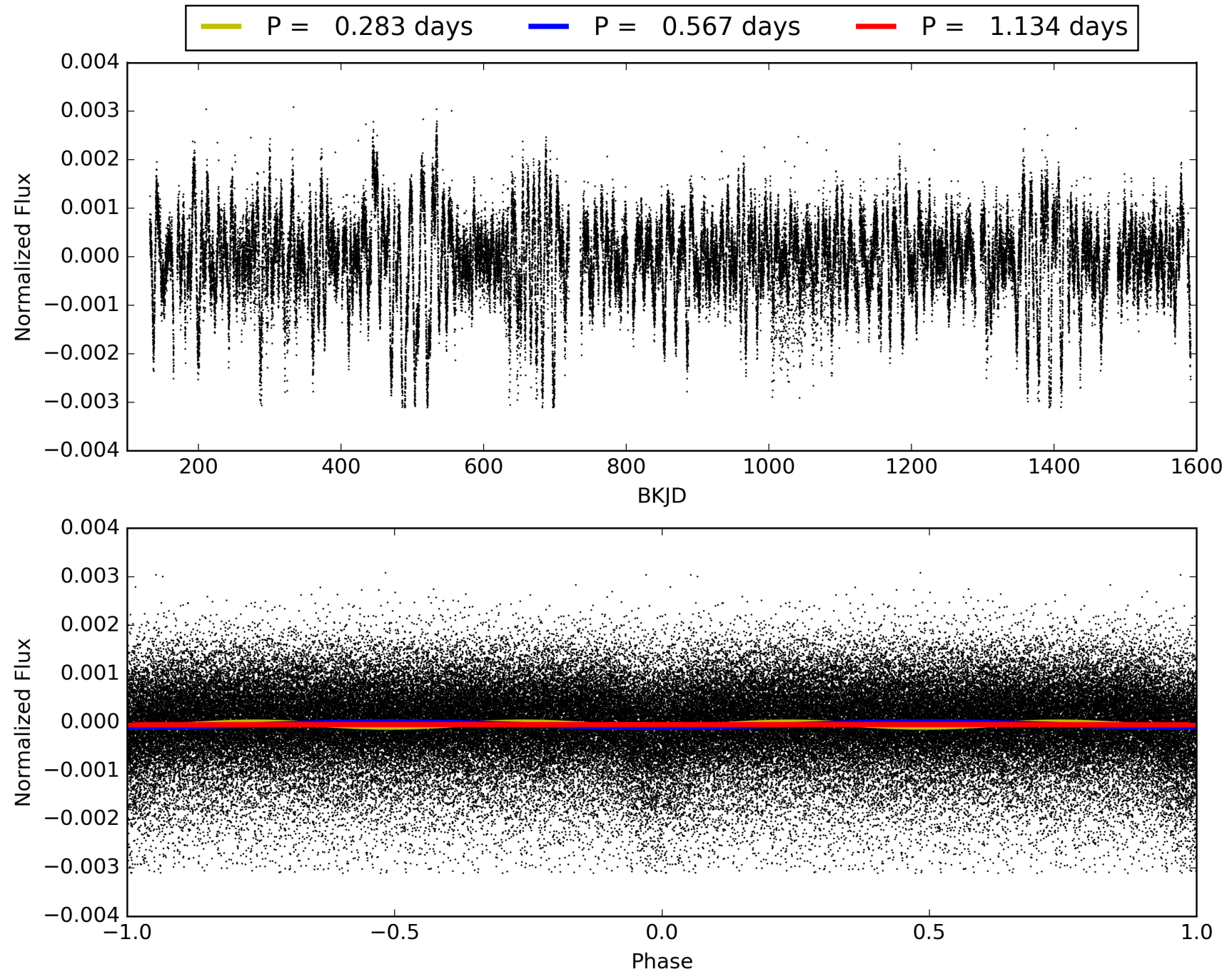
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [6.85σ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: 5.60e-57  
RollingBand-fgt: 1.00 [1127/1132]  
GhostDiagnostic-chr: 1.711  
Centroid-sig: 3.4%  
Centroid-so: 1.150 arcsec [2.21σ]  
OotOffset-rm: 1.947 arcsec [2.21σ]  
KicOffset-rm: 2.118 arcsec [2.59σ]  
OotOffset-st: 3/4/4/4 [15]  
KicOffset-st: 3/4/4/4 [15]  
DiffImageQuality-fgm: 0.07 [1/15]  
DiffImageOverlap-fno: 1.00 [17/17]

# TCE 007038096-02, PDC Light Curves



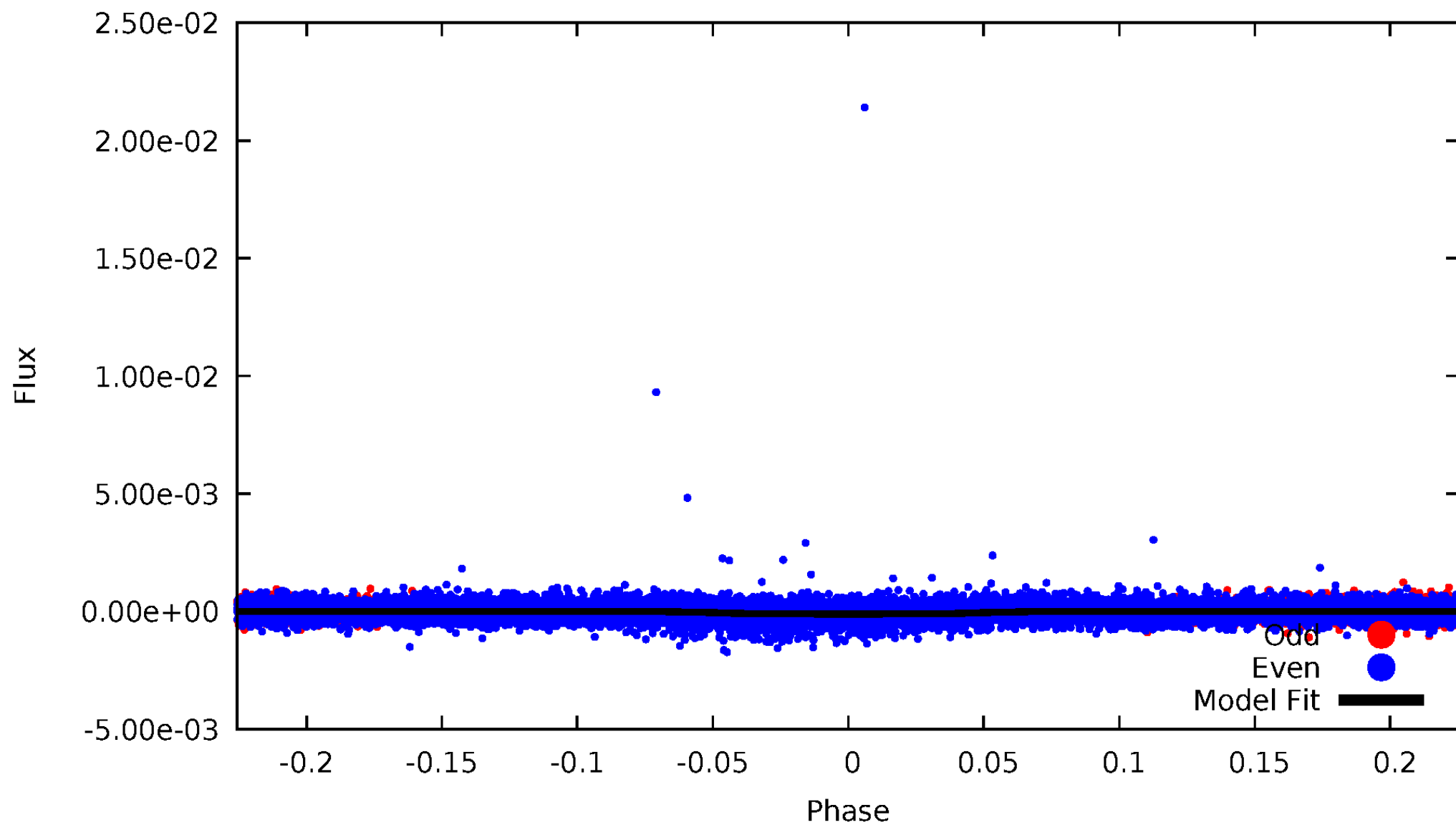
TCE 007038096-02





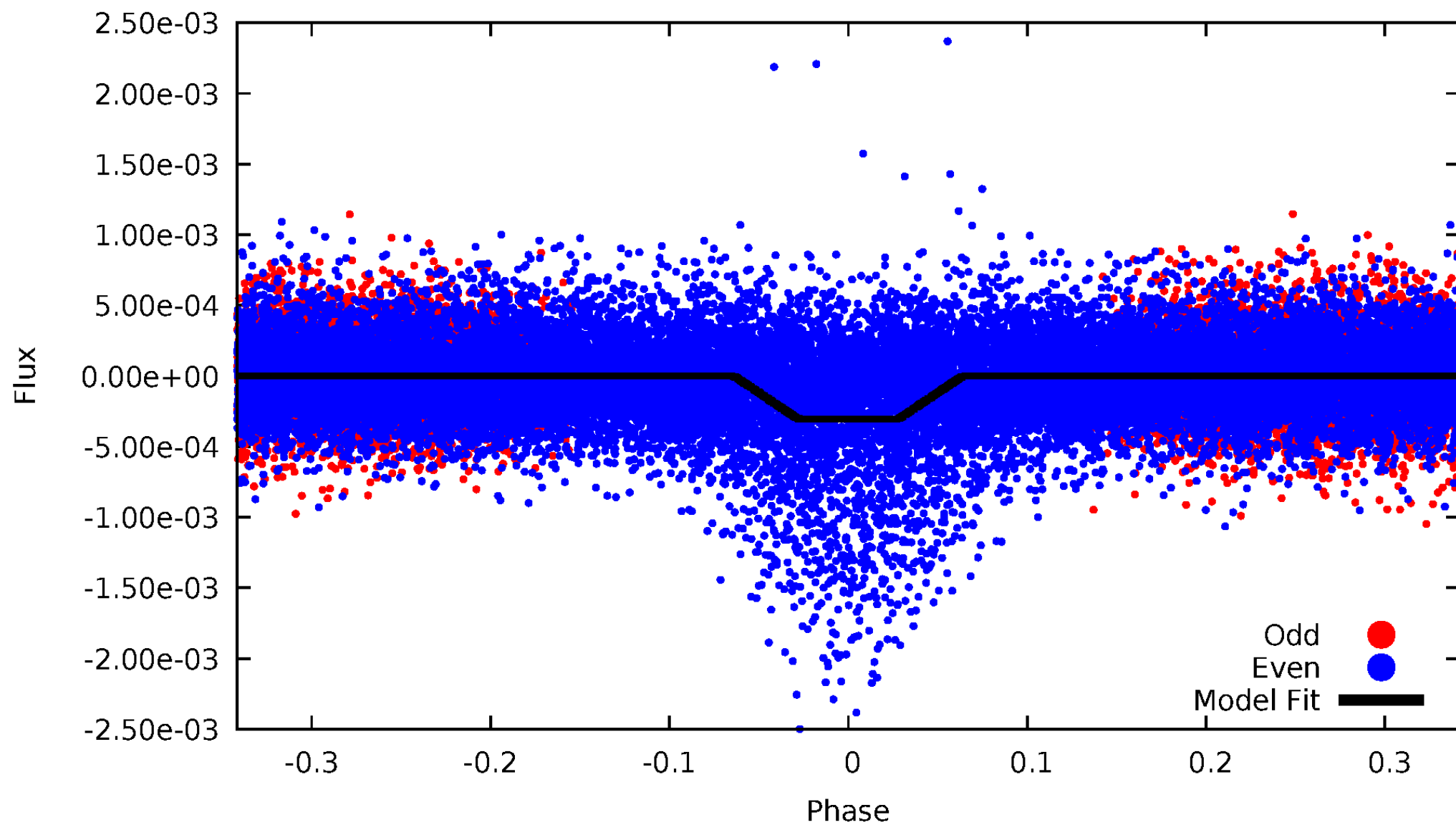
# DV Odd/Even

TCE 007038096-02



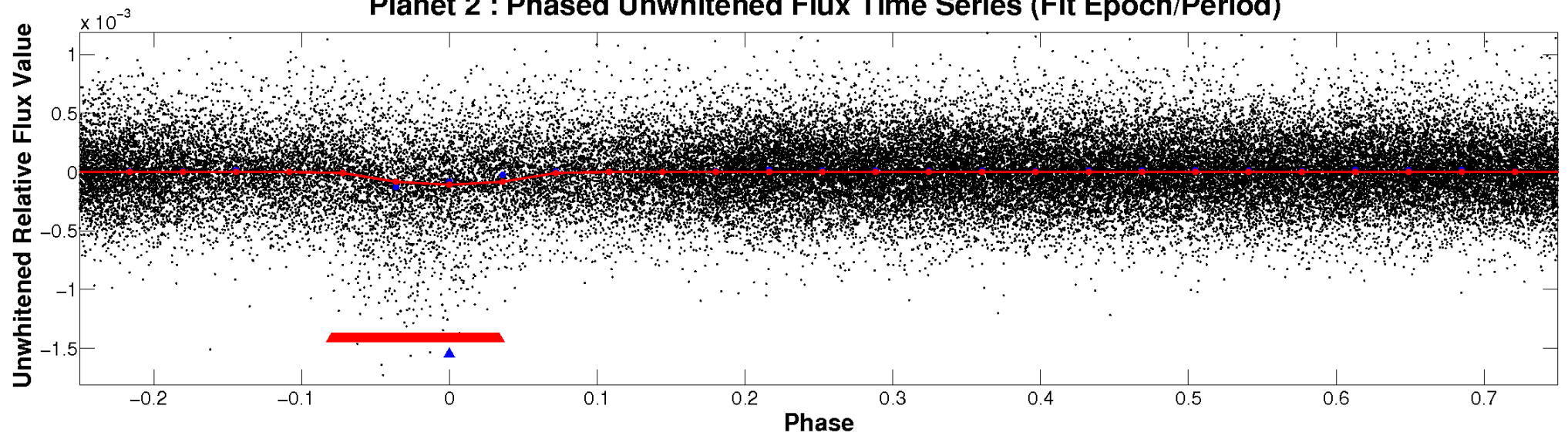
# ALT Odd/Even

TCE 007038096-02

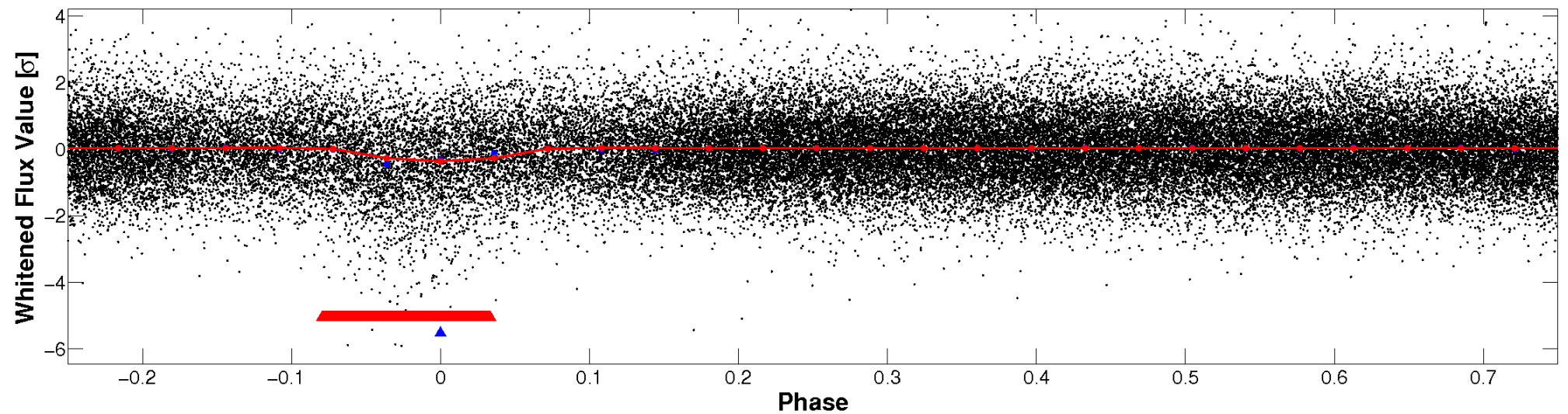


# Non-Whitened Vs. Whitened Light Curve

## Planet 2 : Phased Unwhitened Flux Time Series (Fit Epoch/Period)

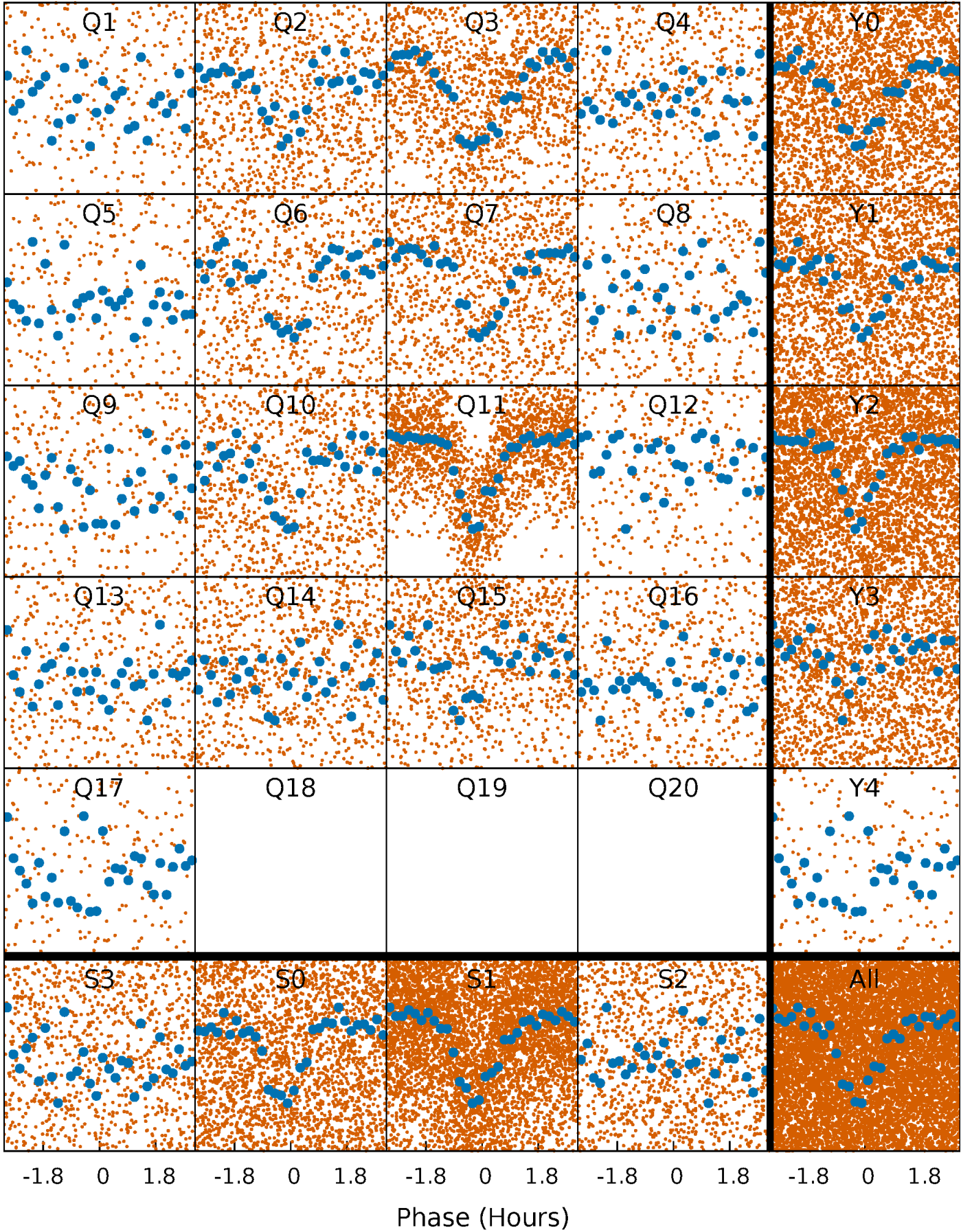


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

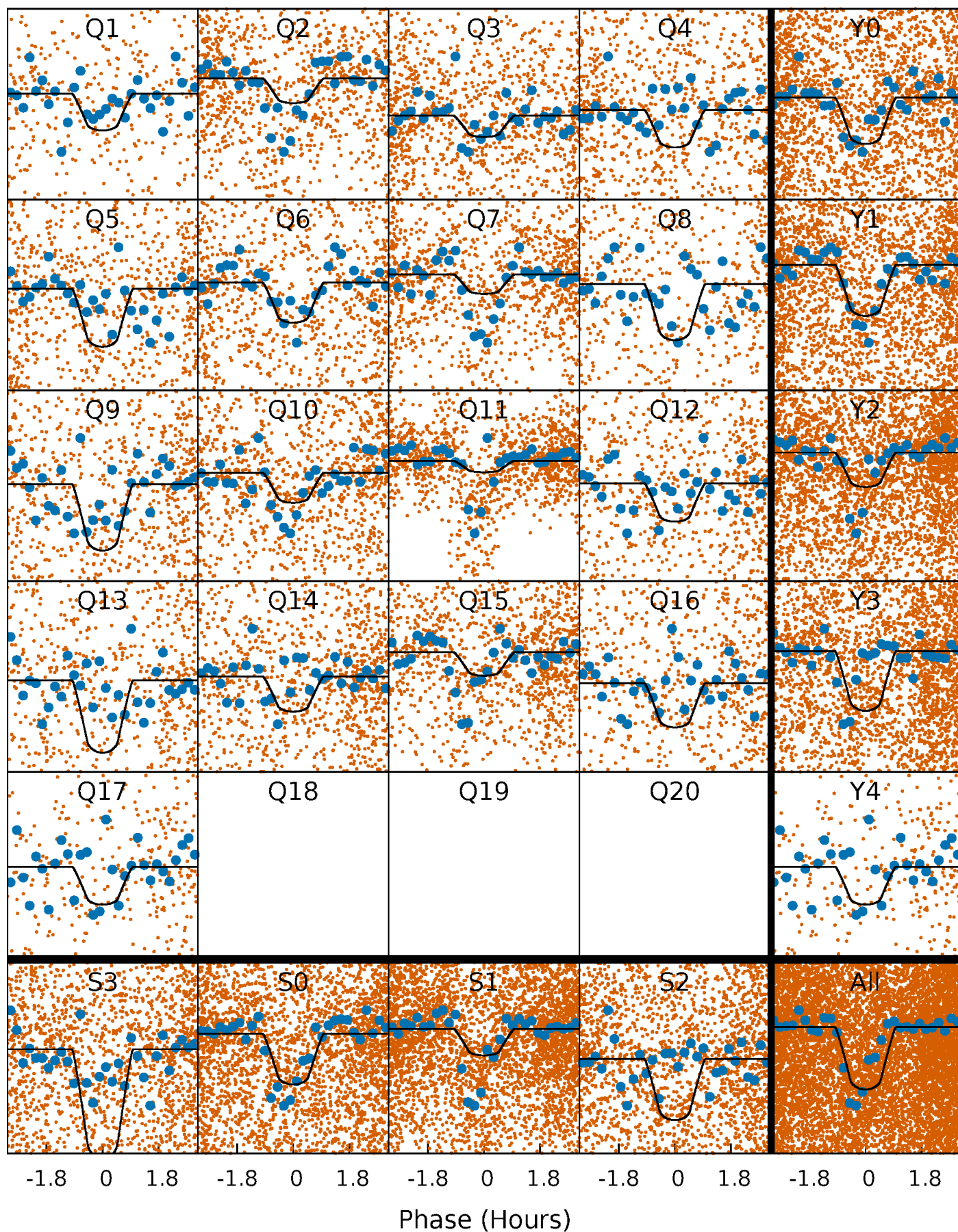
TCE 007038096-02     $P = 0.566809$  Days     $T_0 = 131.796211$  (BKJD)





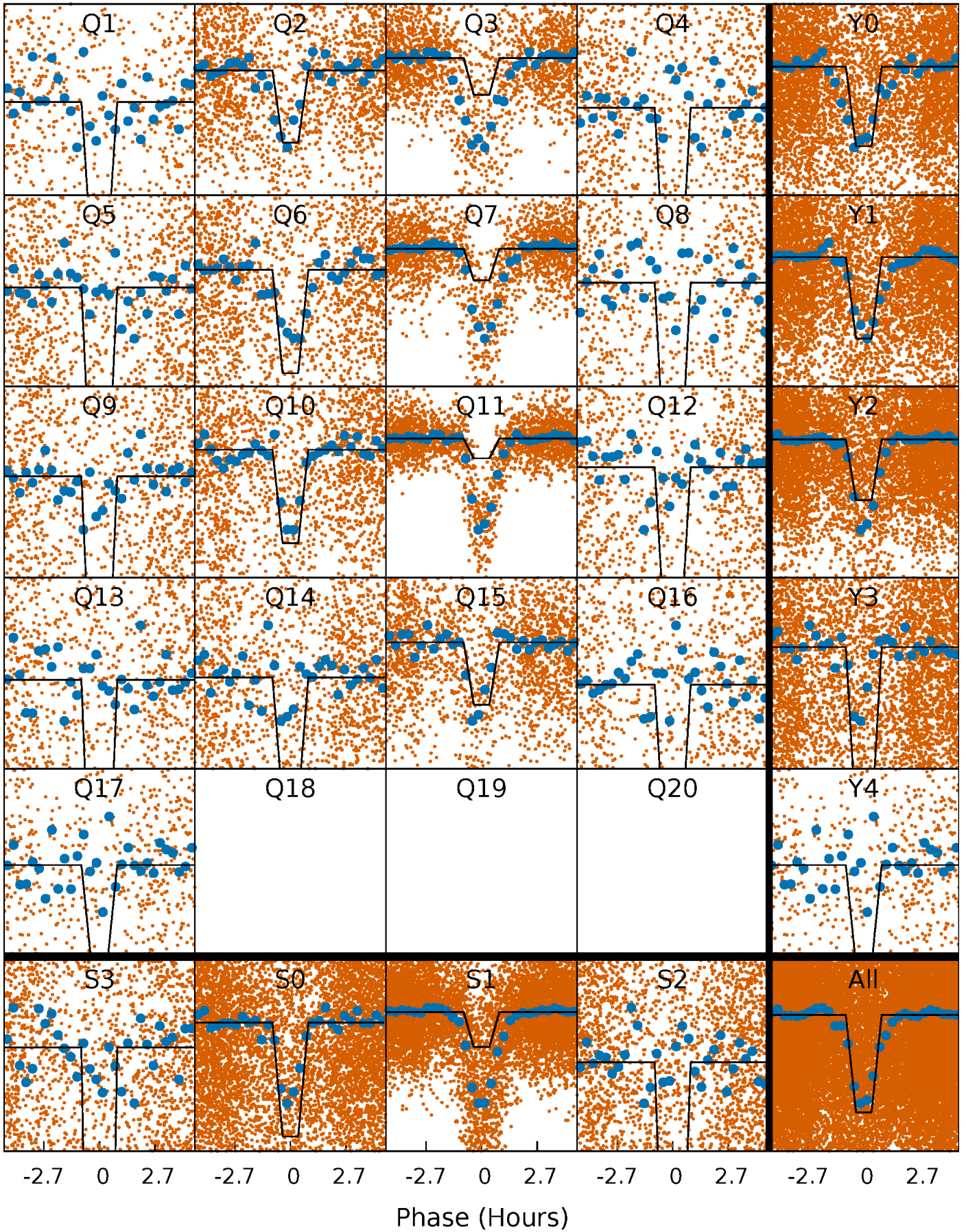
# DV Quarter-Phased Transit Curves

TCE 007038096-02 P= 0.566809 Days  $T_0=131.796211$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

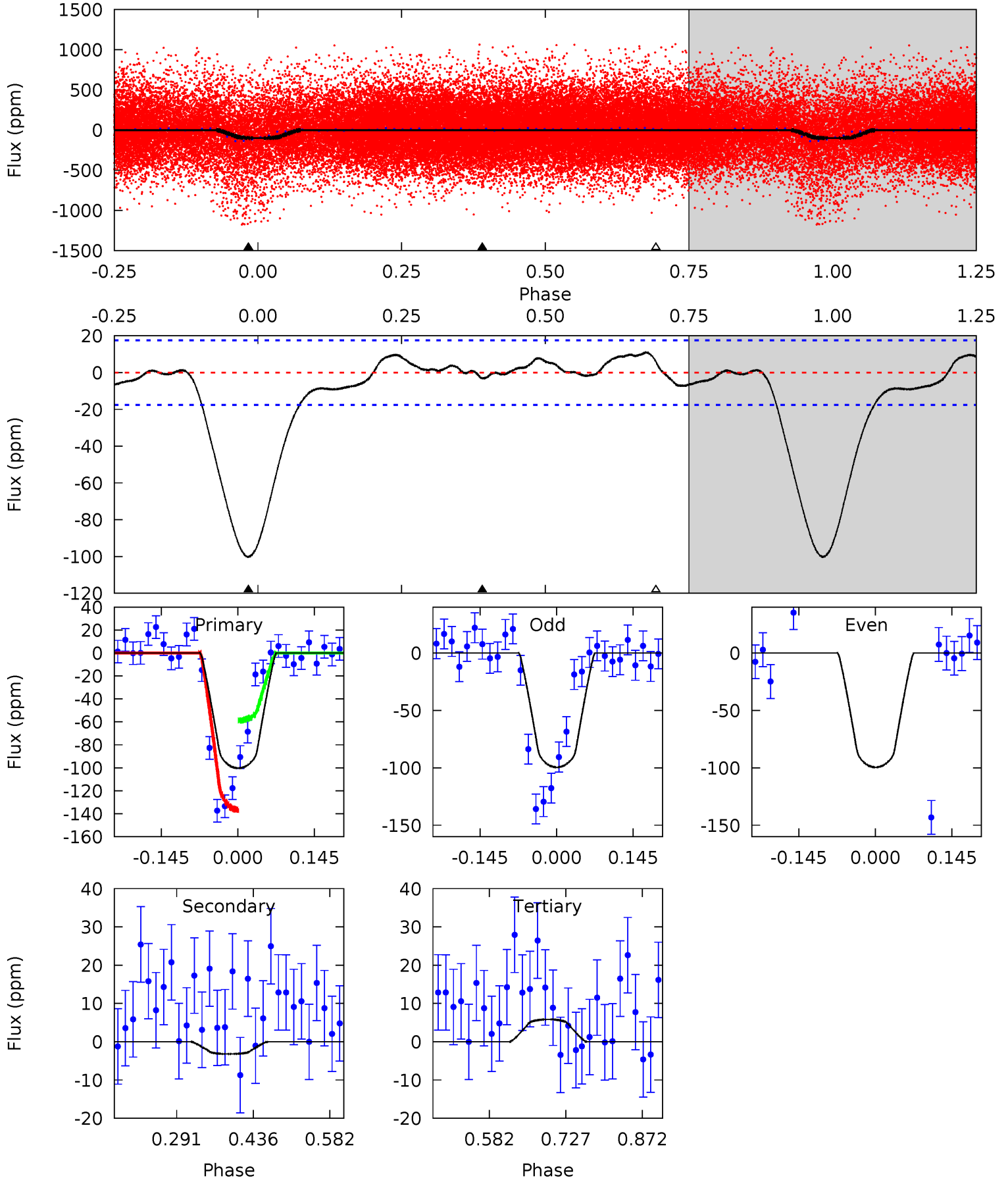
TCE 007038096-02   P= 0.566803 Days    $T_0=131.795819$  (BKJD)



# DV Model-Shift Uniqueness Test

007038096-02, P = 0.566809 Days, E = 131.229402 Days

Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
25.6	0.82	-1.49	0	4.49	1.46	1.57	27.1	25.6	2.31	0.82	0	1.30	0.10	9.94

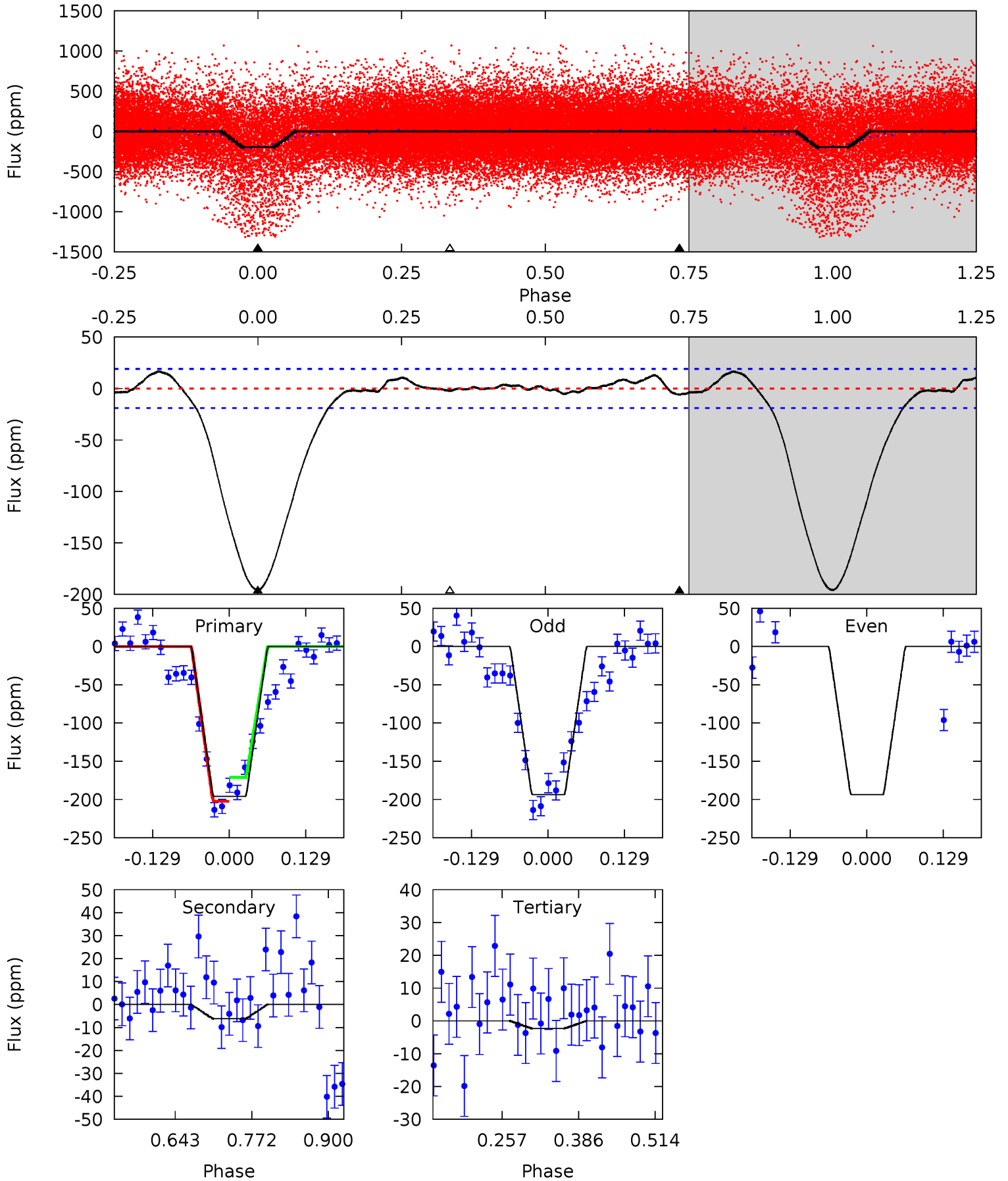




# Alt Model-Shift Uniqueness Test

007038096-02, P = 0.566803 Days, E = 131.229016 Days

Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
46.5	1.47	0.55	0	4.51	1.52	0.87	46.0	46.5	0.93	1.47	0	1.95	0.08	3.73



### Stellar Parameters For KIC 007038096

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6147^{+172}_{-215}$	$4.435^{+0.048}_{-0.192}$	$0.210^{+0.200}_{-0.350}$	$1.096^{+0.301}_{-0.129}$	$1.193^{+0.127}_{-0.170}$	$1.275^{+0.326}_{-0.627}$
	+3%/-3%	+1%/-4%	+95%/-167%	+27%/-12%	+11%/-14%	+26%/-49%
Source	PHO1	KIC0	KIC0	DSEP		

KIC = Kepler Input Catalog; PHO = Photometry; SPE = Spectroscopy; AST = Asteroseismology  
 TRA = Transits; DESP = Dartmouth Models; MULT = Multiple Models

### Secondary Eclipse Parameters for KIC 007038096-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-3\pm4$	$1.39^{+0.54}_{-0.51}$	$3404^{+234}_{-180}$	$-2923^{+6149}_{-501}$	$0.181^{+0.362}_{-0.207}$
Alt.	$-6\pm4$	$2.20^{+0.59}_{-0.53}$	$3401^{+225}_{-165}$	$-3069^{+793}_{-266}$	$0.130^{+0.153}_{-0.097}$

$T_{\text{max}}$  = Theoretical Maximum Planetary Temperature

$T_{\text{obs}}$  = Observed Planetary Temperature (Assuming  $A=0.3$ )

$A_{\text{obs}}$  = Observed Albedo (Assuming  $T=0$ )

If a secondary eclipse is present, the system is likely an EB if  $T_{\text{obs}} \gg T_{\text{max}}$  AND  $A_{\text{obs}} \gg 1.0$

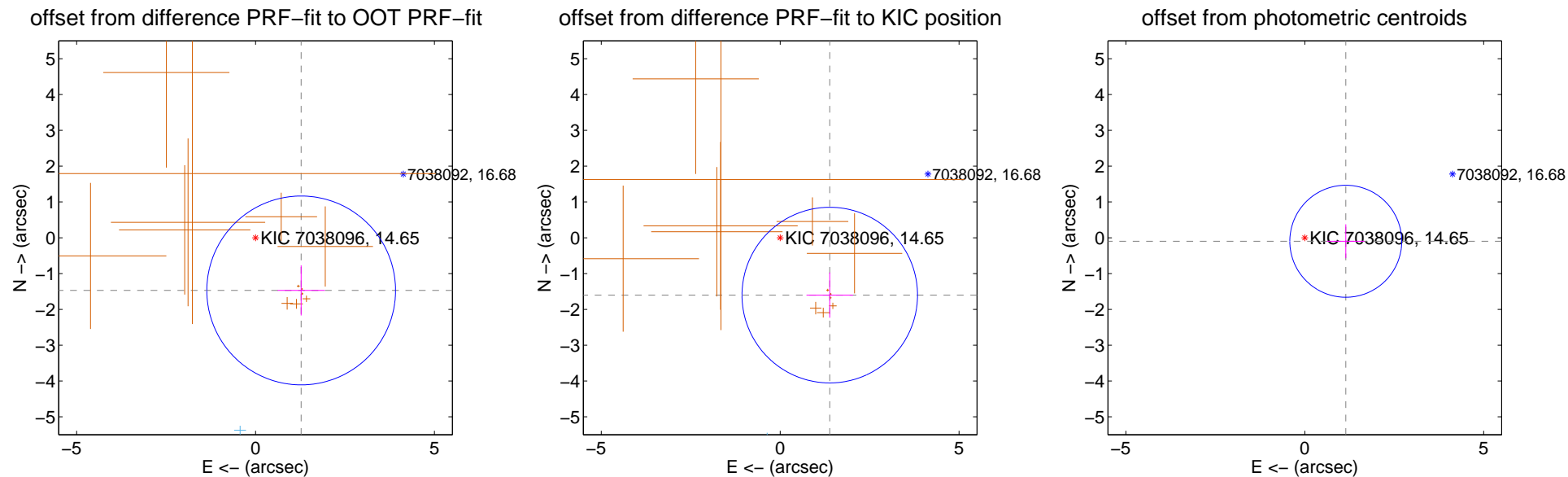
## DV Centroid Data

Supplemental centroid analysis for 007038096-02. Kepler magnitude: 14.65. Transit SNR 18.20

There are 1 quarters with good PRF difference image offsets

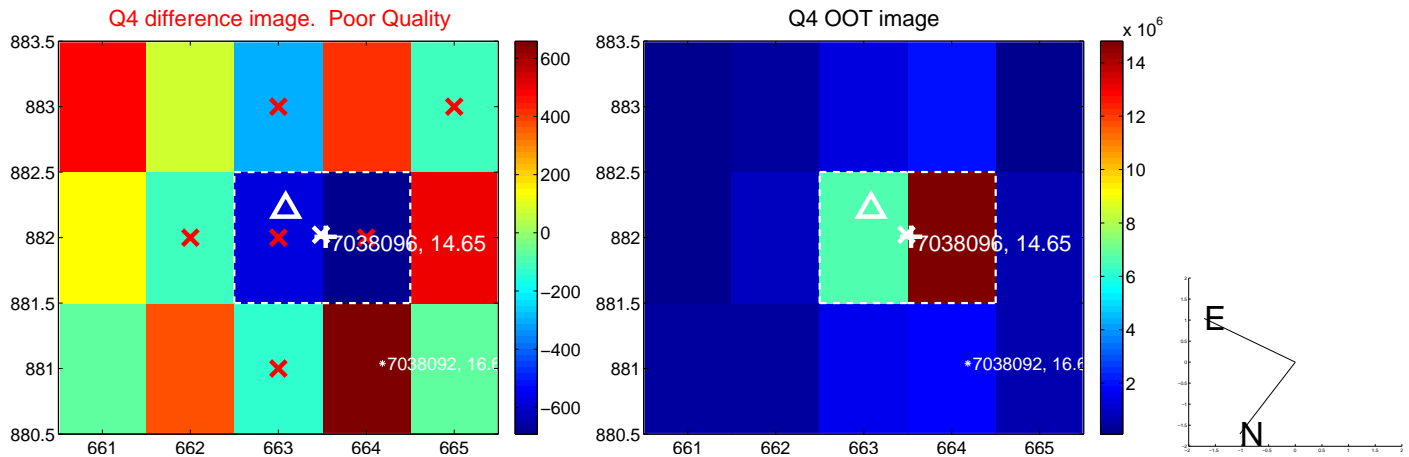
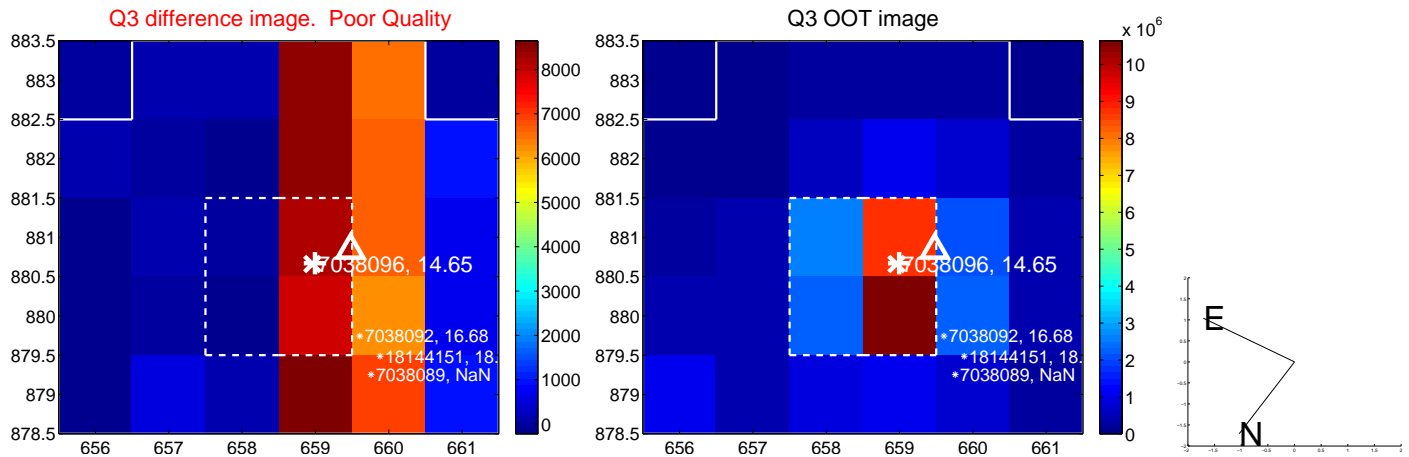
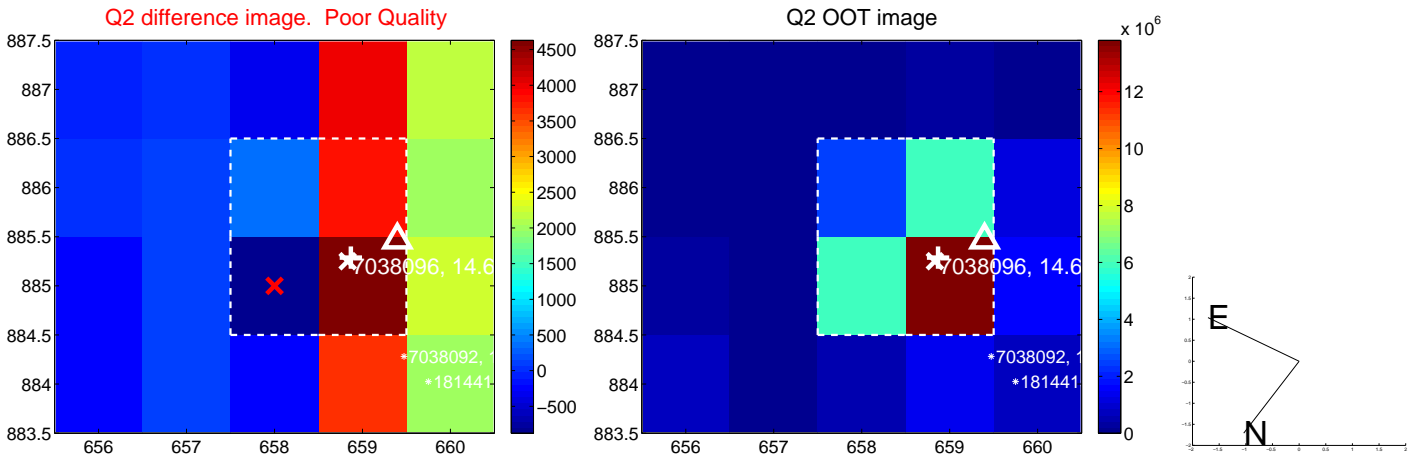
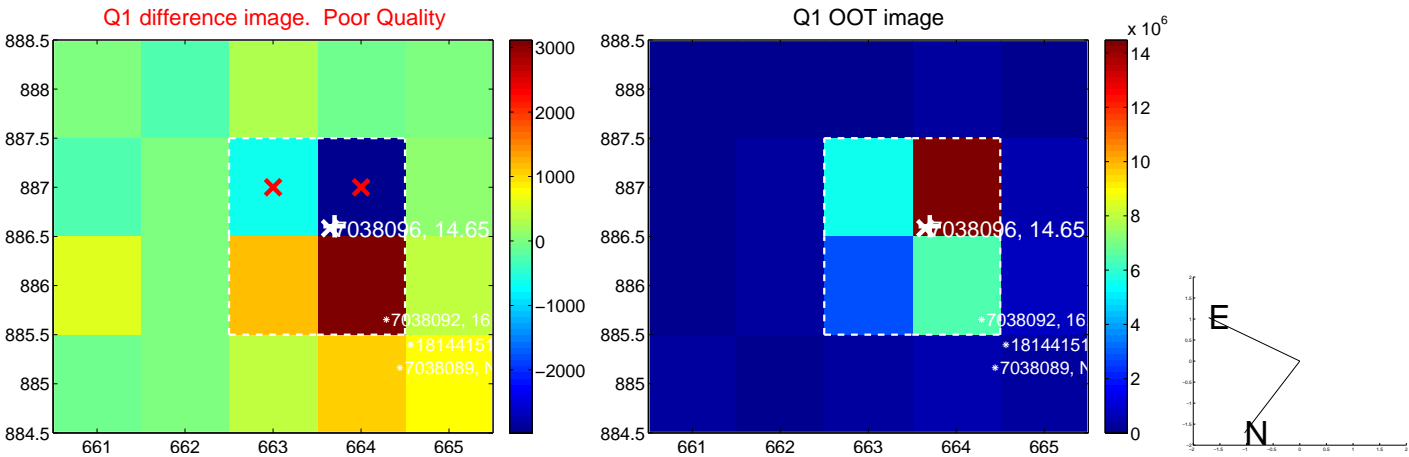
The direct PRF centroid is offset from the target star catalog position by about 0.25 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.947 \pm 0.879$	2.21	$-1.276 \pm 0.660$	$-1.471 \pm 0.698$
PRF-fit source offset from KIC position	$2.118 \pm 0.817$	2.59	$-1.386 \pm 0.651$	$-1.601 \pm 0.632$
photometric centroid source offset	$1.15 \pm 0.52$	2.21	$-1.15 \pm 0.52$	$-0.10 \pm 0.47$

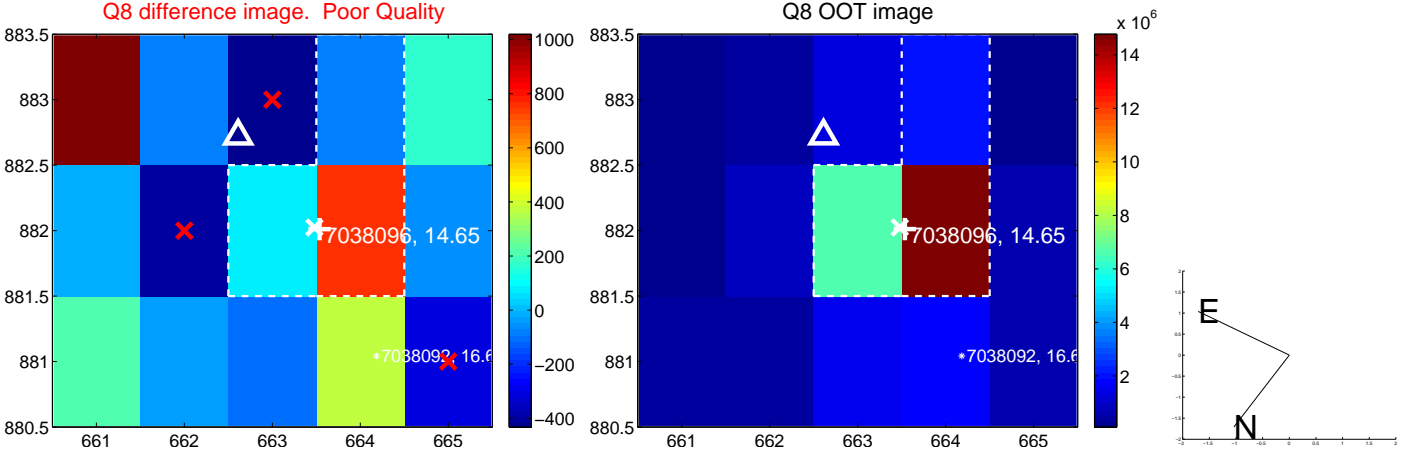
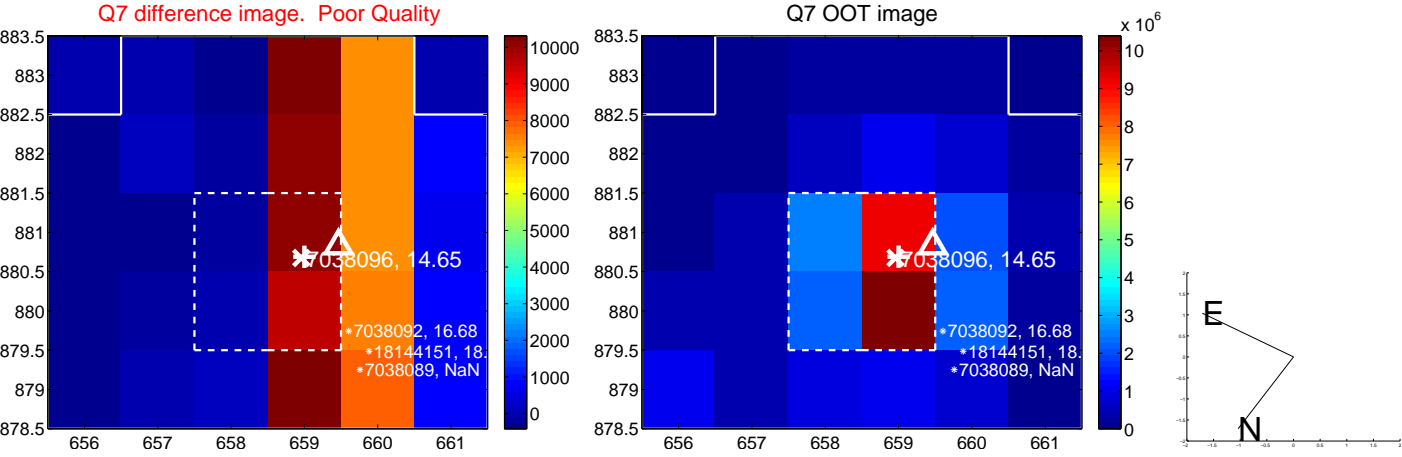
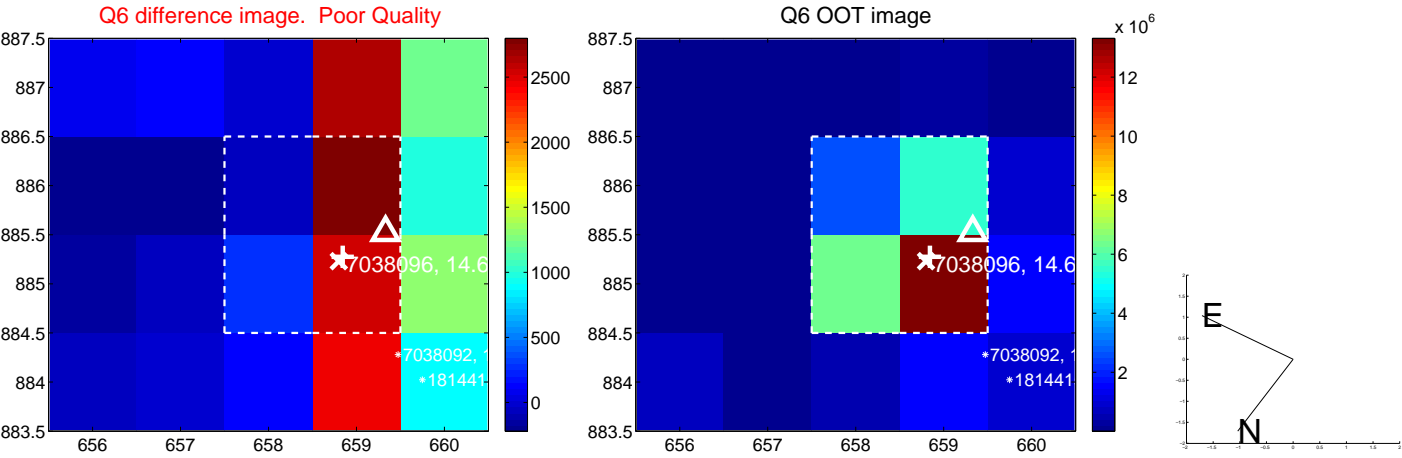
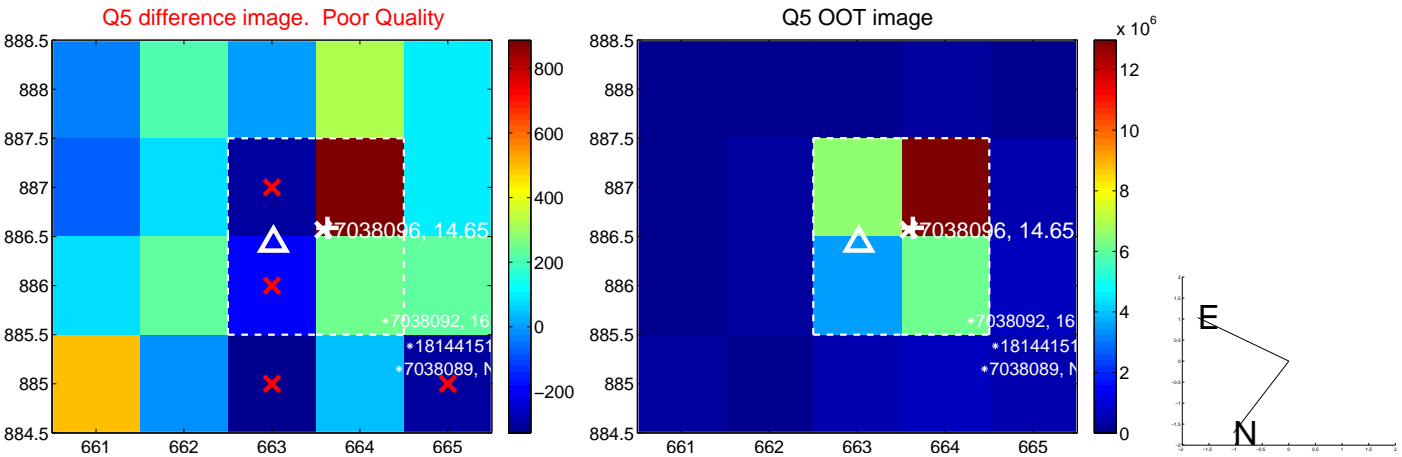


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three- $\sigma$ . Red \*: target star. Blue \*: Other stars. Text next to a star gives its KIC ID and kepmag. KIC IDs > 15,000,000 are from the UKIRT catalog.

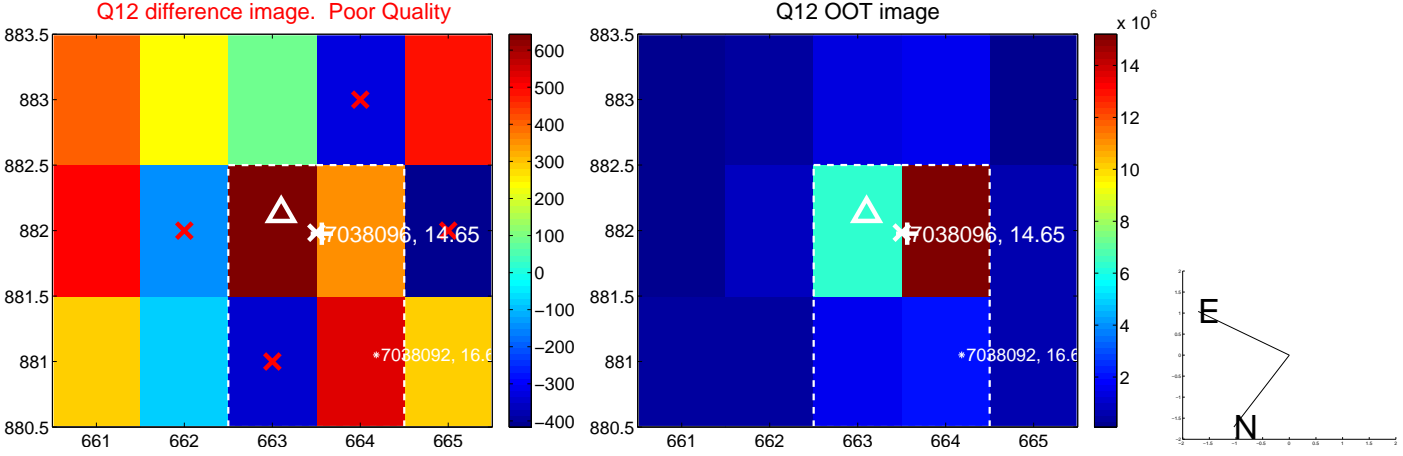
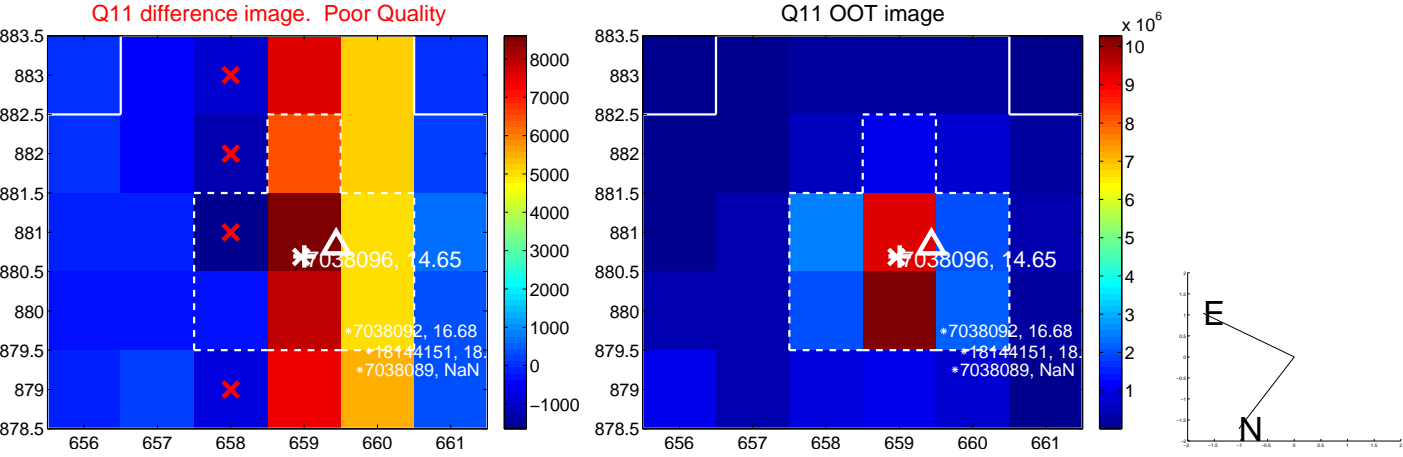
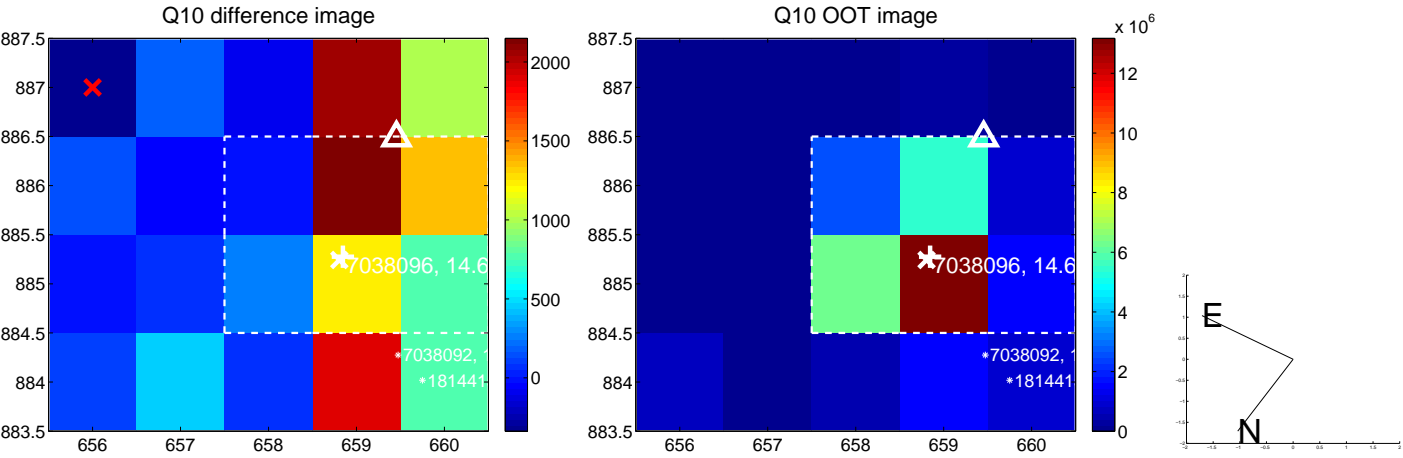
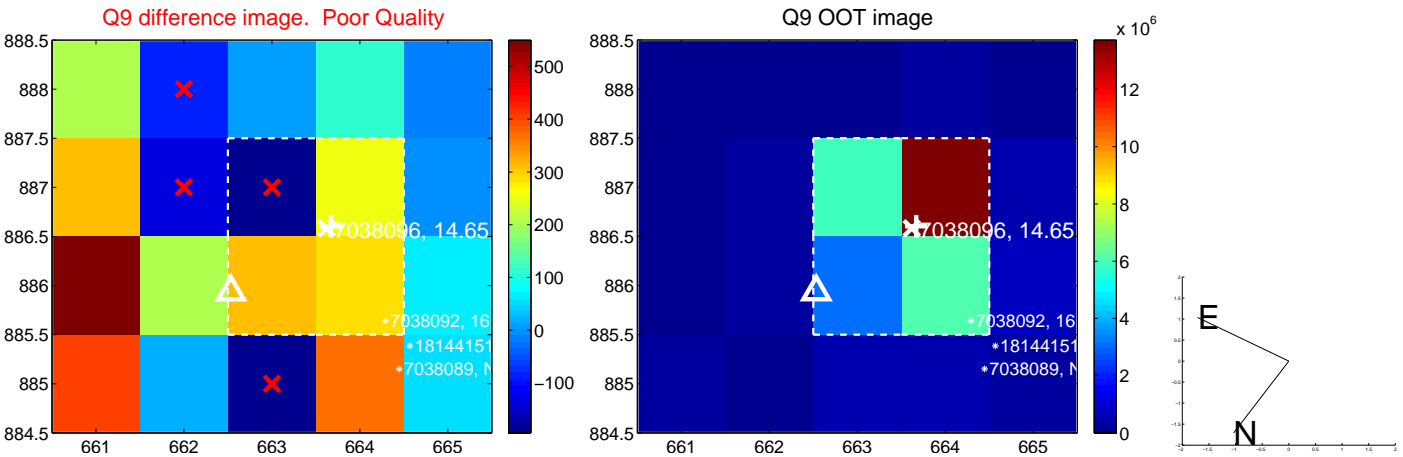
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



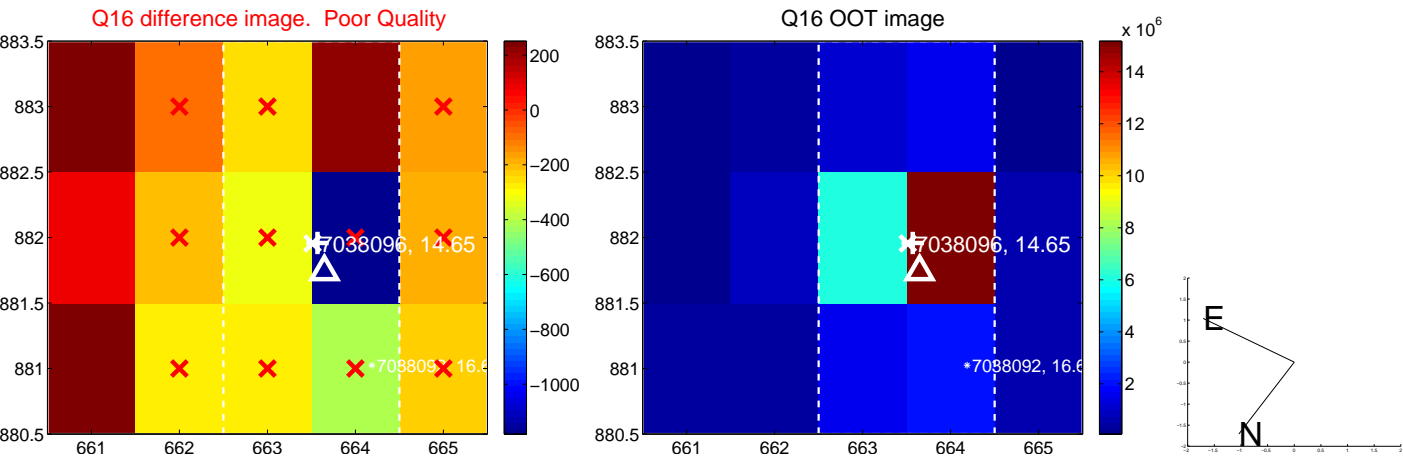
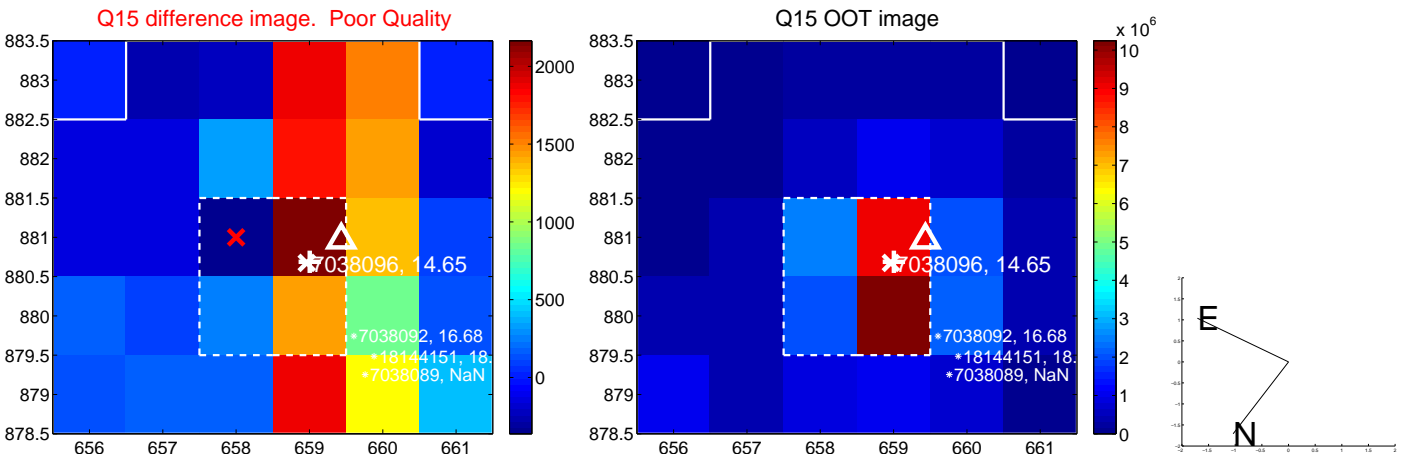
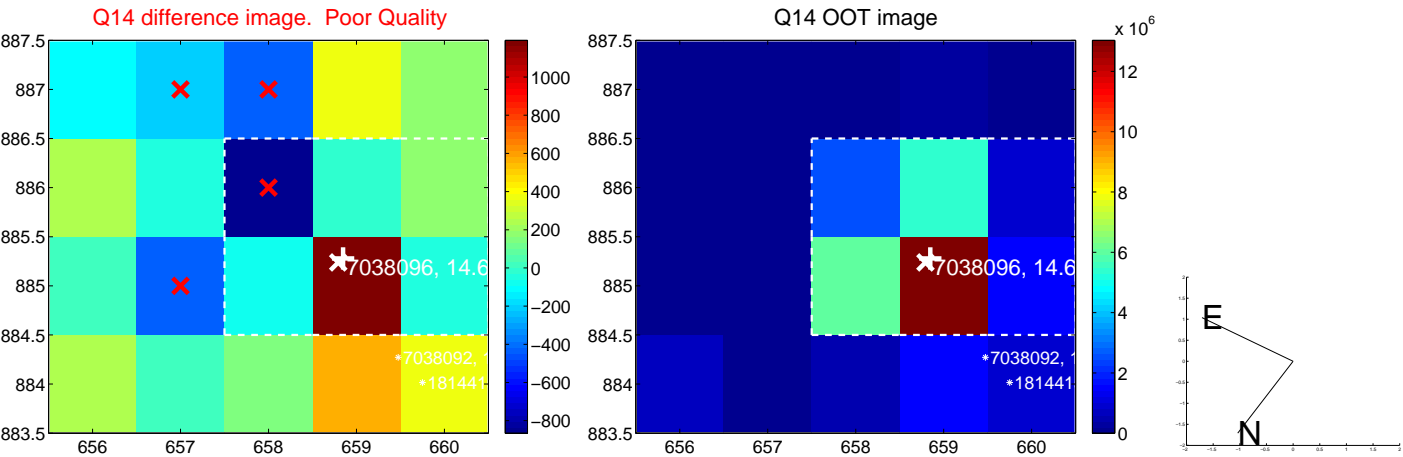
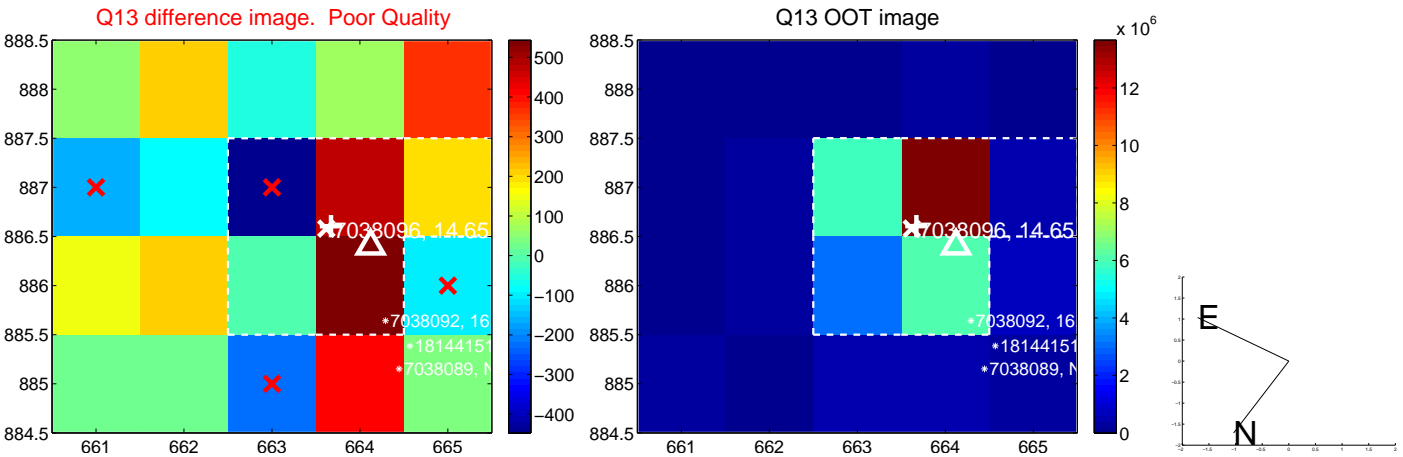
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

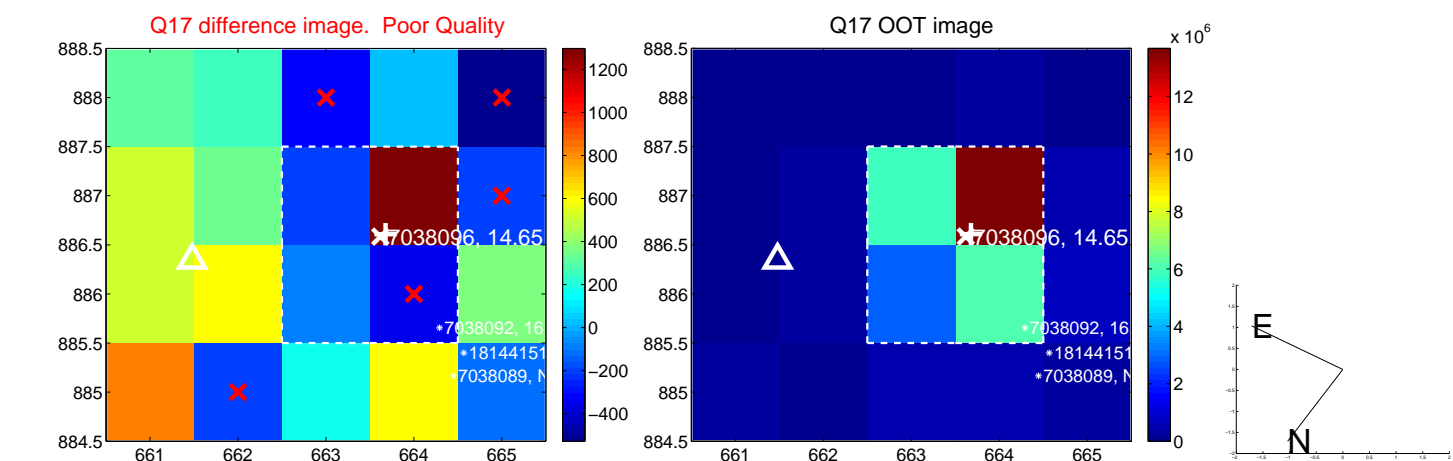


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

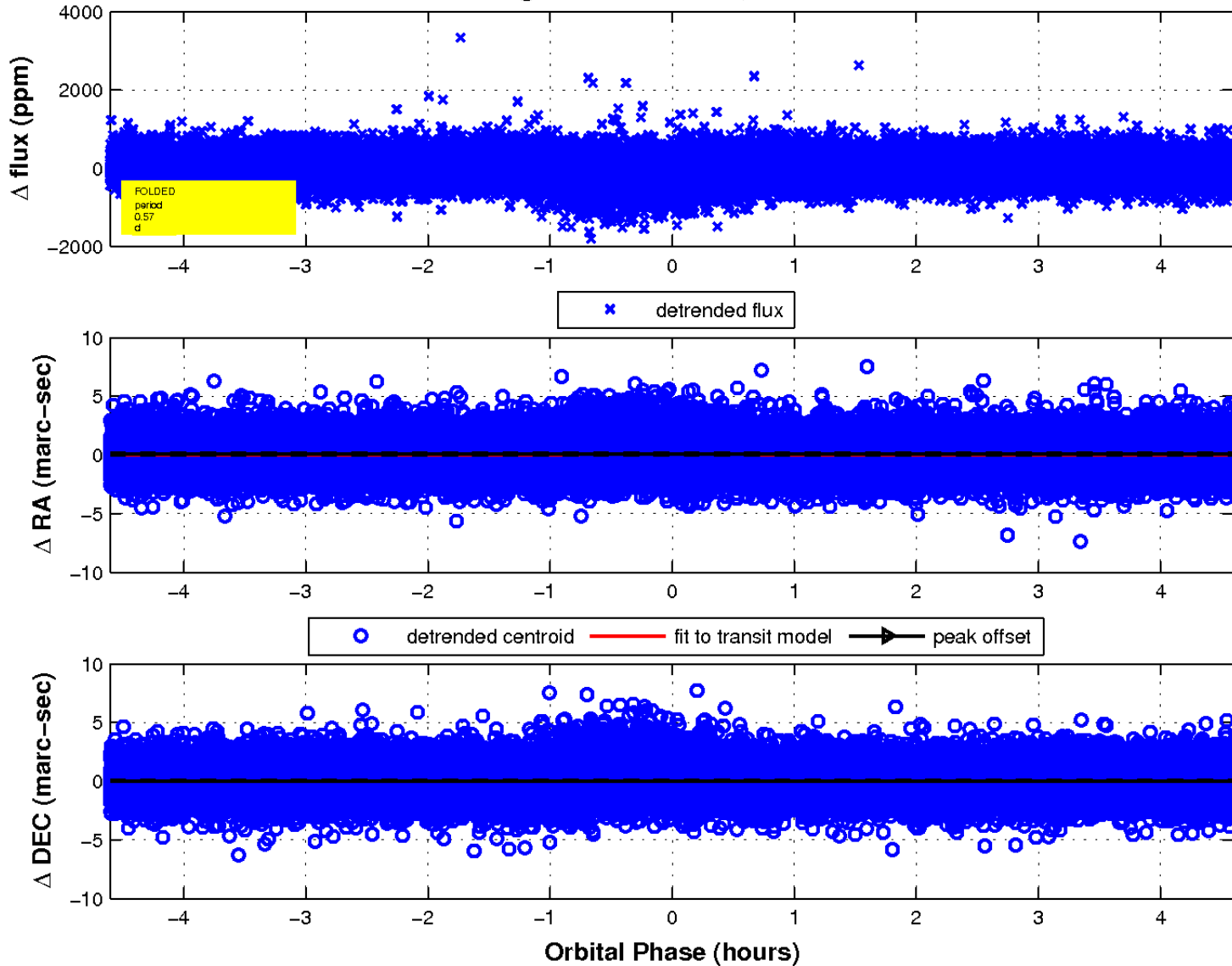




white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



fluxWeightedCentroids, Planet 2 of 2



# UKIRT Image

Declination

