

# KIC 009785454

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009785454-01	OBS	3577.01	184.520208	237.698762	49280.3	15.361	1568.7	1429.7	0.78	5341	24.00	1.36
009785454-02	OBS	No	184.520119	273.603545	47257.1	16.472	1283.2	1233.3	0.78	5341	26.43	1.36

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009785454-01	OBS	FP	0.00	0	1	0	0	MOD_SEC_DV—DEEP_V_SHAPED—HAS_SEC_TCE
009785454-02	OBS	FP	0.00	1	1	0	0	IS_SEC_TCE

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

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

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

## Ephemeris Match Information For 009785454-01

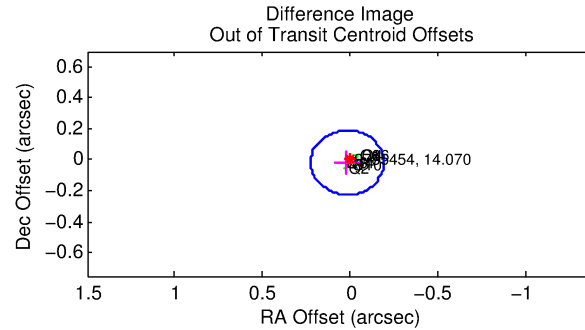
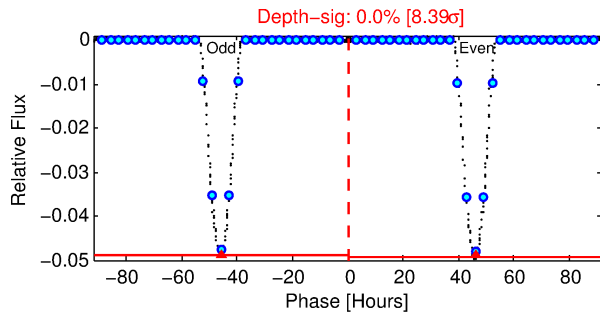
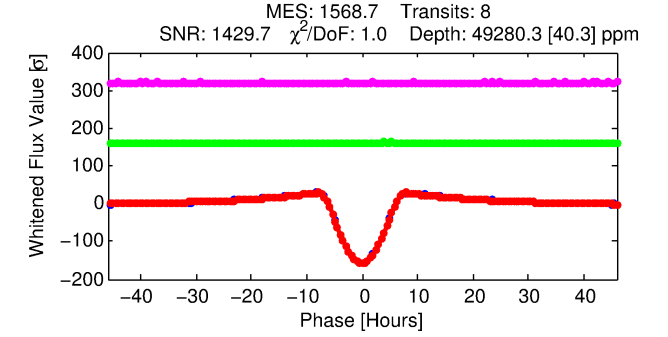
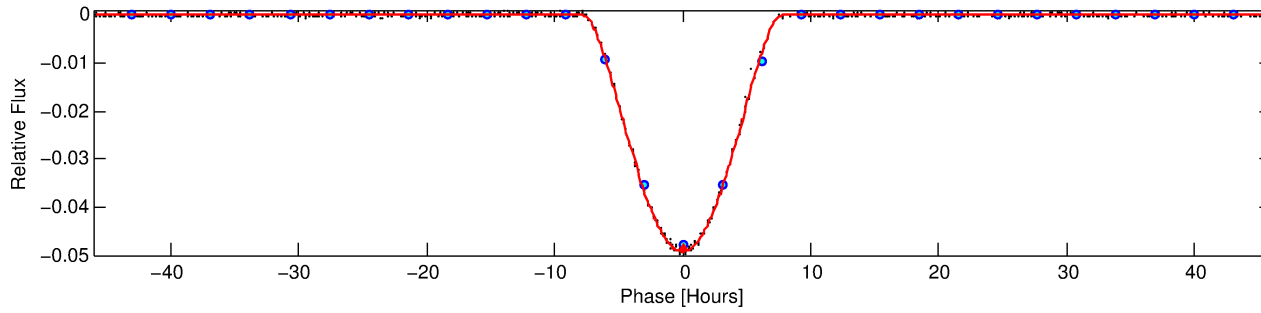
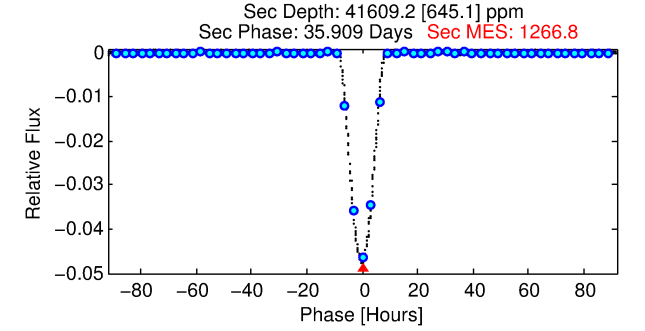
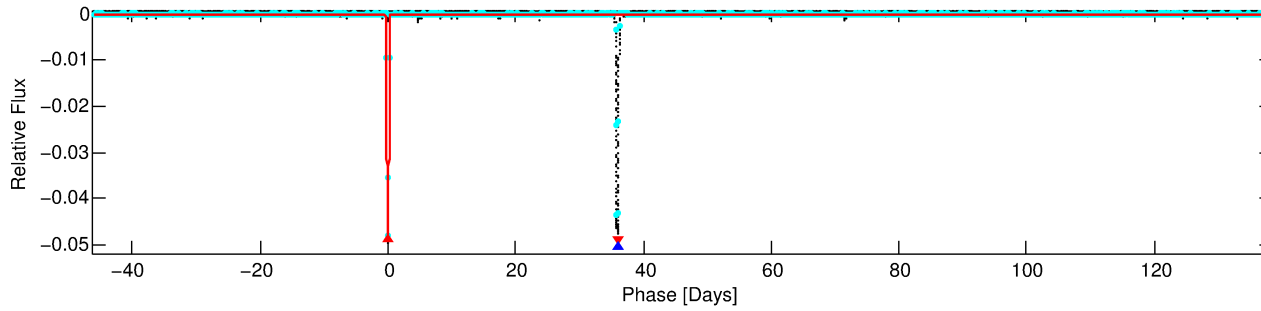
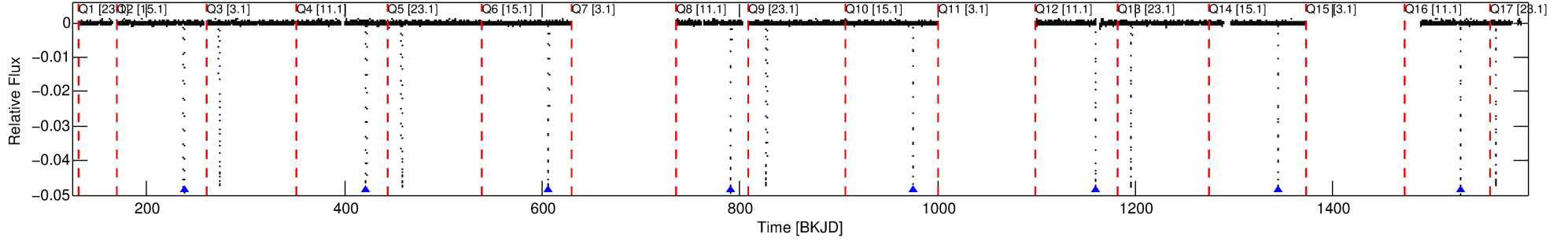
No Significant Match Found

# DV One-Page Summary

KIC: 9785454 Candidate: 1 of 2 Period: 184.520 d

KOI: K03577.01 Corr: 0.998

Kp: 14.07 R\*: 0.78 Rs Teff: 5341.0 K Logg: 4.51 Fe/H: -0.440



## DV Fit Results:

Period = 184.52021 [0.00005] d  
Epoch = 237.6988 [0.0002] BKJD  
Rp/R\* = 0.2834 [0.0051]  
a/R\* = 84.06 [0.17]  
b = 0.90 [0.01]  
Seff = 1.36 [0.36]  
Teq = 275 [18] K  
Rp = 24.00 [4.35] Re  
a = 0.5679 [0.0893] AU  
Ag = 12816.51 [3062.04] [4.19σ]  
Teffp = 4531 [143] K [29.54σ]

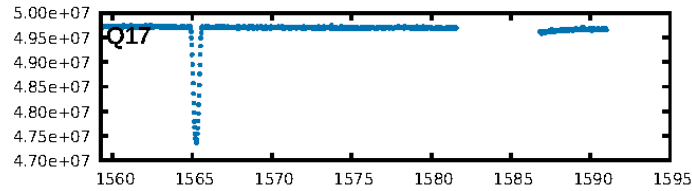
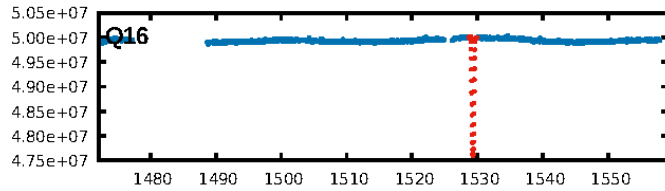
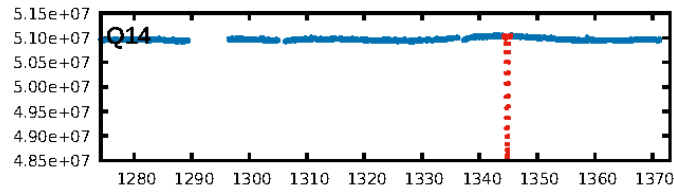
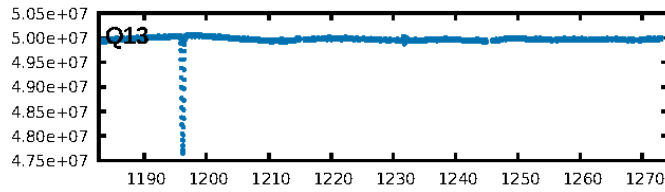
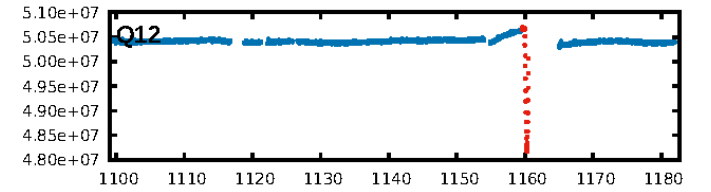
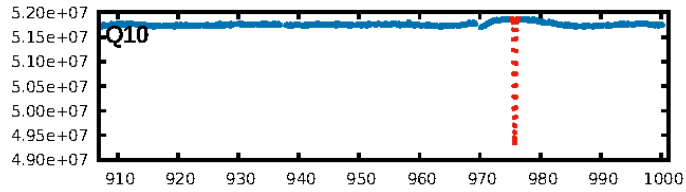
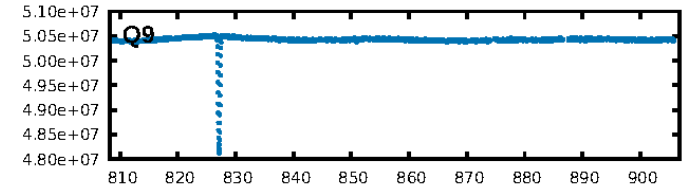
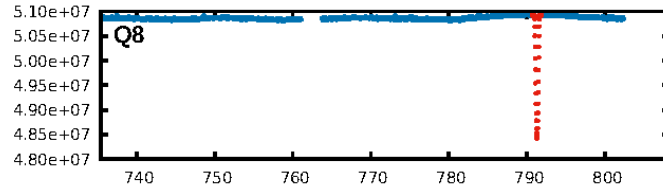
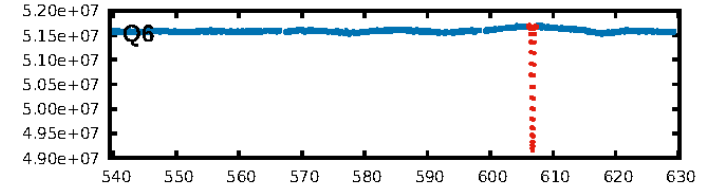
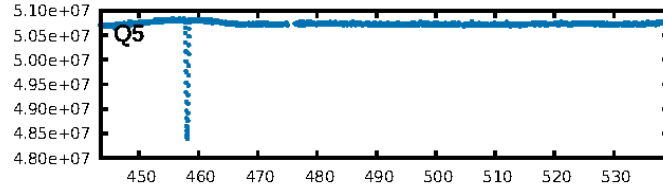
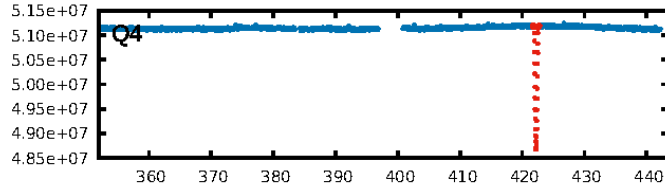
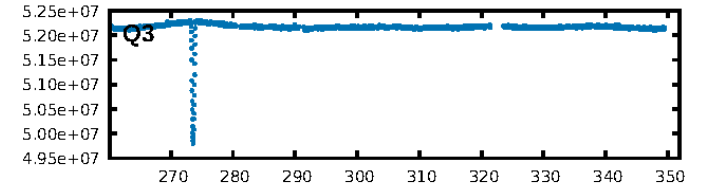
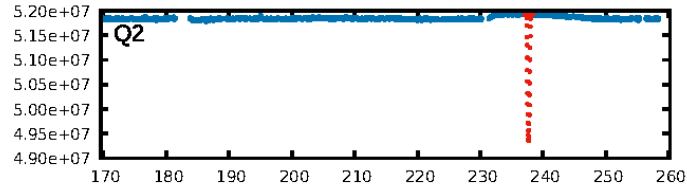
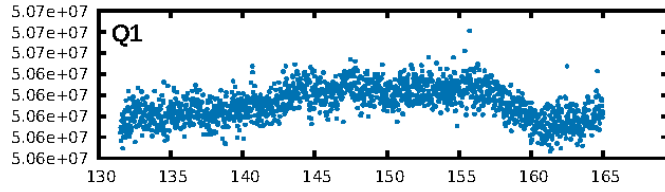
## DV Diagnostic Results:

ShortPeriod-sig: 0.0% [0.00σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 0.0%  
ModelChiSquareGof-sig: 99.7%  
Bootstrap-pfa: 0.00e+00  
RollingBand-fgt: 1.00 [8/8]  
GhostDiagnostic-chr: 5.409  
Centroid-sig: 0.0%  
Centroid-so: 0.162 arcsec [23.87σ]  
OotOffset-rm: 0.025 arcsec [0.37σ]  
KicOffset-rm: 0.113 arcsec [1.64σ]  
OotOffset-st: 4/0/3/0 [7]  
KicOffset-st: 4/0/3/0 [7]  
DiffImageQuality-fgm: 1.00 [7/7]  
DiffImageOverlap-fno: 1.00 [7/7]

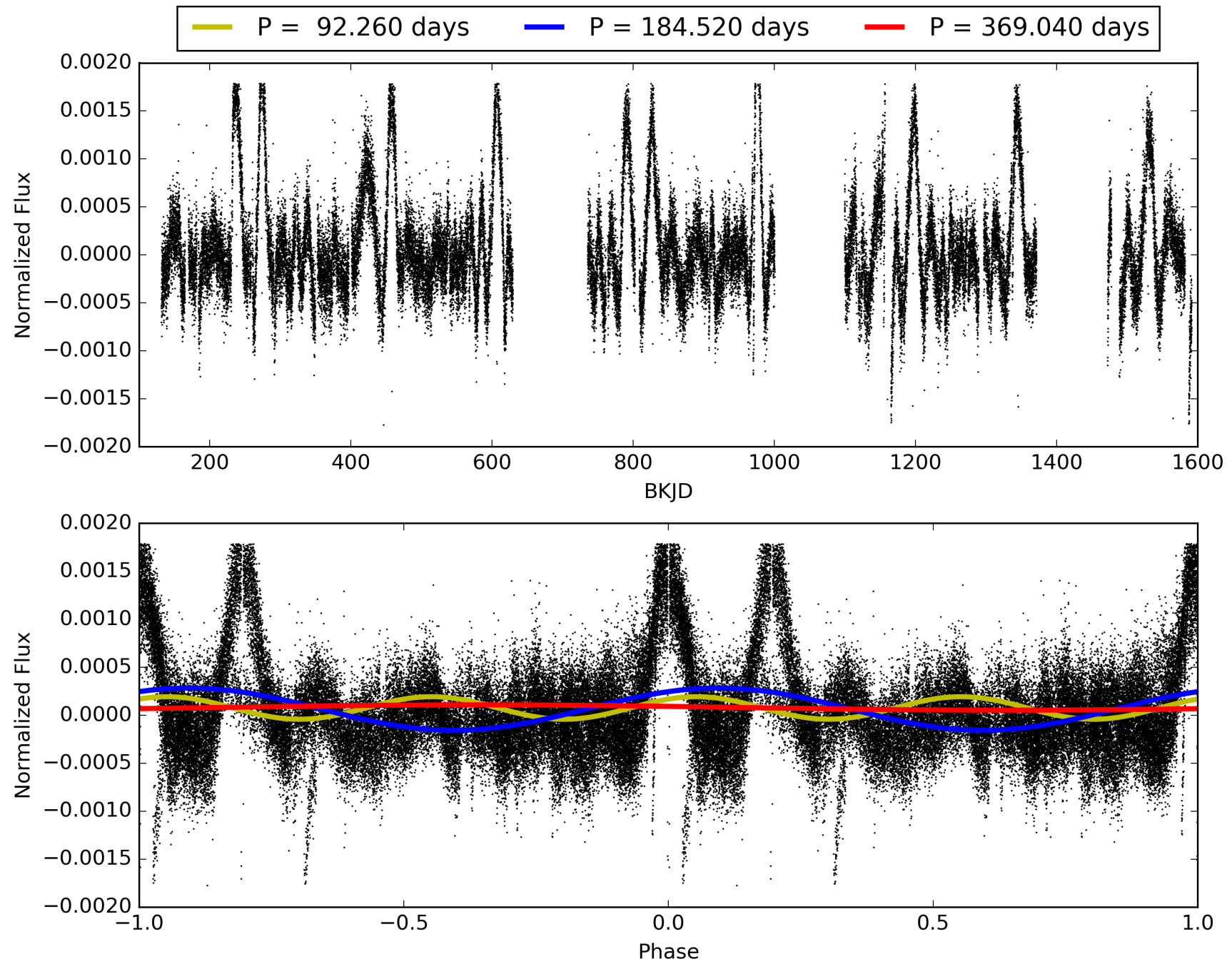
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 11:36:49 Z

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

# TCE 009785454-01, PDC Light Curves

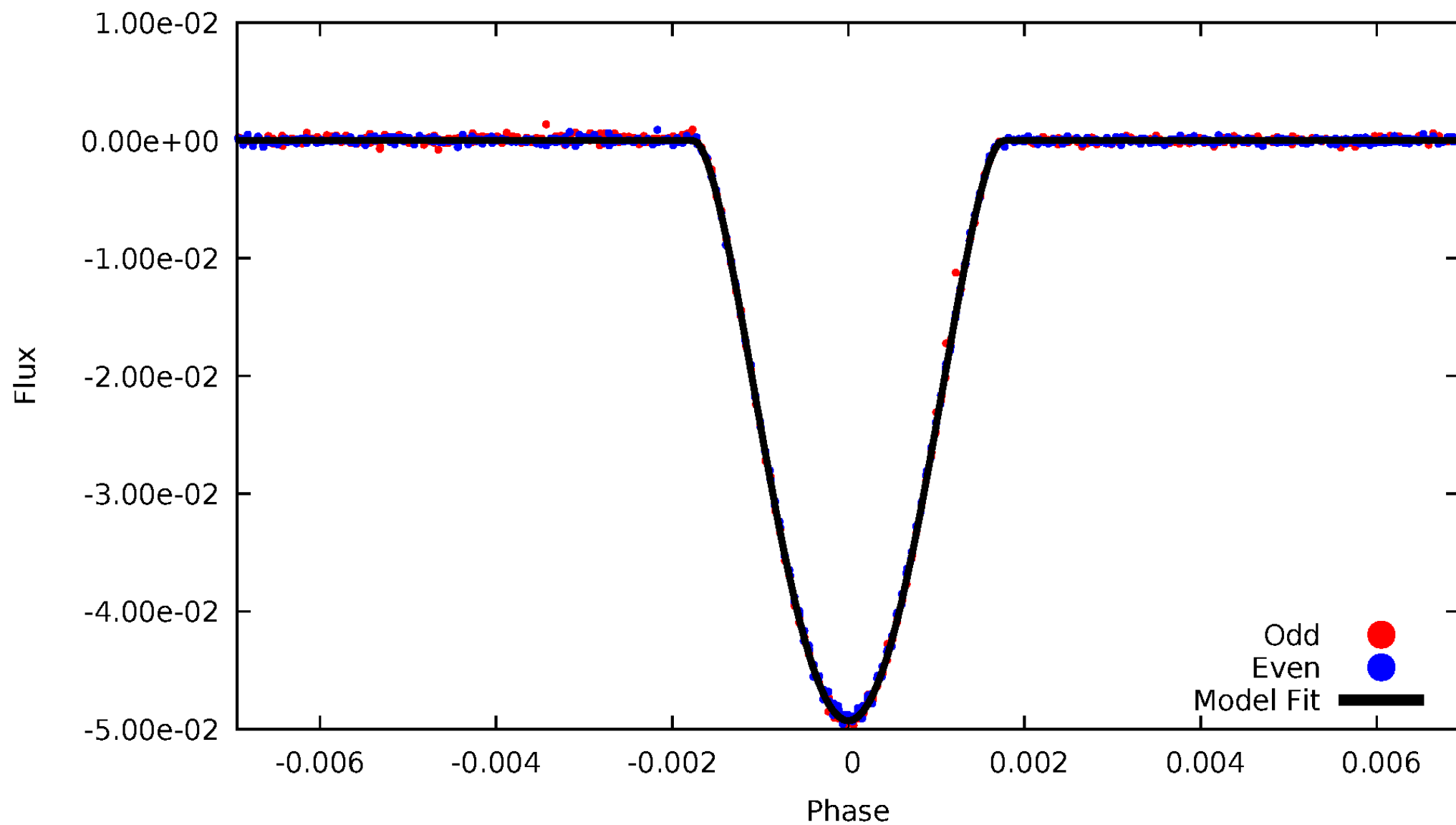


TCE 009785454-01



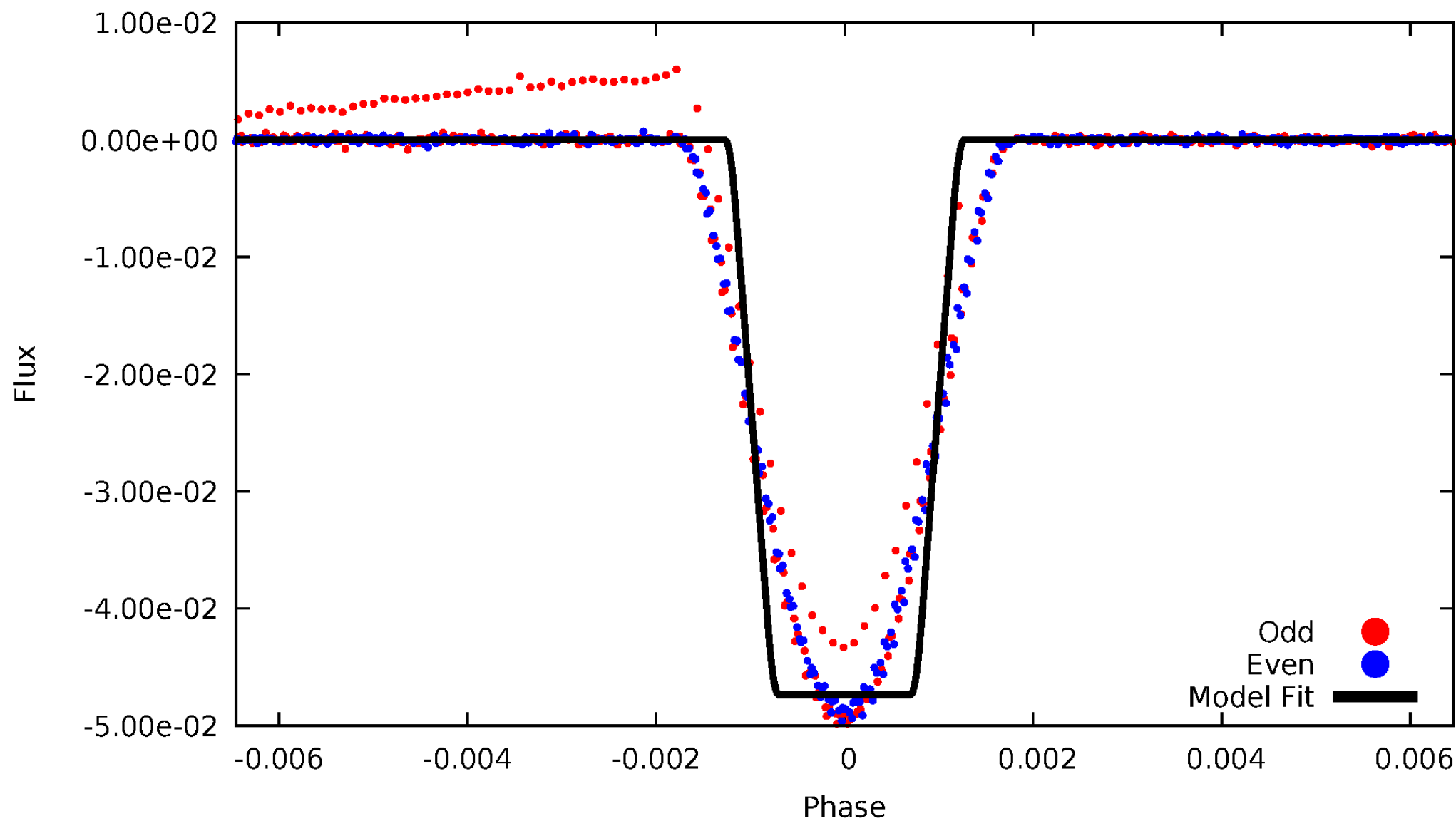
# DV Odd/Even

TCE 009785454-01



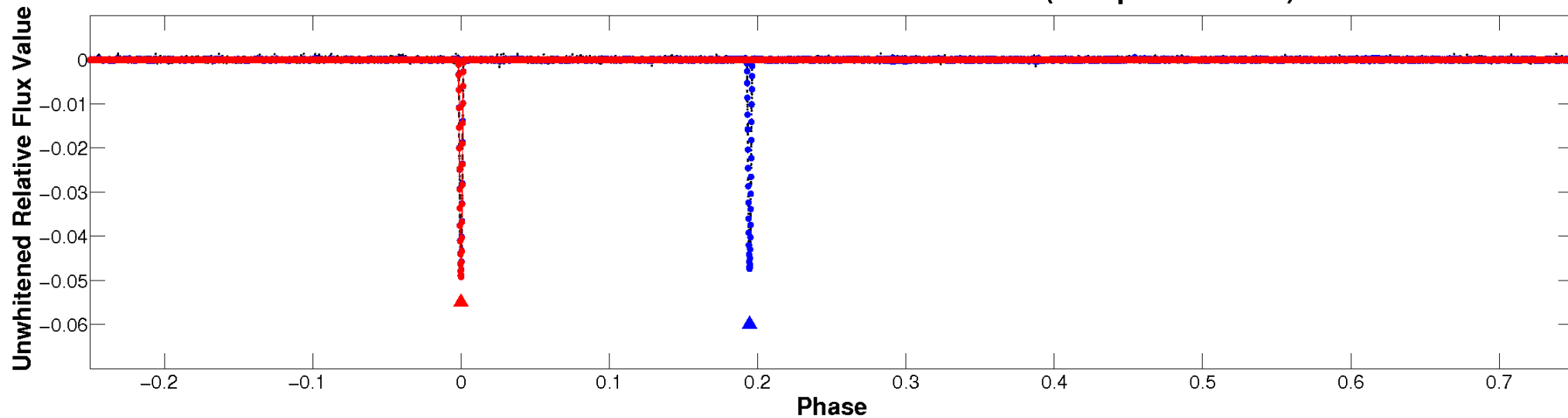
# ALT Odd/Even

TCE 009785454-01

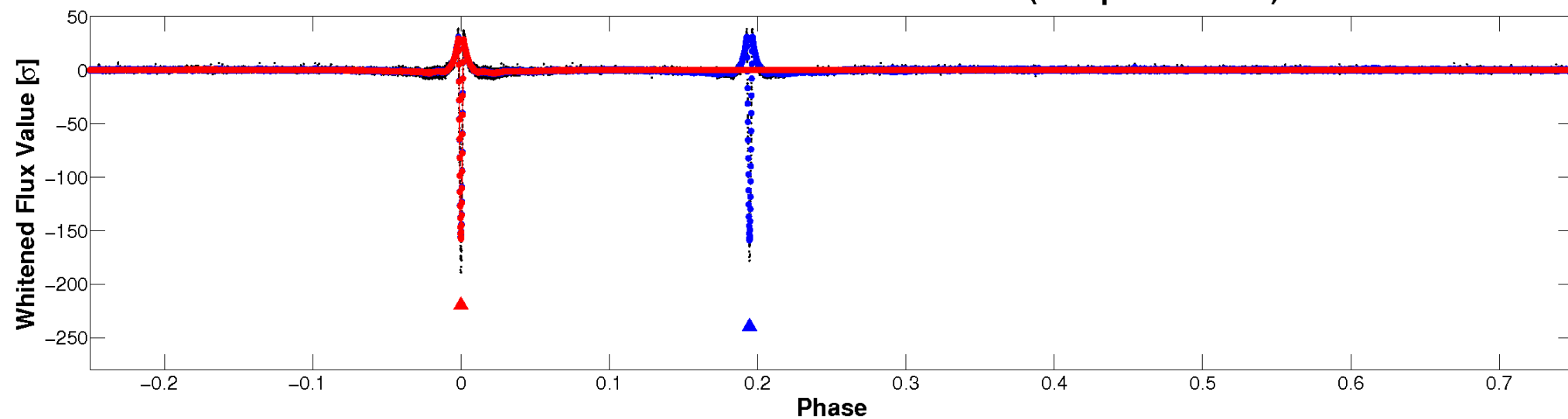


# Non-Whitened Vs. Whitened Light Curve

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

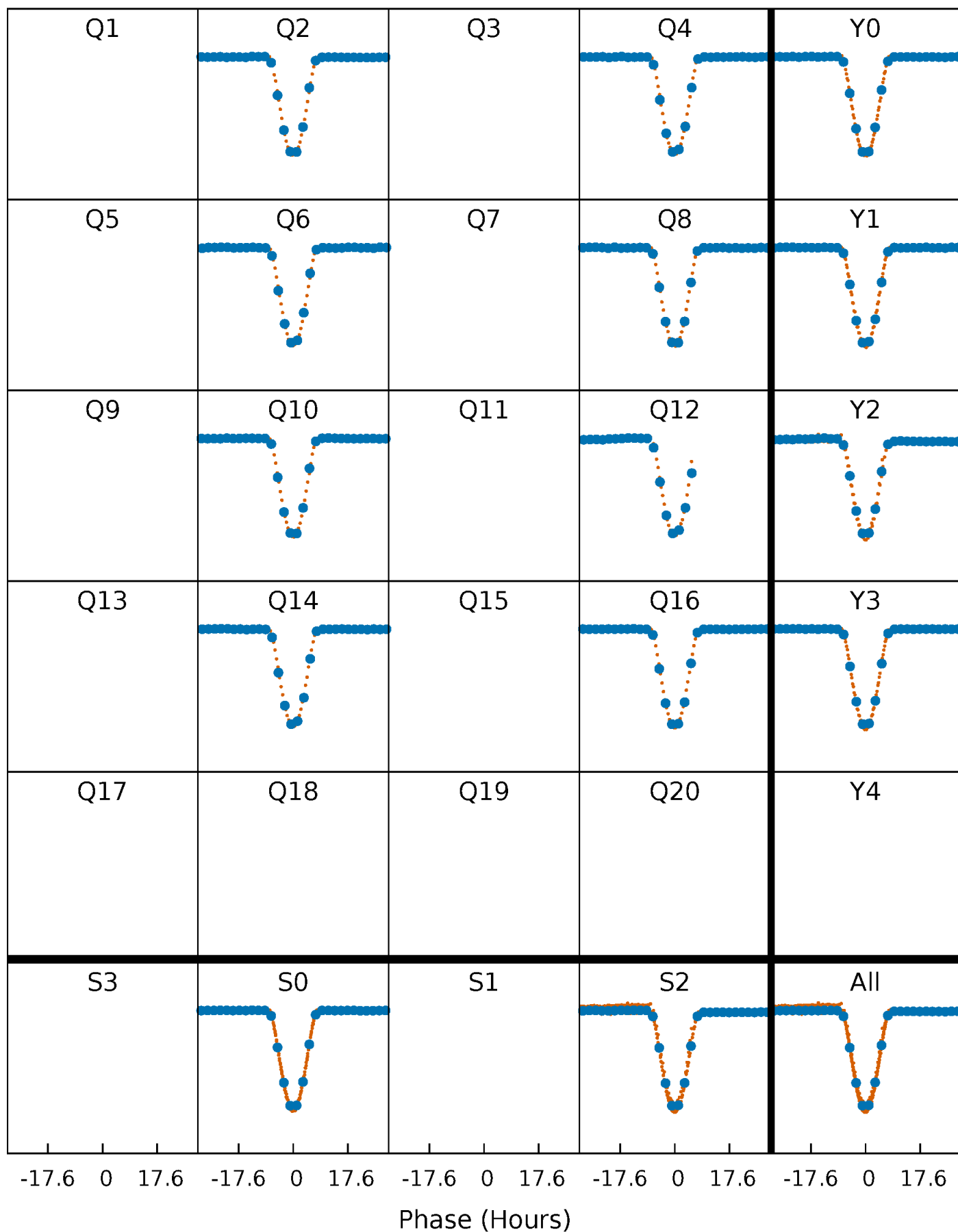


Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

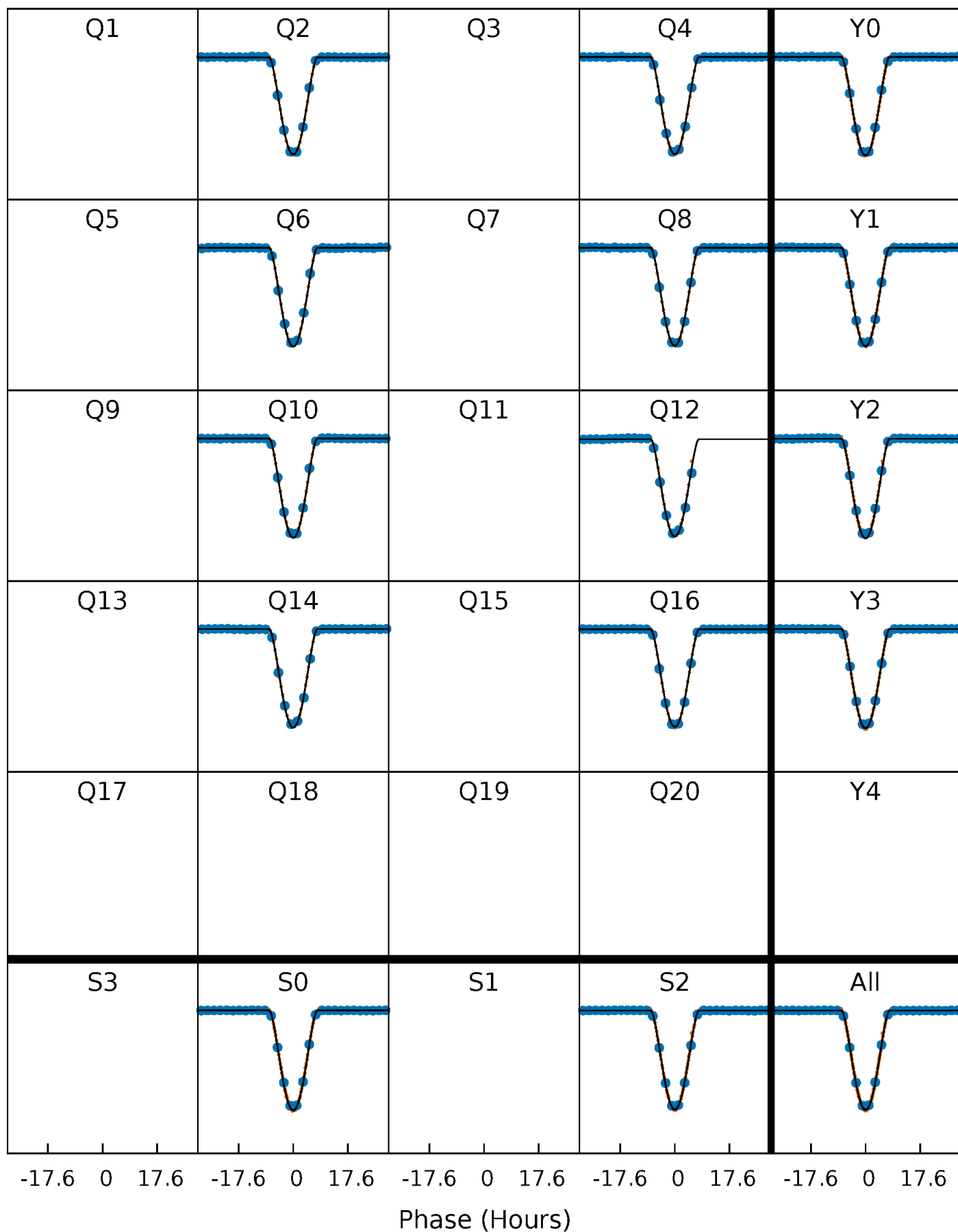
TCE 009785454-01 P=184.520208 Days  $T_0=237.698762$  (BKJD)





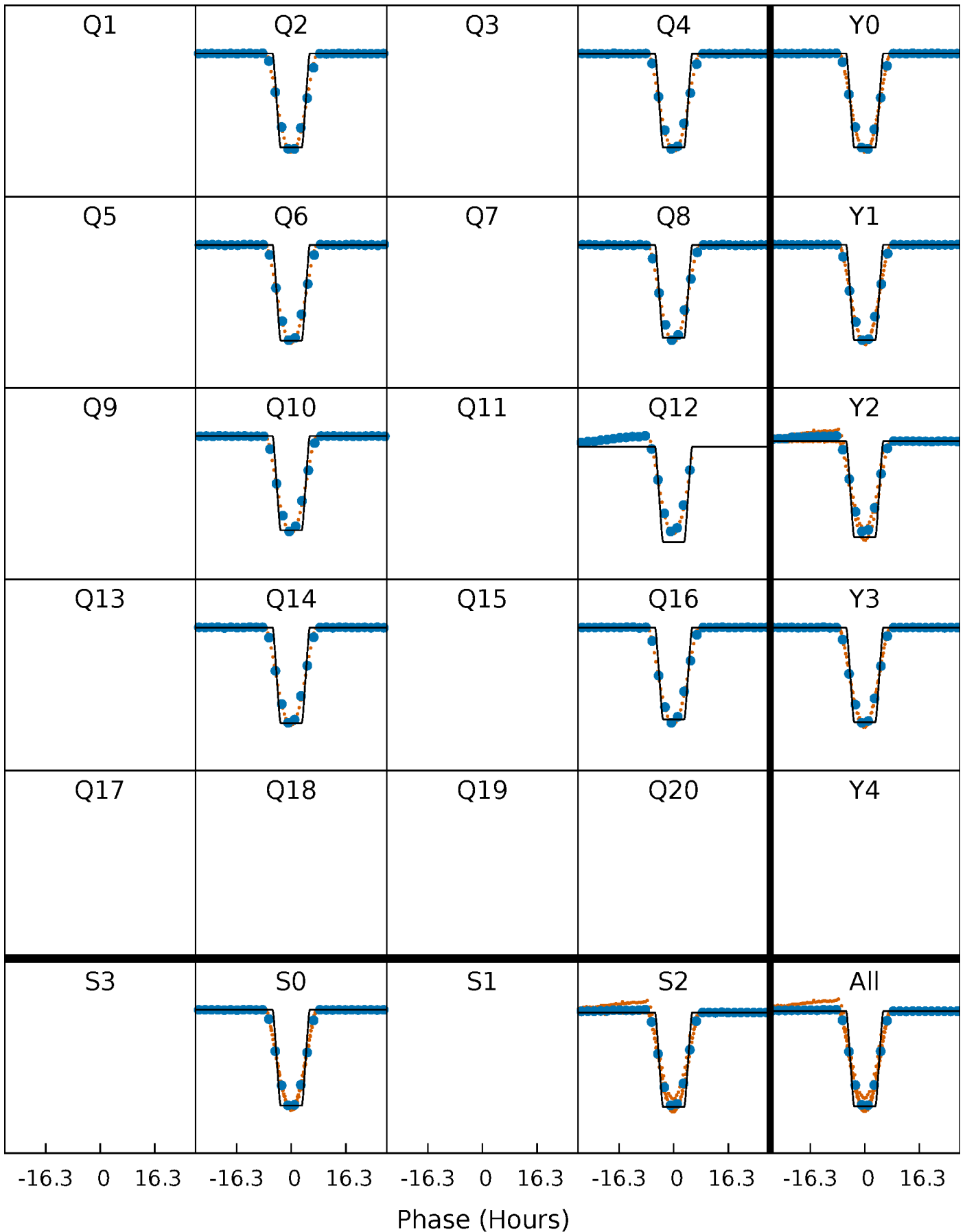
# DV Quarter-Phased Transit Curves

TCE 009785454-01 P=184.520208 Days  $T_0=237.698762$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

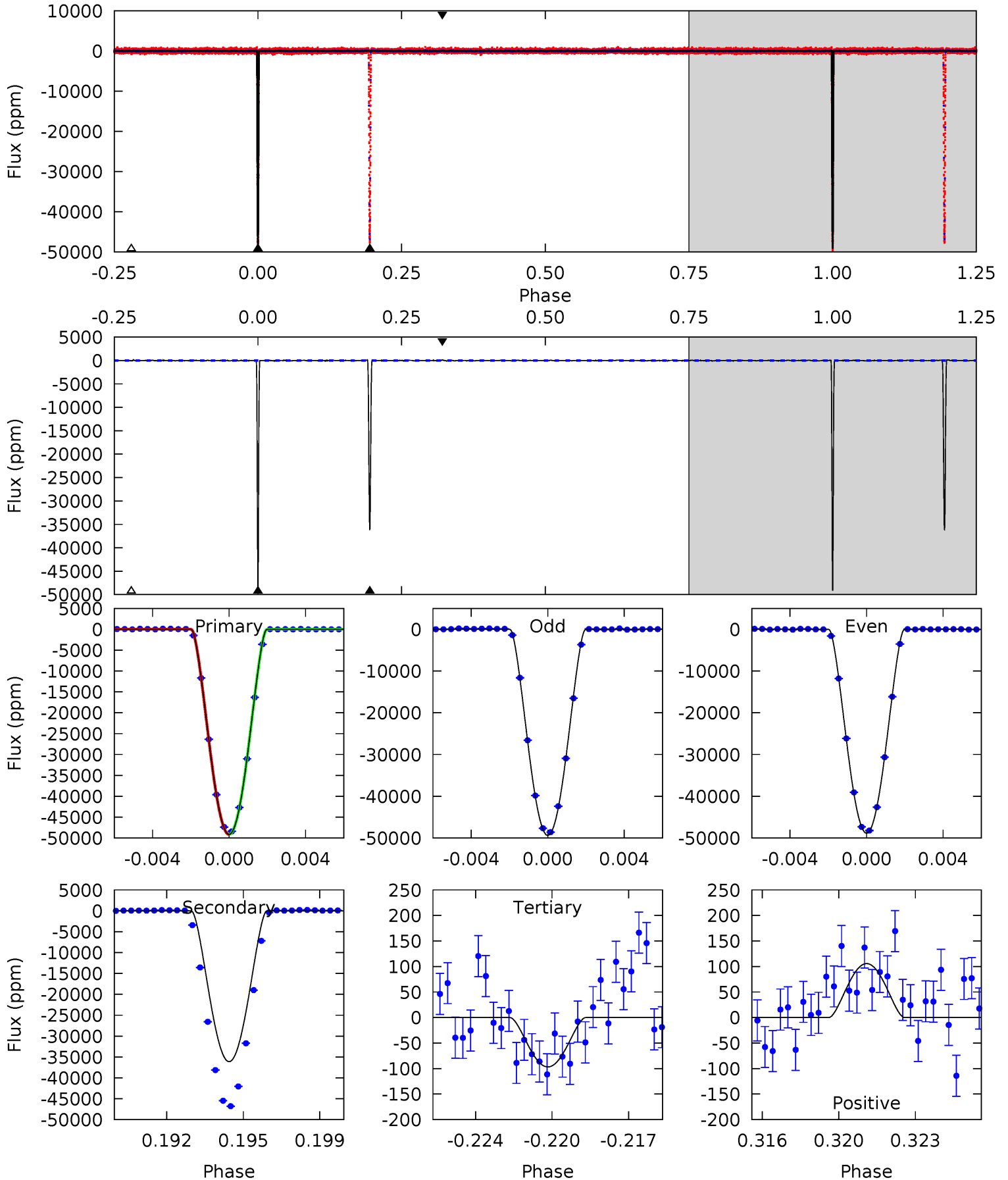
TCE 009785454-01 P=184.521858 Days  $T_0=237.692924$  (BKJD)



# DV Model-Shift Uniqueness Test

009785454-01, P = 184.520208 Days, E = 53.178554 Days

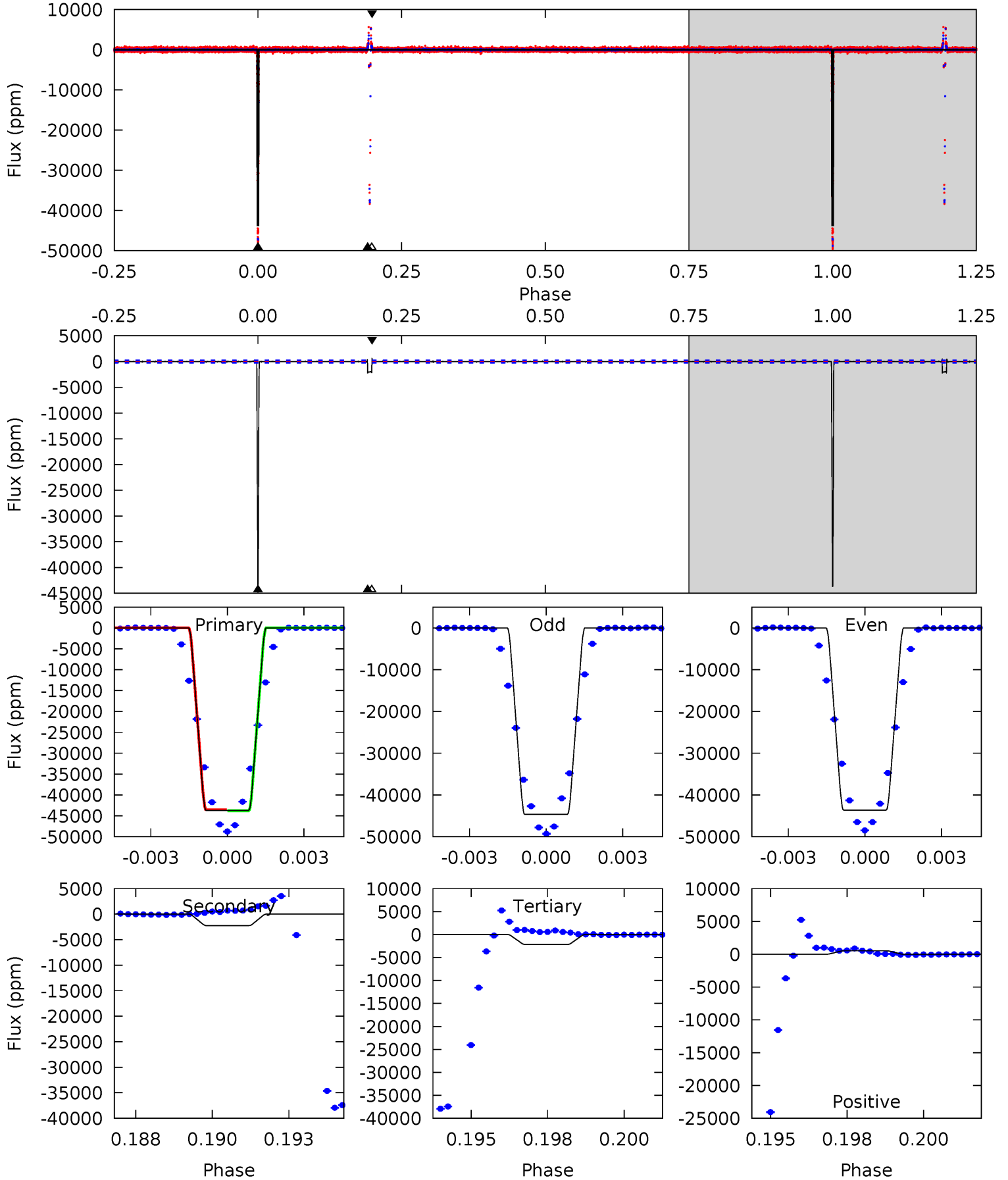
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
3525	2591	6.94	7.58	5.22	2.92	2.41	3518	3517	2584	2583	18.4	1.00	0.00	1.69



# Alt Model-Shift Uniqueness Test

009785454-01, P = 184.521858 Days, E = 53.171066 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
1013	52.0	49.9	12.0	5.29	3.02	1.48	962.7	1001	2.14	39.9	11.5	0.98	0.01	0



### Stellar Parameters For KIC 009785454

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5341^{+160}_{-144}$	$4.514^{+0.096}_{-0.132}$	$-0.440^{+0.350}_{-0.300}$	$0.776^{+0.140}_{-0.105}$	$0.718^{+0.115}_{-0.046}$	$2.166^{+0.980}_{-0.793}$
	+3%/-3%	+2%/-3%	+80%/-68%	+18%/-14%	+16%/-6%	+45%/-37%
Source	PHO1	KIC0	KIC0	DSEP		

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

### Secondary Eclipse Parameters for KIC 009785454-01 / KOI 3577.01

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-36124 \pm 14$	$24.61^{+2.66}_{-2.16}$	$388^{+20}_{-18}$	$4556^{+117}_{-120}$	$11227^{+1873}_{-1871}$
Alt.	$-2244 \pm 43$	$18.71^{+1.96}_{-1.45}$	$388^{+21}_{-18}$	$3110^{+63}_{-64}$	$1148^{+193}_{-187}$

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

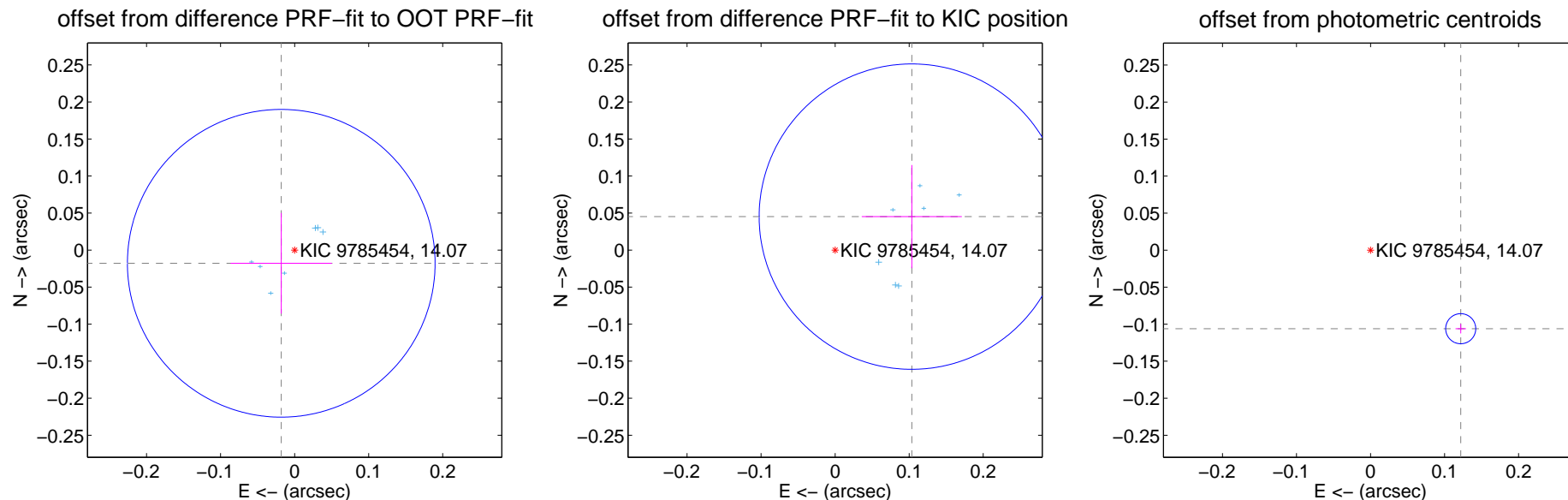
## DV Centroid Data

Supplemental centroid analysis for 009785454-01. Kepler magnitude: 14.07. Transit SNR 1429.71

There are 7 quarters with good PRF difference image offsets

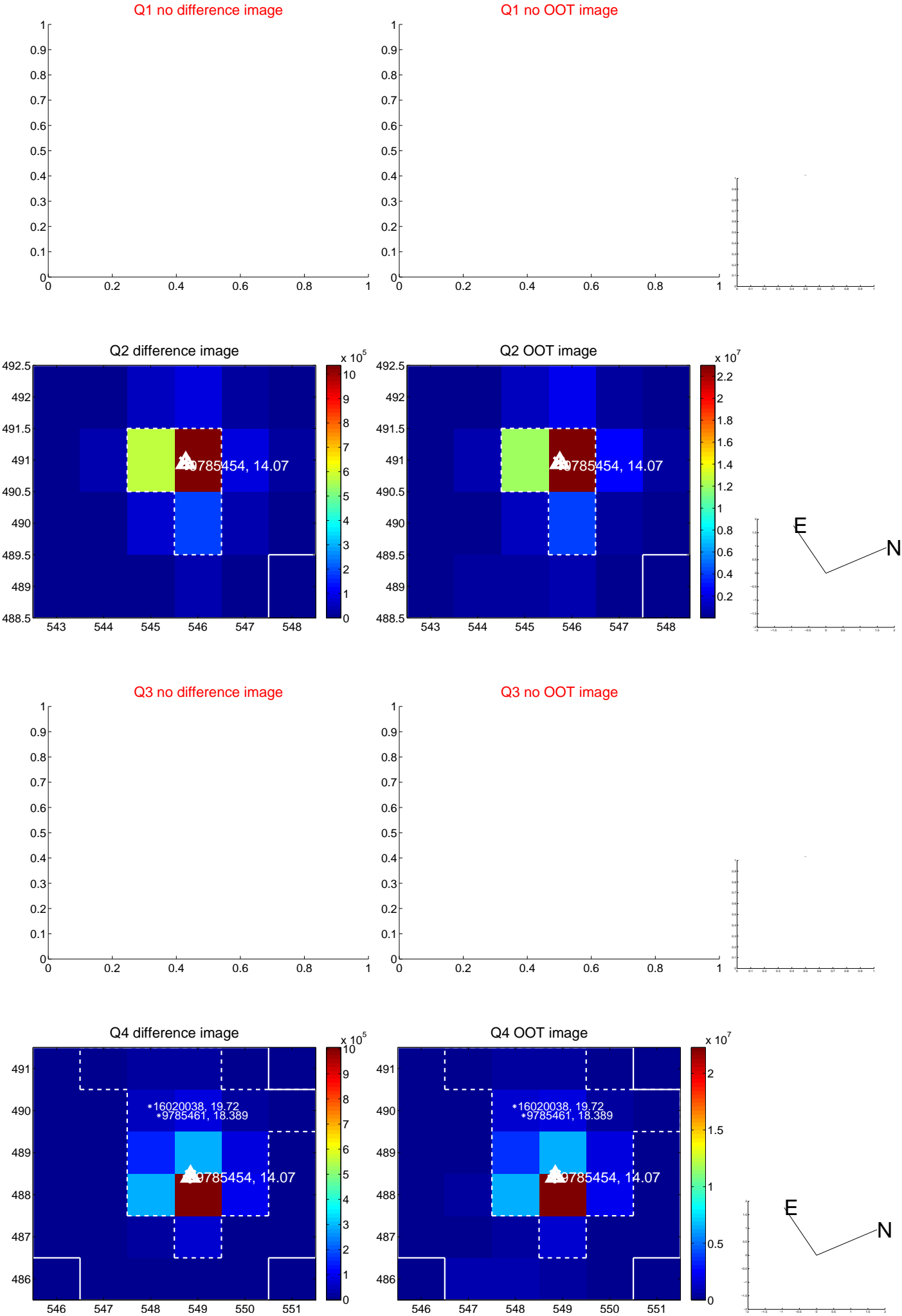
The direct PRF centroid is offset from the target star catalog position by about 0.09 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.025 \pm 0.069$	0.37	$0.018 \pm 0.068$	$-0.018 \pm 0.068$
PRF-fit source offset from KIC position	$0.113 \pm 0.069$	1.64	$-0.104 \pm 0.068$	$0.045 \pm 0.070$
photometric centroid source offset	$0.16 \pm 0.01$	23.87	$-0.12 \pm 0.01$	$-0.11 \pm 0.01$

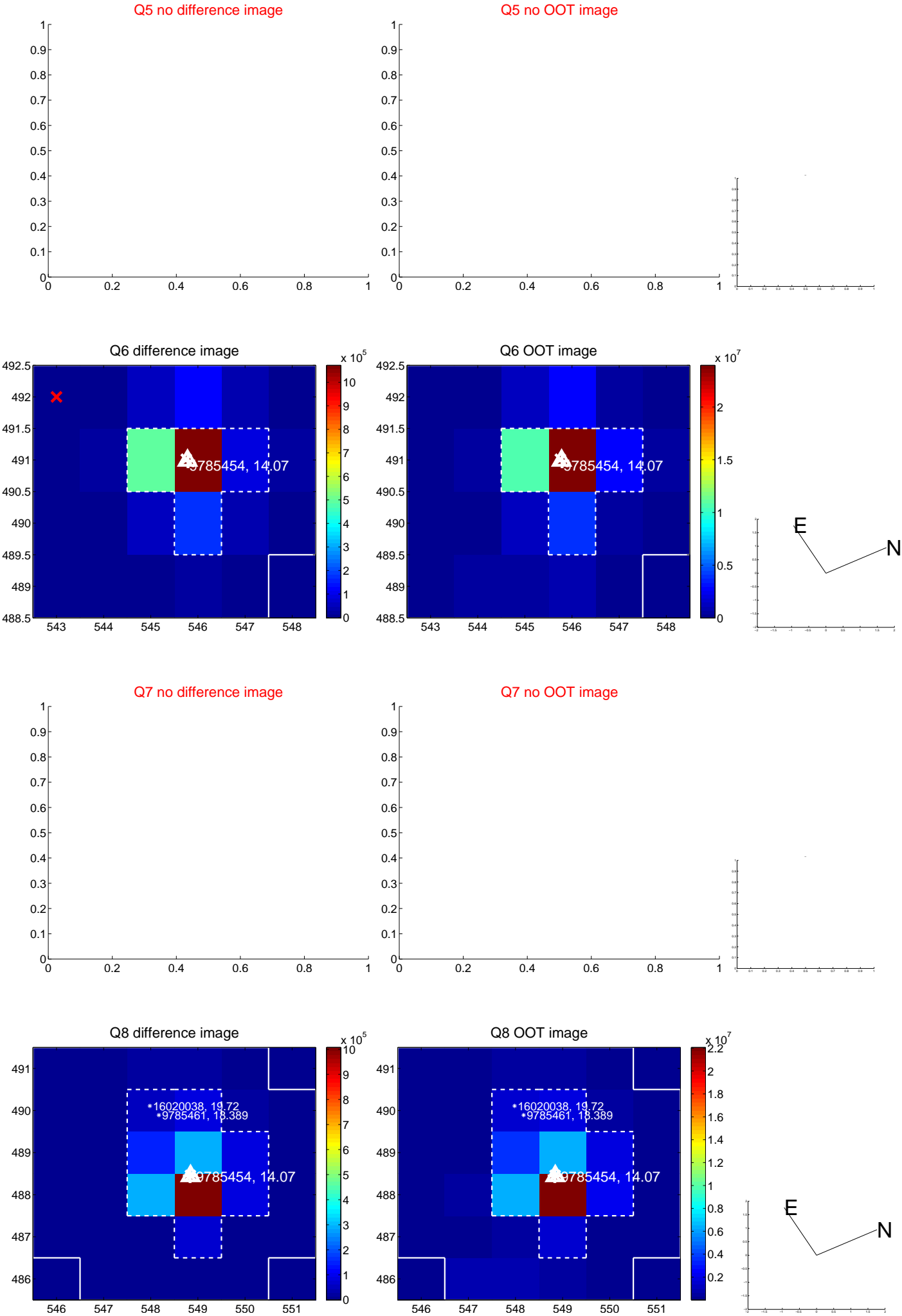


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

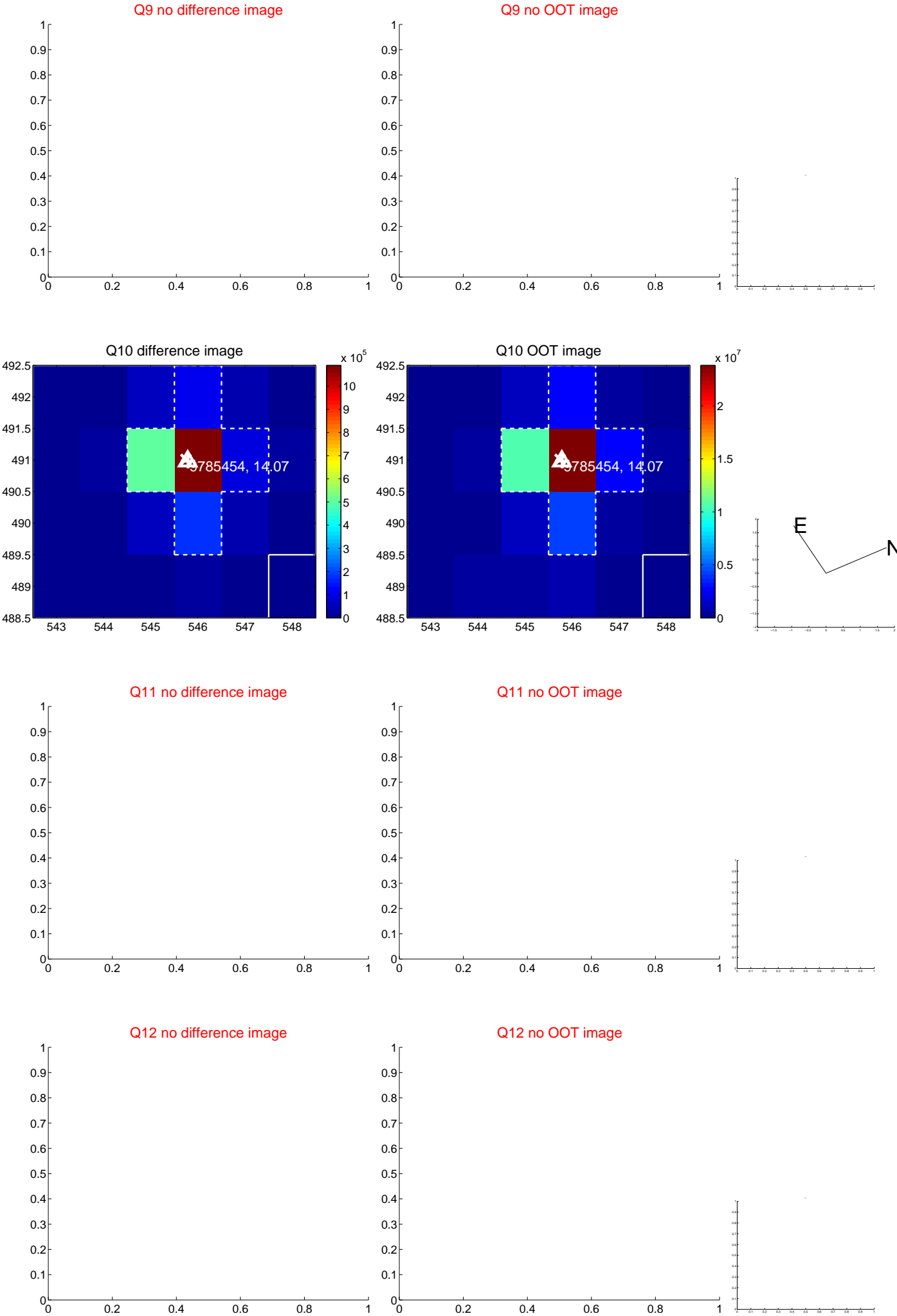


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

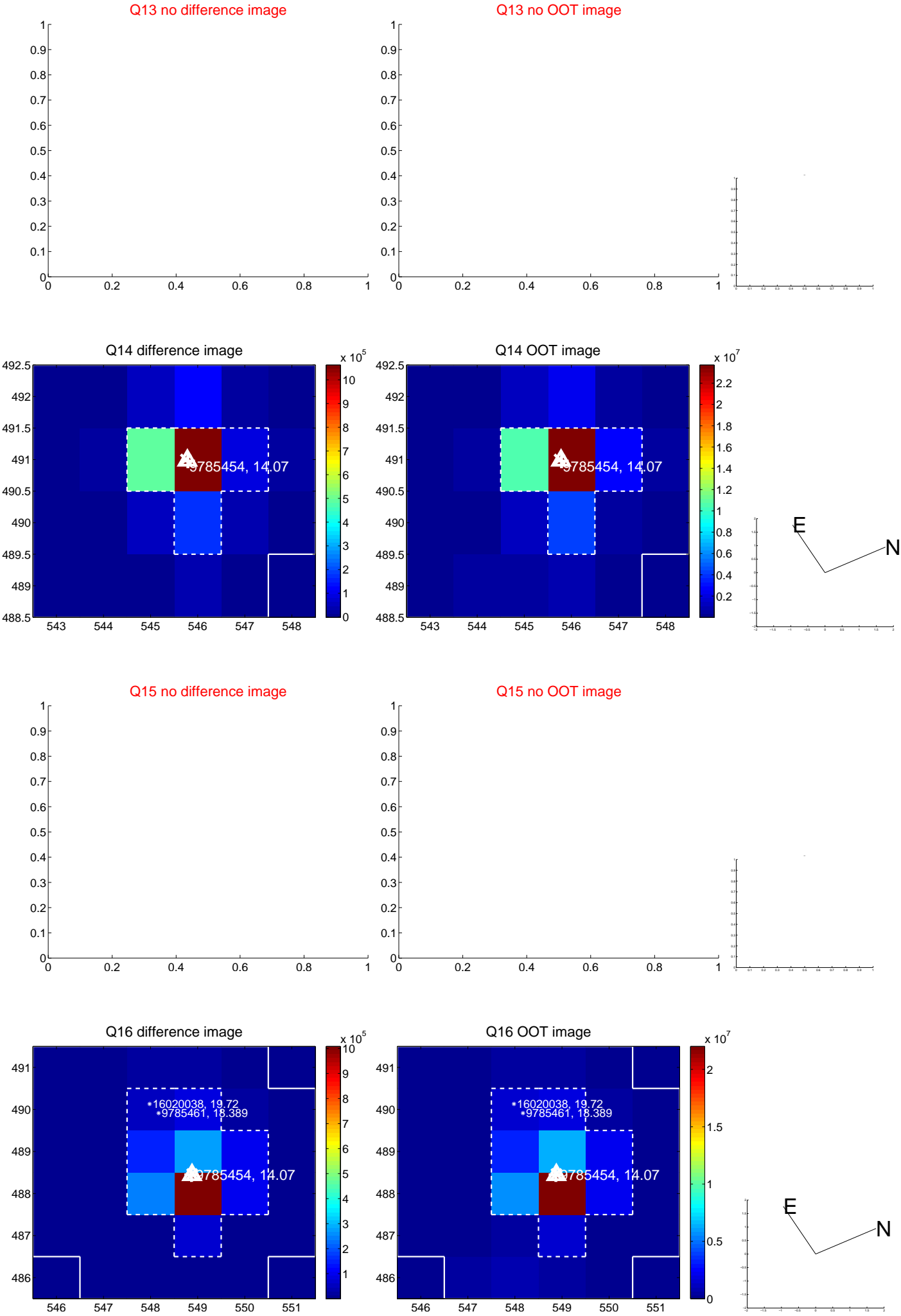




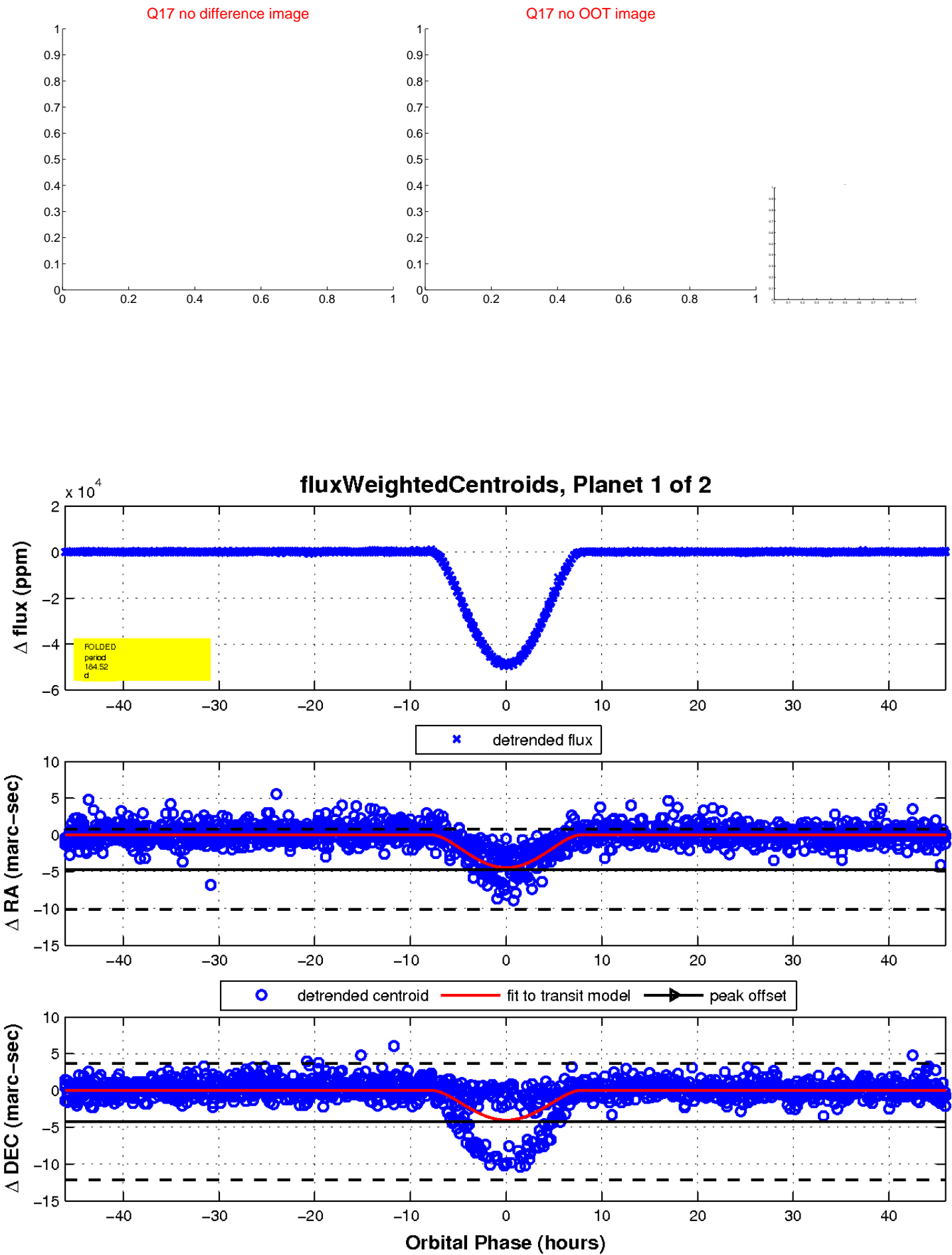
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

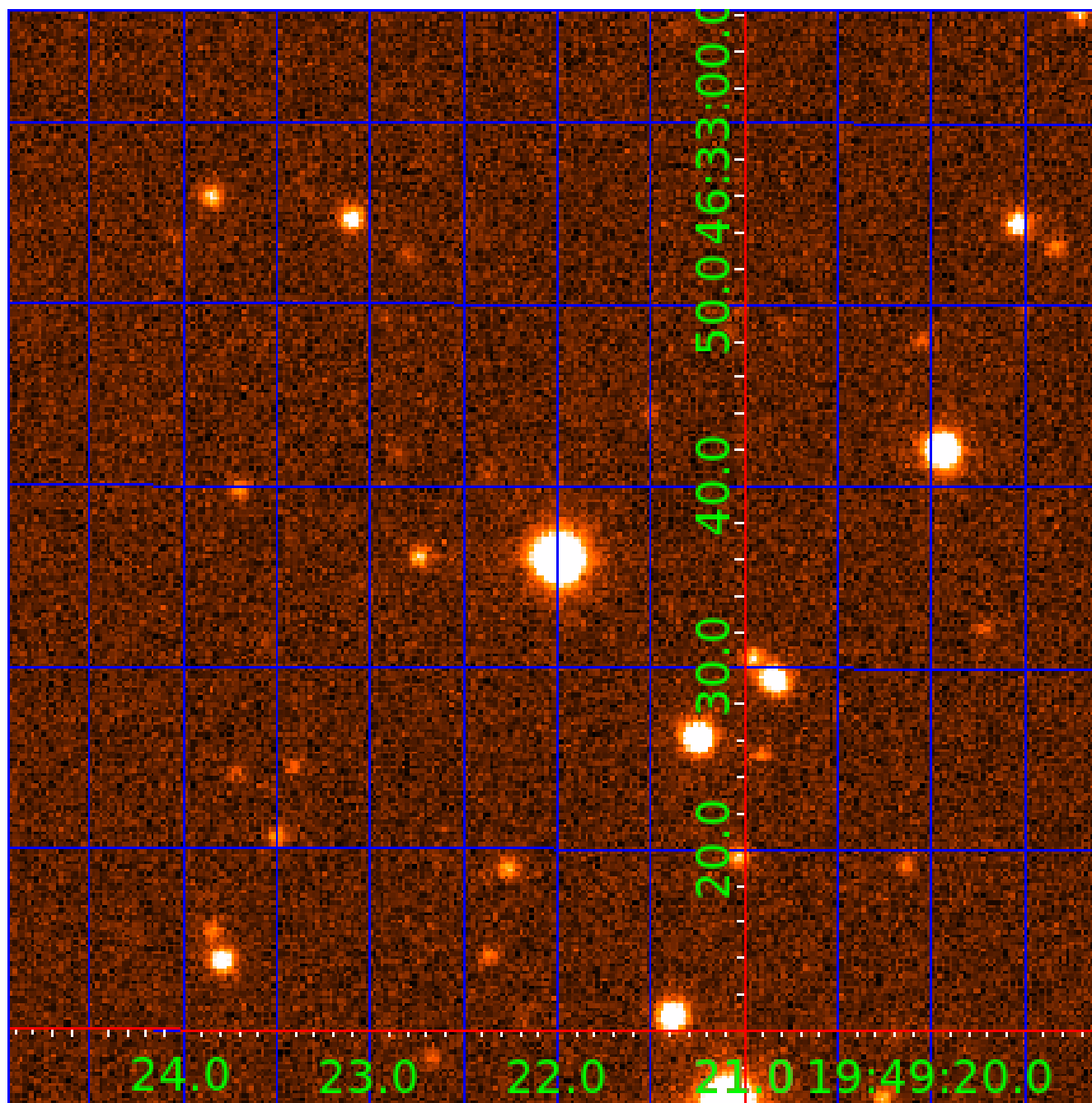


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 009785454

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009785454-01	OBS	3577.01	184.520208	237.698762	49280.3	15.361	1568.7	1429.7	0.78	5341	24.00	1.36
009785454-02	OBS	No	184.520119	273.603545	47257.1	16.472	1283.2	1233.3	0.78	5341	26.43	1.36

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009785454-01	OBS	FP	0.00	0	1	0	0	MOD_SEC_DV—DEEP_V_SHAPED—HAS_SEC_TCE
009785454-02	OBS	FP	0.00	1	1	0	0	IS_SEC_TCE

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

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

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

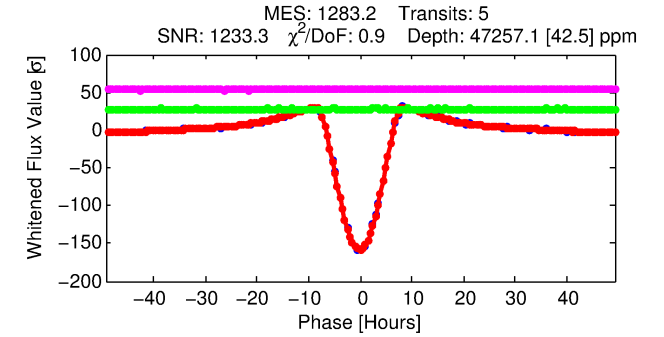
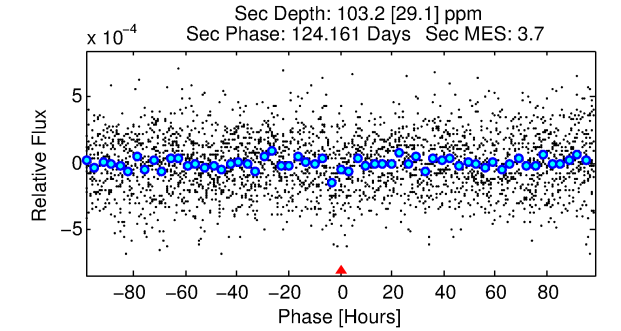
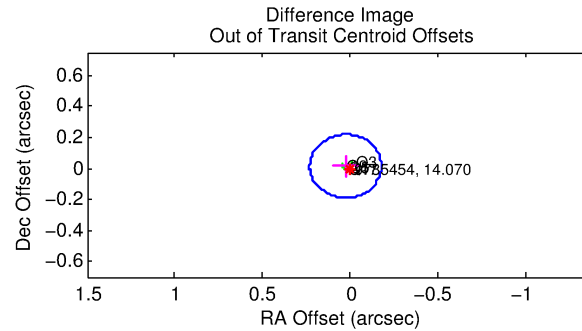
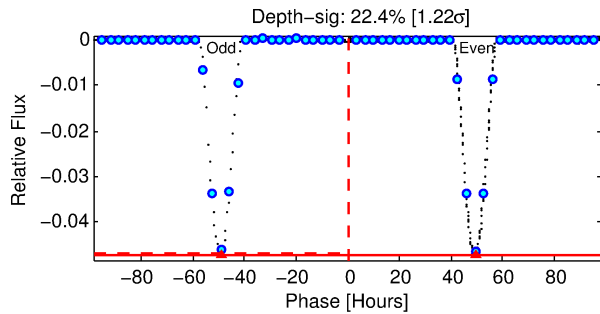
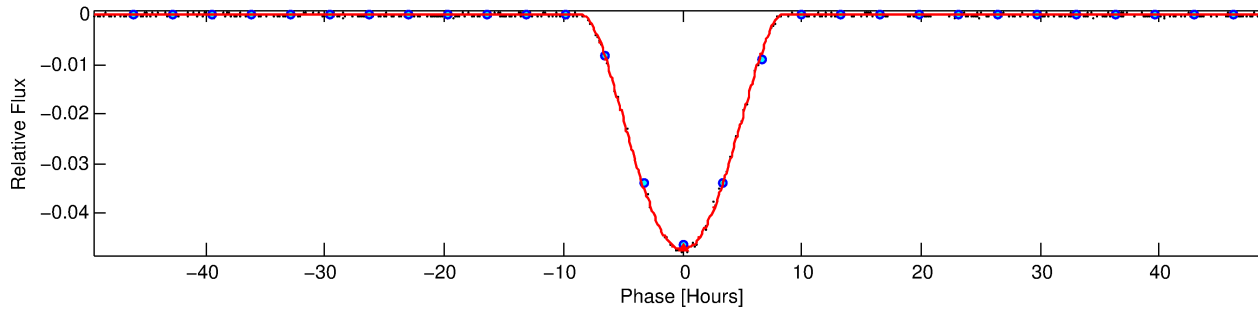
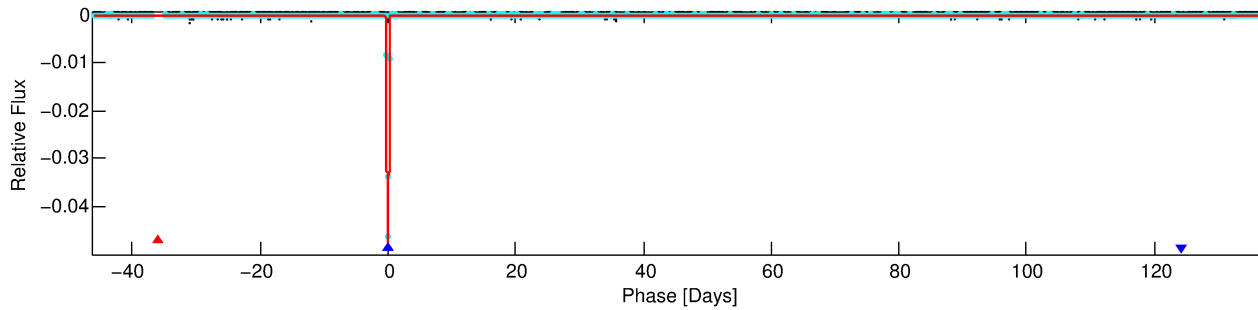
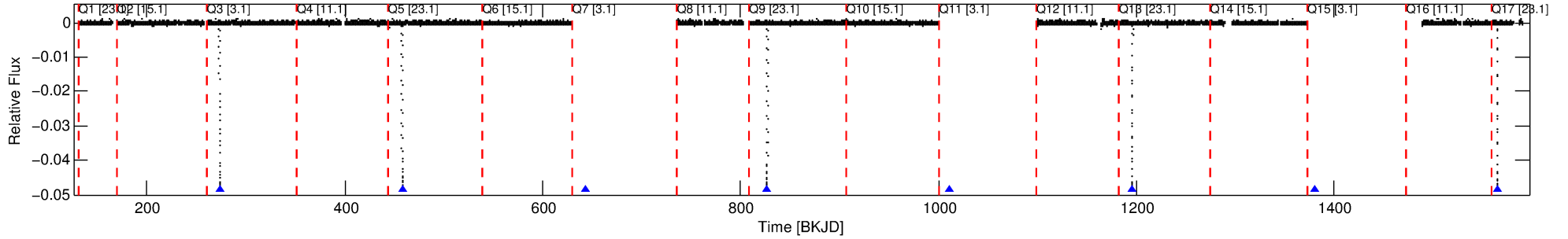
## Ephemeris Match Information For 009785454-02

No Significant Match Found

# DV One-Page Summary

KIC: 9785454 Candidate: 2 of 2 Period: 184.520 d  
KOI: K03577 Corr: No Ephemeris Match

Kp: 14.07 R\*: 0.78 Rs Teff: 5341.0 K Logg: 4.51 Fe/H: -0.440



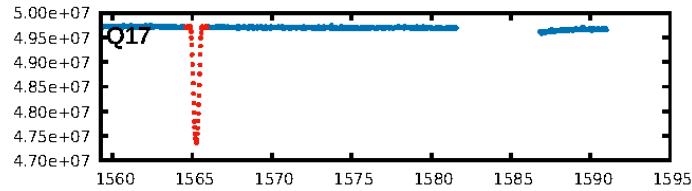
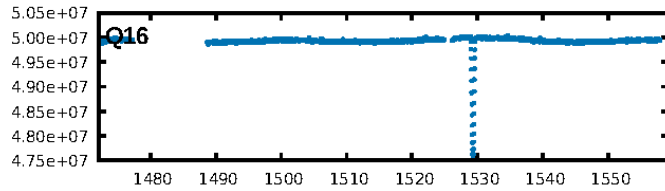
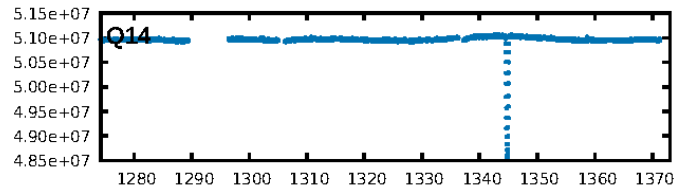
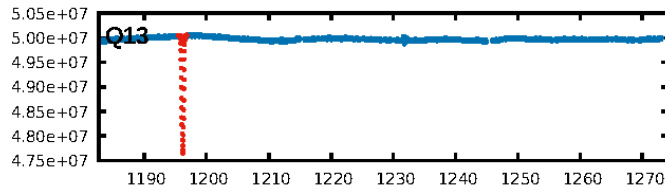
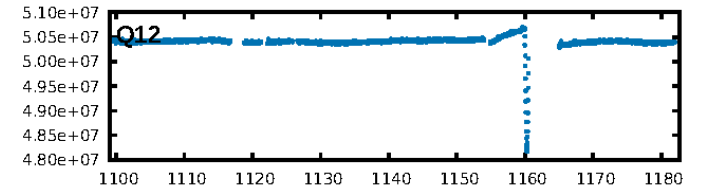
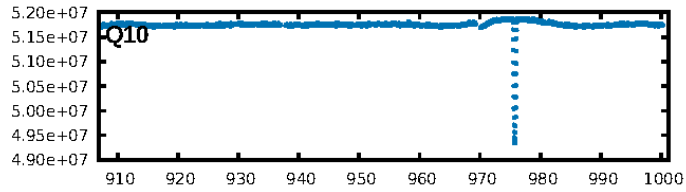
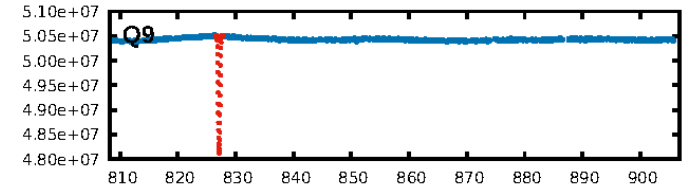
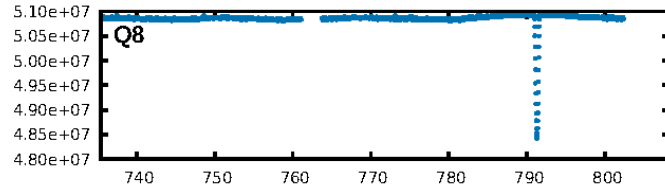
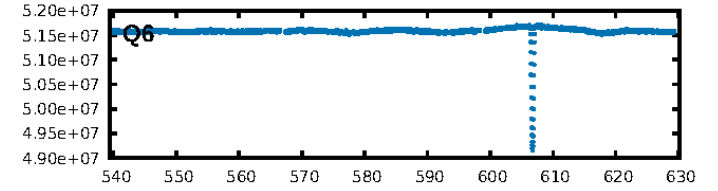
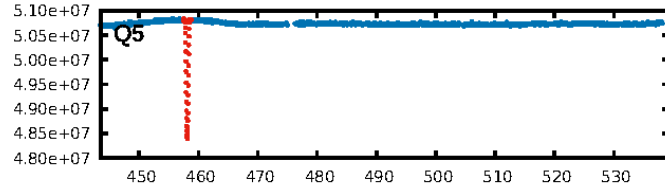
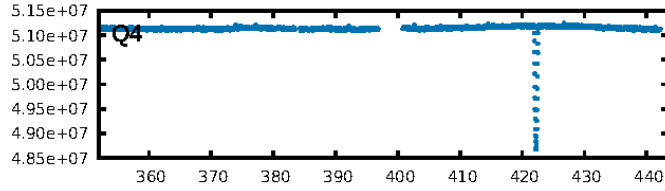
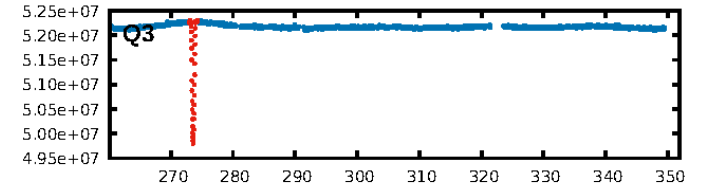
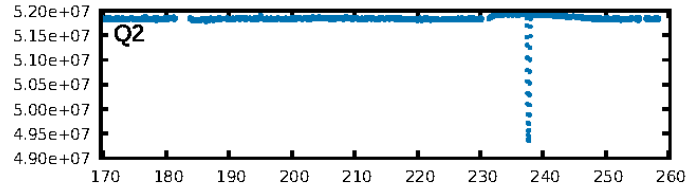
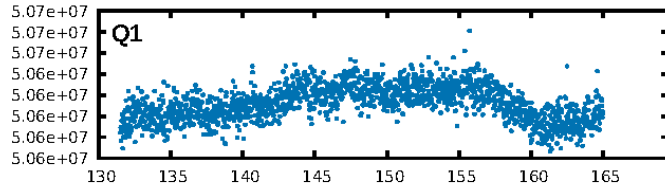
## DV Fit Results:

Period = 184.52012 [0.00005] d  
Epoch = 273.6035 [0.0002] BKJD  
Rp/R\* = 0.3121 [0.0142]  
a/R\* = 77.12 [0.18]  
b = 0.95 [0.02]  
Seff = 1.36 [0.36]  
Teq = 275 [18] K  
Rp = 26.43 [4.92] Re  
a = 0.5679 [0.0893] AU  
Ag = 26.21 [9.92] [2.54σ]  
Teffp = 963 [77] K [8.70σ]

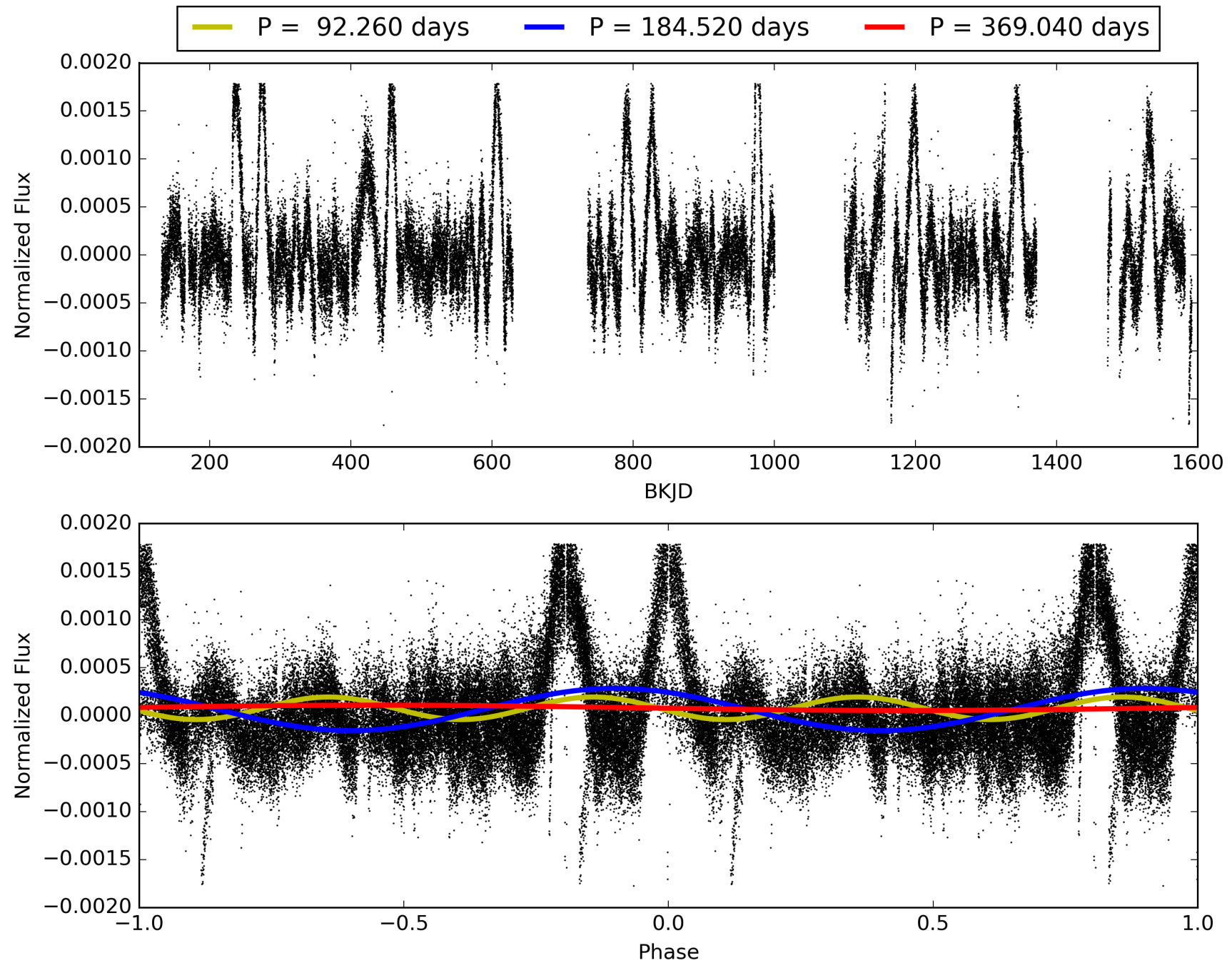
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 0.0% [0.00σ]  
ModelChiSquare2-sig: 20.2%  
ModelChiSquareGof-sig: 99.8%  
Bootstrap-pfa: 0.00e+00  
RollingBand-fgt: 1.00 [4/4]  
GhostDiagnostic-chr: 9.062  
Centroid-sig: 0.0%  
Centroid-so: 0.122 arcsec [17.07σ]  
OotOffset-rm: 0.032 arcsec [0.46σ]  
KicOffset-rm: 0.015 arcsec [0.22σ]  
OotOffset-st: 0/1/0/3 [4]  
KicOffset-st: 0/1/0/3 [4]  
DiffImageQuality-fgm: 1.00 [4/4]  
DiffImageOverlap-fno: 1.00 [4/4]

# TCE 009785454-02, PDC Light Curves



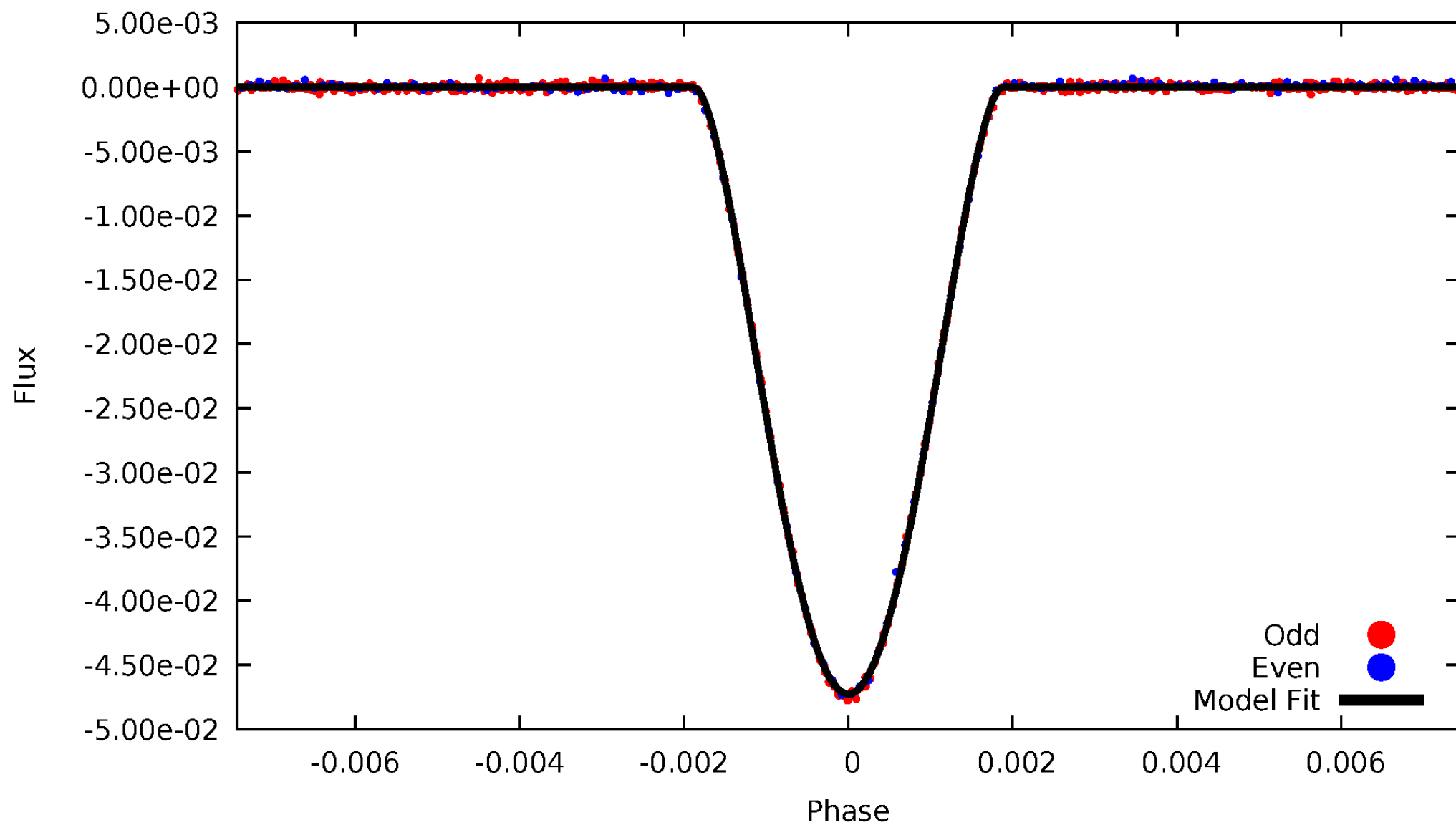
TCE 009785454-02





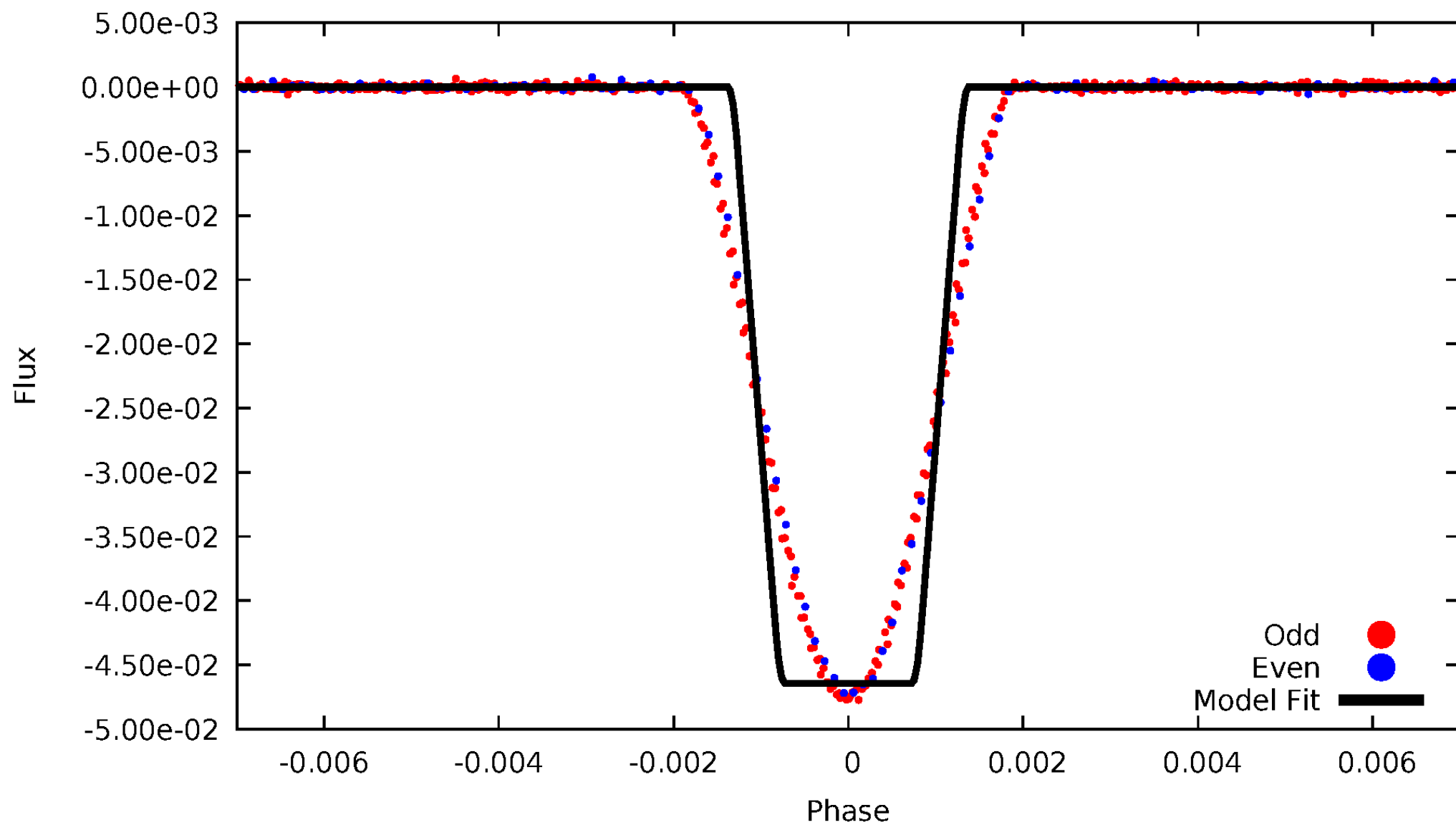
# DV Odd/Even

TCE 009785454-02



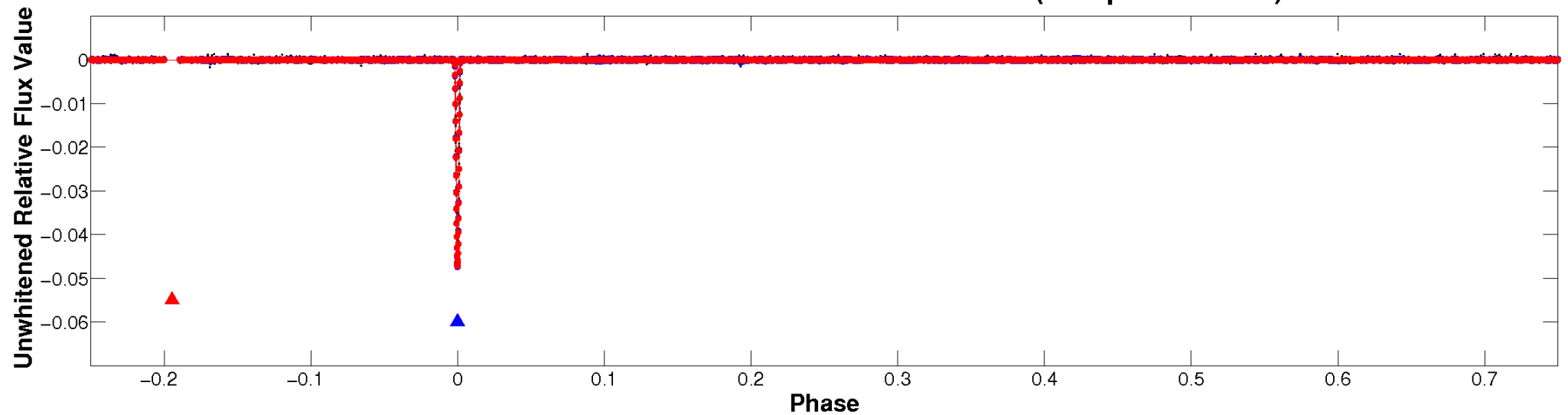
# ALT Odd/Even

TCE 009785454-02

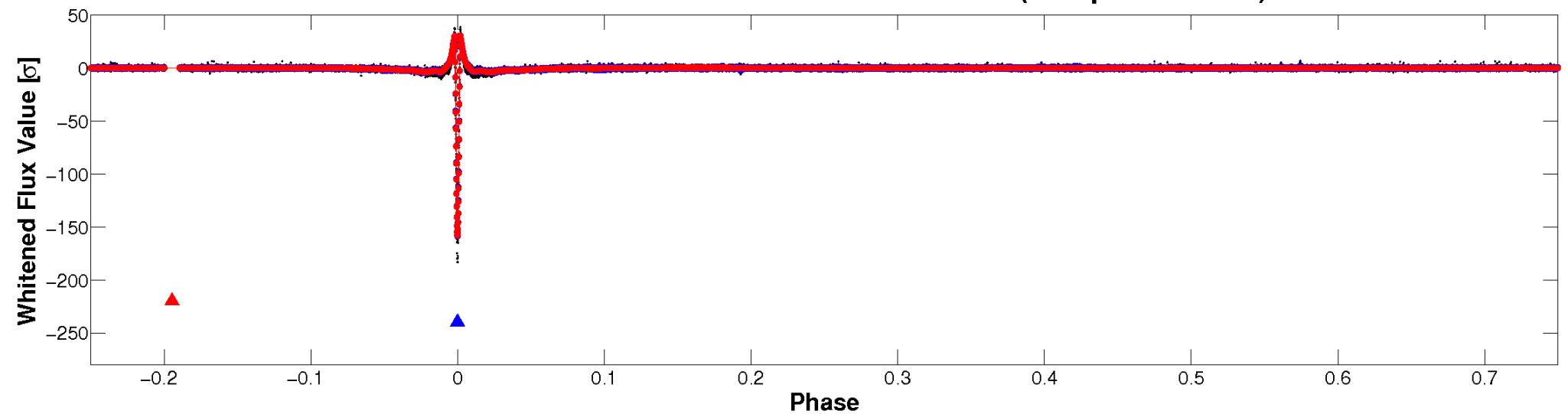


# Non-Whitened Vs. Whitened Light Curve

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

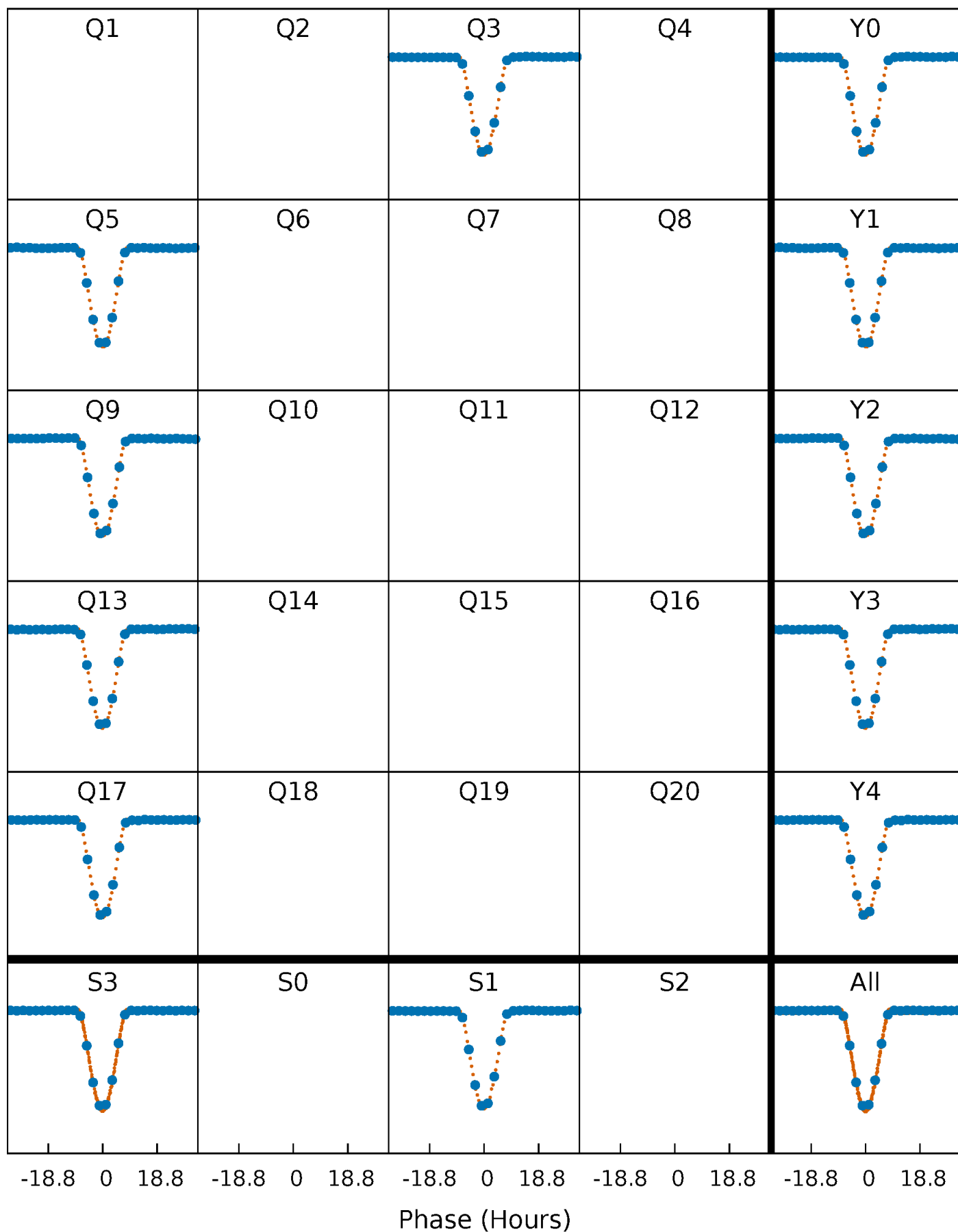


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



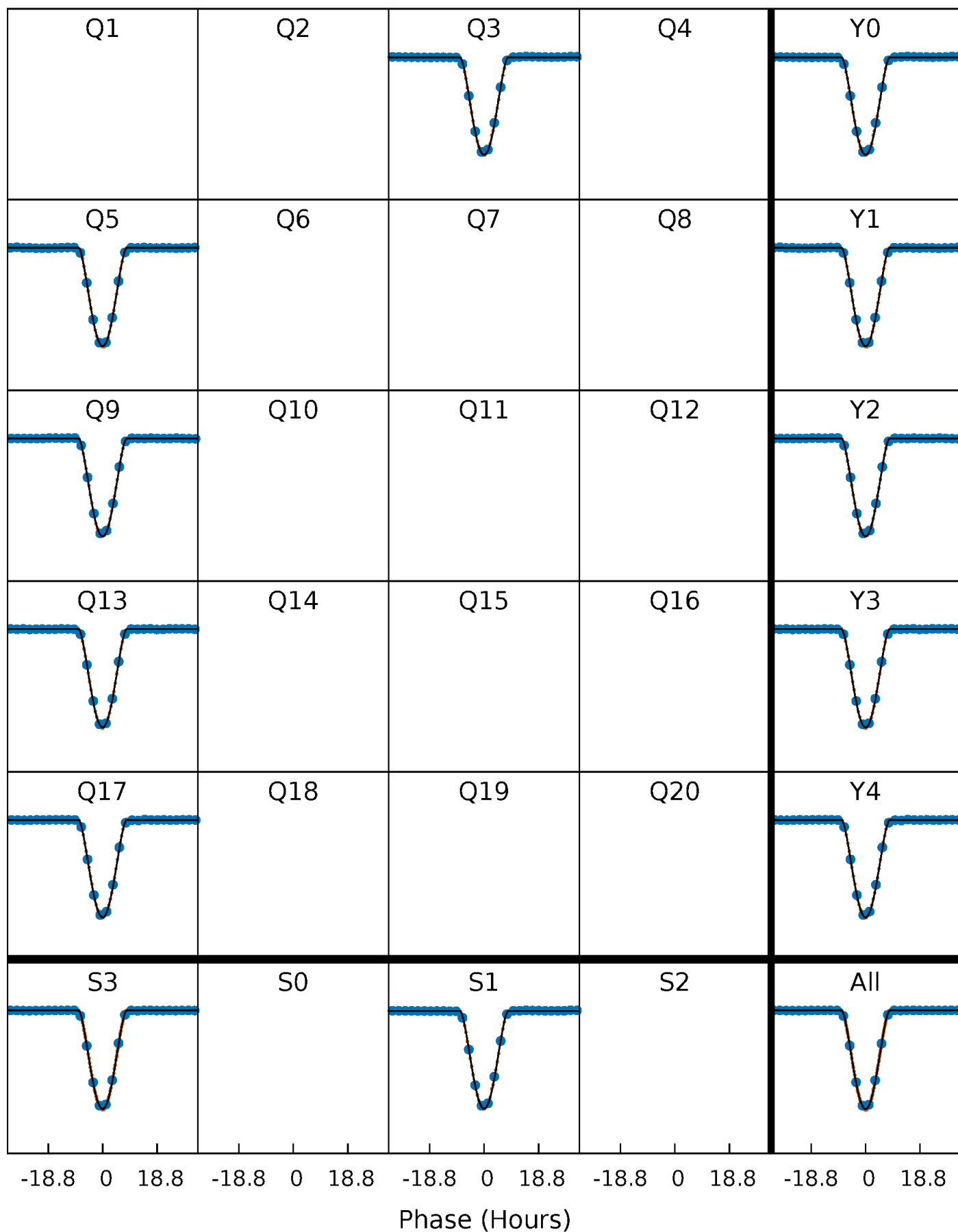
# PDC Quarter-Phased Transit Curves

TCE 009785454-02 P=184.520119 Days  $T_0=273.603545$  (BKJD)



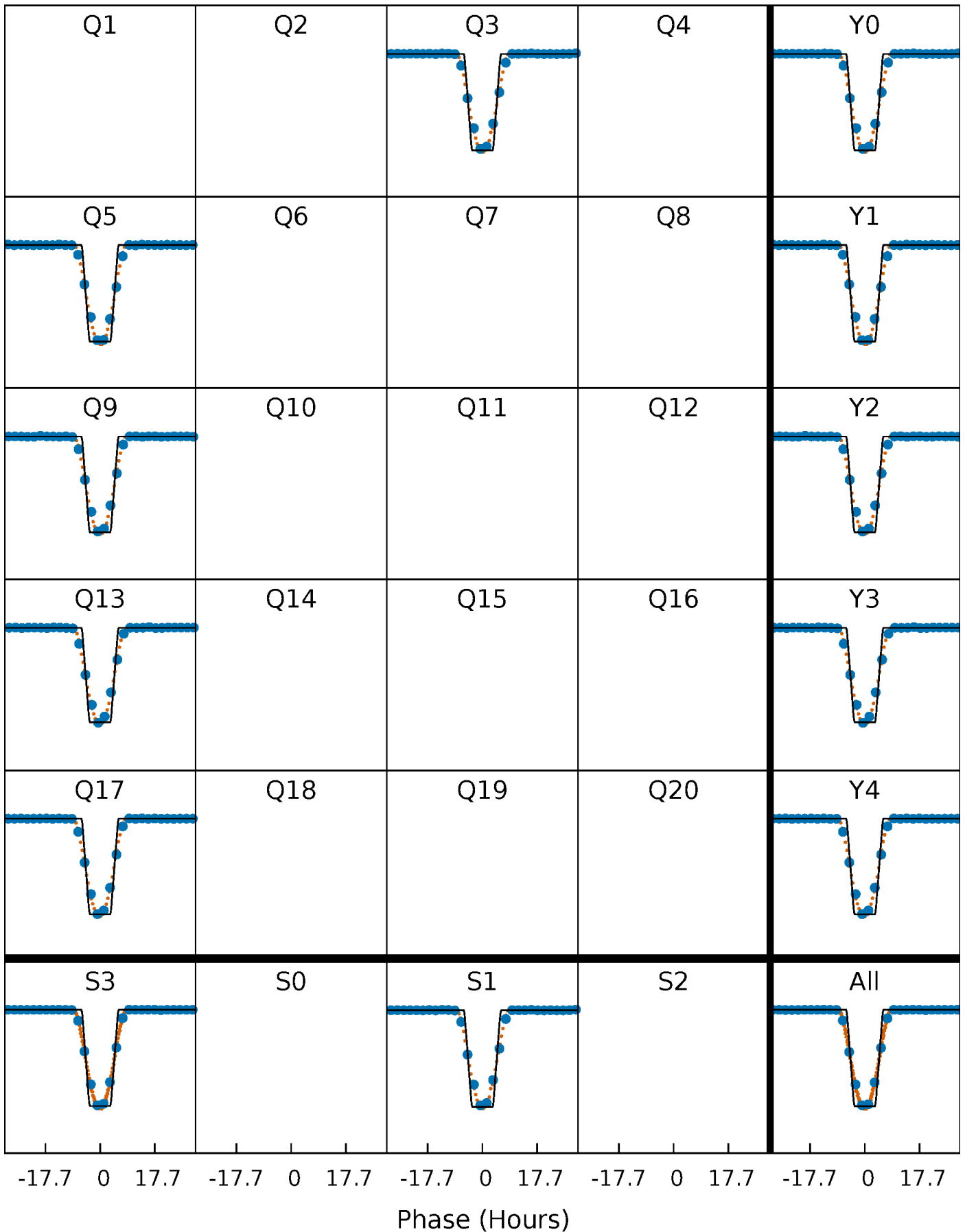
# DV Quarter-Phased Transit Curves

TCE 009785454-02 P=184.520119 Days  $T_0=273.603545$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

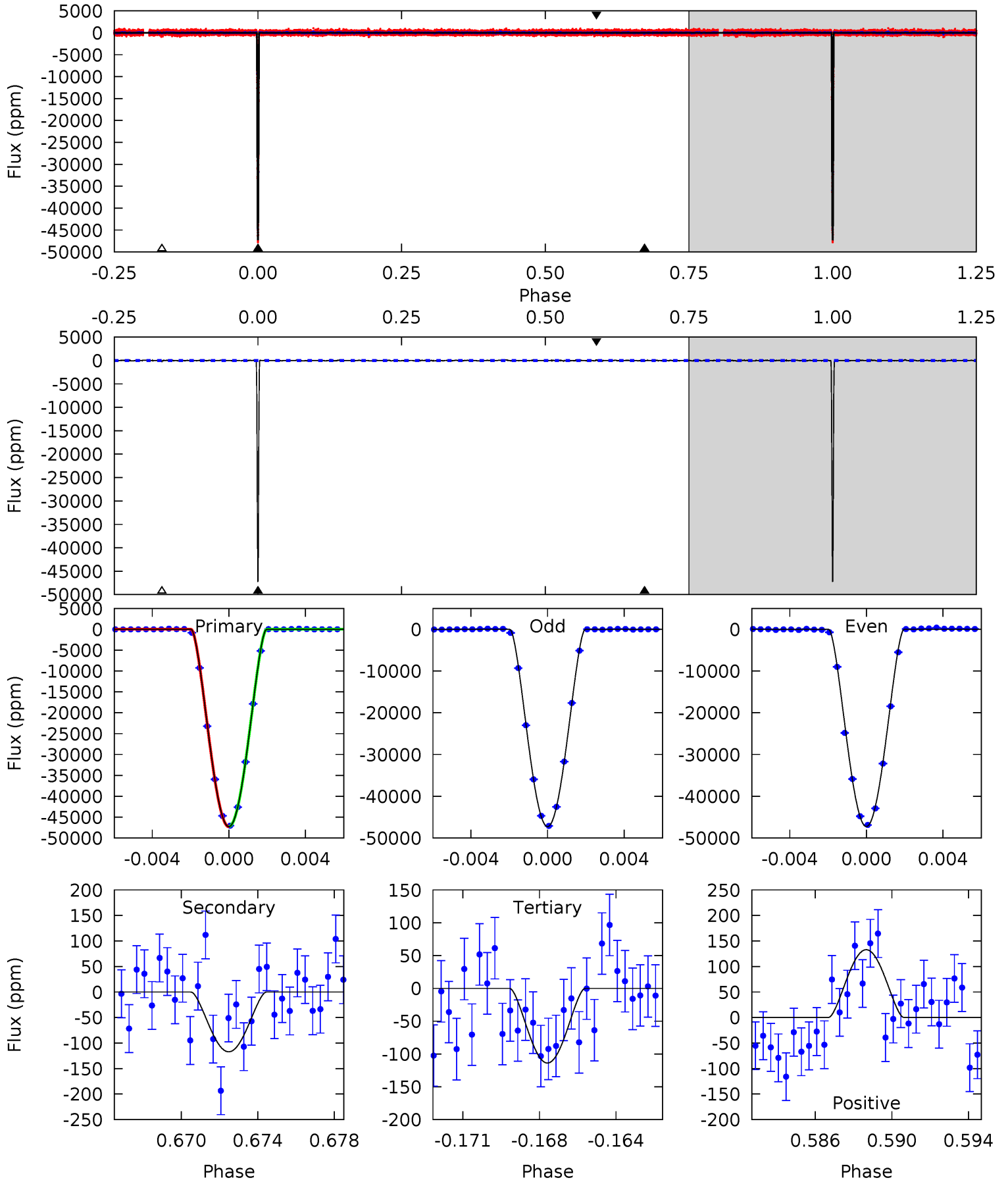
TCE 009785454-02   P=184.521858 Days    $T_0=273.597511$  (BKJD)



# DV Model-Shift Uniqueness Test

009785454-02, P = 184.520119 Days, E = 89.083426 Days

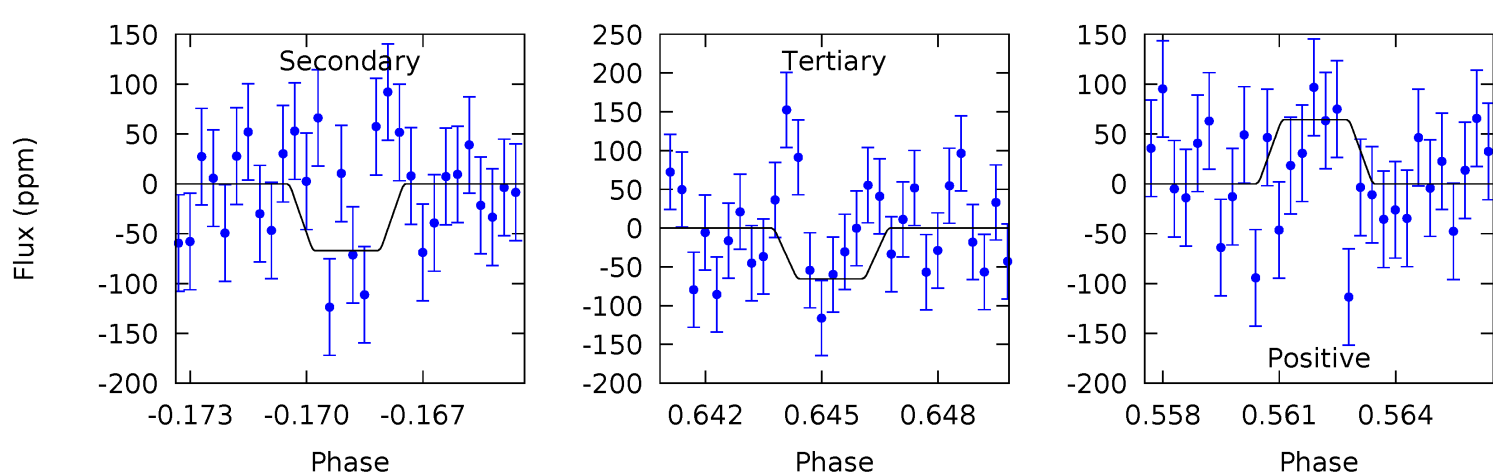
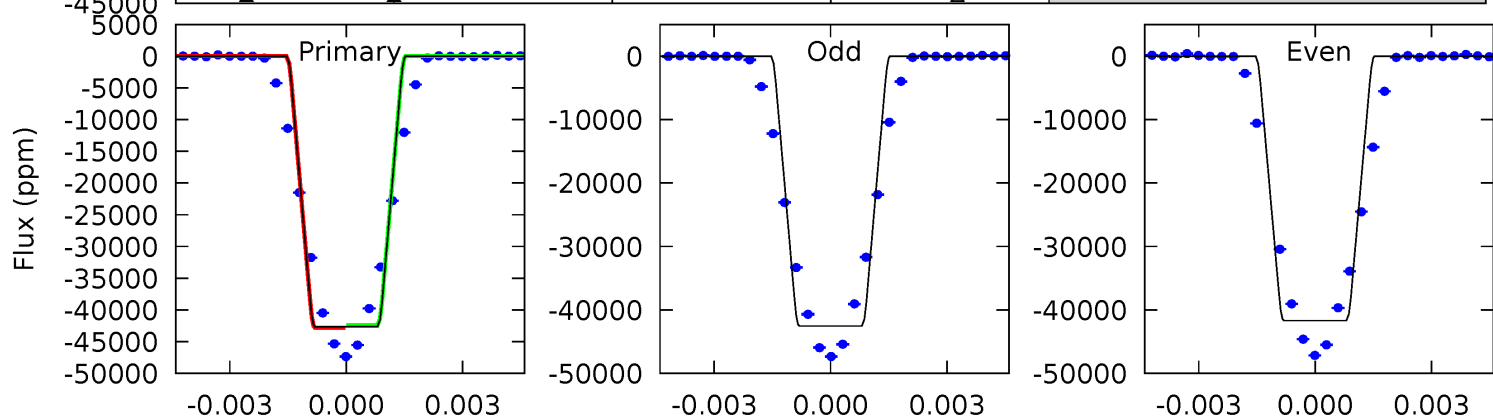
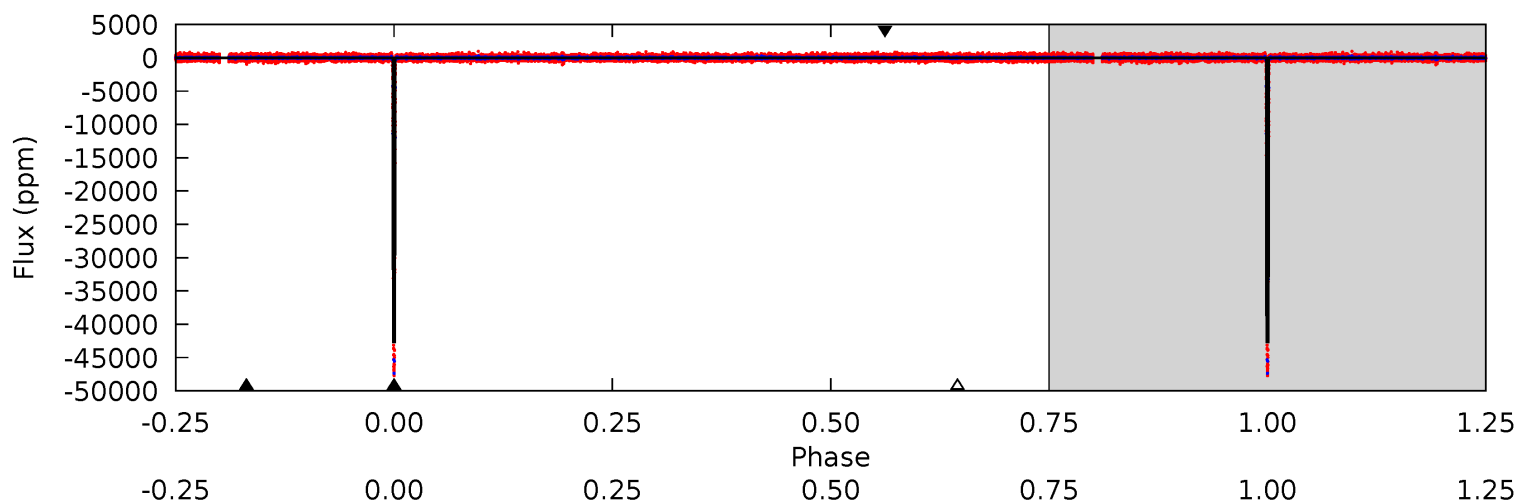
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
2794	6.92	6.72	7.85	5.21	2.89	2.27	2788	2786	0.20	-0.93	0.75	1.00	0.00	1.90



# Alt Model-Shift Uniqueness Test

009785454-02, P = 184.521858 Days, E = 89.075653 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
1945	3.06	2.98	2.93	5.27	3.00	0.80	1942	1942	0.07	0.13	17.6	1.00	0.00	8.24





### Stellar Parameters For KIC 009785454

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$\rho_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5341^{+160}_{-144}$	$4.514^{+0.096}_{-0.132}$	$-0.440^{+0.350}_{-0.300}$	$0.776^{+0.140}_{-0.105}$	$0.718^{+0.115}_{-0.046}$	$2.166^{+0.980}_{-0.793}$
	+3%/-3%	+2%/-3%	+80%/-68%	+18%/-14%	+16%/-6%	+45%/-37%
Source	PHO1	KIC0	KIC0	DSEP		

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

### Secondary Eclipse Parameters for KIC 009785454-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-117 \pm 17$	$26.99^{+3.10}_{-2.61}$	$387^{+21}_{-18}$	$1991^{+42}_{-42}$	$29^{+8}_{-7}$
Alt.	$-67 \pm 22$	$18.60^{+2.46}_{-1.93}$	$388^{+22}_{-17}$	$2029^{+74}_{-82}$	$34^{+15}_{-12}$

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

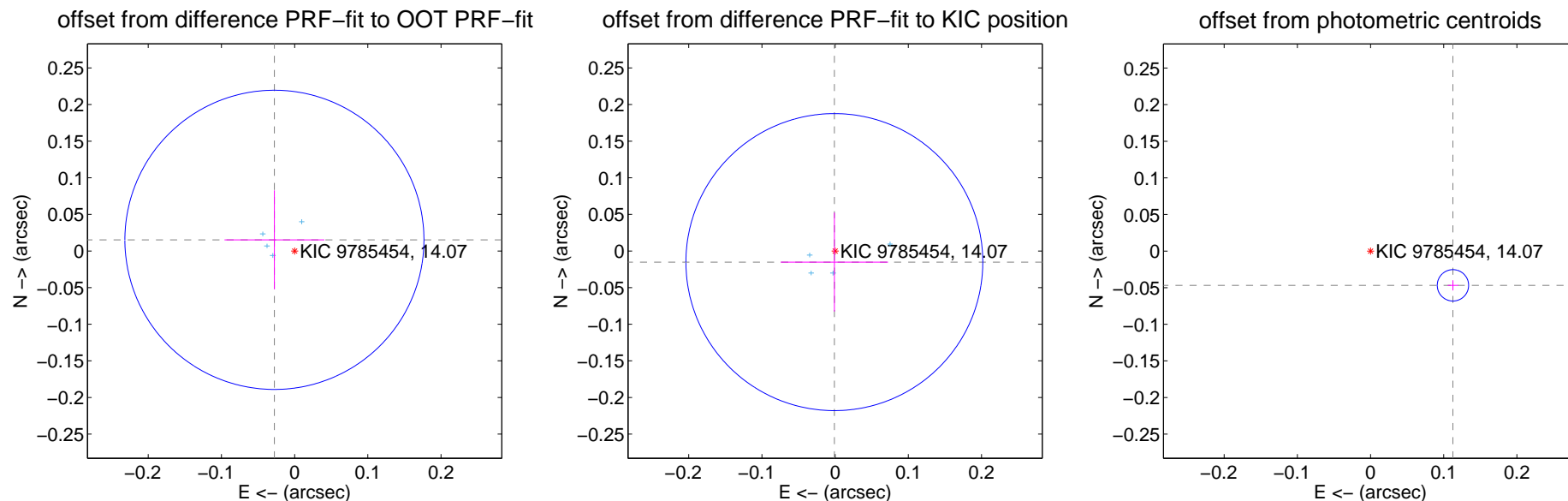
## DV Centroid Data

Supplemental centroid analysis for 009785454-02. Kepler magnitude: 14.07. Transit SNR 1233.35

There are 4 quarters with good PRF difference image offsets

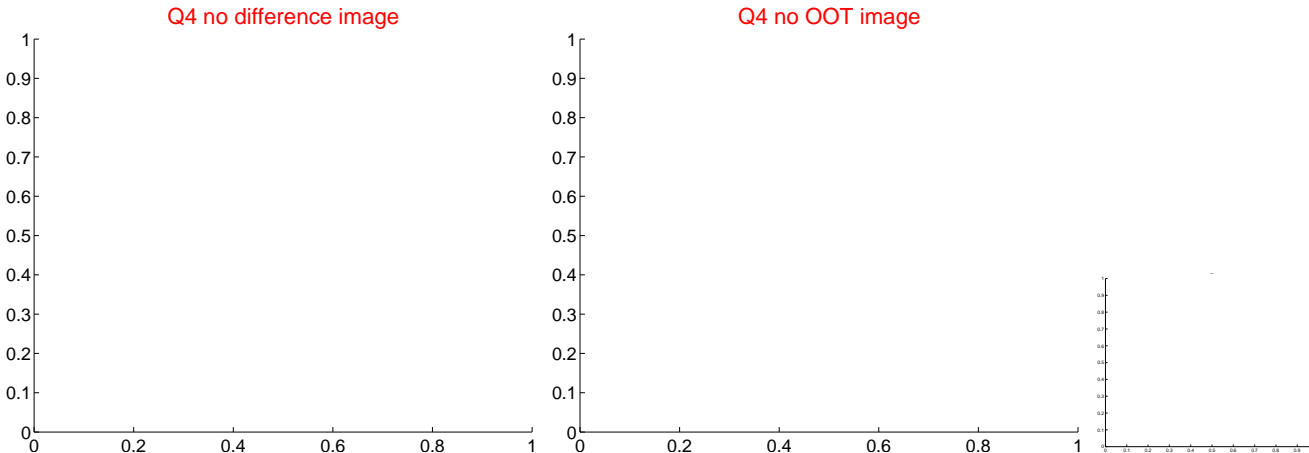
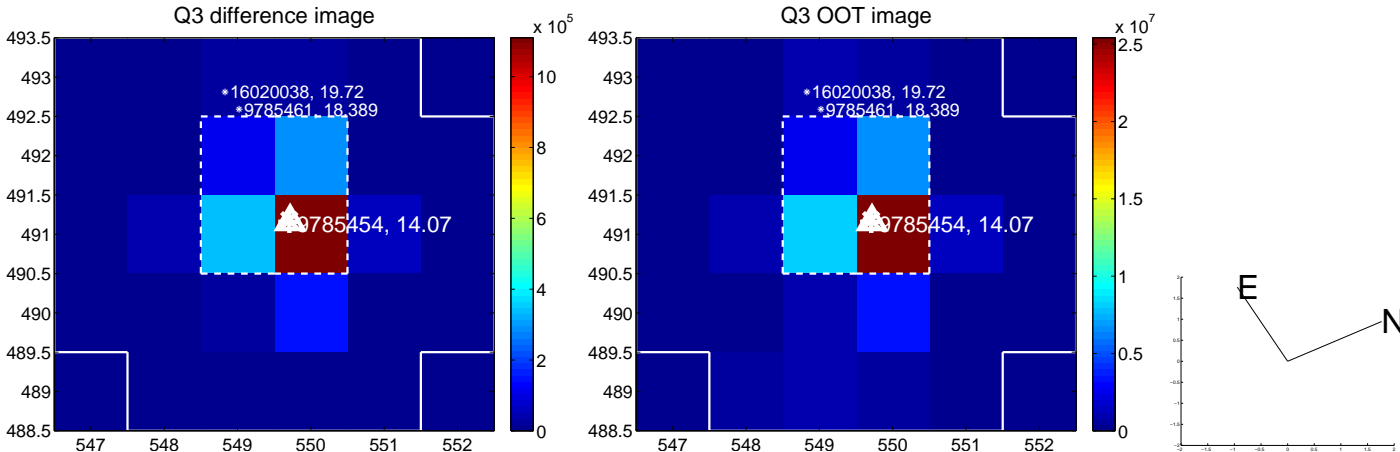
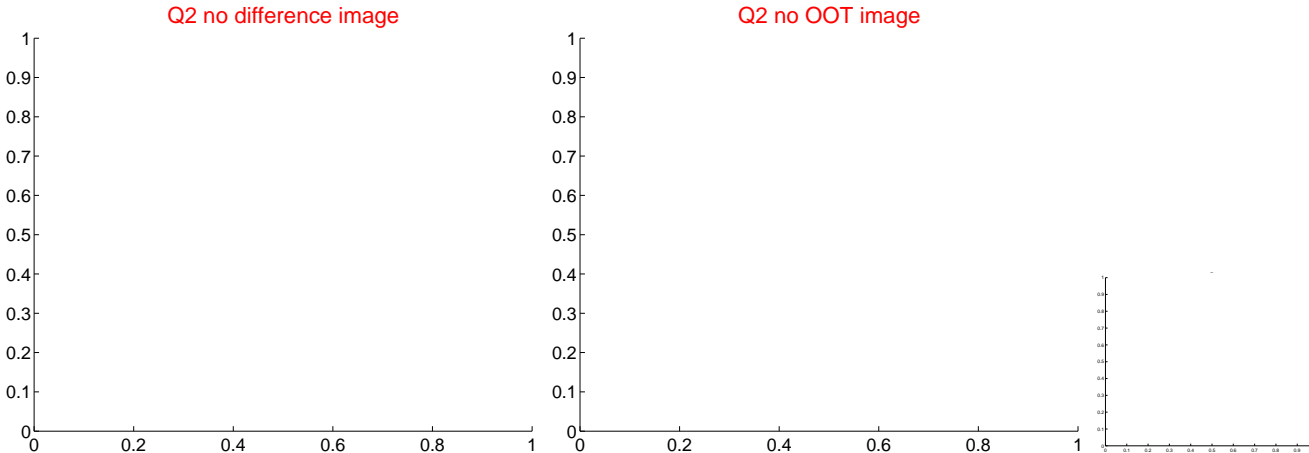
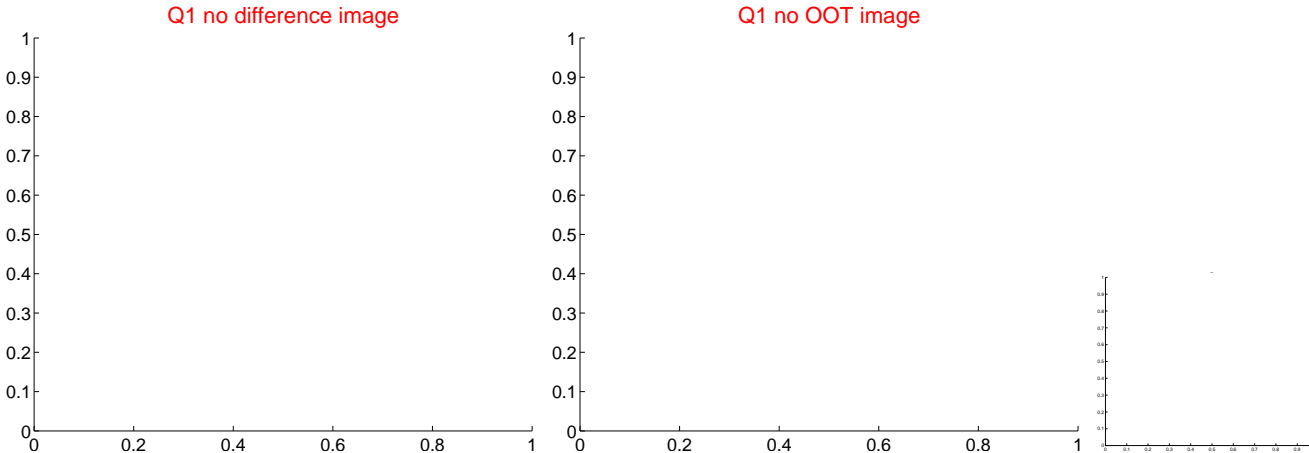
The direct PRF centroid is offset from the target star catalog position by about 0.04 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.032 \pm 0.068$	0.46	$0.028 \pm 0.068$	$0.015 \pm 0.068$
PRF-fit source offset from KIC position	$0.015 \pm 0.068$	0.22	$0.001 \pm 0.073$	$-0.015 \pm 0.068$
photometric centroid source offset	$0.12 \pm 0.01$	17.07	$-0.11 \pm 0.01$	$-0.05 \pm 0.01$

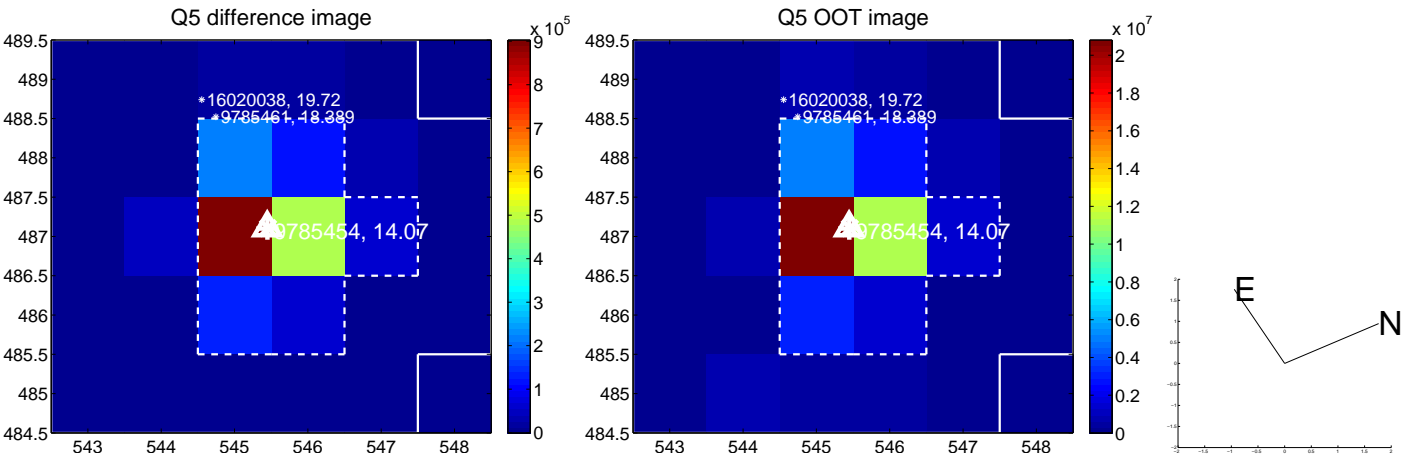


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

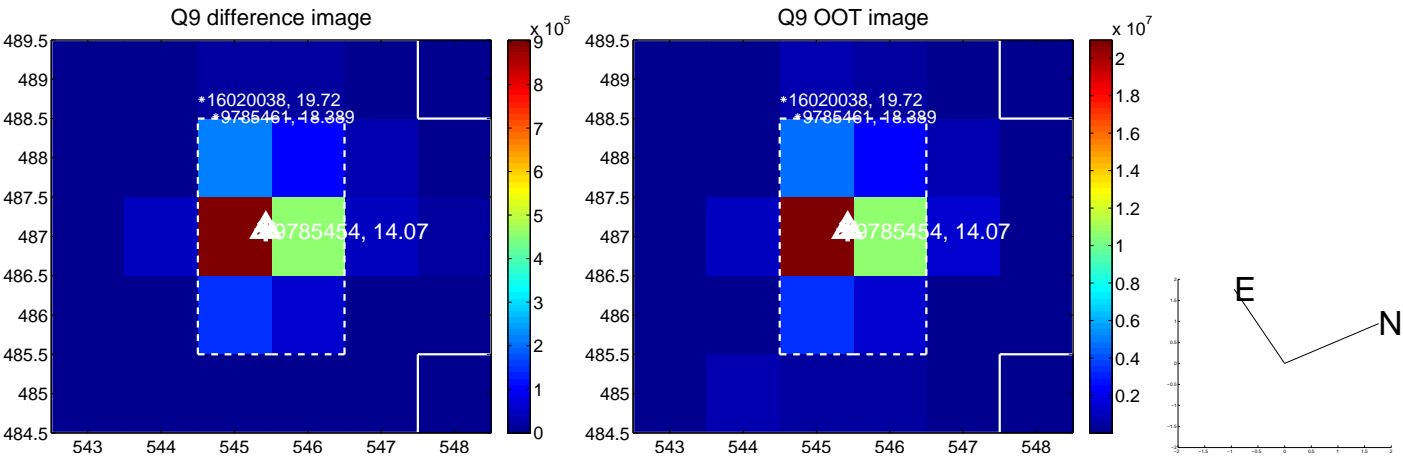
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value



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



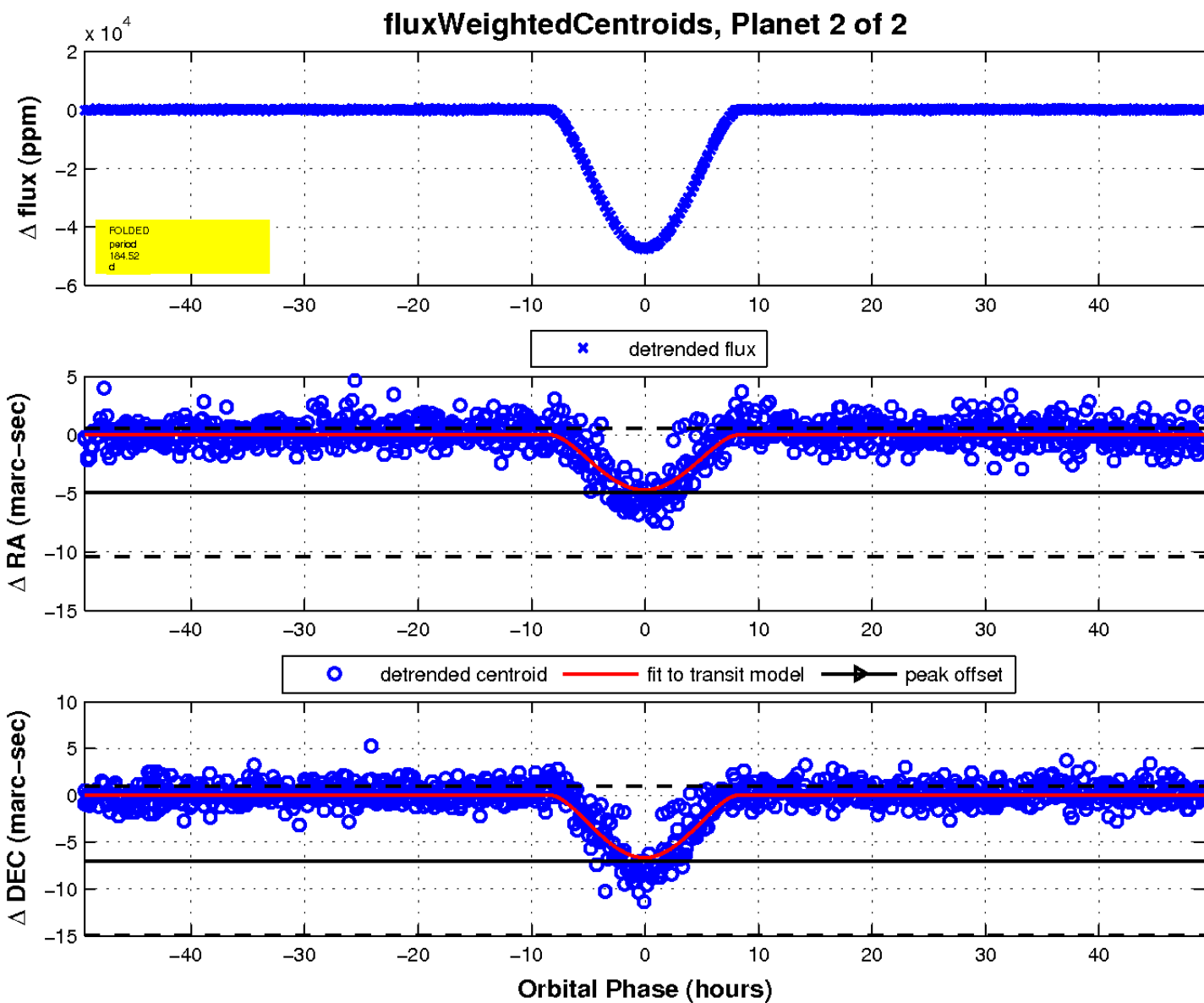
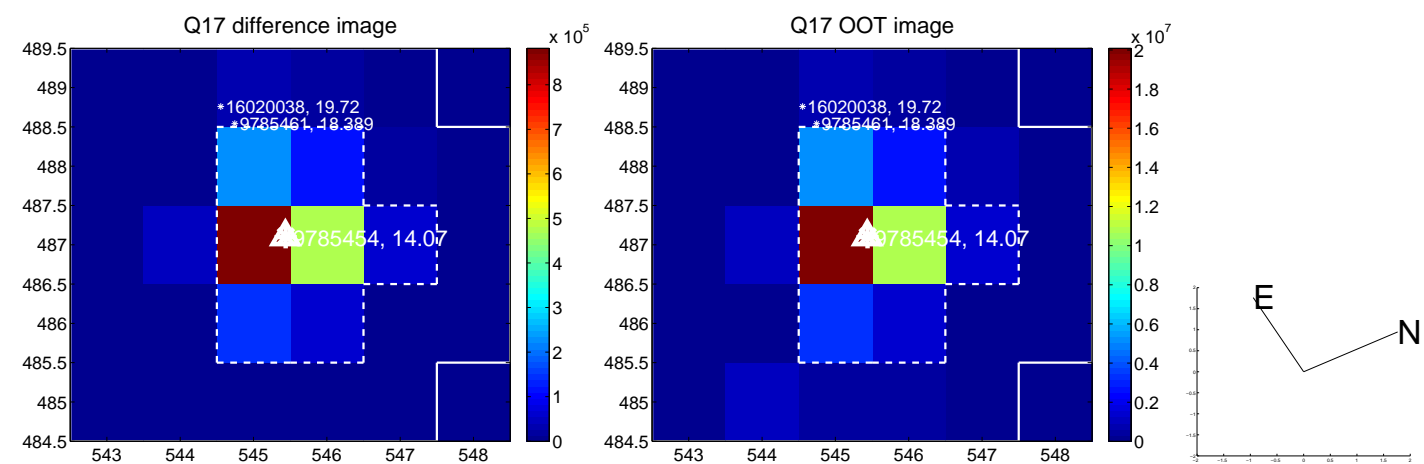
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

