

# KIC 004043443

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
004043443-01	OBS	0231.01	119.839989	161.863865	5435.3	3.611	74.3	72.2	0.68	4602	8.27	1.01
004043443-02	OBS	No	119.840431	137.656967	4828.8	2.678	60.2	67.6	0.68	4602	7.28	1.01

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
004043443-01	OBS	FP	0.00	0	1	0	0	MOD_SEC_DV—MOD_SEC_ALT—DEEP_V_SHAPED—HAS_SEC_TCE
004043443-02	OBS	FP	0.00	1	1	0	0	IS_SEC_TCE

**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.

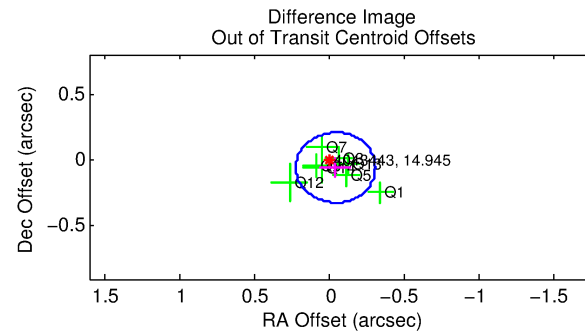
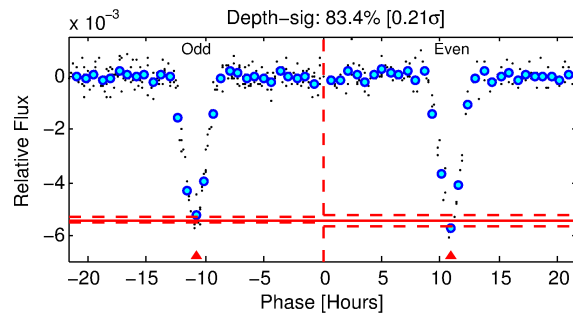
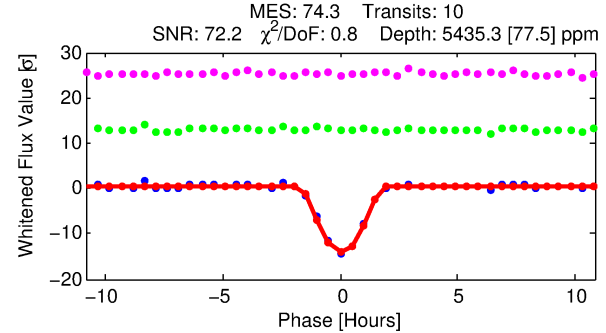
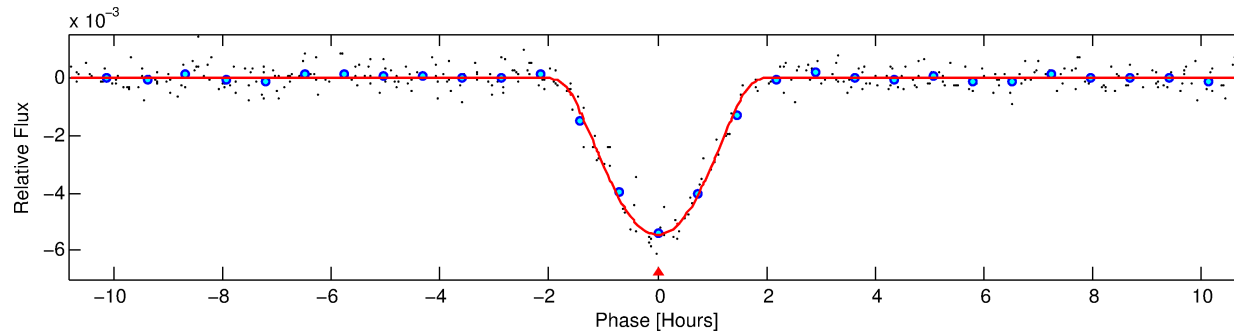
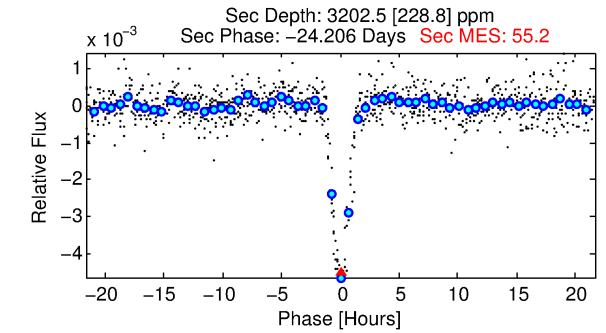
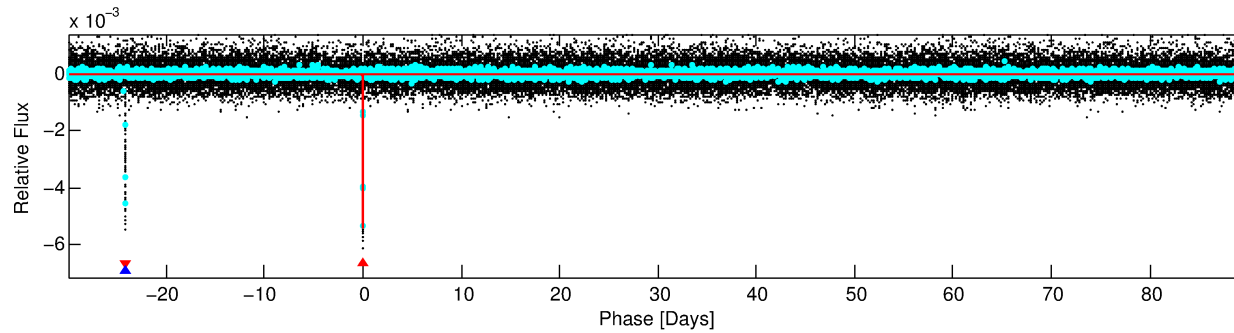
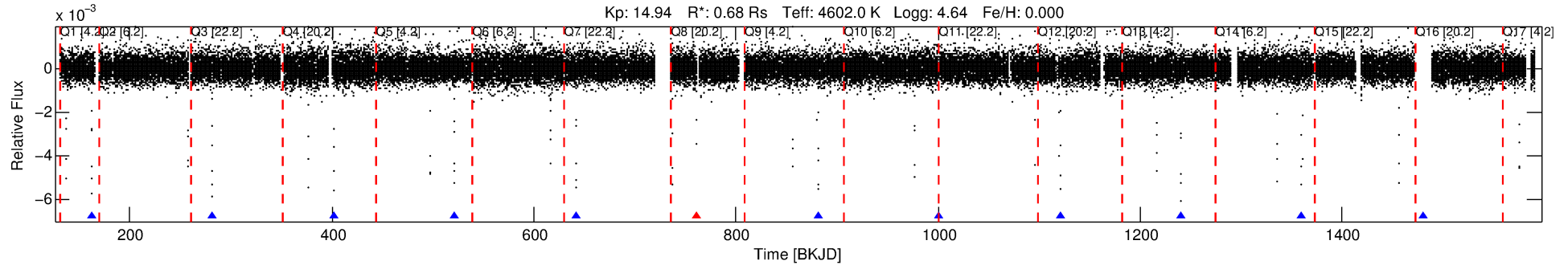
## Ephemeris Match Information For 004043443-01

No Significant Match Found

# DV One-Page Summary

KIC: 4043443 Candidate: 1 of 2 Period: 119.840 d

KOI: K00231.01 Corr: 0.988



## DV Fit Results:

Period = 119.83999 [0.00017] d  
Epoch = 161.8639 [0.0010] BKJD  
Rp/R\* = 0.1123 [0.0480]  
a/R\* = 137.06 [13.56]  
b = 0.97 [0.08]  
Seff = 1.01 [0.11]  
Teq = 255 [7] K  
Rp = 8.27 [3.57] Re  
a = 0.4265 [0.0220] AU  
Ag = 4684.84 [4035.21] [1.16σ]  
Teffp = 3267 [704] K [4.28σ]

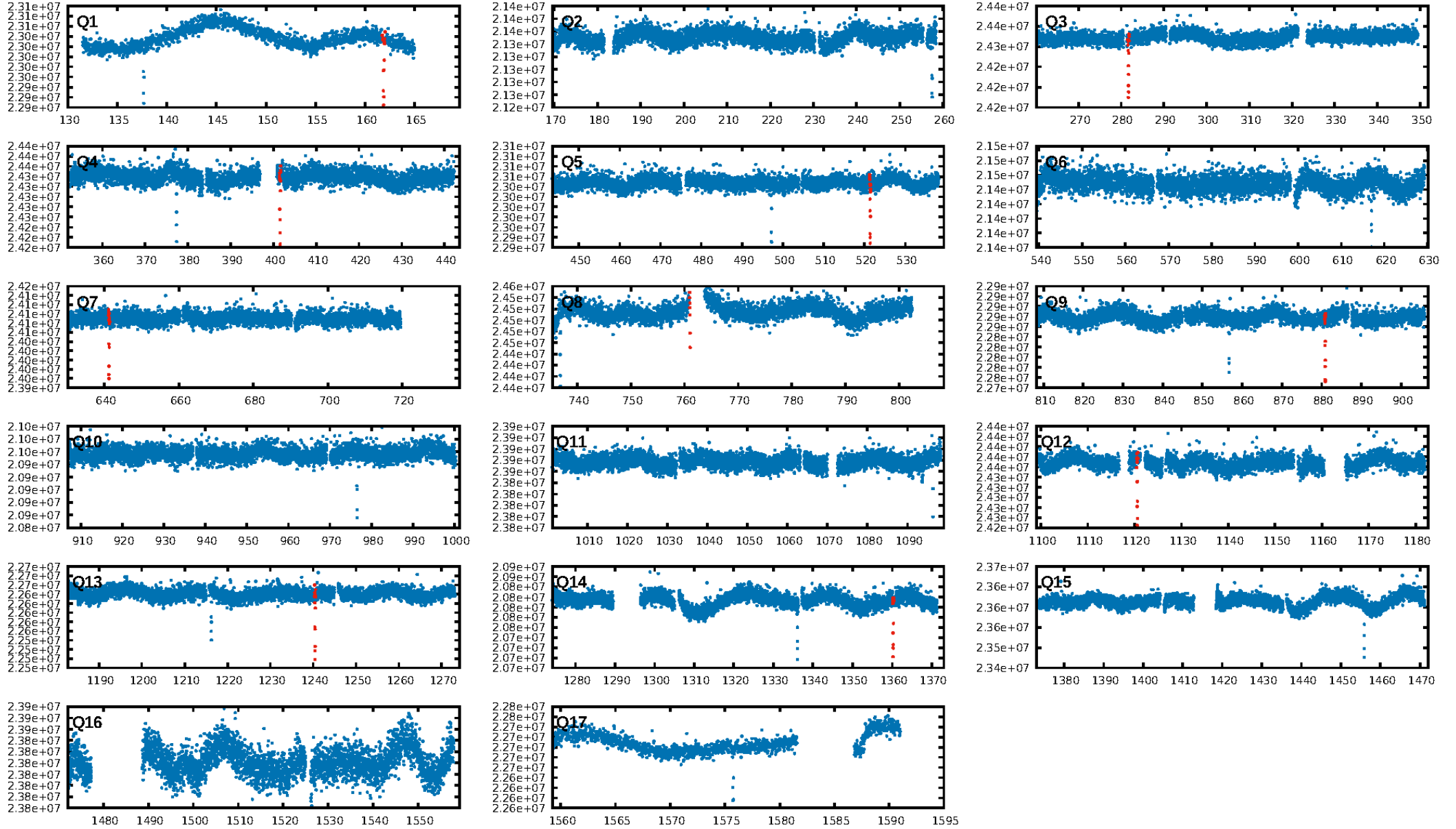
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 0.2% [0.00σ]  
ModelChiSquare2-sig: 5.5%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 0.00e+00  
RollingBand-fgt: 0.89 [8/9]  
GhostDiagnostic-chr: 4.476  
Centroid-sig: 49.9%  
Centroid-so: 0.120 arcsec [0.63σ]  
OotOffset-rm: 0.074 arcsec [0.83σ]  
OotOffset-st: 1/2/1/4 [8]  
KicOffset-rm: 0.109 arcsec [1.17σ]  
KicOffset-st: 1/2/1/4 [8]  
DiffImageQuality-fgm: 1.00 [8/8]  
DiffImageOverlap-fno: 1.00 [8/8]

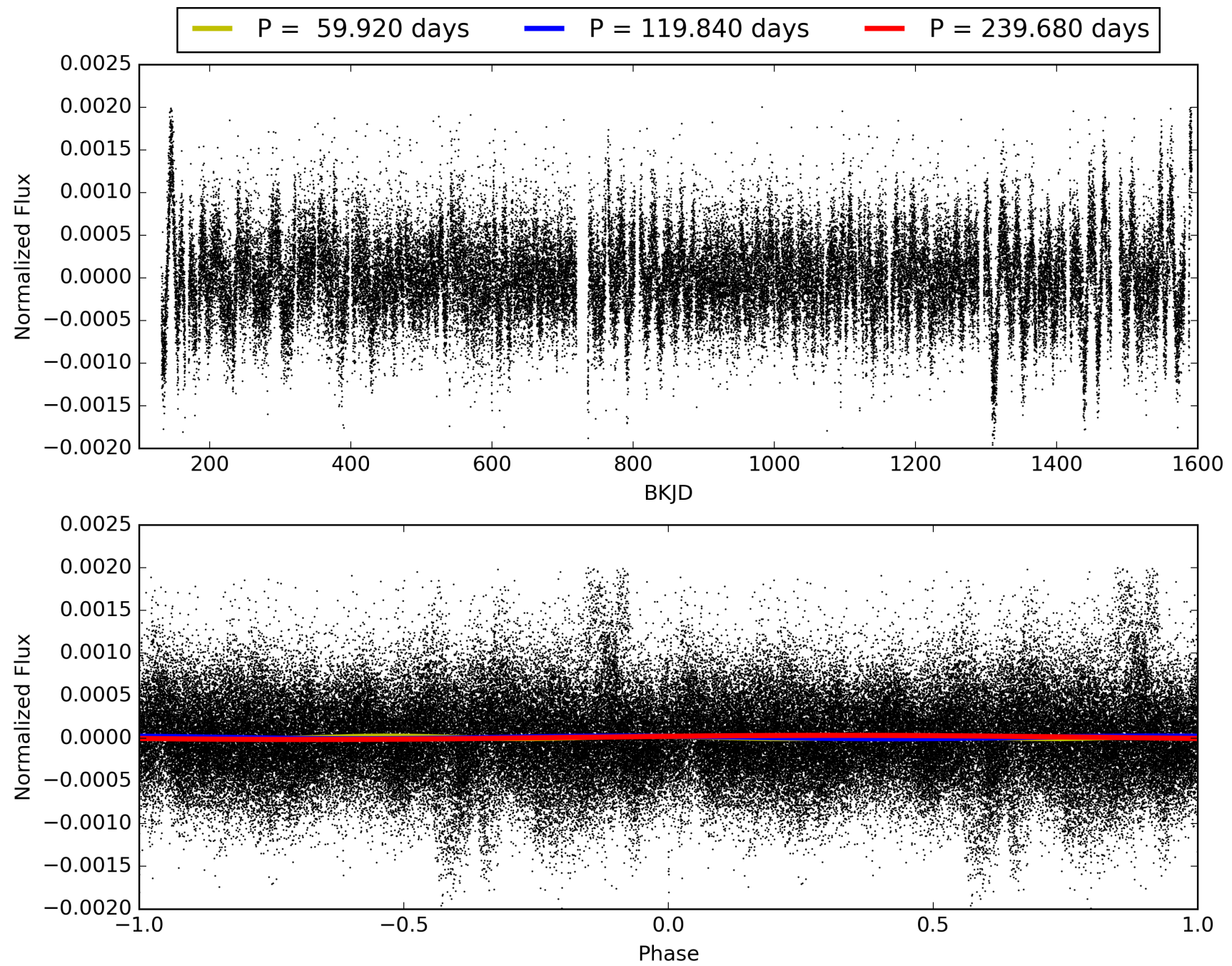
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 00:39:55 Z

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

# TCE 004043443-01, PDC Light Curves

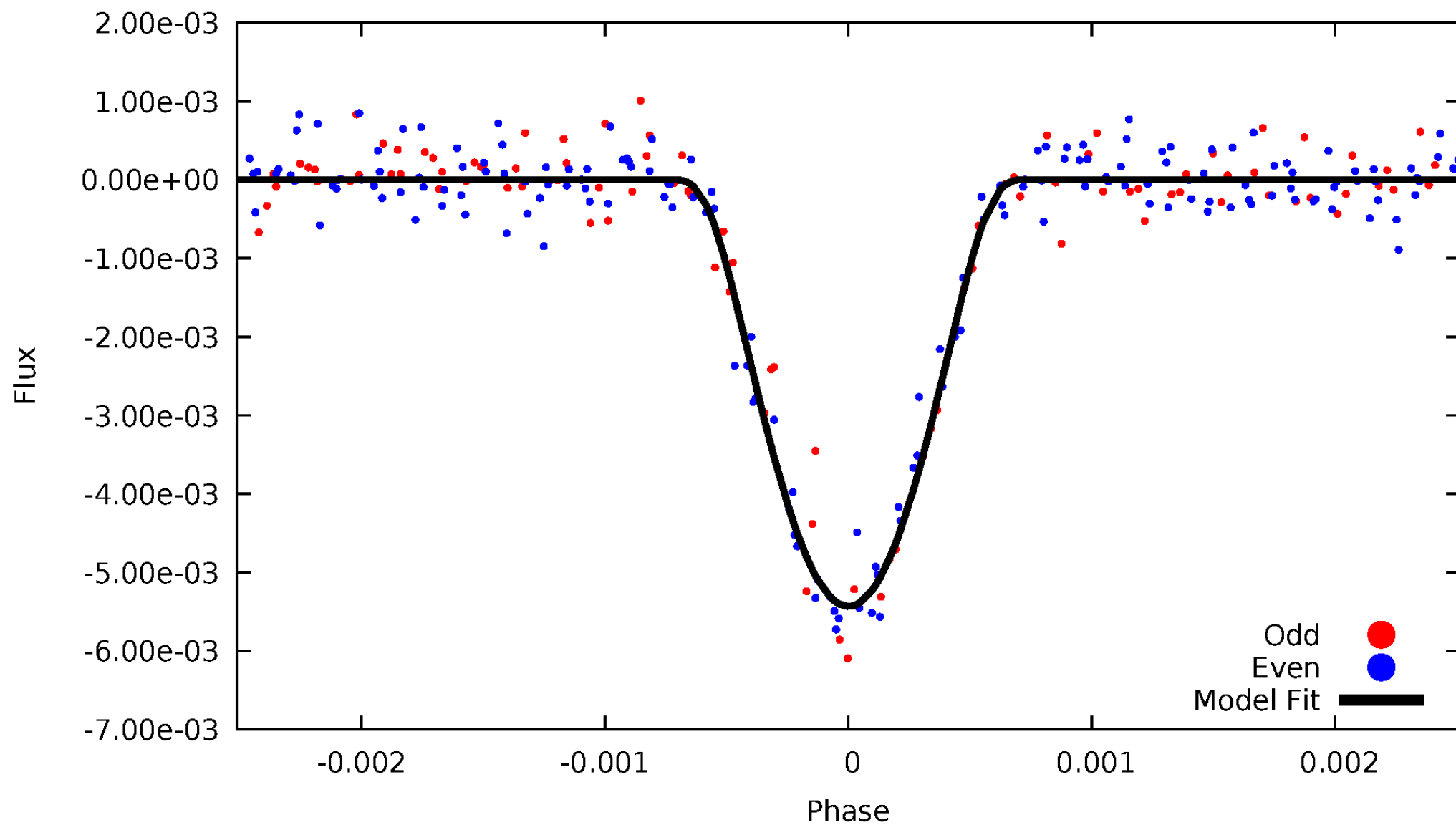


TCE 004043443-01



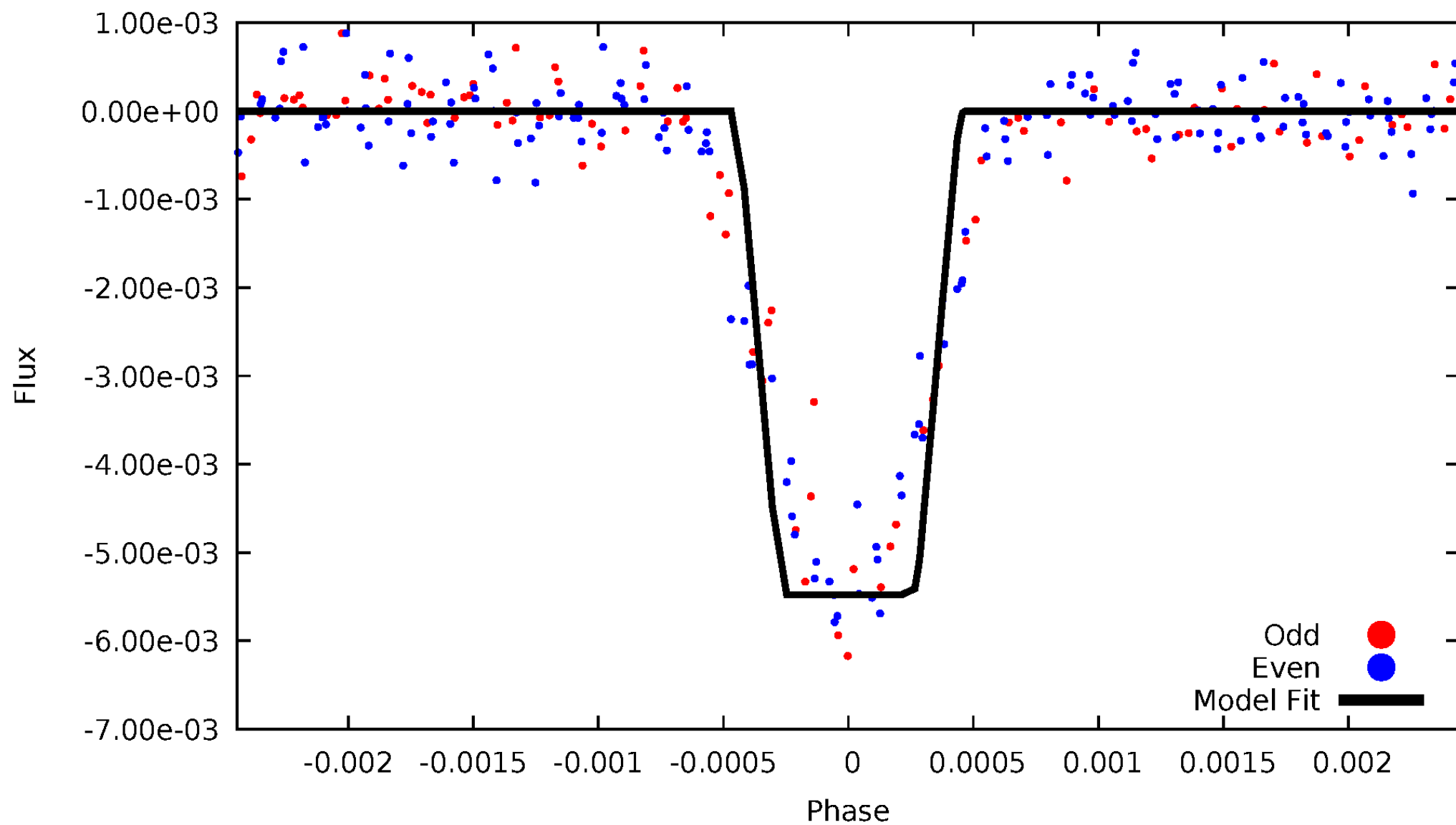
# DV Odd/Even

TCE 004043443-01

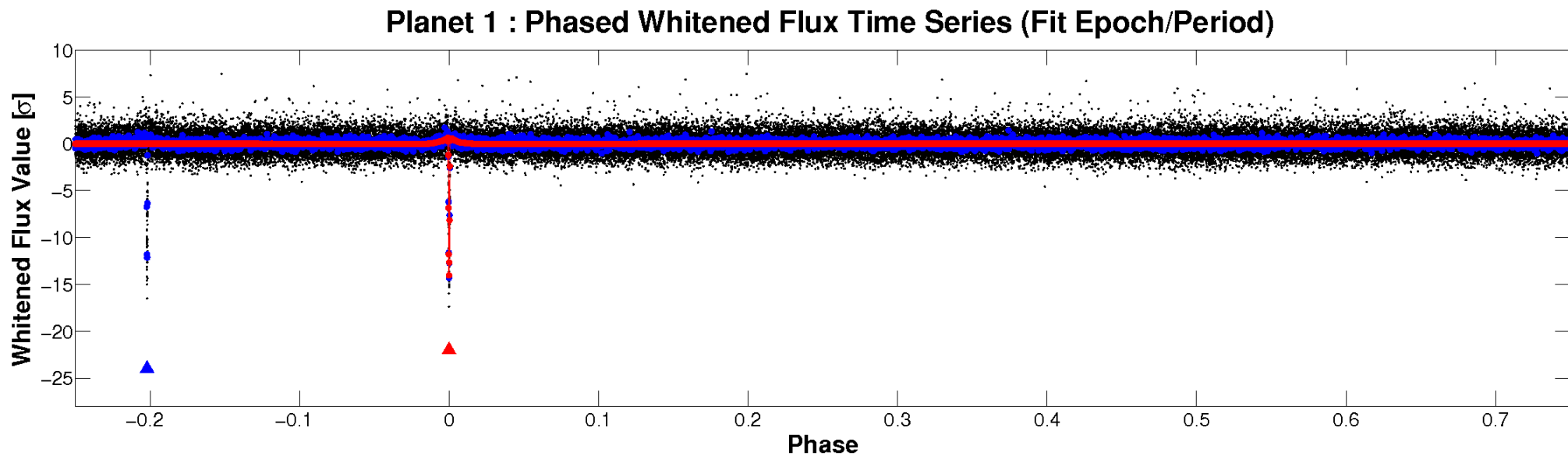
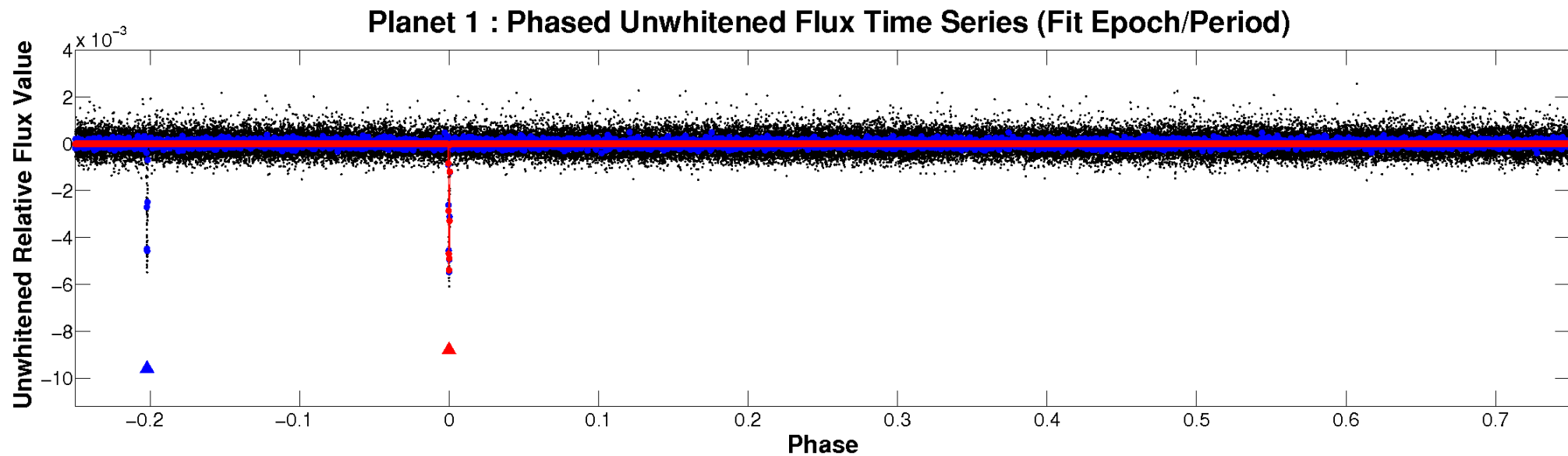


# ALT Odd/Even

TCE 004043443-01

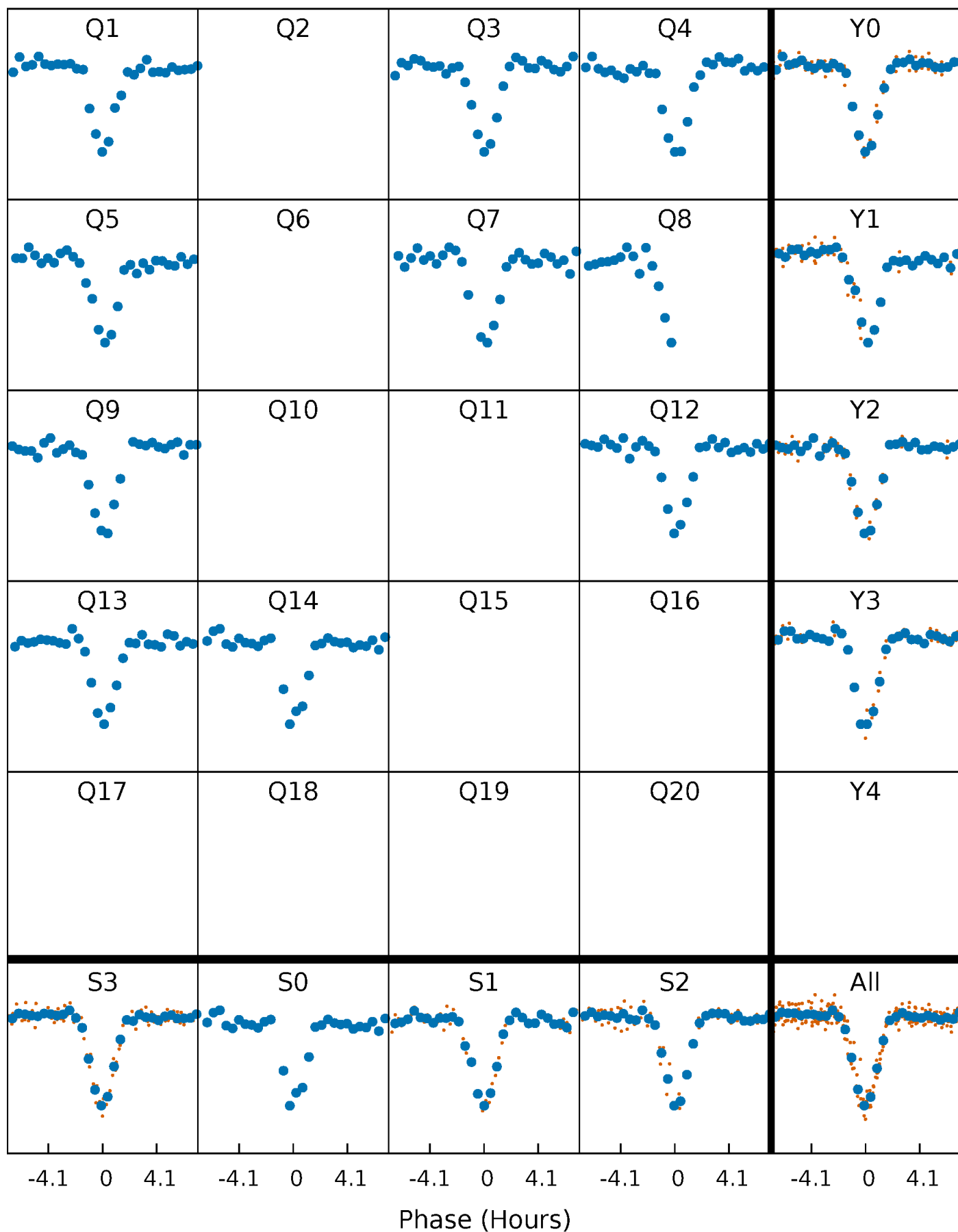


# Non-Whitened Vs. Whitened Light Curve



# PDC Quarter-Phased Transit Curves

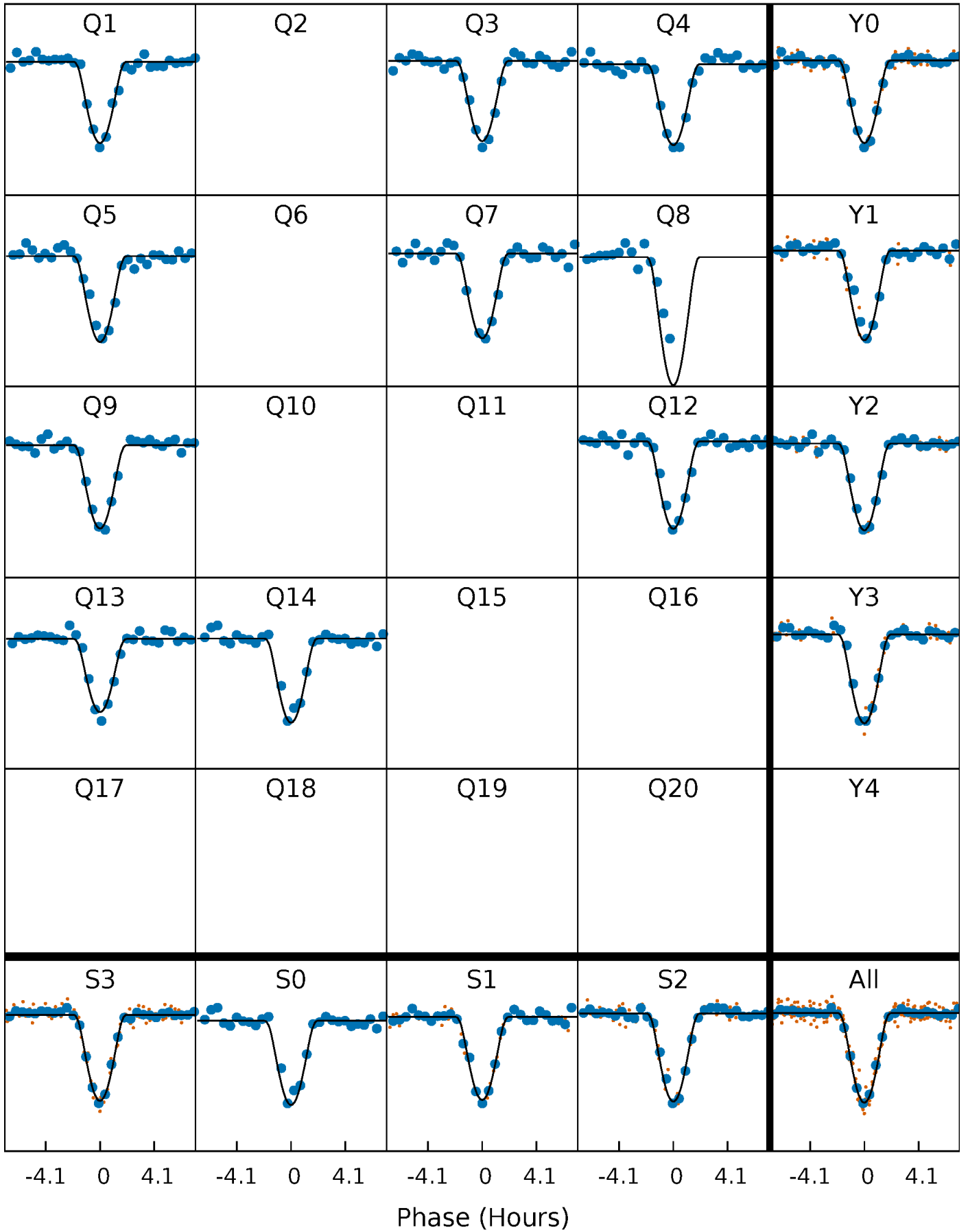
TCE 004043443-01 P=119.839989 Days  $T_0=161.863865$  (BKJD)





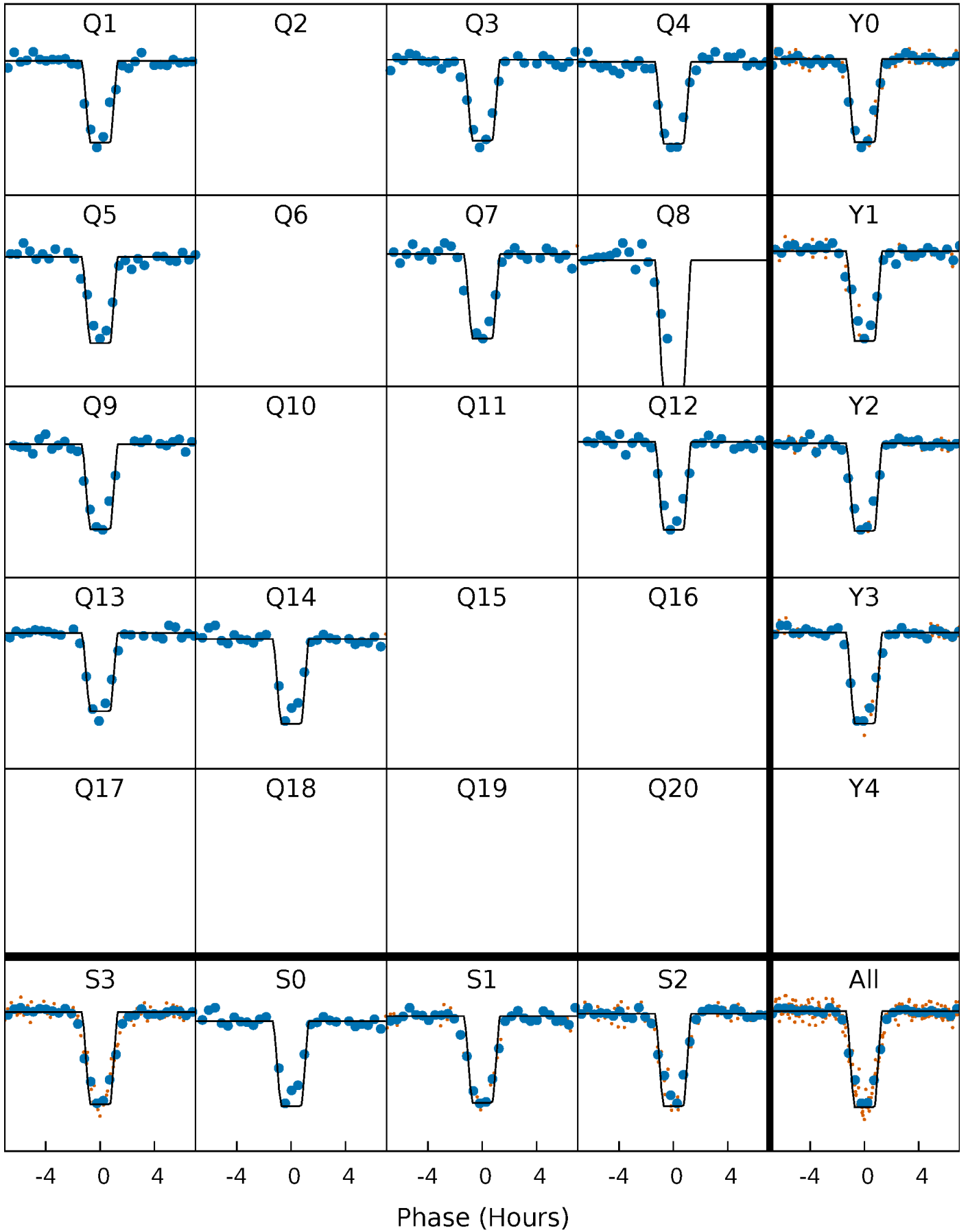
# DV Quarter-Phased Transit Curves

TCE 004043443-01 P=119.839989 Days  $T_0=161.863865$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

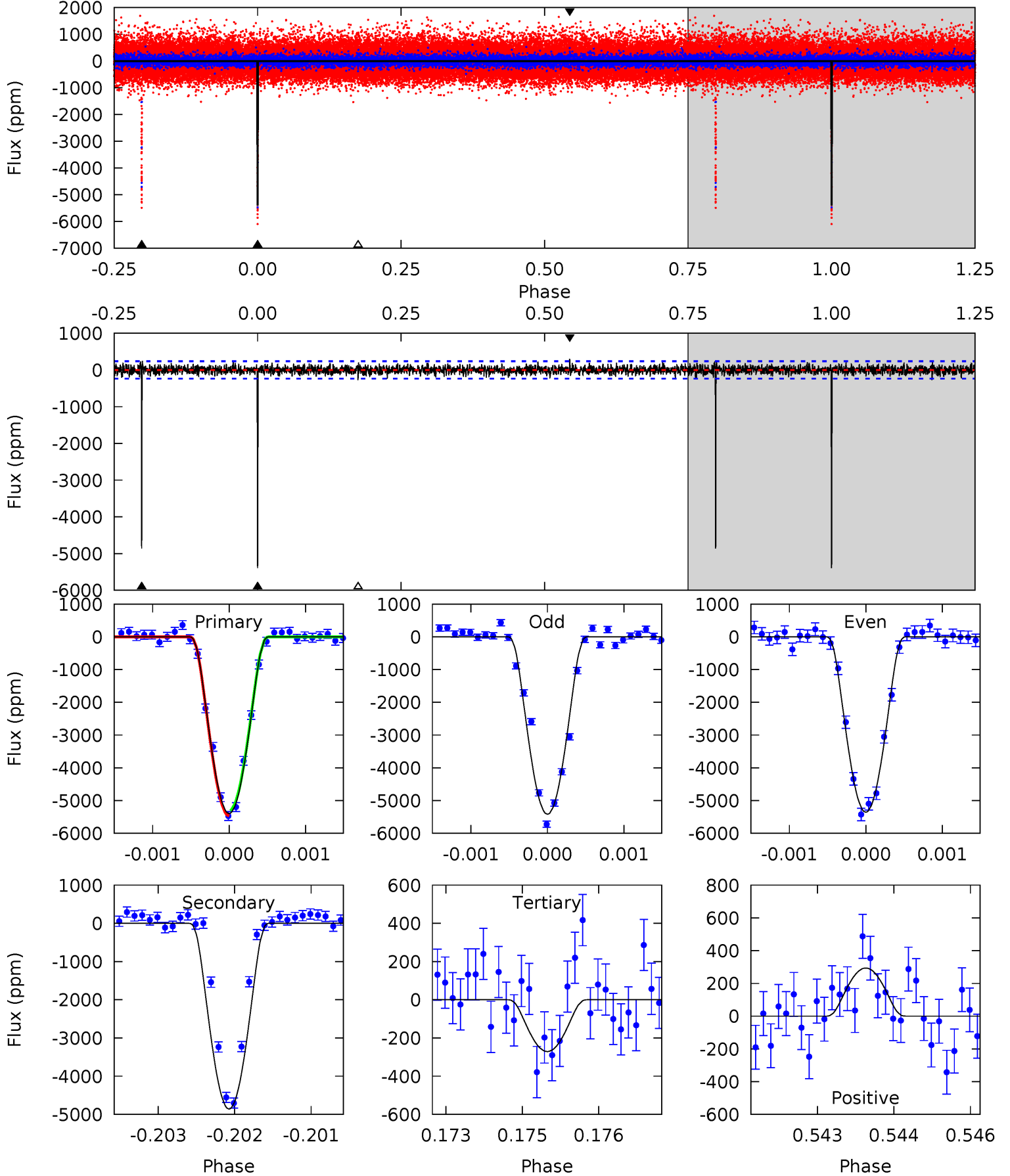
TCE 004043443-01 P=119.839936 Days  $T_0=161.864409$  (BKJD)



# DV Model-Shift Uniqueness Test

004043443-01, P = 119.839989 Days, E = 42.023876 Days

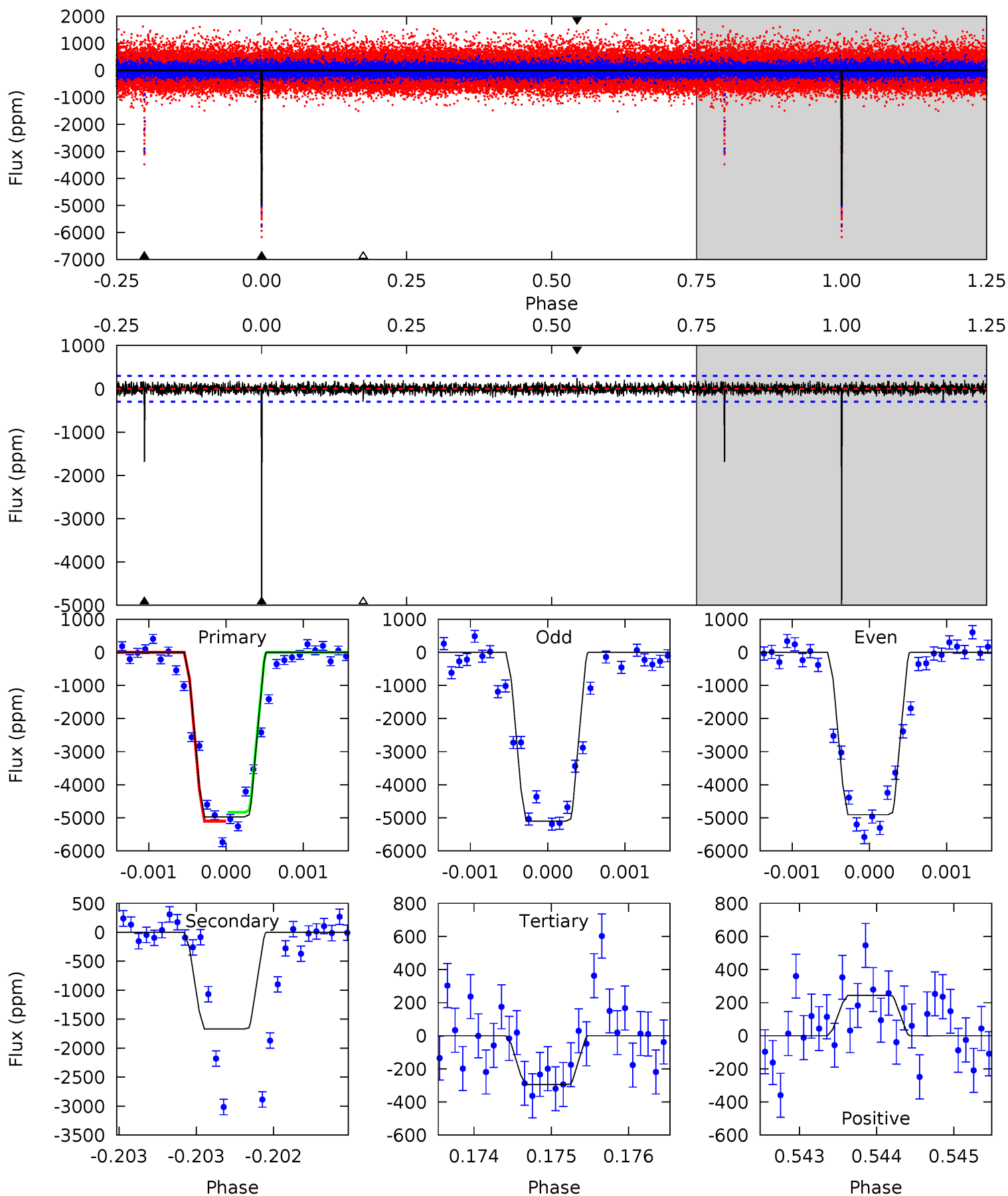
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
124.1	111.8	6.24	6.76	5.40	3.20	1.57	117.9	117.4	105.5	105.0	0.69	0.96	0.05	1.89



# Alt Model-Shift Uniqueness Test

004043443-01, P = 119.839936 Days, E = 42.024473 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
91.6	30.7	5.42	4.49	5.47	3.32	1.16	86.1	87.1	25.3	26.2	1.68	0.99	0.05	2.42



### Stellar Parameters For KIC 004043443

	$T_{\text{eff}}(K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$4602^{+92}_{-92}$	$4.637^{+0.015}_{-0.040}$	$0.000^{+0.150}_{-0.150}$	$0.675^{+0.042}_{-0.024}$	$0.733^{+0.028}_{-0.043}$	$3.350^{+0.240}_{-0.499}$
	+2%/-2%	+0%/-1%	+inf%/-inf%	+6%/-4%	+4%/-6%	+7%/-15%
Source	SPE57	SPE57	SPE57	DSEP		

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

### Secondary Eclipse Parameters for KIC 004043443-01 / KOI 0231.01

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-4860 \pm 43$	$8.43^{+3.58}_{-3.61}$	$359^{+8}_{-8}$	$3866^{+898}_{-430}$	$6806^{+14131}_{-3373}$
Alt.	$-1669 \pm 54$	$5.60^{+3.53}_{-2.98}$	$359^{+9}_{-8}$	$3687^{+1280}_{-506}$	$5247^{+19416}_{-3211}$

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

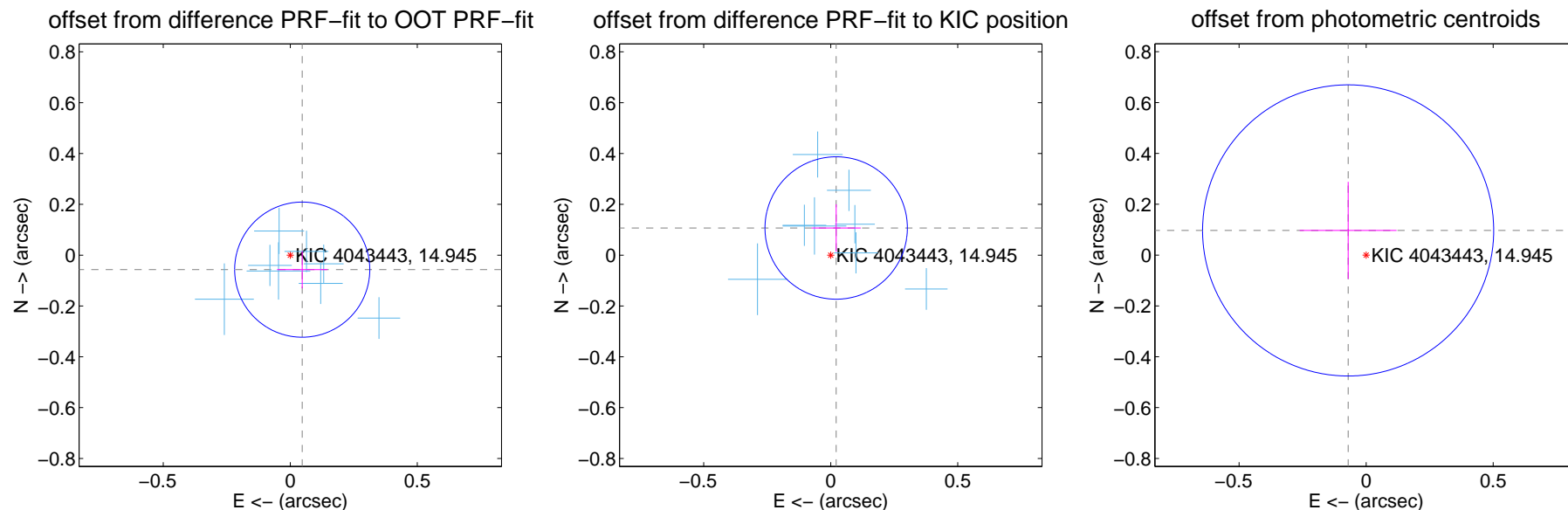
## DV Centroid Data

Supplemental centroid analysis for 004043443-01. Kepler magnitude: 14.95. Transit SNR 72.16

There are 8 quarters with good PRF difference image offsets

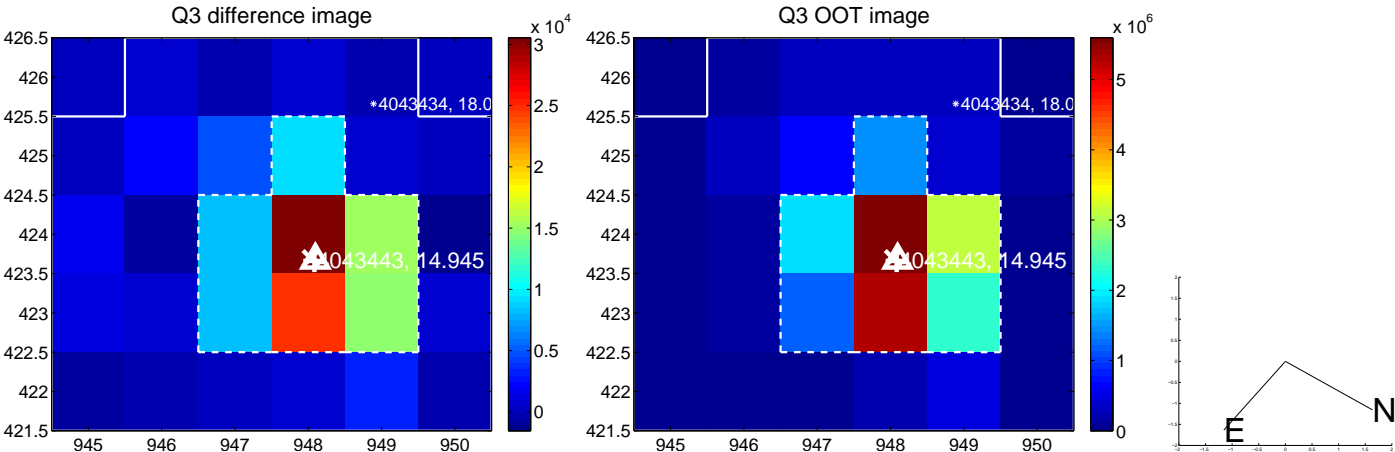
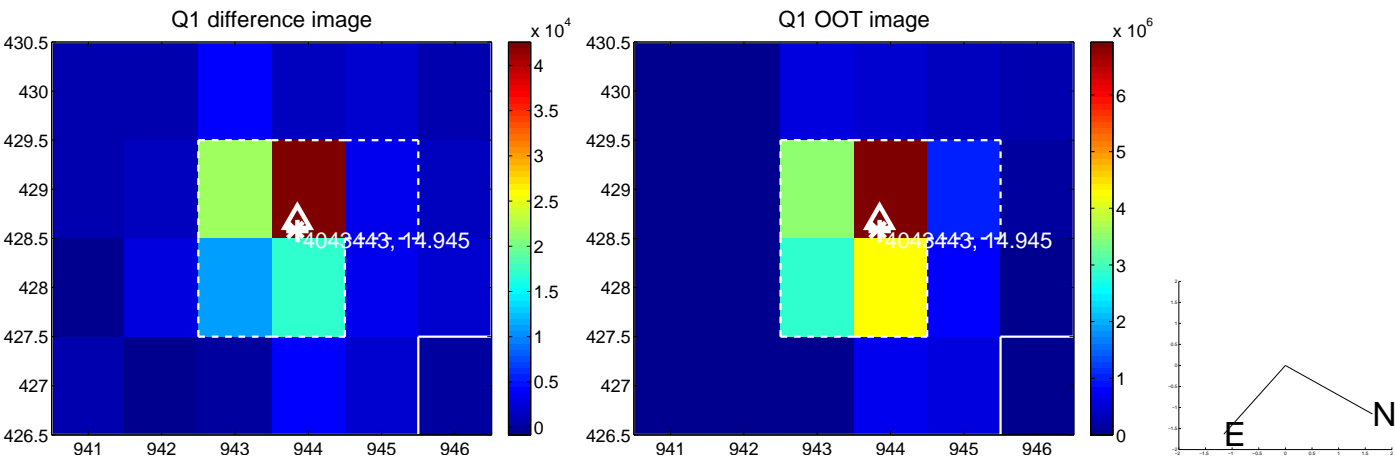
The direct PRF centroid is offset from the target star catalog position by about 0.18 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.074 \pm 0.089$	0.83	$-0.047 \pm 0.099$	$-0.057 \pm 0.073$
PRF-fit source offset from KIC position	$0.109 \pm 0.093$	1.17	$-0.021 \pm 0.097$	$0.107 \pm 0.093$
photometric centroid source offset	$0.12 \pm 0.19$	0.63	$0.07 \pm 0.19$	$0.10 \pm 0.19$

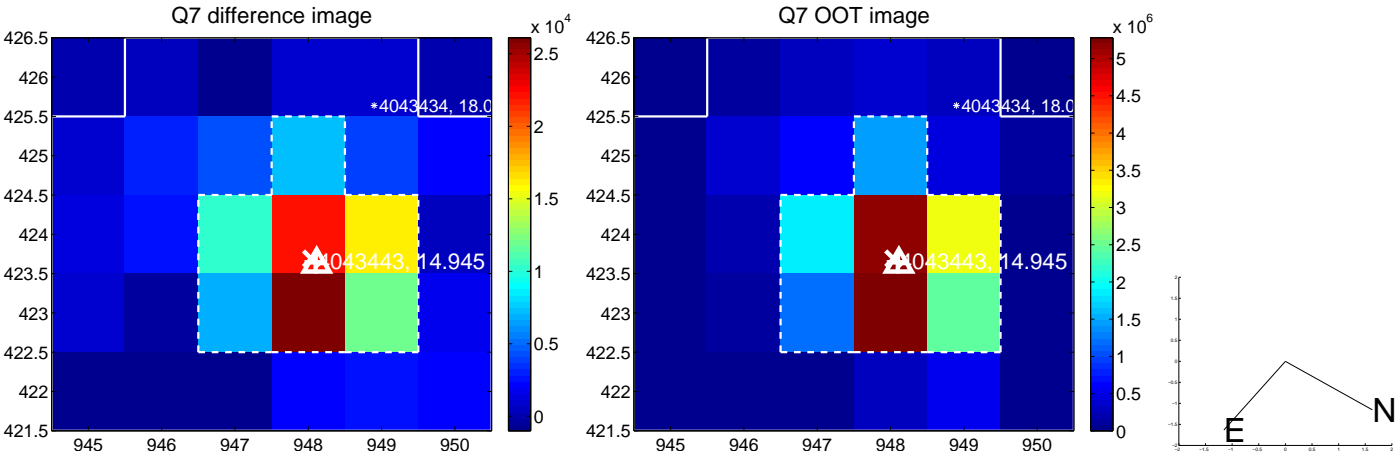
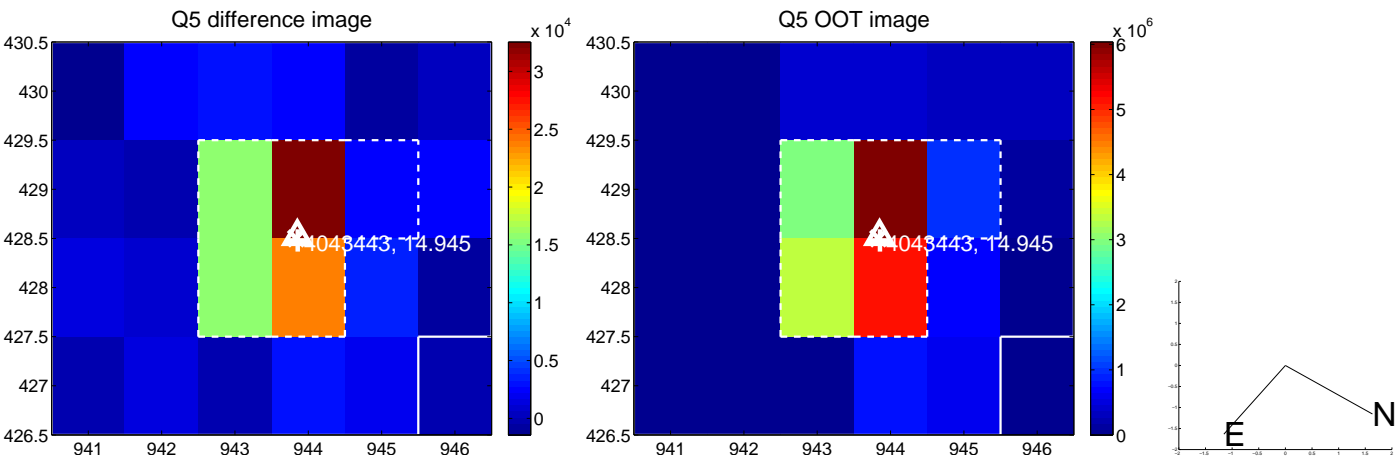


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

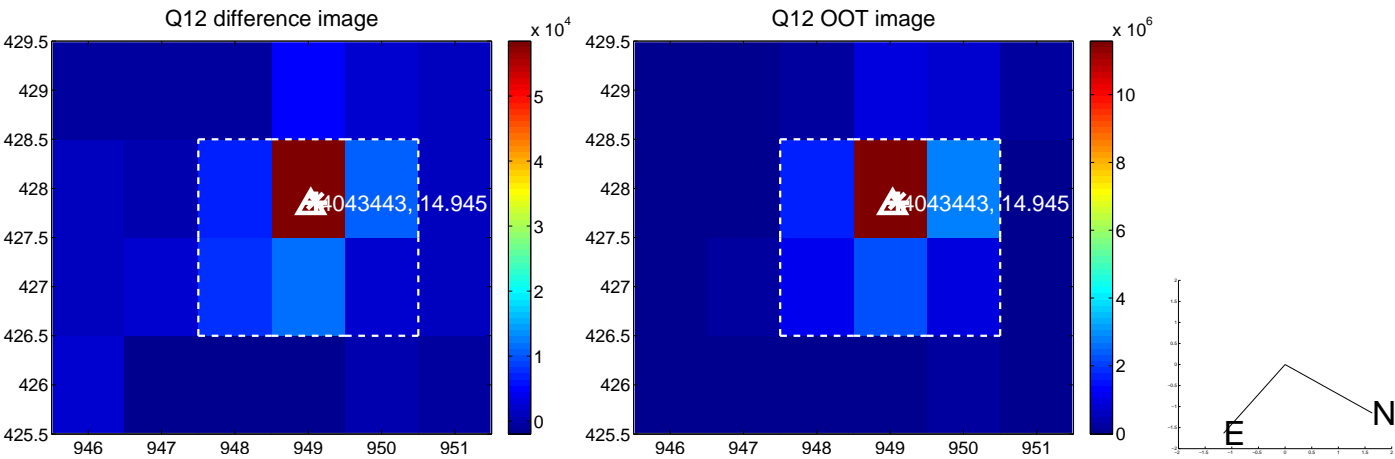
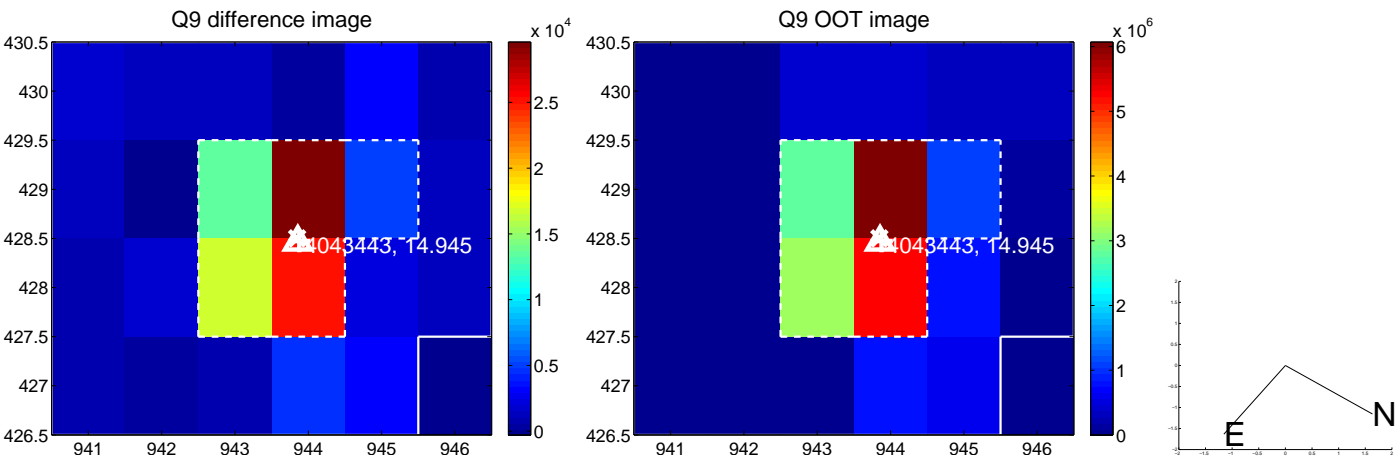


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

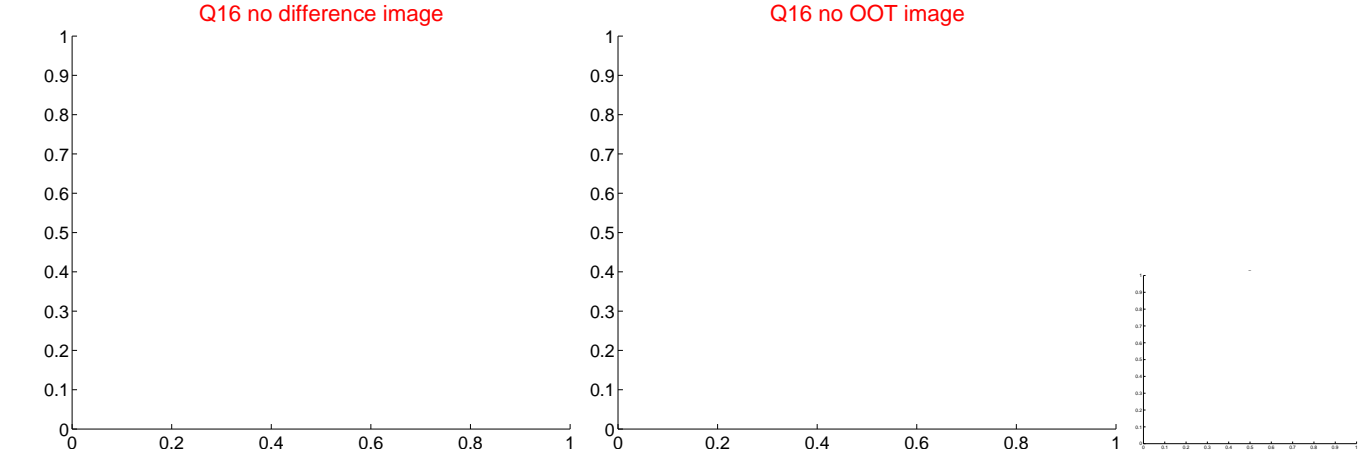
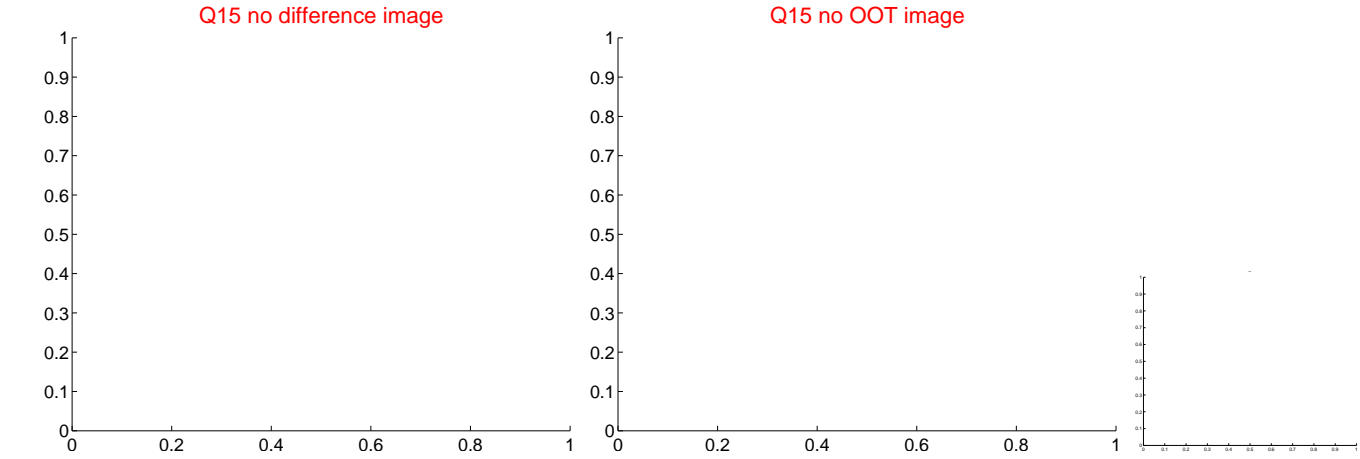
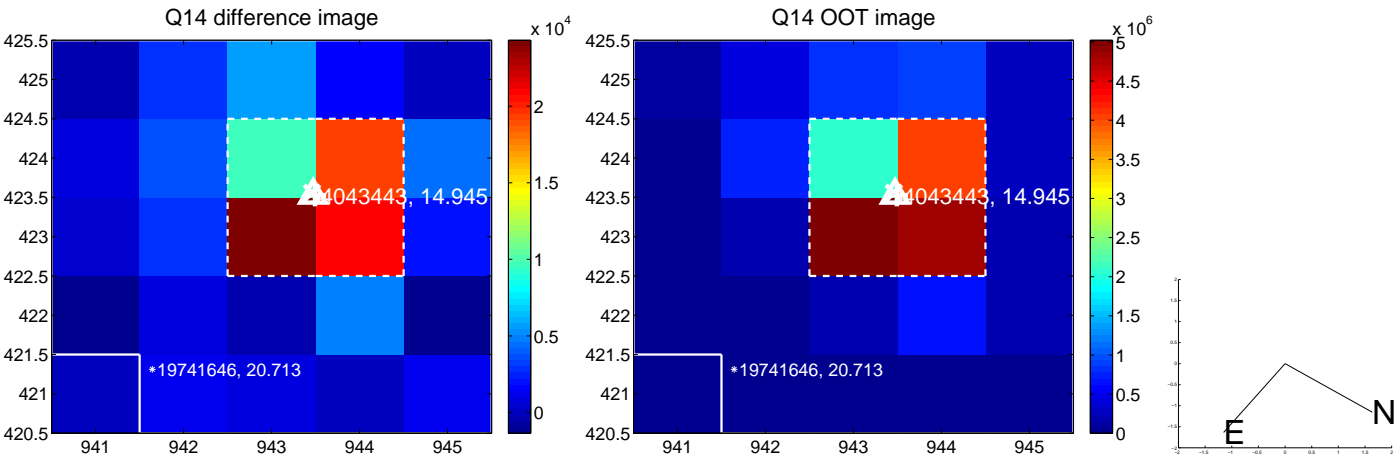
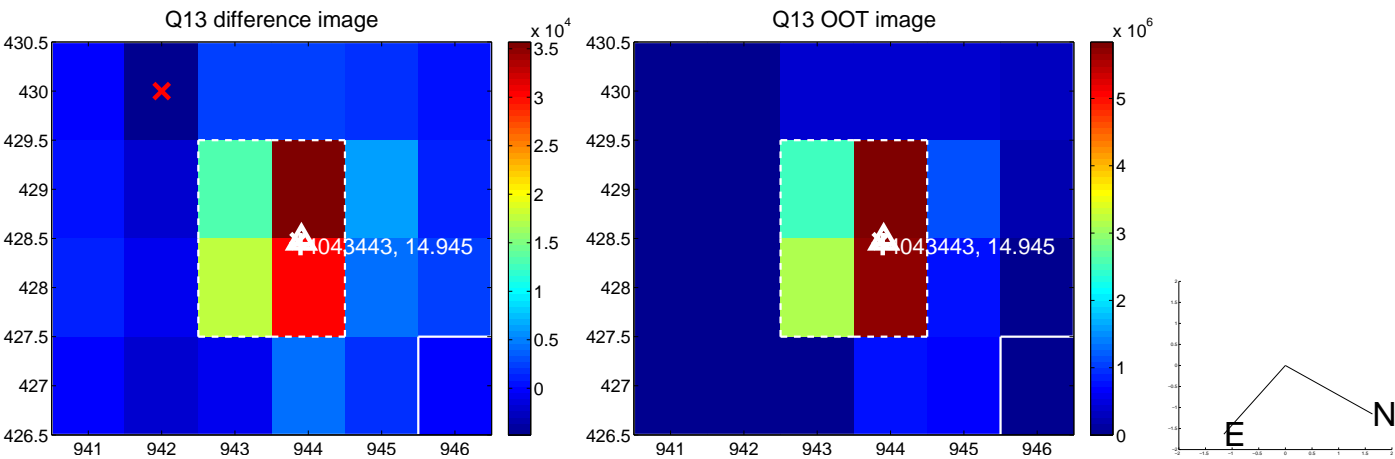




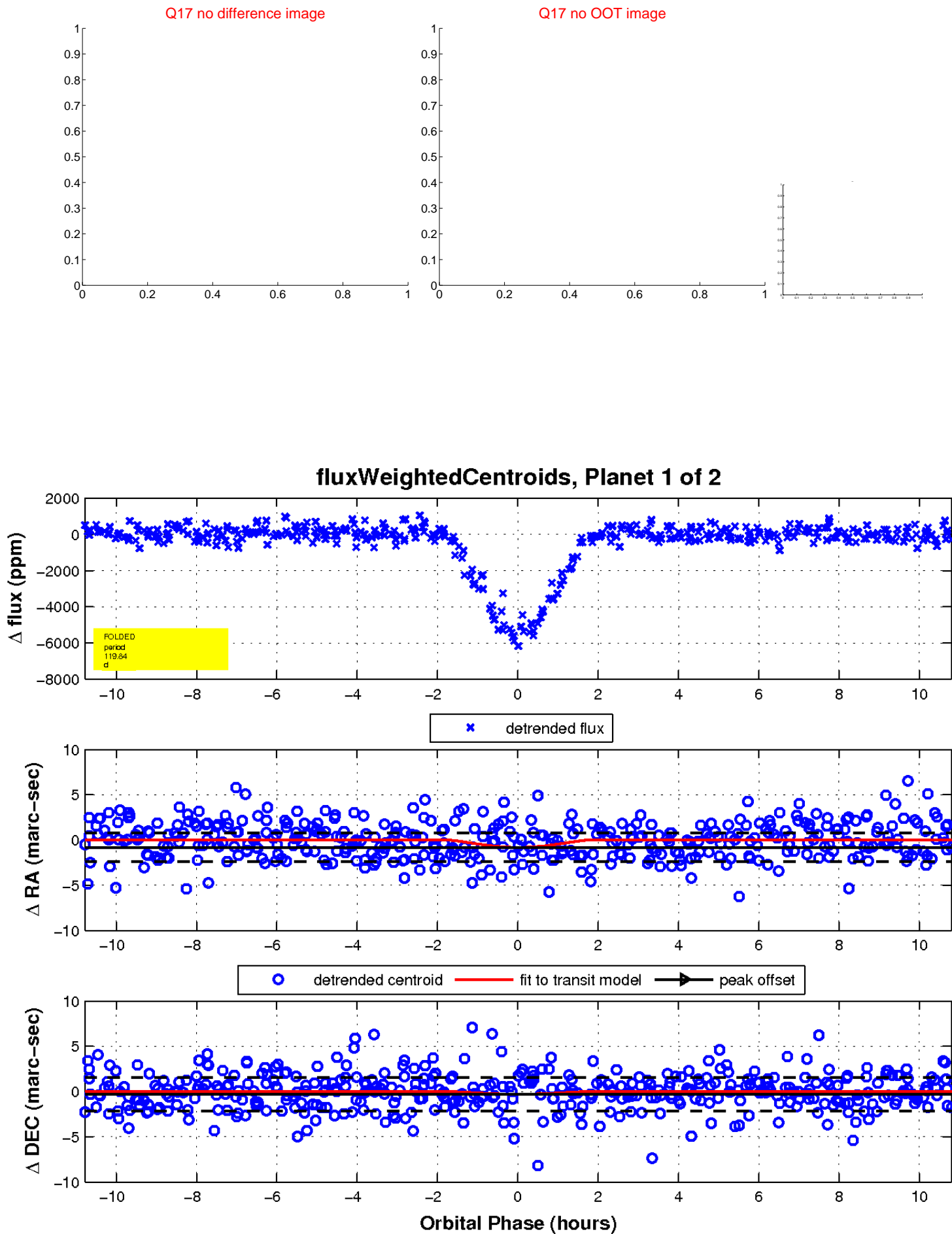
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

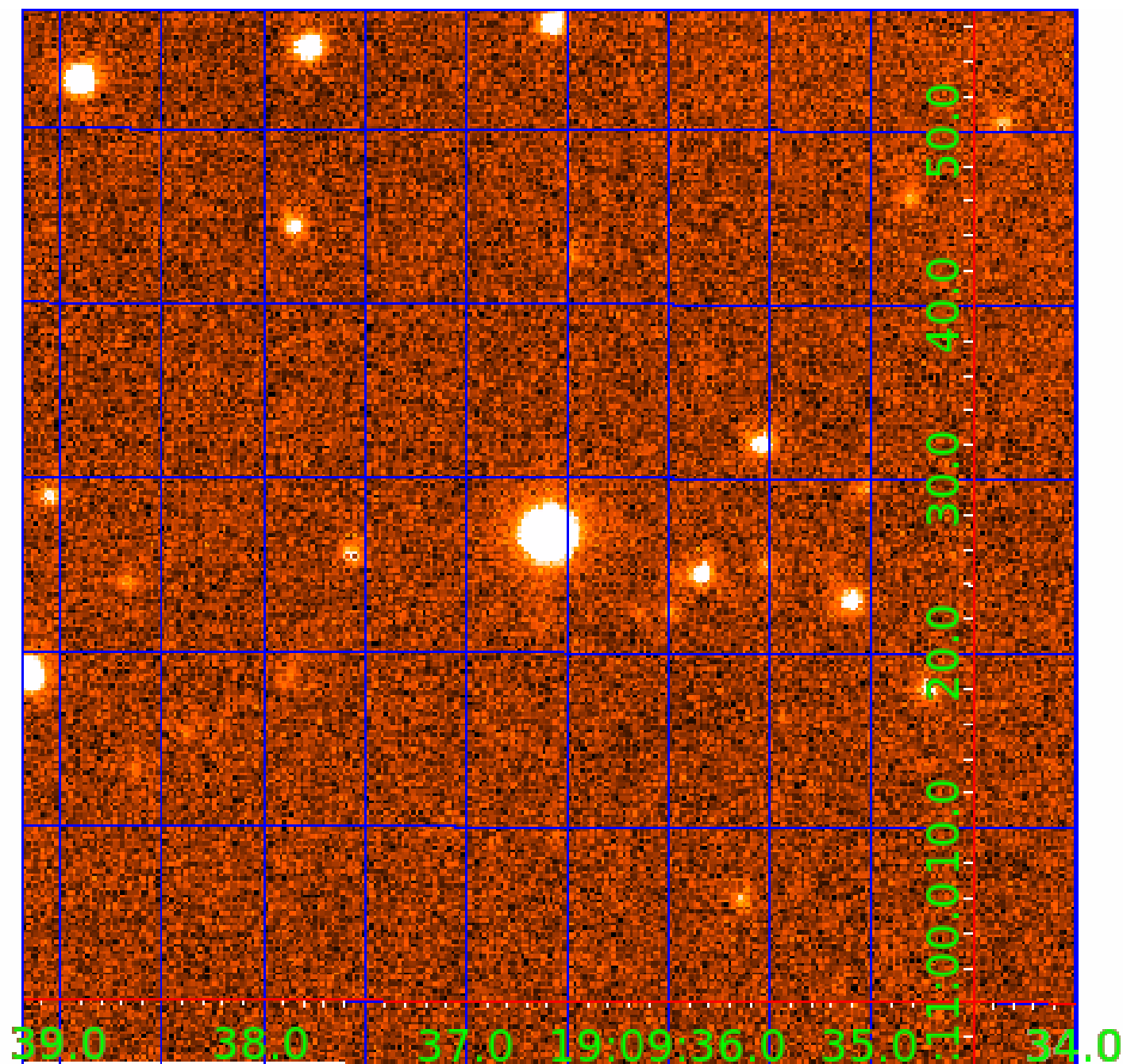


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 004043443

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
004043443-01	OBS	0231.01	119.839989	161.863865	5435.3	3.611	74.3	72.2	0.68	4602	8.27	1.01
004043443-02	OBS	No	119.840431	137.656967	4828.8	2.678	60.2	67.6	0.68	4602	7.28	1.01

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
004043443-01	OBS	FP	0.00	0	1	0	0	MOD_SEC_DV—MOD_SEC_ALT—DEEP_V_SHAPED—HAS_SEC_TCE
004043443-02	OBS	FP	0.00	1	1	0	0	IS_SEC_TCE

**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.

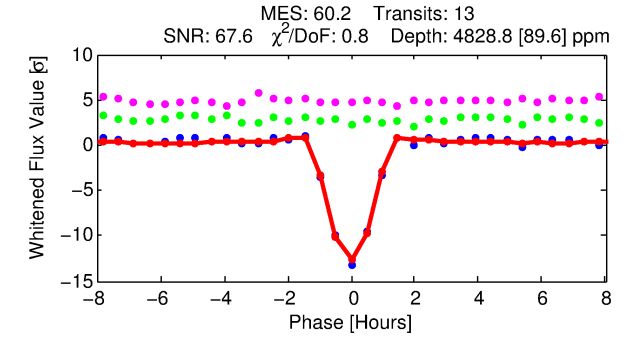
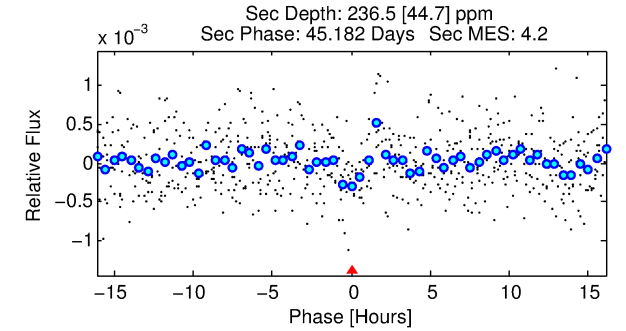
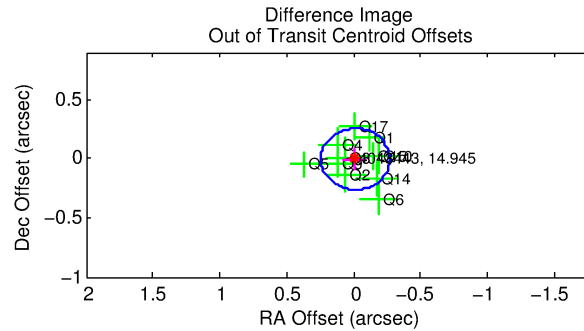
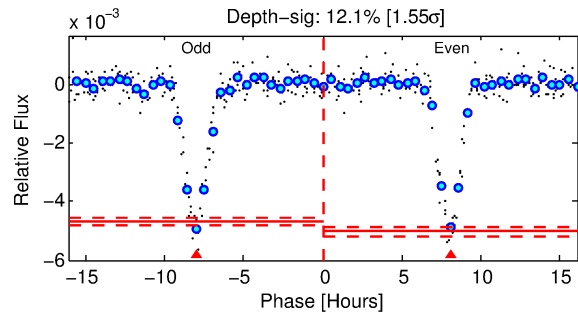
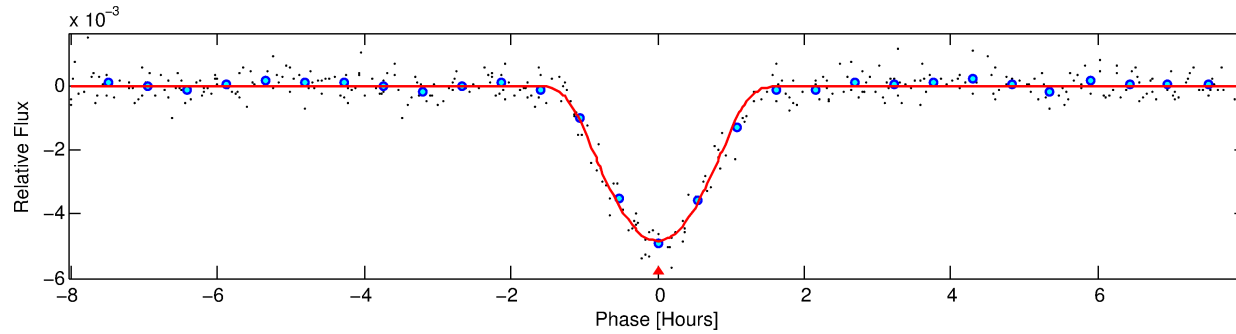
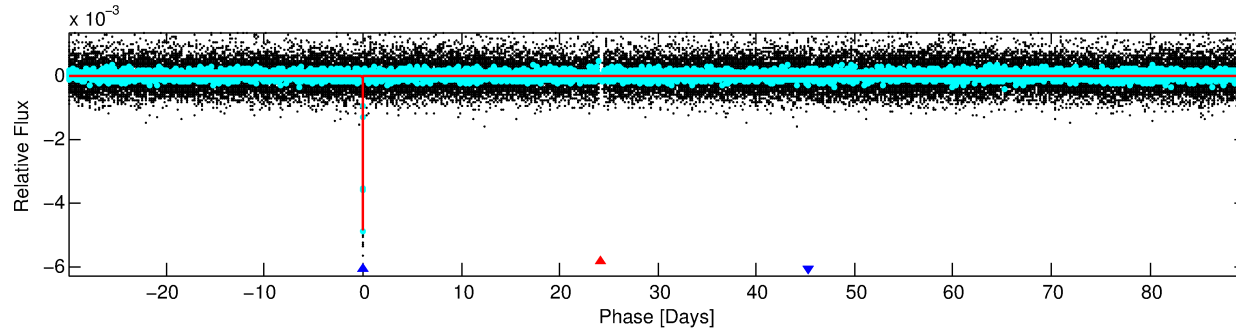
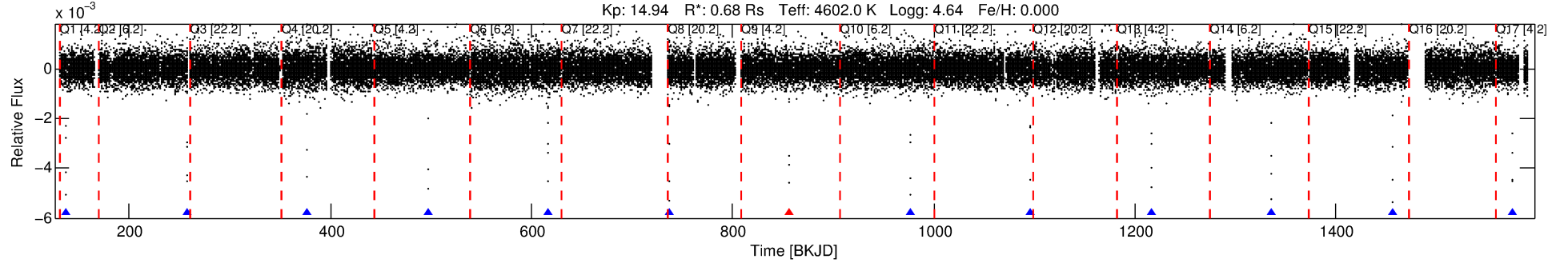
## Ephemeris Match Information For 004043443-02

No Significant Match Found

# DV One-Page Summary

KIC: 4043443 Candidate: 2 of 2 Period: 119.840 d  
KOI: K00231 Corr: No Ephemeris Match

Kp: 14.94 R\*: 0.68 Rs Teff: 4602.0 K Logg: 4.64 Fe/H: 0.000



## DV Fit Results:

Period = 119.84043 [0.00012] d  
Epoch = 137.6570 [0.0009] BKJD  
Rp/R\* = 0.0988 [0.0334]  
a/R\* = 182.89 [18.26]  
b = 0.96 [0.06]  
Seff = 1.01 [0.11]  
Teq = 255 [7] K  
Rp = 7.28 [2.50] Re  
a = 0.4265 [0.0220] AU  
Ag = 447.04 [316.00] [1.41σ]  
Teff = 1816 [321] K [4.86σ]

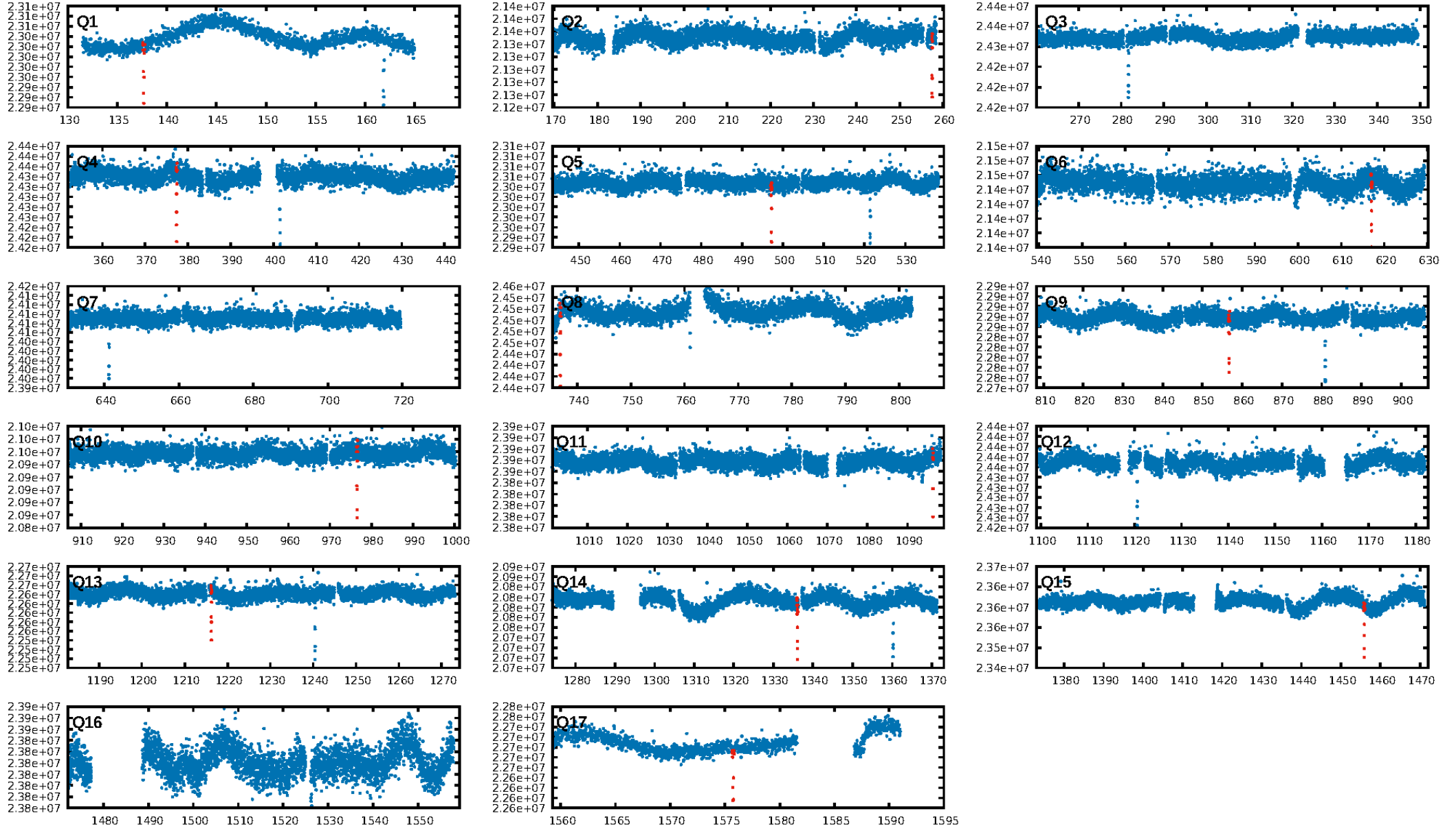
## DV Diagnostic Results:

**ShortPeriod-sig: 0.2% [0.00σ]**  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 68.5%  
ModelChiSquareGof-sig: 99.9%  
Bootstrap-pfa: 0.00e+00  
RollingBand-fgt: 0.91 [10/11]  
GhostDiagnostic-chr: 4.742  
Centroid-sig: 1.0%  
Centroid-so: 0.257 arcsec [1.26σ]  
OotOffset-rm: 0.009 arcsec [0.11σ]  
KicOffset-rm: 0.147 arcsec [1.72σ]  
OotOffset-st: 4/1/2/4 [11]  
KicOffset-st: 4/1/2/4 [11]  
DiffImageQuality-fgm: 1.00 [11/11]  
DiffImageOverlap-fno: 1.00 [11/11]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 00:40:05 Z

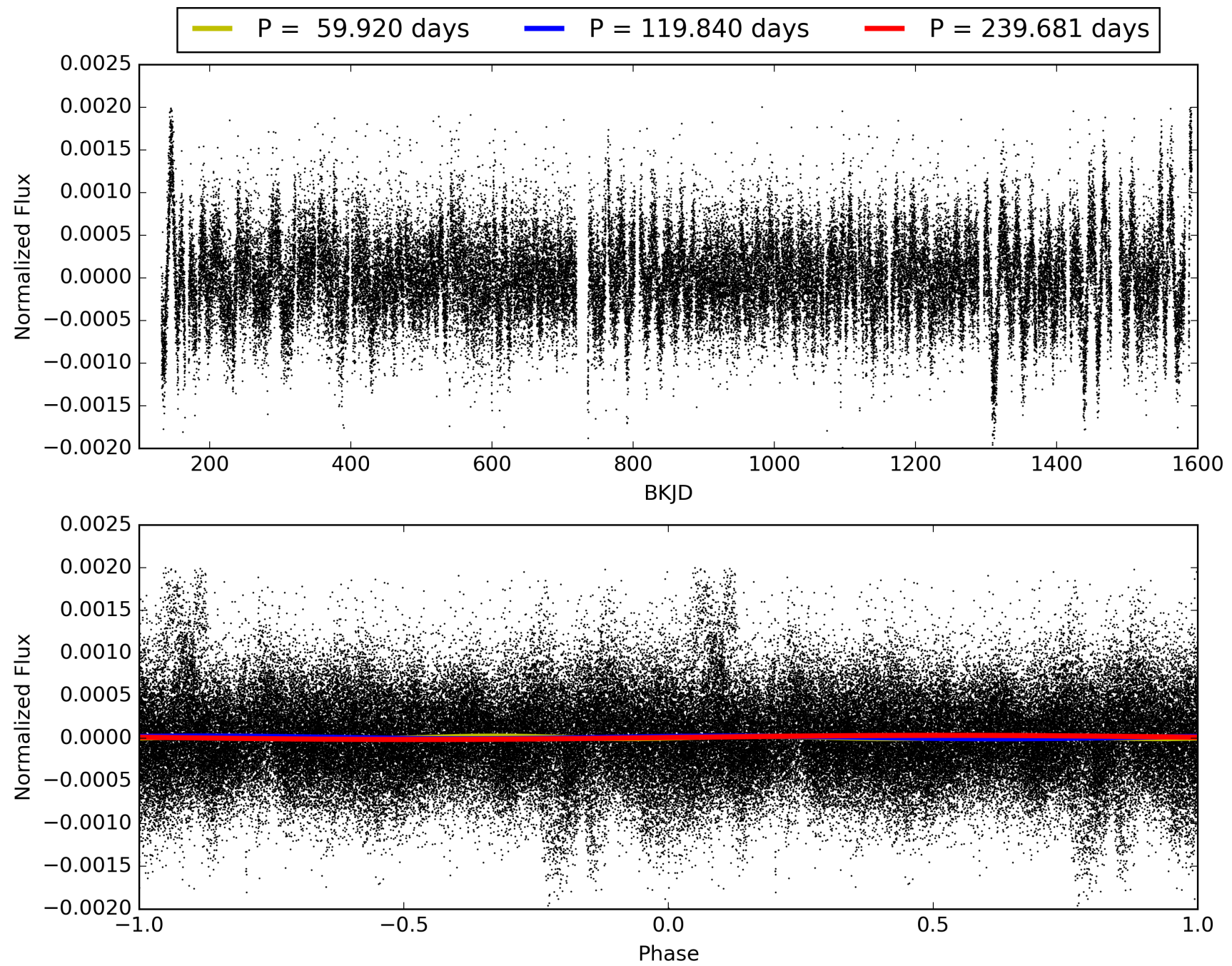
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 004043443-02, PDC Light Curves





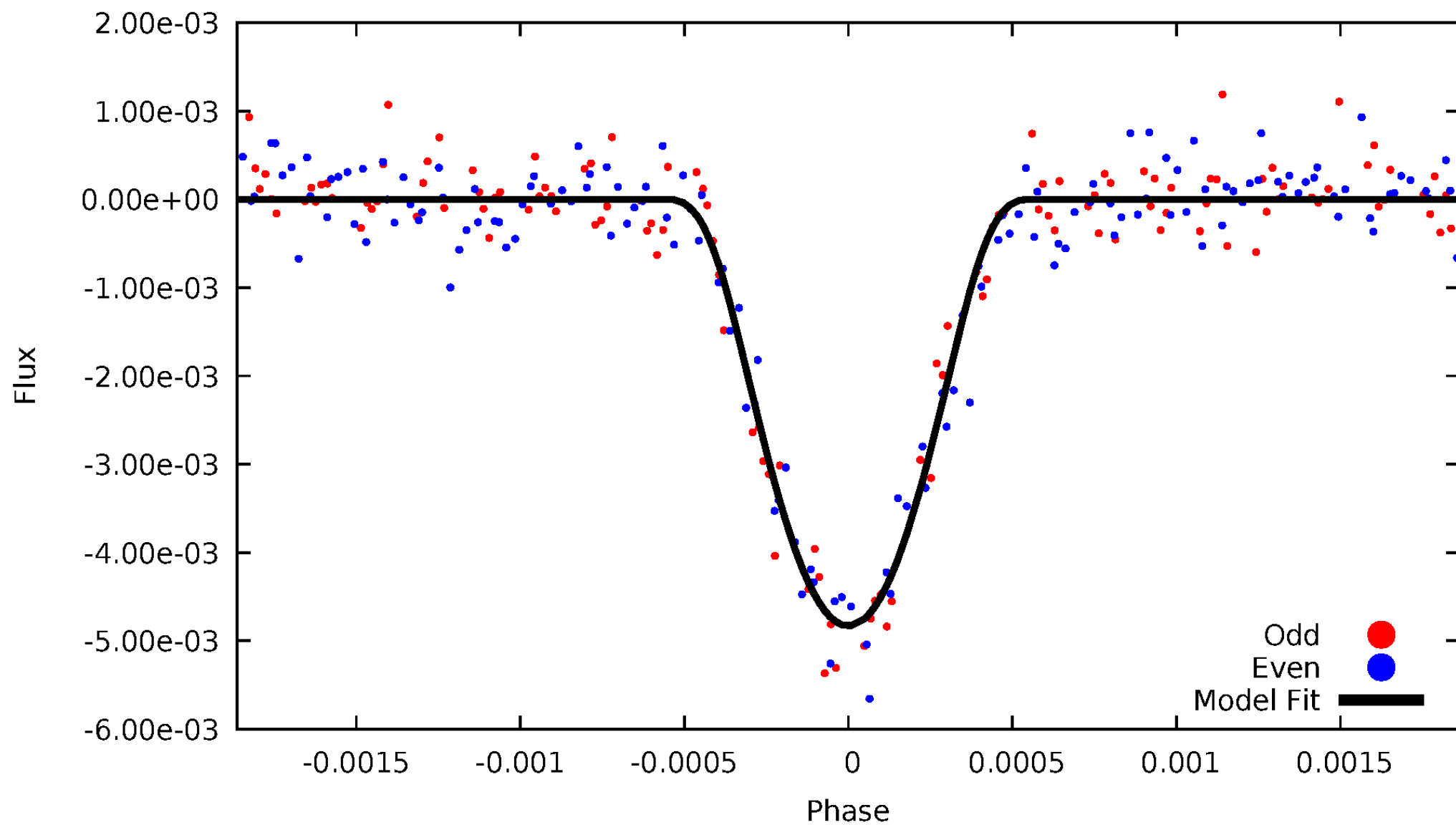
TCE 004043443-02





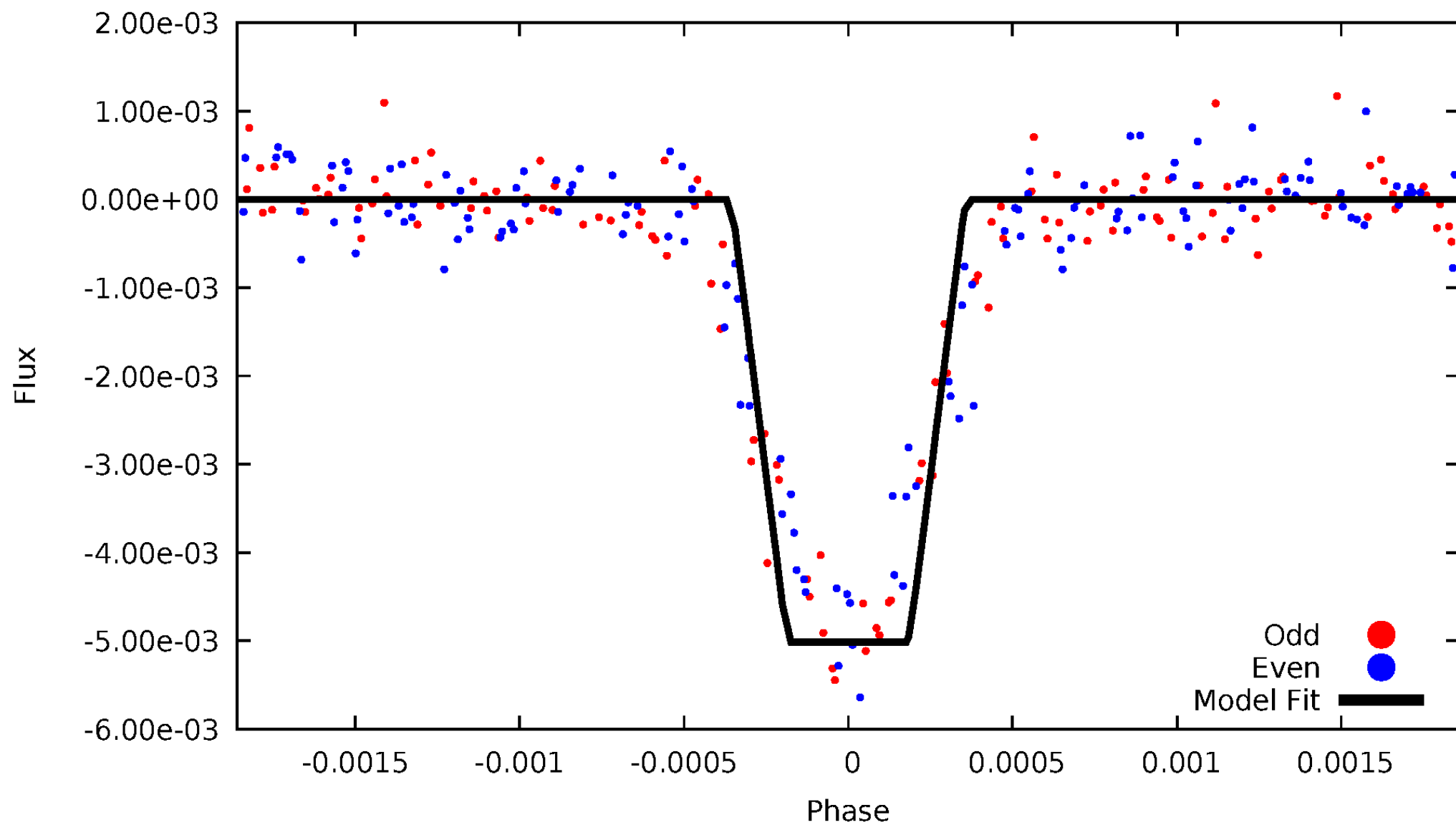
# DV Odd/Even

TCE 004043443-02



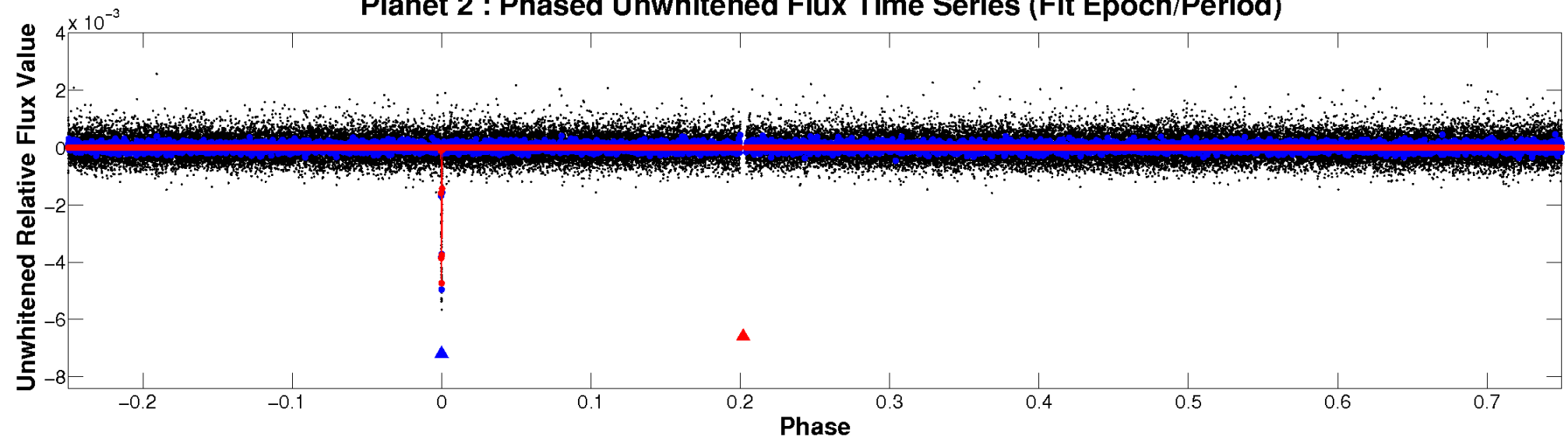
# ALT Odd/Even

TCE 004043443-02

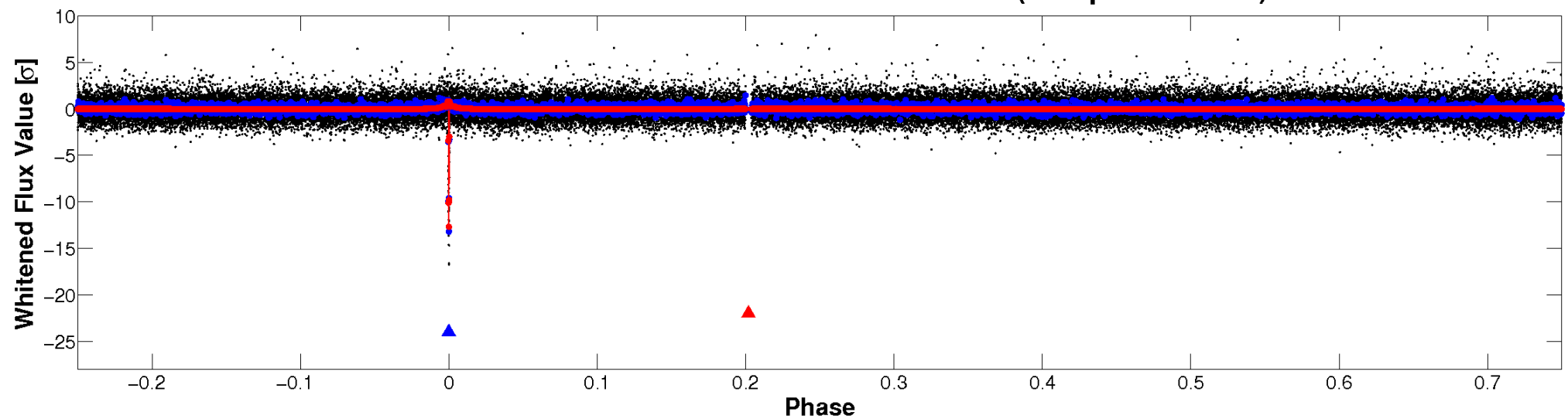


# Non-Whitened Vs. Whitened Light Curve

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

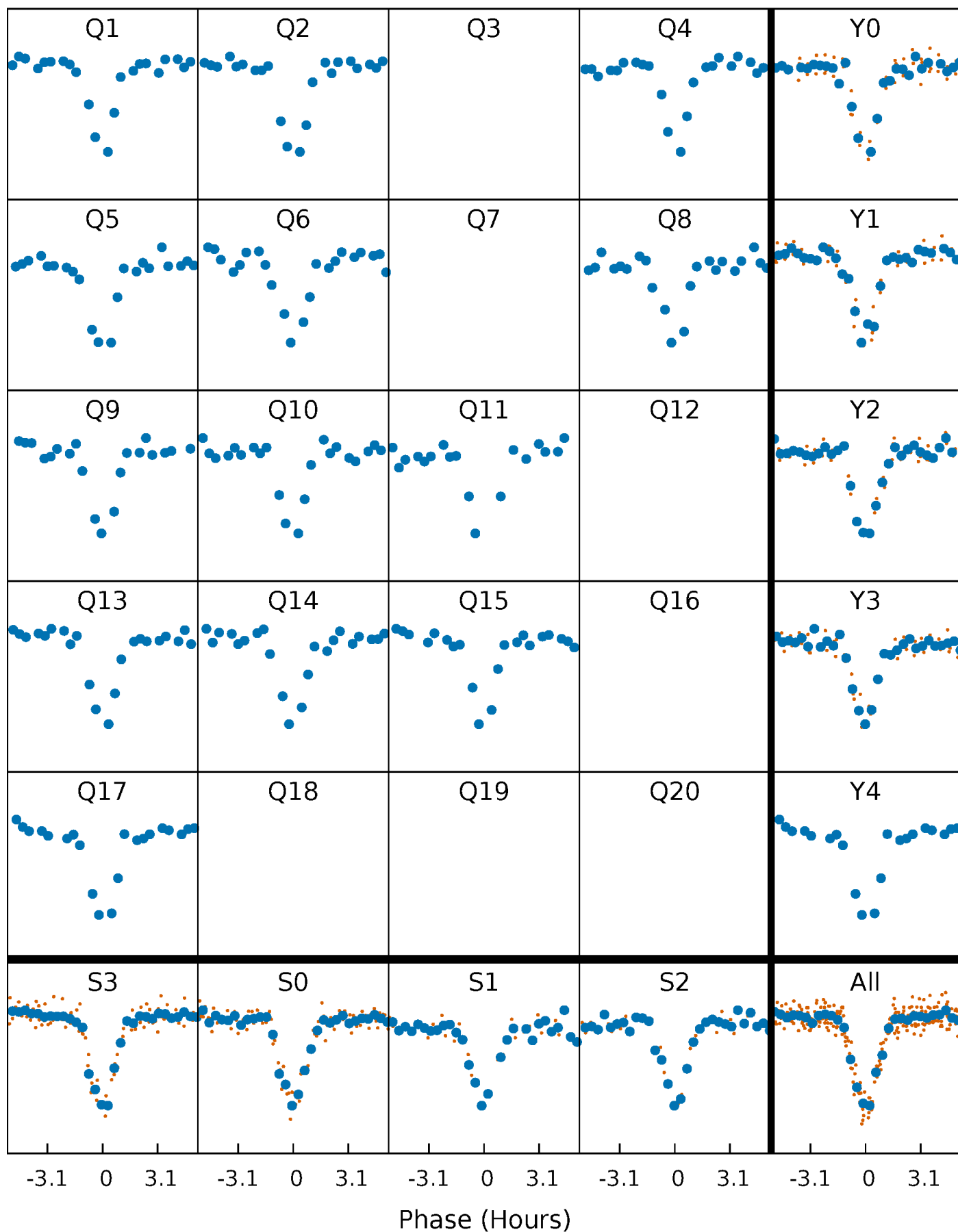


Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



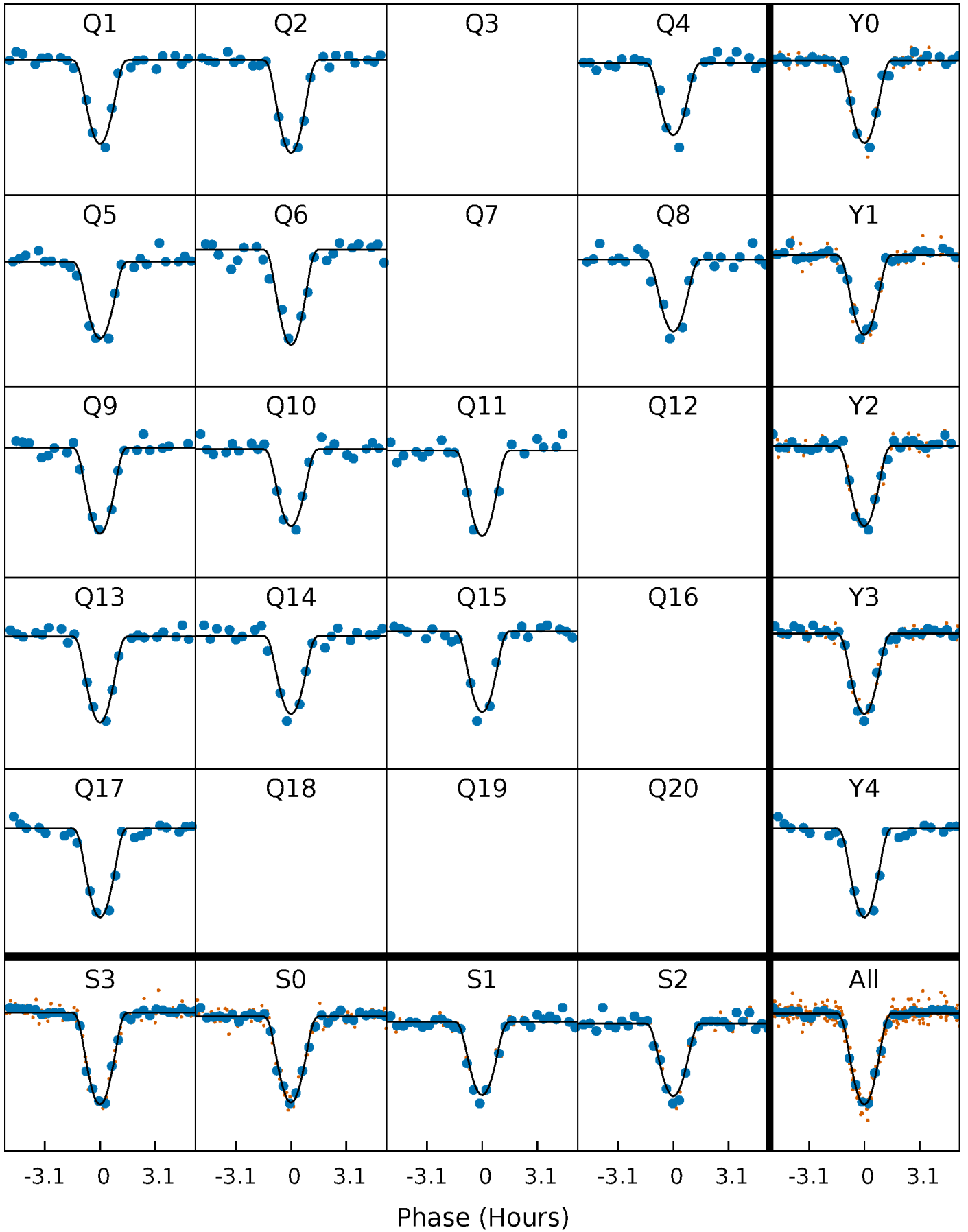
# PDC Quarter-Phased Transit Curves

TCE 004043443-02 P=119.840431 Days  $T_0=137.656967$  (BKJD)



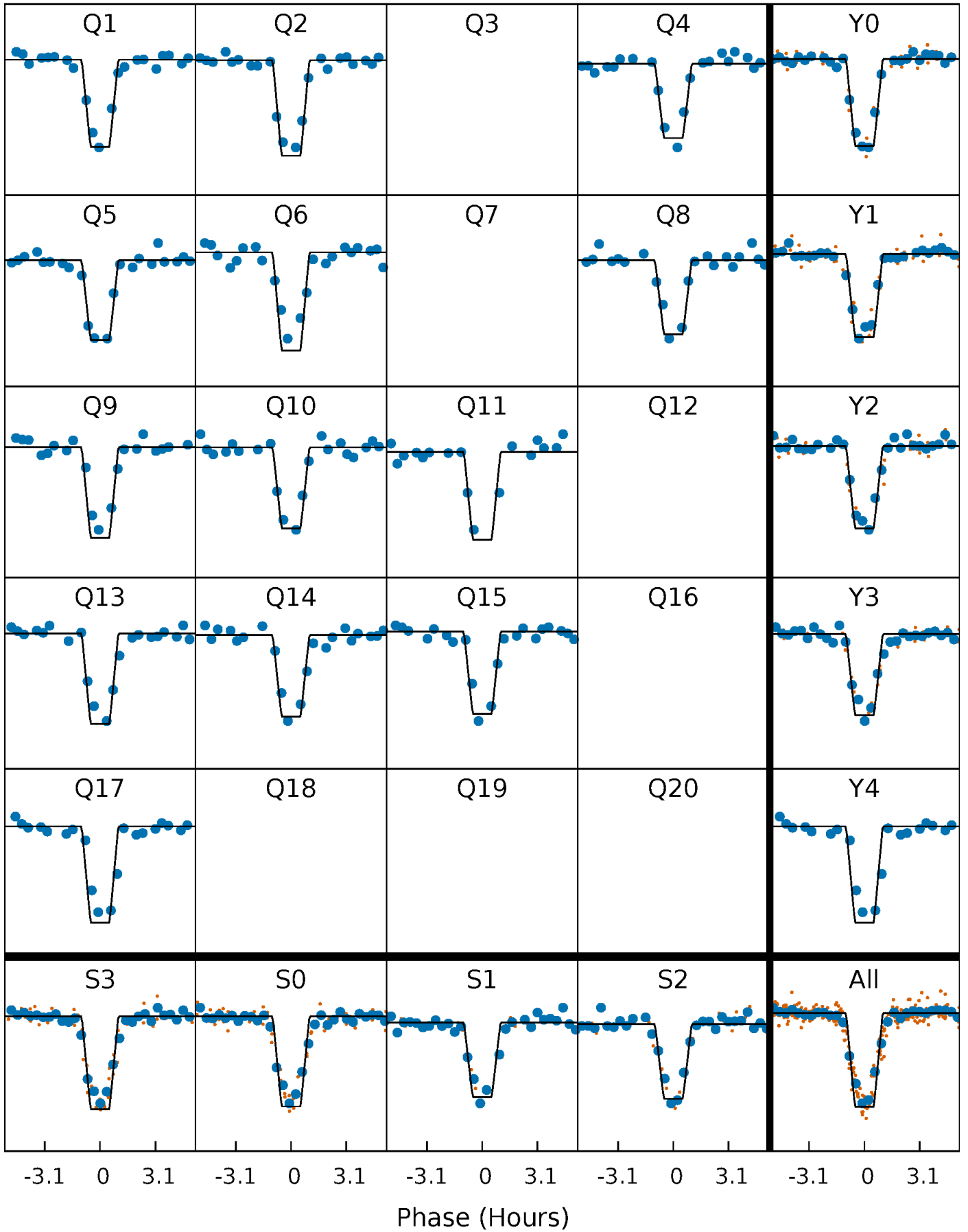
# DV Quarter-Phased Transit Curves

TCE 004043443-02 P=119.840431 Days  $T_0=137.656967$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

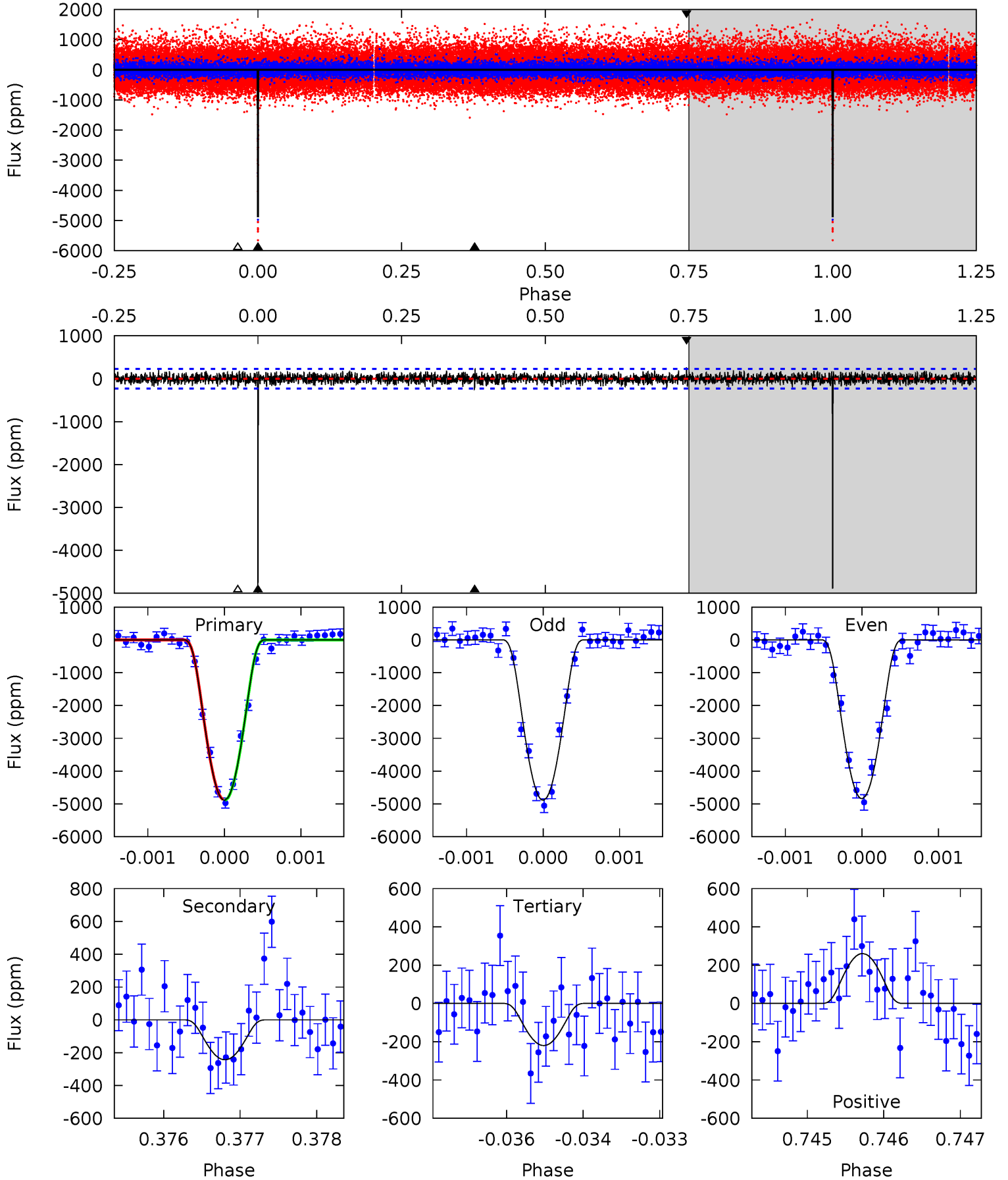
TCE 004043443-02 P=119.839630 Days  $T_0=137.662080$  (BKJD)



# DV Model-Shift Uniqueness Test

004043443-02, P = 119.840431 Days, E = 17.816536 Days

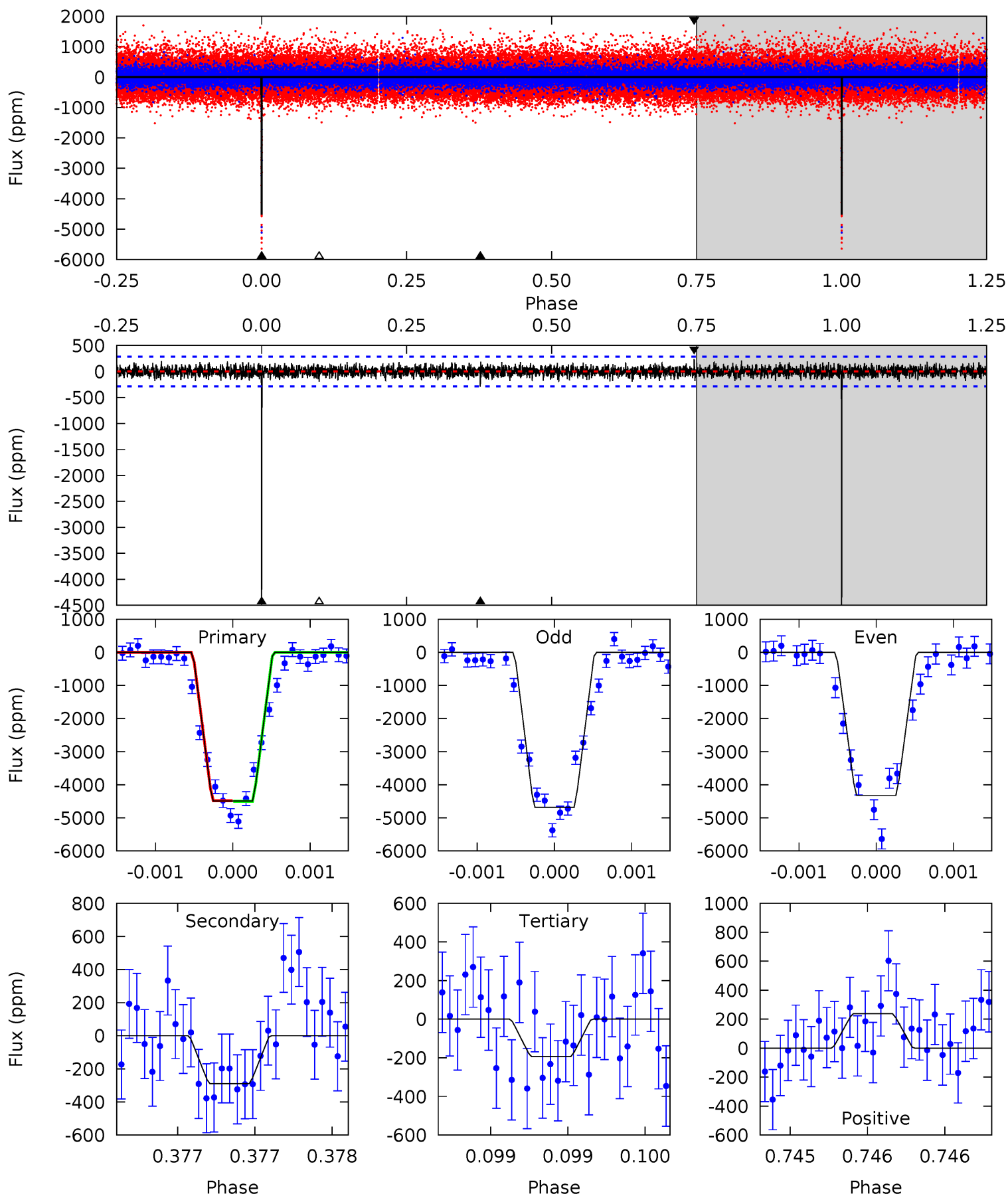
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
117.1	5.82	5.26	6.24	5.44	3.28	1.56	111.8	110.8	0.56	-0.42	0.59	0.99	0.05	0.35



# Alt Model-Shift Uniqueness Test

004043443-02, P = 119.839630 Days, E = 17.822450 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
86.4	5.56	3.72	4.56	5.52	3.39	1.18	82.7	81.8	1.84	1.00	3.43	0.97	0.05	0.17





### Stellar Parameters For KIC 004043443

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M$ ( $M_{\odot}$ )	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$4602^{+92}_{-92}$	$4.637^{+0.015}_{-0.040}$	$0.000^{+0.150}_{-0.150}$	$0.675^{+0.042}_{-0.024}$	$0.733^{+0.028}_{-0.043}$	$3.350^{+0.240}_{-0.499}$
	+2%/-2%	+0%/-1%	+inf%/-inf%	+6%/-4%	+4%/-6%	+7%/-15%
Source	SPE57	SPE57	SPE57	DSEP		

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

### Secondary Eclipse Parameters for KIC 004043443-02 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	$-243 \pm 42$	$7.32^{+2.65}_{-2.53}$	$359^{+9}_{-8}$	$2599^{+293}_{-205}$	$453^{+615}_{-219}$
Alt.	$-289 \pm 52$	$5.39^{+2.38}_{-2.33}$	$359^{+9}_{-8}$	$2875^{+499}_{-283}$	$1002^{+1939}_{-539}$

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

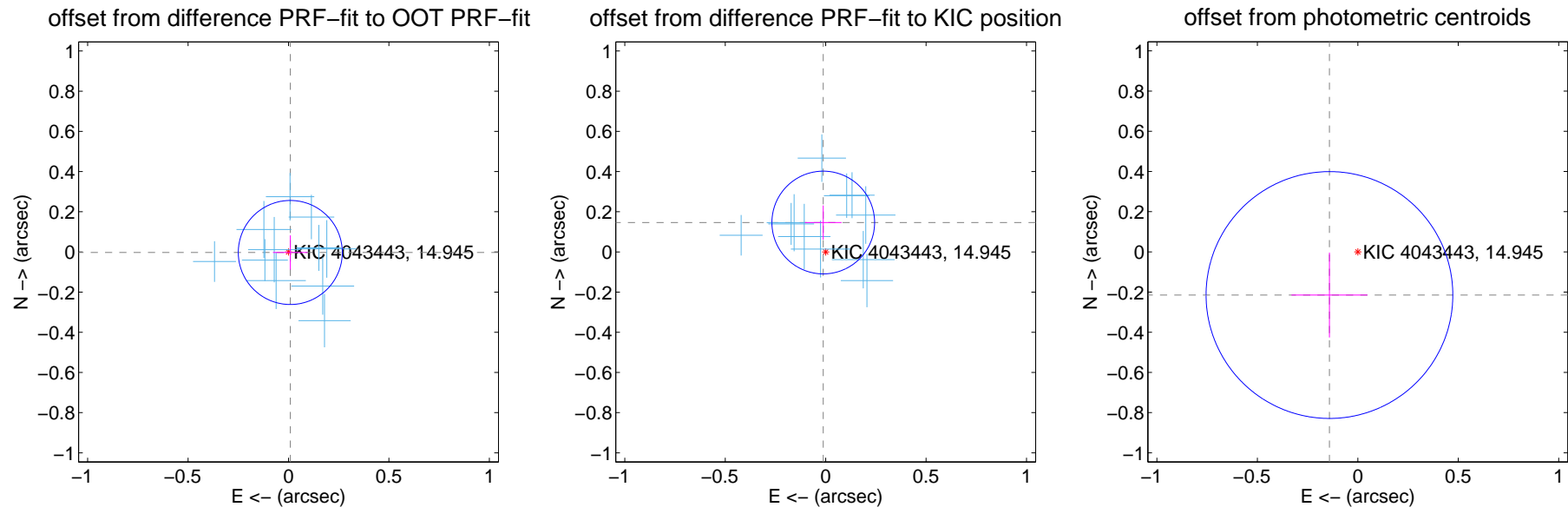
## DV Centroid Data

Supplemental centroid analysis for 004043443-02. Kepler magnitude: 14.95. Transit SNR 67.65

There are 11 quarters with good PRF difference image offsets

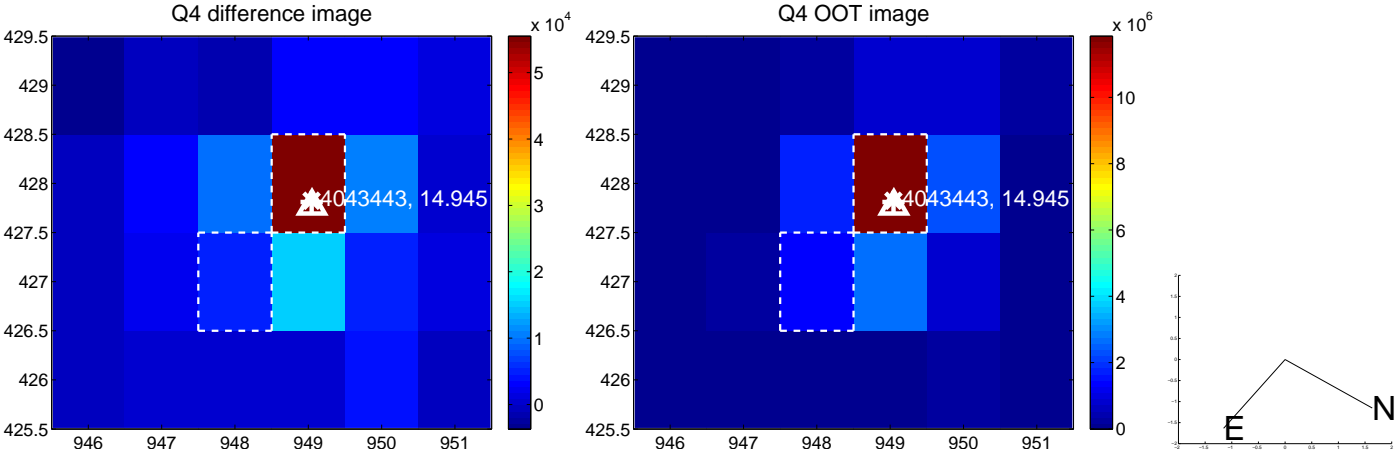
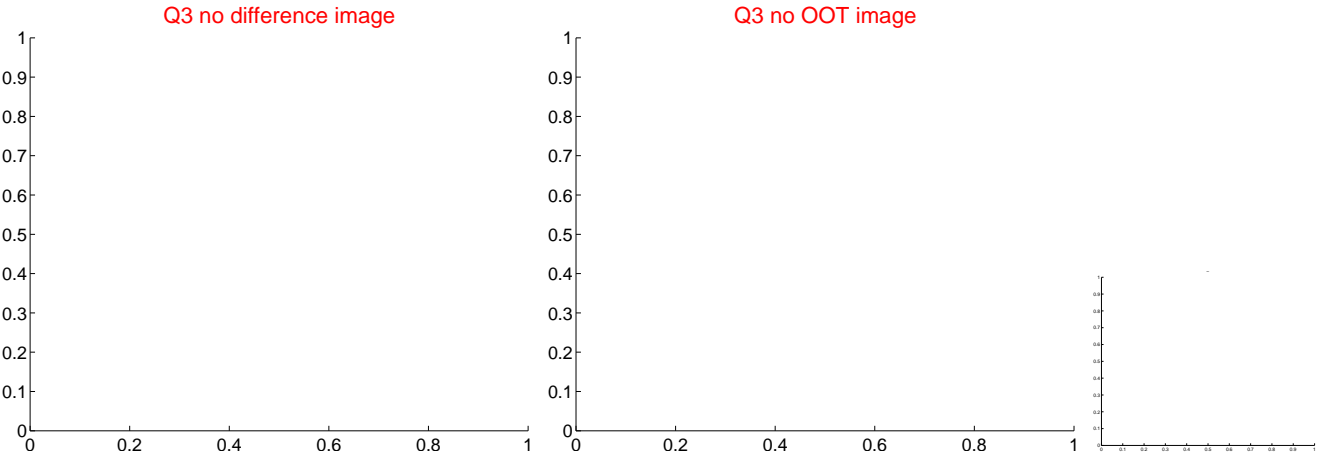
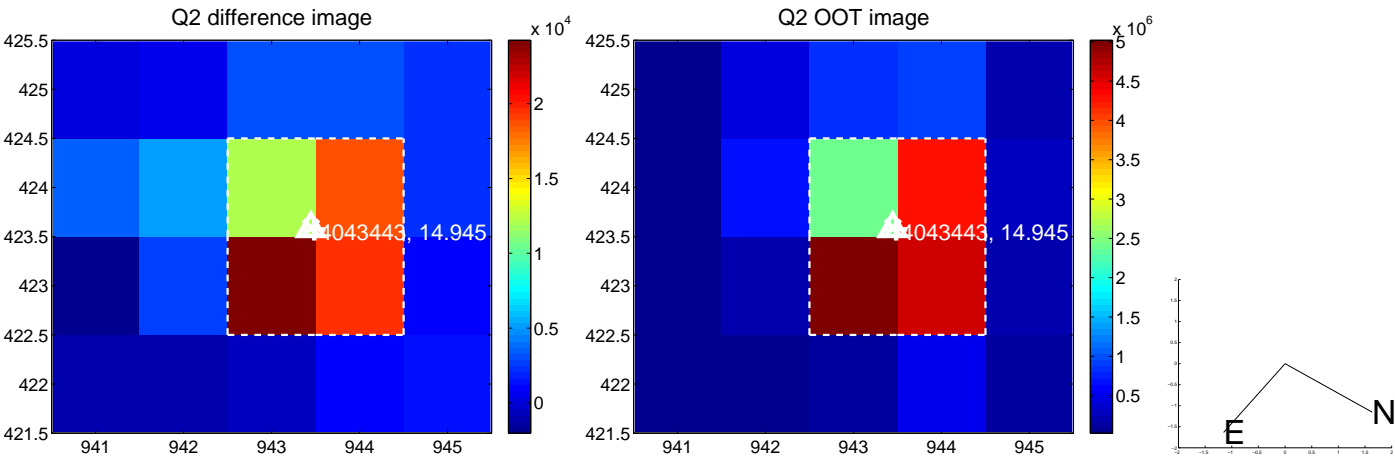
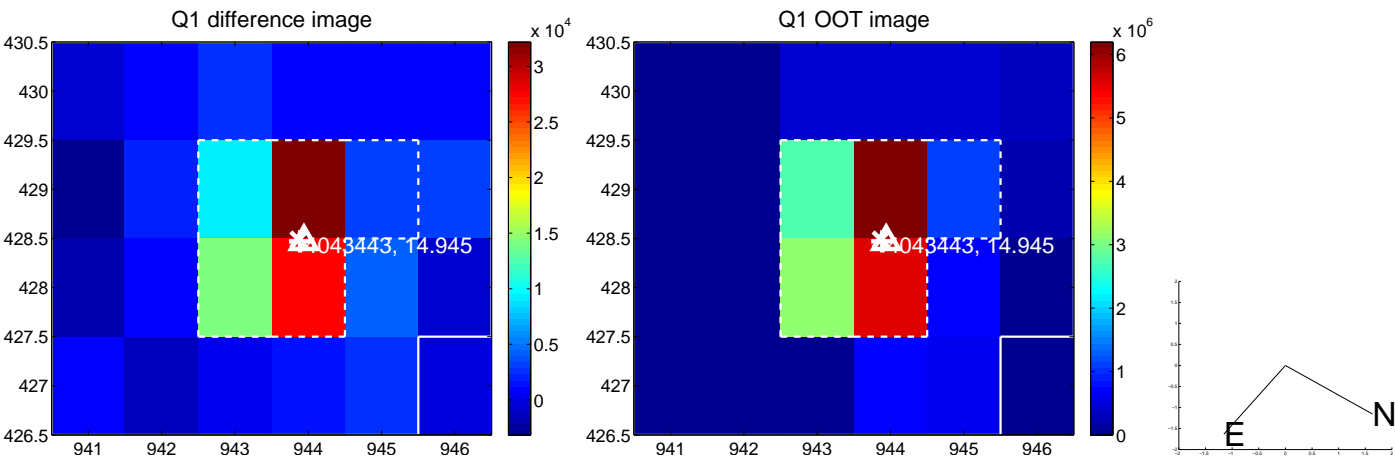
The direct PRF centroid is offset from the target star catalog position by about 0.19 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.009 \pm 0.086$	0.11	$-0.009 \pm 0.086$	$-0.003 \pm 0.085$
PRF-fit source offset from KIC position	$0.147 \pm 0.085$	1.72	$0.012 \pm 0.091$	$0.146 \pm 0.085$
photometric centroid source offset	$0.26 \pm 0.20$	1.26	$0.14 \pm 0.19$	$-0.21 \pm 0.21$

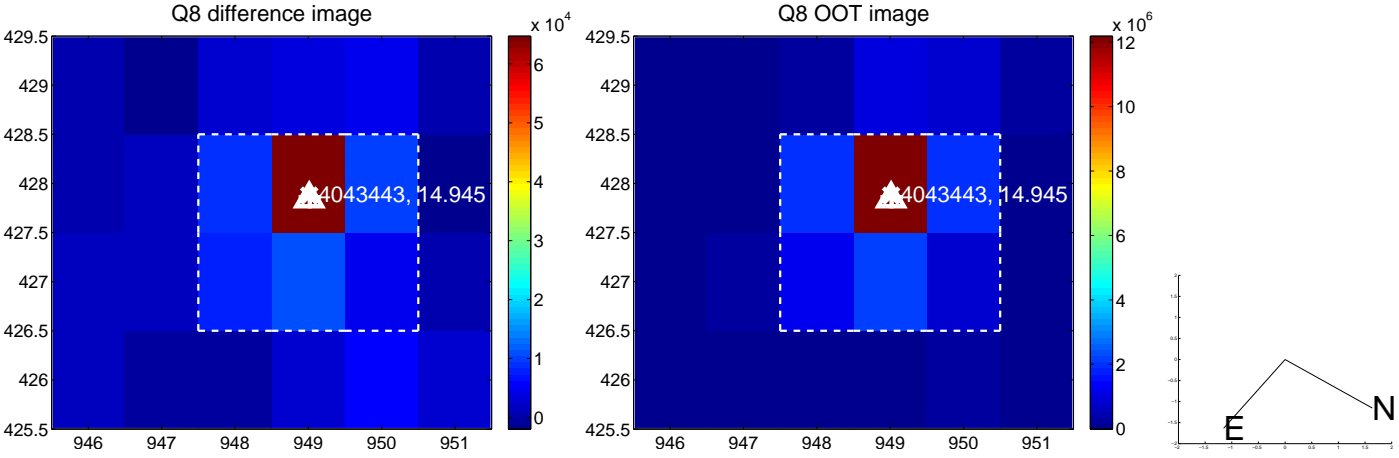
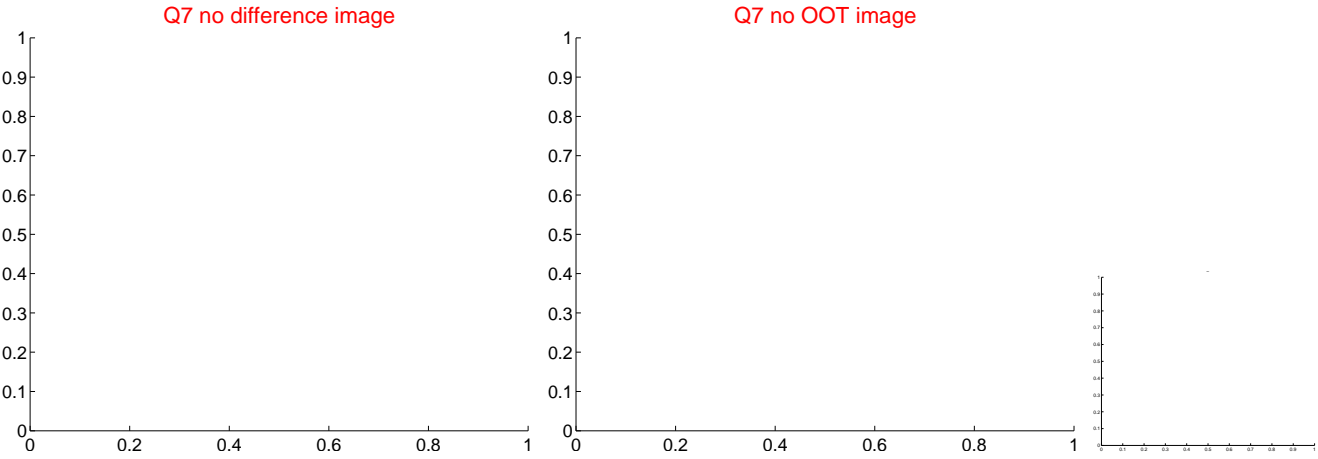
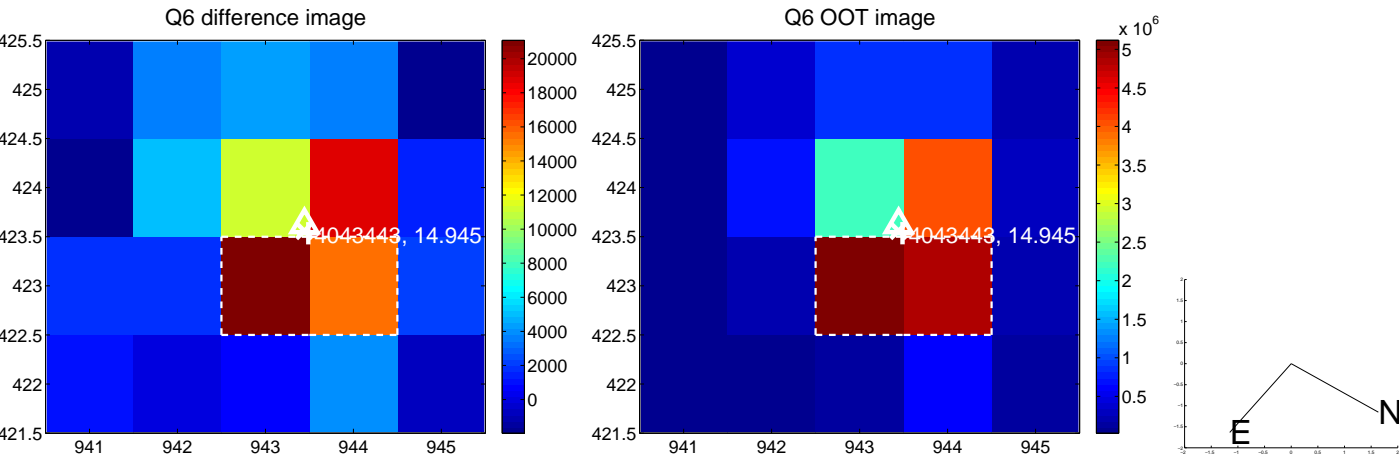
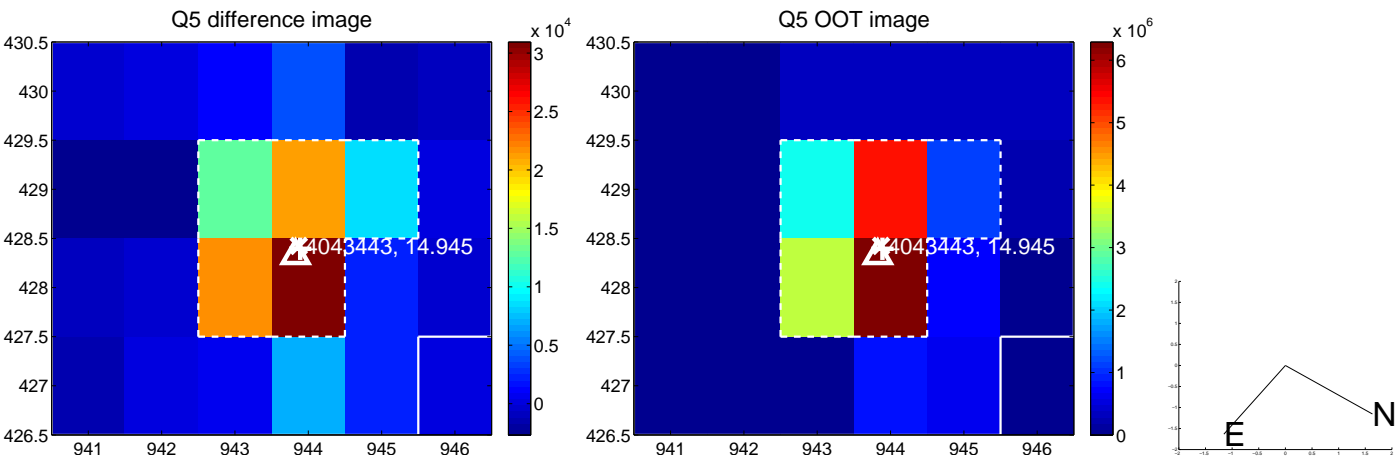


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

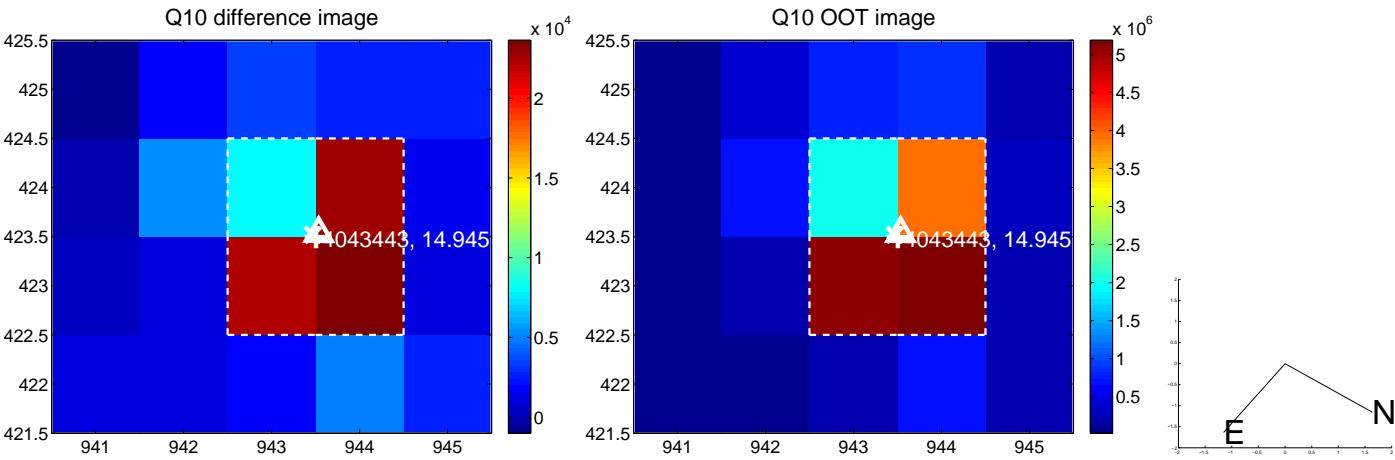
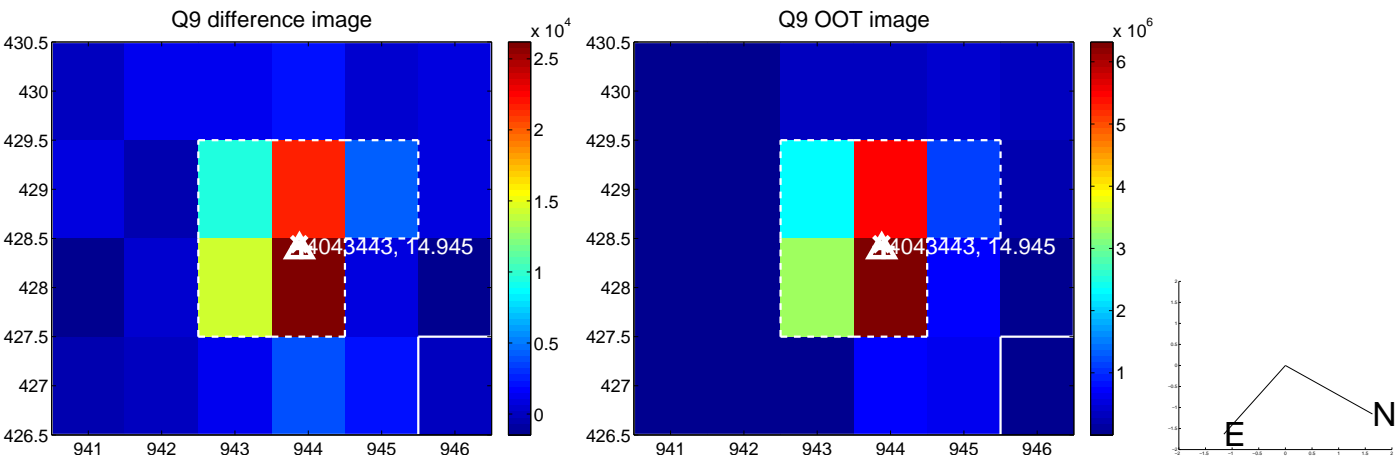
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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.

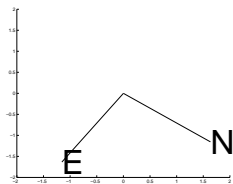
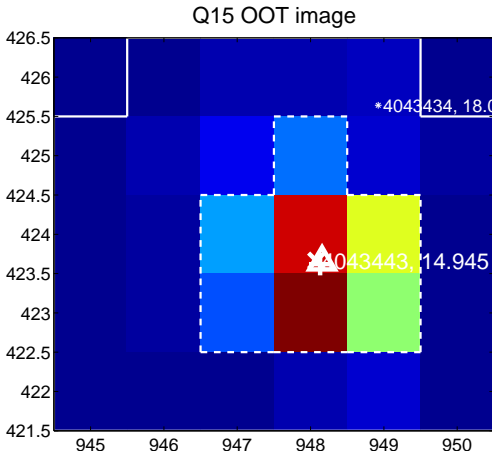
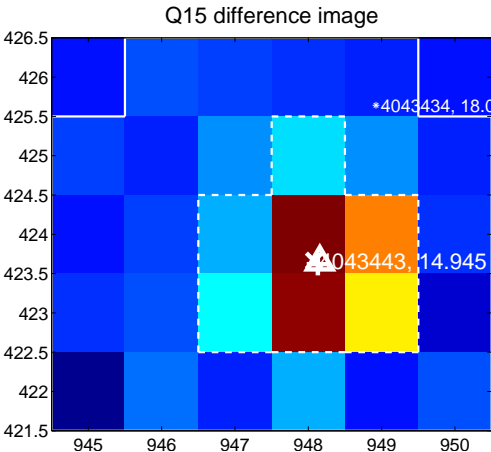
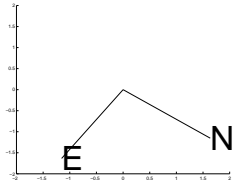
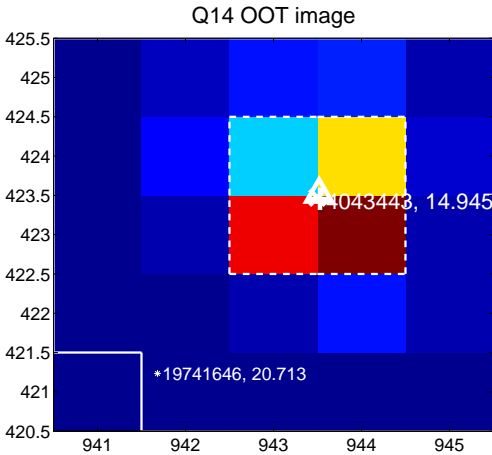
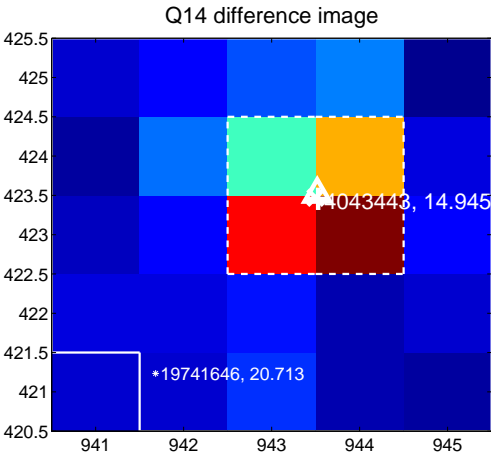


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

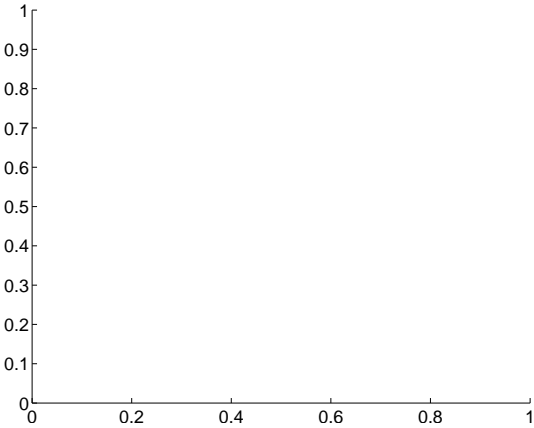
Q13 no difference image



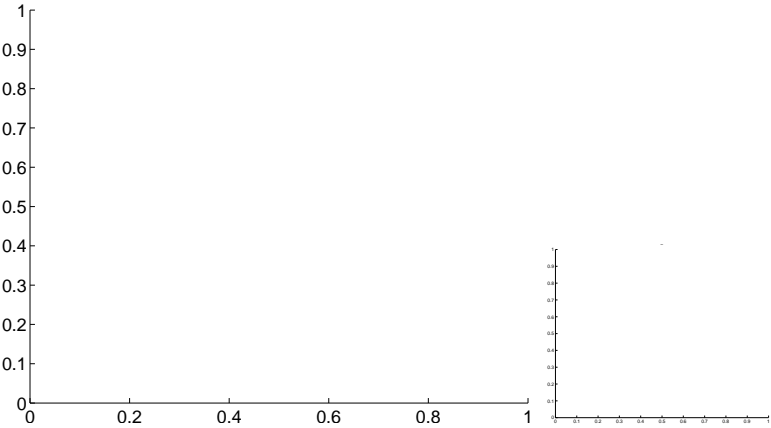
Q13 no OOT image



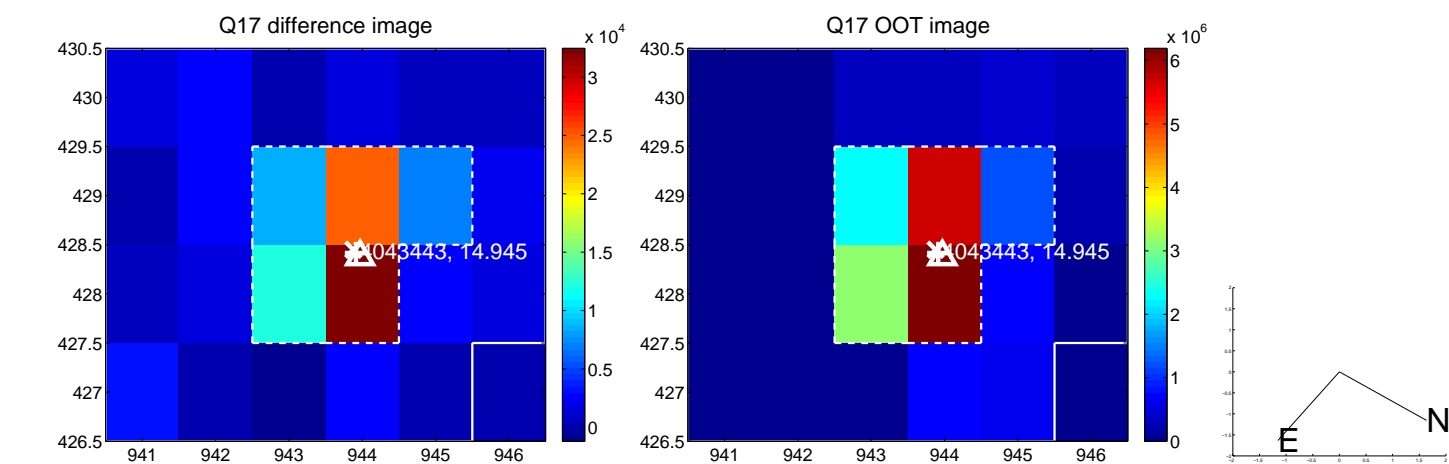
Q16 no difference image



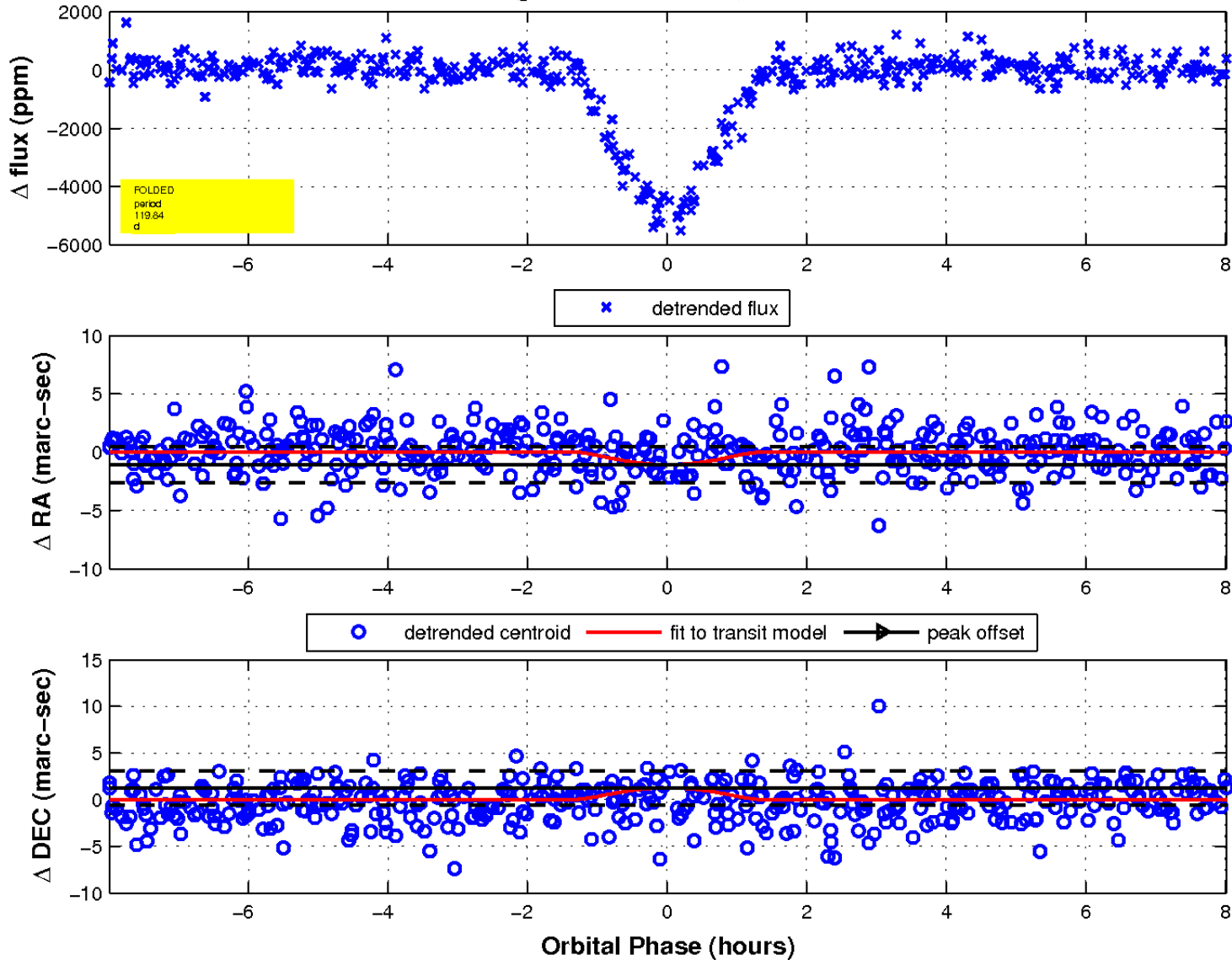
Q16 no OOT image



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



fluxWeightedCentroids, Planet 2 of 2



UKIRT Image

Declination

