

# KIC 009782691

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009782691-01	OBS	0590.01	11.388412	140.387573	424.0	4.173	28.6	30.3	1.46	5876	3.69	217.13
009782691-02	OBS	0590.02	50.698815	141.313095	624.2	6.011	22.8	24.8	1.46	5876	3.95	29.65

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009782691-01	OBS	PC	1.00	0	0	0	0	NO_COMMENT
009782691-02	OBS	PC	0.95	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.

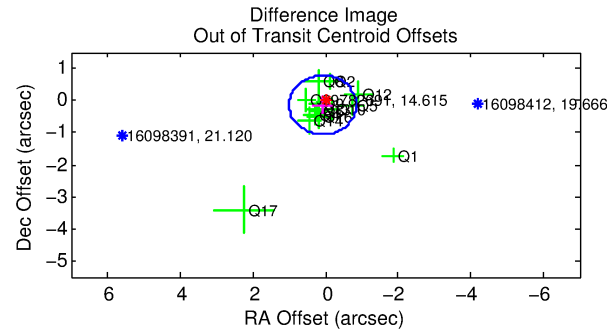
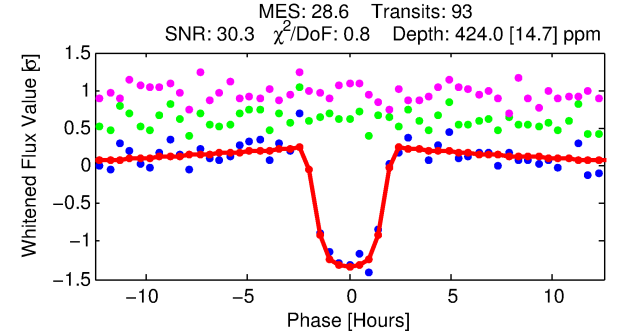
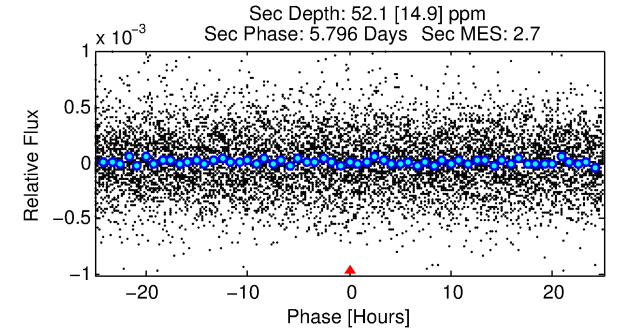
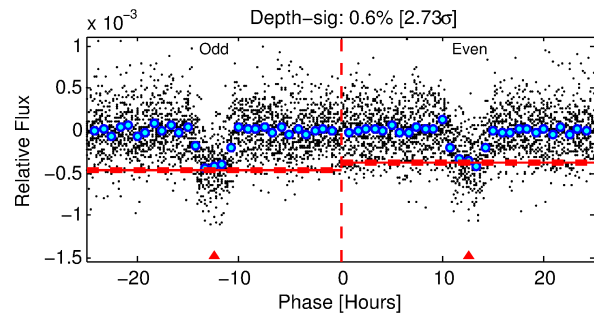
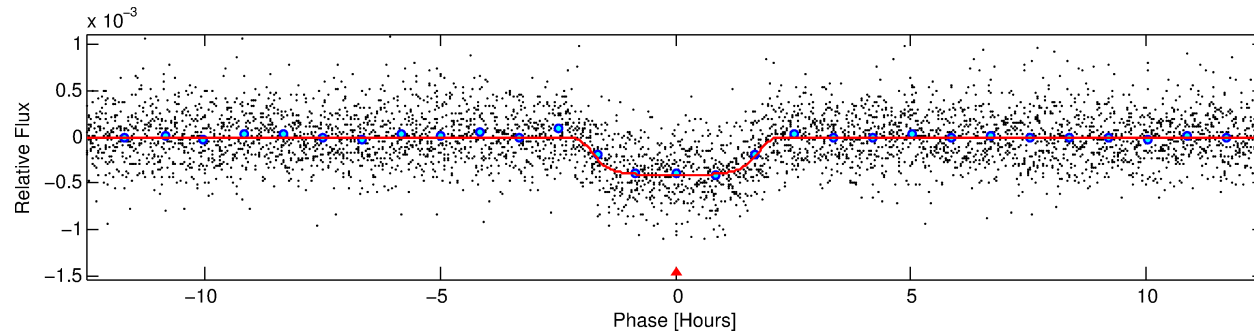
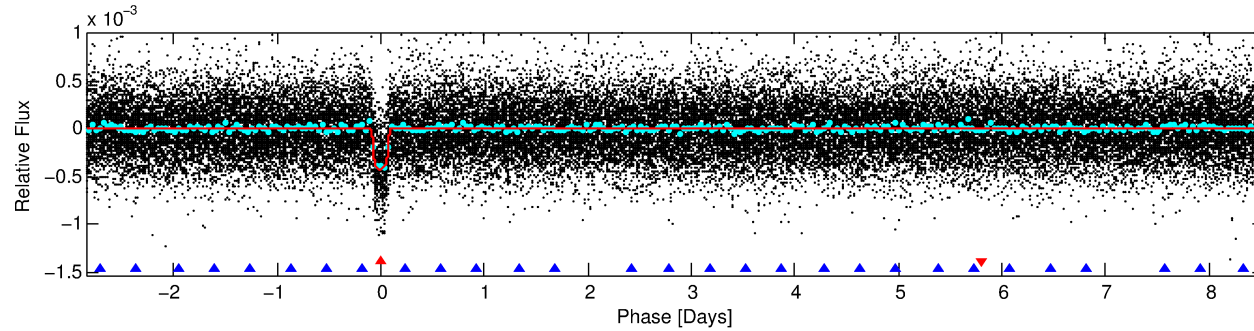
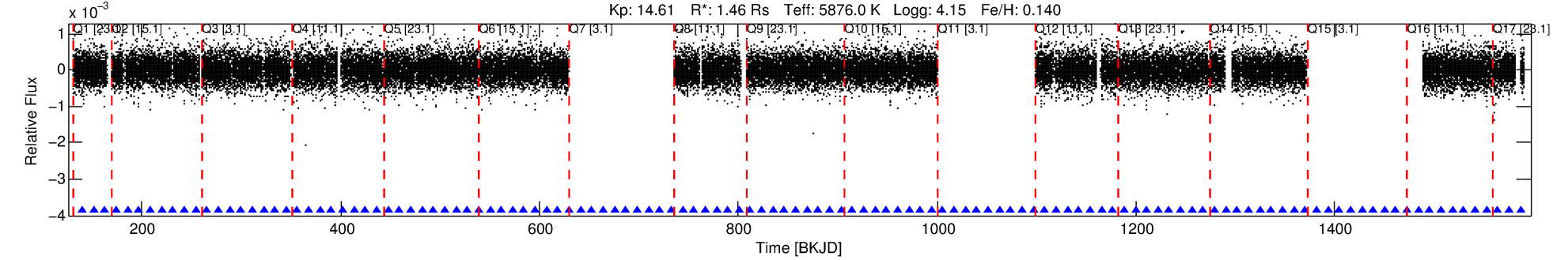
## Ephemeris Match Information For 009782691-01

No Significant Match Found

# DV One-Page Summary

KIC: 9782691 Candidate: 1 of 2 Period: 11.388 d  
KOI: K00590.01 Name: Kepler-193b Corr: 0.933

Kp: 14.61 R\*: 1.46 Rs Teff: 5876.0 K Logg: 4.15 Fe/H: 0.140



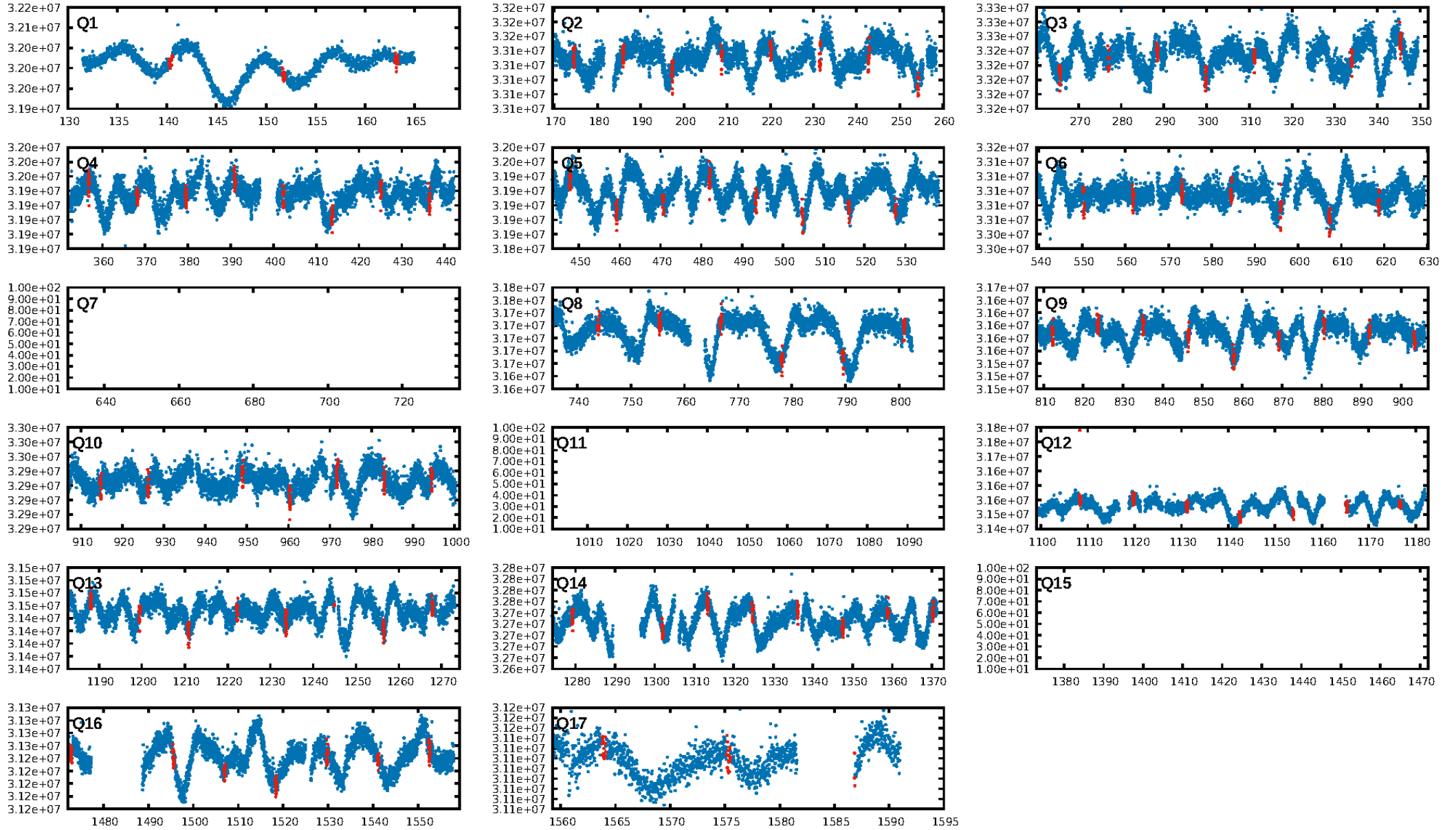
## DV Fit Results:

Period = 11.38841 [0.00004] d  
Epoch = 140.3876 [0.0025] BKJD  
Rp/R\* = 0.0232 [0.0011]  
a/R\* = 8.92 [1.80]  
b = 0.93 [0.03]  
Seff = 217.13 [62.04]  
Teff = 979 [70] K  
Rp = 3.69 [0.74] Re  
a = 0.1021 [0.0184] AU  
Ag = 21.99 [9.05] [2.32σ]  
Teffp = 3277 [251] K [8.83σ]

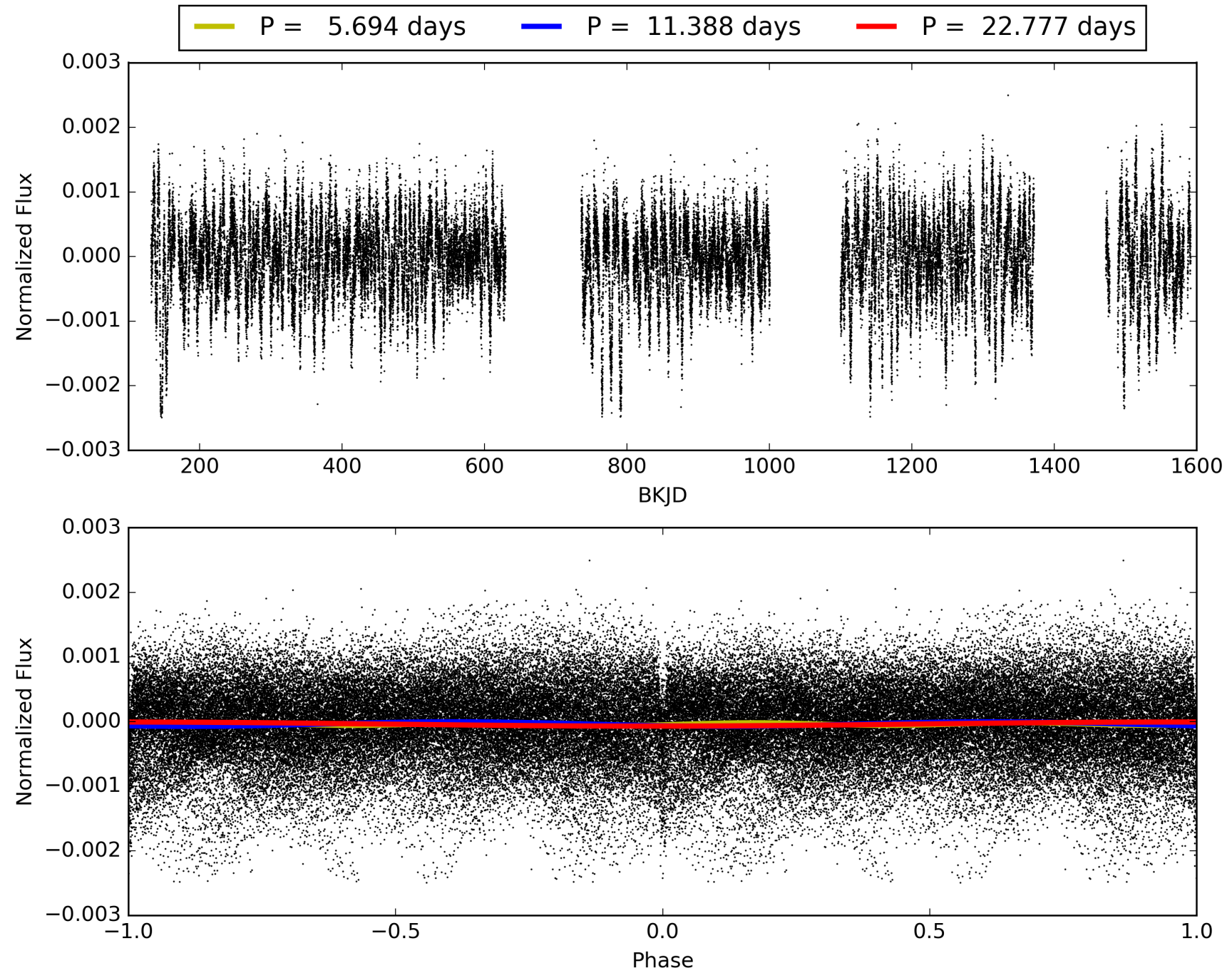
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [128.93σ]  
ModelChiSquare2-sig: 99.3%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 1.21e-177  
RollingBand-fgt: 1.00 [88/88]  
GhostDiagnostic-chr: 4.468  
Centroid-sig: 82.6%  
Centroid-so: 0.214 arcsec [0.49σ]  
OotOffset-rm: 0.159 arcsec [0.52σ]  
KicOffset-rm: 0.211 arcsec [0.79σ]  
OotOffset-st: 4/1/4/5 [14]  
KicOffset-st: 4/1/4/5 [14]  
DiffImageQuality-fgm: 0.93 [13/14]  
DiffImageOverlap-fno: 1.00 [14/14]

# TCE 009782691-01, PDC Light Curves

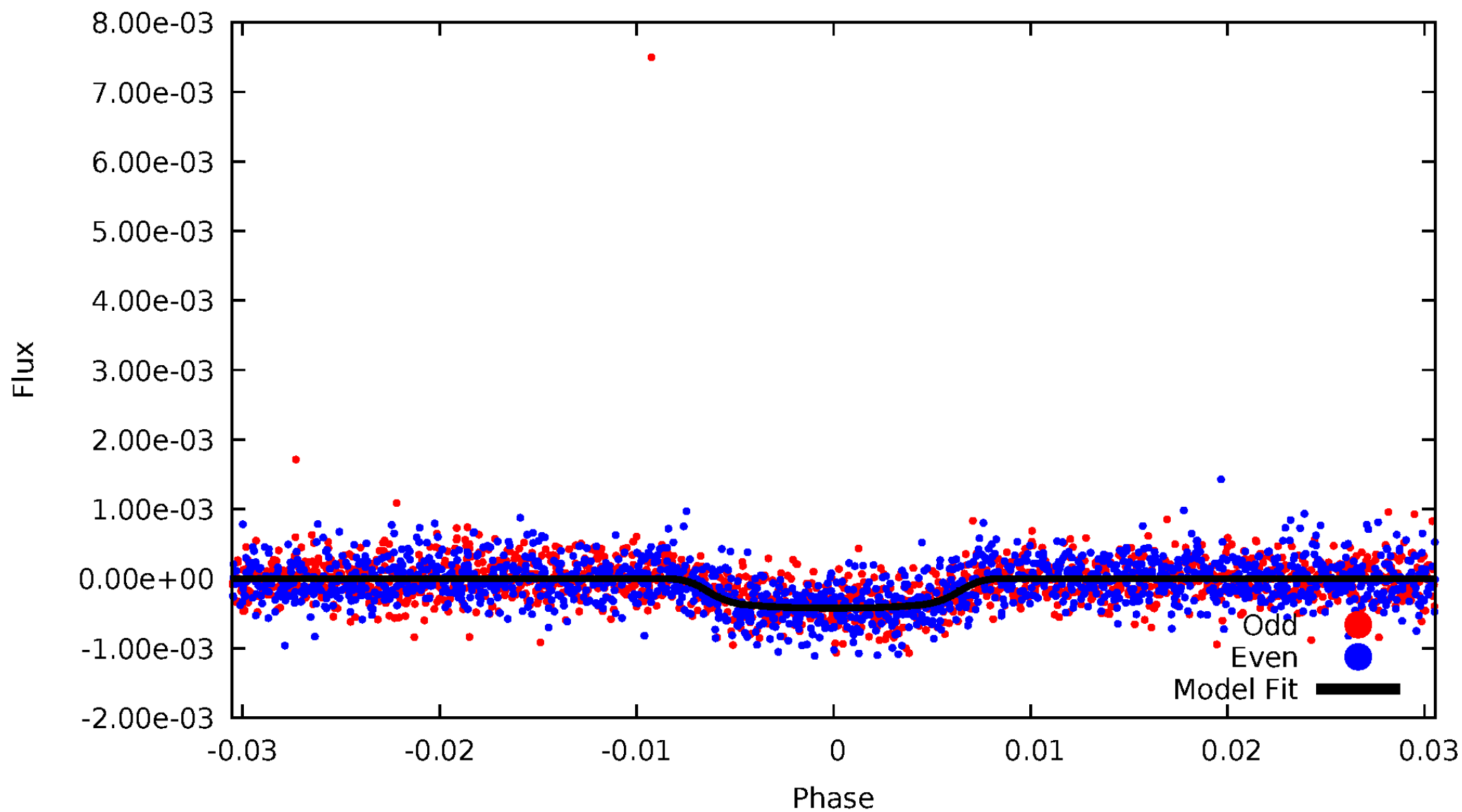


TCE 009782691-01



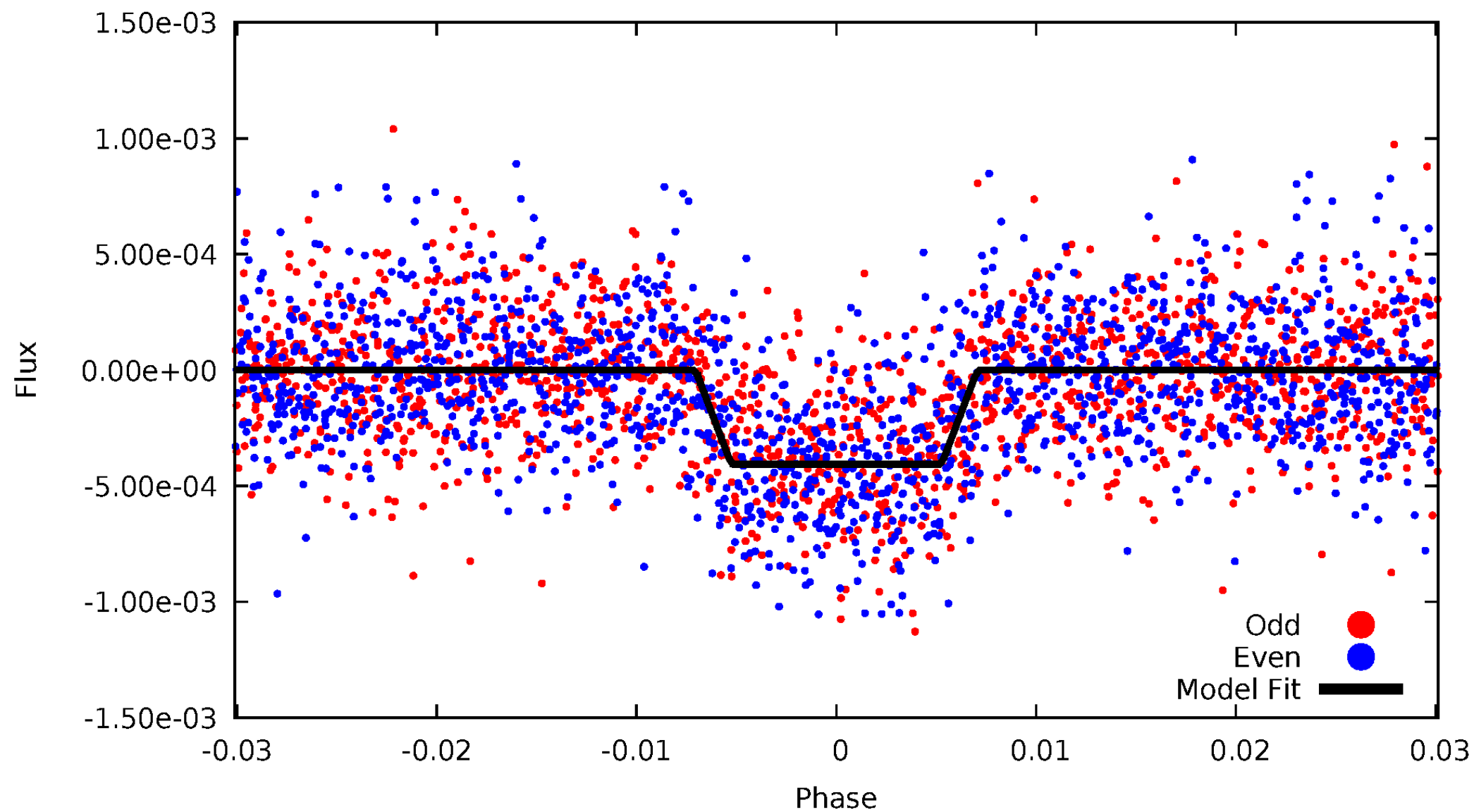
# DV Odd/Even

TCE 009782691-01



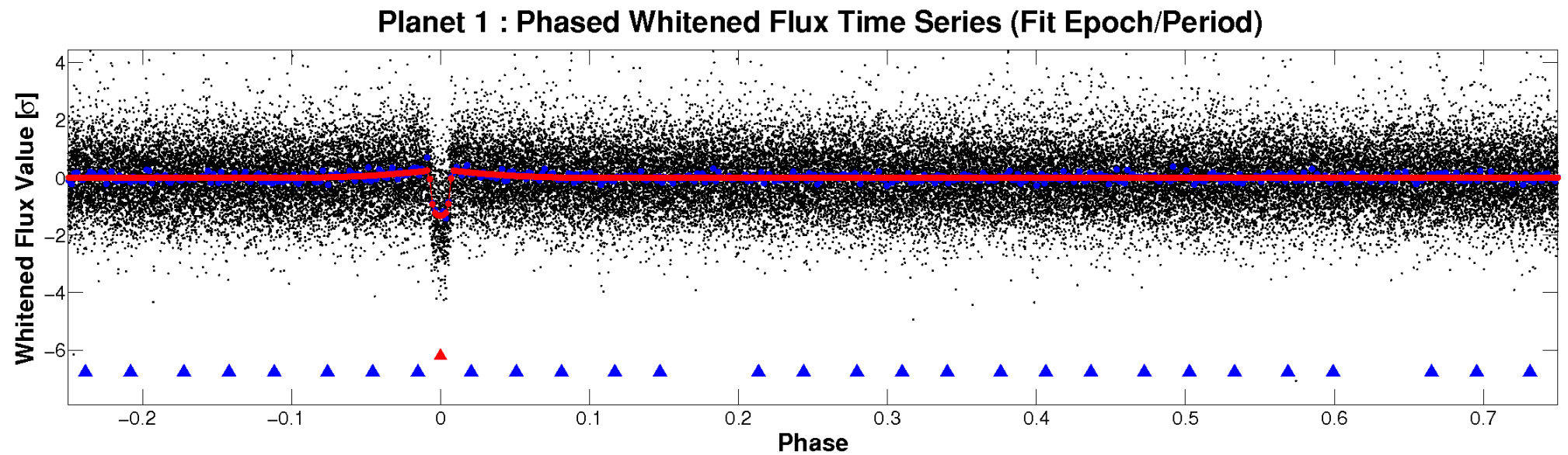
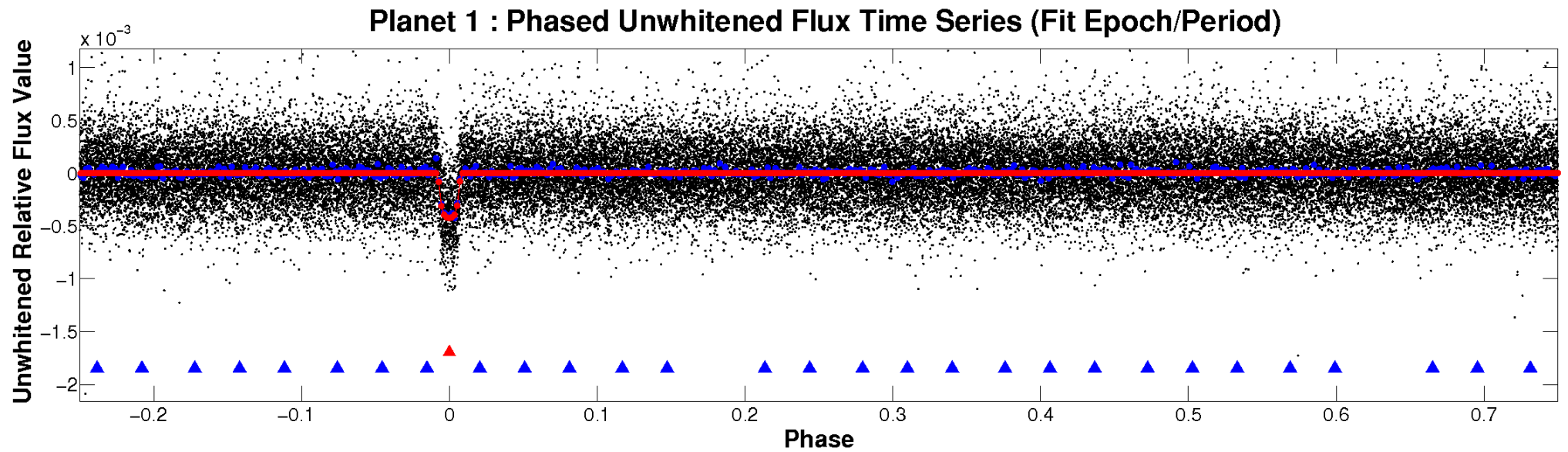
# ALT Odd/Even

TCE 009782691-01



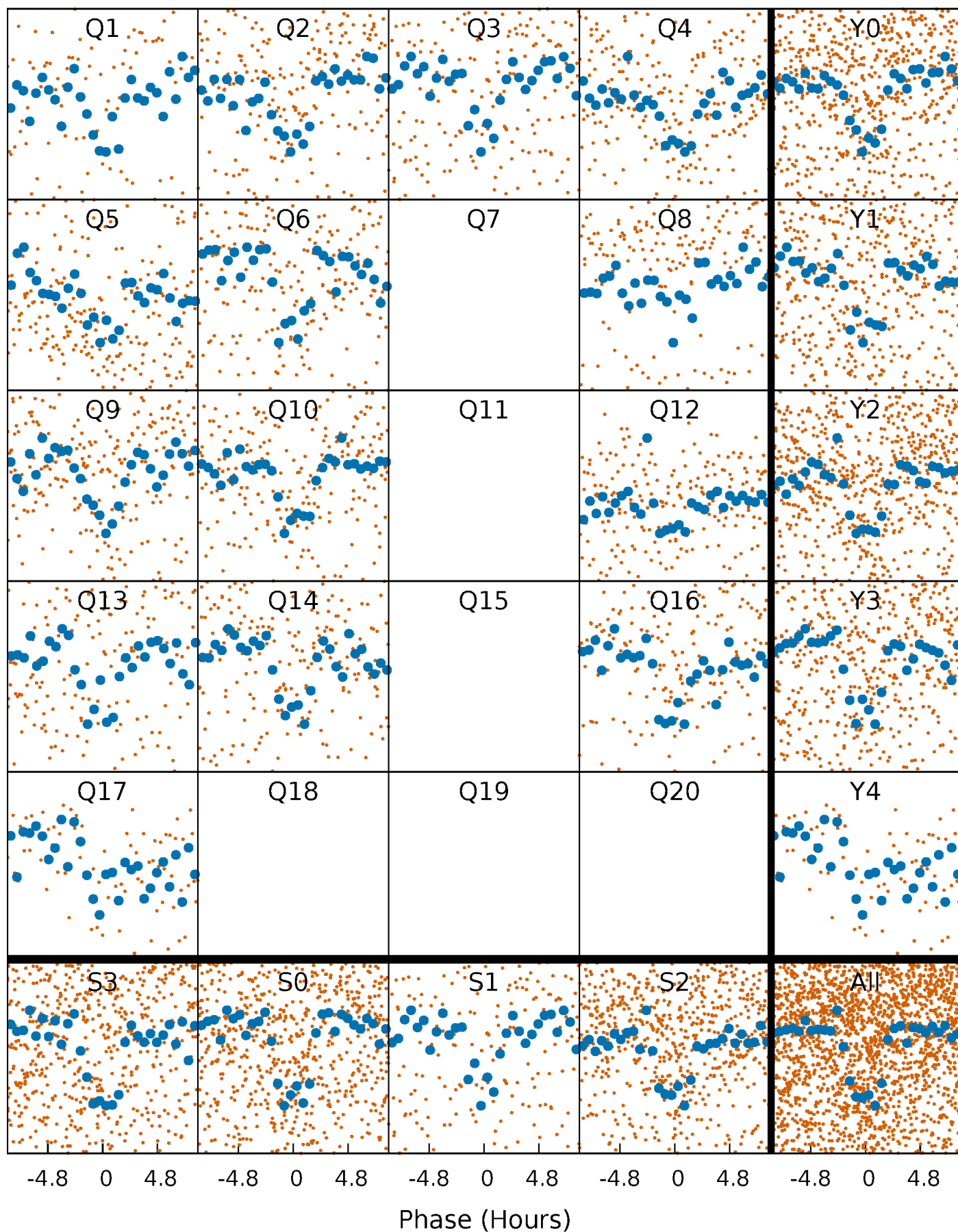


# Non-Whitened Vs. Whitened Light Curve



# PDC Quarter-Phased Transit Curves

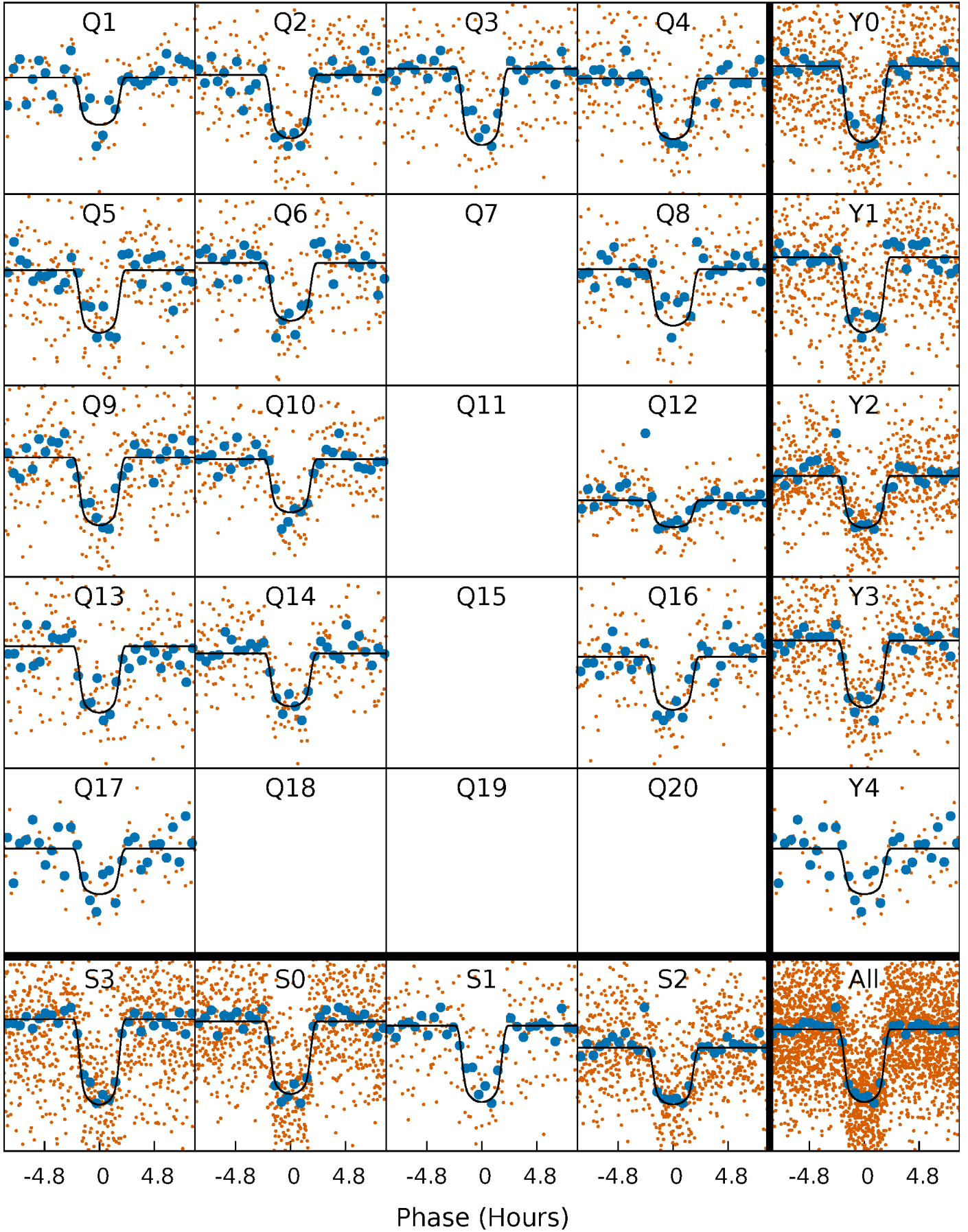
TCE 009782691-01 P= 11.388412 Days  $T_0=140.387573$  (BKJD)





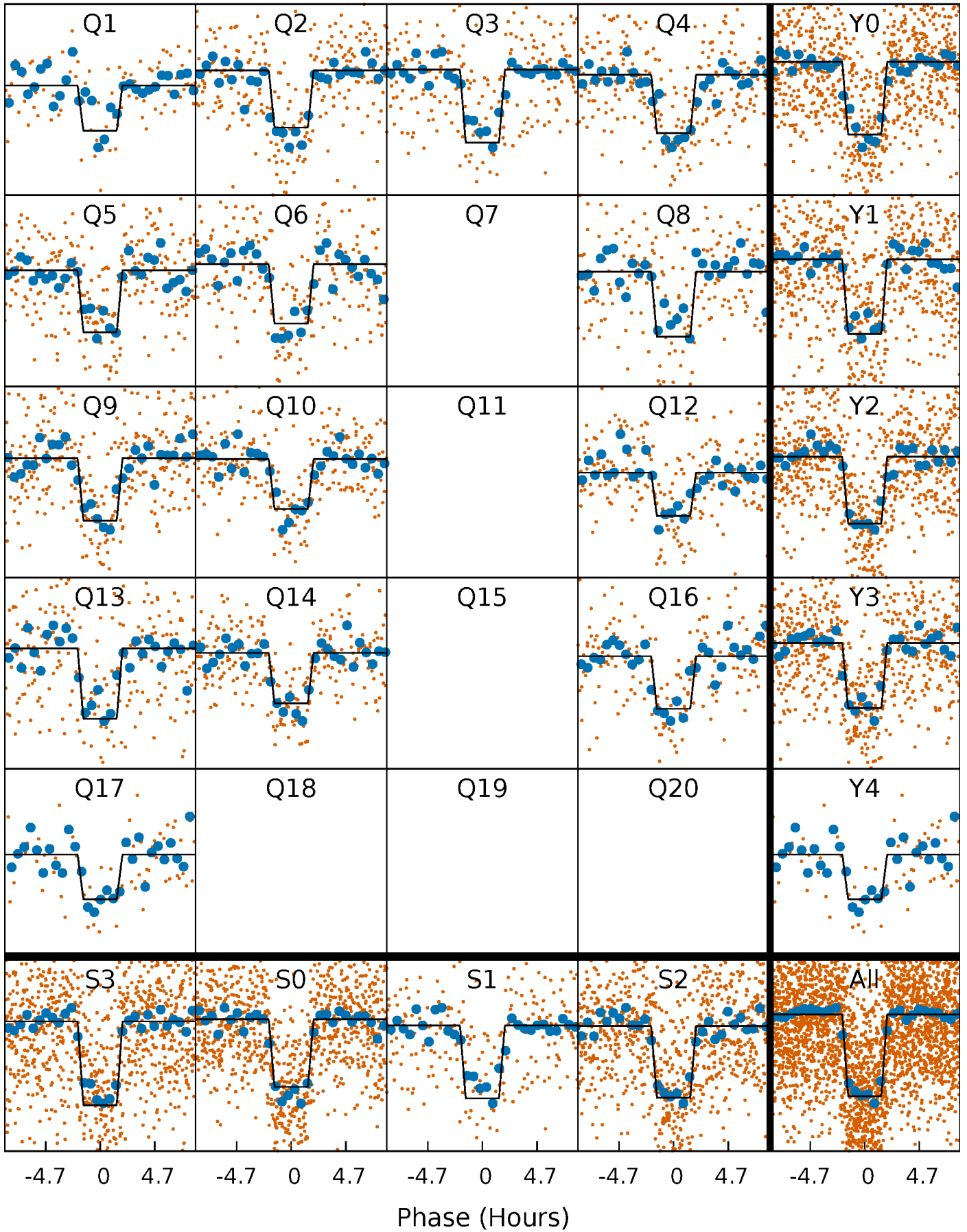
# DV Quarter-Phased Transit Curves

TCE 009782691-01 P= 11.388412 Days  $T_0=140.387573$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

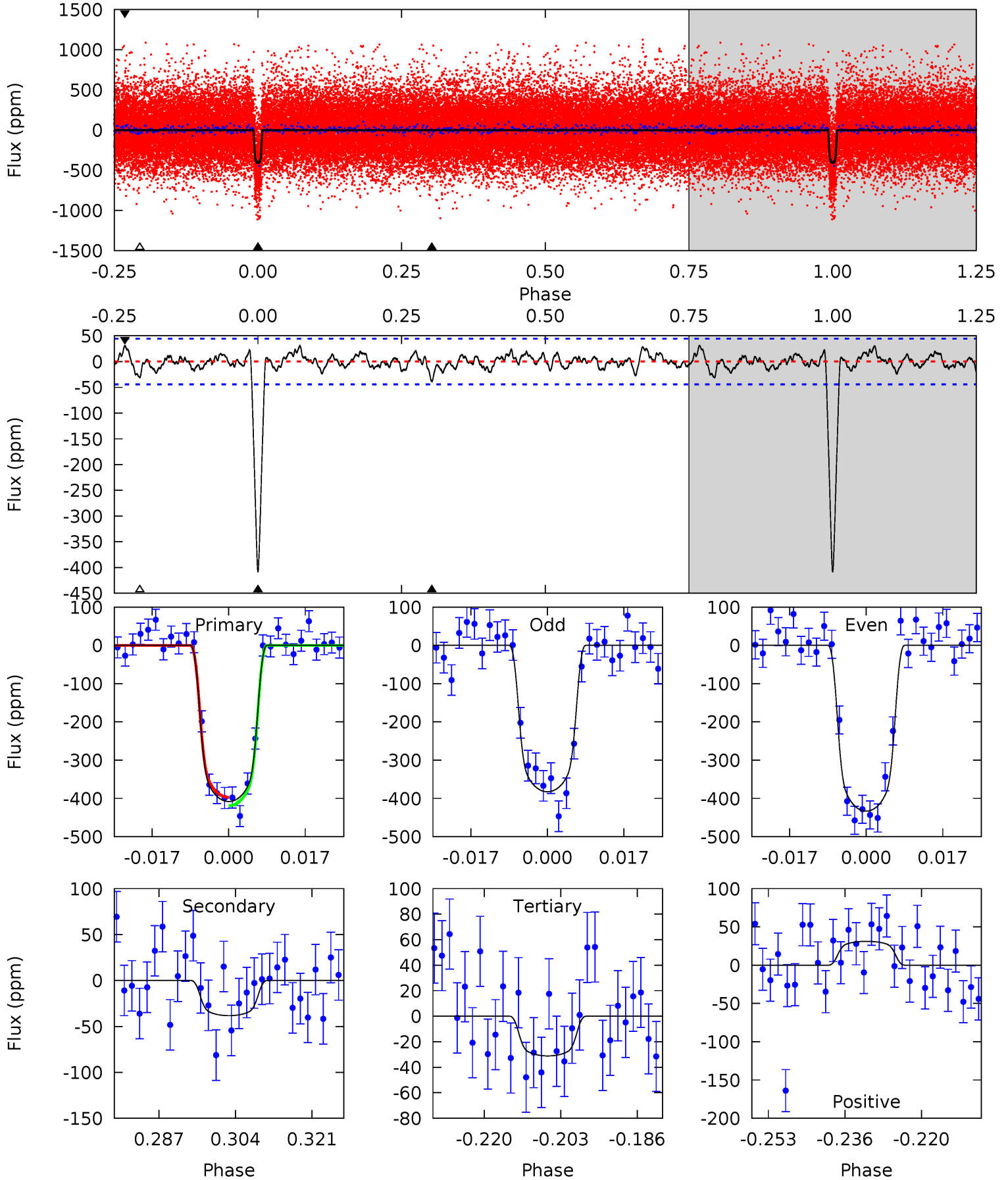
TCE 009782691-01 P= 11.388449 Days  $T_0=140.385666$  (BKJD)



# DV Model-Shift Uniqueness Test

009782691-01, P = 11.388412 Days, E = 128.999161 Days

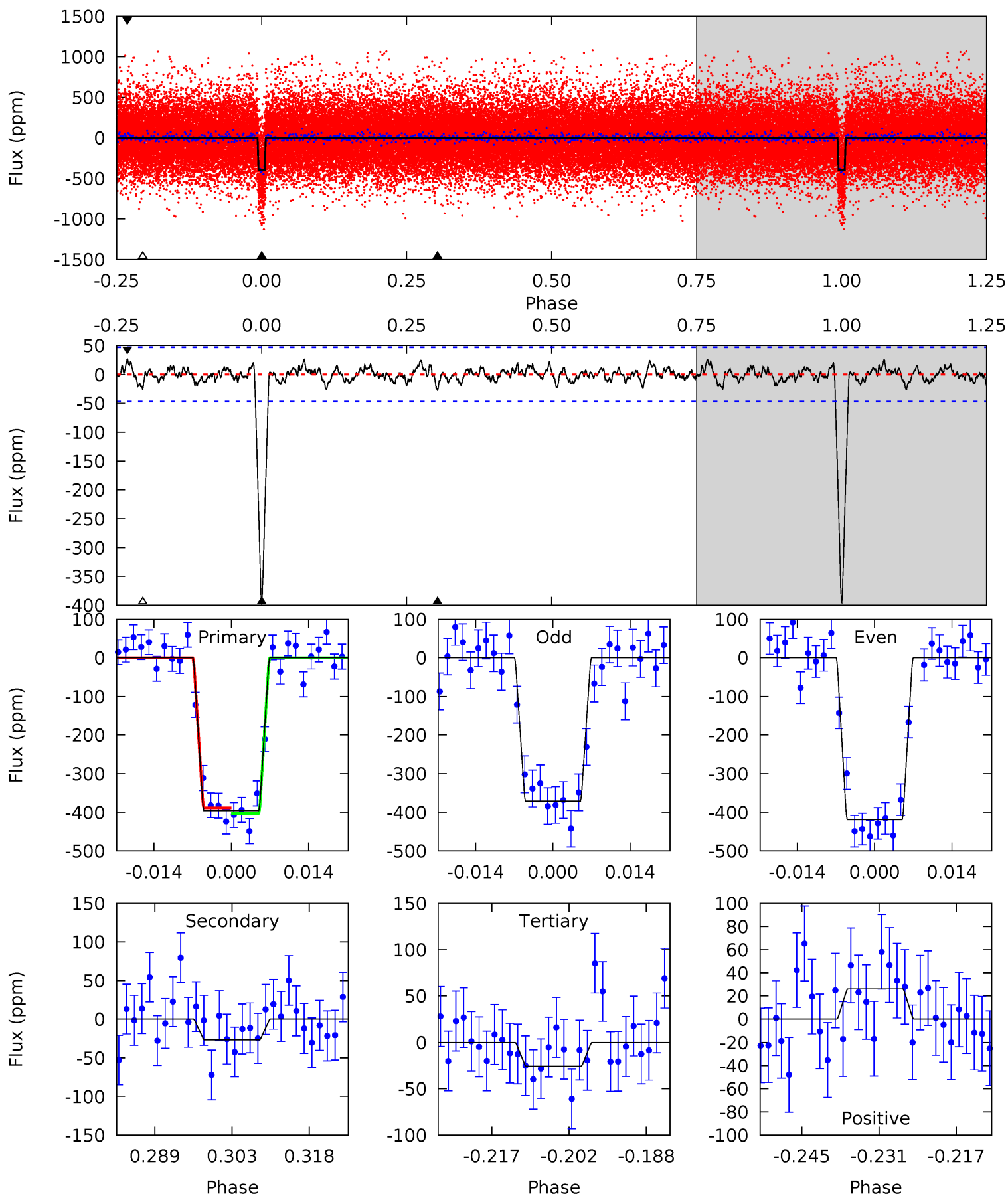
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
45.3	4.25	3.46	3.45	4.92	2.39	1.22	41.9	41.9	0.80	0.80	2.83	1.01	0.07	1.22



# Alt Model-Shift Uniqueness Test

009782691-01, P = 11.388449 Days, E = 128.997217 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
41.6	2.81	2.70	2.75	4.96	2.45	0.97	38.9	38.8	0.11	0.07	2.53	1.03	0.06	0.78



### Stellar Parameters For KIC 009782691

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5876^{+79}_{-79}$	$4.151^{+0.162}_{-0.108}$	$0.140^{+0.150}_{-0.150}$	$1.456^{+0.233}_{-0.284}$	$1.093^{+0.107}_{-0.080}$	$0.499^{+0.427}_{-0.170}$
	+1%/-1%	+4%/-3%	+107%/-107%	+16%/-20%	+10%/-7%	+85%/-34%
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 009782691-01 / KOI 0590.01

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-38 \pm 9$	$3.66^{+0.42}_{-0.41}$	$1361^{+69}_{-72}$	$3502^{+145}_{-155}$	$16^{+6}_{-5}$
Alt.	$-27 \pm 10$	$3.19^{+0.34}_{-0.36}$	$1365^{+60}_{-73}$	$3469^{+184}_{-248}$	$15^{+7}_{-6}$

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



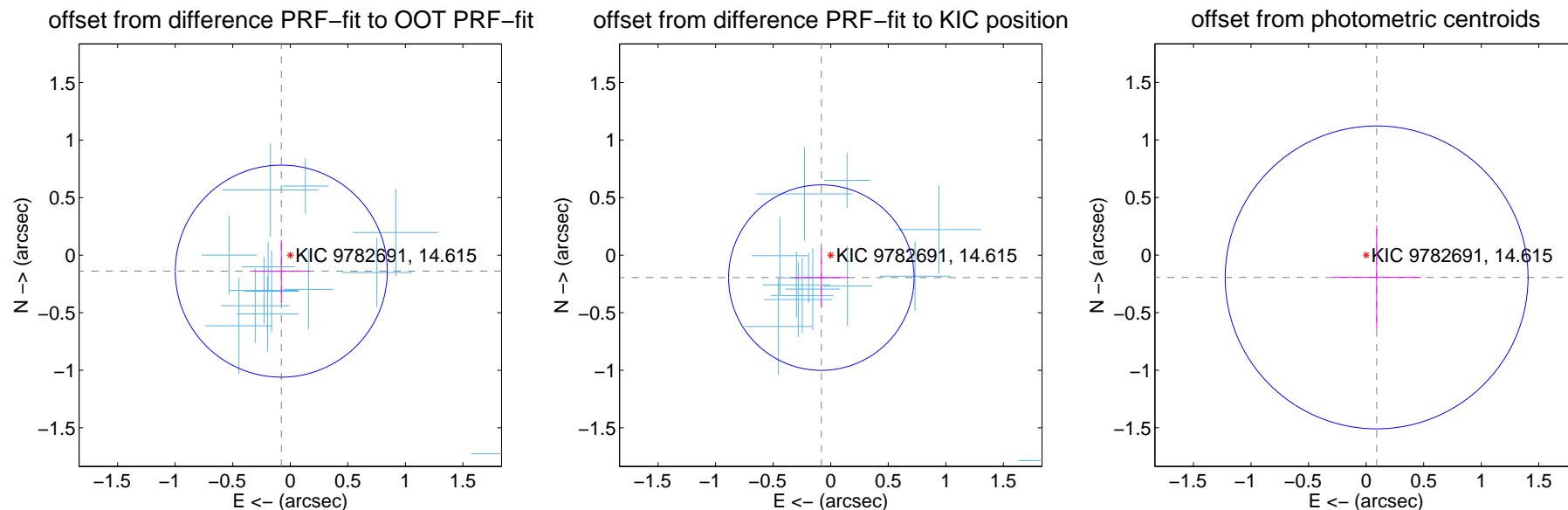
## DV Centroid Data

Supplemental centroid analysis for 009782691-01. Kepler magnitude: 14.62. Transit SNR 30.32

There are 13 quarters with good PRF difference image offsets

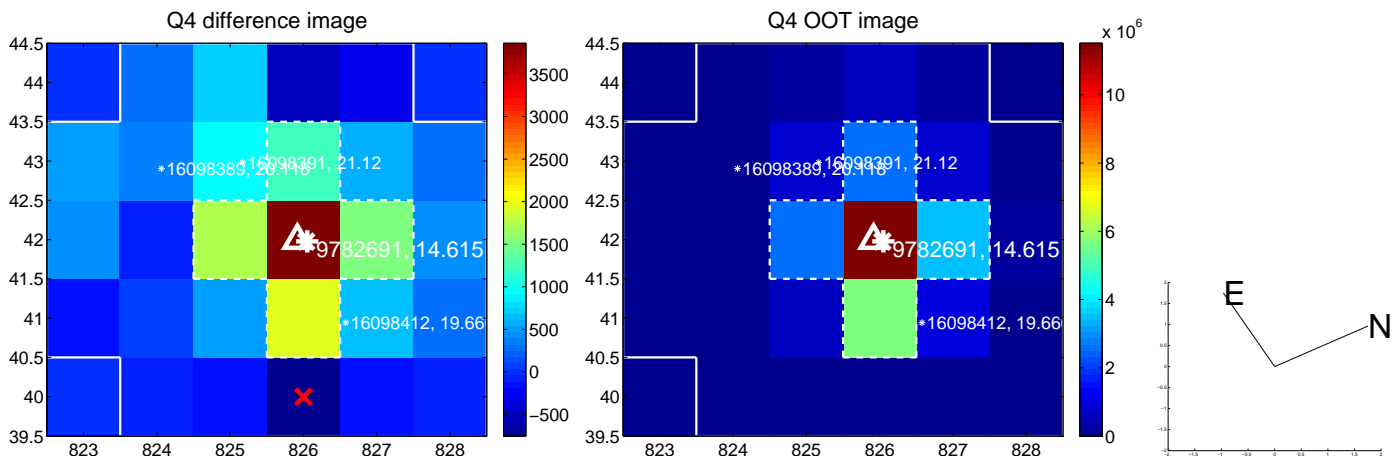
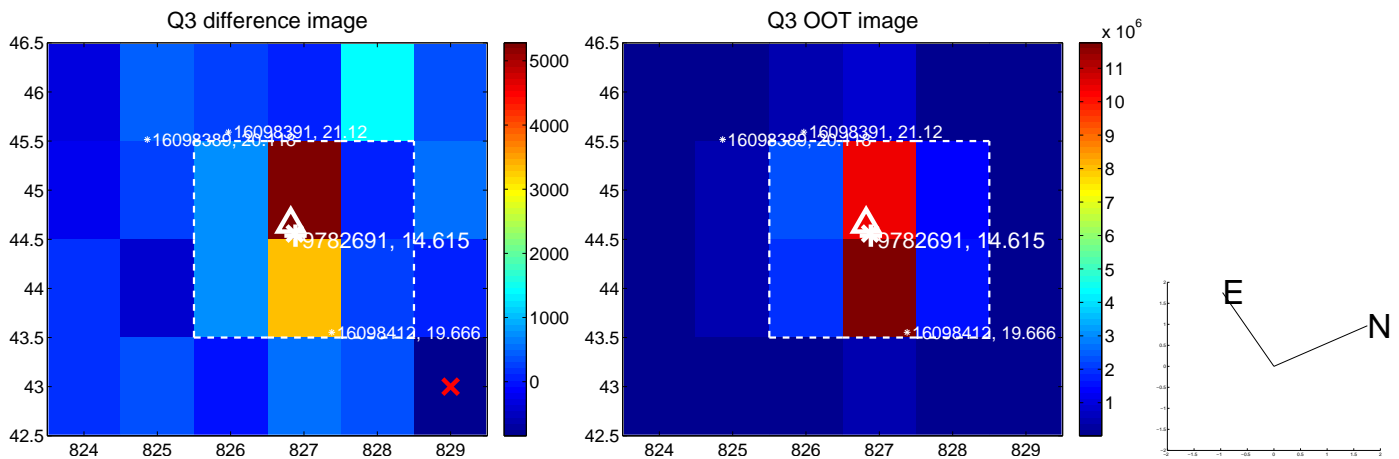
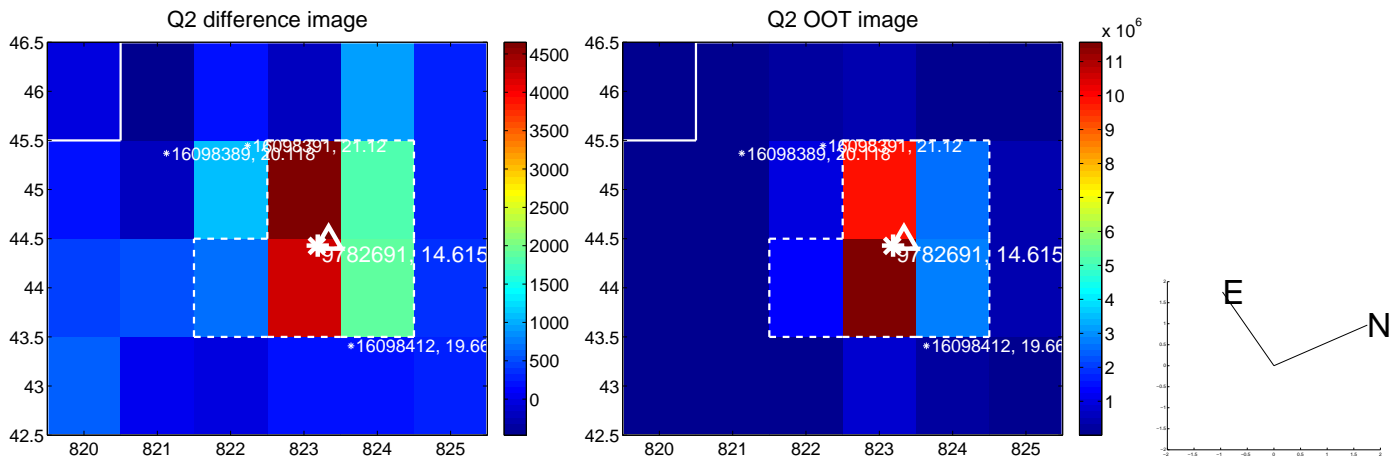
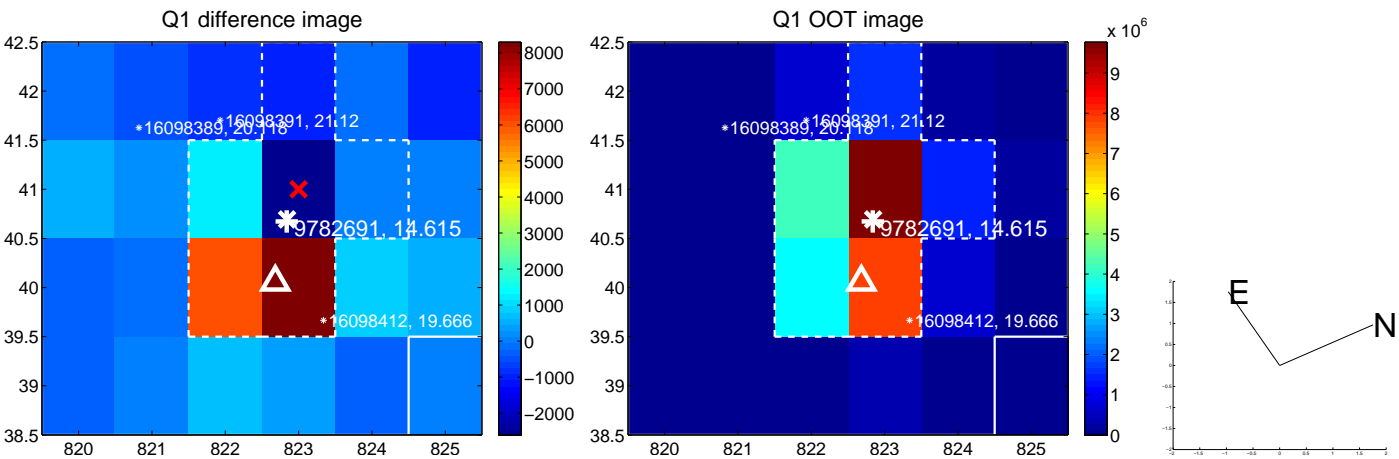
The direct PRF centroid is offset from the target star catalog position by about 0.08 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.159 \pm 0.307$	0.52	$0.078 \pm 0.248$	$-0.139 \pm 0.271$
PRF-fit source offset from KIC position	$0.211 \pm 0.269$	0.79	$0.082 \pm 0.236$	$-0.195 \pm 0.254$
photometric centroid source offset	$0.21 \pm 0.44$	0.49	$-0.09 \pm 0.39$	$-0.19 \pm 0.45$

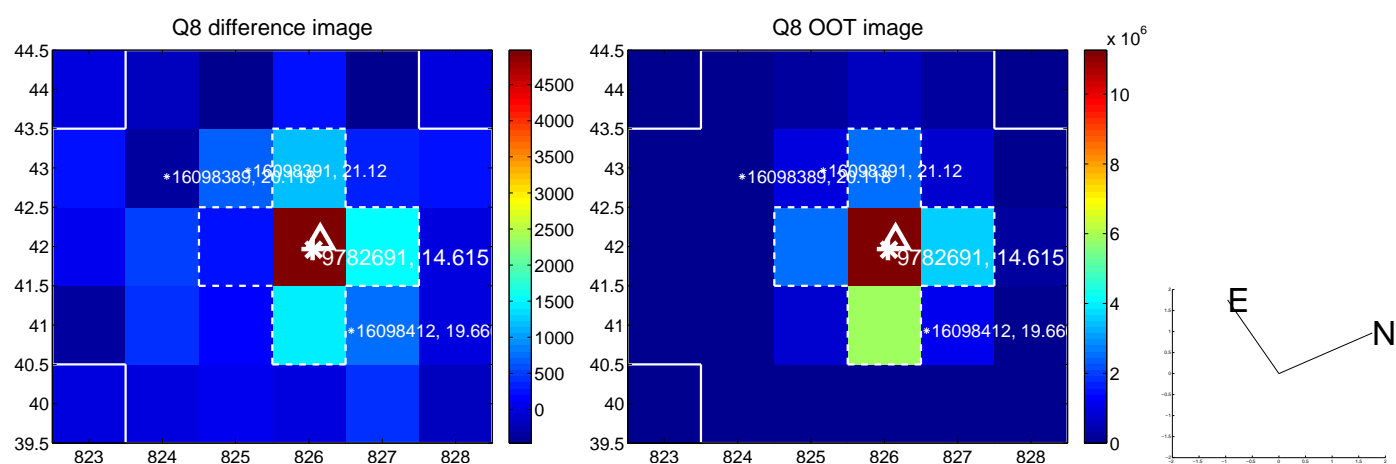
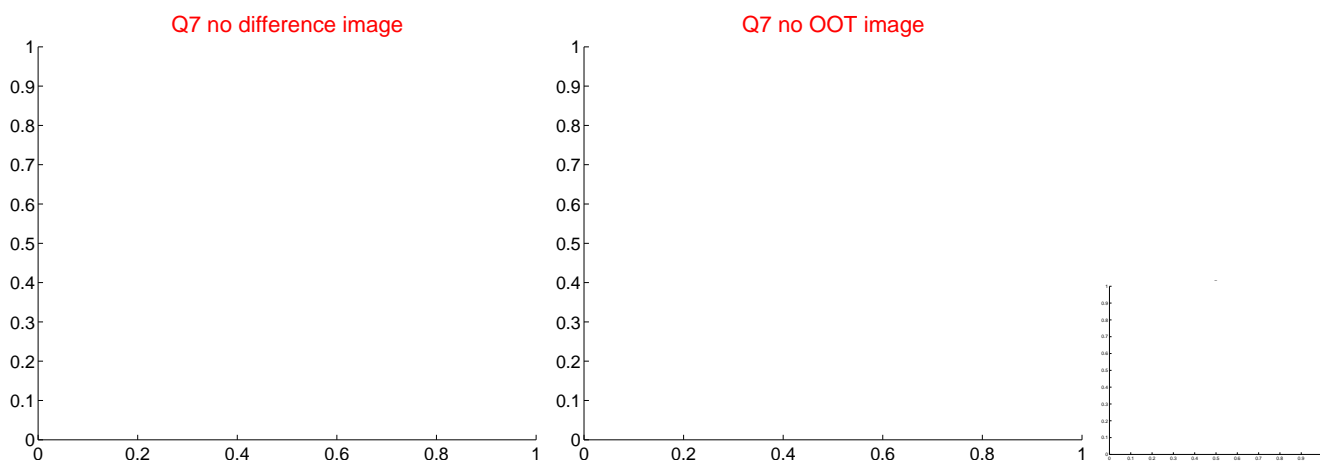
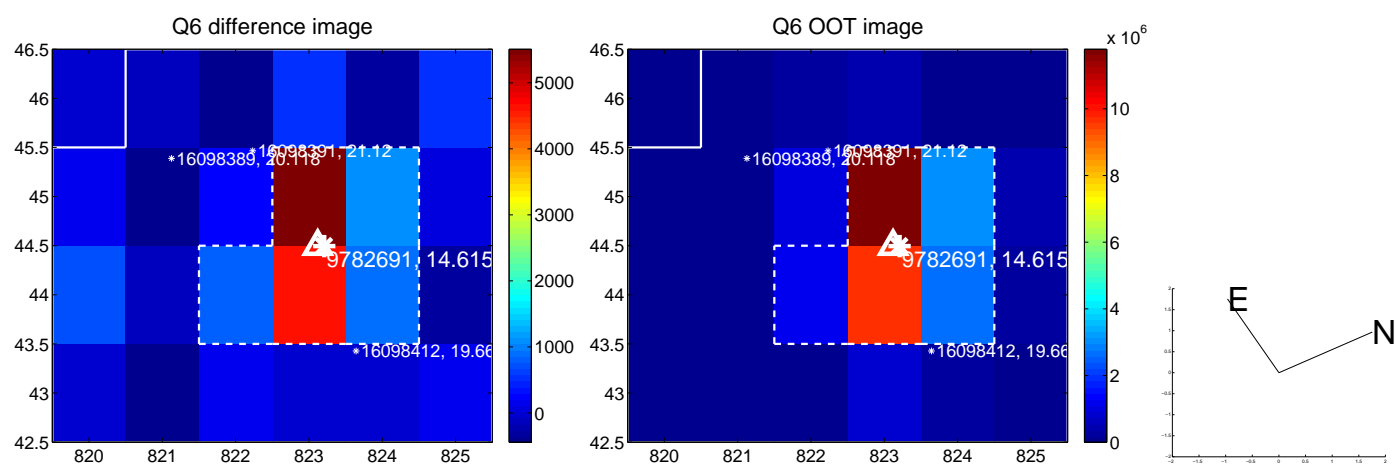
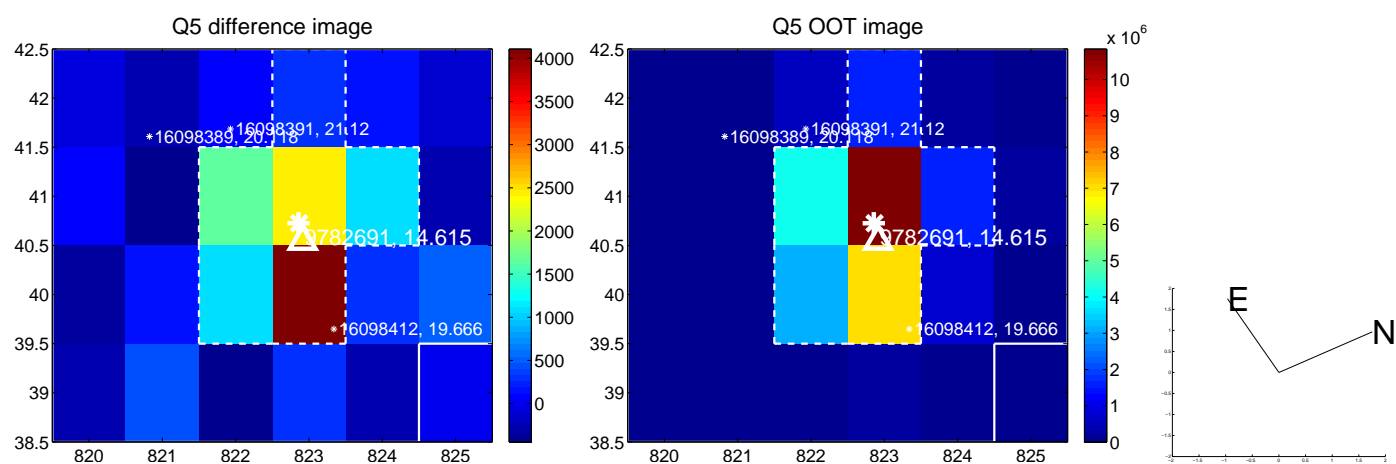


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets**; **Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

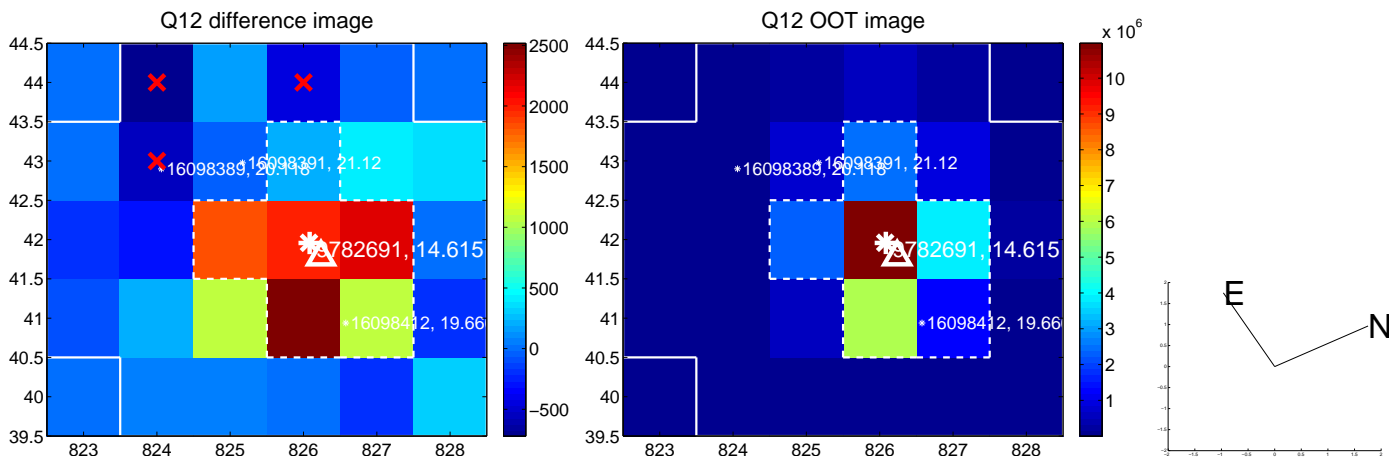
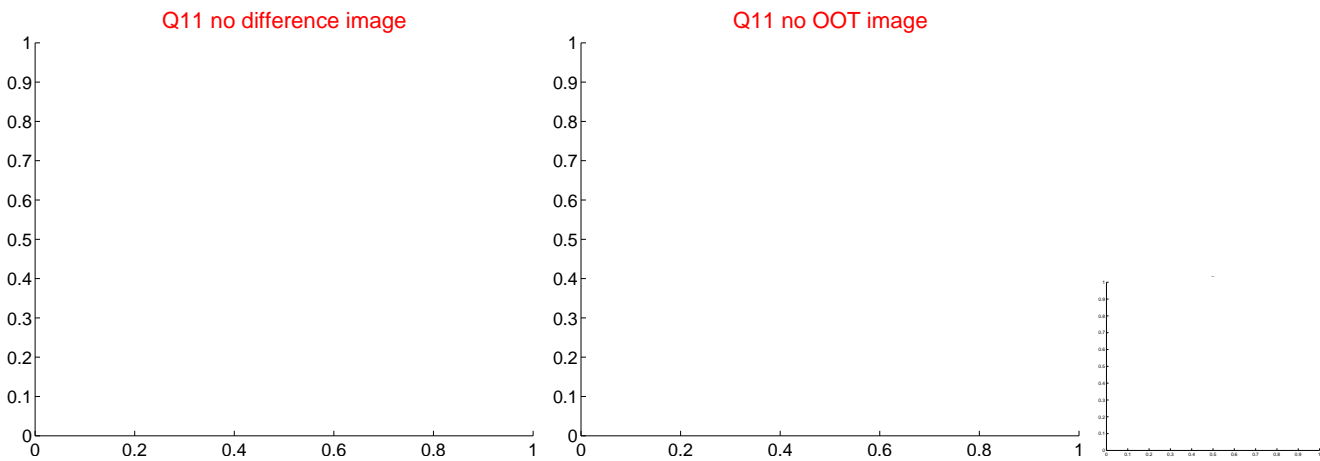
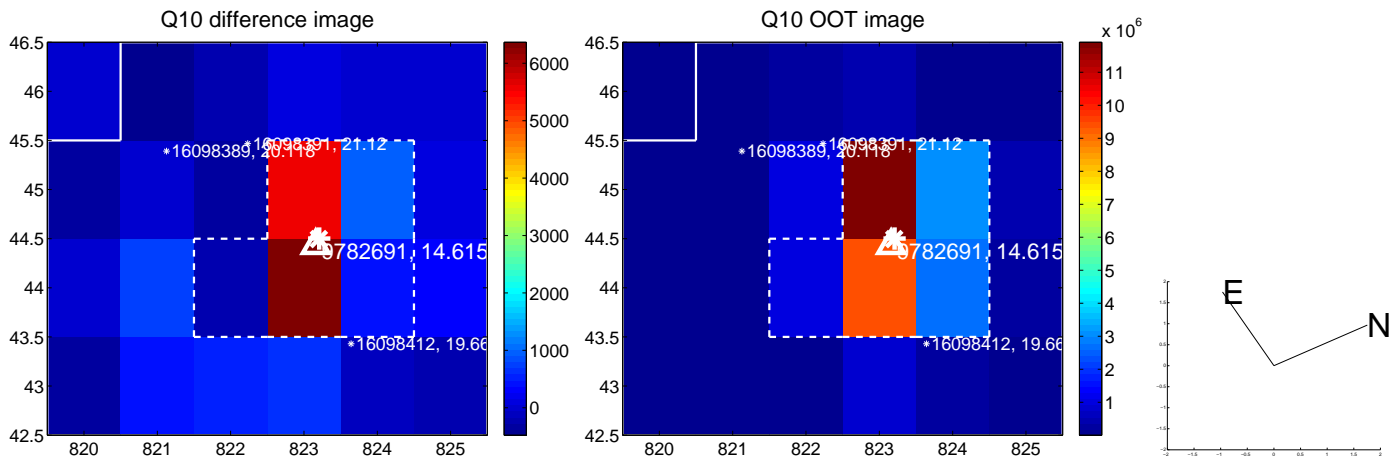
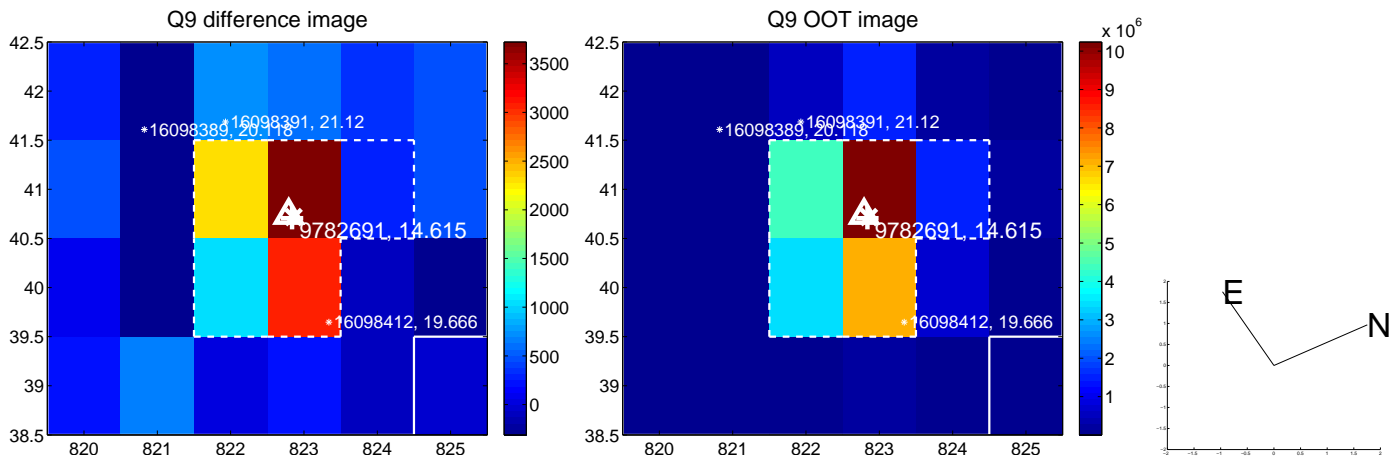
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



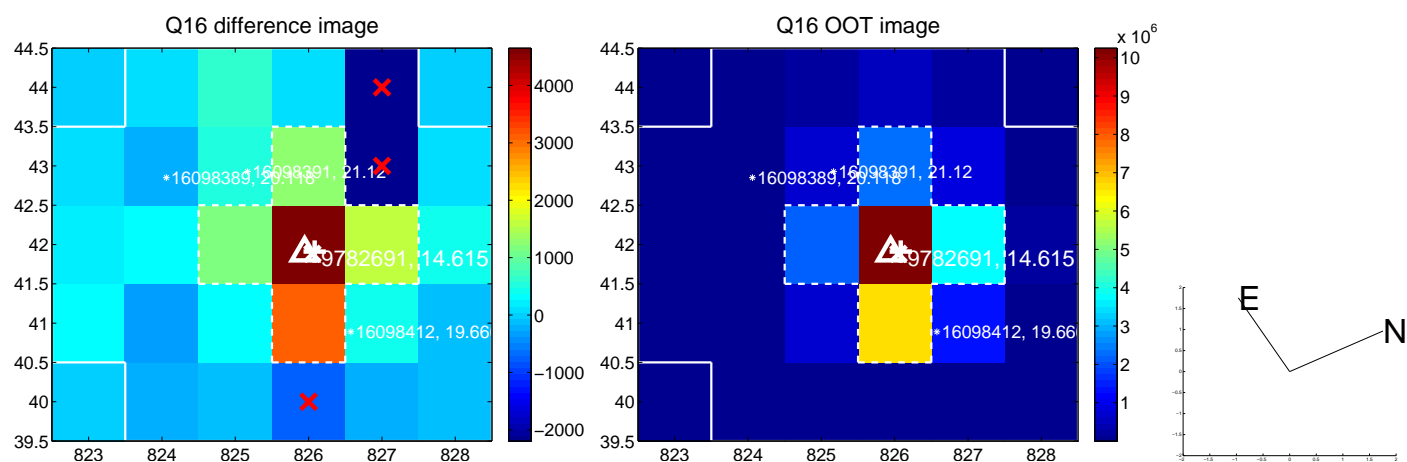
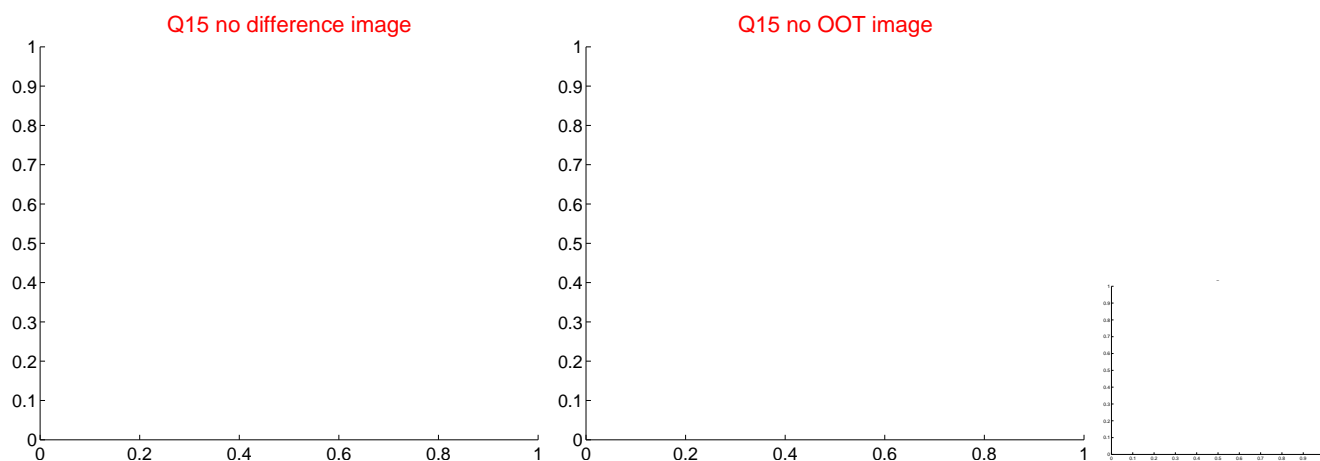
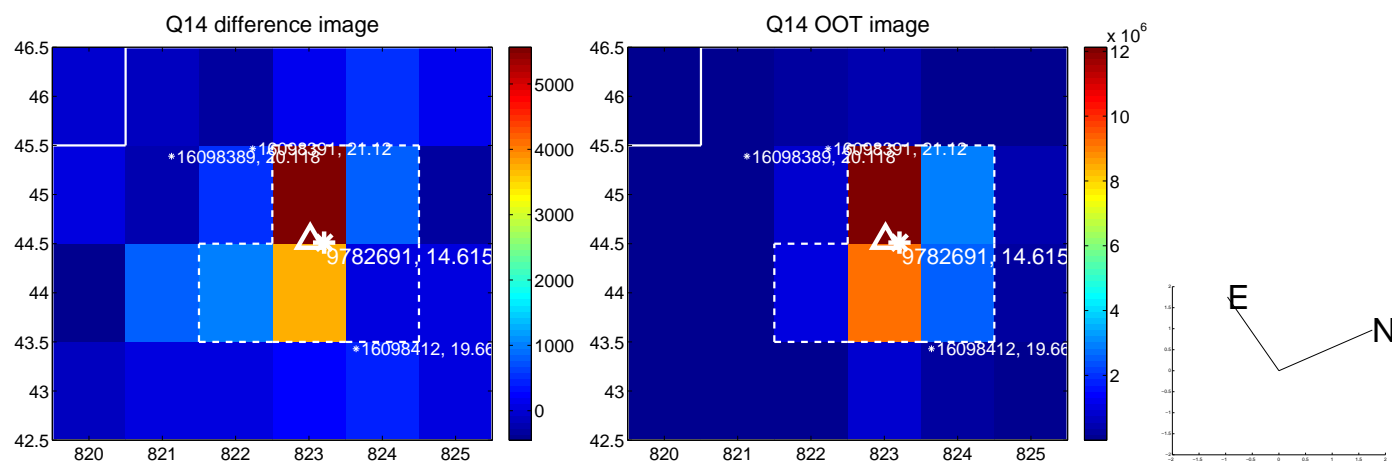
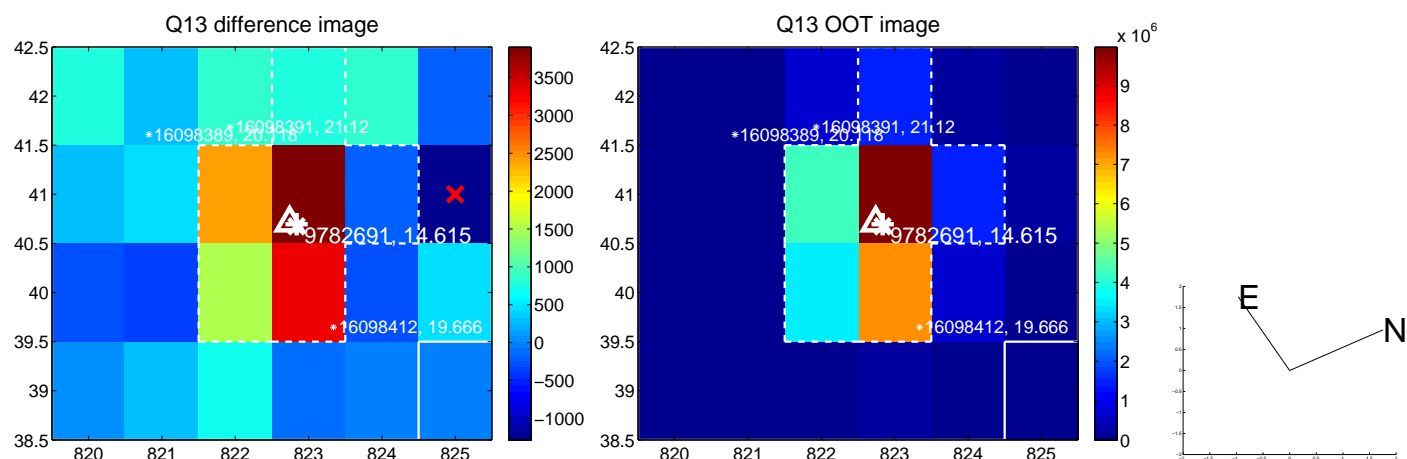
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

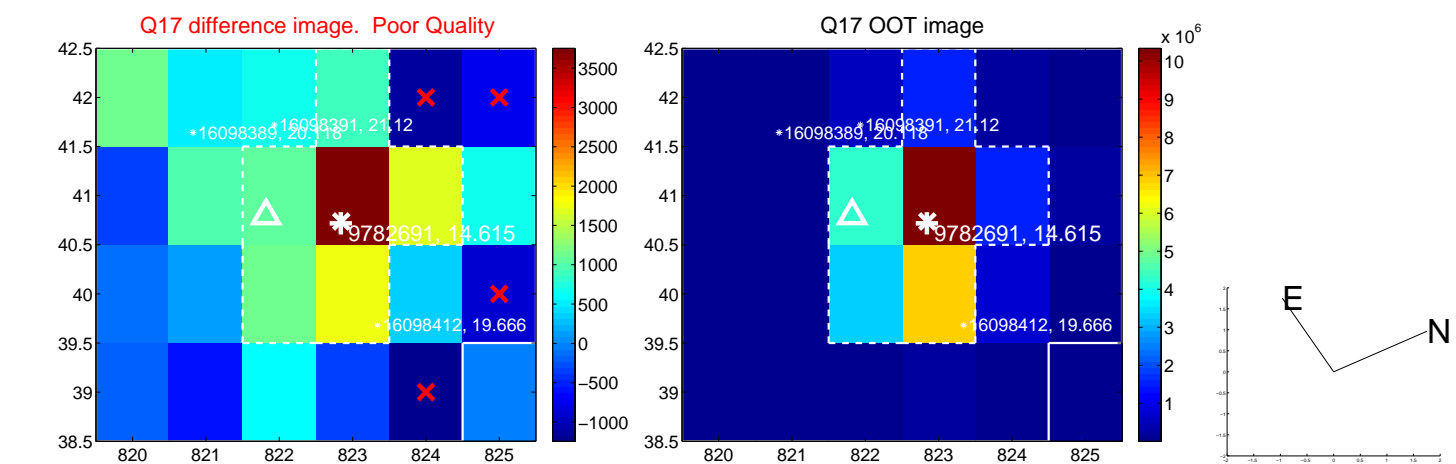


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

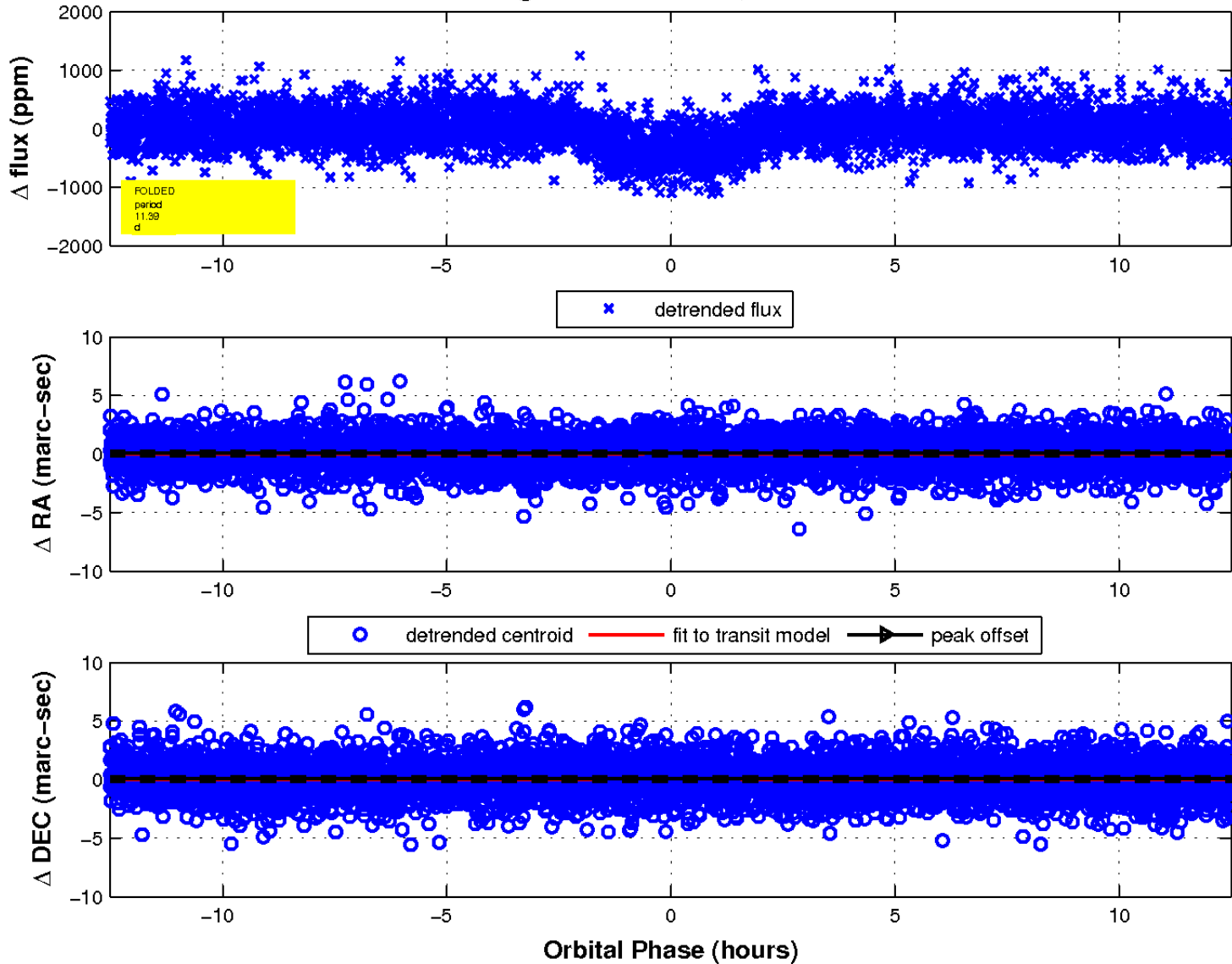




white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

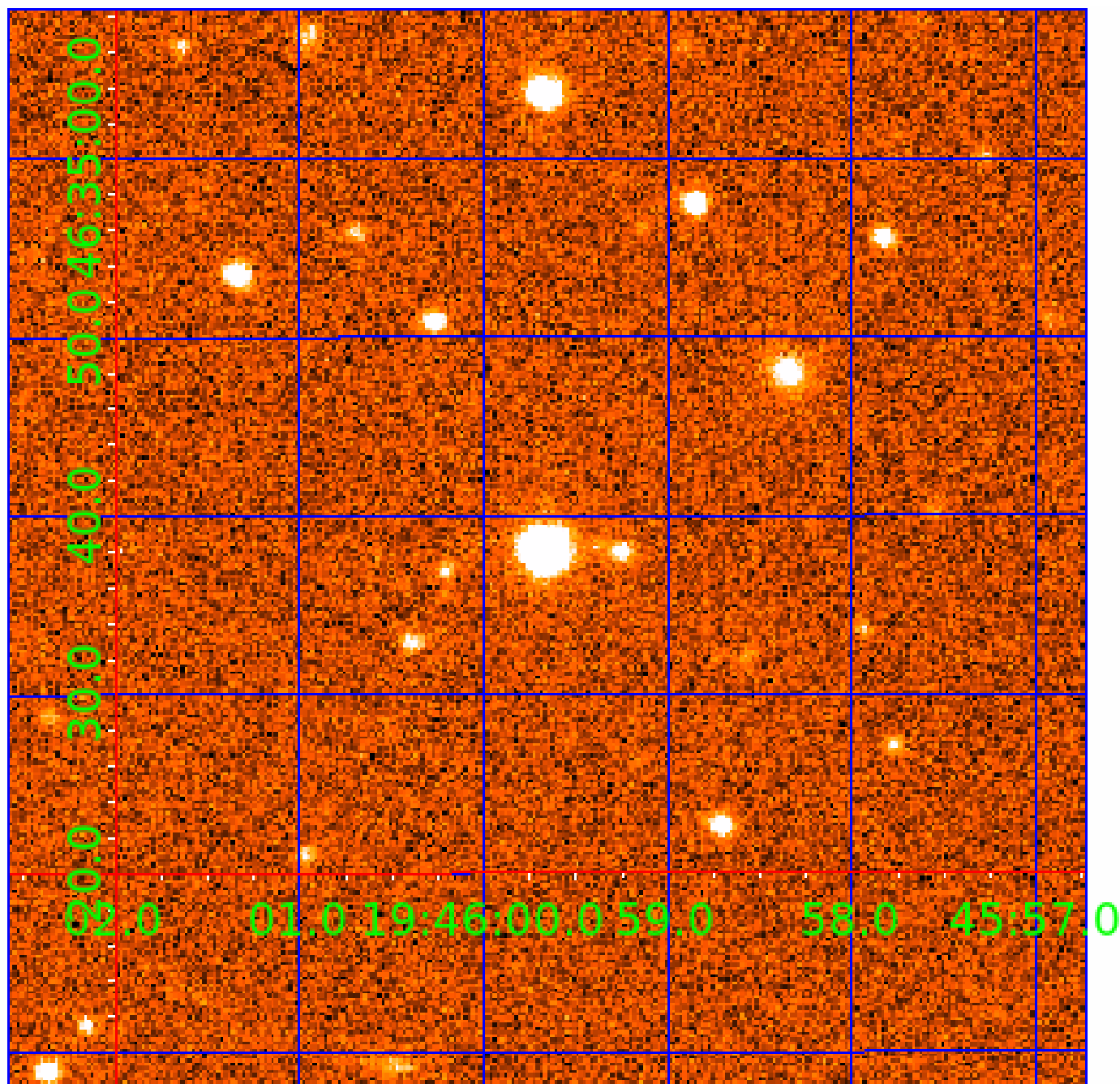


fluxWeightedCentroids, Planet 1 of 2



UKIRT Image

Declination



# KIC 009782691

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009782691-01	OBS	0590.01	11.388412	140.387573	424.0	4.173	28.6	30.3	1.46	5876	3.69	217.13
009782691-02	OBS	0590.02	50.698815	141.313095	624.2	6.011	22.8	24.8	1.46	5876	3.95	29.65

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009782691-01	OBS	PC	1.00	0	0	0	0	NO_COMMENT
009782691-02	OBS	PC	0.95	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.

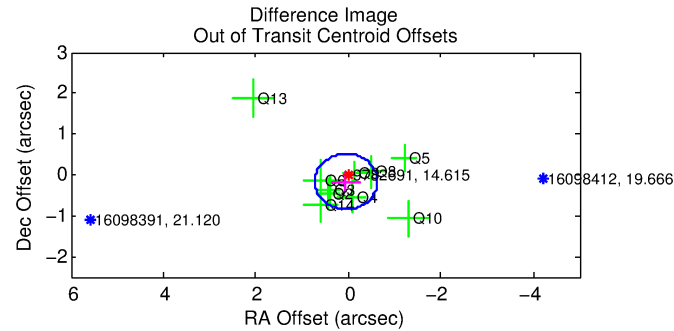
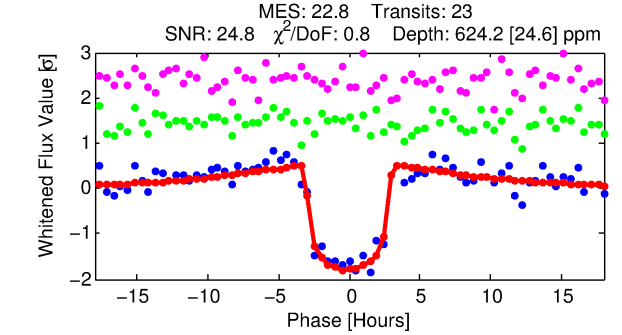
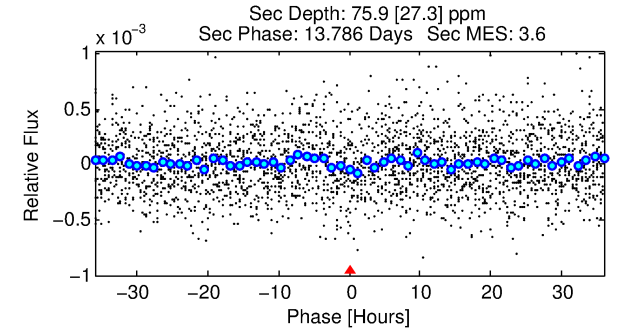
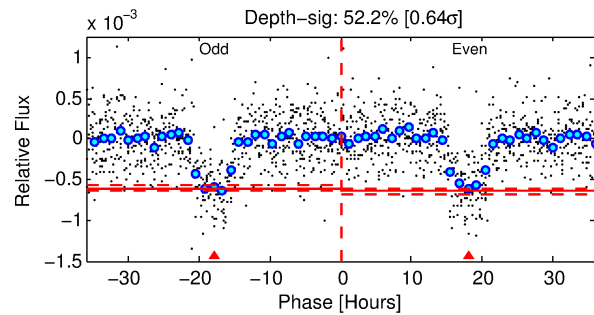
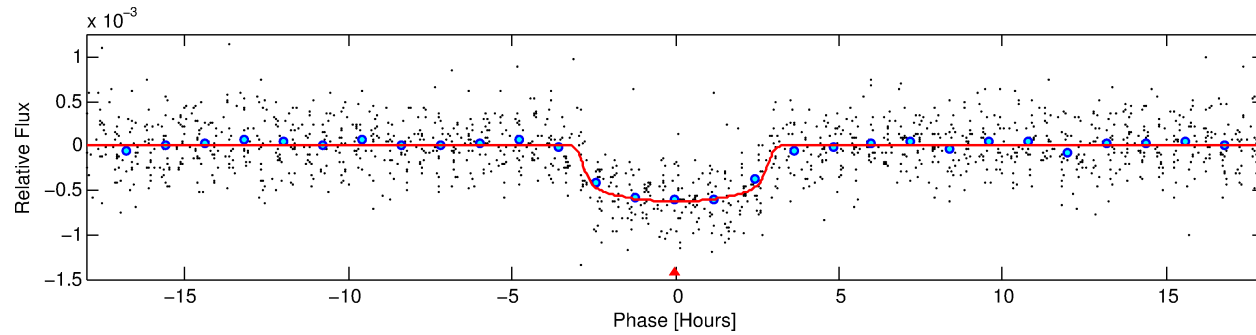
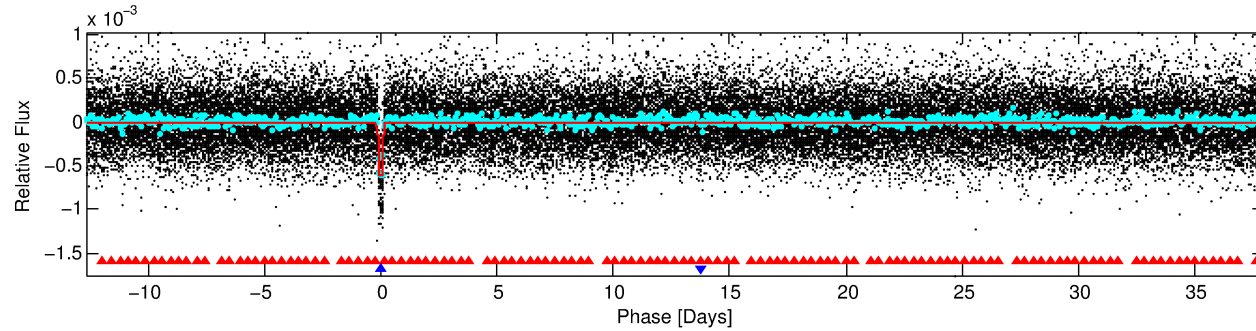
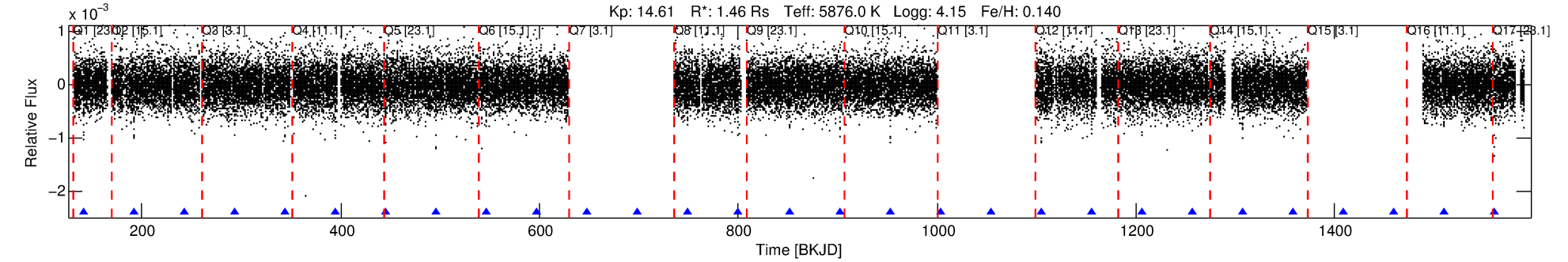
## Ephemeris Match Information For 009782691-02

No Significant Match Found

# DV One-Page Summary

KIC: 9782691 Candidate: 2 of 2 Period: 50.699 d  
KOI: K00590.02 Name: Kepler-193c Corr: 0.987

Kp: 14.61 R\*: 1.46 Rs Teff: 5876.0 K Logg: 4.15 Fe/H: 0.140



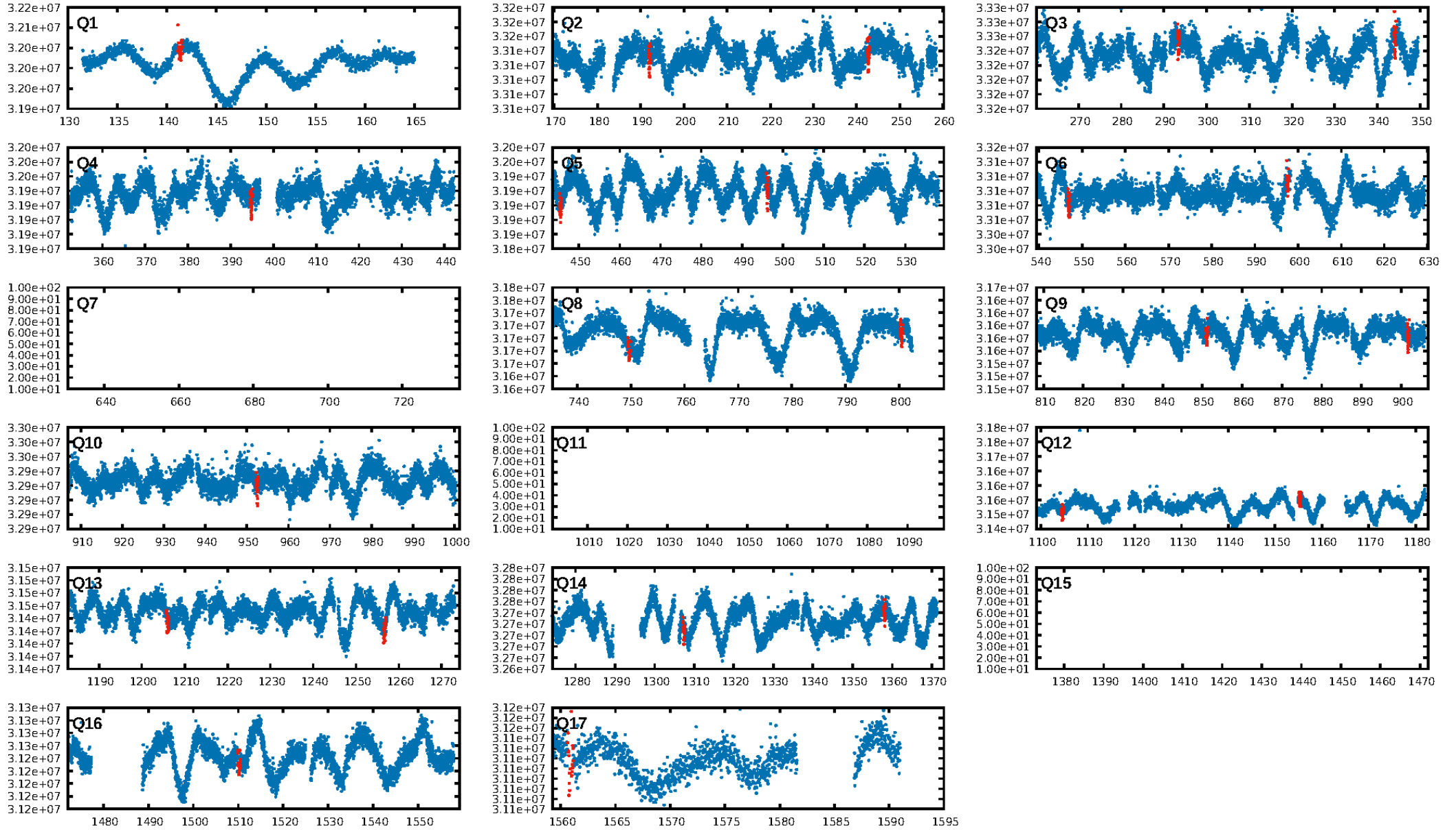
## DV Fit Results:

Period = 50.69881 [0.00025] d  
Epoch = 141.3131 [0.0039] BKJD  
Rp/R\* = 0.0248 [0.0051]  
a/R\* = 45.20 [40.86]  
b = 0.75 [0.54]  
Seff = 29.65 [8.47]  
Teff = 595 [43] K  
Rp = 3.95 [1.11] Re  
a = 0.2764 [0.0497] AU  
Ag = 204.65 [125.02] [1.63σ]  
Teffp = 3480 [474] K [6.06σ]

## DV Diagnostic Results:

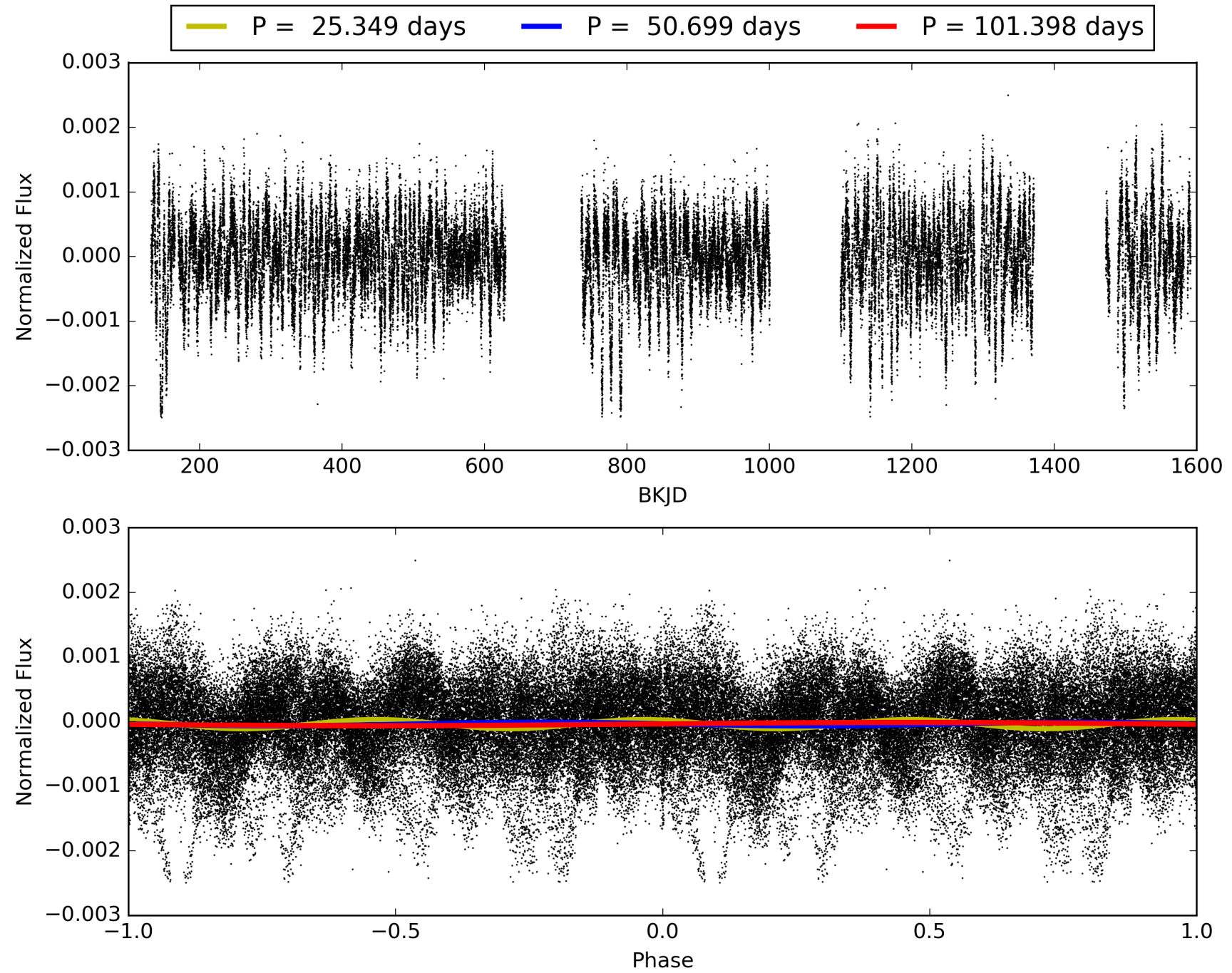
ShortPeriod-sig: 100.0% [128.93σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 76.4%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 5.92e-108  
RollingBand-fgt: 1.00 [21/21]  
GhostDiagnostic-chr: 1151  
Centroid-sig: 0.0%  
Centroid-so: 1.330 arcsec [2.71σ]  
OotOffset-rm: 0.175 arcsec [0.77σ]  
KicOffset-rm: 0.235 arcsec [1.13σ]  
OotOffset-st: 4/1/2/3 [10]  
KicOffset-st: 4/1/2/3 [10]  
DiffImageQuality-fgm: 1.00 [10/10]  
DiffImageOverlap-fno: 0.91 [10/11]

# TCE 009782691-02, PDC Light Curves



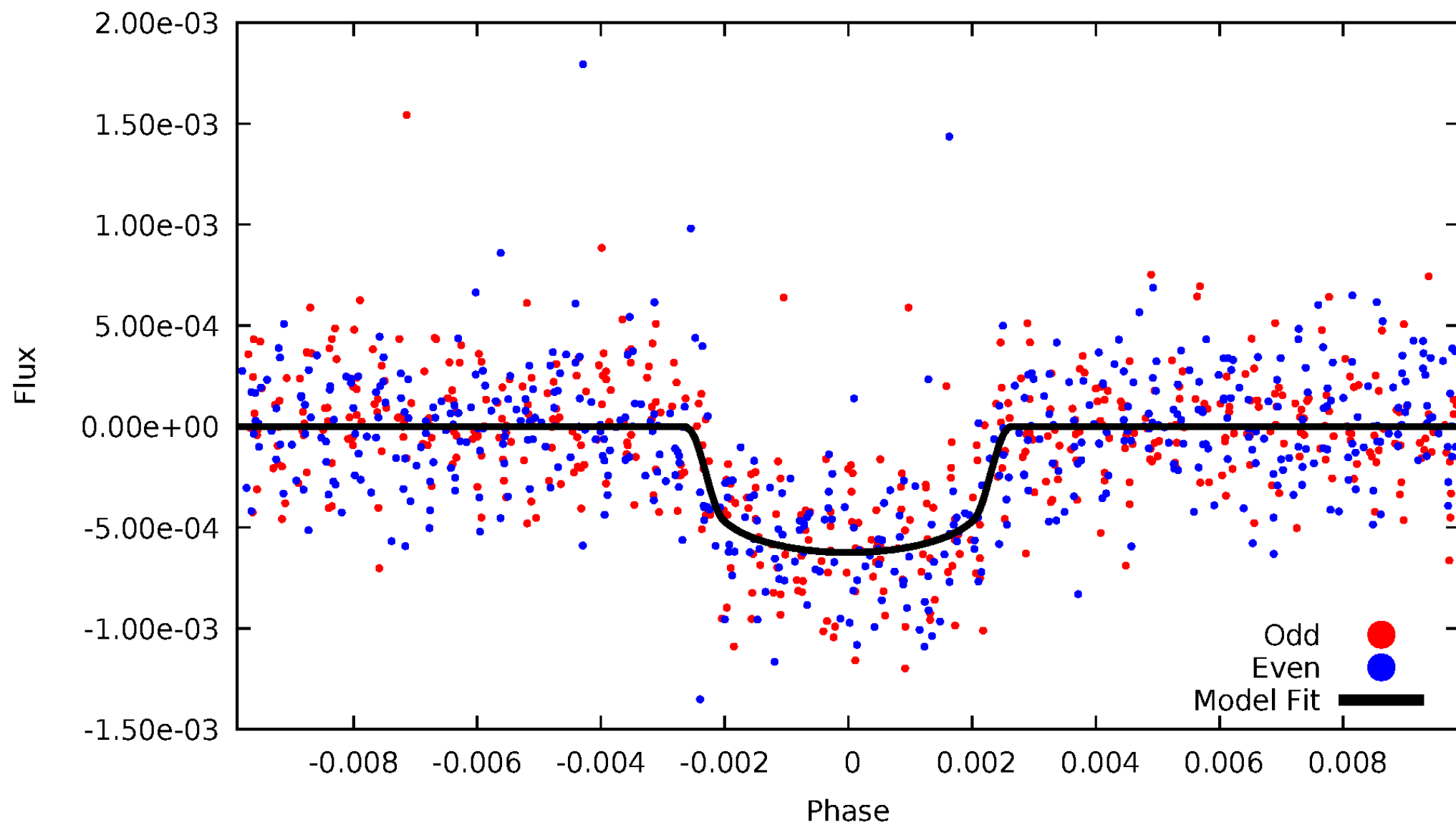


# TCE 009782691-02



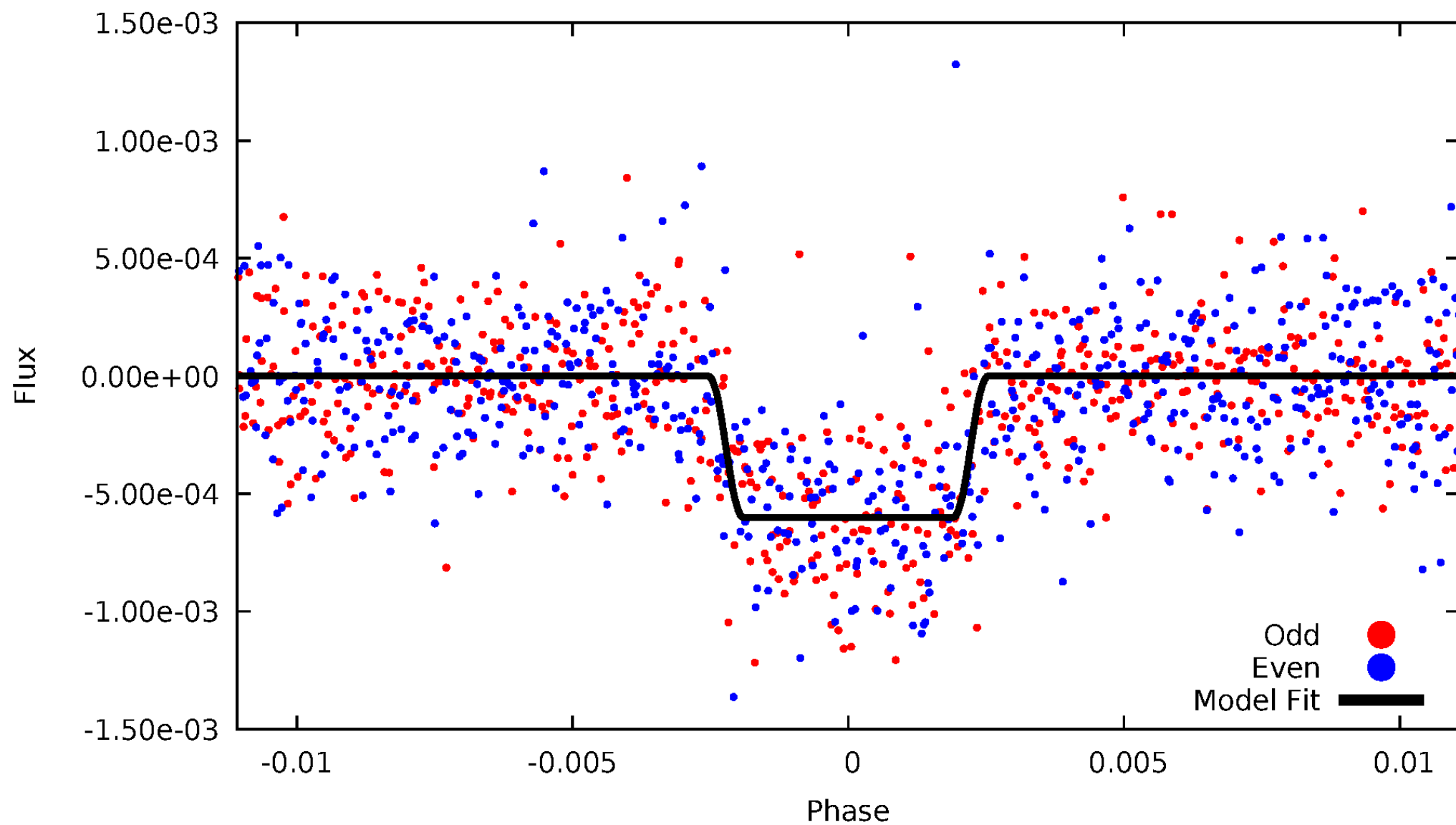
# DV Odd/Even

TCE 009782691-02



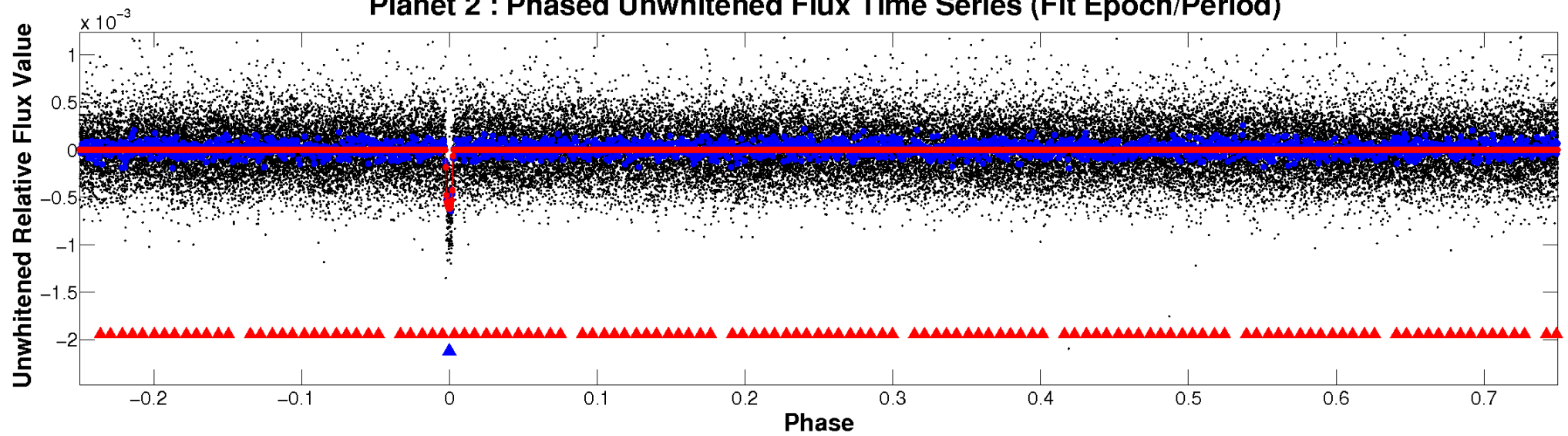
# ALT Odd/Even

TCE 009782691-02

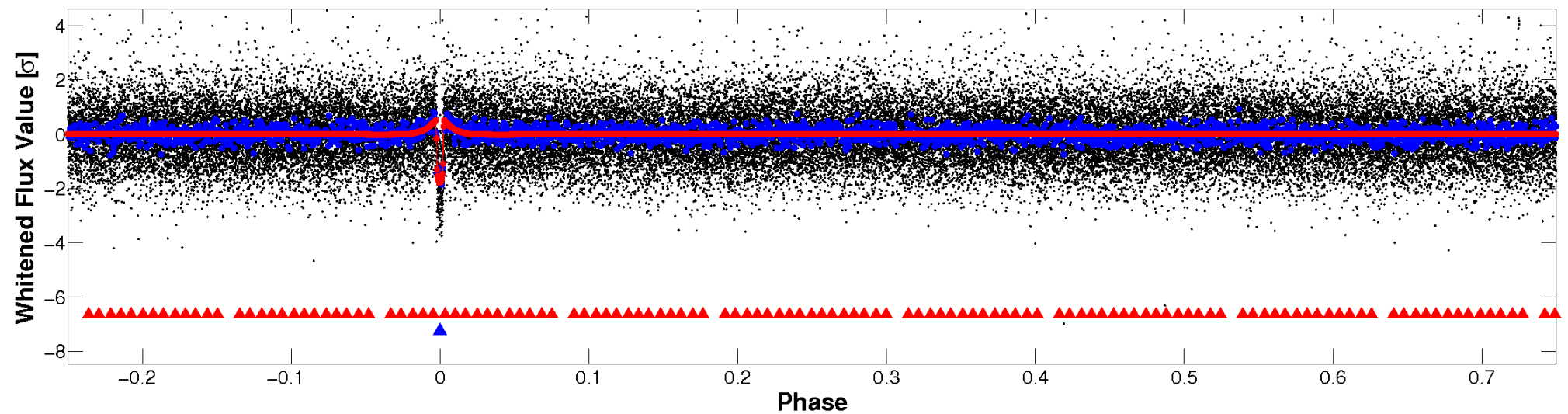


# Non-Whitened Vs. Whitened Light Curve

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

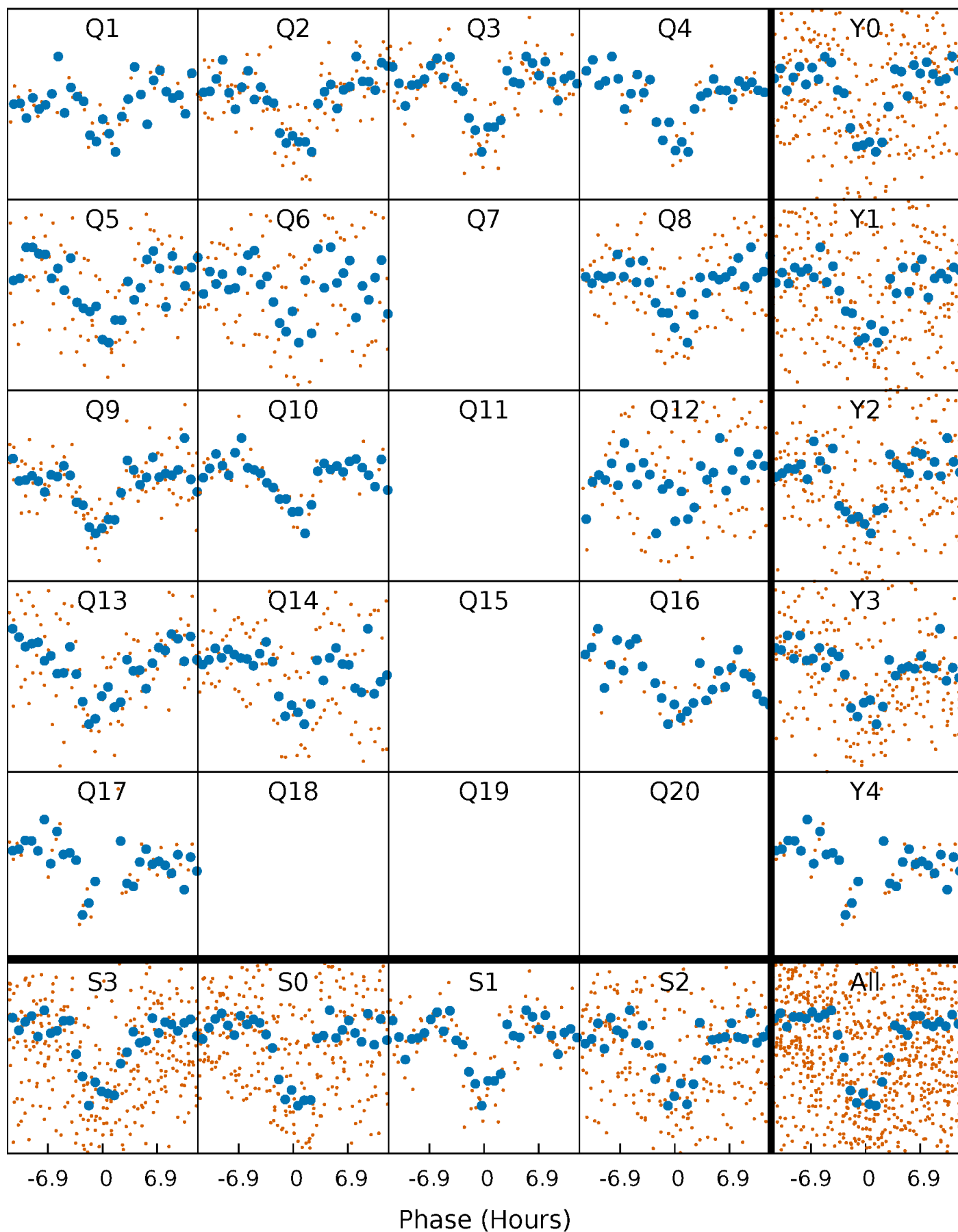


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

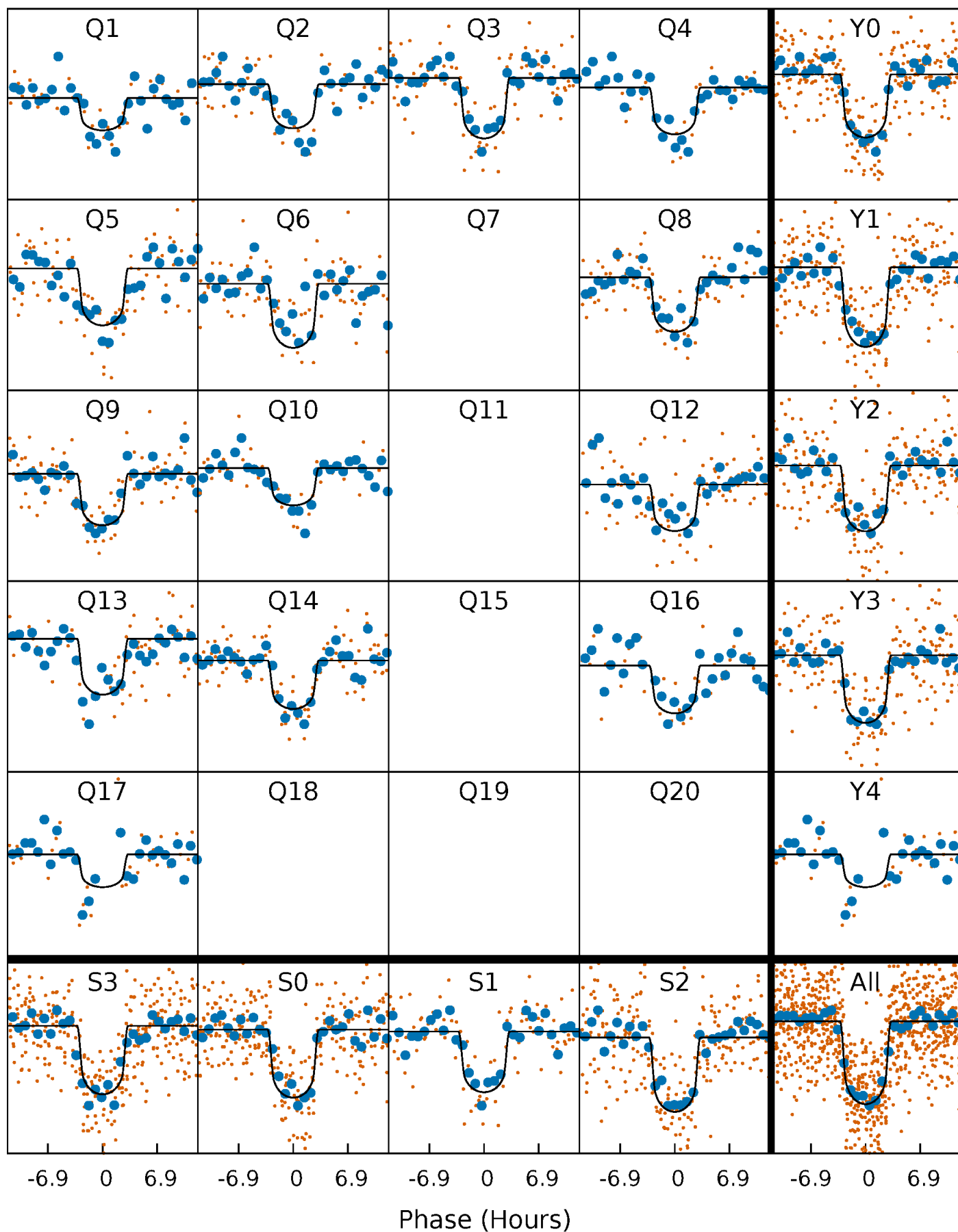
TCE 009782691-02 P= 50.698815 Days  $T_0=141.313095$  (BKJD)





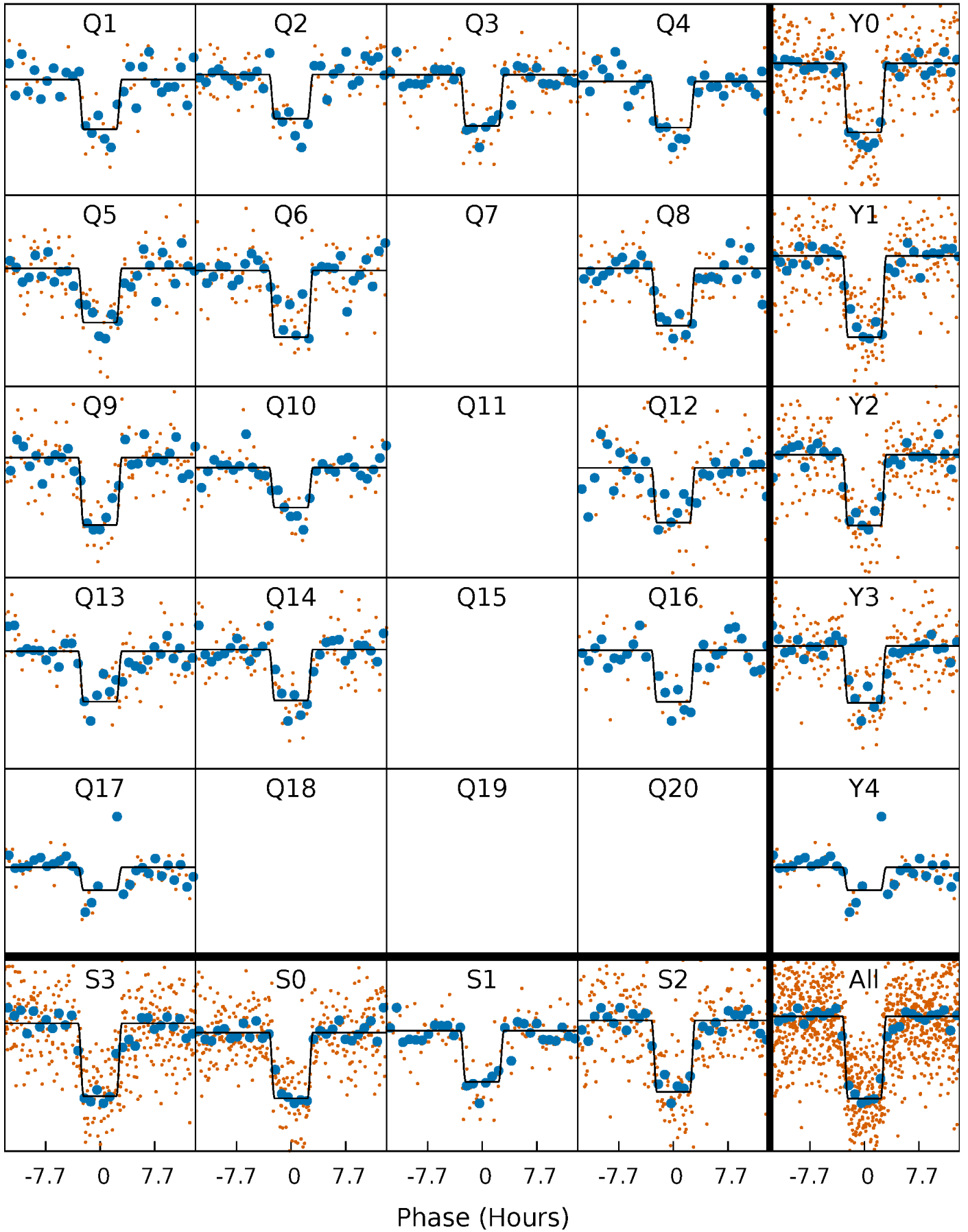
# DV Quarter-Phased Transit Curves

TCE 009782691-02   P= 50.698815 Days    $T_0=141.313095$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

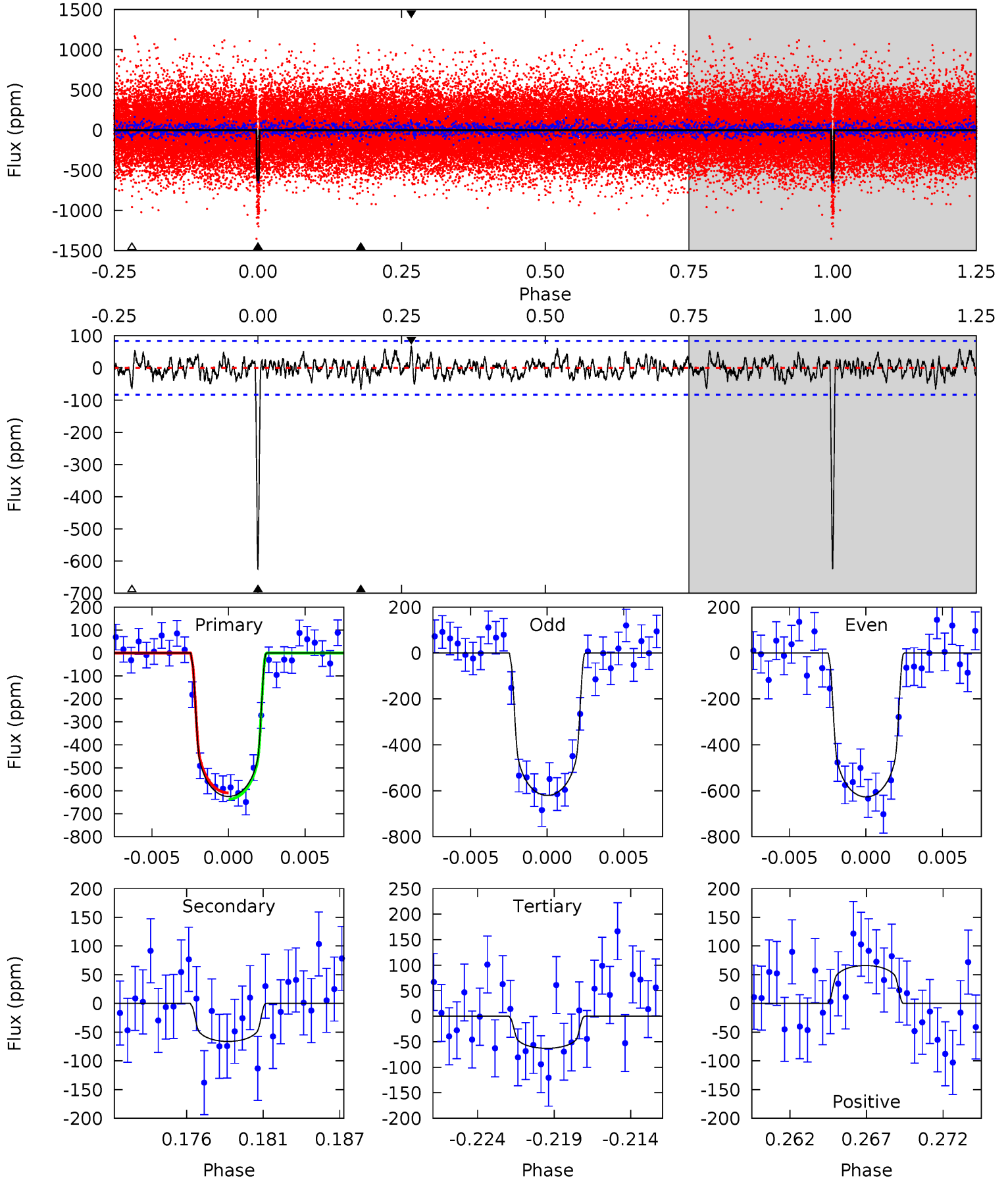
TCE 009782691-02 P= 50.697911 Days  $T_0=141.322425$  (BKJD)



# DV Model-Shift Uniqueness Test

009782691-02, P = 50.698815 Days, E = 90.614280 Days

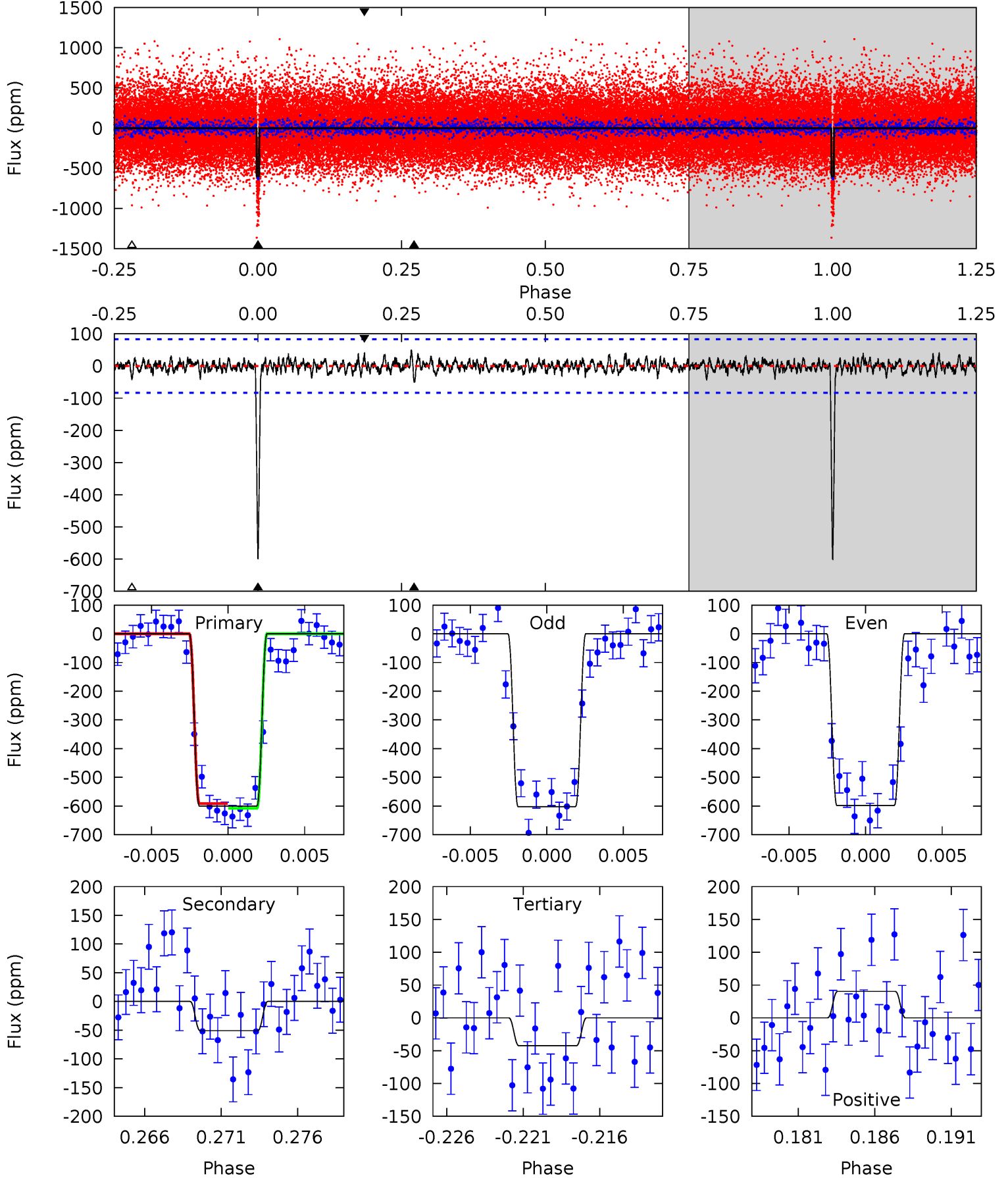
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
38.5	4.08	3.88	4.07	5.15	2.79	1.26	34.7	34.5	0.20	0.01	0.20	0.96	0.10	0.85



# Alt Model-Shift Uniqueness Test

009782691-02, P = 50.697911 Days, E = 90.624514 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
37.1	3.15	2.62	2.50	5.16	2.81	0.79	34.5	34.6	0.52	0.64	0.12	0.98	0.08	0.52



### Stellar Parameters For KIC 009782691

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5876^{+79}_{-79}$	$4.151^{+0.162}_{-0.108}$	$0.140^{+0.150}_{-0.150}$	$1.456^{+0.233}_{-0.284}$	$1.093^{+0.107}_{-0.080}$	$0.499^{+0.427}_{-0.170}$
	+1%/-1%	+4%/-3%	+107%/-107%	+16%/-20%	+10%/-7%	+85%/-34%
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 009782691-02 / KOI 0590.02

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-66 \pm 16$	$3.92^{+0.87}_{-0.86}$	$827^{+38}_{-42}$	$3732^{+351}_{-257}$	$175^{+137}_{-65}$
Alt.	$-51 \pm 16$	$3.87^{+0.90}_{-0.90}$	$829^{+38}_{-44}$	$3590^{+384}_{-281}$	$141^{+118}_{-61}$

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

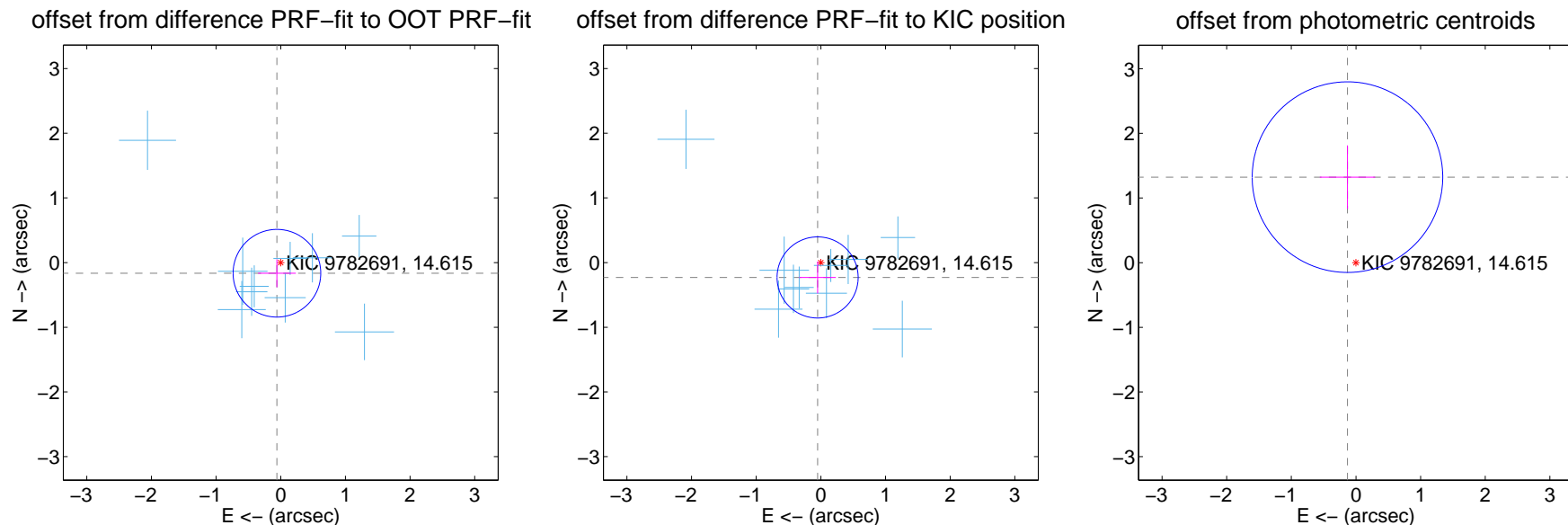
## DV Centroid Data

Supplemental centroid analysis for 009782691-02. Kepler magnitude: 14.62. Transit SNR 24.82

There are 10 quarters with good PRF difference image offsets

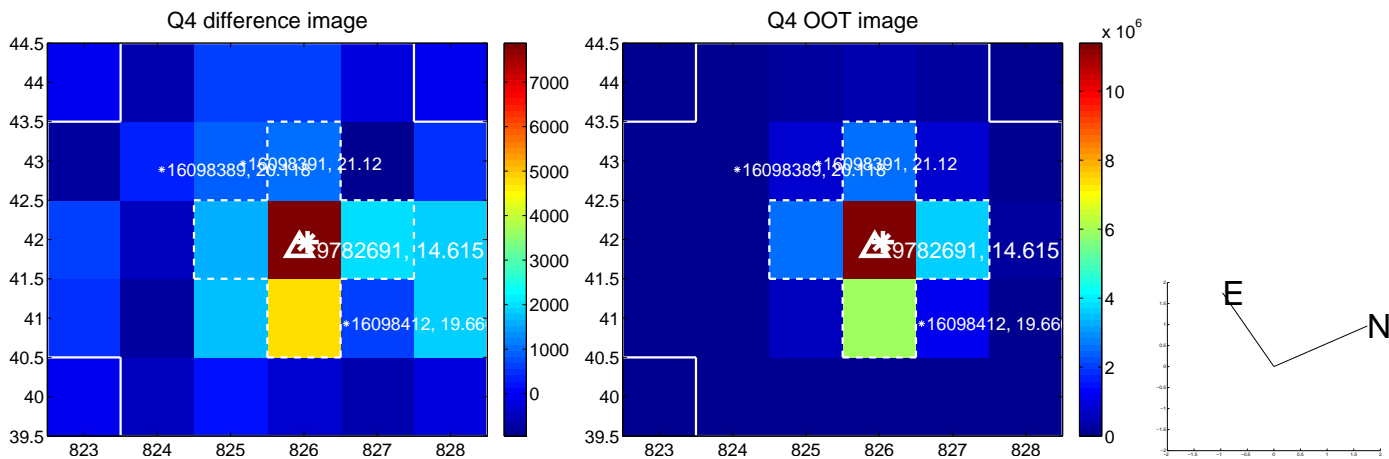
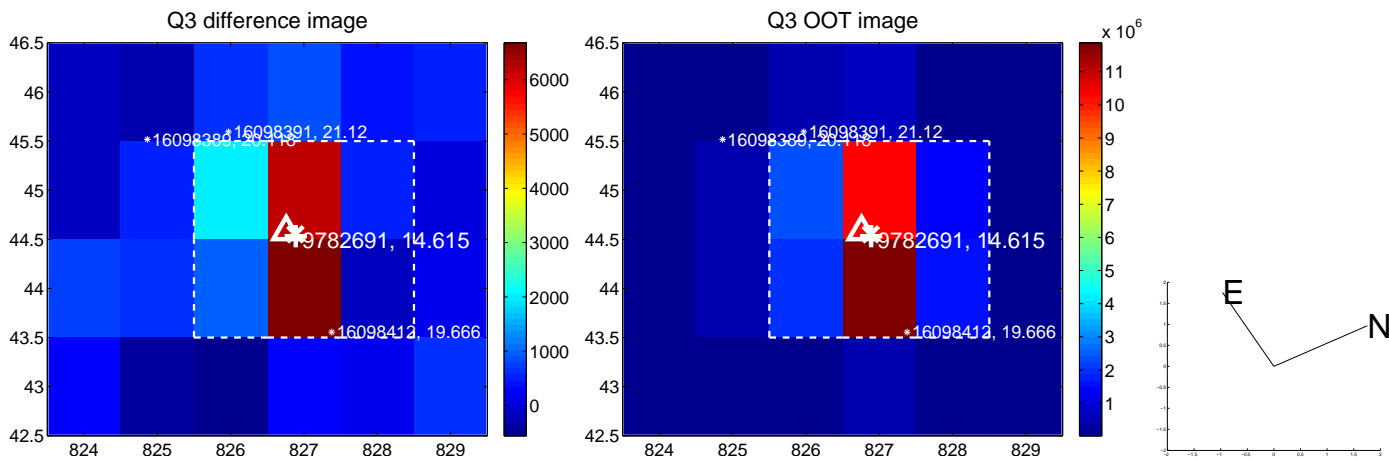
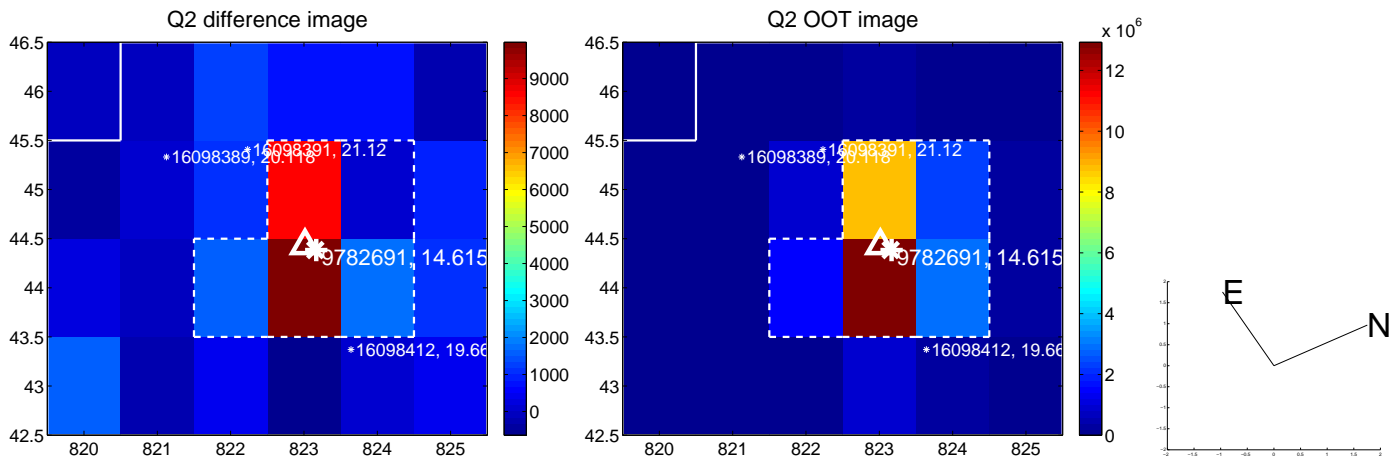
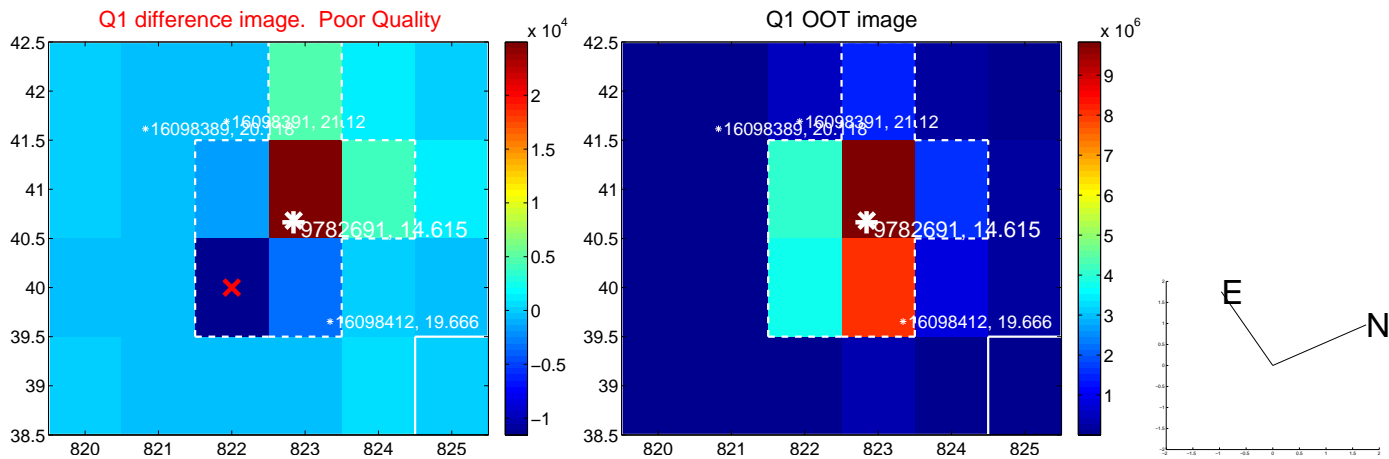
The direct PRF centroid is offset from the target star catalog position by about 0.05 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.175 \pm 0.226$	0.77	$0.059 \pm 0.292$	$-0.165 \pm 0.216$
PRF-fit source offset from KIC position	$0.235 \pm 0.209$	1.13	$0.050 \pm 0.283$	$-0.230 \pm 0.246$
photometric centroid source offset	$1.33 \pm 0.49$	2.71	$0.13 \pm 0.43$	$1.32 \pm 0.49$



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.

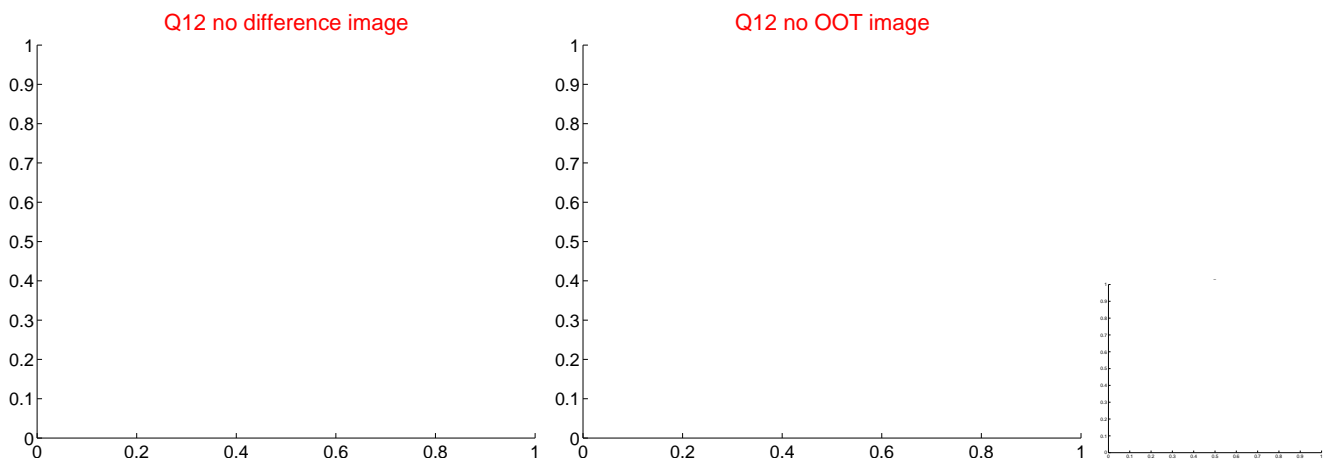
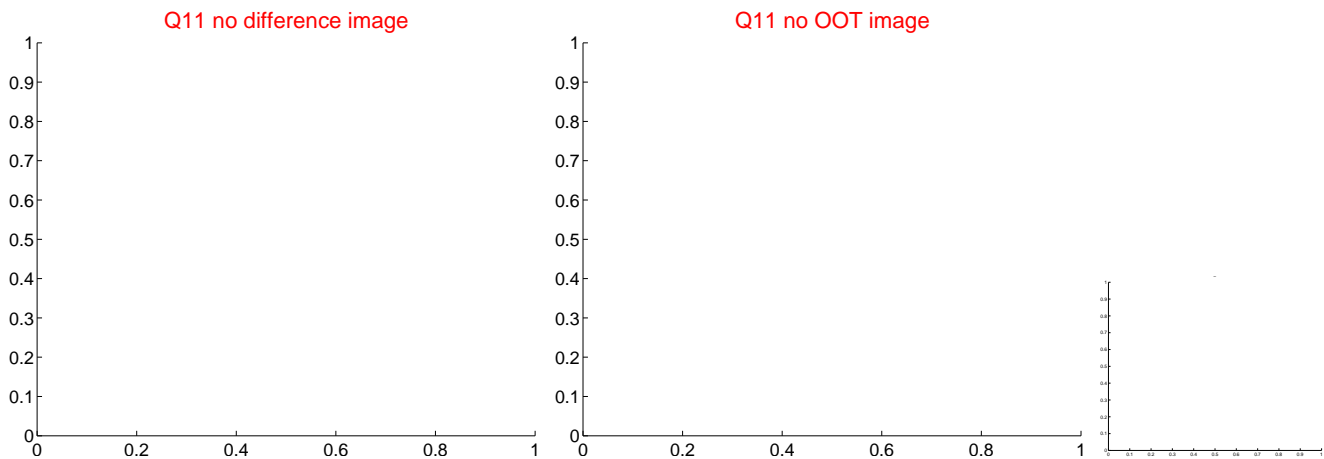
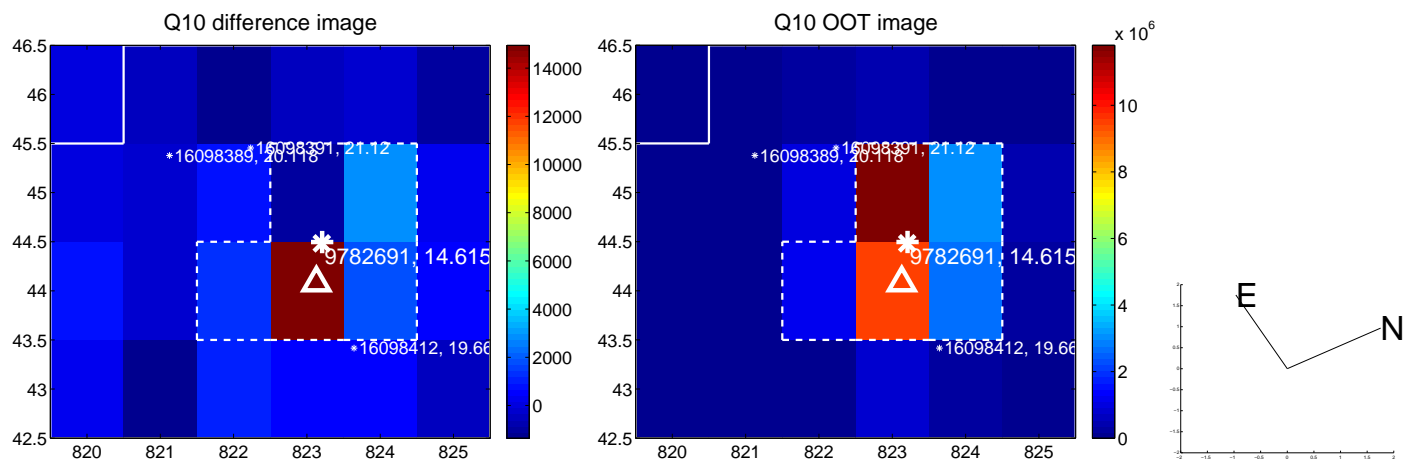
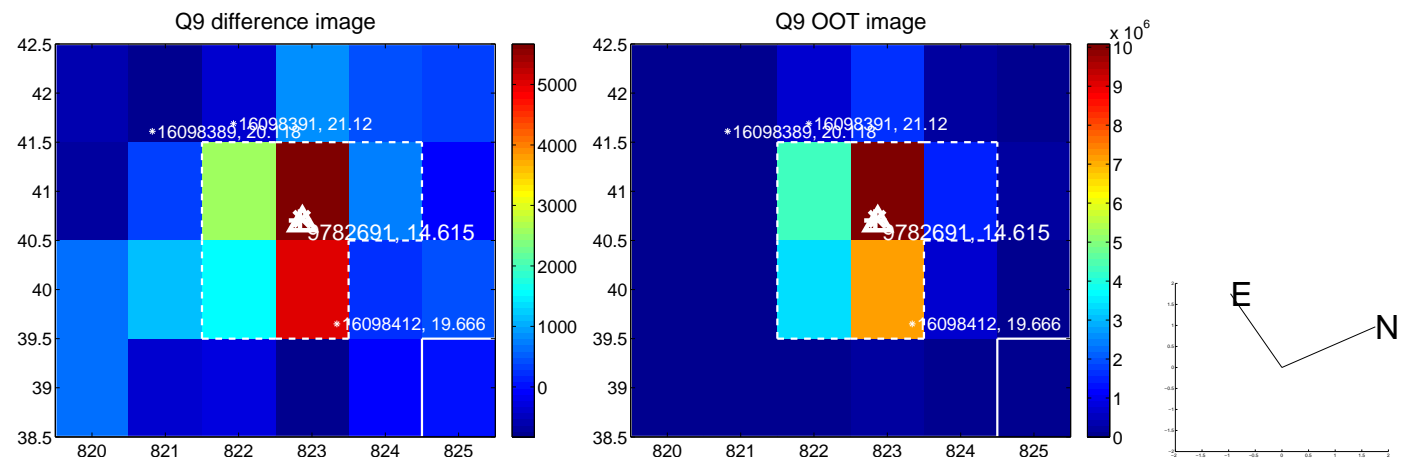
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



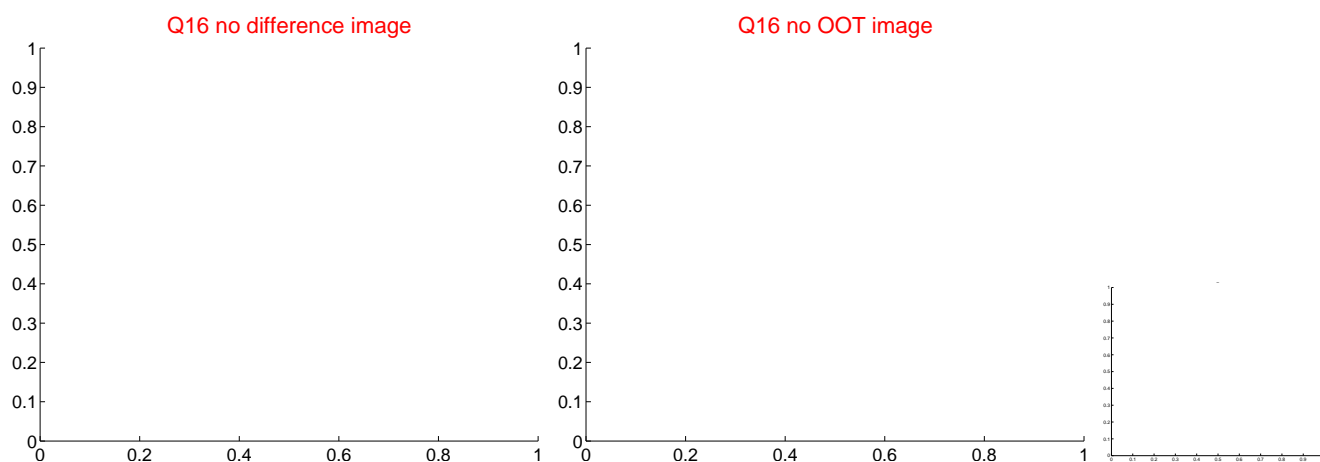
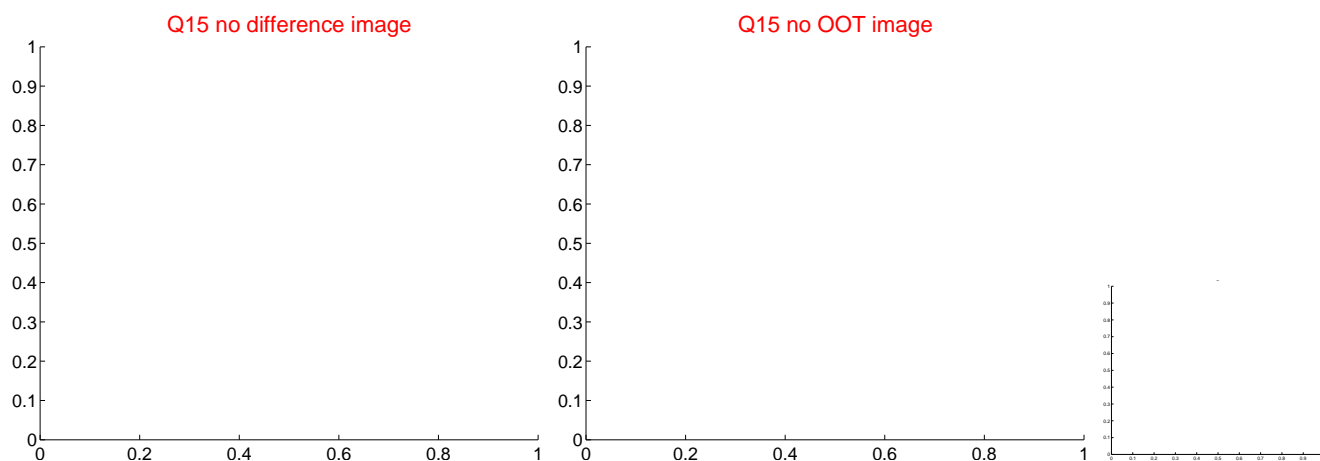
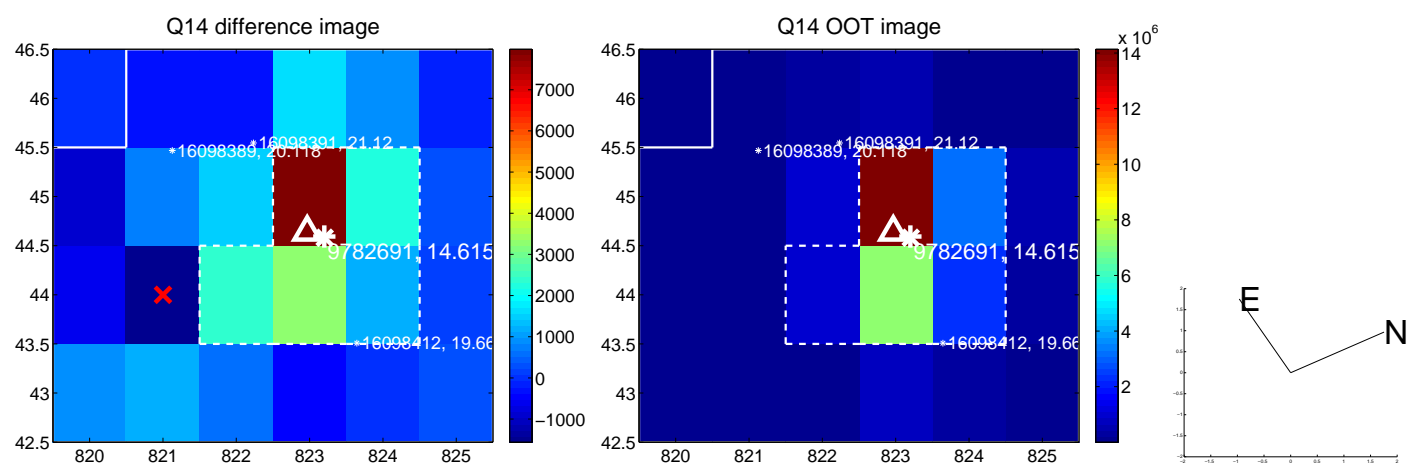
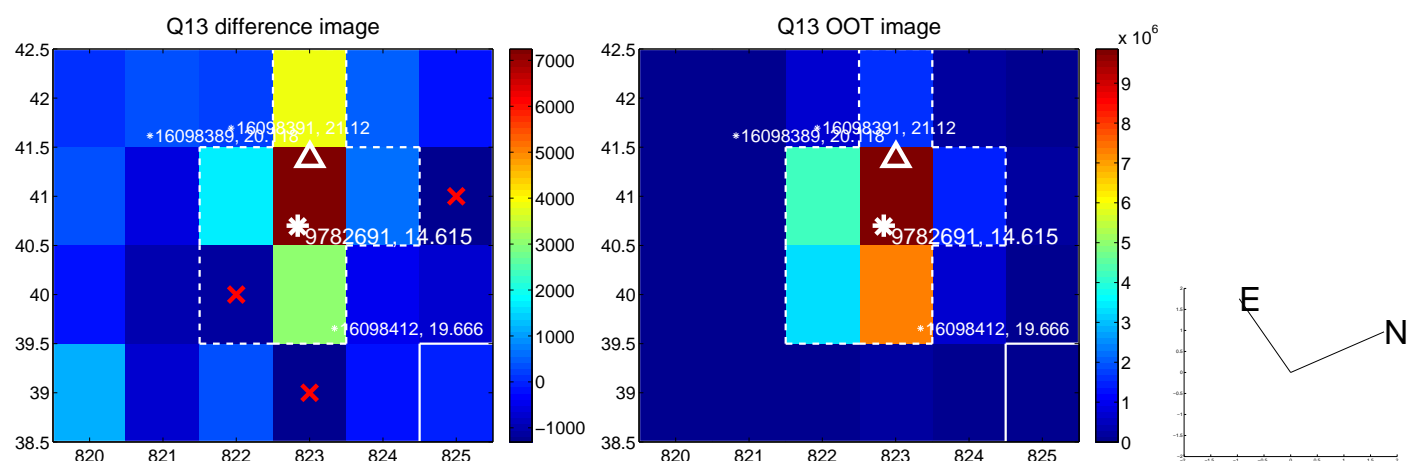




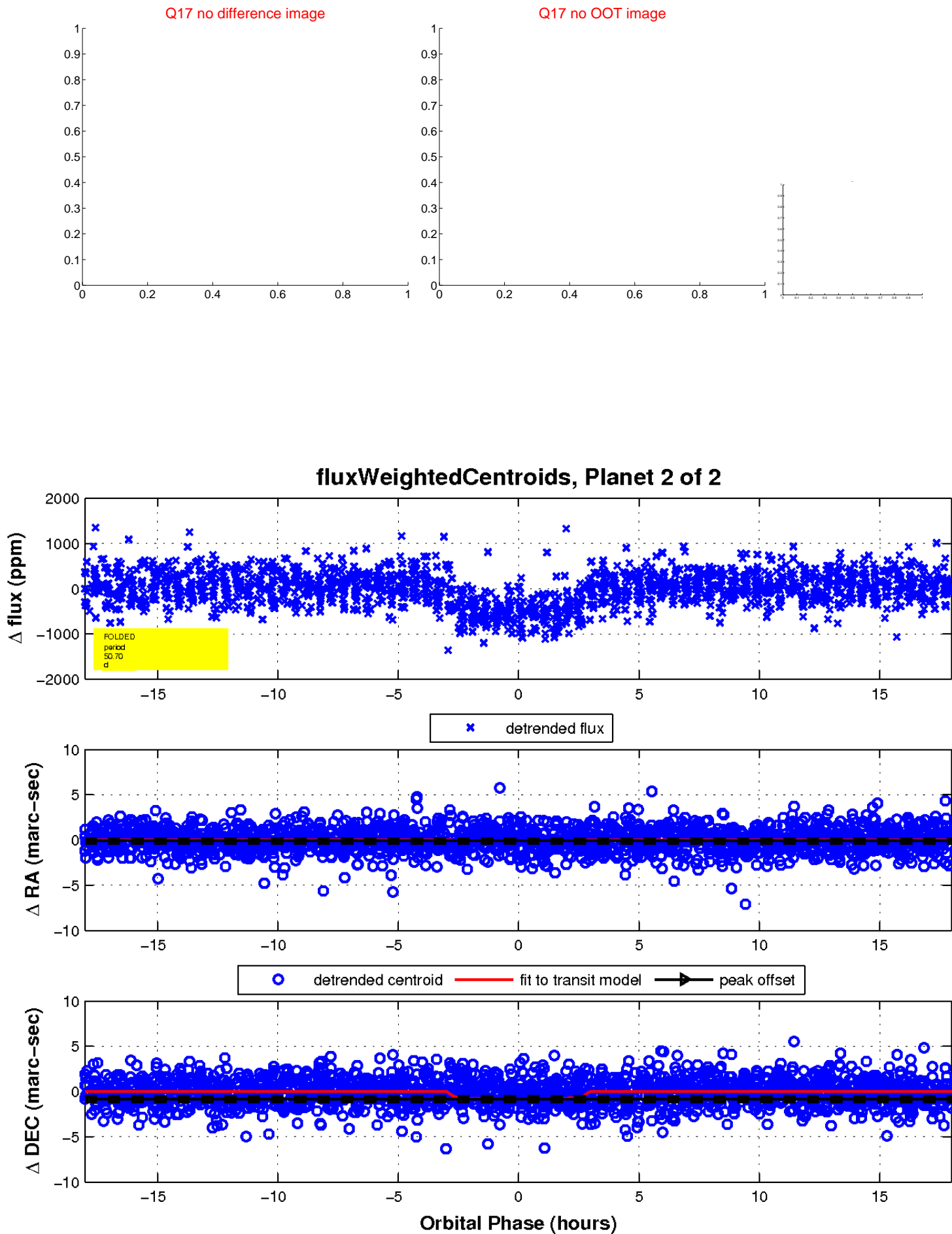
white ×: KIC target position; +: OOT centroid; △: difference centroid. red ×: large negative pixel value.



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

