

# KIC 004159347

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
004159347-01	OBS	0394.01	12.283565	137.512599	586.3	3.646	46.7	53.0	2.76	6171	12.91	767.45
004159347-02	OBS	No	12.283542	142.043751	461.8	2.931	36.7	41.1	2.76	6171	11.46	767.46

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
004159347-01	OBS	FP	0.00	0	1	1	0	MOD_SEC_DV—MOD_SEC_ALT—DEEP_V_SHAPED—HAS_SEC_TCE—CENT_UNRESOLVED_OFFSET
004159347-02	OBS	FP	0.00	1	1	1	0	IS_SEC_TCE—CENT_UNRESOLVED_OFFSET

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

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

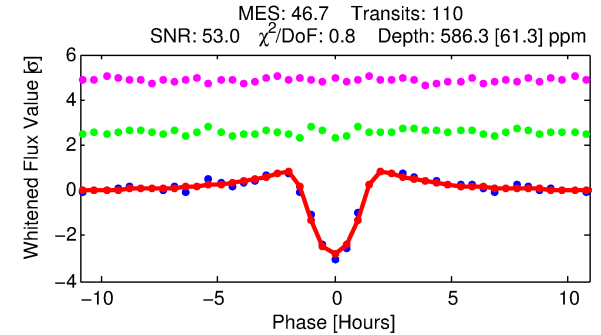
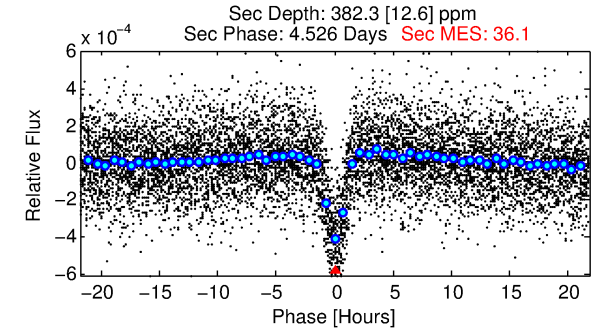
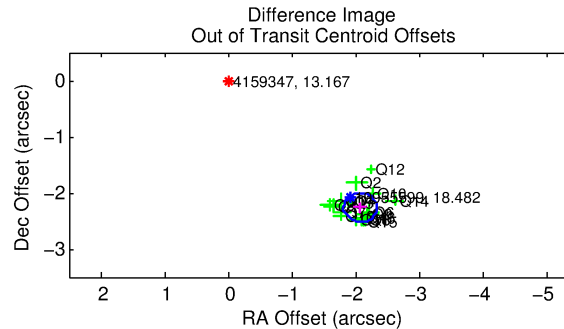
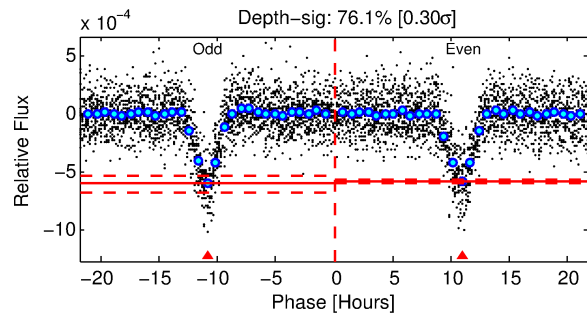
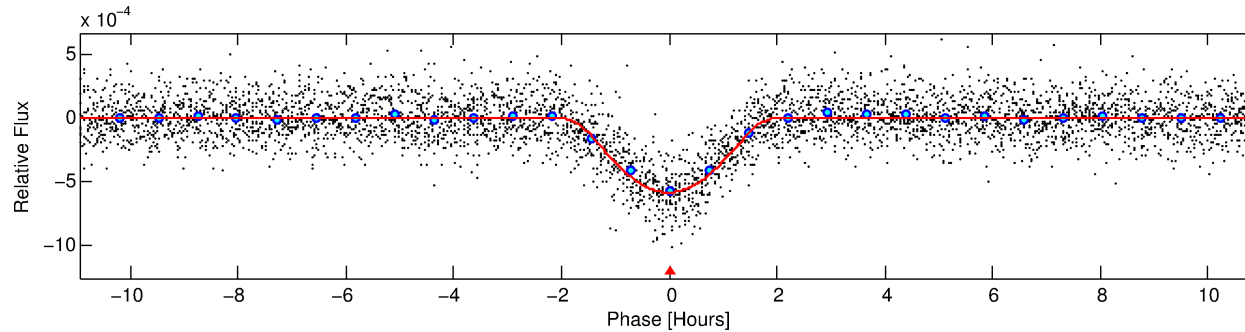
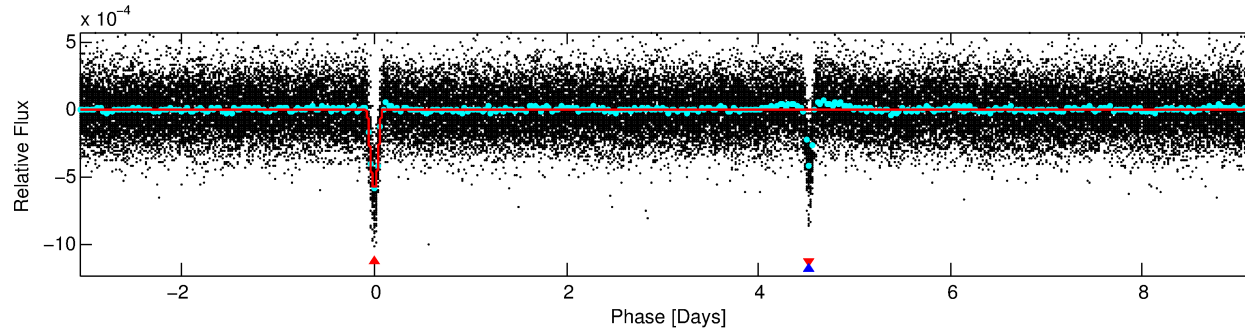
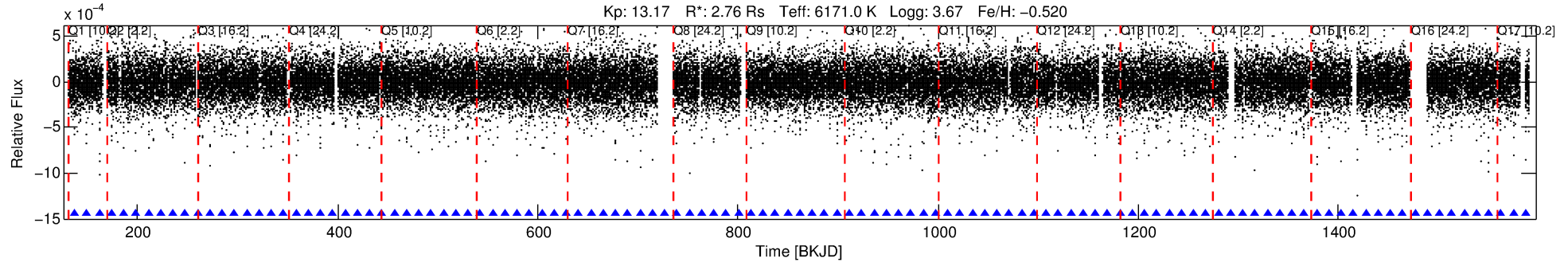
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 004159347-01

No Significant Match Found

# DV One-Page Summary

KIC: 4159347 Candidate: 1 of 2 Period: 12.284 d  
KOI: K00394.01 Corr: 0.990



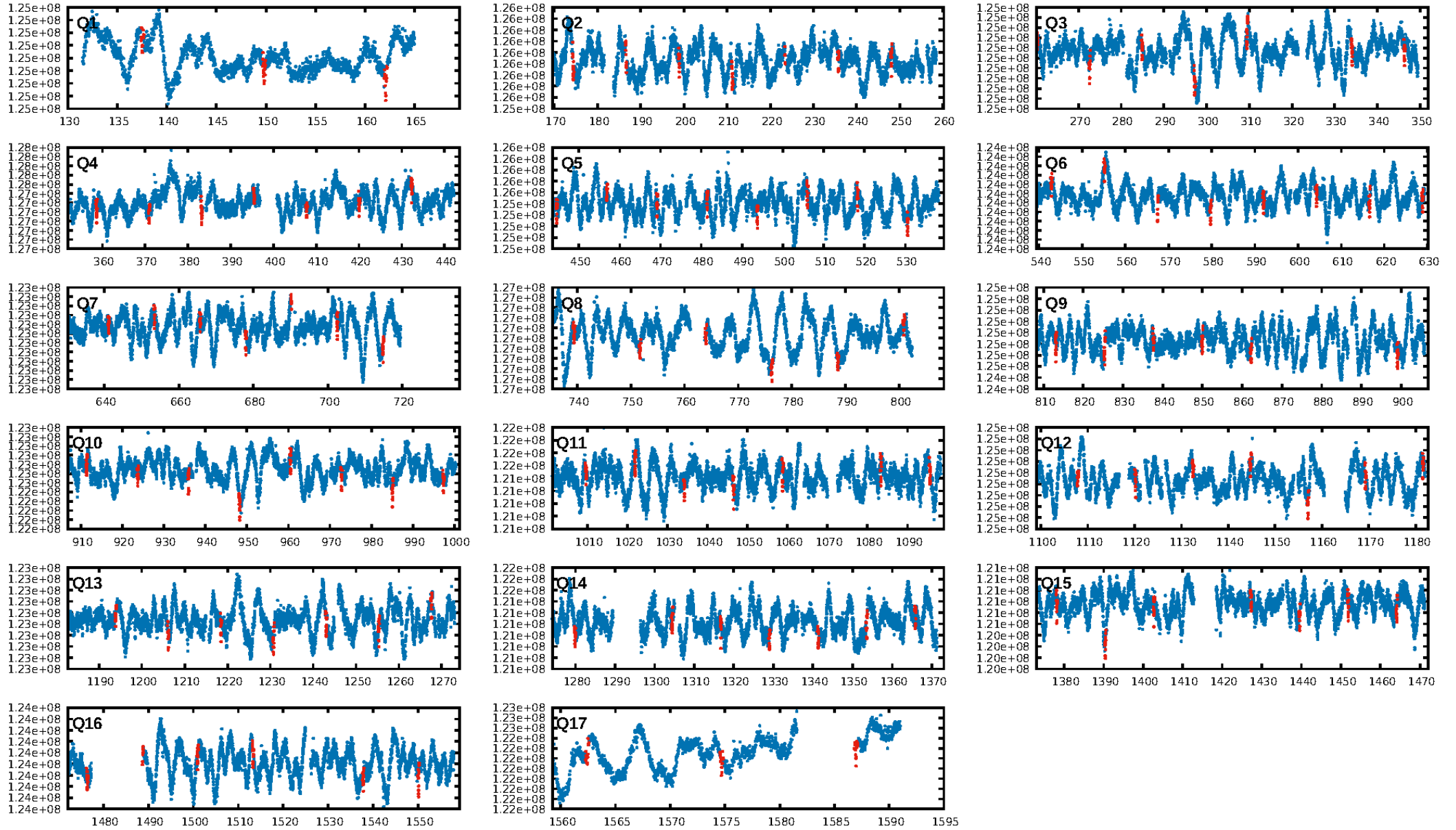
## DV Fit Results:

Period = 12.28356 [0.00002] d  
Epoch = 137.5126 [0.0013] BKJD  
Rp/R\* = 0.0429 [0.0242]  
a/R\* = 7.69 [1.08]  
b = 1.00 [0.04]  
Seff = 767.45 [436.01]  
Teq = 1342 [191] K  
Rp = 12.91 [8.75] Re  
a = 0.1135 [0.0400] AU  
Ag = 16.27 [20.50] [0.75 $\sigma$ ]  
Teffp = 4168 [1185] K [2.35 $\sigma$ ]

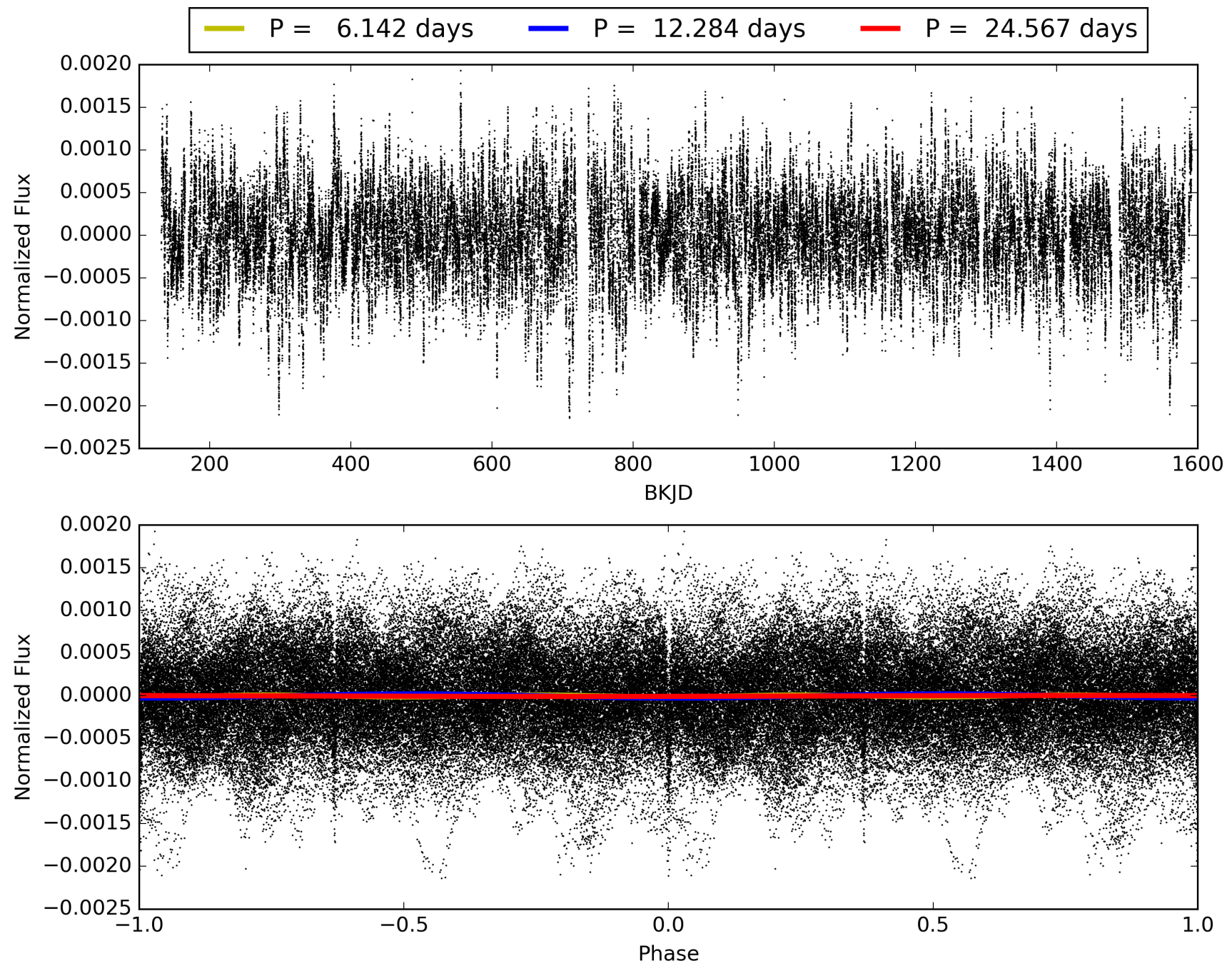
## DV Diagnostic Results:

ShortPeriod-sig: 0.0% [0.00 $\sigma$ ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 66.7%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 0.00e+00  
RollingBand-fgt: 1.00 [104/104]  
GhostDiagnostic-chr: 1.678  
Centroid-sig: 0.0%  
Centroid-so: 3.255 arcsec [18.40 $\sigma$ ]  
OotOffset-rm: 3.072 arcsec [35.33 $\sigma$ ]  
KicOffset-rm: 3.047 arcsec [35.97 $\sigma$ ]  
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 004159347-01, PDC Light Curves

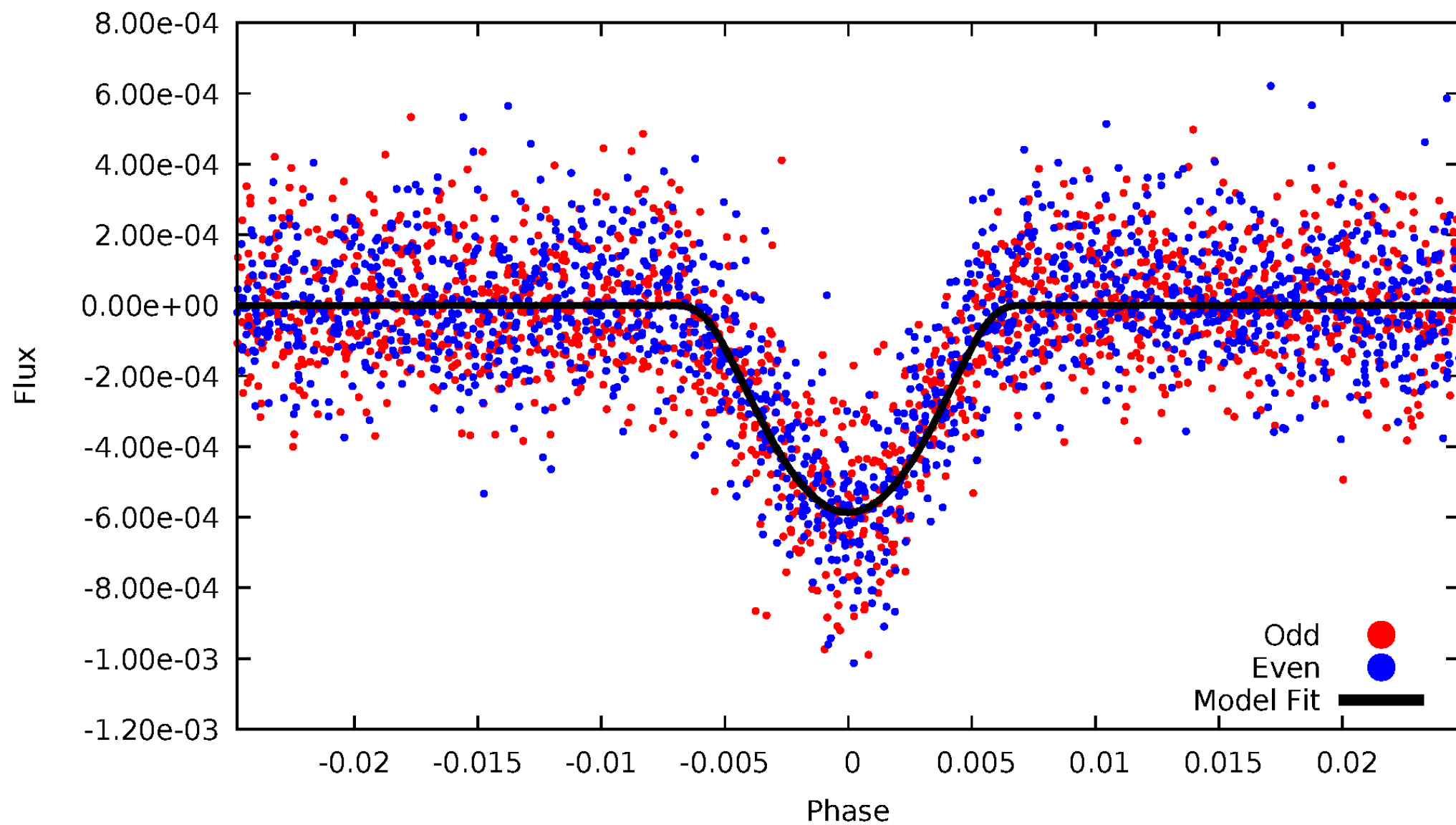


TCE 004159347-01



# DV Odd/Even

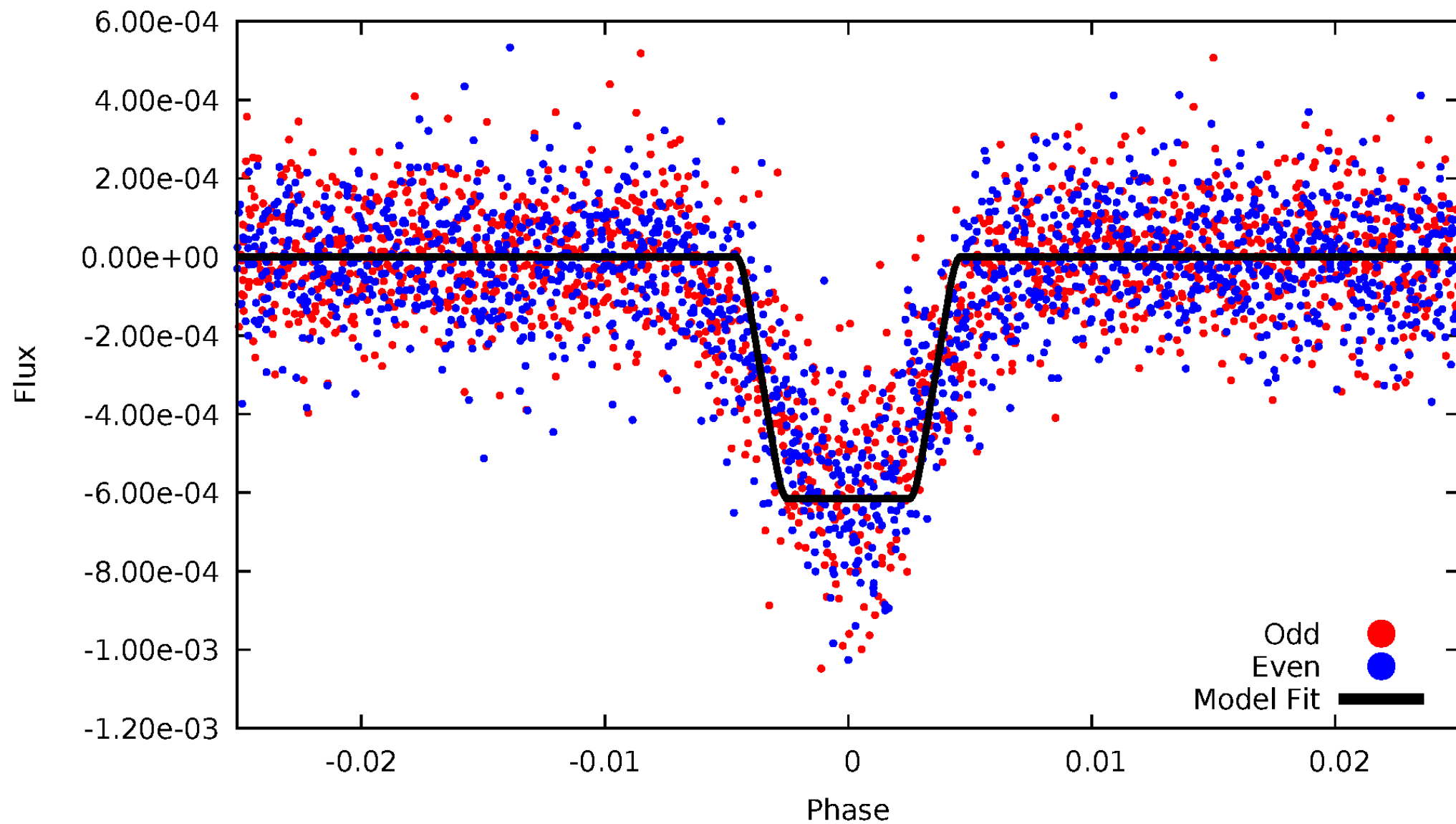
TCE 004159347-01





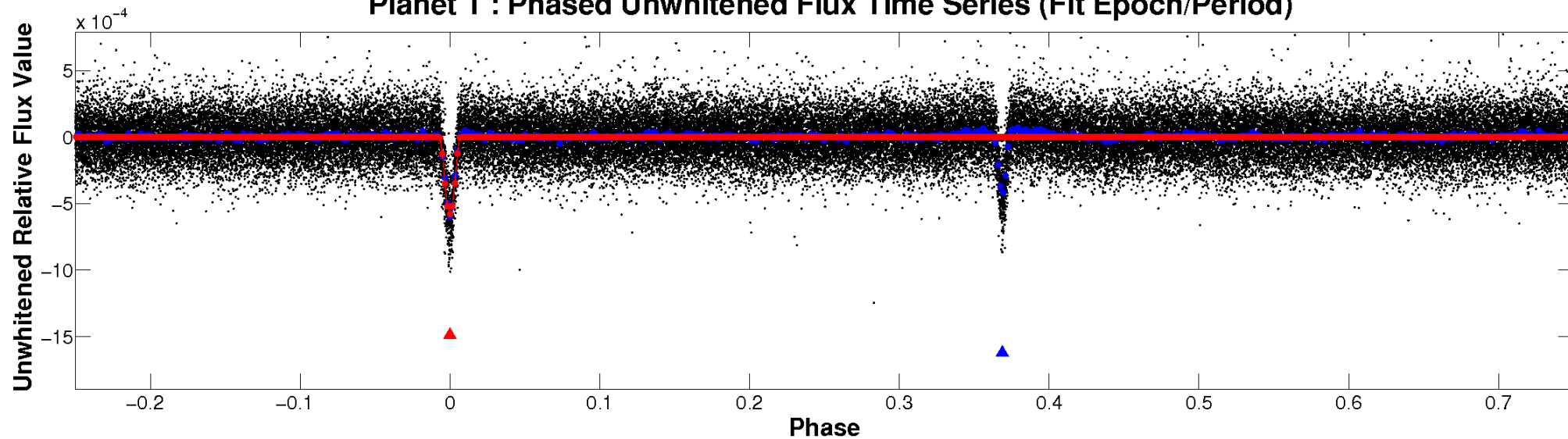
# ALT Odd/Even

TCE 004159347-01

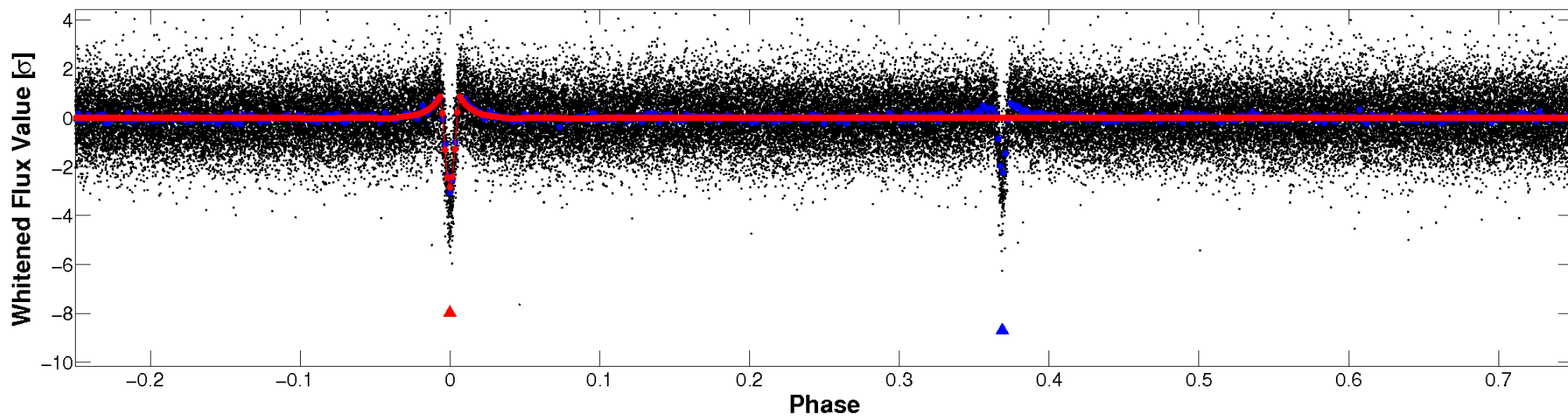


# Non-Whitened Vs. Whitened Light Curve

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

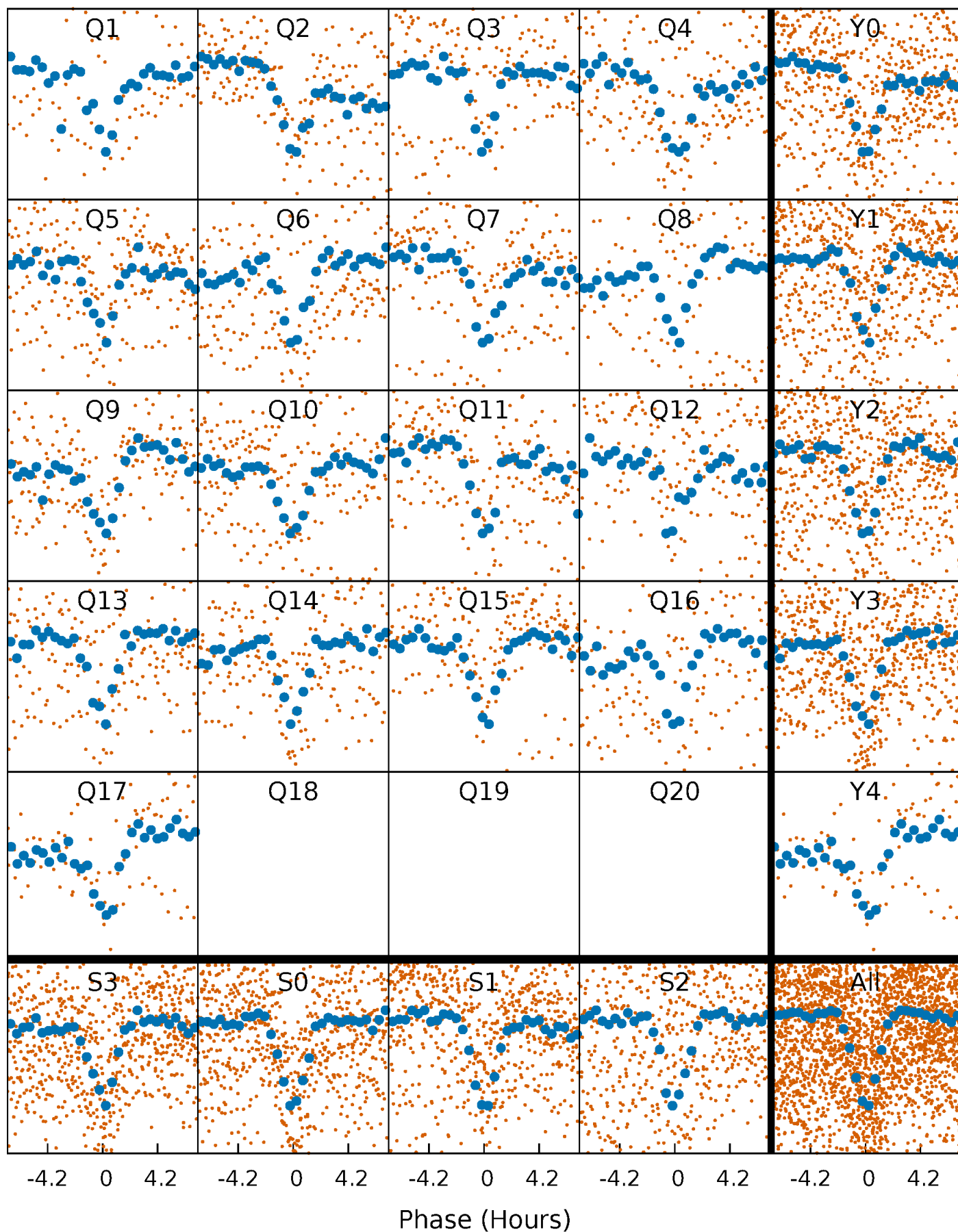


**Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



# PDC Quarter-Phased Transit Curves

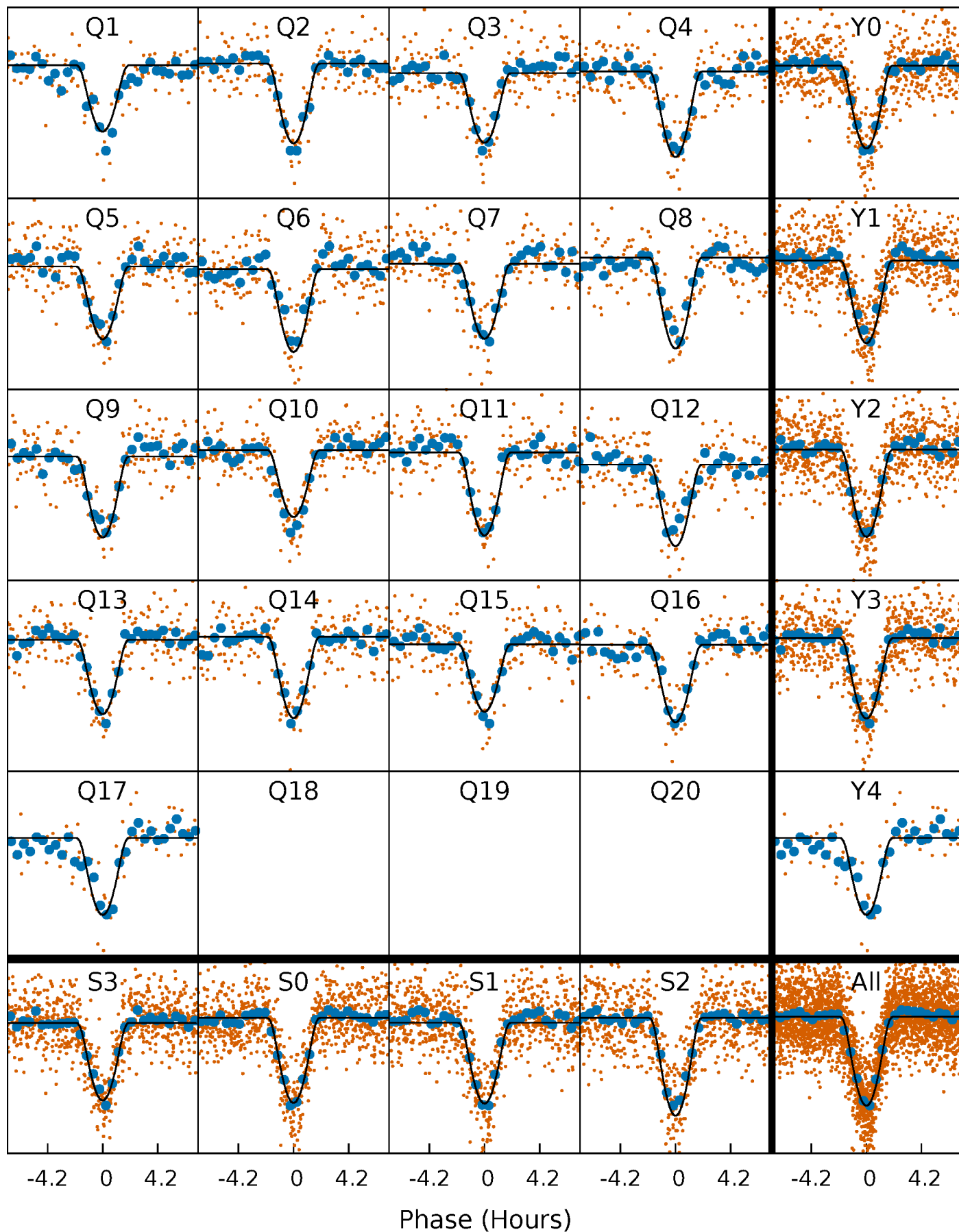
TCE 004159347-01 P= 12.283565 Days  $T_0=137.512599$  (BKJD)





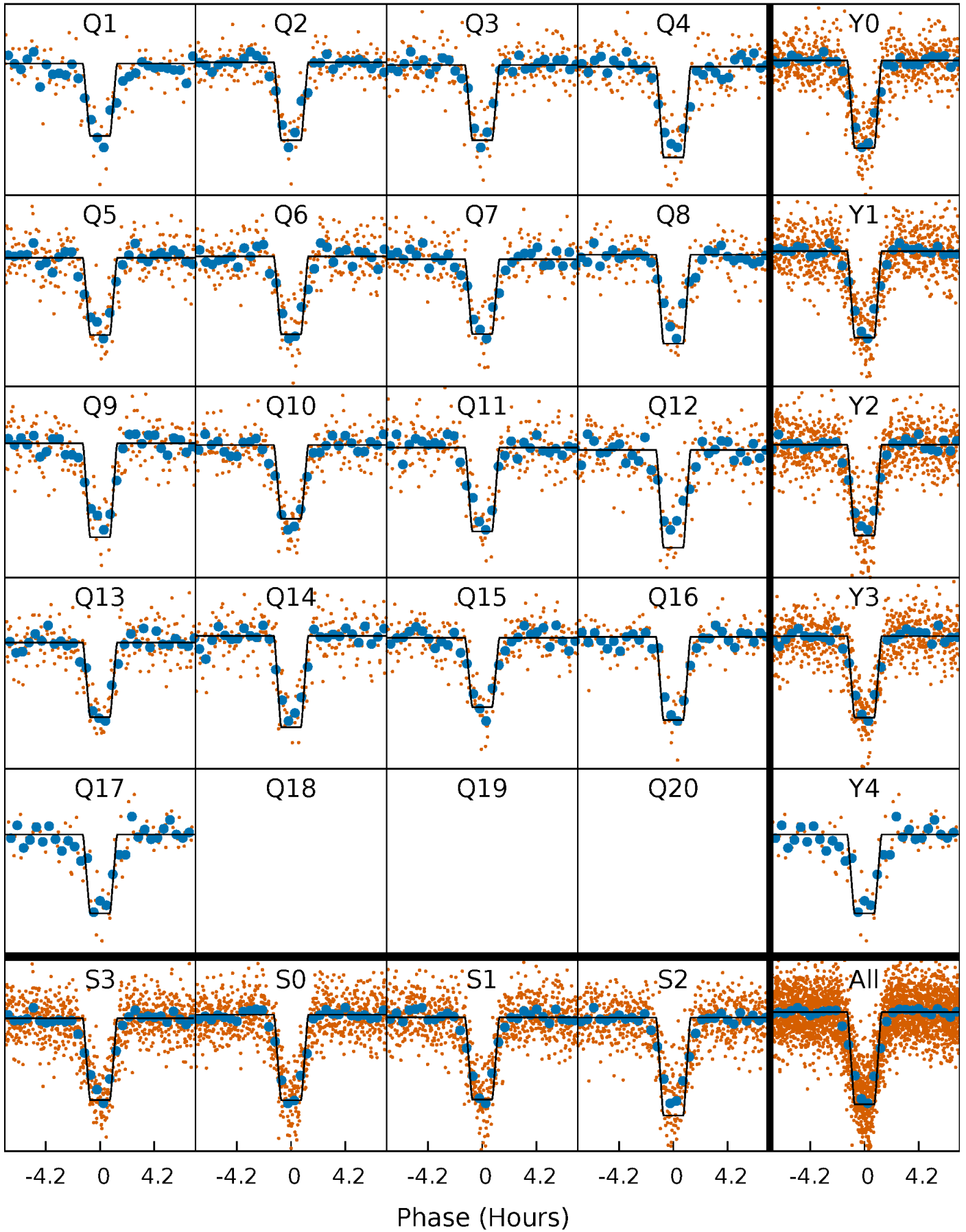
# DV Quarter-Phased Transit Curves

TCE 004159347-01 P= 12.283565 Days  $T_0=137.512599$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

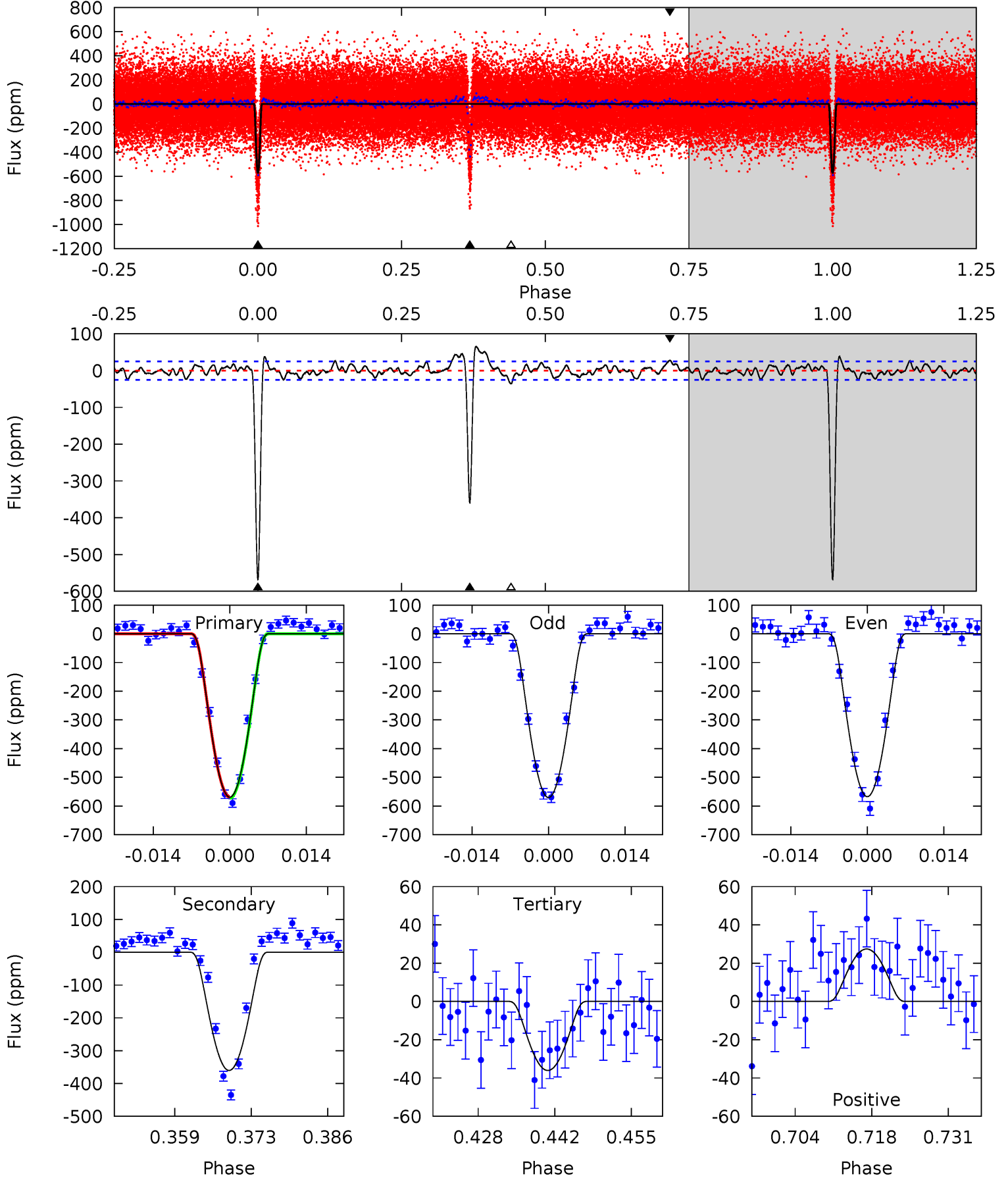
TCE 004159347-01 P= 12.283510 Days  $T_0=137.515466$  (BKJD)



# DV Model-Shift Uniqueness Test

004159347-01, P = 12.283565 Days, E = 125.229034 Days

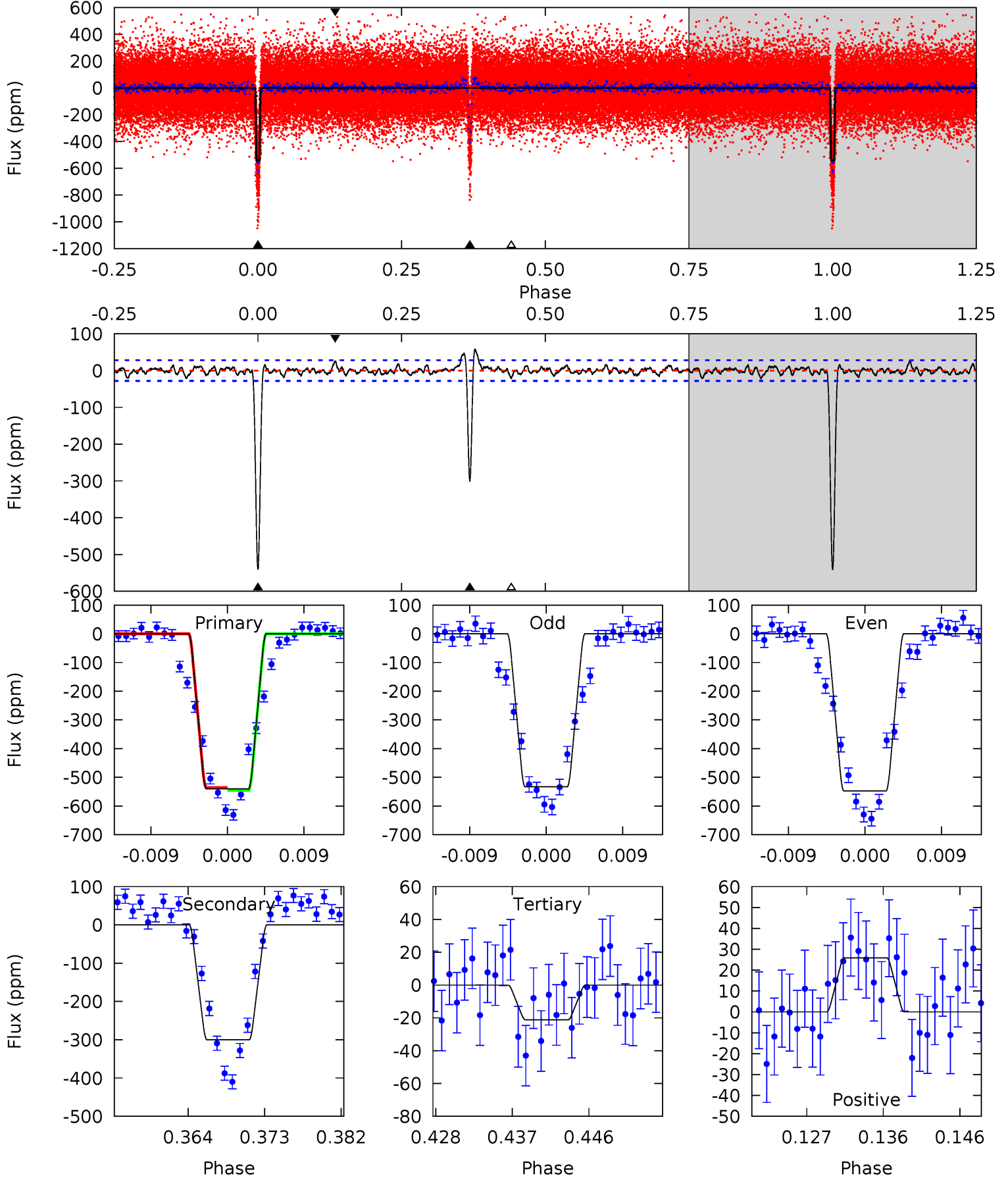
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
112.3	71.1	7.11	5.40	4.96	2.46	2.68	105.1	106.8	64.0	65.7	0.31	0.99	0.10	0.41



# Alt Model-Shift Uniqueness Test

004159347-01, P = 12.283510 Days, E = 125.231956 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
97.0	53.9	3.81	4.64	5.04	2.61	1.56	93.2	92.4	50.1	49.3	1.31	0.99	0.10	0.91



### Stellar Parameters For KIC 004159347

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6171^{+185}_{-185}$	$3.668^{+0.323}_{-0.108}$	$-0.520^{+0.350}_{-0.300}$	$2.759^{+0.557}_{-1.035}$	$1.291^{+0.200}_{-0.300}$	$0.087^{+0.213}_{-0.029}$
	+3%/-3%	+9%/-3%	+67%/-58%	+20%/-38%	+15%/-23%	+247%/-33%
Source	PHO1	FLK73	KIC0	DSEP		

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

### Secondary Eclipse Parameters for KIC 004159347-01 / KOI 0394.01

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-360 \pm 5$	$12.30^{+7.95}_{-6.03}$	$1849^{+114}_{-176}$	$4251^{+1324}_{-616}$	$17^{+47}_{-10}$
Alt.	$-300 \pm 6$	$8.26^{+6.27}_{-5.08}$	$1832^{+130}_{-154}$	$4813^{+2956}_{-892}$	$31^{+169}_{-21}$

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



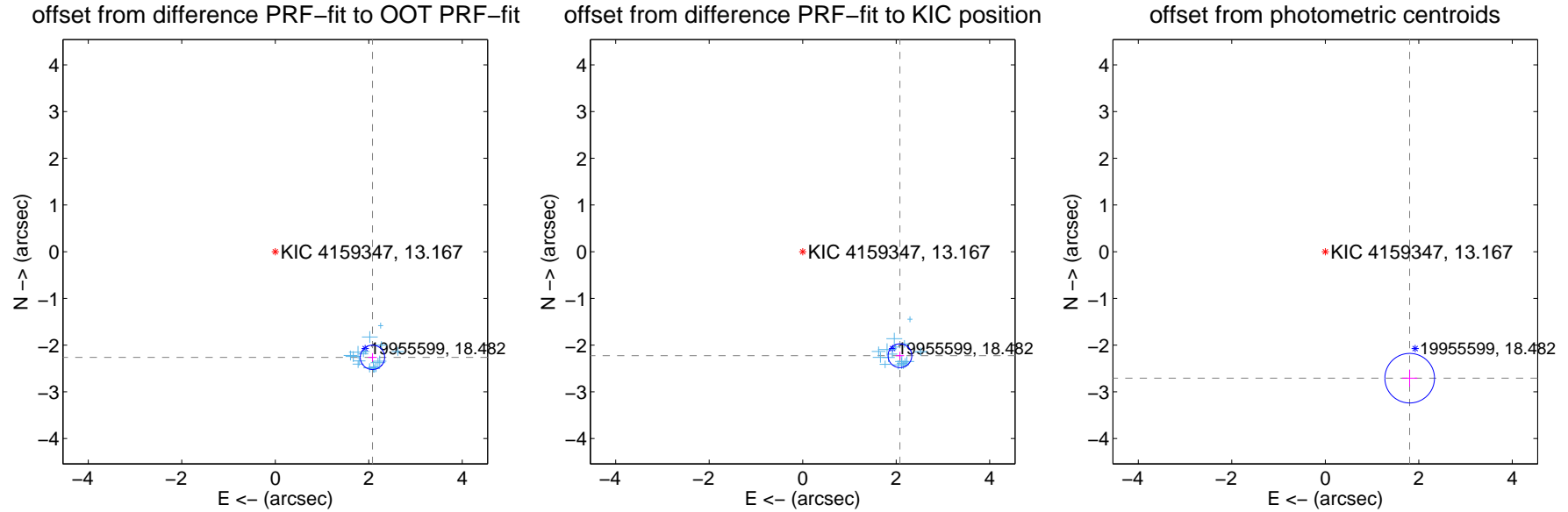
## DV Centroid Data

Supplemental centroid analysis for 004159347-01. Kepler magnitude: 13.17. Transit SNR 53.04

There are 17 quarters with good PRF difference image offsets

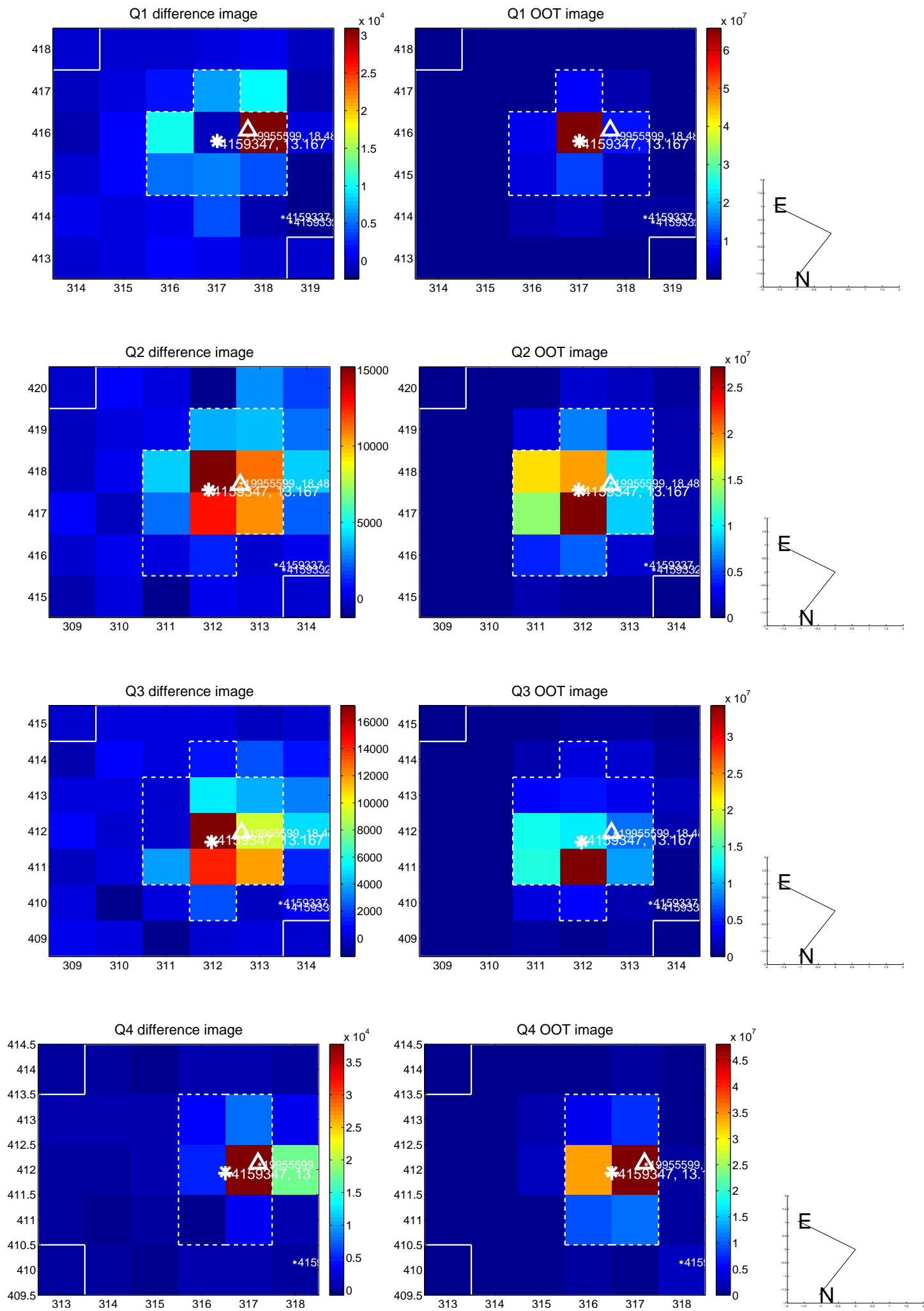
The direct PRF centroid is offset from the target star catalog position by about 0.07 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$3.072 \pm 0.087$	35.33	$-2.079 \pm 0.092$	$-2.262 \pm 0.089$
PRF-fit source offset from KIC position	$3.047 \pm 0.085$	35.97	$-2.080 \pm 0.088$	$-2.227 \pm 0.082$
photometric centroid source offset	$3.25 \pm 0.18$	18.40	$-1.81 \pm 0.16$	$-2.71 \pm 0.18$

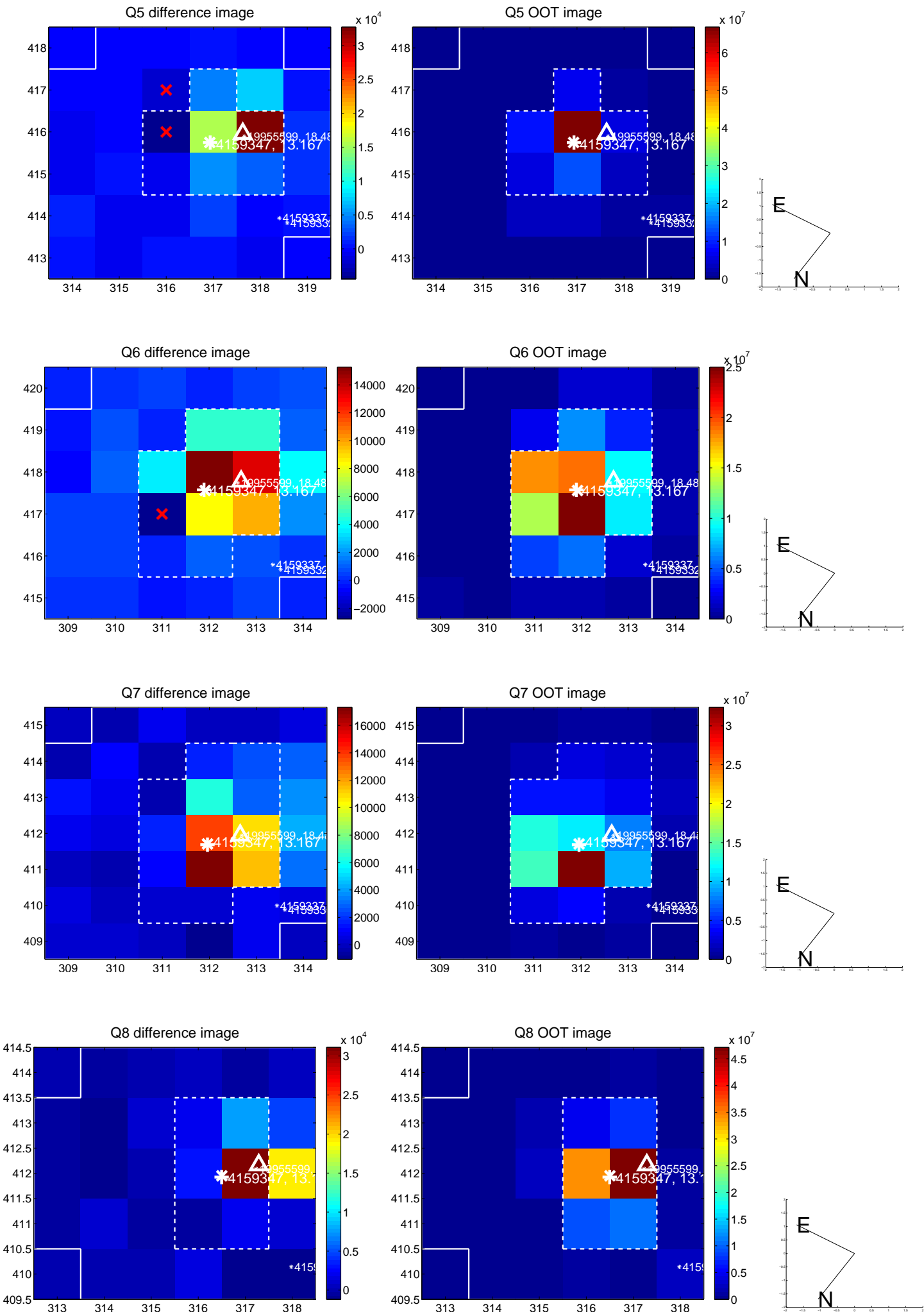


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

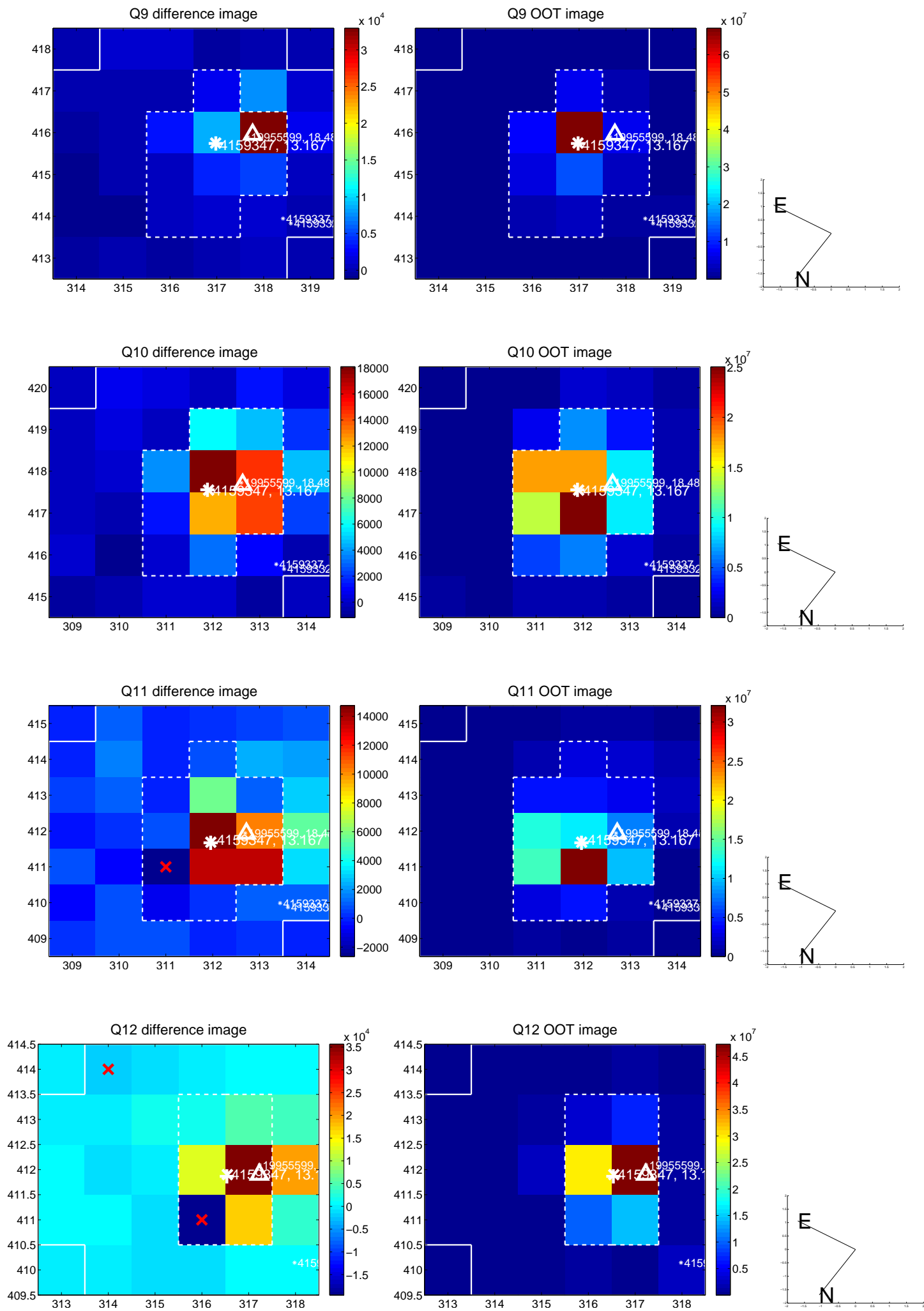
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



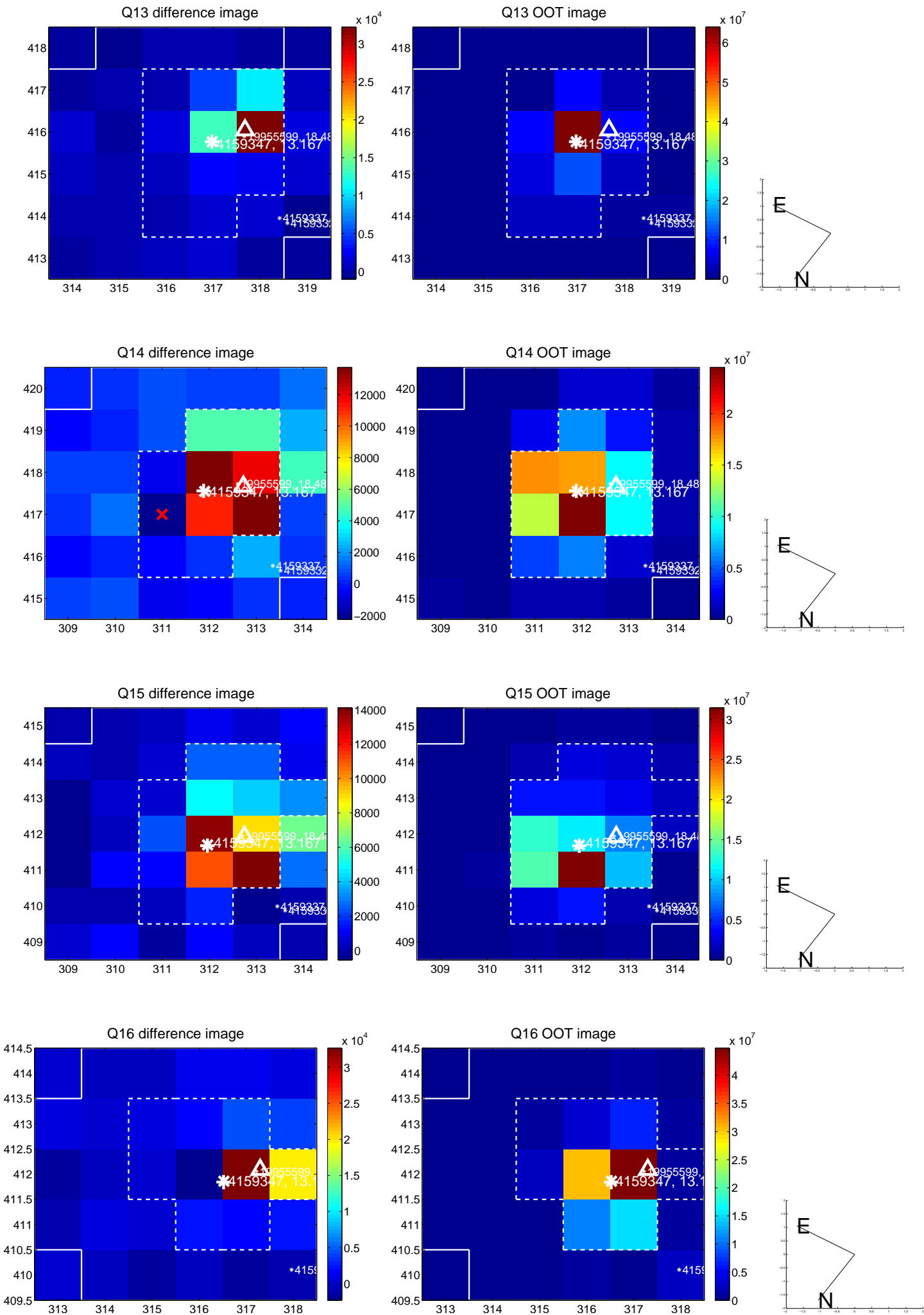
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

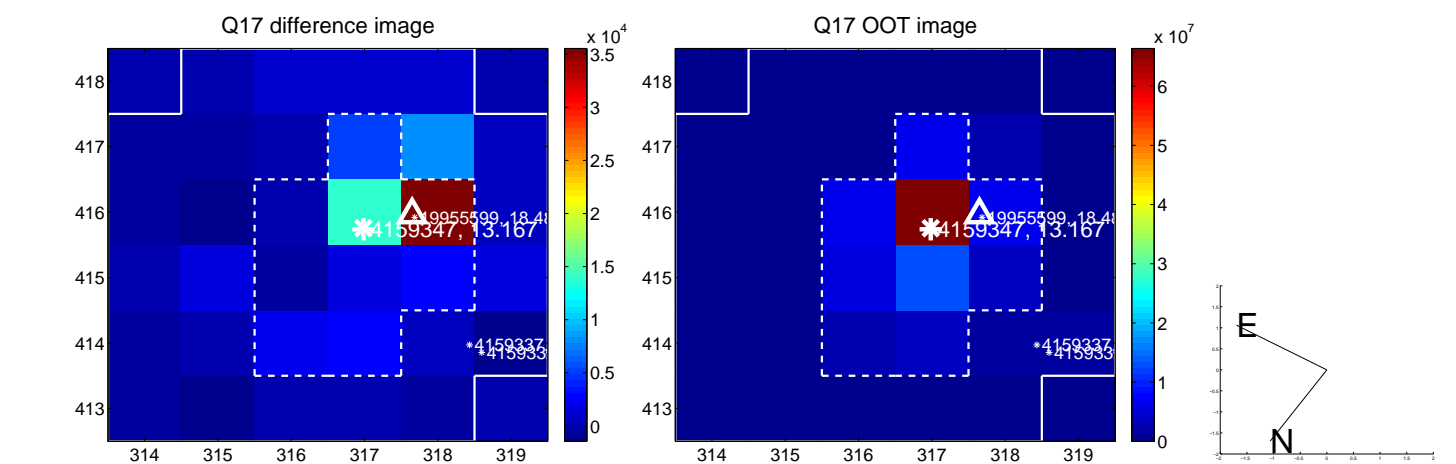


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

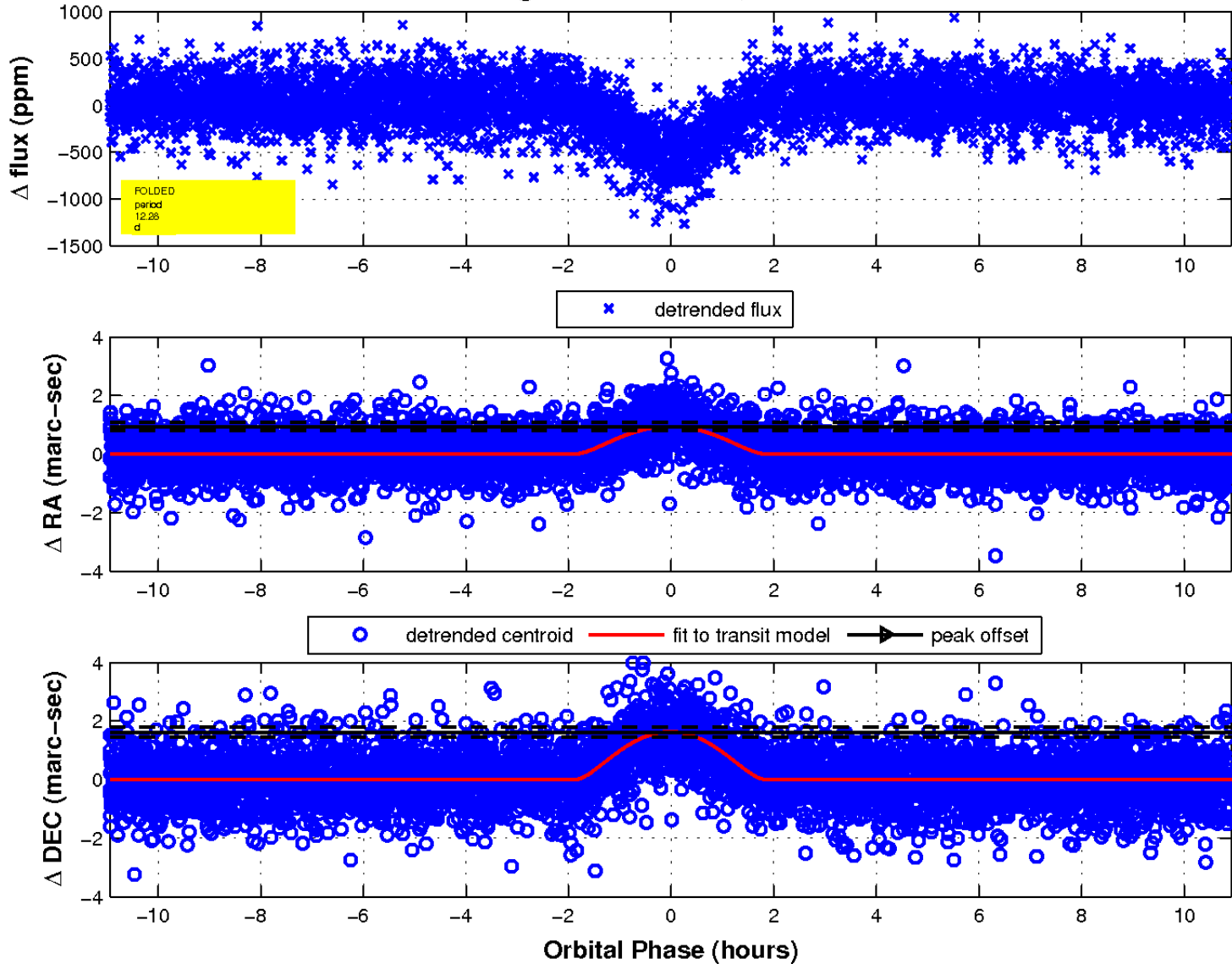




white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

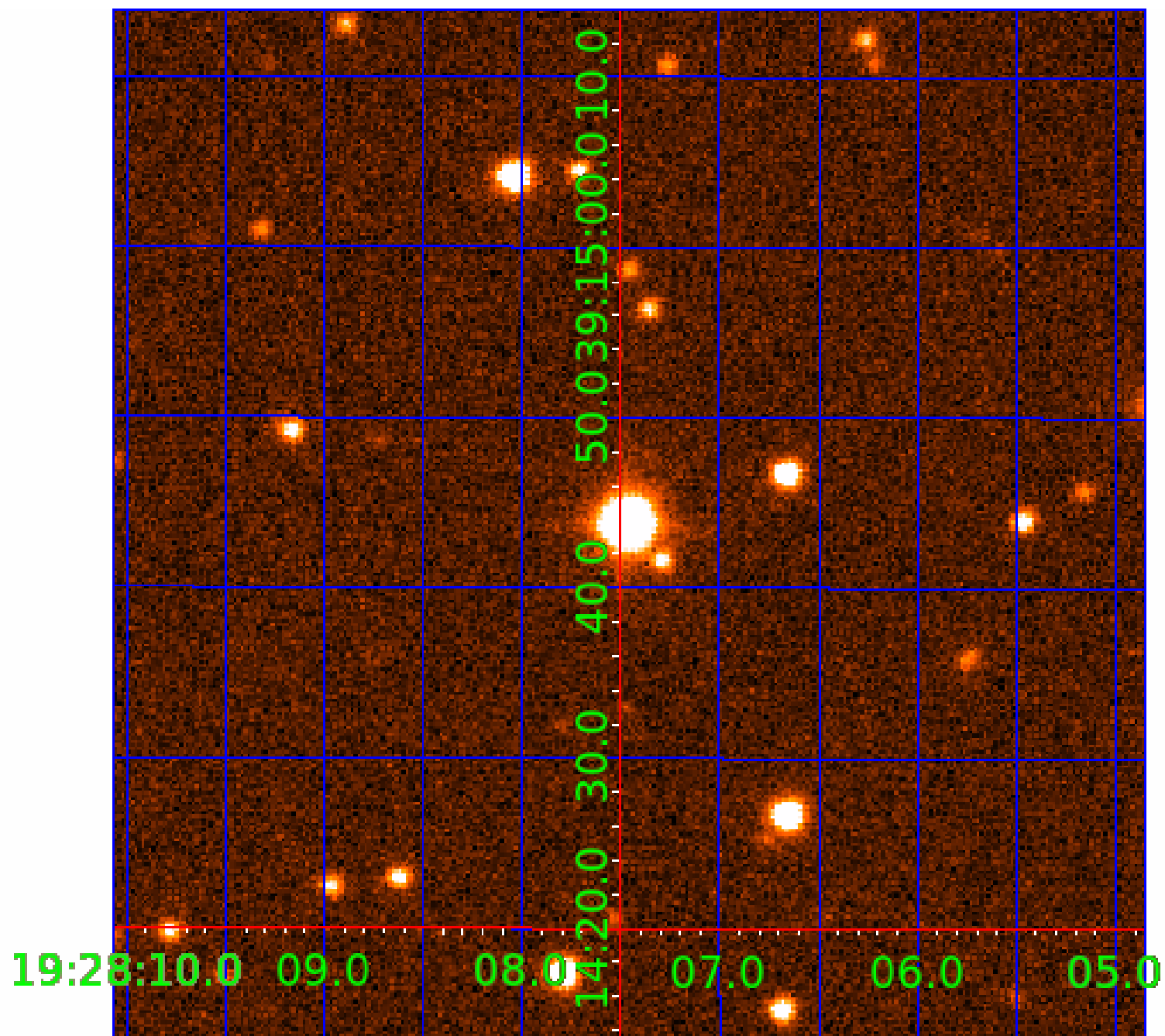


### fluxWeightedCentroids, Planet 1 of 2



UKIRT Image

Declination



# KIC 004159347

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
004159347-01	OBS	0394.01	12.283565	137.512599	586.3	3.646	46.7	53.0	2.76	6171	12.91	767.45
004159347-02	OBS	No	12.283542	142.043751	461.8	2.931	36.7	41.1	2.76	6171	11.46	767.46

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
004159347-01	OBS	FP	0.00	0	1	1	0	MOD_SEC_DV—MOD_SEC_ALT—DEEP_V_SHAPED—HAS_SEC_TCE—CENT_UNRESOLVED_OFFSET
004159347-02	OBS	FP	0.00	1	1	1	0	IS_SEC_TCE—CENT_UNRESOLVED_OFFSET

**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.

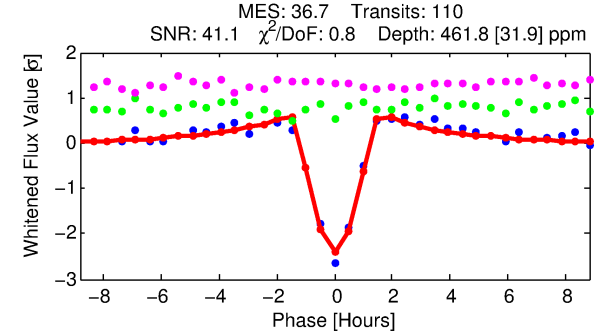
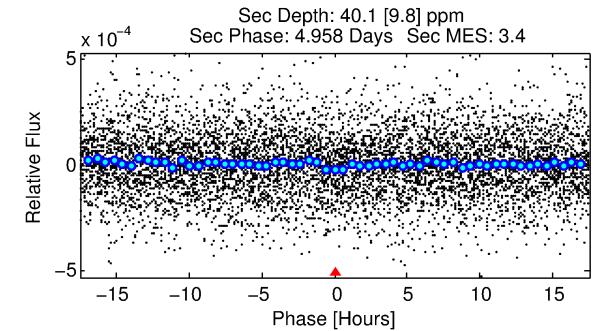
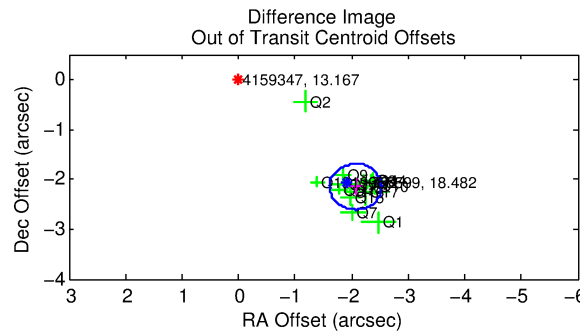
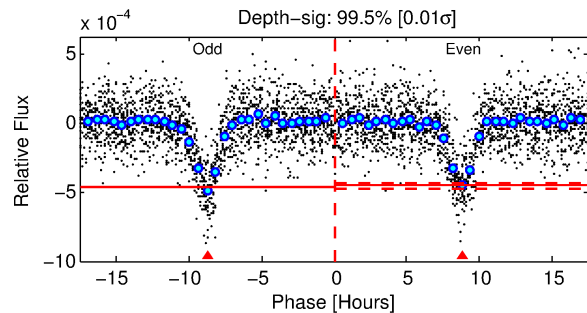
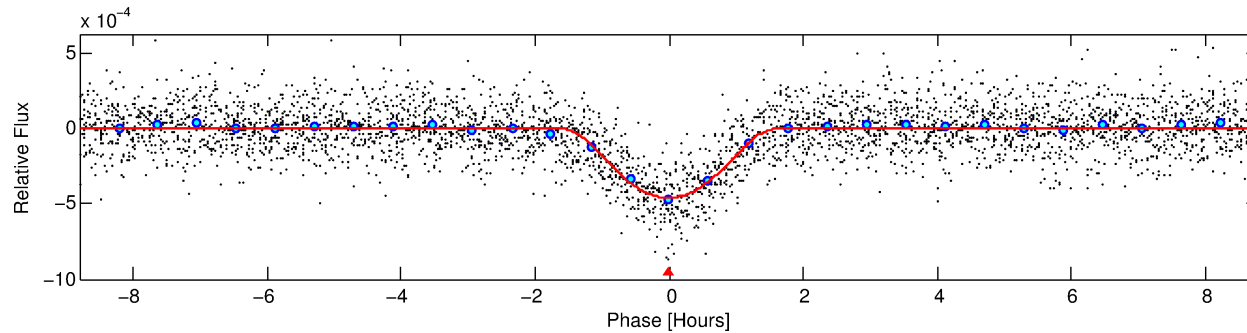
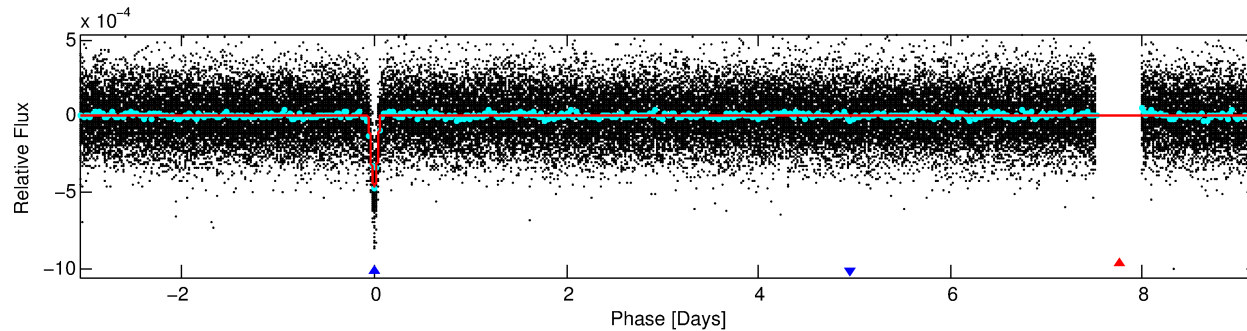
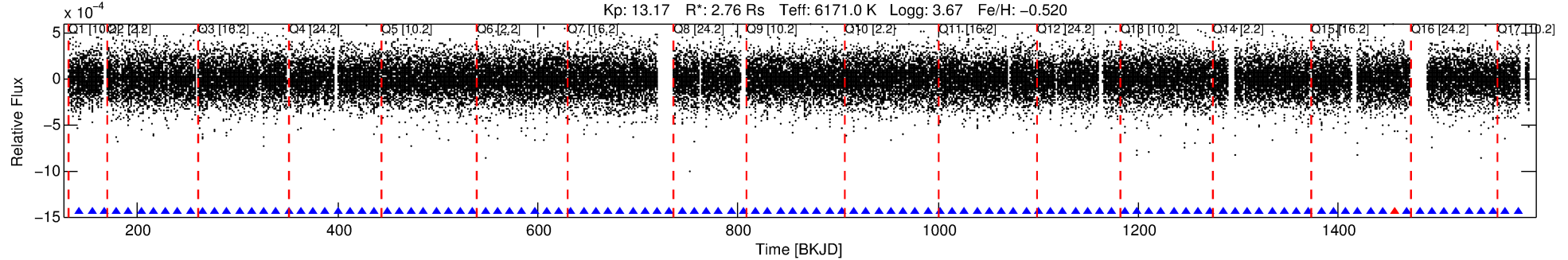
## Ephemeris Match Information For 004159347-02

No Significant Match Found

# DV One-Page Summary

KIC: 4159347 Candidate: 2 of 2 Period: 12.284 d  
KOI: K00394 Corr: No Ephemeris Match

Kp: 13.17 R\*: 2.76 Rs Teff: 6171.0 K Logg: 3.67 Fe/H: -0.520



## DV Fit Results:

Period = 12.28354 [0.00002] d  
Epoch = 142.0438 [0.0014] BKJD  
Rp/R\* = 0.0381 [0.0301]  
a/R\* = 9.04 [1.85]  
b = 1.00 [0.05]  
Seff = 767.45 [436.01]  
Teq = 1342 [191] K  
Rp = 11.46 [10.04] Re  
a = 0.1135 [0.0400] AU  
Ag = 2.16 [3.67] [0.32σ]  
Teffp = 2517 [1010] K [1.14σ]

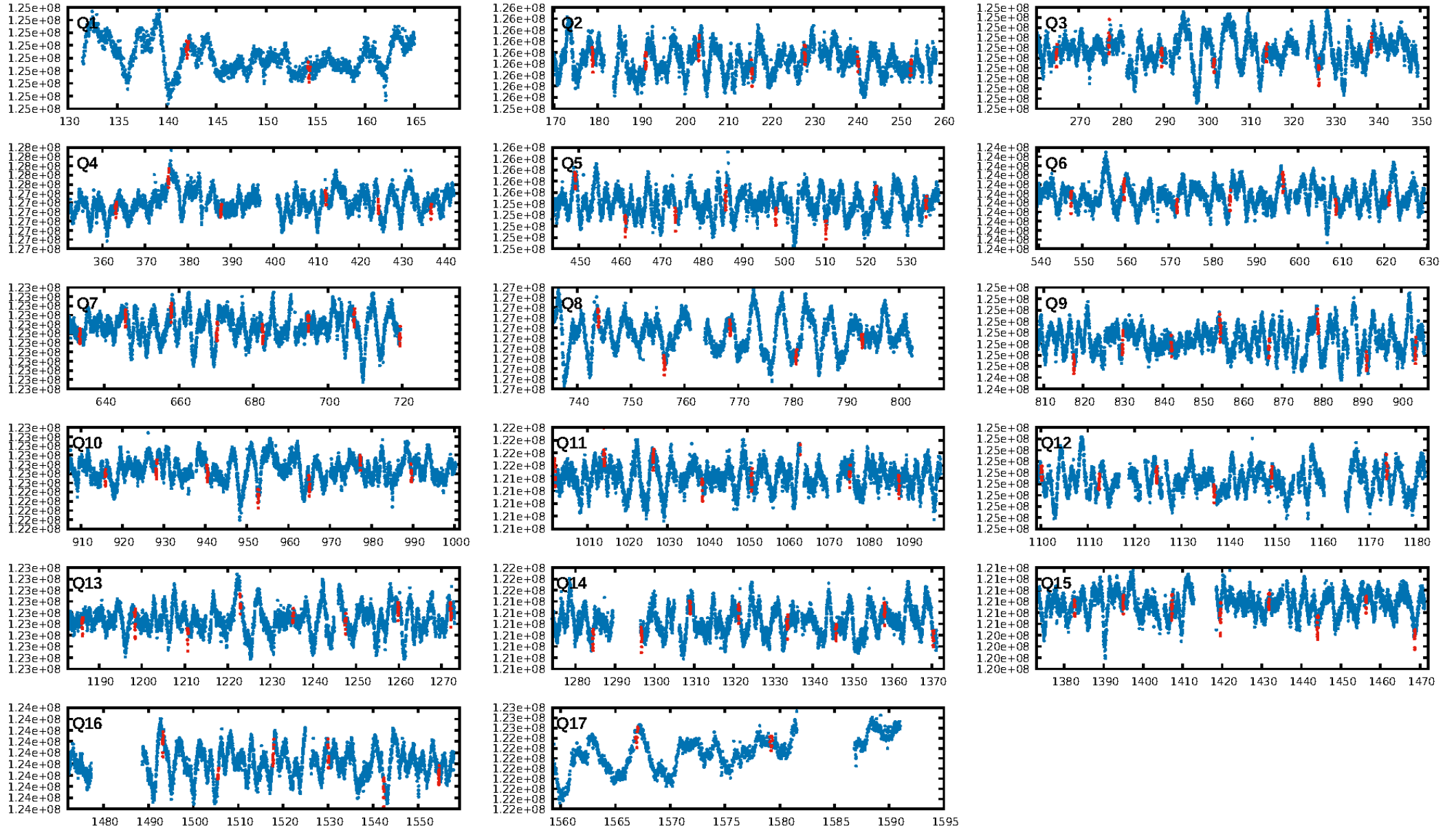
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 0.0% [0.00σ]  
ModelChiSquare2-sig: 99.7%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 3.40e-280  
RollingBand-fgt: 0.99 [105/106]  
GhostDiagnostic-chr: 3.129  
Centroid-sig: 0.0%  
Centroid-so: 3.464 arcsec [14.10σ]  
OotOffset-rm: 2.984 arcsec [19.47σ]  
KicOffset-rm: 2.968 arcsec [19.42σ]  
OotOffset-st: 4/4/3/5 [16]  
KicOffset-st: 4/4/3/5 [16]  
DiffImageQuality-fgm: 1.00 [16/16]  
DiffImageOverlap-fno: 1.00 [17/17]

Software Revision: svn-ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 04:33:31 Z

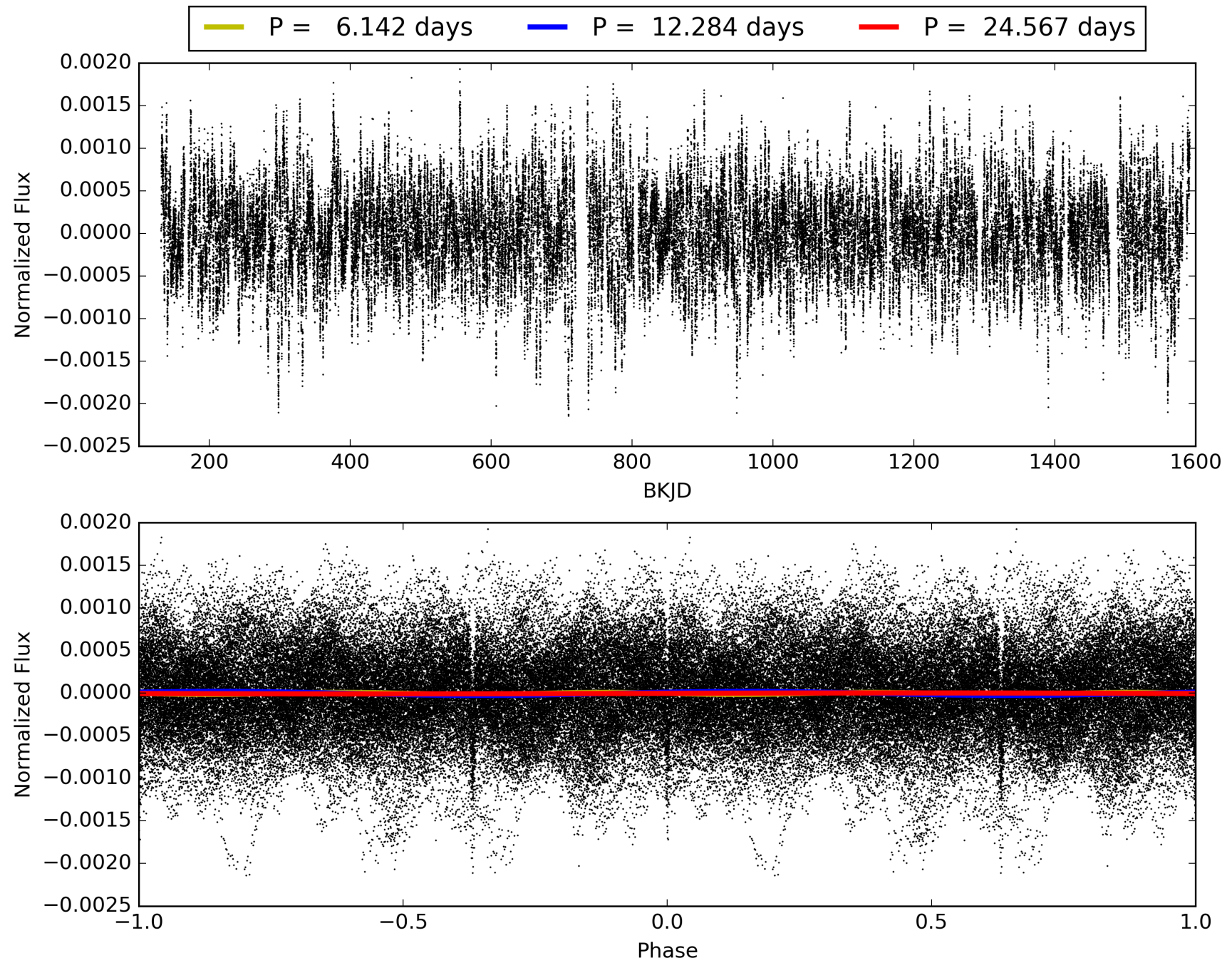
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 004159347-02, PDC Light Curves



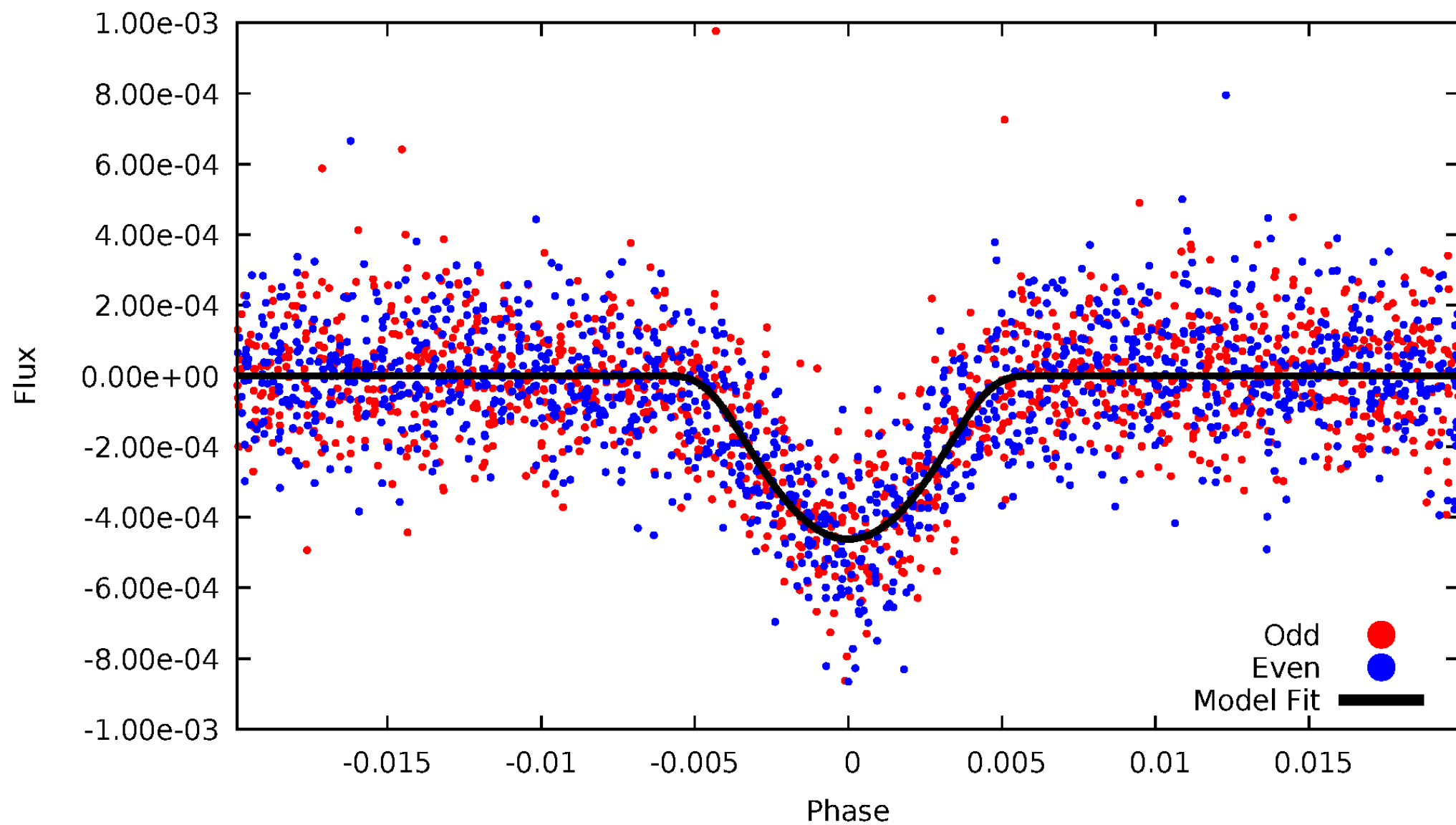


TCE 004159347-02



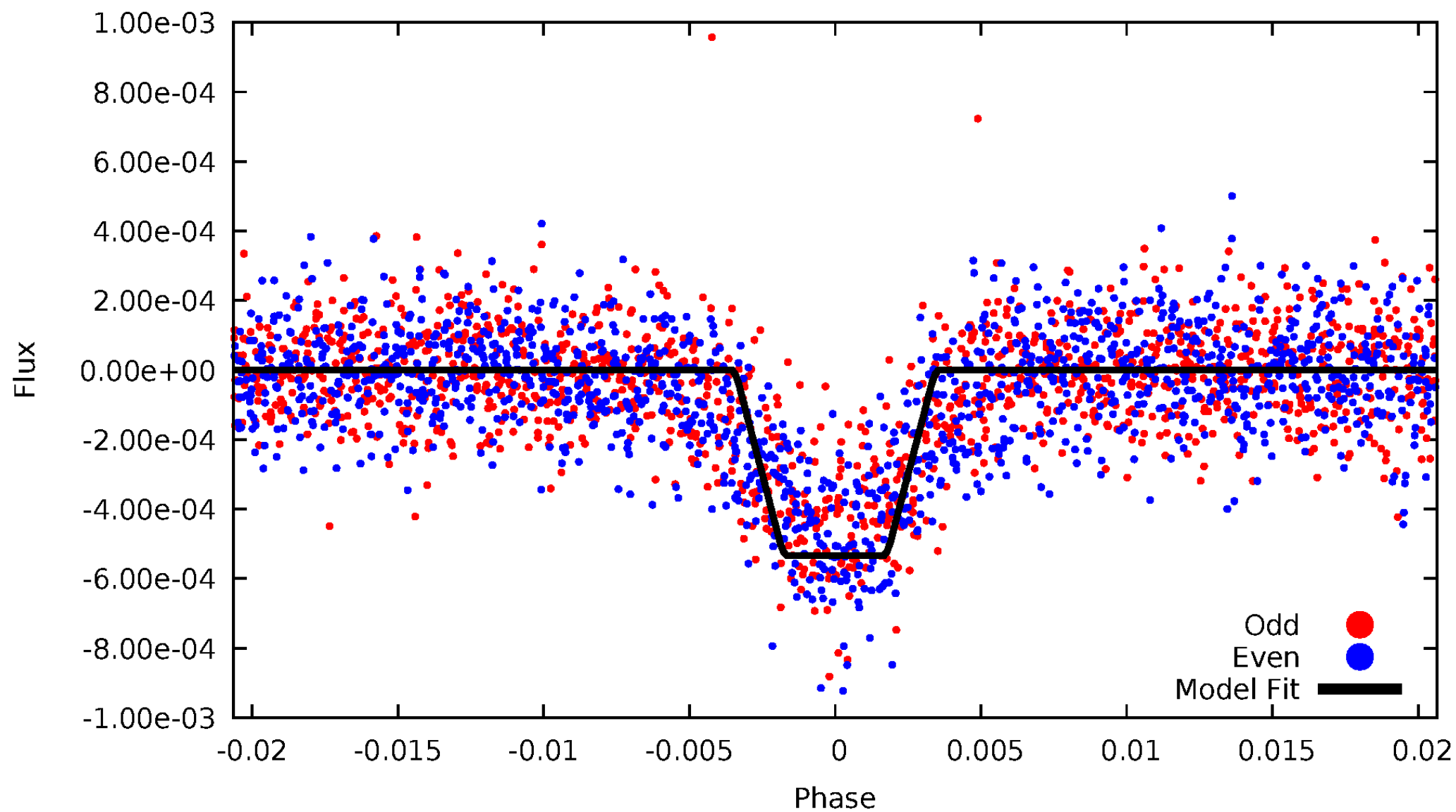
# DV Odd/Even

TCE 004159347-02



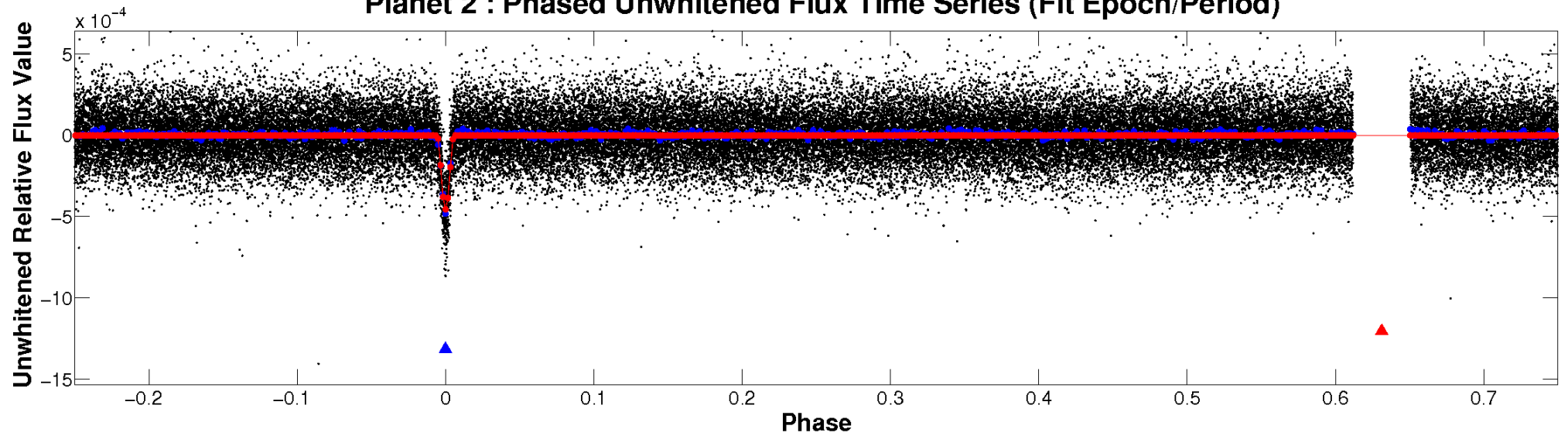
# ALT Odd/Even

TCE 004159347-02

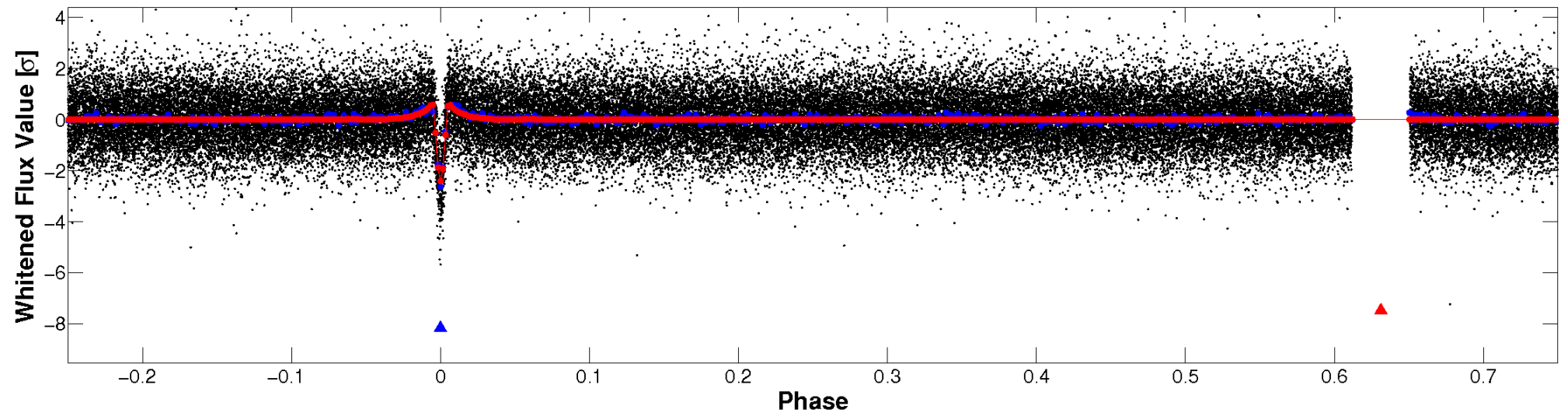


# Non-Whitened Vs. Whitened Light Curve

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

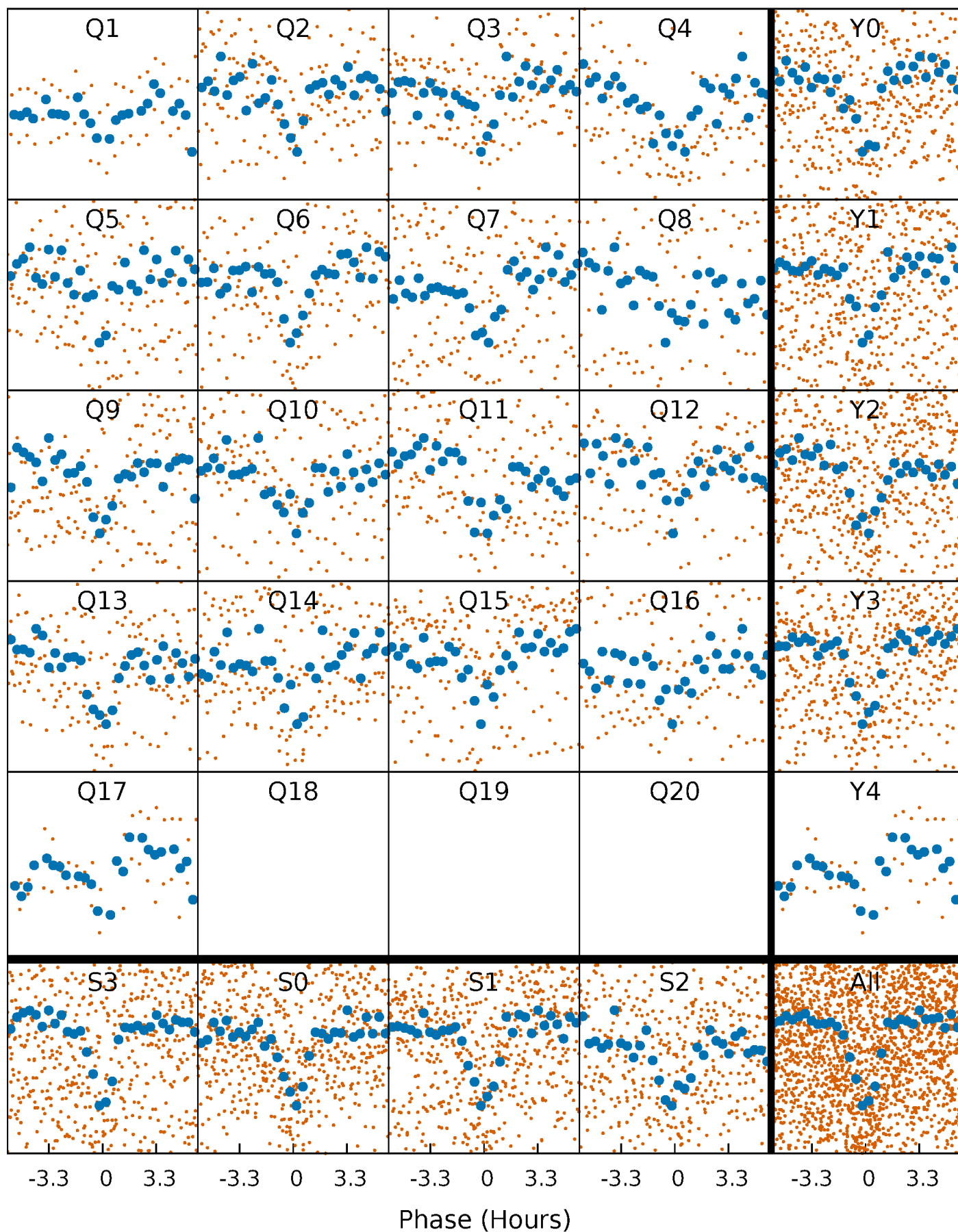


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

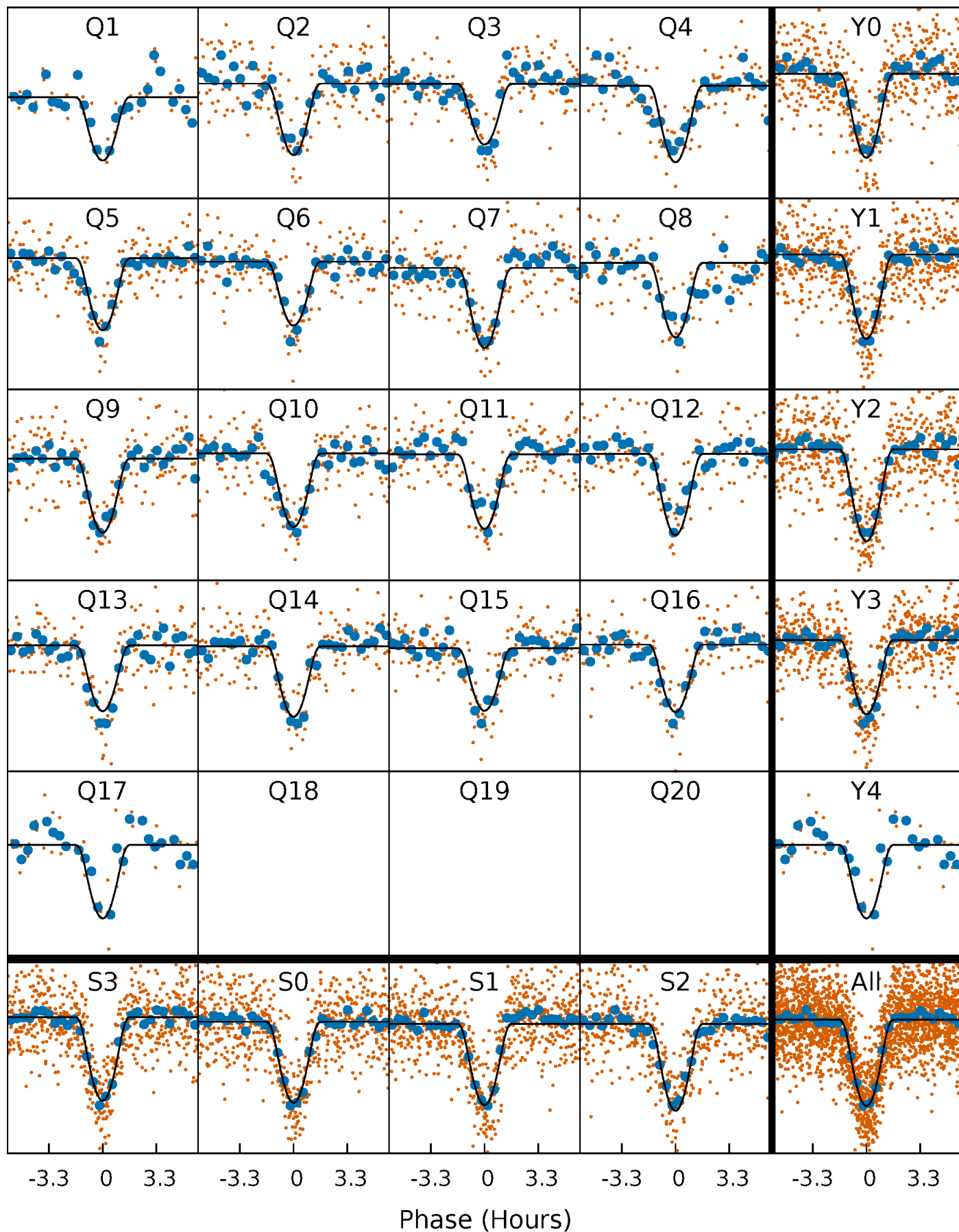
TCE 004159347-02   P= 12.283542 Days    $T_0=142.043751$  (BKJD)





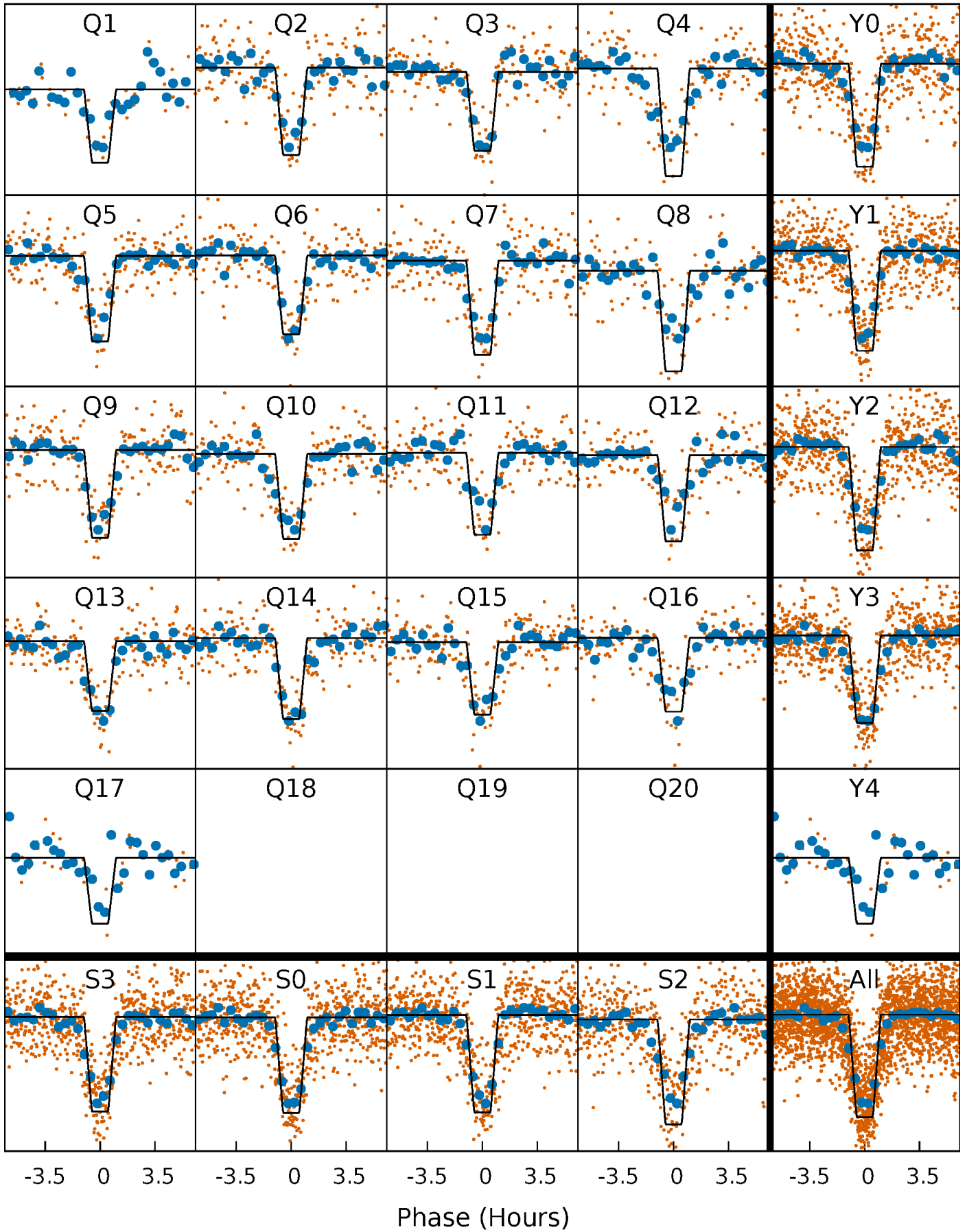
# DV Quarter-Phased Transit Curves

TCE 004159347-02   P= 12.283542 Days    $T_0=142.043751$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

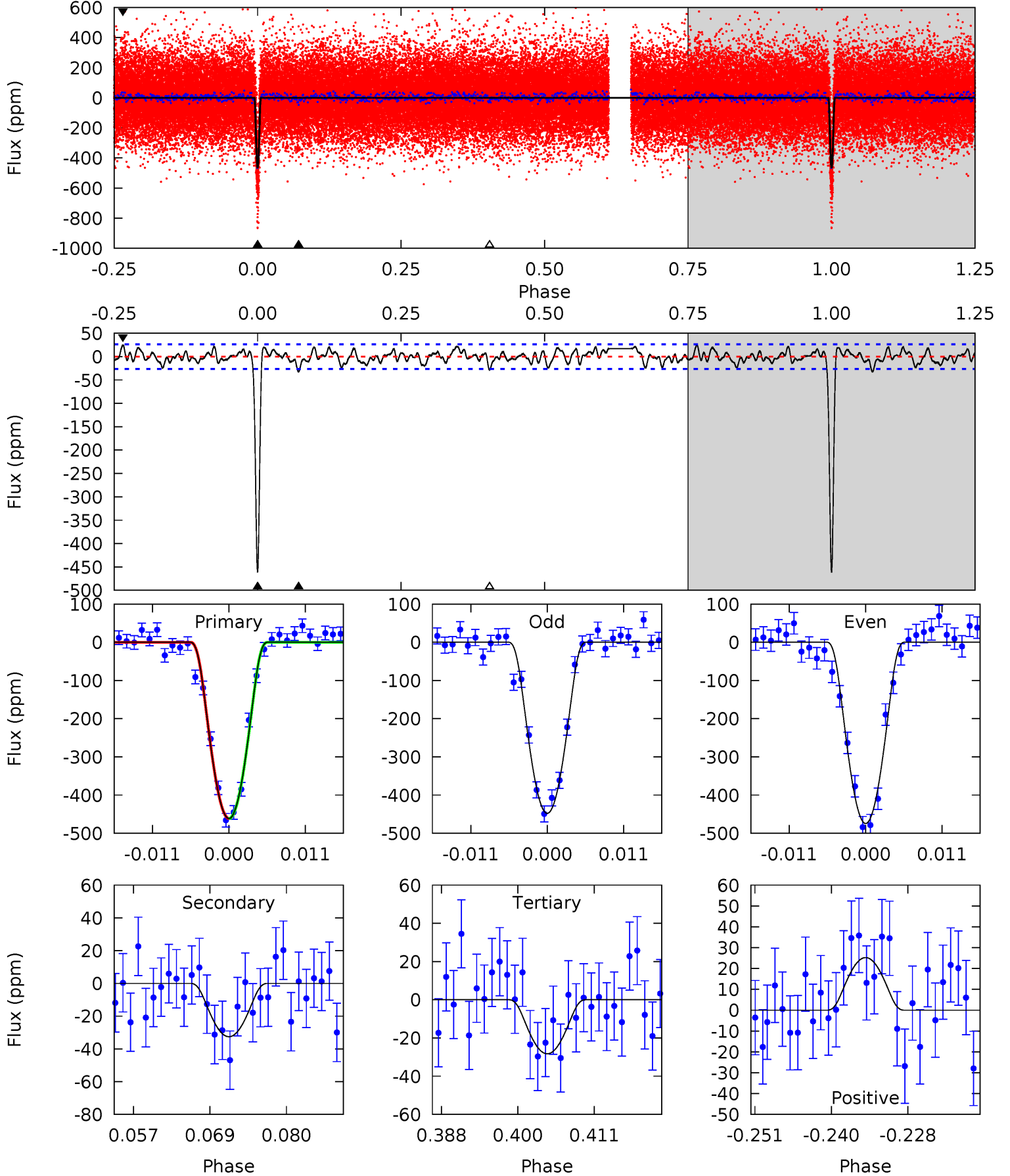
TCE 004159347-02 P= 12.283487 Days  $T_0=142.046633$  (BKJD)



# DV Model-Shift Uniqueness Test

004159347-02,  $P = 12.283542$  Days,  $E = 129.760209$  Days

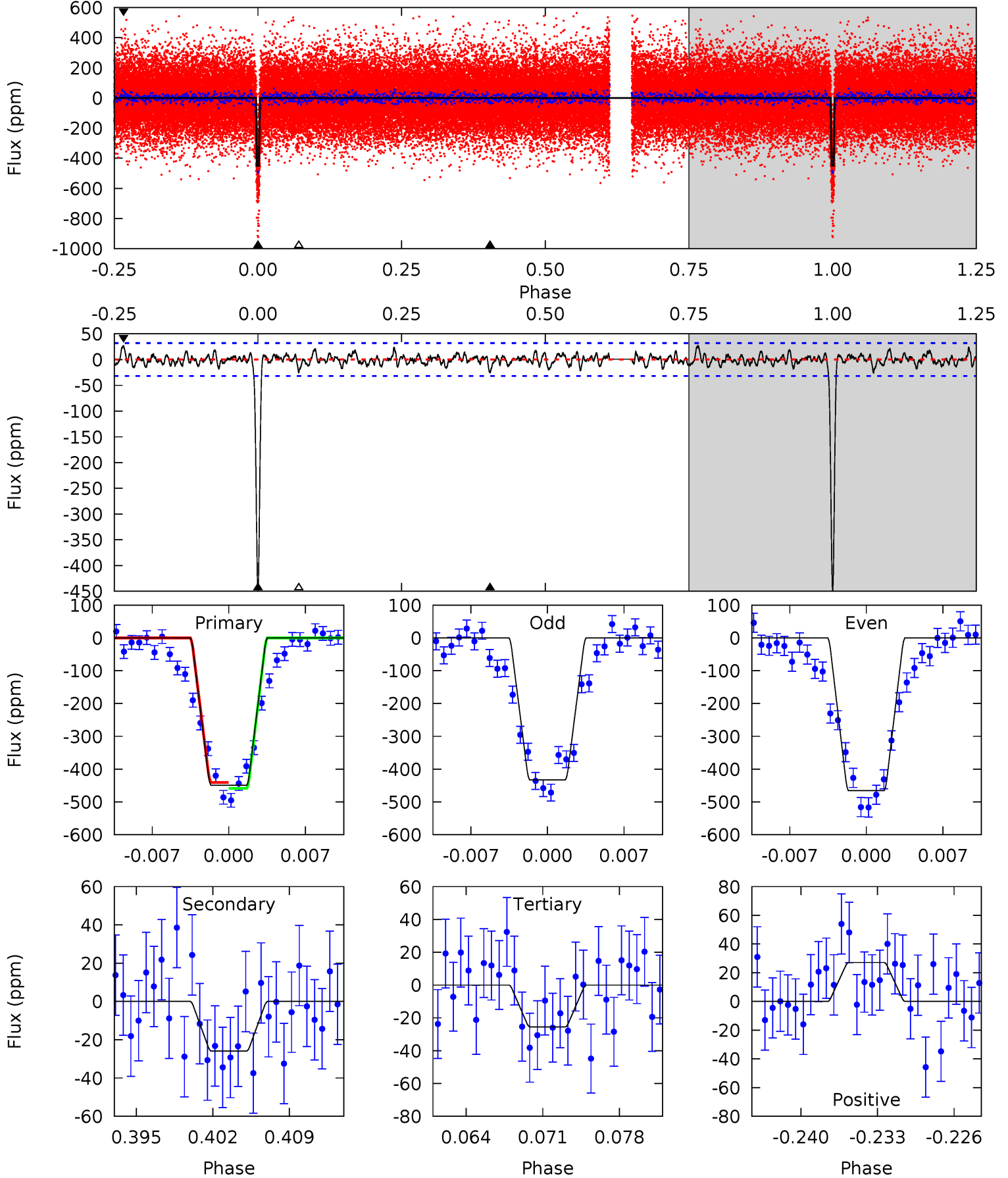
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
86.9	6.14	5.33	4.75	5.00	2.53	1.87	81.6	82.2	0.81	1.38	2.51	0.98	0.05	0.03



# Alt Model-Shift Uniqueness Test

004159347-02,  $P = 12.283487$  Days,  $E = 129.763146$  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
71.8	4.13	4.07	4.33	5.09	2.69	1.23	67.7	67.5	0.06	-0.21	2.65	0.99	0.06	1.46



### Stellar Parameters For KIC 004159347

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6171^{+185}_{-185}$	$3.668^{+0.323}_{-0.108}$	$-0.520^{+0.350}_{-0.300}$	$2.759^{+0.557}_{-1.035}$	$1.291^{+0.200}_{-0.300}$	$0.087^{+0.213}_{-0.029}$
	+3%/-3%	+9%/-3%	+67%/-58%	+20%/-38%	+15%/-23%	+247%/-33%
Source	PHO1	FLK73	KIC0	DSEP		

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

### Secondary Eclipse Parameters for KIC 004159347-02 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-33 \pm 5$	$11.41^{+8.44}_{-6.70}$	$1841^{+122}_{-162}$	$2892^{+941}_{-541}$	$1.765^{+8.174}_{-1.196}$
Alt.	$-26 \pm 6$	$8.64^{+7.92}_{-5.80}$	$1839^{+120}_{-175}$	$3014^{+1479}_{-581}$	$2.411^{+19.686}_{-1.762}$

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

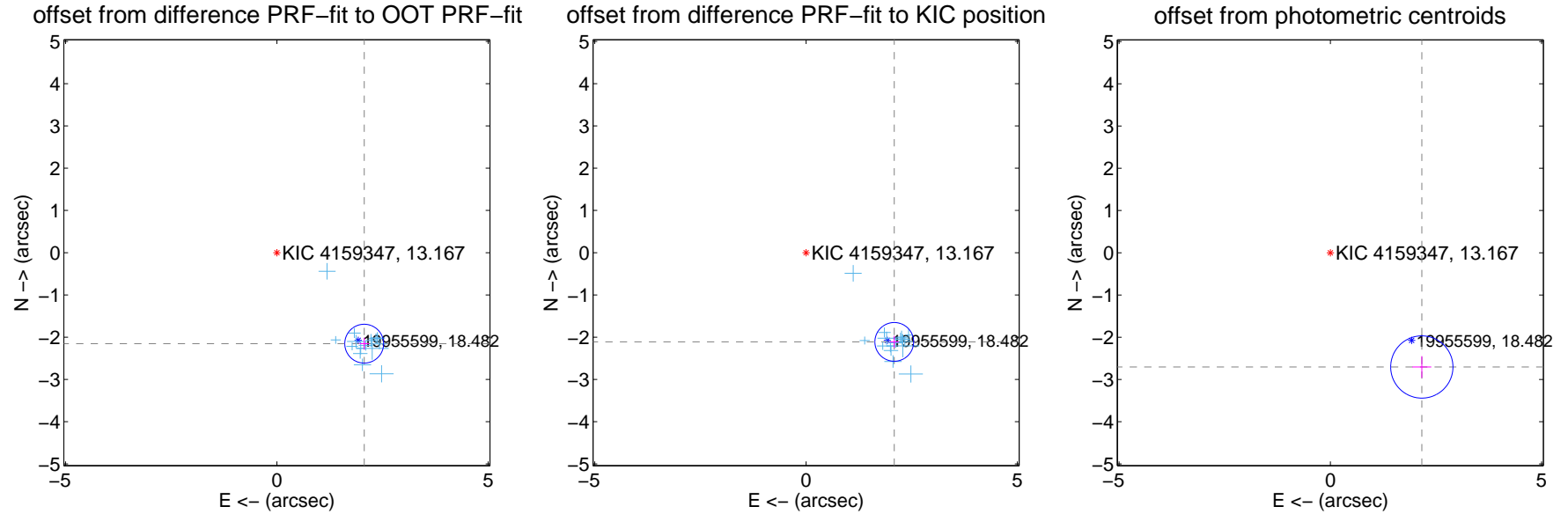
## DV Centroid Data

Supplemental centroid analysis for 004159347-02. Kepler magnitude: 13.17. Transit SNR 41.12

There are 16 quarters with good PRF difference image offsets

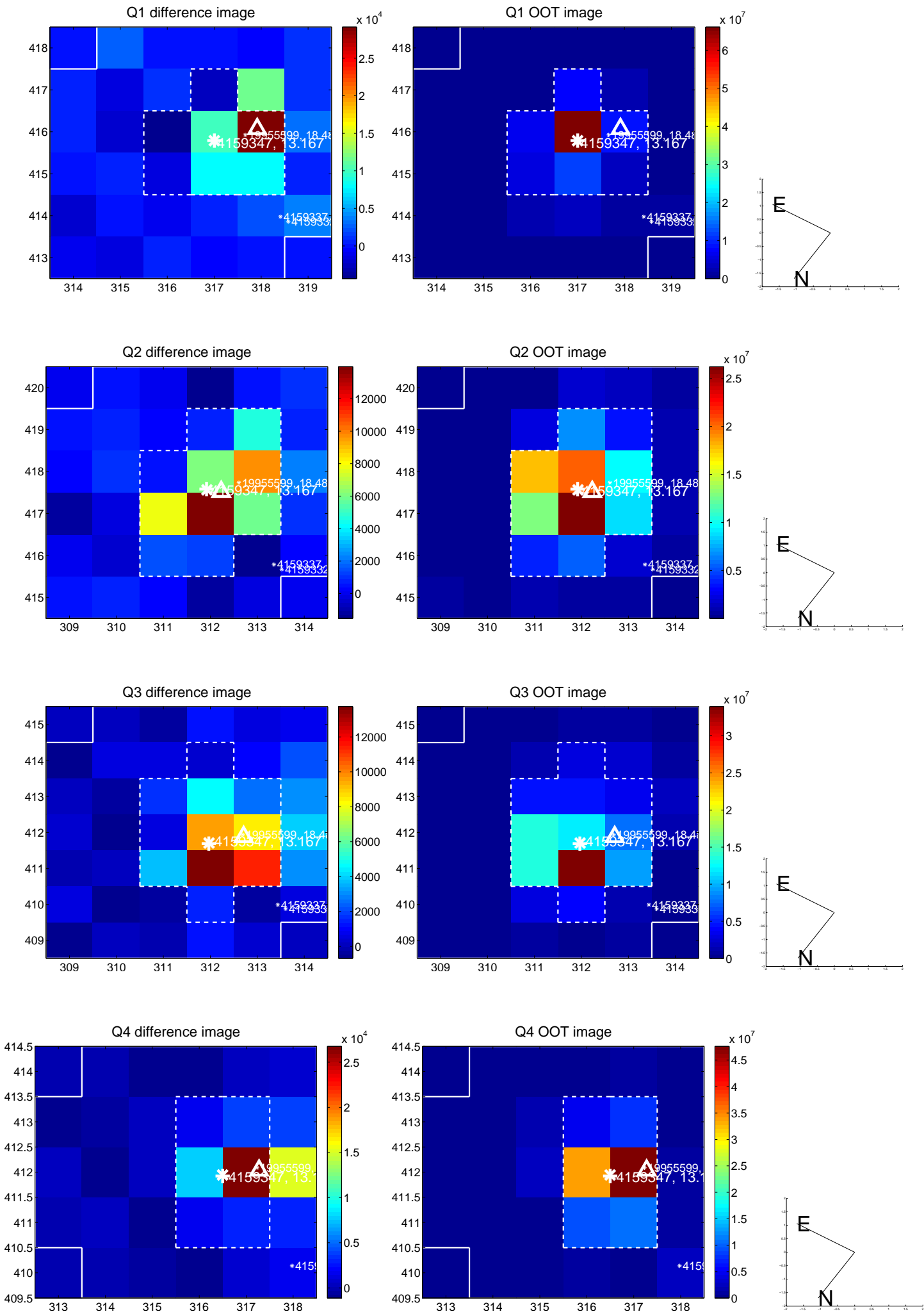
The direct PRF centroid is offset from the target star catalog position by about 0.07 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$2.984 \pm 0.153$	19.47	$-2.066 \pm 0.114$	$-2.153 \pm 0.141$
PRF-fit source offset from KIC position	$2.968 \pm 0.153$	19.42	$-2.087 \pm 0.109$	$-2.111 \pm 0.141$
photometric centroid source offset	$3.46 \pm 0.25$	14.10	$-2.16 \pm 0.22$	$-2.70 \pm 0.26$



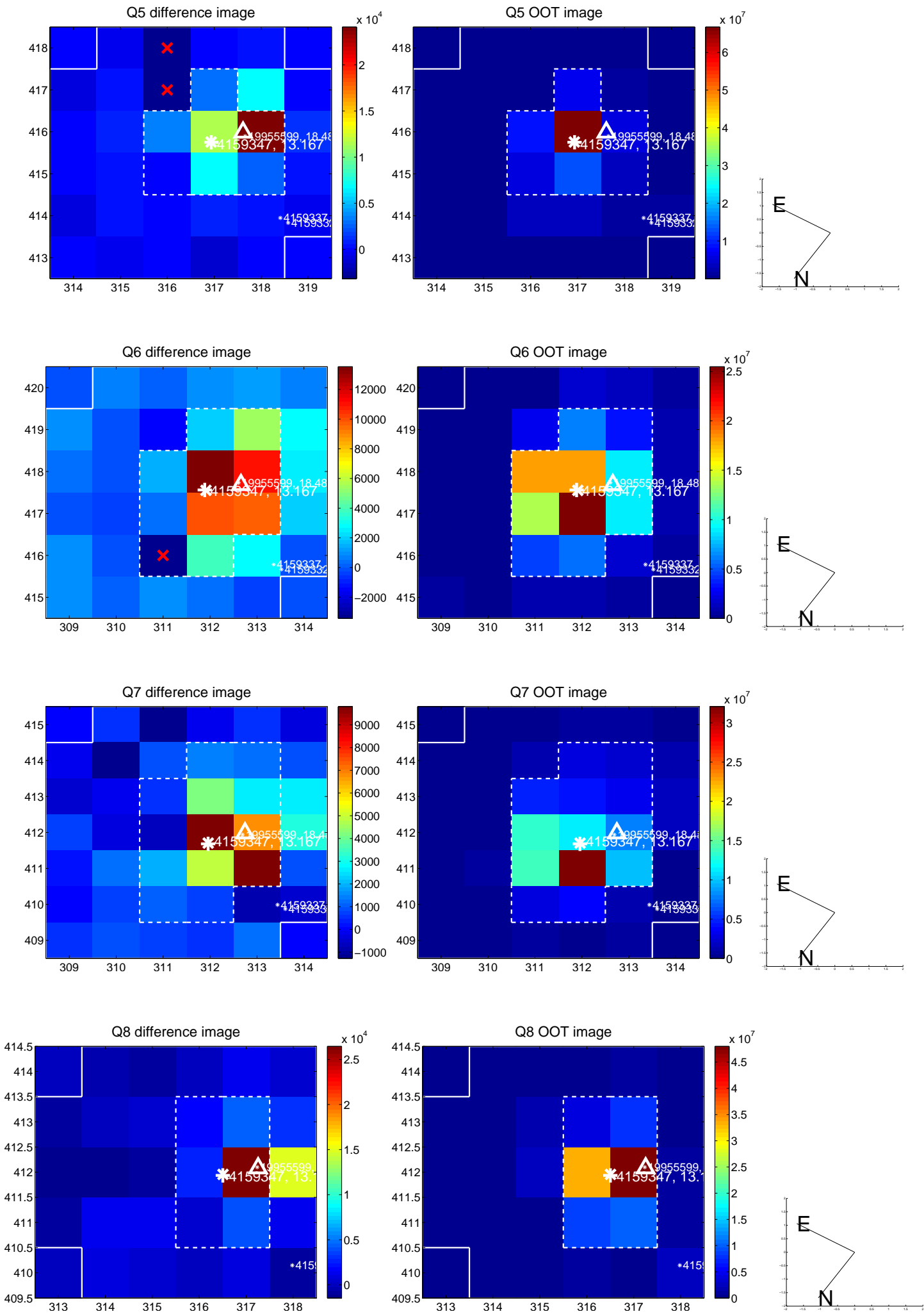
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

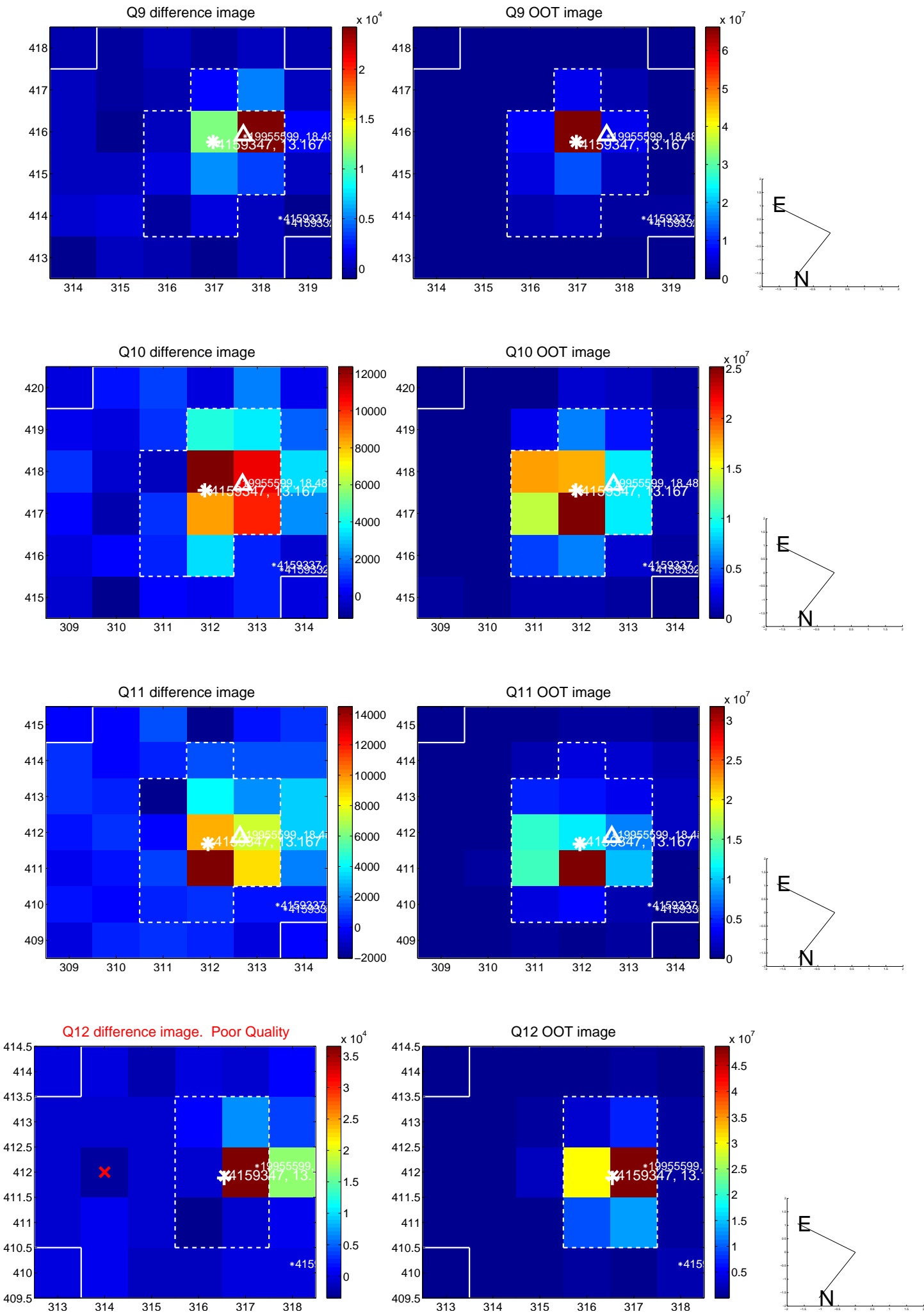




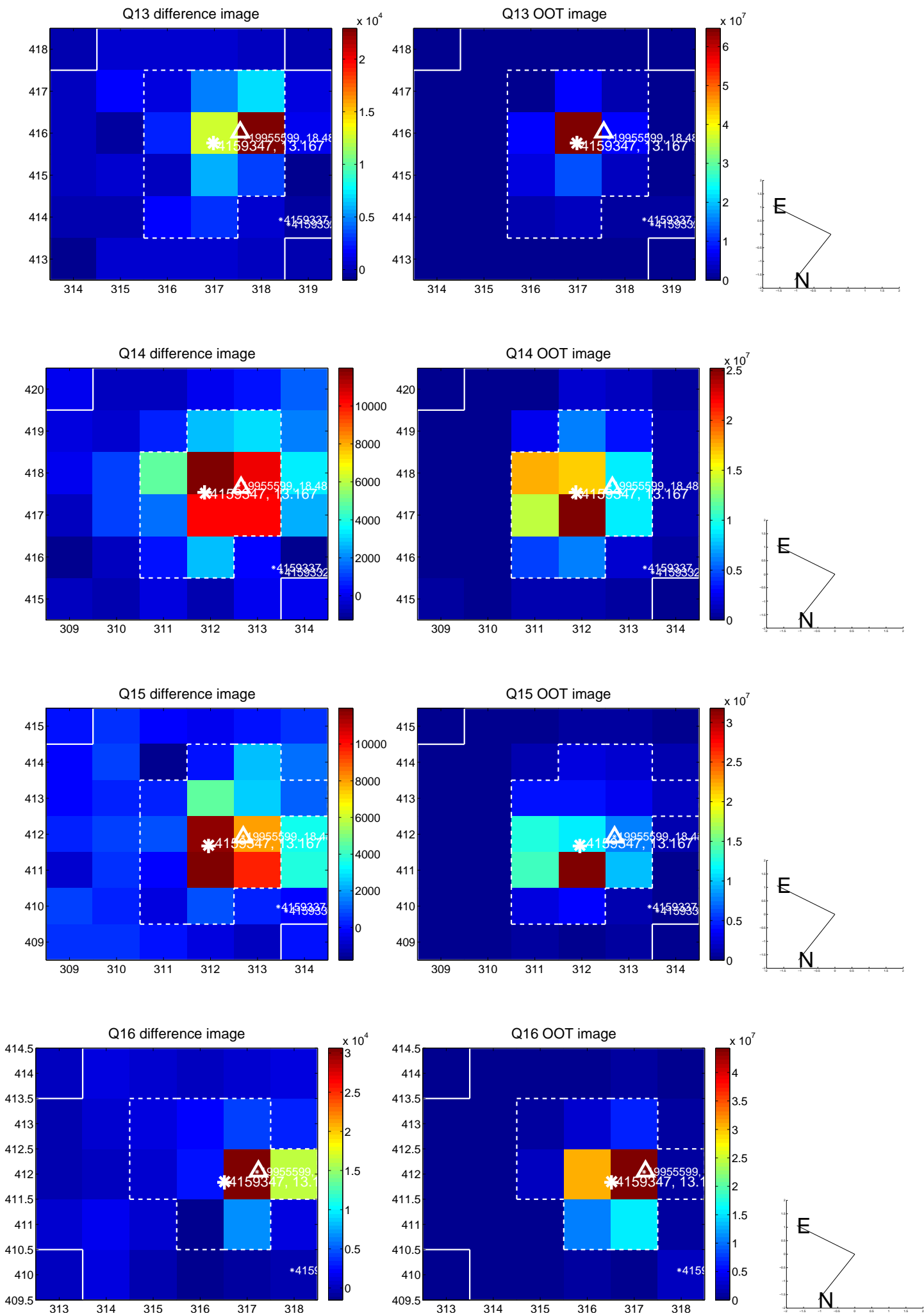
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



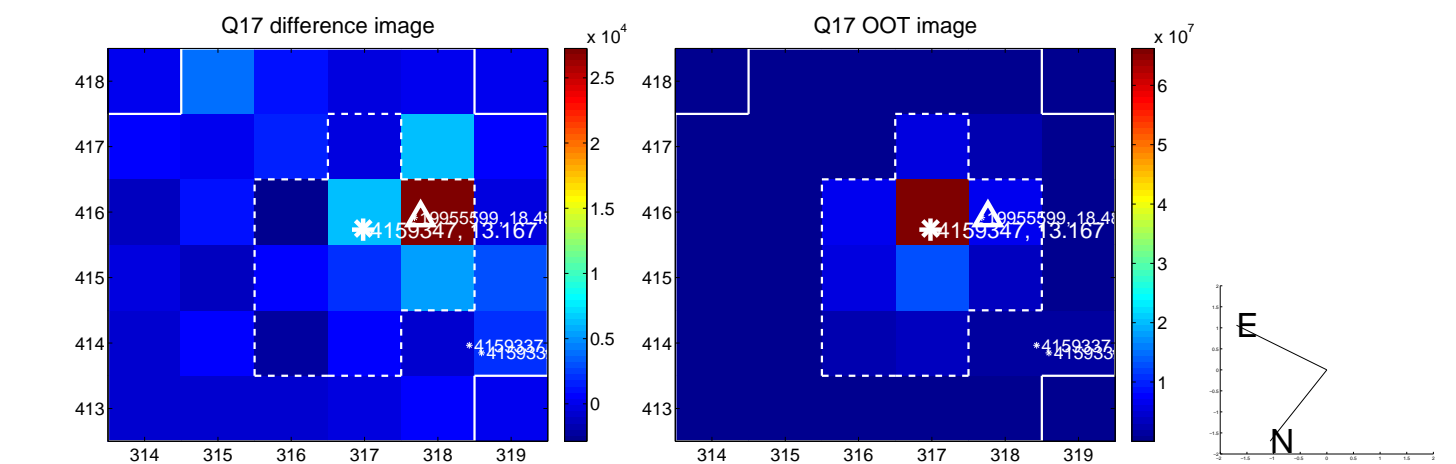
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



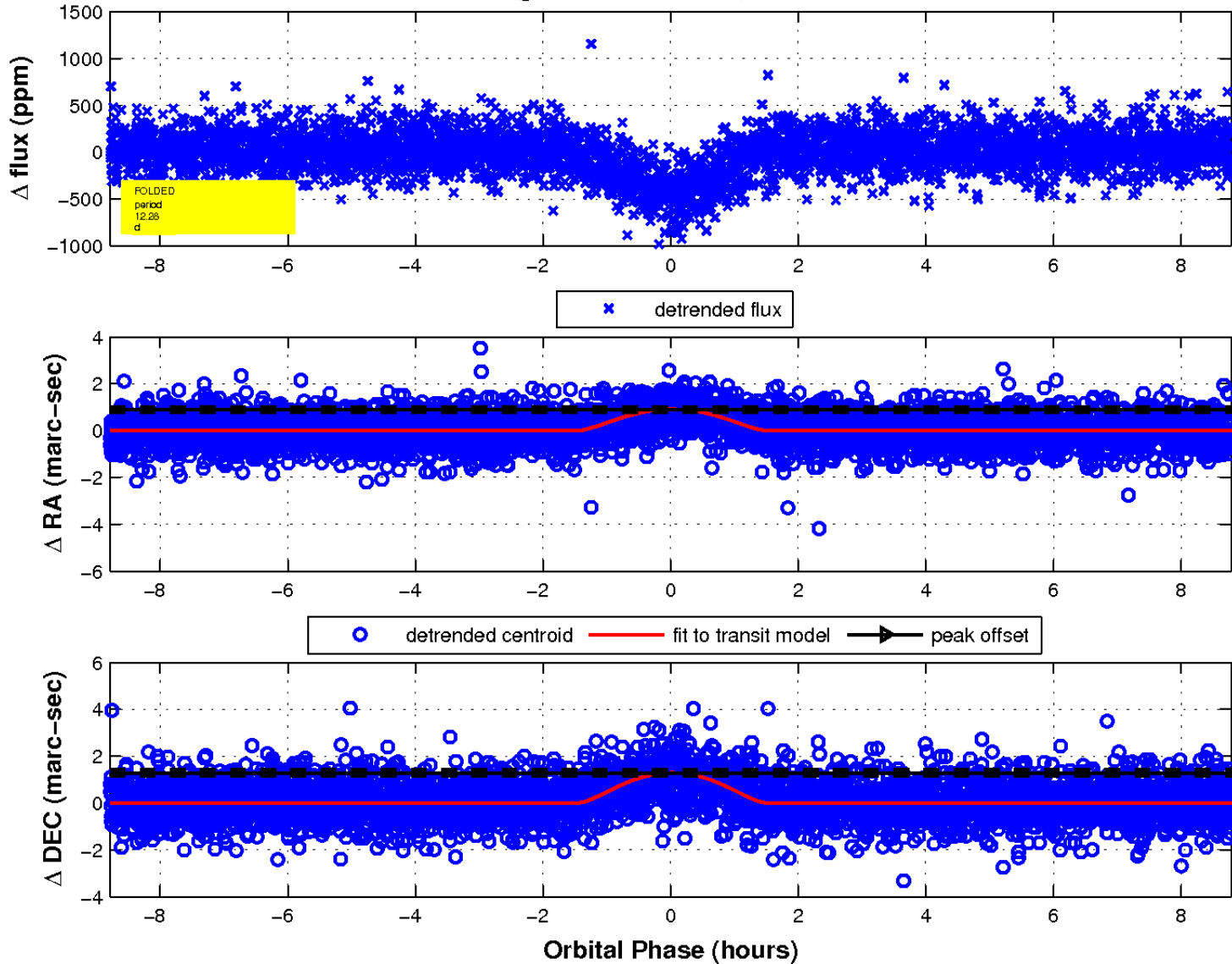
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



fluxWeightedCentroids, Planet 2 of 2



UKIRT Image

Declination

