

# KIC 012058204

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
012058204-01	OBS	2218.01	5.535364	132.757559	251.6	3.002	22.9	24.5	1.10	5588	2.12	292.41
012058204-02	OBS	2218.02	16.726235	143.748604	189.0	2.592	9.1	9.8	1.10	5588	1.68	66.94

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
012058204-01	OBS	PC	1.00	0	0	0	0	NO_COMMENT
012058204-02	OBS	PC	0.98	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.

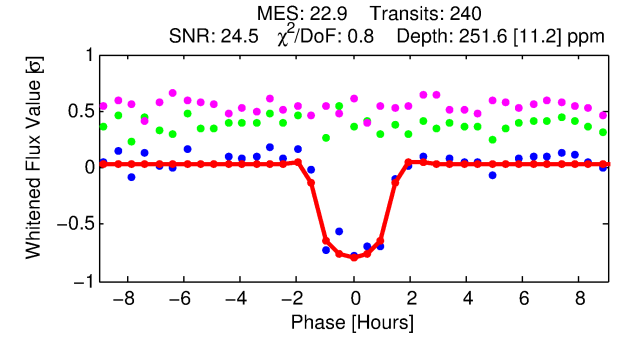
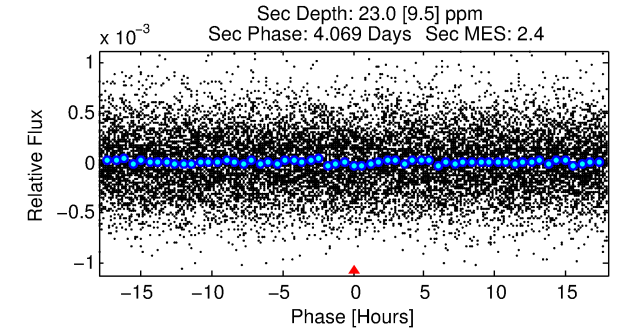
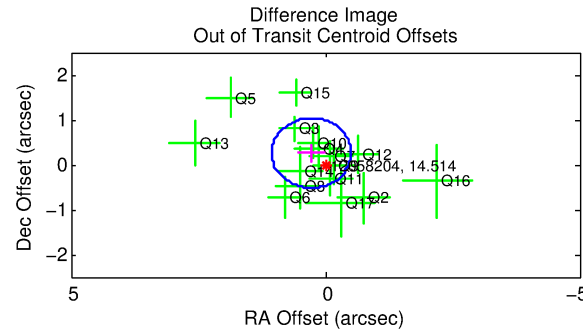
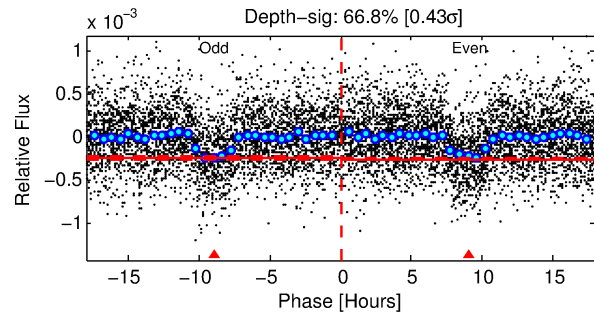
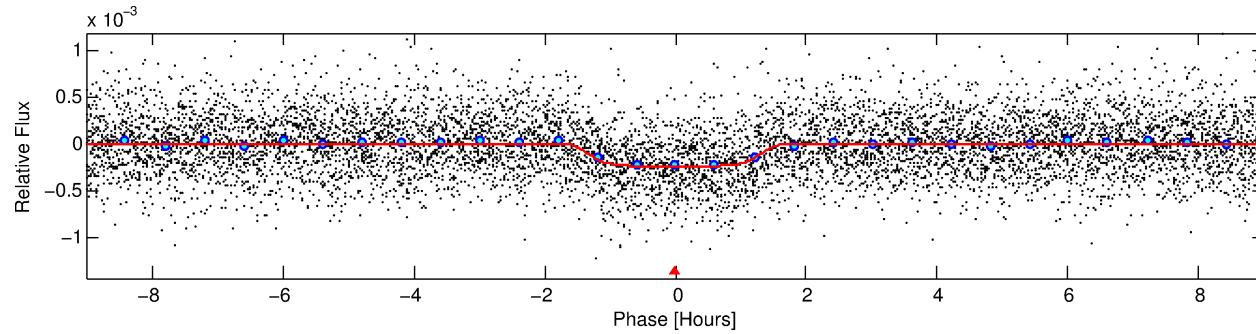
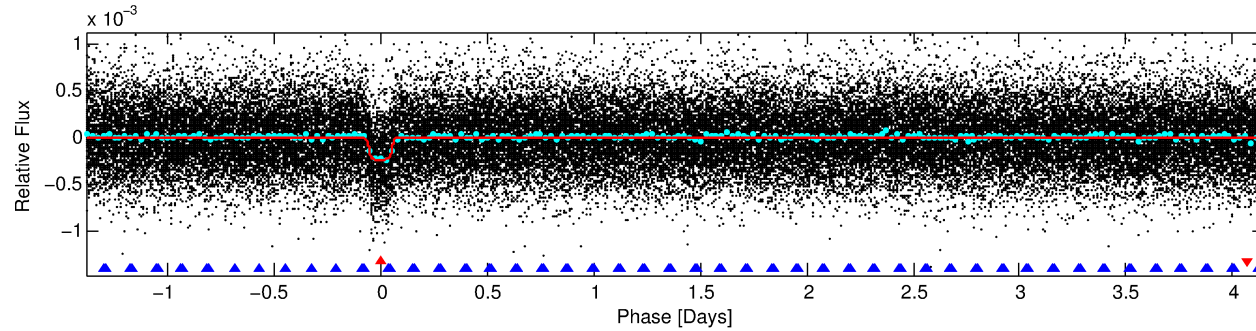
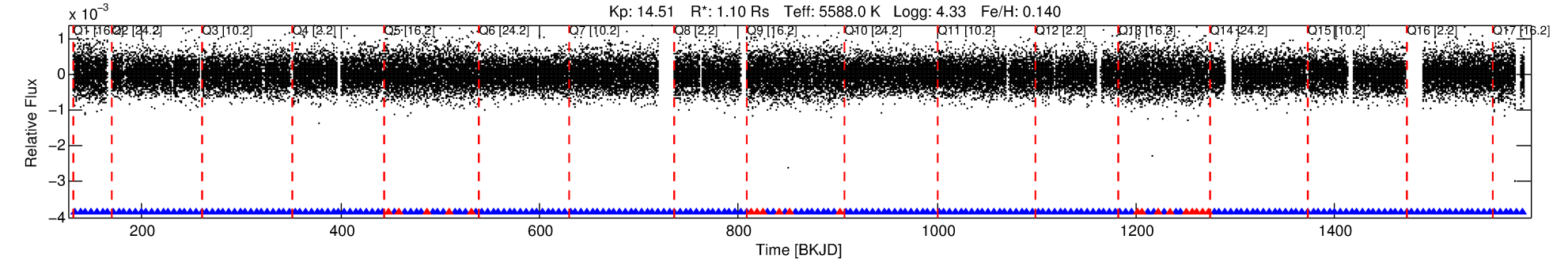
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 012058204-01

No Significant Match Found

# DV One-Page Summary

KIC: 12058204 Candidate: 1 of 2 Period: 5.535 d  
KOI: K02218.01 Name: Kepler-373b Corr: 0.969



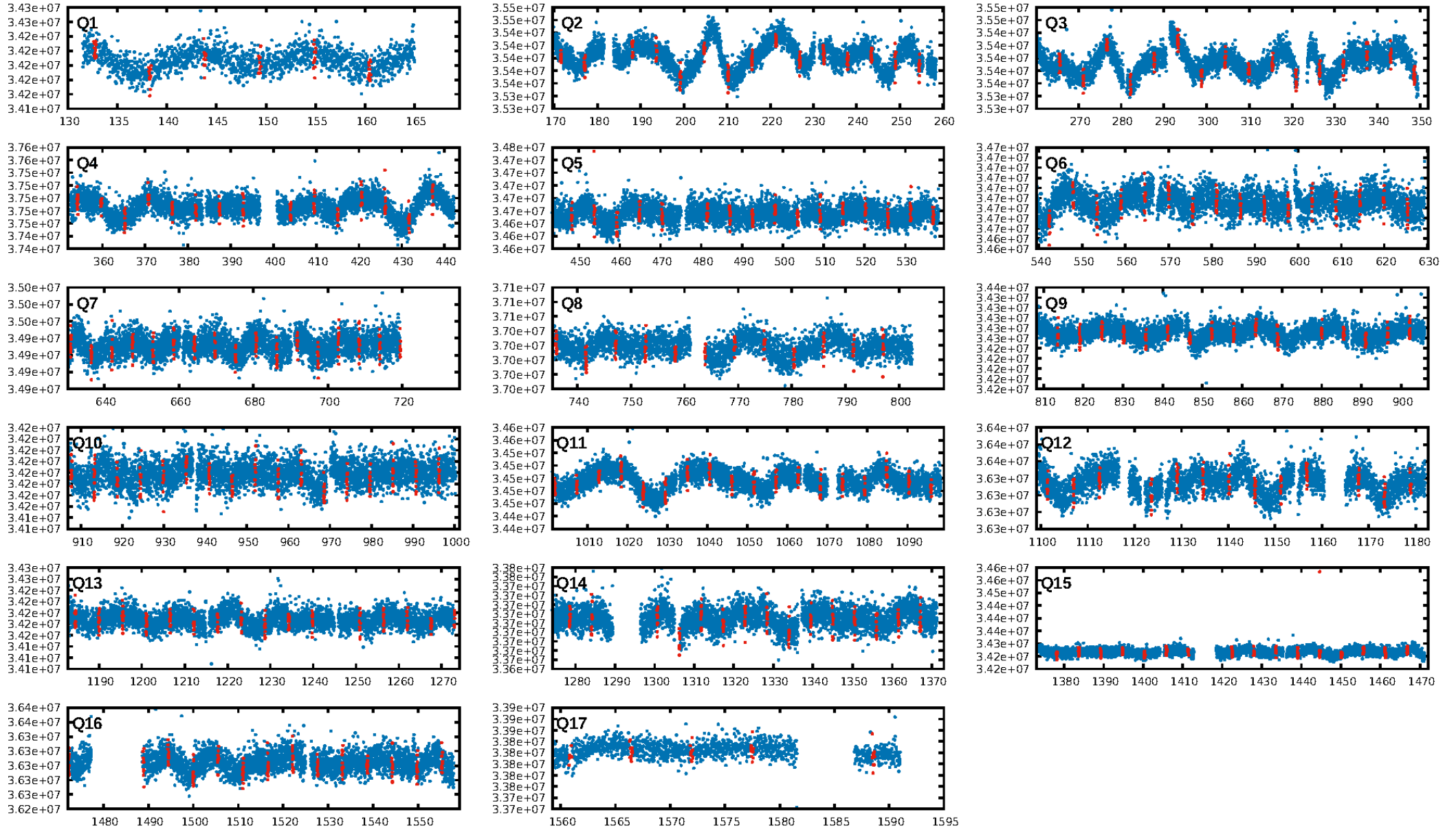
## DV Fit Results:

Period = 5.53536 [0.00002] d  
Epoch = 132.7576 [0.0023] BKJD  
Rp/R\* = 0.0177 [0.0031]  
a/R\* = 6.42 [5.01]  
b = 0.91 [0.15]  
Seff = 292.41 [67.84]  
T<sub>eq</sub> = 1054 [61] K  
Rp = 2.12 [0.49] Re  
a = 0.0601 [0.0085] AU  
Ag = 10.17 [6.01] [1.53 $\sigma$ ]  
T<sub>effp</sub> = 2911 [399] K [4.60 $\sigma$ ]

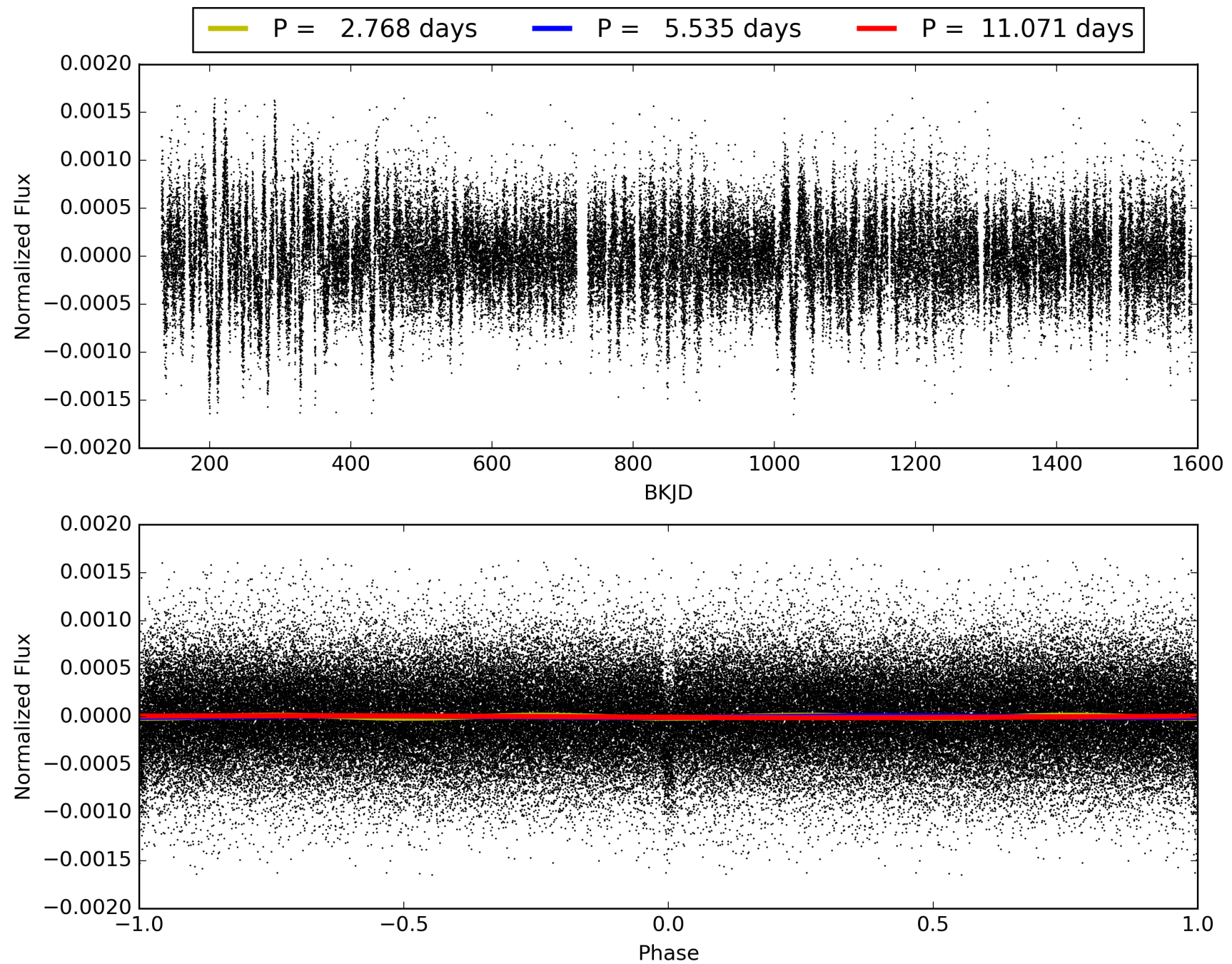
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [67.72 $\sigma$ ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: 7.83e-110  
RollingBand-fgt: 0.91 [209/229]  
GhostDiagnostic-chr: 3.147  
Centroid-sig: 2.4%  
Centroid-so: 0.867 arcsec [1.46 $\sigma$ ]  
OotOffset-rm: 0.382 arcsec [1.47 $\sigma$ ]  
KicOffset-rm: 0.386 arcsec [1.31 $\sigma$ ]  
OotOffset-st: 4/4/4/4 [16]  
KicOffset-st: 4/4/4/4 [16]  
DiffImageQuality-fgm: 0.88 [14/16]  
DiffImageOverlap-fno: 1.00 [17/17]

# TCE 012058204-01, PDC Light Curves

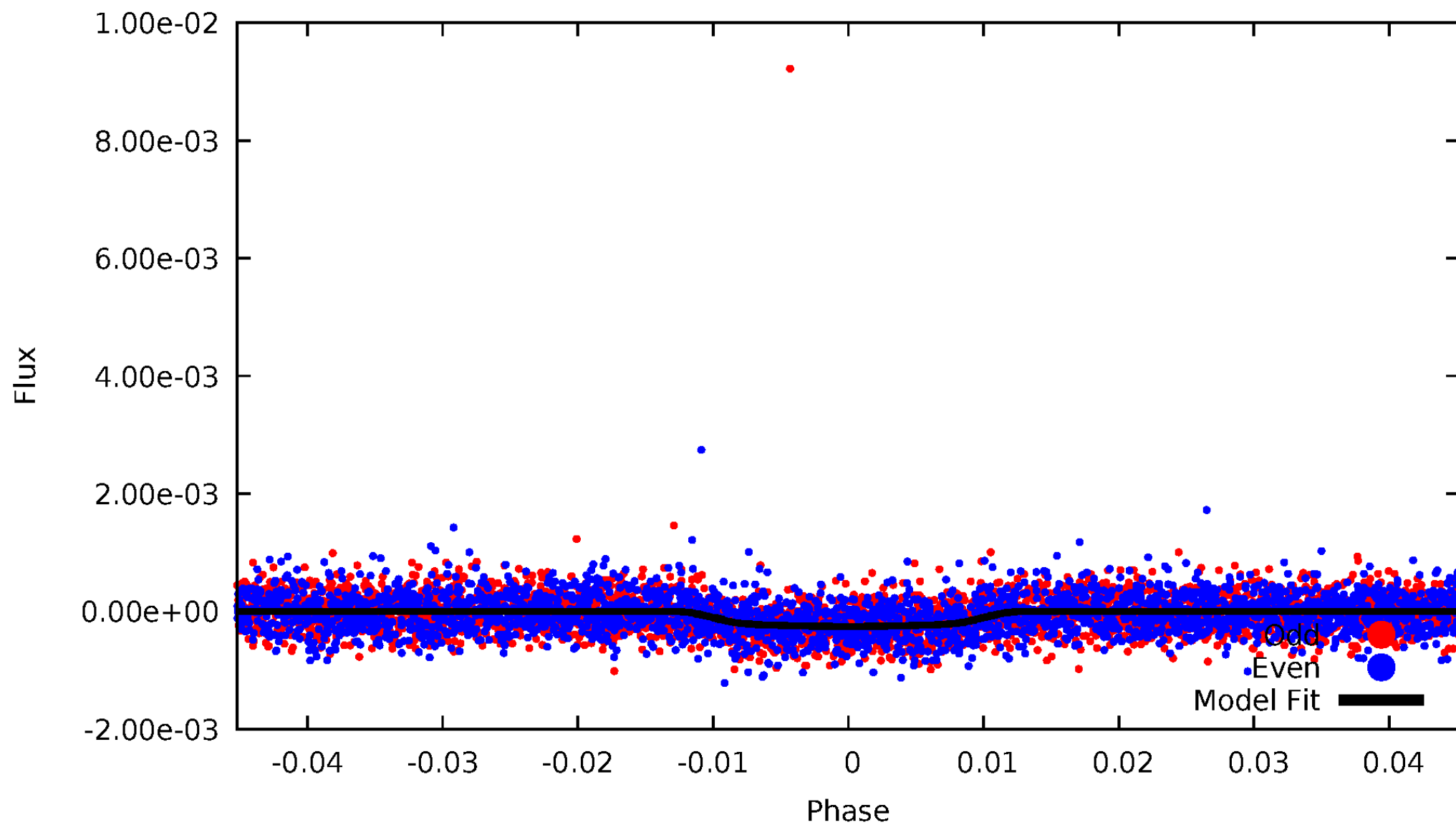


TCE 012058204-01



# DV Odd/Even

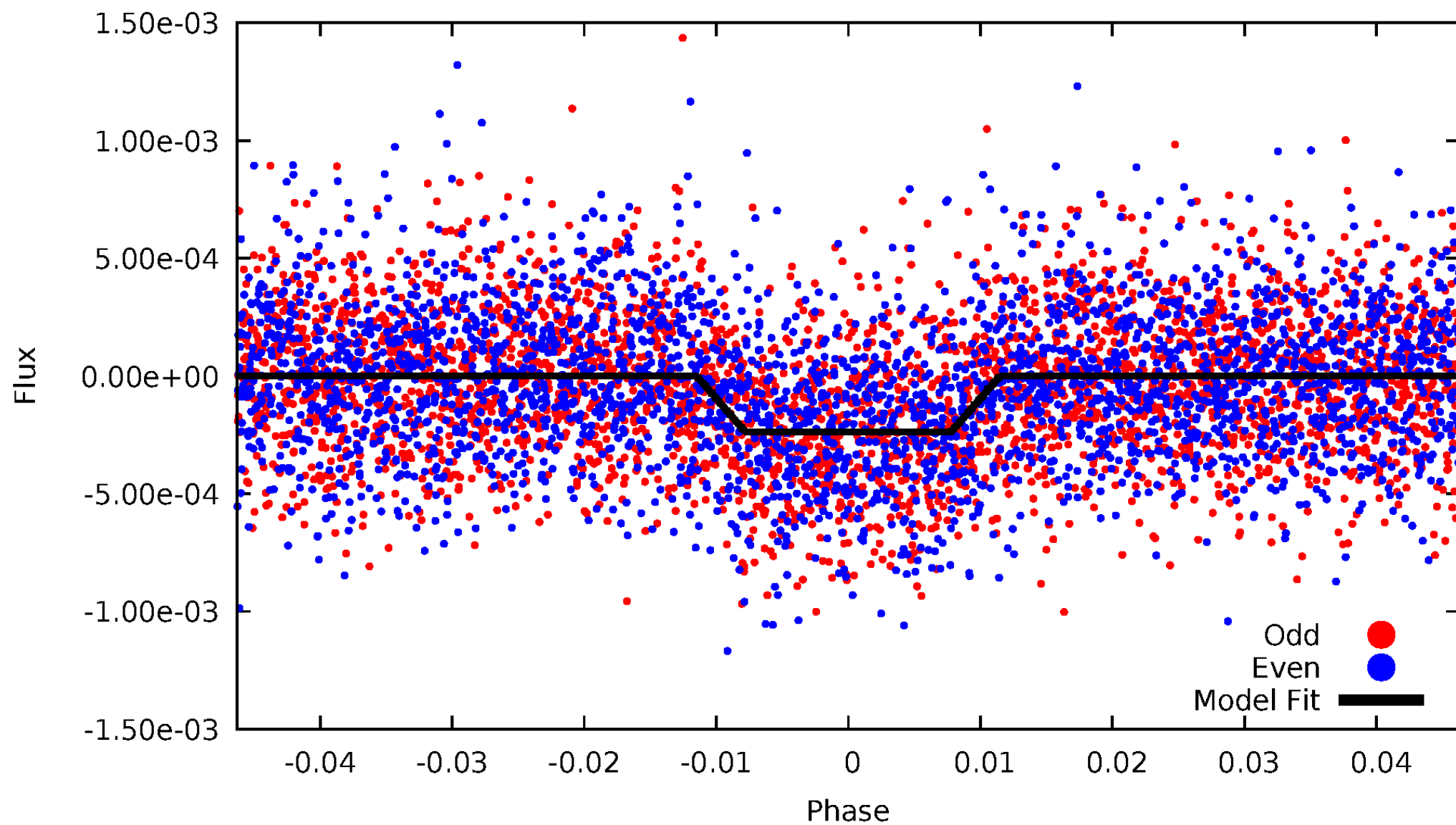
TCE 012058204-01





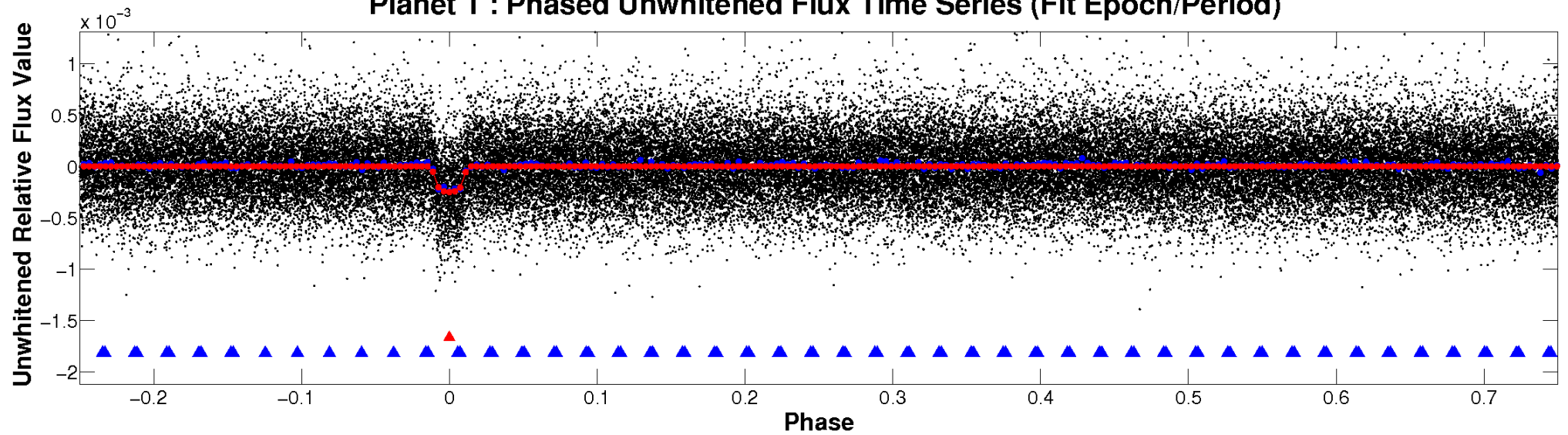
# ALT Odd/Even

TCE 012058204-01

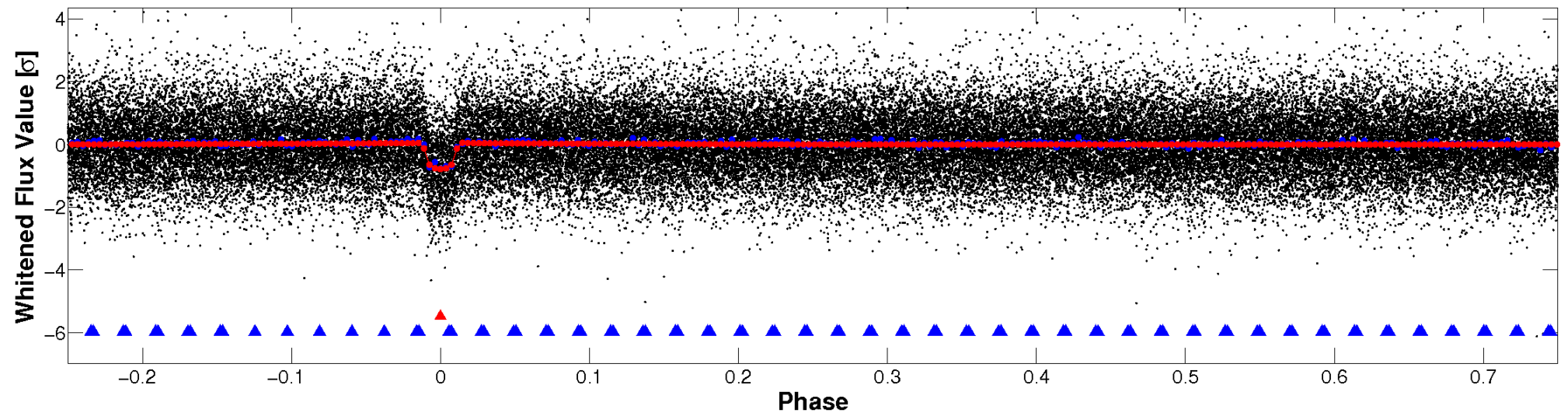


# Non-Whitened Vs. Whitened Light Curve

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

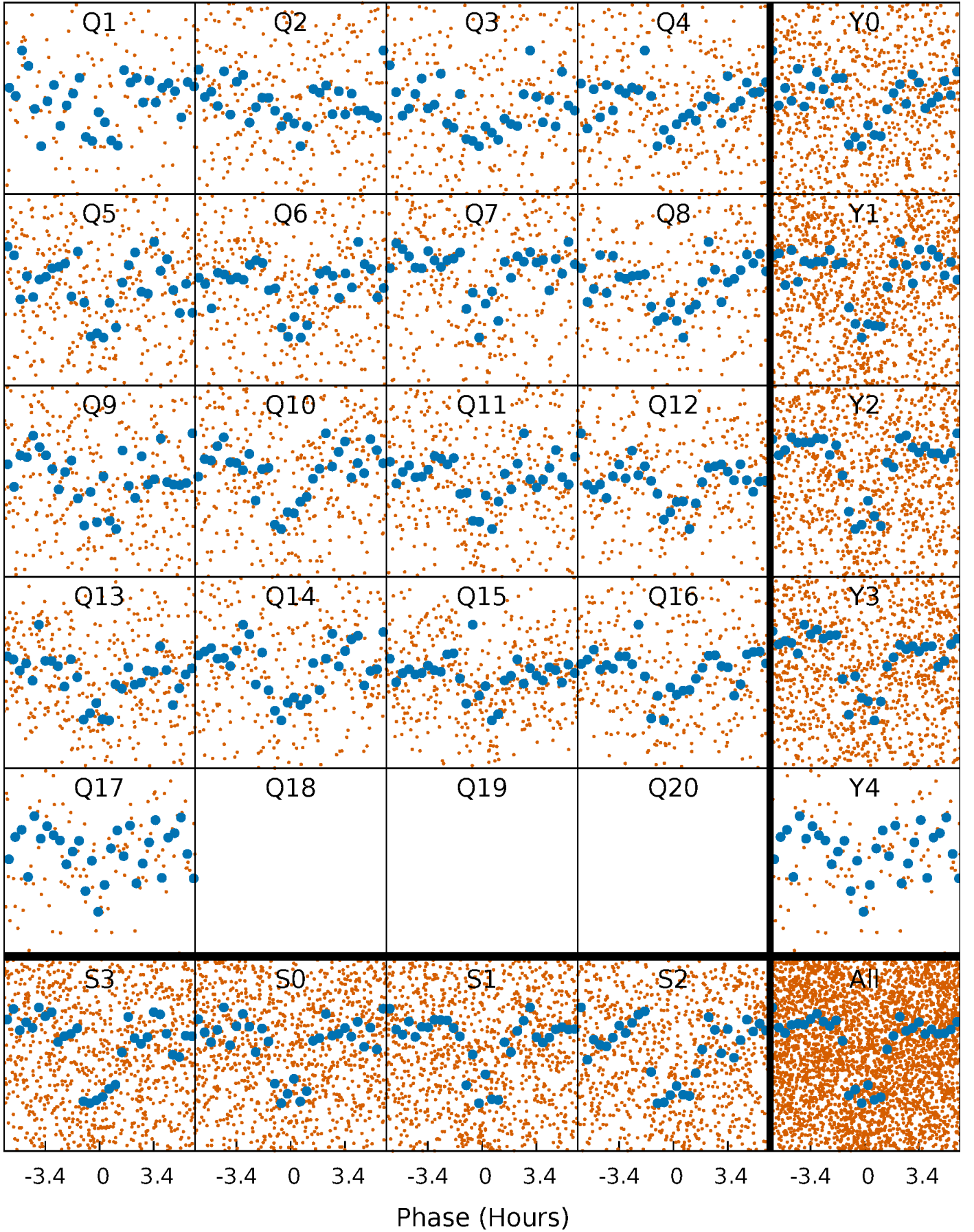


**Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



# PDC Quarter-Phased Transit Curves

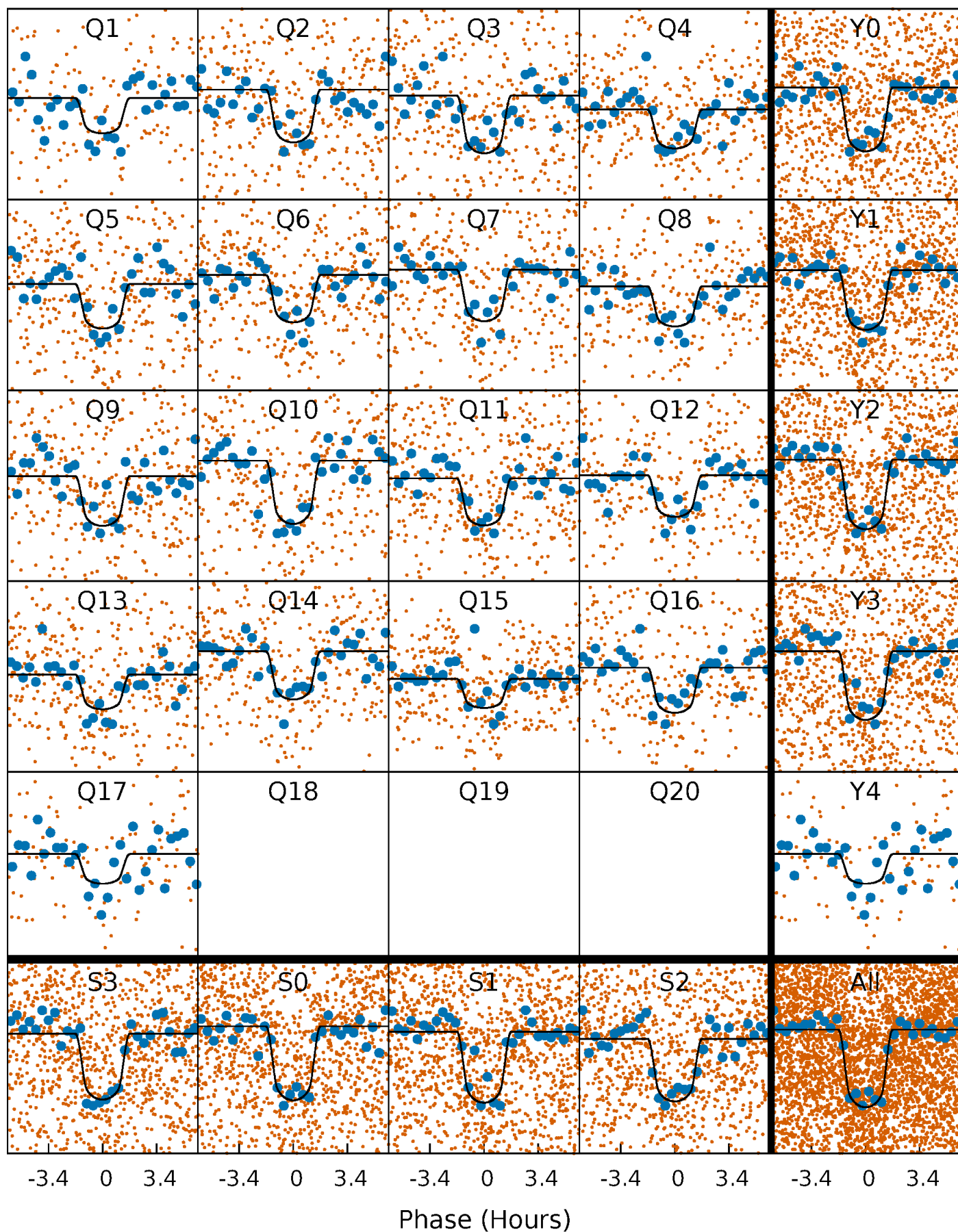
TCE 012058204-01 P= 5.535364 Days  $T_0=132.757559$  (BKJD)





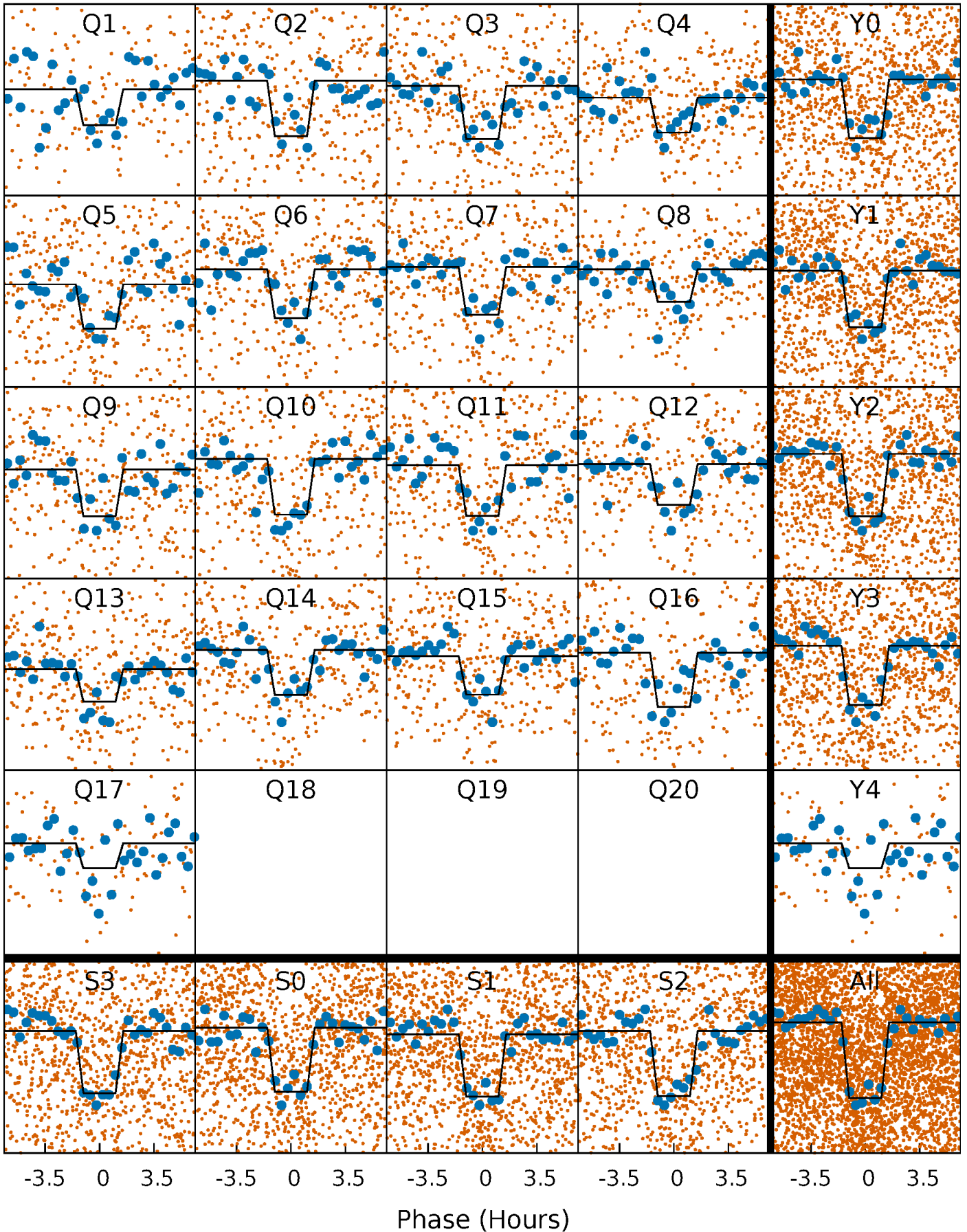
# DV Quarter-Phased Transit Curves

TCE 012058204-01 P= 5.535364 Days  $T_0=132.757559$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

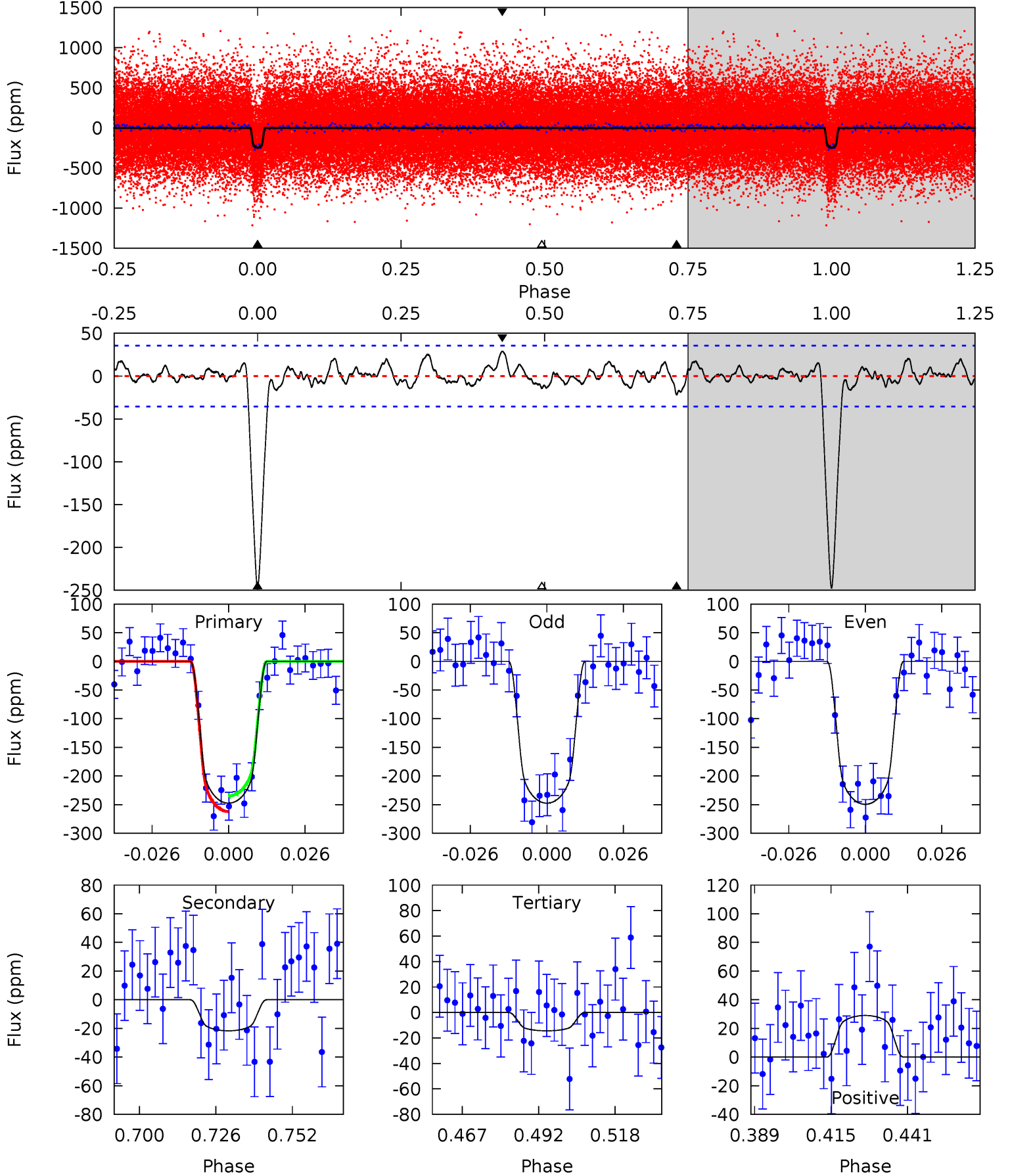
TCE 012058204-01 P= 5.535395 Days  $T_0=132.753937$  (BKJD)



# DV Model-Shift Uniqueness Test

012058204-01, P = 5.535364 Days, E = 127.222195 Days

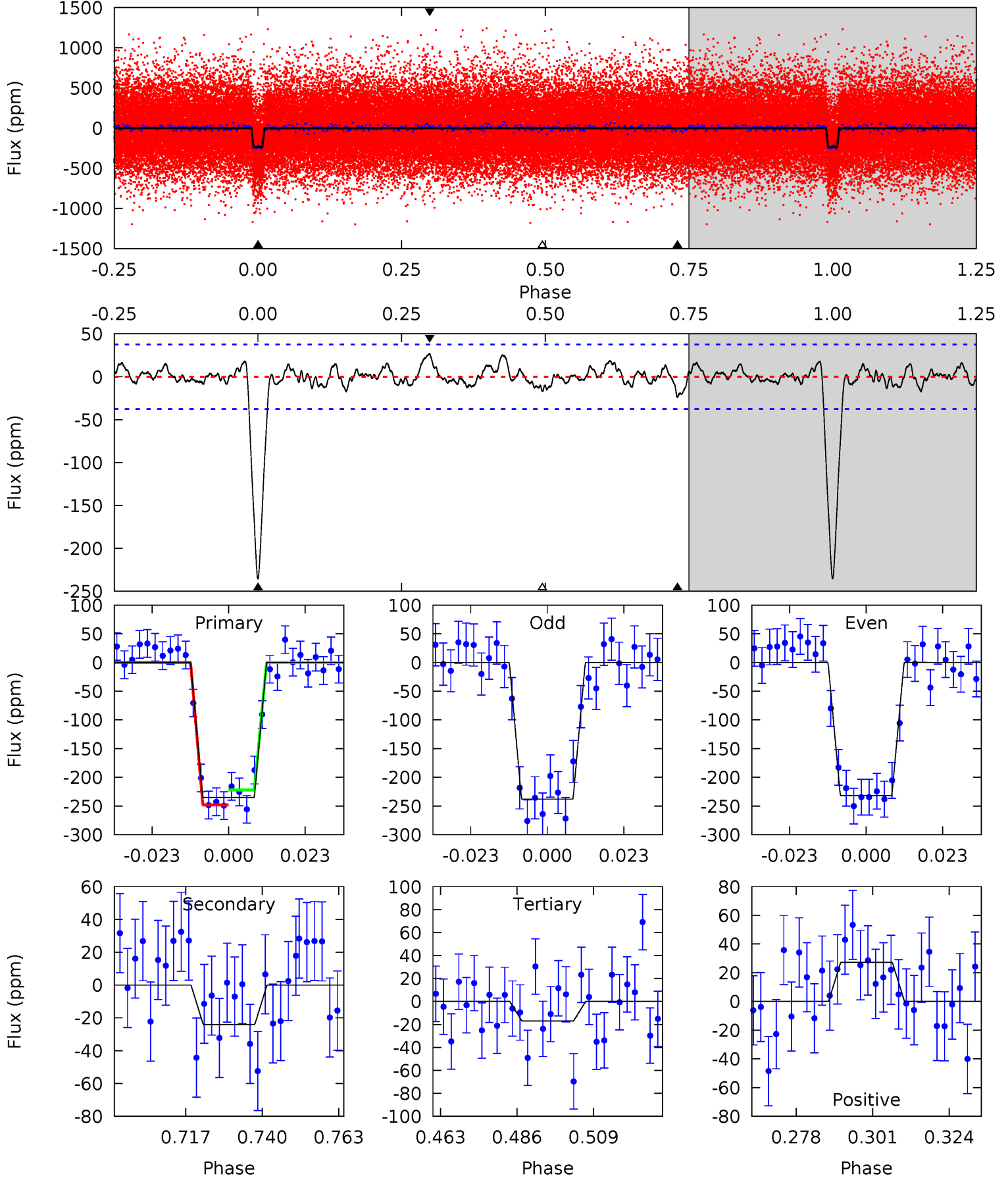
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
33.7	2.95	1.96	3.95	4.84	2.23	1.16	31.7	29.7	0.99	-1.00	0.14	0.92	0.11	1.87



# Alt Model-Shift Uniqueness Test

012058204-01, P = 5.535395 Days, E = 127.218542 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
30.3	3.11	2.21	3.53	4.86	2.27	1.08	28.1	26.8	0.90	-0.42	0.39	0.98	0.10	1.68



### Stellar Parameters For KIC 012058204

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5588^{+75}_{-75}$	$4.331^{+0.132}_{-0.108}$	$0.140^{+0.150}_{-0.150}$	$1.100^{+0.164}_{-0.147}$	$0.946^{+0.064}_{-0.047}$	$1.001^{+0.582}_{-0.314}$
	+1%/-1%	+3%/-2%	+107%/-107%	+15%/-13%	+7%/-5%	+58%/-31%
Source	SPE90	SPE90	SPE90	DSEP		

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

### Secondary Eclipse Parameters for KIC 012058204-01 / KOI 2218.01

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-22 \pm 7$	$2.10^{+0.43}_{-0.39}$	$1472^{+59}_{-62}$	$3360^{+278}_{-266}$	$9.533^{+6.845}_{-4.057}$
Alt.	$-24 \pm 8$	$1.87^{+0.40}_{-0.39}$	$1471^{+64}_{-57}$	$3566^{+315}_{-299}$	$13^{+10}_{-6}$

$T_{\text{max}}$  = 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

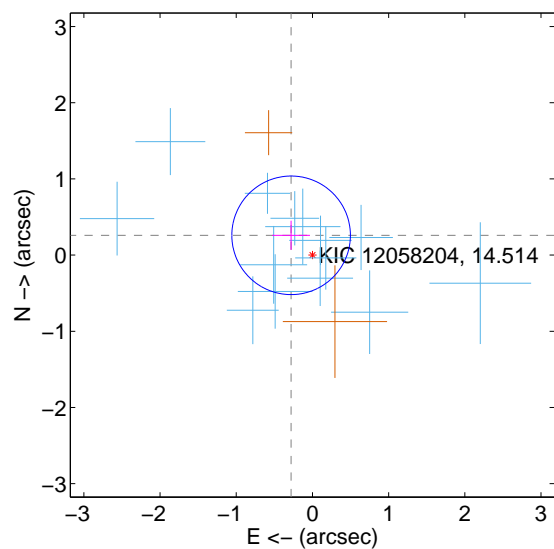
Supplemental centroid analysis for 012058204-01. Kepler magnitude: 14.51. Transit SNR 24.51

There are 14 quarters with good PRF difference image offsets

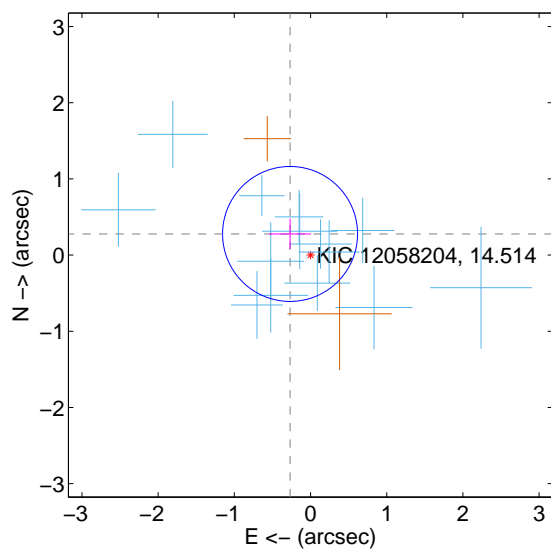
The direct PRF centroid is offset from the target star catalog position by about 0.13 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.382 \pm 0.259$	1.47	$0.280 \pm 0.247$	$0.260 \pm 0.191$
PRF-fit source offset from KIC position	$0.386 \pm 0.295$	1.31	$0.269 \pm 0.276$	$0.278 \pm 0.201$
photometric centroid source offset	$0.87 \pm 0.59$	1.46	$-0.62 \pm 0.61$	$0.61 \pm 0.58$

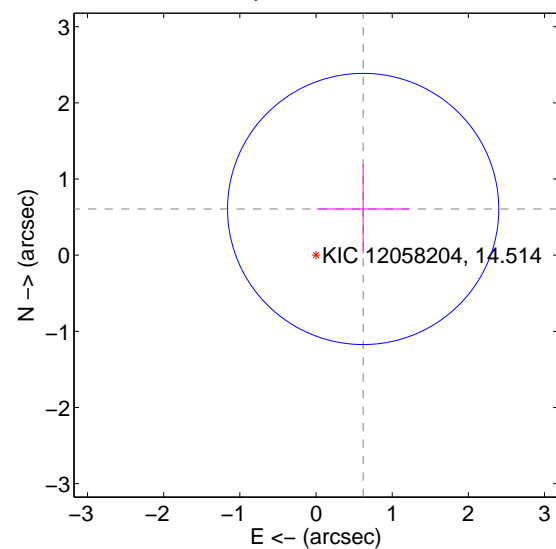
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

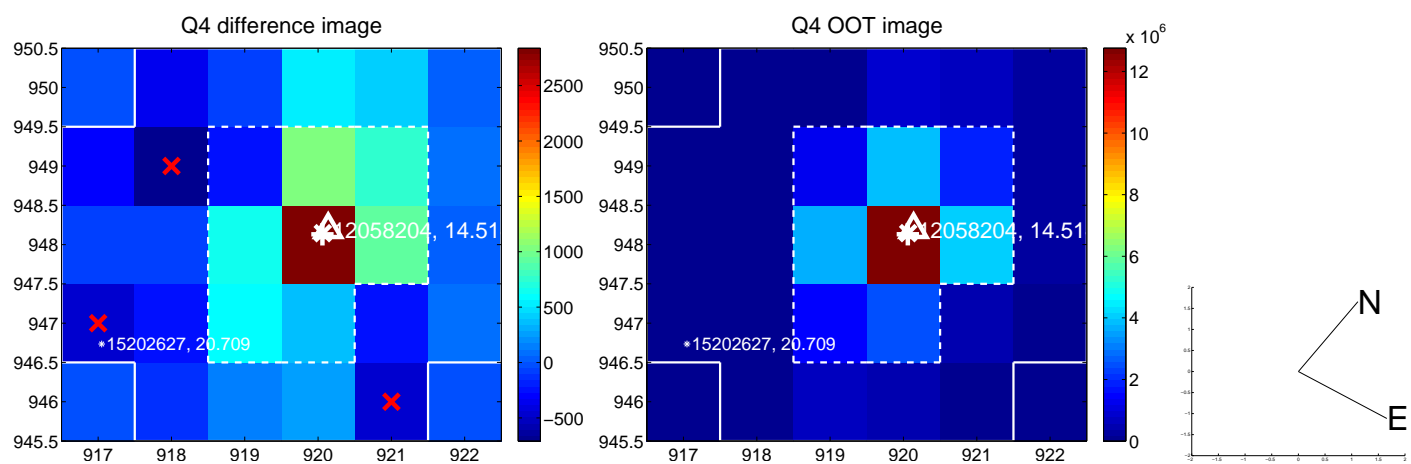
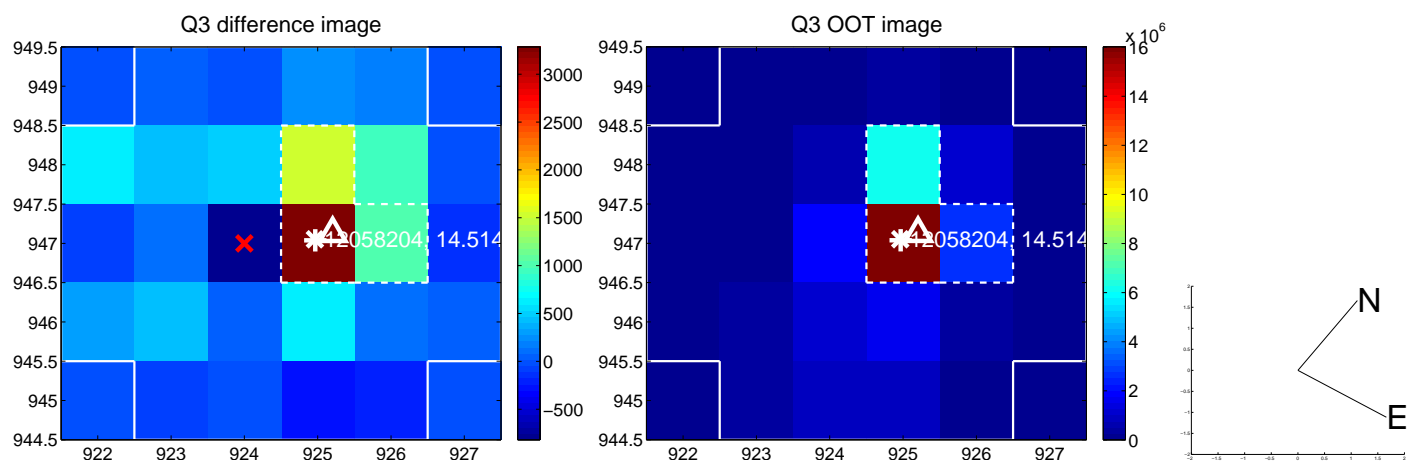
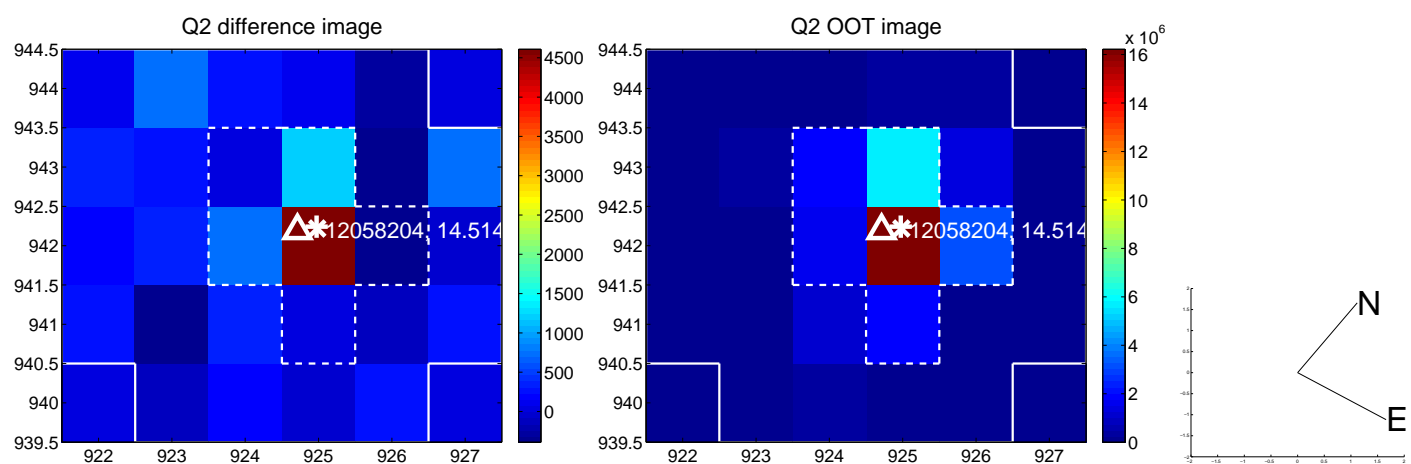
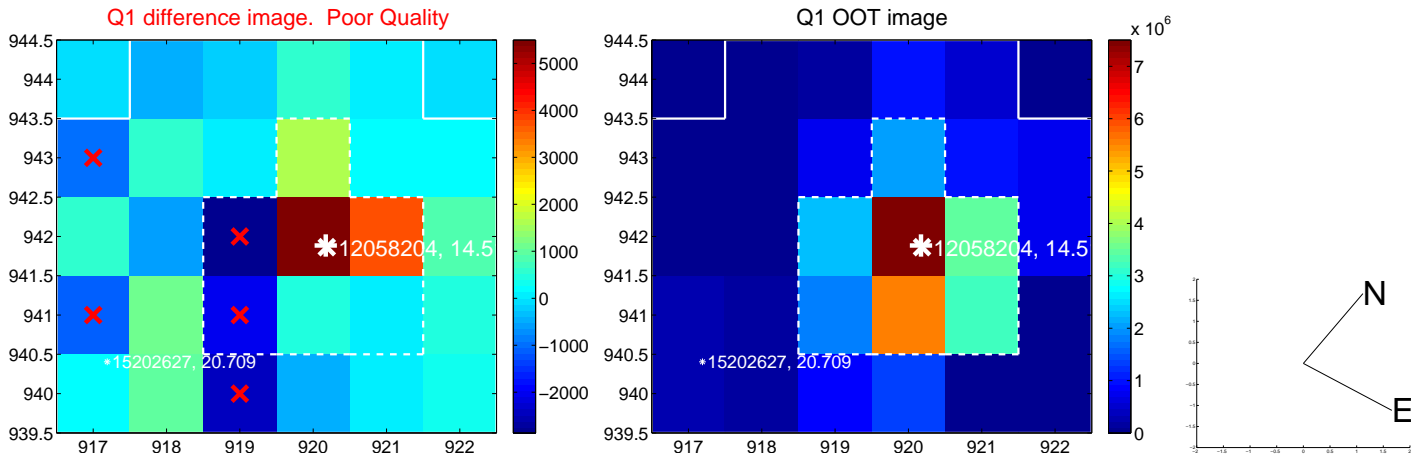


offset from photometric centroids

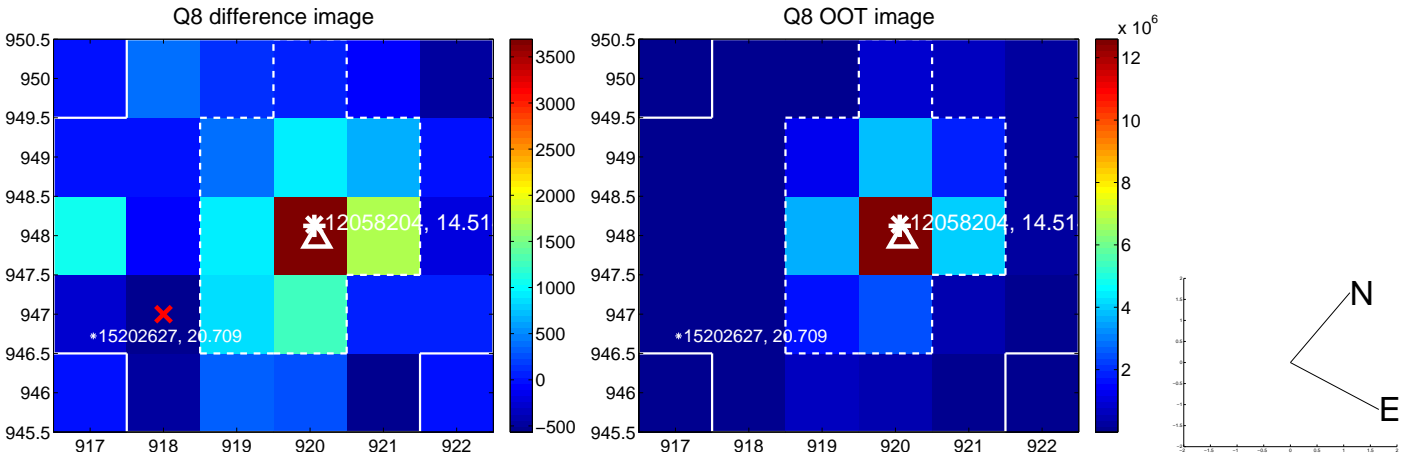
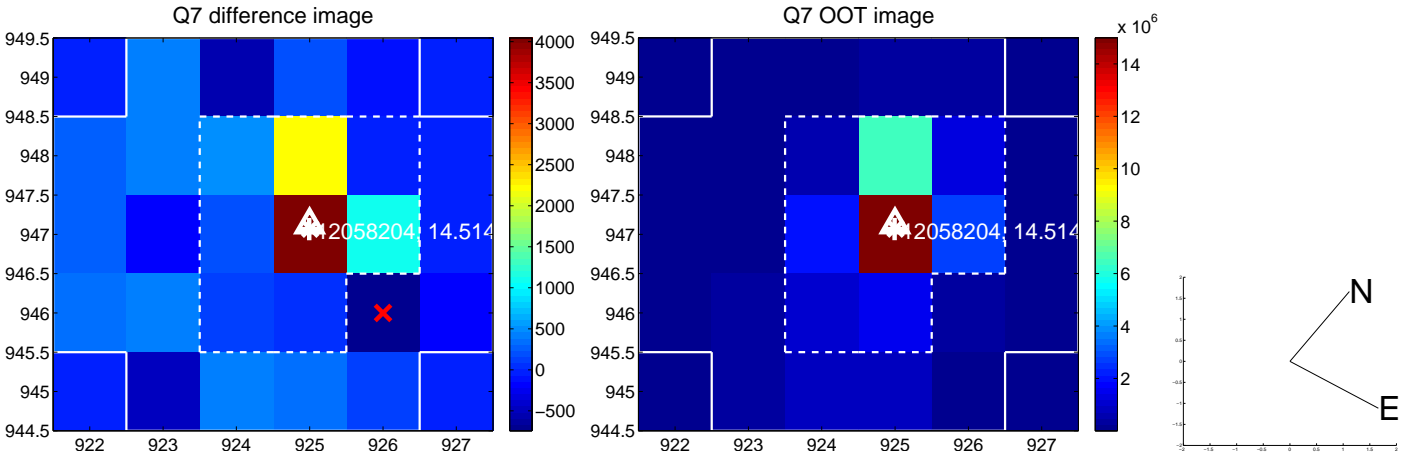
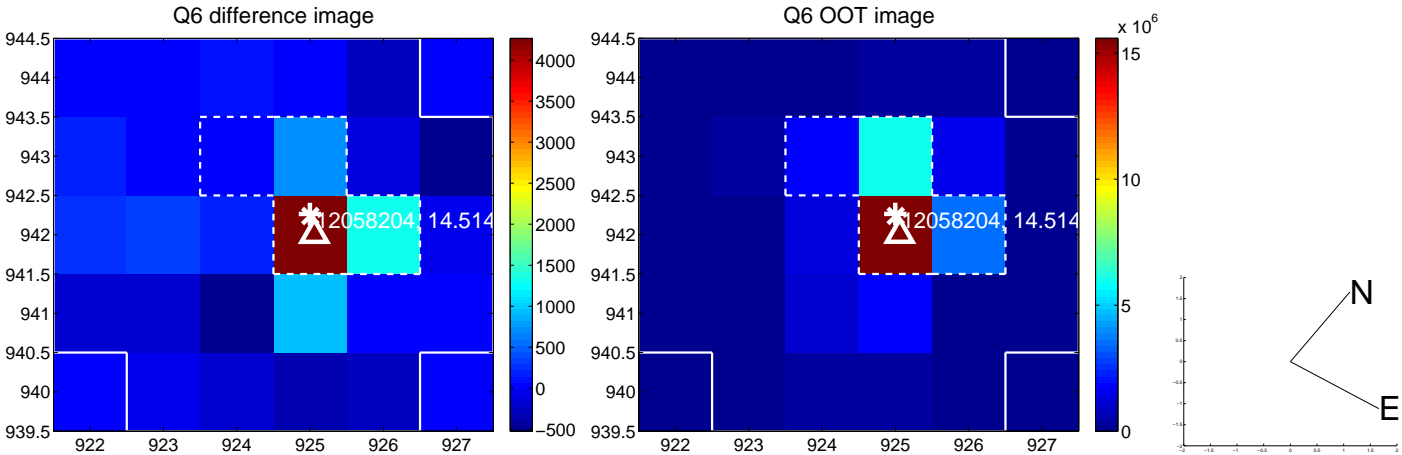
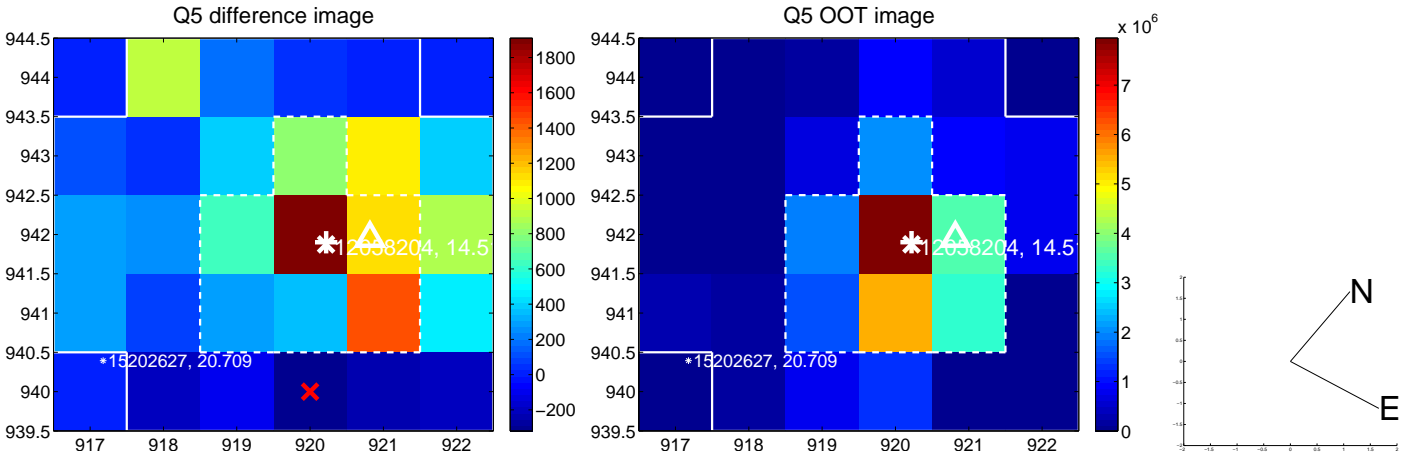


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

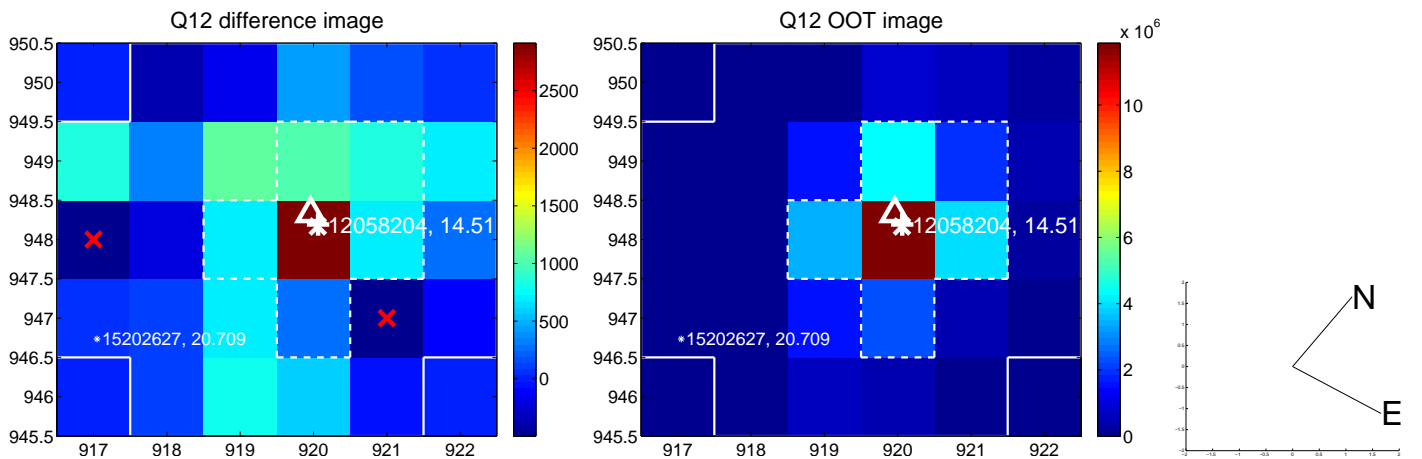
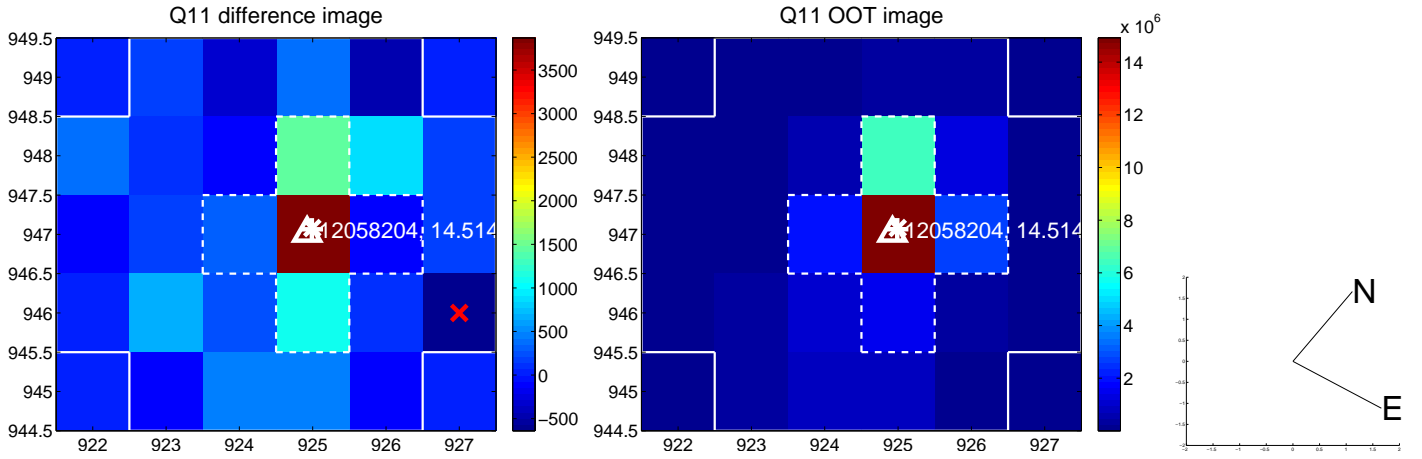
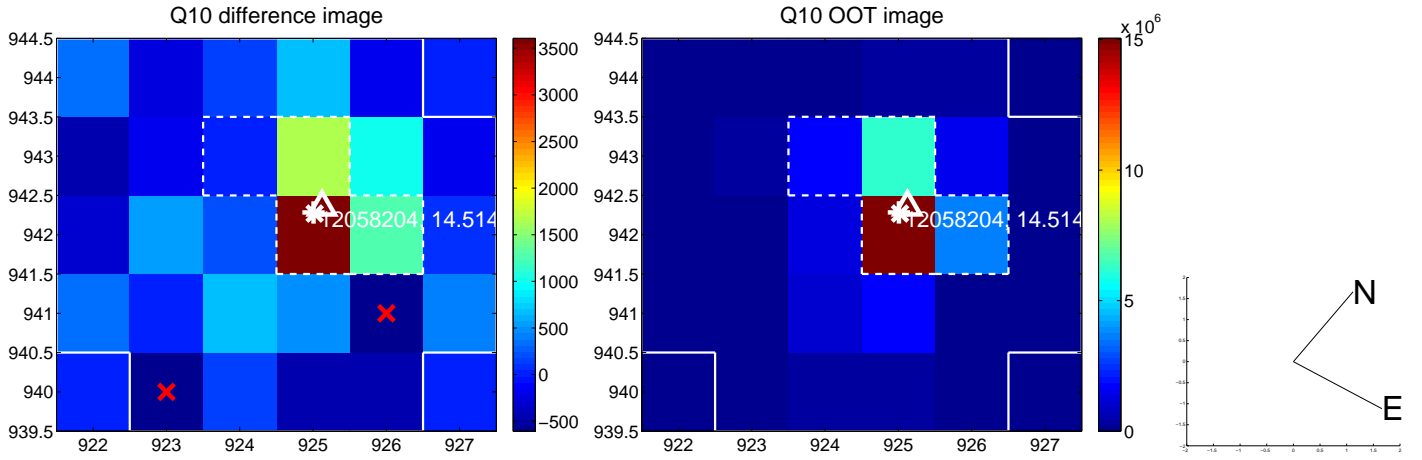
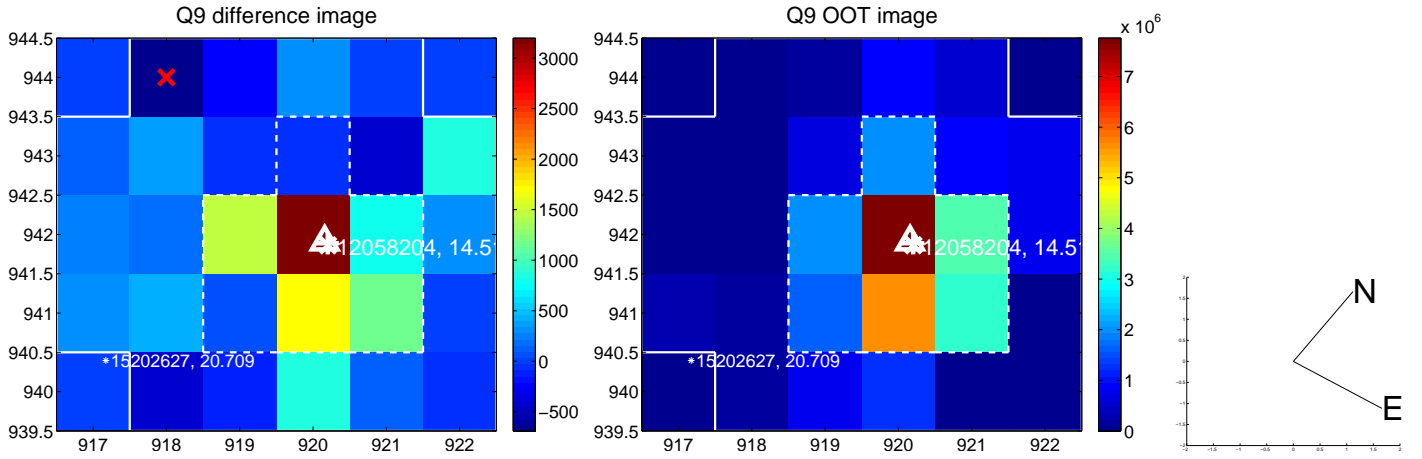
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



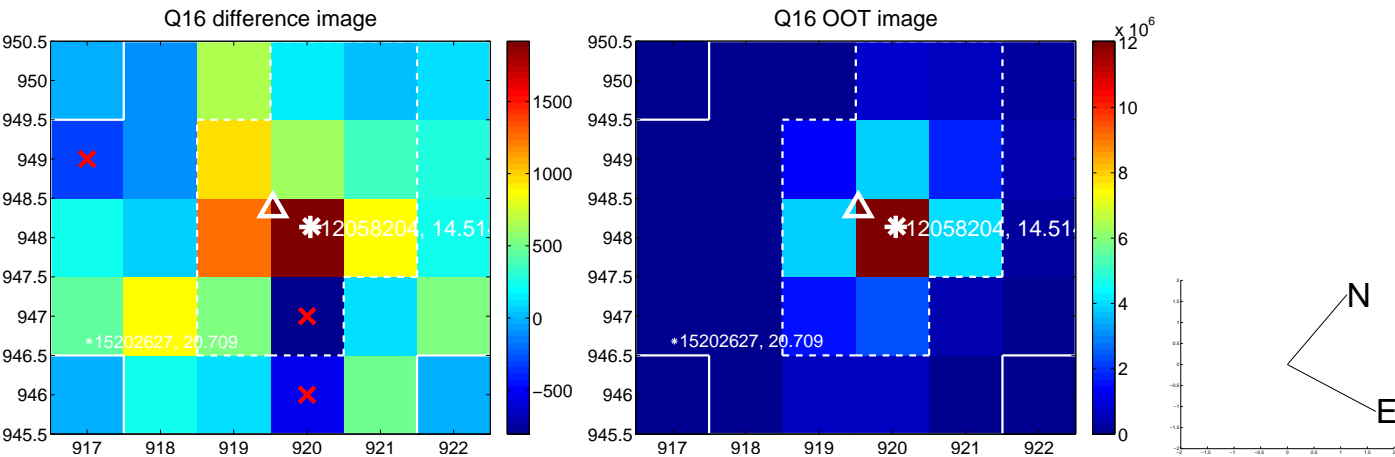
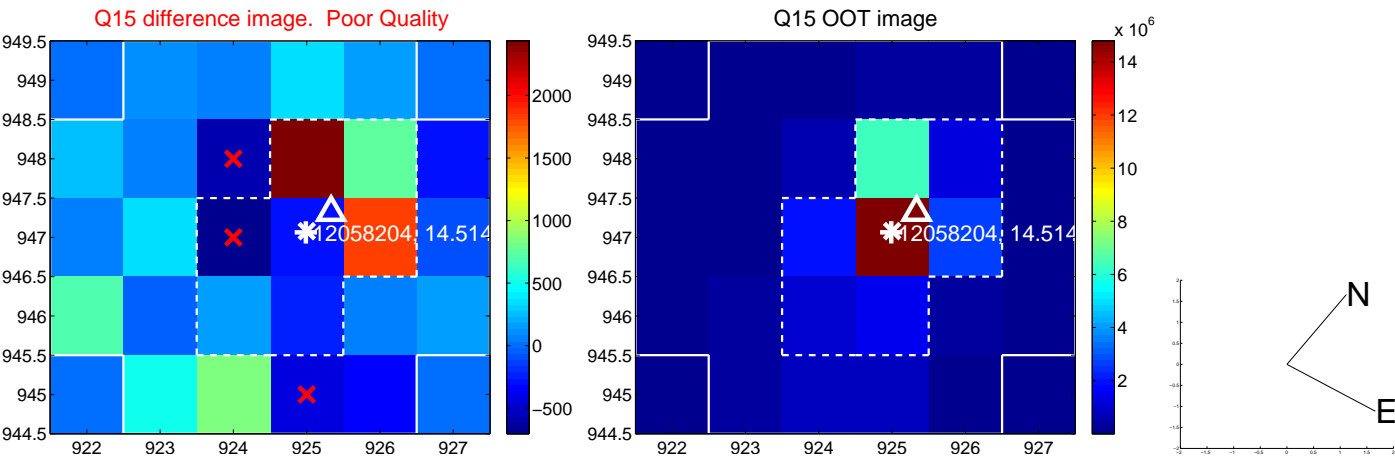
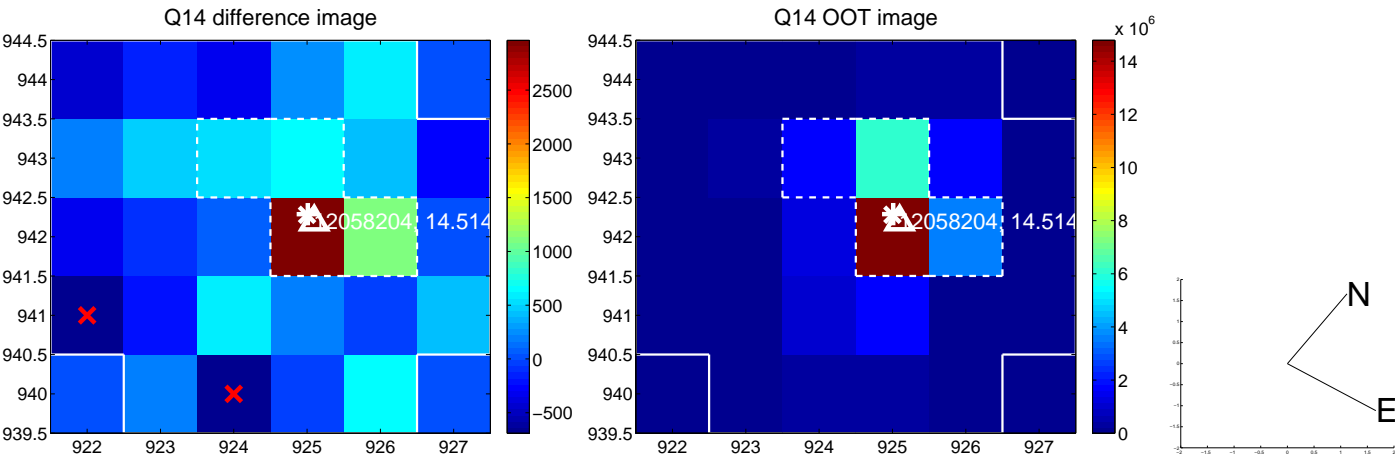
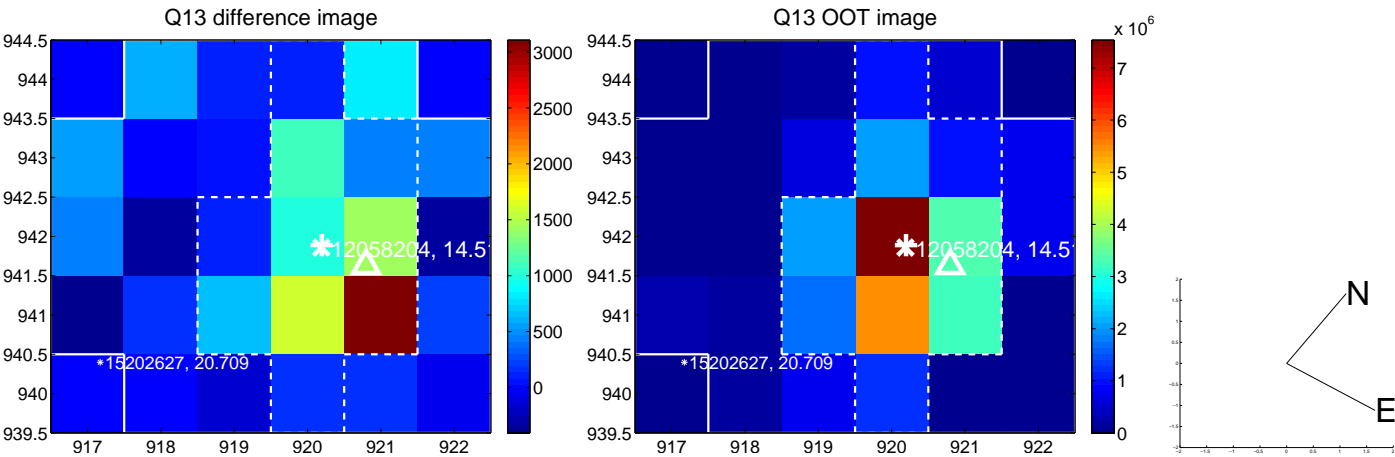
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

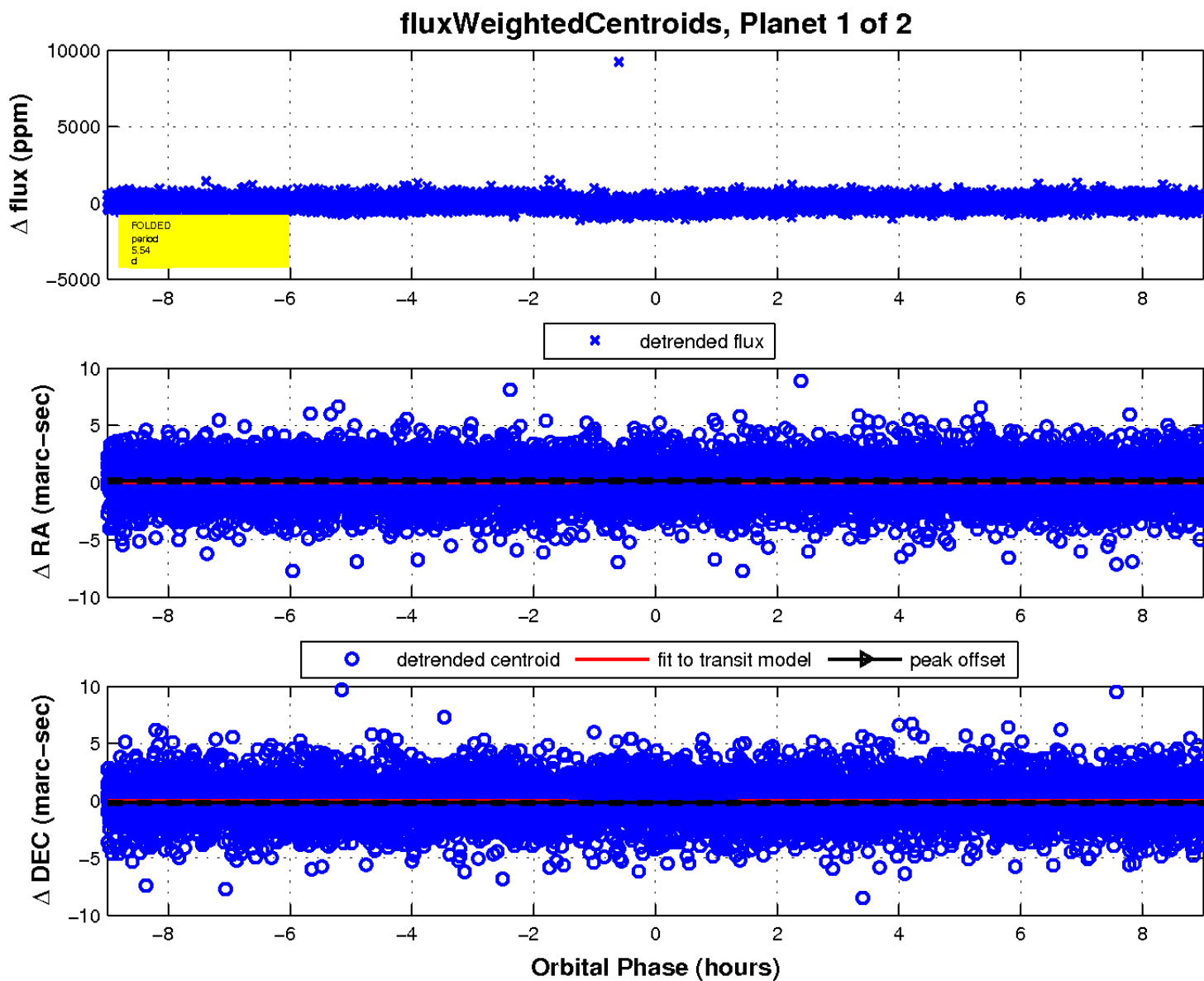
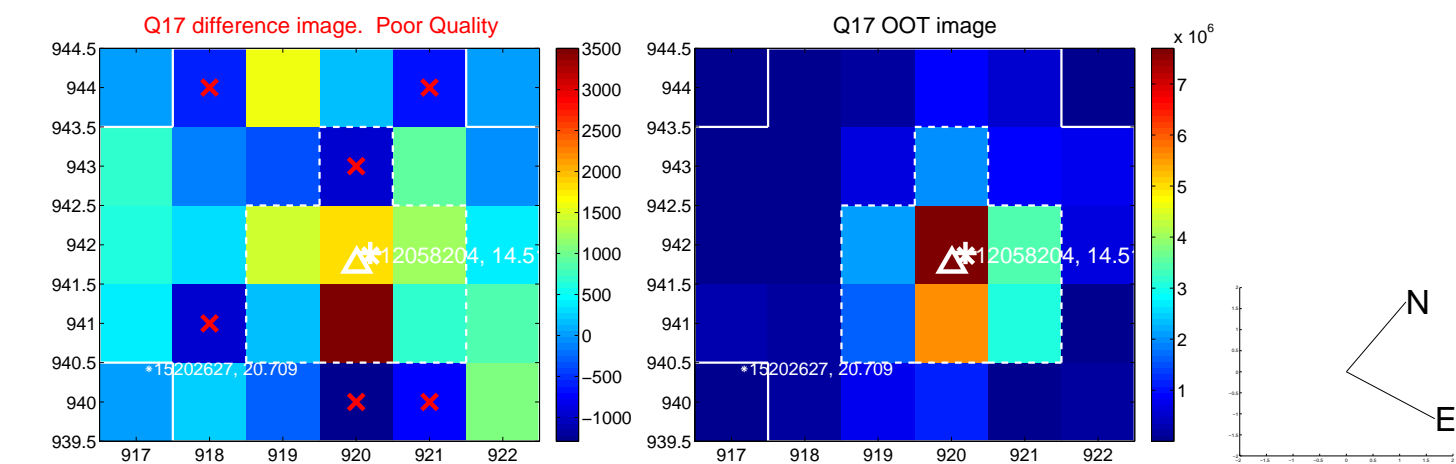


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



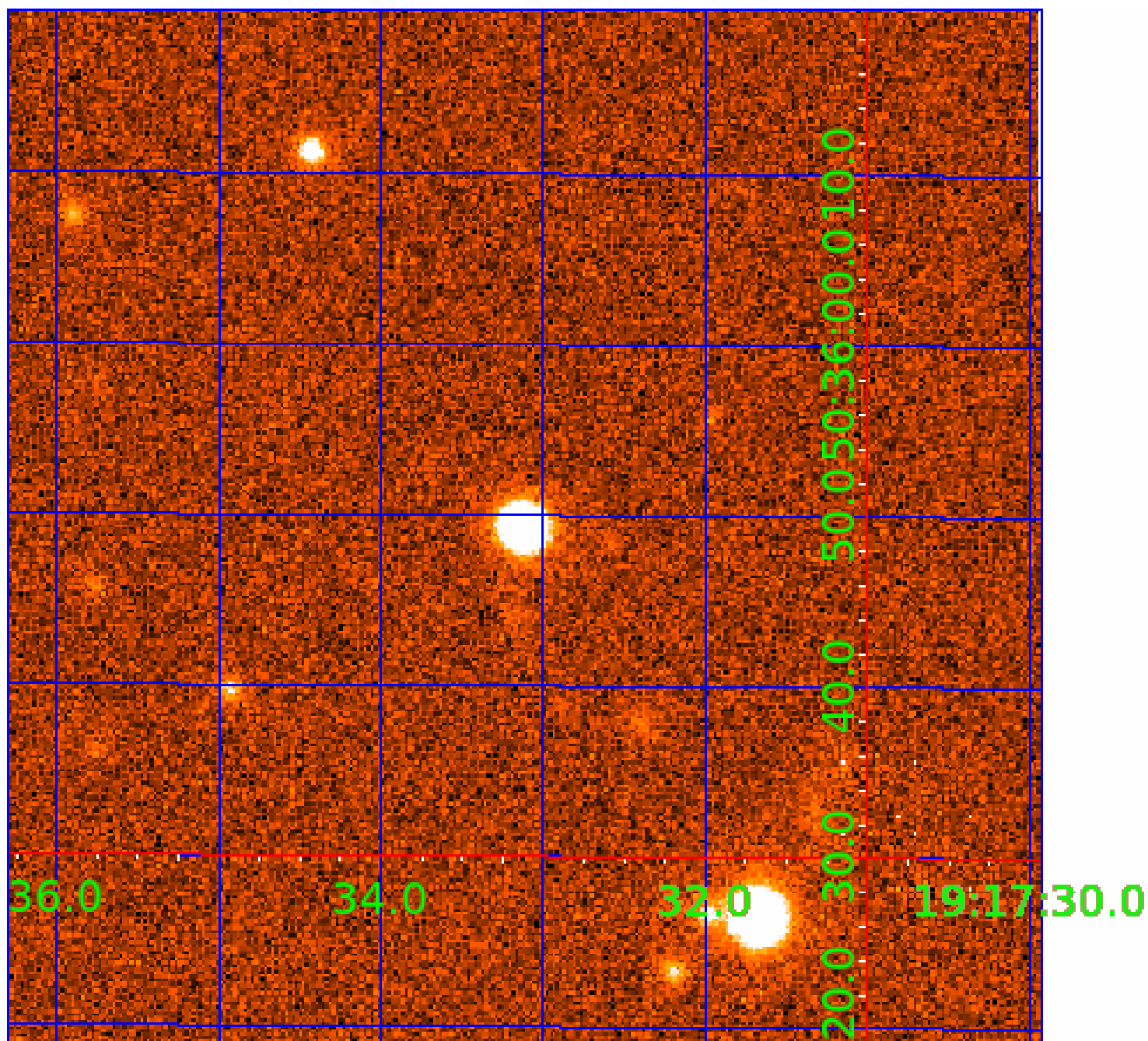


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 012058204

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
012058204-01	OBS	2218.01	5.535364	132.757559	251.6	3.002	22.9	24.5	1.10	5588	2.12	292.41
012058204-02	OBS	2218.02	16.726235	143.748604	189.0	2.592	9.1	9.8	1.10	5588	1.68	66.94

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
012058204-01	OBS	PC	1.00	0	0	0	0	NO_COMMENT
012058204-02	OBS	PC	0.98	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.

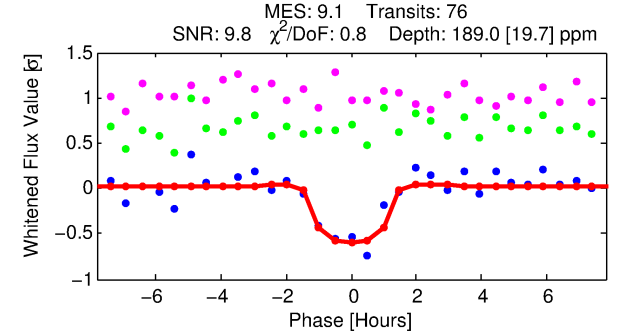
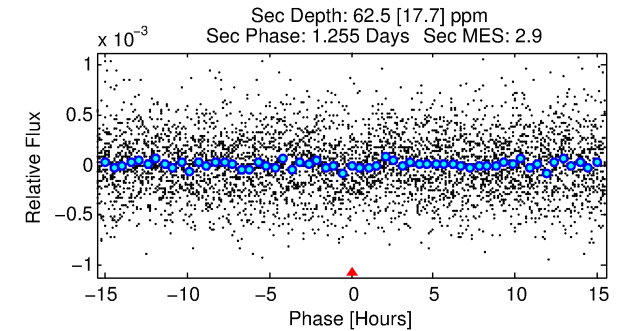
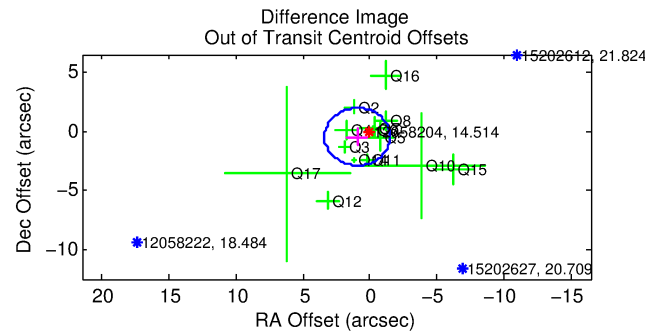
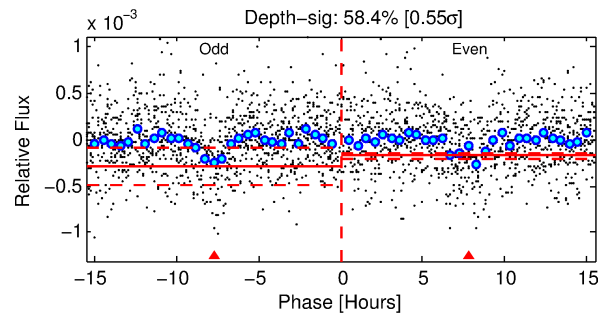
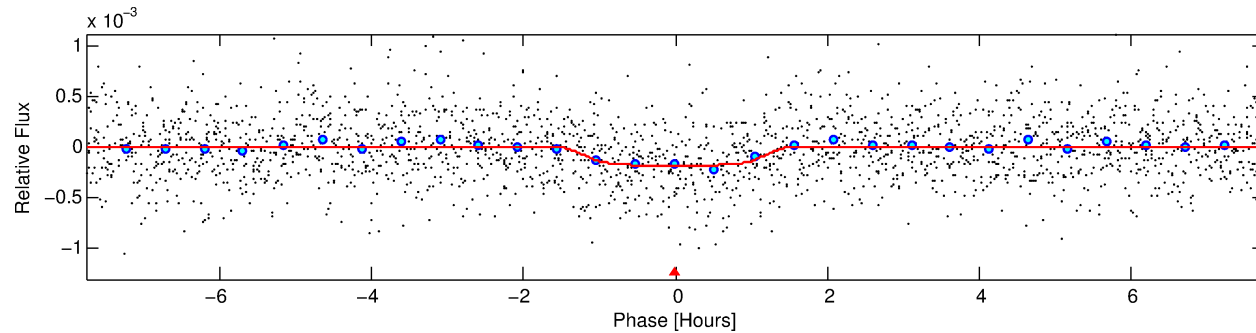
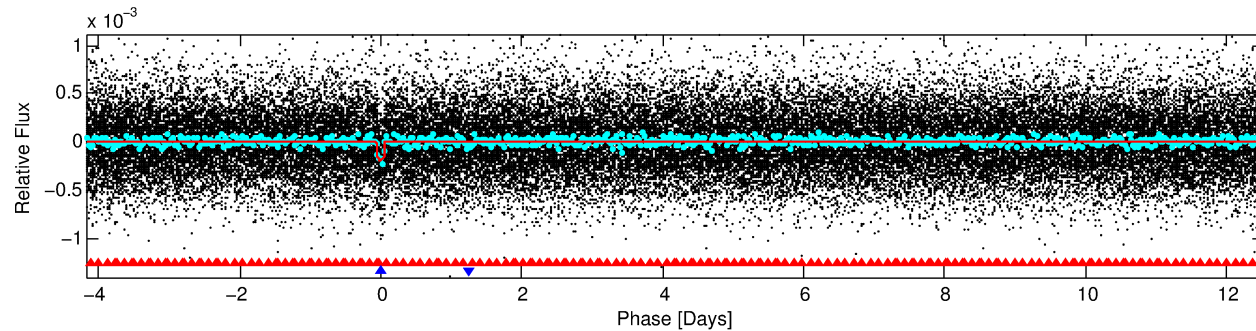
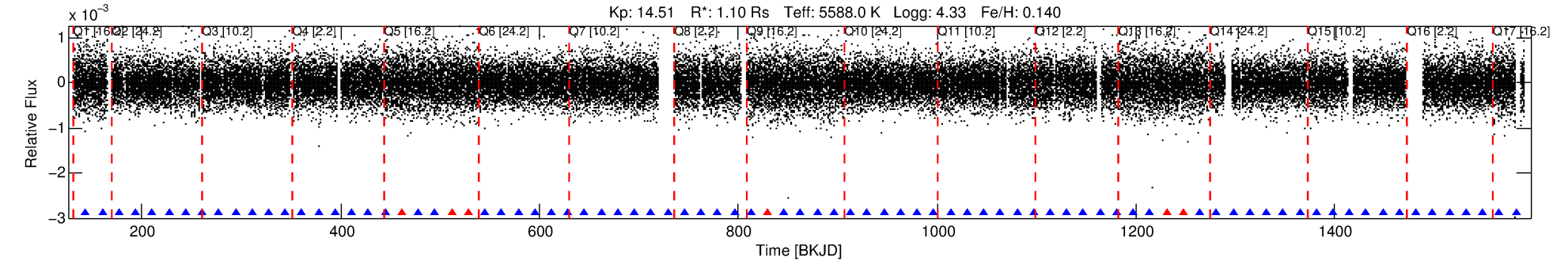
## Ephemeris Match Information For 012058204-02

No Significant Match Found

# DV One-Page Summary

KIC: 12058204 Candidate: 2 of 2 Period: 16.726 d  
KOI: K02218.02 Name: Kepler-373c Corr: 0.916

Kp: 14.51 R\*: 1.10 Rs Teff: 5588.0 K Logg: 4.33 Fe/H: 0.140



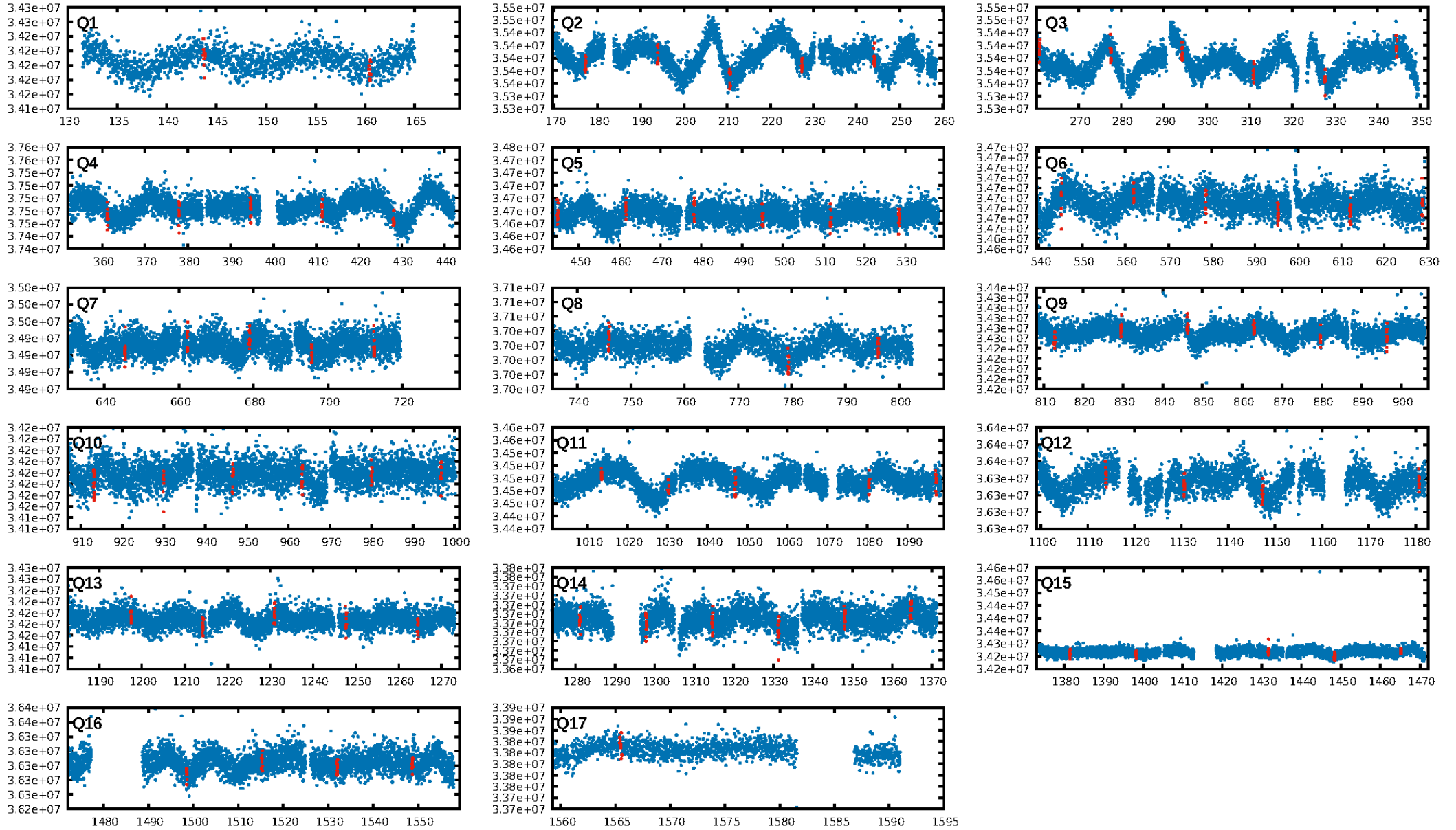
## DV Fit Results:

Period = 16.72624 [0.00013] d  
Epoch = 143.7486 [0.0062] BKJD  
Rp/R\* = 0.0140 [0.0132]  
a/R\* = 31.19 [123.06]  
b = 0.79 [1.89]  
Seff = 66.93 [15.53]  
Teff = 729 [42] K  
Rp = 1.68 [1.60] Re  
a = 0.1257 [0.0178] AU  
Ag = 192.97 [370.56] [0.52σ]  
Teffp = 4203 [2005] K [1.73σ]

## DV Diagnostic Results:

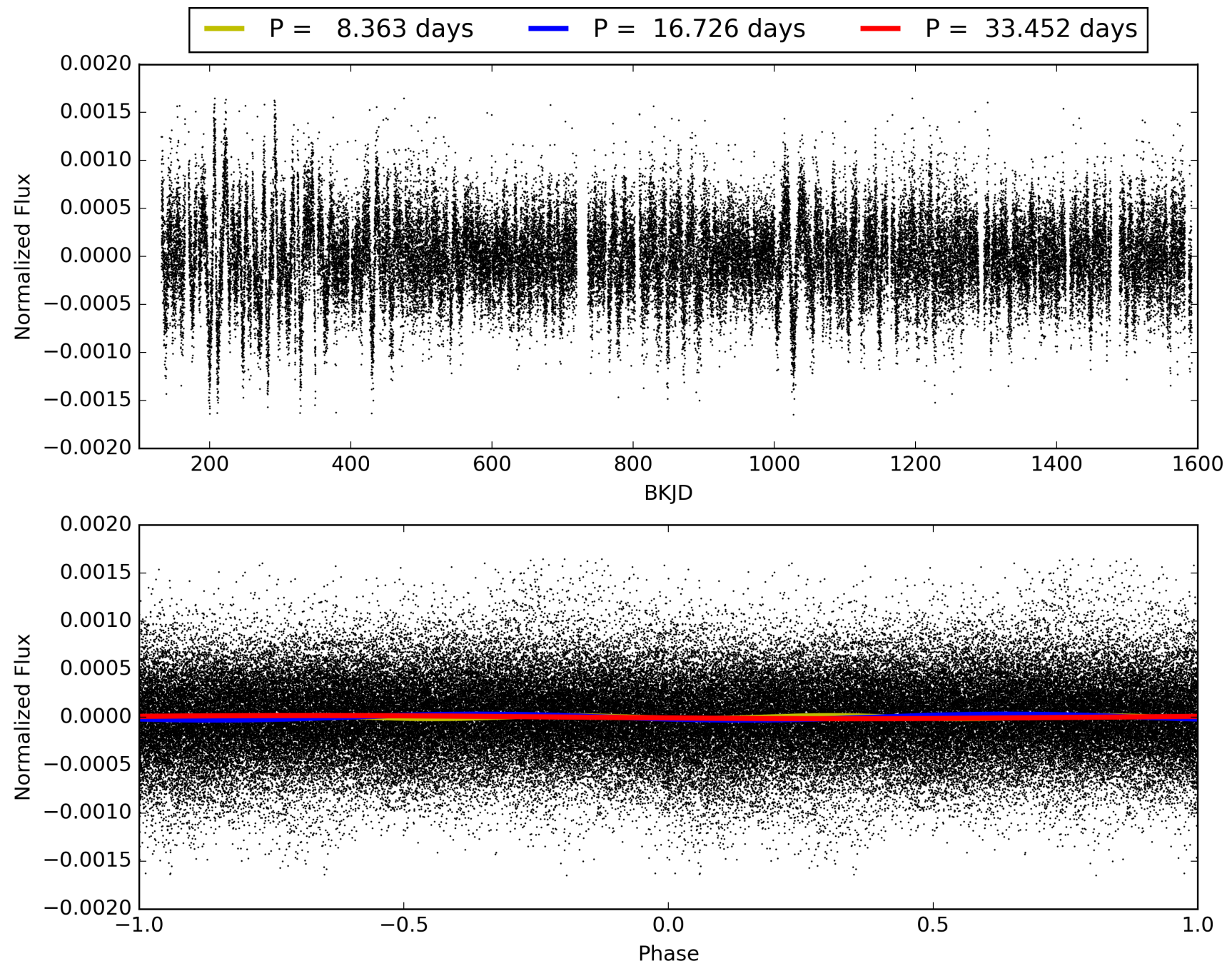
ShortPeriod-sig: 100.0% [67.72σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 97.1%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 2.81e-19  
RollingBand-fgt: 0.92 [69/75]  
GhostDiagnostic-chr: 2.751  
Centroid-sig: 3.8%  
Centroid-so: 2.047 arcsec [1.44σ]  
OotOffset-rm: 1.064 arcsec [1.31σ]  
KicOffset-rm: 1.074 arcsec [1.37σ]  
OotOffset-st: 4/4/4/2 [14]  
KicOffset-st: 4/4/4/2 [14]  
DiffImageQuality-fgm: 0.36 [5/14]  
DiffImageOverlap-fno: 0.94 [16/17]

# TCE 012058204-02, PDC Light Curves



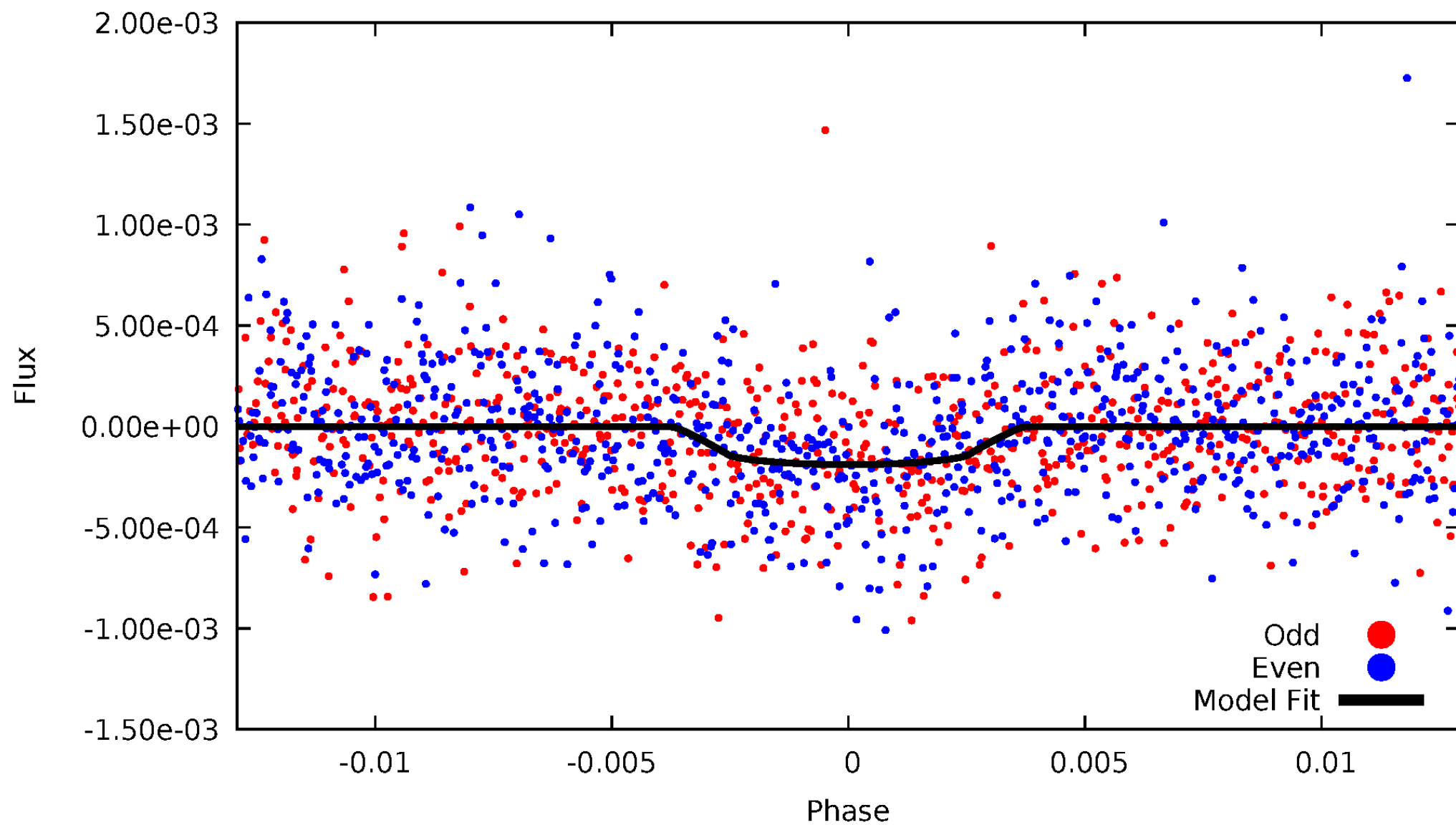


TCE 012058204-02



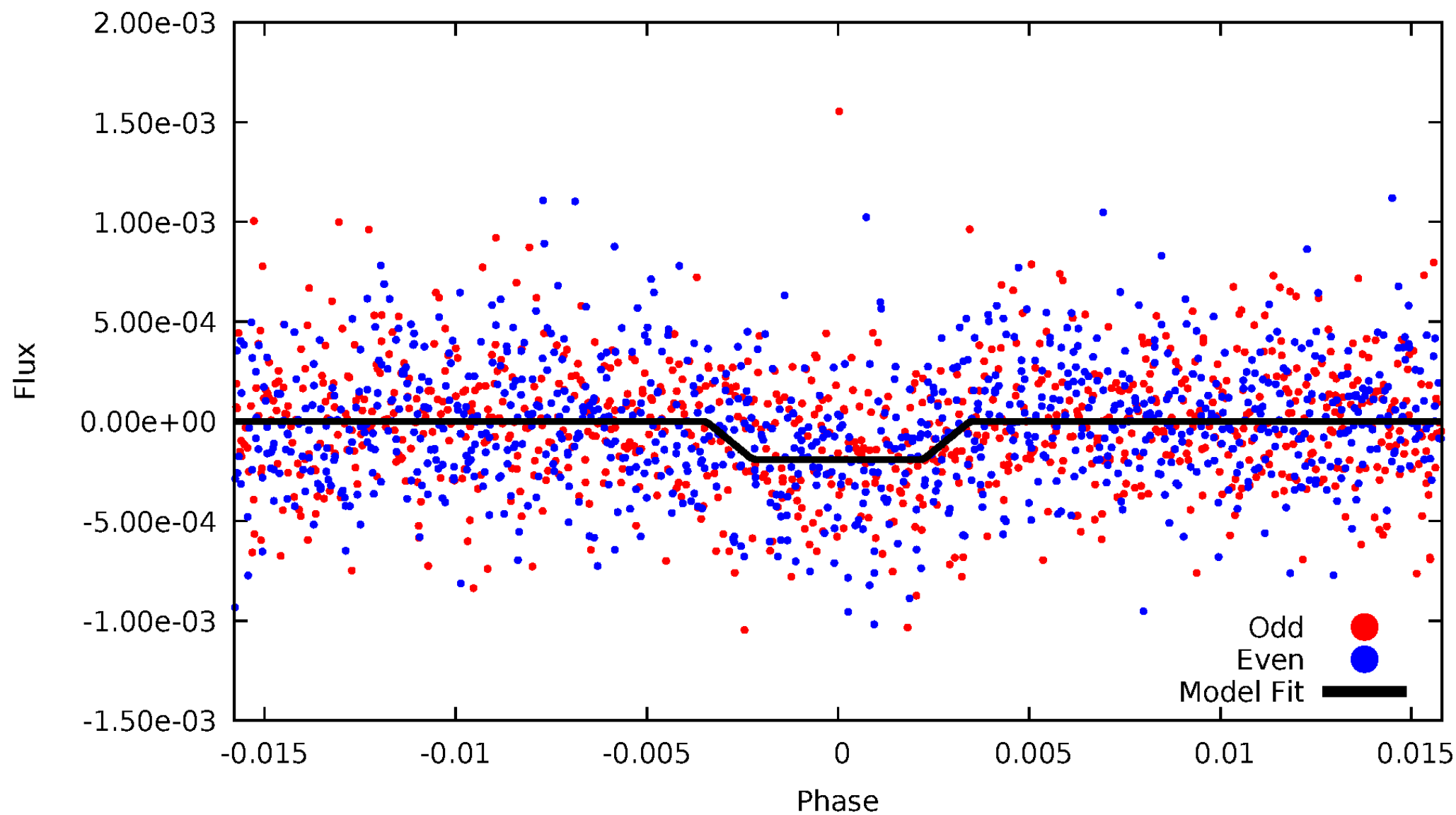
# DV Odd/Even

TCE 012058204-02



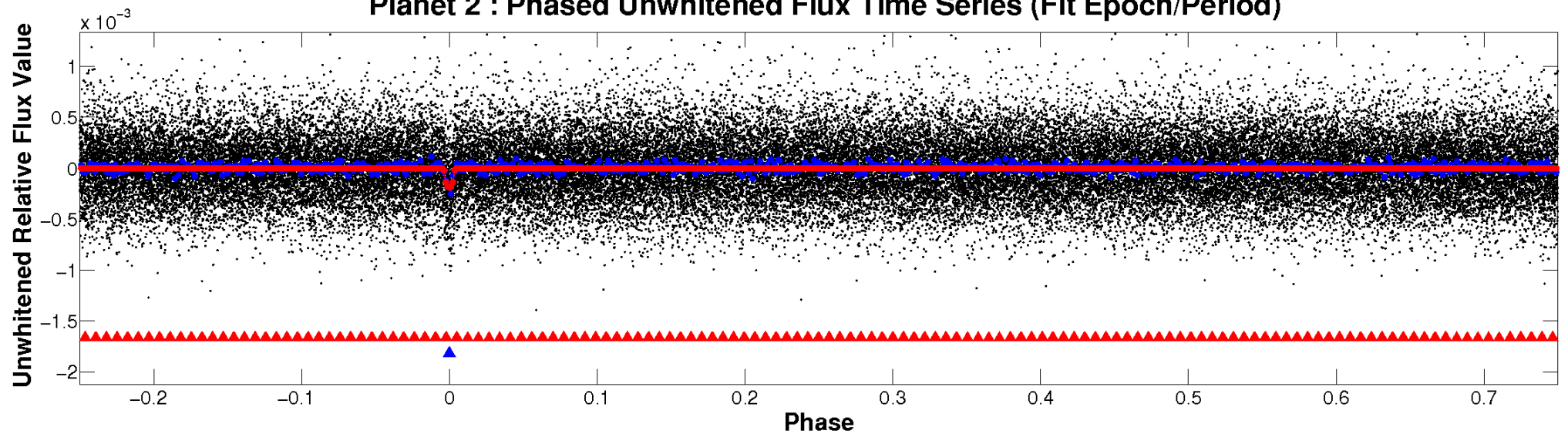
# ALT Odd/Even

TCE 012058204-02

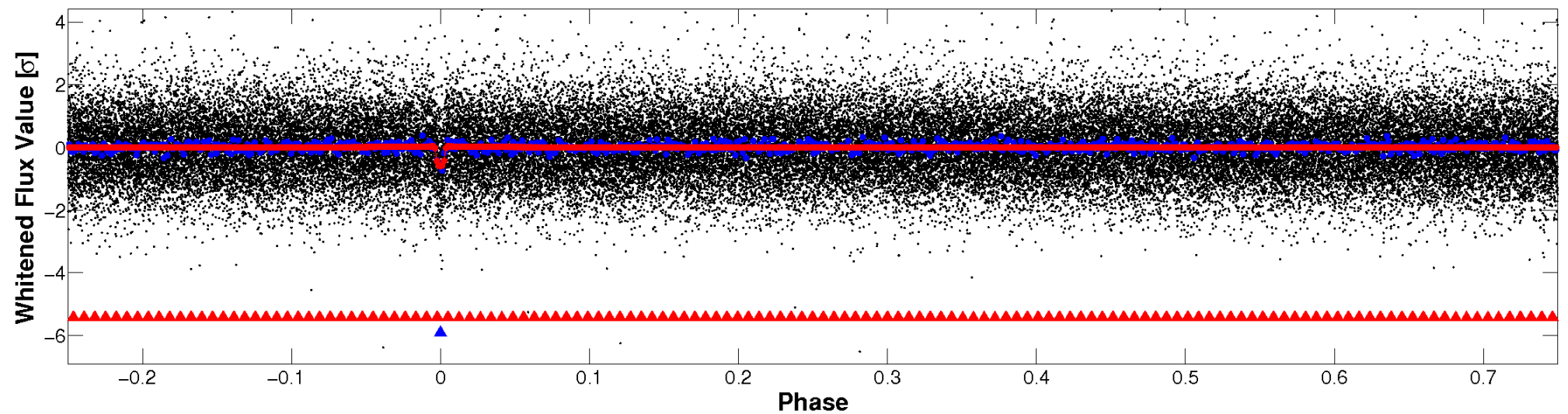


# Non-Whitened Vs. Whitened Light Curve

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

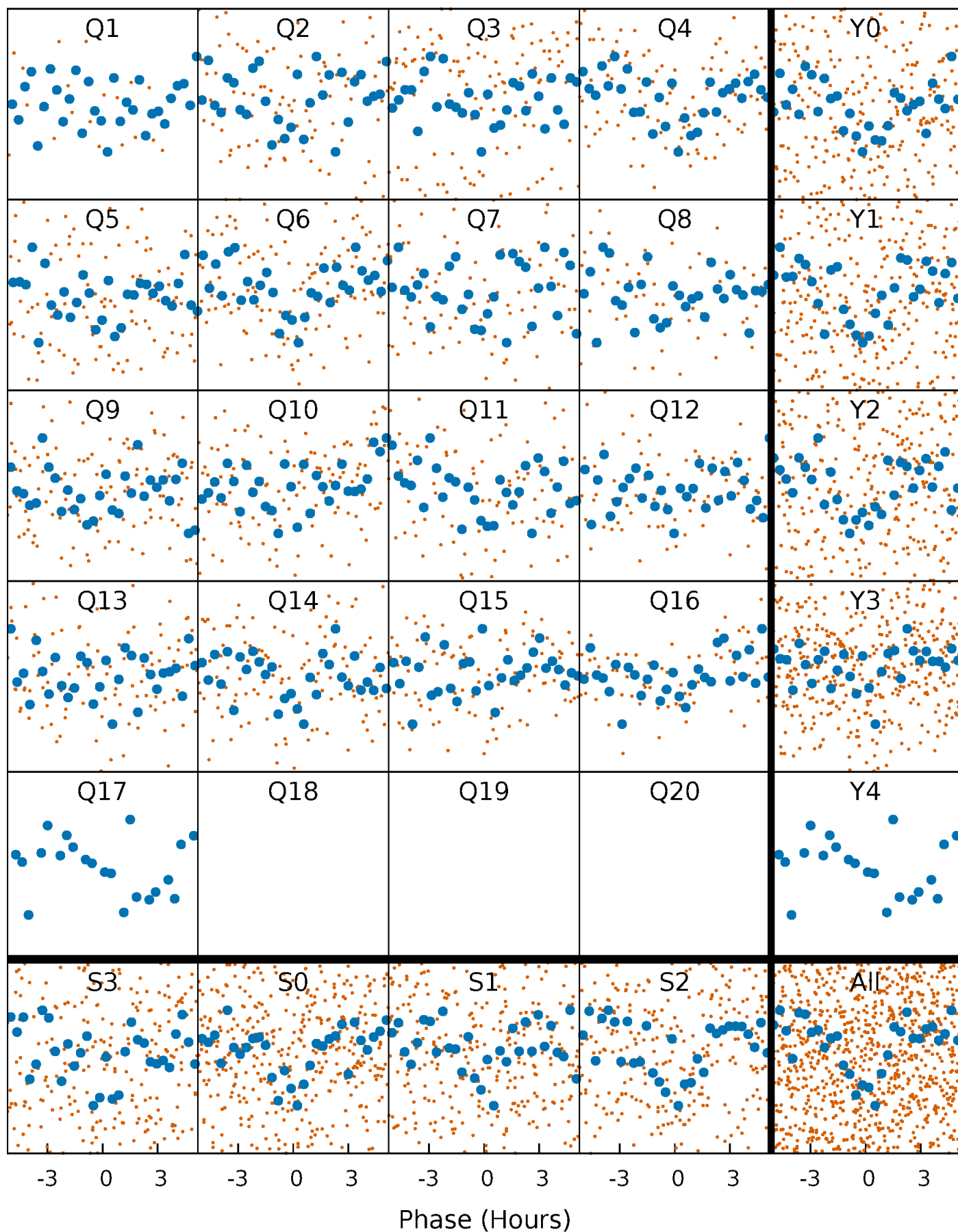


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

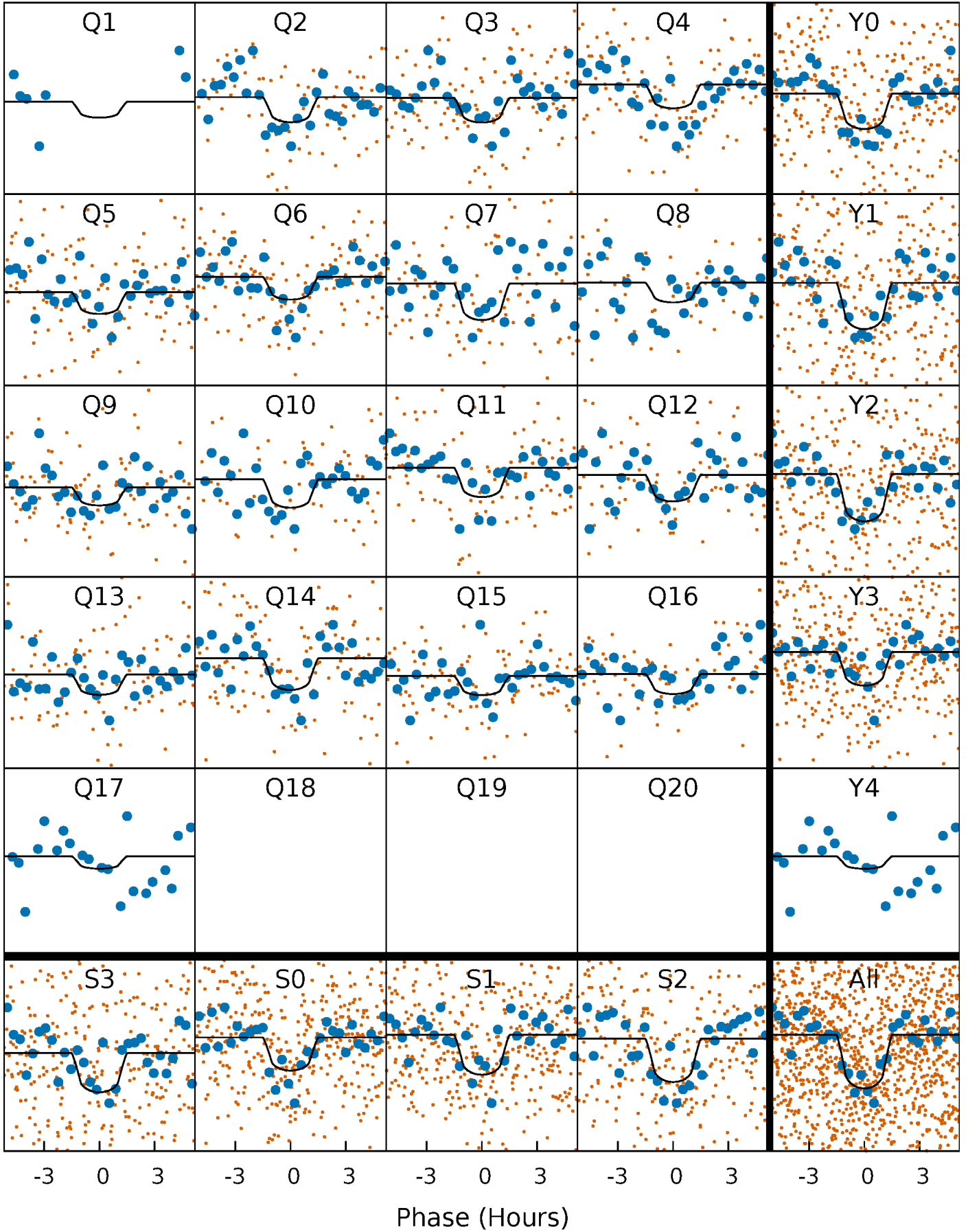
TCE 012058204-02 P= 16.726235 Days  $T_0=143.748604$  (BKJD)





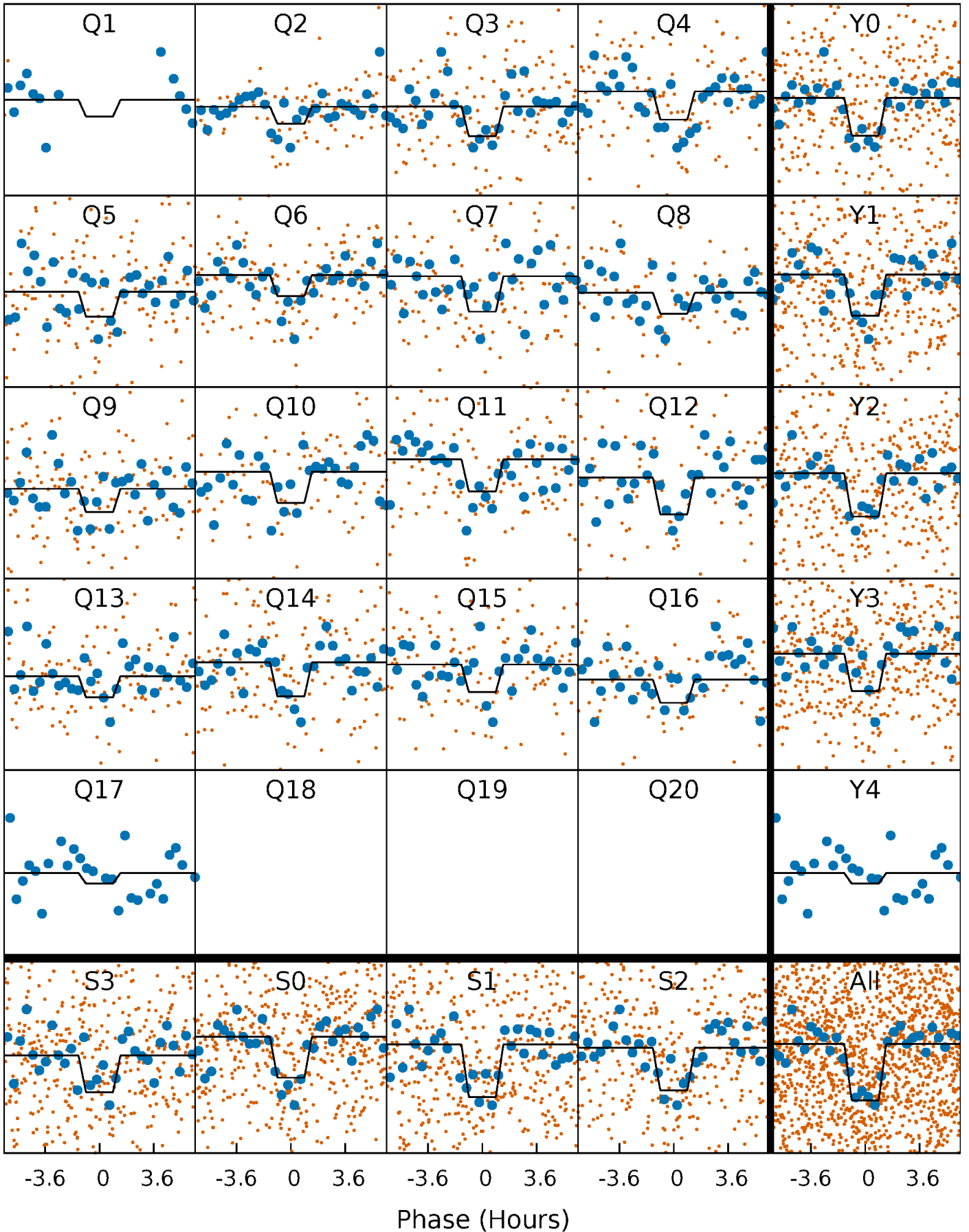
# DV Quarter-Phased Transit Curves

TCE 012058204-02 P= 16.726235 Days  $T_0=143.748604$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

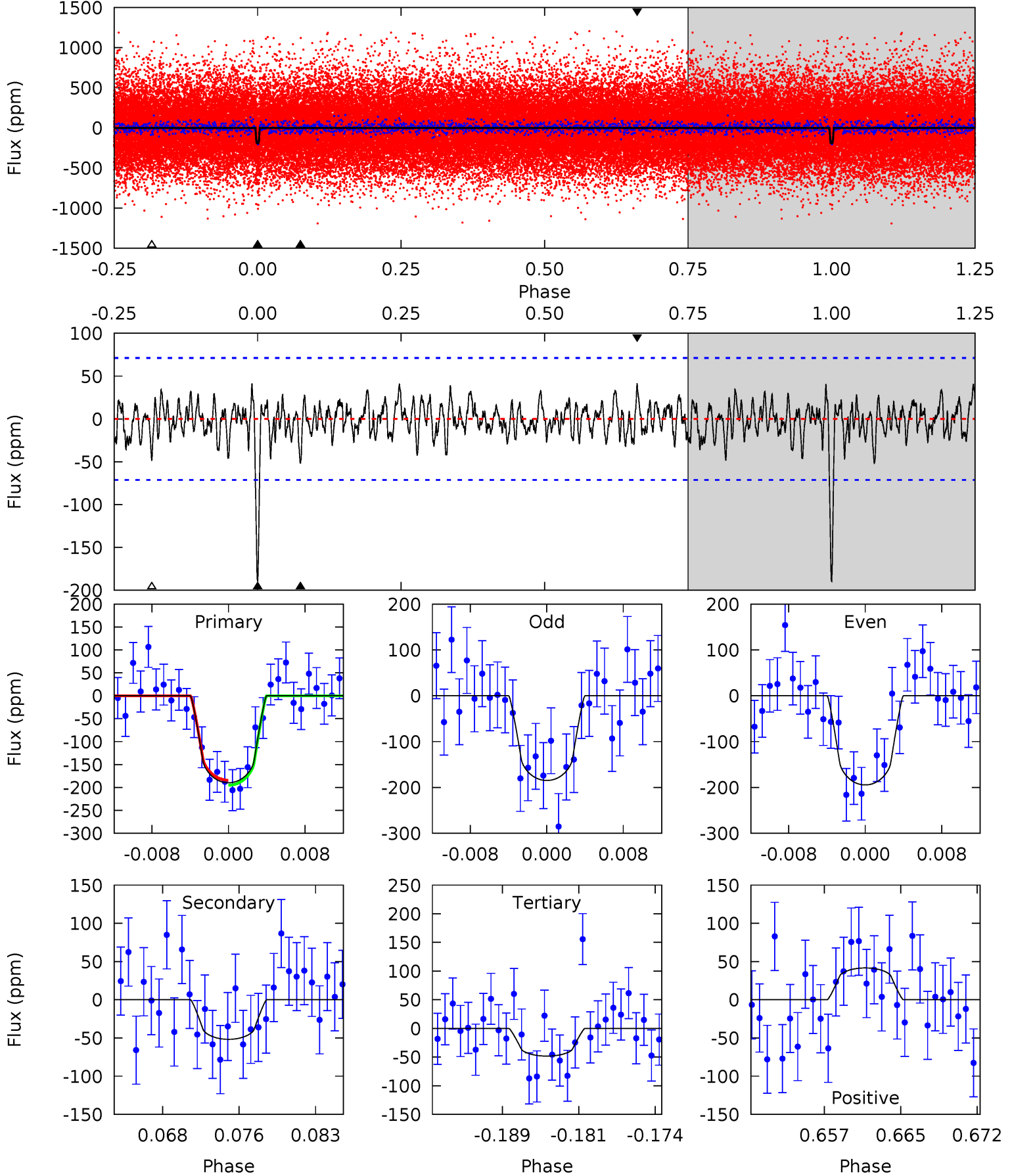
TCE 012058204-02 P= 16.726122 Days  $T_0=143.748619$  (BKJD)



# DV Model-Shift Uniqueness Test

012058204-02, P = 16.726235 Days, E = 127.022369 Days

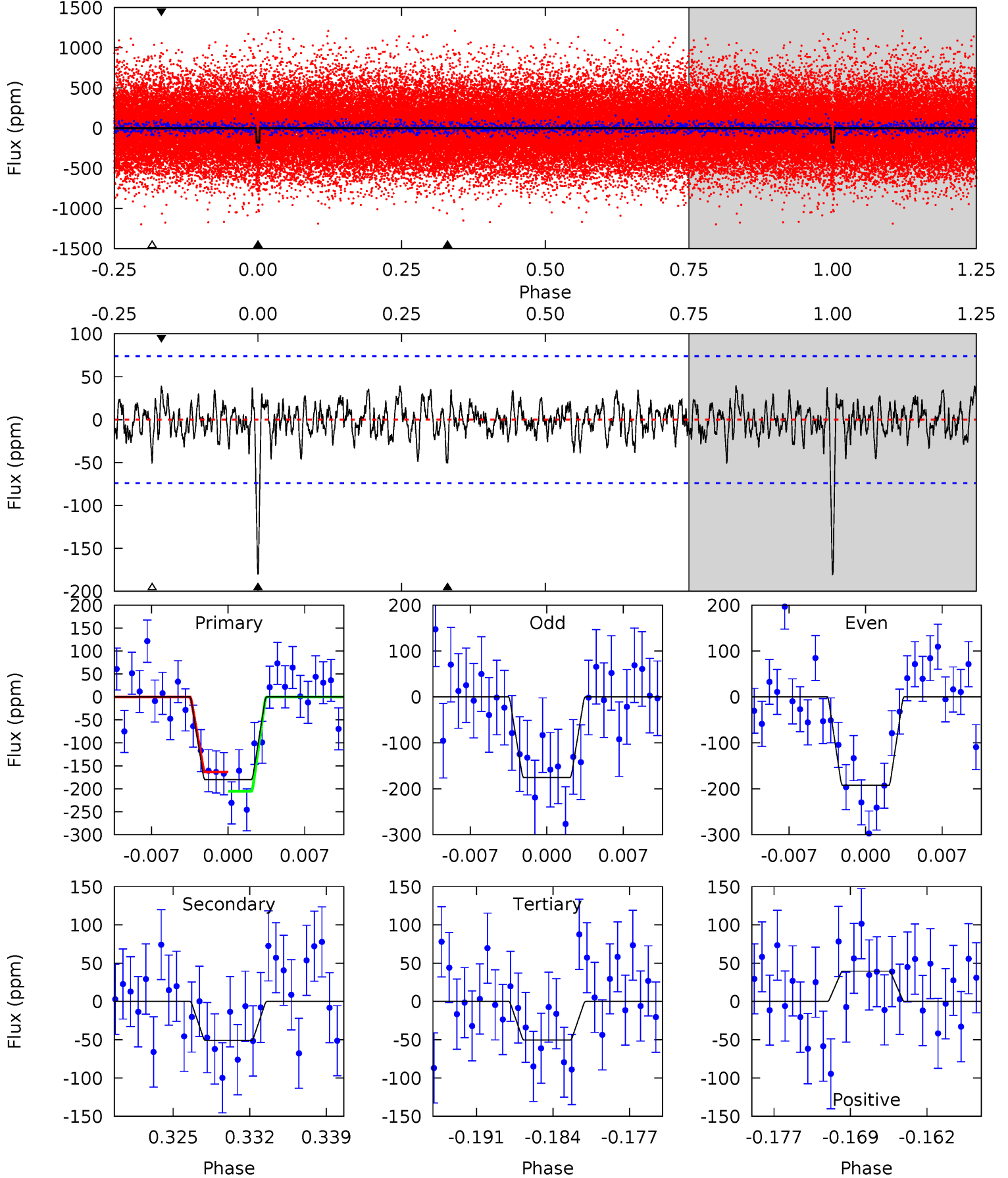
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
13.5	3.70	3.45	2.97	5.08	2.67	1.11	10.1	10.6	0.25	0.72	0.35	1.03	0.18	0.39



# Alt Model-Shift Uniqueness Test

012058204-02, P = 16.726122 Days, E = 127.022497 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
12.4	3.50	3.47	2.73	5.09	2.69	1.04	8.92	9.66	0.03	0.77	0.58	1.17	0.18	1.44



### Stellar Parameters For KIC 012058204

	$T_{\text{eff}} (K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (g \cdot \text{cm}^{-3})$
	$5588^{+75}_{-75}$	$4.331^{+0.132}_{-0.108}$	$0.140^{+0.150}_{-0.150}$	$1.100^{+0.164}_{-0.147}$	$0.946^{+0.064}_{-0.047}$	$1.001^{+0.582}_{-0.314}$
	+1%/-1%	+3%/-2%	+107%/-107%	+15%/-13%	+7%/-5%	+58%/-31%
Source	SPE90	SPE90	SPE90	DSEP		

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

### Secondary Eclipse Parameters for KIC 012058204-02 / KOI 2218.02

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-52 \pm 14$	$1.91^{+1.51}_{-1.18}$	$1016^{+43}_{-43}$	$4047^{+2068}_{-722}$	$124^{+807}_{-86}$
Alt.	$-51 \pm 15$	$2.02^{+1.33}_{-1.26}$	$1015^{+45}_{-39}$	$3913^{+1874}_{-583}$	$106^{+604}_{-69}$

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

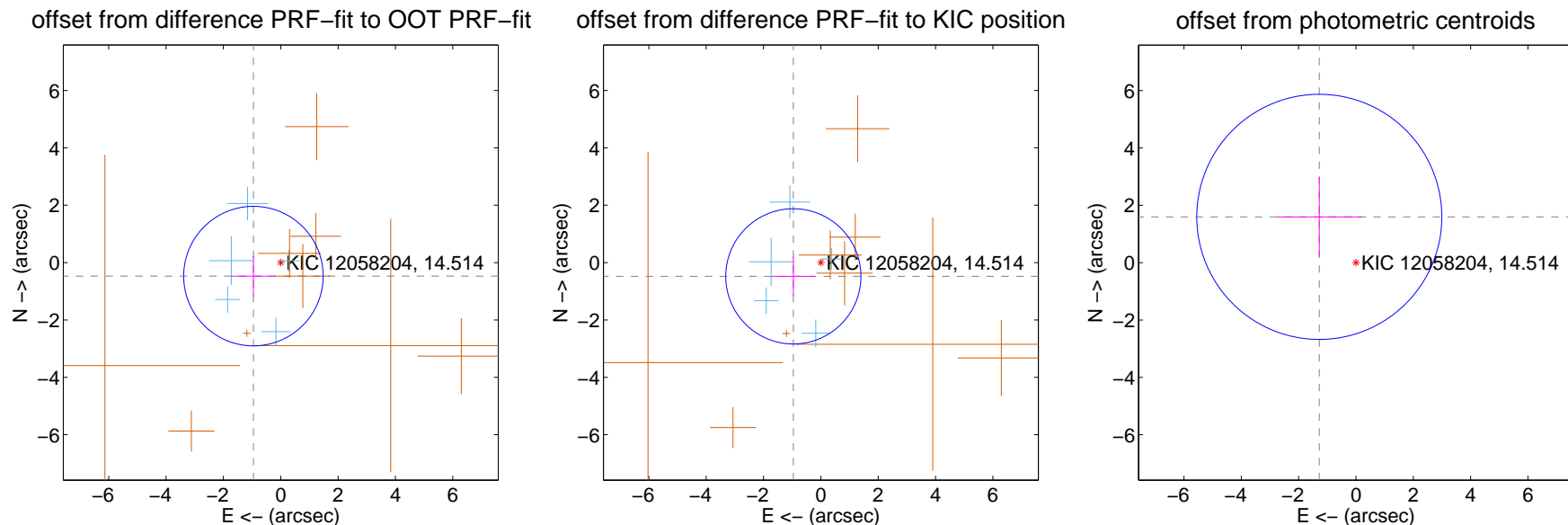
## DV Centroid Data

Supplemental centroid analysis for 012058204-02. Kepler magnitude: 14.51. Transit SNR 9.80

There are 5 quarters with good PRF difference image offsets

The direct PRF centroid is offset from the target star catalog position by about 0.15 arcsec

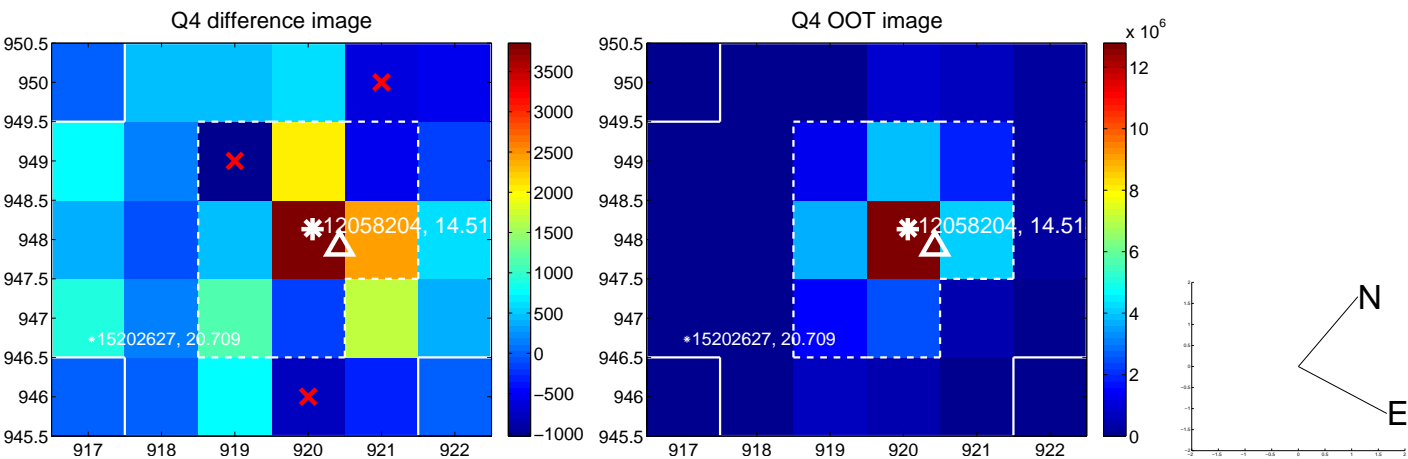
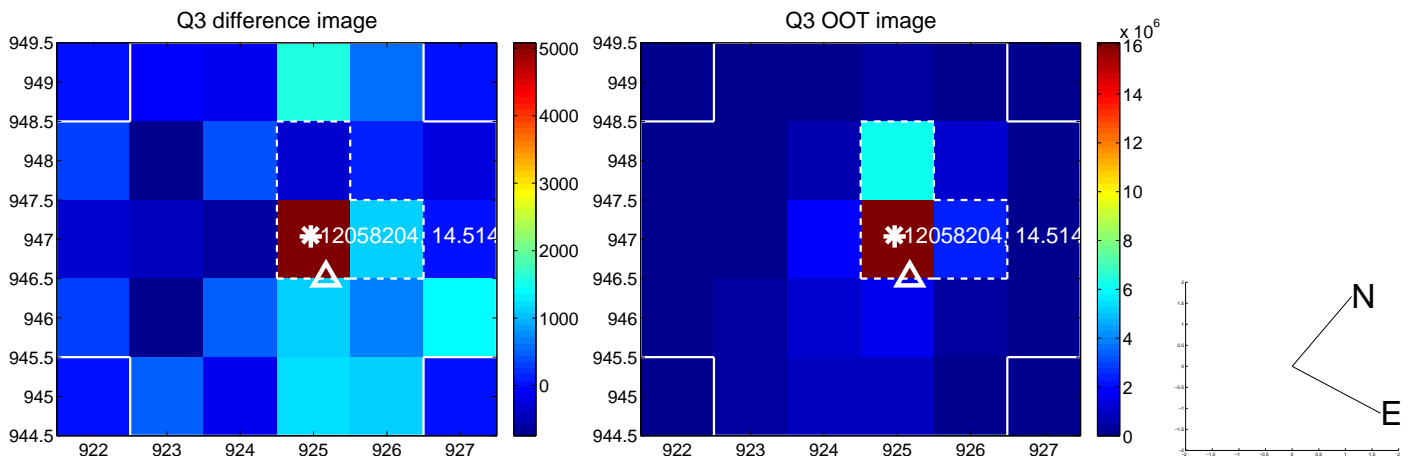
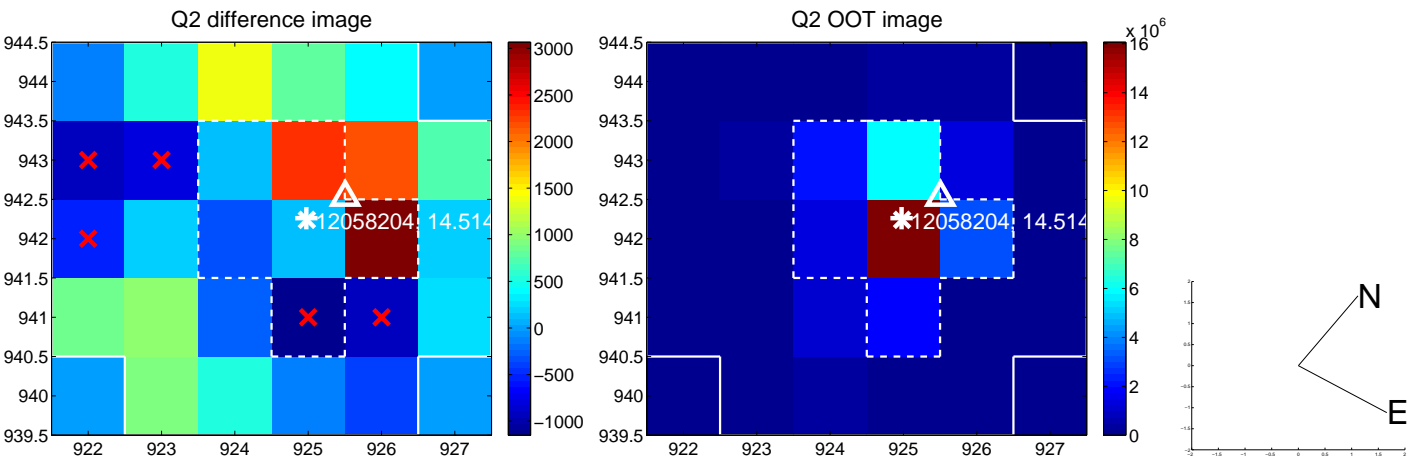
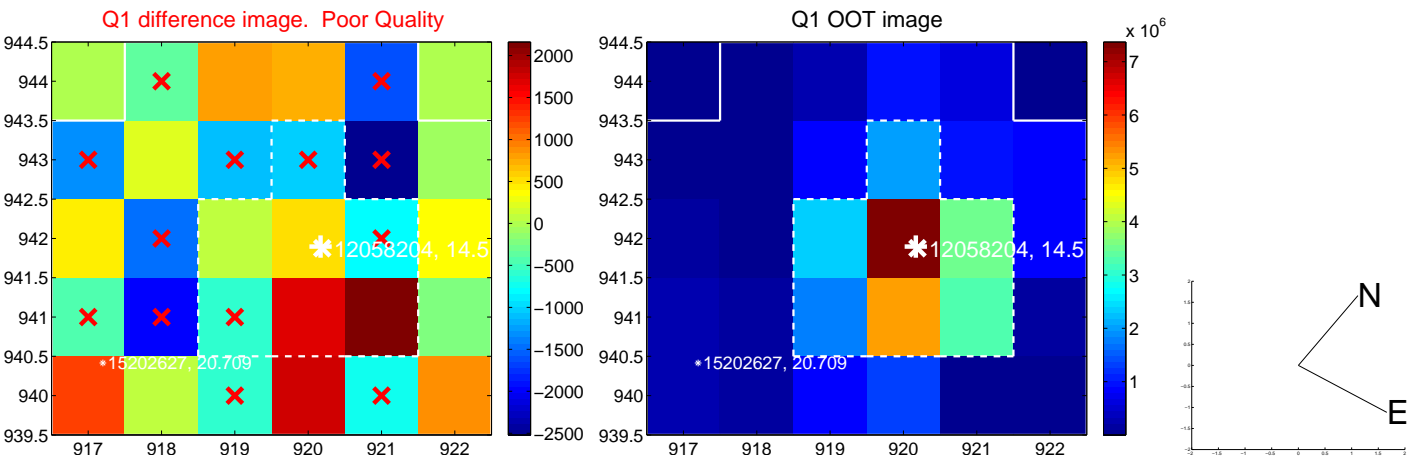
	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.064 \pm 0.811$	1.31	$0.954 \pm 0.764$	$-0.471 \pm 0.701$
PRF-fit source offset from KIC position	$1.074 \pm 0.786$	1.37	$0.960 \pm 0.766$	$-0.480 \pm 0.689$
photometric centroid source offset	$2.05 \pm 1.43$	1.44	$1.28 \pm 1.48$	$1.60 \pm 1.39$



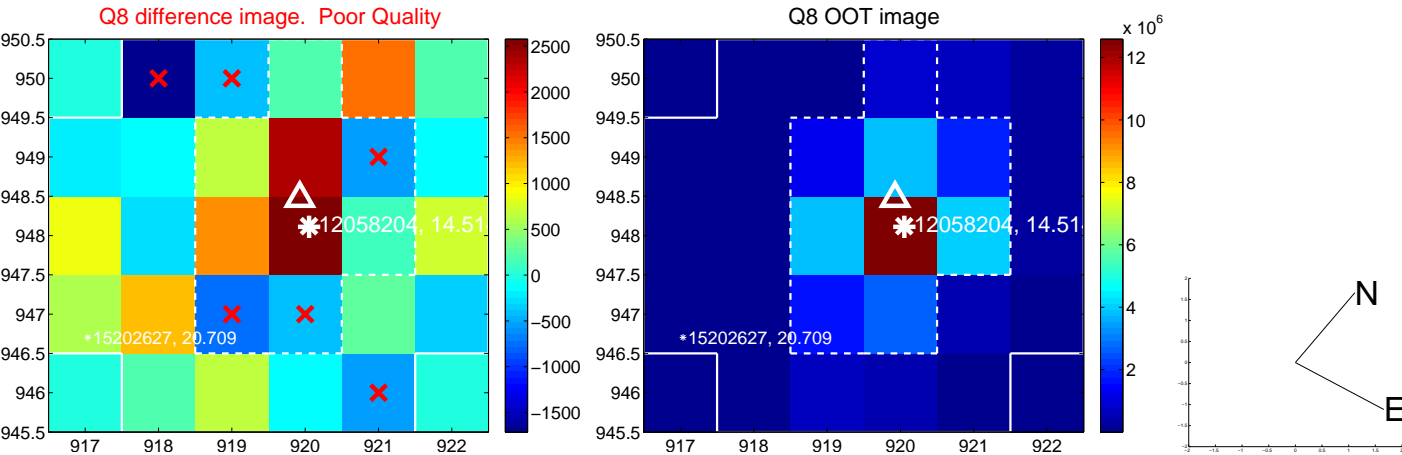
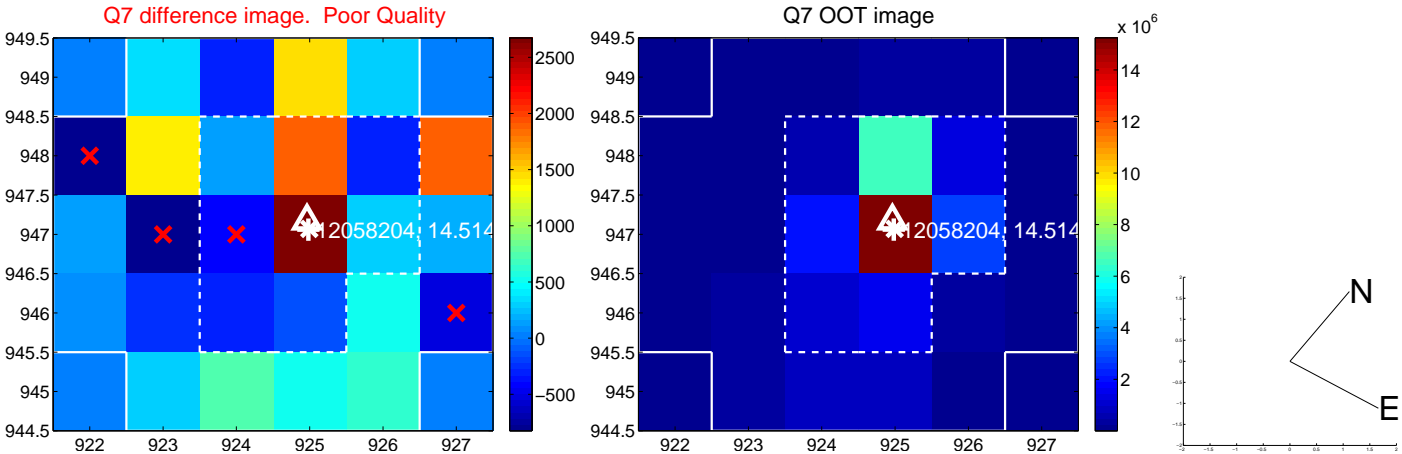
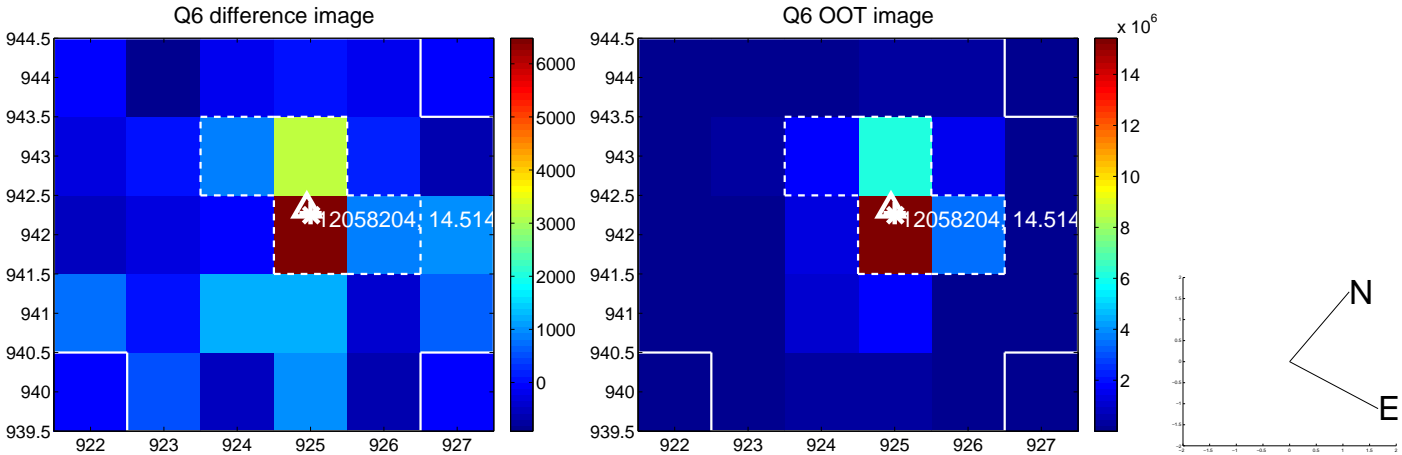
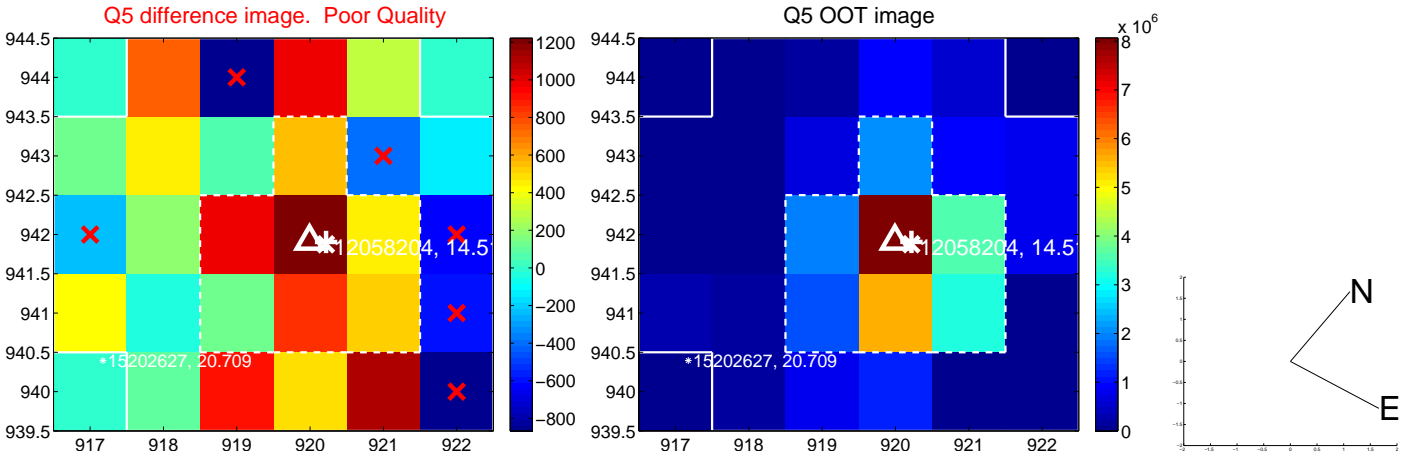
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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



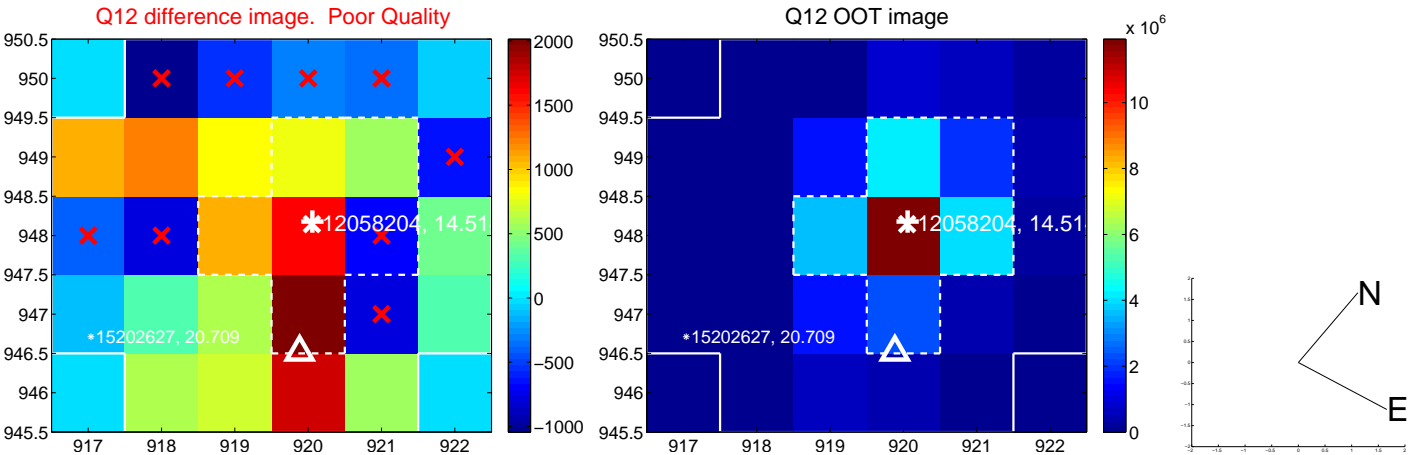
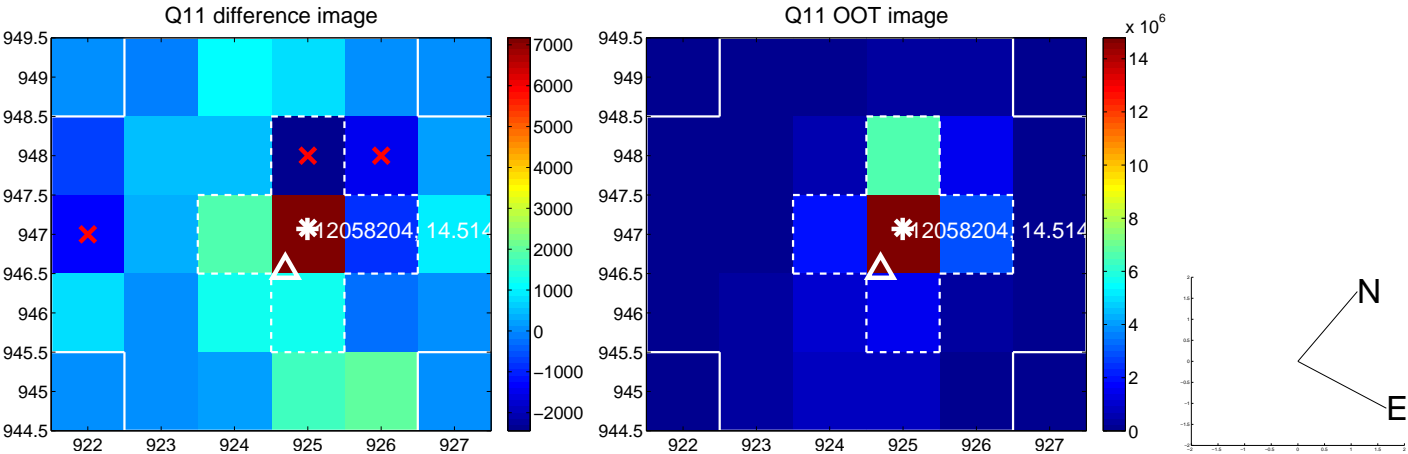
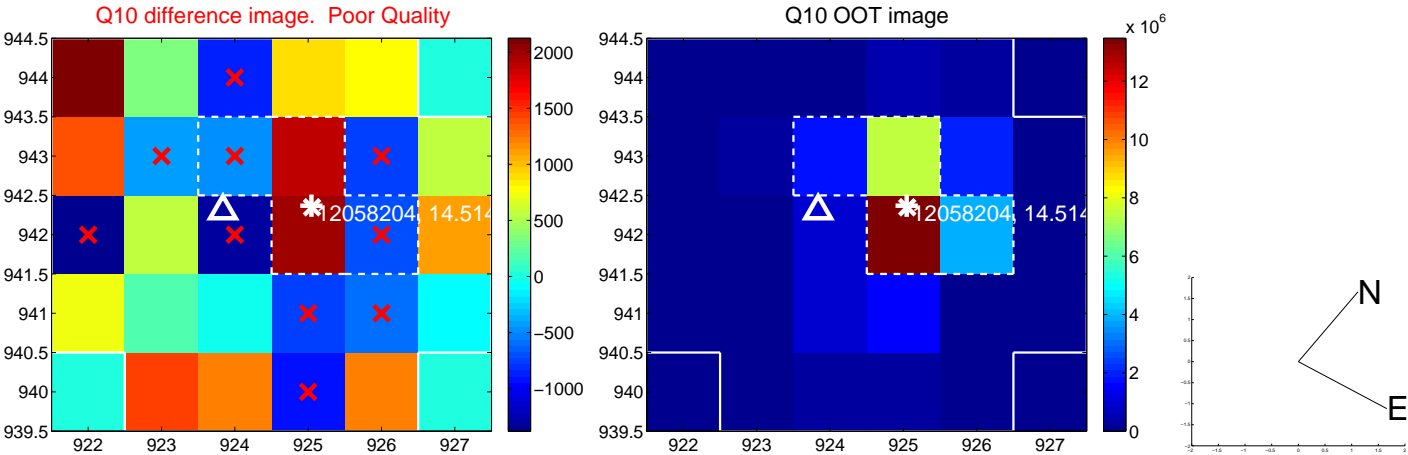
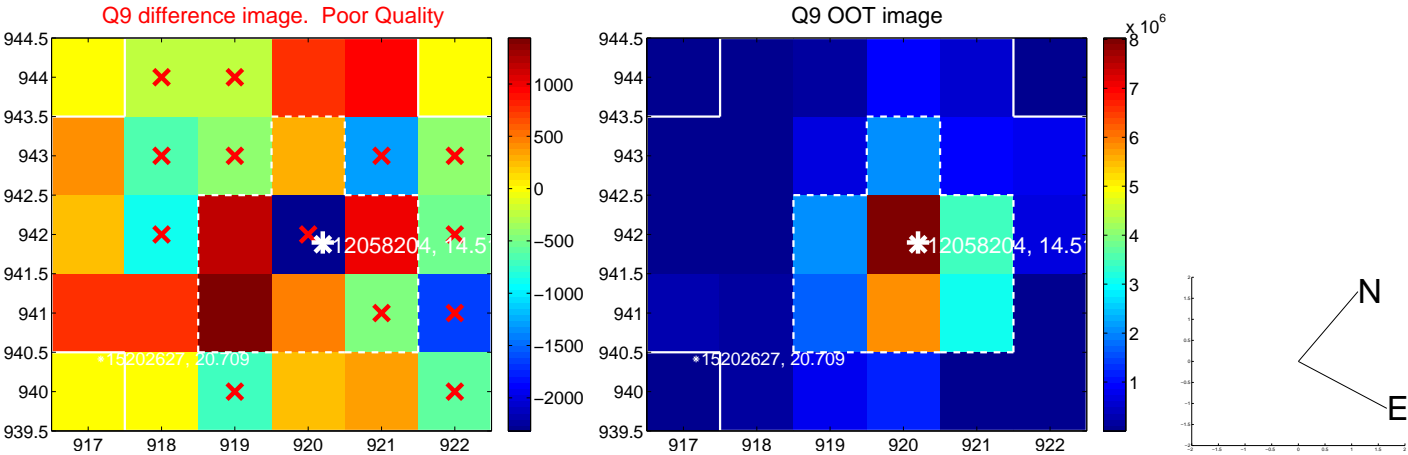
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



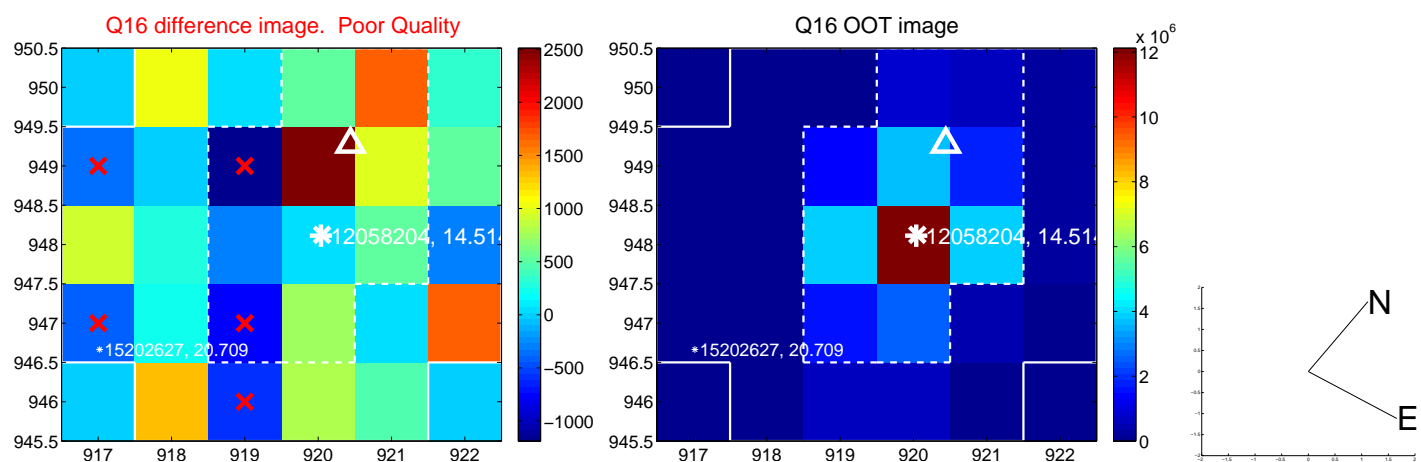
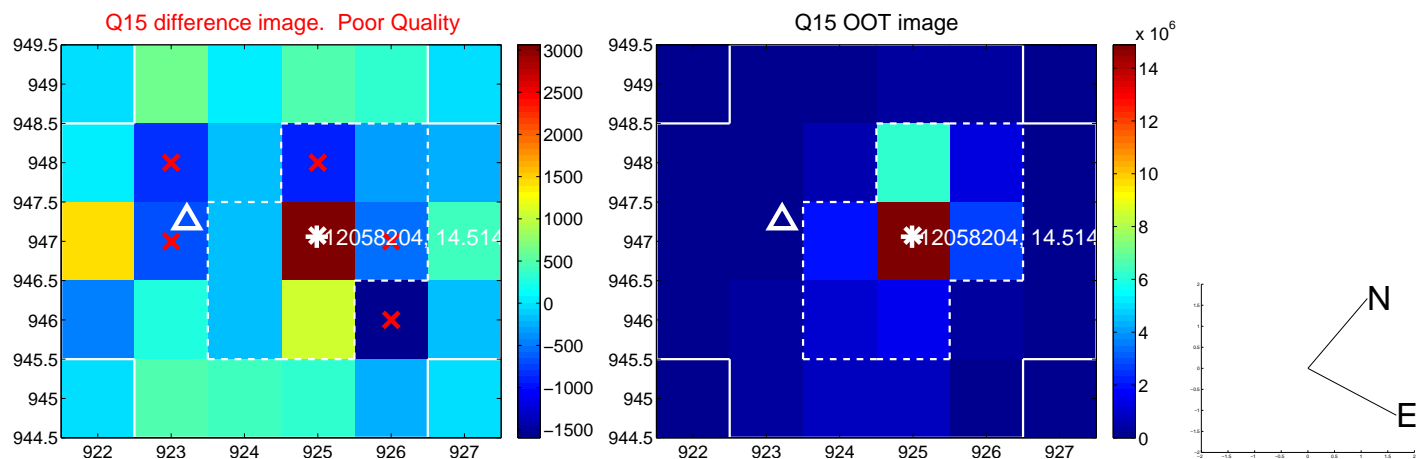
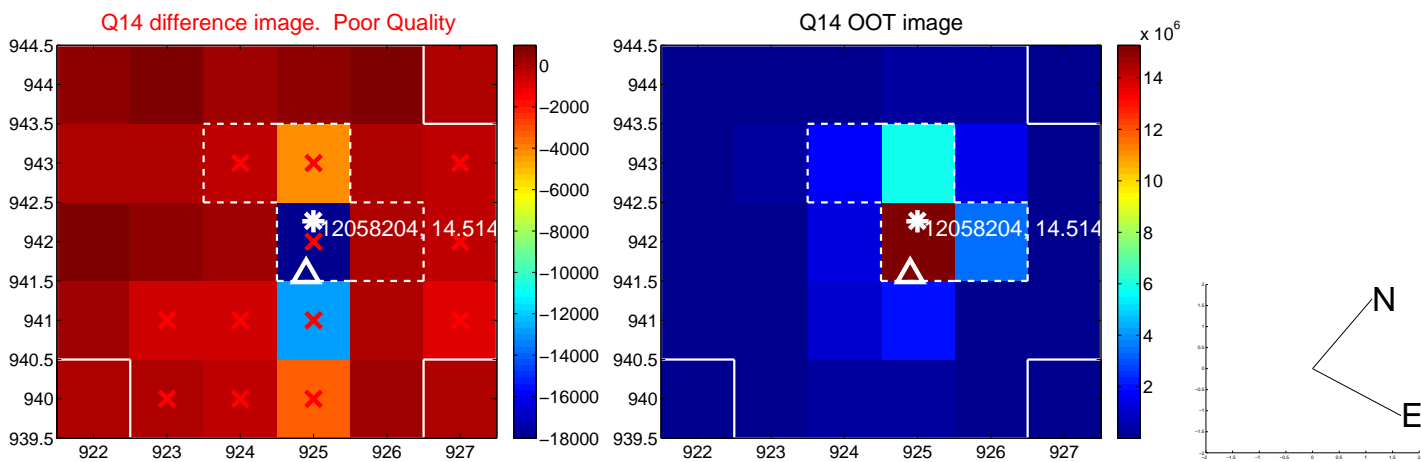
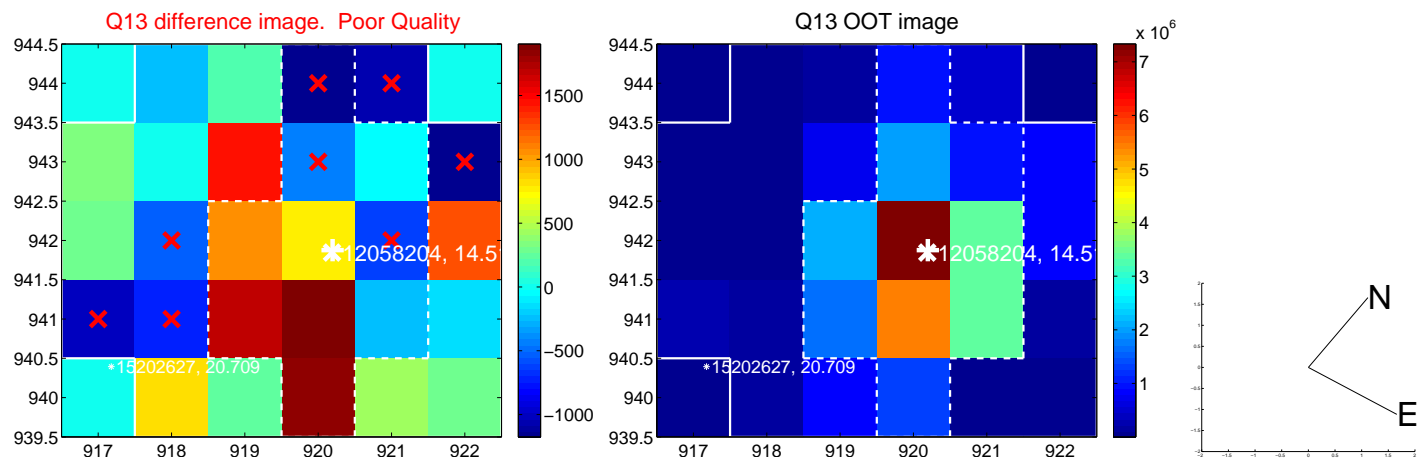
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



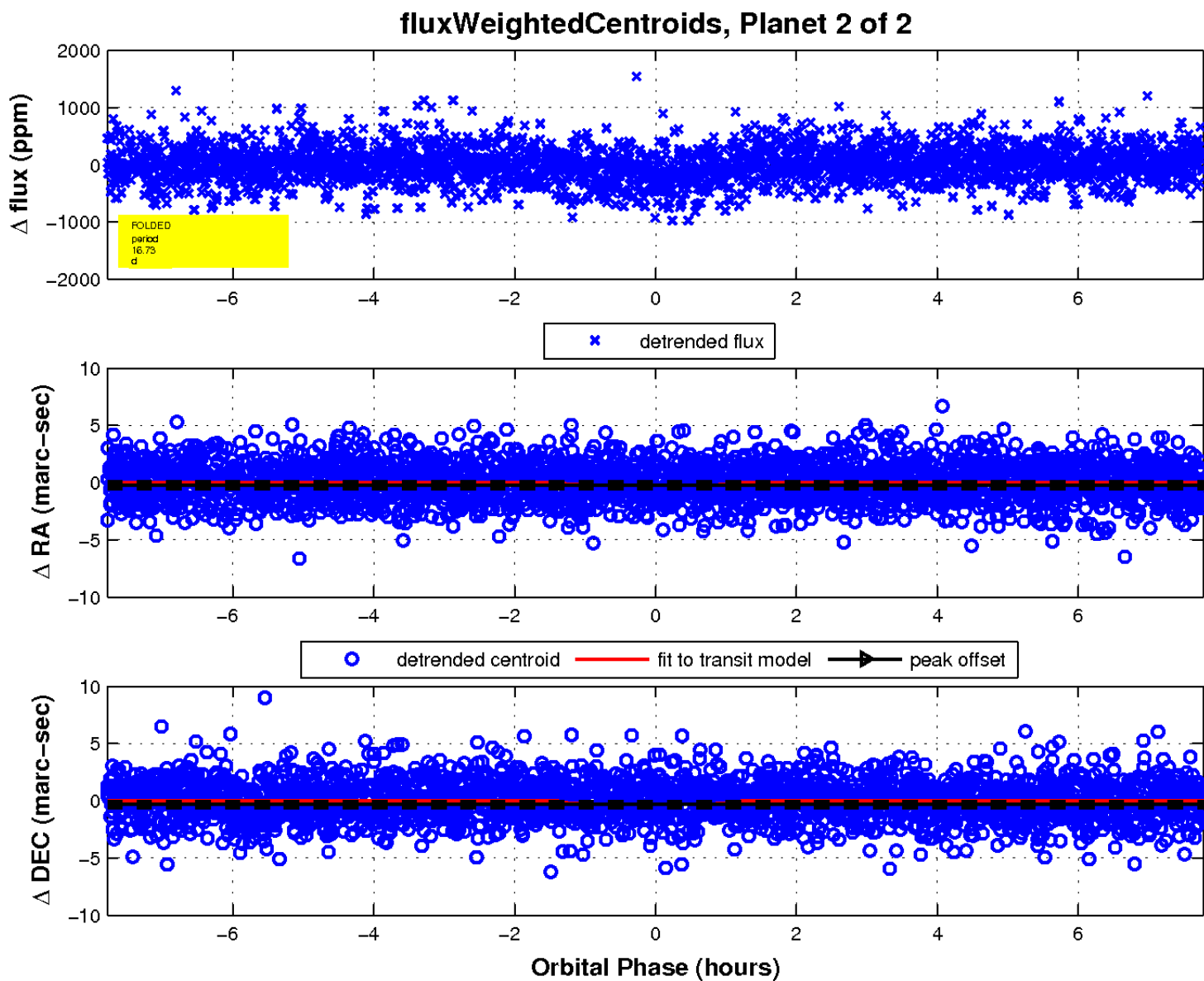
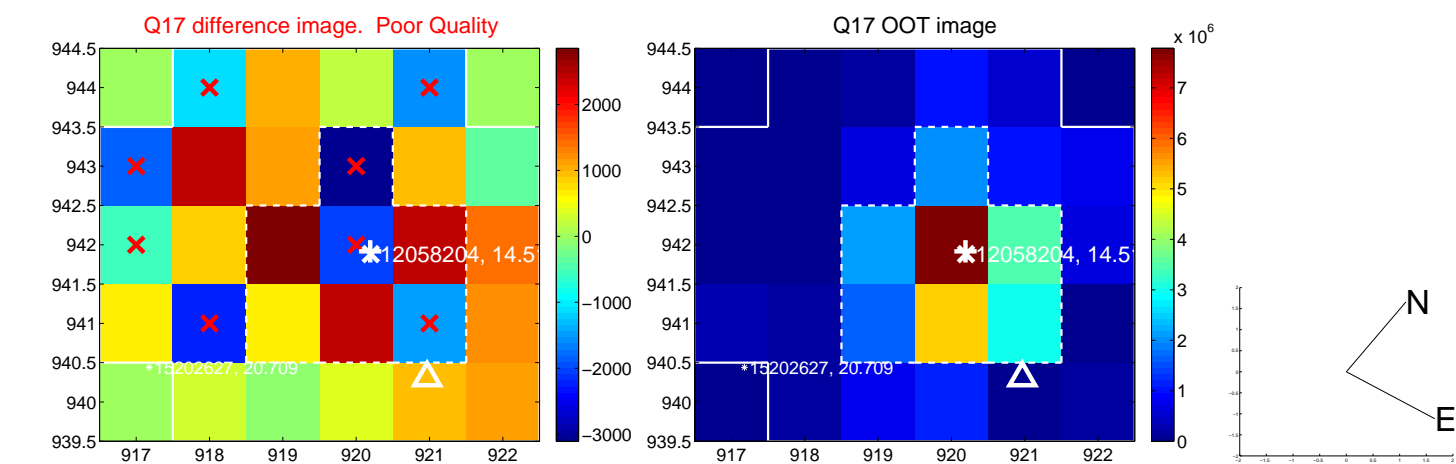
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white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination

