

# KIC 010345478

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
010345478-01	OBS	0737.01	14.498389	139.184566	3236.4	3.765	112.1	113.3	0.73	5268	5.17	32.25
010345478-02	OBS	No	14.498364	133.550495	451.1	2.079	11.7	13.7	0.73	5268	1.80	32.25

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
010345478-01	OBS	FP	0.00	0	1	0	0	MOD_SEC_DV—MOD_SEC_ALT—HAS_SEC_TCE
010345478-02	OBS	FP	0.00	1	1	0	0	IS_SEC_TCE

**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 010345478-01

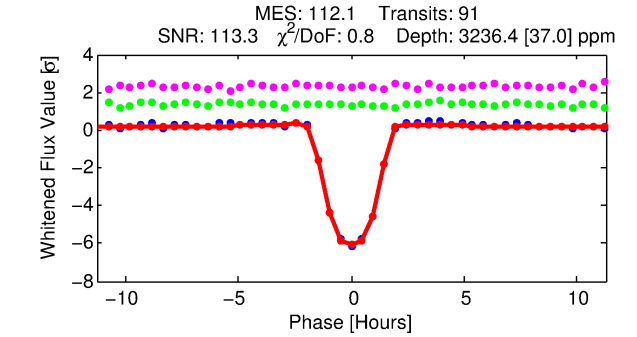
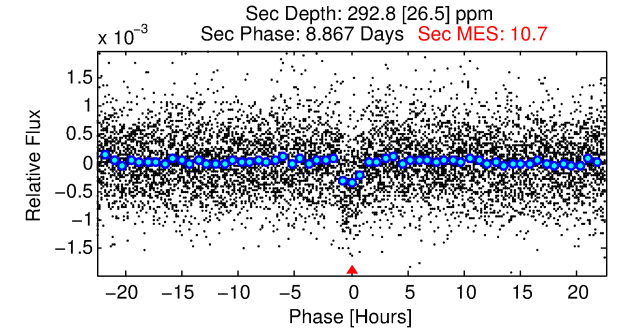
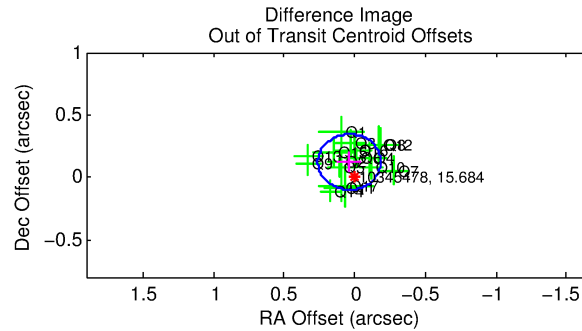
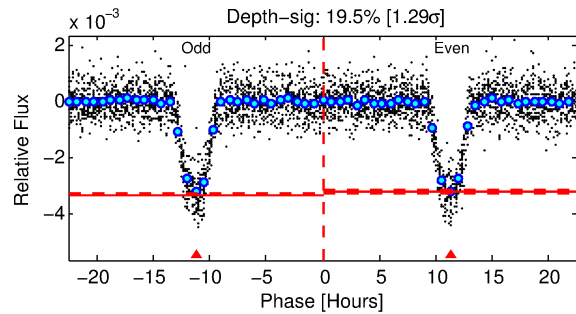
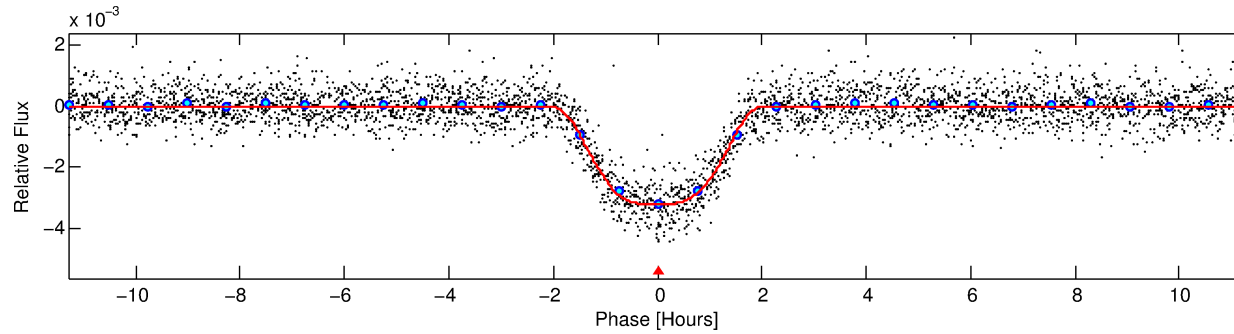
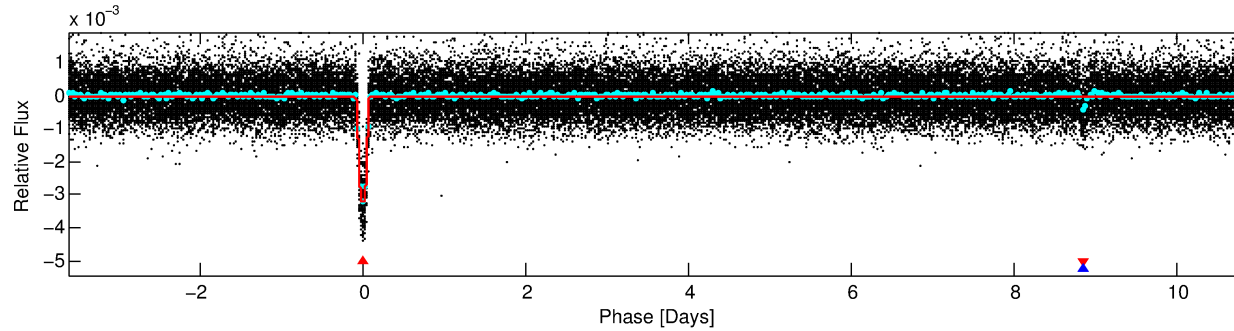
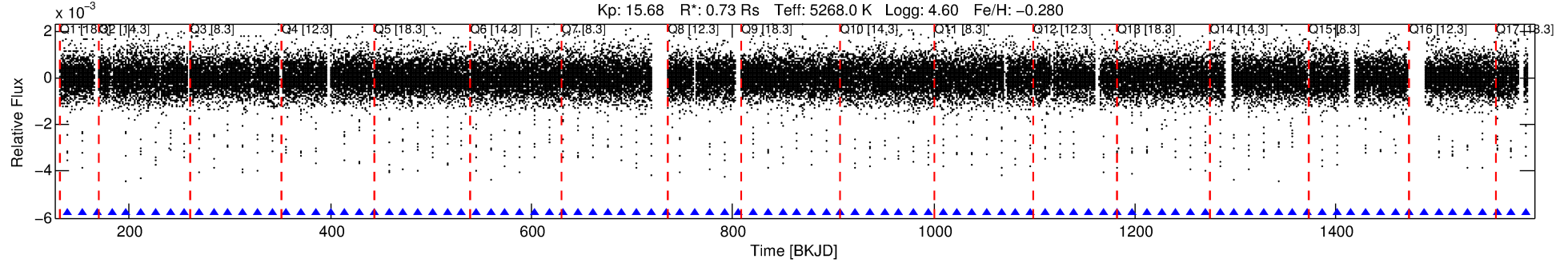
No Significant Match Found

# DV One-Page Summary

KIC: 10345478 Candidate: 1 of 2 Period: 14.498 d

KOI: K00737.01 Corr: 0.986

Kp: 15.68 R\*: 0.73 Rs Teff: 5268.0 K Logg: 4.60 Fe/H: -0.280



## DV Fit Results:

Period = 14.49839 [0.00001] d  
Epoch = 139.1846 [0.0008] BKJD  
Rp/R\* = 0.0644 [0.0007]  
a/R\* = 15.93 [0.39]  
b = 0.92 [0.00]  
Seff = 32.25 [6.56]  
Teq = 608 [31] K  
Rp = 5.17 [0.79] Re  
a = 0.1075 [0.0129] AU  
Ag = 69.75 [13.16] [5.22σ]  
Teffp = 2715 [103] K [19.58σ]

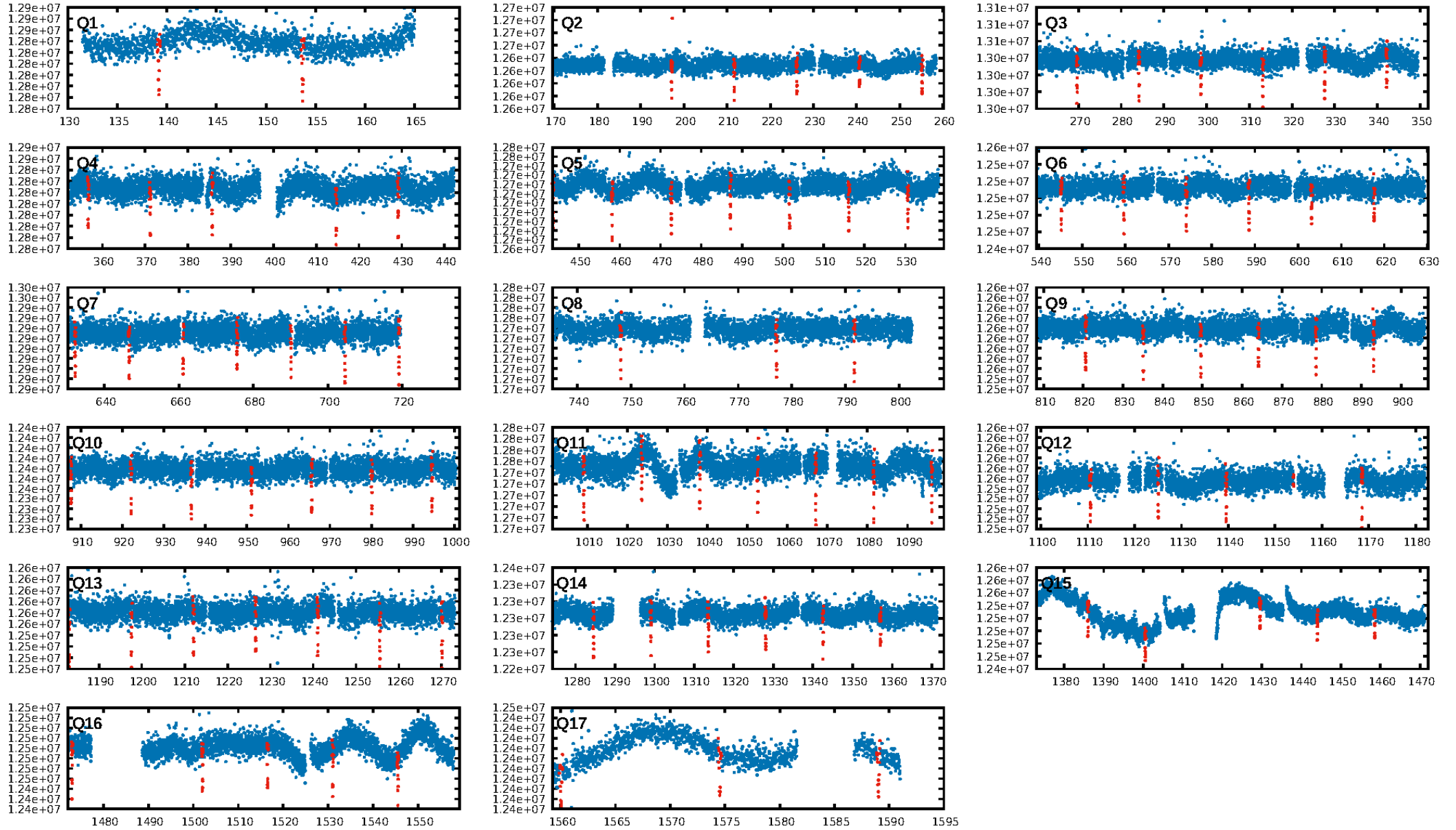
## DV Diagnostic Results:

ShortPeriod-sig: 0.0% [0.00σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 79.6%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 0.00e+00  
RollingBand-fgt: 1.00 [86/86]  
GhostDiagnostic-chr: 3.88  
Centroid-sig: 0.0%  
Centroid-so: 0.242 arcsec [2.08σ]  
OotOffset-rm: 0.127 arcsec [1.72σ]  
KicOffset-rm: 0.222 arcsec [2.89σ]  
OotOffset-st: 4/4/4/5 [17]  
KicOffset-st: 4/4/4/5 [17]  
DiffImageQuality-fgm: 1.00 [17/17]  
DiffImageOverlap-fno: 1.00 [17/17]

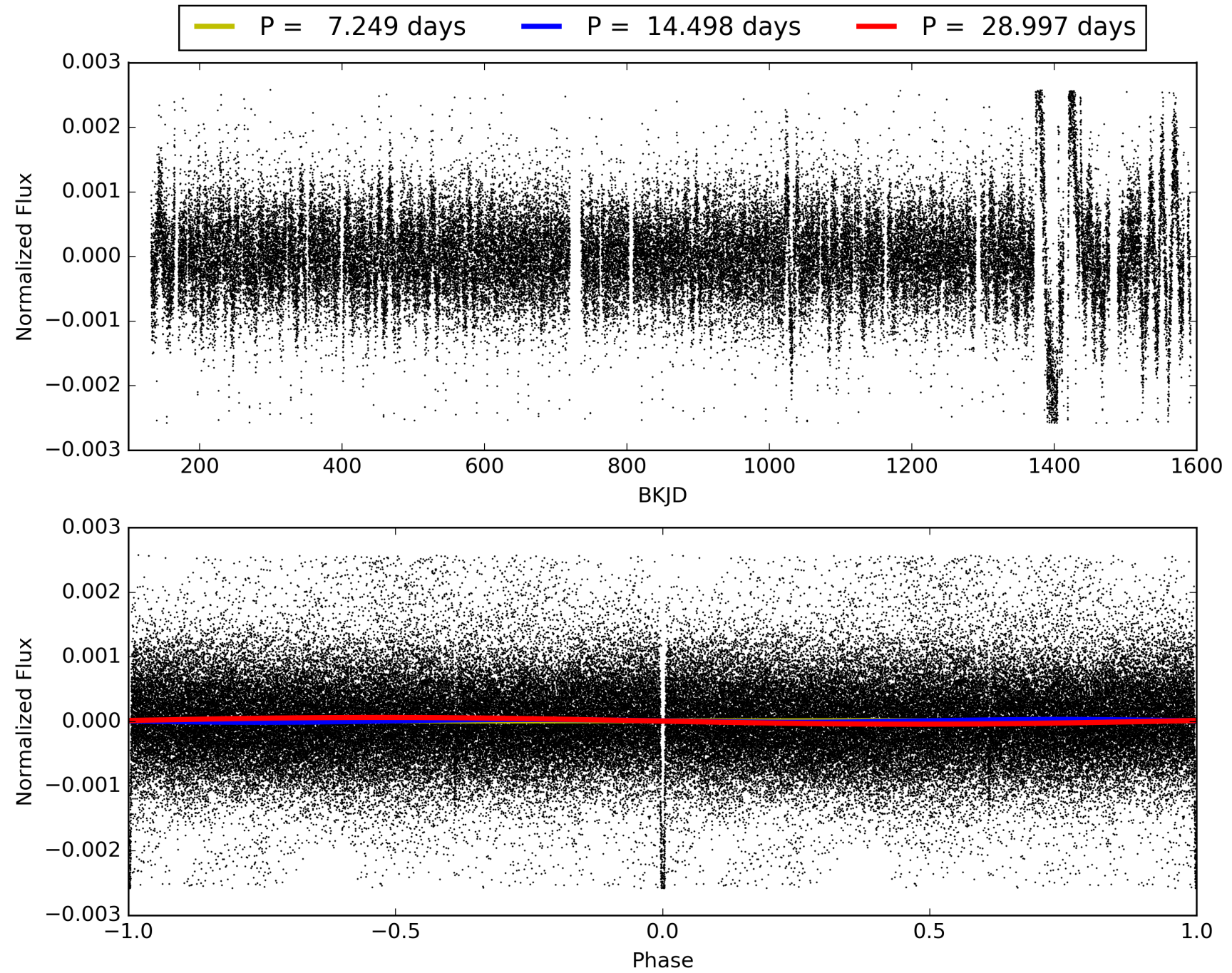
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 29-Jan-2016 20:07:43 Z

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

# TCE 010345478-01, PDC Light Curves

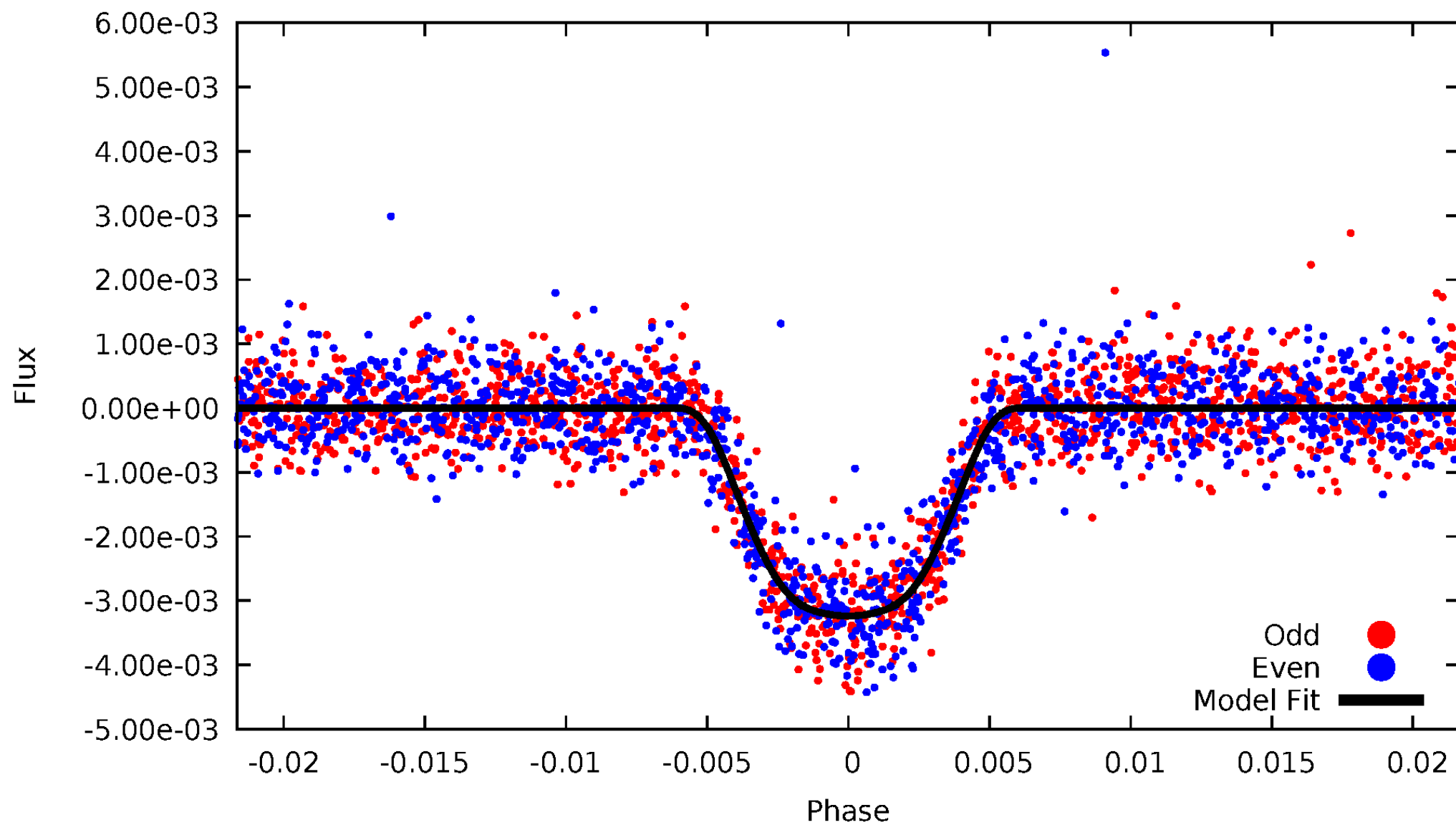


TCE 010345478-01



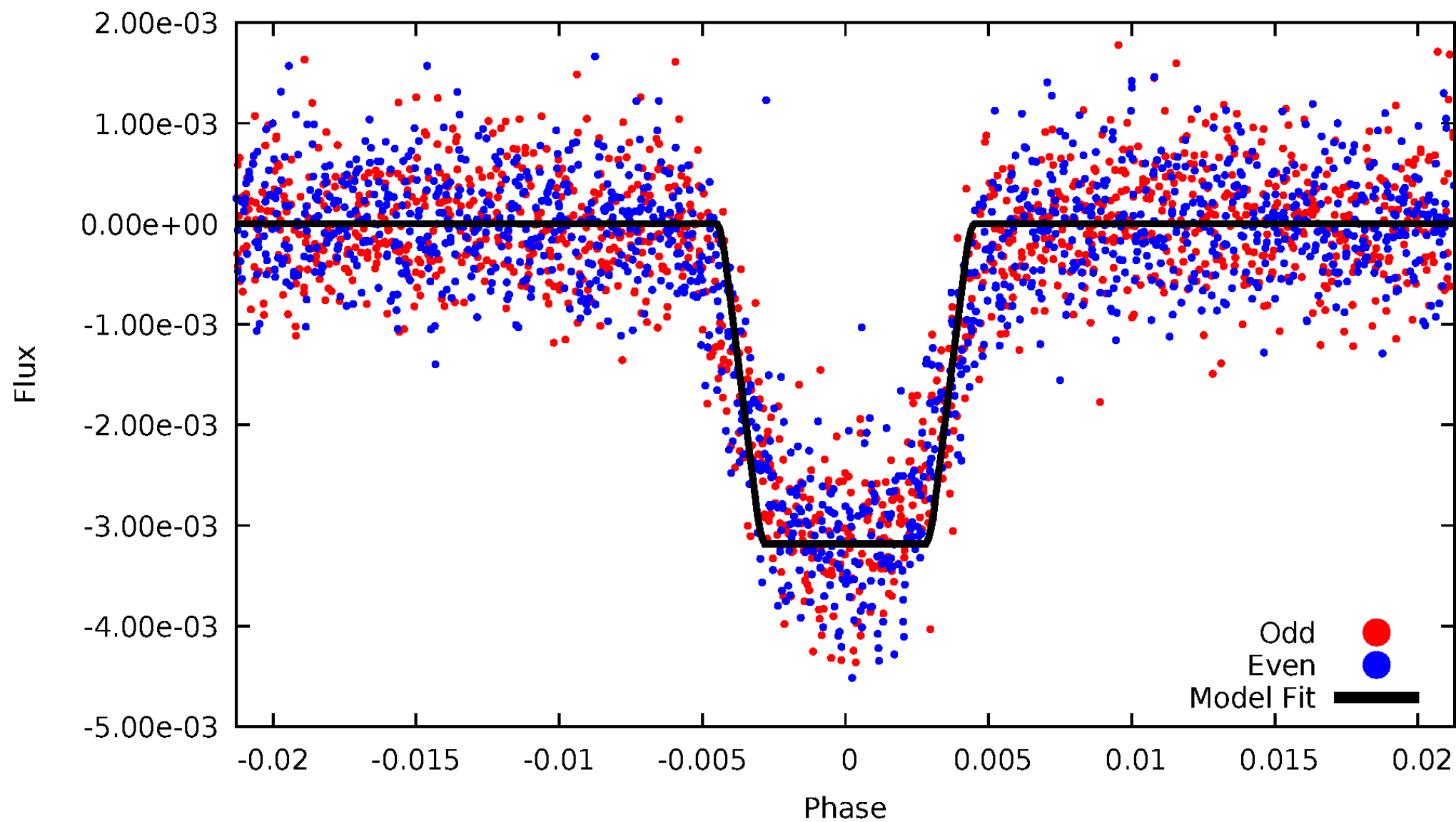
# DV Odd/Even

TCE 010345478-01



# ALT Odd/Even

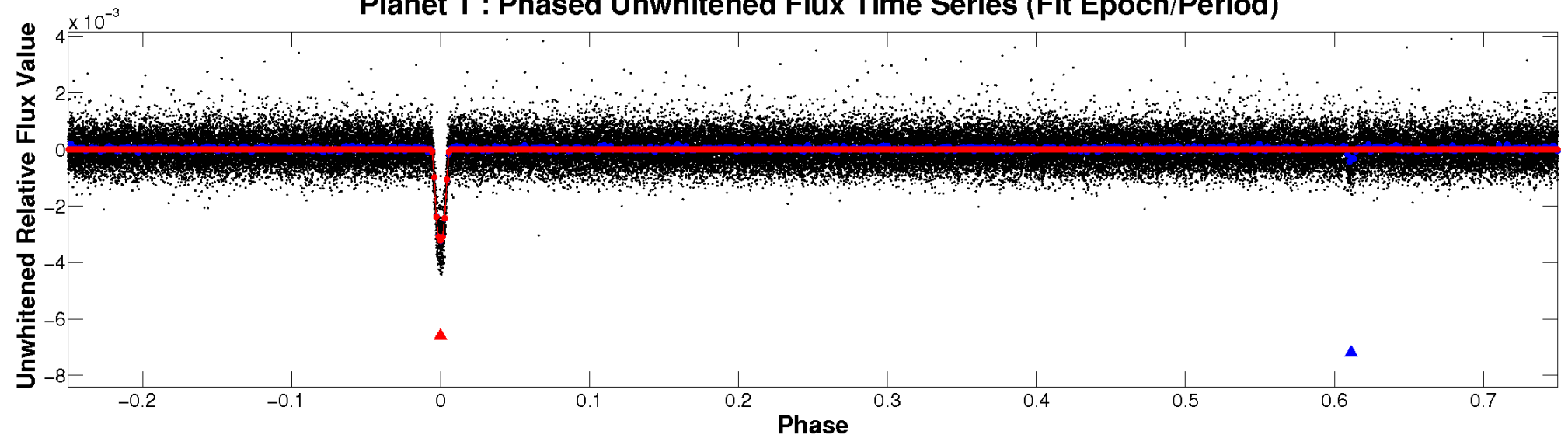
TCE 010345478-01



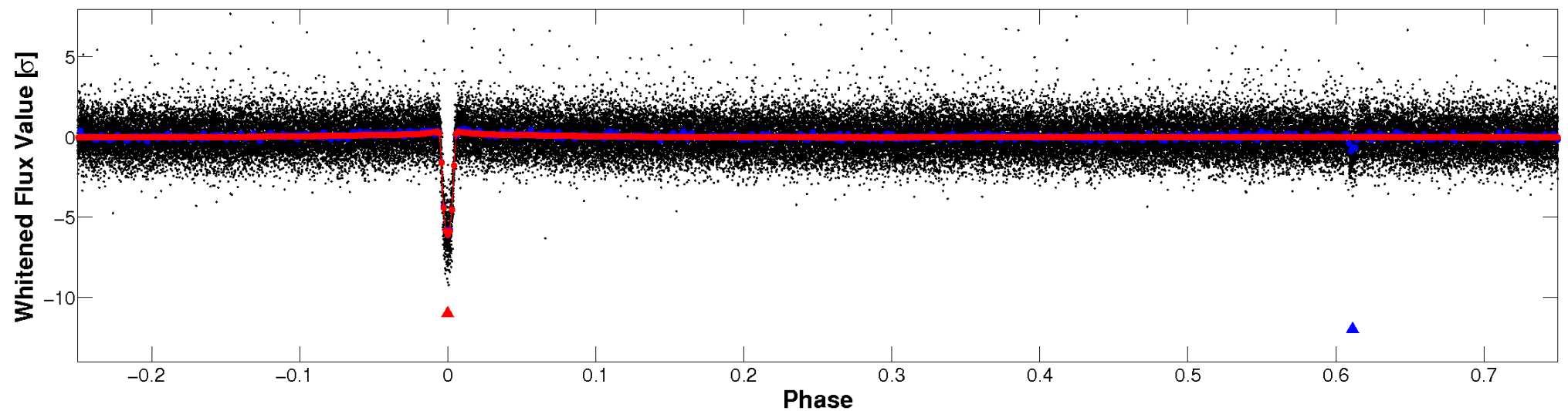


# Non-Whitened Vs. Whitened Light Curve

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

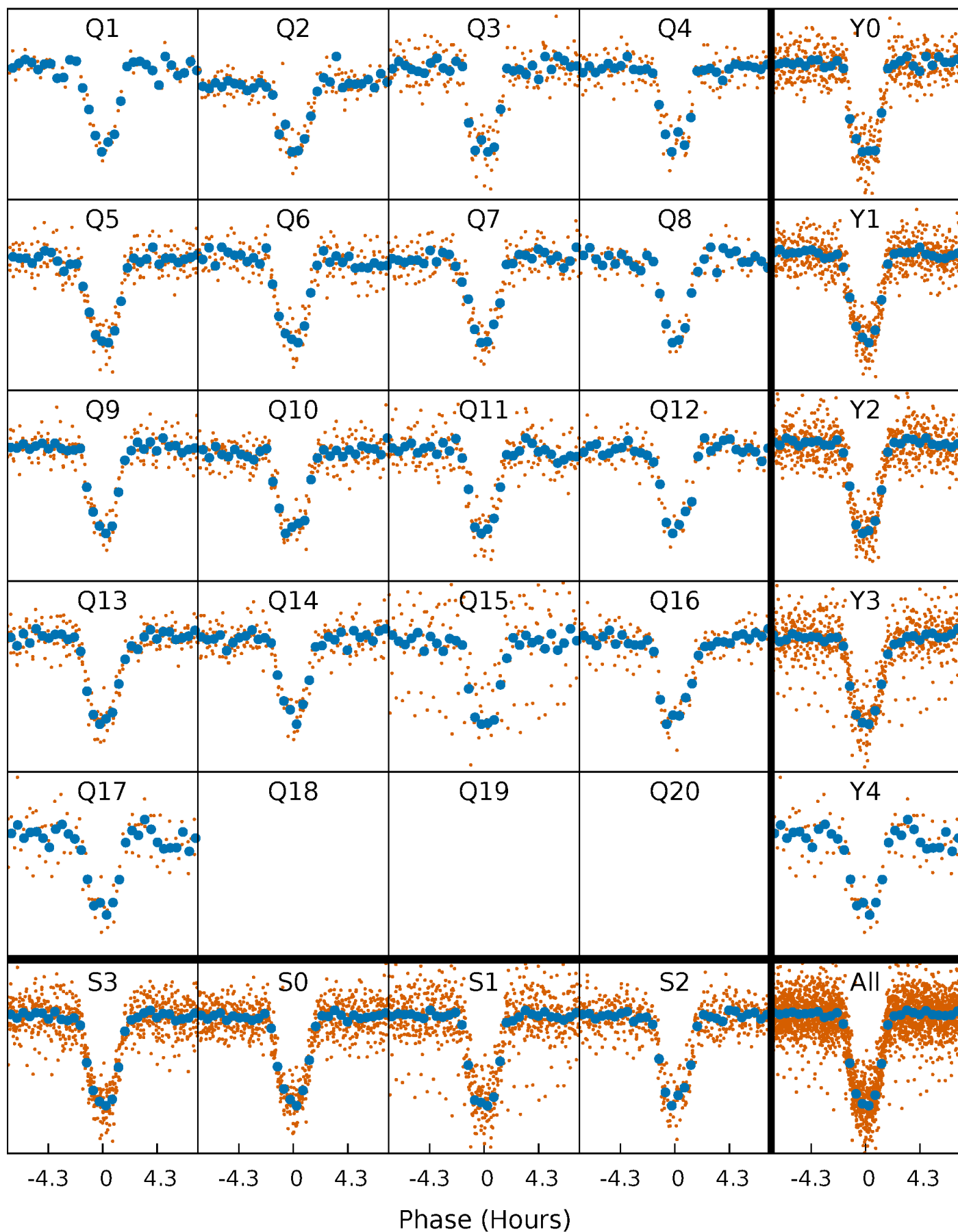


**Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



# PDC Quarter-Phased Transit Curves

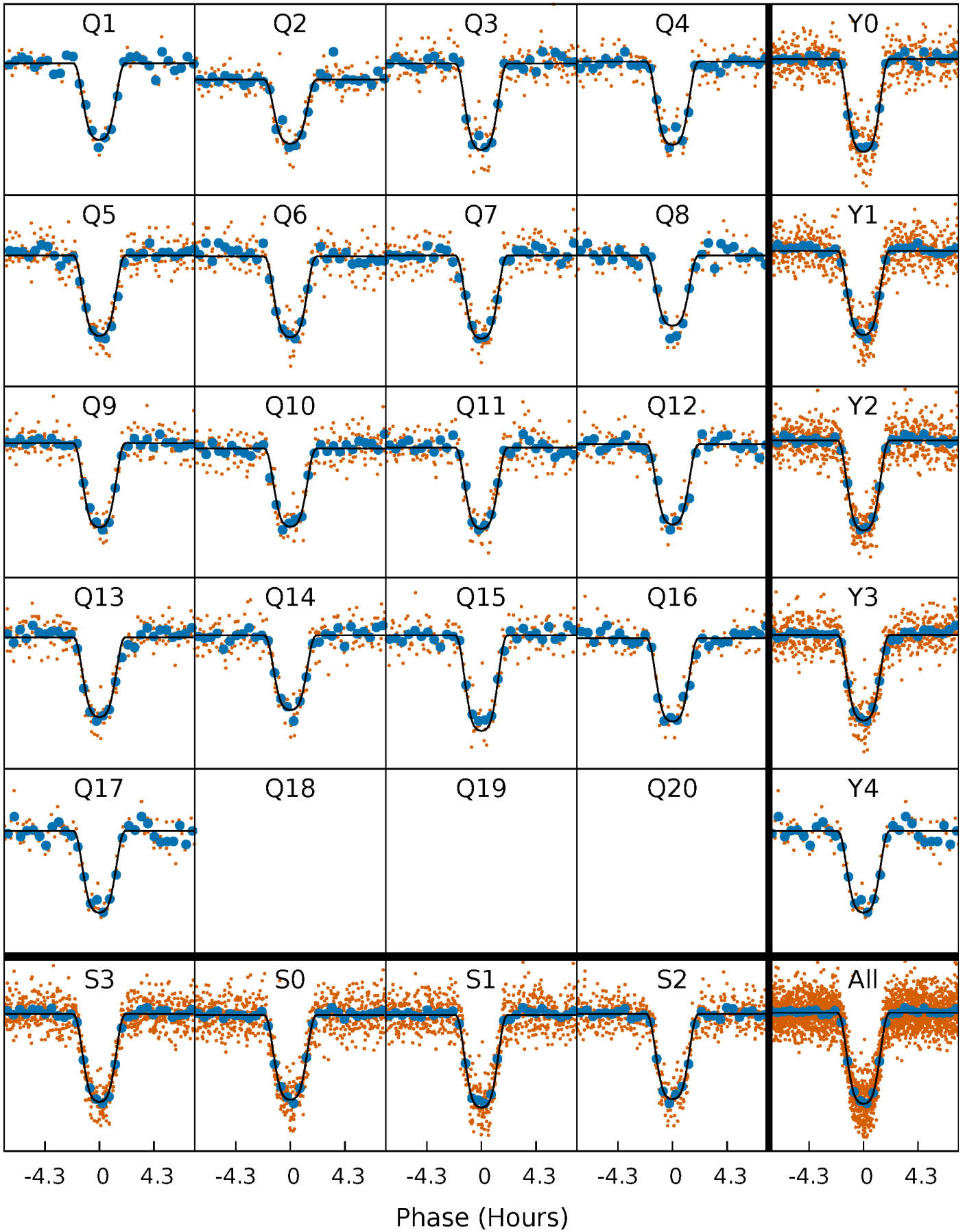
TCE 010345478-01 P= 14.498389 Days  $T_0=139.184566$  (BKJD)





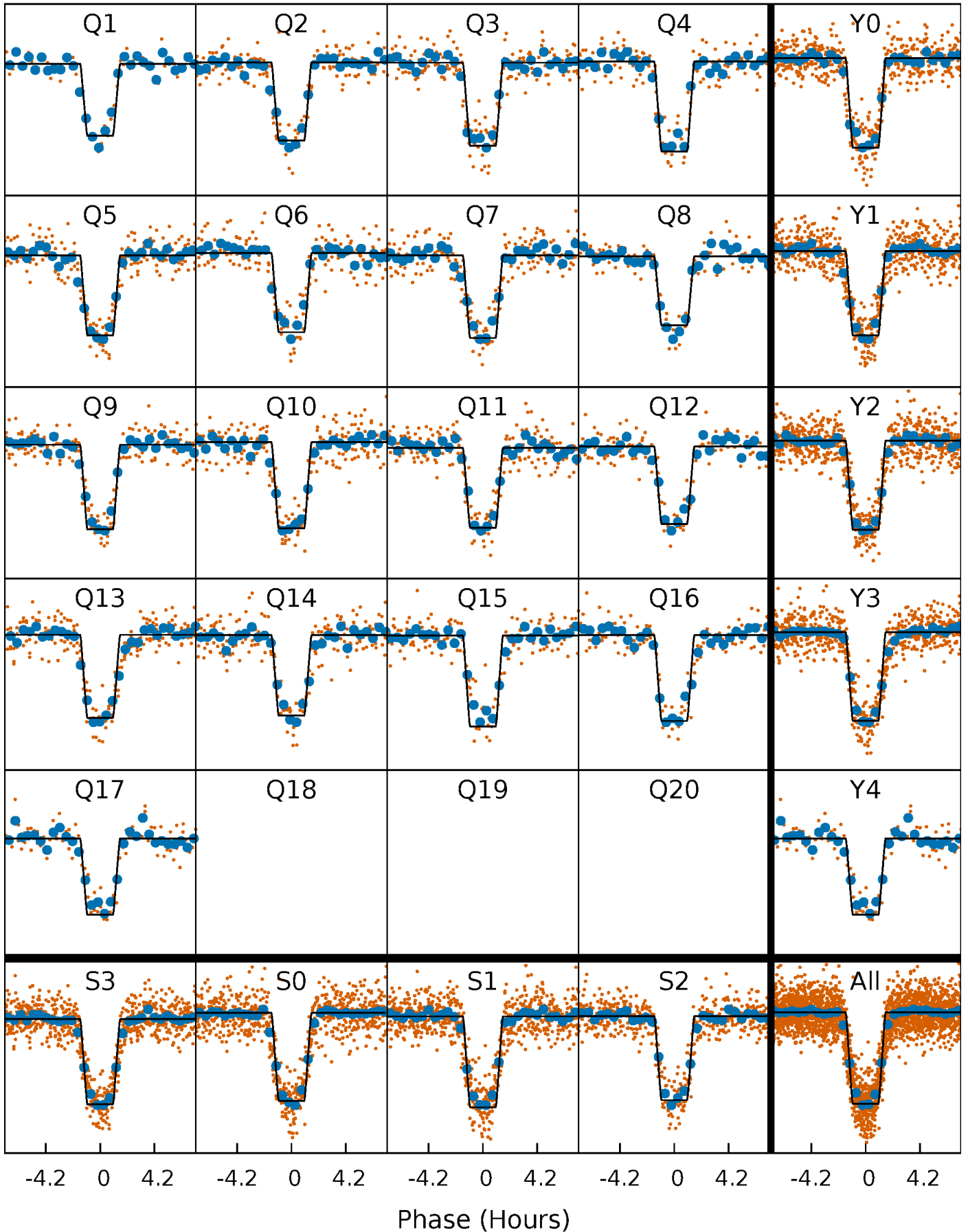
# DV Quarter-Phased Transit Curves

TCE 010345478-01 P= 14.498389 Days  $T_0=139.184566$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

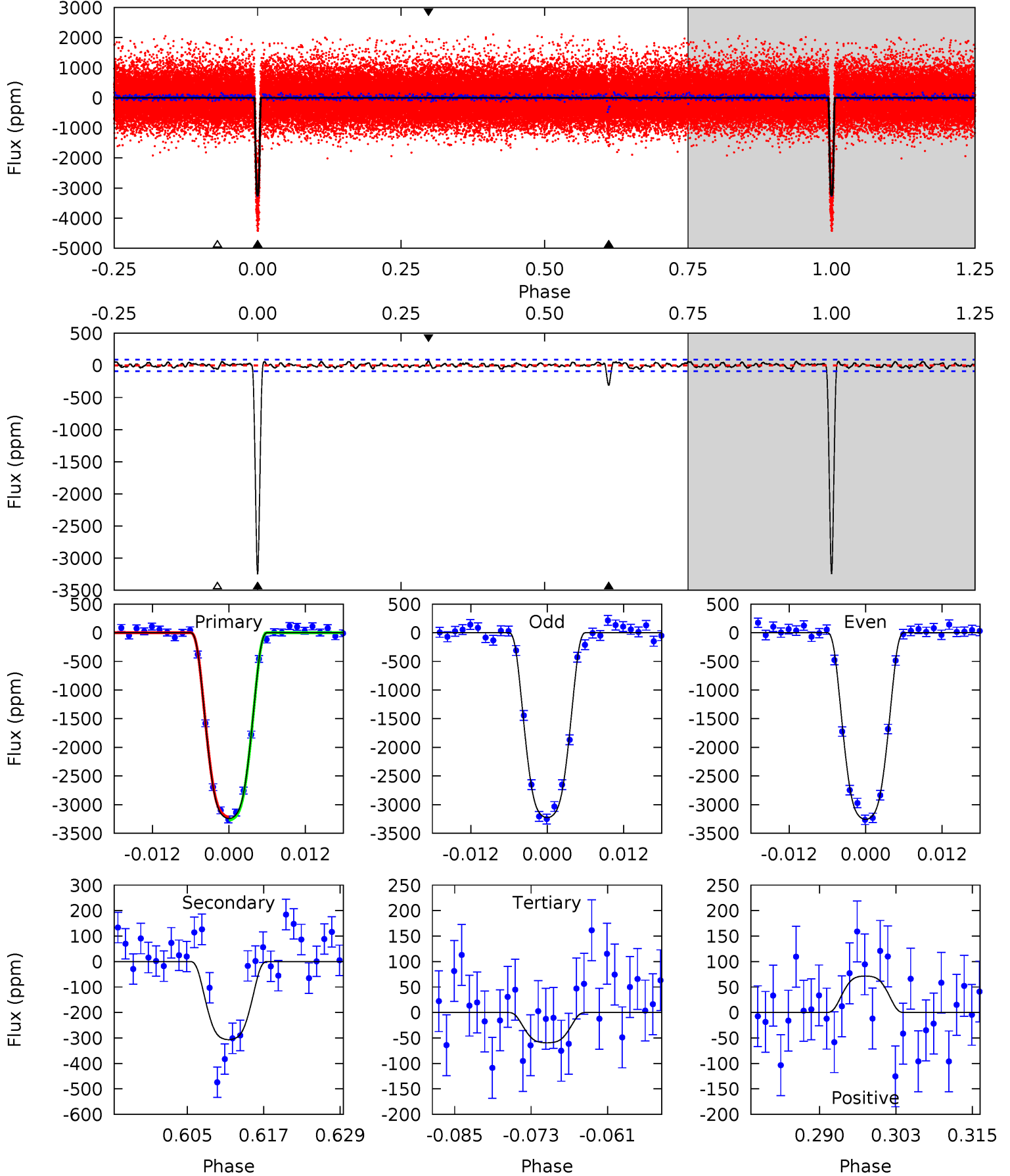
TCE 010345478-01 P= 14.498264 Days  $T_0=139.190970$  (BKJD)



# DV Model-Shift Uniqueness Test

010345478-01, P = 14.498389 Days, E = 124.686177 Days

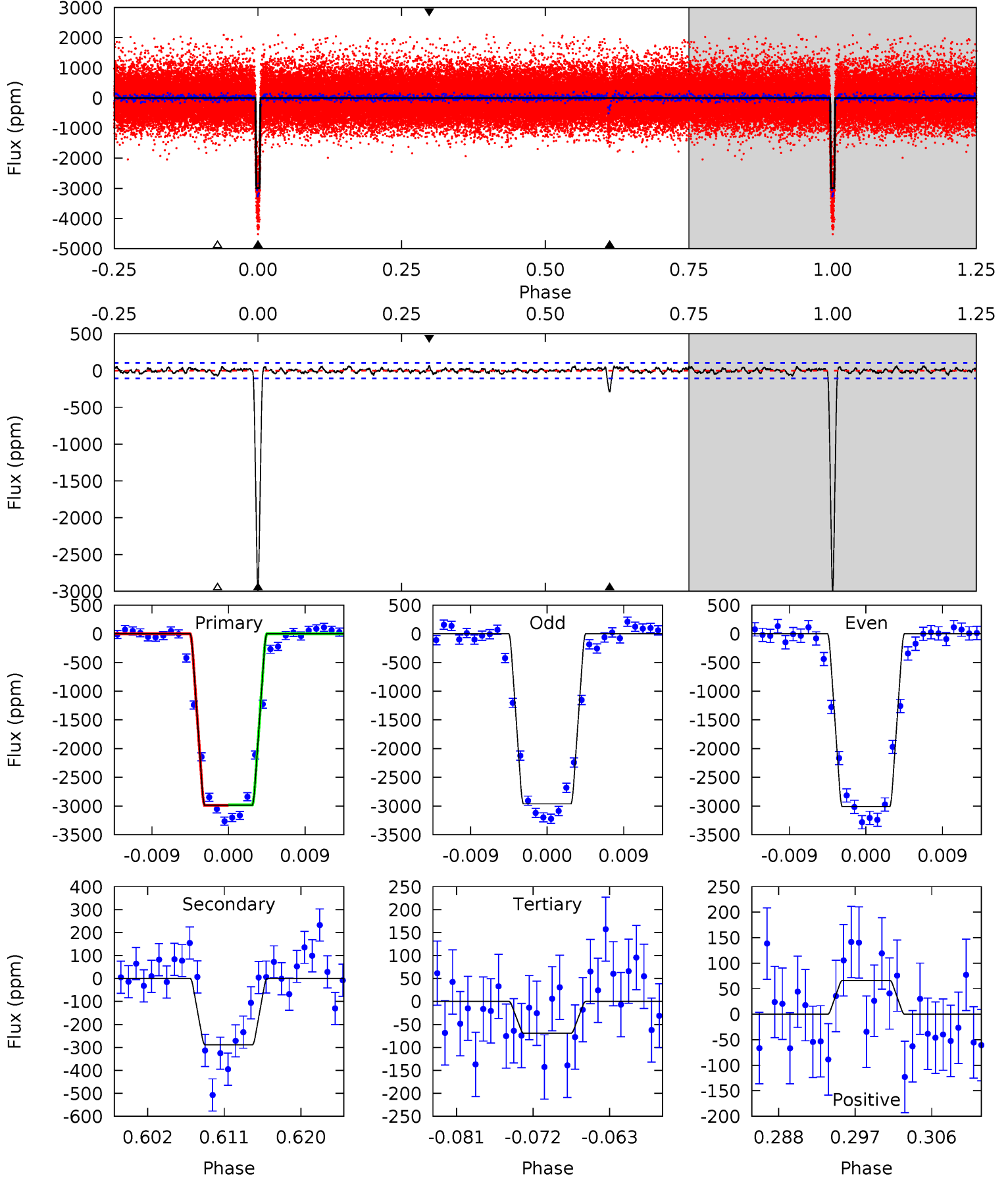
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
179.1	16.9	3.29	3.95	4.99	2.51	1.32	175.8	175.1	13.6	13.0	0.85	0.99	0.02	1.46



# Alt Model-Shift Uniqueness Test

010345478-01, P = 14.498264 Days, E = 124.692706 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
143.2	13.9	3.32	3.18	5.05	2.61	1.05	139.9	140.1	10.5	10.7	1.10	0.99	0.02	0.23



### Stellar Parameters For KIC 010345478

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M$ ( $M_{\odot}$ )	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$5268^{+158}_{-158}$	$4.602^{+0.039}_{-0.084}$	$-0.280^{+0.300}_{-0.300}$	$0.735^{+0.112}_{-0.060}$	$0.789^{+0.085}_{-0.078}$	$2.804^{+0.541}_{-0.783}$
	+3%/-3%	+1%/-2%	+107%/-107%	+15%/-8%	+11%/-10%	+19%/-28%
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 010345478-01 / KOI 0737.01

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	$-307 \pm 18$	$5.21^{+0.44}_{-0.27}$	$857^{+38}_{-30}$	$3285^{+82}_{-67}$	$71^{+8}_{-9}$
Alt.	$-289 \pm 21$	$4.56^{+0.37}_{-0.23}$	$859^{+35}_{-33}$	$3391^{+73}_{-81}$	$86^{+11}_{-10}$

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

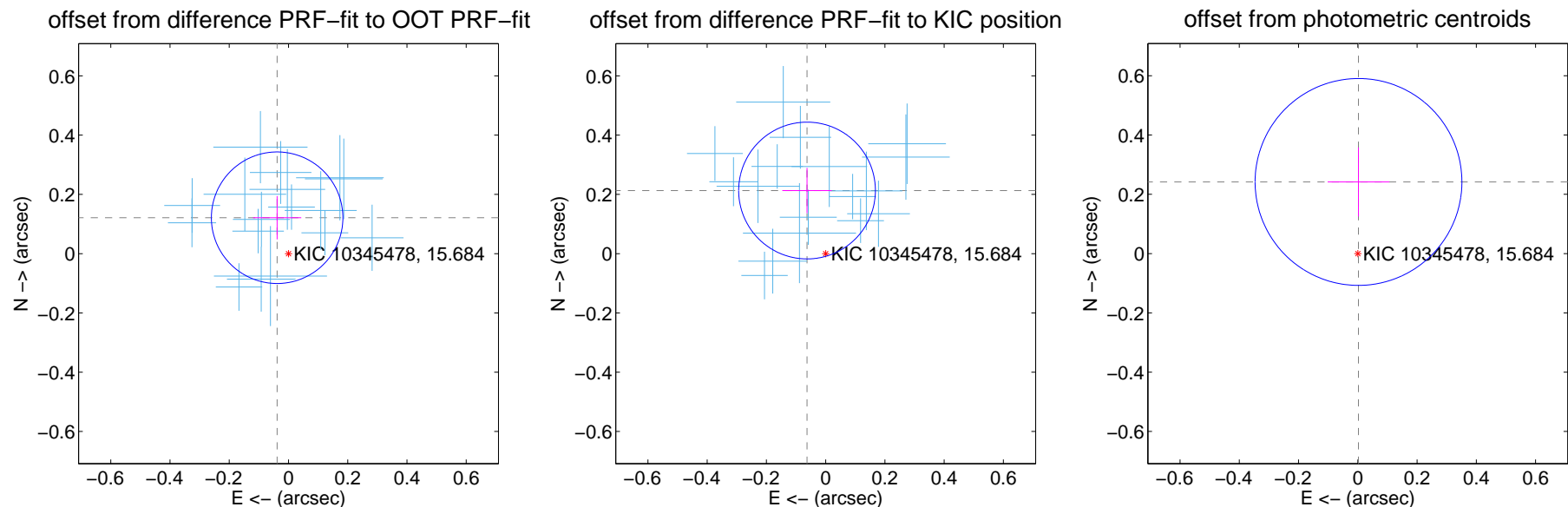
## DV Centroid Data

Supplemental centroid analysis for 010345478-01. Kepler magnitude: 15.68. Transit SNR 113.33

There are 17 quarters with good PRF difference image offsets

The direct PRF centroid is offset from the target star catalog position by about 0.15 arcsec

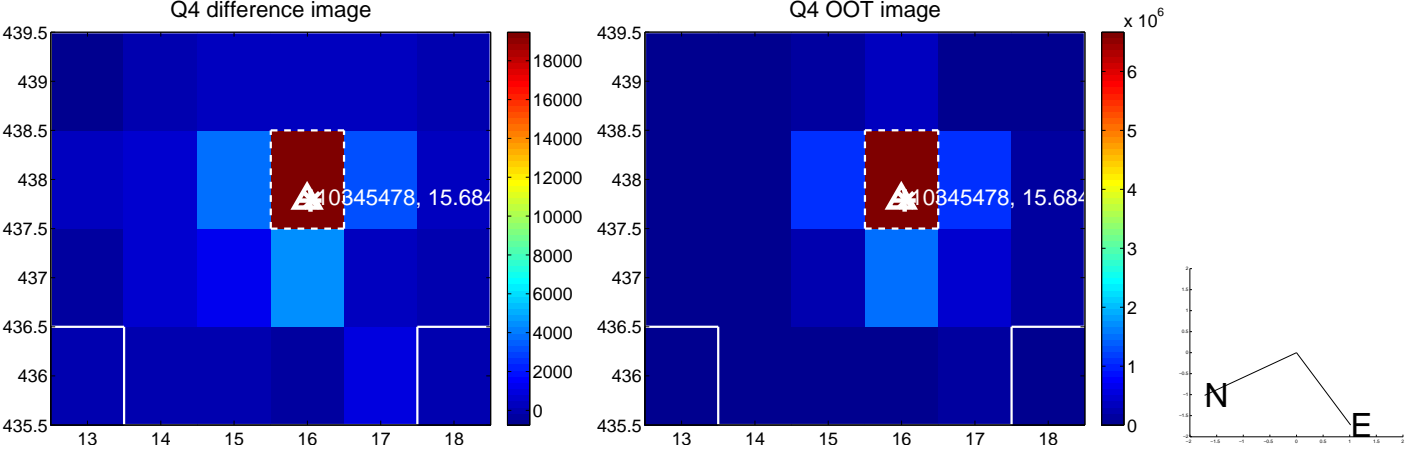
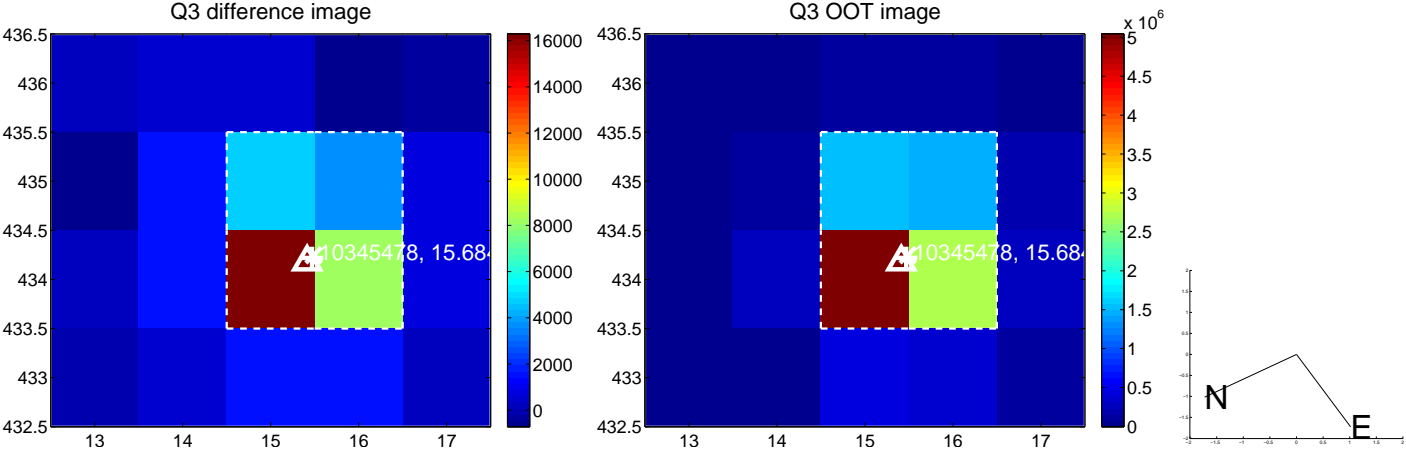
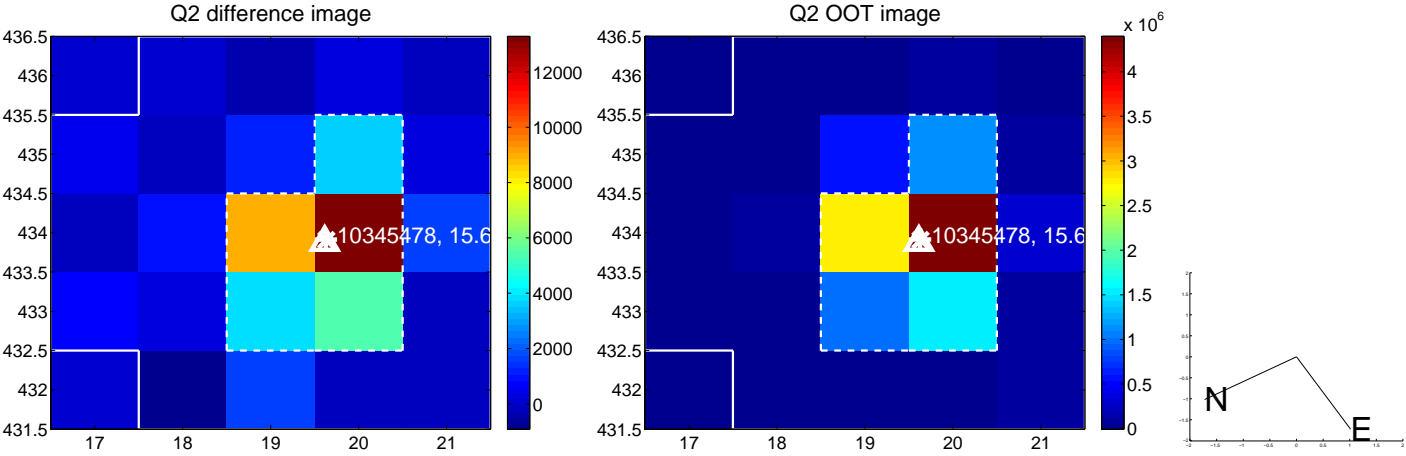
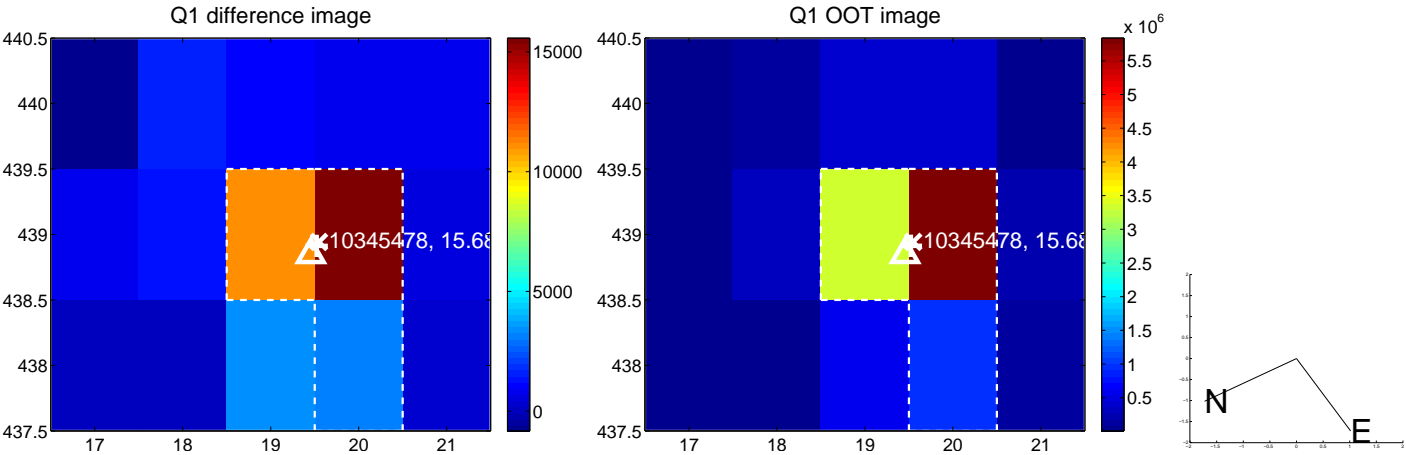
	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.127 \pm 0.074$	1.72	$0.038 \pm 0.082$	$0.121 \pm 0.073$
PRF-fit source offset from KIC position	$0.222 \pm 0.077$	2.89	$0.063 \pm 0.084$	$0.213 \pm 0.076$
photometric centroid source offset	$0.24 \pm 0.12$	2.08	$-0.00 \pm 0.10$	$0.24 \pm 0.12$



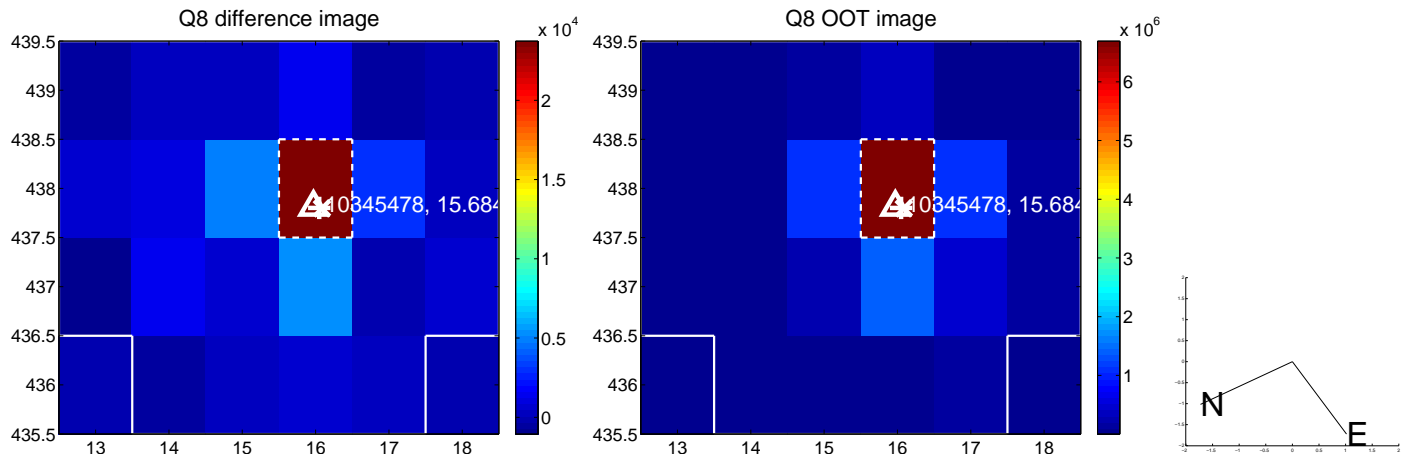
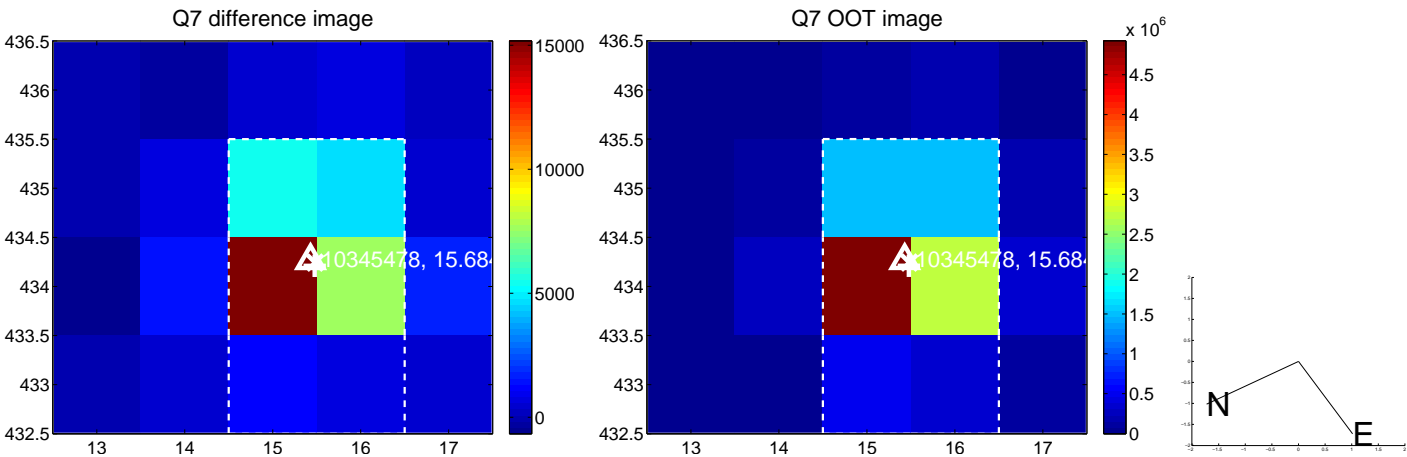
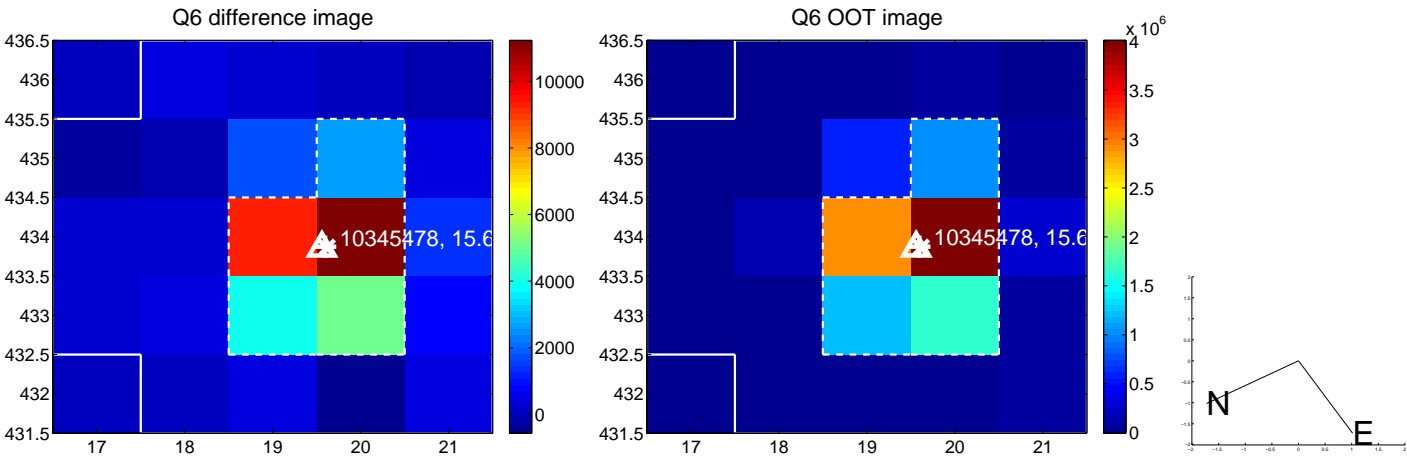
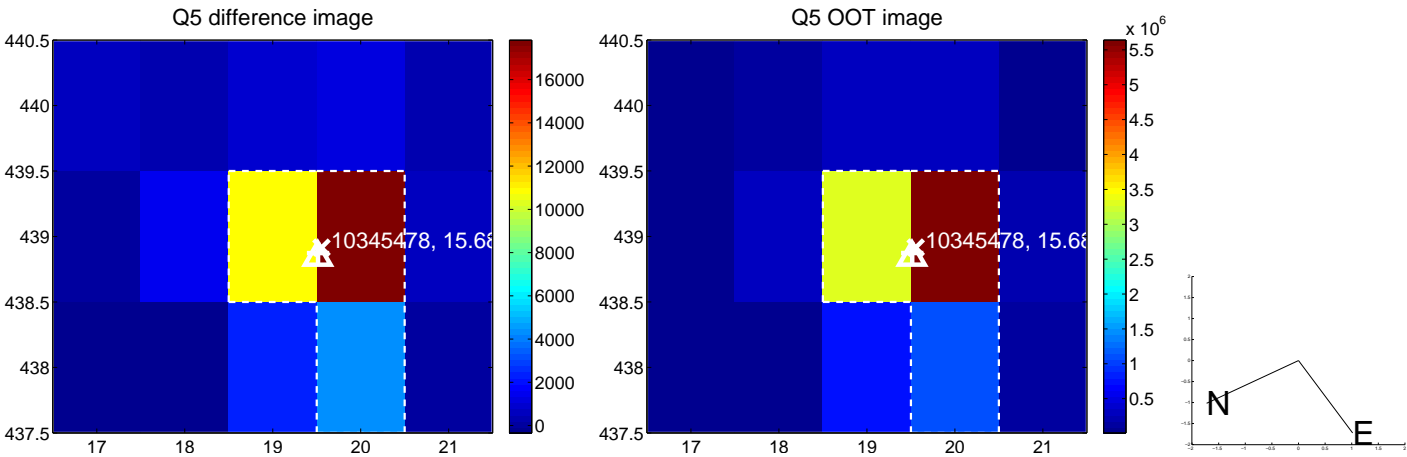
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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



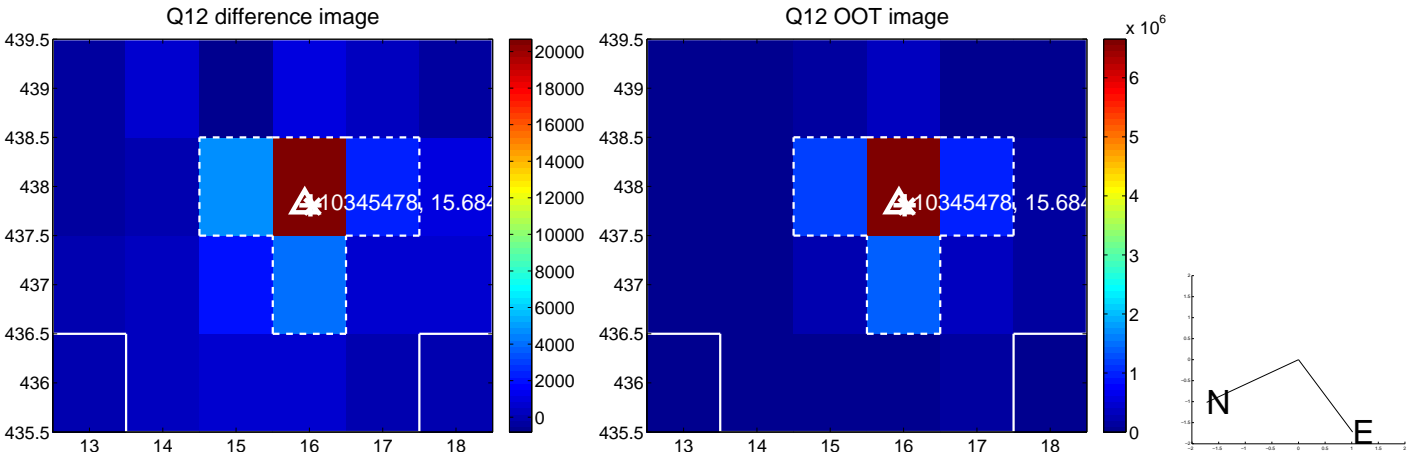
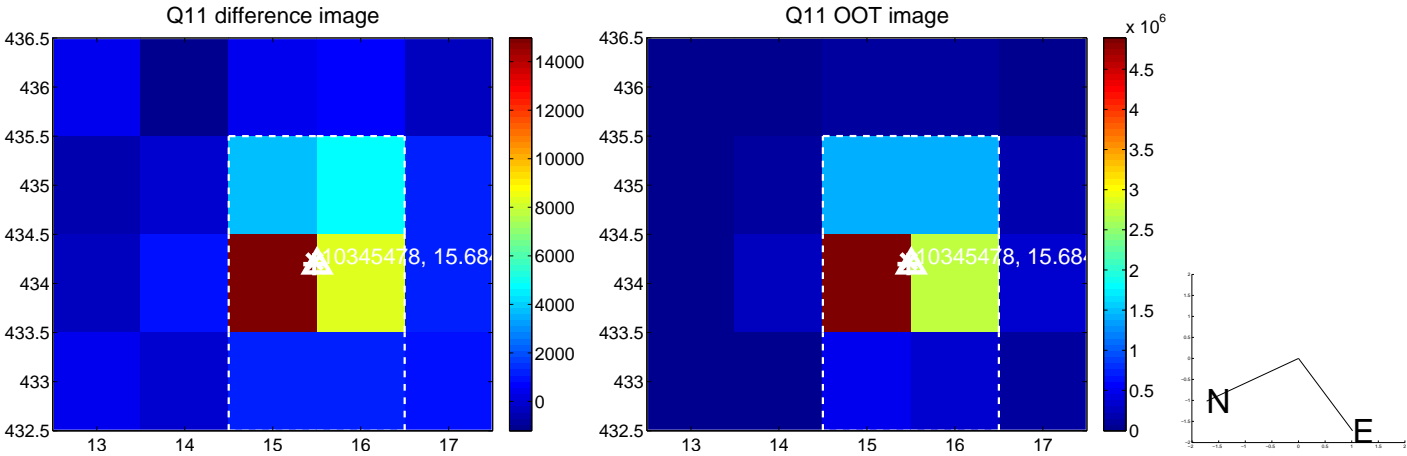
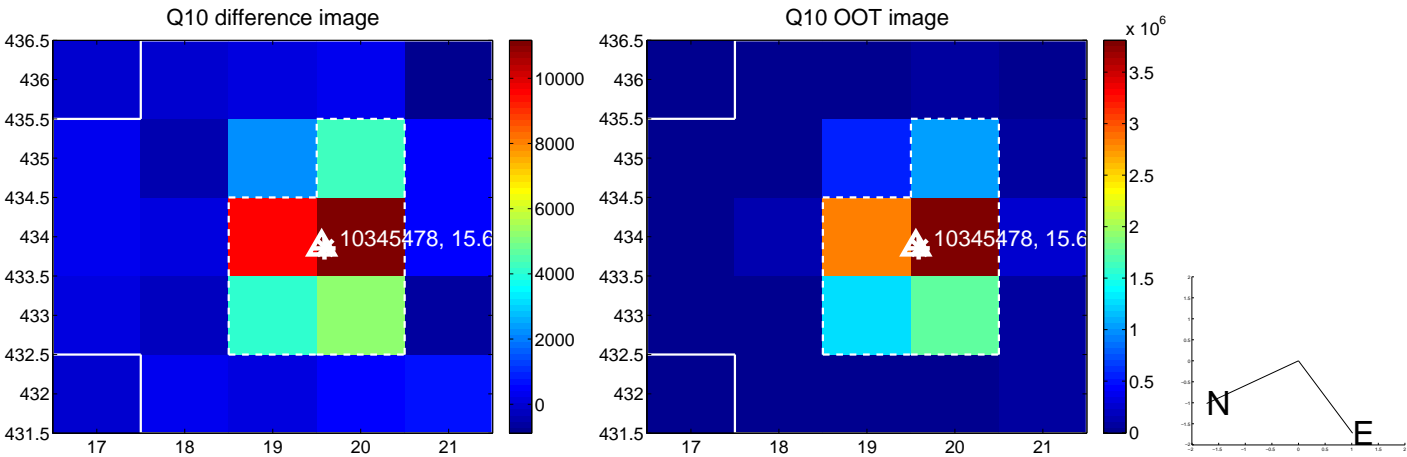
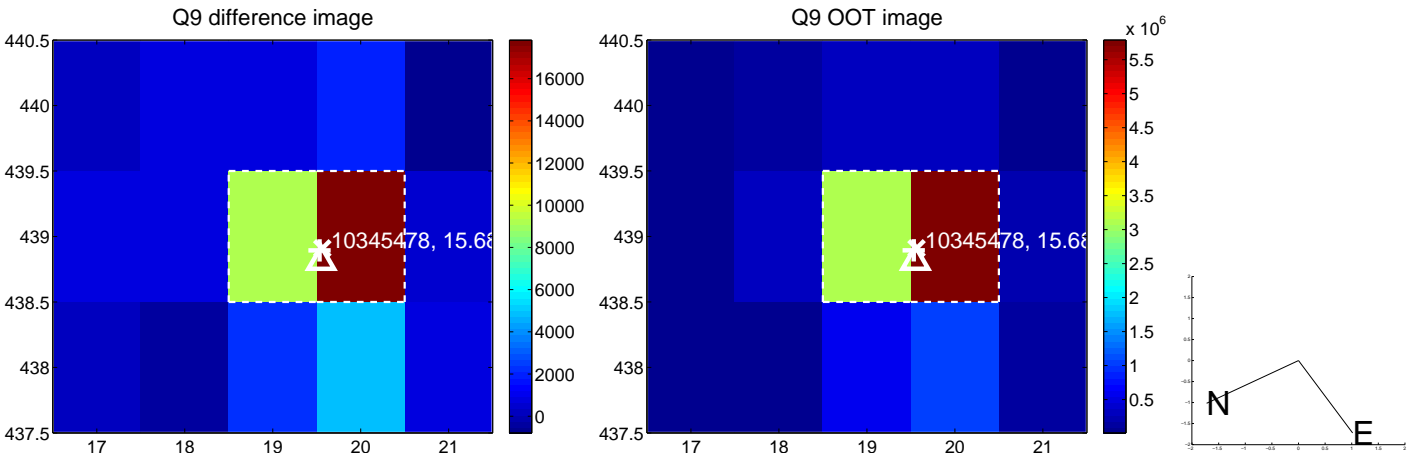
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



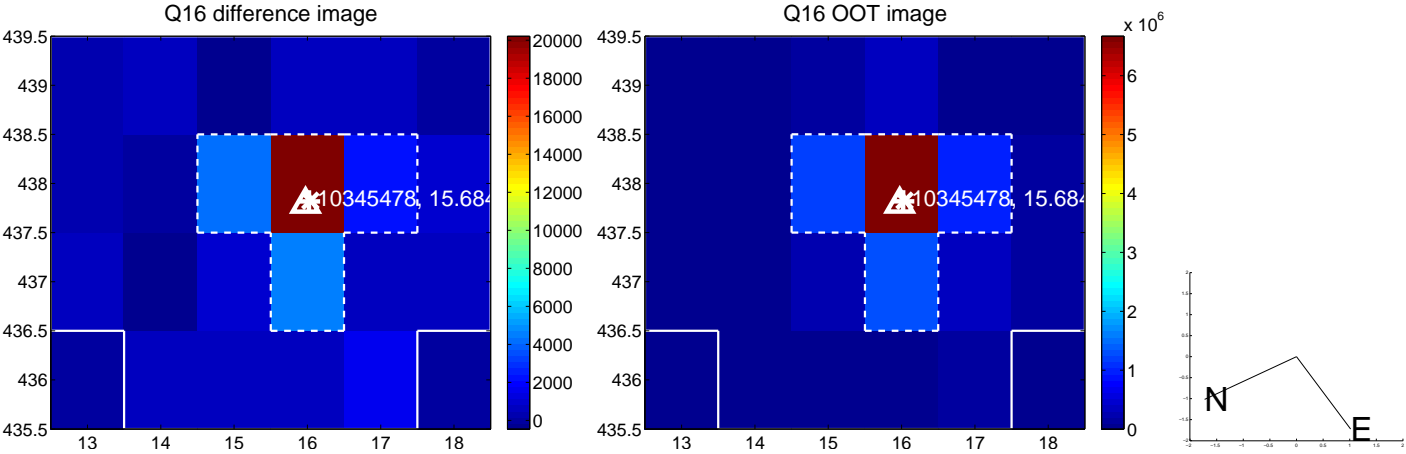
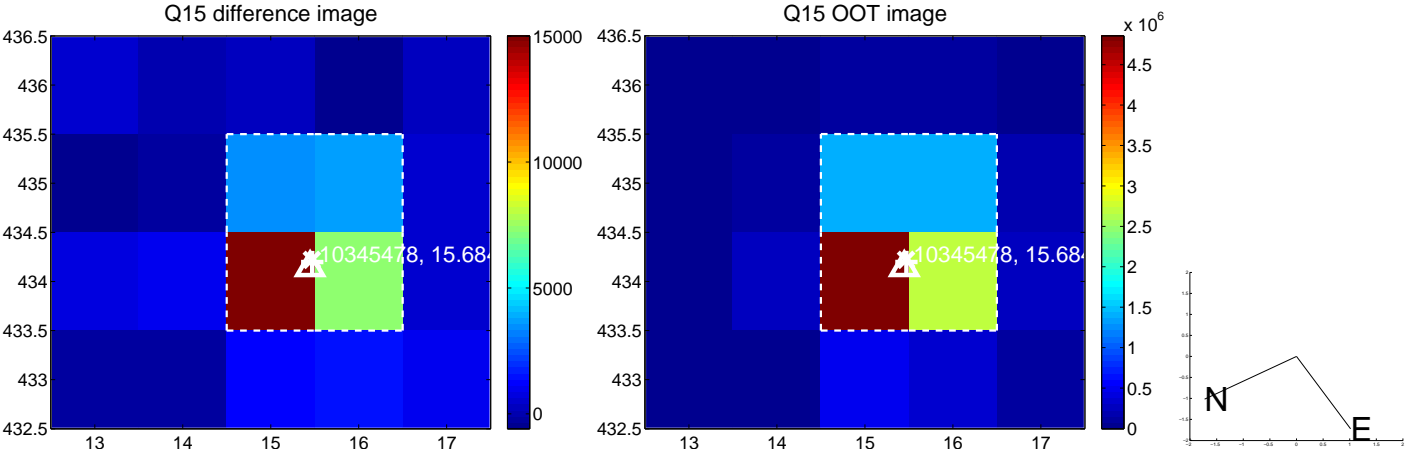
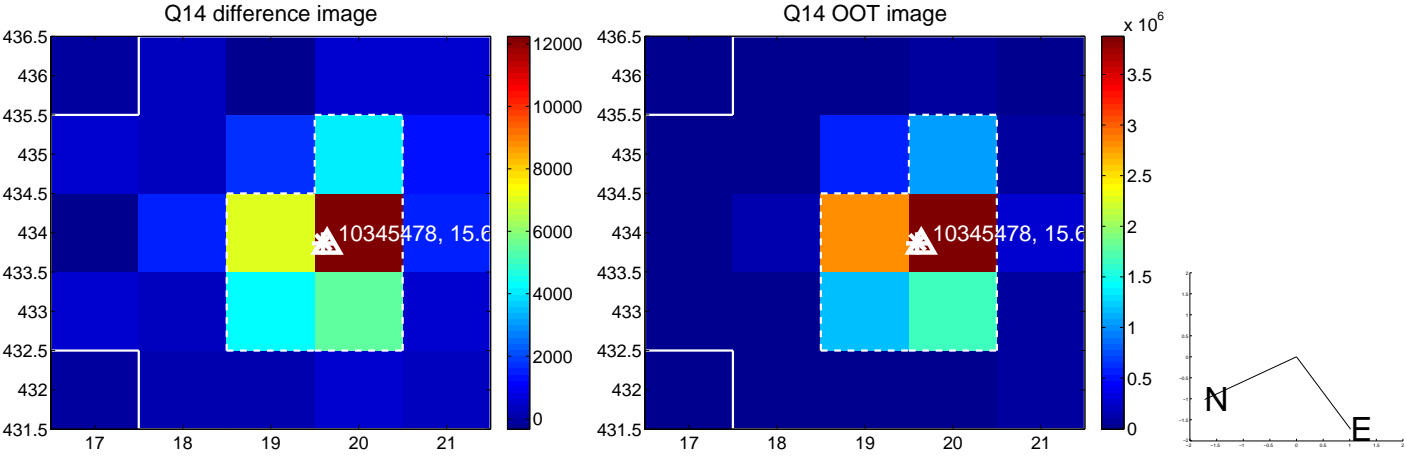
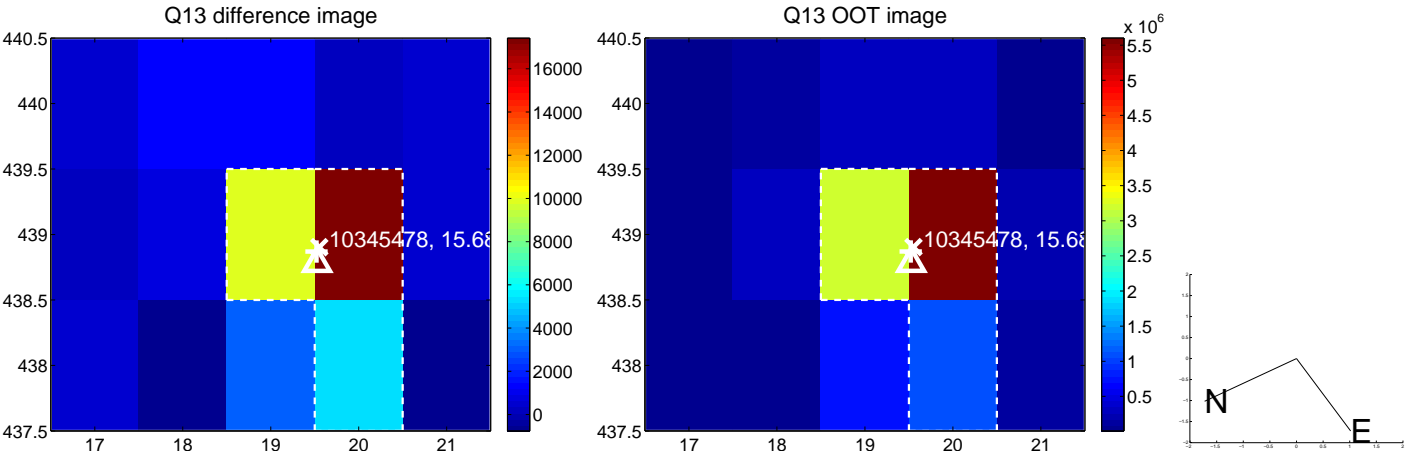
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



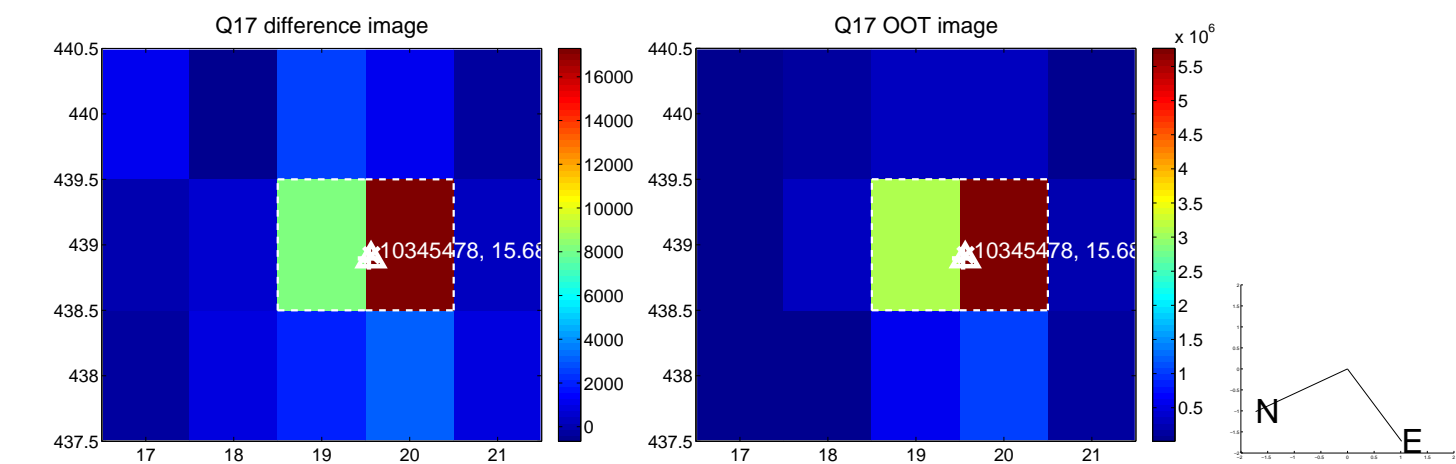
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



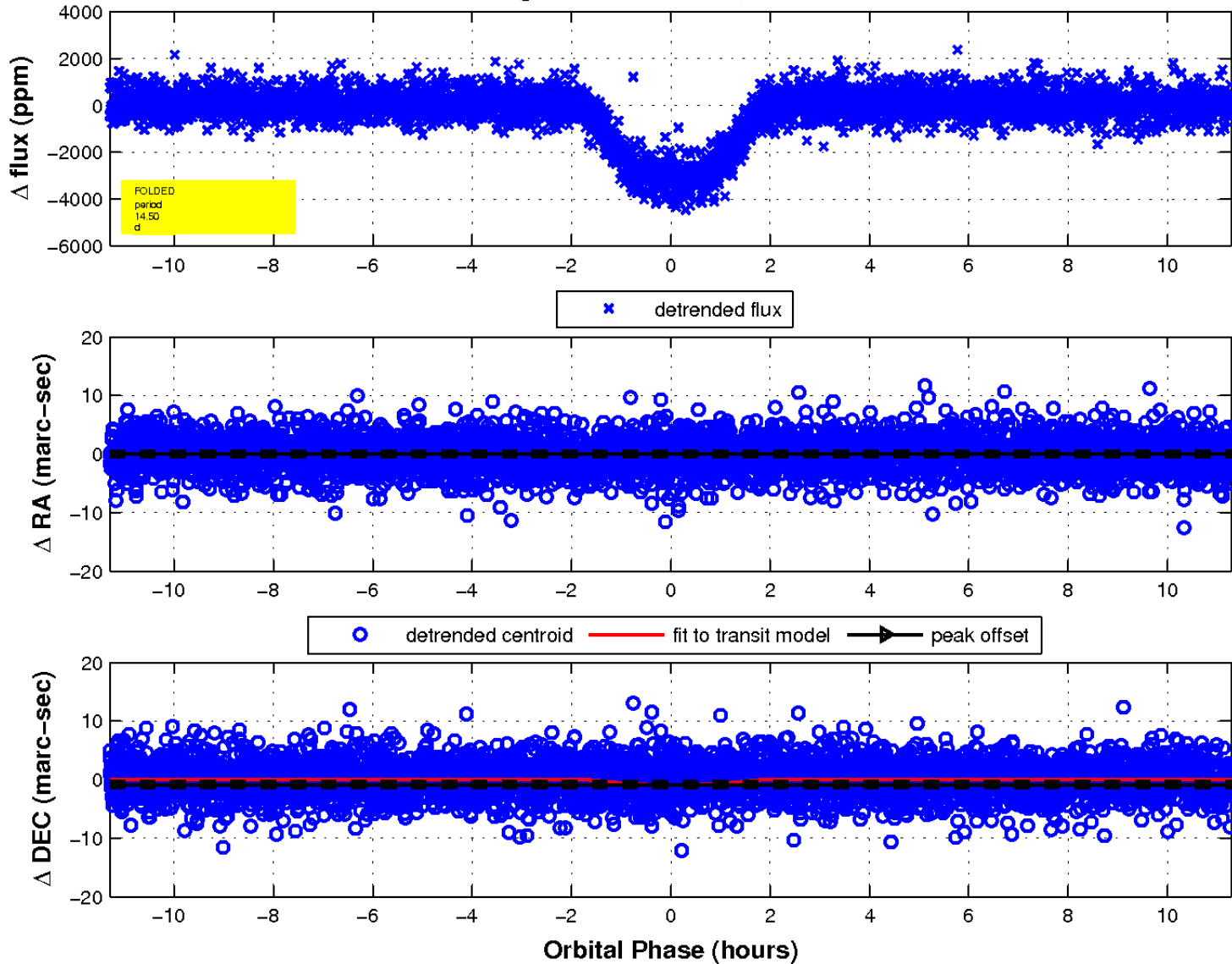
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

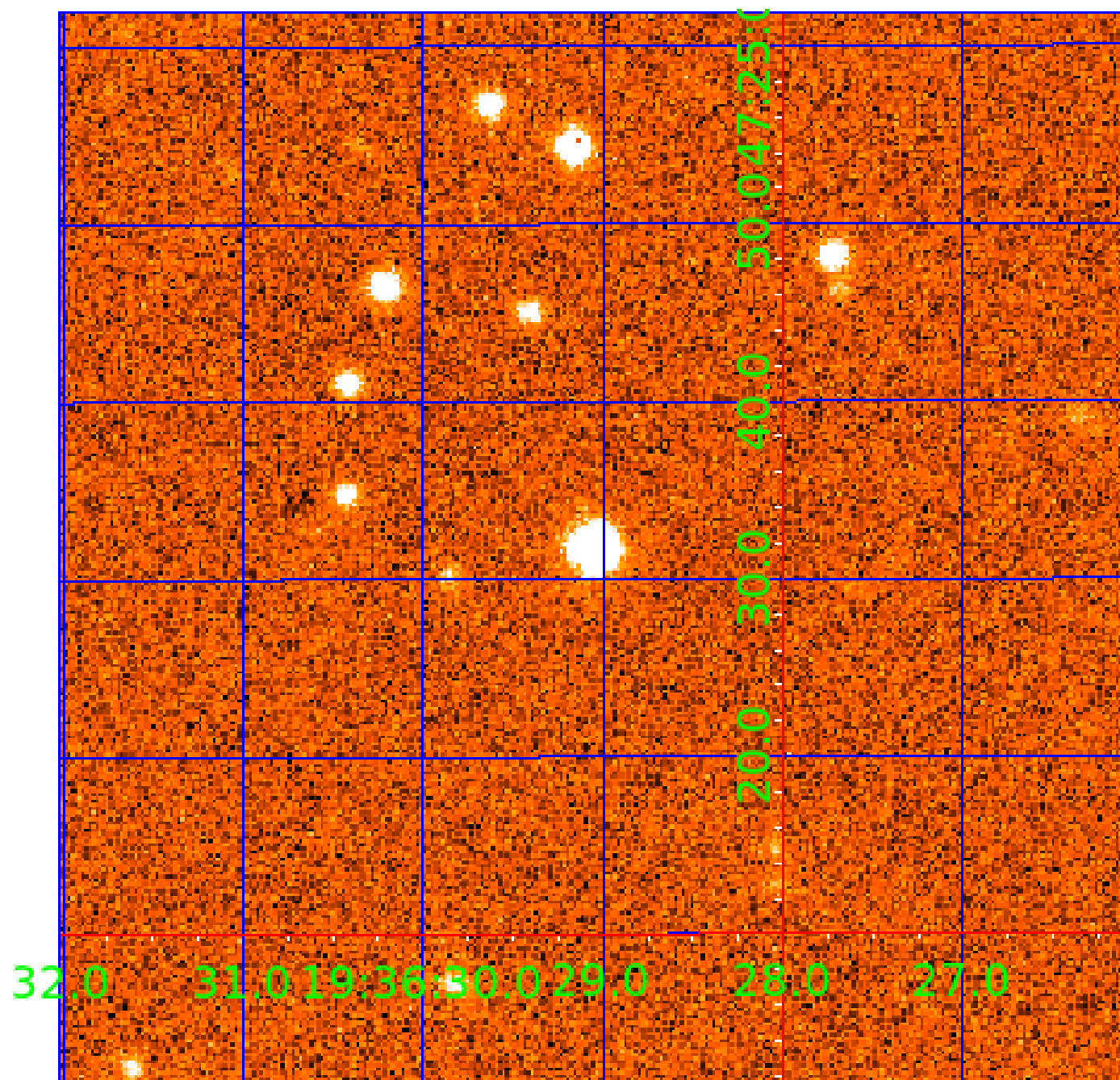


fluxWeightedCentroids, Planet 1 of 2



UKIRT Image

Declination





# KIC 010345478

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
010345478-01	OBS	0737.01	14.498389	139.184566	3236.4	3.765	112.1	113.3	0.73	5268	5.17	32.25
010345478-02	OBS	No	14.498364	133.550495	451.1	2.079	11.7	13.7	0.73	5268	1.80	32.25

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
010345478-01	OBS	FP	0.00	0	1	0	0	MOD_SEC_DV—MOD_SEC_ALT—HAS_SEC_TCE
010345478-02	OBS	FP	0.00	1	1	0	0	IS_SEC_TCE

**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 010345478-02

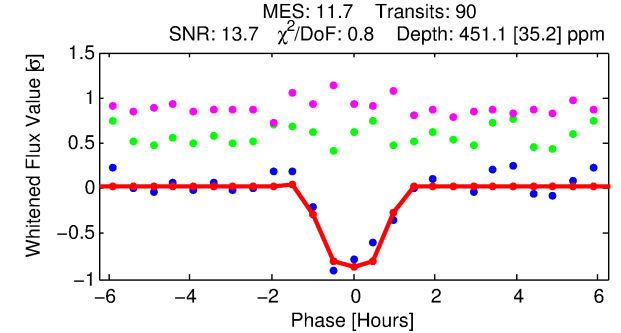
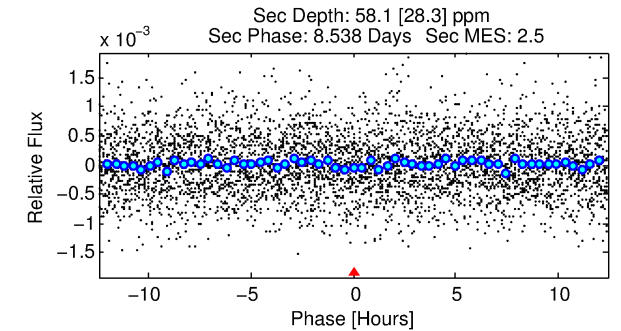
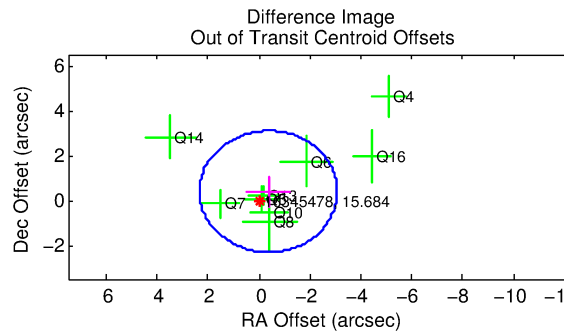
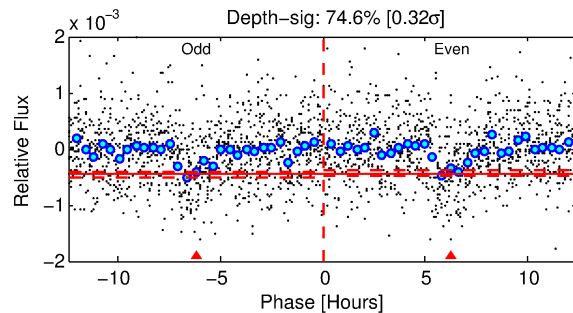
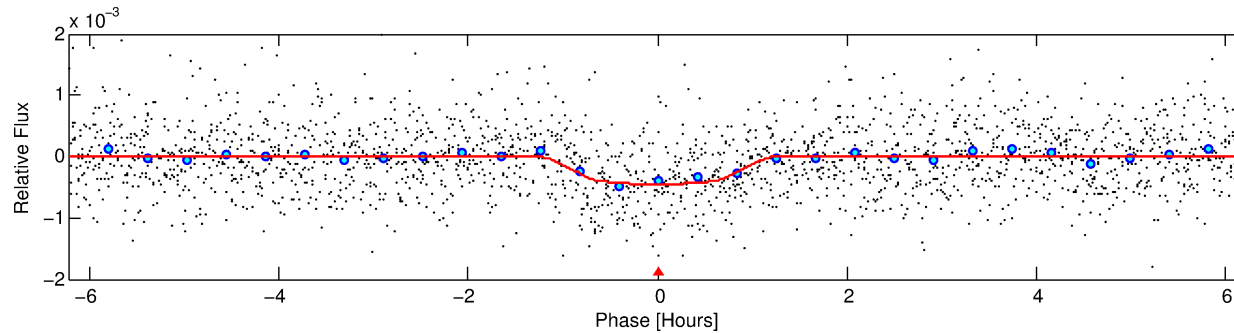
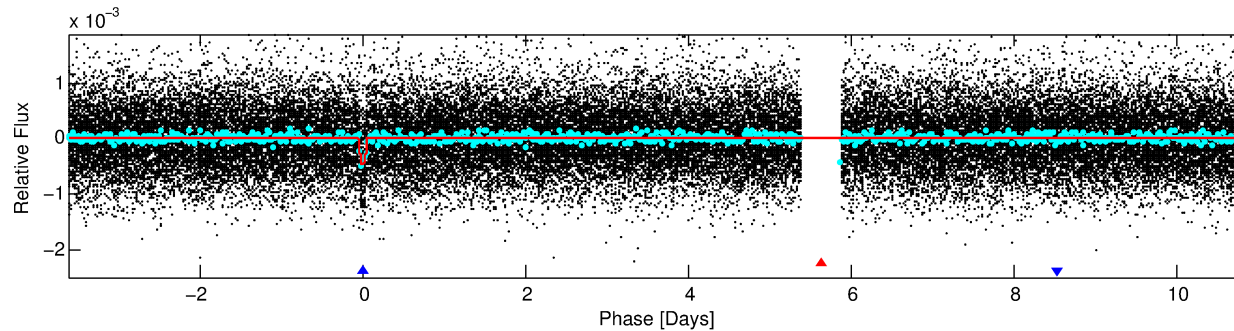
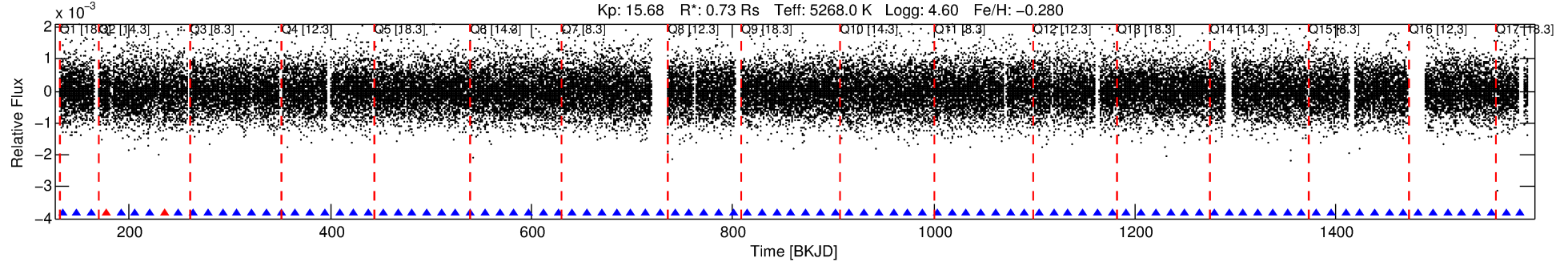
No Significant Match Found

# DV One-Page Summary

KIC: 10345478 Candidate: 2 of 2 Period: 14.498 d

KOI: K00737 Corr: No Ephemeris Match

Kp: 15.68 R\*: 0.73 Rs Teff: 5268.0 K Logg: 4.60 Fe/H: -0.280



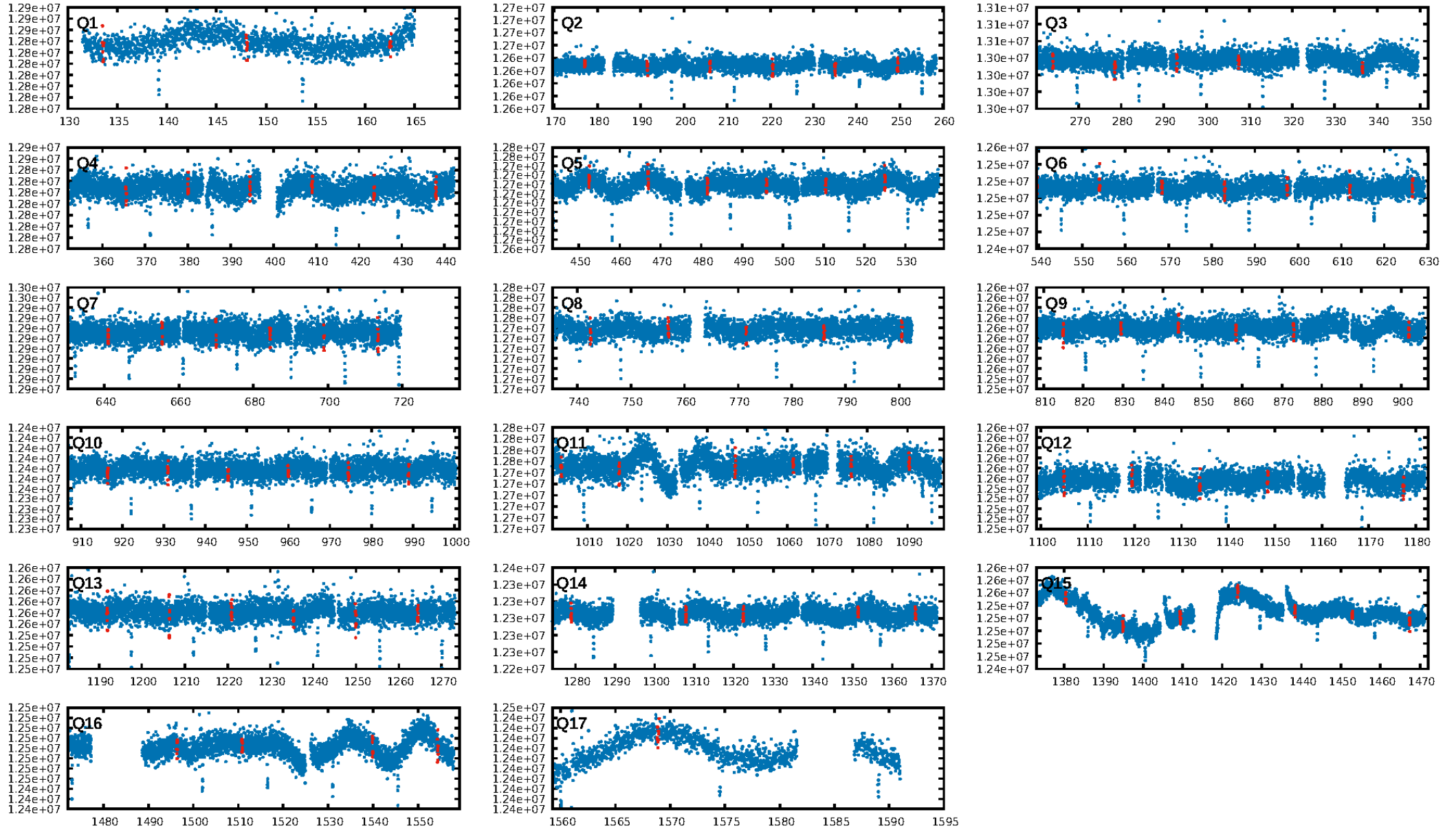
## DV Fit Results:

Period = 14.49836 [0.00007] d  
Epoch = 133.5505 [0.0039] BKJD  
Rp/R\* = 0.0225 [0.0170]  
a/R\* = 30.23 [93.16]  
b = 0.85 [1.03]  
Seff = 32.25 [6.56]  
Teq = 608 [31] K  
Rp = 1.80 [1.39] Re  
a = 0.1075 [0.0129] AU  
Ag = 113.97 [182.30] [0.62σ]  
Teffp = 3070 [1225] K [2.01σ]

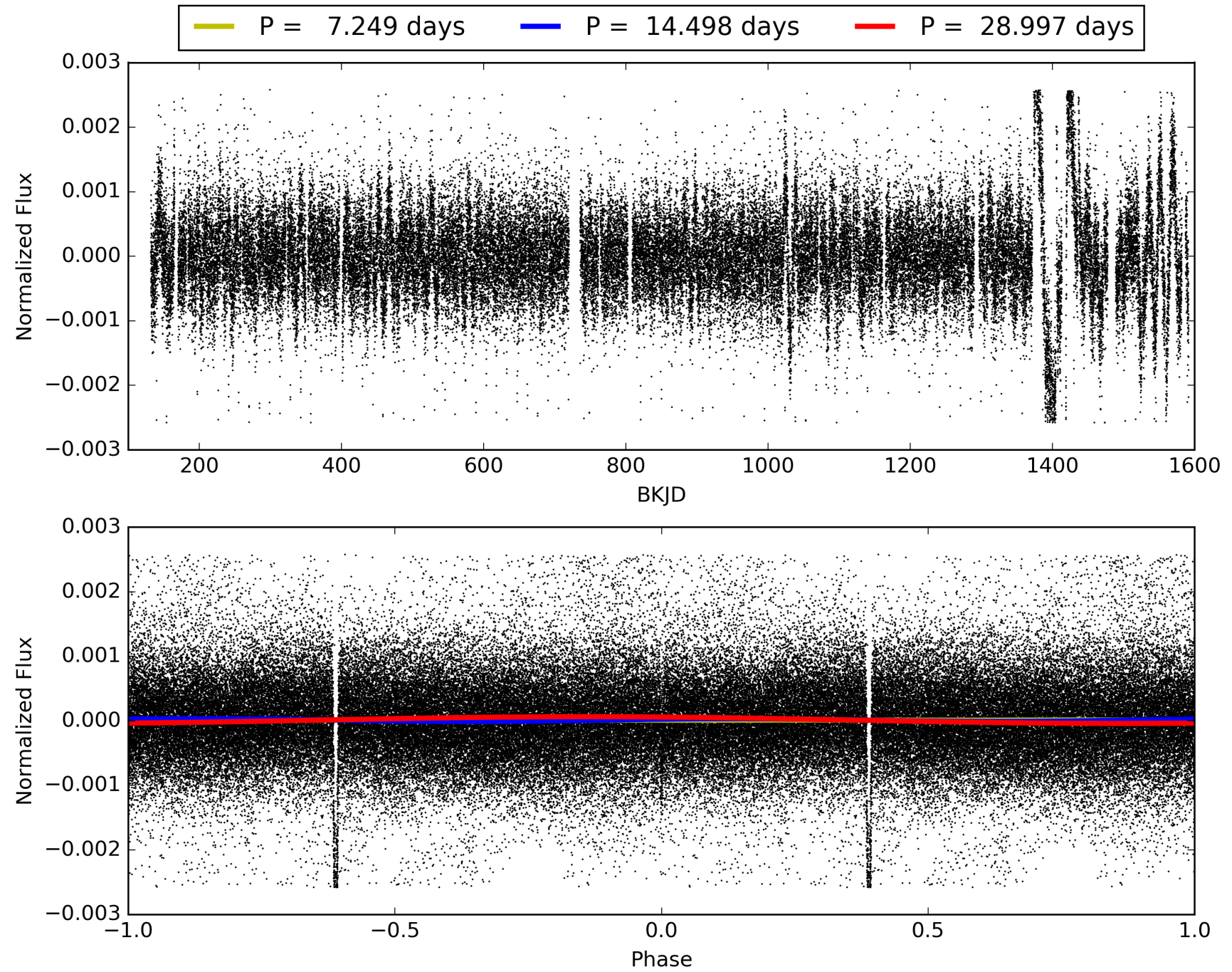
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 0.0% [0.00σ]  
ModelChiSquare2-sig: 99.6%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 1.03e-30  
RollingBand-fgt: 0.98 [84/86]  
GhostDiagnostic-chr: 7.667  
Centroid-sig: 0.1%  
Centroid-so: 2.443 arcsec [2.71σ]  
OotOffset-rm: 0.536 arcsec [0.59σ]  
KicOffset-rm: 0.637 arcsec [0.86σ]  
OotOffset-st: 3/1/3/2 [9]  
KicOffset-st: 3/1/3/2 [9]  
DiffImageQuality-fgm: 0.67 [6/9]  
DiffImageOverlap-fno: 1.00 [17/17]

# TCE 010345478-02, PDC Light Curves

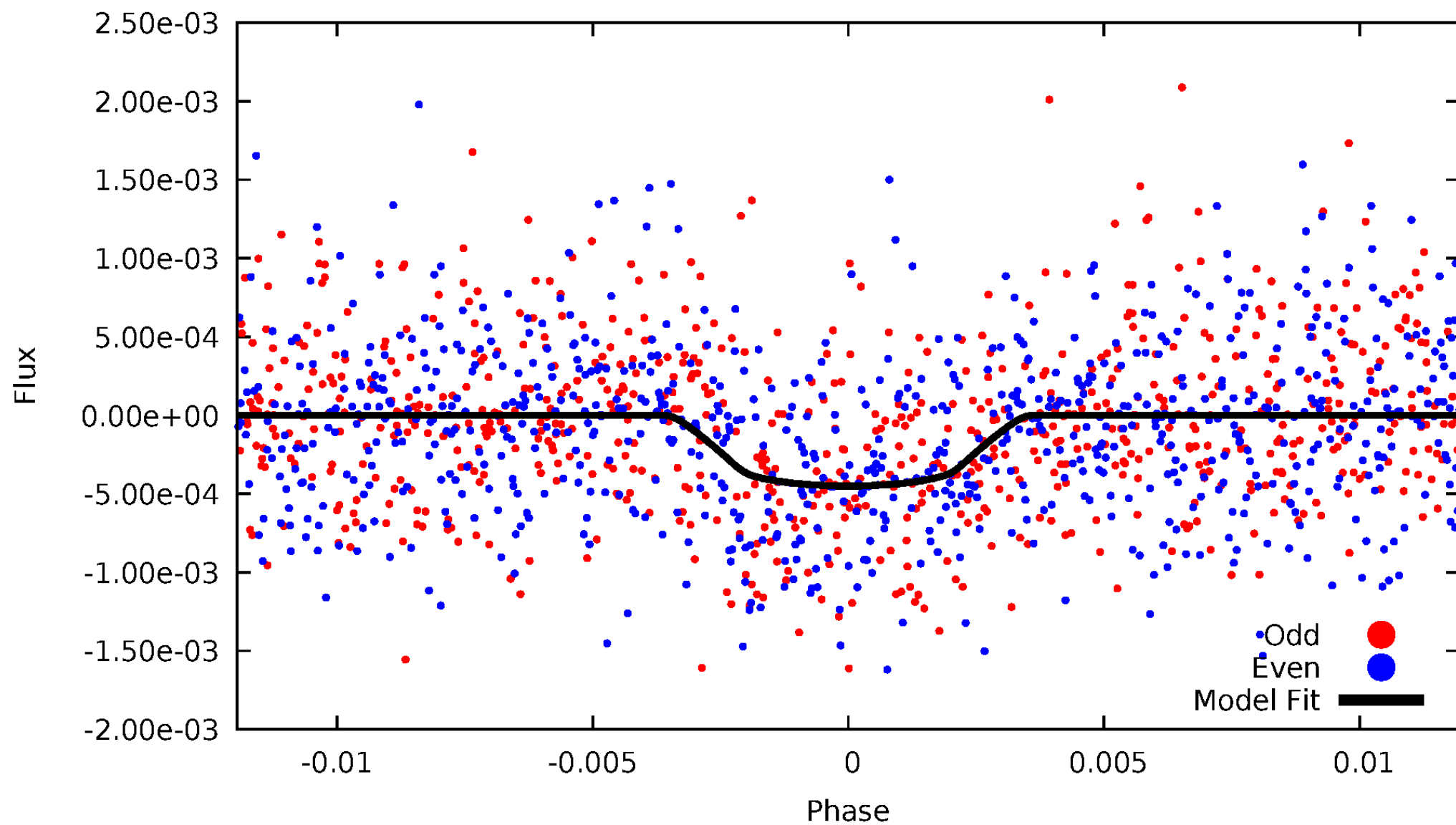


# TCE 010345478-02



# DV Odd/Even

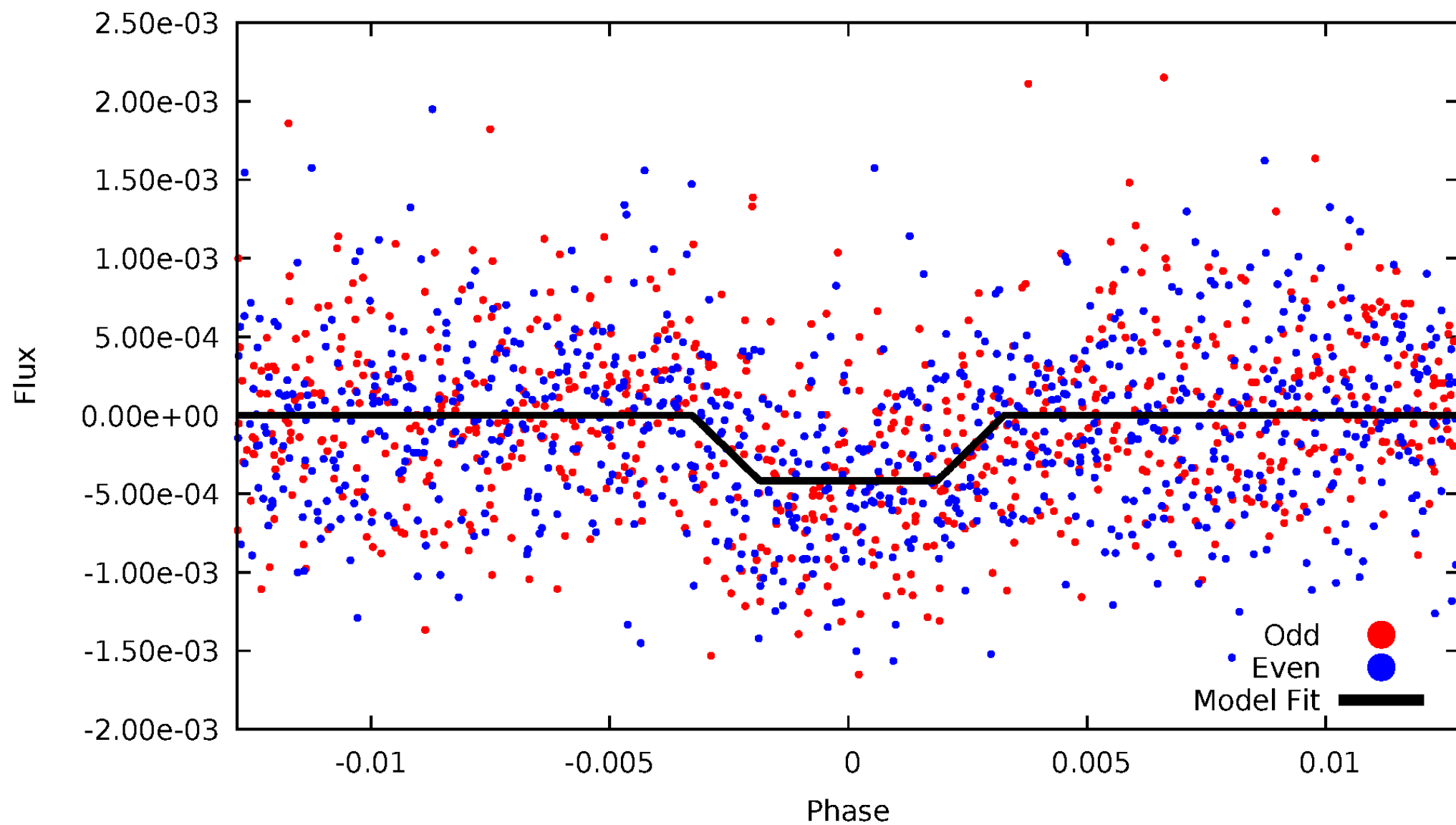
TCE 010345478-02





# ALT Odd/Even

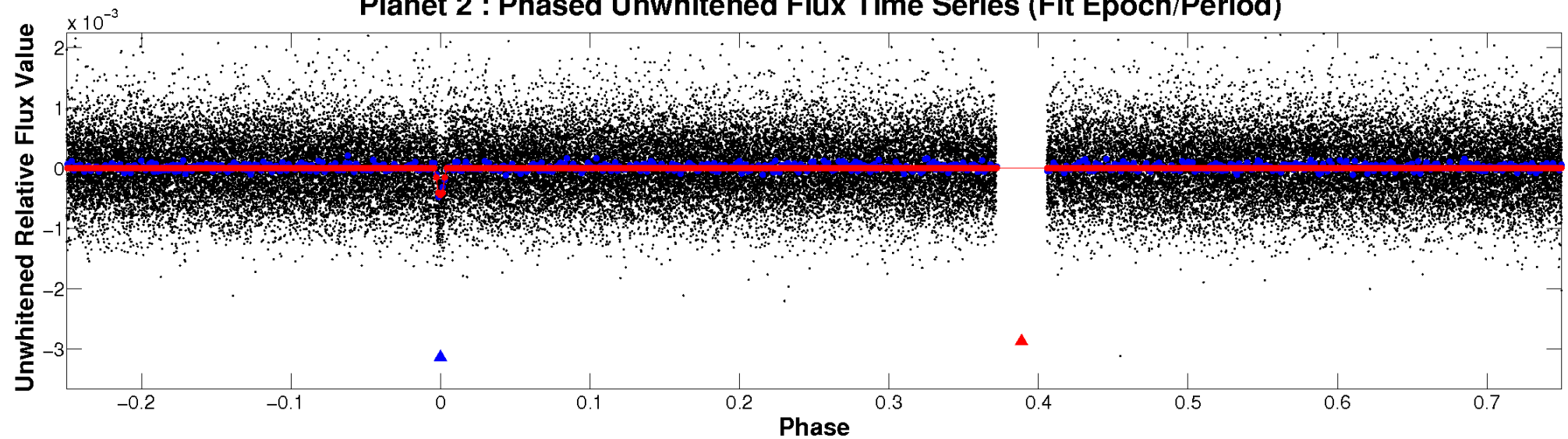
TCE 010345478-02



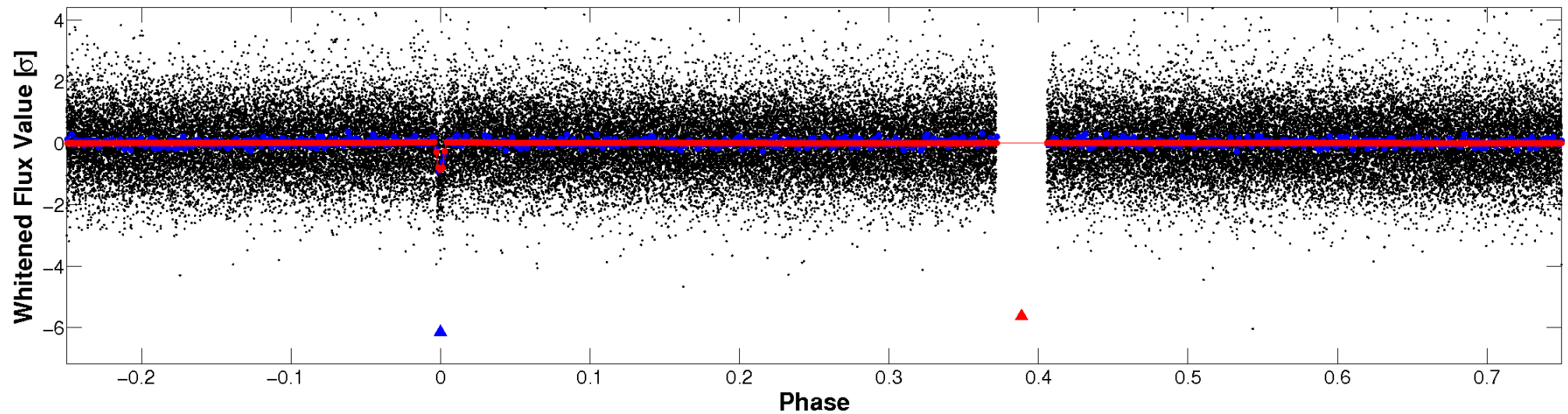


# Non-Whitened Vs. Whitened Light Curve

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

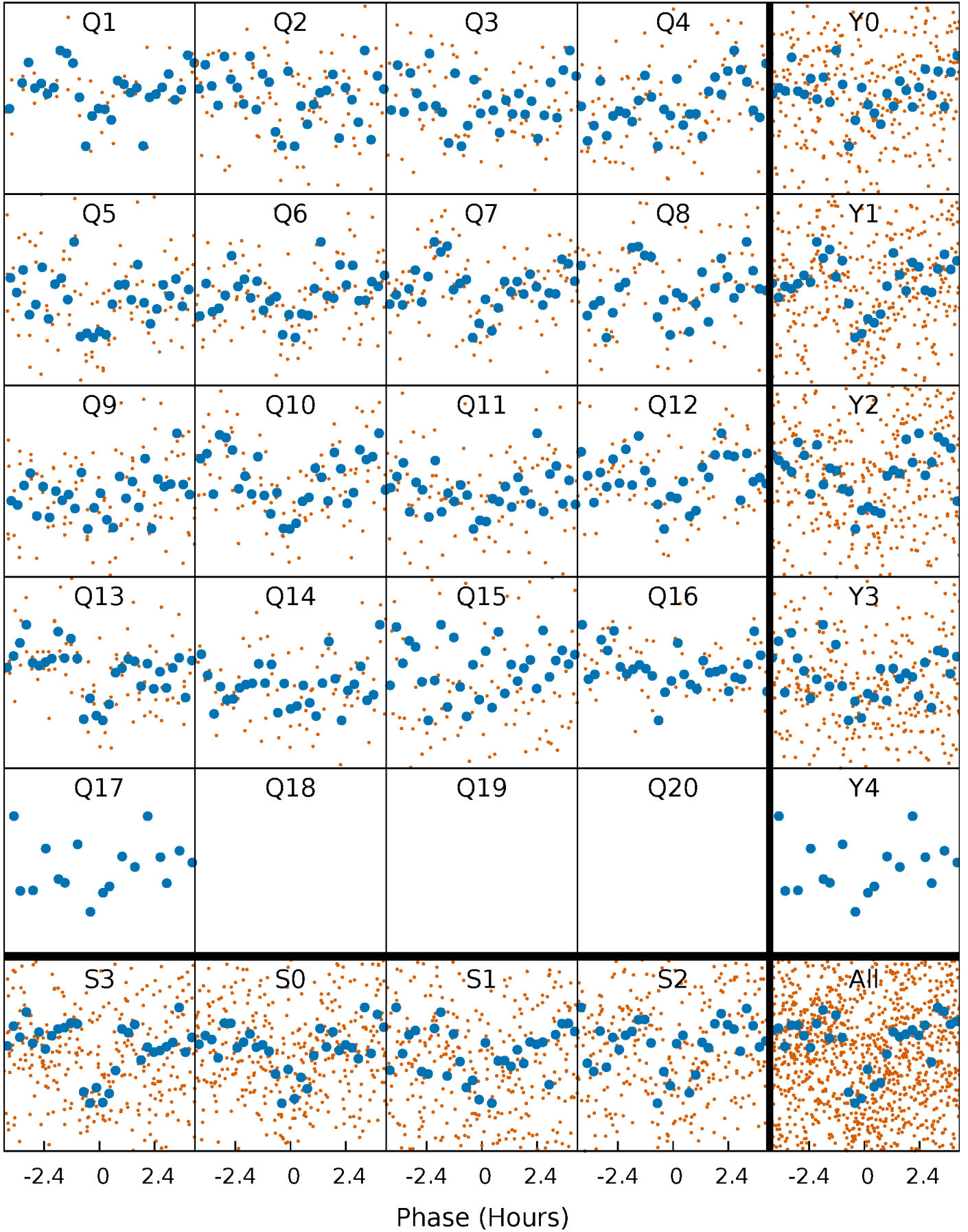


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



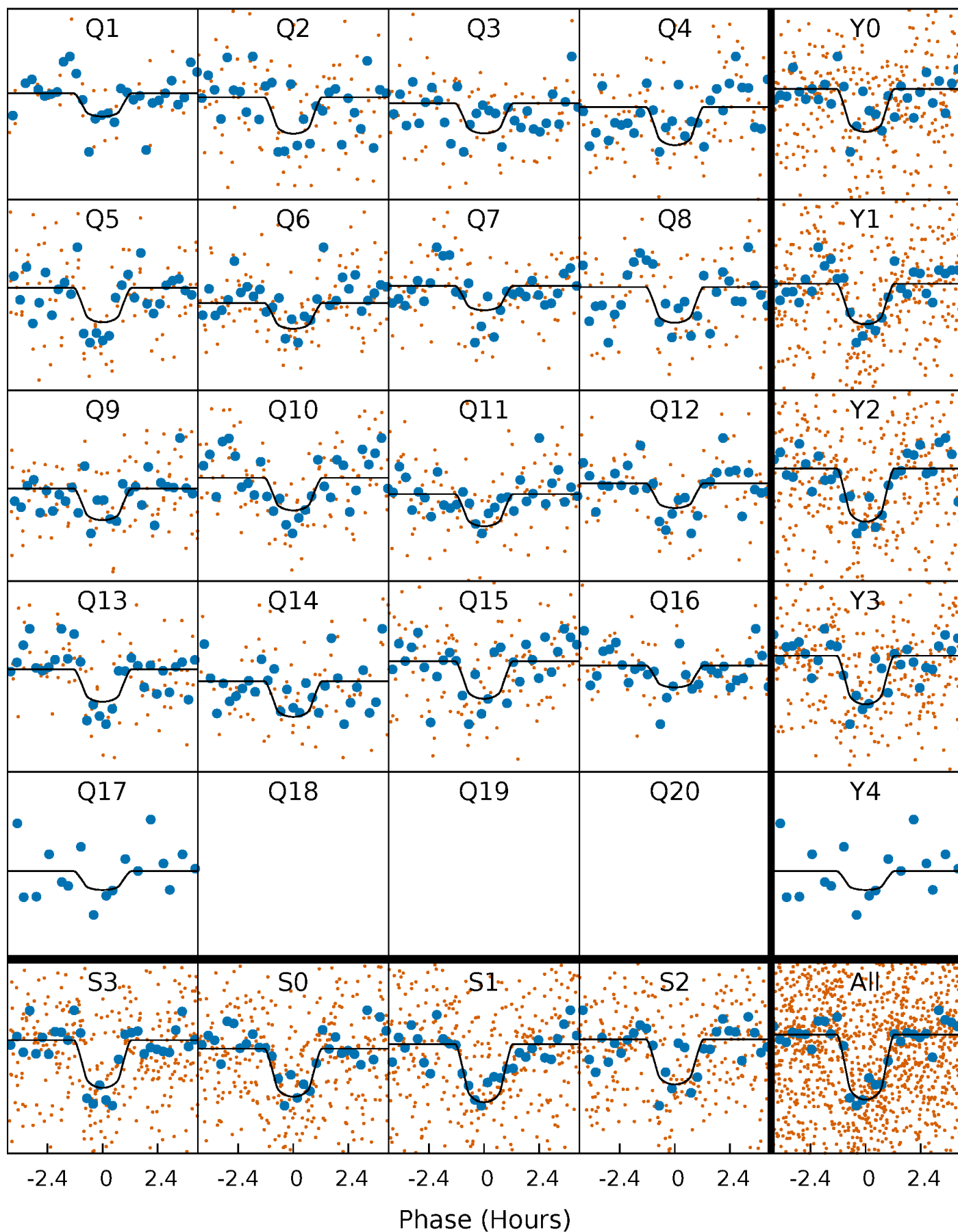
# PDC Quarter-Phased Transit Curves

TCE 010345478-02   P= 14.498364 Days    $T_0=133.550495$  (BKJD)



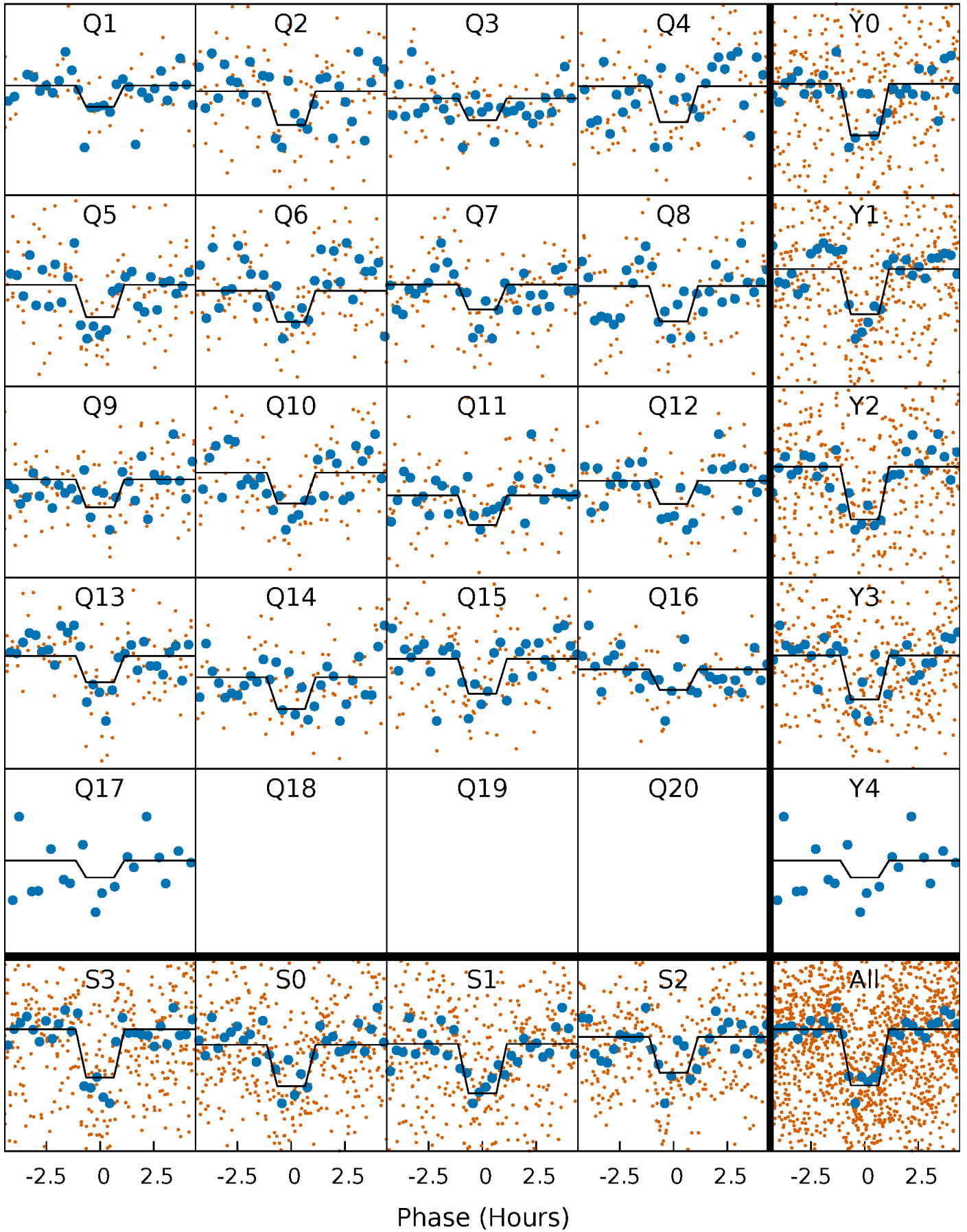
# DV Quarter-Phased Transit Curves

TCE 010345478-02   P= 14.498364 Days    $T_0=133.550495$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

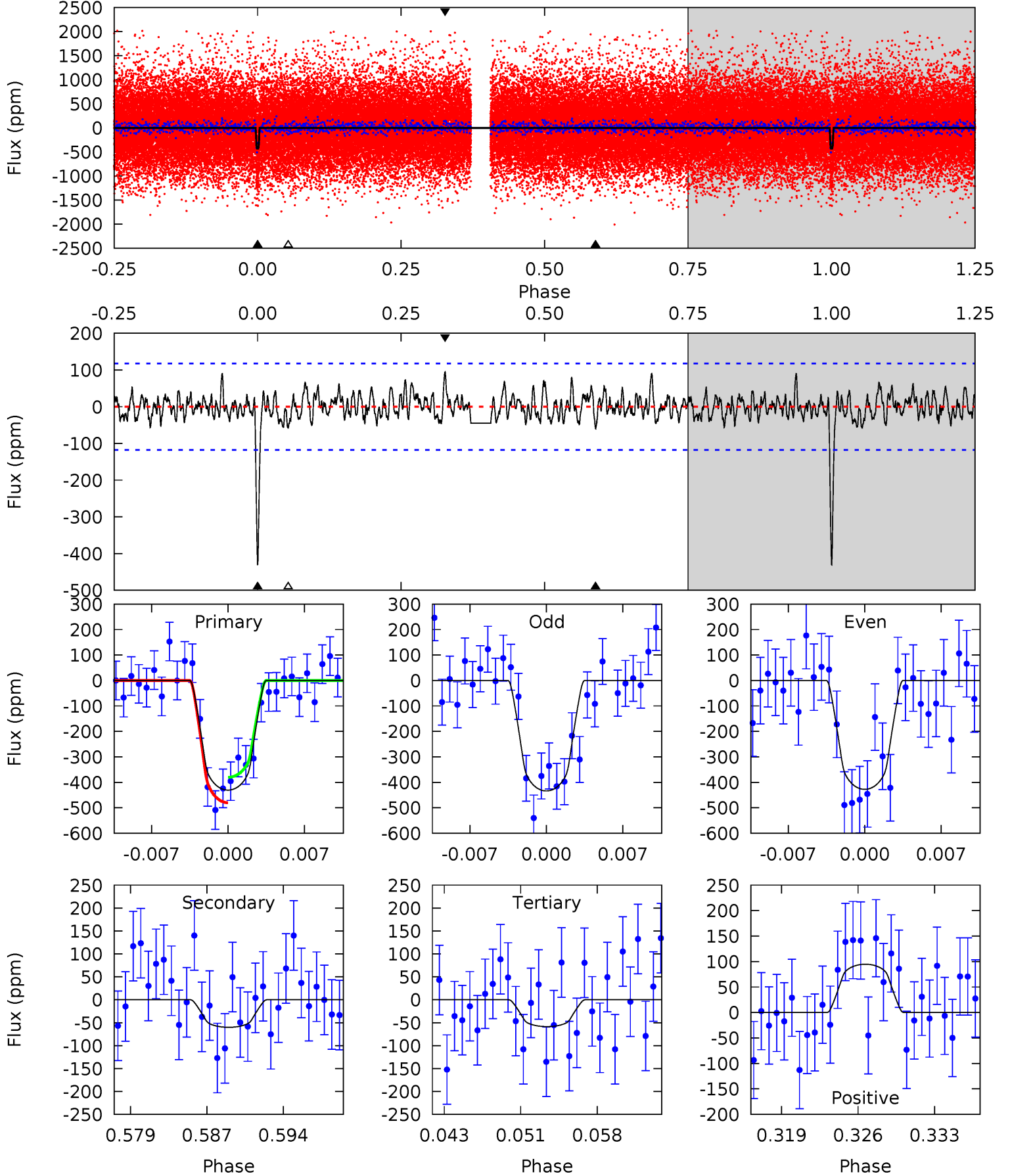
TCE 010345478-02 P= 14.498253 Days  $T_0=133.555991$  (BKJD)



# DV Model-Shift Uniqueness Test

010345478-02,  $P = 14.498364$  Days,  $E = 119.052131$  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
18.6	2.60	2.53	4.09	5.09	2.69	1.16	16.1	14.5	0.07	-1.50	0.14	0.98	0.18	2.16

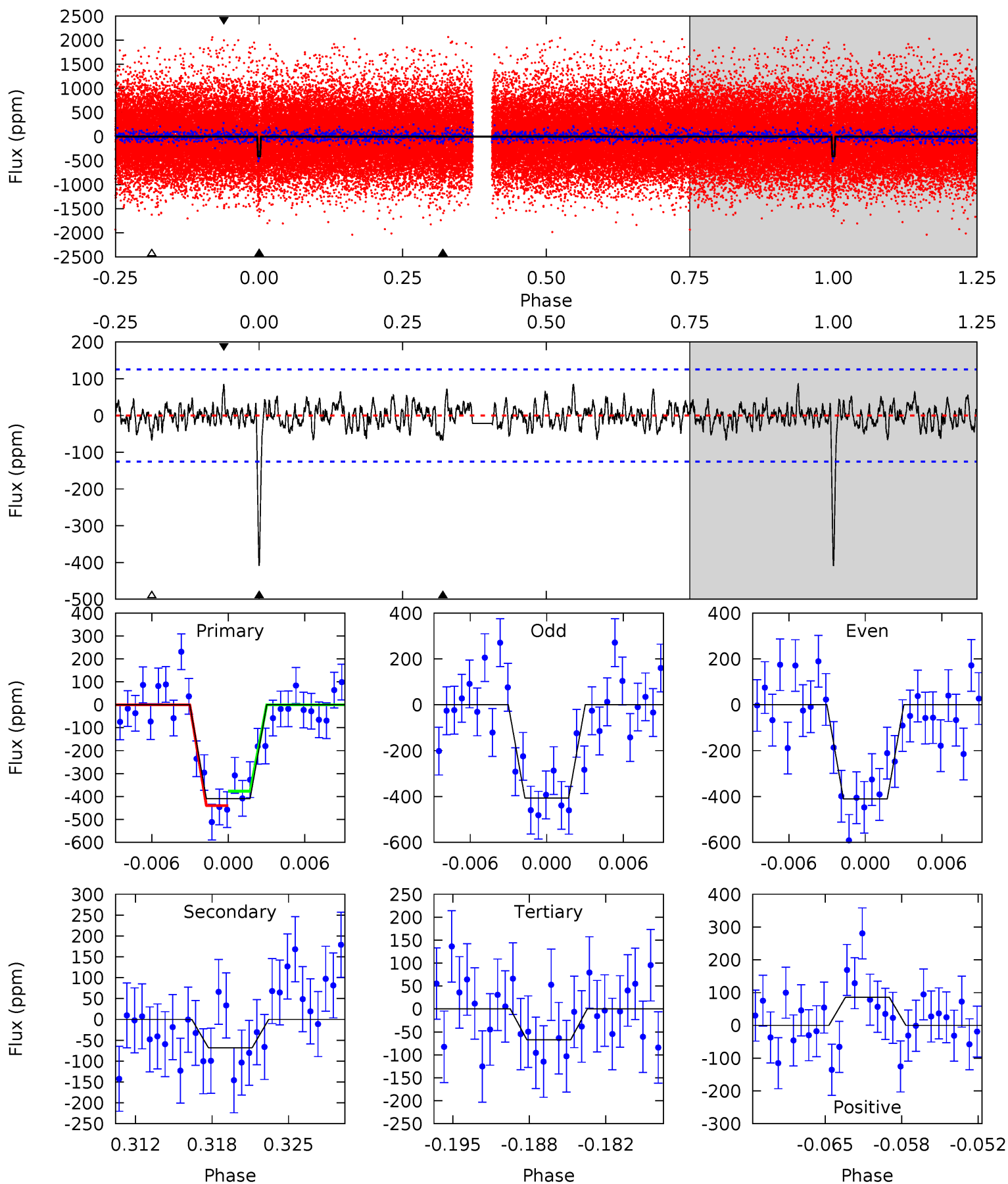




# Alt Model-Shift Uniqueness Test

010345478-02, P = 14.498253 Days, E = 119.057738 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
16.6	2.76	2.74	3.50	5.11	2.72	1.02	13.9	13.1	0.03	-0.73	0.09	0.95	0.17	1.27





### Stellar Parameters For KIC 010345478

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M$ ( $M_{\odot}$ )	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$5268^{+158}_{-158}$	$4.602^{+0.039}_{-0.084}$	$-0.280^{+0.300}_{-0.300}$	$0.735^{+0.112}_{-0.060}$	$0.789^{+0.085}_{-0.078}$	$2.804^{+0.541}_{-0.783}$
	+3%/-3%	+1%/-2%	+107%/-107%	+15%/-8%	+11%/-10%	+19%/-28%
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 010345478-02 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-60 \pm 23$	$1.99^{+1.43}_{-1.12}$	$855^{+36}_{-31}$	$3412^{+1203}_{-558}$	$92^{+401}_{-64}$
Alt.	$-68 \pm 25$	$1.91^{+1.25}_{-1.14}$	$857^{+34}_{-32}$	$3538^{+1334}_{-526}$	$112^{+565}_{-73}$

$T_{max}$  = 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

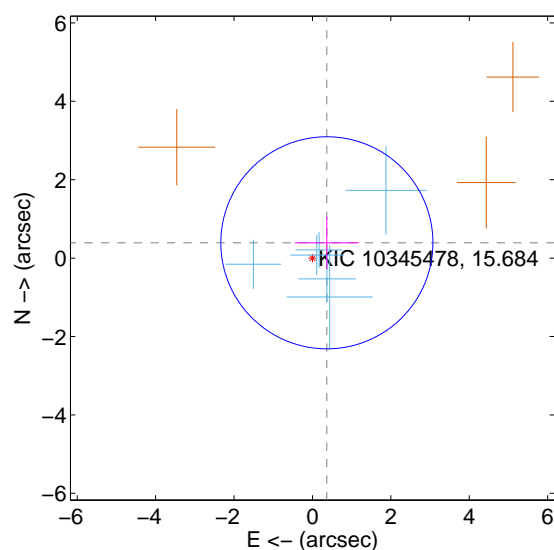
Supplemental centroid analysis for 010345478-02. Kepler magnitude: 15.68. Transit SNR 13.72

There are 6 quarters with good PRF difference image offsets

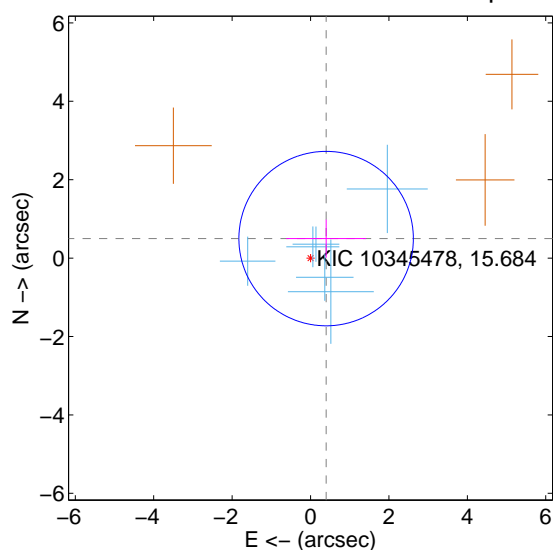
The direct PRF centroid is offset from the target star catalog position by about 0.07 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.536 \pm 0.902$	0.59	$-0.368 \pm 0.815$	$0.390 \pm 0.668$
PRF-fit source offset from KIC position	$0.637 \pm 0.742$	0.86	$-0.398 \pm 1.020$	$0.497 \pm 0.486$
photometric centroid source offset	$2.44 \pm 0.90$	2.71	$2.00 \pm 0.87$	$-1.40 \pm 0.97$

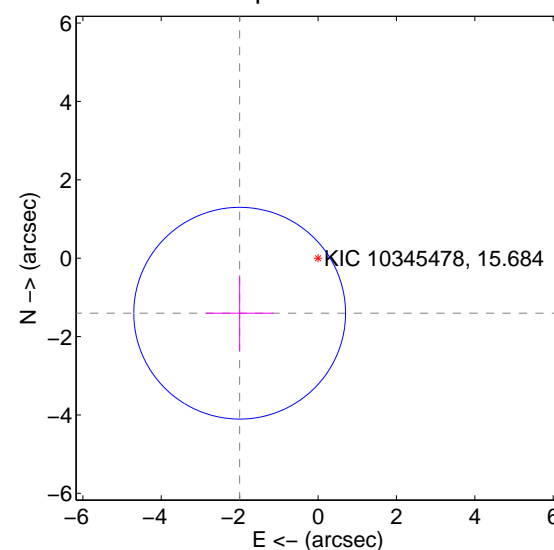
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

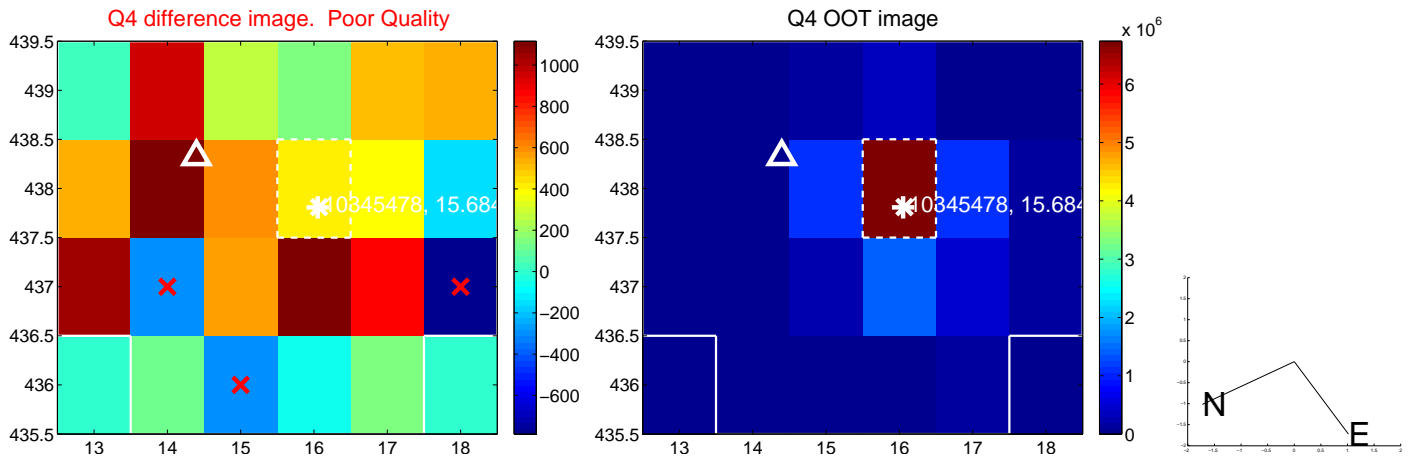
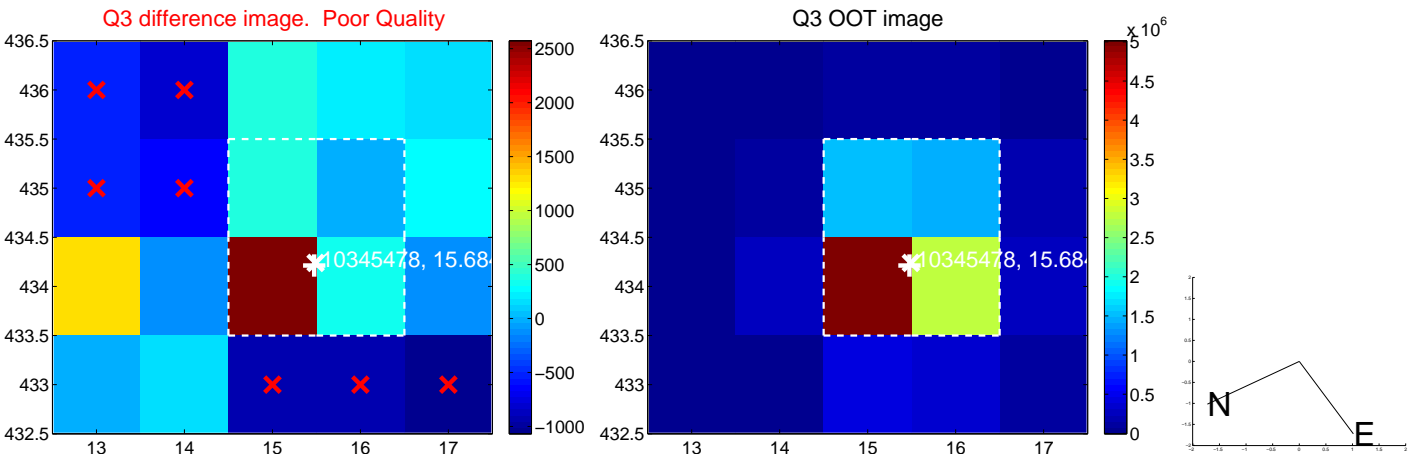
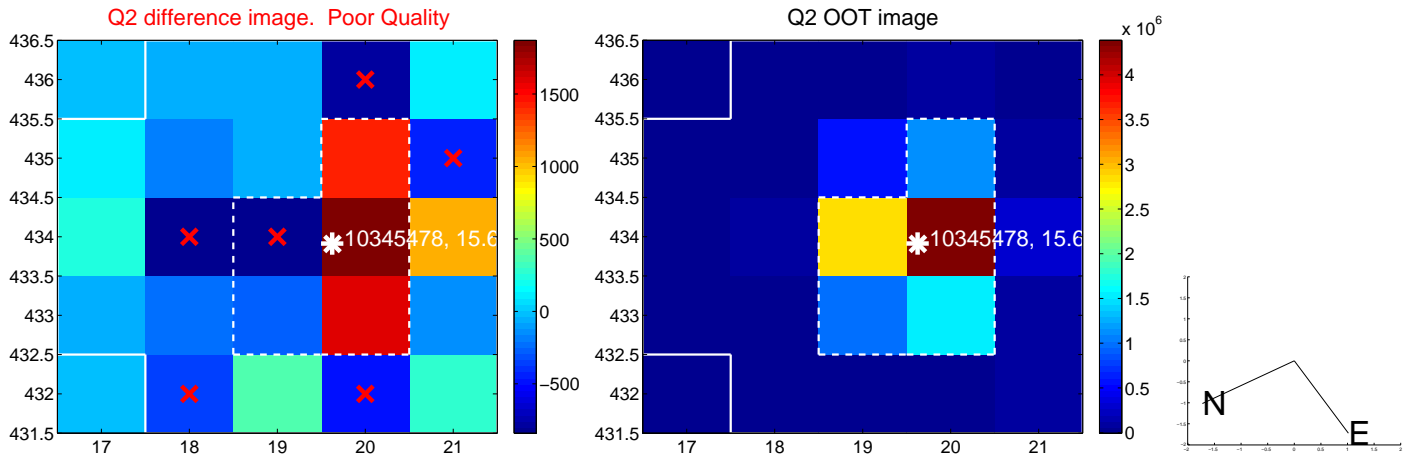
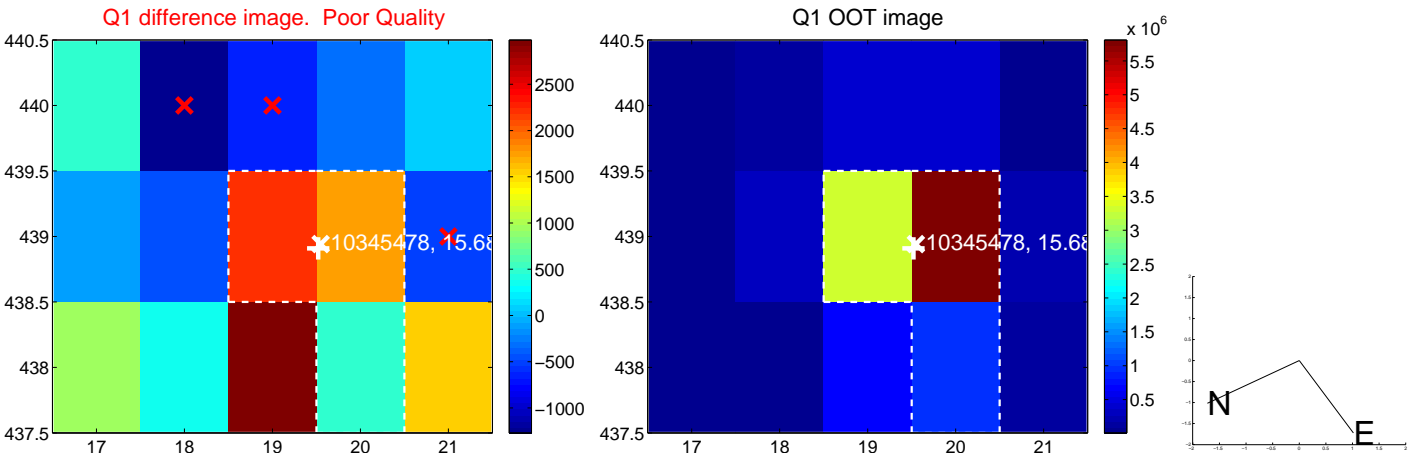


offset from photometric centroids

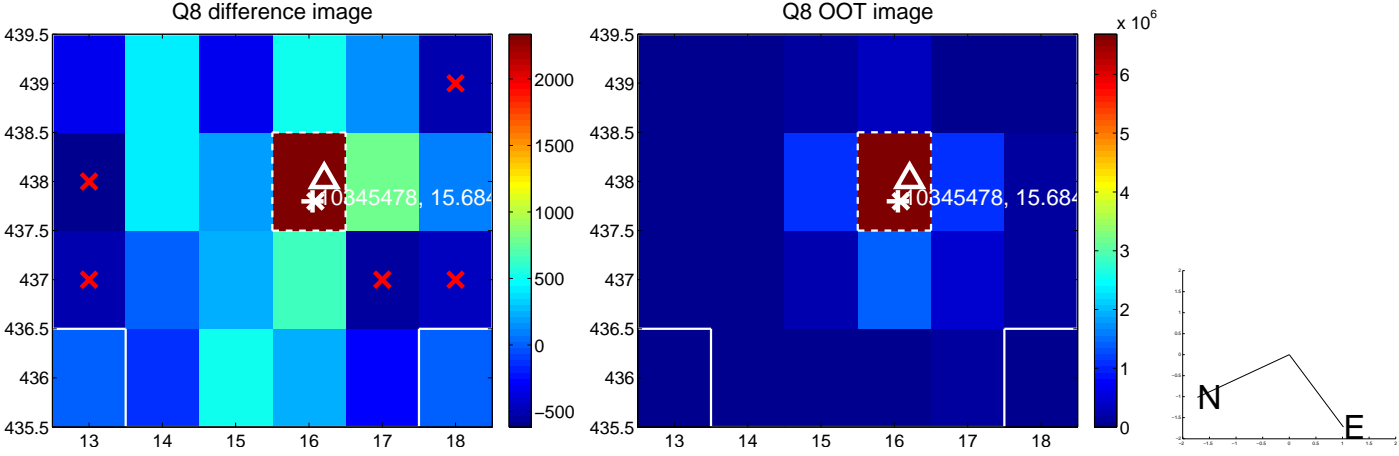
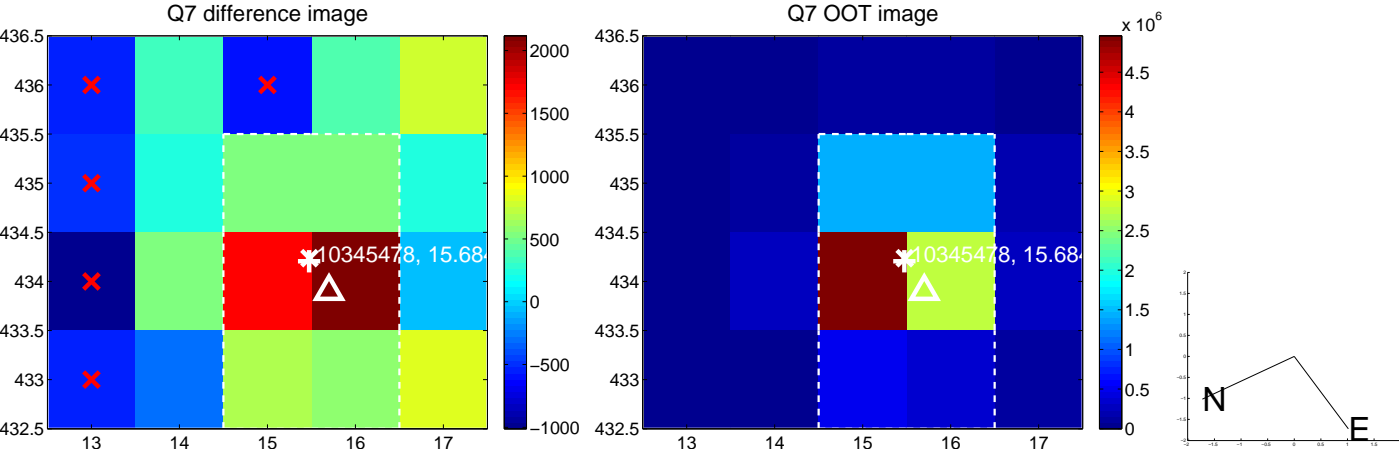
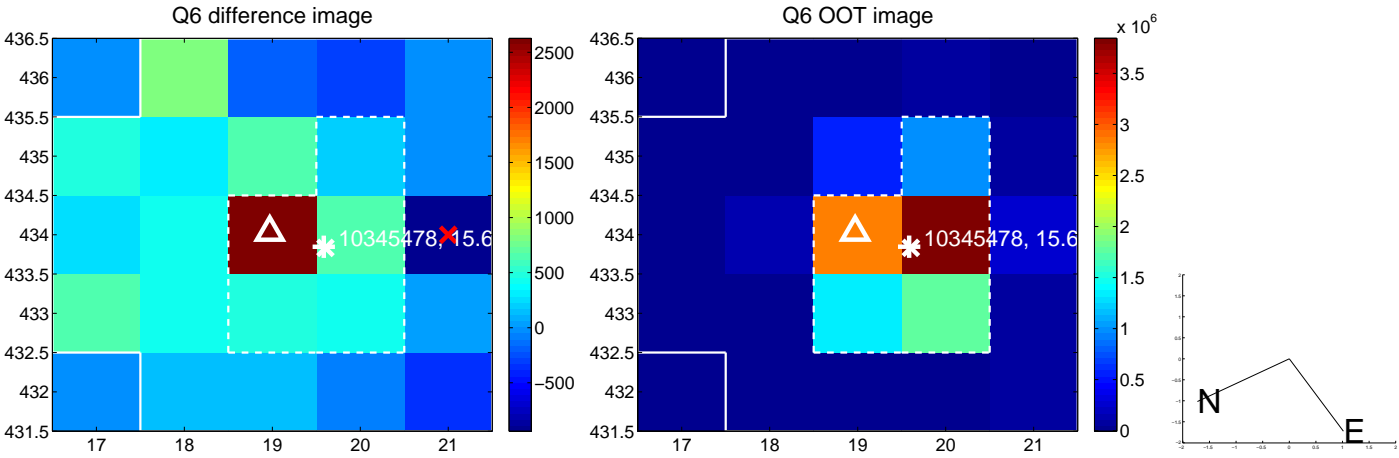
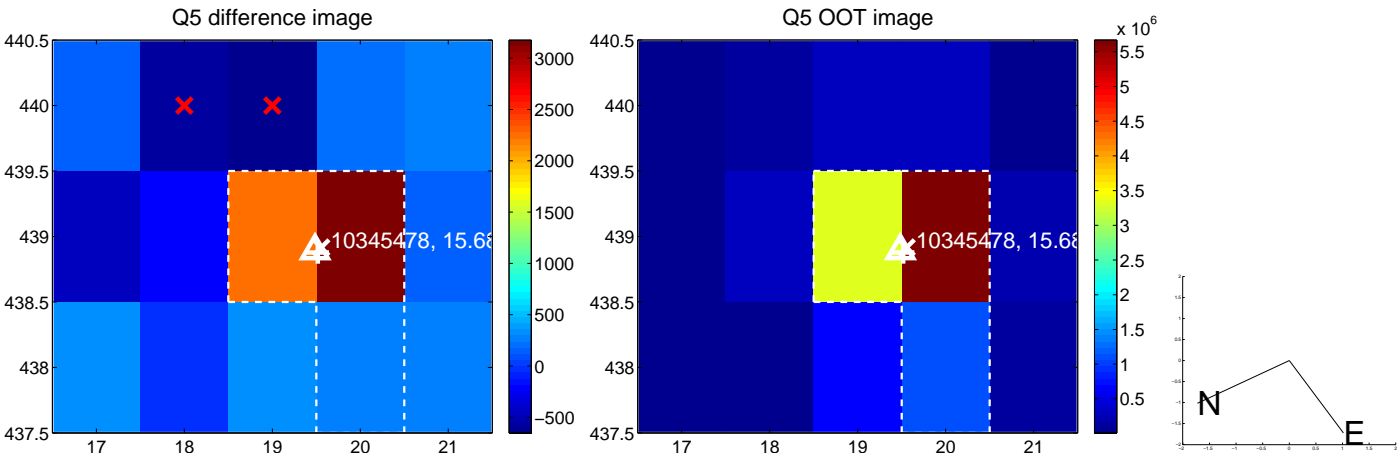


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

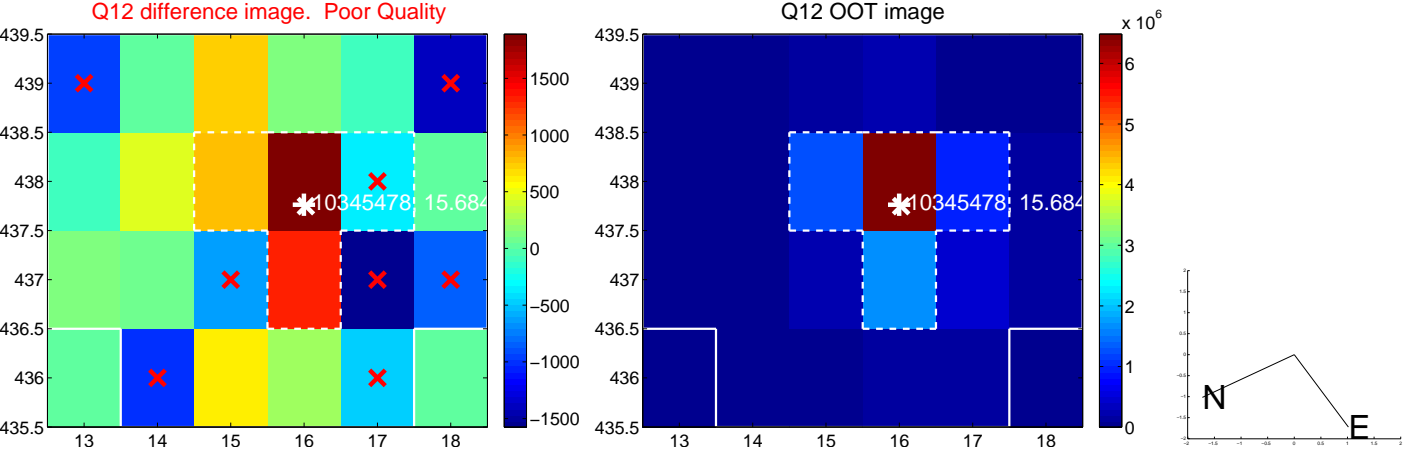
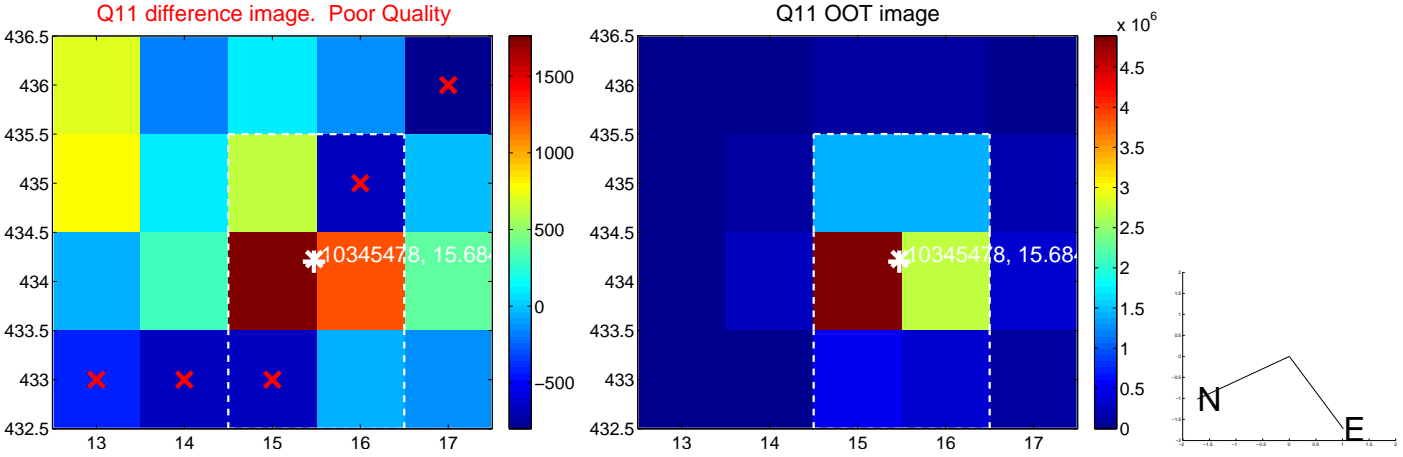
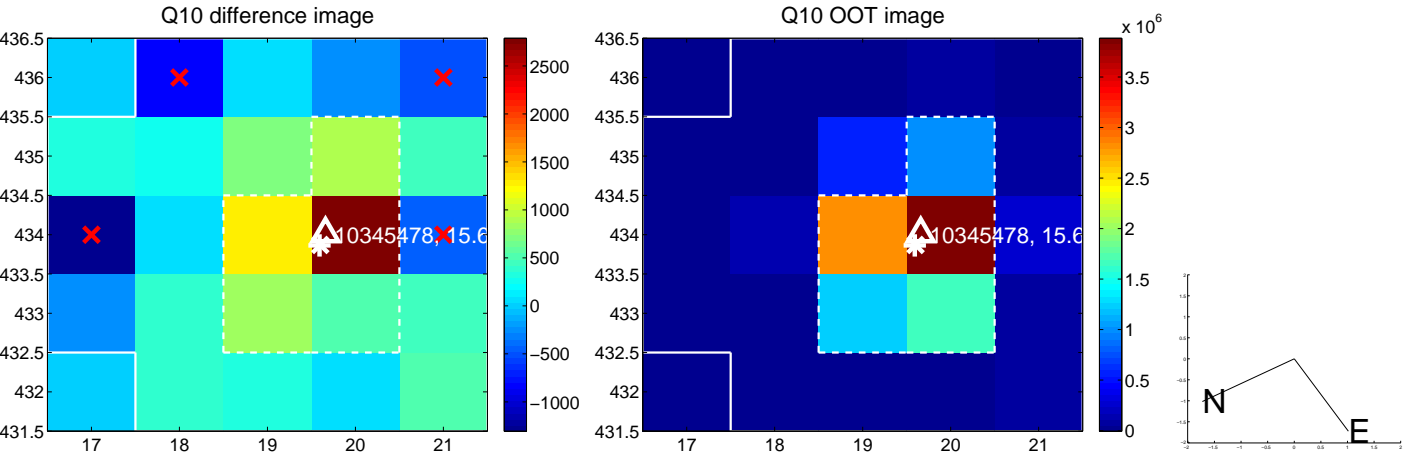
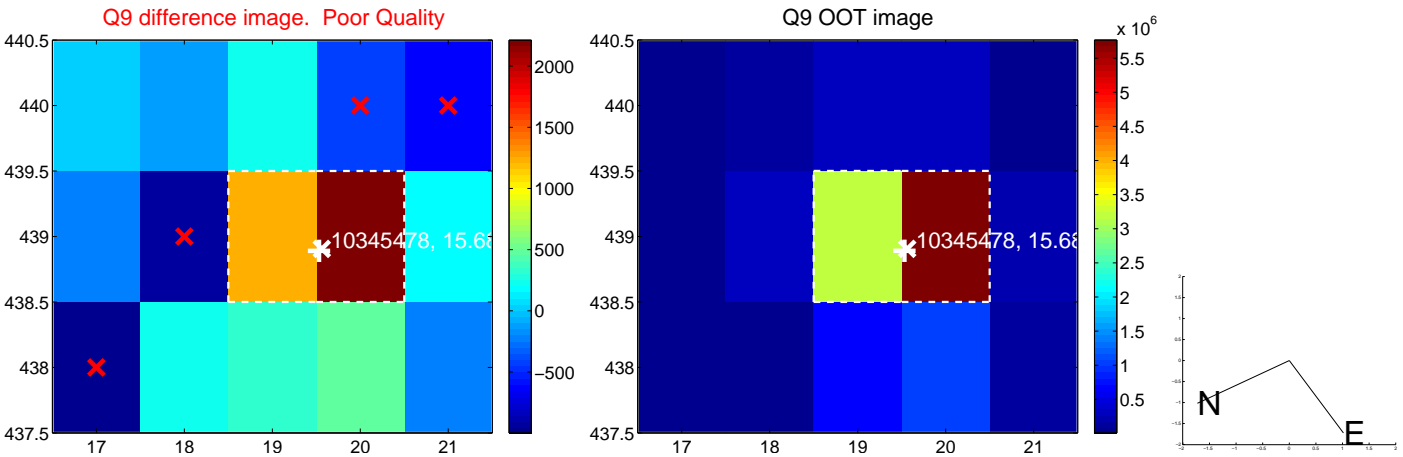
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



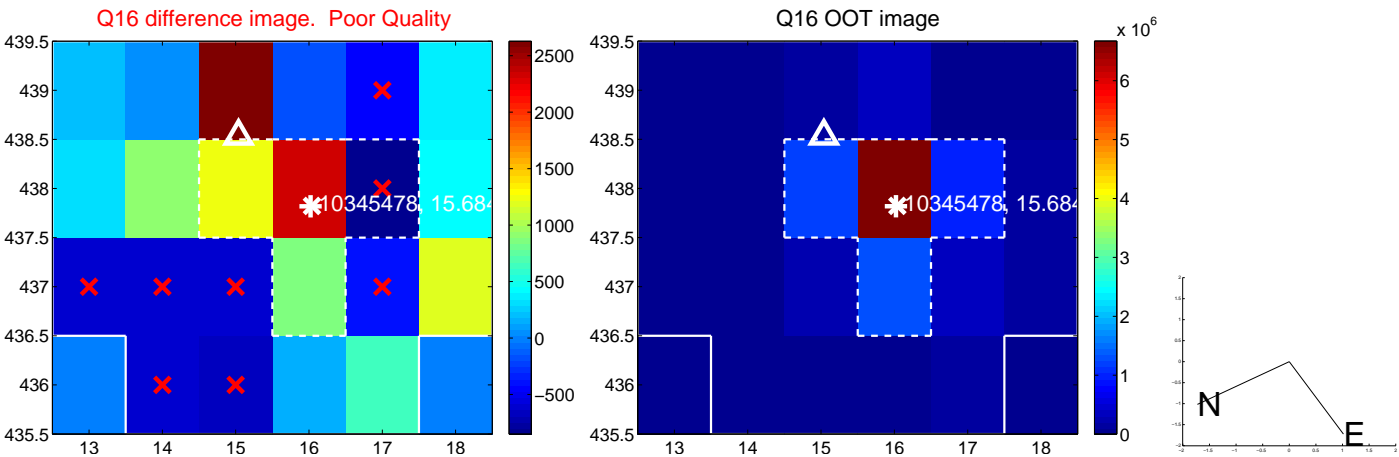
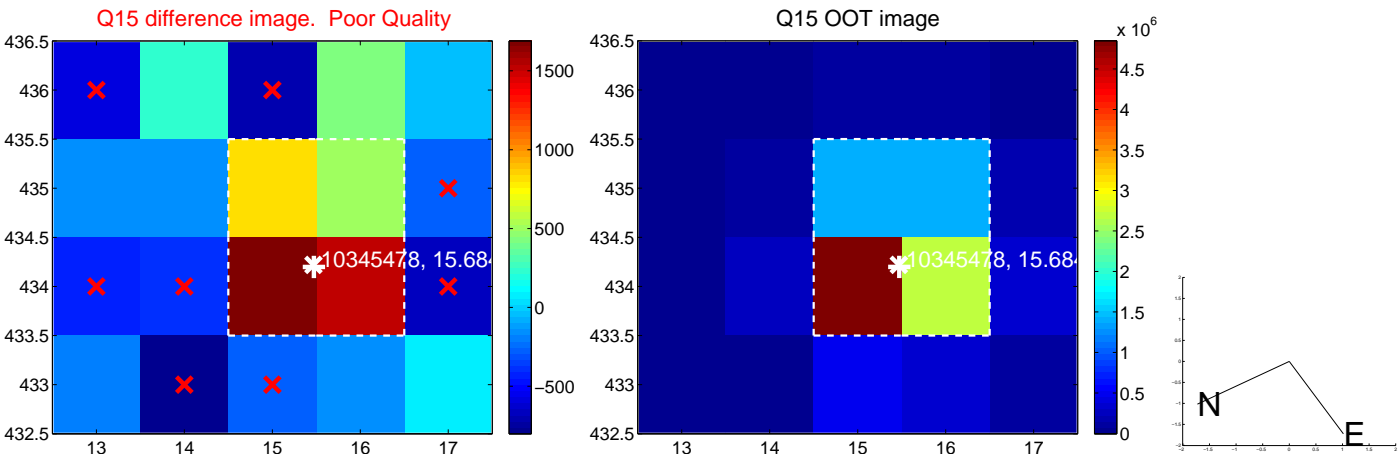
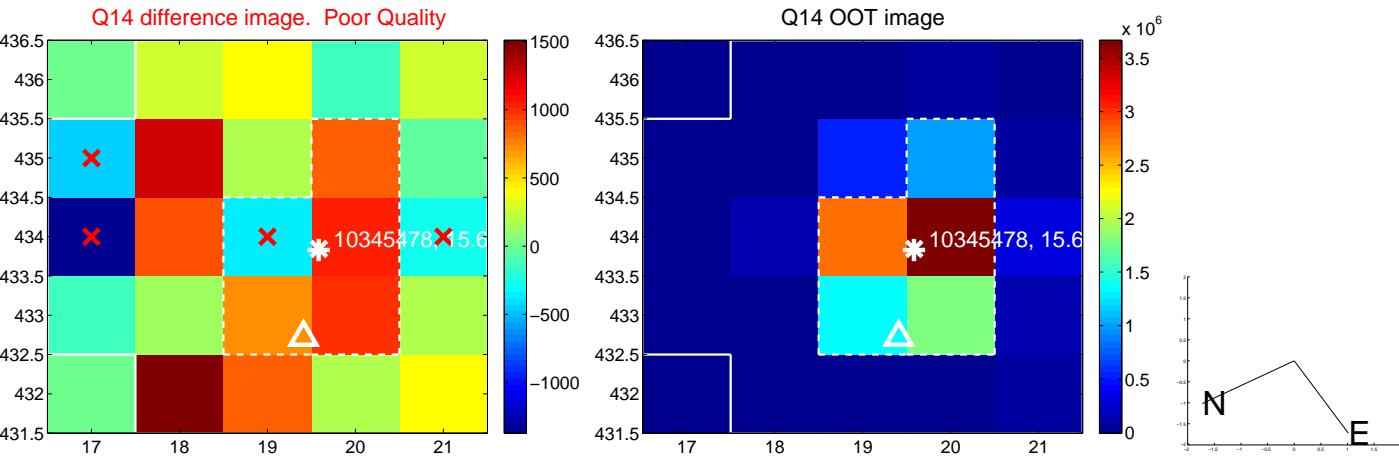
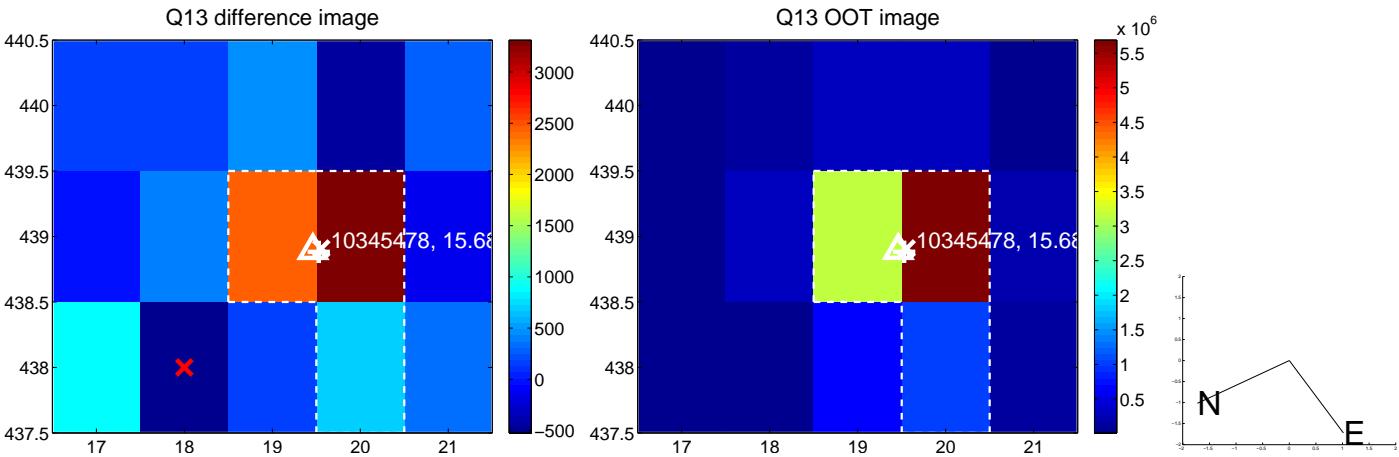
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



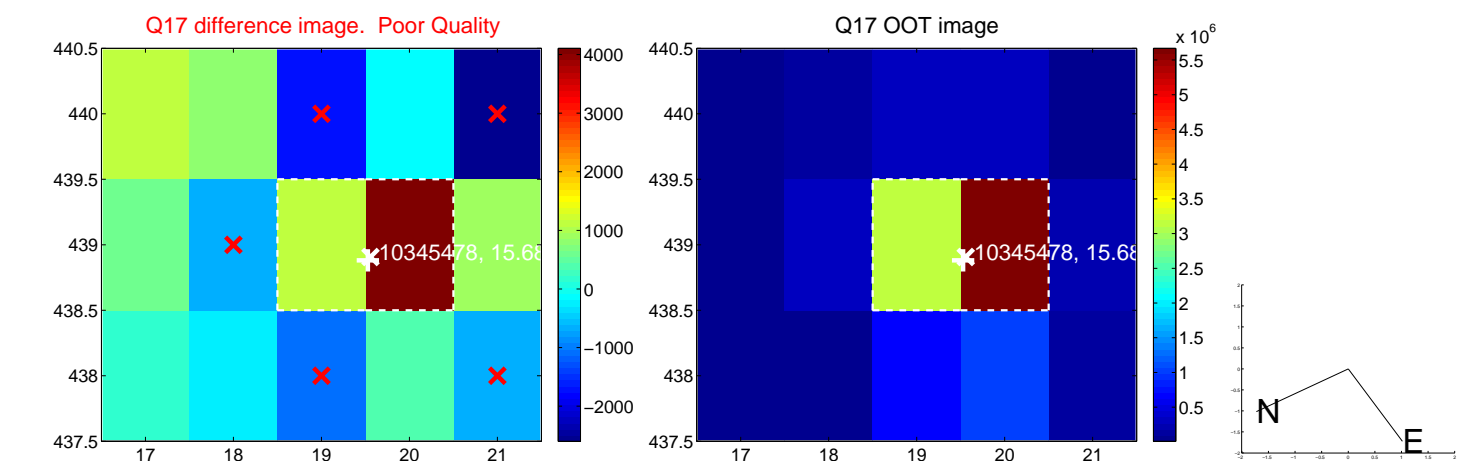
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



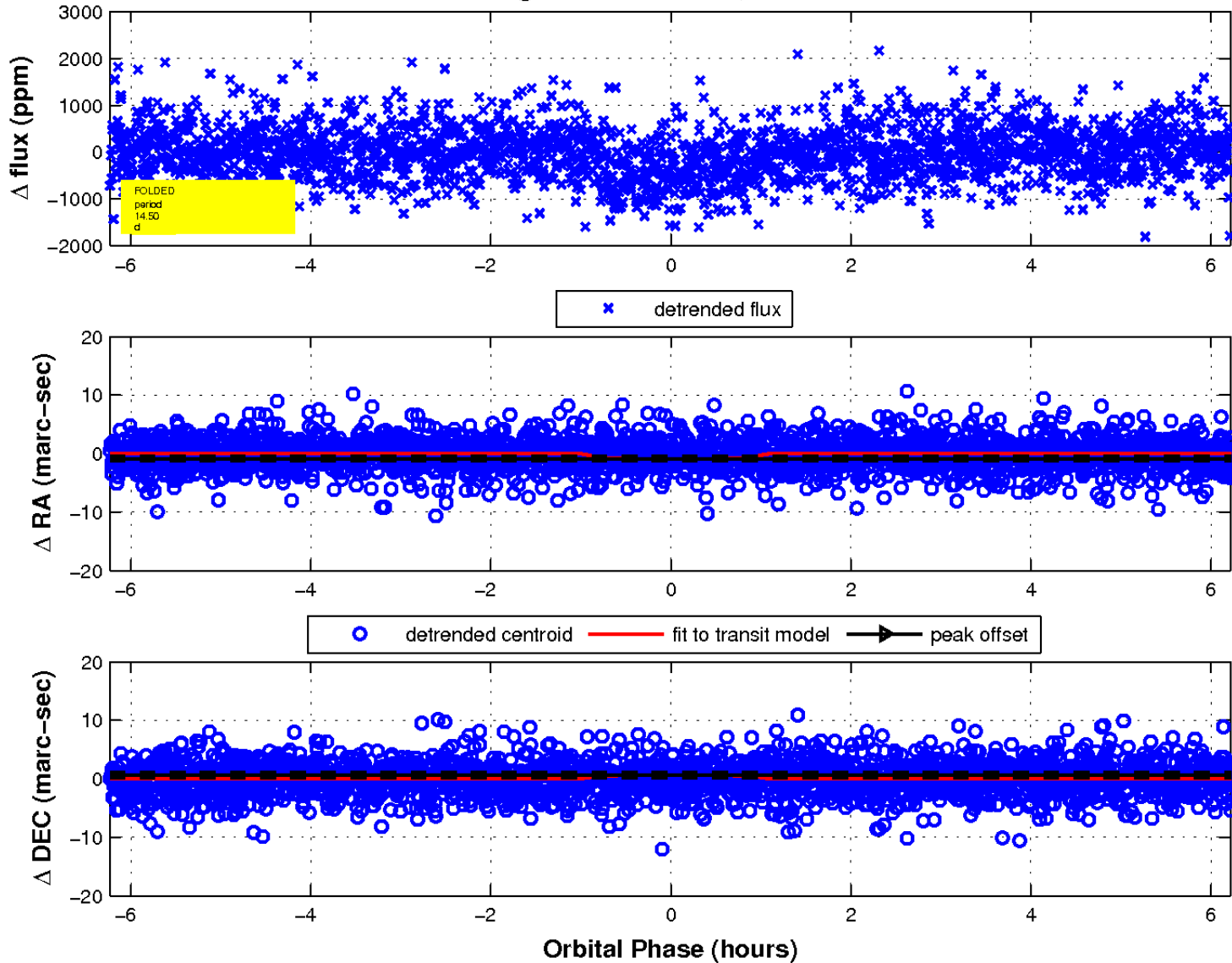
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



fluxWeightedCentroids, Planet 2 of 2





# UKIRT Image

Declination

