

# KIC 010973814

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
010973814-01	OBS	1307.01	44.851966	172.463115	788.7	3.797	27.3	30.3	1.07	5514	3.54	16.38
010973814-02	OBS	1307.02	20.342310	137.696593	545.5	2.424	23.7	27.6	1.07	5514	2.99	47.00

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
010973814-01	OBS	PC	1.00	0	0	0	0	NO_COMMENT
010973814-02	OBS	PC	1.00	0	0	0	0	NO_COMMENT

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

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

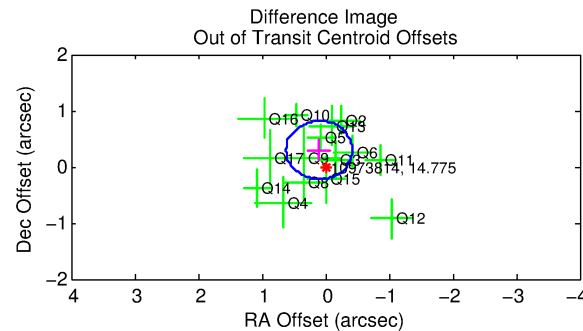
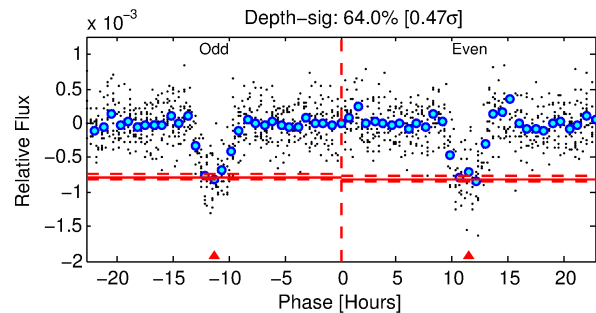
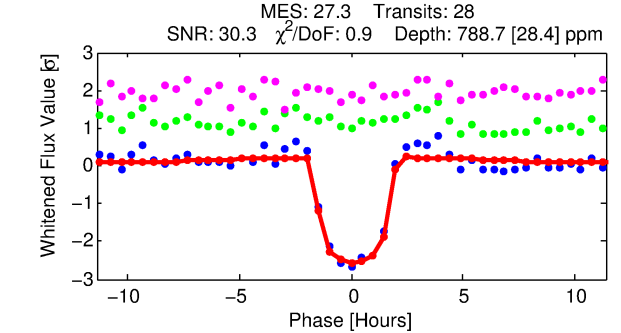
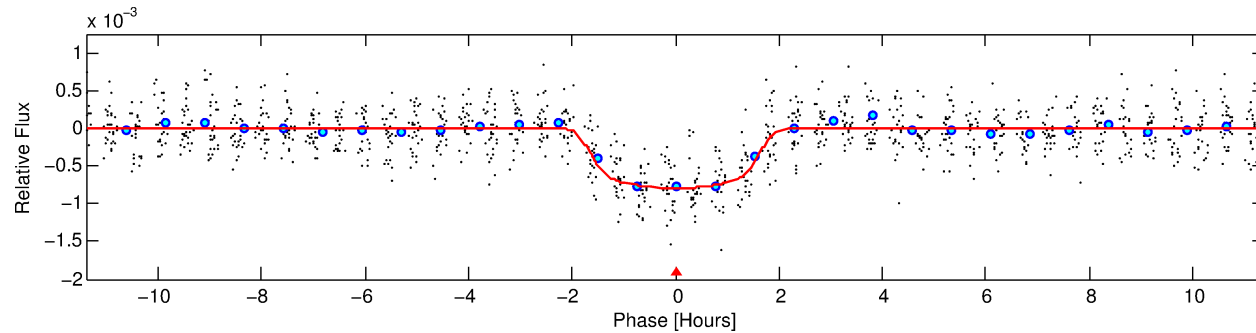
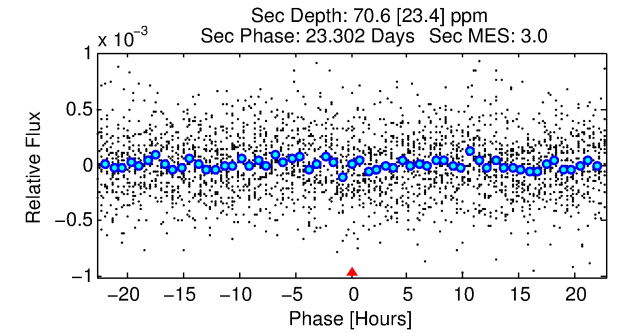
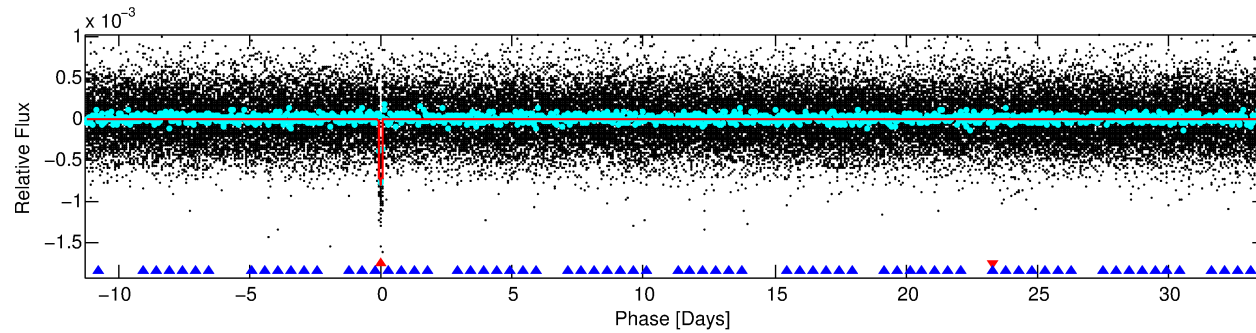
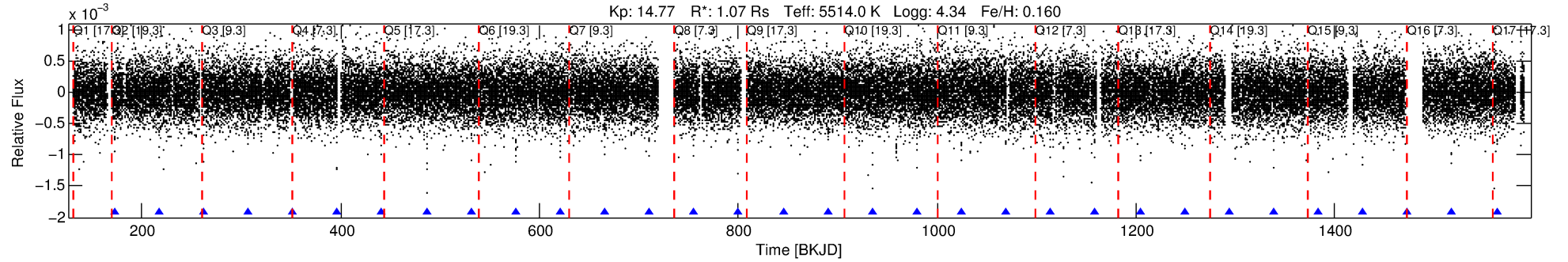
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 010973814-01

No Significant Match Found

# DV One-Page Summary

KIC: 10973814 Candidate: 1 of 2 Period: 44.852 d  
KOI: K01307.01 Name: Kepler-287c Corr: 0.993



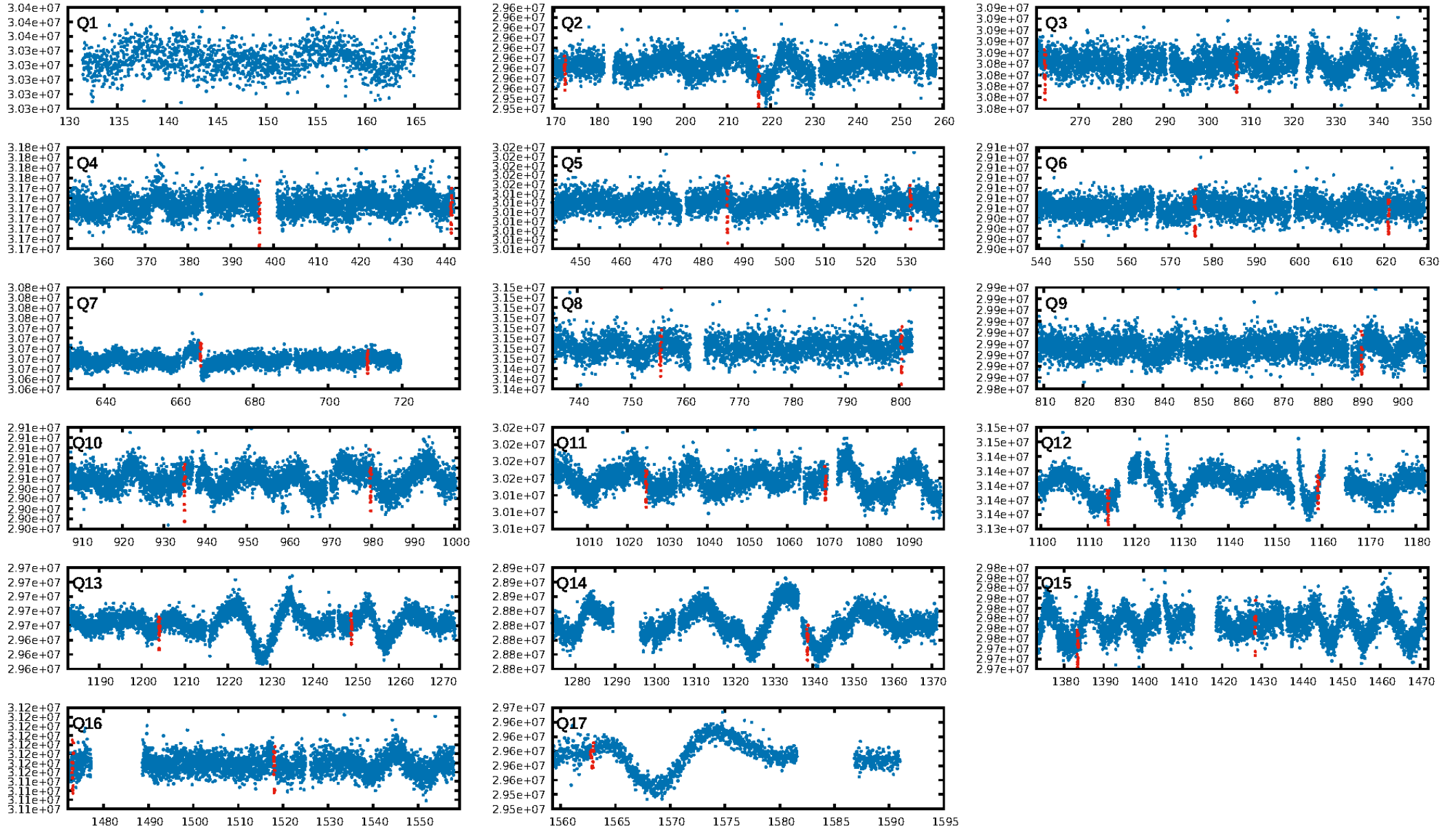
## DV Fit Results:

Period = 44.85197 [0.00015] d  
Epoch = 172.4631 [0.0028] BKJD  
Rp/R\* = 0.0303 [0.0031]  
a/R\* = 48.48 [19.92]  
b = 0.88 [0.11]  
Seff = 16.38 [3.81]  
Teff = 513 [30] K  
Rp = 3.54 [0.65] Re  
a = 0.2408 [0.0345] AU  
Ag = 179.64 [80.81] [2.21σ]  
Teffp = 2904 [285] K [8.35σ]

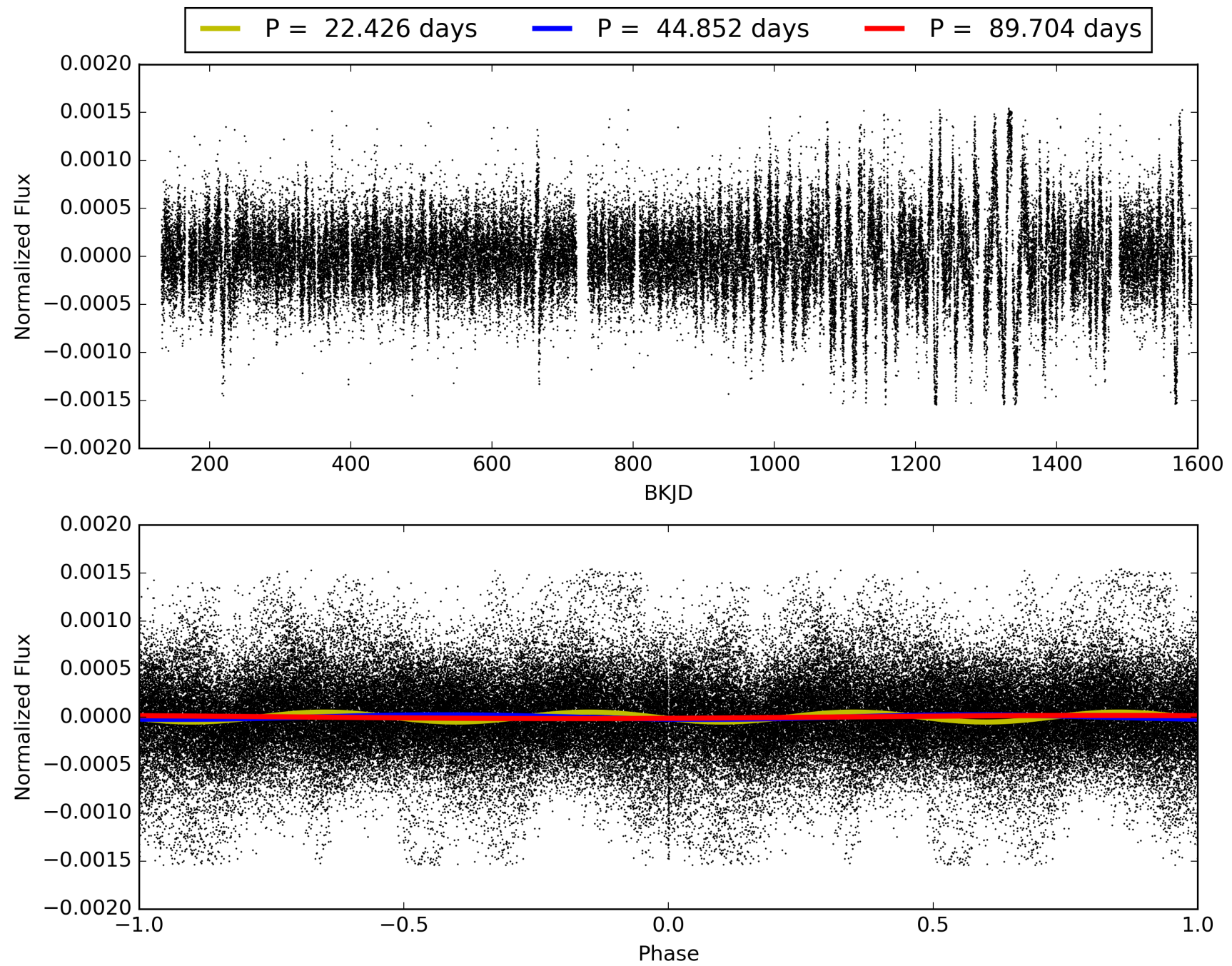
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [130.56σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 37.5%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 1.18e-152  
RollingBand-fgt: 1.00 [27/27]  
GhostDiagnostic-chr: 4.989  
Centroid-sig: 64.9%  
Centroid-so: 0.100 arcsec [0.27σ]  
OotOffset-rm: 0.312 arcsec [1.80σ]  
KicOffset-rm: 0.160 arcsec [0.95σ]  
OotOffset-st: 4/3/4/4 [15]  
KicOffset-st: 4/3/4/4 [15]  
DiffImageQuality-fgm: 1.00 [15/15]  
DiffImageOverlap-fno: 0.94 [15/16]

# TCE 010973814-01, PDC Light Curves

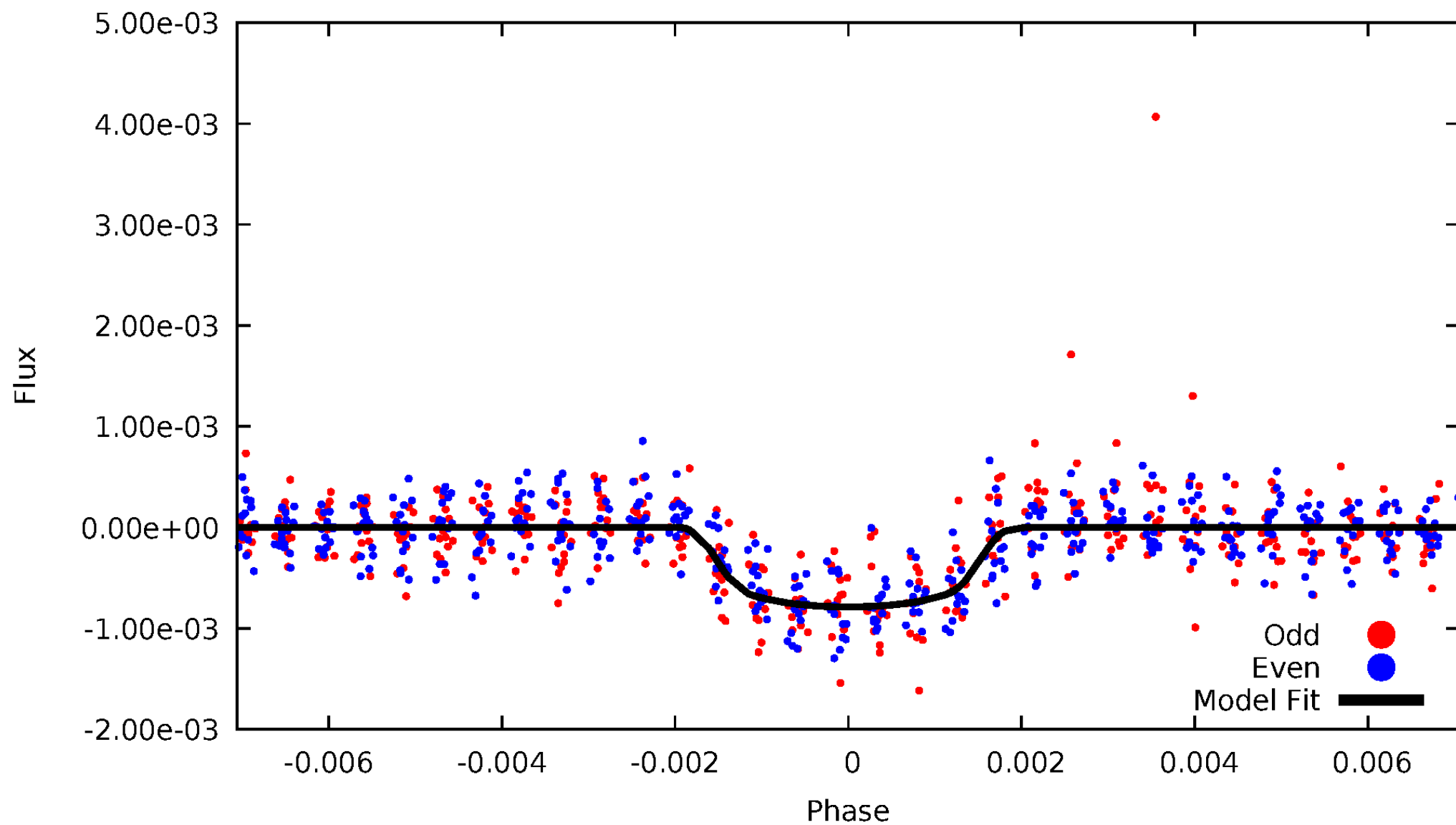


TCE 010973814-01



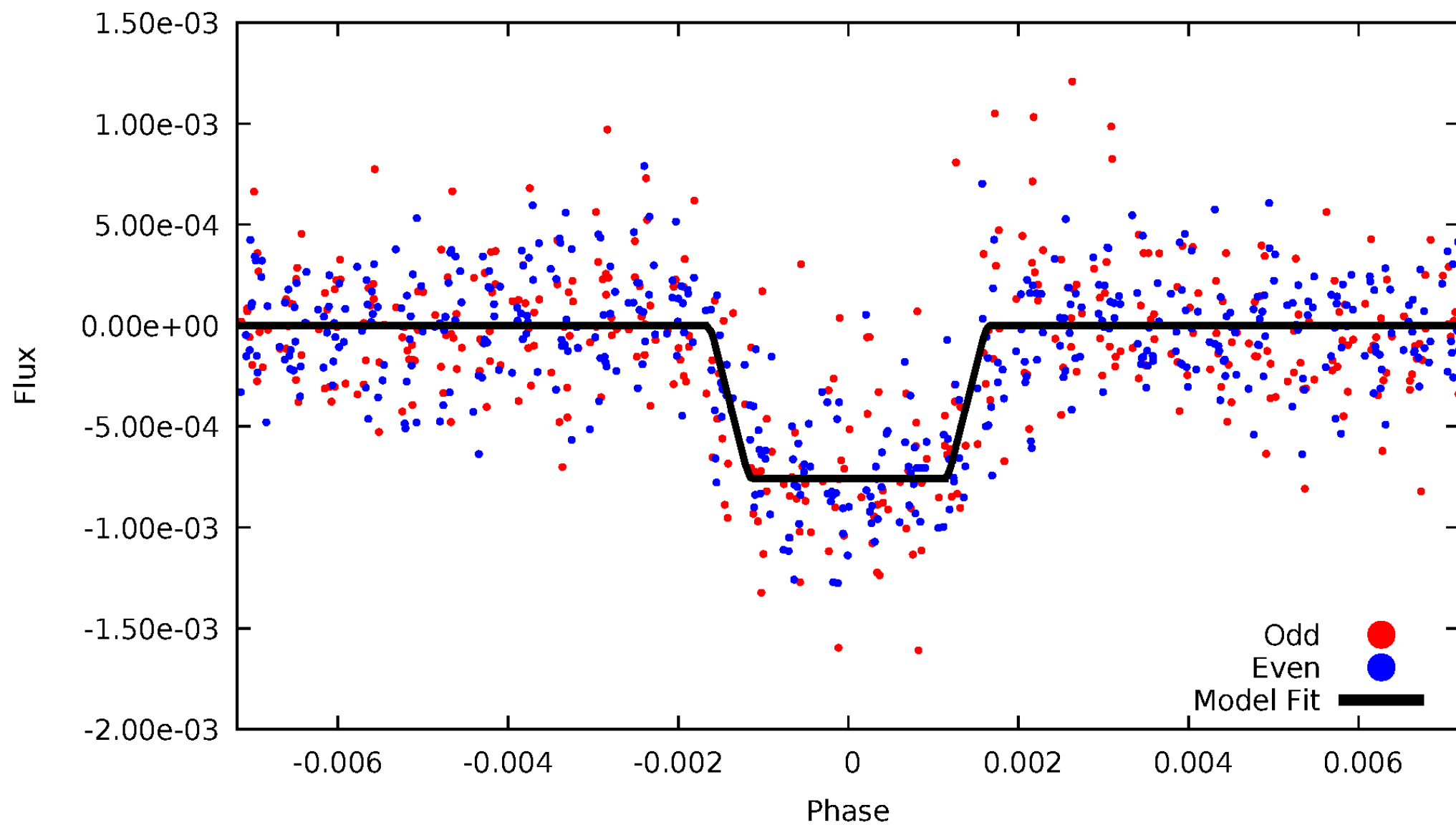
# DV Odd/Even

TCE 010973814-01



# ALT Odd/Even

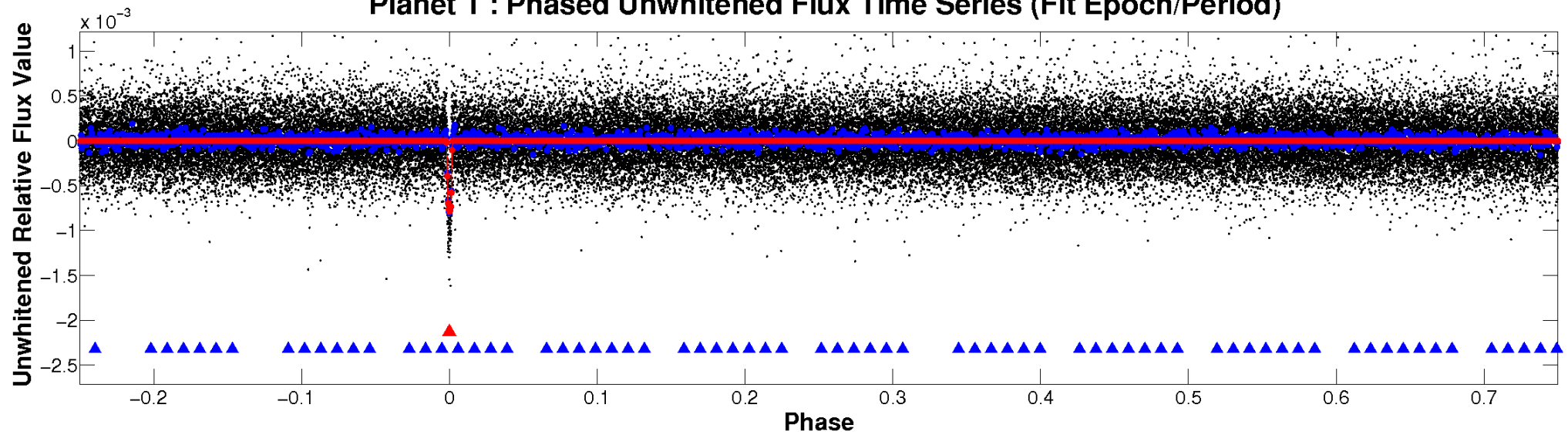
TCE 010973814-01



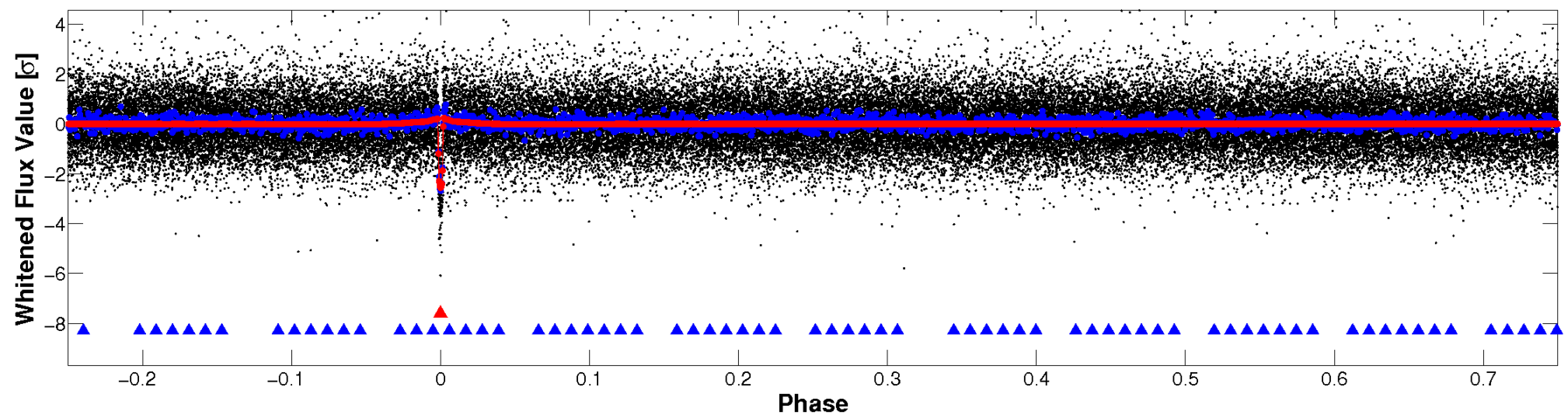


# Non-Whitened Vs. Whitened Light Curve

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

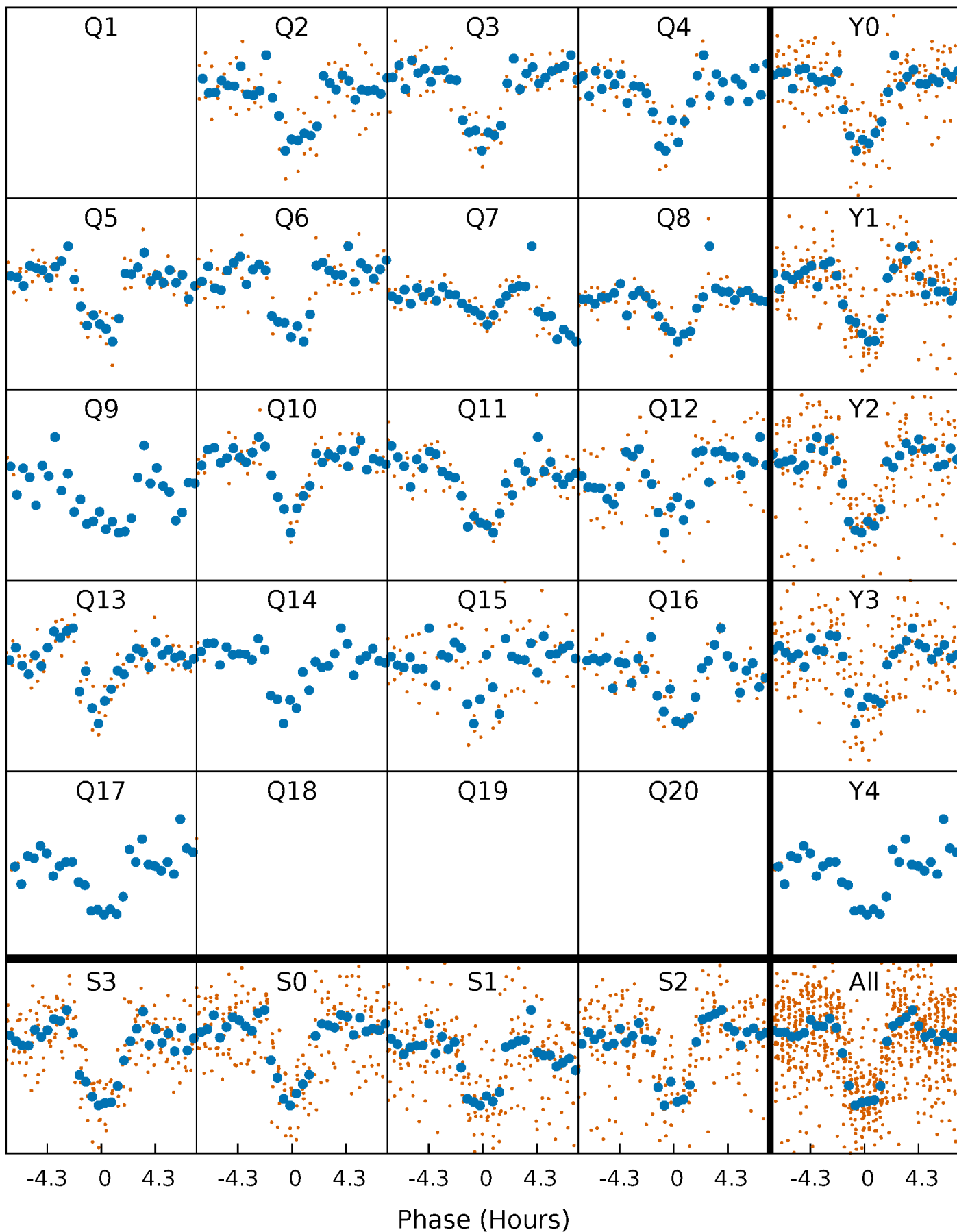


**Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



# PDC Quarter-Phased Transit Curves

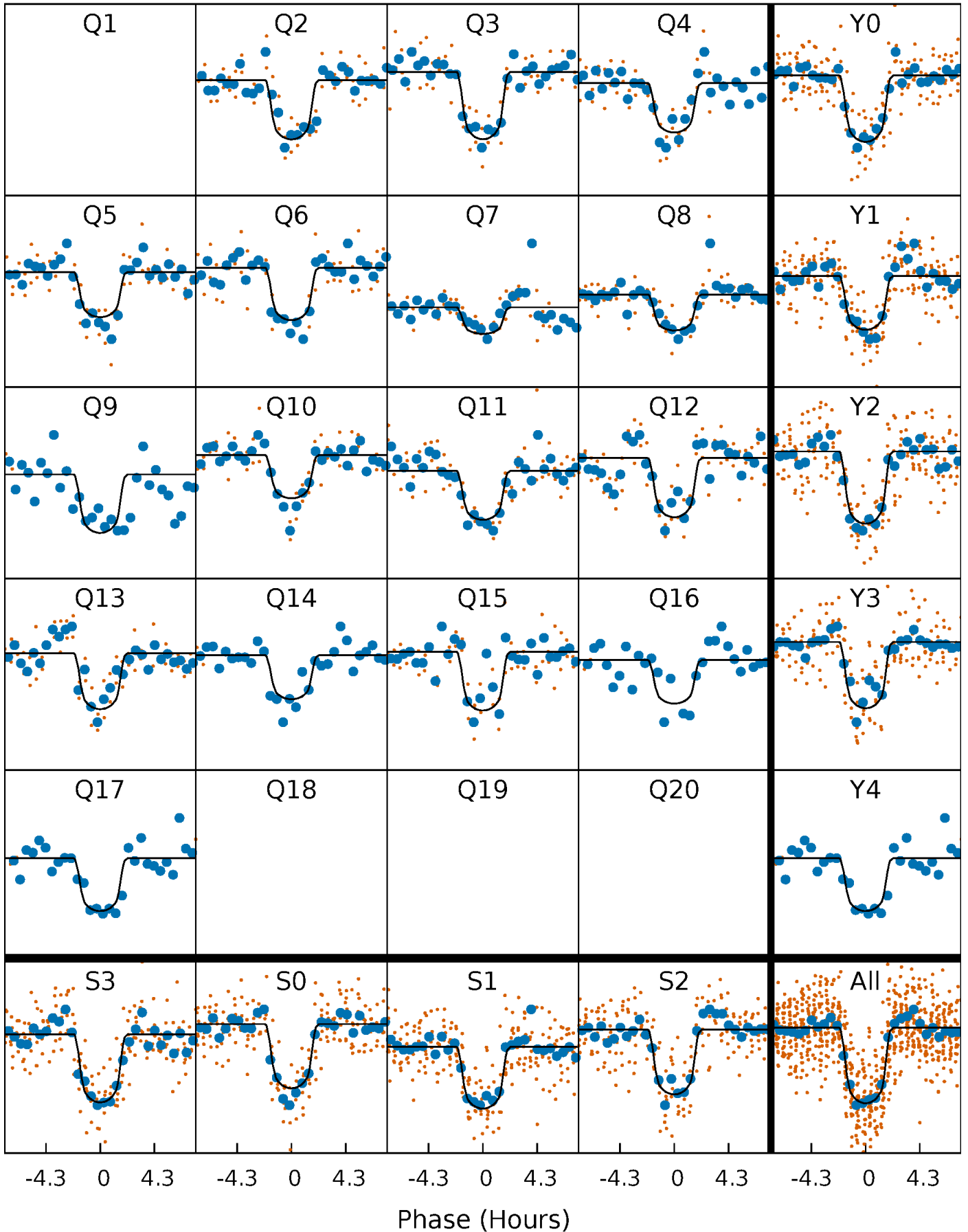
TCE 010973814-01 P= 44.851966 Days  $T_0=172.463115$  (BKJD)





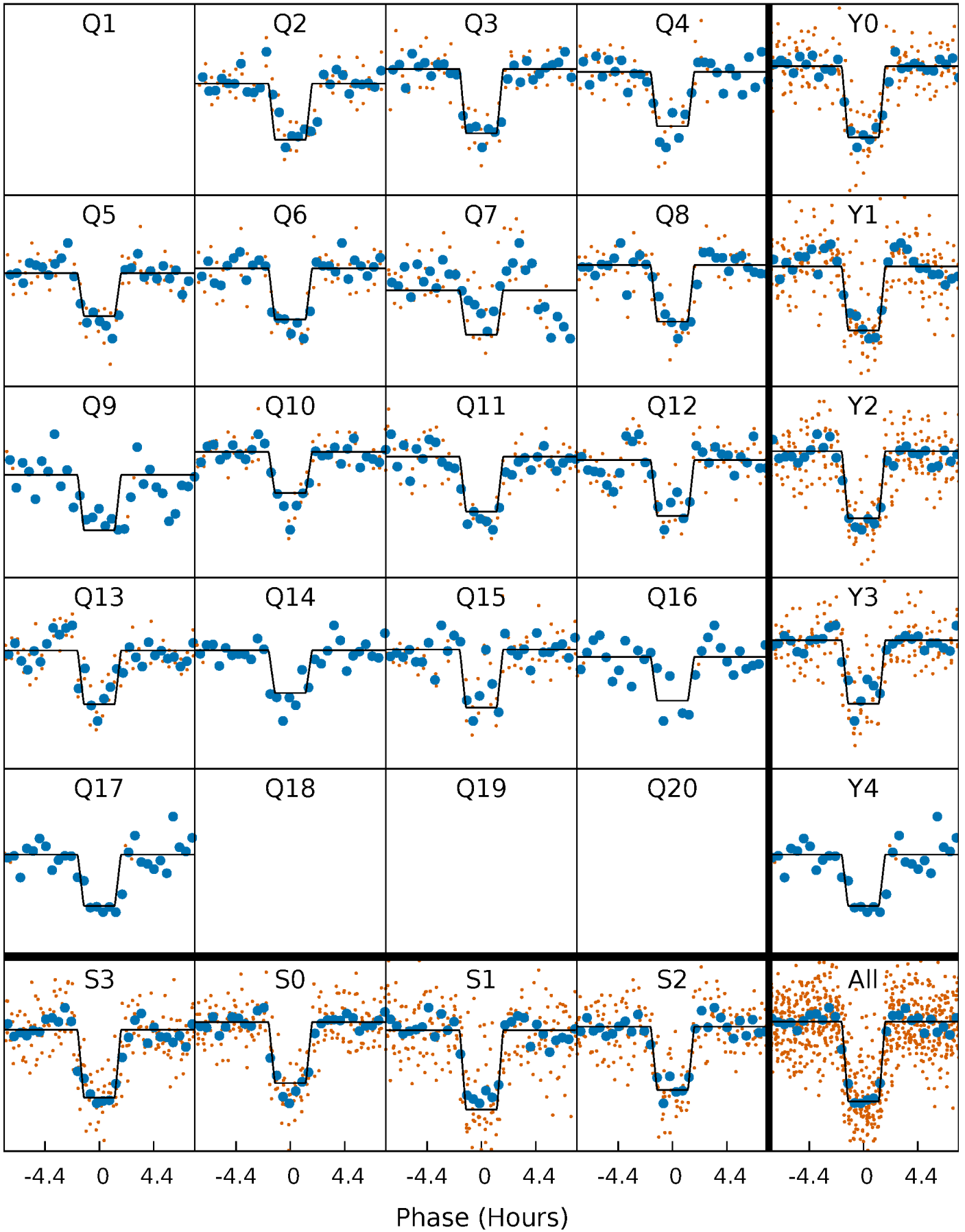
# DV Quarter-Phased Transit Curves

TCE 010973814-01 P= 44.851966 Days  $T_0=172.463115$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

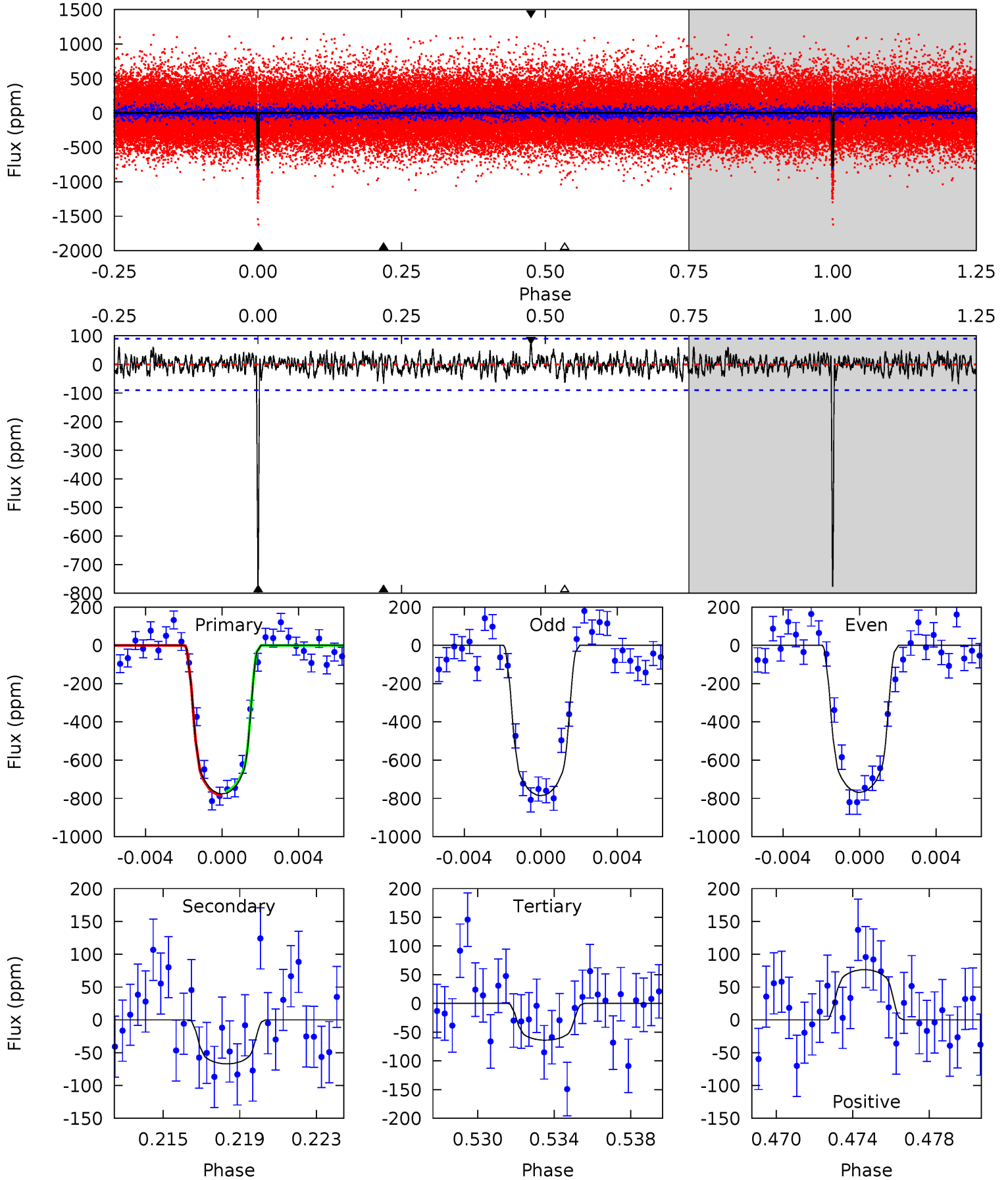
TCE 010973814-01 P= 44.852099 Days  $T_0=172.461916$  (BKJD)



# DV Model-Shift Uniqueness Test

010973814-01,  $P = 44.851966$  Days,  $E = 127.611149$  Days

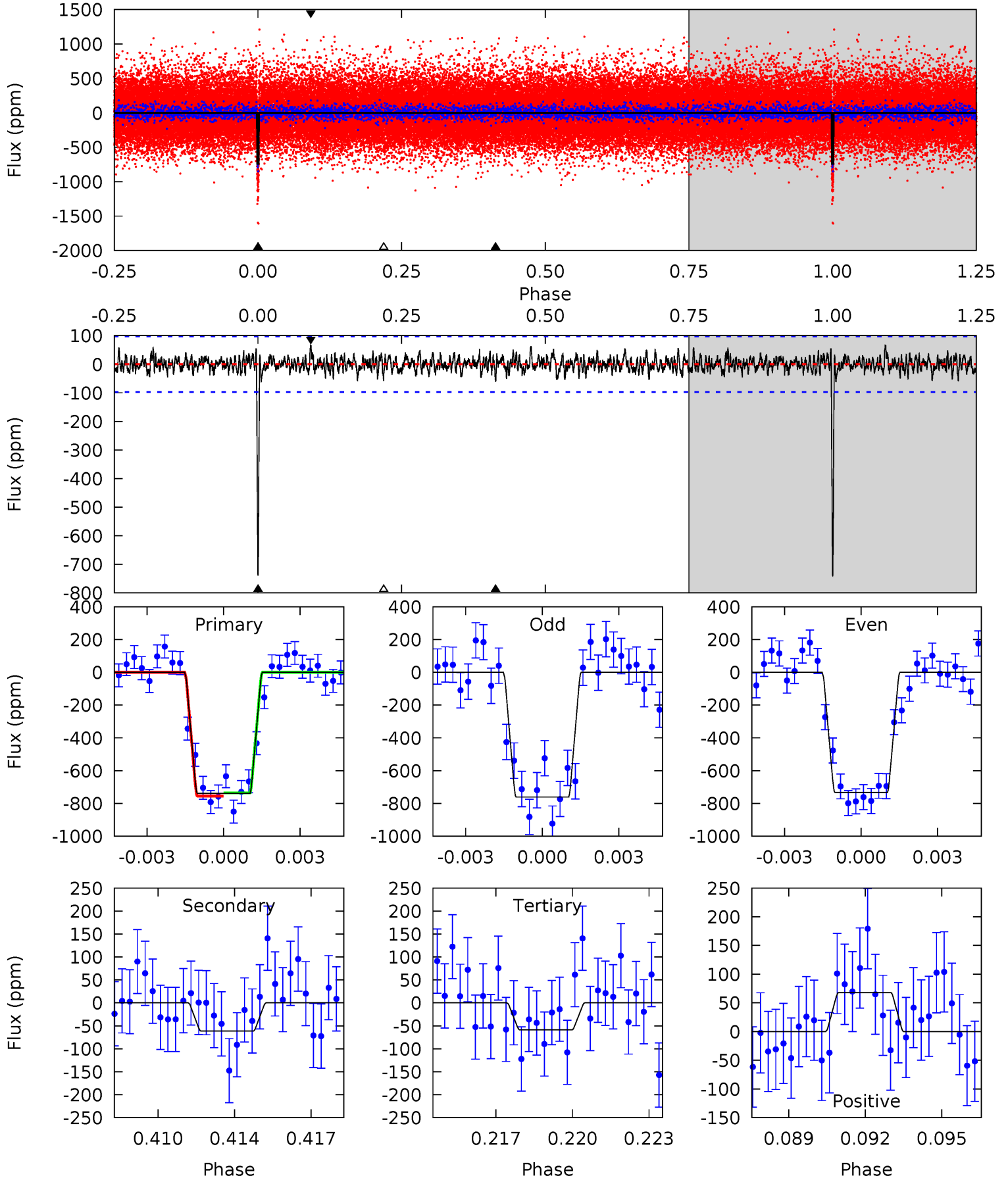
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
44.9	3.88	3.70	4.42	5.20	2.88	1.23	41.2	40.5	0.18	-0.55	0.49	0.99	0.09	0.55



# Alt Model-Shift Uniqueness Test

010973814-01,  $P = 44.852099$  Days,  $E = 127.609817$  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
39.8	3.31	3.16	3.66	5.24	2.94	1.06	36.7	36.2	0.15	-0.35	0.76	0.97	0.08	0.53



### Stellar Parameters For KIC 010973814

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$5514^{+74}_{-74}$	$4.345^{+0.132}_{-0.108}$	$0.160^{+0.150}_{-0.150}$	$1.071^{+0.163}_{-0.134}$	$0.926^{+0.062}_{-0.043}$	$1.063^{+0.600}_{-0.327}$
	+1%/-1%	+3%/-2%	+94%/-94%	+15%/-13%	+7%/-5%	+56%/-31%
Source	SPE90	SPE90	SPE90	DSEP		

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

### Secondary Eclipse Parameters for KIC 010973814-01 / KOI 1307.01

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	$-67 \pm 17$	$3.53^{+0.46}_{-0.47}$	$714^{+33}_{-29}$	$3391^{+170}_{-177}$	$174^{+69}_{-56}$
Alt.	$-61 \pm 19$	$3.16^{+0.53}_{-0.44}$	$713^{+30}_{-29}$	$3439^{+200}_{-204}$	$191^{+100}_{-69}$

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

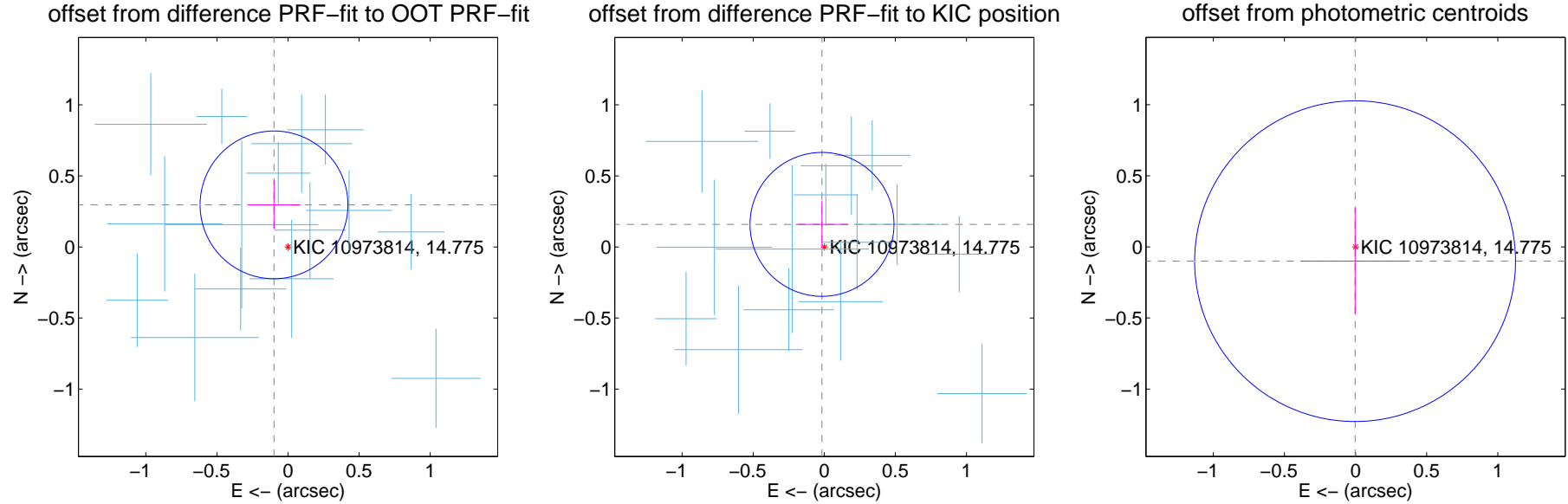
## DV Centroid Data

Supplemental centroid analysis for 010973814-01. Kepler magnitude: 14.78. Transit SNR 30.34

There are 15 quarters with good PRF difference image offsets

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

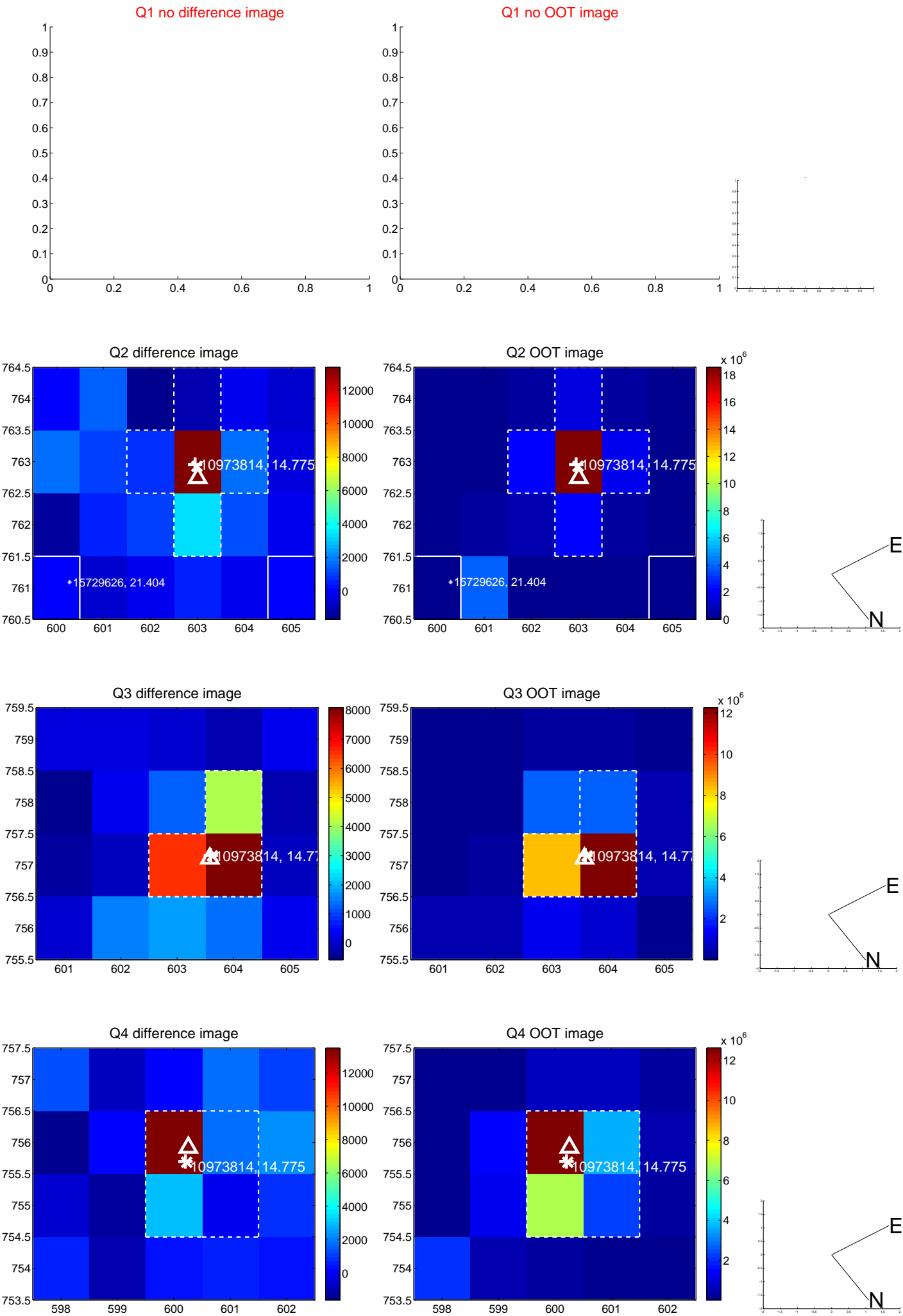
	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.312 \pm 0.173$	1.80	$0.099 \pm 0.186$	$0.296 \pm 0.172$
PRF-fit source offset from KIC position	$0.160 \pm 0.169$	0.95	$0.016 \pm 0.185$	$0.159 \pm 0.169$
photometric centroid source offset	$0.10 \pm 0.38$	0.27	$0.00 \pm 0.39$	$-0.10 \pm 0.38$



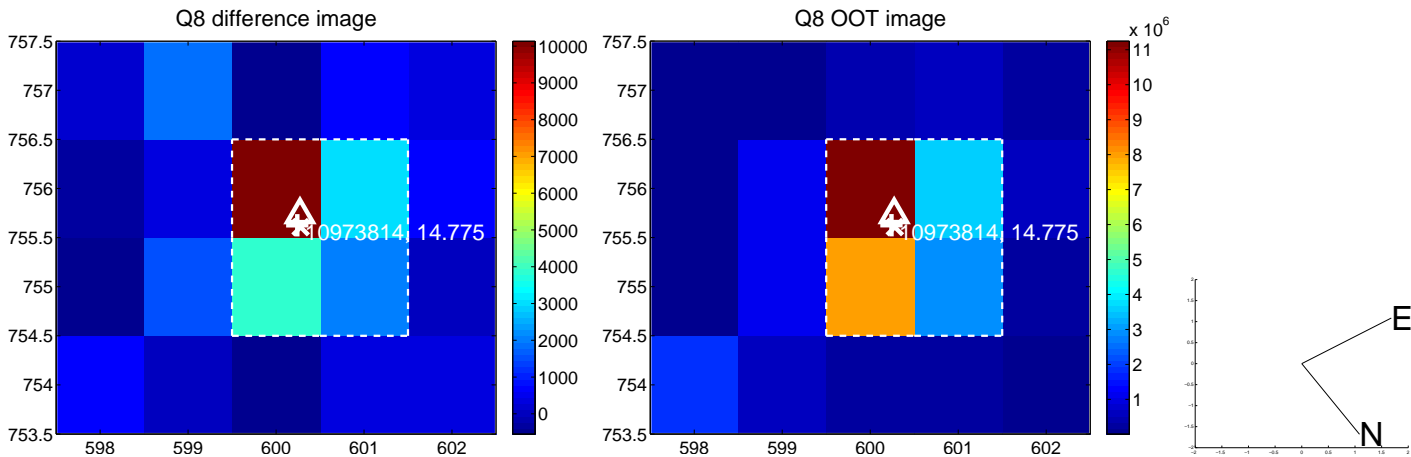
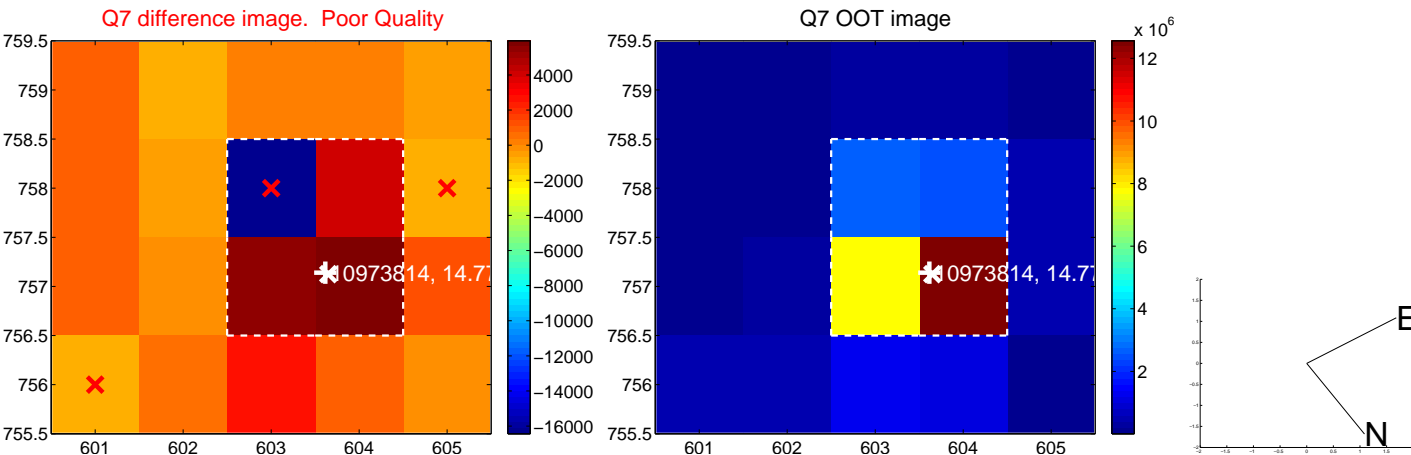
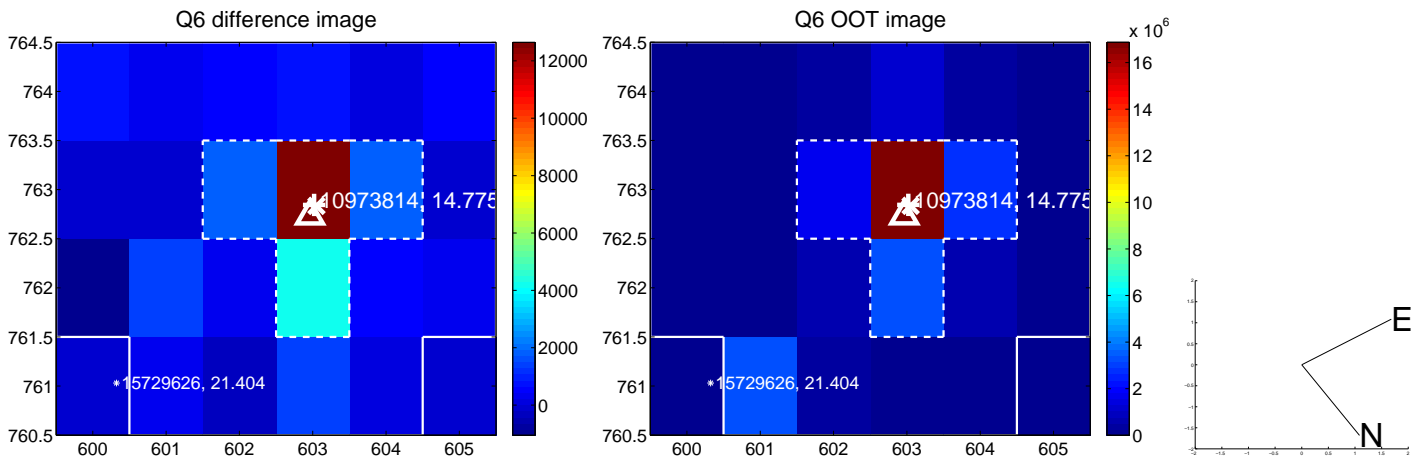
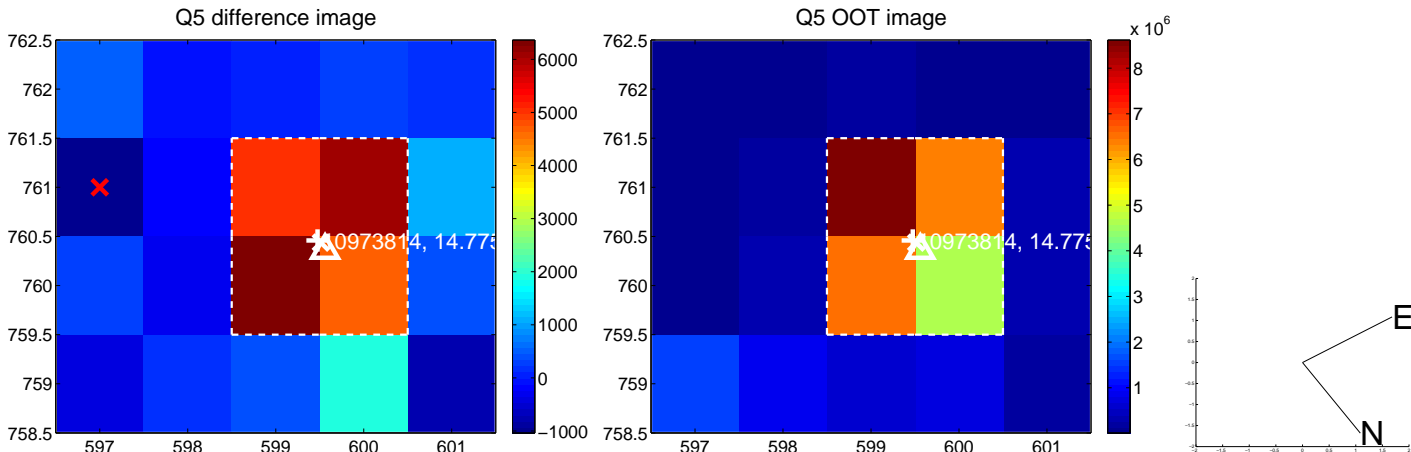
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets**; **Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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



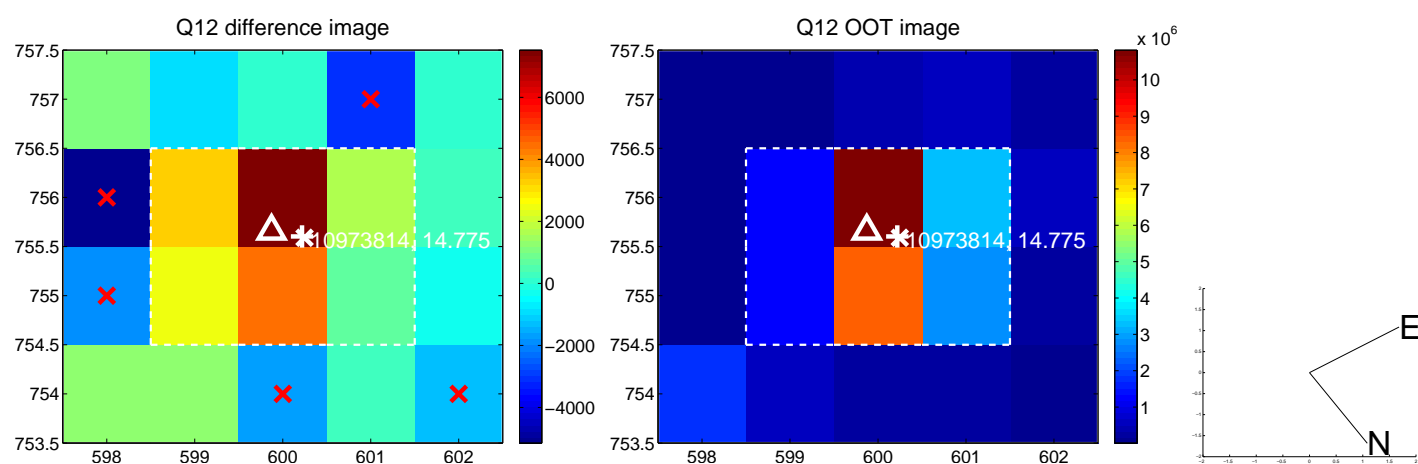
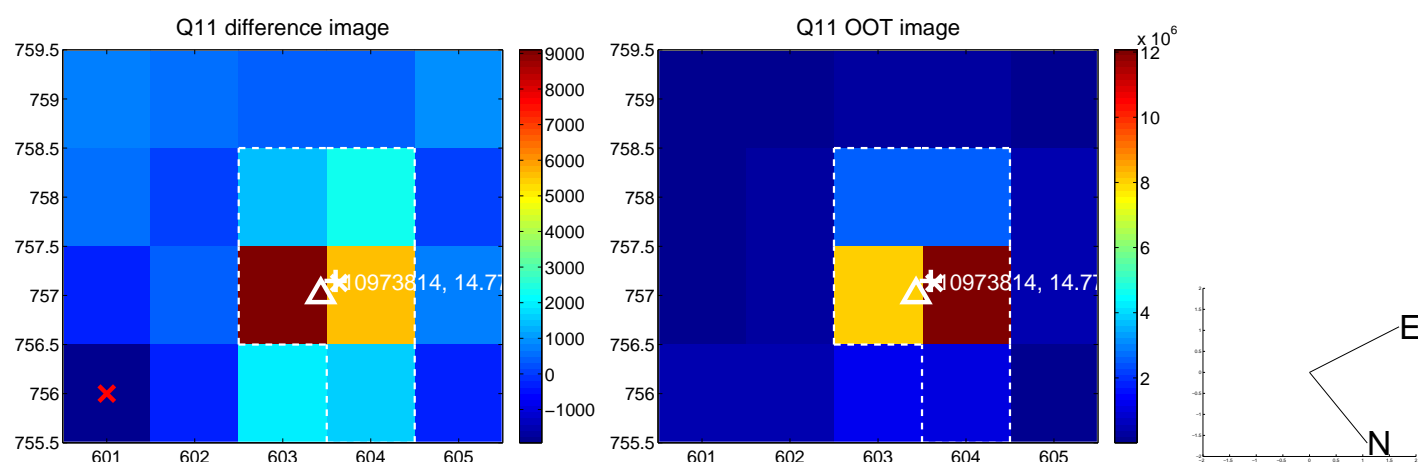
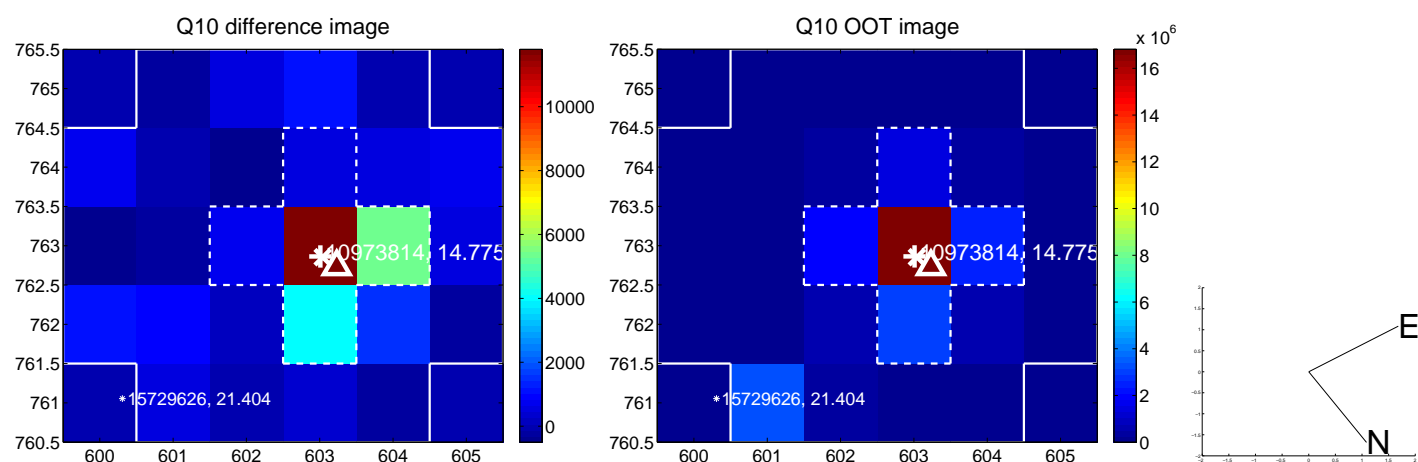
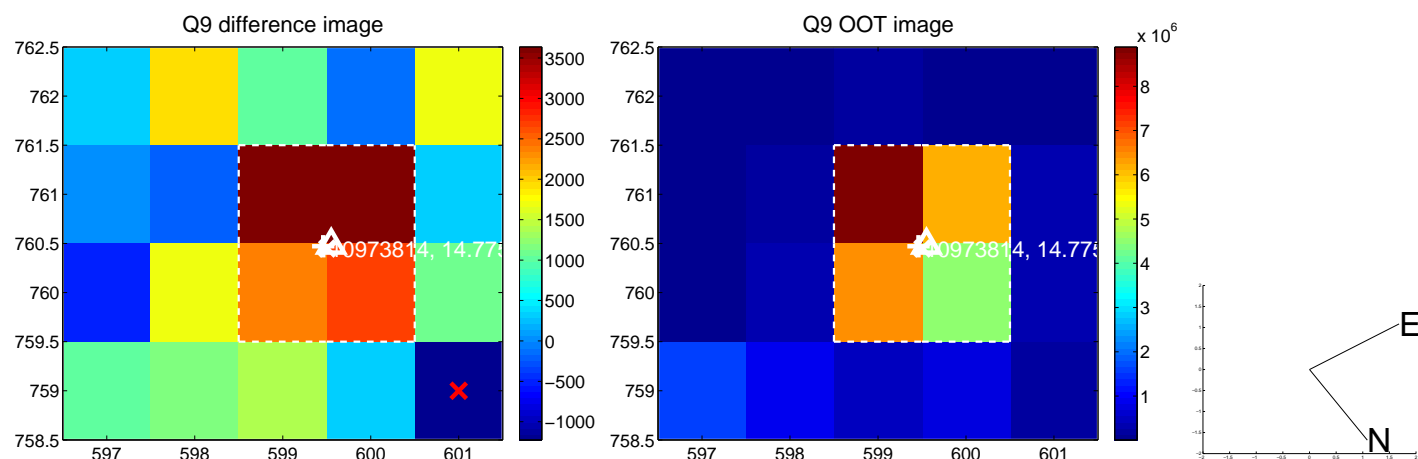
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

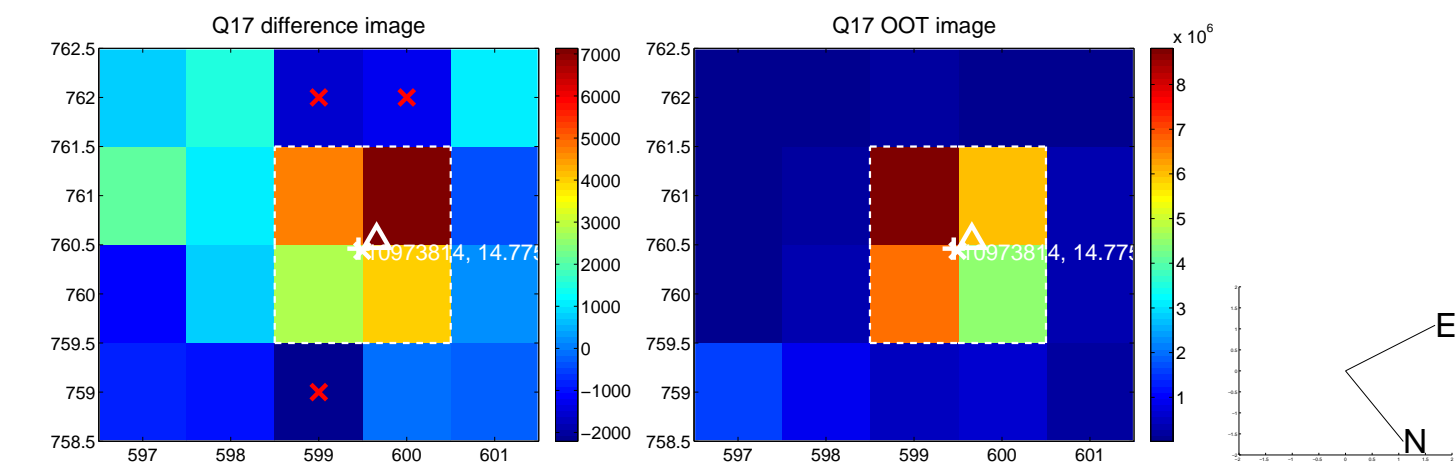


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

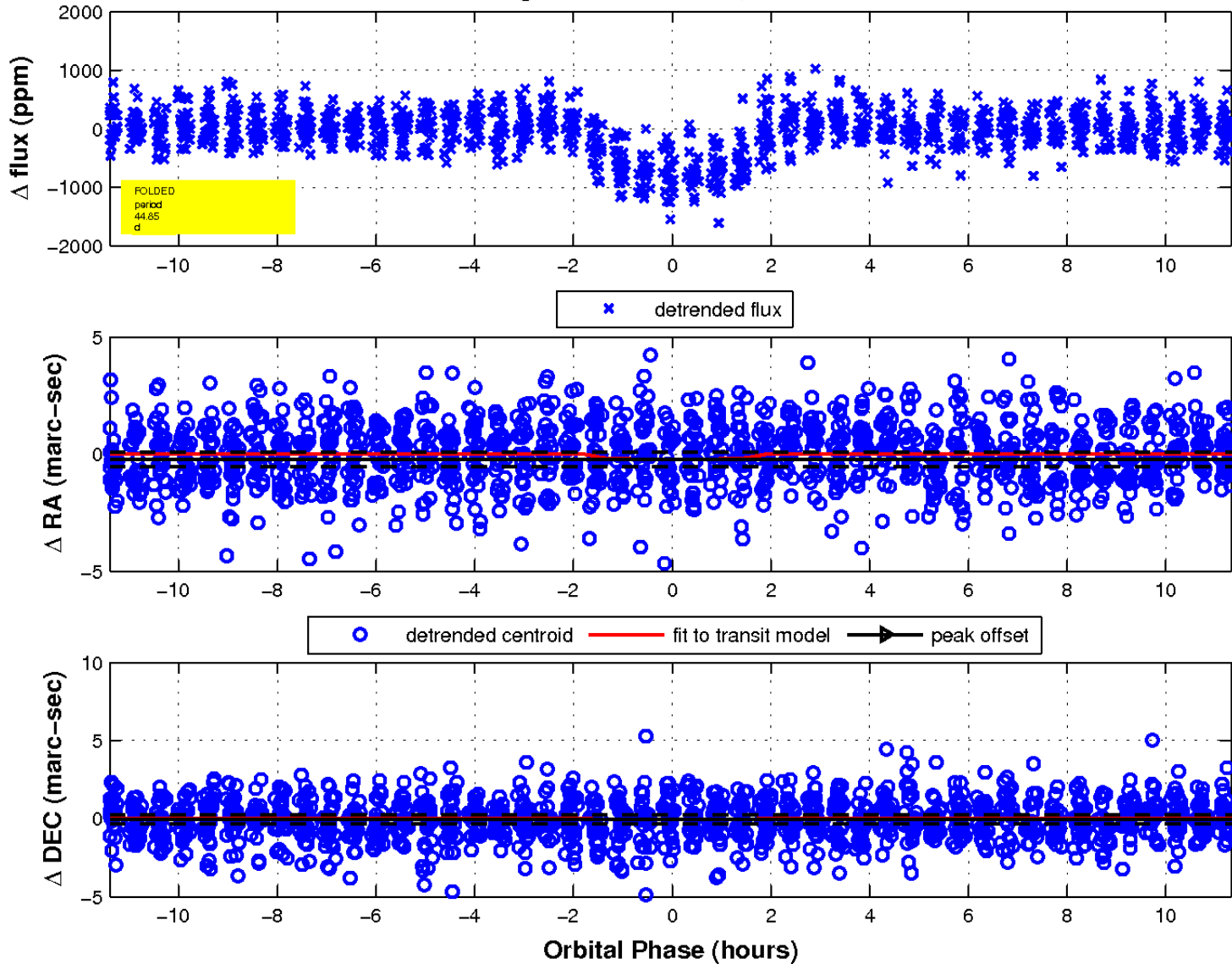




white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

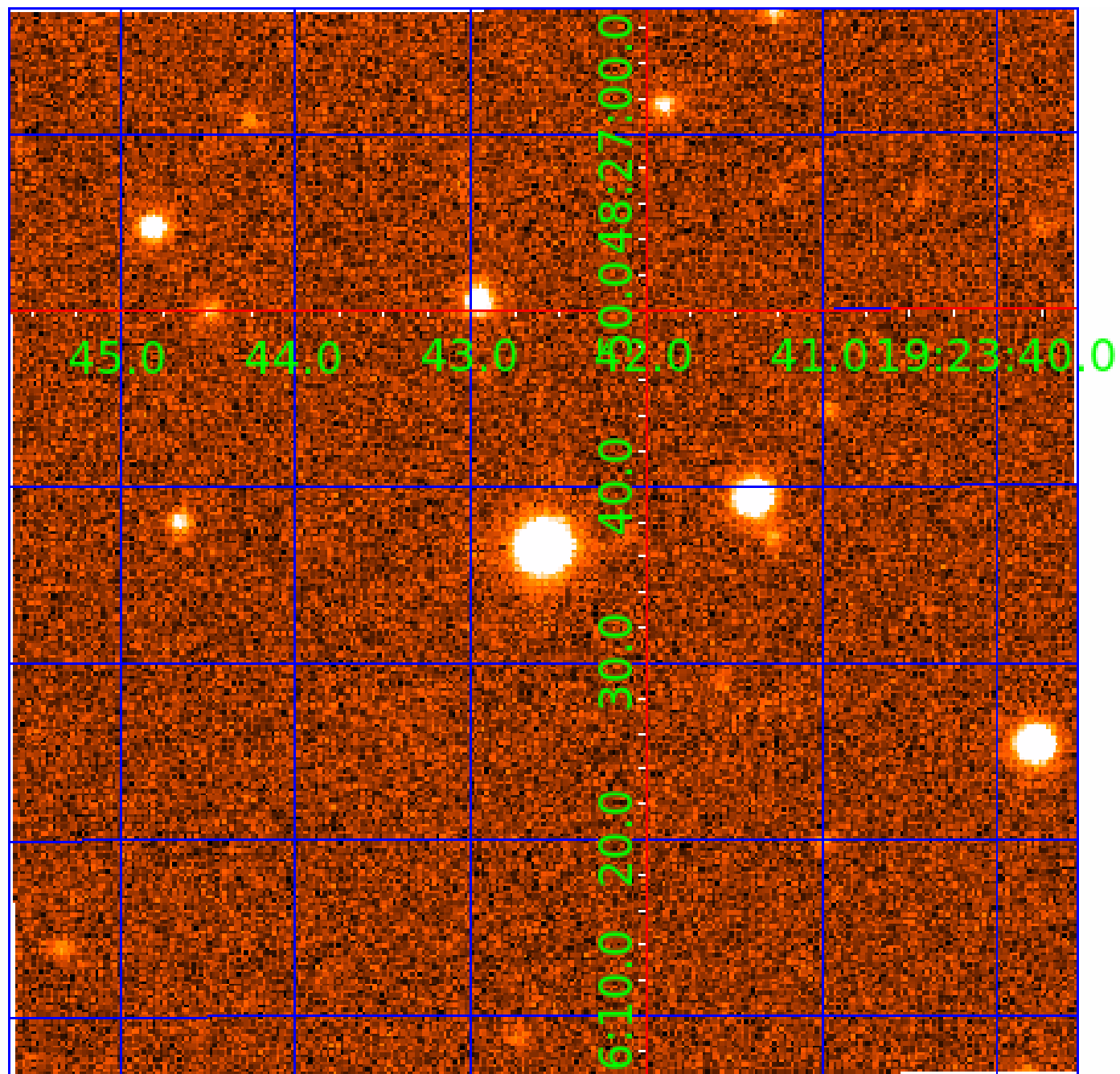


fluxWeightedCentroids, Planet 1 of 2



UKIRT Image

Declination





# KIC 010973814

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
010973814-01	OBS	1307.01	44.851966	172.463115	788.7	3.797	27.3	30.3	1.07	5514	3.54	16.38
010973814-02	OBS	1307.02	20.342310	137.696593	545.5	2.424	23.7	27.6	1.07	5514	2.99	47.00

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
010973814-01	OBS	PC	1.00	0	0	0	0	NO_COMMENT
010973814-02	OBS	PC	1.00	0	0	0	0	NO_COMMENT

**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.

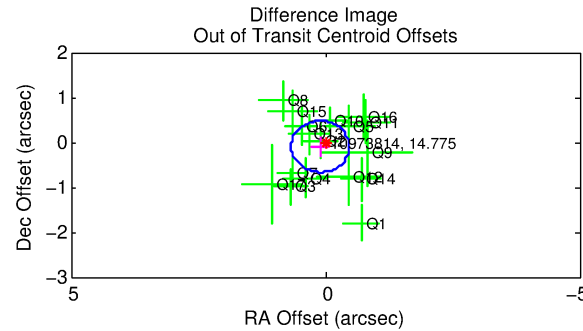
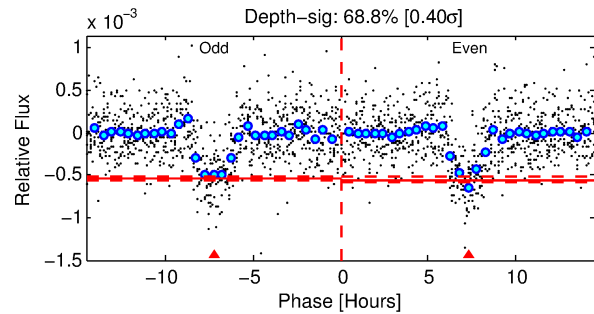
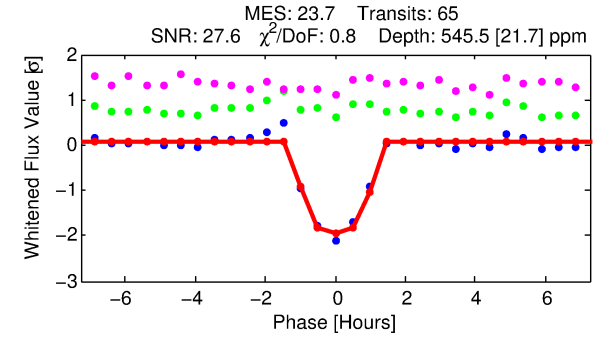
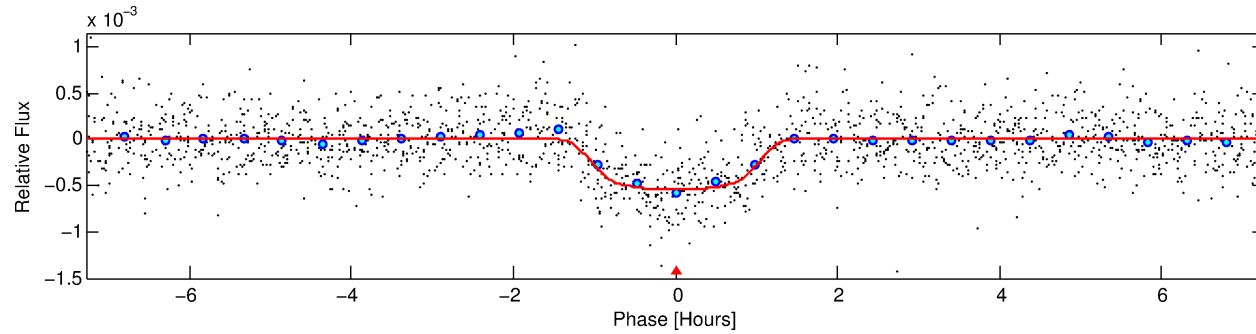
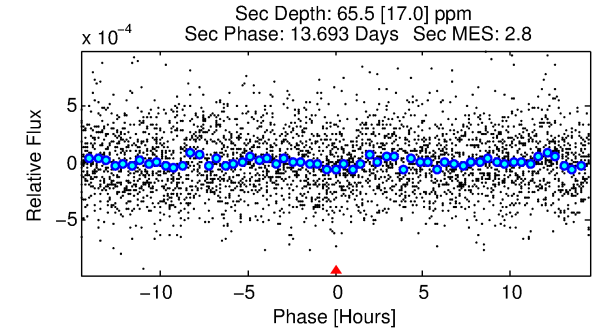
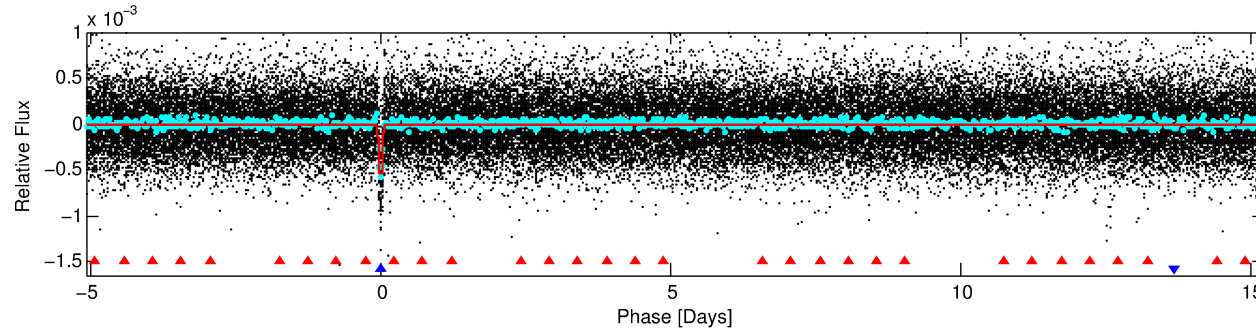
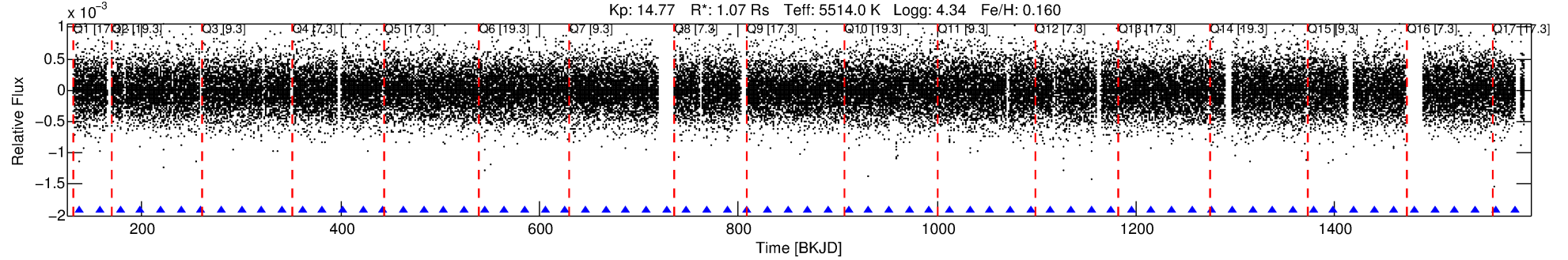
## Ephemeris Match Information For 010973814-02

No Significant Match Found

# DV One-Page Summary

KIC: 10973814 Candidate: 2 of 2 Period: 20.342 d  
KOI: K01307.02 Name: Kepler-287b Corr: 0.959

Kp: 14.77 R\*: 1.07 Rs Teff: 5514.0 K Logg: 4.34 Fe/H: 0.160



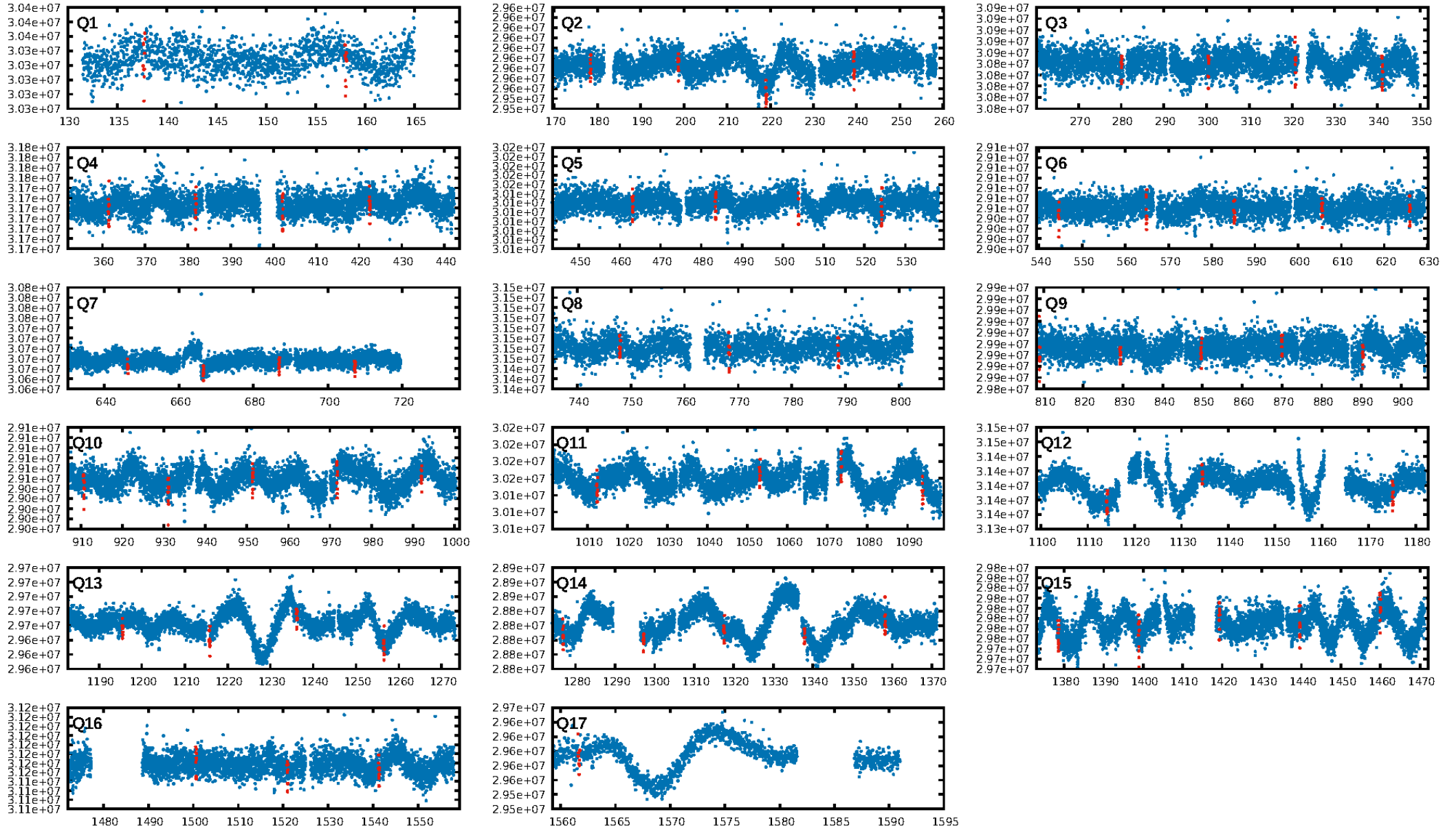
## DV Fit Results:

Period = 20.34231 [0.00006] d  
Epoch = 137.6966 [0.0021] BKJD  
Rp/R\* = 0.0256 [0.0042]  
a/R\* = 32.22 [22.30]  
b = 0.89 [0.16]  
Seff = 47.00 [10.95]  
Teff = 668 [39] K  
Rp = 2.99 [0.67] Re  
a = 0.1422 [0.0204] AU  
Ag = 81.55 [38.90] [2.07sigma]  
Teffp = 3102 [328] K [7.37sigma]

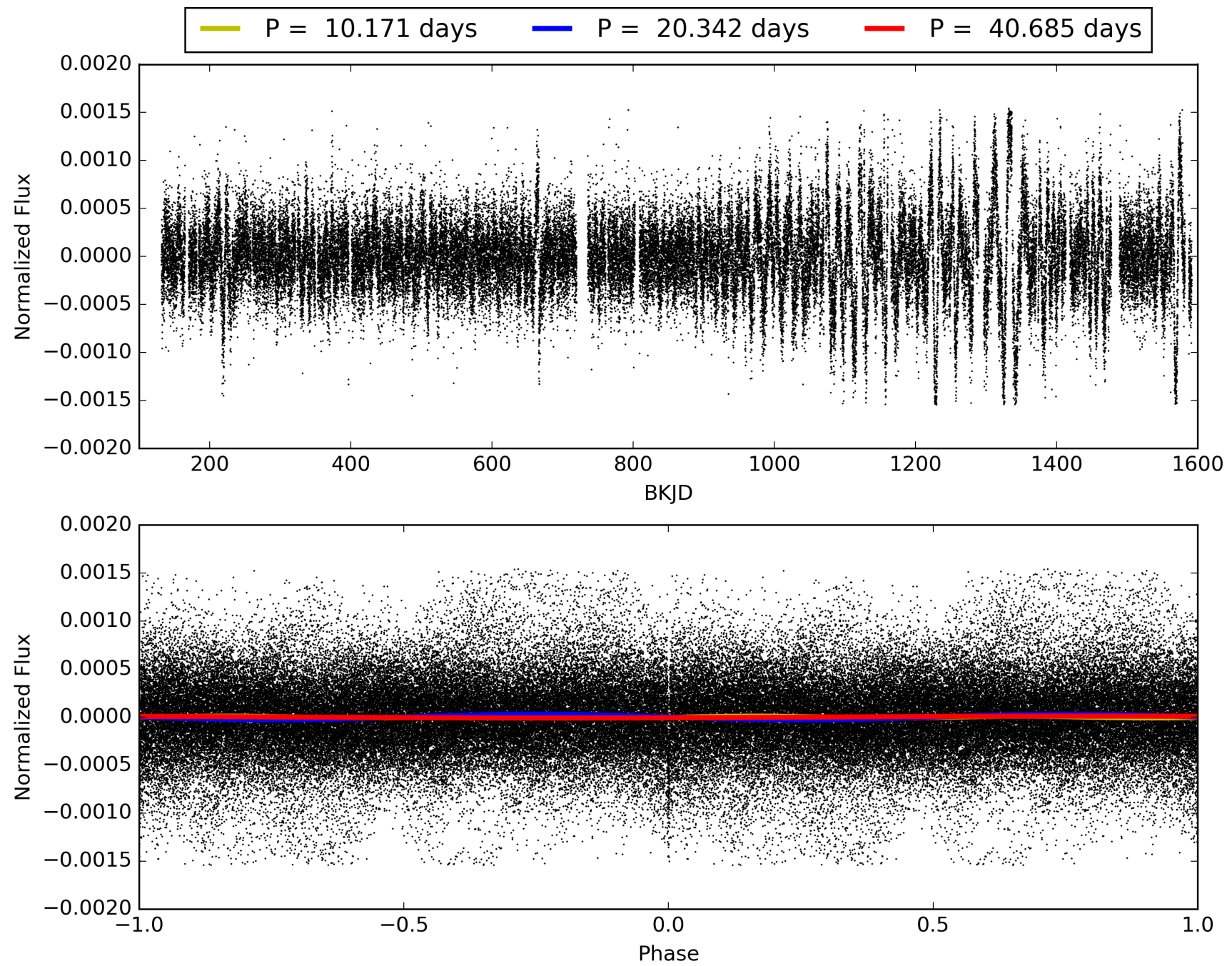
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [130.56sigma]  
ModelChiSquare2-sig: 94.4%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 1.70e-120  
RollingBand-fgt: 1.00 [62/62]  
GhostDiagnostic-chr: 3.739  
Centroid-sig: 0.0%  
Centroid-so: 1.657 arcsec [3.69sigma]  
OotOffset-rm: 0.143 arcsec [0.75sigma]  
KicOffset-rm: 0.237 arcsec [1.16sigma]  
OotOffset-st: 4/4/4/5 [17]  
KicOffset-st: 4/4/4/5 [17]  
DiffImageQuality-fgm: 1.00 [17/17]  
DiffImageOverlap-fno: 1.00 [17/17]

# TCE 010973814-02, PDC Light Curves

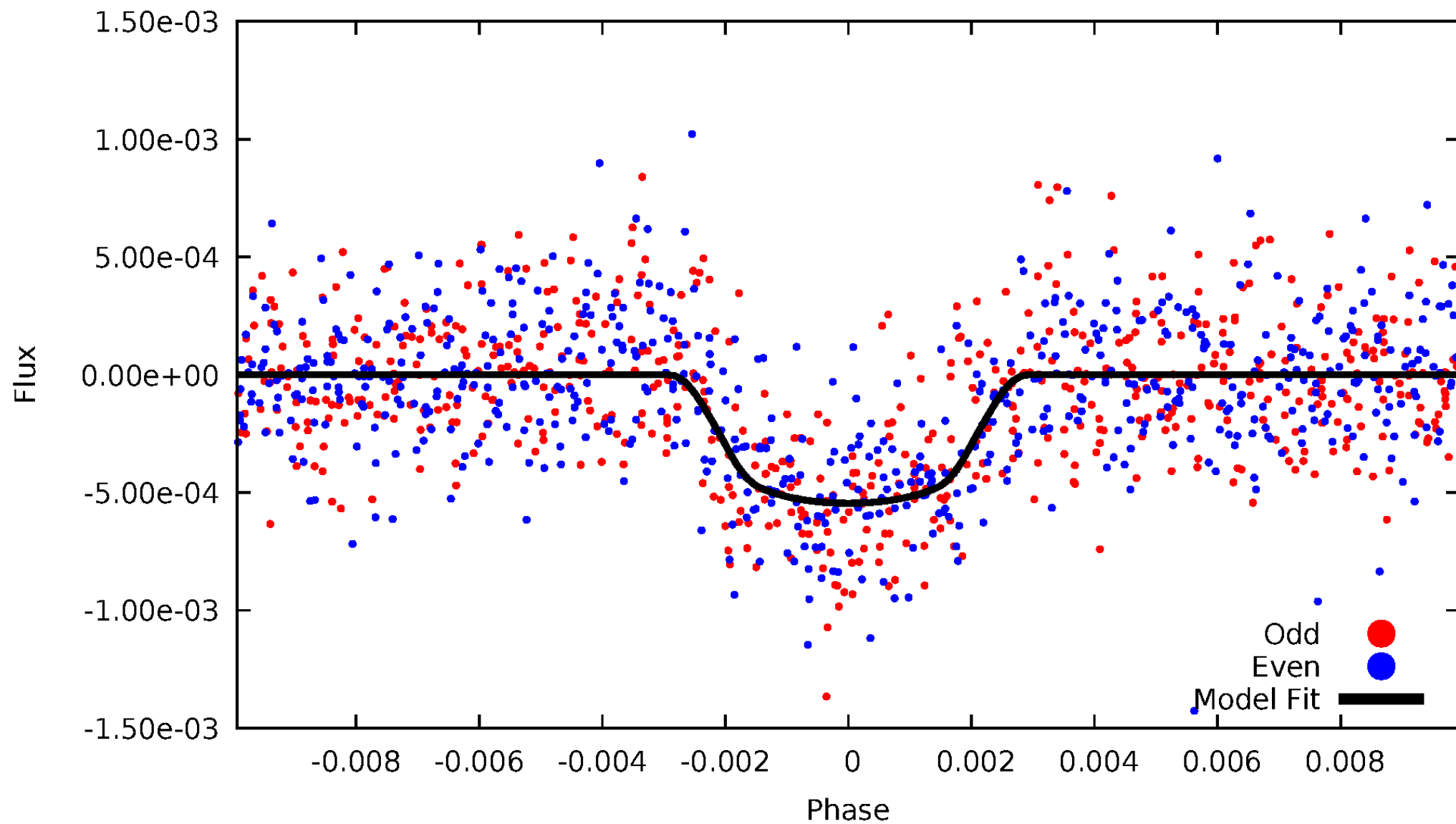


# TCE 010973814-02



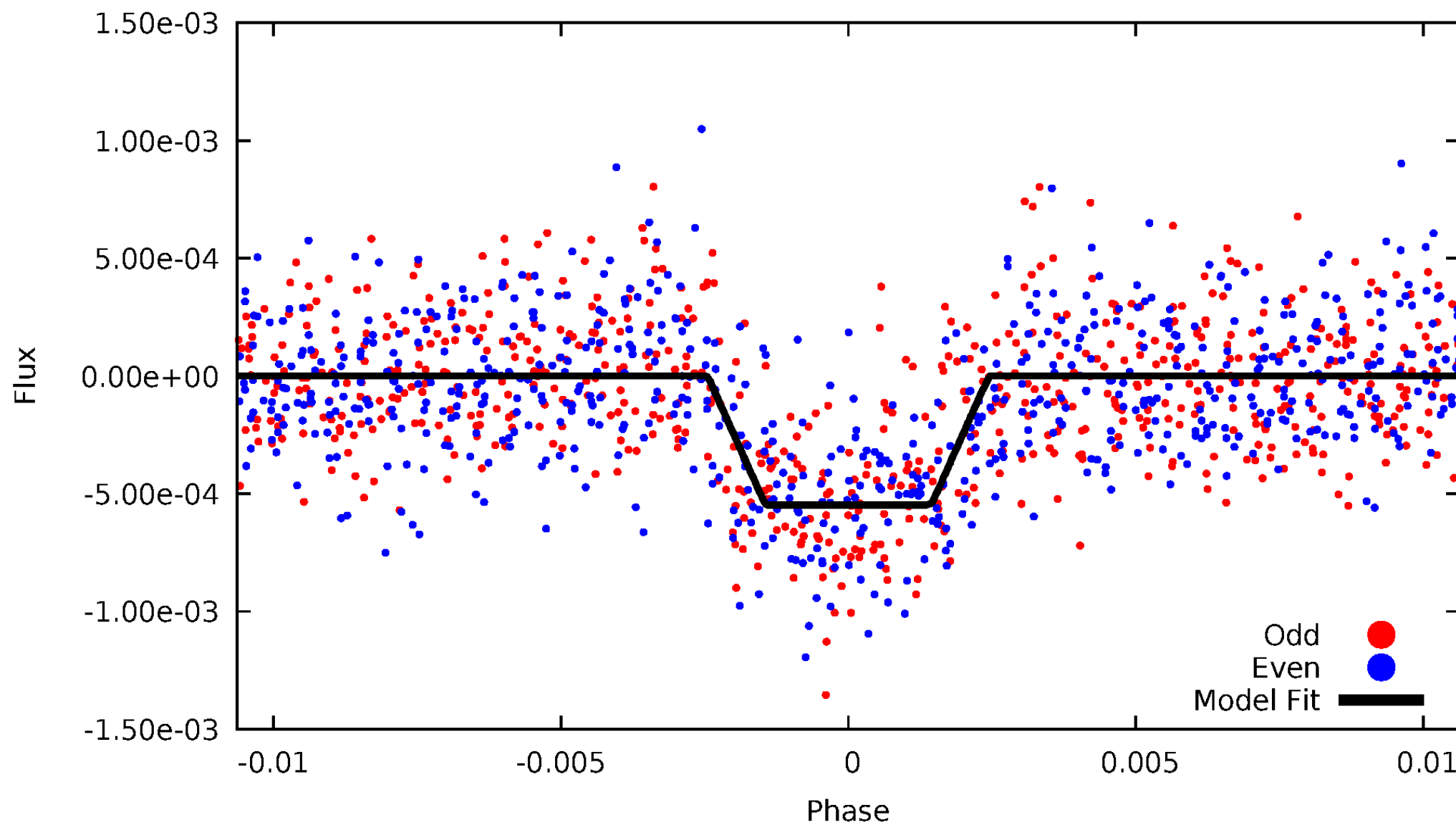
# DV Odd/Even

TCE 010973814-02



# ALT Odd/Even

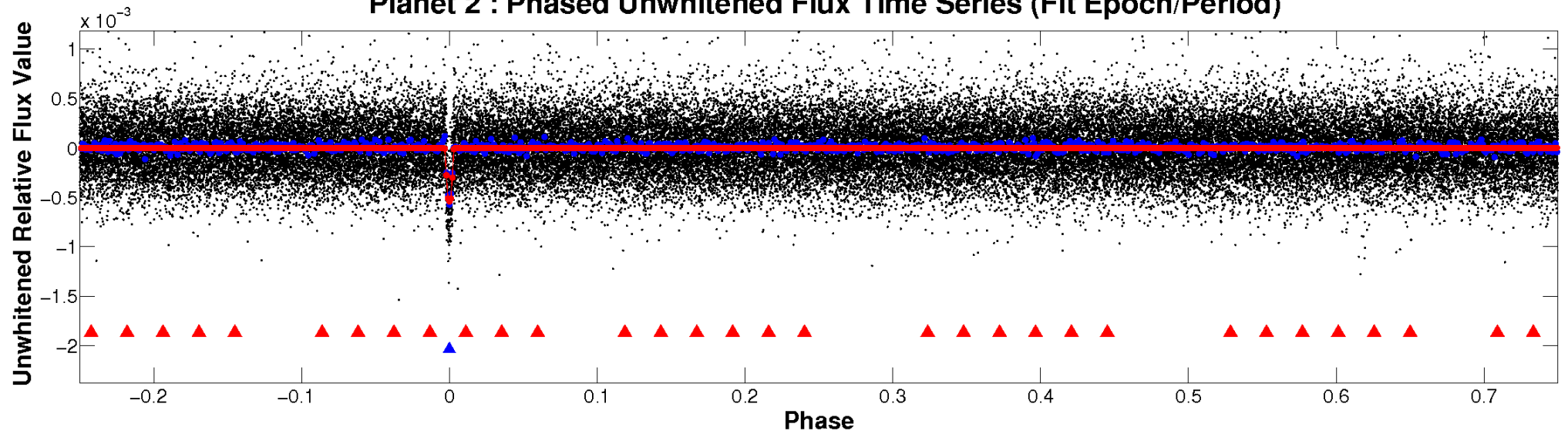
TCE 010973814-02



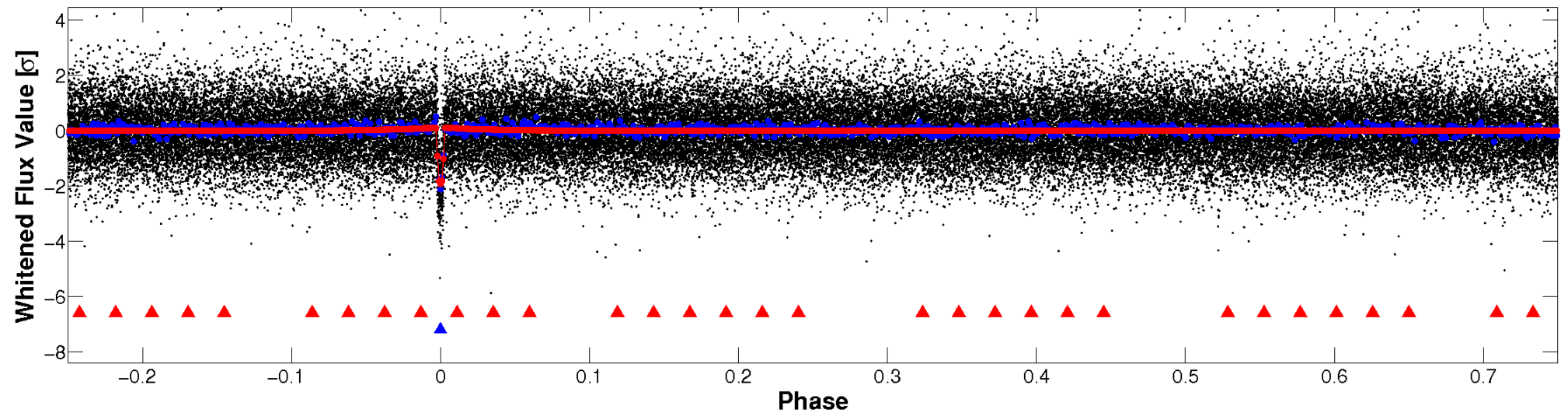


# Non-Whitened Vs. Whitened Light Curve

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

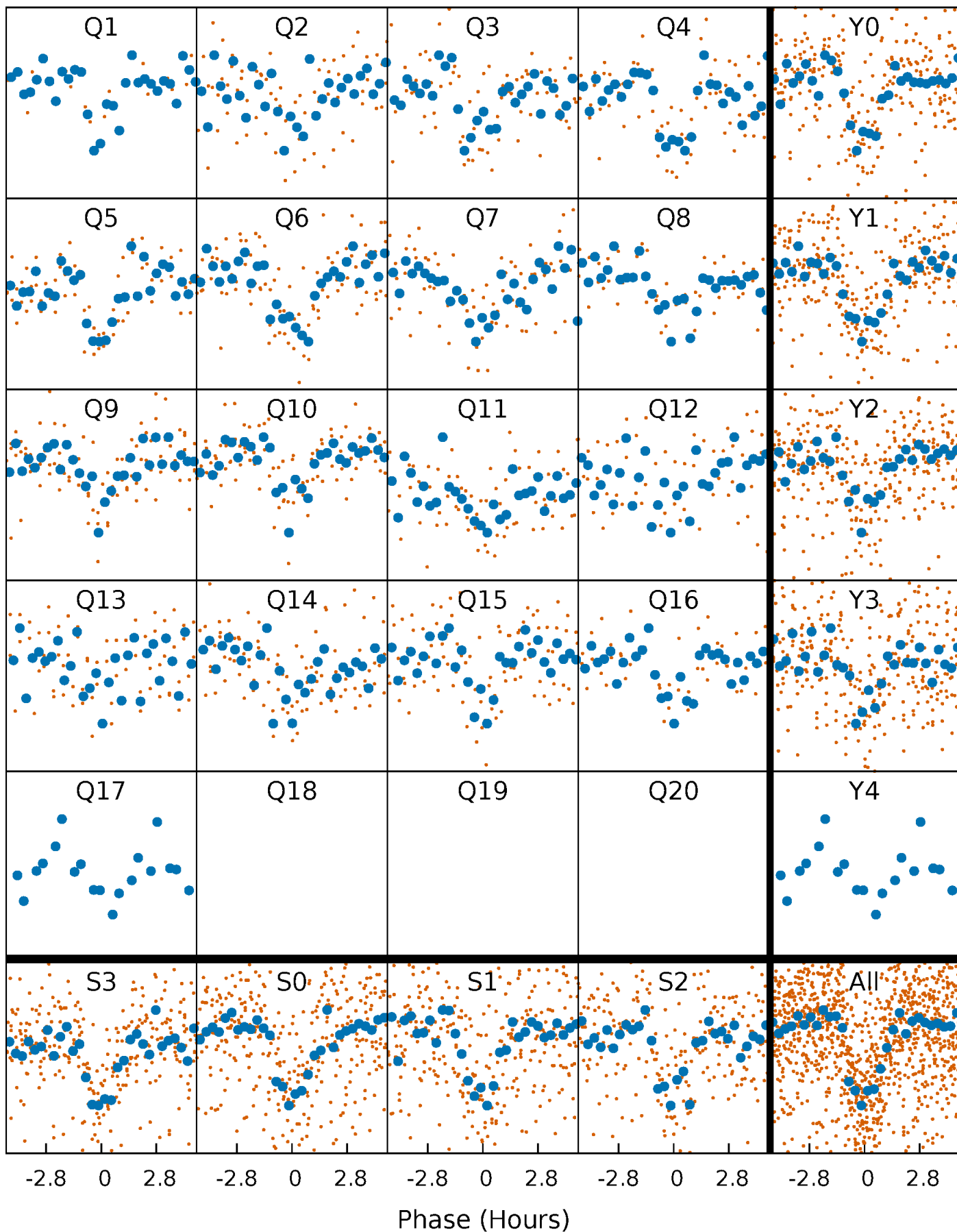


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



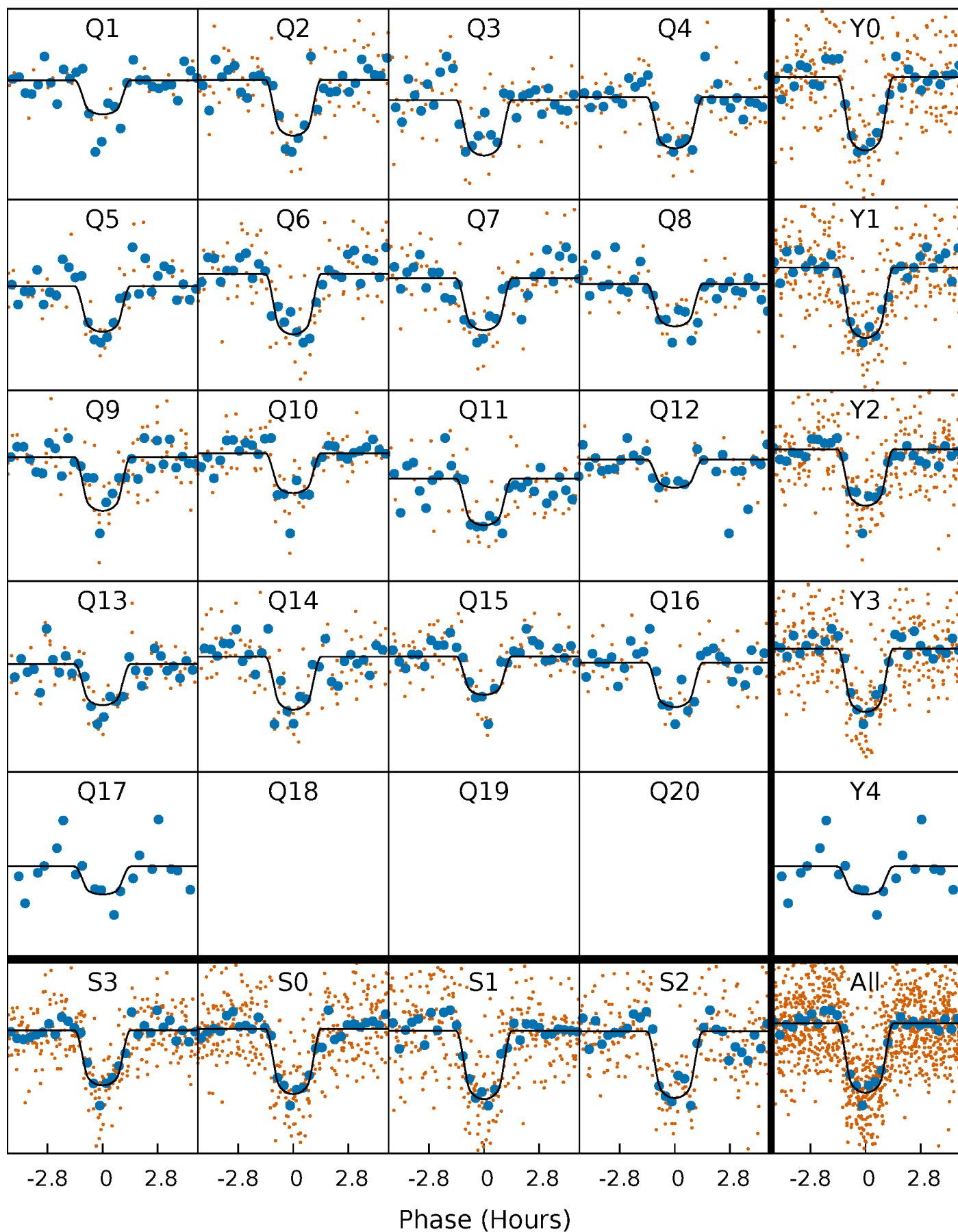
# PDC Quarter-Phased Transit Curves

TCE 010973814-02 P= 20.342310 Days  $T_0=137.696593$  (BKJD)



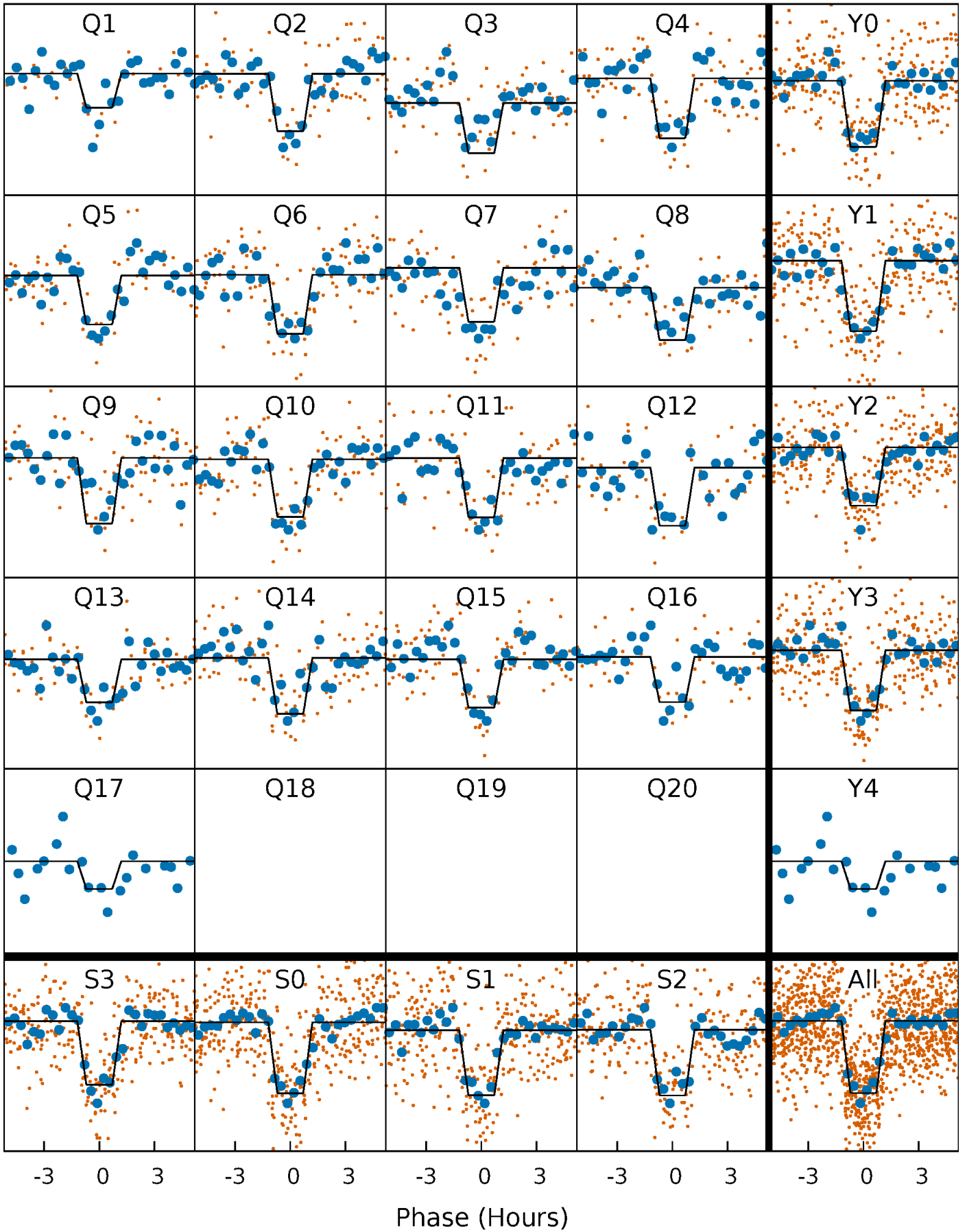
# DV Quarter-Phased Transit Curves

TCE 010973814-02 P= 20.342310 Days  $T_0=137.696593$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

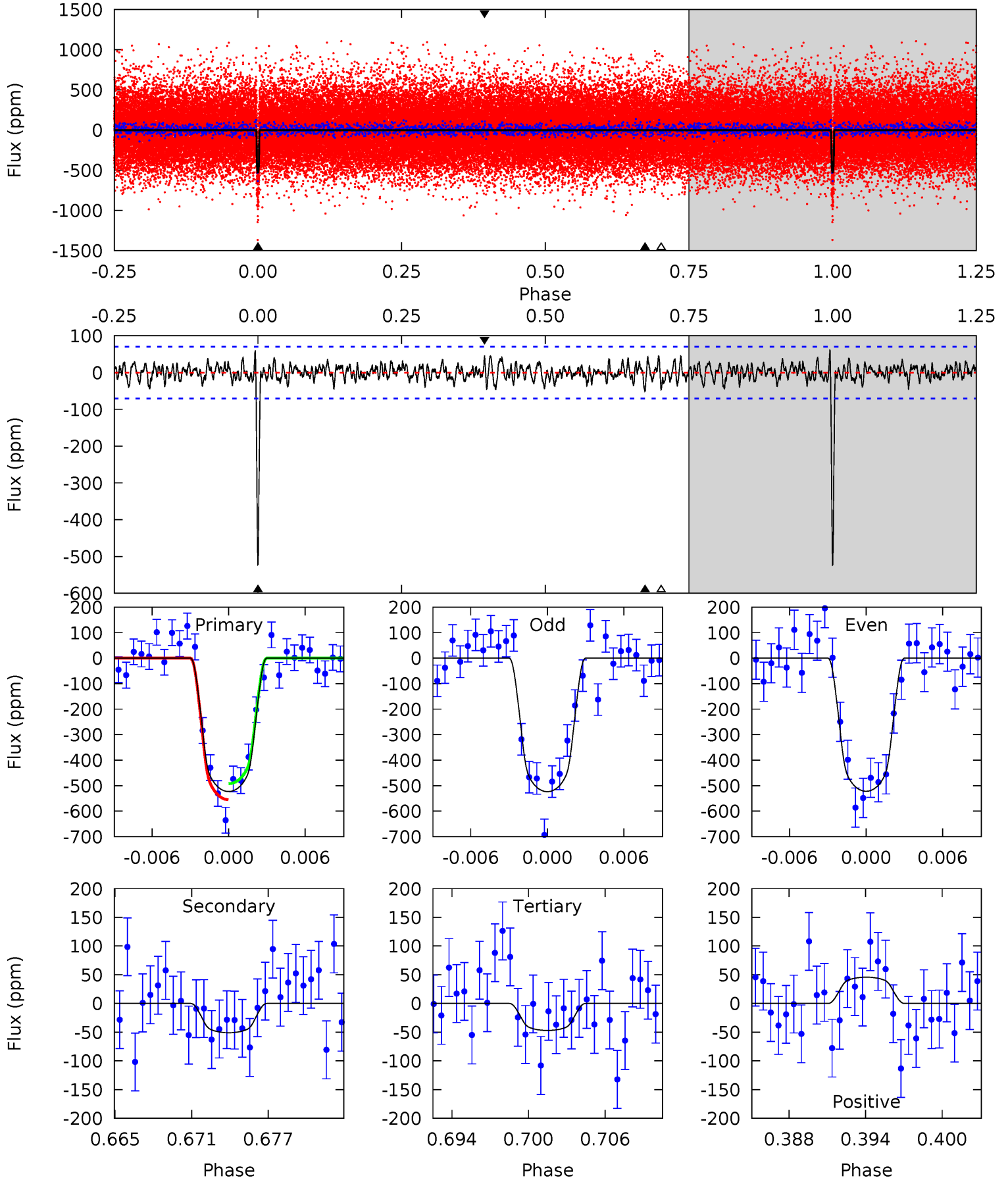
TCE 010973814-02 P= 20.342284 Days  $T_0=137.698358$  (BKJD)



# DV Model-Shift Uniqueness Test

010973814-02, P = 20.342310 Days, E = 117.354283 Days

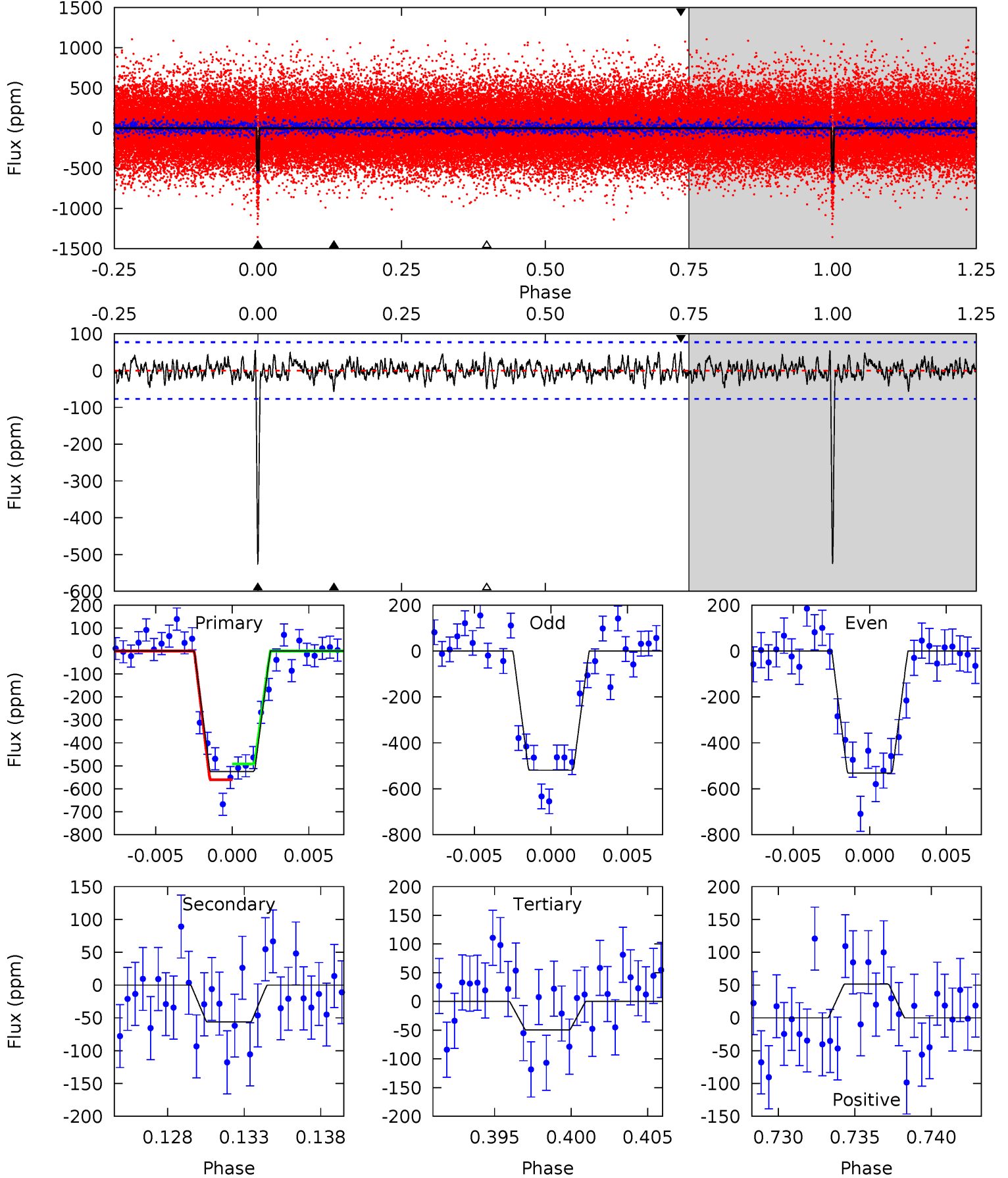
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
38.1	3.72	3.43	3.33	5.13	2.75	1.21	34.7	34.8	0.29	0.38	0.06	1.01	0.10	2.29



# Alt Model-Shift Uniqueness Test

010973814-02,  $P = 20.342284$  Days,  $E = 117.356074$  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
35.2	3.77	3.33	3.45	5.16	2.81	1.14	31.9	31.8	0.44	0.32	0.42	0.98	0.09	2.32





### Stellar Parameters For KIC 010973814

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$5514^{+74}_{-74}$	$4.345^{+0.132}_{-0.108}$	$0.160^{+0.150}_{-0.150}$	$1.071^{+0.163}_{-0.134}$	$0.926^{+0.062}_{-0.043}$	$1.063^{+0.600}_{-0.327}$
	+1%/-1%	+3%/-2%	+94%/-94%	+15%/-13%	+7%/-5%	+56%/-31%
Source	SPE90	SPE90	SPE90	DSEP		

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

### Secondary Eclipse Parameters for KIC 010973814-02 / KOI 1307.02

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	$-51 \pm 14$	$2.98^{+0.57}_{-0.54}$	$929^{+39}_{-38}$	$3405^{+259}_{-221}$	$63^{+38}_{-23}$
Alt.	$-56 \pm 15$	$2.70^{+0.64}_{-0.49}$	$929^{+41}_{-37}$	$3562^{+294}_{-245}$	$84^{+55}_{-32}$

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

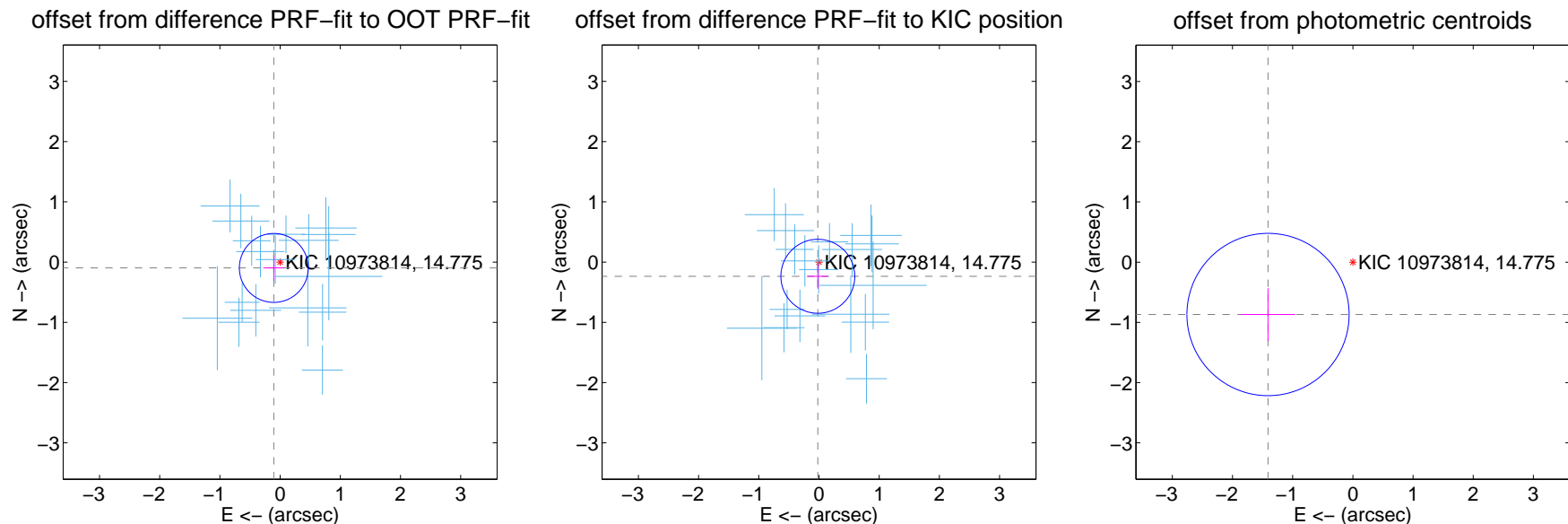
## DV Centroid Data

Supplemental centroid analysis for 010973814-02. Kepler magnitude: 14.78. Transit SNR 27.55

There are 17 quarters with good PRF difference image offsets

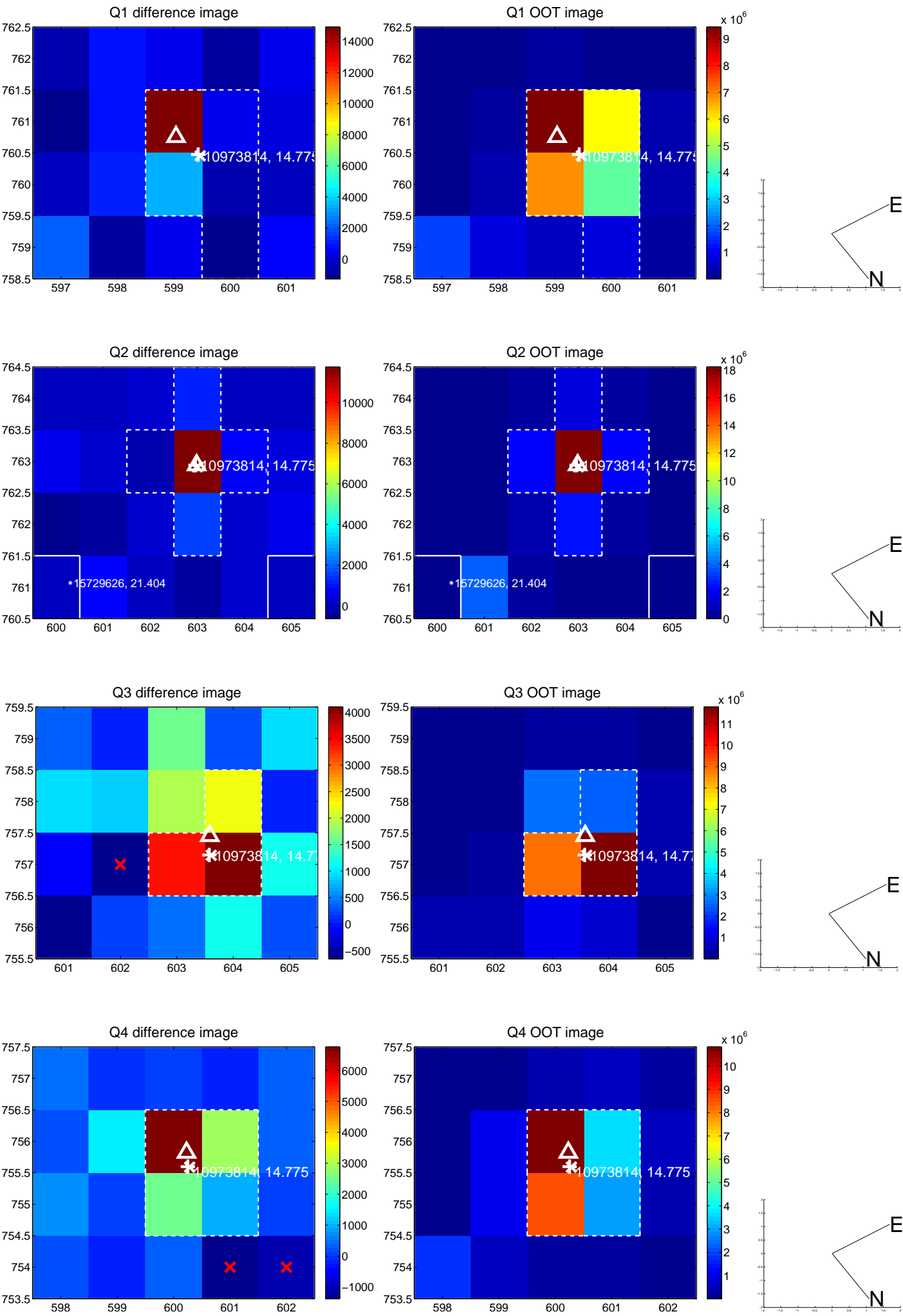
The direct PRF centroid is offset from the target star catalog position by about 0.19 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.143 \pm 0.191$	0.75	$0.105 \pm 0.174$	$-0.097 \pm 0.209$
PRF-fit source offset from KIC position	$0.237 \pm 0.205$	1.16	$0.019 \pm 0.170$	$-0.236 \pm 0.205$
photometric centroid source offset	$1.66 \pm 0.45$	3.69	$1.41 \pm 0.45$	$-0.87 \pm 0.44$

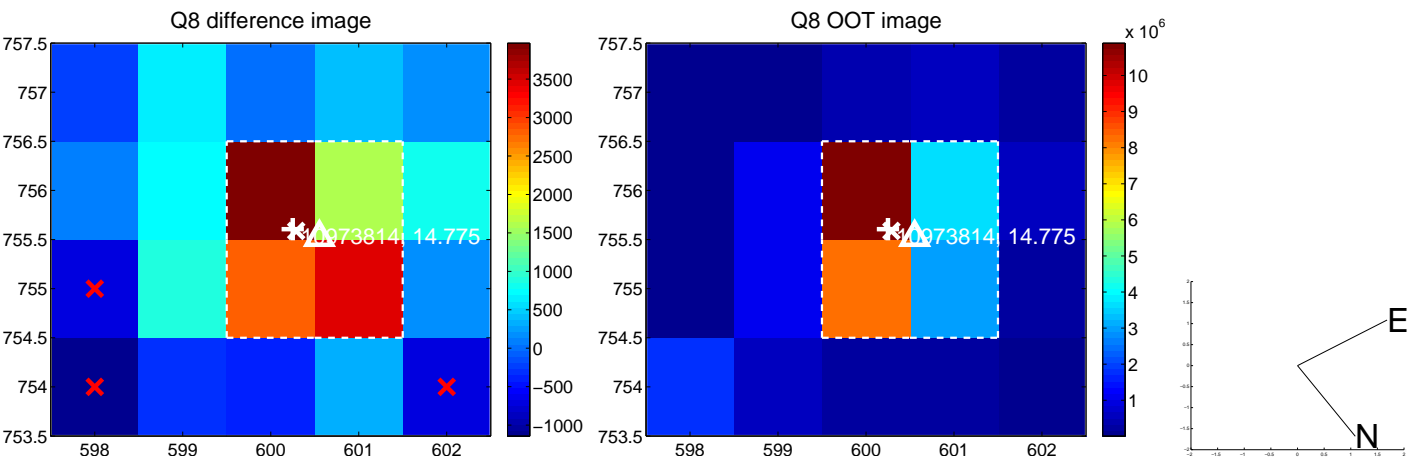
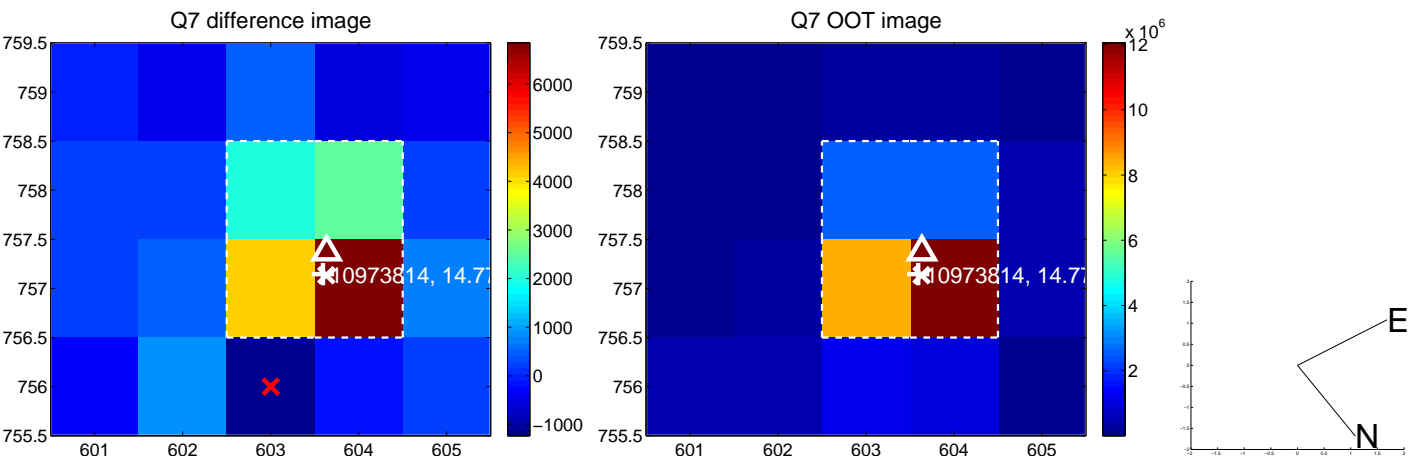
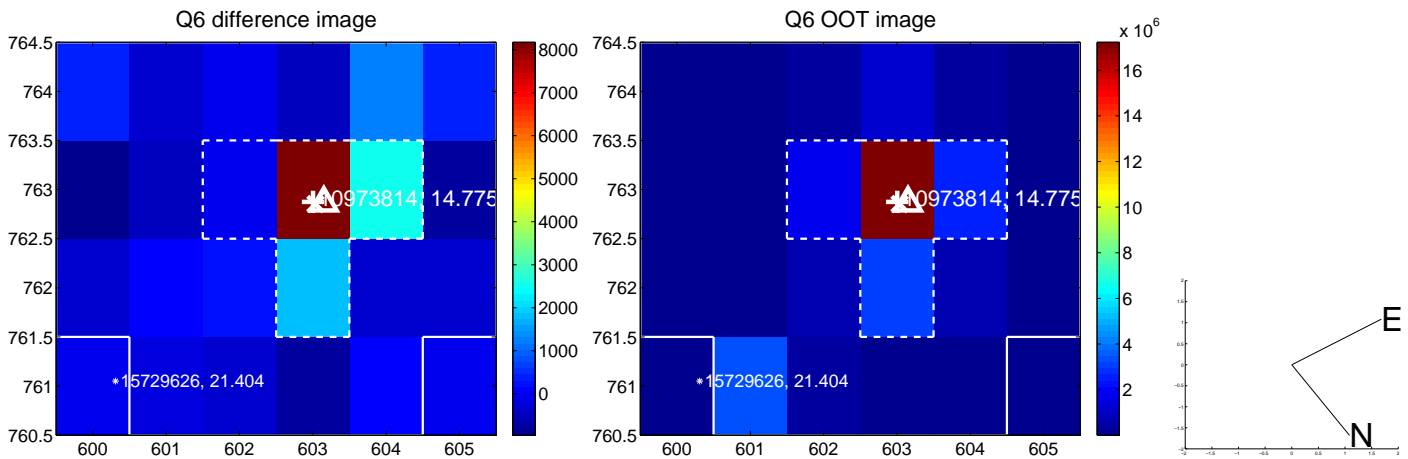
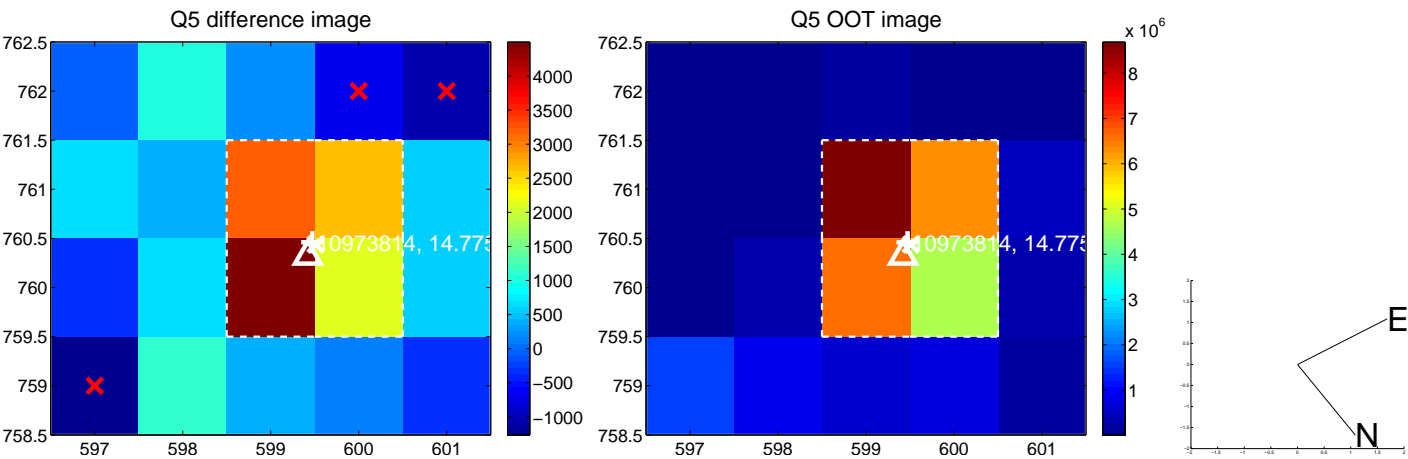


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

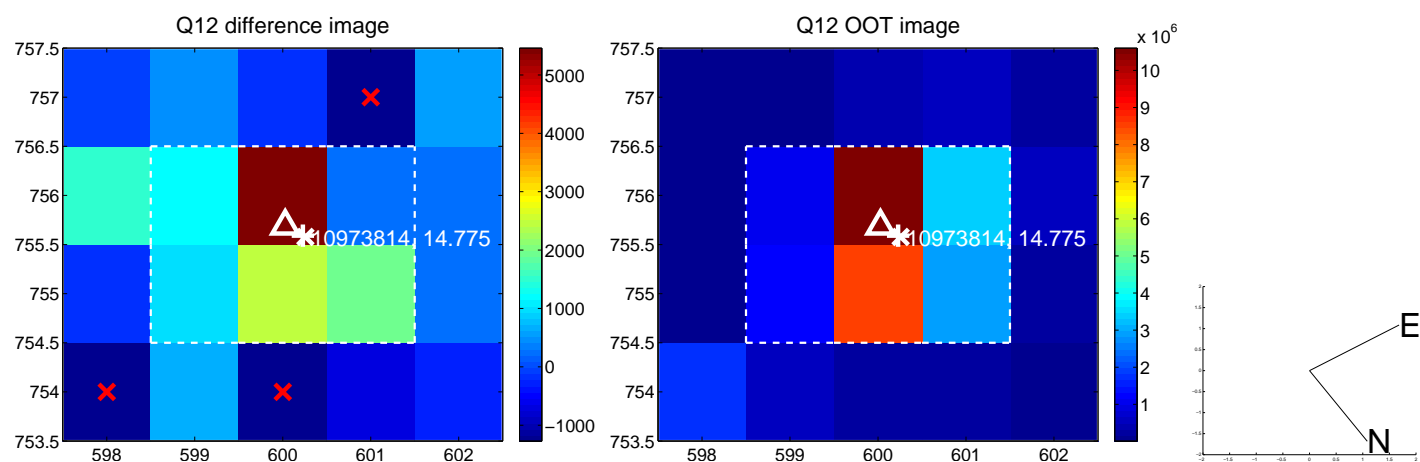
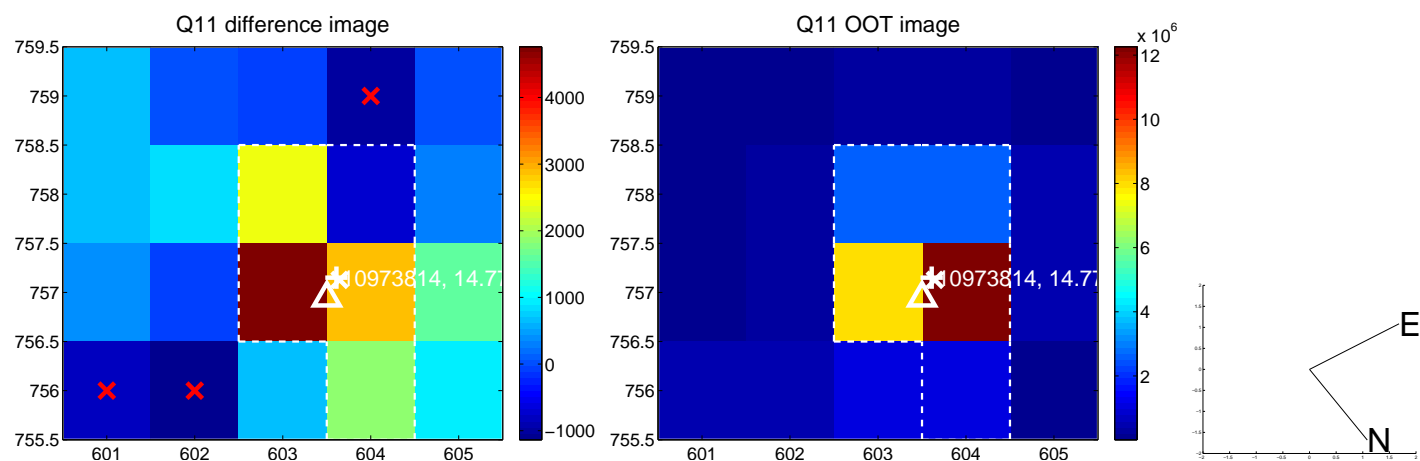
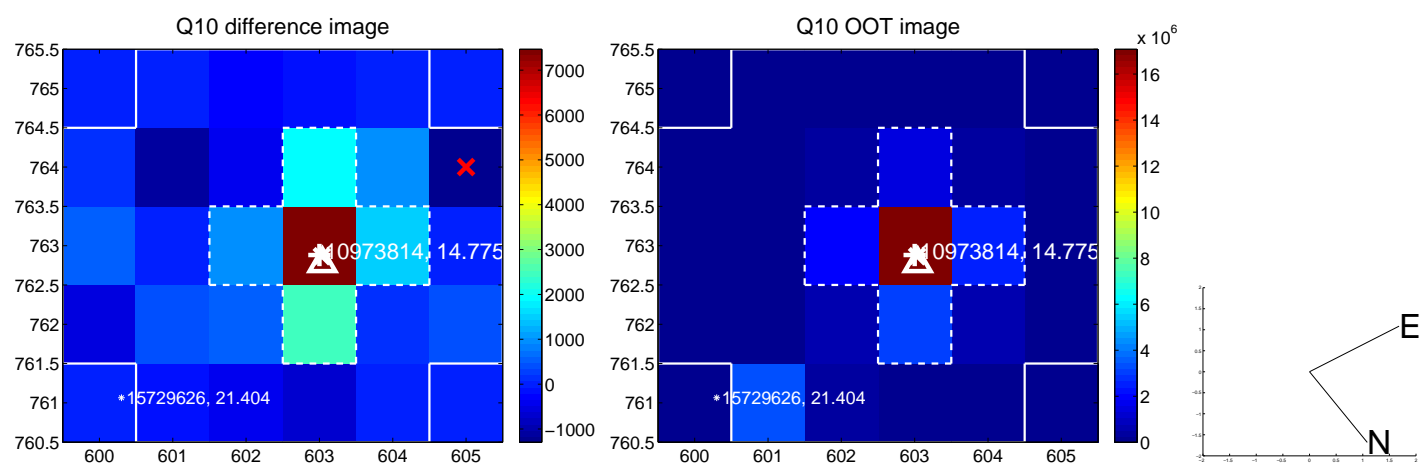
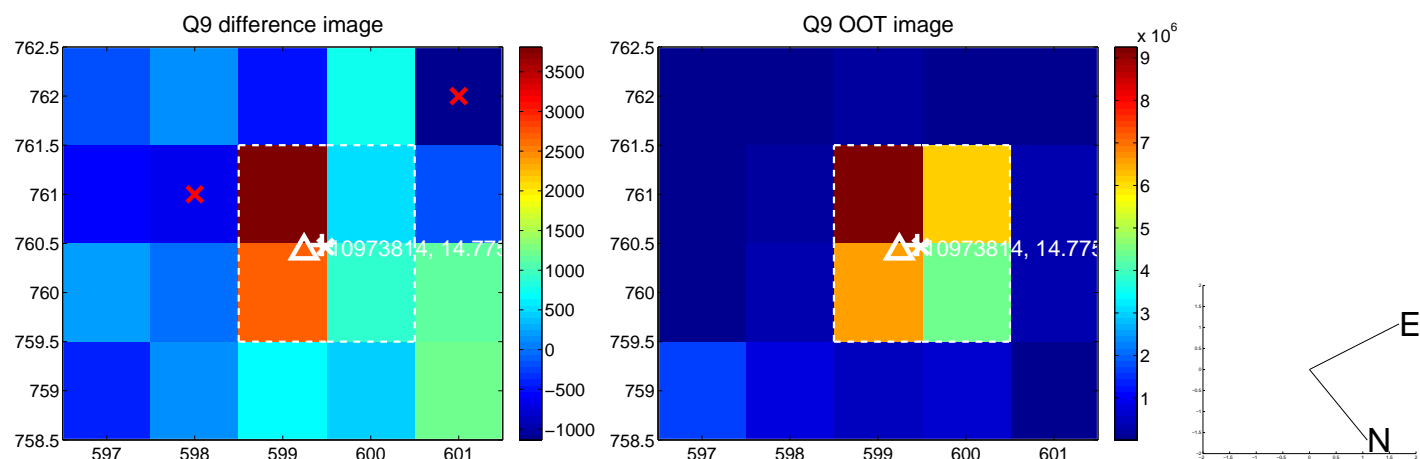
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



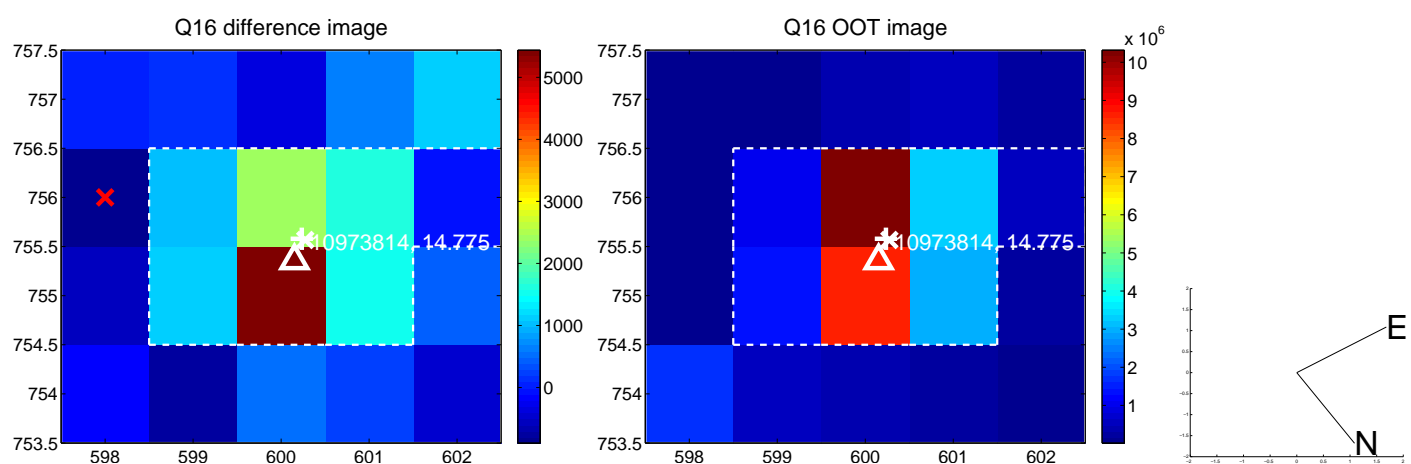
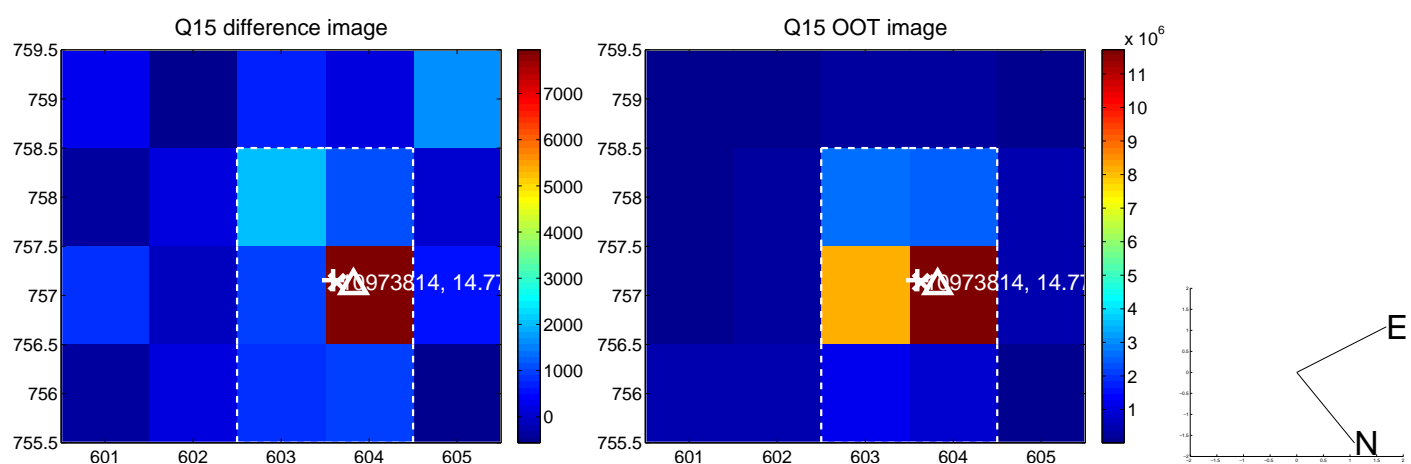
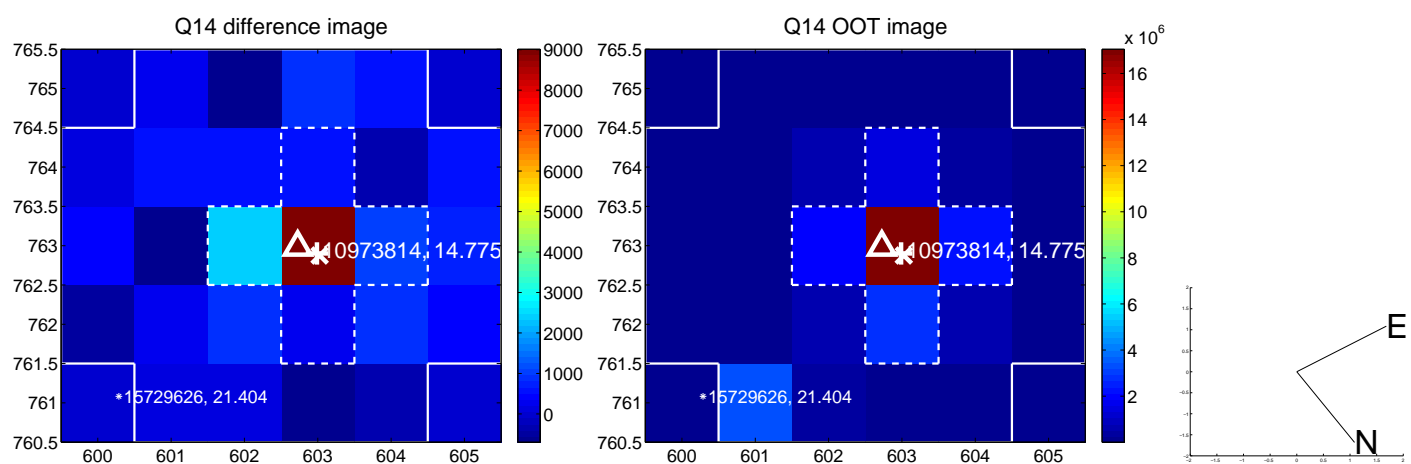
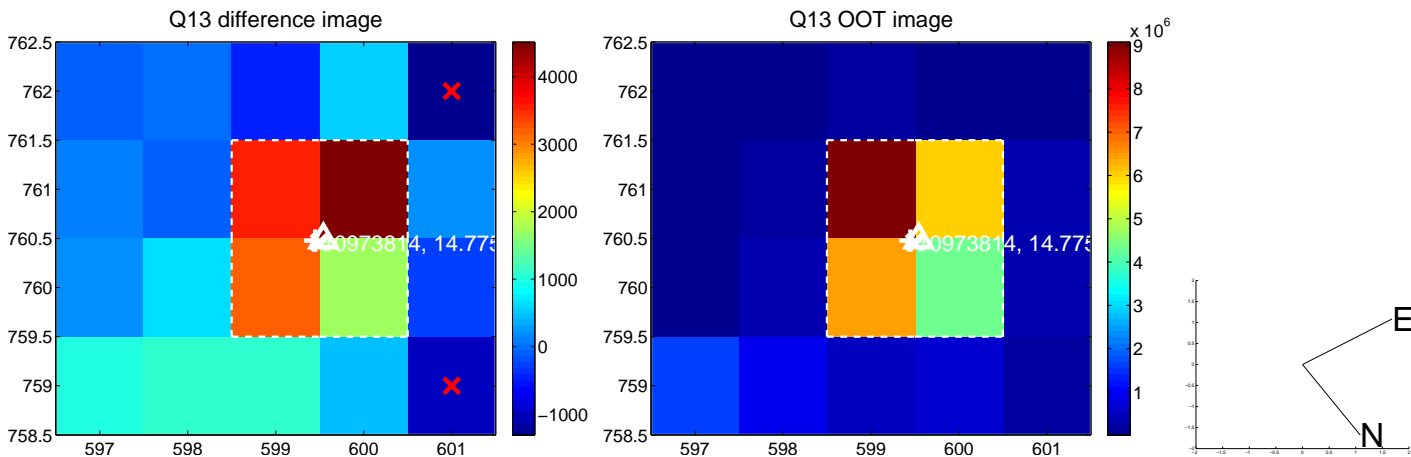
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UKIRT Image

Declination

