

# KIC 011768970

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
011768970-01	OBS	7478.01	15.541359	141.955806	10202.1	2.436	723.1	653.0	3.54	5092	66.46	449.23
011768970-02	OBS	No	15.541358	136.591113	830.0	5.627	71.7	73.9	3.54	5092	20.49	449.23

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
011768970-01	OBS	FP	0.00	0	1	0	0	MOD_SEC_DV—MOD_SEC_ALT—DEEP_V_SHAPED—HAS_SEC_TCE
011768970-02	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.

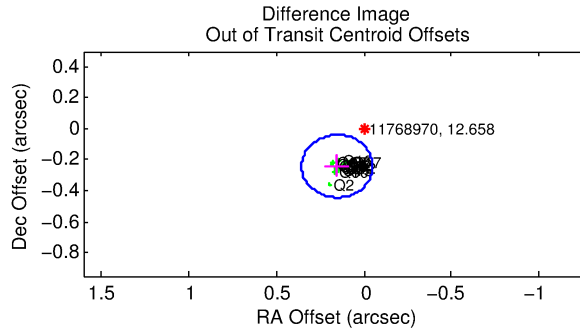
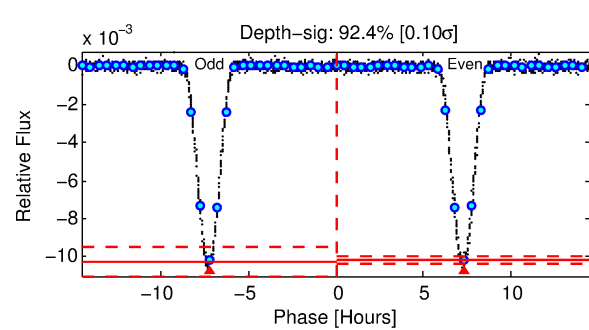
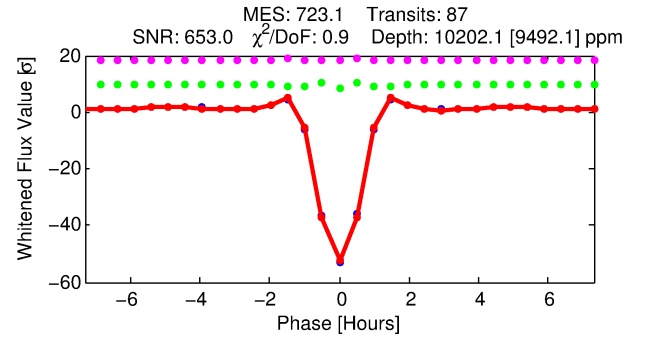
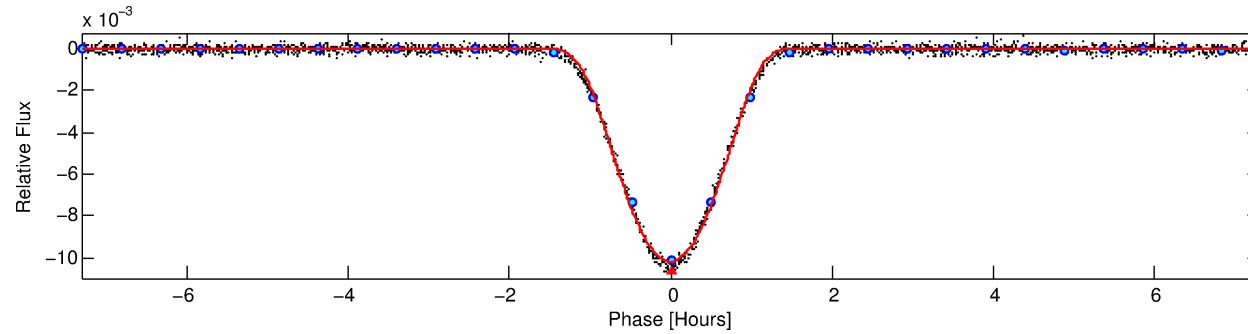
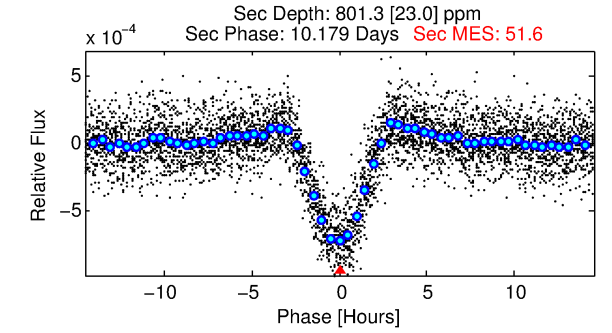
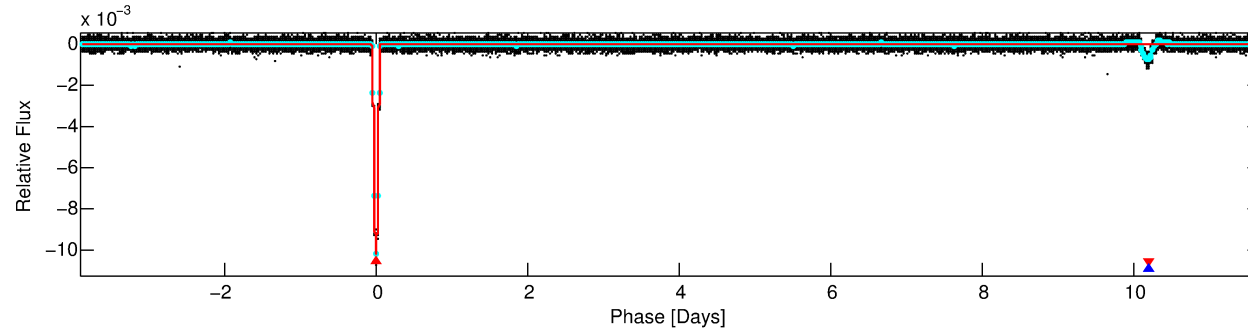
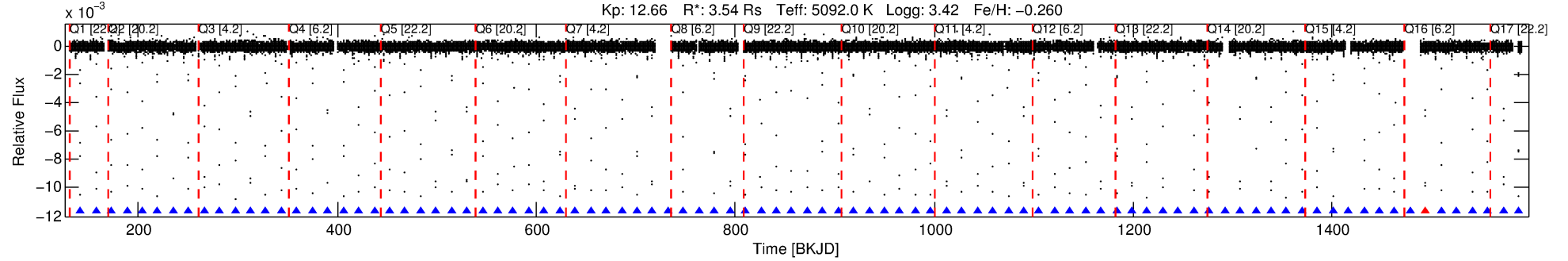
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 011768970-01

No Significant Match Found

# DV One-Page Summary

KIC: 11768970 Candidate: 1 of 2 Period: 15.541 d  
KOI: K07478.01 Corr: 1.000



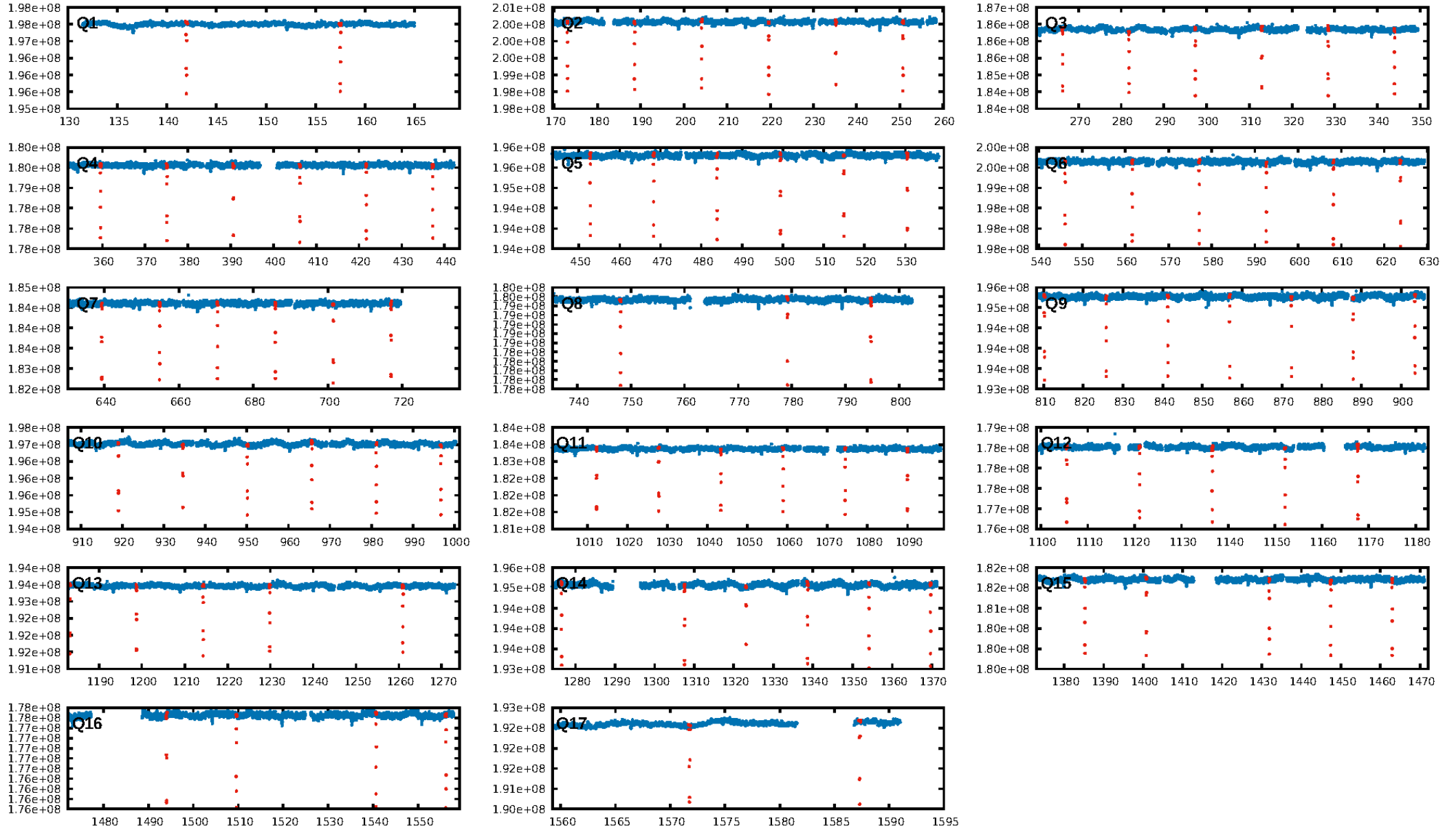
## DV Fit Results:

Period = 15.54136 [0.00000] d  
Epoch = 141.9558 [0.0001] BKJD  
Rp/R\* = 0.1720 [0.0172]  
a/R\* = 29.81 [0.40]  
b = 1.00 [0.08]  
Seff = 449.23 [118.93]  
Teq = 1174 [78] K  
Rp = 66.46 [15.04] Re  
a = 0.1296 [0.0226] AU  
Ag = 1.68 [0.55] [1.23 $\sigma$ ]  
Teffp = 2066 [109] K [6.68 $\sigma$ ]

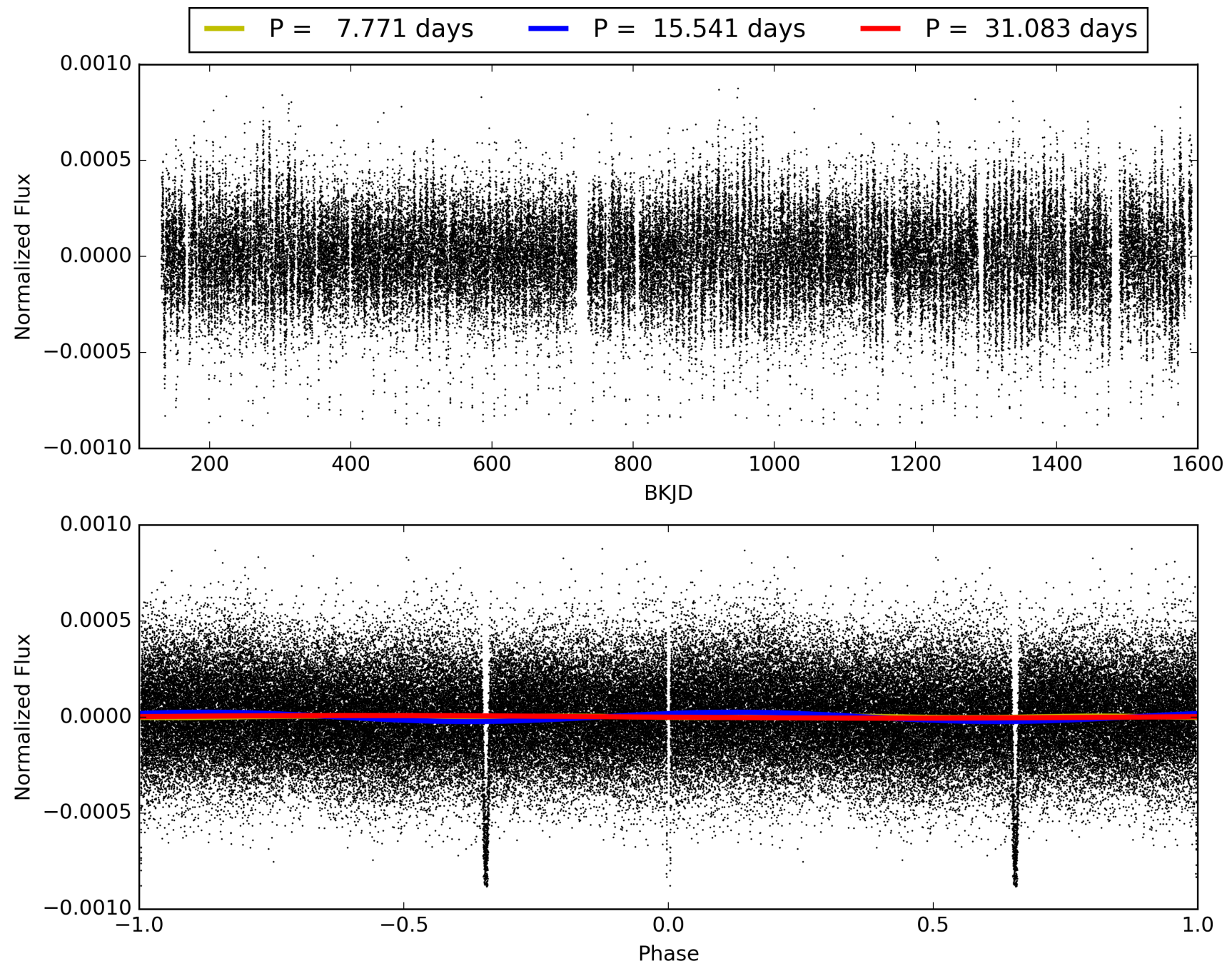
## DV Diagnostic Results:

ShortPeriod-sig: 0.0% [0.00 $\sigma$ ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 91.9%  
ModelChiSquareGof-sig: 92.8%  
Bootstrap-pfa: 0.00e+00  
RollingBand-fgt: 0.99 [82/83]  
GhostDiagnostic-chr: 3.771  
Centroid-sig: 0.0%  
Centroid-so: 0.225 arcsec [22.56 $\sigma$ ]  
OotOffset-rm: 0.287 arcsec [4.25 $\sigma$ ]  
KicOffset-rm: 0.213 arcsec [3.17 $\sigma$ ]  
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]

# TCE 011768970-01, PDC Light Curves

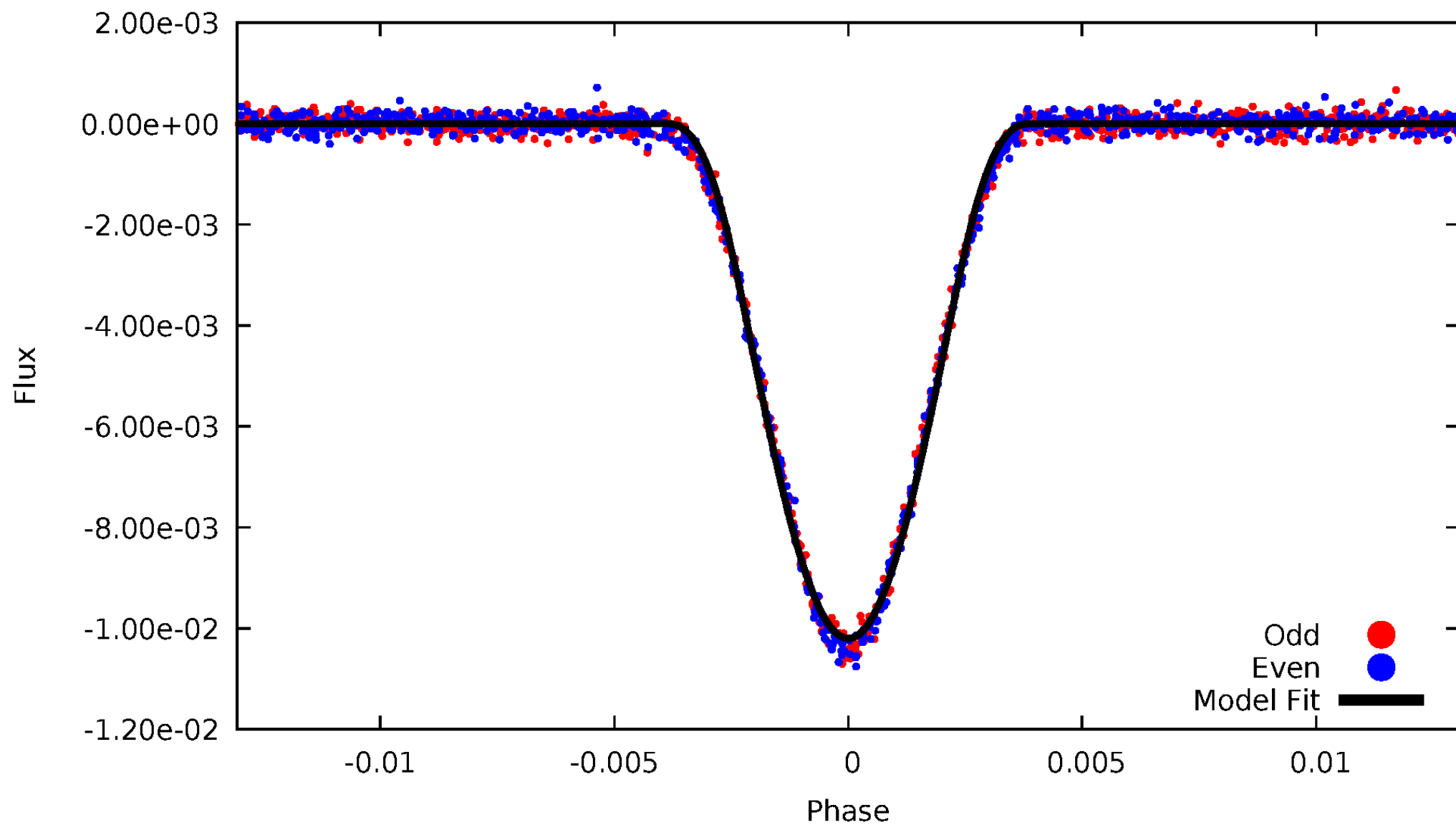


TCE 011768970-01



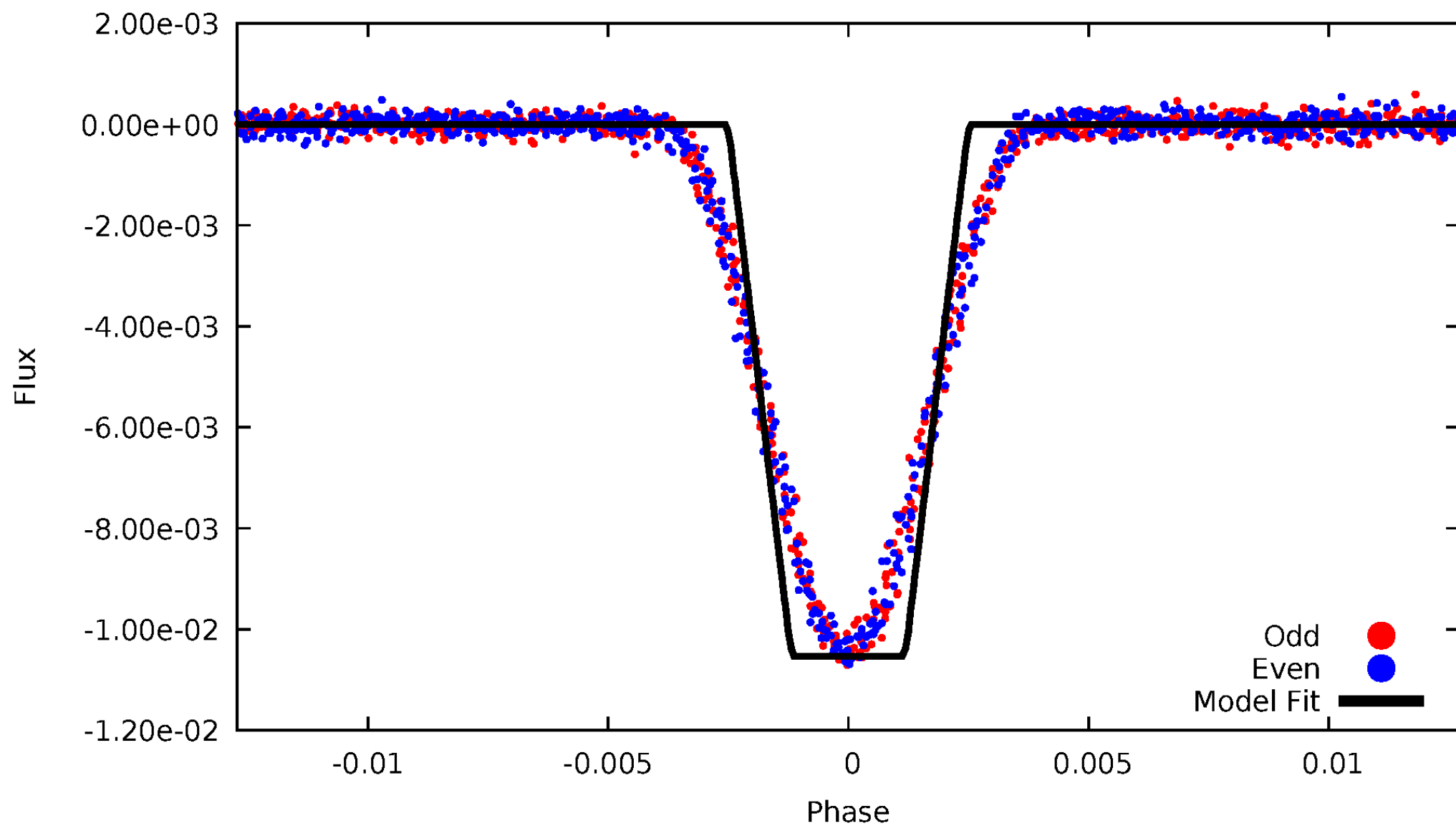
# DV Odd/Even

TCE 011768970-01



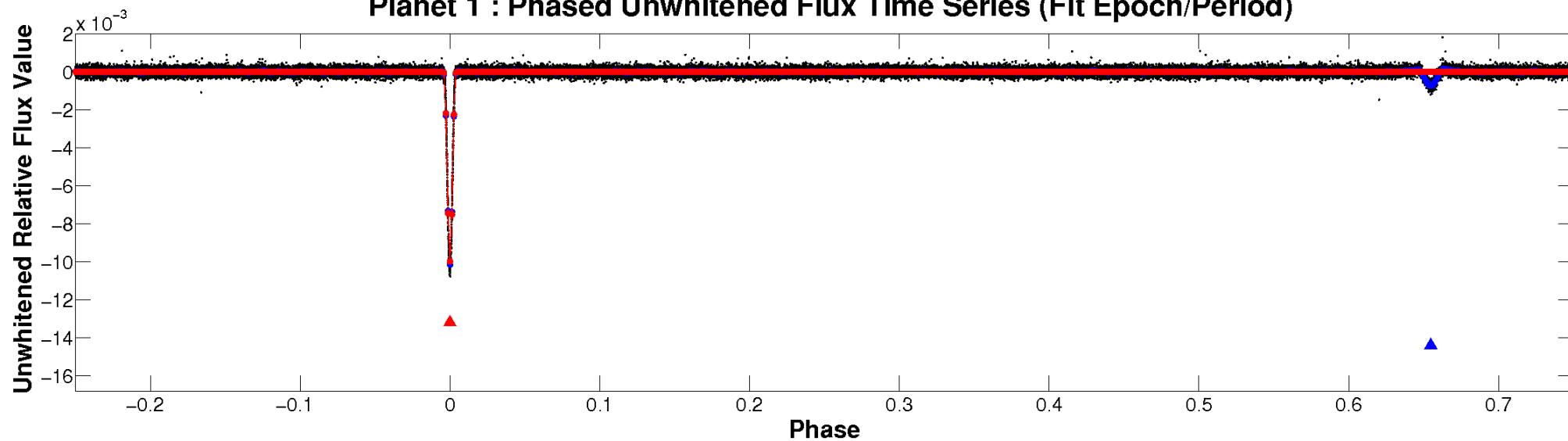
# ALT Odd/Even

TCE 011768970-01

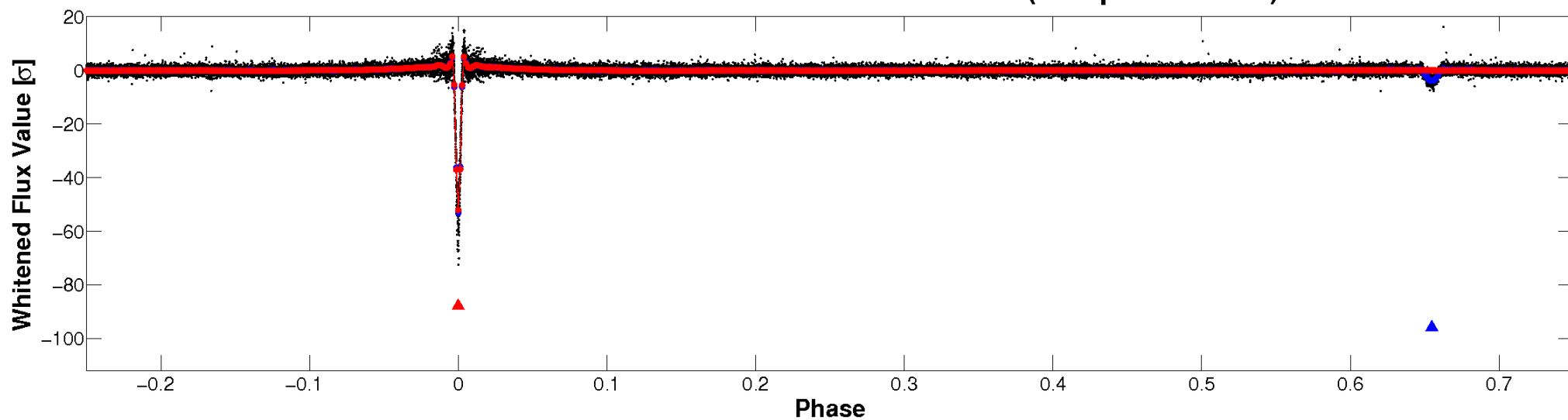


# Non-Whitened Vs. Whitened Light Curve

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

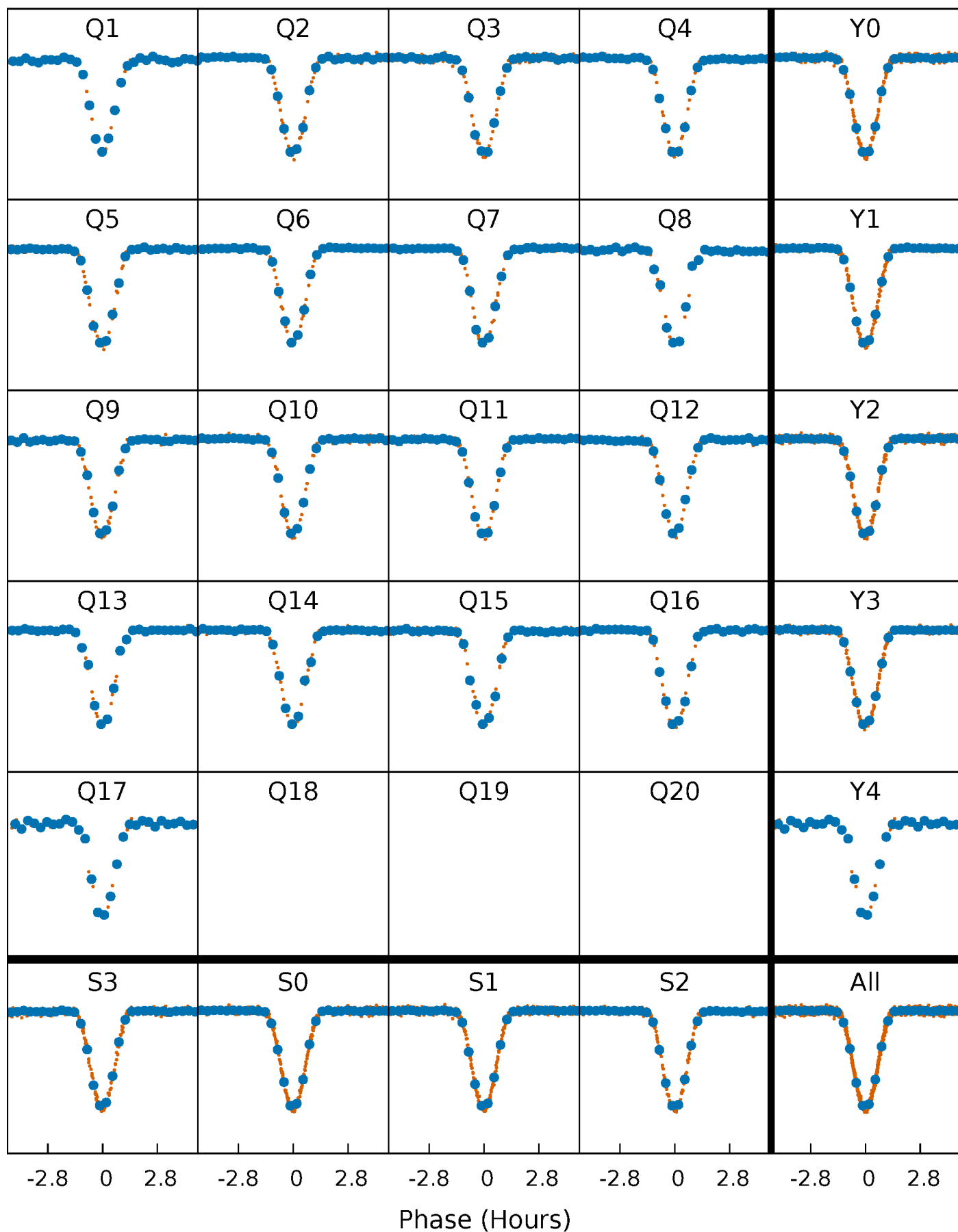


Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

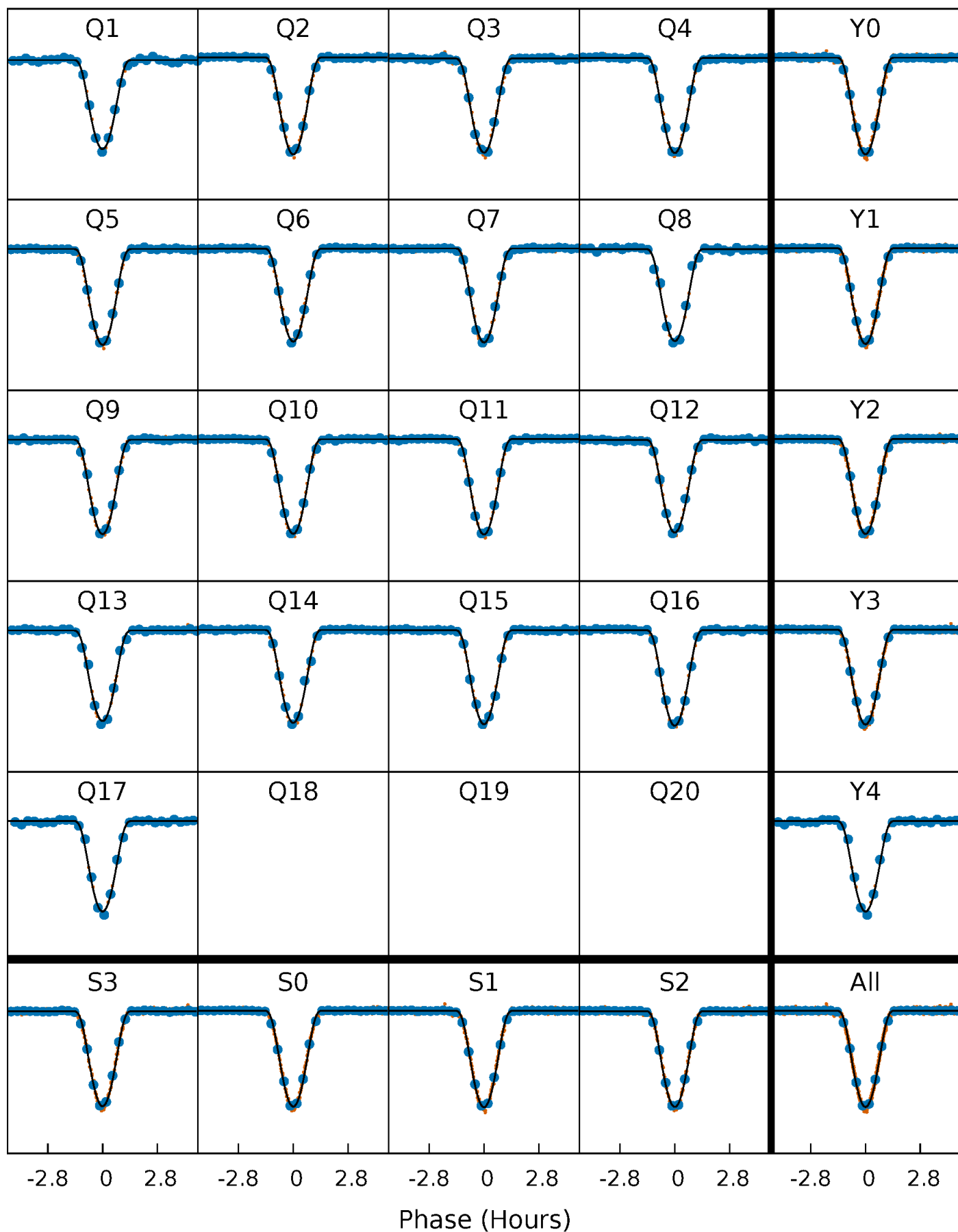
TCE 011768970-01 P= 15.541359 Days  $T_0=141.955806$  (BKJD)





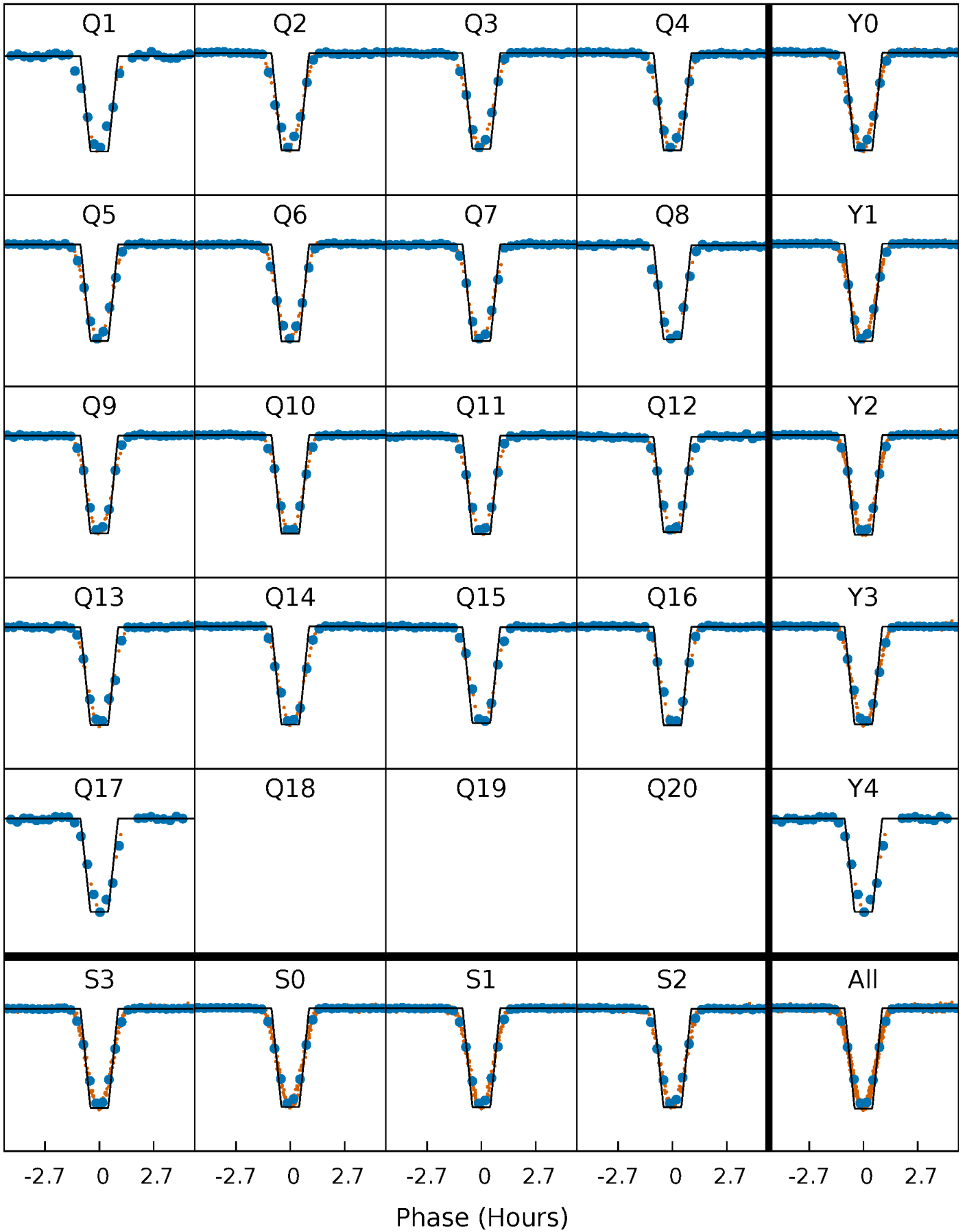
# DV Quarter-Phased Transit Curves

TCE 011768970-01 P= 15.541359 Days  $T_0=141.955806$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

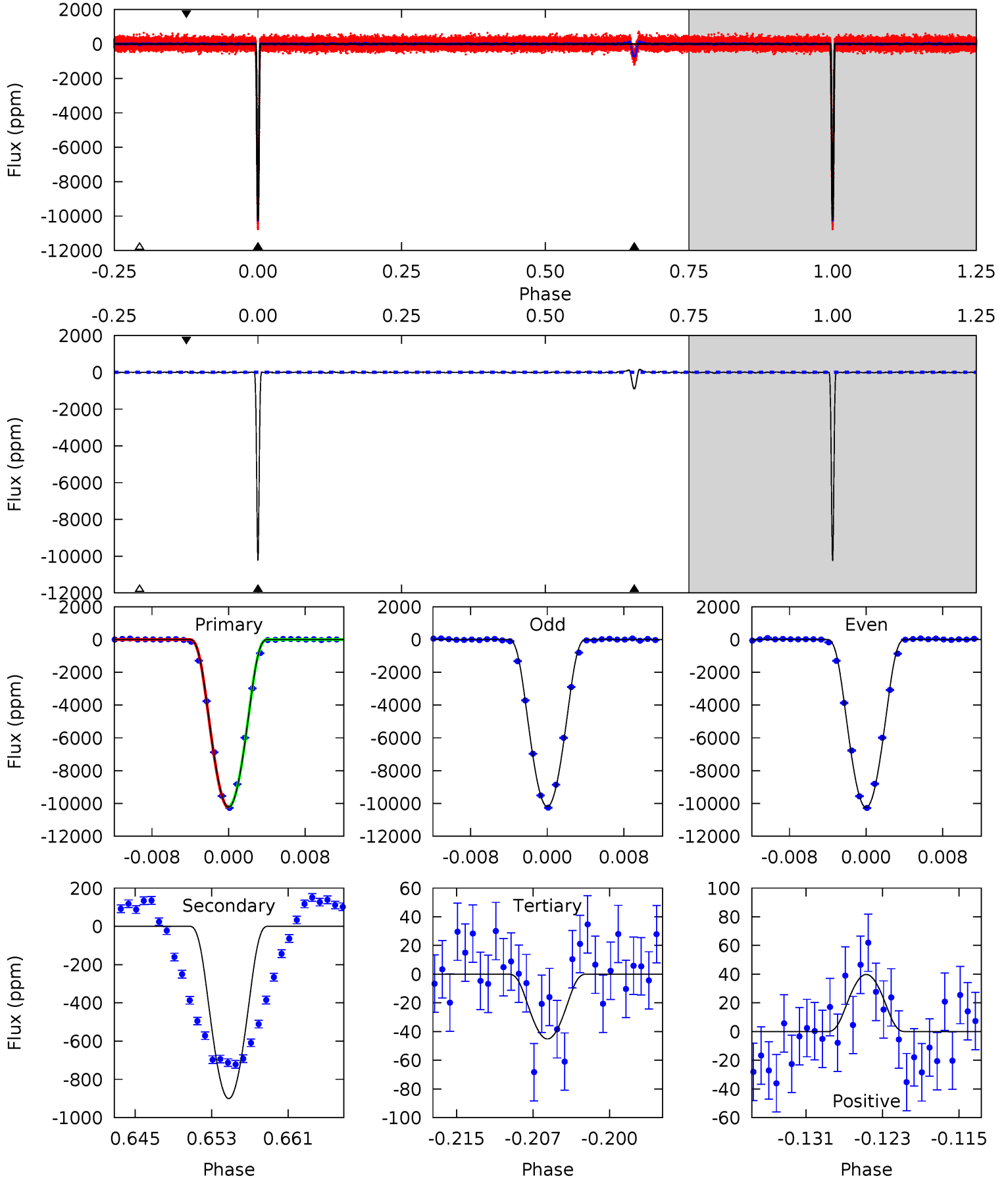
TCE 011768970-01 P= 15.541294 Days  $T_0=141.958667$  (BKJD)



# DV Model-Shift Uniqueness Test

011768970-01, P = 15.541359 Days, E = 126.414447 Days

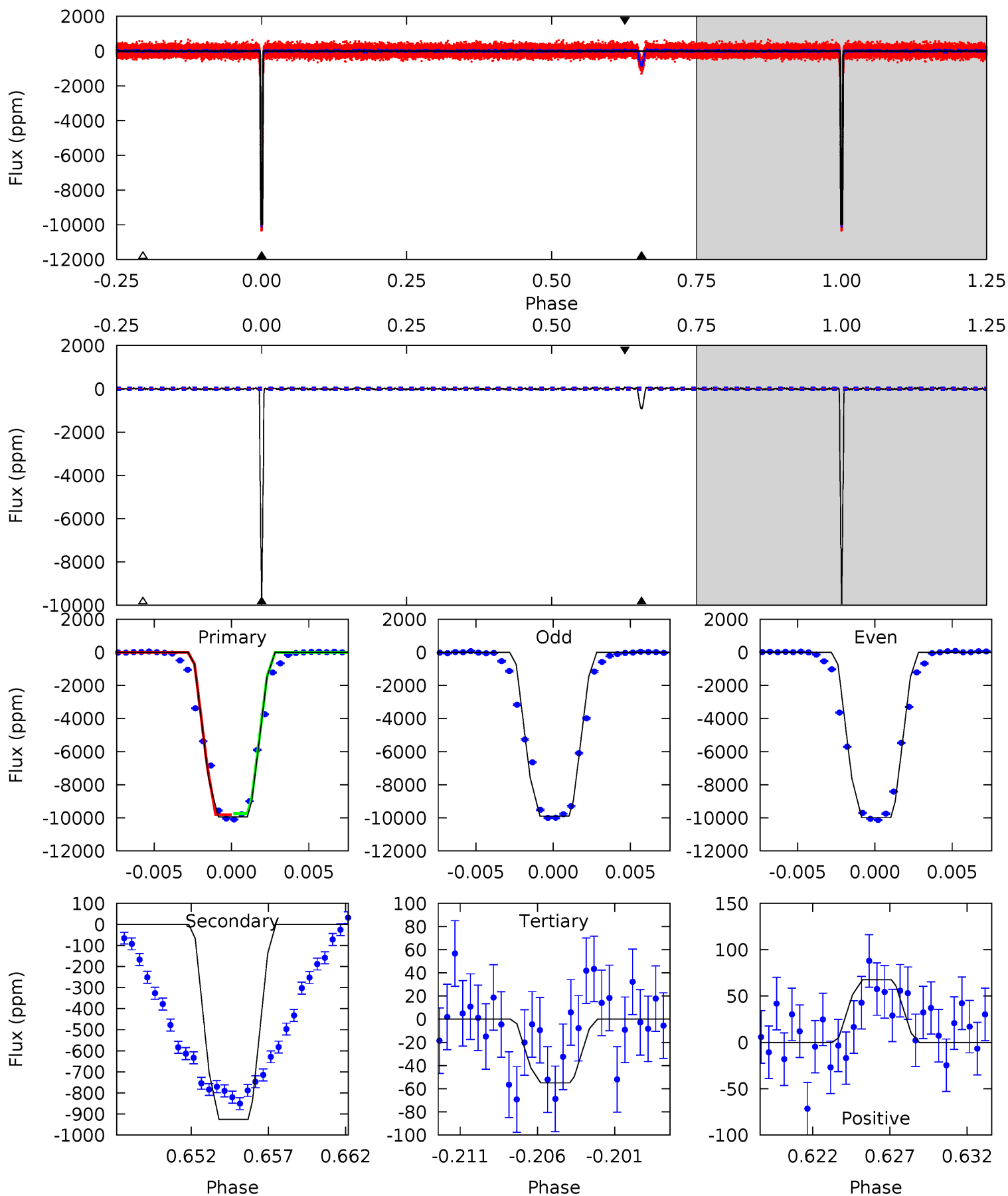
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
1503	132.4	6.64	5.85	5.08	2.67	2.94	1496	1497	125.8	126.6	4.41	1.00	0.02	2.43



# Alt Model-Shift Uniqueness Test

011768970-01, P = 15.541294 Days, E = 126.417373 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
770.4	71.7	4.26	5.23	5.16	2.81	1.68	766.2	765.2	67.5	66.5	3.38	1.00	0.01	2.27



### Stellar Parameters For KIC 011768970

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5092^{+60}_{-76}$	$3.420^{+0.143}_{-0.117}$	$-0.260^{+0.150}_{-0.150}$	$3.540^{+0.654}_{-0.719}$	$1.201^{+0.148}_{-0.221}$	$0.038^{+0.027}_{-0.013}$
	+1%/-1%	+4%/-3%	+58%/-58%	+18%/-20%	+12%/-18%	+70%/-35%
Source	SPE74	SPE74	SPE74	DSEP		

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

### Secondary Eclipse Parameters for KIC 011768970-01 / KOI 7478.01

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-901 \pm 7$	$66.07^{+10.97}_{-9.85}$	$1637^{+83}_{-84}$	$2762^{+104}_{-79}$	$1.915^{+0.635}_{-0.471}$
Alt.	$-926 \pm 13$	$38.83^{+8.48}_{-7.49}$	$1638^{+78}_{-84}$	$3263^{+201}_{-154}$	$5.603^{+2.947}_{-1.730}$

$T_{\text{max}}$  = 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

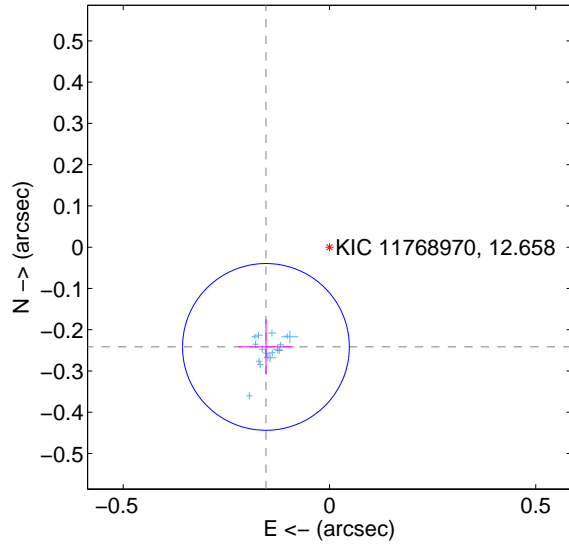
Supplemental centroid analysis for 011768970-01. Kepler magnitude: 12.66. Transit SNR 653.05

There are 17 quarters with good PRF difference image offsets

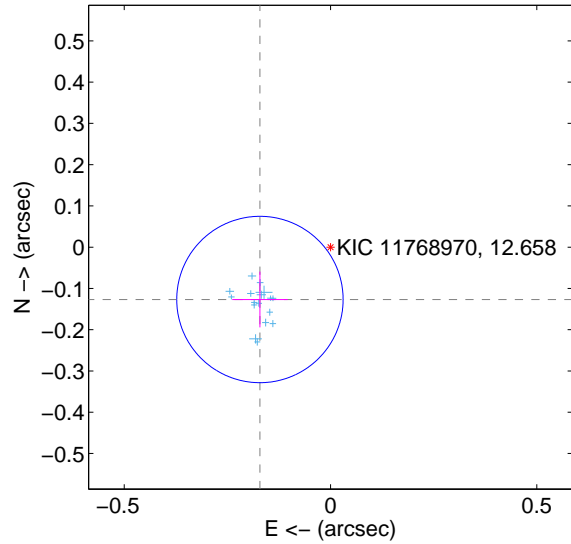
The direct PRF centroid is offset from the target star catalog position by about 0.13 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.287 \pm 0.067$	4.25	$0.154 \pm 0.067$	$-0.242 \pm 0.067$
PRF-fit source offset from KIC position	$0.213 \pm 0.067$	3.17	$0.171 \pm 0.067$	$-0.127 \pm 0.067$
photometric centroid source offset	$0.23 \pm 0.01$	22.56	$0.21 \pm 0.01$	$-0.09 \pm 0.01$

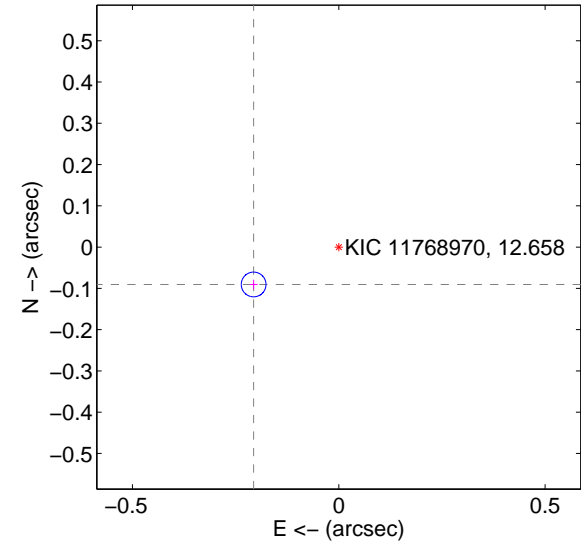
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

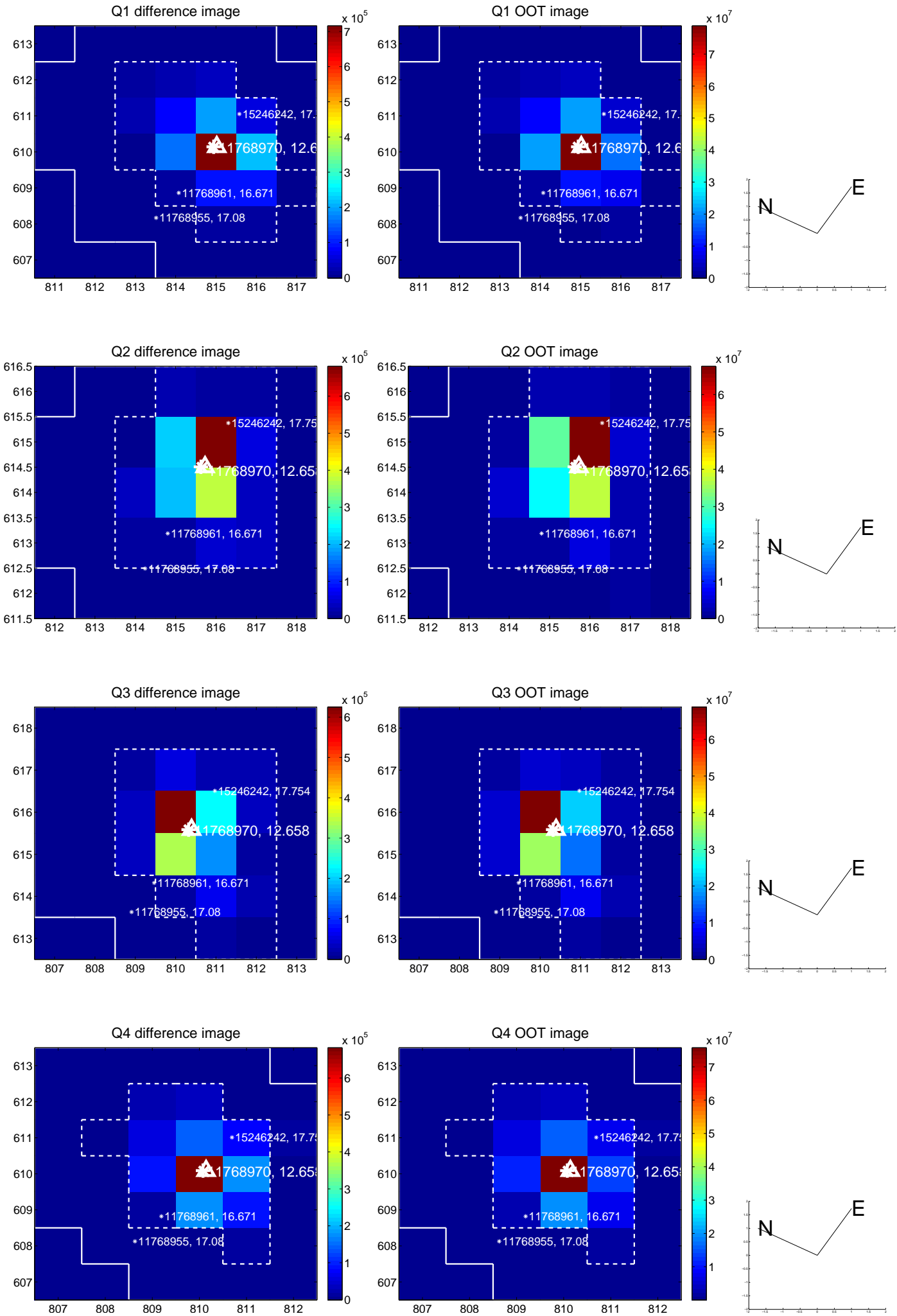


offset from photometric centroids

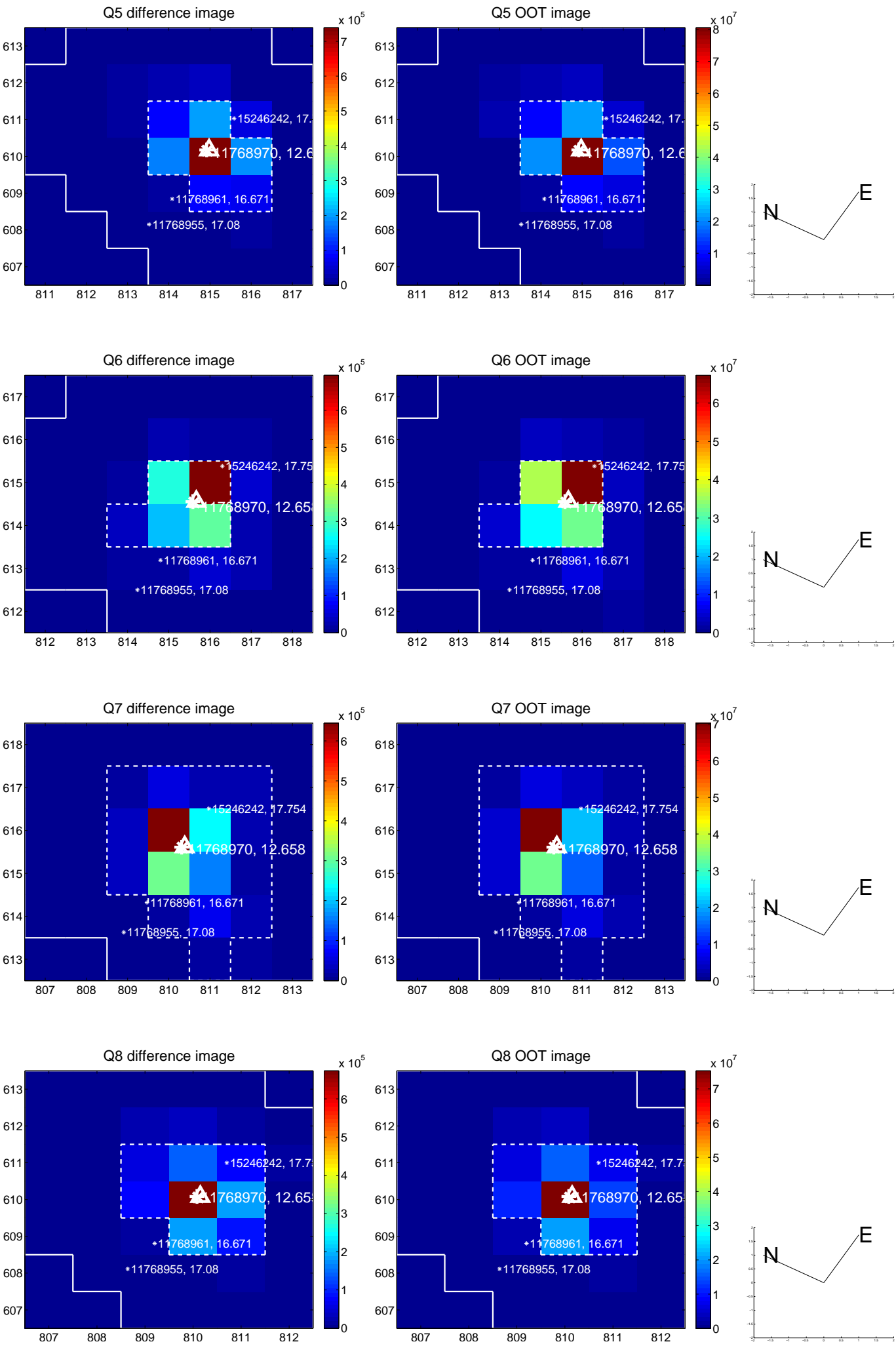


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

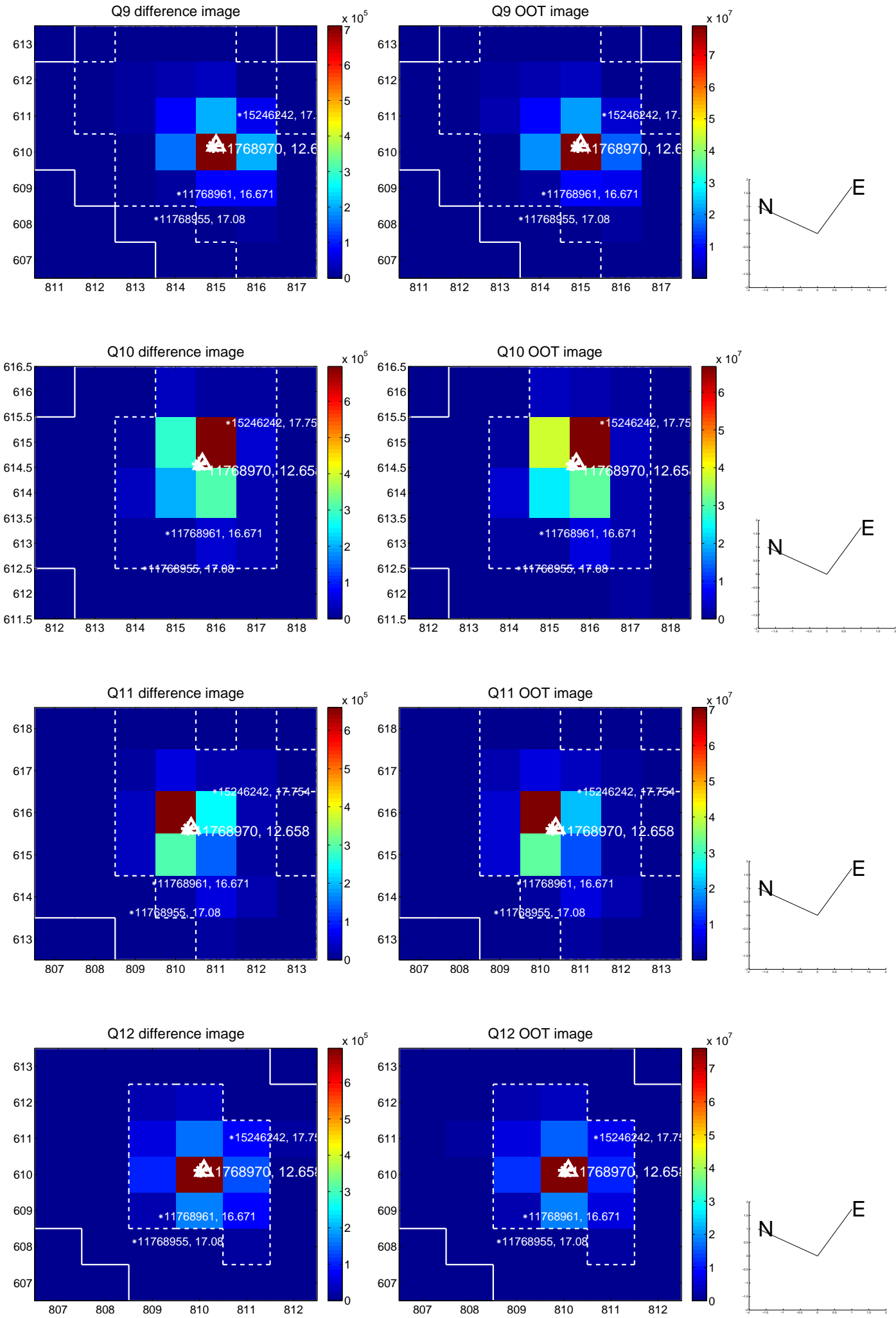


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

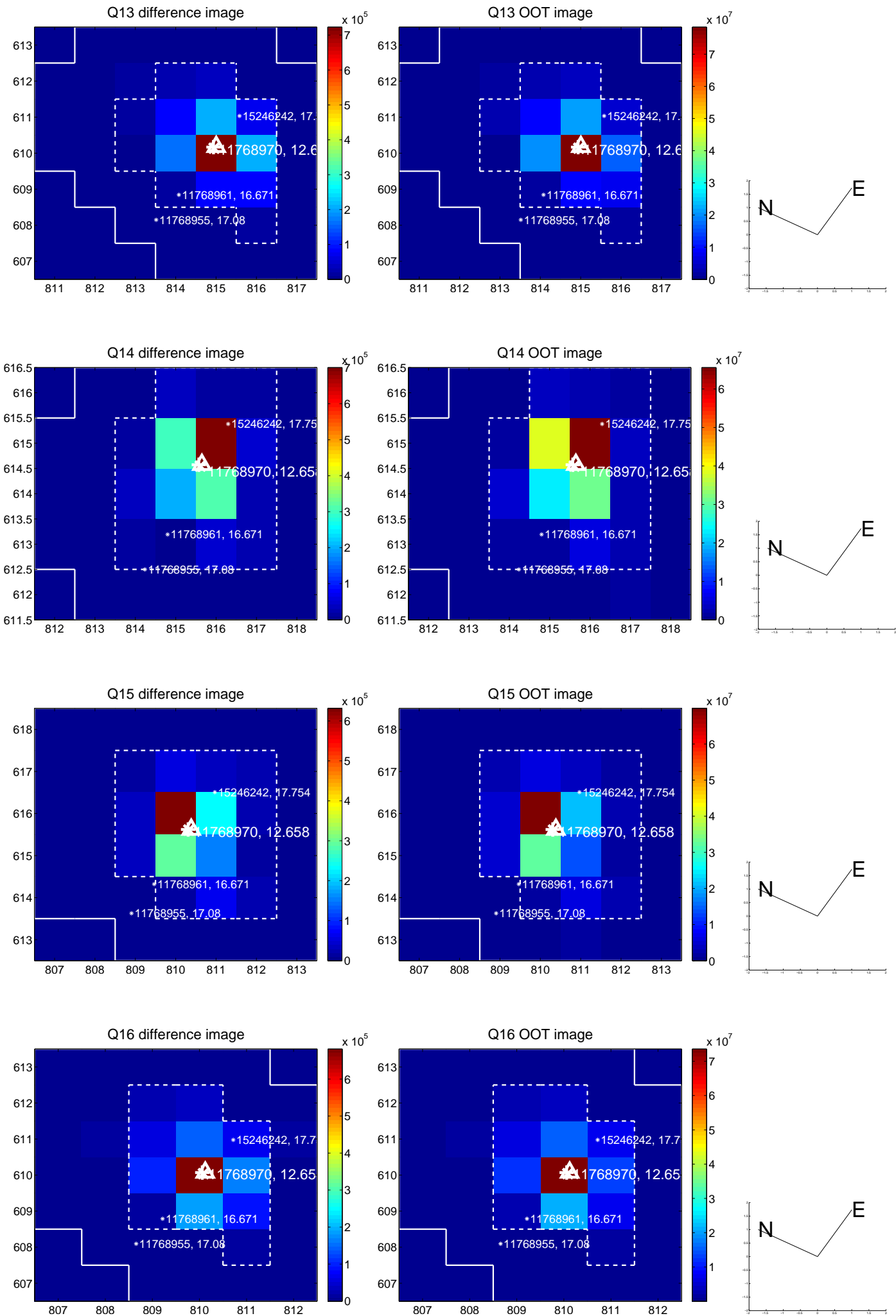




white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

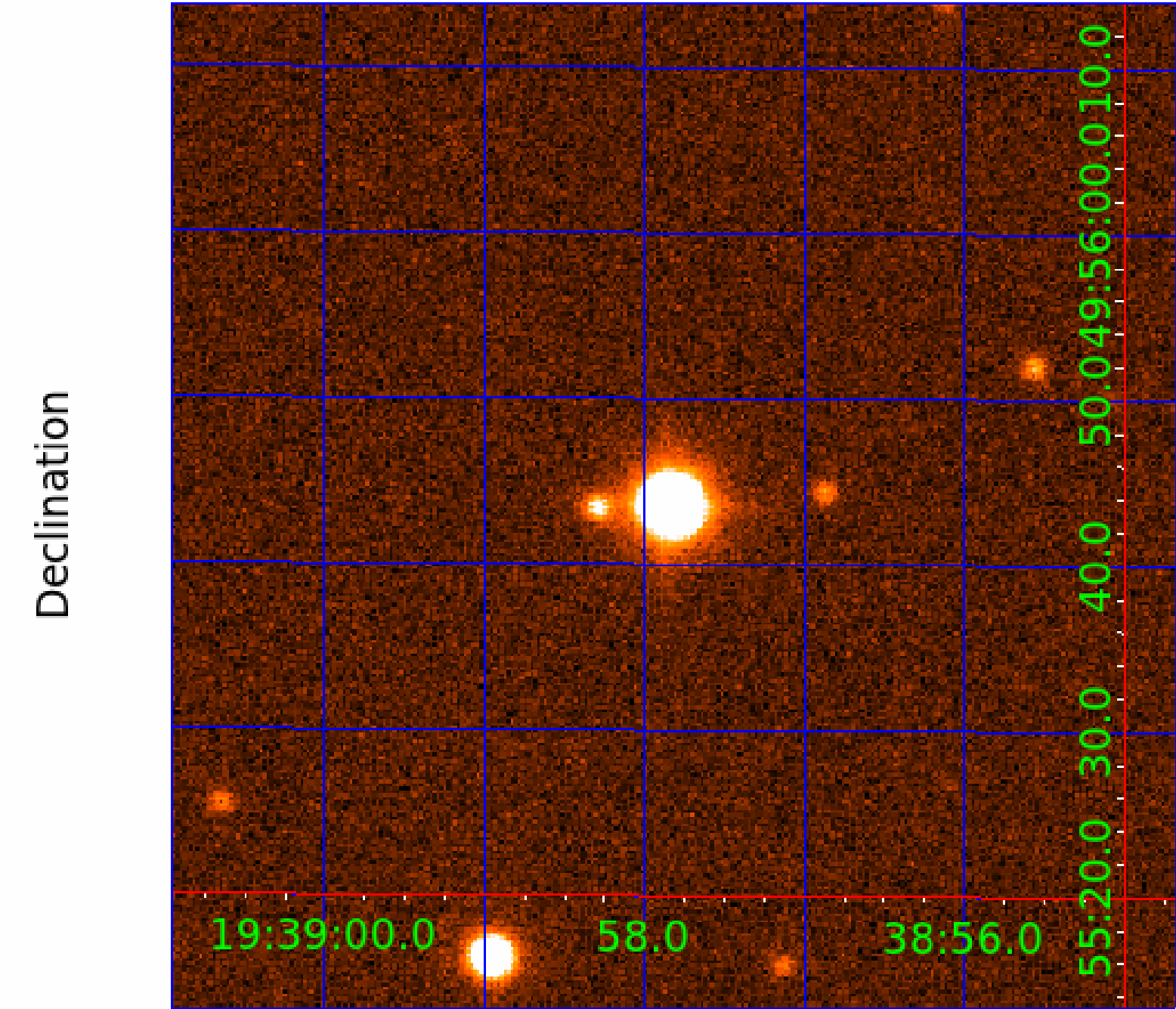


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





UKIRT Image



# KIC 011768970

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
011768970-01	OBS	7478.01	15.541359	141.955806	10202.1	2.436	723.1	653.0	3.54	5092	66.46	449.23
011768970-02	OBS	No	15.541358	136.591113	830.0	5.627	71.7	73.9	3.54	5092	20.49	449.23

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
011768970-01	OBS	FP	0.00	0	1	0	0	MOD_SEC_DV—MOD_SEC_ALT—DEEP_V_SHAPED—HAS_SEC_TCE
011768970-02	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 011768970-02

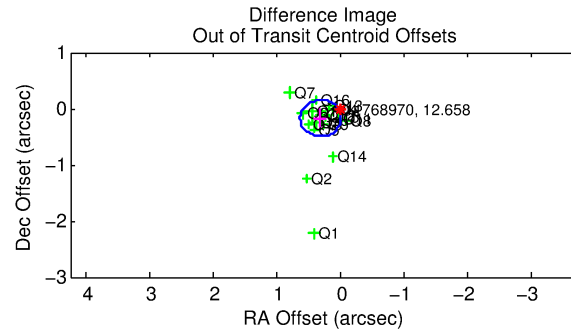
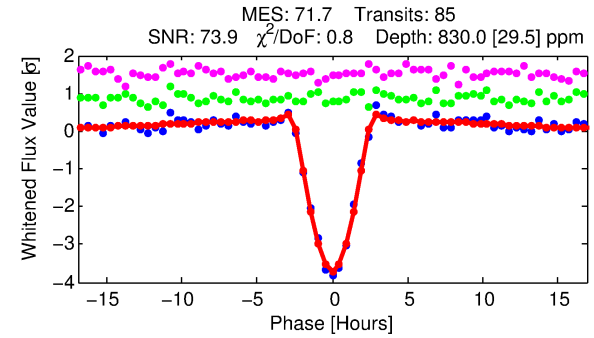
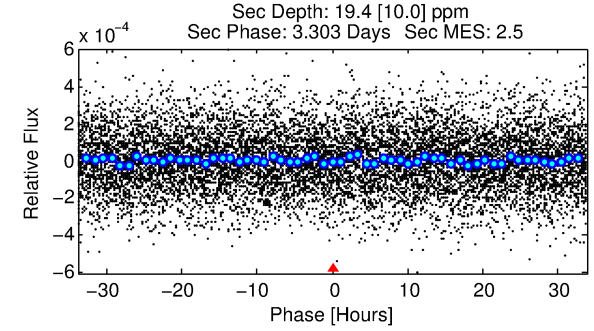
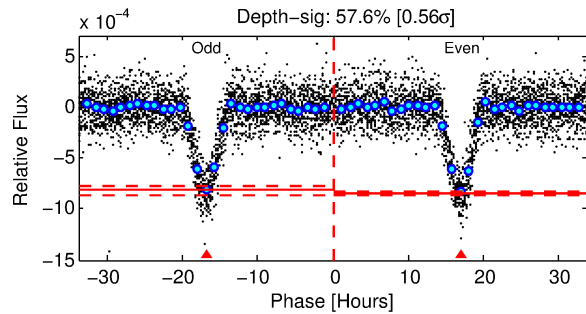
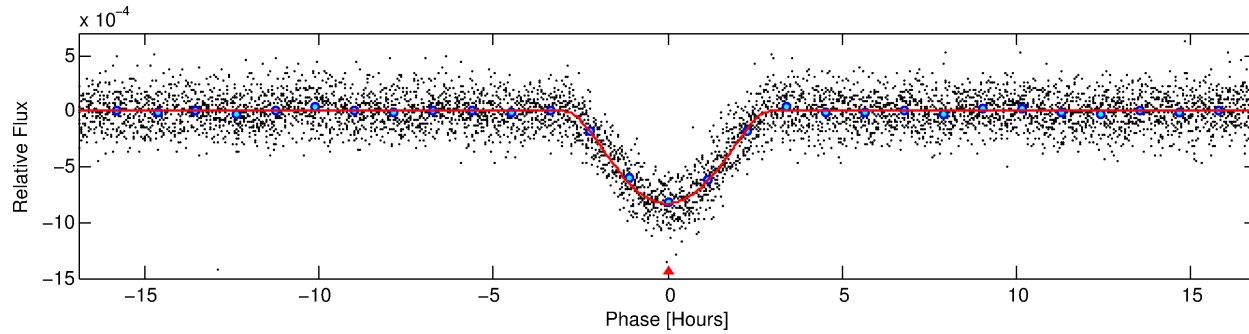
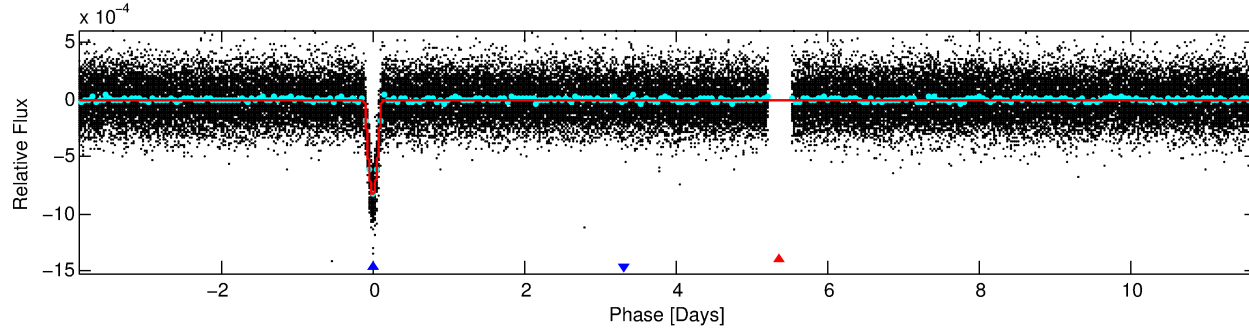
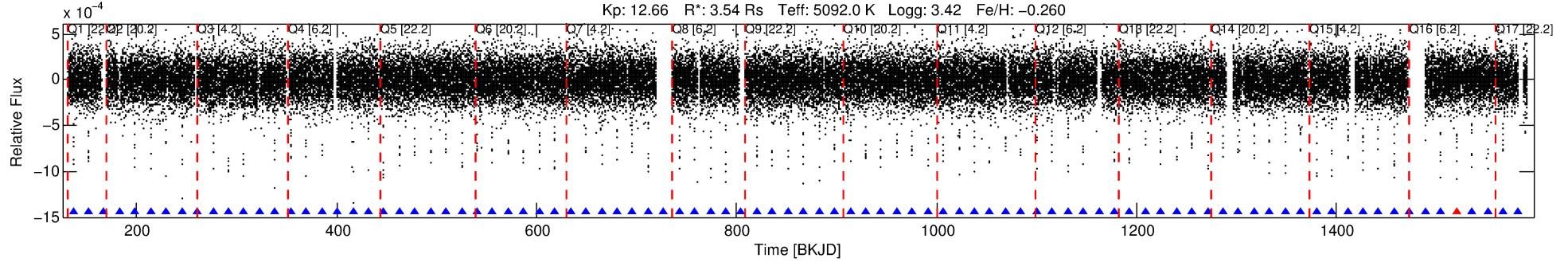
No Significant Match Found

# DV One-Page Summary

KIC: 11768970 Candidate: 2 of 2 Period: 15.541 d

KOI: K07478 Corr: No Ephemeris Match

Kp: 12.66 R\*: 3.54 Rs Teff: 5092.0 K Logg: 3.42 Fe/H: -0.260



## DV Fit Results:

Period = 15.54136 [0.00003] d  
Epoch = 136.5911 [0.0017] BKJD  
Rp/R\* = 0.0530 [0.0205]  
a/R\* = 7.08 [0.63]  
b = 1.00 [0.03]  
Seff = 449.23 [118.93]  
Teq = 1174 [78] K  
Rp = 20.49 [8.93] Re  
a = 0.1296 [0.0226] AU  
Ag = 0.43 [0.41] [-1.40σ]  
Teffp = 1466 [341] K [0.84σ]

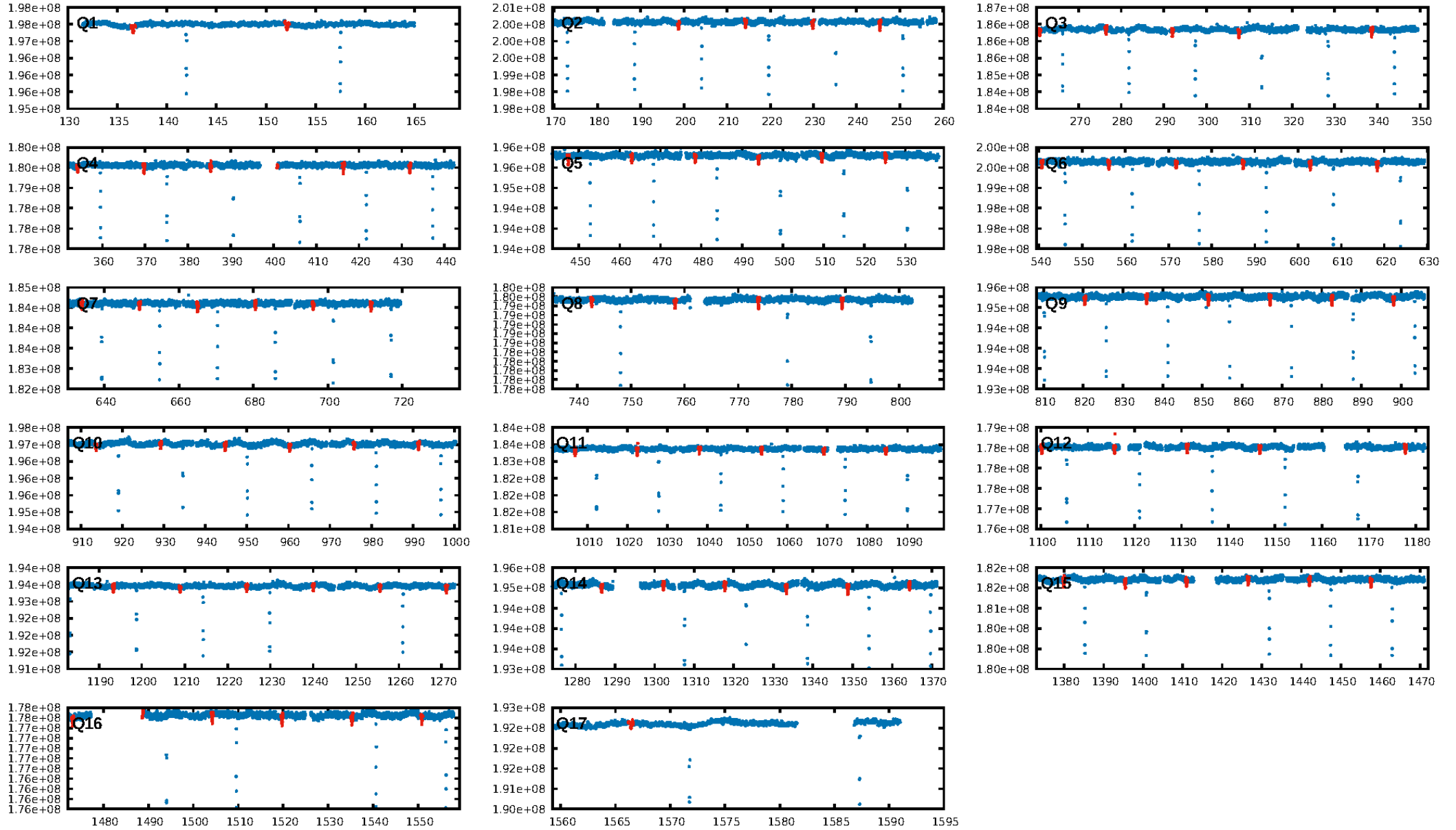
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 0.0% [0.00σ]  
ModelChiSquare2-sig: 93.3%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 0.00e+00  
RollingBand-fgt: 0.99 [81/82]  
GhostDiagnostic-chr: 4.019  
Centroid-sig: 0.0%  
Centroid-so: 0.177 arcsec [2.03σ]  
OotOffset-rm: 0.358 arcsec [3.31σ]  
KicOffset-rm: 0.351 arcsec [4.01σ]  
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 04:07:52 Z

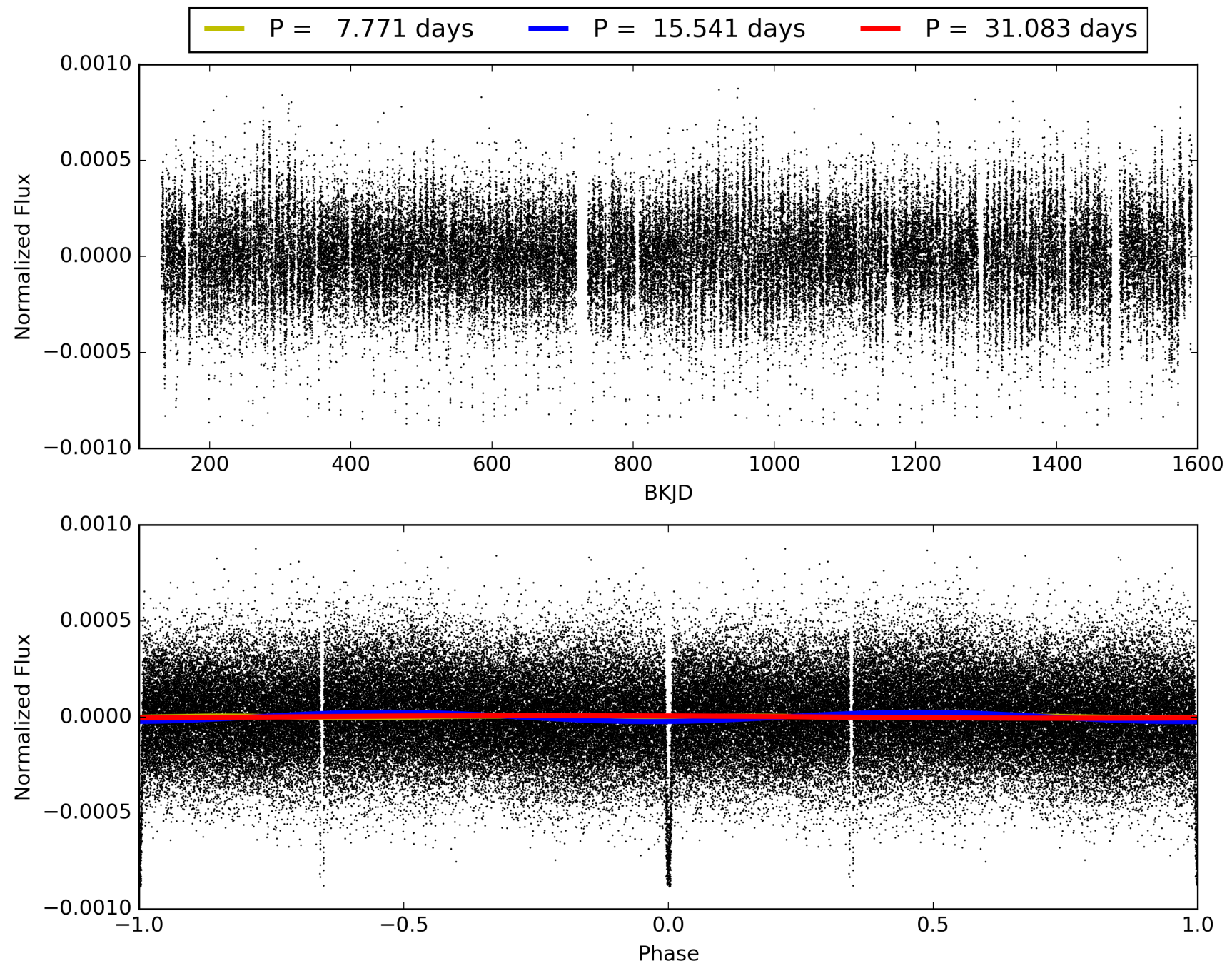
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 011768970-02, PDC Light Curves





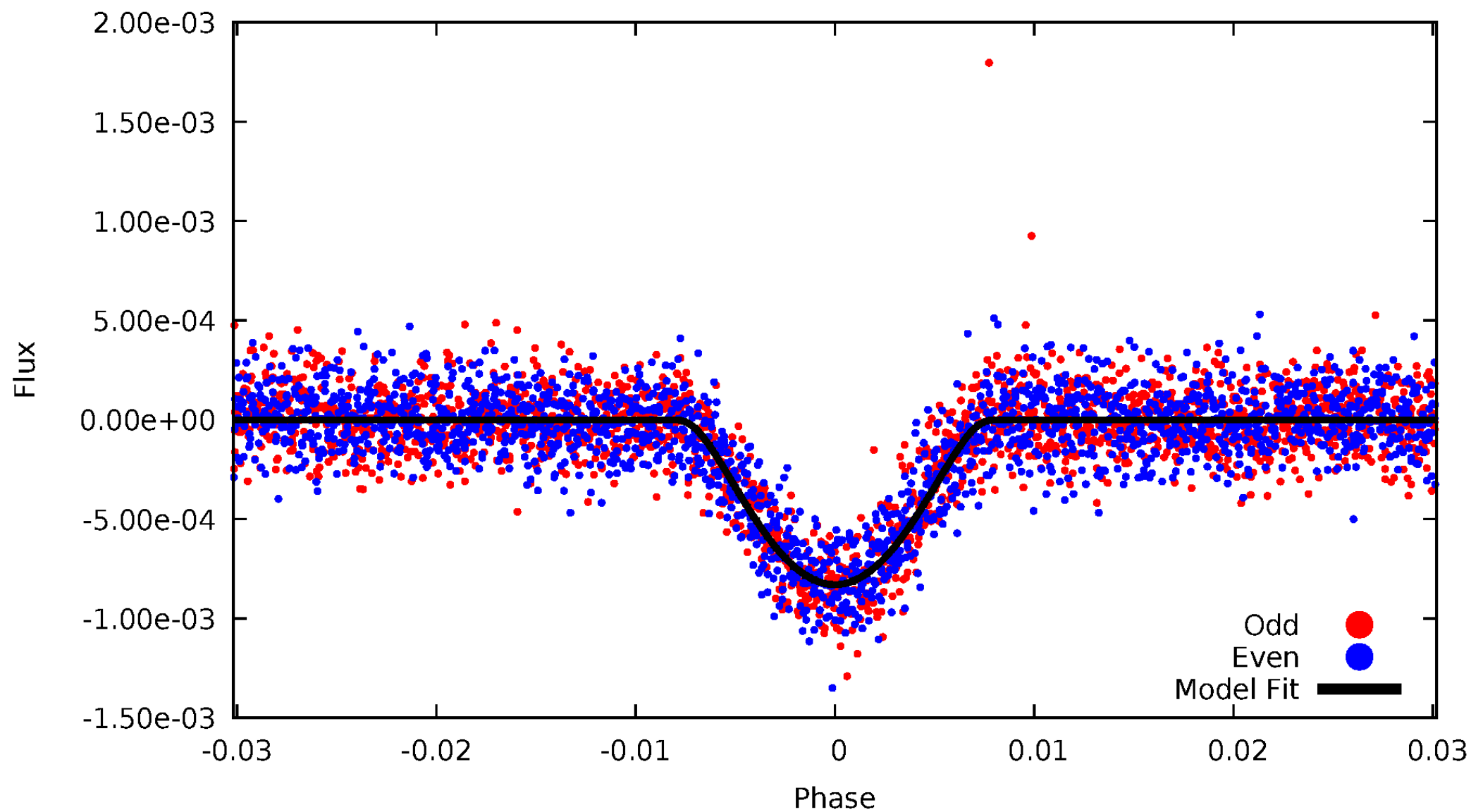
# TCE 011768970-02





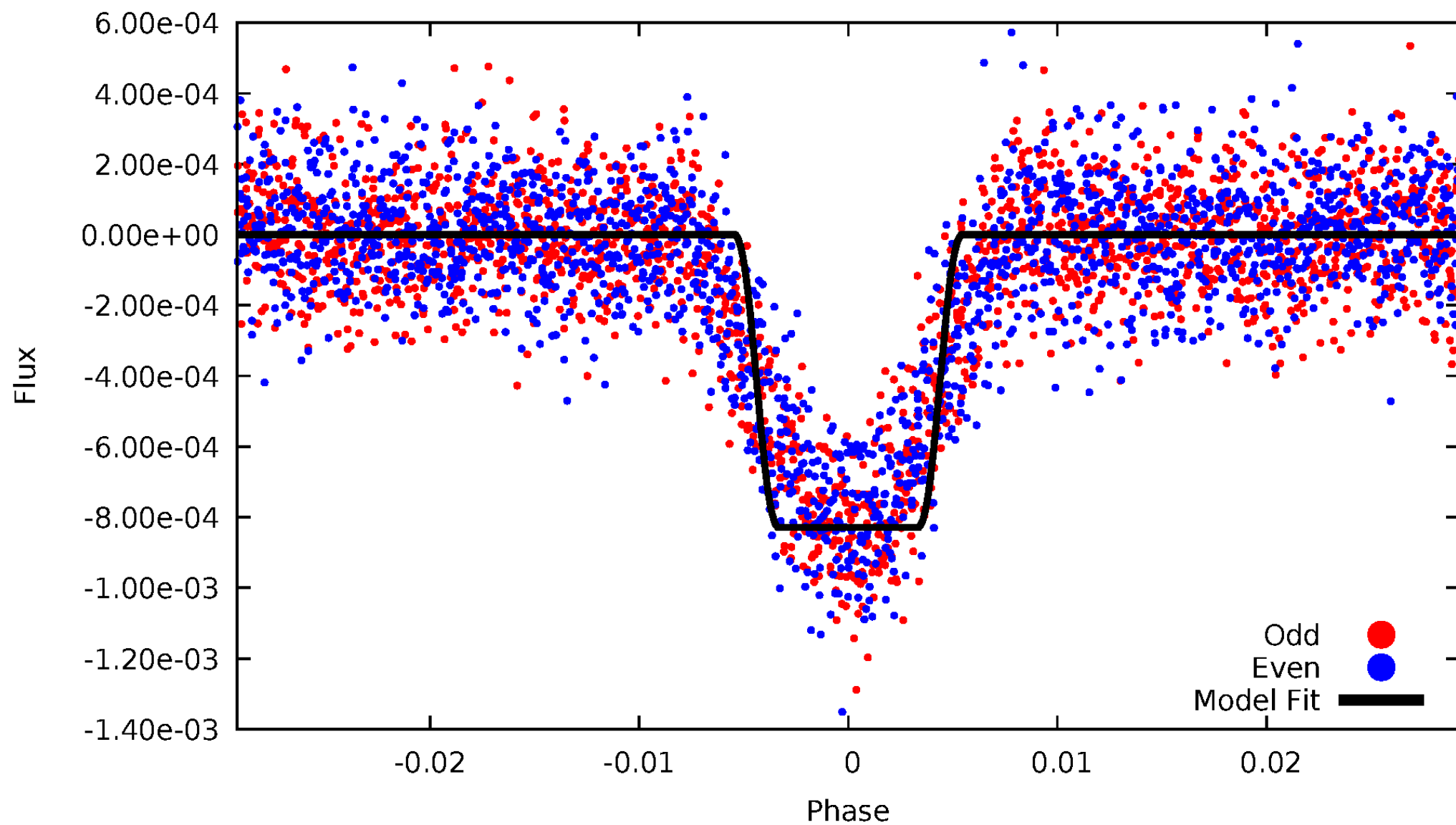
# DV Odd/Even

TCE 011768970-02



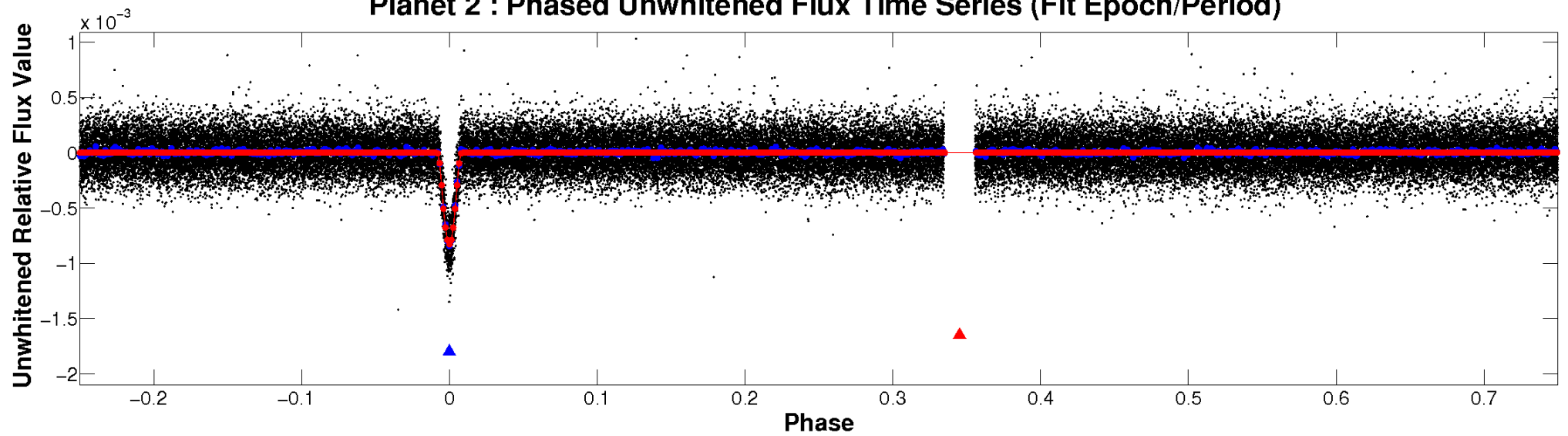
# ALT Odd/Even

TCE 011768970-02

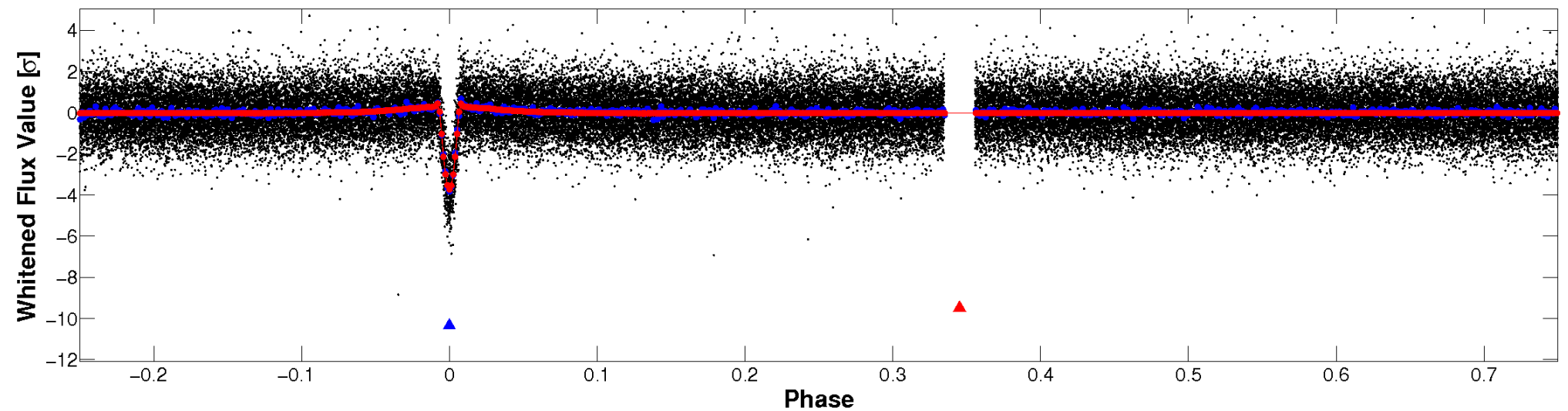


# Non-Whitened Vs. Whitened Light Curve

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

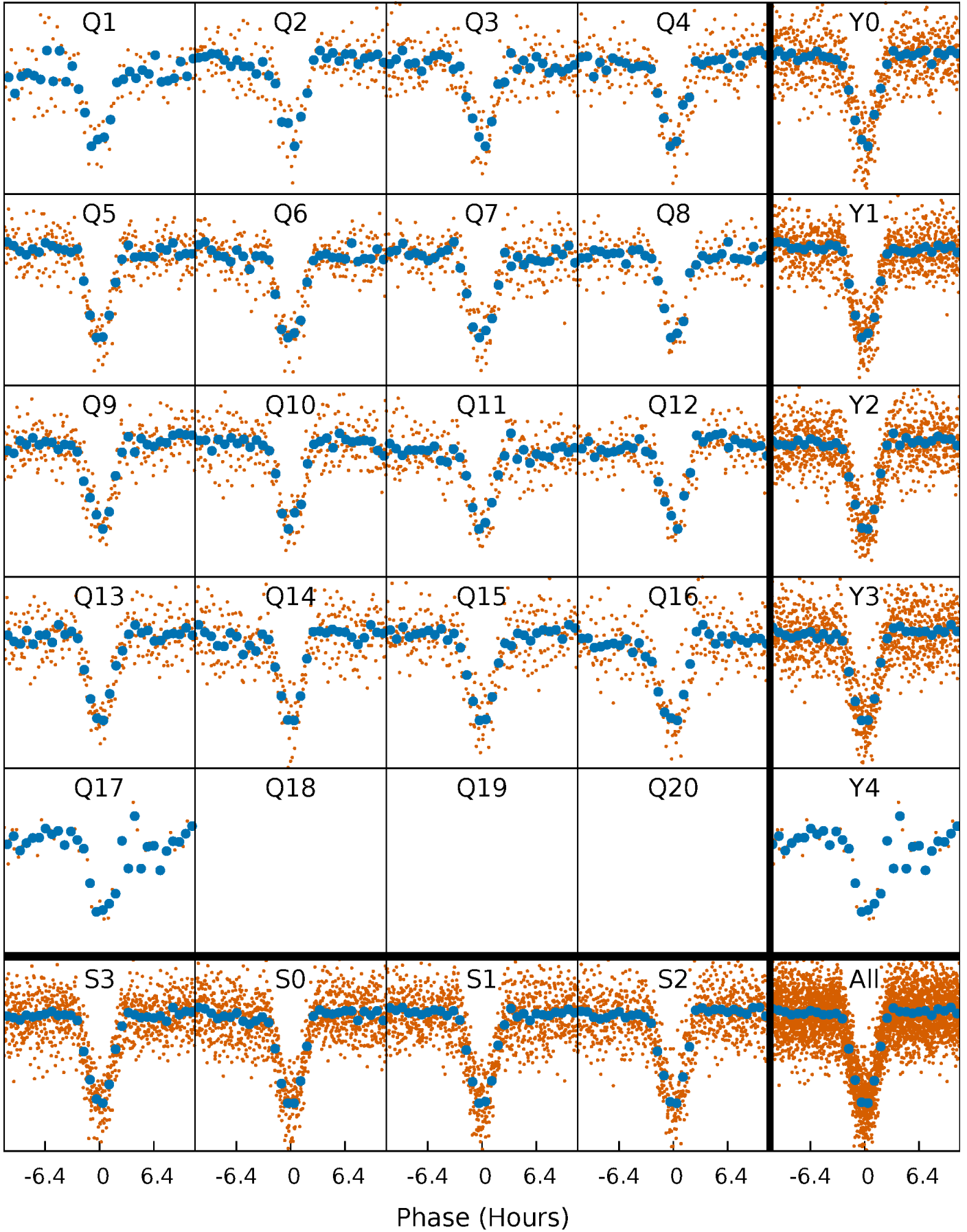


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



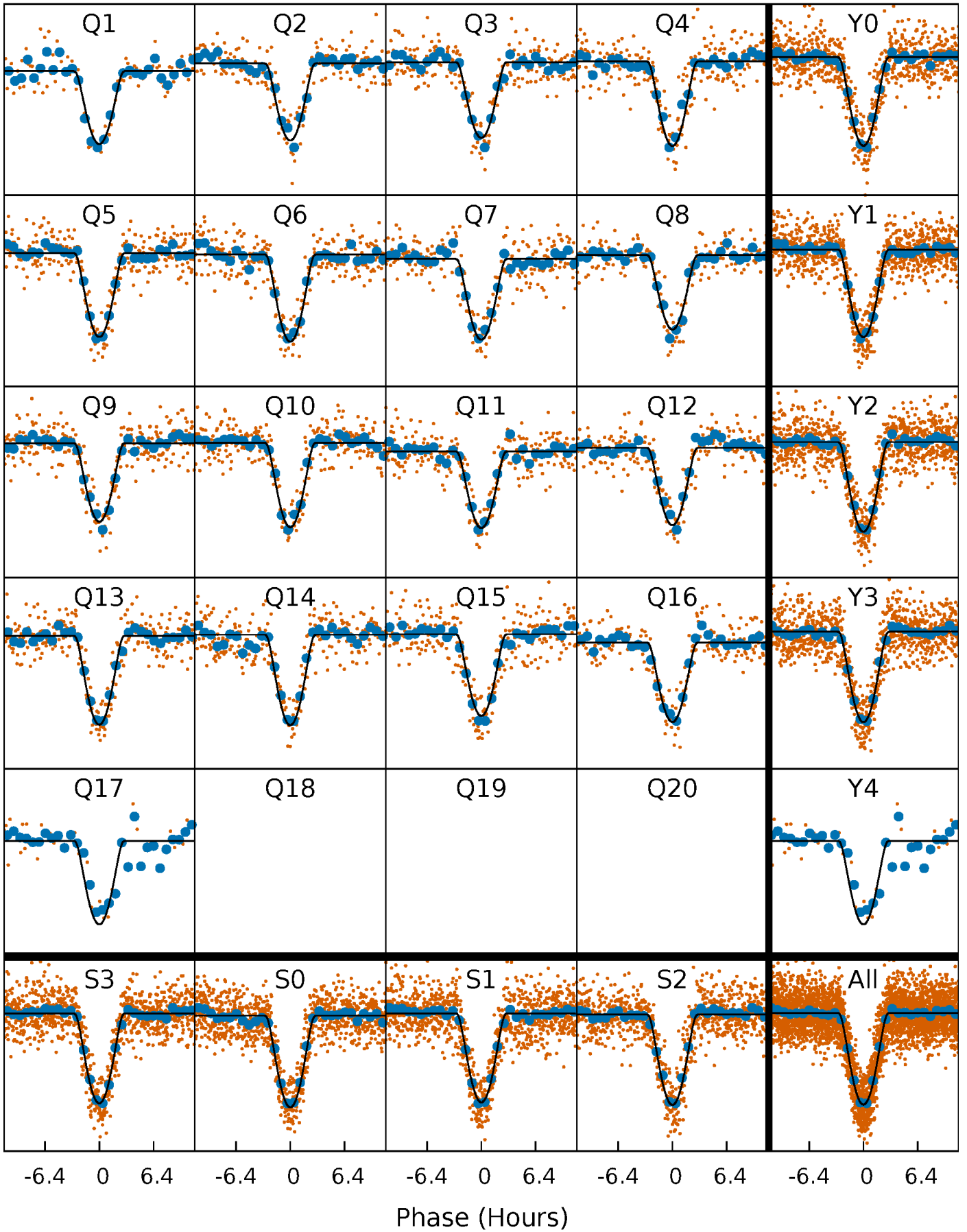
# PDC Quarter-Phased Transit Curves

TCE 011768970-02 P= 15.541358 Days  $T_0=136.591113$  (BKJD)



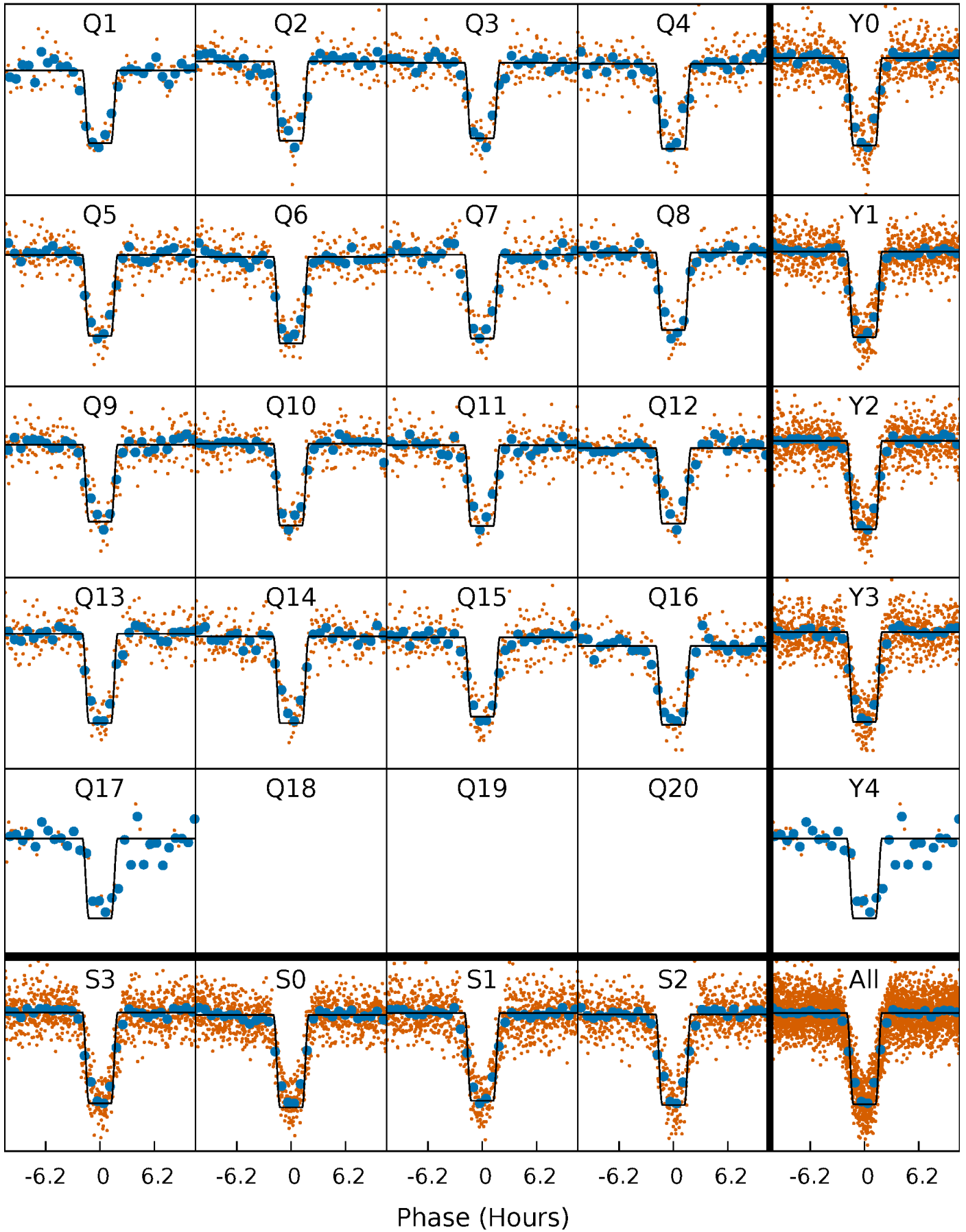
# DV Quarter-Phased Transit Curves

TCE 011768970-02   P= 15.541358 Days    $T_0=136.591113$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

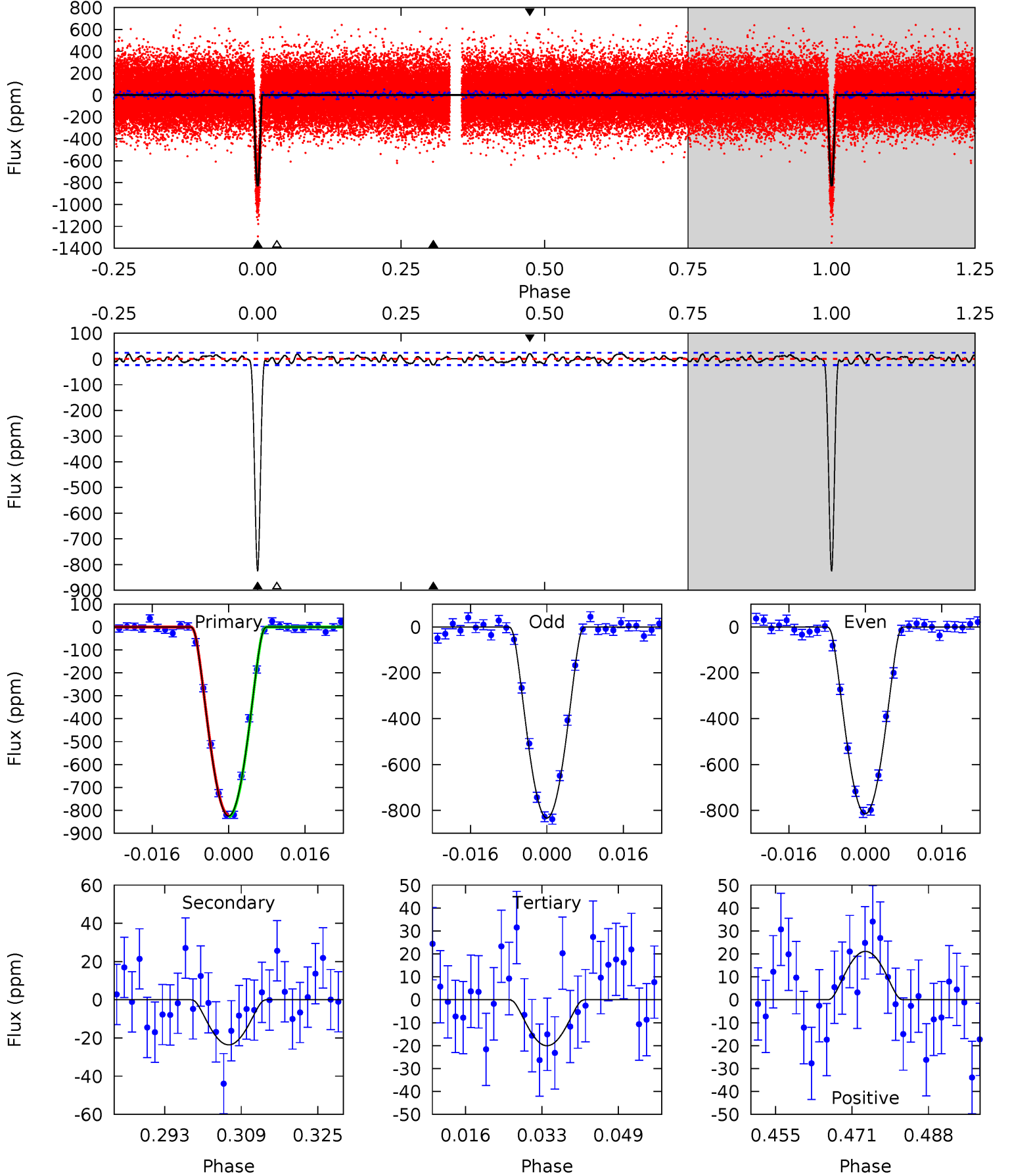
TCE 011768970-02 P= 15.541268 Days  $T_0=136.595378$  (BKJD)



# DV Model-Shift Uniqueness Test

011768970-02,  $P = 15.541358$  Days,  $E = 121.049755$  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
170.0	4.87	4.13	4.35	4.93	2.40	1.81	165.9	165.7	0.73	0.52	1.90	0.99	0.02	0.72

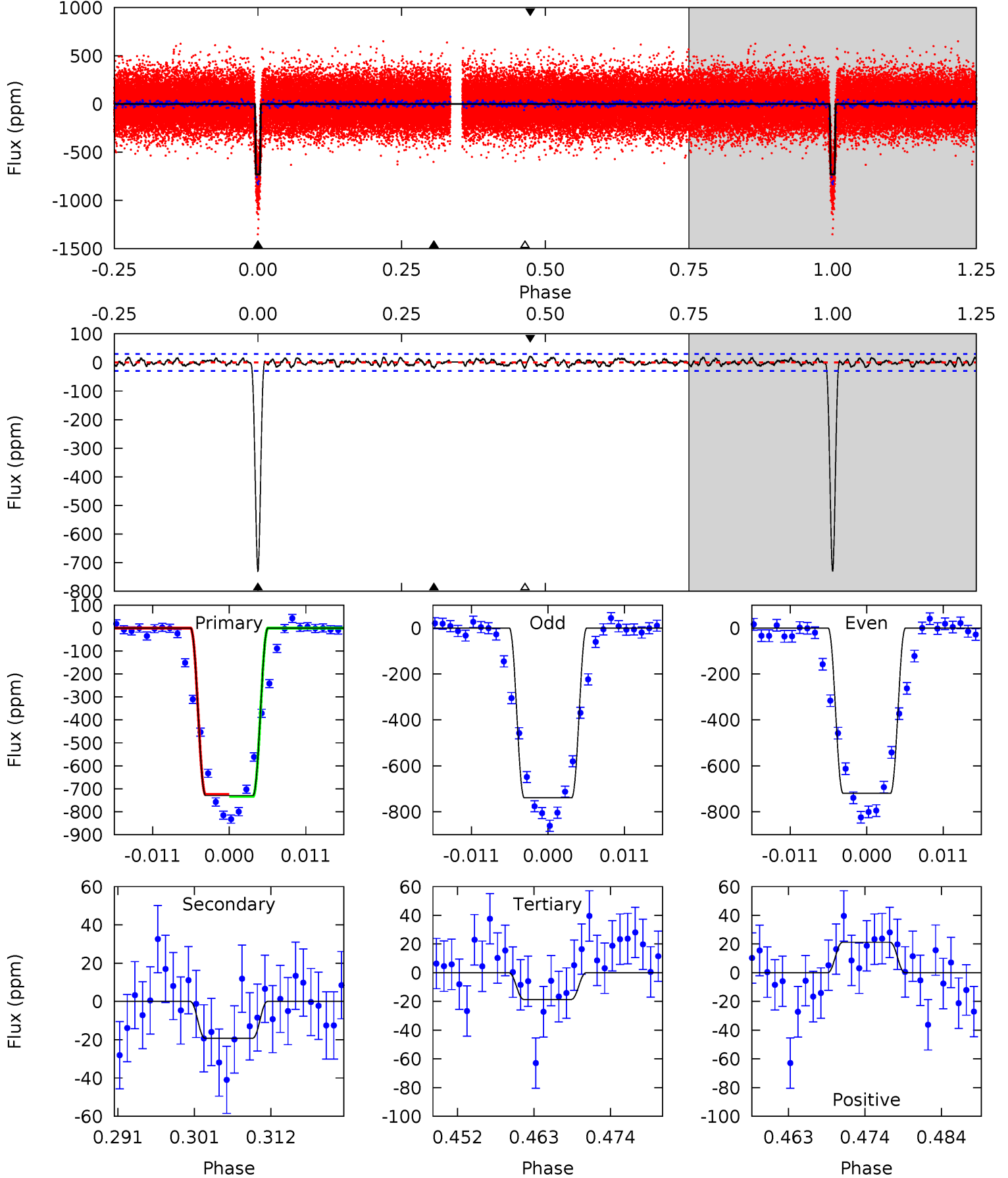




# Alt Model-Shift Uniqueness Test

011768970-02,  $P = 15.541268$  Days,  $E = 121.054110$  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
124.6	3.28	3.18	3.63	5.01	2.55	1.28	121.4	121.0	0.10	-0.35	1.66	1.01	0.03	0.72





### Stellar Parameters For KIC 011768970

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5092^{+60}_{-76}$	$3.420^{+0.143}_{-0.117}$	$-0.260^{+0.150}_{-0.150}$	$3.540^{+0.654}_{-0.719}$	$1.201^{+0.148}_{-0.221}$	$0.038^{+0.027}_{-0.013}$
	+1%/-1%	+4%/-3%	+58%/-58%	+18%/-20%	+12%/-18%	+70%/-35%
Source	SPE74	SPE74	SPE74	DSEP		

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

### Secondary Eclipse Parameters for KIC 011768970-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-24 \pm 5$	$20.20^{+9.53}_{-7.89}$	$1637^{+88}_{-86}$	$2184^{+425}_{-4095}$	$0.530^{+0.841}_{-0.290}$
Alt.	$-19 \pm 6$	$11.71^{+8.16}_{-6.54}$	$1636^{+78}_{-79}$	$2576^{+724}_{-514}$	$1.245^{+4.885}_{-0.818}$

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

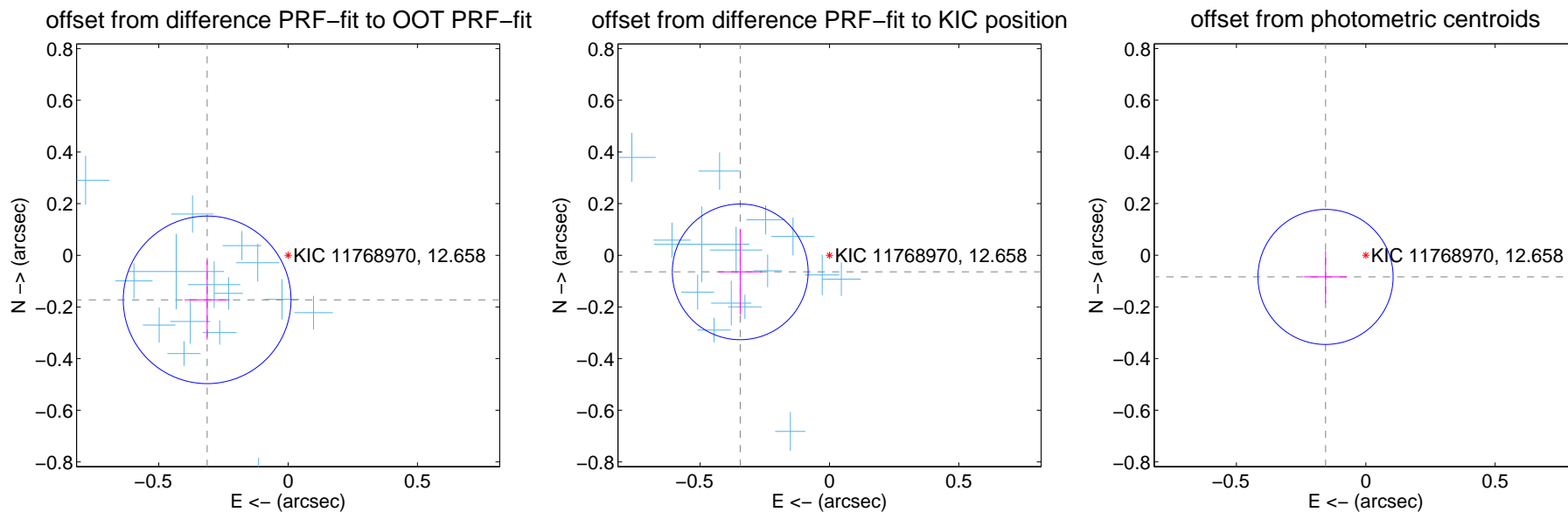
## DV Centroid Data

Supplemental centroid analysis for 011768970-02. Kepler magnitude: 12.66. Transit SNR 73.90

There are 17 quarters with good PRF difference image offsets

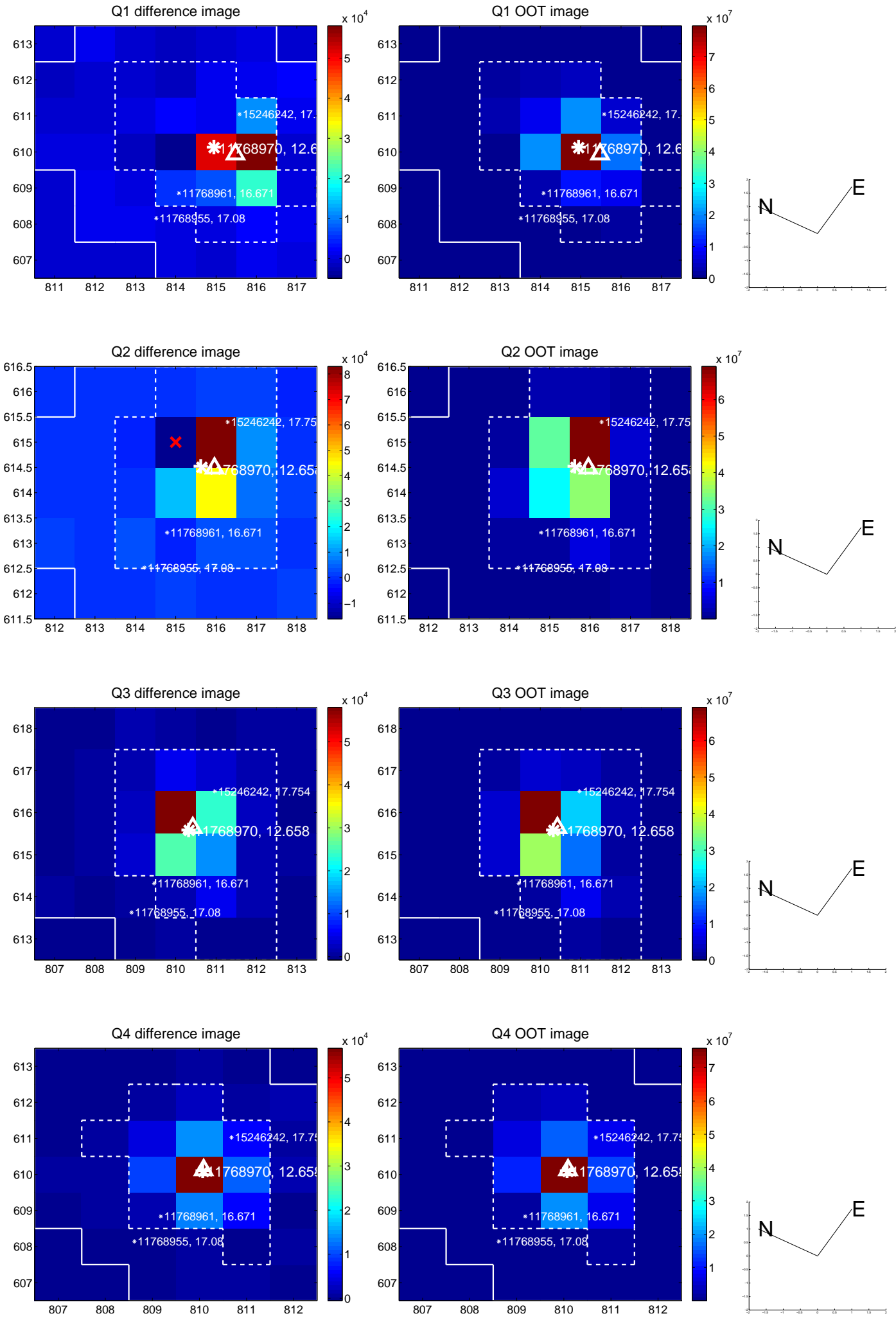
The direct PRF centroid is offset from the target star catalog position by about 0.12 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.358 \pm 0.108$	3.31	$0.313 \pm 0.087$	$-0.172 \pm 0.154$
PRF-fit source offset from KIC position	$0.351 \pm 0.088$	4.01	$0.345 \pm 0.084$	$-0.064 \pm 0.166$
photometric centroid source offset	$0.18 \pm 0.09$	2.03	$0.16 \pm 0.08$	$-0.08 \pm 0.10$

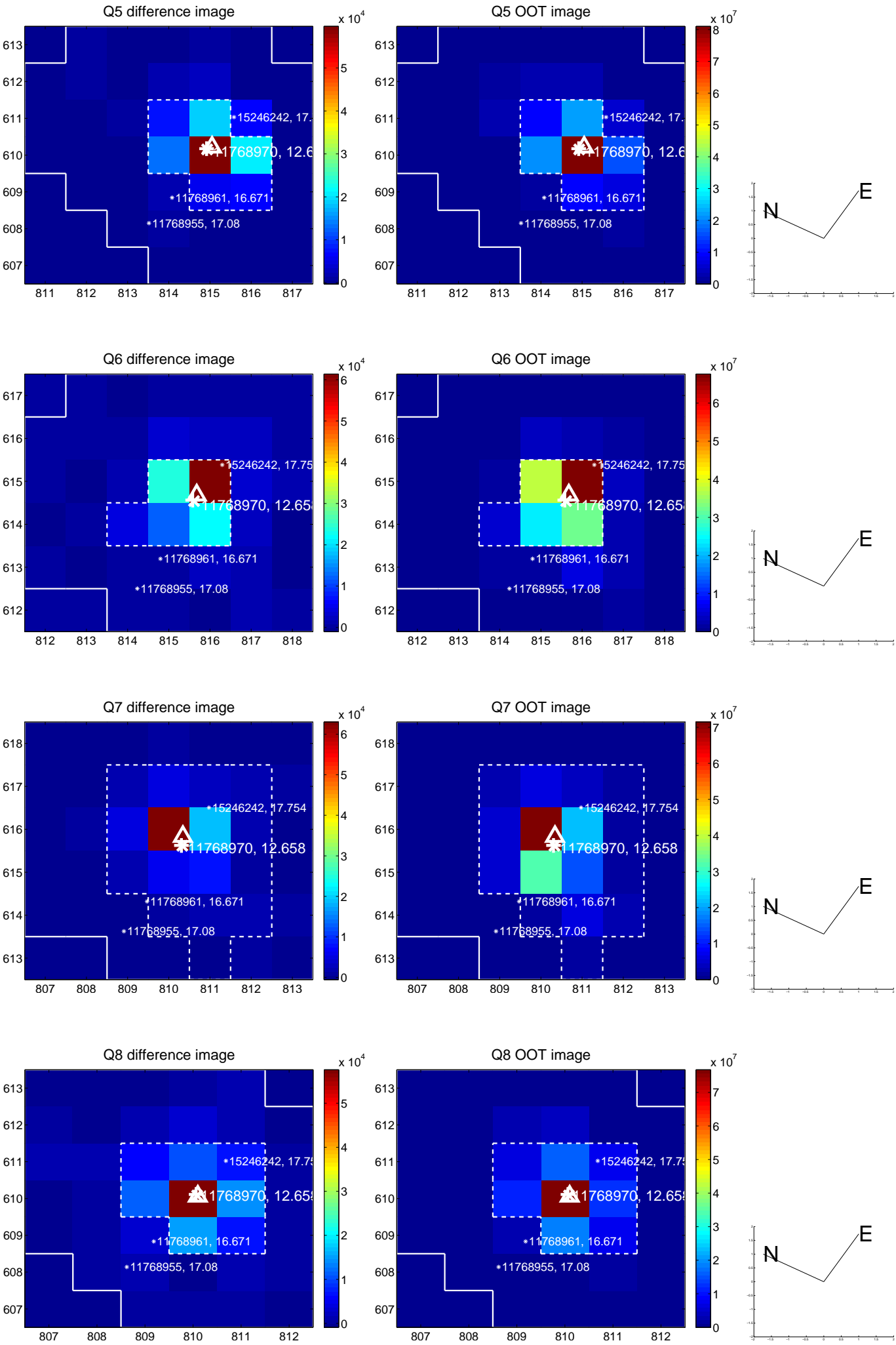


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

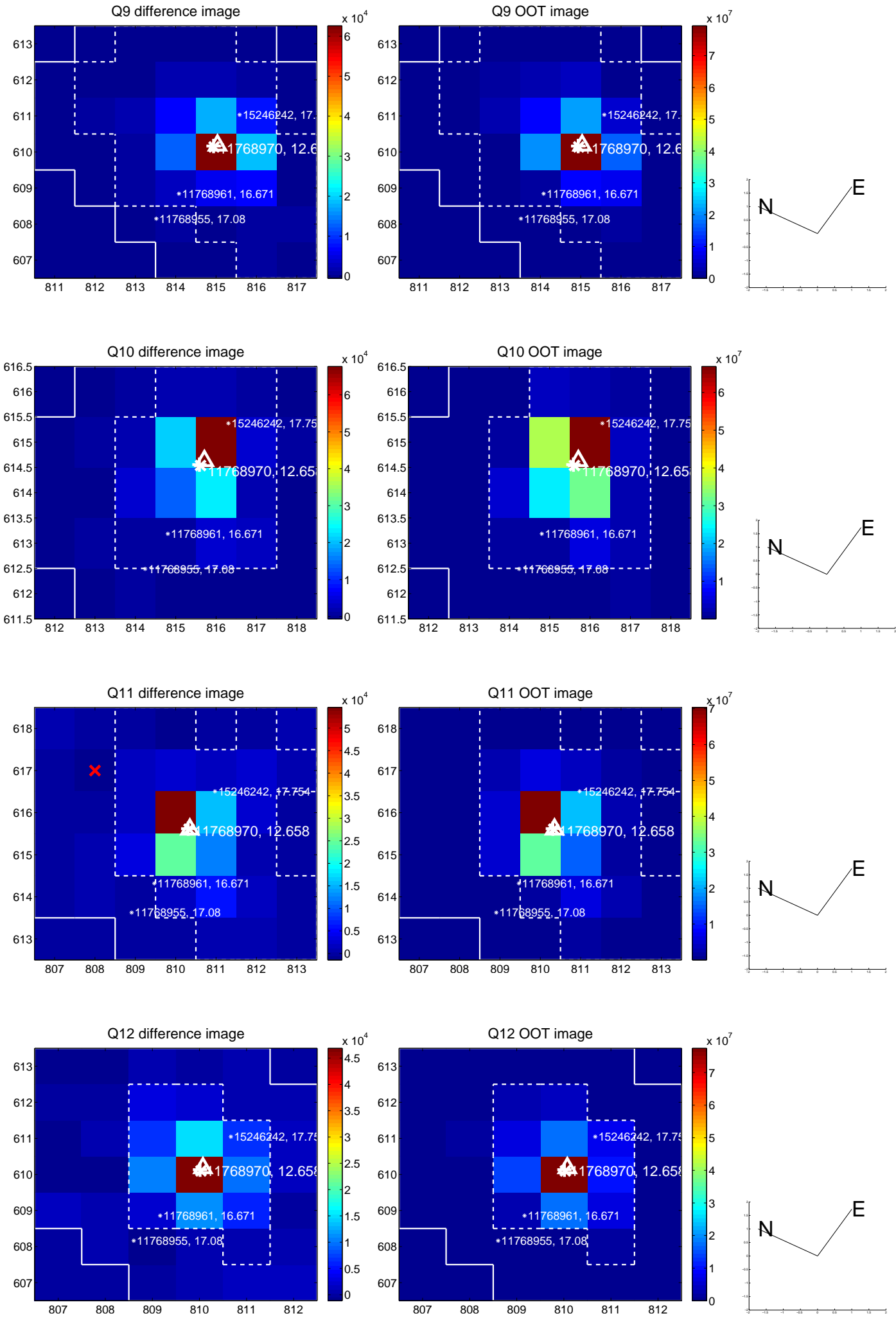
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



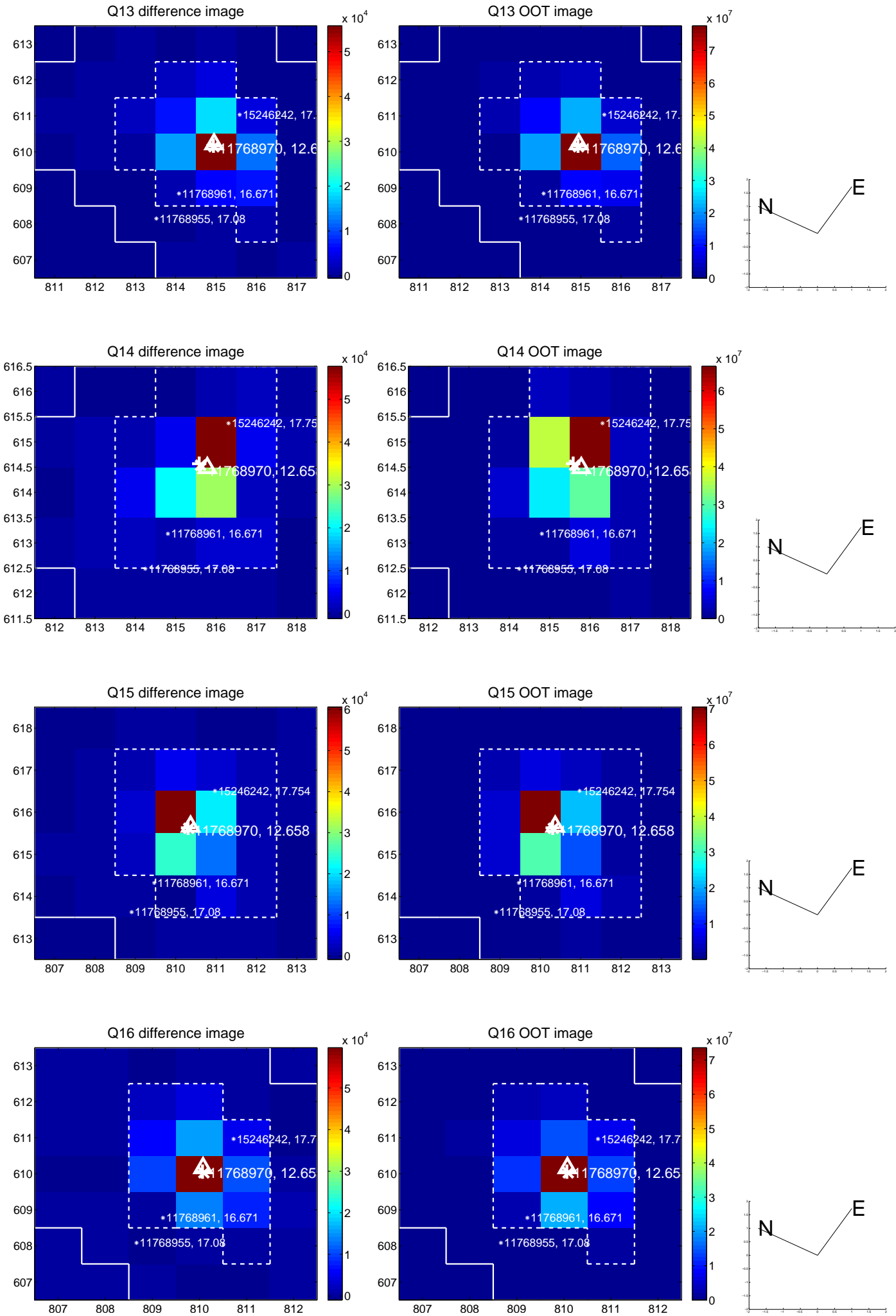
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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.





UKIRT Image

