

# KIC 009028474

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009028474-01	OBS	3510.01	124.937055	177.682301	243052.5	7.485	7997.3	4253.8	0.94	5887	58.16	4.07
009028474-02	OBS	No	124.939325	183.984750	118081.0	11.045	3517.2	4418.7	0.94	5887	47.85	4.07
009028474-03	OBS	No	248.918745	312.240003	310.9	130.763	18.7	7.4	0.94	5887	2.04	1.62
009028474-04	OBS	No	268.367566	263.981763	2029.8	15.000	120.7	-1.0	0.94	5887	4.22	1.47
009028474-05	OBS	No	223.237472	352.638943	570.6	48.532	14.3	15.2	0.94	5887	4.42	1.88

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009028474-01	OBS	FP	0.00	0	1	0	0	MOD_SEC_DV—MOD_SEC_ALT—DEEP_V_SHAPED—HAS_SEC_TCE
009028474-02	OBS	FP	0.00	1	1	0	0	IS_SEC_TCE
009028474-03	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009028474-04	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_NOFITS
009028474-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_ZUMA—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS

**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.

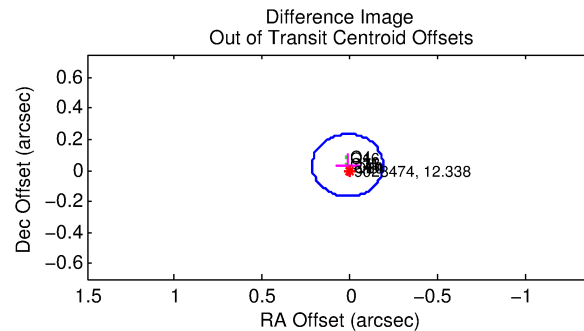
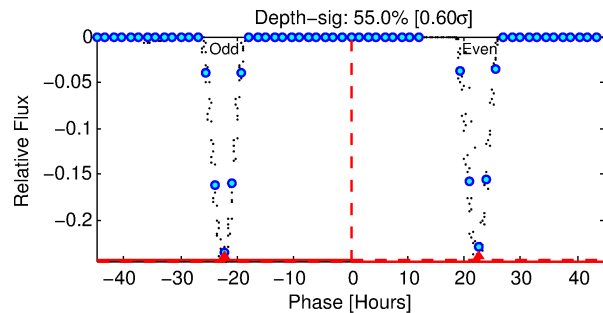
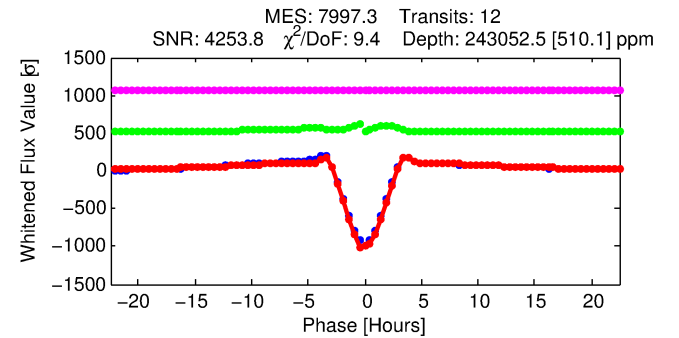
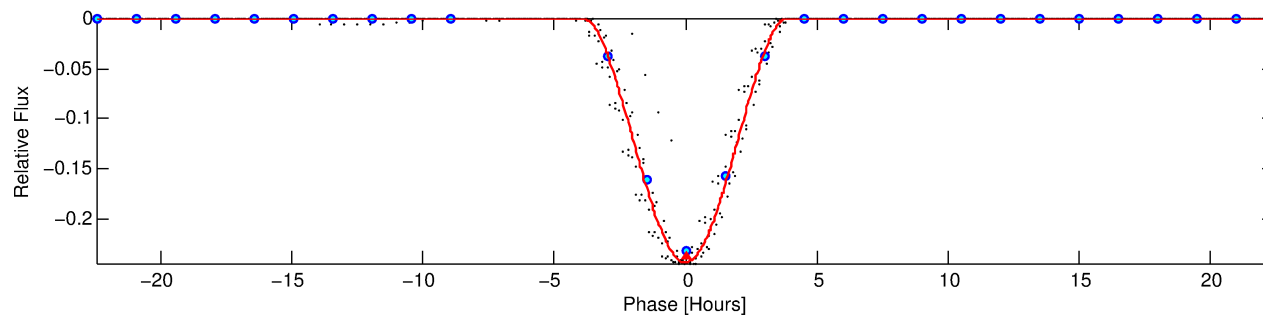
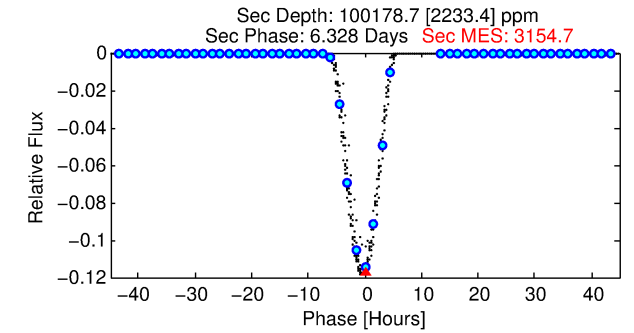
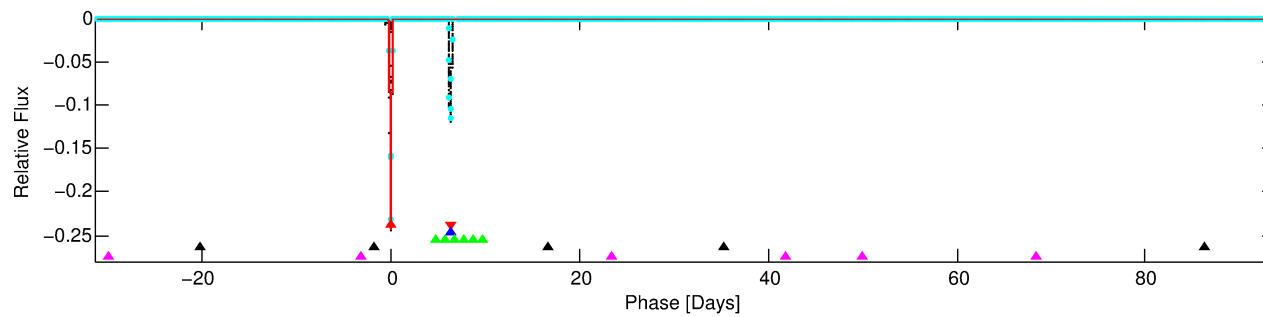
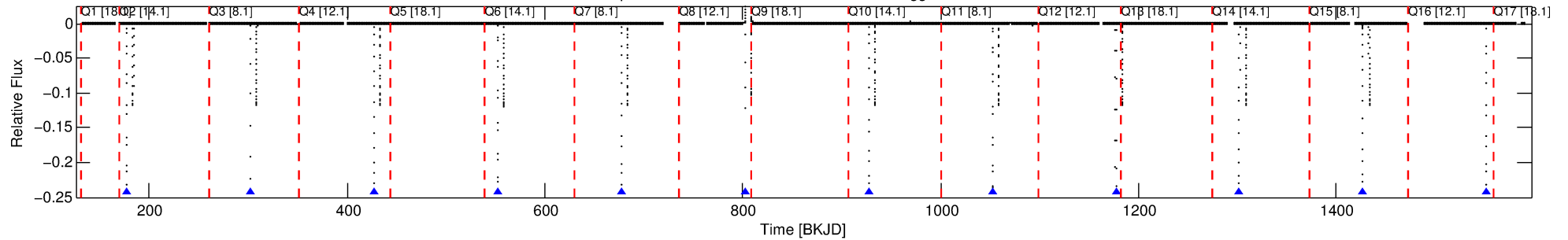
Ephemeris Match Information For 009028474-01

No Significant Match Found

# DV One-Page Summary

KIC: 9028474 Candidate: 1 of 5 Period: 124.937 d  
KOI: K03510.01 Corr: 0.983

Kp: 12.34 R\*: 0.94 Rs Teff: 5887.0 K Logg: 4.48 Fe/H: -0.140



## DV Fit Results:

Period = 124.93705 [0.00004] d  
Epoch = 177.6823 [0.0002] BKJD  
Rp/R\* = 0.5664 [0.1132]  
a/R\* = 177.43 [4.43]  
b = 0.72 [0.19]  
Seff = 4.07 [1.12]  
Teff = 362 [25] K  
Rp = 58.16 [16.53] Re  
a = 0.4840 [0.0834] AU  
Ag = 3817.00 [1809.08] [2.11σ]  
Teffp = 4401 [457] K [8.83σ]

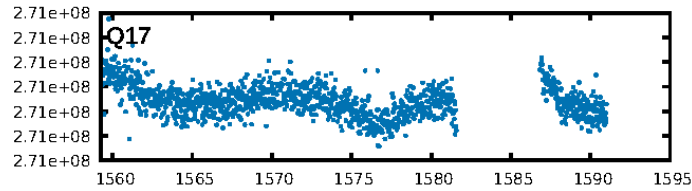
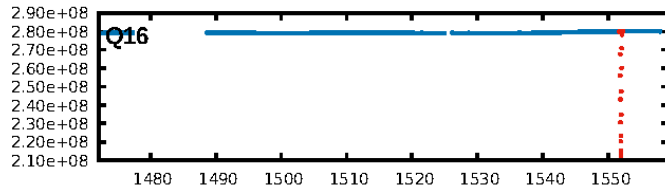
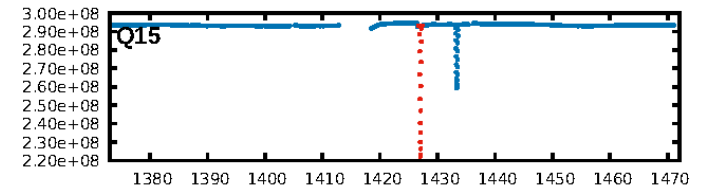
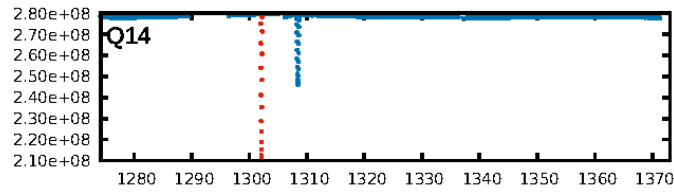
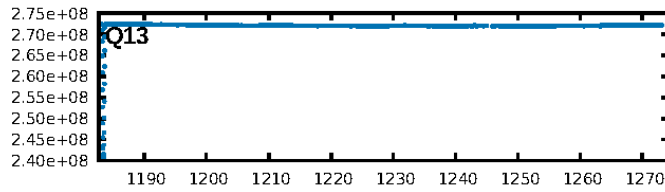
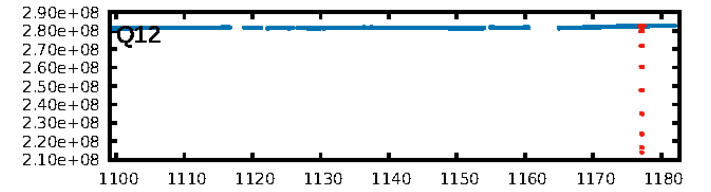
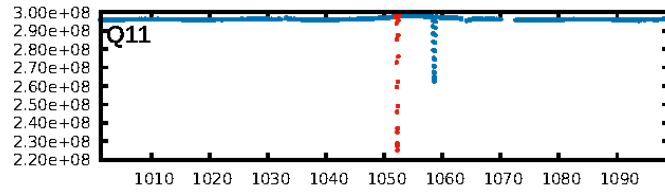
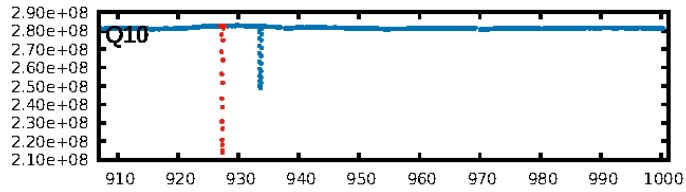
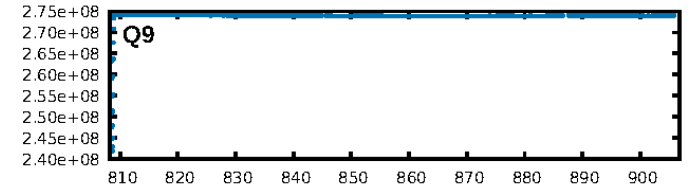
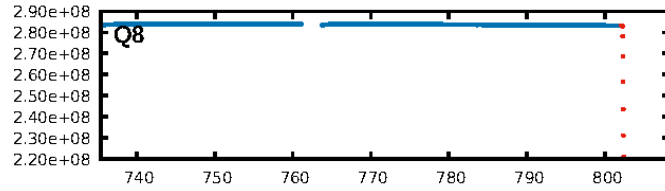
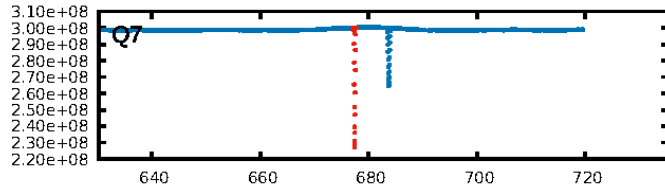
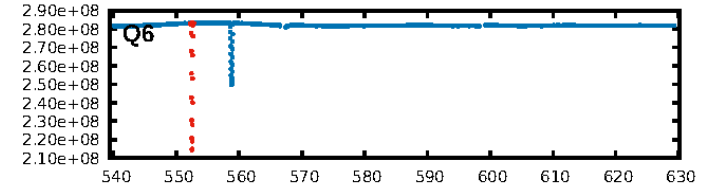
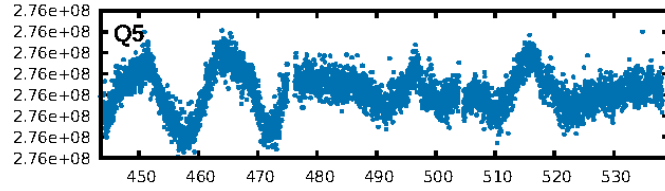
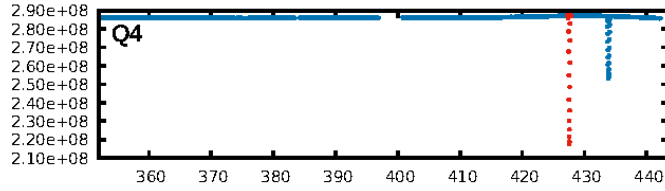
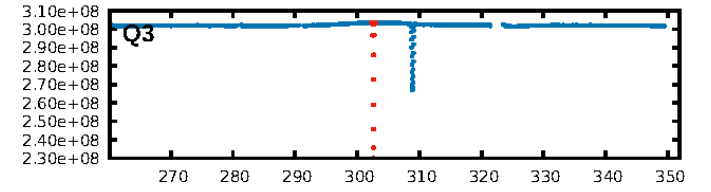
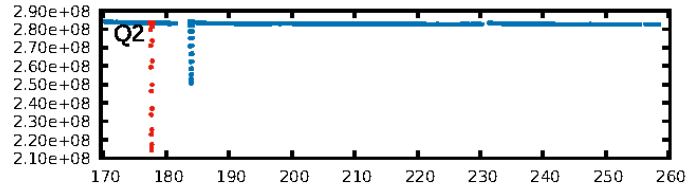
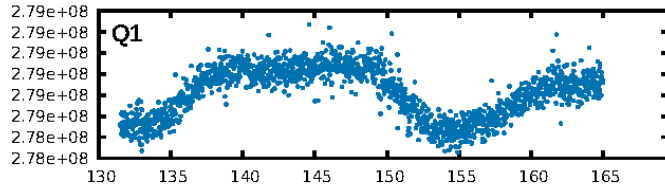
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 0.3% [0.00σ]  
ModelChiSquare2-sig: 0.0%  
ModelChiSquareGof-sig: 0.0%  
Bootstrap-pfa: 0.00e+00  
RollingBand-fgt: 1.00 [12/12]  
GhostDiagnostic-chr: 15.37  
Centroid-sig: 0.0%  
Centroid-so: 0.141 arcsec [267.56σ]  
OotOffset-rm: 0.037 arcsec [0.55σ]  
KicOffset-rm: 0.112 arcsec [1.67σ]  
OotOffset-st: 4/4/2/0 [10]  
KicOffset-st: 4/4/2/0 [10]  
DiffImageQuality-fgm: 1.00 [10/10]  
DiffImageOverlap-fno: 1.00 [10/10]

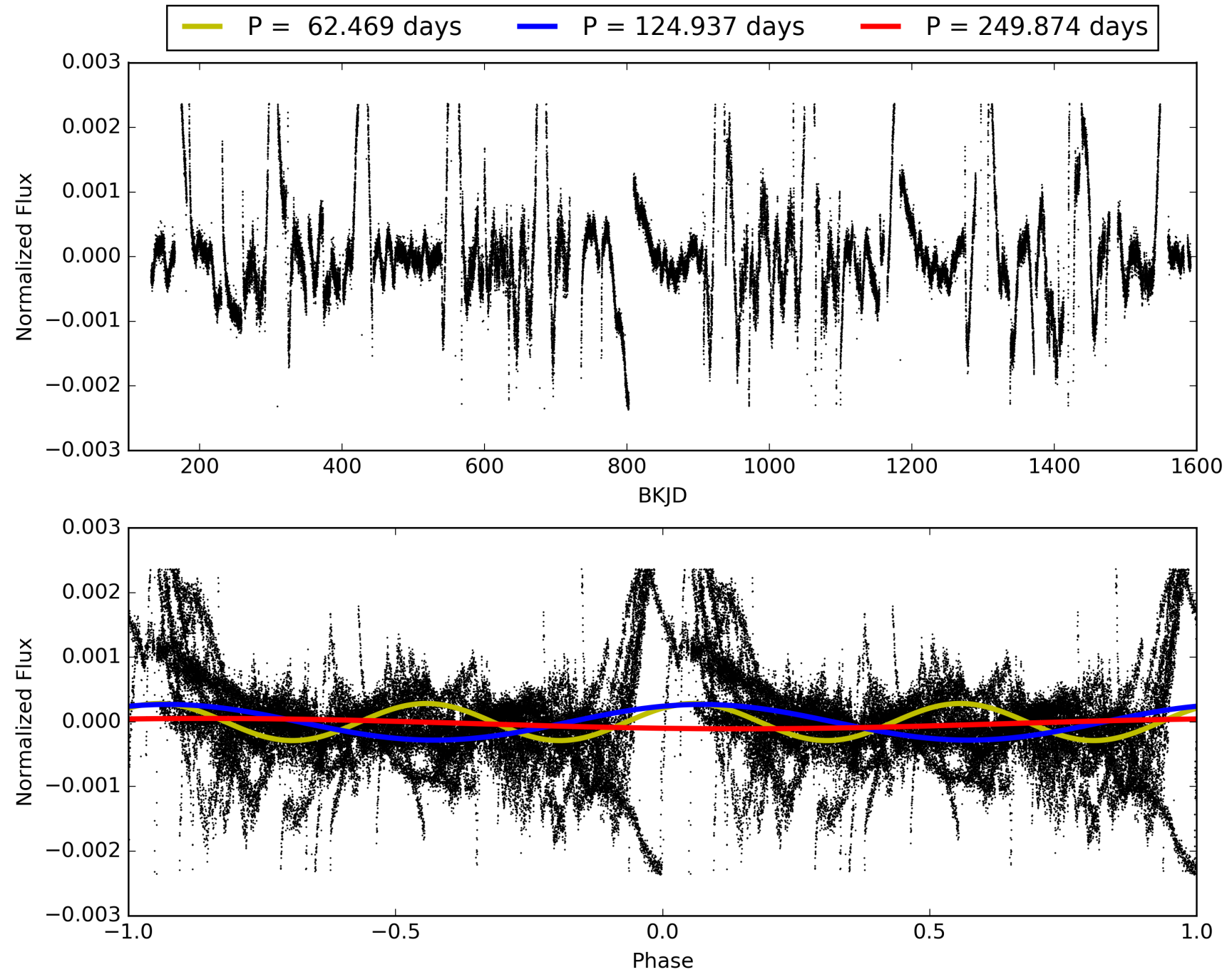
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 21:29:47 Z

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

# TCE 009028474-01, PDC Light Curves



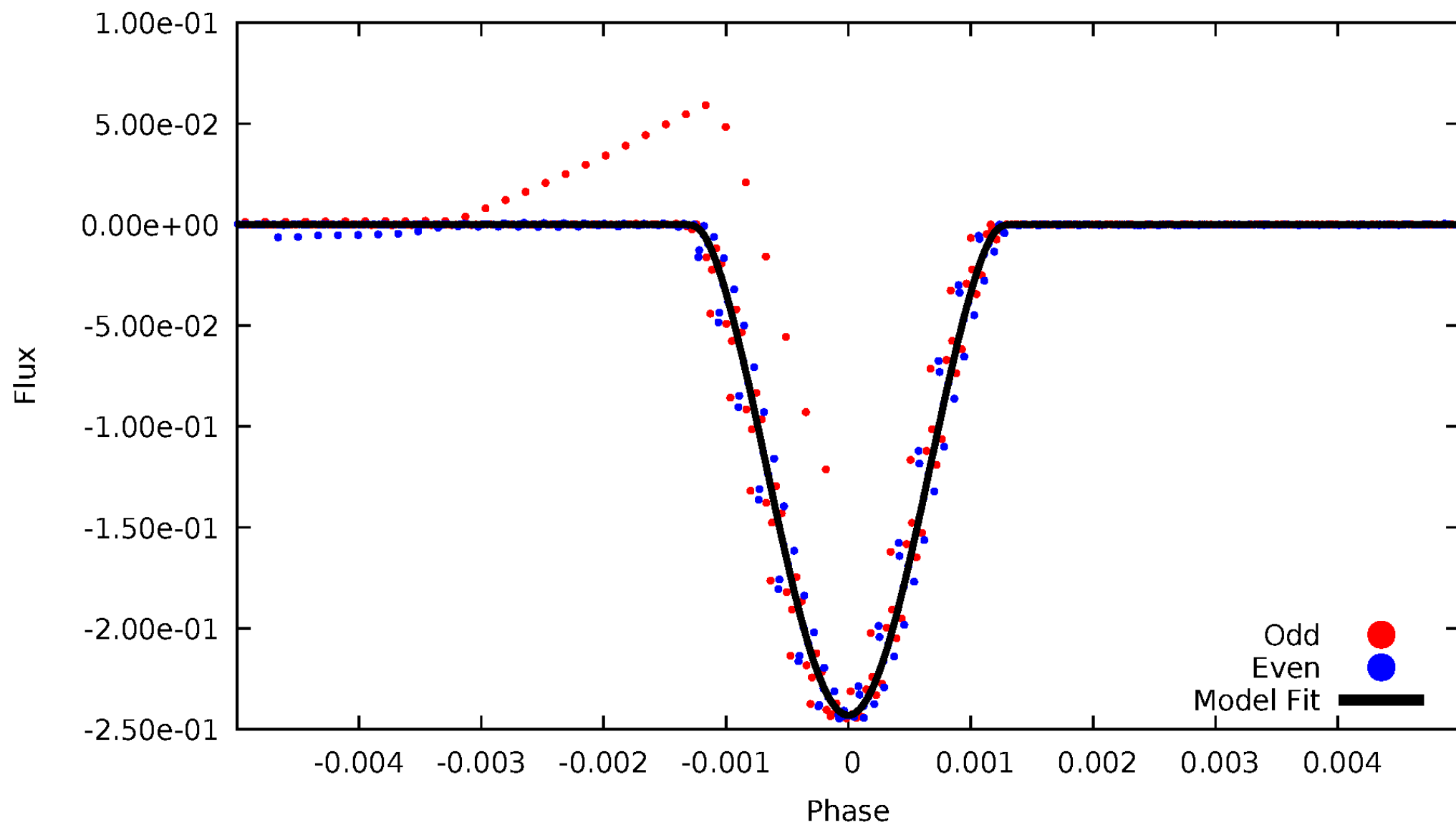
TCE 009028474-01





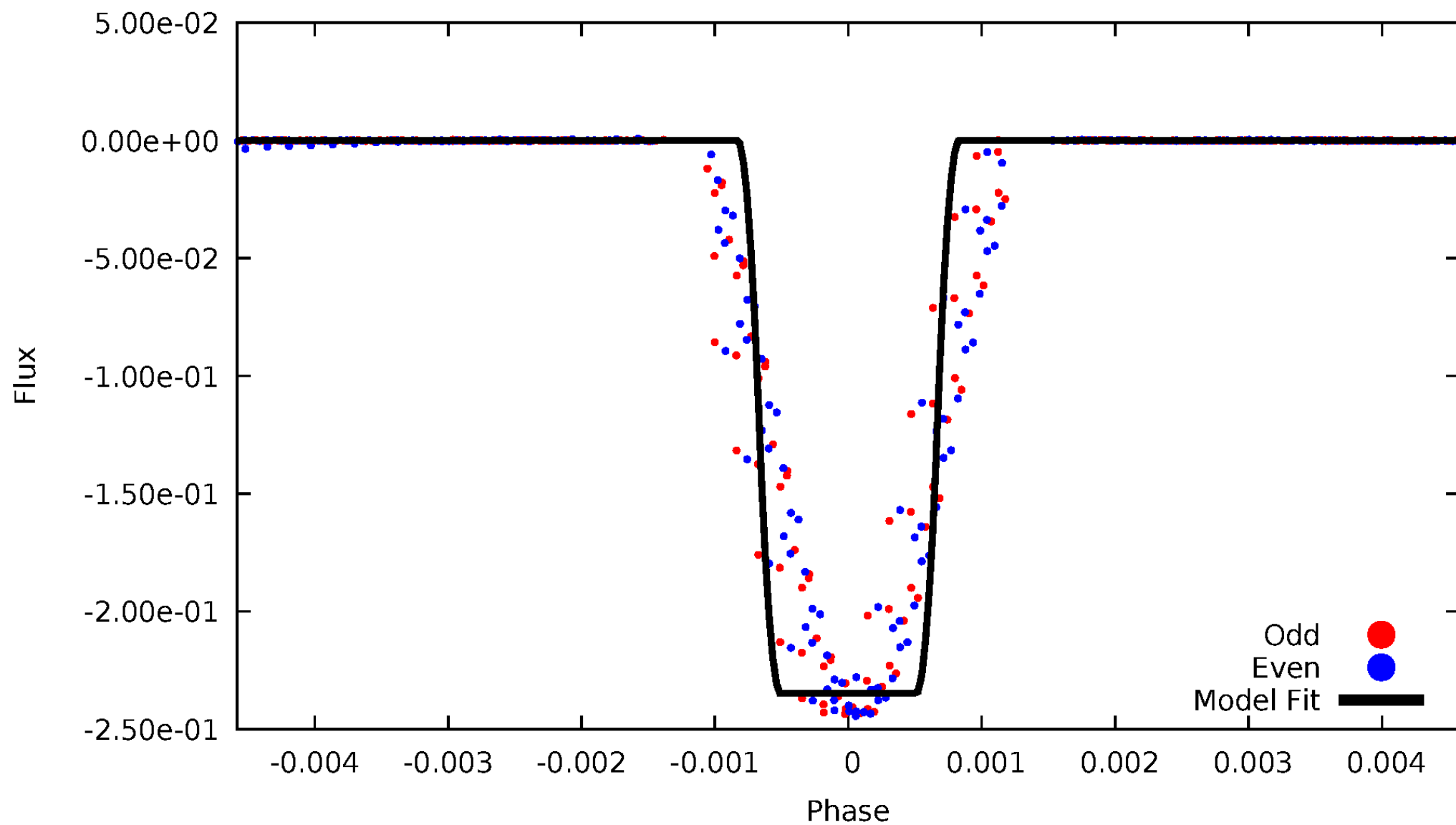
# DV Odd/Even

TCE 009028474-01



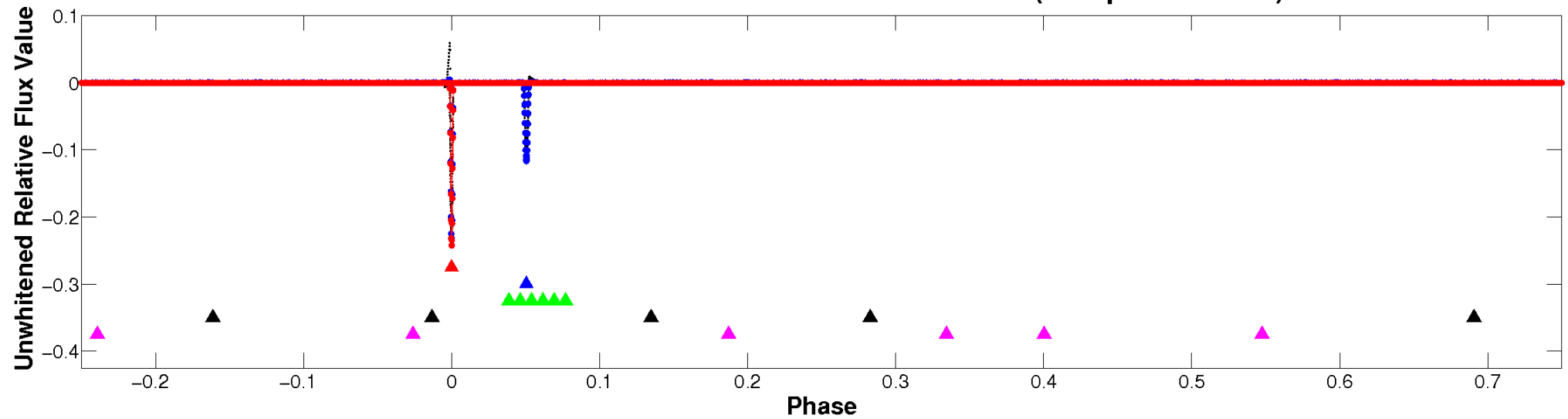
# ALT Odd/Even

TCE 009028474-01

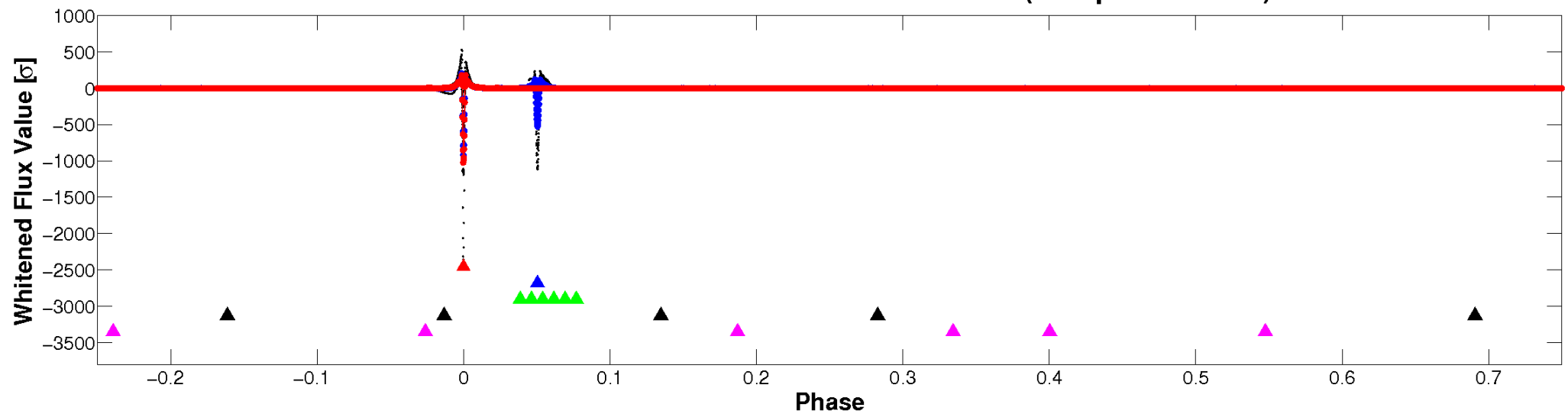


# Non-Whitened Vs. Whitened Light Curve

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

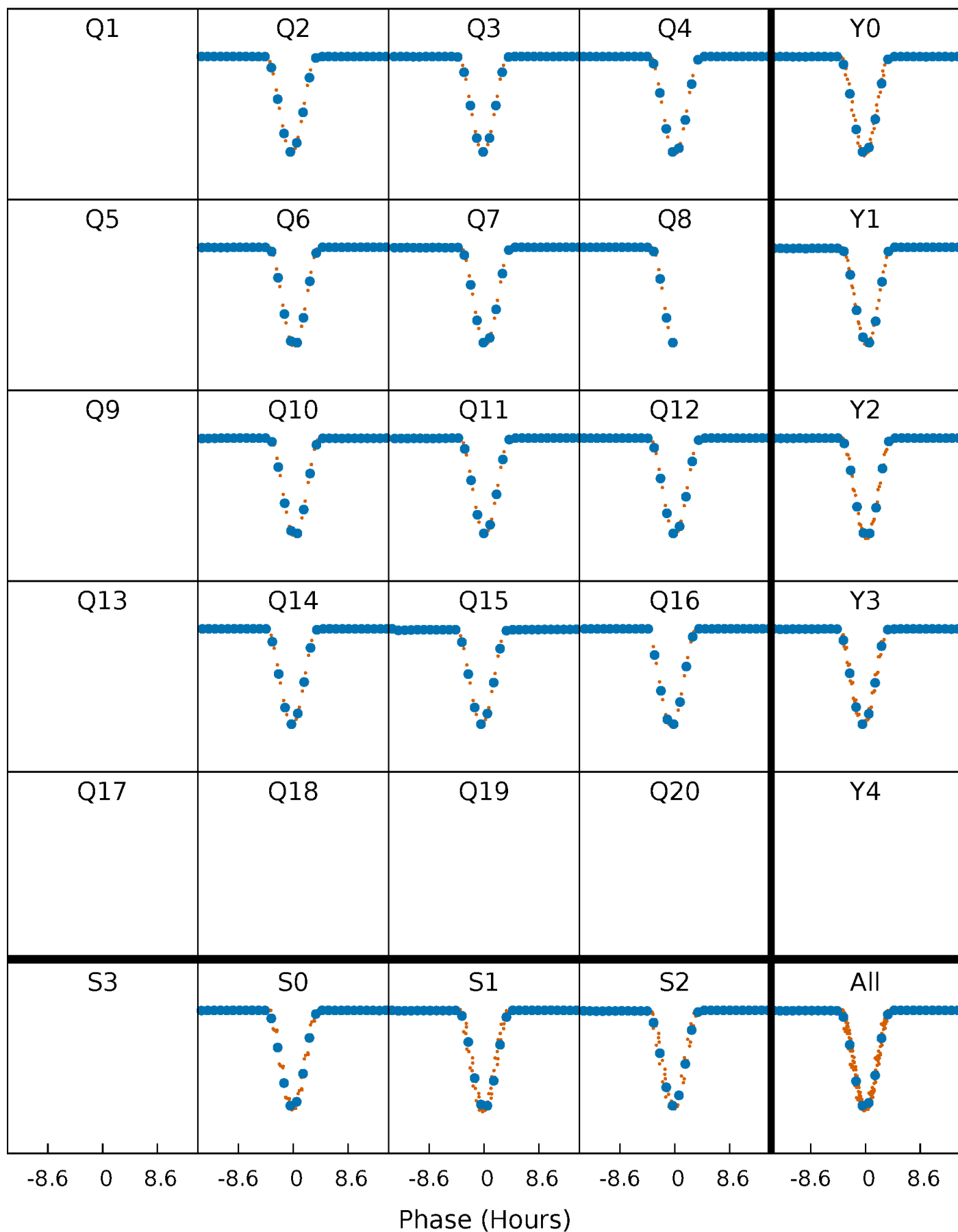


## Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)



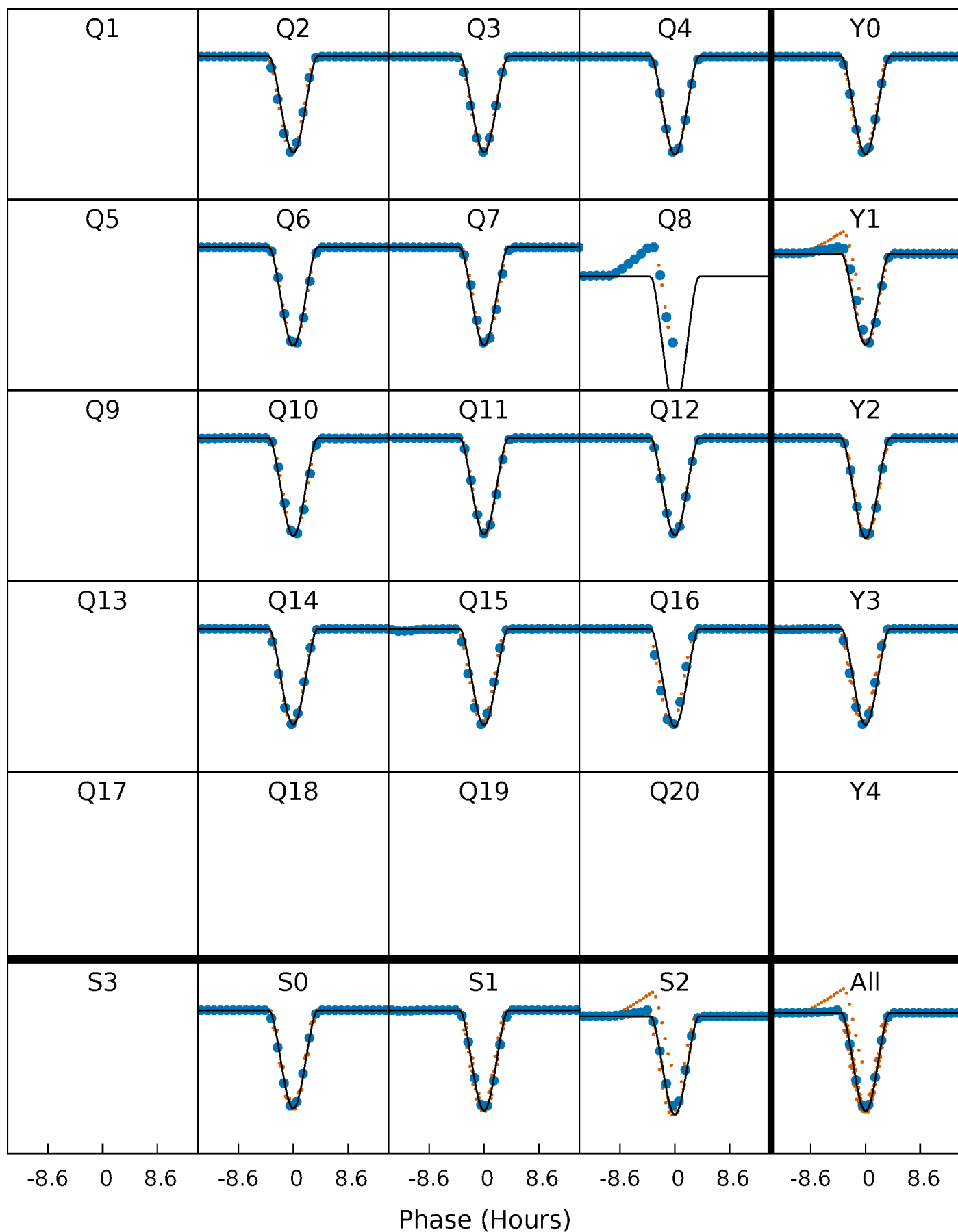
# PDC Quarter-Phased Transit Curves

TCE 009028474-01 P=124.937055 Days  $T_0=177.682301$  (BKJD)



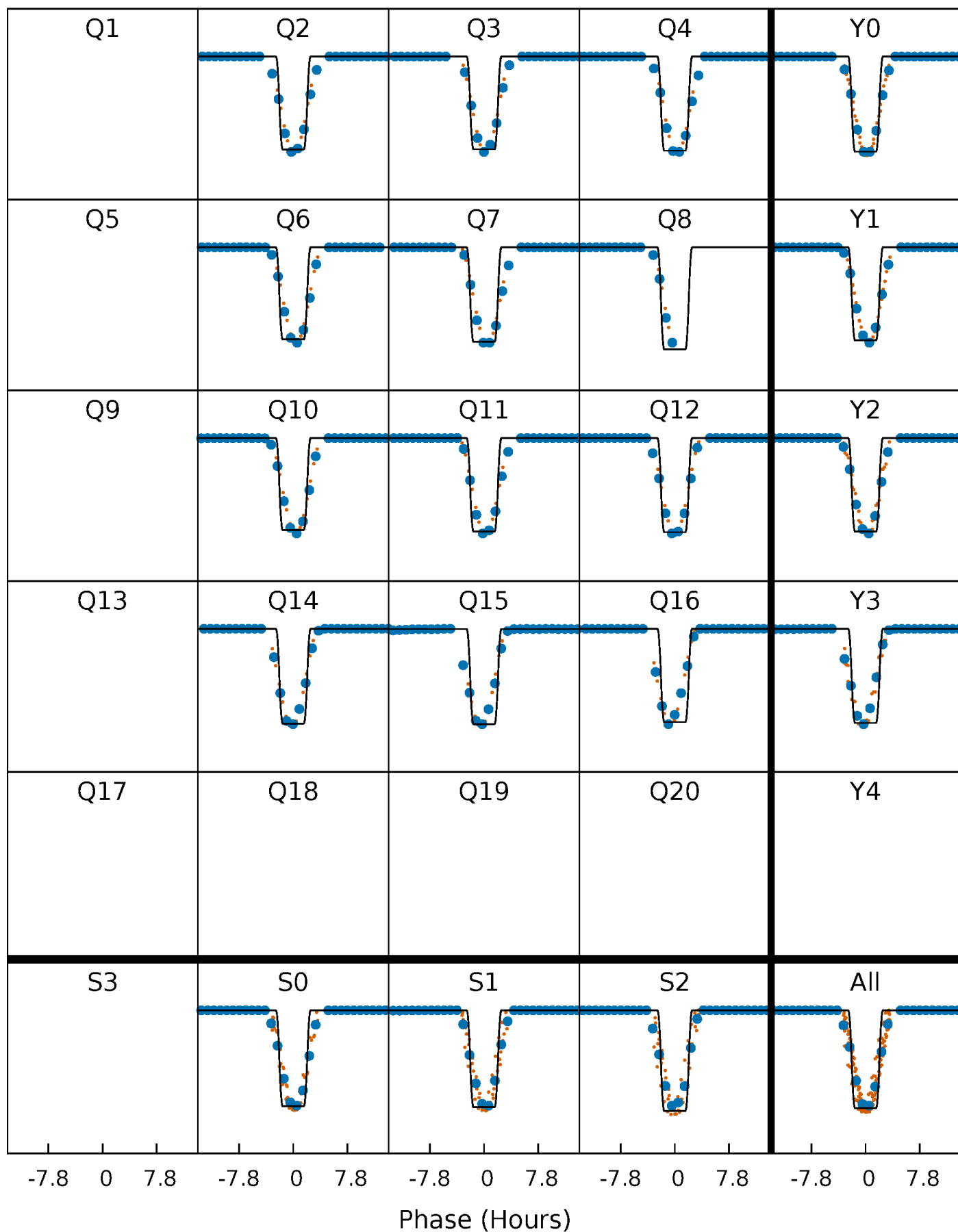
# DV Quarter-Phased Transit Curves

TCE 009028474-01 P=124.937055 Days  $T_0=177.682301$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

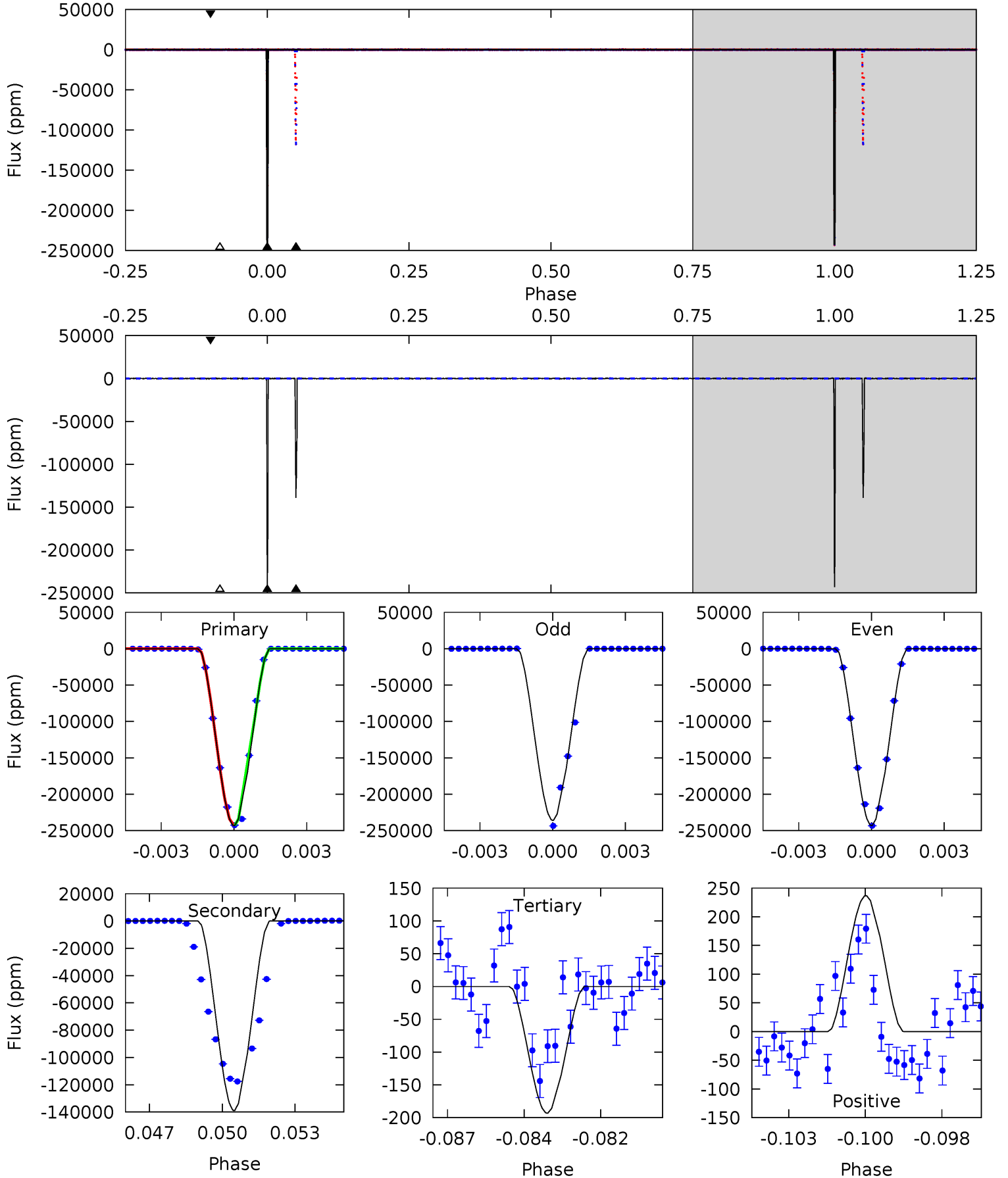
TCE 009028474-01 P=124.938965 Days  $T_0=177.666089$  (BKJD)



# DV Model-Shift Uniqueness Test

009028474-01, P = 124.937055 Days, E = 52.745246 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
9806	5604	7.79	9.56	5.28	3.01	2.02	9798	9797	5596	5595	123.1	0.95	0.00	0.37

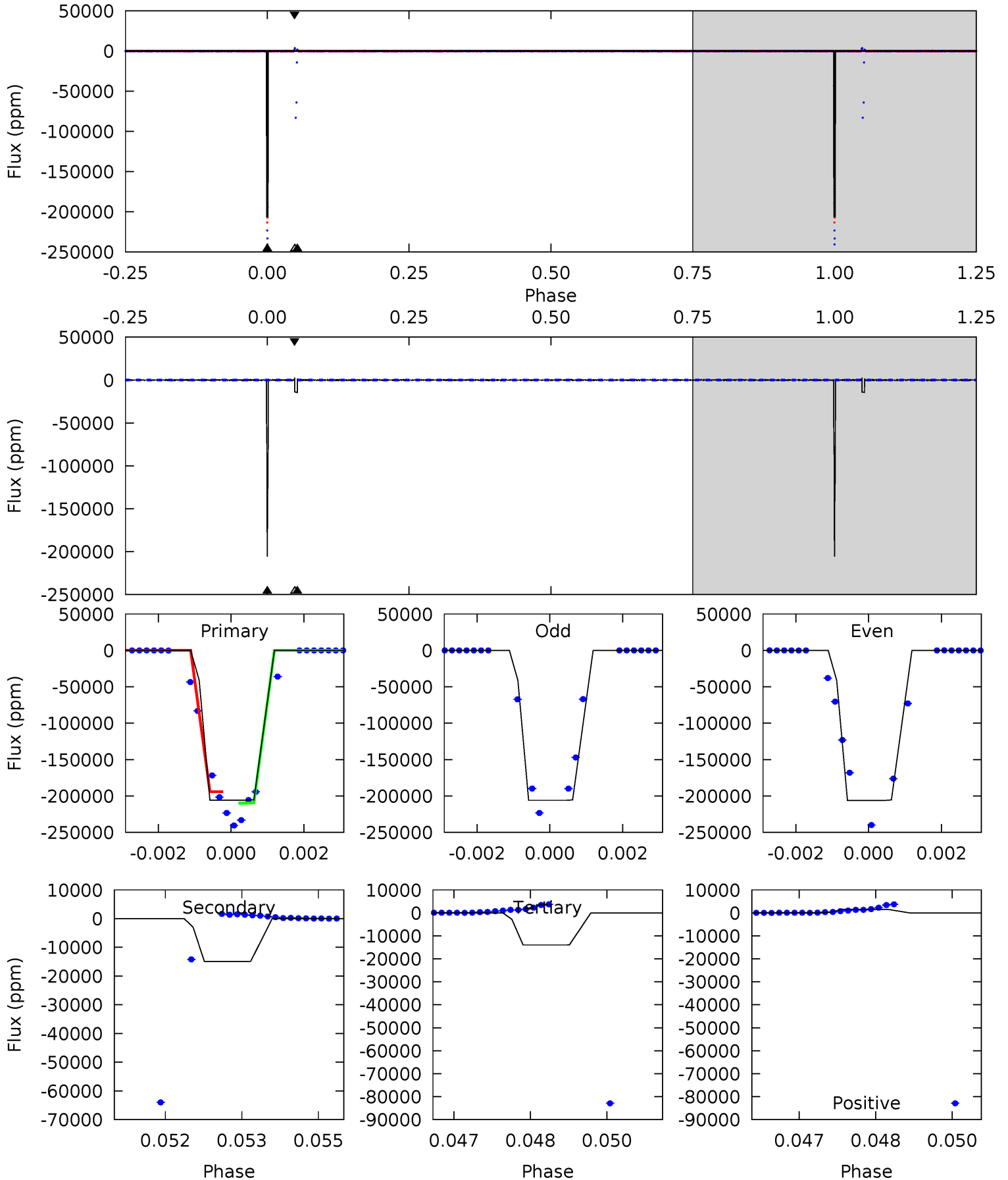




# Alt Model-Shift Uniqueness Test

009028474-01, P = 124.938965 Days, E = 52.727124 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
1966	142.6	133.5	14.5	5.36	3.14	1.13	1833	1952	9.05	128.1	0.11	0.99	0.01	0



### Stellar Parameters For KIC 009028474

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5887^{+132}_{-162}$	$4.477^{+0.060}_{-0.140}$	$-0.140^{+0.300}_{-0.300}$	$0.941^{+0.190}_{-0.102}$	$0.970^{+0.110}_{-0.110}$	$1.640^{+0.428}_{-0.689}$
	+2%/-3%	+1%/-3%	+214%/-214%	+20%/-11%	+11%/-11%	+26%/-42%
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 009028474-01 / KOI 3510.01

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-138943 \pm 25$	$60.21^{+12.68}_{-14.02}$	$511^{+27}_{-21}$	$5038^{+548}_{-393}$	$5700^{+3937}_{-1872}$
Alt.	$-14925 \pm 105$	$50.50^{+13.58}_{-12.01}$	$512^{+26}_{-22}$	$3469^{+316}_{-230}$	$760^{+537}_{-286}$

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

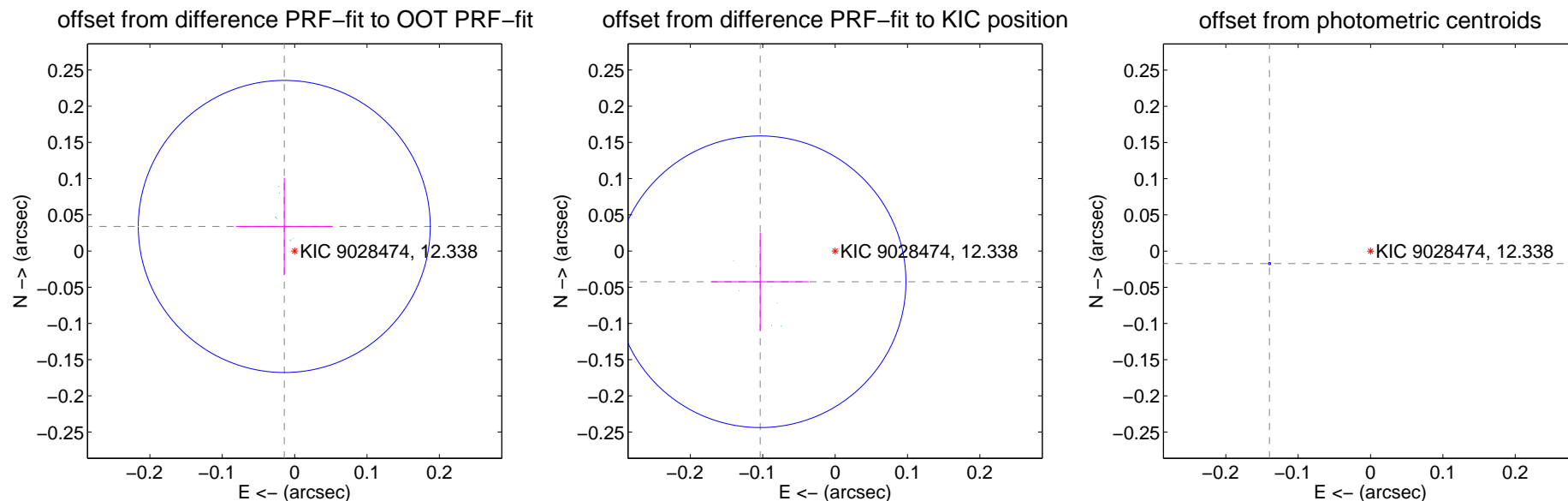
## DV Centroid Data

Supplemental centroid analysis for 009028474-01. Kepler magnitude: 12.34. Transit SNR 4253.78

There are 10 quarters with good PRF difference image offsets

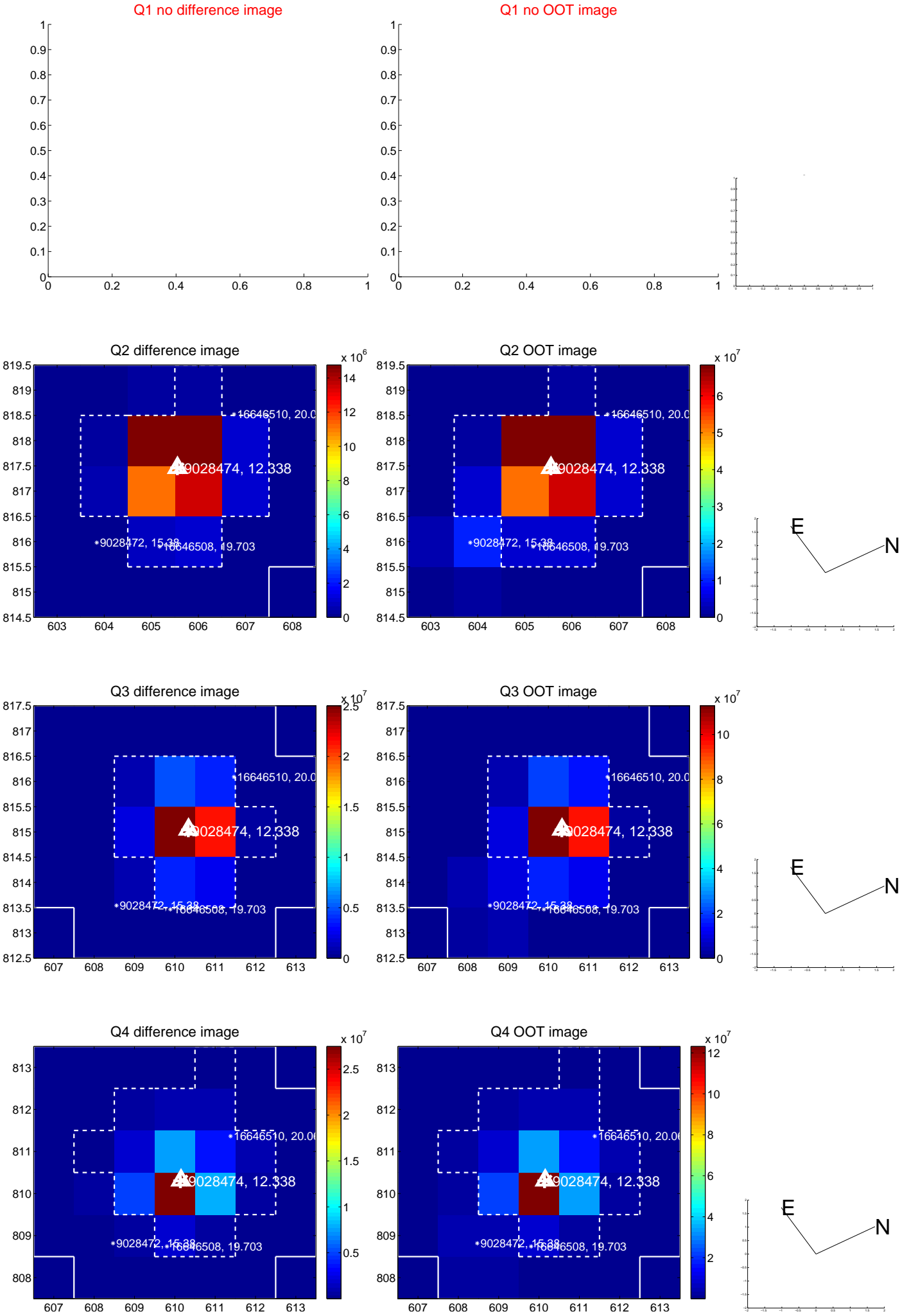
The direct PRF centroid is offset from the target star catalog position by about 0.19 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.037 \pm 0.067$	0.55	$0.014 \pm 0.067$	$0.034 \pm 0.067$
PRF-fit source offset from KIC position	$0.112 \pm 0.067$	1.67	$0.104 \pm 0.067$	$-0.042 \pm 0.067$
photometric centroid source offset	$0.14 \pm 0.00$	267.56	$0.14 \pm 0.00$	$-0.02 \pm 0.00$



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.

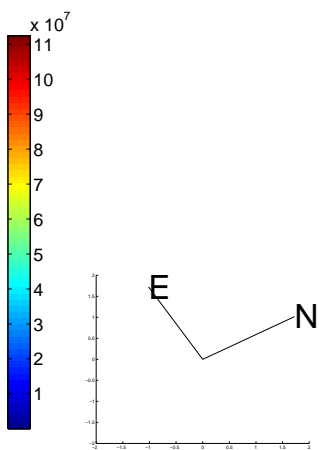
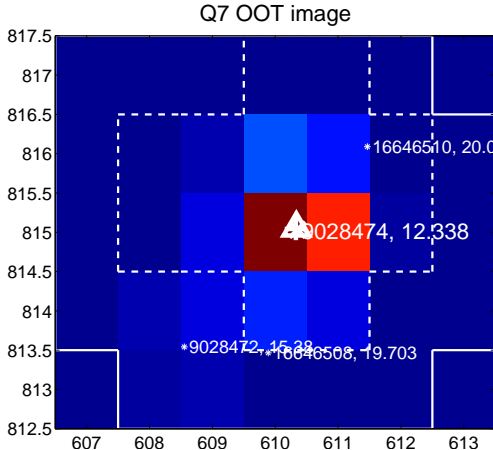
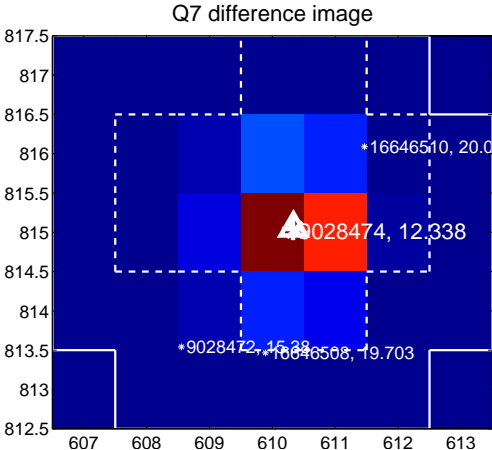
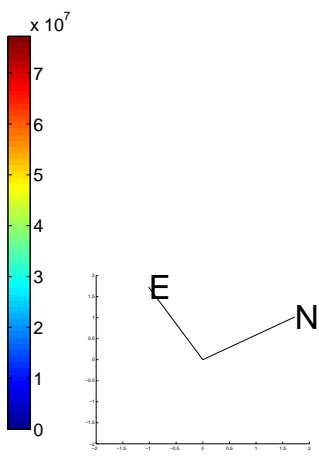
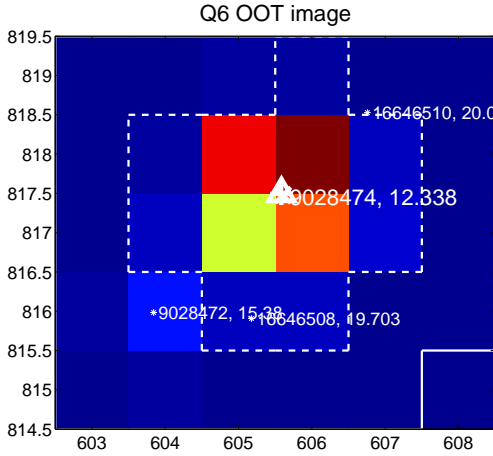
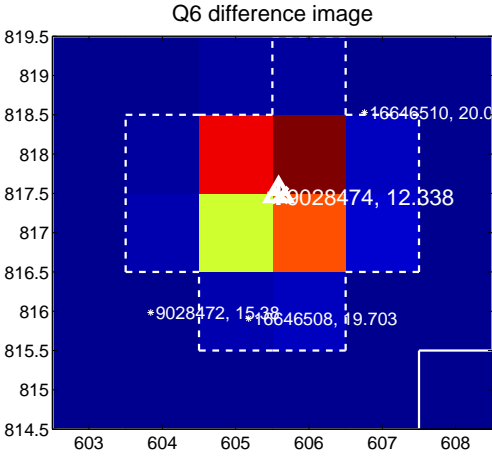
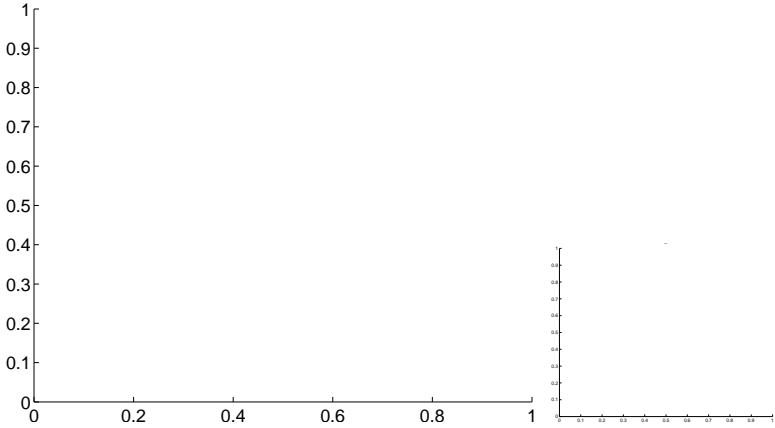


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

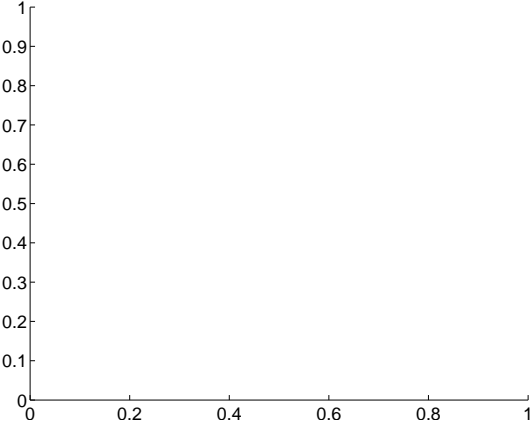
Q5 no difference image



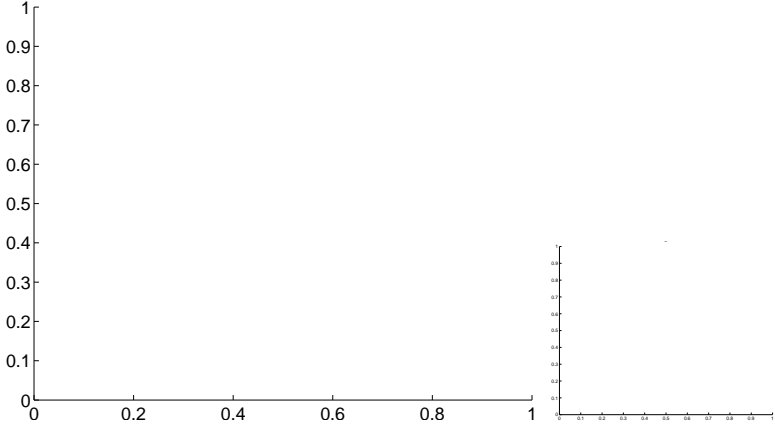
Q5 no OOT image



Q8 no difference image



Q8 no OOT image

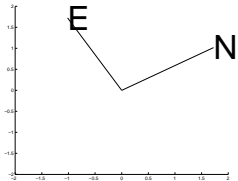
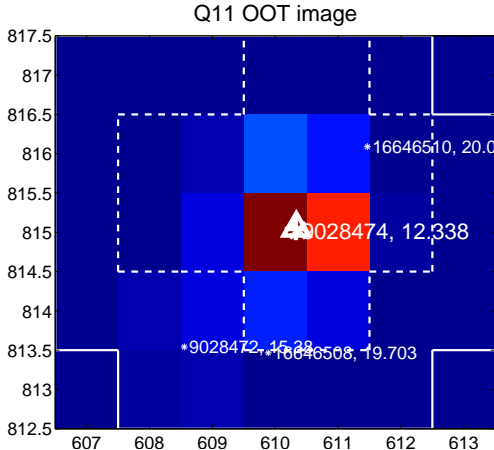
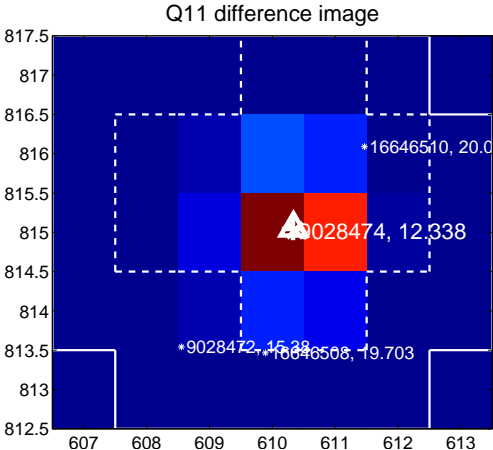
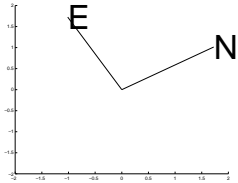
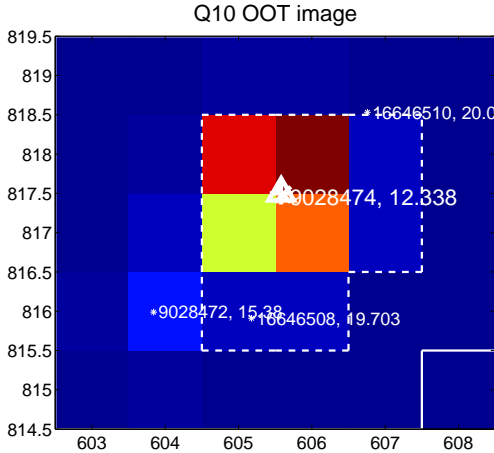
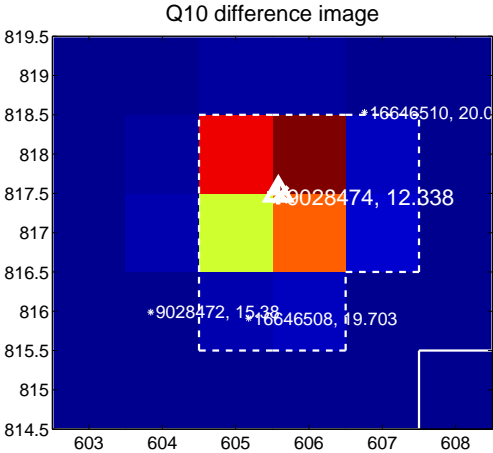
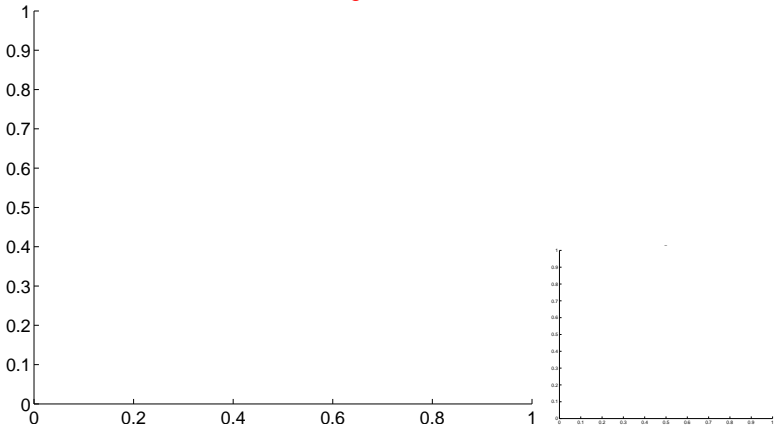


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

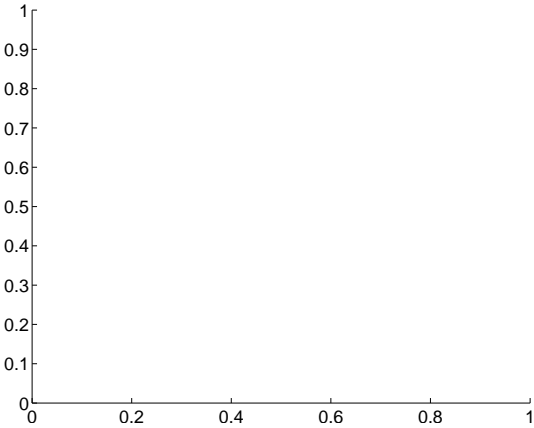
Q9 no difference image



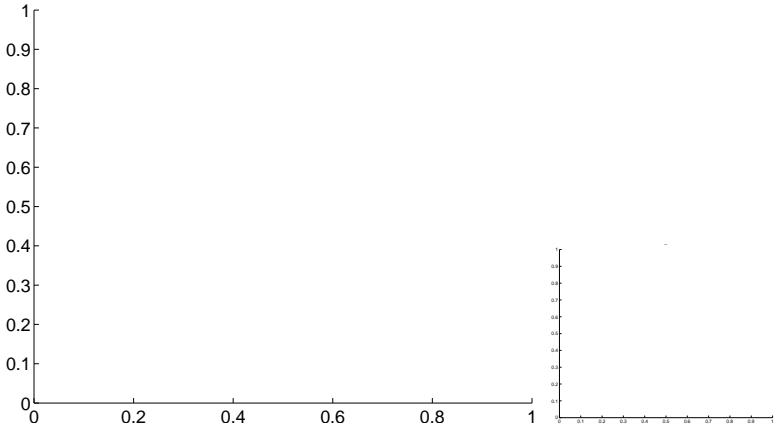
Q9 no OOT image



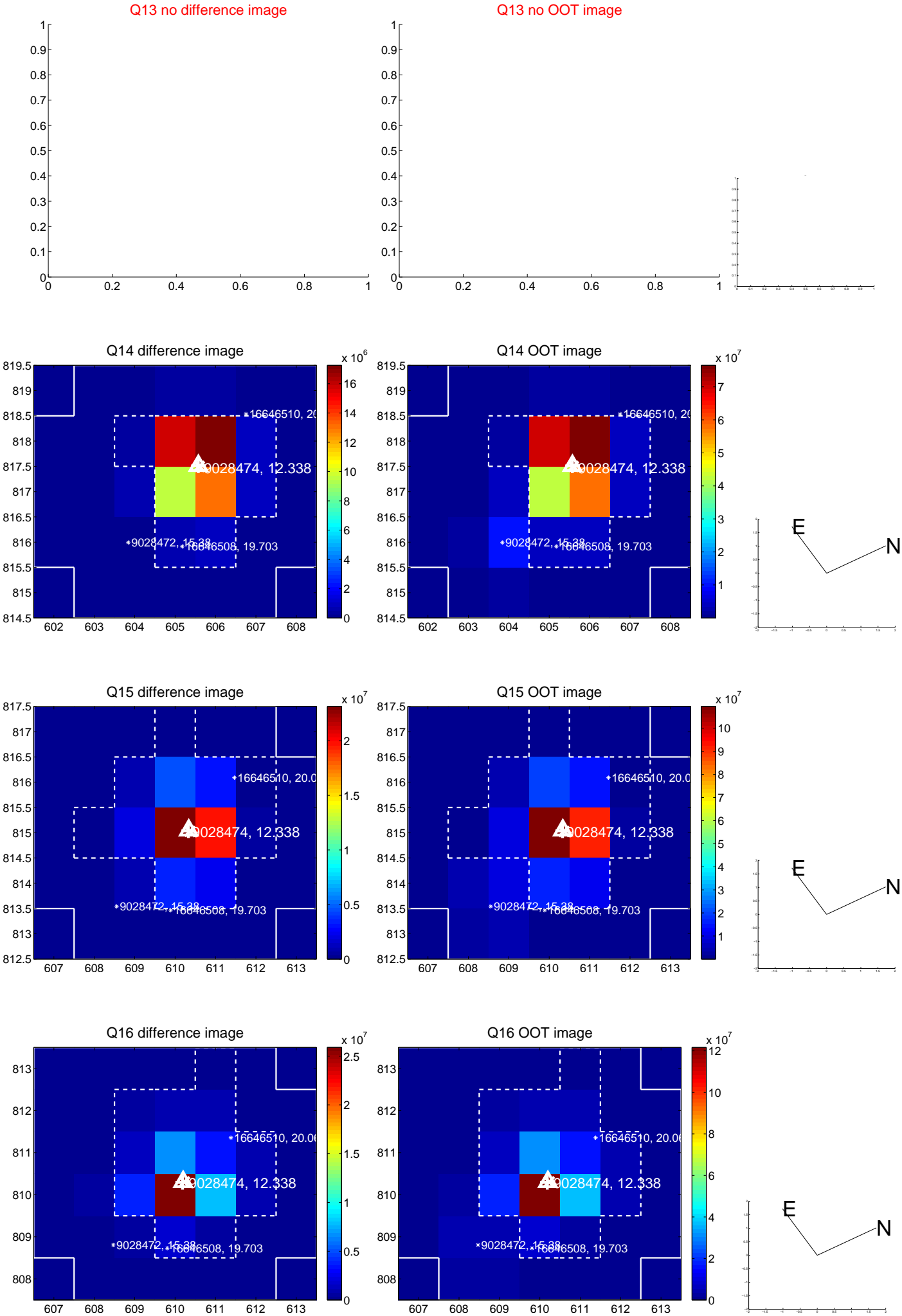
Q12 no difference image



Q12 no OOT image

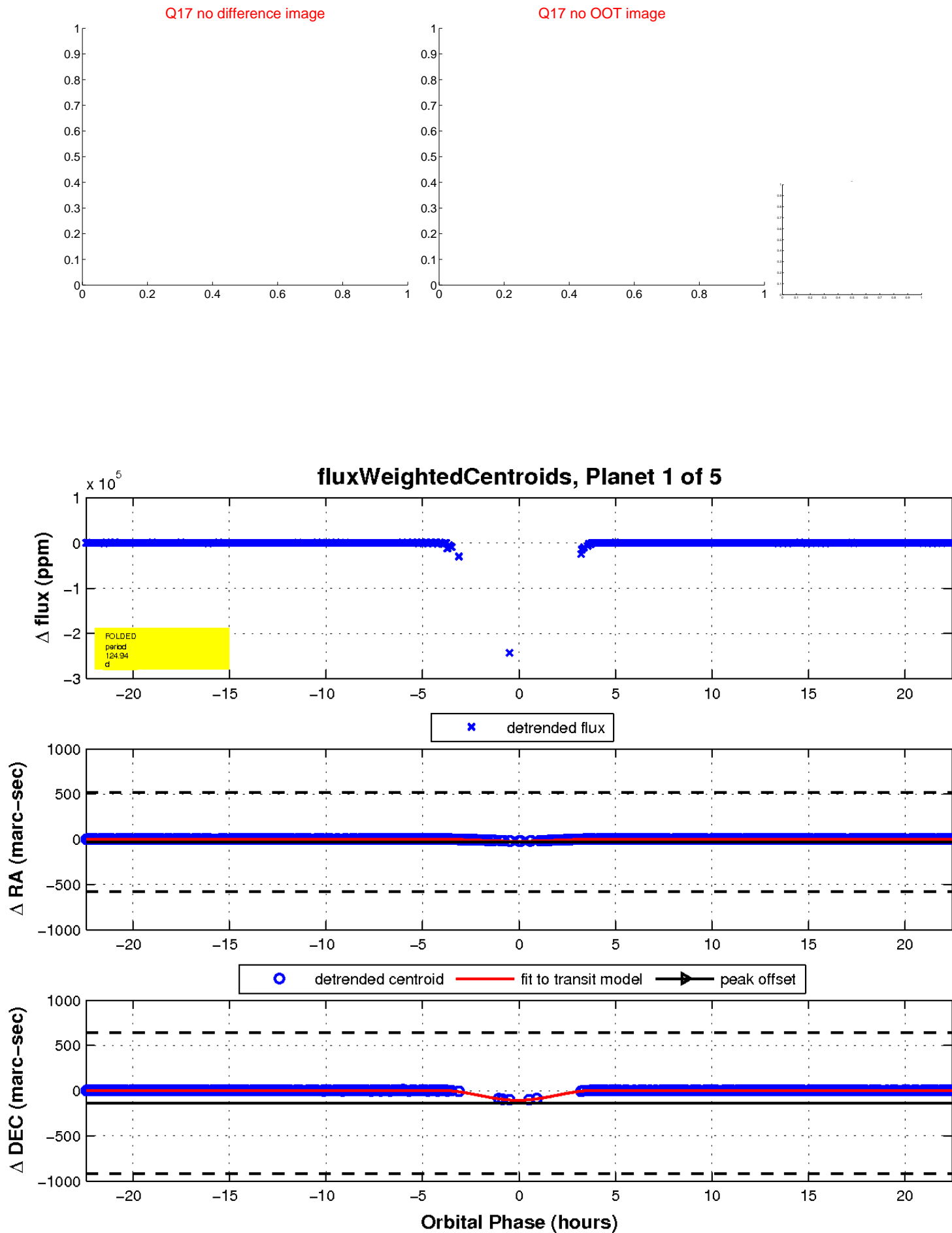


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



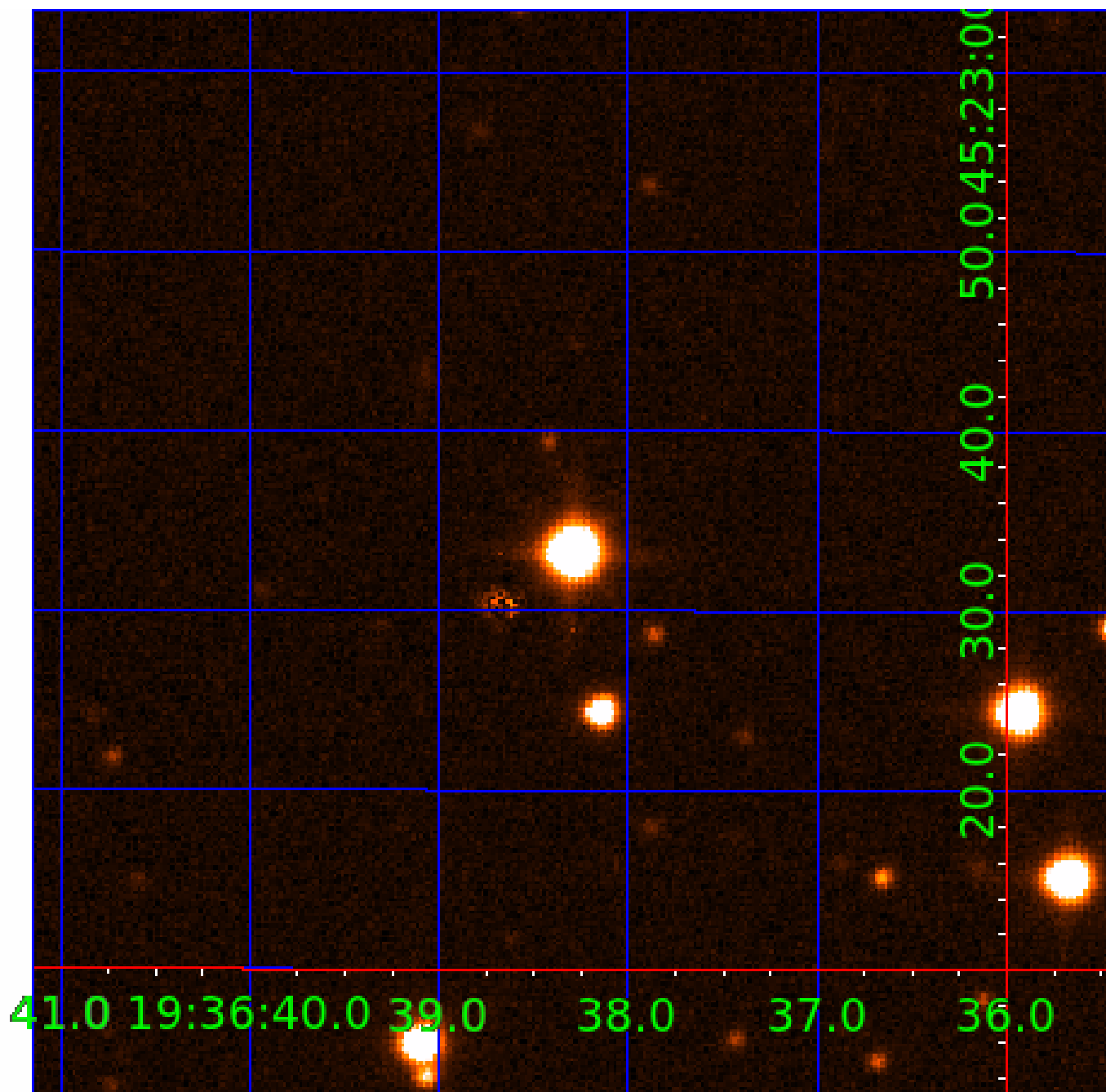


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 009028474

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009028474-01	OBS	3510.01	124.937055	177.682301	243052.5	7.485	7997.3	4253.8	0.94	5887	58.16	4.07
009028474-02	OBS	No	124.939325	183.984750	118081.0	11.045	3517.2	4418.7	0.94	5887	47.85	4.07
009028474-03	OBS	No	248.918745	312.240003	310.9	130.763	18.7	7.4	0.94	5887	2.04	1.62
009028474-04	OBS	No	268.367566	263.981763	2029.8	15.000	120.7	-1.0	0.94	5887	4.22	1.47
009028474-05	OBS	No	223.237472	352.638943	570.6	48.532	14.3	15.2	0.94	5887	4.42	1.88

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009028474-01	OBS	FP	0.00	0	1	0	0	MOD_SEC_DV—MOD_SEC_ALT—DEEP_V_SHAPED—HAS_SEC_TCE
009028474-02	OBS	FP	0.00	1	1	0	0	IS_SEC_TCE
009028474-03	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009028474-04	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_NOFITS
009028474-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_ZUMA—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS

**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 009028474-02

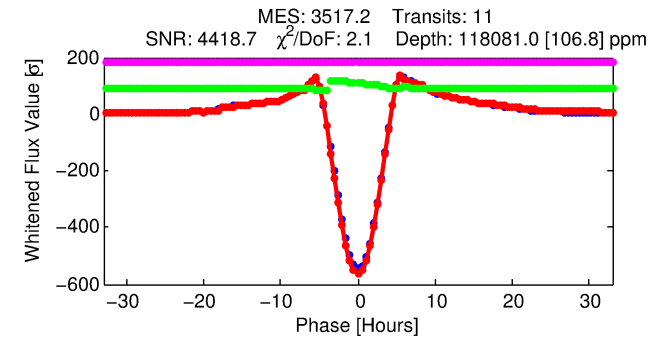
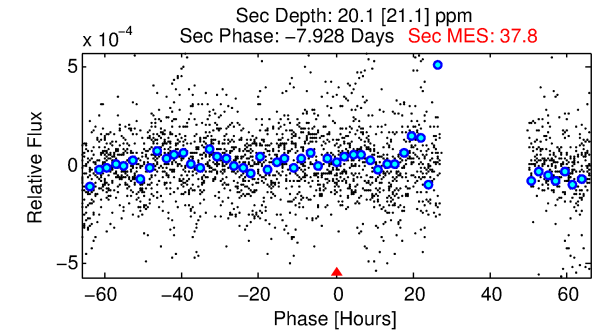
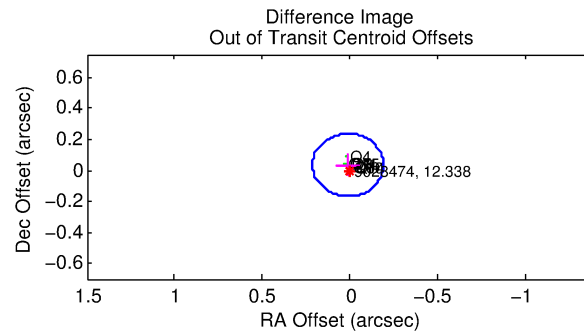
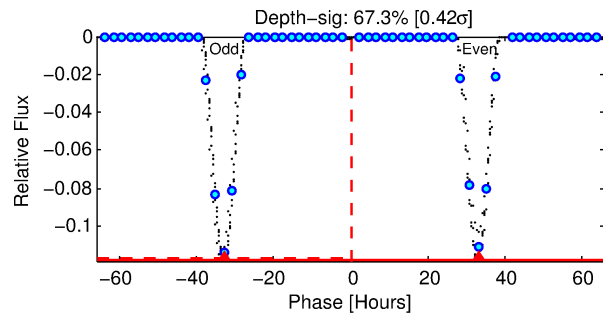
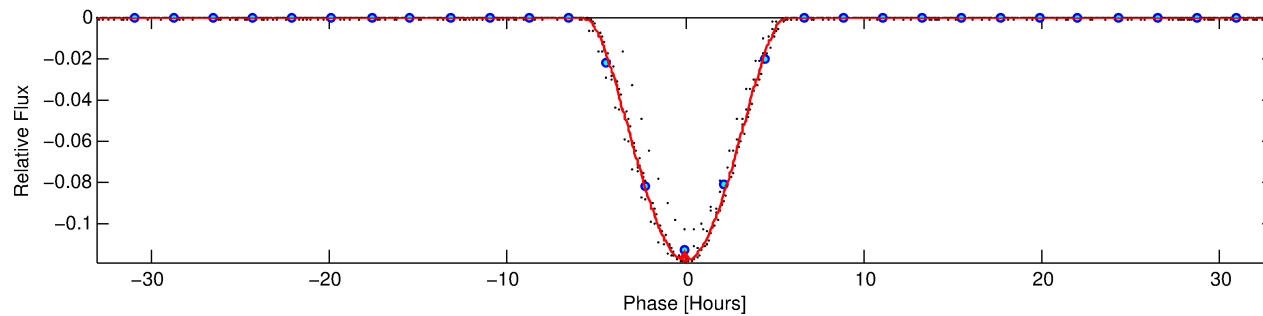
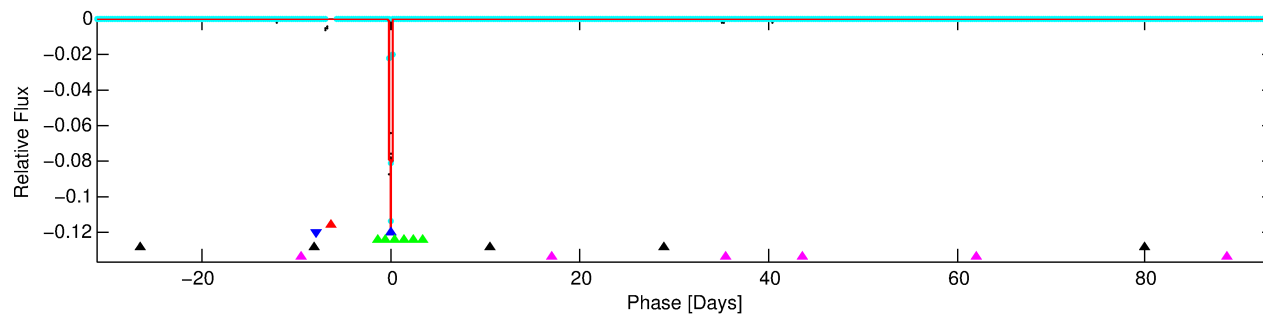
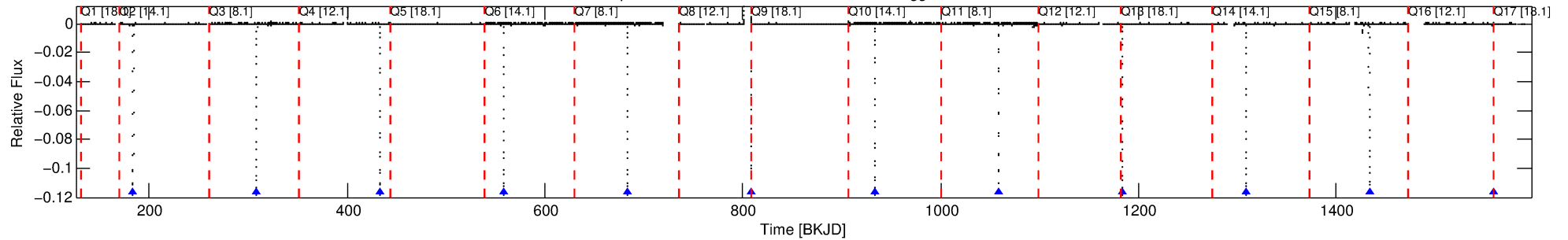
No Significant Match Found

# DV One-Page Summary

KIC: 9028474 Candidate: 2 of 5 Period: 124.939 d

KOI: K03510 Corr: No Ephemeris Match

Kp: 12.34 R\*: 0.94 Rs Teff: 5887.0 K Logg: 4.48 Fe/H: -0.140



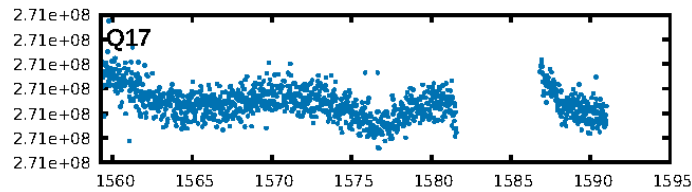
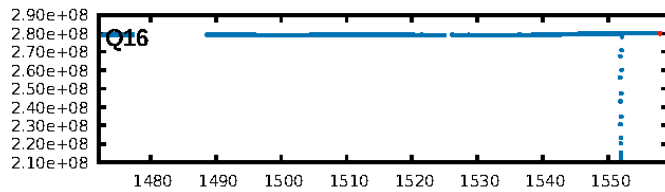
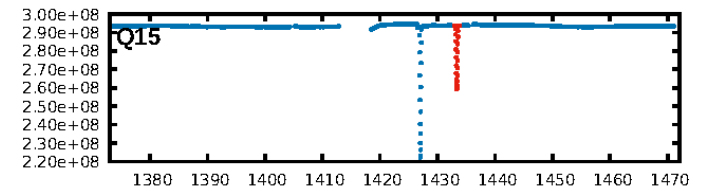
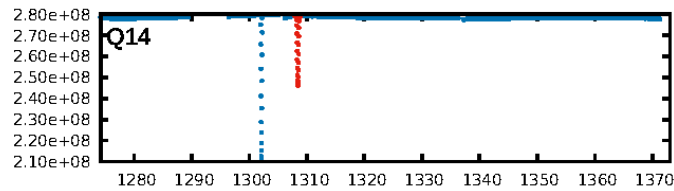
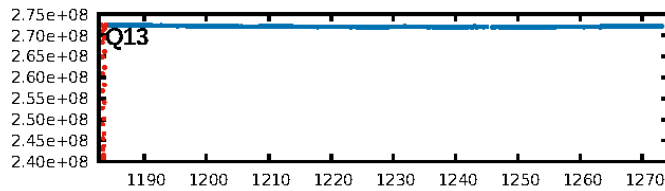
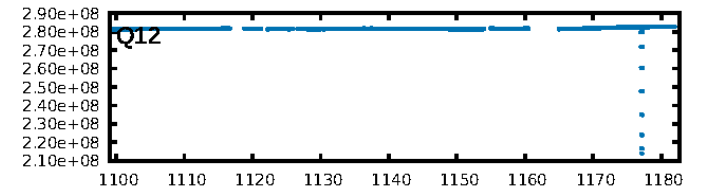
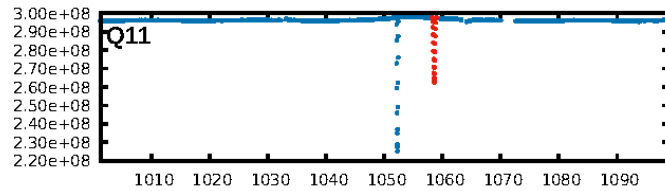
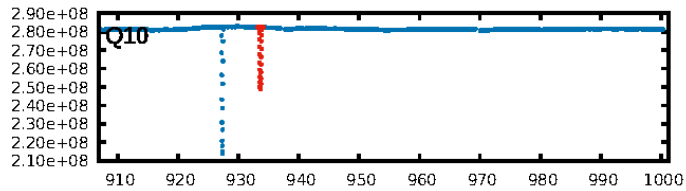
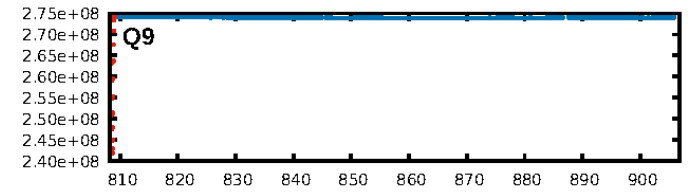
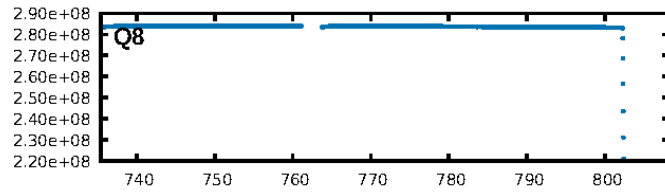
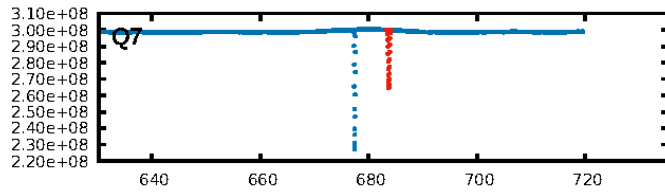
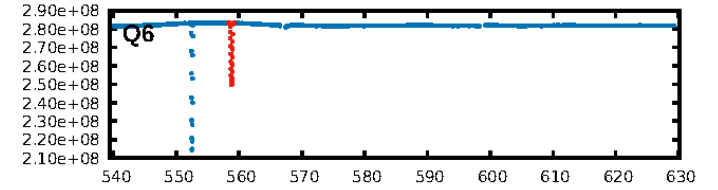
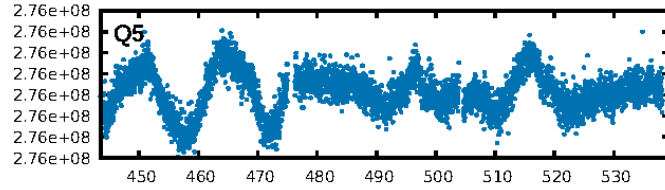
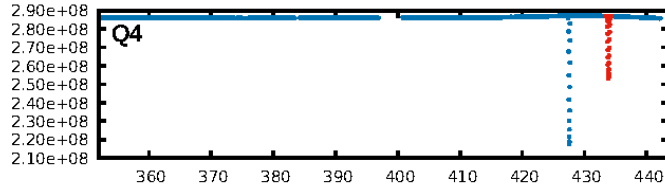
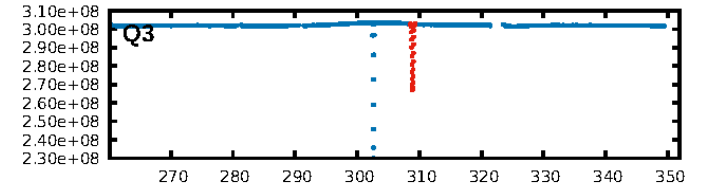
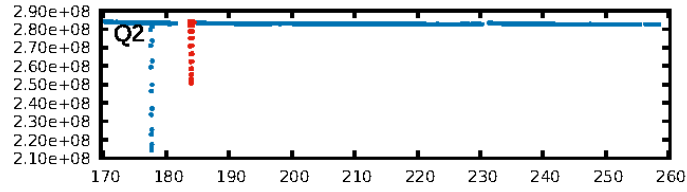
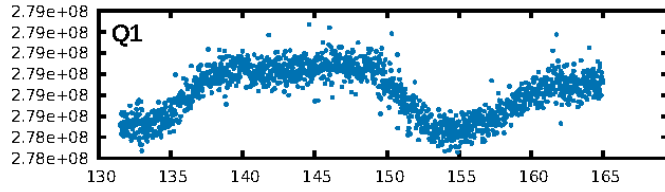
## DV Fit Results:

Period = 124.93933 [0.00002] d  
Epoch = 183.9847 [0.0001] BKJD  
Rp/R\* = 0.4660 [0.0400]  
a/R\* = 99.51 [0.48]  
b = 0.91 [0.06]  
Seff = 4.07 [1.12]  
Teq = 362 [25] K  
Rp = 47.85 [10.50] Re  
a = 0.4840 [0.0834] AU  
Ag = 1.13 [1.24] [0.11σ]  
Teffp = 577 [155] K [1.38σ]

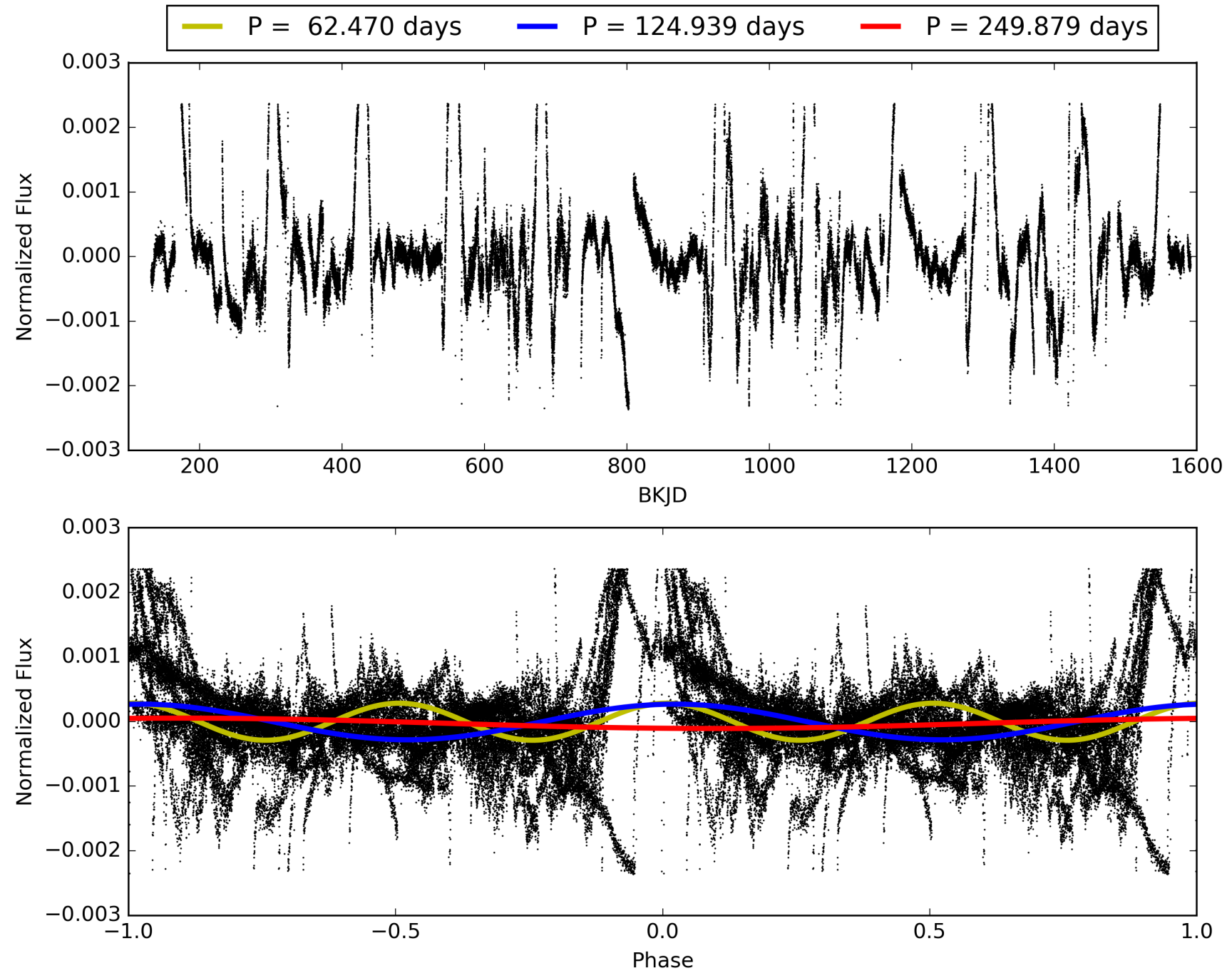
## DV Diagnostic Results:

ShortPeriod-sig: 0.3% [0.00σ]  
LongPeriod-sig: 100.0% [47.40σ]  
ModelChiSquare2-sig: 0.0%  
ModelChiSquareGof-sig: 0.0%  
Bootstrap-pfa: 0.00e+00  
RollingBand-fgt: 1.00 [11/11]  
GhostDiagnostic-chr: 13.65  
Centroid-sig: 0.0%  
Centroid-so: 0.137 arcsec [147.57σ]  
OotOffset-rm: 0.037 arcsec [0.55σ]  
KicOffset-rm: 0.110 arcsec [1.64σ]  
OotOffset-st: 3/4/1/0 [8]  
KicOffset-st: 3/4/1/0 [8]  
DiffImageQuality-fgm: 1.00 [8/8]  
DiffImageOverlap-fno: 0.50 [4/8]

# TCE 009028474-02, PDC Light Curves

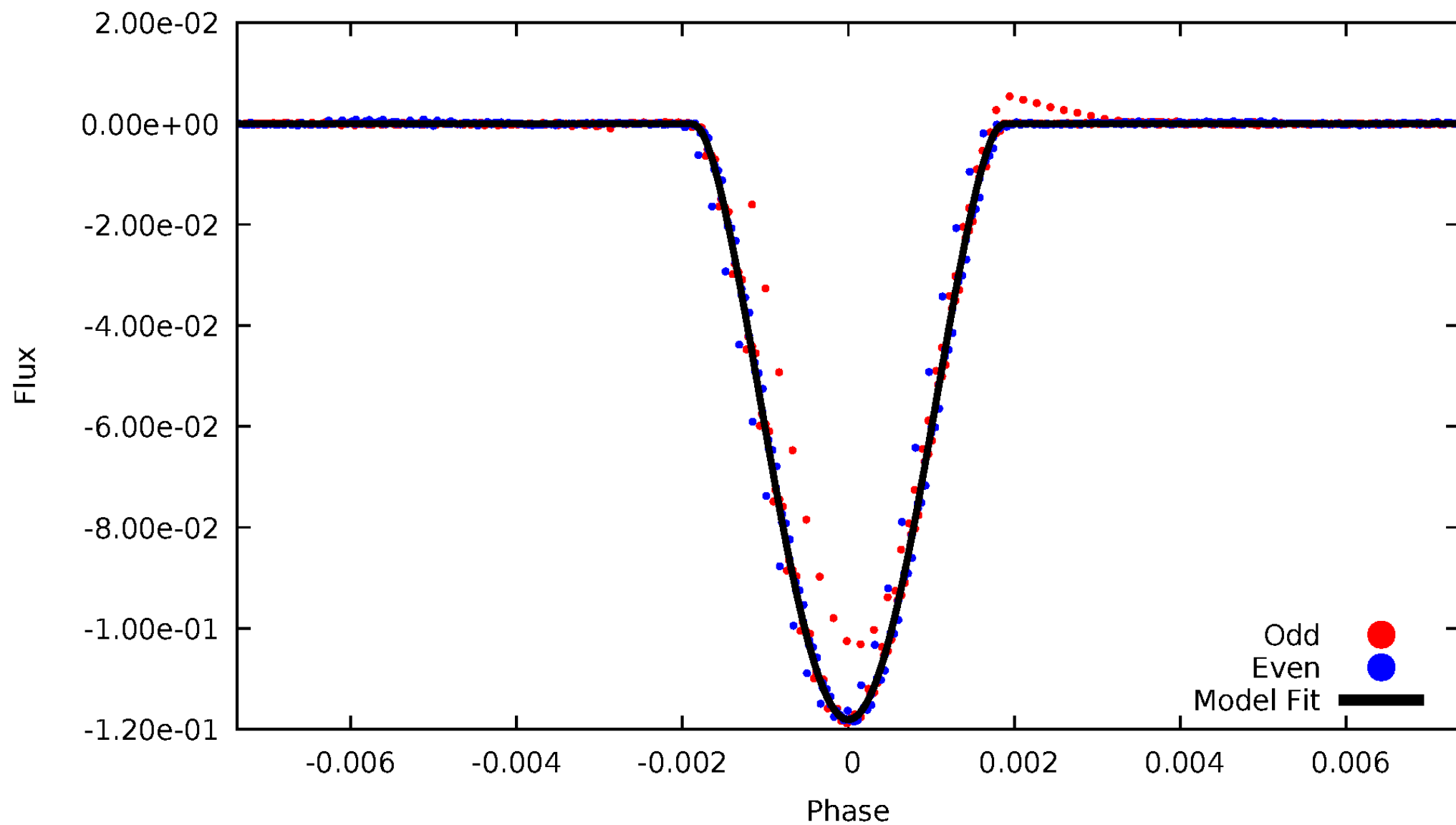


TCE 009028474-02



# DV Odd/Even

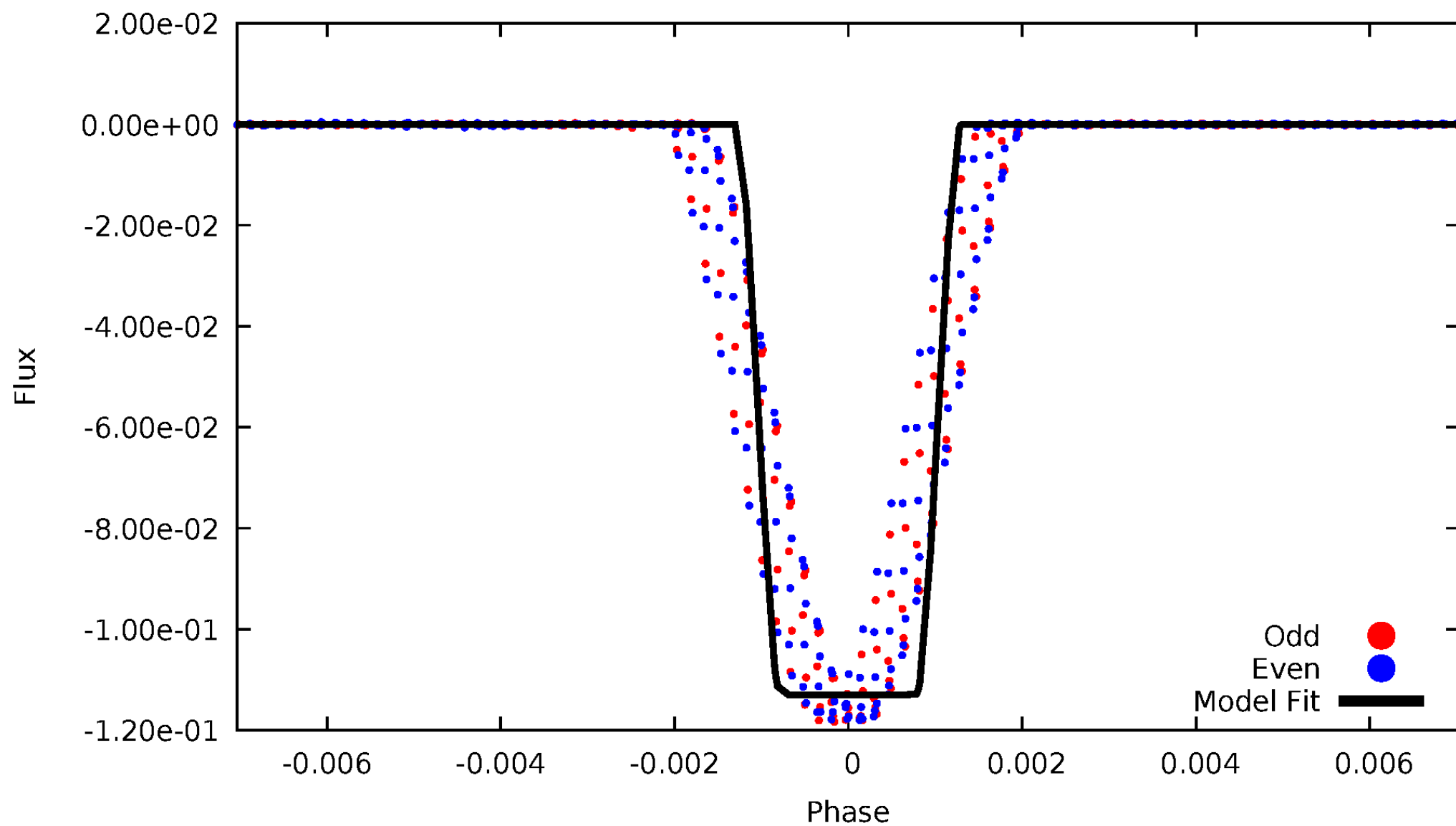
TCE 009028474-02





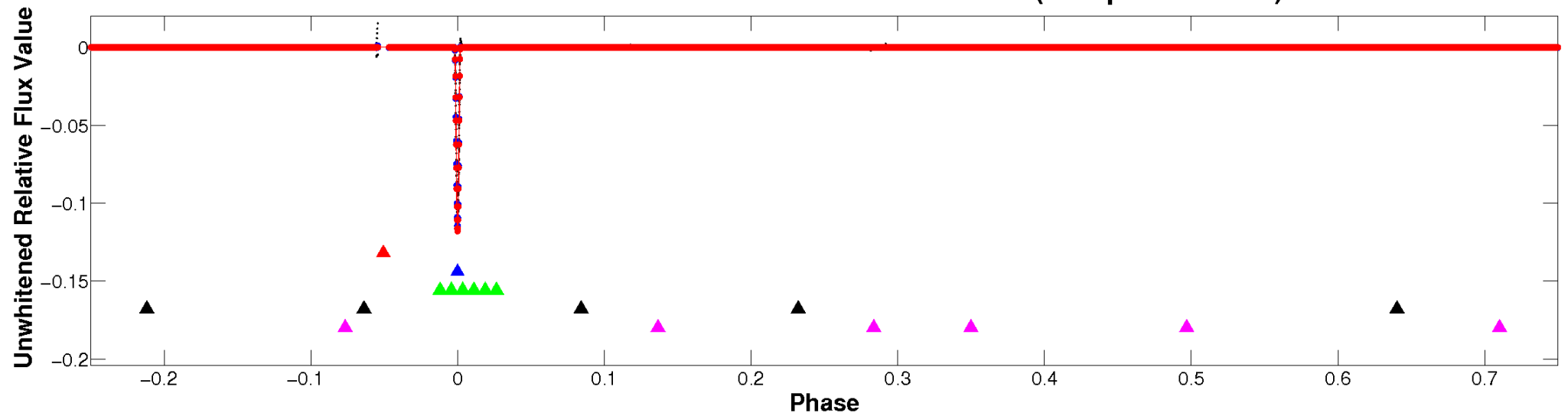
# ALT Odd/Even

TCE 009028474-02

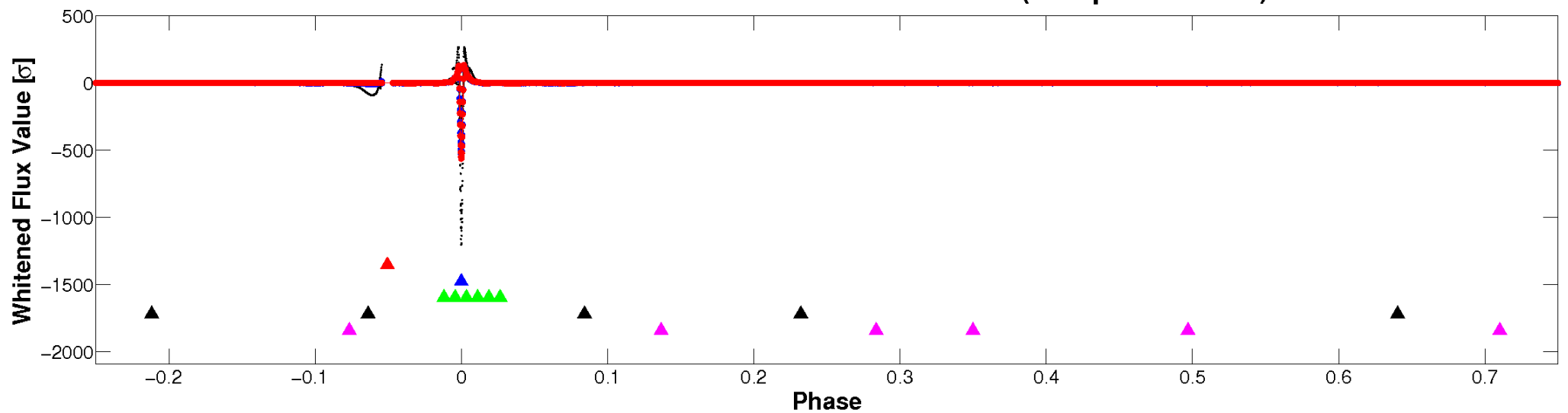


# Non-Whitened Vs. Whitened Light Curve

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

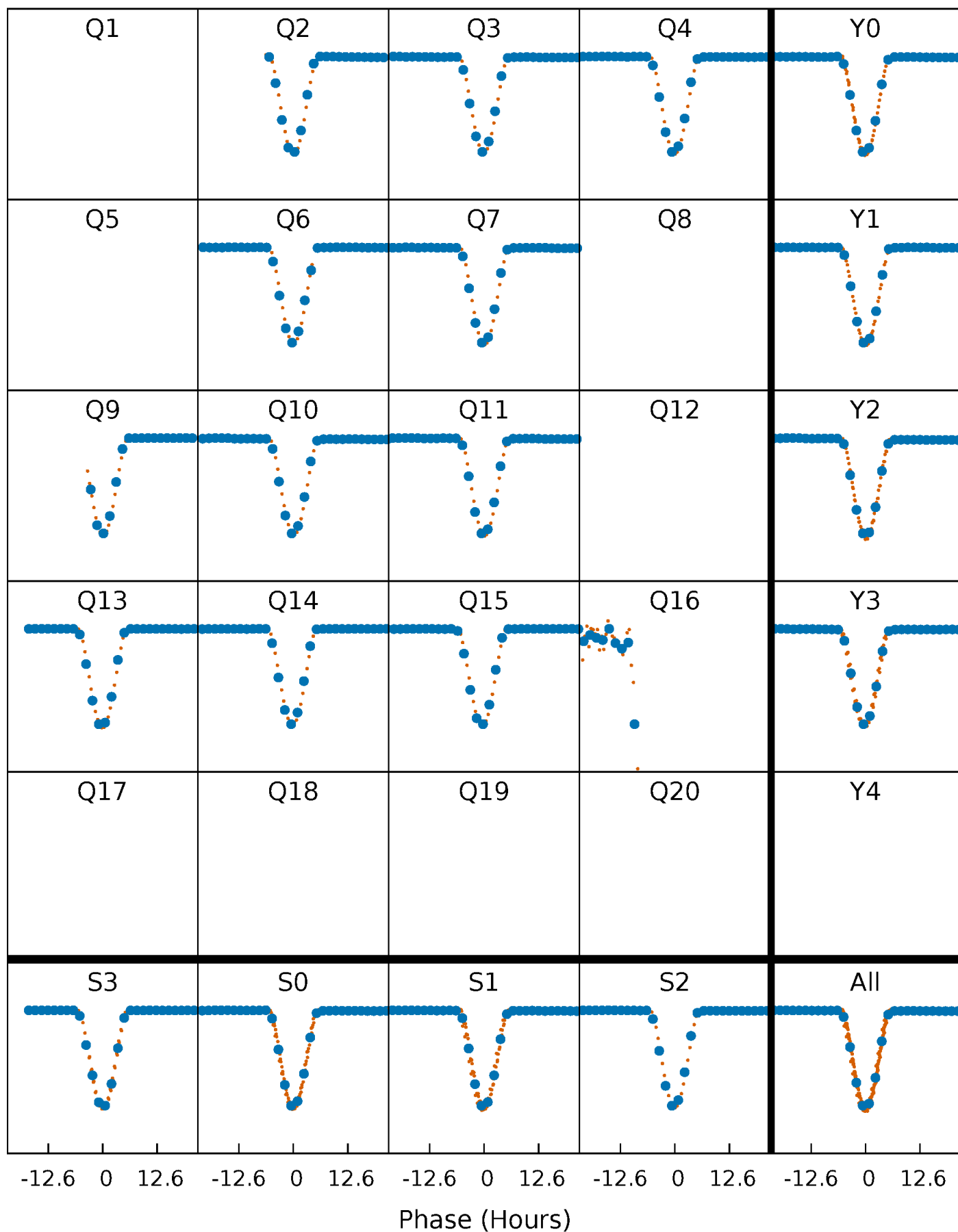


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



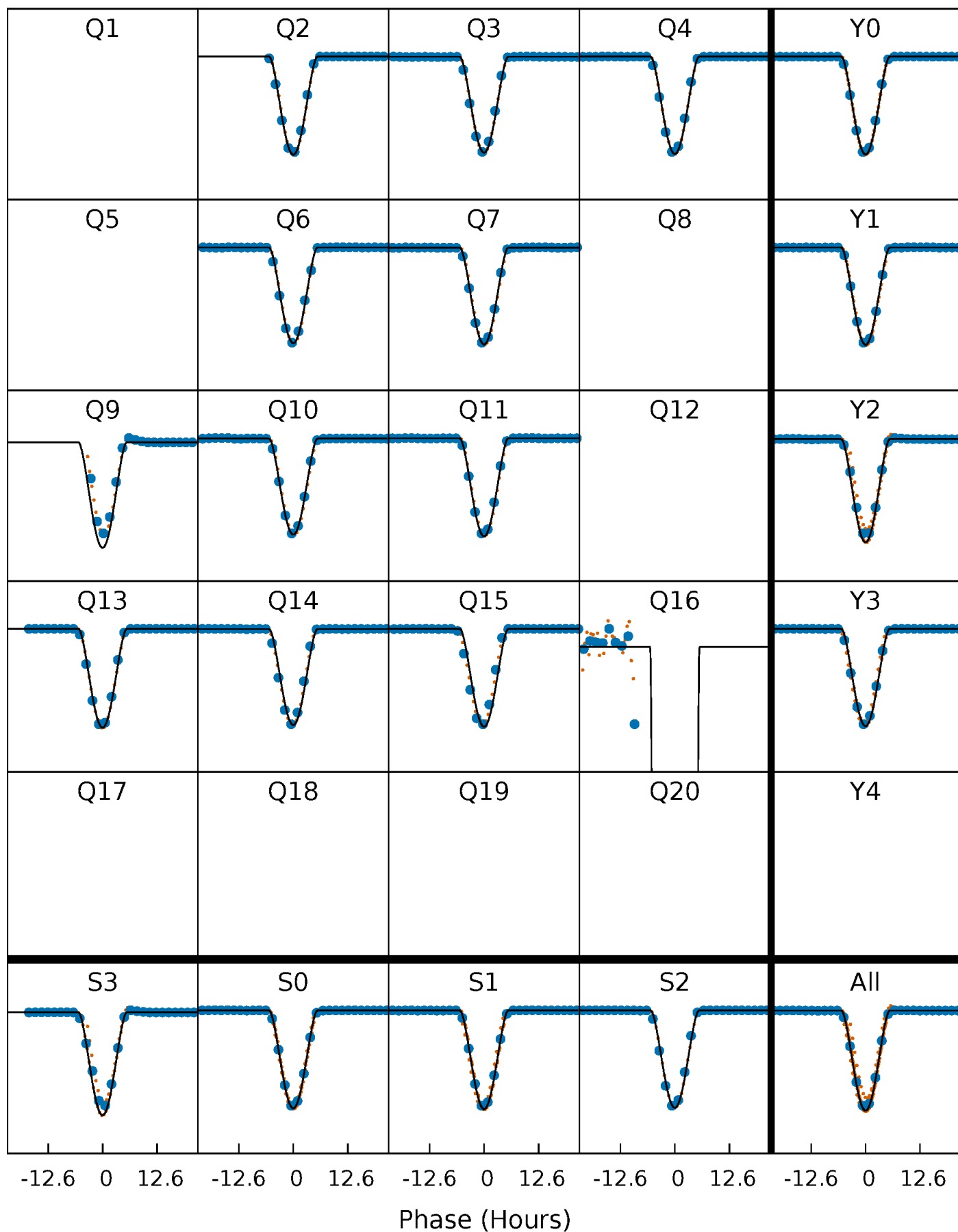
# PDC Quarter-Phased Transit Curves

TCE 009028474-02 P=124.939325 Days  $T_0=183.984750$  (BKJD)



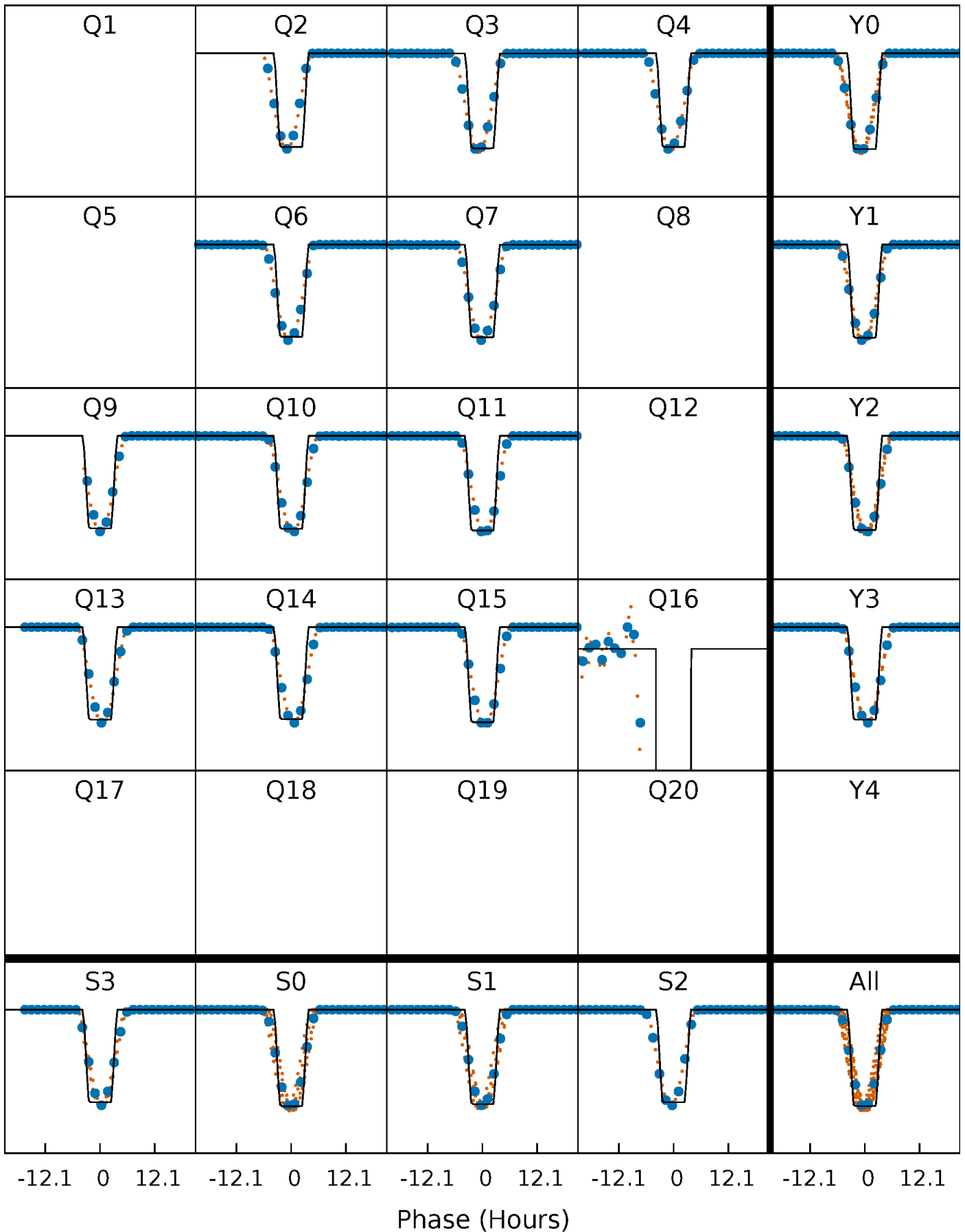
# DV Quarter-Phased Transit Curves

TCE 009028474-02 P=124.939325 Days  $T_0=183.984750$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

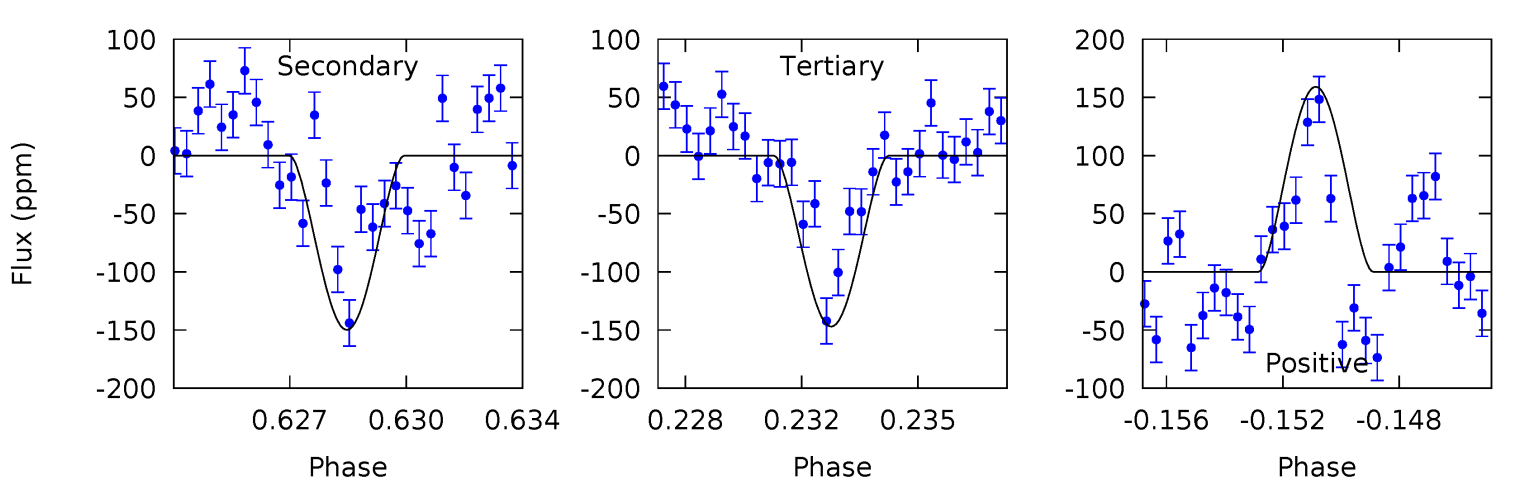
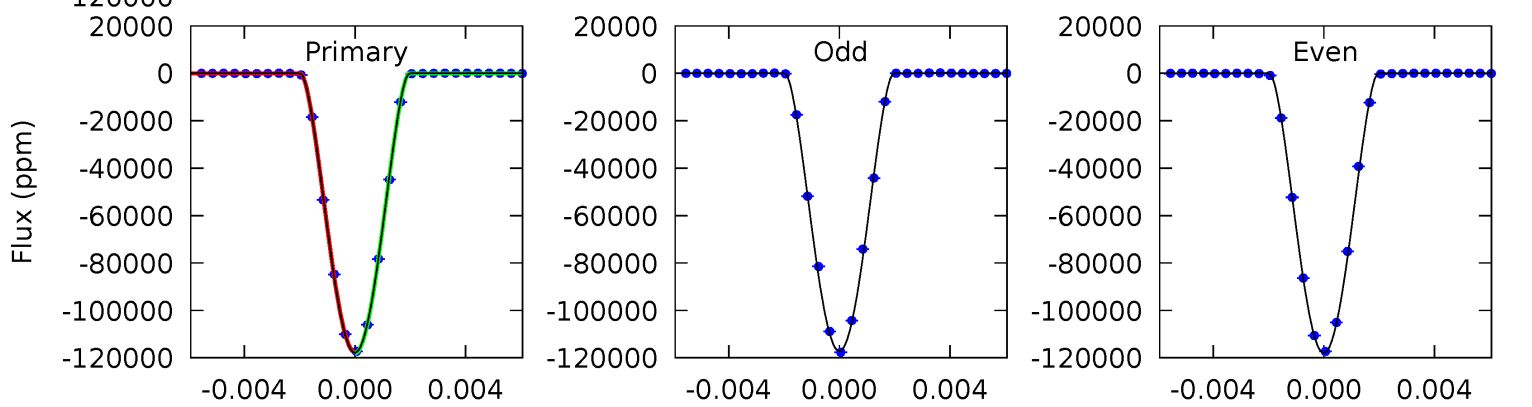
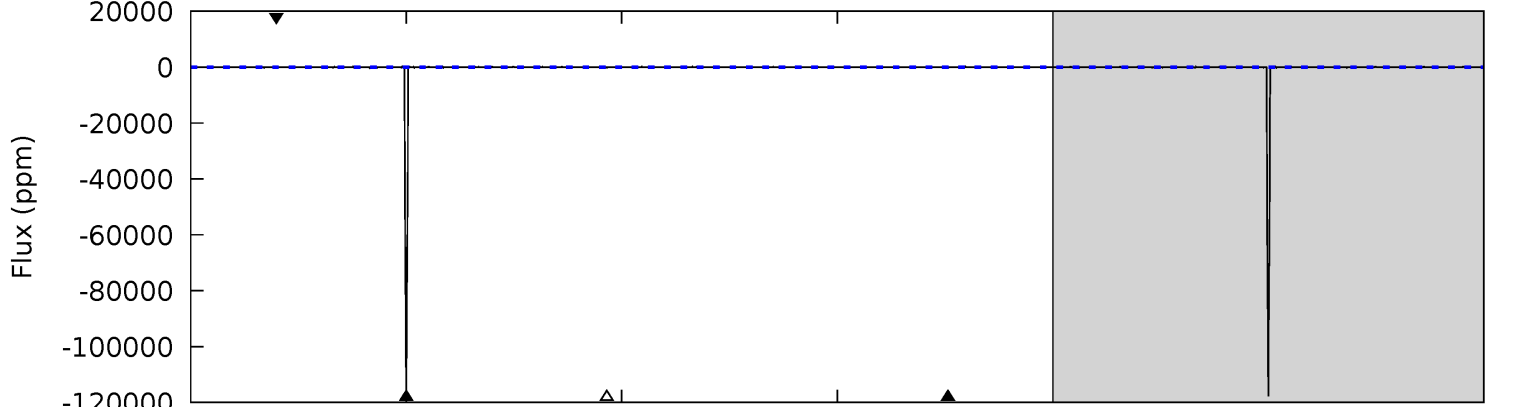
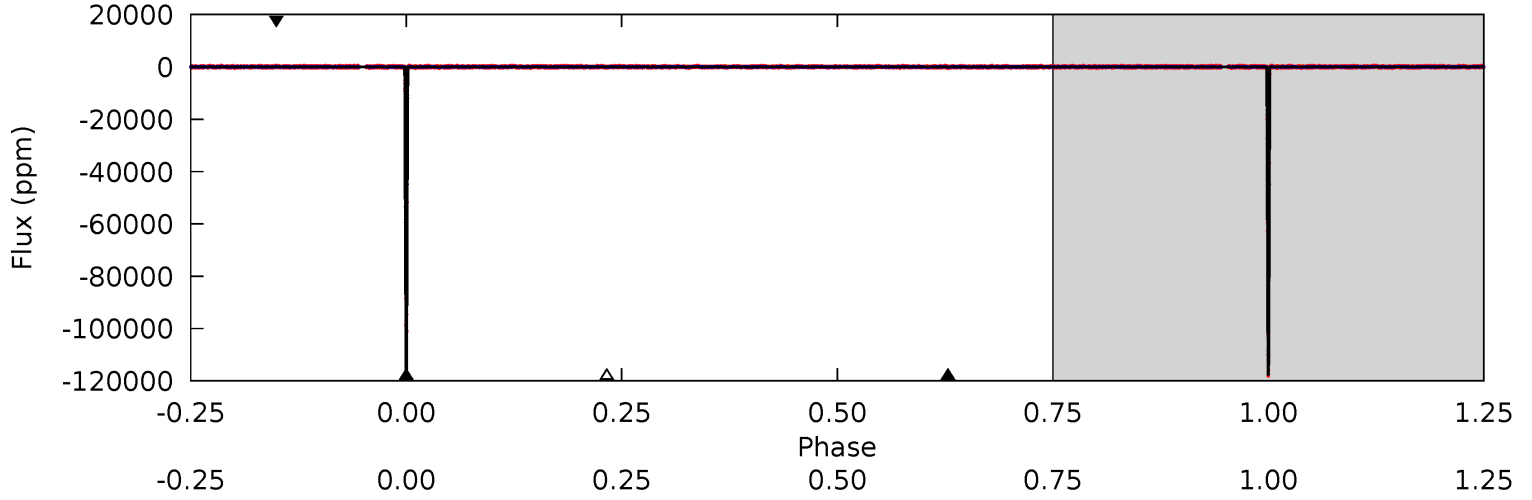
TCE 009028474-02 P=124.931117 Days  $T_0=184.027587$  (BKJD)



# DV Model-Shift Uniqueness Test

009028474-02, P = 124.939325 Days, E = 59.045425 Days

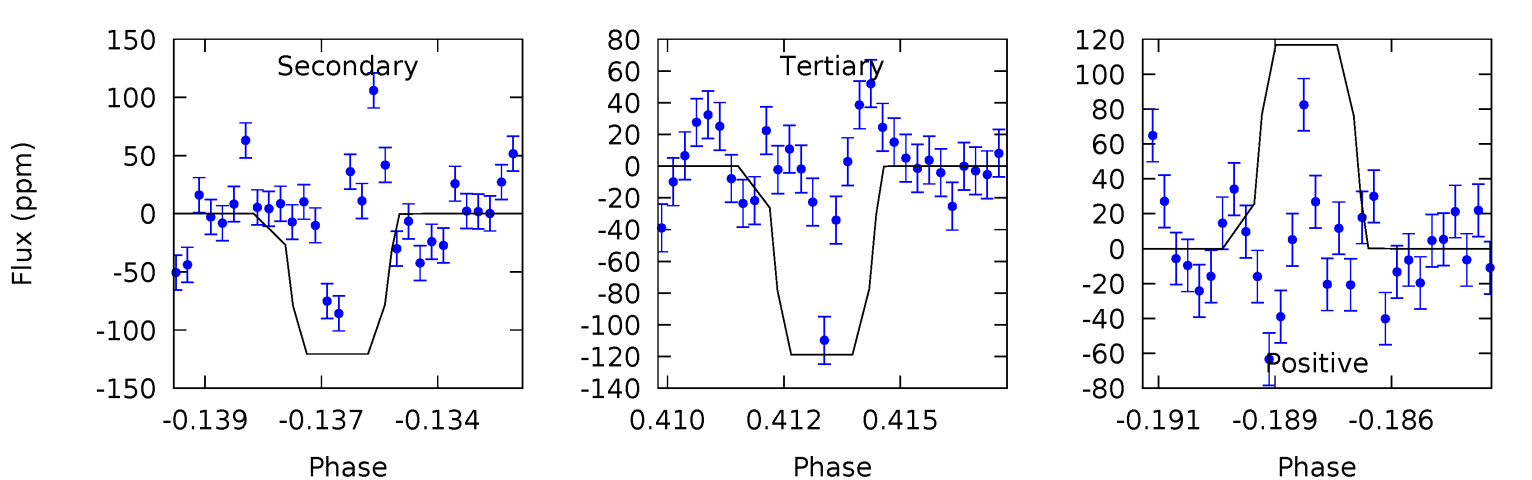
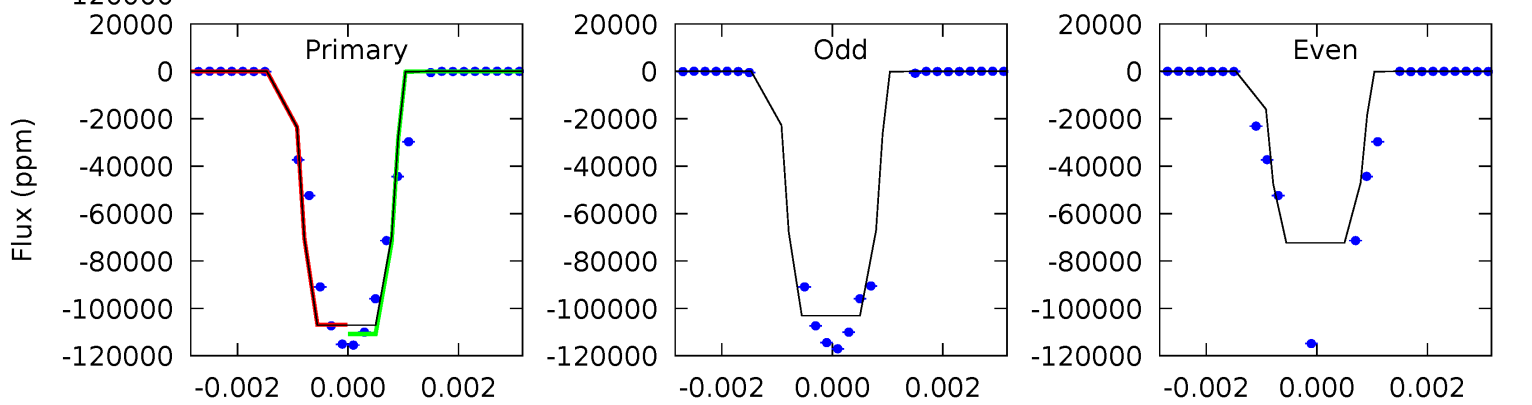
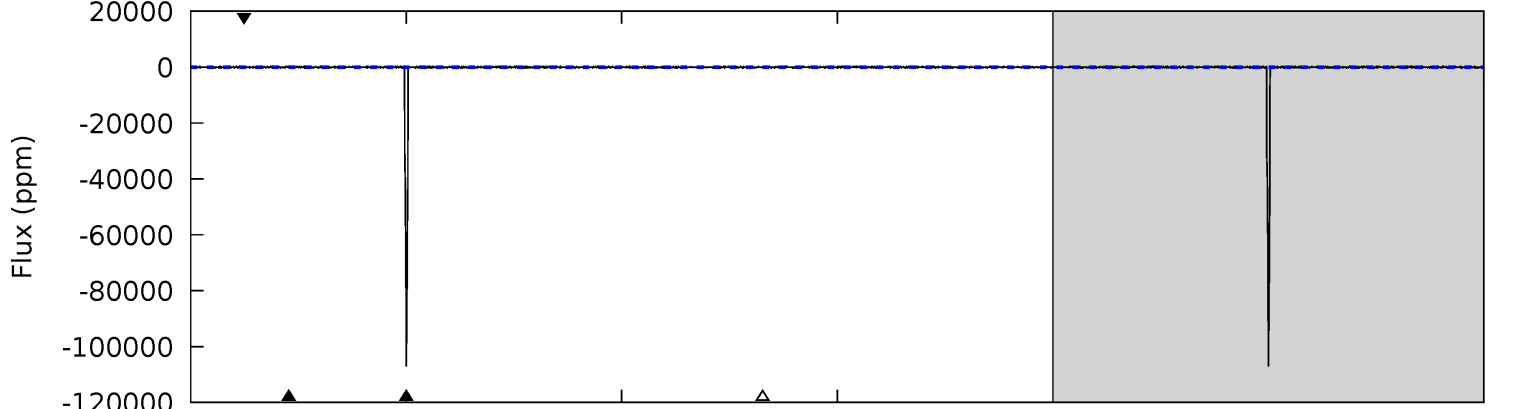
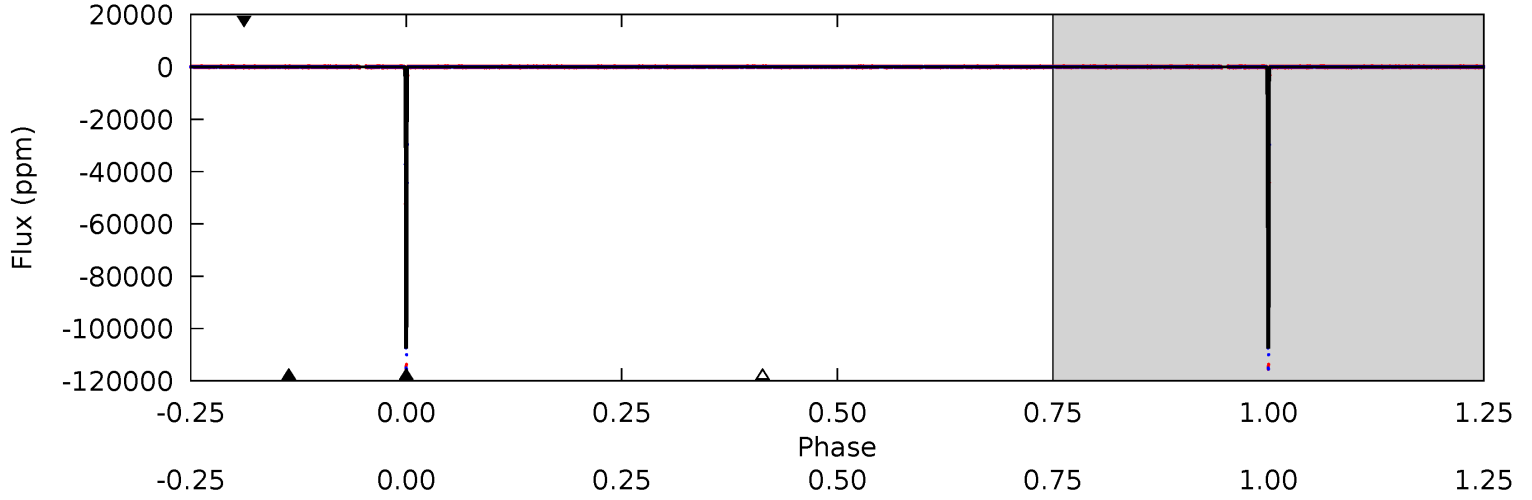
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
7496	9.53	9.35	10.1	5.21	2.89	2.58	7487	7486	0.18	-0.59	24.7	0.98	0.00	0



# Alt Model-Shift Uniqueness Test

009028474-02, P = 124.931117 Days, E = 59.096470 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
4486	5.05	4.98	4.89	5.29	3.03	1.21	4481	4481	0.07	0.15	635.7	1.00	0.00	0



### Stellar Parameters For KIC 009028474

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5887^{+132}_{-162}$	$4.477^{+0.060}_{-0.140}$	$-0.140^{+0.300}_{-0.300}$	$0.941^{+0.190}_{-0.102}$	$0.970^{+0.110}_{-0.110}$	$1.640^{+0.428}_{-0.689}$
	+2%/-3%	+1%/-3%	+214%/-214%	+20%/-11%	+11%/-11%	+26%/-42%
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 009028474-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-150 \pm 16$	$49.06^{+7.11}_{-5.26}$	$513^{+25}_{-22}$	$1954^{+52}_{-46}$	$7.787^{+2.371}_{-1.753}$
Alt.	$-121 \pm 24$	$35.68^{+5.38}_{-5.31}$	$513^{+26}_{-22}$	$2044^{+73}_{-69}$	$12^{+5}_{-4}$

$T_{max}$  = Theoretical Maximum Planetary Temperature

$T_{obs}$  = Observed Planetary Temperature (Assuming A=0.3)

$A_{obs}$  = Observed Albedo (Assuming T=0)

If a secondary eclipse is present, the system is likely an EB if  $T_{obs} \gg T_{max}$  AND  $A_{obs} \gg 1.0$



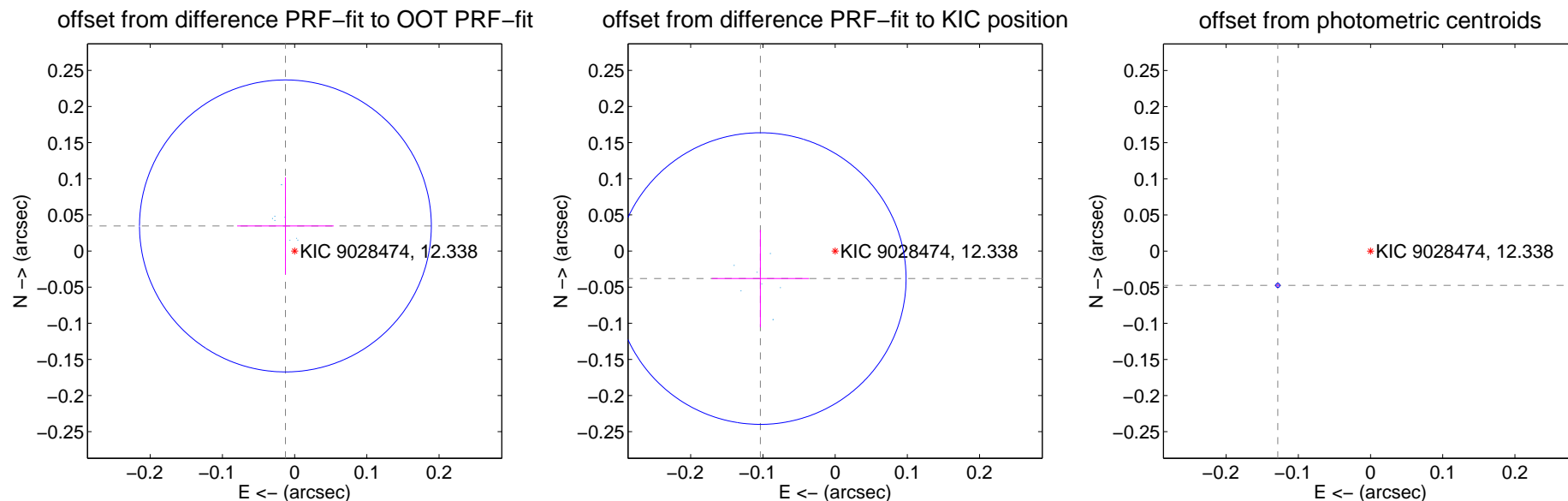
## DV Centroid Data

Supplemental centroid analysis for 009028474-02. Kepler magnitude: 12.34. Transit SNR 4418.68

There are 8 quarters with good PRF difference image offsets

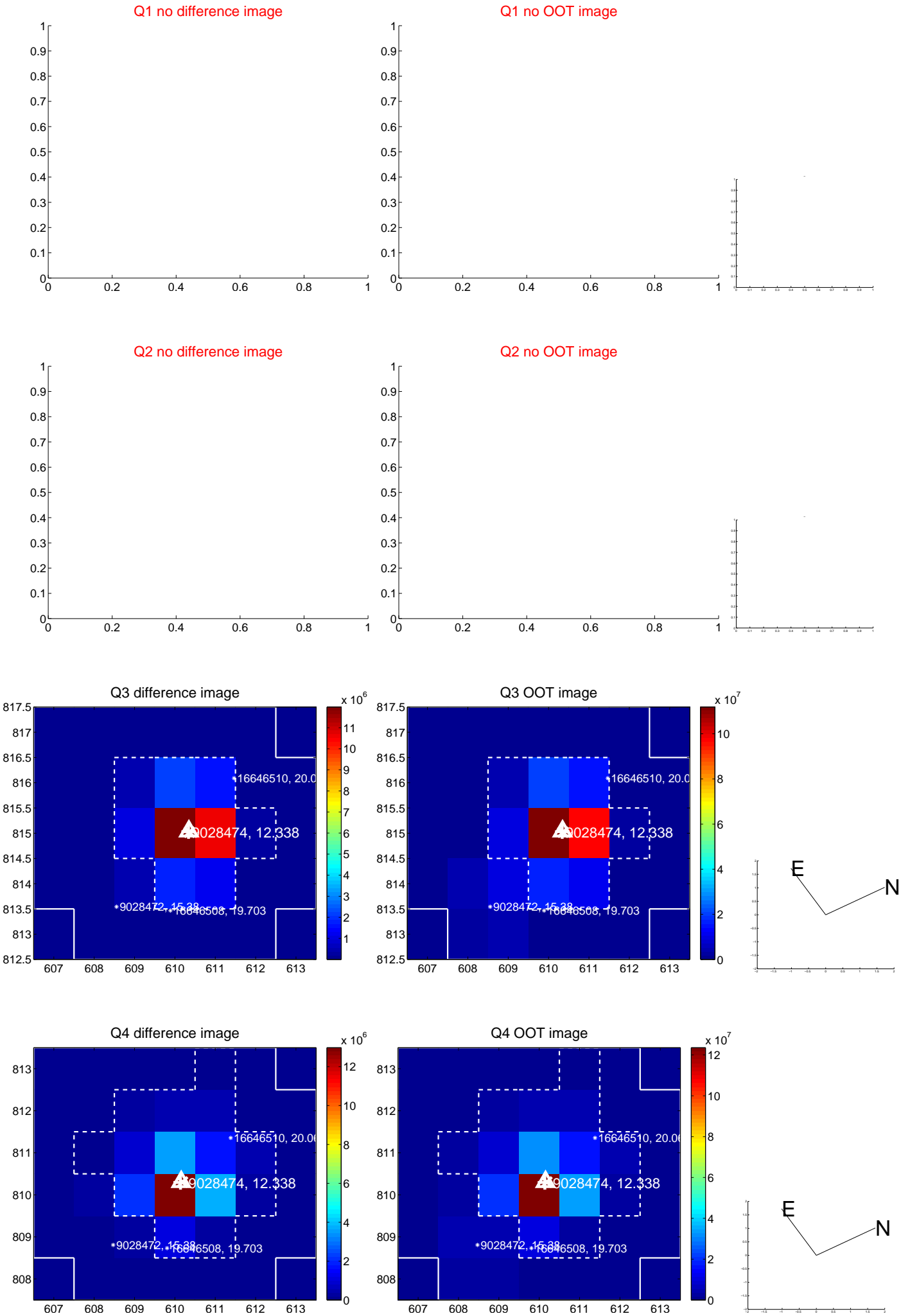
The direct PRF centroid is offset from the target star catalog position by about 0.15 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.037 \pm 0.067$	0.55	$0.013 \pm 0.067$	$0.035 \pm 0.067$
PRF-fit source offset from KIC position	$0.110 \pm 0.067$	1.64	$0.104 \pm 0.067$	$-0.038 \pm 0.067$
photometric centroid source offset	$0.14 \pm 0.00$	147.57	$0.13 \pm 0.00$	$-0.05 \pm 0.00$



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.

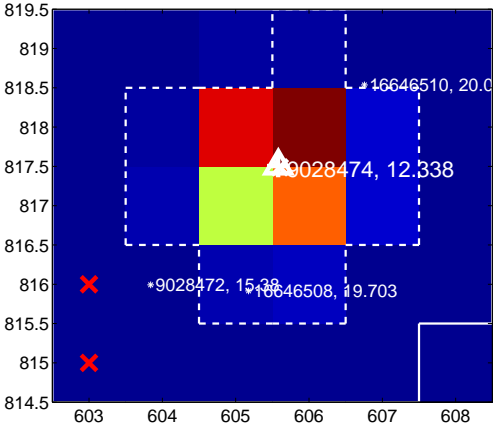
Q5 no difference image



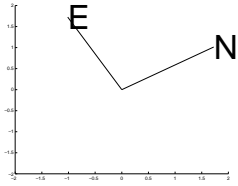
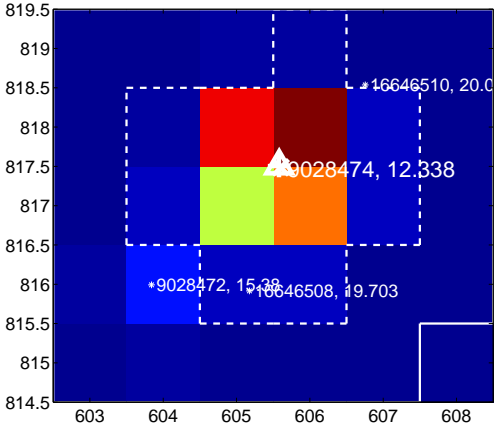
Q5 no OOT image



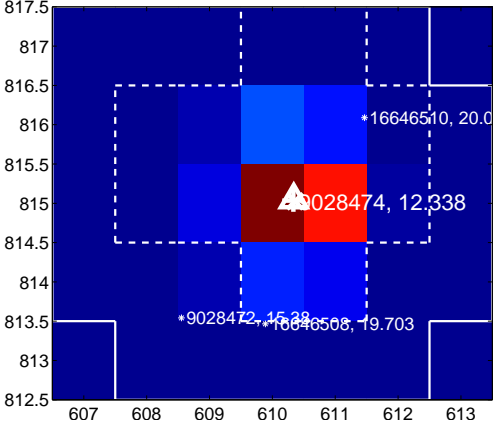
Q6 difference image



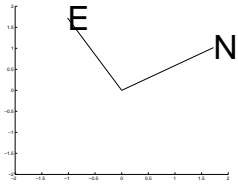
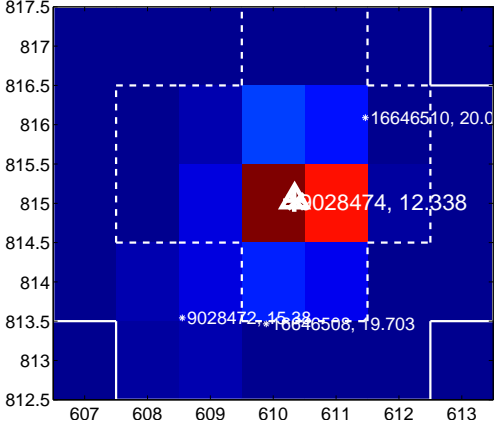
Q6 OOT image



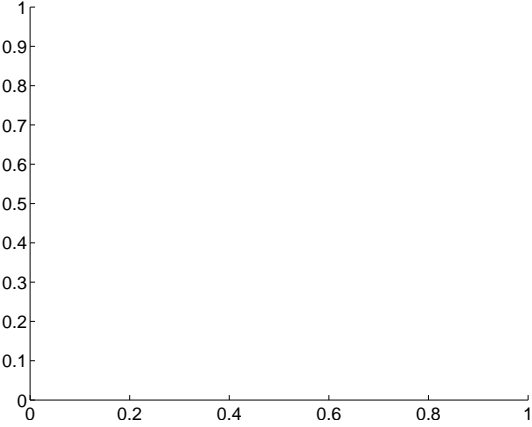
Q7 difference image



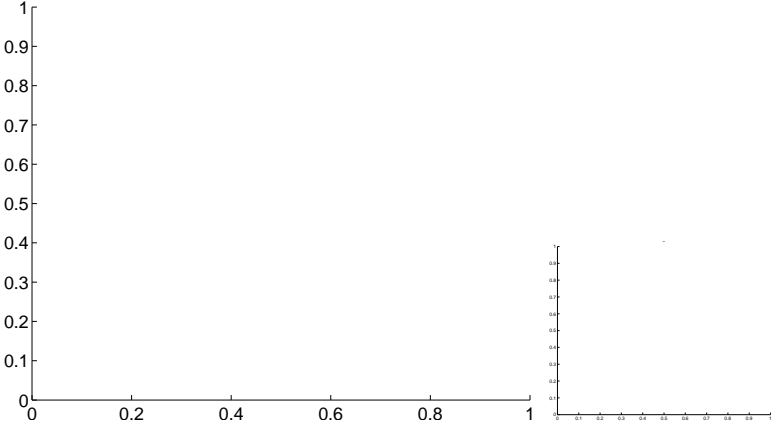
Q7 OOT image



Q8 no difference image



Q8 no OOT image

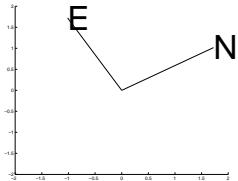
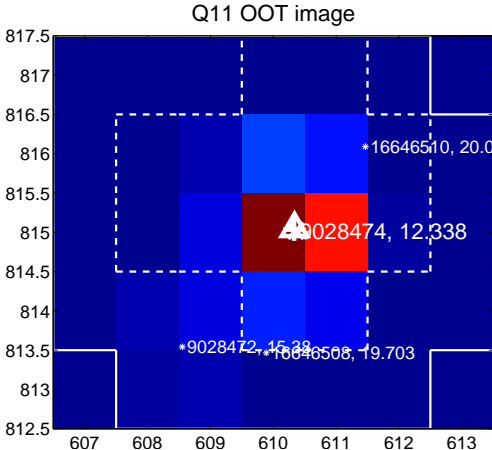
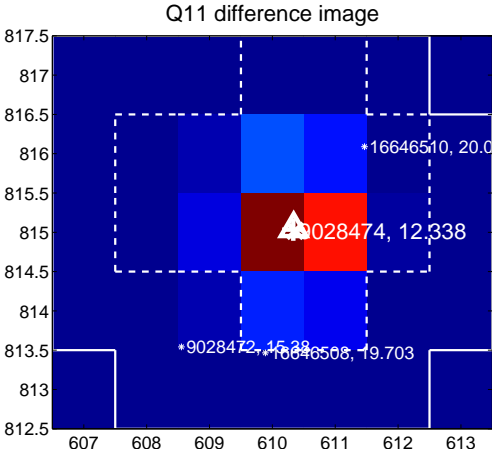
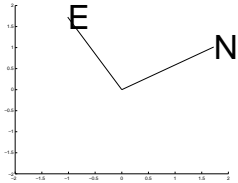
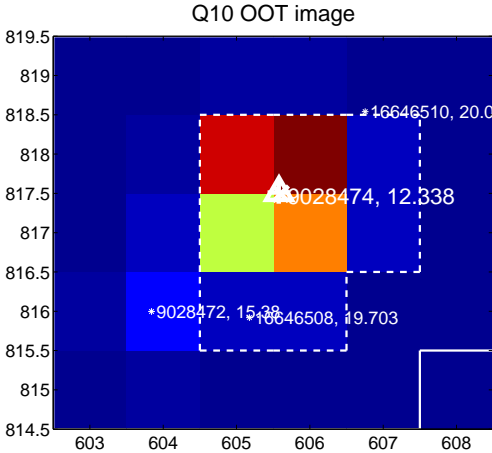
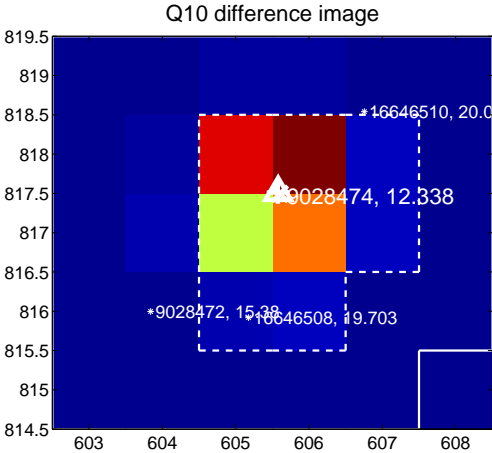


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

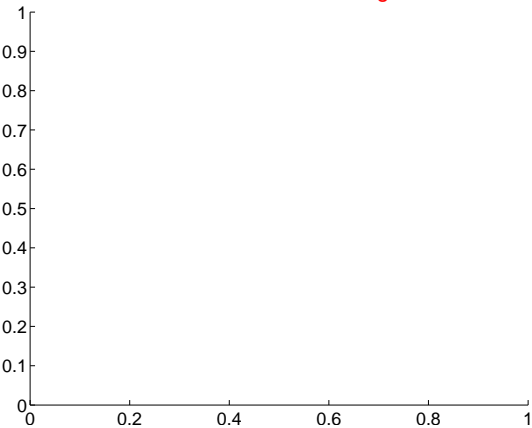
Q9 no difference image



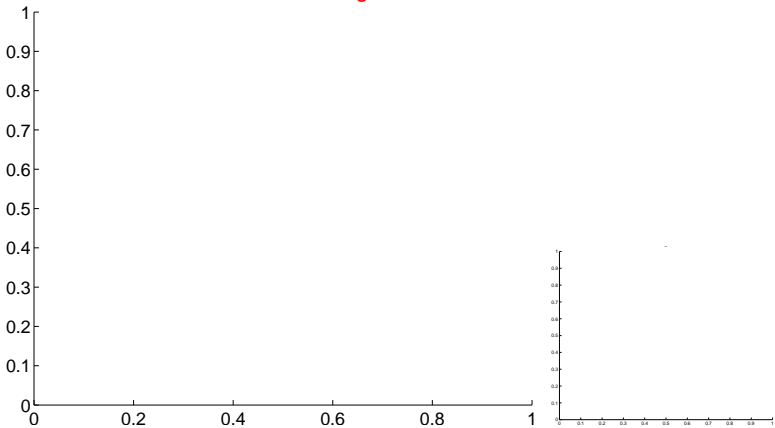
Q9 no OOT image



Q12 no difference image



Q12 no OOT image



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

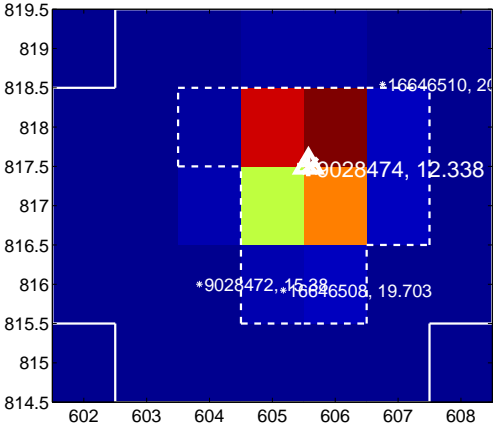
Q13 no difference image



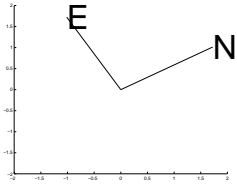
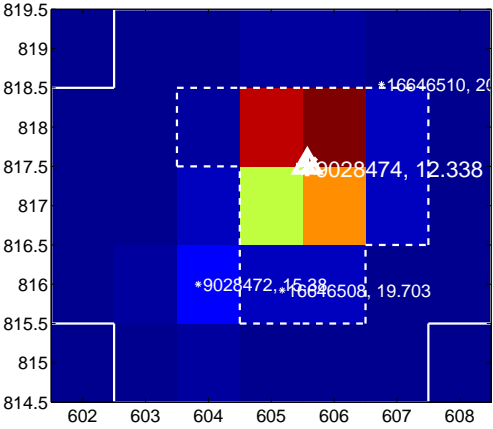
Q13 no OOT image



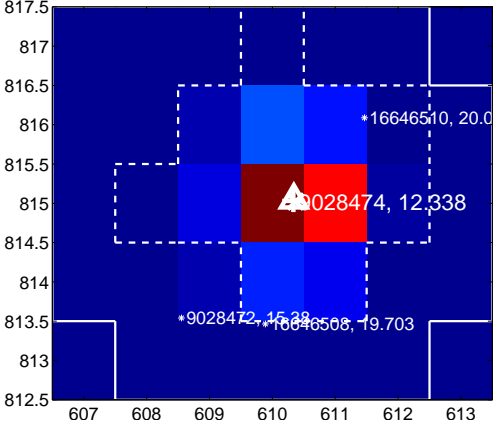
Q14 difference image



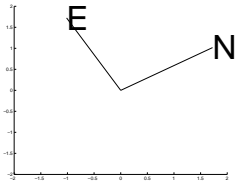
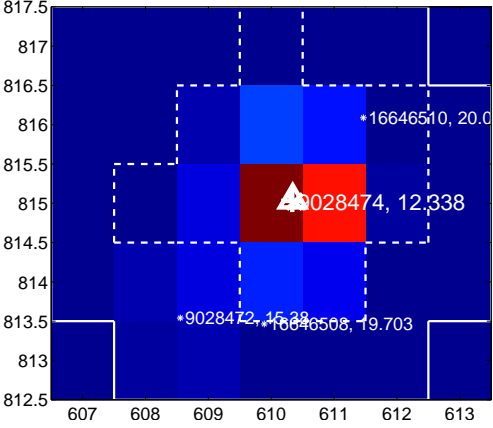
Q14 OOT image



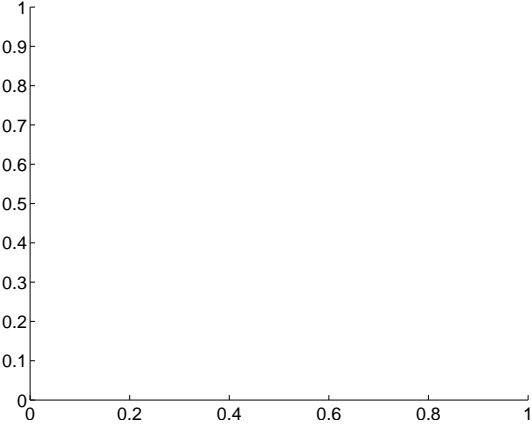
Q15 difference image



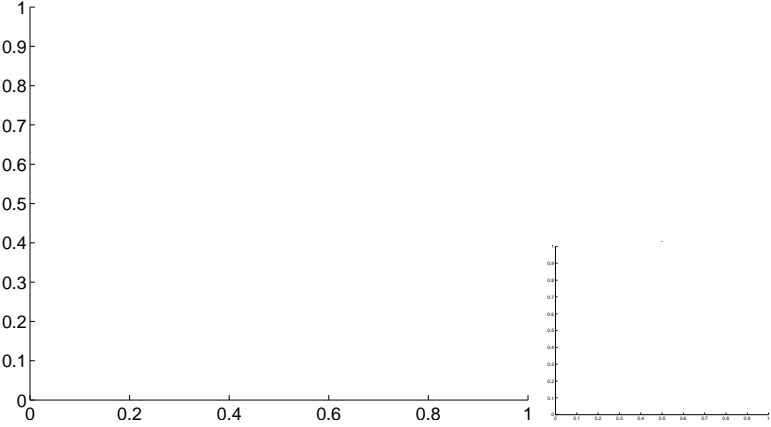
Q15 OOT image



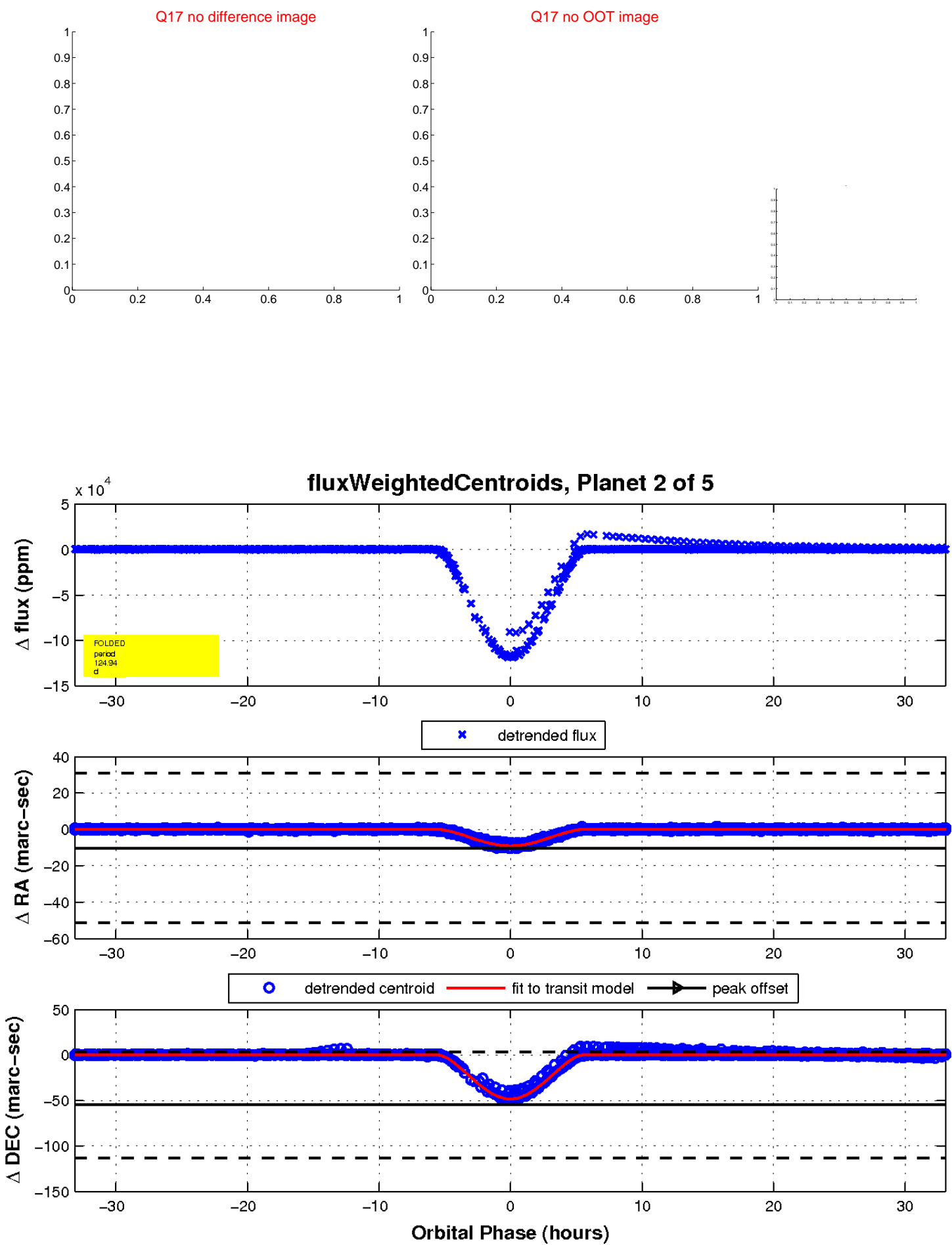
Q16 no difference image



Q16 no OOT image

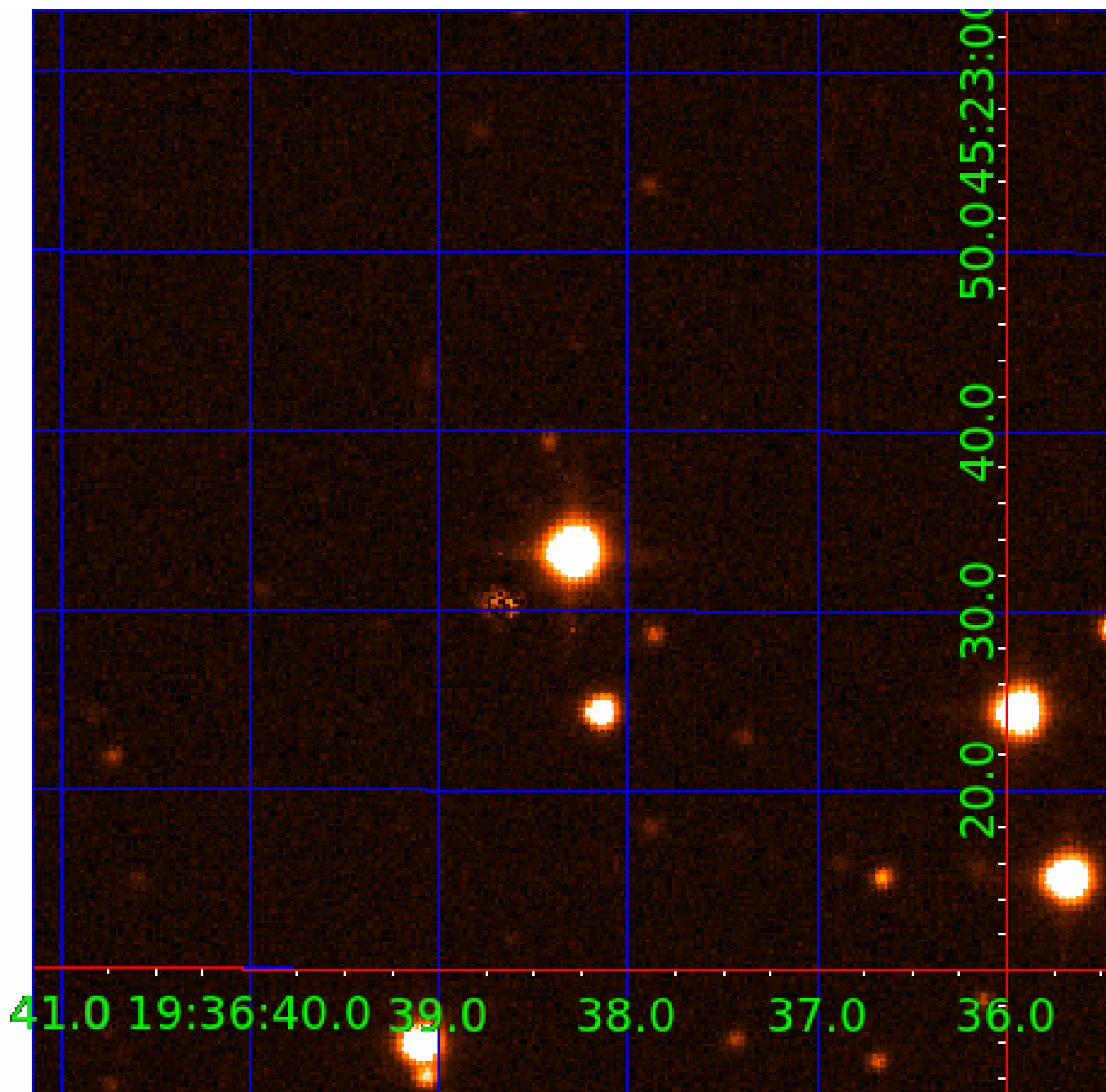


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



# UKIRT Image

Declination



# KIC 009028474

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009028474-01	OBS	3510.01	124.937055	177.682301	243052.5	7.485	7997.3	4253.8	0.94	5887	58.16	4.07
009028474-02	OBS	No	124.939325	183.984750	118081.0	11.045	3517.2	4418.7	0.94	5887	47.85	4.07
009028474-03	OBS	No	248.918745	312.240003	310.9	130.763	18.7	7.4	0.94	5887	2.04	1.62
009028474-04	OBS	No	268.367566	263.981763	2029.8	15.000	120.7	-1.0	0.94	5887	4.22	1.47
009028474-05	OBS	No	223.237472	352.638943	570.6	48.532	14.3	15.2	0.94	5887	4.42	1.88

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009028474-01	OBS	FP	0.00	0	1	0	0	MOD_SEC_DV—MOD_SEC_ALT—DEEP_V_SHAPED—HAS_SEC_TCE
009028474-02	OBS	FP	0.00	1	1	0	0	IS_SEC_TCE
009028474-03	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009028474-04	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_NOFITS
009028474-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_ZUMA—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS

**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 009028474-03

No Significant Match Found

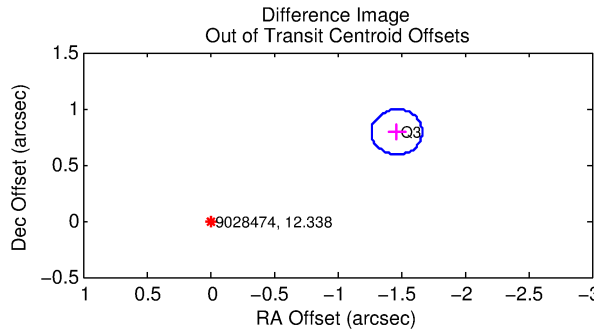
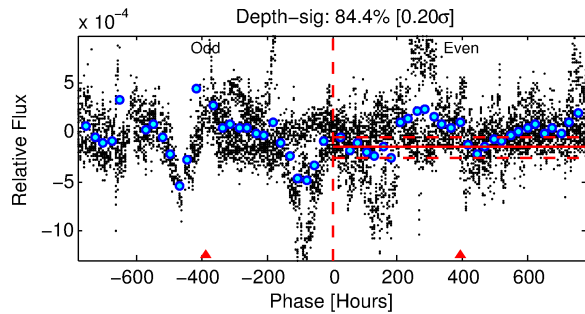
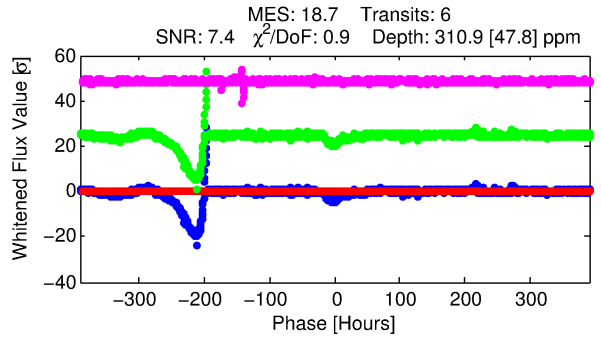
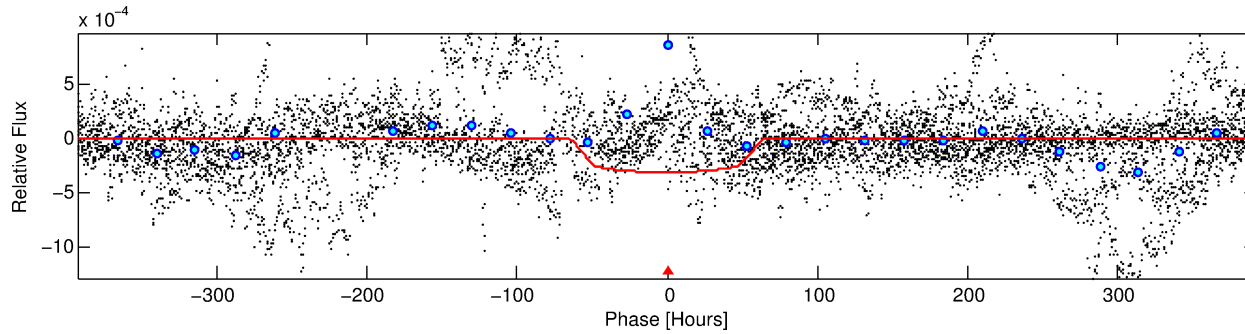
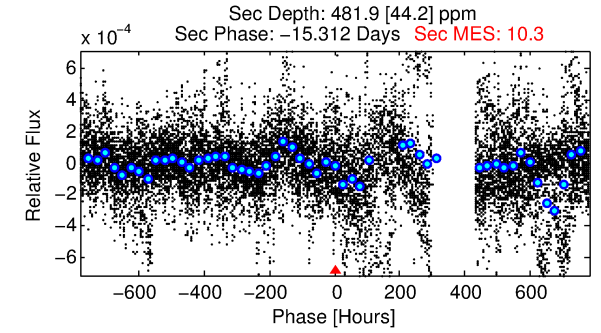
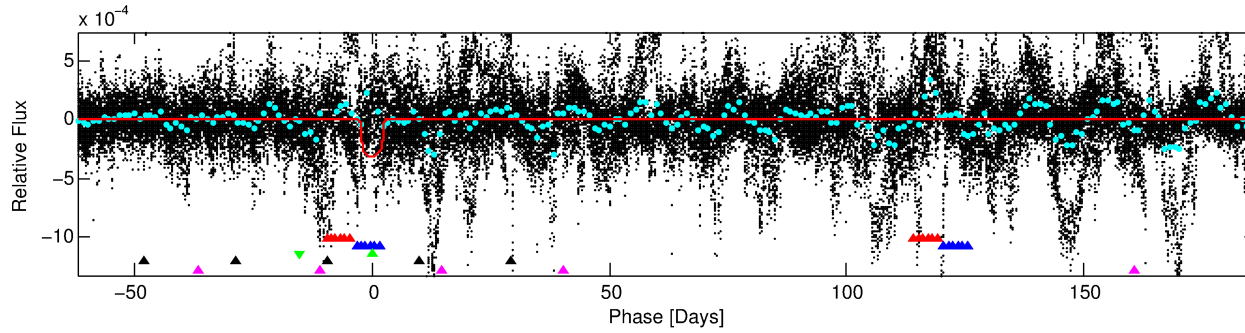
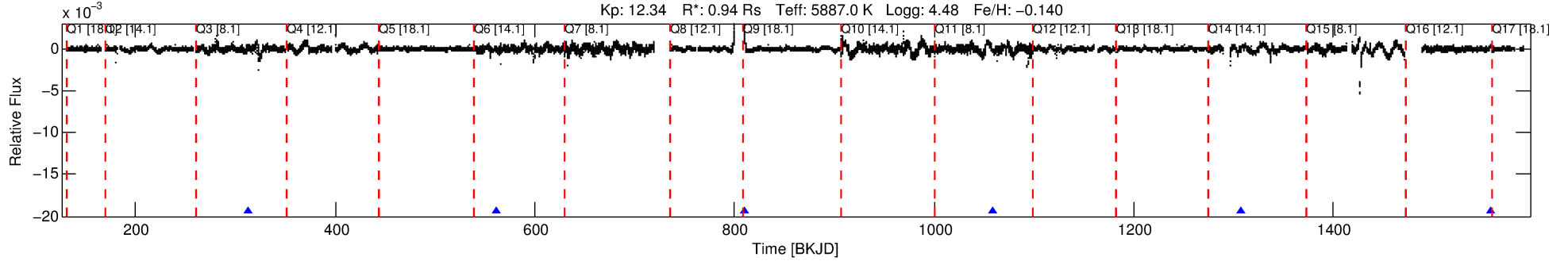


# DV One-Page Summary

KIC: 9028474 Candidate: 3 of 5 Period: 248.919 d

KOI: K03510 Corr: No Ephemeris Match

Kp: 12.34 R\*: 0.94 Rs Teff: 5887.0 K Logg: 4.48 Fe/H: -0.140



## DV Fit Results:

Period = 248.91875 [0.03382] d  
Epoch = 312.2400 [0.1345] BKJD  
Rp/R\* = 0.0198 [0.0016]  
a/R\* = 6.06 [0.67]  
b = 0.93 [0.02]  
Seff = 1.62 [0.45]  
Teq = 288 [20] K  
Rp = 2.04 [0.44] Re  
a = 0.7664 [0.1320] AU  
Ag = 37519.85 [11854.37] [3.16σ]  
Teffp = 6192 [338] K [17.45σ]

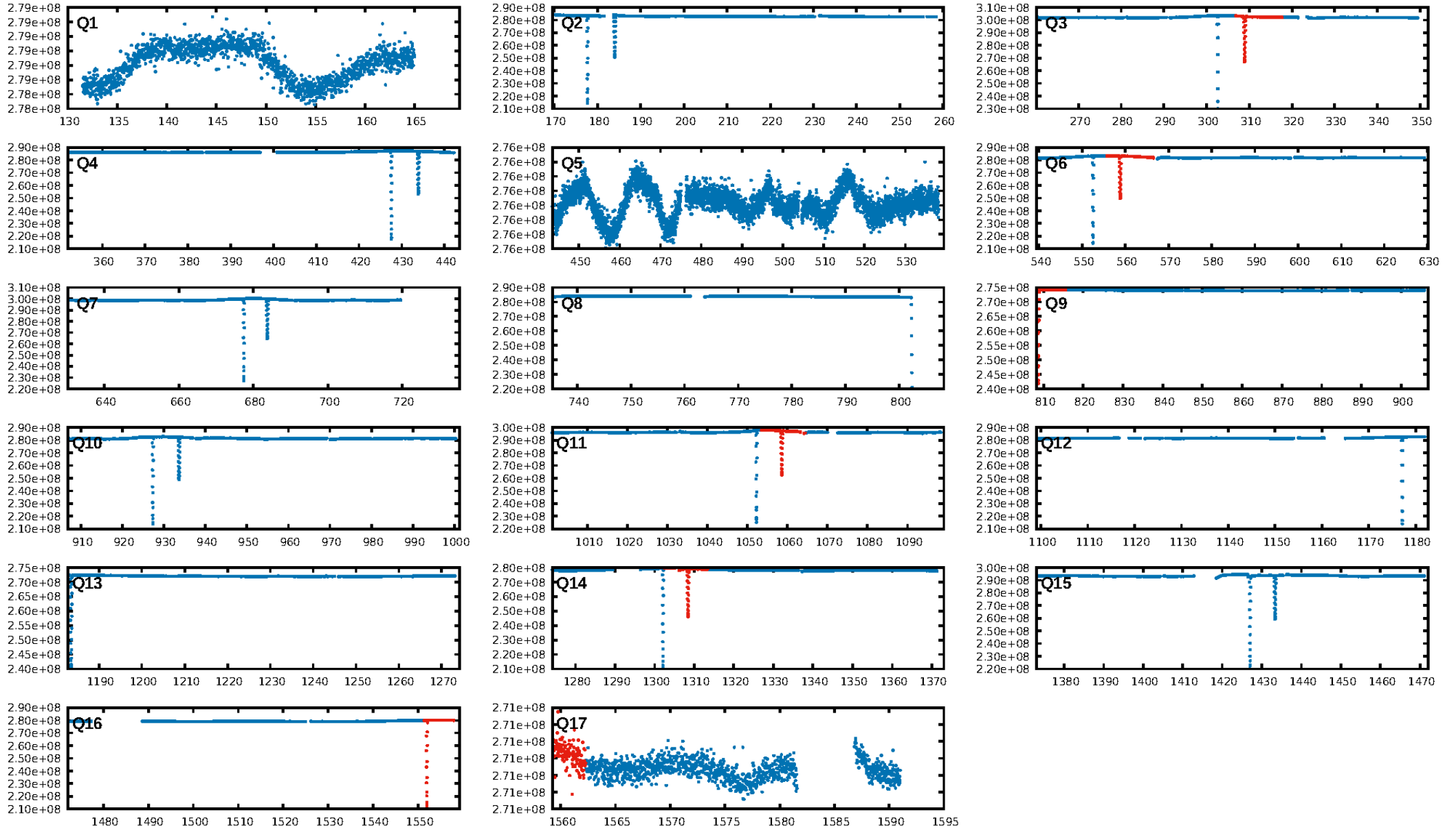
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [4.42σ]  
LongPeriod-sig: 100.0% [3.55σ]  
ModelChiSquare2-sig: 0.0%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 4.73e-36  
RollingBand-fgt: 1.00 [6/6]  
GhostDiagnostic-chr: 4.301  
Centroid-sig: 87.4%  
Centroid-so: 0.496 arcsec [3.83σ]  
OotOffset-rm: 1.665 arcsec [24.94σ]  
KicOffset-rm: 1.568 arcsec [23.47σ]  
OotOffset-st: 0/1/0/0 [1]  
KicOffset-st: 0/1/0/0 [1]  
DiffImageQuality-fgm: 0.00 [0/1]  
DiffImageOverlap-fno: 0.00 [0/1]

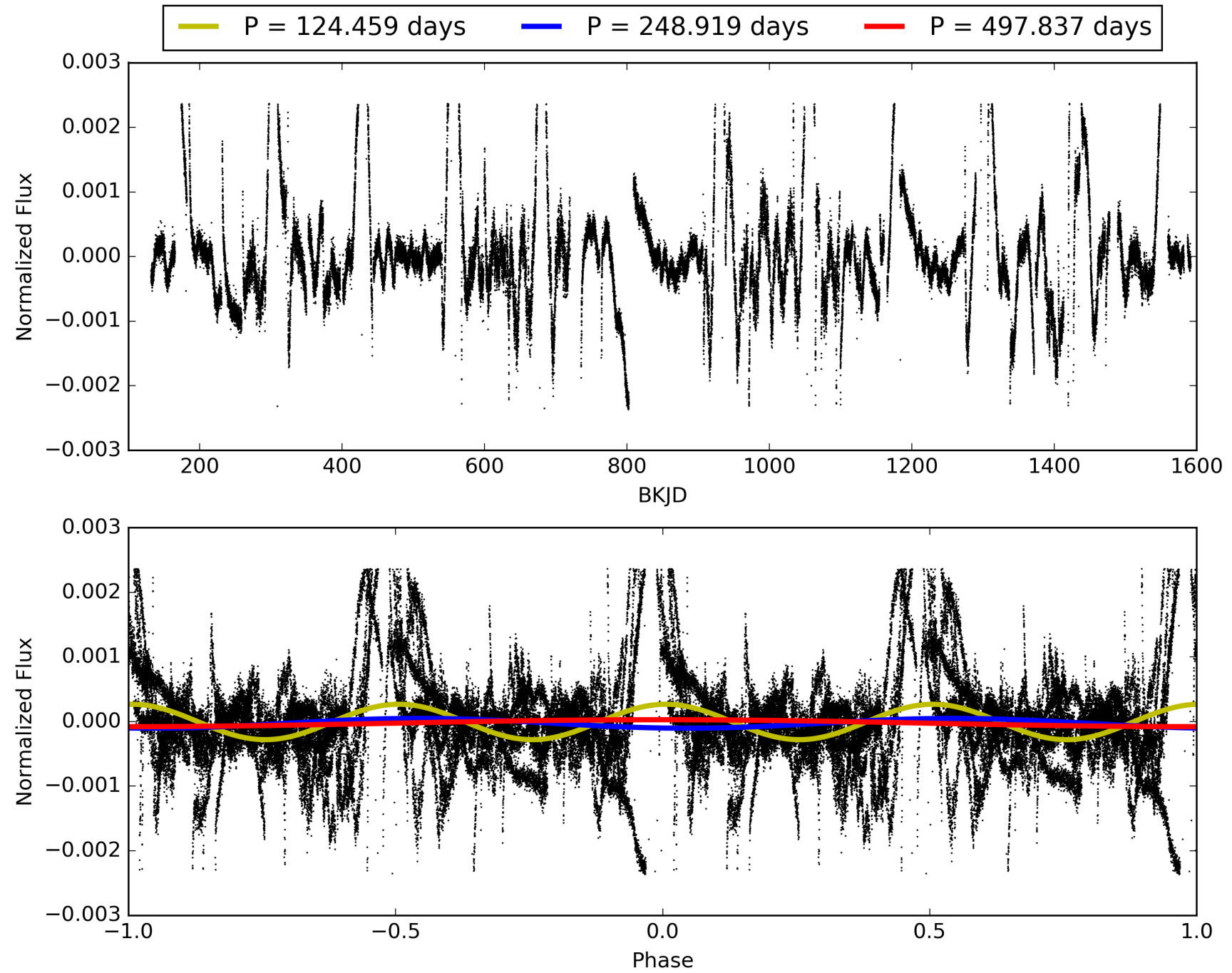
Software Revision: svn-ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 21:30:01 Z

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

# TCE 009028474-03, PDC Light Curves

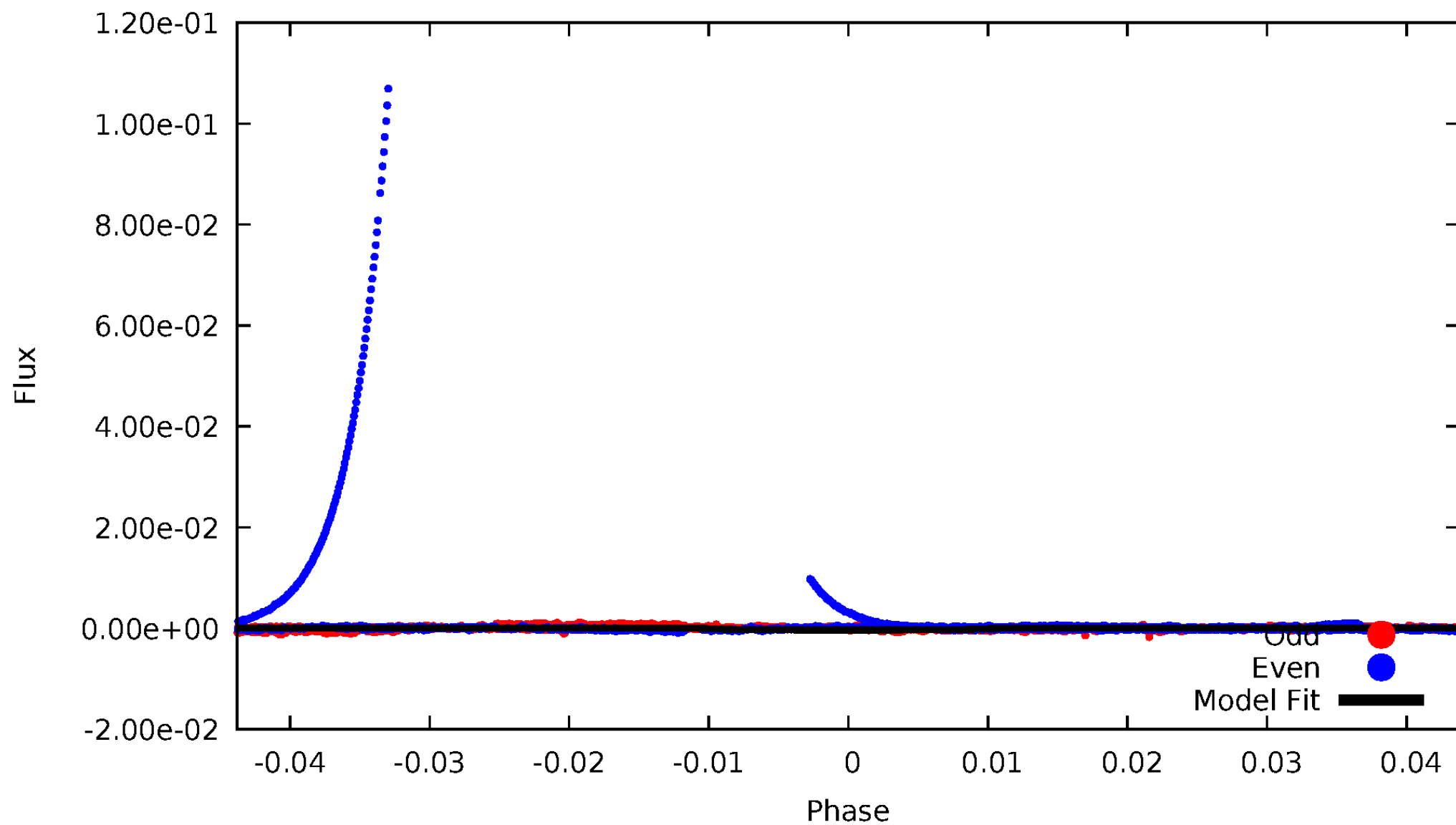


TCE 009028474-03



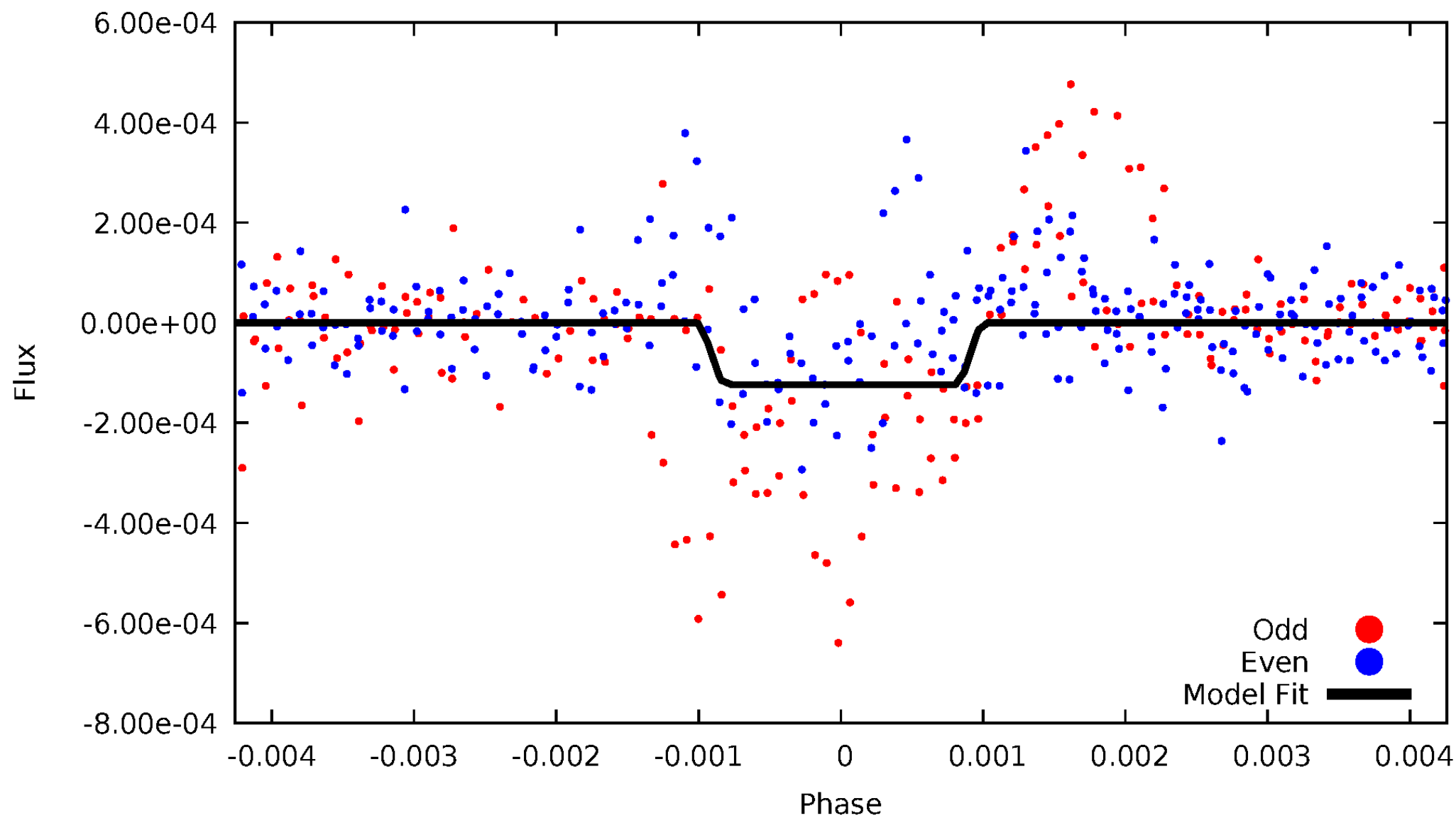
# DV Odd/Even

TCE 009028474-03



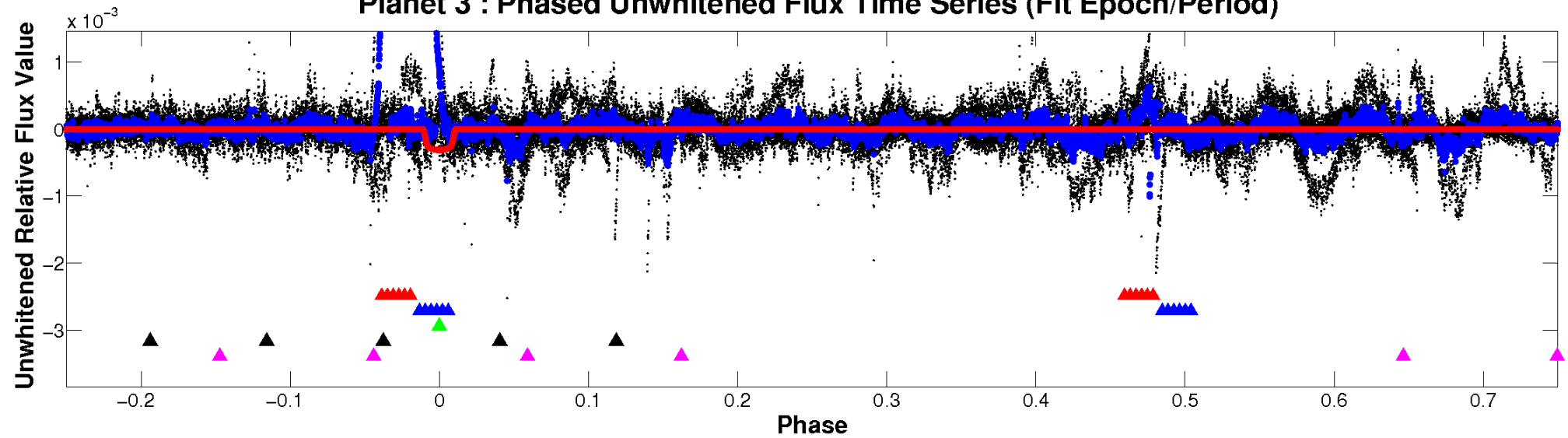
# ALT Odd/Even

TCE 009028474-03

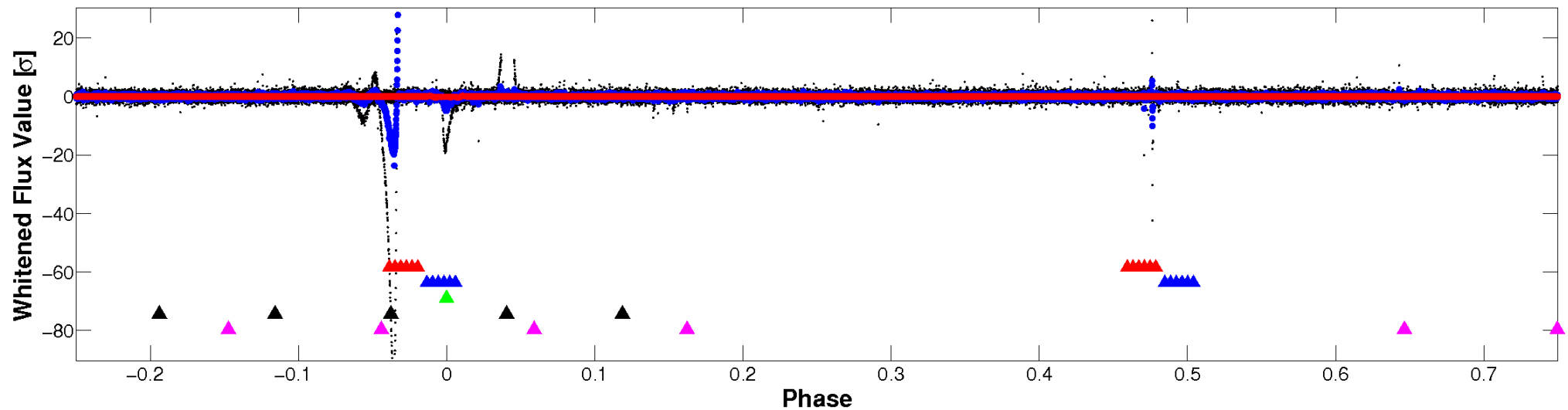


# Non-Whitened Vs. Whitened Light Curve

Planet 3 : Phased Unwhitened Flux Time Series (Fit Epoch/Period)

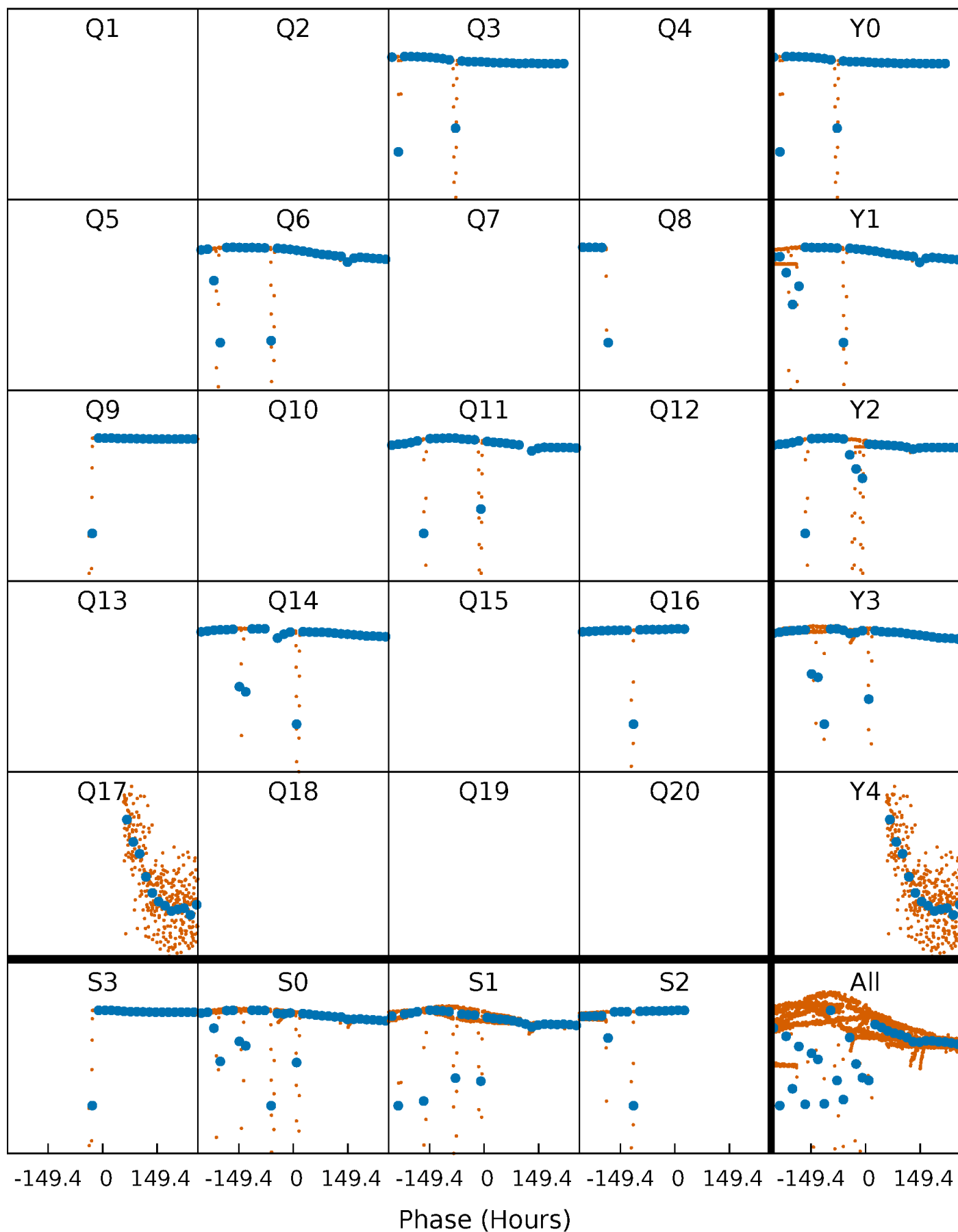


Planet 3 : Phased Whitened Flux Time Series (Fit Epoch/Period)



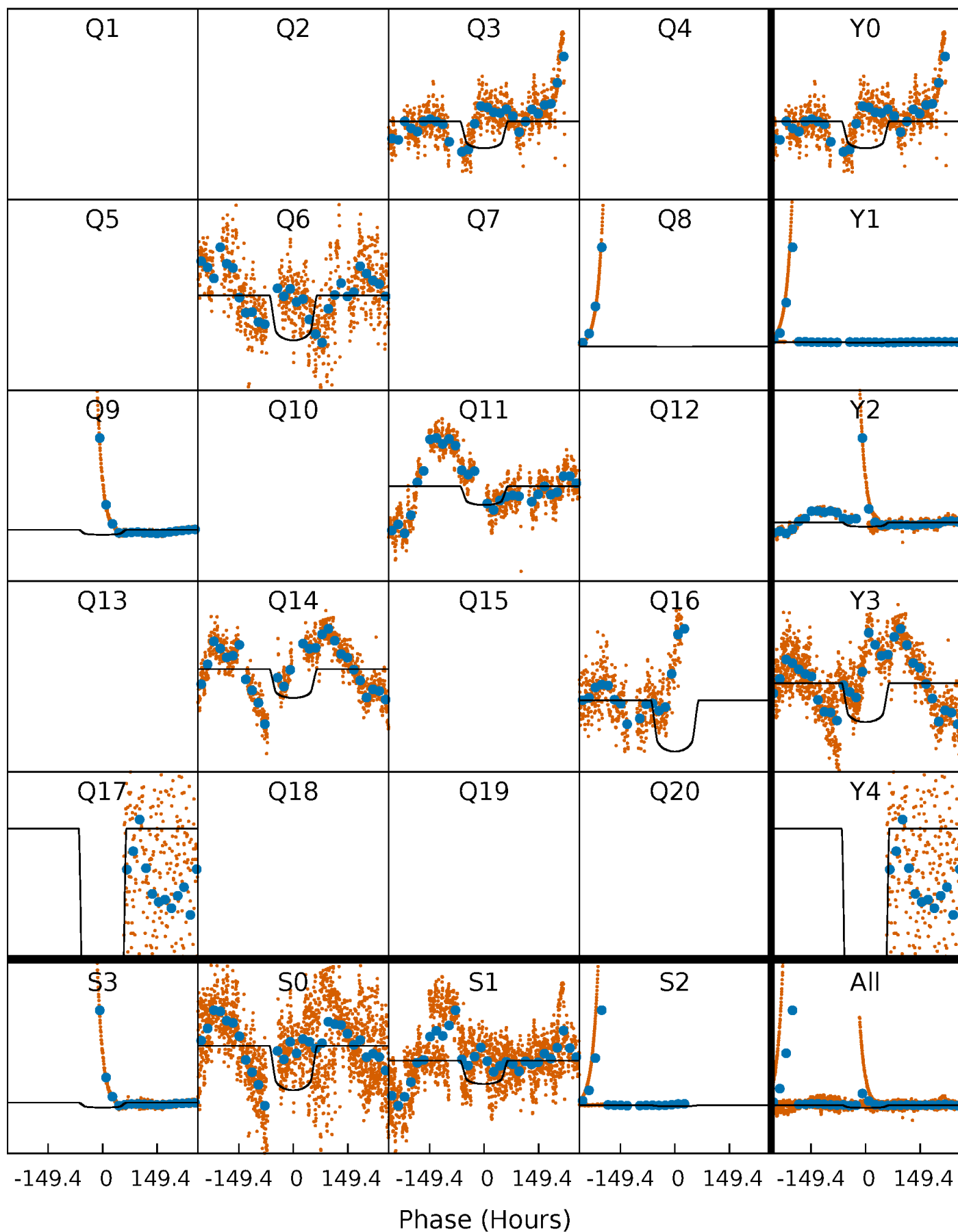
# PDC Quarter-Phased Transit Curves

TCE 009028474-03 P=248.918745 Days  $T_0=312.240003$  (BKJD)



# DV Quarter-Phased Transit Curves

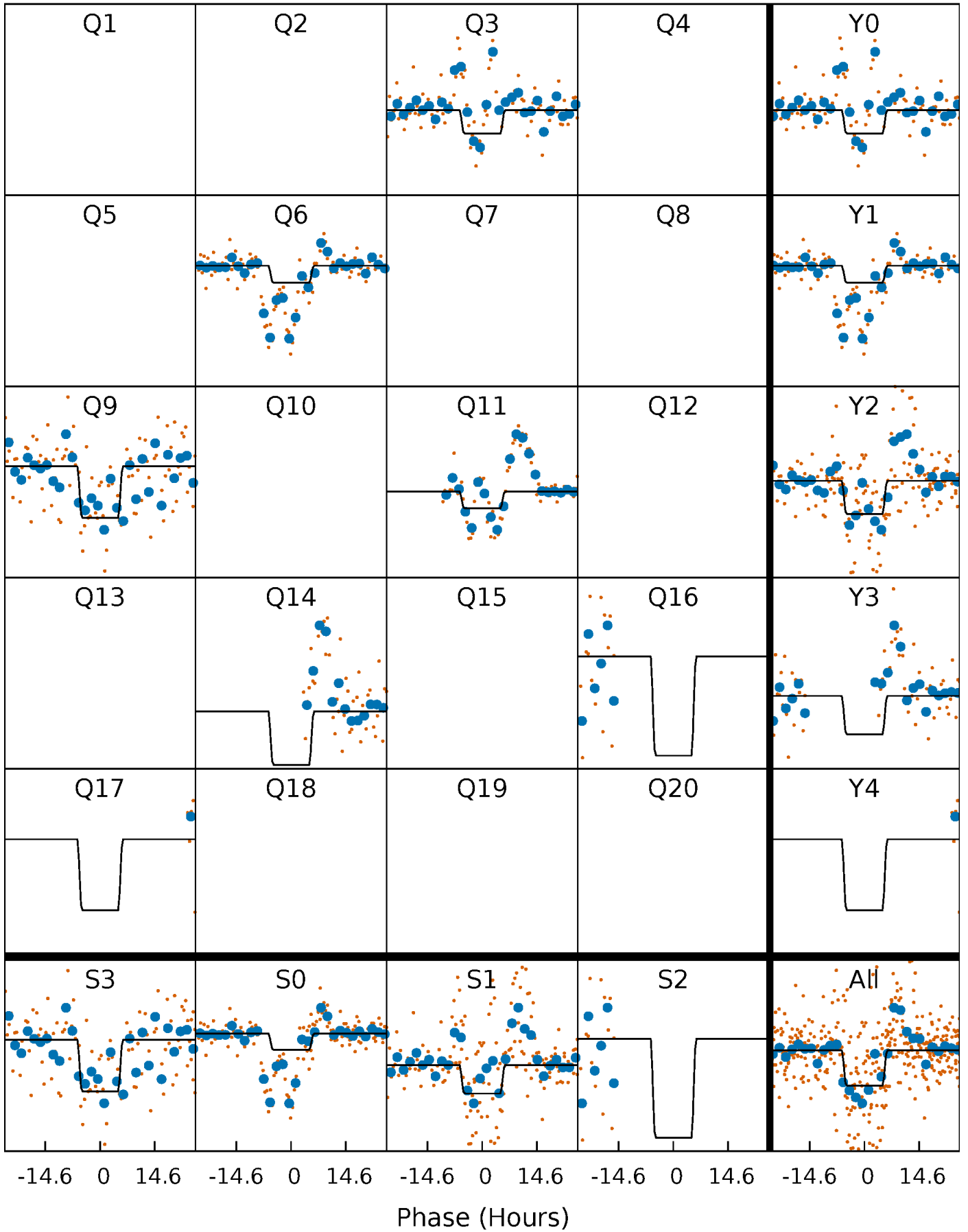
TCE 009028474-03     $P=248.918745$  Days     $T_0=312.240003$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

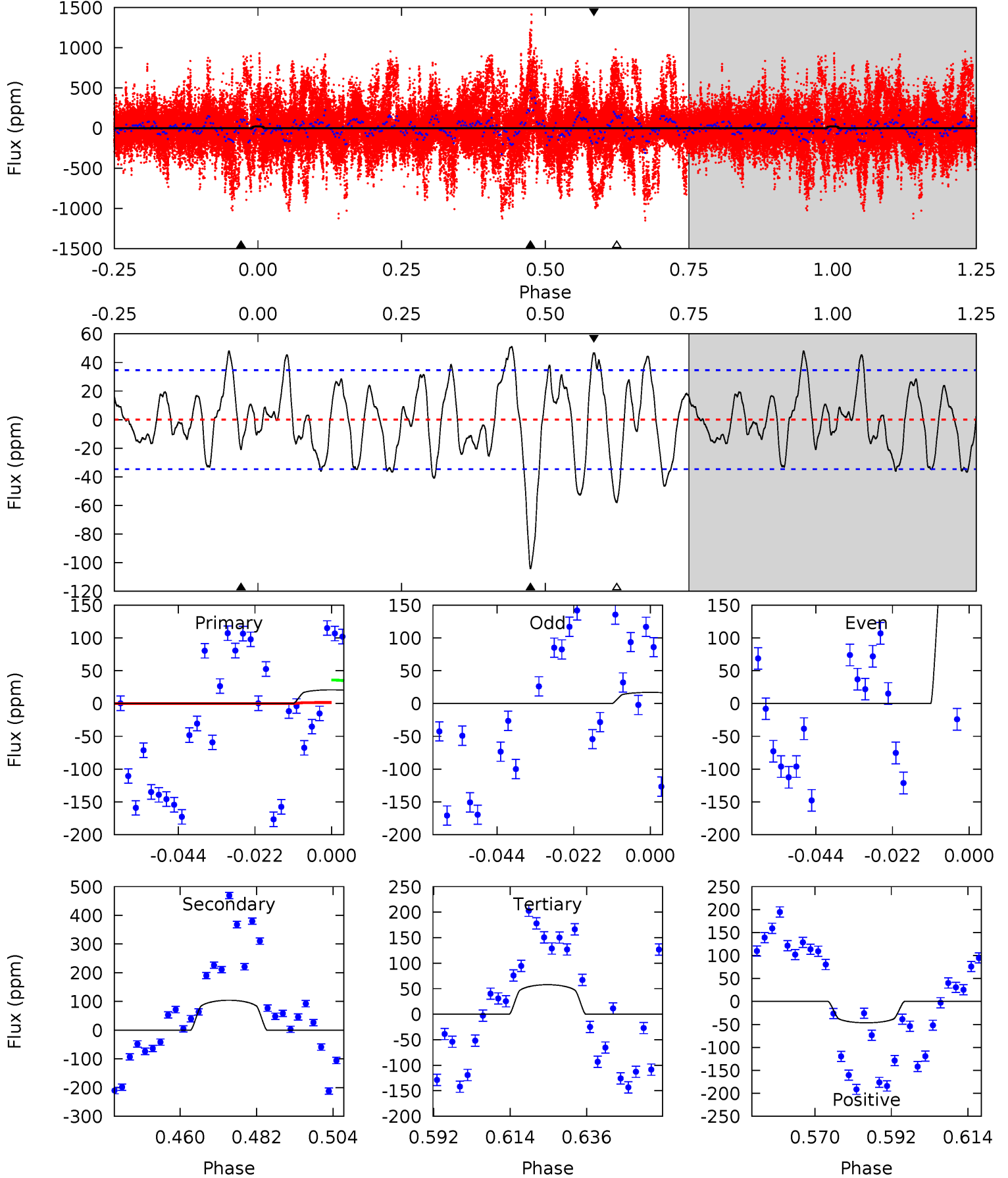
TCE 009028474-03 P=249.268998 Days  $T_0=311.927135$  (BKJD)



# DV Model-Shift Uniqueness Test

009028474-03, P = 248.918745 Days, E = 63.321258 Days

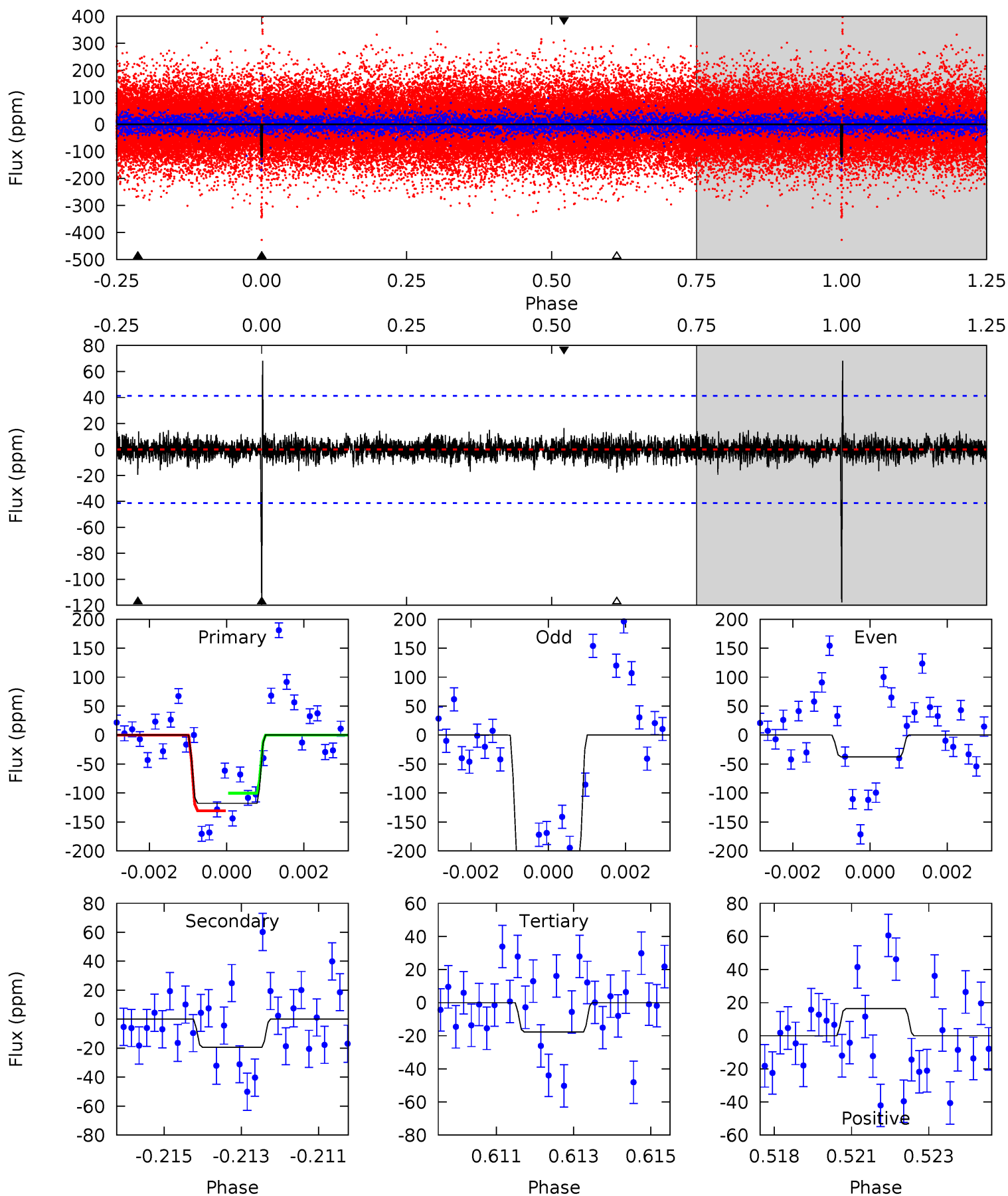
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
2.94	14.7	8.16	6.56	4.87	2.29	3.25	-5.22	-3.62	6.52	8.12	16.0	10.8	0.33	2.46



# Alt Model-Shift Uniqueness Test

009028474-03, P = 249.268998 Days, E = 62.658137 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
15.2	2.50	2.29	2.11	5.32	3.08	0.57	12.9	13.1	0.21	0.39	12.5	0.99	0.37	0



### Stellar Parameters For KIC 009028474

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5887^{+132}_{-162}$	$4.477^{+0.060}_{-0.140}$	$-0.140^{+0.300}_{-0.300}$	$0.941^{+0.190}_{-0.102}$	$0.970^{+0.110}_{-0.110}$	$1.640^{+0.428}_{-0.689}$
	+2%/-3%	+1%/-3%	+214%/-214%	+20%/-11%	+11%/-11%	+26%/-42%
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 009028474-03 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-104 \pm 7$	$2.09^{+0.27}_{-0.24}$	$406^{+21}_{-16}$	$4427^{+177}_{-178}$	$7681^{+1943}_{-1716}$
Alt.	$-19 \pm 8$	$1.18^{+0.22}_{-0.20}$	$405^{+22}_{-15}$	$4010^{+343}_{-373}$	$4425^{+2811}_{-1960}$

$T_{max}$  = Theoretical Maximum Planetary Temperature

$T_{obs}$  = Observed Planetary Temperature (Assuming  $A=0.3$ )

$A_{obs}$  = Observed Albedo (Assuming  $T=0$ )

If a secondary eclipse is present, the system is likely an EB if  $T_{obs} \gg T_{max}$  AND  $A_{obs} \gg 1.0$

## DV Centroid Data

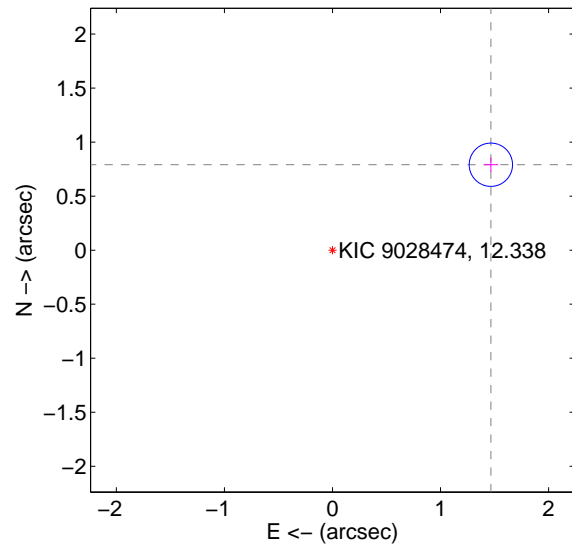
Supplemental centroid analysis for 009028474-03. Kepler magnitude: 12.34. Transit SNR 7.43

There are 0 quarters with good PRF difference image offsets

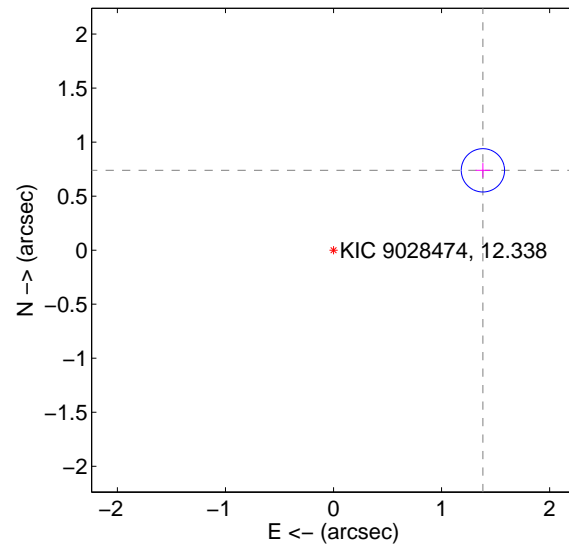
The direct PRF centroid is offset from the target star catalog position by about 0.10 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.665 \pm 0.067$	24.94	$-1.466 \pm 0.067$	$0.791 \pm 0.067$
PRF-fit source offset from KIC position	$1.568 \pm 0.067$	23.47	$-1.382 \pm 0.067$	$0.739 \pm 0.067$
photometric centroid source offset	$0.50 \pm 0.13$	3.83	$0.04 \pm 0.15$	$-0.49 \pm 0.13$

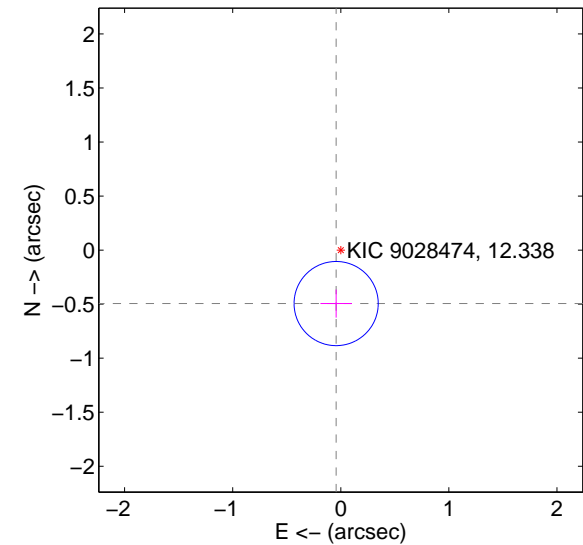
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

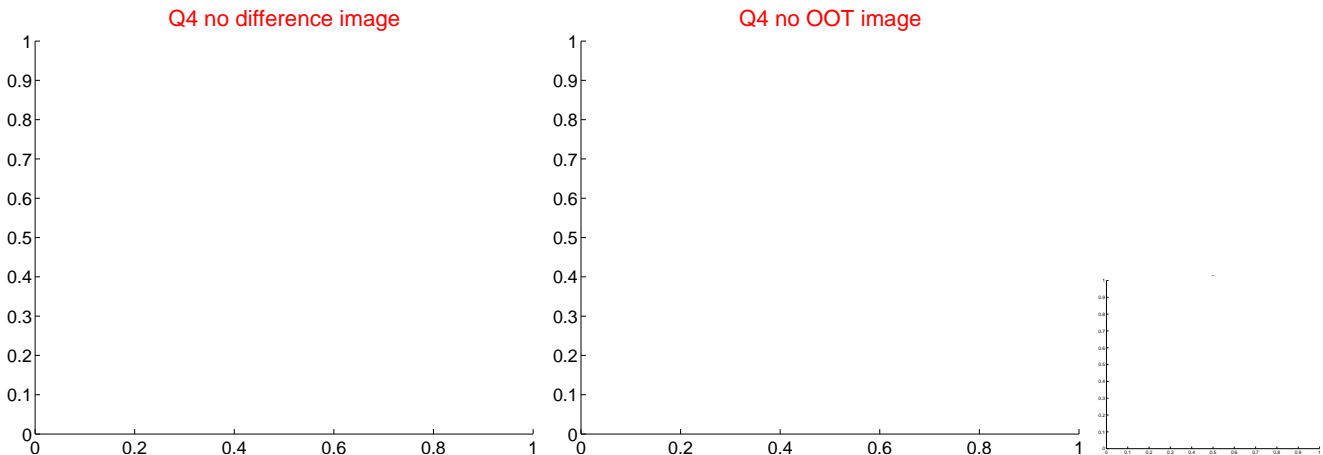
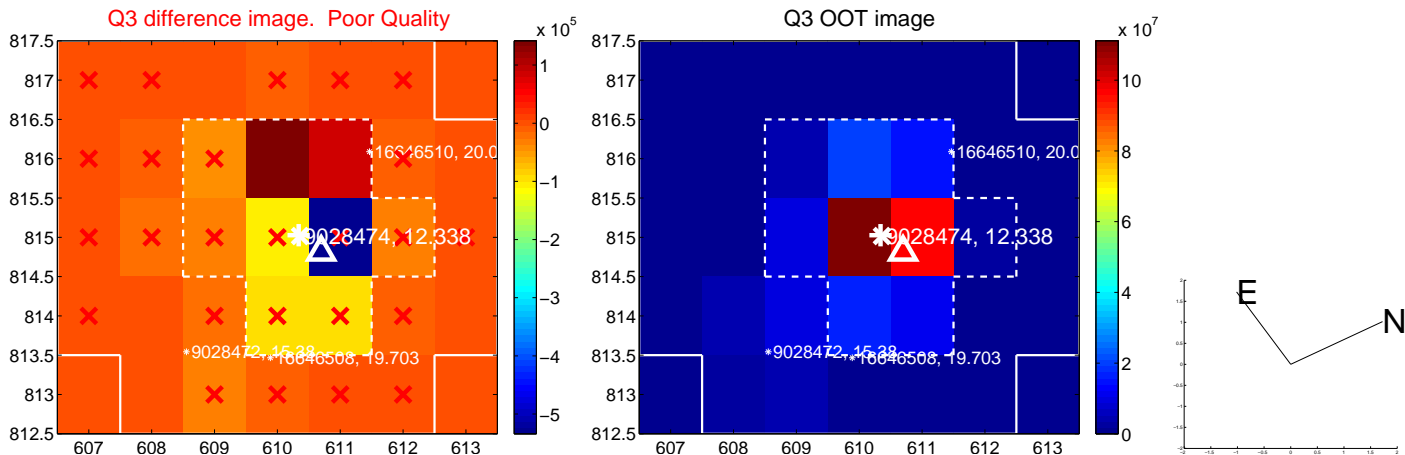
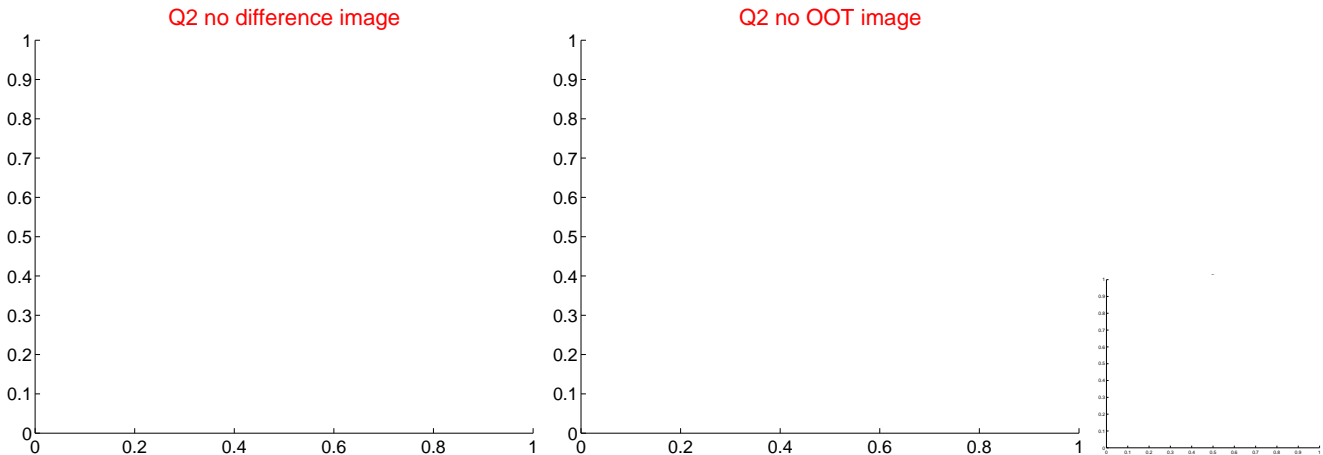
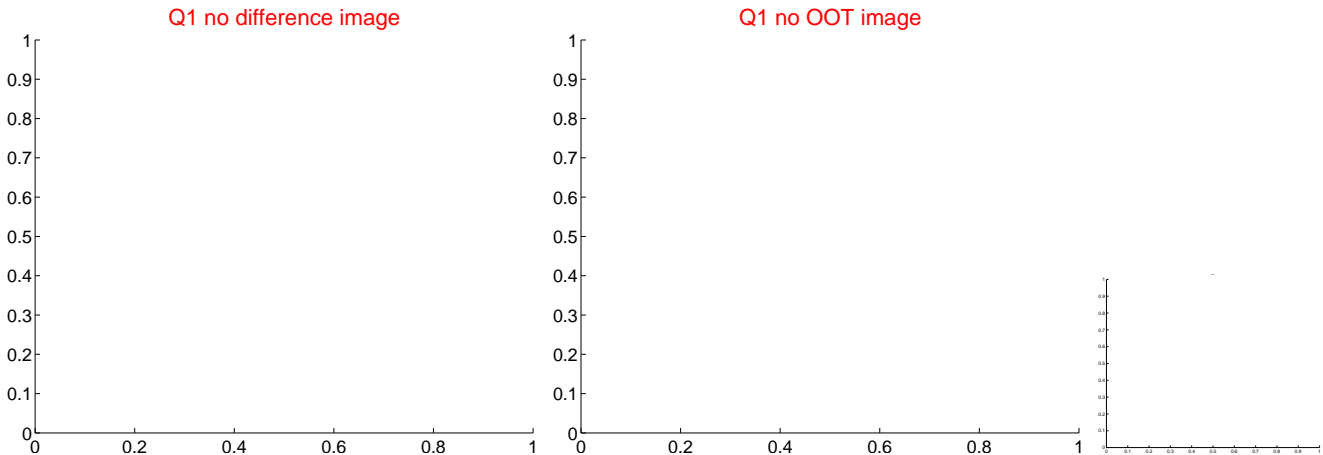


offset from photometric centroids



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.

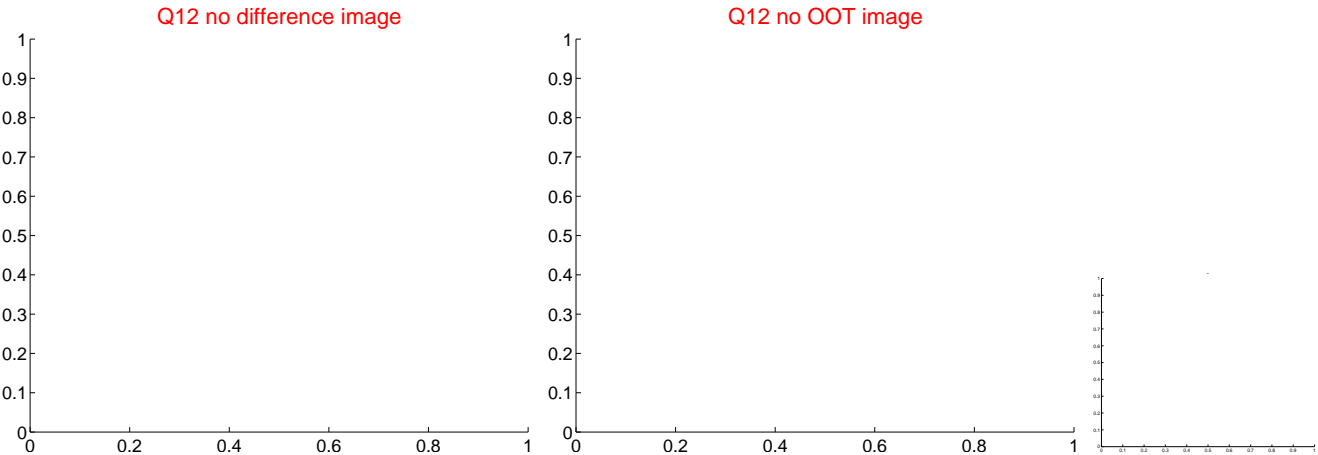
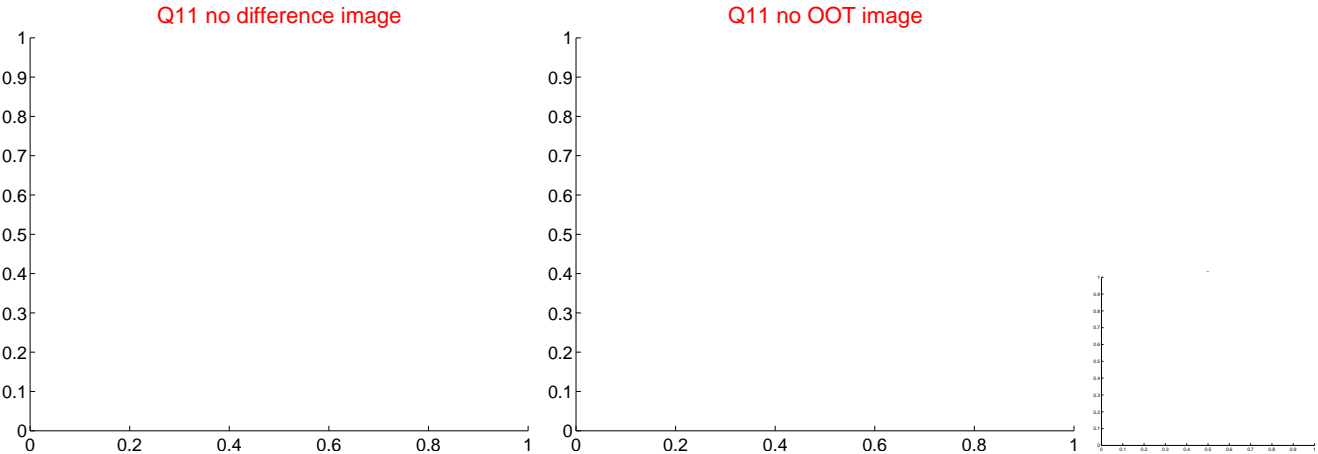
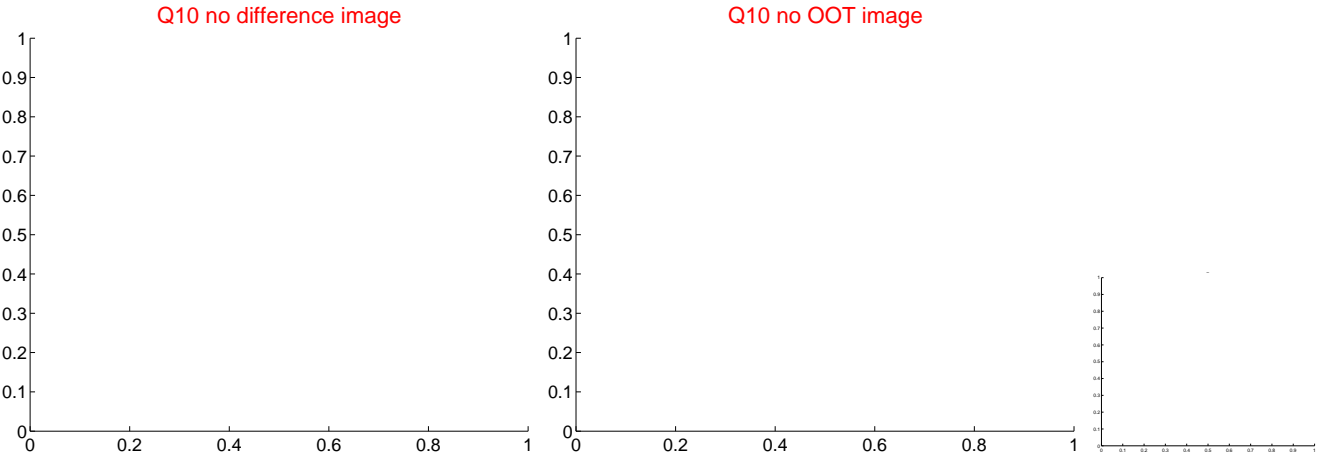
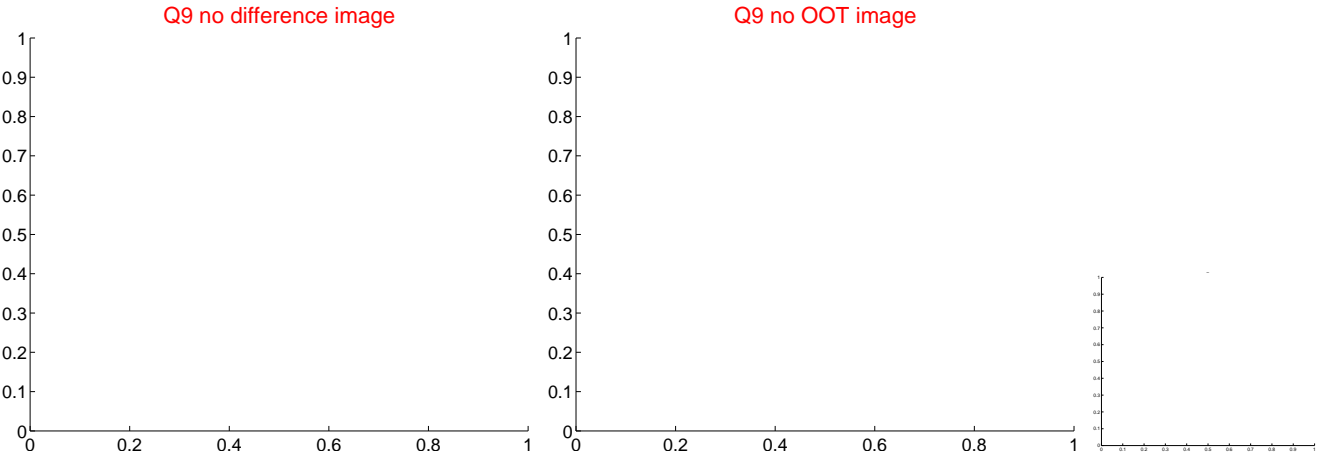
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value



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.

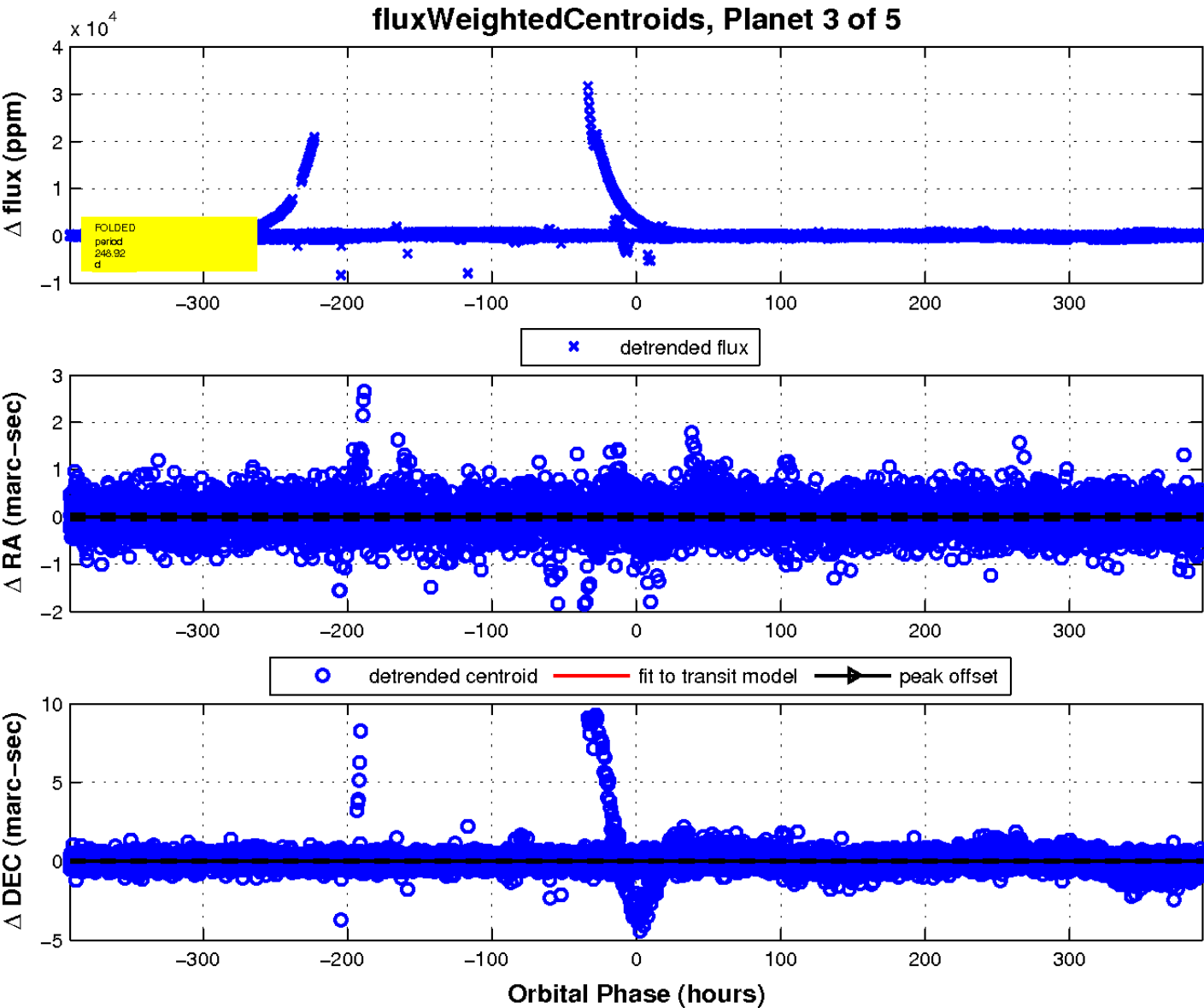
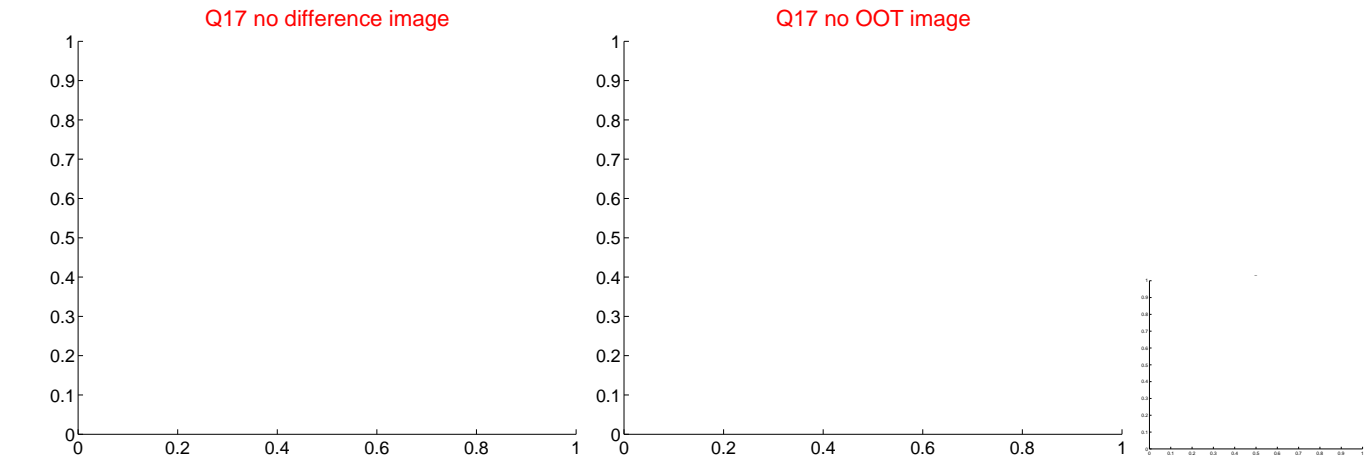




white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

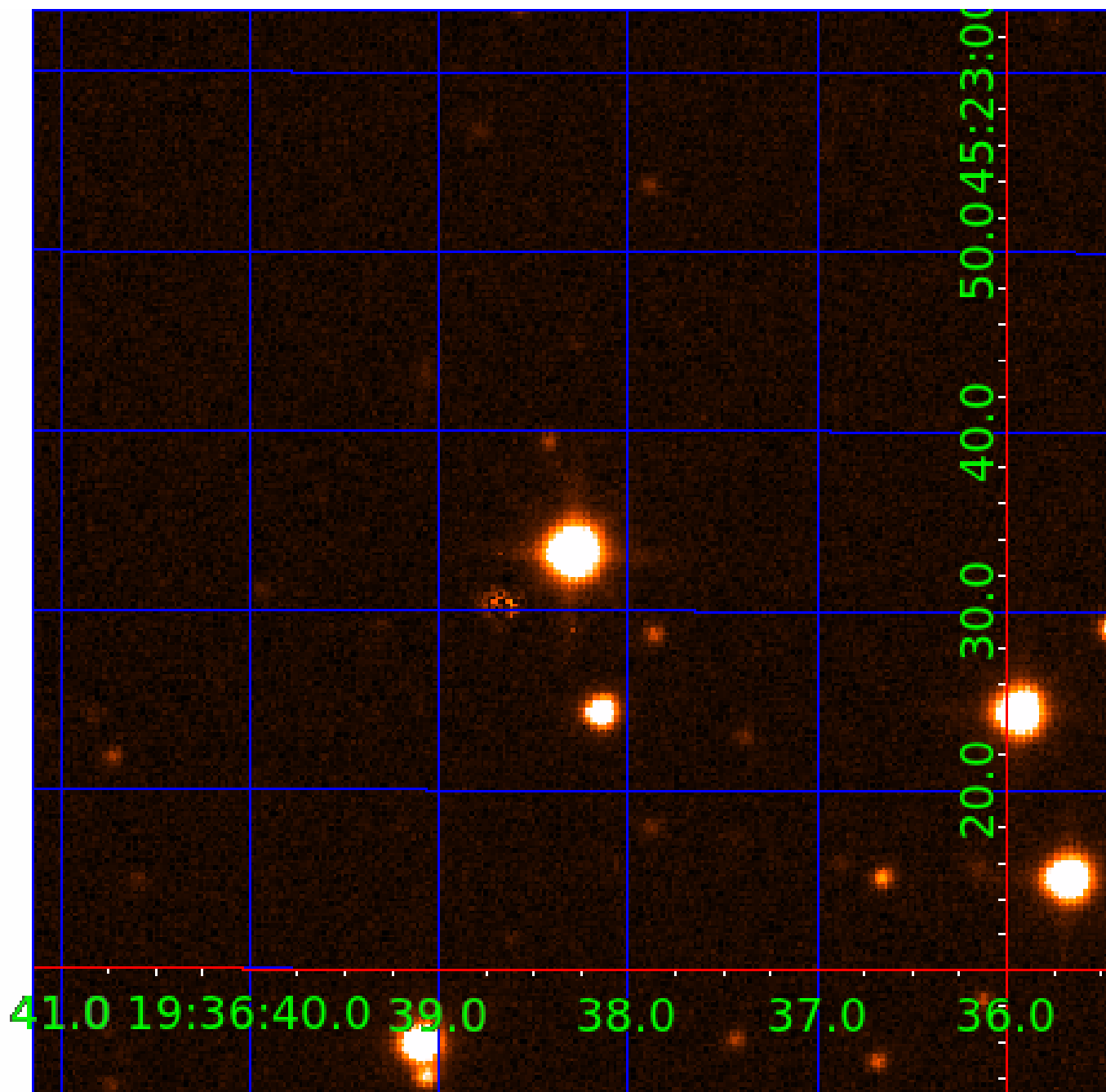


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 009028474

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009028474-01	OBS	3510.01	124.937055	177.682301	243052.5	7.485	7997.3	4253.8	0.94	5887	58.16	4.07
009028474-02	OBS	No	124.939325	183.984750	118081.0	11.045	3517.2	4418.7	0.94	5887	47.85	4.07
009028474-03	OBS	No	248.918745	312.240003	310.9	130.763	18.7	7.4	0.94	5887	2.04	1.62
009028474-04	OBS	No	268.367566	263.981763	2029.8	15.000	120.7	-1.0	0.94	5887	4.22	1.47
009028474-05	OBS	No	223.237472	352.638943	570.6	48.532	14.3	15.2	0.94	5887	4.42	1.88

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009028474-01	OBS	FP	0.00	0	1	0	0	MOD_SEC_DV—MOD_SEC_ALT—DEEP_V_SHAPED—HAS_SEC_TCE
009028474-02	OBS	FP	0.00	1	1	0	0	IS_SEC_TCE
009028474-03	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009028474-04	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_NOFITS
009028474-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_ZUMA—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS

**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 009028474-04

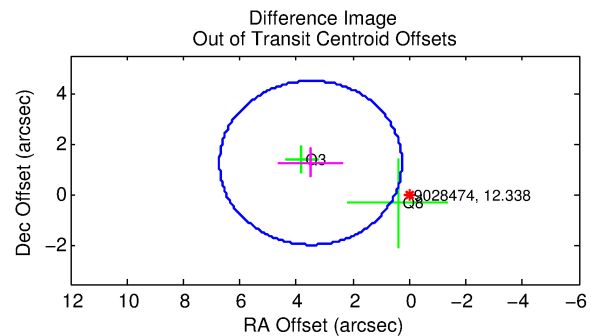
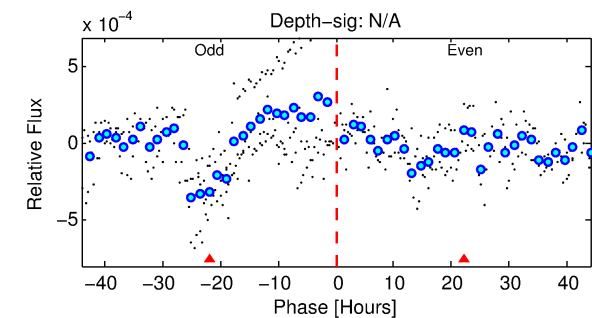
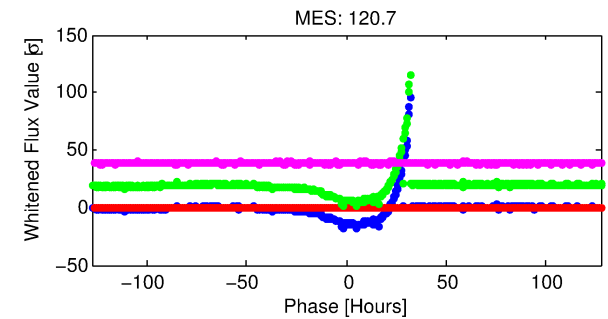
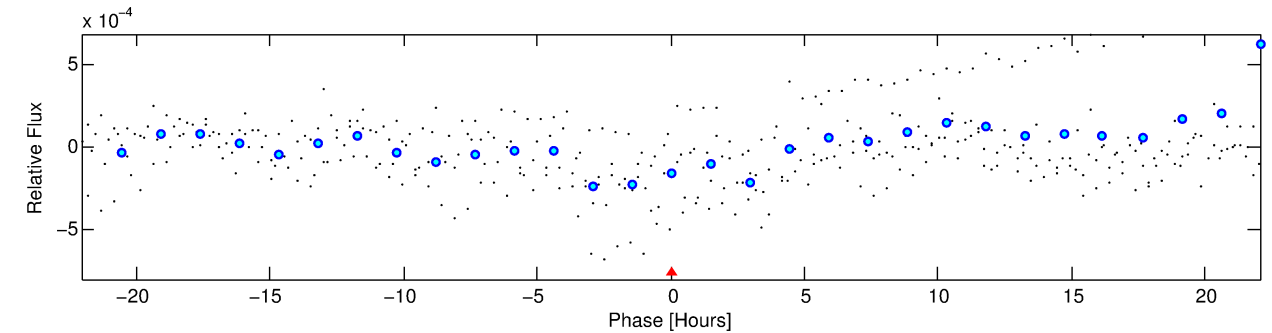
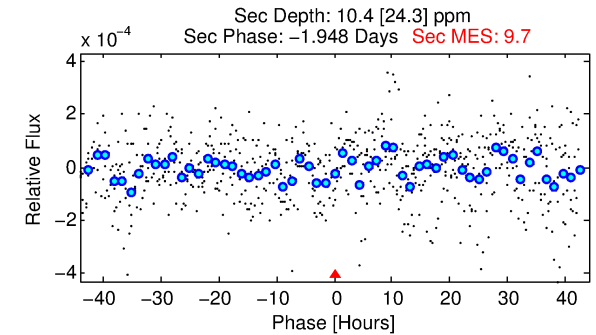
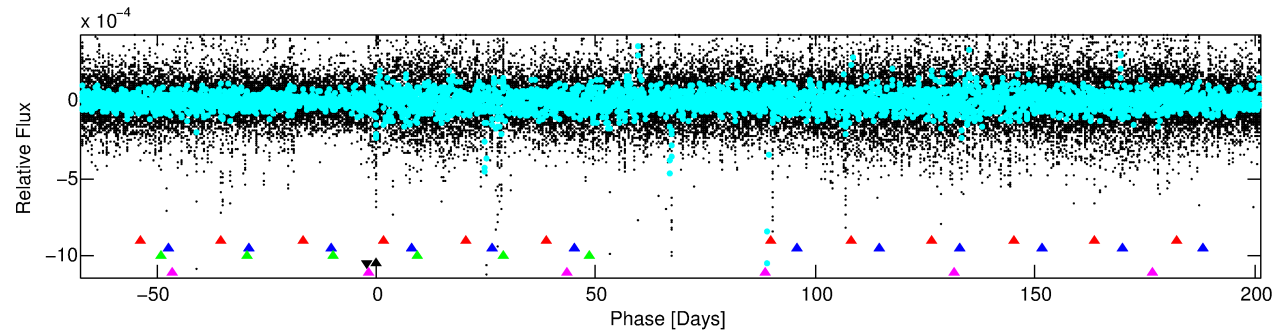
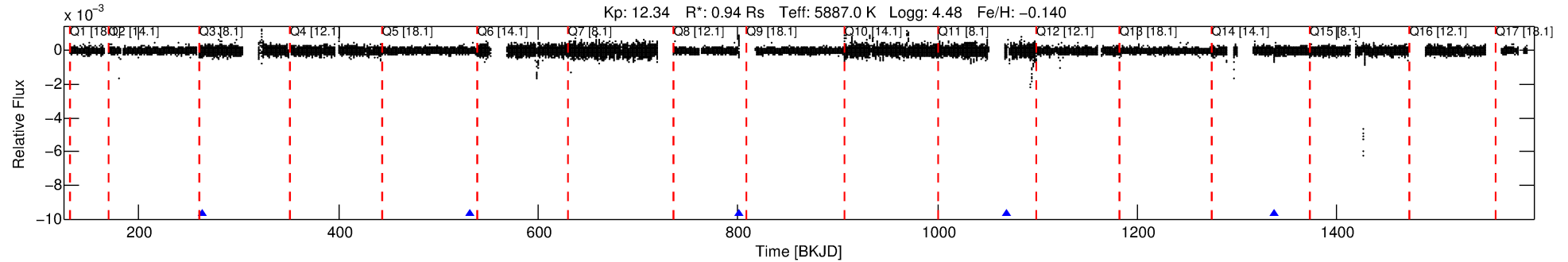
No Significant Match Found

# DV One-Page Summary

KIC: 9028474 Candidate: 4 of 5 Period: 268.368 d

KOI: K03510 Corr: No Ephemeris Match

Kp: 12.34 R\*: 0.94 Rs Teff: 5887.0 K Logg: 4.48 Fe/H: -0.140



## TPS TCE Results:

Period = 268.36757 d  
Epoch = 263.9818 BKJD

DV fit results are unavailable

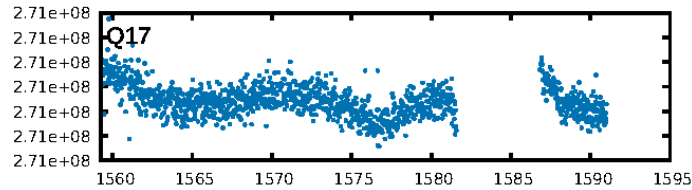
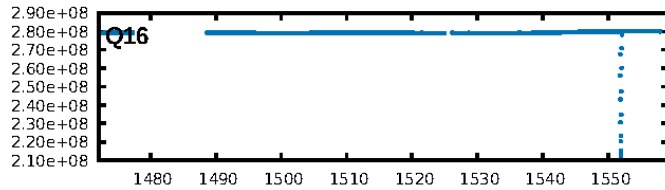
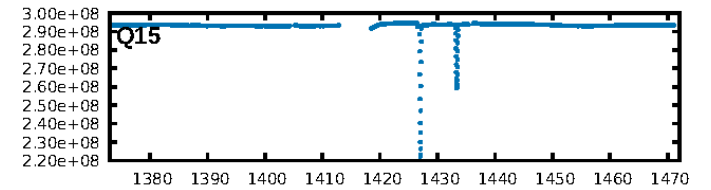
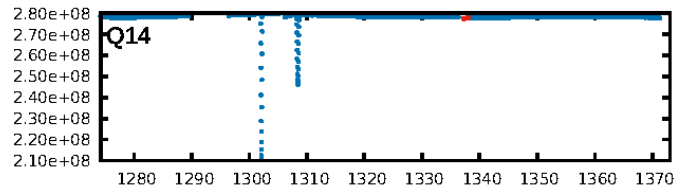
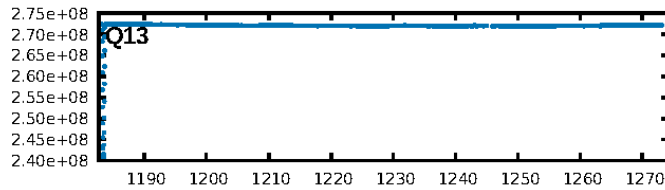
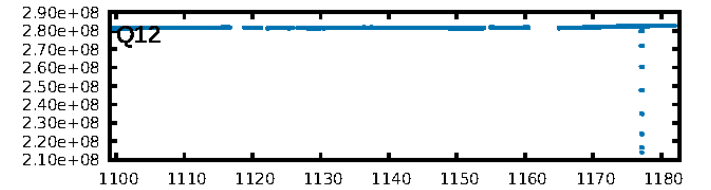
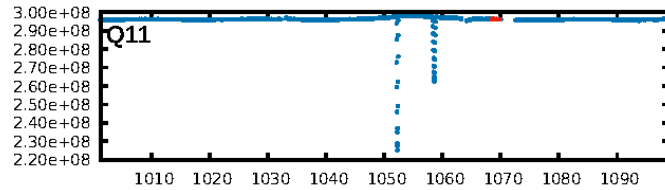
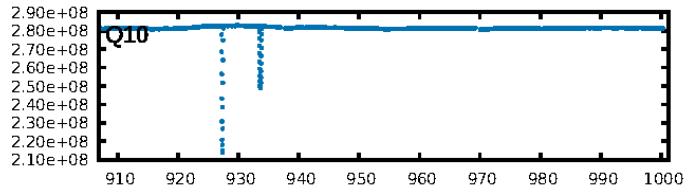
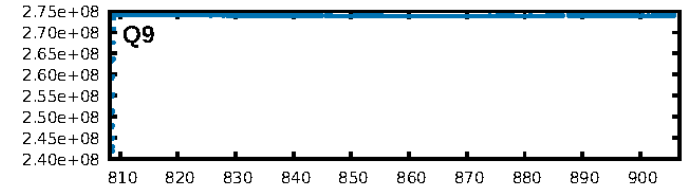
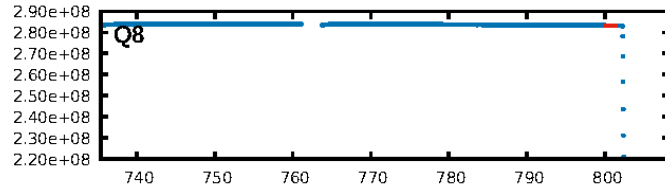
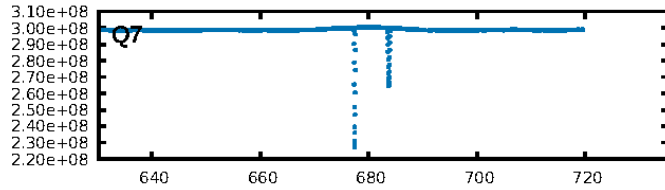
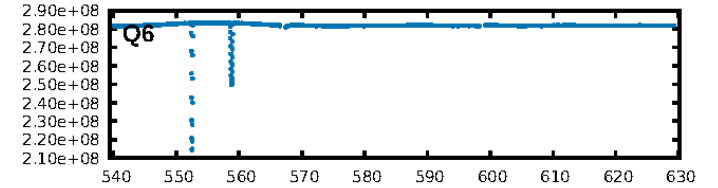
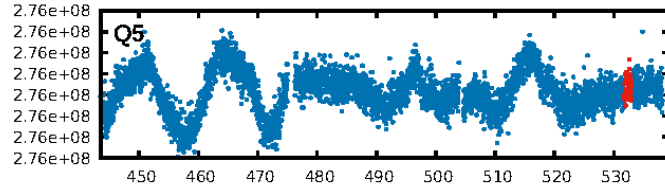
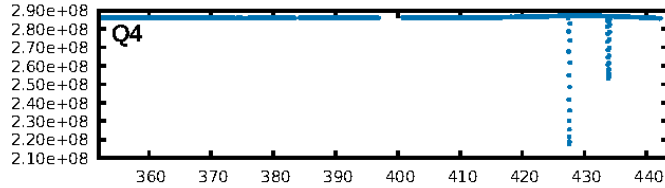
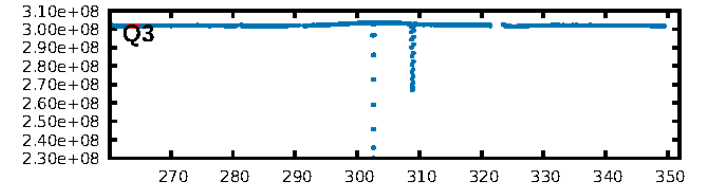
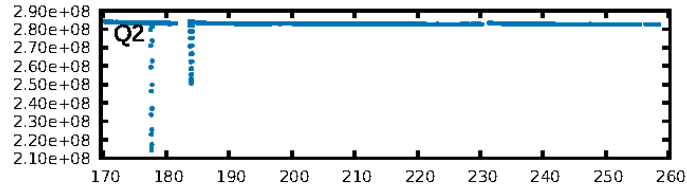
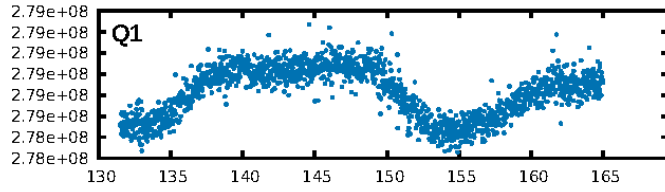
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [3.55σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: 0.00e+00  
RollingBand-fgt: 1.00 [5/5]  
GhostDiagnostic-chr: -1.658  
Centroid-sig: 21.7%  
Centroid-so: 0.690 arcsec [2.76σ]  
OotOffset-rm: 3.718 arcsec [3.45σ]  
KicOffset-rm: 3.770 arcsec [3.41σ]  
OotOffset-st: 0/1/1/0 [2]  
KicOffset-st: 0/1/1/0 [2]  
DiffImageQuality-fgm: 0.50 [1/2]  
DiffImageOverlap-fno: 0.75 [3/4]

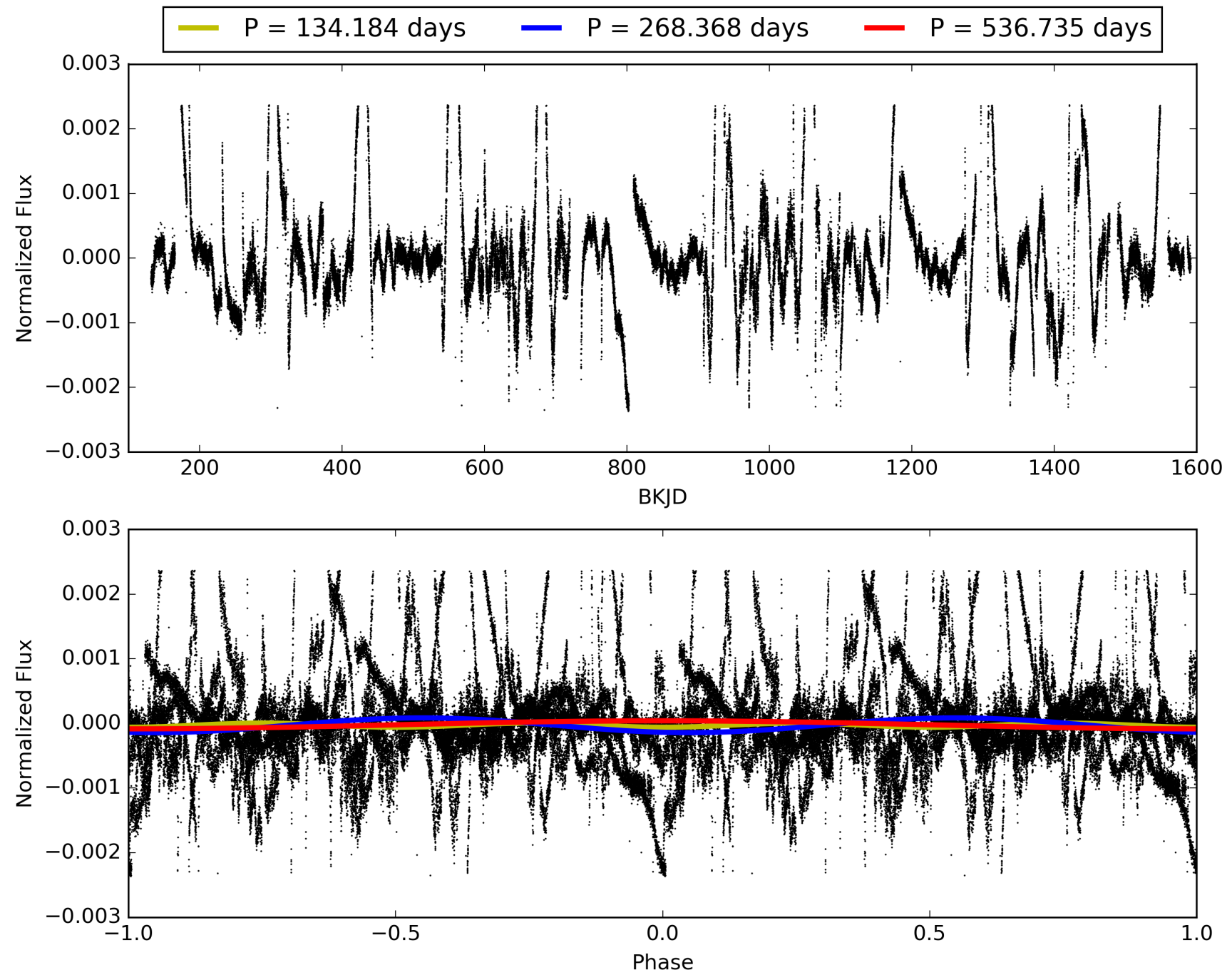
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 21:30:10 Z

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

# TCE 009028474-04, PDC Light Curves

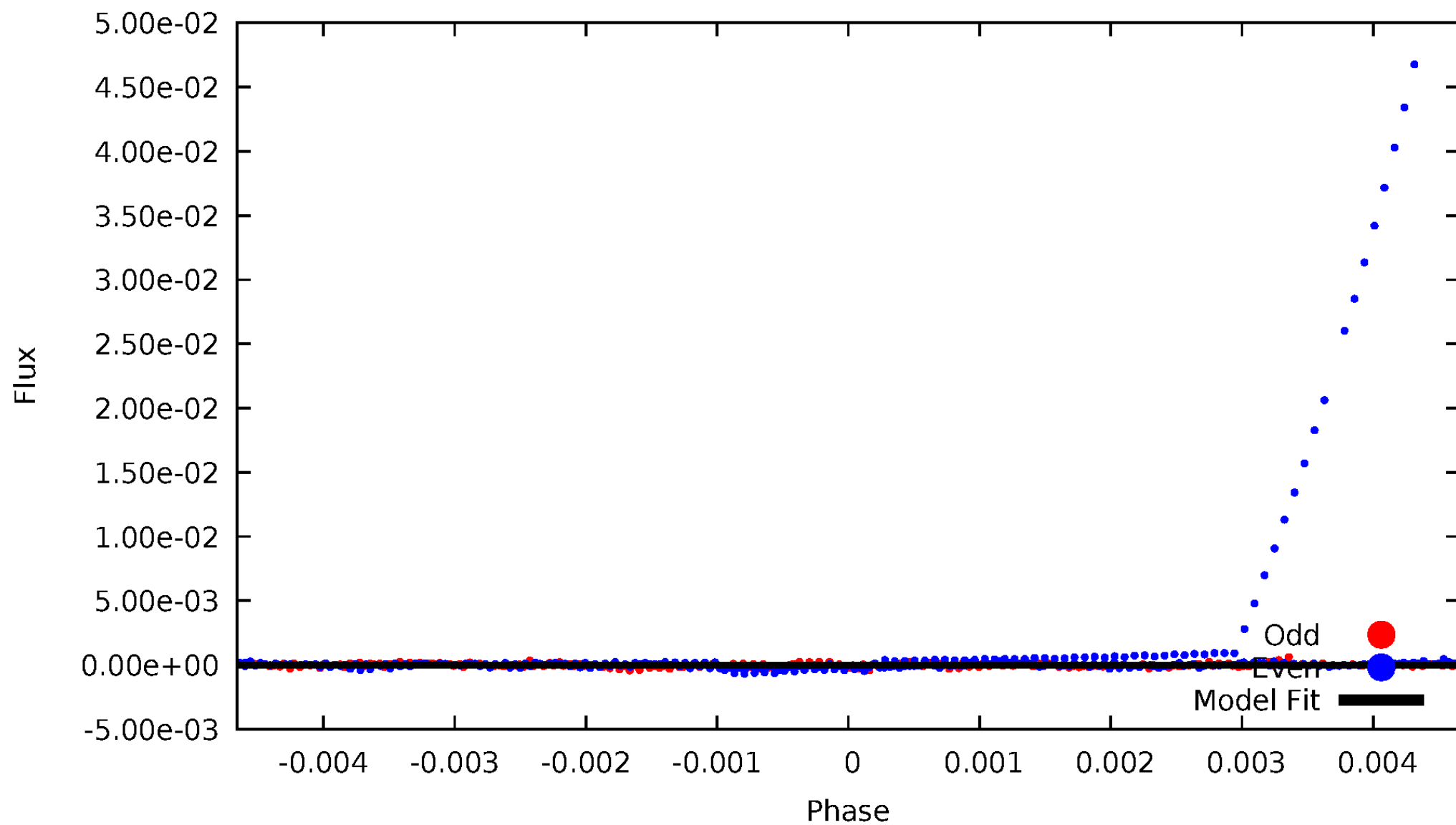


TCE 009028474-04



# DV Odd/Even

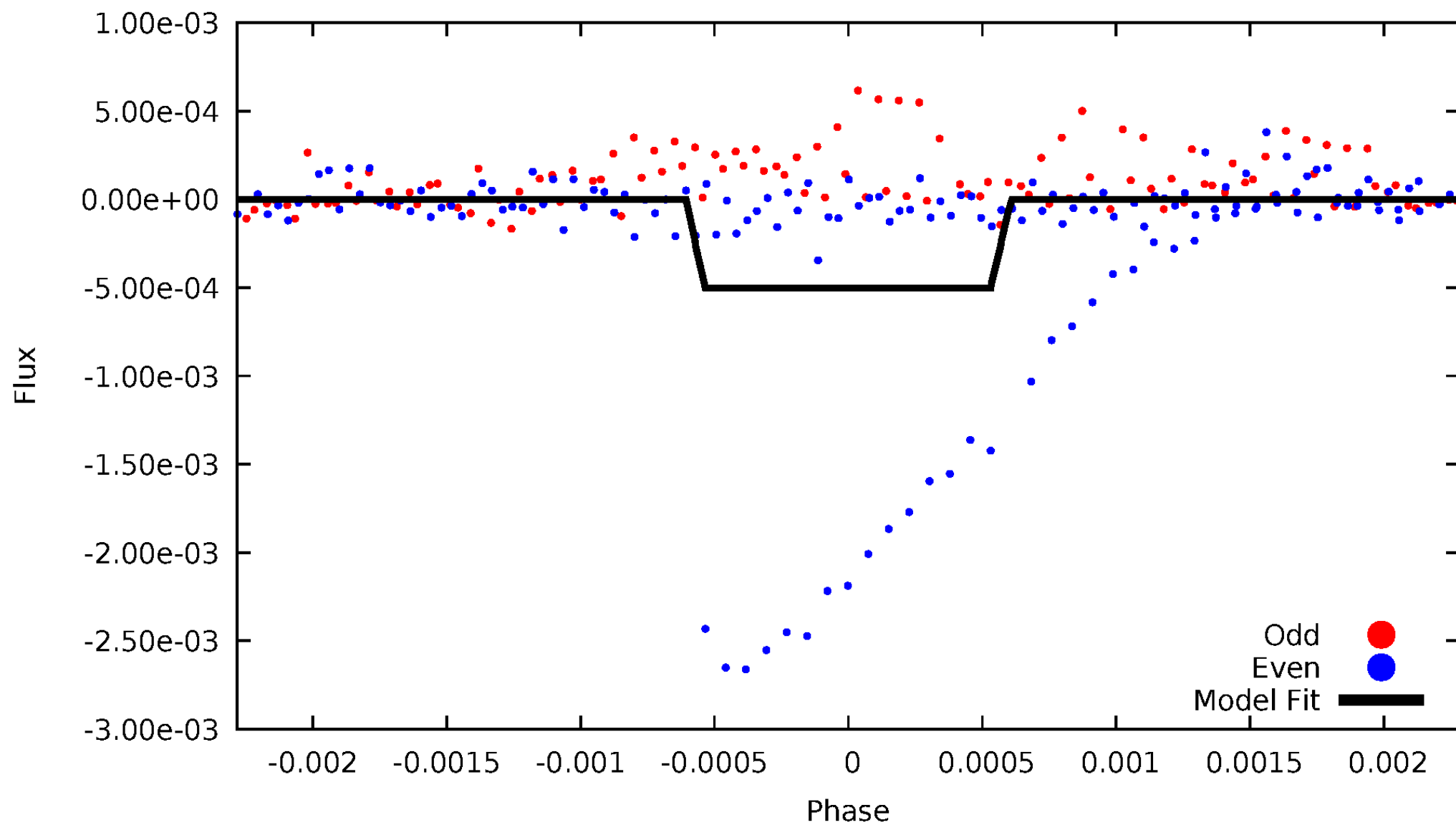
TCE 009028474-04





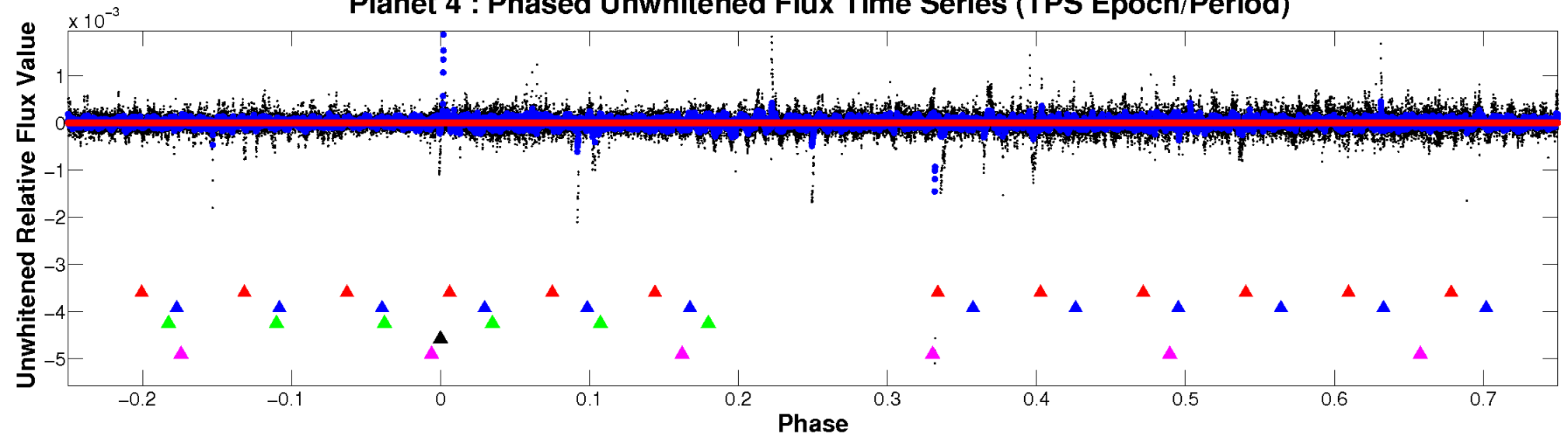
# ALT Odd/Even

TCE 009028474-04

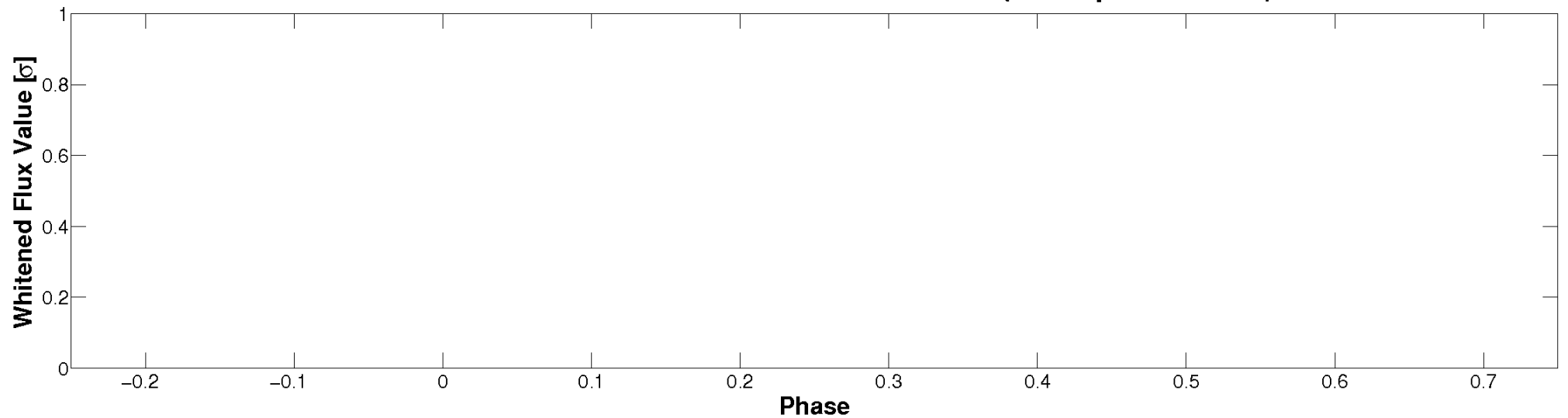


# Non-Whitened Vs. Whitened Light Curve

**Planet 4 : Phased Unwhitened Flux Time Series (TPS Epoch/Period)**

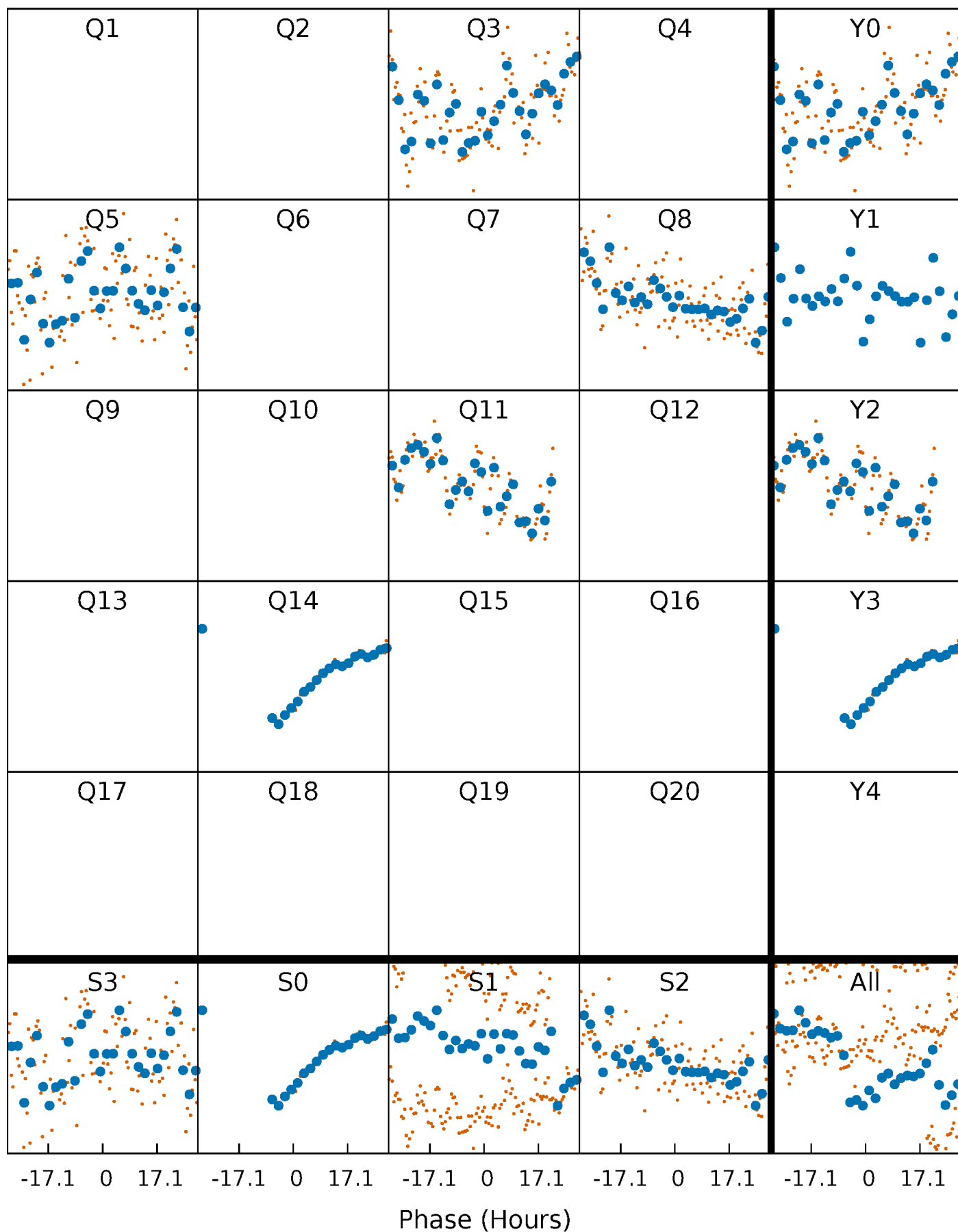


**Planet 4 : Phased Whitened Flux Time Series (TPS Epoch/Period)**



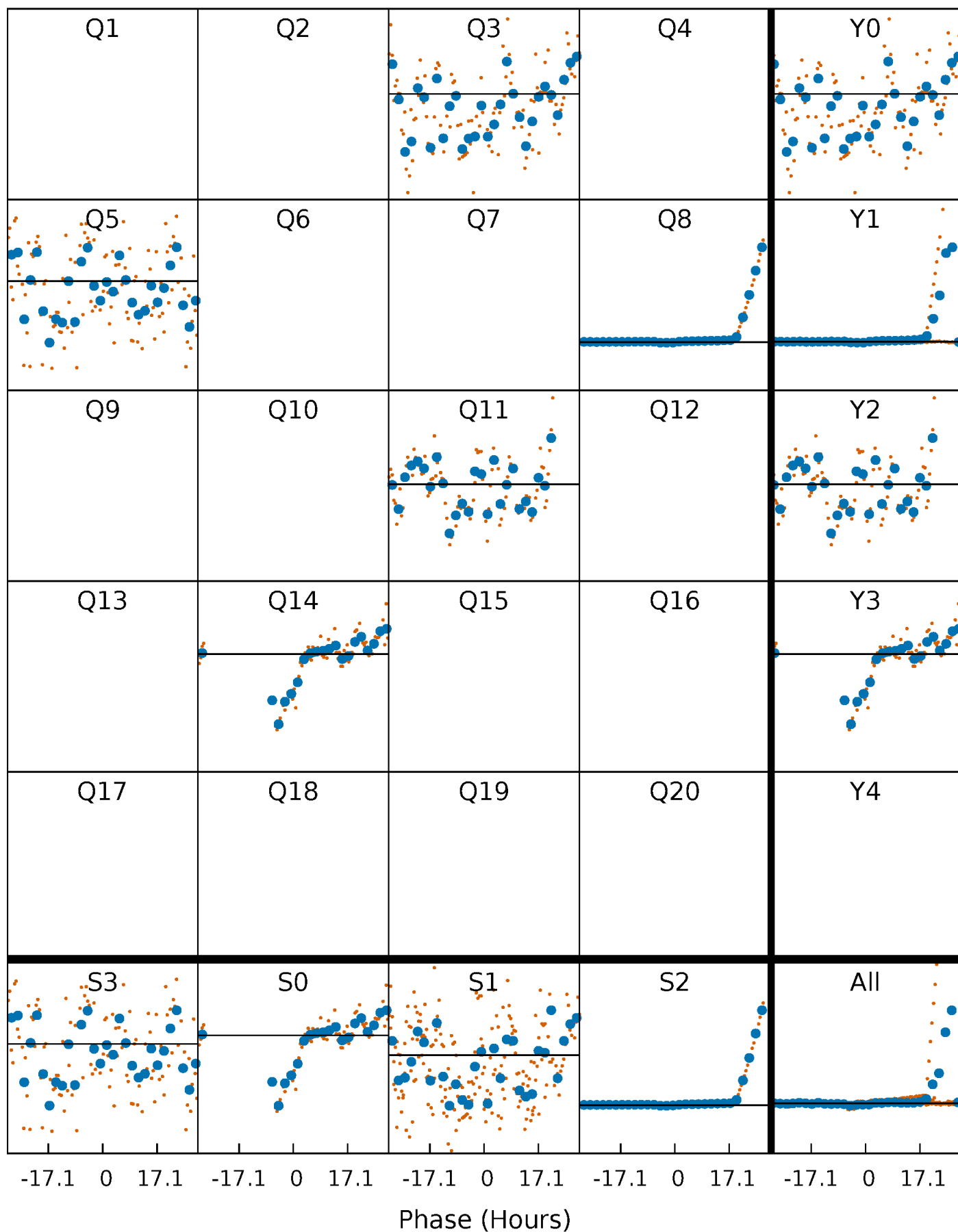
# PDC Quarter-Phased Transit Curves

TCE 009028474-04 P=268.367566 Days  $T_0=263.981763$  (BKJD)



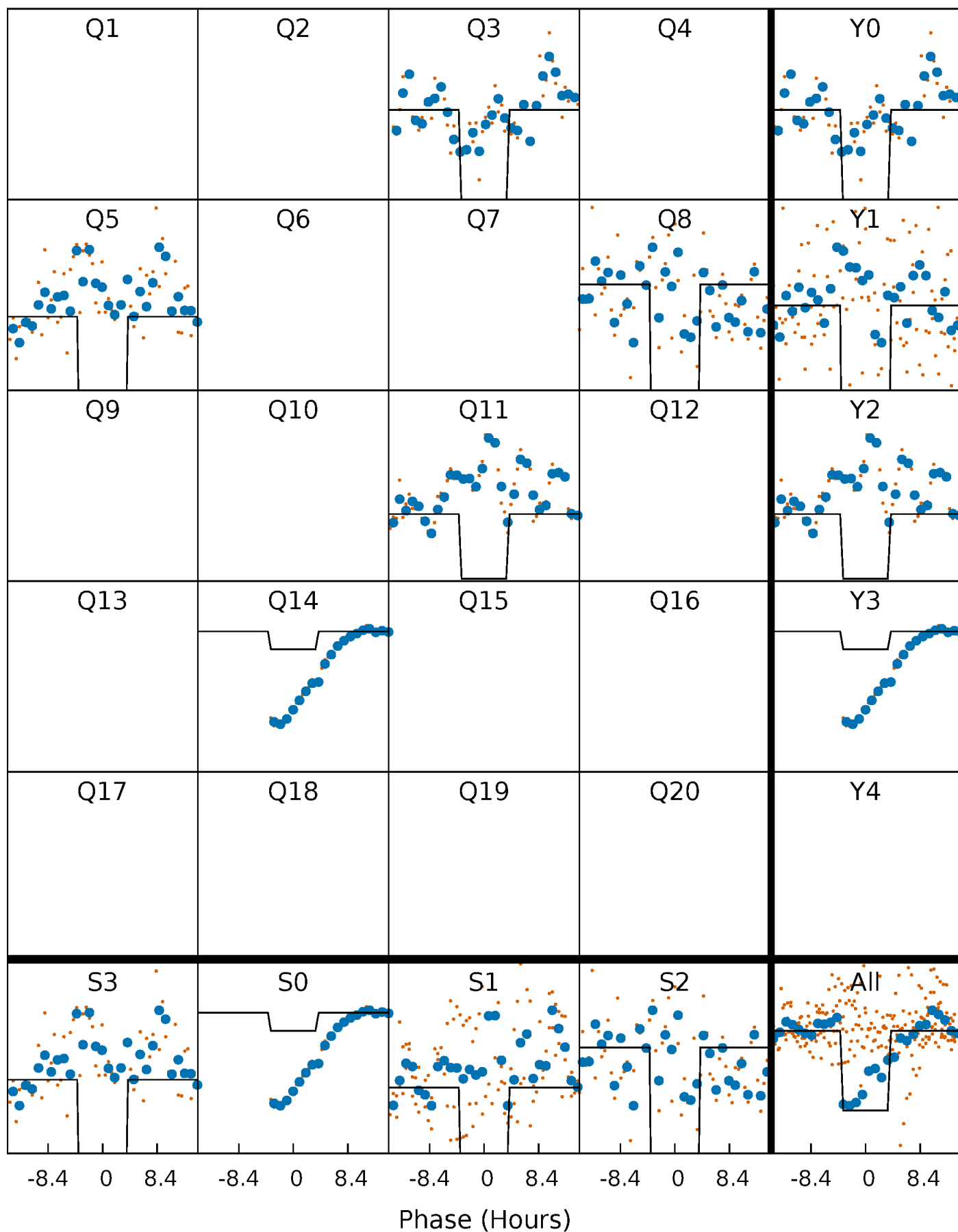
# DV Quarter-Phased Transit Curves

TCE 009028474-04     $P=268.367566$  Days     $T_0=263.981763$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

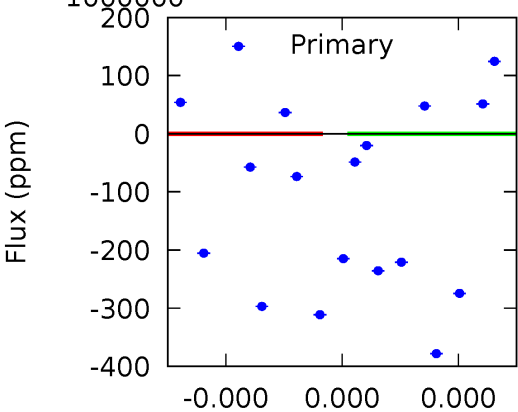
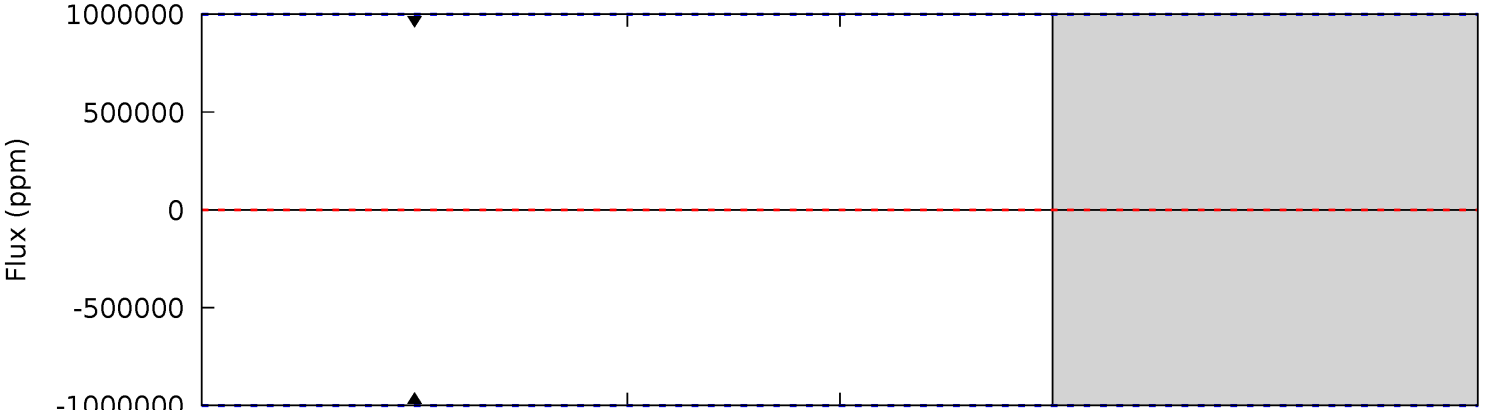
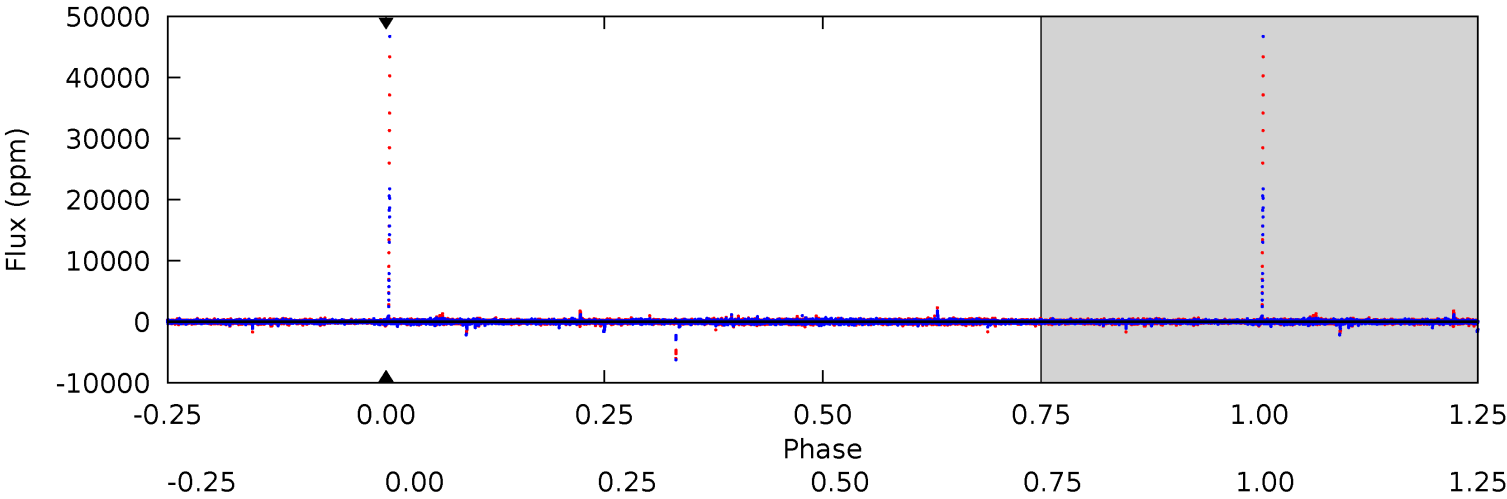
TCE 009028474-04 P=268.367566 Days  $T_0=263.871918$  (BKJD)



# DV Model-Shift Uniqueness Test

009028474-04, P = 268.367566 Days, E = 263.981763 Days

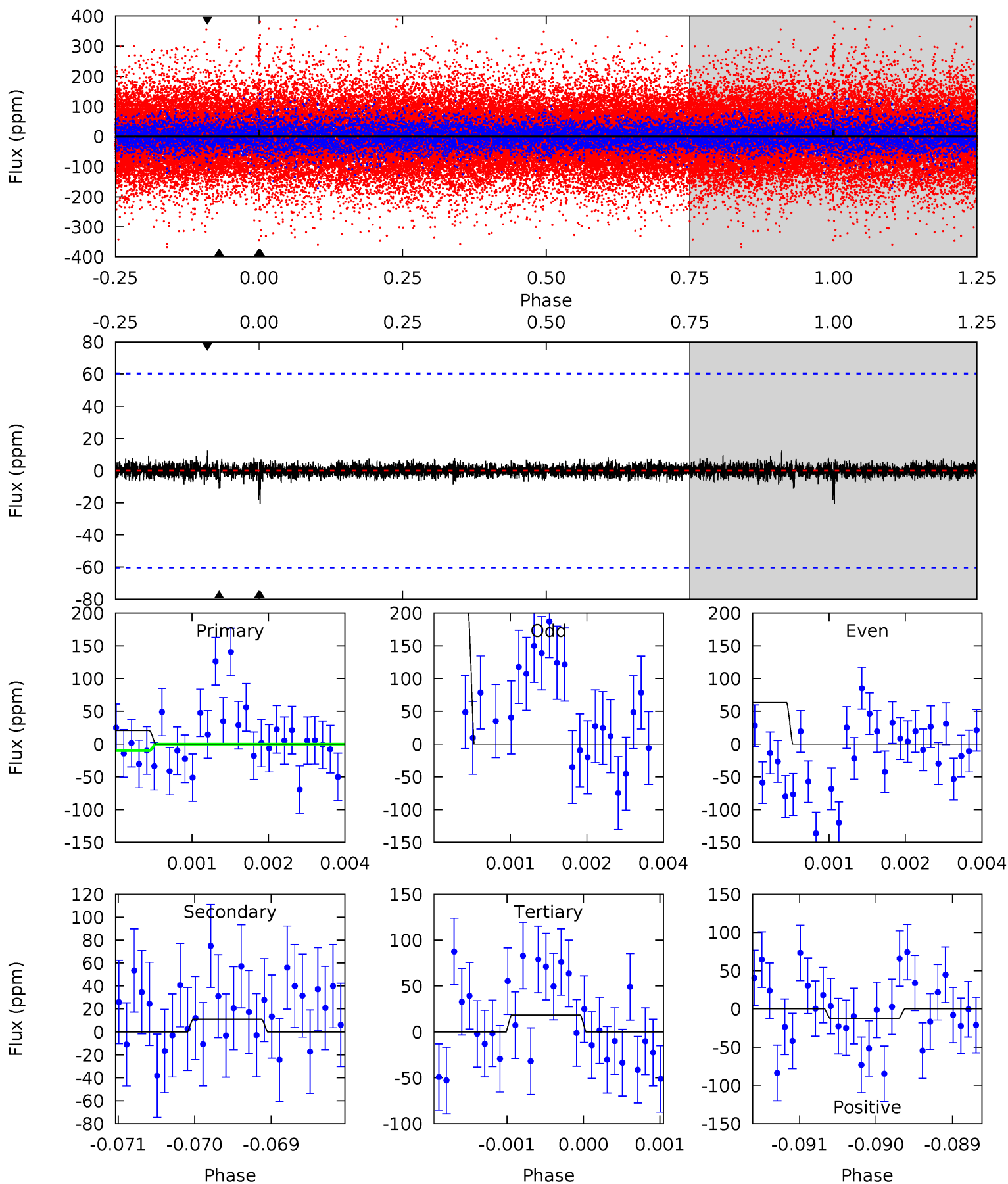
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
0	0	0	0	1.00	1.00	1.00	0	0	0	0	0	0	0	0



# Alt Model-Shift Uniqueness Test

009028474-04, P = 268.367566 Days, E = 263.871918 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
1.84	1.00	1.64	1.12	5.42	3.25	0.21	0.20	0.72	-0.64	-0.11	6.62	13.9	0.38	0



### Stellar Parameters For KIC 009028474

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$5887^{+132}_{-162}$	$4.477^{+0.060}_{-0.140}$	$-0.140^{+0.300}_{-0.300}$	$0.941^{+0.190}_{-0.102}$	$0.970^{+0.110}_{-0.110}$	$1.640^{+0.428}_{-0.689}$
	+2%/-3%	+1%/-3%	+214%/-214%	+20%/-11%	+11%/-11%	+26%/-42%
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 009028474-04 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	$0 \pm 1000000$	$8.66^{+9.10}_{-6.08}$	$396^{+20}_{-16}$	$4598^{+17011}_{-23198}$	$10986^{+964649}_{-805479}$
Alt.	$-11 \pm 11$	$8.08^{+8.40}_{-5.68}$	$398^{+19}_{-16}$	$2116^{+772}_{-986}$	$45^{+582}_{-45}$

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



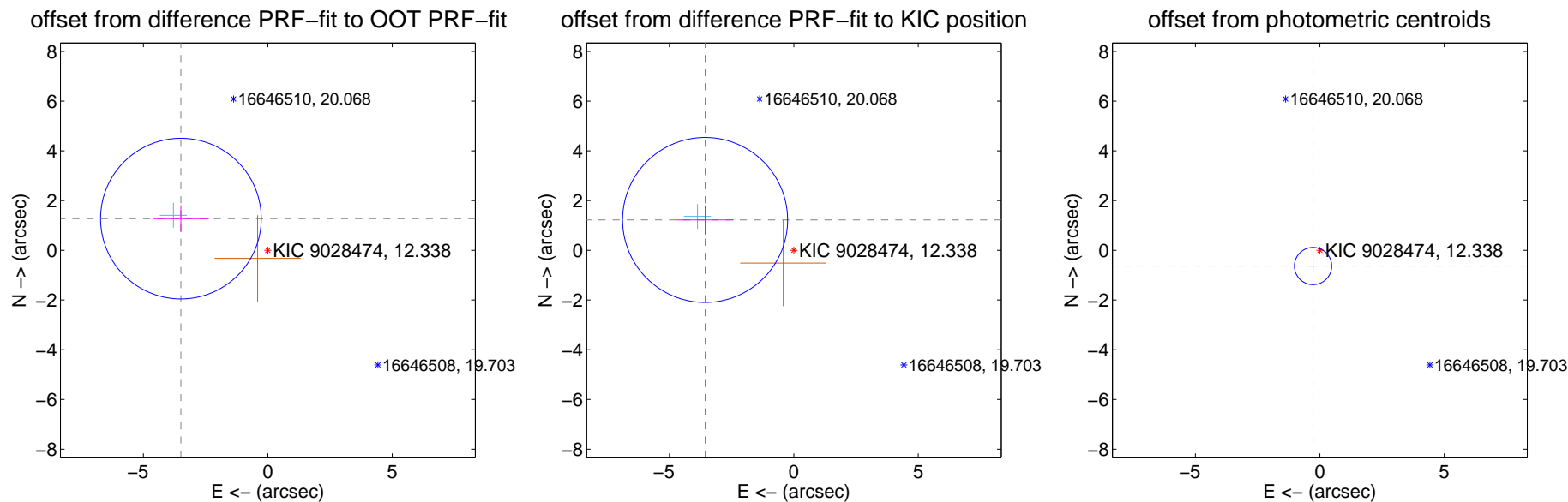
## DV Centroid Data

Supplemental centroid analysis for 009028474-04. Kepler magnitude: 12.34. Transit SNR -1.00

There are 1 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	$3.718 \pm 1.077$	3.45	$3.493 \pm 1.129$	$1.274 \pm 0.539$
PRF-fit source offset from KIC position	$3.770 \pm 1.106$	3.41	$3.567 \pm 1.151$	$1.219 \pm 0.584$
photometric centroid source offset	$0.69 \pm 0.25$	2.76	$0.27 \pm 0.24$	$-0.63 \pm 0.25$



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.

Q1 no difference image



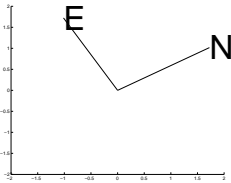
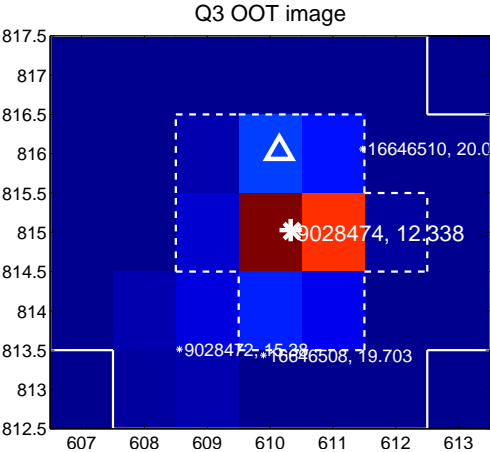
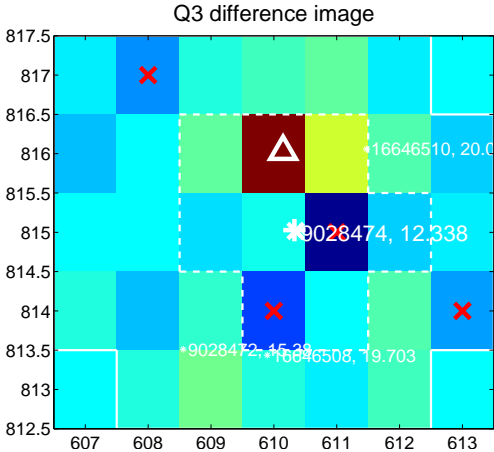
Q1 no OOT image



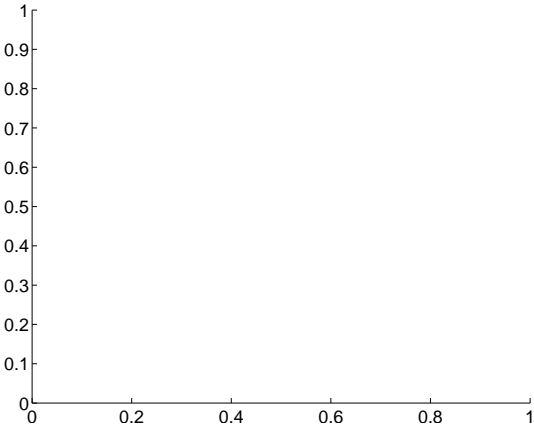
Q2 no difference image



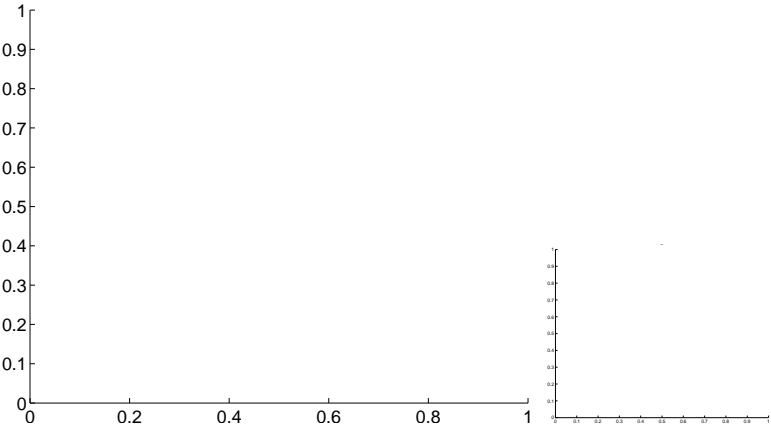
Q2 no OOT image



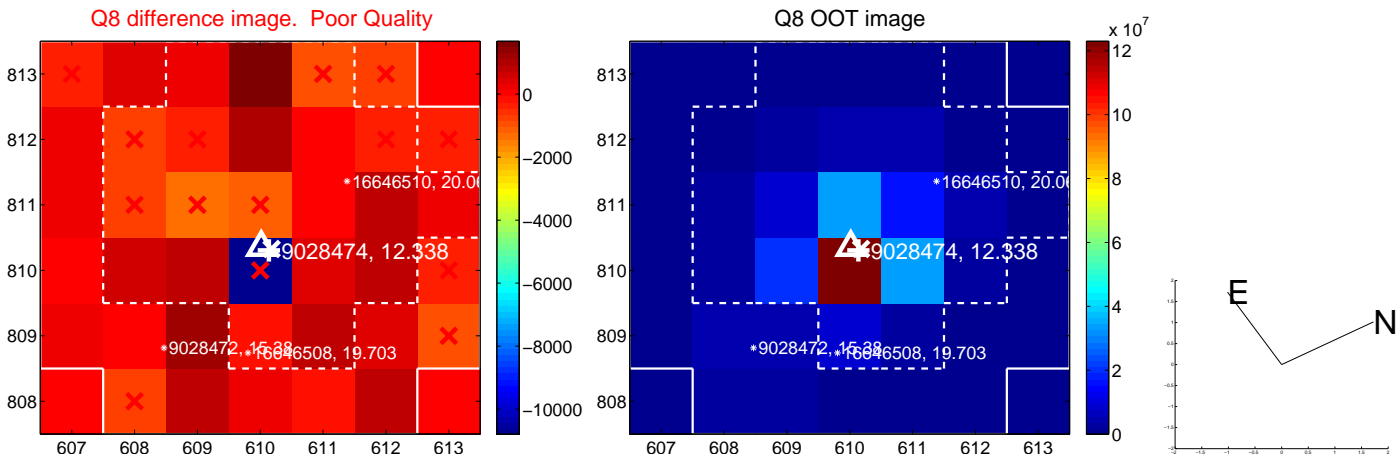
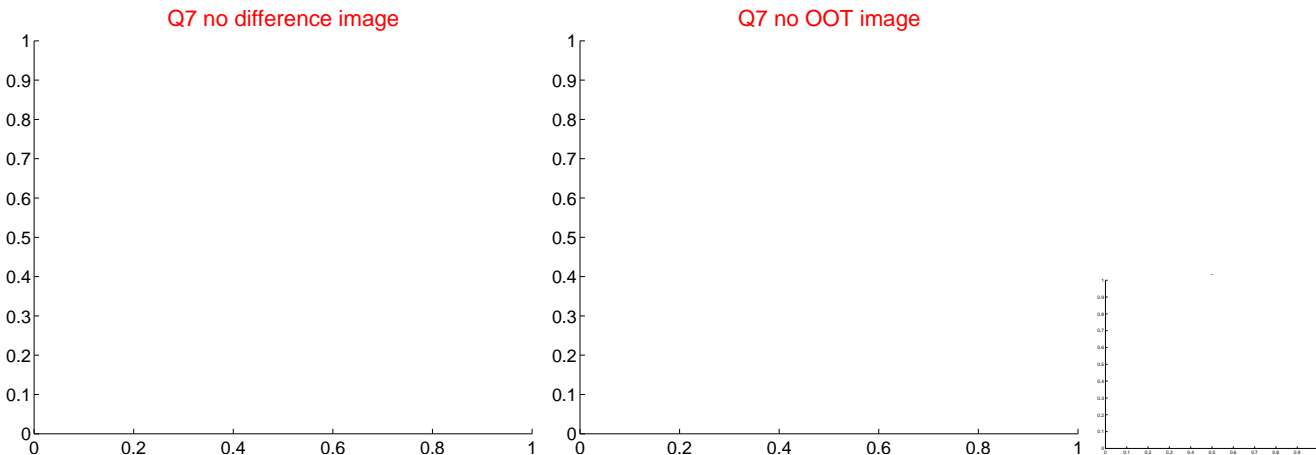
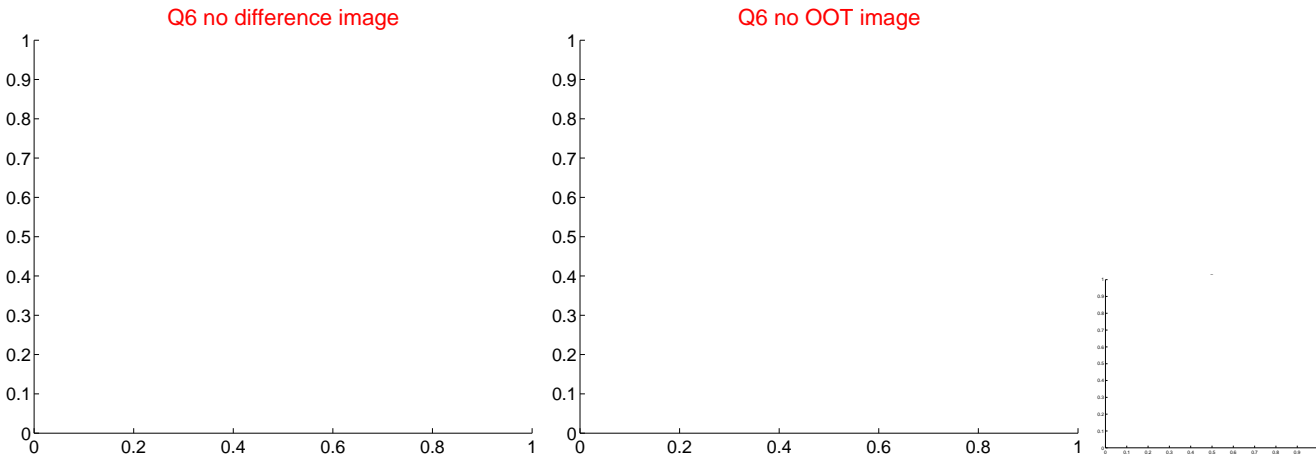
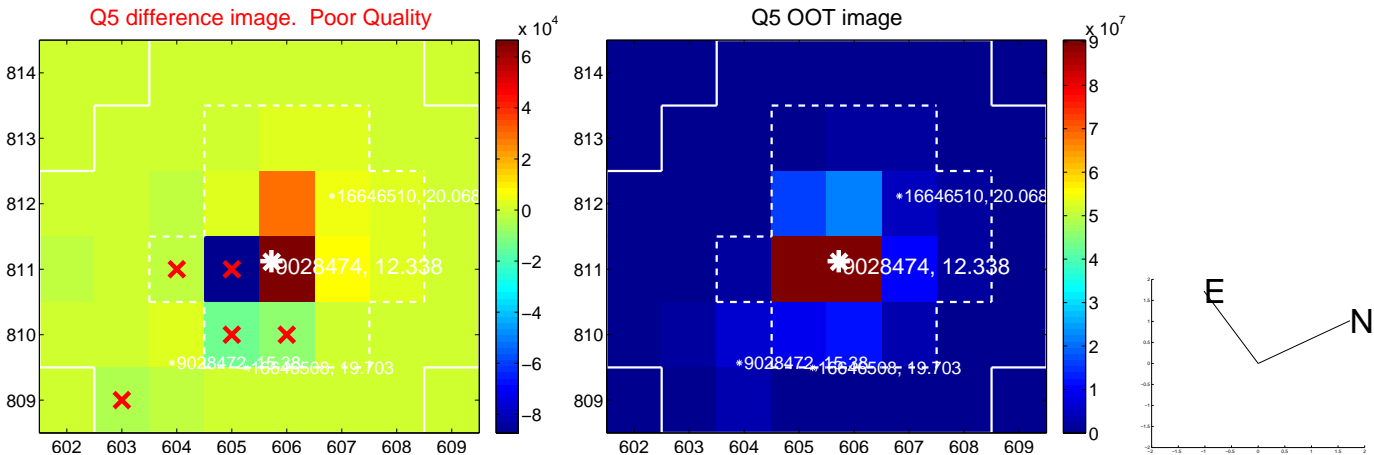
Q4 no difference image



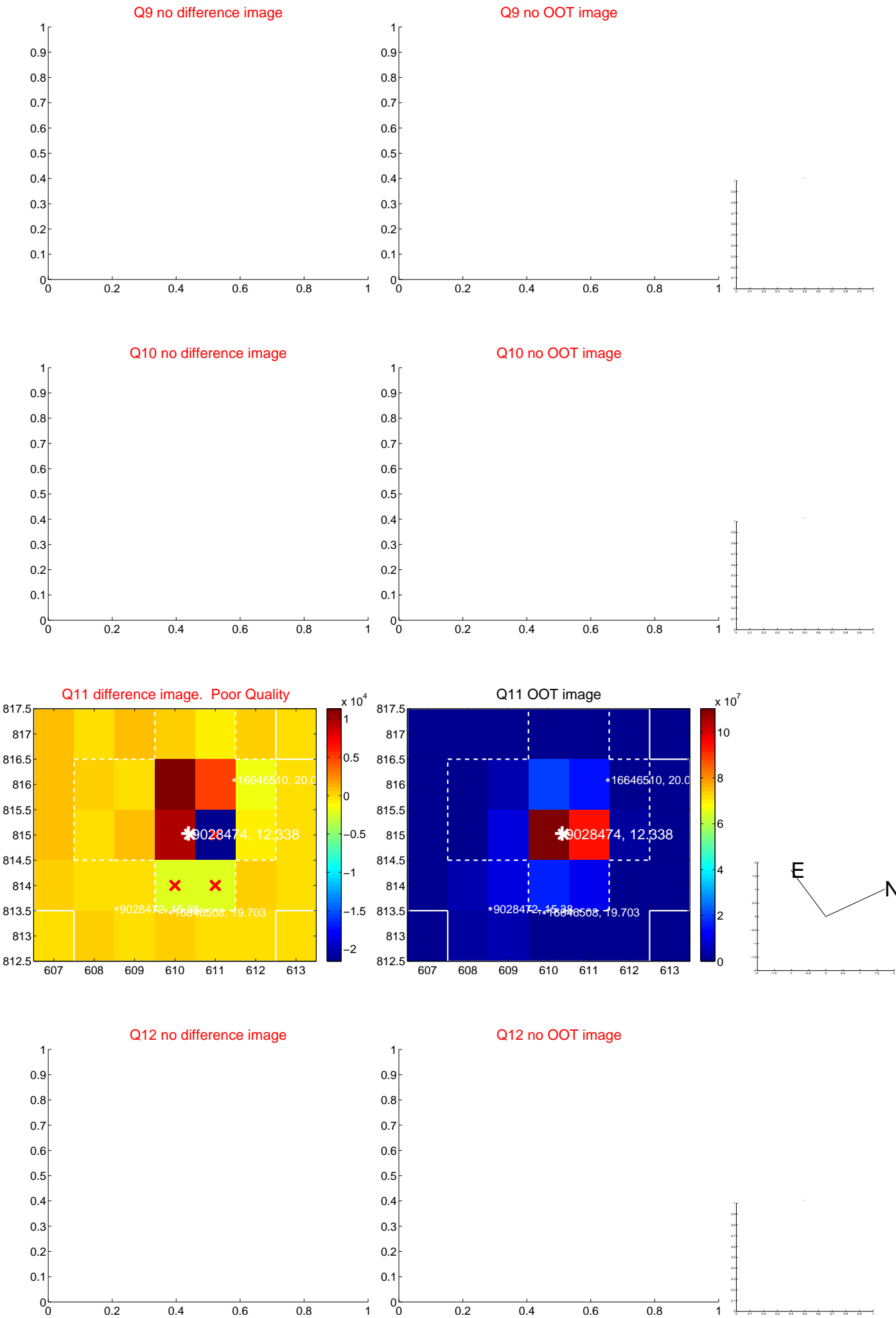
Q4 no OOT image



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



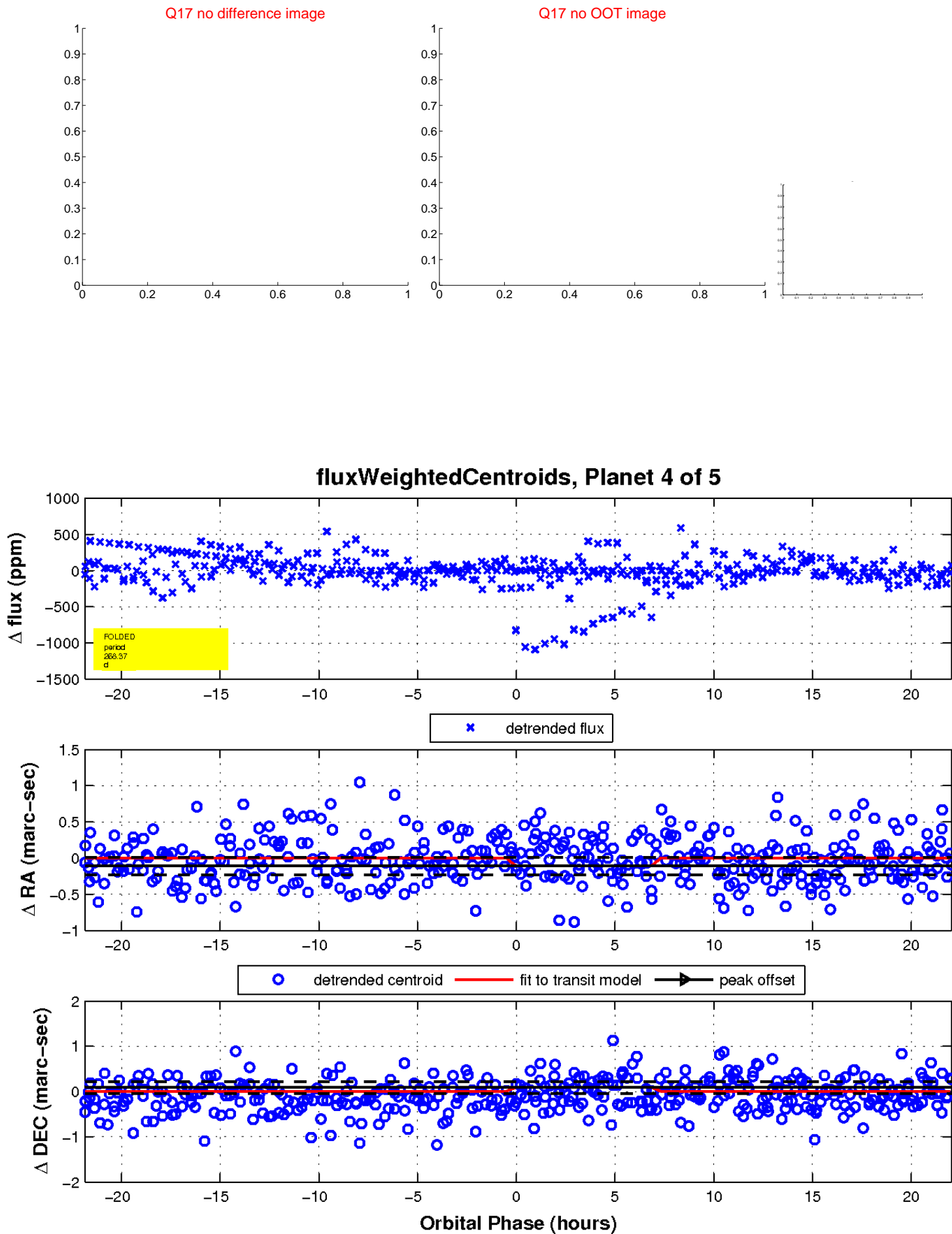
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

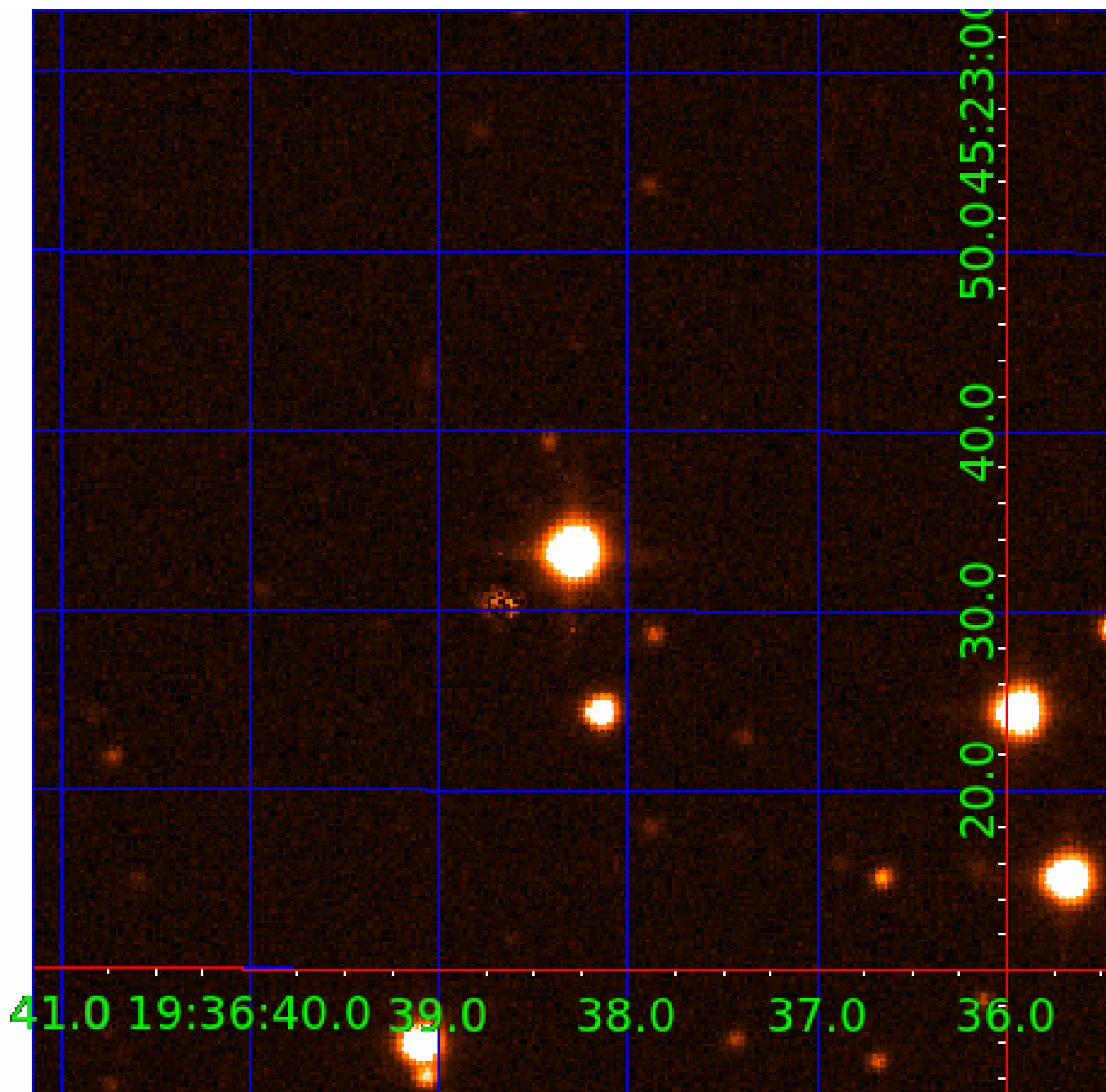


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 009028474

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009028474-01	OBS	3510.01	124.937055	177.682301	243052.5	7.485	7997.3	4253.8	0.94	5887	58.16	4.07
009028474-02	OBS	No	124.939325	183.984750	118081.0	11.045	3517.2	4418.7	0.94	5887	47.85	4.07
009028474-03	OBS	No	248.918745	312.240003	310.9	130.763	18.7	7.4	0.94	5887	2.04	1.62
009028474-04	OBS	No	268.367566	263.981763	2029.8	15.000	120.7	-1.0	0.94	5887	4.22	1.47
009028474-05	OBS	No	223.237472	352.638943	570.6	48.532	14.3	15.2	0.94	5887	4.42	1.88

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009028474-01	OBS	FP	0.00	0	1	0	0	MOD_SEC_DV—MOD_SEC_ALT—DEEP_V_SHAPED—HAS_SEC_TCE
009028474-02	OBS	FP	0.00	1	1	0	0	IS_SEC_TCE
009028474-03	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009028474-04	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_NOFITS
009028474-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_ZUMA—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS

**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 009028474-05

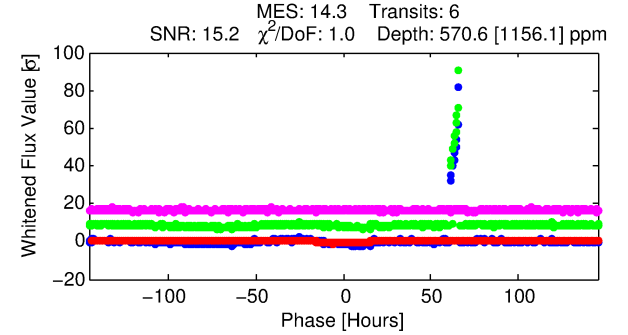
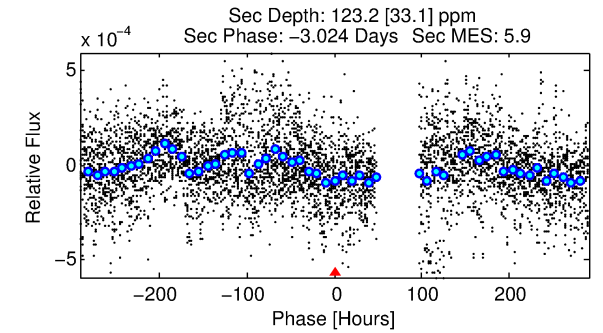
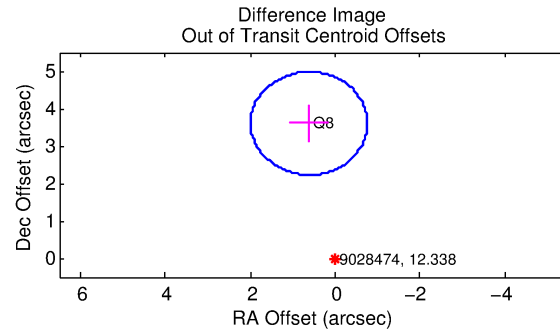
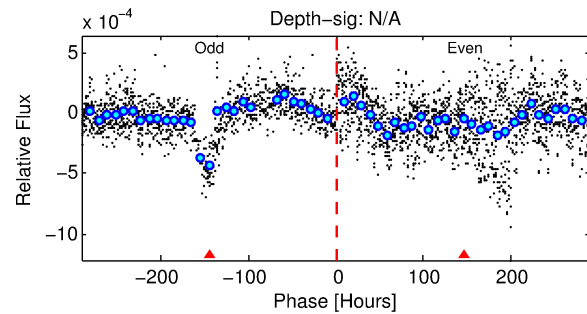
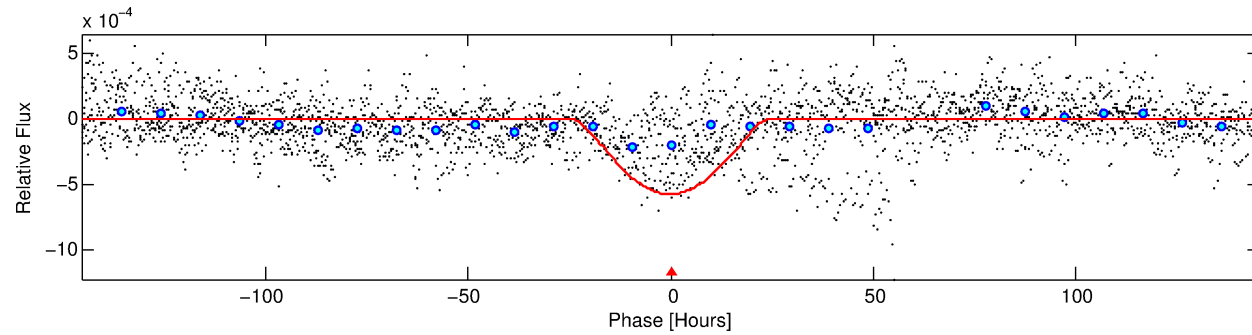
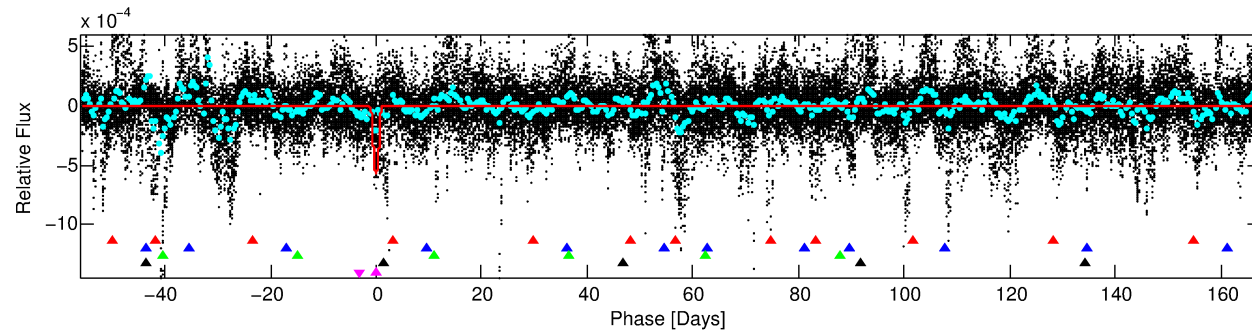
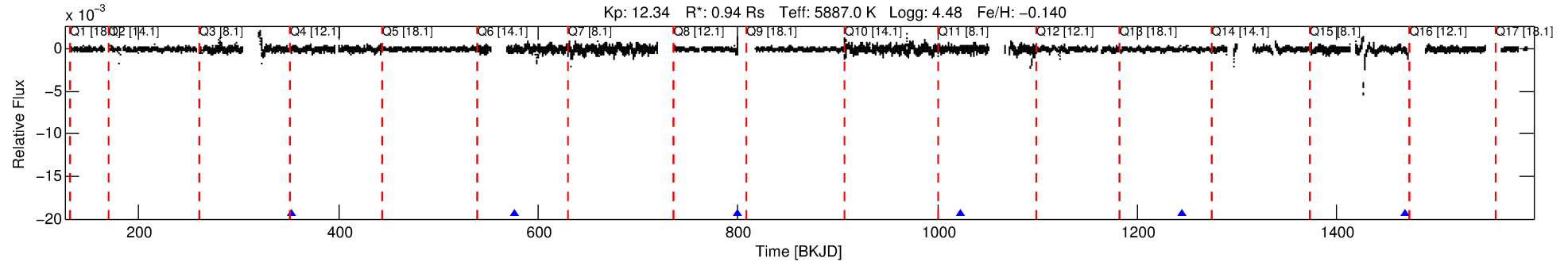
No Significant Match Found



# DV One-Page Summary

KIC: 9028474 Candidate: 5 of 5 Period: 223.237 d

KOI: K03510 Corr: No Ephemeris Match



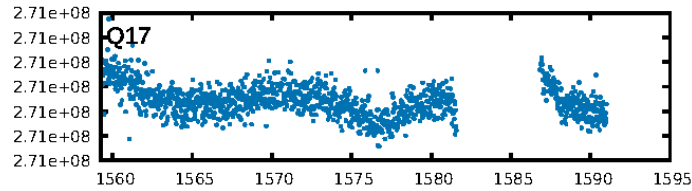
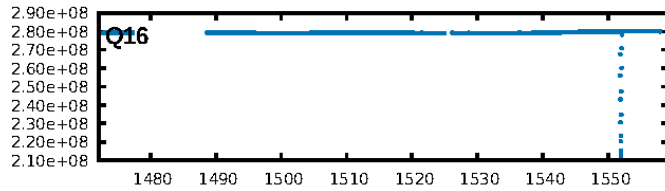
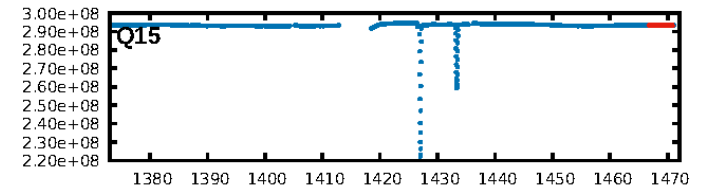
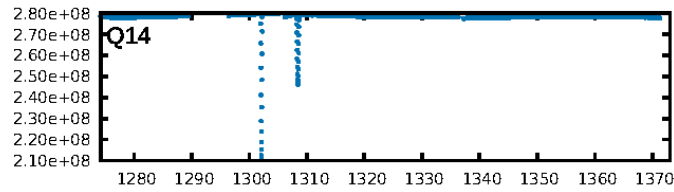
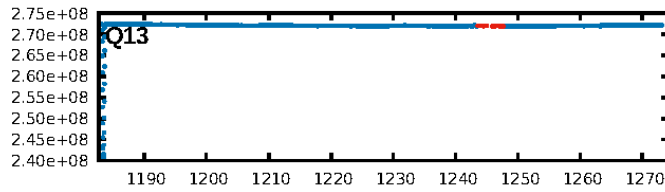
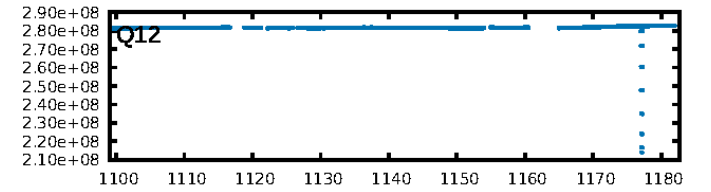
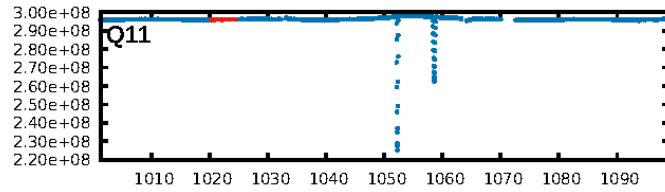
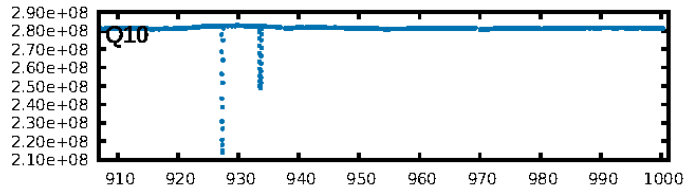
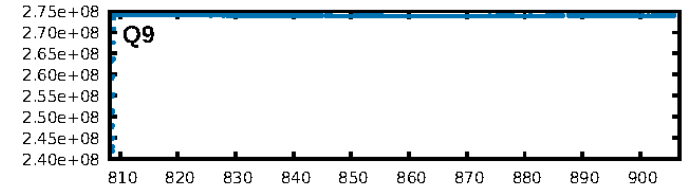
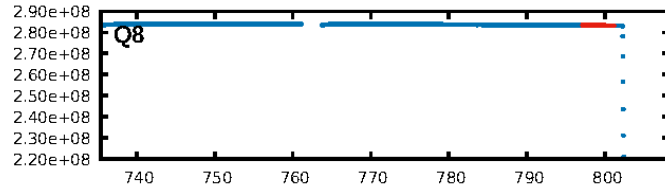
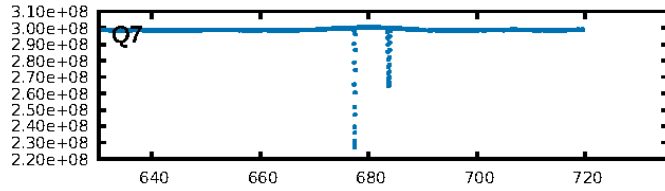
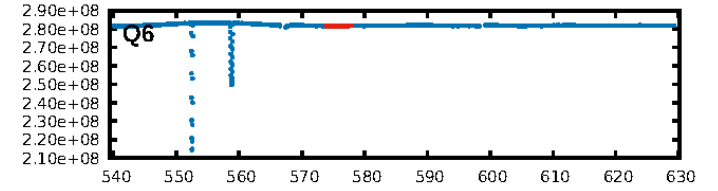
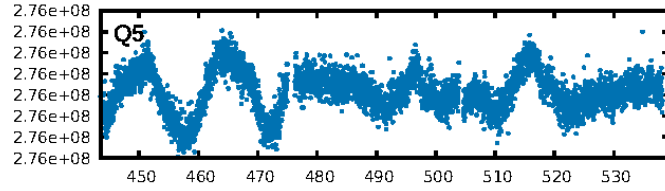
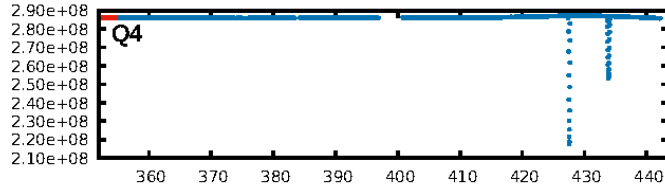
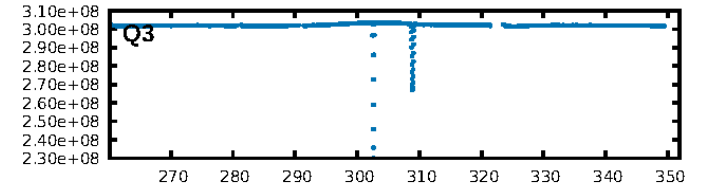
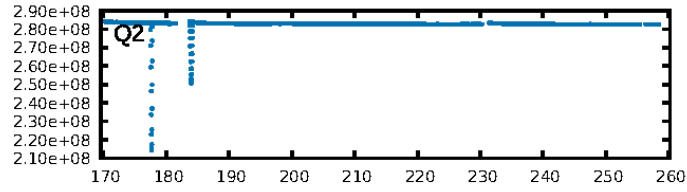
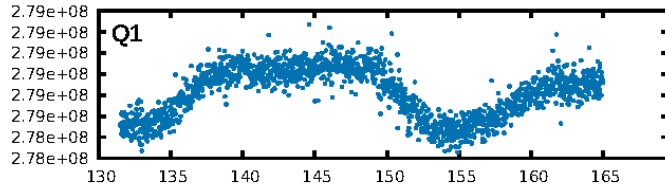
## DV Fit Results:

Period = 223.23747 [0.04568] d  
Epoch = 352.6389 [0.1529] BKJD  
Rp/R\* = 0.0431 [0.1113]  
a/R\* = 10.48 [6.44]  
b = 1.00 [0.22]  
Seff = 1.88 [0.52]  
Teq = 298 [21] K  
Rp = 4.43 [11.47] Re  
a = 0.7127 [0.1228] AU  
Ag = 1759.07 [9113.18] [0.19 $\sigma$ ]  
Teffp = 2988 [3866] K [0.70 $\sigma$ ]

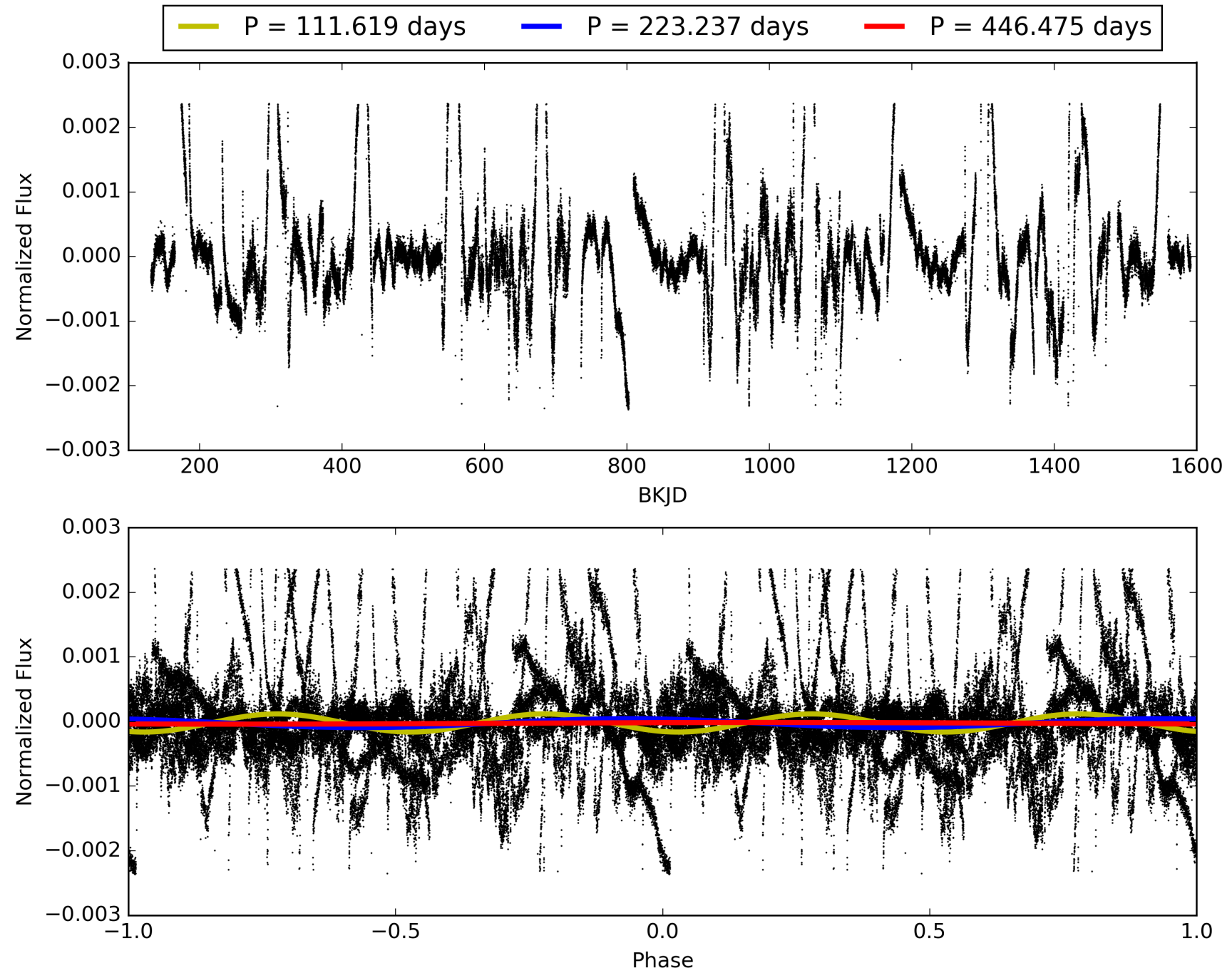
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [47.40 $\sigma$ ]  
LongPeriod-sig: 100.0% [4.42 $\sigma$ ]  
ModelChiSquare2-sig: 0.0%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 4.49e-19  
RollingBand-fgt: 1.00 [6/6]  
GhostDiagnostic-chr: -1.204  
Centroid-sig: 0.3%  
Centroid-so: 0.109 arcsec [0.56 $\sigma$ ]  
OotOffset-rm: 3.655 arcsec [7.97 $\sigma$ ]  
KicOffset-rm: 3.469 arcsec [7.56 $\sigma$ ]  
OotOffset-st: 0/0/1/0 [1]  
KicOffset-st: 0/0/1/0 [1]  
DiffImageQuality-fgm: 0.00 [0/1]  
DiffImageOverlap-fno: 0.50 [1/2]

# TCE 009028474-05, PDC Light Curves

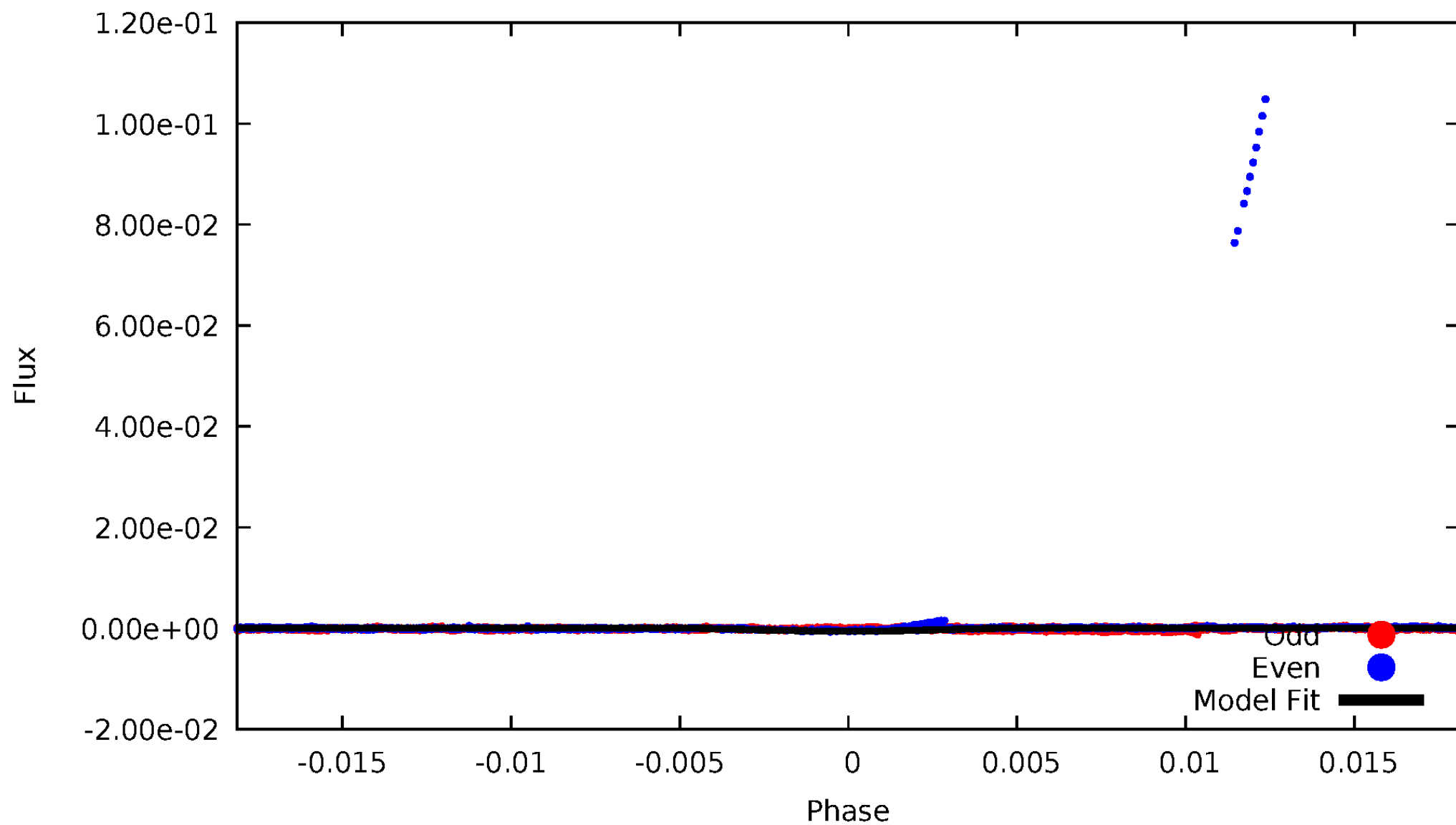


TCE 009028474-05



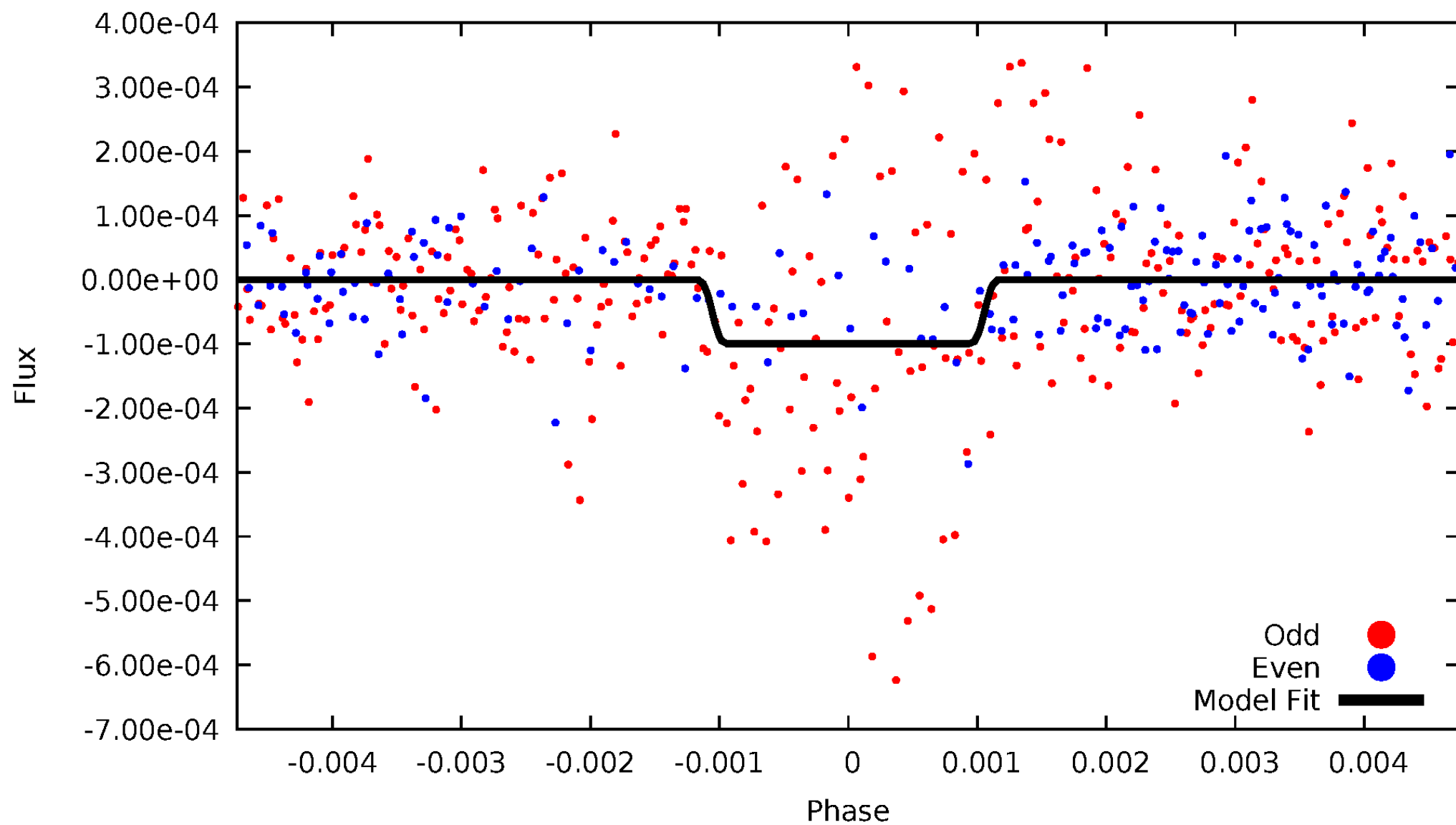
# DV Odd/Even

TCE 009028474-05



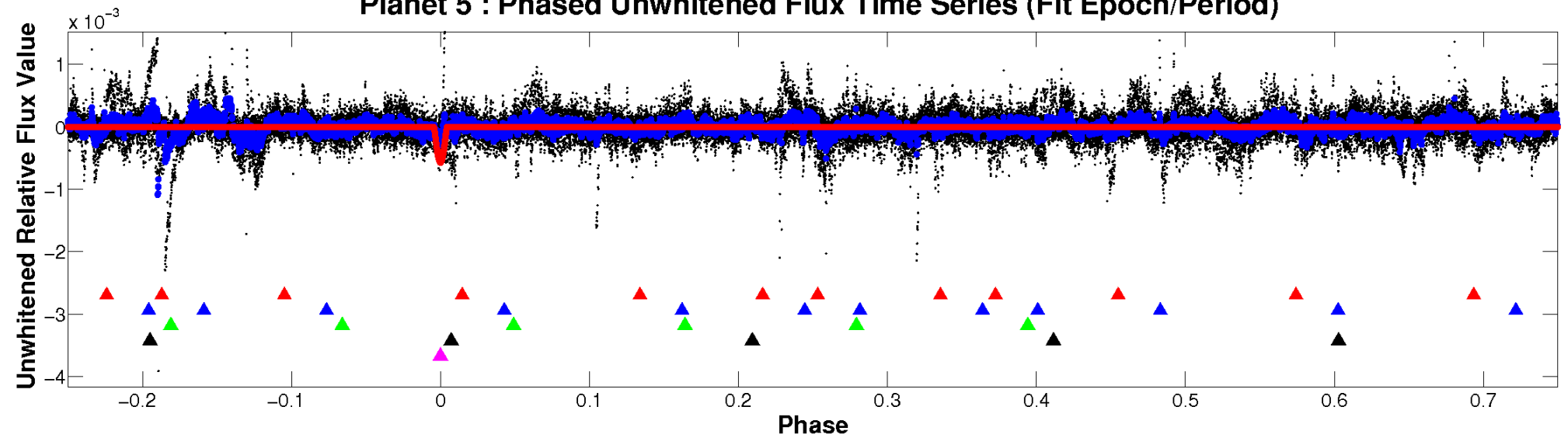
# ALT Odd/Even

TCE 009028474-05

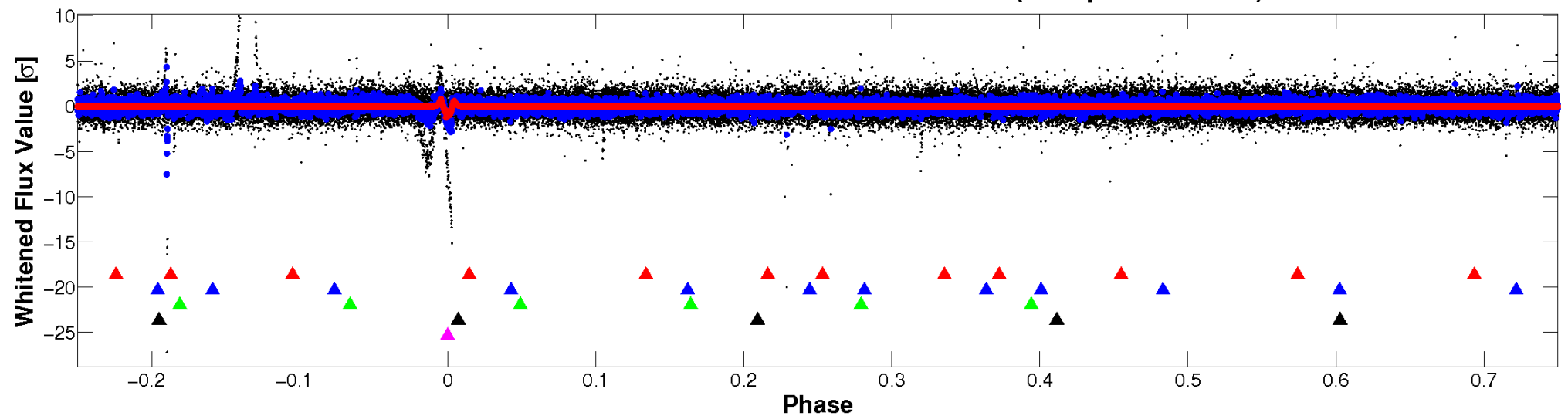


# Non-Whitened Vs. Whitened Light Curve

## Planet 5 : Phased Unwhitened Flux Time Series (Fit Epoch/Period)

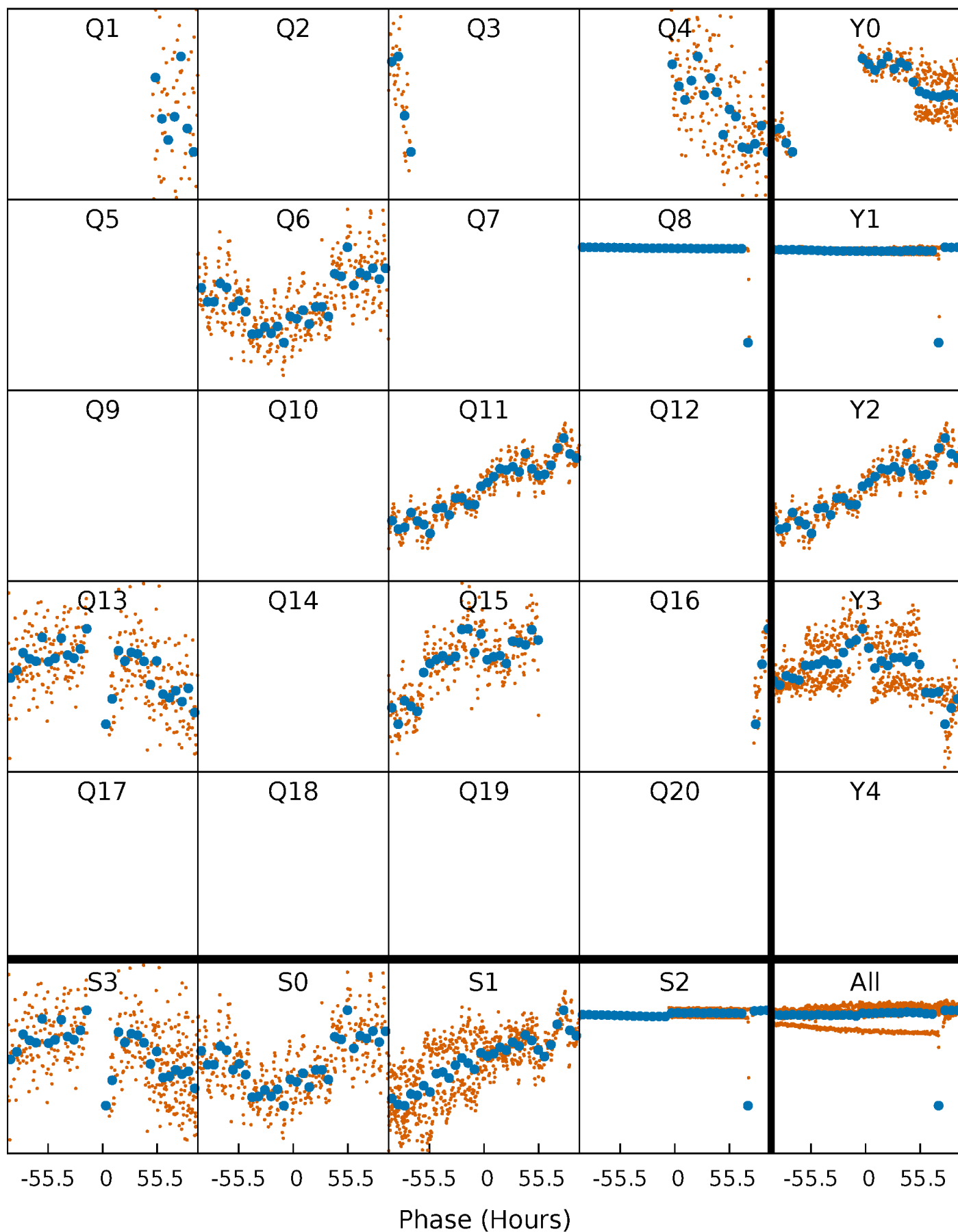


## Planet 5 : Phased Whitened Flux Time Series (Fit Epoch/Period)



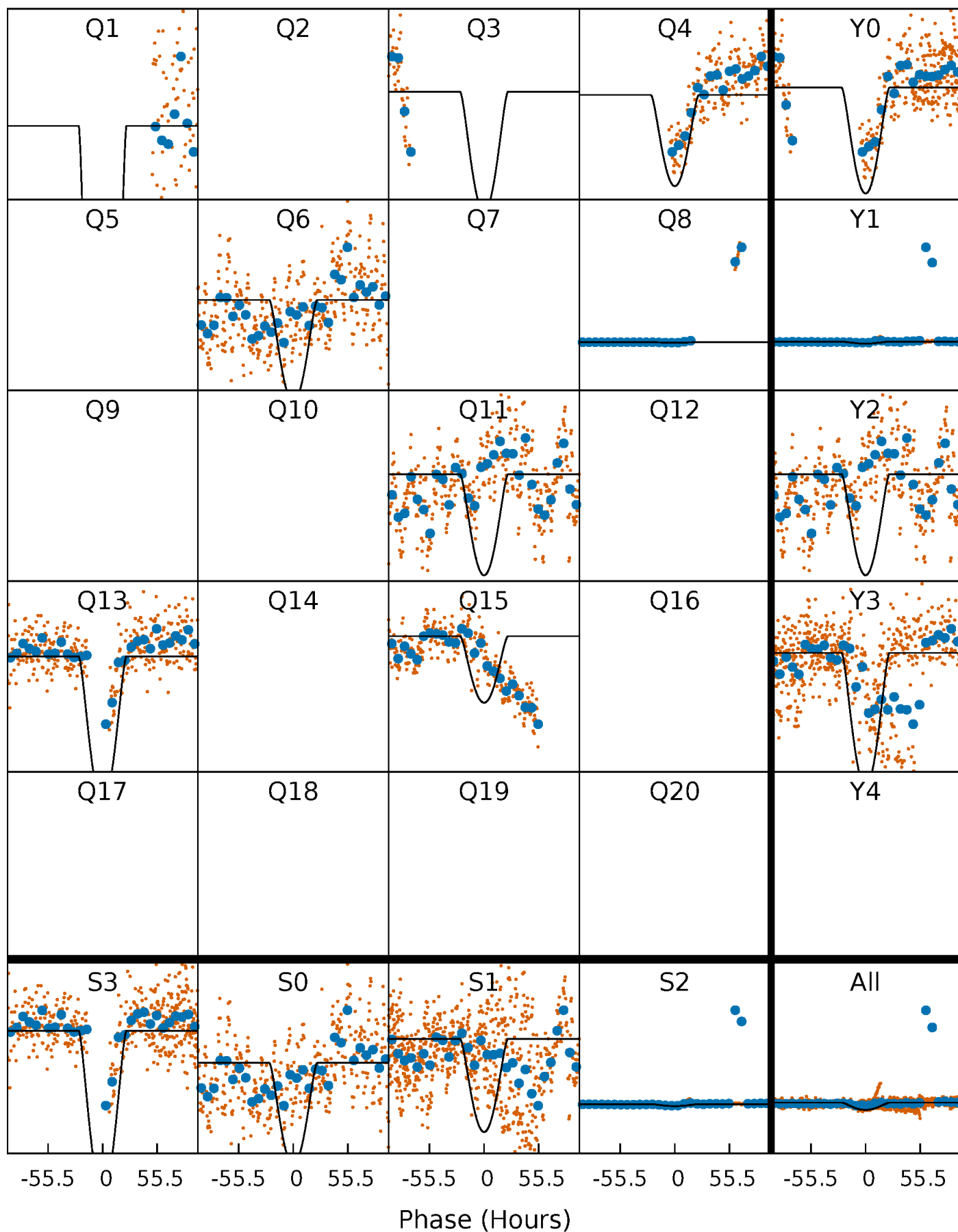
# PDC Quarter-Phased Transit Curves

TCE 009028474-05     $P=223.237472$  Days     $T_0=352.638943$  (BKJD)



# DV Quarter-Phased Transit Curves

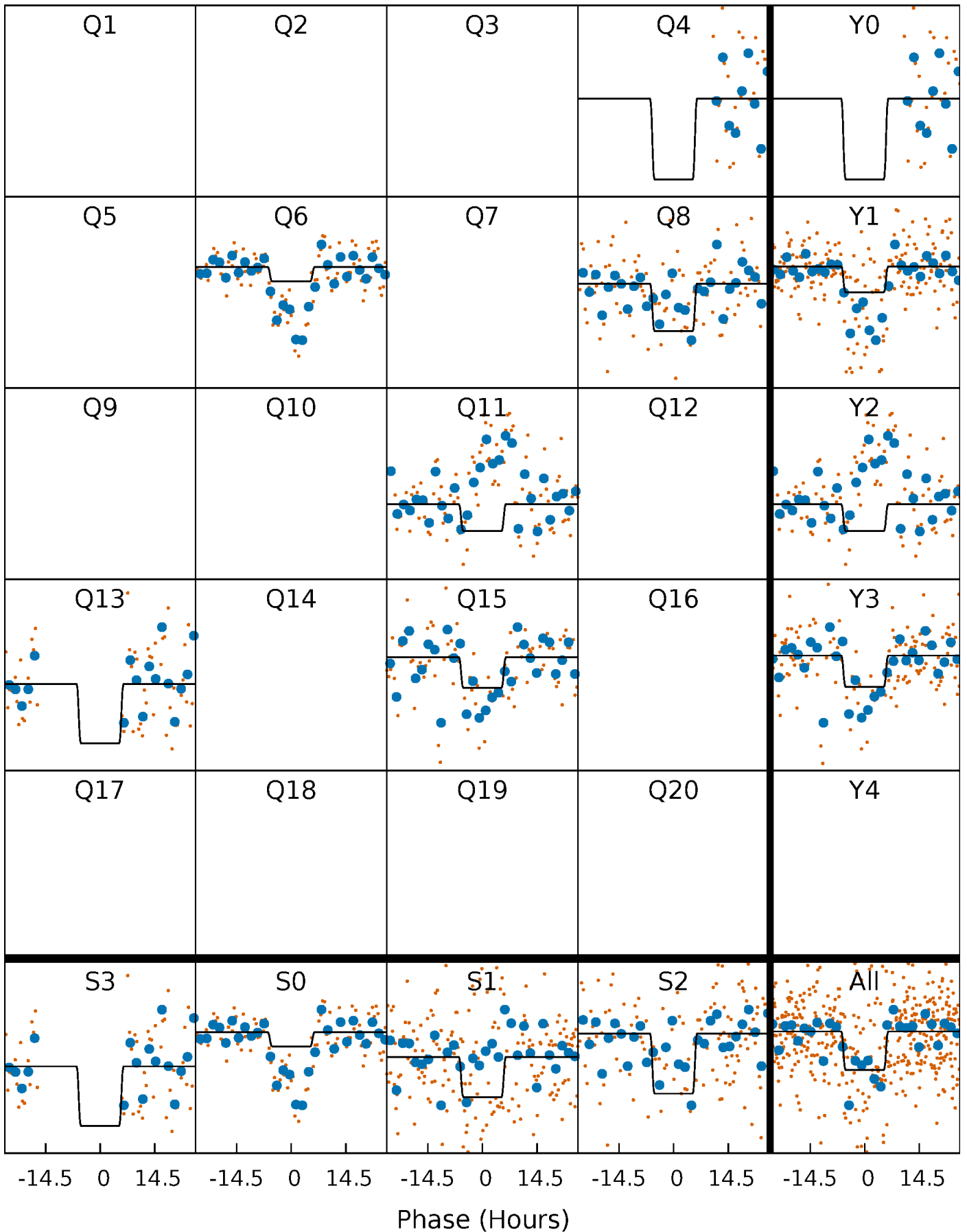
TCE 009028474-05     $P=223.237472$  Days     $T_0=352.638943$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

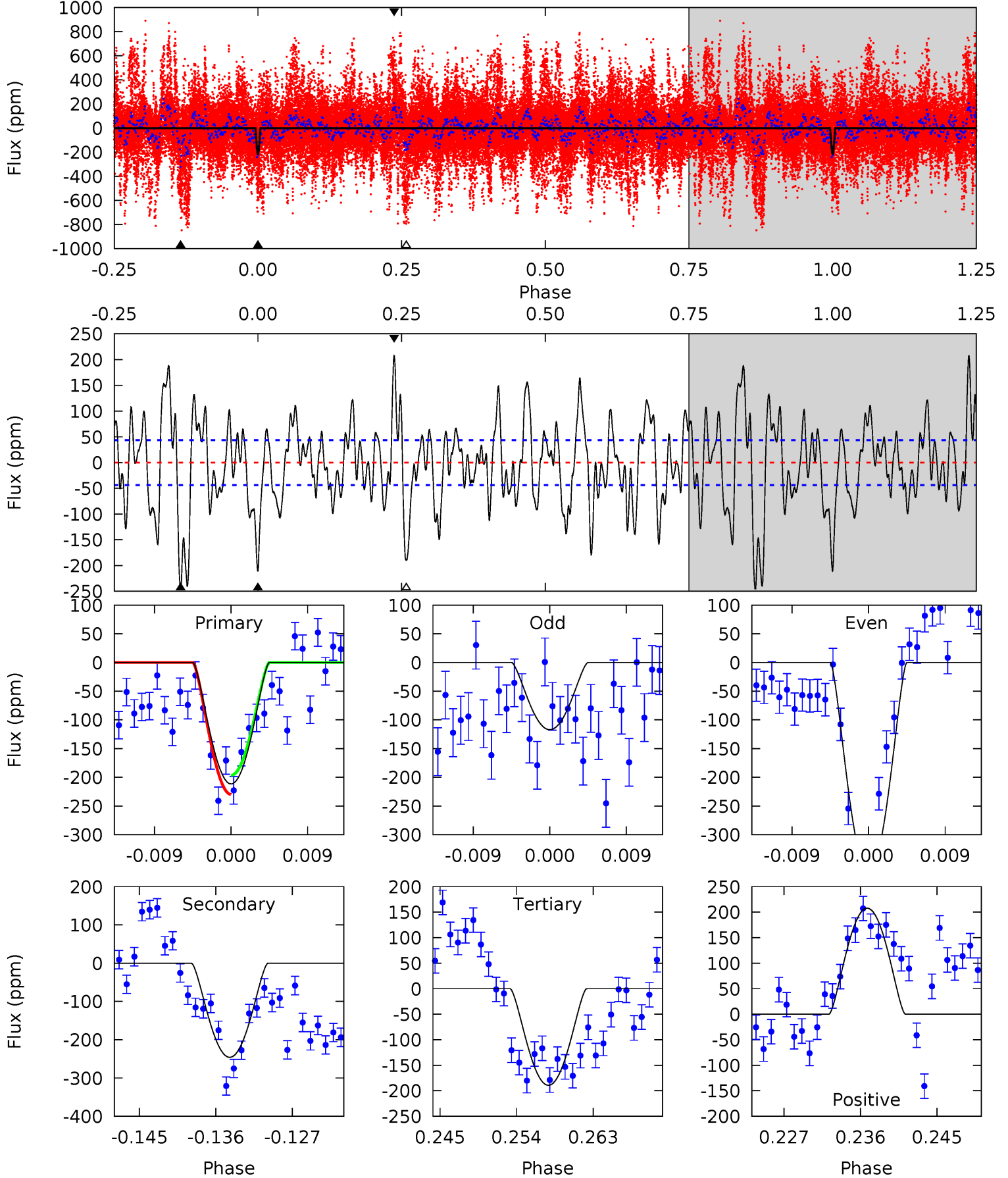
TCE 009028474-05     $P=223.413734$  Days     $T_0=351.958292$  (BKJD)



# DV Model-Shift Uniqueness Test

009028474-05, P = 223.237472 Days, E = 129.401471 Days

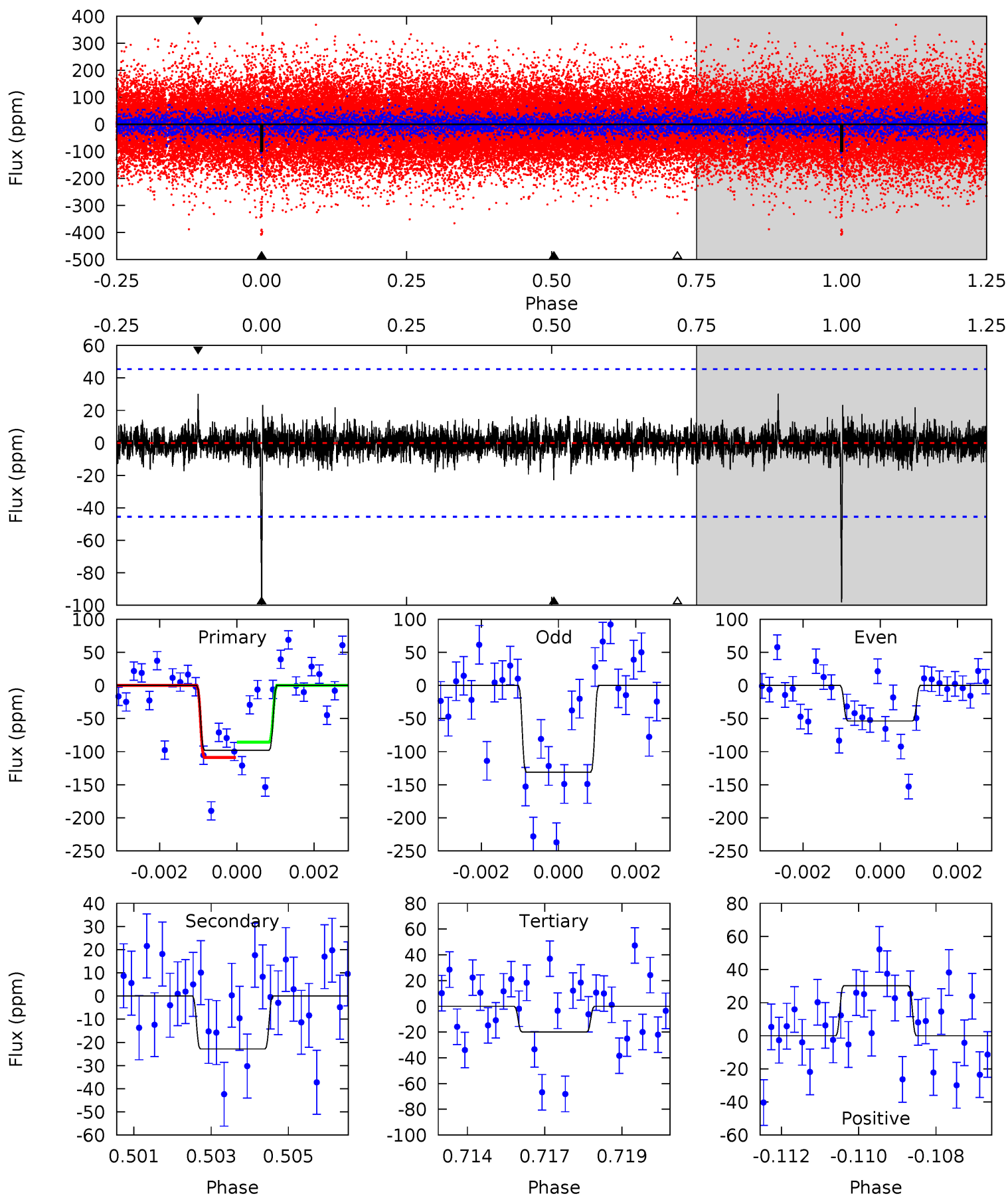
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
24.5	28.4	21.9	24.0	5.04	2.61	8.40	2.58	0.44	6.55	4.41	14.3	0.89	0.46	1.93



# Alt Model-Shift Uniqueness Test

009028474-05, P = 223.413734 Days, E = 128.544558 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
11.4	2.67	2.32	3.53	5.31	3.06	0.62	9.12	7.91	0.34	-0.86	4.07	1.18	0.24	1.34



### Stellar Parameters For KIC 009028474

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5887^{+132}_{-162}$	$4.477^{+0.060}_{-0.140}$	$-0.140^{+0.300}_{-0.300}$	$0.941^{+0.190}_{-0.102}$	$0.970^{+0.110}_{-0.110}$	$1.640^{+0.428}_{-0.689}$
	+2%/-3%	+1%/-3%	+214%/-214%	+20%/-11%	+11%/-11%	+26%/-42%
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 009028474-05 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-246 \pm 9$	$9.98^{+9.57}_{-7.23}$	$422^{+23}_{-18}$	$3048^{+1665}_{-498}$	$690^{+8232}_{-511}$
Alt.	$-23 \pm 9$	$8.54^{+9.35}_{-6.04}$	$421^{+21}_{-17}$	$2314^{+914}_{-353}$	$81^{+961}_{-64}$

$T_{max}$  = Theoretical Maximum Planetary Temperature

$T_{obs}$  = Observed Planetary Temperature (Assuming  $A=0.3$ )

$A_{obs}$  = Observed Albedo (Assuming  $T=0$ )

If a secondary eclipse is present, the system is likely an EB if  $T_{obs} \gg T_{max}$  AND  $A_{obs} \gg 1.0$

## DV Centroid Data

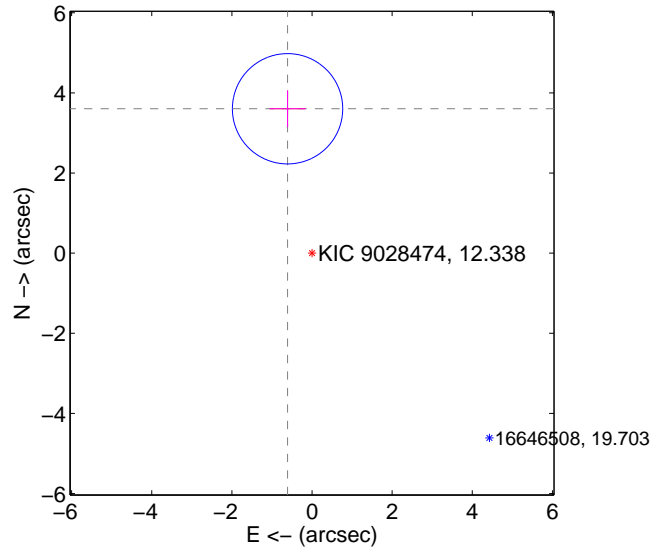
Supplemental centroid analysis for 009028474-05. Kepler magnitude: 12.34. Transit SNR 15.19

There are 0 quarters with good PRF difference image offsets

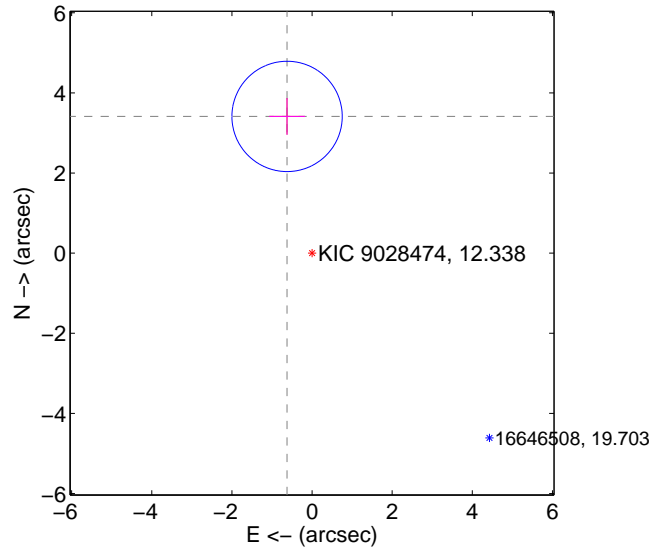
The direct PRF centroid is offset from the target star catalog position by about 0.19 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$3.655 \pm 0.459$	7.97	$0.610 \pm 0.448$	$3.603 \pm 0.459$
PRF-fit source offset from KIC position	$3.469 \pm 0.459$	7.56	$0.623 \pm 0.448$	$3.412 \pm 0.459$
photometric centroid source offset	$0.11 \pm 0.19$	0.56	$-0.03 \pm 0.19$	$-0.10 \pm 0.19$

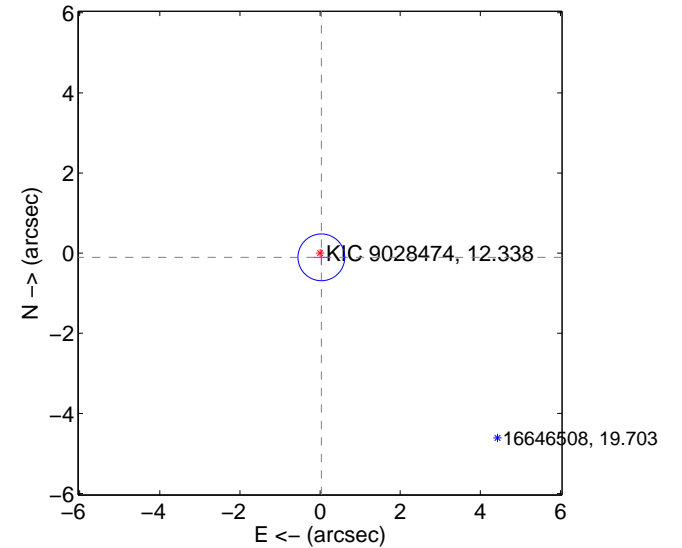
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position



offset from photometric centroids

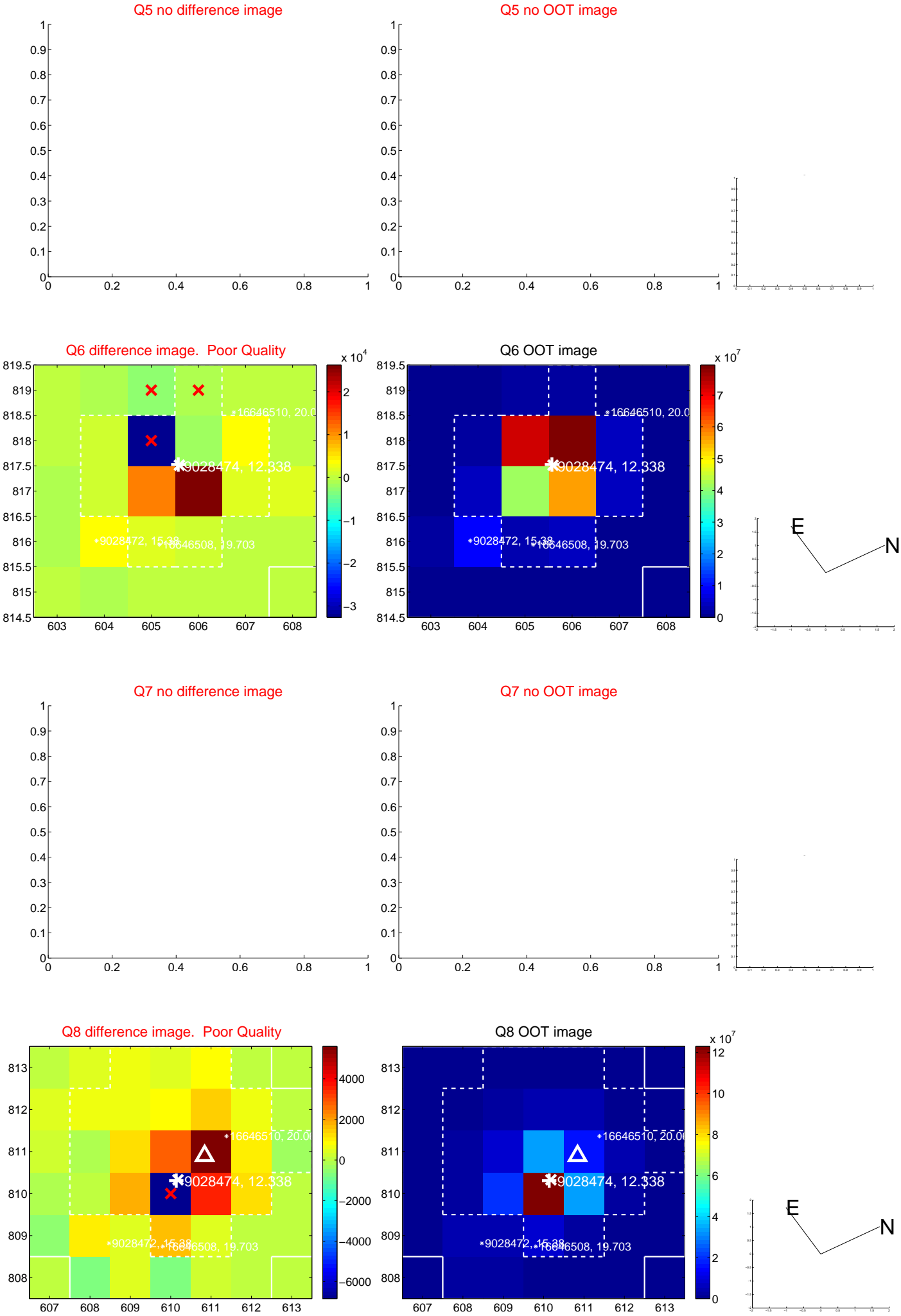


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

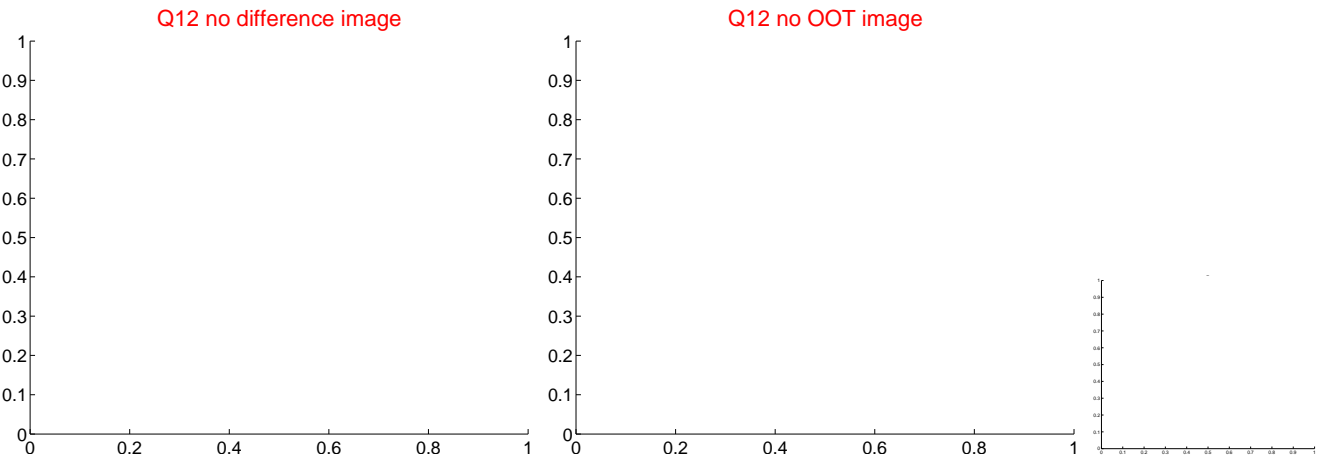
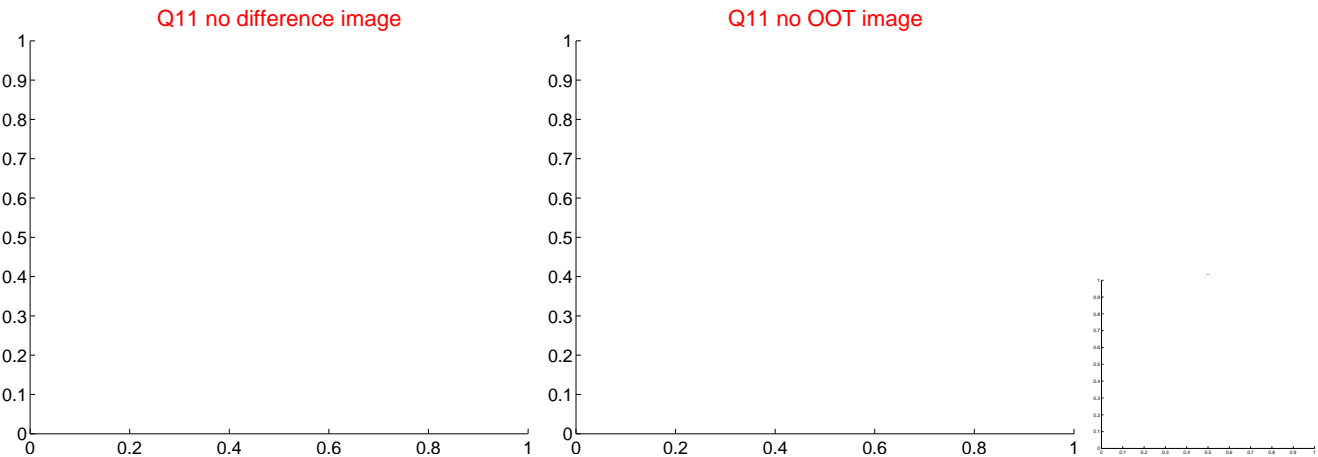
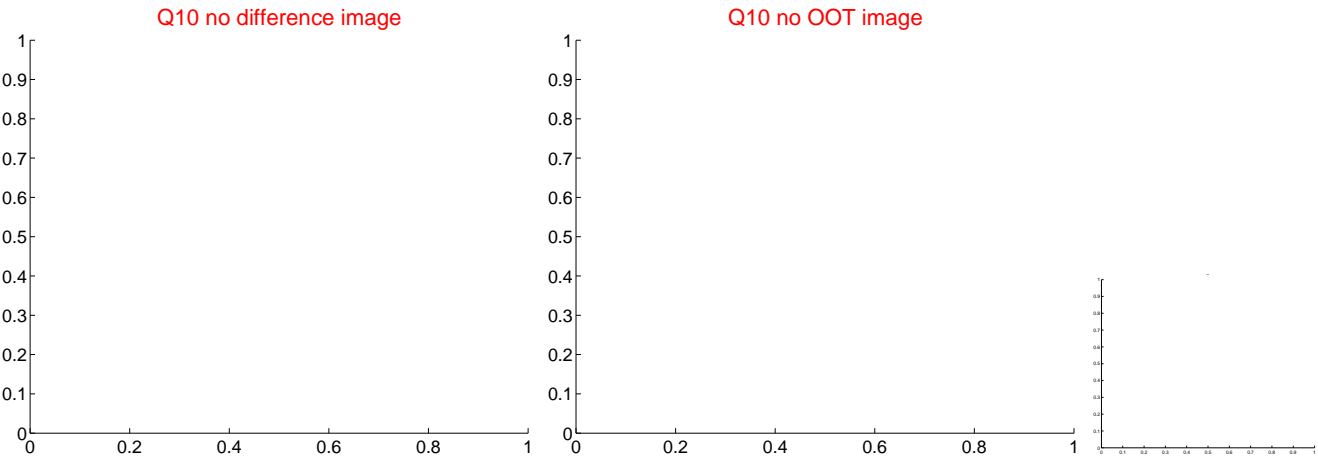
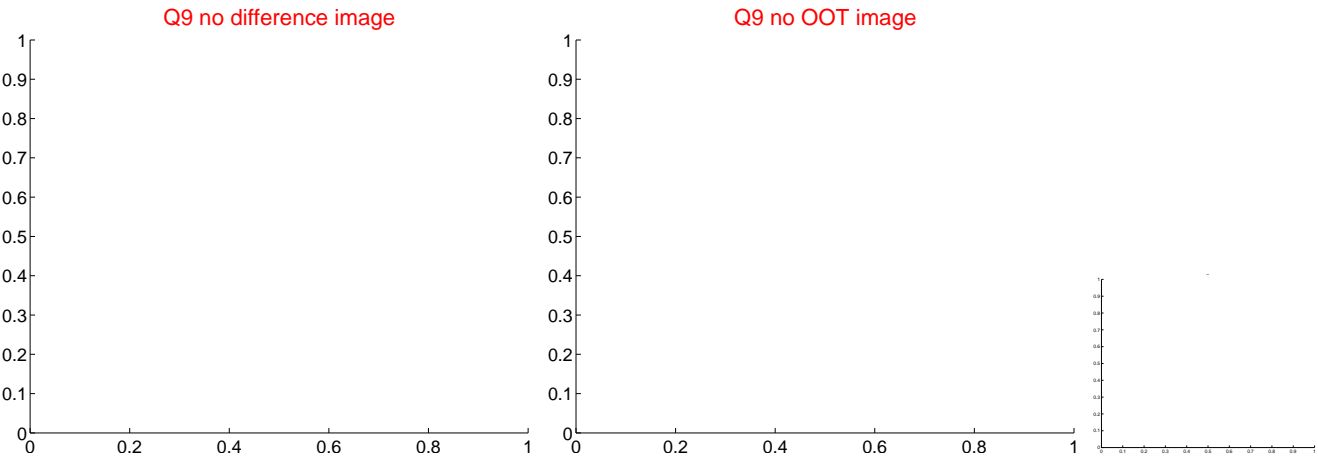
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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.

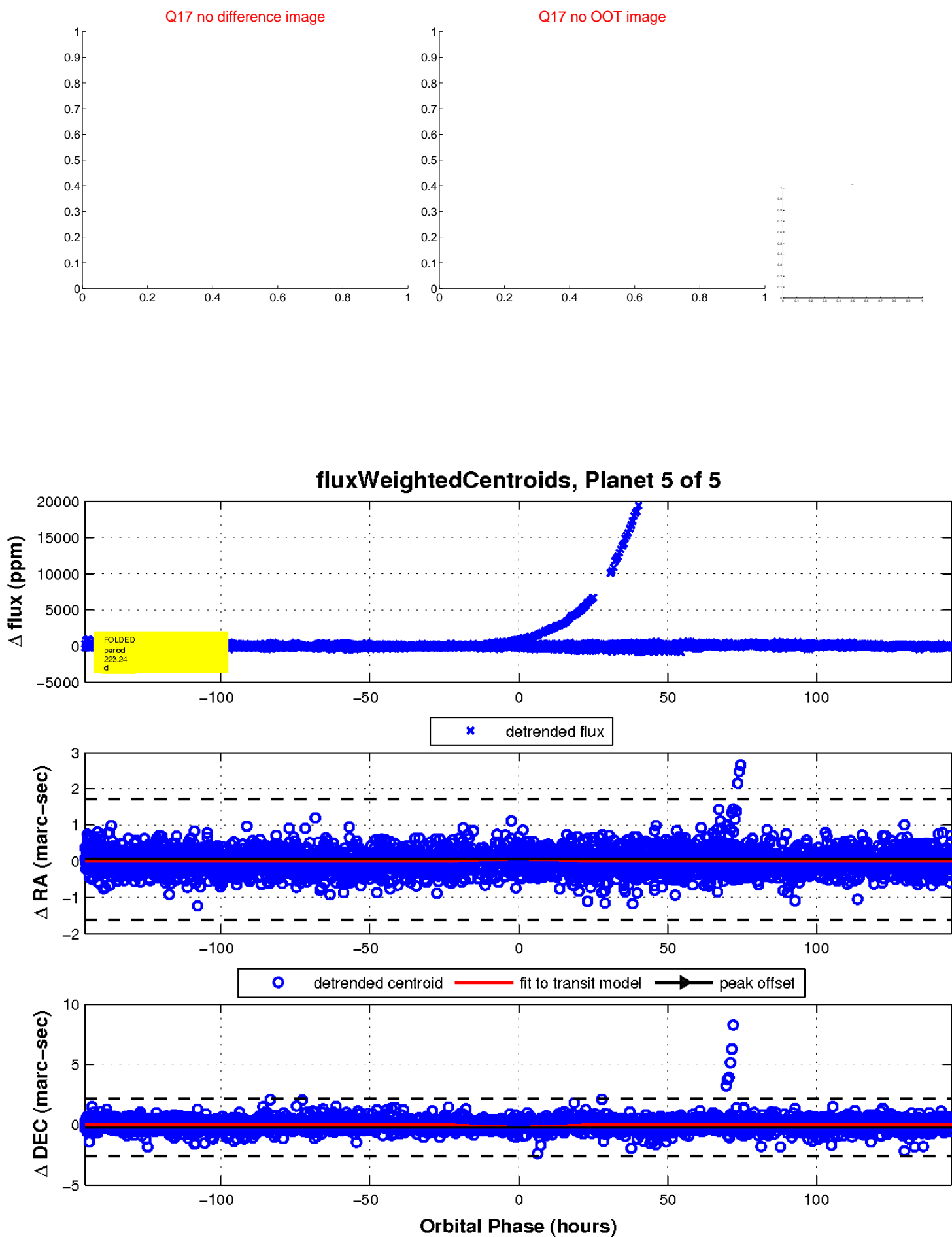




white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



UKIRT Image

Declination

