

# KIC 008478994

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
008478994-01	OBS	0245.01	39.792239	135.457732	605.8	4.602	175.6	167.4	0.78	5437	2.11	10.40
008478994-02	OBS	0245.02	21.301920	149.236765	90.4	3.934	29.9	34.3	0.78	5437	0.89	23.93

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
008478994-01	OBS	PC	1.00	0	0	0	0	CENT_SATURATED
008478994-02	OBS	PC	1.00	0	0	0	0	CENT_SATURATED

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

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

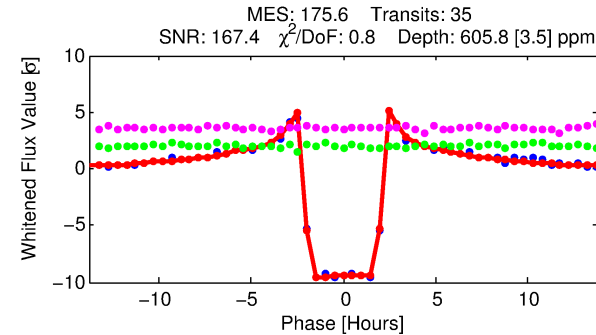
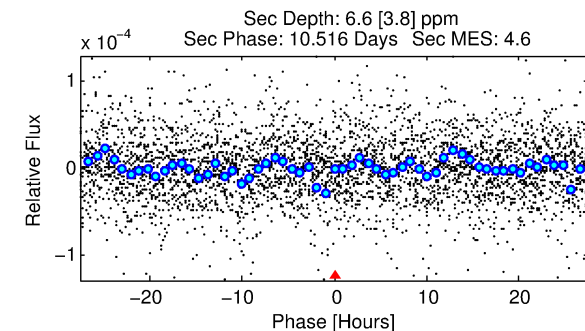
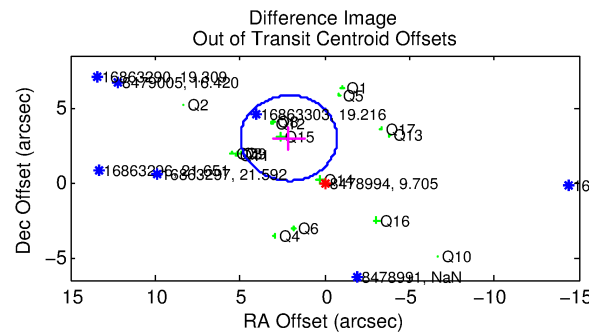
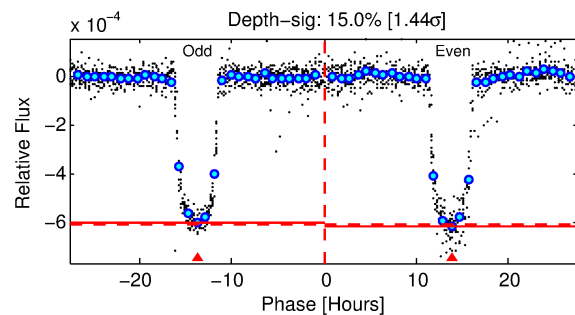
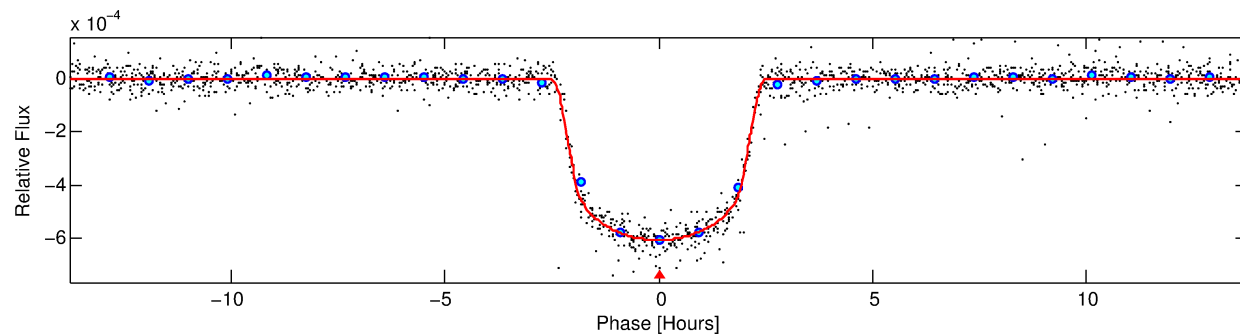
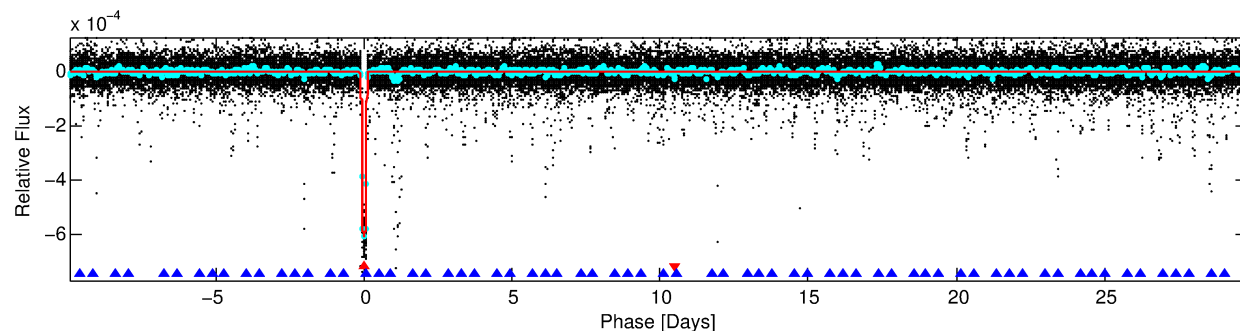
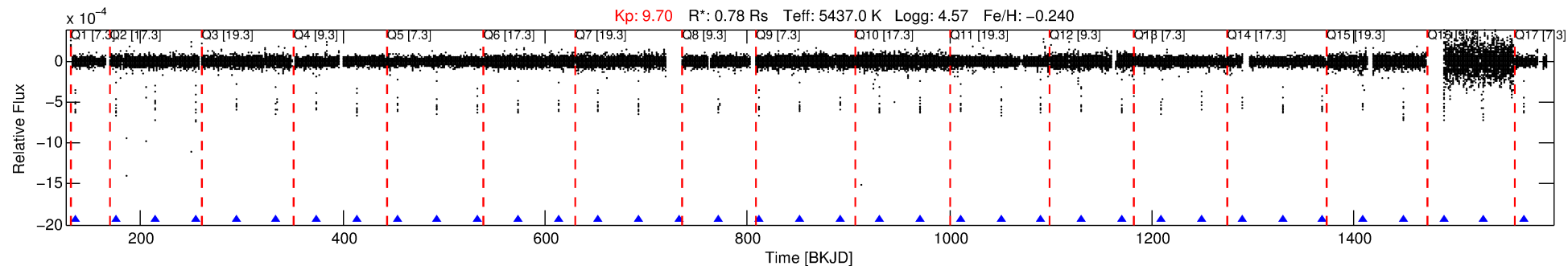
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 008478994-01

No Significant Match Found

# DV One-Page Summary

KIC: 8478994 Candidate: 1 of 2 Period: 39.792 d  
KOI: K00245.01 Name: Kepler-37d Corr: 0.983



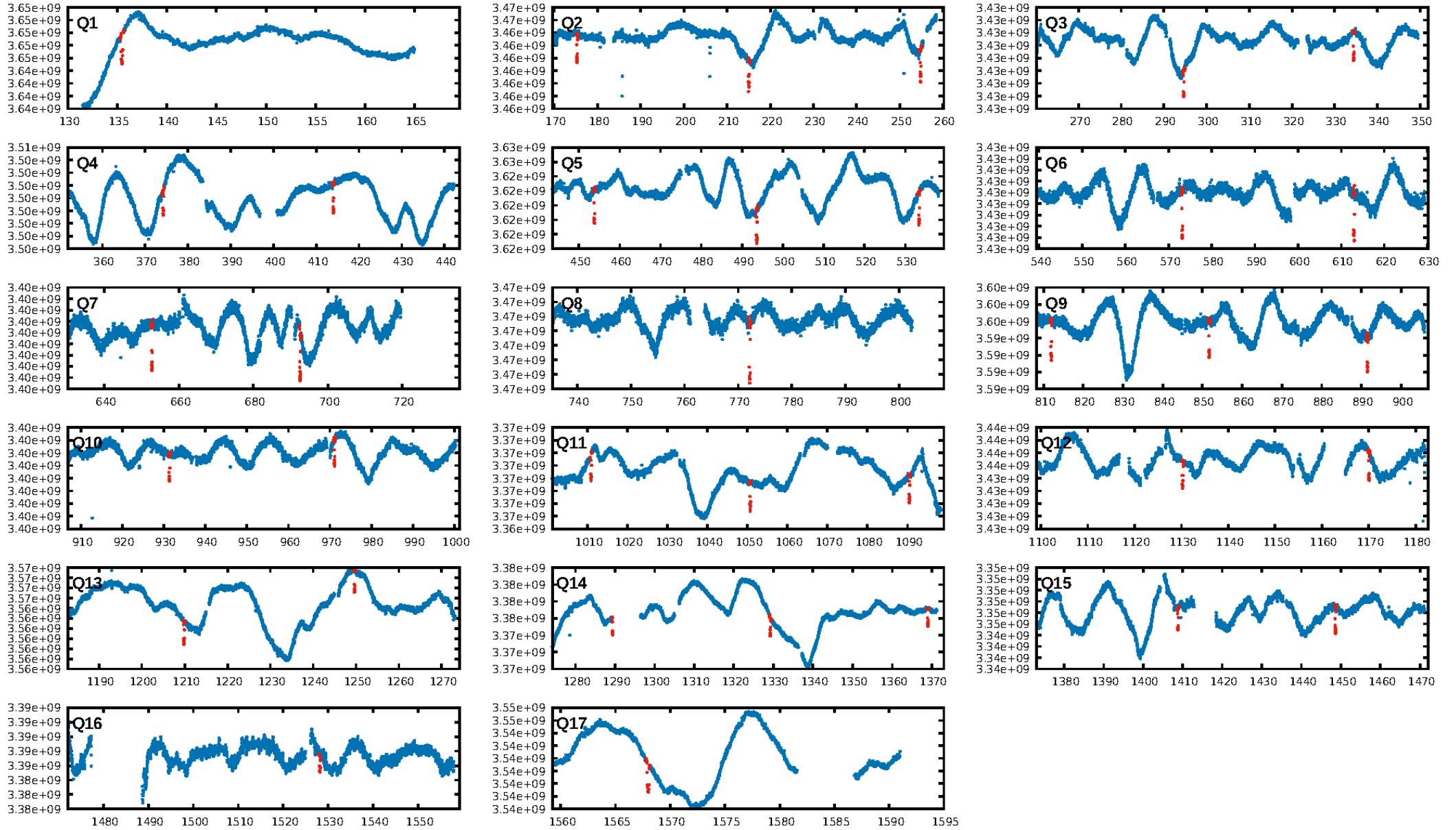
## DV Fit Results:

Period = 39.79224 [0.00002] d  
Epoch = 135.4577 [0.0004] BKJD  
Rp/R\* = 0.0248 [0.0006]  
a/R\* = 44.35 [4.29]  
b = 0.77 [0.05]  
Seff = 10.40 [0.84]  
Teq = 458 [9] K  
Rp = 2.11 [0.10] Re  
a = 0.2143 [0.0079] AU  
Ag = 37.13 [21.97] [1.64σ]  
Teffp = 1748 [259] K [4.98σ]

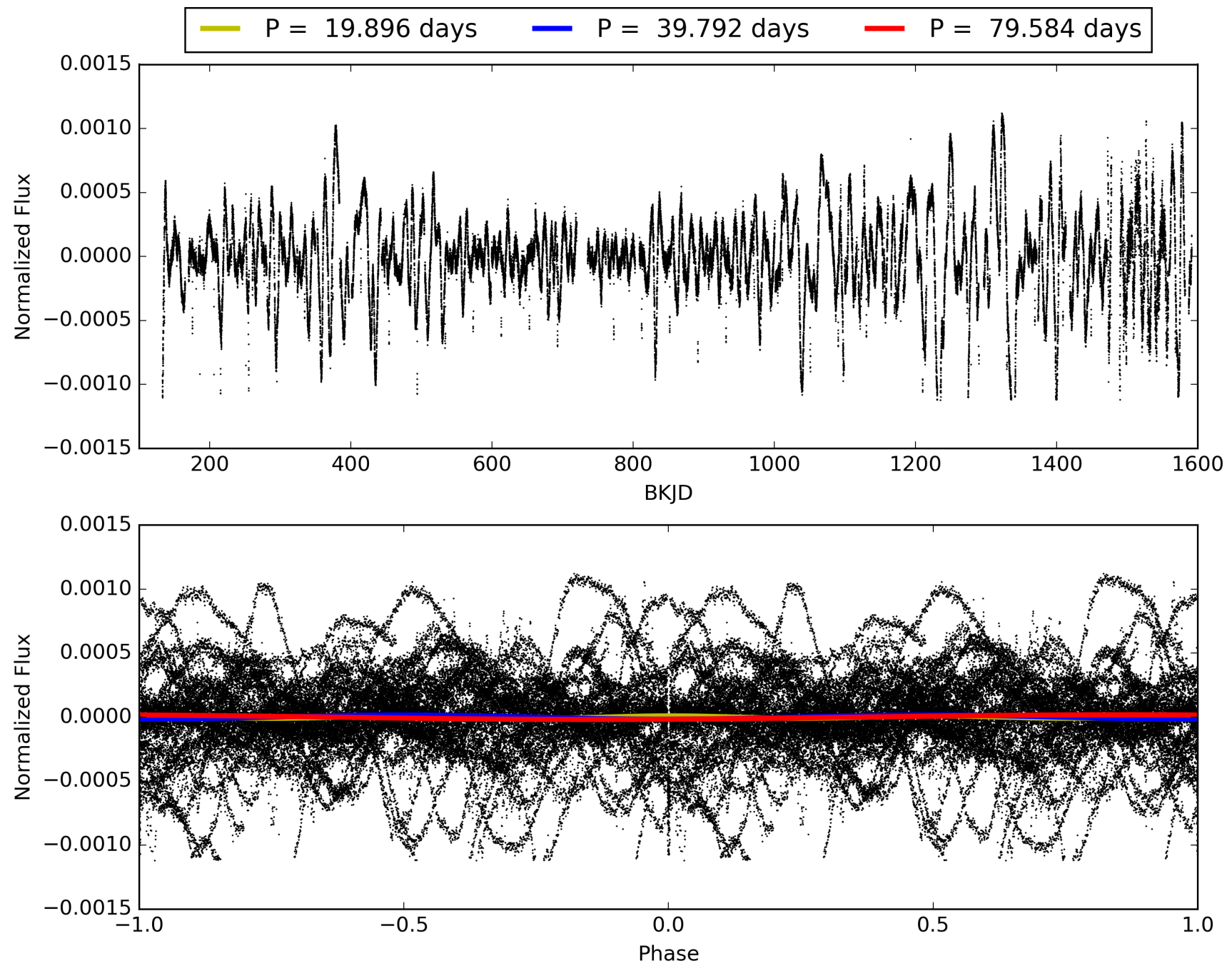
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [73.29σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 71.1%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 0.00e+00  
RollingBand-fgt: 1.00 [33/33]  
GhostDiagnostic-chr: N/A  
Centroid-sig: 0.0%  
Centroid-so: 1.370 arcsec [16.08σ]  
OotOffset-rm: 3.642 arcsec [3.84σ]  
KicOffset-rm: 3.165 arcsec [3.40σ]  
OotOffset-st: 4/4/4/5 [17]  
KicOffset-st: 4/4/4/5 [17]  
DiffImageQuality-fgm: 0.00 [0/17]  
DiffImageOverlap-fno: 1.00 [17/17]

# TCE 008478994-01, PDC Light Curves

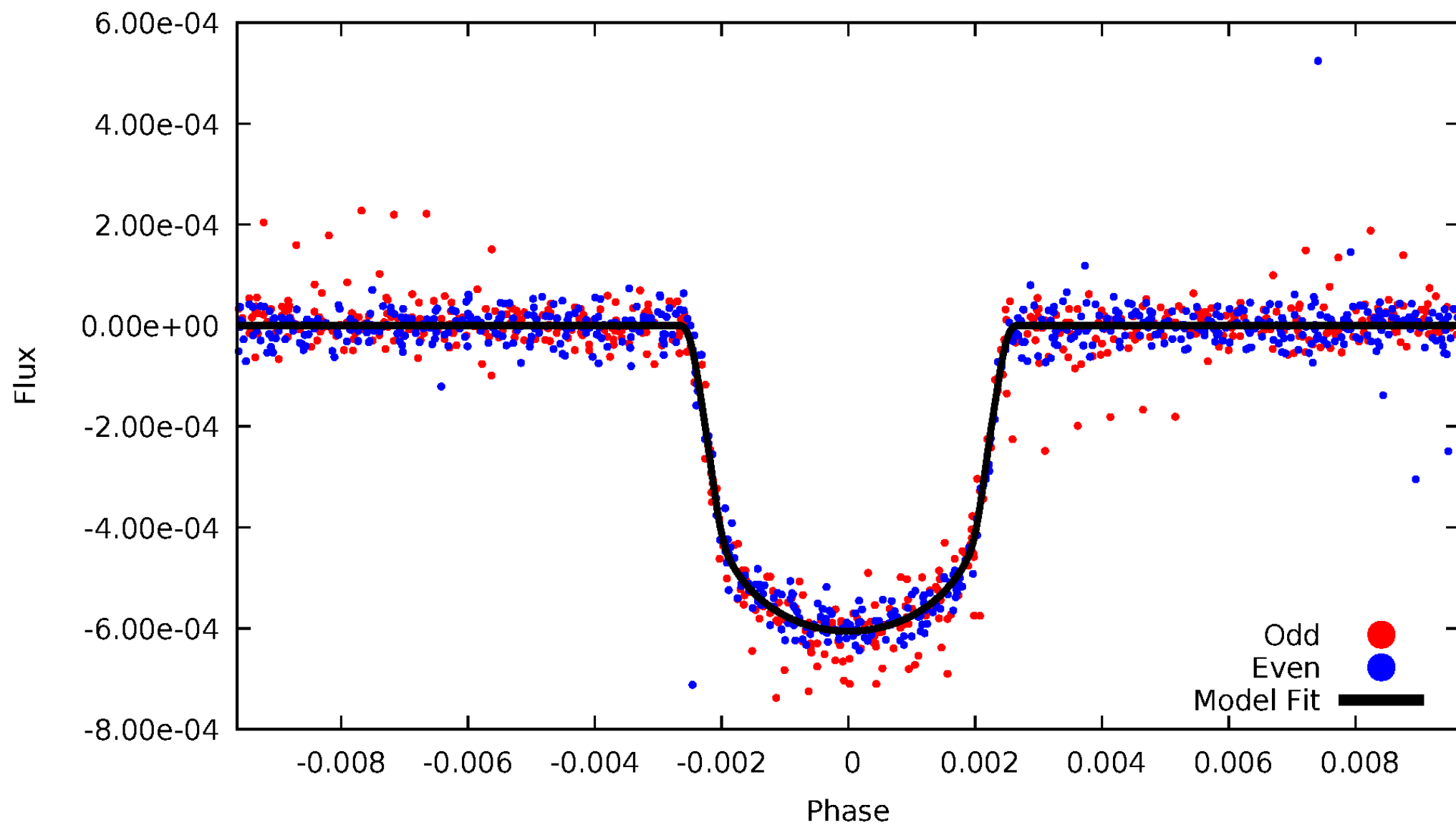


TCE 008478994-01



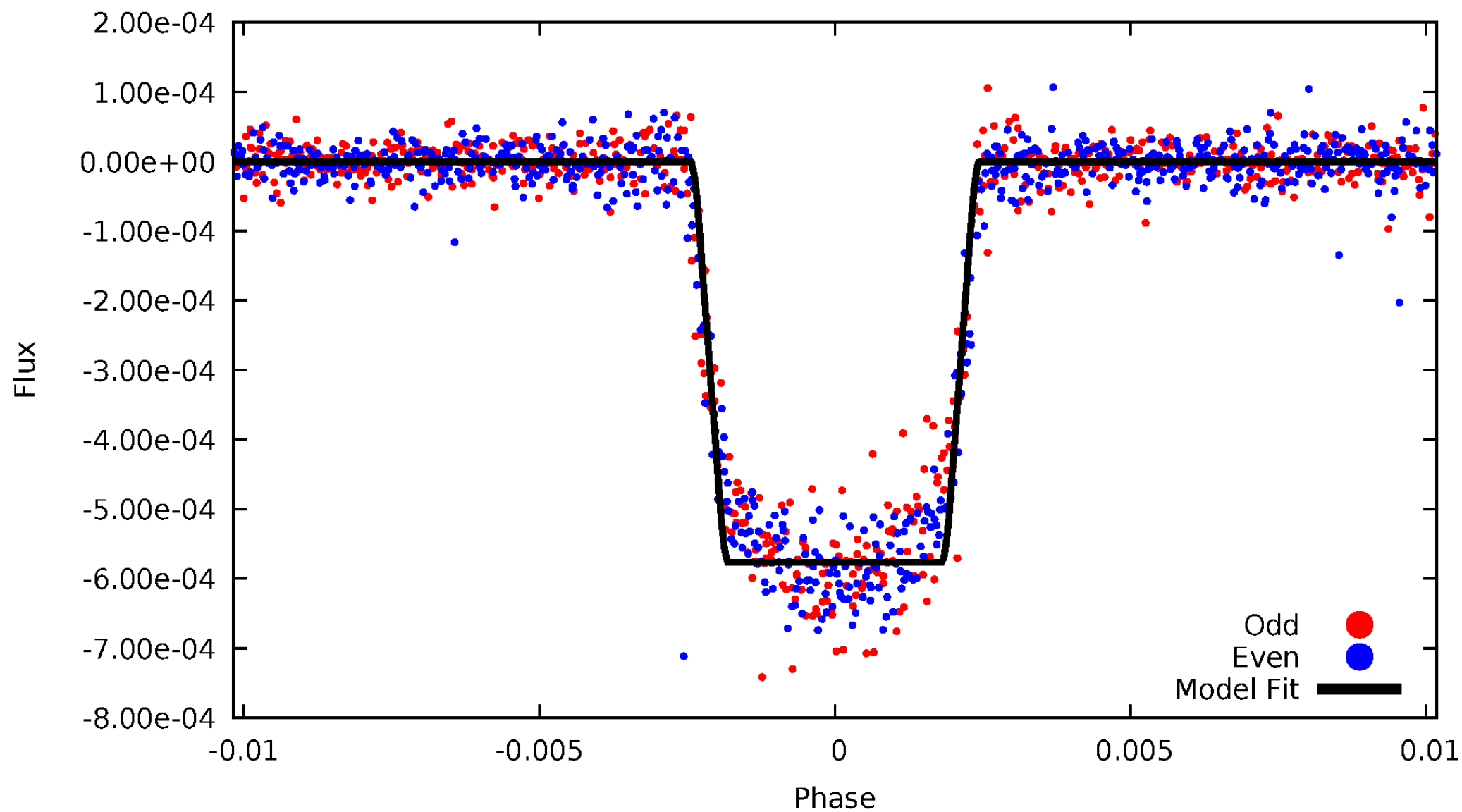
# DV Odd/Even

TCE 008478994-01



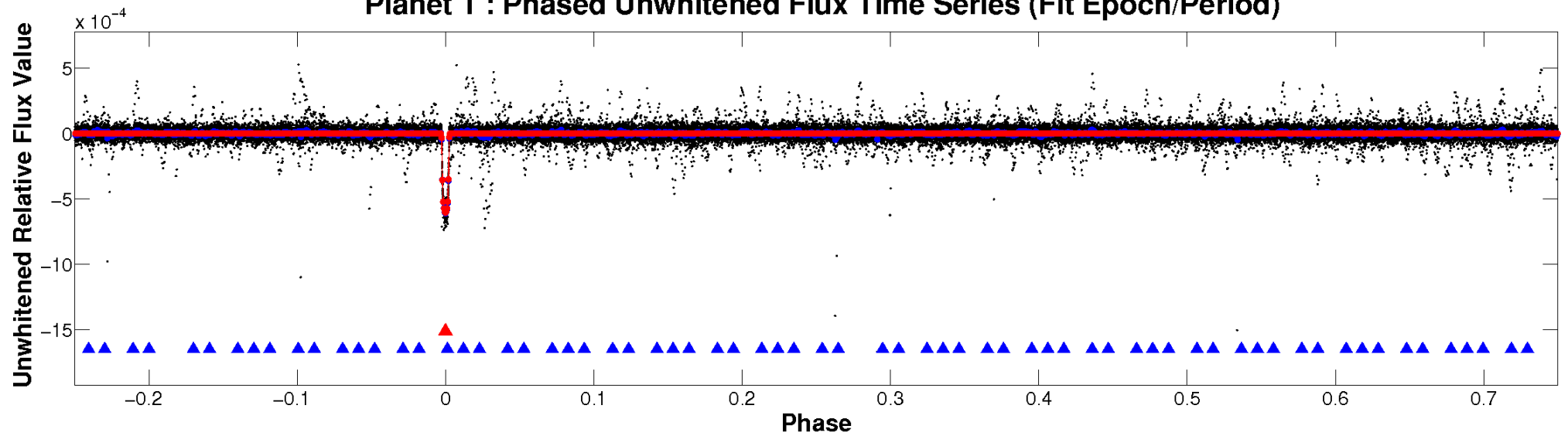
# ALT Odd/Even

TCE 008478994-01

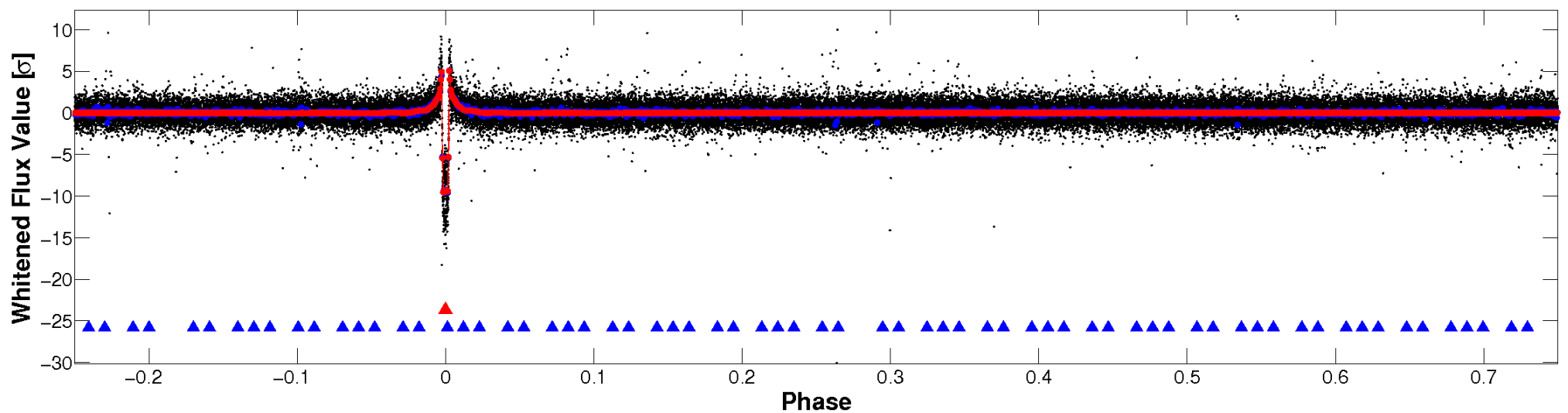


# Non-Whitened Vs. Whitened Light Curve

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

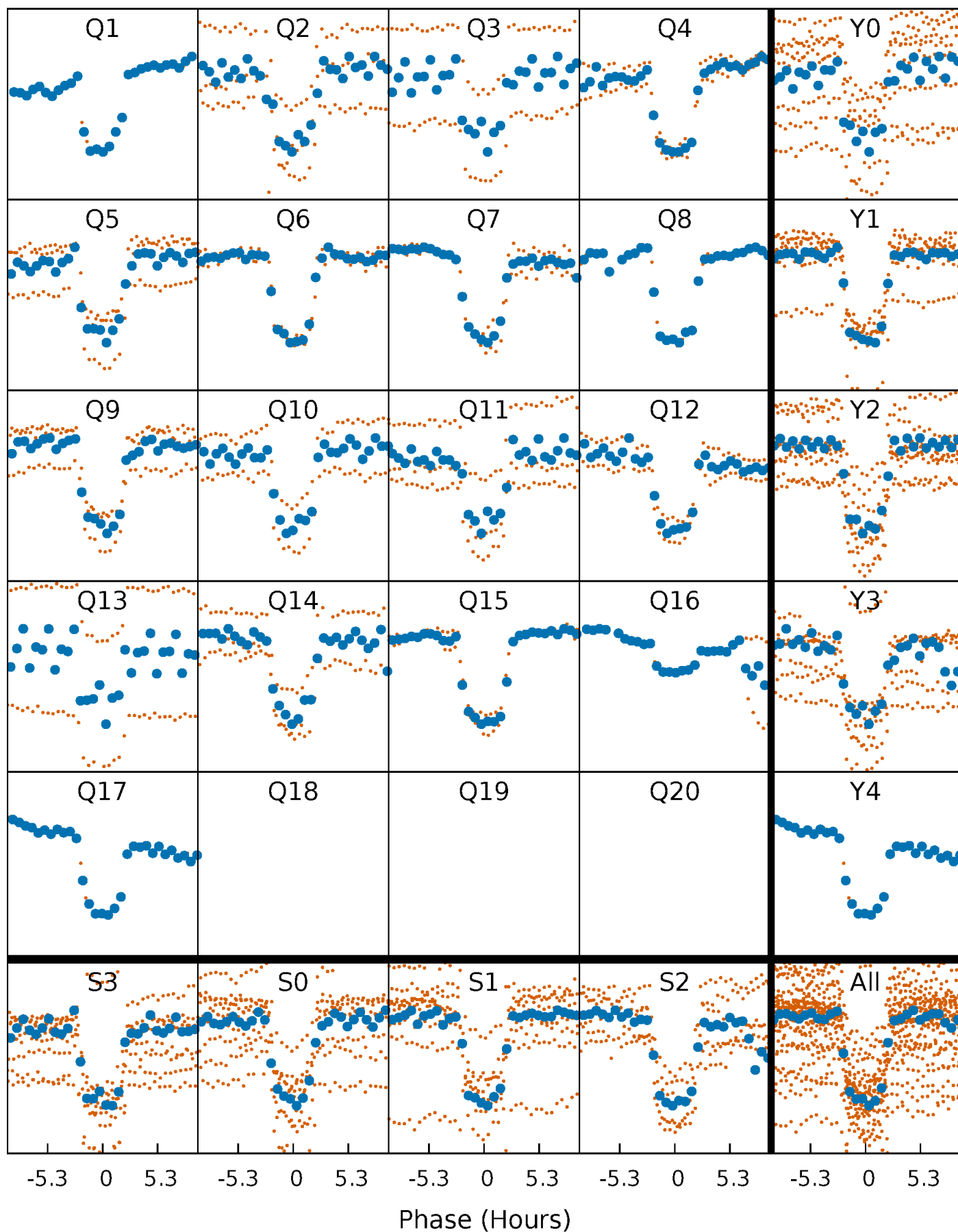


Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

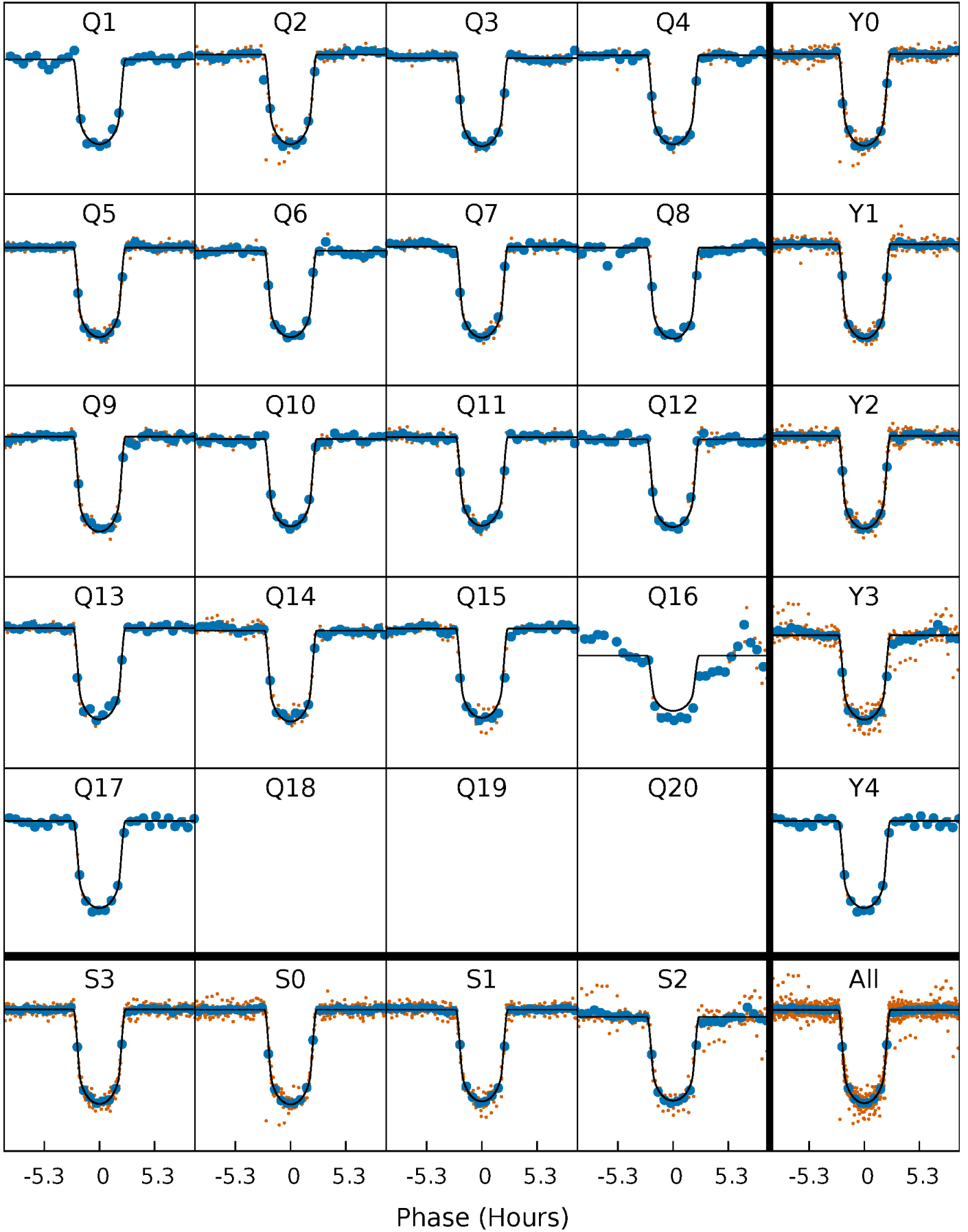
TCE 008478994-01 P= 39.792239 Days  $T_0=135.457732$  (BKJD)





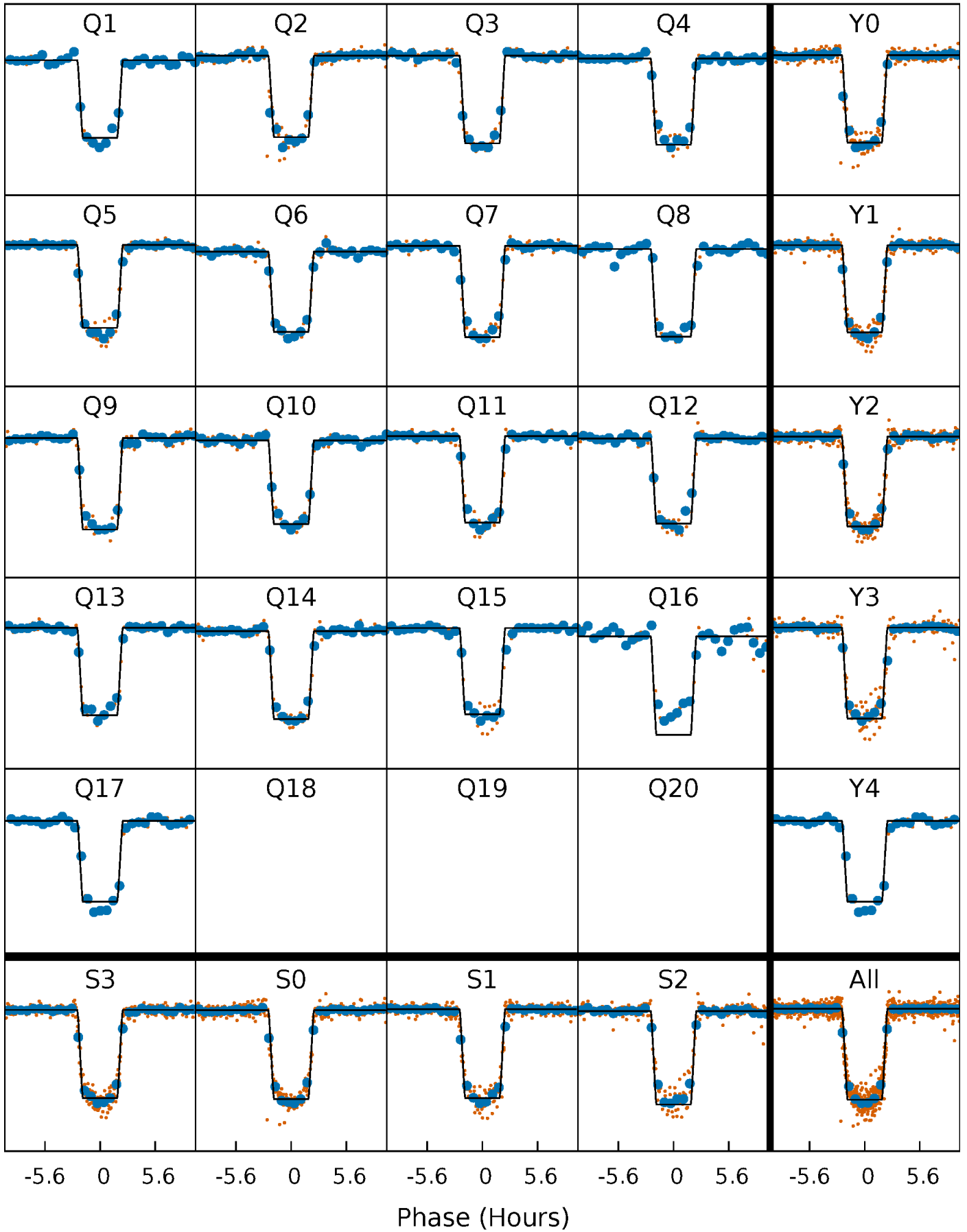
# DV Quarter-Phased Transit Curves

TCE 008478994-01 P= 39.792239 Days  $T_0=135.457732$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

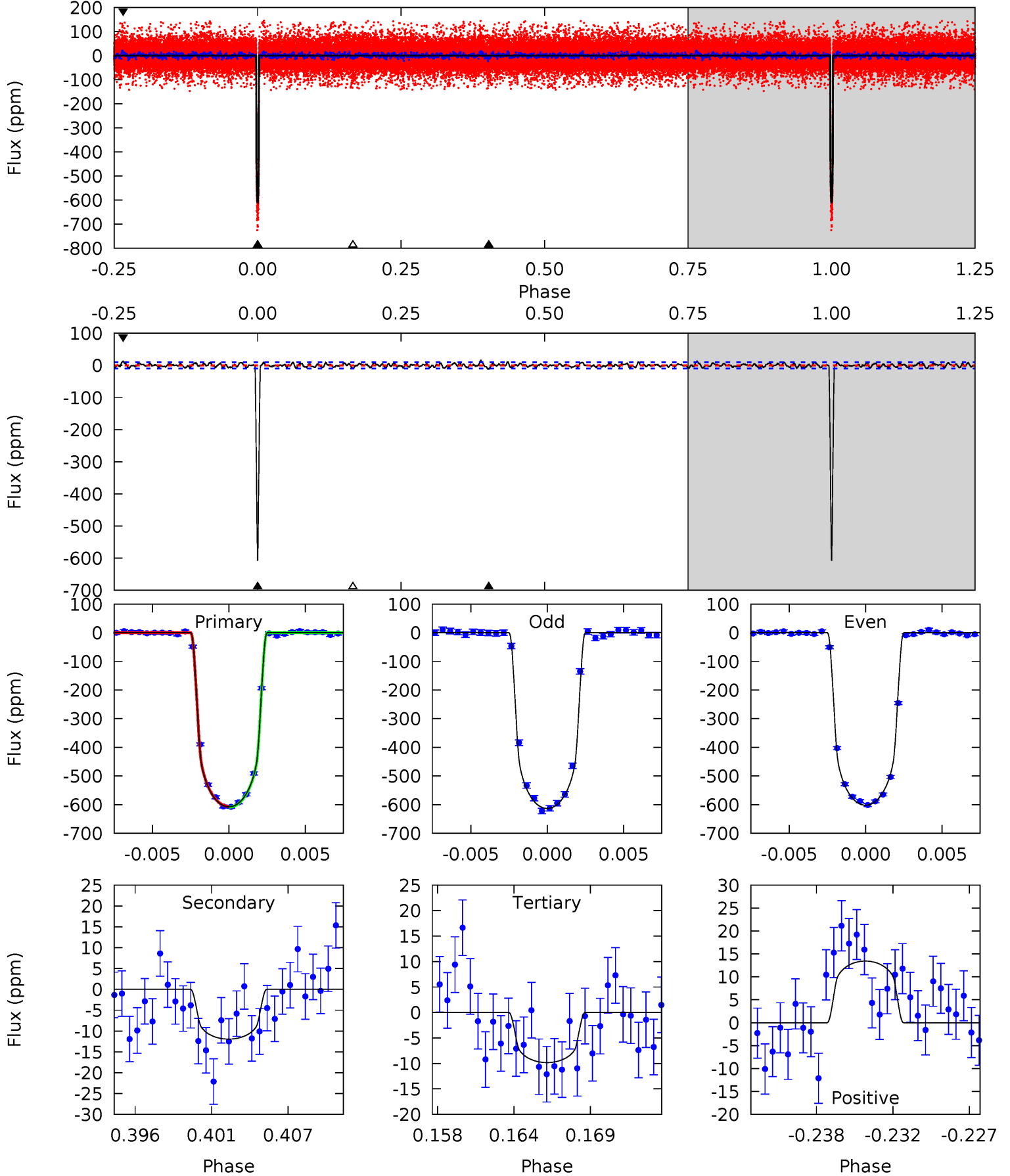
TCE 008478994-01 P= 39.791995 Days  $T_0=135.462282$  (BKJD)



# DV Model-Shift Uniqueness Test

008478994-01, P = 39.792239 Days, E = 95.665493 Days

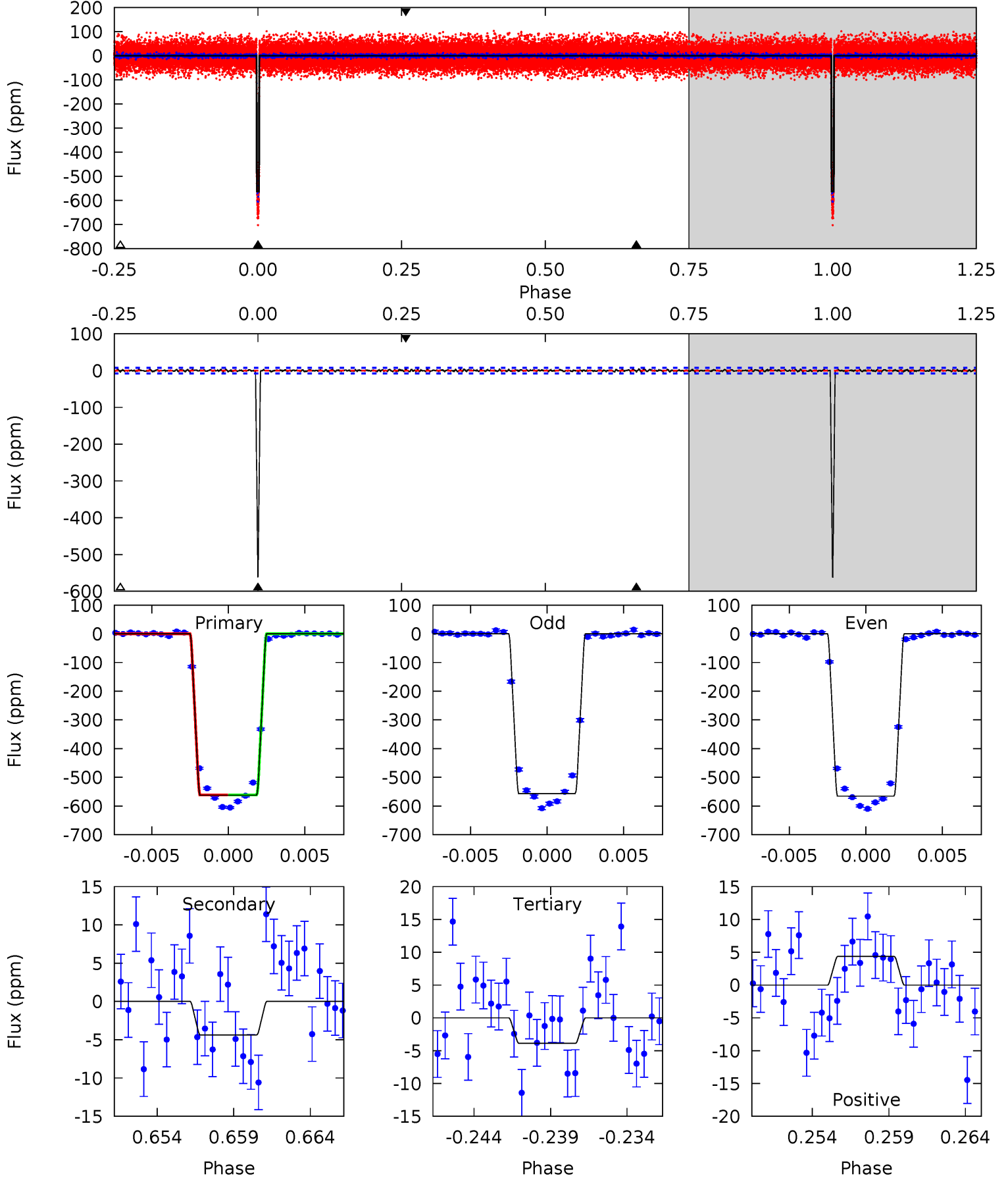
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
319.9	6.29	5.17	7.08	5.15	2.79	2.07	314.8	312.9	1.12	-0.79	2.98	1.00	0.02	0.72



# Alt Model-Shift Uniqueness Test

008478994-01, P = 39.791995 Days, E = 95.670287 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
378.2	2.94	2.61	2.92	5.16	2.81	0.91	375.6	375.3	0.33	0.02	3.00	1.00	0.01	0.11



### Stellar Parameters For KIC 008478994

	$T_{\text{eff}}(K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5437^{+73}_{-81}$	$4.571^{+0.020}_{-0.030}$	$-0.240^{+0.150}_{-0.150}$	$0.781^{+0.034}_{-0.031}$	$0.829^{+0.044}_{-0.054}$	$2.455^{+0.213}_{-0.237}$
	+1%/-1%	+0%/-1%	+62%/-62%	+4%/-4%	+5%/-7%	+9%/-10%
Source	SPE72	AST69	SPE72	DSEP		

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

### Secondary Eclipse Parameters for KIC 008478994-01 / KOI 0245.01

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-12 \pm 2$	$2.13^{+0.08}_{-0.08}$	$641^{+11}_{-11}$	$2770^{+63}_{-67}$	$66^{+13}_{-11}$
Alt.	$-4 \pm 1$	$2.05^{+0.08}_{-0.07}$	$642^{+11}_{-12}$	$2463^{+89}_{-119}$	$26^{+9}_{-9}$

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

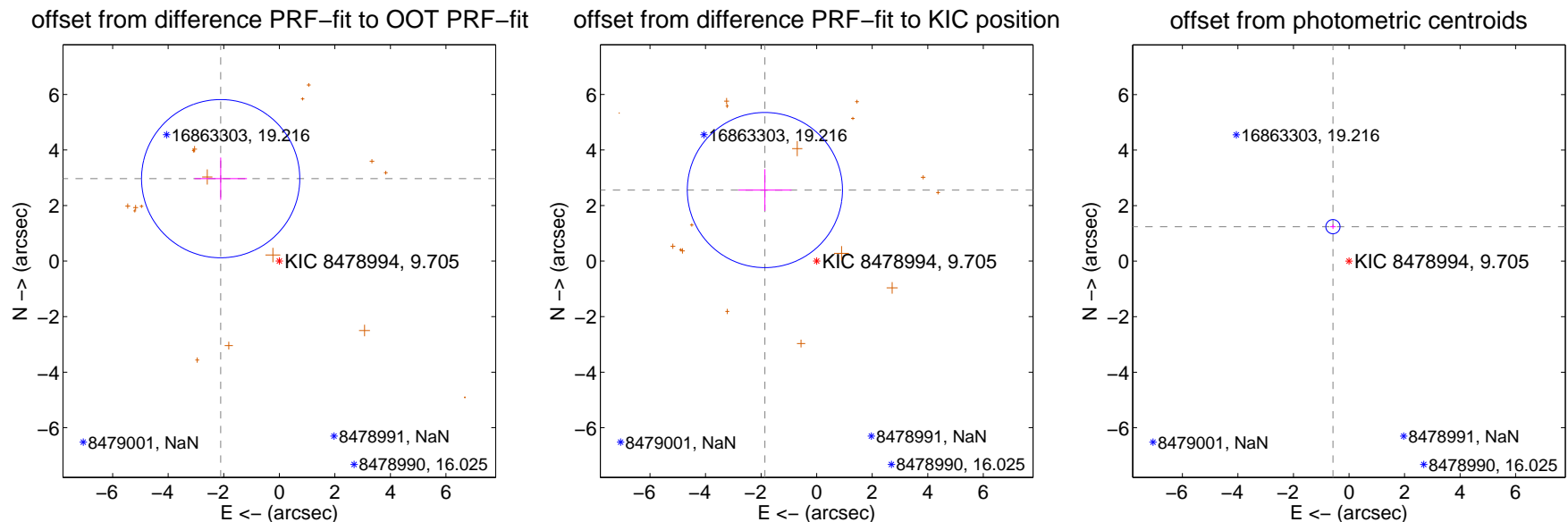
## DV Centroid Data

Supplemental centroid analysis for 008478994-01. **Kepler magnitude: 9.71.** Transit SNR 167.39

**There are 0 quarters with good PRF difference image offsets**

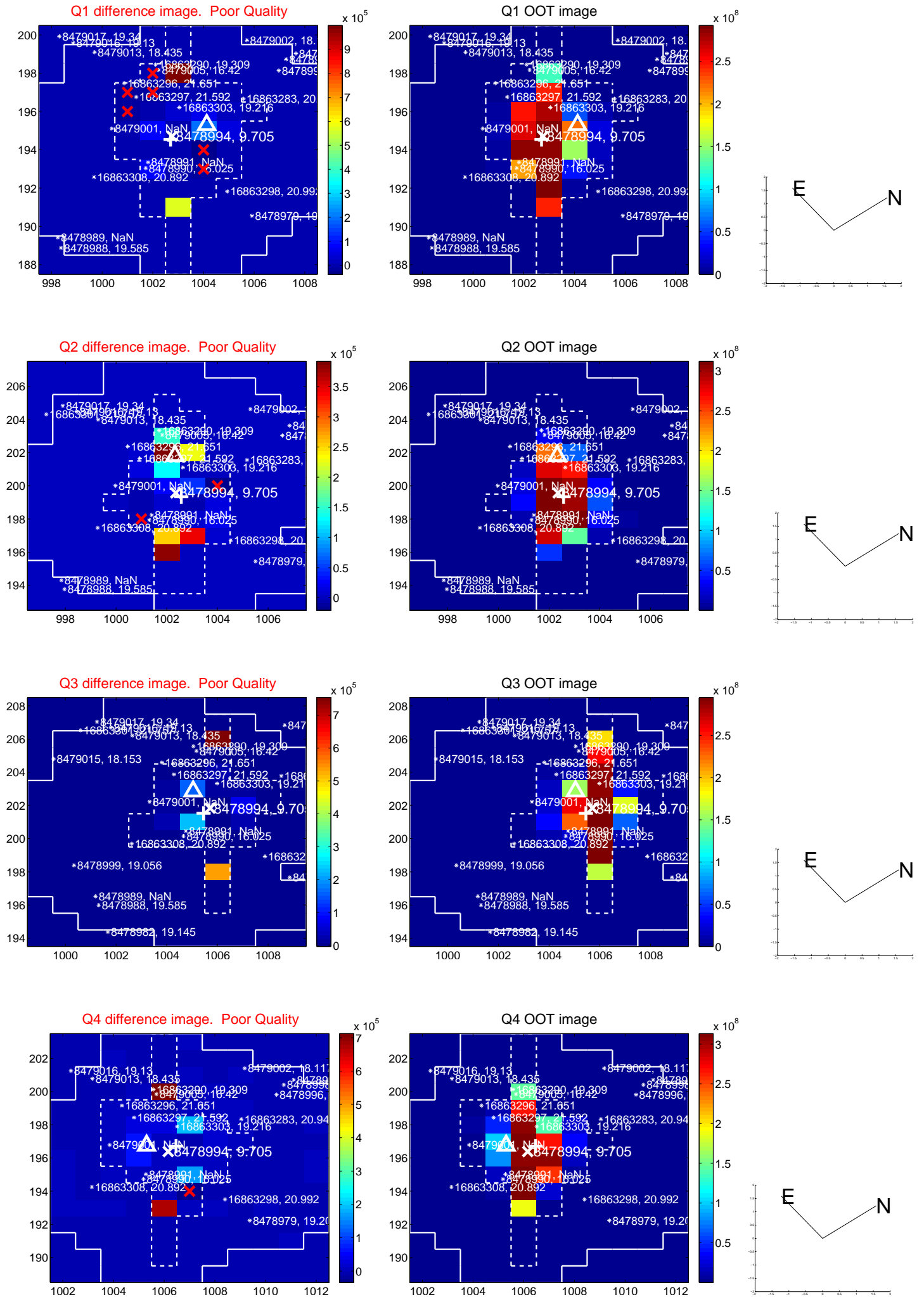
The direct PRF centroid is offset from the target star catalog position by about 0.76 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	<b><math>3.642 \pm 0.949</math></b>	<b>3.84</b>	$2.111 \pm 0.943$	$2.968 \pm 0.762$
PRF-fit source offset from KIC position	<b><math>3.165 \pm 0.931</math></b>	<b>3.40</b>	$1.863 \pm 0.957$	$2.558 \pm 0.751$
photometric centroid source offset	<b><math>1.37 \pm 0.09</math></b>	<b>16.08</b>	$0.58 \pm 0.10$	$1.24 \pm 0.08$

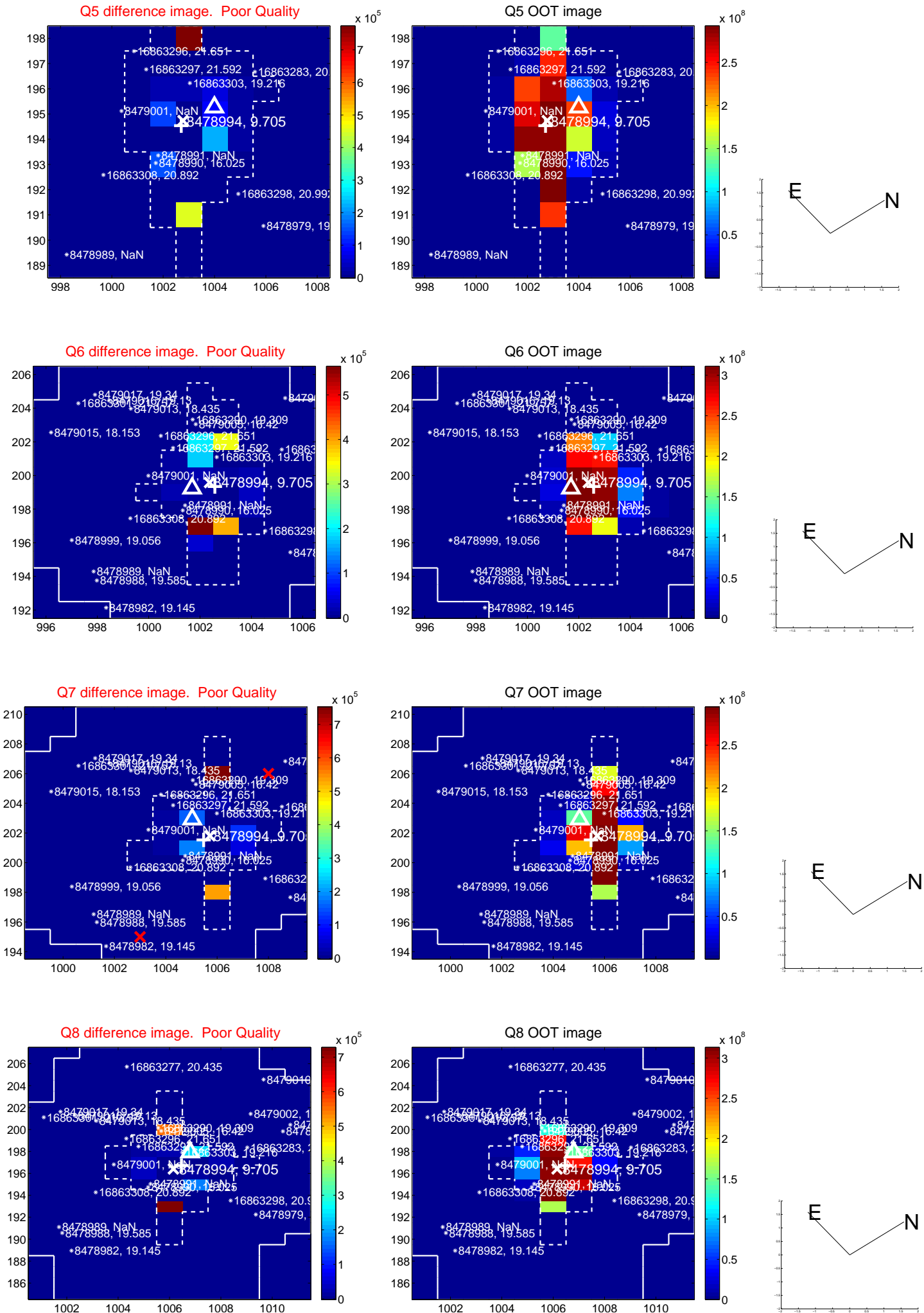


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

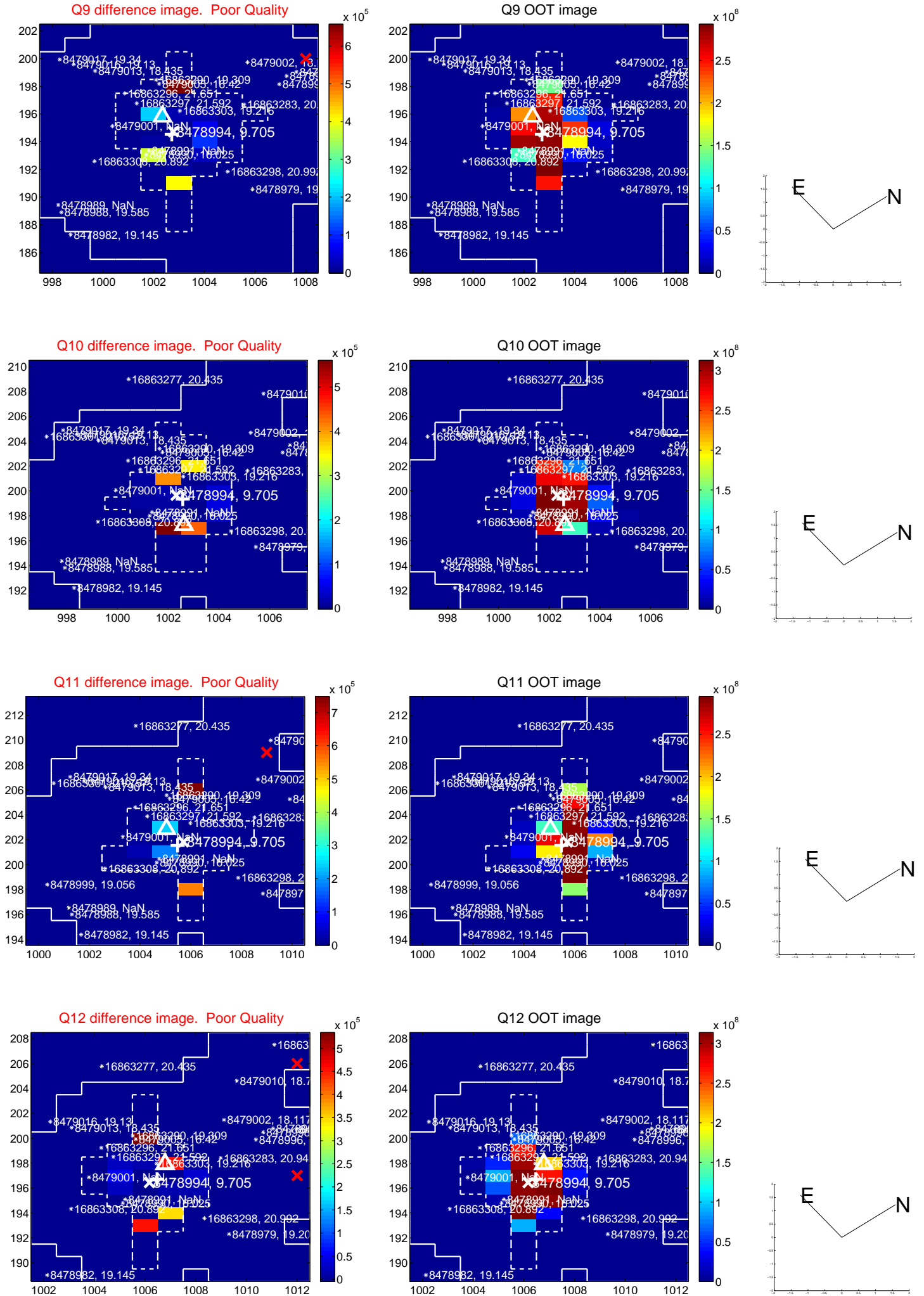


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

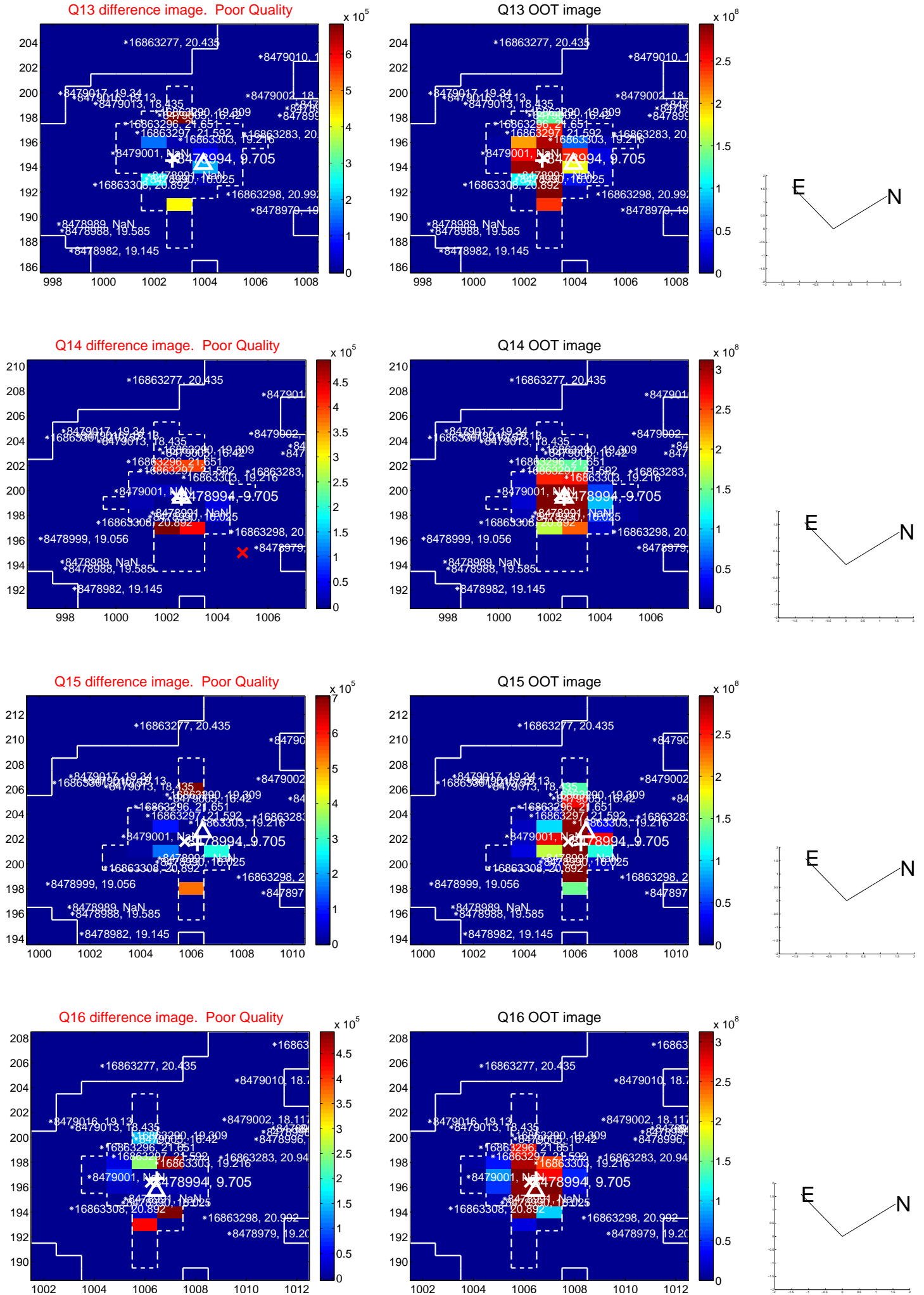




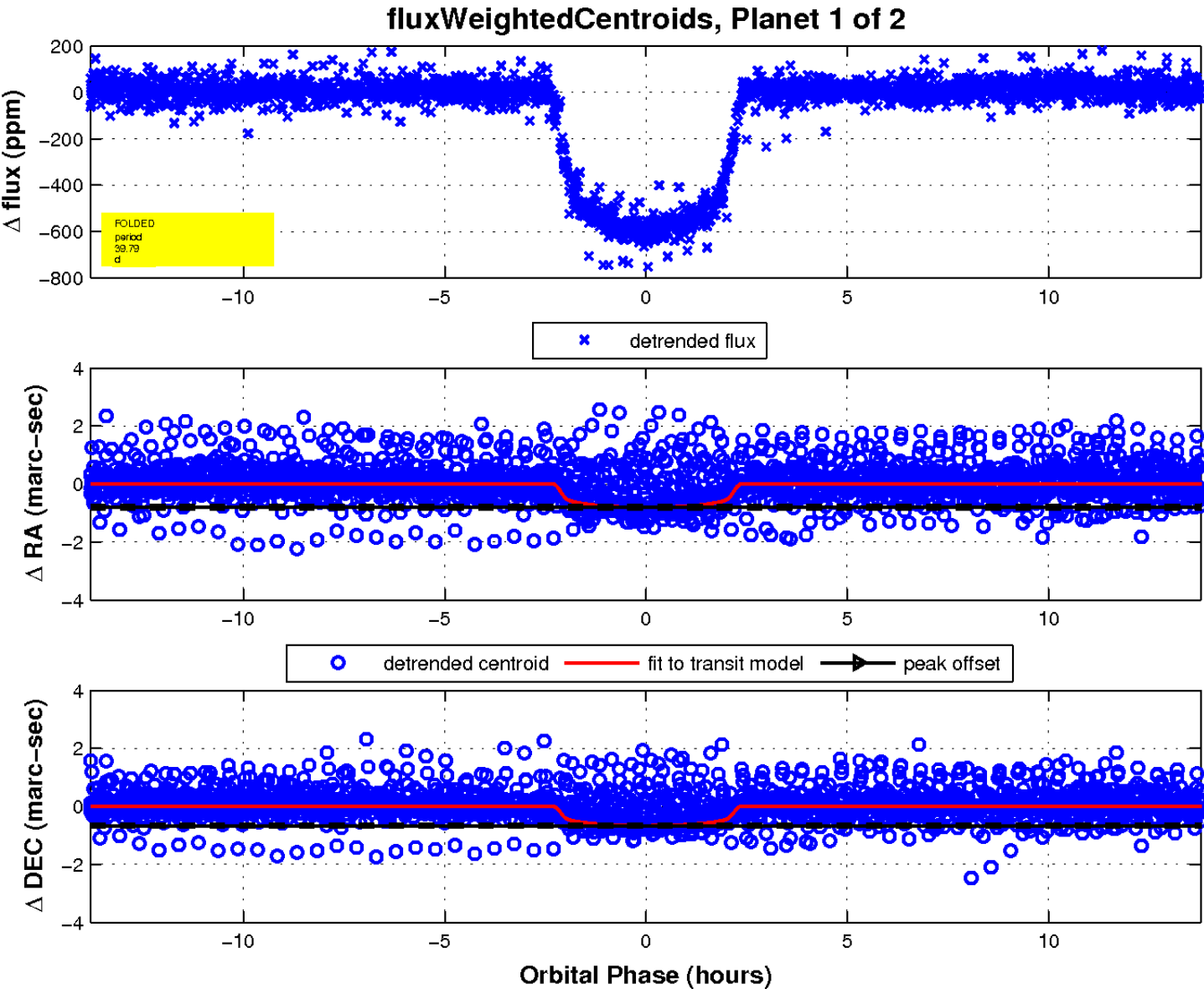
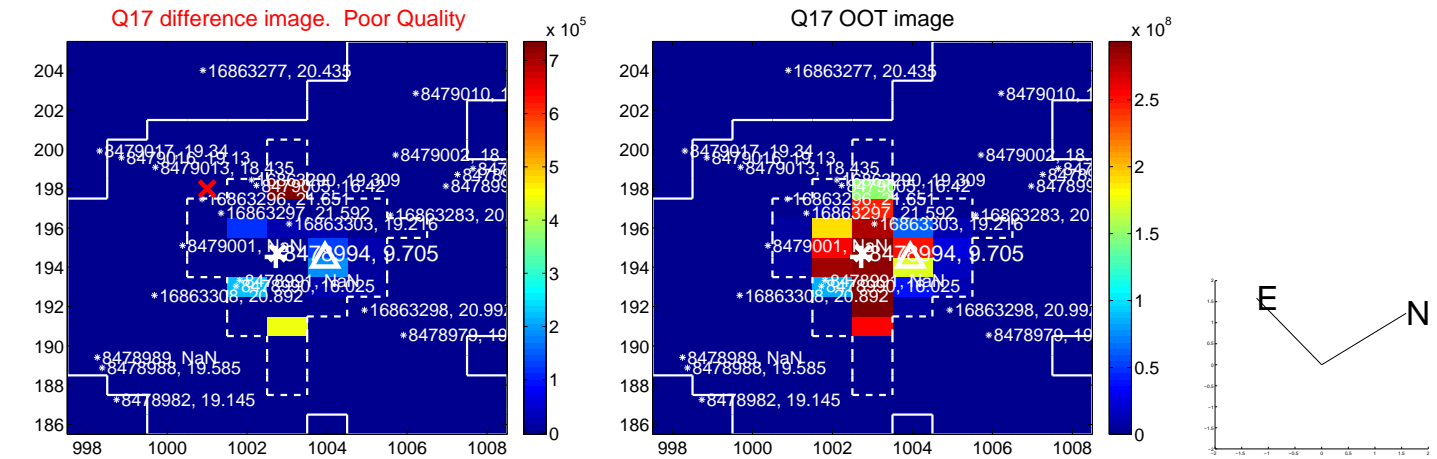
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

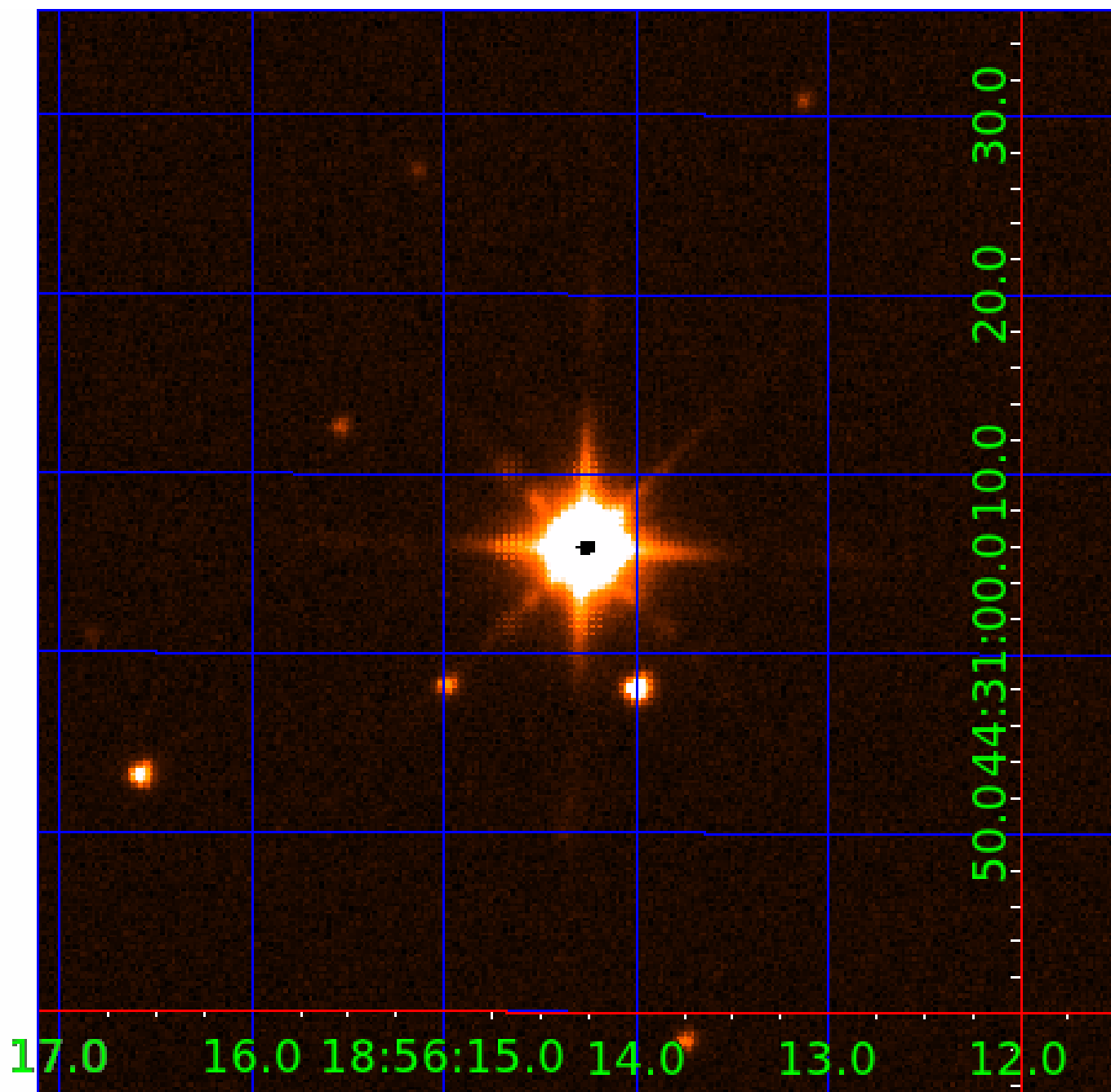


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 008478994

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
008478994-01	OBS	0245.01	39.792239	135.457732	605.8	4.602	175.6	167.4	0.78	5437	2.11	10.40
008478994-02	OBS	0245.02	21.301920	149.236765	90.4	3.934	29.9	34.3	0.78	5437	0.89	23.93

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
008478994-01	OBS	PC	1.00	0	0	0	0	CENT_SATURATED
008478994-02	OBS	PC	1.00	0	0	0	0	CENT_SATURATED

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

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

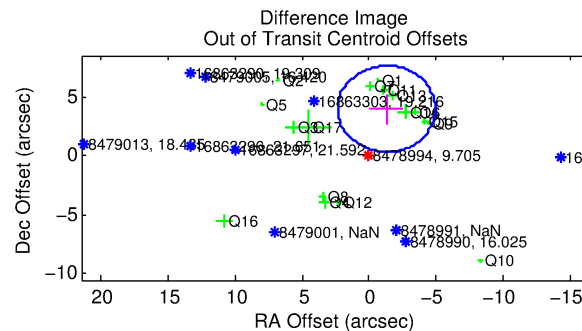
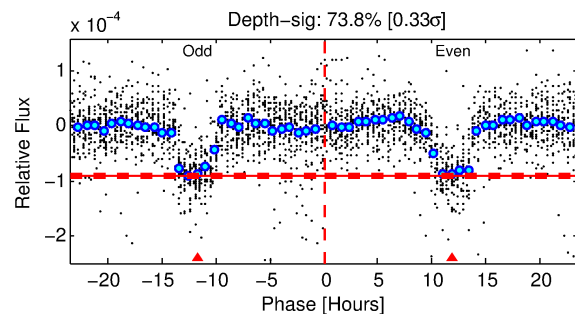
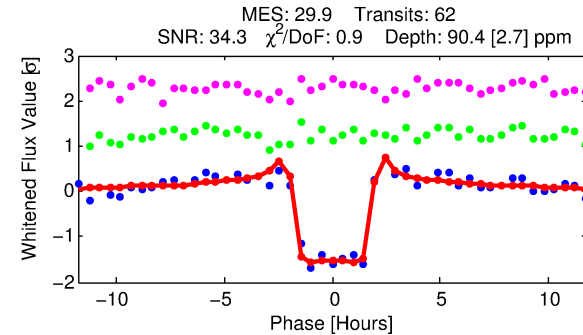
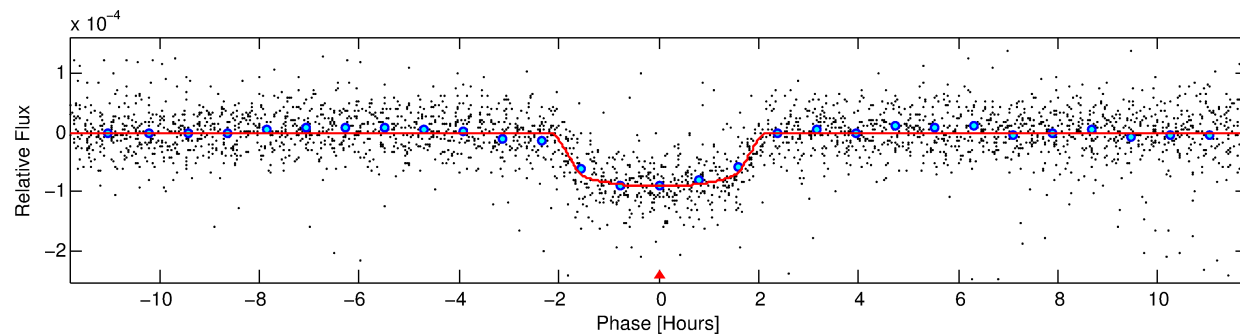
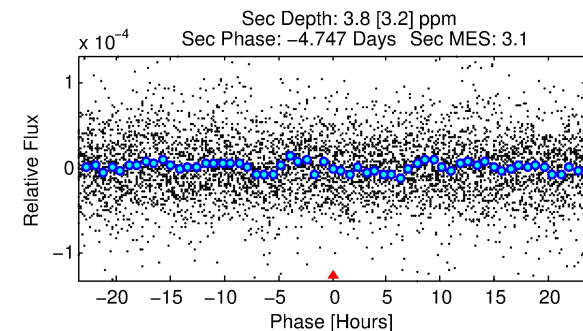
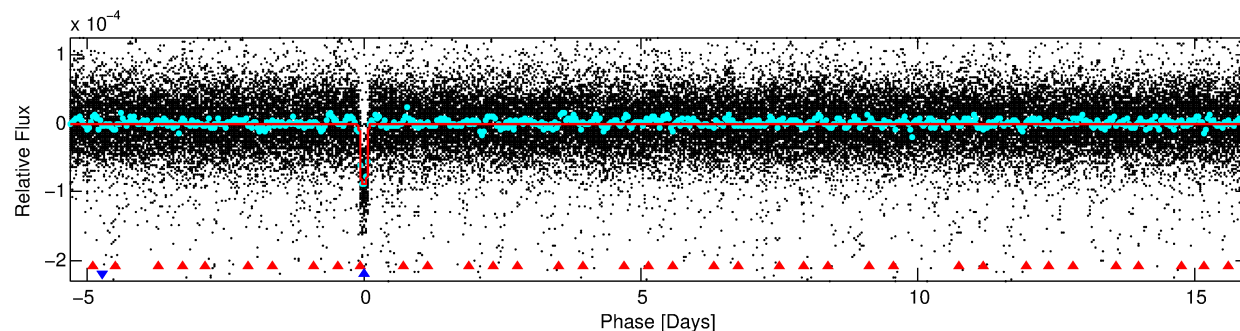
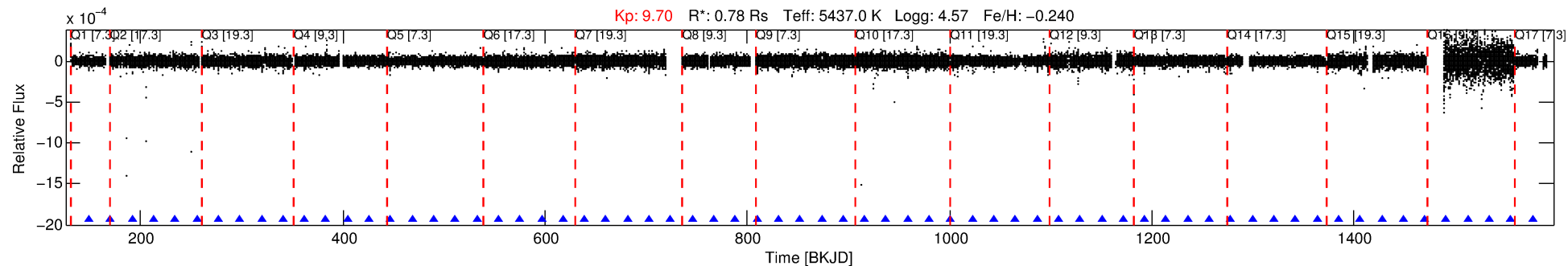
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 008478994-02

No Significant Match Found

# DV One-Page Summary

KIC: 8478994 Candidate: 2 of 2 Period: 21.302 d  
KOI: K00245.02 Name: Kepler-37c Corr: 0.984



## DV Fit Results:

Period = 21.30192 [0.00004] d  
Epoch = 149.2368 [0.0016] BKJD  
Rp/R\* = 0.0104 [0.0010]  
a/R\* = 18.91 [8.11]  
b = 0.90 [0.09]  
Seff = 23.93 [1.93]  
Teq = 564 [11] K  
Rp = 0.89 [0.09] Re  
a = 0.1413 [0.0052] AU  
Ag = 52.06 [45.14] [1.13σ]  
Teffp = 2342 [508] K [3.50σ]

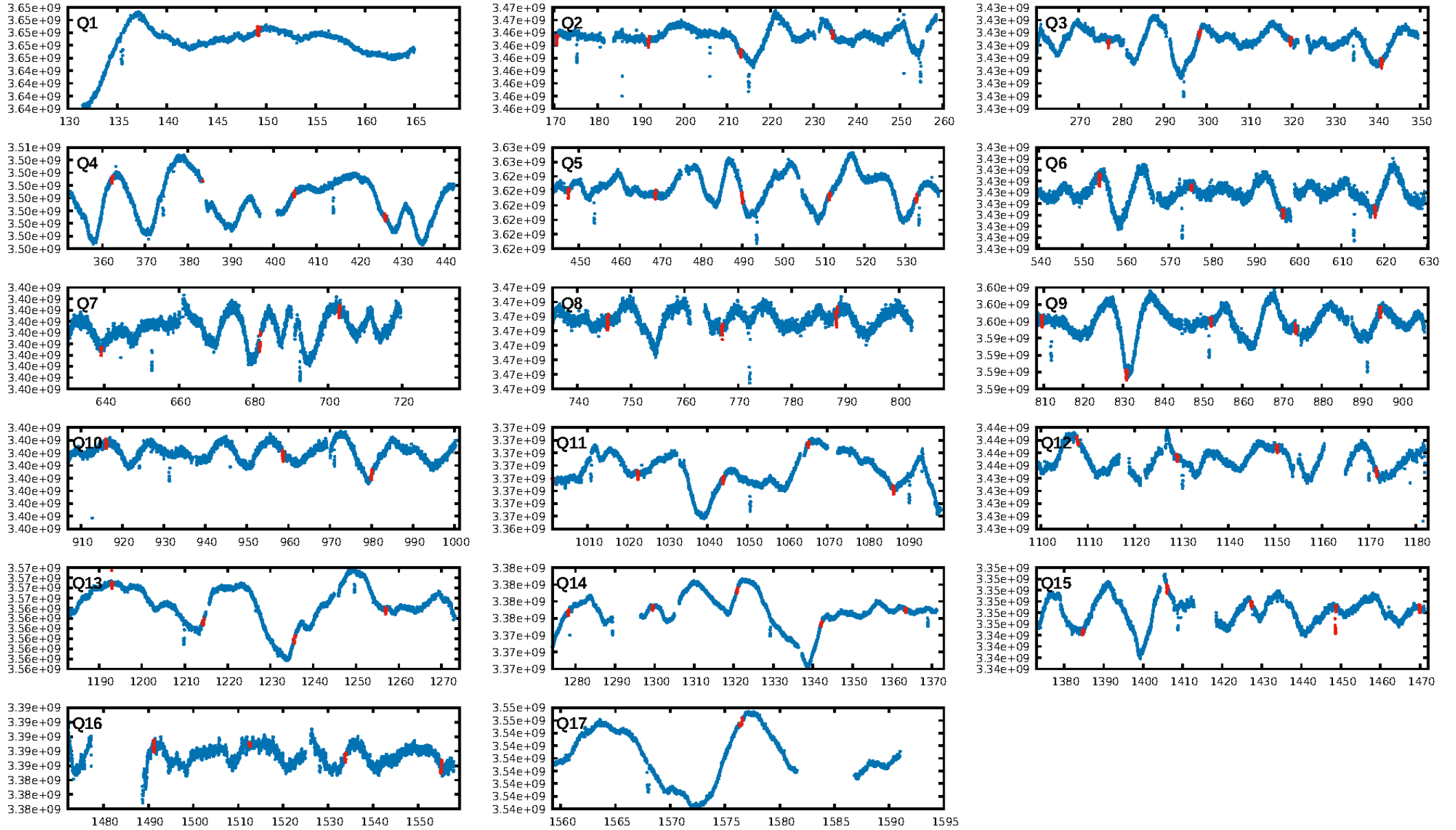
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [73.29σ]  
ModelChiSquare2-sig: 39.9%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 2.53e-150  
RollingBand-fgt: 1.00 [60/60]  
GhostDiagnostic-chr: N/A  
Centroid-sig: 12.8%  
Centroid-so: 0.402 arcsec [0.98σ]  
OotOffset-rm: 4.181 arcsec [3.44σ]  
KicOffset-rm: 3.833 arcsec [4.11σ]  
OotOffset-st: 4/4/4/5 [17]  
KicOffset-st: 4/4/4/5 [17]  
DiffImageQuality-fgm: 0.06 [1/17]  
DiffImageOverlap-fno: 1.00 [17/17]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 17:48:29 Z

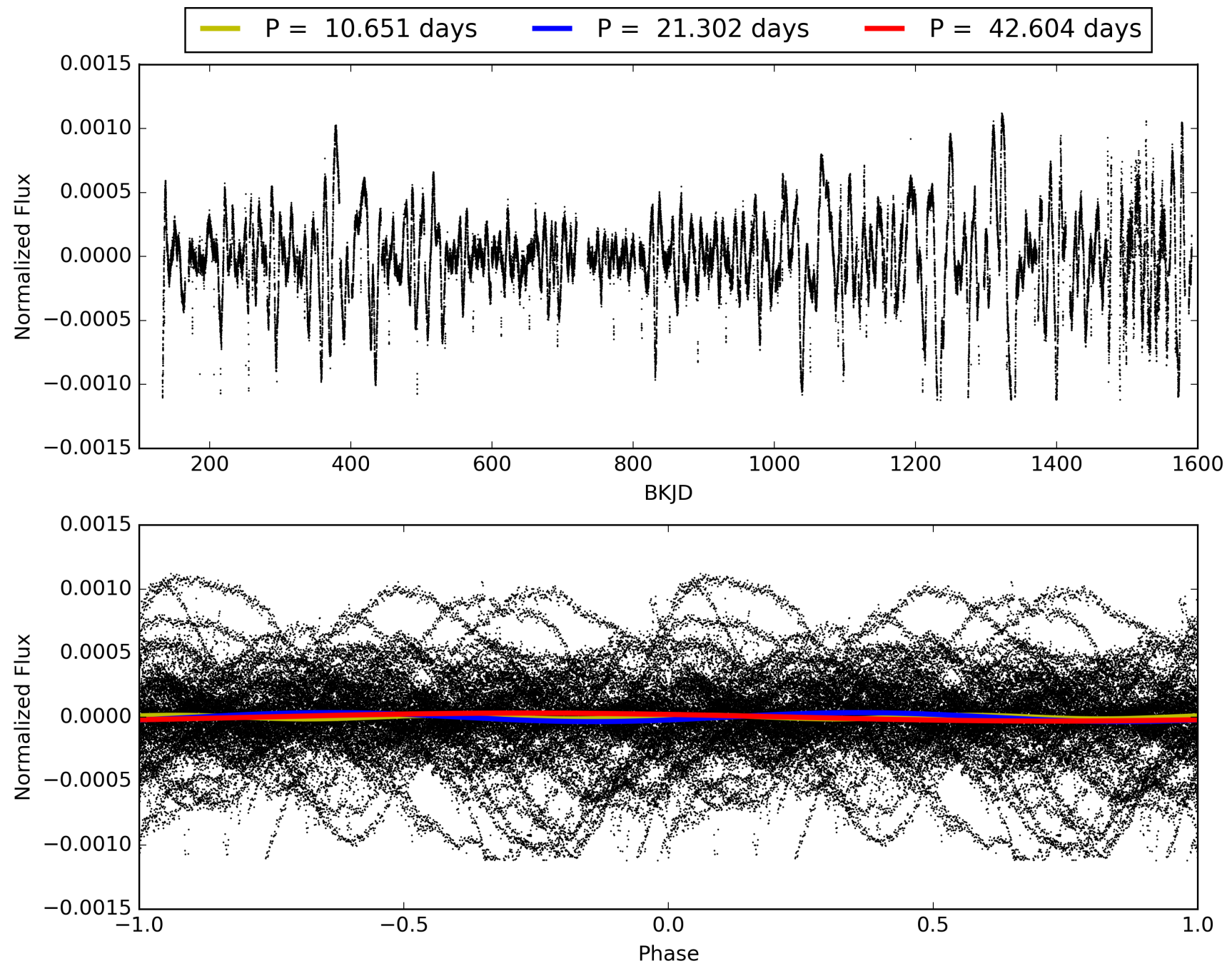
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 008478994-02, PDC Light Curves





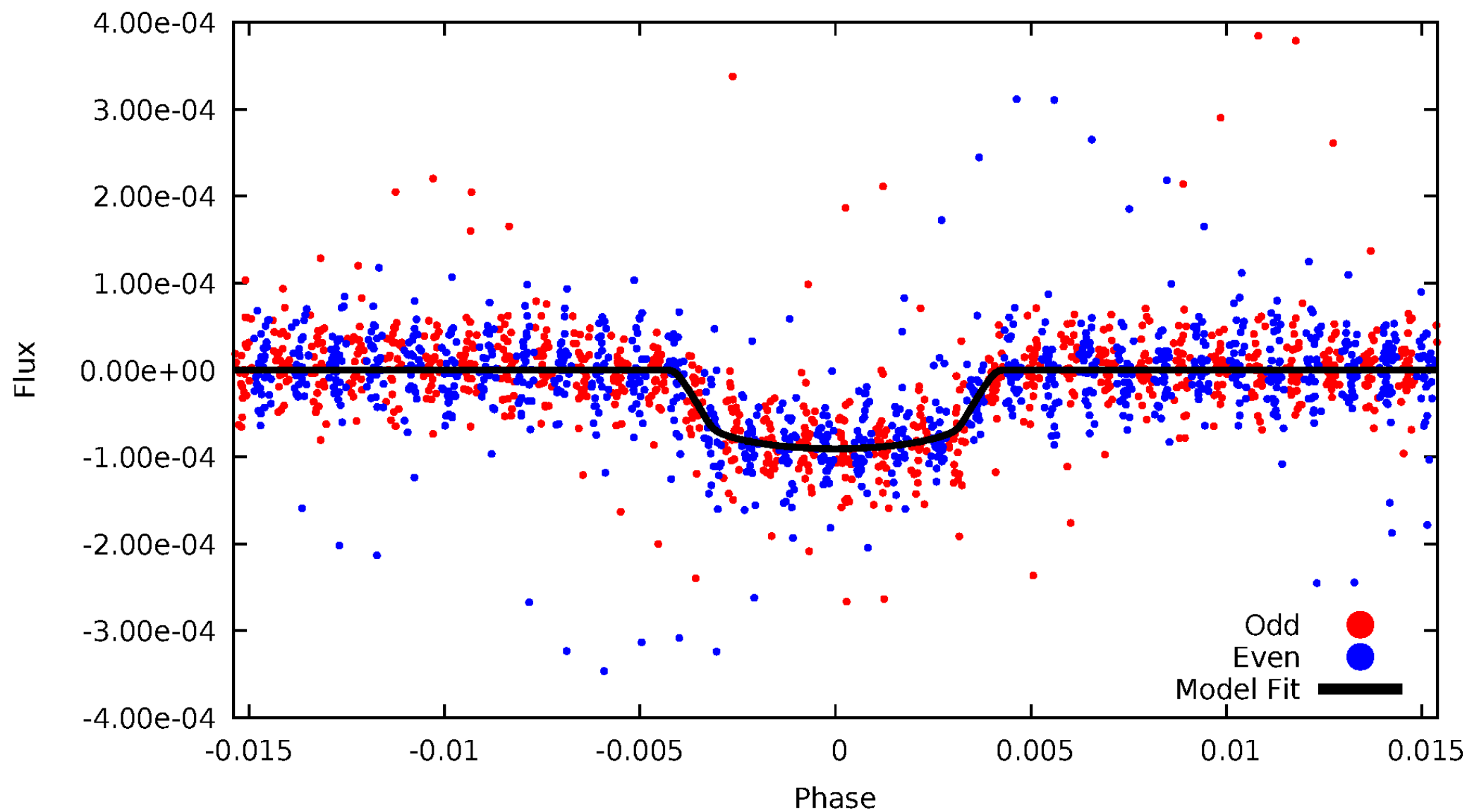
TCE 008478994-02





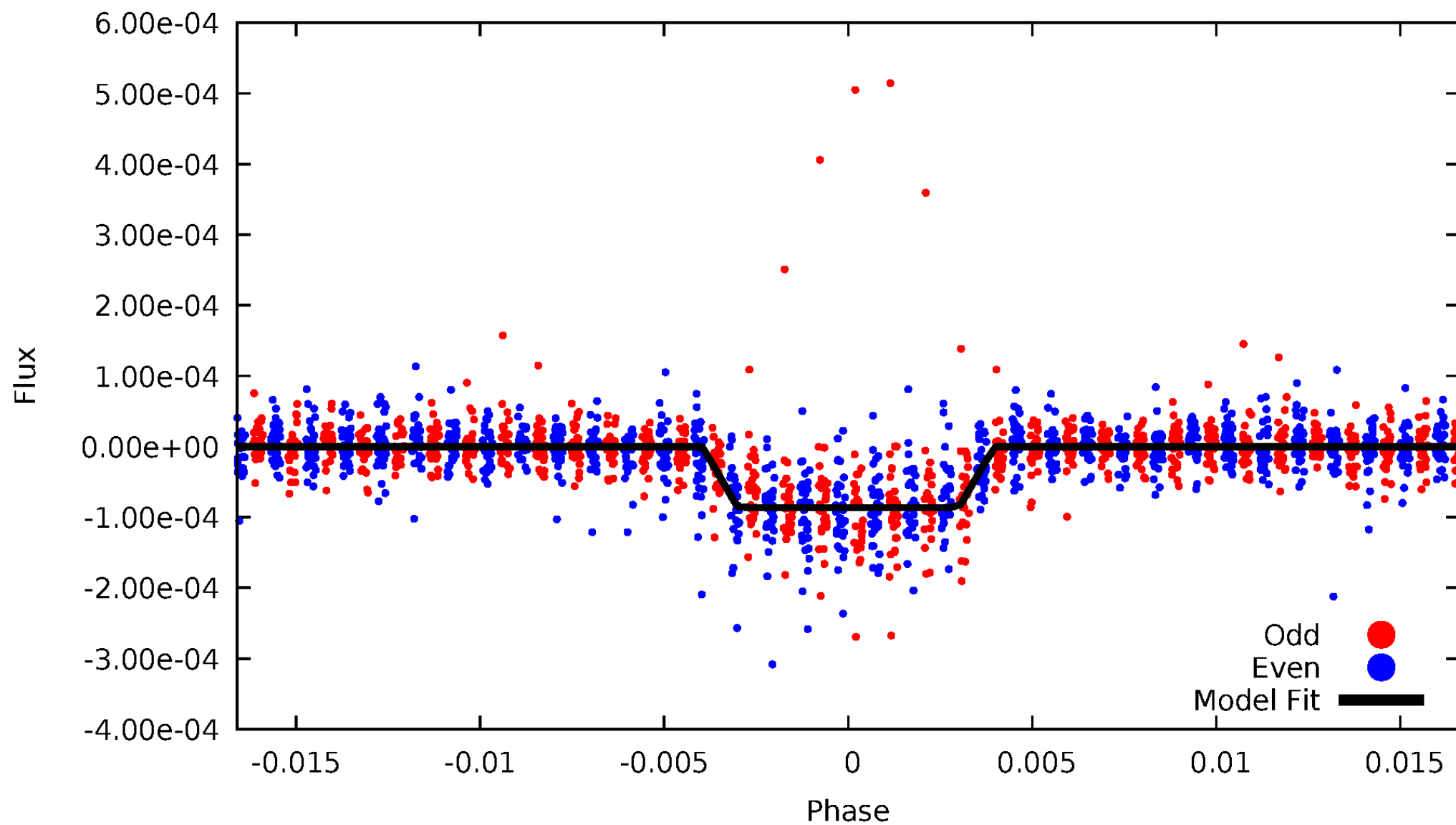
# DV Odd/Even

TCE 008478994-02



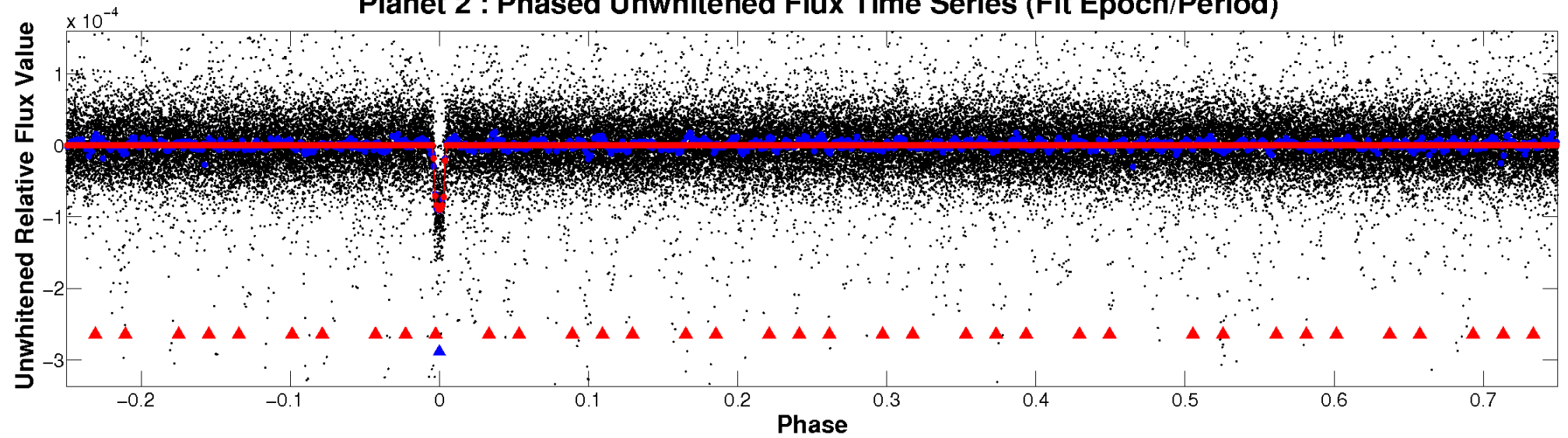
# ALT Odd/Even

TCE 008478994-02

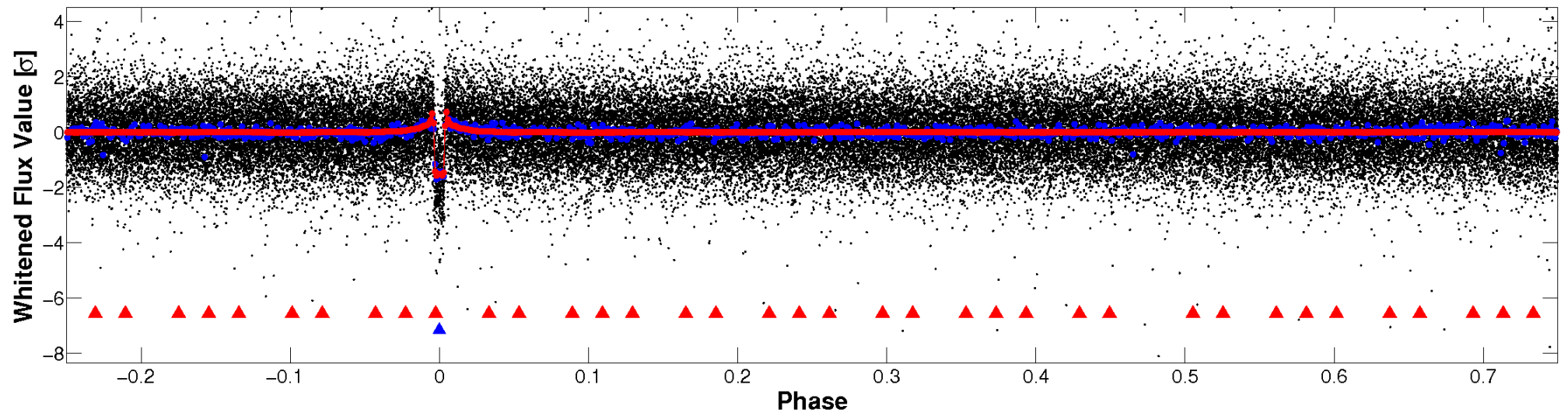


# Non-Whitened Vs. Whitened Light Curve

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

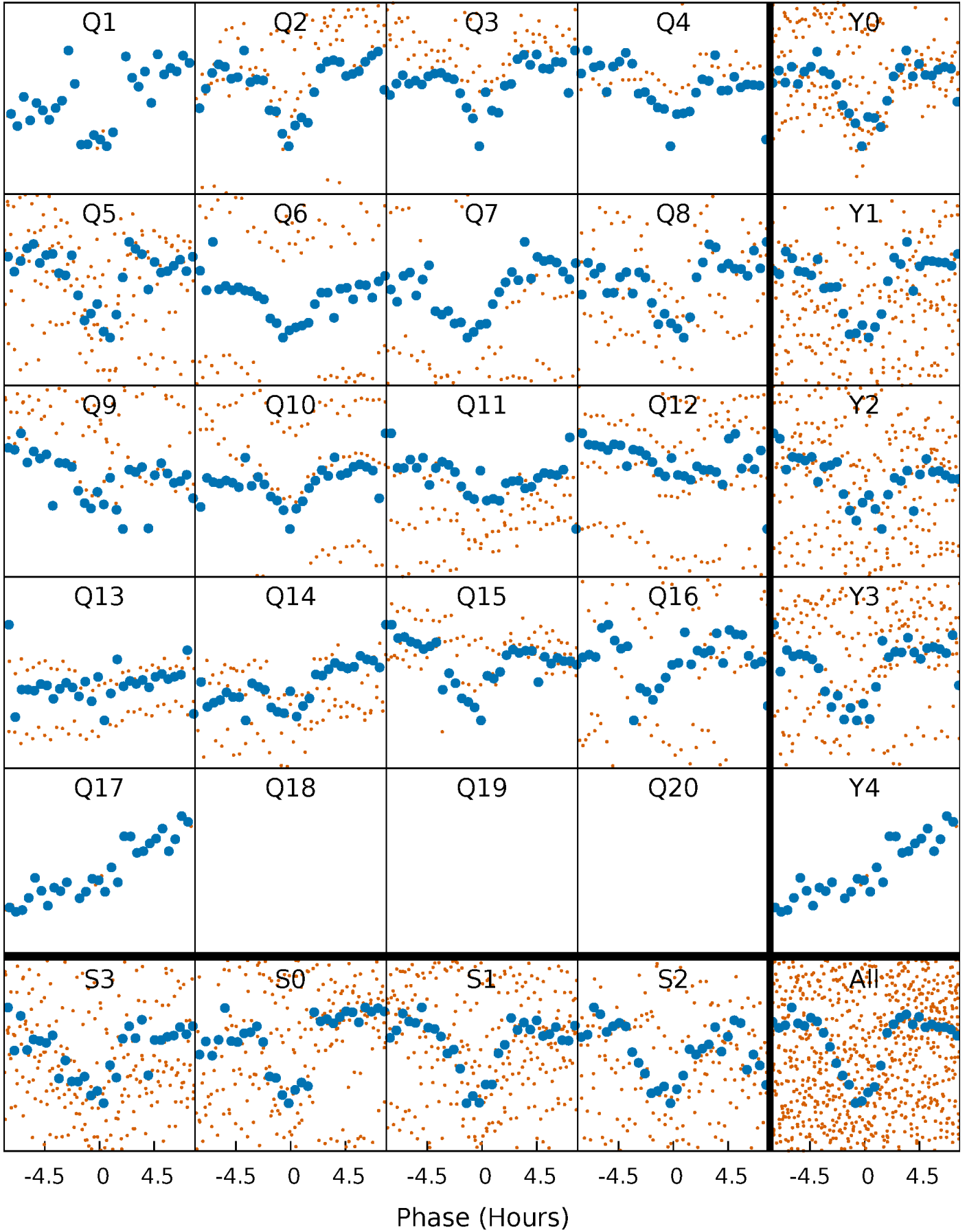


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



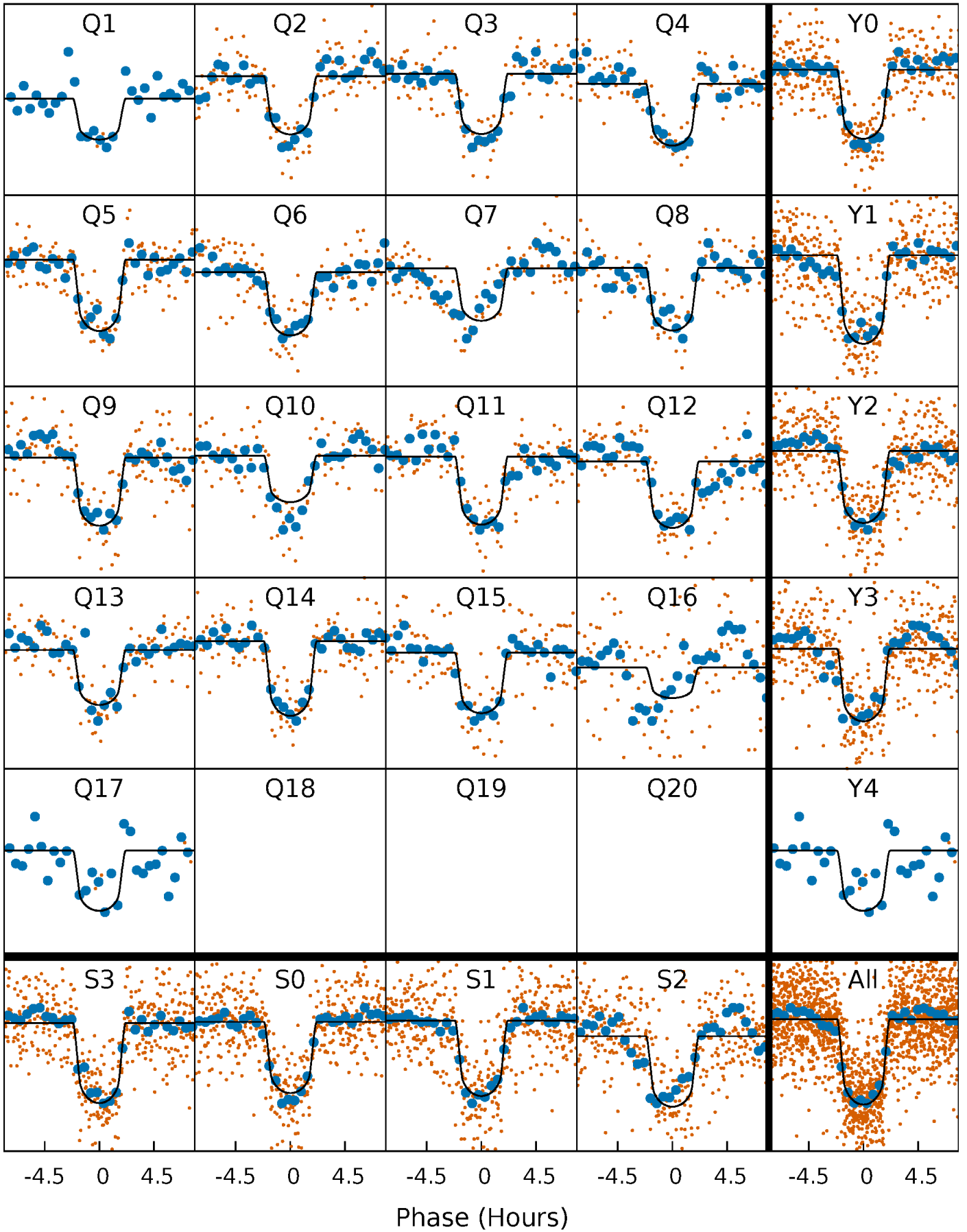
# PDC Quarter-Phased Transit Curves

TCE 008478994-02 P= 21.301920 Days  $T_0=149.236765$  (BKJD)



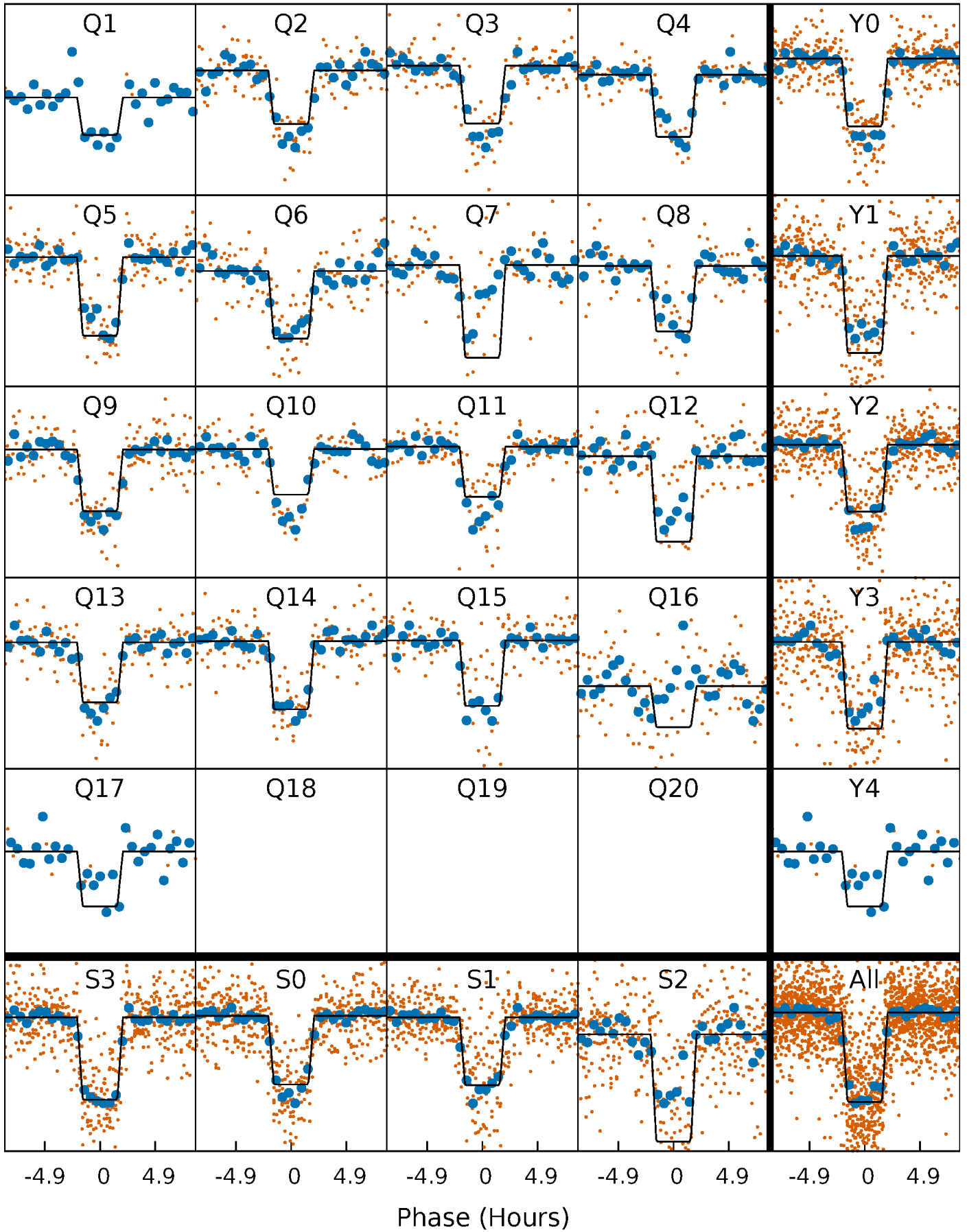
# DV Quarter-Phased Transit Curves

TCE 008478994-02 P= 21.301920 Days  $T_0=149.236765$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

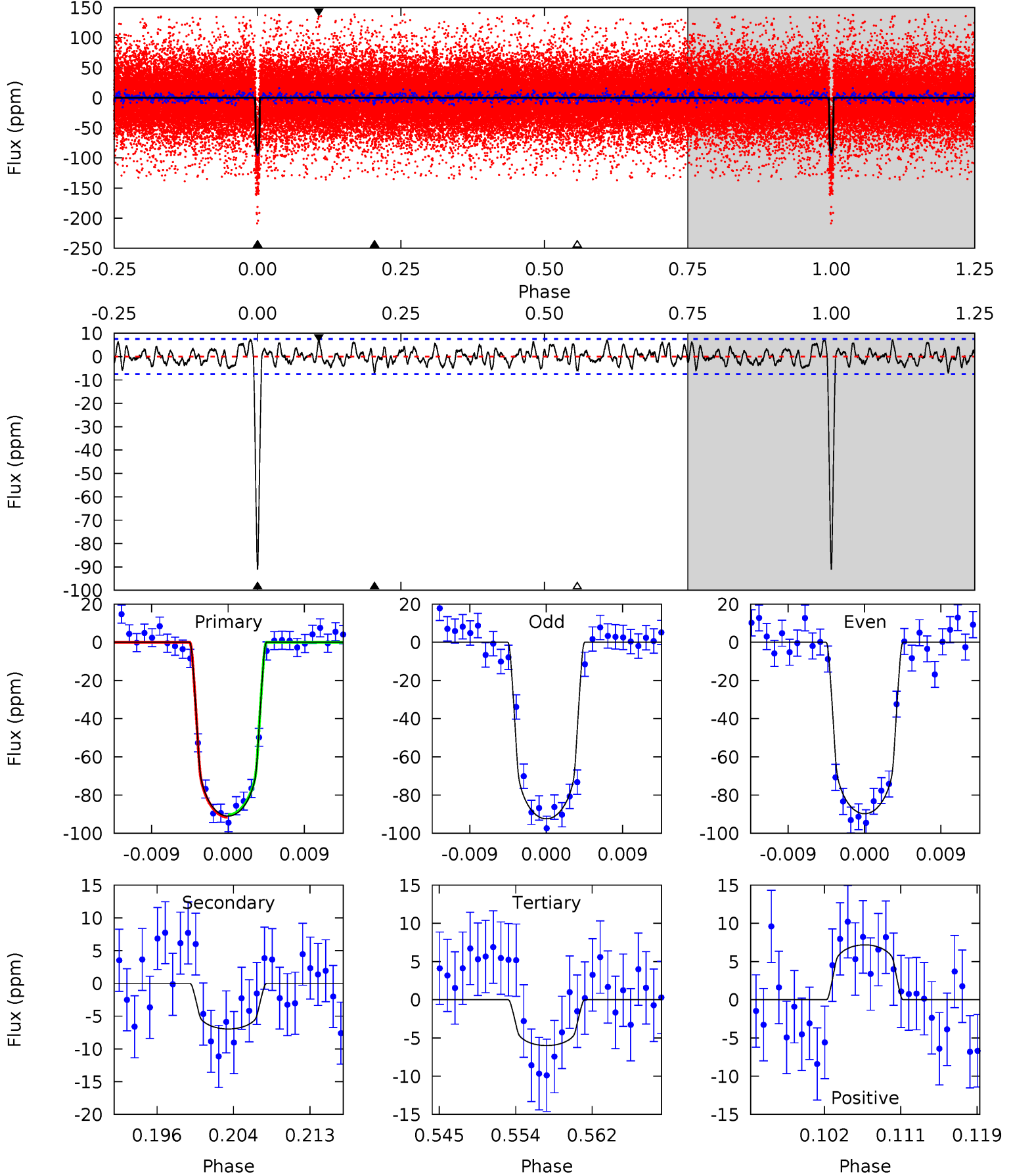
TCE 008478994-02 P= 21.302005 Days  $T_0=149.233024$  (BKJD)



# DV Model-Shift Uniqueness Test

008478994-02,  $P = 21.301920$  Days,  $E = 127.934845$  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
61.2	4.68	4.03	4.83	5.06	2.63	1.79	57.2	56.4	0.65	-0.15	0.90	0.98	0.07	0.40

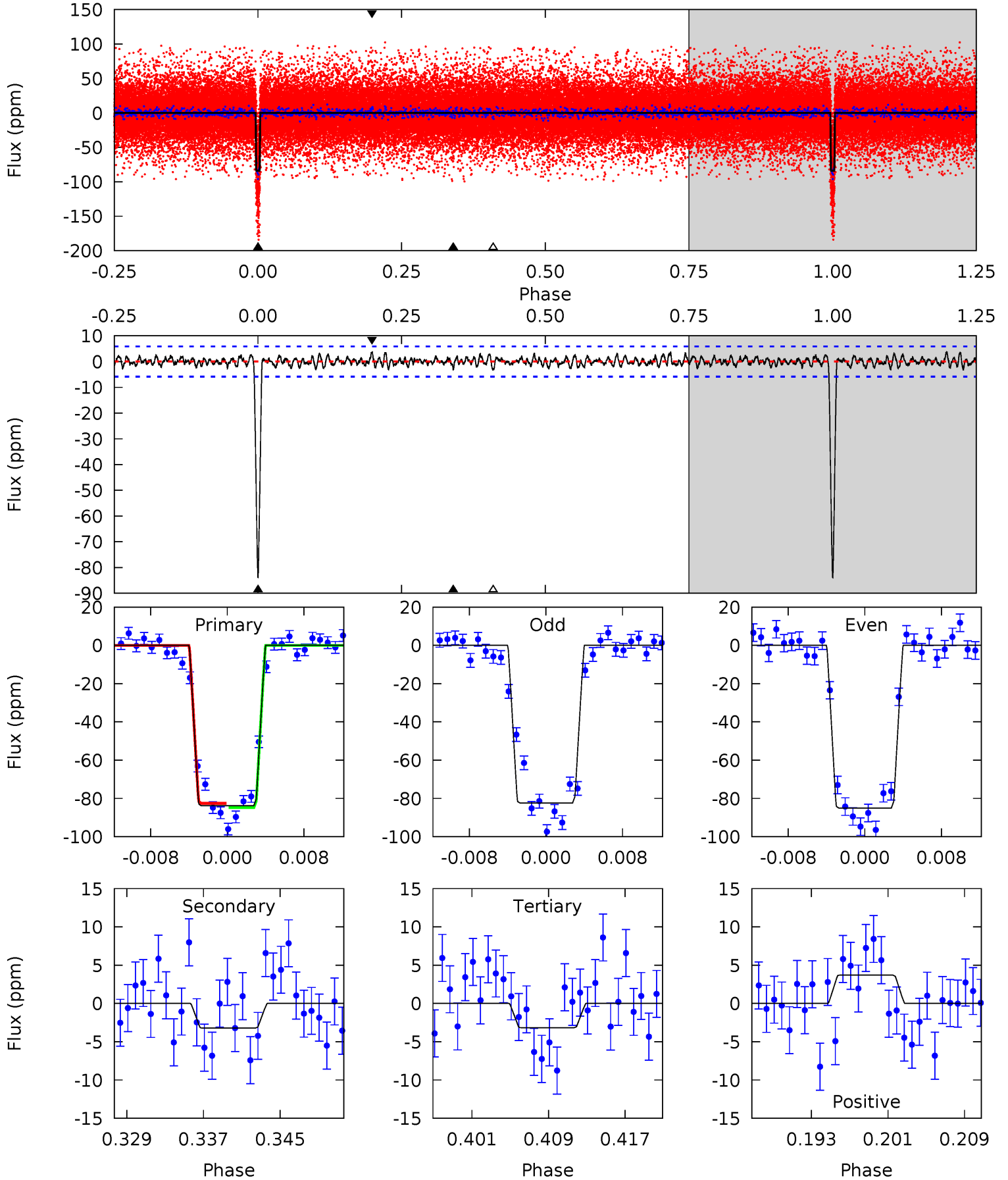




# Alt Model-Shift Uniqueness Test

008478994-02, P = 21.302005 Days, E = 127.931019 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
72.6	2.79	2.74	3.20	5.07	2.65	1.05	69.8	69.4	0.04	-0.42	1.13	0.91	0.04	0.97





### Stellar Parameters For KIC 008478994

	$T_{\text{eff}}(K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5437^{+73}_{-81}$	$4.571^{+0.020}_{-0.030}$	$-0.240^{+0.150}_{-0.150}$	$0.781^{+0.034}_{-0.031}$	$0.829^{+0.044}_{-0.054}$	$2.455^{+0.213}_{-0.237}$
	+1%/-1%	+0%/-1%	+62%/-62%	+4%/-4%	+5%/-7%	+9%/-10%
Source	SPE72	AST69	SPE72	DSEP		

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

### Secondary Eclipse Parameters for KIC 008478994-02 / KOI 0245.02

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-7 \pm 1$	$0.90^{+0.09}_{-0.09}$	$790^{+14}_{-14}$	$3271^{+154}_{-138}$	$94^{+33}_{-23}$
Alt.	$-3 \pm 1$	$0.79^{+0.09}_{-0.09}$	$788^{+14}_{-13}$	$3011^{+186}_{-203}$	$54^{+27}_{-22}$

$T_{max}$  = 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

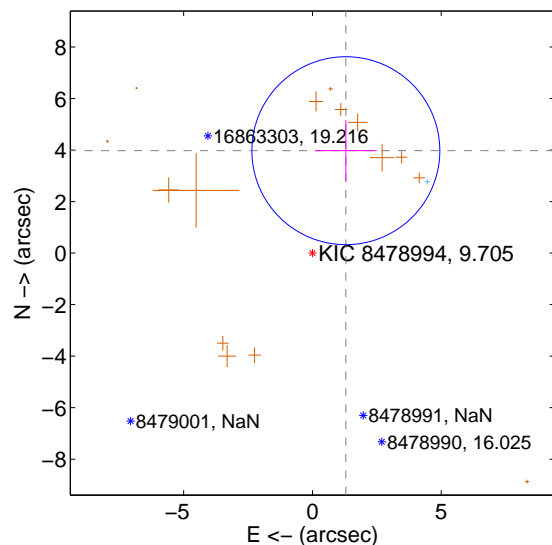
Supplemental centroid analysis for 008478994-02. **Kepler magnitude: 9.71.** Transit SNR 34.27

**There are 1 quarters with good PRF difference image offsets**

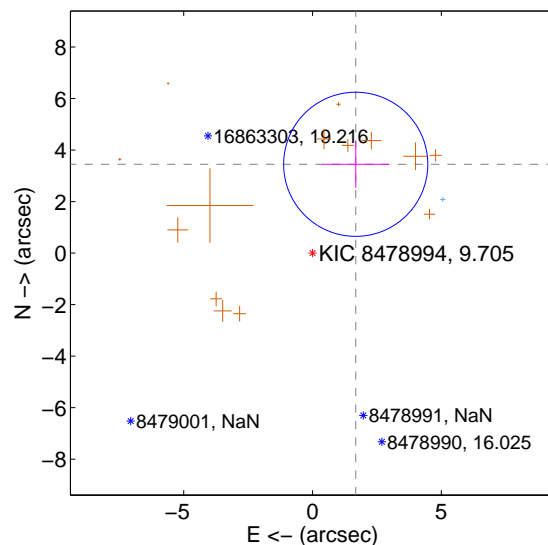
The direct PRF centroid is offset from the target star catalog position by about 0.80 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	<b><math>4.181 \pm 1.216</math></b>	<b>3.44</b>	$-1.296 \pm 1.197$	$3.974 \pm 1.192$
PRF-fit source offset from KIC position	<b><math>3.833 \pm 0.932</math></b>	<b>4.11</b>	$-1.676 \pm 1.297$	$3.447 \pm 0.911$
photometric centroid source offset	$0.40 \pm 0.41$	0.98	$-0.14 \pm 0.51$	$0.38 \pm 0.39$

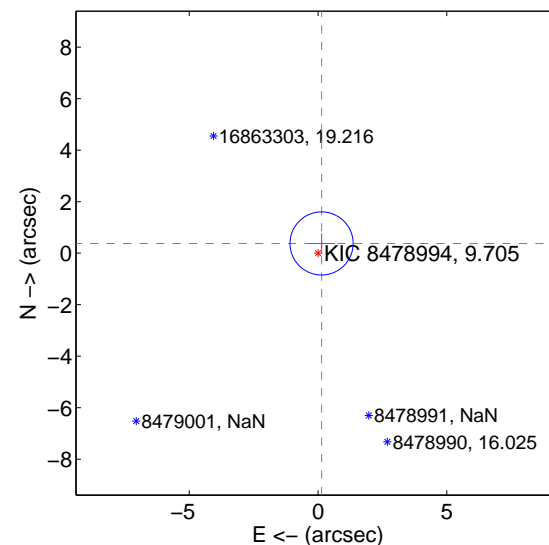
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

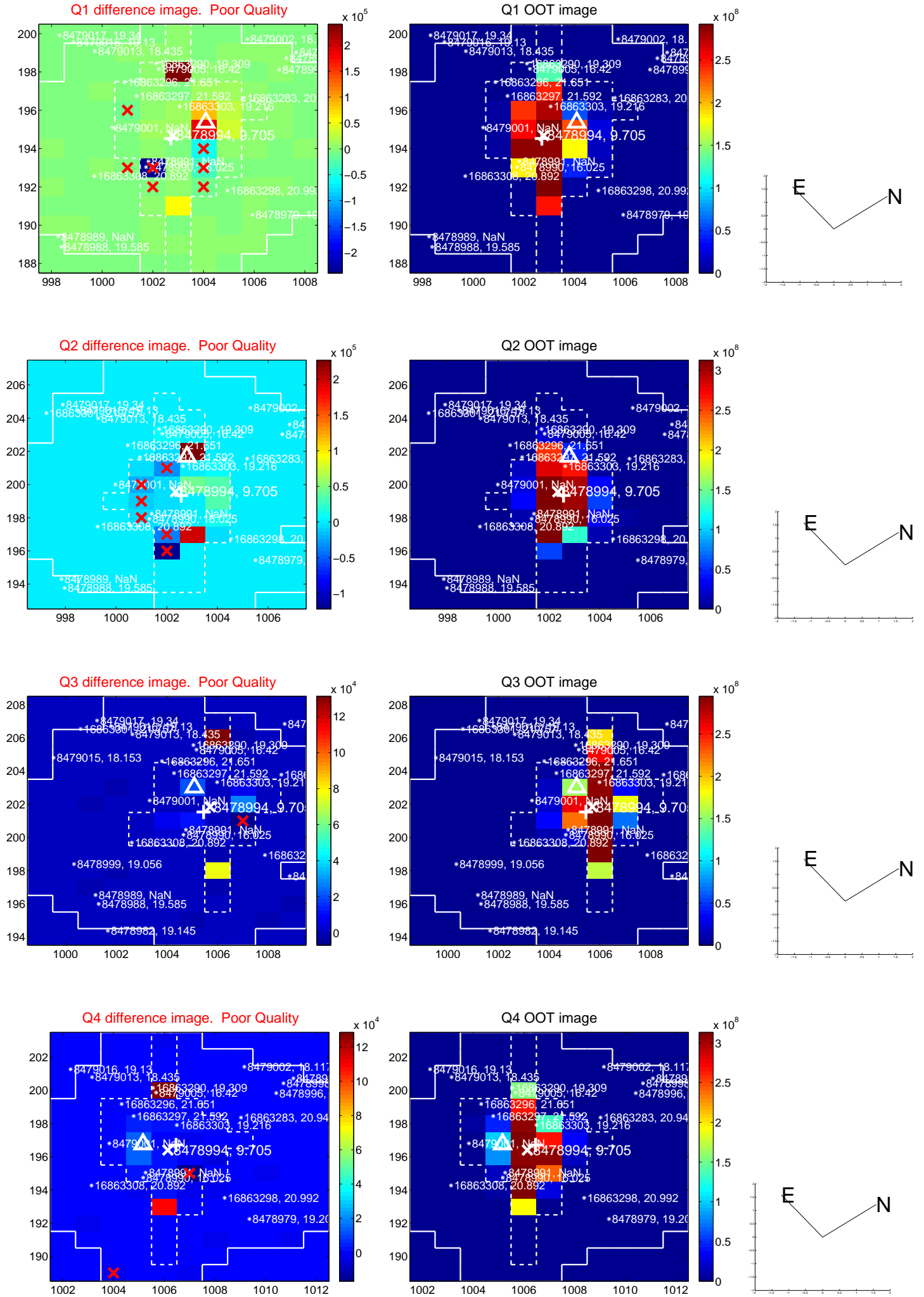


offset from photometric centroids

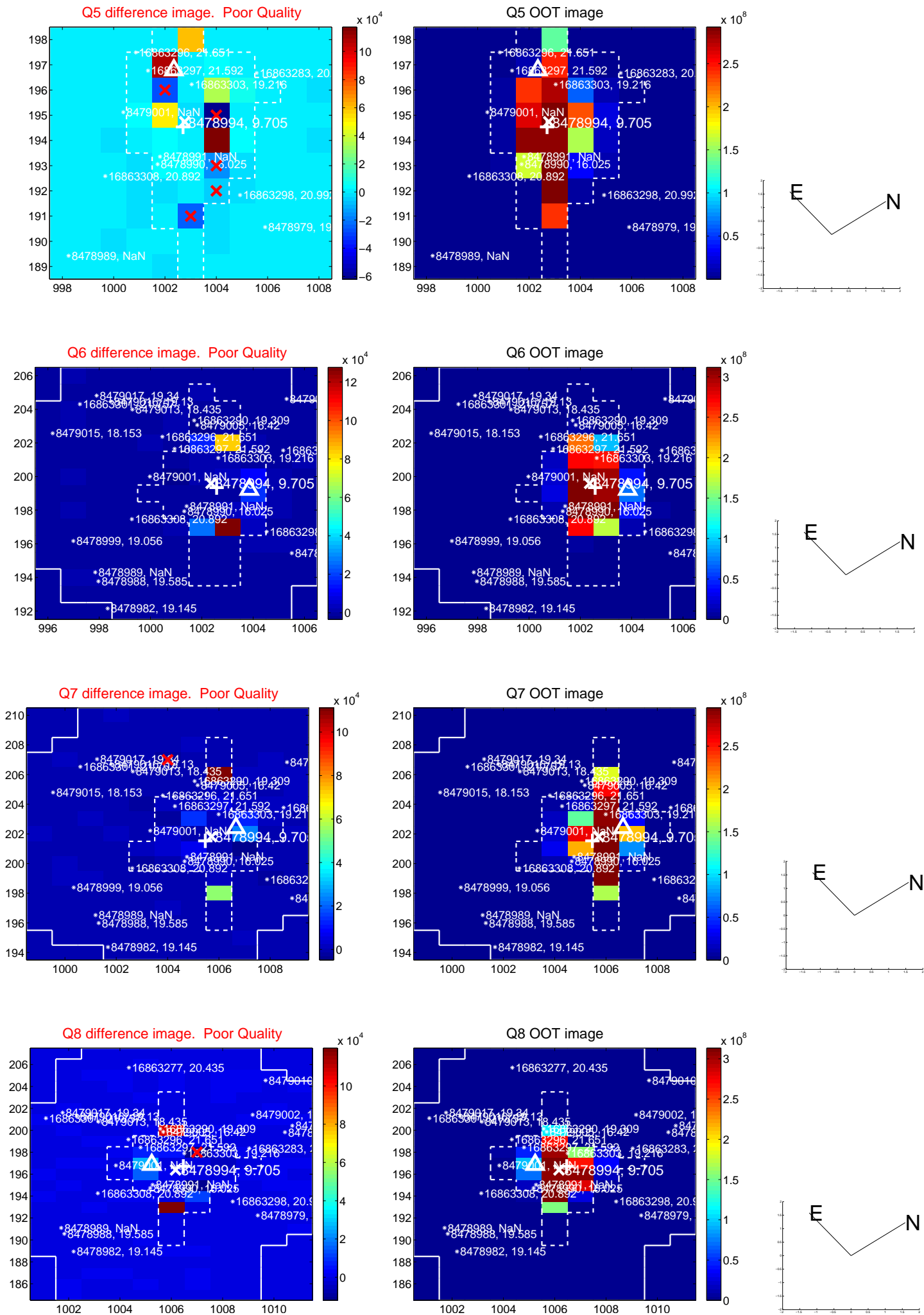


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

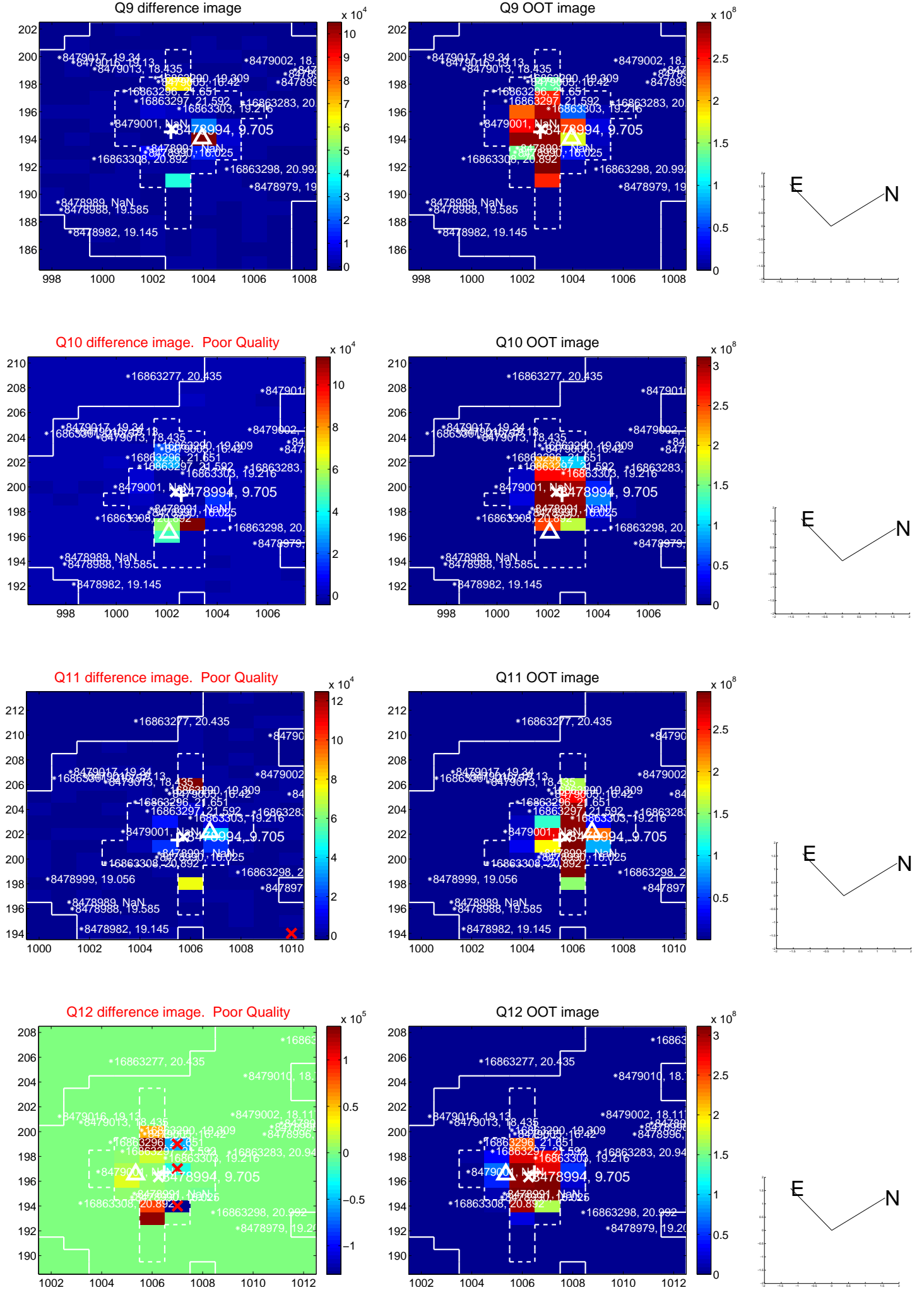
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



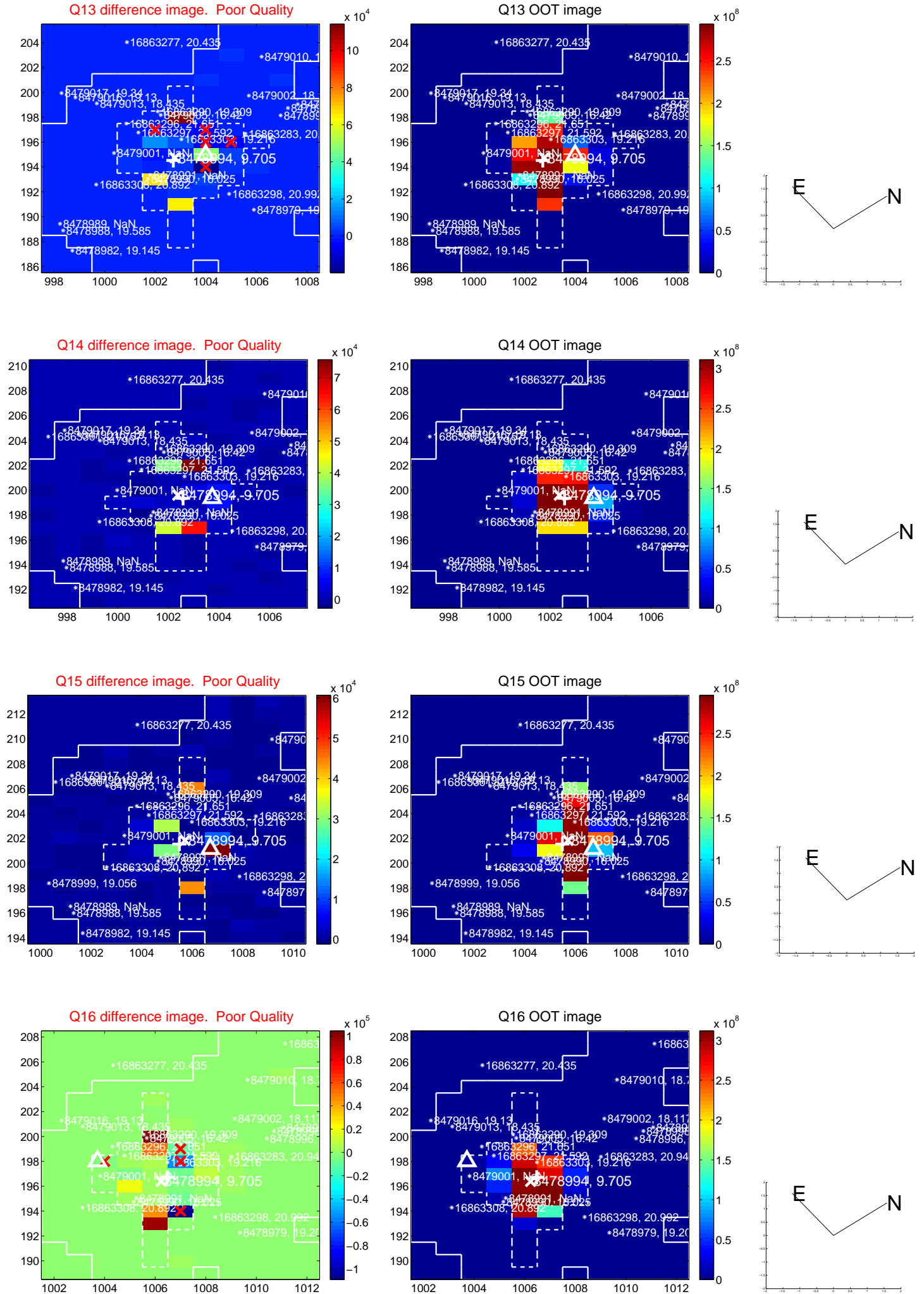
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

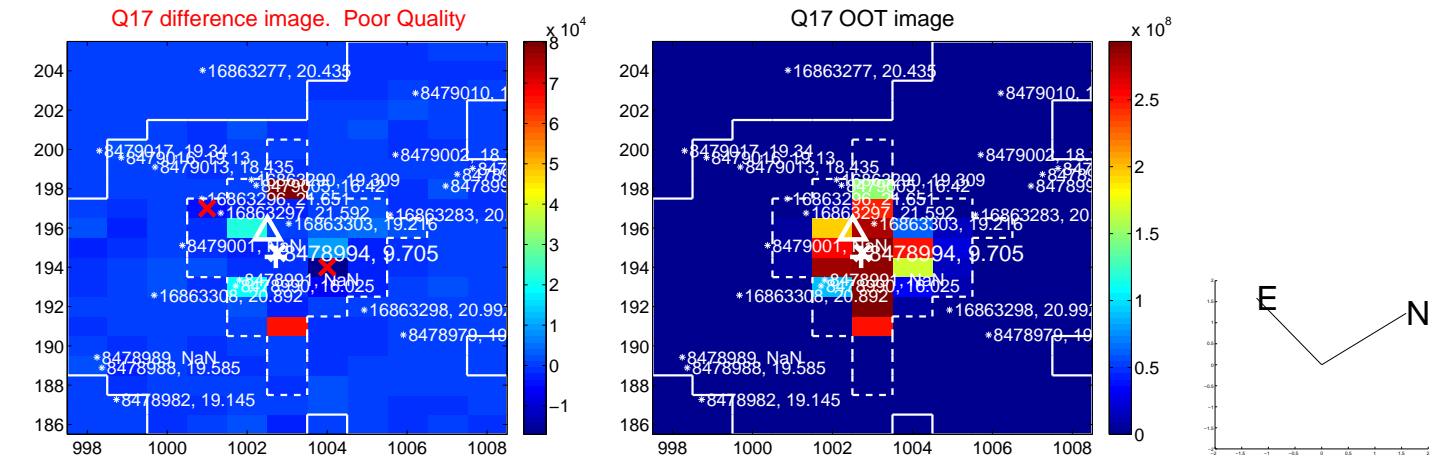


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

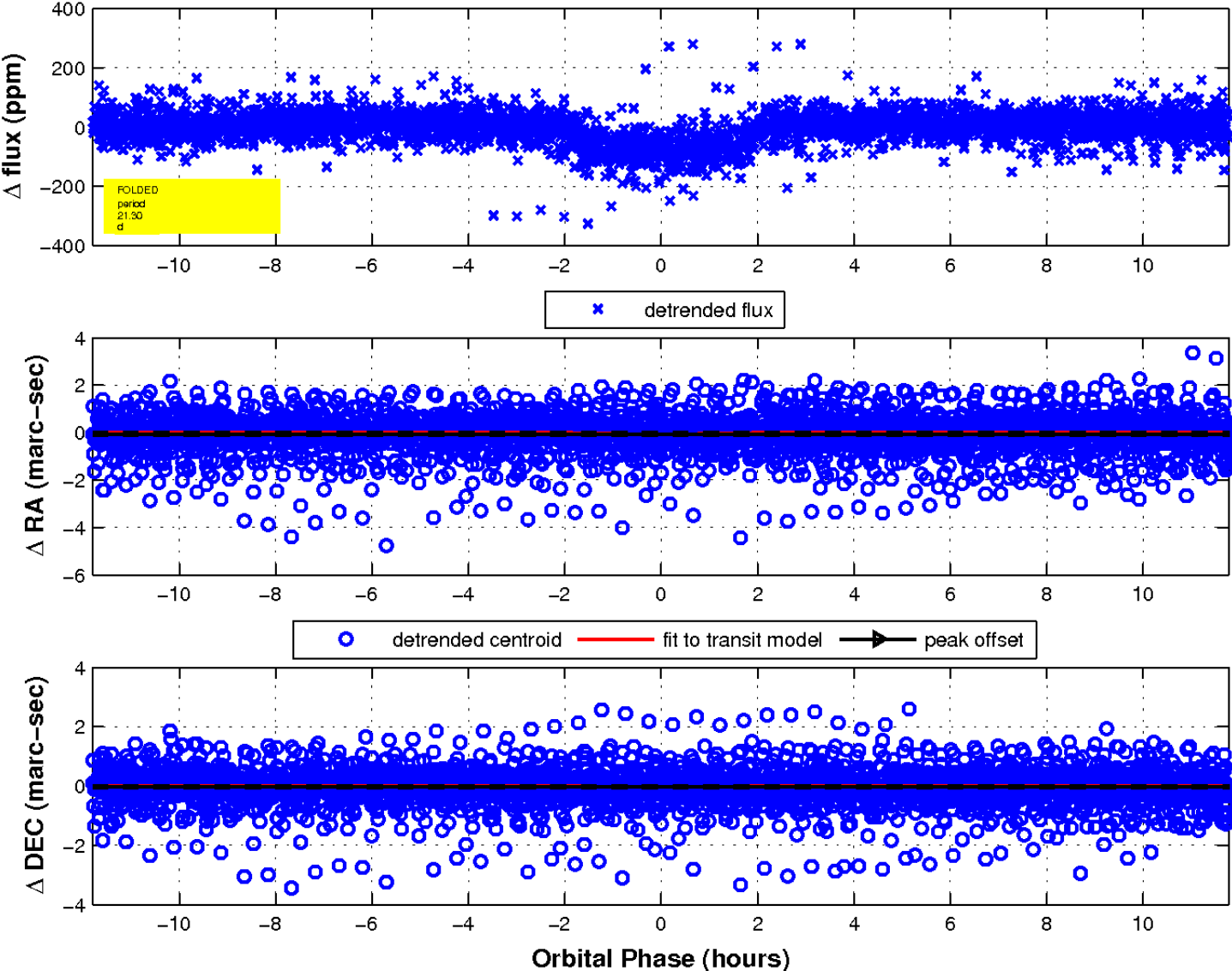




white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\Delta$ : difference centroid. red  $\times$ : large negative pixel value.



fluxWeightedCentroids, Planet 2 of 2



UKIRT Image

Declination

