

# KIC 003942670

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
003942670-01	OBS	0392.01	33.416152	137.919943	263.8	8.533	23.2	24.1	1.42	6007	2.88	53.27
003942670-02	OBS	0392.02	12.610791	138.188933	93.5	4.574	10.2	11.3	1.42	6007	1.63	195.31

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
003942670-01	OBS	PC	1.00	0	0	0	0	NO_COMMENT
003942670-02	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.

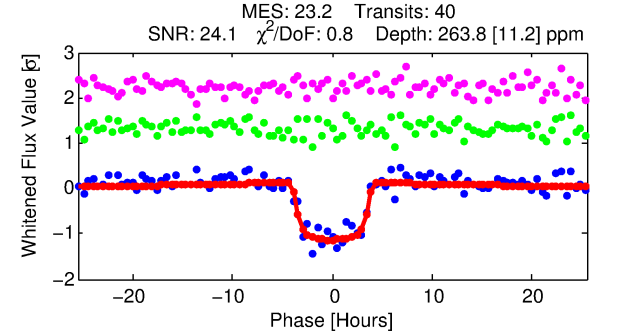
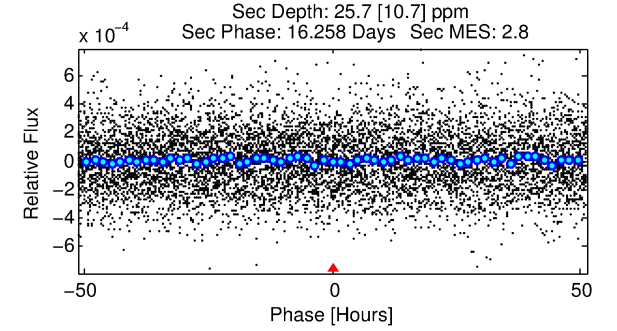
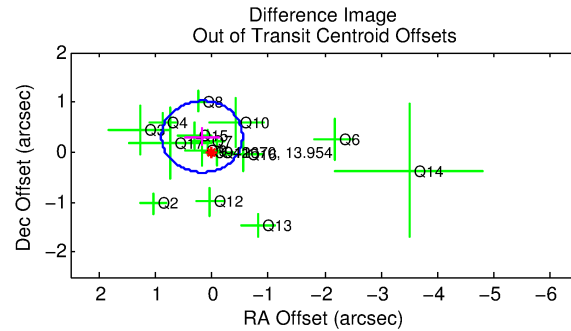
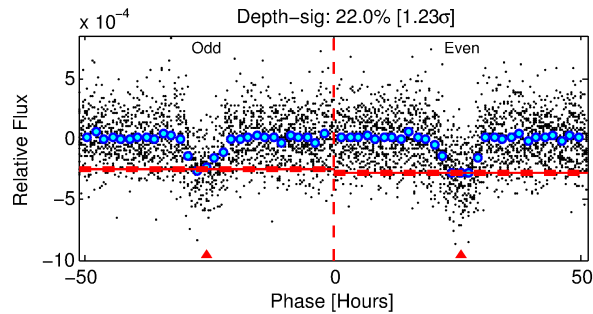
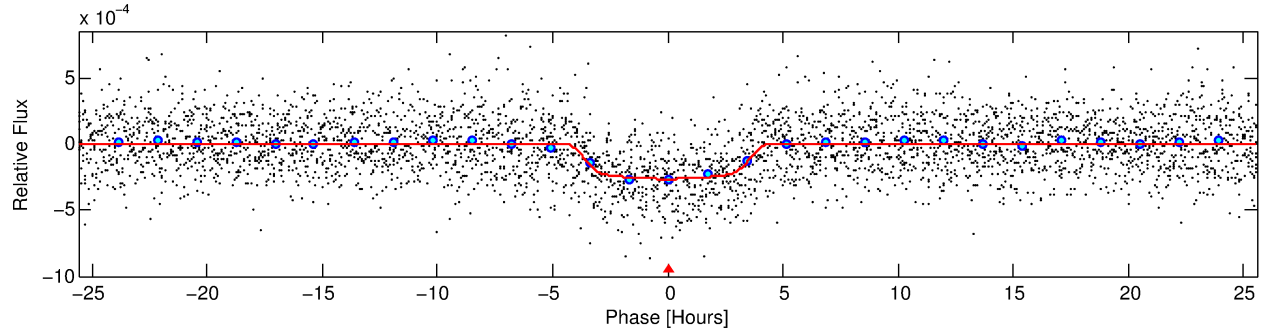
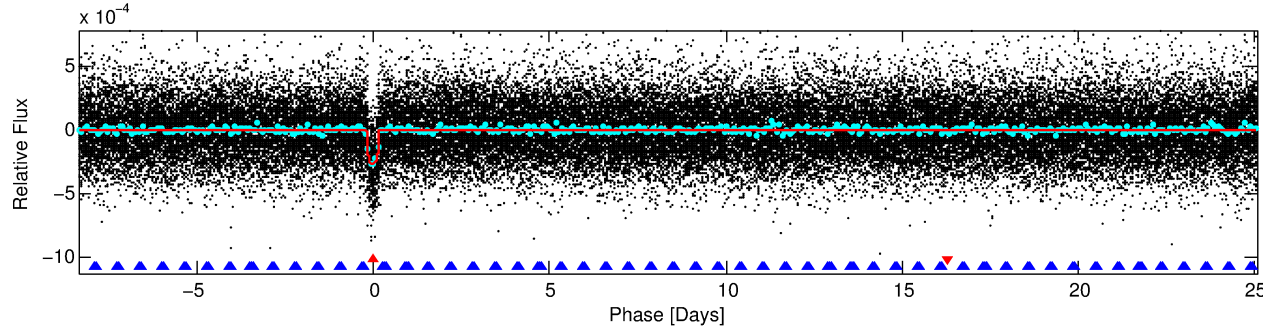
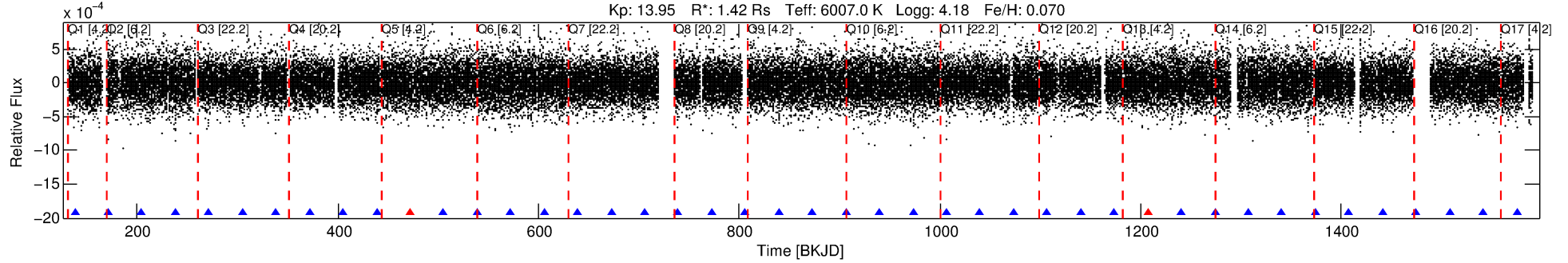
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 003942670-01

No Significant Match Found

# DV One-Page Summary

KIC: 3942670 Candidate: 1 of 2 Period: 33.416 d  
KOI: K00392.01 Name: Kepler-147c Corr: 0.976



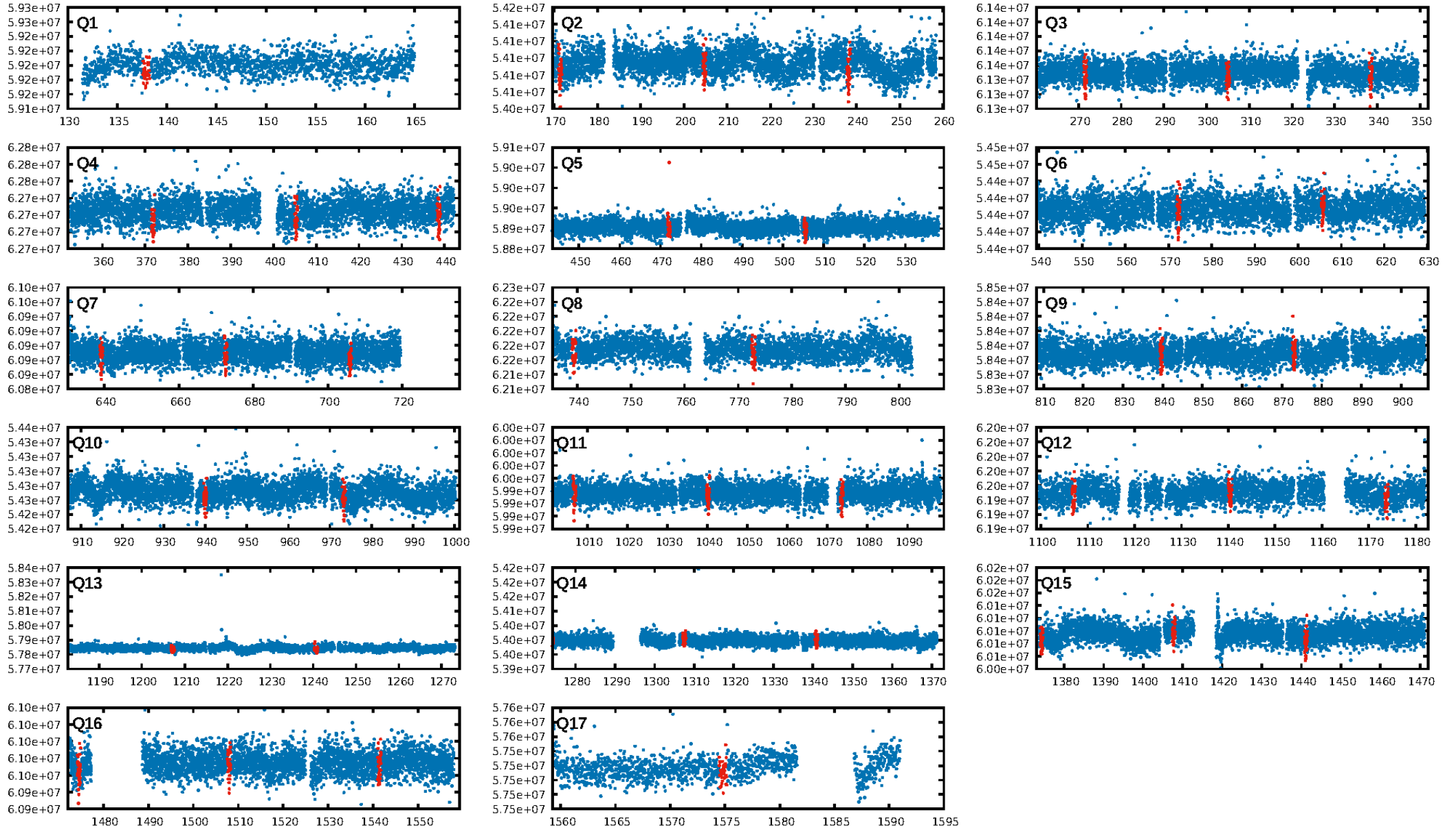
## DV Fit Results:

Period = 33.41615 [0.00026] d  
Epoch = 137.9199 [0.0065] BKJD  
Rp/R\* = 0.0186 [0.0008]  
a/R\* = 11.42 [1.93]  
b = 0.94 [0.02]  
Seff = 53.26 [15.41]  
T<sub>eq</sub> = 689 [50] K  
Rp = 2.88 [0.55] Re  
a = 0.2101 [0.0368] AU  
Ag = 75.26 [38.14] [1.95 $\sigma$ ]  
T<sub>effp</sub> = 3137 [339] K [7.16 $\sigma$ ]

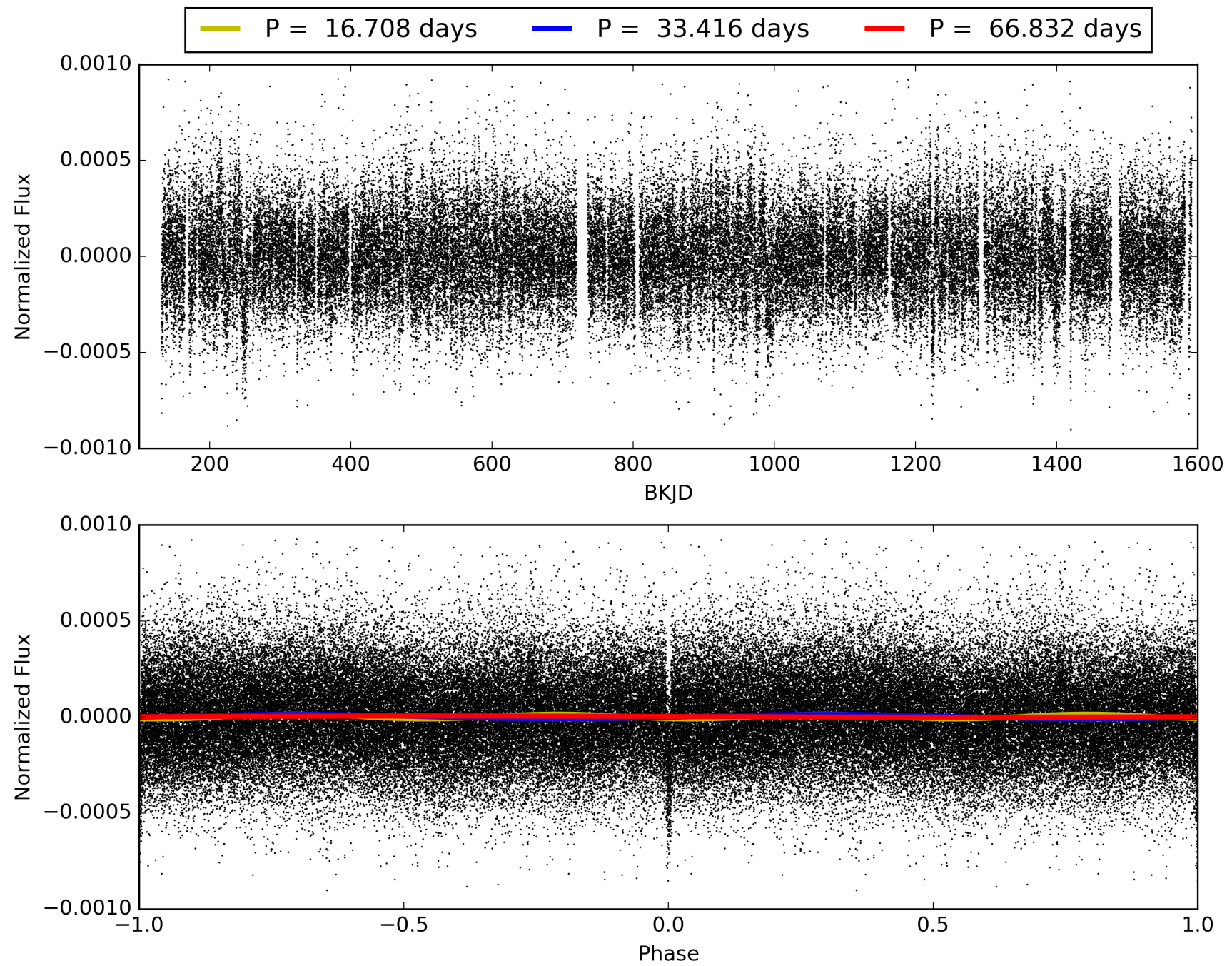
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [51.57 $\sigma$ ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 97.6%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 7.69e-99  
RollingBand-fgt: 0.95 [36/38]  
GhostDiagnostic-chr: 4.501  
Centroid-sig: 0.0%  
Centroid-so: 1.636 arcsec [2.65 $\sigma$ ]  
OotOffset-rm: 0.355 arcsec [1.48 $\sigma$ ]  
KicOffset-rm: 0.330 arcsec [1.68 $\sigma$ ]  
OotOffset-st: 4/4/4/3 [15]  
KicOffset-st: 4/4/4/3 [15]  
DiffImageQuality-fgm: 0.87 [13/15]  
DiffImageOverlap-fno: 0.94 [16/17]

# TCE 003942670-01, PDC Light Curves

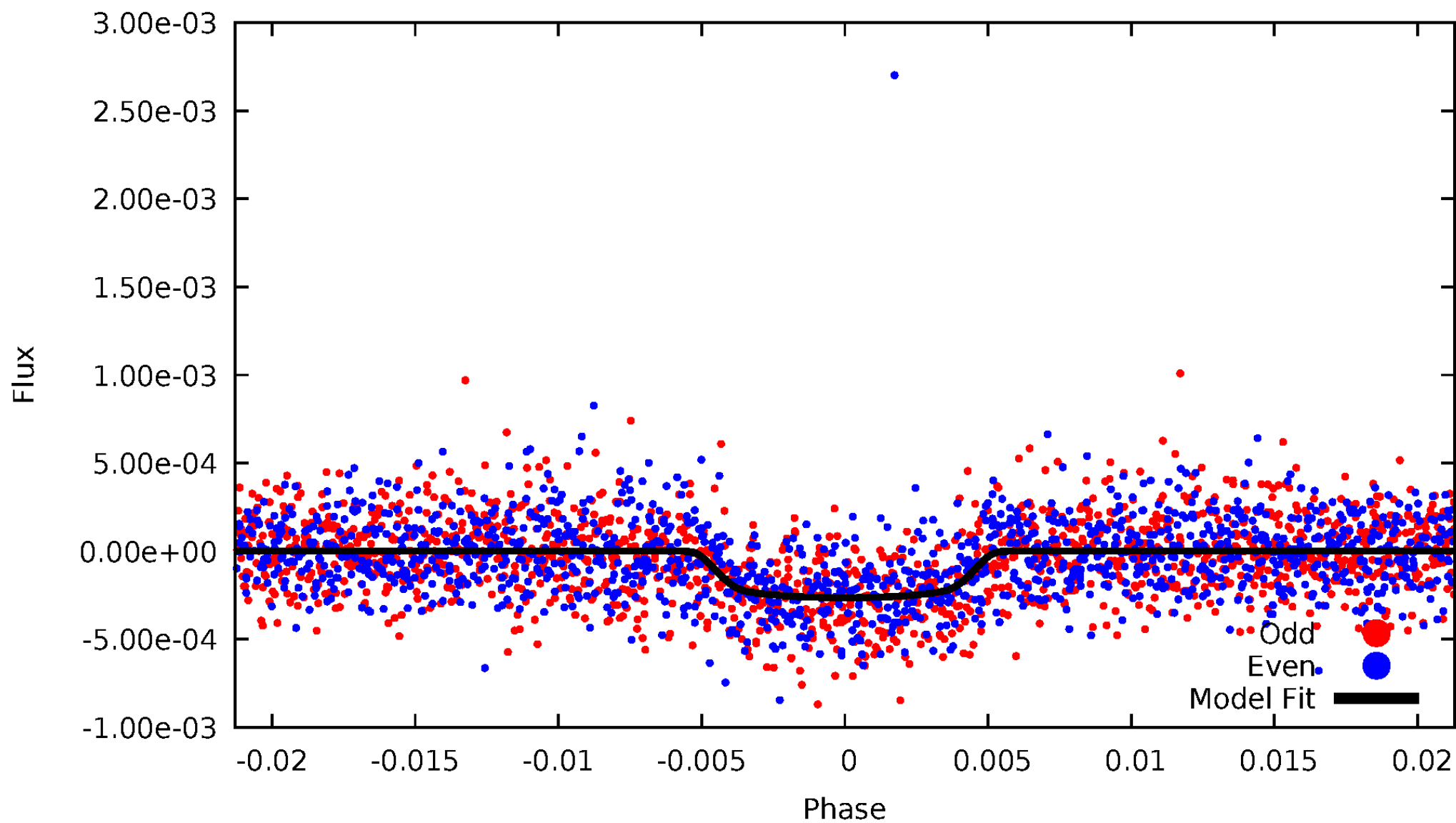


TCE 003942670-01



# DV Odd/Even

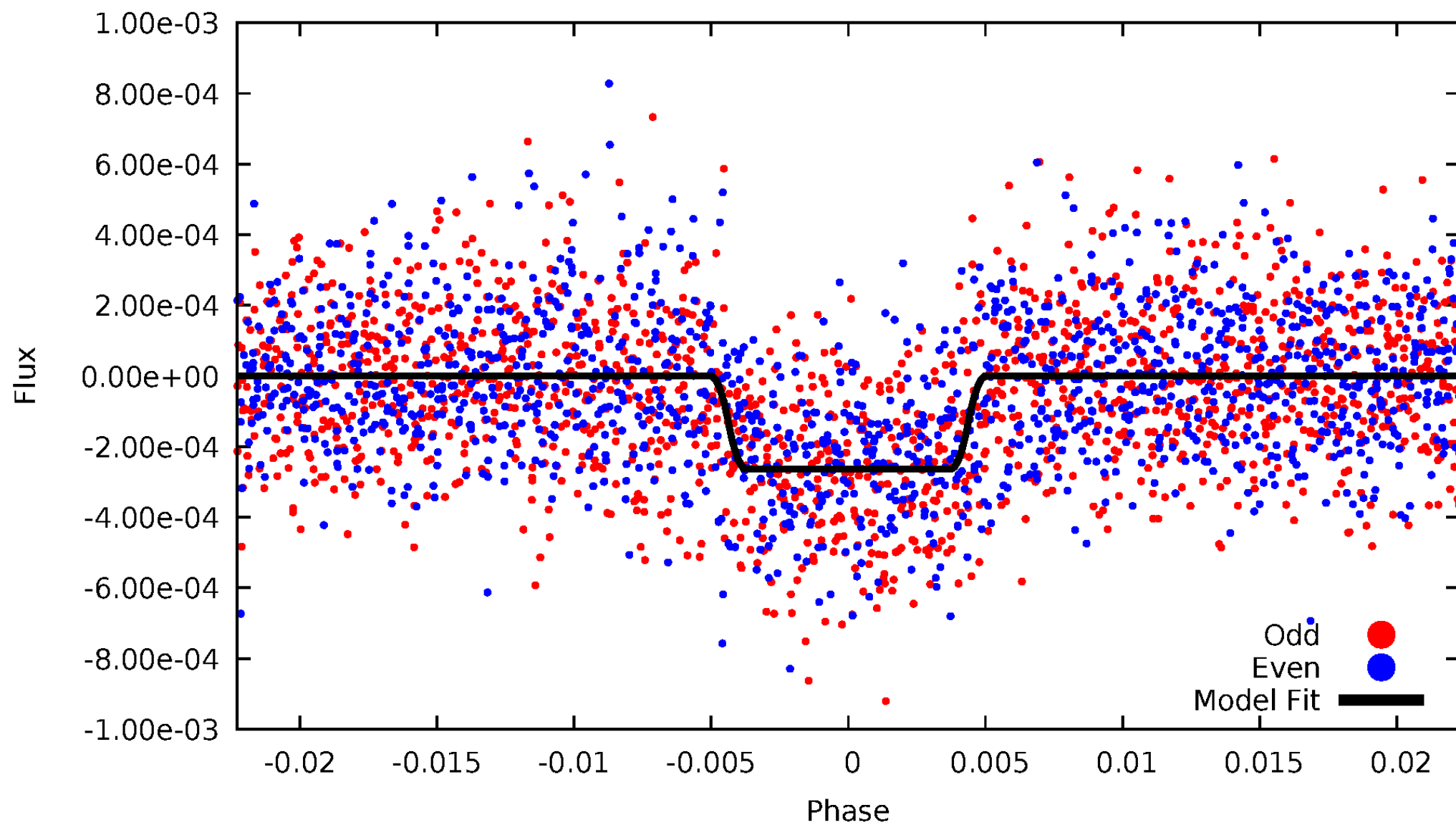
TCE 003942670-01





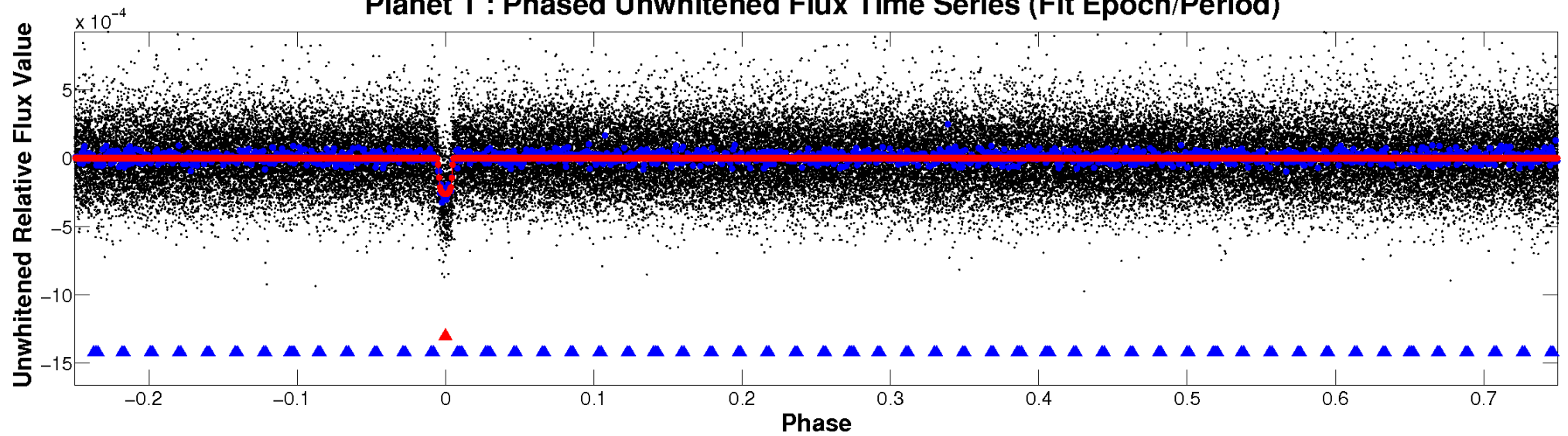
# ALT Odd/Even

TCE 003942670-01

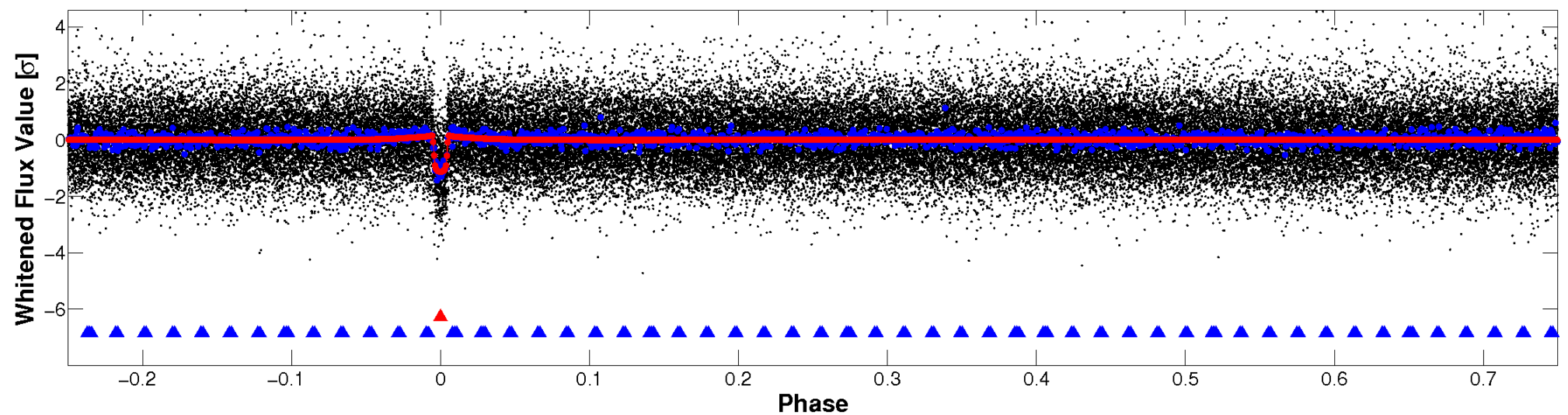


# Non-Whitened Vs. Whitened Light Curve

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

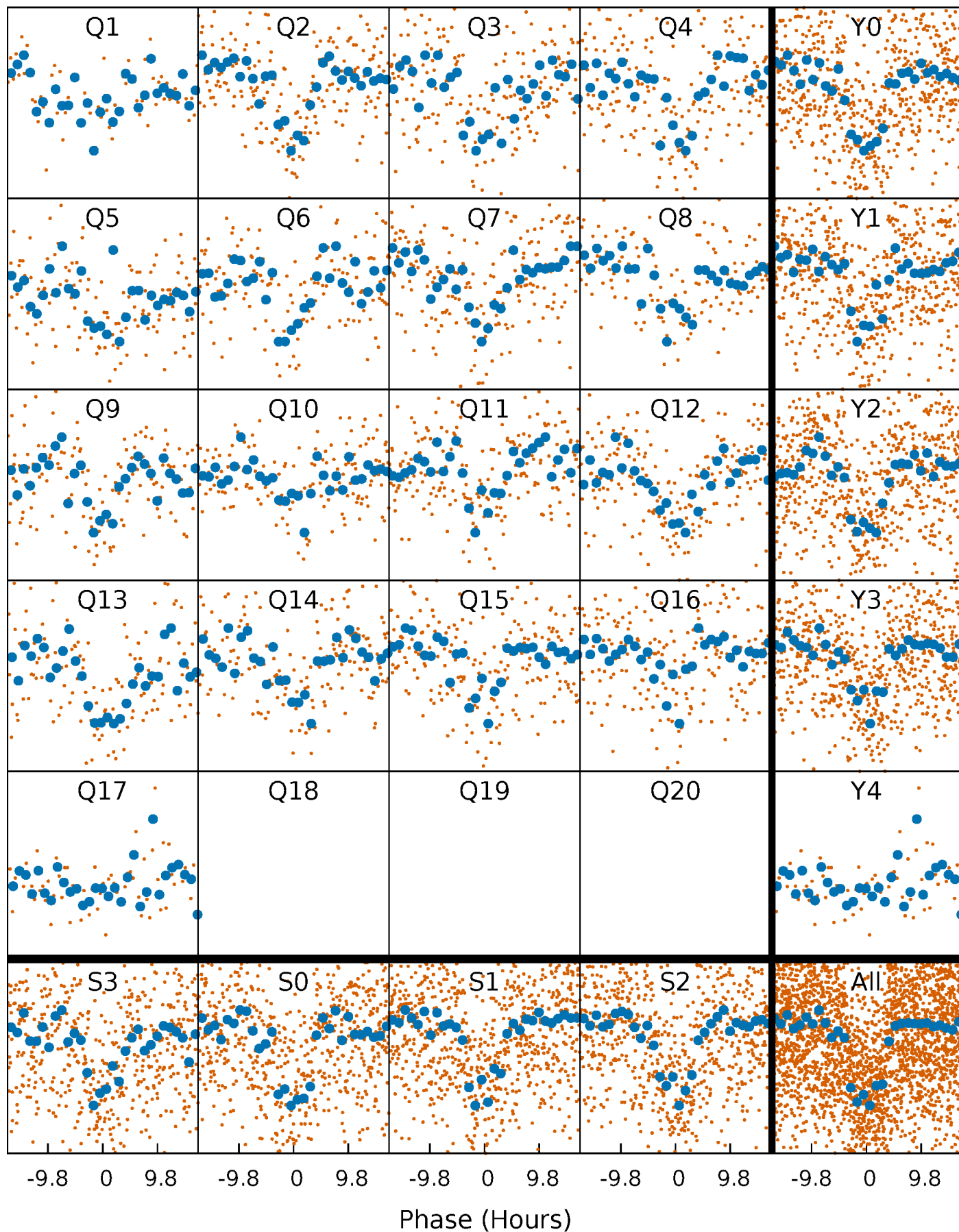


Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

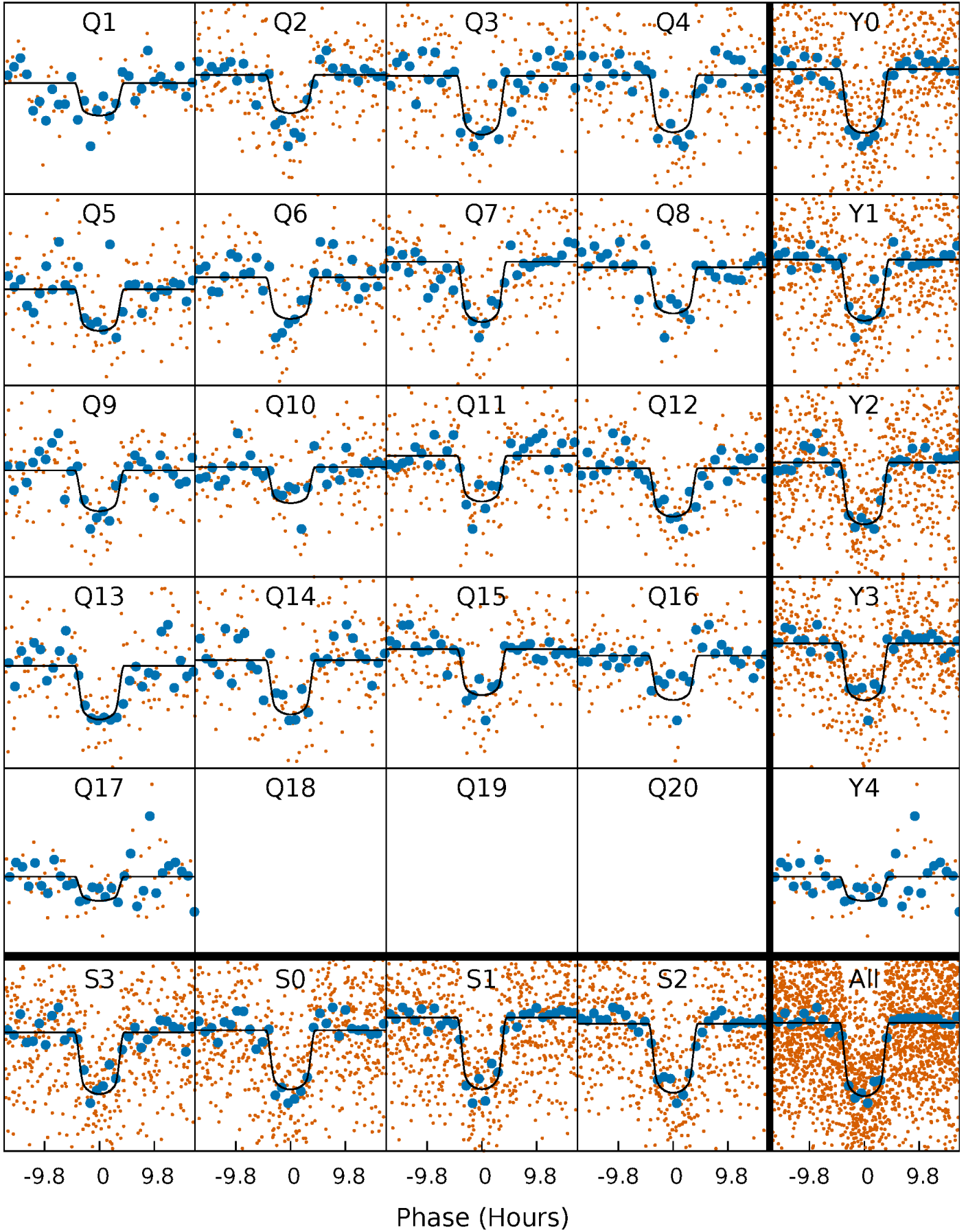
TCE 003942670-01 P= 33.416152 Days  $T_0=137.919943$  (BKJD)





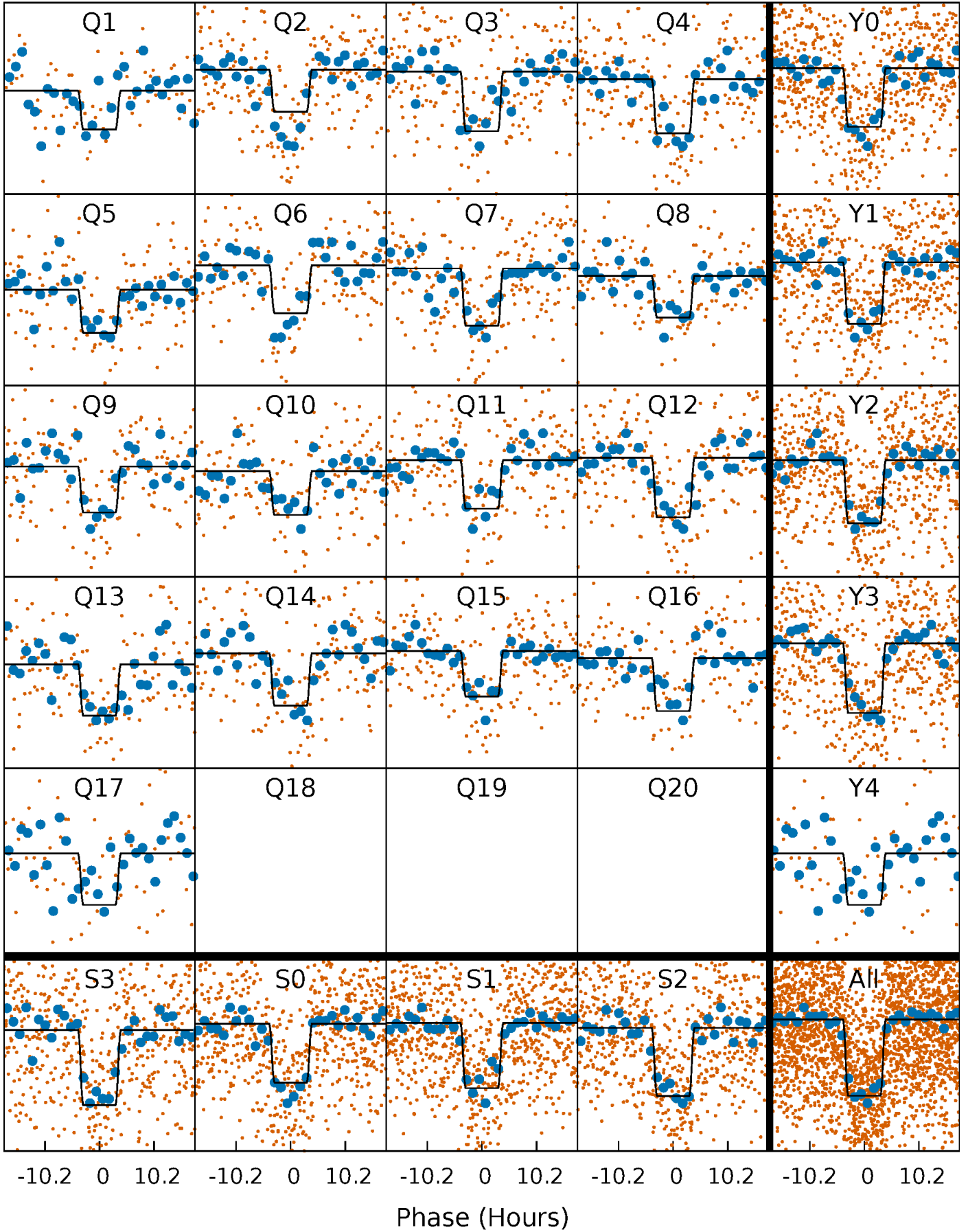
# DV Quarter-Phased Transit Curves

TCE 003942670-01 P= 33.416152 Days  $T_0=137.919943$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

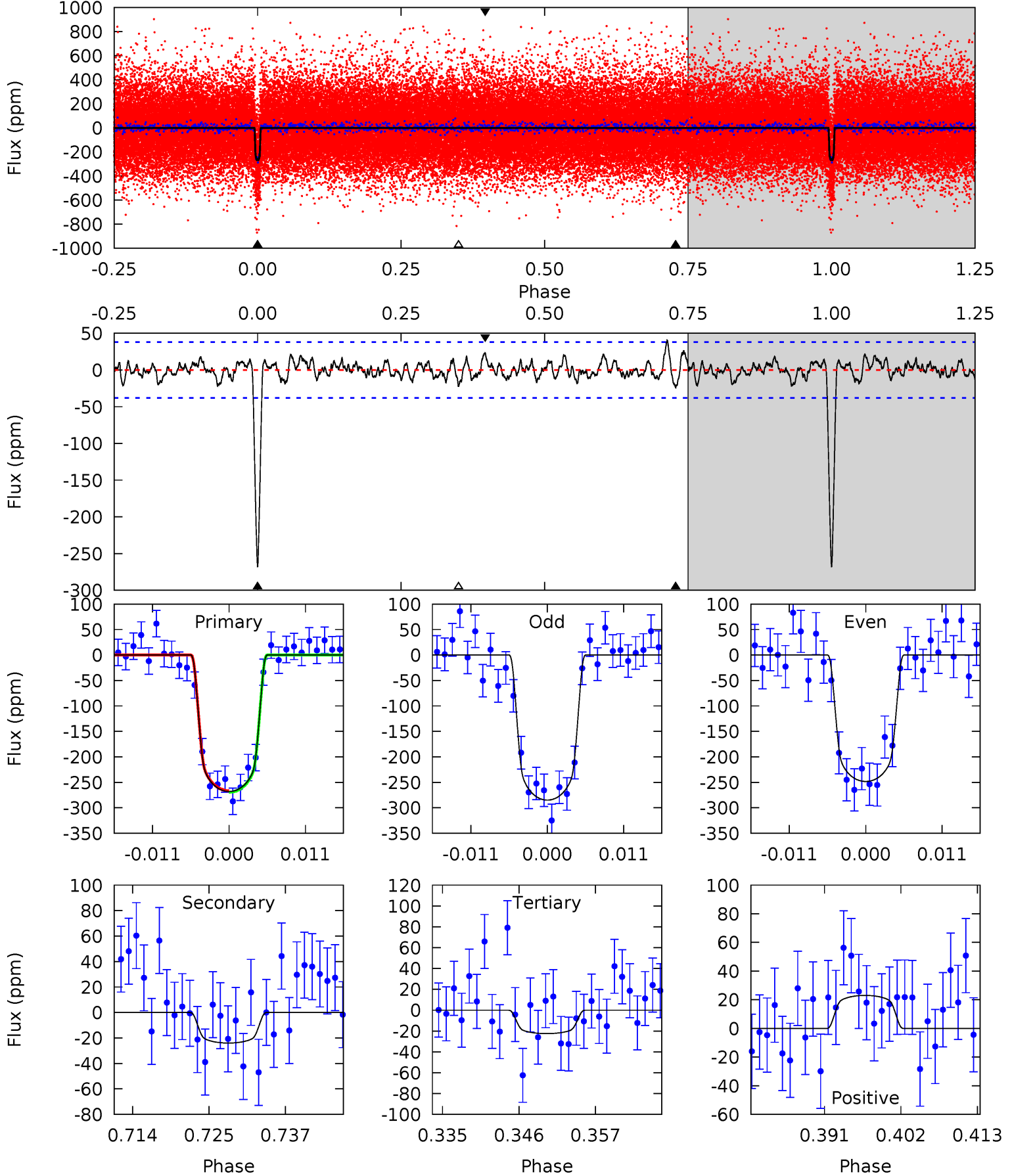
TCE 003942670-01 P= 33.415202 Days  $T_0=137.939701$  (BKJD)



# DV Model-Shift Uniqueness Test

003942670-01, P = 33.416152 Days, E = 104.503791 Days

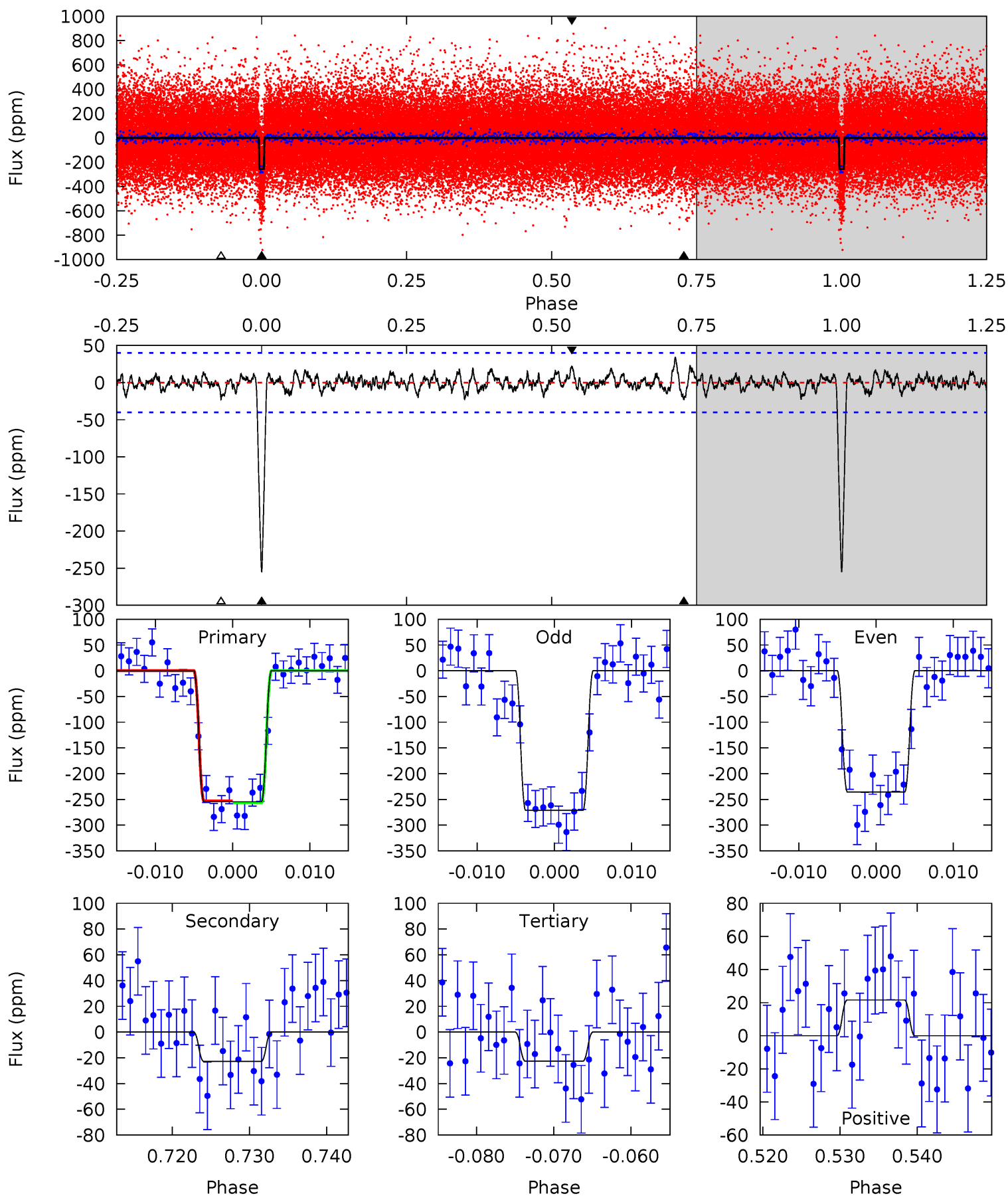
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
35.2	3.15	2.95	3.02	5.01	2.54	1.22	32.2	32.2	0.20	0.13	2.39	1.01	0.13	0.19



# Alt Model-Shift Uniqueness Test

003942670-01, P = 33.415202 Days, E = 104.524499 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
31.9	2.85	2.84	2.71	5.03	2.58	1.00	29.1	29.2	0.01	0.15	2.23	1.04	0.12	0.23



### Stellar Parameters For KIC 003942670

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6007^{+122}_{-122}$	$4.178^{+0.162}_{-0.108}$	$0.070^{+0.150}_{-0.150}$	$1.420^{+0.263}_{-0.263}$	$1.108^{+0.111}_{-0.083}$	$0.545^{+0.455}_{-0.181}$
	+2%/-2%	+4%/-3%	+214%/-214%	+19%/-19%	+10%/-7%	+83%/-33%
Source	SPE58	SPE58	SPE58	DSEP		

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

### Secondary Eclipse Parameters for KIC 003942670-01 / KOI 0392.01

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	-24±8	$2.85^{+0.31}_{-0.30}$	$956^{+48}_{-47}$	$3542^{+172}_{-206}$	$71^{+31}_{-24}$
Alt.	-23±8	$2.48^{+0.30}_{-0.27}$	$957^{+49}_{-51}$	$3679^{+202}_{-264}$	$90^{+40}_{-35}$

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



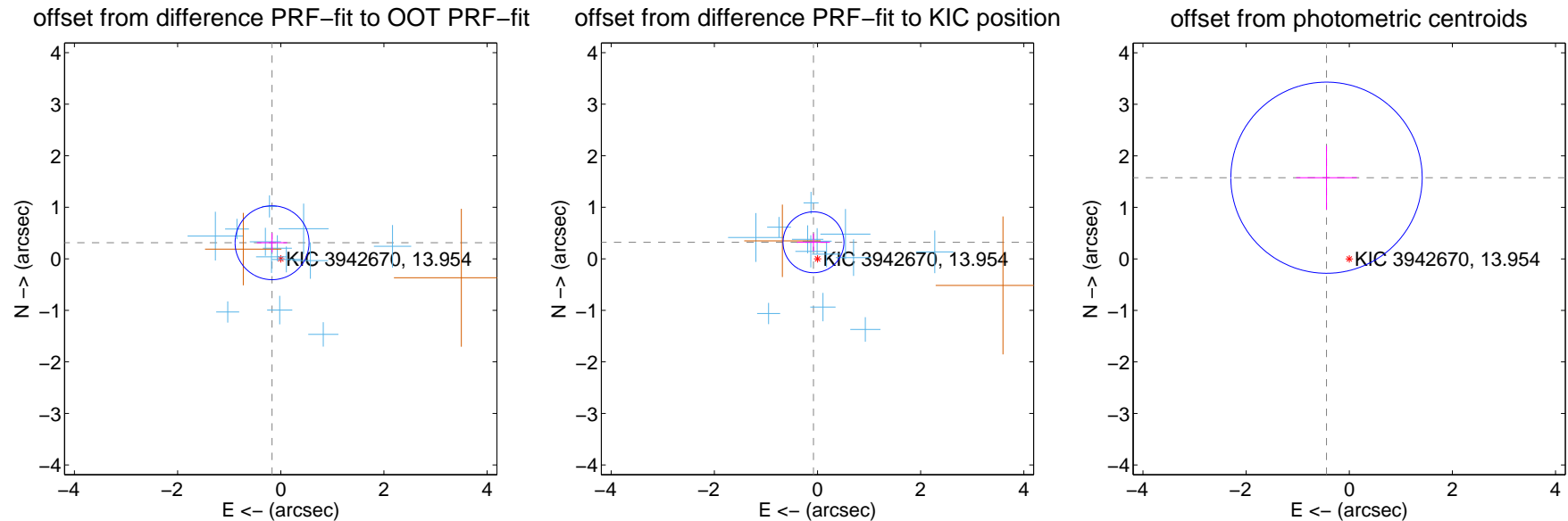
## DV Centroid Data

Supplemental centroid analysis for 003942670-01. Kepler magnitude: 13.95. Transit SNR 24.06

There are 13 quarters with good PRF difference image offsets

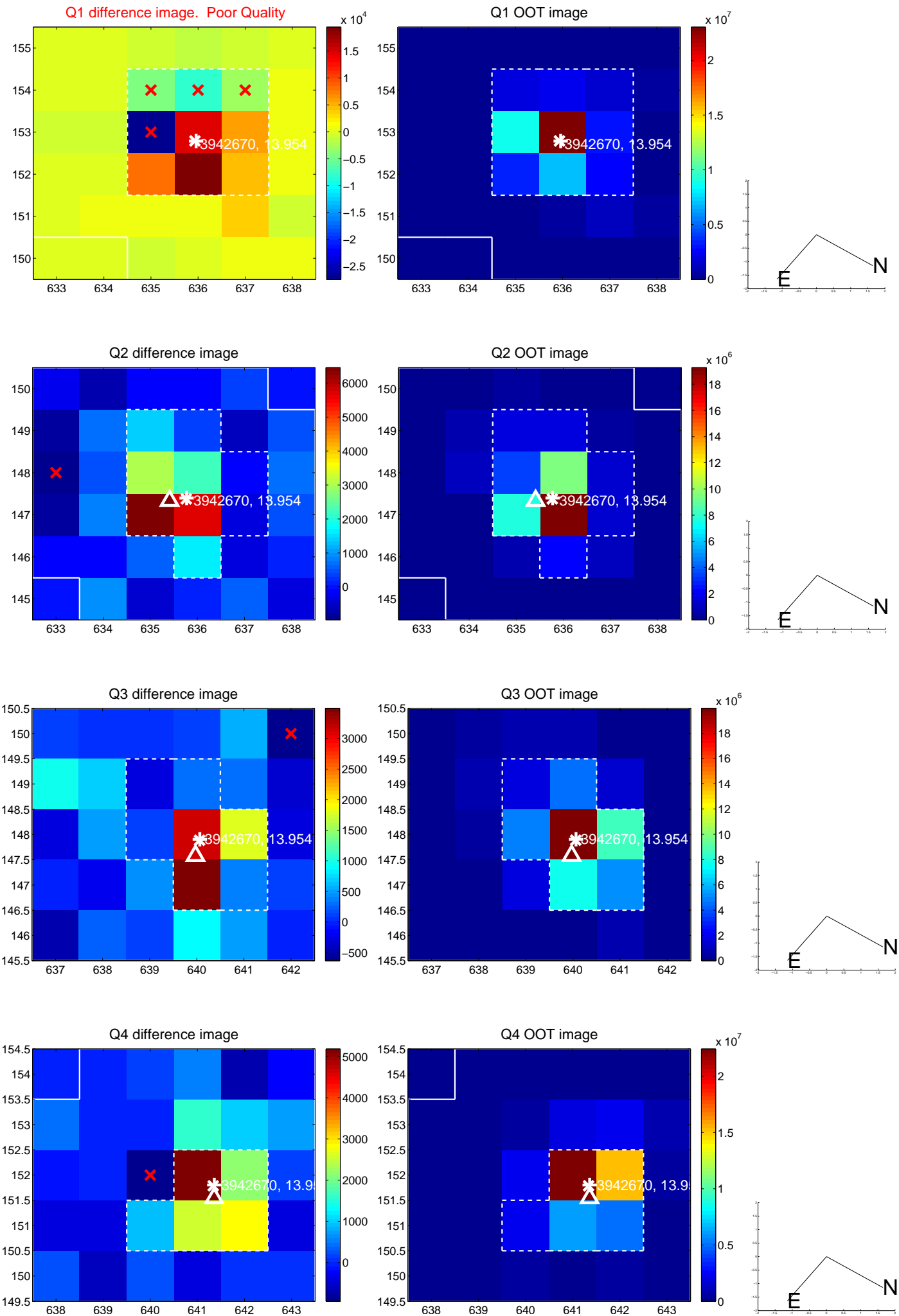
The direct PRF centroid is offset from the target star catalog position by about 0.17 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.355 \pm 0.239$	1.48	$0.169 \pm 0.294$	$0.312 \pm 0.186$
PRF-fit source offset from KIC position	$0.330 \pm 0.197$	1.68	$0.078 \pm 0.318$	$0.321 \pm 0.171$
photometric centroid source offset	$1.64 \pm 0.62$	2.65	$0.44 \pm 0.59$	$1.58 \pm 0.62$

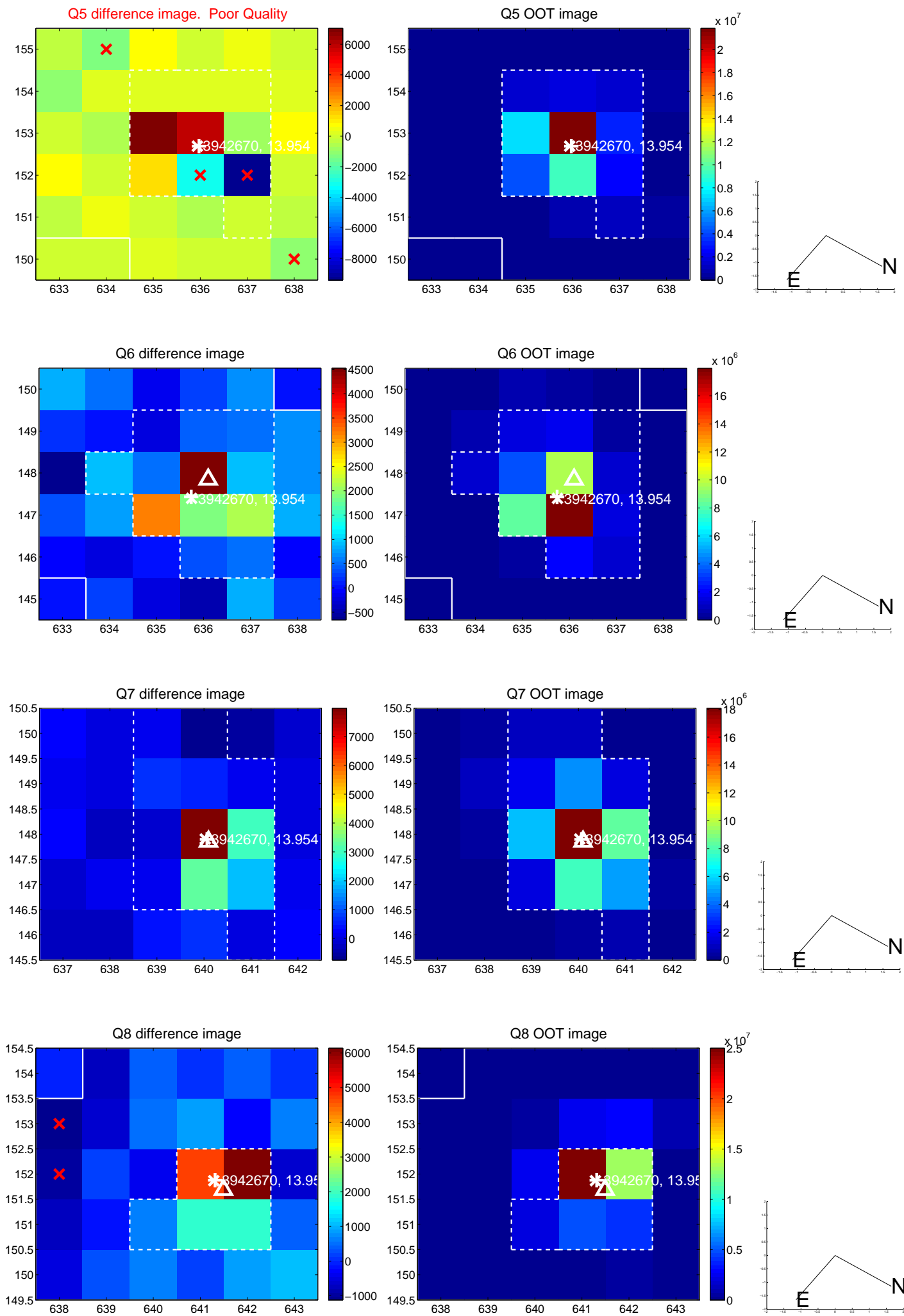


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

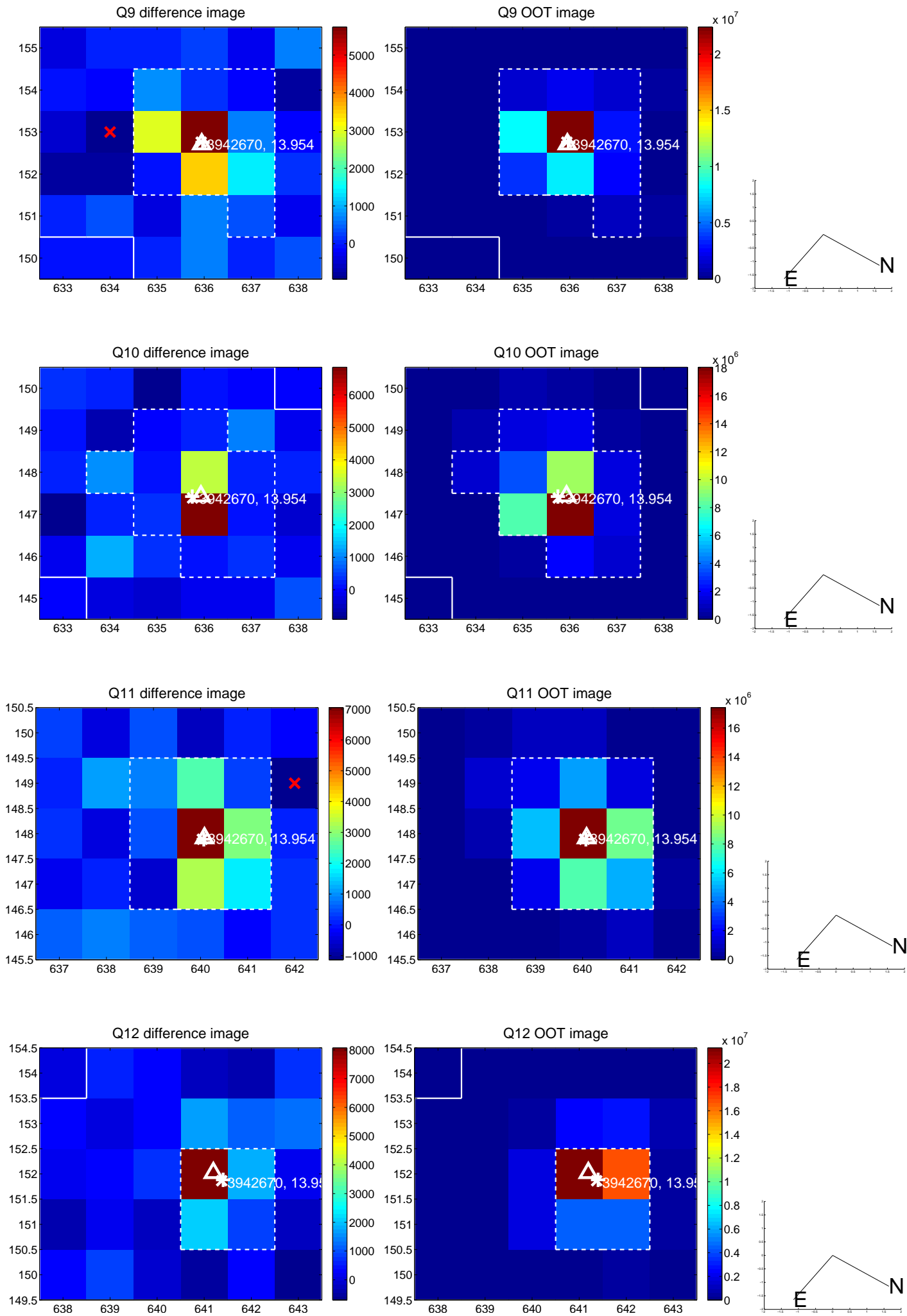
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



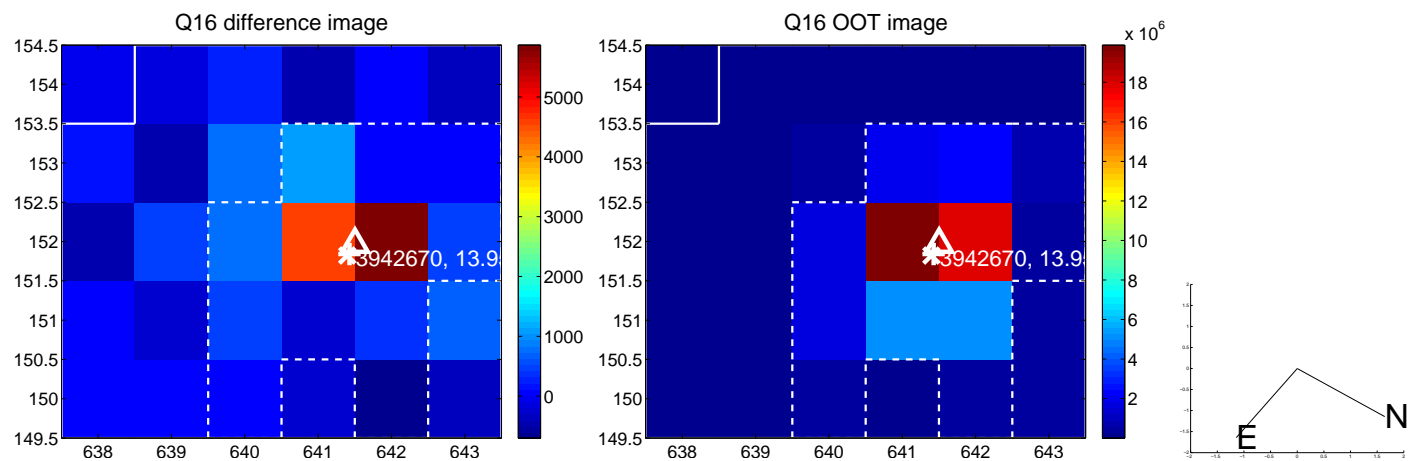
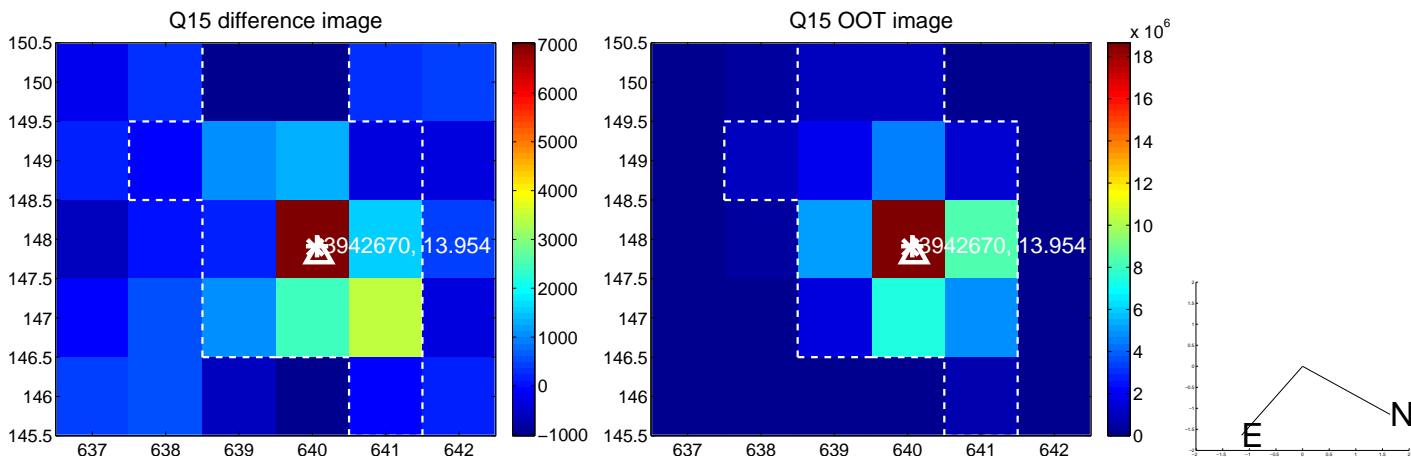
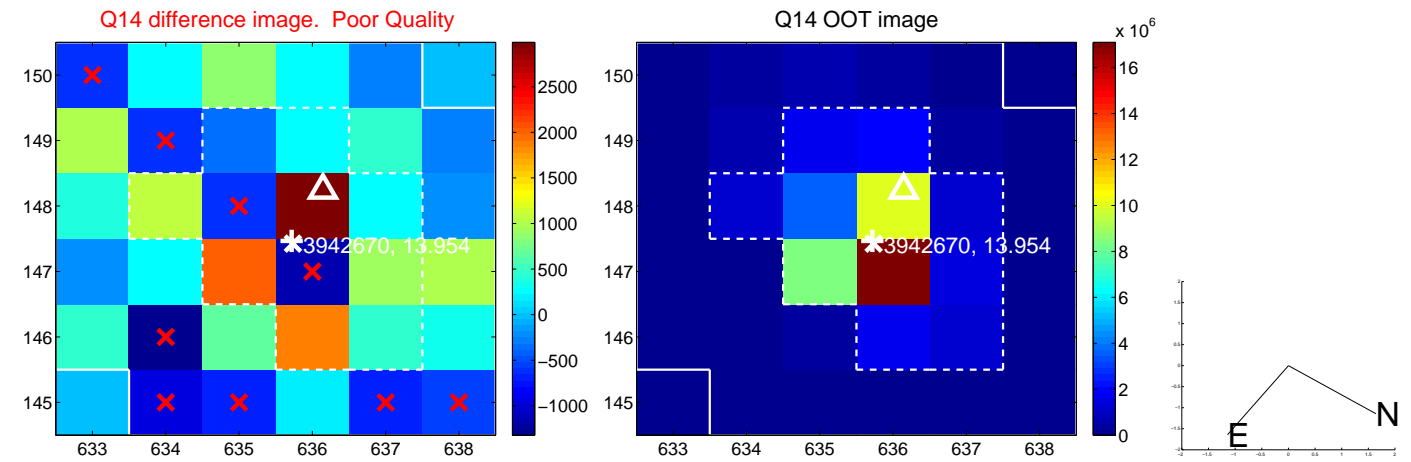
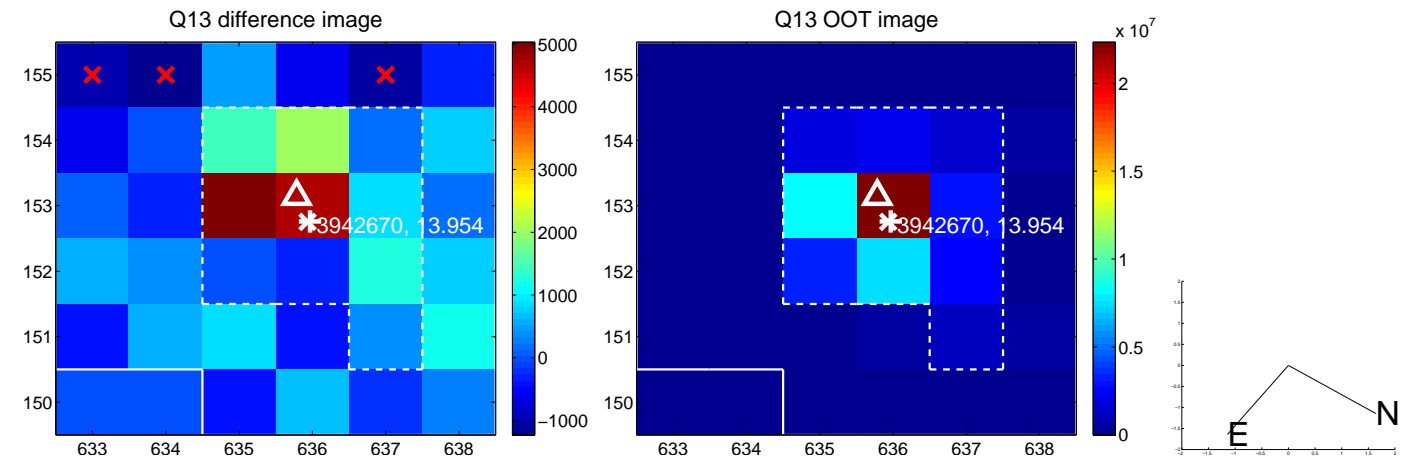
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

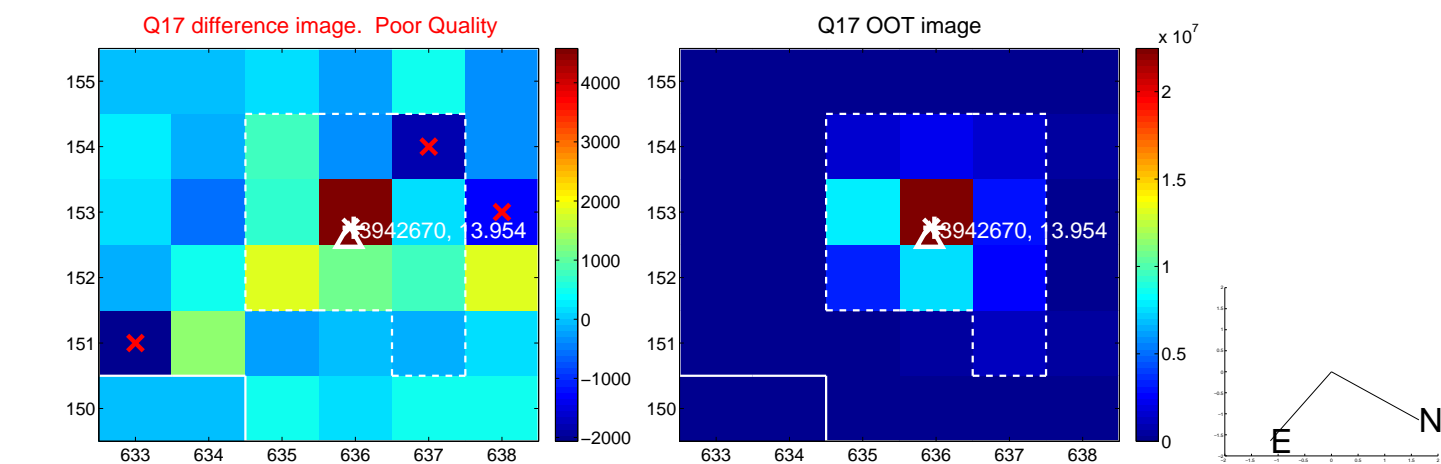


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

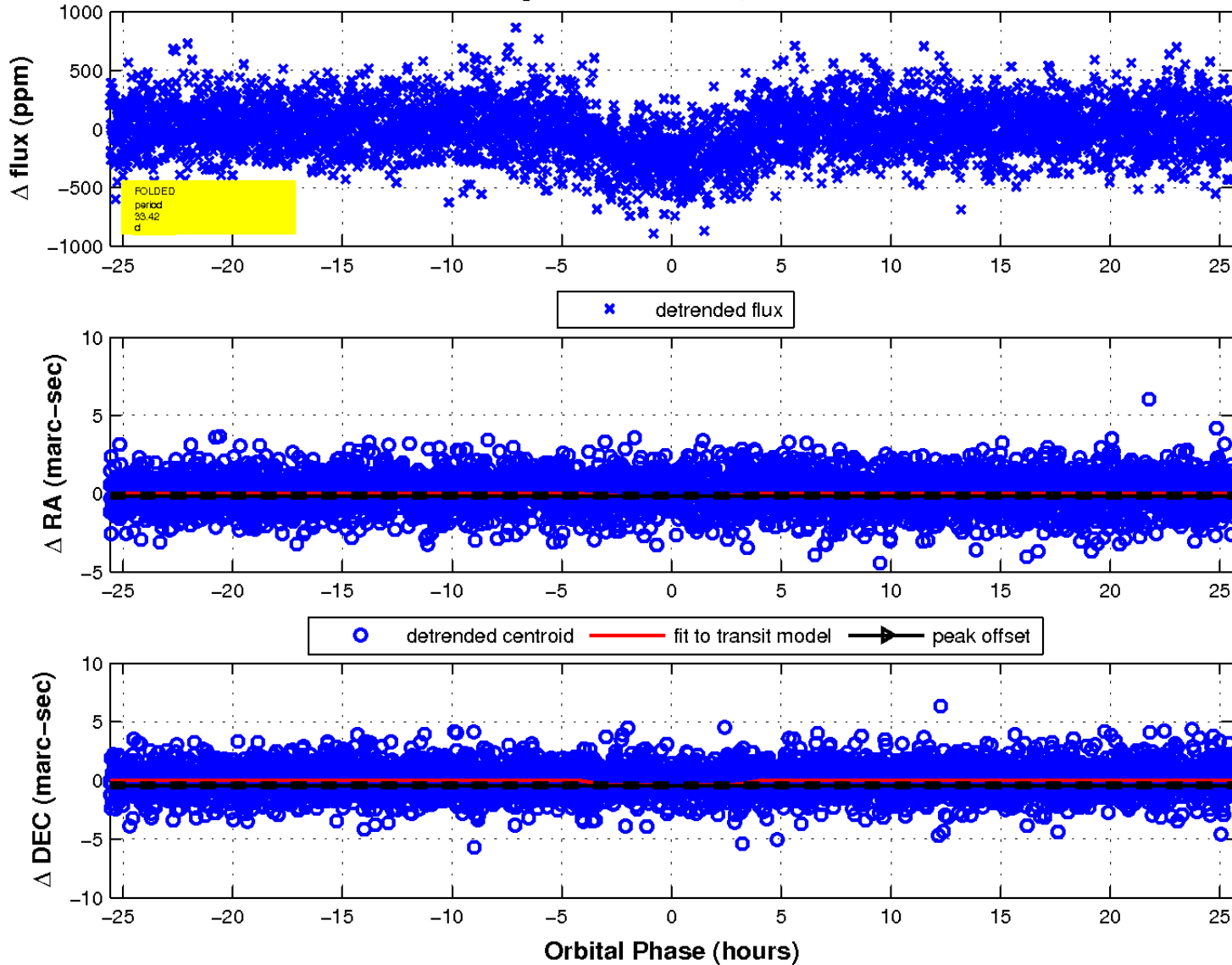




white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

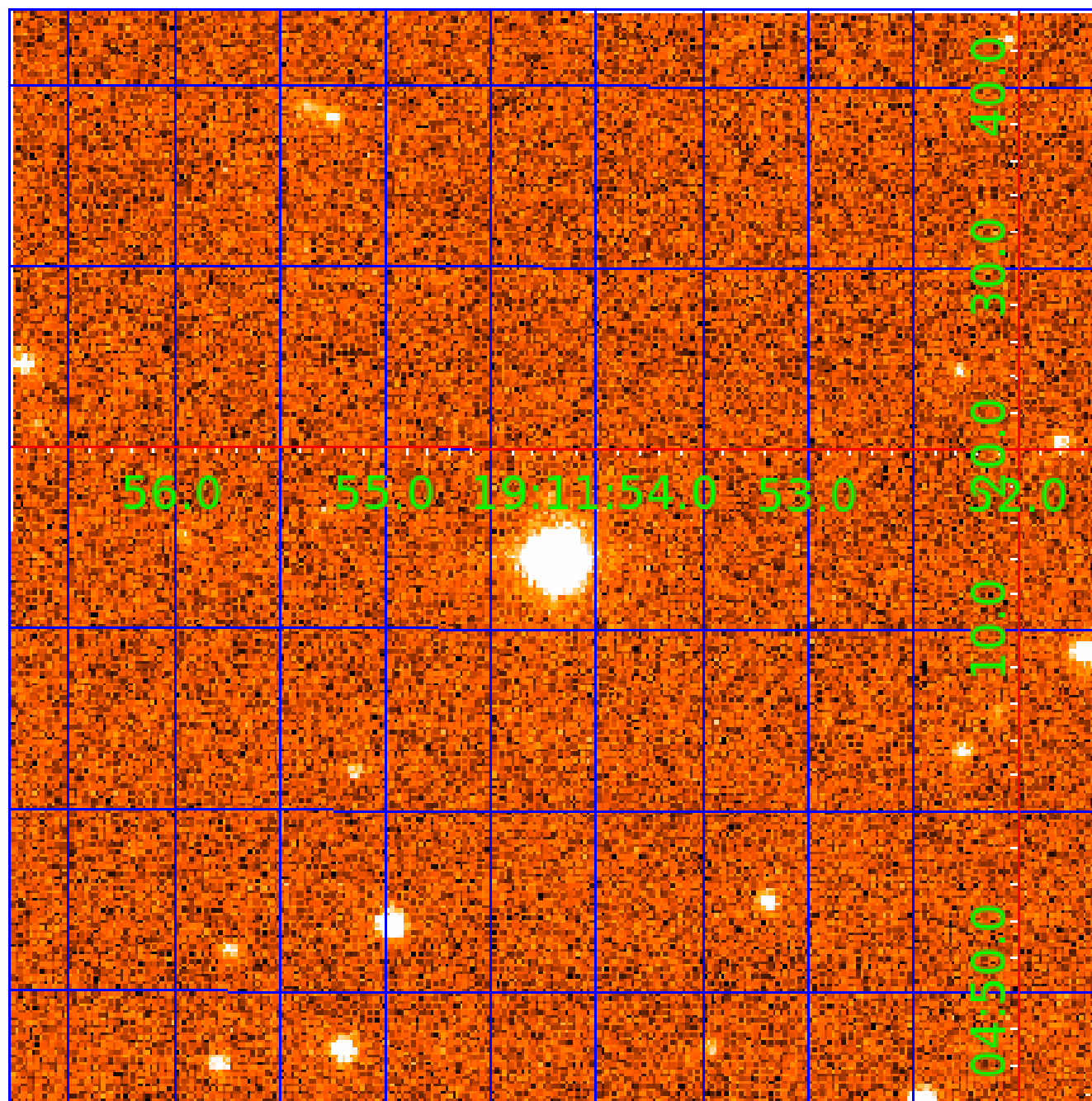


fluxWeightedCentroids, Planet 1 of 2



# UKIRT Image

Declination



# KIC 003942670

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
003942670-01	OBS	0392.01	33.416152	137.919943	263.8	8.533	23.2	24.1	1.42	6007	2.88	53.27
003942670-02	OBS	0392.02	12.610791	138.188933	93.5	4.574	10.2	11.3	1.42	6007	1.63	195.31

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
003942670-01	OBS	PC	1.00	0	0	0	0	NO_COMMENT
003942670-02	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.

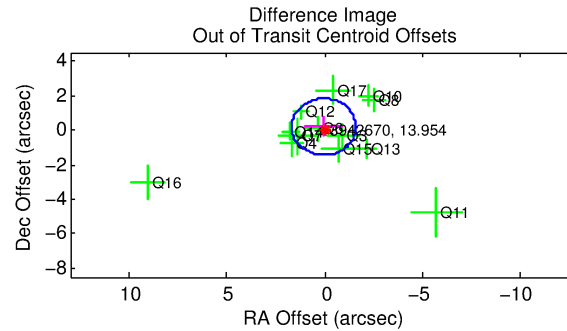
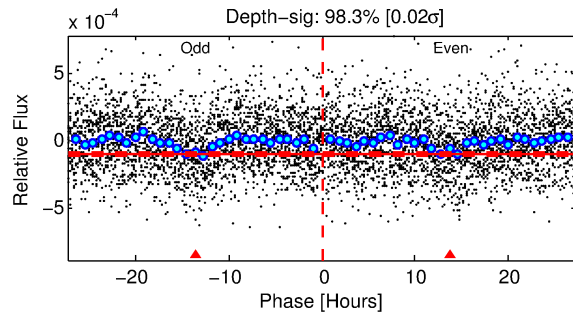
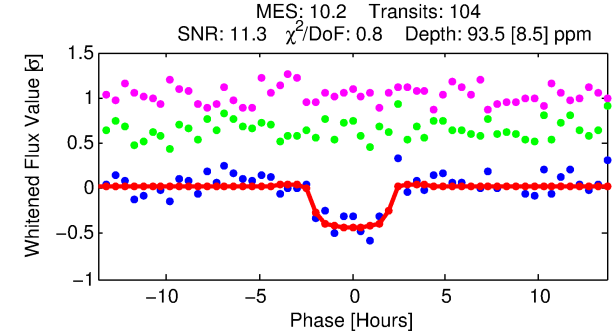
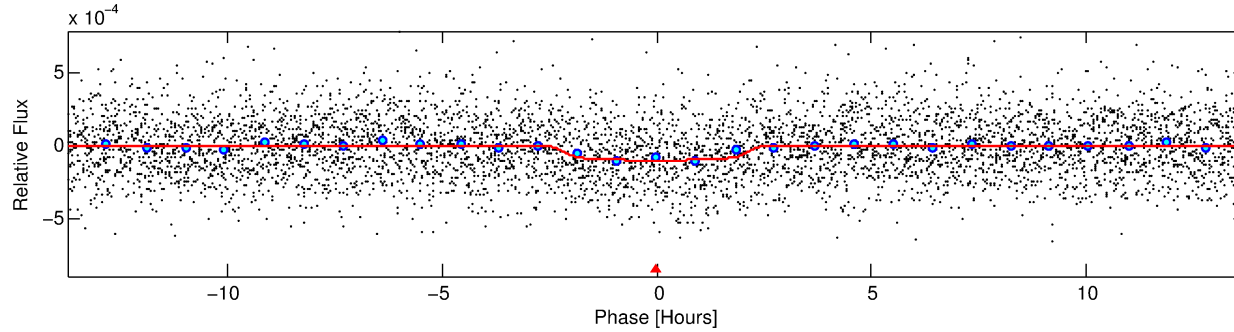
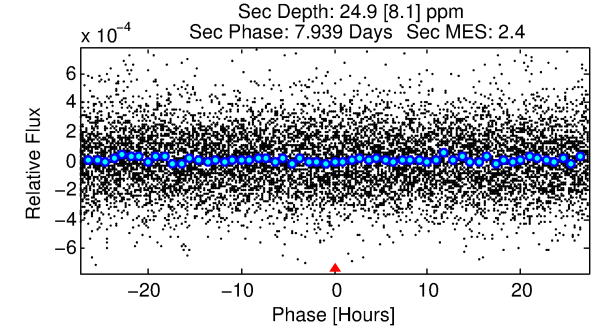
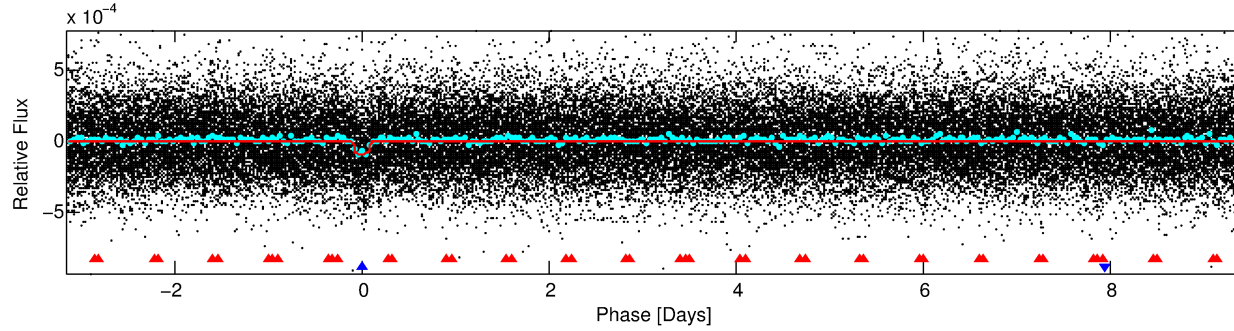
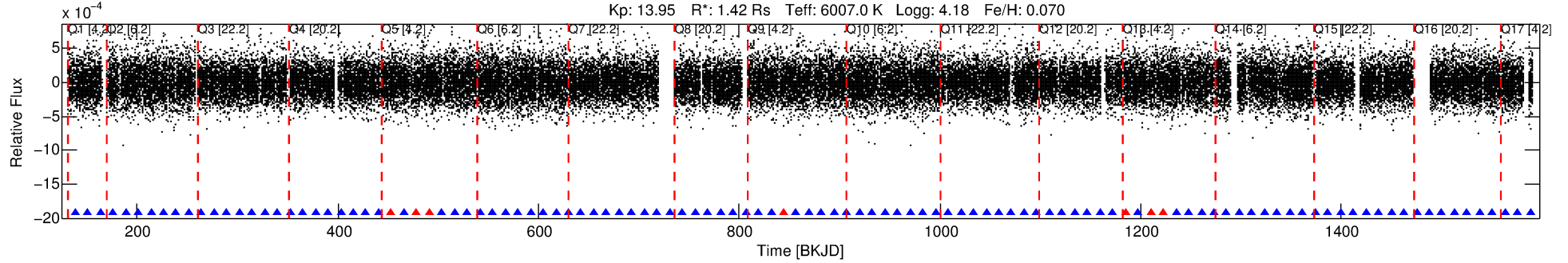
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 003942670-02

No Significant Match Found

# DV One-Page Summary

KIC: 3942670 Candidate: 2 of 2 Period: 12.611 d  
KOI: K00392.02 Name: Kepler-147b Corr: 0.972



## DV Fit Results:

Period = 12.61079 [0.00013] d  
Epoch = 138.1889 [0.0079] BKJD  
Rp/R\* = 0.0105 [0.0042]  
a/R\* = 9.53 [19.10]  
b = 0.90 [0.41]  
Seff = 195.31 [56.50]  
Teff = 953 [69] K  
Rp = 1.63 [0.71] Re  
a = 0.1097 [0.0192] AU  
Ag = 62.01 [55.98] [1.09σ]  
Teffp = 4136 [892] K [3.56σ]

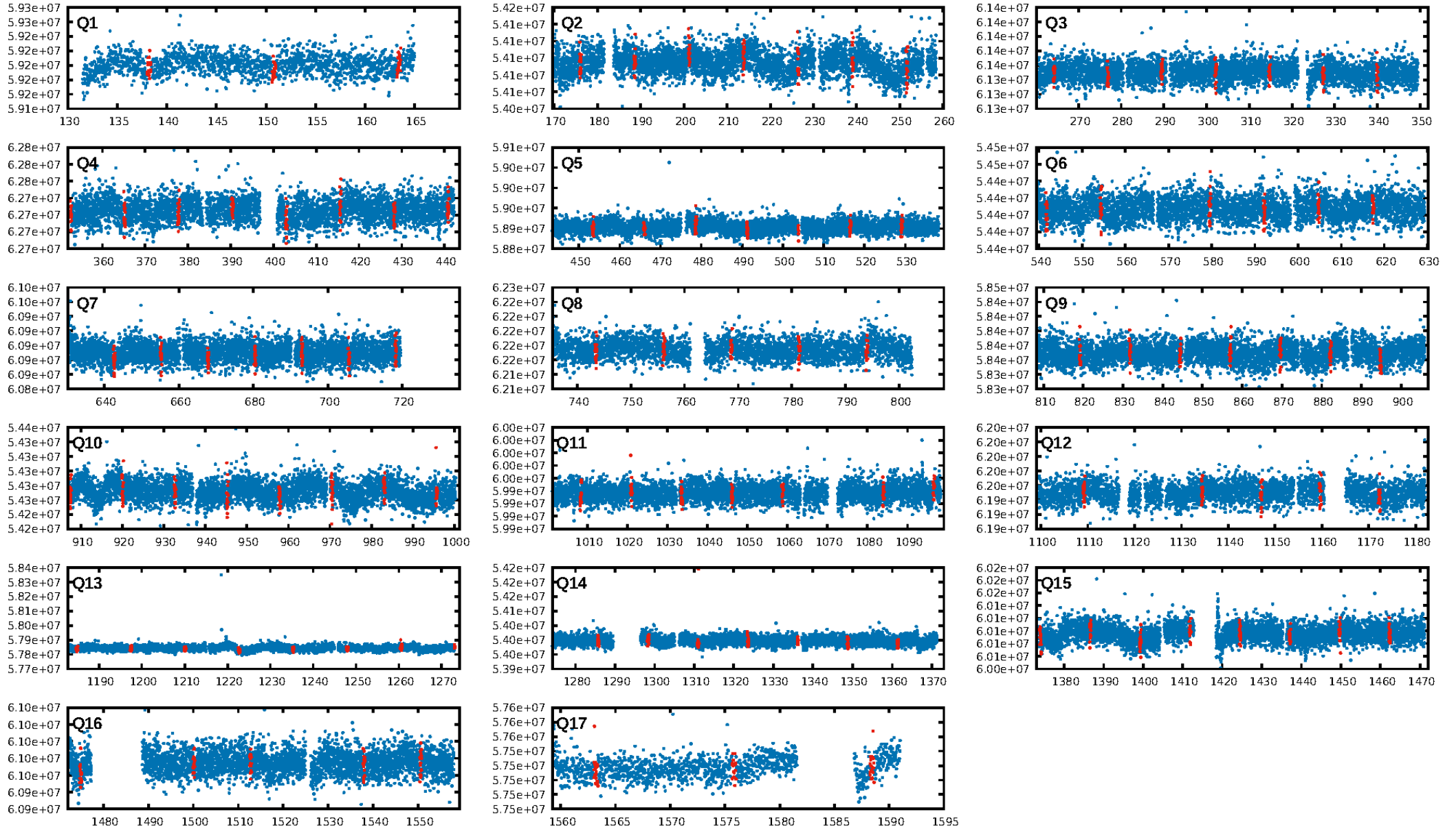
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [51.57σ]  
ModelChiSquare2-sig: 96.9%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 4.07e-23  
RollingBand-fgt: 0.93 [92/99]  
GhostDiagnostic-chr: 3.623  
Centroid-sig: 78.4%  
Centroid-so: 0.490 arcsec [0.38σ]  
OotOffset-rm: 0.198 arcsec [0.36σ]  
KicOffset-rm: 0.209 arcsec [0.40σ]  
OotOffset-st: 3/4/4/2 [13]  
KicOffset-st: 3/4/4/2 [13]  
DiffImageQuality-fgm: 0.54 [7/13]  
DiffImageOverlap-fno: 1.00 [17/17]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 20:36:03 Z

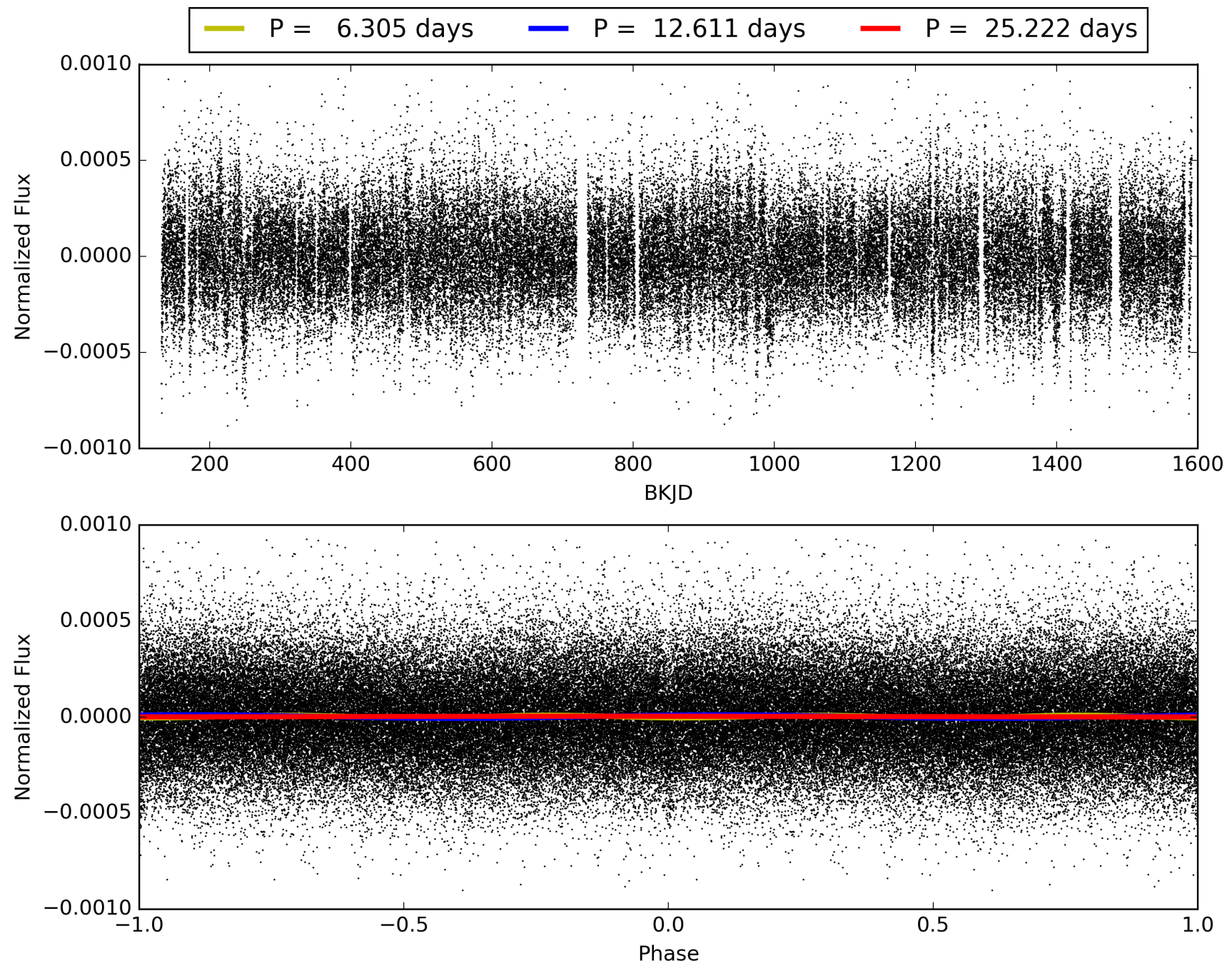
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 003942670-02, PDC Light Curves



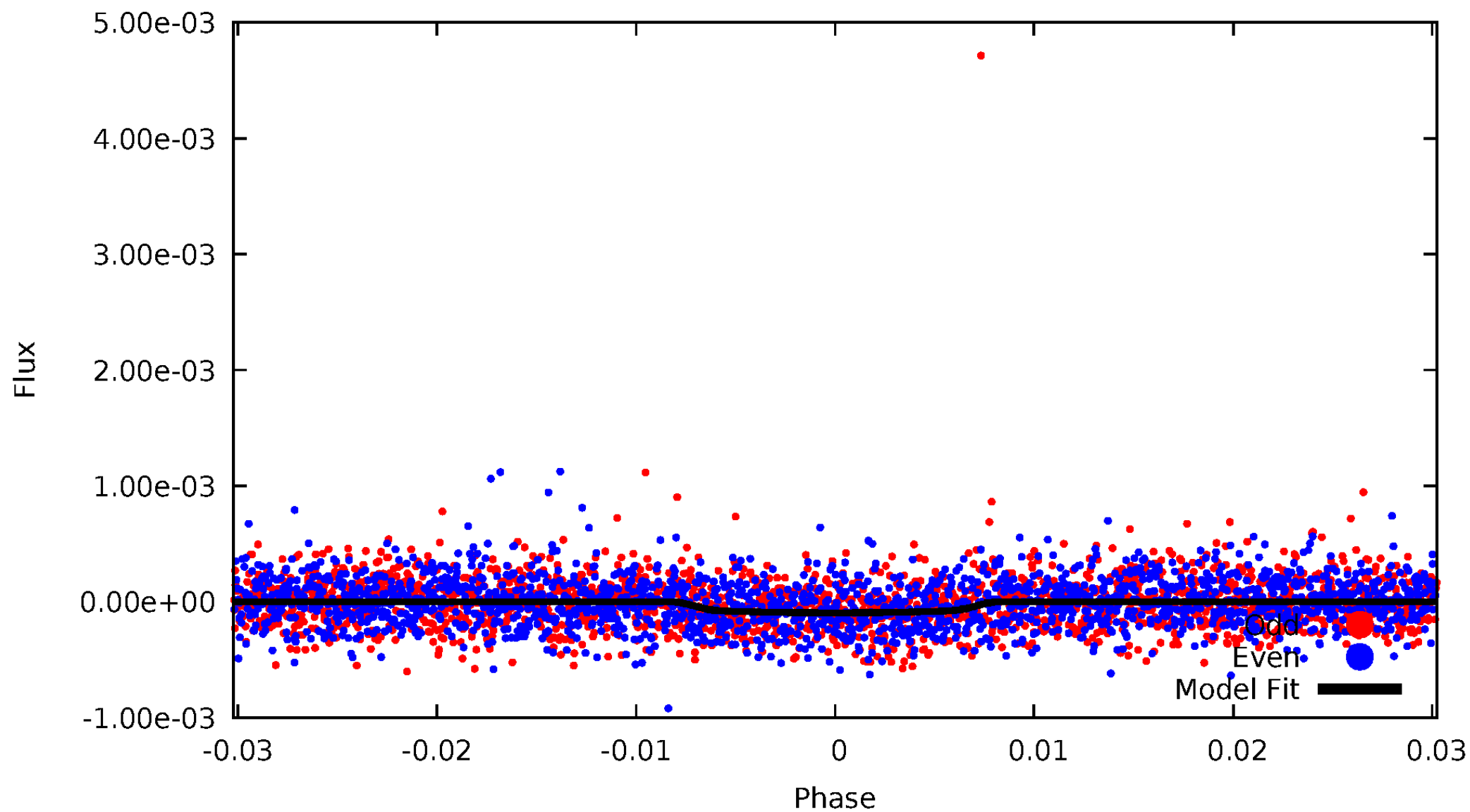


TCE 003942670-02



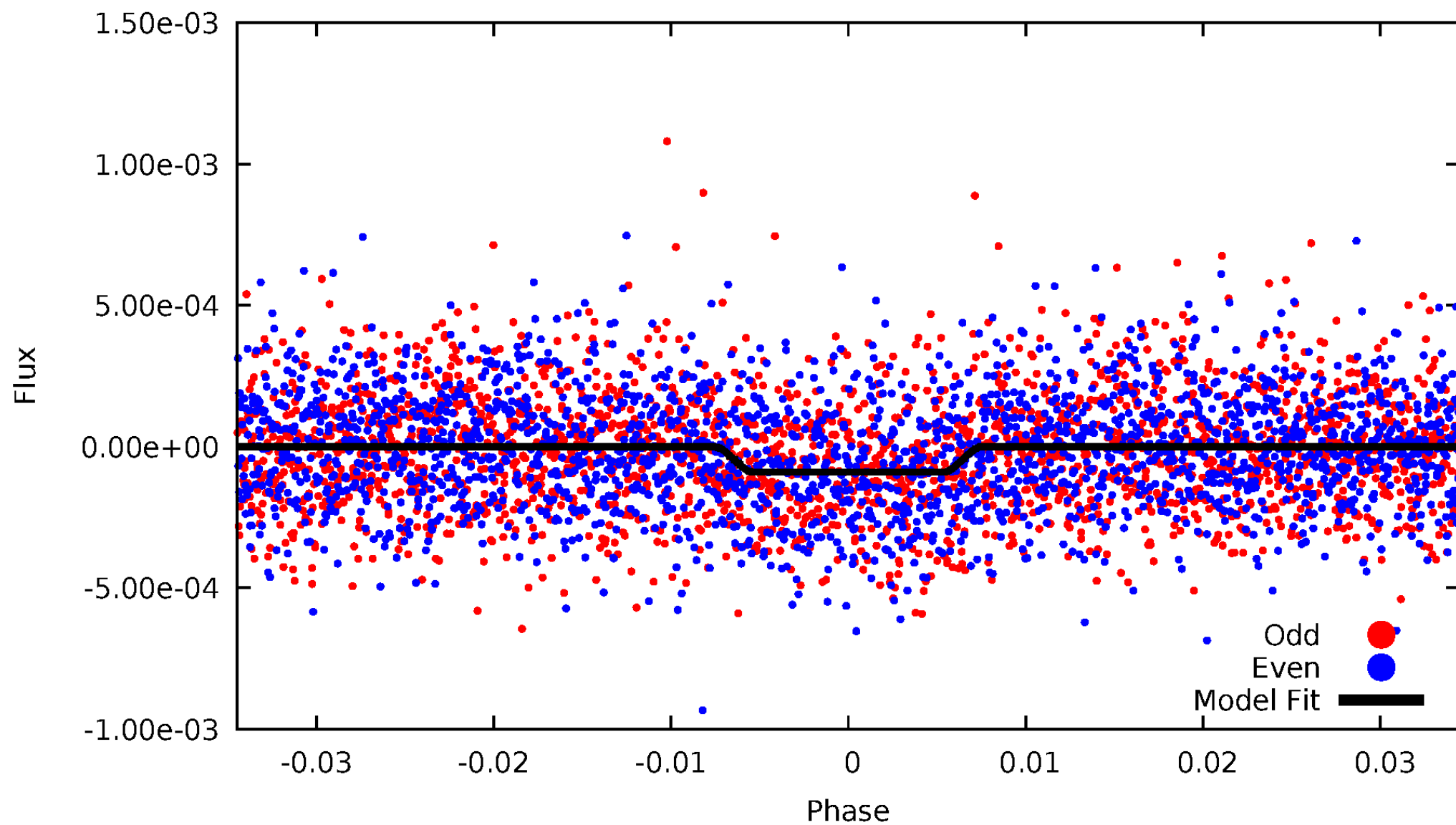
# DV Odd/Even

TCE 003942670-02



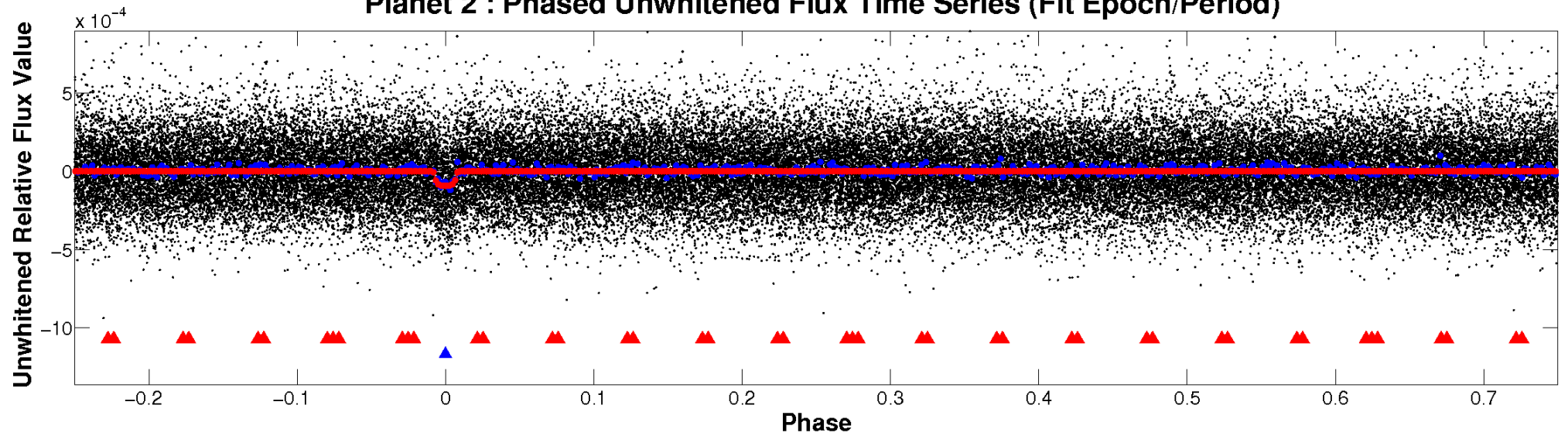
# ALT Odd/Even

TCE 003942670-02

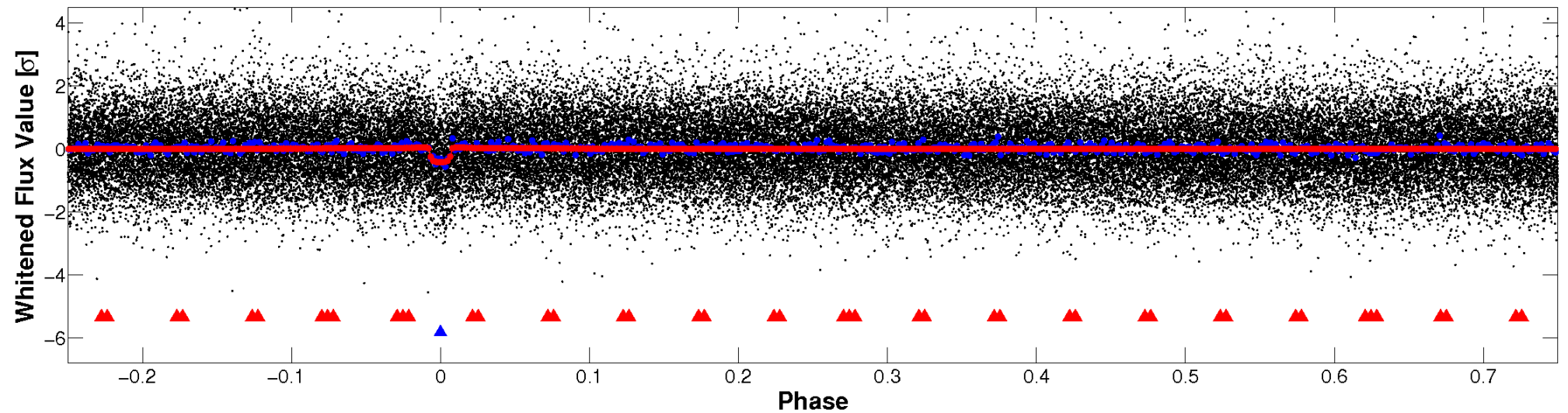


# Non-Whitened Vs. Whitened Light Curve

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



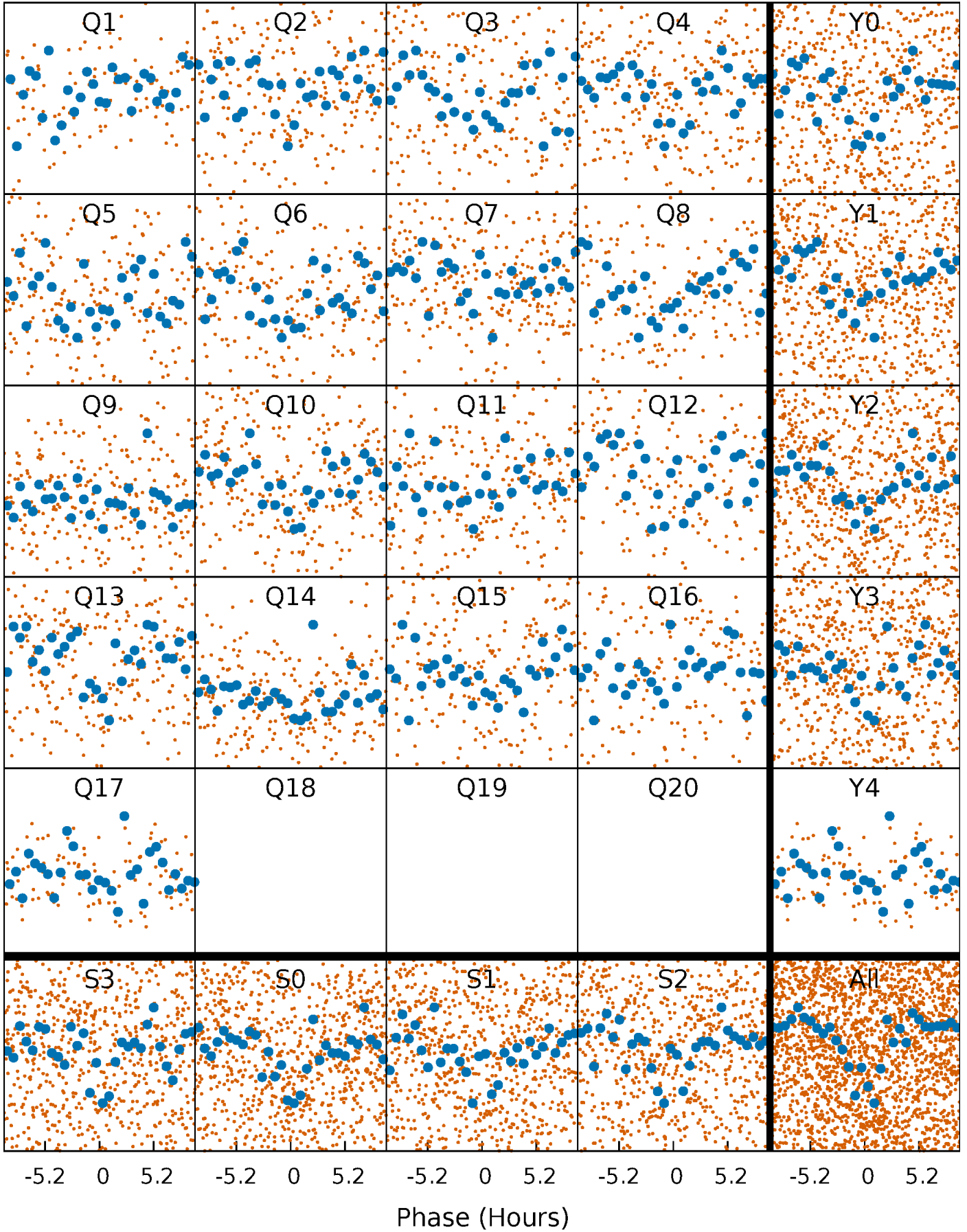
## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)





# PDC Quarter-Phased Transit Curves

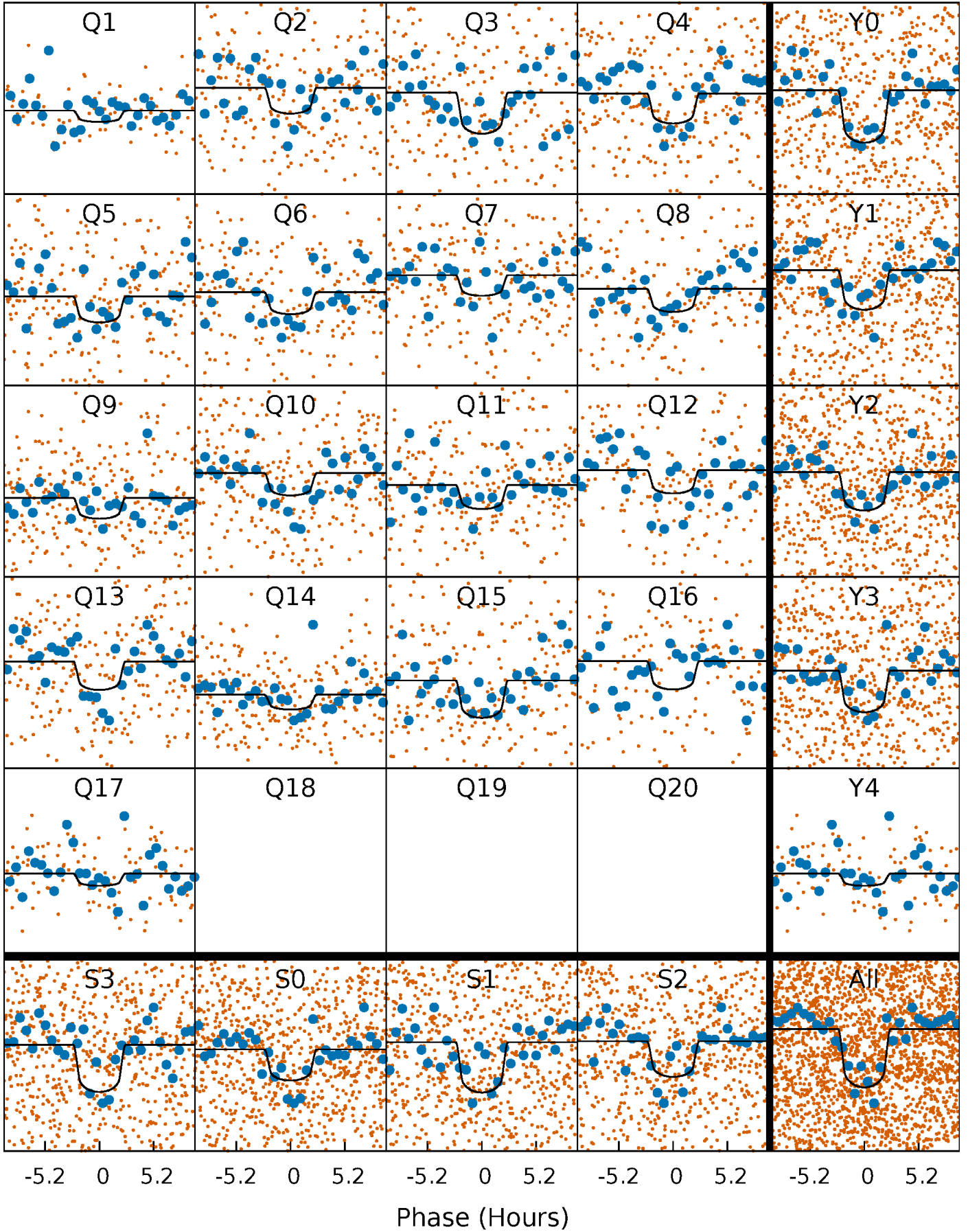
TCE 003942670-02 P= 12.610791 Days  $T_0=138.188933$  (BKJD)





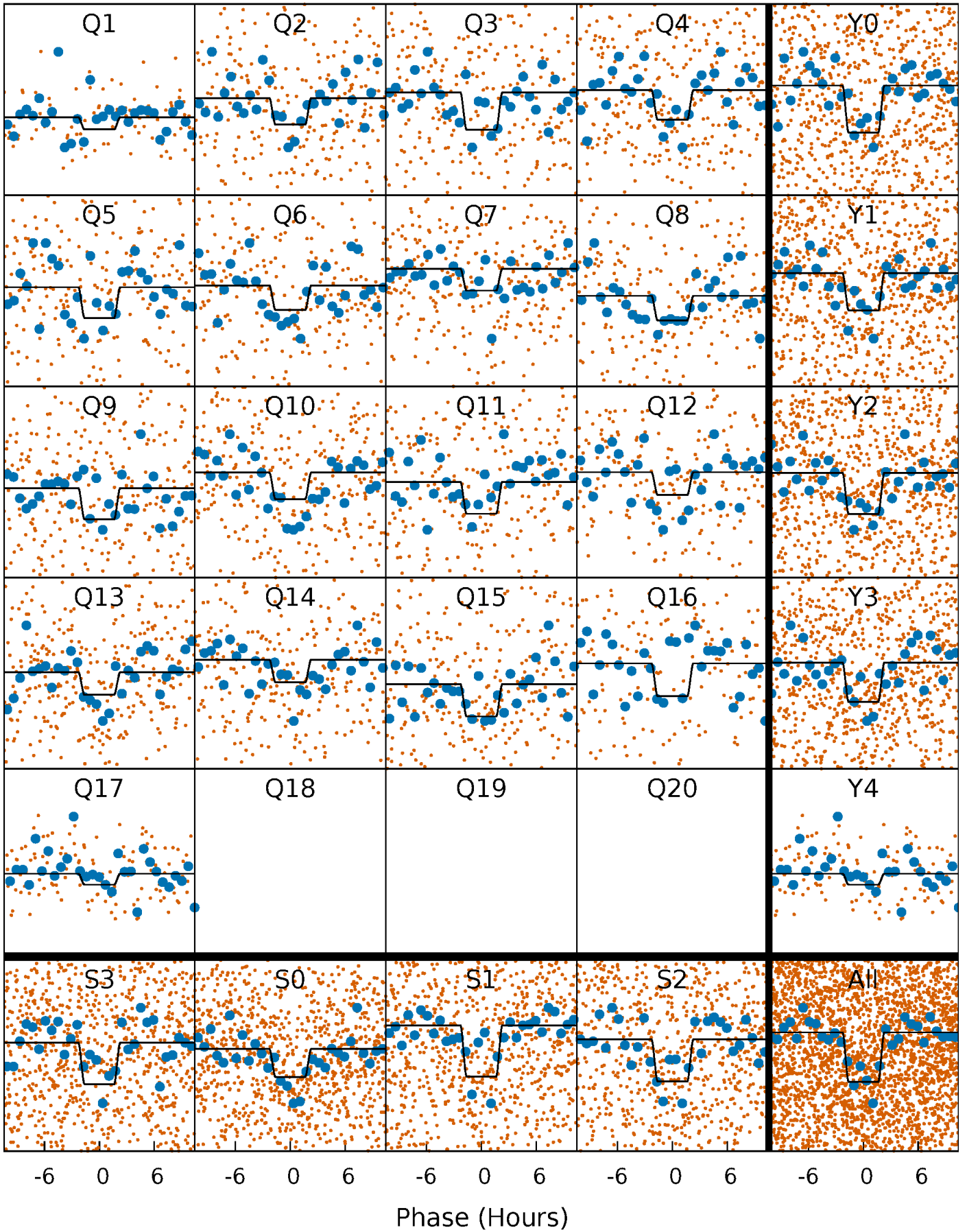
# DV Quarter-Phased Transit Curves

TCE 003942670-02   P= 12.610791 Days    $T_0=138.188933$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

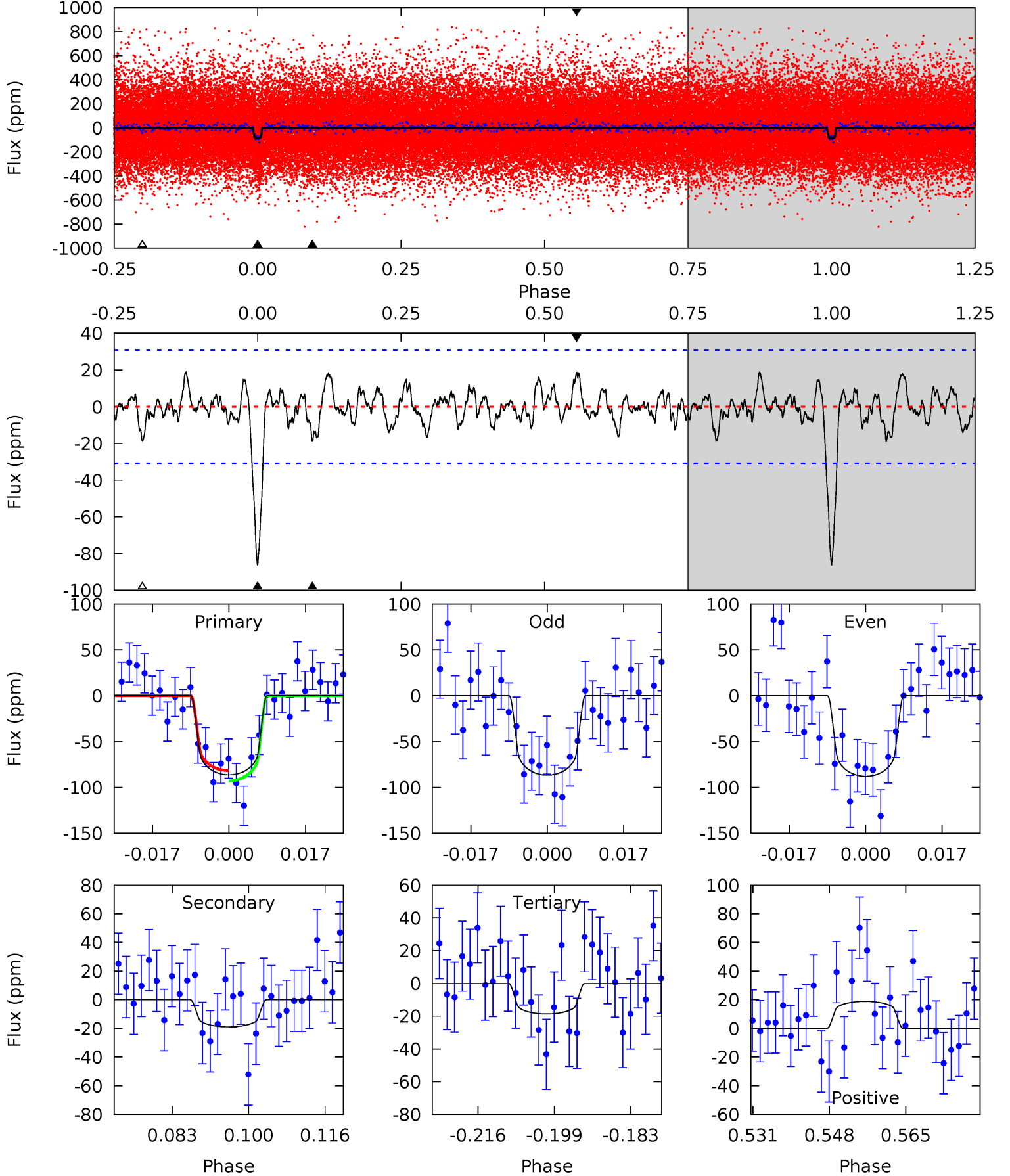
TCE 003942670-02 P= 12.611019 Days  $T_0=138.171854$  (BKJD)



# DV Model-Shift Uniqueness Test

003942670-02, P = 12.610791 Days, E = 125.578142 Days

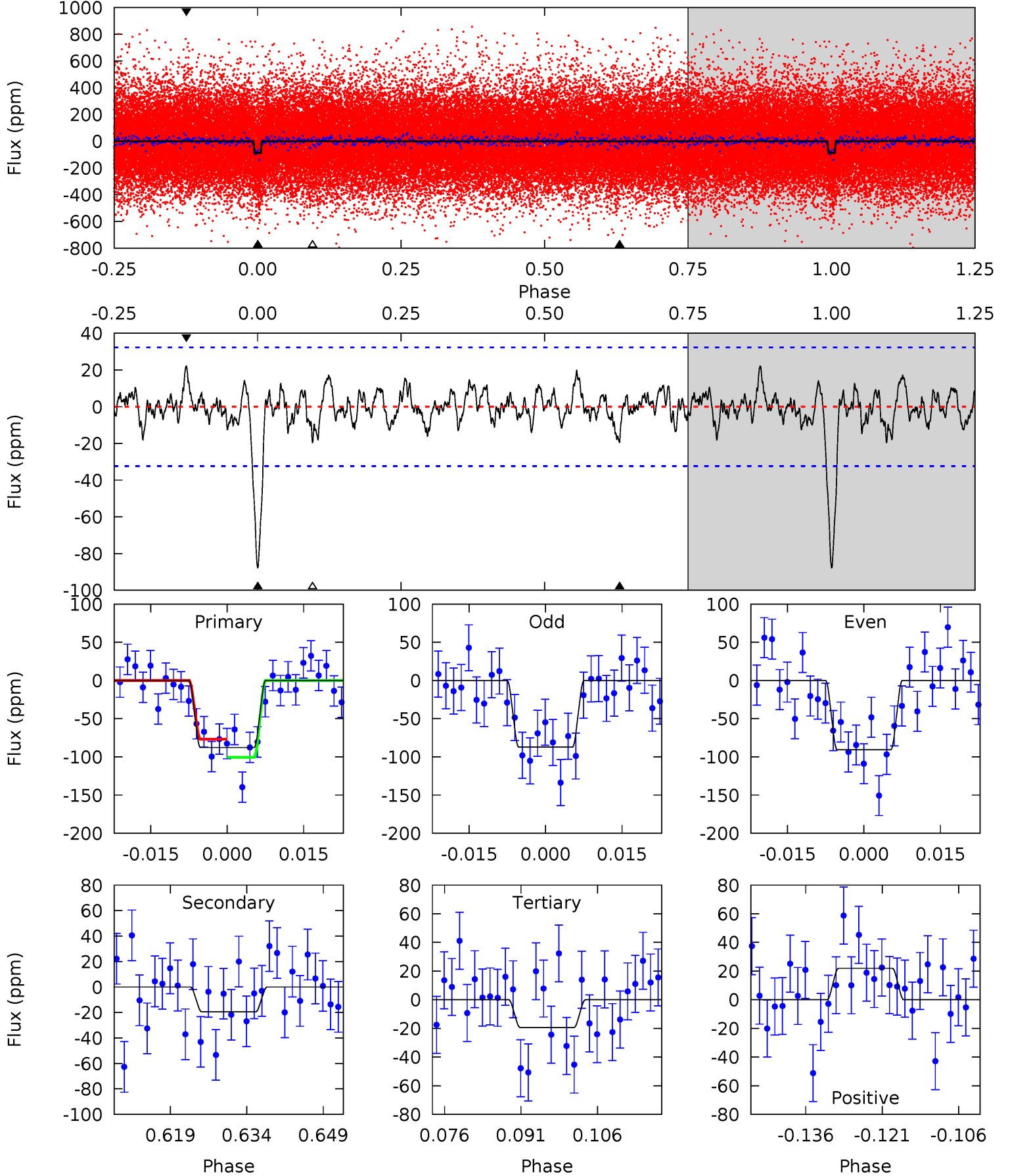
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
13.8	3.02	2.98	3.01	4.93	2.40	1.10	10.8	10.8	0.04	0.01	0.10	1.06	0.18	0.90



# Alt Model-Shift Uniqueness Test

003942670-02,  $P = 12.611019$  Days,  $E = 125.560835$  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
13.4	2.99	2.97	3.36	4.95	2.43	1.05	10.5	10.1	0.02	-0.37	0.26	1.08	0.20	1.81



### Stellar Parameters For KIC 003942670

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6007^{+122}_{-122}$	$4.178^{+0.162}_{-0.108}$	$0.070^{+0.150}_{-0.150}$	$1.420^{+0.263}_{-0.263}$	$1.108^{+0.111}_{-0.083}$	$0.545^{+0.455}_{-0.181}$
	+2%/-2%	+4%/-3%	+214%/-214%	+19%/-19%	+10%/-7%	+83%/-33%
Source	SPE58	SPE58	SPE58	DSEP		

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

### Secondary Eclipse Parameters for KIC 003942670-02 / KOI 0392.02

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-19 \pm 6$	$1.60^{+0.67}_{-0.65}$	$1327^{+66}_{-72}$	$4101^{+897}_{-524}$	$48^{+85}_{-27}$
Alt.	$-20 \pm 7$	$1.47^{+0.63}_{-0.64}$	$1323^{+68}_{-66}$	$4301^{+1140}_{-616}$	$59^{+131}_{-34}$

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

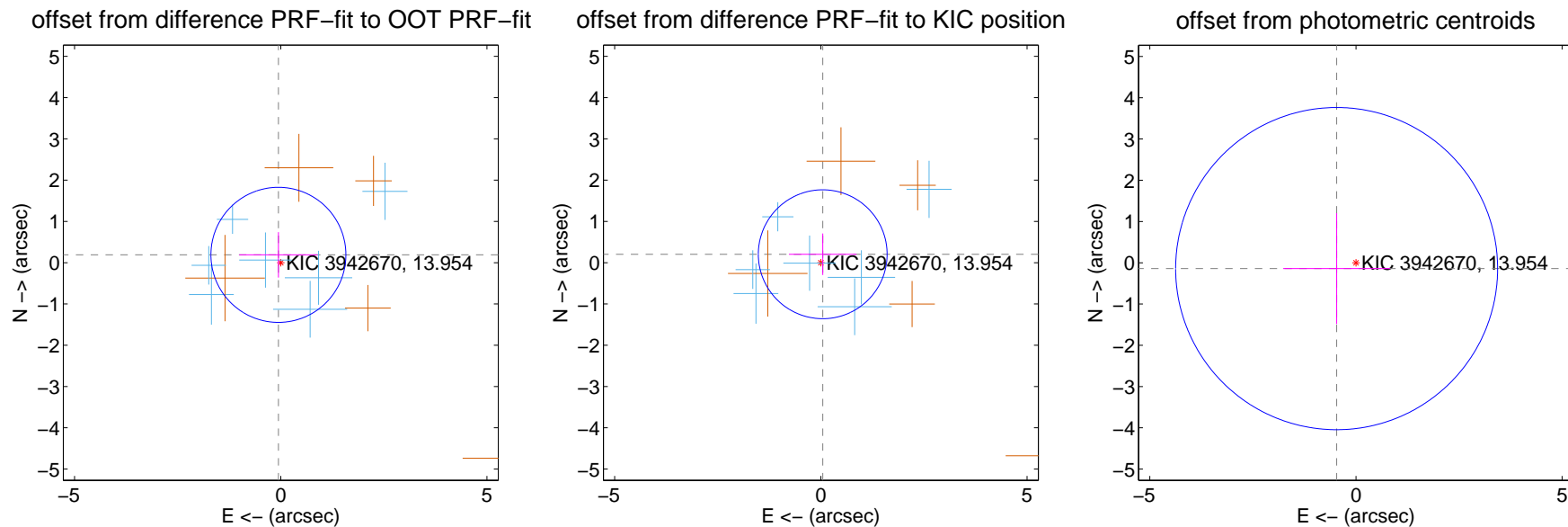
## DV Centroid Data

Supplemental centroid analysis for 003942670-02. Kepler magnitude: 13.95. Transit SNR 11.26

There are 7 quarters with good PRF difference image offsets

The direct PRF centroid is offset from the target star catalog position by about 0.17 arcsec

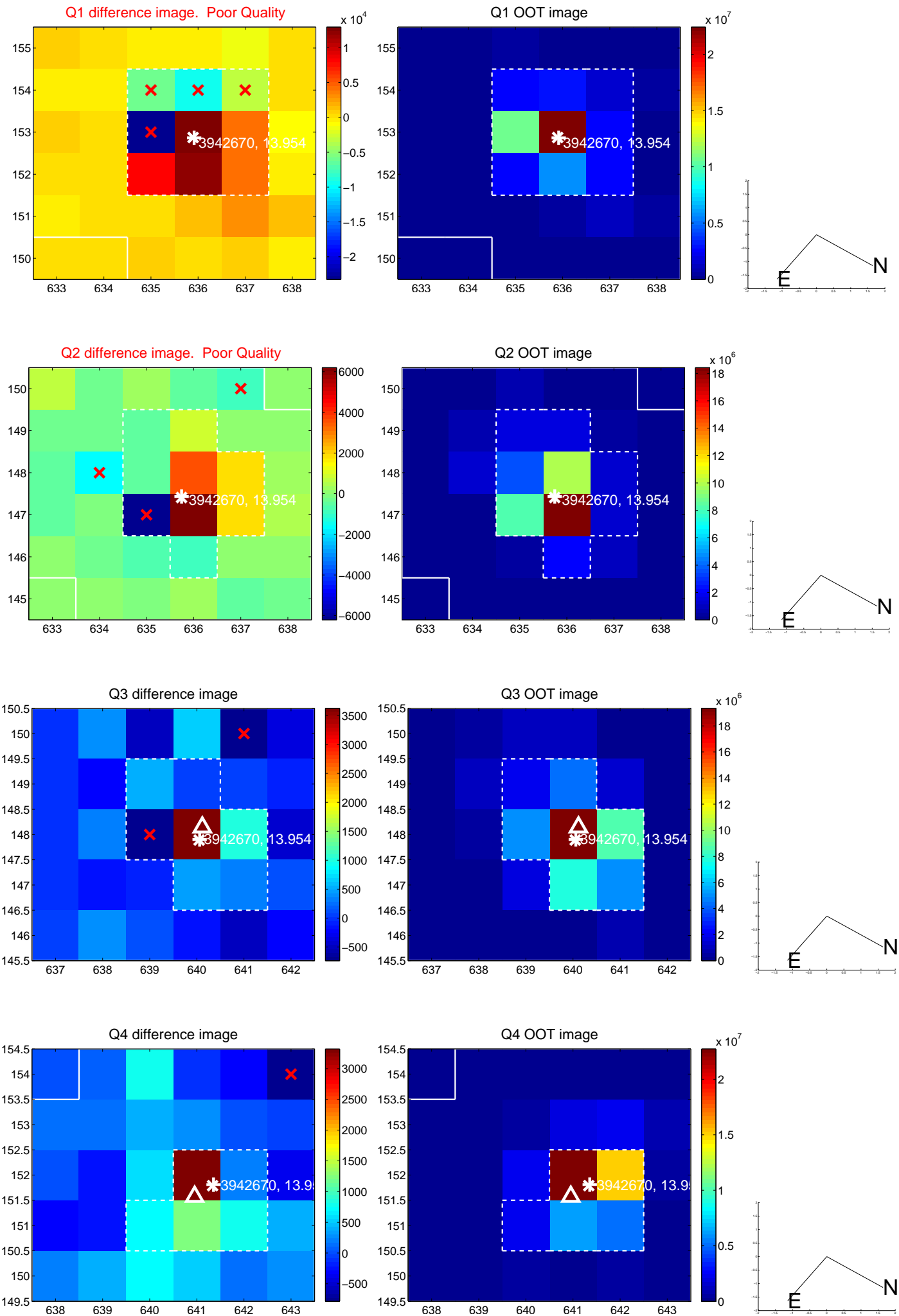
	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.198 \pm 0.545$	0.36	$0.057 \pm 0.950$	$0.190 \pm 0.551$
PRF-fit source offset from KIC position	$0.209 \pm 0.520$	0.40	$-0.045 \pm 0.820$	$0.205 \pm 0.502$
photometric centroid source offset	$0.49 \pm 1.30$	0.38	$0.47 \pm 1.30$	$-0.14 \pm 1.35$



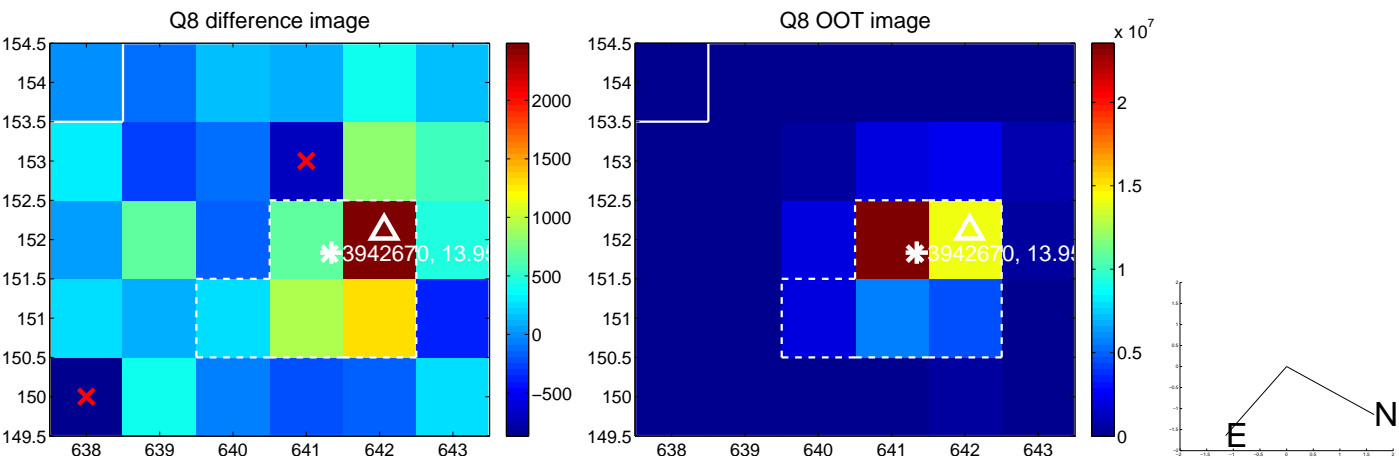
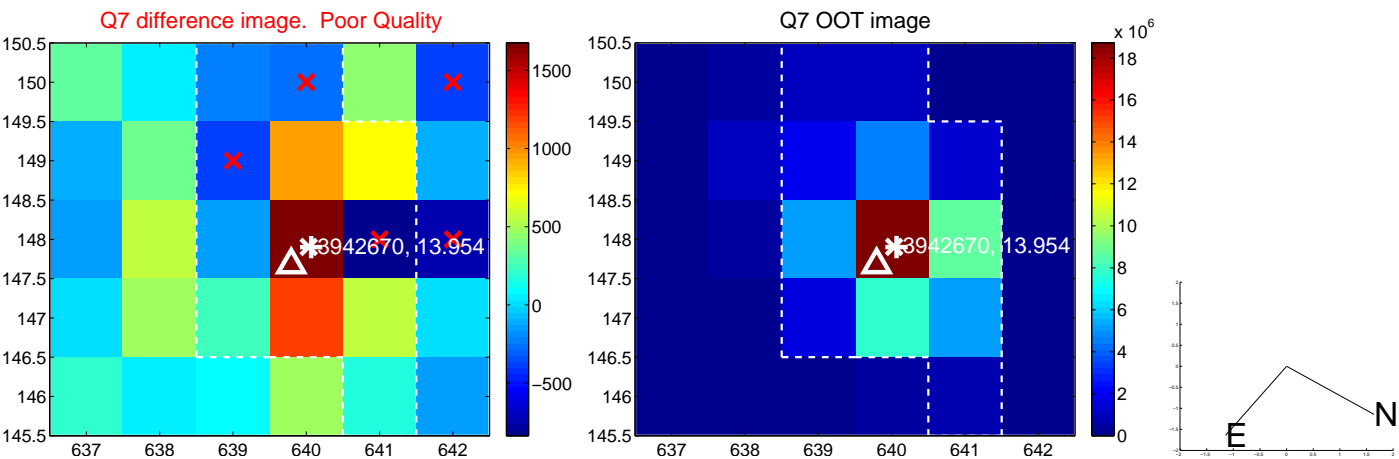
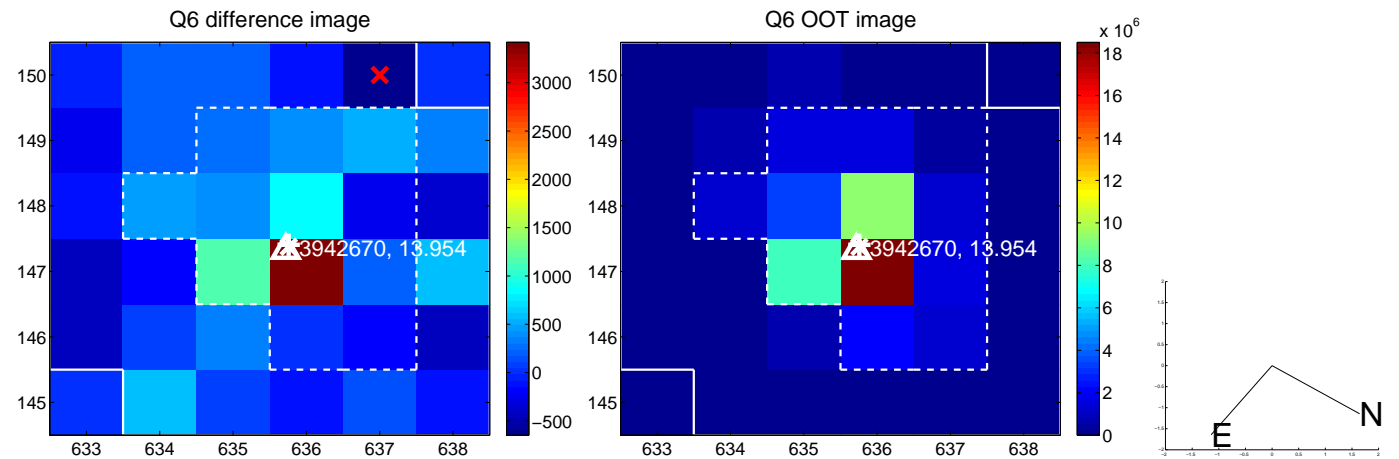
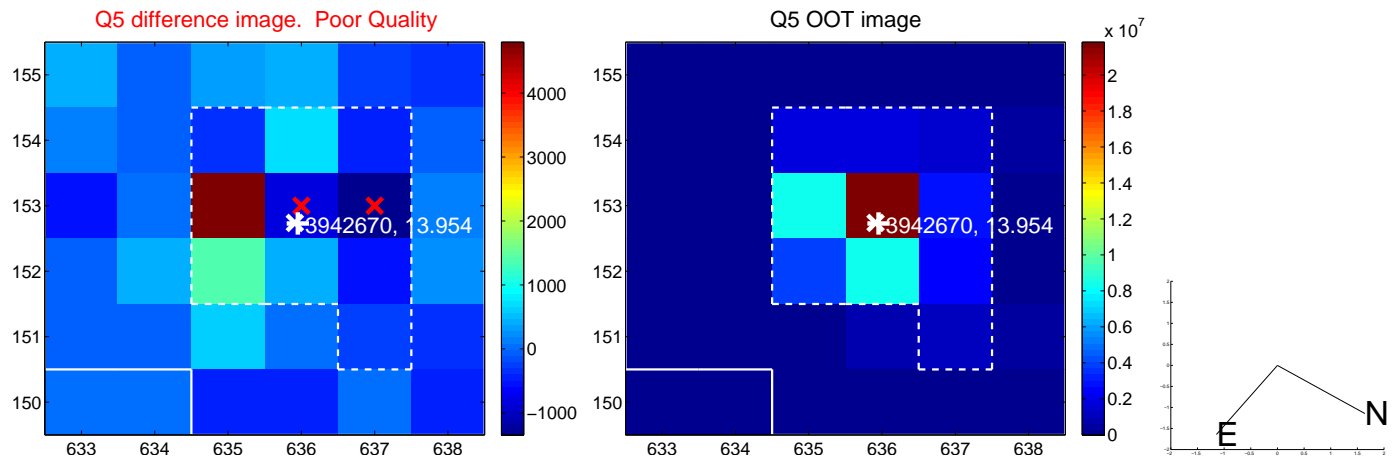
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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



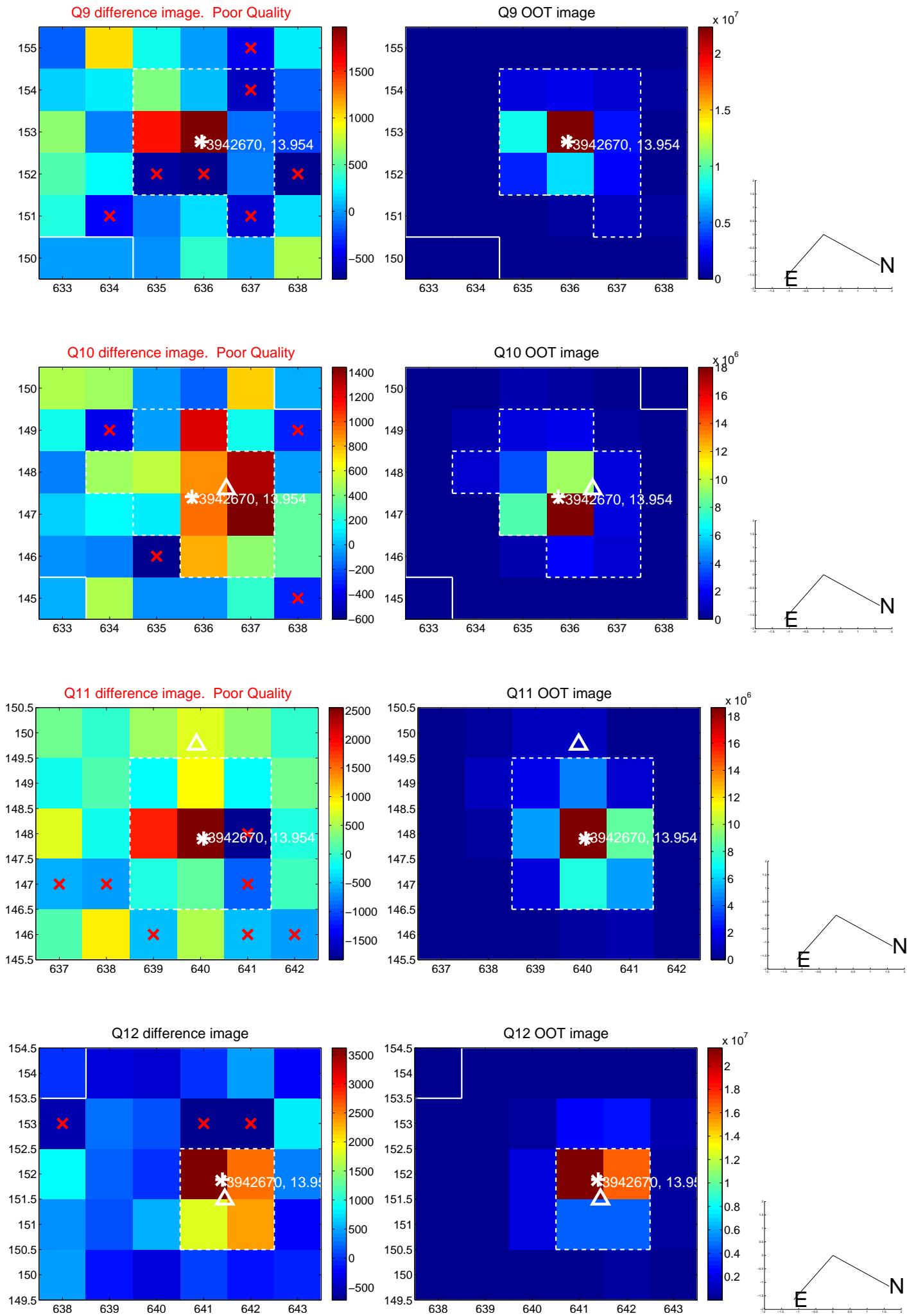
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



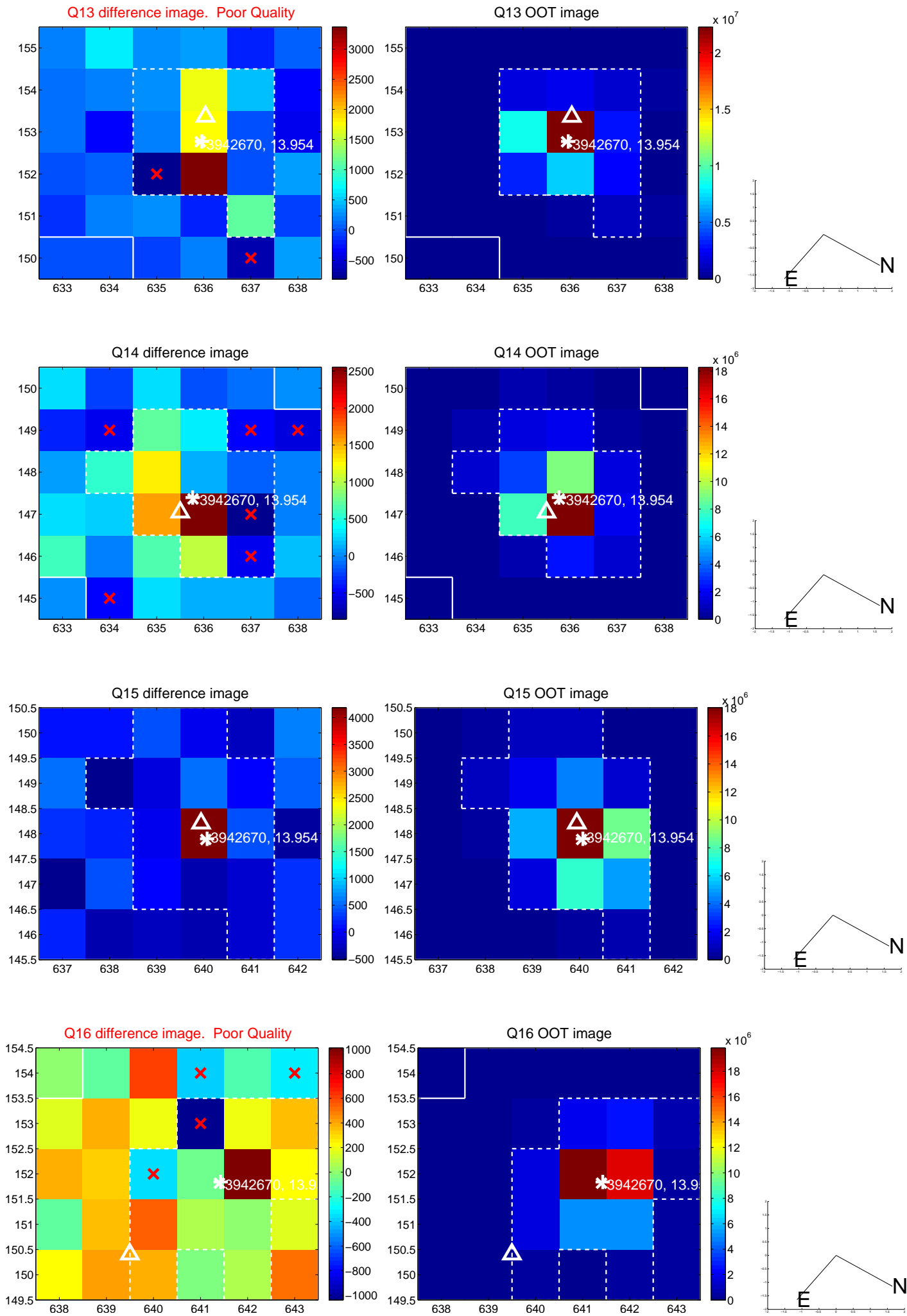
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



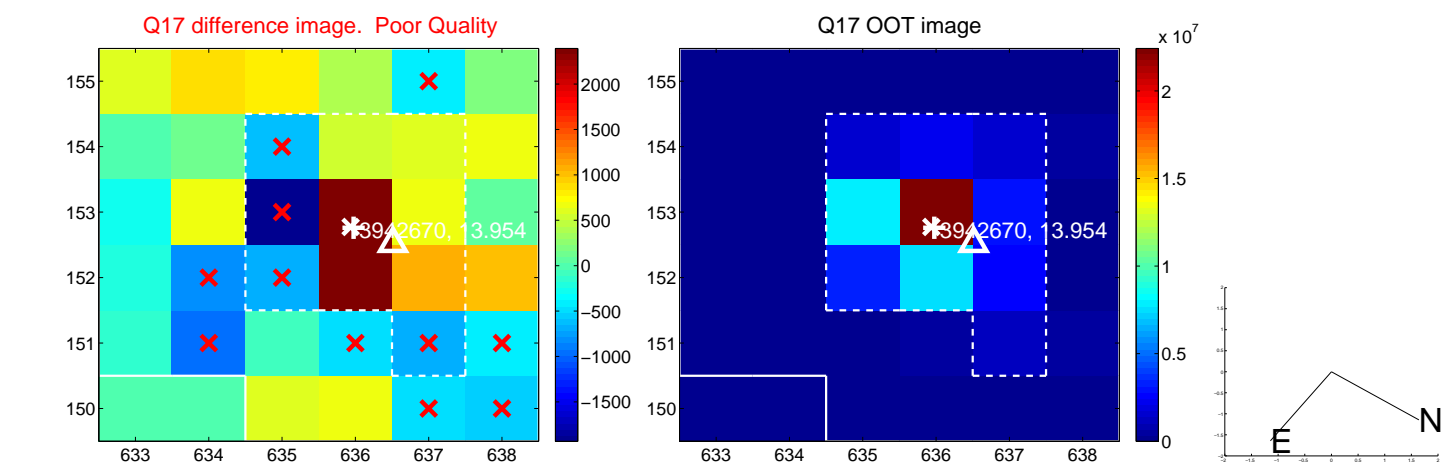
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



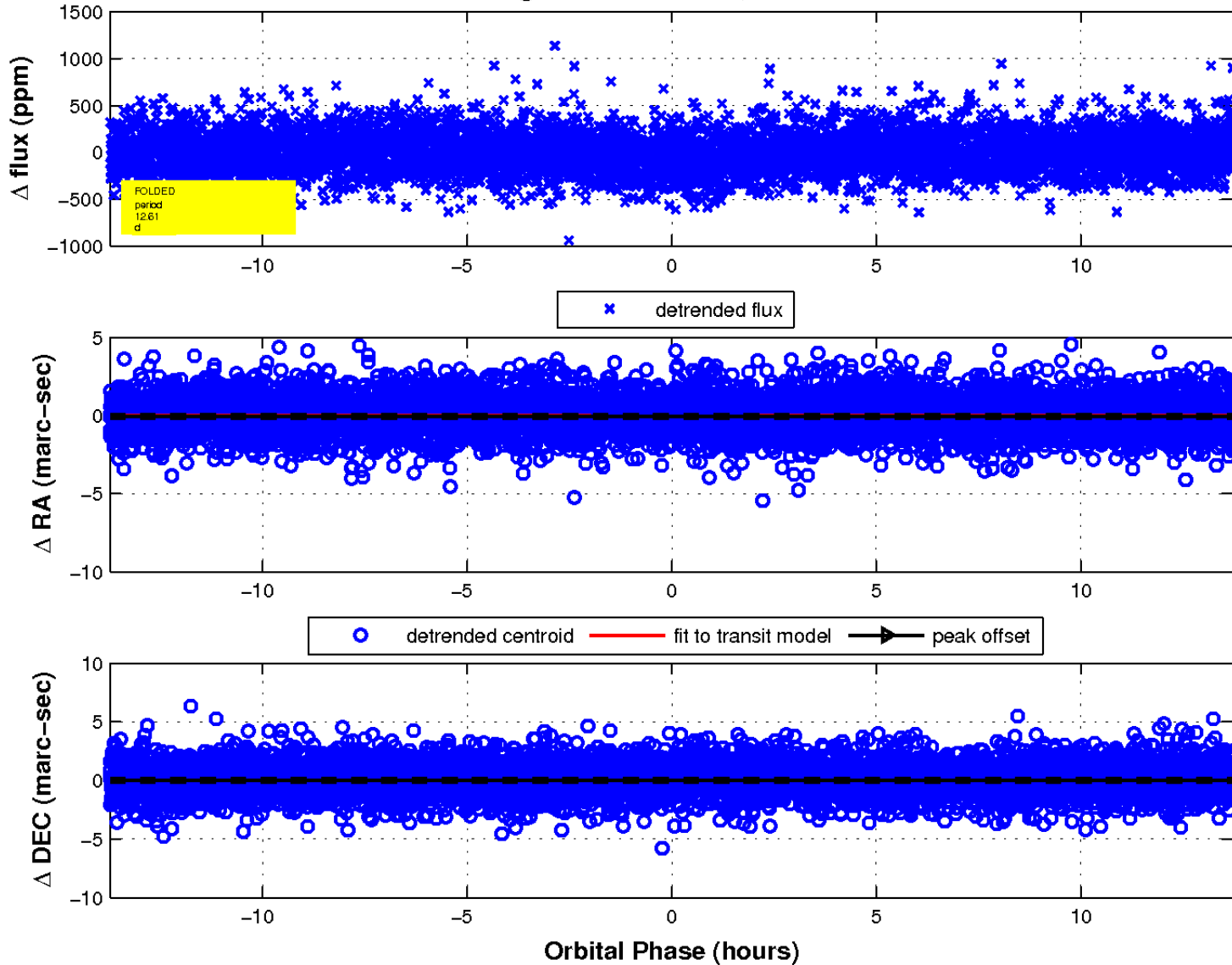
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



fluxWeightedCentroids, Planet 2 of 2



# UKIRT Image

Declination

