

# KIC 004544620

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
004544620-01	OBS	3915.01	2.189045	132.099796	457.7	3.589	27.0	29.5	0.78	5401	2.31	466.37
004544620-02	OBS	No	2.189092	133.509977	259.4	2.062	16.3	16.0	0.78	5401	1.50	466.36

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
004544620-01	OBS	FP	0.00	0	1	1	1	MOD_SEC_ALT—HAS_SEC_TCE—CENT_RESOLVED_OFFSET—HALO_GHOST—EPHEM_MATCH
004544620-02	OBS	FP	0.00	1	1	1	1	IS_SEC_TCE—CENT_RESOLVED_OFFSET—EPHEM_MATCH

**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 004544620-01

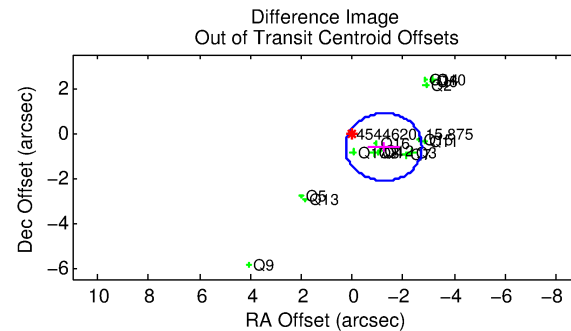
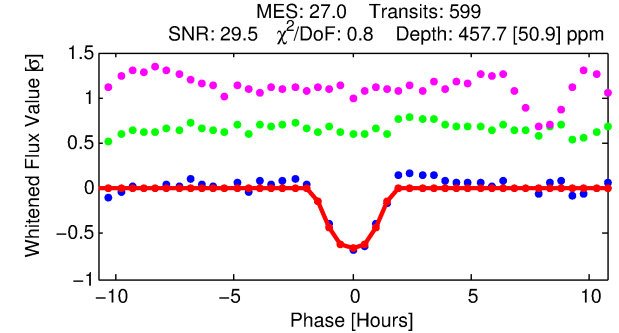
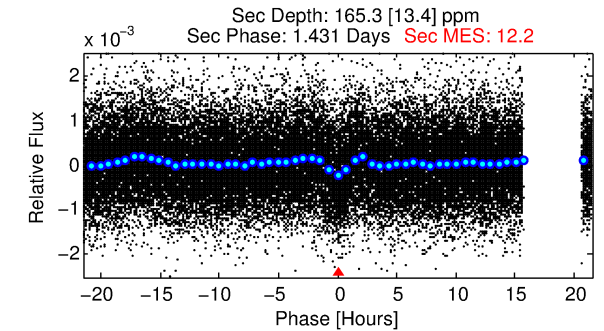
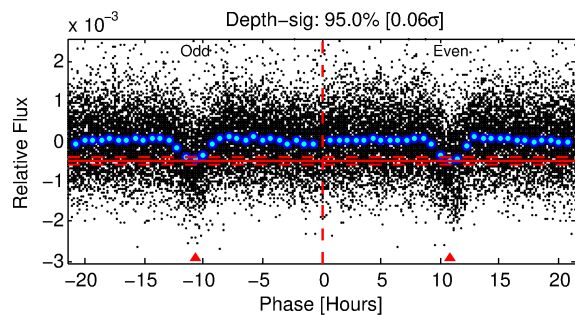
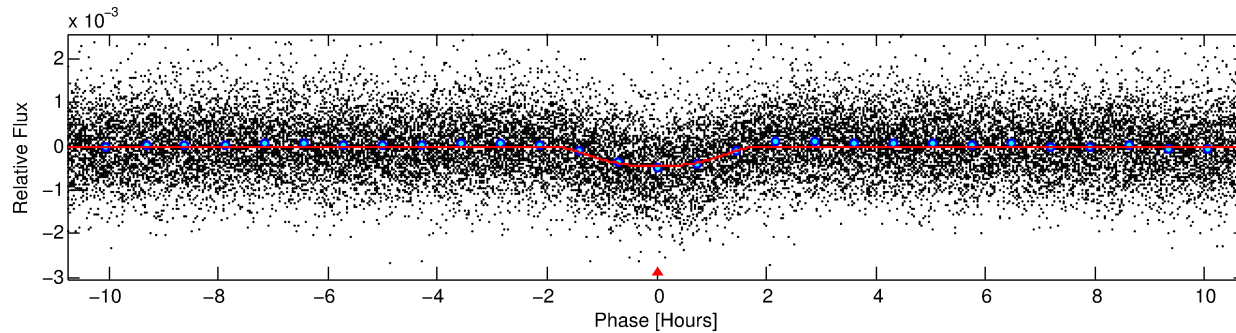
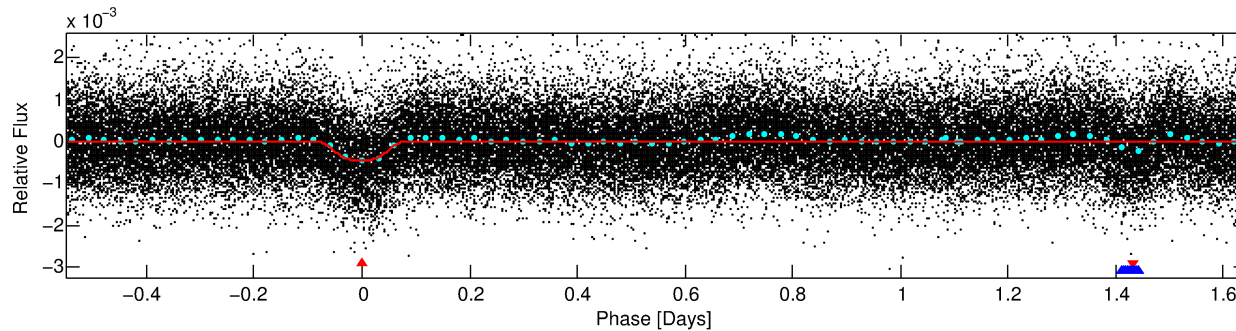
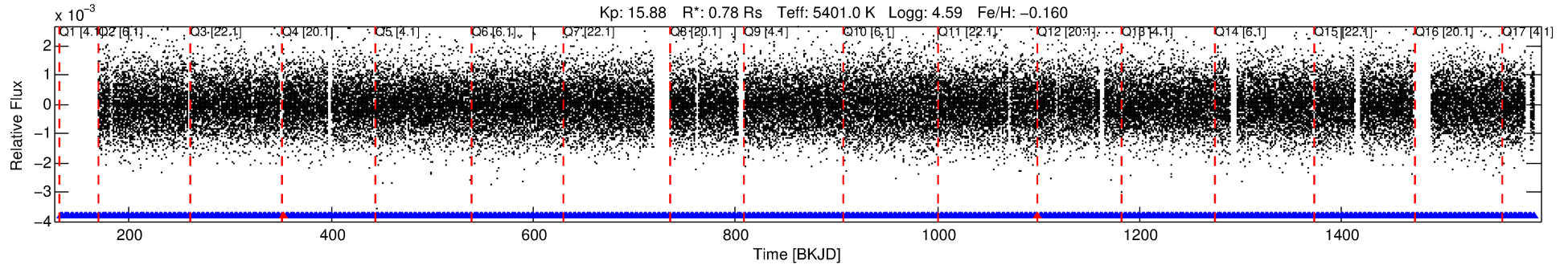
TCE (1)	KIC	Parent (2)	Parent KIC	$P_1:P_2$	Dist ( $''$ )	$\Delta$ Row	$\Delta$ Col	$m_2$	$m_1$	$D_2/D_1$	Mechanism	Flag	$\sigma_P$	$\sigma_T$
004544620-01	4544620	004544587-pri	4544587	1:1	52.0	-1	13	10.80	15.87	977.95	Direct-PRF	0	1.64	1.03

**Notes:**  $P_1:P_2$  is the period ratio. Dist is the distance in arcseconds.  $\Delta$ Row and  $\Delta$ Col are the number of pixels apart in row and column.  $m_2$  and  $m_1$  are the magnitudes of the parent and child.  $D_2/D_1$  is the parent's transit depth divided by the child's.  $\sigma_P$  and  $\sigma_T$  are the significance of the match in period and epoch. For a match to be considered significant  $\sigma_P < 5.0$  and  $\sigma_T < 5.0$ . Matches which have  $\sigma_P$  and  $\sigma_T$  very close to this cutoff should receive extra scrutiny, especially if the period ratio is very large.

# DV One-Page Summary

KIC: 4544620 Candidate: 1 of 2 Period: 2.189 d  
KOI: K03915.01 Corr: 0.822

Kp: 15.88 R\*: 0.78 Rs Teff: 5401.0 K Logg: 4.59 Fe/H: -0.160



## DV Fit Results:

Period = 2.18905 [0.00001] d  
Epoch = 132.0998 [0.0021] BKJD  
Rp/R\* = 0.0273 [0.0030]  
a/R\* = 1.81 [0.14]  
b = 0.97 [0.01]  
Seff = 466.37 [110.61]  
Teq = 1185 [70] K  
Rp = 2.31 [0.47] Re  
a = 0.0314 [0.0045] AU  
Ag = 16.78 [5.19] [3.04σ]  
Teff = 3708 [240] K [10.08σ]

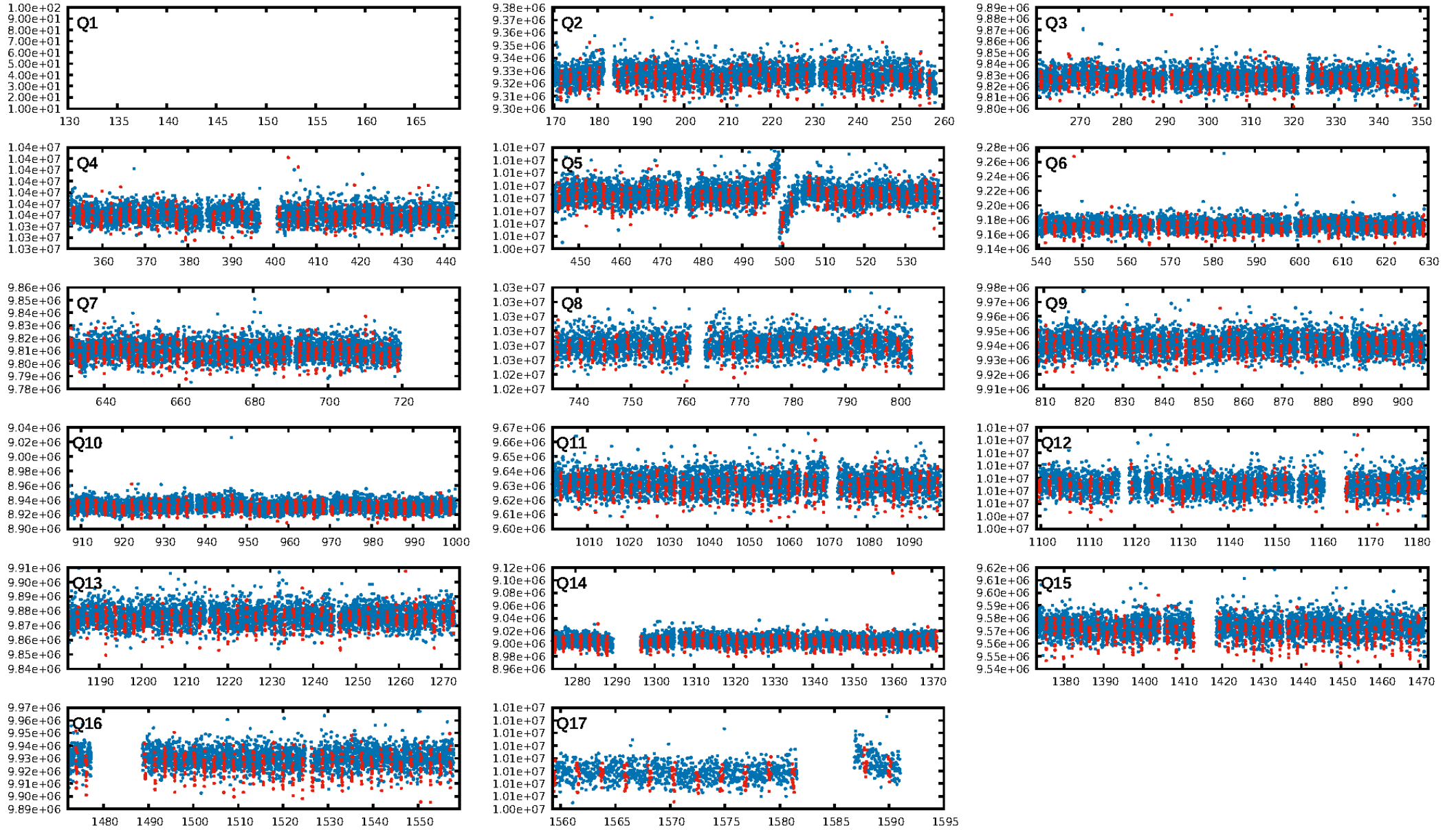
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 0.0% [0.00σ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: 4.24e-154  
RollingBand-fgt: 1.00 [584/586]  
GhostDiagnostic-chr: 0.1748  
Centroid-sig: 0.0%  
Centroid-so: 1.740 arcsec [4.50σ]  
OotOffset-rm: 1.393 arcsec [2.77σ]  
OotOffset-st: 4/4/4/4 [16]  
KicOffset-rm: 4.515 arcsec [12.82σ]  
KicOffset-st: 4/4/4/4 [16]  
DiffImageQuality-fgm: 0.00 [0/16]  
DiffImageOverlap-fno: 1.00 [16/16]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 11:53:48 Z

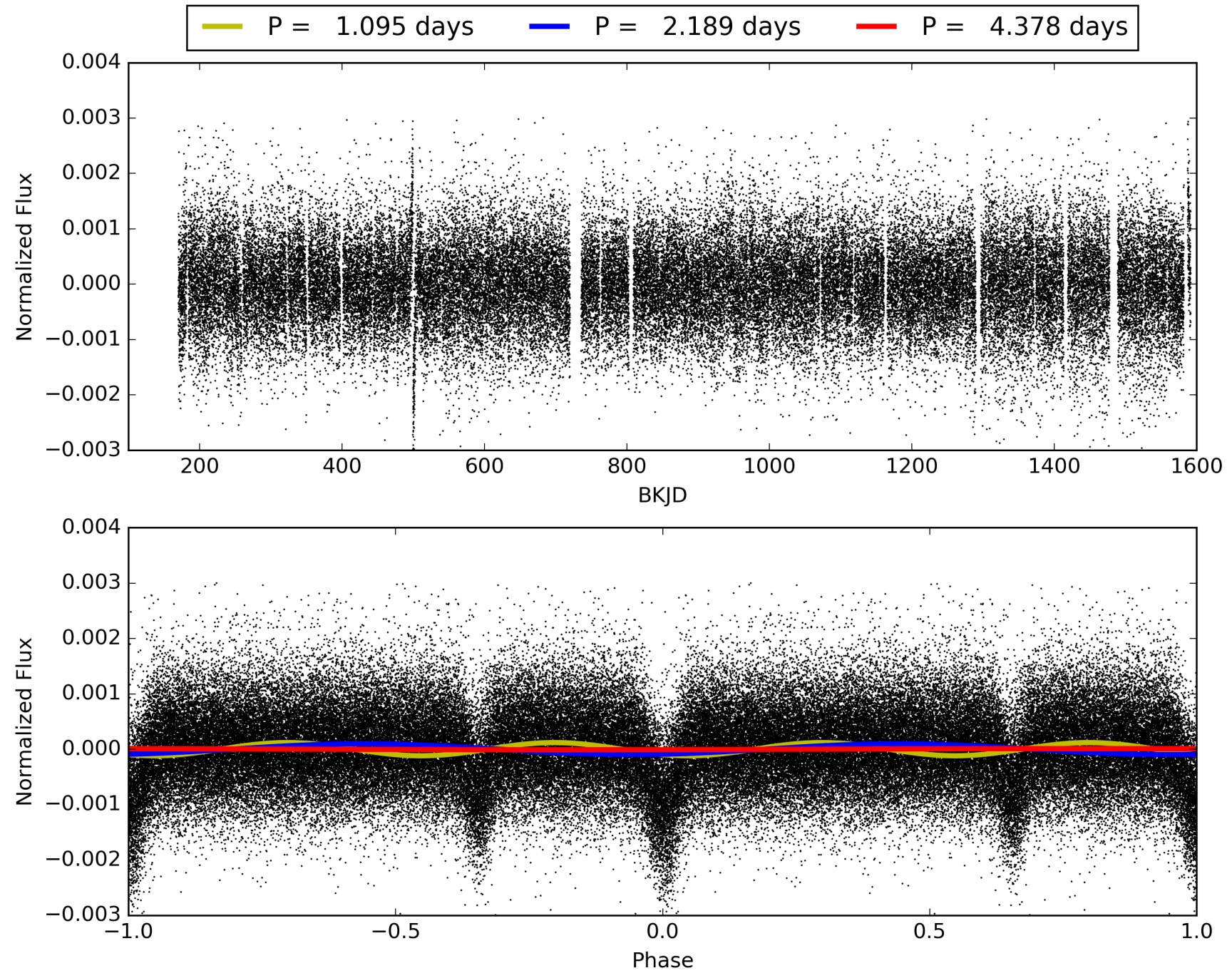
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 004544620-01, PDC Light Curves



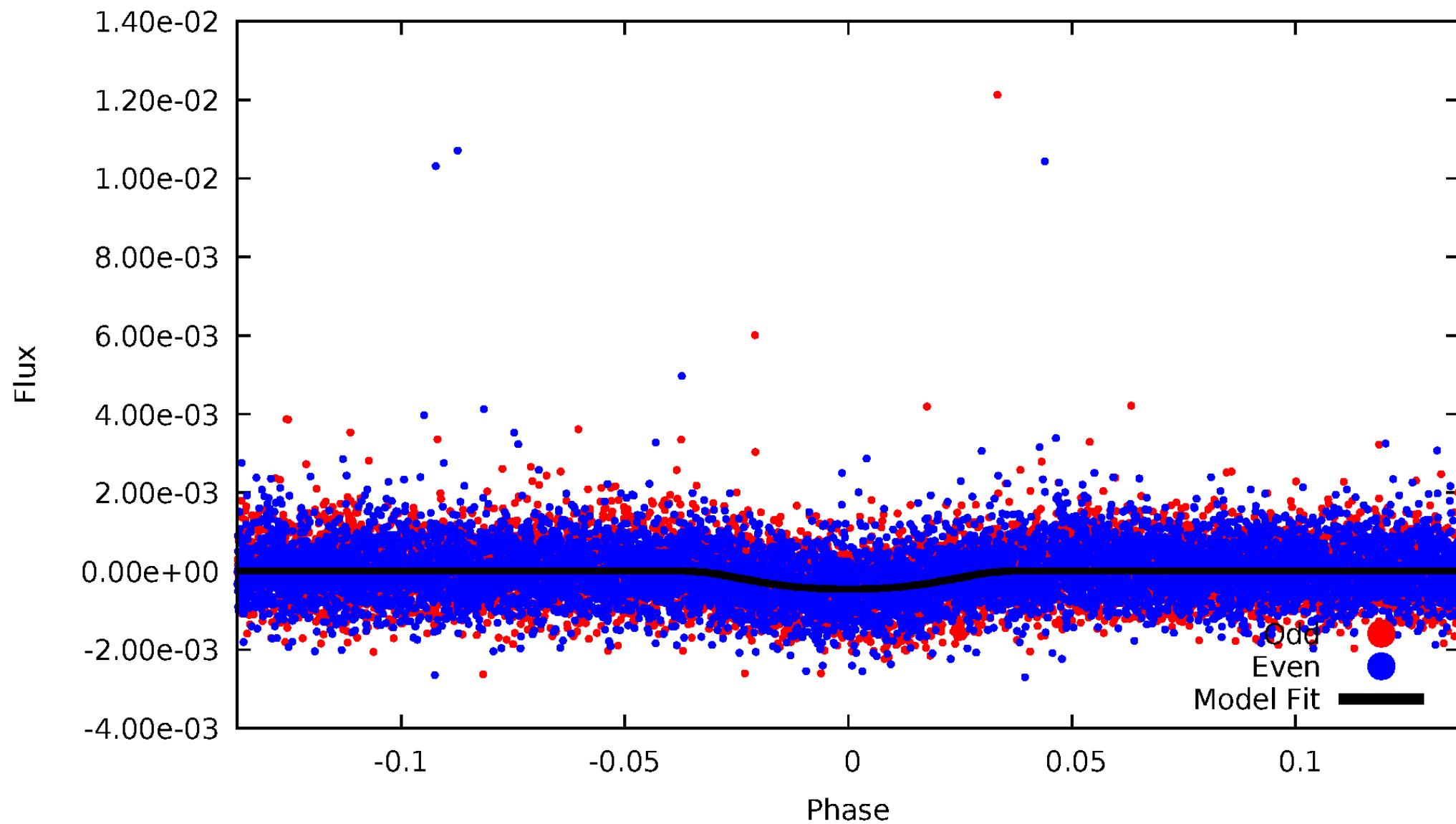


TCE 004544620-01



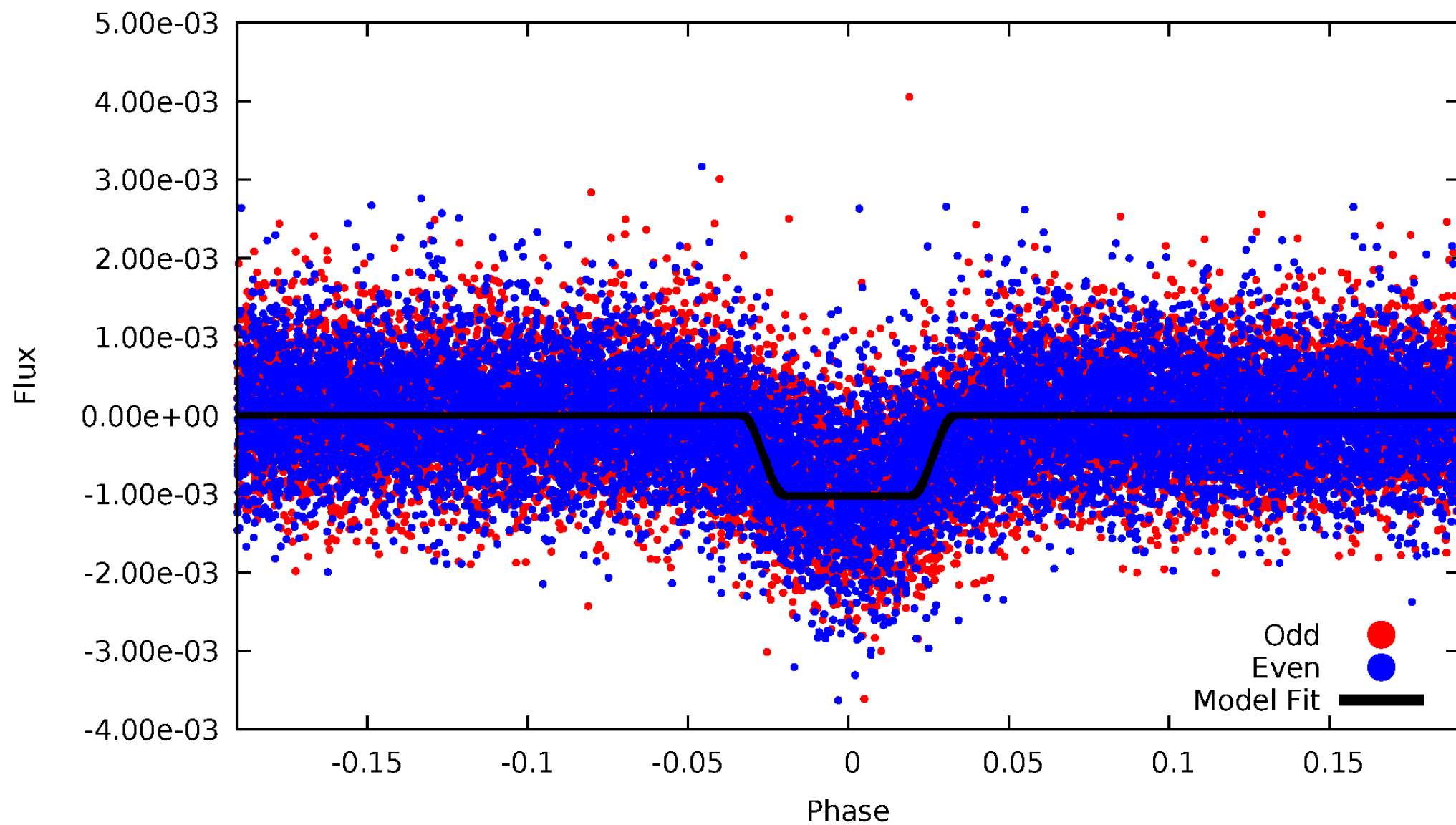
# DV Odd/Even

TCE 004544620-01



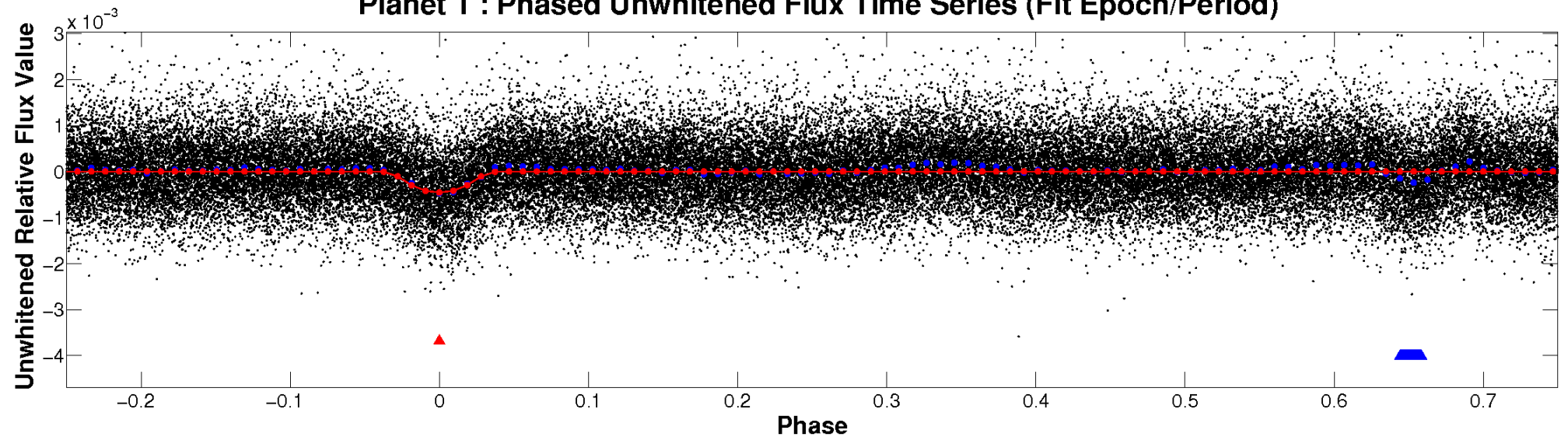
# ALT Odd/Even

TCE 004544620-01

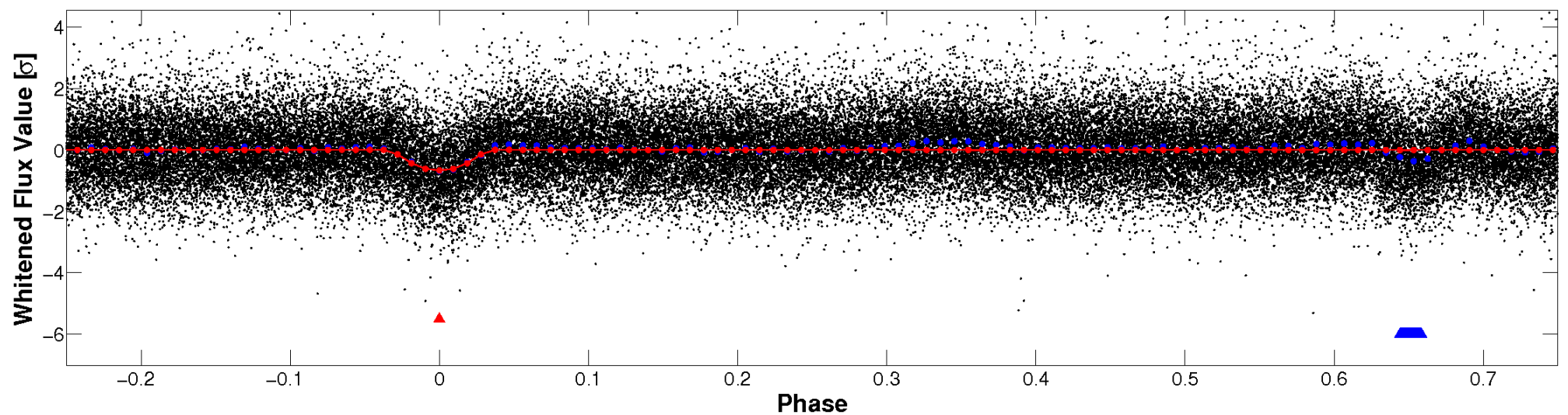


# Non-Whitened Vs. Whitened Light Curve

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



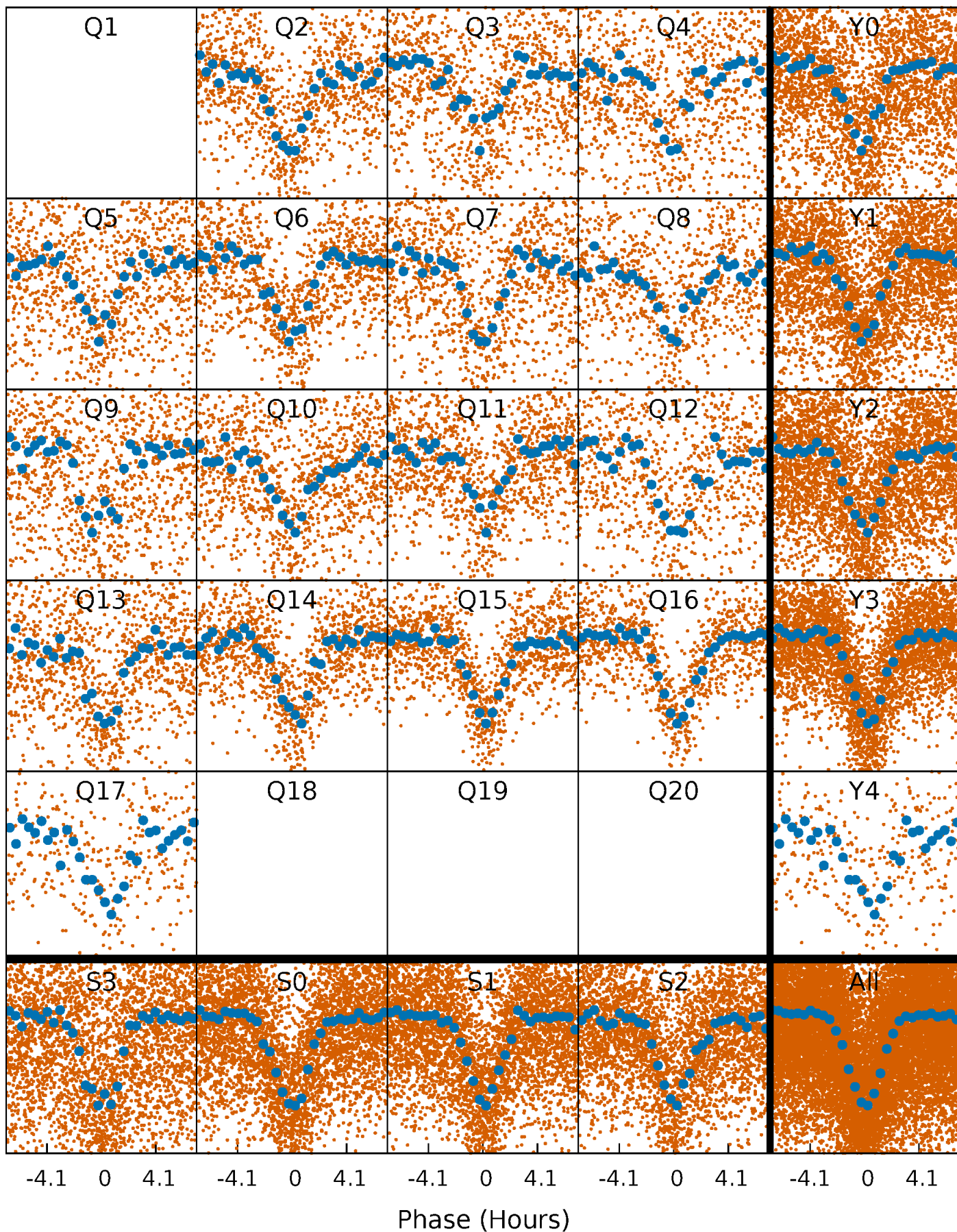
**Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)**





# PDC Quarter-Phased Transit Curves

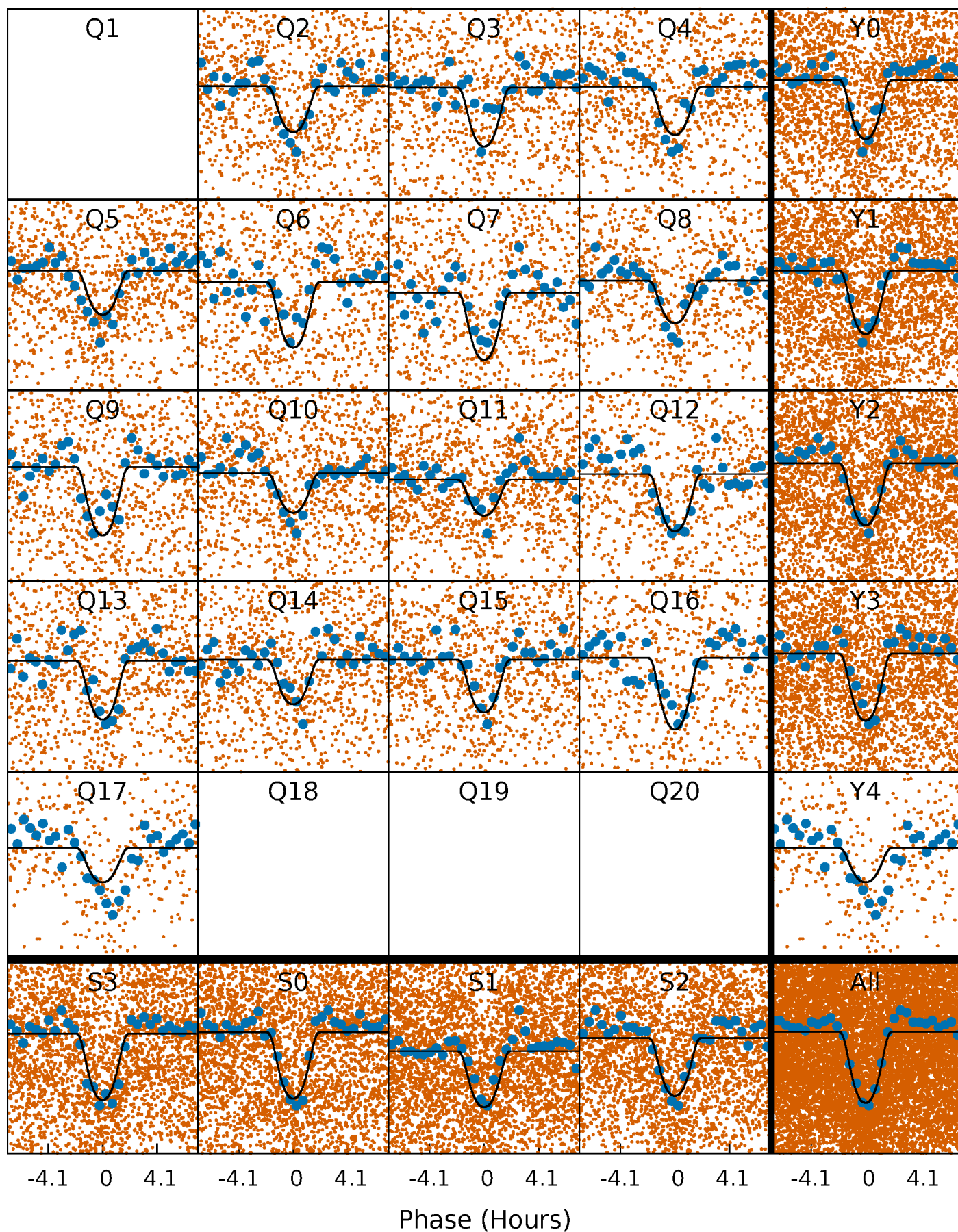
TCE 004544620-01 P= 2.189045 Days  $T_0=132.099796$  (BKJD)





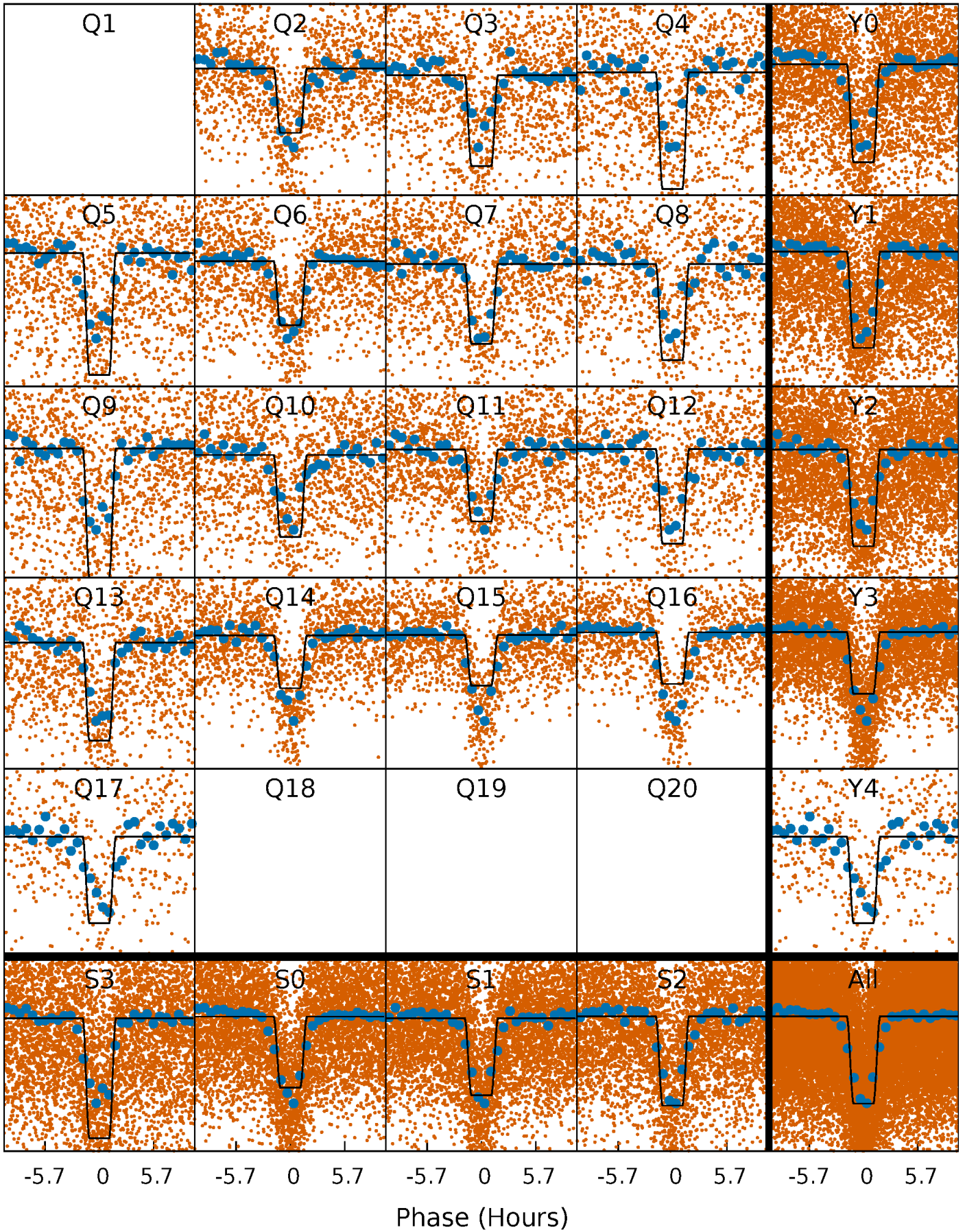
# DV Quarter-Phased Transit Curves

TCE 004544620-01 P= 2.189045 Days  $T_0=132.099796$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

TCE 004544620-01 P= 2.189068 Days  $T_0=132.093750$  (BKJD)

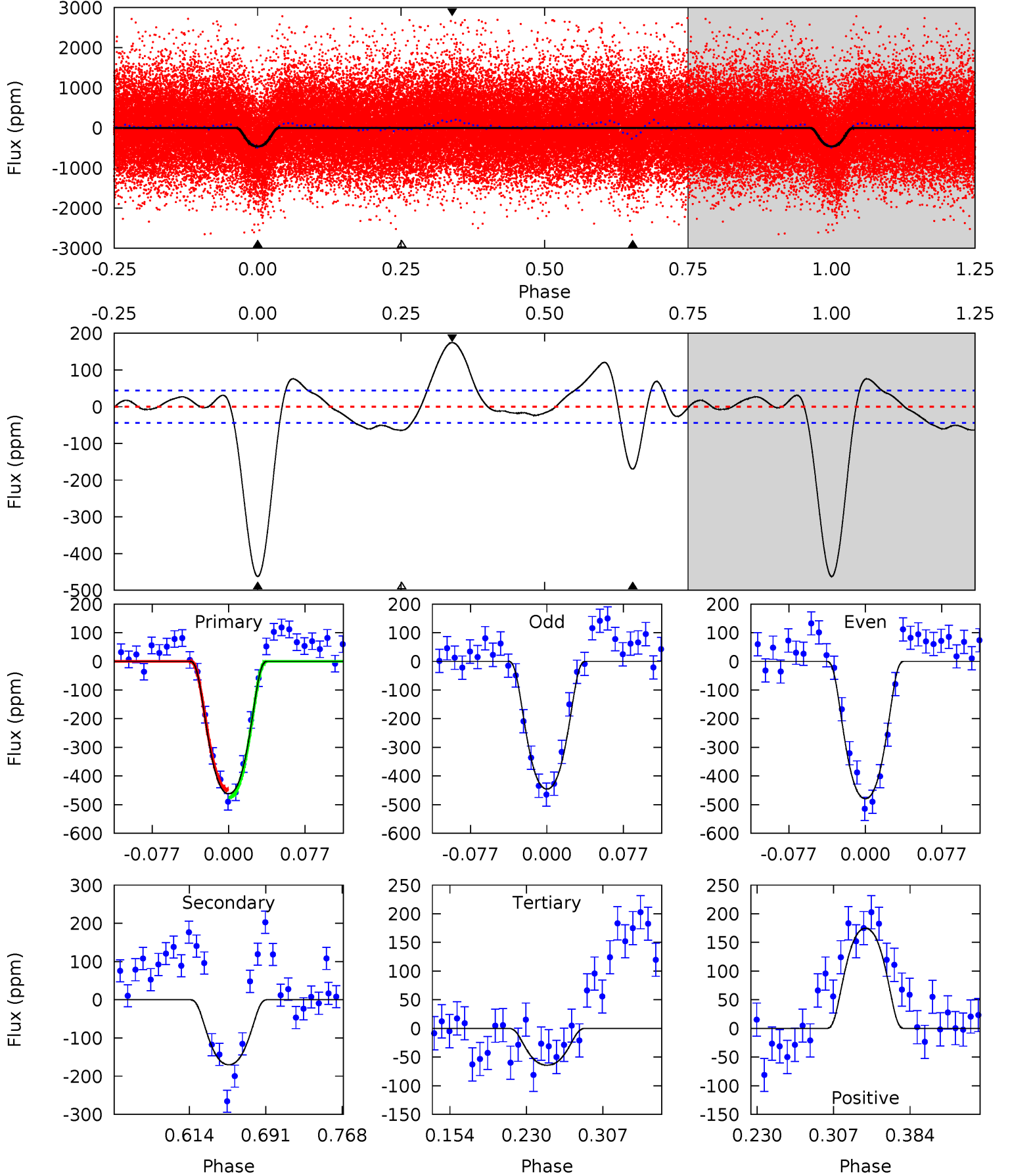




# DV Model-Shift Uniqueness Test

004544620-01, P = 2.189045 Days, E = 132.099796 Days

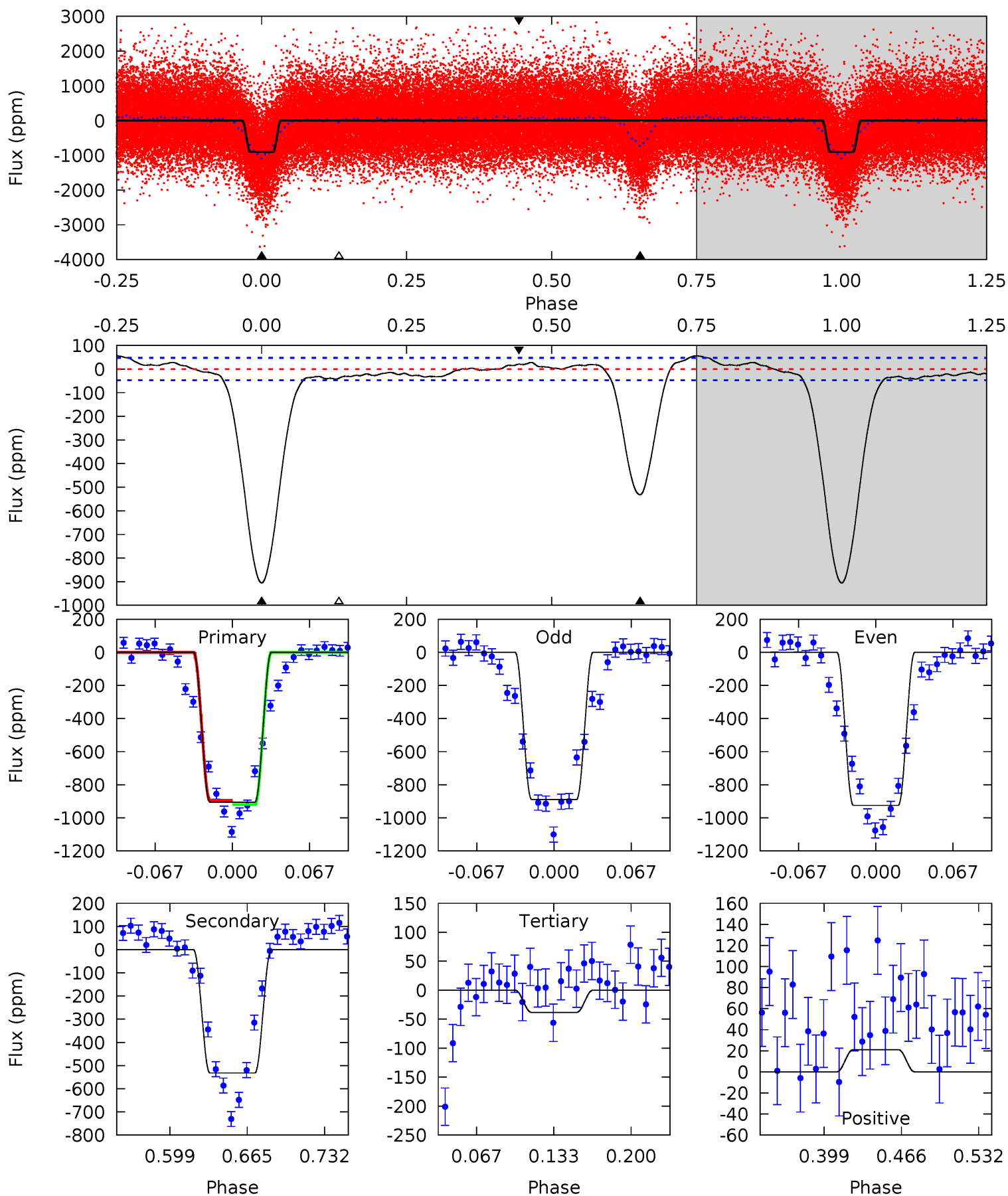
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
48.3	17.8	6.70	18.3	4.62	1.77	5.63	41.6	30.1	11.1	-0.48	1.76	0.98	0.27	1.36



# Alt Model-Shift Uniqueness Test

004544620-01, P = 2.189068 Days, E = 132.093750 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
88.8	52.2	3.76	2.07	4.65	1.83	2.47	85.1	86.8	48.4	50.1	1.73	1.04	0.06	1.24





### Stellar Parameters For KIC 004544620

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5401^{+159}_{-159}$	$4.593^{+0.037}_{-0.112}$	$-0.160^{+0.300}_{-0.300}$	$0.777^{+0.132}_{-0.066}$	$0.871^{+0.070}_{-0.104}$	$2.616^{+0.493}_{-0.917}$
	+3%/-3%	+1%/-2%	+188%/-188%	+17%/-8%	+8%/-12%	+19%/-35%
Source	PHO1	KIC0	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 004544620-01 / KOI 3915.01

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-170 \pm 10$	$2.37^{+0.30}_{-0.30}$	$1679^{+78}_{-65}$	$4001^{+209}_{-163}$	$16^{+5}_{-4}$
Alt.	$-532 \pm 10$	$2.77^{+0.34}_{-0.29}$	$1680^{+79}_{-69}$	$4690^{+238}_{-202}$	$37^{+8}_{-7}$

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

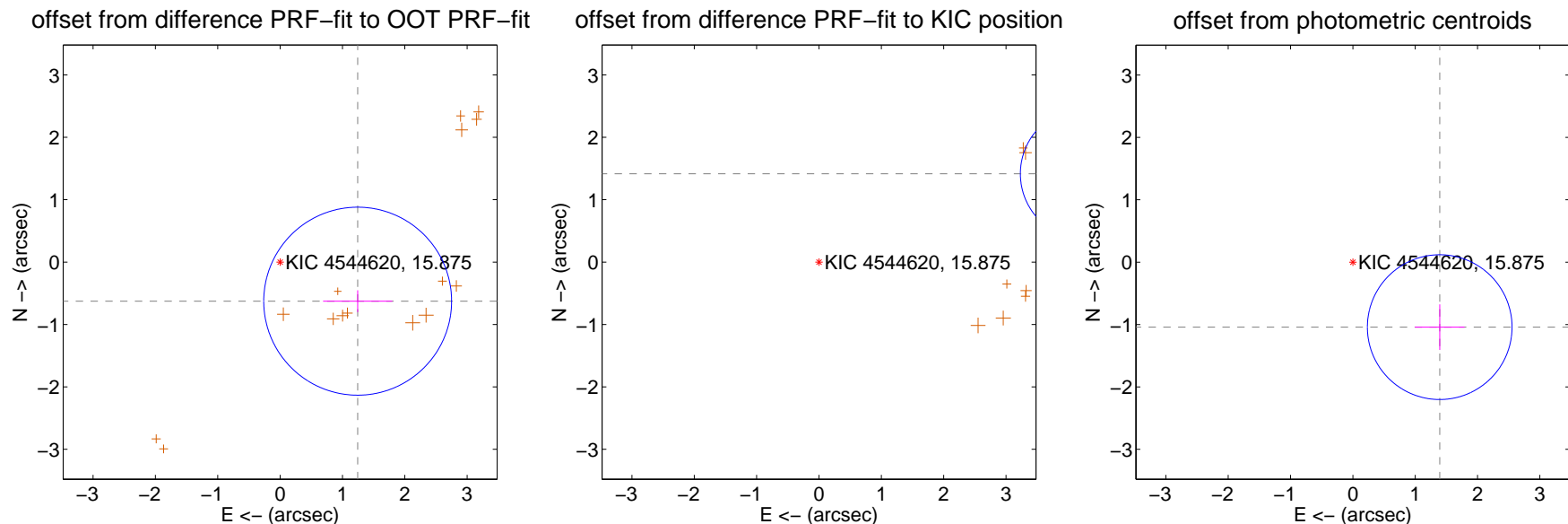
## DV Centroid Data

Supplemental centroid analysis for 004544620-01. Kepler magnitude: 15.88. Transit SNR 29.54

There are 0 quarters with good PRF difference image offsets

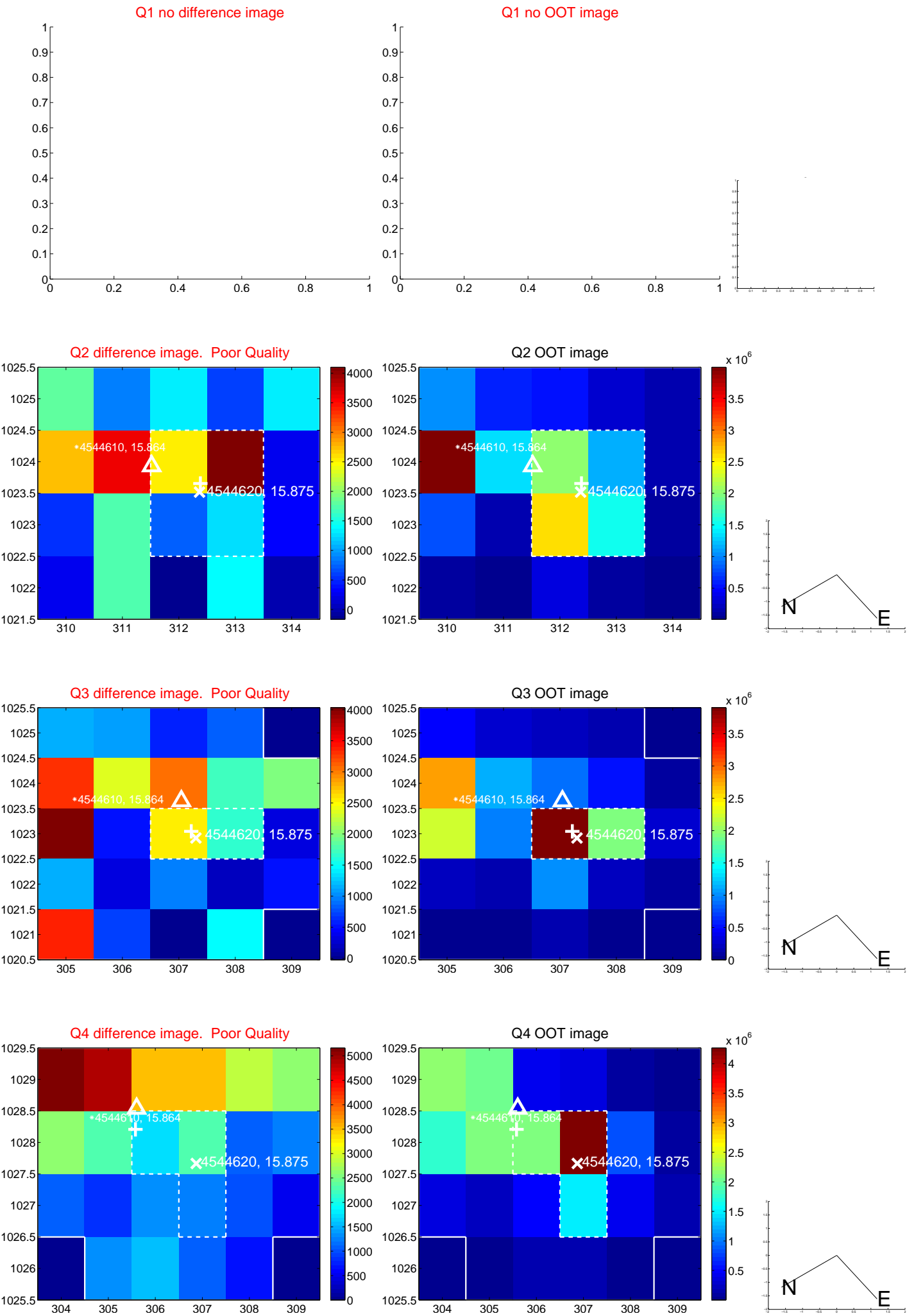
The OOT PRF centroid is offset from the target star catalog position by about 6.66 arcsec so the offset from difference PRF-fit to OOT-fit may be invalid.

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.393 \pm 0.502$	2.77	$-1.244 \pm 0.555$	$-0.627 \pm 0.174$
PRF-fit source offset from KIC position	$4.515 \pm 0.352$	12.82	$-4.288 \pm 0.295$	$1.416 \pm 0.295$
photometric centroid source offset	$1.74 \pm 0.39$	4.50	$-1.39 \pm 0.40$	$-1.04 \pm 0.37$

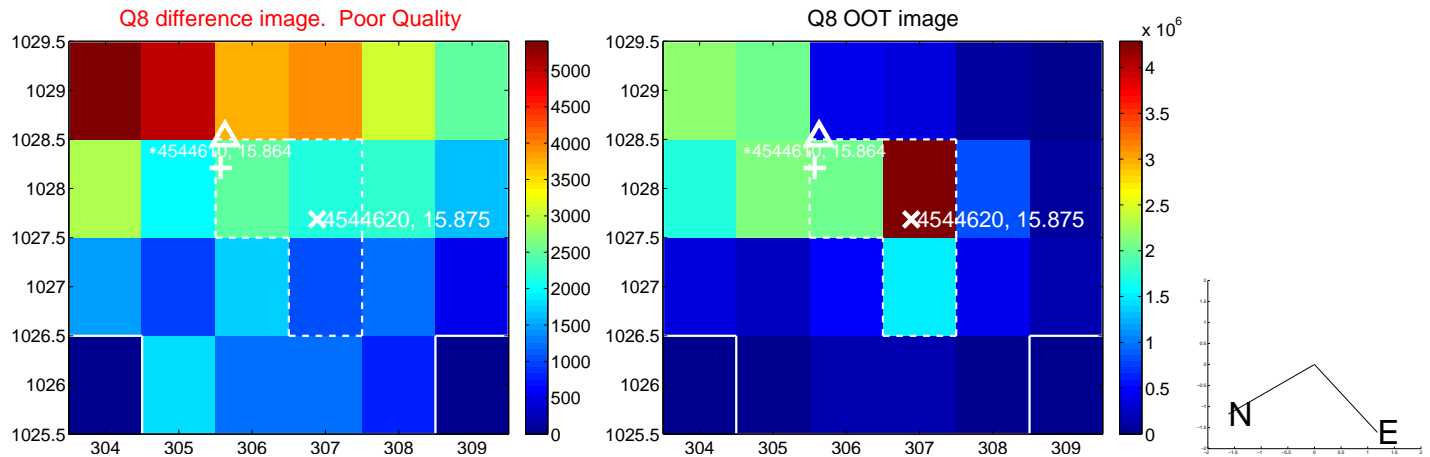
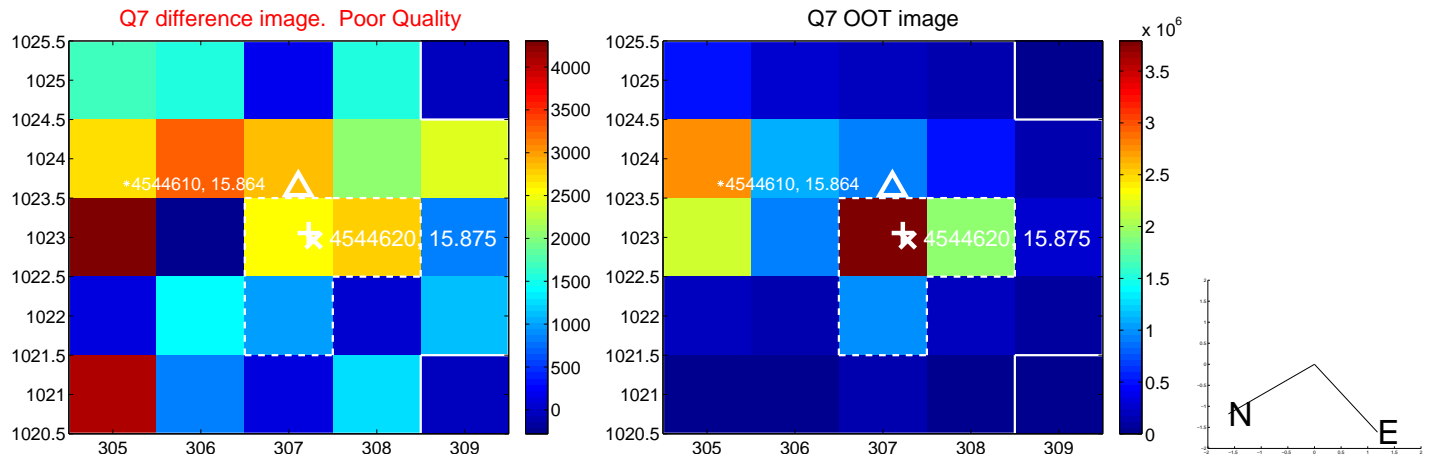
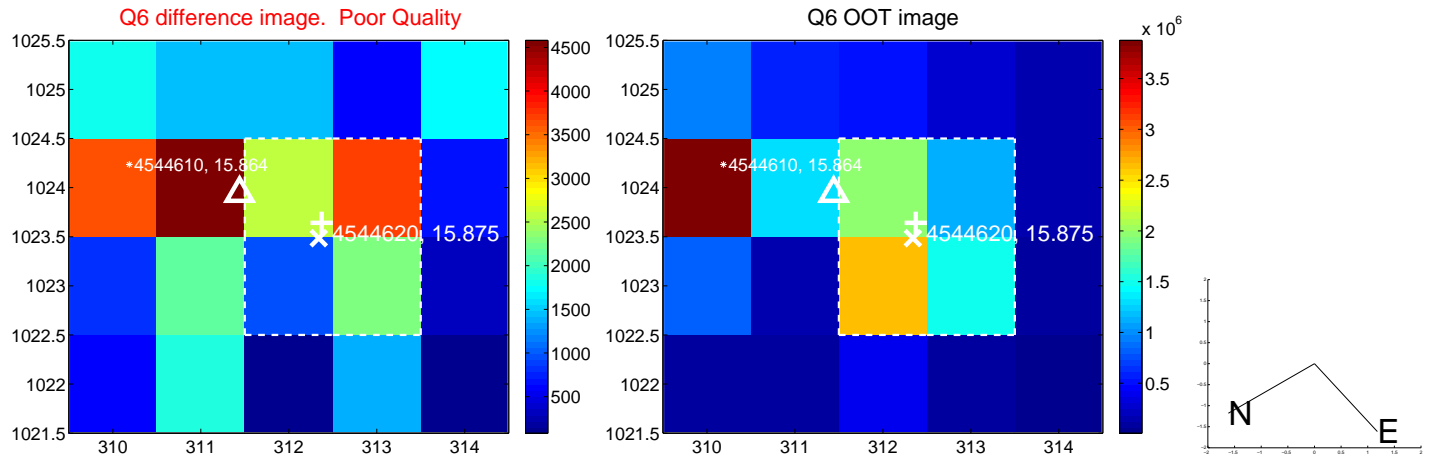
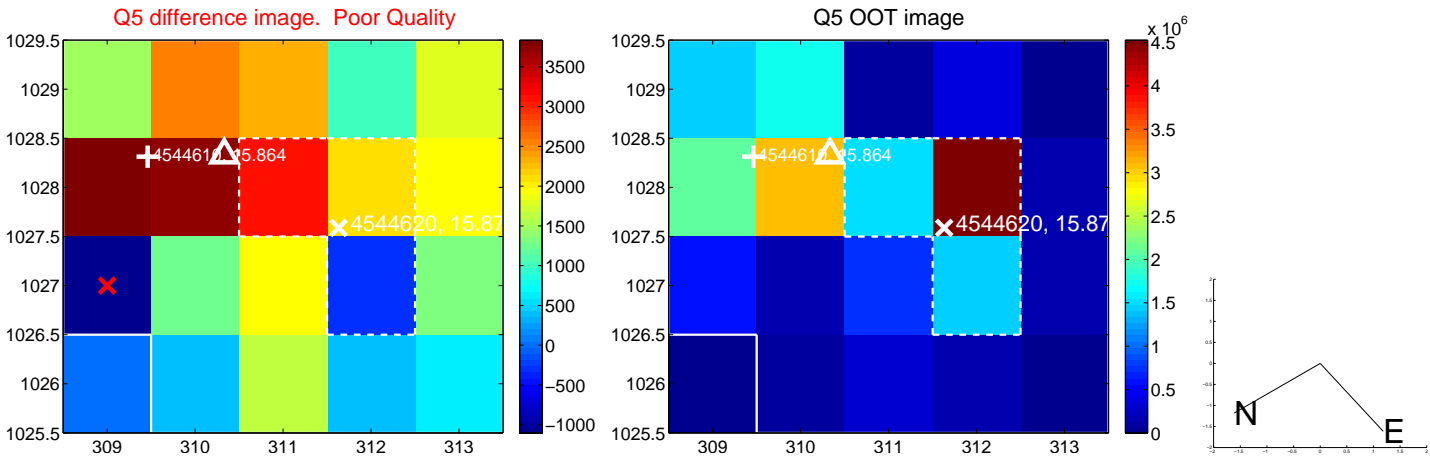


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

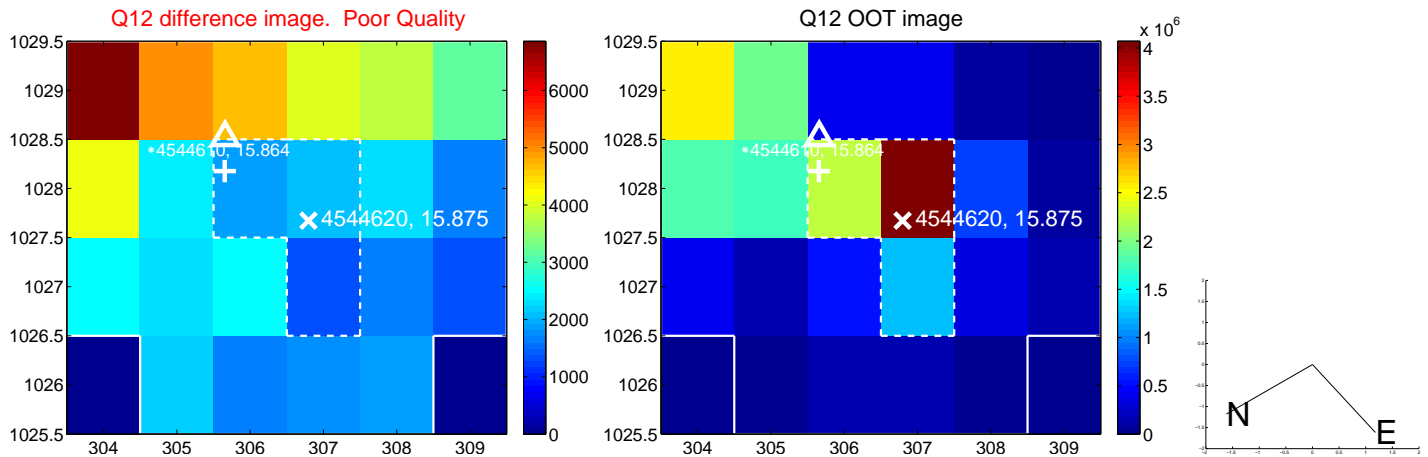
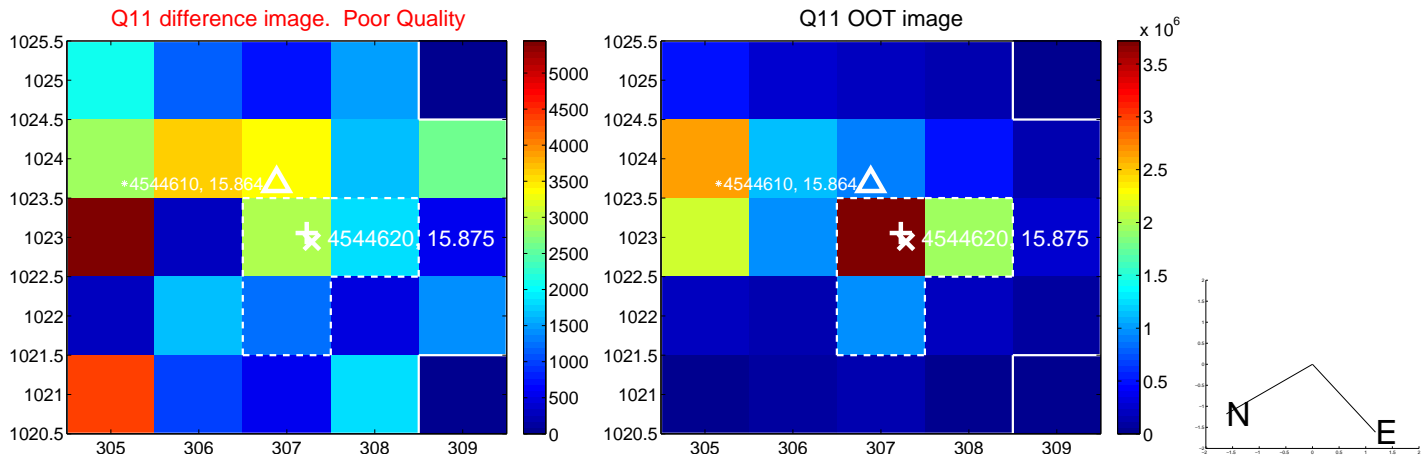
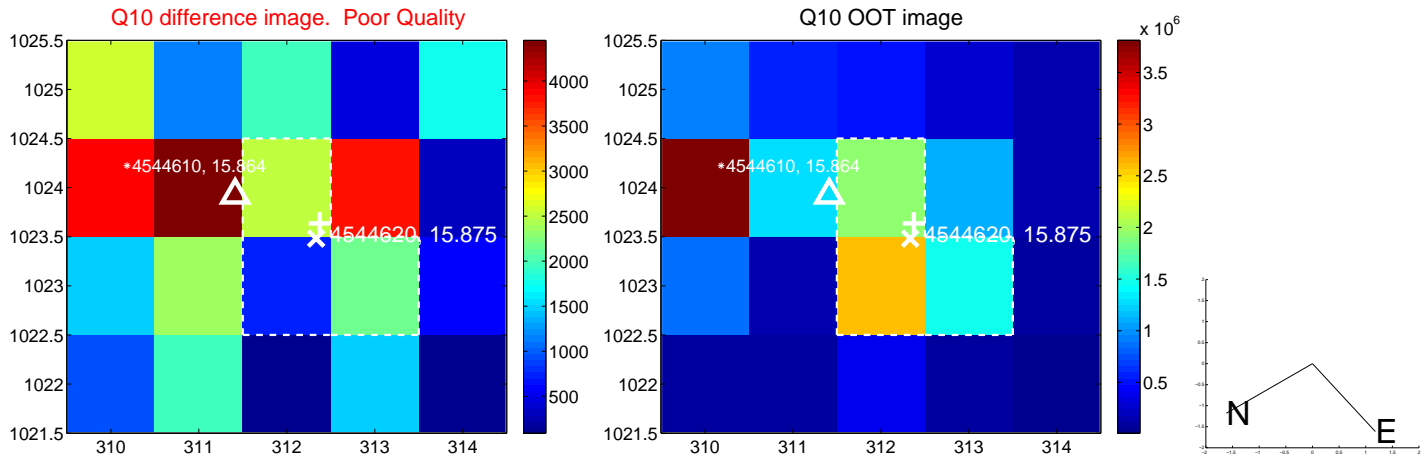
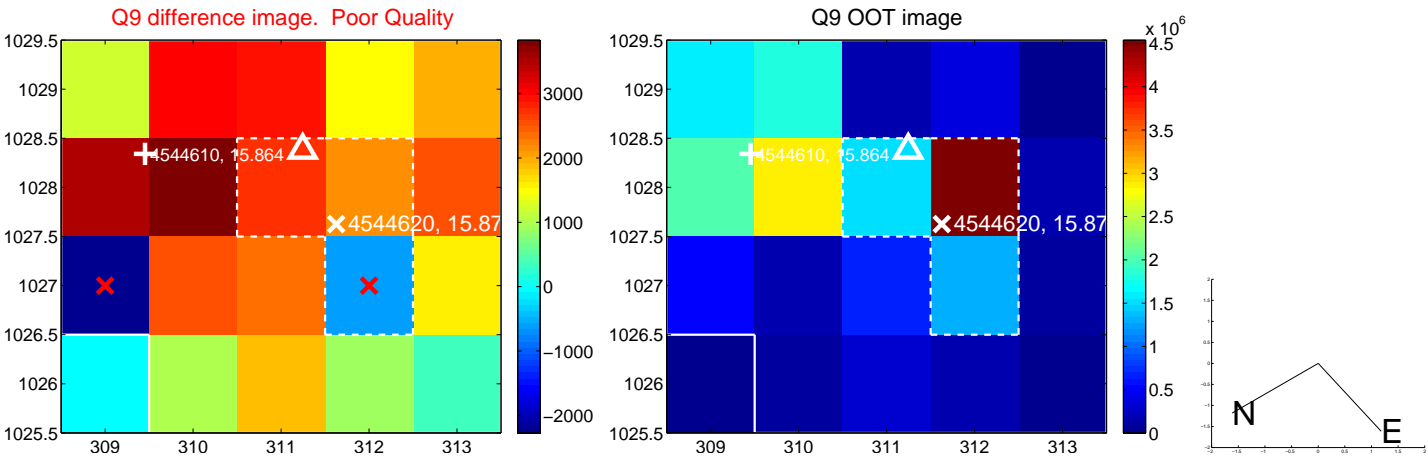


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

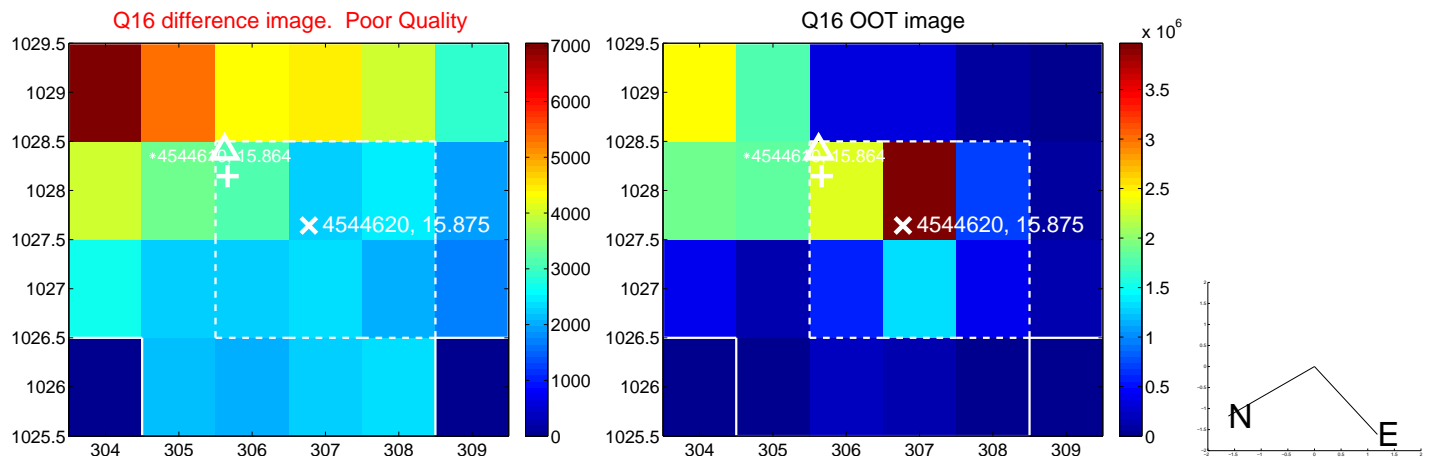
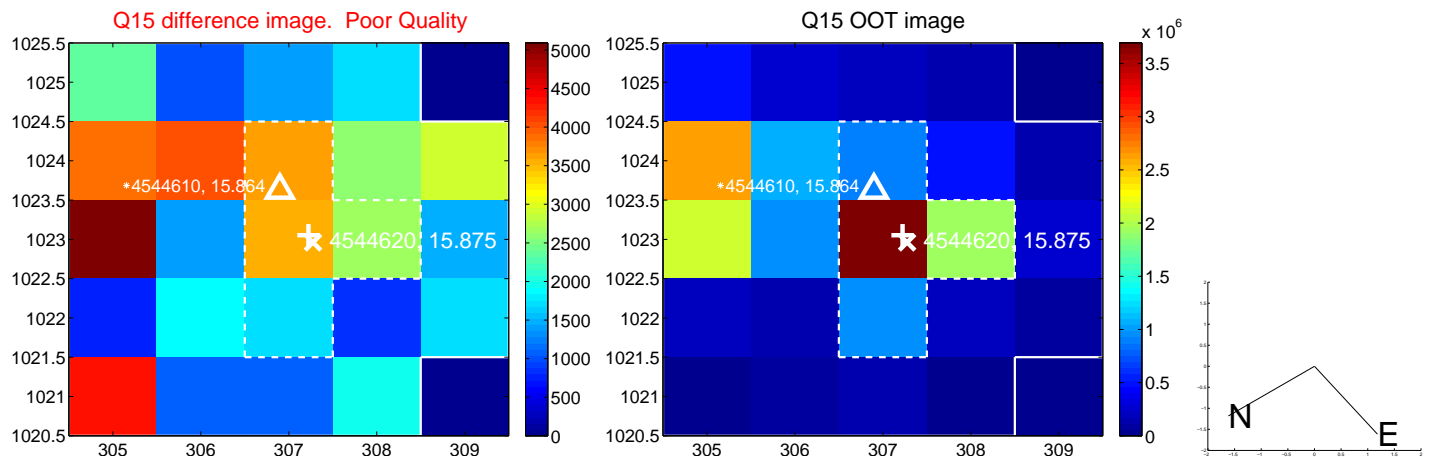
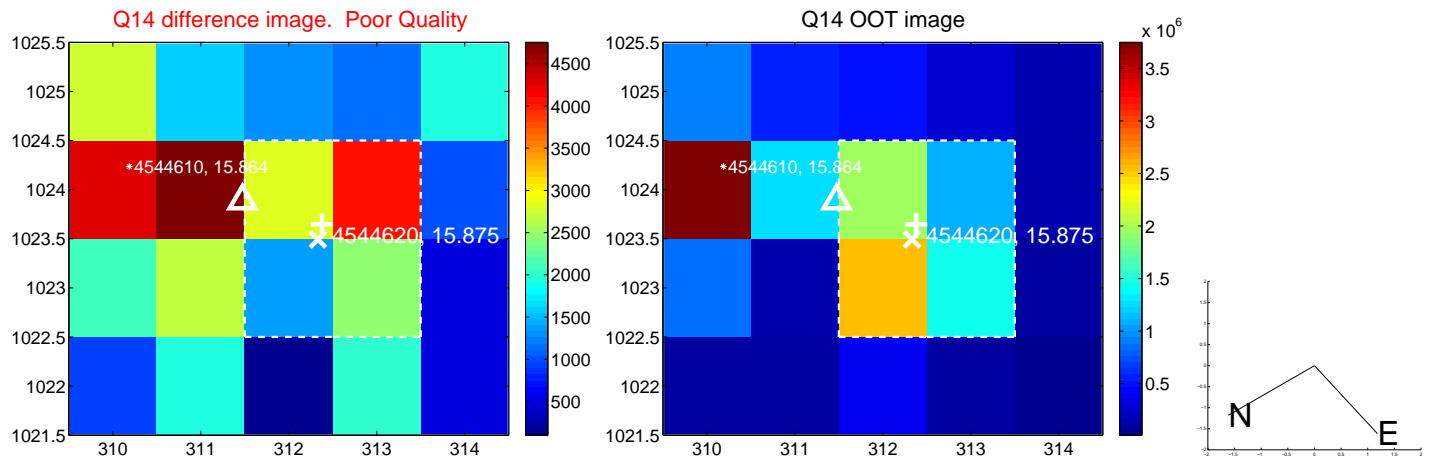
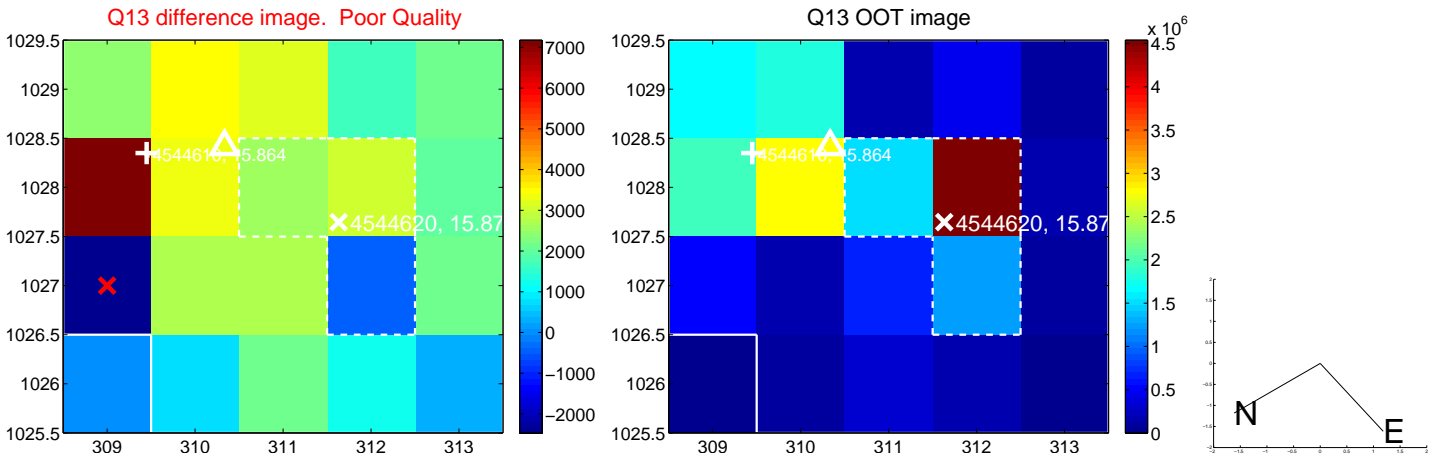




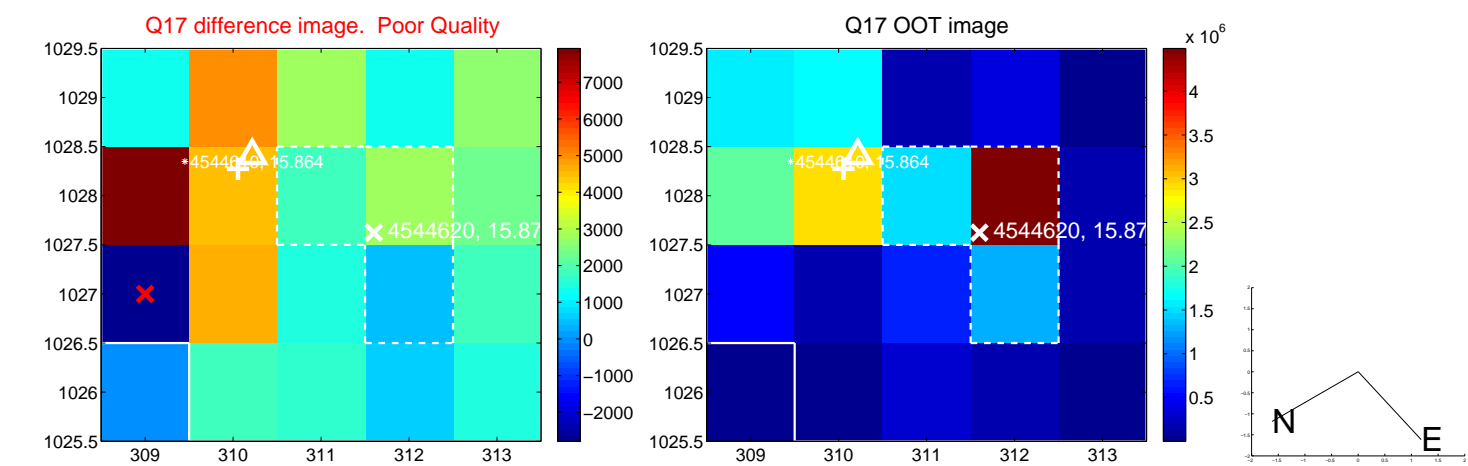
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



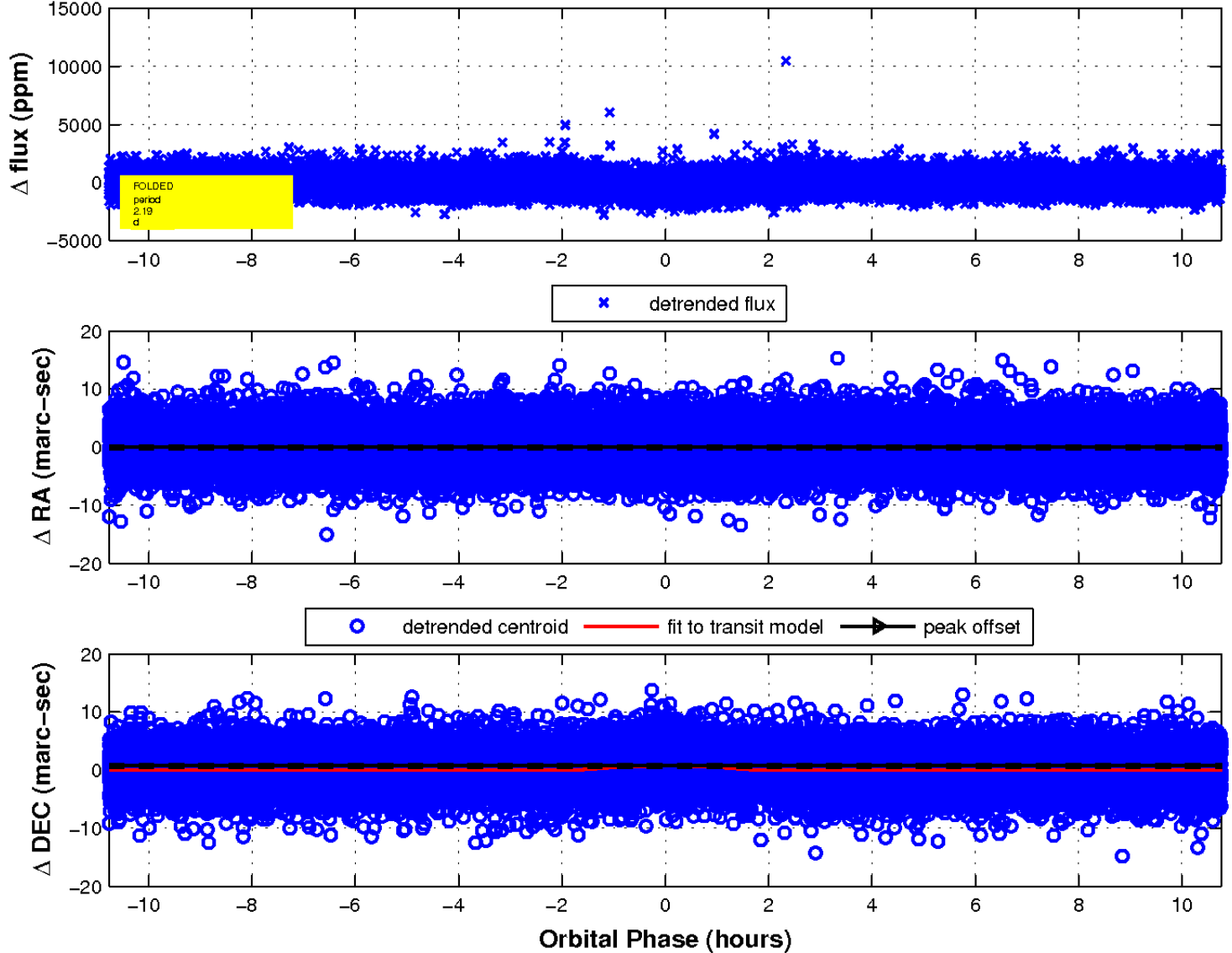
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

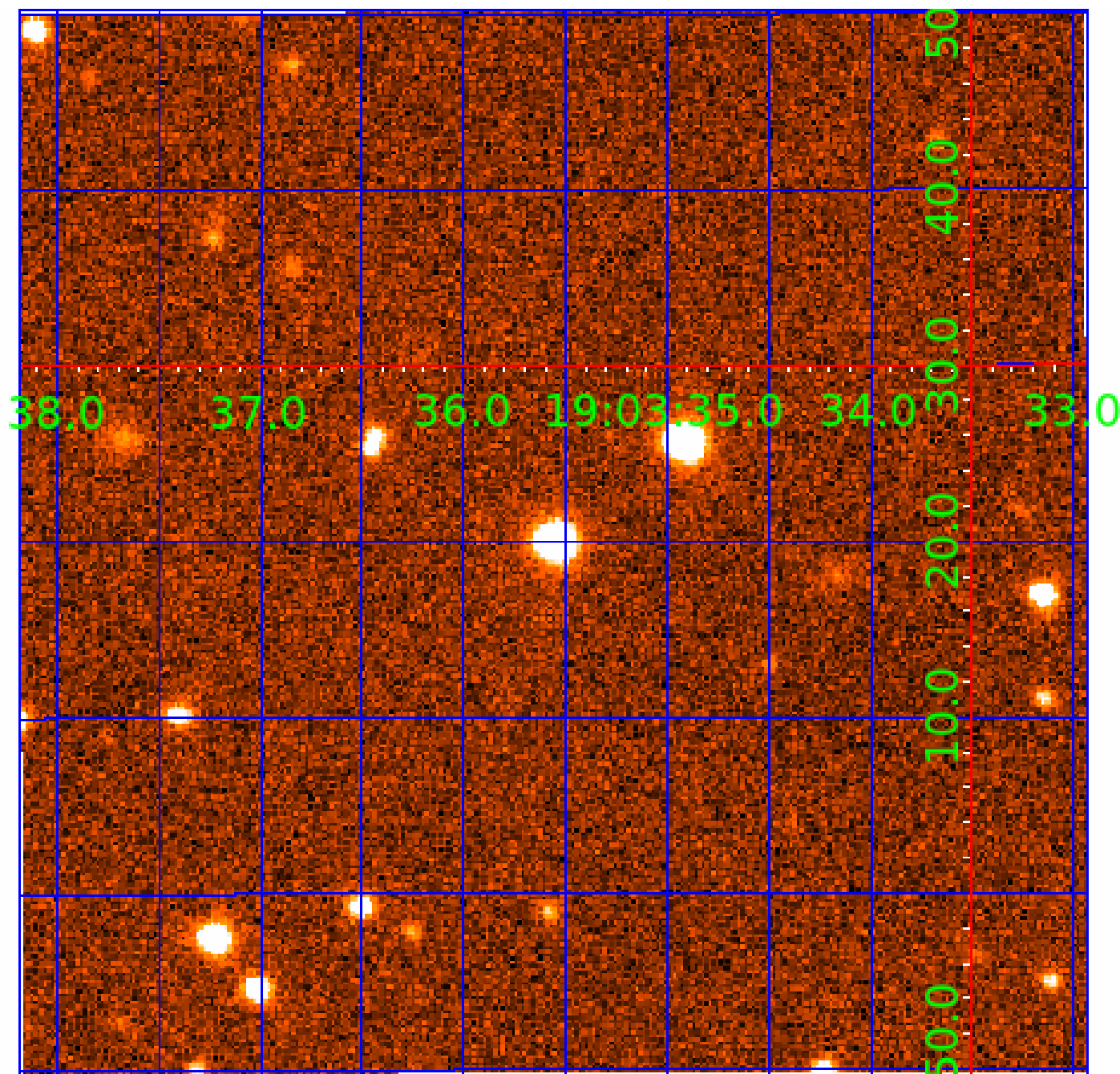


fluxWeightedCentroids, Planet 1 of 2



UKIRT Image

Declination





# KIC 004544620

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
004544620-01	OBS	3915.01	2.189045	132.099796	457.7	3.589	27.0	29.5	0.78	5401	2.31	466.37
004544620-02	OBS	No	2.189092	133.509977	259.4	2.062	16.3	16.0	0.78	5401	1.50	466.36

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
004544620-01	OBS	FP	0.00	0	1	1	1	MOD_SEC_ALT—HAS_SEC_TCE—CENT_RESOLVED_OFFSET—HALO_GHOST—EPHEM_MATCH
004544620-02	OBS	FP	0.00	1	1	1	1	IS_SEC_TCE—CENT_RESOLVED_OFFSET—EPHEM_MATCH

**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 004544620-02

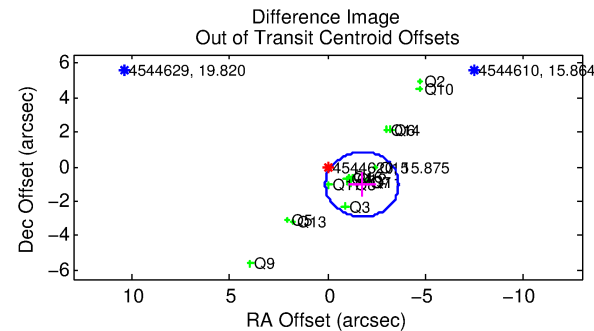
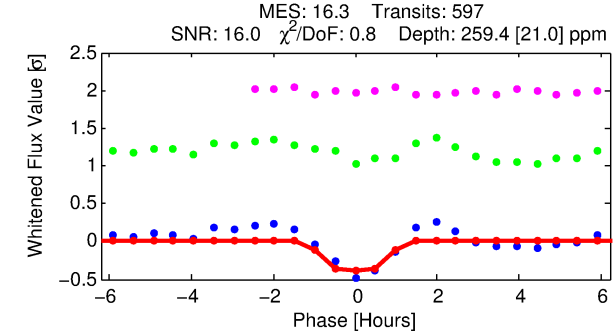
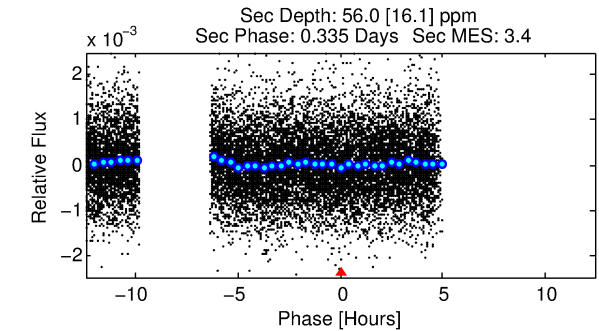
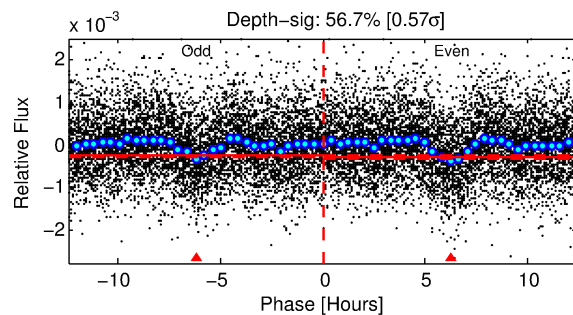
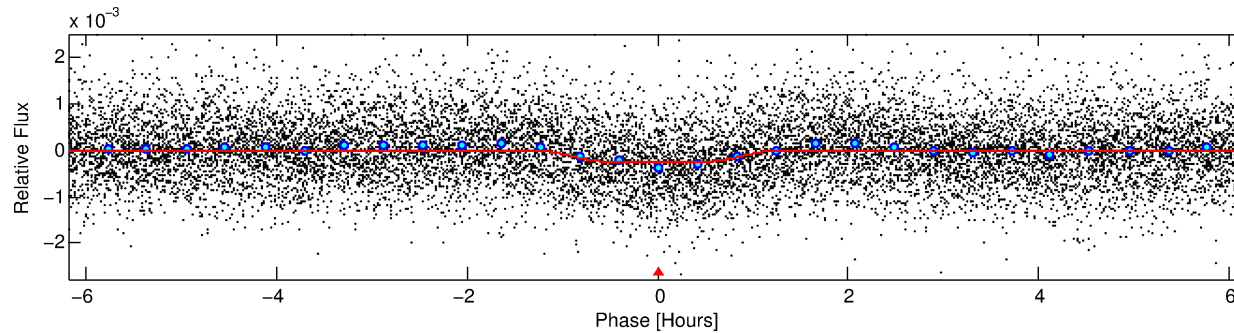
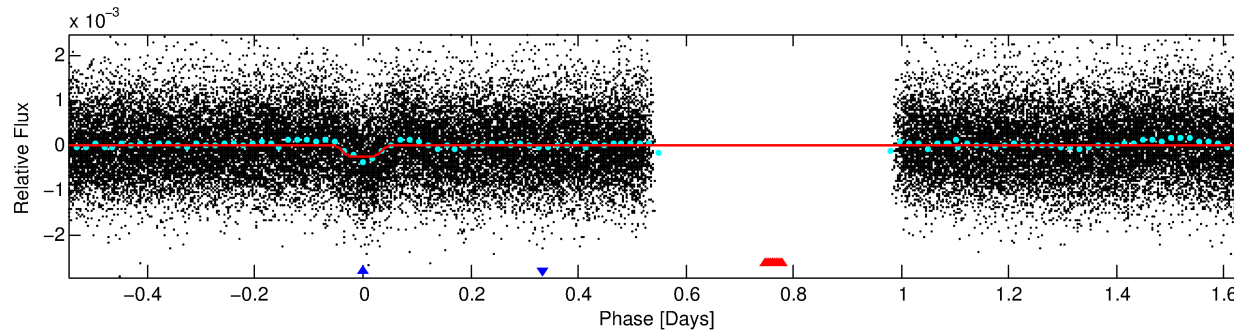
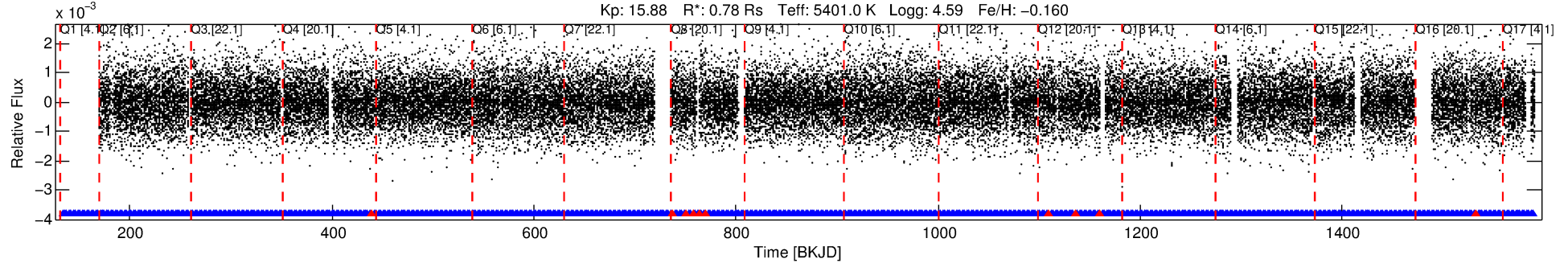
TCE (1)	KIC	Parent (2)	Parent KIC	$P_1:P_2$	Dist ( $''$ )	$\Delta$ Row	$\Delta$ Col	$m_2$	$m_1$	$D_2/D_1$	Mechanism	Flag	$\sigma_P$	$\sigma_T$
004544620-02	4544620	004544587-sec	4544587	1:1	52.0	-1	13	10.80	15.87	1251.00	Direct-PRF	0	0.16	0.14

**Notes:**  $P_1:P_2$  is the period ratio. Dist is the distance in arcseconds.  $\Delta$ Row and  $\Delta$ Col are the number of pixels apart in row and column.  $m_2$  and  $m_1$  are the magnitudes of the parent and child.  $D_2/D_1$  is the parent's transit depth divided by the child's.  $\sigma_P$  and  $\sigma_T$  are the significance of the match in period and epoch. For a match to be considered significant  $\sigma_P < 5.0$  and  $\sigma_T < 5.0$ . Matches which have  $\sigma_P$  and  $\sigma_T$  very close to this cutoff should receive extra scrutiny, especially if the period ratio is very large.

# DV One-Page Summary

KIC: 4544620 Candidate: 2 of 2 Period: 2.189 d  
KOI: K03915 Corr: No Ephemeris Match

Kp: 15.88 R\*: 0.78 Rs Teff: 5401.0 K Logg: 4.59 Fe/H: -0.160



## DV Fit Results:

Period = 2.18909 [0.00001] d  
Epoch = 133.5100 [0.0021] BKJD  
Rp/R\* = 0.0177 [0.0083]  
a/R\* = 3.97 [7.67]  
b = 0.90 [0.45]  
Seff = 466.36 [110.61]  
Teq = 1185 [70] K  
Rp = 1.50 [0.75] Re  
a = 0.0314 [0.0045] AU  
Ag = 13.43 [13.50] [0.92σ]  
Teffp = 3507 [869] K [2.66σ]

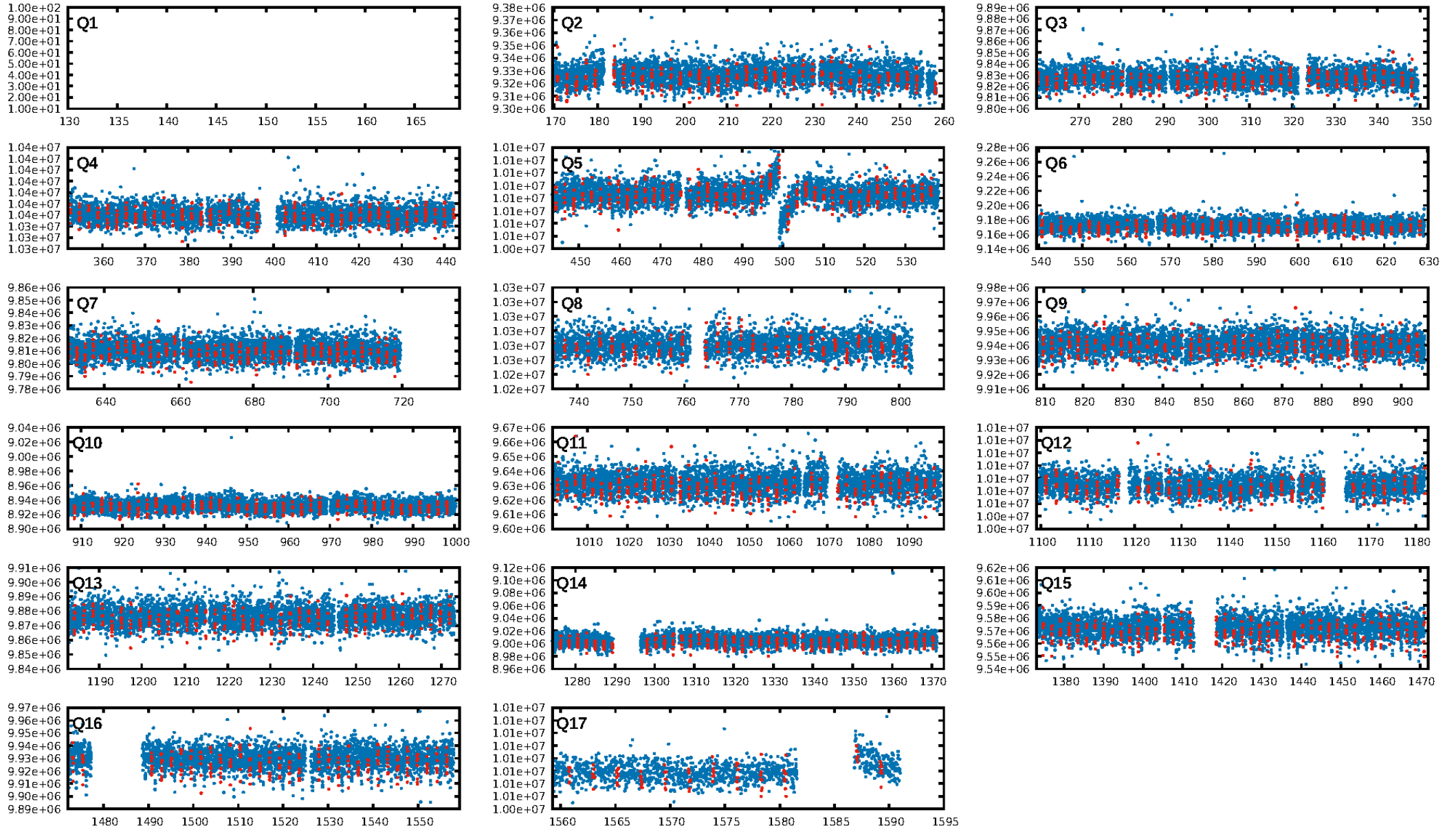
## DV Diagnostic Results:

ShortPeriod-sig: 0.0% [0.00σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: 1.60e-58  
RollingBand-fgt: 0.98 [575/585]  
GhostDiagnostic-chr: 0.4199  
Centroid-sig: 0.0%  
Centroid-so: 1.818 arcsec [2.54σ]  
OotOffset-rm: 2.040 arcsec [3.27σ]  
KicOffset-rm: 4.658 arcsec [9.85σ]  
OotOffset-st: 4/4/4/4 [16]  
KicOffset-st: 4/4/4/4 [16]  
DiffImageQuality-fgm: 0.00 [0/16]  
DiffImageOverlap-fno: 1.00 [16/16]

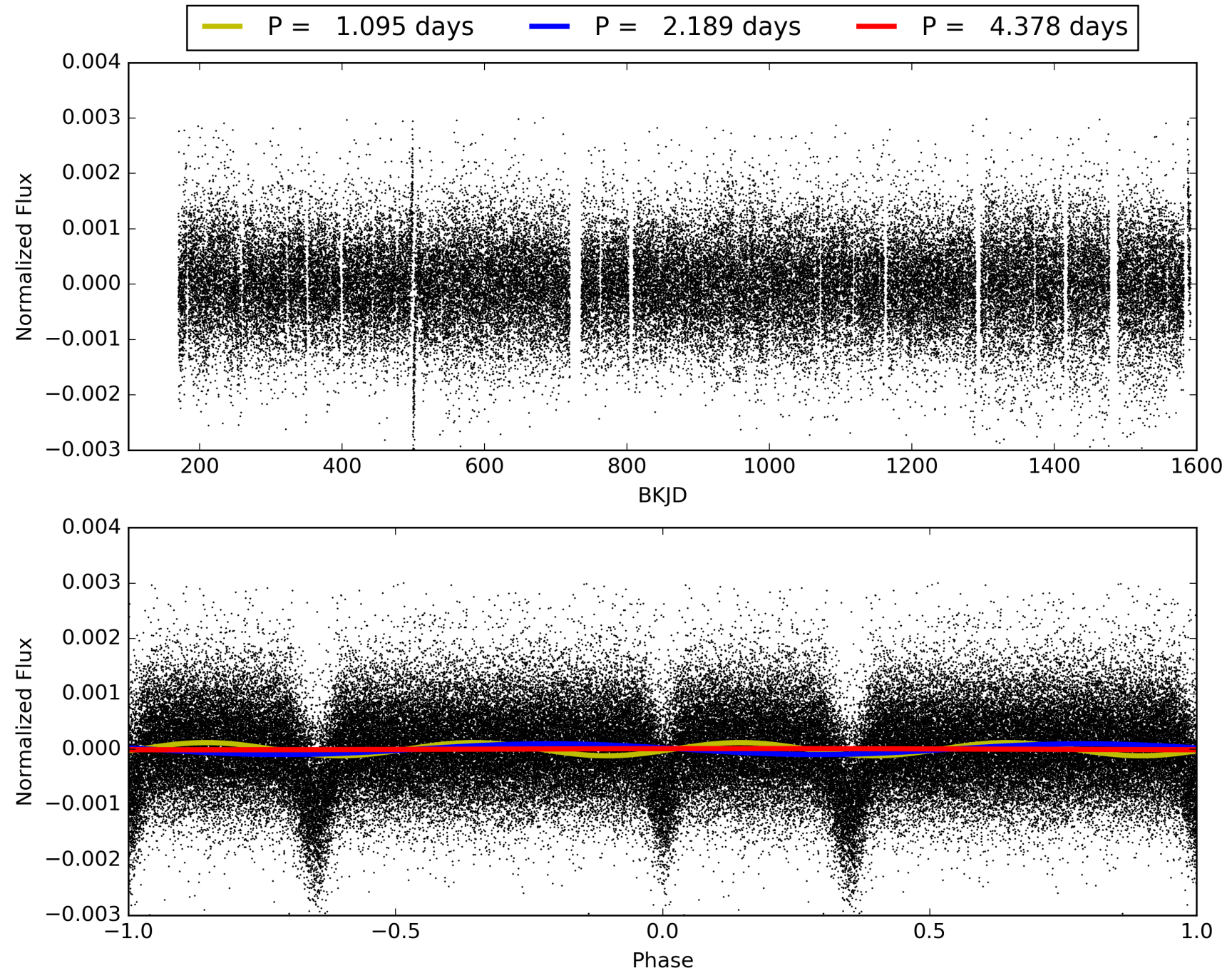
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 11:53:57 Z

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

# TCE 004544620-02, PDC Light Curves



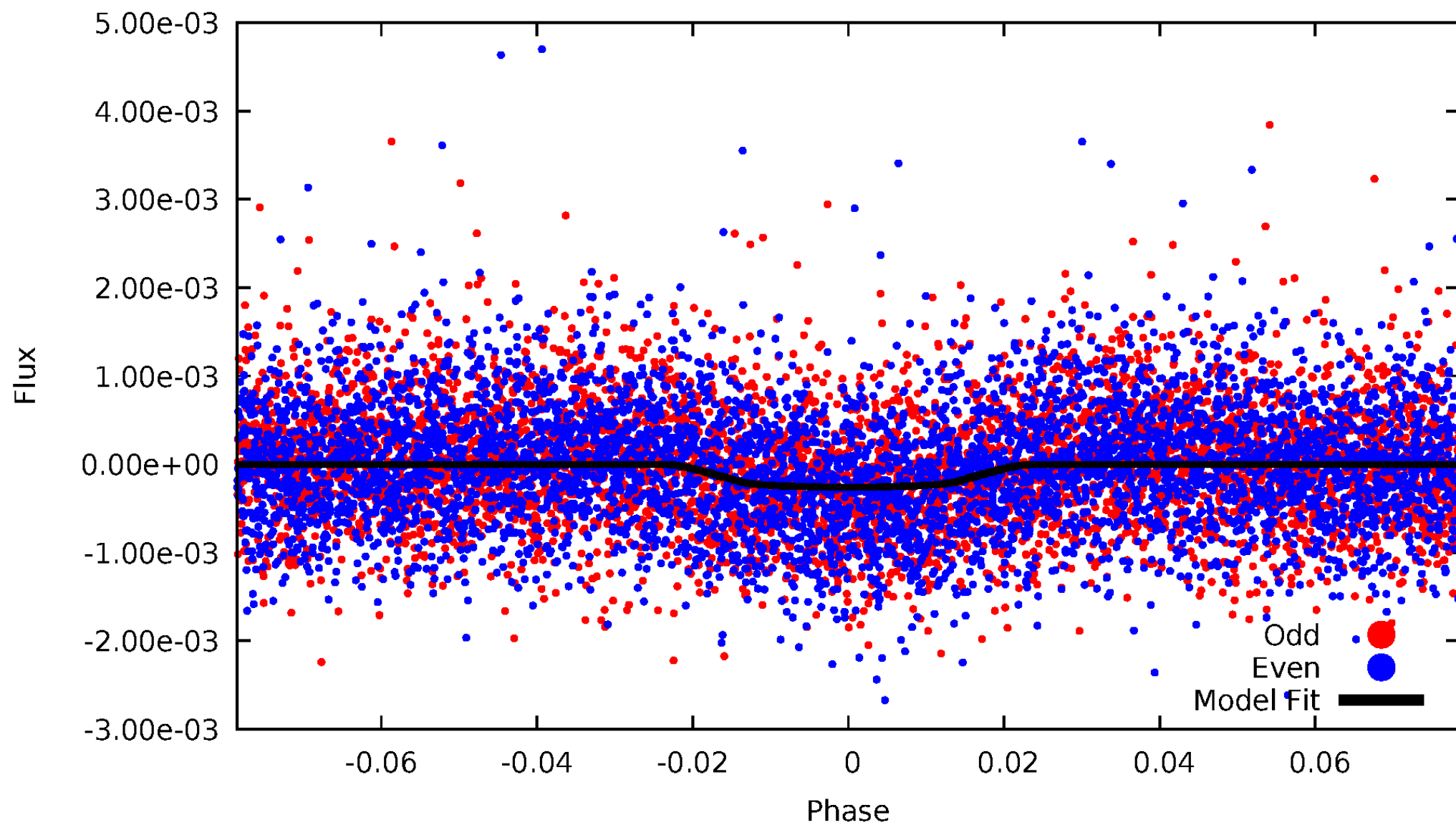
TCE 004544620-02





# DV Odd/Even

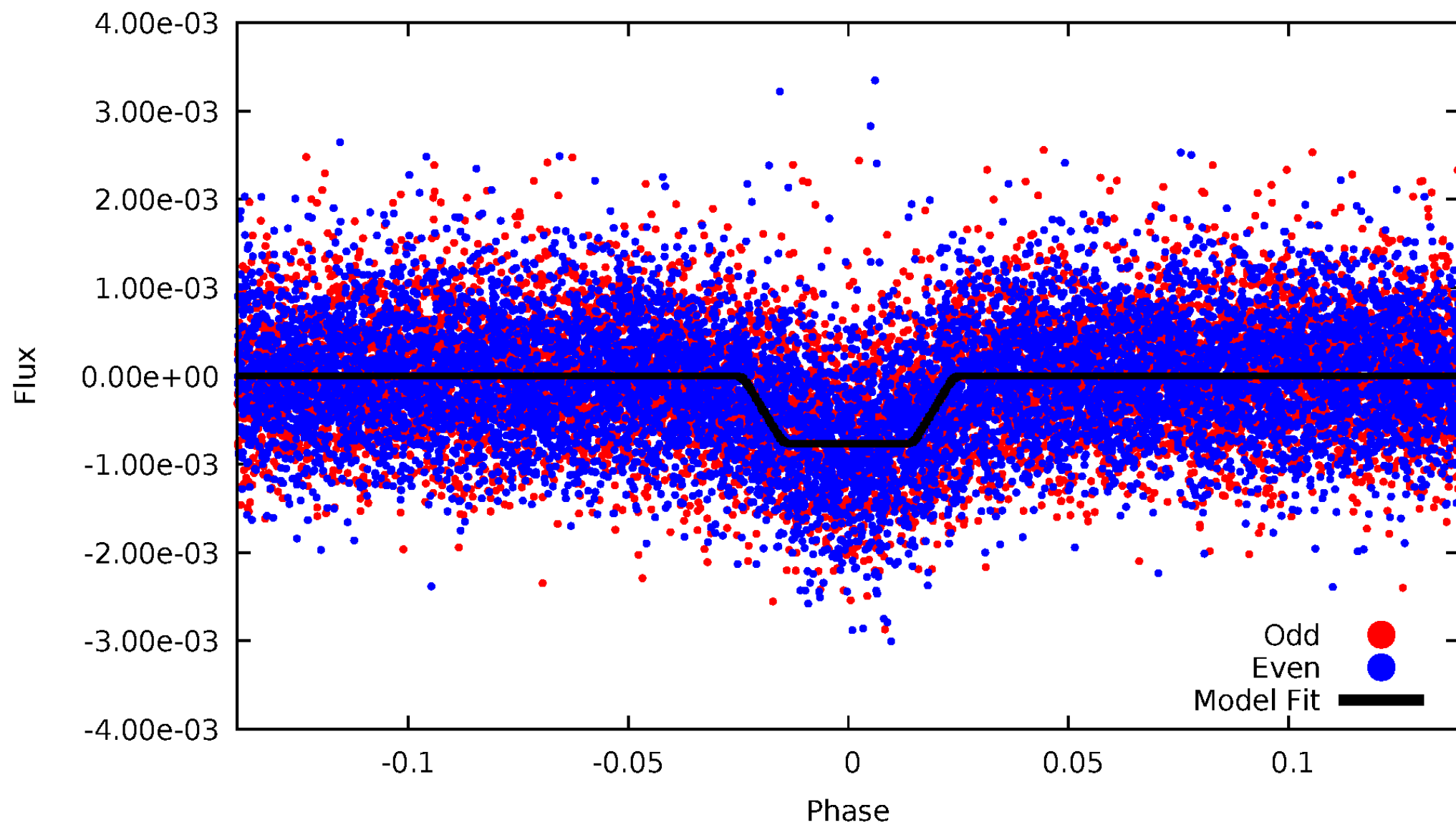
TCE 004544620-02





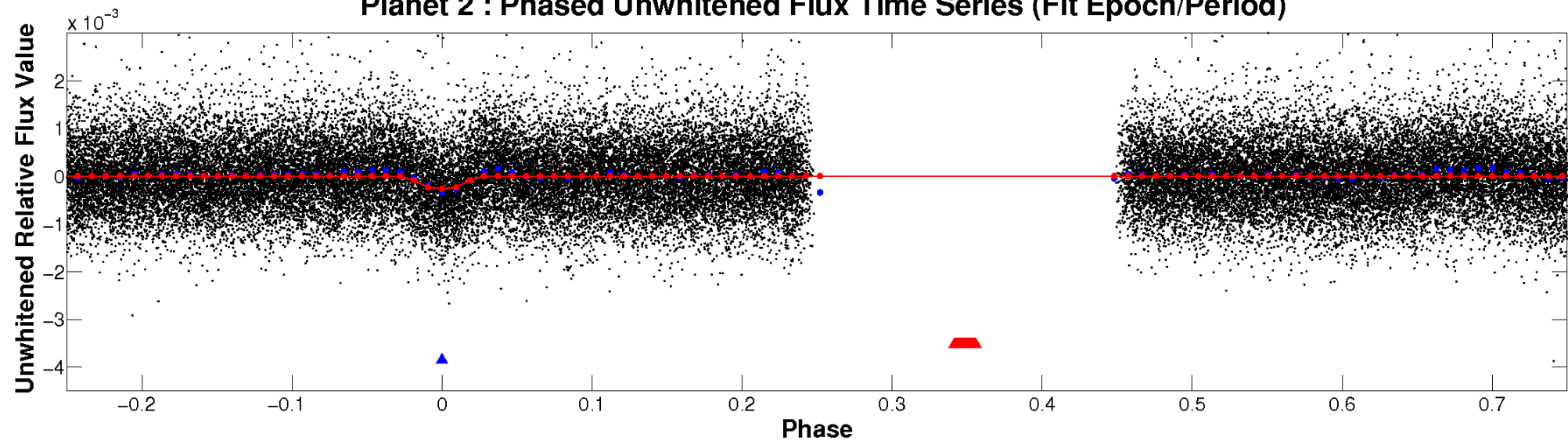
# ALT Odd/Even

TCE 004544620-02

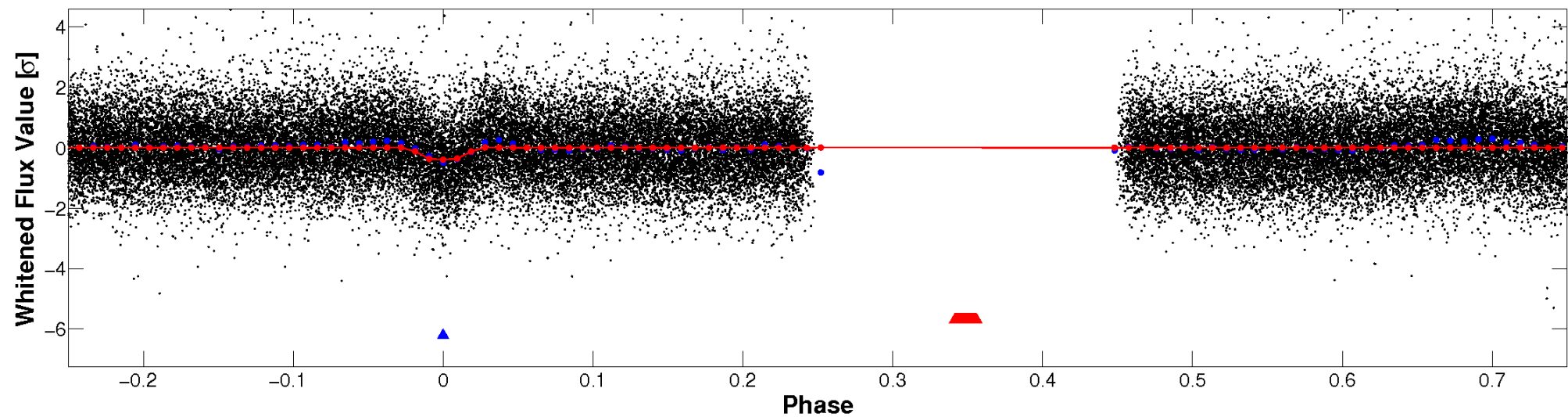


# Non-Whitened Vs. Whitened Light Curve

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

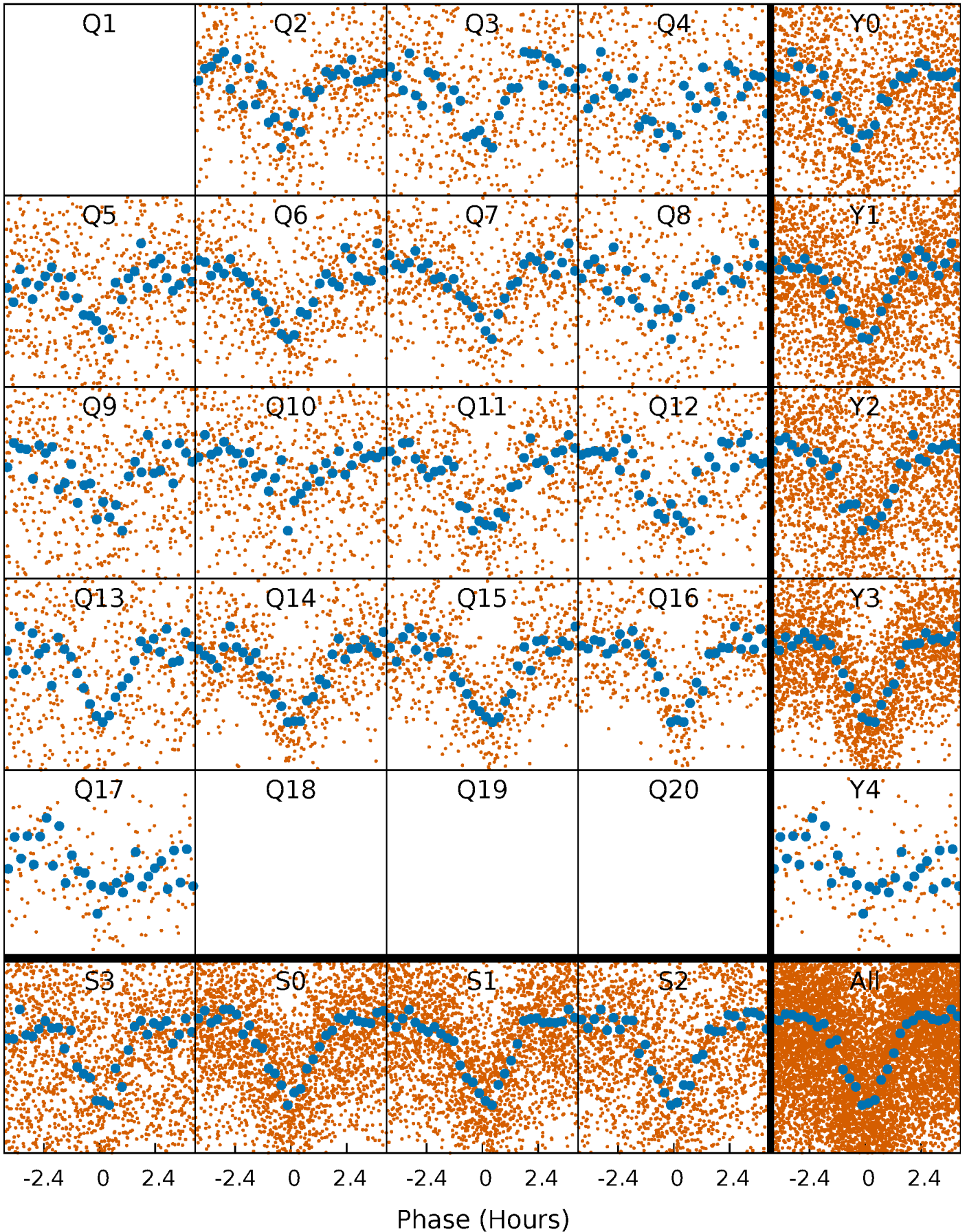


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

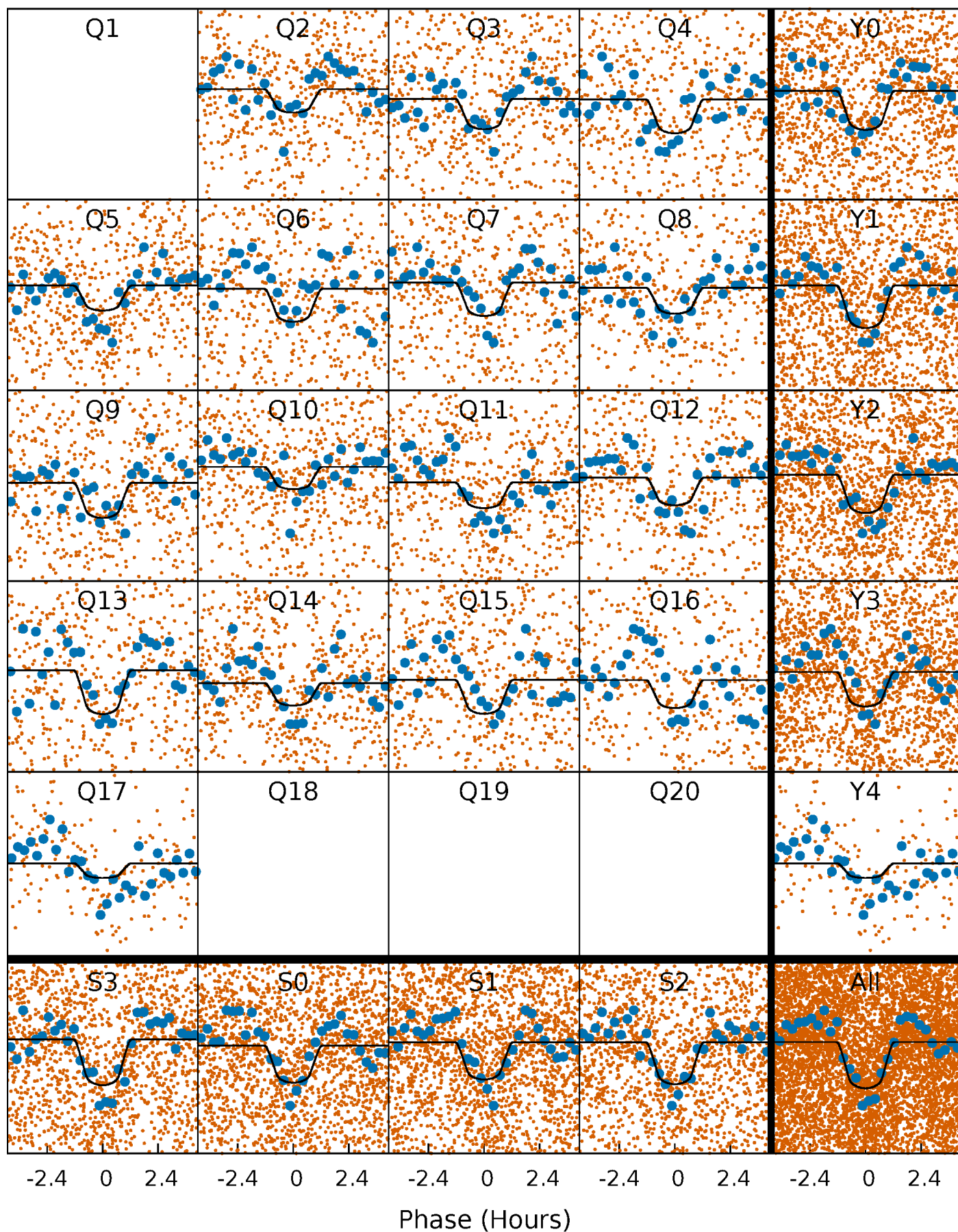
TCE 004544620-02   P= 2.189092 Days    $T_0=133.509977$  (BKJD)





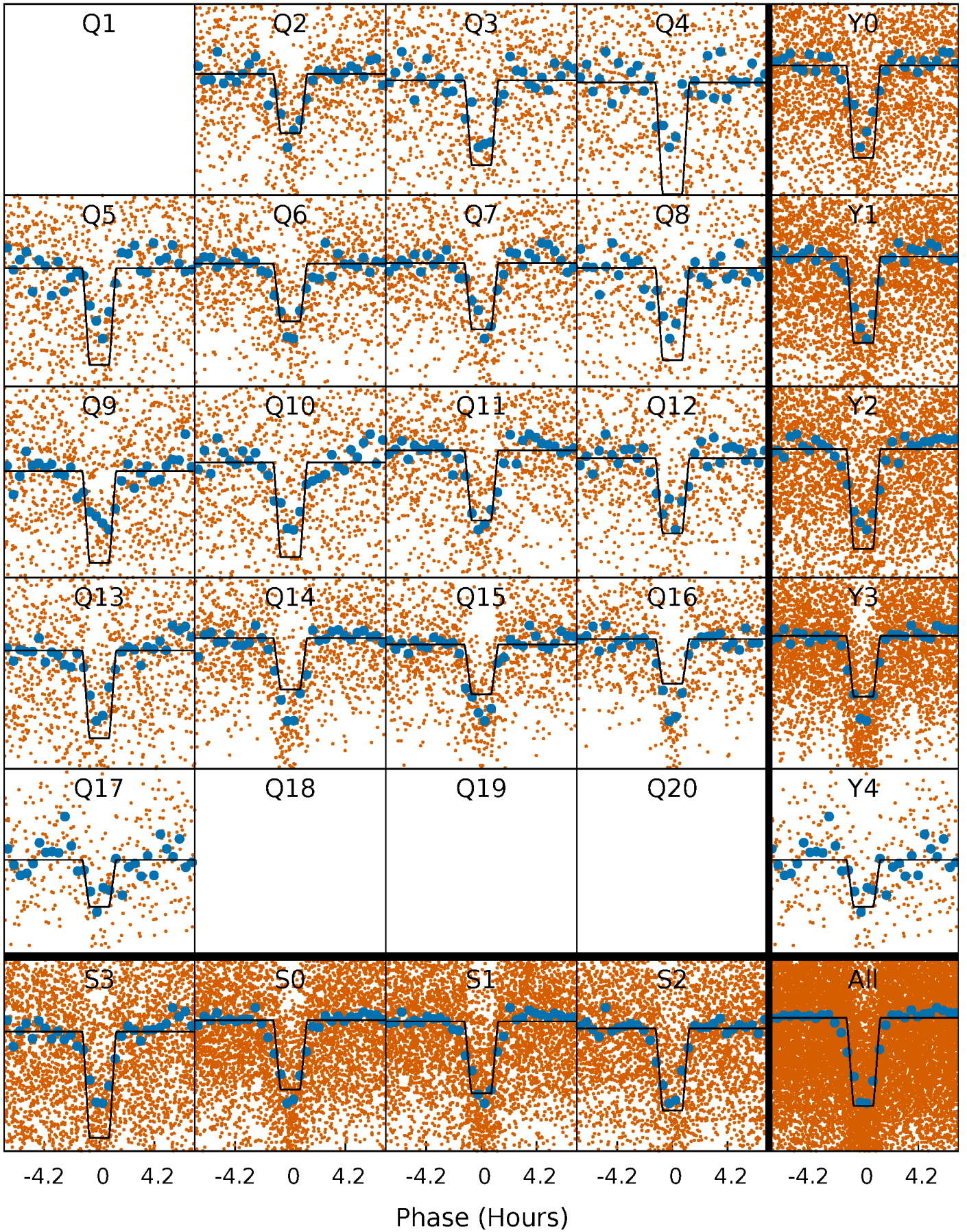
# DV Quarter-Phased Transit Curves

TCE 004544620-02 P= 2.189092 Days  $T_0=133.509977$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

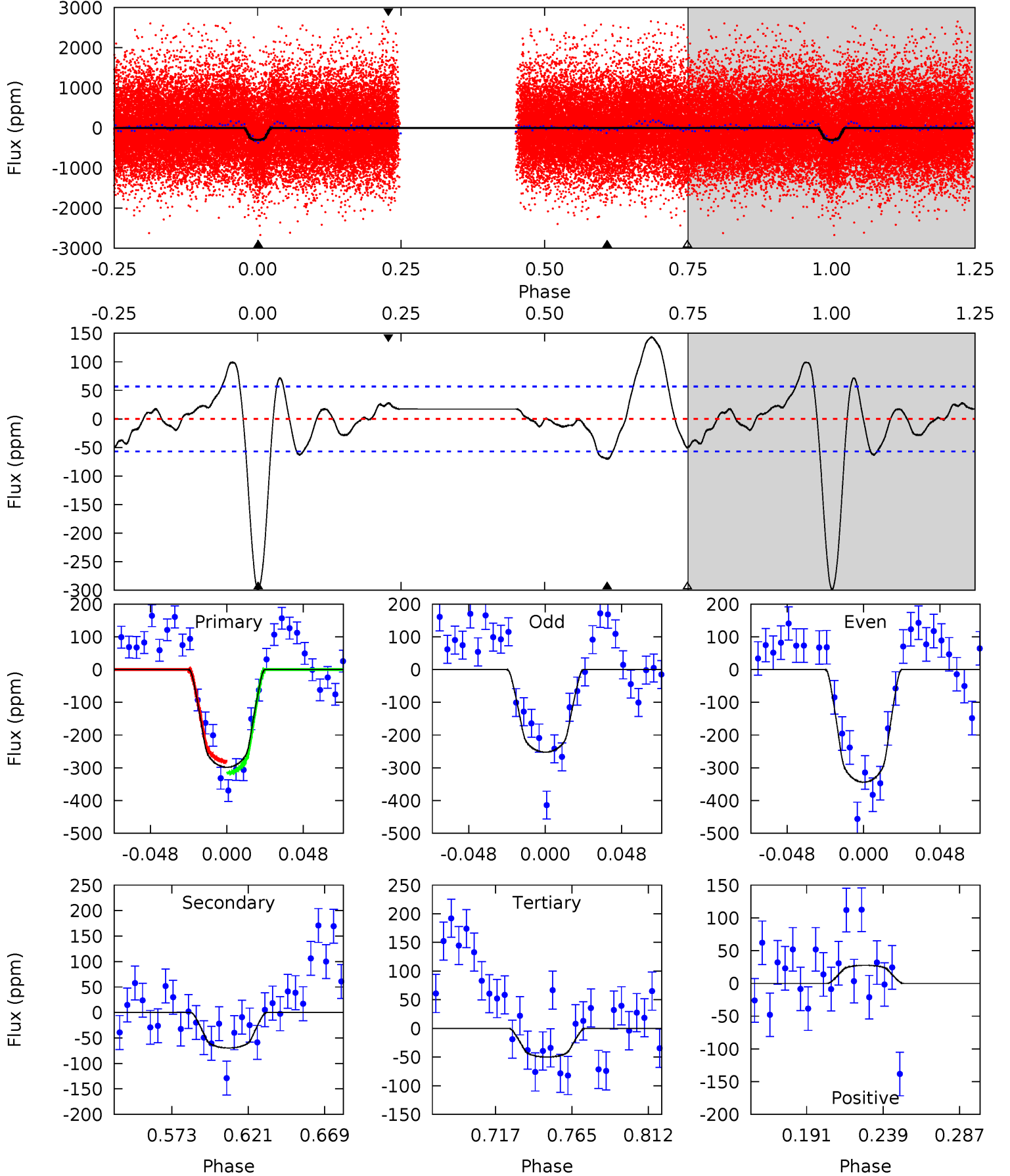
TCE 004544620-02 P= 2.189130 Days  $T_0=133.496950$  (BKJD)



# DV Model-Shift Uniqueness Test

004544620-02, P = 2.189092 Days, E = 133.509977 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
24.8	5.80	4.15	2.29	4.72	1.98	3.64	20.6	22.5	1.64	3.50	3.83	1.01	0.32	1.48

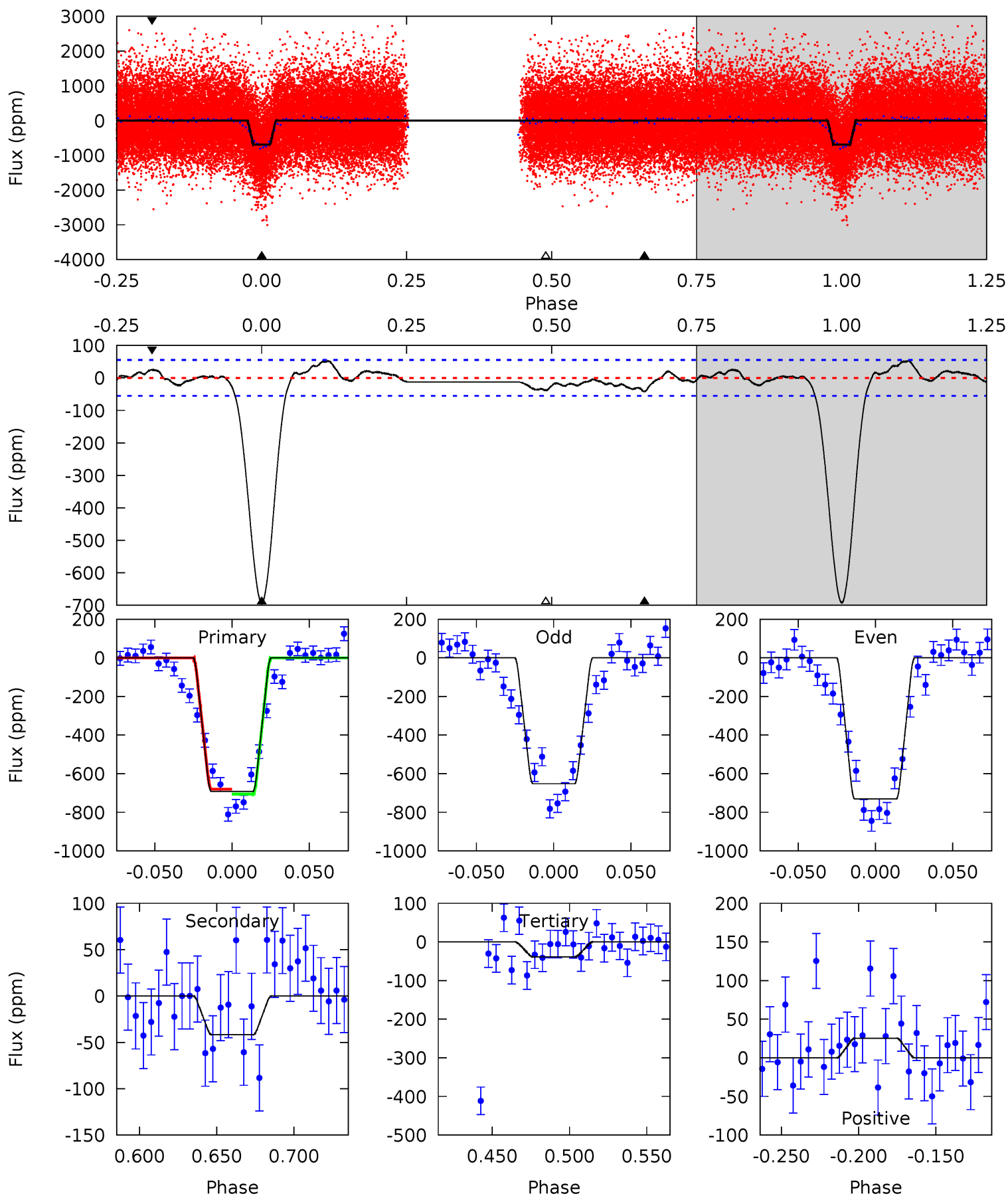




# Alt Model-Shift Uniqueness Test

004544620-02, P = 2.189130 Days, E = 133.496950 Days

Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
58.9	3.55	3.28	2.15	4.71	1.96	1.66	55.6	56.8	0.27	1.40	3.37	1.00	0.07	1.08



### Stellar Parameters For KIC 004544620

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5401^{+159}_{-159}$	$4.593^{+0.037}_{-0.112}$	$-0.160^{+0.300}_{-0.300}$	$0.777^{+0.132}_{-0.066}$	$0.871^{+0.070}_{-0.104}$	$2.616^{+0.493}_{-0.917}$
	+3%/-3%	+1%/-2%	+188%/-188%	+17%/-8%	+8%/-12%	+19%/-35%
Source	PHO1	KIC0	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 004544620-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-70 \pm 12$	$1.60^{+0.70}_{-0.73}$	$1677^{+72}_{-63}$	$3951^{+942}_{-487}$	$14^{+32}_{-8}$
Alt.	$-42 \pm 12$	$2.45^{+0.75}_{-0.74}$	$1682^{+80}_{-70}$	$3145^{+360}_{-308}$	$3.727^{+3.983}_{-1.787}$

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

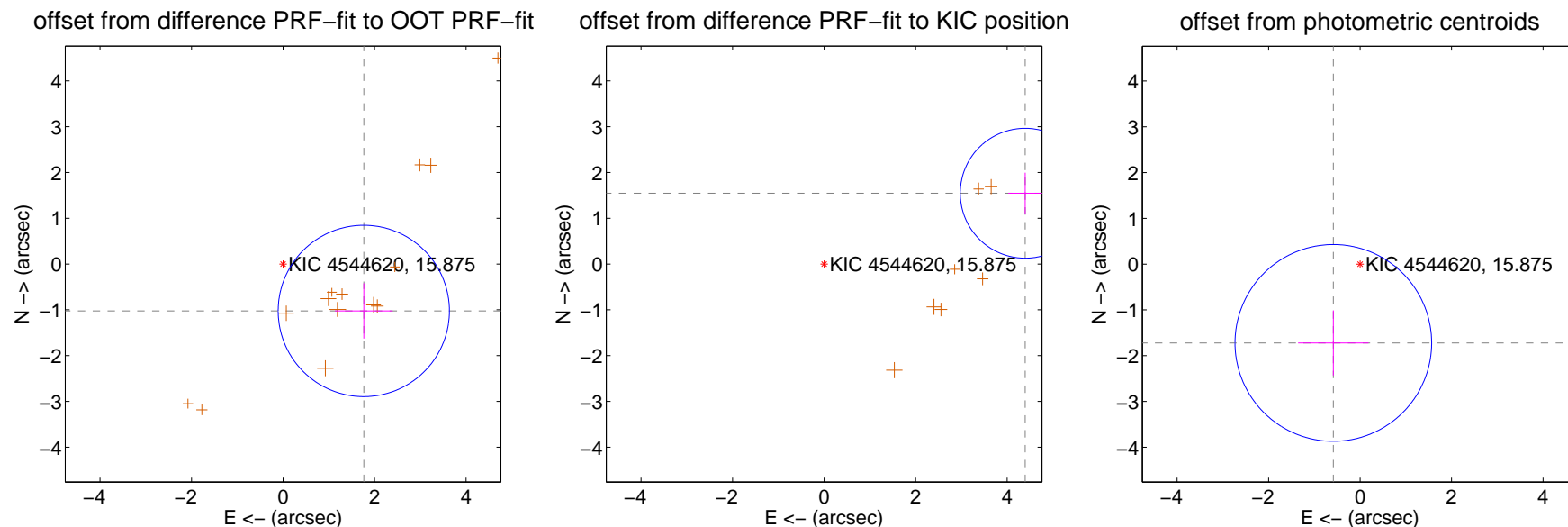
## DV Centroid Data

Supplemental centroid analysis for 004544620-02. Kepler magnitude: 15.88. Transit SNR 15.96

There are 0 quarters with good PRF difference image offsets

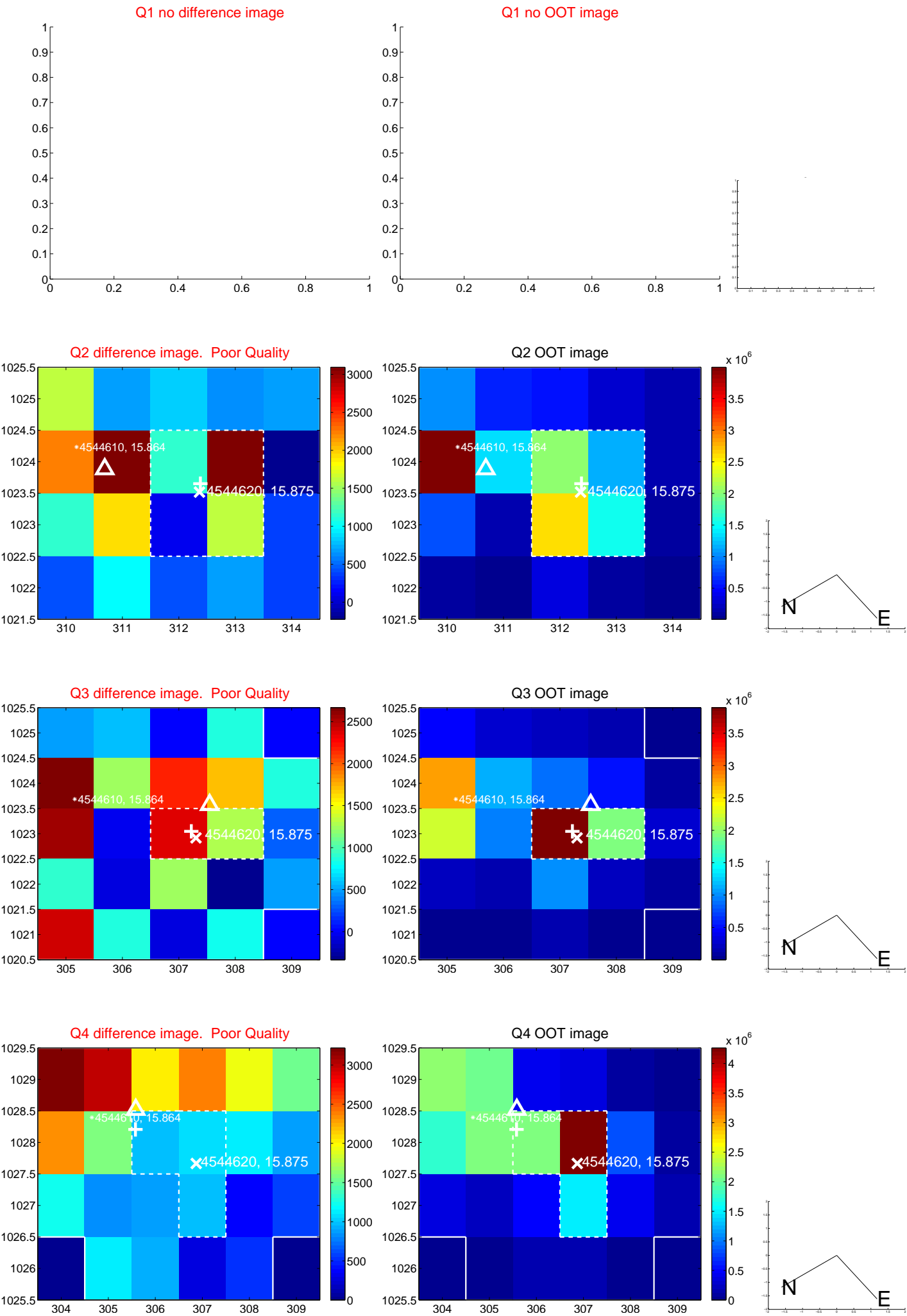
The OOT PRF centroid is offset from the target star catalog position by about 6.66 arcsec so the offset from difference PRF-fit to OOT-fit may be invalid.

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$2.040 \pm 0.624$	<b>3.27</b>	$-1.764 \pm 0.630$	$-1.024 \pm 0.604$
PRF-fit source offset from KIC position	$4.658 \pm 0.473$	<b>9.85</b>	$-4.394 \pm 0.366$	$1.546 \pm 0.448$
photometric centroid source offset	$1.82 \pm 0.72$	2.54	$0.58 \pm 0.77$	$-1.72 \pm 0.71$

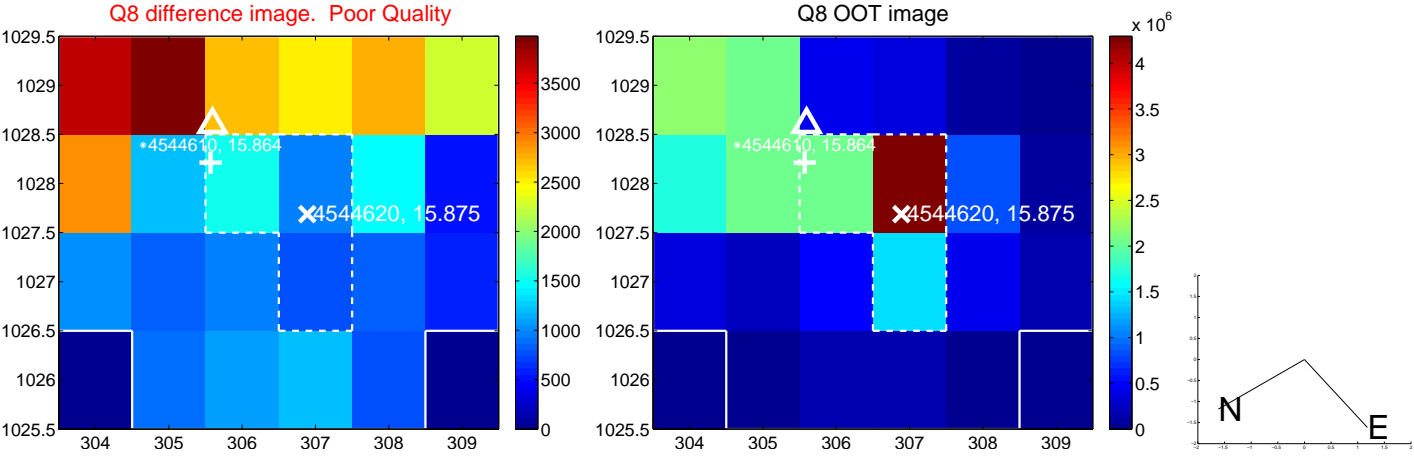
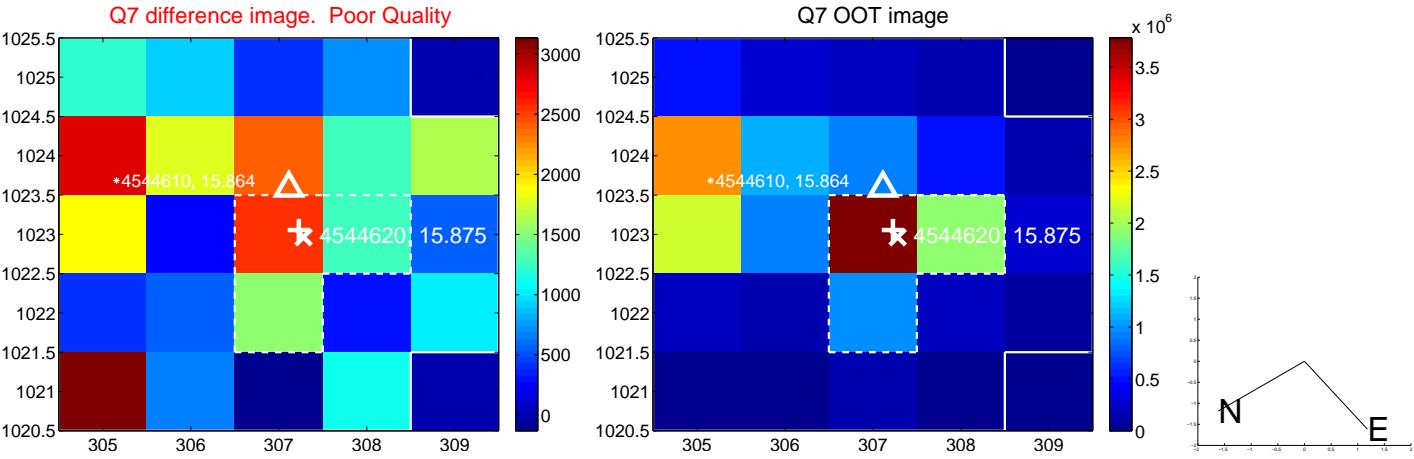
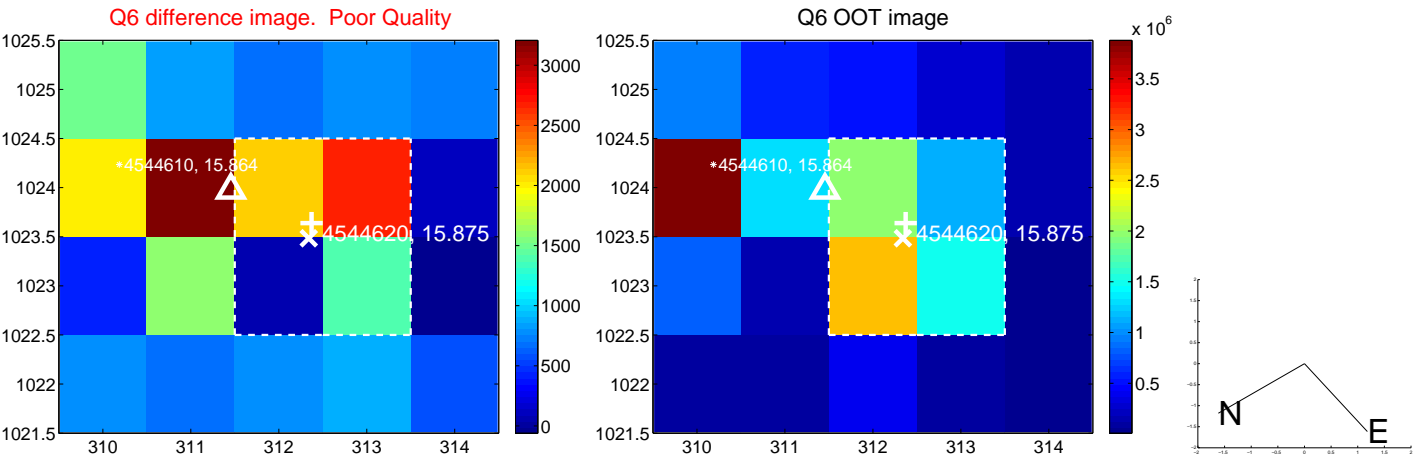
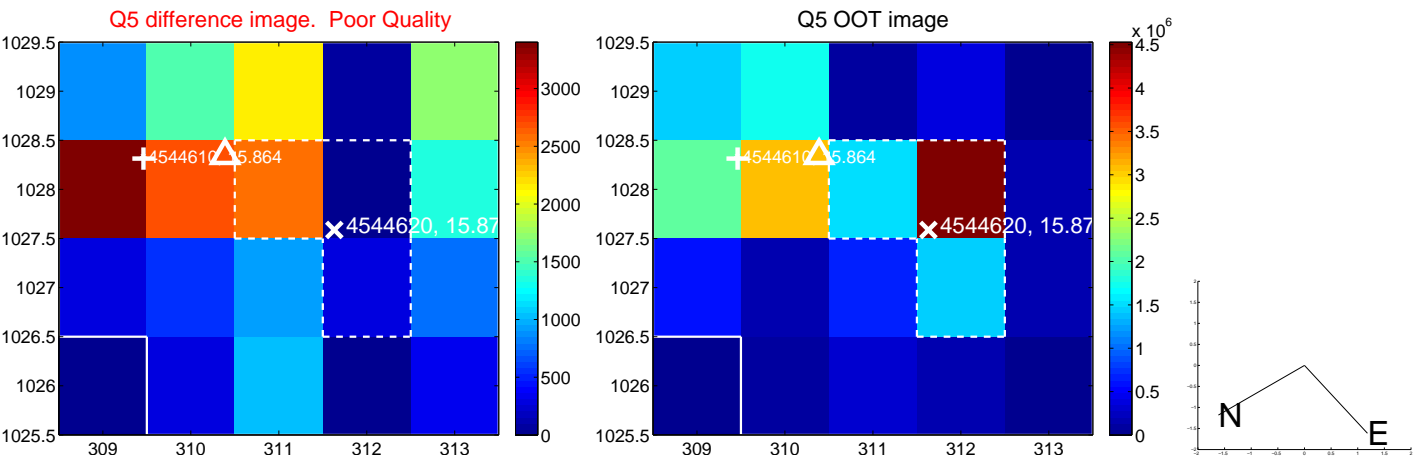


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

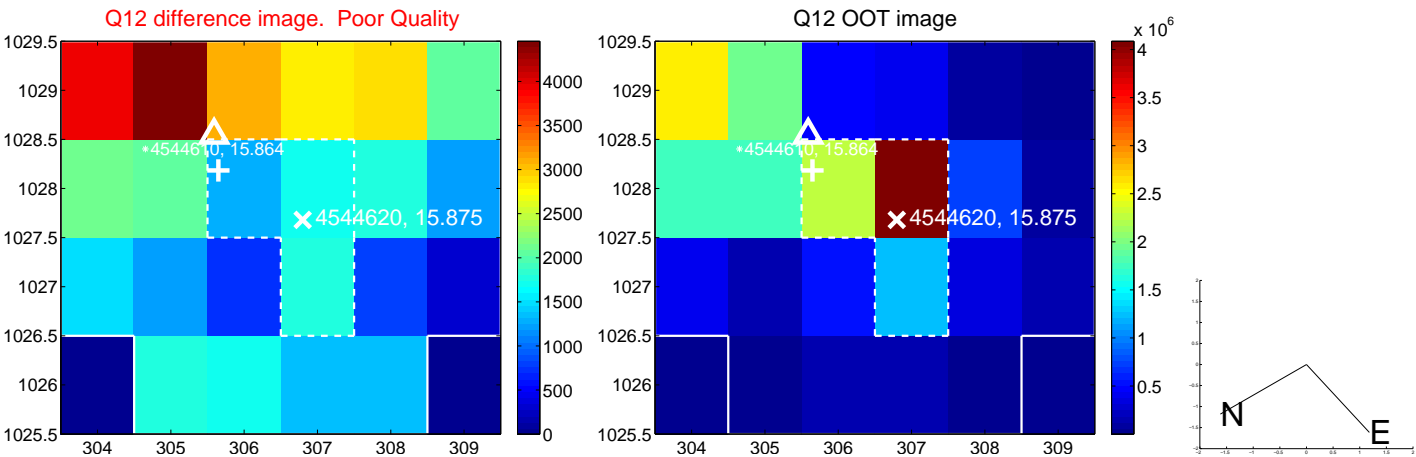
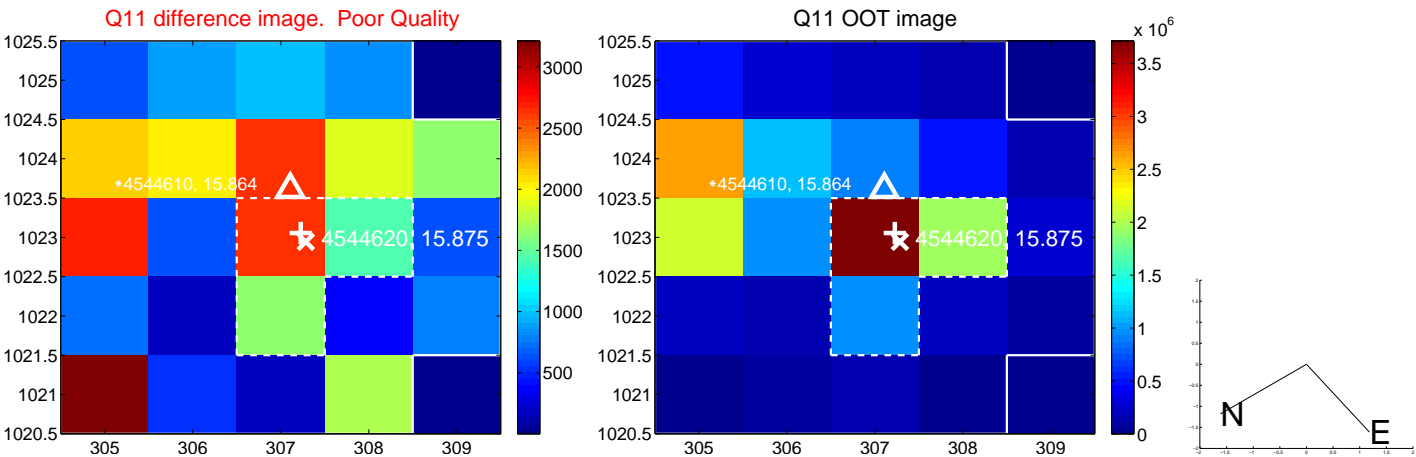
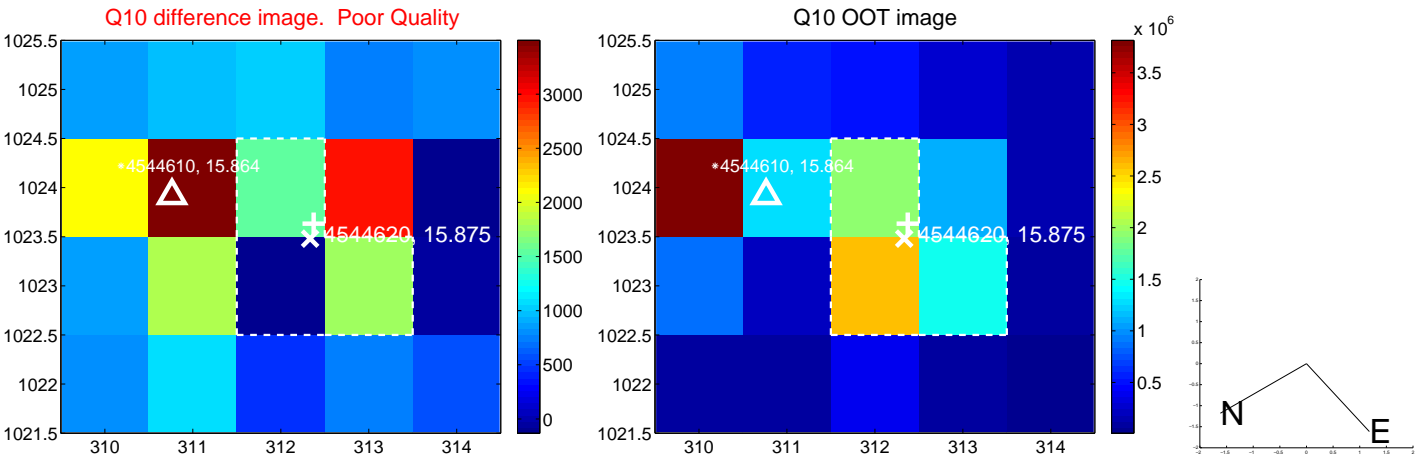
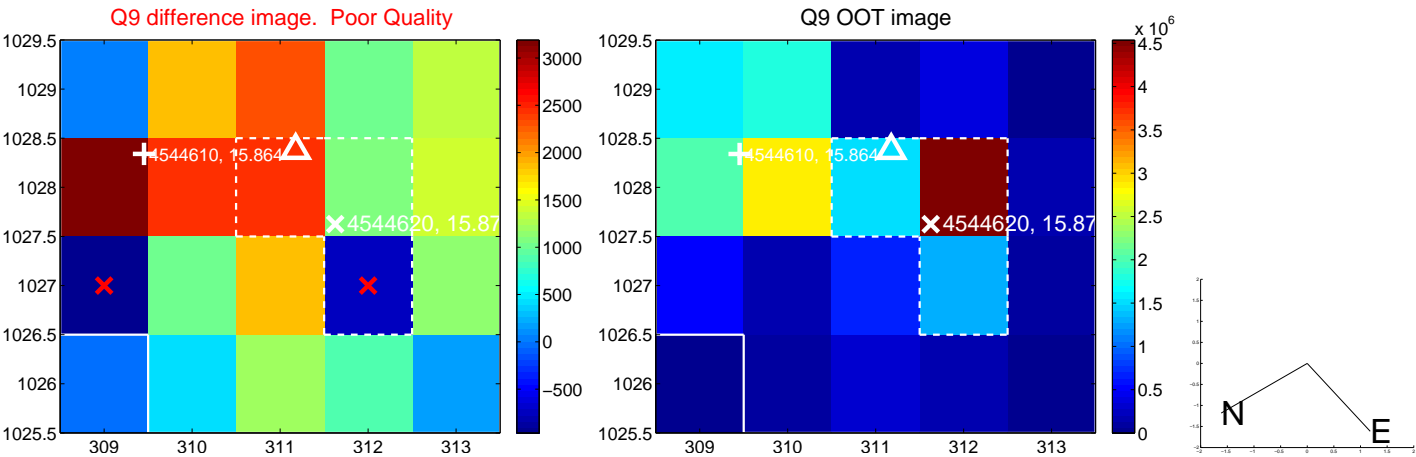


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

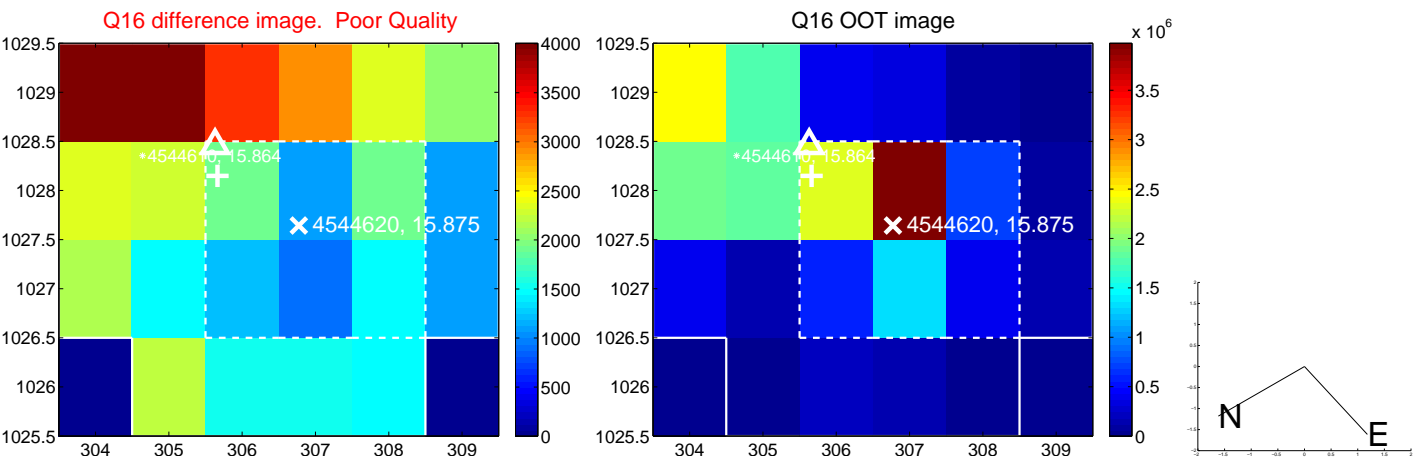
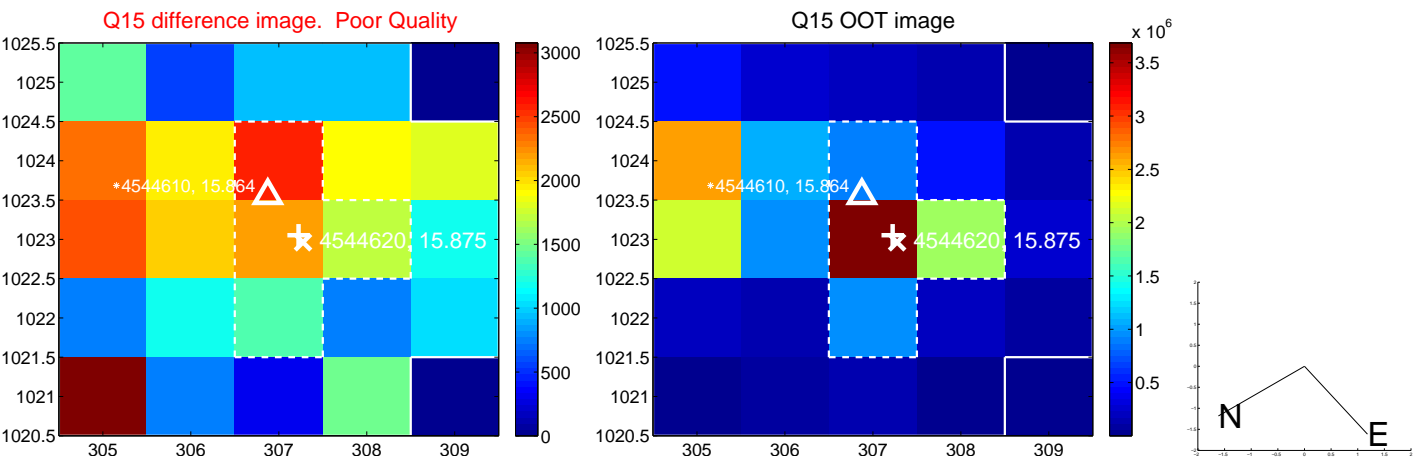
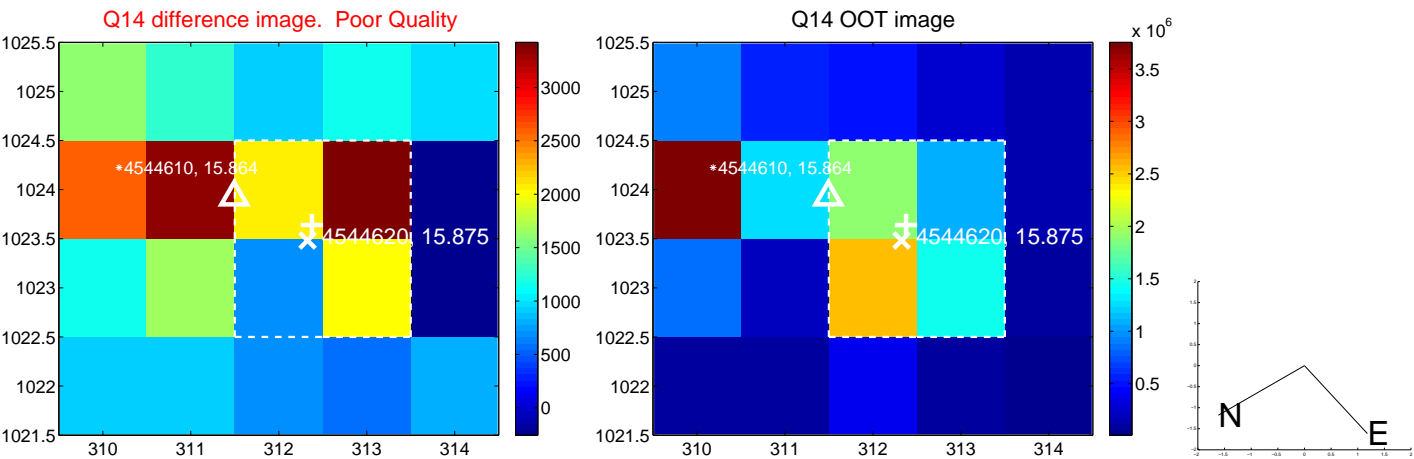
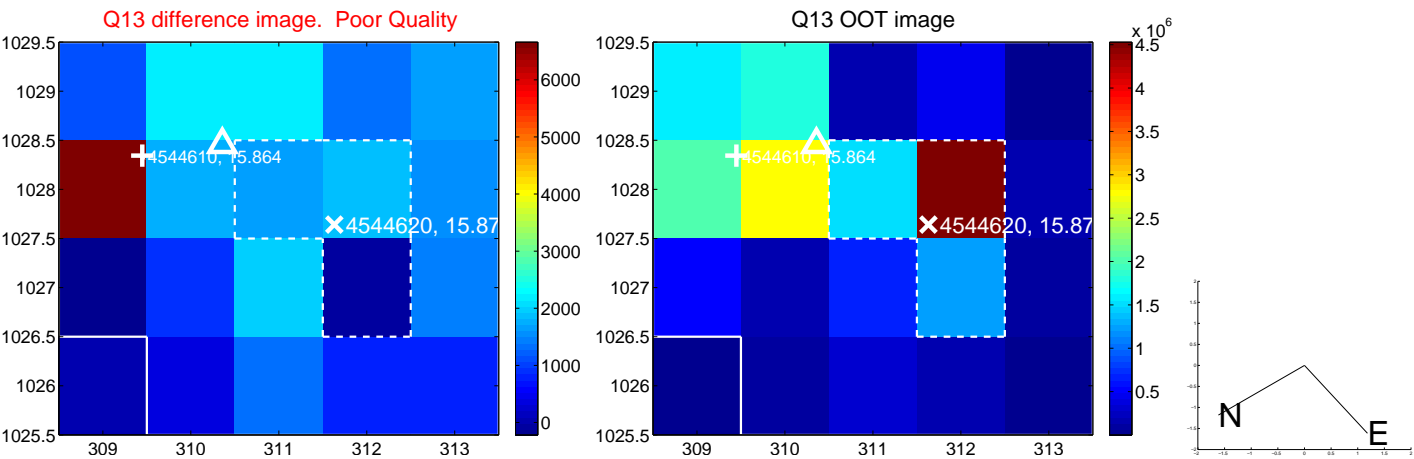




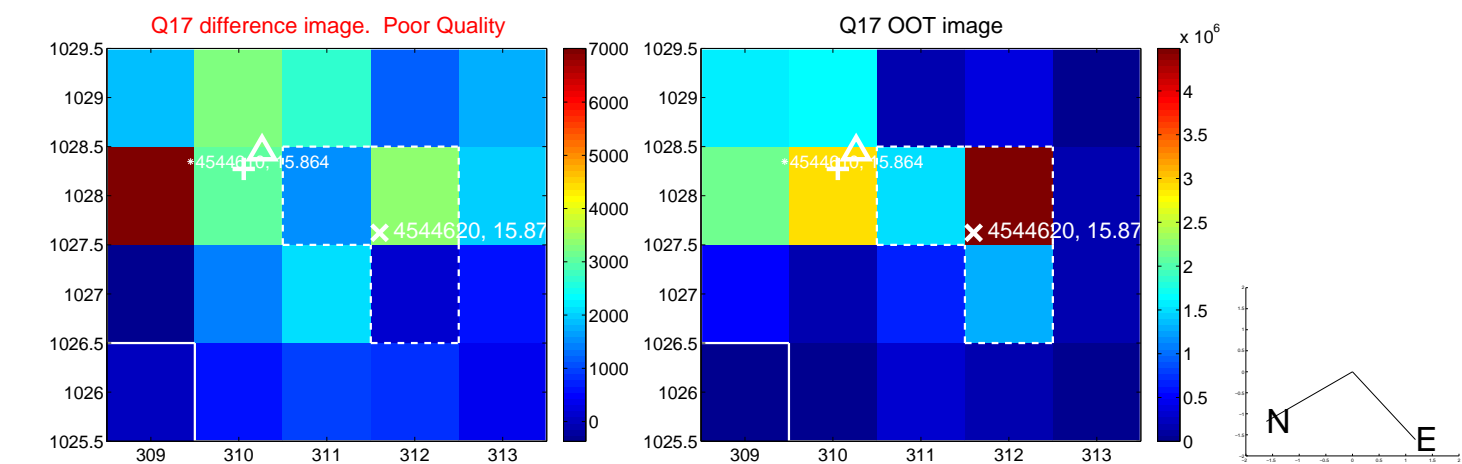
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



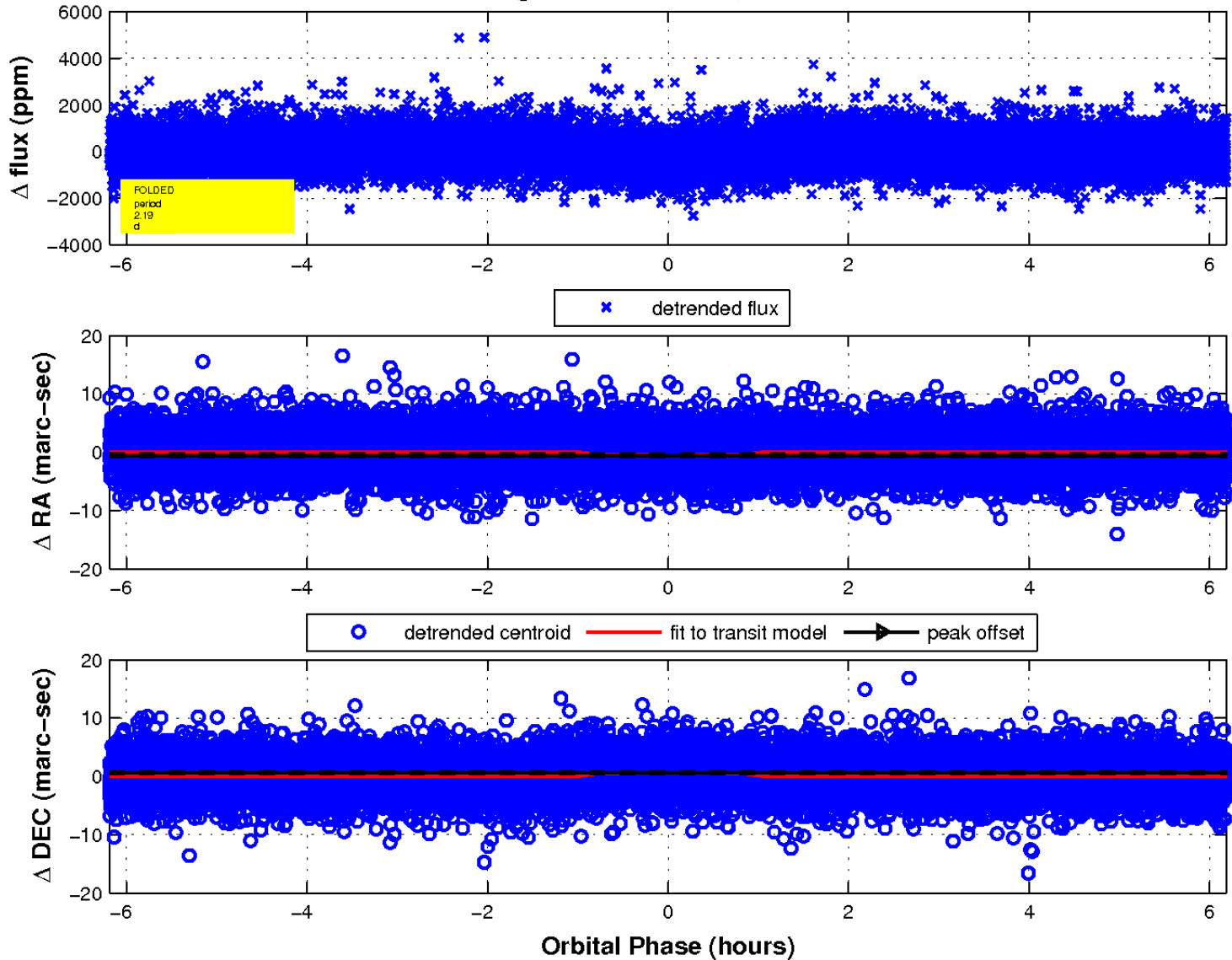
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



fluxWeightedCentroids, Planet 2 of 2



UKIRT Image

Declination

