

# KIC 003644738

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
003644738-01	OBS	7660.01	358.983537	295.827987	809.7	25.442	10.4	11.4	0.95	6117	3.26	1.13
003644738-02	OBS	No	359.067135	274.164708	611.7	9.716	7.4	7.7	0.95	6117	2.46	1.13

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
003644738-01	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_MARSHALL_SKYE—CENT_FEW_DIFFS—HALO_GHOST
003644738-02	OBS	FP	0.00	1	0	0	1	INDIV_TRANS_MARSHALL_SKYE—SAME_NTL_PERIOD—CENT_FEW_DIFFS—EPHEM_MATCH

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

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

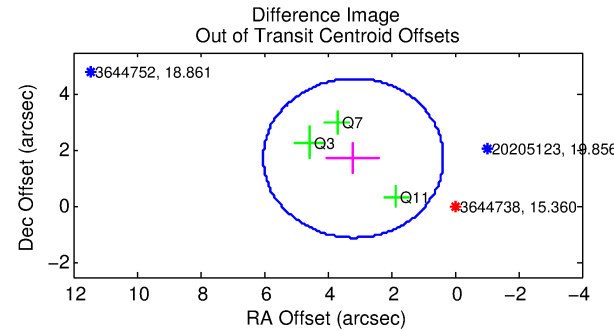
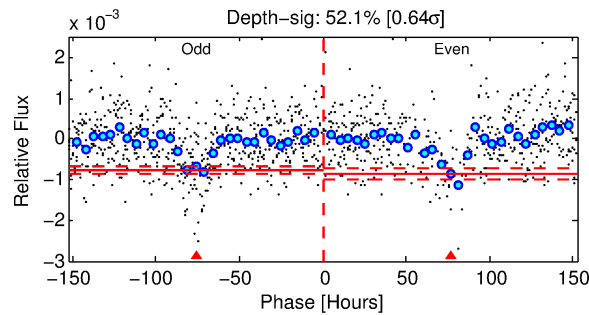
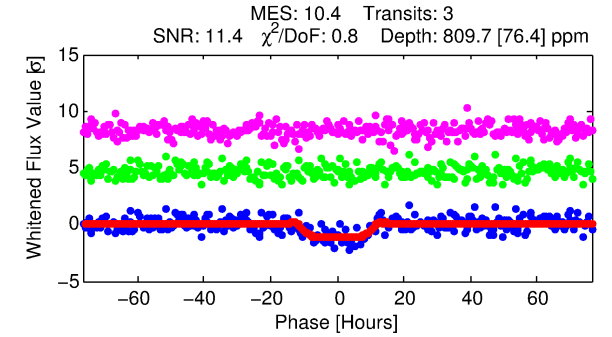
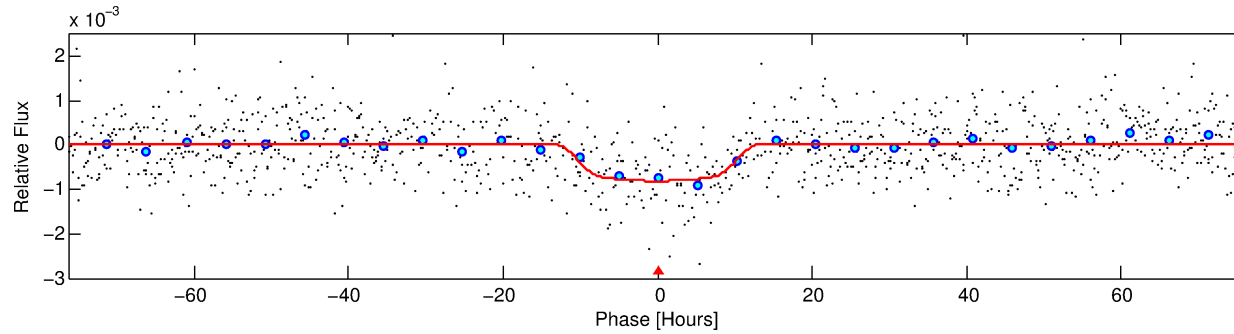
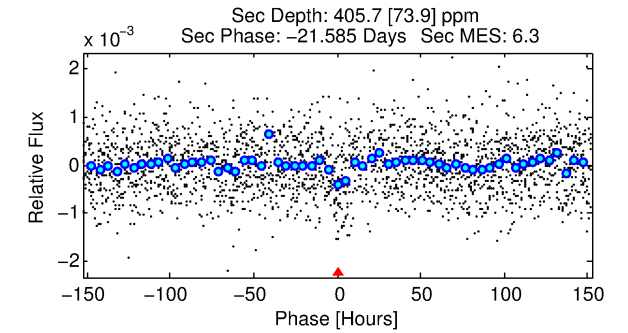
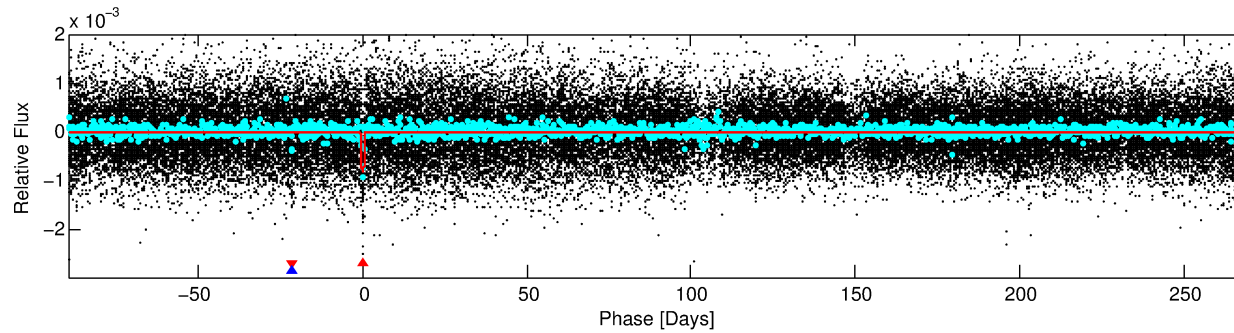
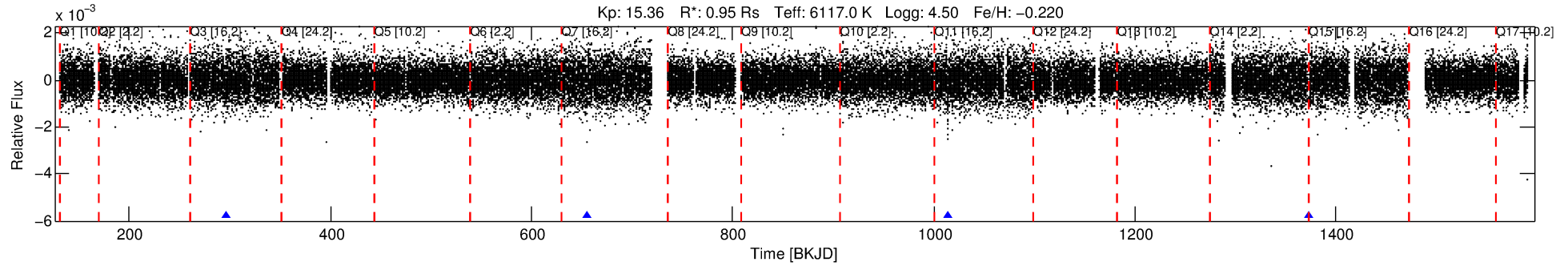
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 003644738-01

No Significant Match Found

# DV One-Page Summary

KIC: 3644738 Candidate: 1 of 2 Period: 358.984 d



## DV Fit Results:

Period = 358.98354 [0.02831] d  
Epoch = 295.8280 [0.0373] BKJD  
Rp/R\* = 0.0316 [0.0025]  
a/R\* = 48.58 [13.67]  
b = 0.93 [0.04]  
Seff = 1.13 [0.41]  
Teq = 263 [24] K  
Rp = 3.26 [0.88] Re  
a = 0.9969 [0.2217] AU  
Ag = 20832.59 [8523.64] [2.44σ]  
Teffp = 4886 [340] K [13.58σ]

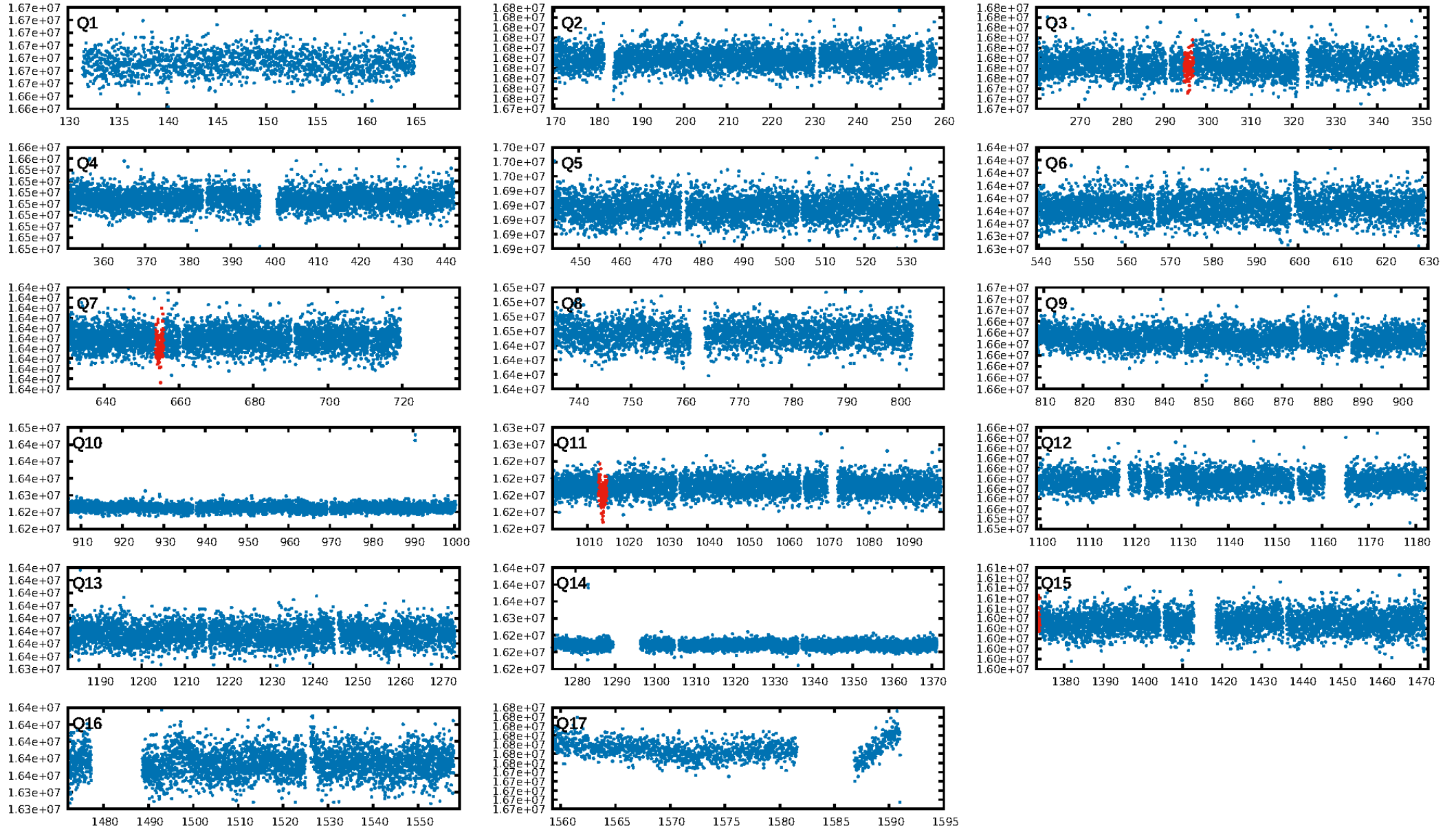
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 5.9% [0.07σ]  
ModelChiSquare2-sig: 4.6%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 2.51e-15  
RollingBand-fgt: 1.00 [3/3]  
**GhostDiagnostic-chr: 0.2399**  
Centroid-sig: 6.0%  
Centroid-so: 1.554 arcsec [1.10σ]  
**OotOffset-rm: 3.629 arcsec [3.84σ]**  
**KicOffset-rm: 3.590 arcsec [4.14σ]**  
OotOffset-st: 0/3/0/0 [3]  
KicOffset-st: 0/3/0/0 [3]  
DiffImageQuality-fgm: 0.00 [0/3]  
DiffImageOverlap-fno: 1.00 [3/3]

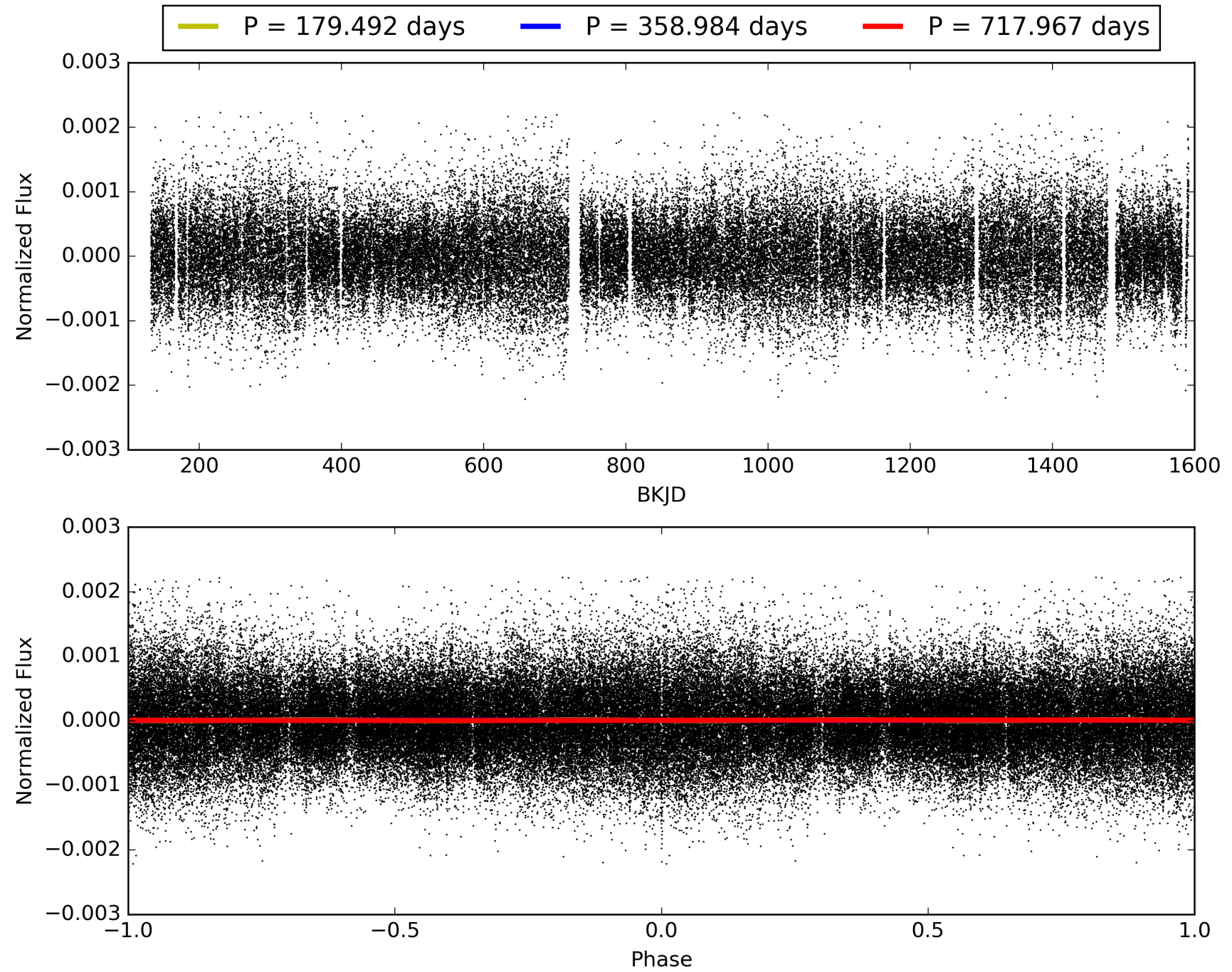
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 00:25:05 Z

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

# TCE 003644738-01, PDC Light Curves

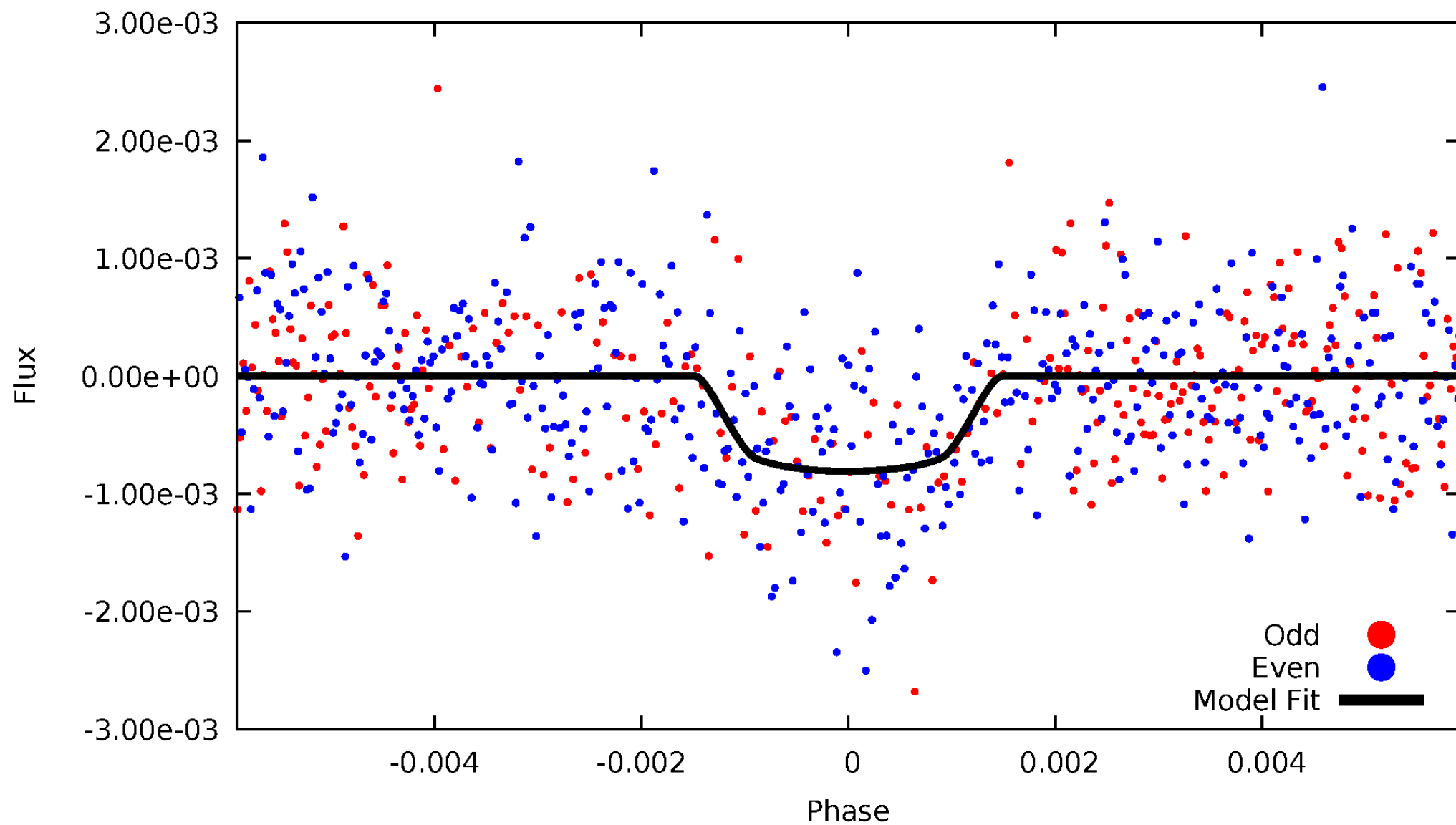


# TCE 003644738-01



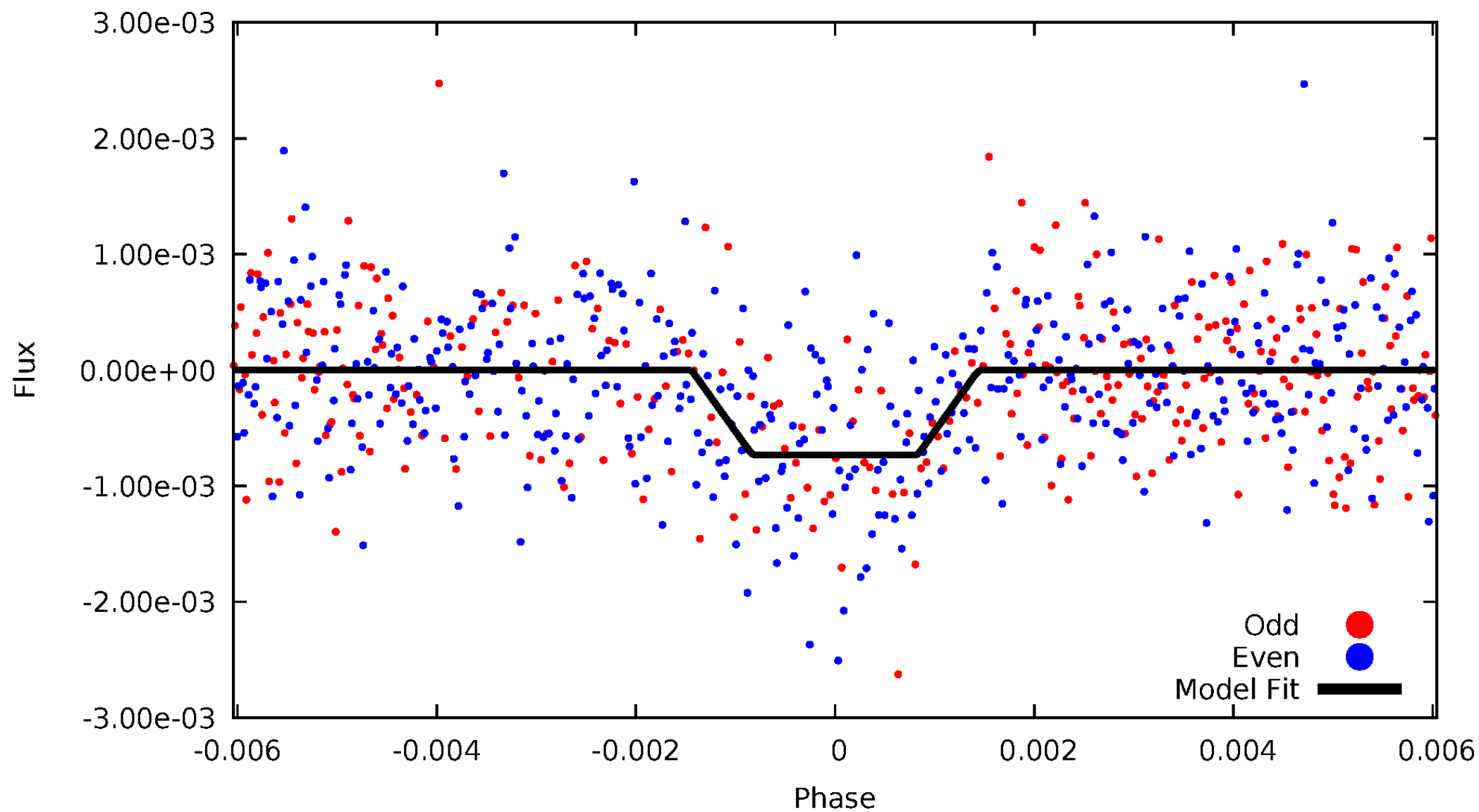
# DV Odd/Even

TCE 003644738-01



# ALT Odd/Even

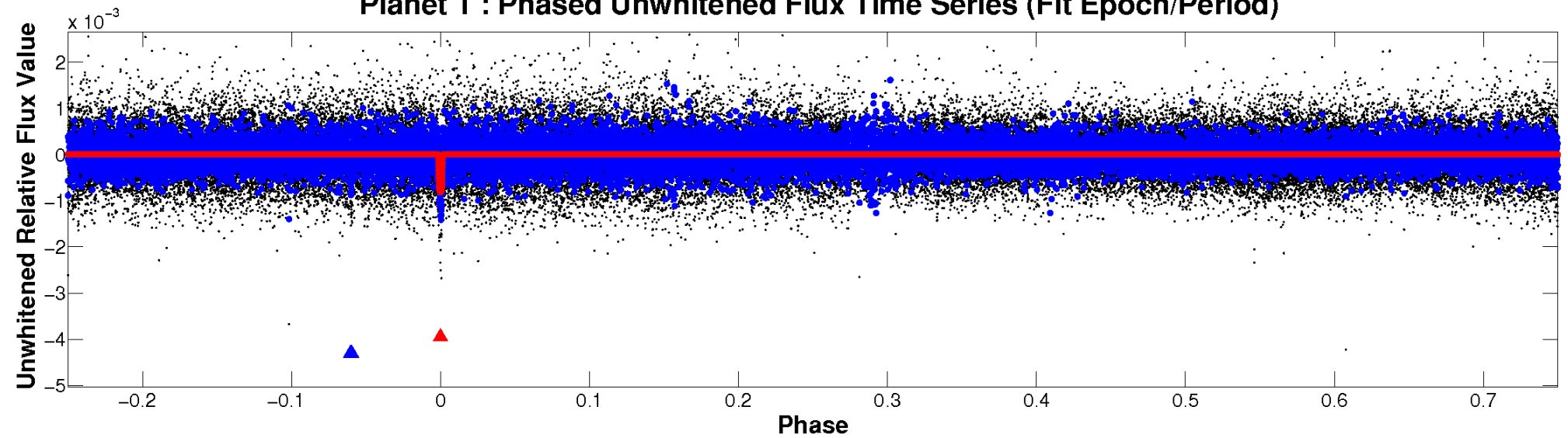
TCE 003644738-01



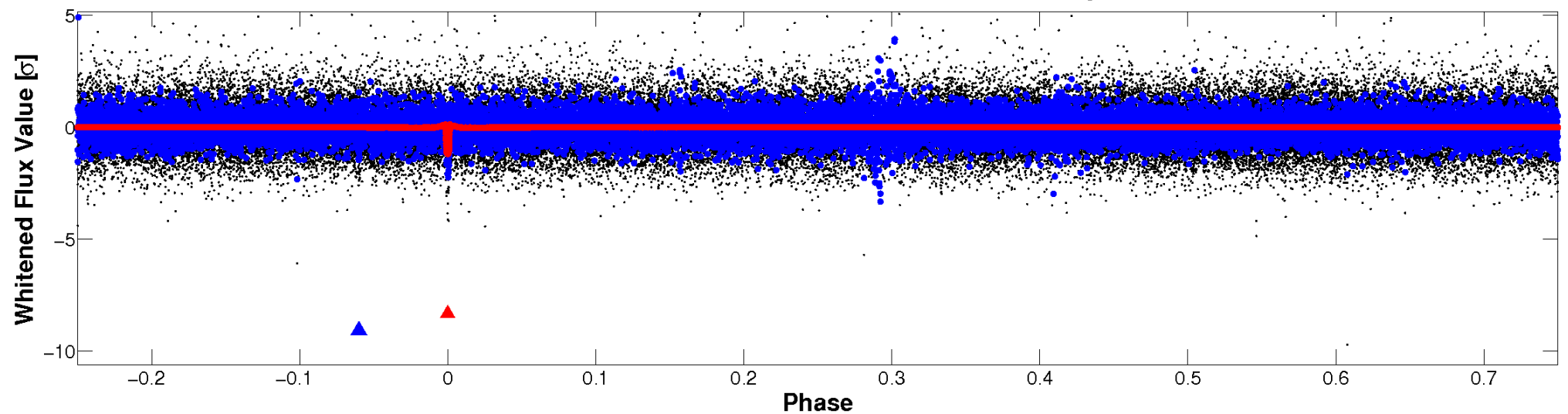


# Non-Whitened Vs. Whitened Light Curve

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

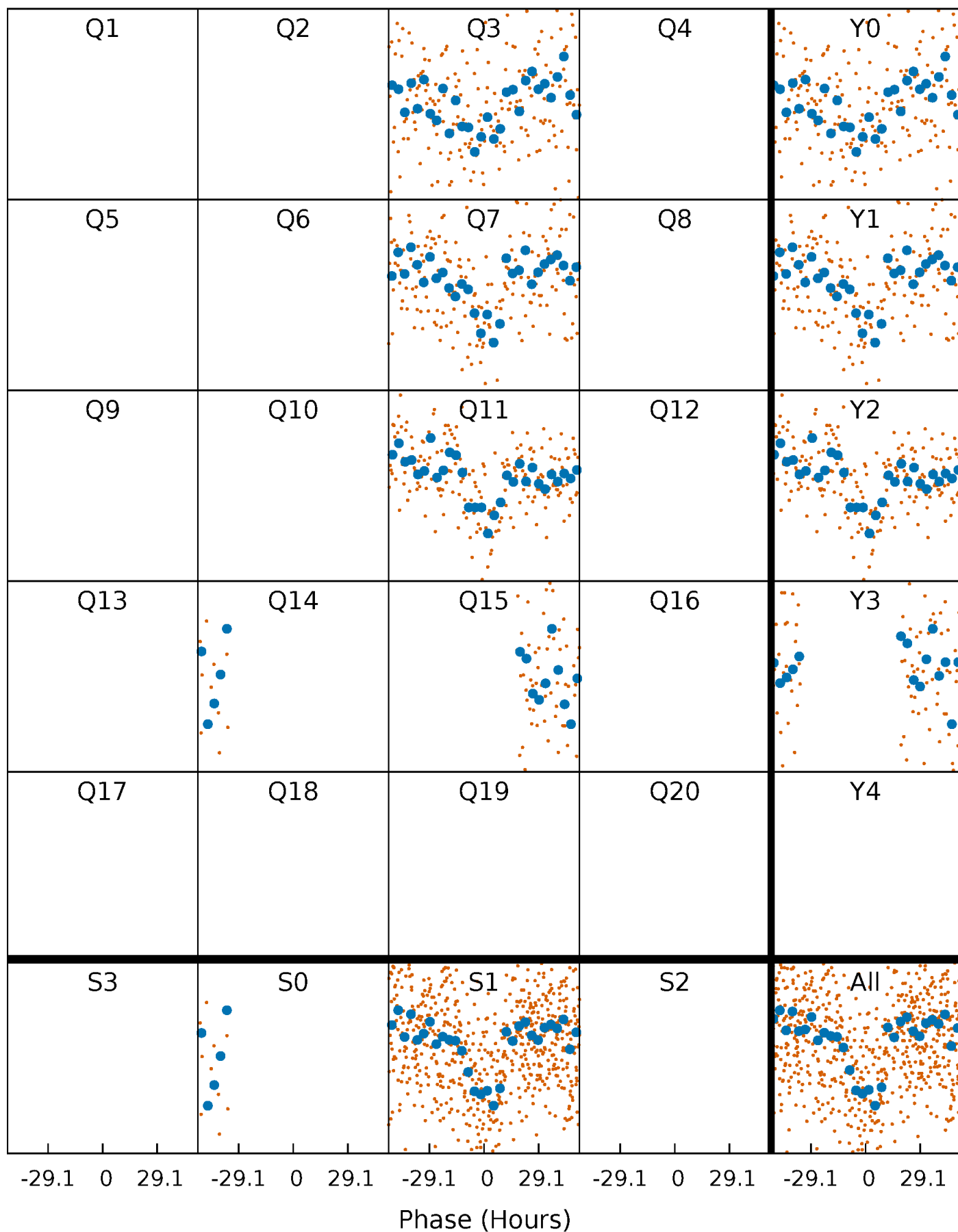


**Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



# PDC Quarter-Phased Transit Curves

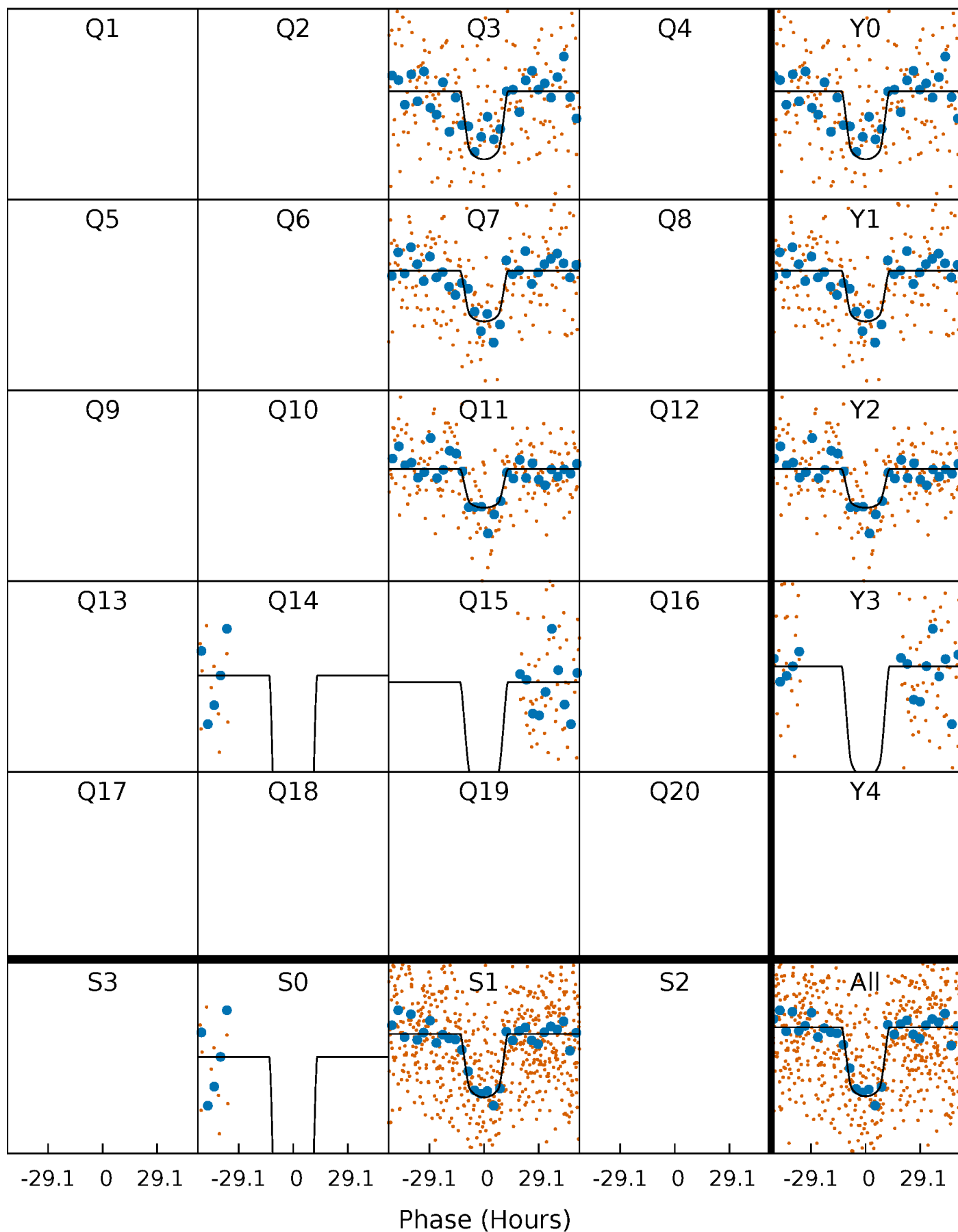
TCE 003644738-01 P=358.983537 Days  $T_0=295.827987$  (BKJD)





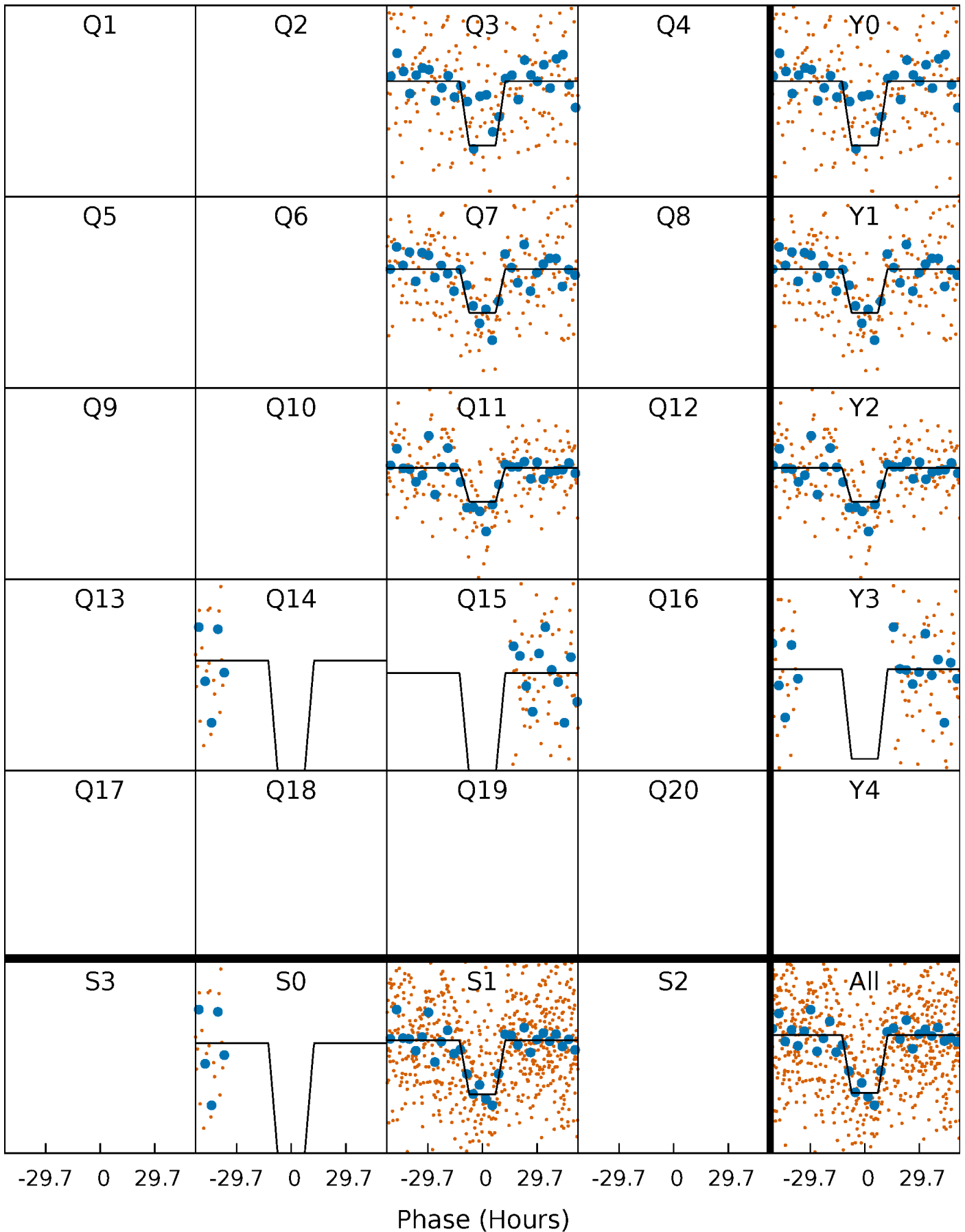
# DV Quarter-Phased Transit Curves

TCE 003644738-01 P=358.983537 Days  $T_0=295.827987$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

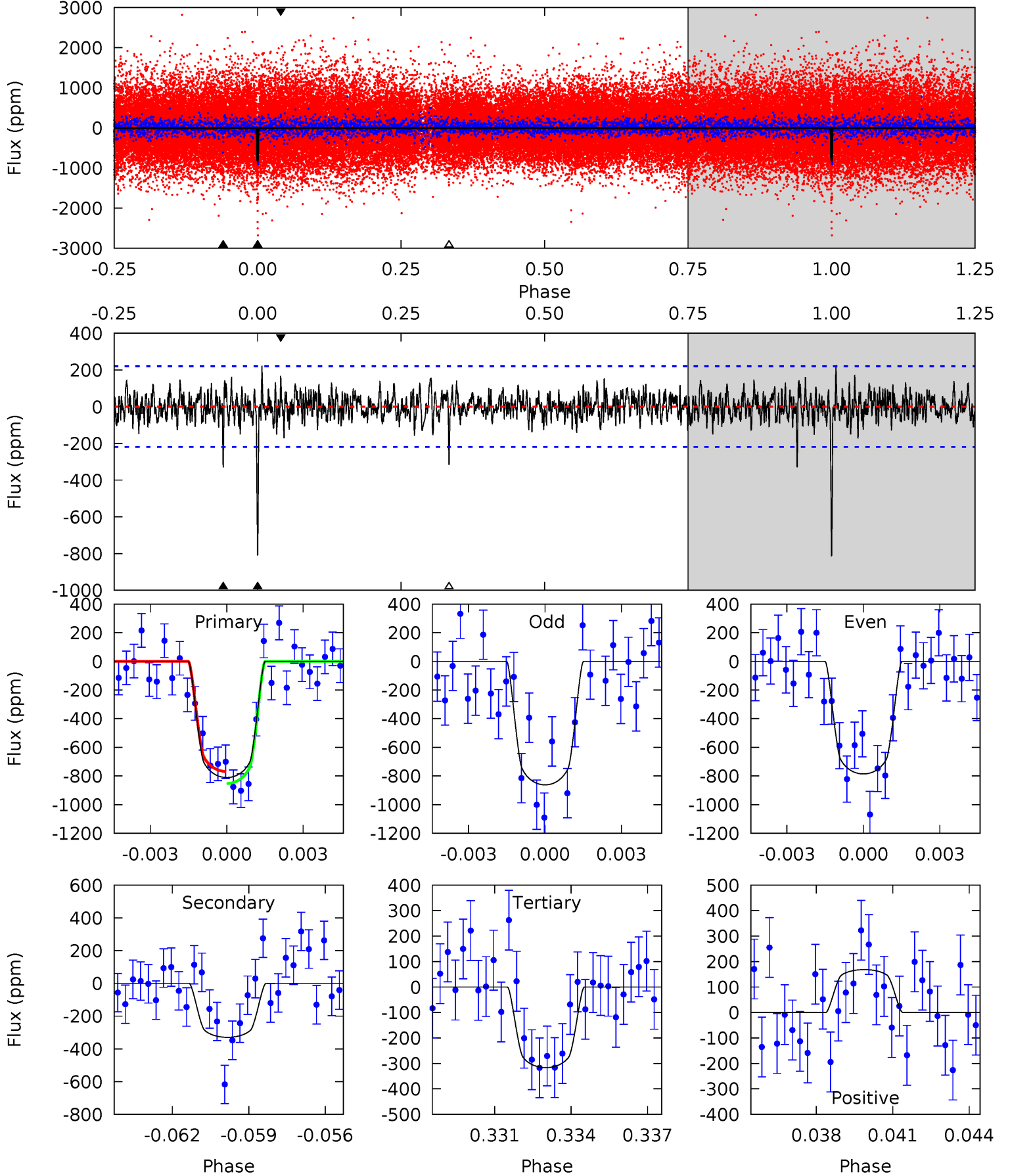
TCE 003644738-01 P=359.031272 Days  $T_0=295.782914$  (BKJD)



# DV Model-Shift Uniqueness Test

003644738-01, P = 358.983537 Days, E = 295.827987 Days

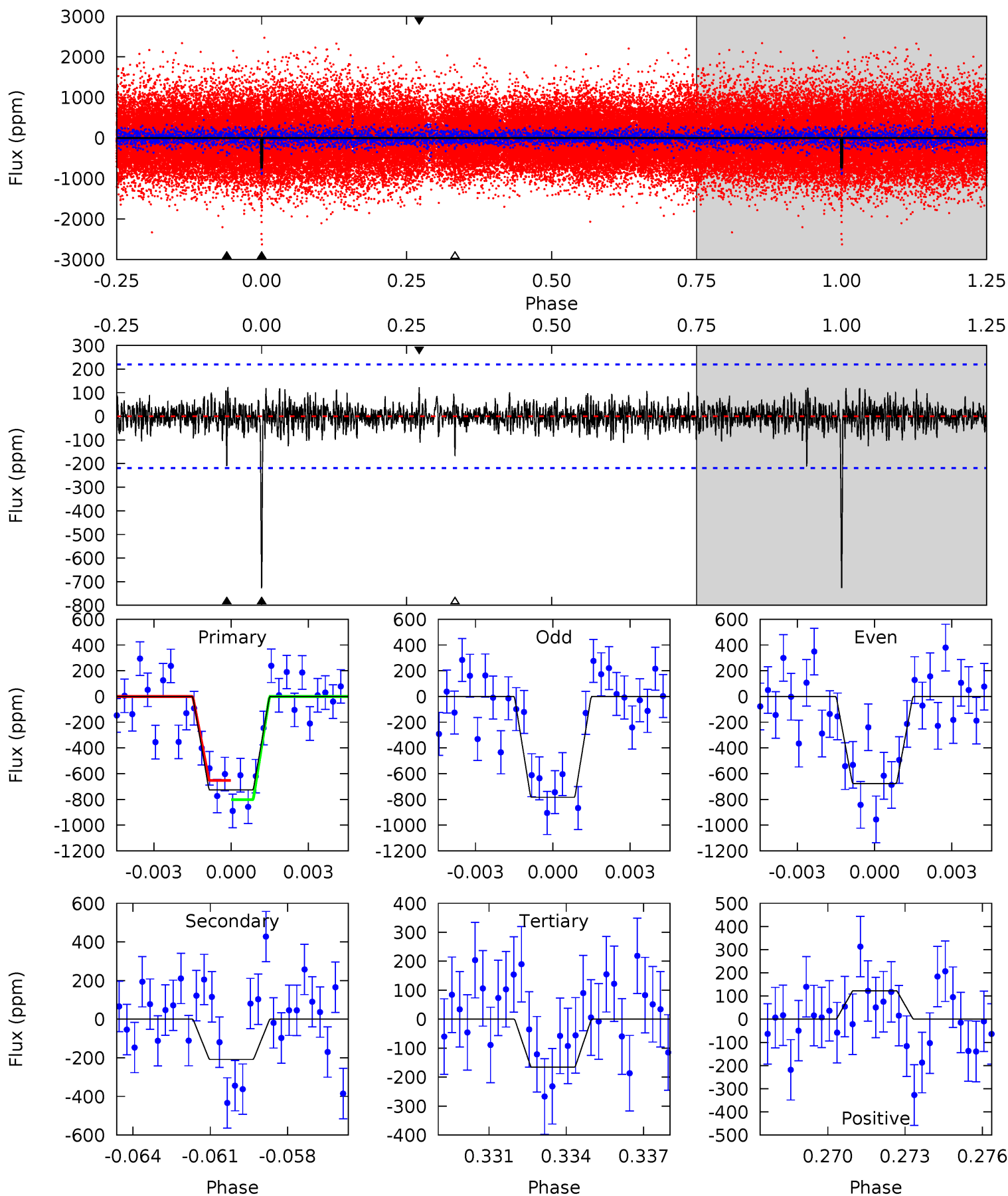
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
19.4	7.89	7.57	4.03	5.26	2.97	1.31	11.8	15.4	0.31	3.86	0.85	0.94	0.21	1.00



# Alt Model-Shift Uniqueness Test

003644738-01, P = 359.031272 Days, E = 295.782914 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
17.4	5.00	3.96	2.94	5.26	2.98	0.86	13.5	14.5	1.03	2.06	1.21	0.93	0.14	1.79



### Stellar Parameters For KIC 003644738

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6117^{+170}_{-212}$	$4.496^{+0.046}_{-0.184}$	$-0.220^{+0.300}_{-0.300}$	$0.947^{+0.244}_{-0.104}$	$1.025^{+0.116}_{-0.142}$	$1.702^{+0.411}_{-0.808}$
	+3%/-3%	+1%/-4%	+136%/-136%	+26%/-11%	+11%/-14%	+24%/-47%
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 003644738-01 / KOI 7660.01

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-329 \pm 42$	$3.39^{+0.54}_{-0.41}$	$374^{+23}_{-17}$	$4751^{+244}_{-217}$	$15215^{+4489}_{-3910}$
Alt.	$-208 \pm 42$	$2.89^{+0.48}_{-0.37}$	$375^{+24}_{-19}$	$4622^{+268}_{-272}$	$12967^{+5062}_{-3805}$

$T_{max}$  = Theoretical Maximum Planetary Temperature  
 $T_{obs}$  = Observed Planetary Temperature (Assuming  $A=0.3$ )  
 $A_{obs}$  = Observed Albedo (Assuming  $T=0$ )

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

## DV Centroid Data

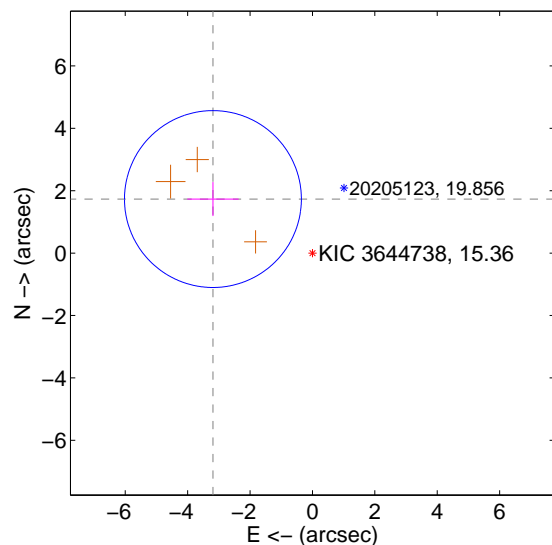
Supplemental centroid analysis for 003644738-01. Kepler magnitude: 15.36. Transit SNR 11.43

There are 0 quarters with good PRF difference image offsets

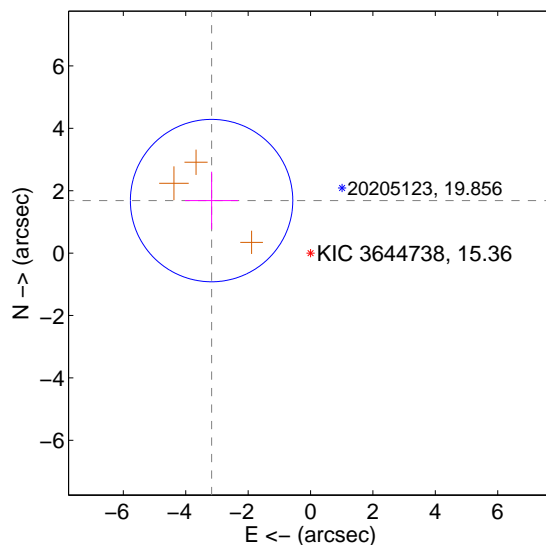
The direct PRF centroid is offset from the target star catalog position by about 0.07 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$3.629 \pm 0.945$	3.84	$3.189 \pm 0.822$	$1.732 \pm 0.545$
PRF-fit source offset from KIC position	$3.590 \pm 0.867$	4.14	$3.171 \pm 0.851$	$1.683 \pm 0.923$
photometric centroid source offset	$1.55 \pm 1.41$	1.10	$0.95 \pm 1.41$	$1.23 \pm 1.41$

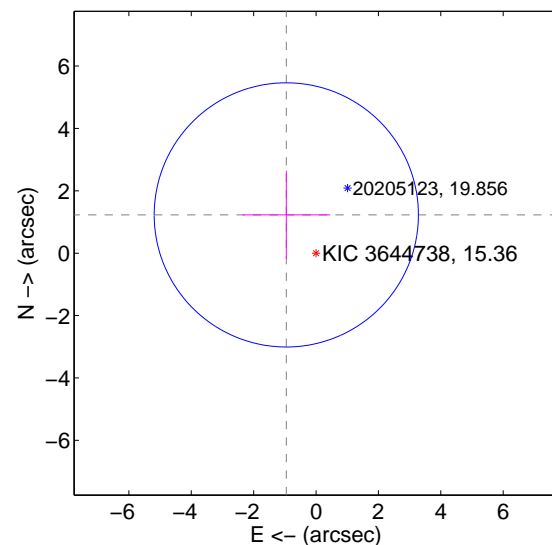
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

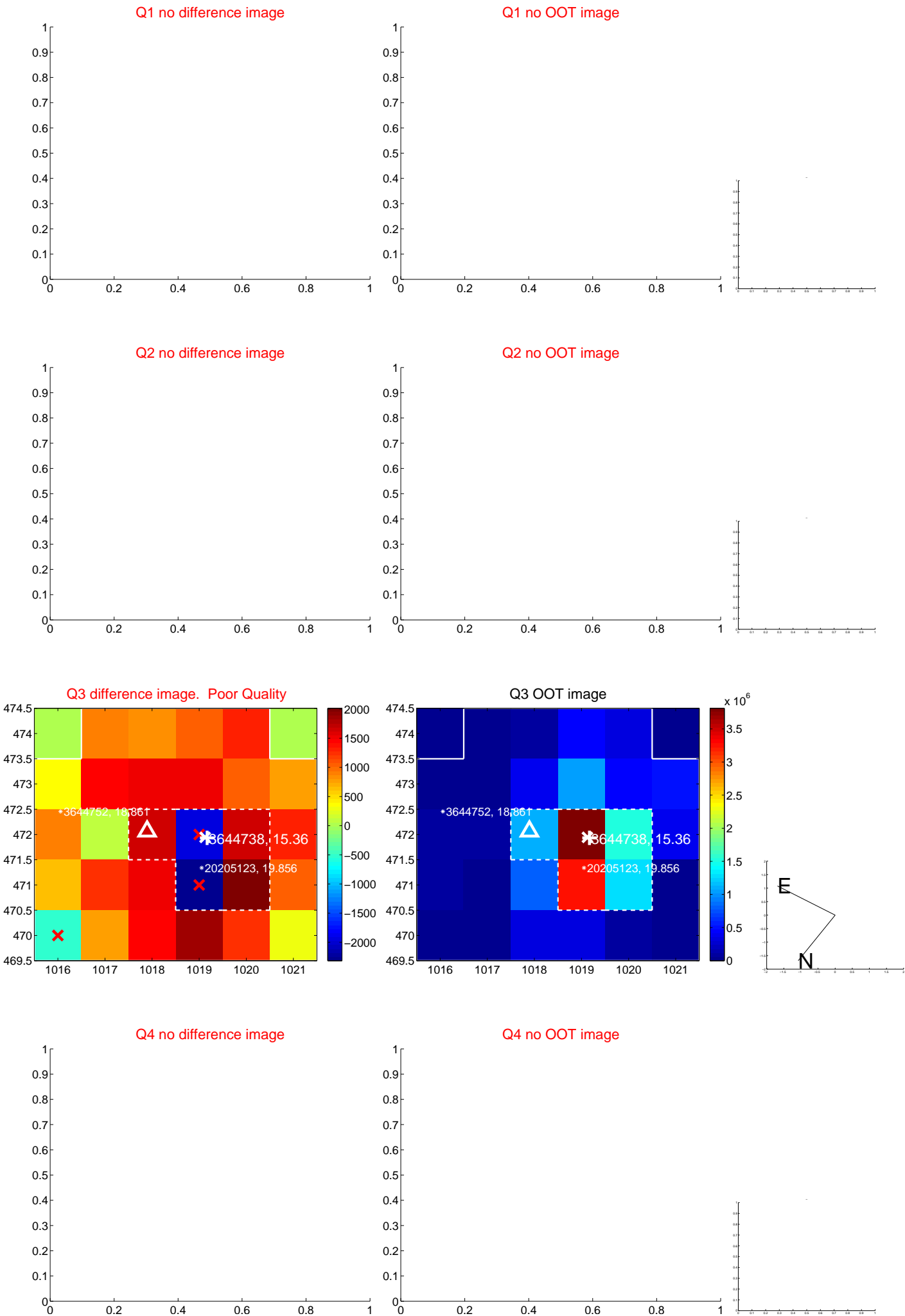


offset from photometric centroids



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 ×: KIC target position; +: OOT centroid; △: difference centroid. red ×: large negative pixel value.





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

Q5 no difference image



Q5 no OOT image



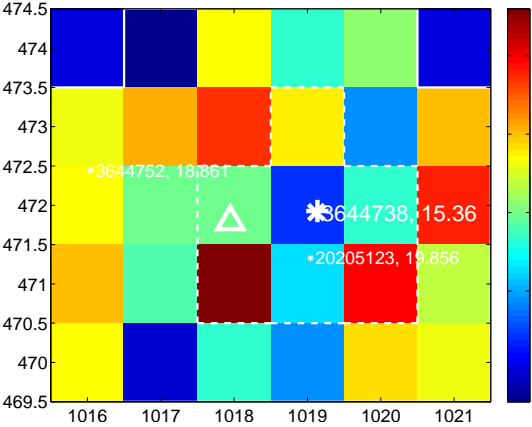
Q6 no difference image



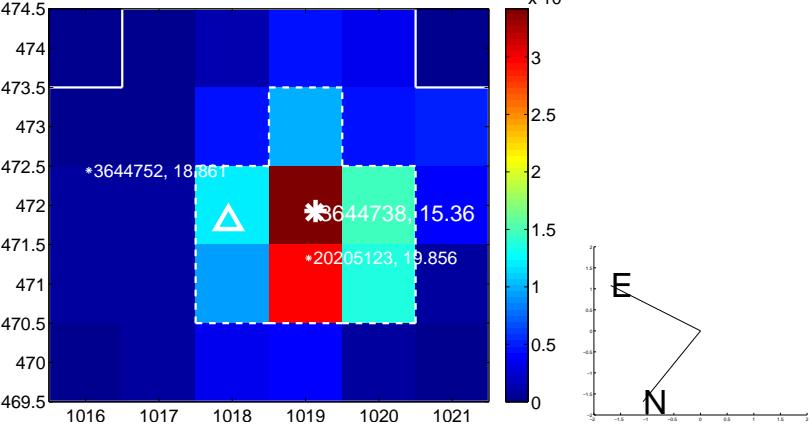
Q6 no OOT image



Q7 difference image. Poor Quality



Q7 OOT image



Q8 no difference image



Q8 no OOT image



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

Q9 no difference image



Q9 no OOT image



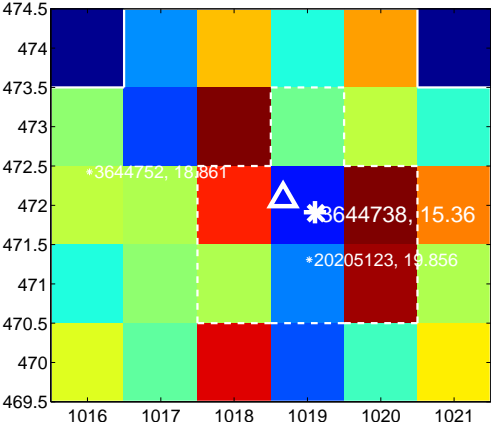
Q10 no difference image



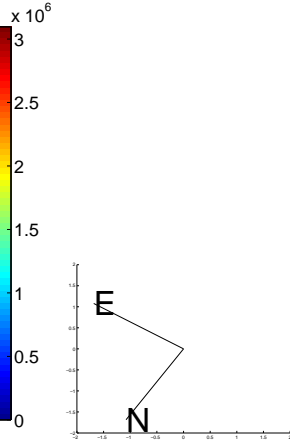
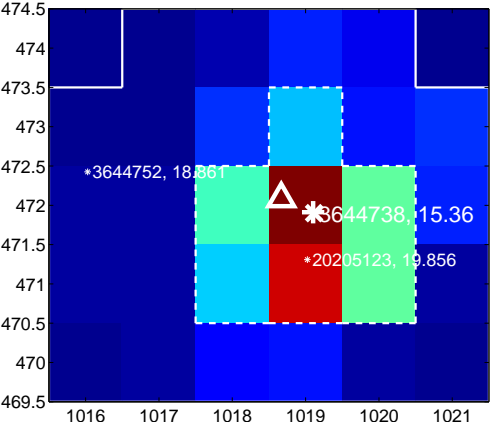
Q10 no OOT image



Q11 difference image. Poor Quality



Q11 OOT image



Q12 no difference image



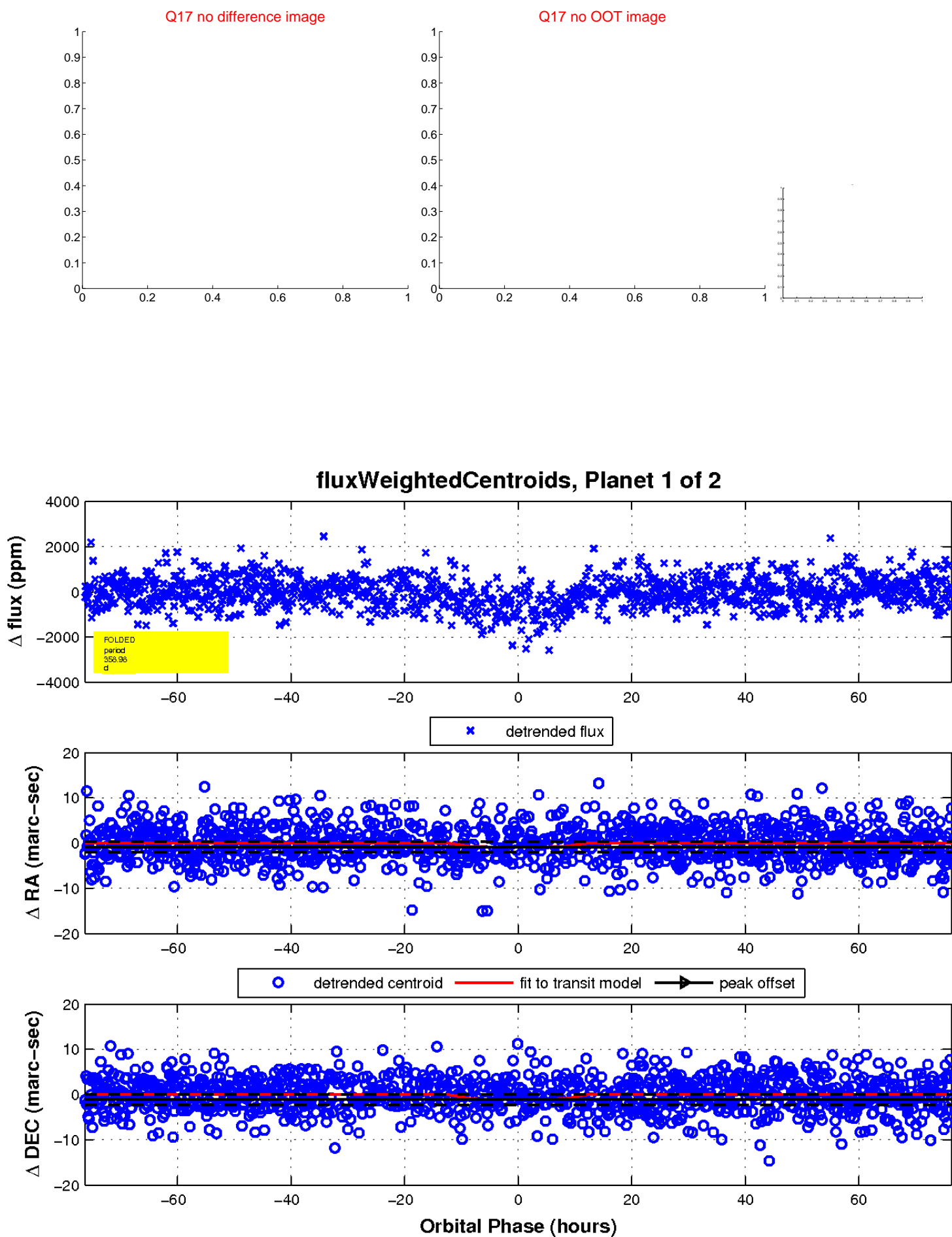
Q12 no OOT image



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

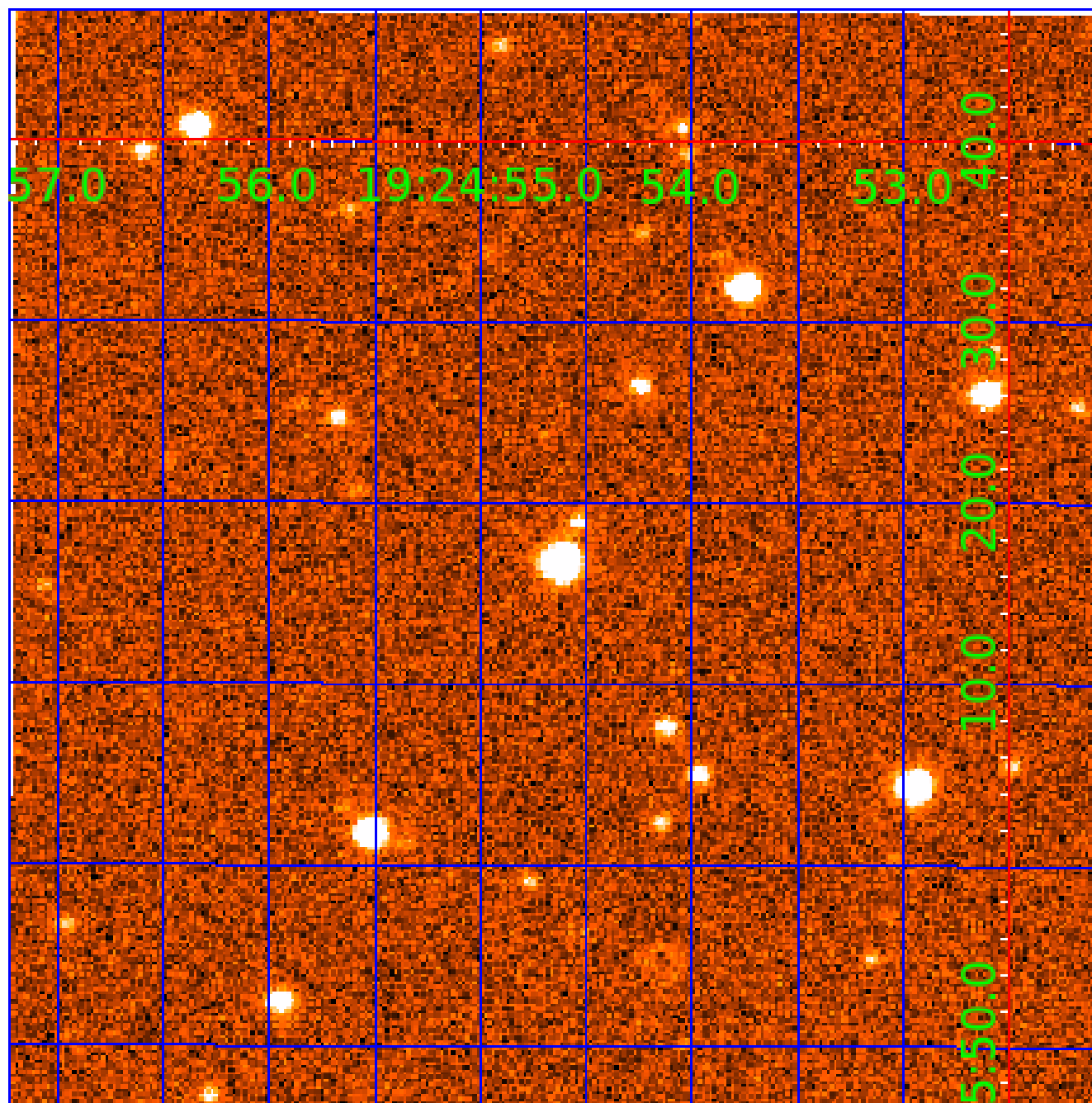


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 003644738

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
003644738-01	OBS	7660.01	358.983537	295.827987	809.7	25.442	10.4	11.4	0.95	6117	3.26	1.13
003644738-02	OBS	No	359.067135	274.164708	611.7	9.716	7.4	7.7	0.95	6117	2.46	1.13

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
003644738-01	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_MARSHALL_SKYE—CENT_FEW_DIFFS—HALO_GHOST
003644738-02	OBS	FP	0.00	1	0	0	1	INDIV_TRANS_MARSHALL_SKYE—SAME_NTL_PERIOD—CENT_FEW_DIFFS—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.

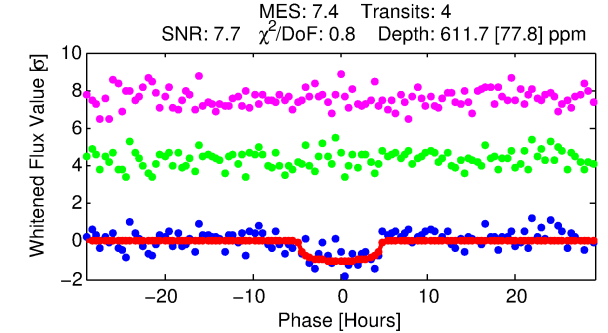
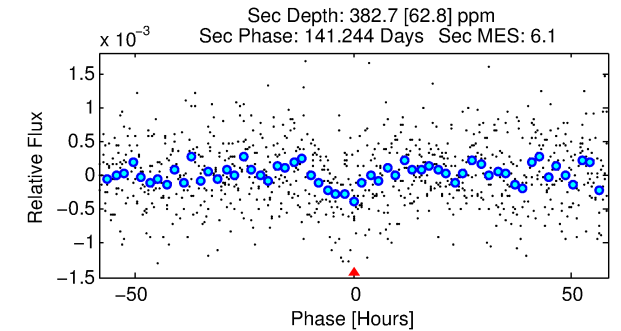
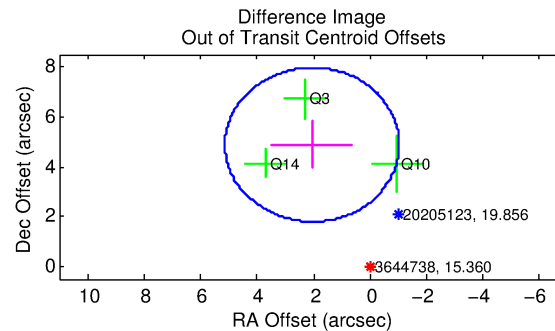
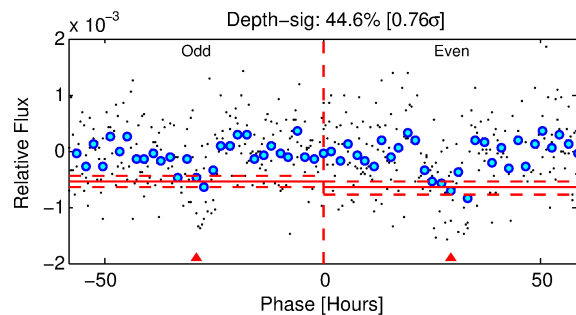
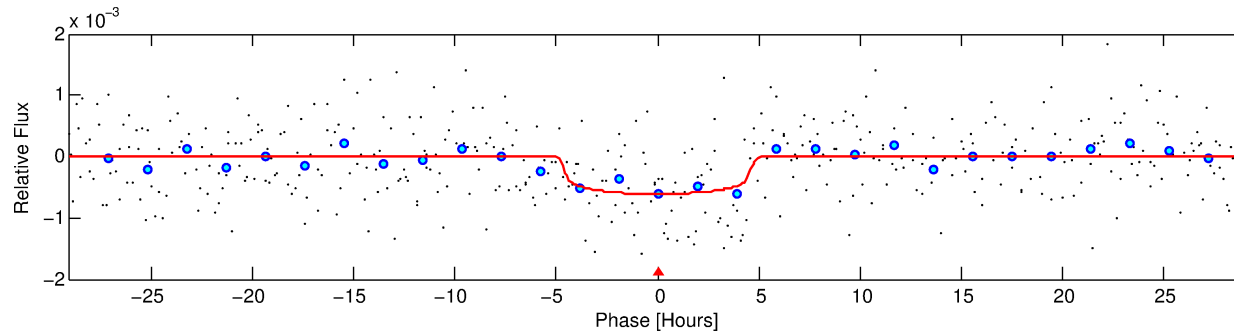
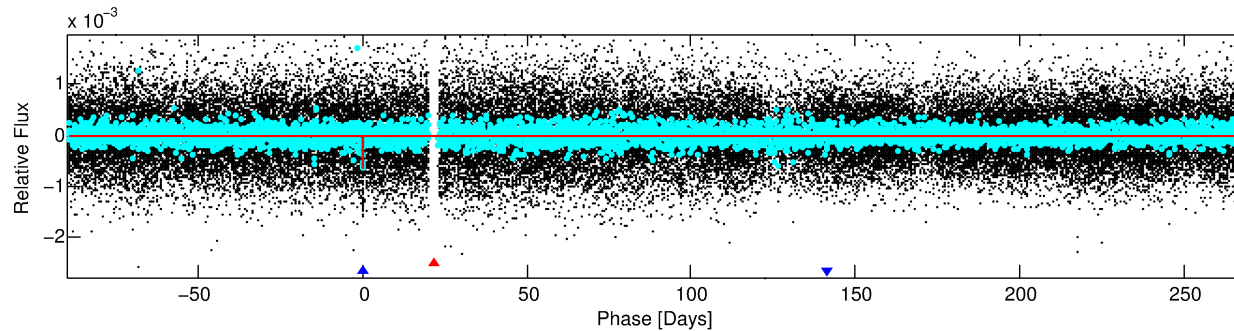
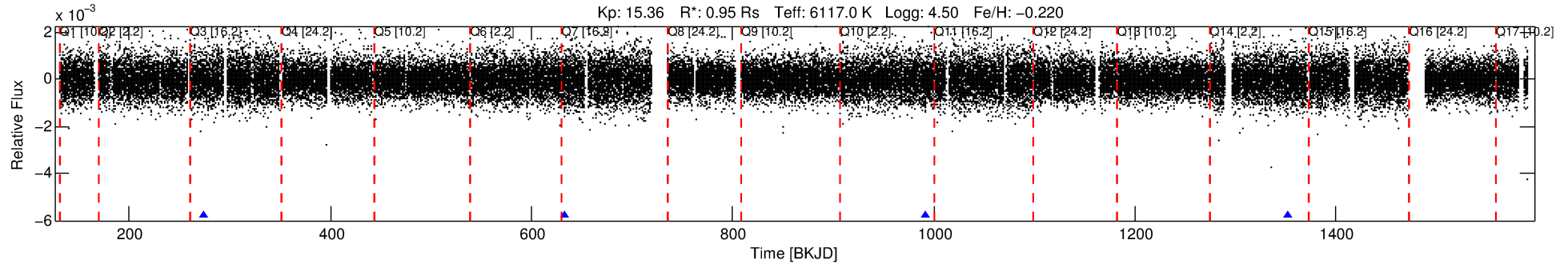
## Ephemeris Match Information For 003644738-02

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	$\sigma_P$	$\sigma_T$
003644738-02	3644738	003644542-sec	3644542	3:1	161.6	17	-37	8.35	15.36	419.93	Direct-PRF	0	3.50	0.70

**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: 3644738 Candidate: 2 of 2 Period: 359.067 d



## DV Fit Results:

Period = 359.06713 [0.00979] d  
Epoch = 274.1647 [0.0182] BKJD  
Rp/R\* = 0.0238 [0.0184]  
a/R\* = 228.74 [878.57]  
b = 0.63 [3.76]  
Seff = 1.13 [0.41]  
Teq = 263 [24] K  
Rp = 2.46 [2.01] Re  
a = 0.9970 [0.2217] AU  
Ag = 34588.67 [55086.80] [0.63 $\sigma$ ]  
Teffp = 5545 [2168] K [2.44 $\sigma$ ]

## DV Diagnostic Results:

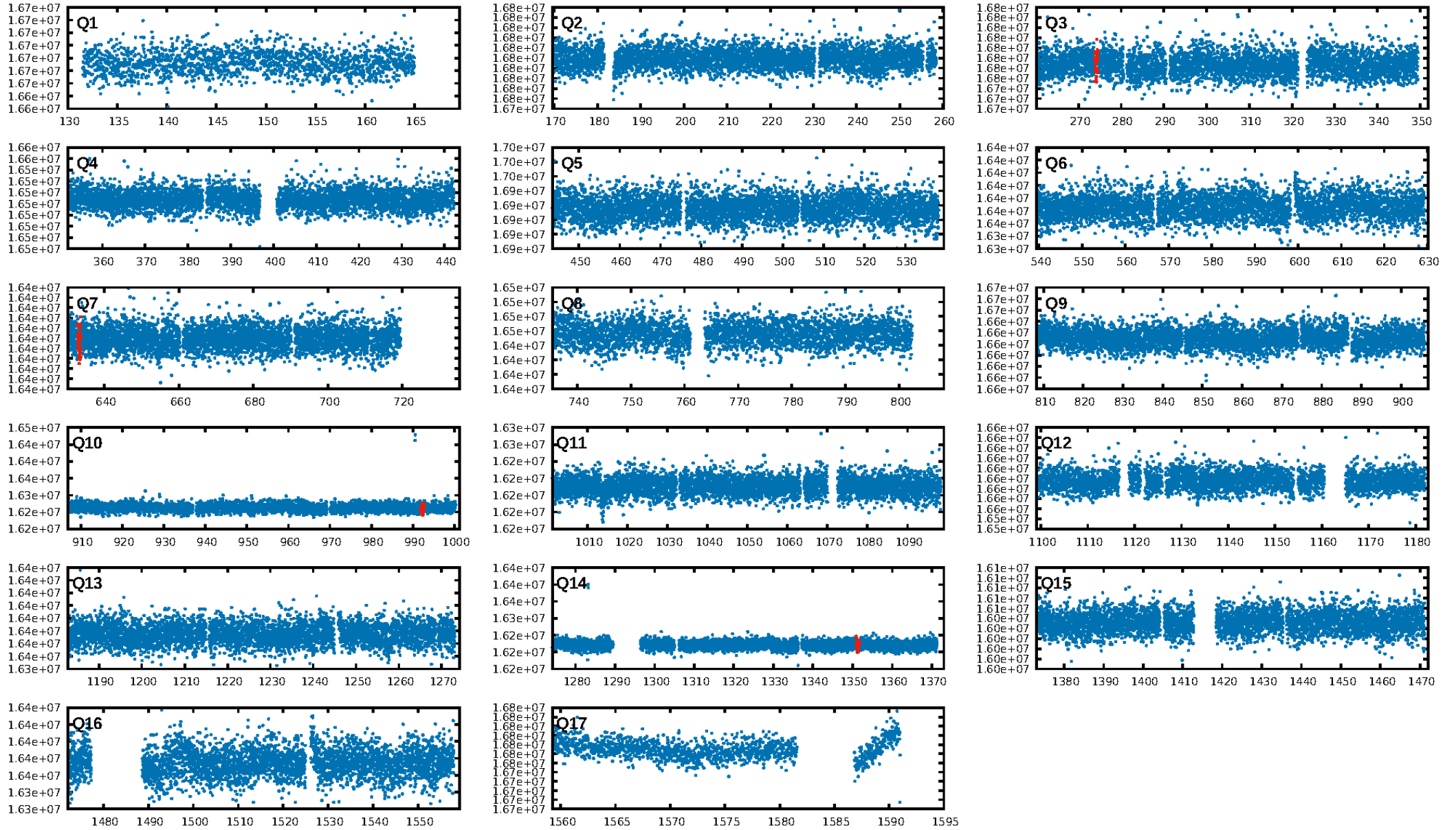
ShortPeriod-sig: 5.9% [0.07 $\sigma$ ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 40.5%  
ModelChiSquareGof-sig: 99.6%  
**Bootstrap-pfa: 1.65e-09**  
RollingBand-fgt: 1.00 [4/4]  
**GhostDiagnostic-chr: 0.6236**  
Centroid-sig: 4.8%  
Centroid-so: 2.789 arcsec [1.22 $\sigma$ ]  
**OotOffset-rm: 5.293 arcsec [5.15 $\sigma$ ]**  
**KicOffset-rm: 5.148 arcsec [4.99 $\sigma$ ]**  
OotOffset-st: 2/1/0/0 [3]  
KicOffset-st: 2/1/0/0 [3]  
DiffImageQuality-fgm: 0.00 [0/3]  
DiffImageOverlap-fno: 1.00 [3/3]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 00:25:15 Z

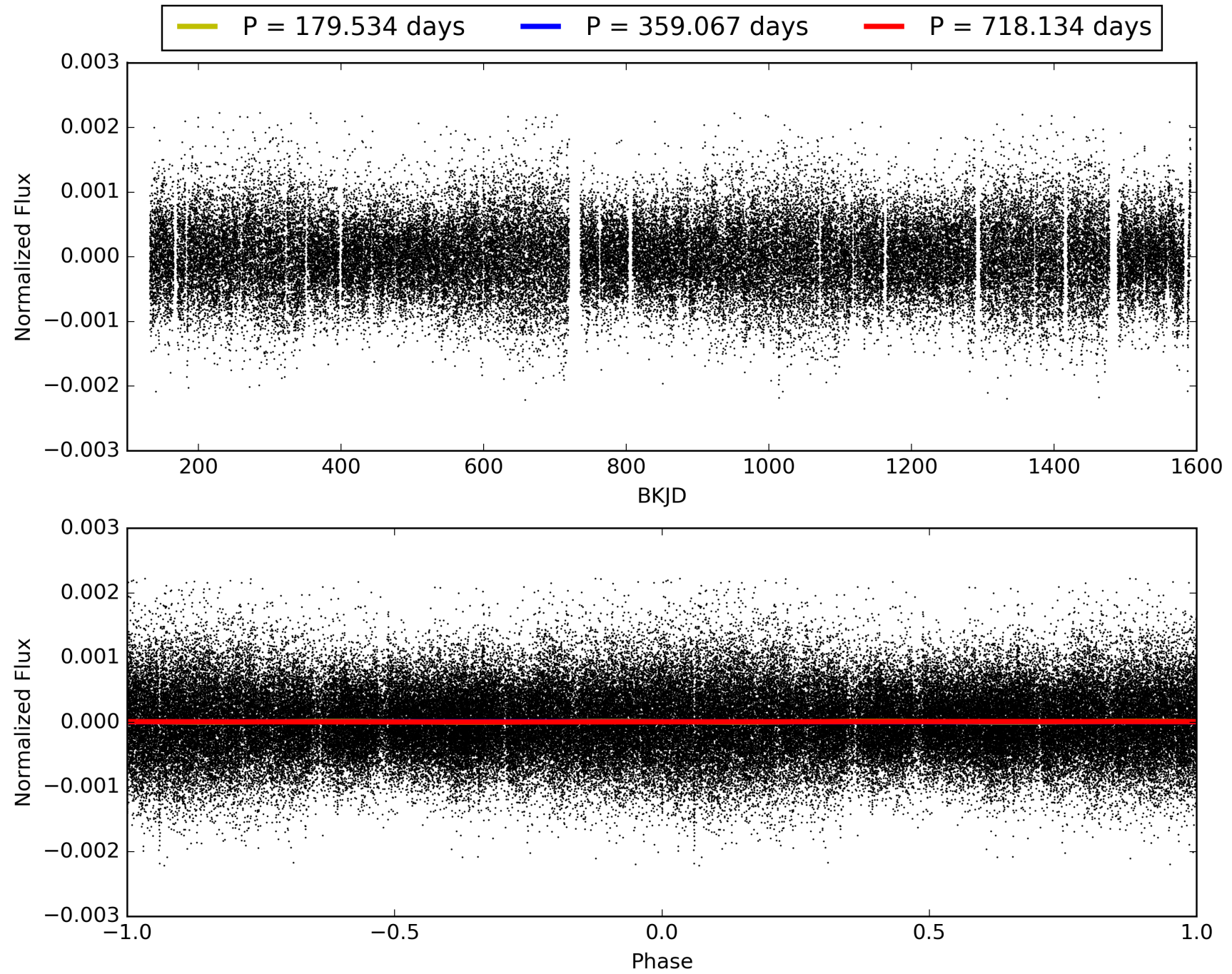
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center



# TCE 003644738-02, PDC Light Curves

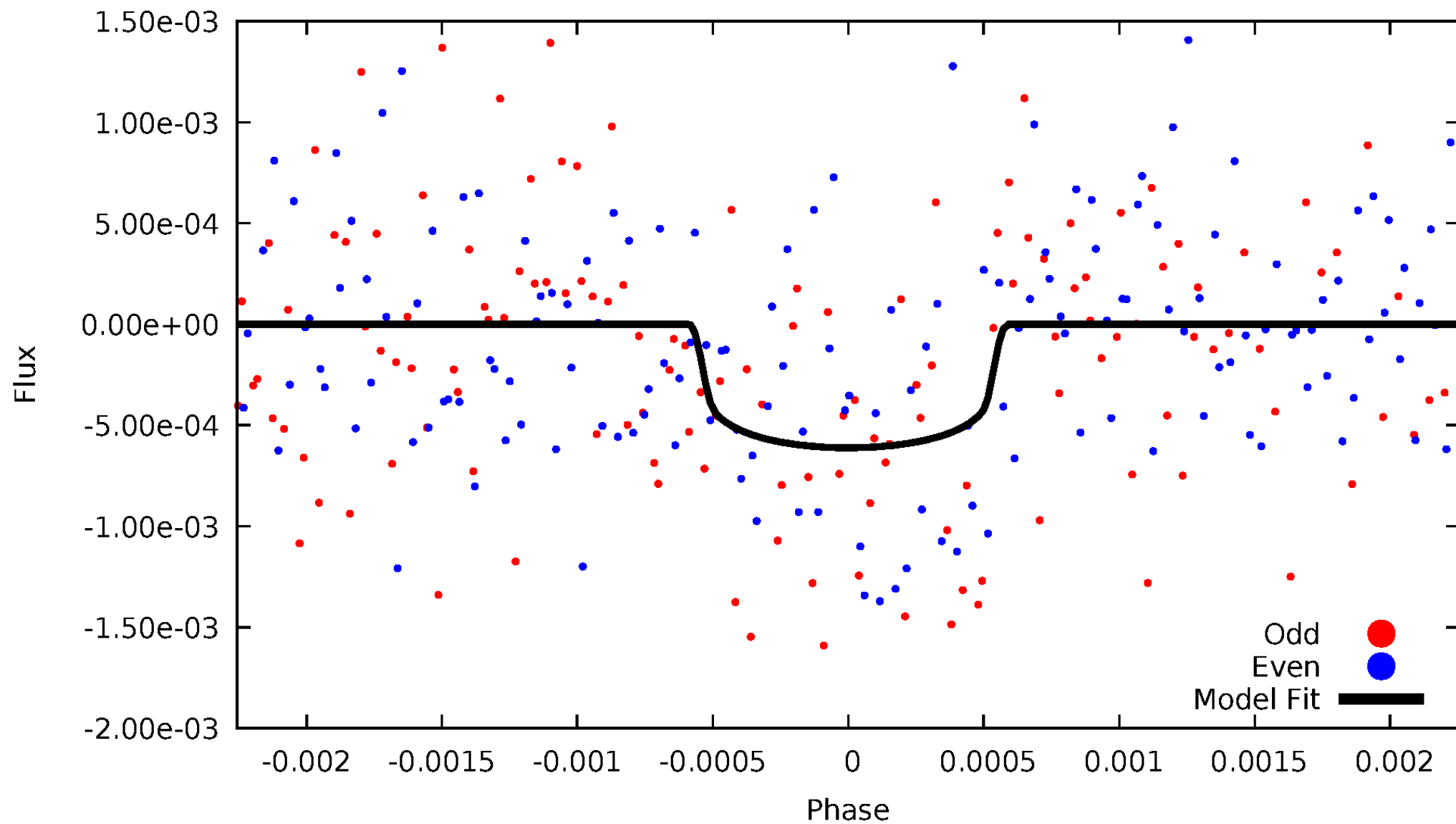


TCE 003644738-02



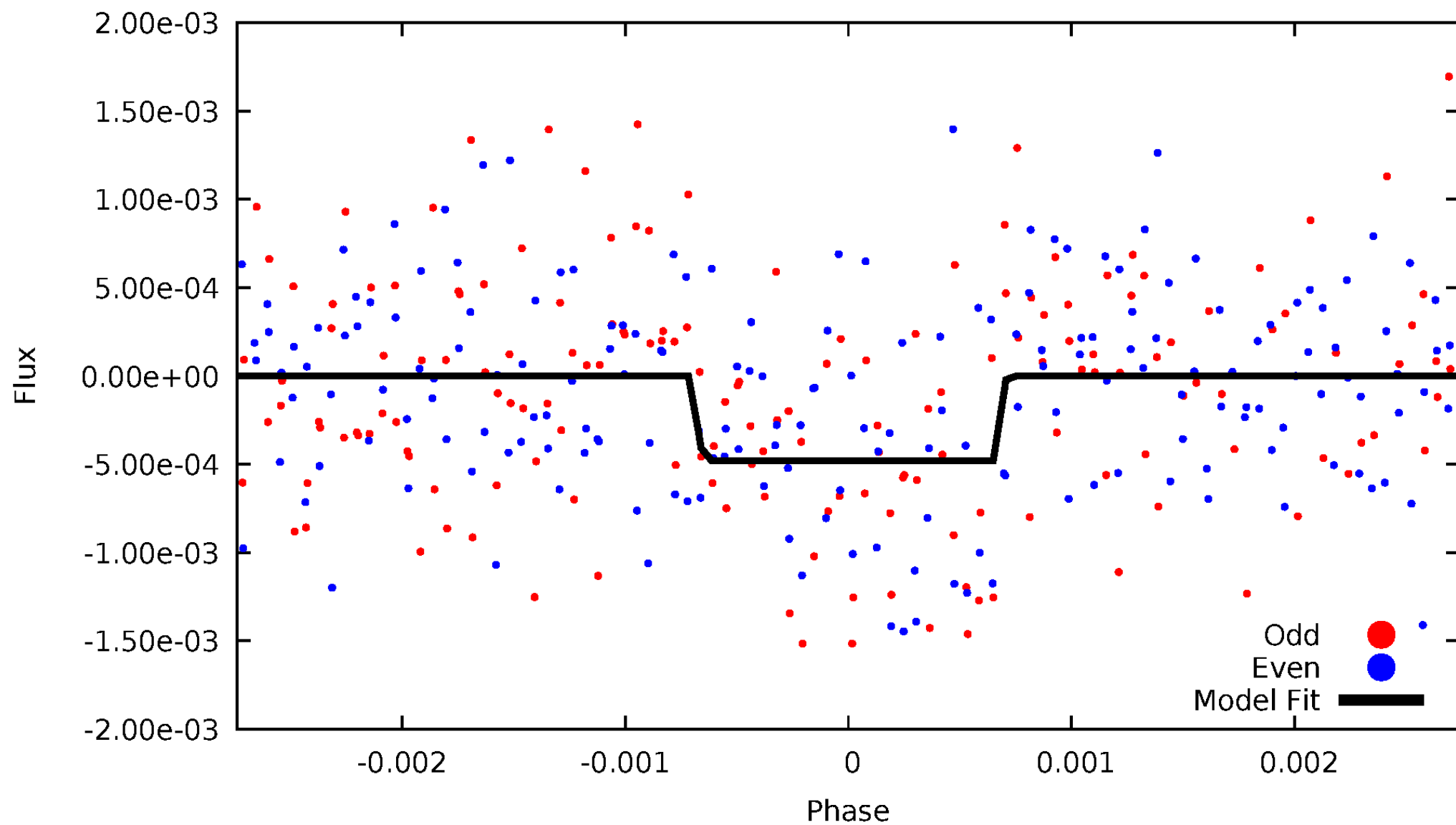
# DV Odd/Even

TCE 003644738-02



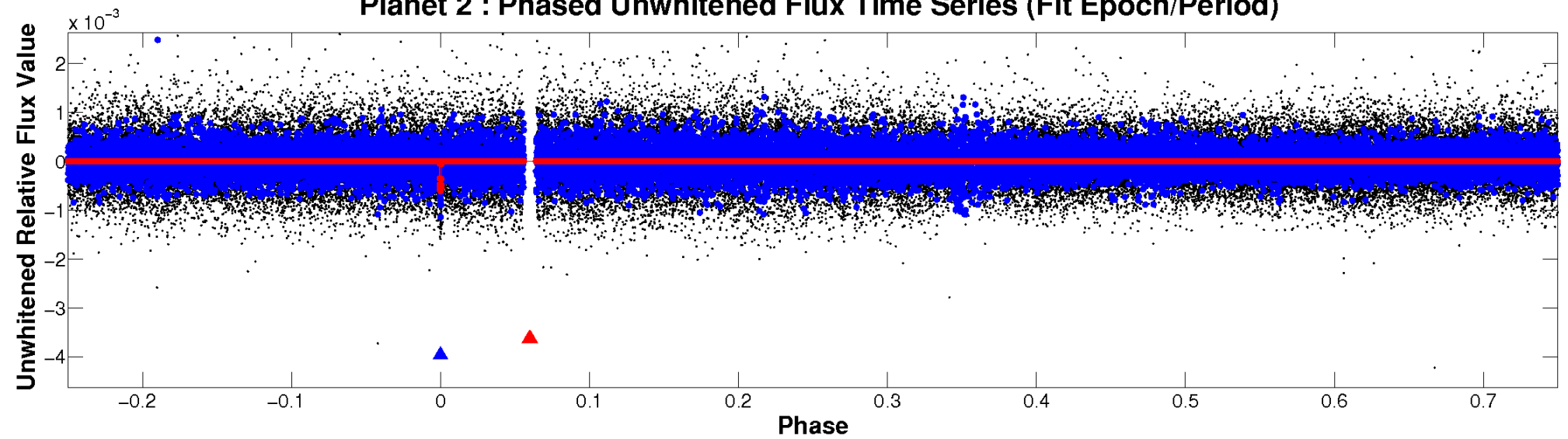
# ALT Odd/Even

TCE 003644738-02

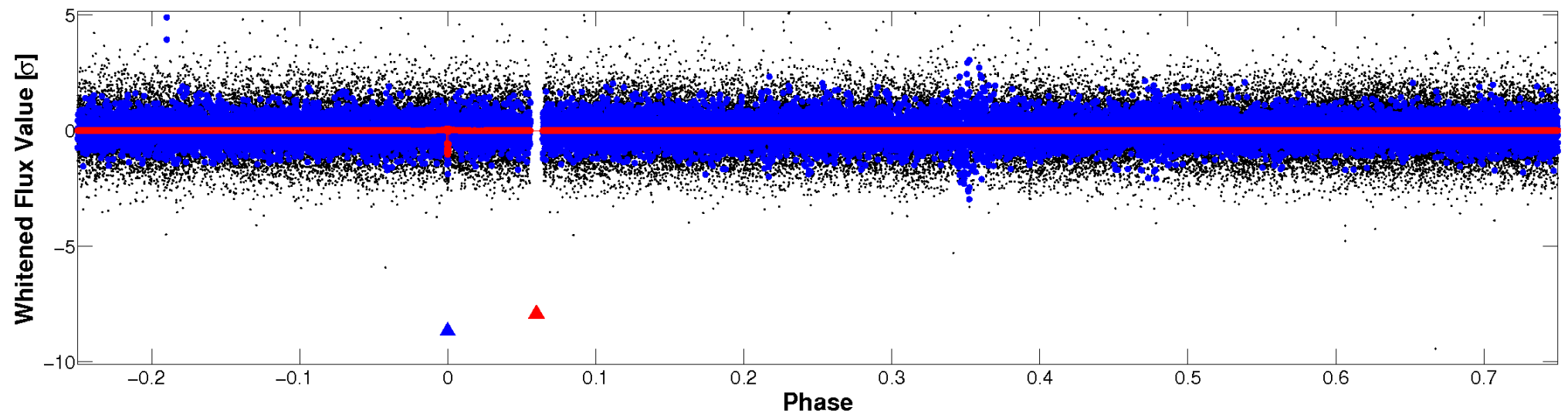


# Non-Whitened Vs. Whitened Light Curve

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

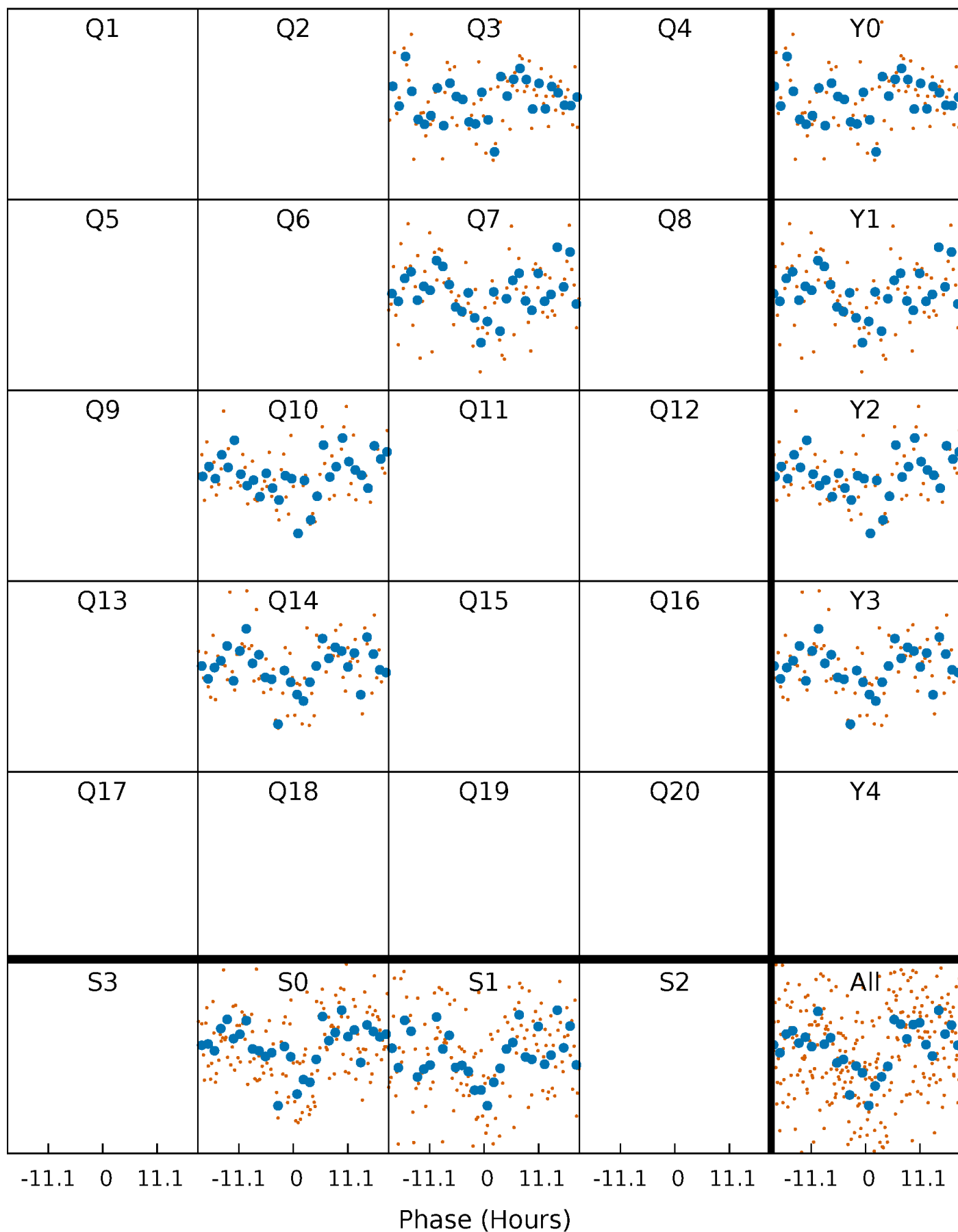


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



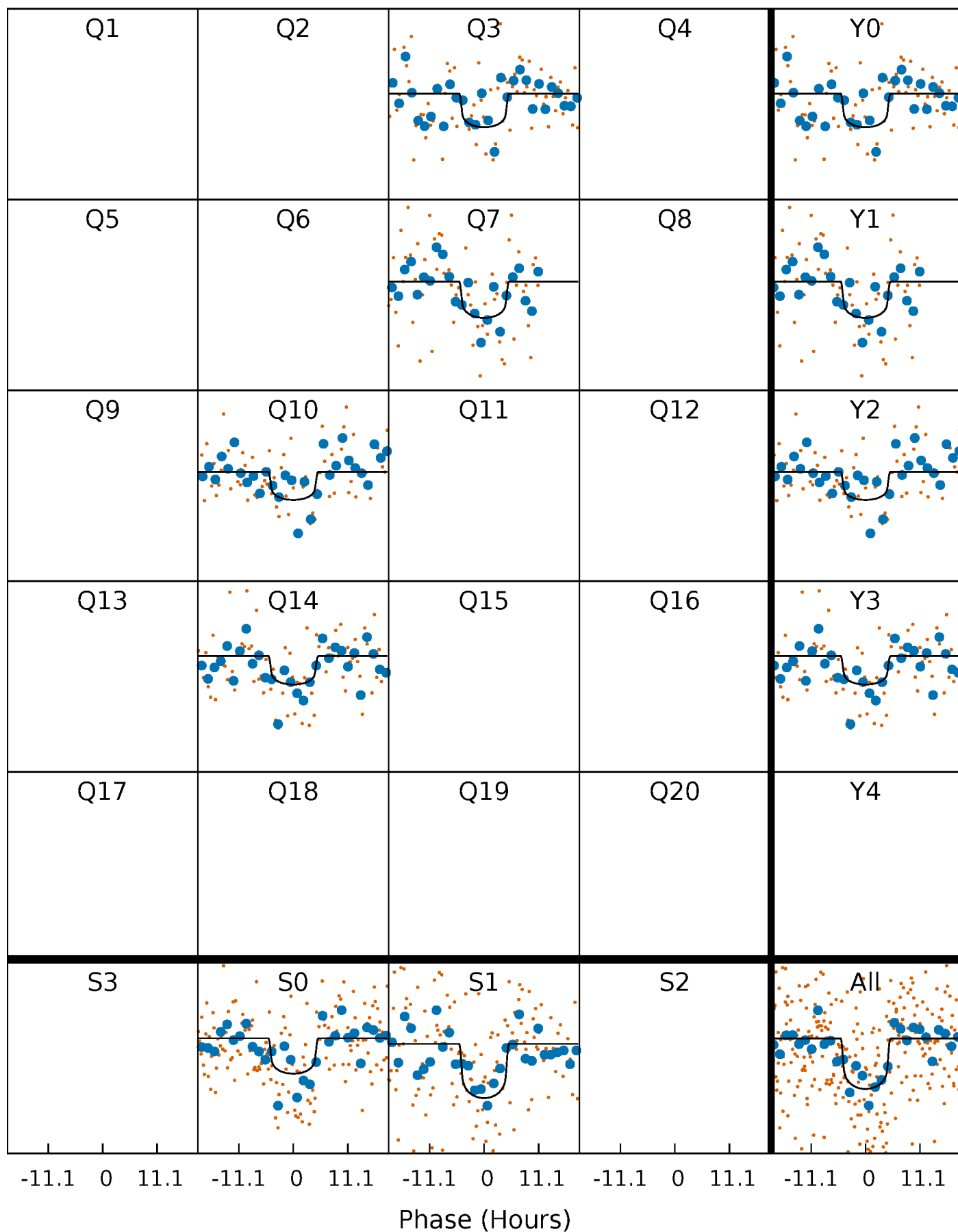
# PDC Quarter-Phased Transit Curves

TCE 003644738-02     $P=359.067135$  Days     $T_0=274.164709$  (BKJD)



# DV Quarter-Phased Transit Curves

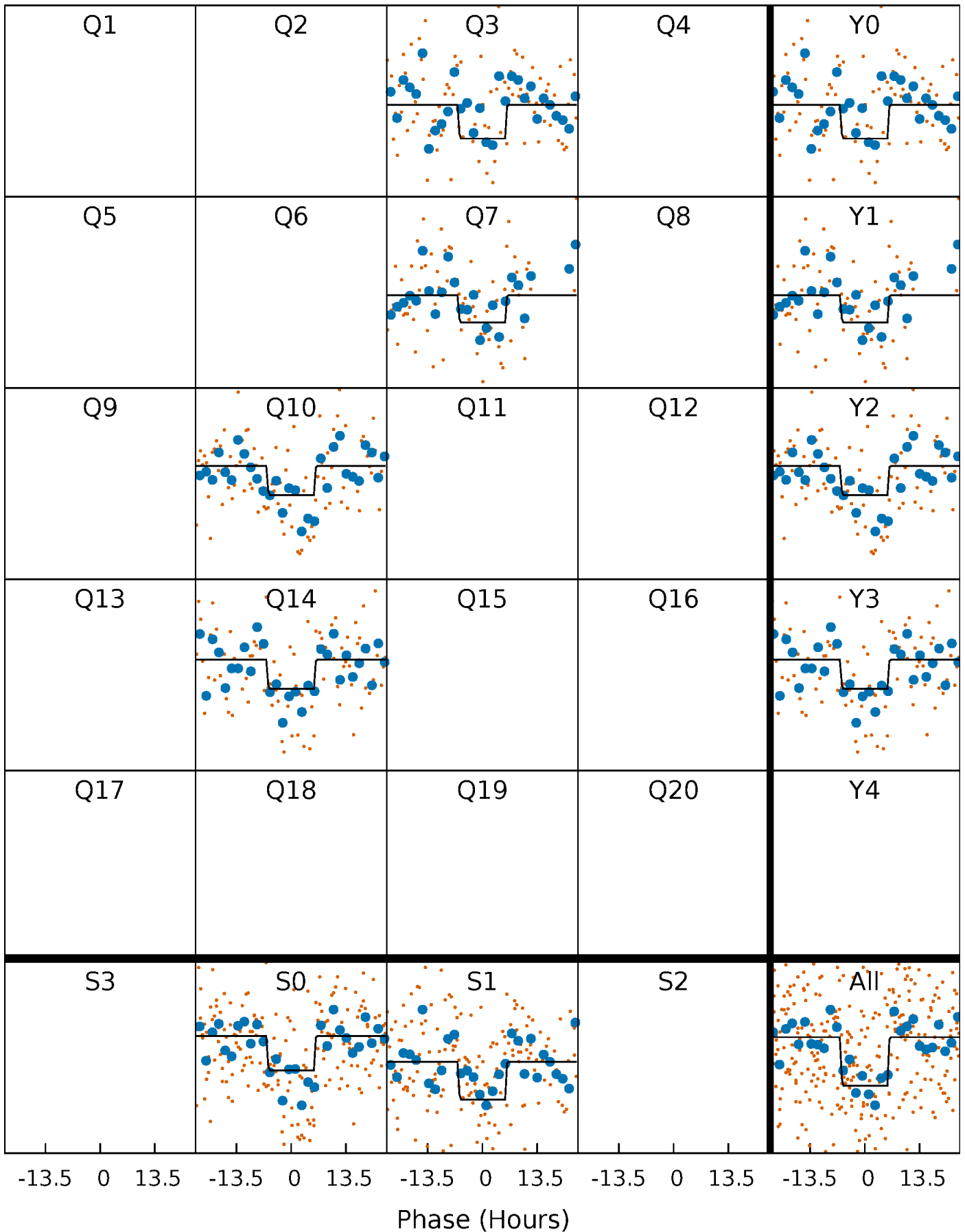
TCE 003644738-02 P=359.067135 Days  $T_0=274.164709$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

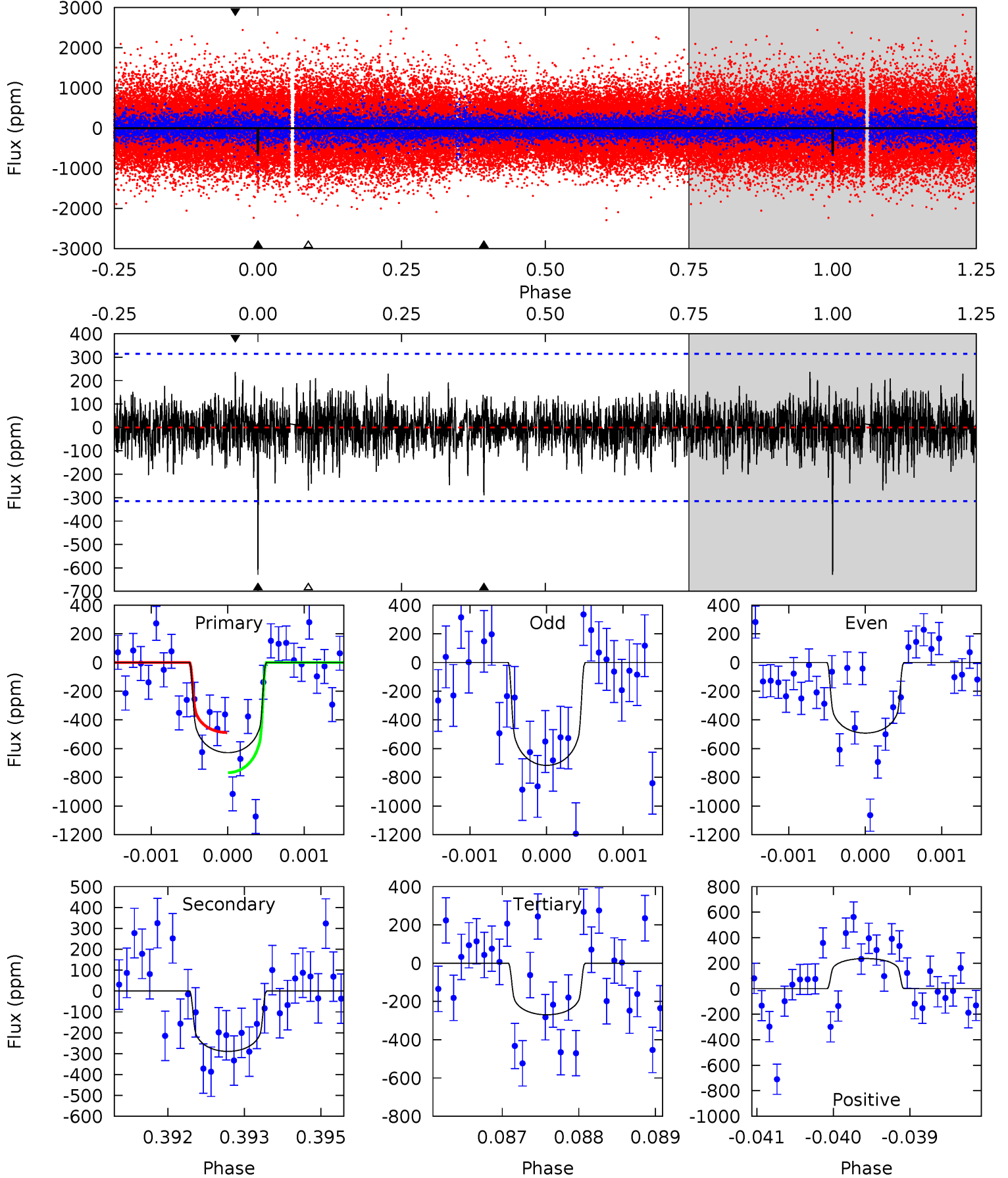
TCE 003644738-02 P=359.058516 Days  $T_0=274.134849$  (BKJD)



# DV Model-Shift Uniqueness Test

003644738-02, P = 359.067135 Days, E = 274.164709 Days

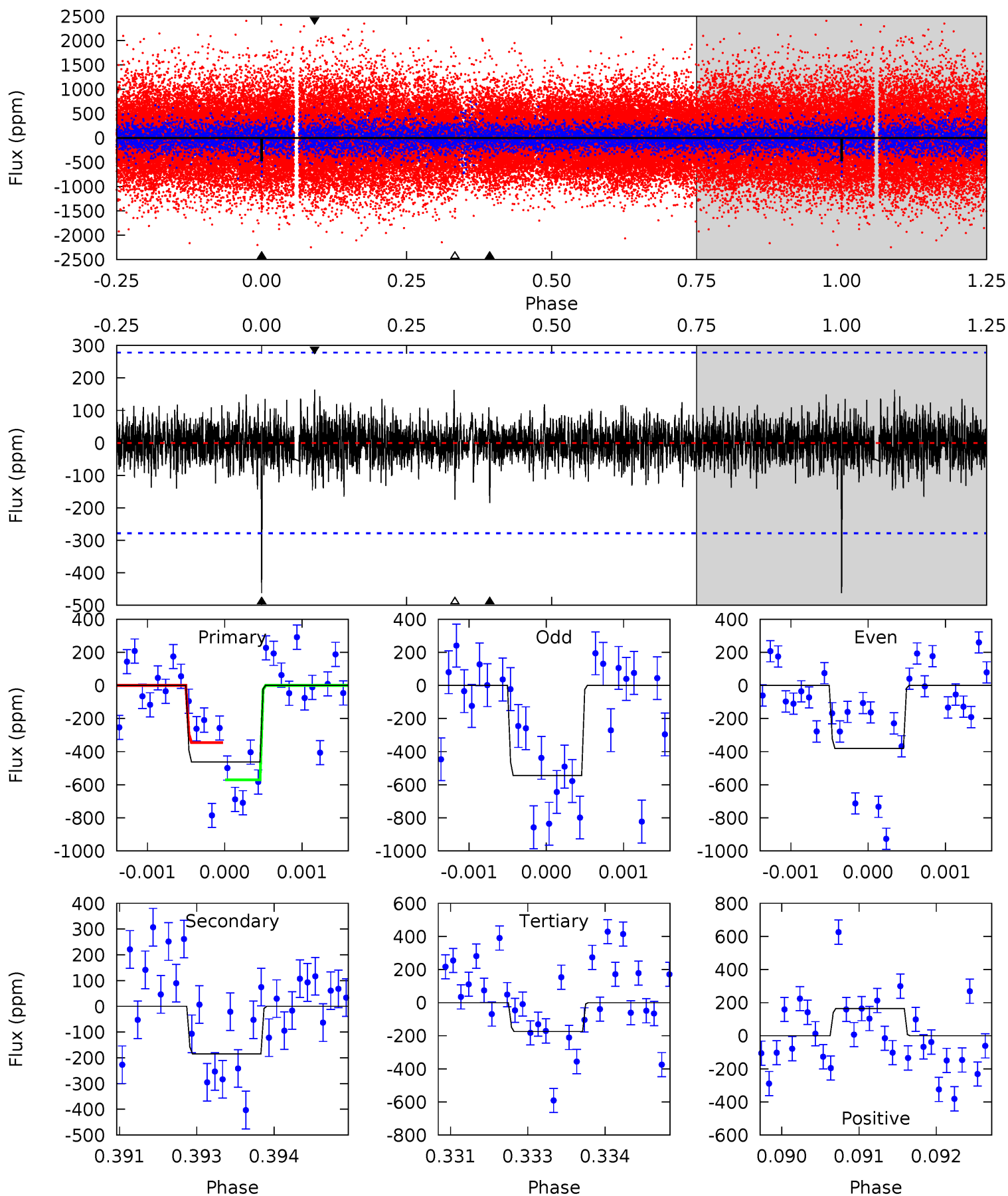
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
10.8	4.98	4.64	4.07	5.42	3.25	1.10	6.18	6.75	0.34	0.91	1.95	0.94	0.27	2.40



# Alt Model-Shift Uniqueness Test

003644738-02,  $P = 359.058516$  Days,  $E = 274.134849$  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
8.95	3.57	3.39	3.18	5.39	3.19	0.81	5.56	5.77	0.19	0.39	1.59	0.87	0.26	2.17



### Stellar Parameters For KIC 003644738

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M$ ( $M_{\odot}$ )	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6117^{+170}_{-212}$	$4.496^{+0.046}_{-0.184}$	$-0.220^{+0.300}_{-0.300}$	$0.947^{+0.244}_{-0.104}$	$1.025^{+0.116}_{-0.142}$	$1.702^{+0.411}_{-0.808}$
	+3%/-3%	+1%/-4%	+136%/-136%	+26%/-11%	+11%/-14%	+24%/-47%
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 003644738-02 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	$-289 \pm 58$	$2.77^{+1.97}_{-1.67}$	$374^{+23}_{-17}$	$5033^{+3085}_{-948}$	$19903^{+104736}_{-13063}$
Alt.	$-184 \pm 52$	$2.66^{+1.90}_{-1.61}$	$374^{+24}_{-17}$	$4667^{+2471}_{-882}$	$14238^{+73024}_{-9767}$

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

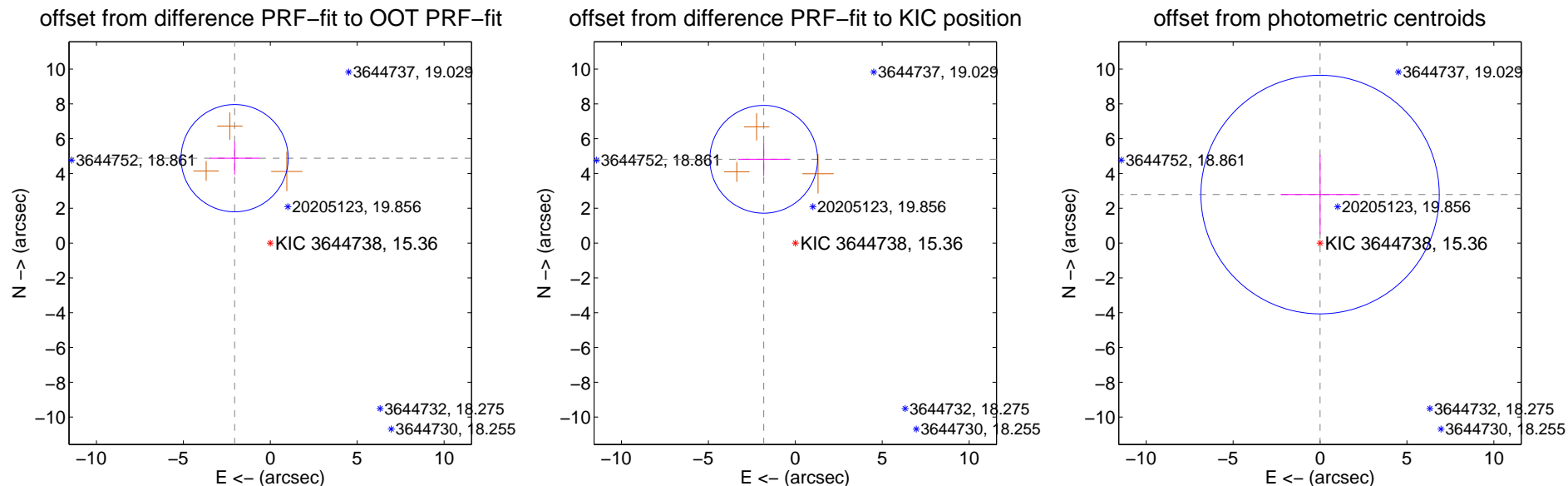
## DV Centroid Data

Supplemental centroid analysis for 003644738-02. Kepler magnitude: 15.36. Transit SNR 7.74

There are 0 quarters with good PRF difference image offsets

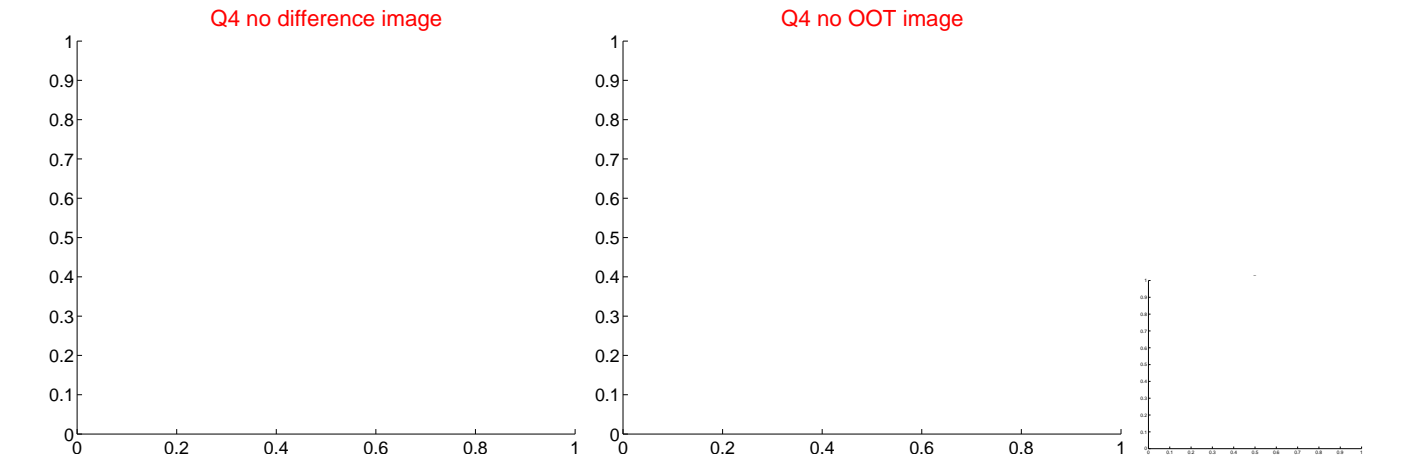
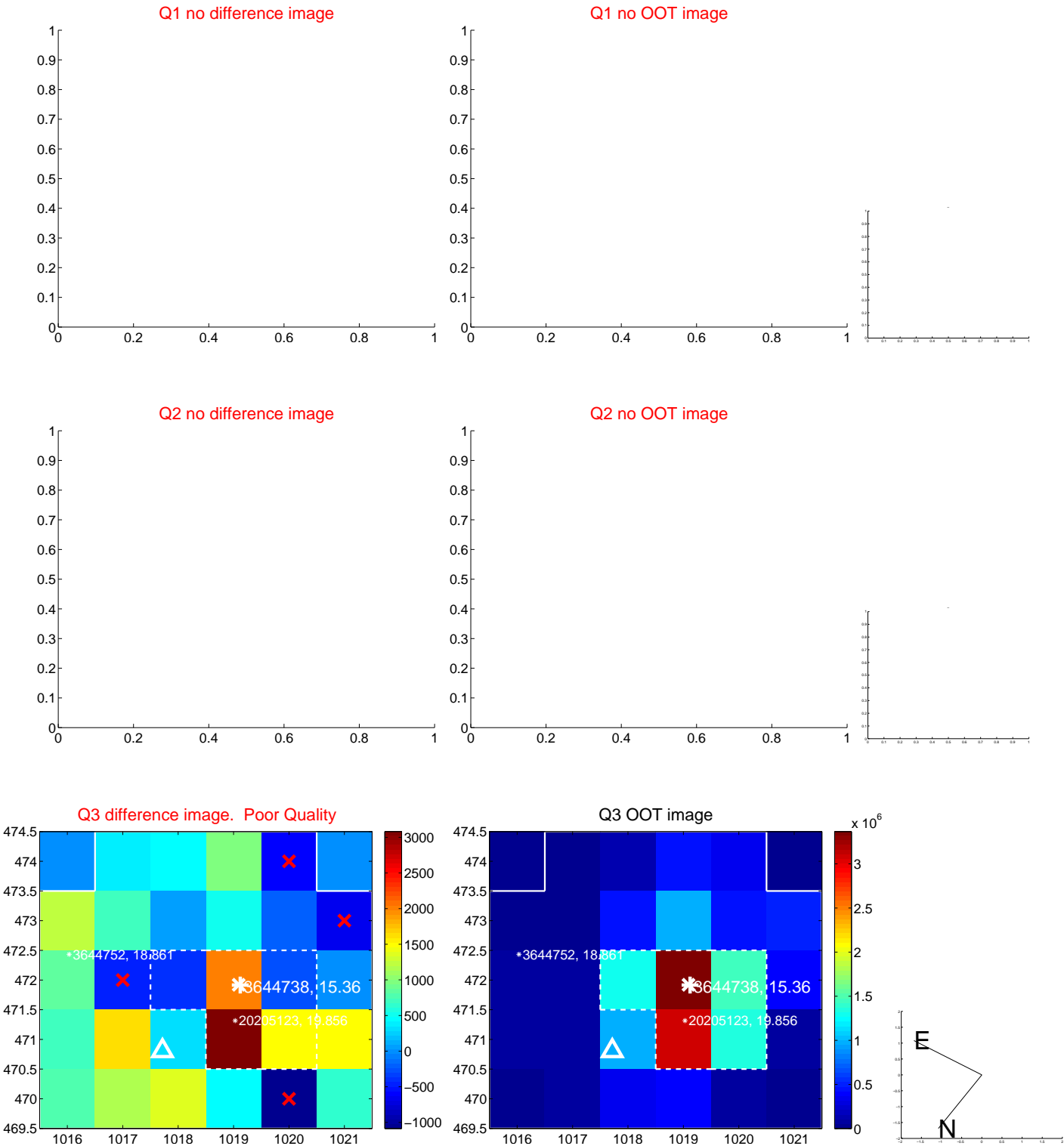
The direct PRF centroid is offset from the target star catalog position by about 0.33 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$5.293 \pm 1.027$	5.15	$2.051 \pm 1.419$	$4.879 \pm 0.941$
PRF-fit source offset from KIC position	$5.148 \pm 1.033$	4.99	$1.818 \pm 1.462$	$4.816 \pm 0.956$
photometric centroid source offset	$2.79 \pm 2.29$	1.22	$-0.00 \pm 2.27$	$2.79 \pm 2.29$



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 ×: KIC target position; +: OOT centroid; △: difference centroid. red ✕: large negative pixel value.

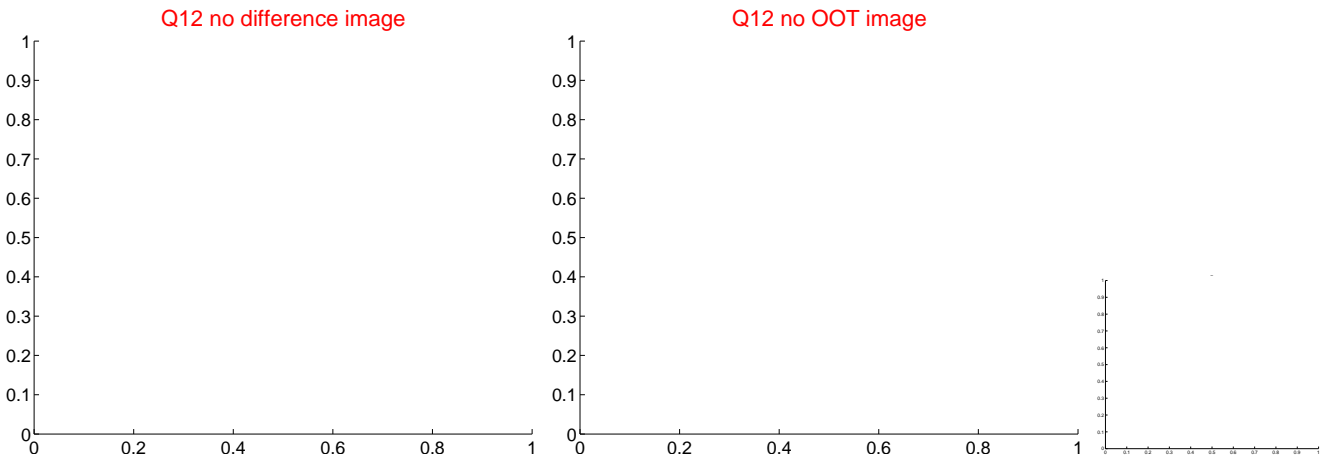
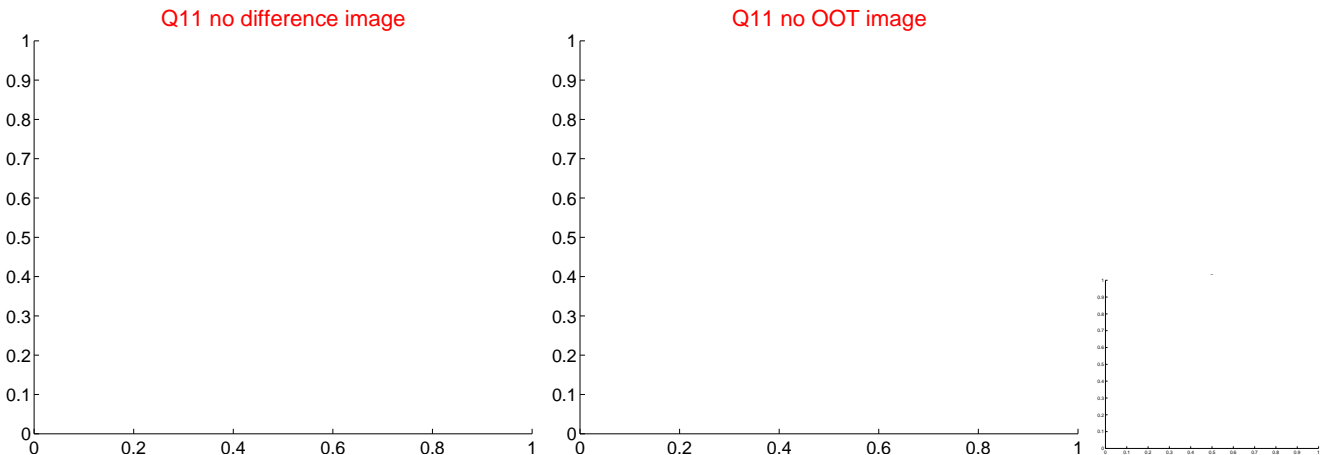
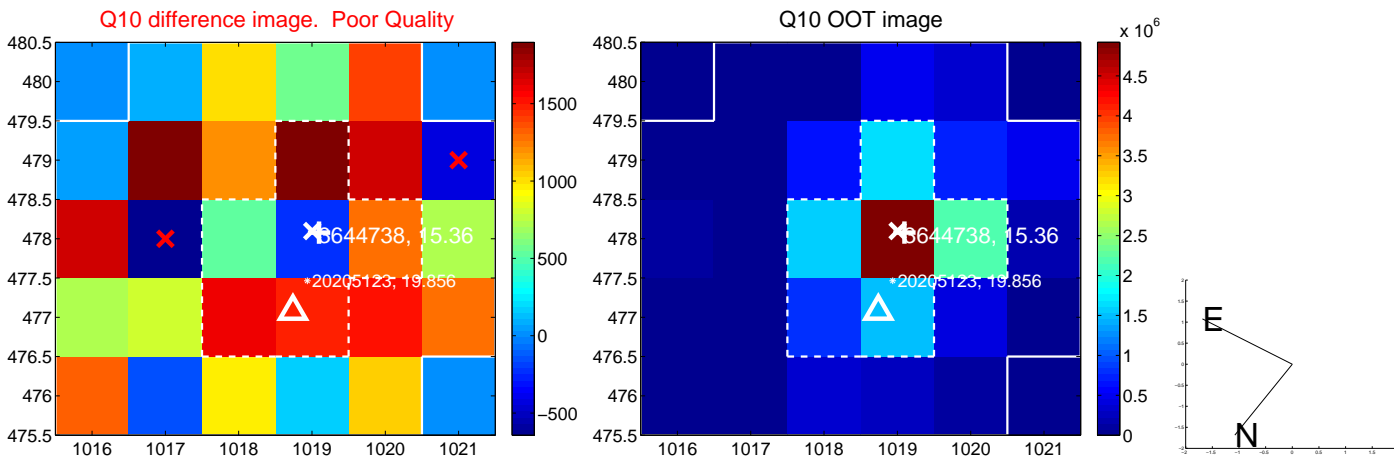
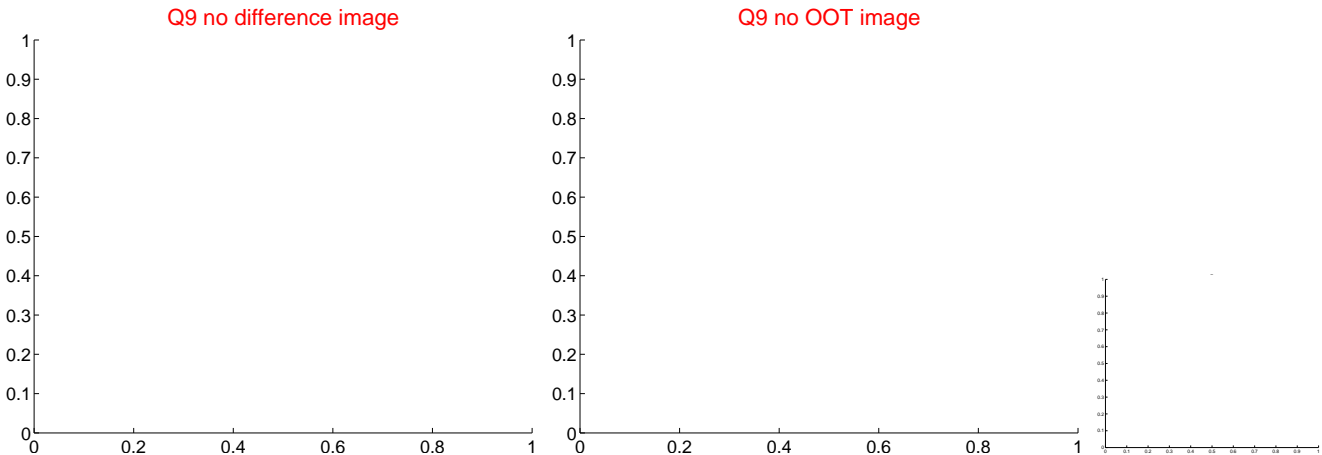


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

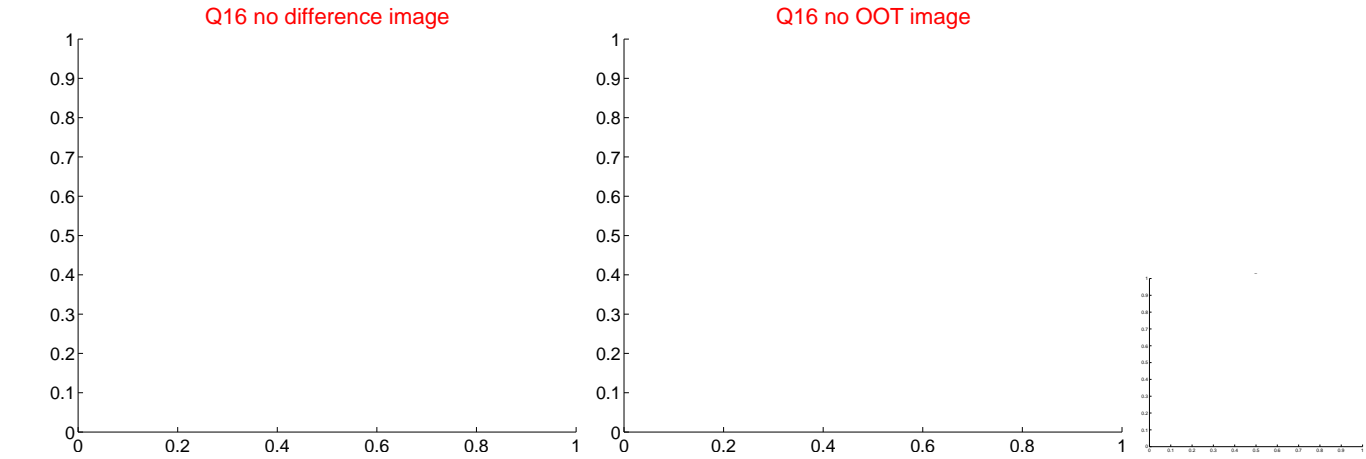
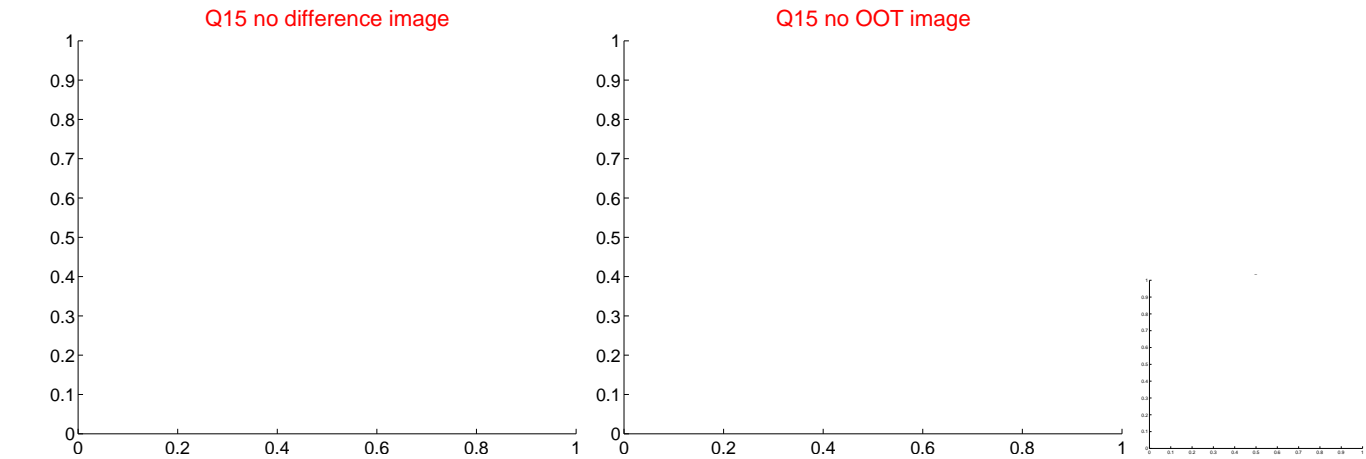
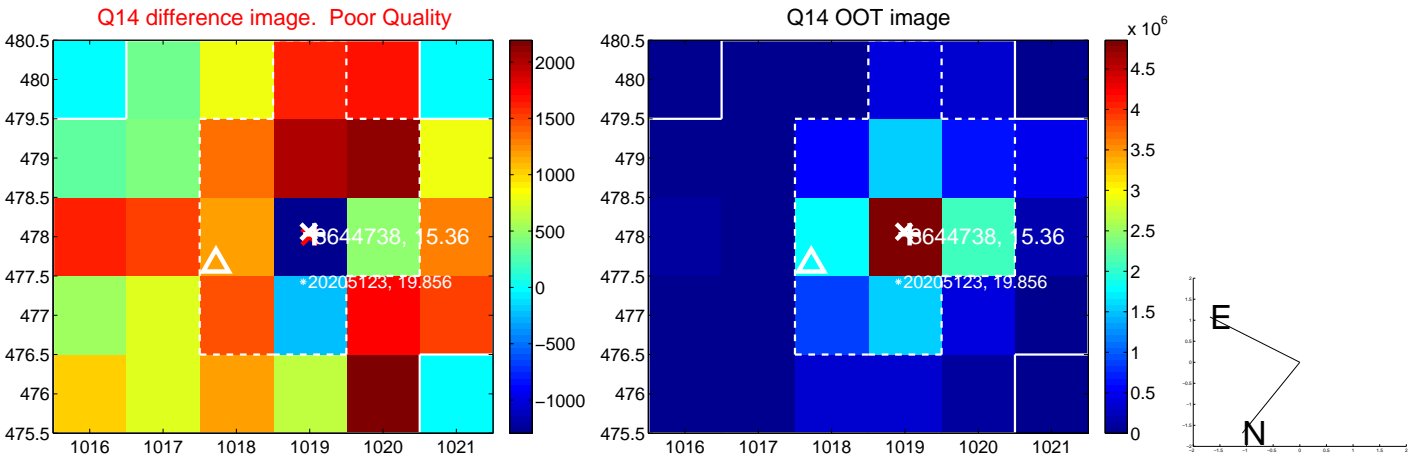
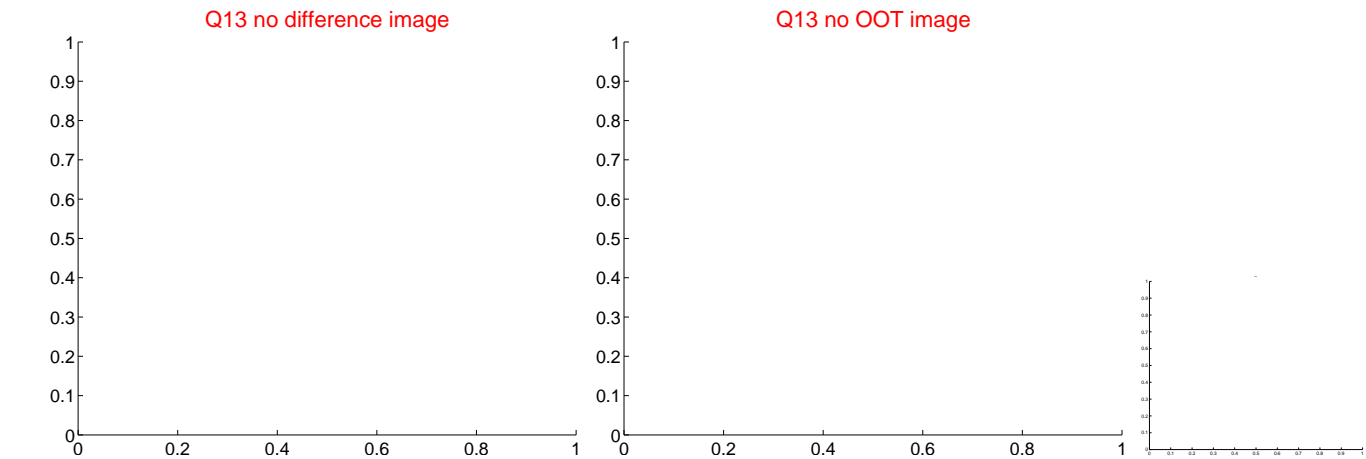




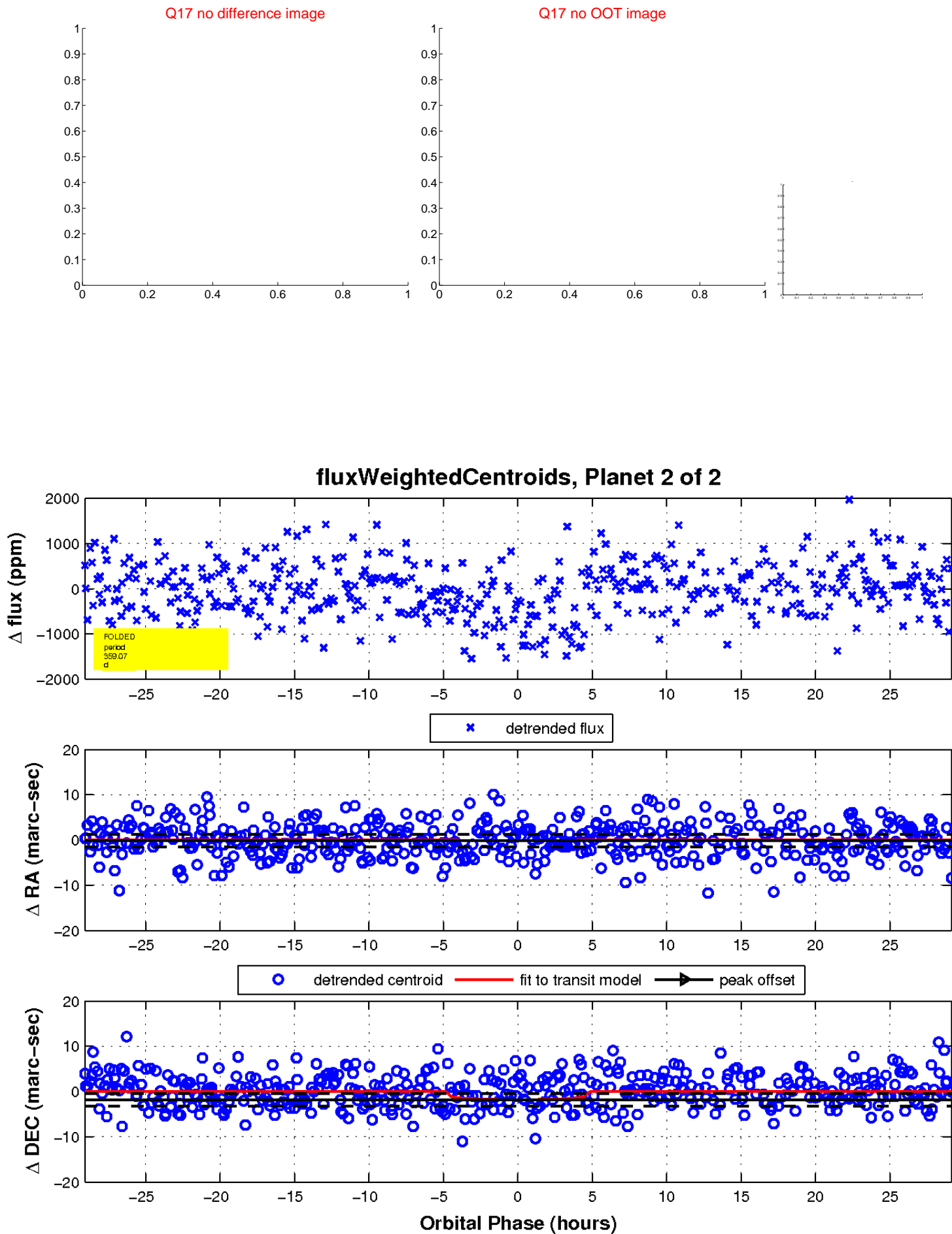
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UKIRT Image

Declination

