

# KIC 004743513

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
004743513-01	OBS	0024.01	2.086068	133.418685	3409.4	2.161	698.0	476.0	1.42	6131	9.96	2746.81
004743513-02	OBS	No	2.086065	132.377256	112.4	1.691	26.0	30.9	1.42	6131	1.76	2746.81

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
004743513-01	OBS	FP	0.00	0	1	1	1	MOD_SEC_DV—PLANET_OCCULT_DV—MOD_SEC_ALT—PLANET_OCCULT_ALT—HAS_SEC_TCE—CENT_UNRESOLVED_OFFSET—HALO_GHOST—EPHEM_MATCH
004743513-02	OBS	FP	0.00	1	1	1	1	IS_SEC_TCE—CENT_UNRESOLVED_OFFSET—HALO_GHOST—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 004743513-01

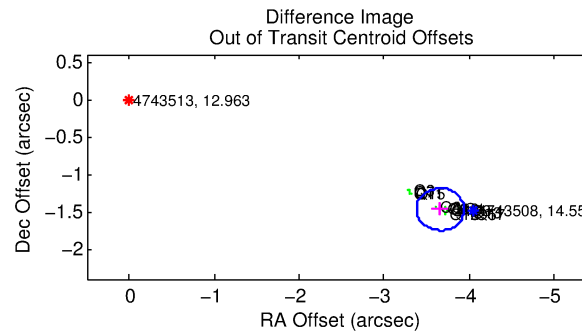
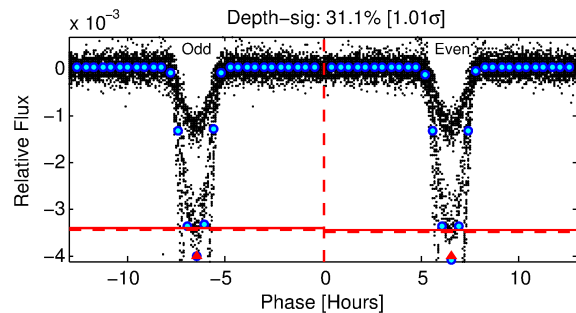
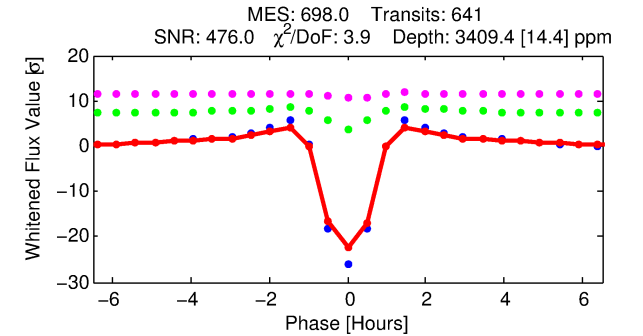
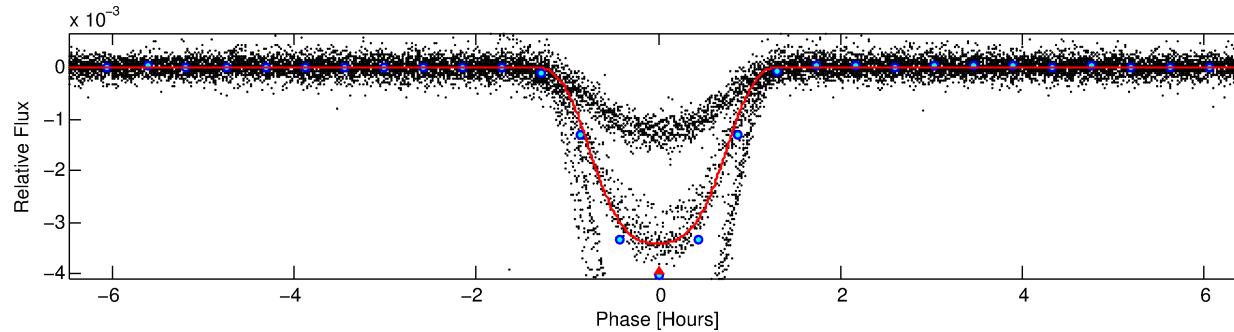
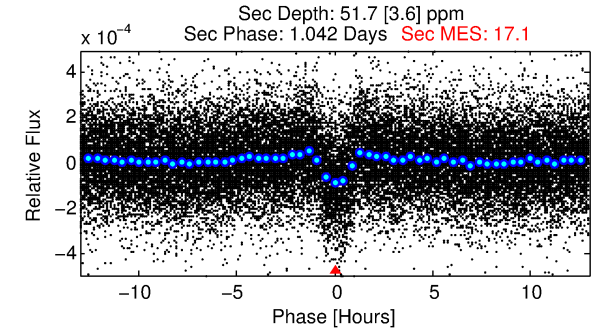
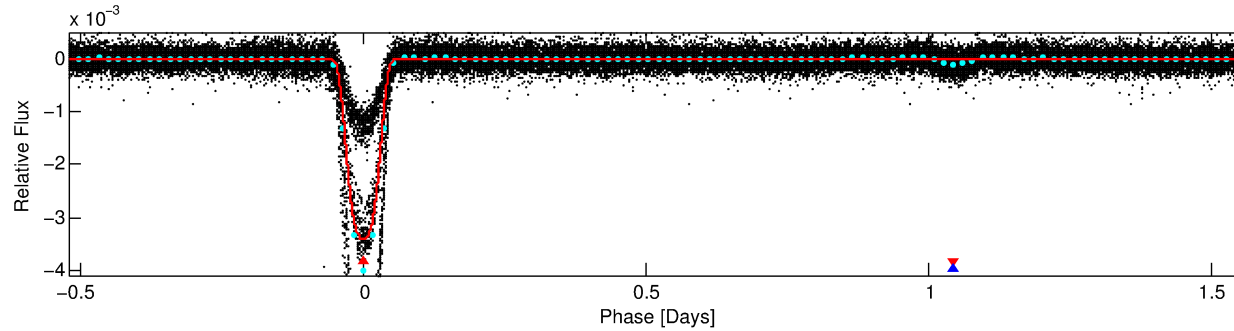
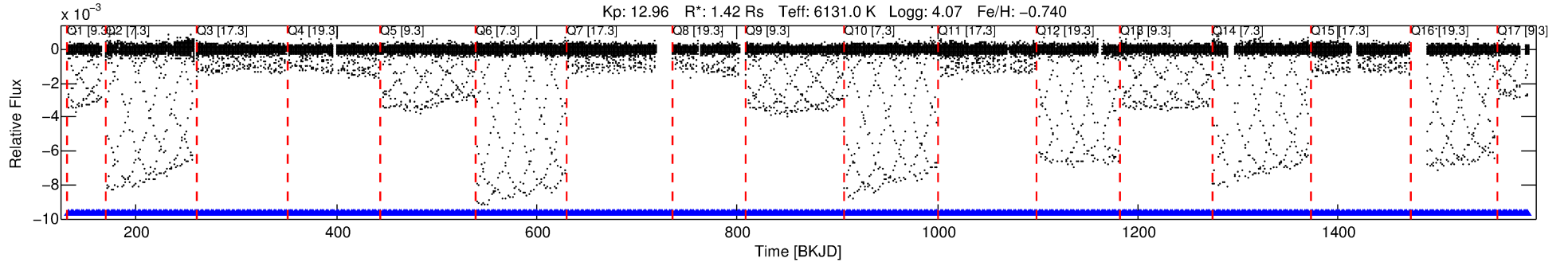
TCE (1)	KIC	Parent (2)	Parent KIC	$P_1:P_2$	Dist ( $''$ )	$\Delta$ Row	$\Delta$ Col	$m_2$	$m_1$	$D_2/D_1$	Mechanism	Flag	$\sigma_P$	$\sigma_T$
004743513-01	4743513	3572.01	4743508	1:1	4.3	0	-1	14.55	12.96	17.21	Direct-PRF	0	0.26	0.14

**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: 4743513 Candidate: 1 of 2 Period: 2.086 d  
KOI: K00024.01 Corr: 0.972

Kp: 12.96 R\*: 1.42 Rs Teff: 6131.0 K Logg: 4.07 Fe/H: -0.740



## DV Fit Results:

Period = 2.08607 [0.00000] d  
Epoch = 133.4187 [0.0001] BKJD  
Rp/R\* = 0.0644 [0.0002]  
a/R\* = 4.06 [0.03]  
b = 0.92 [0.00]  
Seff = 2746.81 [1391.98]  
Teq = 1846 [234] K  
Rp = 9.96 [3.03] Re  
a = 0.0304 [0.0092] AU  
Ag = 0.27 [0.13] [-5.55σ]  
Teffp = 2048 [67] K [0.83σ]

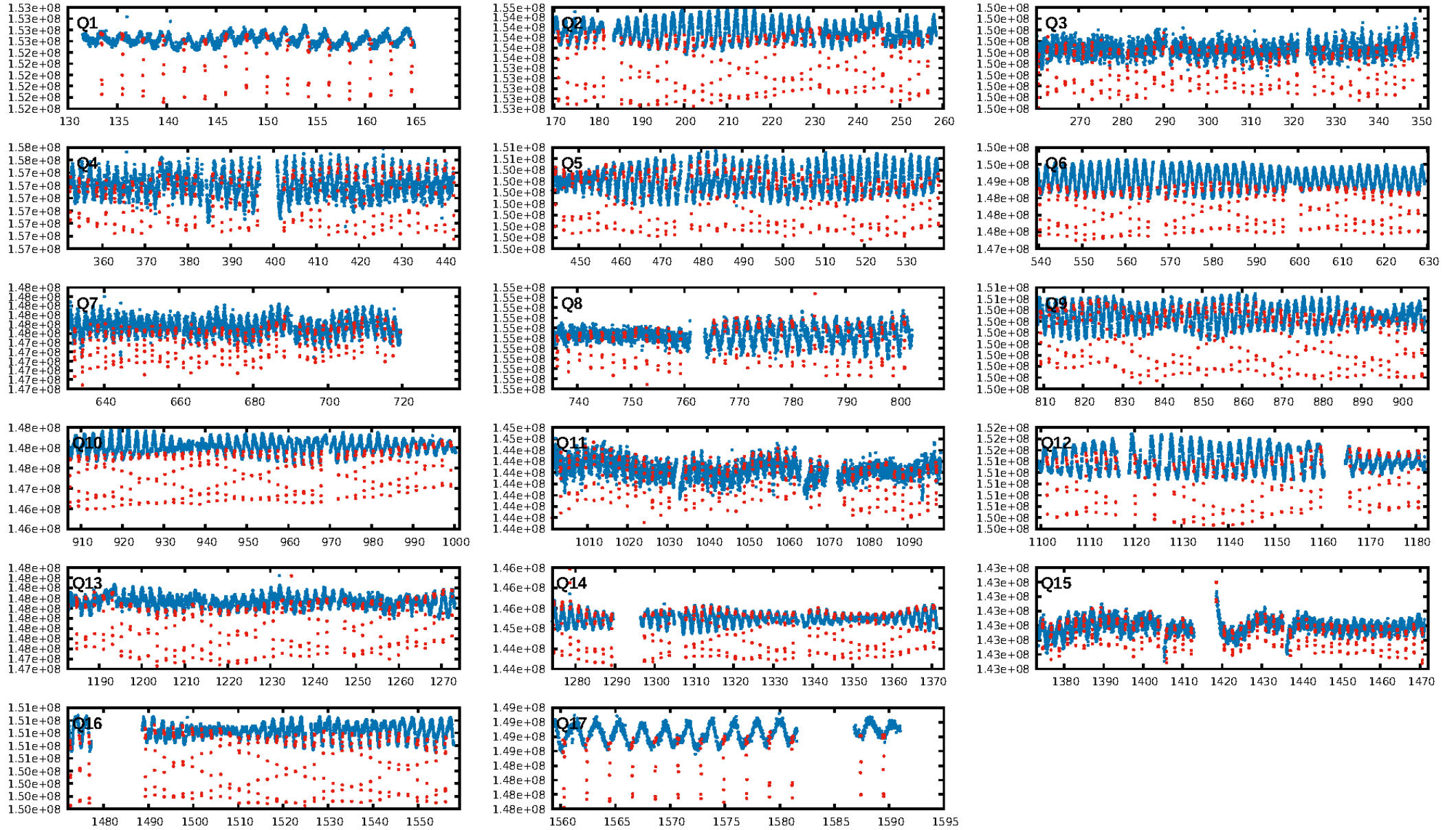
## DV Diagnostic Results:

ShortPeriod-sig: 0.0% [0.00σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: 0.00e+00  
RollingBand-fgt: 1.00 [612/612]  
GhostDiagnostic-chr: -0.1301  
Centroid-sig: 0.0%  
Centroid-so: 8.213 arcsec [506.21σ]  
OotOffset-rm: 3.947 arcsec [42.20σ]  
KicOffset-rm: 4.366 arcsec [61.53σ]  
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]

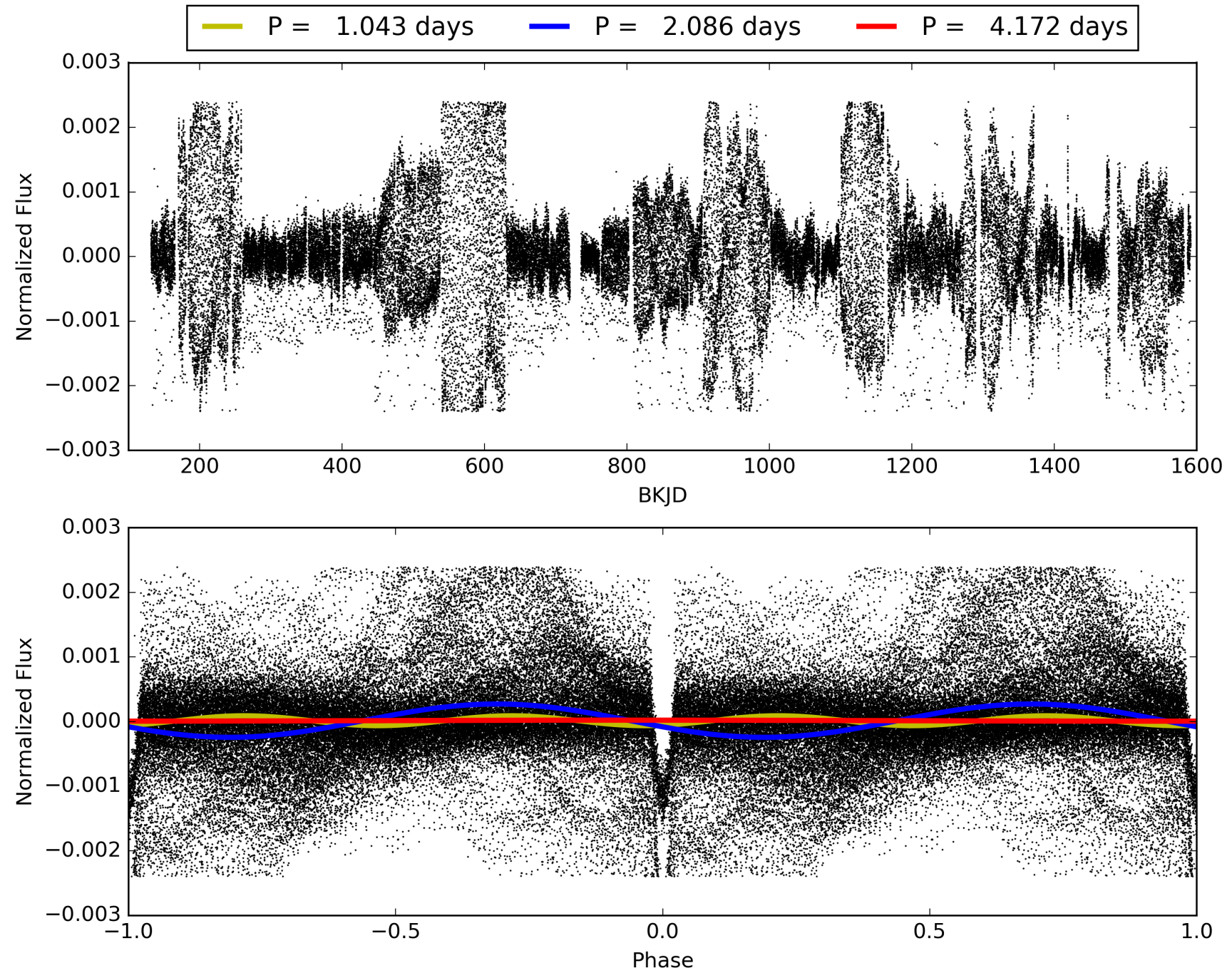
Software Revision: svn-ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 22:26:40 Z

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

# TCE 004743513-01, PDC Light Curves

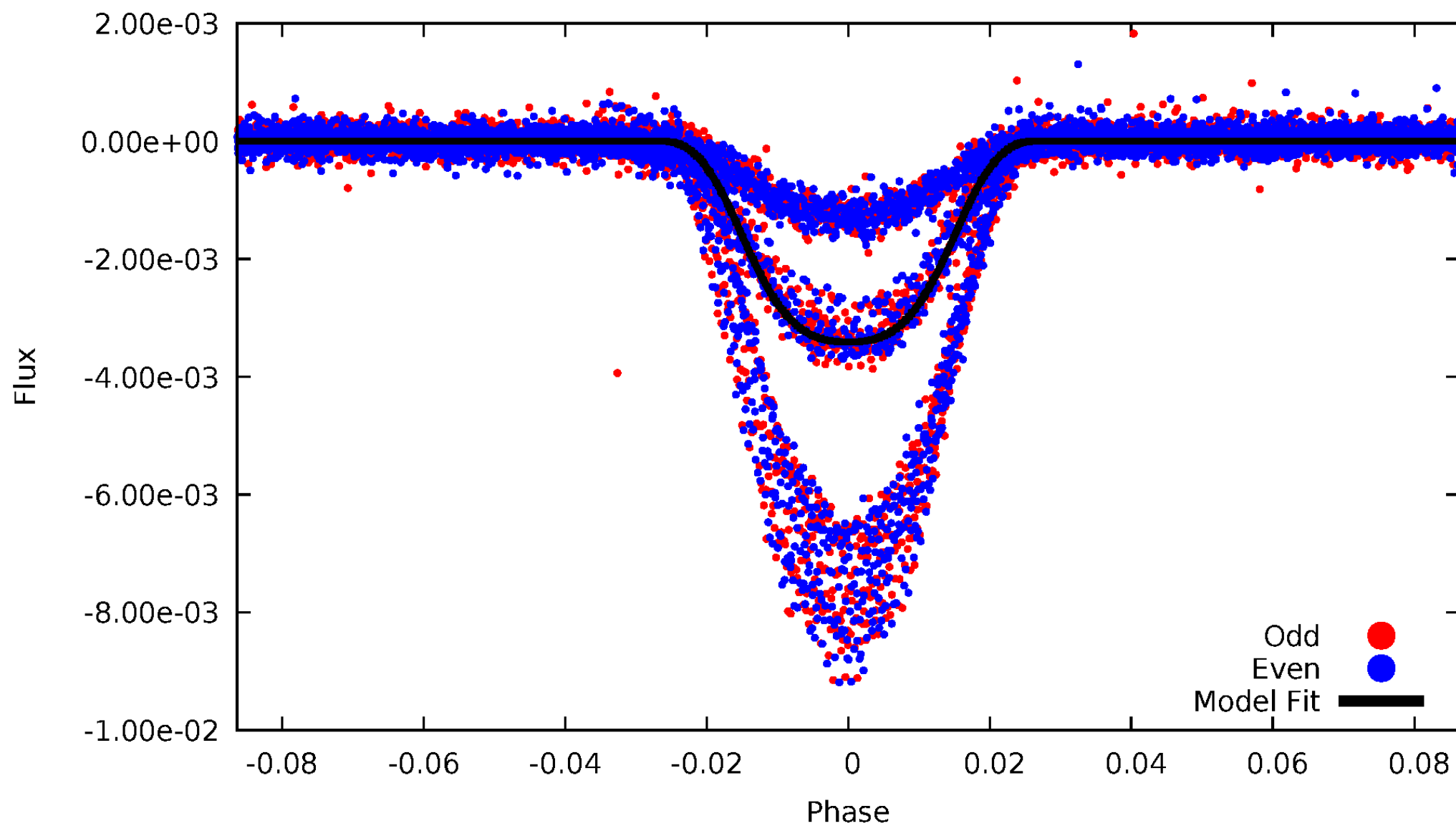


TCE 004743513-01



# DV Odd/Even

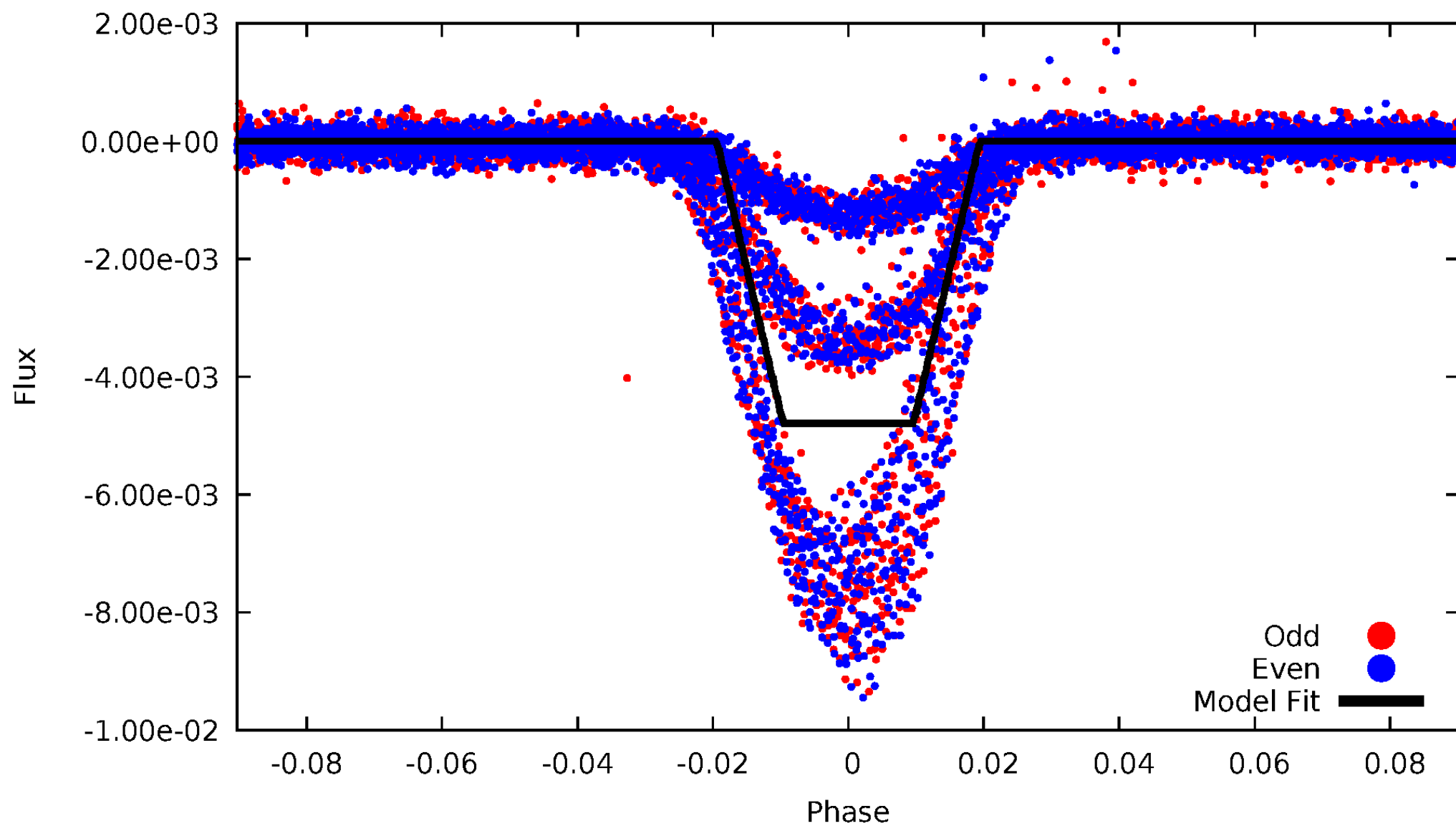
TCE 004743513-01





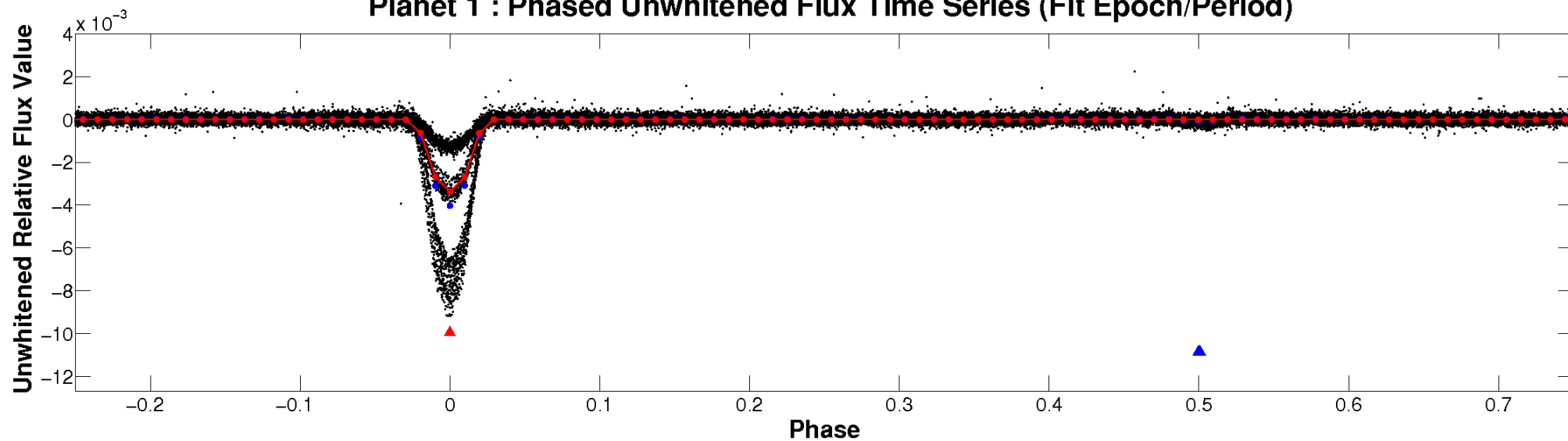
# ALT Odd/Even

TCE 004743513-01

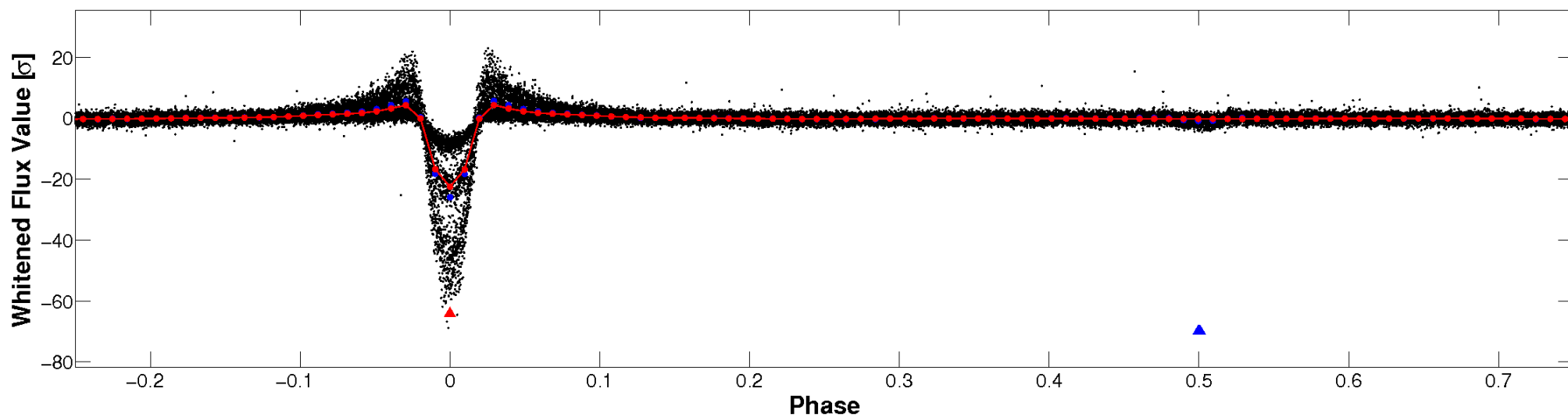


# Non-Whitened Vs. Whitened Light Curve

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

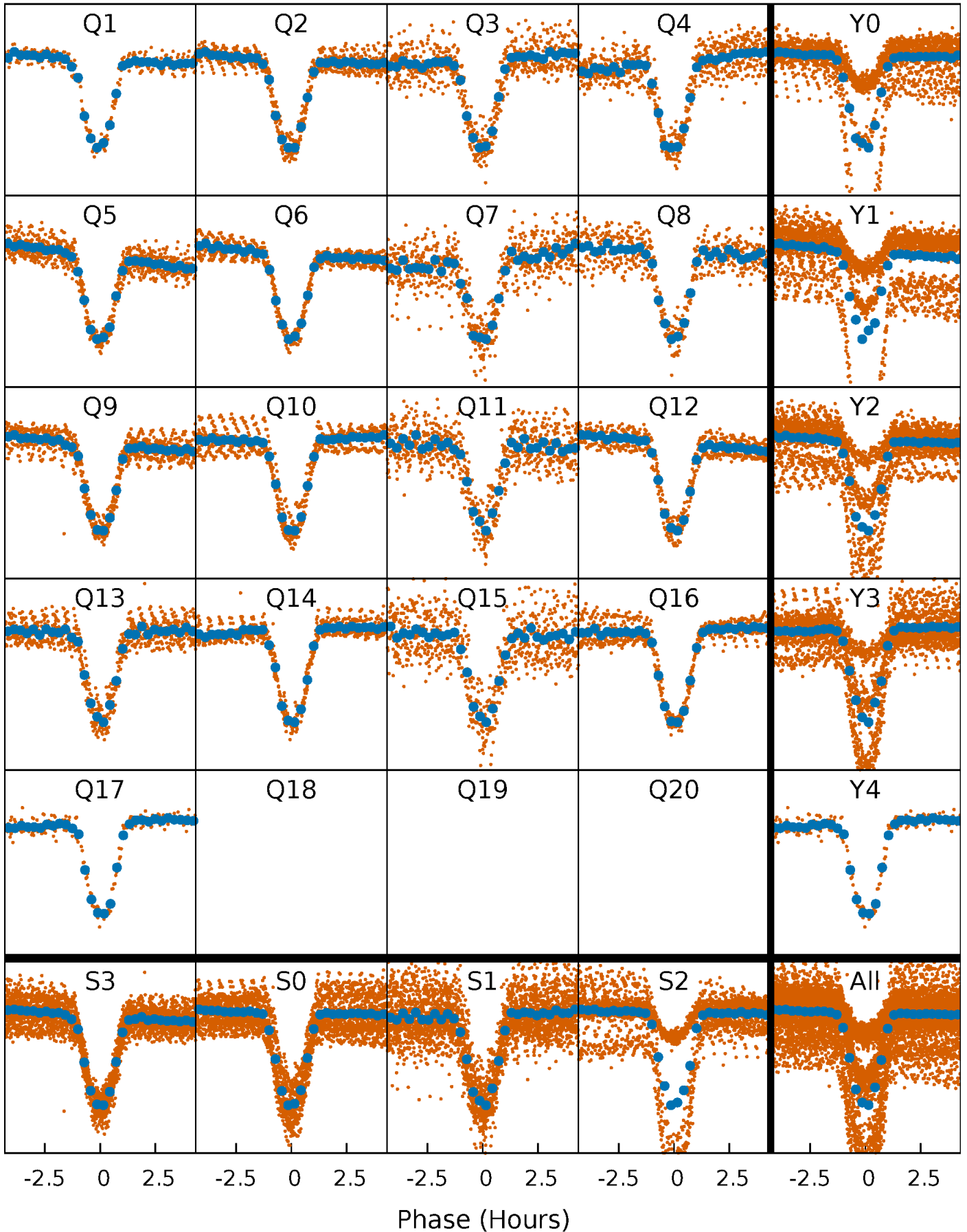


## Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

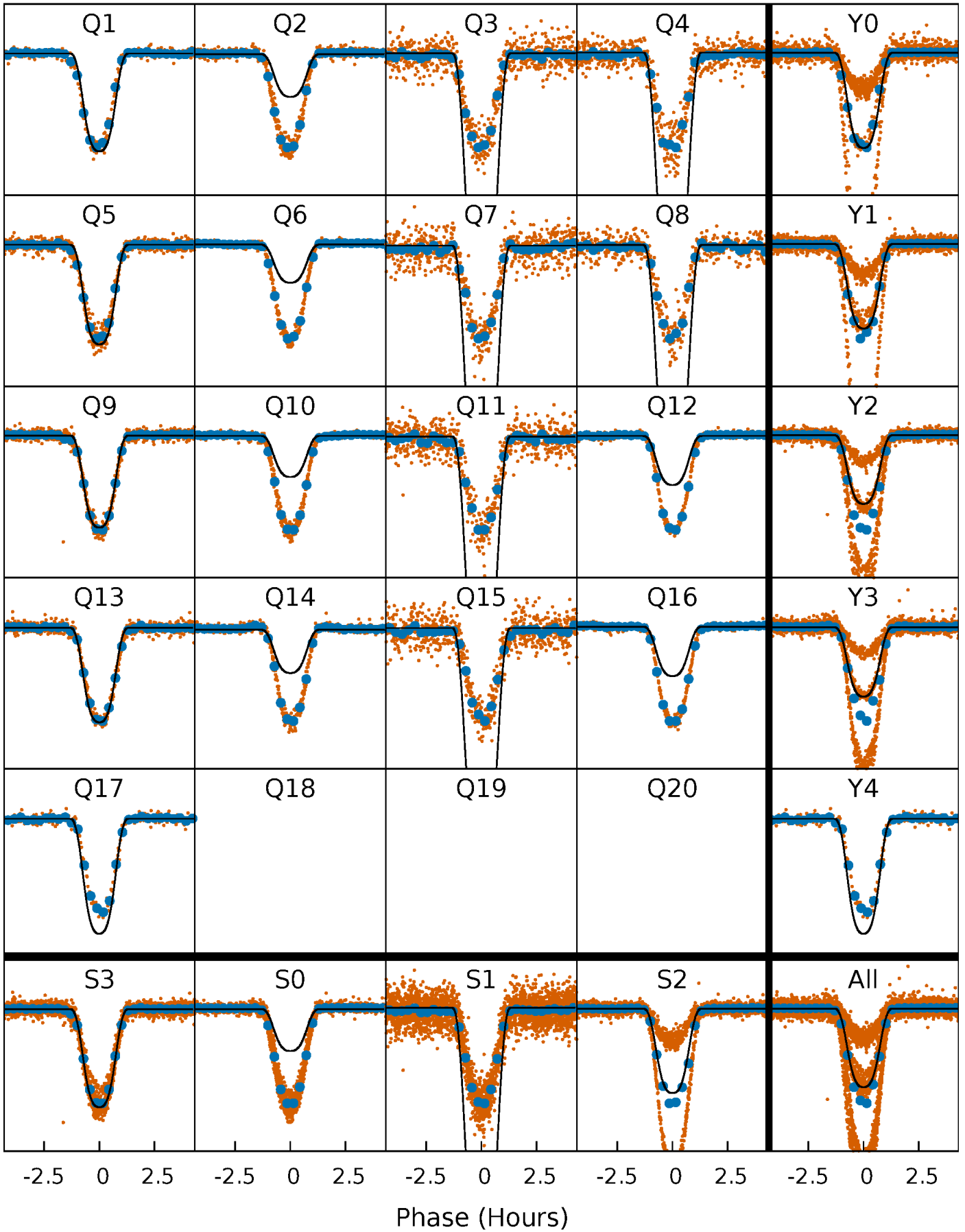
TCE 004743513-01 P= 2.086068 Days  $T_0=133.418685$  (BKJD)





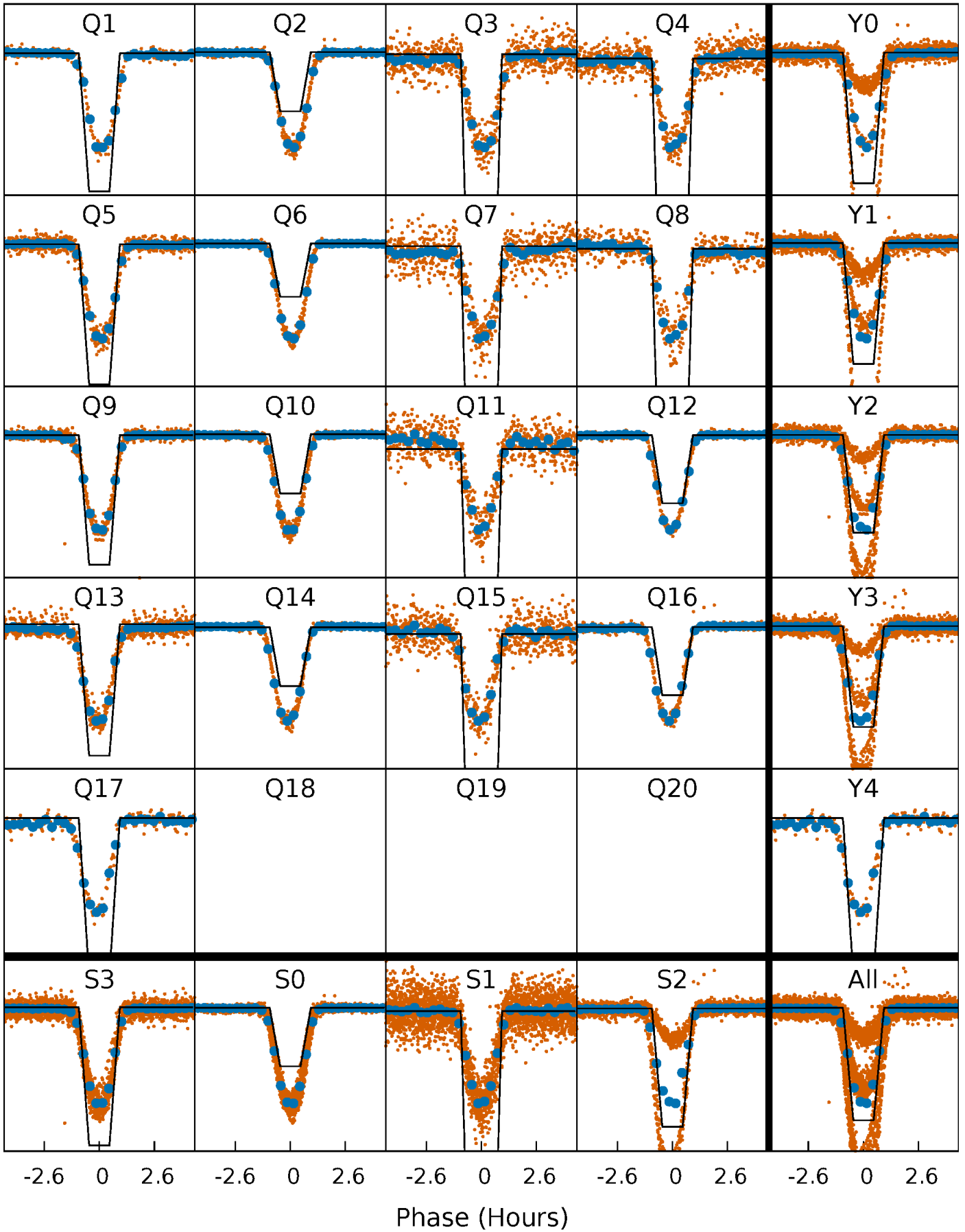
# DV Quarter-Phased Transit Curves

TCE 004743513-01 P= 2.086068 Days  $T_0=133.418685$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

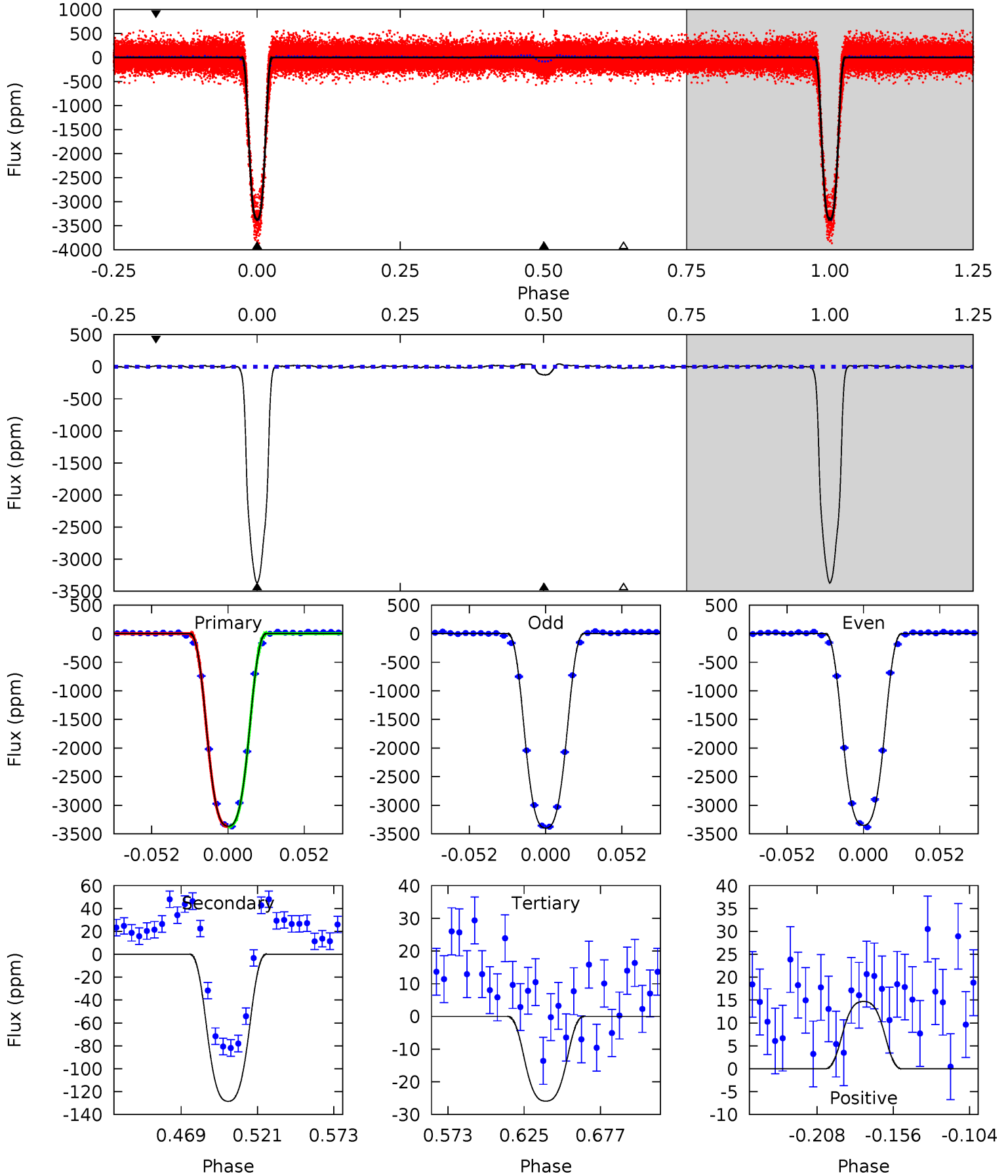
TCE 004743513-01 P= 2.086094 Days  $T_0=133.410002$  (BKJD)



# DV Model-Shift Uniqueness Test

004743513-01, P = 2.086068 Days, E = 131.332617 Days

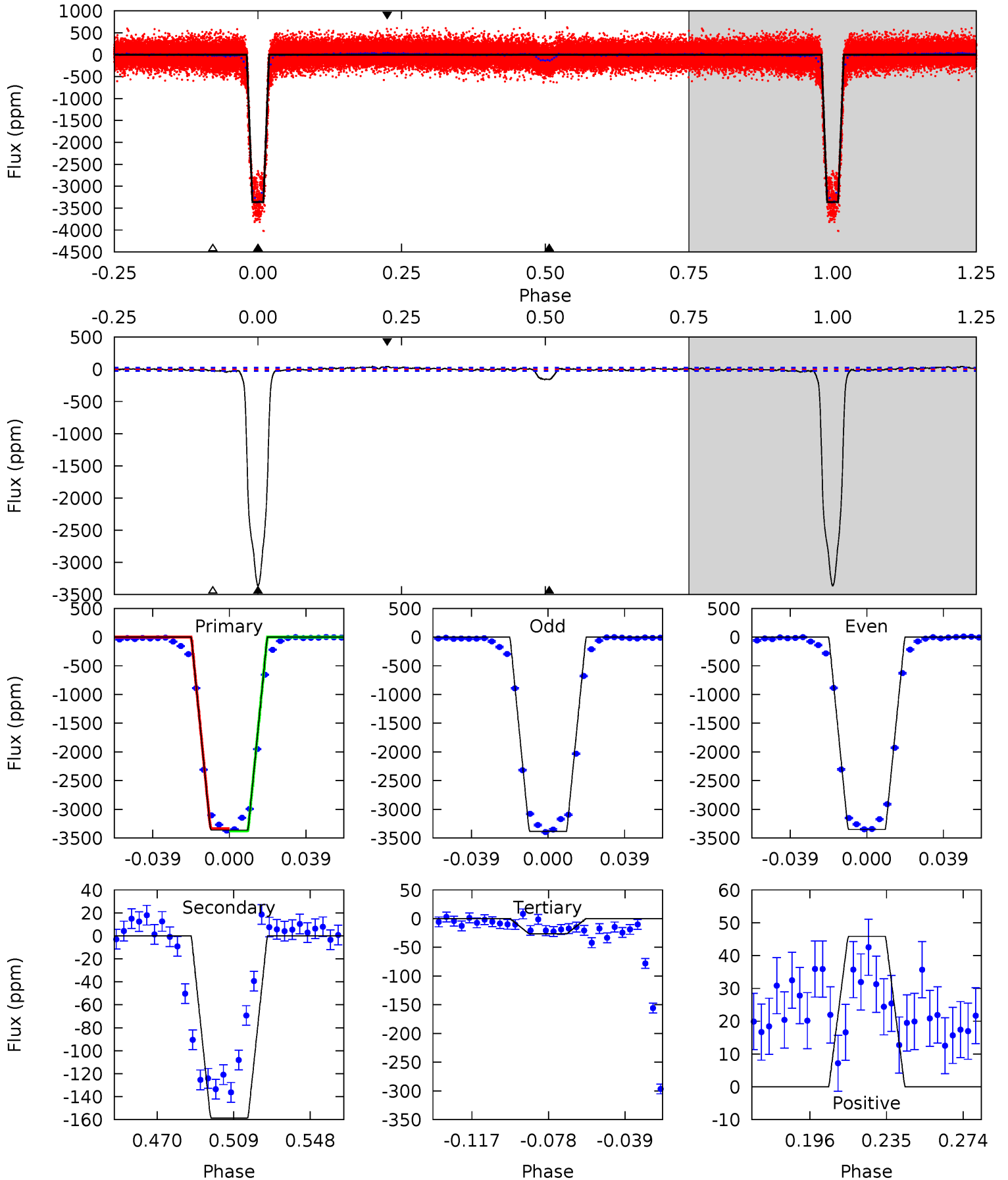
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
974.3	37.2	7.50	4.25	4.70	1.94	2.94	966.8	970.1	29.7	32.9	7.05	1.20	0.01	0



# Alt Model-Shift Uniqueness Test

004743513-01, P = 2.086094 Days, E = 131.323908 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
605.5	28.6	4.78	8.26	4.76	2.06	2.56	600.7	597.2	23.8	20.3	3.10	1.19	0.01	0



### Stellar Parameters For KIC 004743513

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6131^{+168}_{-153}$	$4.071^{+0.294}_{-0.126}$	$-0.740^{+0.300}_{-0.250}$	$1.417^{+0.287}_{-0.431}$	$0.862^{+0.119}_{-0.064}$	$0.427^{+0.745}_{-0.182}$
	+3%/-2%	+7%/-3%	+41%/-34%	+20%/-30%	+14%/-7%	+175%/-43%
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 004743513-01 / KOI 0024.01

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-128 \pm 3$	$9.87^{+1.14}_{-1.46}$	$2547^{+167}_{-212}$	$2926^{+94}_{-89}$	$0.687^{+0.261}_{-0.131}$
Alt.	$-159 \pm 6$	$10.56^{+1.17}_{-1.84}$	$2540^{+172}_{-220}$	$2978^{+91}_{-87}$	$0.745^{+0.324}_{-0.155}$

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

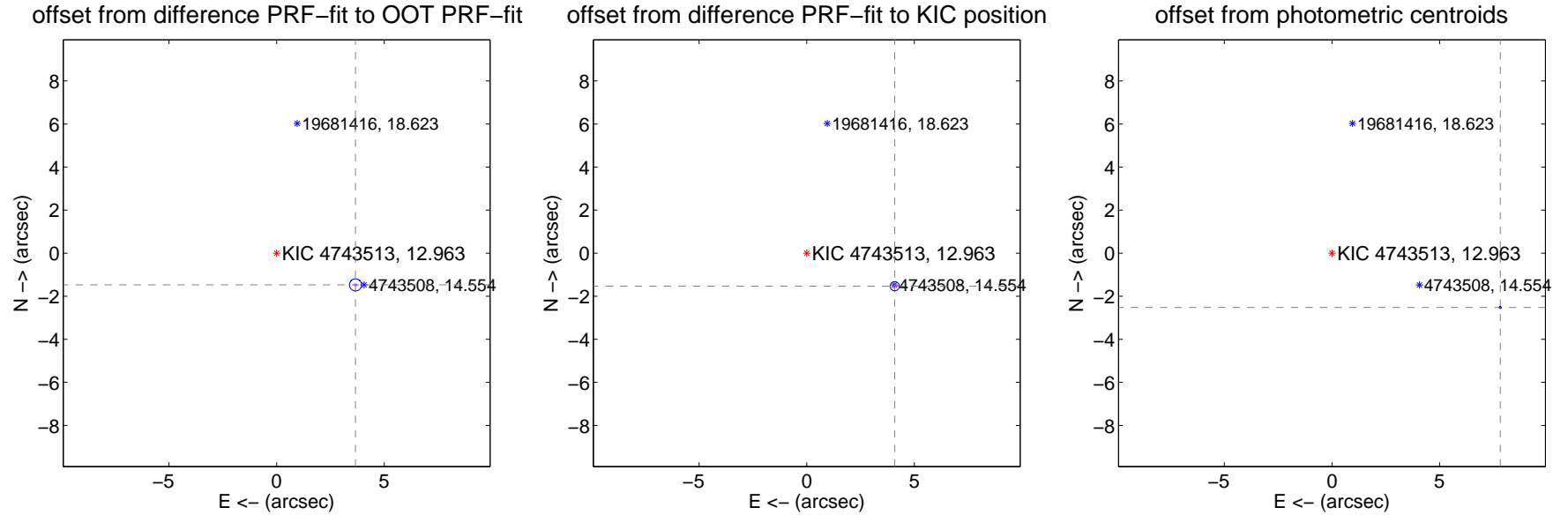
## DV Centroid Data

Supplemental centroid analysis for 004743513-01. Kepler magnitude: 12.96. Transit SNR 475.99

There are 17 quarters with good PRF difference image offsets

The direct PRF centroid is offset from the target star catalog position by about 0.06 arcsec

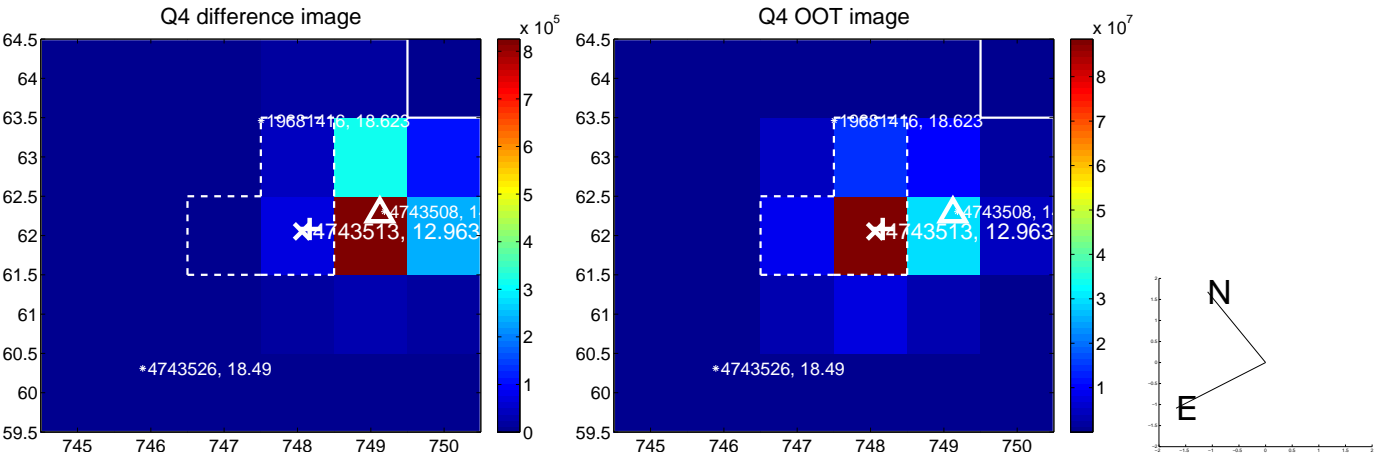
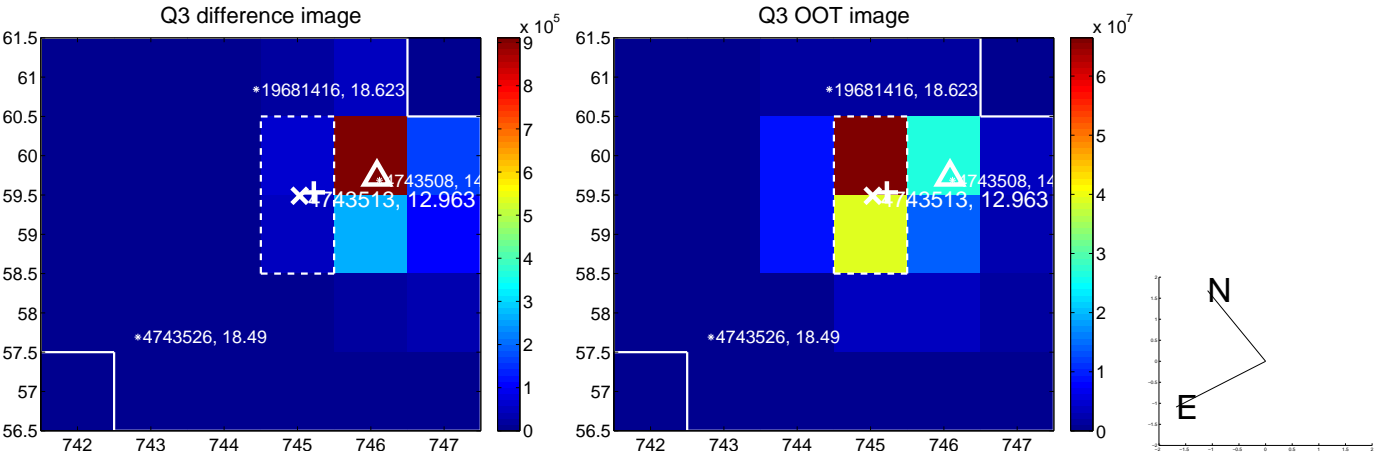
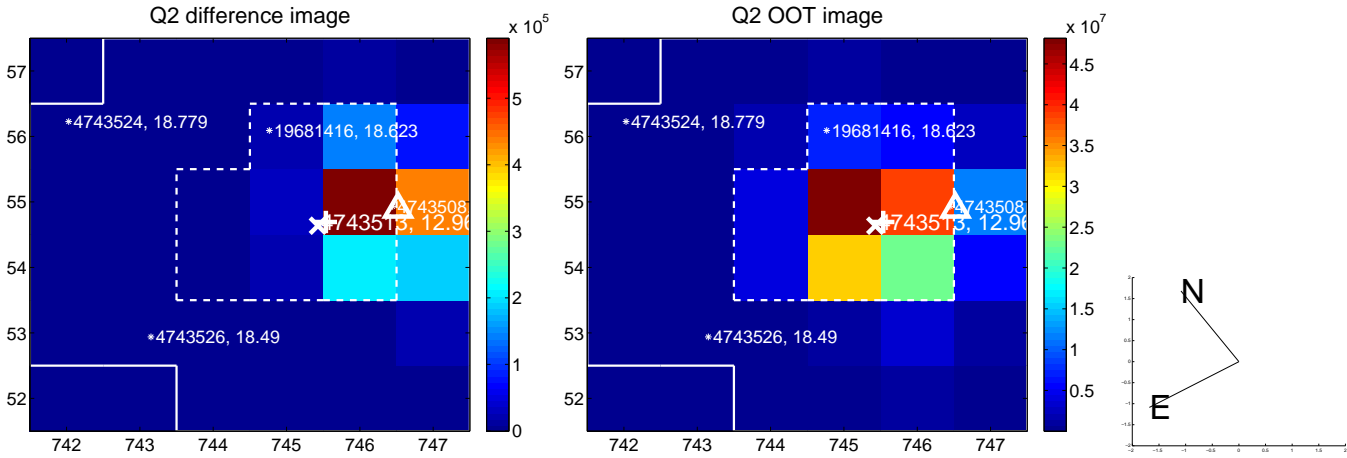
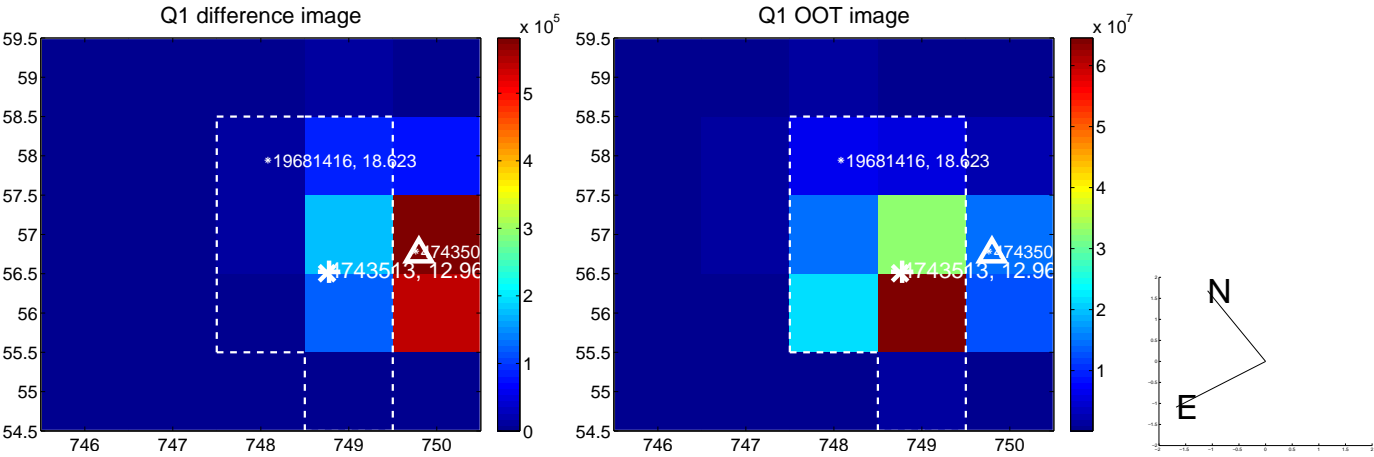
	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$3.947 \pm 0.094$	42.20	$-3.663 \pm 0.091$	$-1.471 \pm 0.071$
PRF-fit source offset from KIC position	$4.366 \pm 0.071$	61.53	$-4.088 \pm 0.070$	$-1.534 \pm 0.069$
photometric centroid source offset	$8.21 \pm 0.02$	506.21	$-7.82 \pm 0.02$	$-2.52 \pm 0.01$



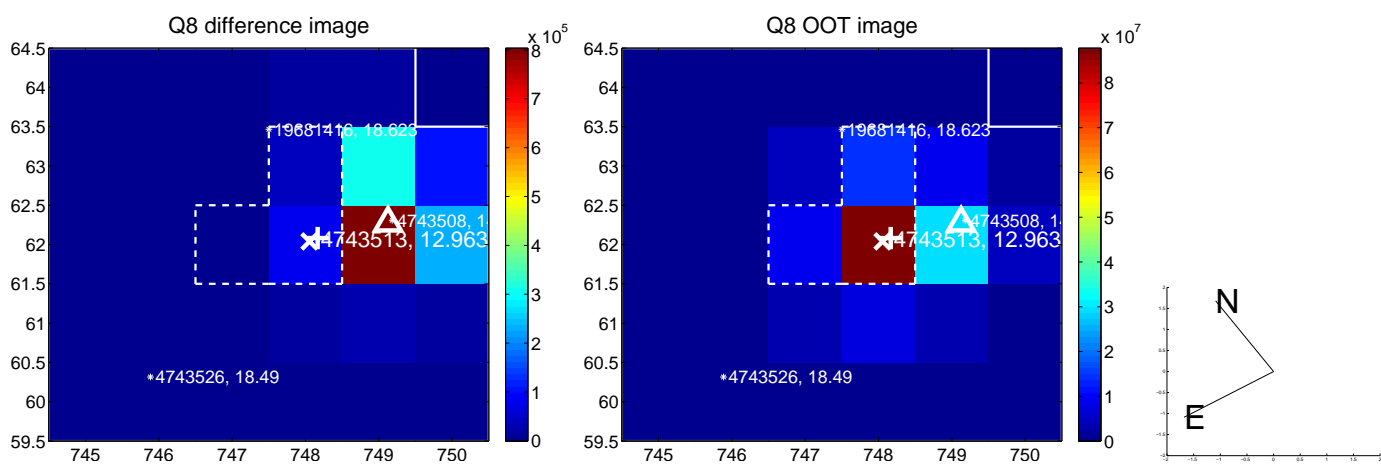
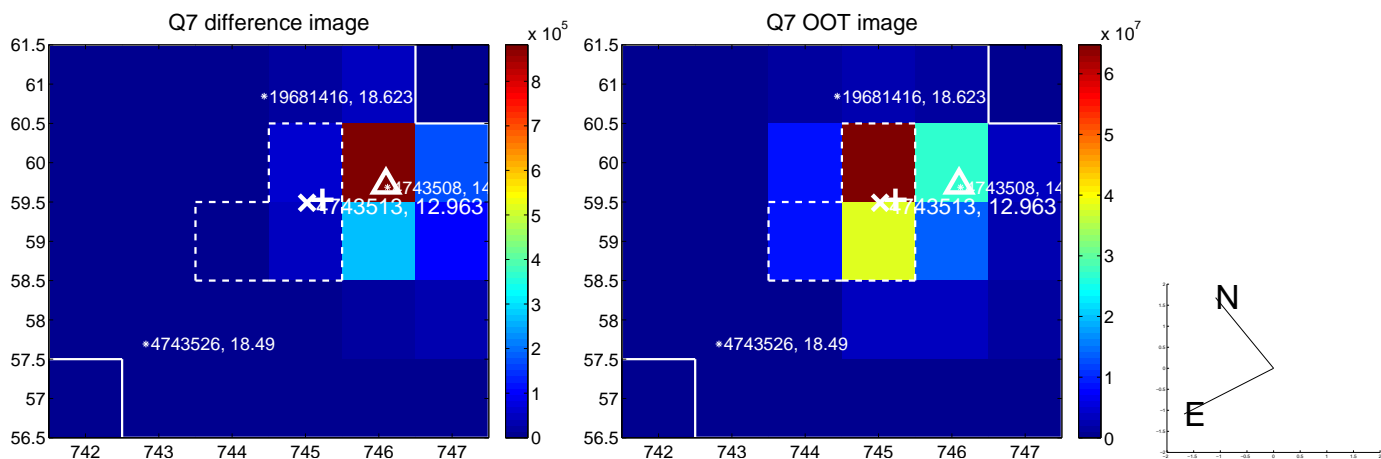
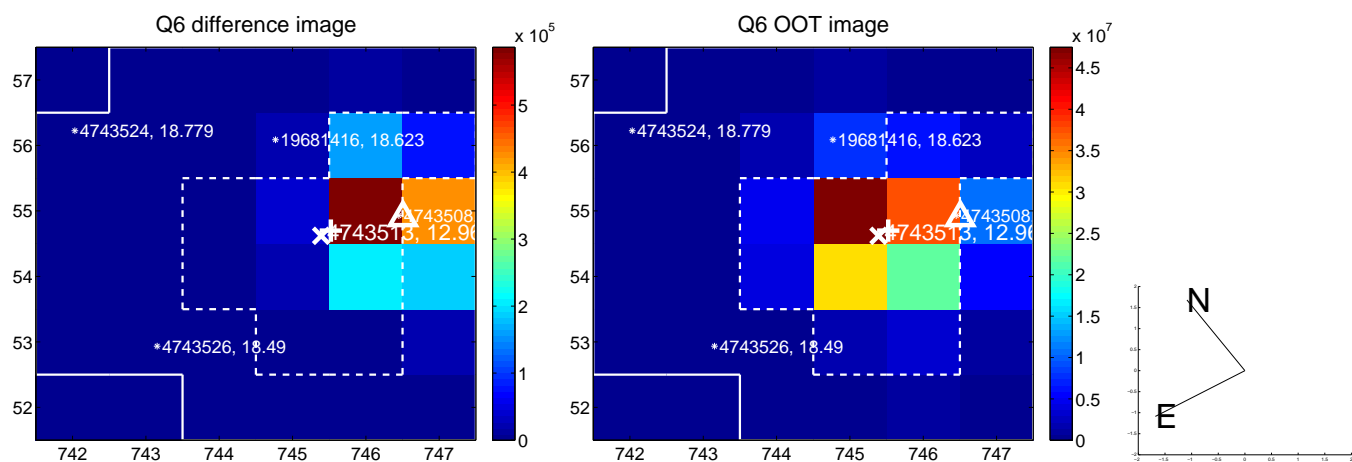
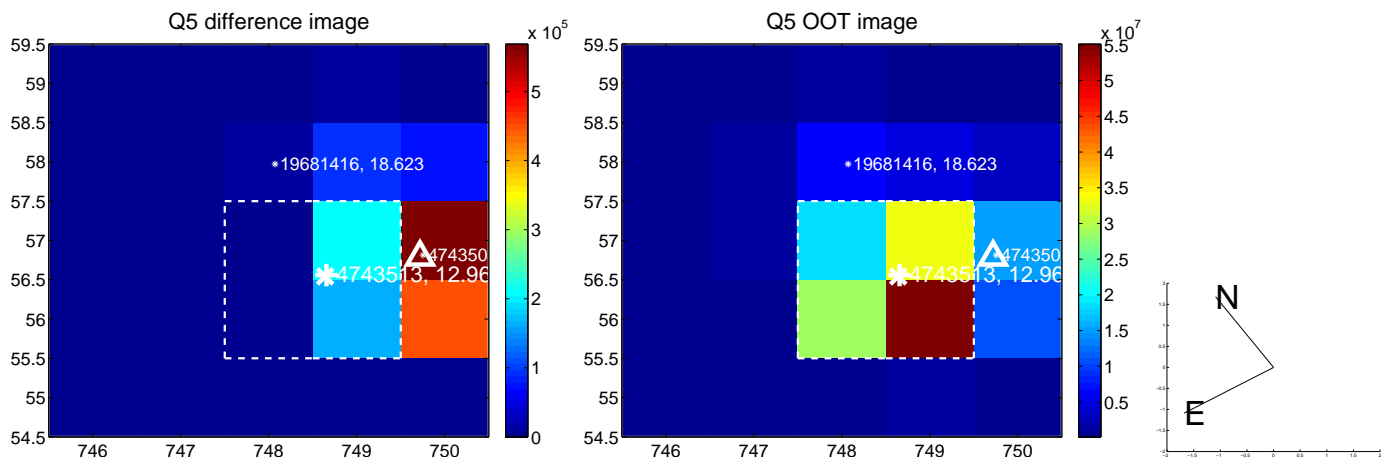
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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



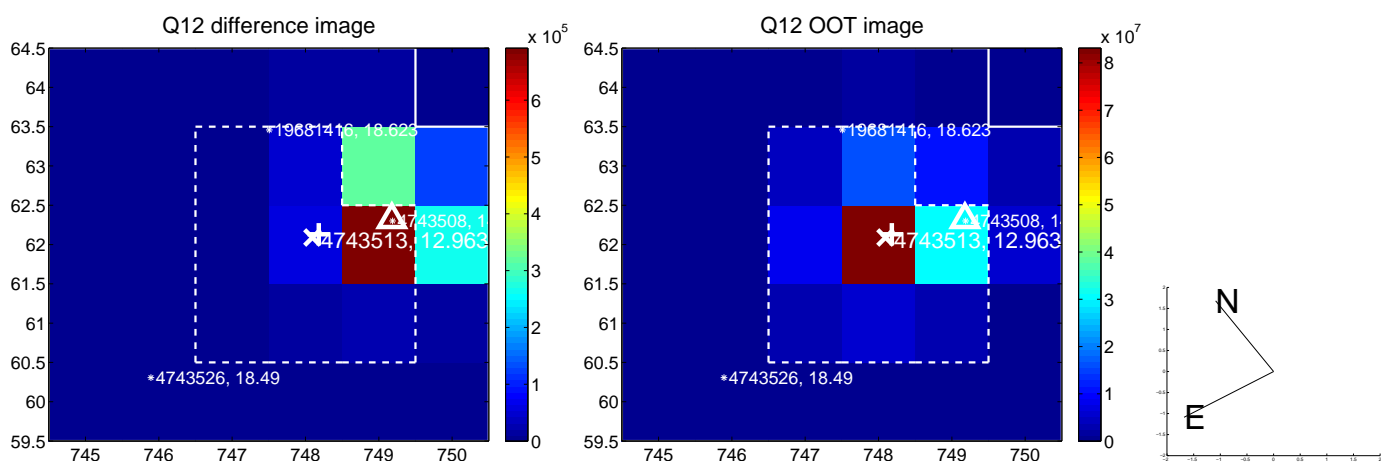
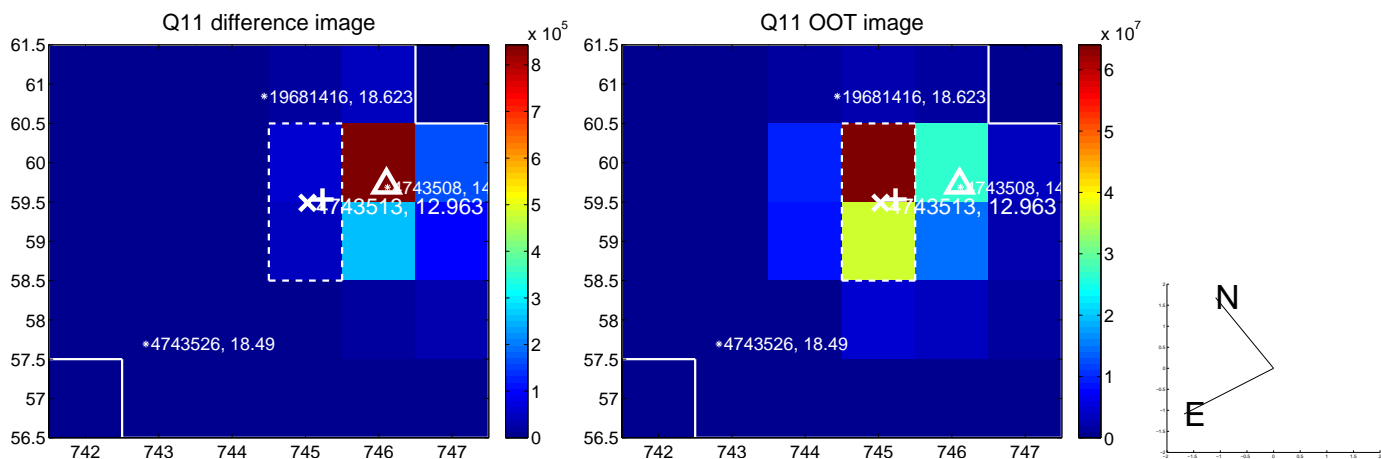
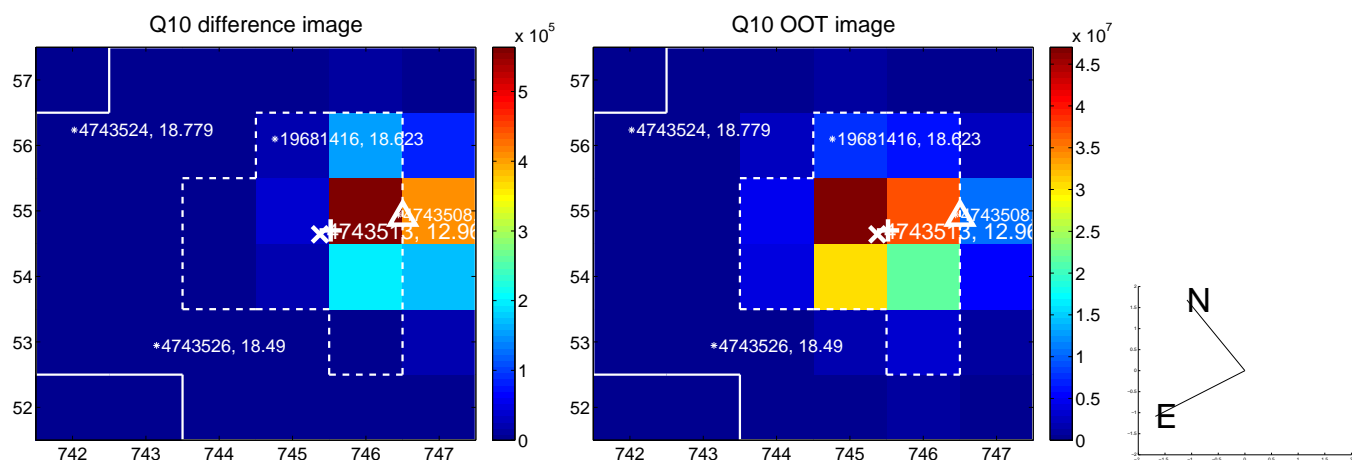
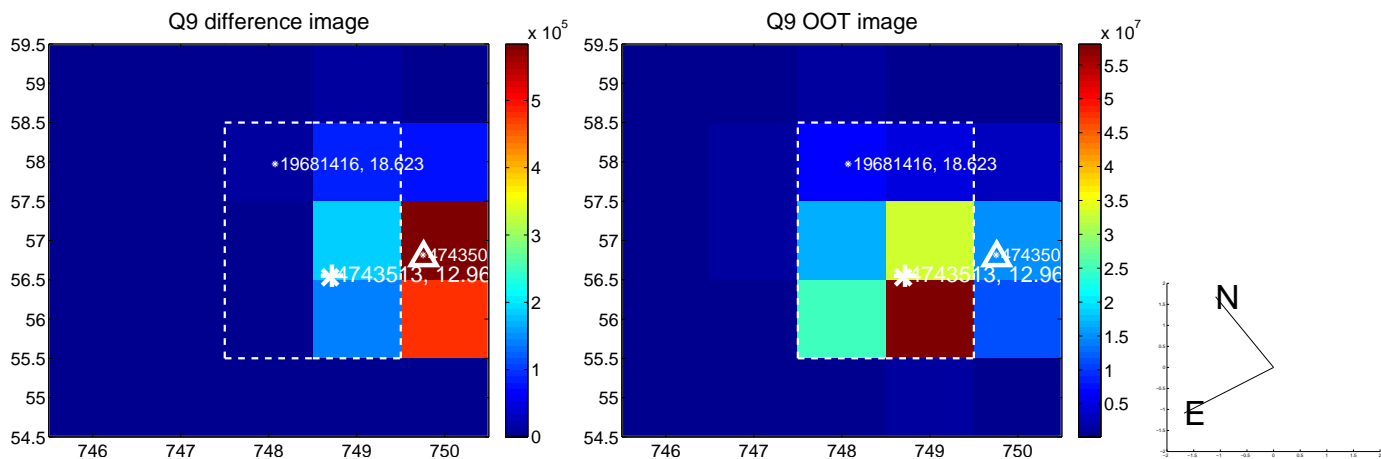
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



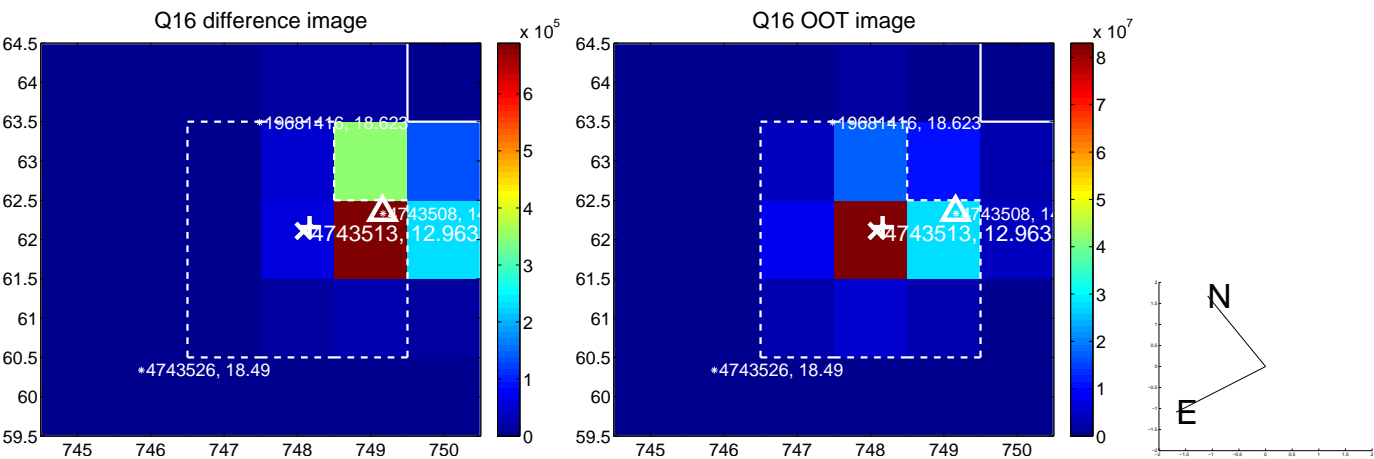
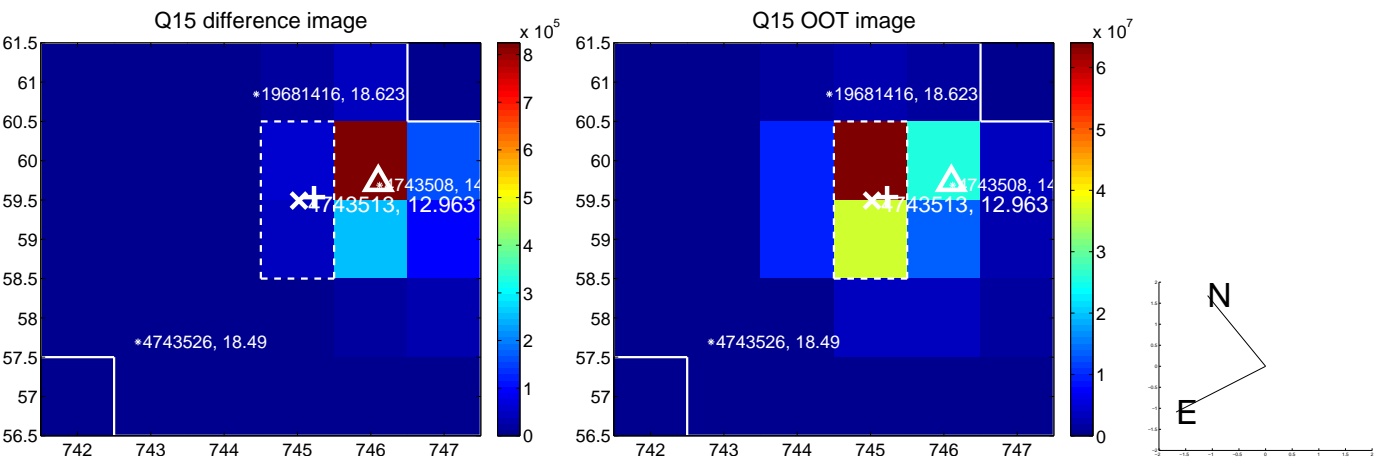
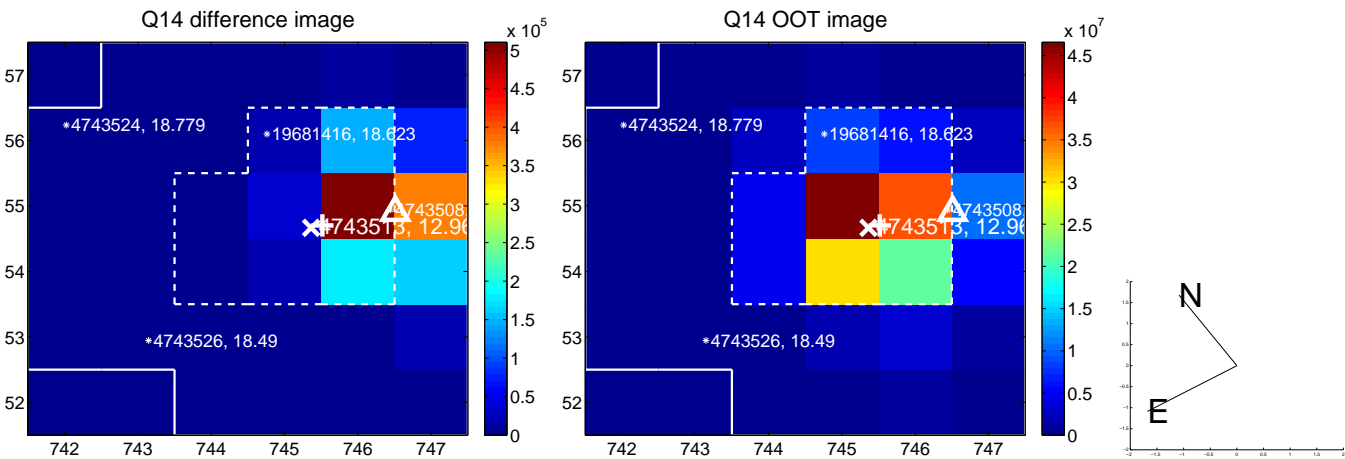
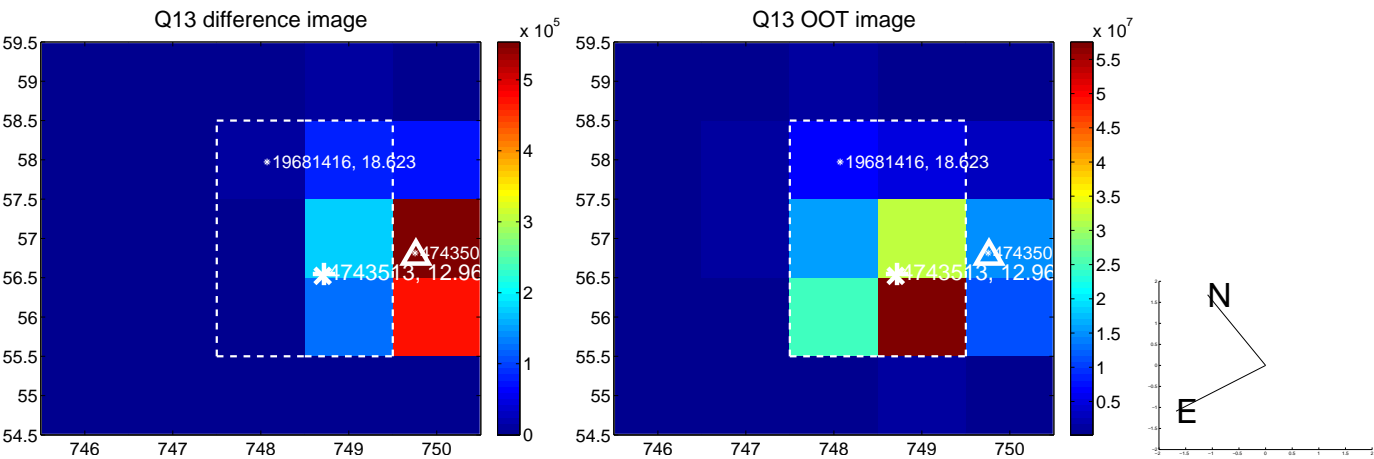
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



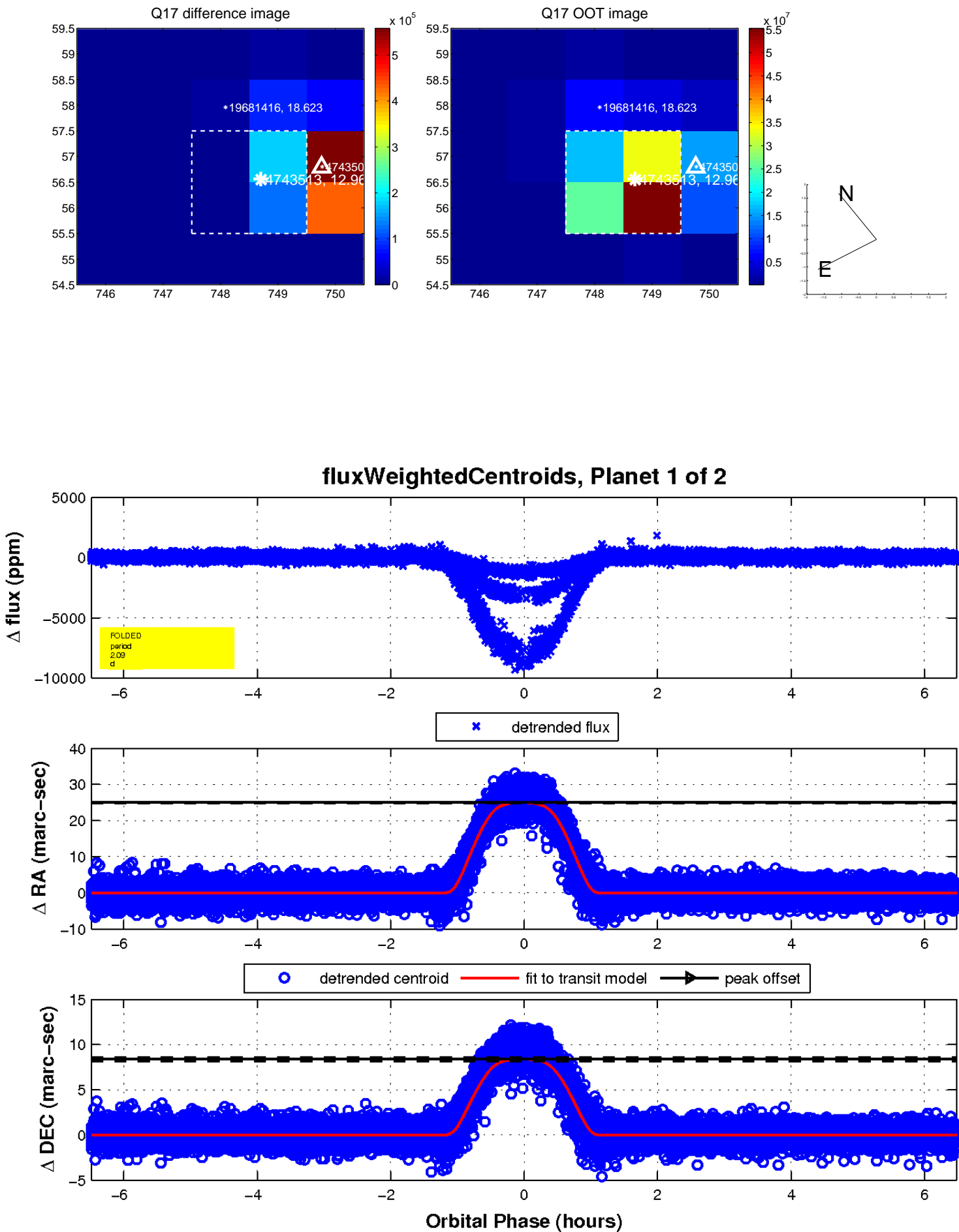
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

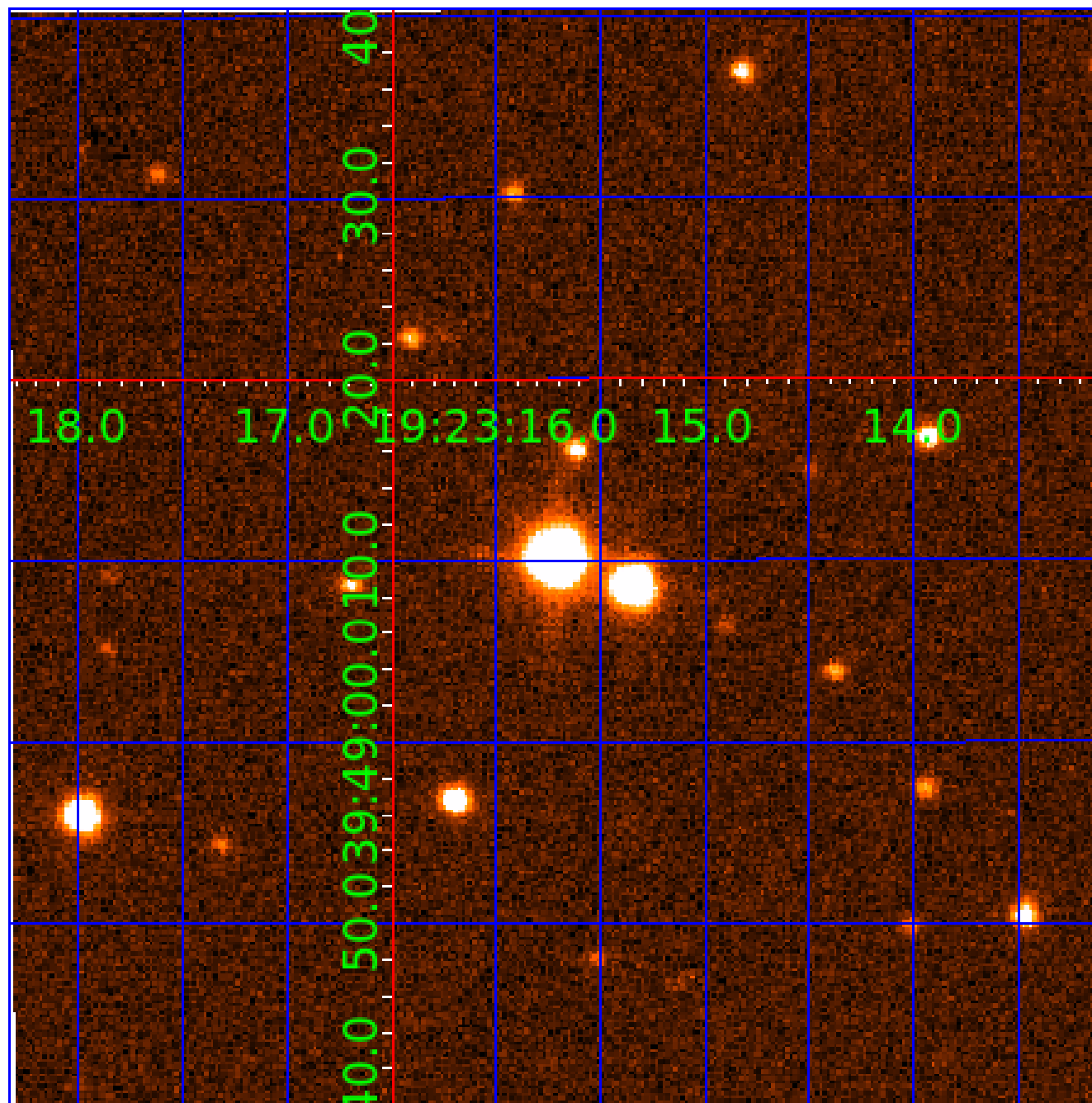


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination





# KIC 004743513

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
004743513-01	OBS	0024.01	2.086068	133.418685	3409.4	2.161	698.0	476.0	1.42	6131	9.96	2746.81
004743513-02	OBS	No	2.086065	132.377256	112.4	1.691	26.0	30.9	1.42	6131	1.76	2746.81

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
004743513-01	OBS	FP	0.00	0	1	1	1	MOD_SEC_DV—PLANET_OCCULT_DV—MOD_SEC_ALT—PLANET_OCCULT_ALT—HAS_SEC_TCE—CENT_UNRESOLVED_OFFSET—HALO_GHOST—EPHEM_MATCH
004743513-02	OBS	FP	0.00	1	1	1	1	IS_SEC_TCE—CENT_UNRESOLVED_OFFSET—HALO_GHOST—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 004743513-02

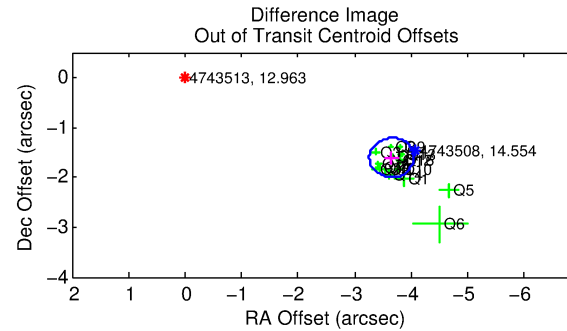
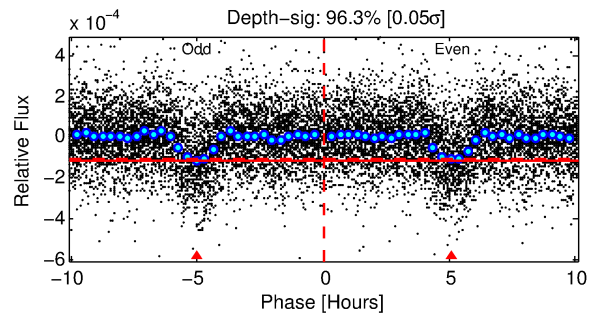
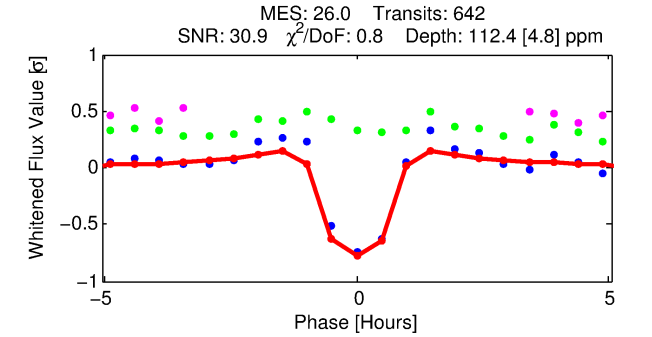
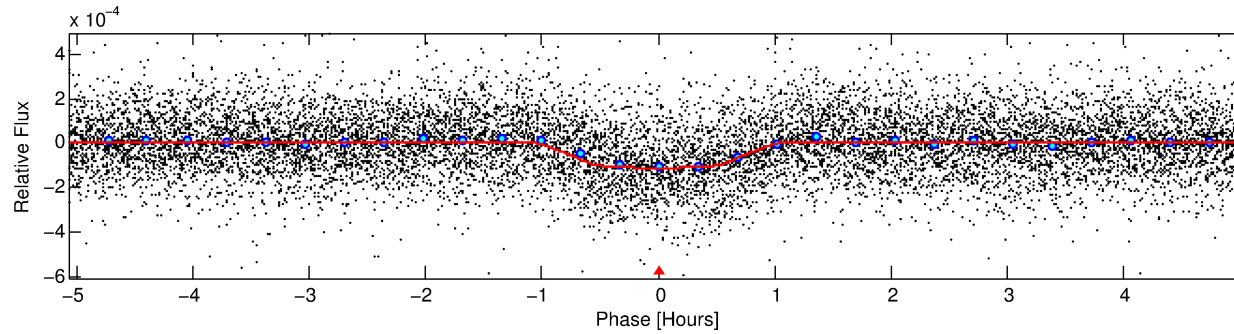
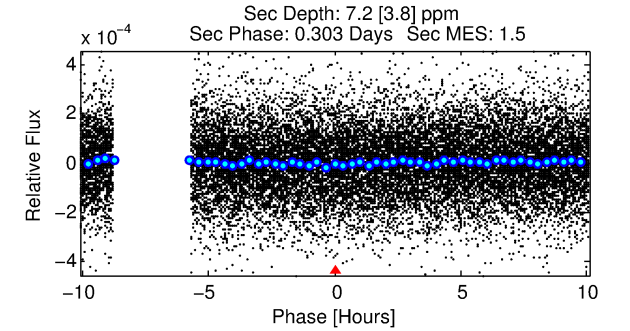
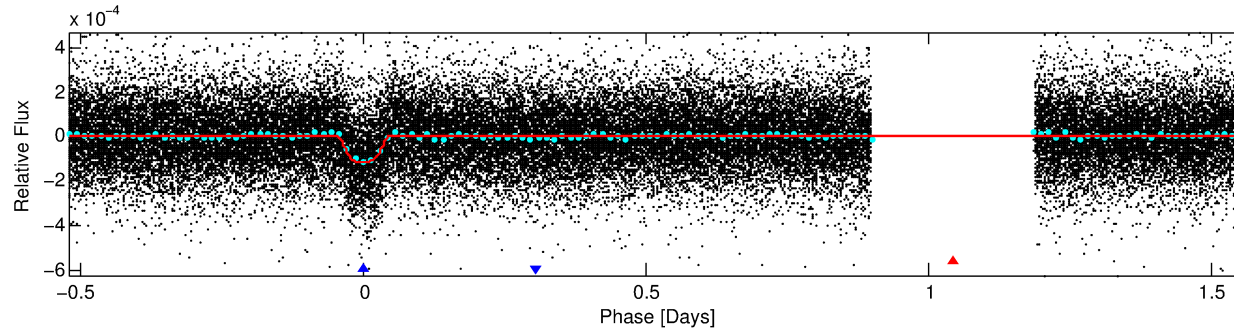
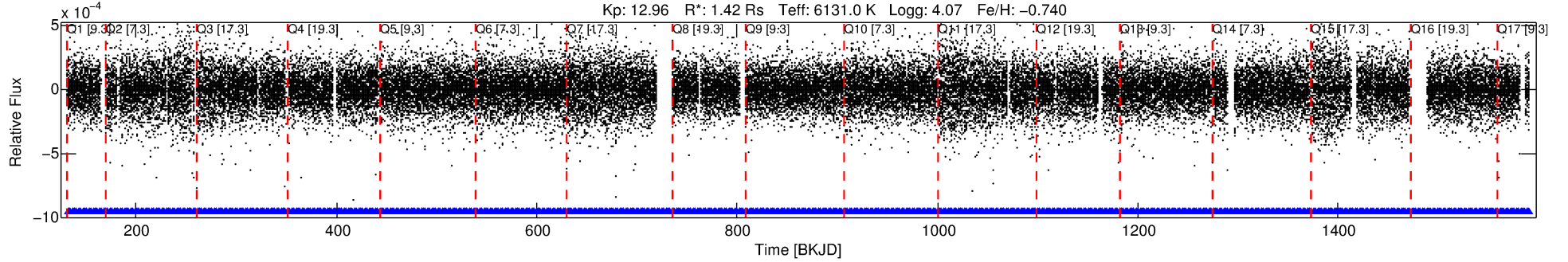
TCE (1)	KIC	Parent (2)	Parent KIC	$P_1:P_2$	Dist (")	$\Delta$ Row	$\Delta$ Col	$m_2$	$m_1$	$D_2/D_1$	Mechanism	Flag	$\sigma_P$	$\sigma_T$
004743513-02	4743513	004743508-02	4743508	1:1	4.3	0	-1	14.55	12.96	7.79	Direct-PRF	0	0.27	0.14

**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: 4743513 Candidate: 2 of 2 Period: 2.086 d  
KOI: K00024 Corr: No Ephemeris Match

Kp: 12.96 R\*: 1.42 Rs Teff: 6131.0 K Logg: 4.07 Fe/H: -0.740



## DV Fit Results:

Period = 2.08606 [0.00000] d  
Epoch = 132.3773 [0.0008] BKJD  
Rp/R\* = 0.0114 [0.0021]  
a/R\* = 4.43 [4.29]  
b = 0.90 [0.22]  
Seff = 2746.81 [1391.99]  
Teq = 1846 [234] K  
Rp = 1.76 [0.62] Re  
a = 0.0304 [0.0092] AU  
Ag = 1.18 [0.96] [0.19σ]  
Teffp = 2977 [481] K [2.11σ]

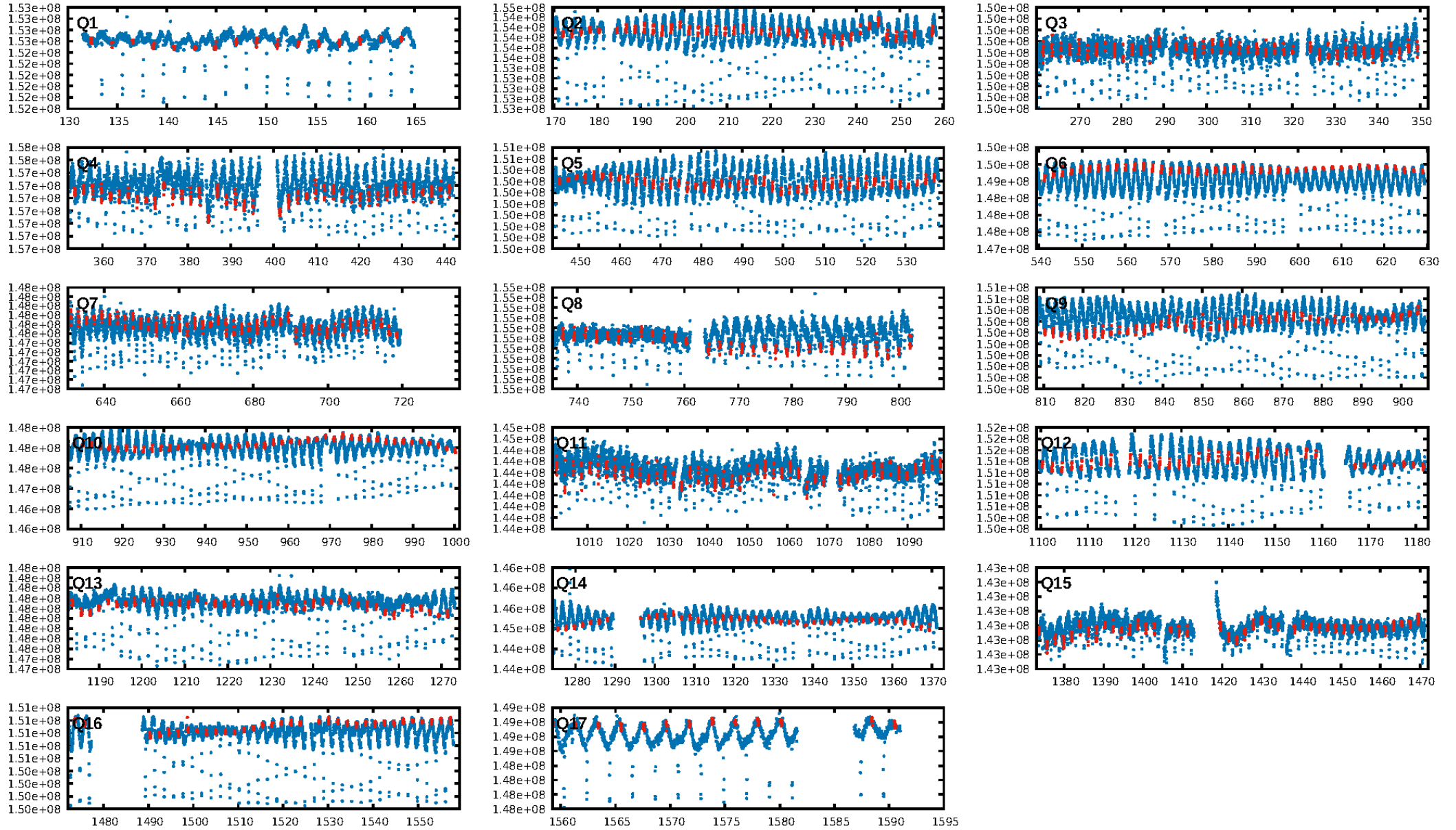
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 0.0% [0.00σ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: 1.66e-144  
RollingBand-fgt: 1.00 [613/613]  
GhostDiagnostic-chr: 0.1991  
Centroid-sig: 0.0%  
Centroid-so: 7.124 arcsec [17.05σ]  
OotOffset-rm: 3.990 arcsec [30.45σ]  
KicOffset-rm: 4.449 arcsec [35.41σ]  
OotOffset-st: 4/4/4/4 [16]  
KicOffset-st: 4/4/4/4 [16]  
DiffImageQuality-fgm: 1.00 [16/16]  
DiffImageOverlap-fno: 1.00 [17/17]

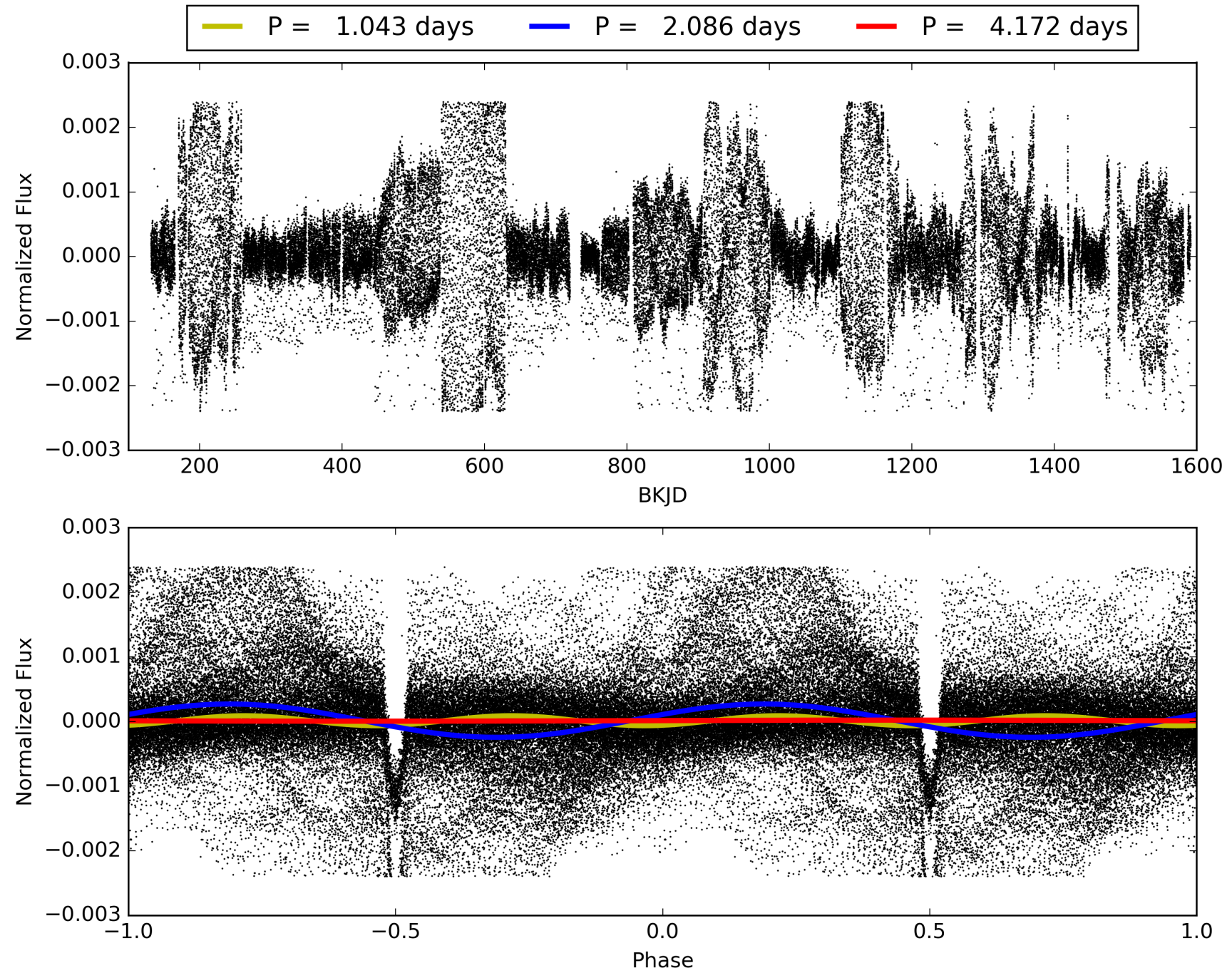
Software Revision: svn-ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 22:26:48 Z

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

# TCE 004743513-02, PDC Light Curves



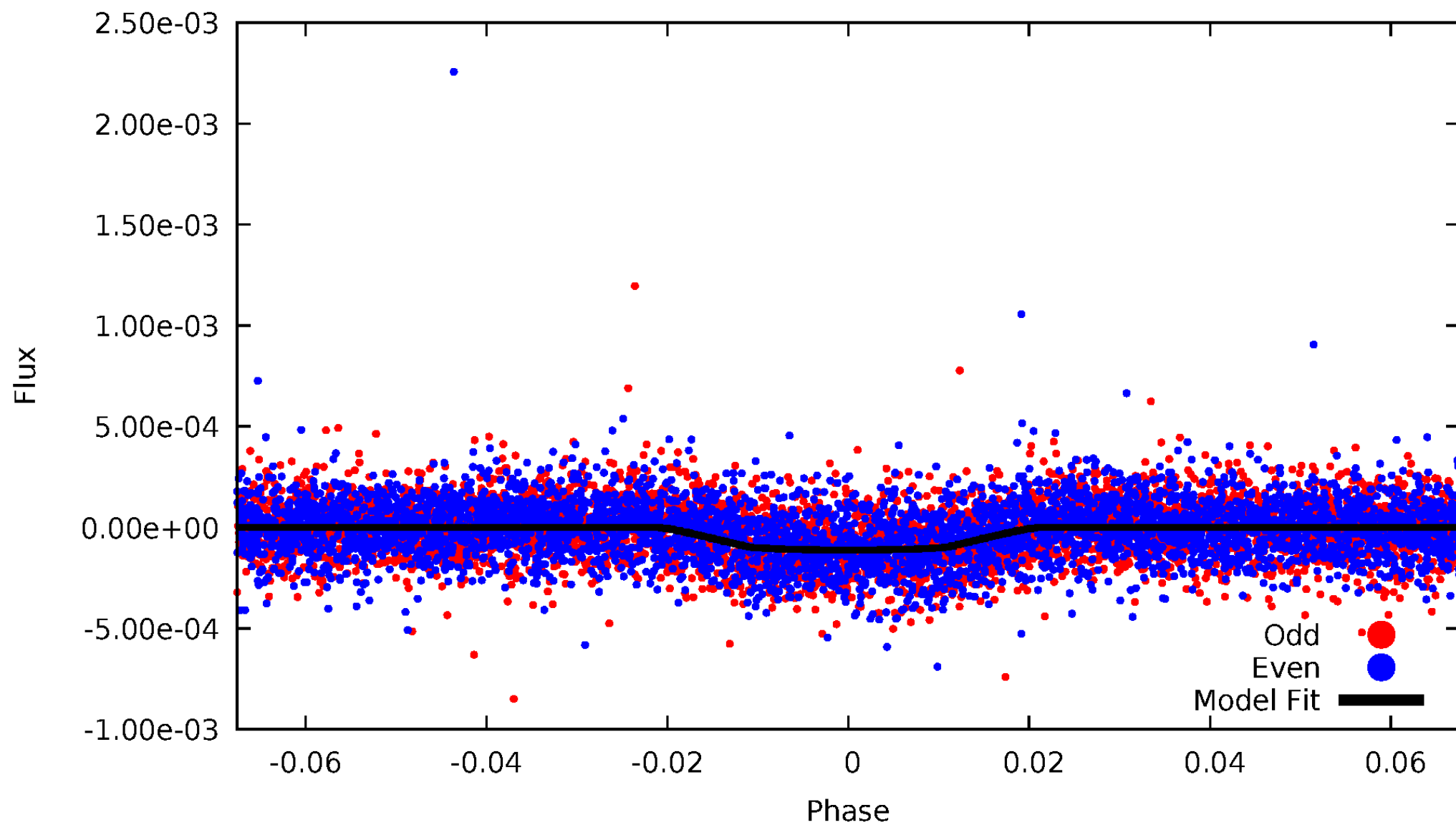
TCE 004743513-02





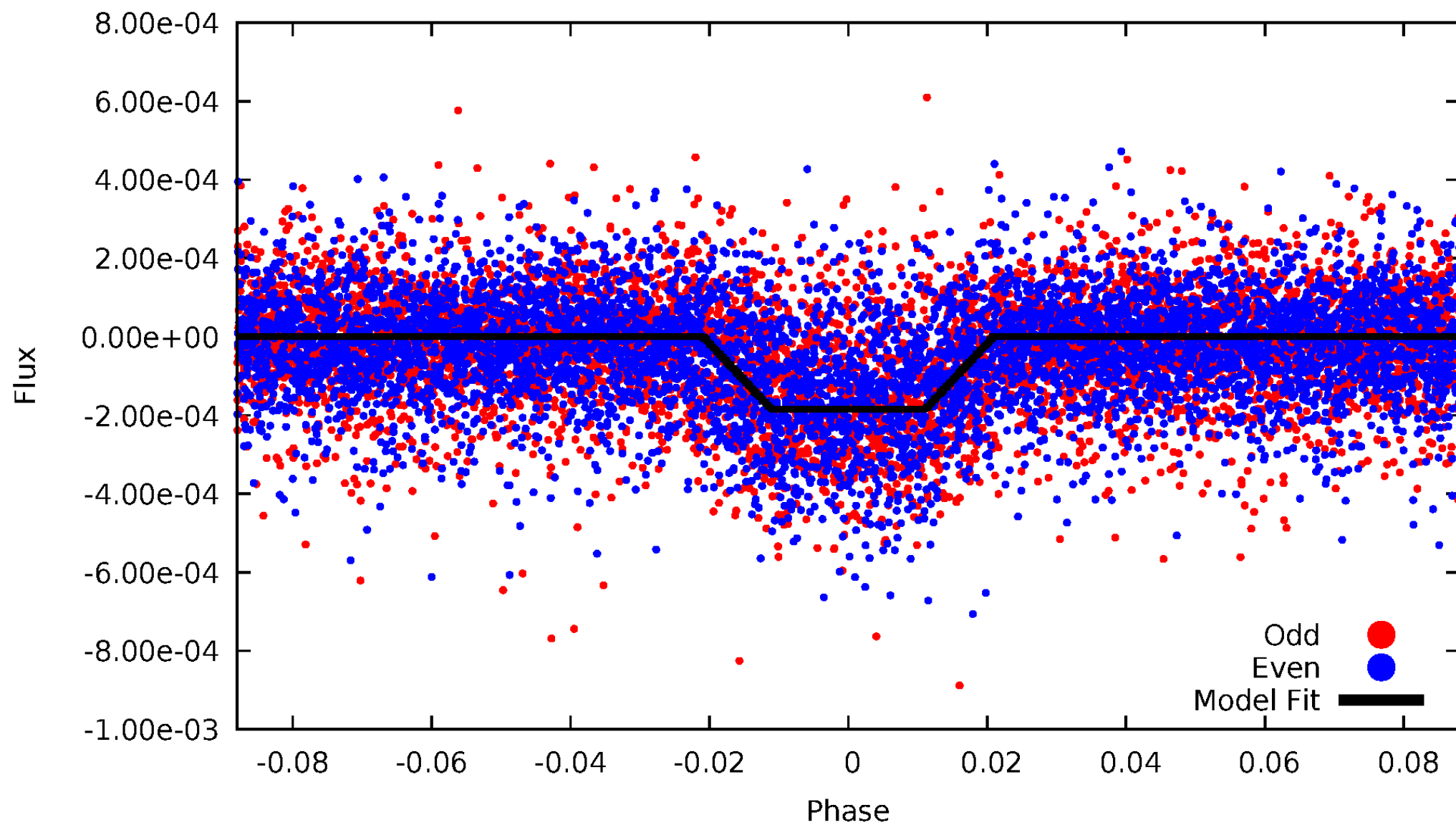
DV Odd/Even

TCE 004743513-02



# ALT Odd/Even

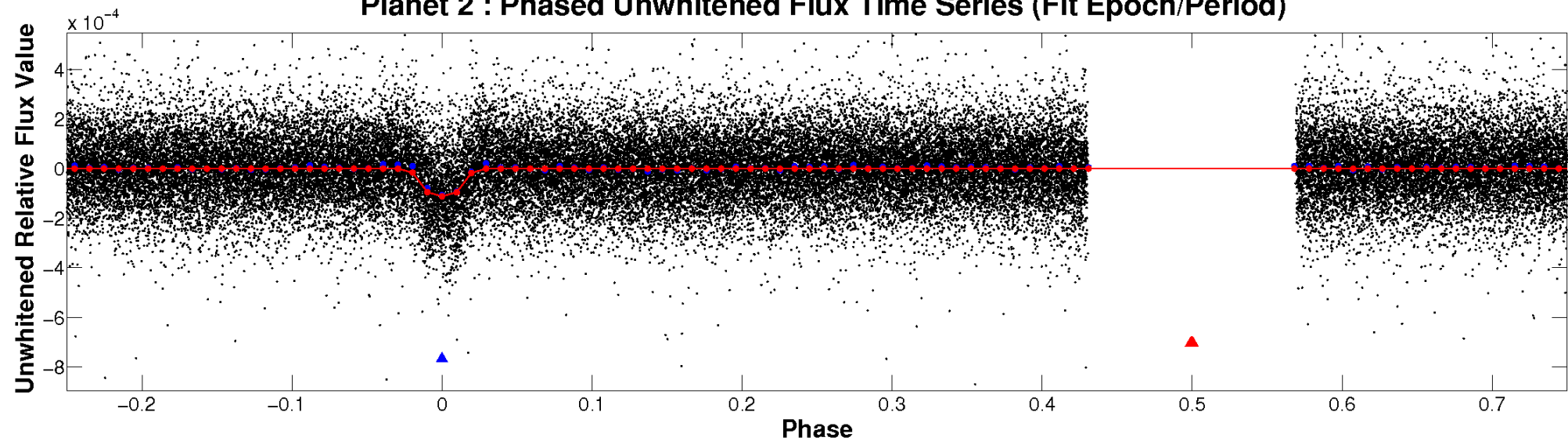
TCE 004743513-02



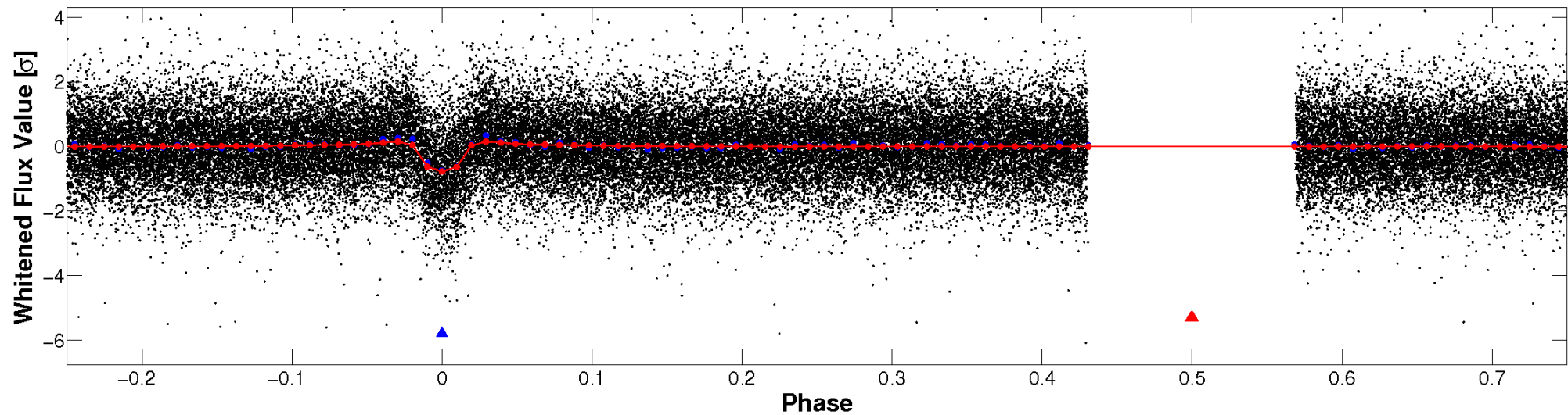


# Non-Whitened Vs. Whitened Light Curve

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

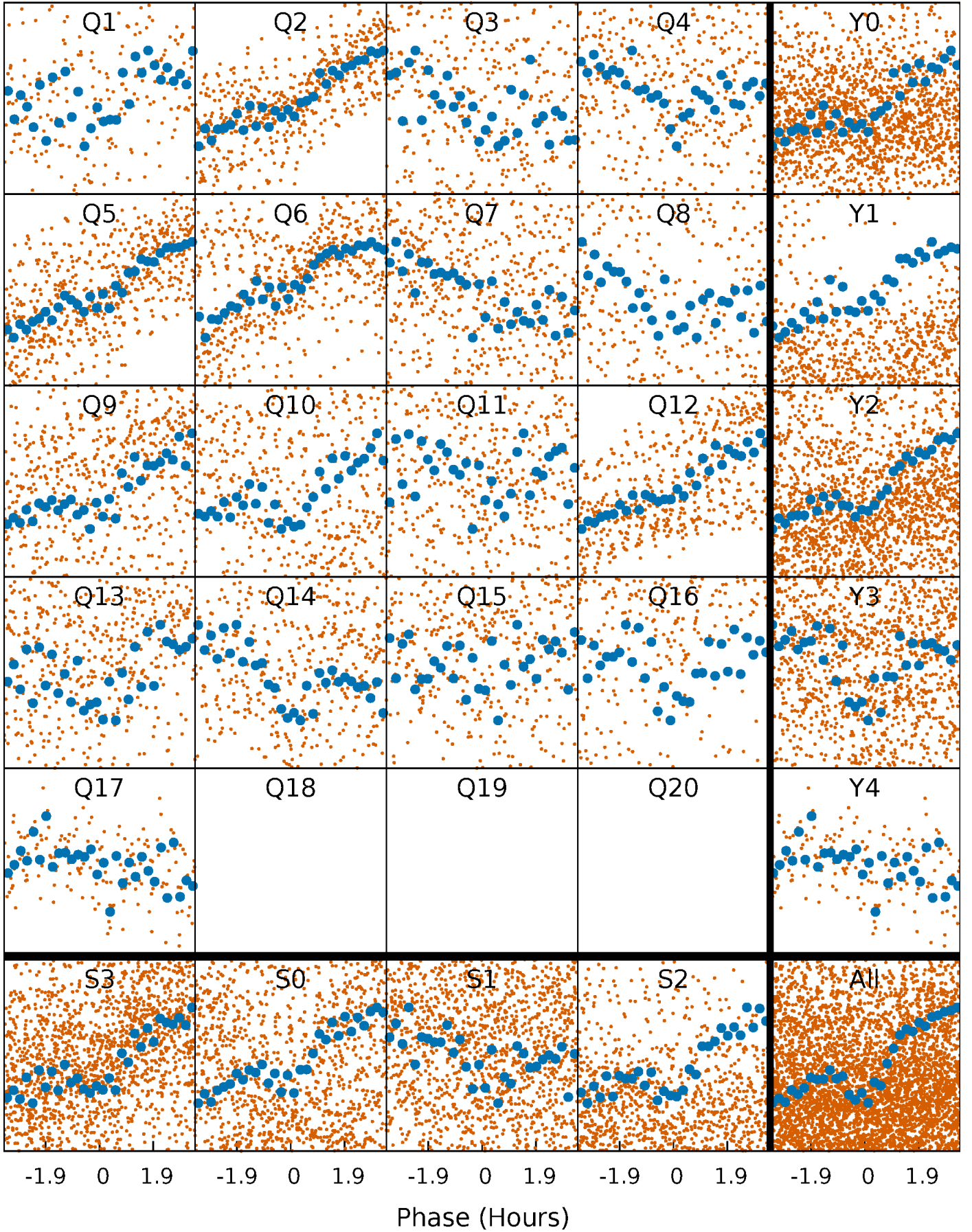


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



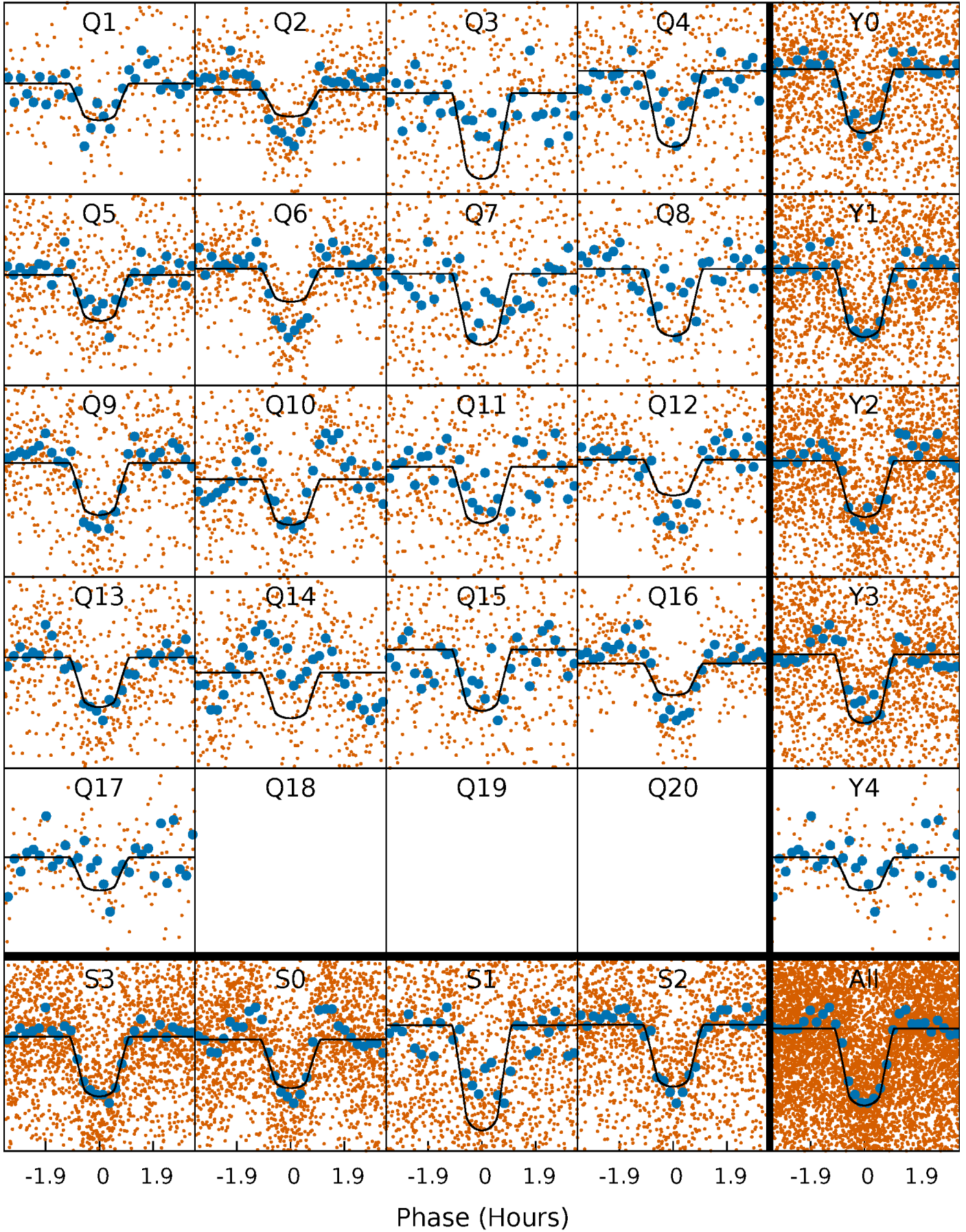
# PDC Quarter-Phased Transit Curves

TCE 004743513-02   P= 2.086065 Days    $T_0=132.377255$  (BKJD)



# DV Quarter-Phased Transit Curves

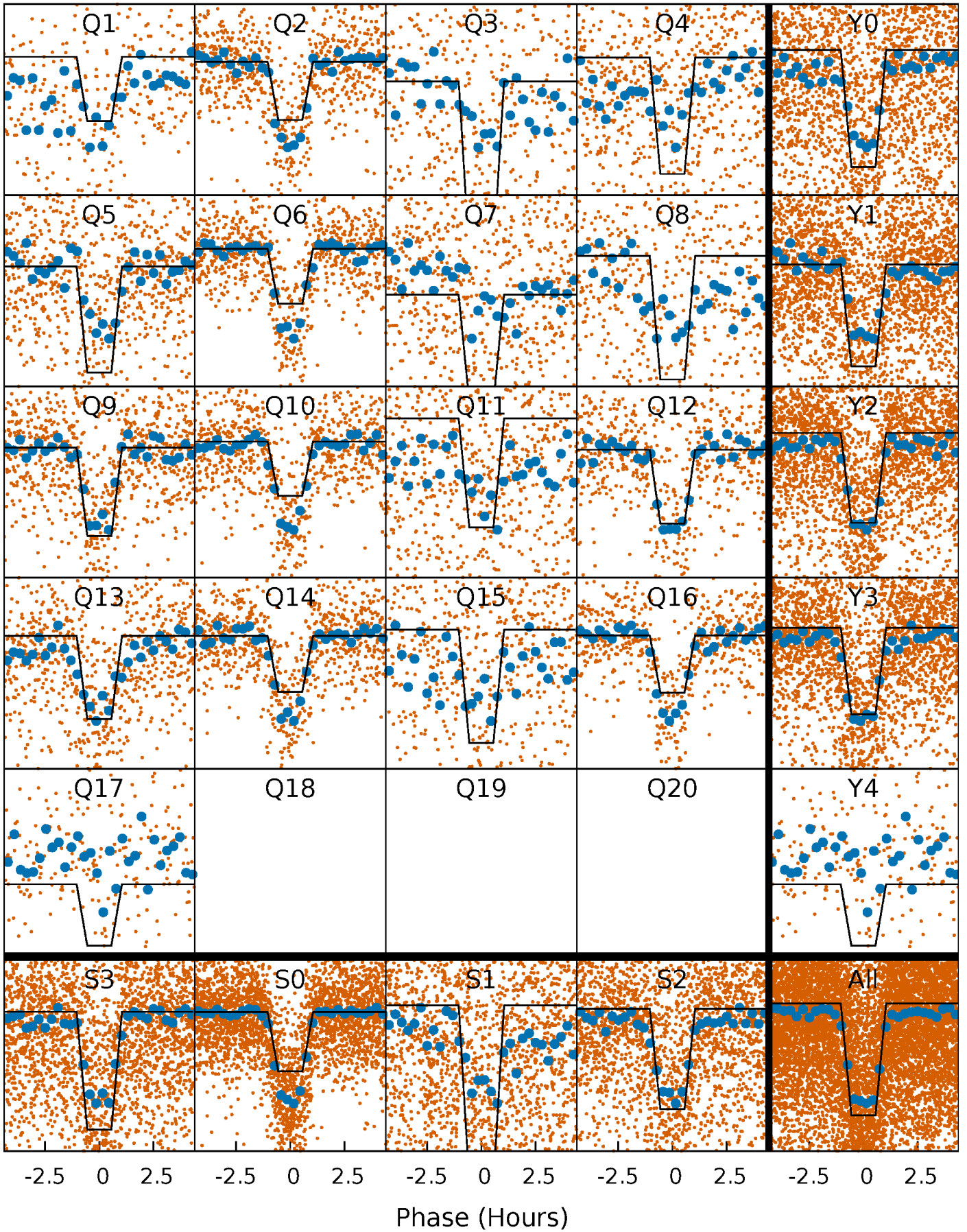
TCE 004743513-02   P= 2.086065 Days    $T_0=132.377255$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

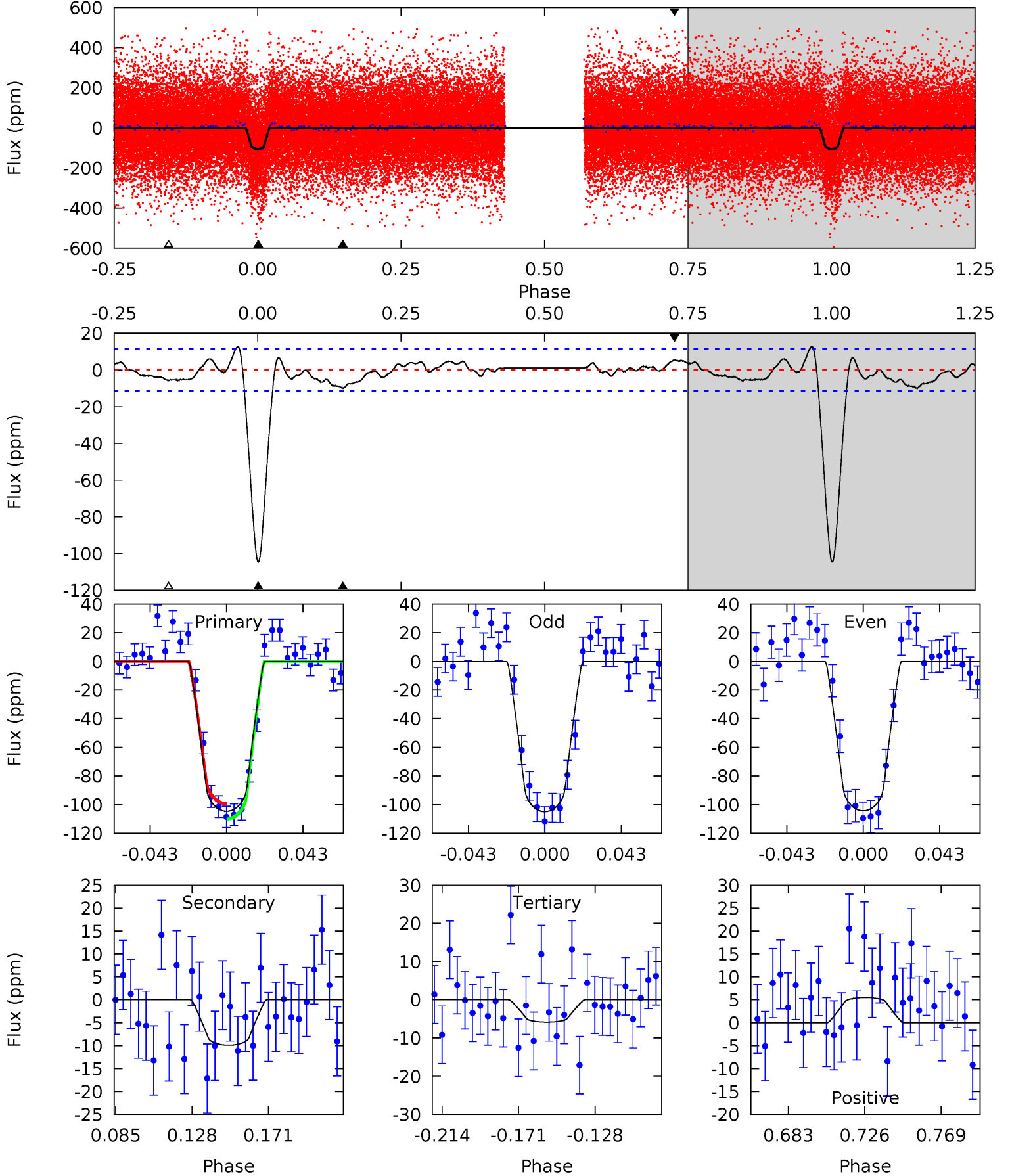
TCE 004743513-02 P= 2.086081 Days  $T_0=132.373121$  (BKJD)



# DV Model-Shift Uniqueness Test

004743513-02, P = 2.086065 Days, E = 130.291190 Days

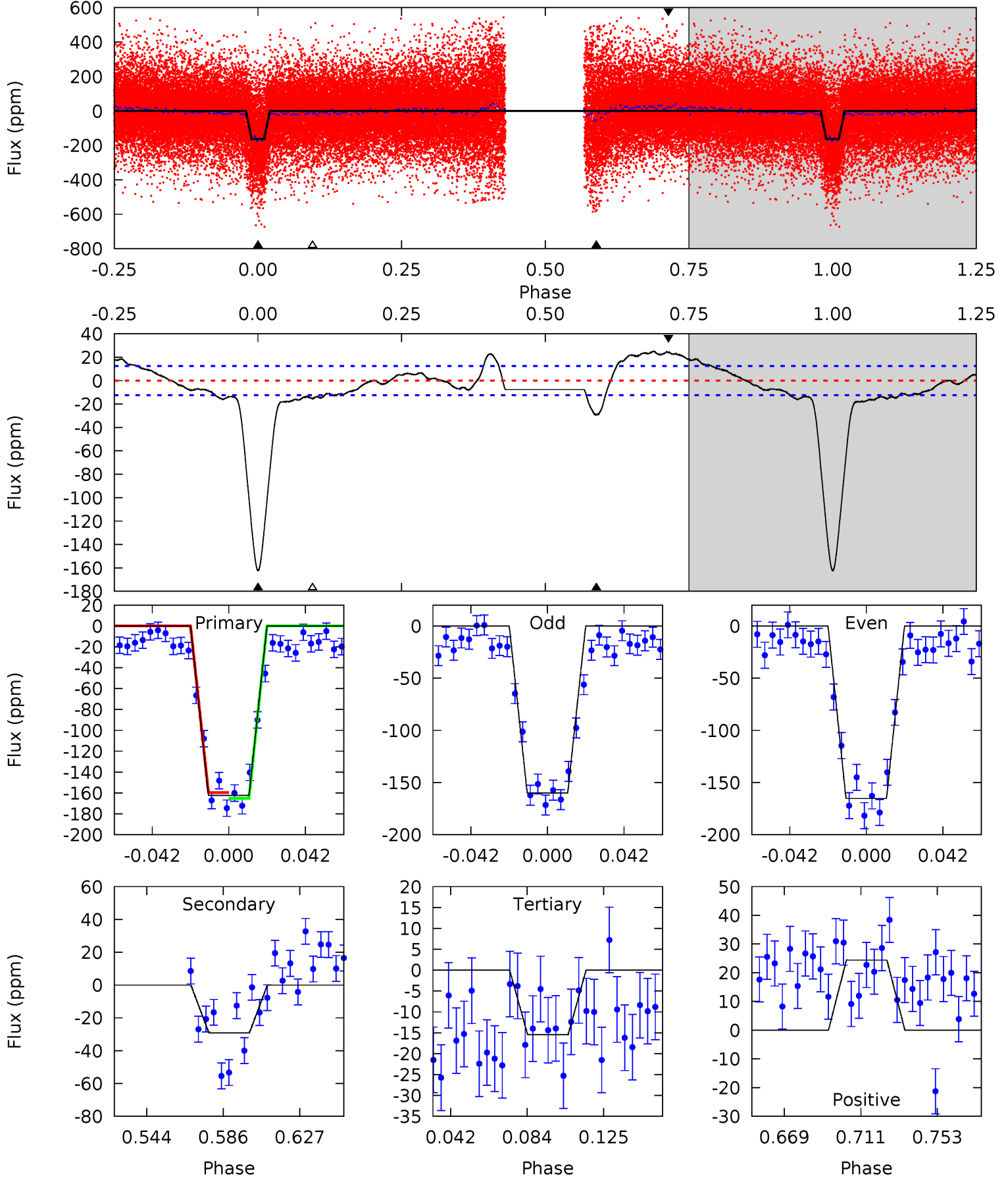
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
43.6	4.13	2.44	2.29	4.74	2.03	1.30	41.2	41.3	1.69	1.85	0.13	0.96	0.11	2.26



# Alt Model-Shift Uniqueness Test

004743513-02, P = 2.086081 Days, E = 130.287040 Days

Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
61.7	11.1	5.87	9.27	4.74	2.04	4.89	55.8	52.4	5.20	1.80	1.01	0.96	0.13	1.07





### Stellar Parameters For KIC 004743513

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6131^{+168}_{-153}$	$4.071^{+0.294}_{-0.126}$	$-0.740^{+0.300}_{-0.250}$	$1.417^{+0.287}_{-0.431}$	$0.862^{+0.119}_{-0.064}$	$0.427^{+0.745}_{-0.182}$
	+3%/-2%	+7%/-3%	+41%/-34%	+20%/-30%	+14%/-7%	+175%/-43%
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 004743513-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-10 \pm 2$	$1.71^{+0.43}_{-0.41}$	$2552^{+168}_{-214}$	$3539^{+340}_{-294}$	$1.725^{+1.406}_{-0.671}$
Alt.	$-29 \pm 3$	$2.04^{+0.43}_{-0.41}$	$2548^{+162}_{-198}$	$4087^{+281}_{-250}$	$3.631^{+2.084}_{-1.225}$

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

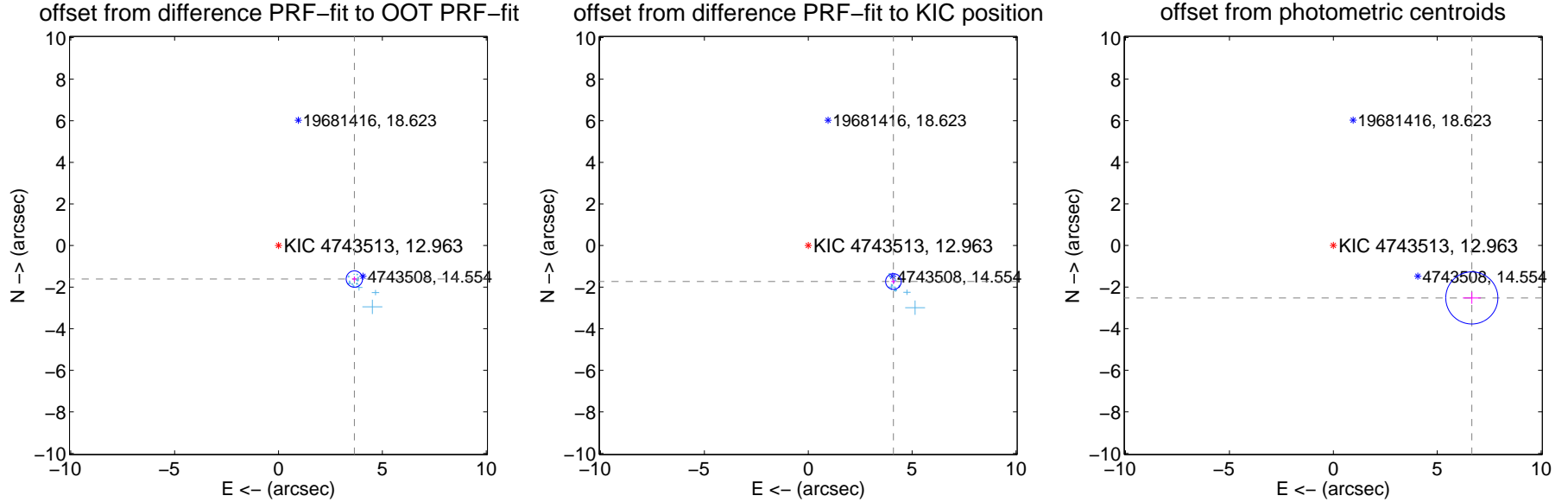
## DV Centroid Data

Supplemental centroid analysis for 004743513-02. Kepler magnitude: 12.96. Transit SNR 30.89

There are 16 quarters with good PRF difference image offsets

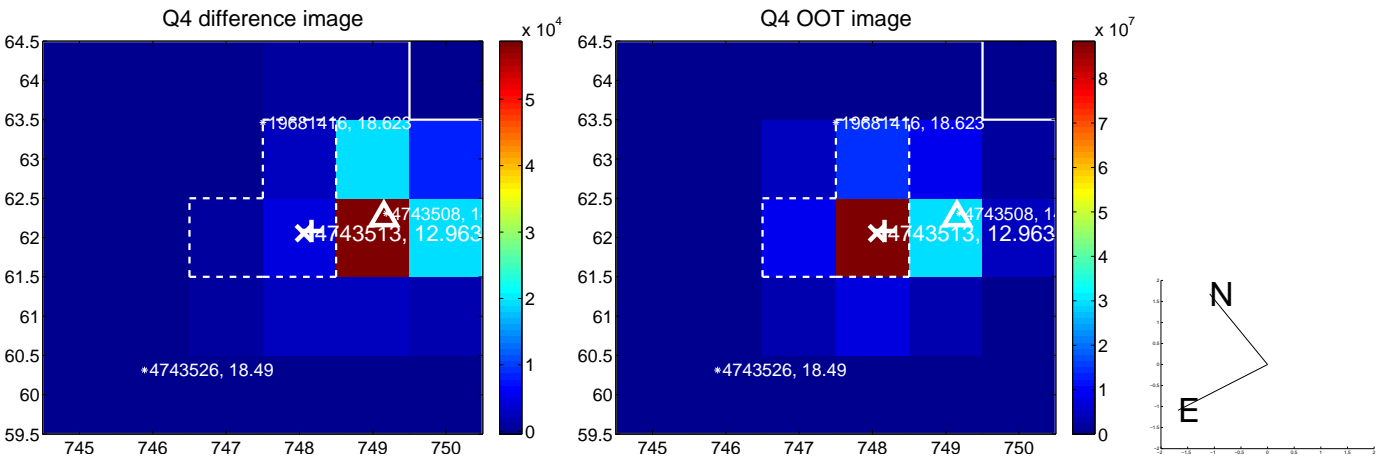
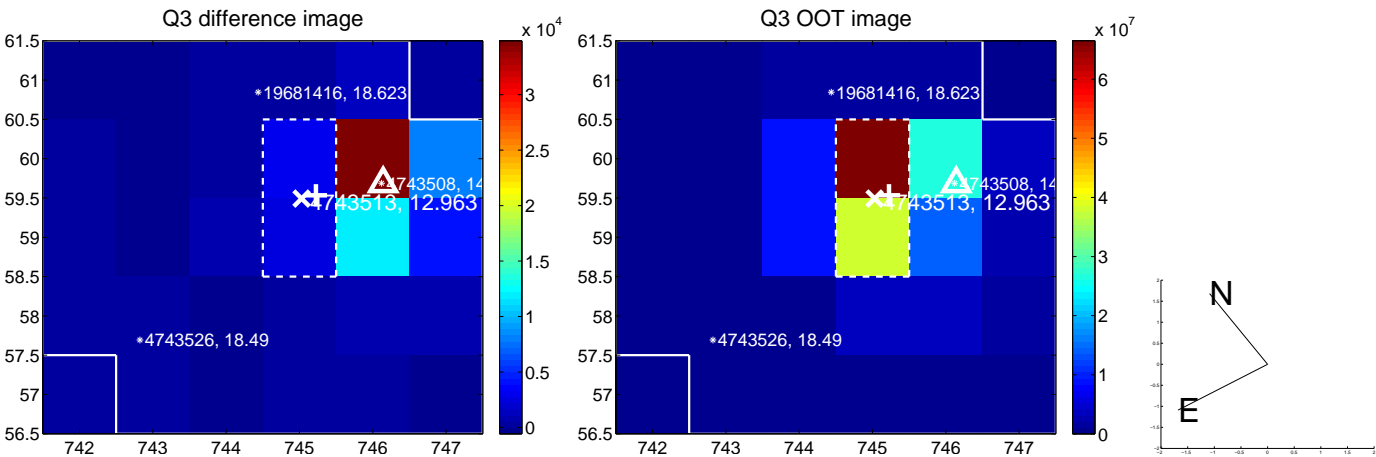
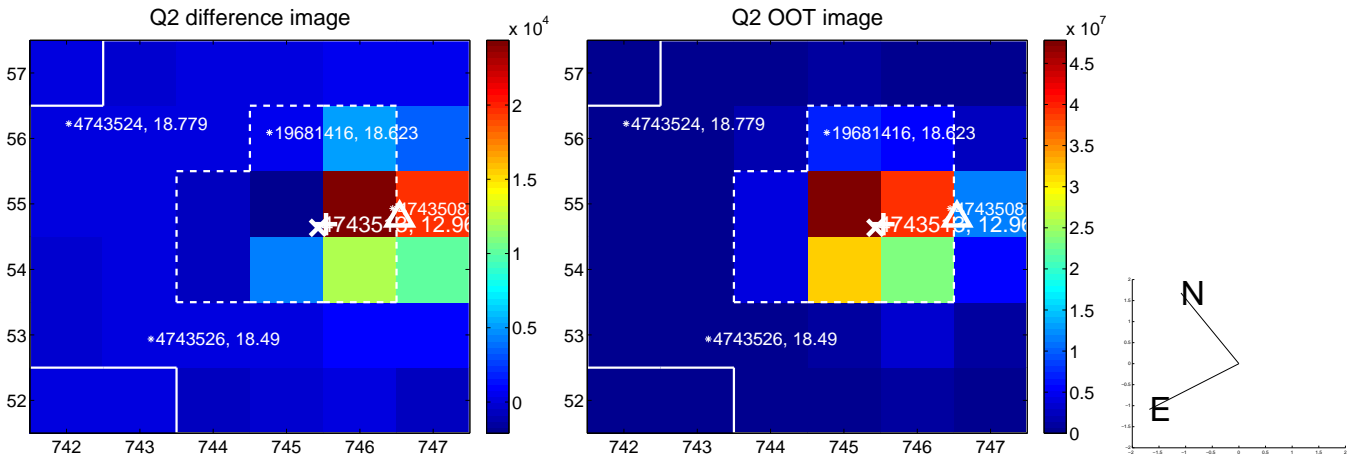
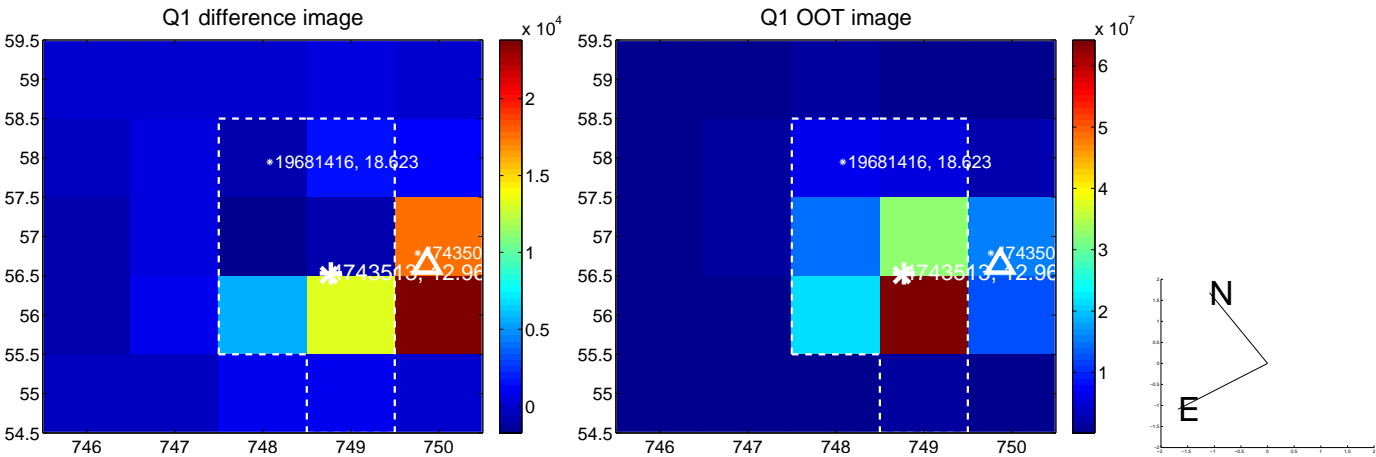
The direct PRF centroid is offset from the target star catalog position by about 0.38 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$3.990 \pm 0.131$	30.45	$-3.651 \pm 0.114$	$-1.611 \pm 0.113$
PRF-fit source offset from KIC position	$4.449 \pm 0.126$	35.41	$-4.100 \pm 0.104$	$-1.729 \pm 0.116$
photometric centroid source offset	$7.12 \pm 0.42$	17.05	$-6.66 \pm 0.43$	$-2.52 \pm 0.28$

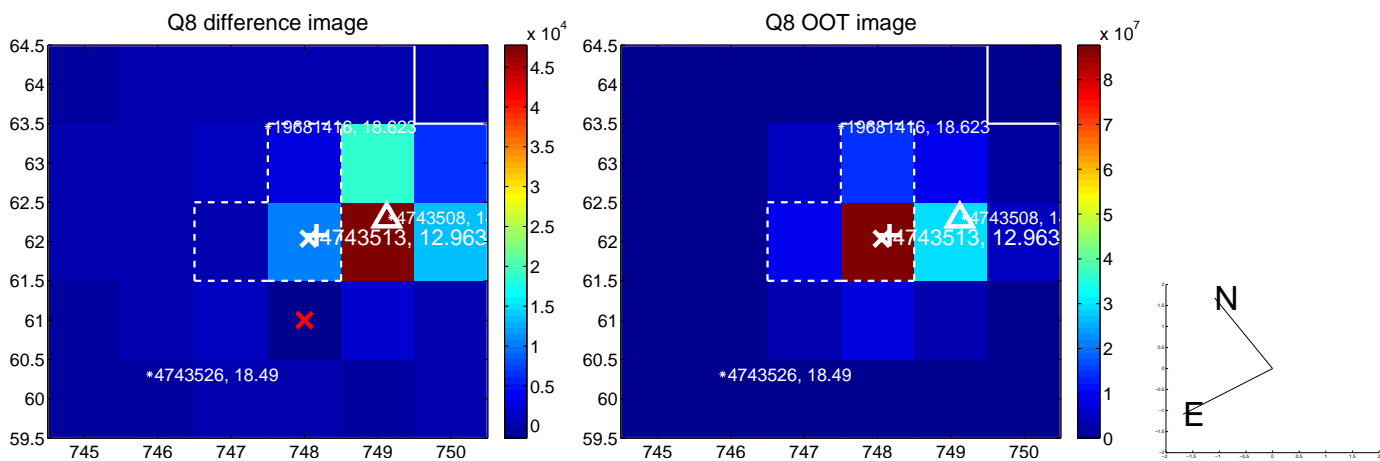
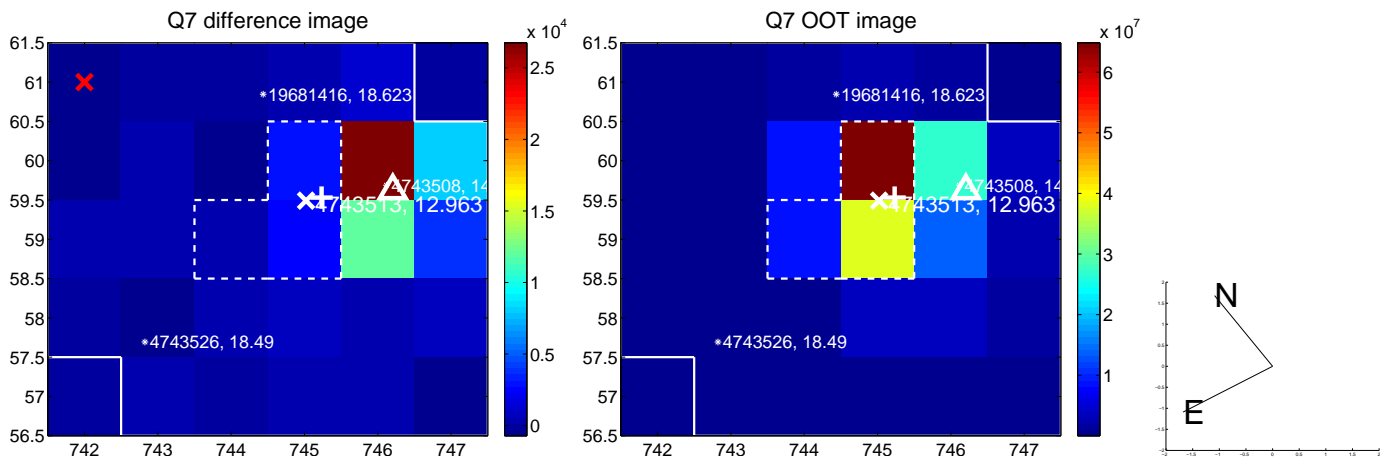
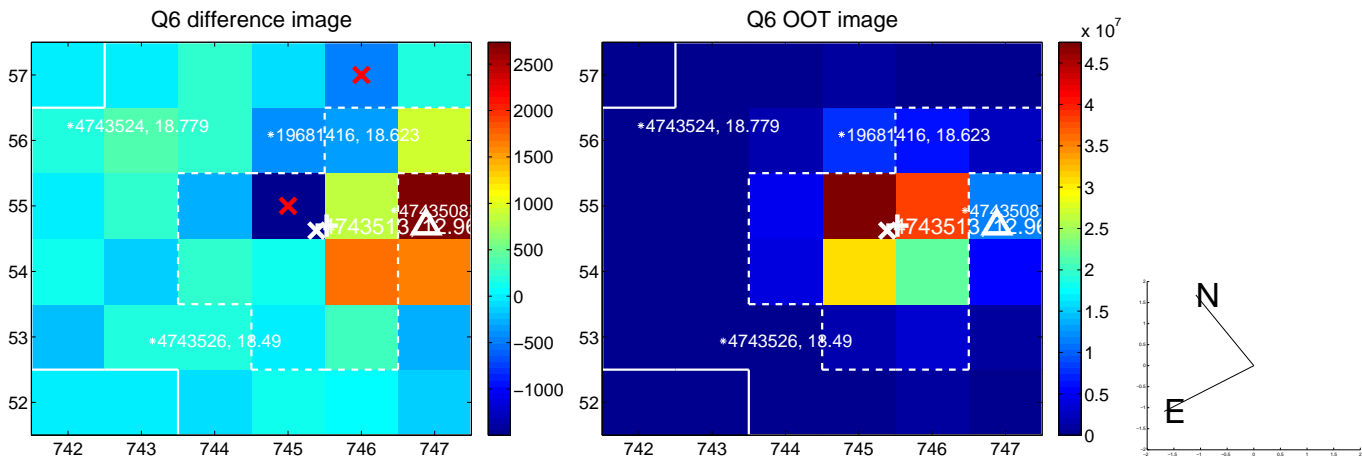
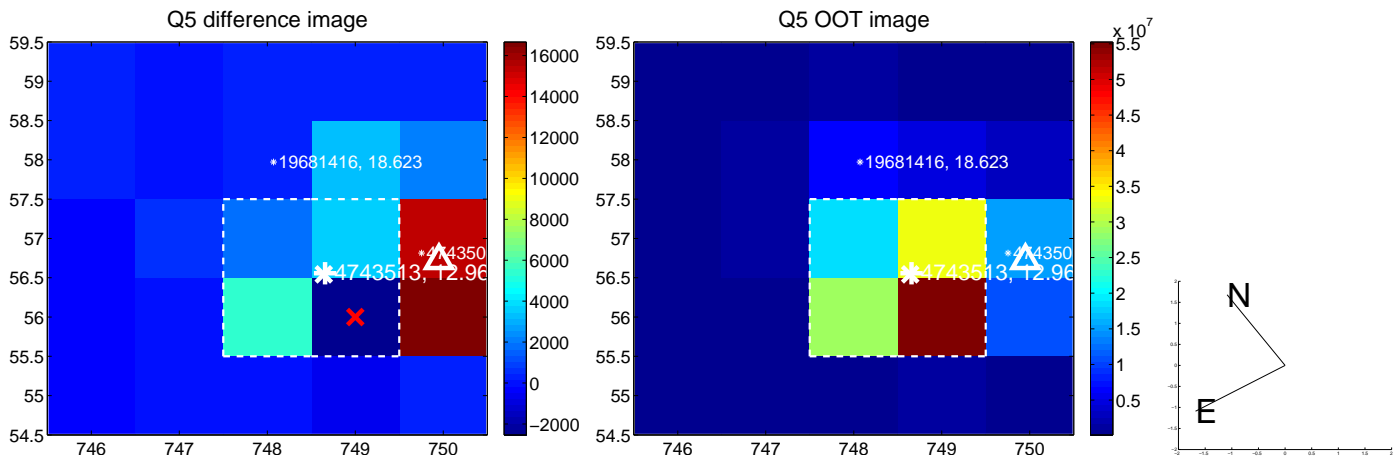


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets**; **Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

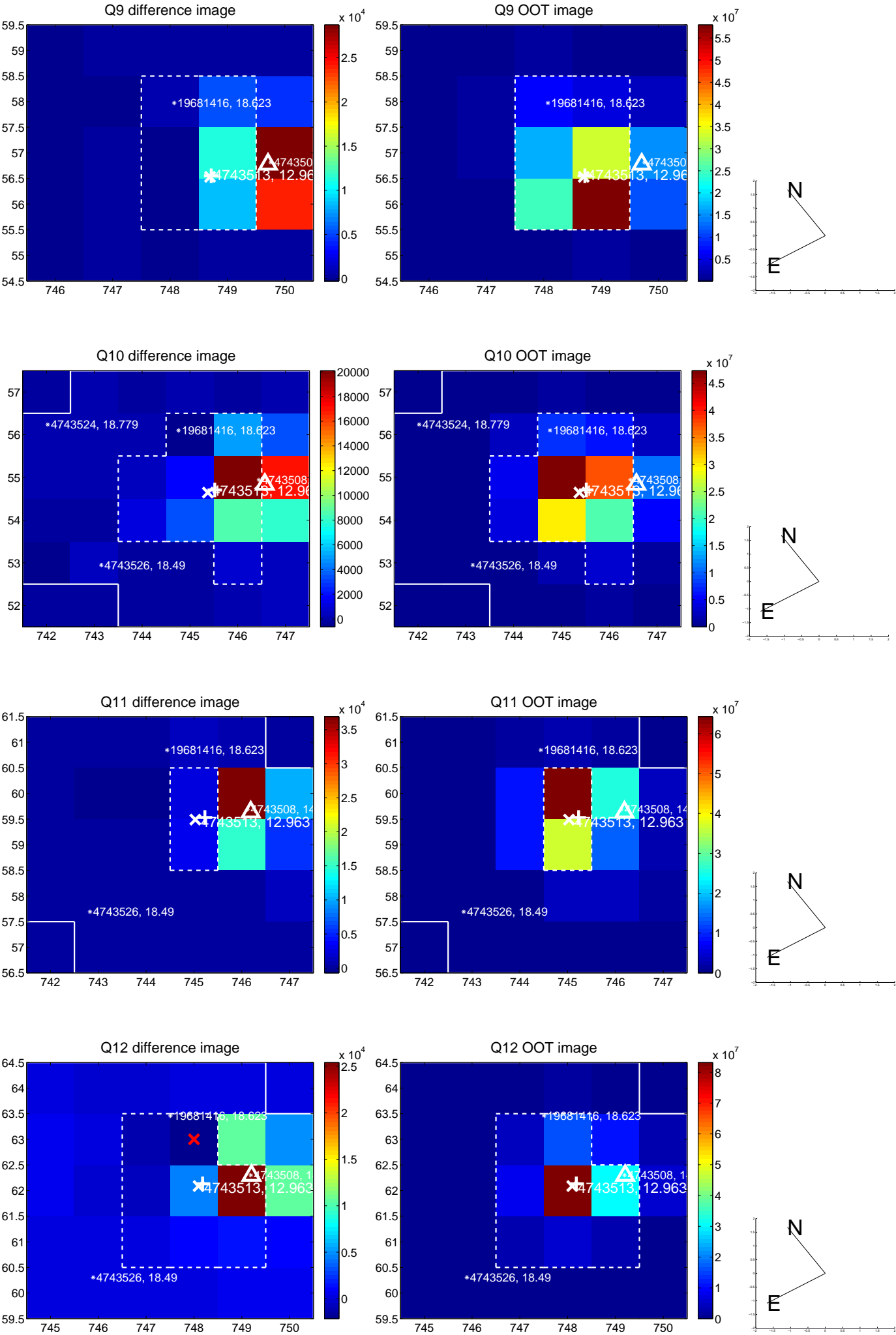
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



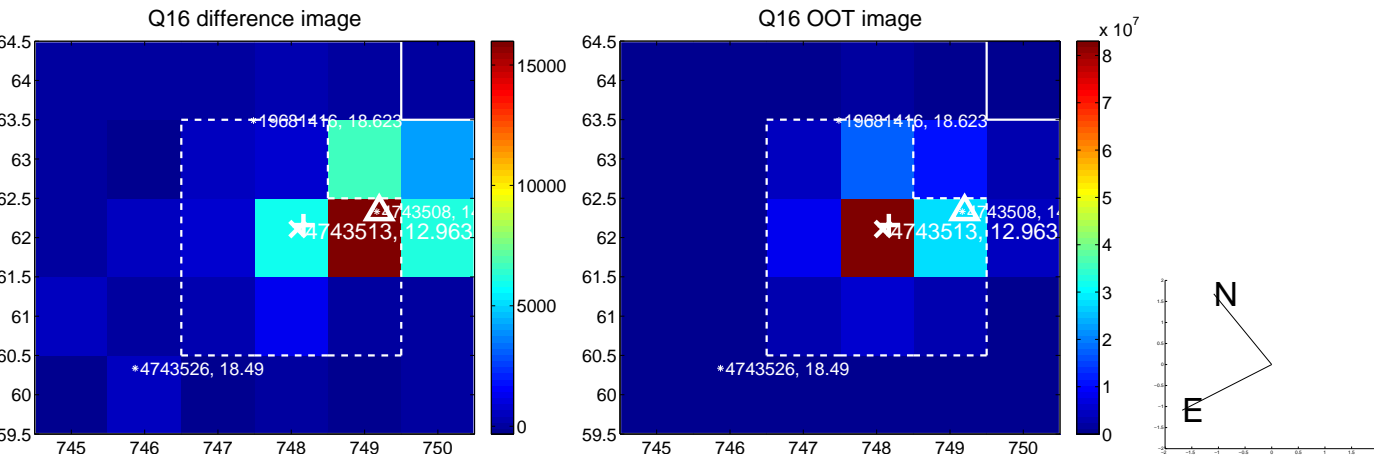
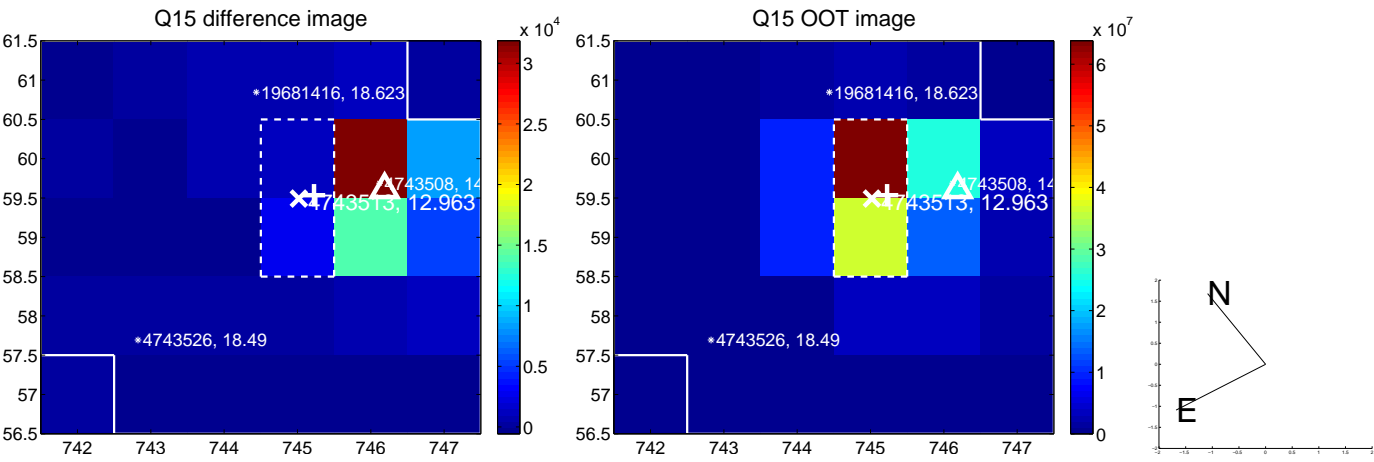
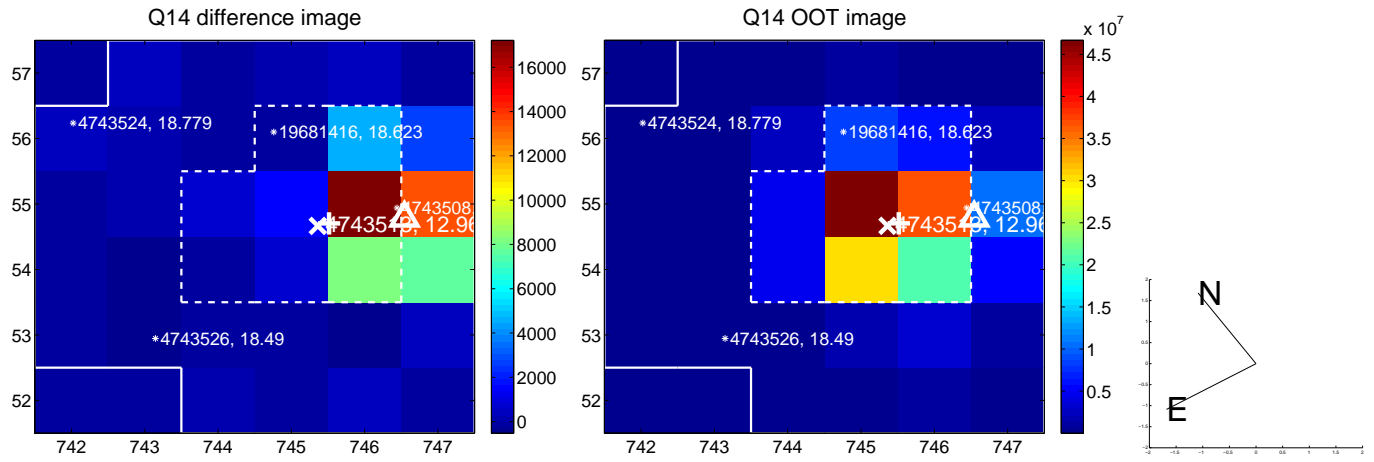
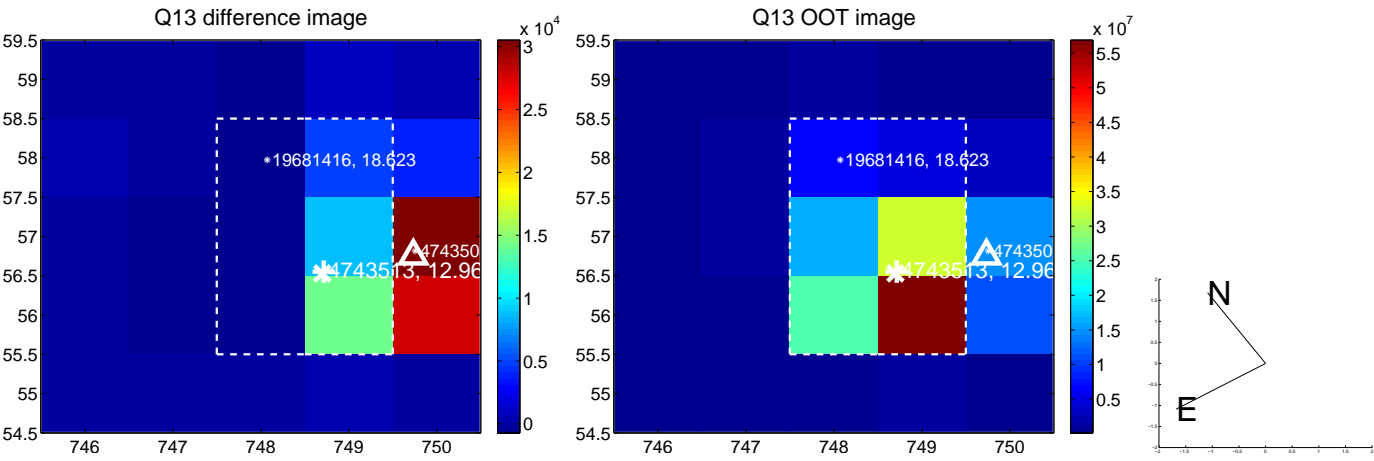
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



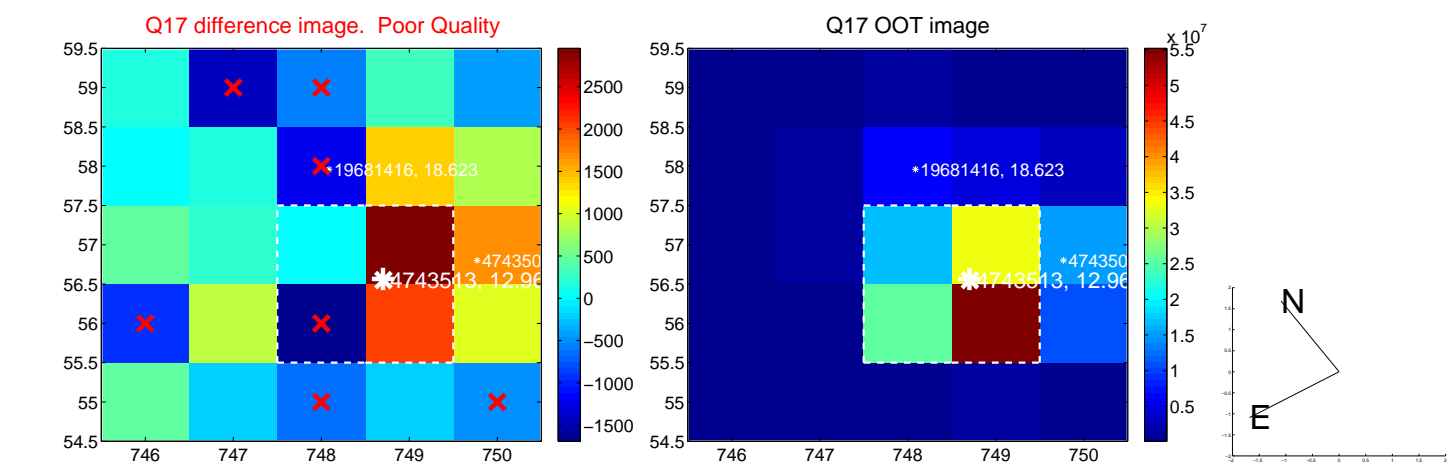
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



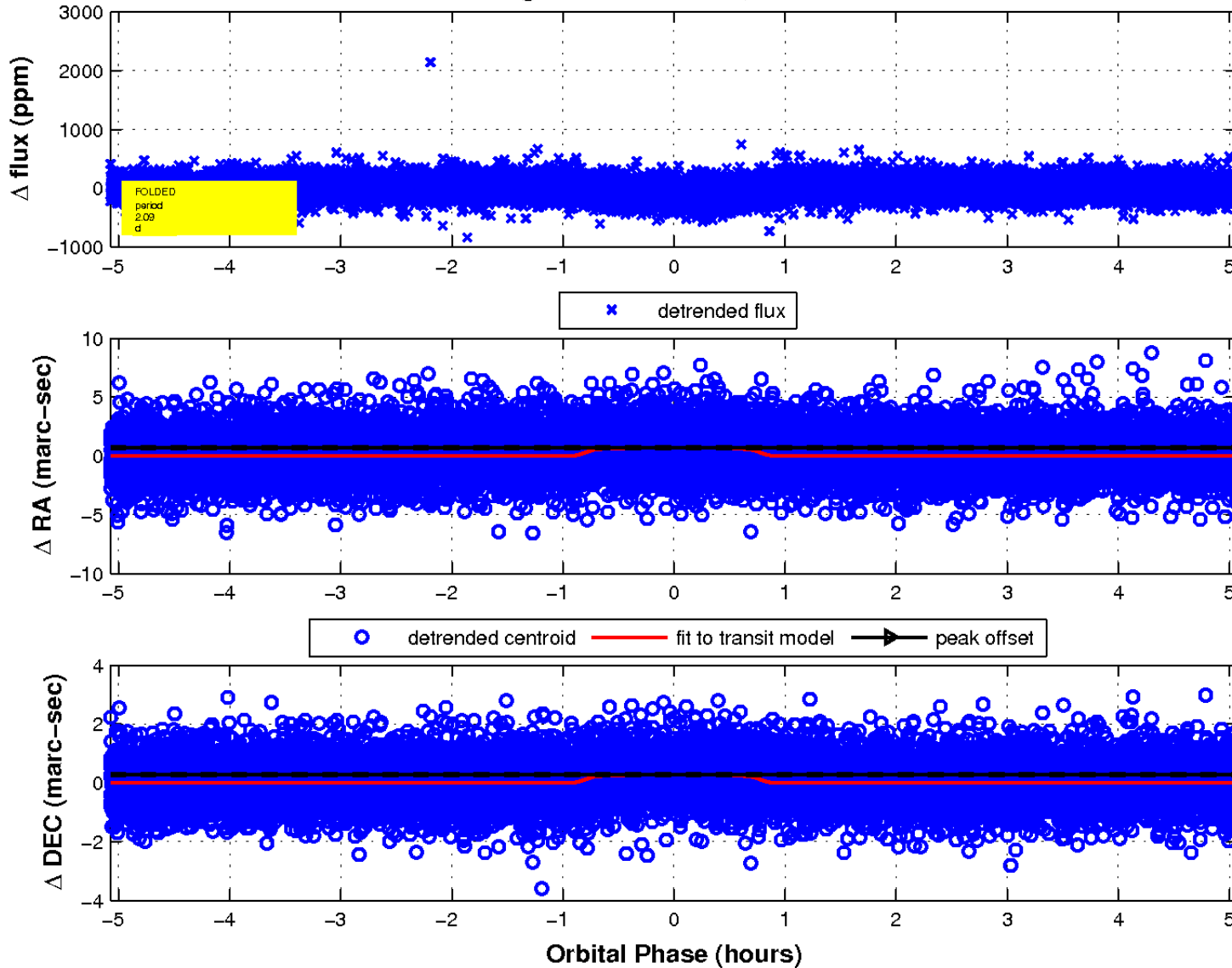
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



### fluxWeightedCentroids, Planet 2 of 2





UKIRT Image

Declination

