

# KIC 004586468

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
004586468-01	OBS	No	623.004817	318.152222	70739.0	17.958	677.2	603.5	0.69	5025	25.09	0.17
004586468-02	OBS	No	623.003455	201.389059	54609.2	22.794	380.2	300.3	0.69	5025	22.48	0.17

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
004586468-01	OBS	FP	0.00	1	0	1	1	INDIV_TRANS_MARSHALL—INCONSISTENT_TRANS—CENT_FEW_DIFFS—HALO_GHOST—EPHEM_MATCH
004586468-02	OBS	FP	0.00	1	0	1	1	INDIV_TRANS_MARSHALL—SAME_NTL_PERIOD—CENT_FEW_DIFFS—HALO_GHOST—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.

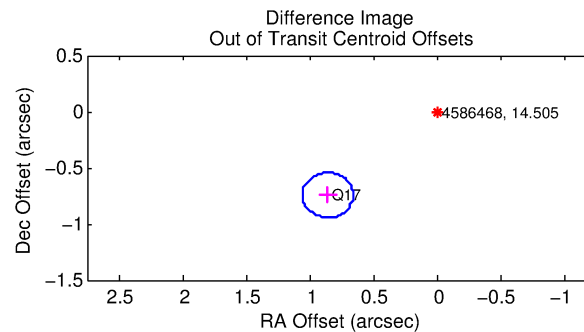
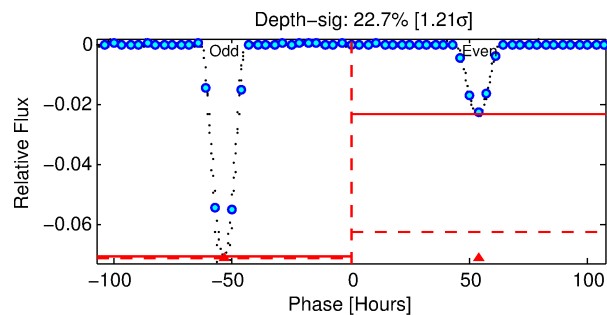
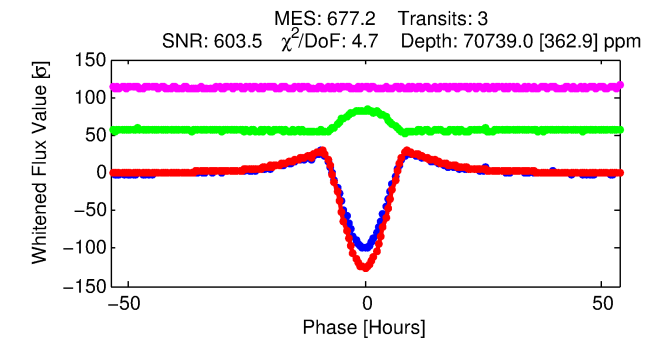
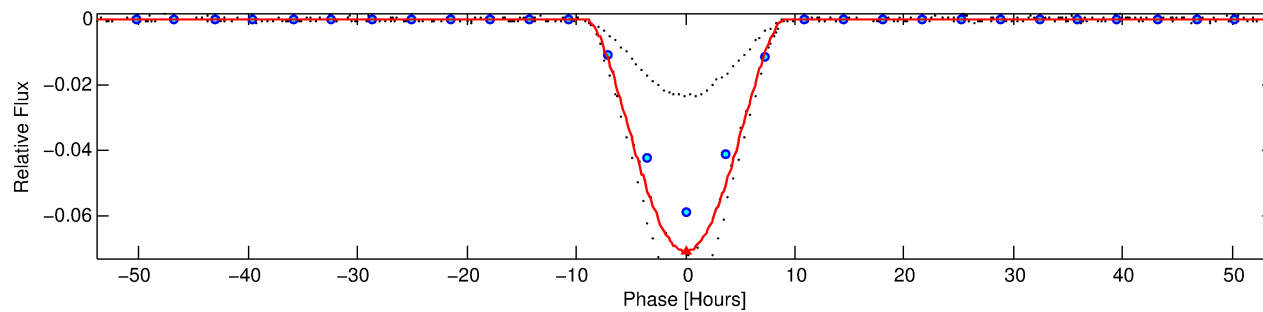
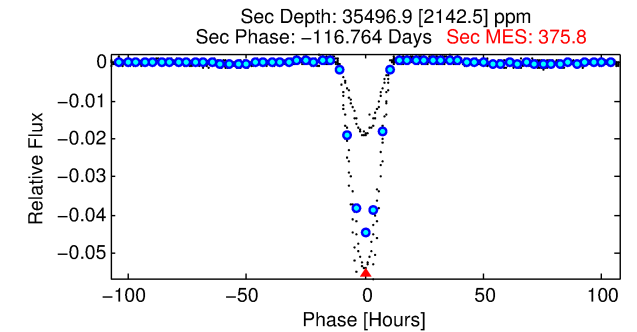
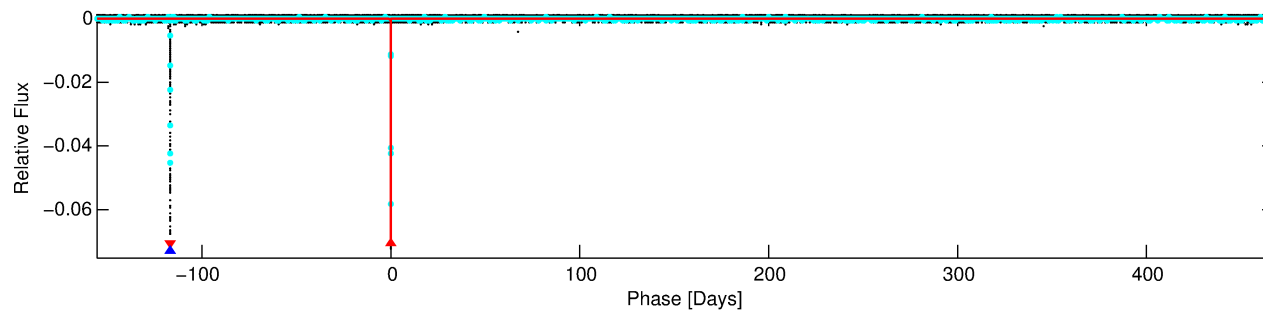
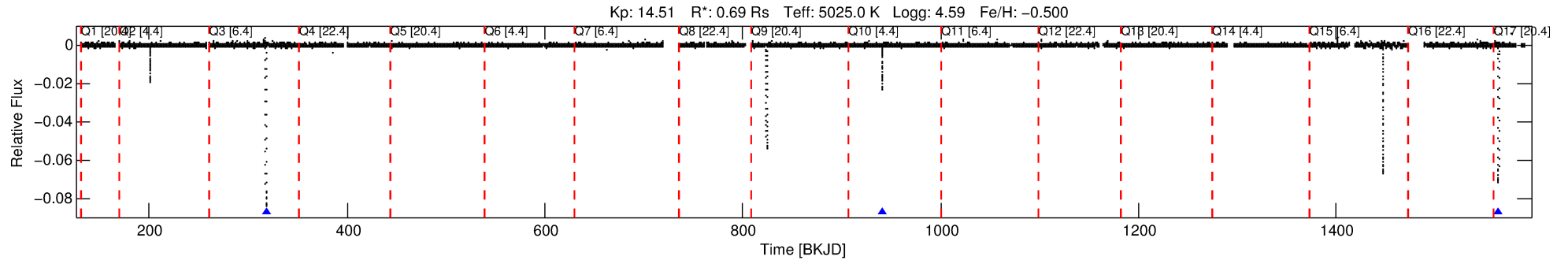
## Ephemeris Match Information For 004586468-01

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	$\sigma_P$	$\sigma_T$
004586468-01	4586468	004586482-01	4586482	1:1	6.0	1	0	14.02	14.50	2.48	Direct-PRF	0	0.01	0.01

**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: 4586468 Candidate: 1 of 2 Period: 623.005 d



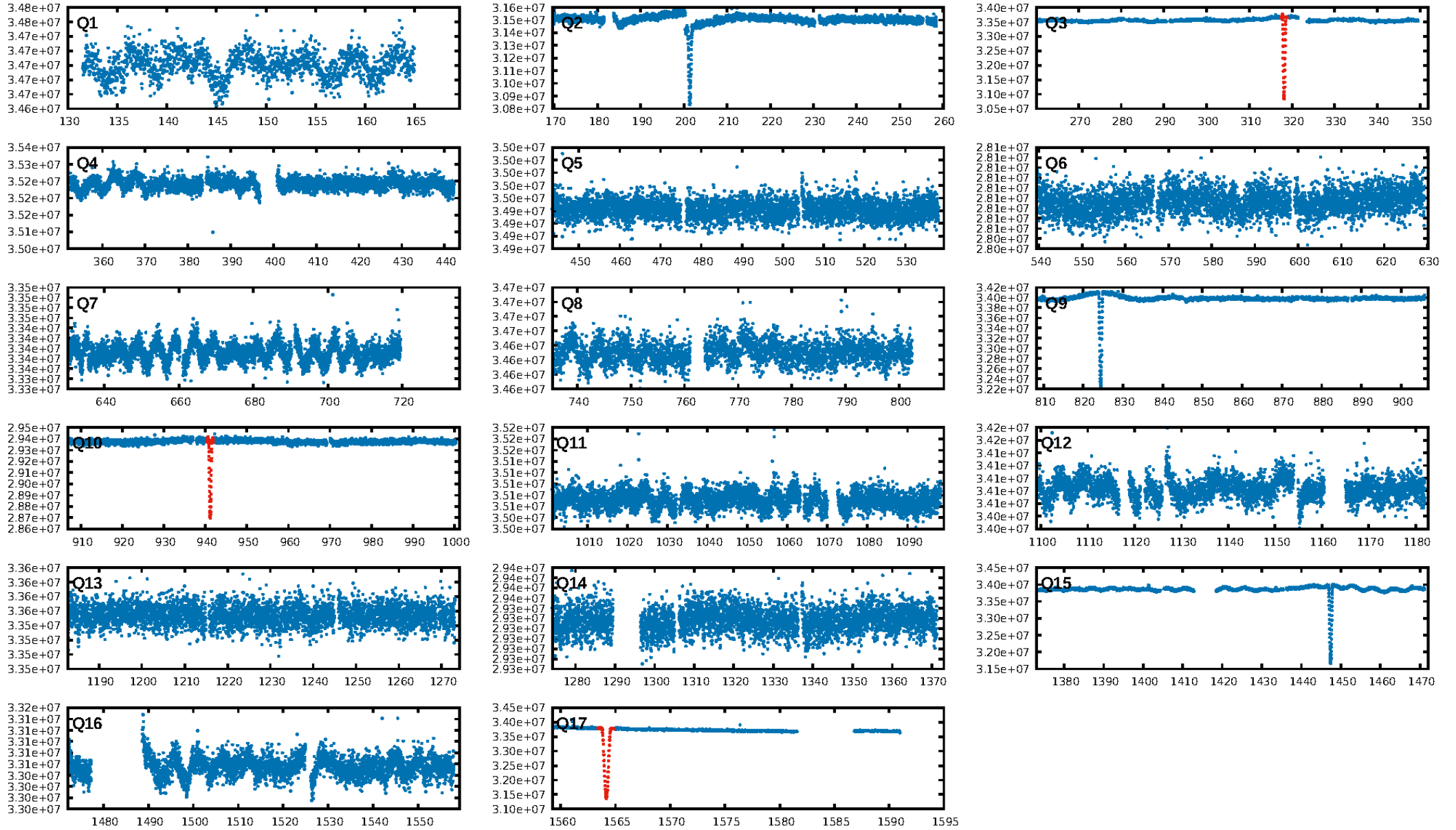
## DV Fit Results:

Period = 623.00482 [0.00102] d  
Epoch = 318.1522 [0.0015] BKJD  
Rp/R\* = 0.3357 [0.0504]  
a/R\* = 266.84 [2.61]  
b = 0.88 [0.08]  
Seff = 0.17 [0.03]  
Teq = 165 [7] K  
Rp = 25.10 [4.77] Re  
a = 1.2440 [0.1182] AU  
Ag = 47986.92 [16031.18] [2.99σ]  
Teffp = 3764 [309] K [11.64σ]

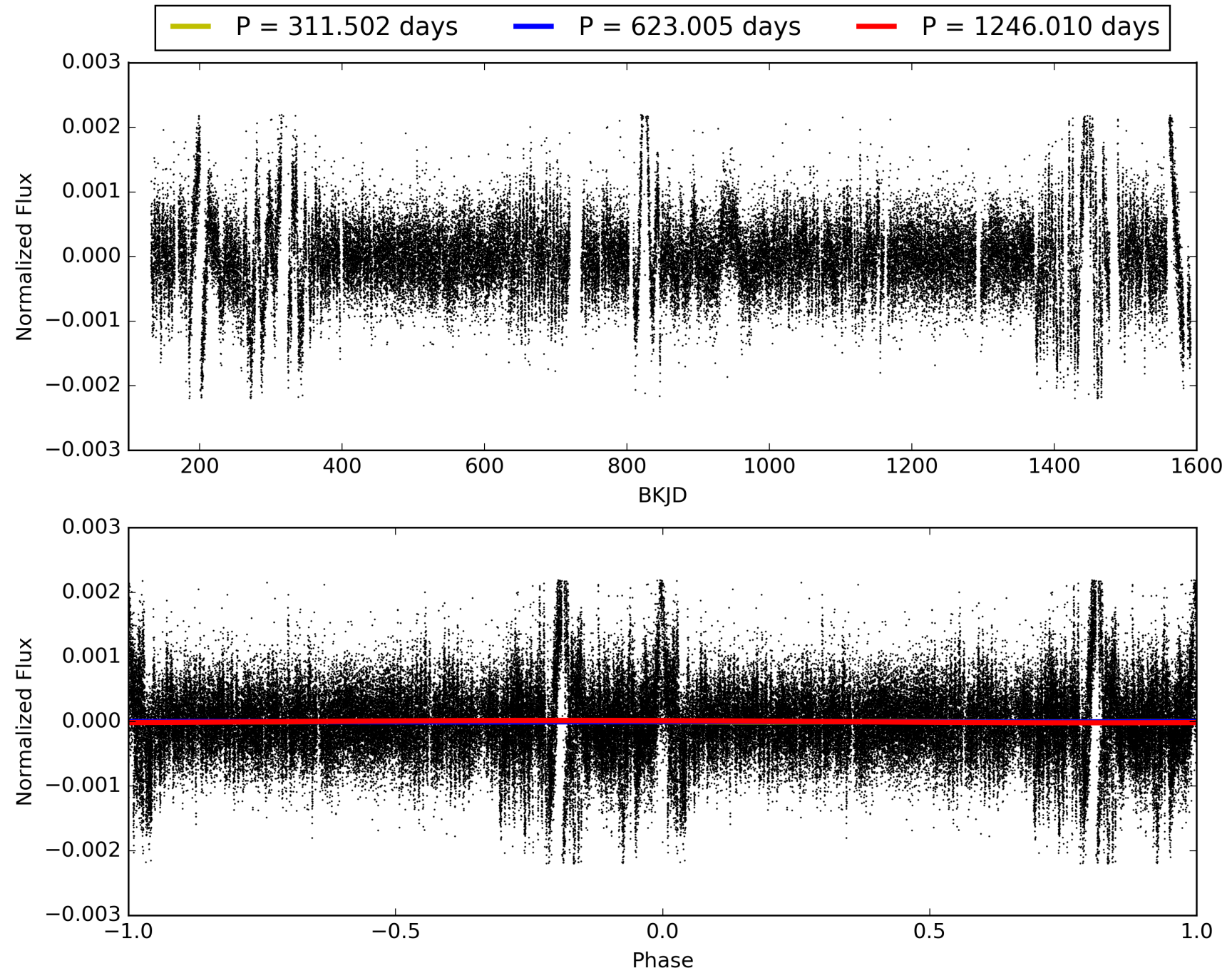
## DV Diagnostic Results:

ShortPeriod-sig: 0.1% [0.00σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 0.0%  
ModelChiSquareGoF-sig: 0.0%  
Bootstrap-pfa: 0.00e+00  
RollingBand-fgt: 1.00 [2/2]  
GhostDiagnostic-chr: -0.06265  
Centroid-sig: 0.0%  
Centroid-so: 5.535 arcsec [829.96σ]  
OotOffset-rm: 1.136 arcsec [17.02σ]  
KicOffset-rm: 6.098 arcsec [91.41σ]  
OotOffset-st: 0/0/0/1 [1]  
KicOffset-st: 0/0/0/1 [1]  
DiffImageQuality-fgm: 1.00 [1/1]  
DiffImageOverlap-fno: 1.00 [3/3]

# TCE 004586468-01, PDC Light Curves

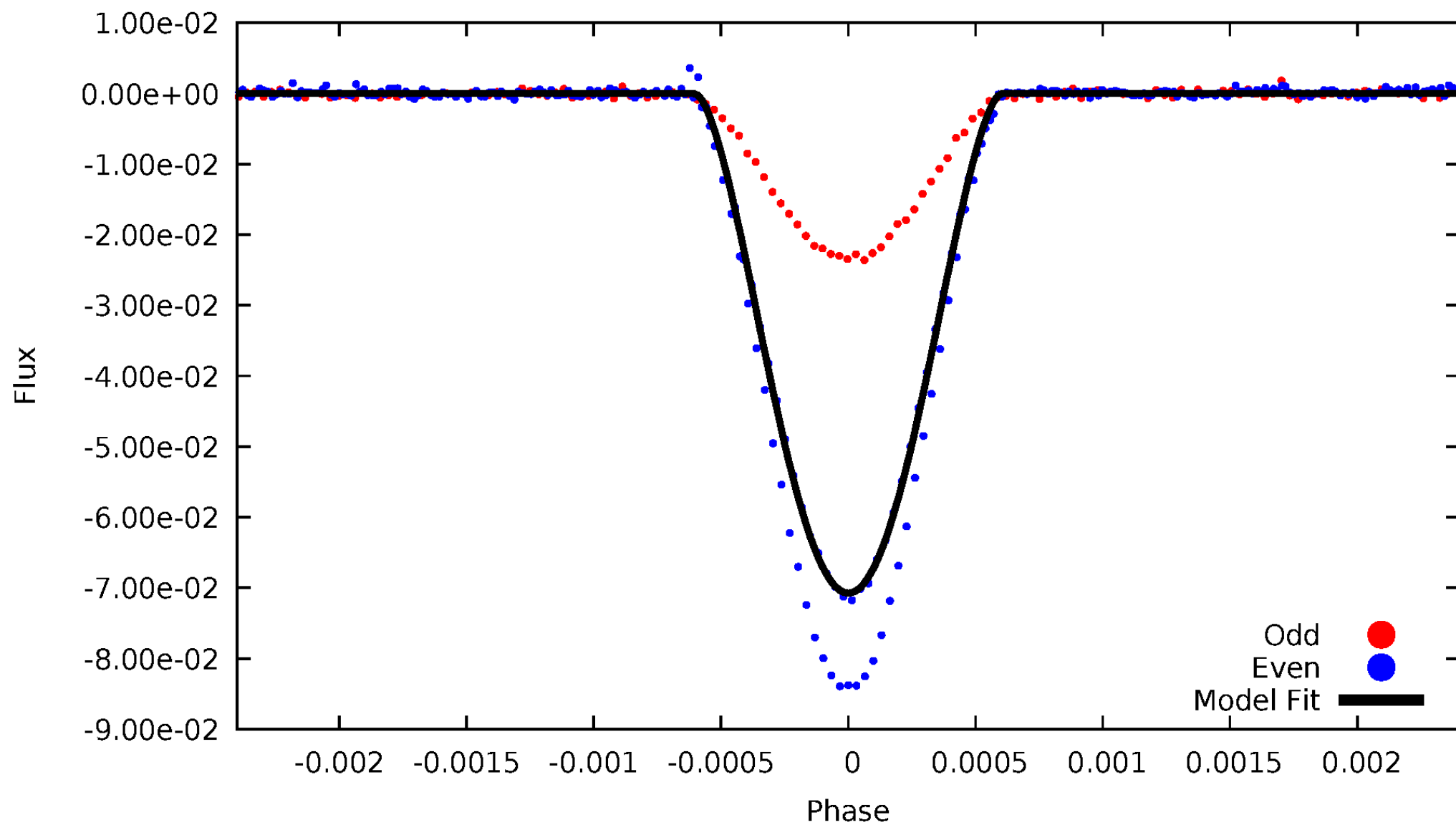


TCE 004586468-01



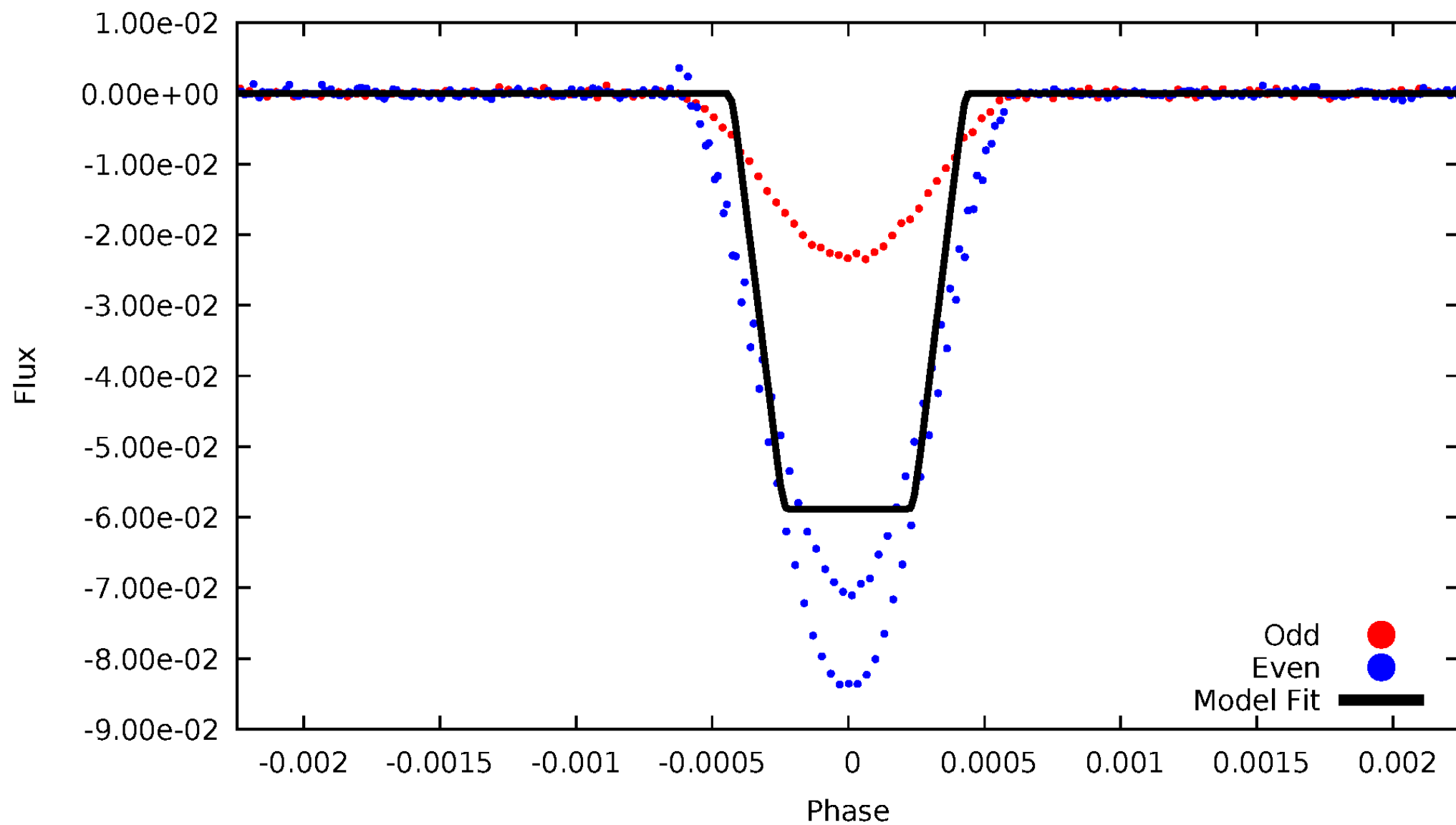
# DV Odd/Even

TCE 004586468-01



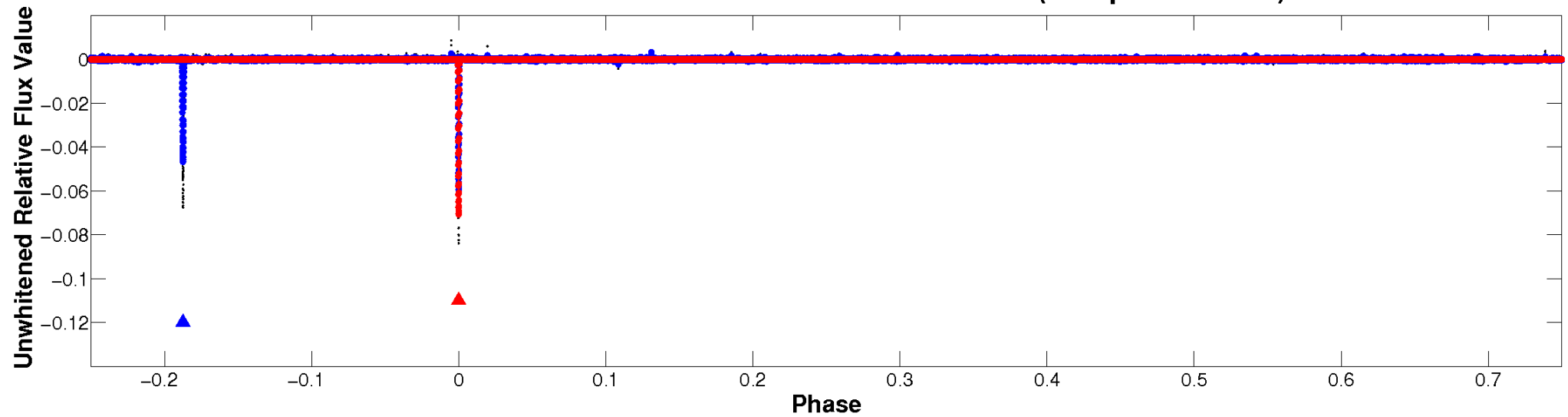
# ALT Odd/Even

TCE 004586468-01

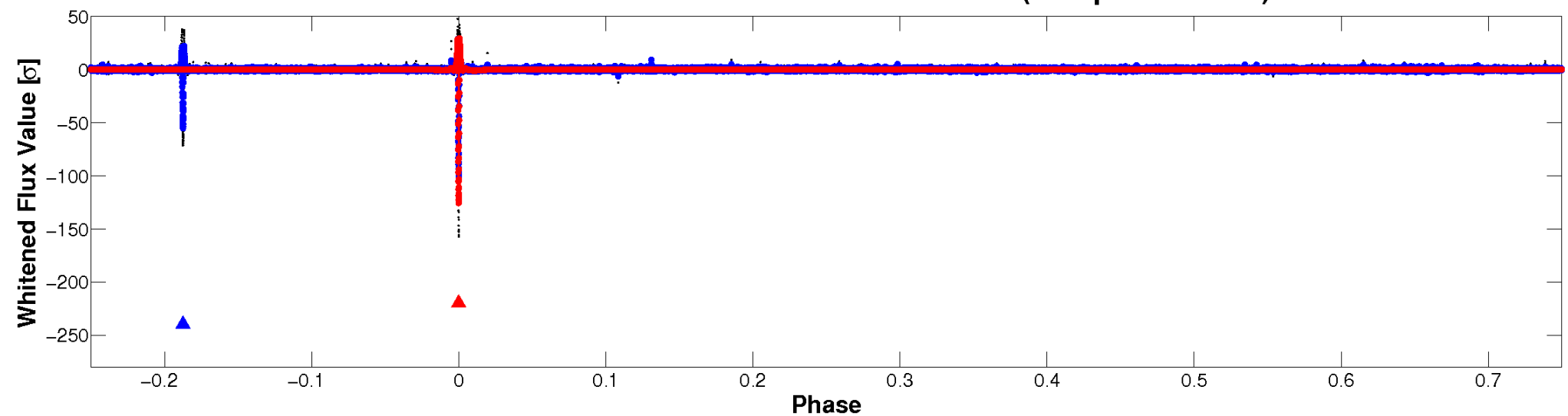


# Non-Whitened Vs. Whitened Light Curve

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

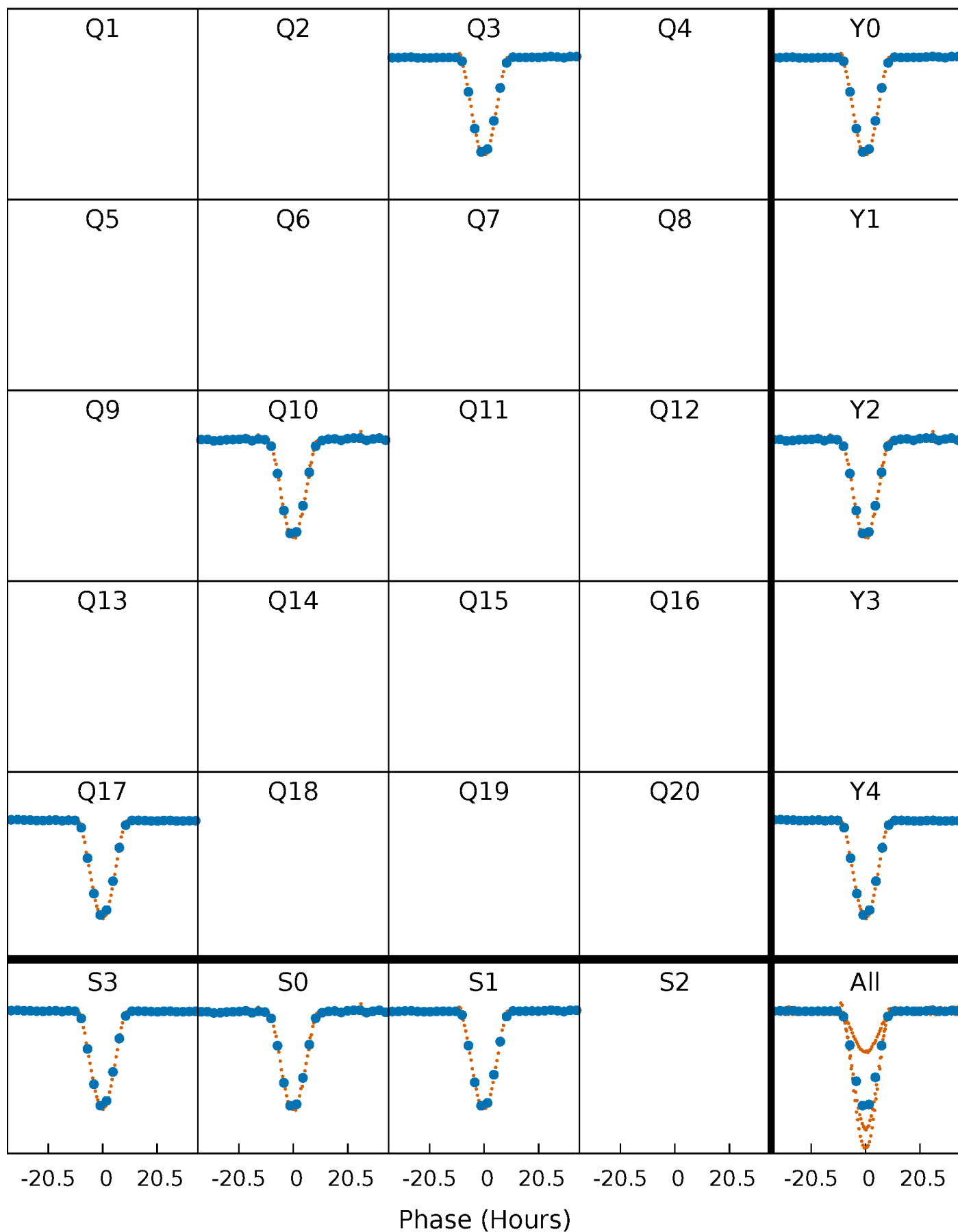


## Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

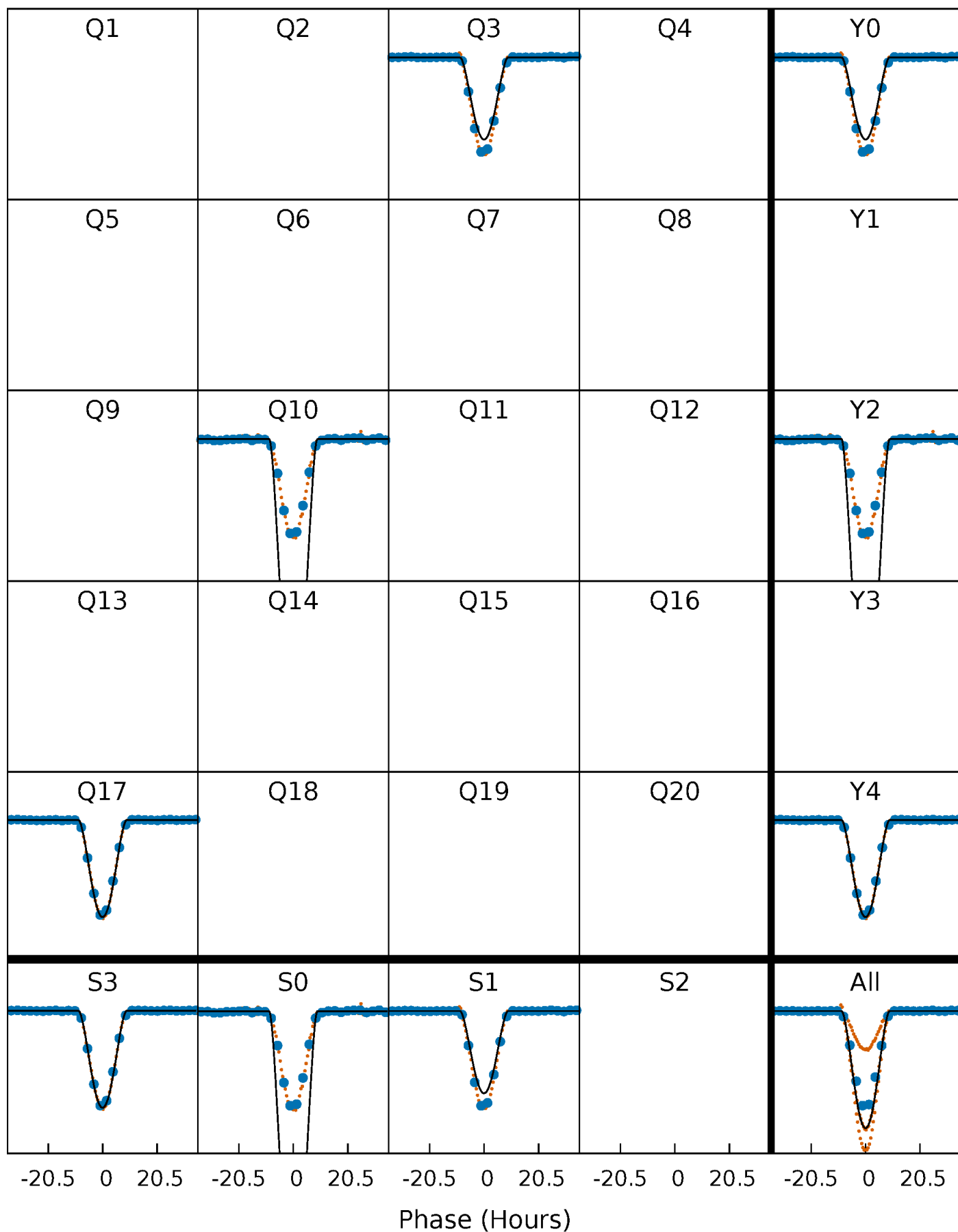
TCE 004586468-01 P=623.004817 Days  $T_0=318.152222$  (BKJD)





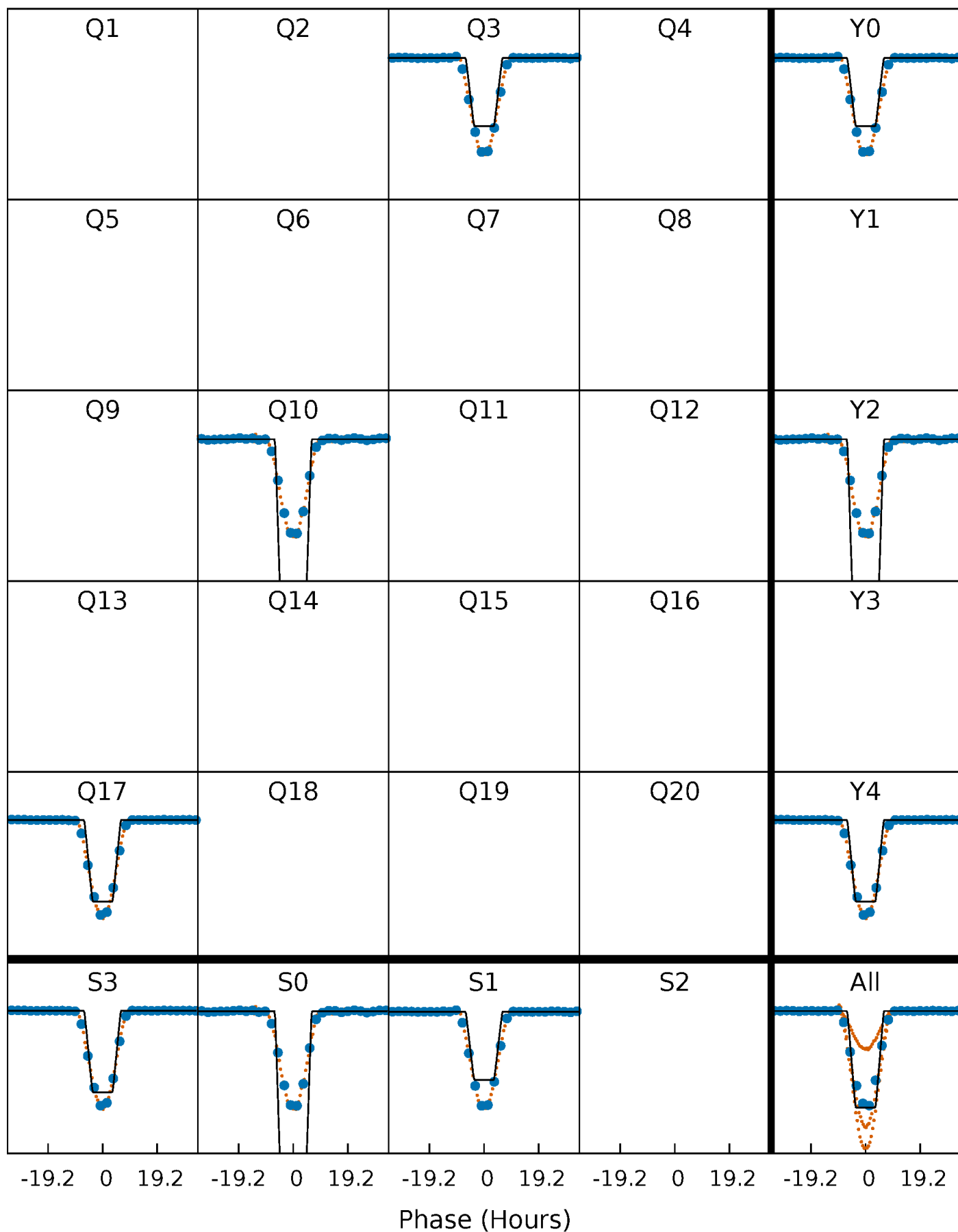
# DV Quarter-Phased Transit Curves

TCE 004586468-01 P=623.004817 Days  $T_0=318.152222$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

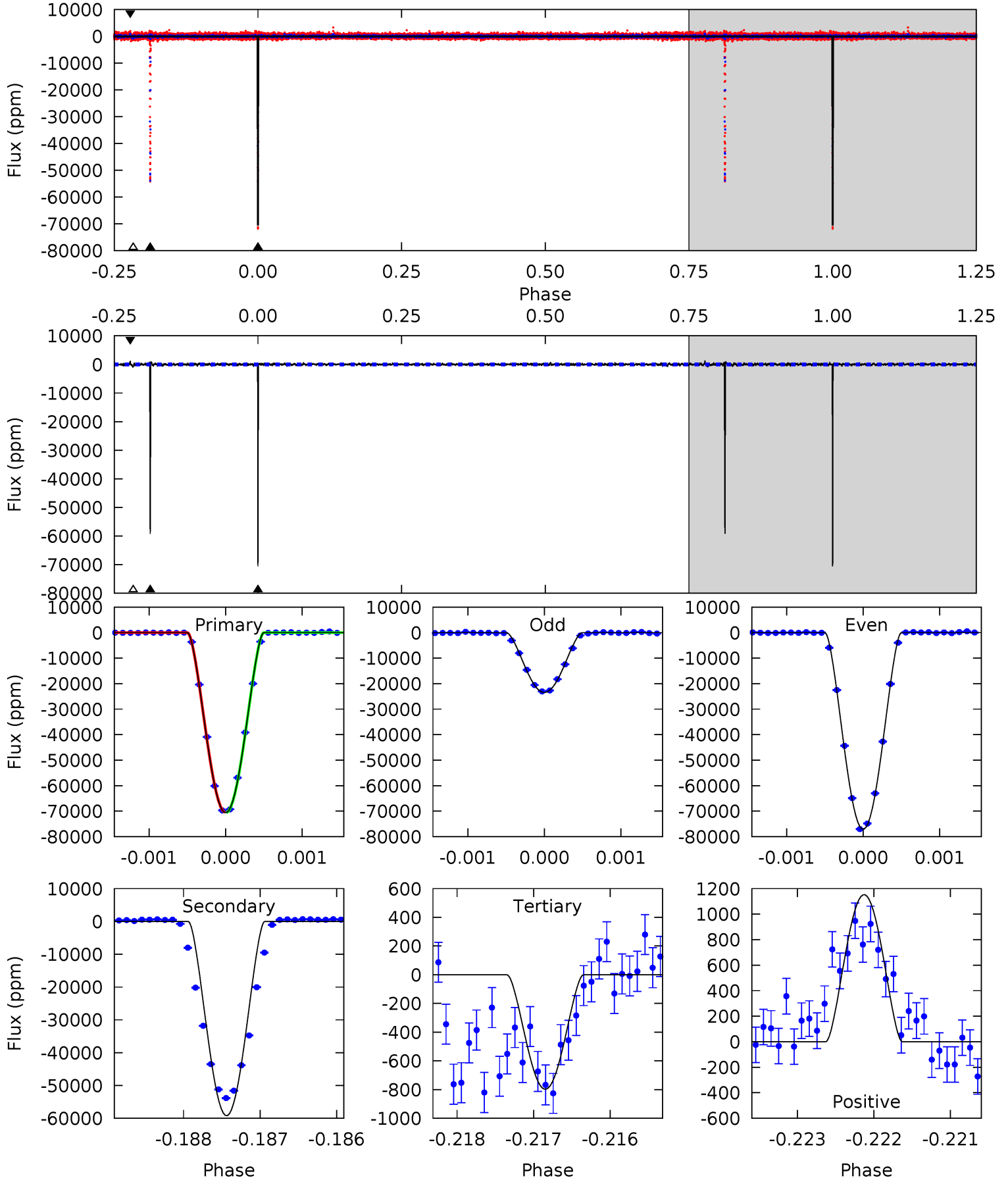
TCE 004586468-01 P=623.005622 Days  $T_0=318.151078$  (BKJD)



# DV Model-Shift Uniqueness Test

004586468-01, P = 623.004817 Days, E = 318.152222 Days

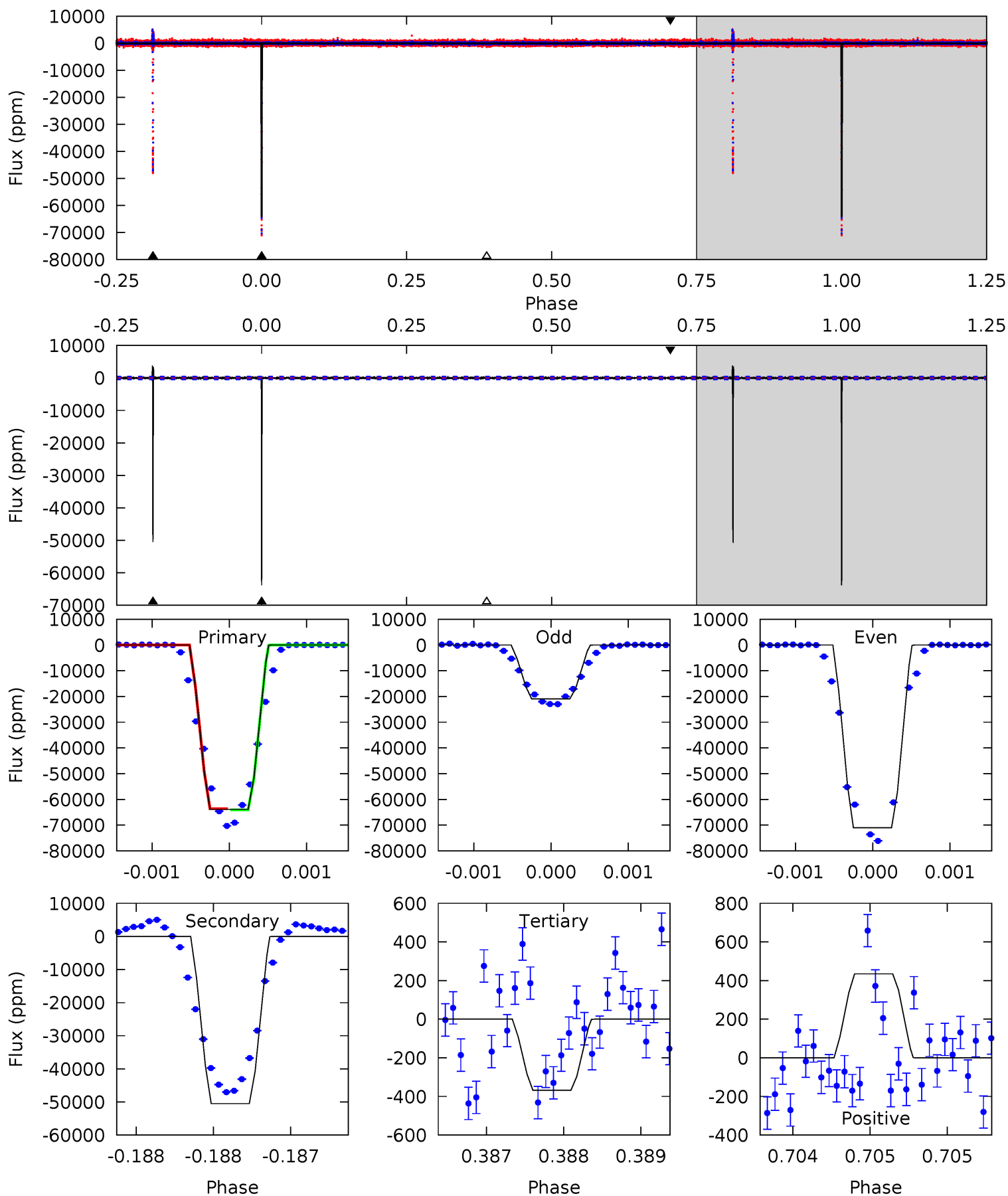
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
1163	974.9	13.1	19.0	5.42	3.24	2.88	1150	1144	961.8	955.9	660.3	0.84	0.02	0



# Alt Model-Shift Uniqueness Test

004586468-01, P = 623.005622 Days, E = 318.151078 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
820.0	648.8	4.72	5.58	5.48	3.33	1.55	815.3	814.5	644.1	643.3	352.1	0.84	0.06	0



### Stellar Parameters For KIC 004586468

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$5025^{+150}_{-150}$	$4.587^{+0.071}_{-0.065}$	$-0.500^{+0.300}_{-0.300}$	$0.685^{+0.080}_{-0.073}$	$0.661^{+0.096}_{-0.041}$	$2.896^{+0.934}_{-0.651}$
	+3%/-3%	+2%/-1%	+60%/-60%	+12%/-11%	+15%/-6%	+32%/-22%
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 004586468-01 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	$-59160 \pm 61$	$25.33^{+4.35}_{-4.14}$	$229^{+9}_{-8}$	$4467^{+332}_{-274}$	$84330^{+36645}_{-21241}$
Alt.	$-50507 \pm 78$	$18.40^{+4.13}_{-3.74}$	$229^{+9}_{-10}$	$4893^{+519}_{-379}$	$136371^{+78540}_{-44826}$

$T_{\text{max}}$  = 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

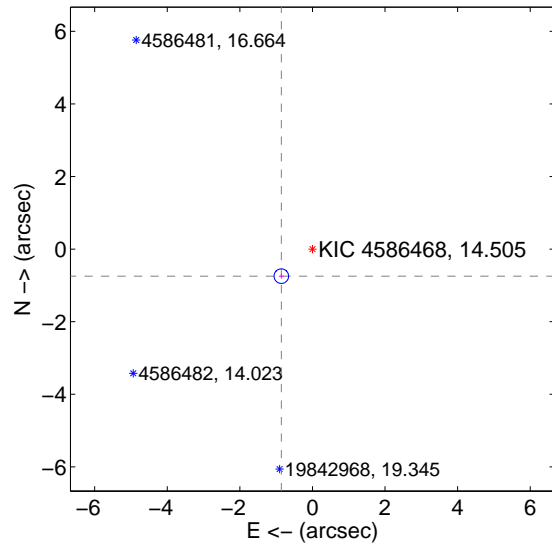
Supplemental centroid analysis for 004586468-01. Kepler magnitude: 14.51. Transit SNR 603.55

There are 1 quarters with good PRF difference image offsets

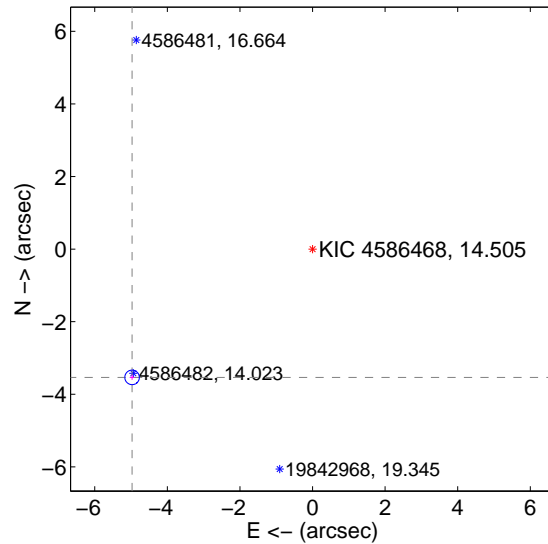
The OOT PRF centroid is offset from the target star catalog position by about 4.97 arcsec so the offset from difference PRF-fit to OOT-fit may be invalid.

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.136 \pm 0.067$	17.02	$0.857 \pm 0.067$	$-0.745 \pm 0.067$
PRF-fit source offset from KIC position	$6.098 \pm 0.067$	91.41	$4.970 \pm 0.067$	$-3.534 \pm 0.067$
photometric centroid source offset	$5.53 \pm 0.01$	829.96	$4.45 \pm 0.01$	$-3.29 \pm 0.01$

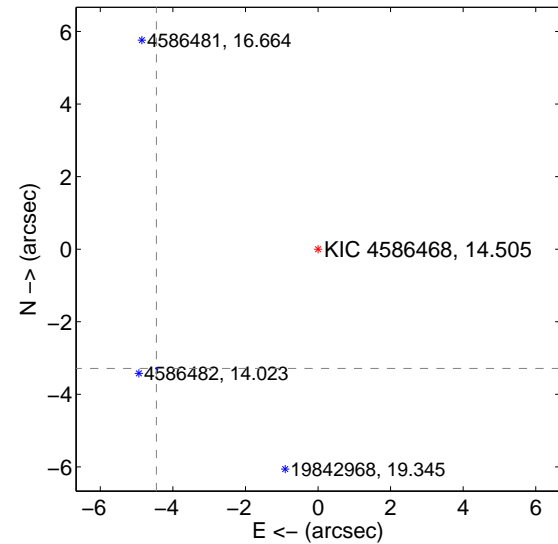
offset from difference PRF-fit to OOT PRF-fit



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.

Q1 no difference image



Q1 no OOT image



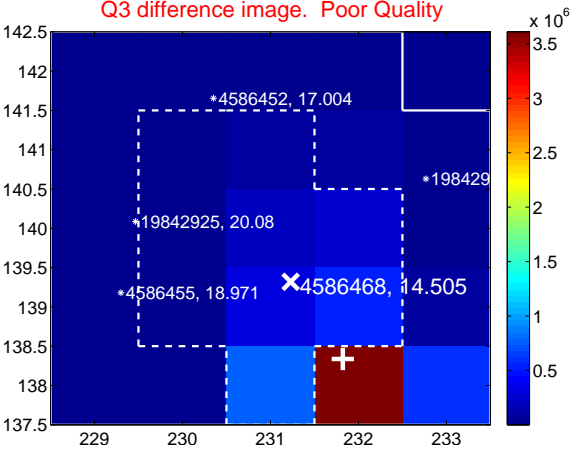
Q2 no difference image



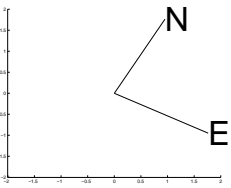
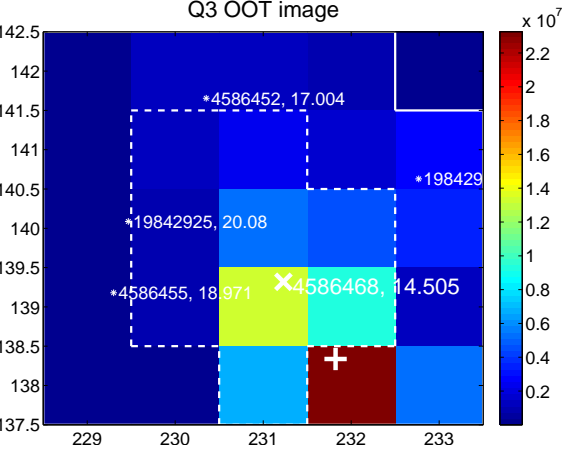
Q2 no OOT image



Q3 difference image. Poor Quality



Q3 OOT image



Q4 no difference image



Q4 no OOT image

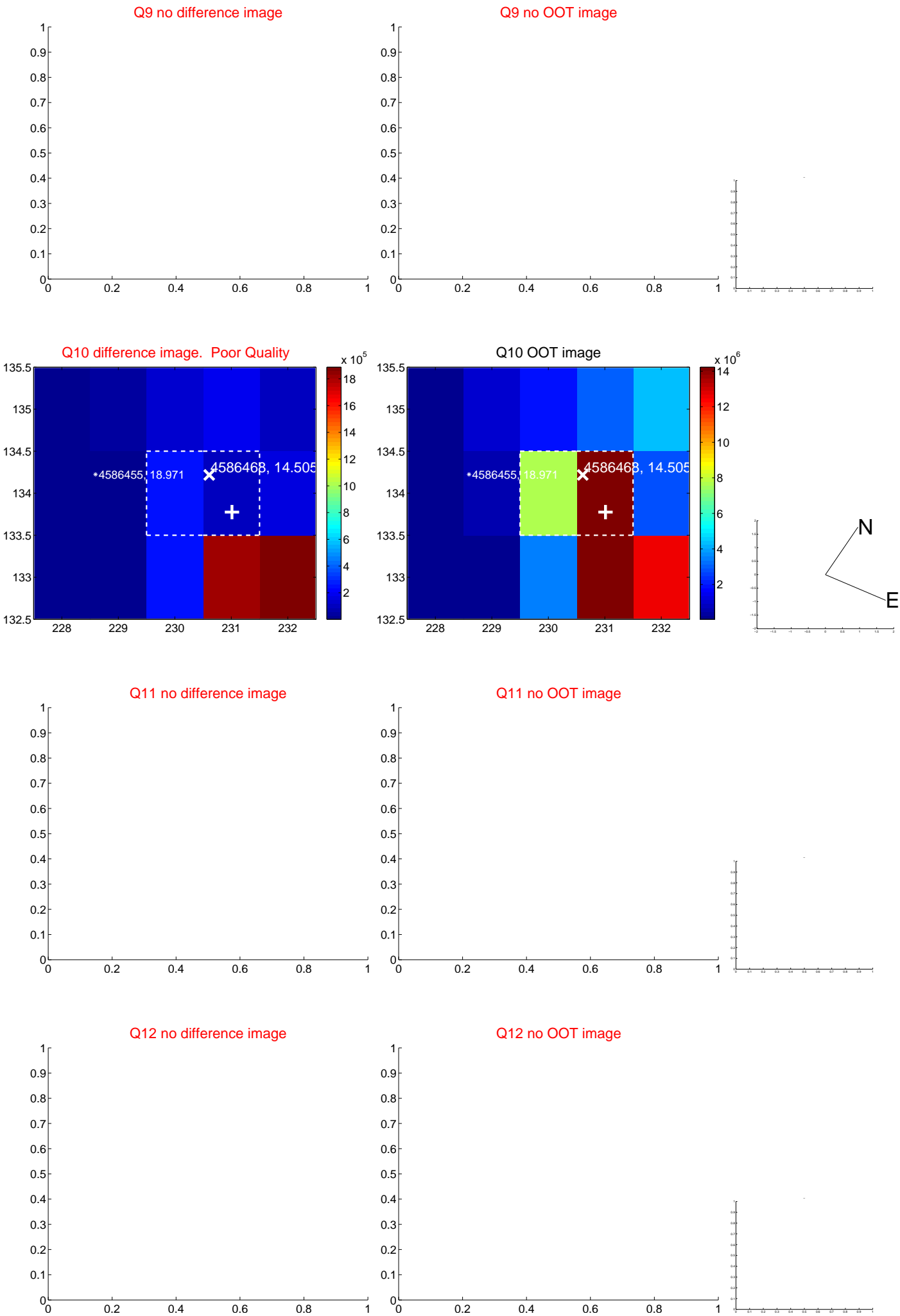


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





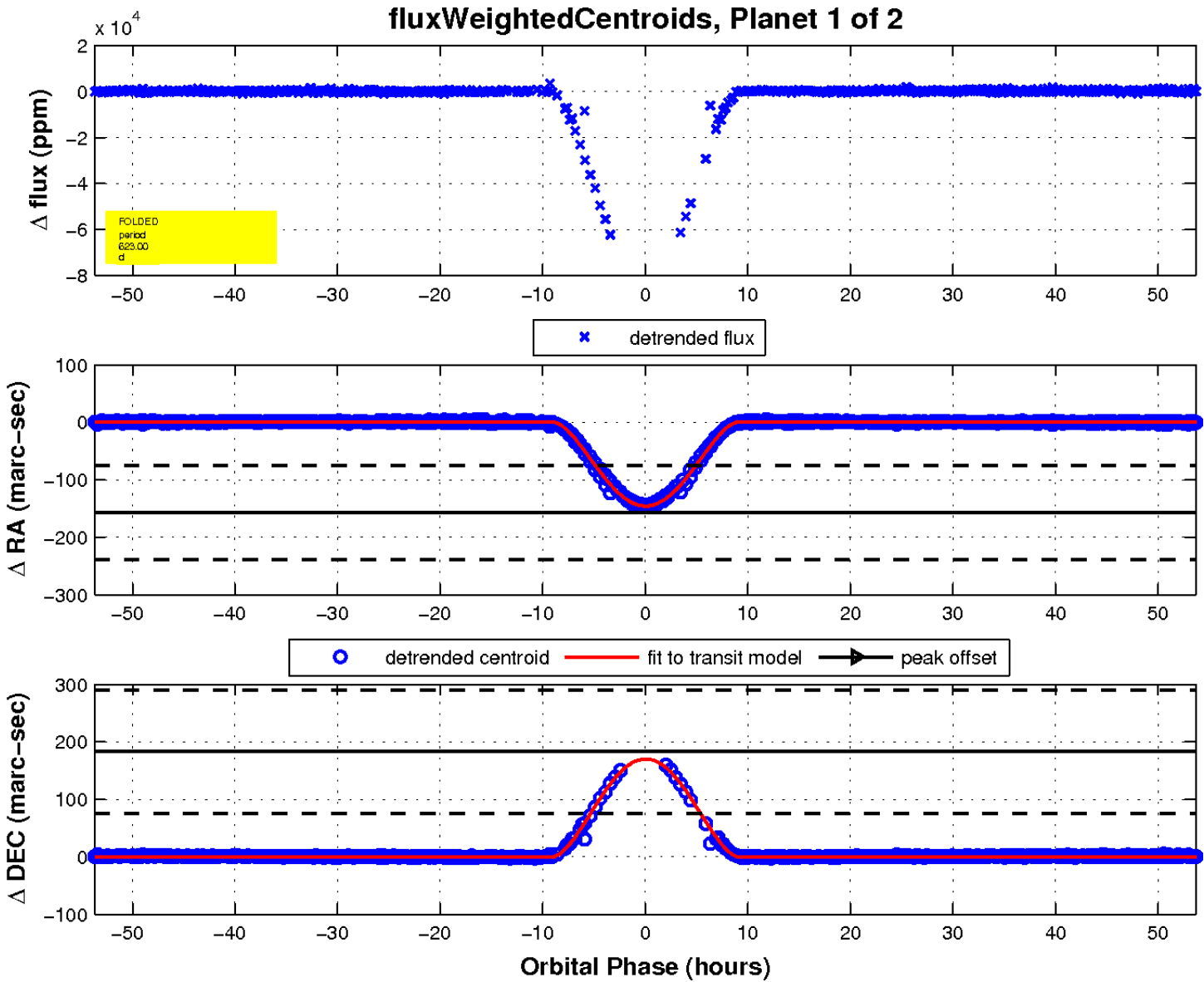
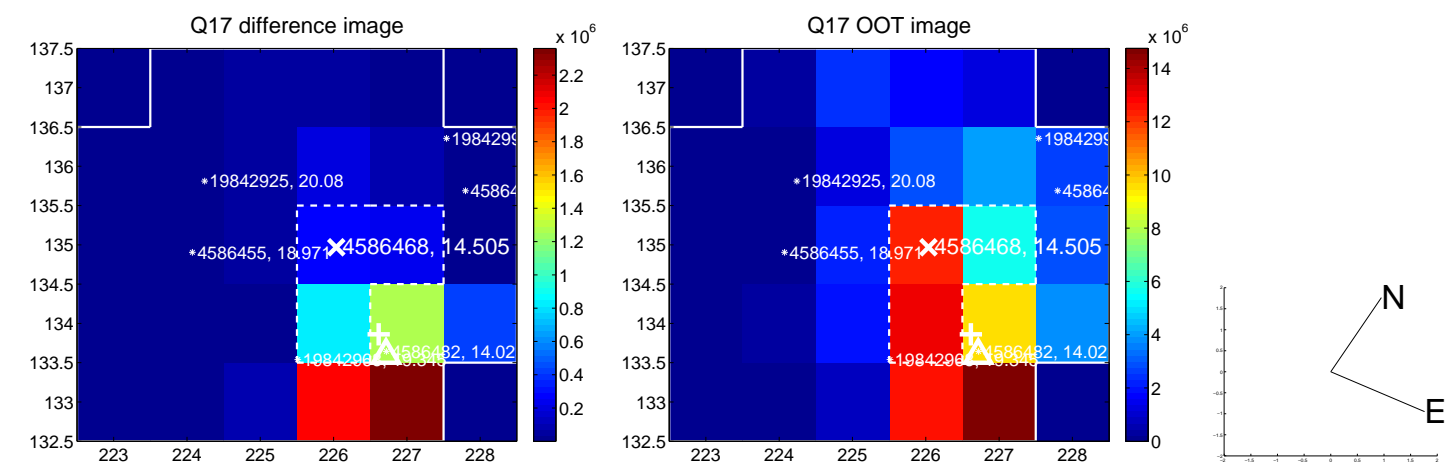
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



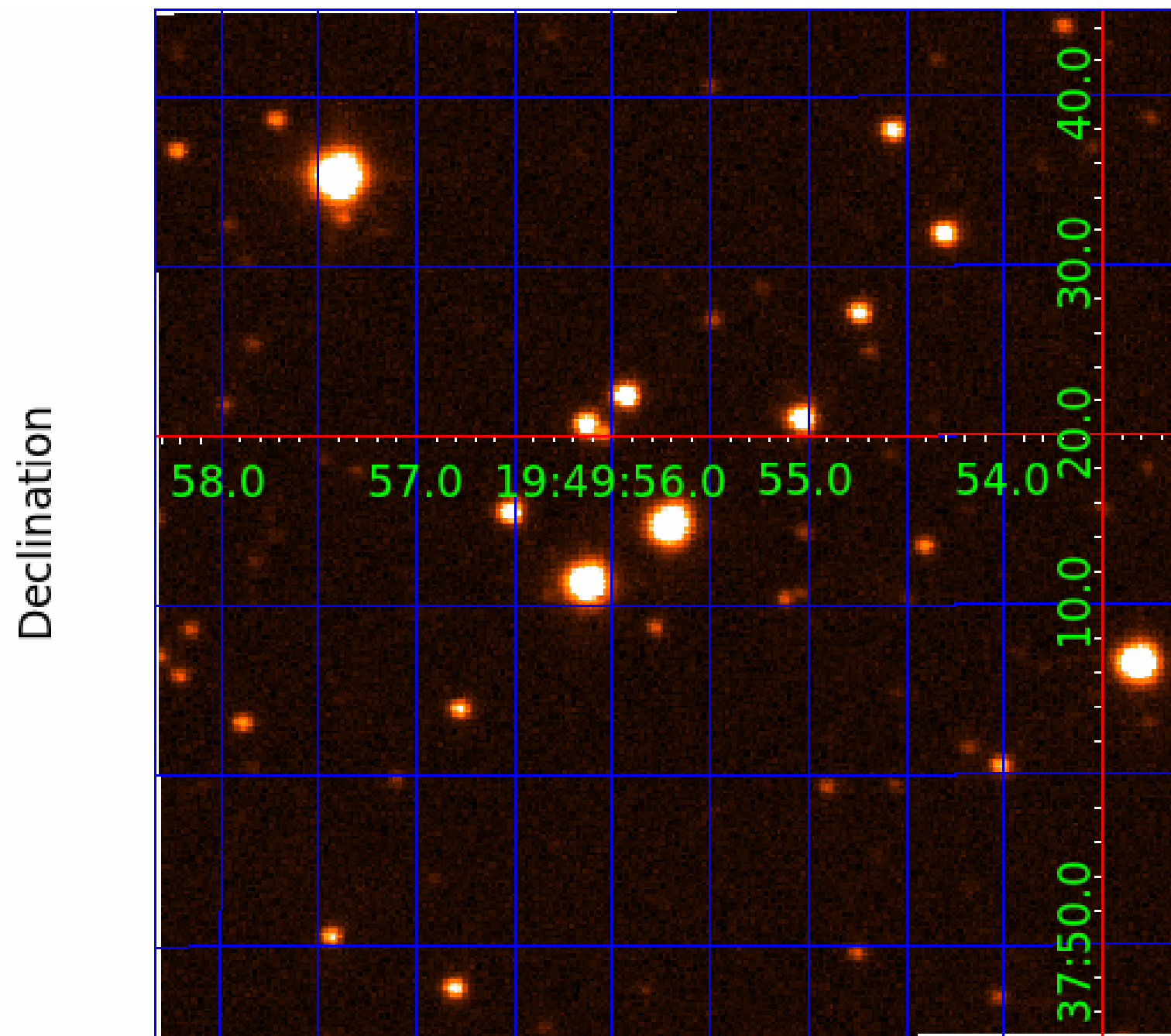
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



UKIRT Image



# KIC 004586468

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
004586468-01	OBS	No	623.004817	318.152222	70739.0	17.958	677.2	603.5	0.69	5025	25.09	0.17
004586468-02	OBS	No	623.003455	201.389059	54609.2	22.794	380.2	300.3	0.69	5025	22.48	0.17

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
004586468-01	OBS	FP	0.00	1	0	1	1	INDIV_TRANS_MARSHALL—INCONSISTENT_TRANS—CENT_FEW_DIFFS—HALO_GHOST—EPHEM_MATCH
004586468-02	OBS	FP	0.00	1	0	1	1	INDIV_TRANS_MARSHALL—SAME_NTL_PERIOD—CENT_FEW_DIFFS—HALO_GHOST—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.

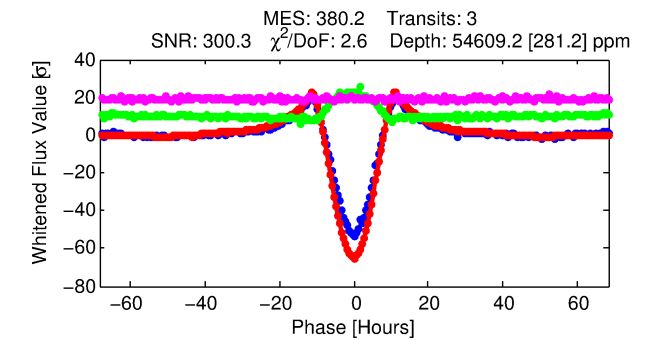
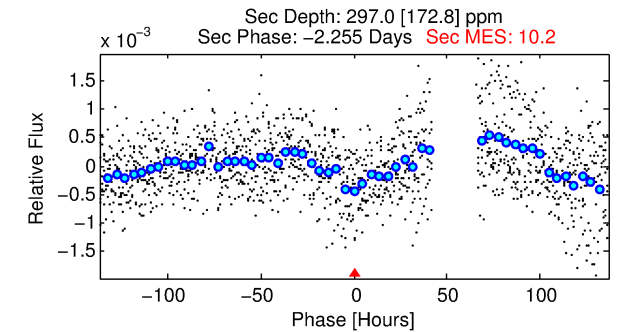
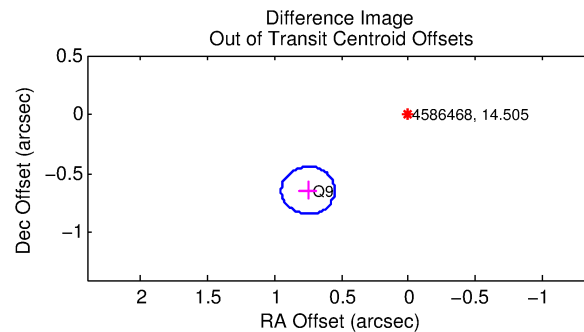
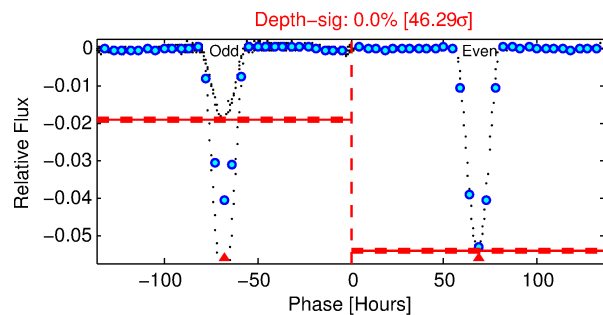
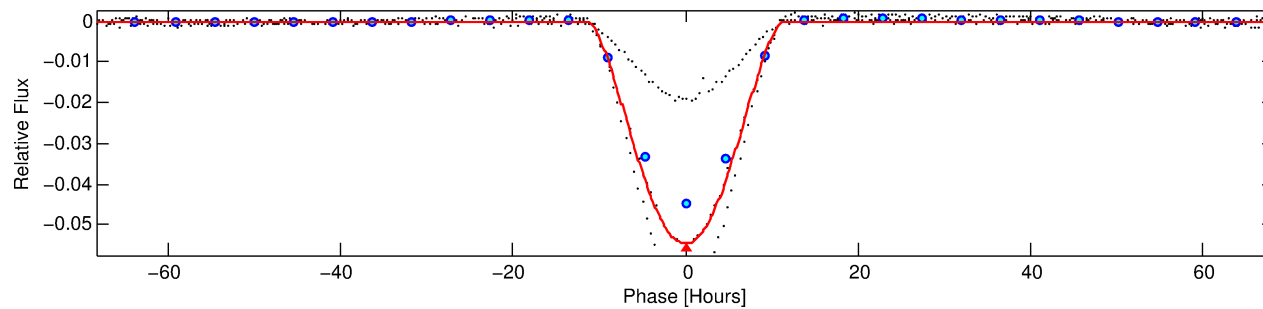
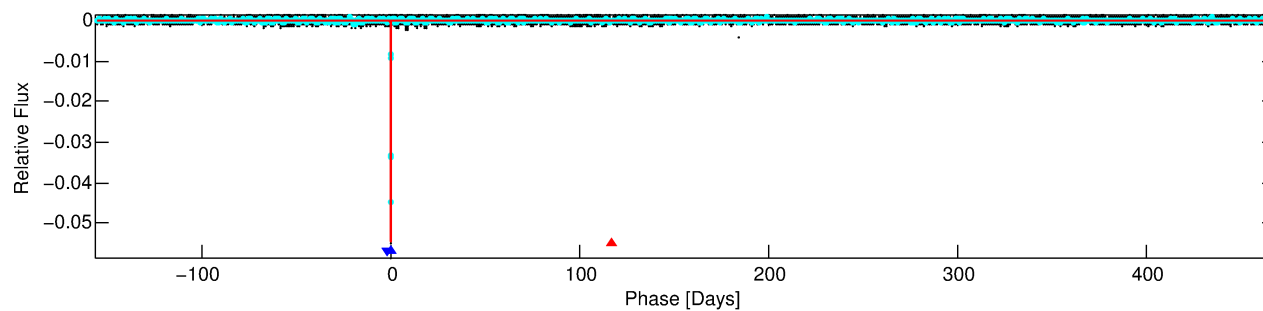
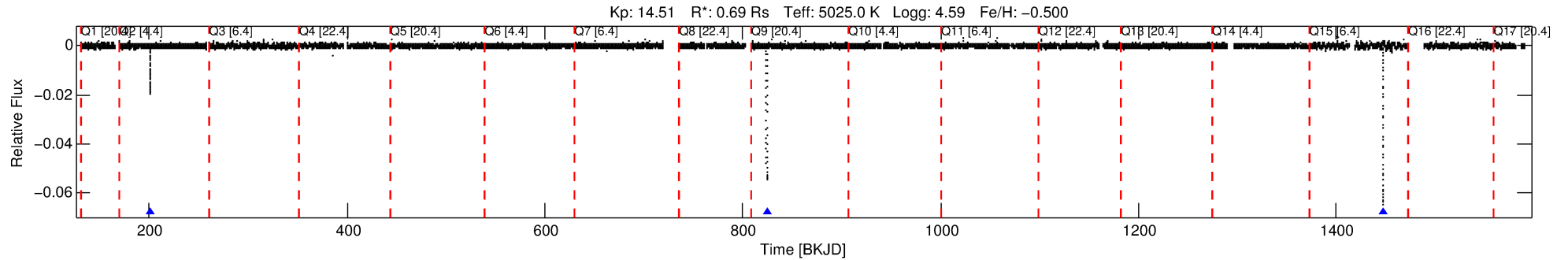
## Ephemeris Match Information For 004586468-02

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	$\sigma_P$	$\sigma_T$
004586468-02	4586468	5073.01	4586482	1:1	6.0	1	0	14.02	14.50	2.69	Direct-PRF	0	0.02	0.01

**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: 4586468 Candidate: 2 of 2 Period: 623.003 d



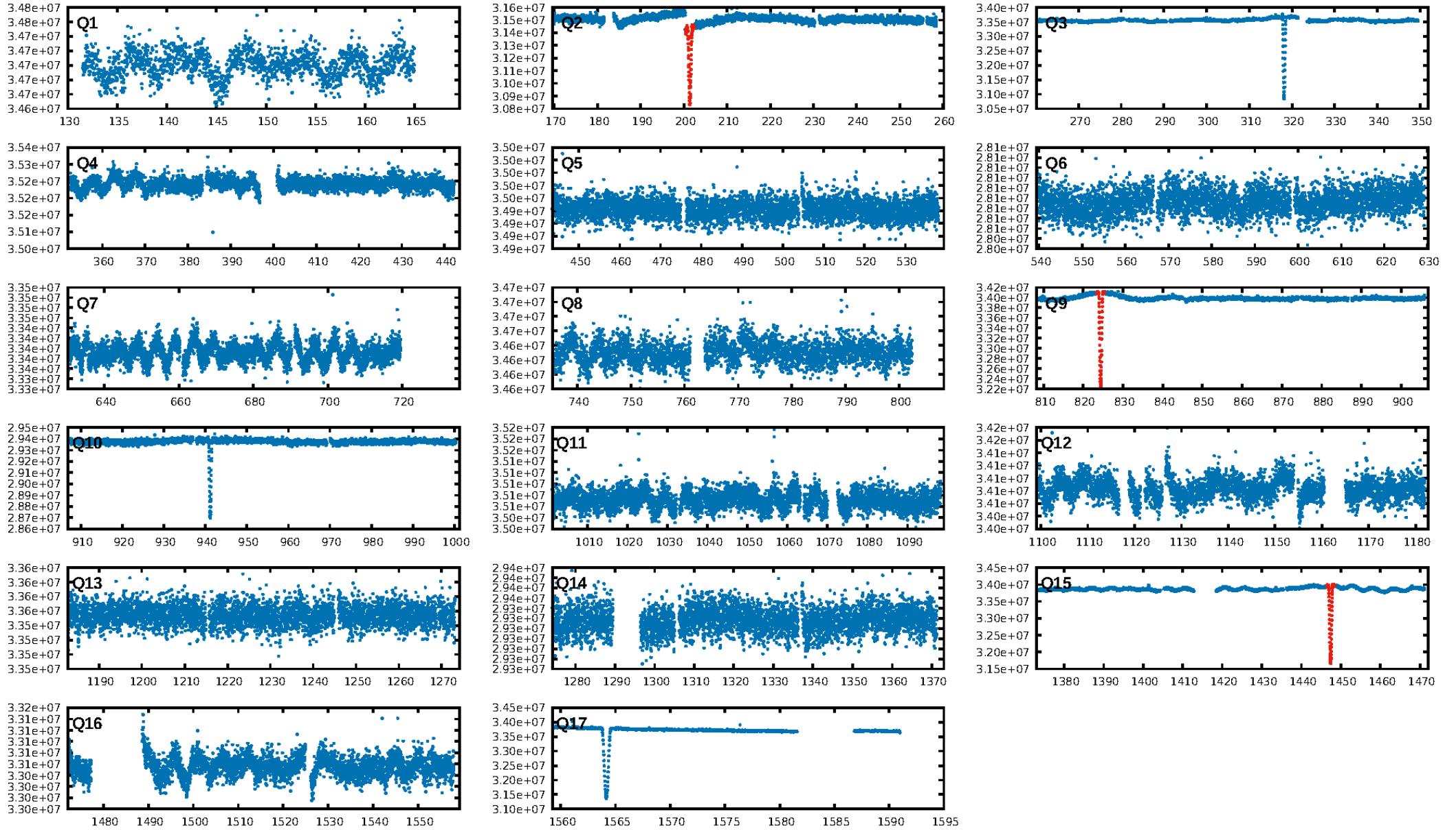
## DV Fit Results:

Period = 623.00346 [0.00119] d  
Epoch = 201.3891 [0.0015] BKJD  
Rp/R\* = 0.3007 [0.0306]  
a/R\* = 196.78 [1.83]  
b = 0.90 [0.05]  
Seff = 0.17 [0.03]  
Teq = 165 [7] K  
Rp = 22.48 [3.48] Re  
a = 1.2440 [0.1182] AU  
Ag = 500.56 [315.77] [1.58 $\sigma$ ]  
Teffp = 1203 [189] K [5.50 $\sigma$ ]

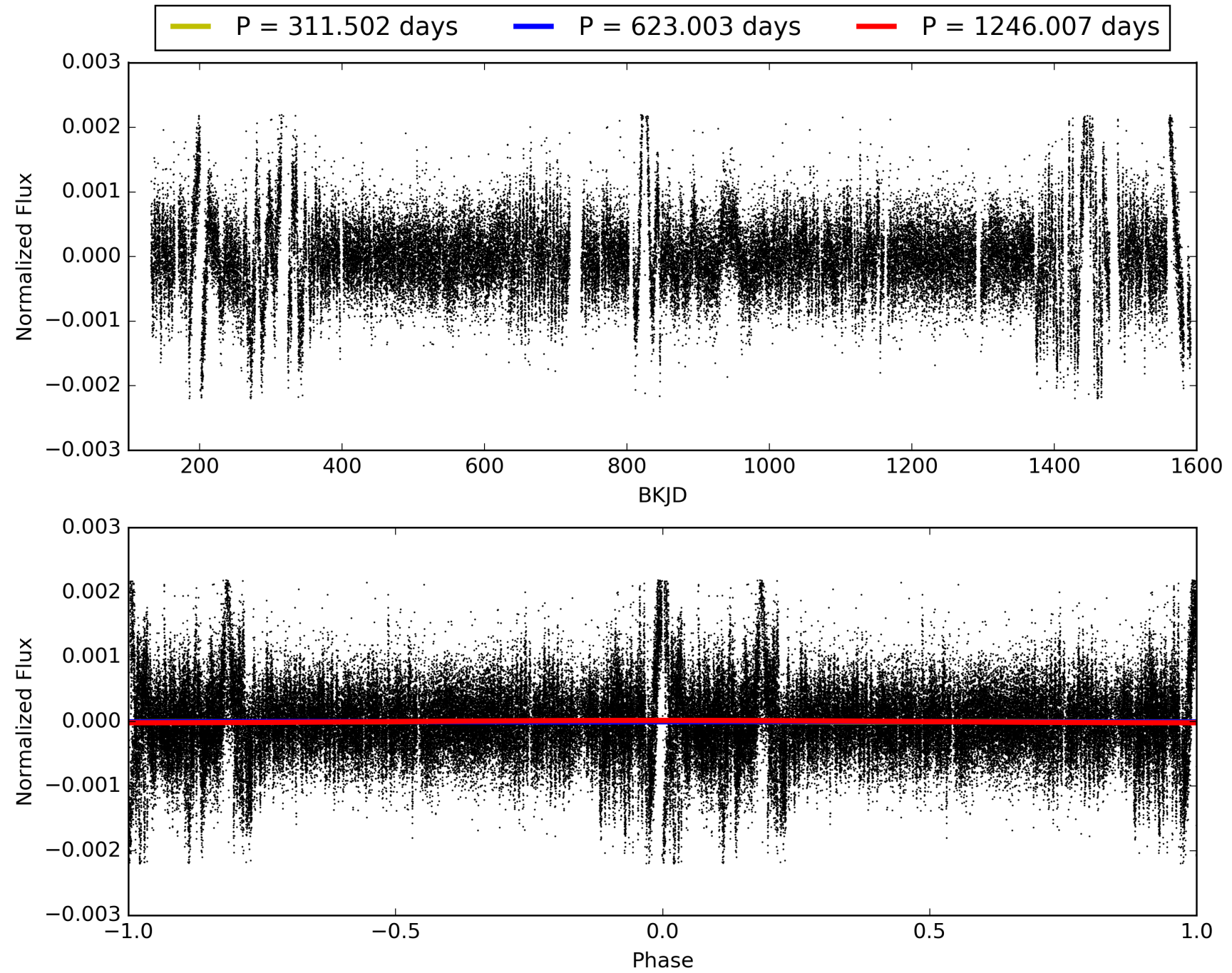
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 0.1% [0.00 $\sigma$ ]  
ModelChiSquare2-sig: 0.0%  
ModelChiSquareGof-sig: 18.8%  
Bootstrap-pfa: 0.00e+00  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: -0.2316  
Centroid-sig: 0.0%  
Centroid-so: 5.833 arcsec [432.24 $\sigma$ ]  
OotOffset-rm: 0.987 arcsec [14.80 $\sigma$ ]  
KicOffset-rm: 6.041 arcsec [90.56 $\sigma$ ]  
OotOffset-st: 0/0/0/1 [1]  
KicOffset-st: 0/0/0/1 [1]  
DiffImageQuality-fgm: 1.00 [1/1]  
DiffImageOverlap-fno: 1.00 [2/2]

# TCE 004586468-02, PDC Light Curves



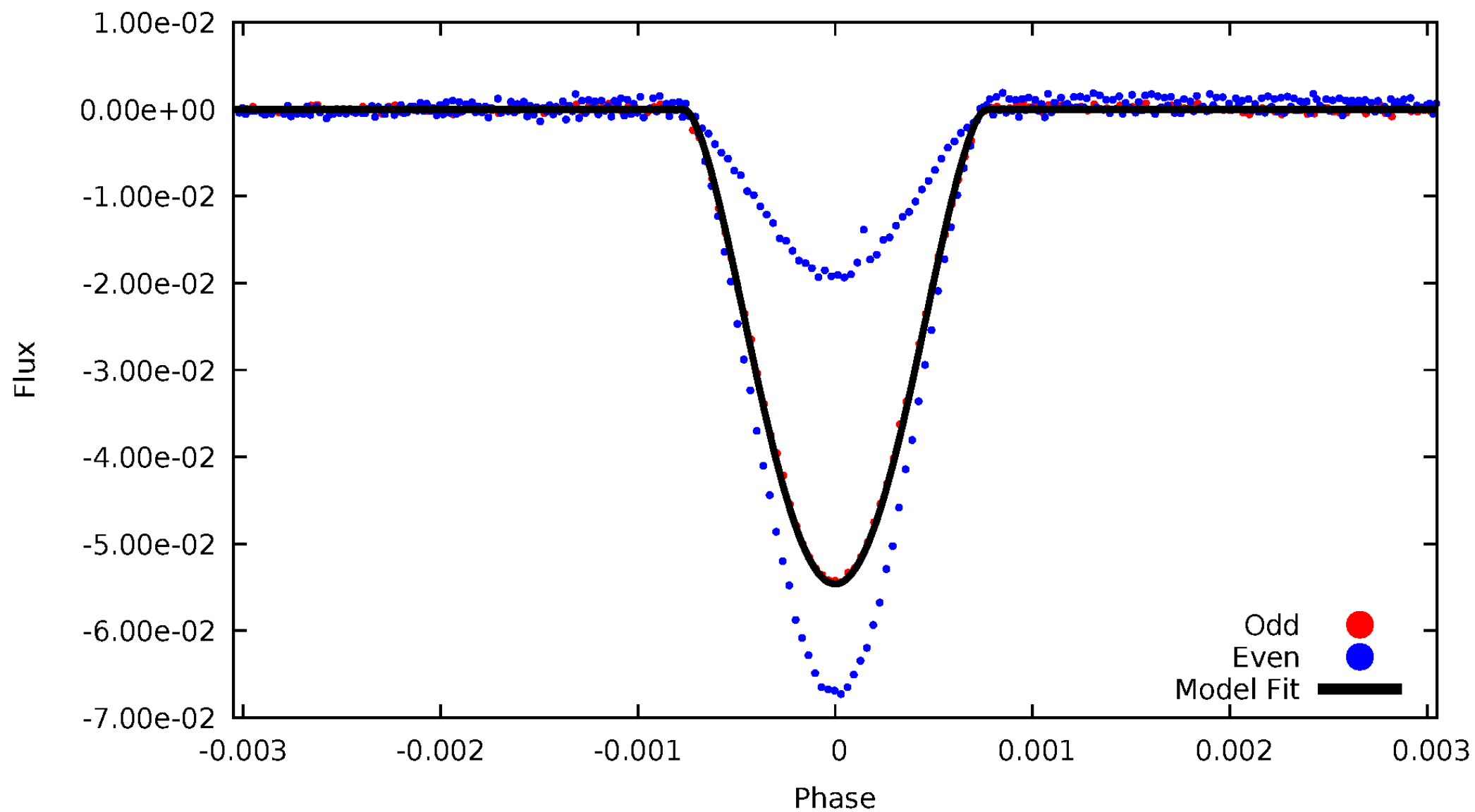
TCE 004586468-02





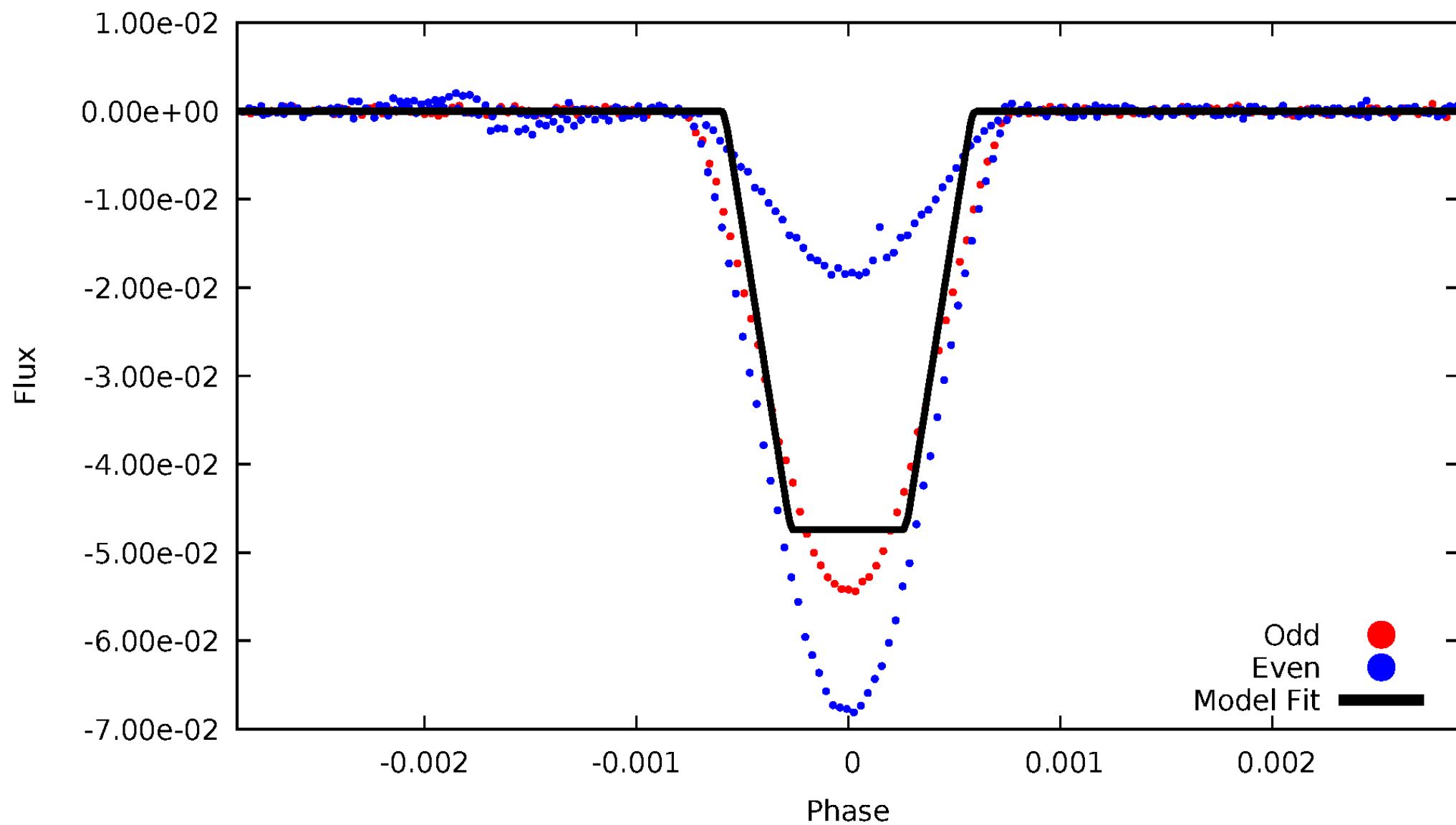
# DV Odd/Even

TCE 004586468-02



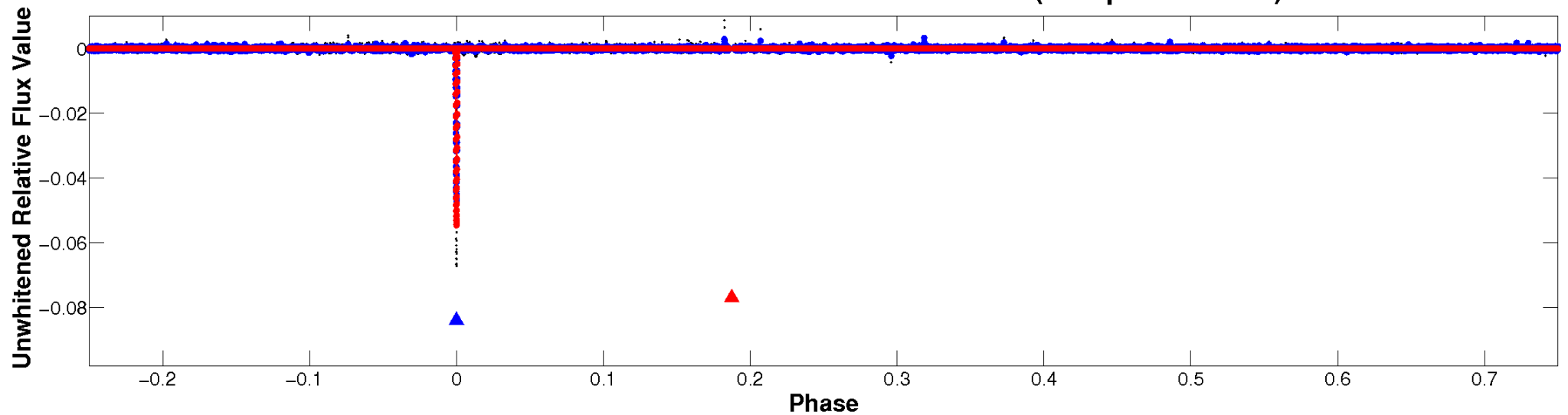
# ALT Odd/Even

TCE 004586468-02

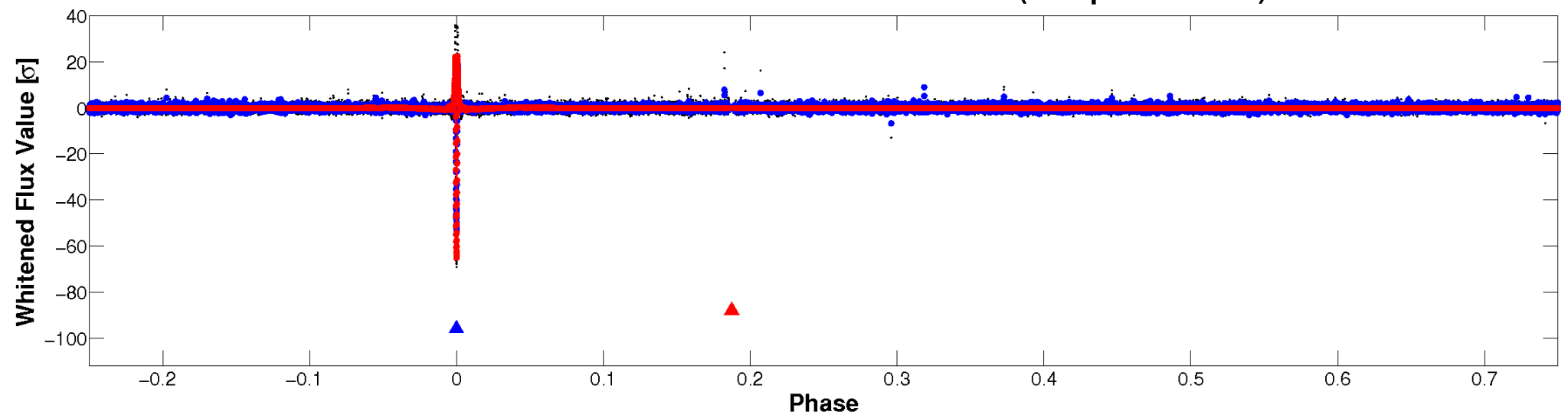


# Non-Whitened Vs. Whitened Light Curve

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

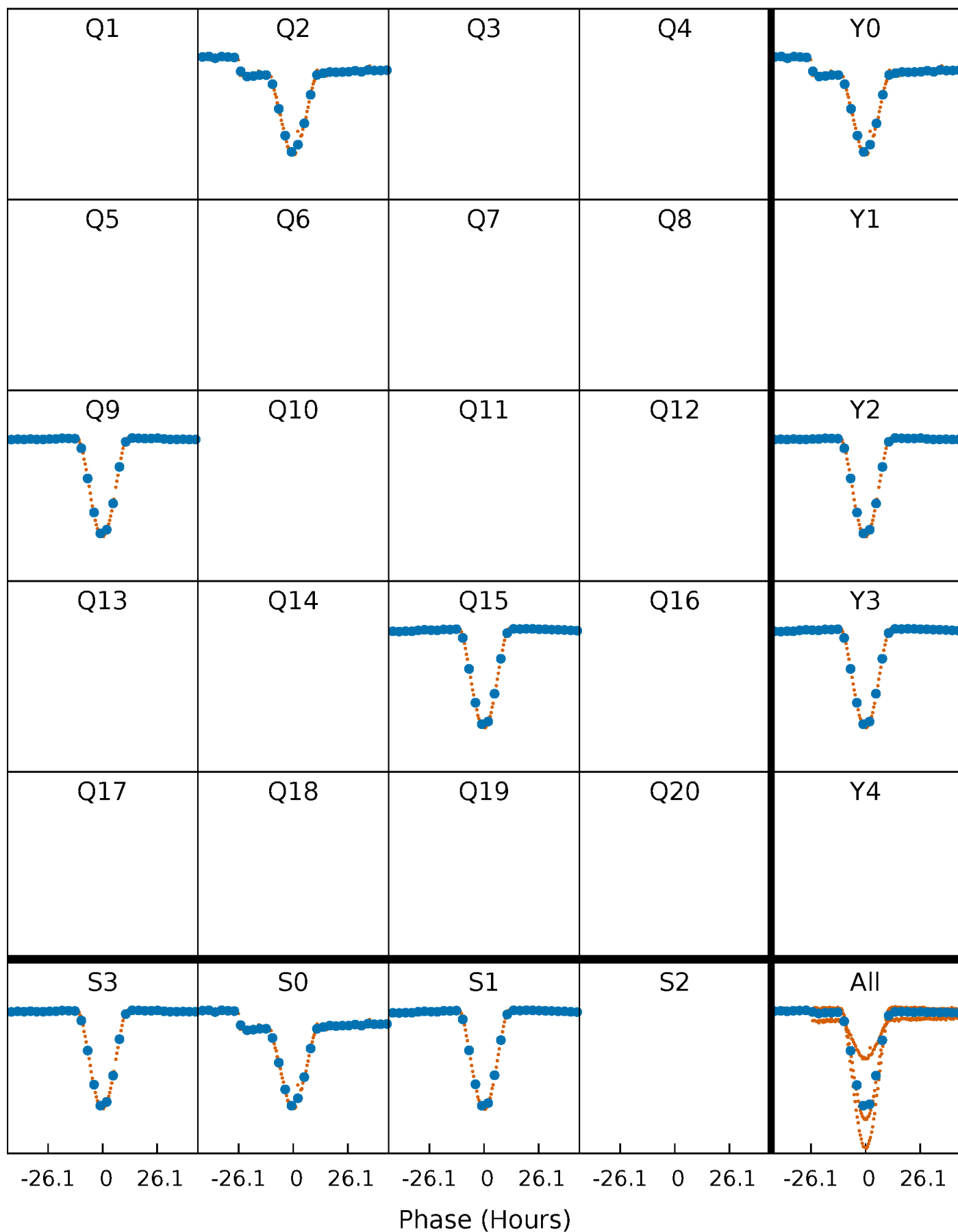


**Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



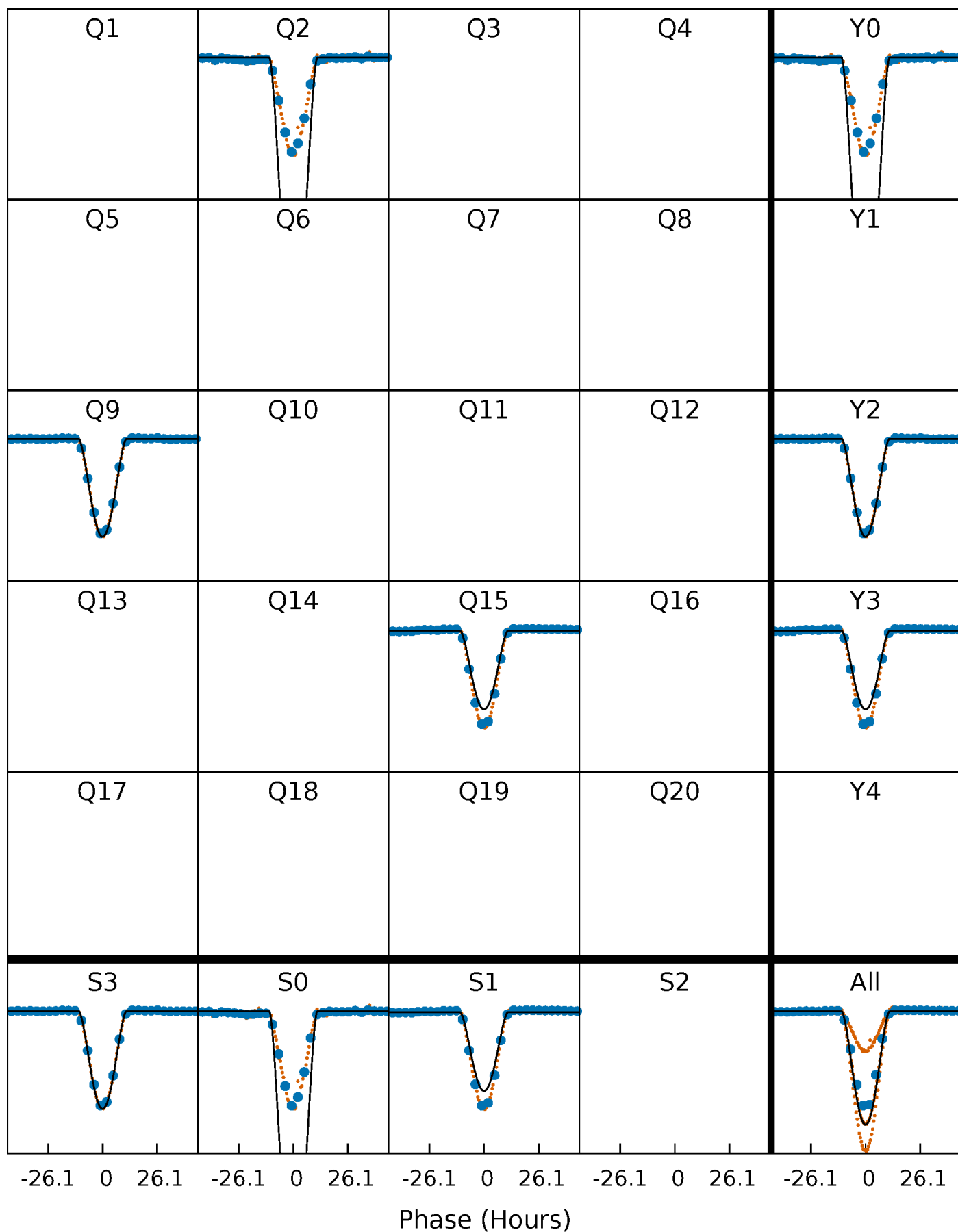
# PDC Quarter-Phased Transit Curves

TCE 004586468-02 P=623.003455 Days  $T_0=201.389059$  (BKJD)



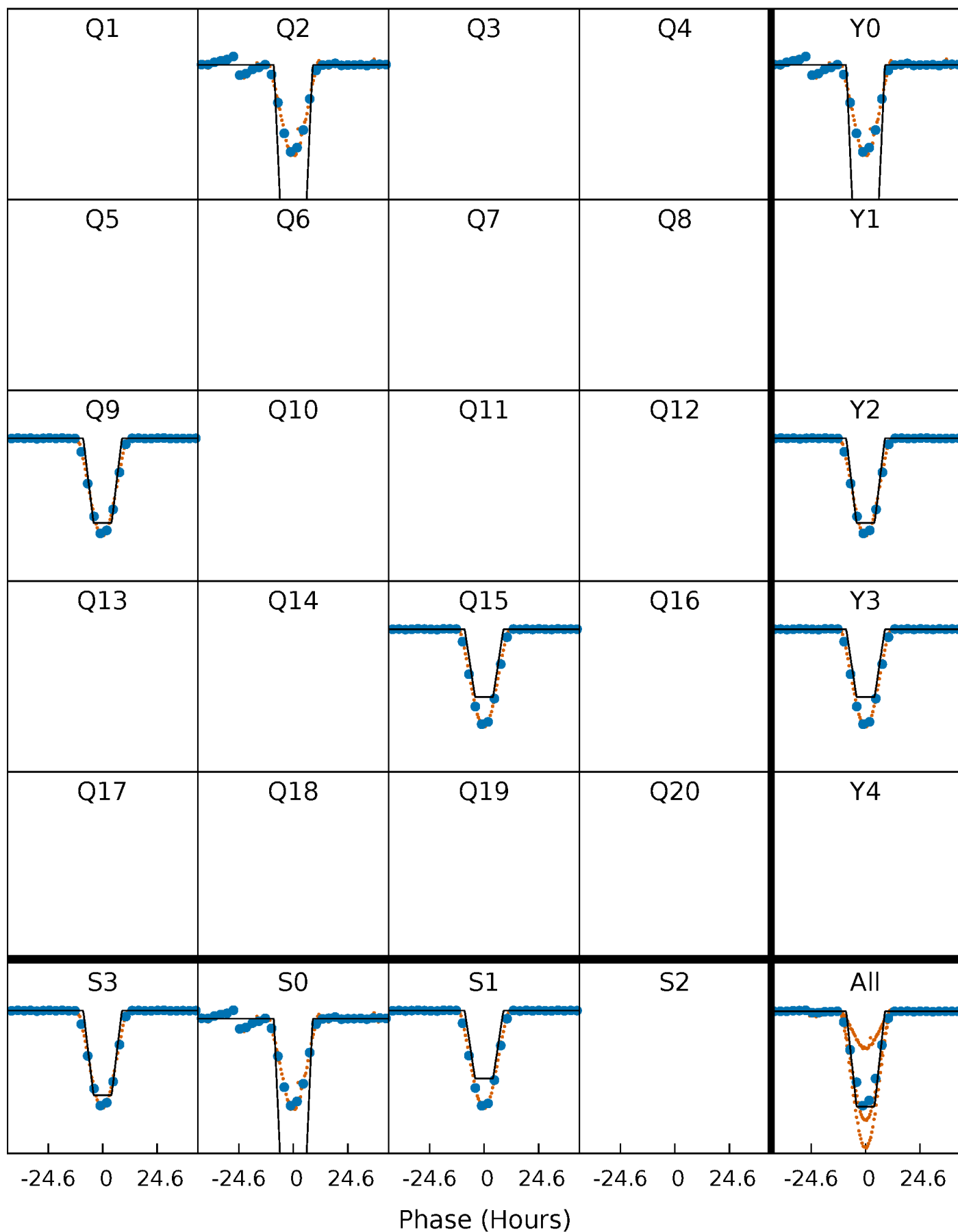
# DV Quarter-Phased Transit Curves

TCE 004586468-02 P=623.003455 Days  $T_0=201.389059$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

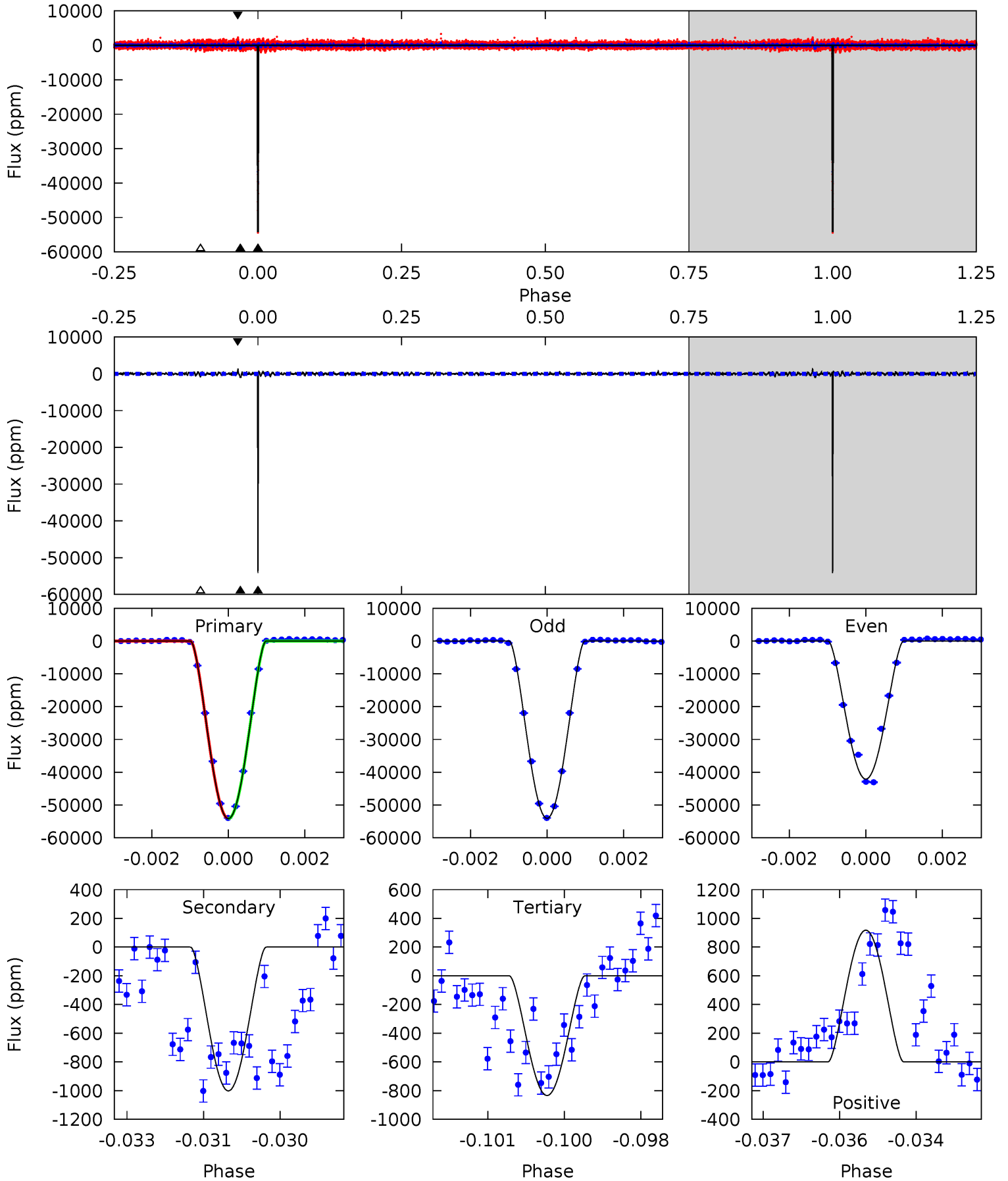
TCE 004586468-02 P=623.005622 Days  $T_0=201.386511$  (BKJD)



# DV Model-Shift Uniqueness Test

004586468-02, P = 623.003455 Days, E = 201.389059 Days

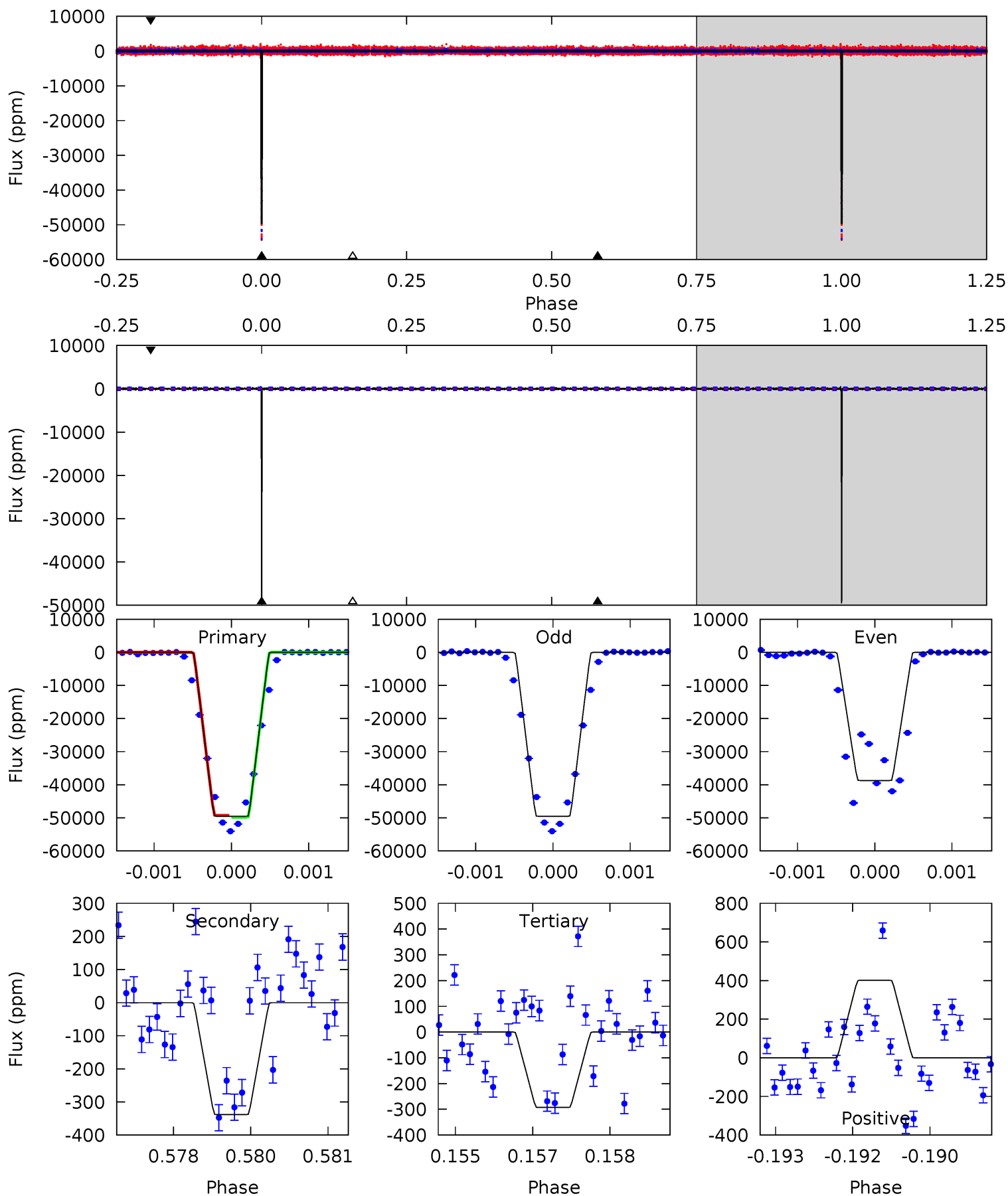
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
1018	18.8	15.7	17.3	5.37	3.16	3.66	1003	1001	3.15	1.58	158.2	0.86	0.02	0



# Alt Model-Shift Uniqueness Test

004586468-02, P = 623.005622 Days, E = 201.386511 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
809.9	5.53	4.78	6.55	5.42	3.24	1.33	805.1	803.4	0.74	-1.03	129.1	0.86	0.01	0





### Stellar Parameters For KIC 004586468

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$5025^{+150}_{-150}$	$4.587^{+0.071}_{-0.065}$	$-0.500^{+0.300}_{-0.300}$	$0.685^{+0.080}_{-0.073}$	$0.661^{+0.096}_{-0.041}$	$2.896^{+0.934}_{-0.651}$
	+3%/-3%	+2%/-1%	+60%/-60%	+12%/-11%	+15%/-6%	+32%/-22%
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 004586468-02 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-1002 \pm 53$	$22.60^{+2.76}_{-2.58}$	$230^{+9}_{-9}$	$2467^{+81}_{-69}$	$1688^{+483}_{-326}$
Alt.	$-338 \pm 61$	$16.38^{+2.65}_{-2.57}$	$229^{+10}_{-9}$	$2340^{+111}_{-96}$	$1076^{+512}_{-313}$

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

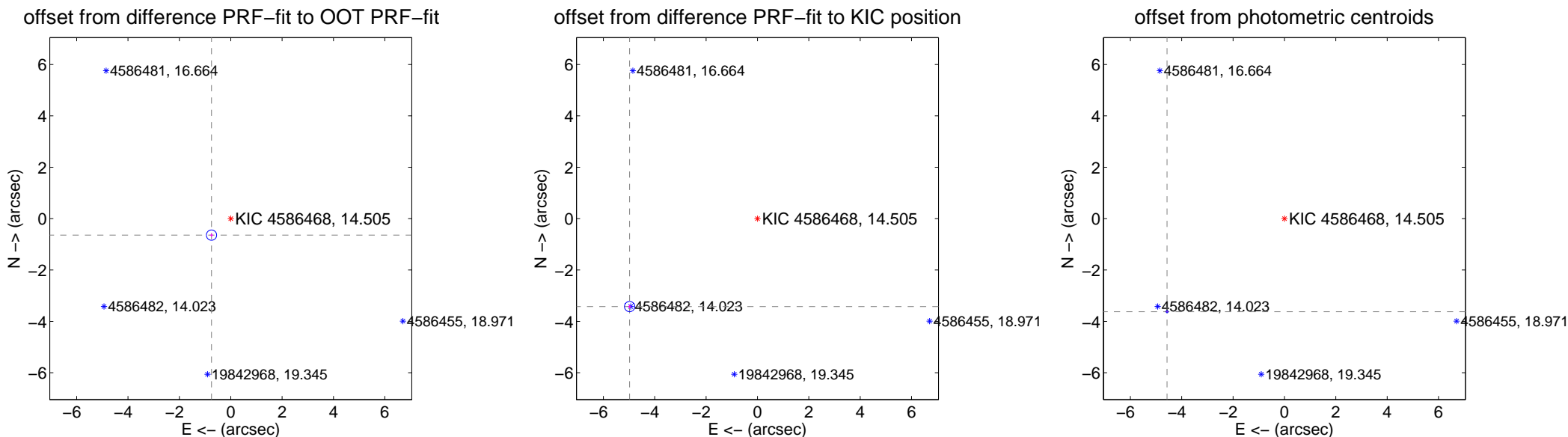
## DV Centroid Data

Supplemental centroid analysis for 004586468-02. Kepler magnitude: 14.51. Transit SNR 300.25

There are 1 quarters with good PRF difference image offsets

The OOT PRF centroid is offset from the target star catalog position by about 5.06 arcsec so the offset from difference PRF-fit to OOT-fit may be invalid.

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.987 \pm 0.067$	14.80	$0.750 \pm 0.067$	$-0.642 \pm 0.067$
PRF-fit source offset from KIC position	$6.041 \pm 0.067$	90.56	$4.978 \pm 0.067$	$-3.423 \pm 0.067$
photometric centroid source offset	$5.83 \pm 0.01$	432.24	$4.57 \pm 0.01$	$-3.62 \pm 0.01$



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.

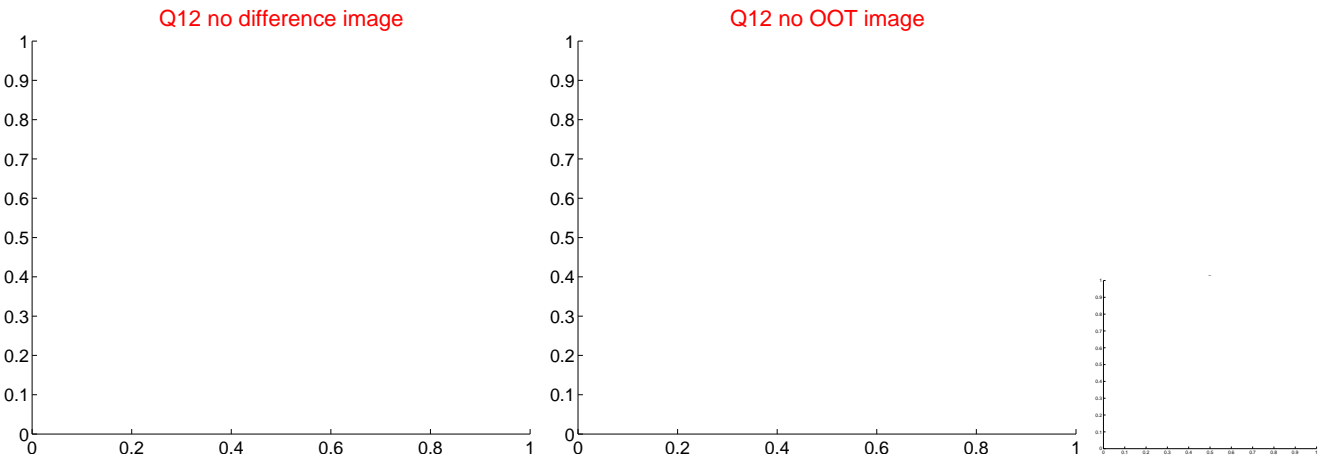
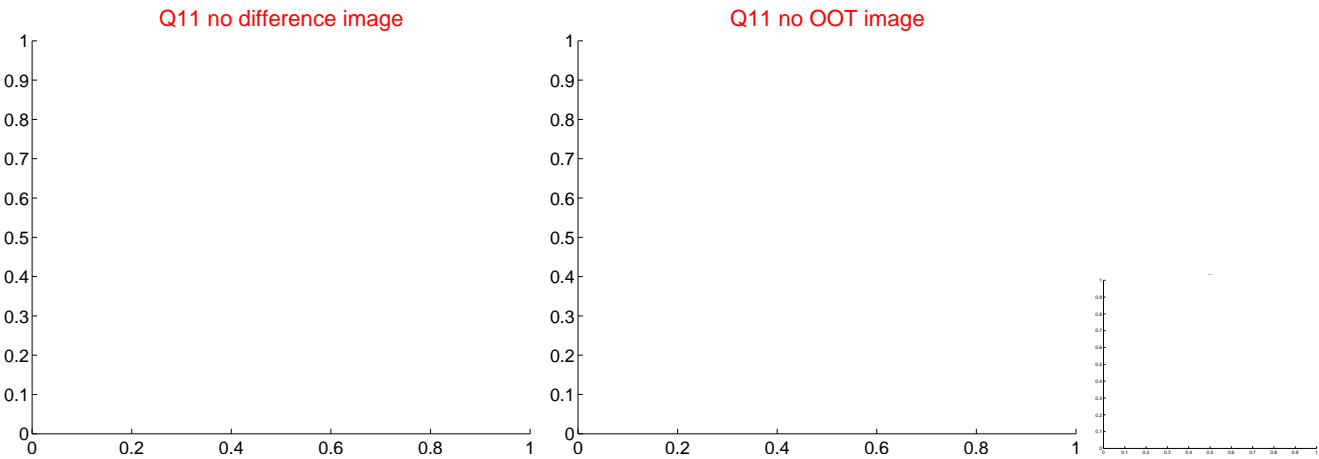
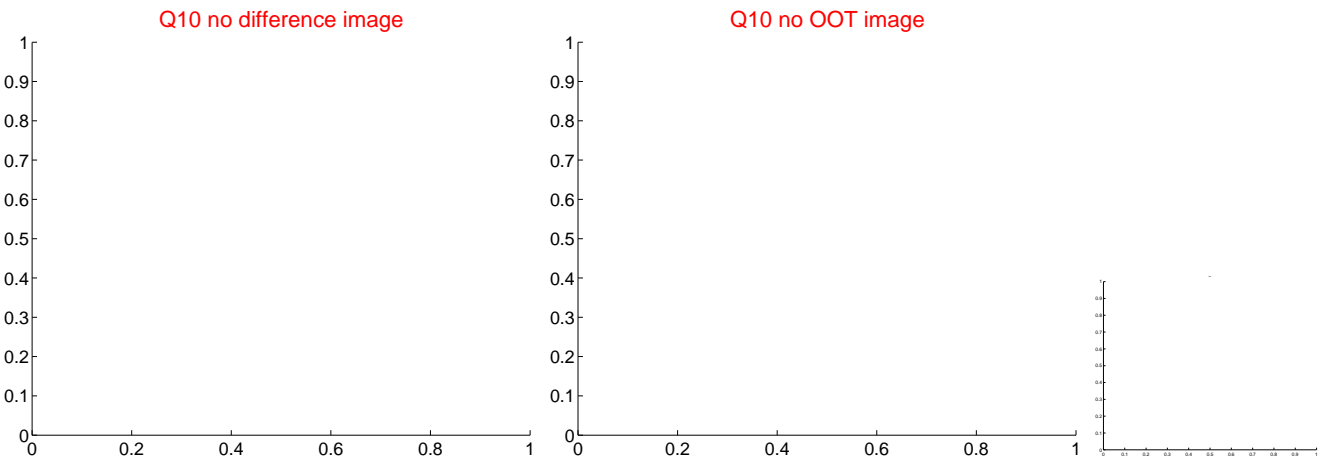
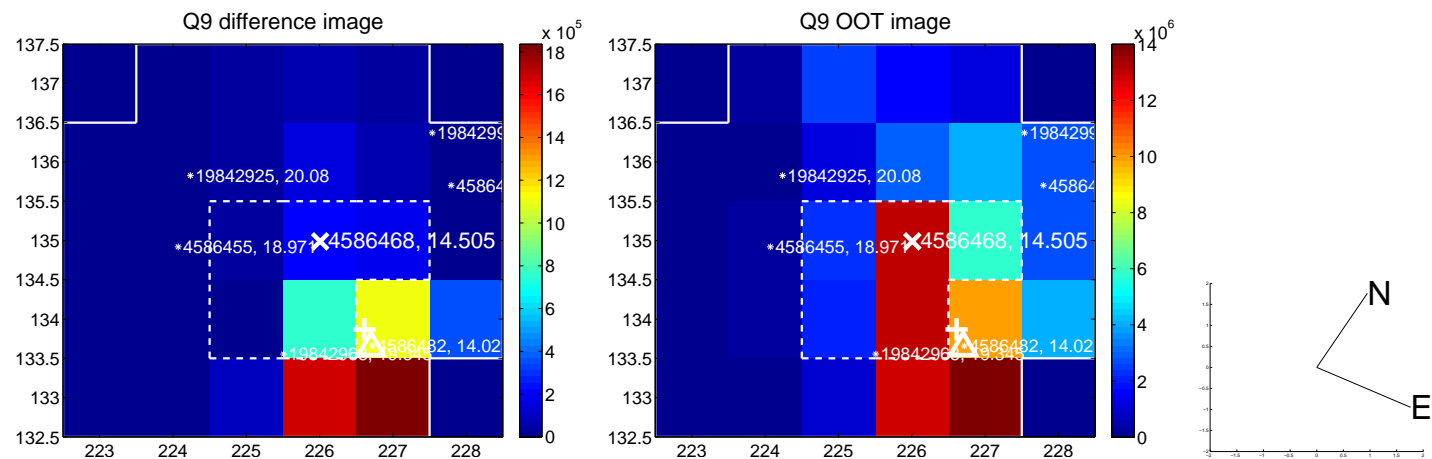
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



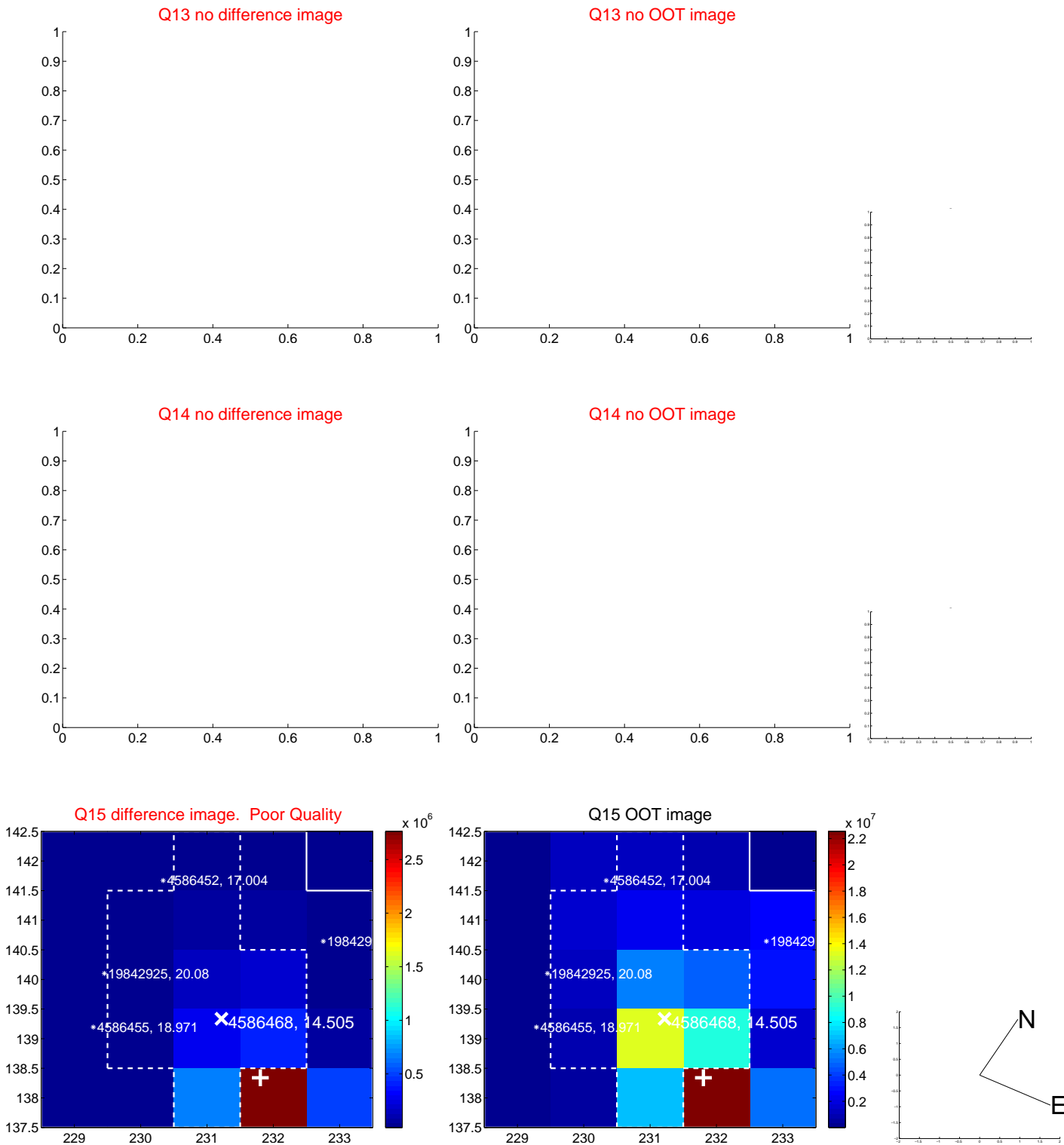
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



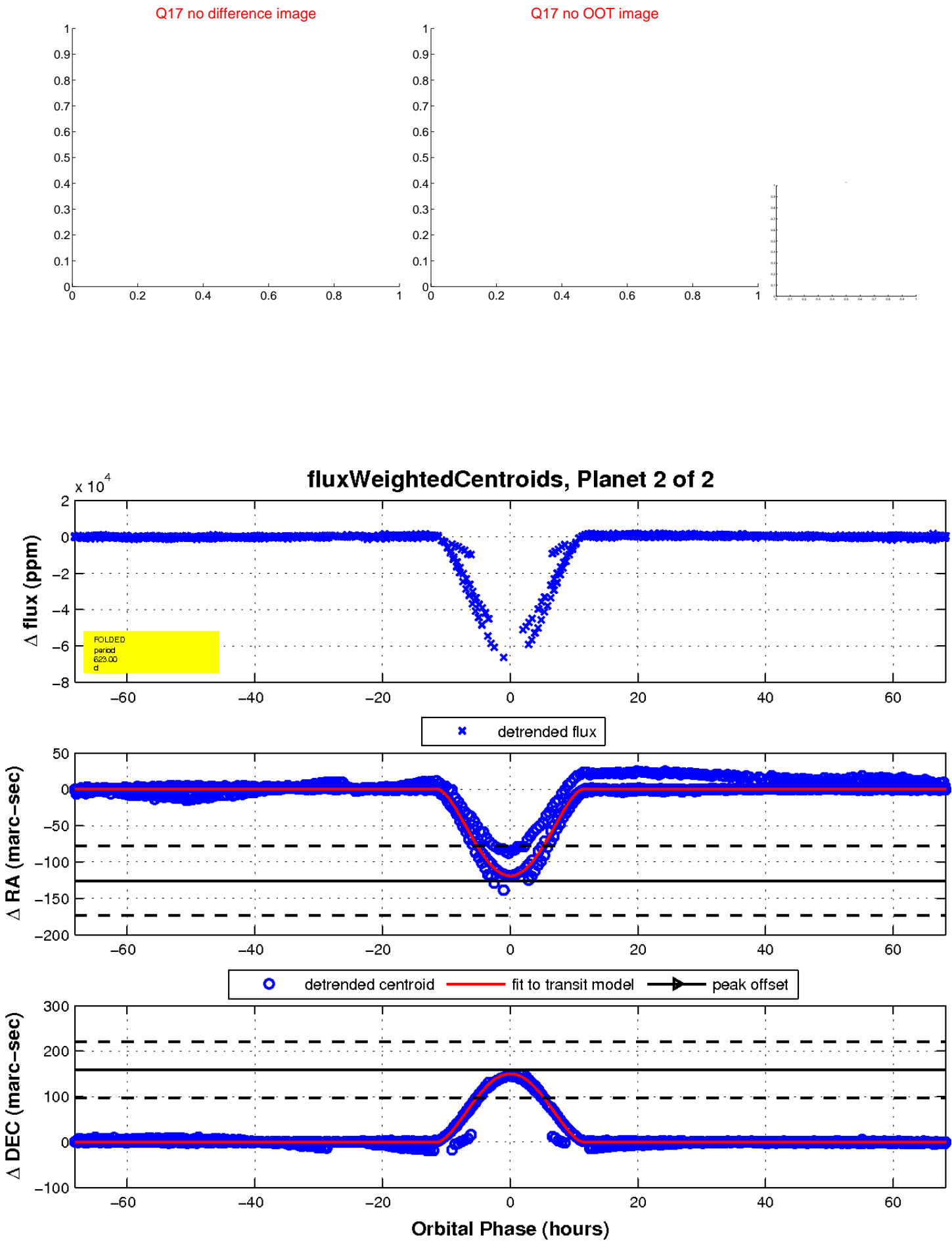
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



white ×: 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.



UKIRT Image

