

# KIC 004478168

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
004478168-01	OBS	0626.01	14.586497	143.048147	378.7	4.043	42.8	47.1	1.19	6063	2.53	125.02
004478168-02	OBS	0626.02	8.029214	132.829693	65.0	3.677	9.9	10.6	1.19	6063	1.13	277.13

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
004478168-01	OBS	PC	1.00	0	0	0	0	NO_COMMENT
004478168-02	OBS	PC	0.99	0	0	0	0	NO_COMMENT

**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 004478168-01

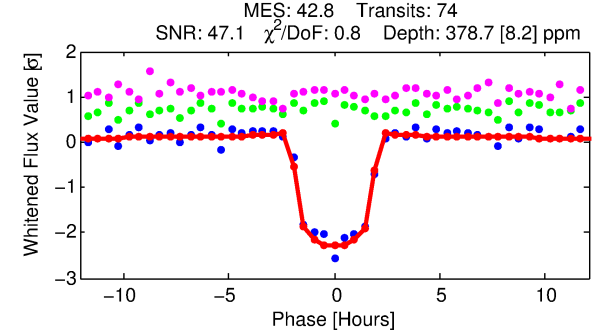
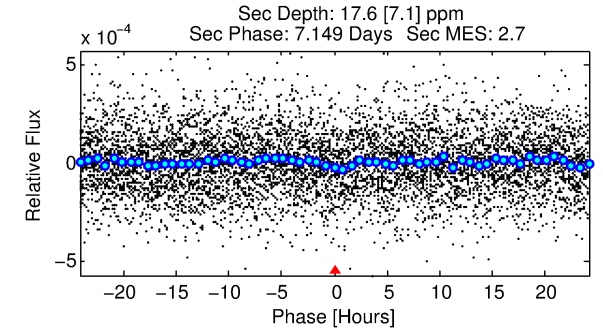
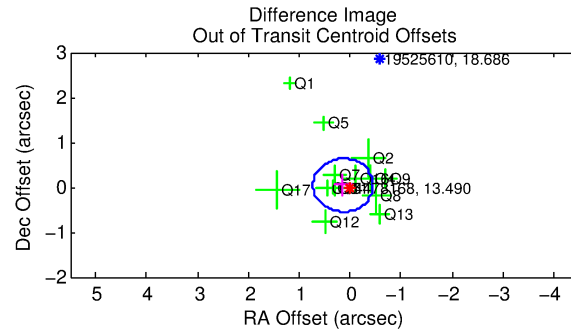
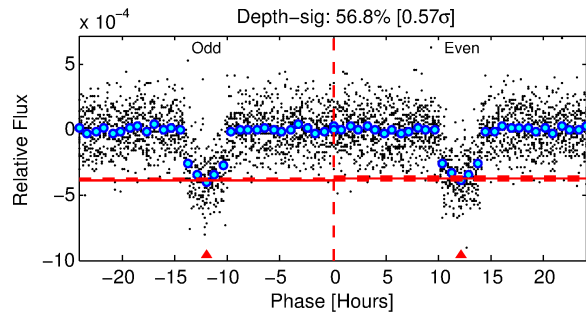
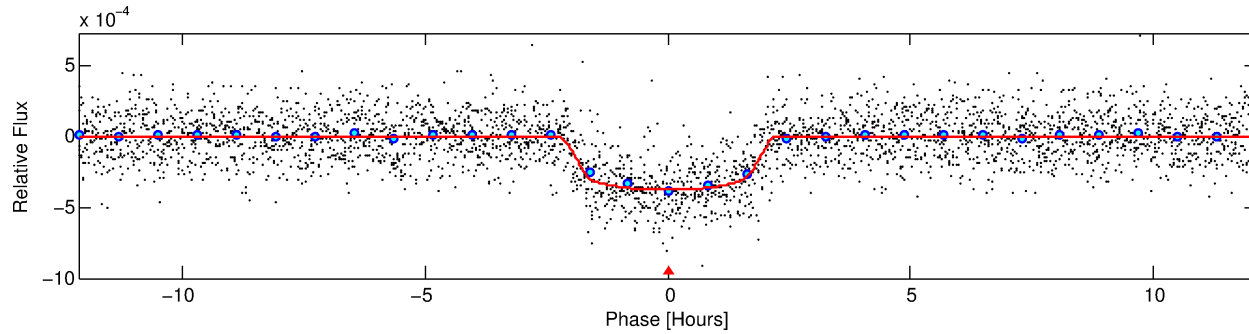
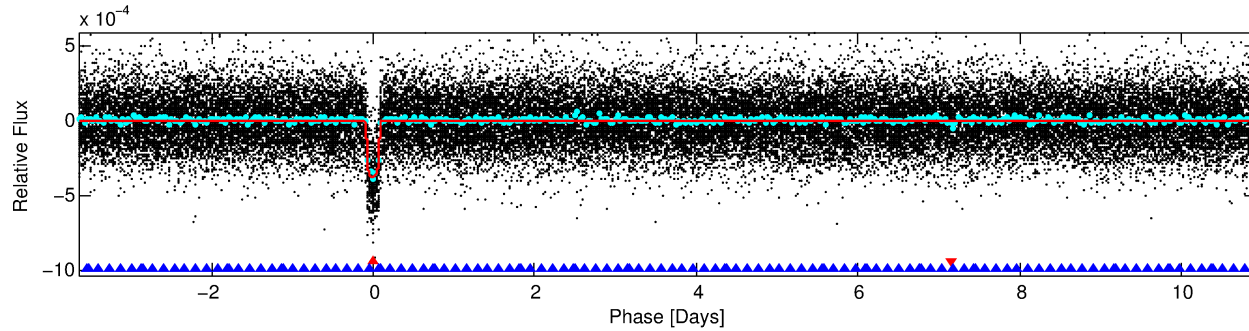
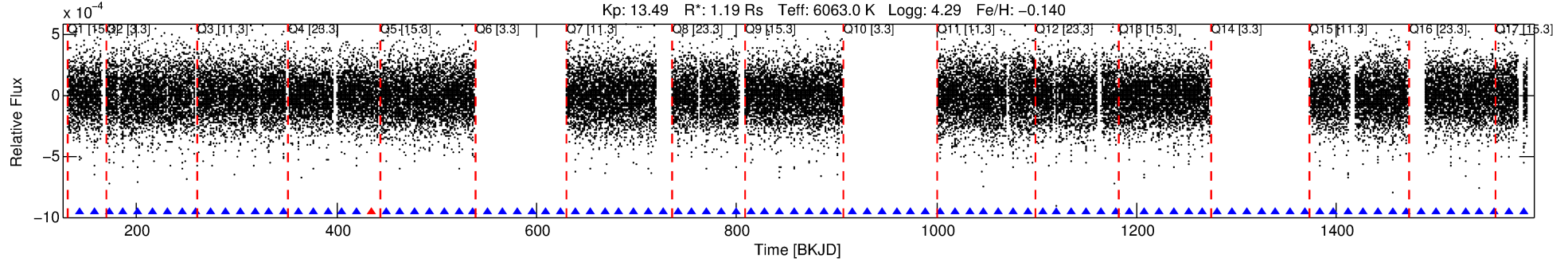
No Significant Match Found

# DV One-Page Summary

KIC: 4478168 Candidate: 1 of 2 Period: 14.586 d

KOI: K00626.01 Corr: 0.993

Kp: 13.49 R\*: 1.19 Rs Teff: 6063.0 K Logg: 4.29 Fe/H: -0.140



## DV Fit Results:

Period = 14.58650 [0.00003] d  
Epoch = 143.0481 [0.0017] BKJD  
Rp/R\* = 0.0195 [0.0033]  
a/R\* = 18.57 [15.40]  
b = 0.77 [0.45]  
Seff = 125.02 [31.41]  
Teq = 853 [54] K  
Rp = 2.53 [0.58] Re  
a = 0.1172 [0.0175] AU  
Ag = 20.80 [11.99] [1.65σ]  
Teffp = 2815 [376] K [5.17σ]

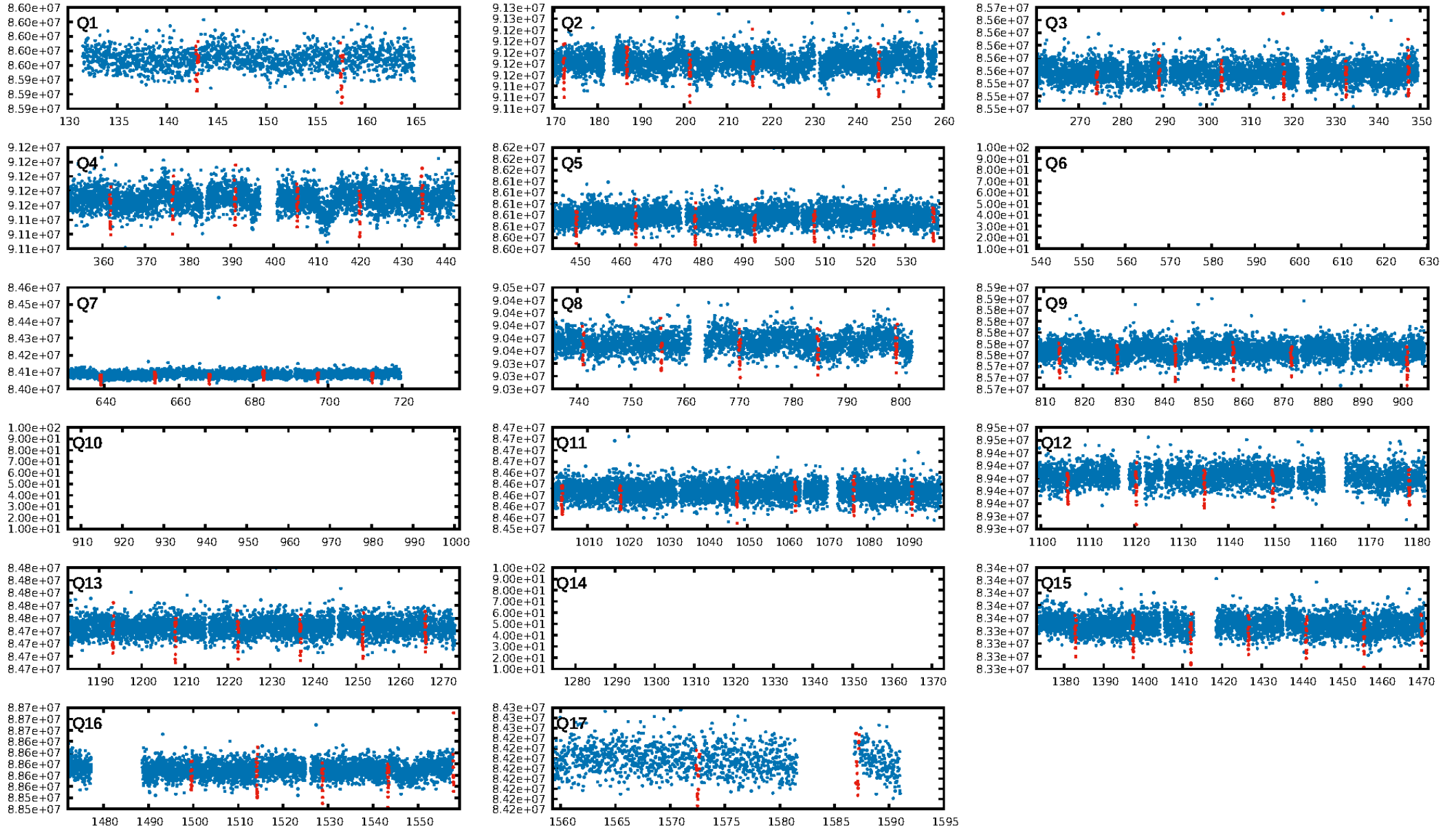
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [28.80σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 96.4%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 0.00e+00  
RollingBand-fgt: 0.99 [69/70]  
GhostDiagnostic-chr: -578.6  
Centroid-sig: N/A  
Centroid-so: 0.201 arcsec [0.63σ]  
OotOffset-rm: 0.144 arcsec [0.73σ]  
KicOffset-rm: 0.168 arcsec [0.73σ]  
OotOffset-st: 1/4/4/5 [14]  
KicOffset-st: 1/4/4/5 [14]  
DiffImageQuality-fgm: 0.93 [13/14]  
DiffImageOverlap-fno: 1.00 [14/14]

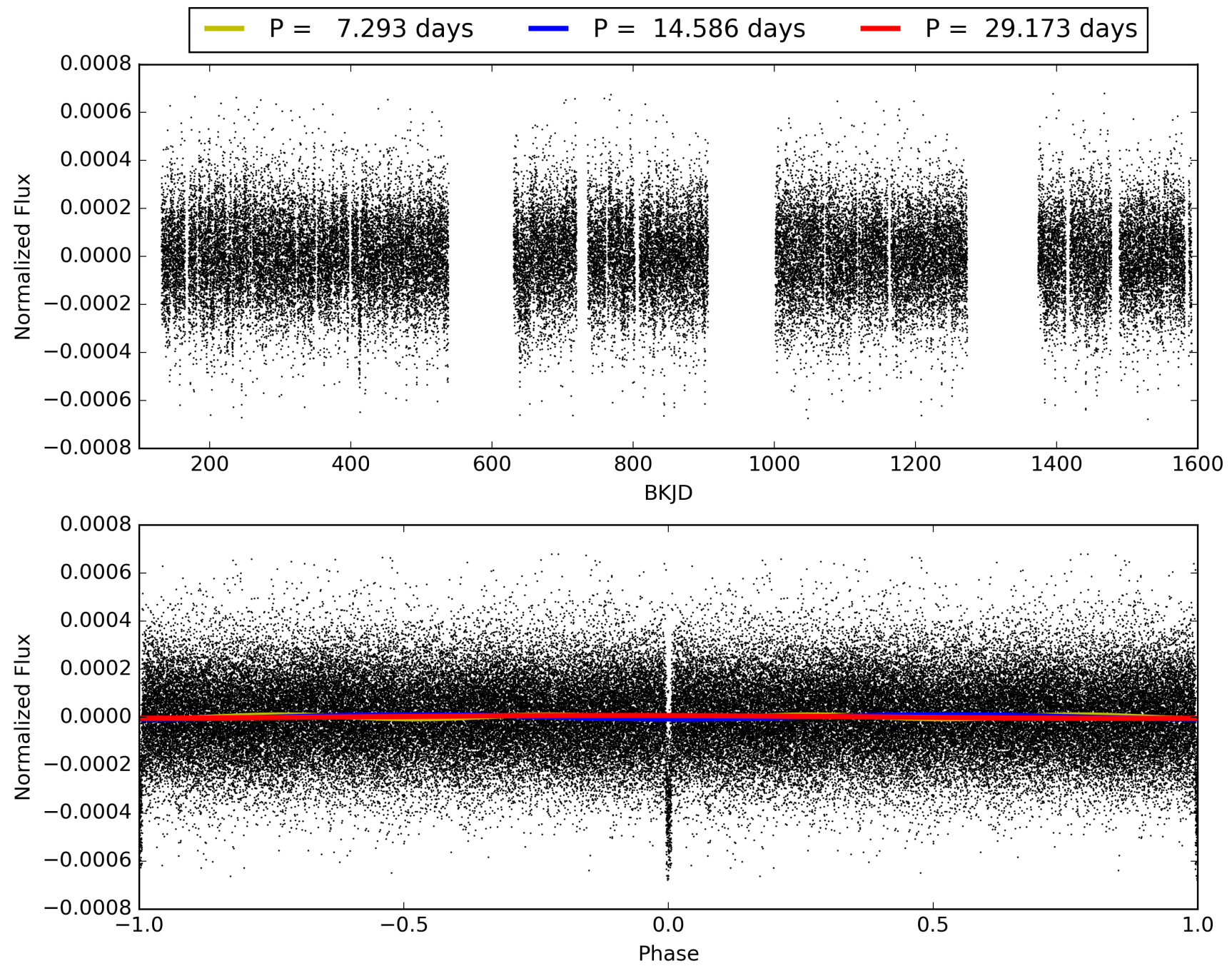
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 30-Jan-2016 00:42:10 Z

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

# TCE 004478168-01, PDC Light Curves

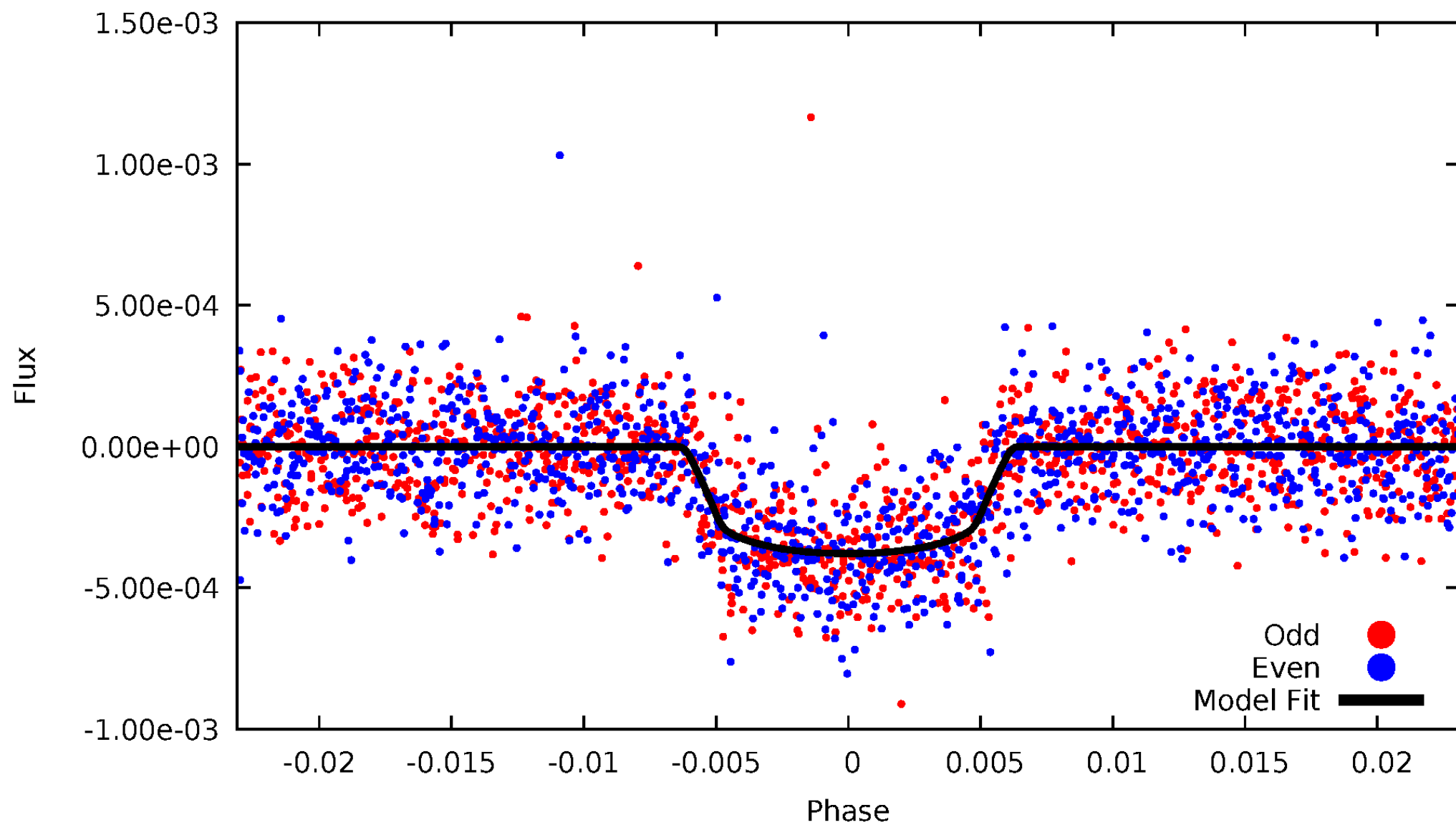


TCE 004478168-01



# DV Odd/Even

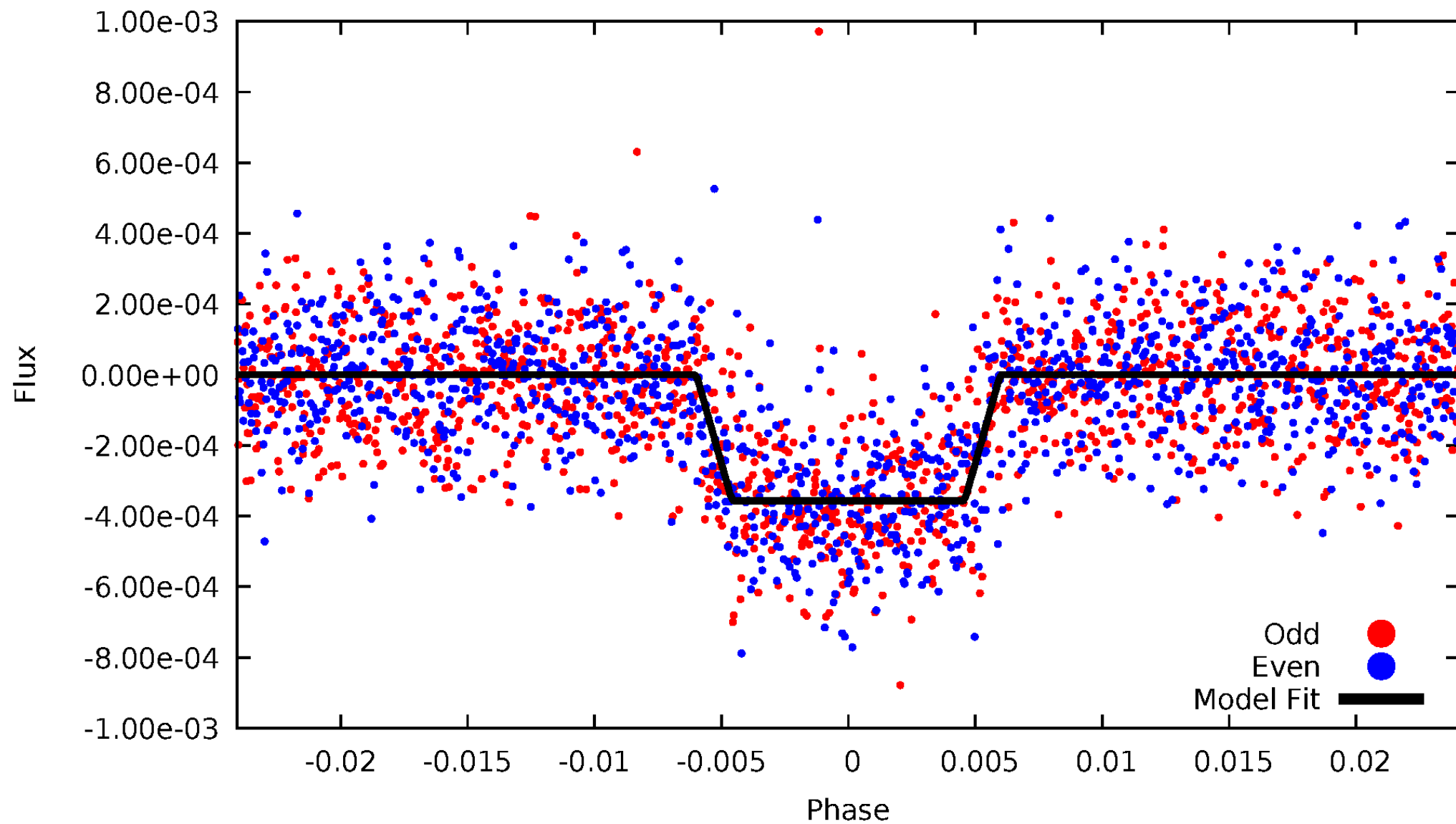
TCE 004478168-01





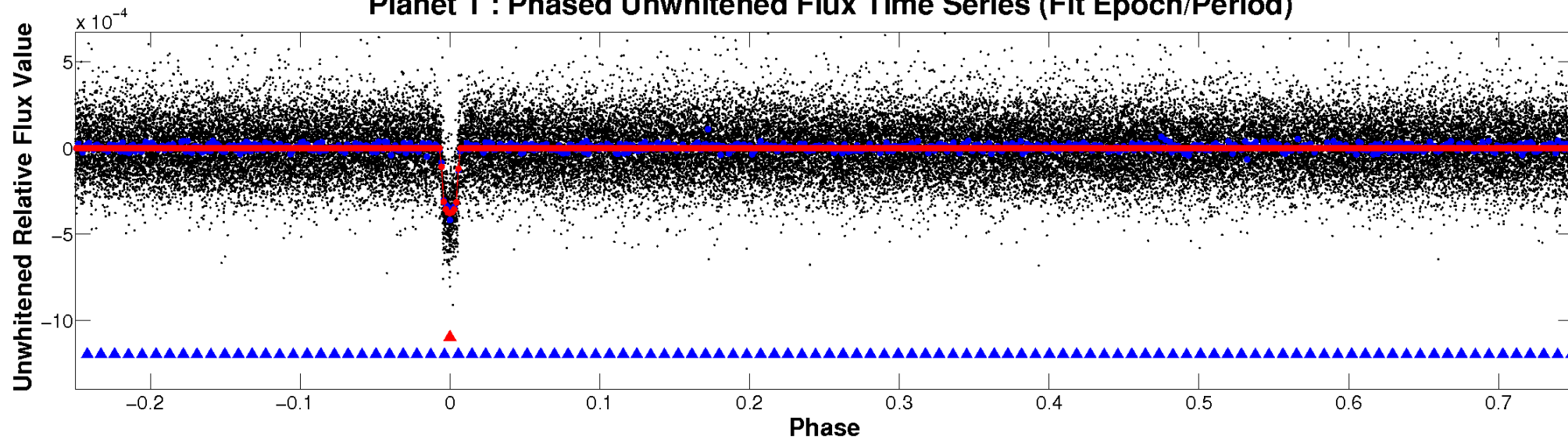
# ALT Odd/Even

TCE 004478168-01

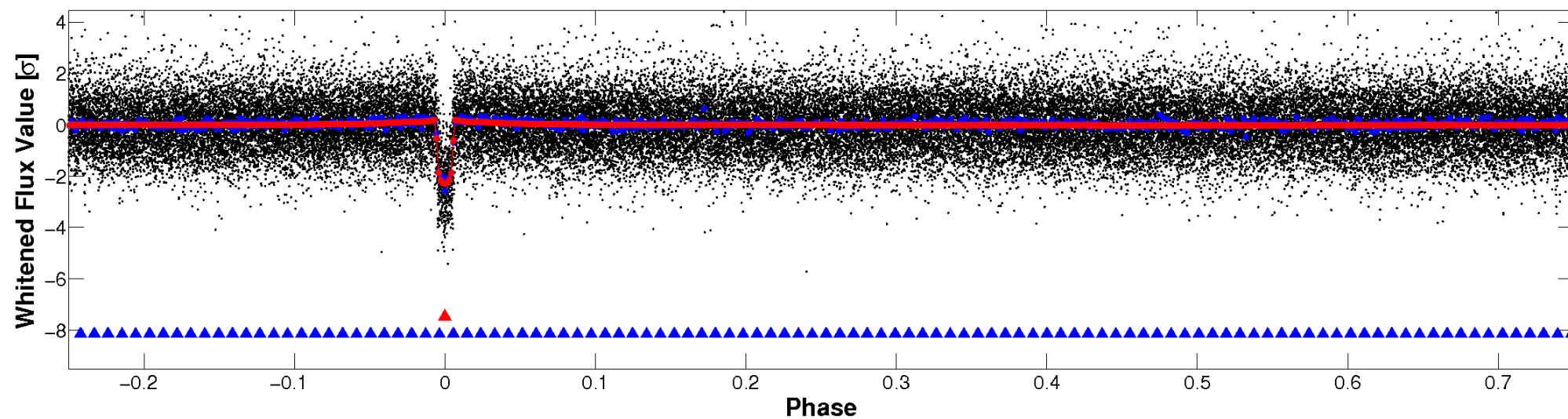


# Non-Whitened Vs. Whitened Light Curve

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

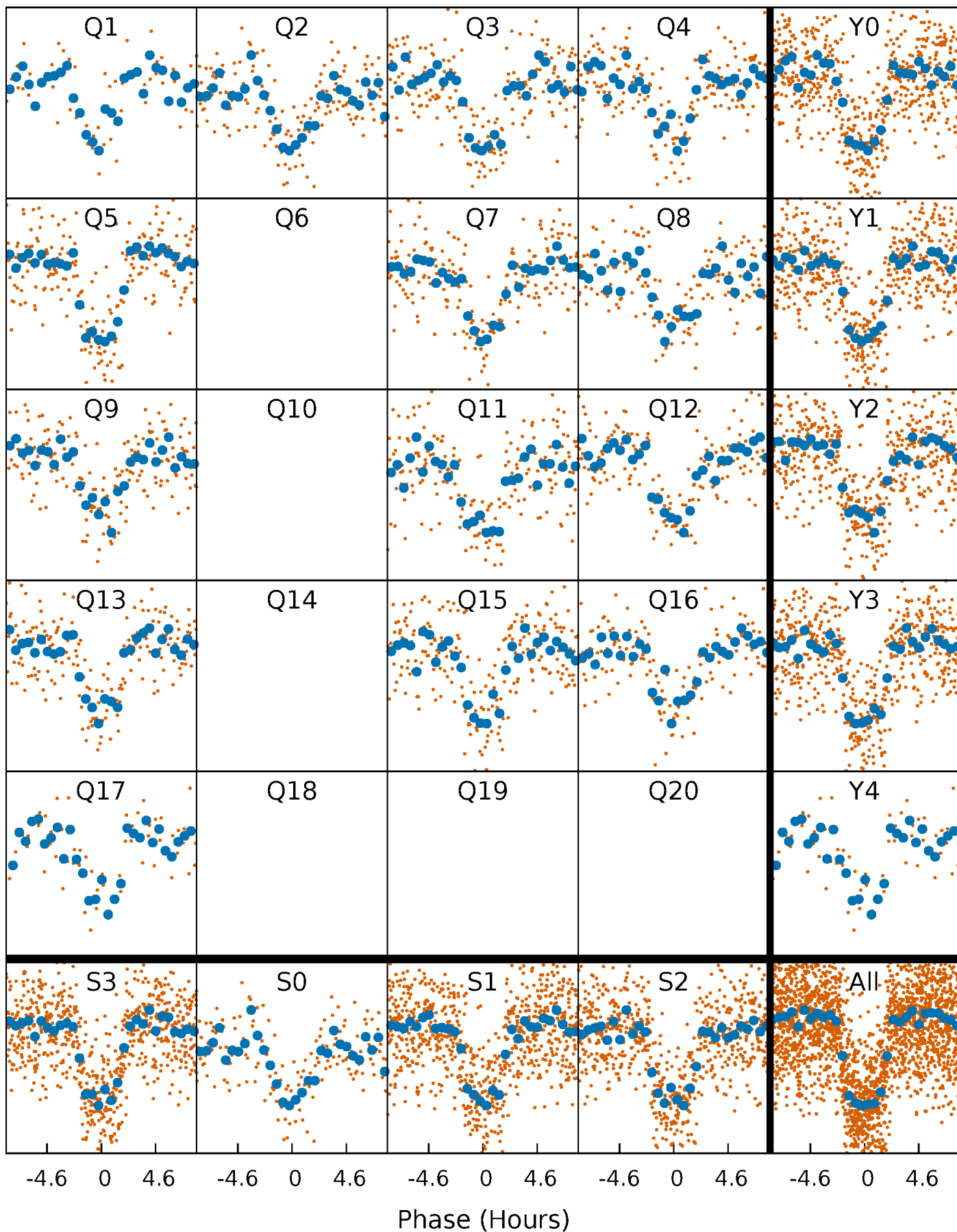


**Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



# PDC Quarter-Phased Transit Curves

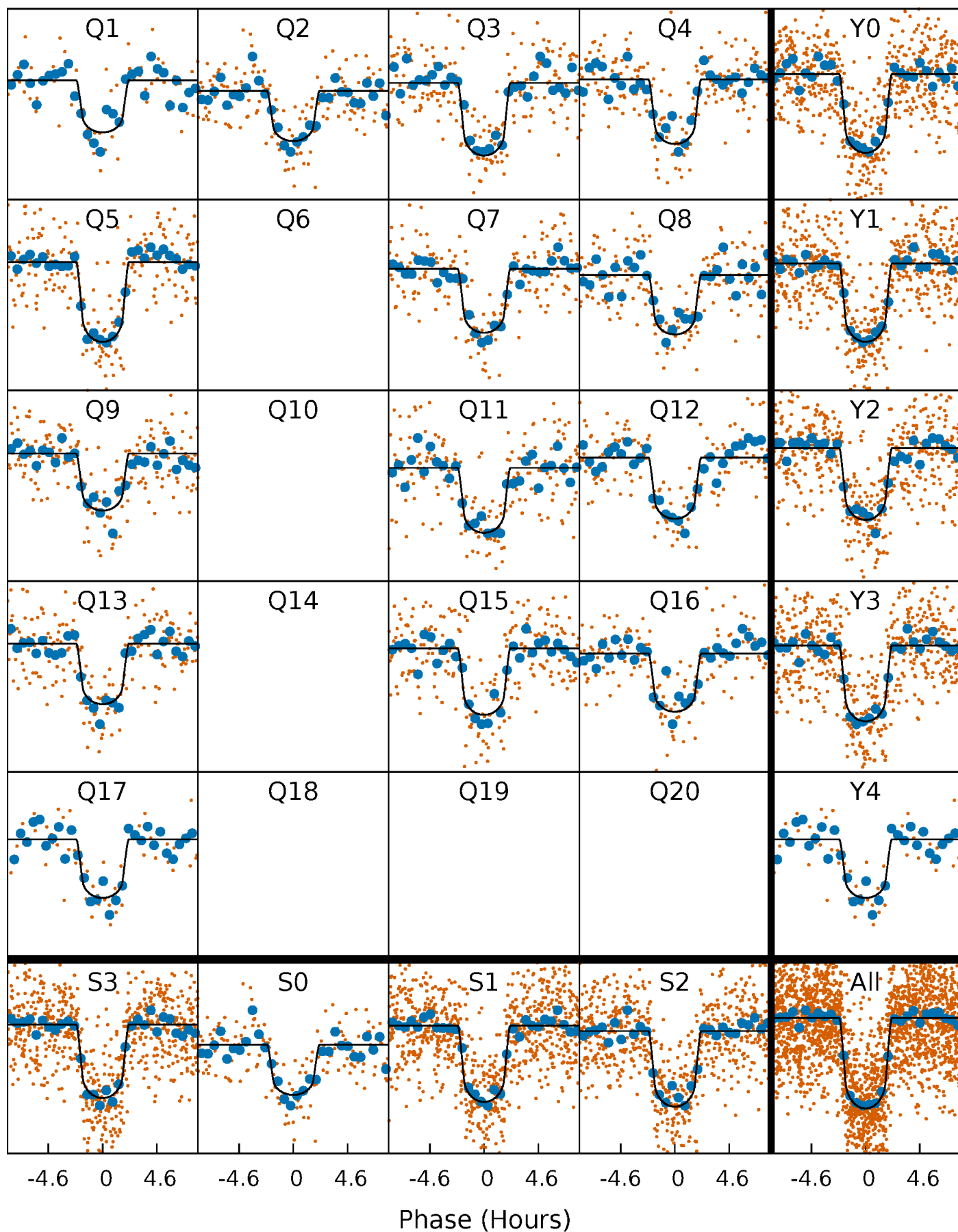
TCE 004478168-01 P= 14.586497 Days  $T_0=143.048147$  (BKJD)





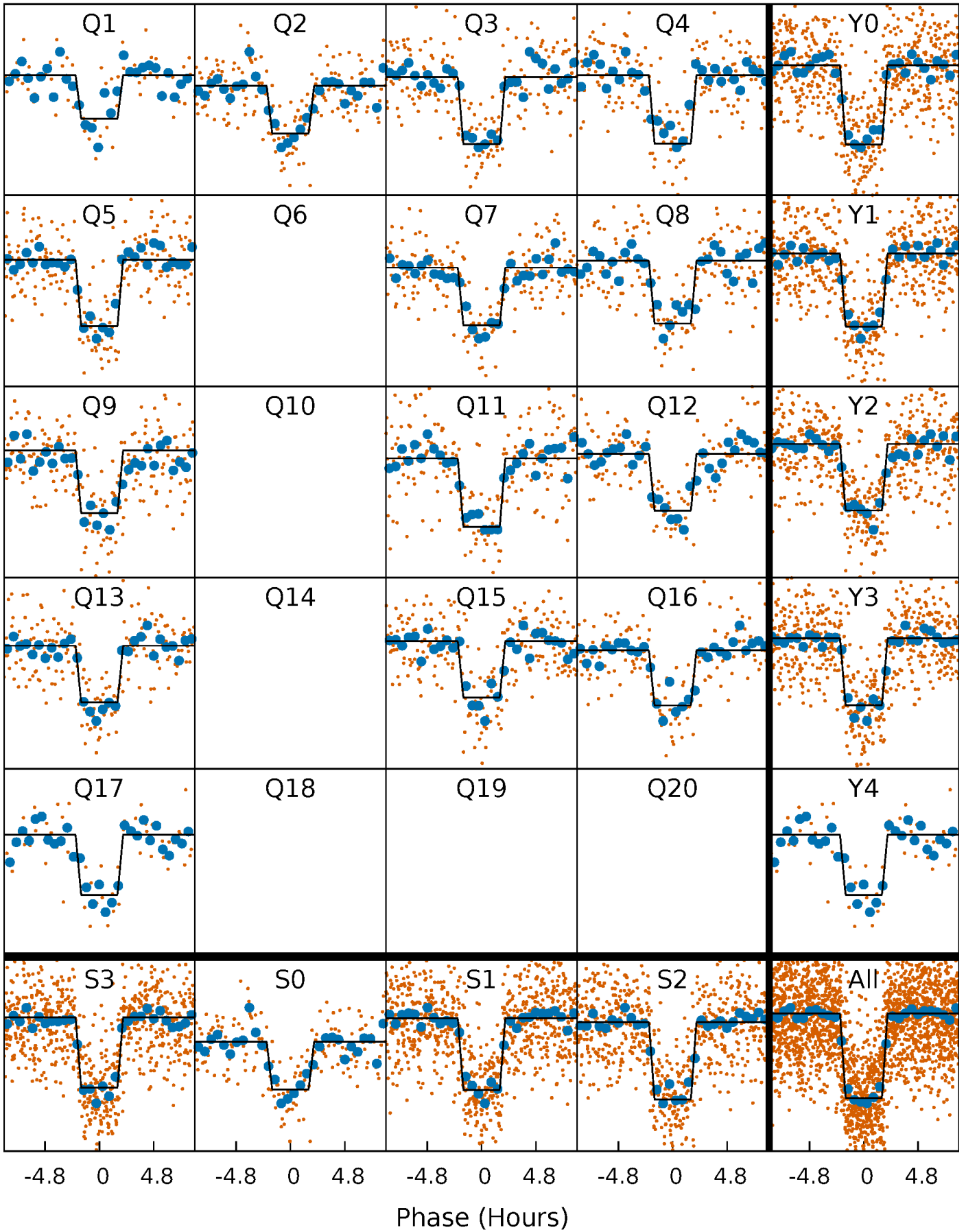
# DV Quarter-Phased Transit Curves

TCE 004478168-01 P= 14.586497 Days  $T_0=143.048147$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

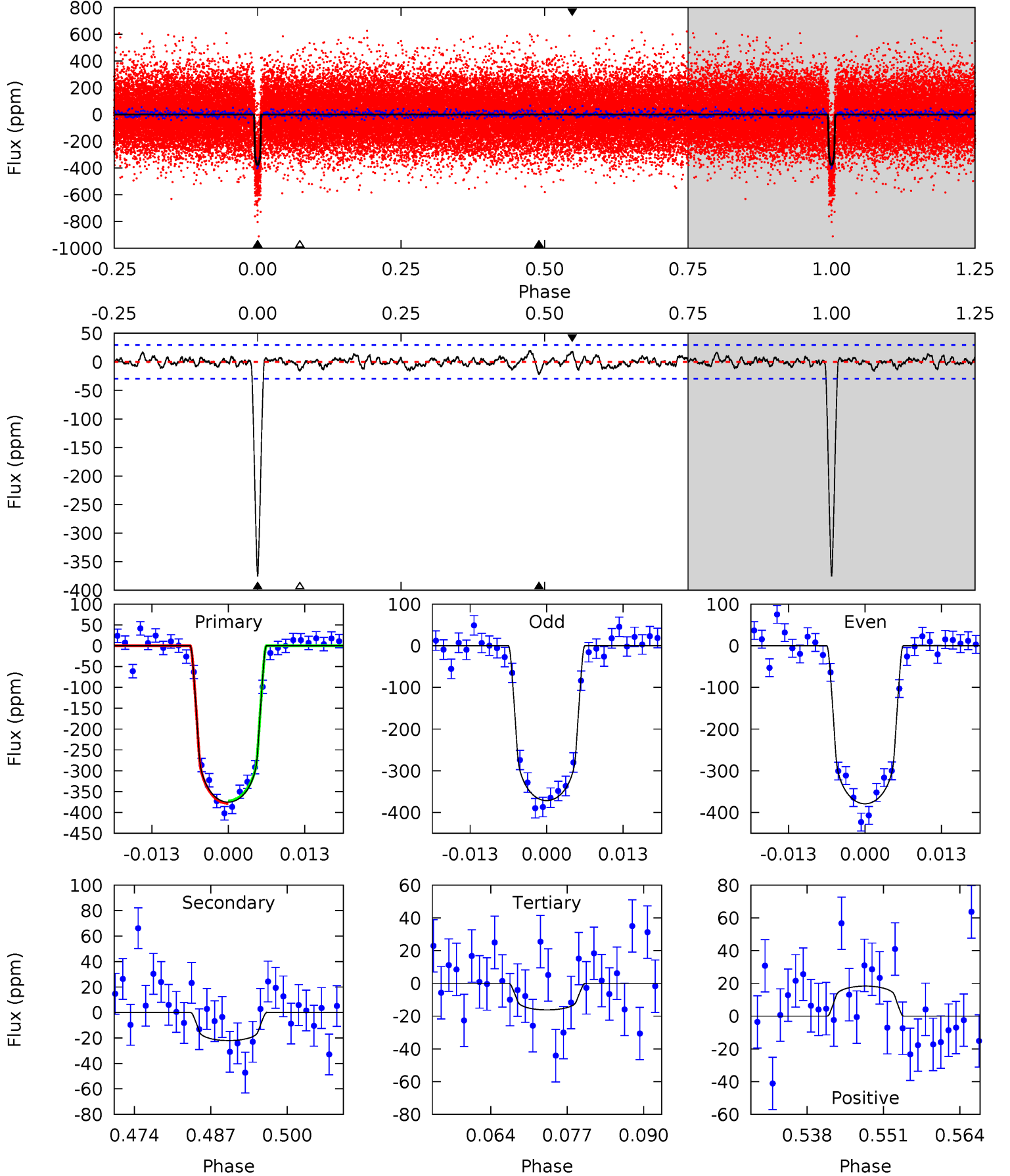
TCE 004478168-01 P= 14.586399 Days  $T_0=143.054020$  (BKJD)



# DV Model-Shift Uniqueness Test

004478168-01, P = 14.586497 Days, E = 128.461650 Days

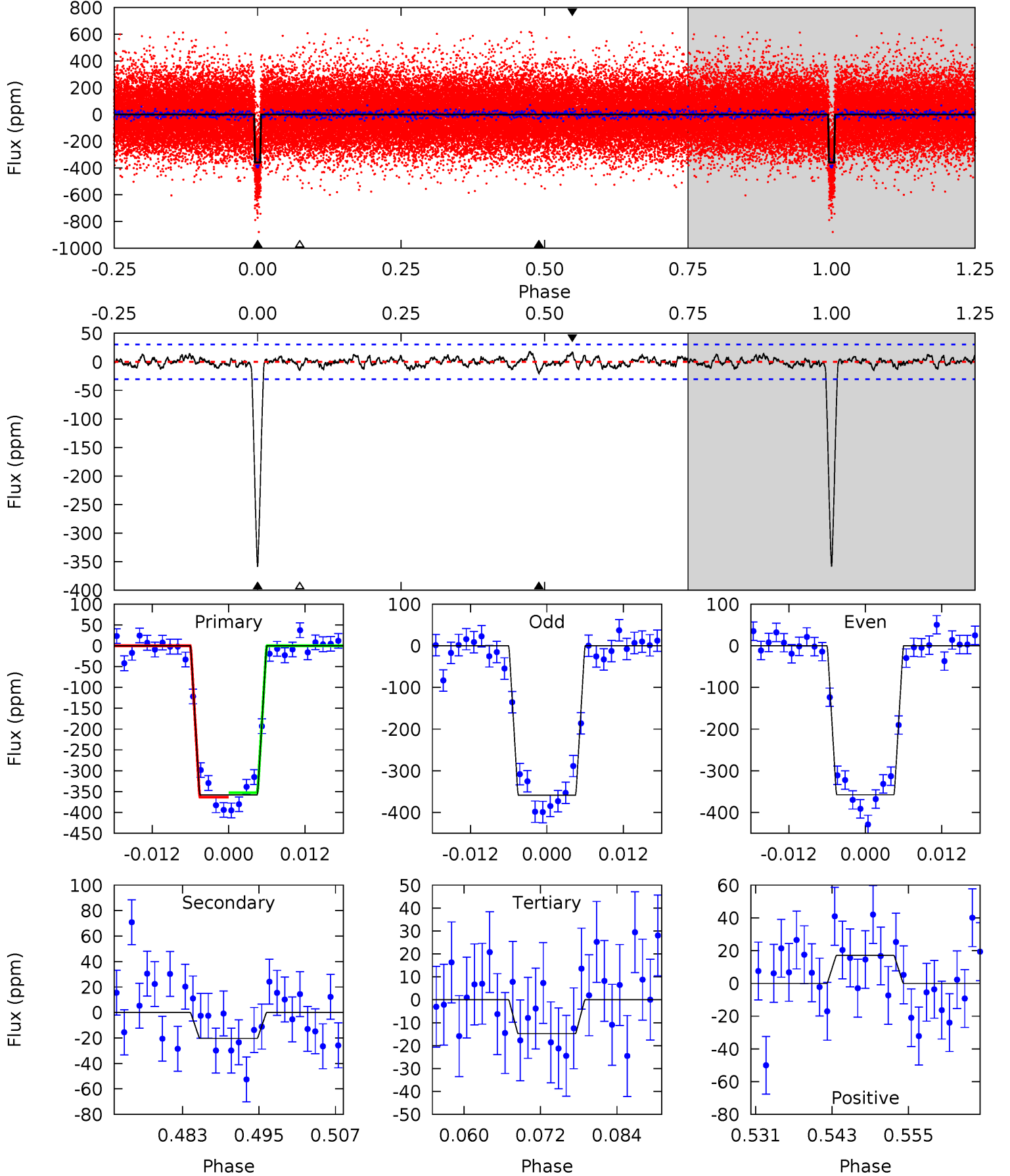
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
63.7	3.74	2.75	3.11	4.98	2.49	1.02	60.9	60.6	0.99	0.63	0.64	0.99	0.05	0.49



# Alt Model-Shift Uniqueness Test

004478168-01,  $P = 14.586399$  Days,  $E = 128.467621$  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
58.9	3.35	2.43	2.81	4.99	2.51	0.96	56.5	56.1	0.91	0.54	0.08	0.97	0.05	0.90



### Stellar Parameters For KIC 004478168

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6063^{+121}_{-133}$	$4.290^{+0.137}_{-0.112}$	$-0.140^{+0.150}_{-0.150}$	$1.191^{+0.189}_{-0.189}$	$1.009^{+0.082}_{-0.067}$	$0.841^{+0.527}_{-0.302}$
	+2%/-2%	+3%/-3%	+107%/-107%	+16%/-16%	+8%/-7%	+63%/-36%
Source	SPE59	SPE59	SPE59	DSEP		

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

### Secondary Eclipse Parameters for KIC 004478168-01 / KOI 0626.01

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-22 \pm 6$	$2.55^{+0.45}_{-0.50}$	$1186^{+59}_{-57}$	$3444^{+279}_{-238}$	$25^{+16}_{-10}$
Alt.	$-20 \pm 6$	$2.42^{+0.55}_{-0.45}$	$1188^{+56}_{-58}$	$3441^{+280}_{-235}$	$25^{+16}_{-10}$

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



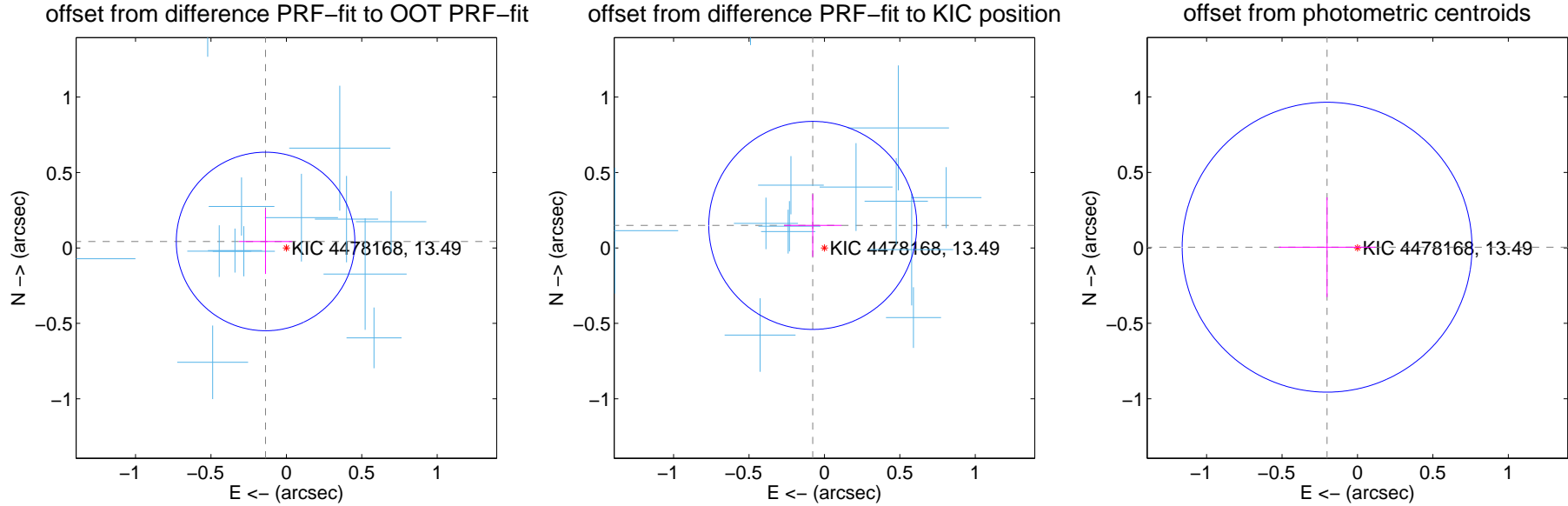
## DV Centroid Data

Supplemental centroid analysis for 004478168-01. Kepler magnitude: 13.49. Transit SNR 47.12

There are 13 quarters with good PRF difference image offsets

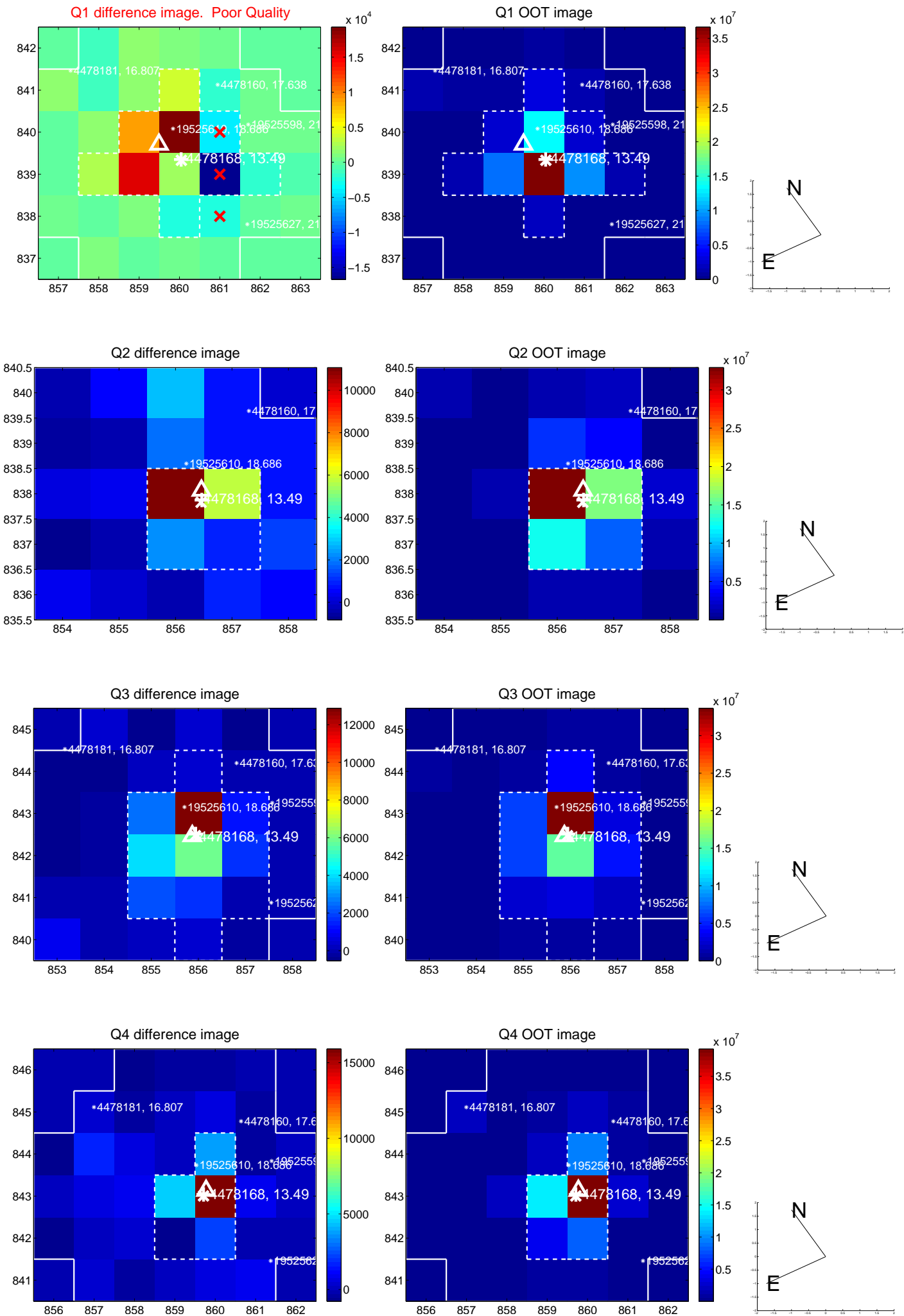
The direct PRF centroid is offset from the target star catalog position by about 0.19 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.144 \pm 0.197$	0.73	$0.138 \pm 0.177$	$0.043 \pm 0.215$
PRF-fit source offset from KIC position	$0.168 \pm 0.230$	0.73	$0.077 \pm 0.190$	$0.149 \pm 0.207$
photometric centroid source offset	$0.20 \pm 0.32$	0.63	$0.20 \pm 0.32$	$0.00 \pm 0.33$

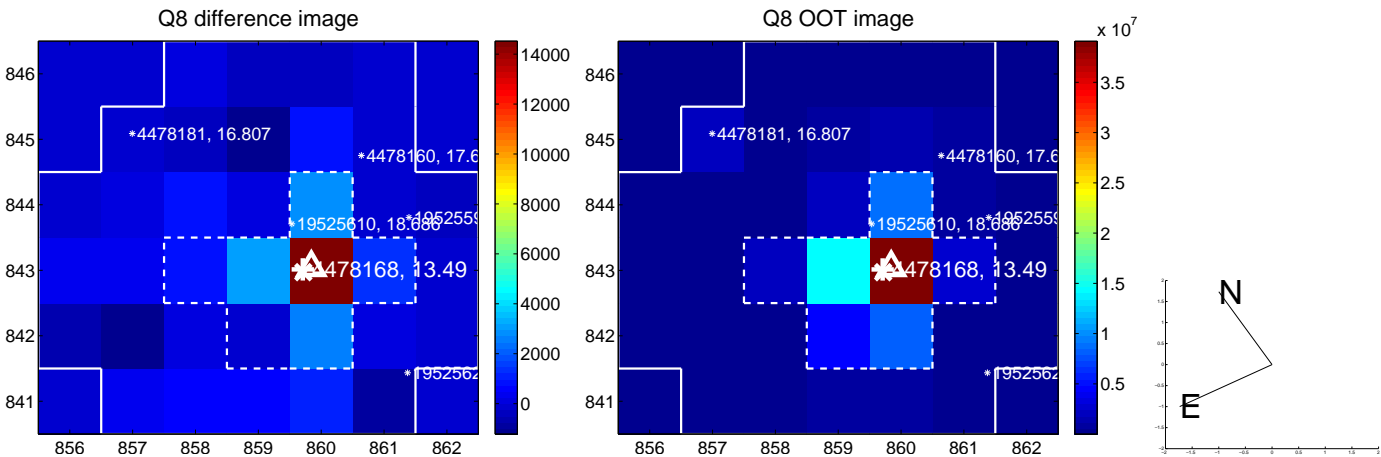
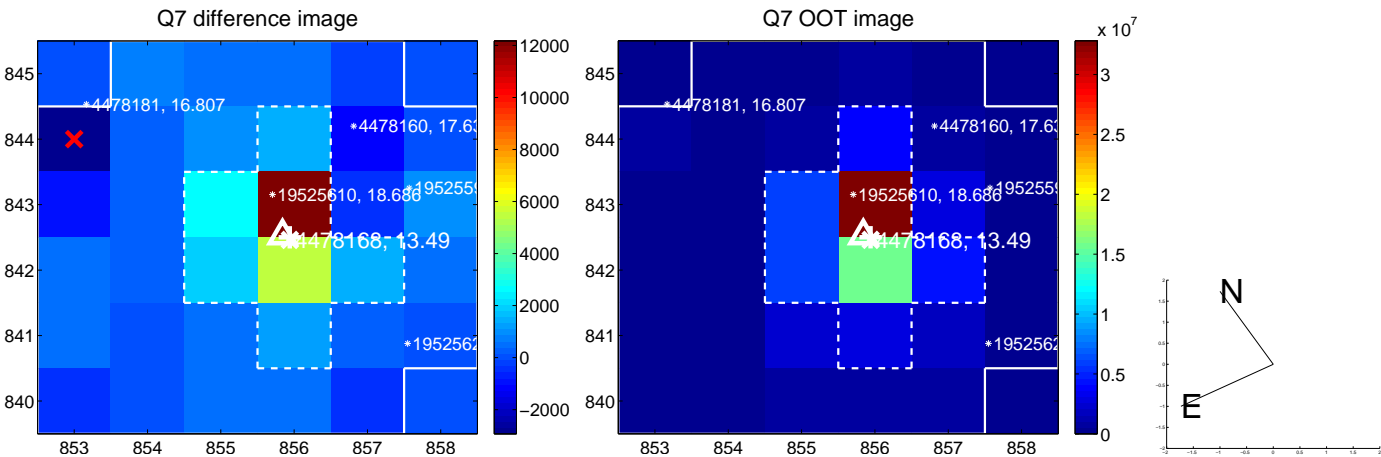
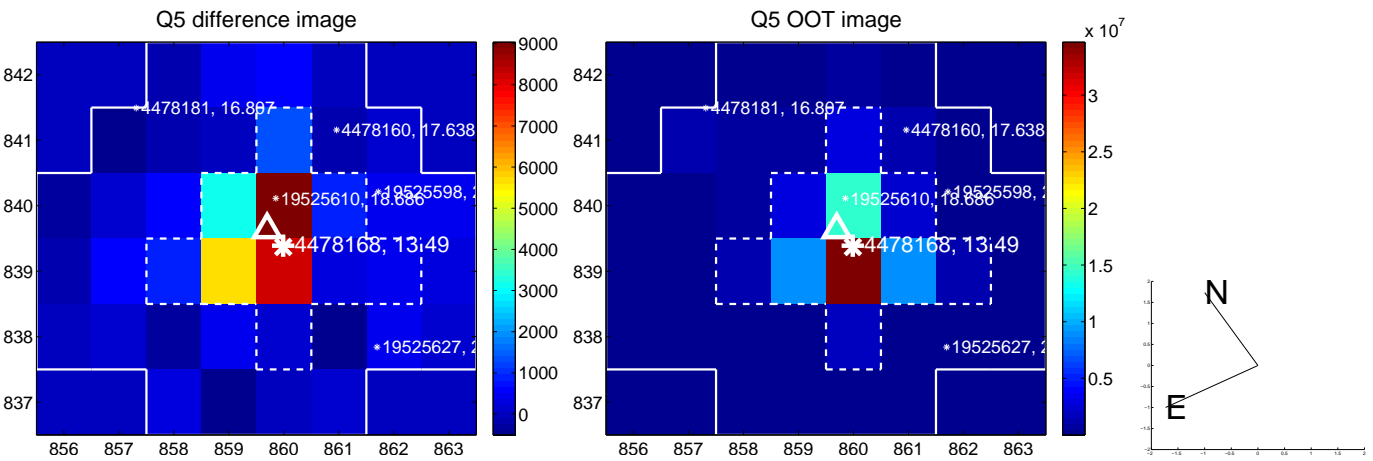


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

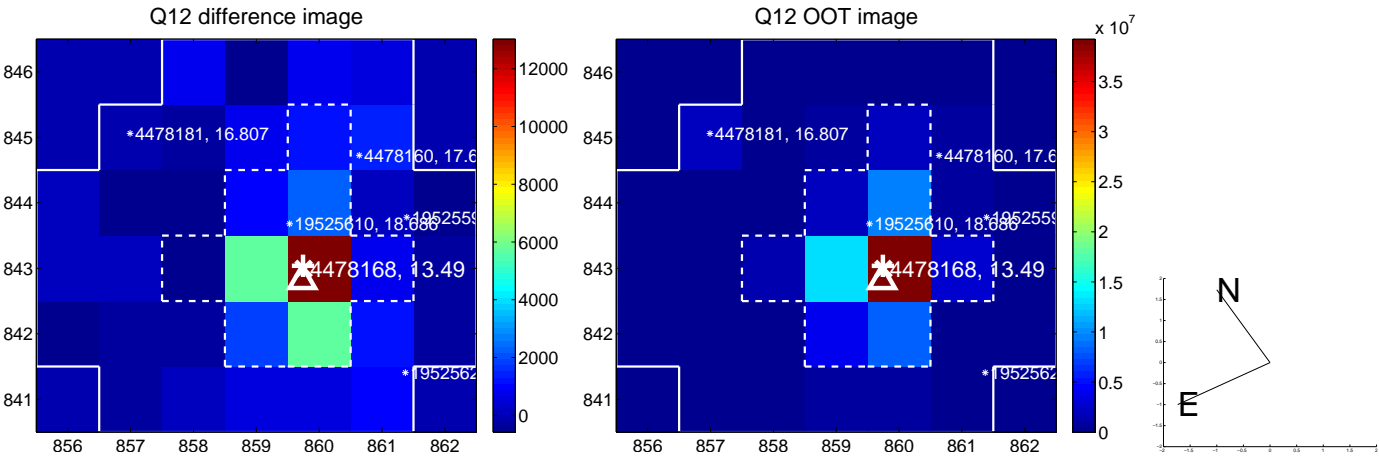
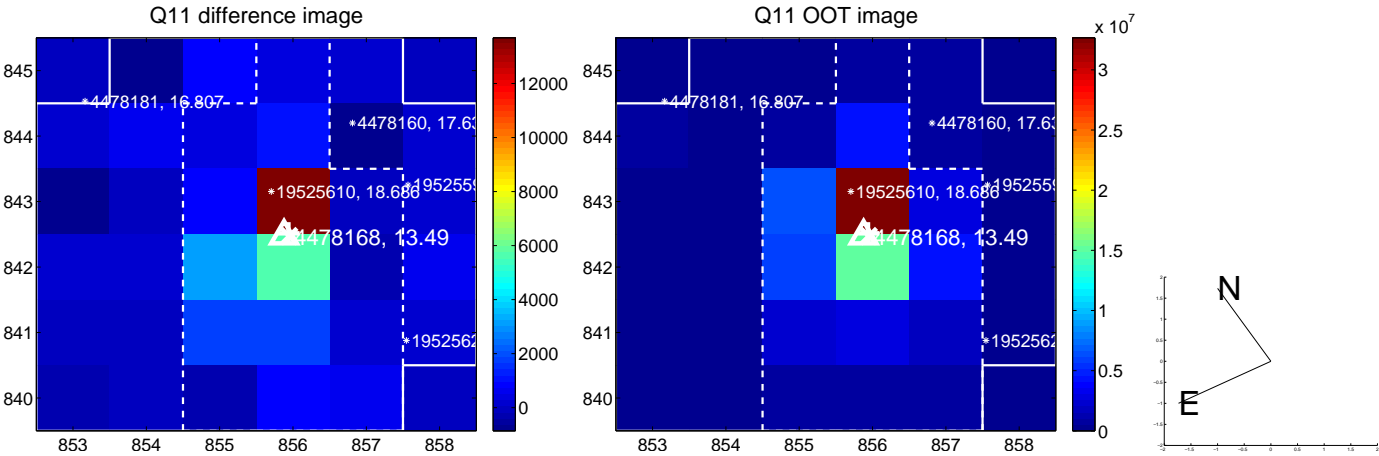
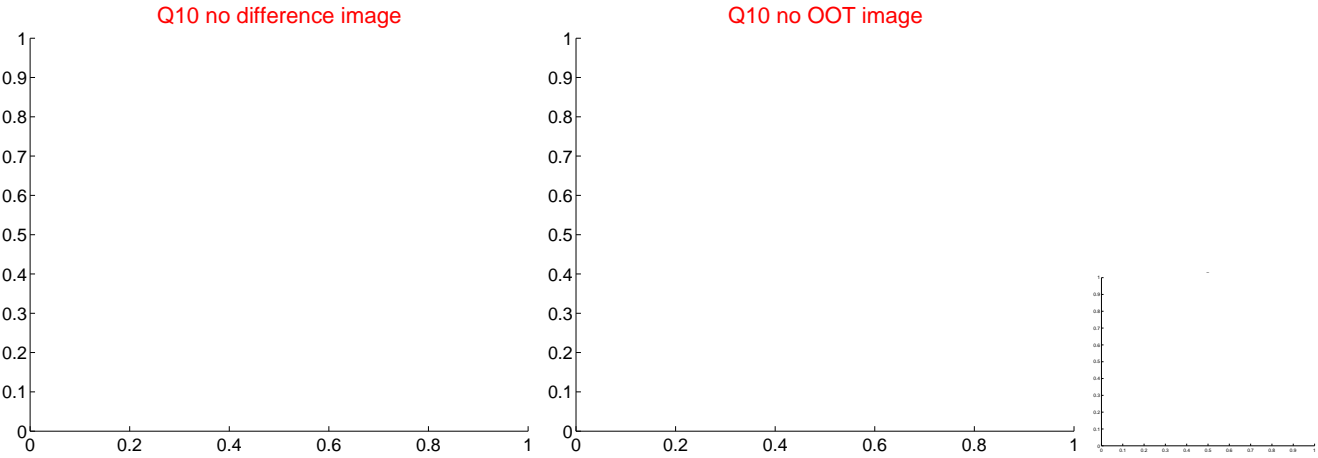
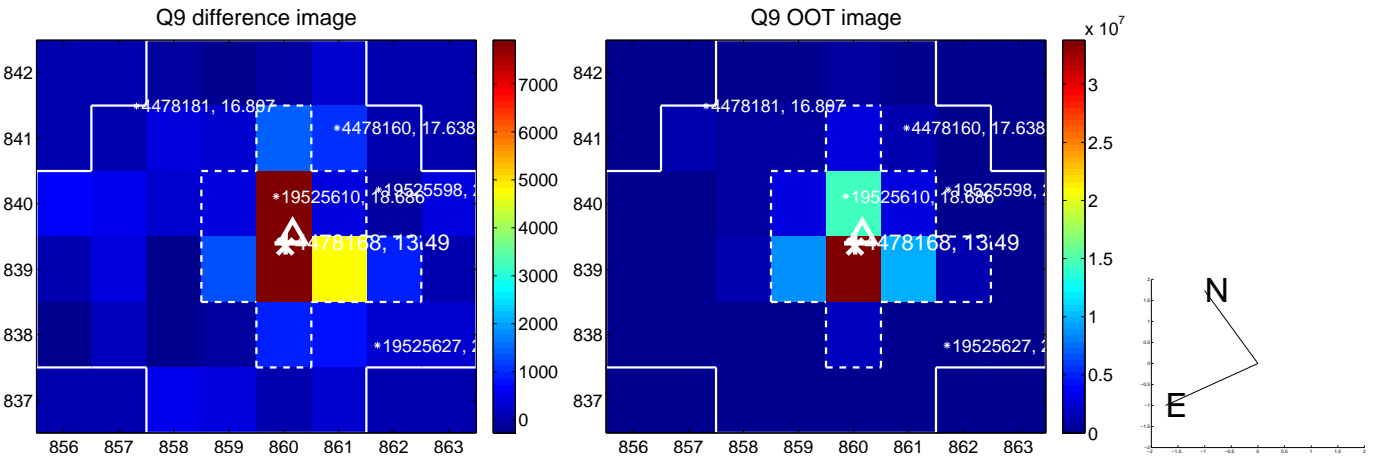
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



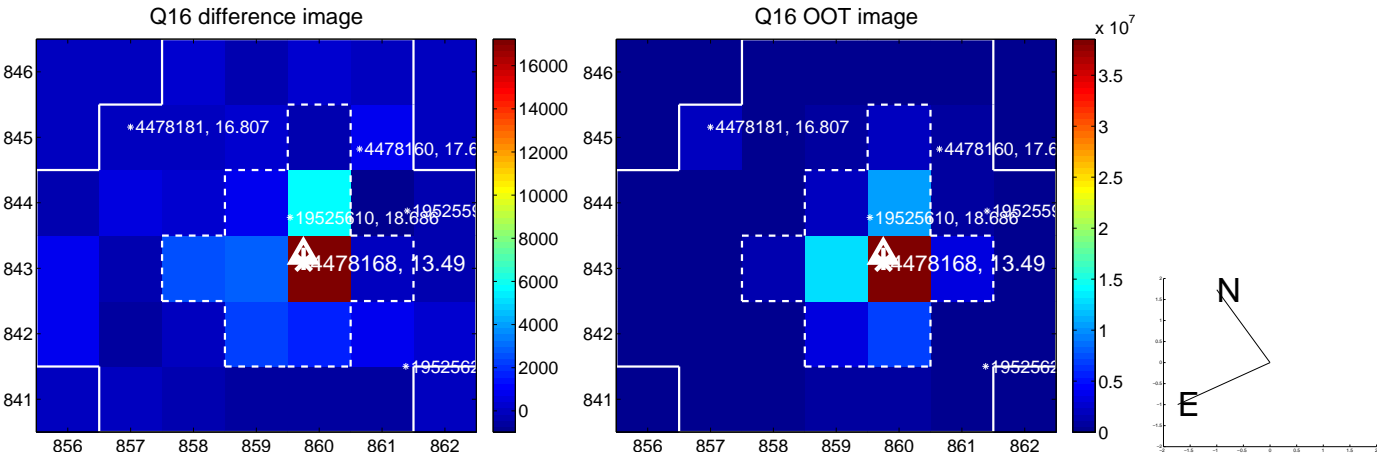
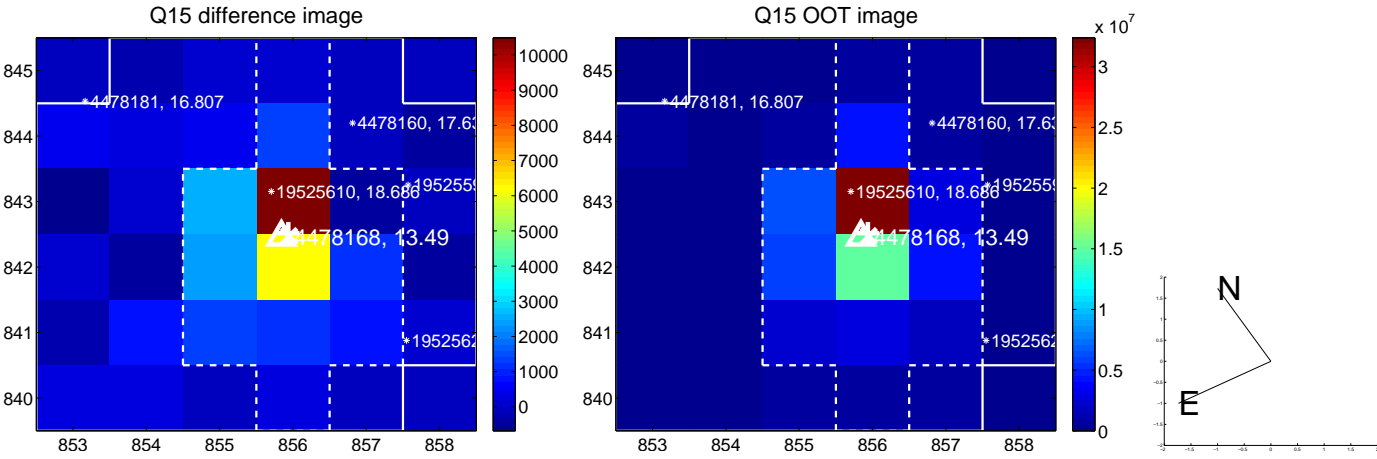
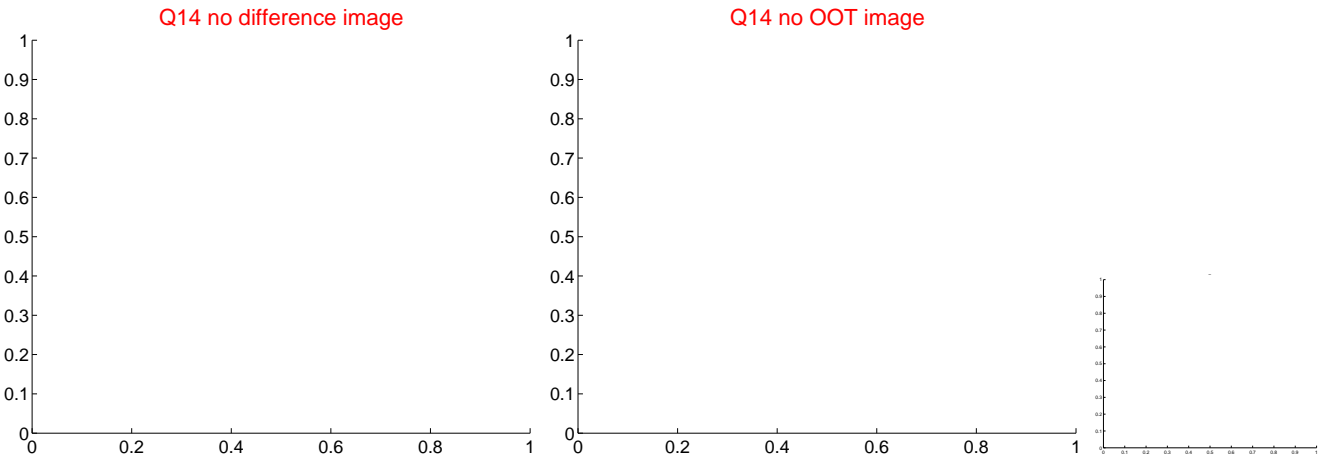
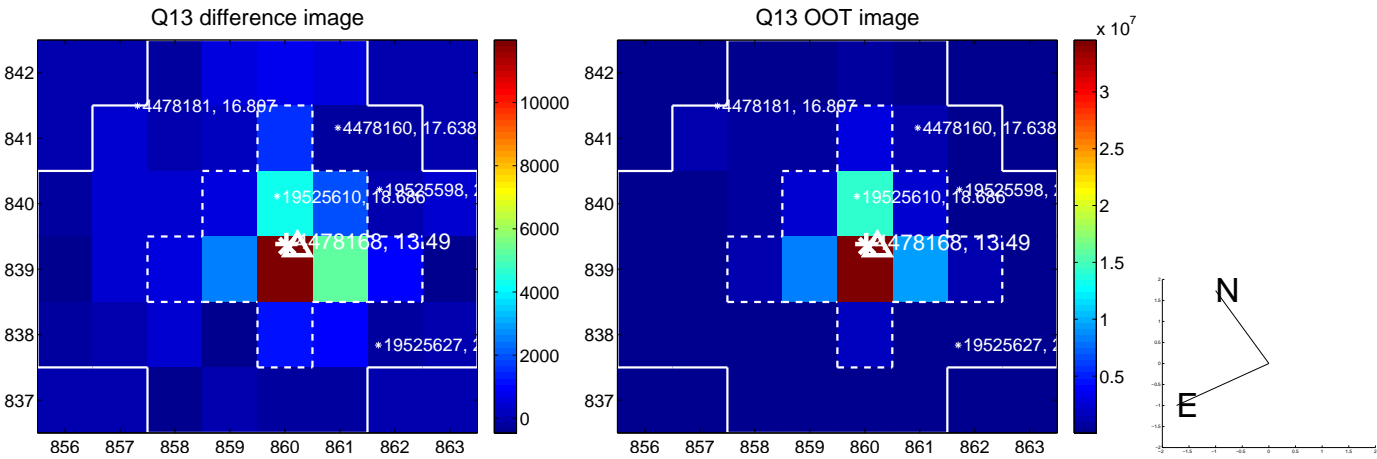
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

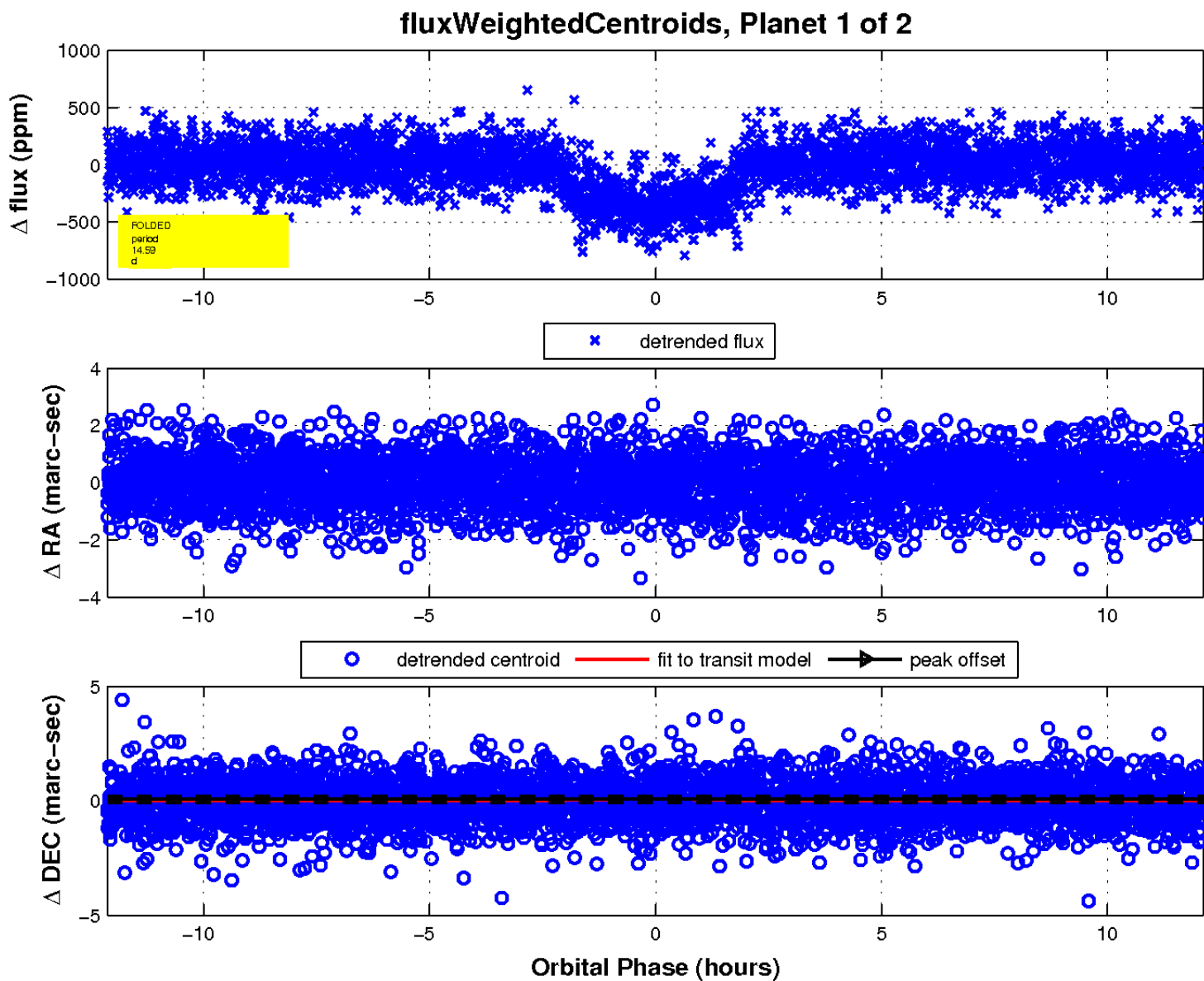
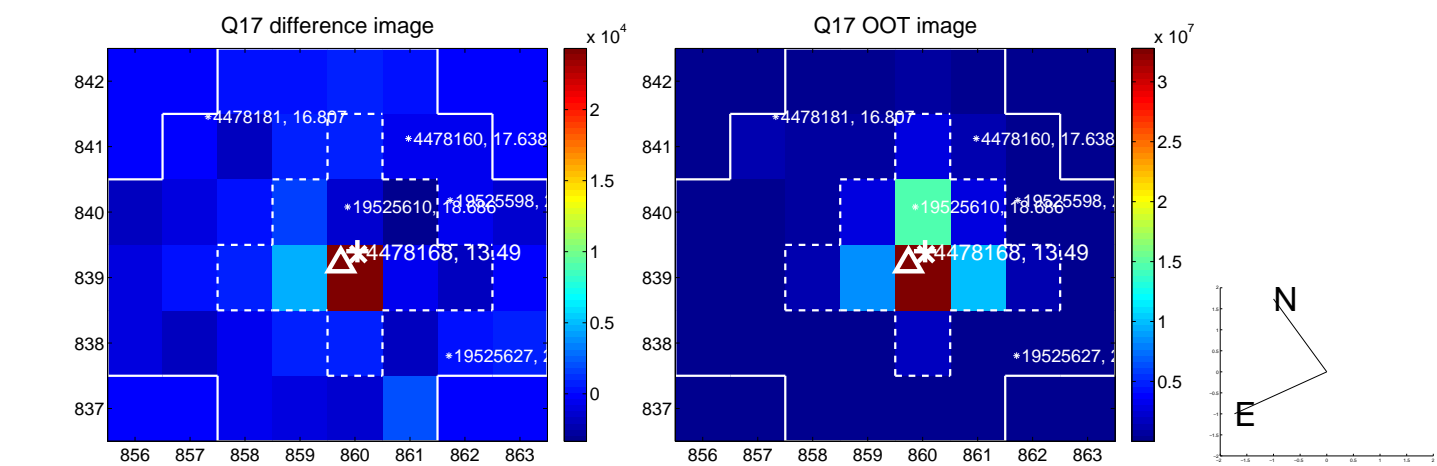


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

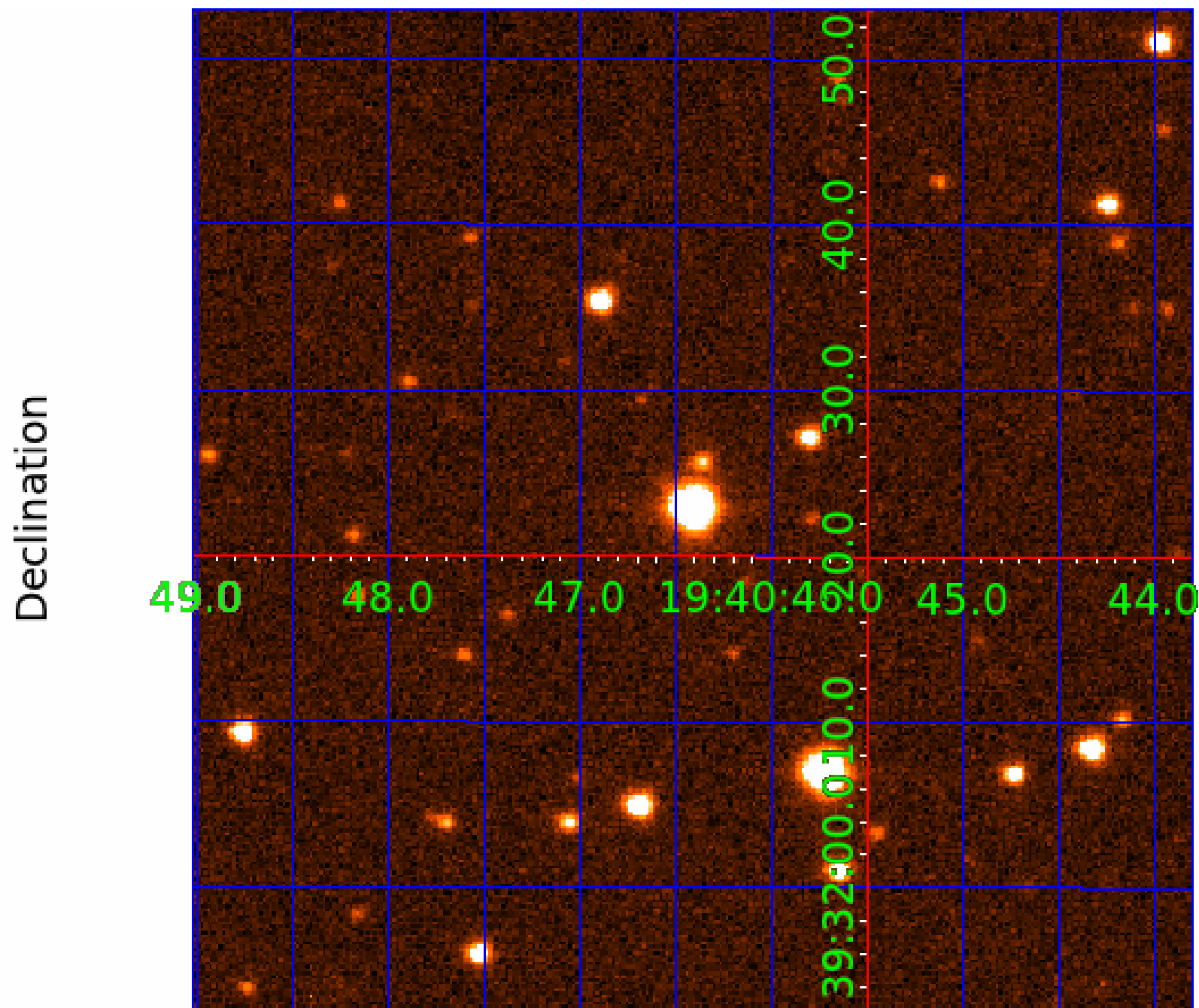




white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image



# KIC 004478168

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
004478168-01	OBS	0626.01	14.586497	143.048147	378.7	4.043	42.8	47.1	1.19	6063	2.53	125.02
004478168-02	OBS	0626.02	8.029214	132.829693	65.0	3.677	9.9	10.6	1.19	6063	1.13	277.13

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
004478168-01	OBS	PC	1.00	0	0	0	0	NO_COMMENT
004478168-02	OBS	PC	0.99	0	0	0	0	NO_COMMENT

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

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

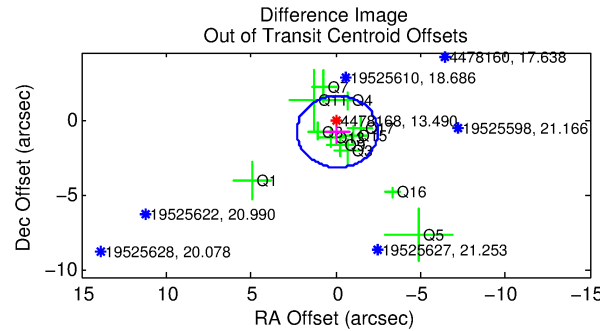
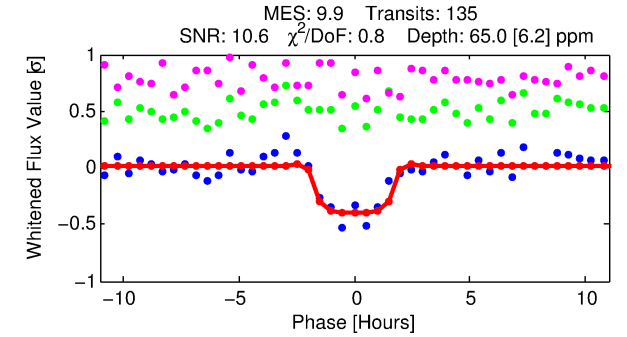
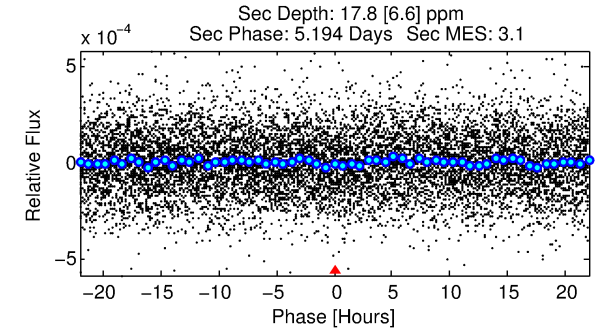
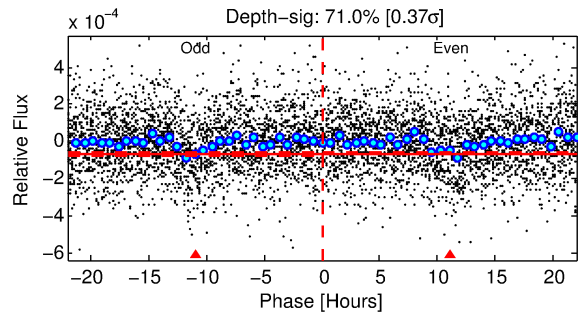
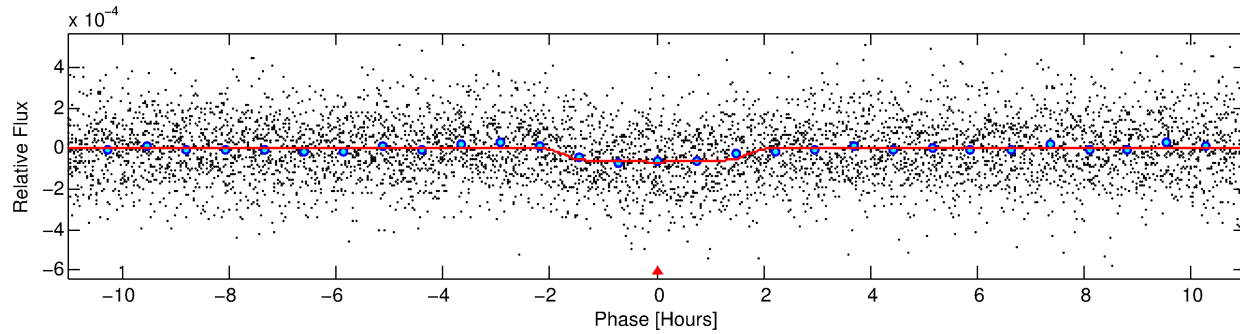
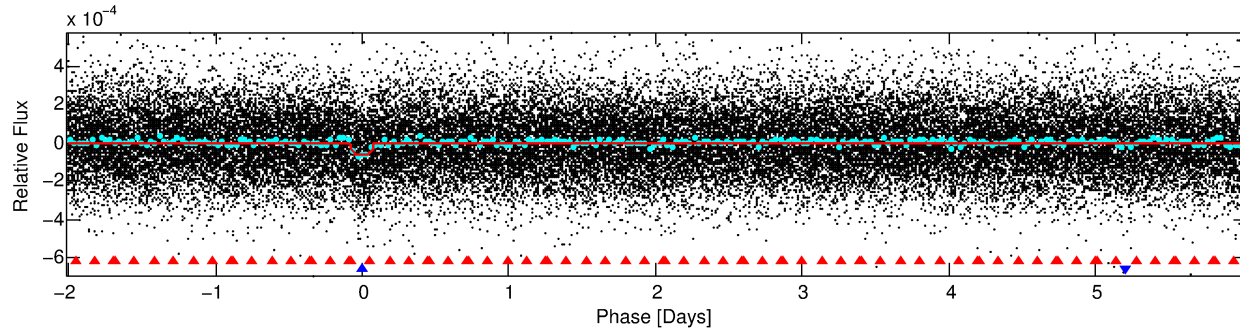
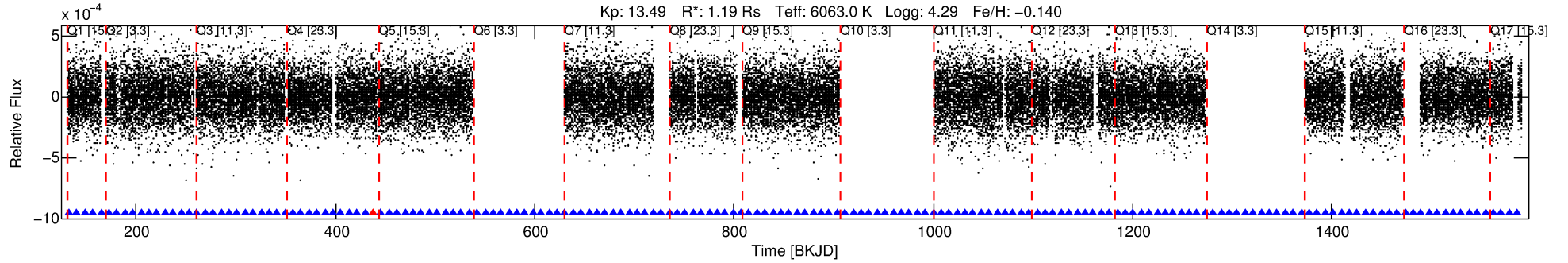
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 004478168-02

No Significant Match Found

# DV One-Page Summary

KIC: 4478168 Candidate: 2 of 2 Period: 8.029 d  
KOI: K00626.02 Corr: 0.940



## DV Fit Results:

Period = 8.02921 [0.00006] d  
Epoch = 132.8297 [0.0063] BKJD  
Rp/R\* = 0.0087 [0.0040]  
a/R\* = 7.63 [18.27]  
b = 0.90 [0.52]  
Seff = 277.13 [69.63]  
Teq = 1040 [65] K  
Rp = 1.13 [0.55] Re  
a = 0.0787 [0.0117] AU  
Ag = 47.32 [48.27] [0.96 $\sigma$ ]  
Teffp = 4219 [1051] K [3.02 $\sigma$ ]

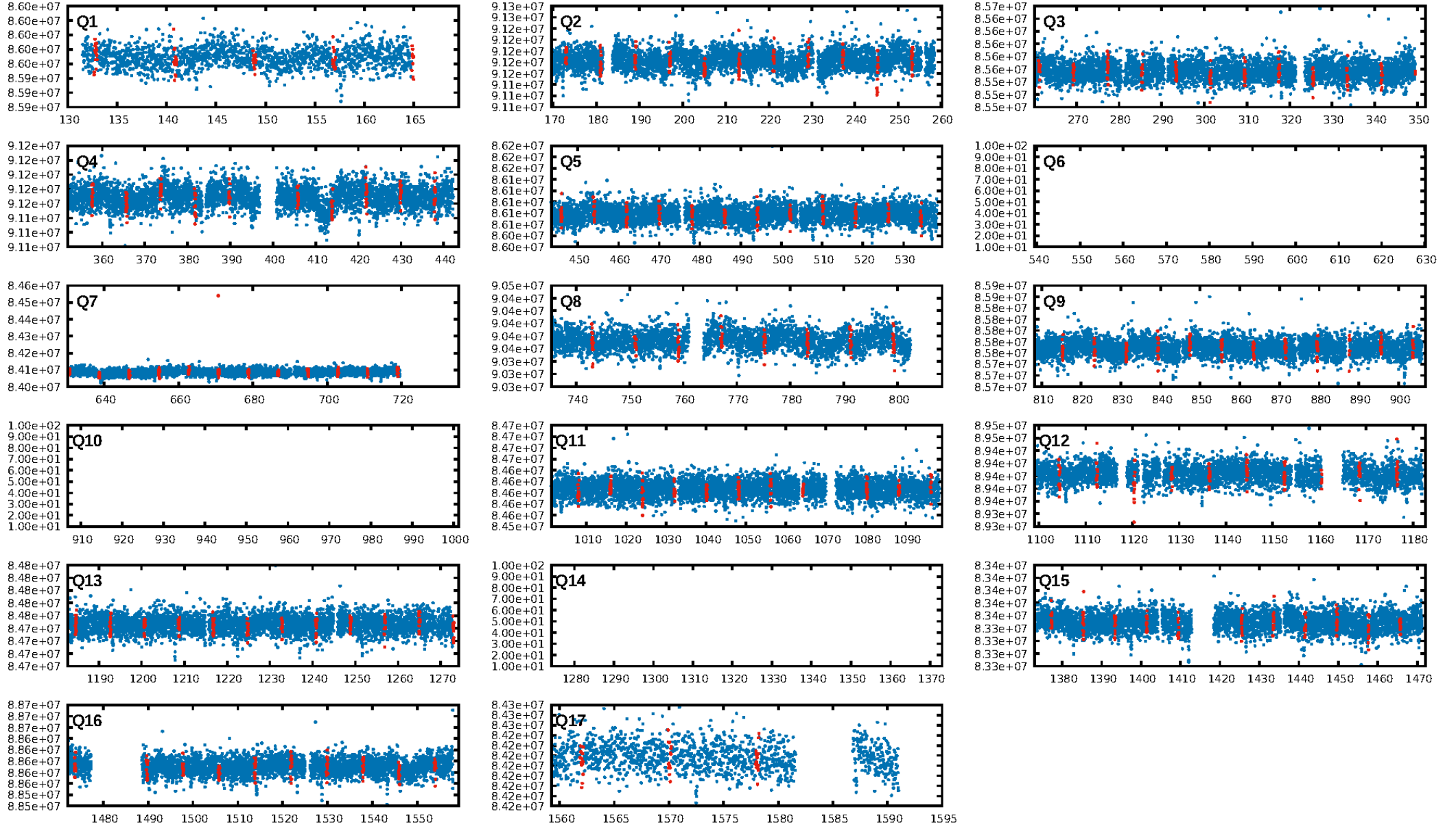
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [28.8 $\sigma$ ]  
ModelChiSquare2-sig: 100.0%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 1.15e-23  
RollingBand-fgt: 0.99 [126/127]  
GhostDiagnostic-chr: 1.328  
Centroid-sig: N/A  
Centroid-so: 2.231 arcsec [1.55 $\sigma$ ]  
OotOffset-rm: 0.806 arcsec [1.01 $\sigma$ ]  
OotOffset-st: 0/4/3/5 [12]  
KicOffset-rm: 0.661 arcsec [0.84 $\sigma$ ]  
KicOffset-st: 0/4/3/5 [12]  
DiffImageQuality-fgm: 0.67 [8/12]  
DiffImageOverlap-fno: 1.00 [14/14]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 30-Jan-2016 00:42:16 Z

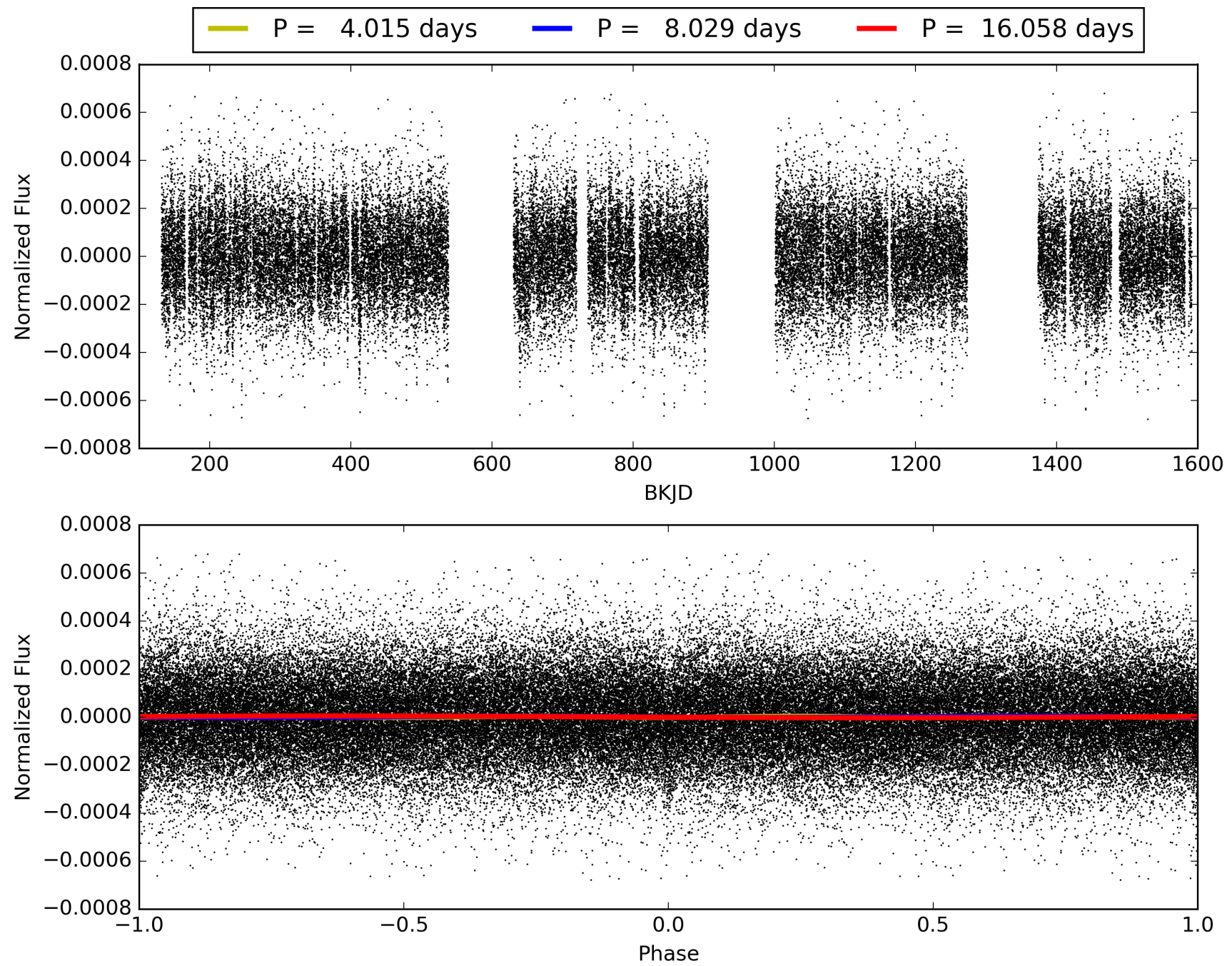
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 004478168-02, PDC Light Curves



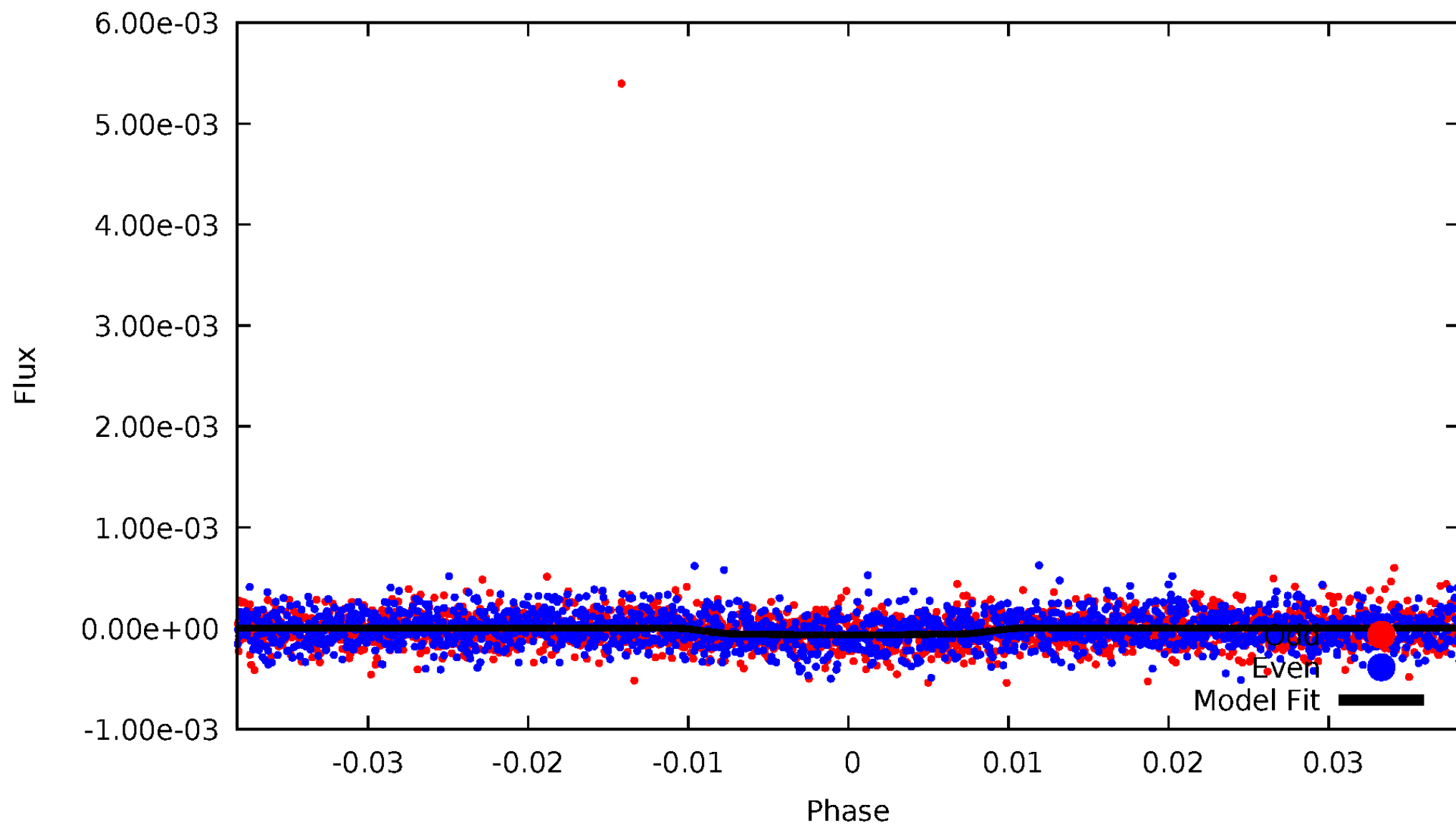


TCE 004478168-02



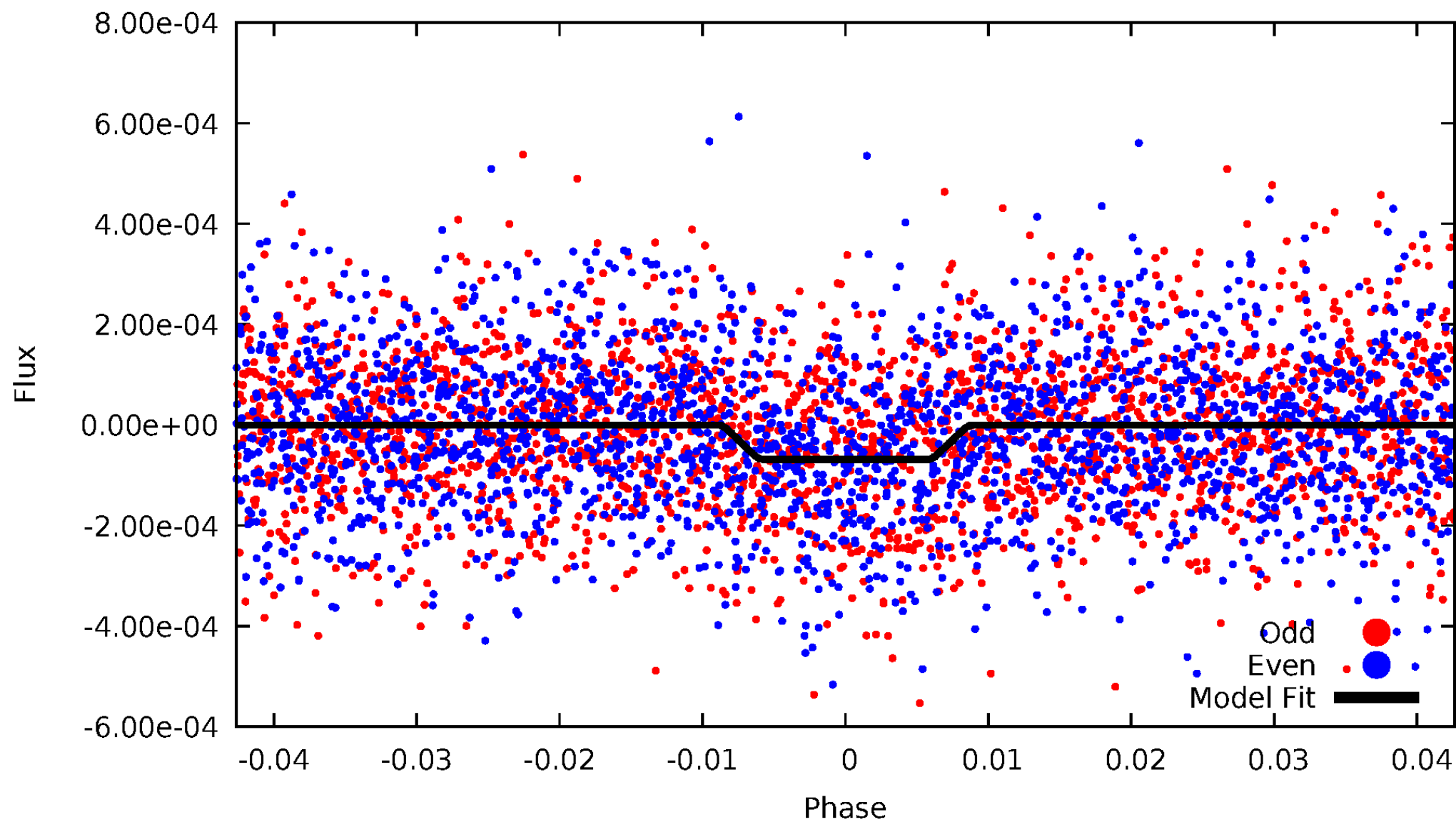
# DV Odd/Even

TCE 004478168-02



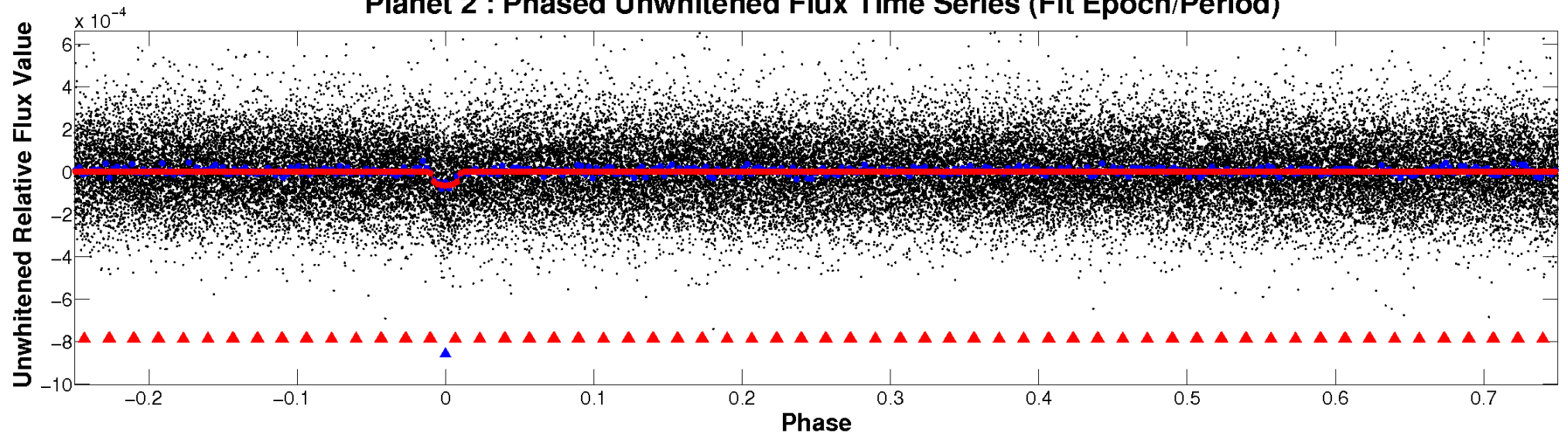
# ALT Odd/Even

TCE 004478168-02

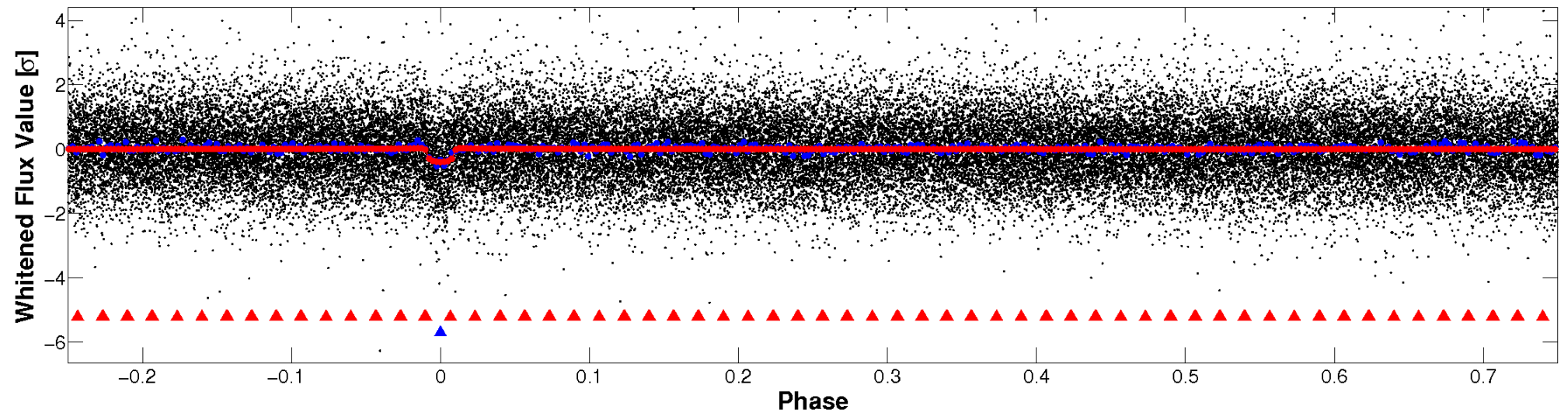


# Non-Whitened Vs. Whitened Light Curve

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

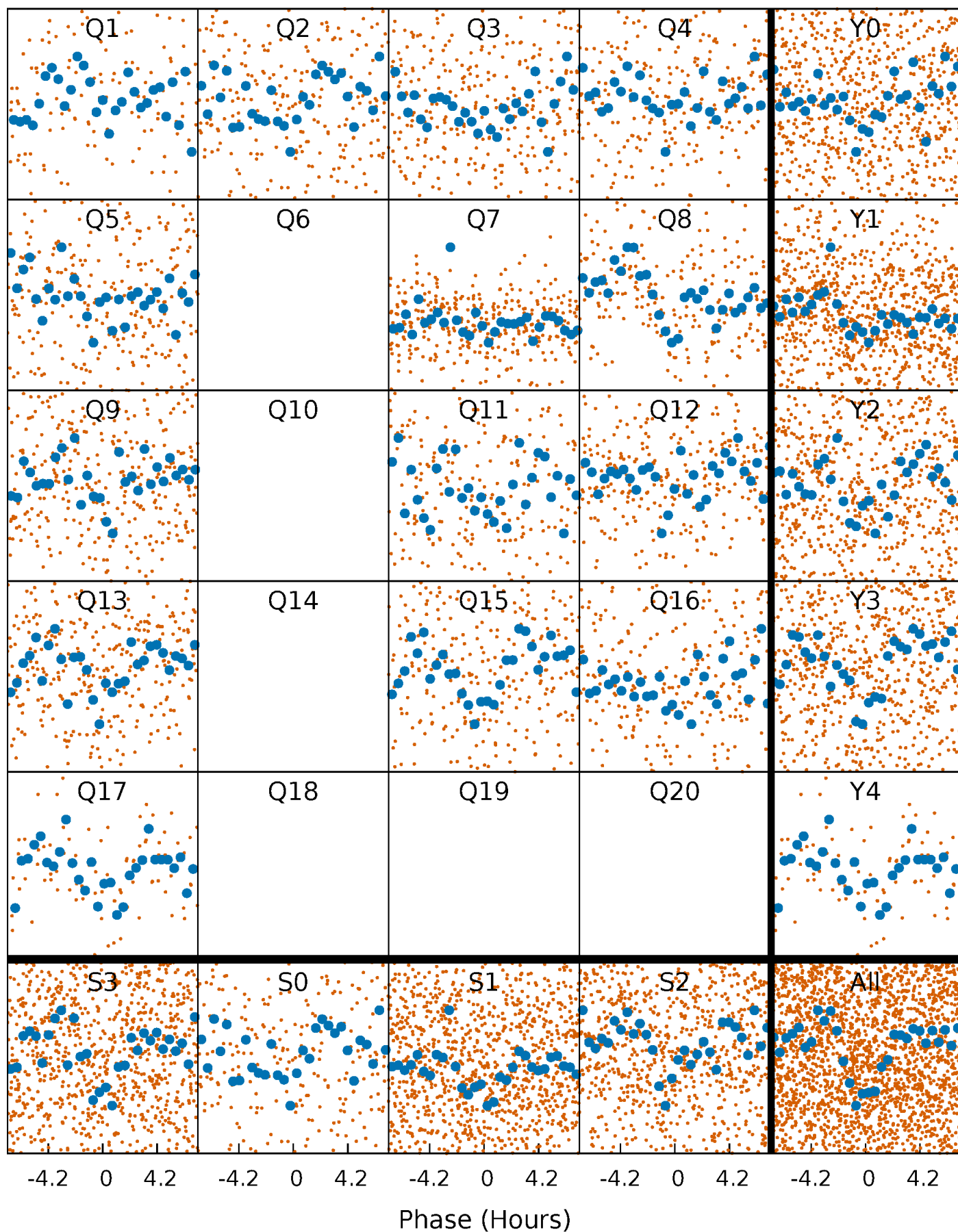


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

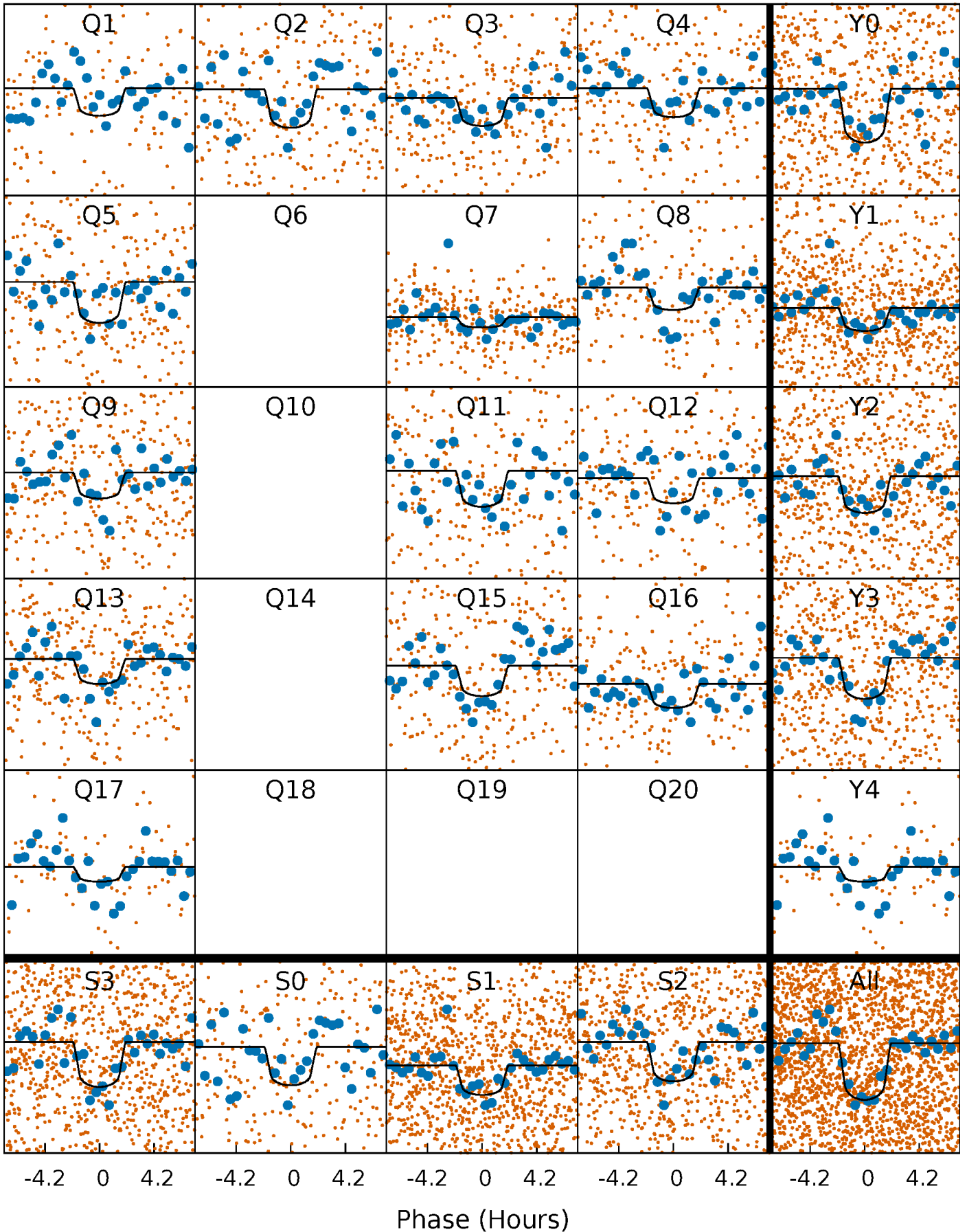
TCE 004478168-02   P= 8.029214 Days    $T_0=132.829693$  (BKJD)





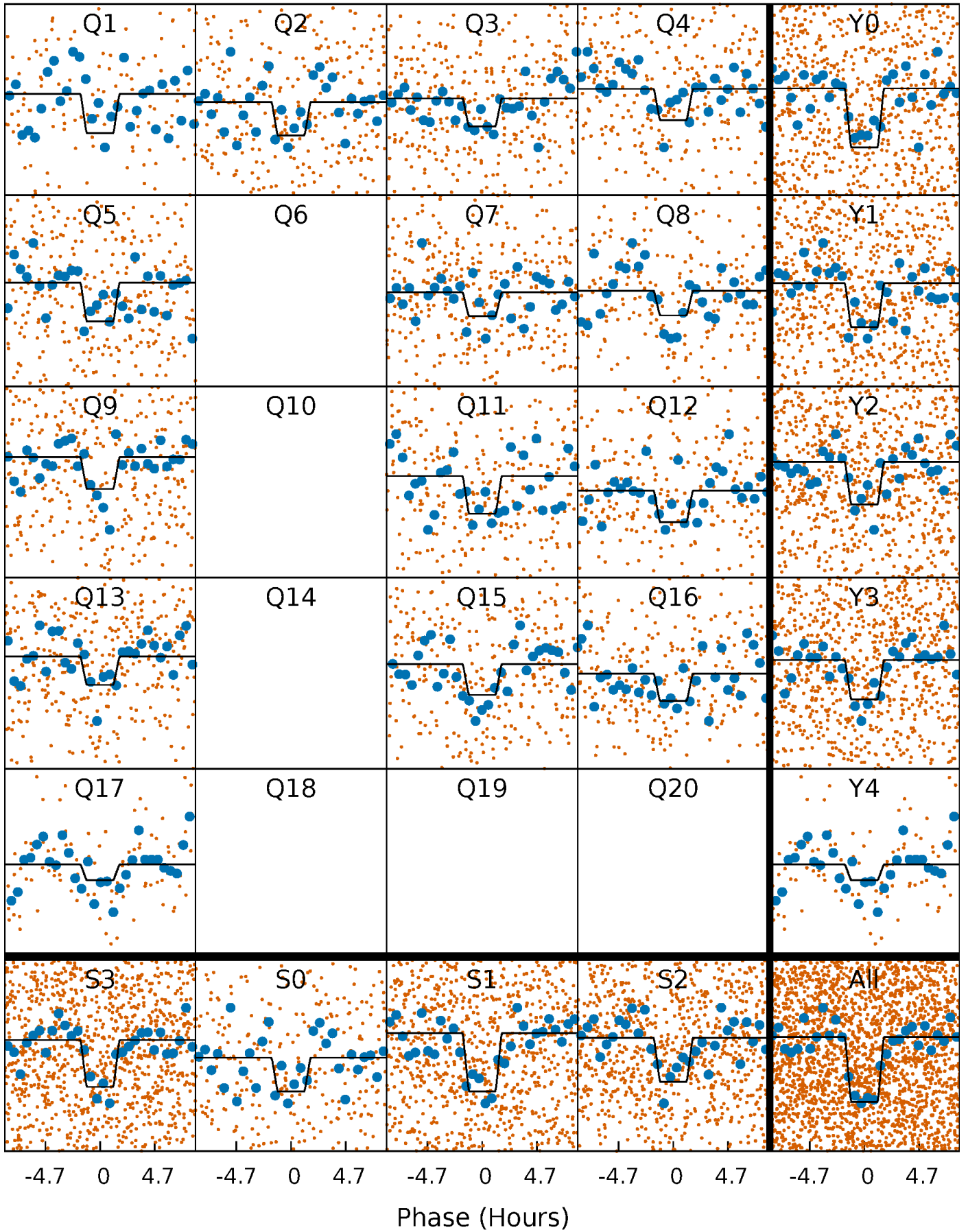
# DV Quarter-Phased Transit Curves

TCE 004478168-02   P= 8.029214 Days    $T_0=132.829693$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

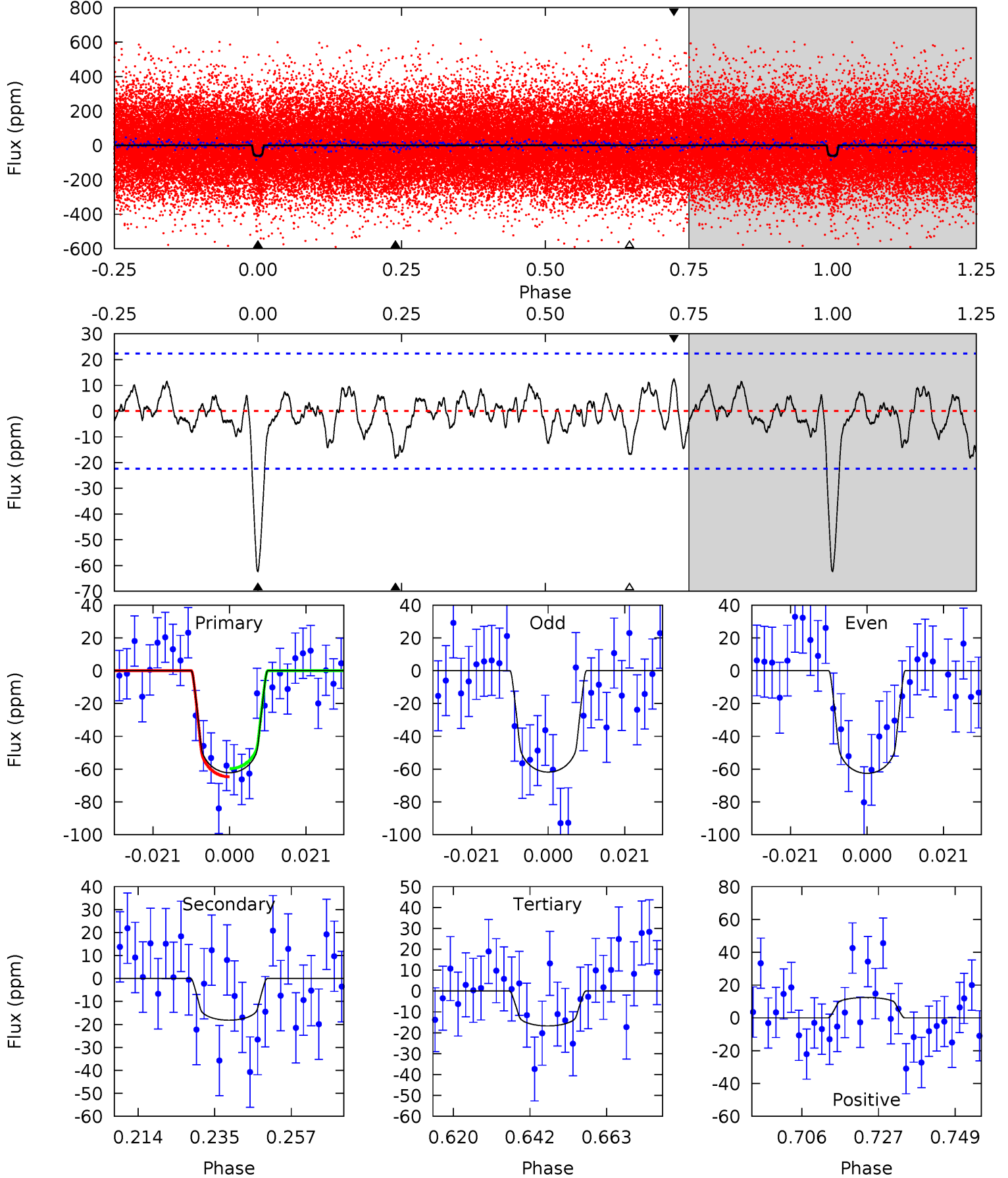
TCE 004478168-02 P= 8.029201 Days  $T_0=132.829192$  (BKJD)



# DV Model-Shift Uniqueness Test

004478168-02, P = 8.029214 Days, E = 124.800479 Days

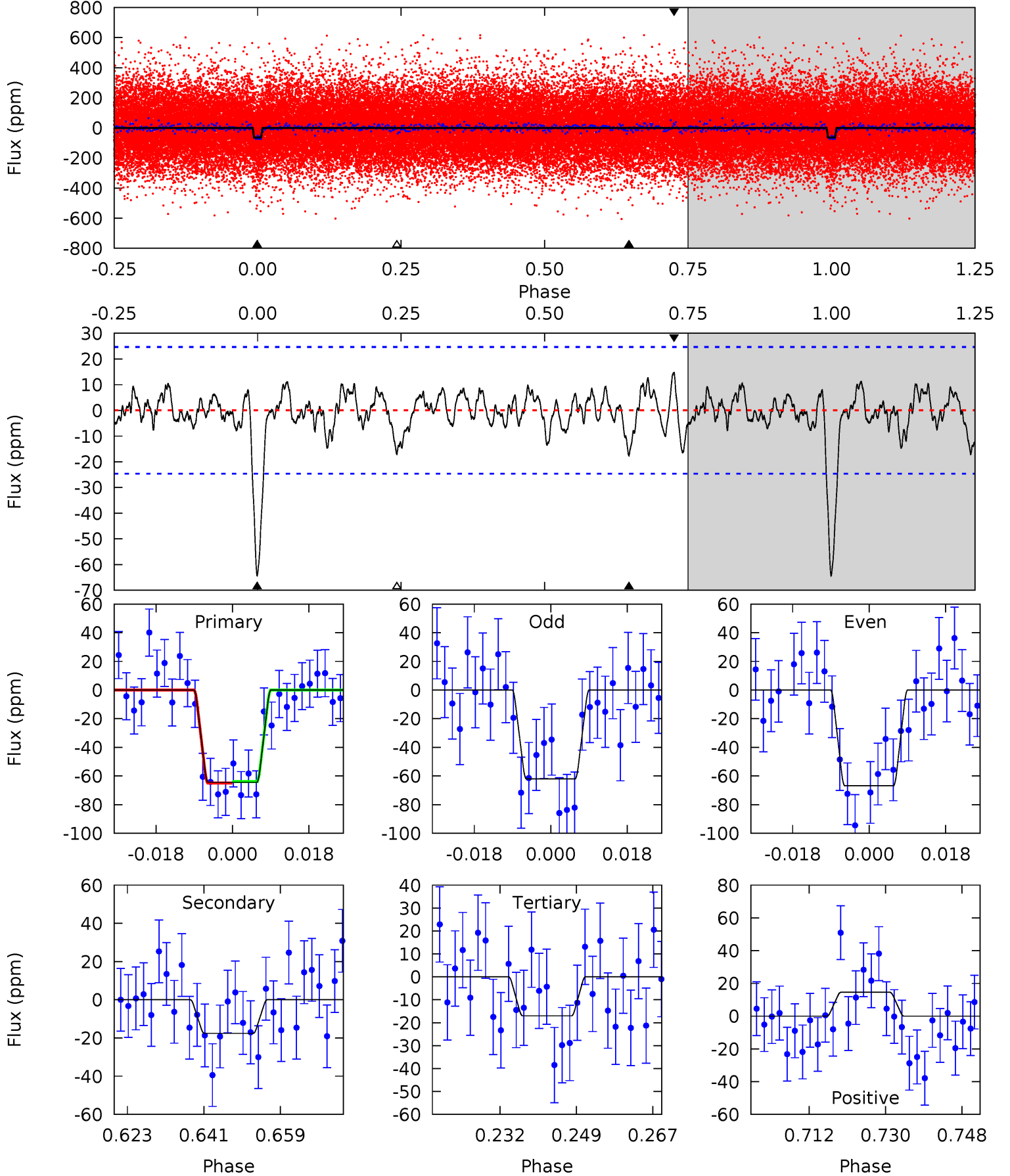
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
13.6	3.96	3.65	2.70	4.88	2.30	1.19	9.92	10.9	0.31	1.26	0.09	1.05	0.17	0.54



# Alt Model-Shift Uniqueness Test

004478168-02, P = 8.029201 Days, E = 124.799991 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
12.8	3.51	3.40	2.91	4.91	2.37	1.12	9.45	9.93	0.11	0.59	0.47	0.96	0.18	0.11



### Stellar Parameters For KIC 004478168

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6063^{+121}_{-133}$	$4.290^{+0.137}_{-0.112}$	$-0.140^{+0.150}_{-0.150}$	$1.191^{+0.189}_{-0.189}$	$1.009^{+0.082}_{-0.067}$	$0.841^{+0.527}_{-0.302}$
	+2%/-2%	+3%/-3%	+107%/-107%	+16%/-16%	+8%/-7%	+63%/-36%
Source	SPE59	SPE59	SPE59	DSEP		

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

### Secondary Eclipse Parameters for KIC 004478168-02 / KOI 0626.02

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-18 \pm 5$	$1.13^{+0.52}_{-0.51}$	$1451^{+68}_{-73}$	$4402^{+1234}_{-566}$	$48^{+108}_{-26}$
Alt.	$-18 \pm 5$	$1.09^{+0.55}_{-0.50}$	$1447^{+66}_{-74}$	$4455^{+1378}_{-648}$	$51^{+136}_{-29}$

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

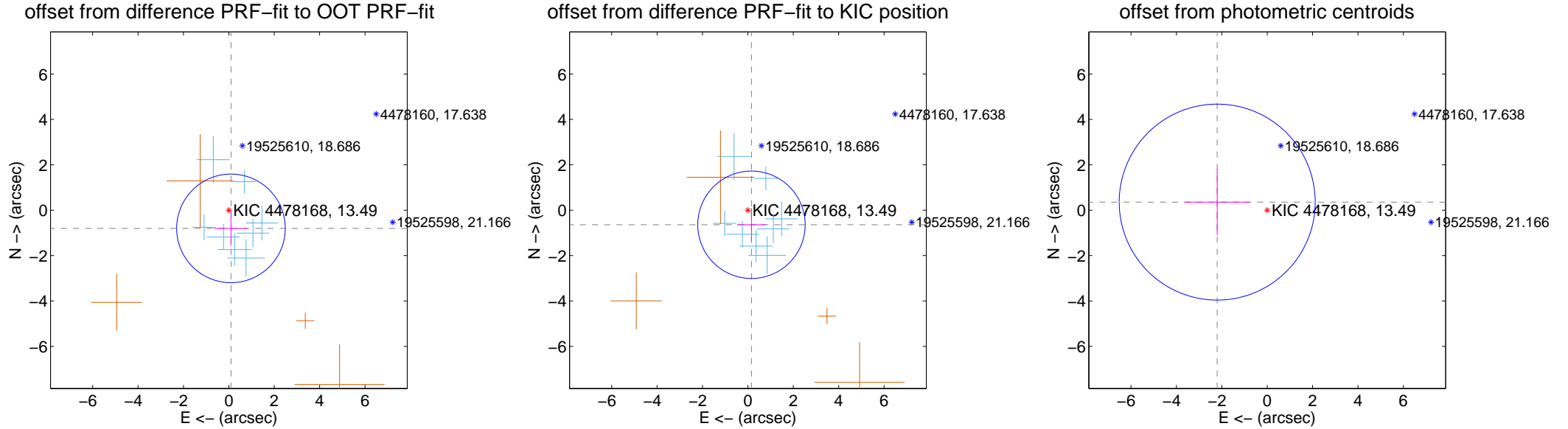
## DV Centroid Data

Supplemental centroid analysis for 004478168-02. Kepler magnitude: 13.49. Transit SNR 10.63

There are 8 quarters with good PRF difference image offsets

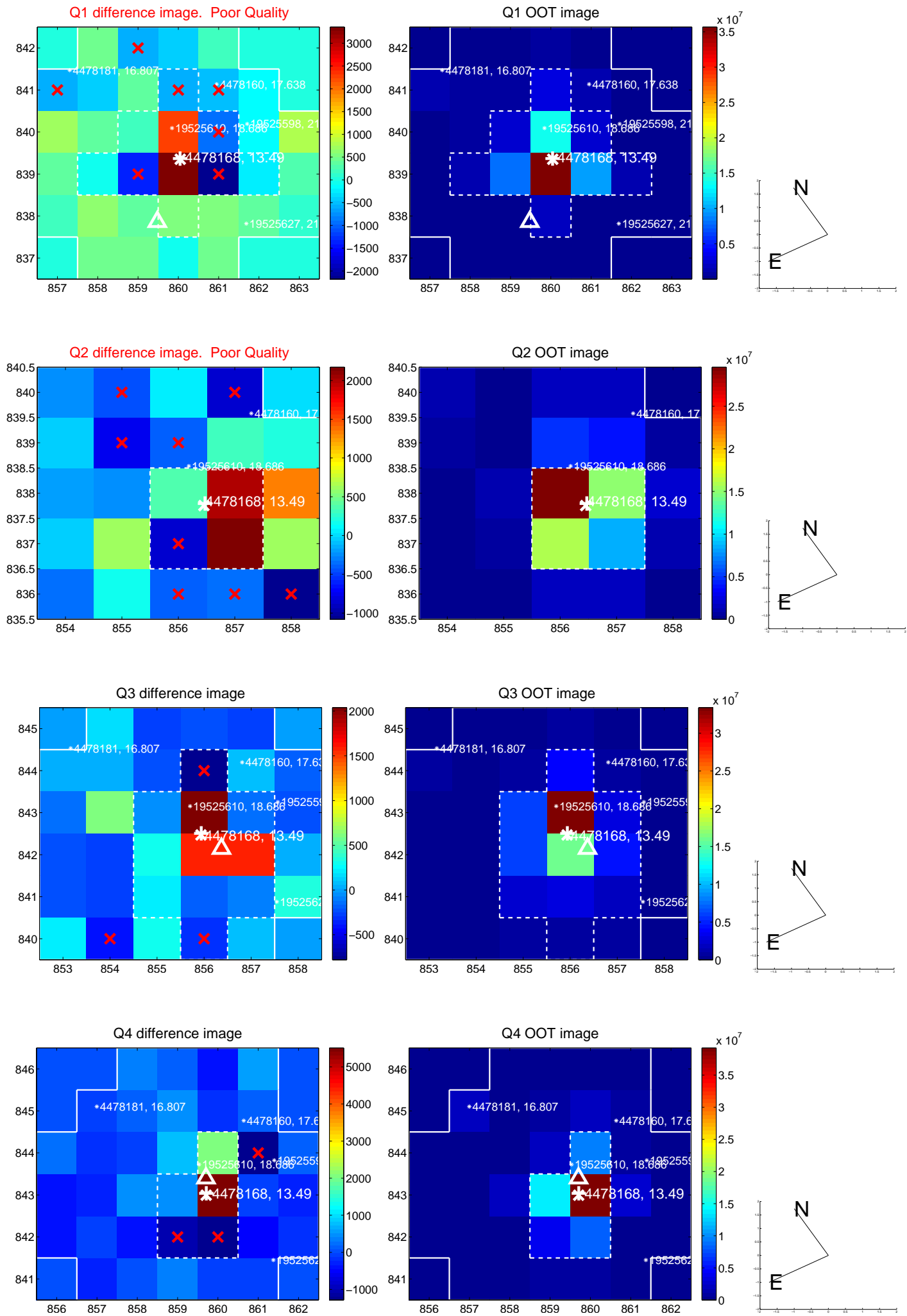
The direct PRF centroid is offset from the target star catalog position by about 0.18 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.806 \pm 0.797$	1.01	$-0.093 \pm 0.744$	$-0.800 \pm 0.763$
PRF-fit source offset from KIC position	$0.661 \pm 0.788$	0.84	$-0.157 \pm 0.634$	$-0.642 \pm 0.734$
photometric centroid source offset	$2.23 \pm 1.44$	1.55	$2.20 \pm 1.44$	$0.36 \pm 1.46$



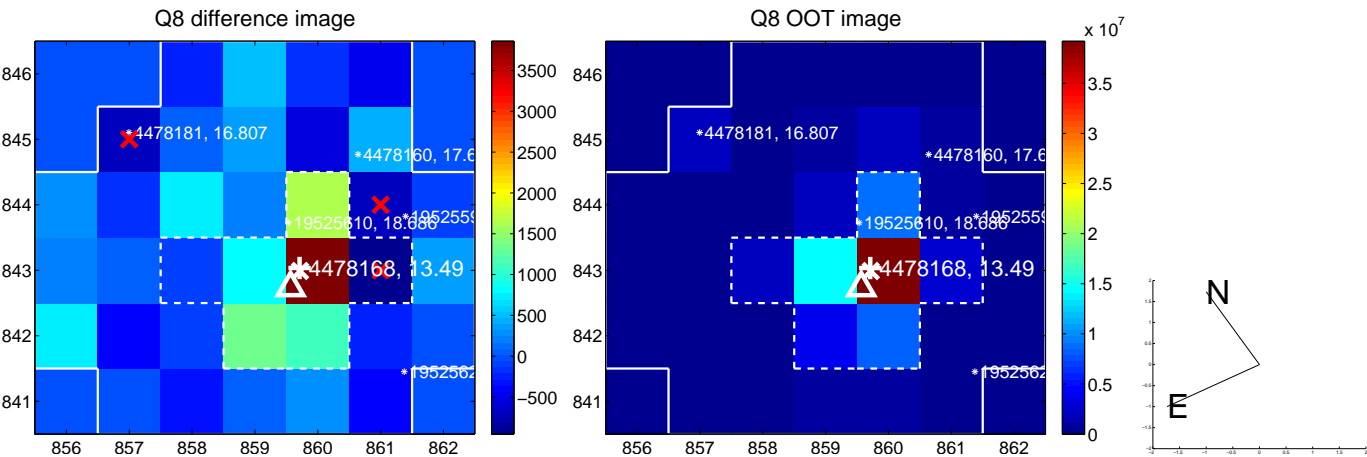
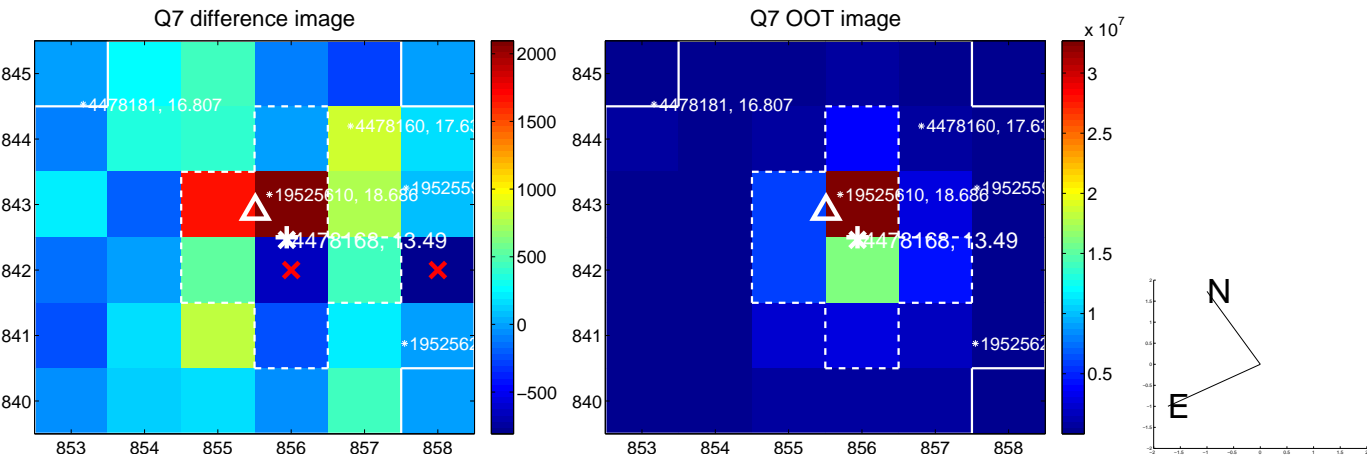
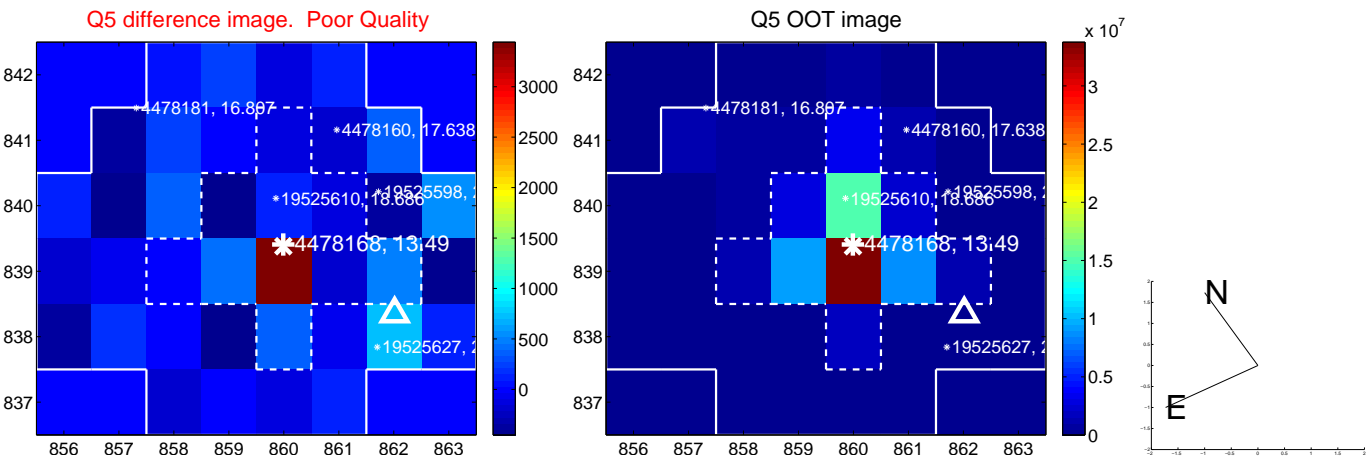
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

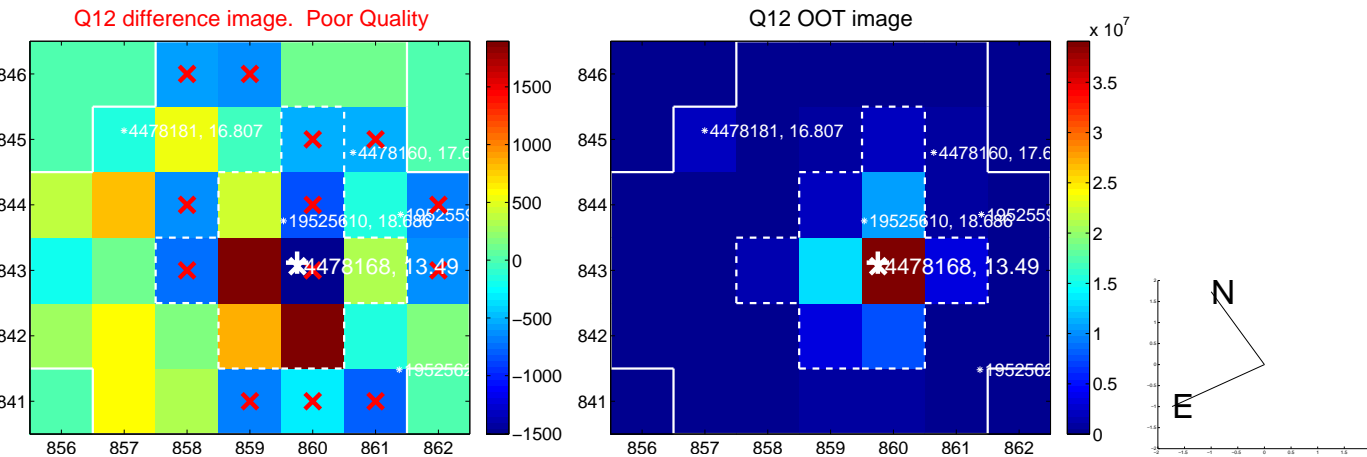
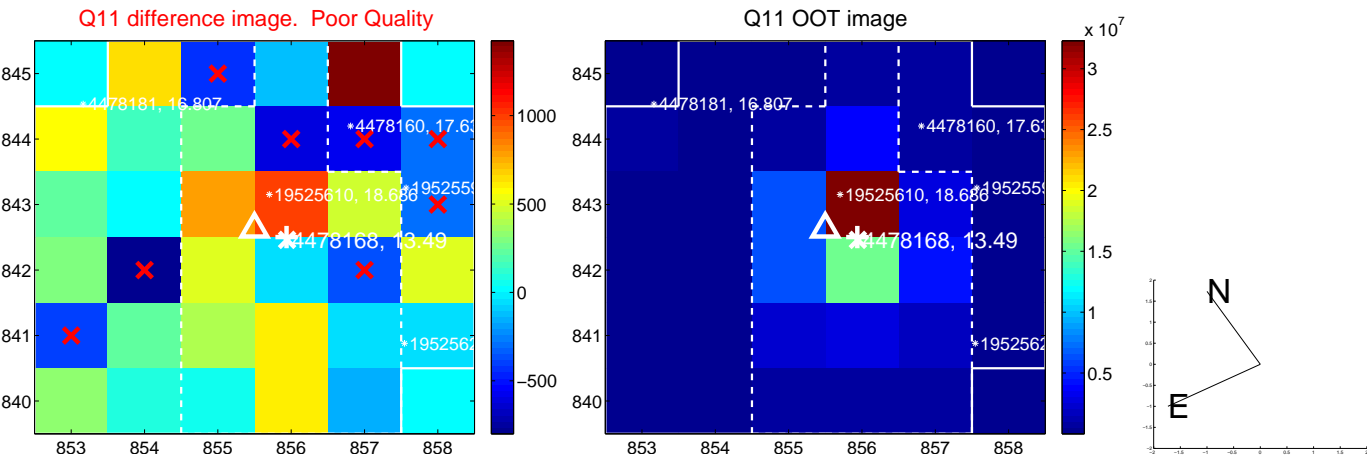
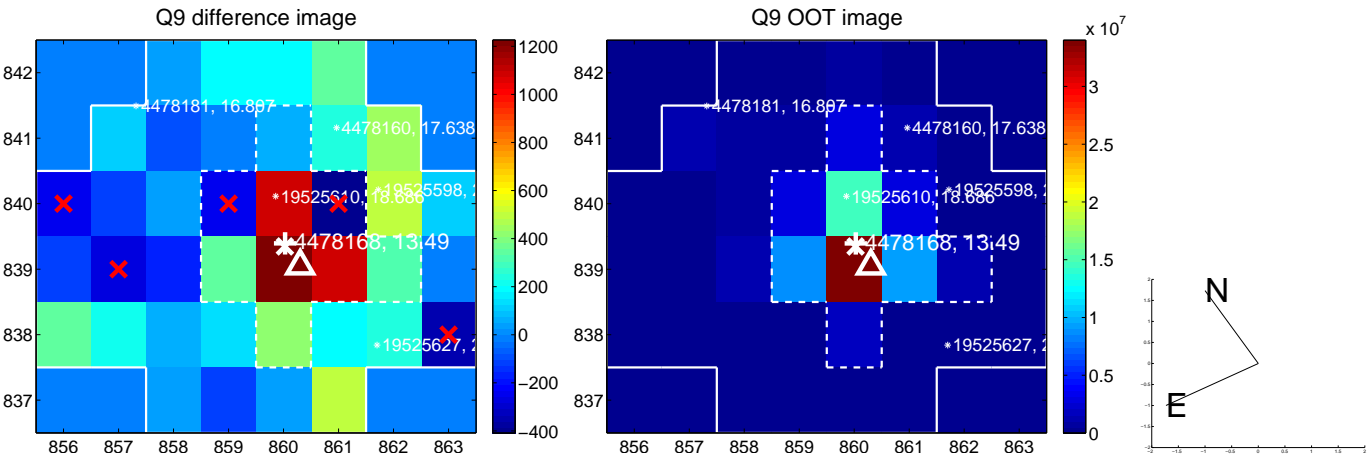




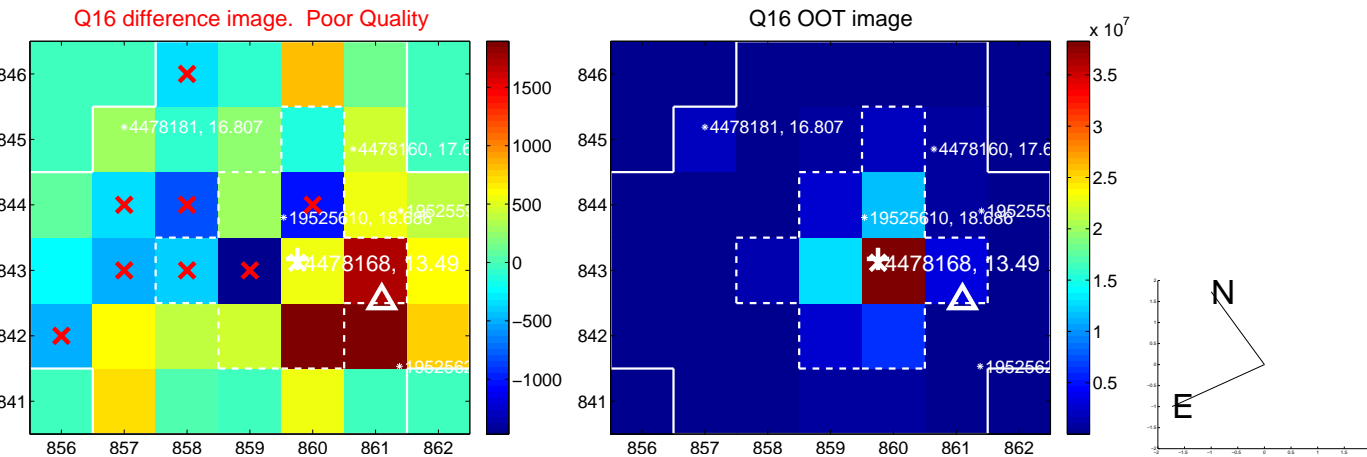
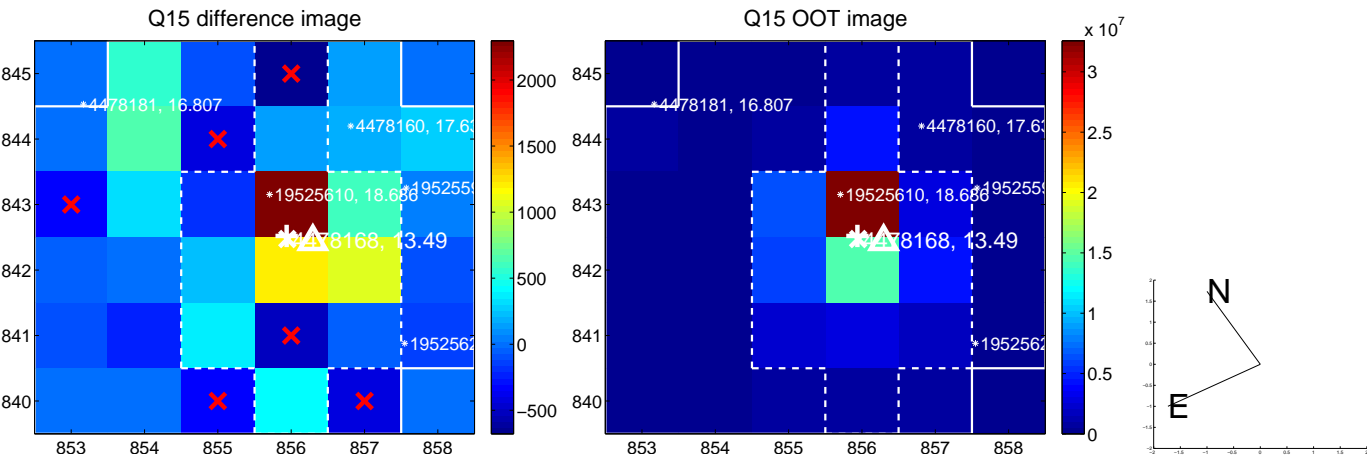
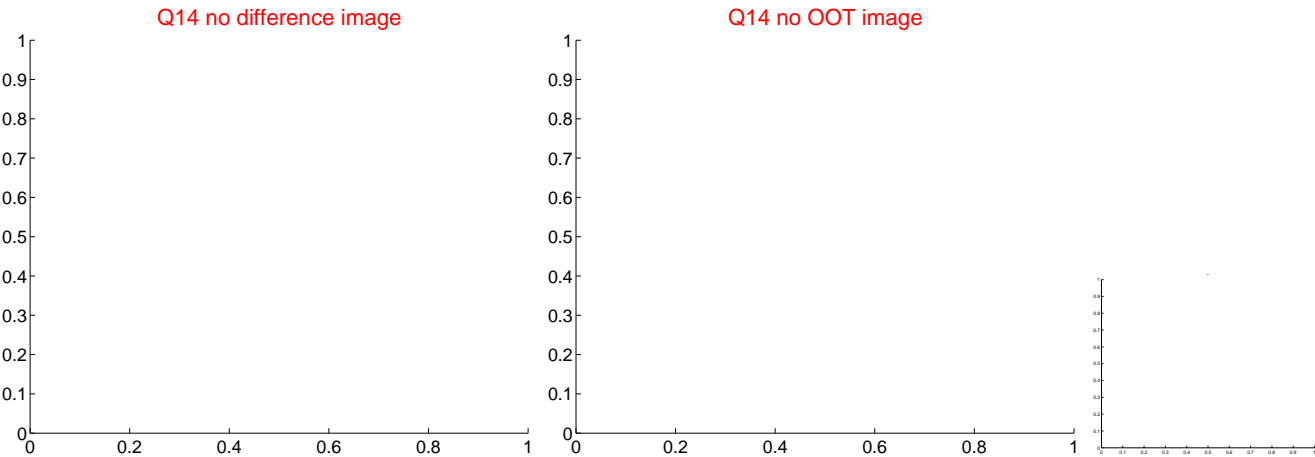
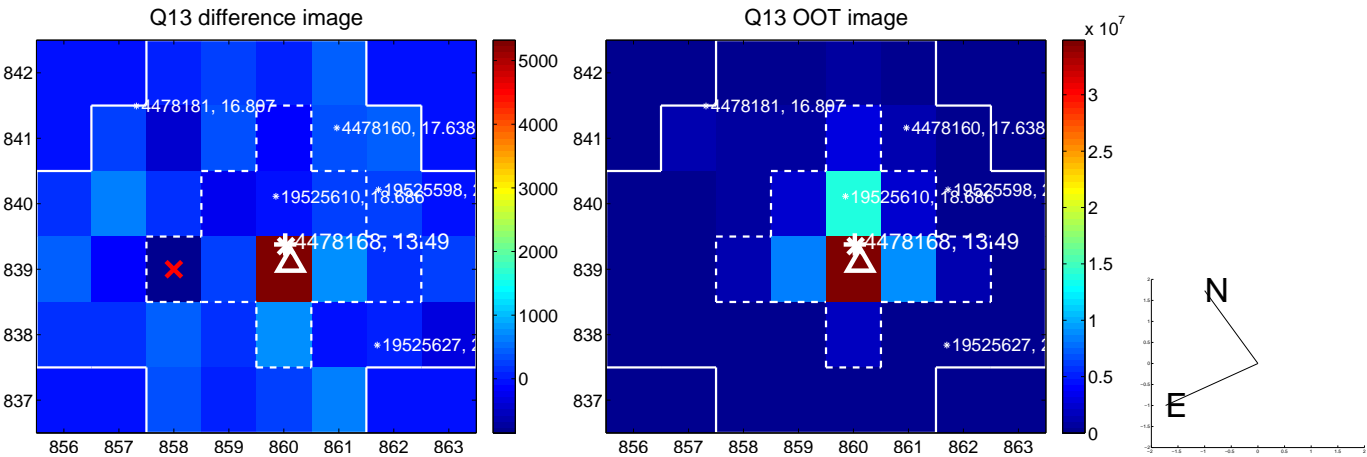
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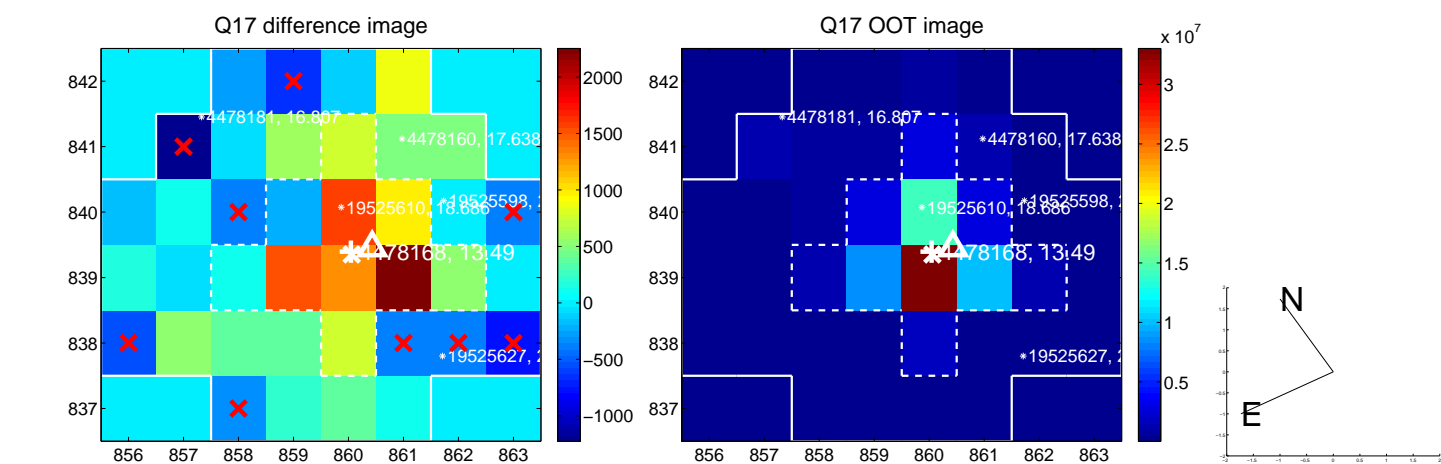
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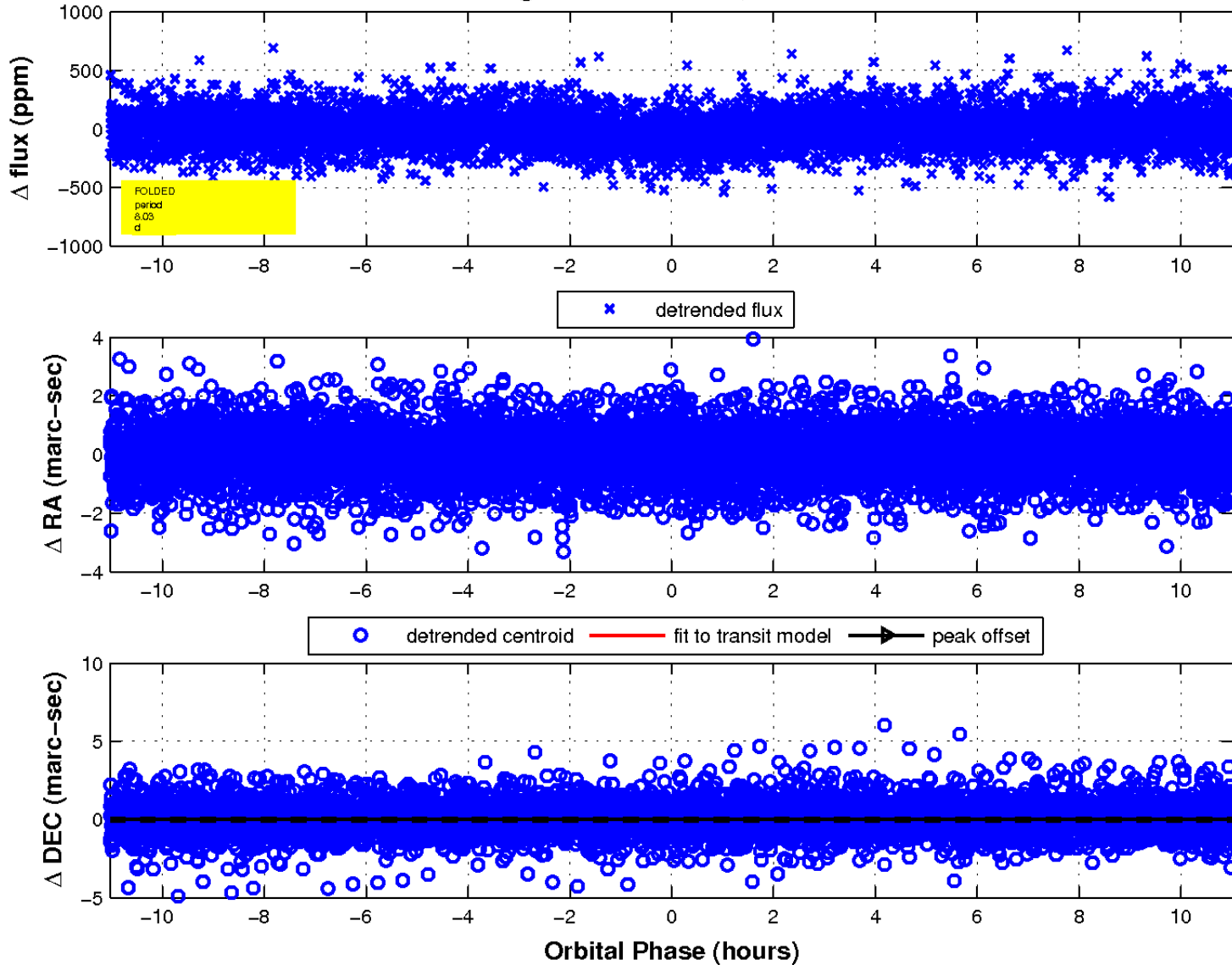
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



fluxWeightedCentroids, Planet 2 of 2



UKIRT Image

