

# KIC 010027323

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
010027323-01	OBS	1596.01	5.923647	134.683663	393.5	2.792	23.1	23.9	0.50	3883	1.13	18.90
010027323-02	OBS	1596.02	105.358224	138.681670	1237.7	3.721	16.5	19.3	0.50	3883	1.83	0.41

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
010027323-01	OBS	PC	1.00	0	0	0	0	CENT_KIC_POS
010027323-02	OBS	PC	0.74	0	0	0	0	CENT_KIC_POS

**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.

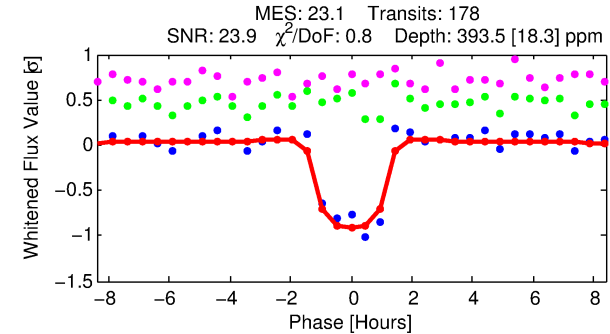
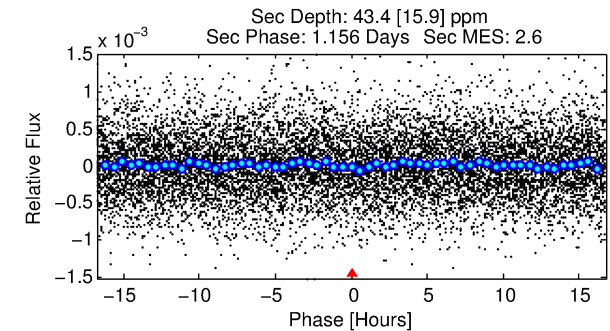
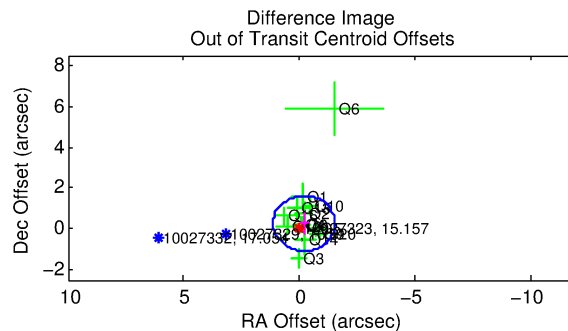
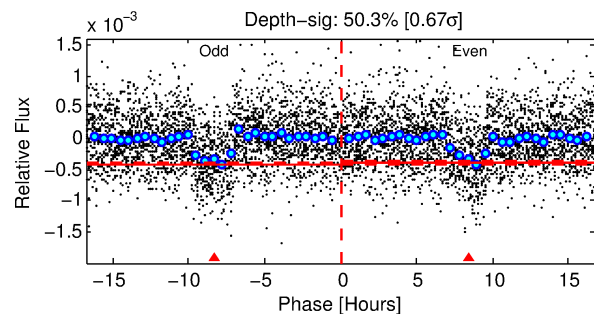
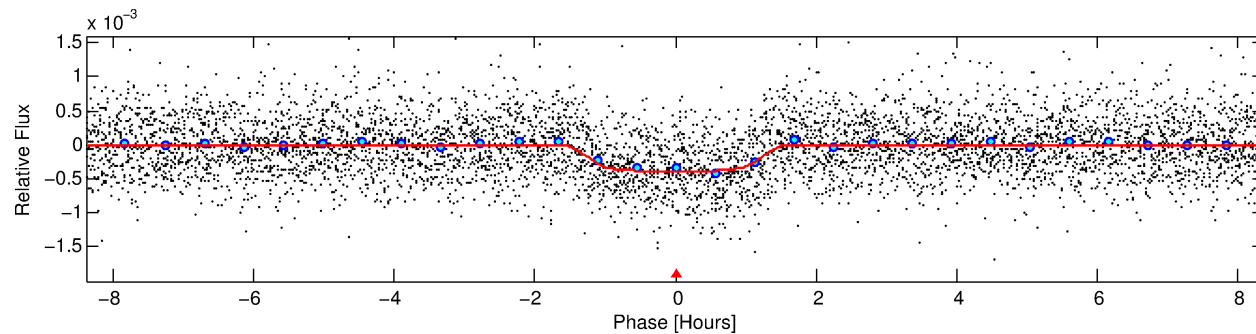
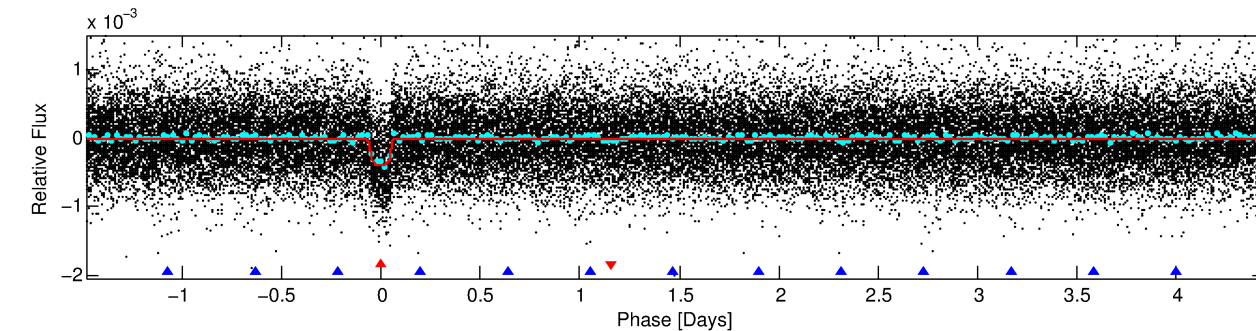
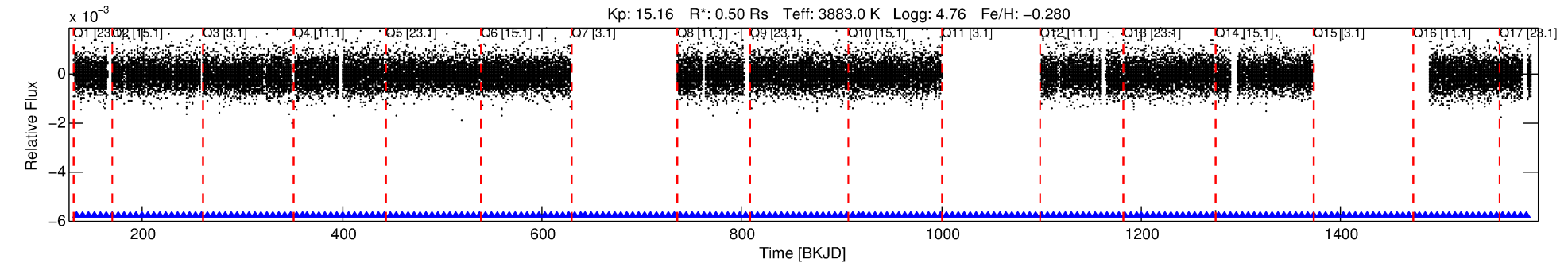
## Ephemeris Match Information For 010027323-01

No Significant Match Found

# DV One-Page Summary

KIC: 10027323 Candidate: 1 of 2 Period: 5.924 d  
KOI: K01596.01 Name: Kepler-309b Corr: 0.976

Kp: 15.16 R\*: 0.50 Rs Teff: 3883.0 K Logg: 4.76 Fe/H: -0.280



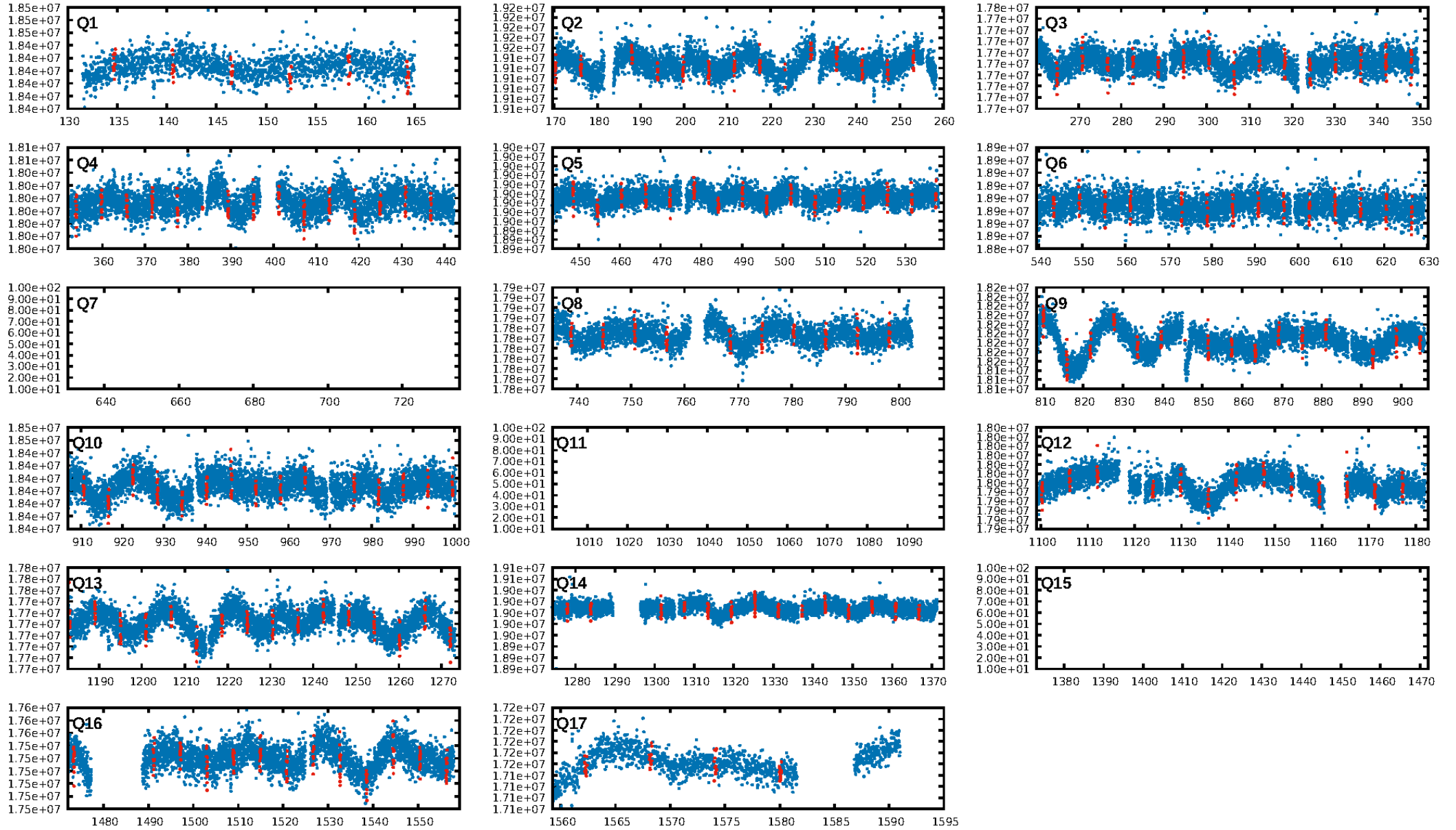
## DV Fit Results:

Period = 5.92365 [0.00002] d  
Epoch = 134.6837 [0.0021] BKJD  
Rp/R\* = 0.0209 [0.0047]  
a/R\* = 8.82 [9.43]  
b = 0.87 [0.32]  
Seff = 18.90 [2.42]  
Teff = 532 [17] K  
Rp = 1.13 [0.27] Re  
a = 0.0515 [0.0034] AU  
Ag = 49.56 [29.05] [1.67σ]  
Teffp = 2181 [320] K [5.14σ]

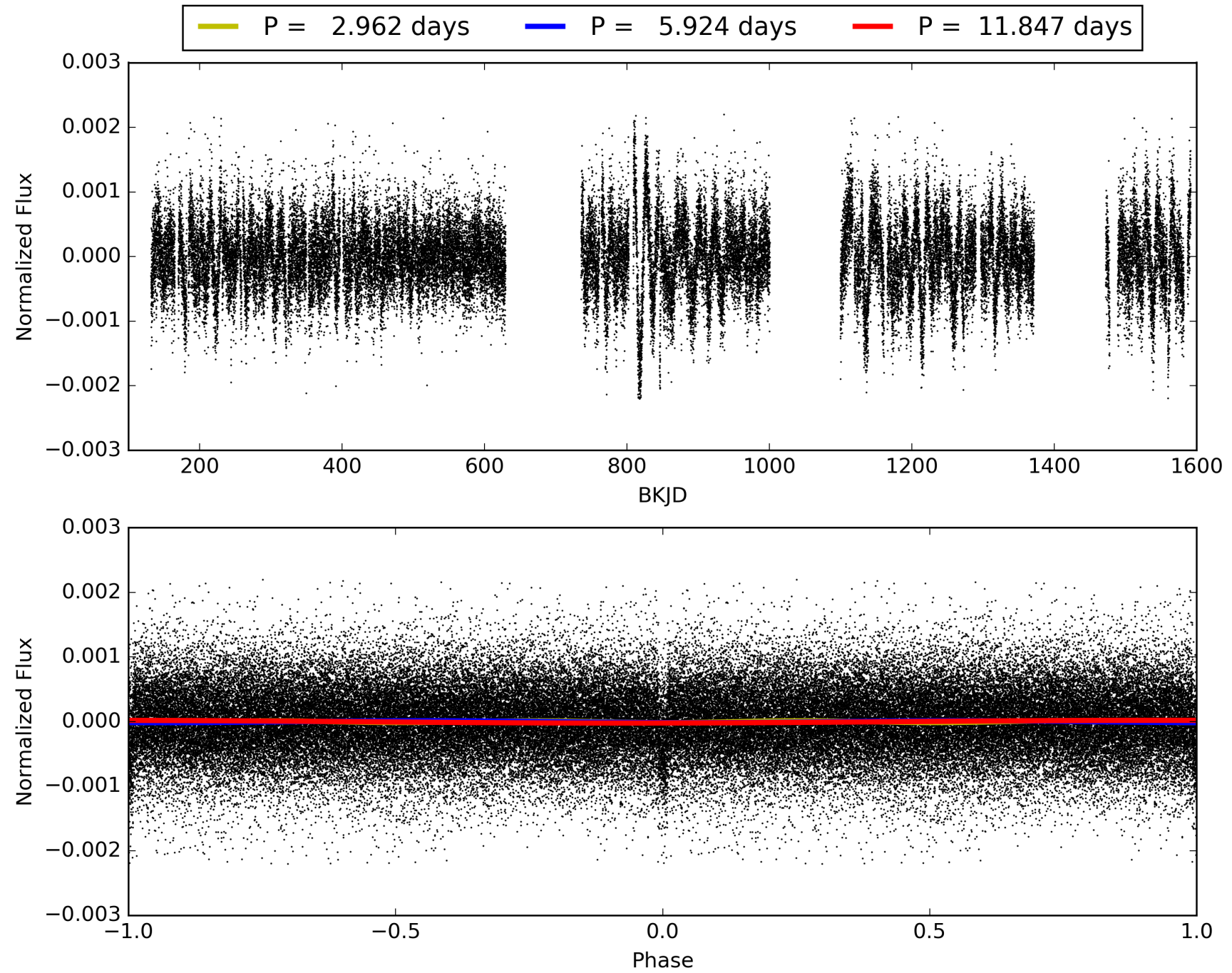
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [512.96σ]  
ModelChiSquare2-sig: 100.0%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 4.19e-116  
RollingBand-fgt: 1.00 [168/168]  
GhostDiagnostic-chr: 3.75  
Centroid-sig: 27.5%  
Centroid-so: 0.662 arcsec [1.25σ]  
OotOffset-rm: 0.338 arcsec [0.75σ]  
KicOffset-rm: 0.691 arcsec [1.49σ]  
OotOffset-st: 4/1/4/4 [13]  
KicOffset-st: 4/1/4/4 [13]  
DiffImageQuality-fgm: 0.92 [12/13]  
DiffImageOverlap-fno: 1.00 [14/14]

# TCE 010027323-01, PDC Light Curves

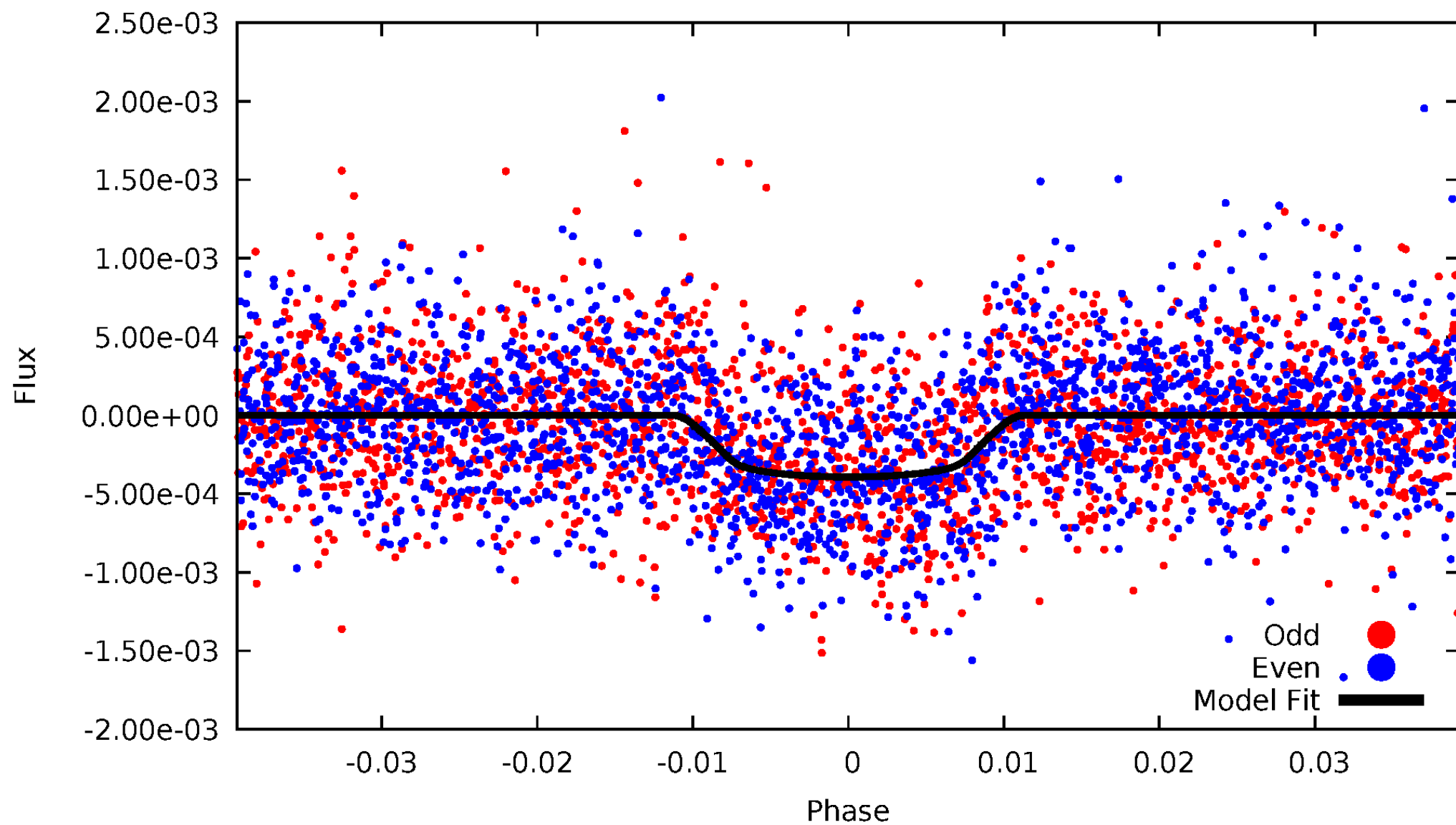


TCE 010027323-01



# DV Odd/Even

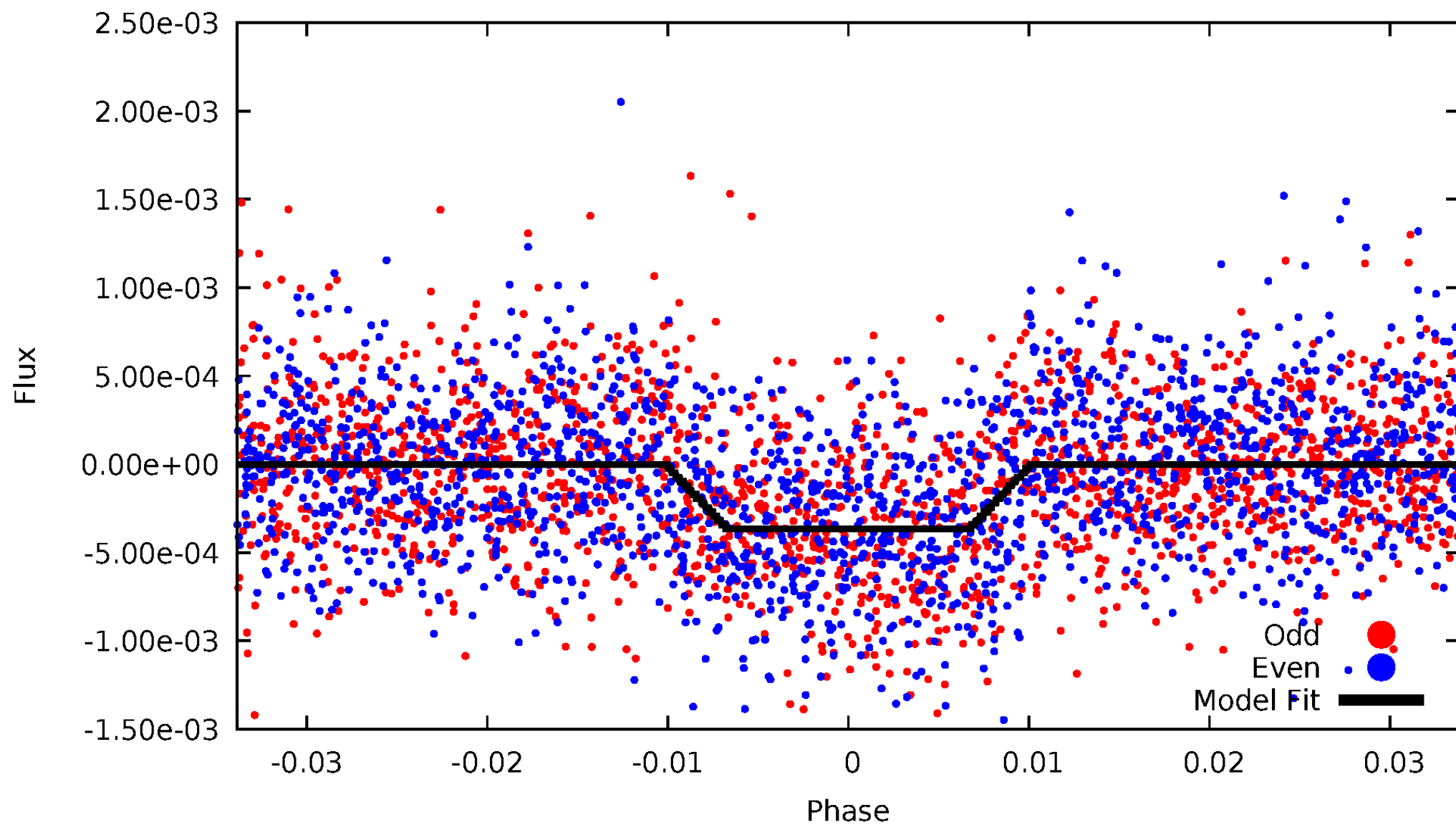
TCE 010027323-01





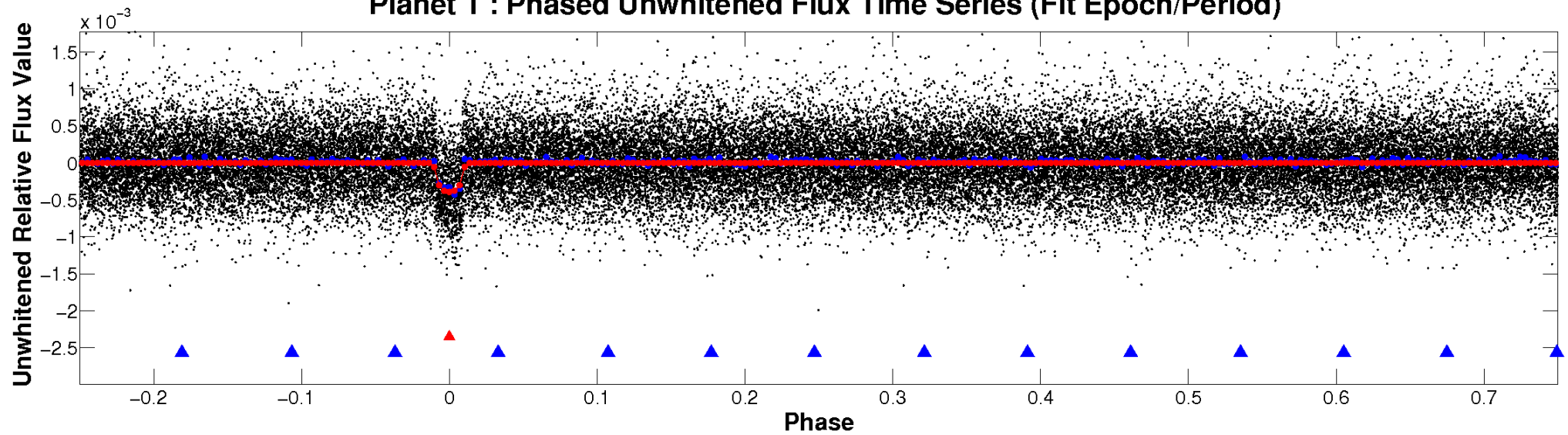
# ALT Odd/Even

TCE 010027323-01

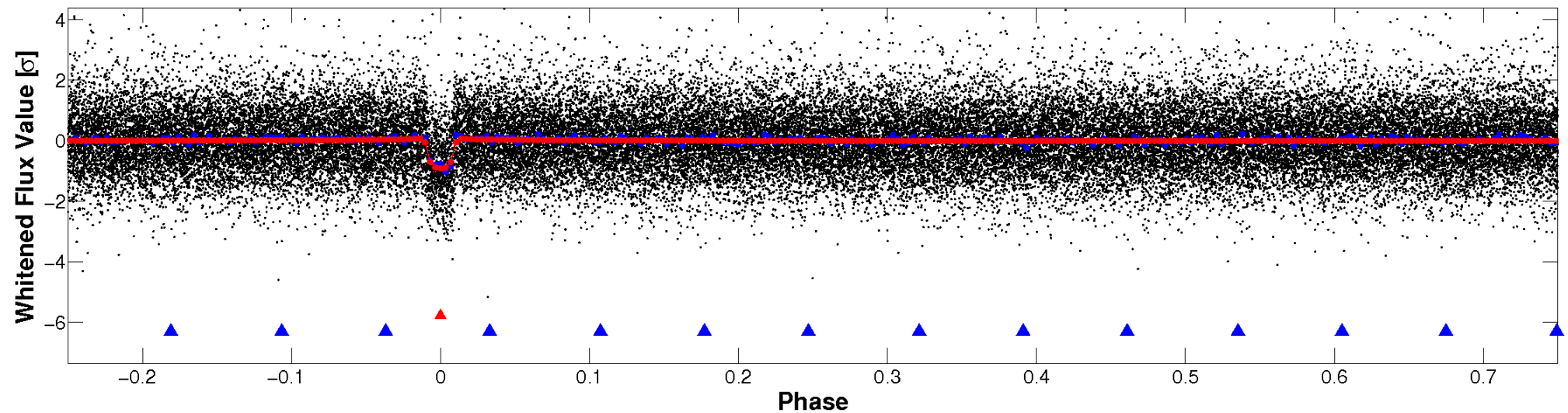


# Non-Whitened Vs. Whitened Light Curve

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

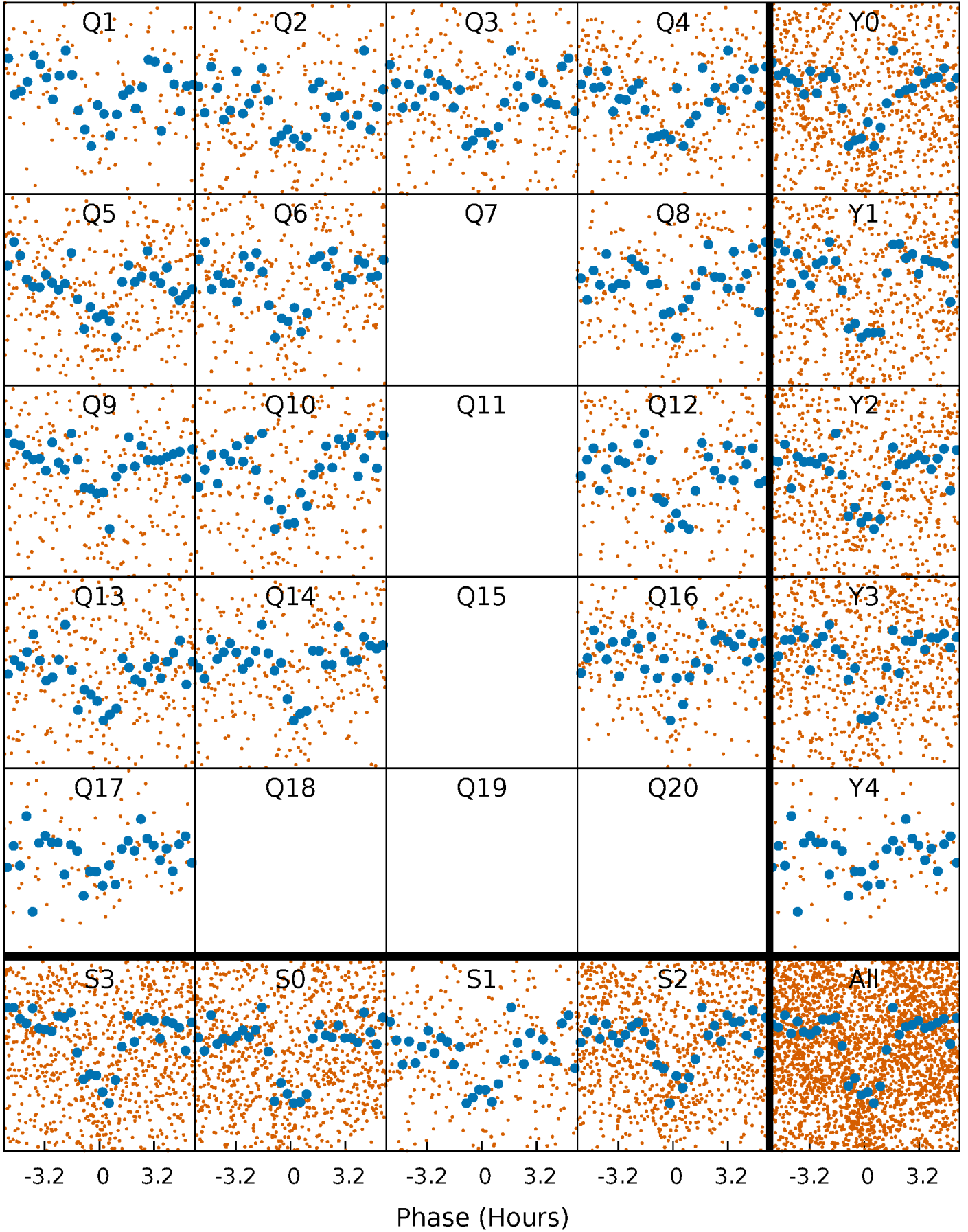


**Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



# PDC Quarter-Phased Transit Curves

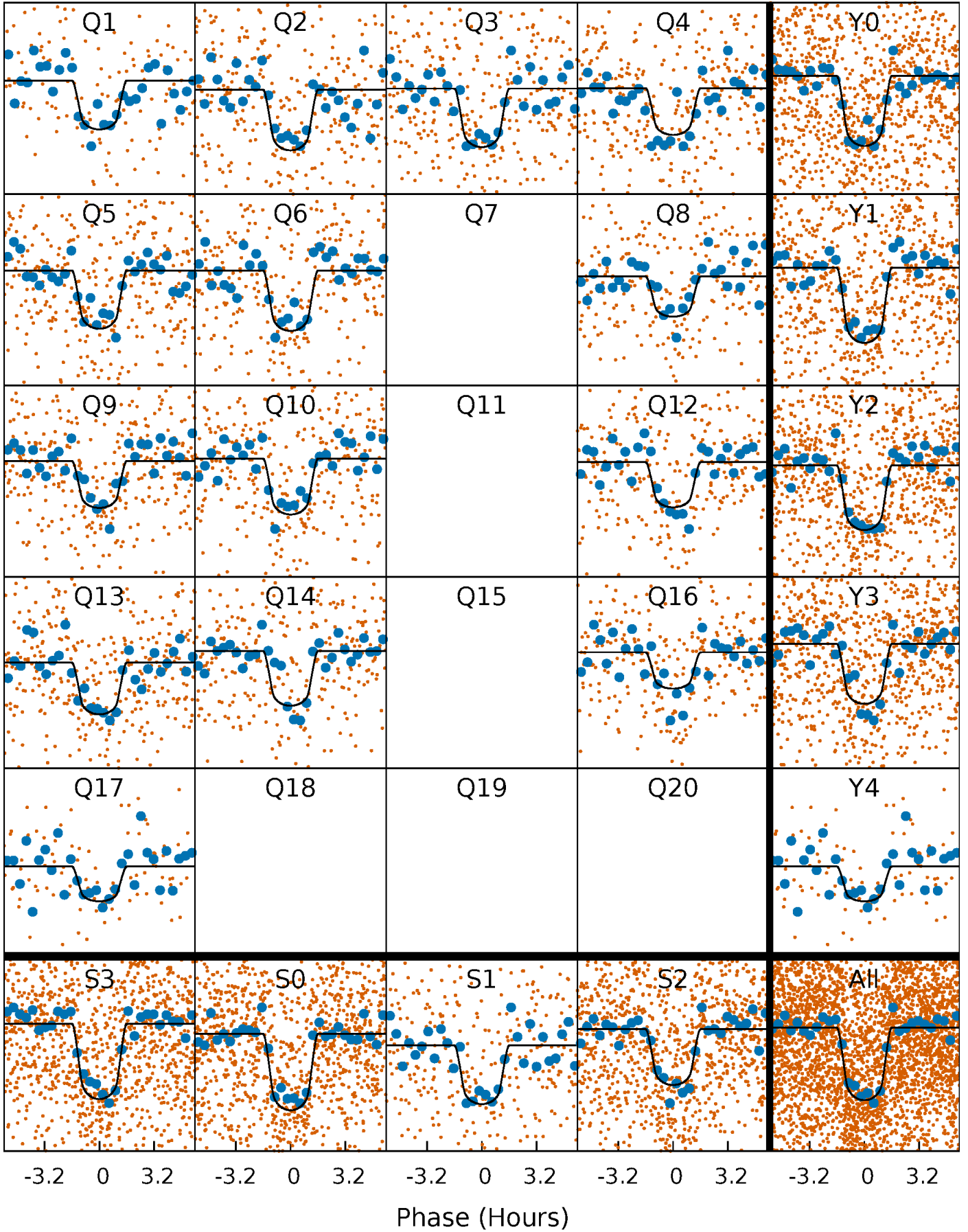
TCE 010027323-01 P= 5.923647 Days  $T_0=134.683663$  (BKJD)





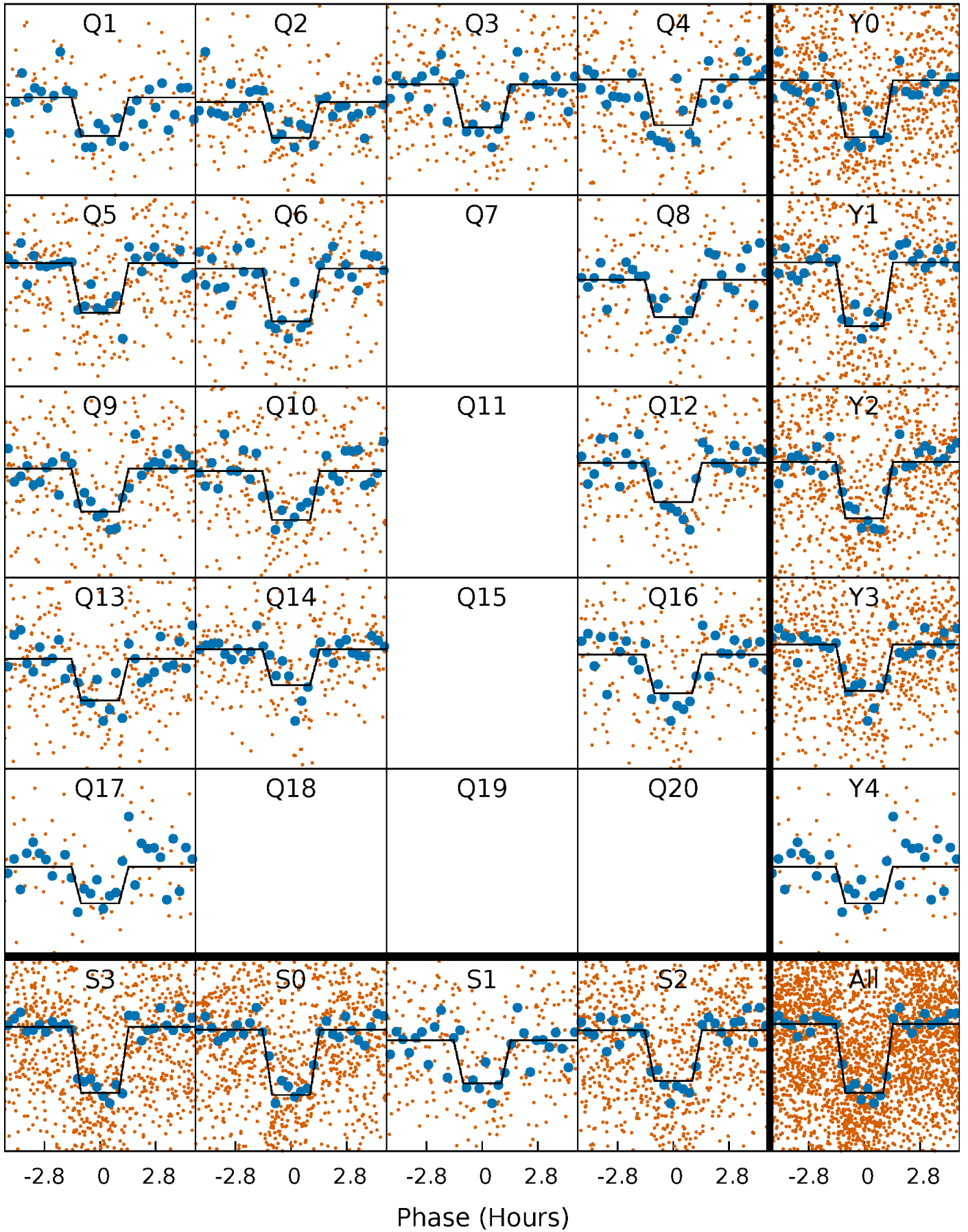
# DV Quarter-Phased Transit Curves

TCE 010027323-01 P= 5.923647 Days  $T_0=134.683663$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

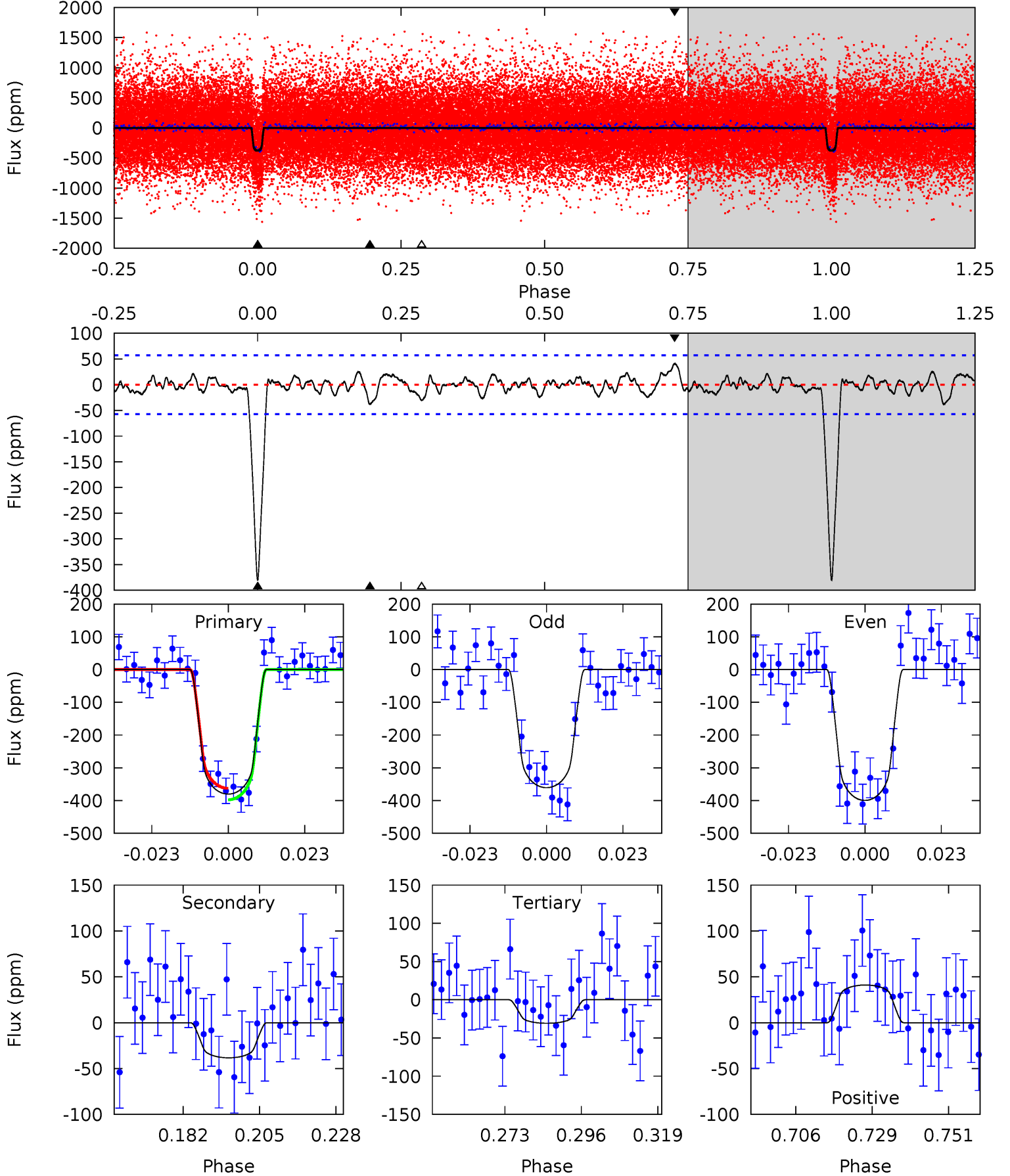
TCE 010027323-01 P= 5.923695 Days  $T_0=134.678740$  (BKJD)



# DV Model-Shift Uniqueness Test

010027323-01, P = 5.923647 Days, E = 128.760016 Days

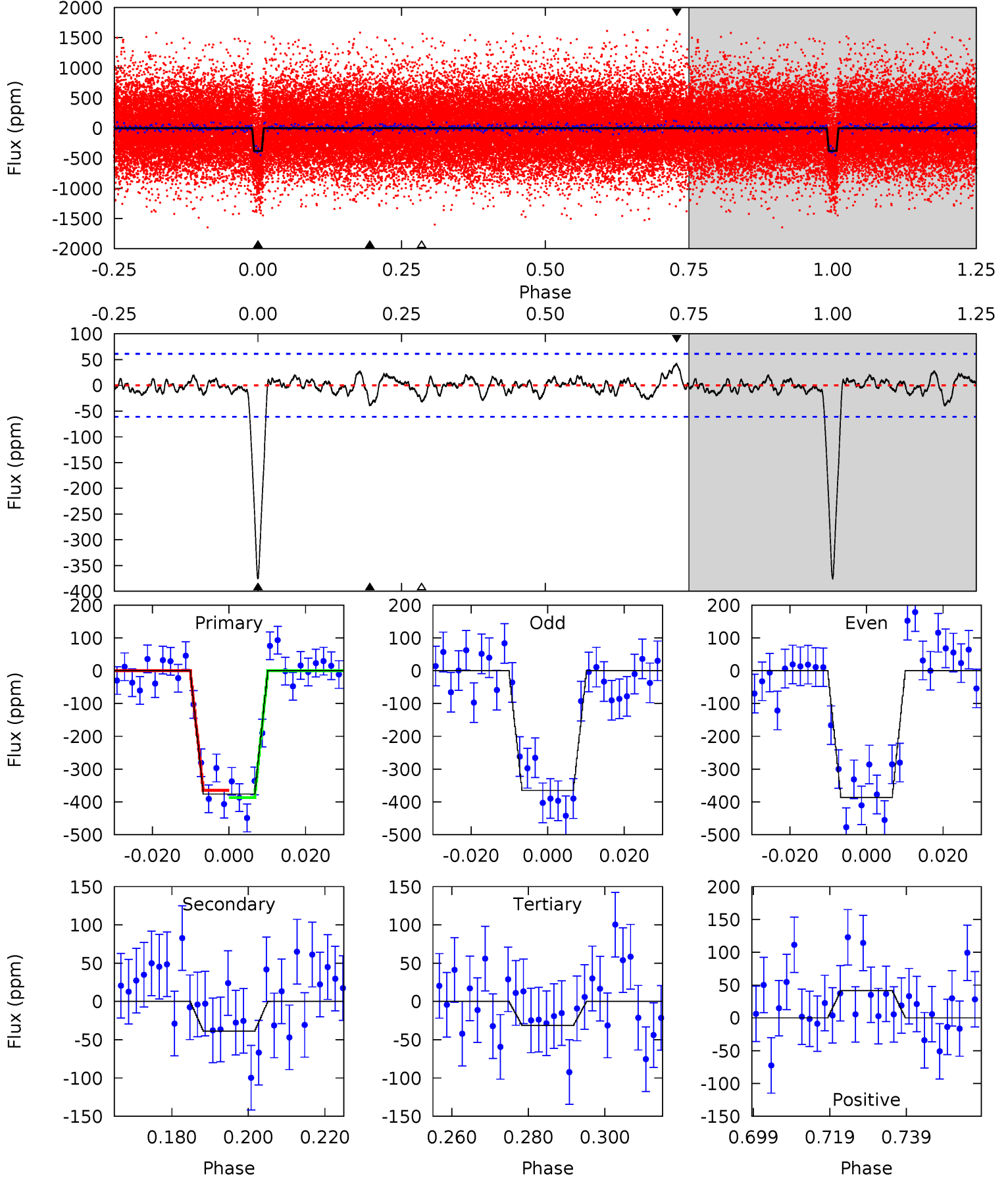
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
32.4	3.26	2.62	3.50	4.87	2.28	1.04	29.7	28.9	0.64	-0.24	1.66	1.03	0.10	1.49



# Alt Model-Shift Uniqueness Test

010027323-01, P = 5.923695 Days, E = 128.755045 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
30.1	3.11	2.51	3.32	4.89	2.33	0.96	27.6	26.8	0.60	-0.21	0.86	1.07	0.10	0.90



### Stellar Parameters For KIC 010027323

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$3883^{+69}_{-93}$	$4.762^{+0.040}_{-0.036}$	$-0.280^{+0.150}_{-0.150}$	$0.496^{+0.036}_{-0.044}$	$0.518^{+0.029}_{-0.044}$	$5.992^{+1.248}_{-0.859}$
	+2%/-2%	+1%/-1%	+54%/-54%	+7%/-9%	+6%/-8%	+21%/-14%
Source	SPE5	SPE5	SPE5	DSEP		

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

### Secondary Eclipse Parameters for KIC 010027323-01 / KOI 1596.01

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	$-38 \pm 12$	$1.12^{+0.27}_{-0.25}$	$742^{+18}_{-21}$	$2707^{+213}_{-174}$	$45^{+34}_{-18}$
Alt.	$-39 \pm 13$	$1.04^{+0.24}_{-0.27}$	$741^{+19}_{-21}$	$2759^{+256}_{-212}$	$54^{+42}_{-25}$

$T_{\text{max}}$  = 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  $A_{\text{obs}} \gg 1.0$



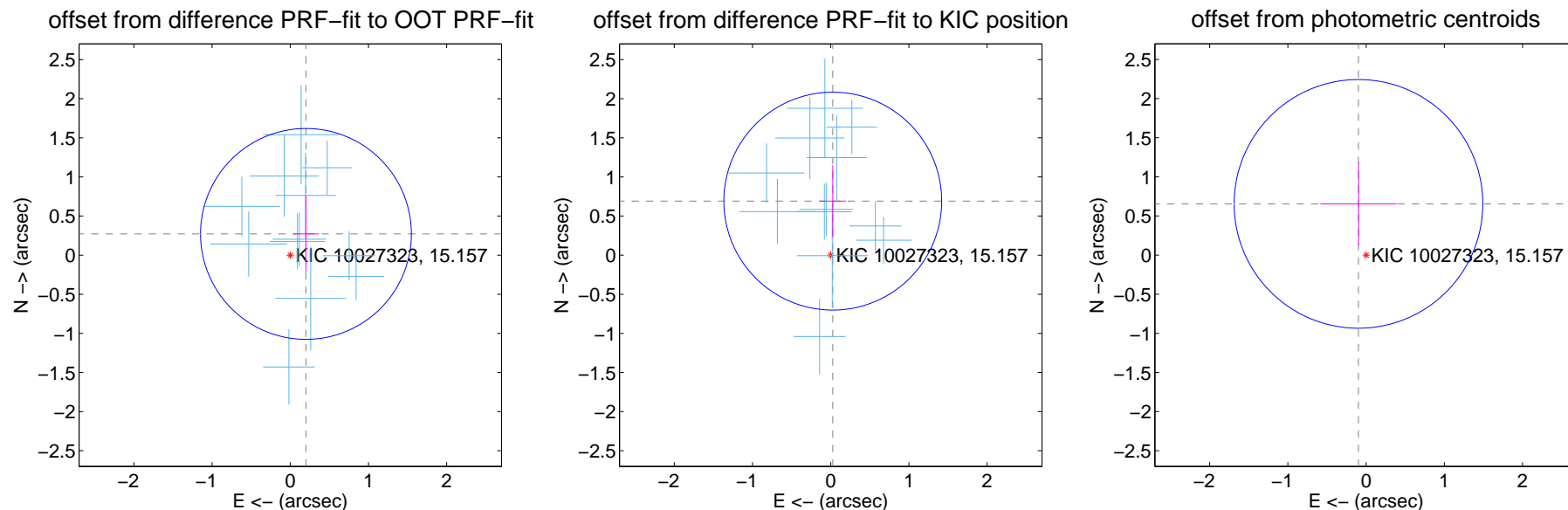
## DV Centroid Data

Supplemental centroid analysis for 010027323-01. Kepler magnitude: 15.16. Transit SNR 23.91

There are 12 quarters with good PRF difference image offsets

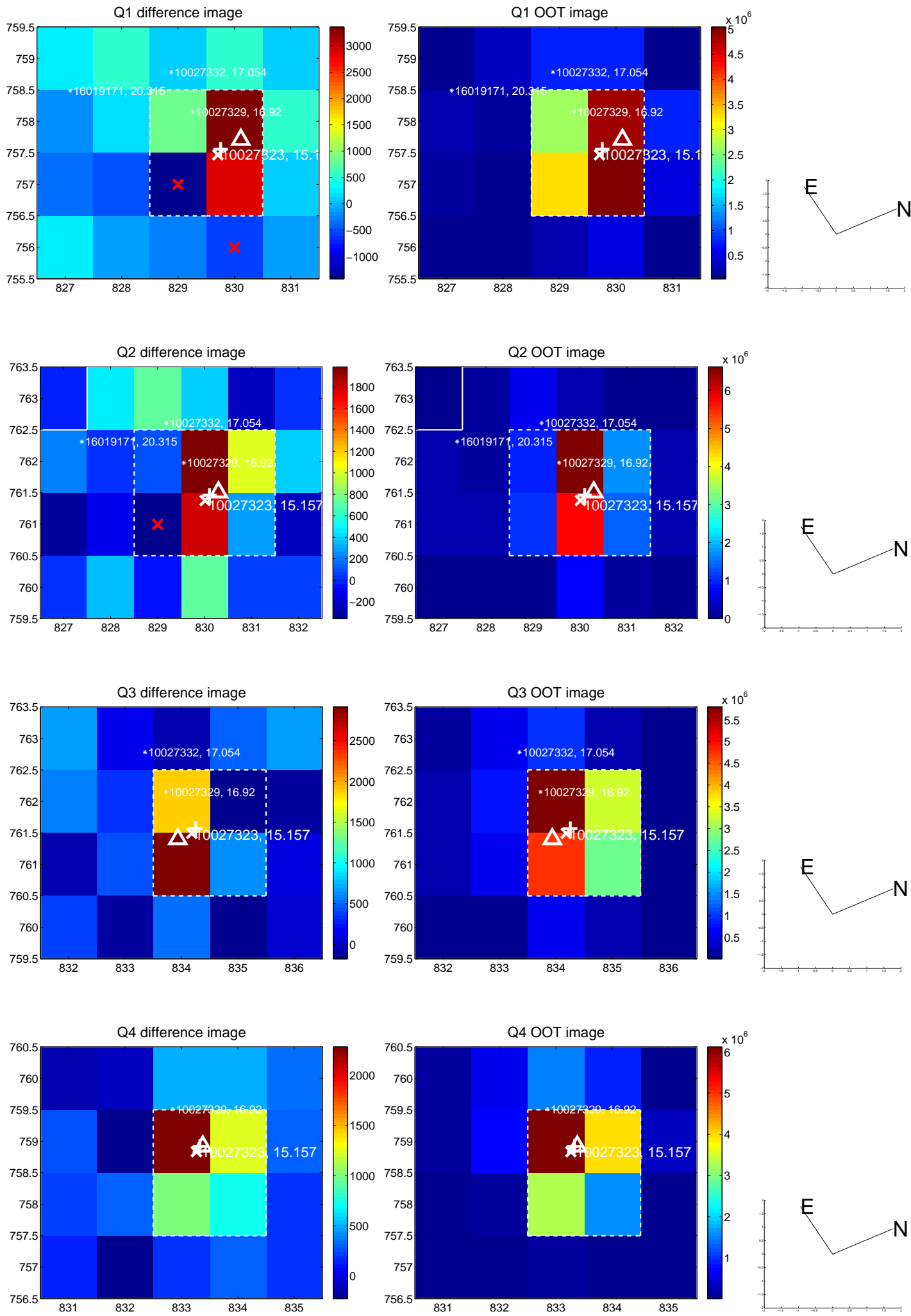
The direct PRF centroid is offset from the target star catalog position by about 0.47 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.338 \pm 0.449$	0.75	$-0.201 \pm 0.167$	$0.272 \pm 0.486$
PRF-fit source offset from KIC position	$0.691 \pm 0.464$	1.49	$-0.026 \pm 0.170$	$0.691 \pm 0.461$
photometric centroid source offset	$0.66 \pm 0.53$	1.25	$0.10 \pm 0.49$	$0.65 \pm 0.53$

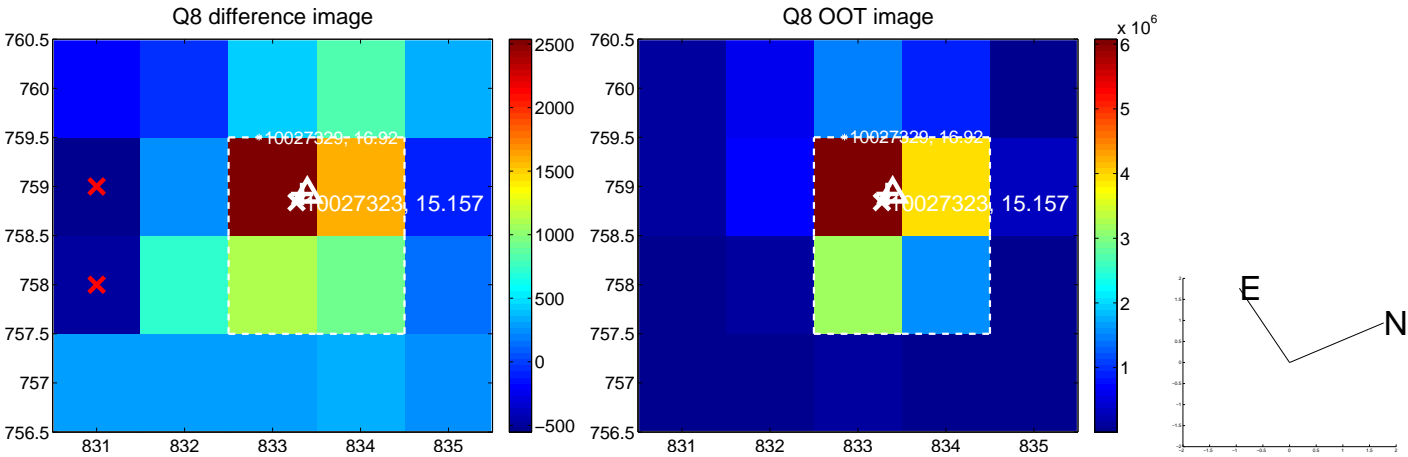
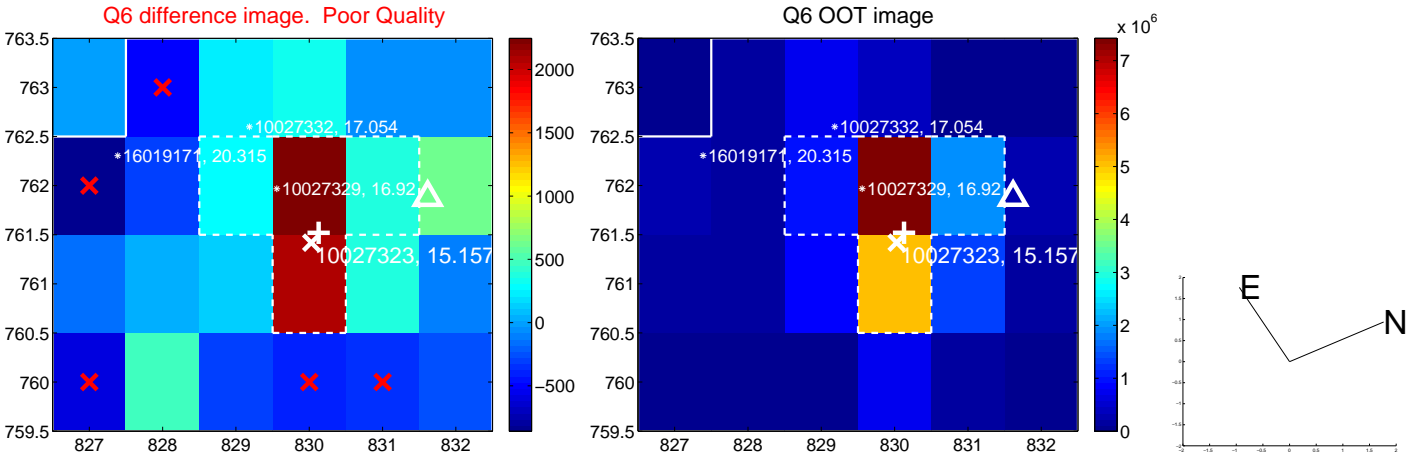
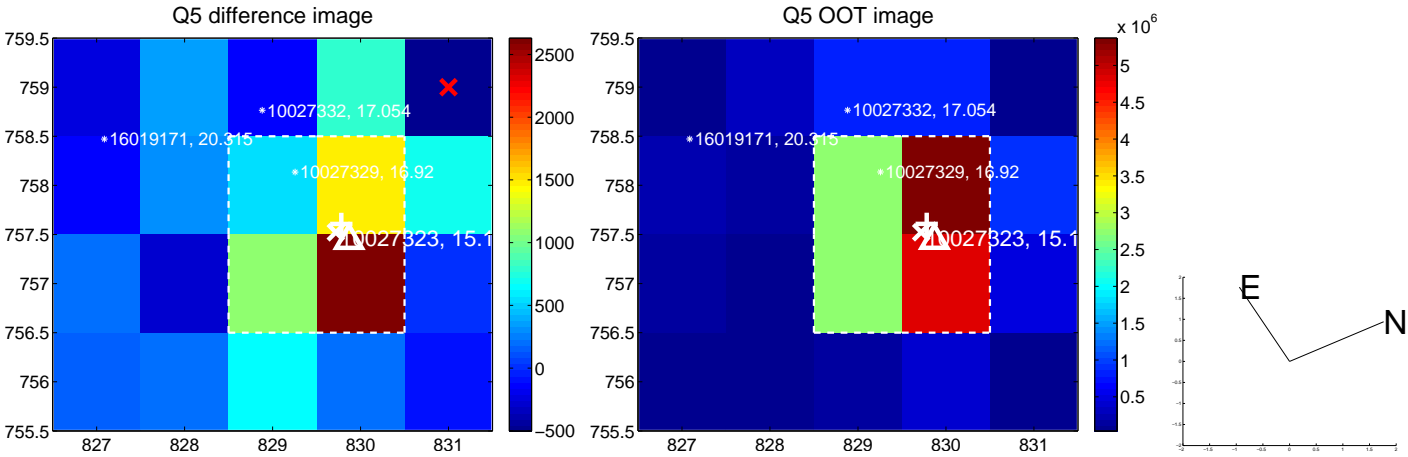


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: 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.

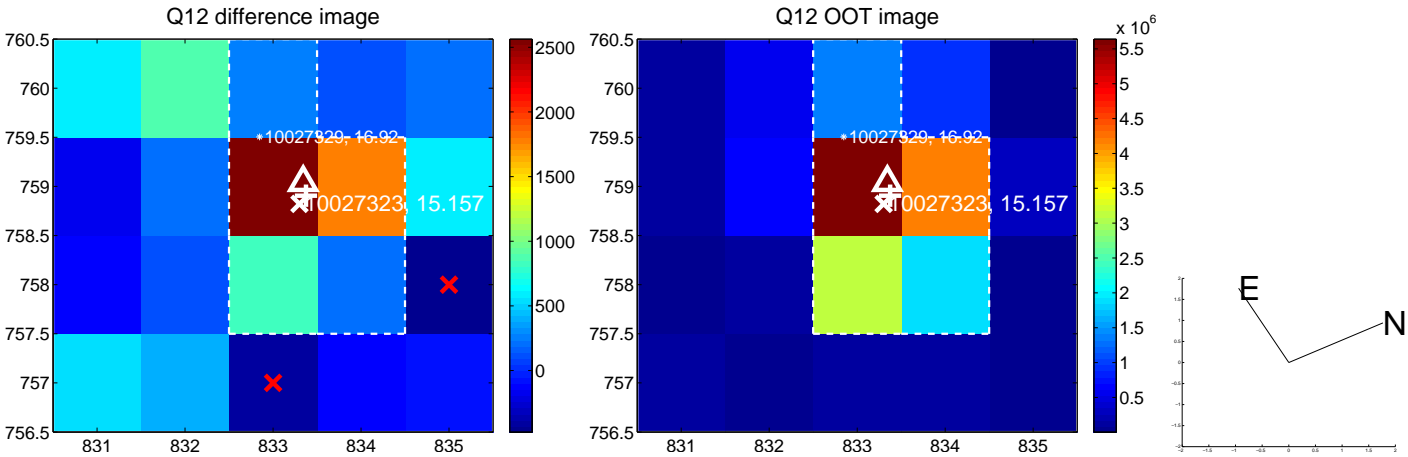
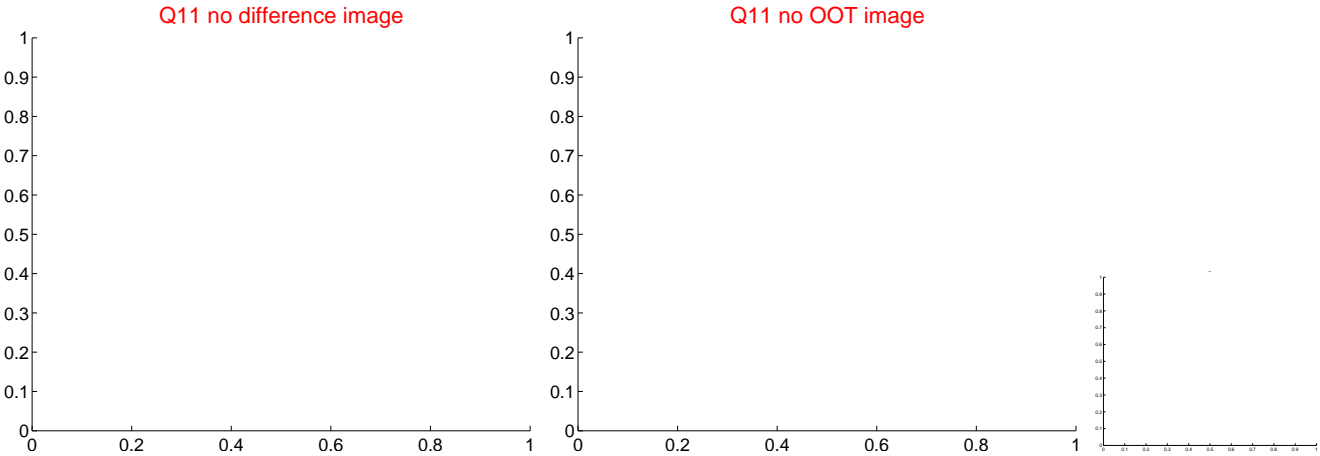
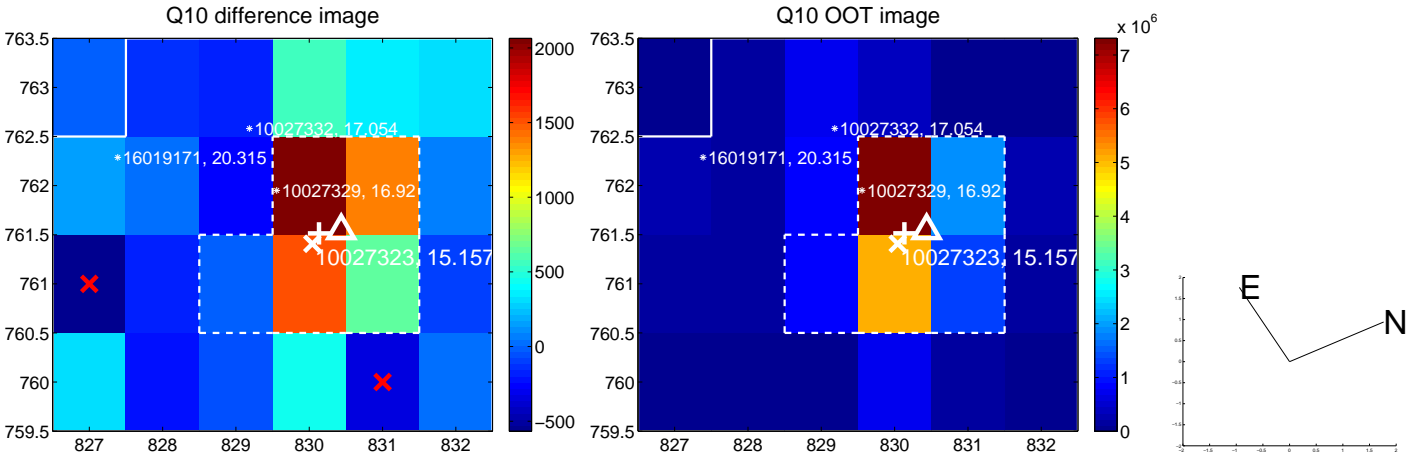
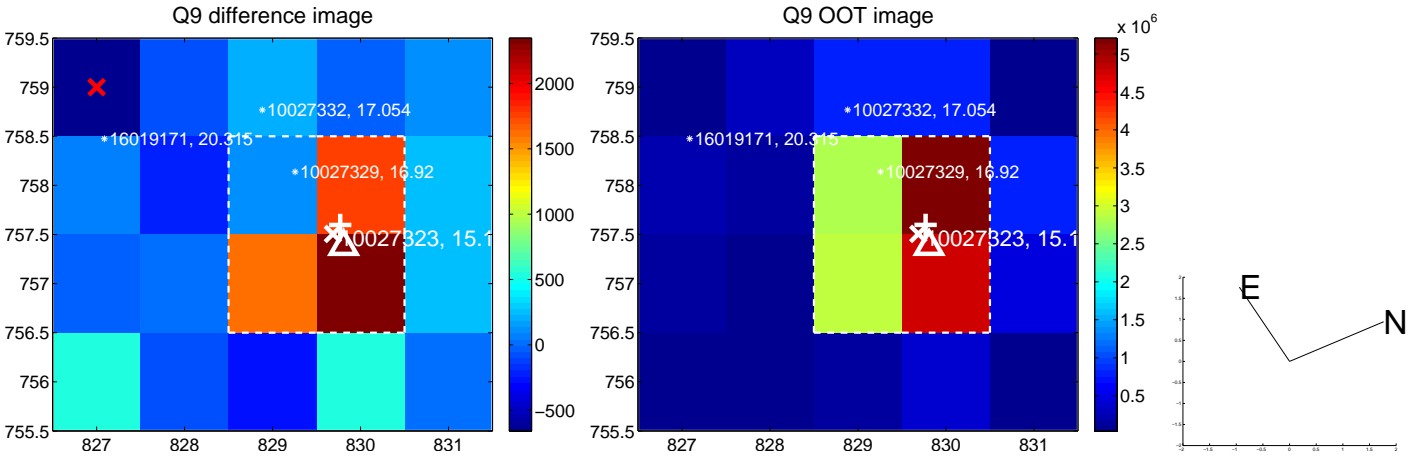
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



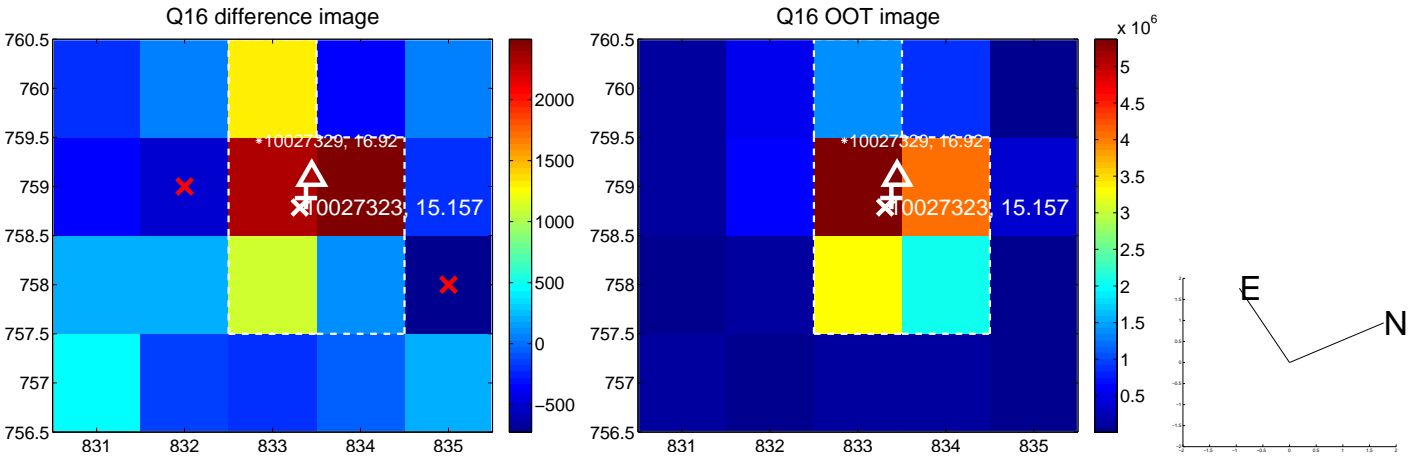
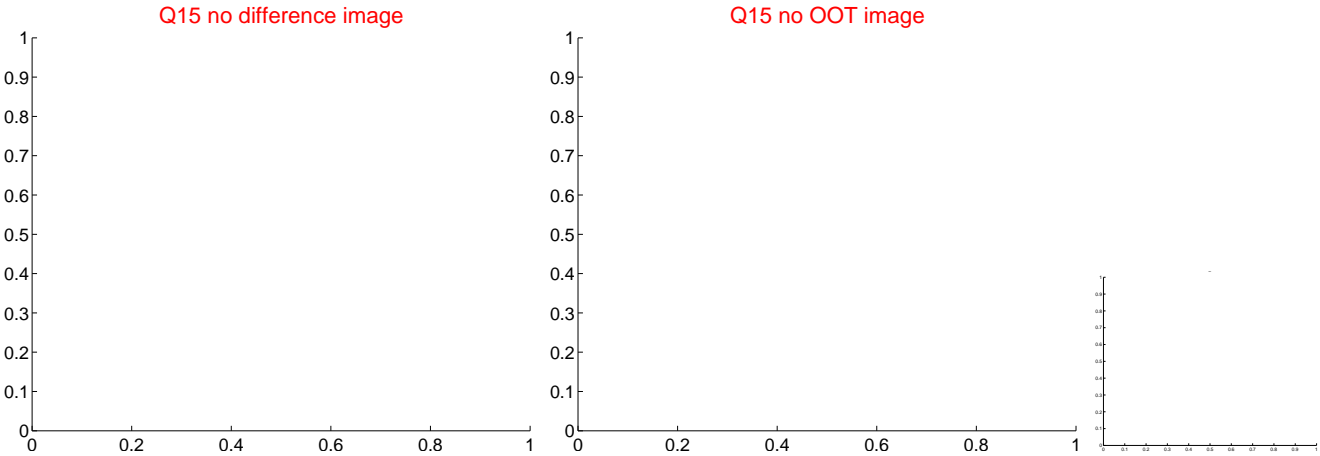
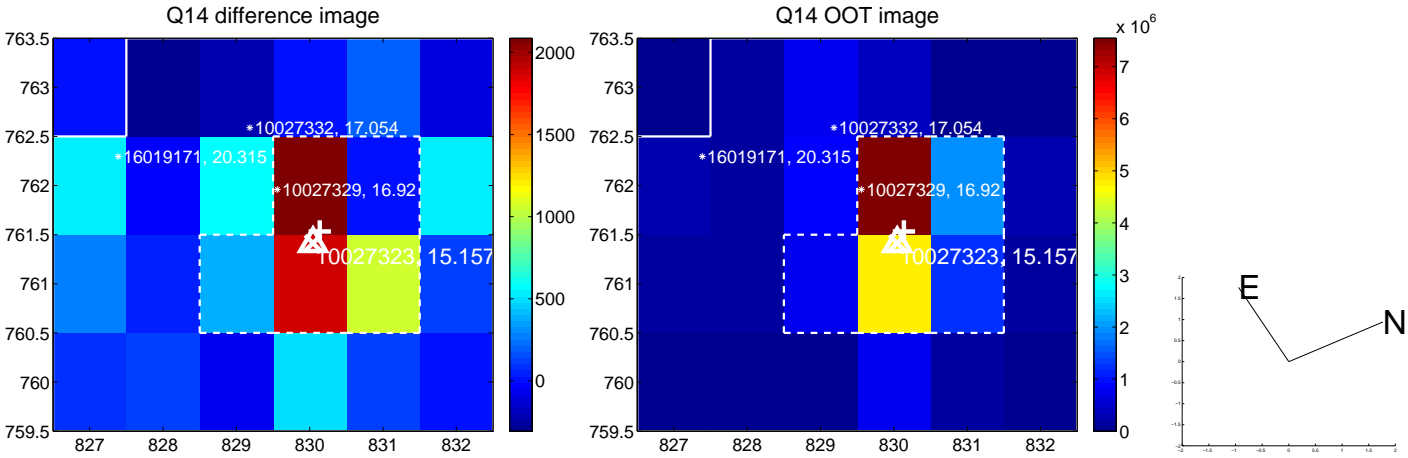
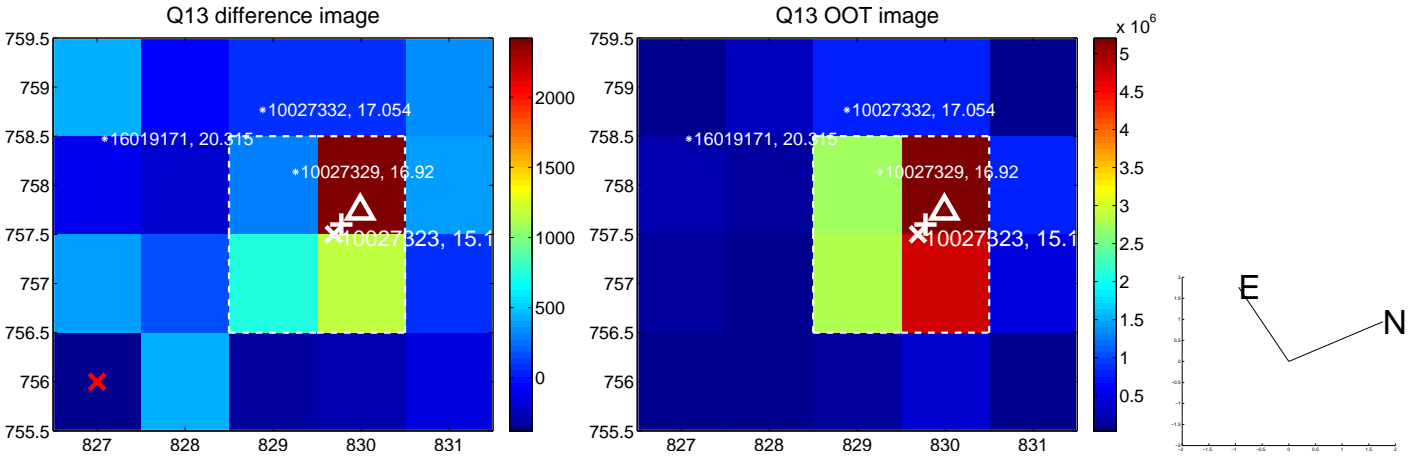
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

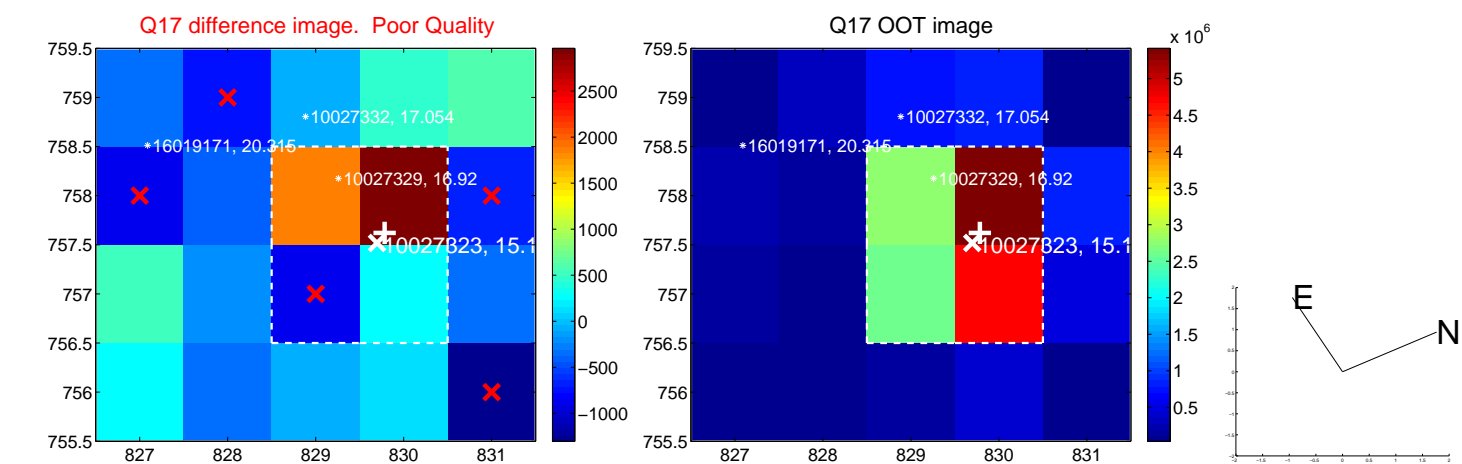


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

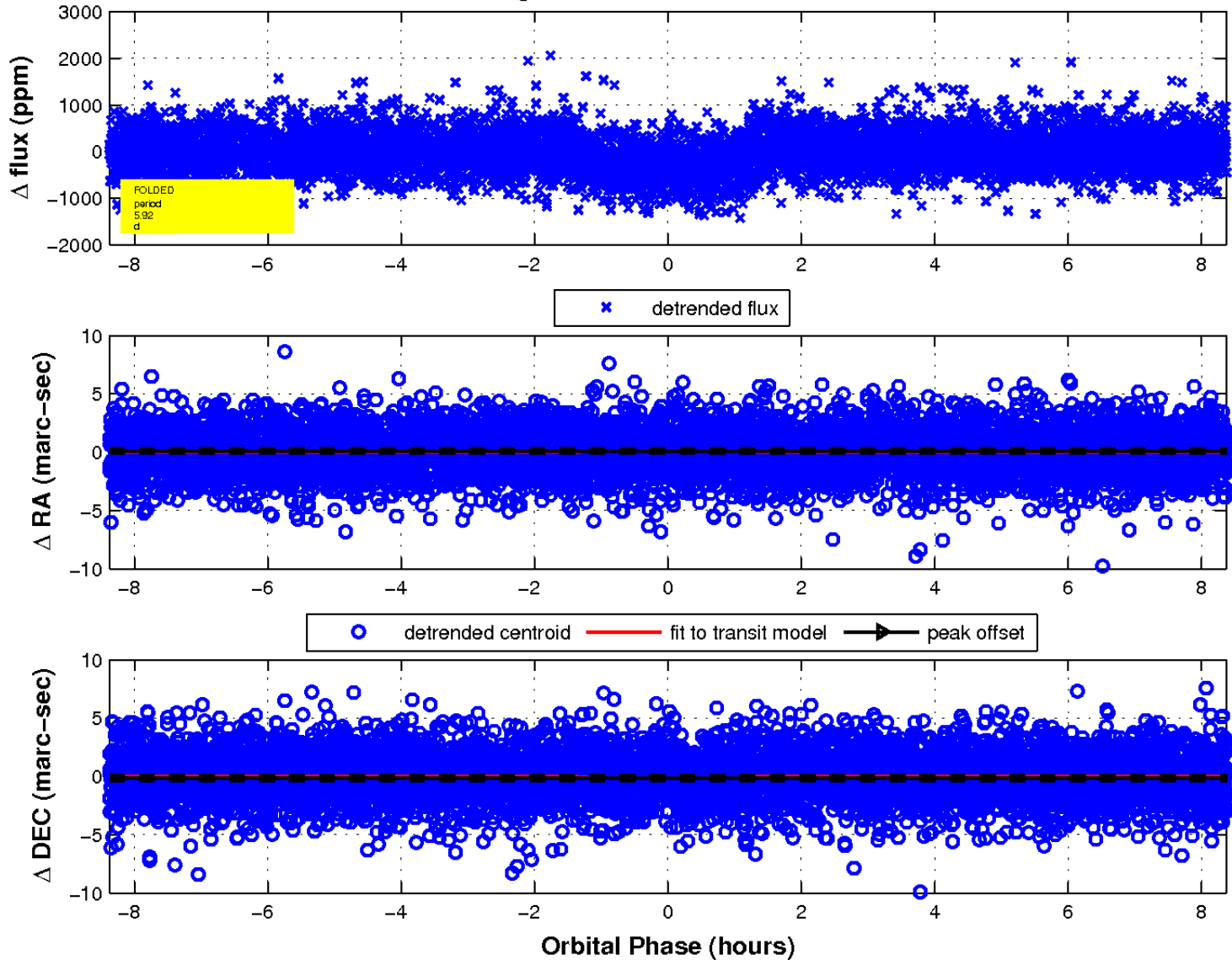




white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

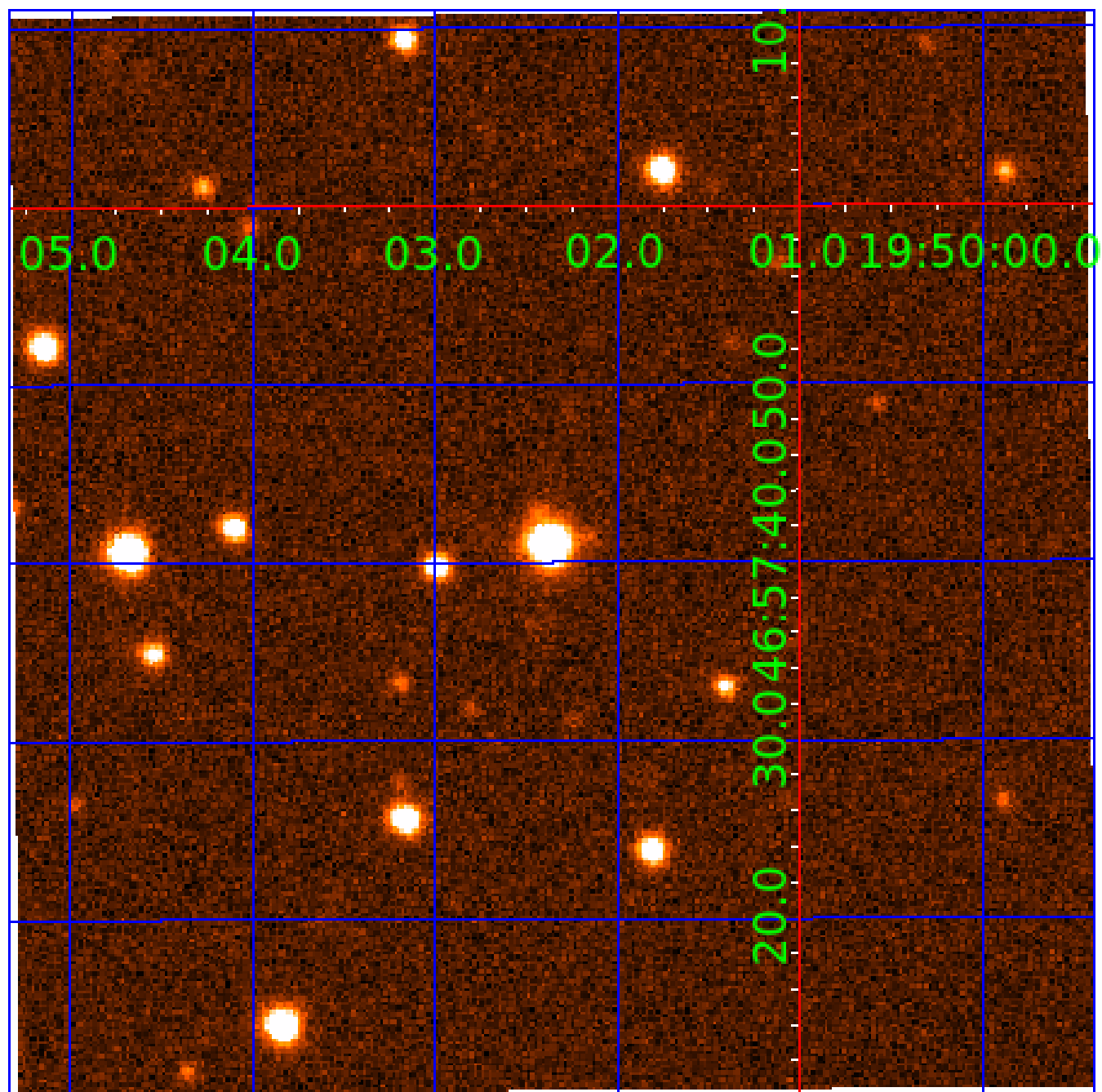


fluxWeightedCentroids, Planet 1 of 2



UKIRT Image

Declination



# KIC 010027323

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
010027323-01	OBS	1596.01	5.923647	134.683663	393.5	2.792	23.1	23.9	0.50	3883	1.13	18.90
010027323-02	OBS	1596.02	105.358224	138.681670	1237.7	3.721	16.5	19.3	0.50	3883	1.83	0.41

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
010027323-01	OBS	PC	1.00	0	0	0	0	CENT_KIC_POS
010027323-02	OBS	PC	0.74	0	0	0	0	CENT_KIC_POS

**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.

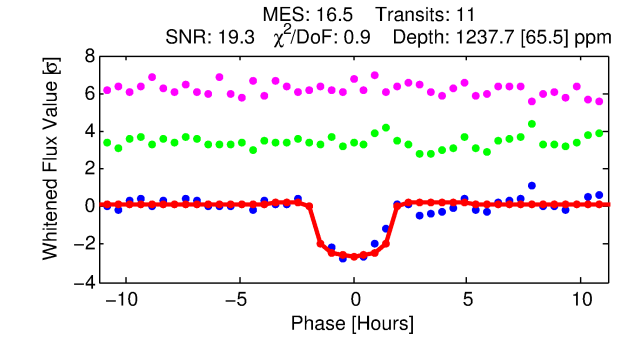
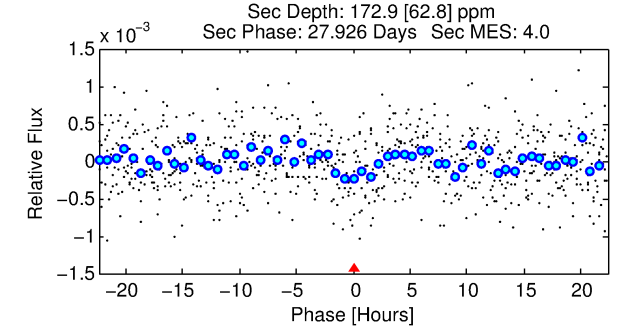
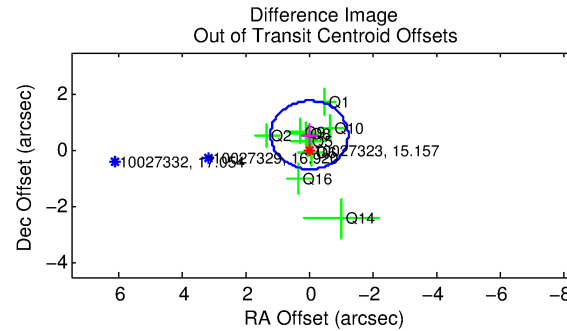
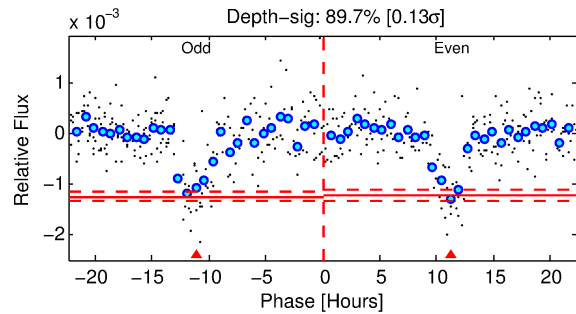
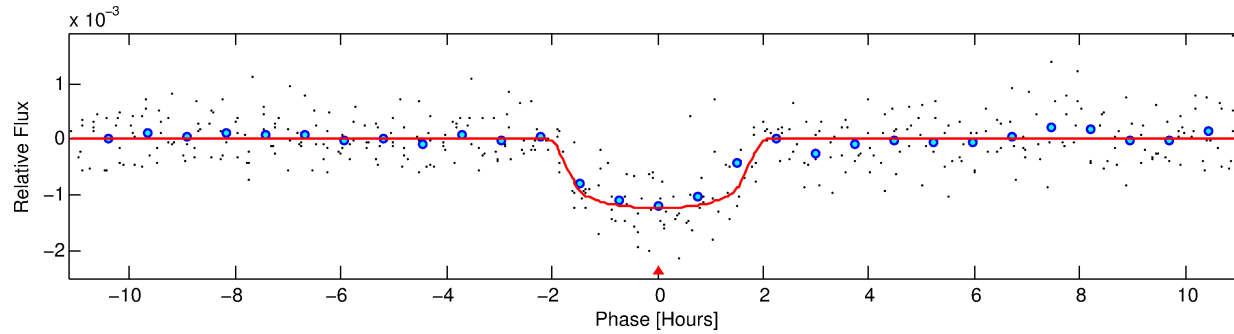
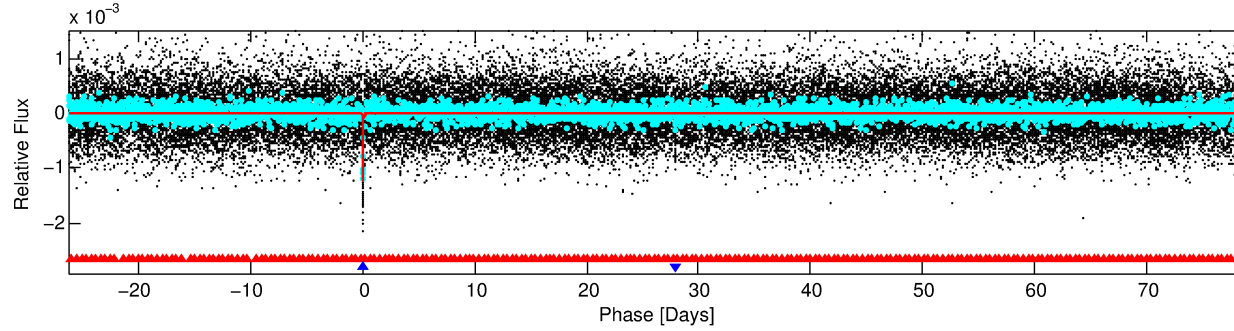
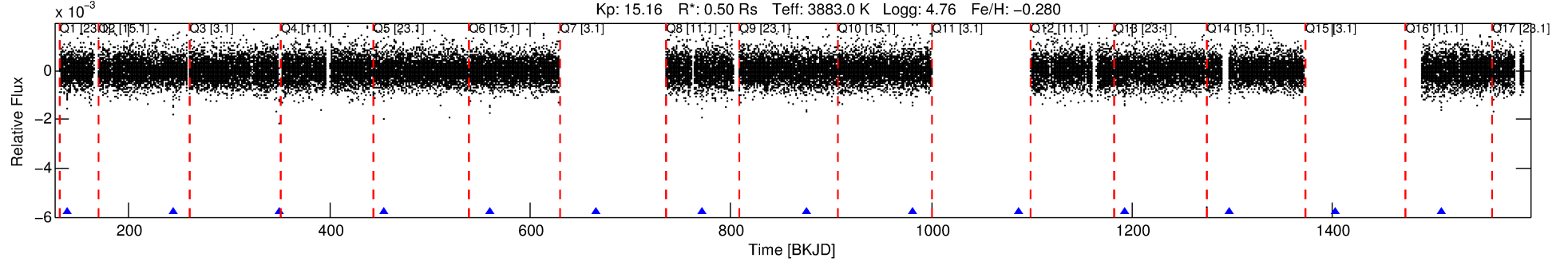
## Ephemeris Match Information For 010027323-02

No Significant Match Found

# DV One-Page Summary

KIC: 10027323 Candidate: 2 of 2 Period: 105.358 d  
KOI: K01596.02 Name: Kepler-309c Corr: 0.986

Kp: 15.16 R\*: 0.50 Rs Teff: 3883.0 K Logg: 4.76 Fe/H: -0.280



## DV Fit Results:

Period = 105.35822 [0.00046] d  
Epoch = 138.6817 [0.0037] BKJD  
Rp/R\* = 0.0339 [0.0137]  
a/R\* = 175.69 [338.38]  
b = 0.64 [1.78]  
Seff = 0.41 [0.05]  
Teq = 204 [7] K  
Rp = 1.83 [0.76] Re  
a = 0.3509 [0.0234] AU  
Ag = 3478.03 [3091.91] [1.12σ]  
Teffp = 2418 [538] K [4.12σ]

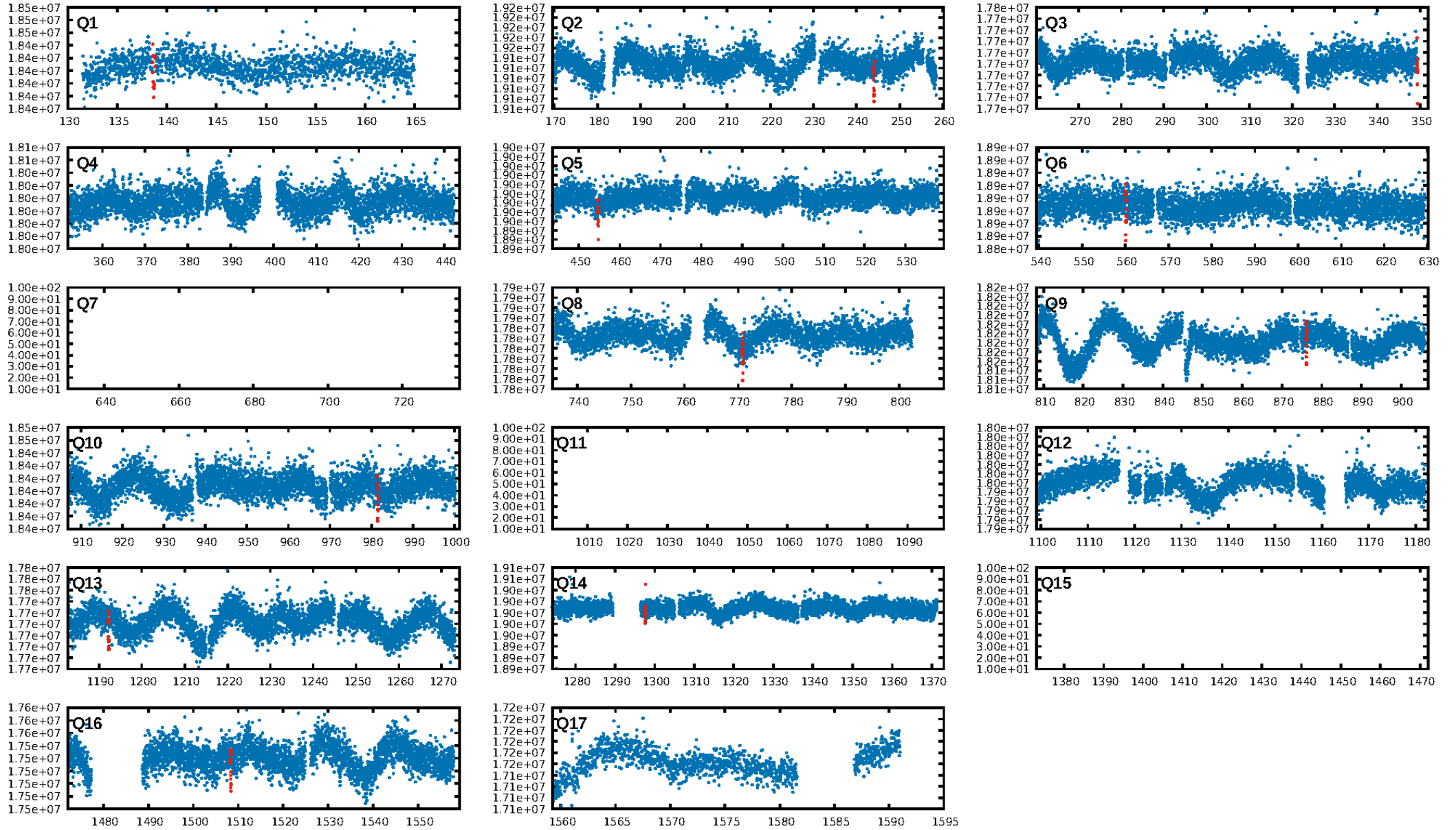
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [512.96σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 81.6%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 5.92e-43  
RollingBand-fgt: 1.00 [10/10]  
GhostDiagnostic-chr: 6.287  
Centroid-sig: 5.4%  
Centroid-so: 1.323 arcsec [2.48σ]  
OotOffset-rm: 0.556 arcsec [1.37σ]  
KicOffset-rm: 0.949 arcsec [2.49σ]  
OotOffset-st: 4/0/2/3 [9]  
KicOffset-st: 4/0/2/3 [9]  
DiffImageQuality-fgm: 0.89 [8/9]  
DiffImageOverlap-fno: 0.78 [7/9]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 11:44:41 Z

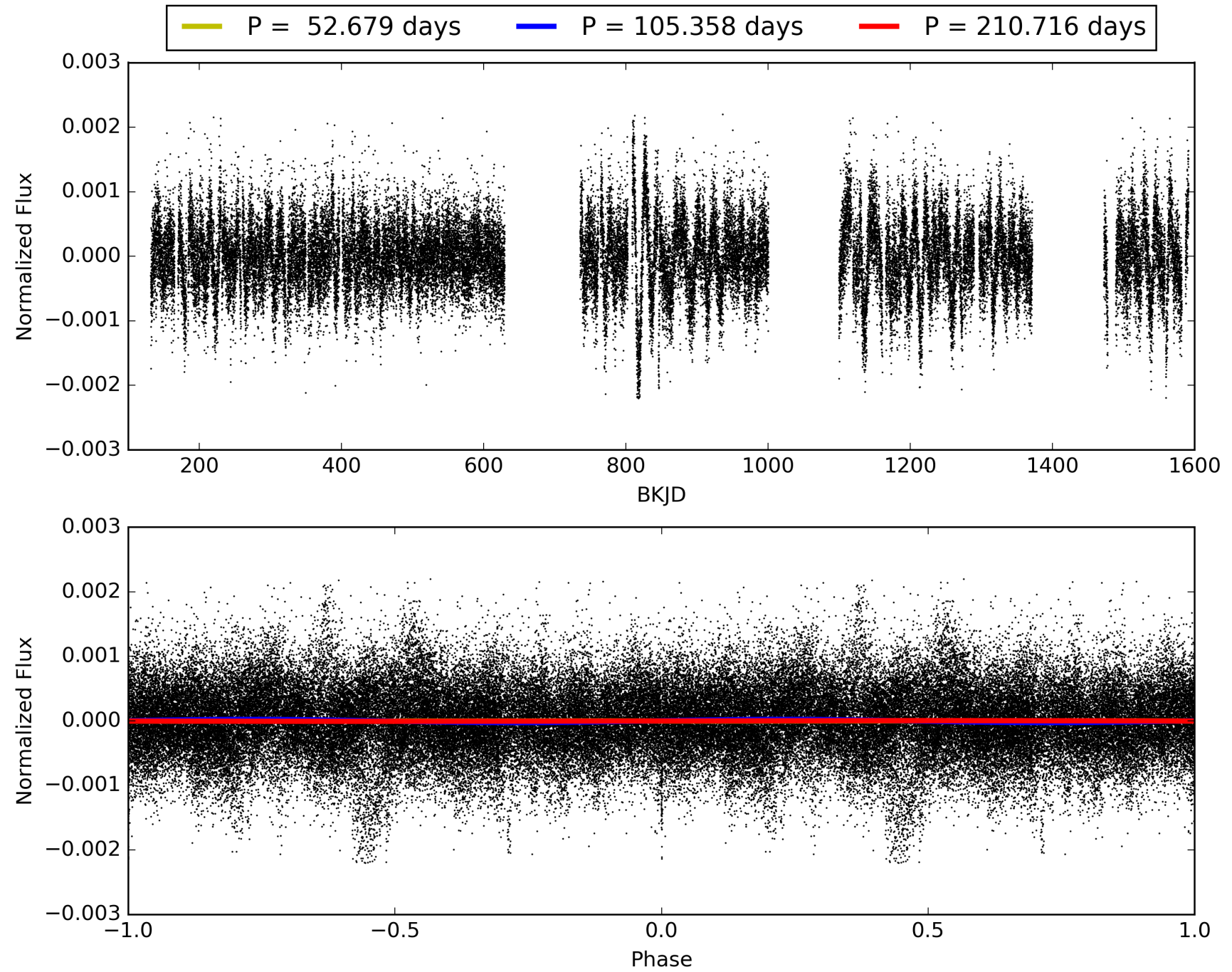
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 010027323-02, PDC Light Curves



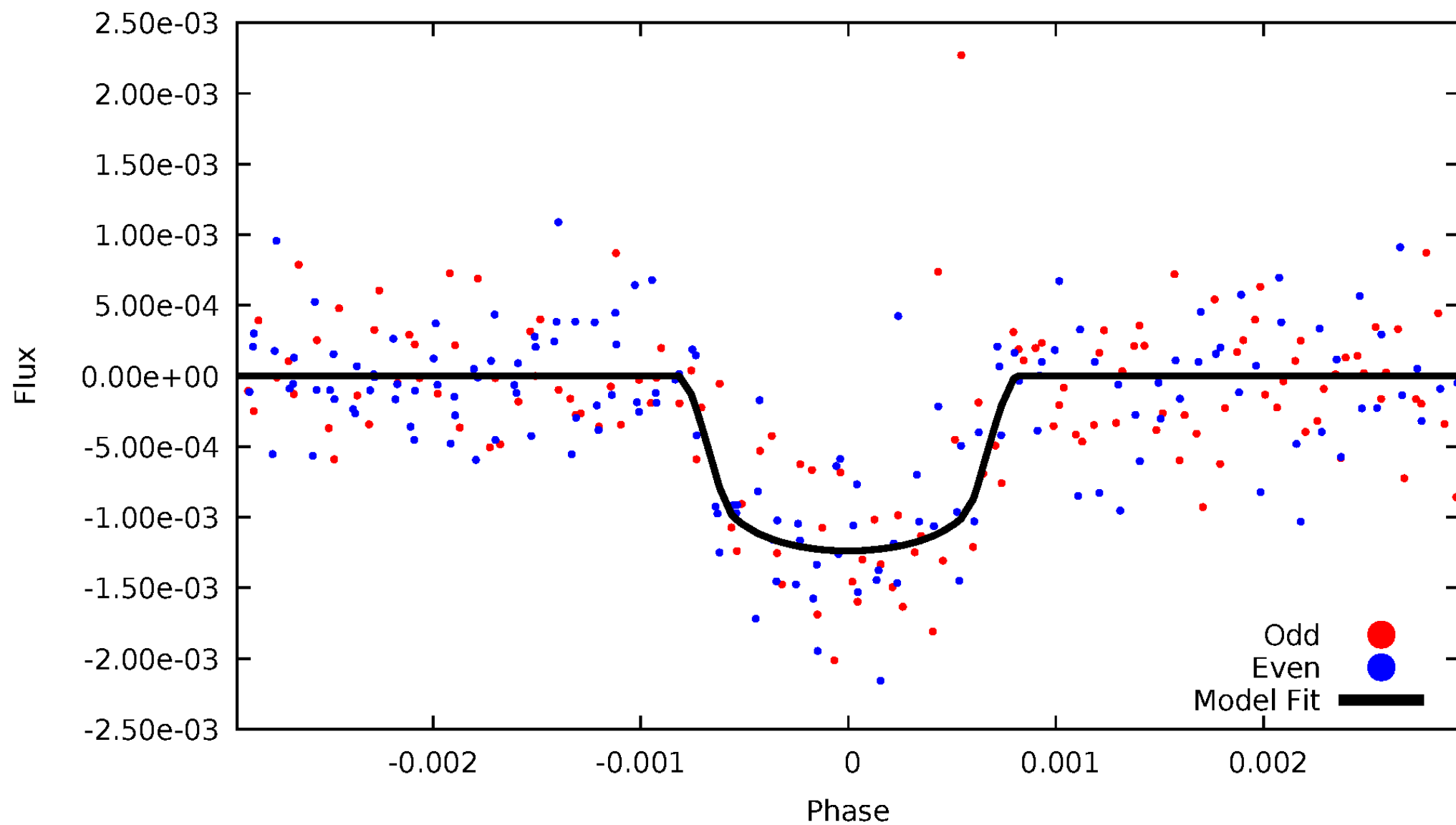


# TCE 010027323-02



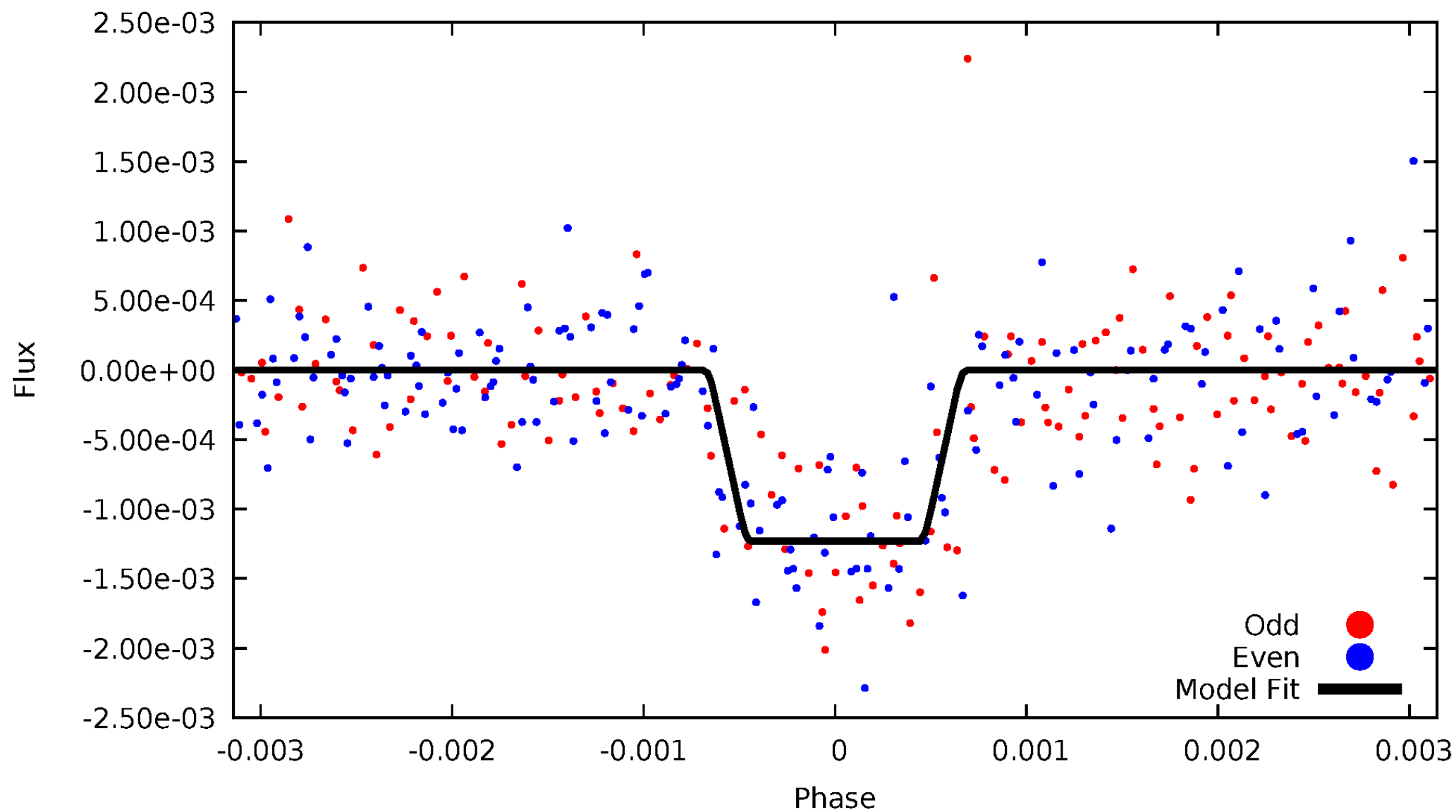
# DV Odd/Even

TCE 010027323-02



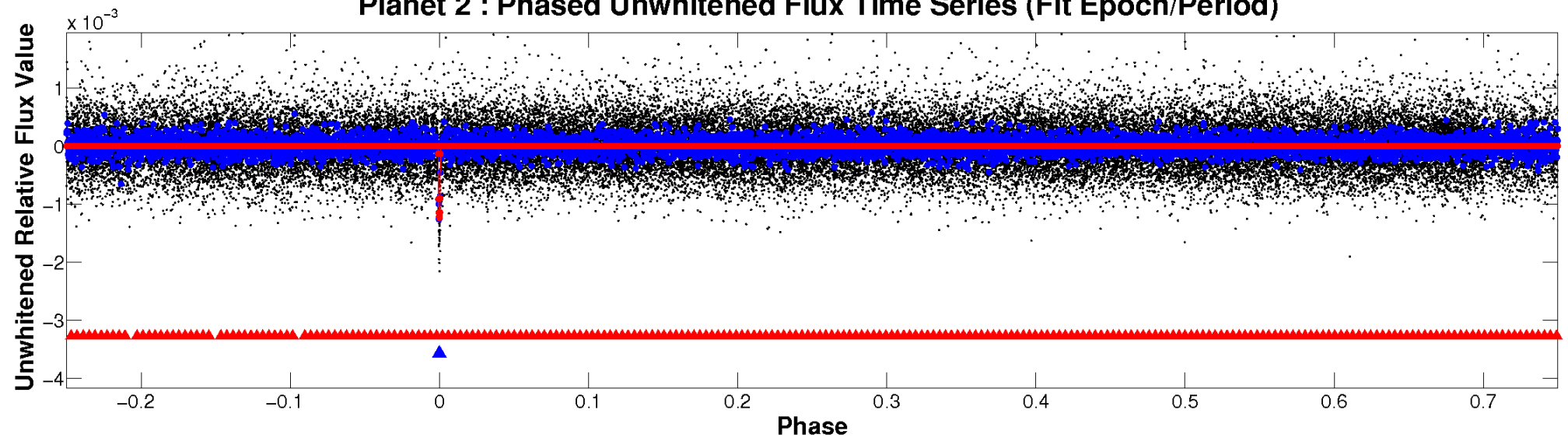
# ALT Odd/Even

TCE 010027323-02

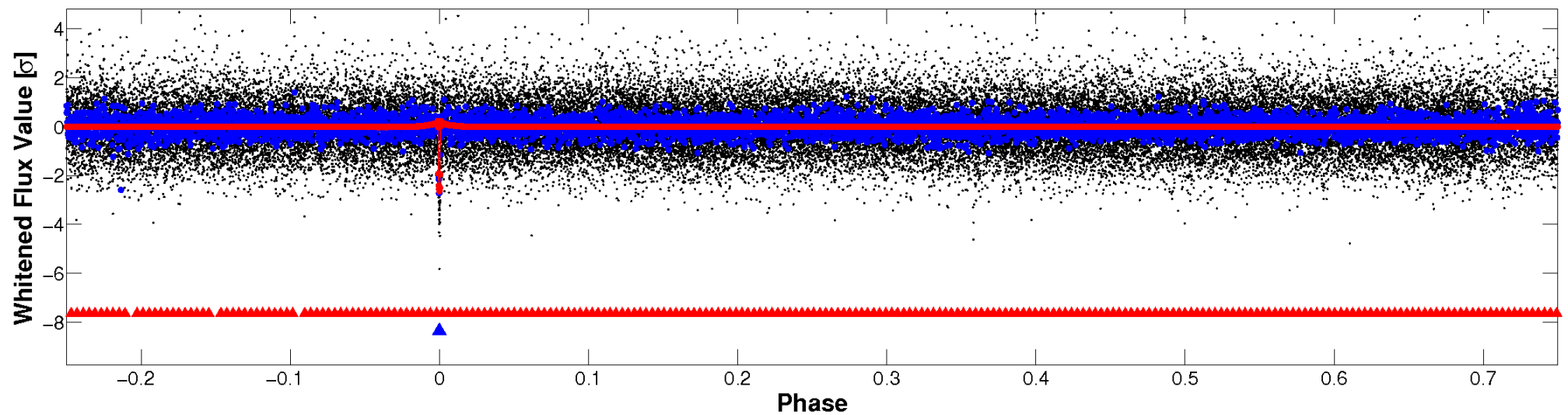


# Non-Whitened Vs. Whitened Light Curve

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

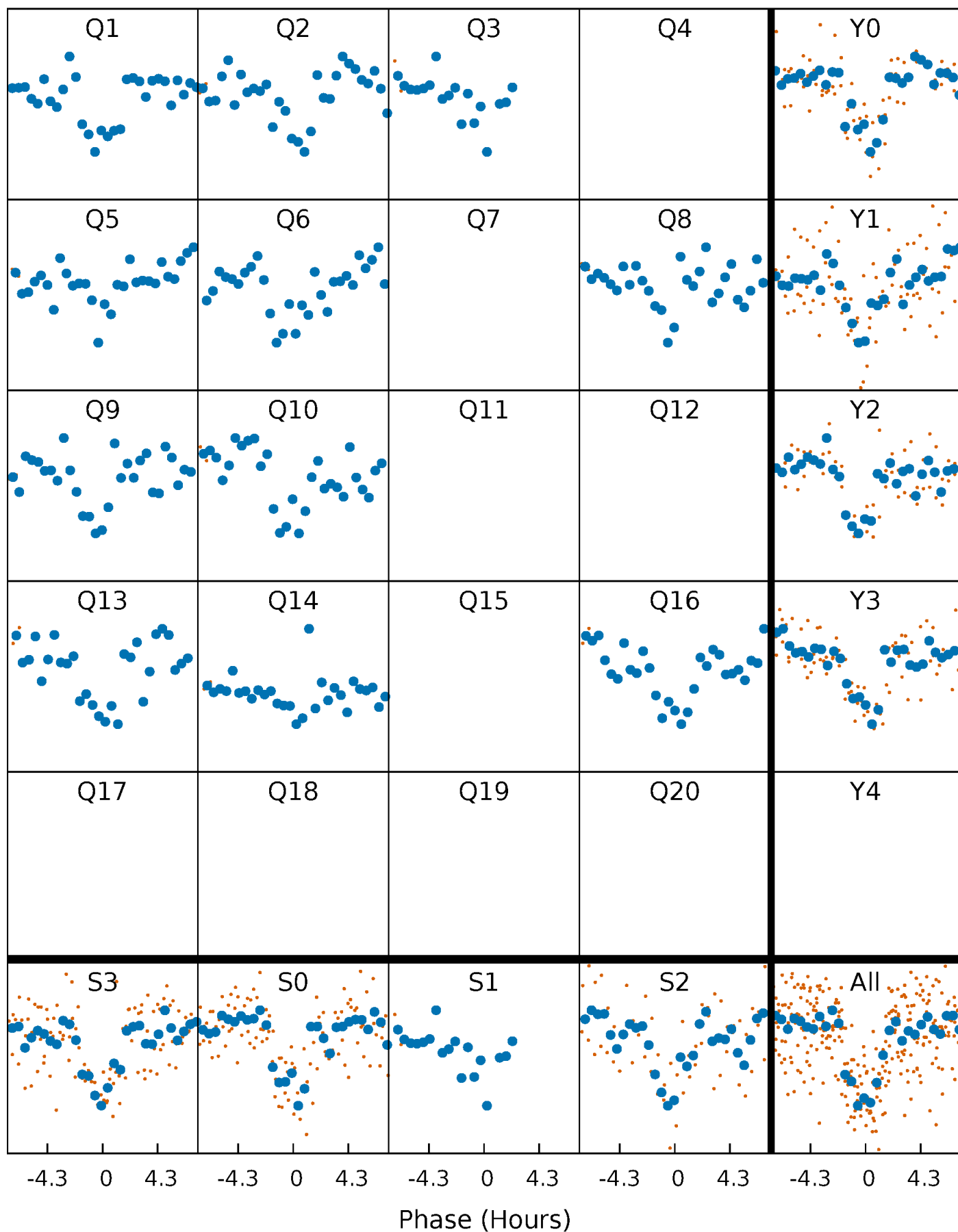


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



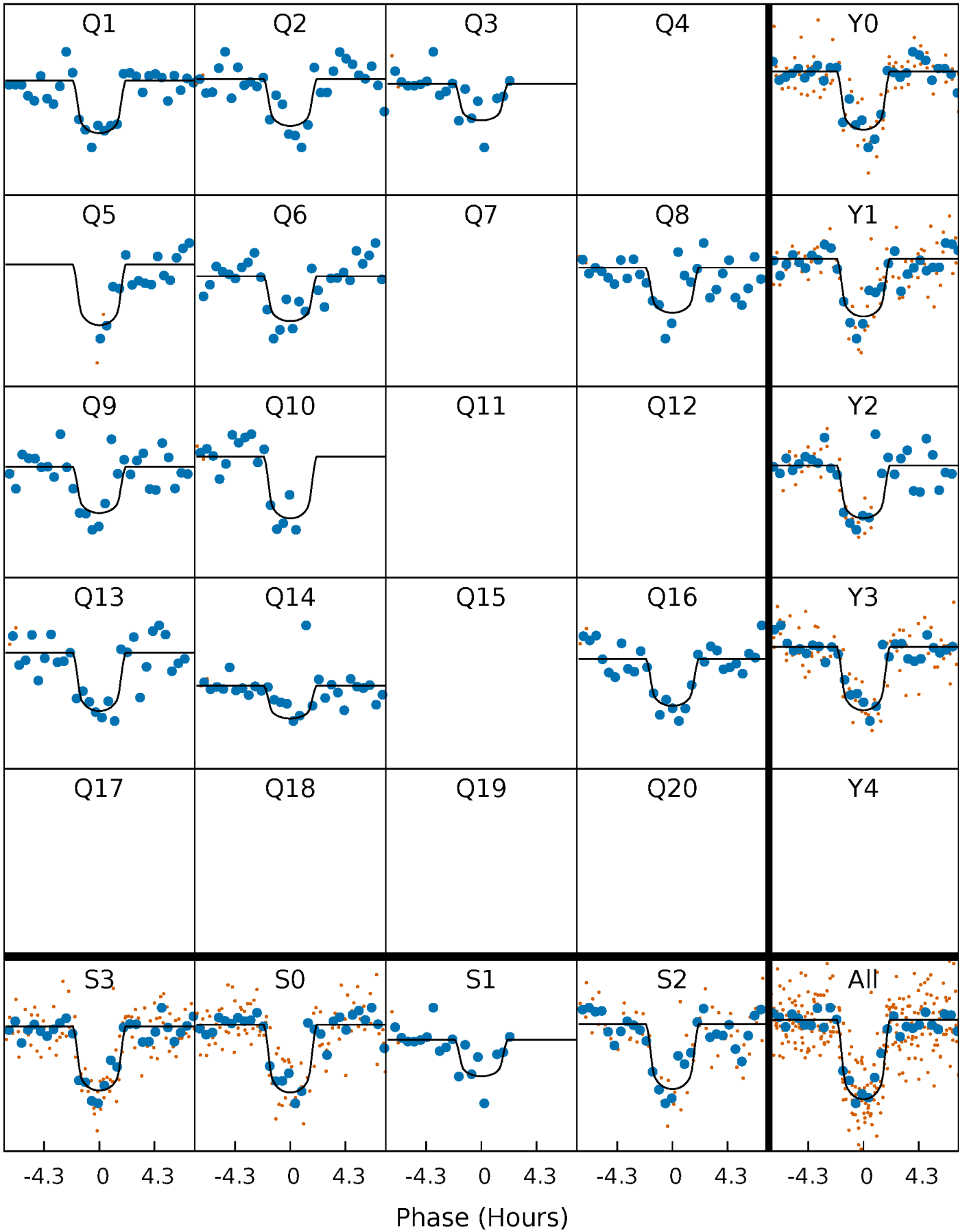
# PDC Quarter-Phased Transit Curves

TCE 010027323-02 P=105.358224 Days  $T_0=138.681670$  (BKJD)



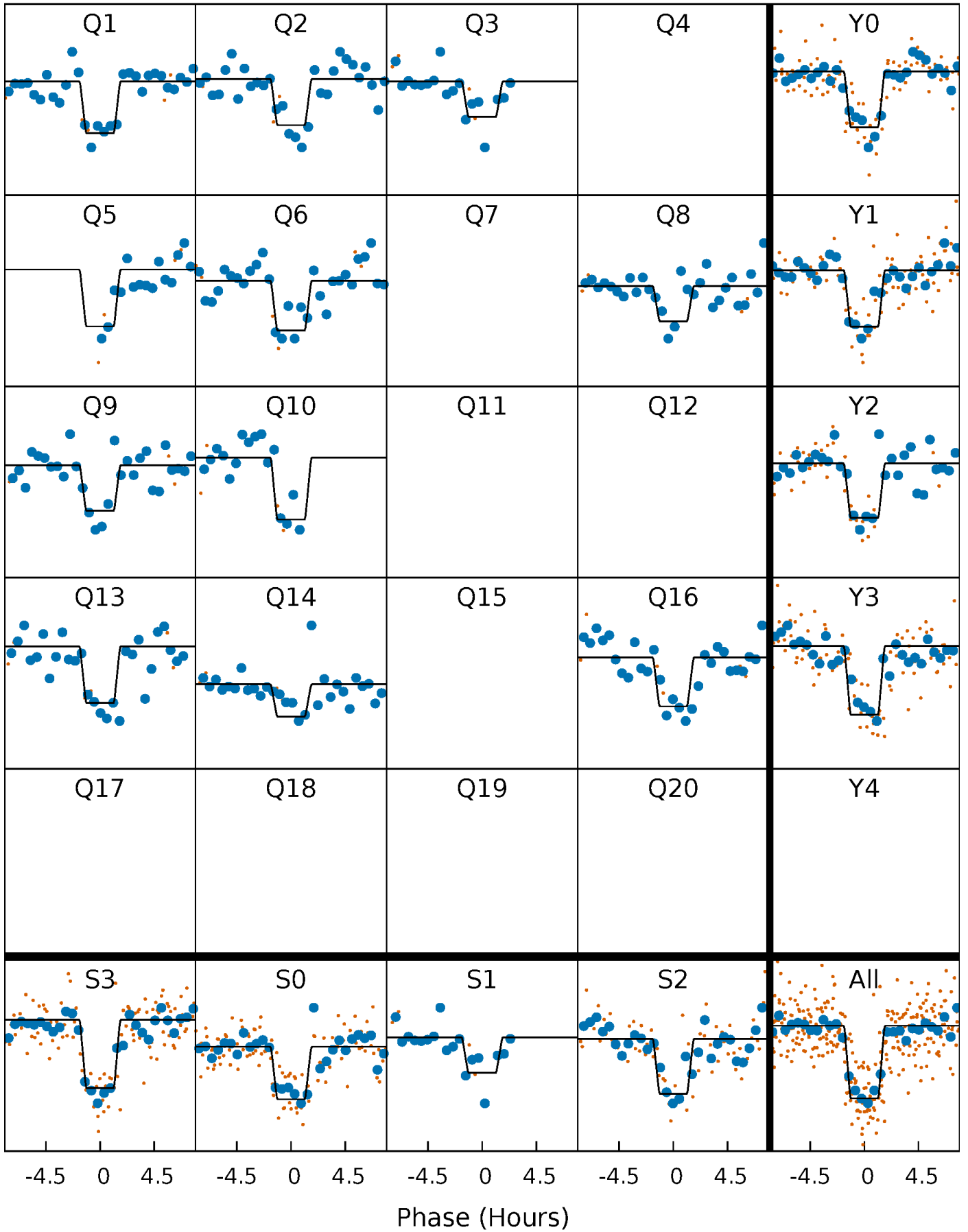
# DV Quarter-Phased Transit Curves

TCE 010027323-02     $P=105.358224$  Days     $T_0=138.681670$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

TCE 010027323-02 P=105.356491 Days  $T_0=138.685135$  (BKJD)

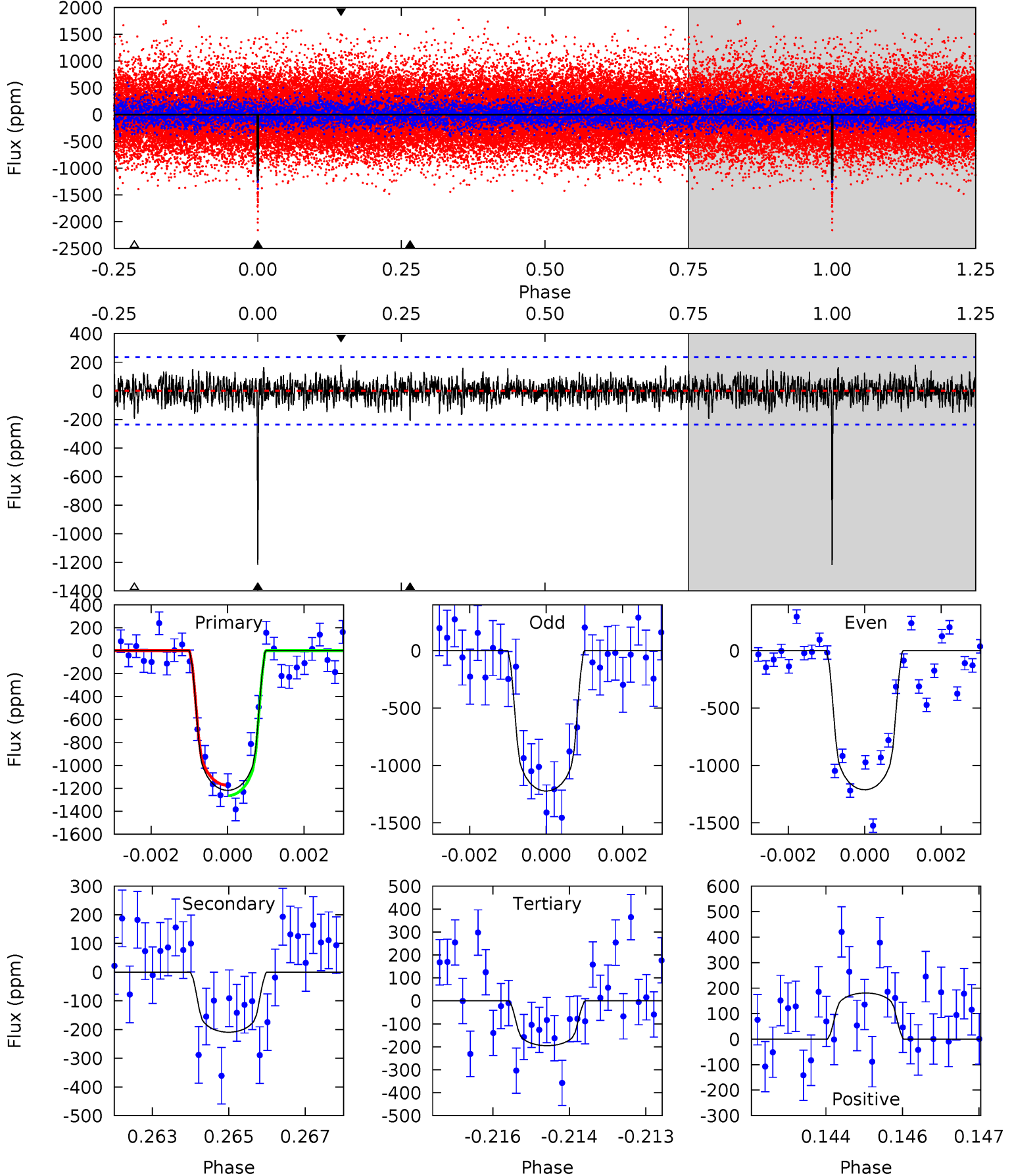




# DV Model-Shift Uniqueness Test

010027323-02,  $P = 105.358224$  Days,  $E = 33.323446$  Days

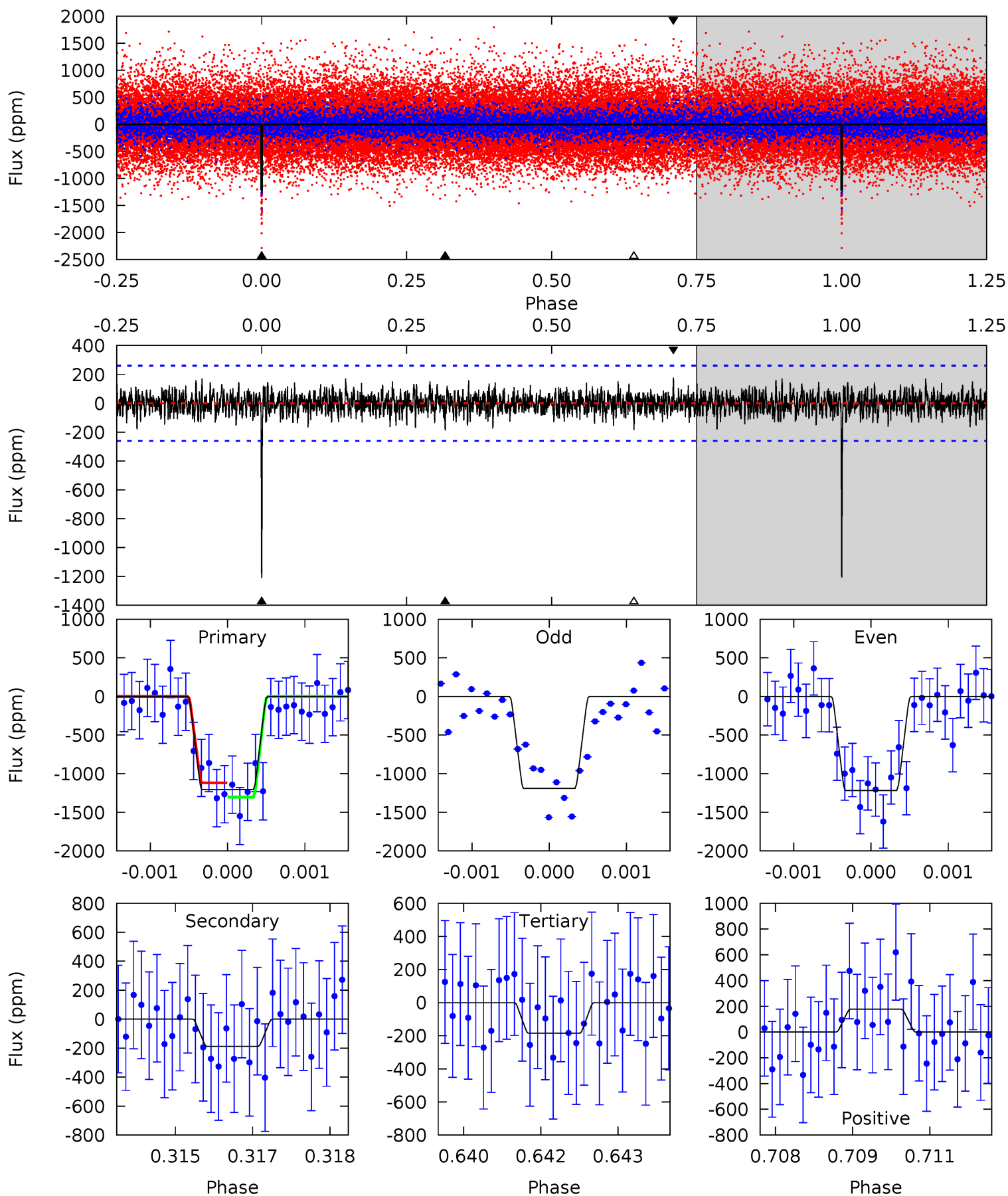
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
27.7	4.76	4.44	4.11	5.36	3.15	1.22	23.3	23.6	0.32	0.64	0.13	0.90	0.13	1.05



# Alt Model-Shift Uniqueness Test

010027323-02, P = 105.356491 Days, E = 33.328644 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
25.0	3.89	3.83	3.66	5.40	3.21	1.09	21.1	21.3	0.06	0.23	0.25	0.97	0.13	1.89



### Stellar Parameters For KIC 010027323

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$3883^{+69}_{-93}$	$4.762^{+0.040}_{-0.036}$	$-0.280^{+0.150}_{-0.150}$	$0.496^{+0.036}_{-0.044}$	$0.518^{+0.029}_{-0.044}$	$5.992^{+1.248}_{-0.859}$
	+2%/-2%	+1%/-1%	+54%/-54%	+7%/-9%	+6%/-8%	+21%/-14%
Source	SPE5	SPE5	SPE5	DSEP		

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

### Secondary Eclipse Parameters for KIC 010027323-02 / KOI 1596.02

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	$-209 \pm 44$	$1.84^{+0.73}_{-0.72}$	$284^{+7}_{-8}$	$2967^{+455}_{-274}$	$4126^{+6904}_{-2139}$
Alt.	$-188 \pm 48$	$1.92^{+0.72}_{-0.69}$	$284^{+7}_{-8}$	$2882^{+418}_{-259}$	$3371^{+4902}_{-1677}$

$T_{\text{max}}$  = 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  $A_{\text{obs}} \gg 1.0$

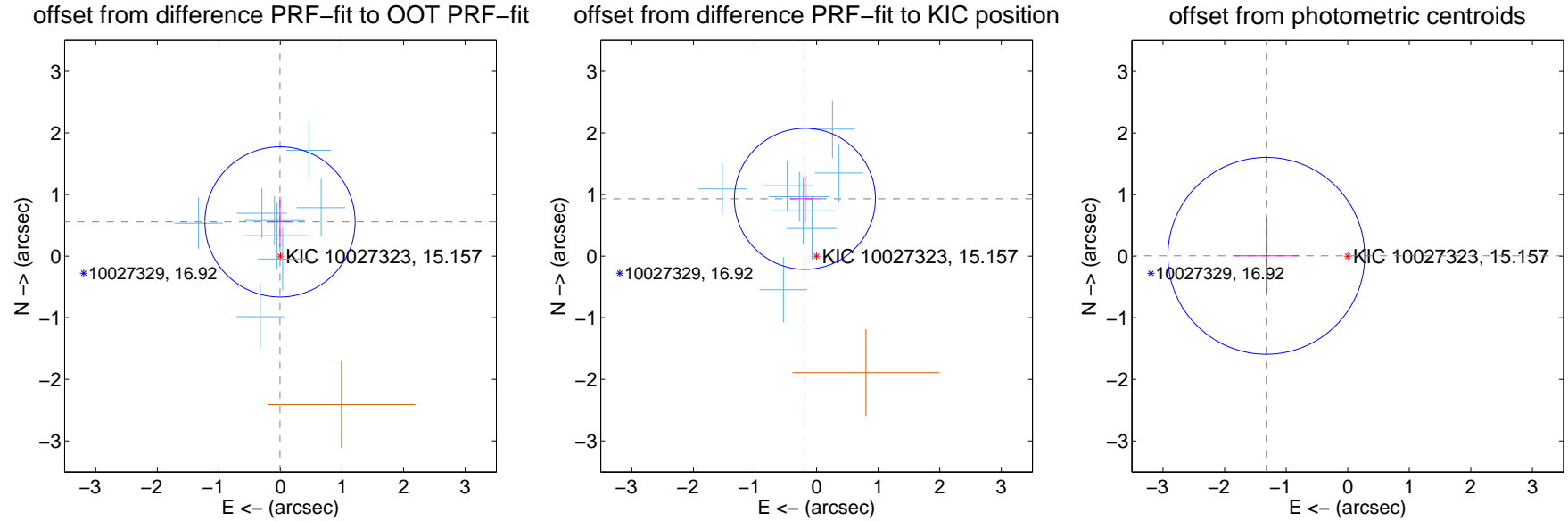
## DV Centroid Data

Supplemental centroid analysis for 010027323-02. Kepler magnitude: 15.16. Transit SNR 19.29

There are 8 quarters with good PRF difference image offsets

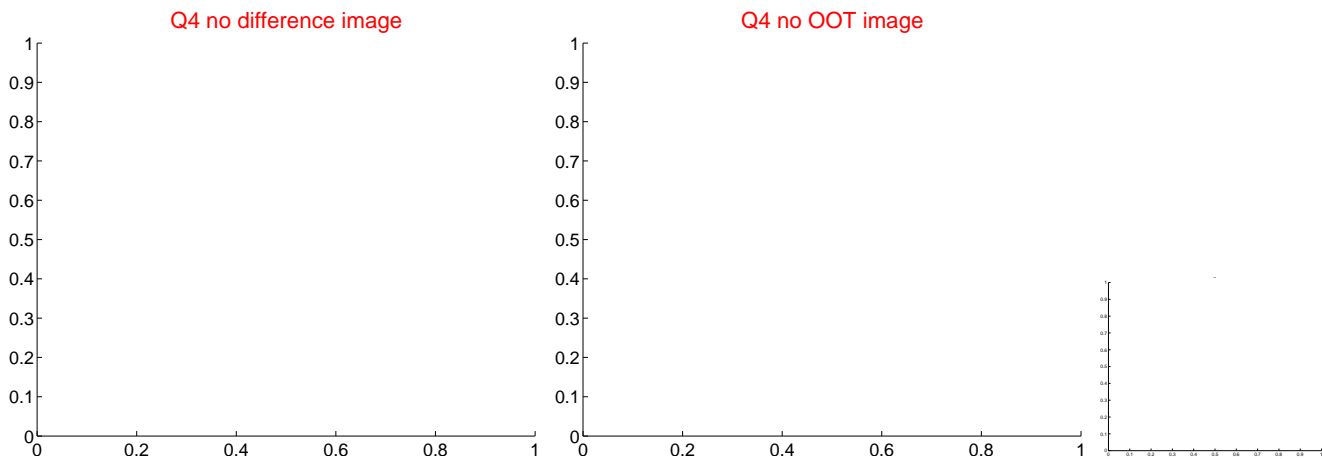
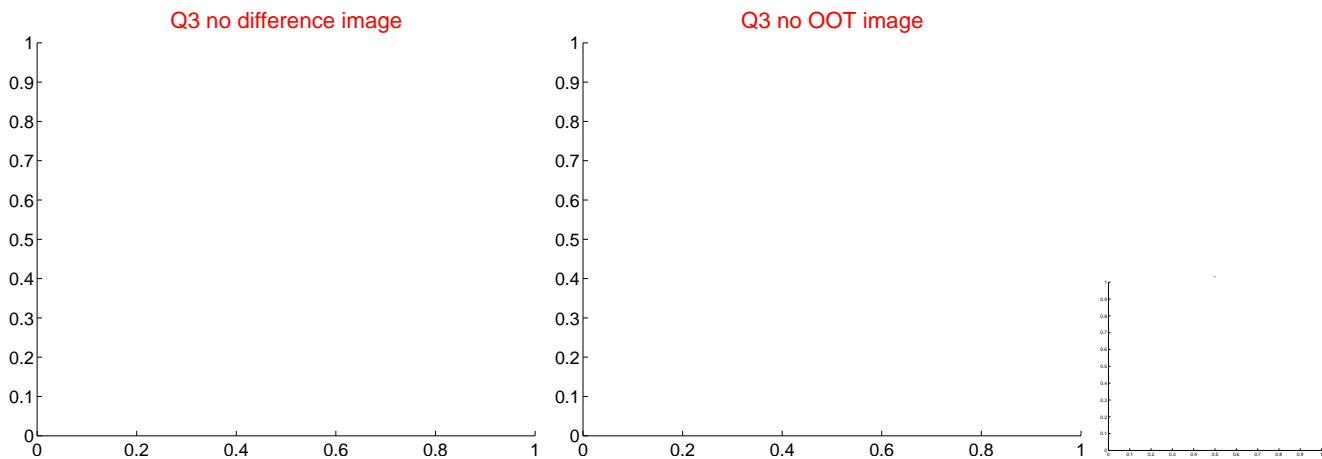
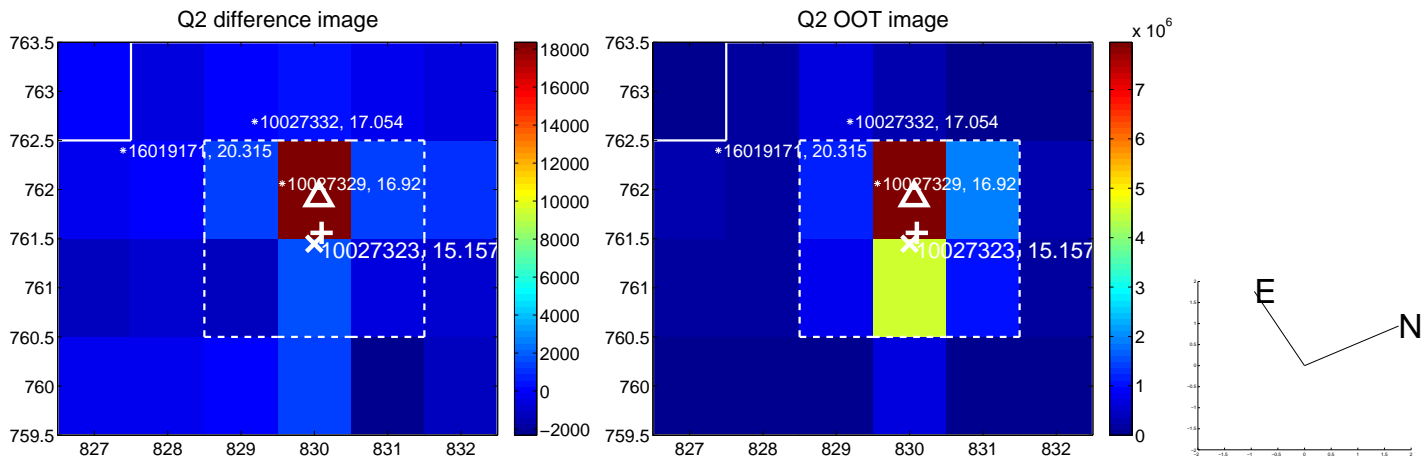
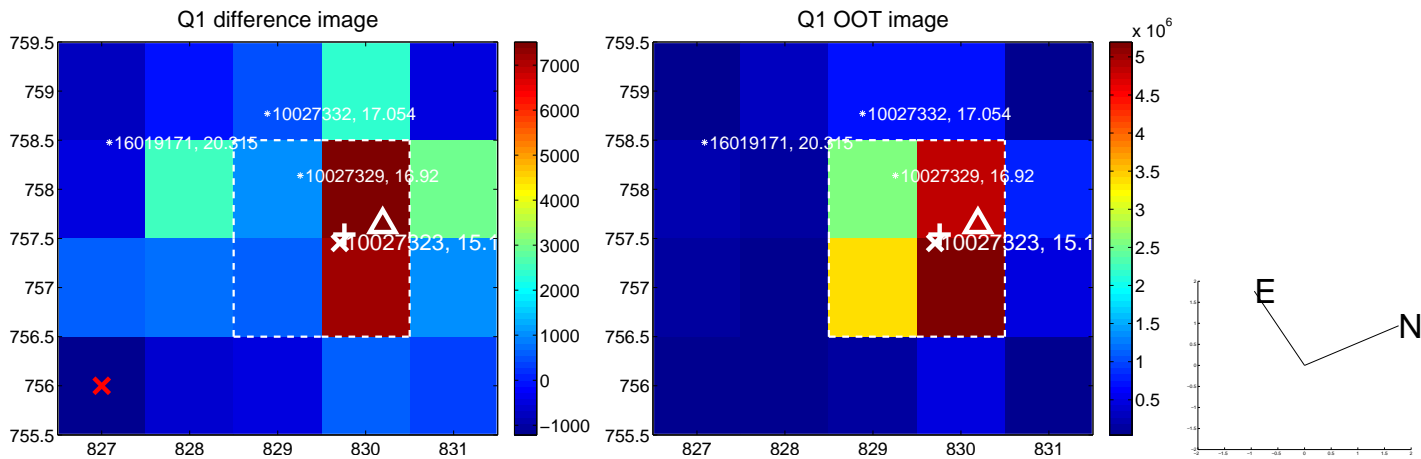
The direct PRF centroid is offset from the target star catalog position by about 0.49 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.556 \pm 0.406$	1.37	$0.007 \pm 0.218$	$0.556 \pm 0.406$
PRF-fit source offset from KIC position	$0.949 \pm 0.382$	2.49	$0.190 \pm 0.241$	$0.930 \pm 0.378$
photometric centroid source offset	$1.32 \pm 0.53$	2.48	$1.32 \pm 0.53$	$0.01 \pm 0.60$

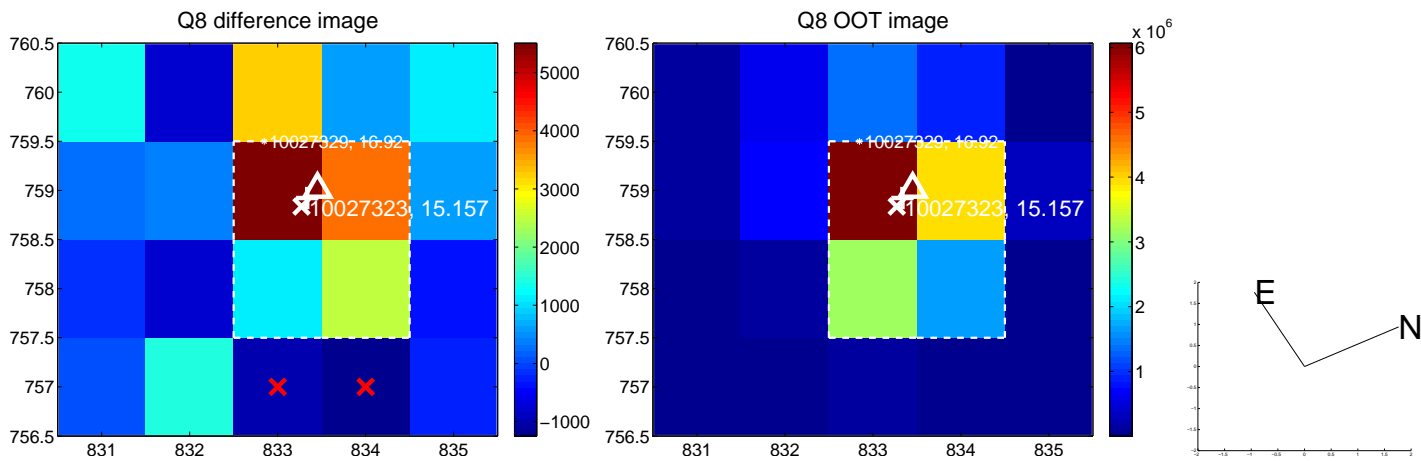
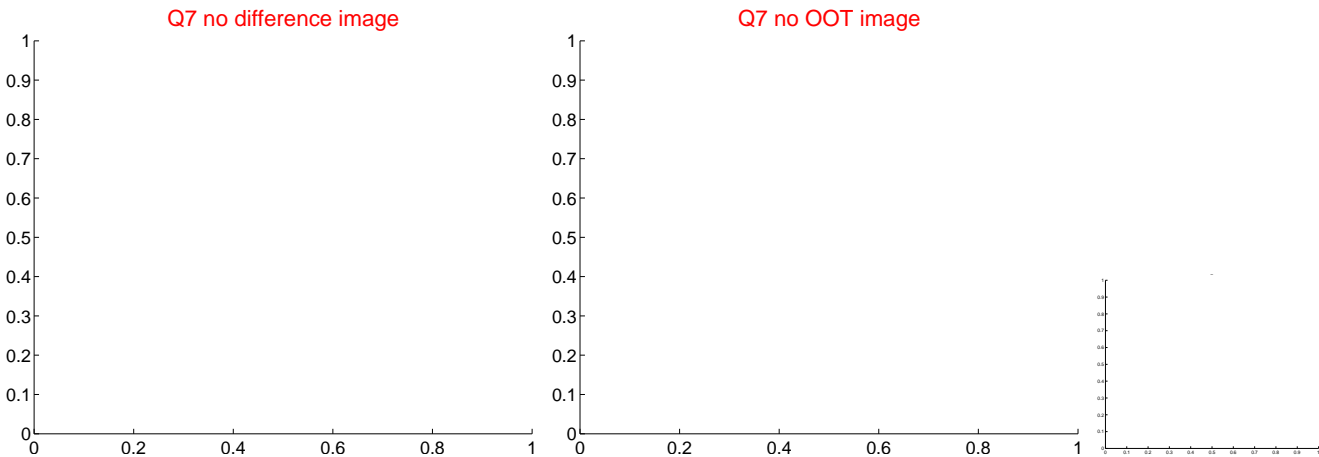
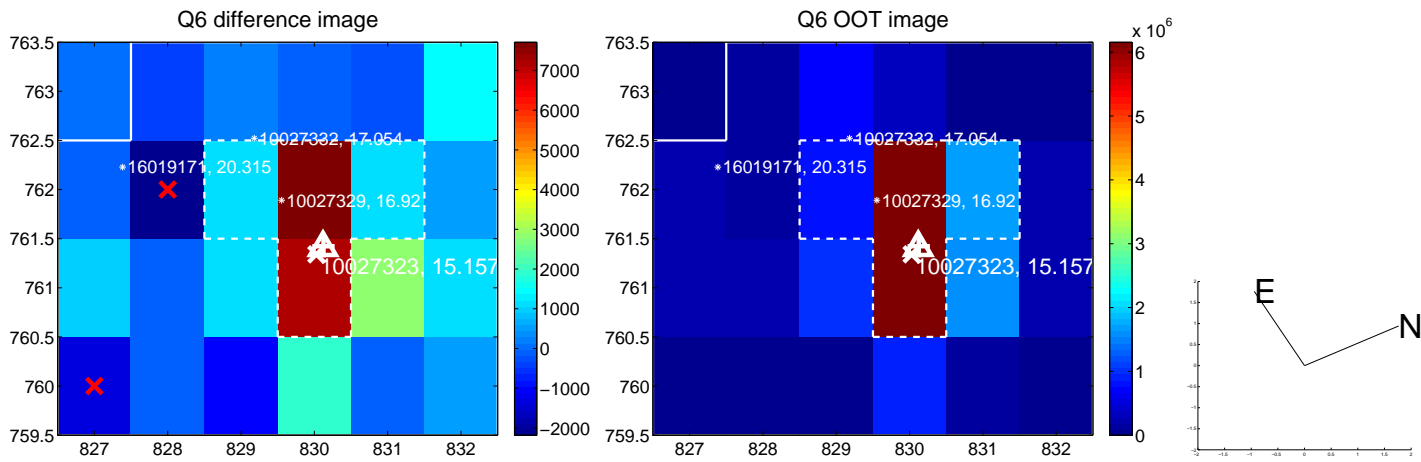
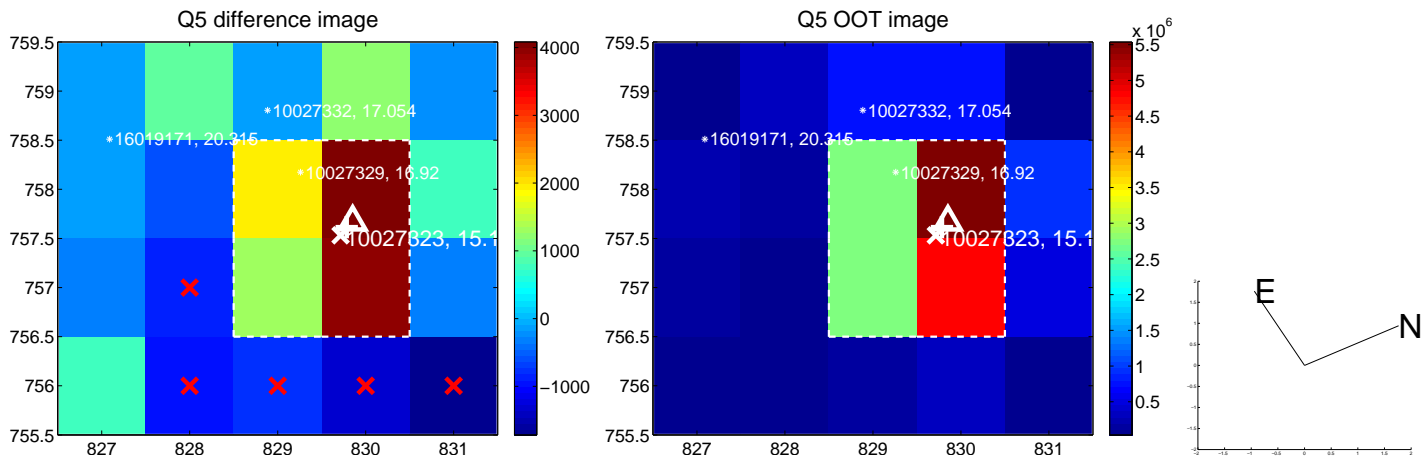


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: 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.

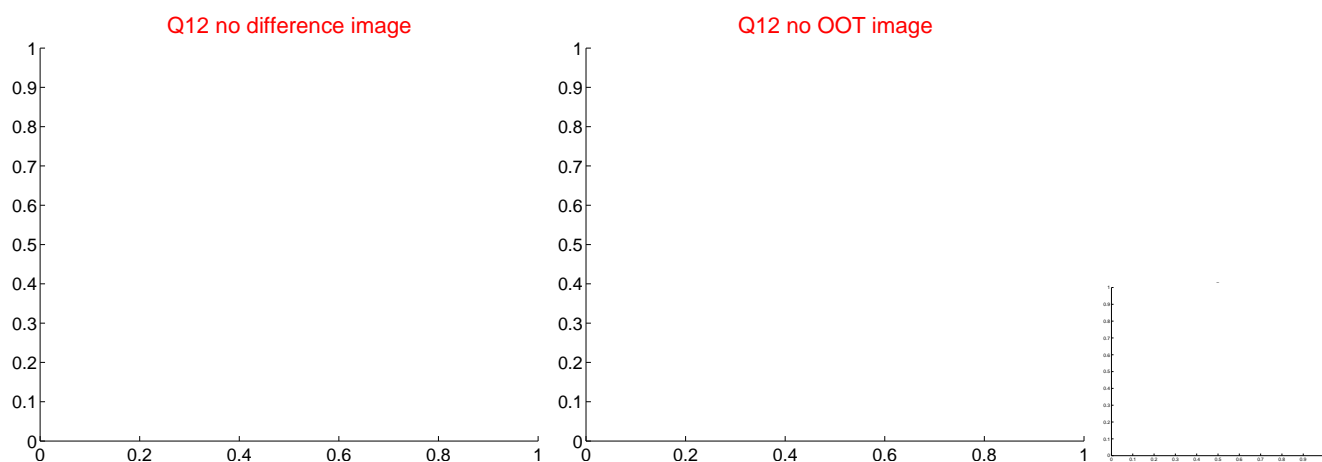
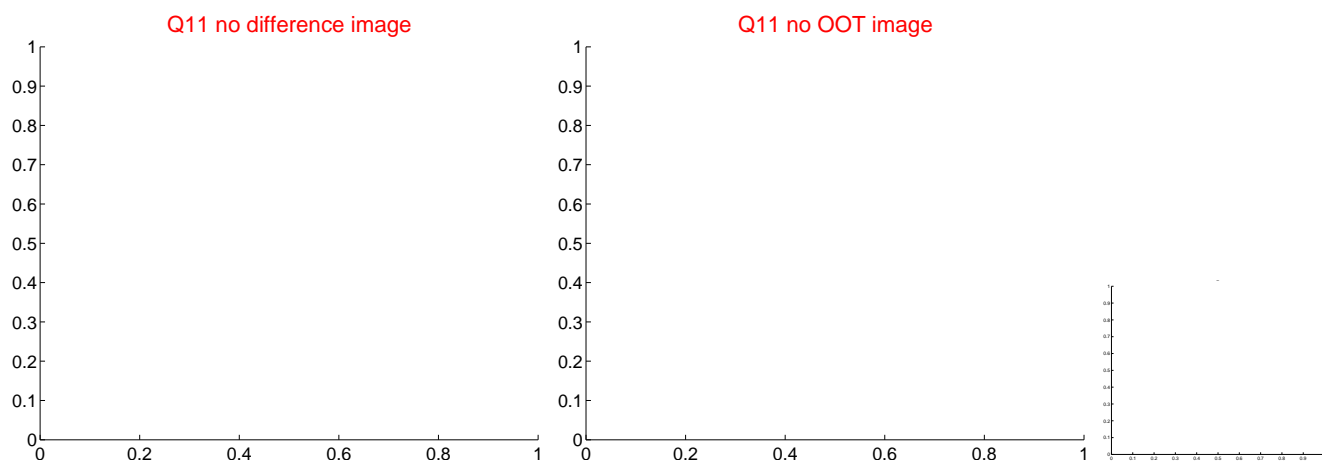
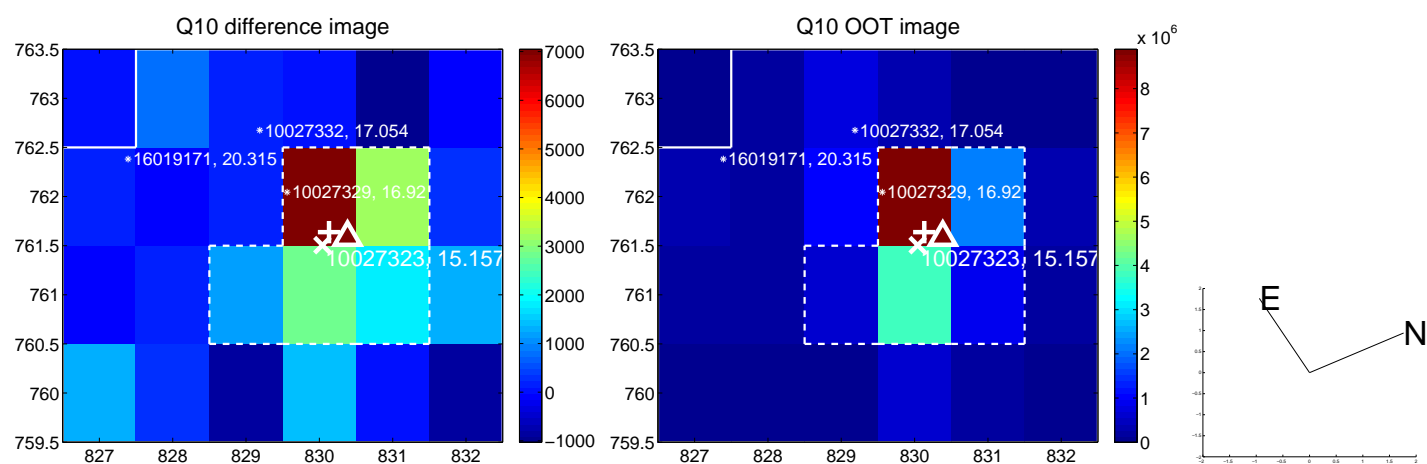
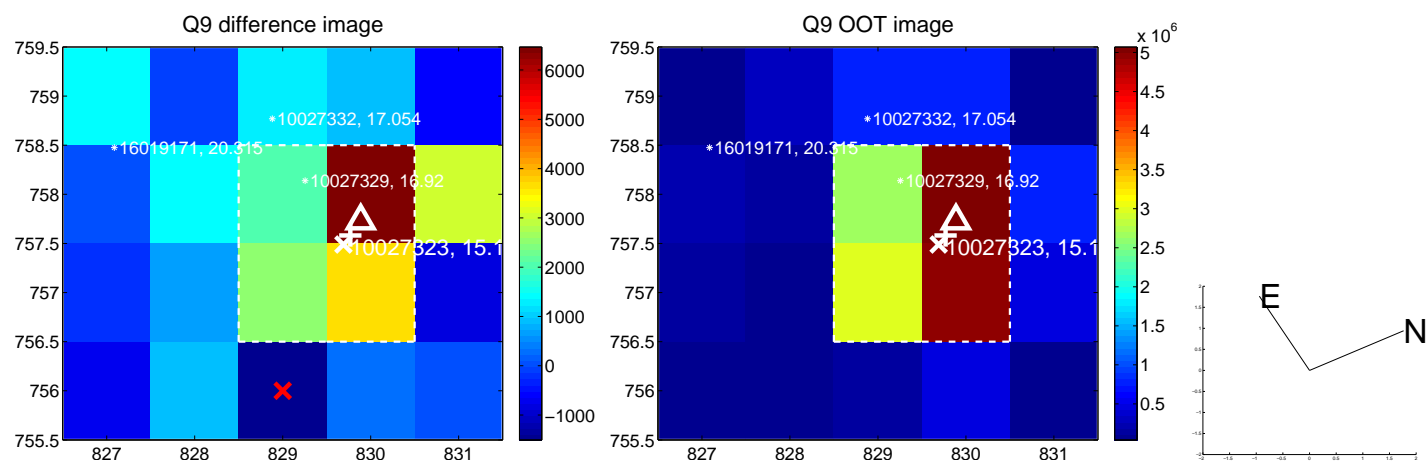
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



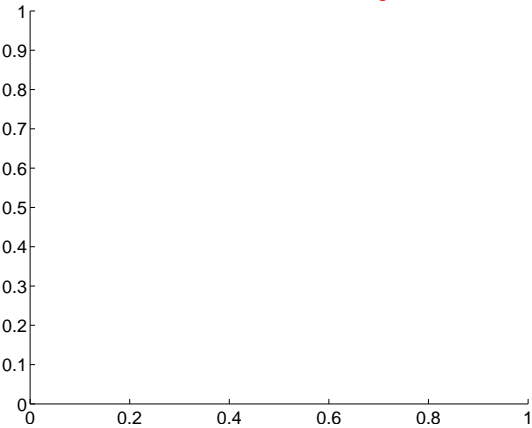
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value





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

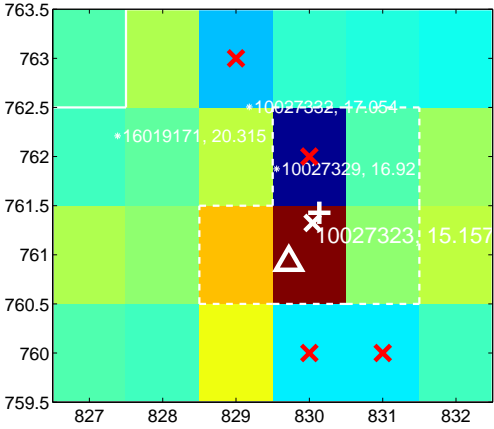
Q13 no difference image



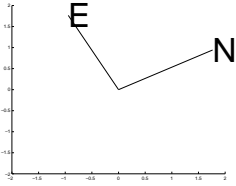
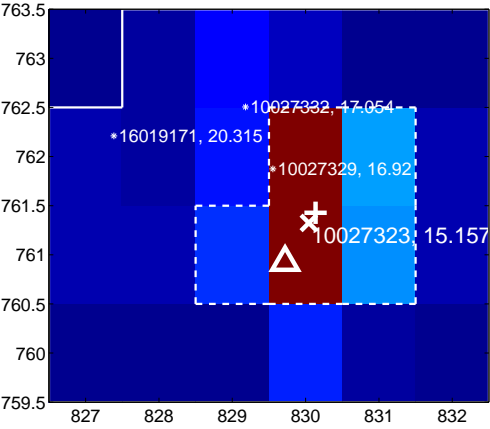
Q13 no OOT image



Q14 difference image. Poor Quality



Q14 OOT image



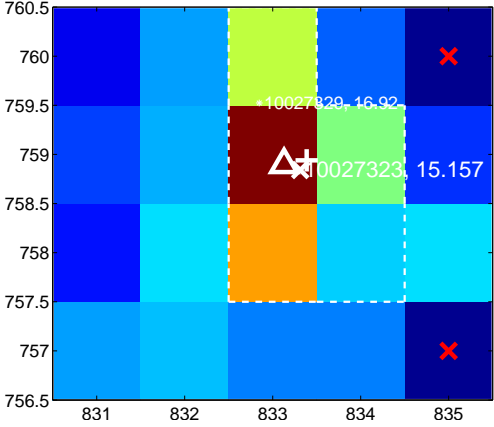
Q15 no difference image



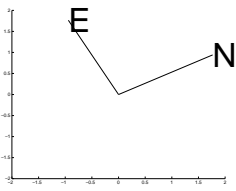
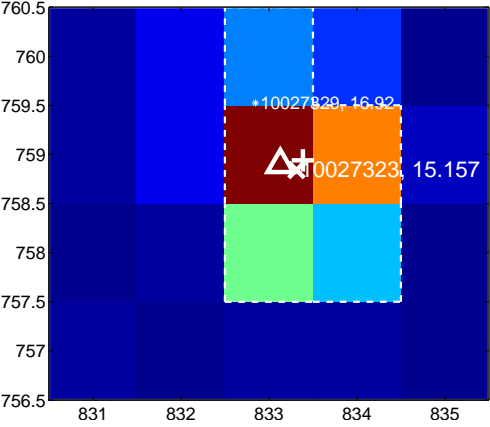
Q15 no OOT image



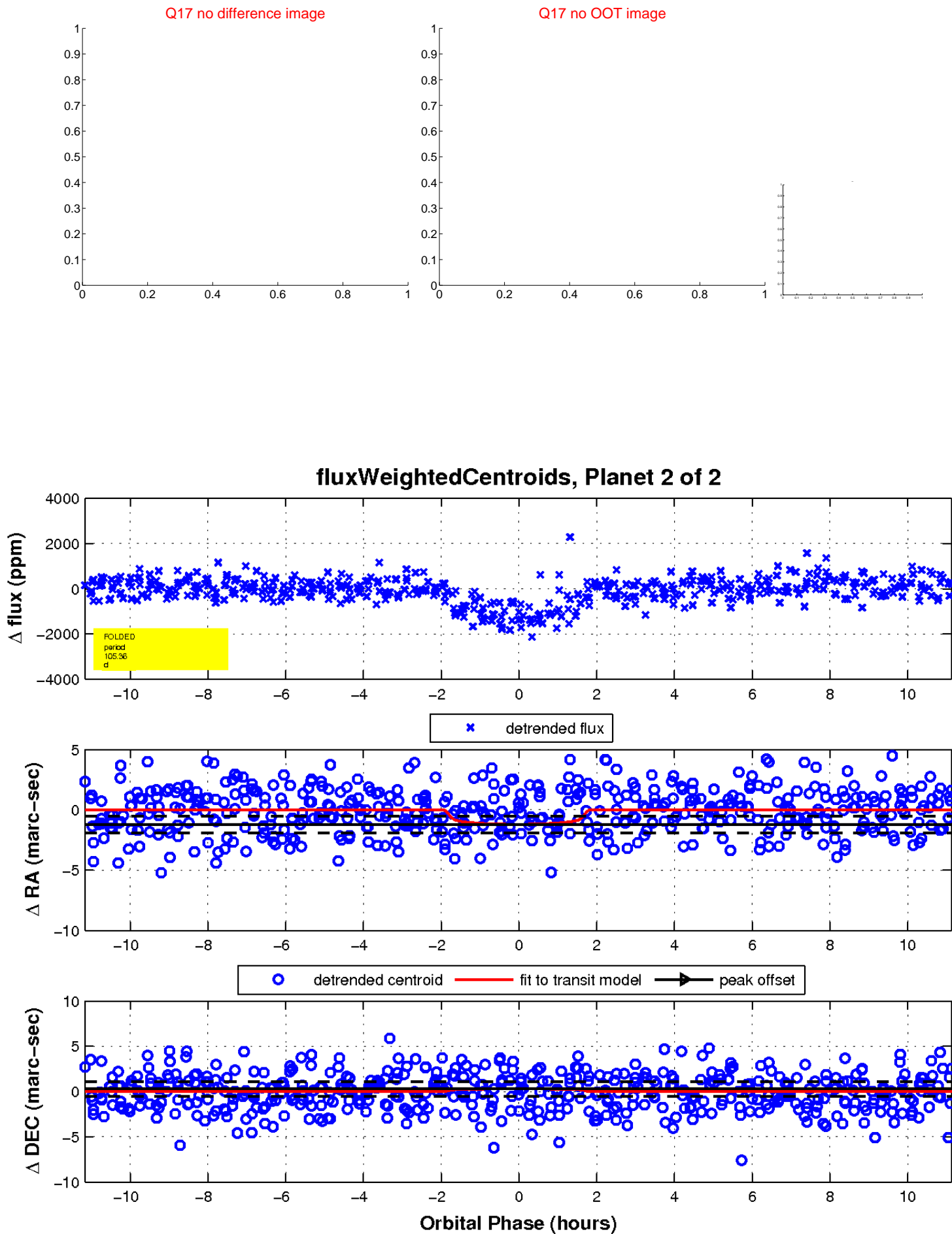
Q16 difference image



Q16 OOT image



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



UKIRT Image

Declination

