

# KIC 010412044

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
010412044-01	OBS	No	217.410359	140.894954	2536.3	1.840	13.1	8.0	0.45	3651	2.45	0.11
010412044-02	OBS	No	266.794685	377.959858	2321.4	4.958	11.1	6.8	0.45	3651	2.13	0.08
010412044-03	OBS	No	135.936292	156.835508	1625.7	5.173	11.0	6.7	0.45	3651	2.13	0.20
010412044-04	OBS	No	347.092671	259.473532	3168.1	4.346	10.4	7.7	0.45	3651	2.63	0.06
010412044-05	OBS	No	196.325909	195.517815	2079.5	3.049	10.9	8.4	0.45	3651	2.19	0.12
010412044-06	OBS	No	3.328827	133.848494	1333.0	1.500	8.1	-1.0	0.45	3651	1.62	27.91

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
010412044-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL_TRACKER—LPP_ALT—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS
010412044-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_CHASES_MARSHALL—ALL_TRANS_CHASES—CENT_FEW_MEAS
010412044-03	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—CENT_FEW_DIFFS
010412044-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
010412044-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL_SKYE—LPP_DV—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—CENT_FEW_DIFFS
010412044-06	OBS	FP	0.00	1	0	0	0	LPP_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_NOFITS

**Notes:** OBS = Observed. INJ = Injected. INV = Inverted. SCR = Scrambled.

N = Not Transit-Like. S = Stellar Eclipse. C = Centroid Offset. E = Ephemeris Match.

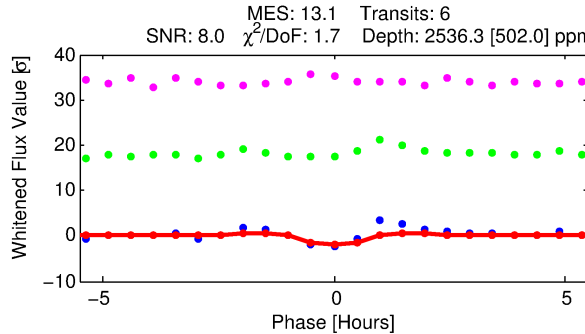
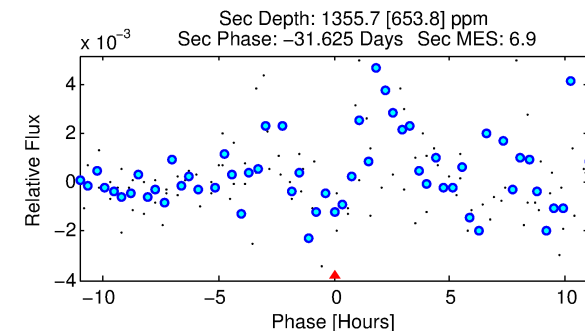
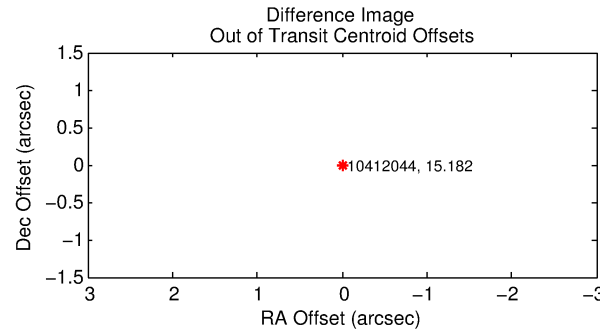
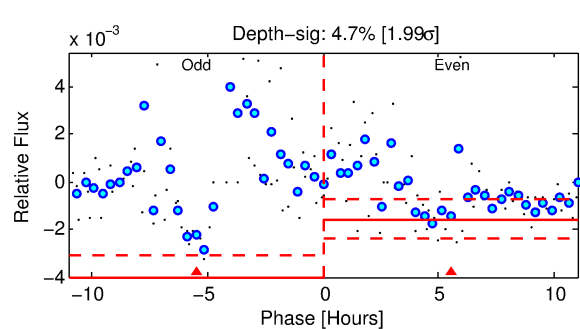
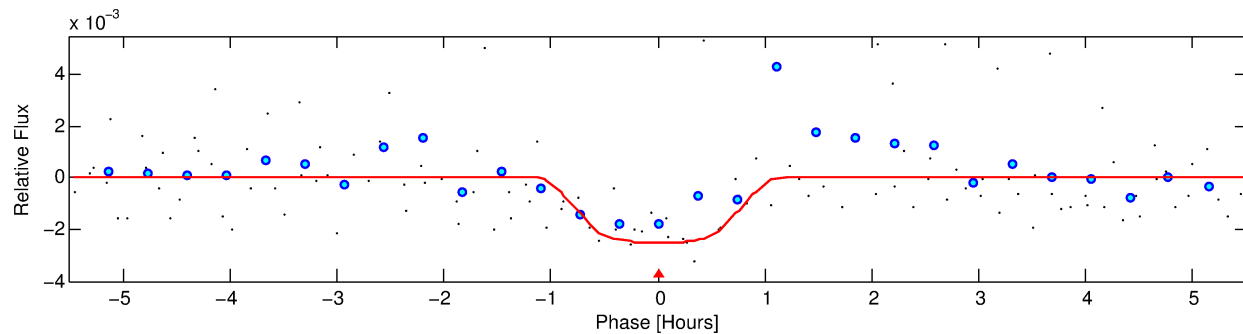
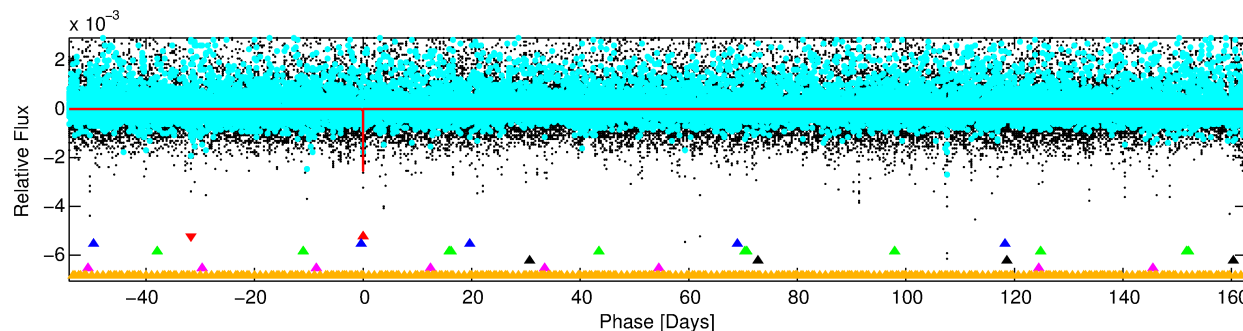
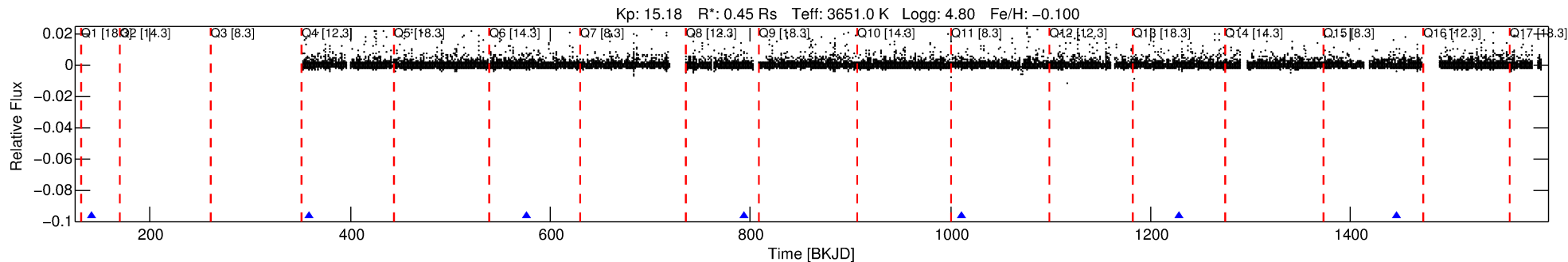
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 010412044-01

No Significant Match Found

# DV One-Page Summary

KIC: 10412044 Candidate: 1 of 6 Period: 217.410 d



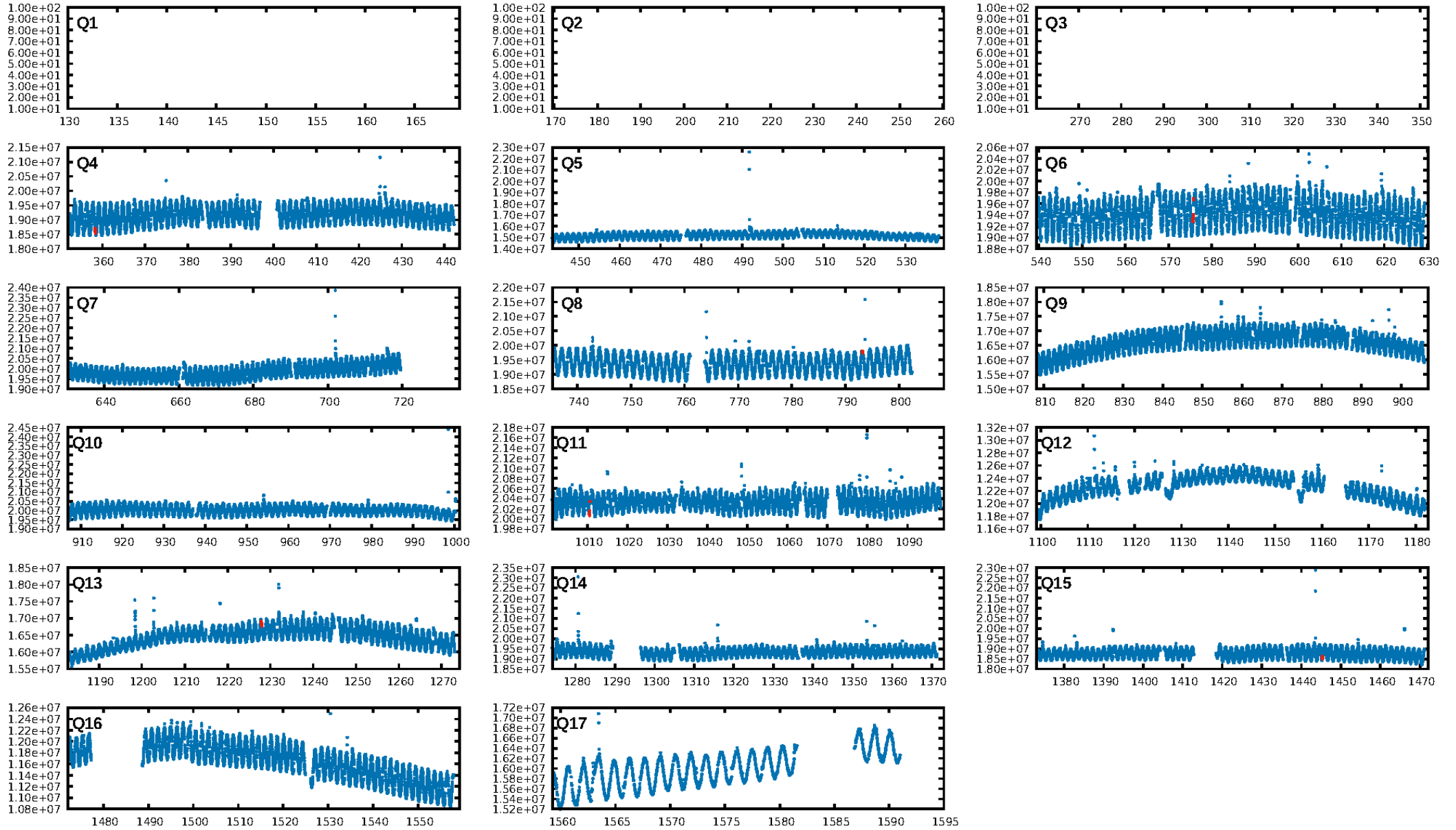
## DV Fit Results:

Period = 217.41036 [0.00235] d  
Epoch = 140.8950 [0.0106] BKJD  
Rp/R\* = 0.0504 [0.0450]  
a/R\* = 657.93 [2518.28]  
b = 0.76 [2.17]  
Seff = 0.11 [0.01]  
Teff = 146 [5] K  
Rp = 2.45 [2.21] Re  
a = 0.5463 [0.0412] AU  
Ag = 37045.56 [68718.73] [0.54σ]  
Teffp = 3122 [1447] K [2.06σ]

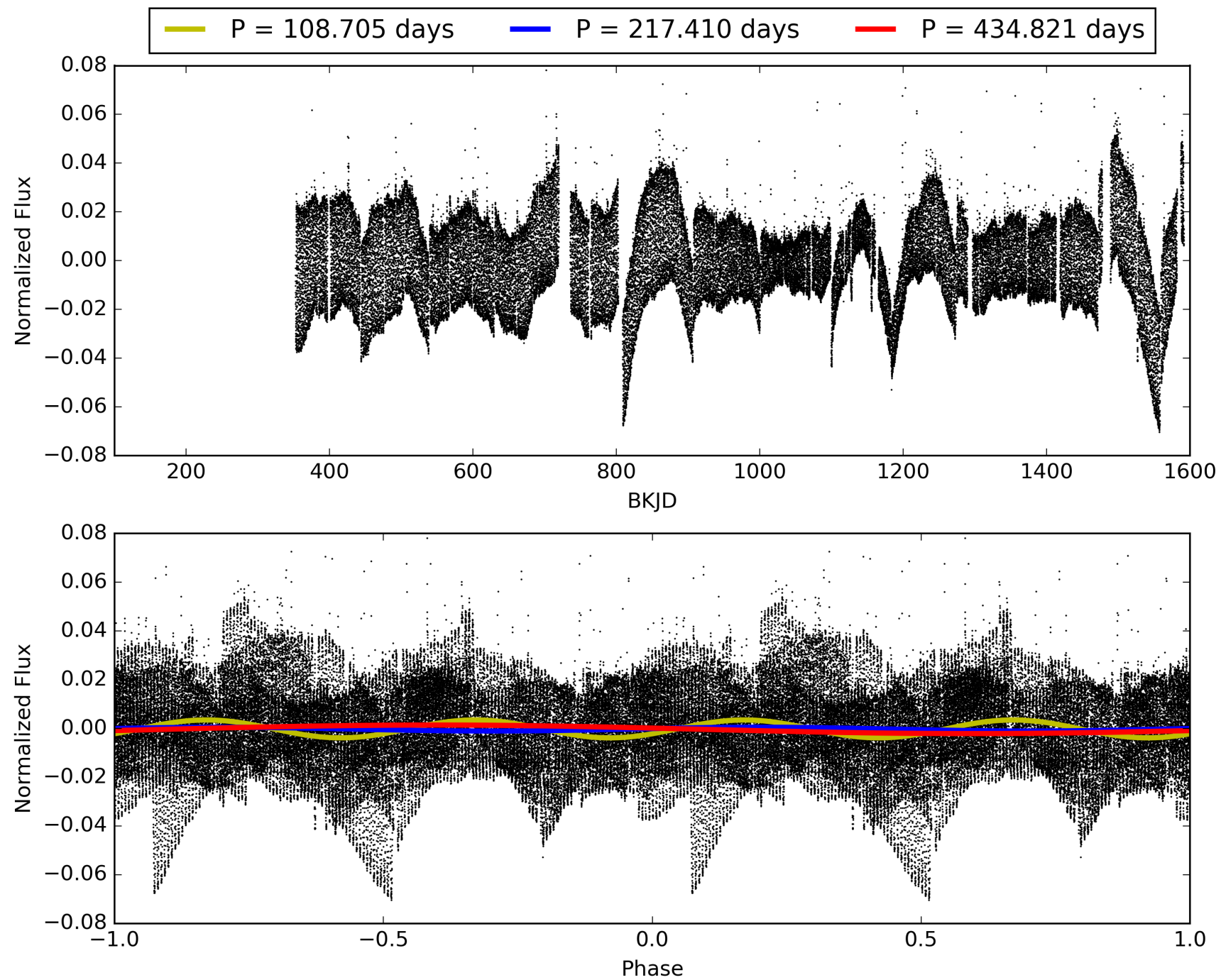
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [142.08σ]  
LongPeriod-sig: 100.0% [224.10σ]  
ModelChiSquare2-sig: 2.2%  
ModelChiSquareGof-sig: 80.9%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [6/6]  
GhostDiagnostic-chr: 28.92  
Centroid-sig: 0.7%  
Centroid-so: 3.082 arcsec [5.73σ]  
OotOffset-rm: N/A  
KicOffset-rm: 0.189 arcsec [1.27σ]  
OotOffset-st: 0/0/0 [0]  
KicOffset-st: 0/1/2/0 [3]  
DiffImageQuality-fgm: 0.67 [2/3]  
DiffImageOverlap-fno: 0.67 [4/6]

# TCE 010412044-01, PDC Light Curves



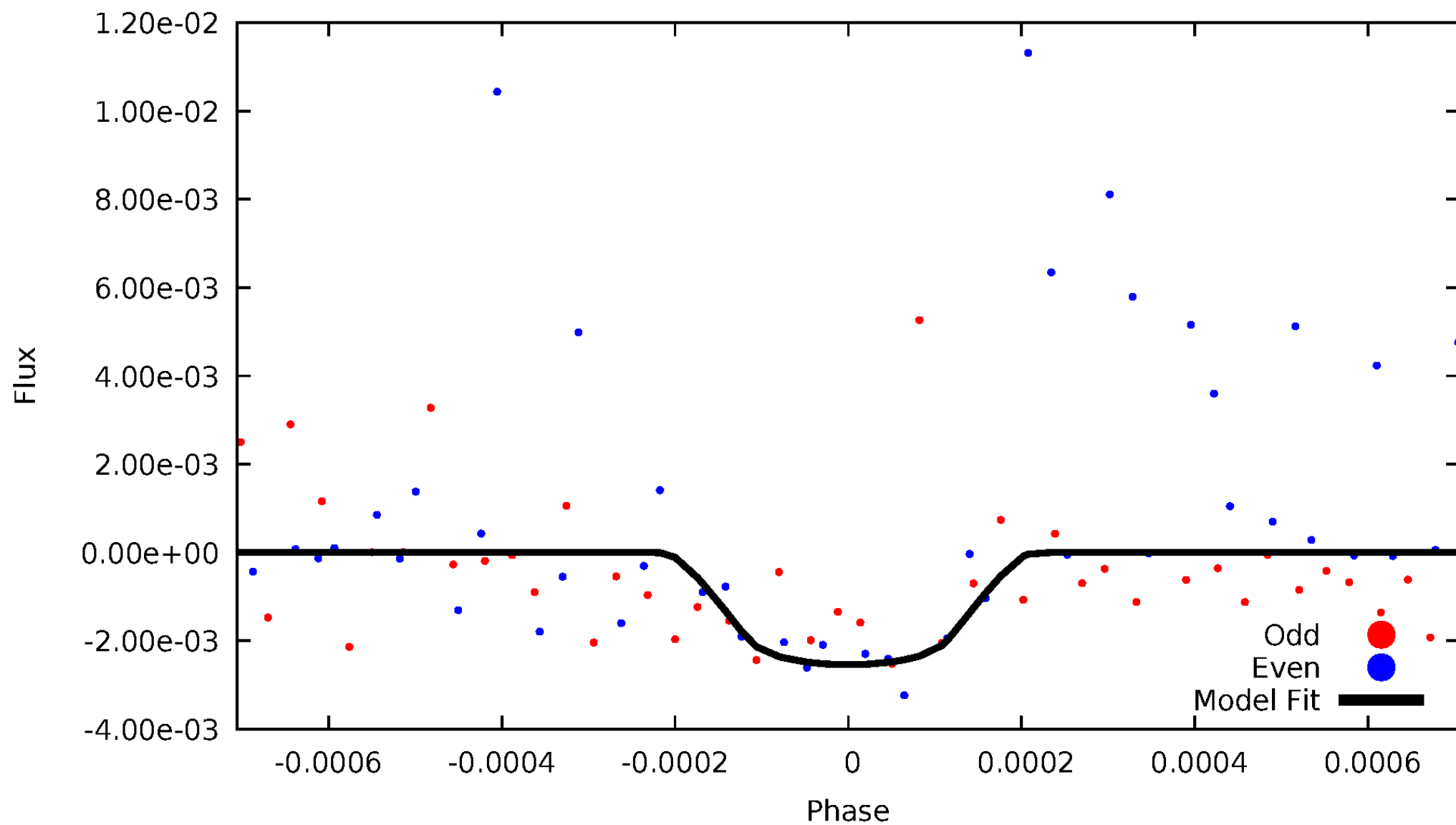
TCE 010412044-01





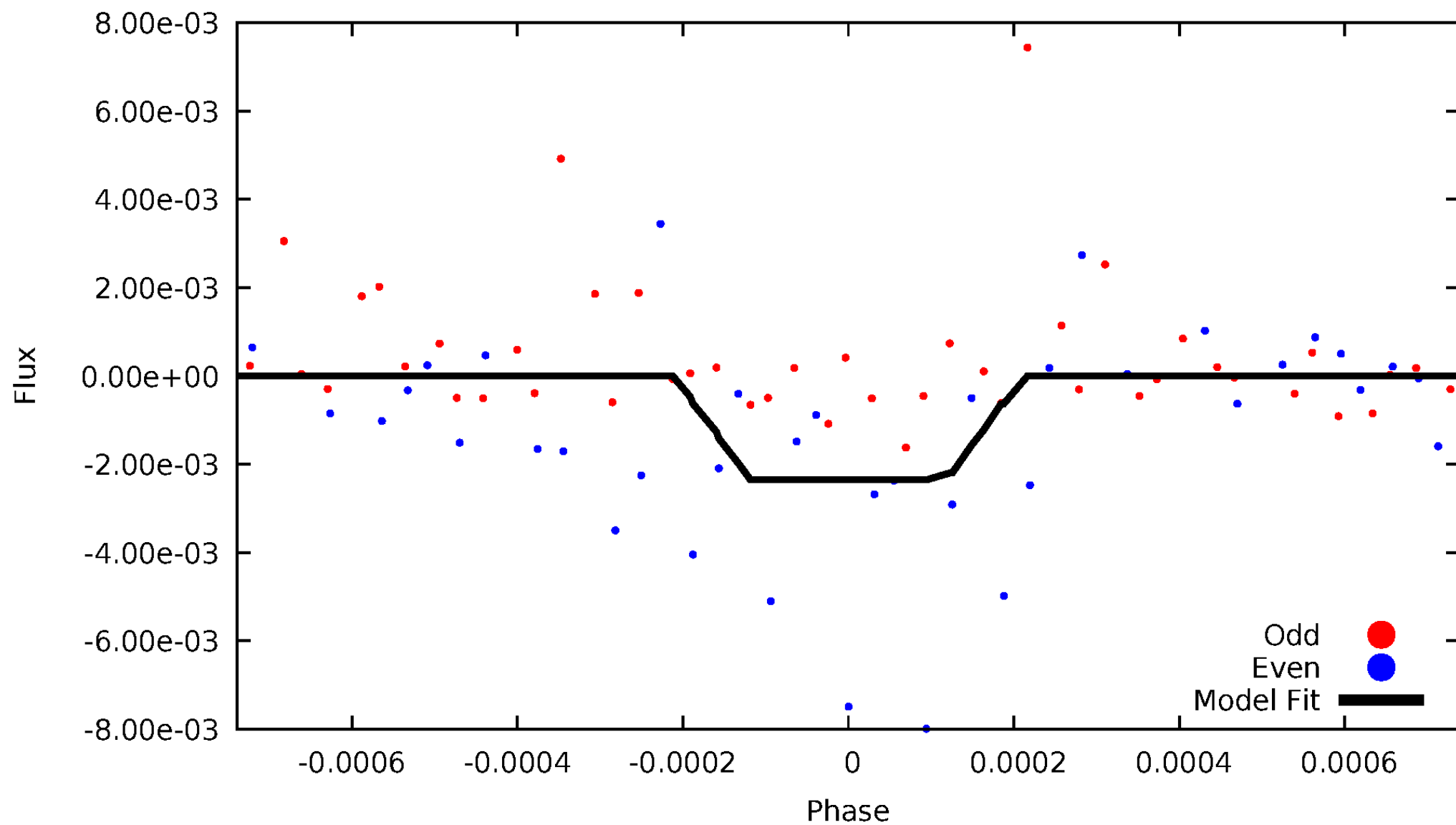
# DV Odd/Even

TCE 010412044-01

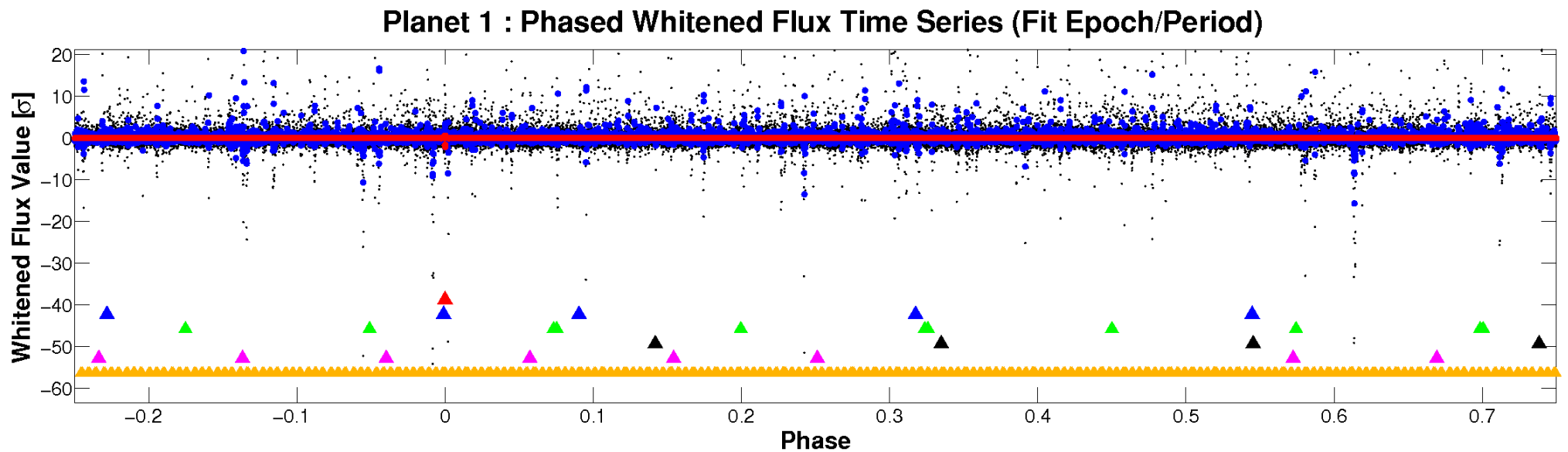
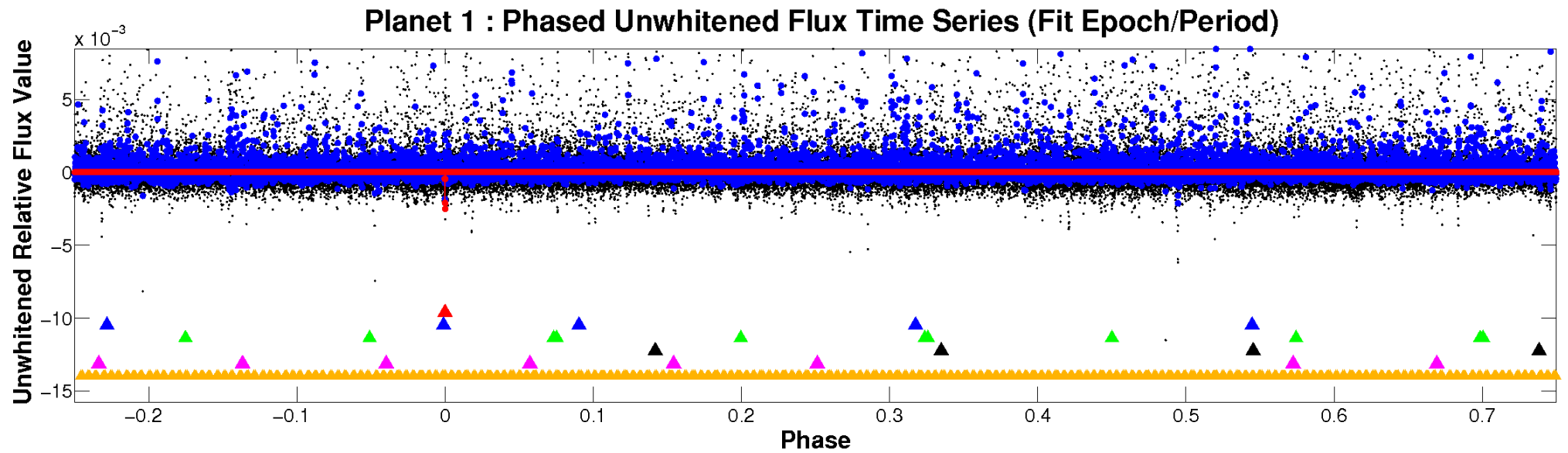


# ALT Odd/Even

TCE 010412044-01

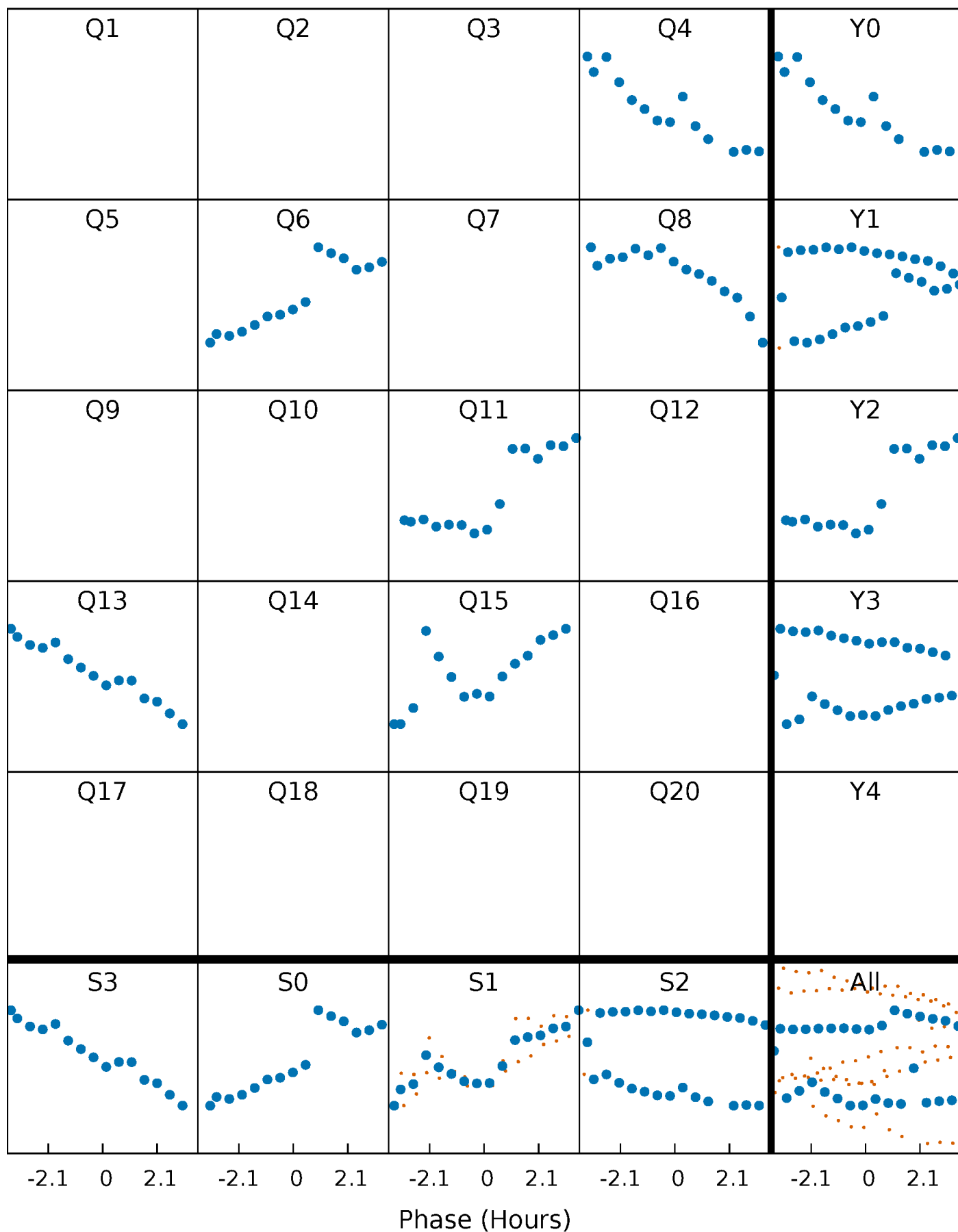


# Non-Whitened Vs. Whitened Light Curve



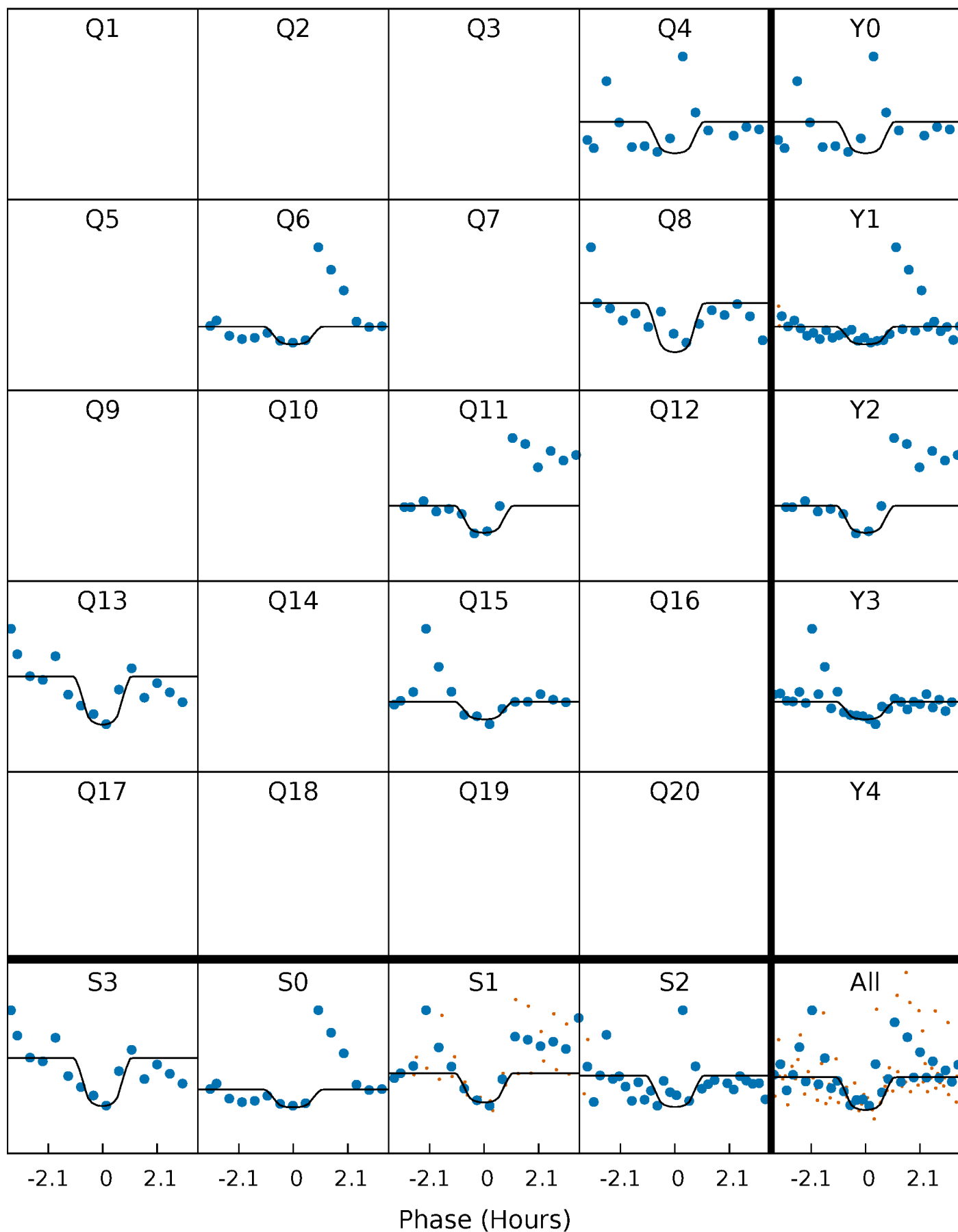
# PDC Quarter-Phased Transit Curves

TCE 010412044-01 P=217.410359 Days  $T_0=140.894954$  (BKJD)



# DV Quarter-Phased Transit Curves

TCE 010412044-01 P=217.410359 Days  $T_0=140.894954$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

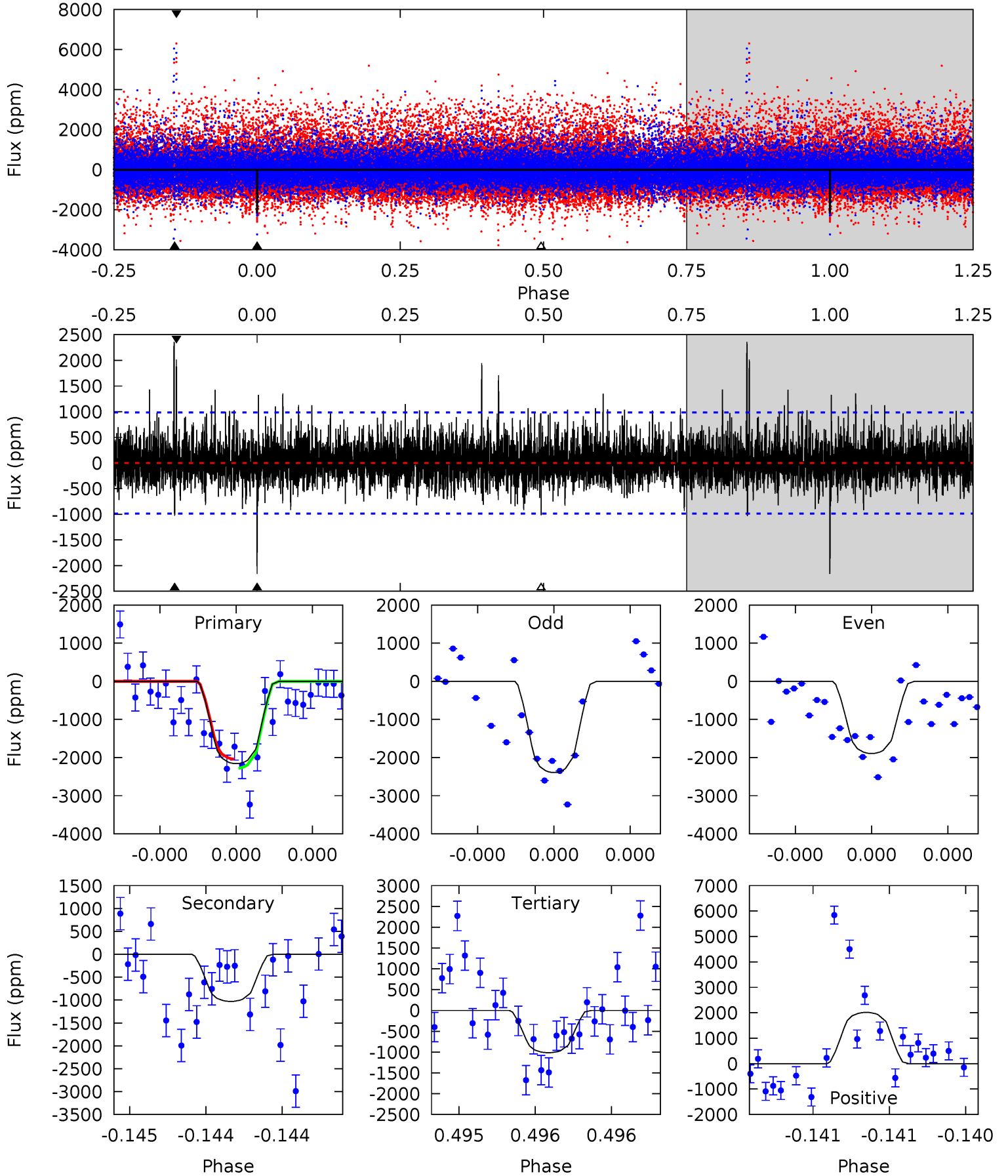
TCE 010412044-01 P=217.416624 Days  $T_0=140.859443$  (BKJD)



# DV Model-Shift Uniqueness Test

010412044-01, P = 217.410359 Days, E = 140.894954 Days

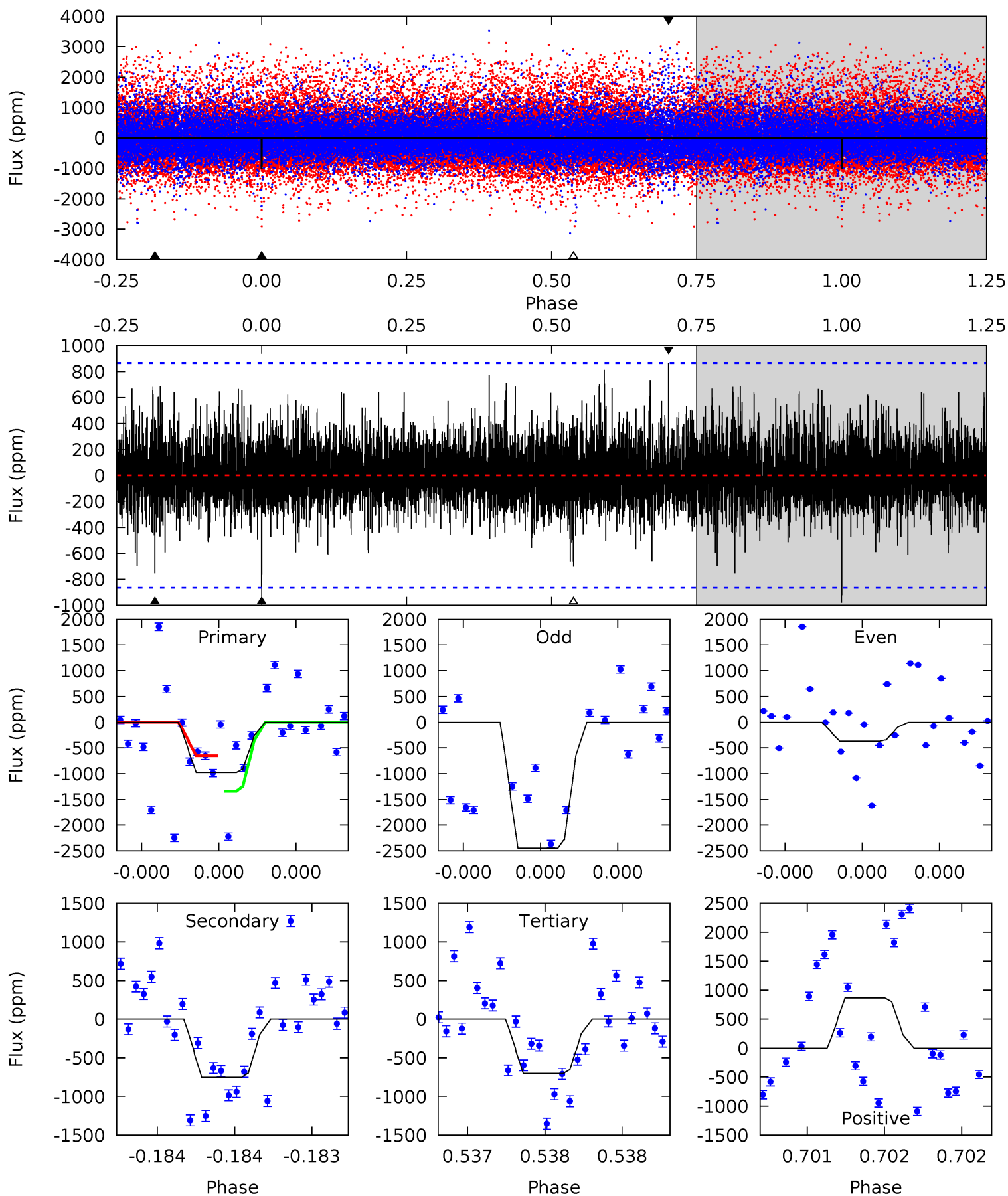
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
12.3	5.85	5.77	11.5	5.60	3.52	1.73	6.50	0.82	0.08	-5.60	1.27	0.78	0.52	0.69



# Alt Model-Shift Uniqueness Test

010412044-01, P = 217.416624 Days, E = 140.859443 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
6.35	4.88	4.55	5.60	5.61	3.54	1.15	1.79	0.75	0.32	-0.73	6.68	1.80	0.47	2.24



### Stellar Parameters For KIC 010412044

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (g \cdot \text{cm}^{-3})$
	$3651^{+73}_{-73}$	$4.802^{+0.048}_{-0.032}$	$-0.100^{+0.100}_{-0.100}$	$0.446^{+0.036}_{-0.044}$	$0.461^{+0.034}_{-0.042}$	$7.297^{+1.807}_{-1.001}$
	+2%/-2%	+1%/-1%	+100%/-100%	+8%/-10%	+7%/-9%	+25%/-14%
Source	PHO2	PHO2	PHO2	DSEP		

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

### Secondary Eclipse Parameters for KIC 010412044-01 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	-1029±176	$2.67^{+1.96}_{-1.59}$	$202^{+5}_{-5}$	$3063^{+1077}_{-418}$	$22465^{+120058}_{-14954}$
Alt.	-752±154	$2.70^{+2.08}_{-1.73}$	$203^{+5}_{-5}$	$2943^{+1077}_{-424}$	$16771^{+109060}_{-11596}$

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

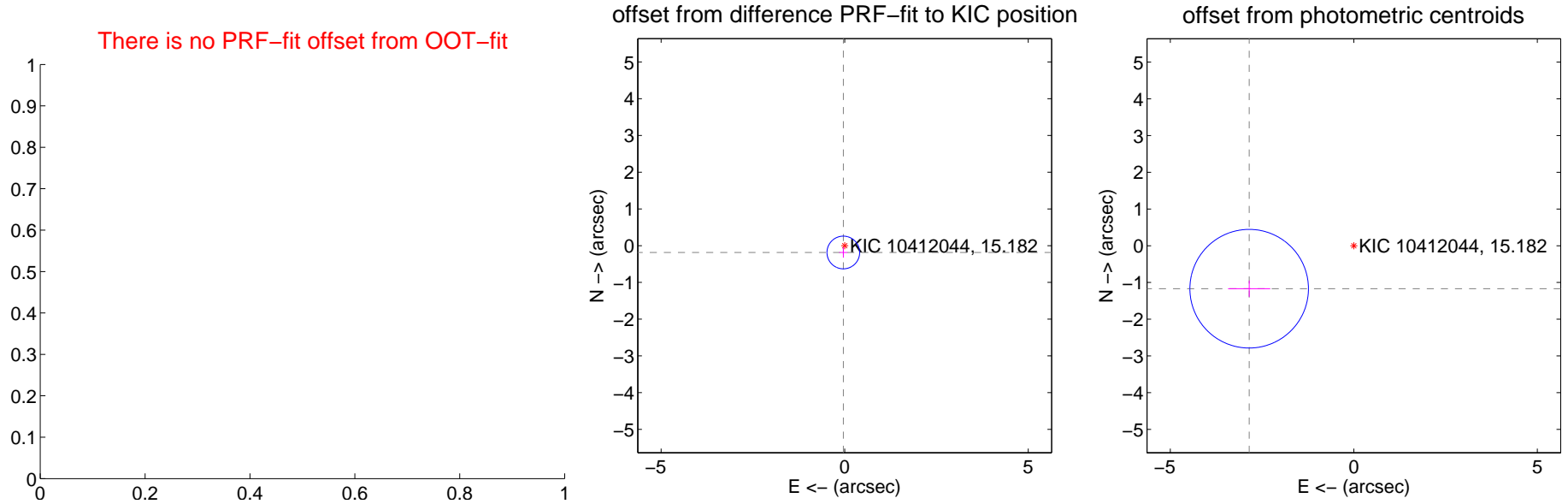
## DV Centroid Data

Supplemental centroid analysis for 010412044-01. Kepler magnitude: 15.18. Transit SNR 8.05

There are 2 quarters with good PRF difference image offsets

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

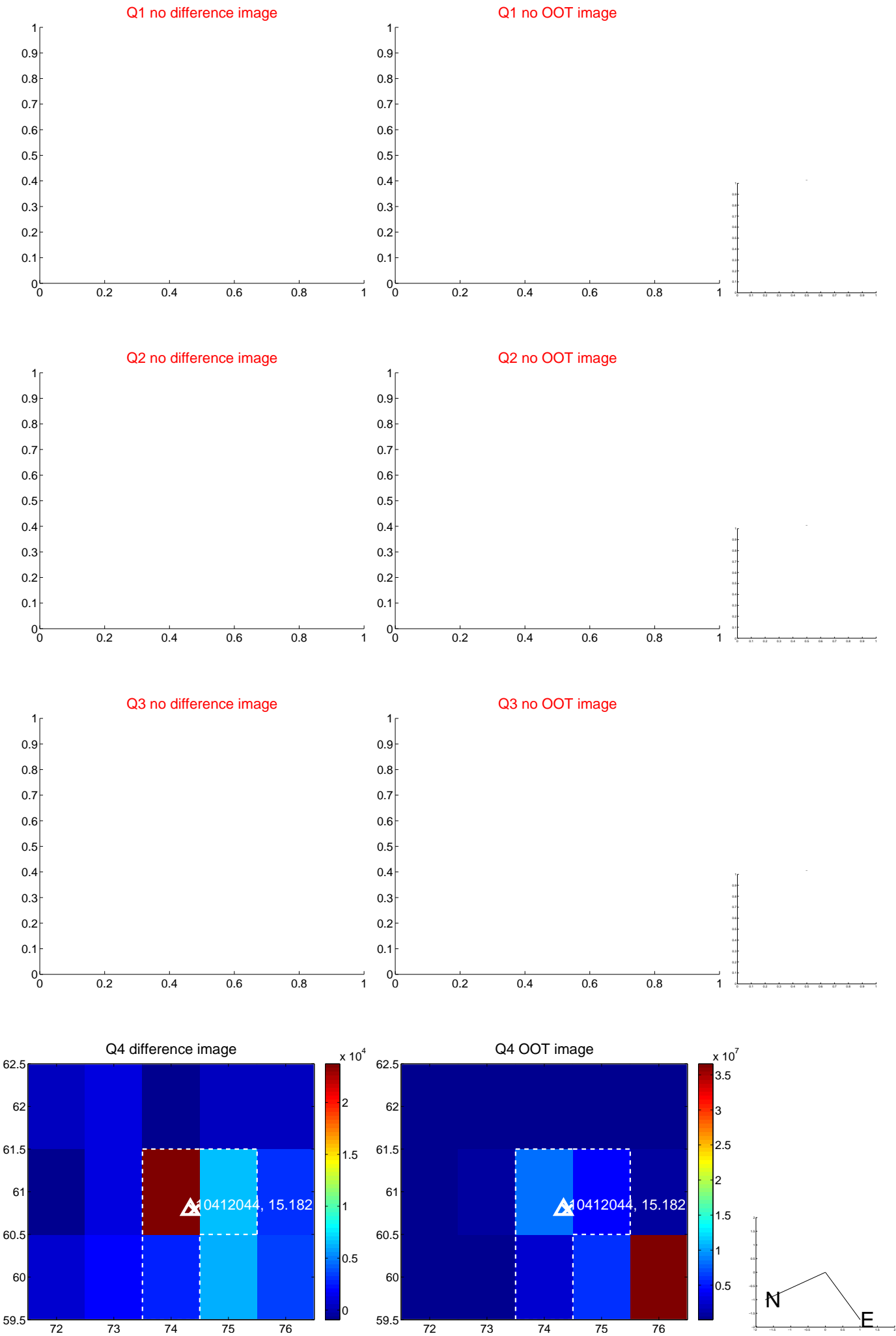
	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	—	—	—	—
PRF-fit source offset from KIC position	$0.189 \pm 0.148$	1.27	$0.037 \pm 0.111$	$-0.185 \pm 0.140$
photometric centroid source offset	$3.08 \pm 0.54$	5.73	$2.85 \pm 0.57$	$-1.17 \pm 0.22$



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.

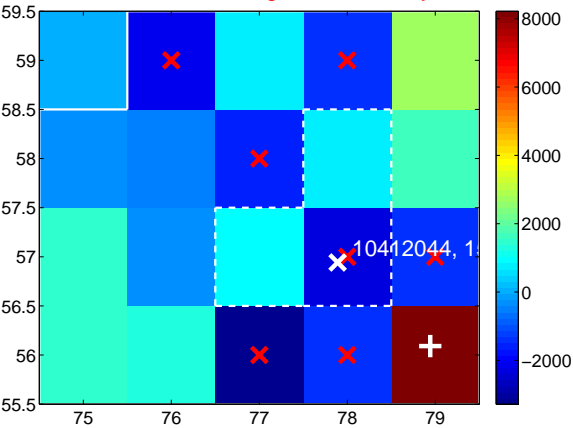
Q5 no difference image



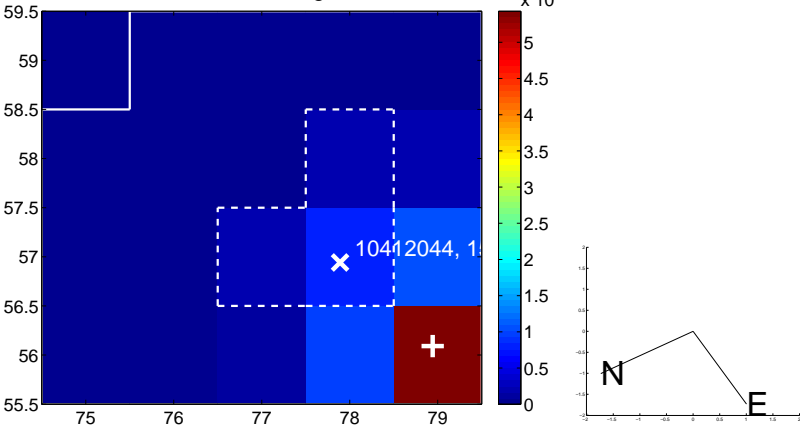
Q5 no OOT image



Q6 difference image. Poor Quality



Q6 OOT image



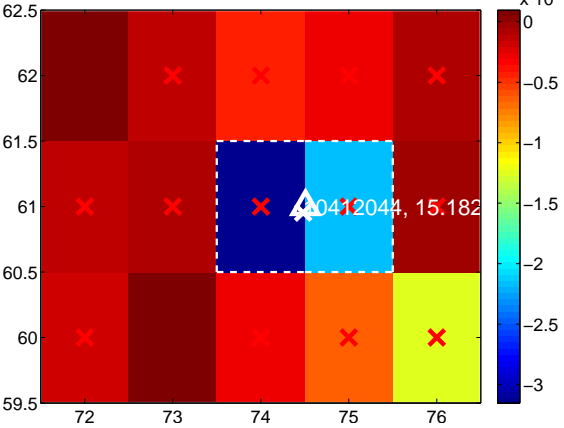
Q7 no difference image



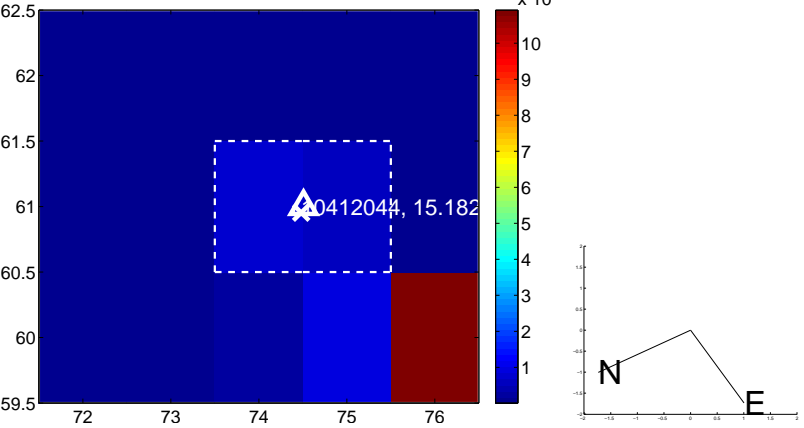
Q7 no OOT image



Q8 difference image. Poor Quality



Q8 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



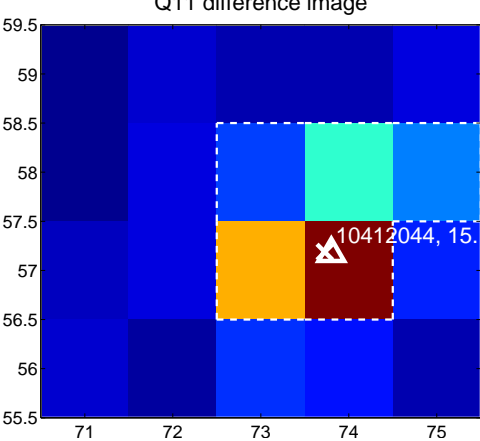
Q10 no difference image



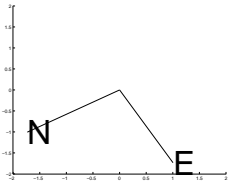
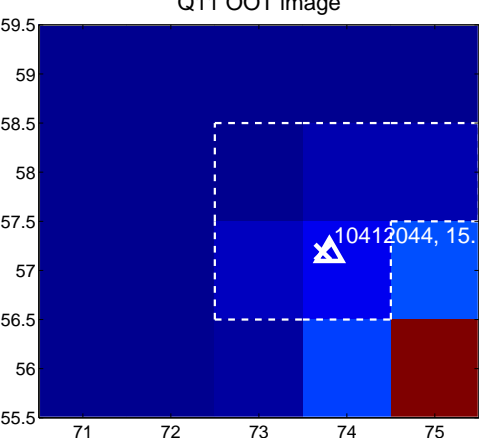
Q10 no OOT image



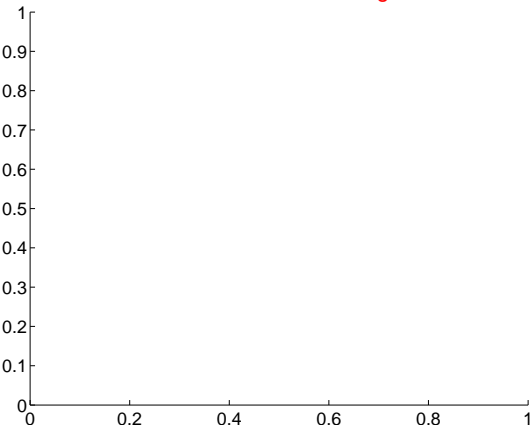
Q11 difference image



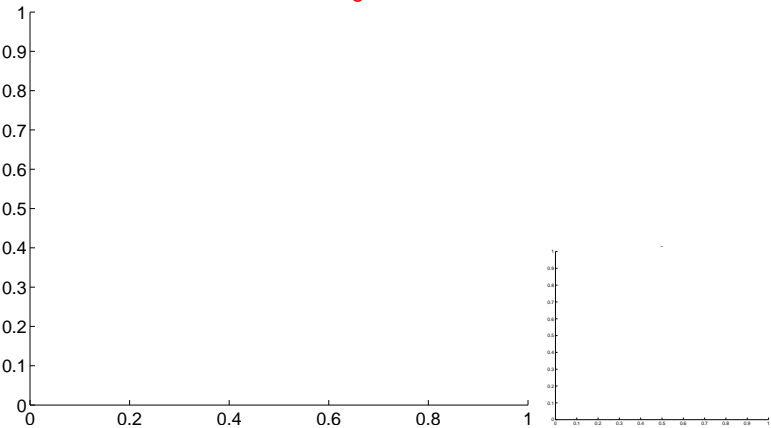
Q11 OOT image



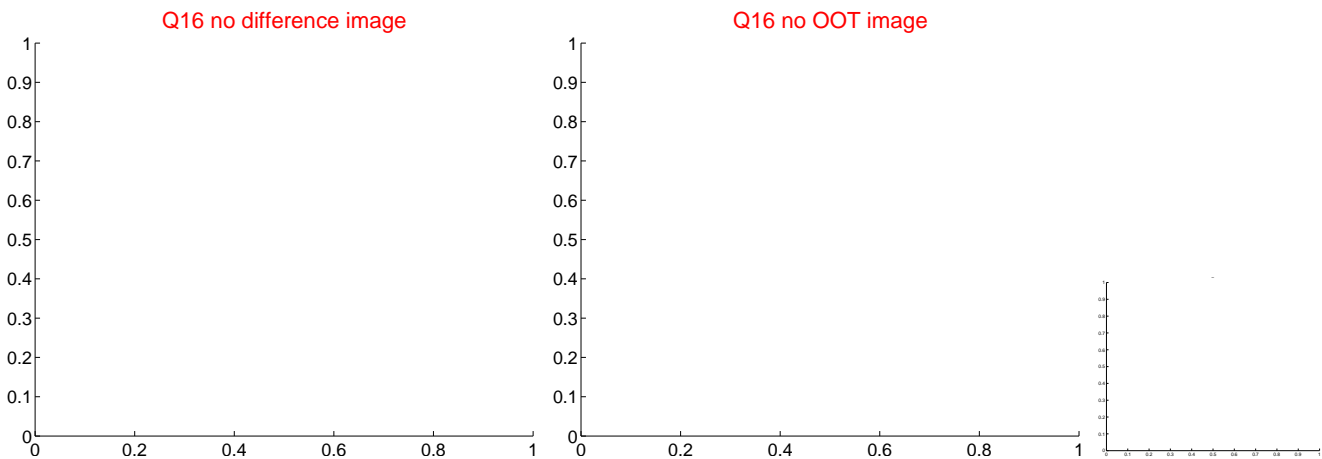
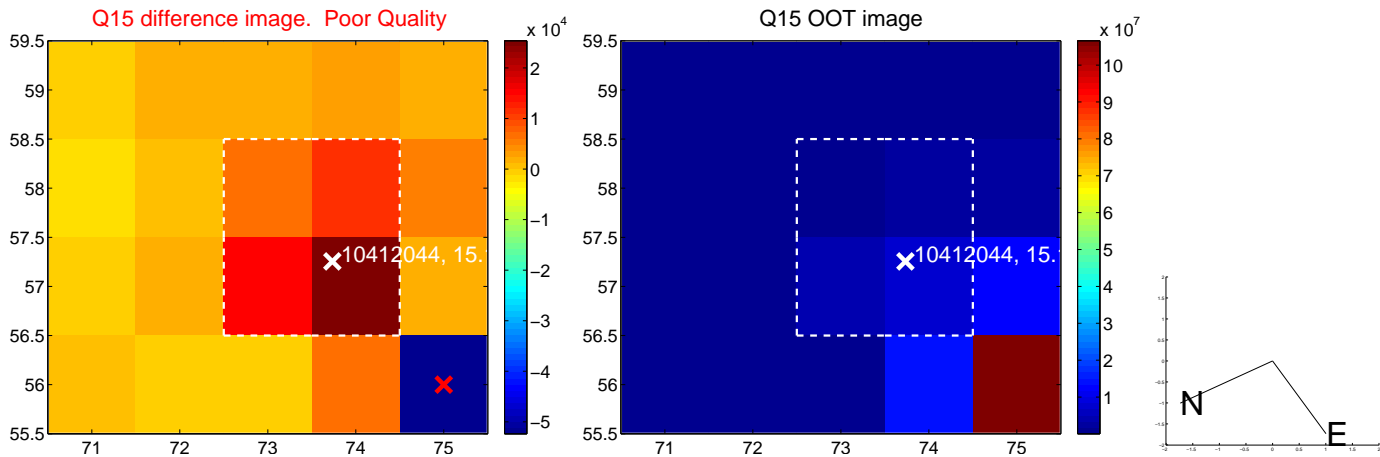
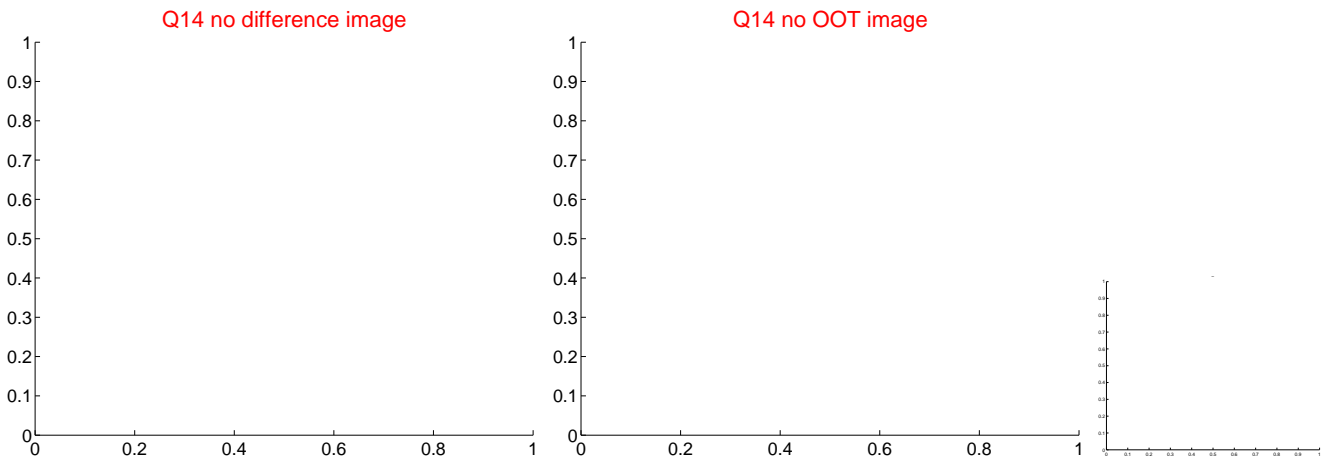
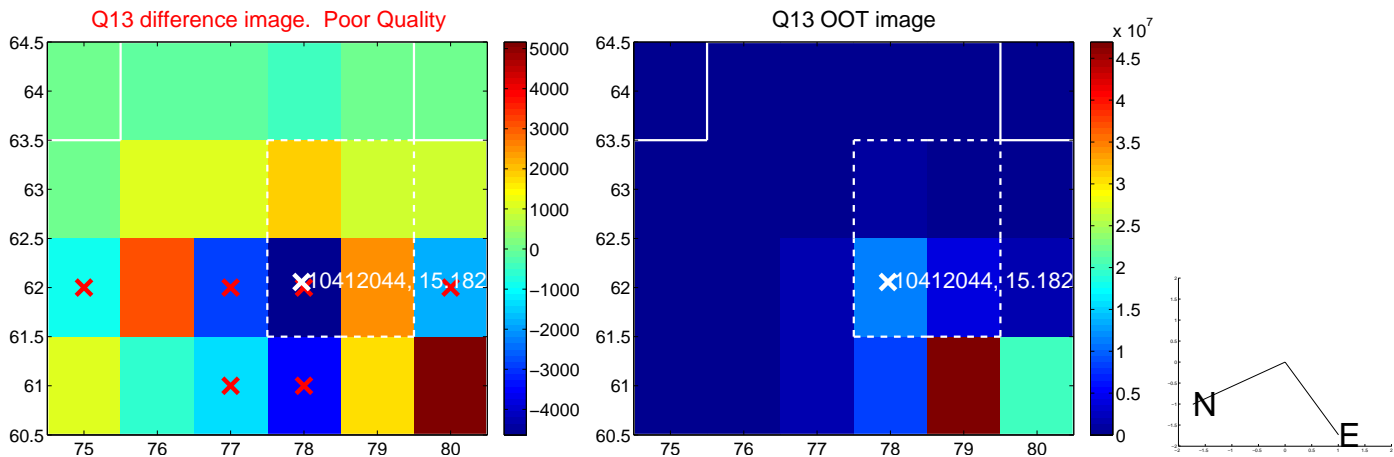
Q12 no difference image



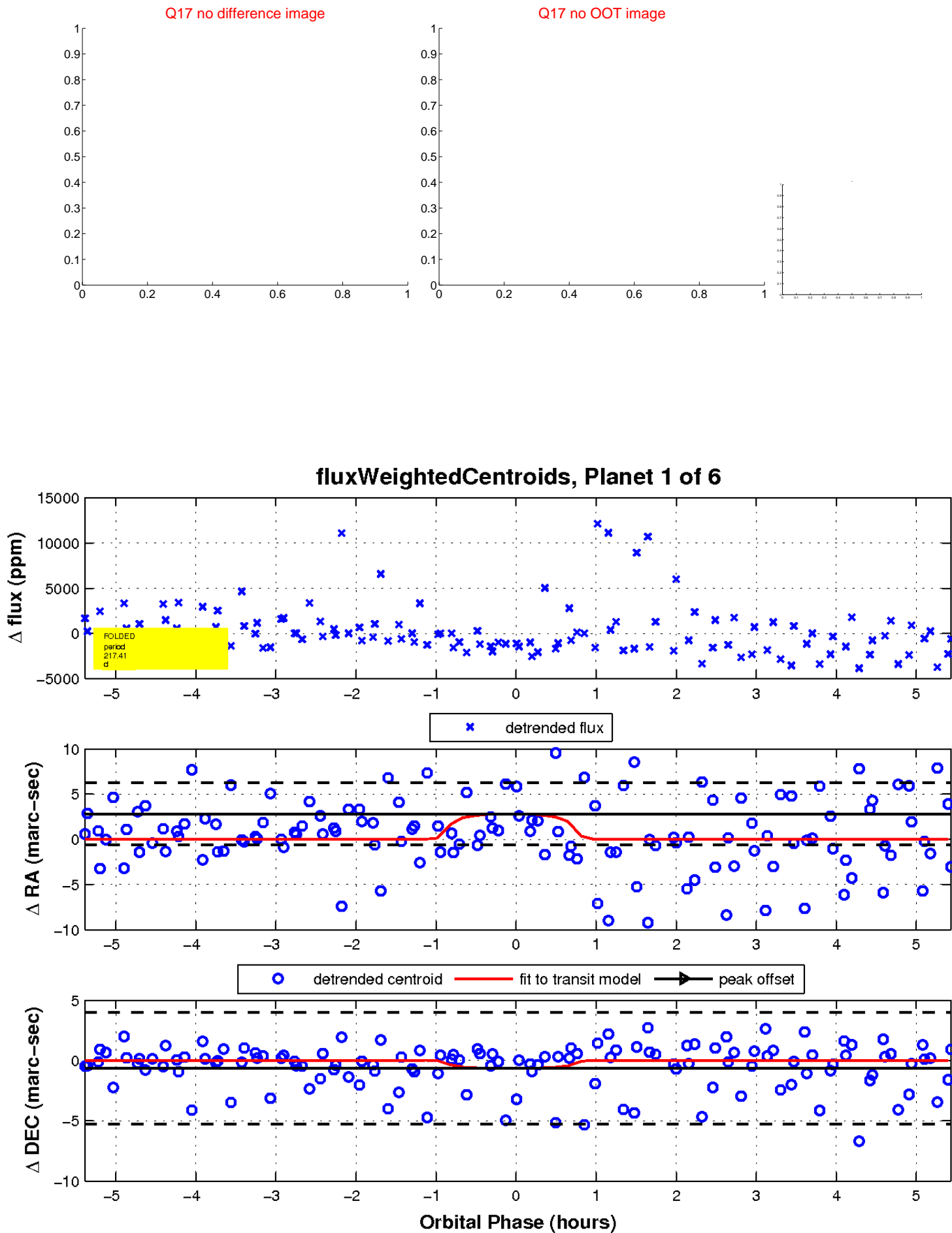
Q12 no OOT image



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



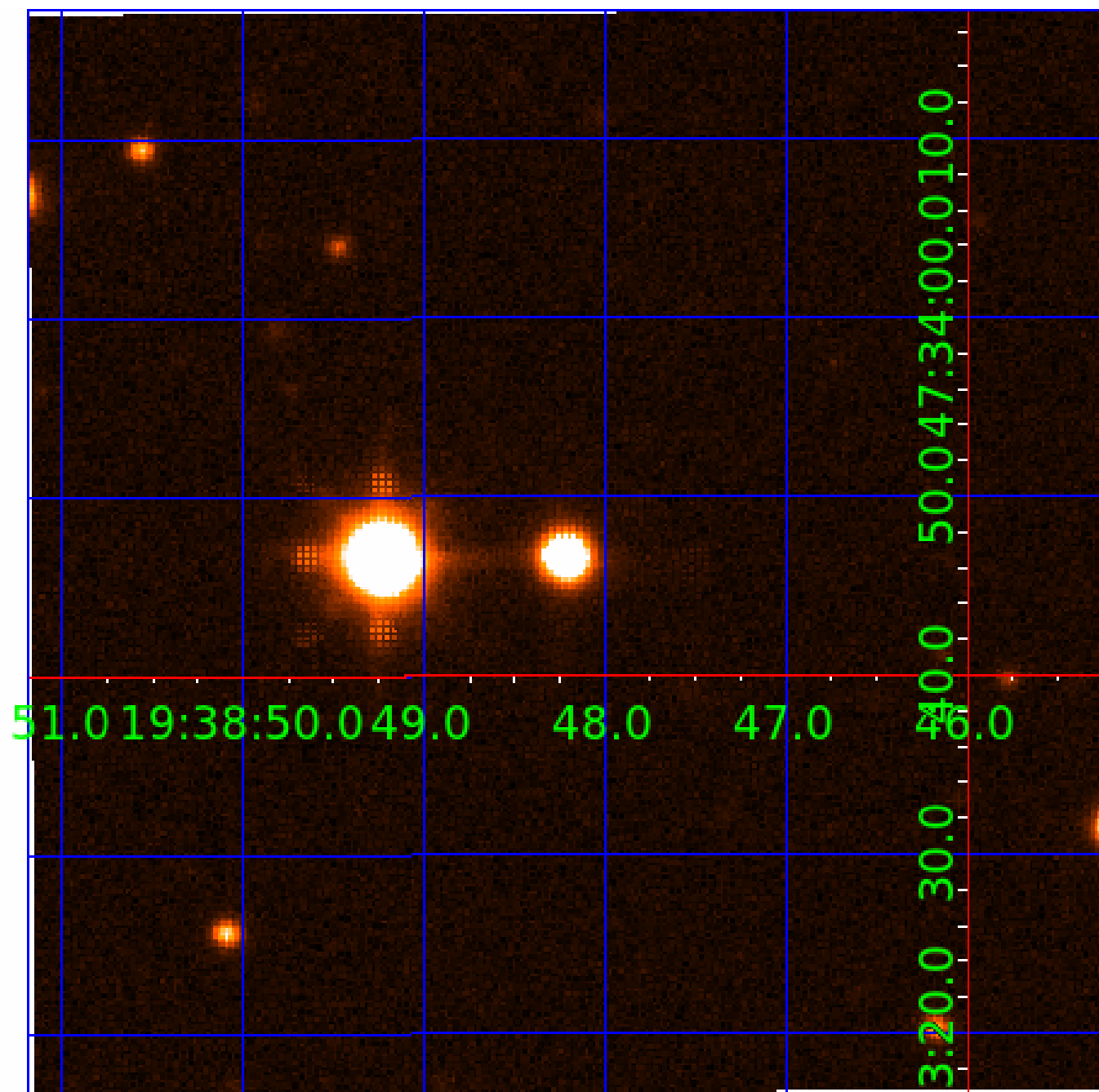
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





UKIRT Image

Declination



# KIC 010412044

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
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010412044-04	OBS	No	347.092671	259.473532	3168.1	4.346	10.4	7.7	0.45	3651	2.63	0.06
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## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
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010412044-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_CHASES_MARSHALL—ALL_TRANS_CHASES—CENT_FEW_MEAS
010412044-03	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—CENT_FEW_DIFFS
010412044-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
010412044-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL_SKYE—LPP_DV—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—CENT_FEW_DIFFS
010412044-06	OBS	FP	0.00	1	0	0	0	LPP_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_NOFITS

**Notes:** OBS = Observed. INJ = Injected. INV = Inverted. SCR = Scrambled.

N = Not Transit-Like. S = Stellar Eclipse. C = Centroid Offset. E = Ephemeris Match.

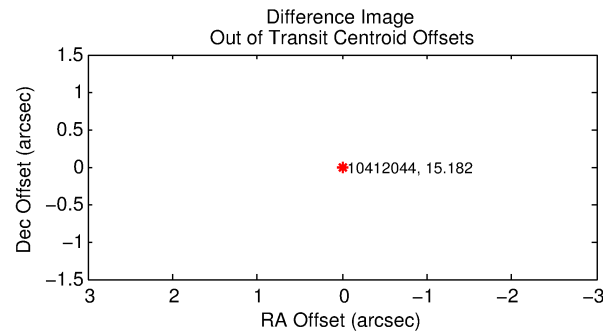
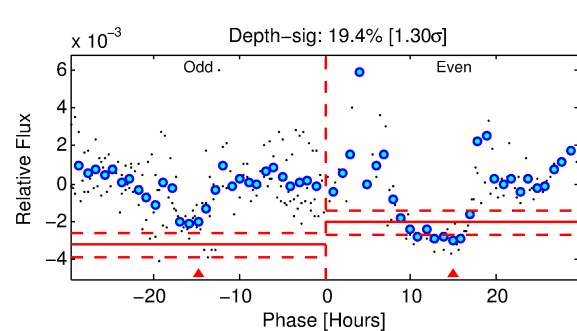
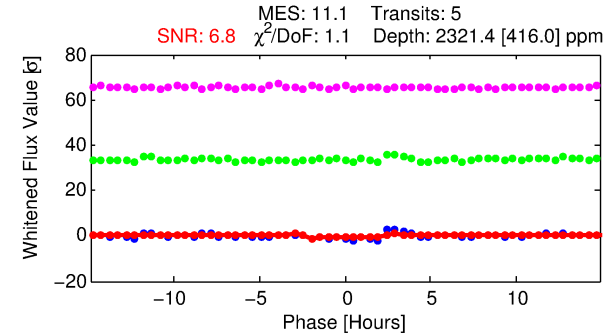
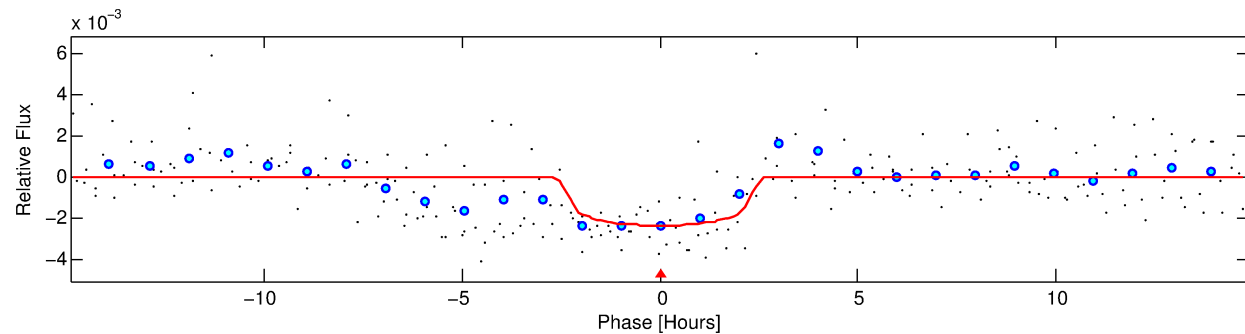
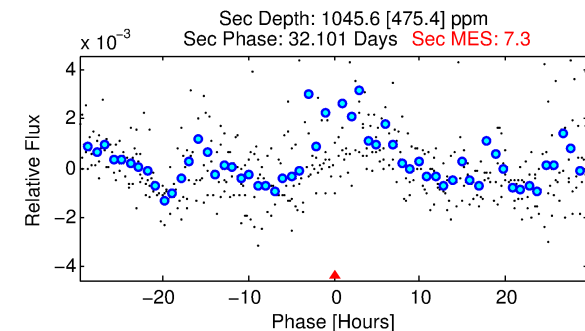
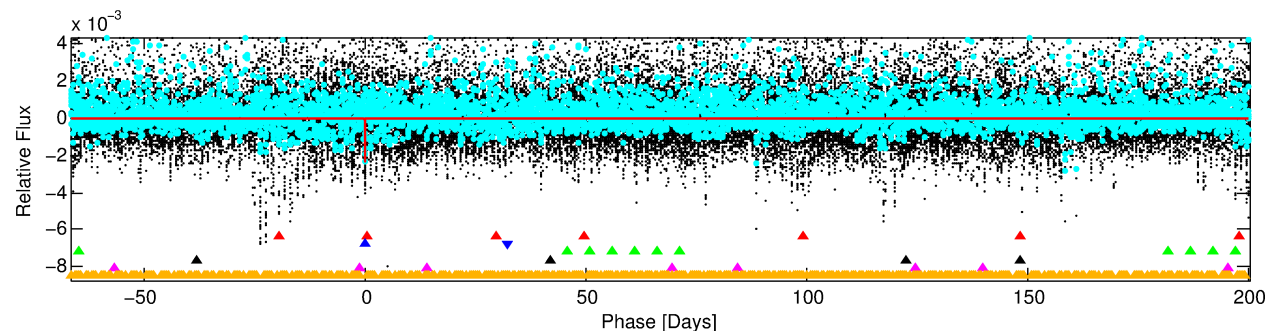
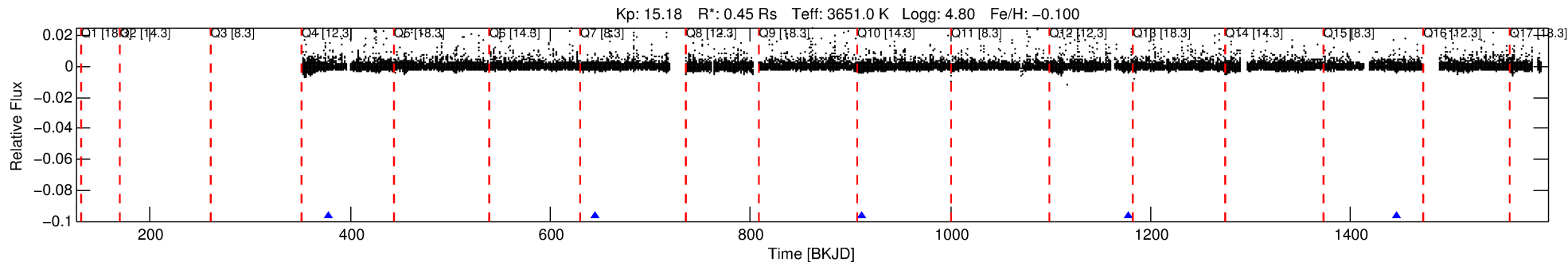
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 010412044-02

No Significant Match Found

# DV One-Page Summary

KIC: 10412044 Candidate: 2 of 6 Period: 266.795 d



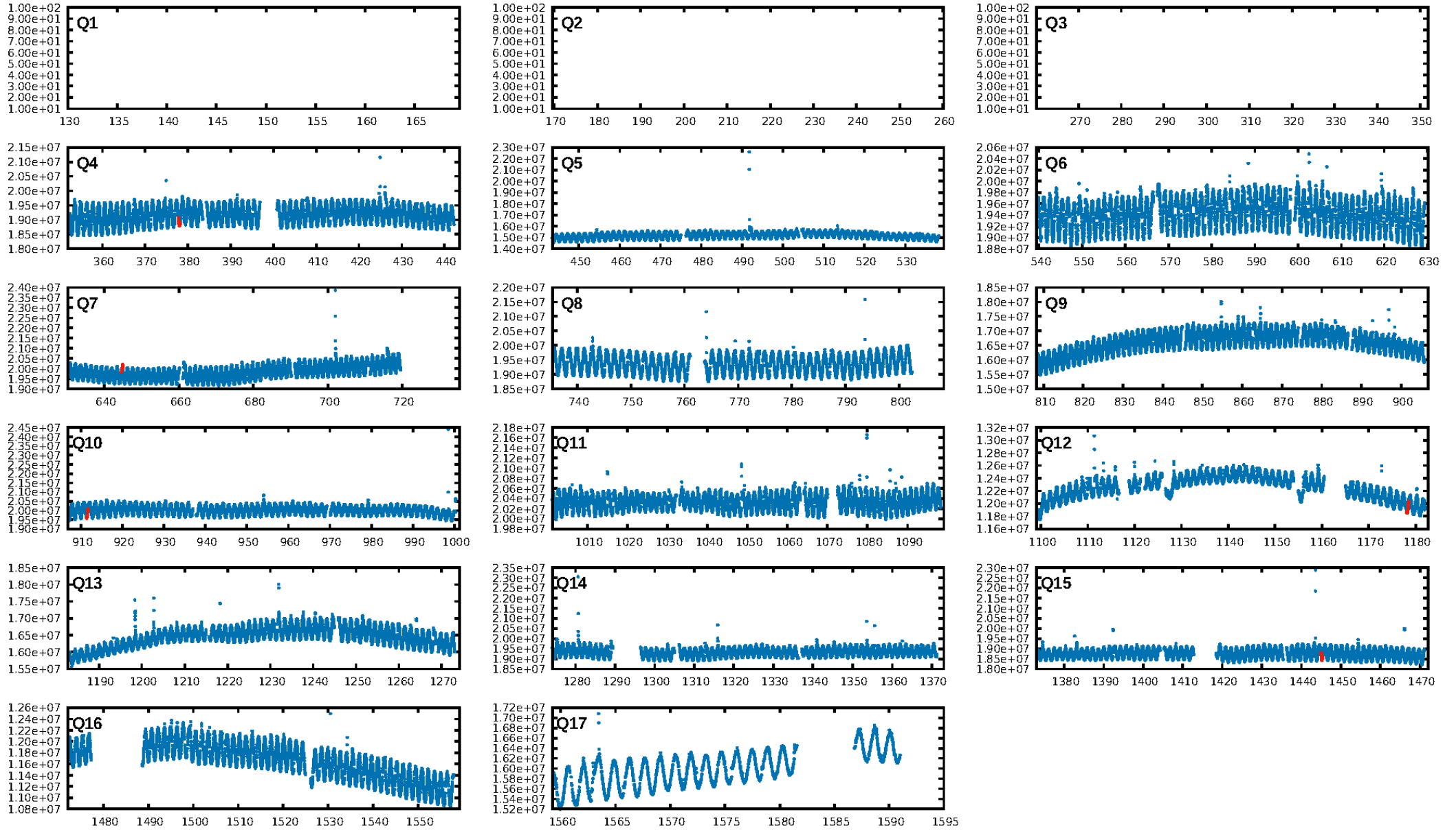
## DV Fit Results:

Period = 266.79469 [0.00268] d  
Epoch = 377.9599 [0.0058] BKJD  
Rp/R\* = 0.0438 [0.0541]  
a/R\* = 422.79 [2259.75]  
b = 0.18 [29.20]  
Seff = 0.08 [0.01]  
Teq = 136 [4] K  
Rp = 2.13 [2.64] Re  
a = 0.6262 [0.0472] AU  
Ag = 49639.48 [124680.77] [0.40σ]  
Teffp = 3137 [1969] K [1.52σ]

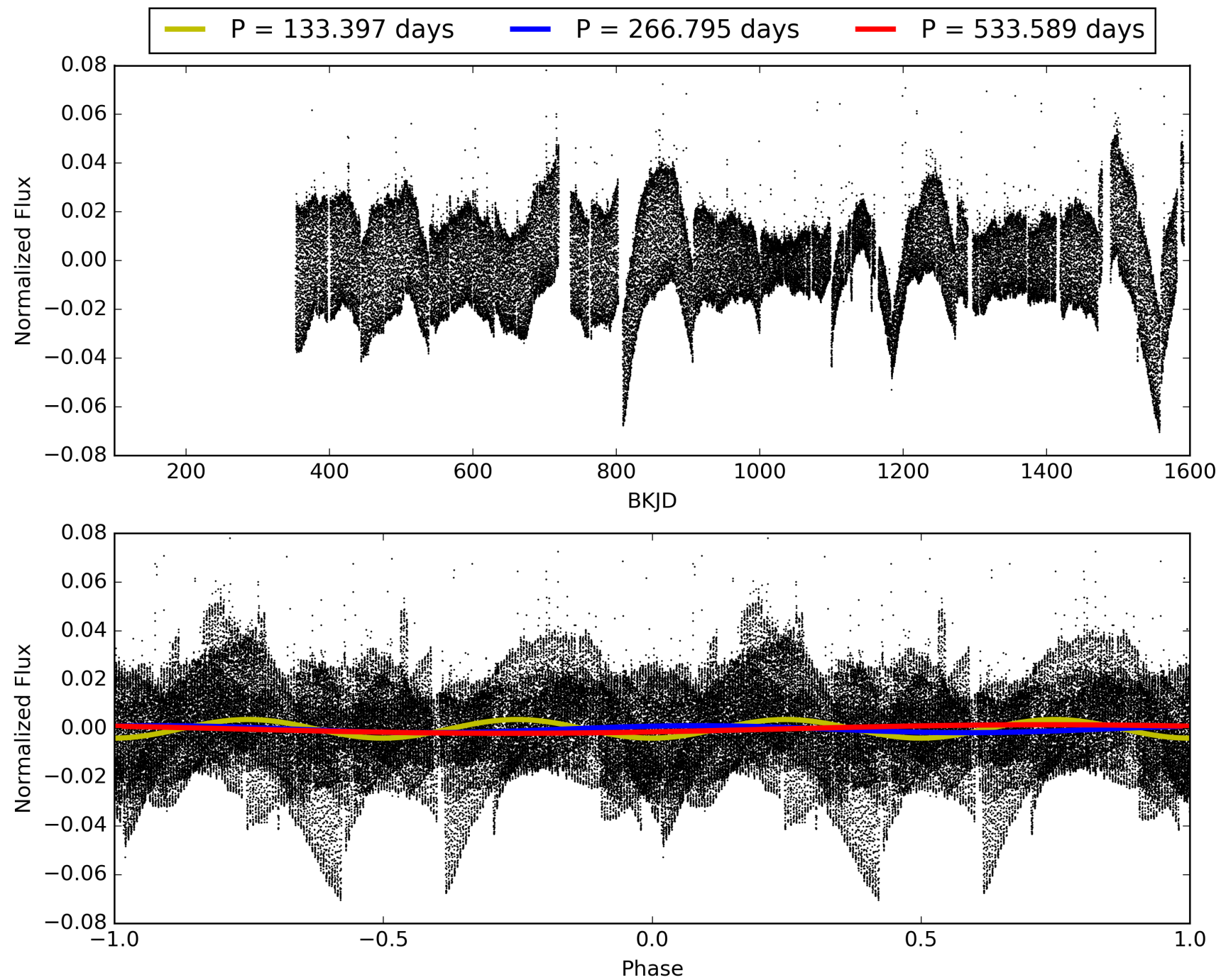
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [224.10σ]  
LongPeriod-sig: 100.0% [292.27σ]  
ModelChiSquare2-sig: 35.9%  
ModelChiSquareGof-sig: 98.1%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [5/5]  
GhostDiagnostic-chr: 0.9953  
Centroid-sig: 0.0%  
Centroid-so: 3.237 arcsec [5.57σ]  
OotOffset-rm: N/A  
KicOffset-rm: 0.321 arcsec [3.41σ]  
OotOffset-st: 0/0/0 [0]  
KicOffset-st: 1/1/2/0 [4]  
DiffImageQuality-fgm: 1.00 [4/4]  
DiffImageOverlap-fno: 0.75 [3/4]

# TCE 010412044-02, PDC Light Curves



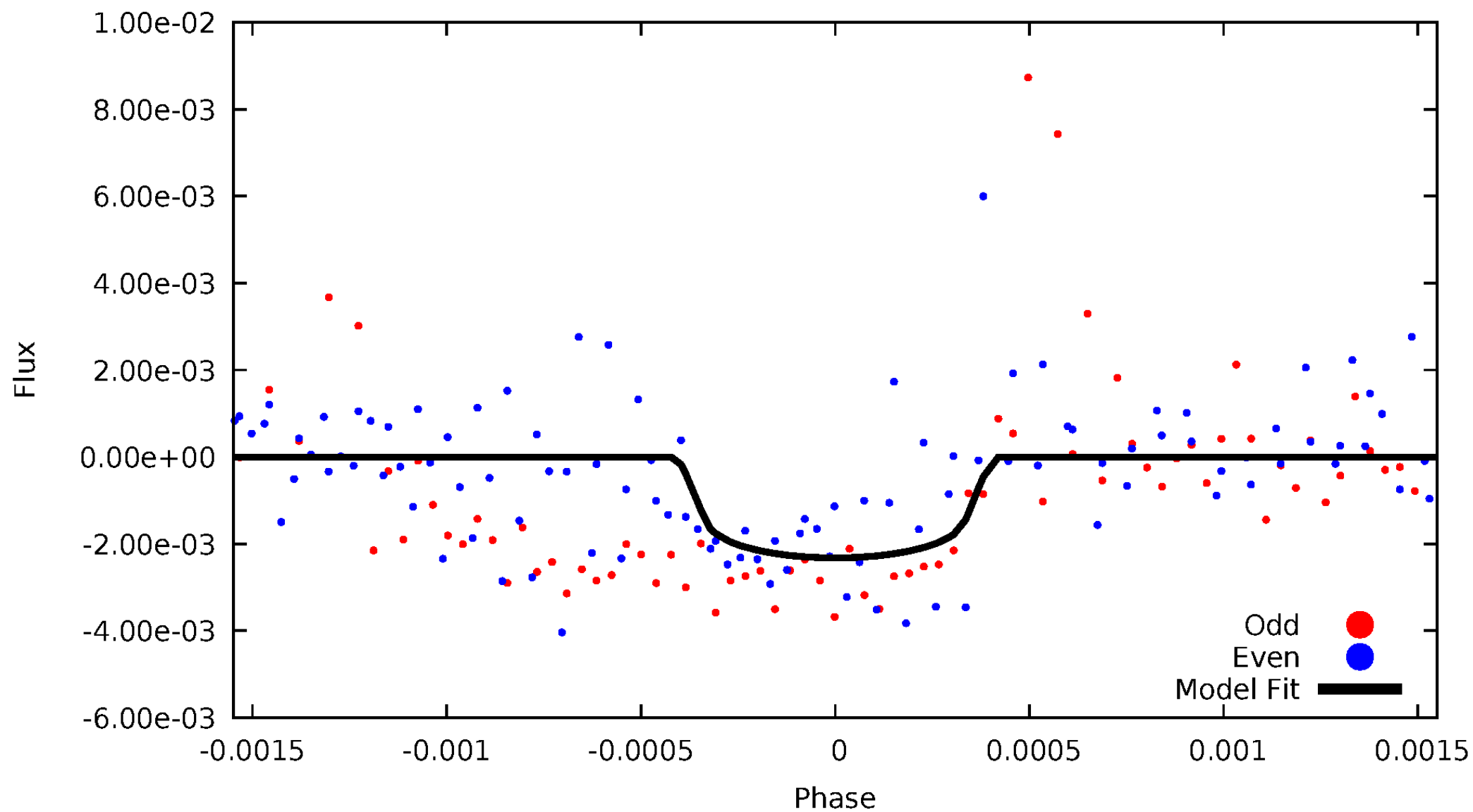
# TCE 010412044-02





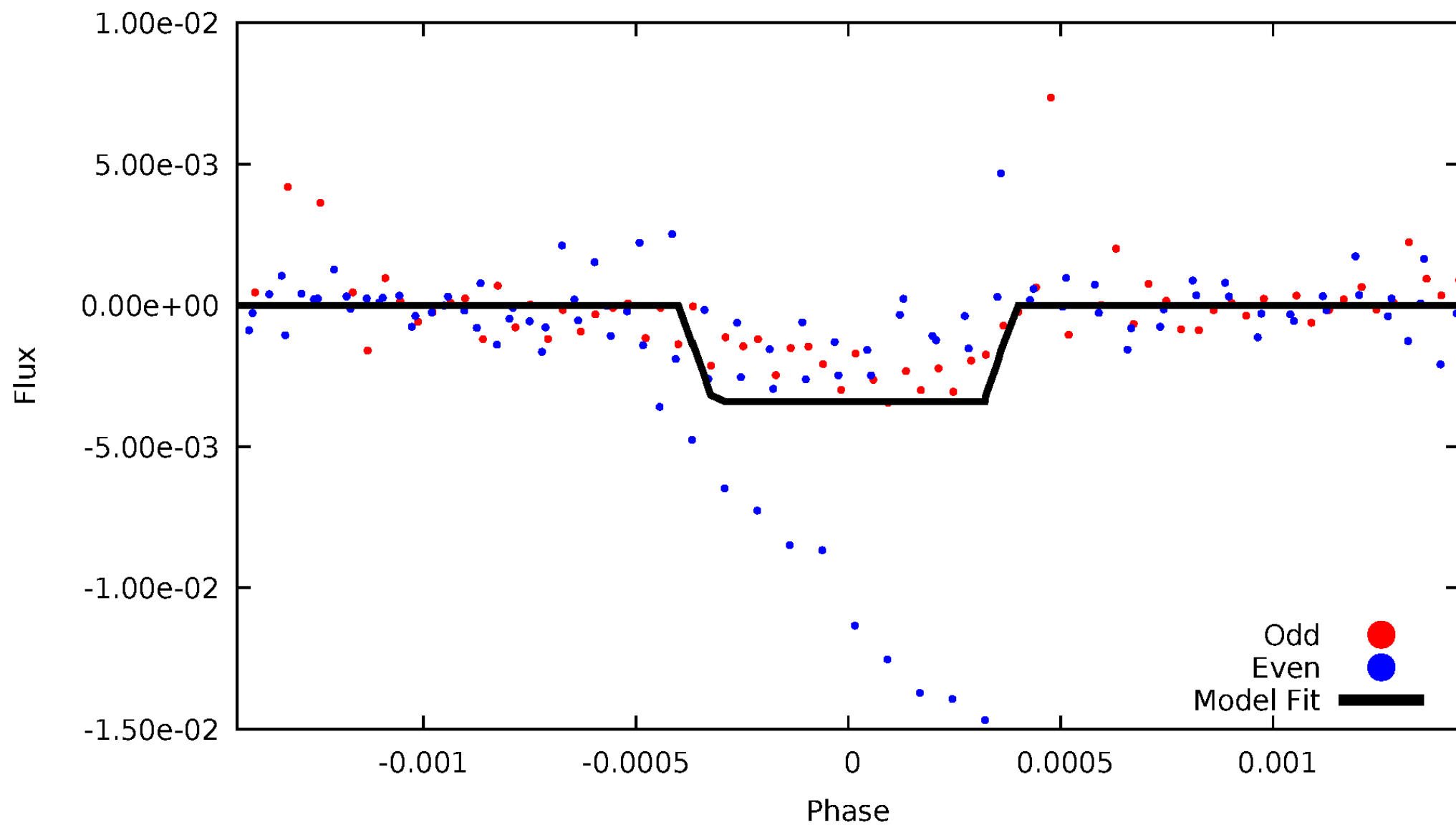
# DV Odd/Even

TCE 010412044-02



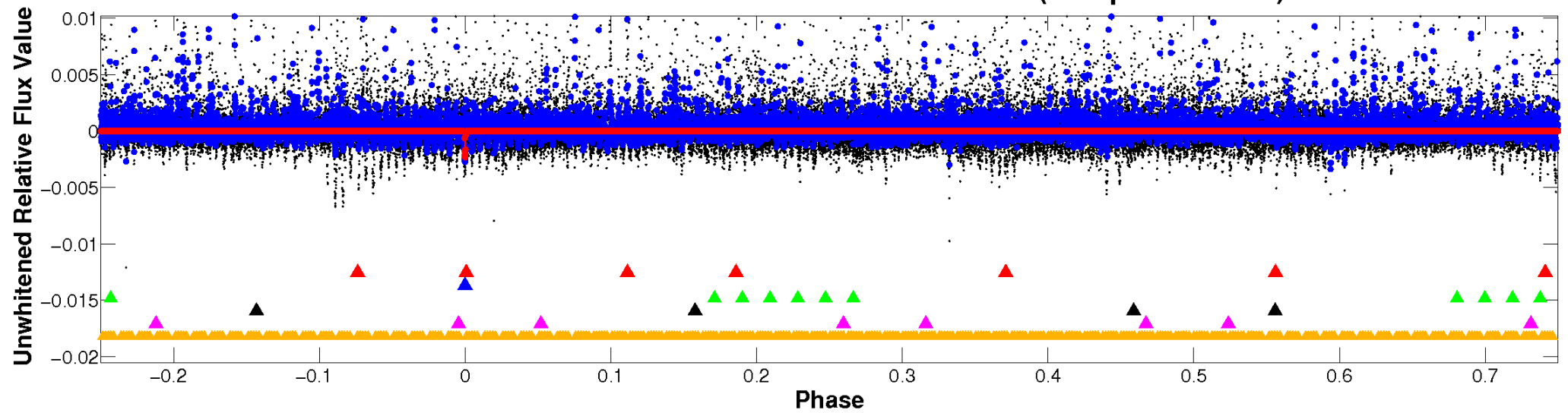
# ALT Odd/Even

TCE 010412044-02

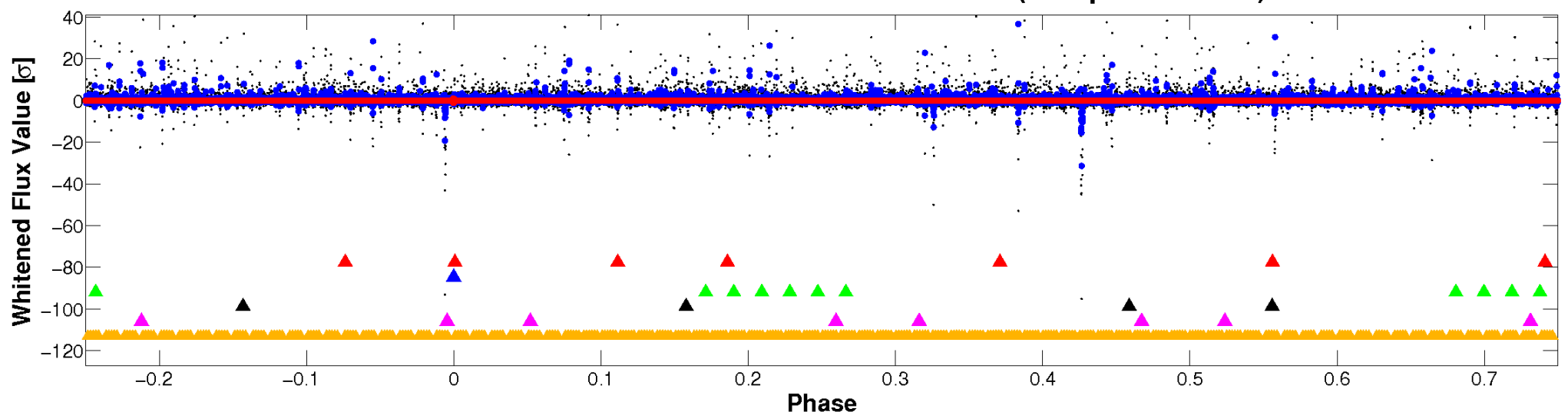


# Non-Whitened Vs. Whitened Light Curve

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

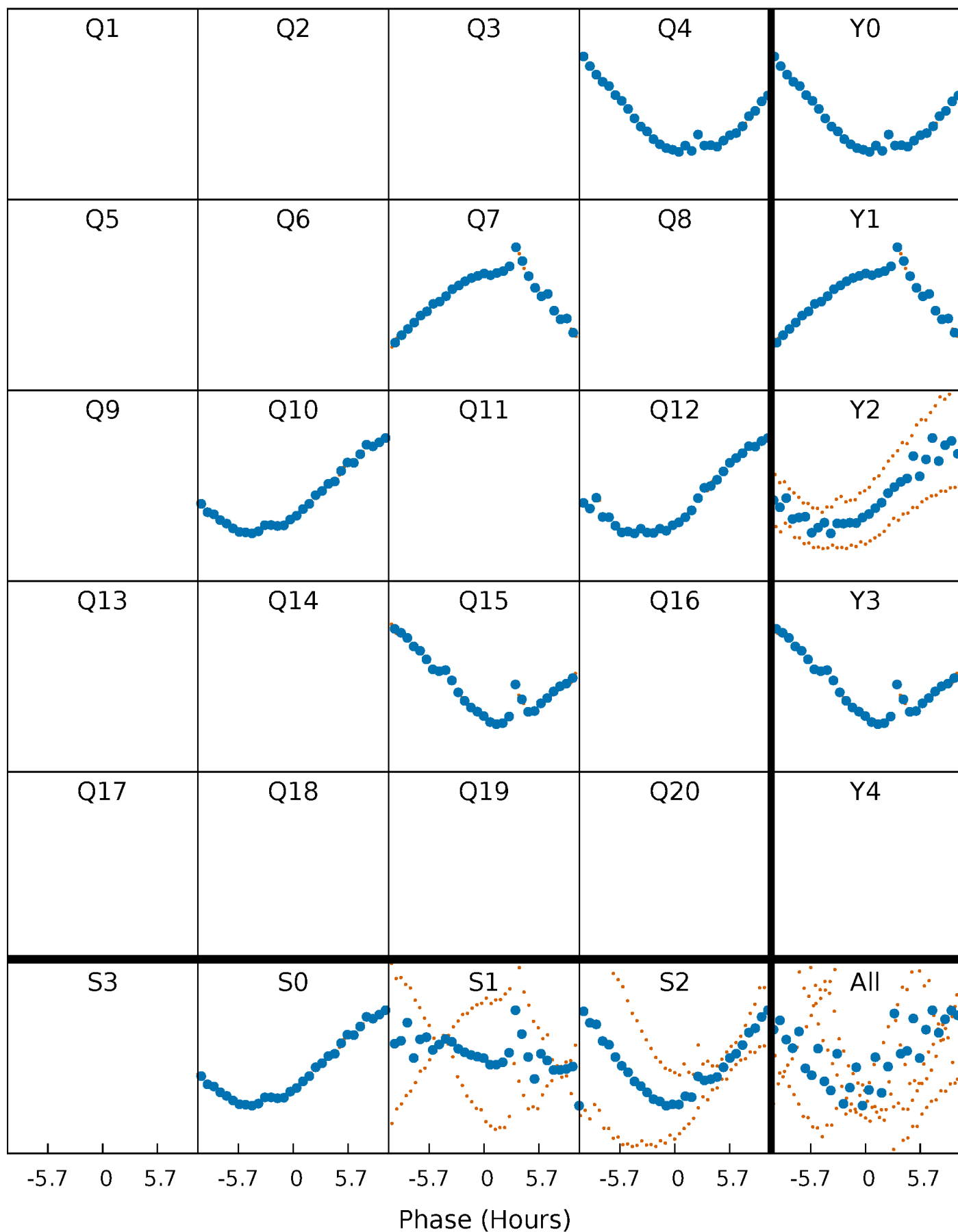


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



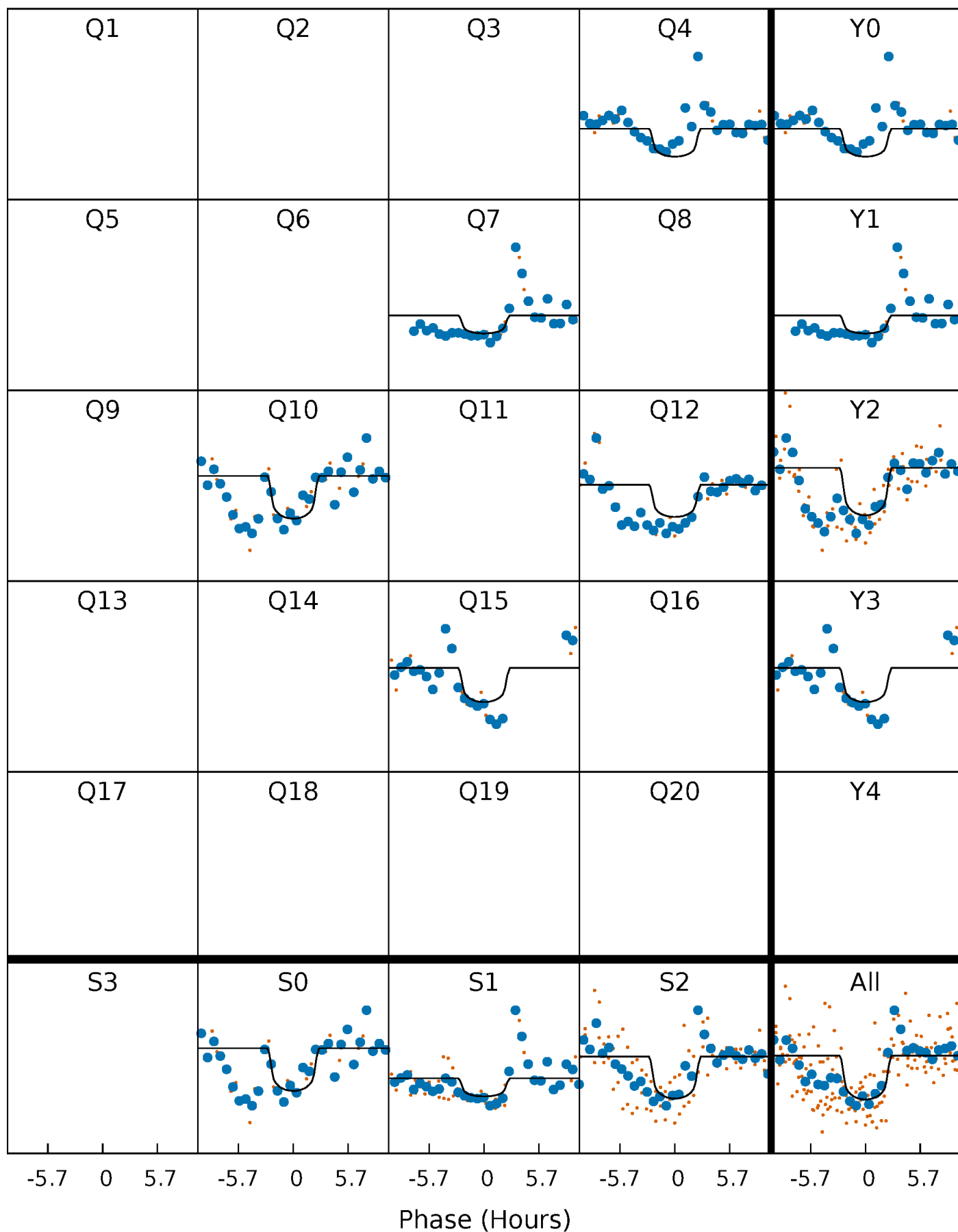
# PDC Quarter-Phased Transit Curves

TCE 010412044-02 P=266.794685 Days  $T_0=377.959858$  (BKJD)



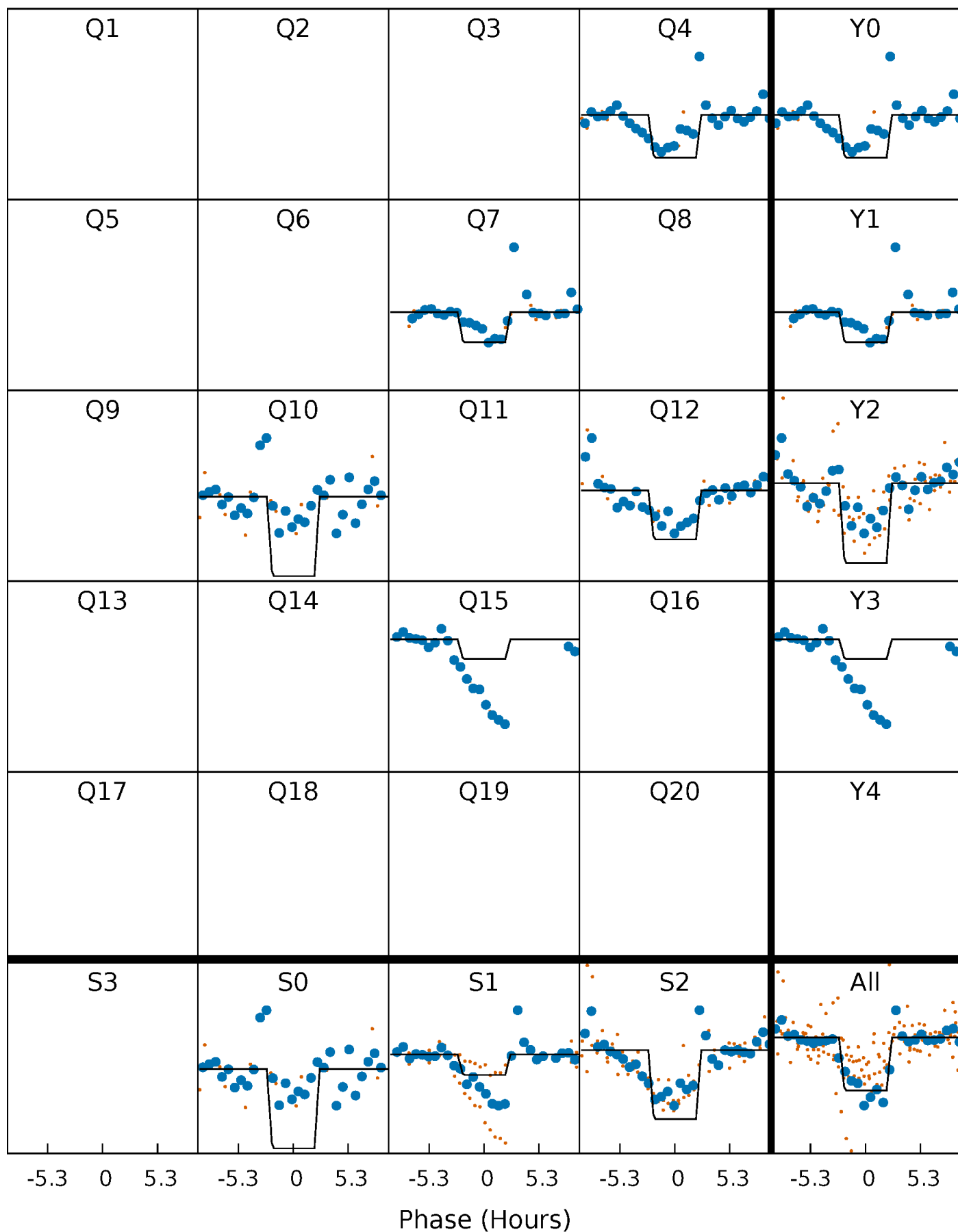
# DV Quarter-Phased Transit Curves

TCE 010412044-02 P=266.794685 Days  $T_0=377.959858$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

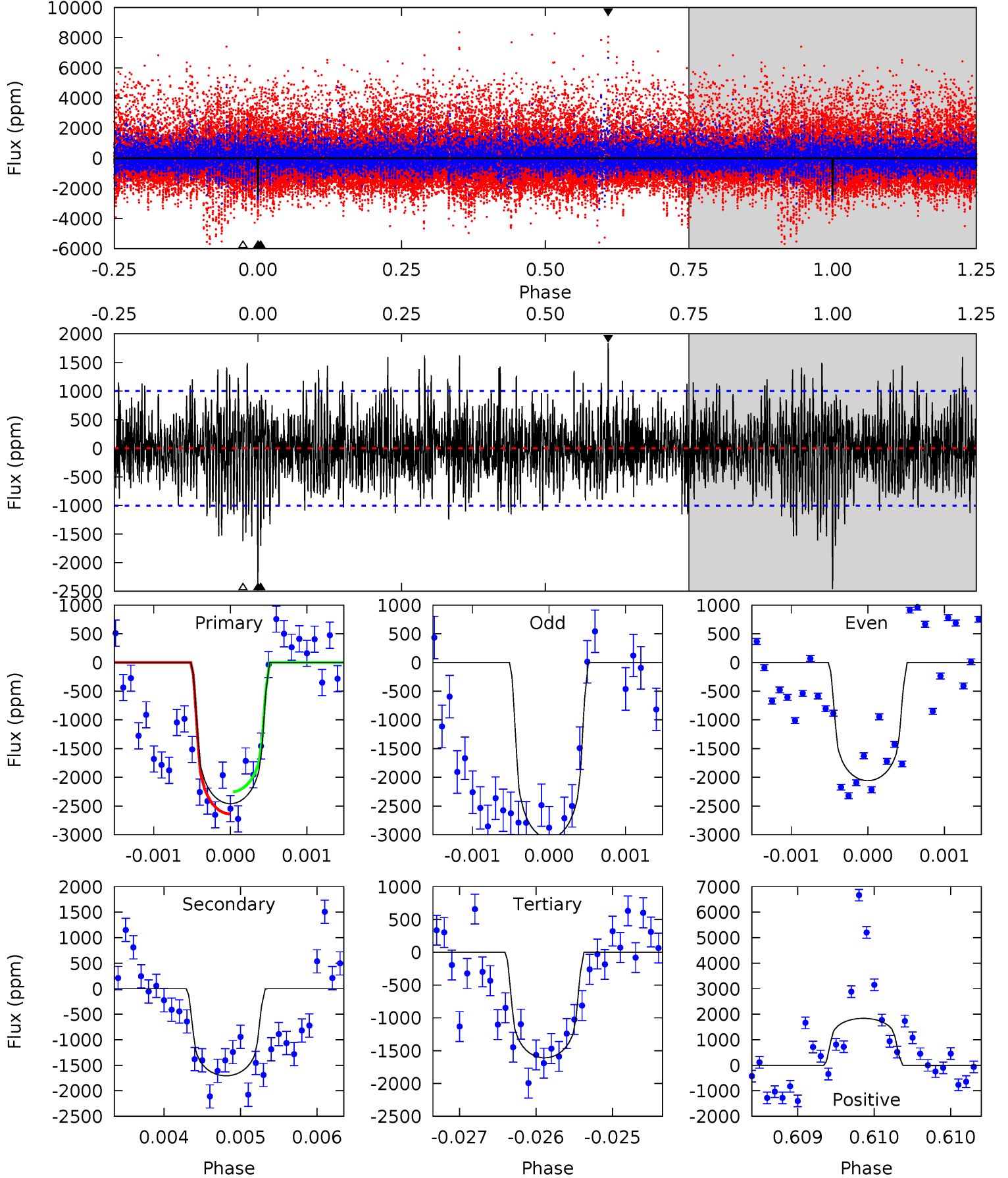
TCE 010412044-02 P=266.794182 Days  $T_0=377.965578$  (BKJD)



# DV Model-Shift Uniqueness Test

010412044-02, P = 266.794685 Days, E = 111.165173 Days

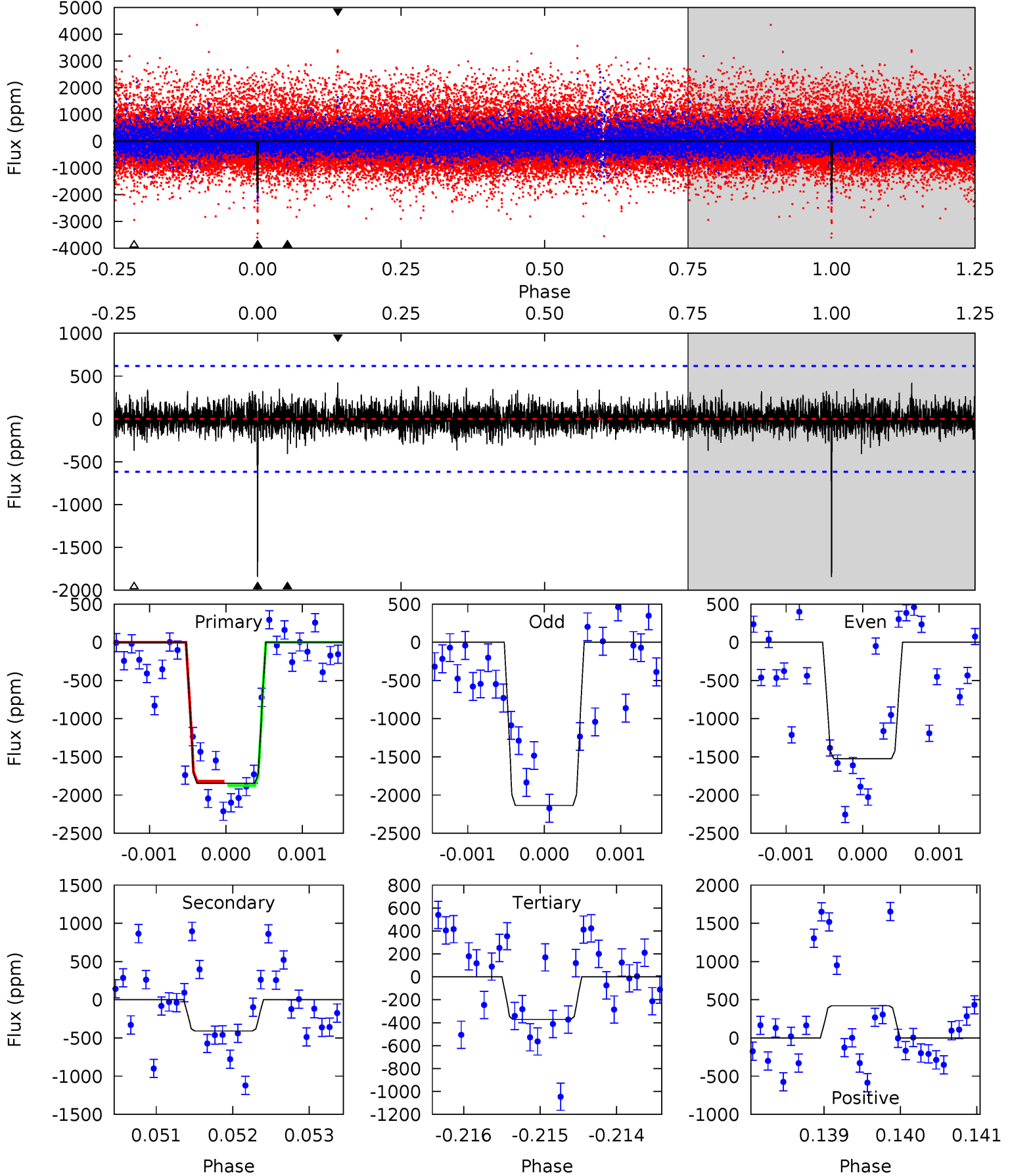
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
13.5	9.35	8.81	10.1	5.49	3.35	2.46	4.66	3.40	0.53	-0.72	2.27	0.85	0.43	1.06



# Alt Model-Shift Uniqueness Test

010412044-02, P = 266.794182 Days, E = 111.171396 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
16.4	3.63	3.31	3.76	5.50	3.36	0.84	13.1	12.7	0.33	-0.13	2.66	1.70	0.19	0.25





### Stellar Parameters For KIC 010412044

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (g \cdot \text{cm}^{-3})$
	$3651^{+73}_{-73}$	$4.802^{+0.048}_{-0.032}$	$-0.100^{+0.100}_{-0.100}$	$0.446^{+0.036}_{-0.044}$	$0.461^{+0.034}_{-0.042}$	$7.297^{+1.807}_{-1.001}$
	+2%/-2%	+1%/-1%	+100%/-100%	+8%/-10%	+7%/-9%	+25%/-14%
Source	PHO2	PHO2	PHO2	DSEP		

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

### Secondary Eclipse Parameters for KIC 010412044-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-1707 \pm 183$	$2.89^{+2.23}_{-1.88}$	$189^{+5}_{-5}$	$3263^{+1474}_{-510}$	$44499^{+329640}_{-30653}$
Alt.	$-408 \pm 112$	$3.08^{+2.49}_{-1.90}$	$189^{+5}_{-5}$	$2610^{+794}_{-343}$	$9029^{+50275}_{-6265}$

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

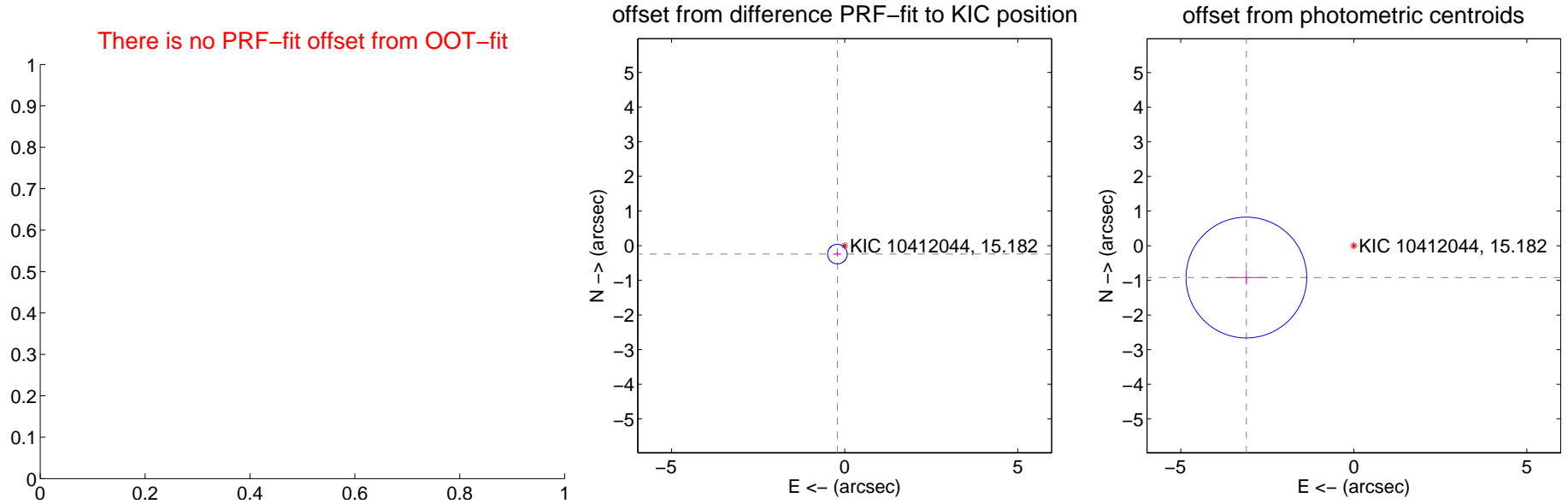
## DV Centroid Data

Supplemental centroid analysis for 010412044-02. Kepler magnitude: 15.18. Transit SNR 6.80

There are 4 quarters with good PRF difference image offsets

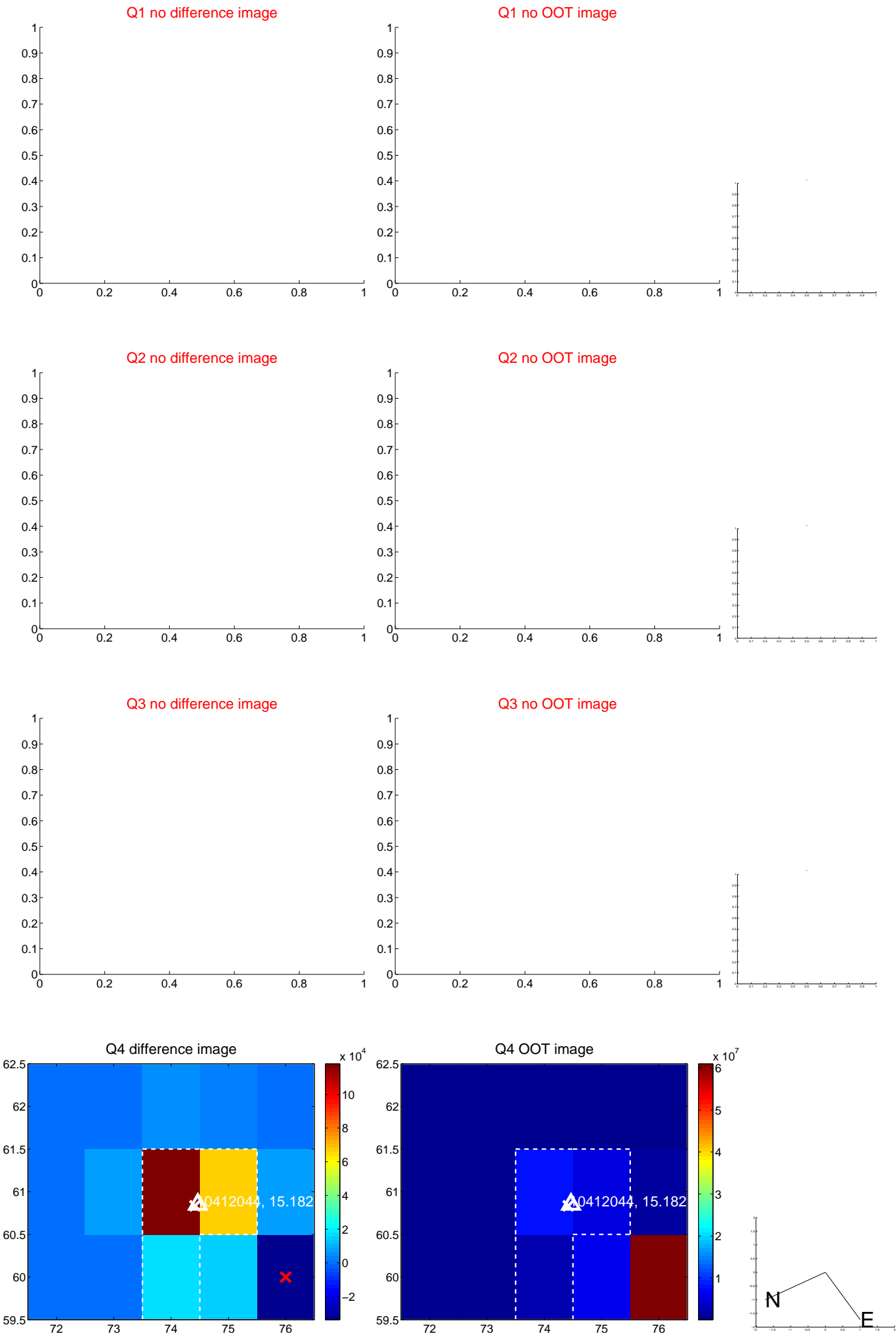
The direct PRF centroid is offset from the target star catalog position by about NaN arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	—	—	—	—
PRF-fit source offset from KIC position	$0.321 \pm 0.094$	3.41	$0.210 \pm 0.116$	$-0.243 \pm 0.074$
photometric centroid source offset	$3.24 \pm 0.58$	5.57	$3.10 \pm 0.60$	$-0.92 \pm 0.21$



Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three- $\sigma$ . Red \*: target star. Blue \*: Other stars. Text next to a star gives its KIC ID and kepmag. KIC IDs > 15,000,000 are from the UKIRT catalog.

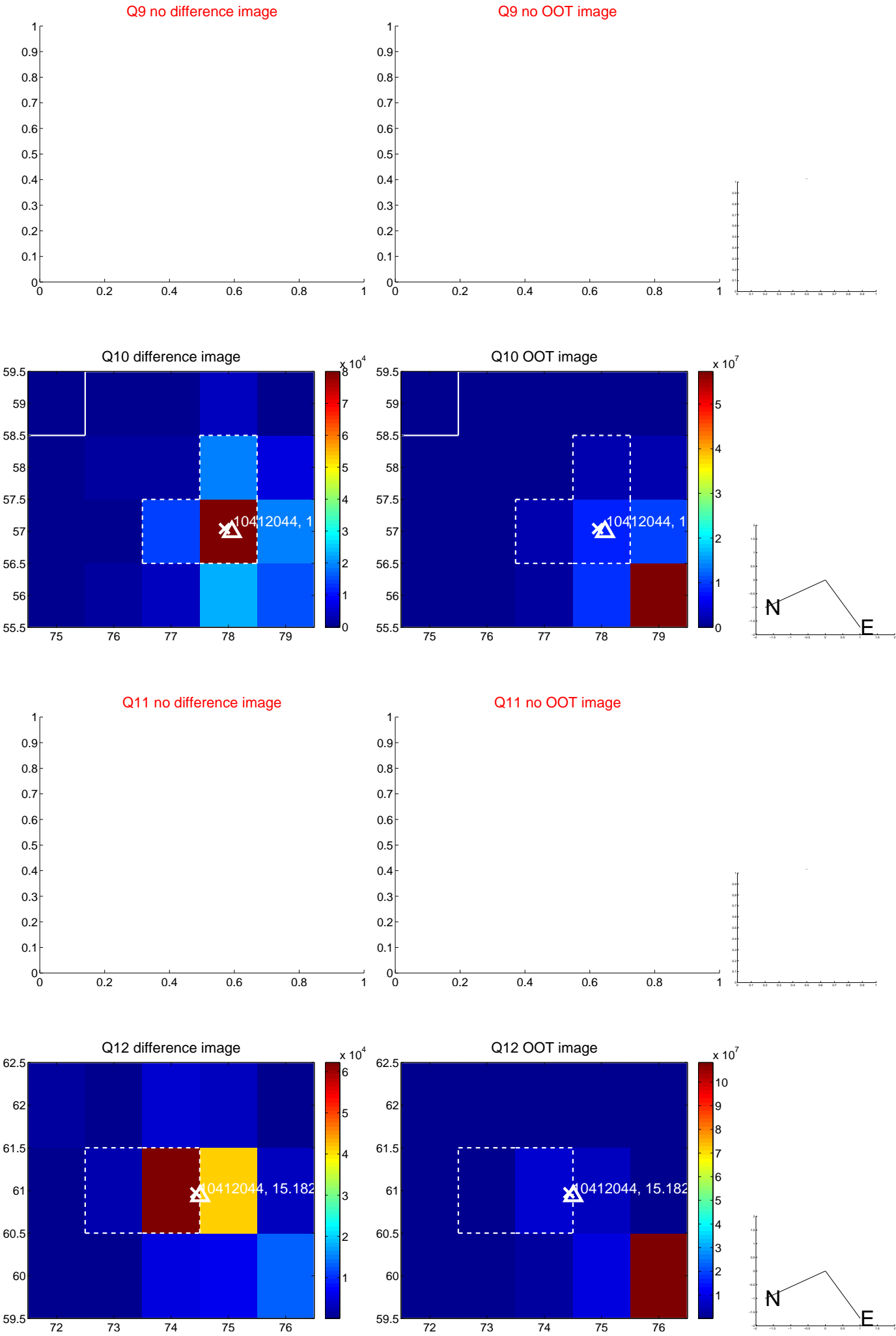
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



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

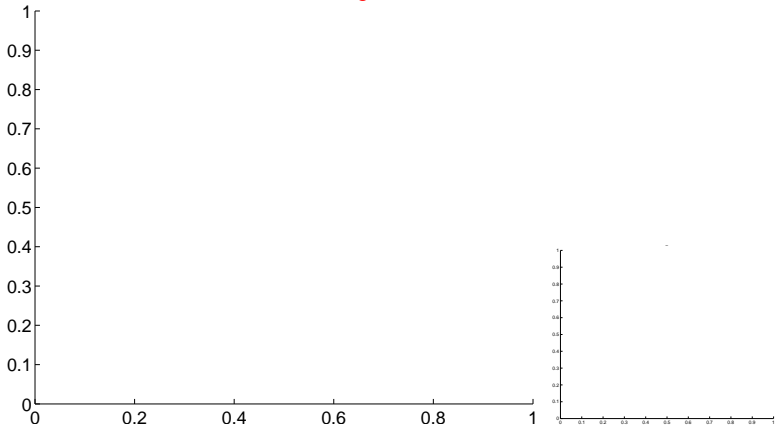


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

Q13 no difference image



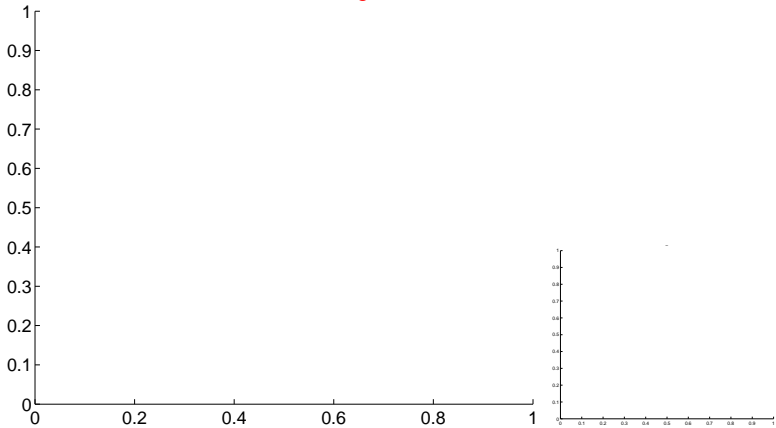
Q13 no OOT image



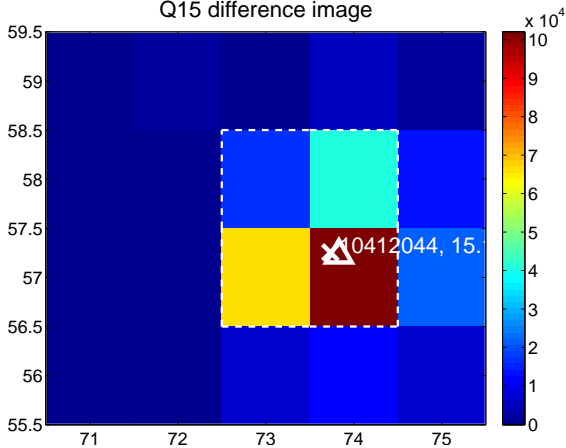
Q14 no difference image



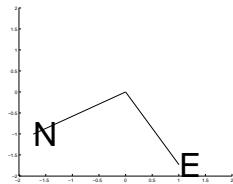
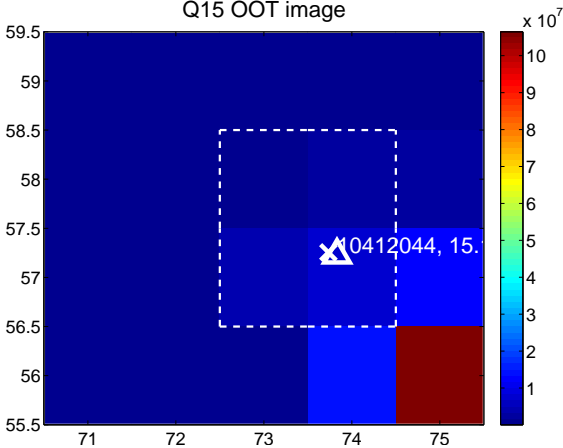
Q14 no OOT image



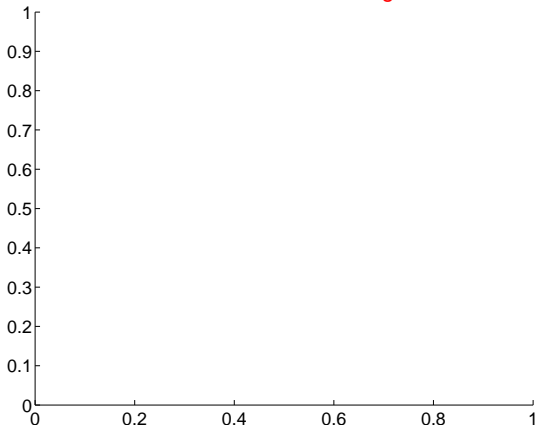
Q15 difference image



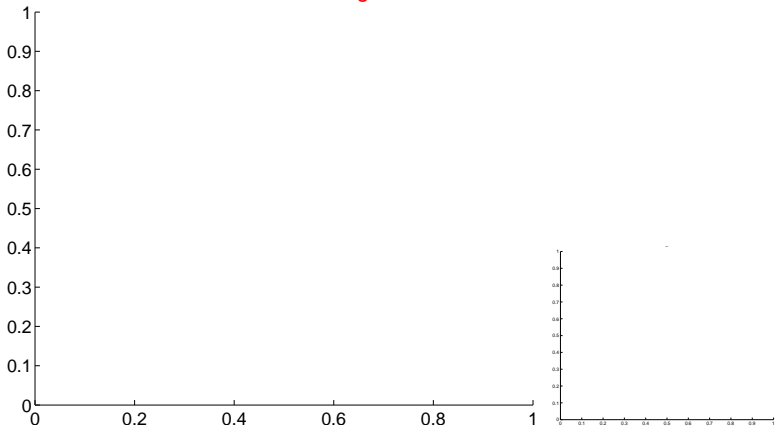
Q15 OOT image



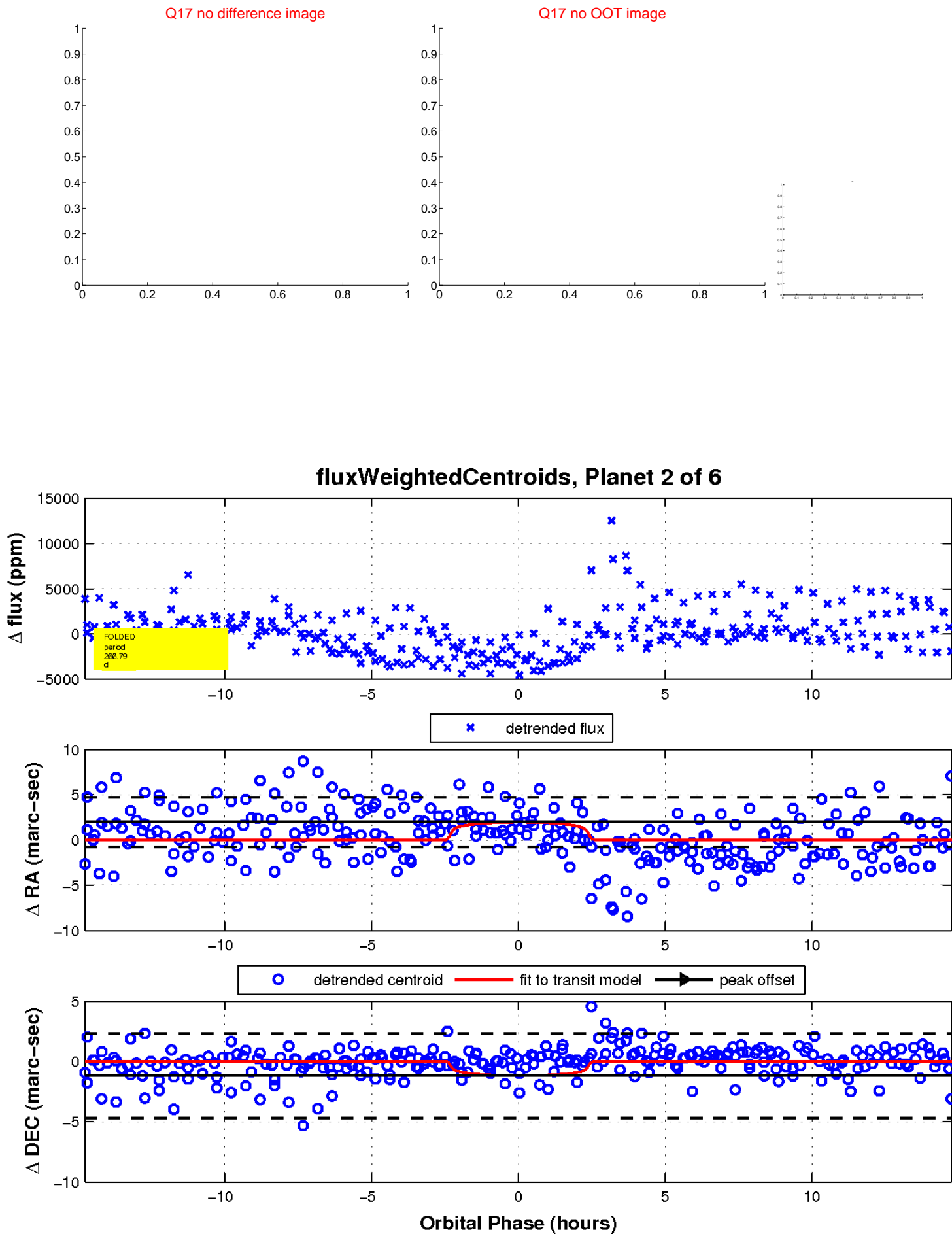
Q16 no difference image



Q16 no OOT image



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



Declination



# KIC 010412044

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
010412044-01	OBS	No	217.410359	140.894954	2536.3	1.840	13.1	8.0	0.45	3651	2.45	0.11
010412044-02	OBS	No	266.794685	377.959858	2321.4	4.958	11.1	6.8	0.45	3651	2.13	0.08
010412044-03	OBS	No	135.936292	156.835508	1625.7	5.173	11.0	6.7	0.45	3651	2.13	0.20
010412044-04	OBS	No	347.092671	259.473532	3168.1	4.346	10.4	7.7	0.45	3651	2.63	0.06
010412044-05	OBS	No	196.325909	195.517815	2079.5	3.049	10.9	8.4	0.45	3651	2.19	0.12
010412044-06	OBS	No	3.328827	133.848494	1333.0	1.500	8.1	-1.0	0.45	3651	1.62	27.91

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
010412044-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL_TRACKER—LPP_ALT—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS
010412044-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_CHASES_MARSHALL—ALL_TRANS_CHASES—CENT_FEW_MEAS
010412044-03	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—CENT_FEW_DIFFS
010412044-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
010412044-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL_SKYE—LPP_DV—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—CENT_FEW_DIFFS
010412044-06	OBS	FP	0.00	1	0	0	0	LPP_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_NOFITS

**Notes:** OBS = Observed. INJ = Injected. INV = Inverted. SCR = Scrambled.

N = Not Transit-Like. S = Stellar Eclipse. C = Centroid Offset. E = Ephemeris Match.

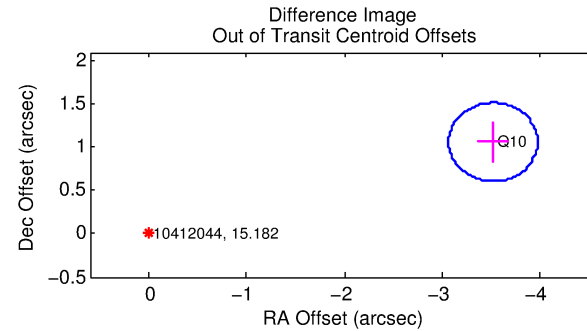
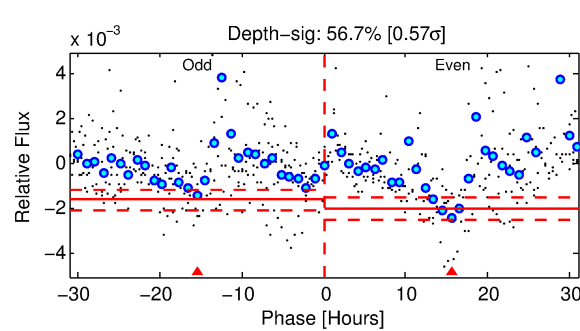
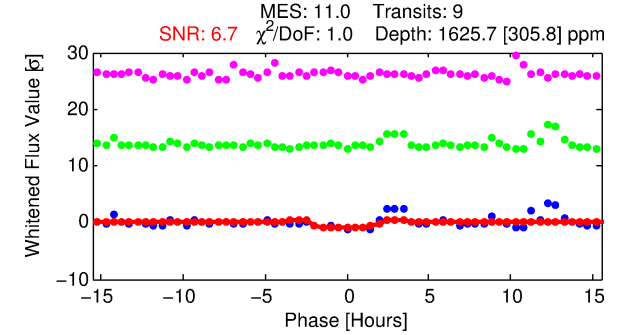
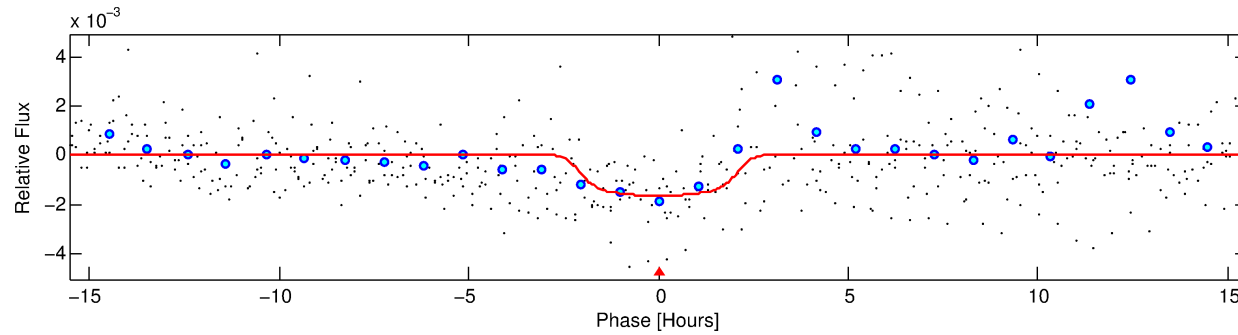
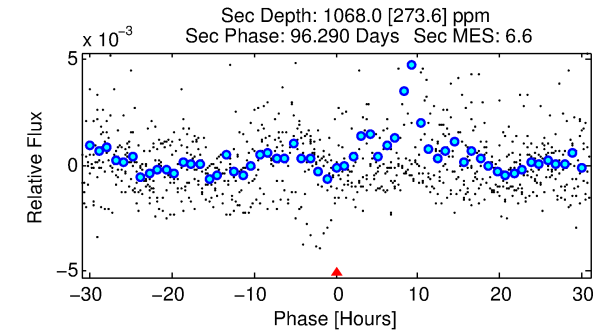
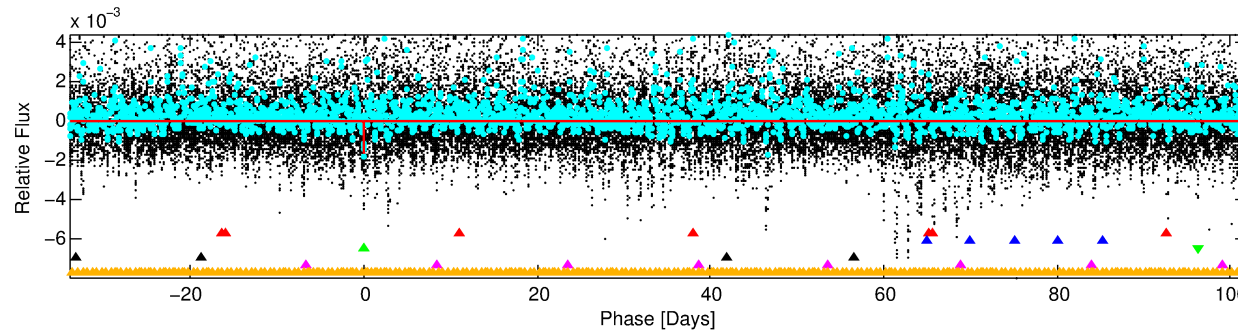
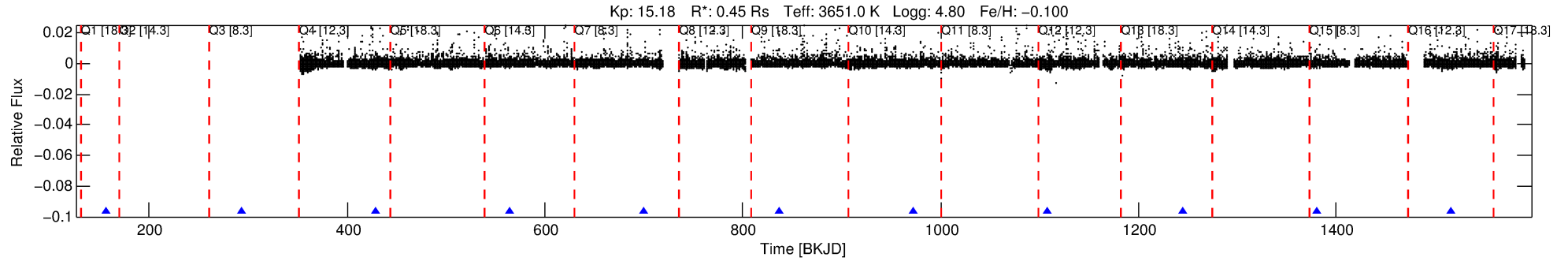
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 010412044-03

No Significant Match Found

# DV One-Page Summary

KIC: 10412044 Candidate: 3 of 6 Period: 135.936 d



## DV Fit Results:

Period = 135.93629 [0.00243] d  
Epoch = 156.8355 [0.0160] BKJD  
Rp/R\* = 0.0437 [0.0061]  
a/R\* = 108.37 [38.46]  
b = 0.89 [0.08]  
Seff = 0.20 [0.03]  
Teff = 170 [5] K  
Rp = 2.13 [0.36] Re  
a = 0.3995 [0.0301] AU  
Ag = 20725.75 [8089.14] [2.56 sigma]  
Teffp = 3157 [305] K [9.80 sigma]

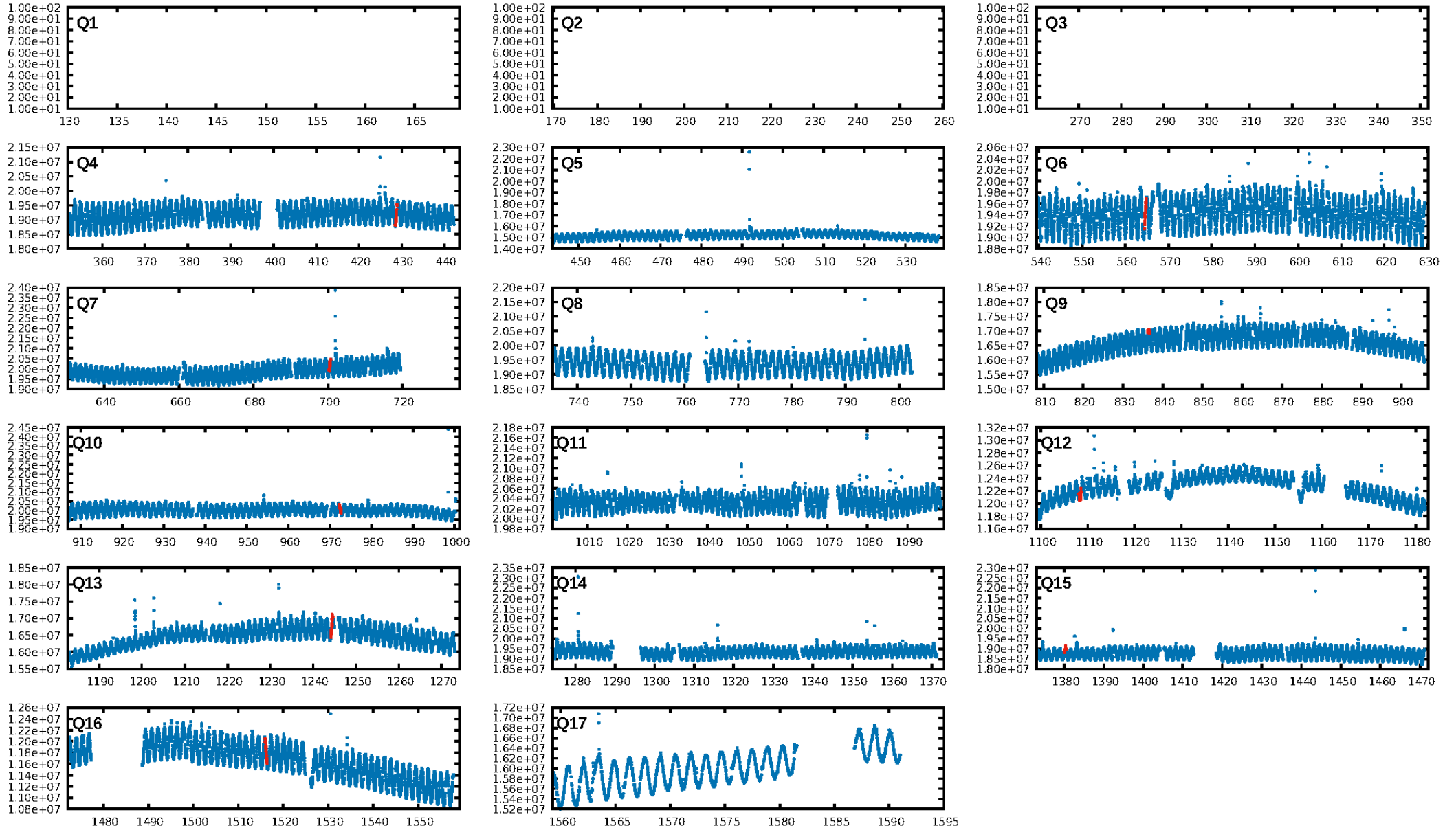
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [590.94 sigma]  
LongPeriod-sig: 100.0% [241.38 sigma]  
ModelChiSquare2-sig: 51.5%  
ModelChiSquareGoF-sig: 99.7%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [9/9]  
GhostDiagnostic-chr: 0.3583  
Centroid-sig: 12.5%  
Centroid-so: 3.459 arcsec [5.71 sigma]  
OotOffset-rm: 3.677 arcsec [24.24 sigma]  
KicOffset-rm: 0.366 arcsec [1.91 sigma]  
OotOffset-st: 1/0/0/0 [1]  
KicOffset-st: 2/2/2/1 [7]  
DiffImageQuality-fgm: 0.29 [2/7]  
DiffImageOverlap-fno: 0.75 [6/8]

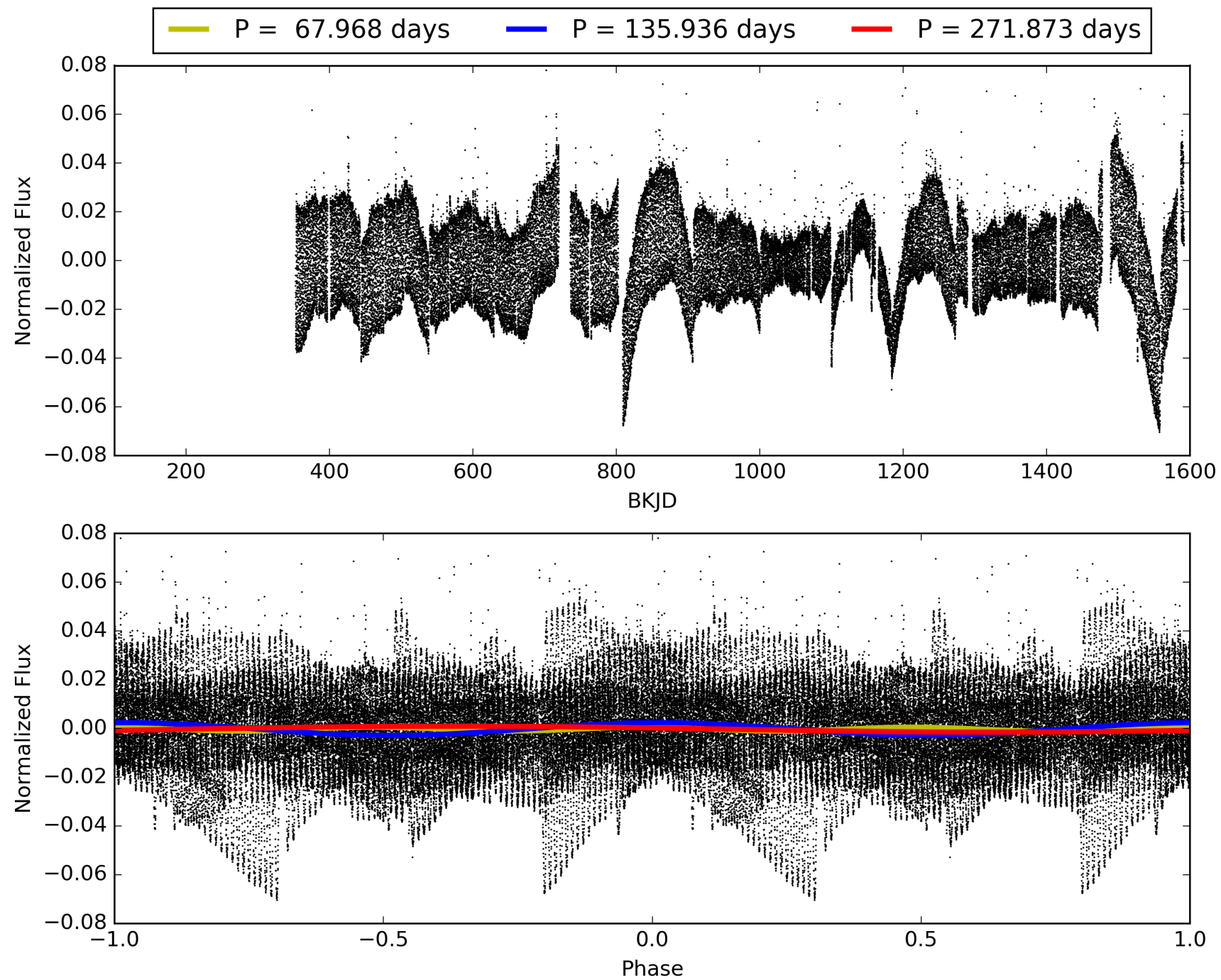
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 01:06:03 Z

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

# TCE 010412044-03, PDC Light Curves

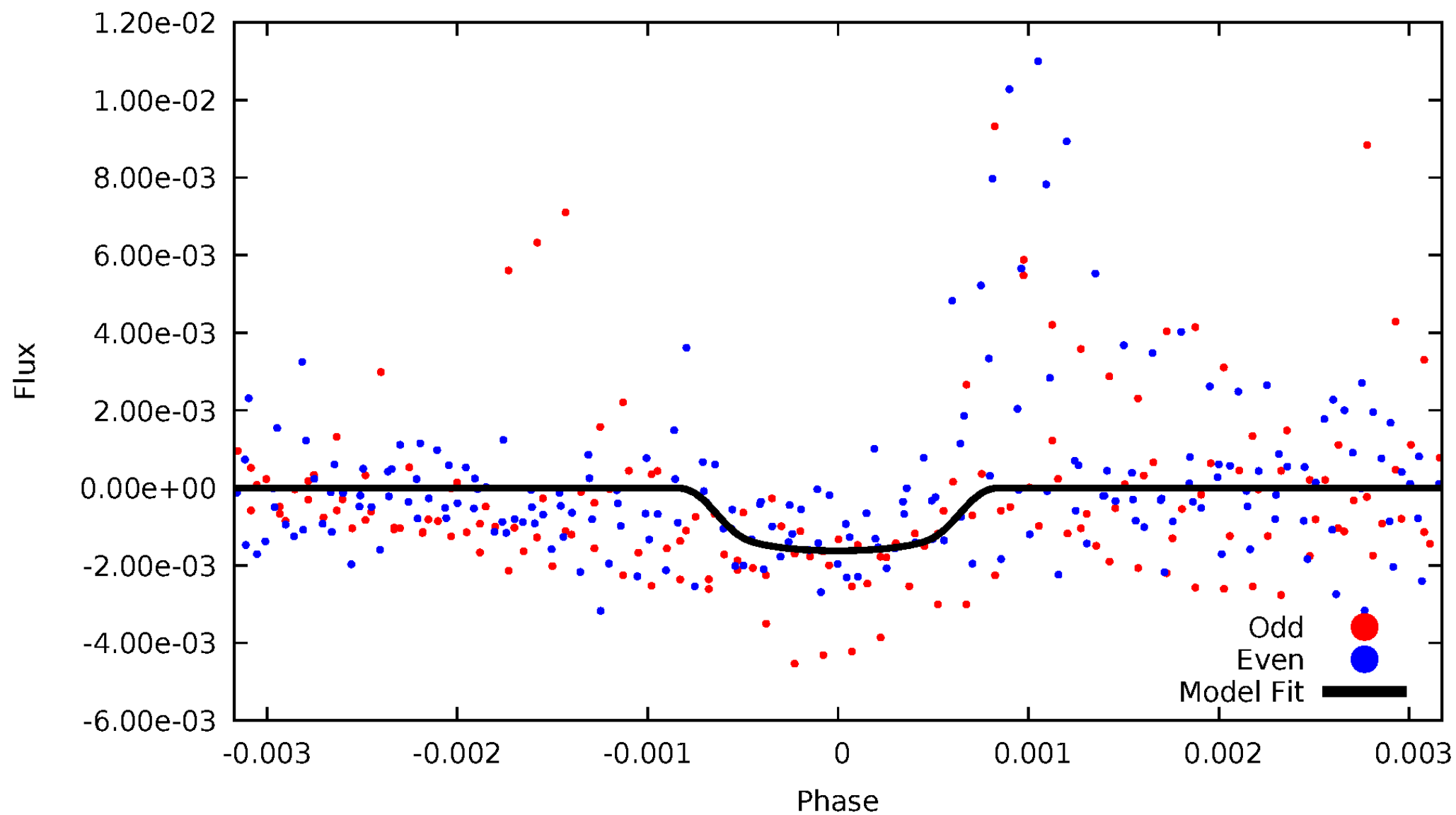


# TCE 010412044-03



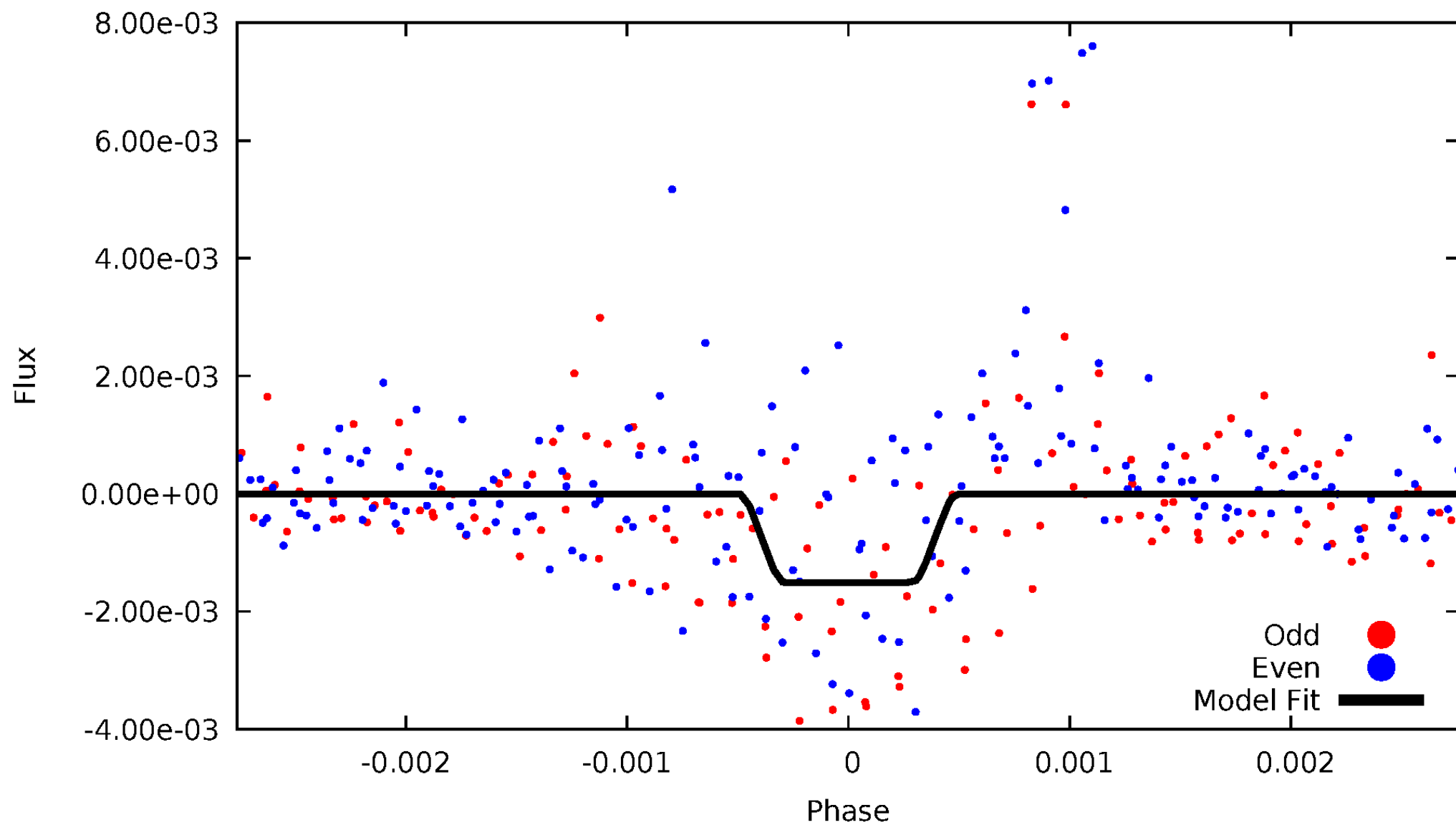
# DV Odd/Even

TCE 010412044-03



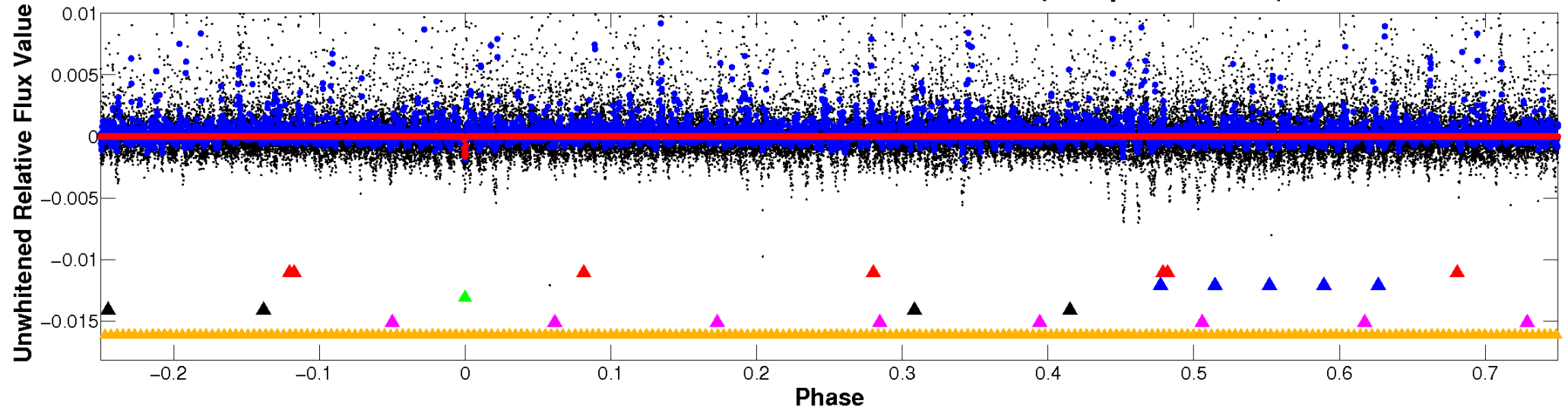
# ALT Odd/Even

TCE 010412044-03

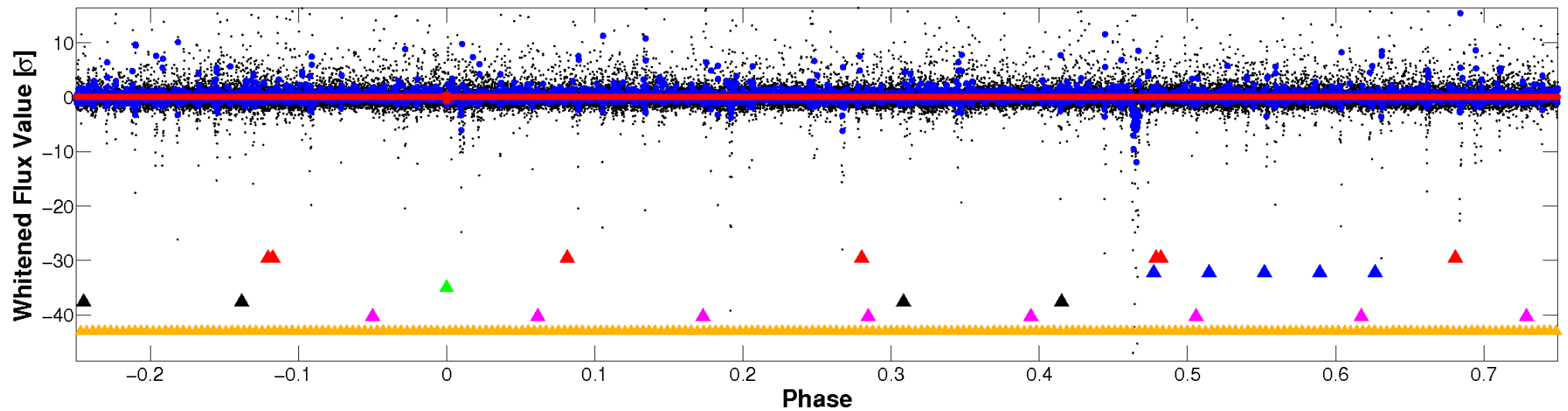


# Non-Whitened Vs. Whitened Light Curve

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

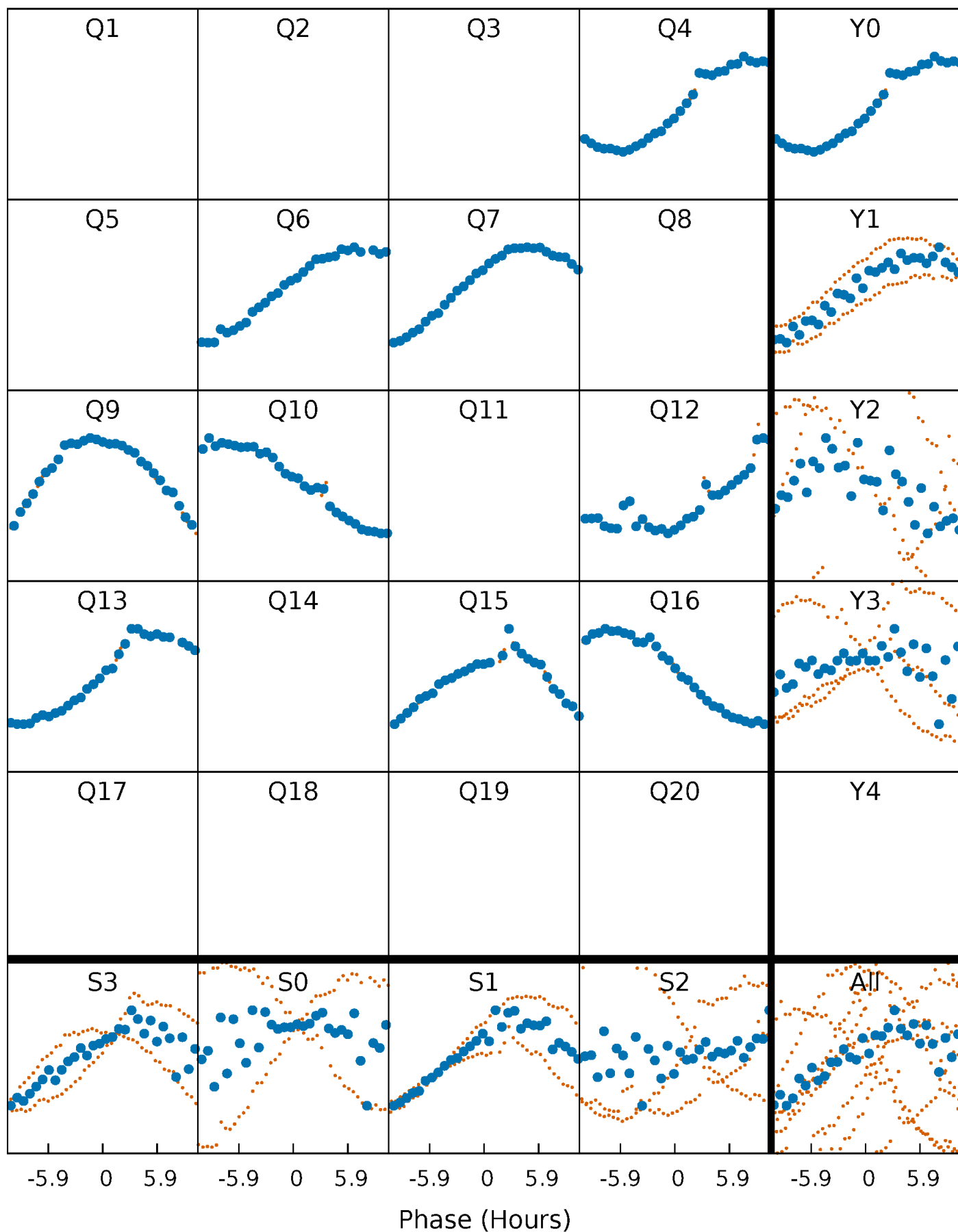


Planet 3 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

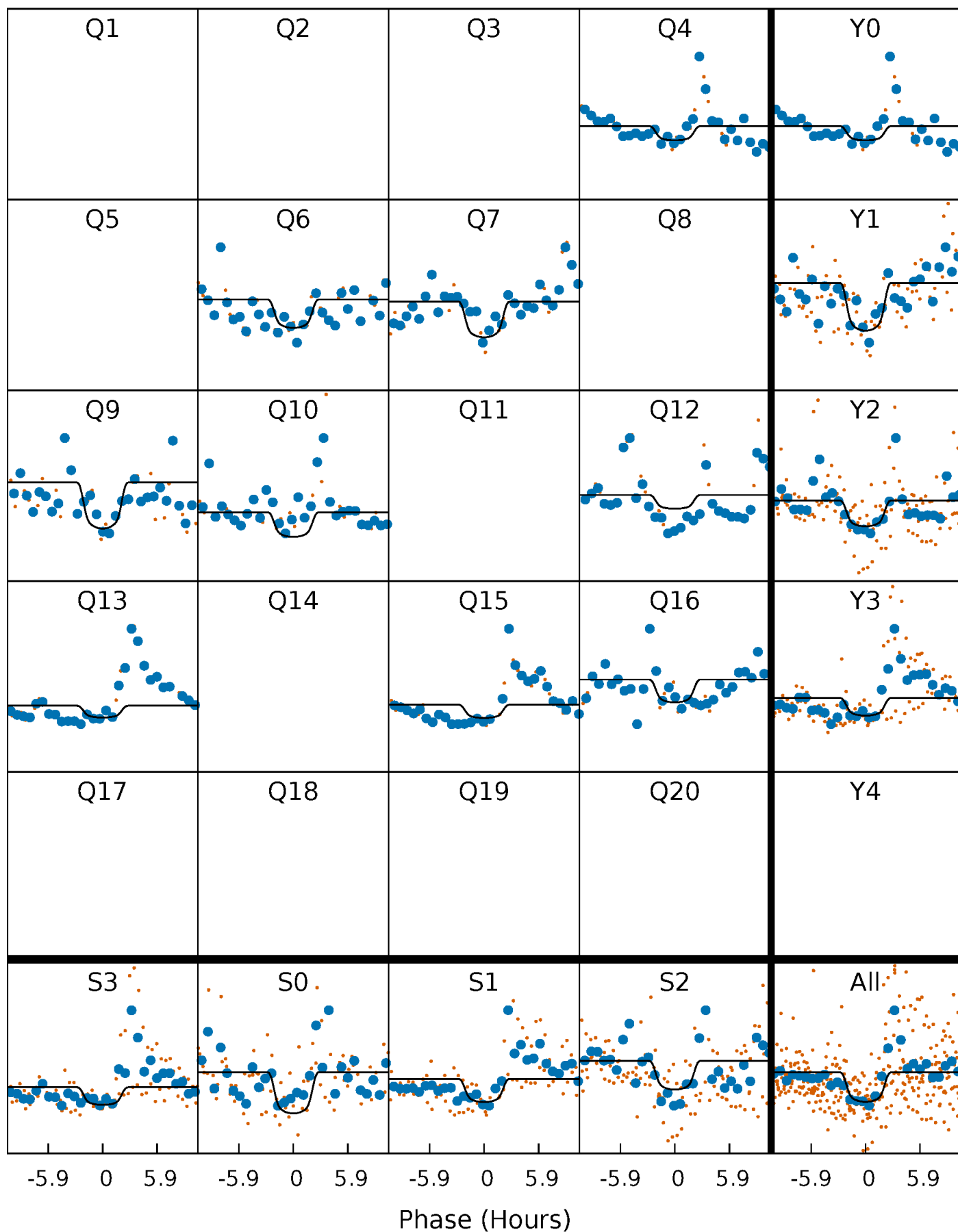
TCE 010412044-03 P=135.936292 Days  $T_0=156.835508$  (BKJD)





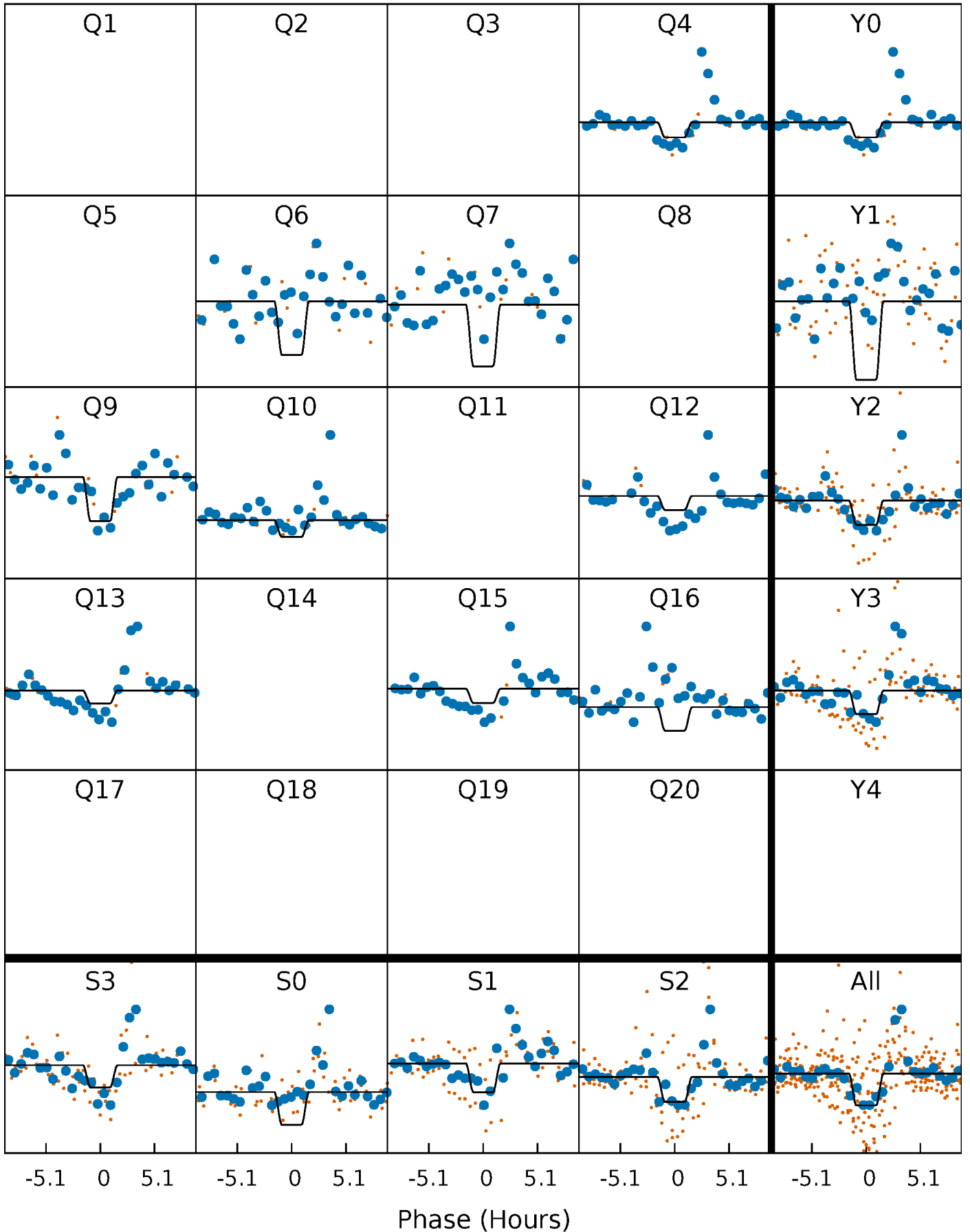
# DV Quarter-Phased Transit Curves

TCE 010412044-03 P=135.936292 Days  $T_0=156.835508$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

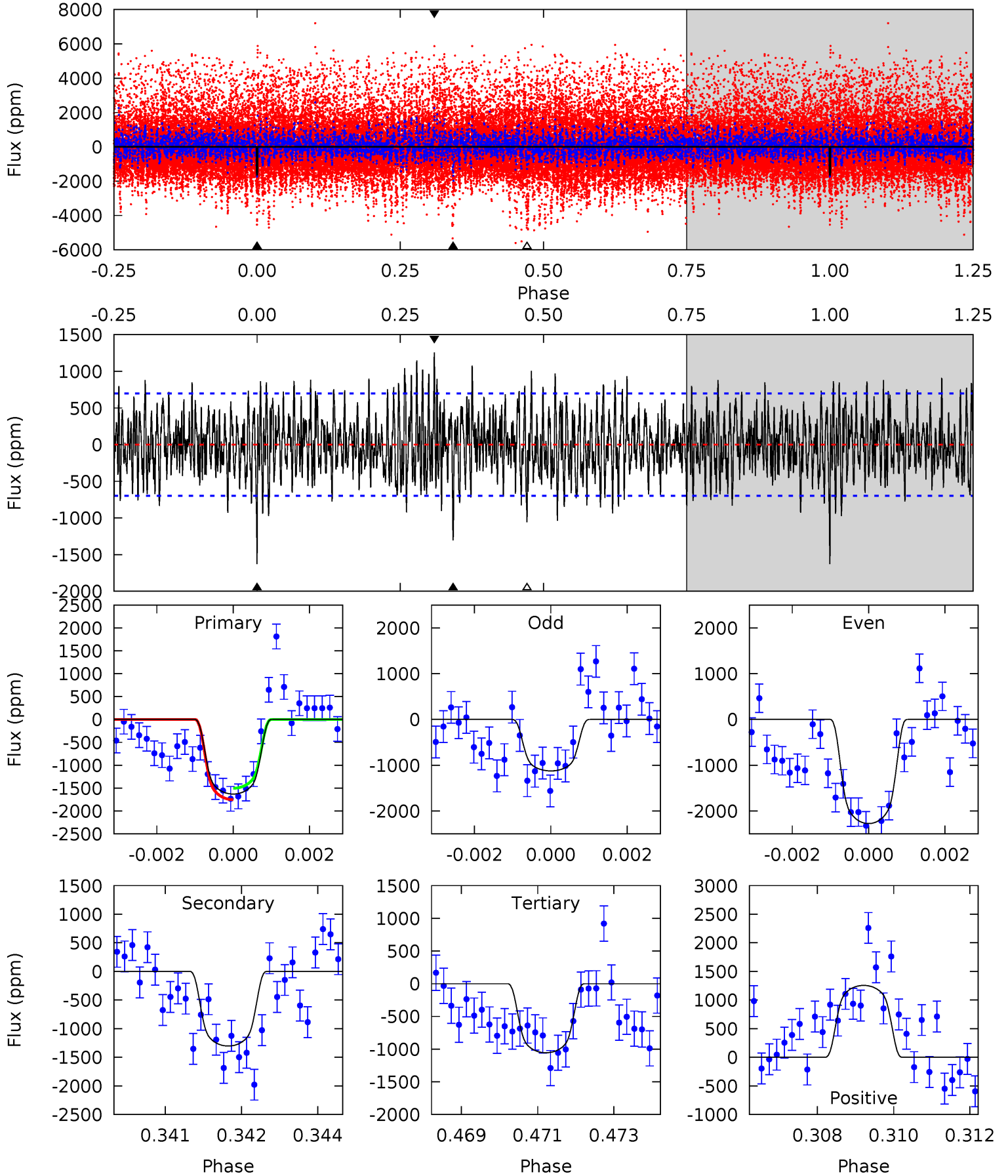
TCE 010412044-03 P=135.936588 Days  $T_0=156.832446$  (BKJD)



# DV Model-Shift Uniqueness Test

010412044-03, P = 135.936292 Days, E = 156.835508 Days

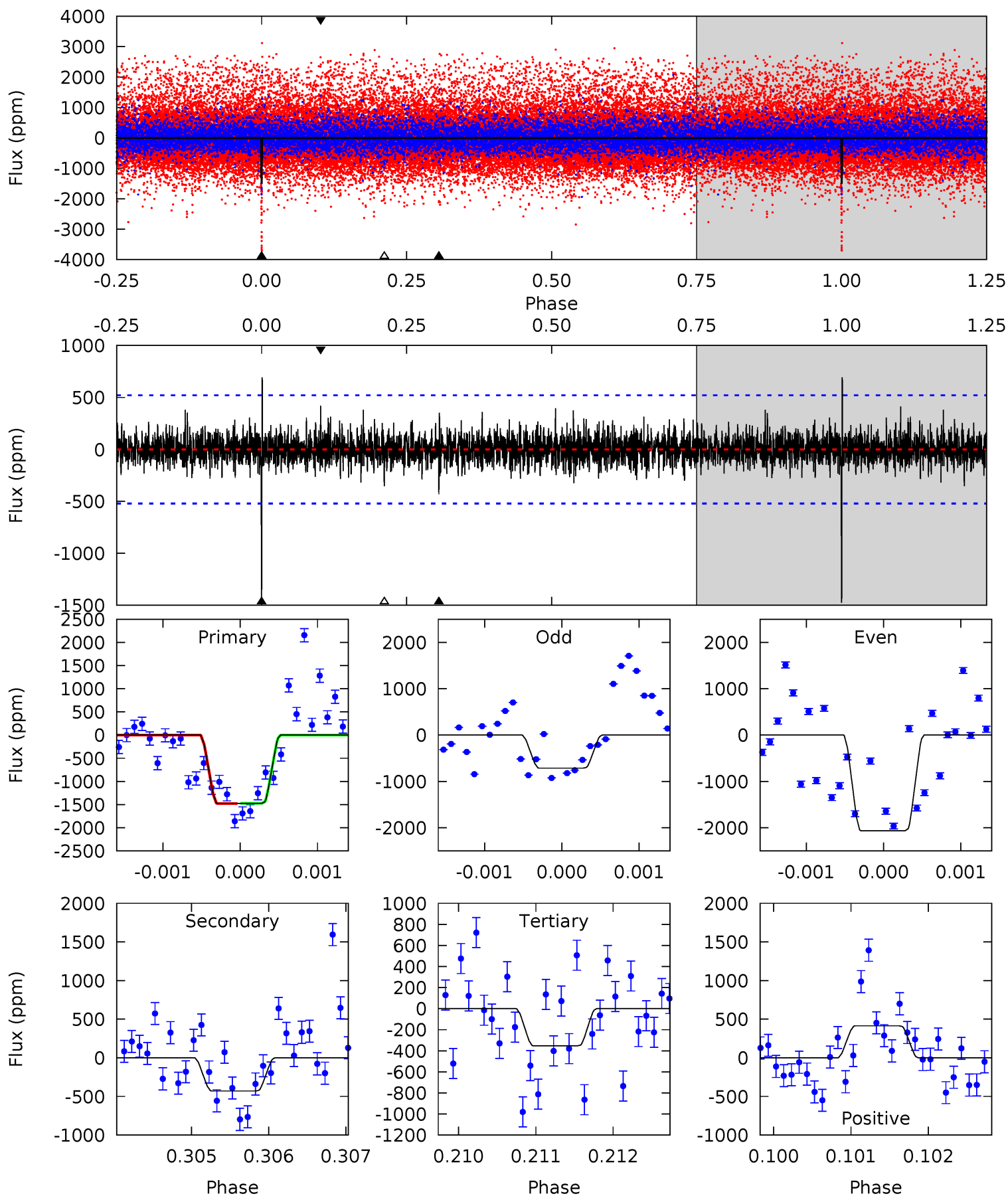
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
12.5	10.00	8.10	9.63	5.35	3.14	2.77	4.40	2.87	1.90	0.37	4.34	1.13	0.44	0.97



# Alt Model-Shift Uniqueness Test

010412044-03, P = 135.936588 Days, E = 156.832446 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
15.4	4.50	3.70	4.33	5.46	3.30	1.06	11.7	11.1	0.80	0.16	7.12	1.01	0.32	0.03



### Stellar Parameters For KIC 010412044

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (g \cdot \text{cm}^{-3})$
	$3651^{+73}_{-73}$	$4.802^{+0.048}_{-0.032}$	$-0.100^{+0.100}_{-0.100}$	$0.446^{+0.036}_{-0.044}$	$0.461^{+0.034}_{-0.042}$	$7.297^{+1.807}_{-1.001}$
	+2%/-2%	+1%/-1%	+100%/-100%	+8%/-10%	+7%/-9%	+25%/-14%
Source	PHO2	PHO2	PHO2	DSEP		

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

### Secondary Eclipse Parameters for KIC 010412044-03 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-1304 \pm 130$	$2.09^{+0.32}_{-0.28}$	$237^{+6}_{-7}$	$3444^{+177}_{-154}$	$26060^{+8974}_{-6205}$
Alt.	$-429 \pm 96$	$1.87^{+0.30}_{-0.31}$	$237^{+6}_{-7}$	$3023^{+180}_{-180}$	$10658^{+5511}_{-3565}$

$T_{max}$  = 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

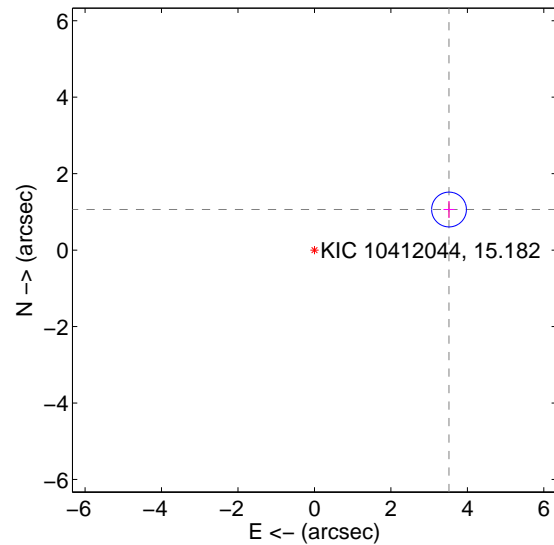
Supplemental centroid analysis for 010412044-03. Kepler magnitude: 15.18. Transit SNR 6.66

There are 2 quarters with good PRF difference image offsets

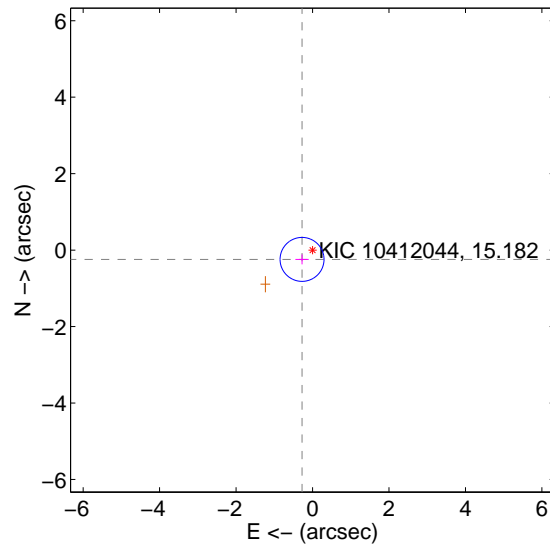
The OOT PRF centroid is offset from the target star catalog position by about 5.14 arcsec so the offset from difference PRF-fit to OOT-fit may be invalid.

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$3.677 \pm 0.152$	24.24	$-3.520 \pm 0.144$	$1.062 \pm 0.221$
PRF-fit source offset from KIC position	$0.366 \pm 0.192$	1.91	$0.274 \pm 0.173$	$-0.243 \pm 0.130$
photometric centroid source offset	$3.46 \pm 0.61$	5.71	$3.23 \pm 0.64$	$-1.24 \pm 0.24$

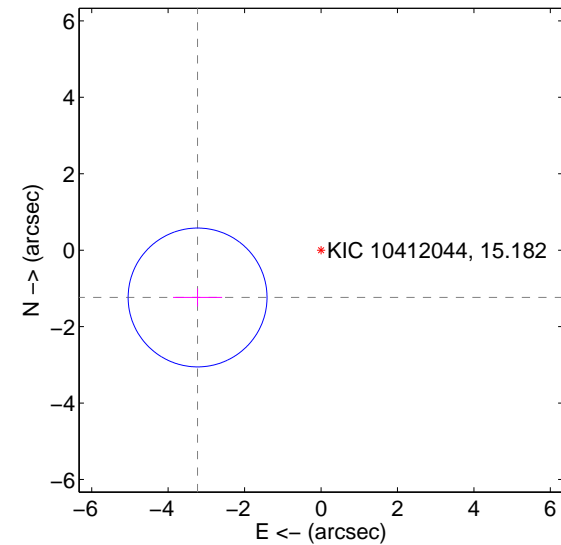
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

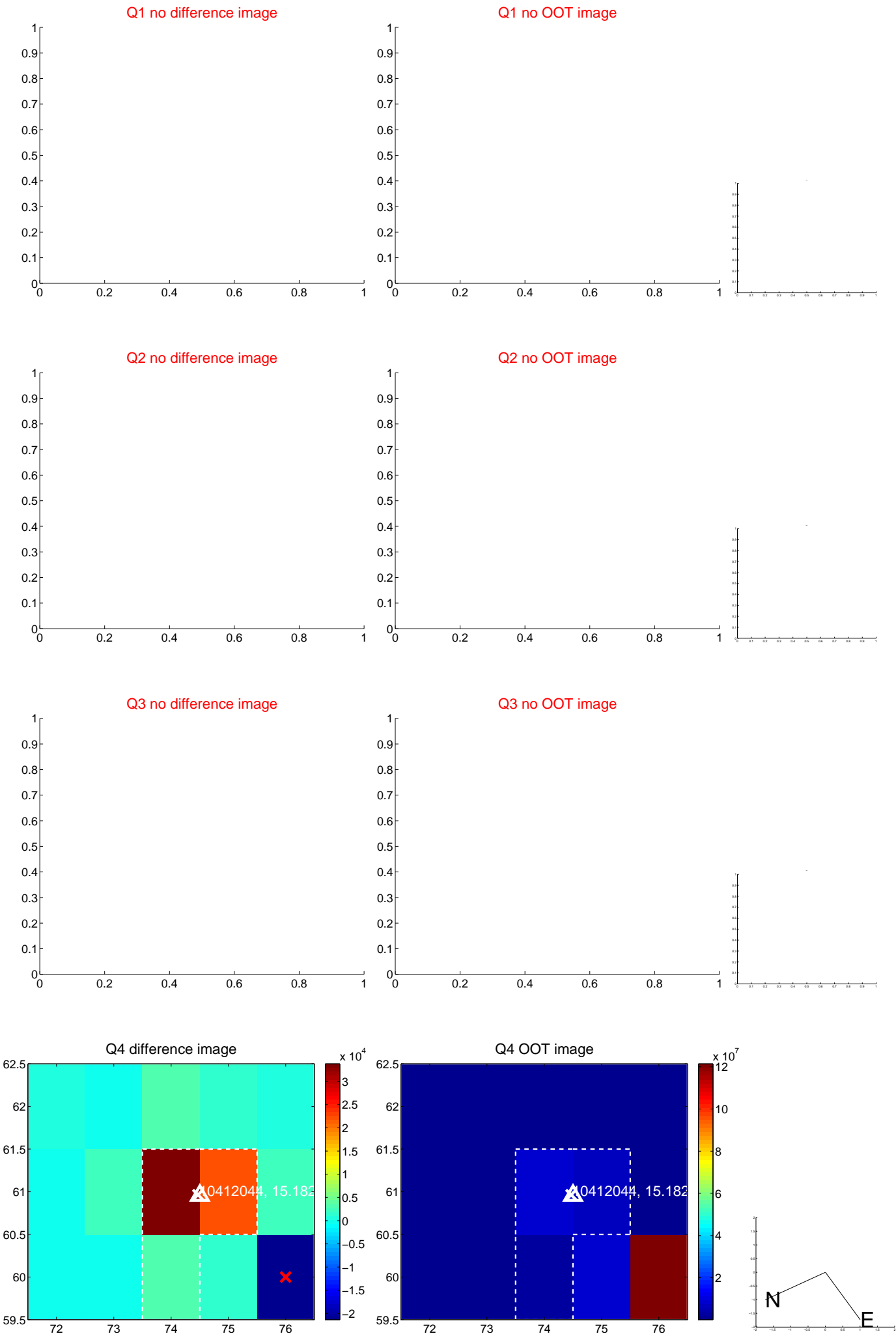


offset from photometric centroids

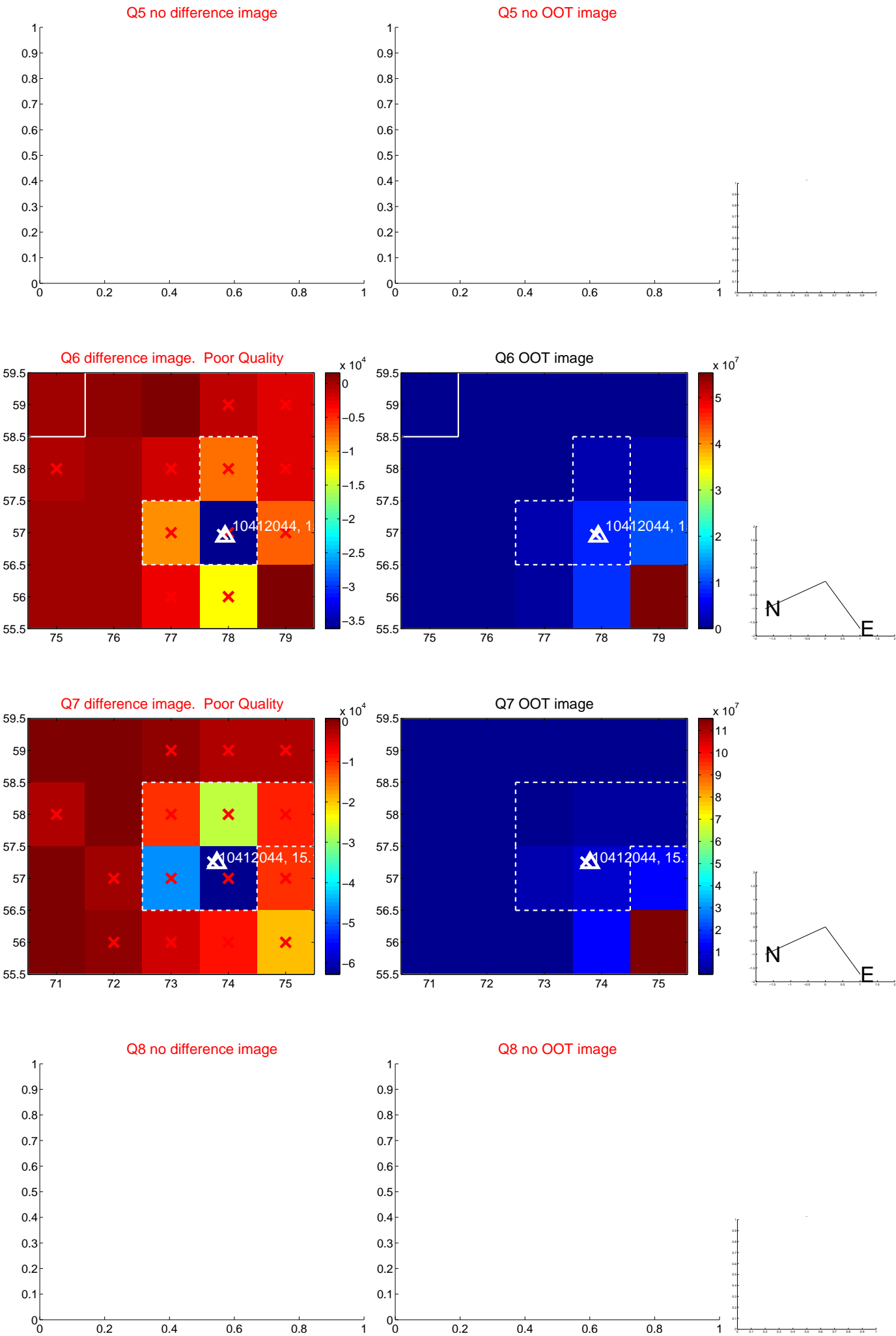


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

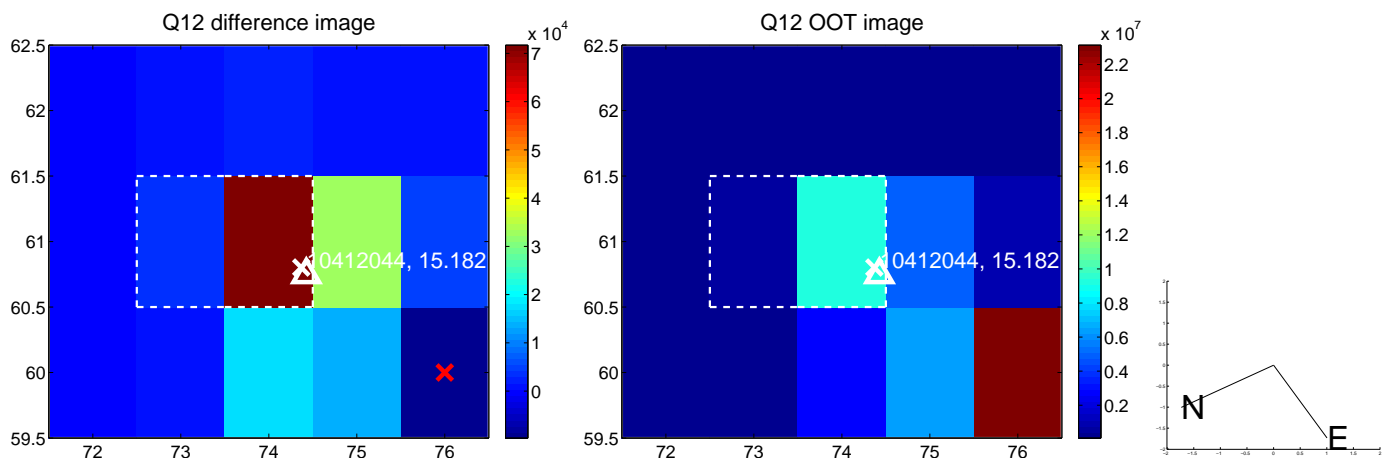
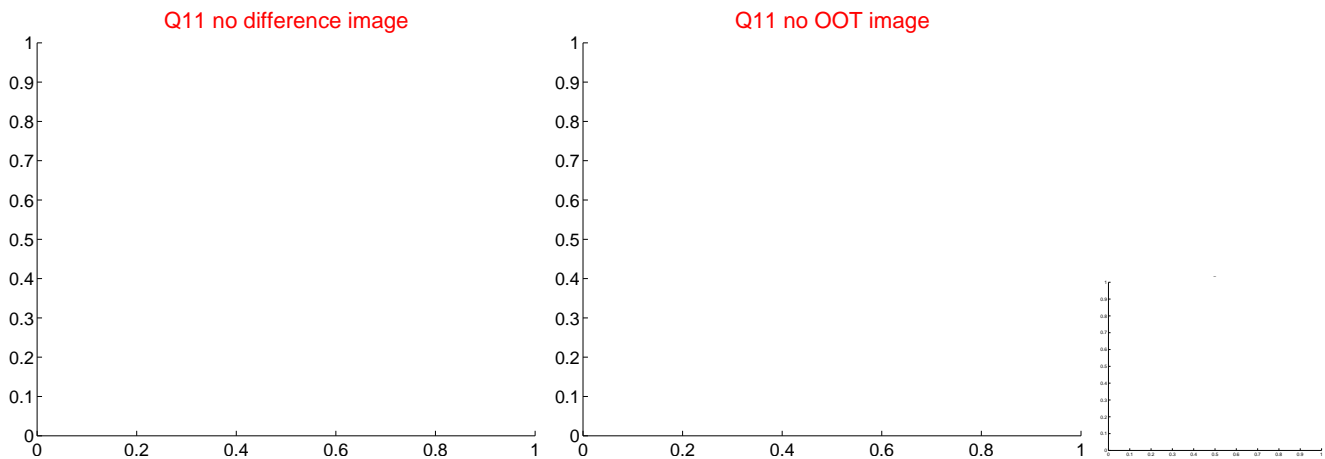
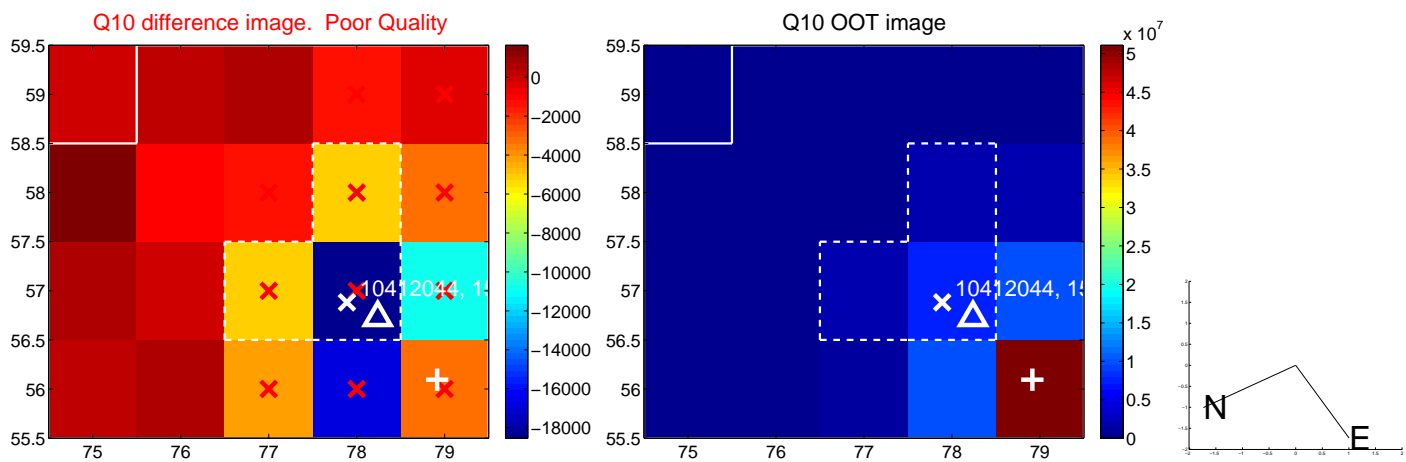
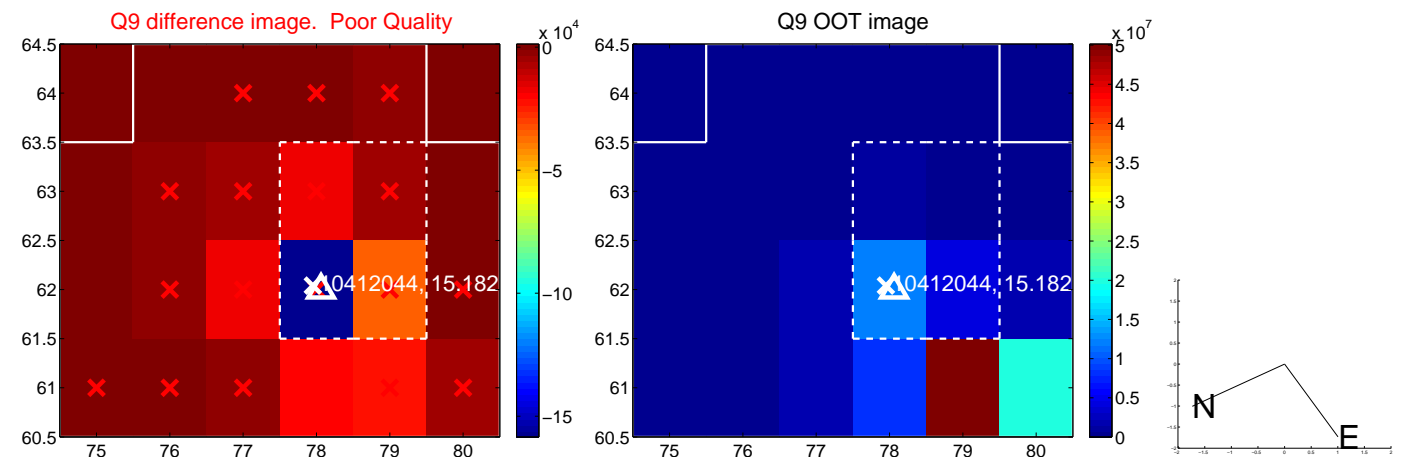


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

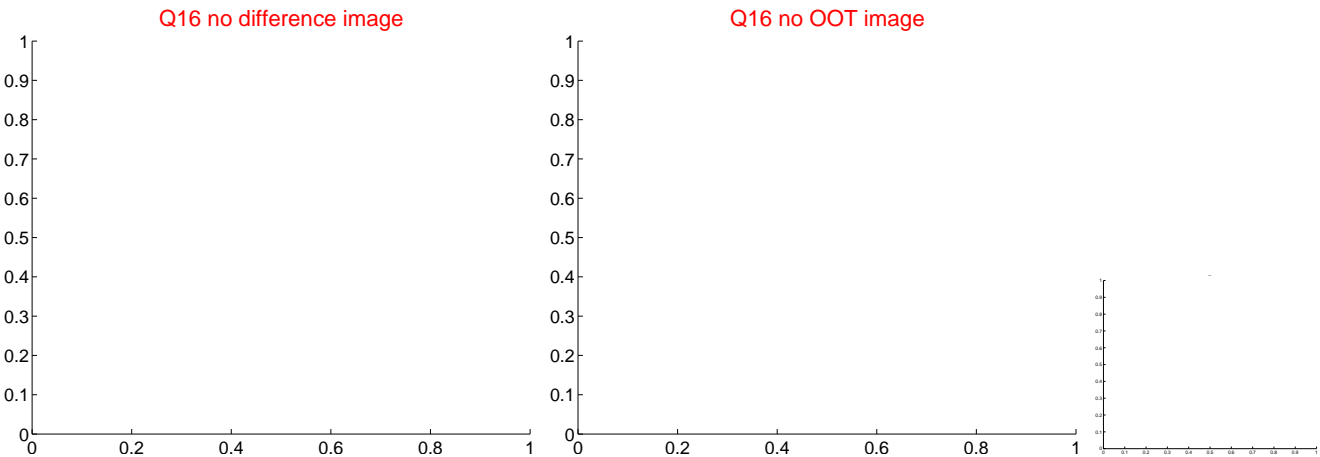
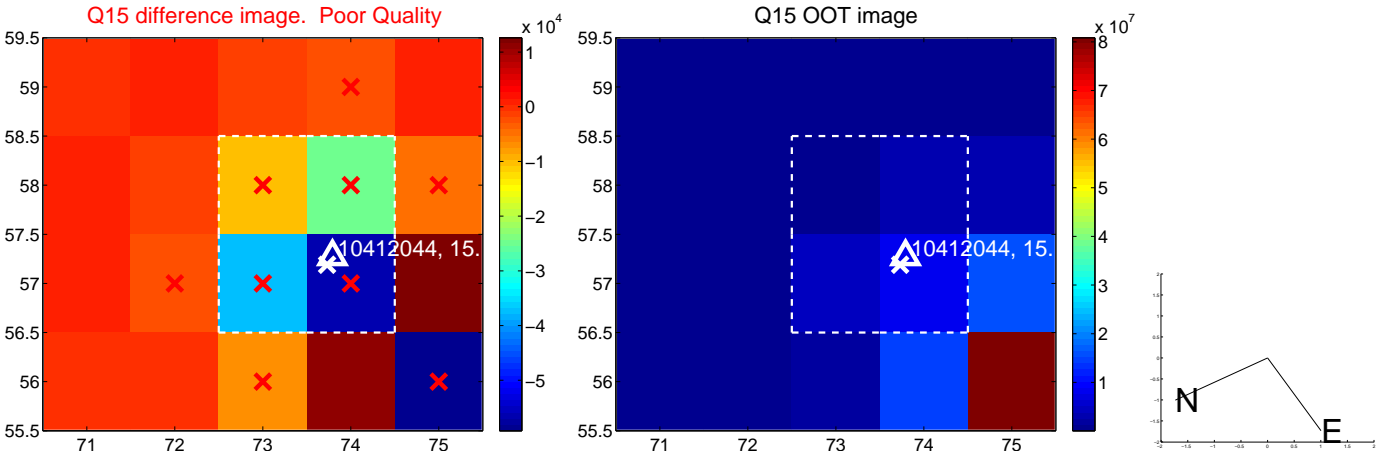
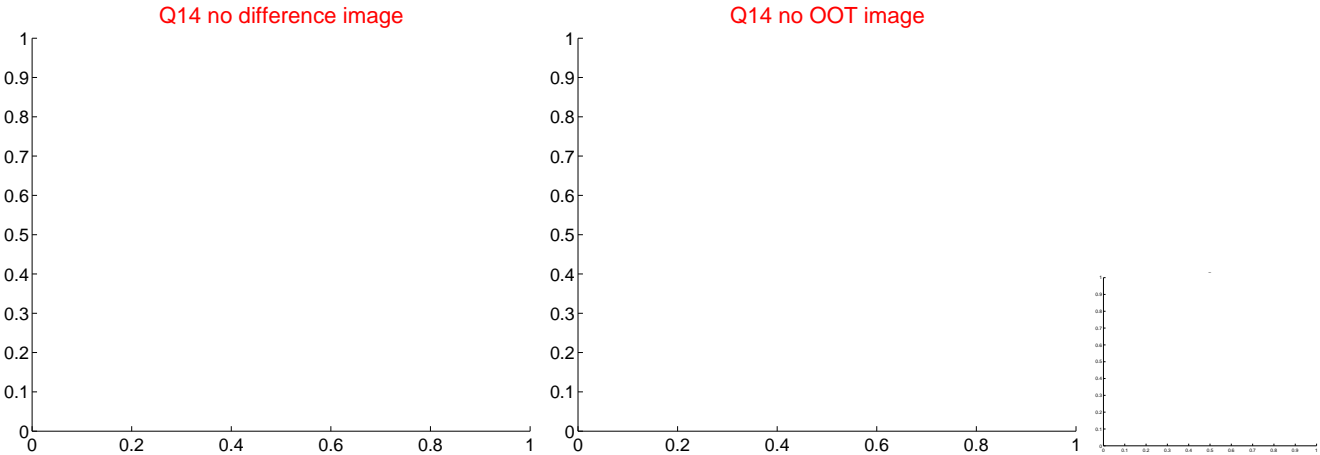
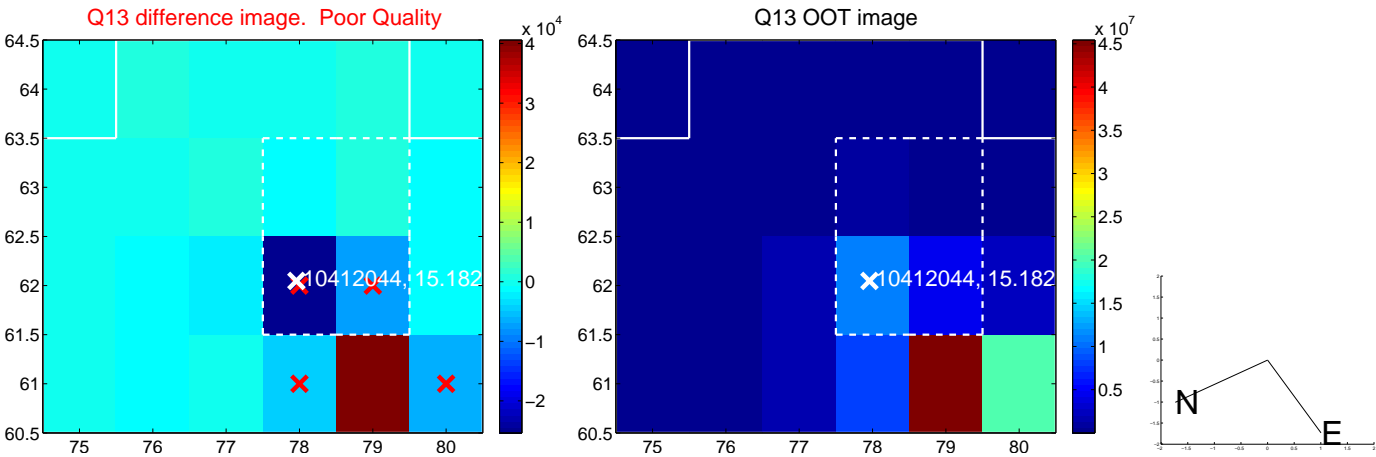




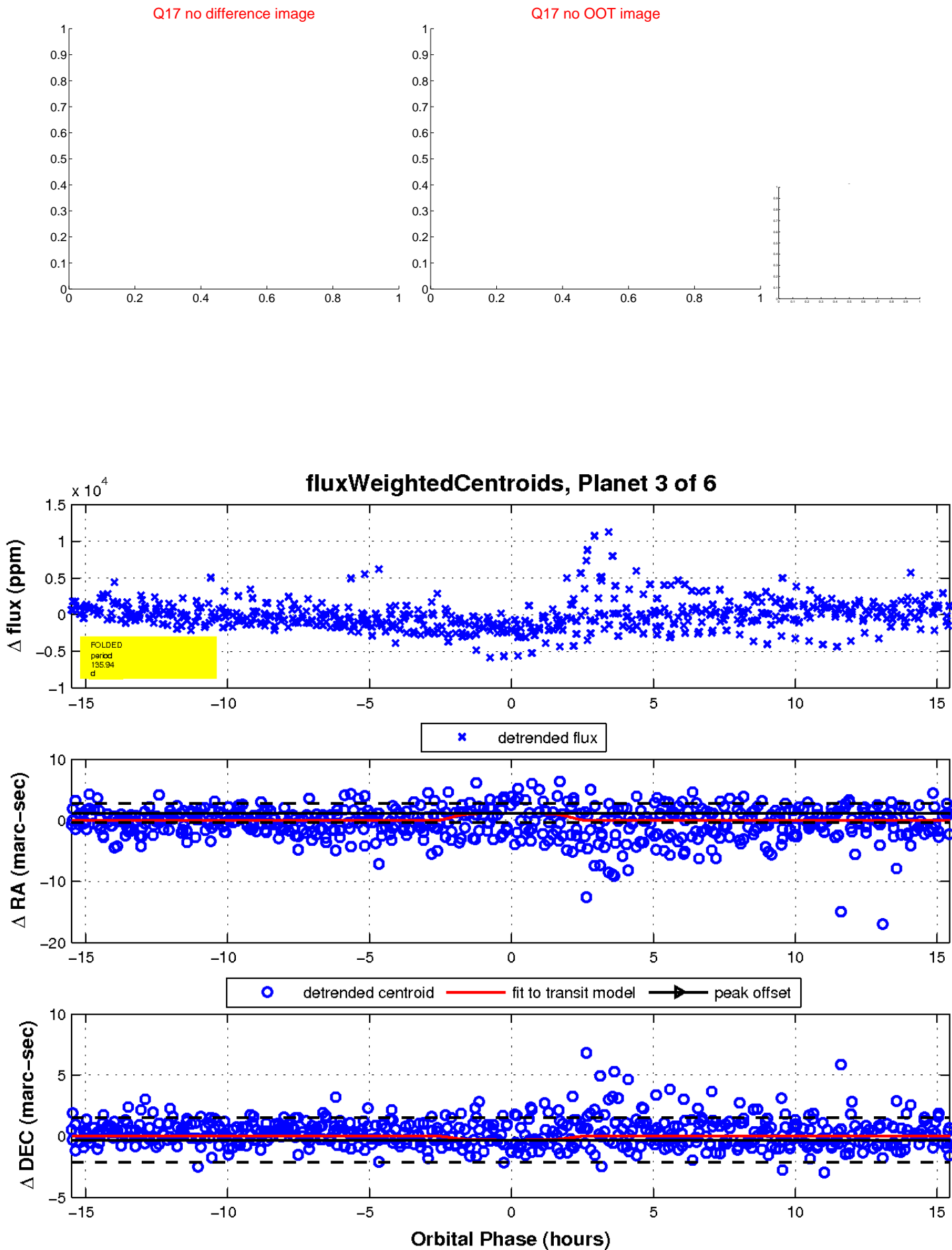
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

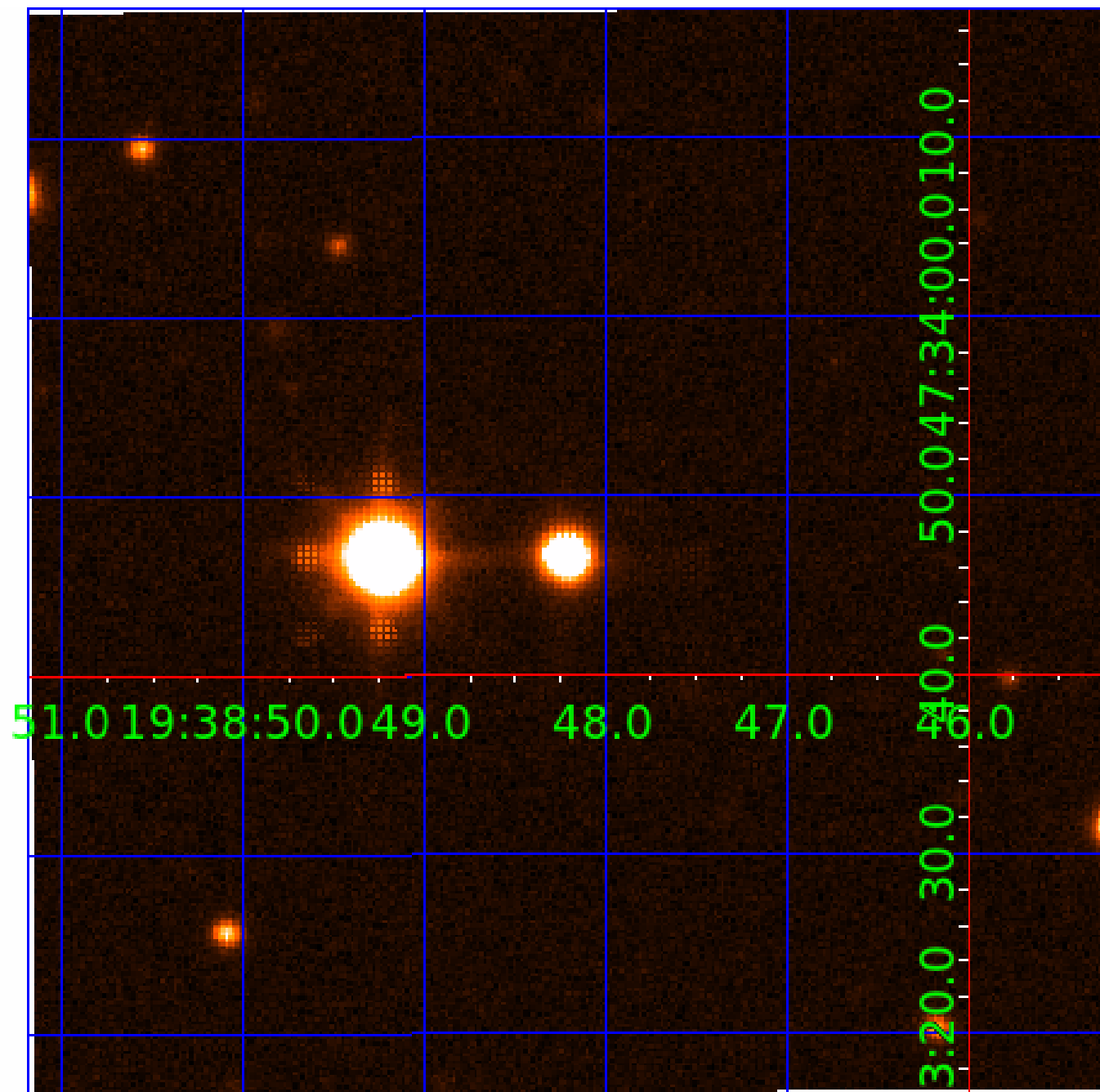


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 010412044

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
010412044-01	OBS	No	217.410359	140.894954	2536.3	1.840	13.1	8.0	0.45	3651	2.45	0.11
010412044-02	OBS	No	266.794685	377.959858	2321.4	4.958	11.1	6.8	0.45	3651	2.13	0.08
010412044-03	OBS	No	135.936292	156.835508	1625.7	5.173	11.0	6.7	0.45	3651	2.13	0.20
010412044-04	OBS	No	347.092671	259.473532	3168.1	4.346	10.4	7.7	0.45	3651	2.63	0.06
010412044-05	OBS	No	196.325909	195.517815	2079.5	3.049	10.9	8.4	0.45	3651	2.19	0.12
010412044-06	OBS	No	3.328827	133.848494	1333.0	1.500	8.1	-1.0	0.45	3651	1.62	27.91

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
010412044-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL_TRACKER—LPP_ALT—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS
010412044-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_CHASES_MARSHALL—ALL_TRANS_CHASES—CENT_FEW_MEAS
010412044-03	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—CENT_FEW_DIFFS
010412044-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
010412044-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL_SKYE—LPP_DV—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—CENT_FEW_DIFFS
010412044-06	OBS	FP	0.00	1	0	0	0	LPP_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_NOFITS

**Notes:** OBS = Observed. INJ = Injected. INV = Inverted. SCR = Scrambled.

N = Not Transit-Like. S = Stellar Eclipse. C = Centroid Offset. E = Ephemeris Match.

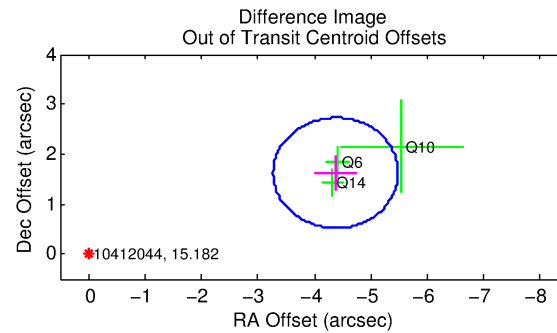
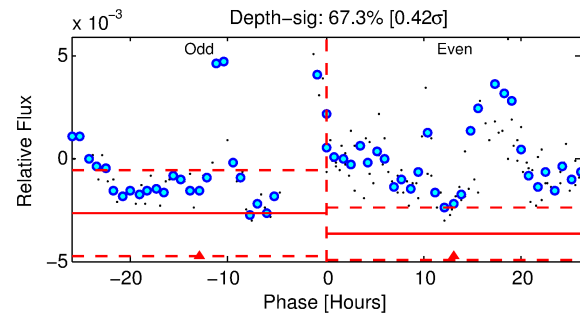
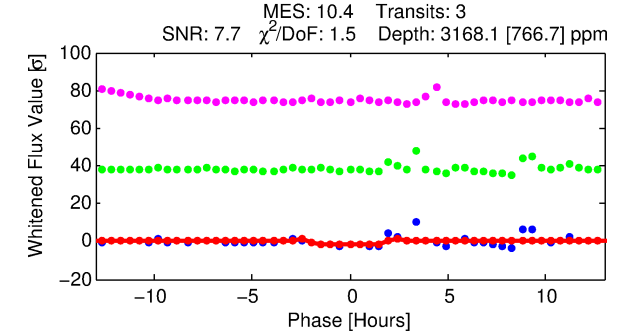
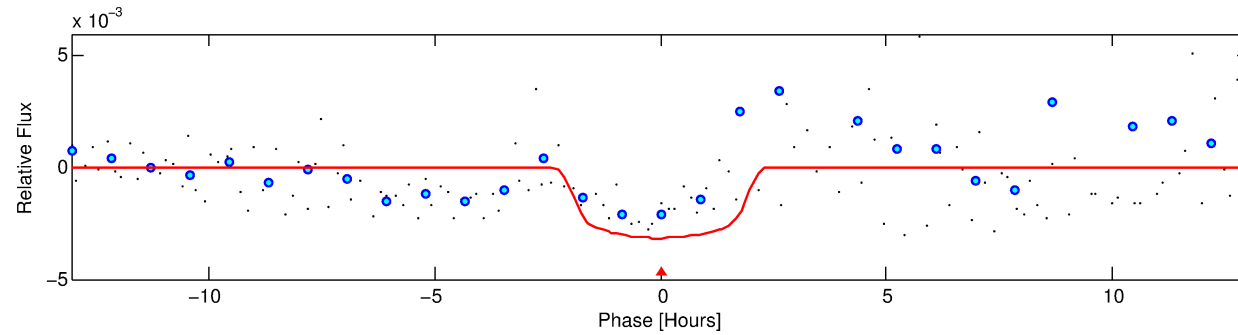
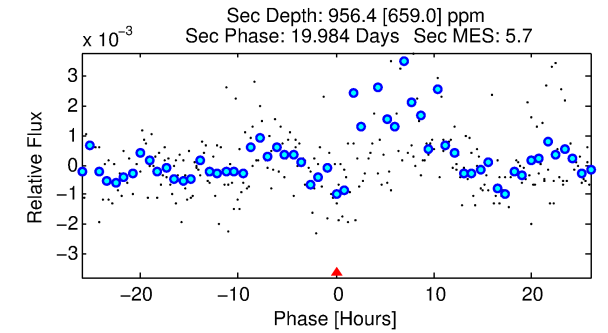
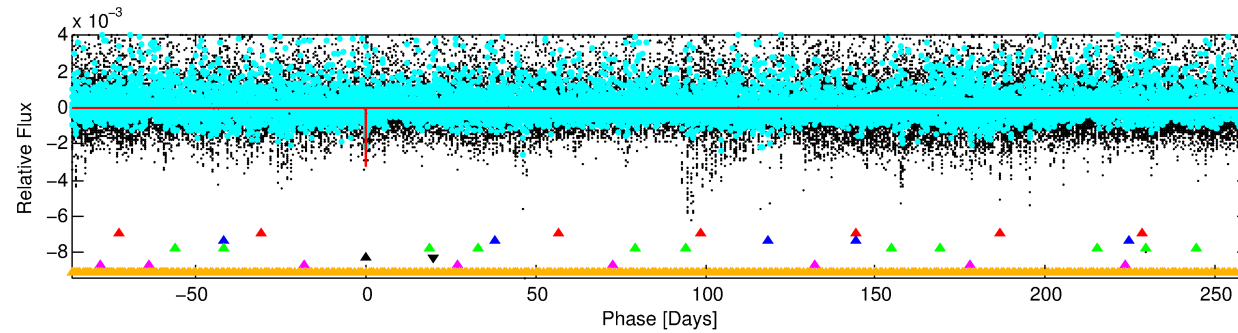
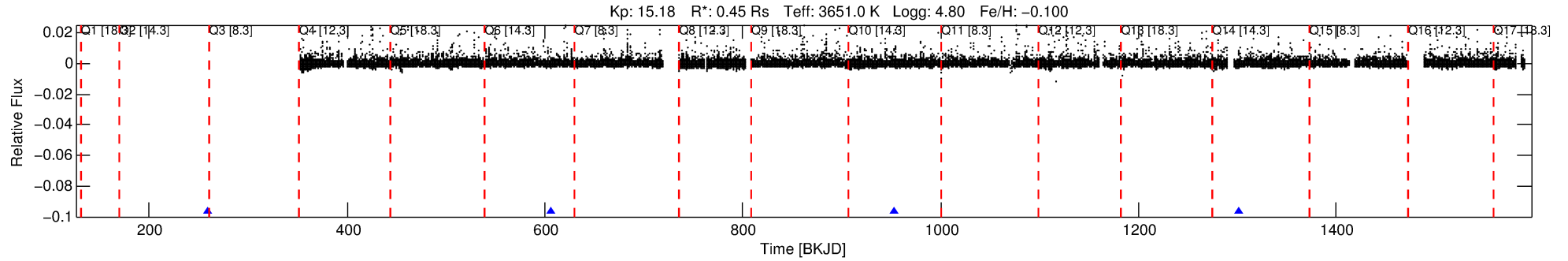
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 010412044-04

No Significant Match Found

# DV One-Page Summary

KIC: 10412044 Candidate: 4 of 6 Period: 347.093 d



## DV Fit Results:

Period = 347.09267 [0.00997] d  
Epoch = 259.4735 [0.0211] BKJD  
Rp/R\* = 0.0539 [0.0343]  
a/R\* = 516.47 [1355.30]  
b = 0.63 [2.55]  
Seff = 0.06 [0.01]  
Teff = 125 [4] K  
Rp = 2.63 [1.69] Re  
a = 0.7462 [0.0563] AU  
Ag = 42504.03 [61615.58] [0.69σ]  
Teffp = 2764 [1001] K [2.64σ]

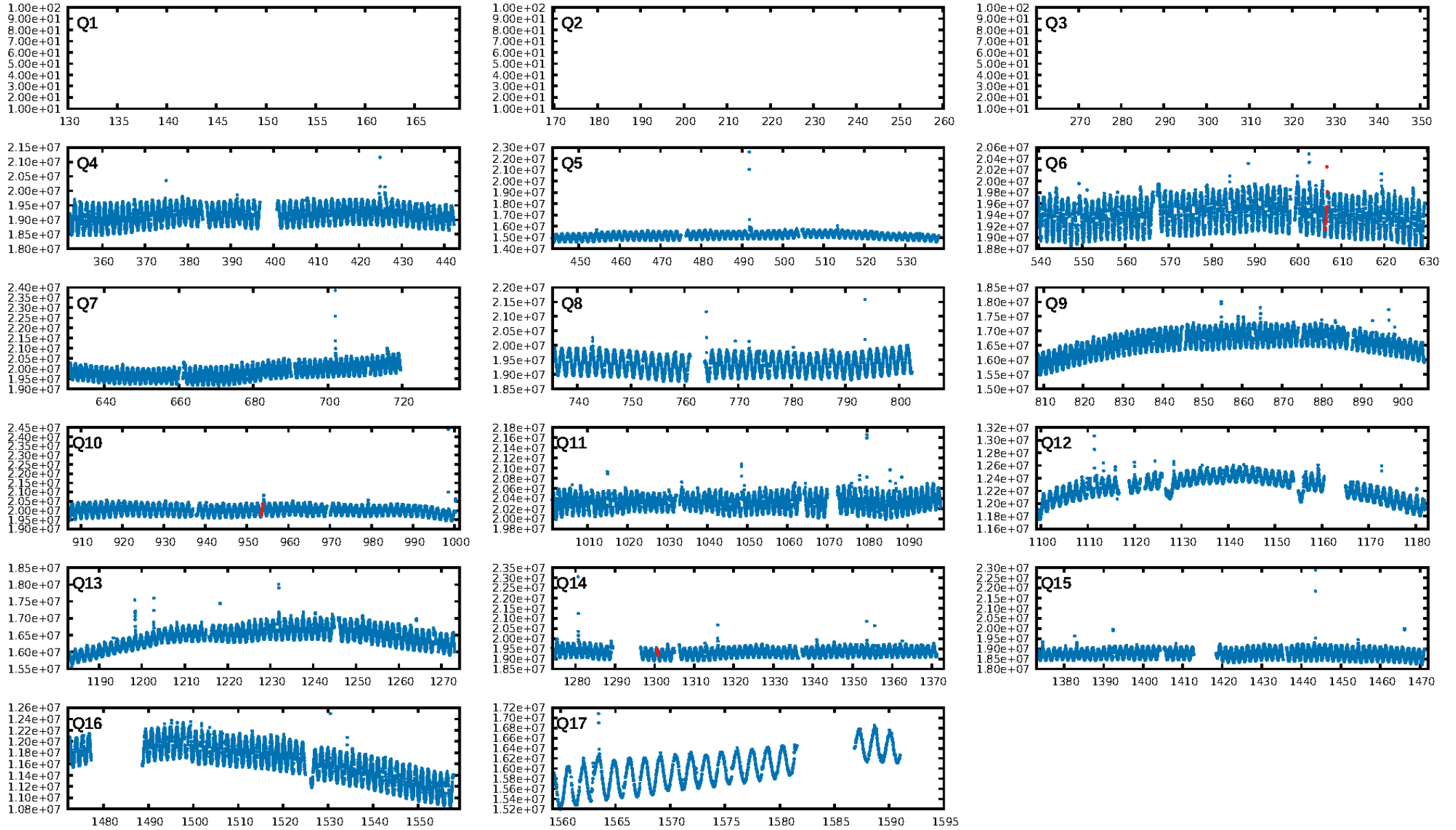
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [292.27σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 80.9%  
ModelChiSquareGof-sig: 99.0%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: 2.738  
Centroid-sig: 3.6%  
Centroid-so: 3.162 arcsec [6.97σ]  
OotOffset-rm: 4.667 arcsec [12.66σ]  
KicOffset-rm: 0.684 arcsec [1.74σ]  
OotOffset-st: 3/0/0/0 [3]  
KicOffset-st: 3/0/0/0 [3]  
DiffImageQuality-fgm: 0.33 [1/3]  
DiffImageOverlap-fno: 0.67 [2/3]

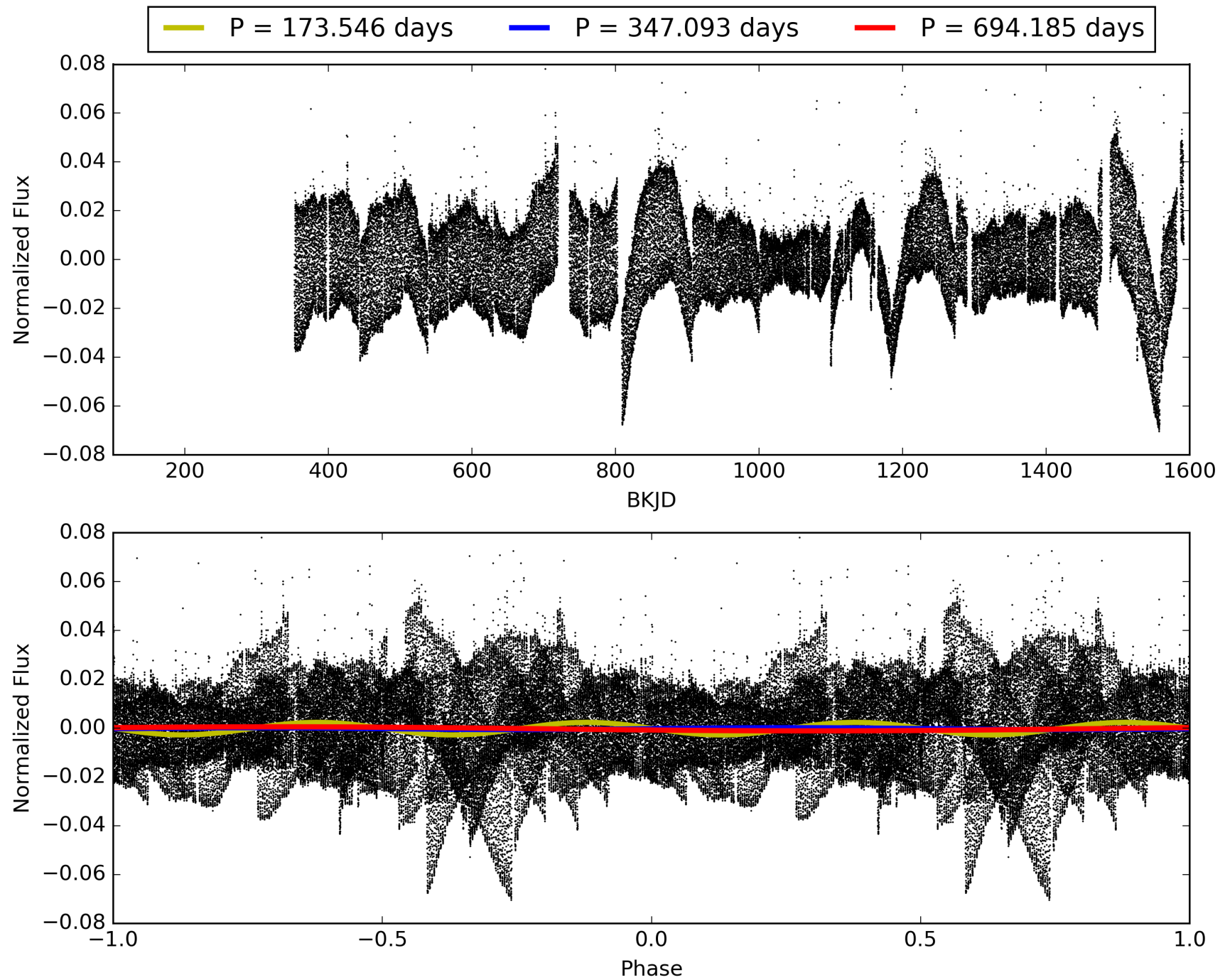
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 01:06:14 Z

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

# TCE 010412044-04, PDC Light Curves



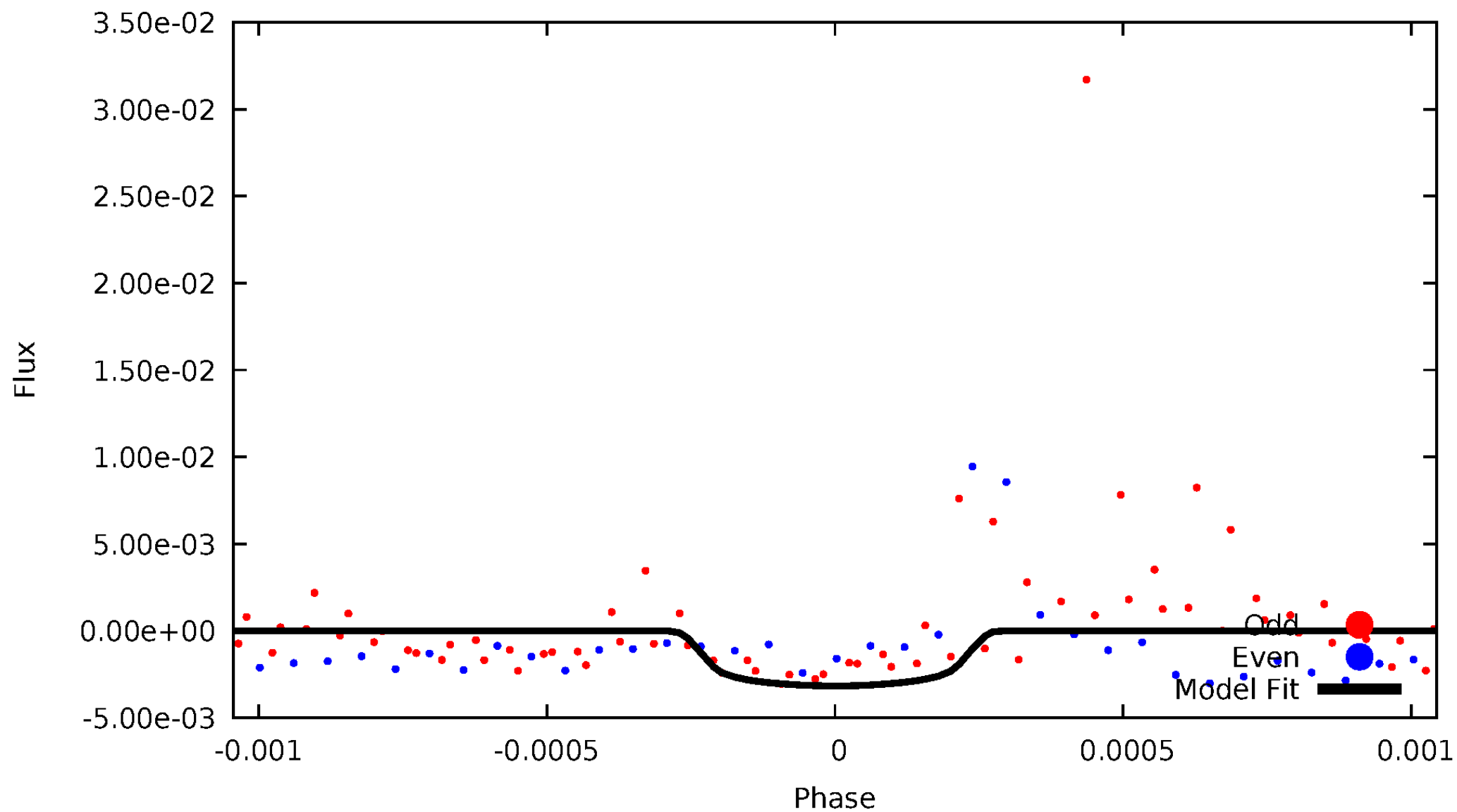
# TCE 010412044-04





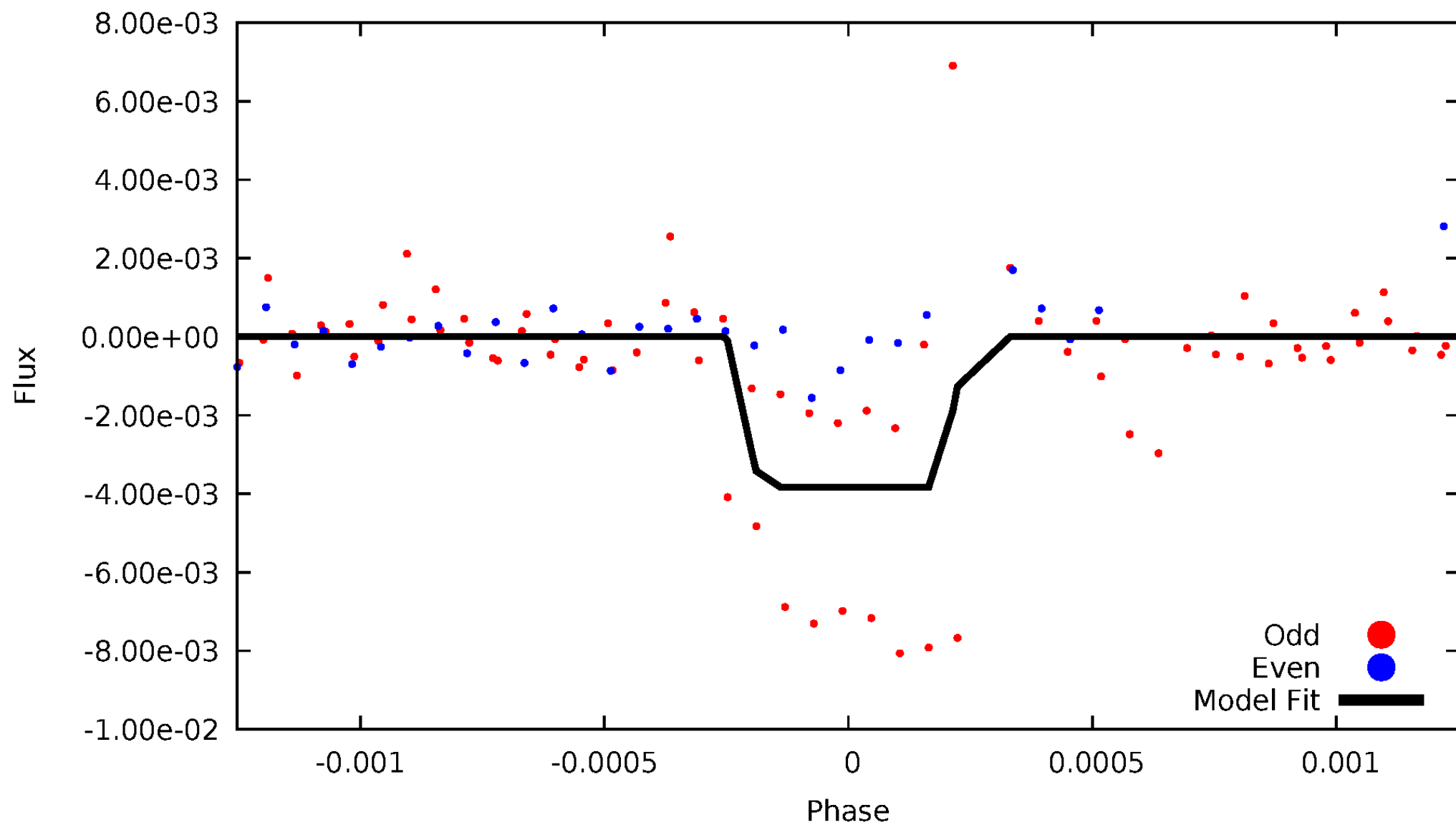
# DV Odd/Even

TCE 010412044-04



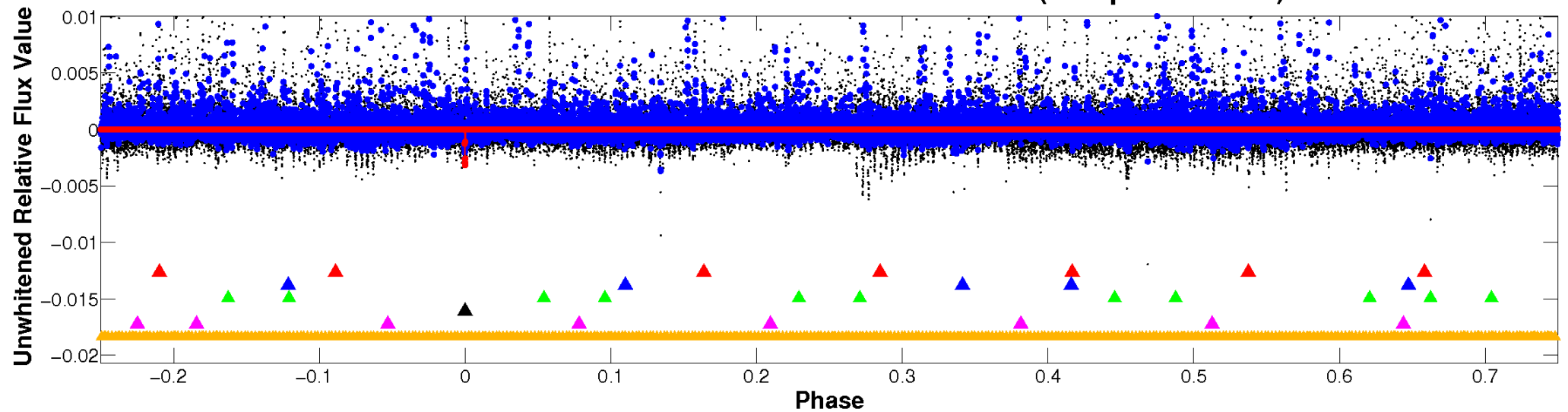
# ALT Odd/Even

TCE 010412044-04

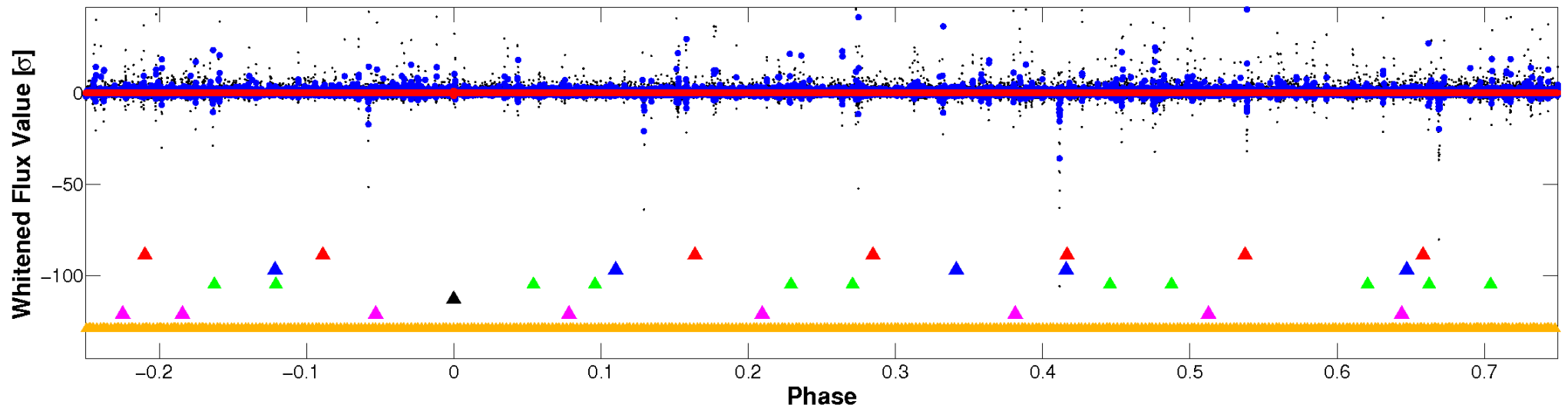


# Non-Whitened Vs. Whitened Light Curve

## Planet 4 : Phased Unwhitened Flux Time Series (Fit Epoch/Period)

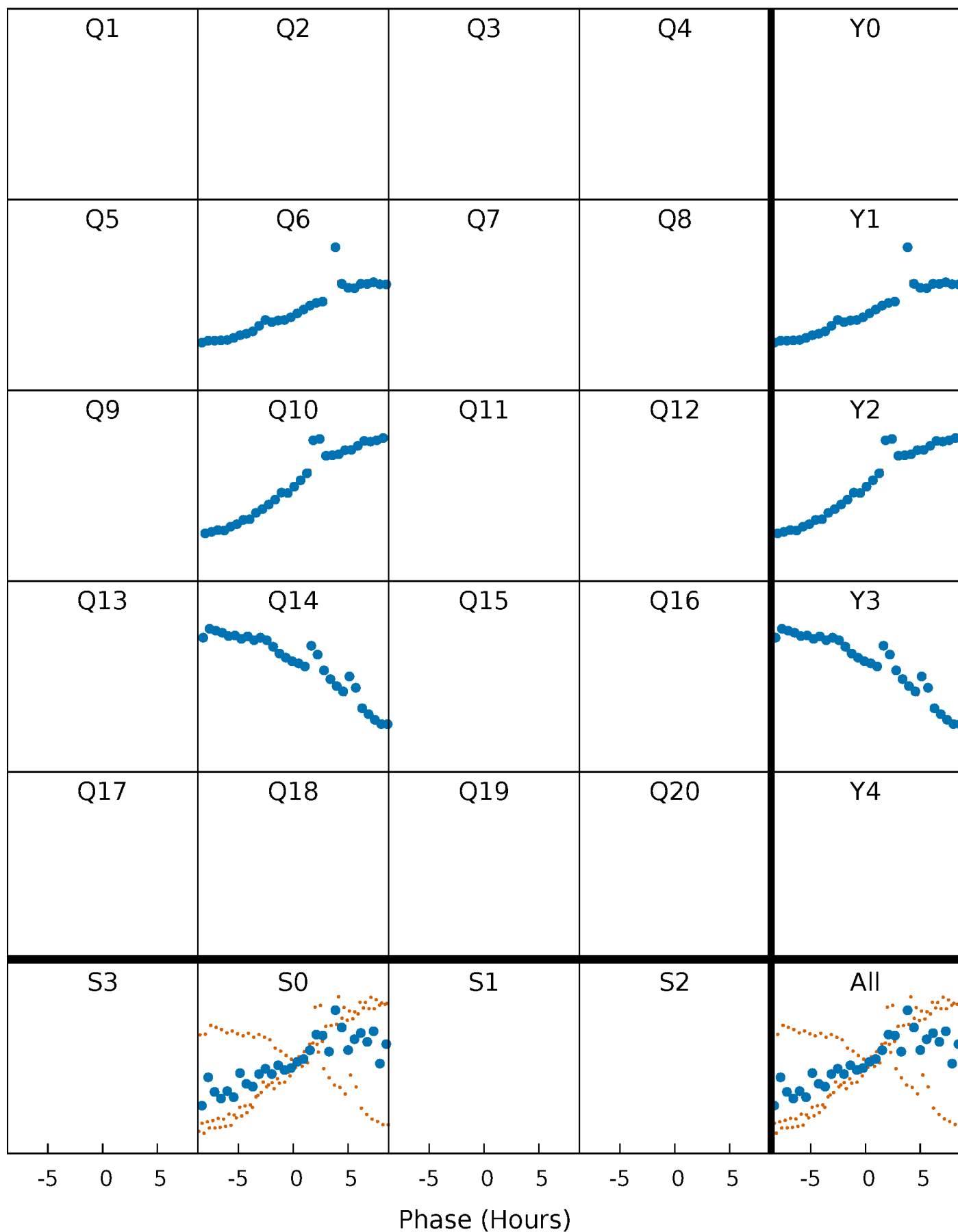


## Planet 4 : Phased Whitened Flux Time Series (Fit Epoch/Period)



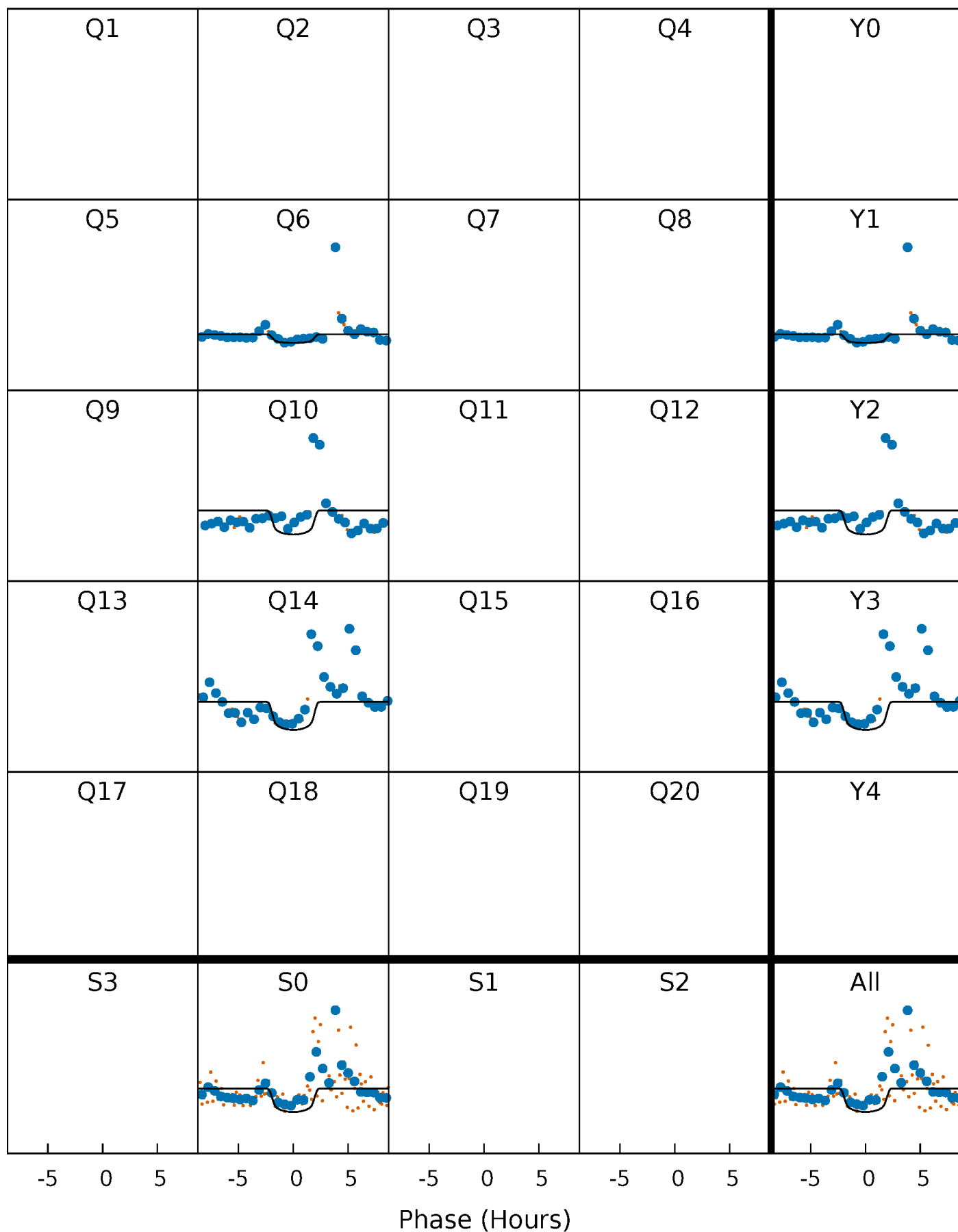
# PDC Quarter-Phased Transit Curves

TCE 010412044-04 P=347.092671 Days  $T_0=259.473532$  (BKJD)



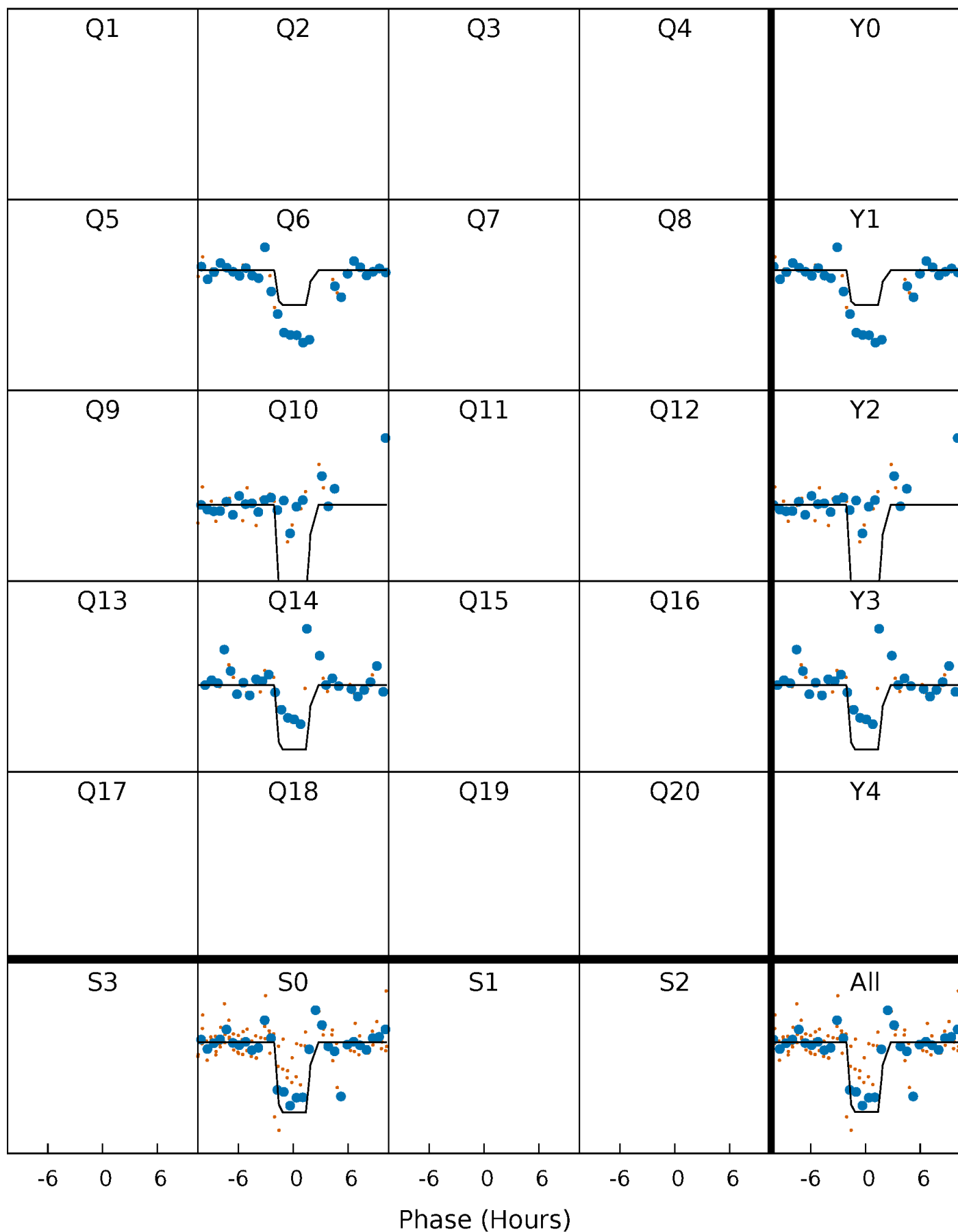
# DV Quarter-Phased Transit Curves

TCE 010412044-04     $P=347.092671$  Days     $T_0=259.473532$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

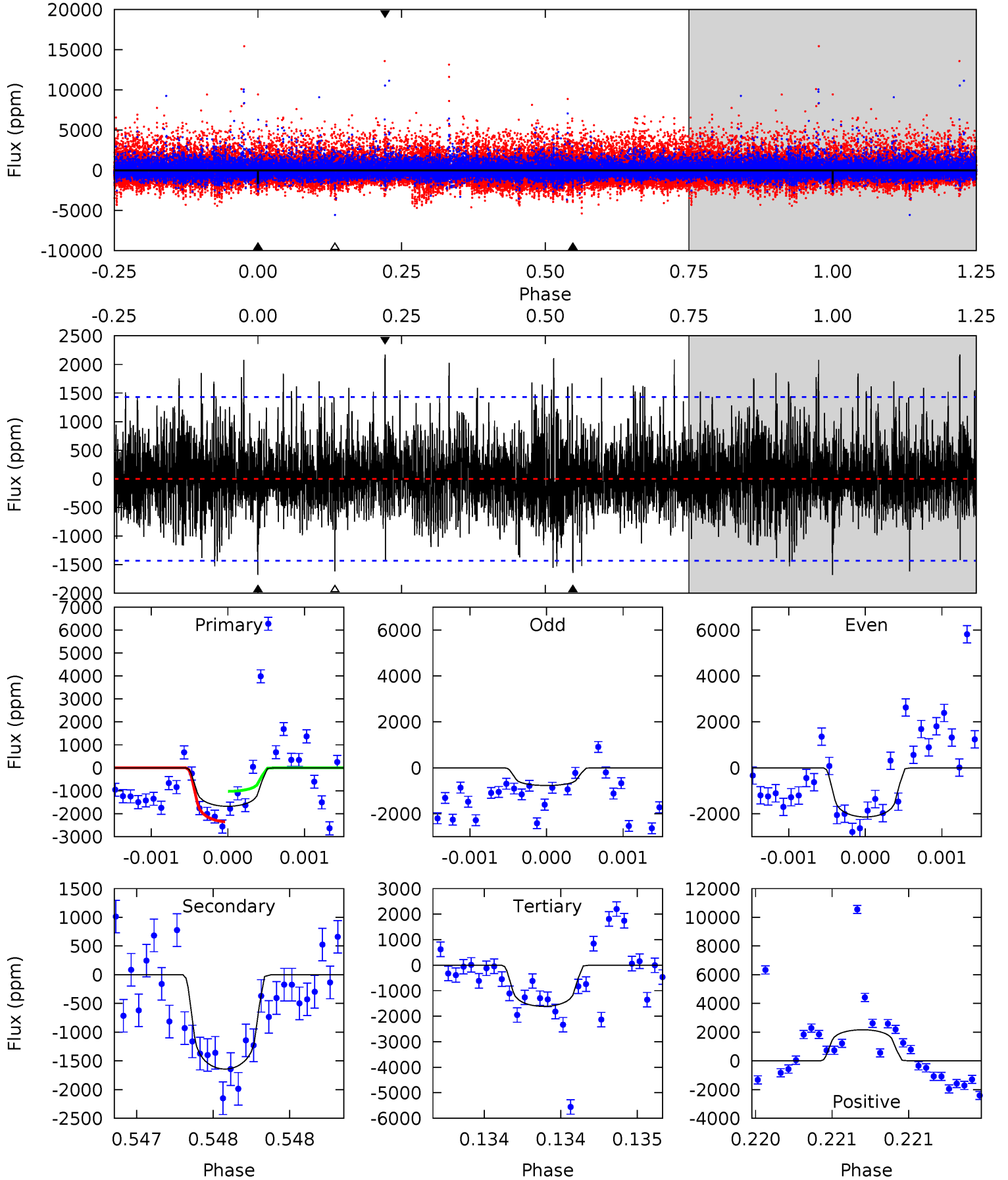
TCE 010412044-04     $P=347.086576$  Days     $T_0=259.492320$  (BKJD)



# DV Model-Shift Uniqueness Test

010412044-04, P = 347.092671 Days, E = 259.473532 Days

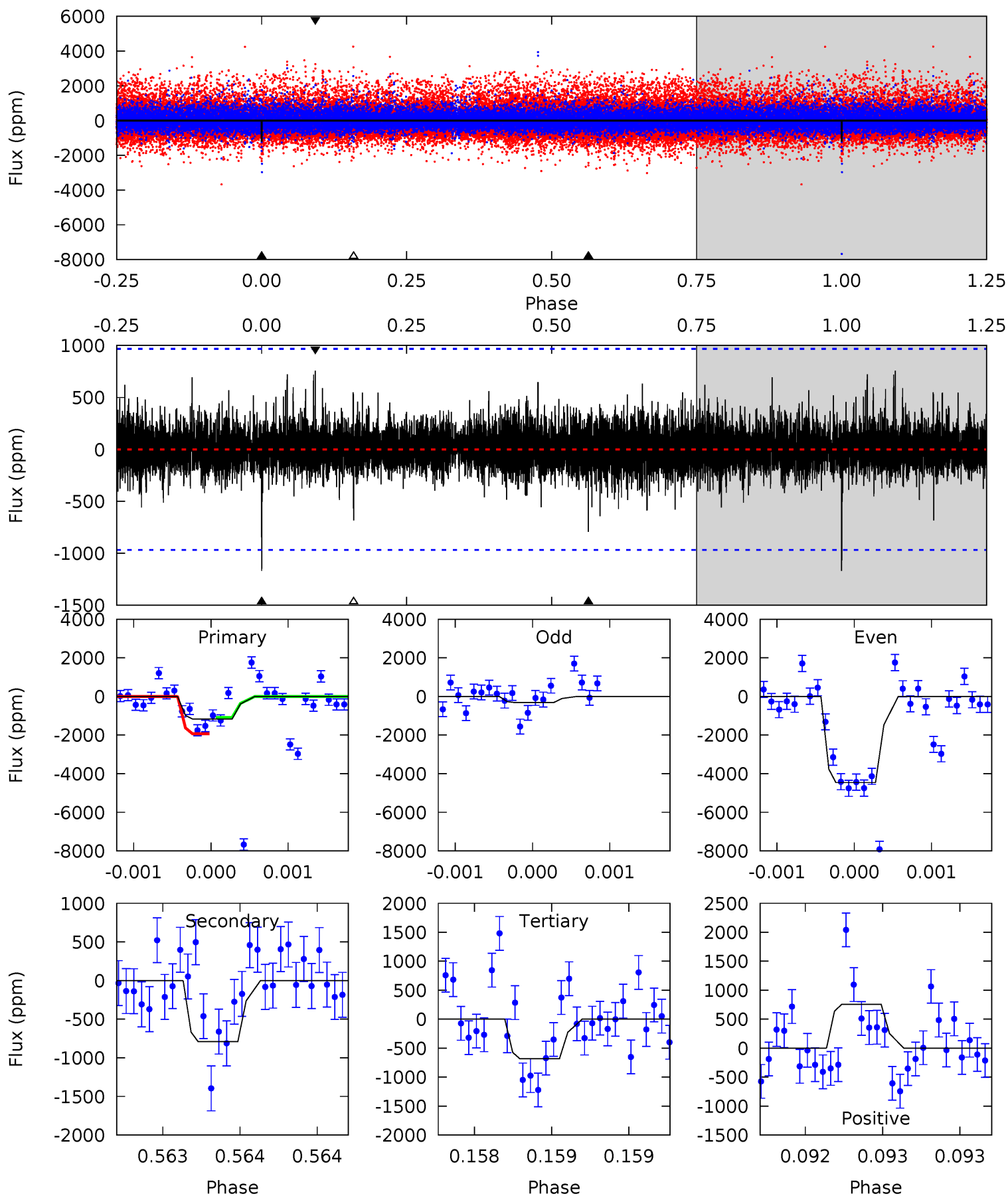
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
6.52	6.39	6.28	8.44	5.56	3.47	1.85	0.24	-1.91	0.11	-2.05	1.99	1.15	0.56	2.60



# Alt Model-Shift Uniqueness Test

010412044-04, P = 347.086576 Days, E = 259.492320 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
6.70	4.54	3.91	4.33	5.55	3.44	0.82	2.79	2.37	0.63	0.21	12.6	2.64	0.39	2.52





### Stellar Parameters For KIC 010412044

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (g \cdot \text{cm}^{-3})$
	$3651^{+73}_{-73}$	$4.802^{+0.048}_{-0.032}$	$-0.100^{+0.100}_{-0.100}$	$0.446^{+0.036}_{-0.044}$	$0.461^{+0.034}_{-0.042}$	$7.297^{+1.807}_{-1.001}$
	+2%/-2%	+1%/-1%	+100%/-100%	+8%/-10%	+7%/-9%	+25%/-14%
Source	PHO2	PHO2	PHO2	DSEP		

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

### Secondary Eclipse Parameters for KIC 010412044-04 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-1643 \pm 257$	$2.67^{+1.73}_{-1.60}$	$173^{+5}_{-5}$	$3306^{+1166}_{-437}$	$72721^{+348064}_{-47549}$
Alt.	$-792 \pm 174$	$3.05^{+1.60}_{-1.50}$	$173^{+4}_{-5}$	$2866^{+639}_{-301}$	$26460^{+72650}_{-15294}$

$T_{max}$  = 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

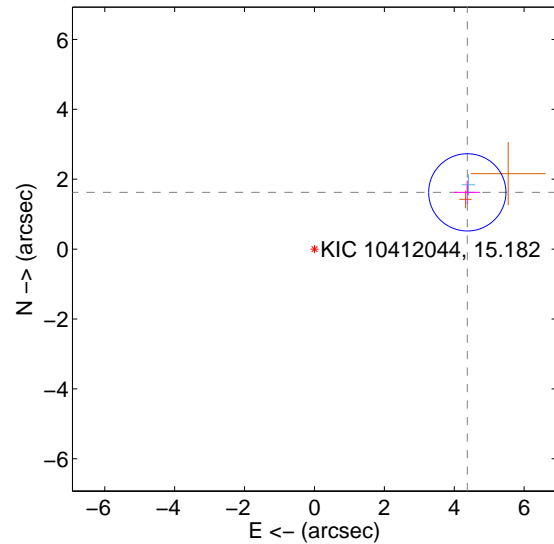
Supplemental centroid analysis for 010412044-04. Kepler magnitude: 15.18. Transit SNR 7.72

There are 1 quarters with good PRF difference image offsets

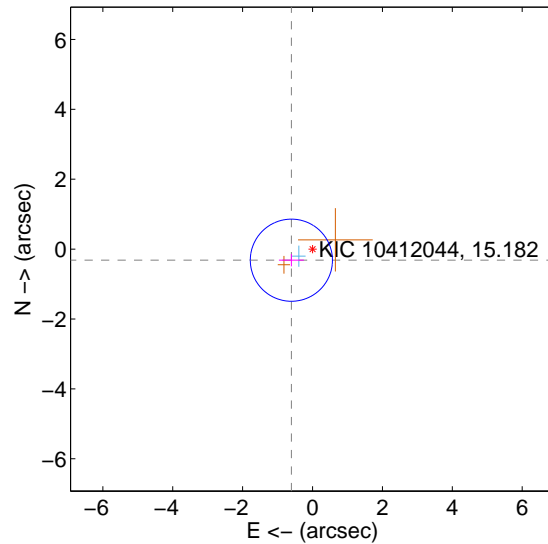
The OOT PRF centroid is offset from the target star catalog position by about 5.47 arcsec so the offset from difference PRF-fit to OOT-fit may be invalid.

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$4.667 \pm 0.369$	12.66	$-4.375 \pm 0.373$	$1.625 \pm 0.336$
PRF-fit source offset from KIC position	$0.684 \pm 0.392$	1.74	$0.605 \pm 0.358$	$-0.318 \pm 0.175$
photometric centroid source offset	$3.16 \pm 0.45$	6.97	$2.87 \pm 0.49$	$-1.32 \pm 0.21$

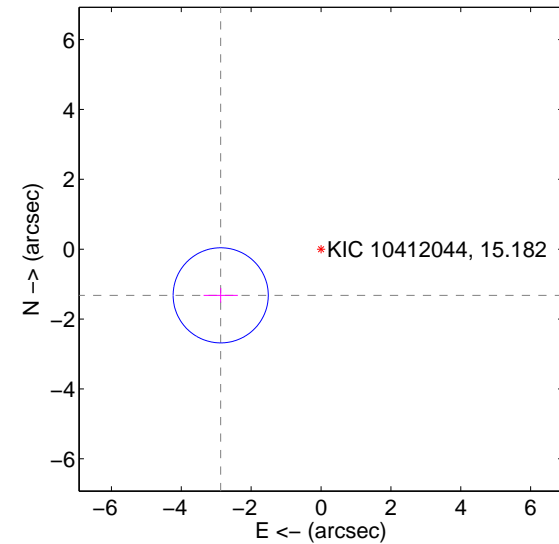
offset from difference PRF-fit to OOT PRF-fit



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.

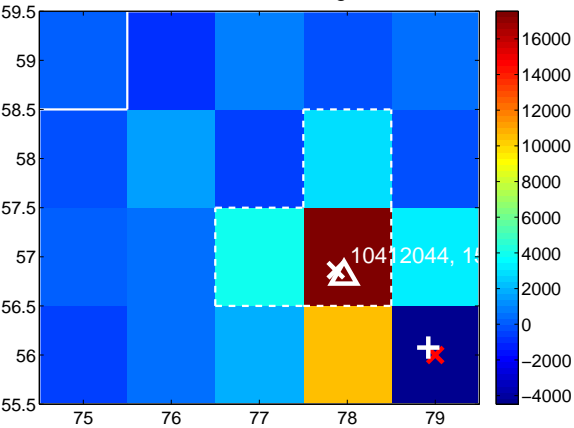
Q5 no difference image



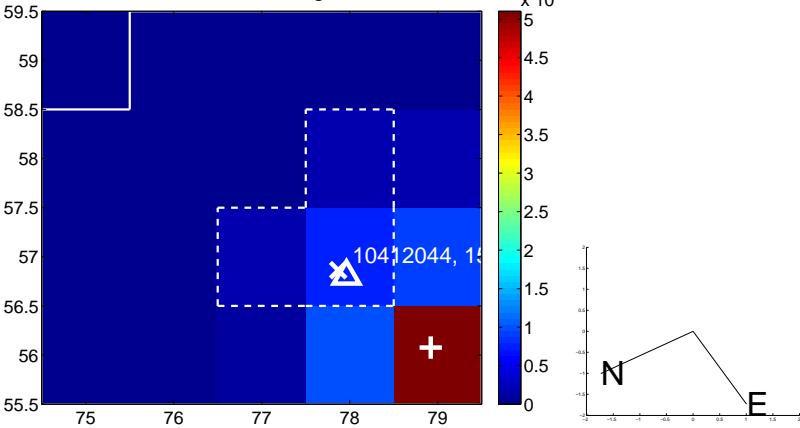
Q5 no OOT image



Q6 difference image



Q6 OOT image



Q7 no difference image



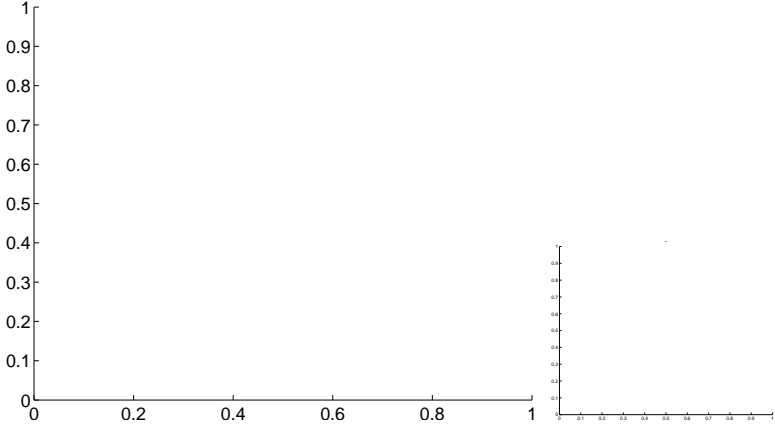
Q7 no OOT image



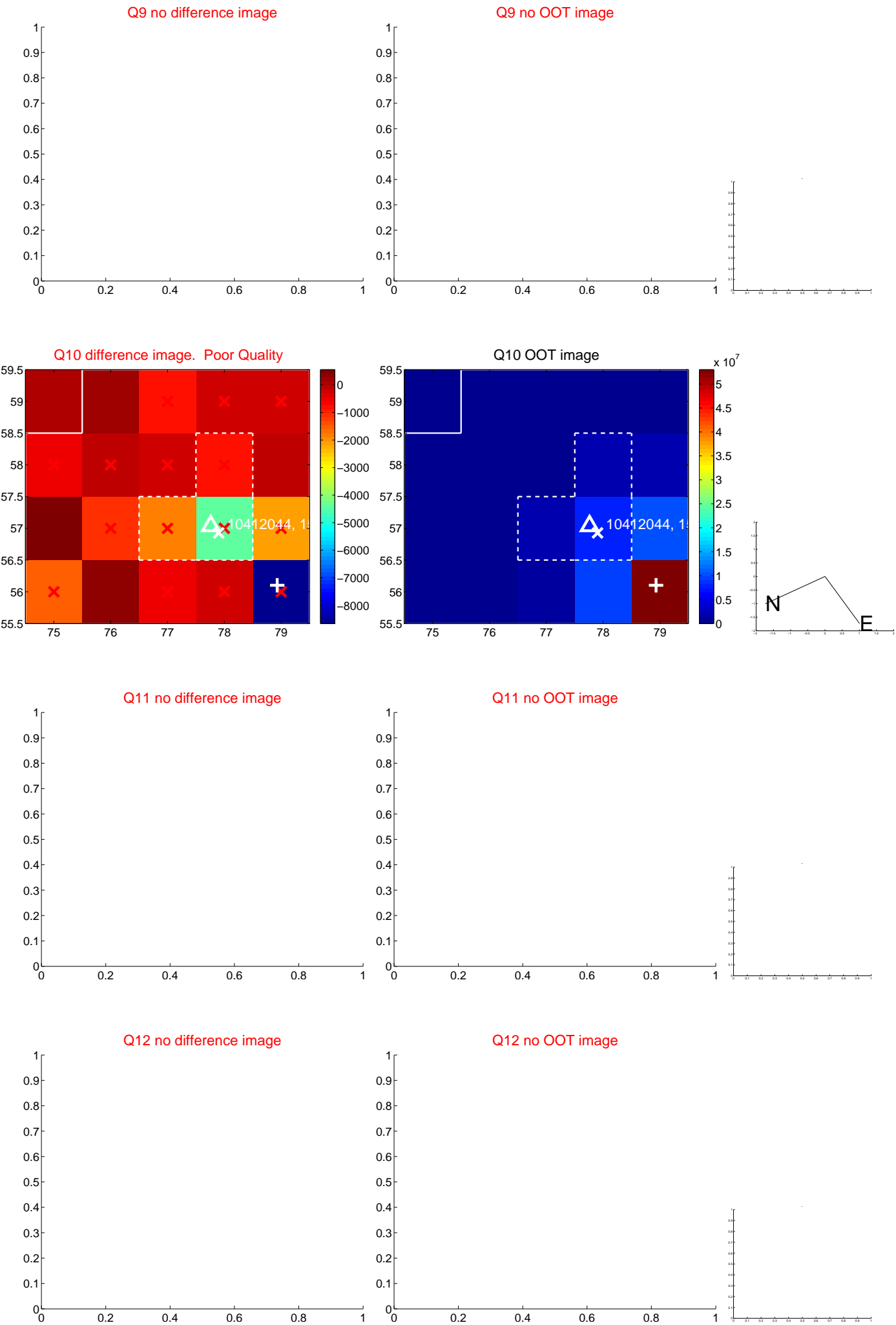
Q8 no difference image



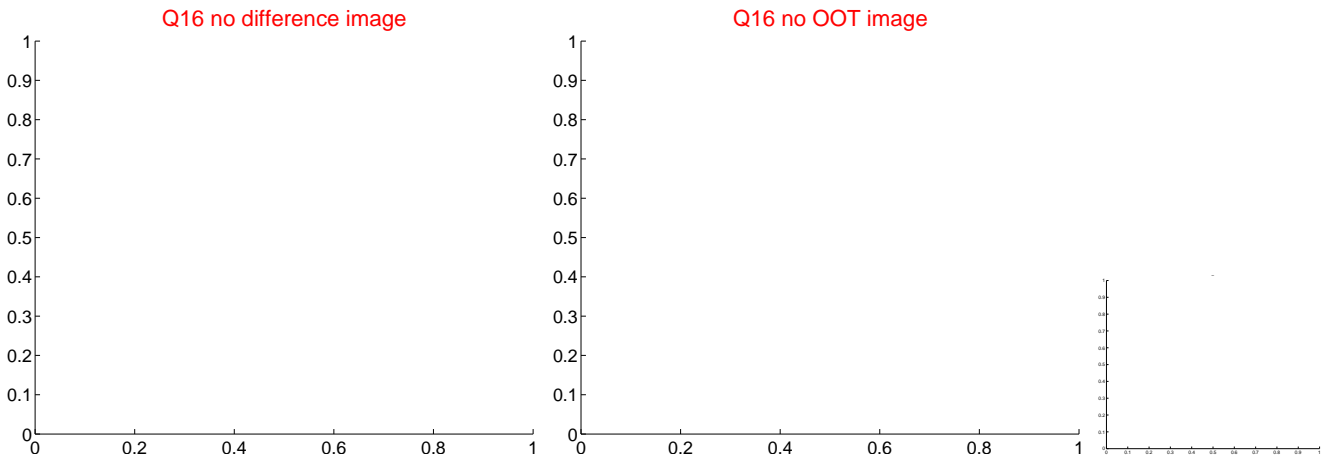
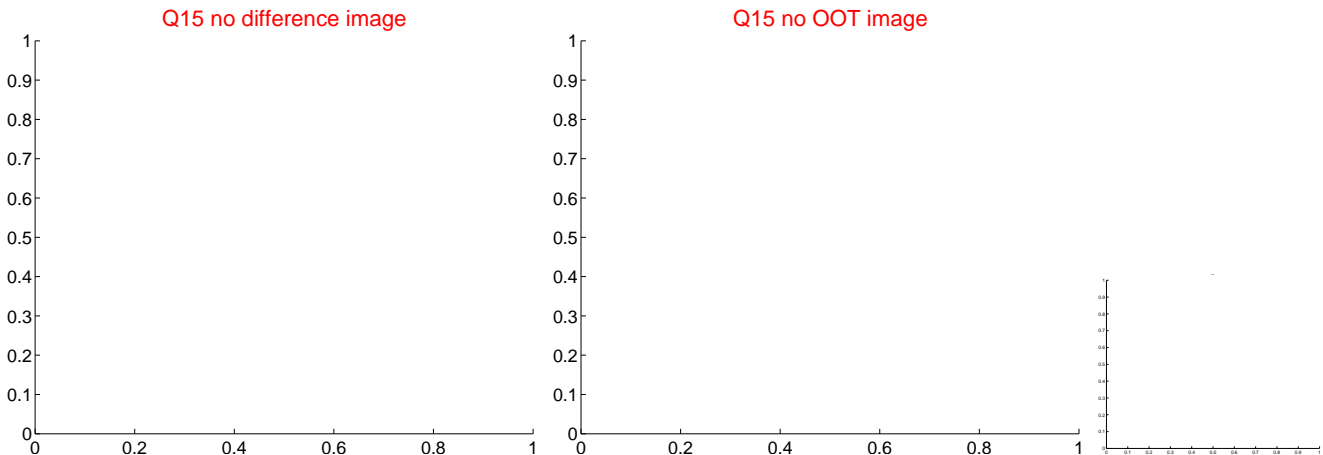
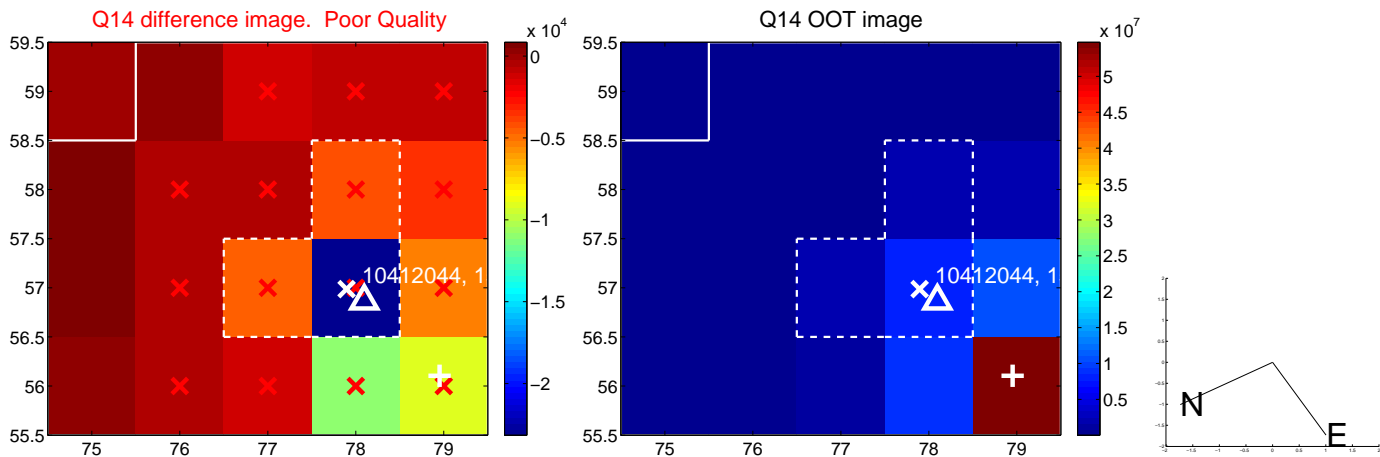
Q8 no OOT image



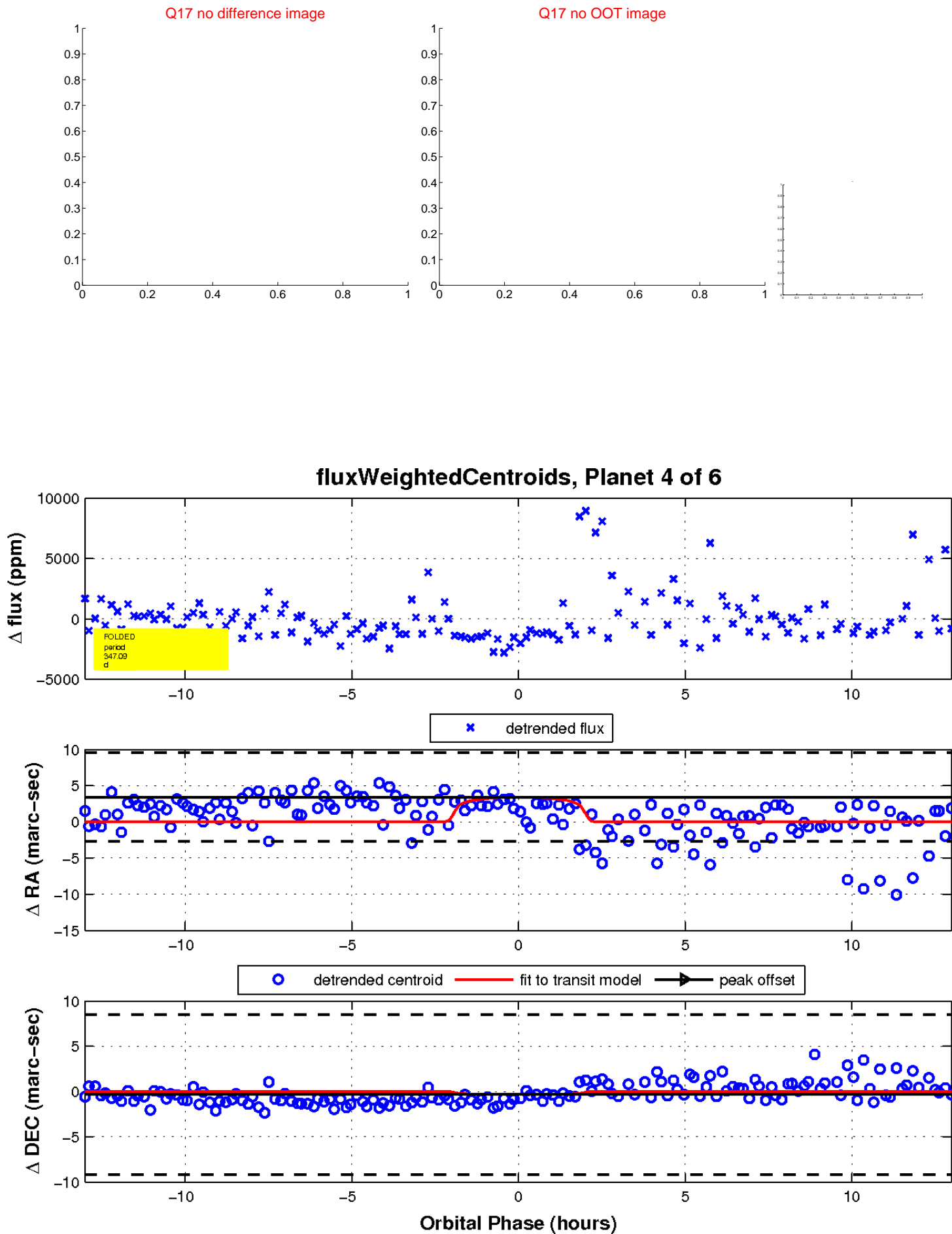
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

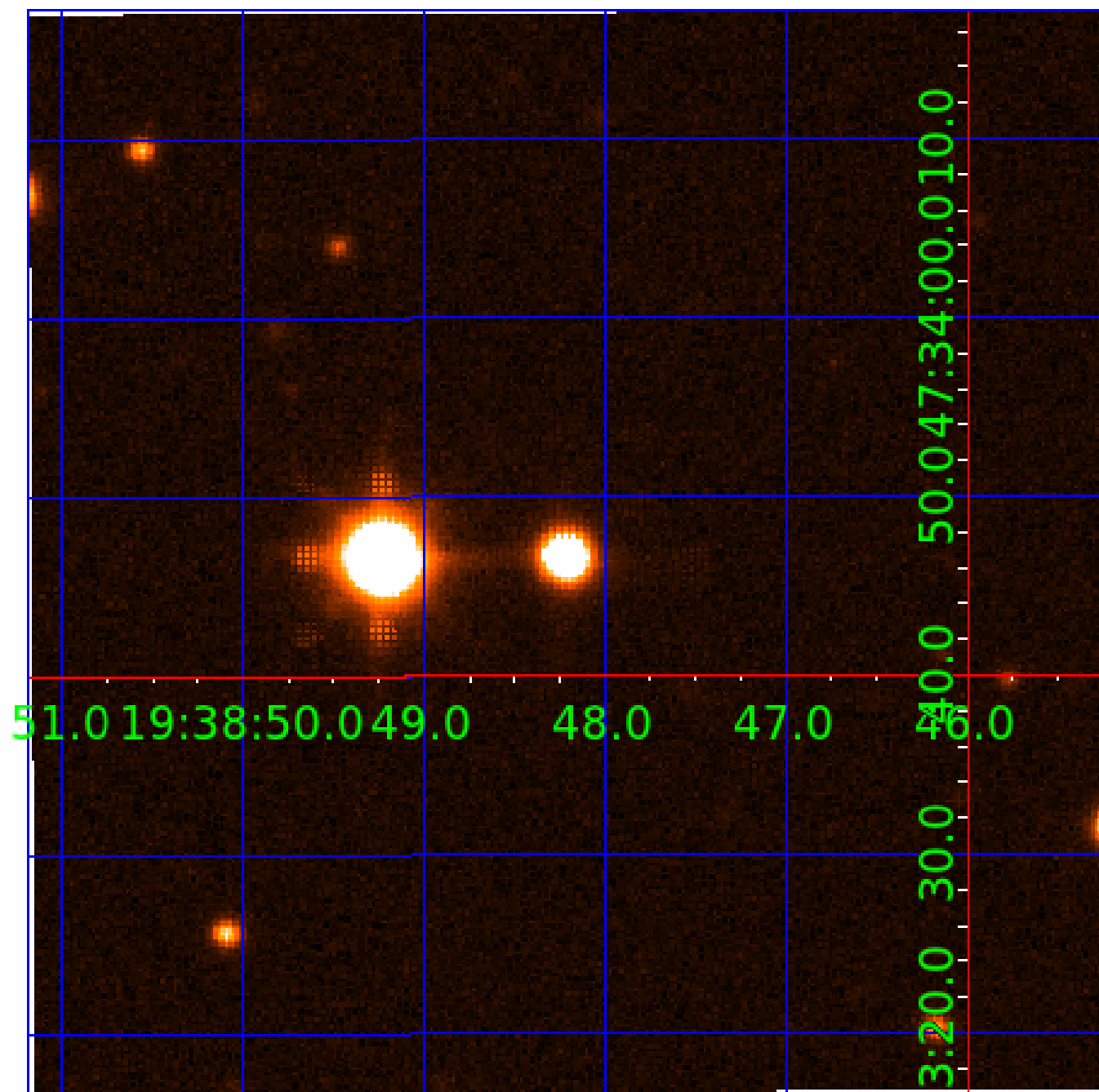


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination





# KIC 010412044

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
010412044-01	OBS	No	217.410359	140.894954	2536.3	1.840	13.1	8.0	0.45	3651	2.45	0.11
010412044-02	OBS	No	266.794685	377.959858	2321.4	4.958	11.1	6.8	0.45	3651	2.13	0.08
010412044-03	OBS	No	135.936292	156.835508	1625.7	5.173	11.0	6.7	0.45	3651	2.13	0.20
010412044-04	OBS	No	347.092671	259.473532	3168.1	4.346	10.4	7.7	0.45	3651	2.63	0.06
010412044-05	OBS	No	196.325909	195.517815	2079.5	3.049	10.9	8.4	0.45	3651	2.19	0.12
010412044-06	OBS	No	3.328827	133.848494	1333.0	1.500	8.1	-1.0	0.45	3651	1.62	27.91

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
010412044-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL_TRACKER—LPP_ALT—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS
010412044-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_CHASES_MARSHALL—ALL_TRANS_CHASES—CENT_FEW_MEAS
010412044-03	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—CENT_FEW_DIFFS
010412044-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
010412044-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL_SKYE—LPP_DV—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—CENT_FEW_DIFFS
010412044-06	OBS	FP	0.00	1	0	0	0	LPP_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_NOFITS

**Notes:** OBS = Observed. INJ = Injected. INV = Inverted. SCR = Scrambled.

N = Not Transit-Like. S = Stellar Eclipse. C = Centroid Offset. E = Ephemeris Match.

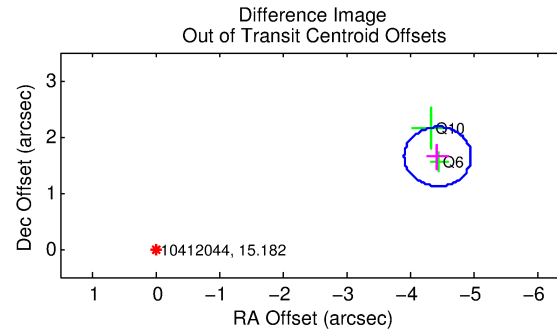
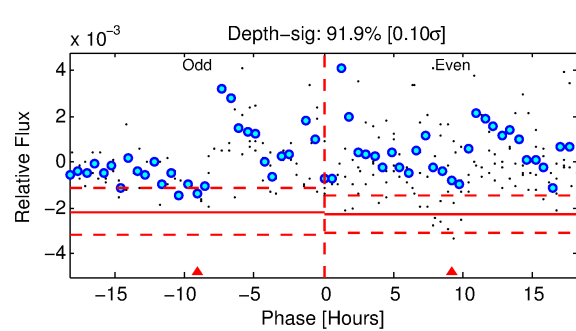
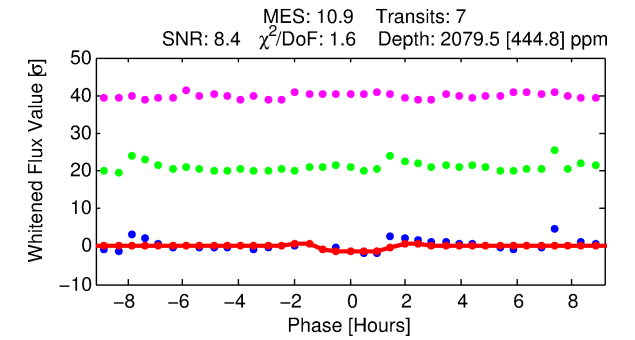
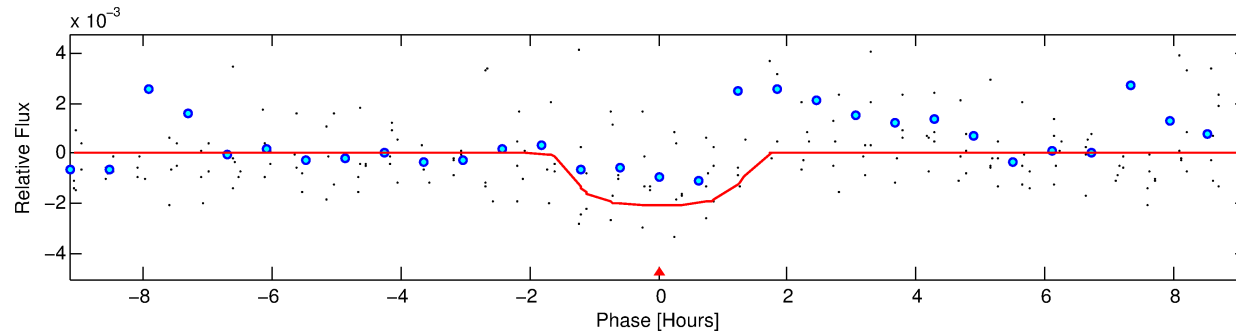
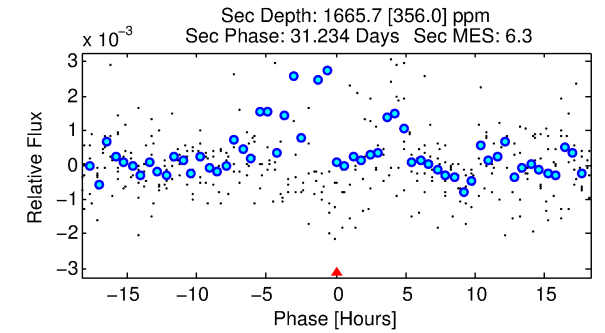
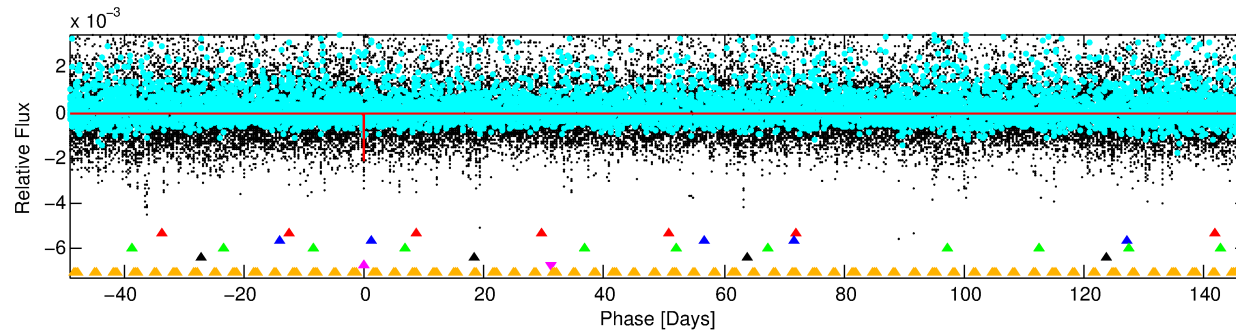
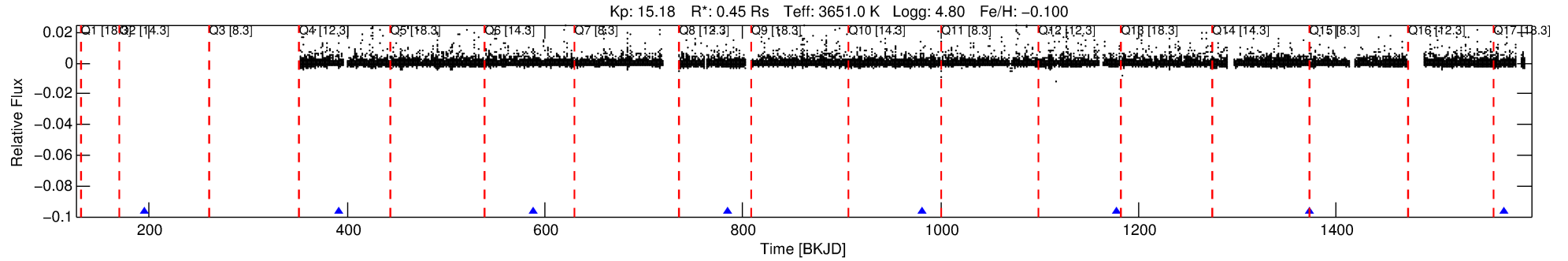
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 010412044-05

No Significant Match Found

# DV One-Page Summary

KIC: 10412044 Candidate: 5 of 6 Period: 196.326 d



## DV Fit Results:

Period = 196.32591 [0.00244] d  
Epoch = 195.5178 [0.0106] BKJD  
Rp/R\* = 0.0451 [0.0356]  
a/R\* = 366.80 [1229.82]  
b = 0.73 [2.12]  
Seff = 0.12 [0.02]  
Teff = 151 [5] K  
Rp = 2.20 [1.74] Re  
a = 0.5104 [0.0385] AU  
Ag = 49544.33 [78994.55] [0.63σ]  
Teffp = 3473 [1383] K [2.40σ]

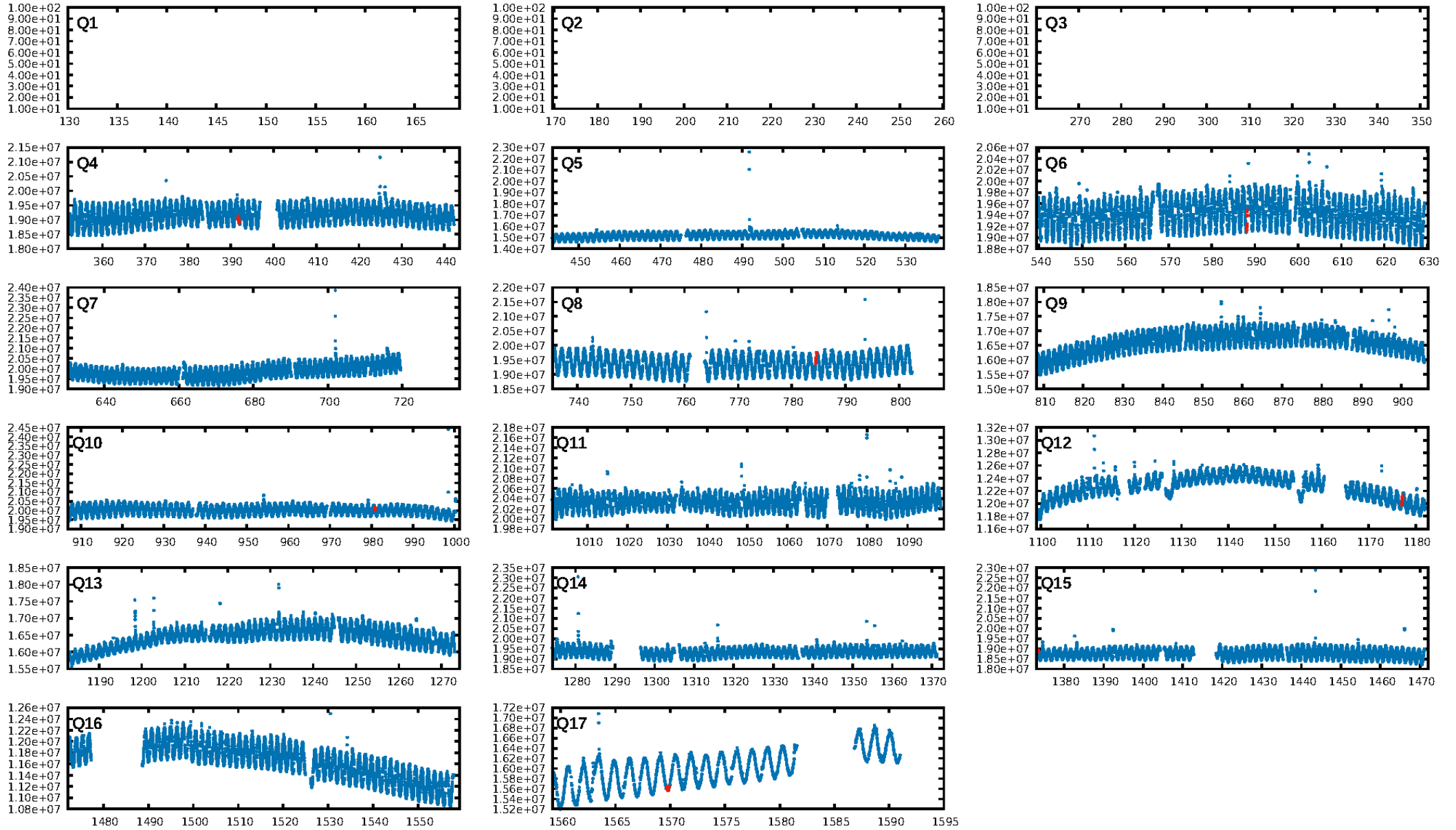
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [241.38σ]  
LongPeriod-sig: 100.0% [142.08σ]  
ModelChiSquare2-sig: 1.9%  
ModelChiSquareGof-sig: 78.6%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [6/6]  
GhostDiagnostic-chr: 5.589  
Centroid-sig: 13.4%  
Centroid-so: 3.500 arcsec [5.33σ]  
OotOffset-rm: 4.733 arcsec [26.92σ]  
KicOffset-rm: 0.354 arcsec [3.11σ]  
OotOffset-st: 2/0/0 [2]  
KicOffset-st: 2/0/2 [5]  
DiffImageQuality-fgm: 0.60 [3/5]  
DiffImageOverlap-fno: 1.00 [6/6]

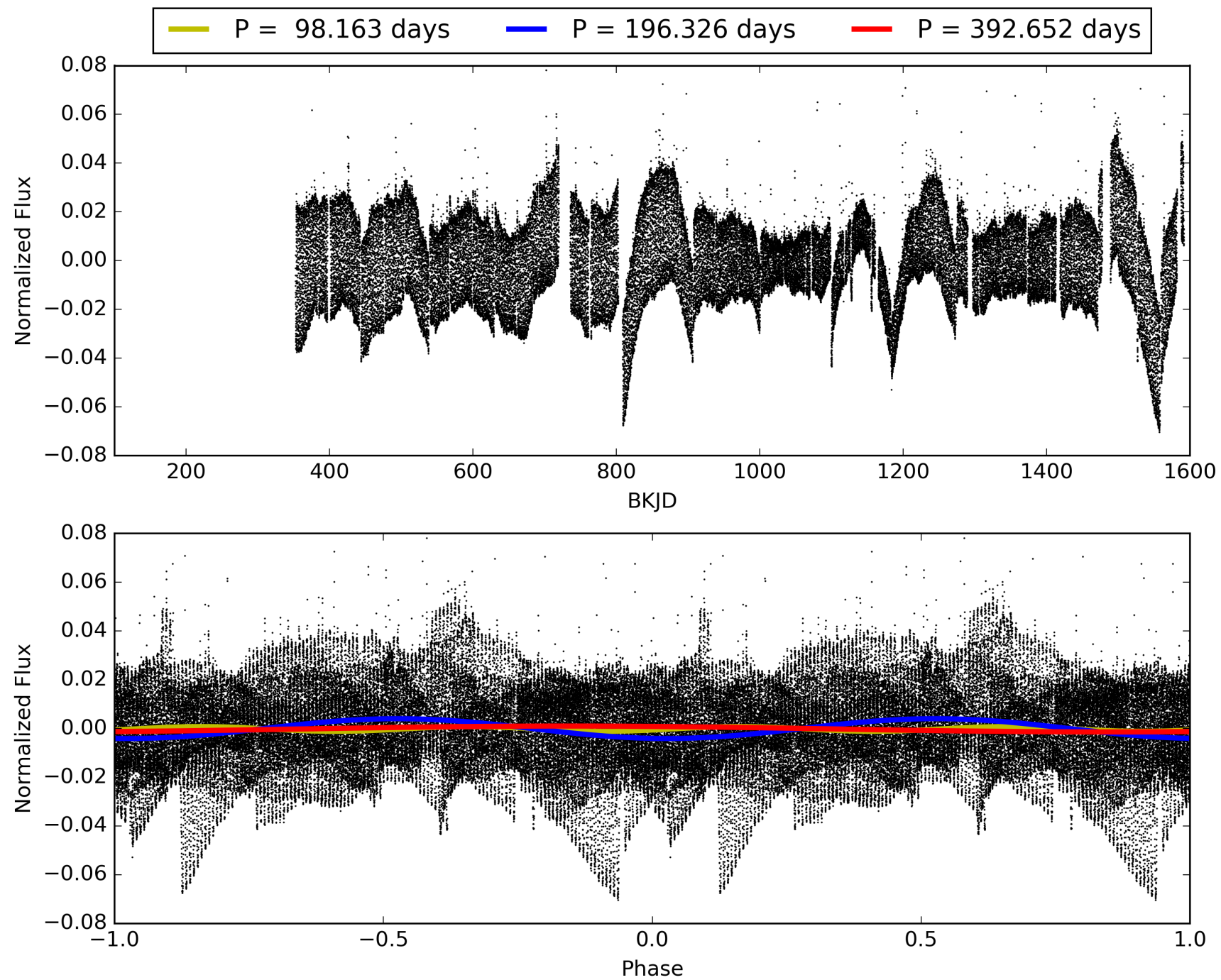
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 01:06:25 Z

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

# TCE 010412044-05, PDC Light Curves

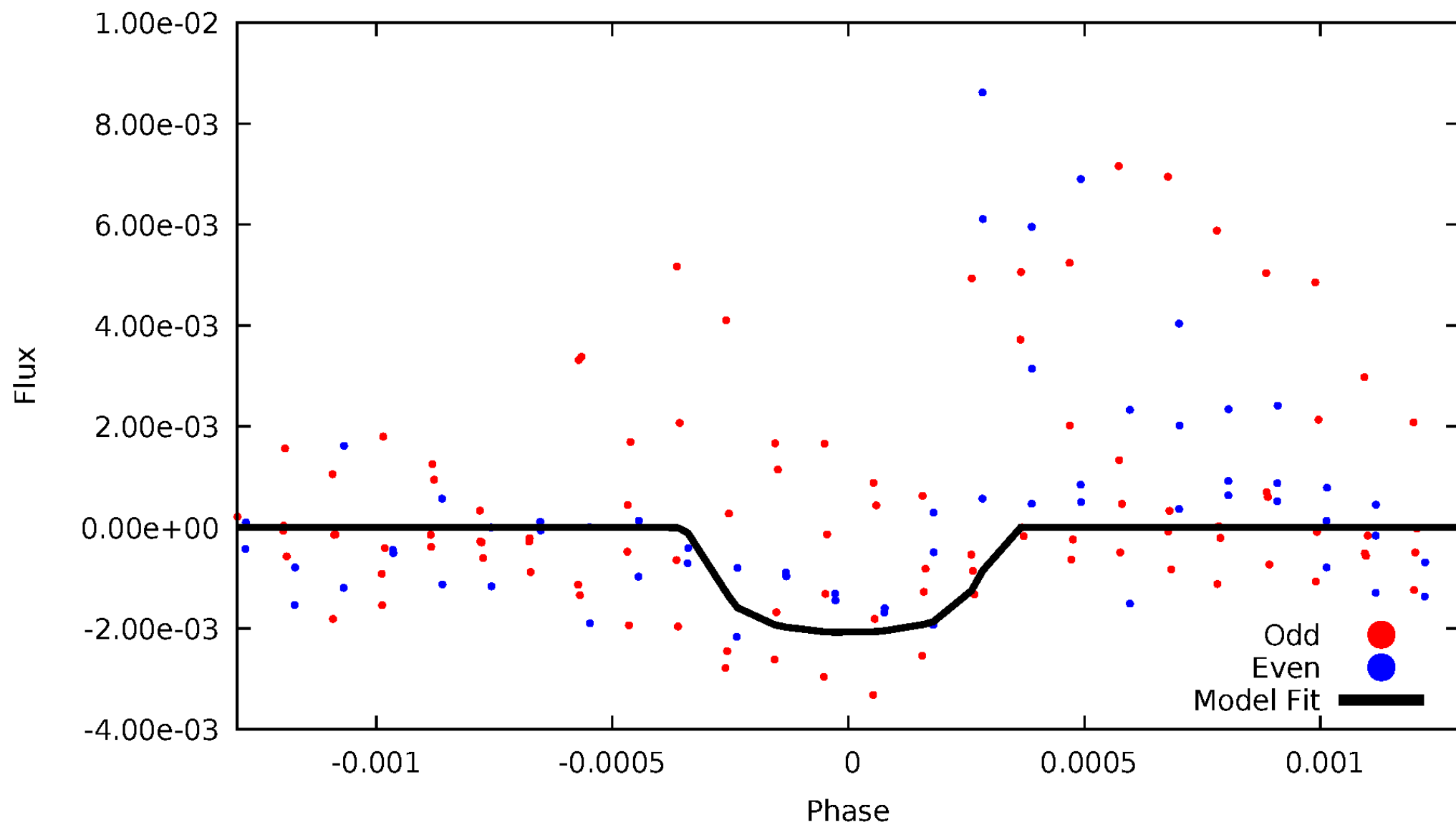


# TCE 010412044-05



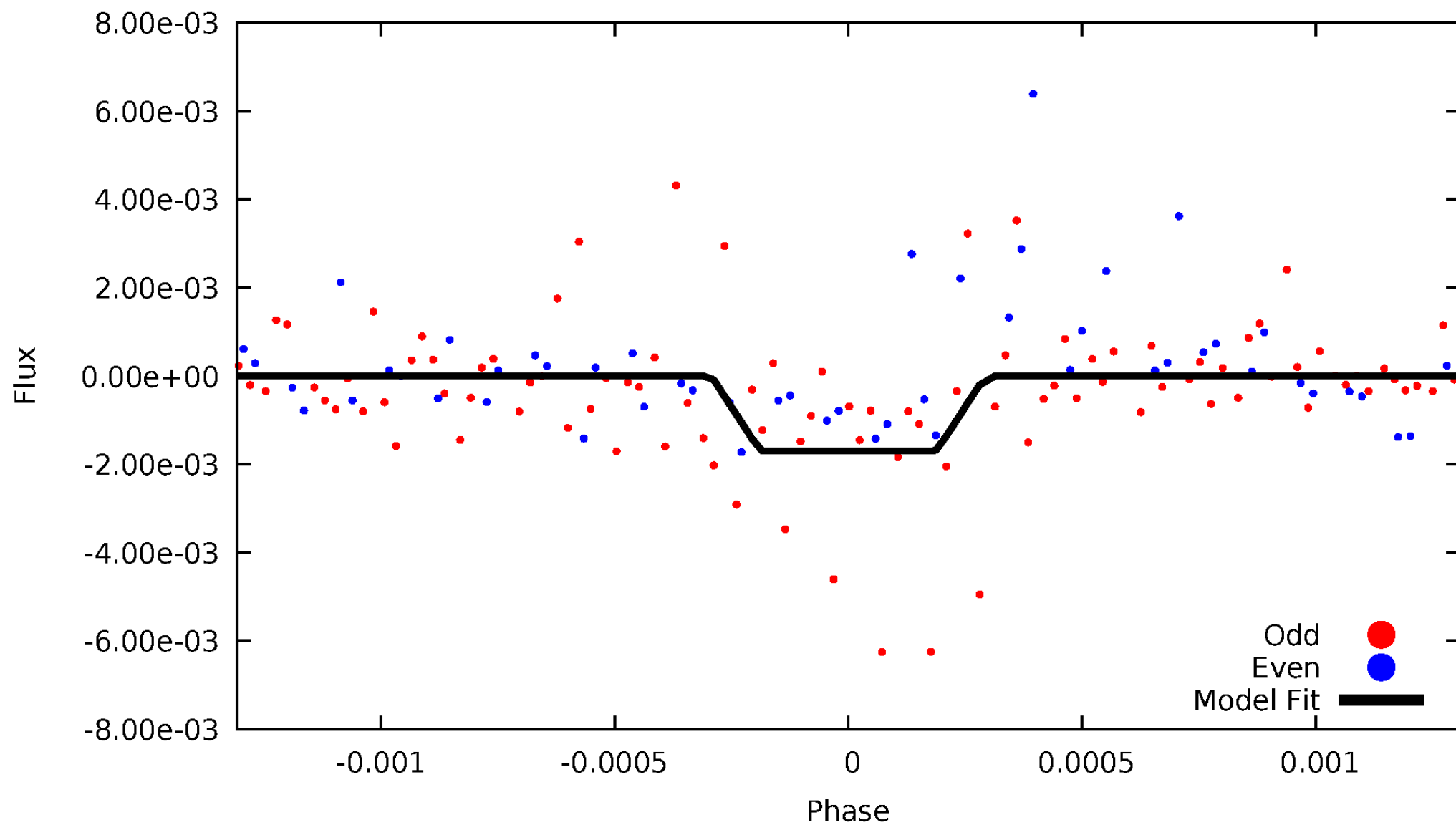
# DV Odd/Even

TCE 010412044-05

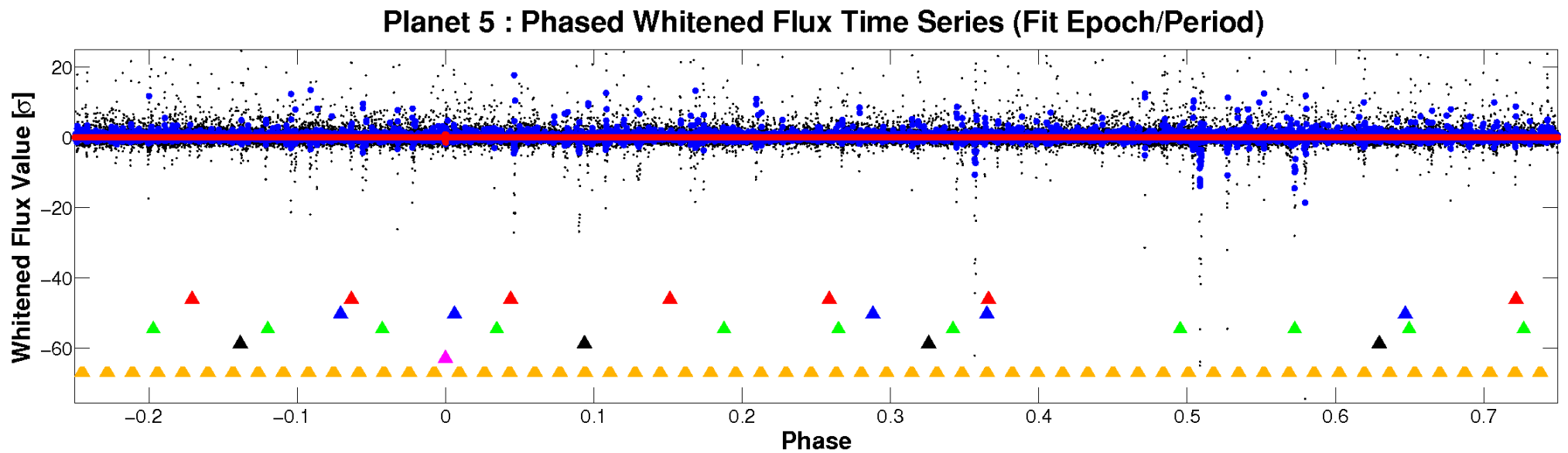
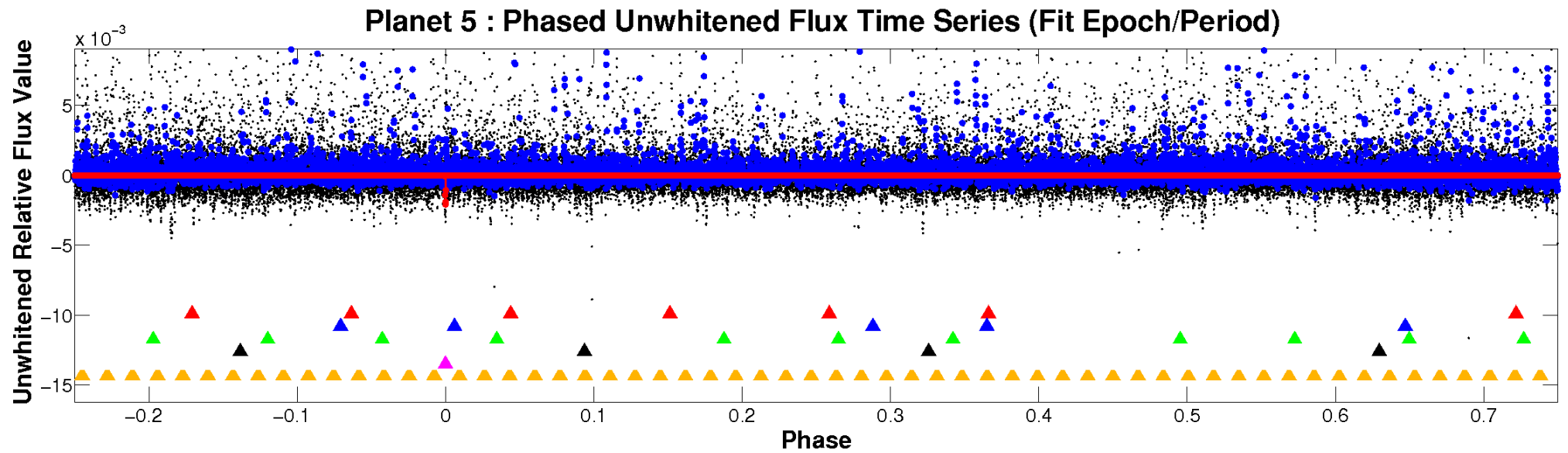


# ALT Odd/Even

TCE 010412044-05

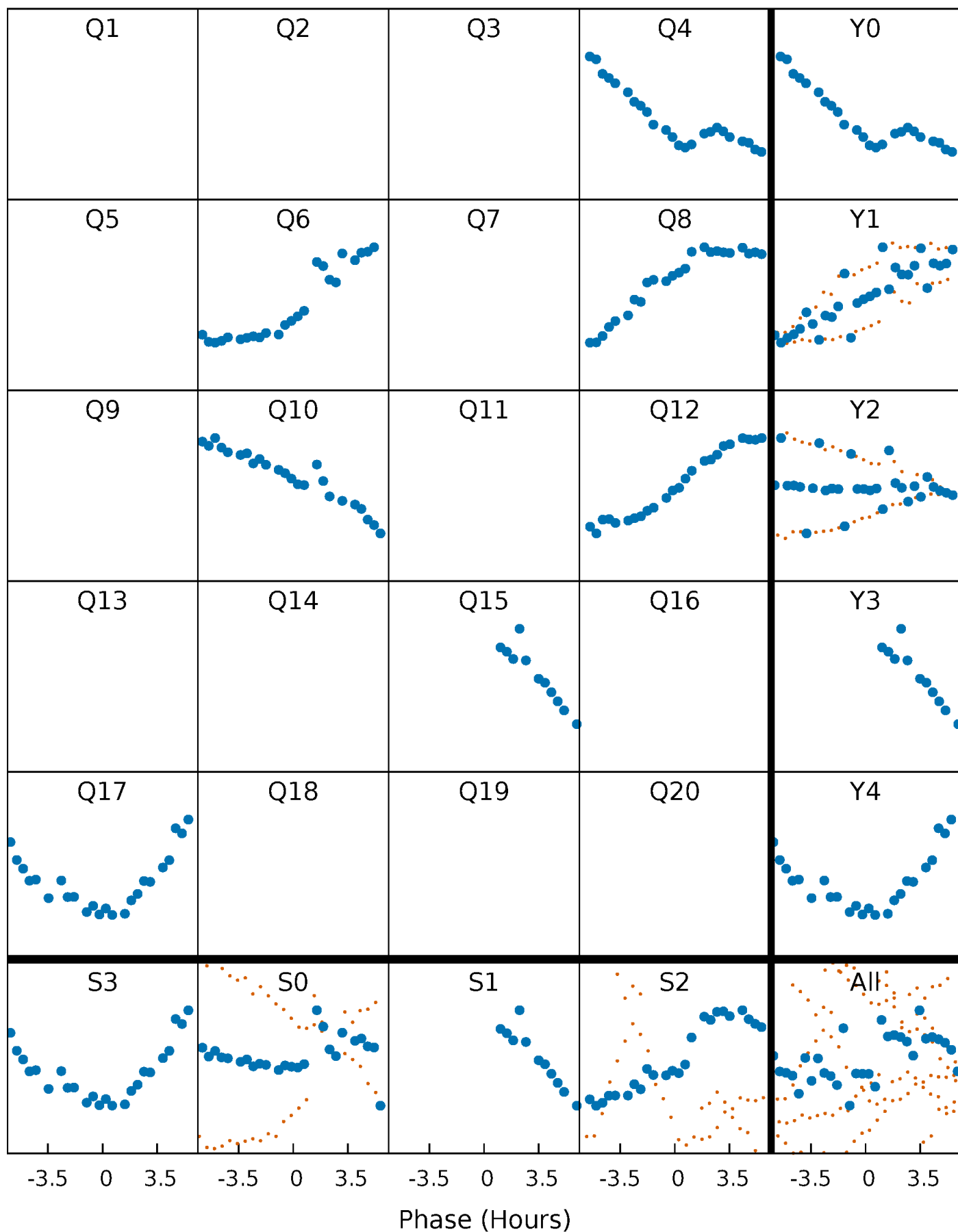


# Non-Whitened Vs. Whitened Light Curve



# PDC Quarter-Phased Transit Curves

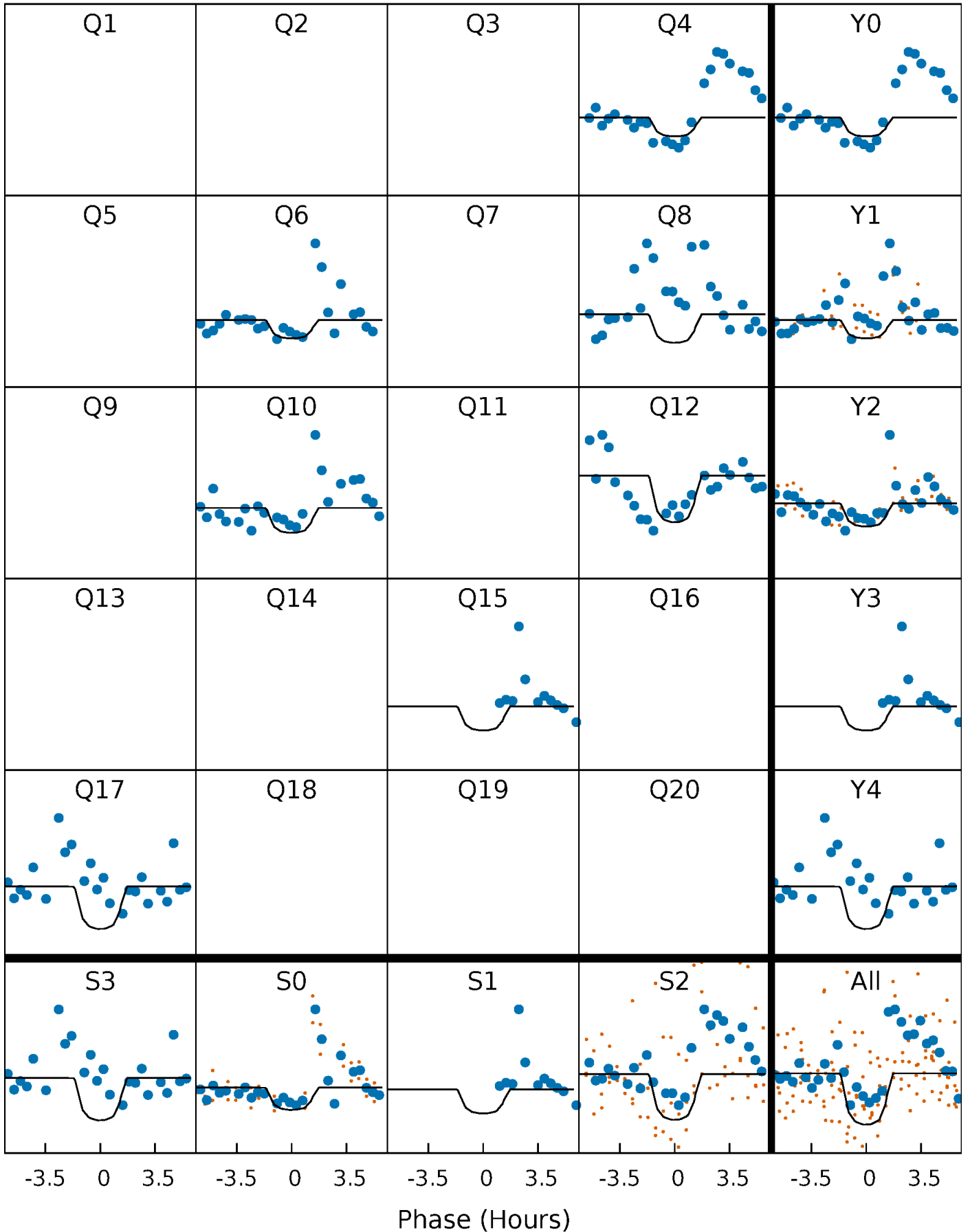
TCE 010412044-05 P=196.325909 Days  $T_0=195.517815$  (BKJD)





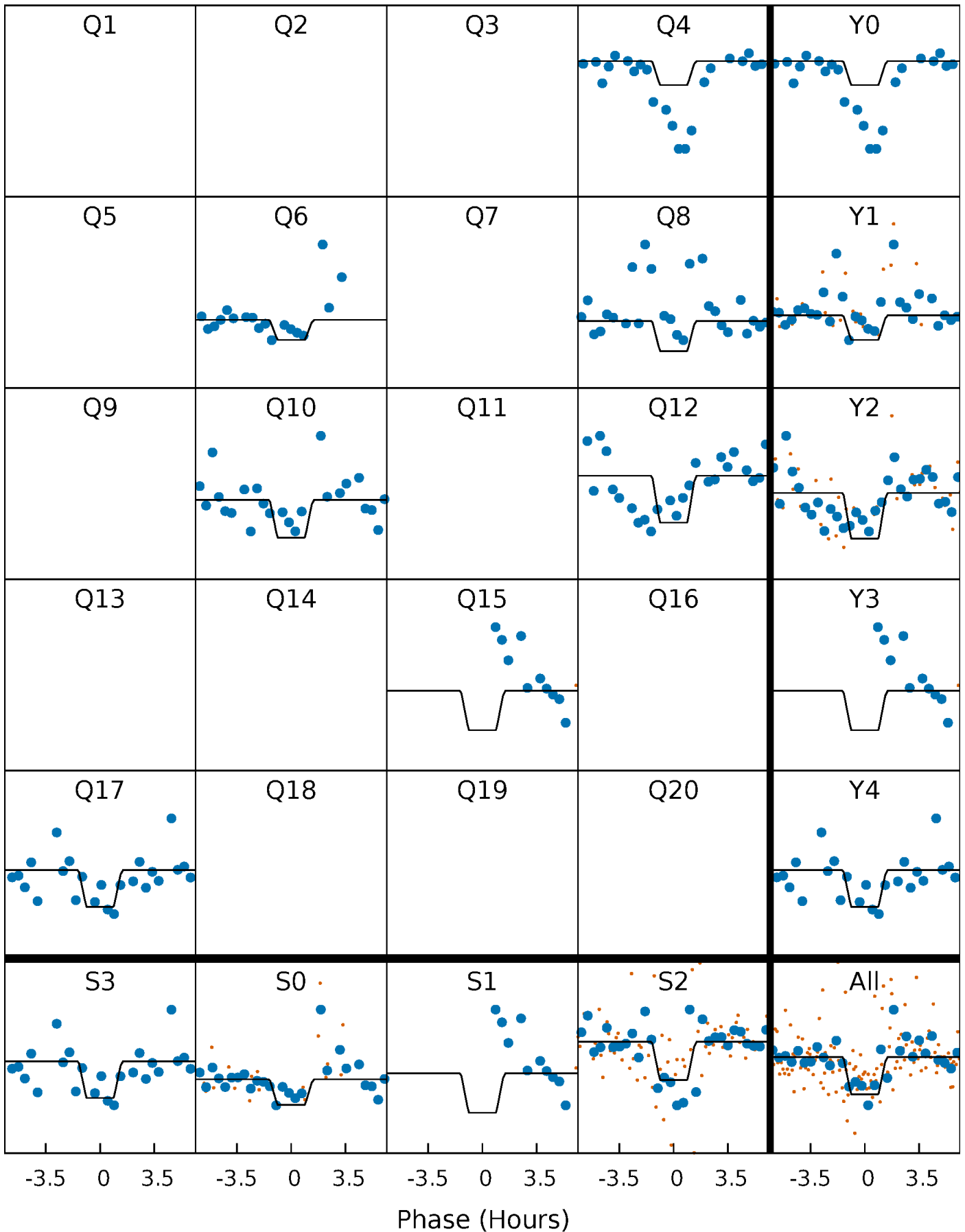
# DV Quarter-Phased Transit Curves

TCE 010412044-05     $P=196.325909$  Days     $T_0=195.517815$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

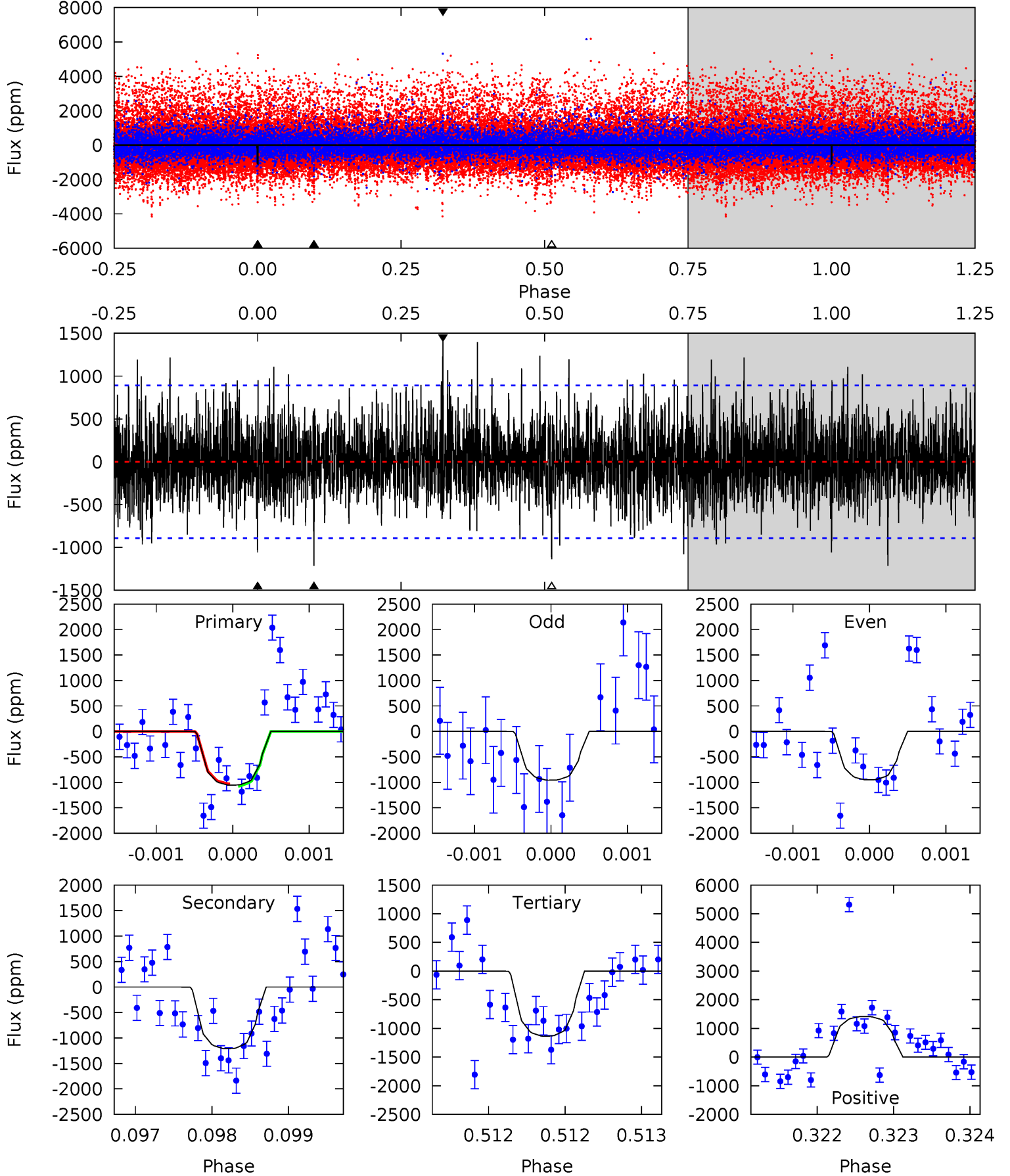
TCE 010412044-05     $P=196.328449$  Days     $T_0=195.511294$  (BKJD)



# DV Model-Shift Uniqueness Test

010412044-05, P = 196.325909 Days, E = 195.517815 Days

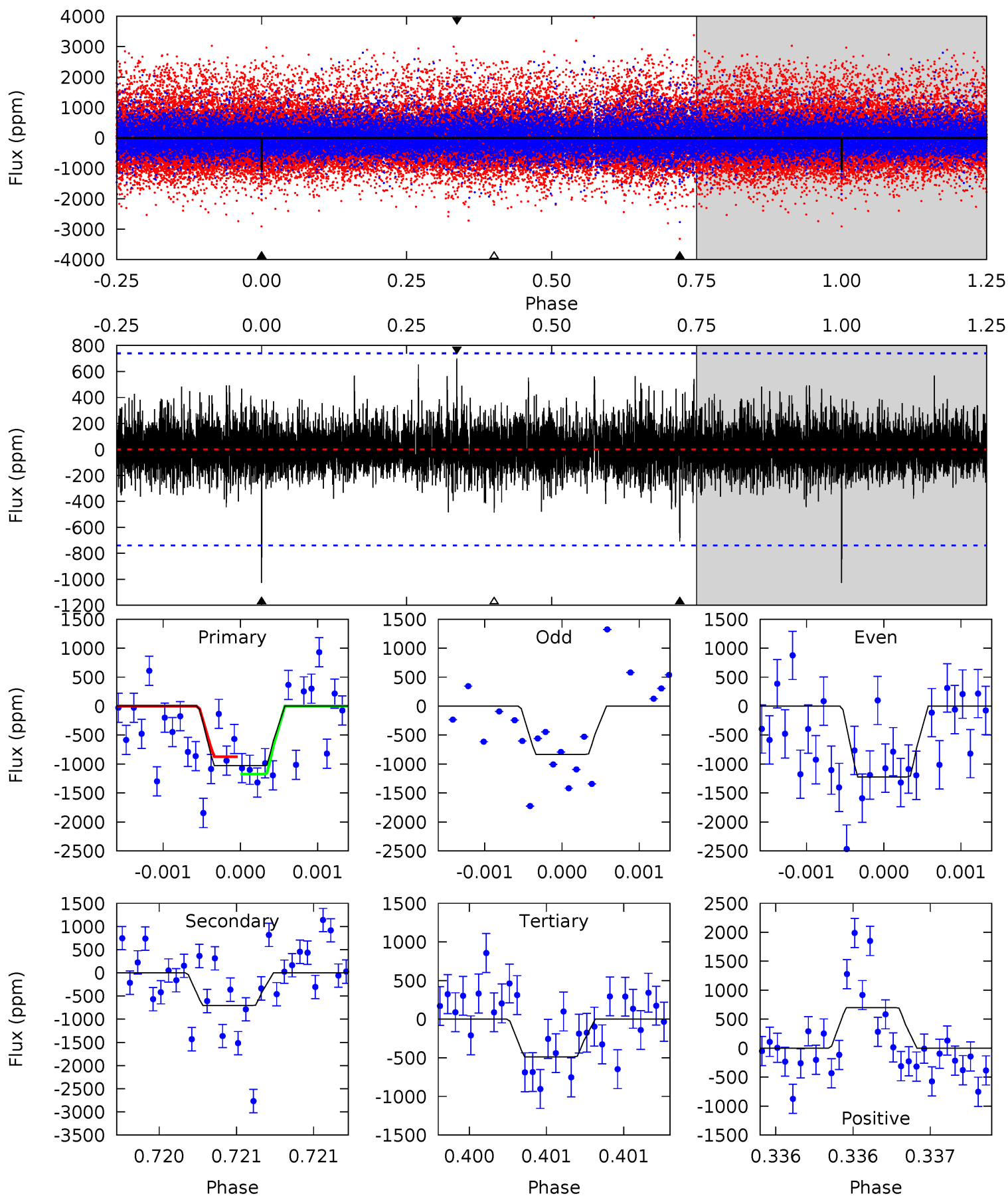
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
6.53	7.49	7.03	8.75	5.51	3.38	1.94	-0.50	-2.22	0.46	-1.26	0.02	0.83	0.54	0.14



# Alt Model-Shift Uniqueness Test

010412044-05, P = 196.328449 Days, E = 195.511294 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
7.72	5.32	3.66	5.26	5.56	3.46	1.00	4.07	2.46	1.66	0.05	1.48	0.86	0.41	1.13



### Stellar Parameters For KIC 010412044

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$3651^{+73}_{-73}$	$4.802^{+0.048}_{-0.032}$	$-0.100^{+0.100}_{-0.100}$	$0.446^{+0.036}_{-0.044}$	$0.461^{+0.034}_{-0.042}$	$7.297^{+1.807}_{-1.001}$
	+2%/-2%	+1%/-1%	+100%/-100%	+8%/-10%	+7%/-9%	+25%/-14%
Source	PHO2	PHO2	PHO2	DSEP		

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

### Secondary Eclipse Parameters for KIC 010412044-05 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	-1212±162	$2.42^{+1.64}_{-1.34}$	$210^{+5}_{-6}$	$3275^{+1071}_{-466}$	$31387^{+125925}_{-20531}$
Alt.	-707±133	$2.35^{+1.55}_{-1.49}$	$210^{+5}_{-6}$	$3025^{+1156}_{-389}$	$18048^{+115914}_{-11699}$

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

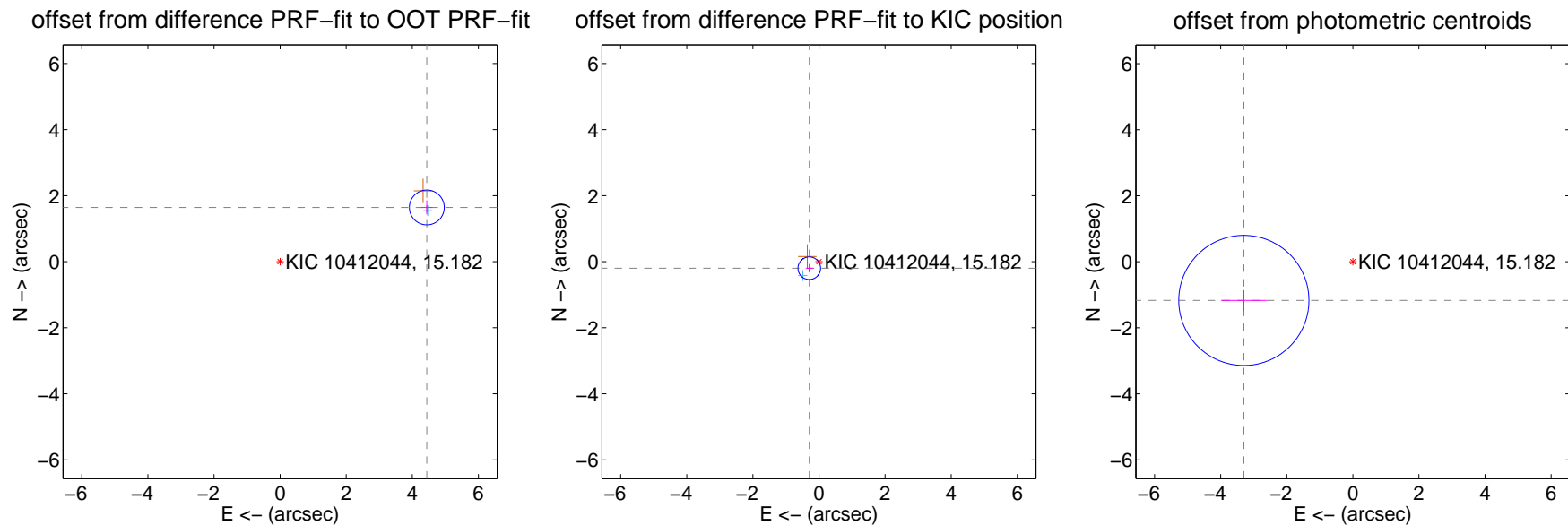
## DV Centroid Data

Supplemental centroid analysis for 010412044-05. Kepler magnitude: 15.18. Transit SNR 8.41

There are 3 quarters with good PRF difference image offsets

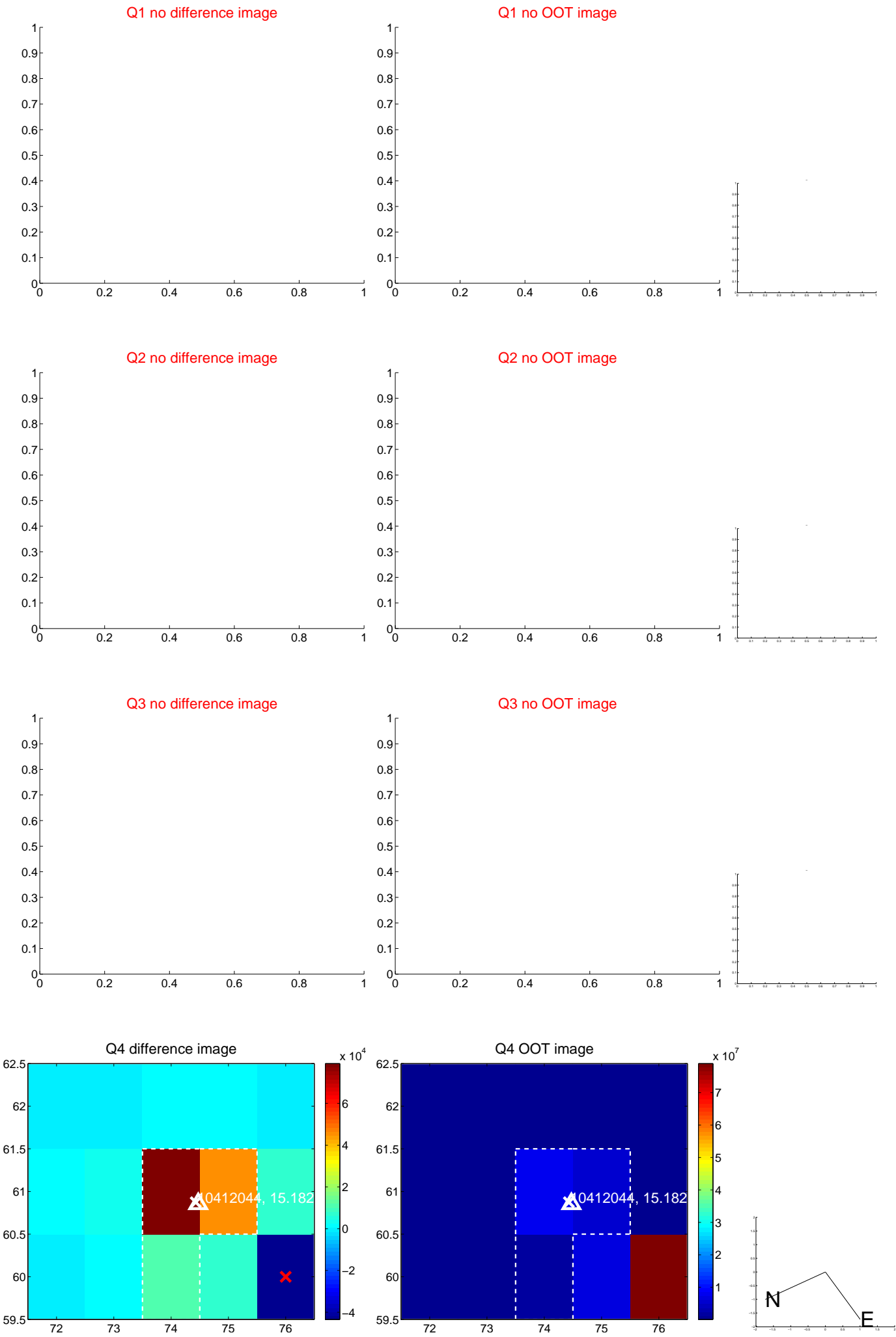
The OOT PRF centroid is offset from the target star catalog position by about 5.08 arcsec so the offset from difference PRF-fit to OOT-fit may be invalid.

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$4.733 \pm 0.176$	26.92	$-4.439 \pm 0.170$	$1.643 \pm 0.213$
PRF-fit source offset from KIC position	$0.354 \pm 0.114$	3.11	$0.293 \pm 0.105$	$-0.198 \pm 0.131$
photometric centroid source offset	$3.50 \pm 0.66$	5.33	$3.30 \pm 0.69$	$-1.17 \pm 0.31$

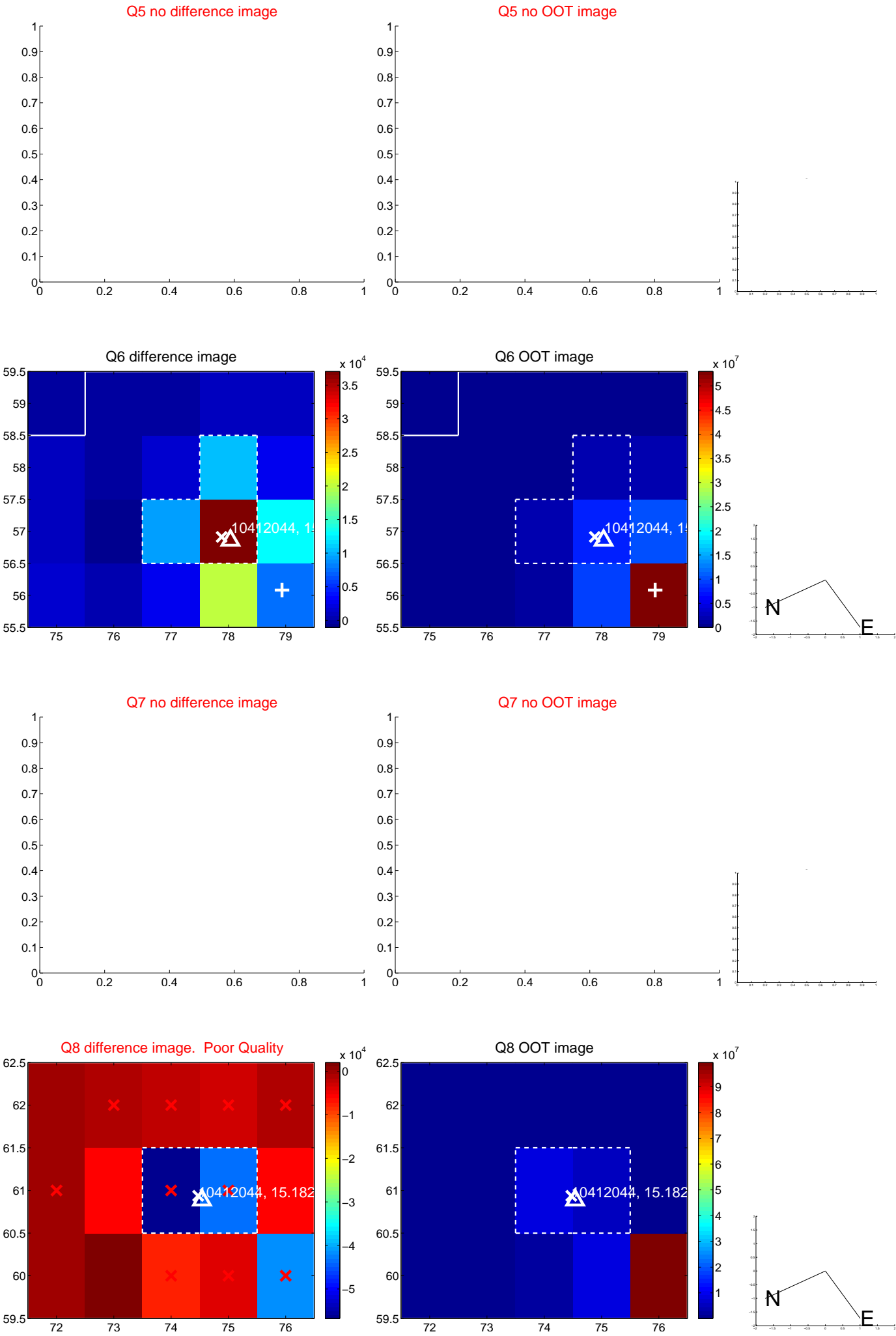


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three- $\sigma$ . Red \*: target star. Blue \*: Other stars. Text next to a star gives its KIC ID and kepmag. KIC IDs > 15,000,000 are from the UKIRT catalog.

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

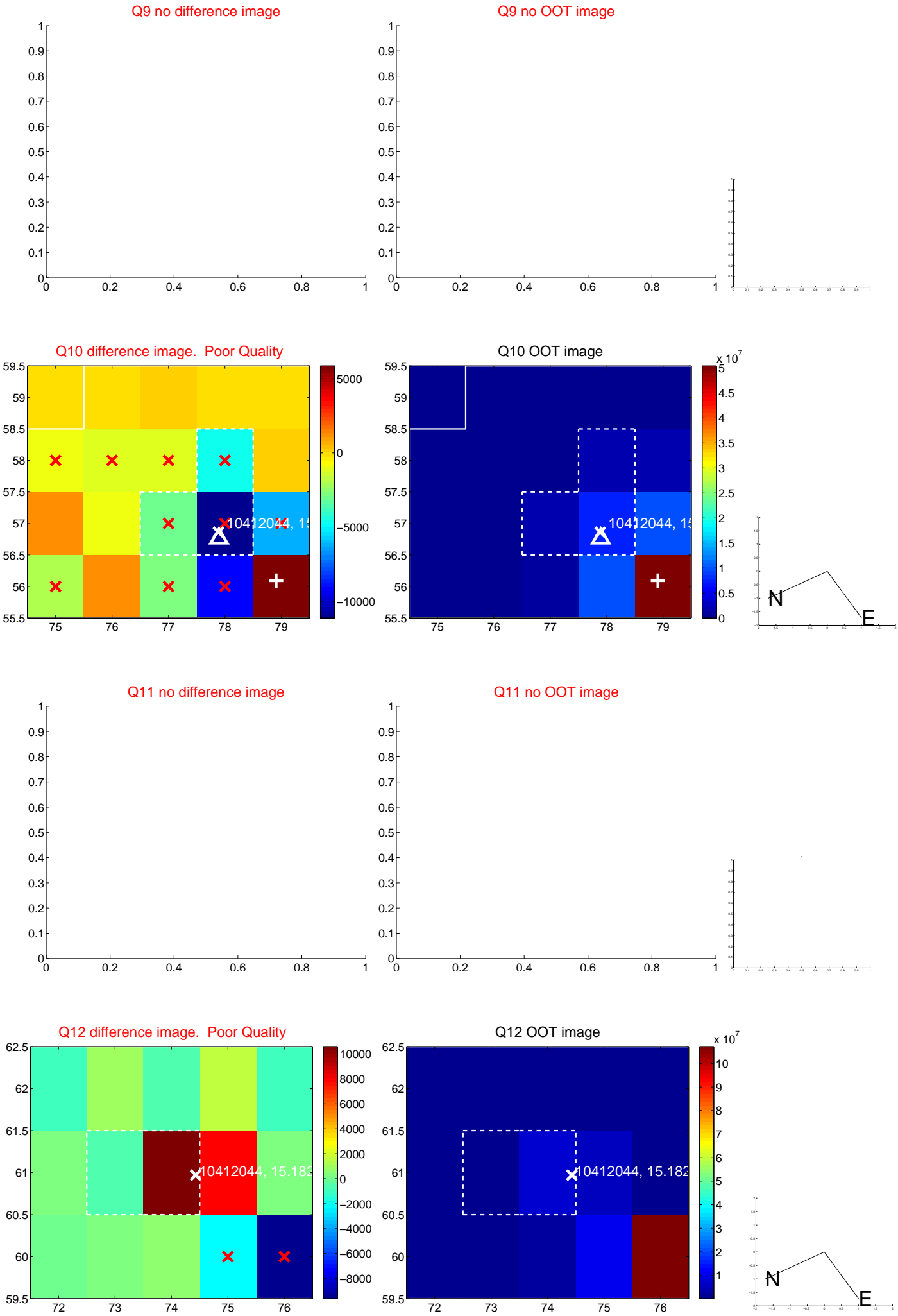


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





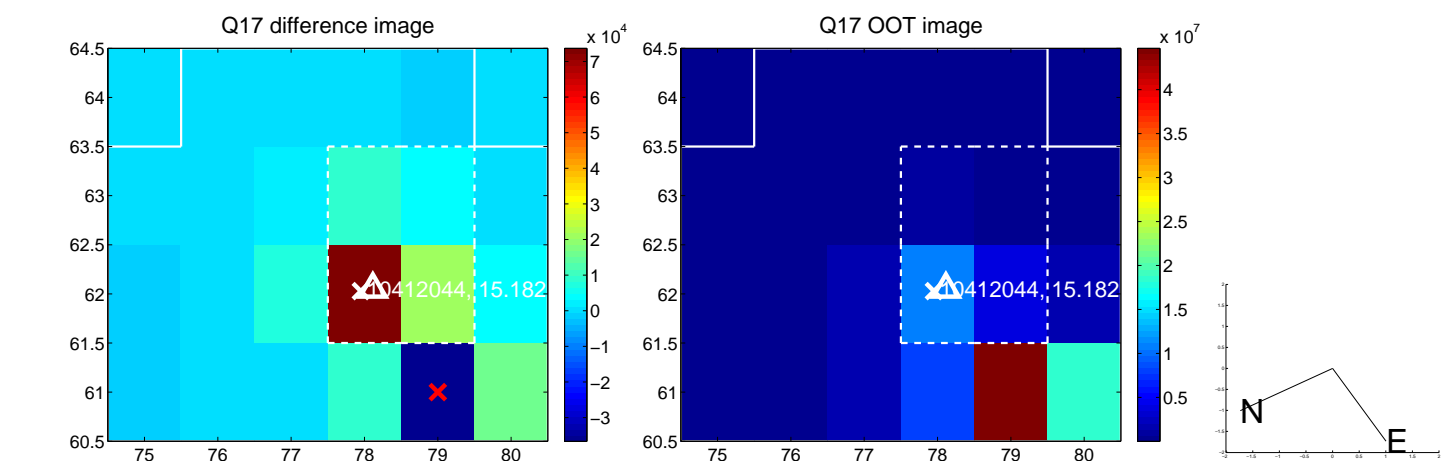
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



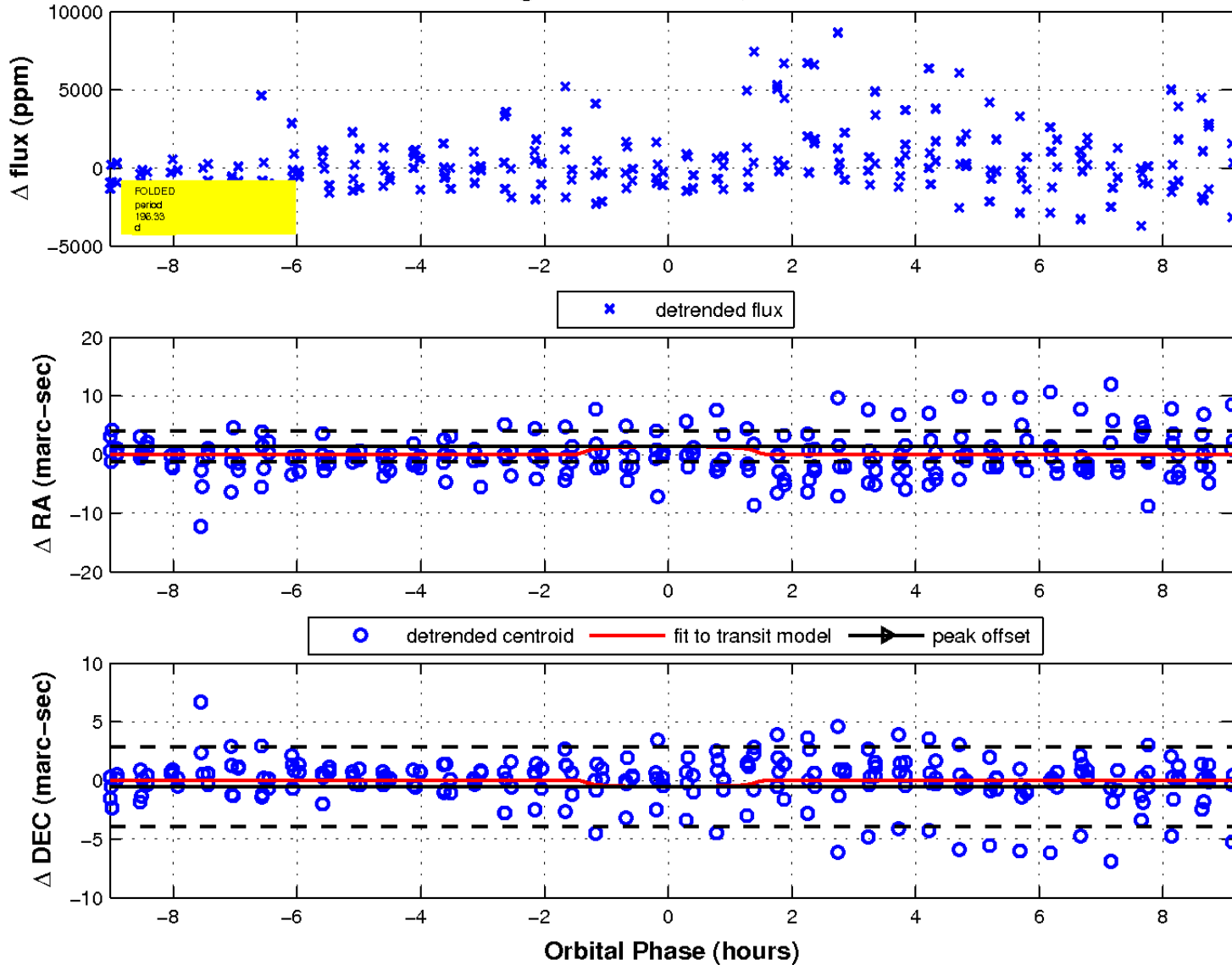
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

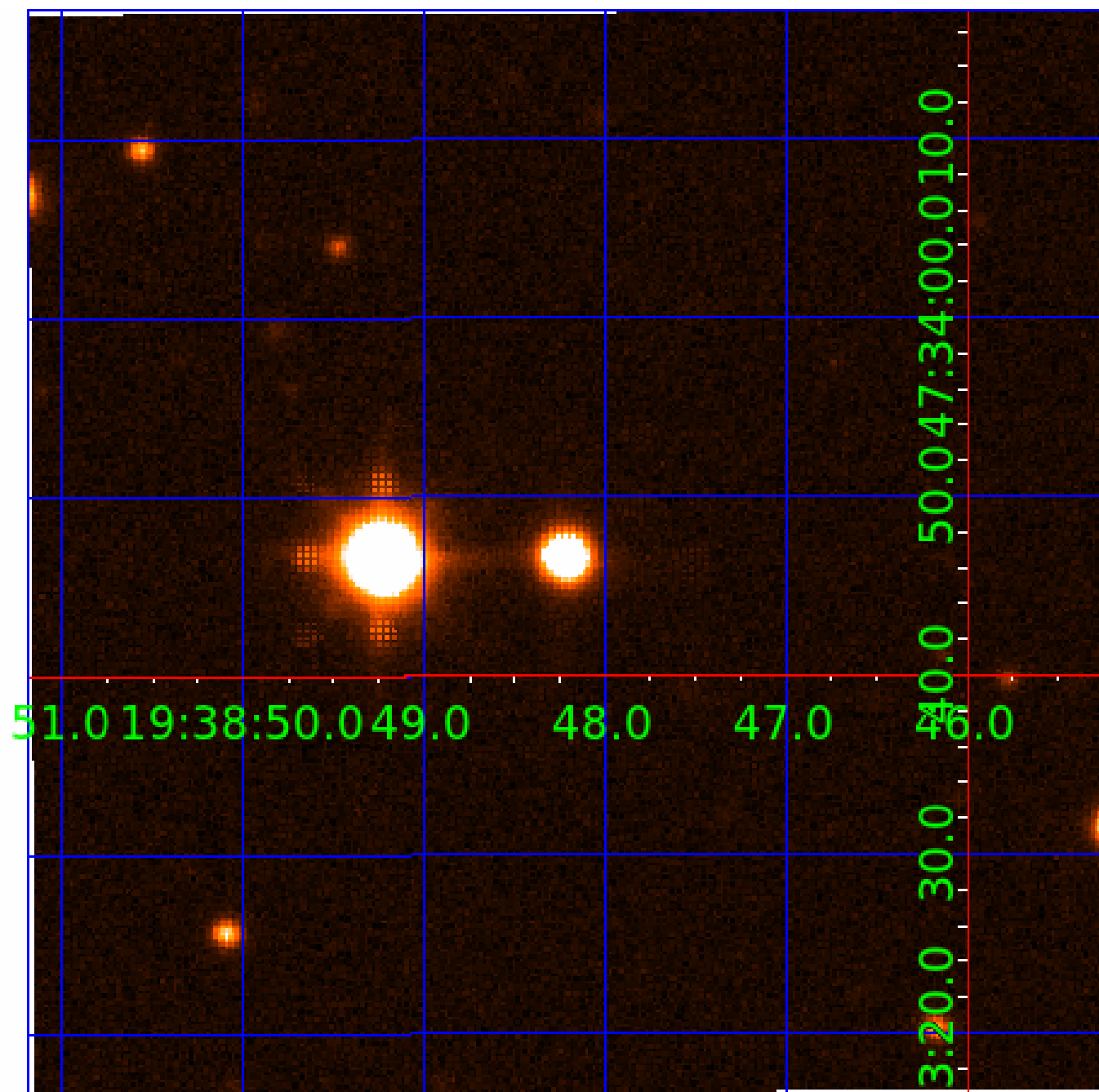


fluxWeightedCentroids, Planet 5 of 6



UKIRT Image

Declination



# KIC 010412044

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
010412044-01	OBS	No	217.410359	140.894954	2536.3	1.840	13.1	8.0	0.45	3651	2.45	0.11
010412044-02	OBS	No	266.794685	377.959858	2321.4	4.958	11.1	6.8	0.45	3651	2.13	0.08
010412044-03	OBS	No	135.936292	156.835508	1625.7	5.173	11.0	6.7	0.45	3651	2.13	0.20
010412044-04	OBS	No	347.092671	259.473532	3168.1	4.346	10.4	7.7	0.45	3651	2.63	0.06
010412044-05	OBS	No	196.325909	195.517815	2079.5	3.049	10.9	8.4	0.45	3651	2.19	0.12
010412044-06	OBS	No	3.328827	133.848494	1333.0	1.500	8.1	-1.0	0.45	3651	1.62	27.91

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
010412044-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL_TRACKER—LPP_ALT—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS
010412044-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_CHASES_MARSHALL—ALL_TRANS_CHASES—CENT_FEW_MEAS
010412044-03	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—CENT_FEW_DIFFS
010412044-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
010412044-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL_SKYE—LPP_DV—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—CENT_FEW_DIFFS
010412044-06	OBS	FP	0.00	1	0	0	0	LPP_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_NOFITS

**Notes:** OBS = Observed. INJ = Injected. INV = Inverted. SCR = Scrambled.

N = Not Transit-Like. S = Stellar Eclipse. C = Centroid Offset. E = Ephemeris Match.

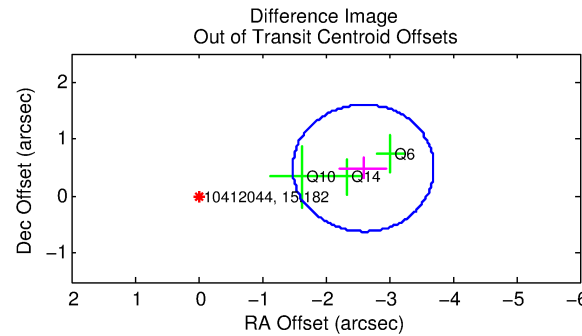
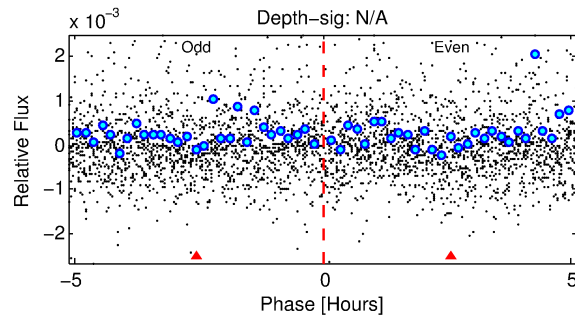
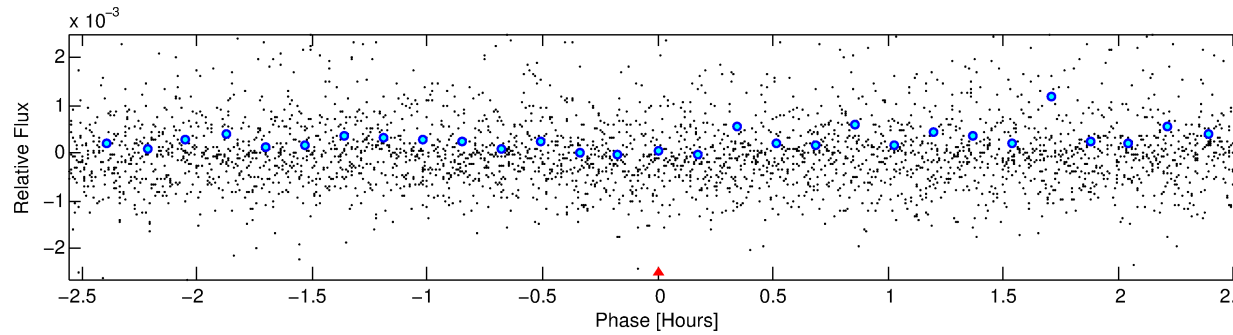
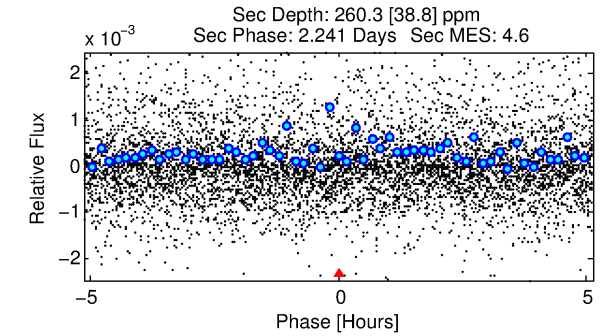
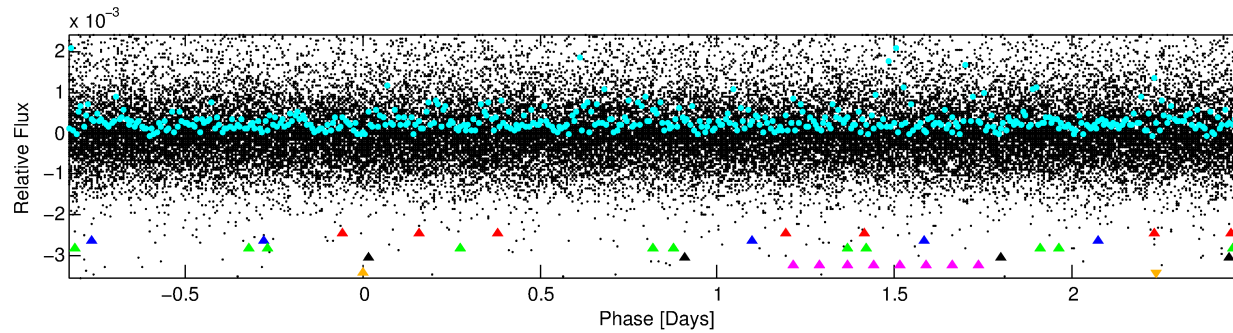
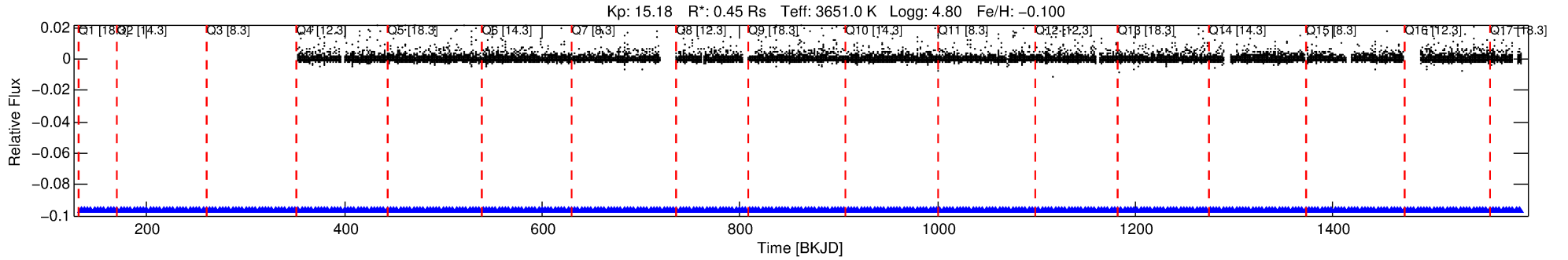
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 010412044-06

No Significant Match Found

# DV One-Page Summary

KIC: 10412044 Candidate: 6 of 6 Period: 3.329 d



## TPS TCE Results:

Period = 3.32883 d  
Epoch = 133.8485 BKJD

DV fit results are unavailable

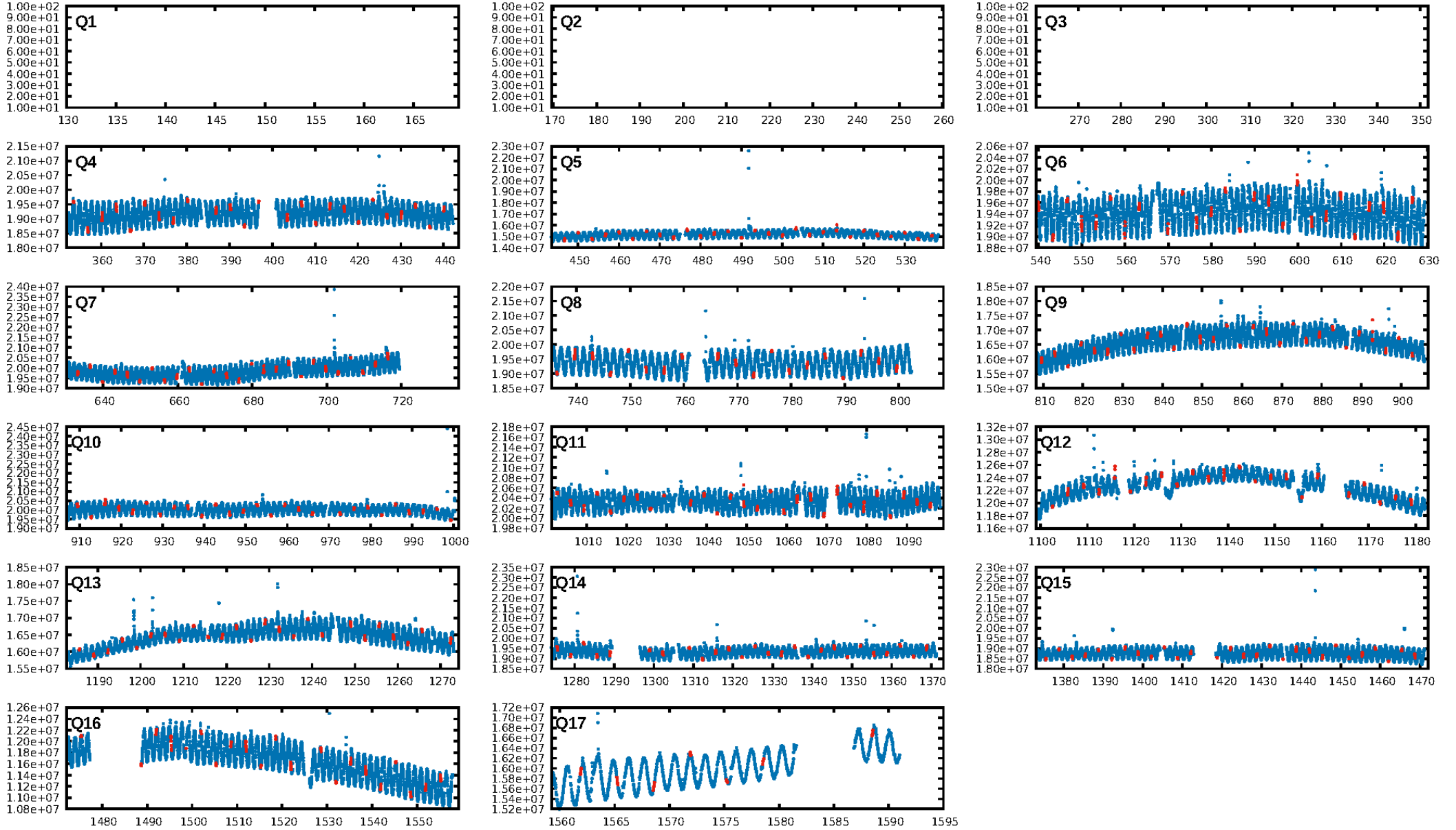
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [590.94σ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [325/325]  
GhostDiagnostic-chr: 6.089  
Centroid-sig: 0.0%  
Centroid-so: 0.418 arcsec [0.37σ]  
OotOffset-rm: 2.641 arcsec [7.13σ]  
KicOffset-rm: 1.591 arcsec [3.52σ]  
OotOffset-st: 3/0/0/0 [3]  
KicOffset-st: 3/2/2/2 [9]  
DiffImageQuality-fgm: 0.56 [5/9]  
DiffImageOverlap-fno: 1.00 [14/14]

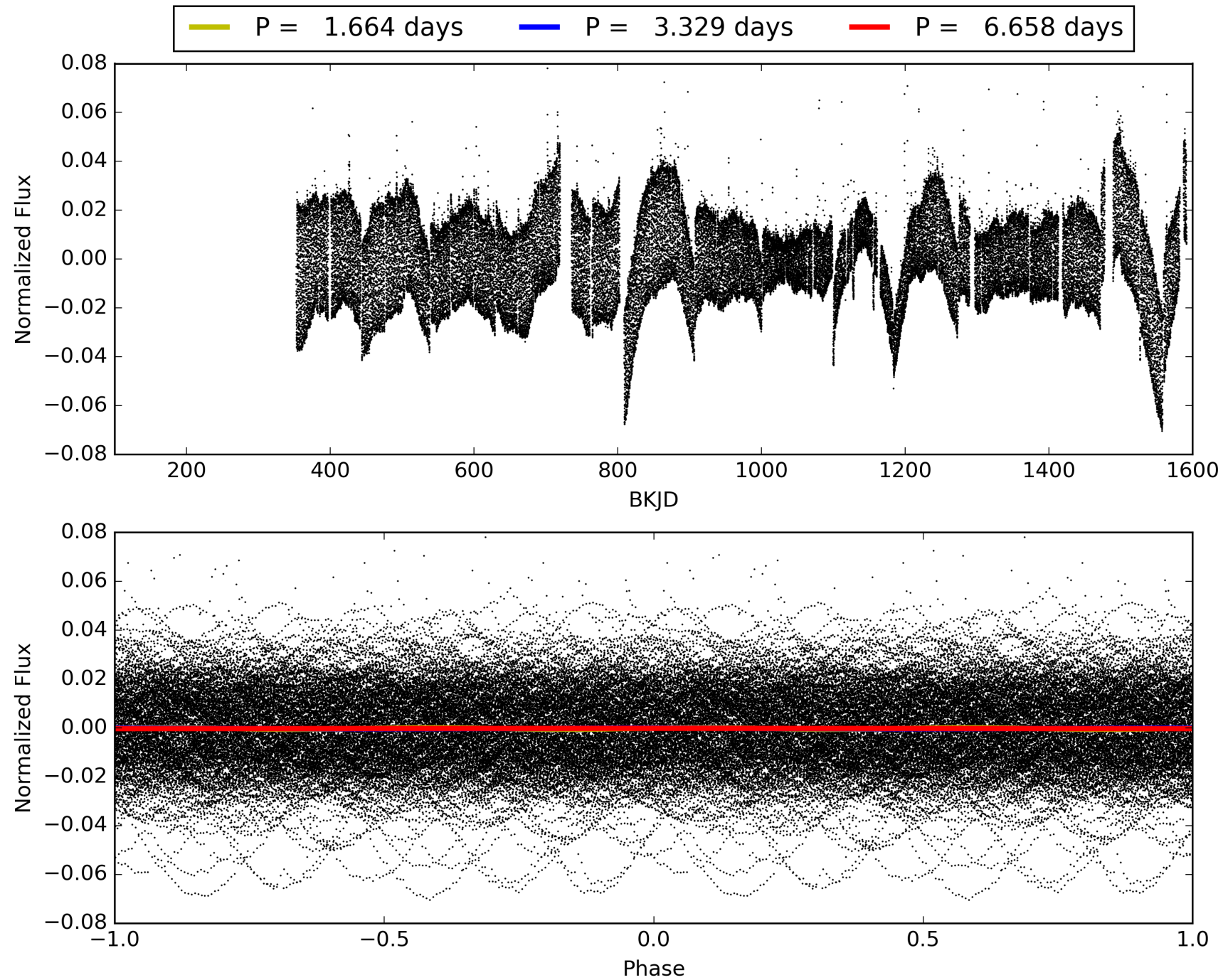
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 01:06:30 Z

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

# TCE 010412044-06, PDC Light Curves



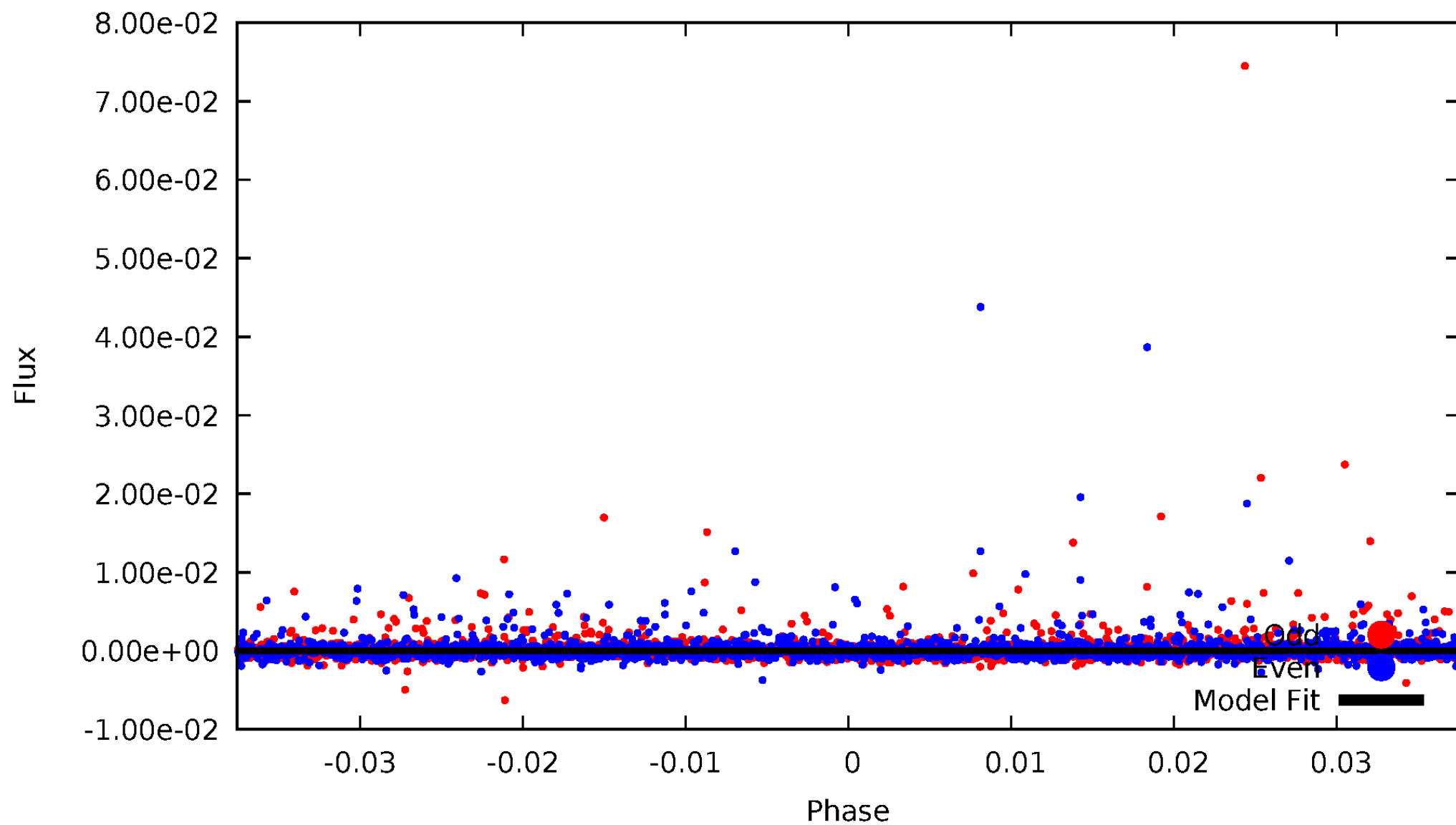
# TCE 010412044-06





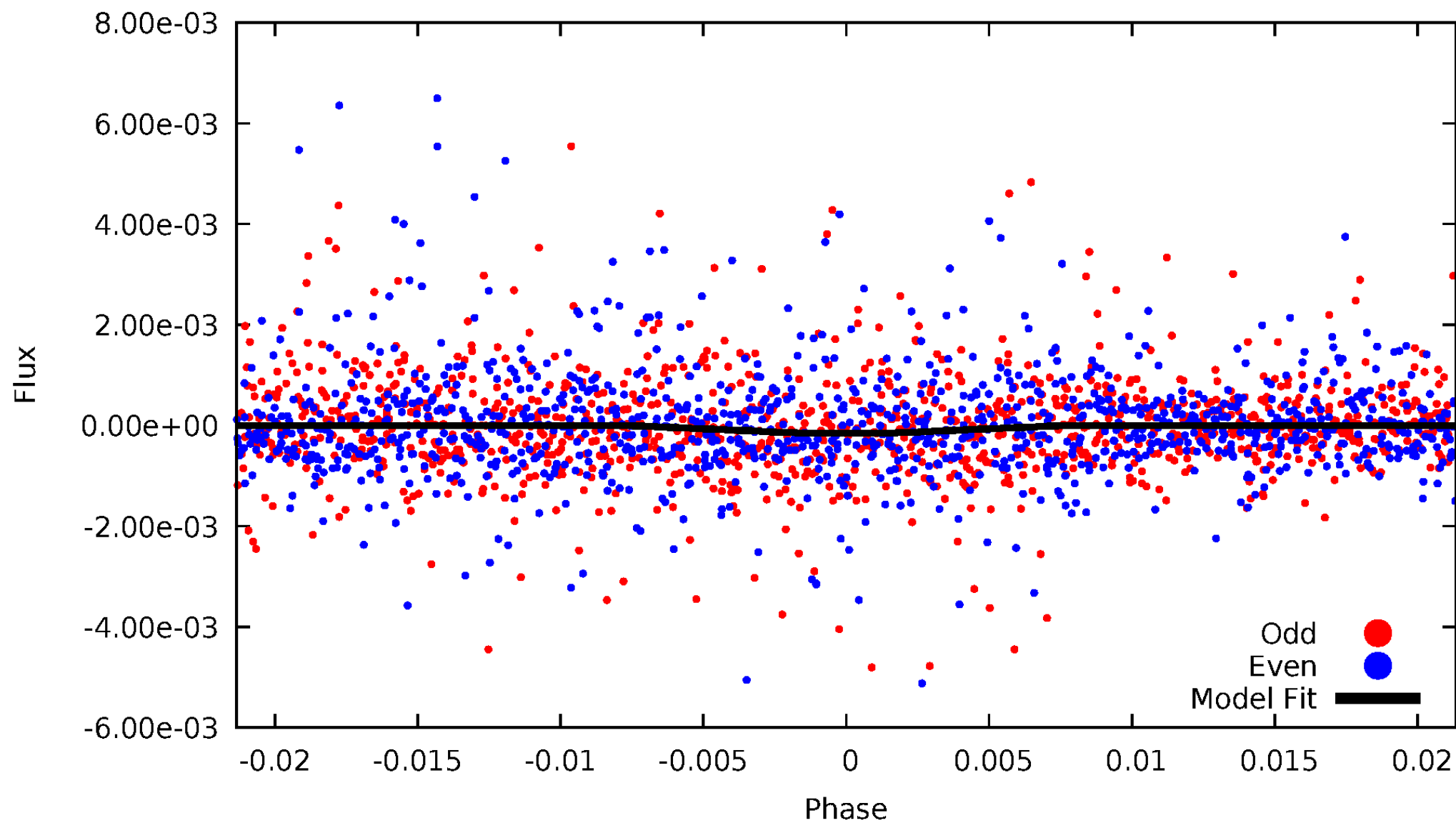
# DV Odd/Even

TCE 010412044-06



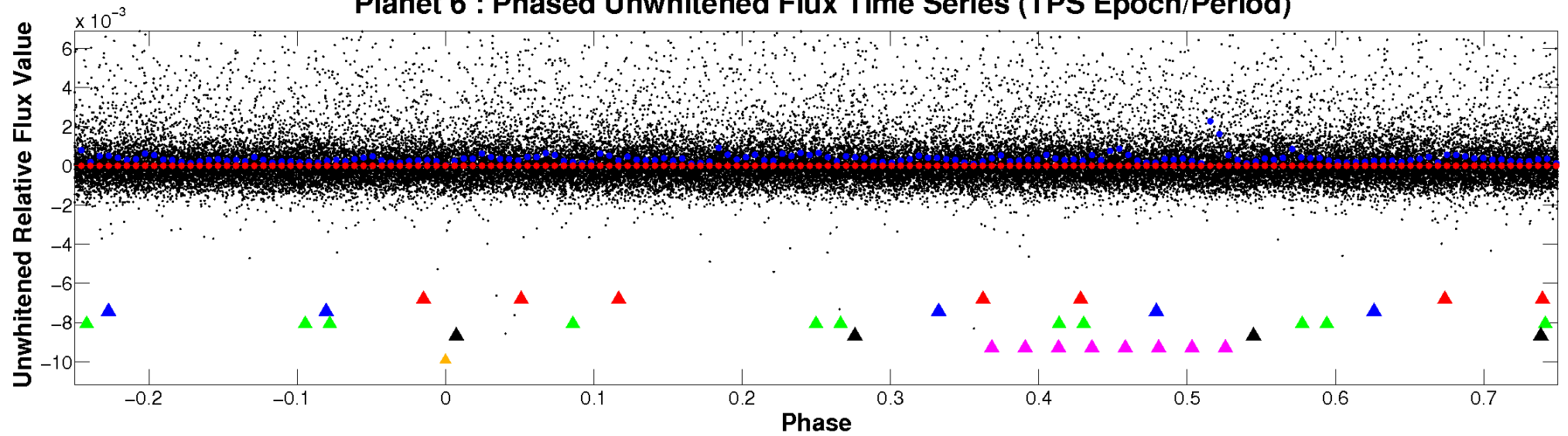
# ALT Odd/Even

TCE 010412044-06



# Non-Whitened Vs. Whitened Light Curve

**Planet 6 : Phased Unwhitened Flux Time Series (TPS Epoch/Period)**

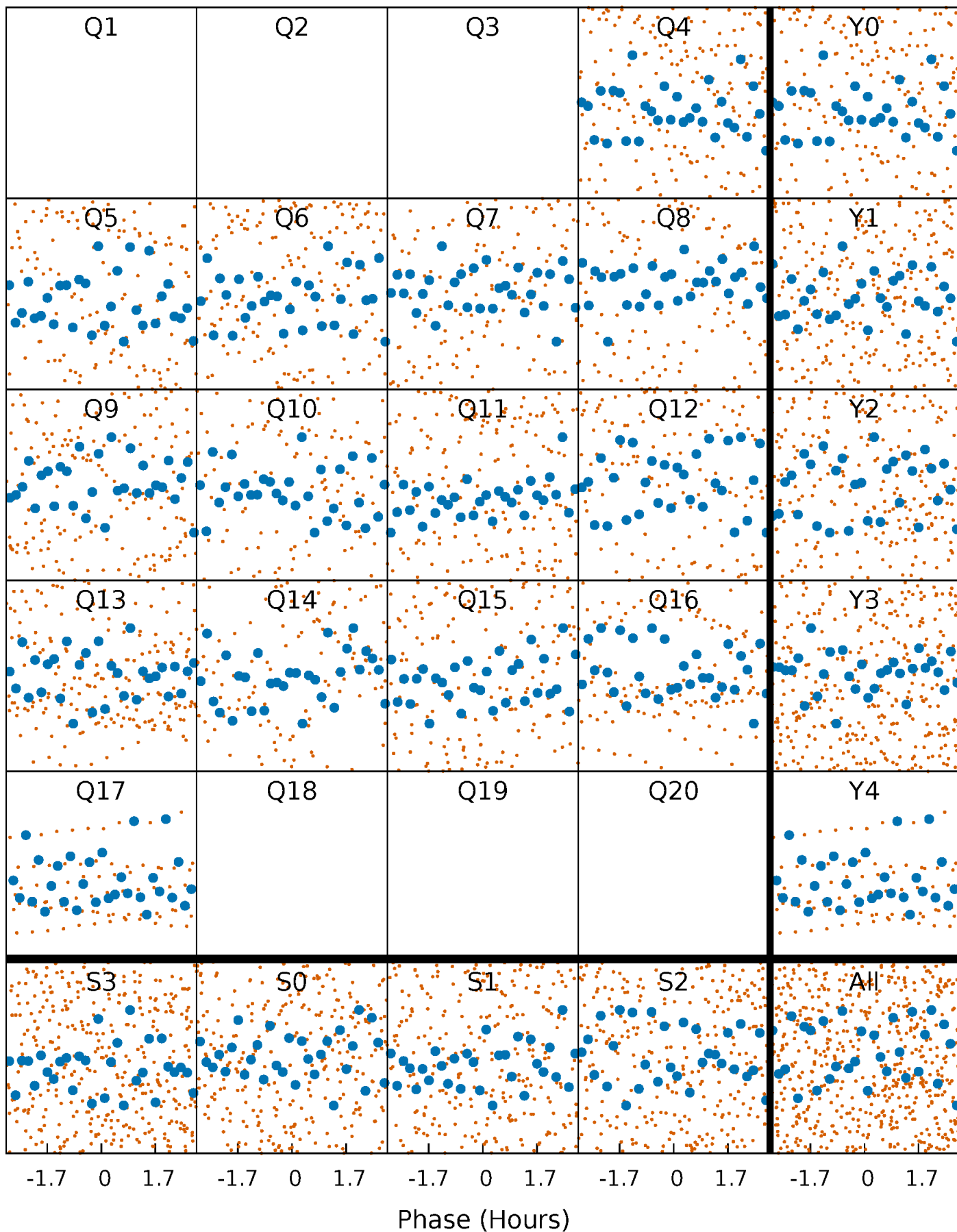


**Planet 6 : Phased Whitened Flux Time Series (TPS Epoch/Period)**



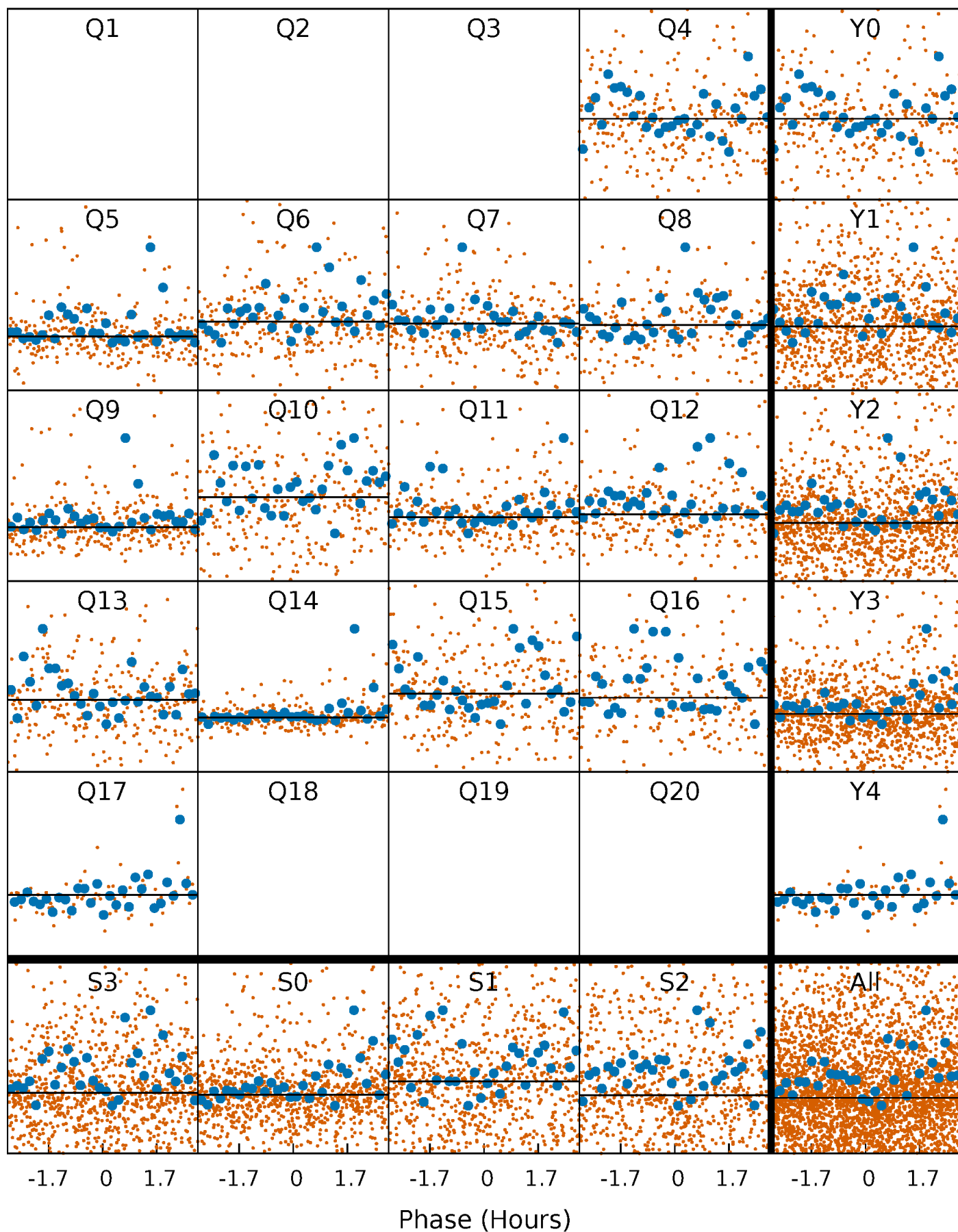
# PDC Quarter-Phased Transit Curves

TCE 010412044-06 P= 3.328827 Days  $T_0=133.848494$  (BKJD)



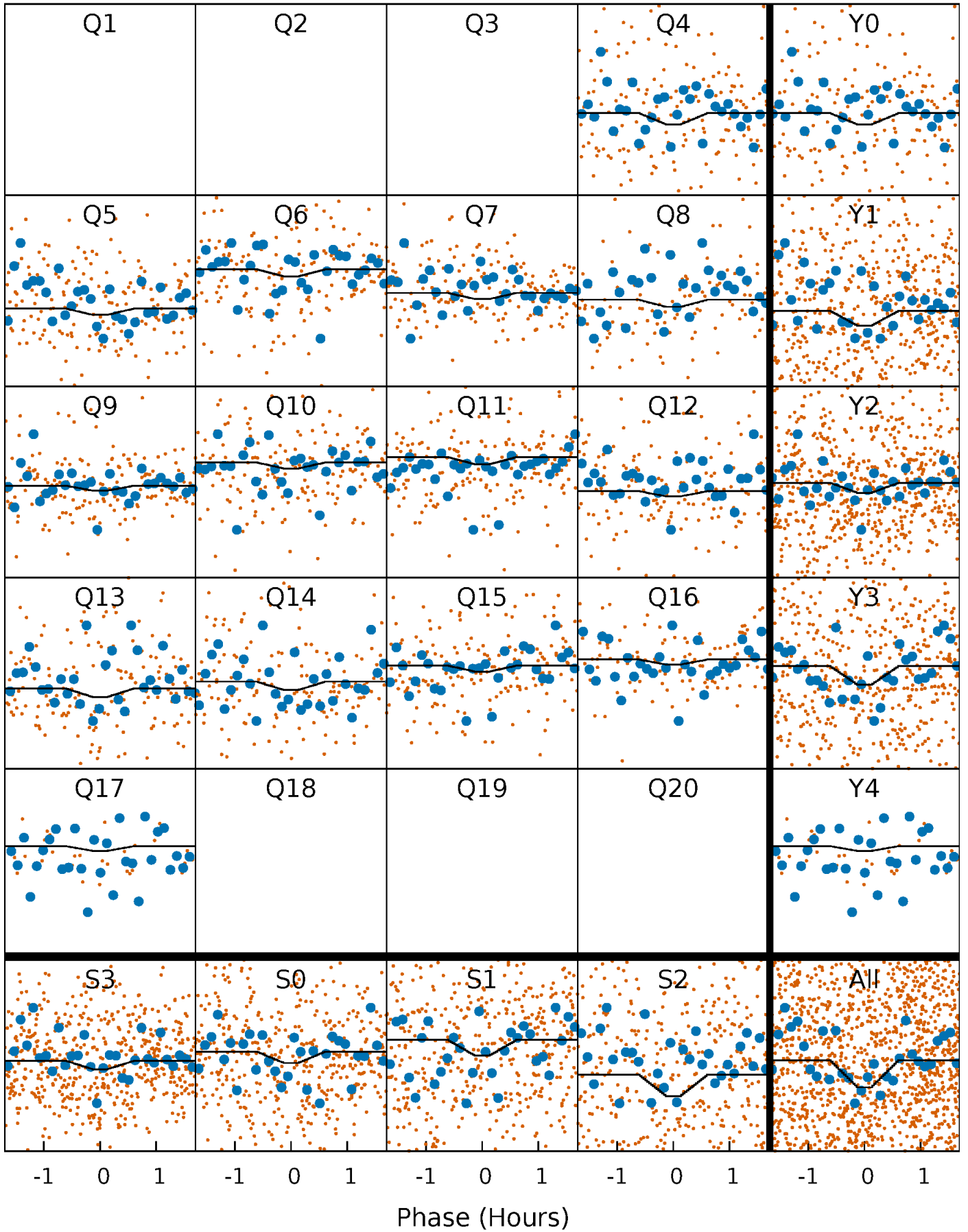
# DV Quarter-Phased Transit Curves

TCE 010412044-06 P= 3.328827 Days  $T_0=133.848494$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

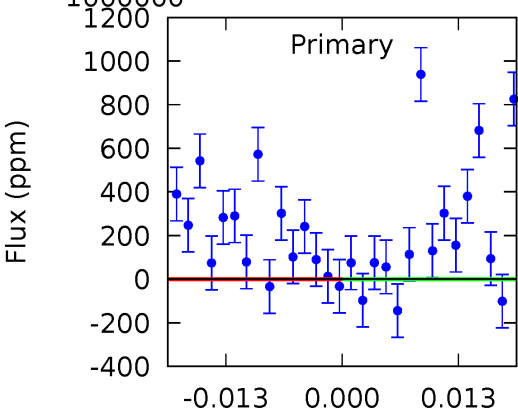
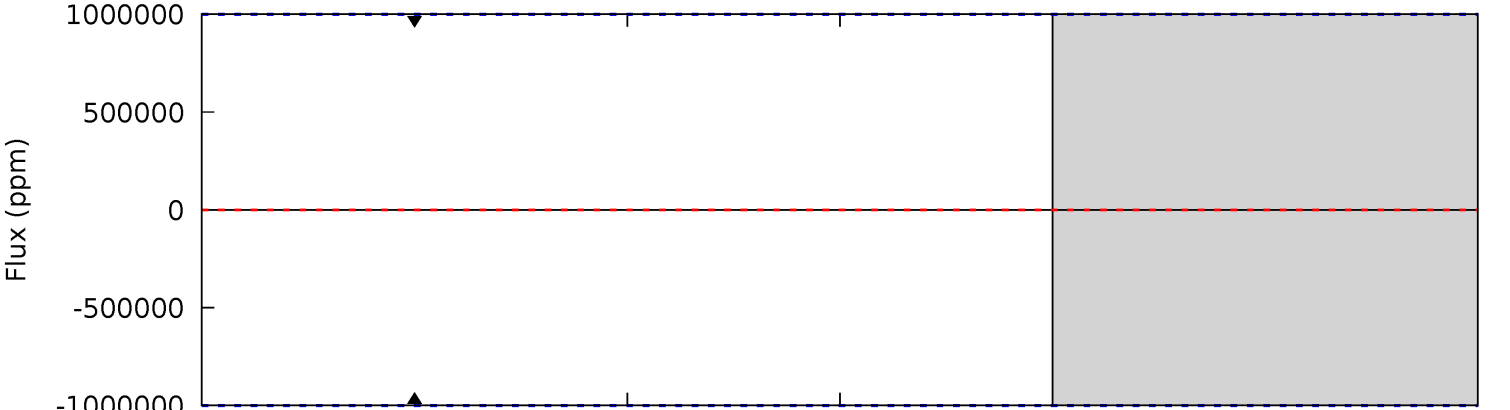
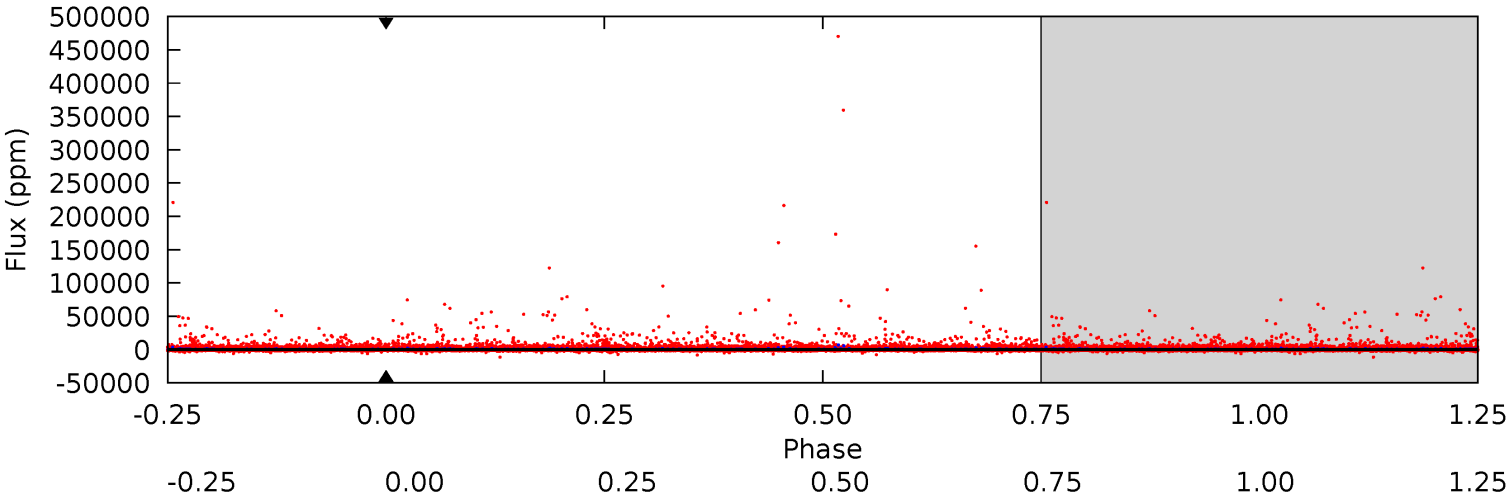
TCE 010412044-06 P= 3.328827 Days  $T_0=133.858614$  (BKJD)



# DV Model-Shift Uniqueness Test

010412044-06, P = 3.328827 Days, E = 133.848494 Days

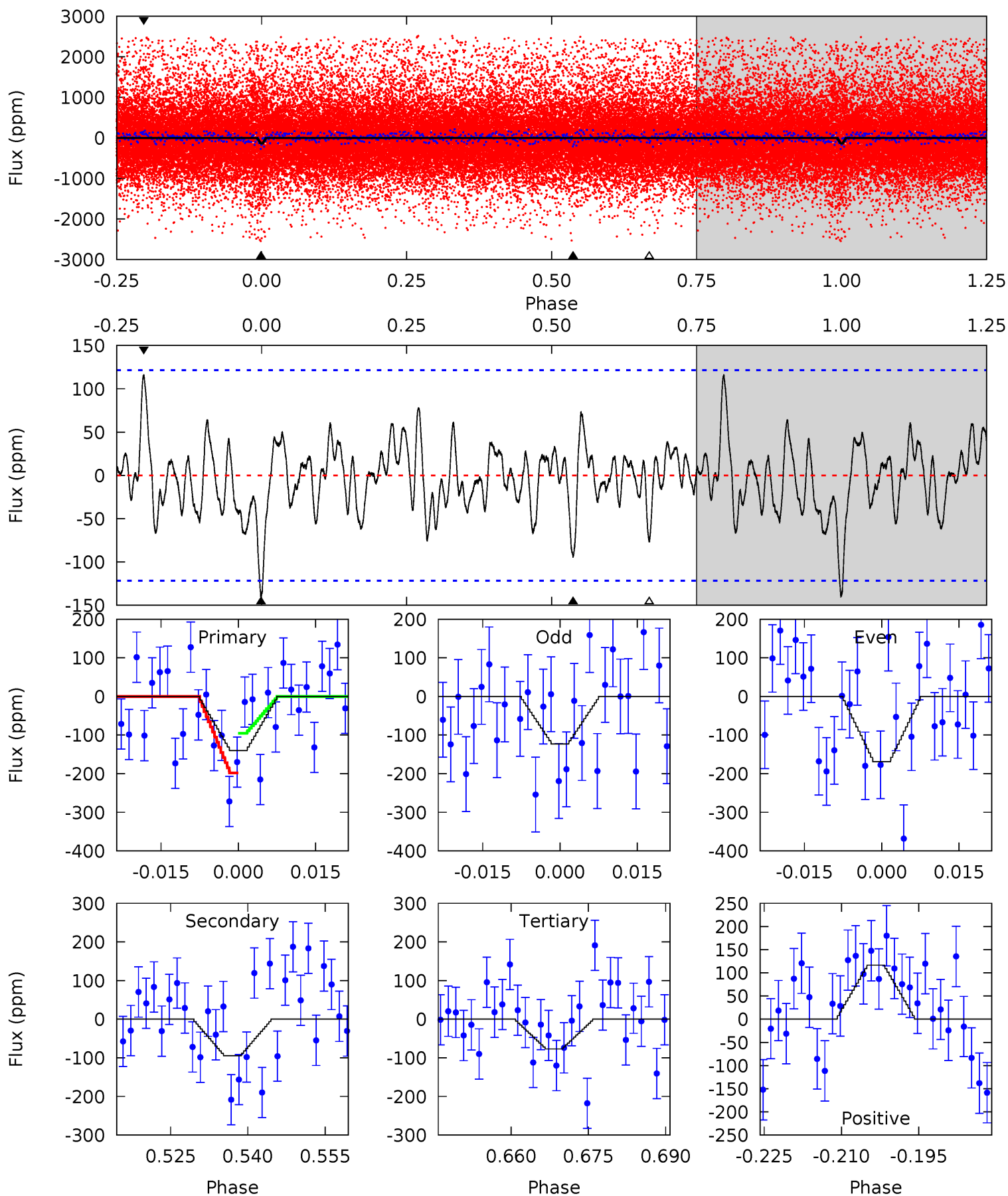
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
0	0	0	0	1.00	1.00	1.00	0	0	0	0	0	0	0	0



# Alt Model-Shift Uniqueness Test

010412044-06, P = 3.328827 Days, E = 133.858614 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
5.70	3.86	3.14	4.75	4.95	2.43	1.29	2.56	0.95	0.72	-0.89	0.94	0.79	0.45	2.11





### Stellar Parameters For KIC 010412044

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (g \cdot \text{cm}^{-3})$
	$3651^{+73}_{-73}$	$4.802^{+0.048}_{-0.032}$	$-0.100^{+0.100}_{-0.100}$	$0.446^{+0.036}_{-0.044}$	$0.461^{+0.034}_{-0.042}$	$7.297^{+1.807}_{-1.001}$
	+2%/-2%	+1%/-1%	+100%/-100%	+8%/-10%	+7%/-9%	+25%/-14%
Source	PHO2	PHO2	PHO2	DSEP		

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

### Secondary Eclipse Parameters for KIC 010412044-06 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$0 \pm 1000000$	$4.05^{+3.73}_{-2.88}$	$815^{+22}_{-20}$	$2527^{+4942}_{-9317}$	$22^{+7536}_{-5201}$
Alt.	$-95 \pm 25$	$3.32^{+3.72}_{-2.24}$	$816^{+22}_{-20}$	$2154^{+698}_{-360}$	$5.102^{+45.210}_{-3.975}$

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

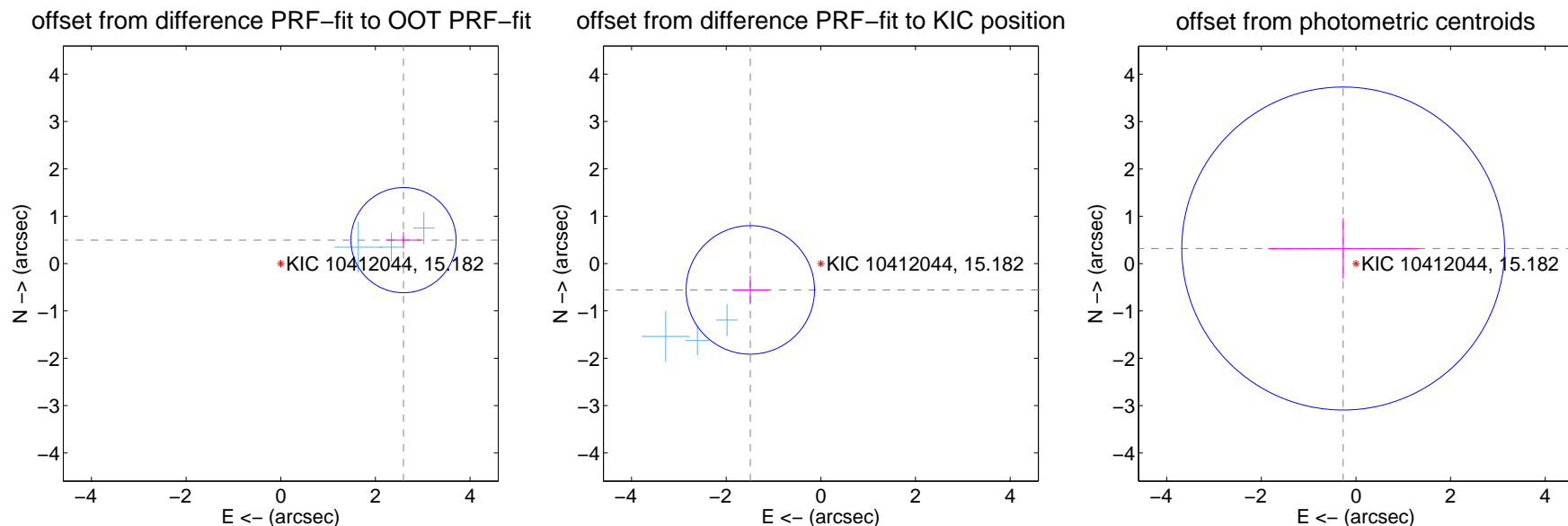
## DV Centroid Data

Supplemental centroid analysis for 010412044-06. Kepler magnitude: 15.18. Transit SNR -1.00

There are 5 quarters with good PRF difference image offsets

The OOT PRF centroid is offset from the target star catalog position by about 5.33 arcsec so the offset from difference PRF-fit to OOT-fit may be invalid.

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$2.641 \pm 0.370$	7.13	$-2.595 \pm 0.376$	$0.495 \pm 0.171$
PRF-fit source offset from KIC position	$1.591 \pm 0.452$	3.52	$1.491 \pm 0.382$	$-0.557 \pm 0.302$
photometric centroid source offset	$0.42 \pm 1.14$	0.37	$0.27 \pm 1.59$	$0.32 \pm 0.64$



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



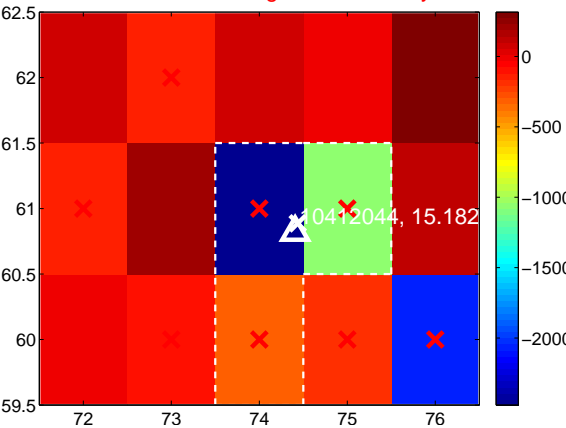
Q3 no difference image



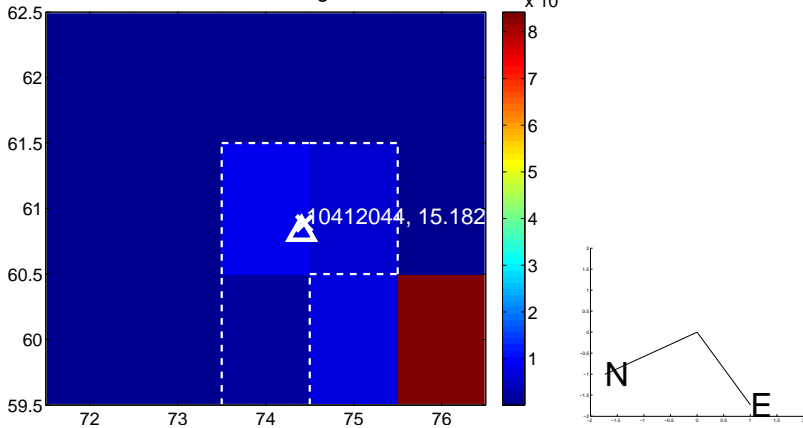
Q3 no OOT image



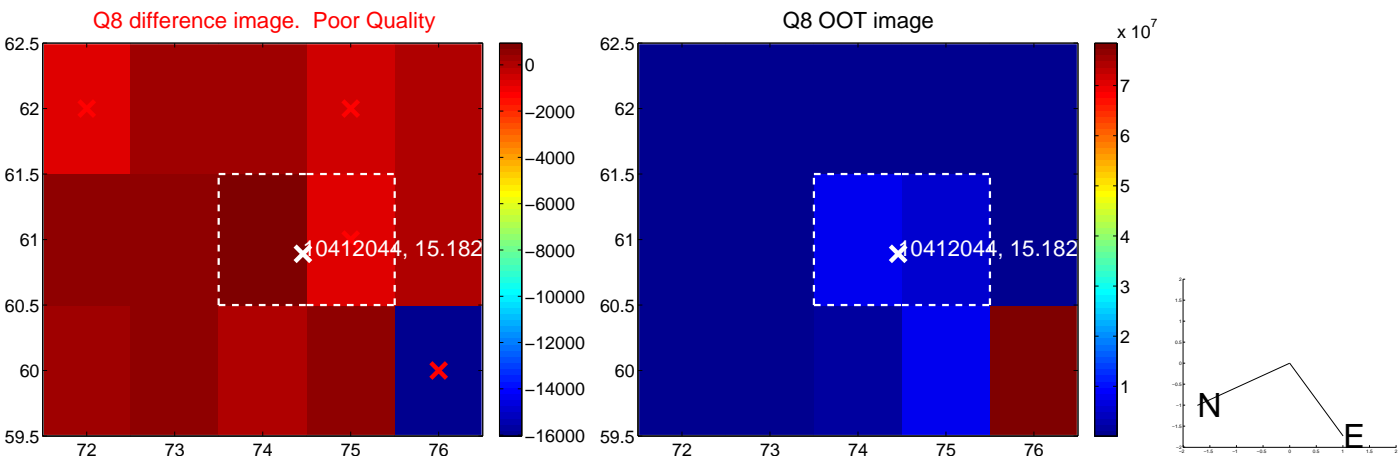
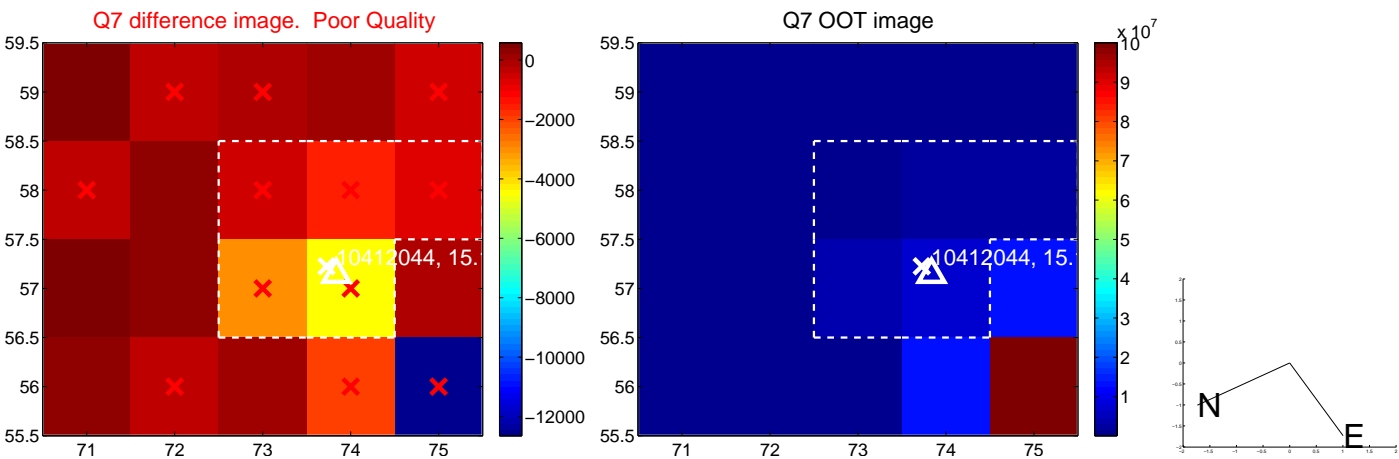
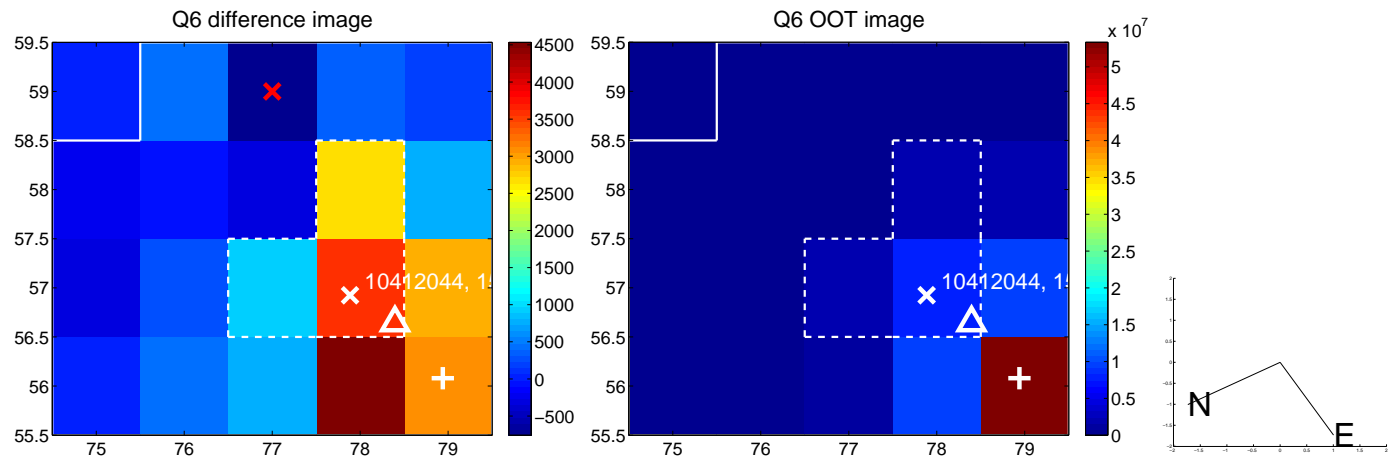
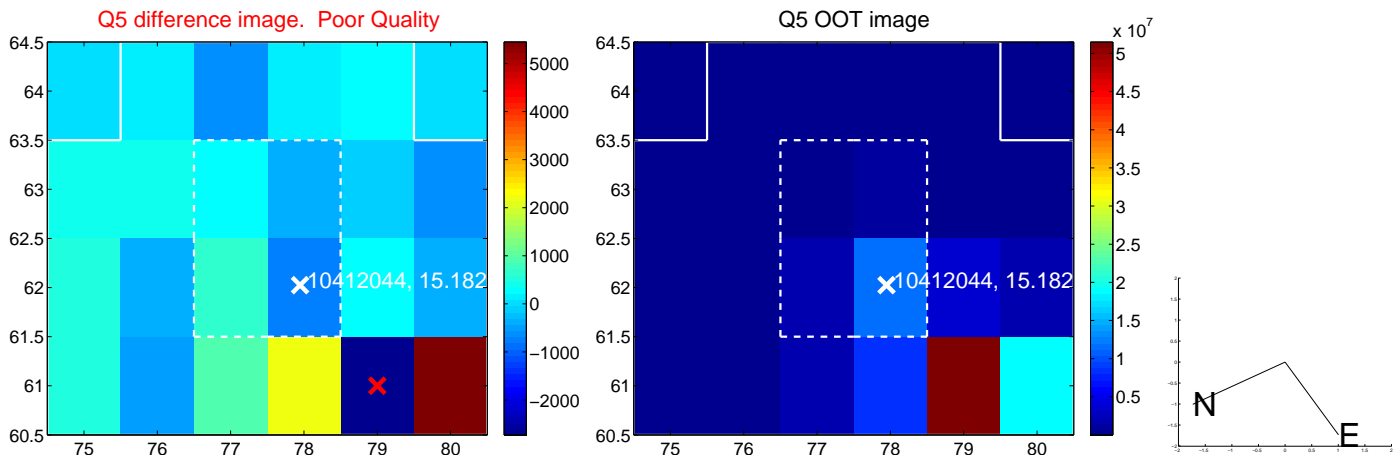
Q4 difference image. Poor Quality



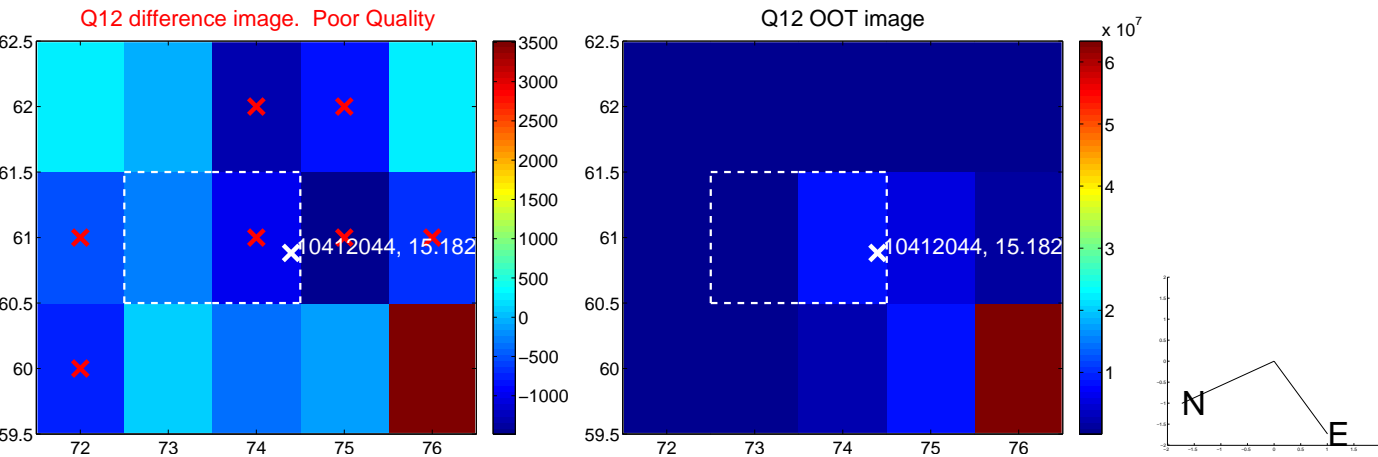
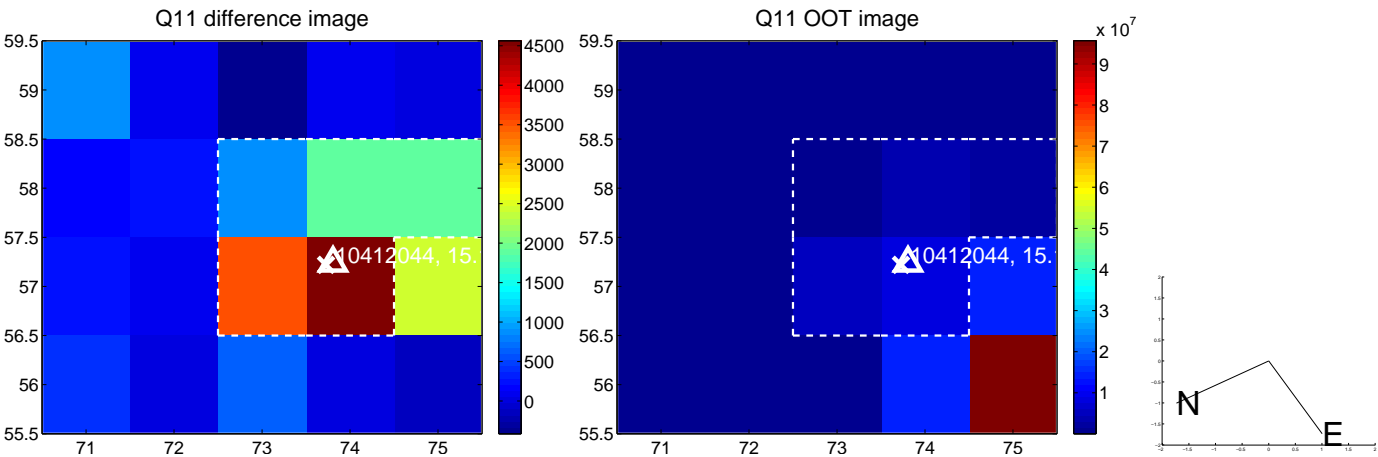
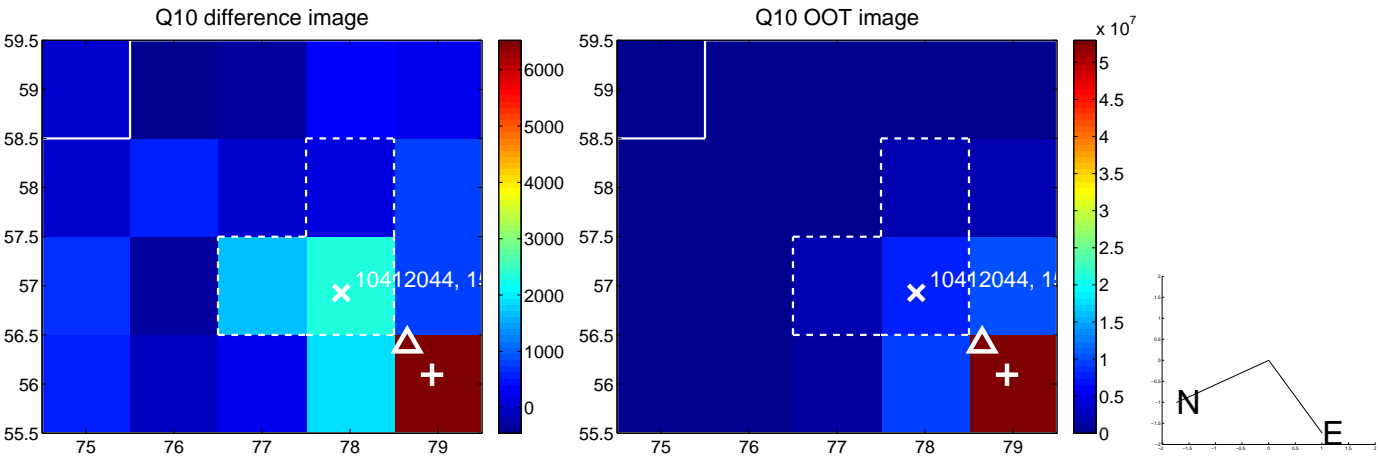
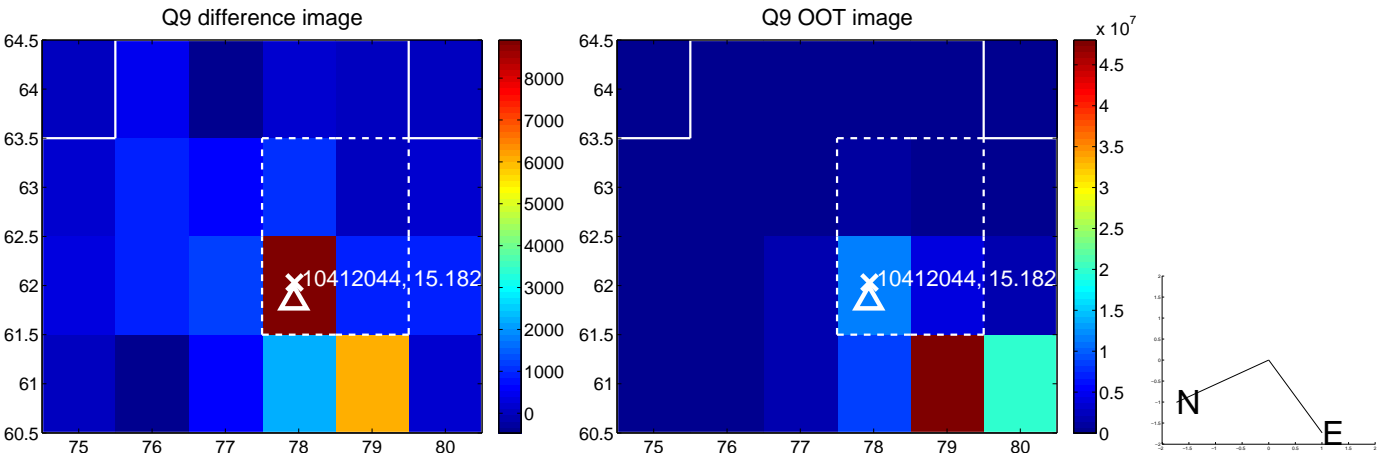
Q4 OOT image



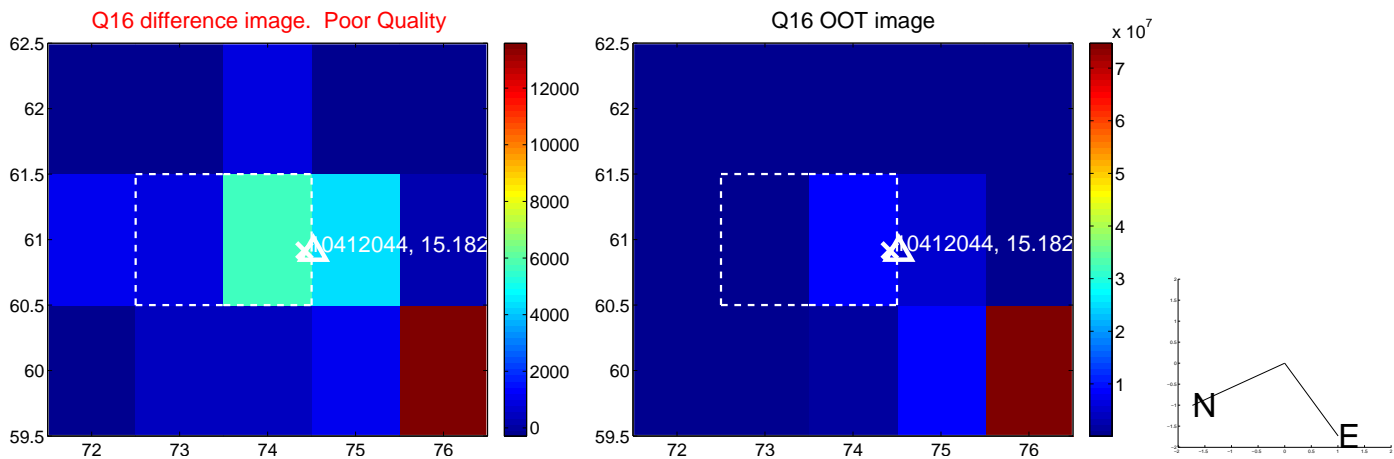
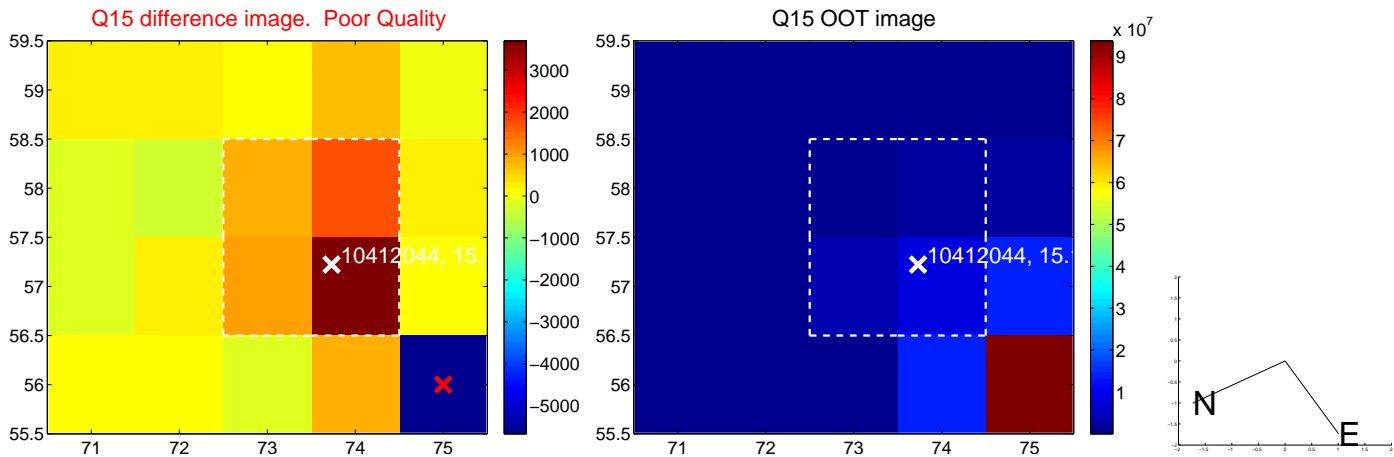
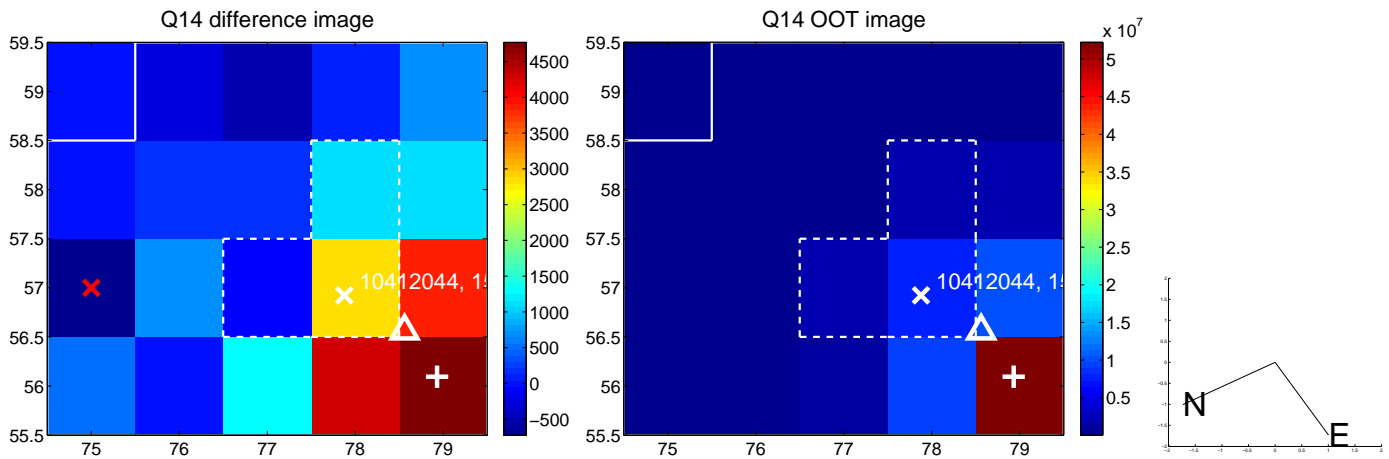
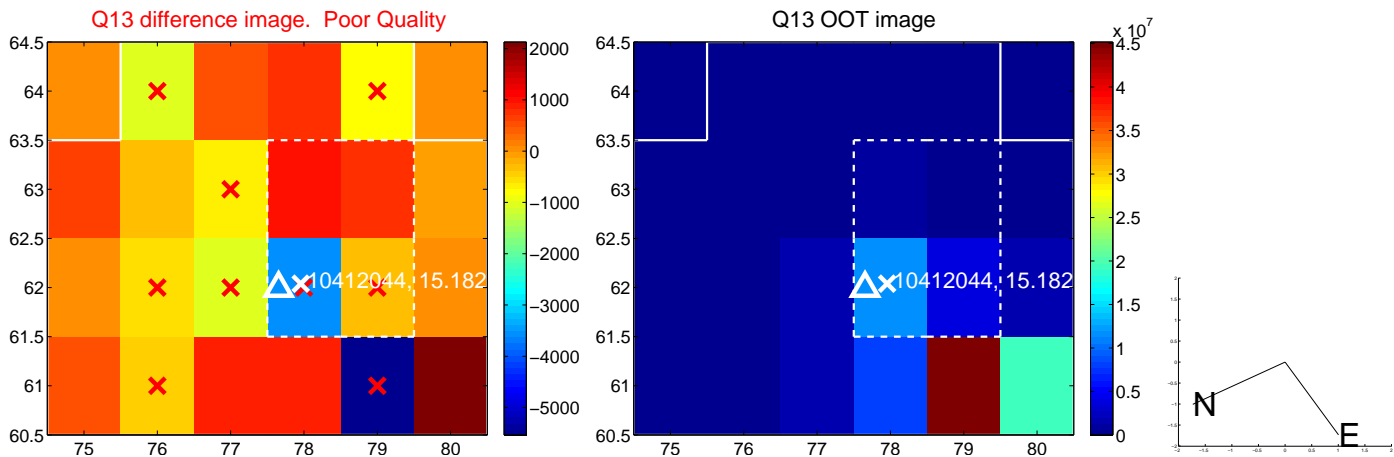
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



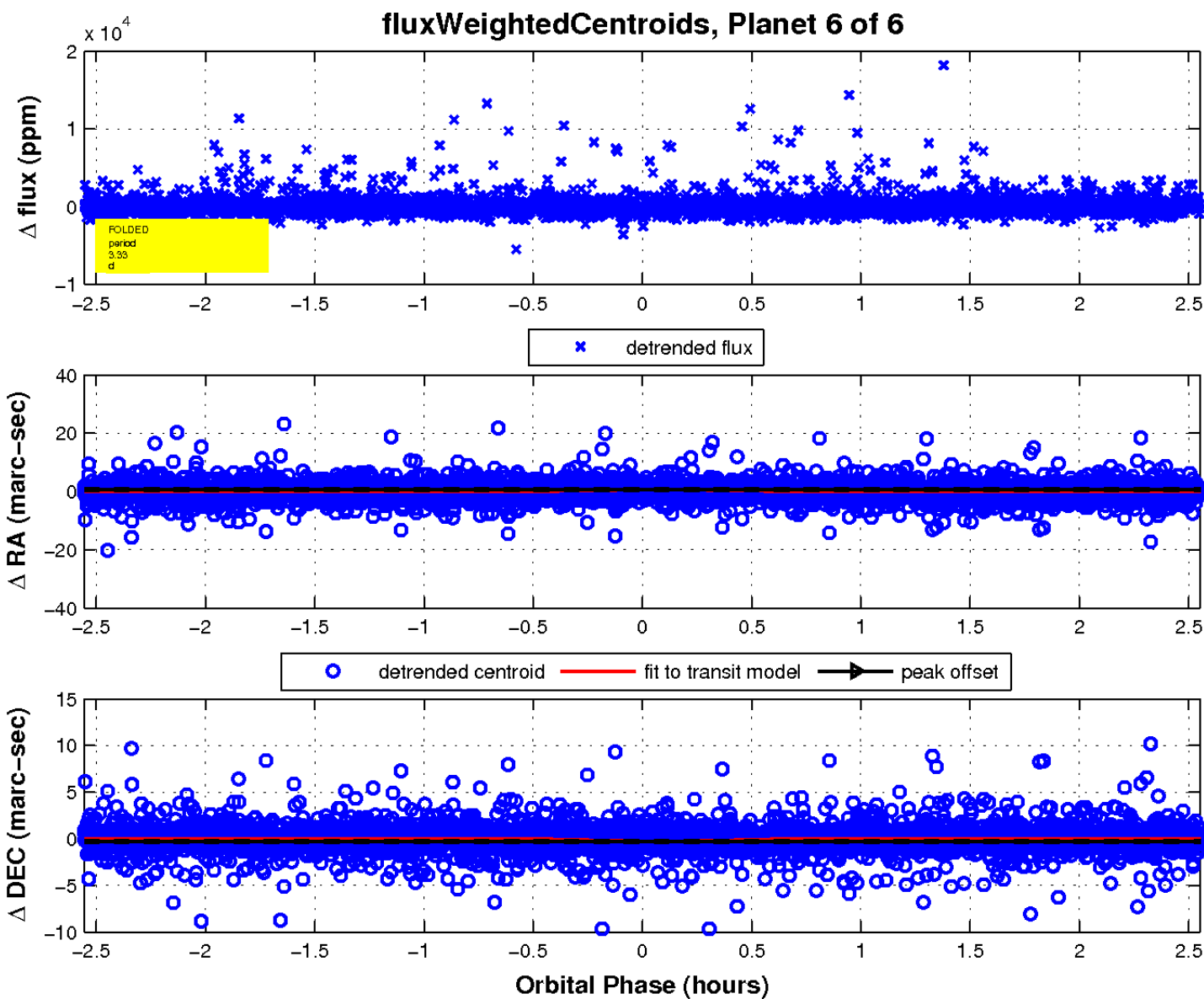
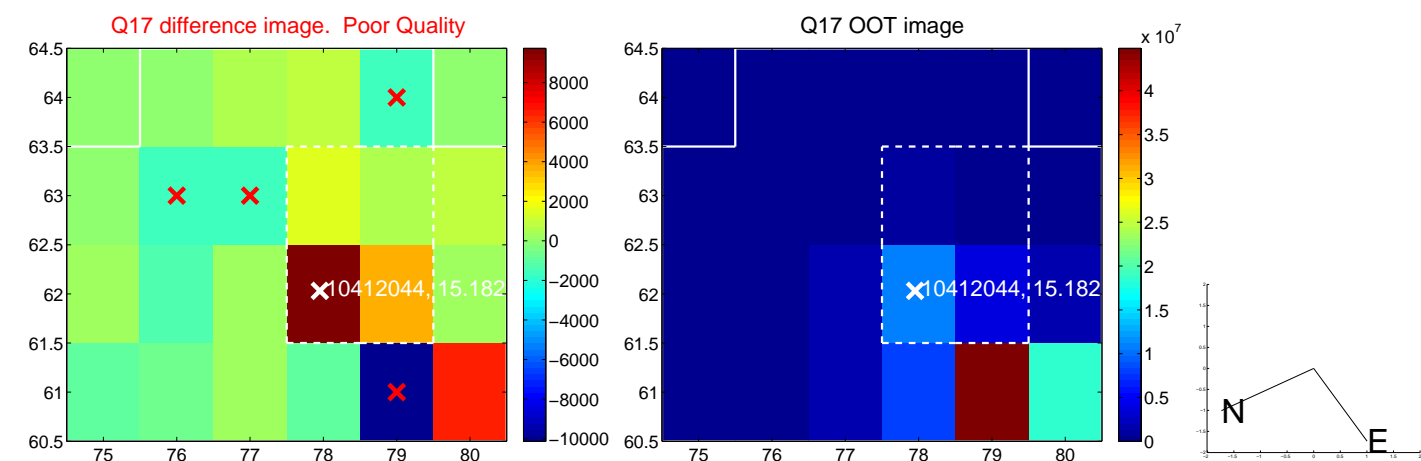
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

