

# KIC 009528430

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009528430-01	OBS	3489.01	90.082537	173.987623	43411.8	19.721	2006.5	2153.8	2.34	6523	49.20	46.67
009528430-02	OBS	No	90.082780	148.949760	2363.0	16.303	140.0	148.0	2.34	6523	12.73	46.67

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009528430-01	OBS	FP	0.00	0	1	0	0	MOD_SEC_DV—MOD_SEC_ALT—HAS_SEC_TCE
009528430-02	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.

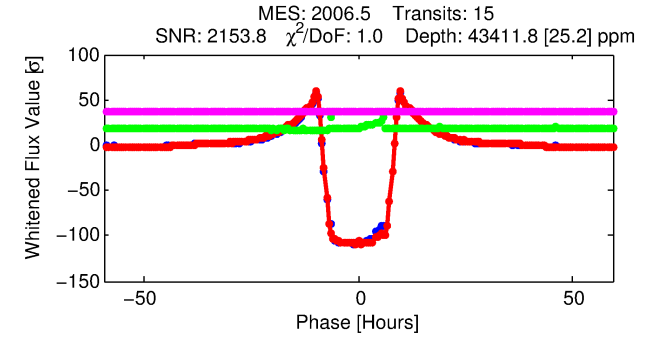
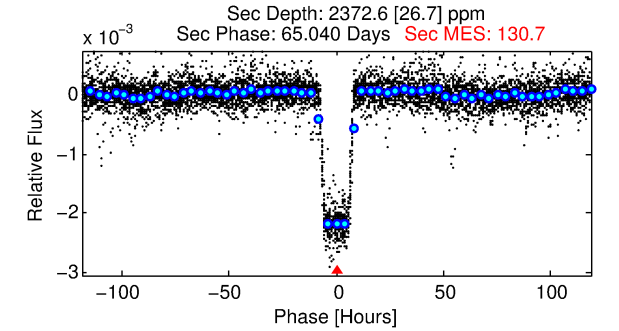
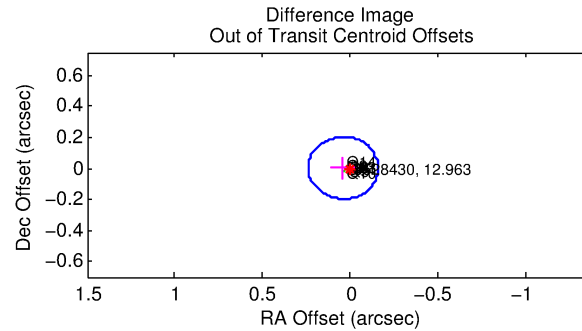
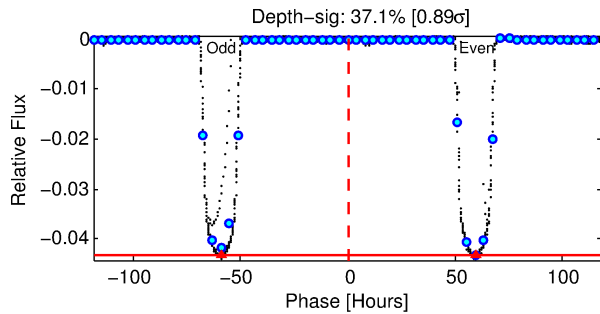
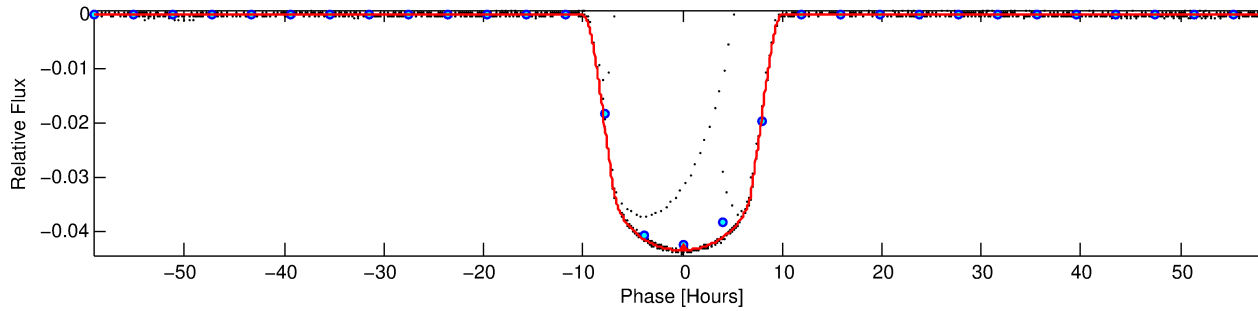
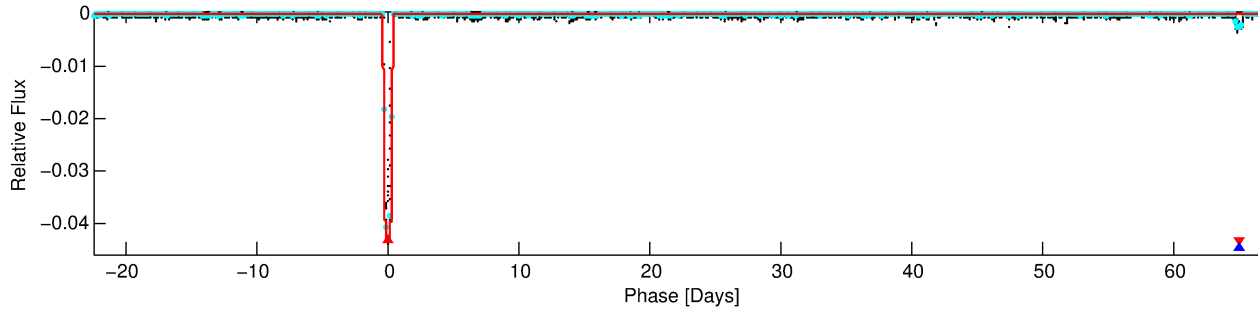
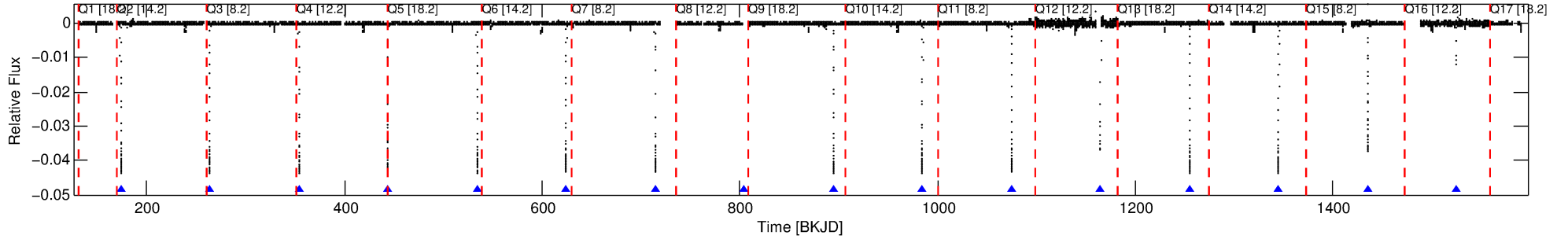
## Ephemeris Match Information For 009528430-01

No Significant Match Found

# DV One-Page Summary

KIC: 9528430 Candidate: 1 of 2 Period: 90.083 d  
KOI: K03489.01 Corr: 0.999

Kp: 12.96 R\*: 2.34 Rs Teff: 6523.0 K Logg: 3.83 Fe/H: -0.200



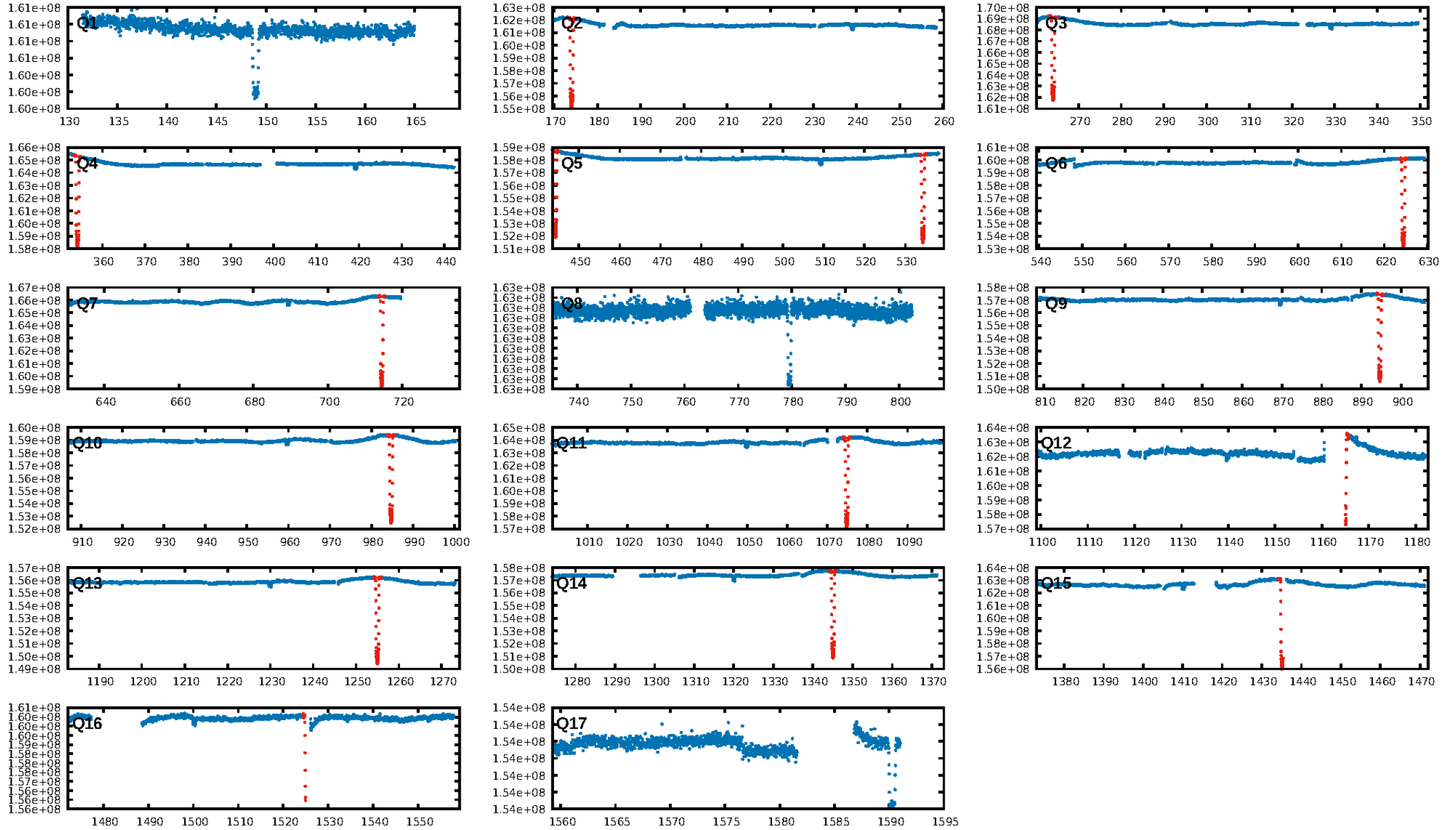
## DV Fit Results:

Period = 90.08254 [0.00002] d  
Epoch = 173.9876 [0.0001] BKJD  
Rp/R\* = 0.1924 [0.0001]  
a/R\* = 41.43 [0.04]  
b = 0.11 [0.01]  
Seff = 46.67 [24.07]  
Teq = 666 [86] K  
Rp = 49.20 [17.07] Re  
a = 0.4368 [0.1407] AU  
Ag = 102.90 [51.92] [1.96σ]  
Teffp = 3282 [89] K [21.14σ]

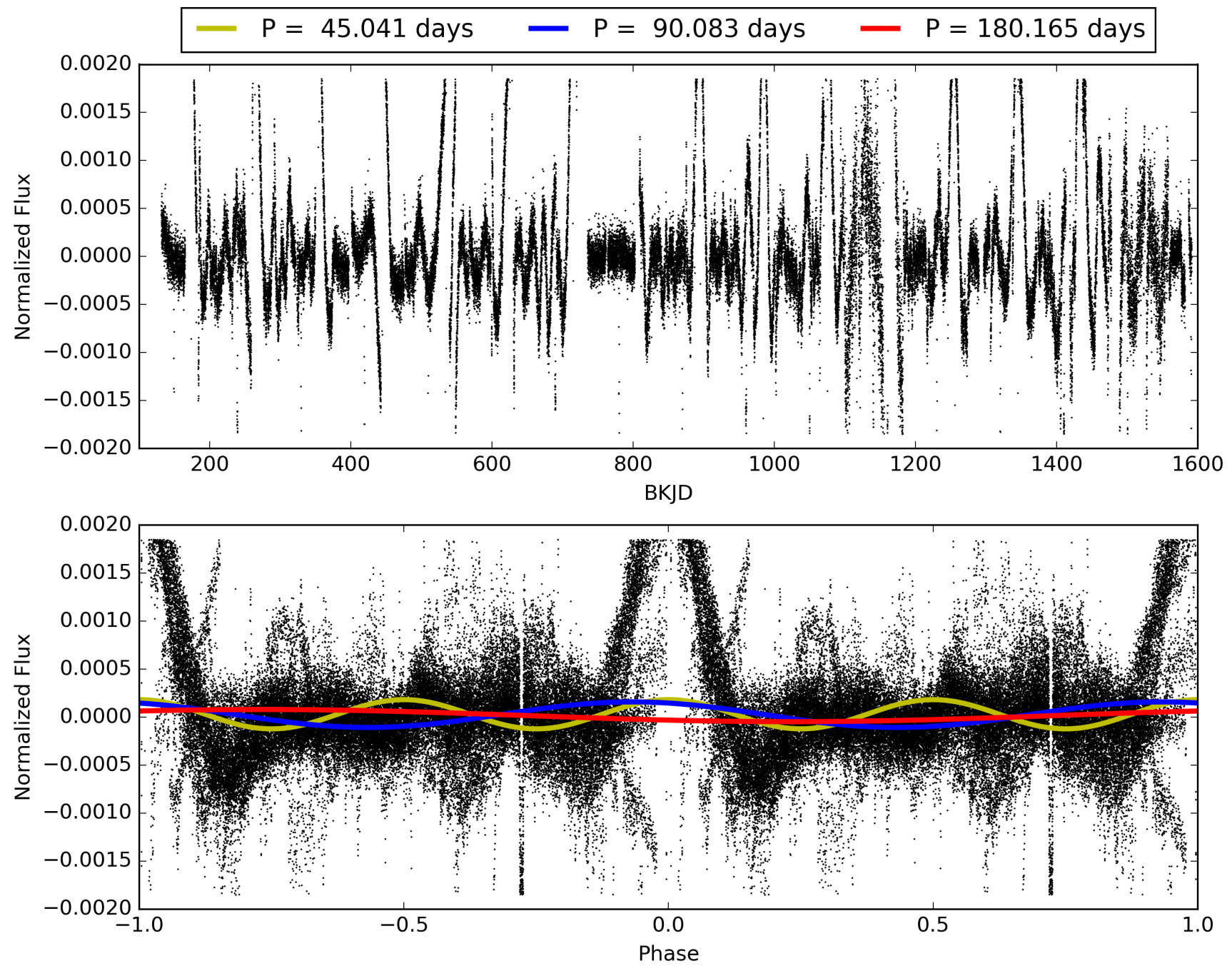
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 0.0% [0.00σ]  
ModelChiSquare2-sig: 0.0%  
ModelChiSquareGof-sig: 0.0%  
Bootstrap-pfa: 0.00e+00  
RollingBand-fgt: 1.00 [15/15]  
GhostDiagnostic-chr: 12.93  
Centroid-sig: 0.0%  
Centroid-so: 0.066 arcsec [22.23σ]  
OotOffset-rm: 0.041 arcsec [0.62σ]  
OotOffset-st: 4/2/0/3 [9]  
KicOffset-rm: 0.081 arcsec [1.18σ]  
KicOffset-st: 4/2/0/3 [9]  
DiffImageQuality-fgm: 1.00 [9/9]  
DiffImageOverlap-fno: 1.00 [9/9]

# TCE 009528430-01, PDC Light Curves

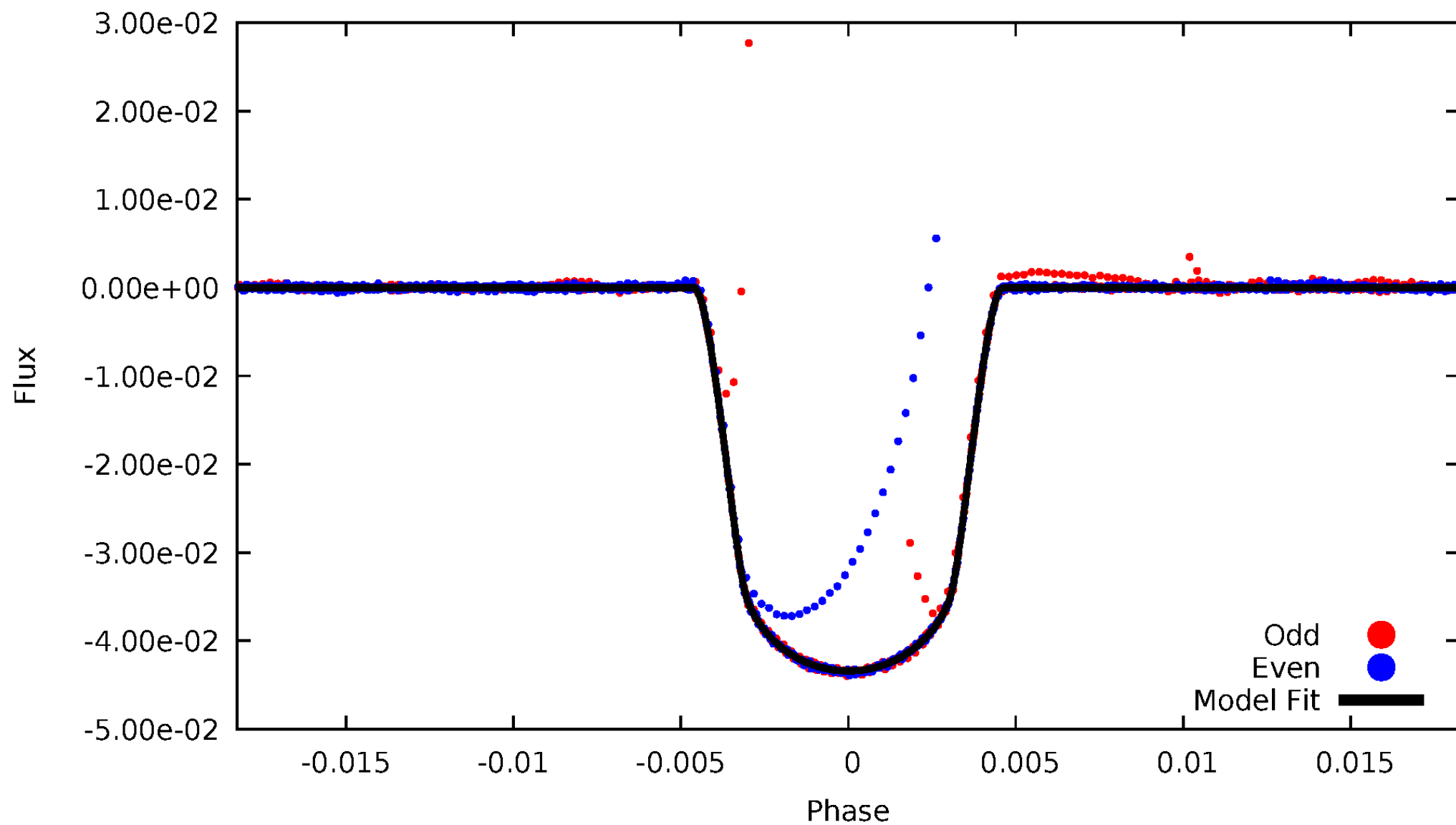


TCE 009528430-01



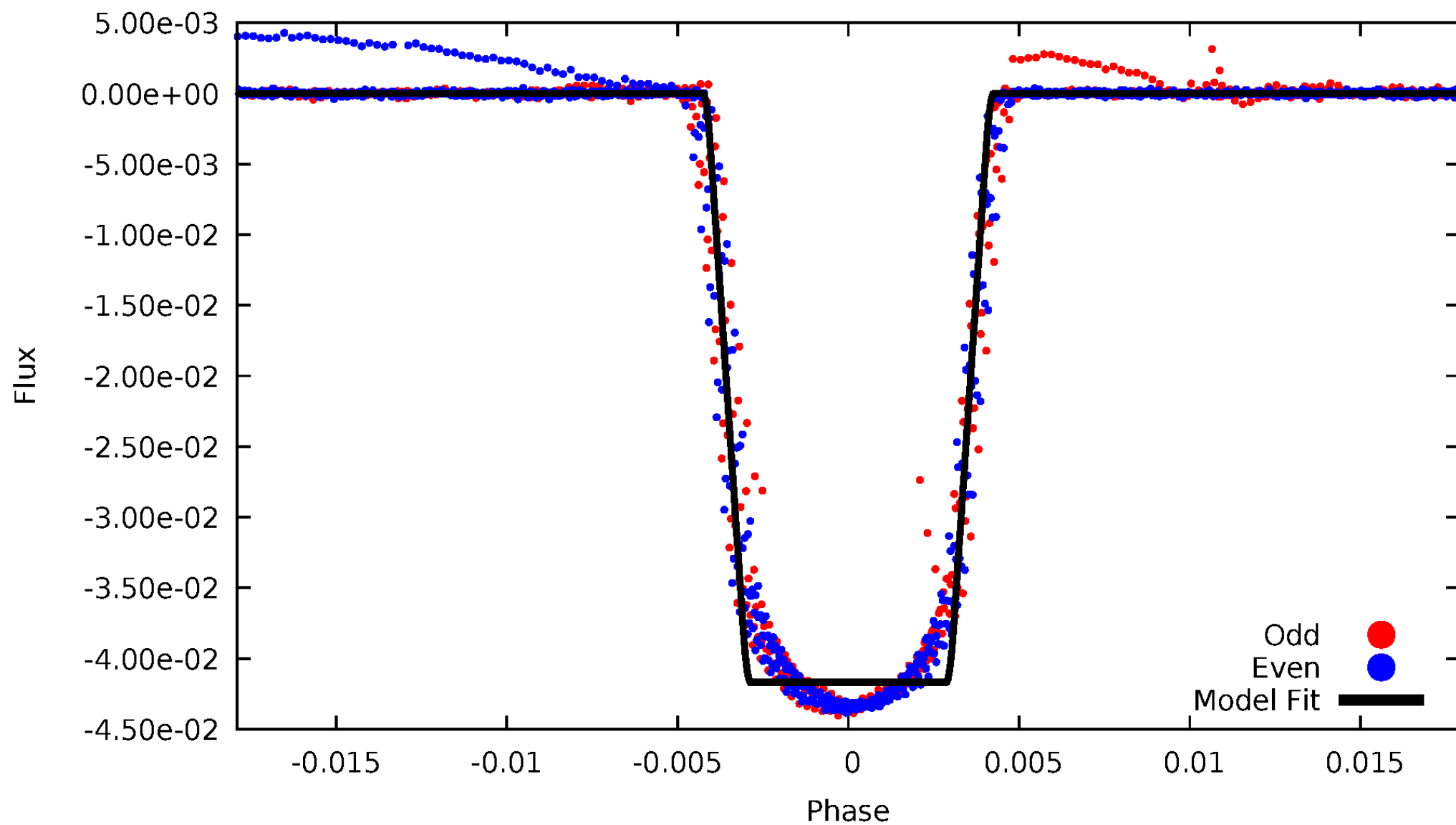
# DV Odd/Even

TCE 009528430-01



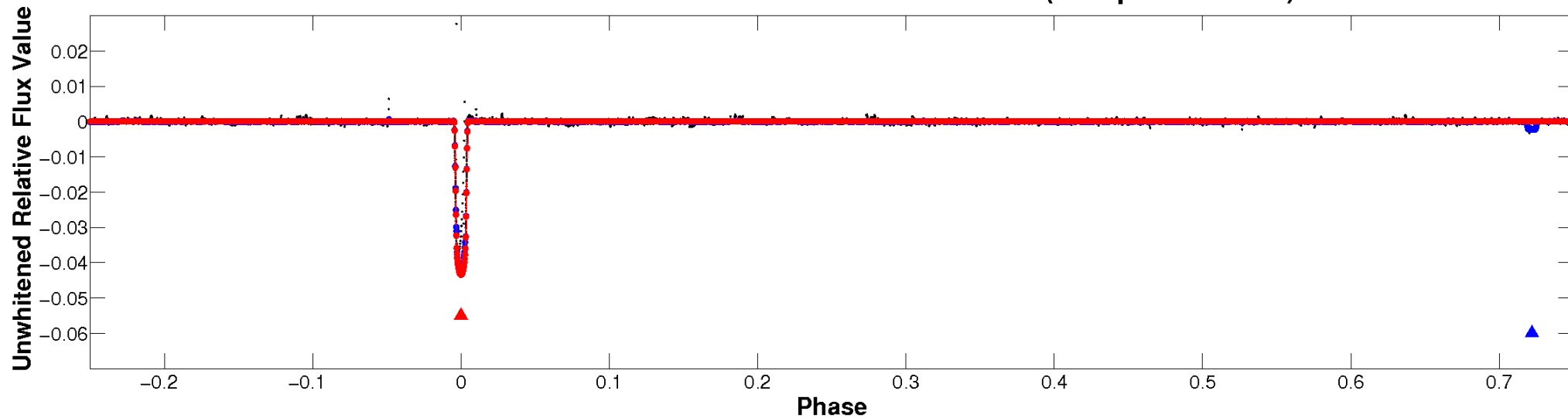
# ALT Odd/Even

TCE 009528430-01

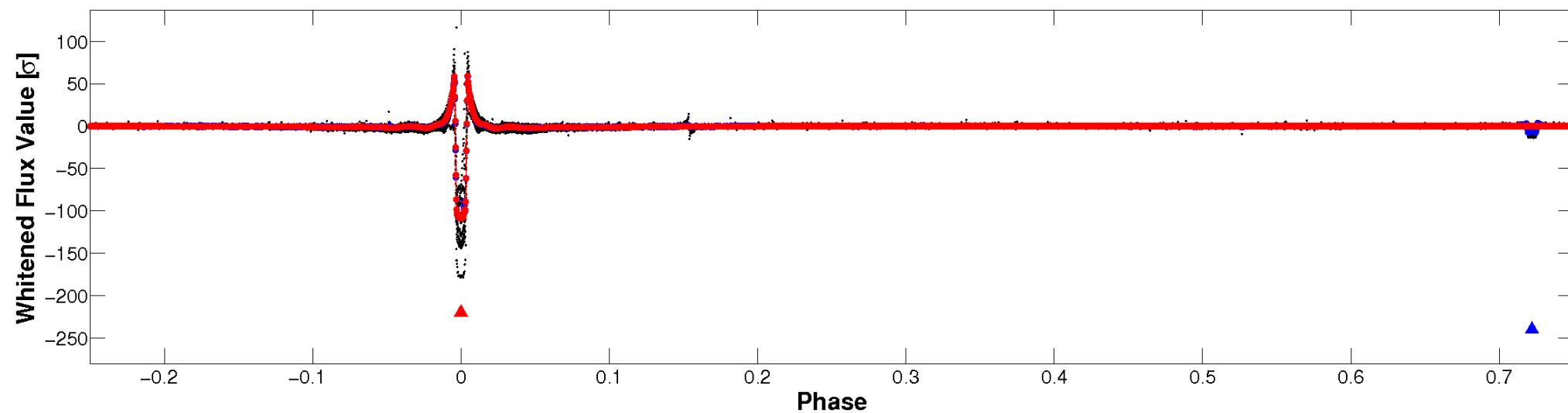


# Non-Whitened Vs. Whitened Light Curve

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

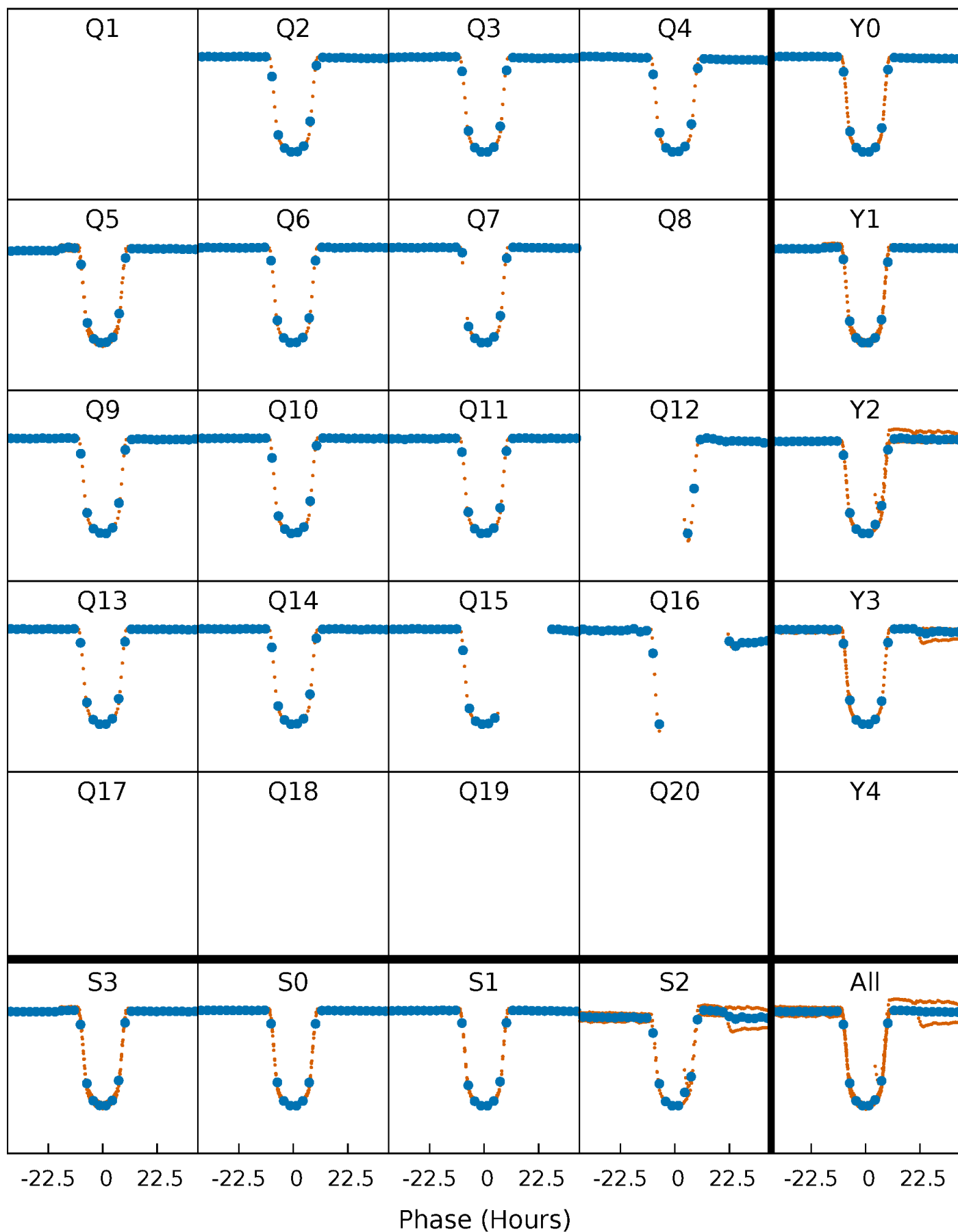


**Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



# PDC Quarter-Phased Transit Curves

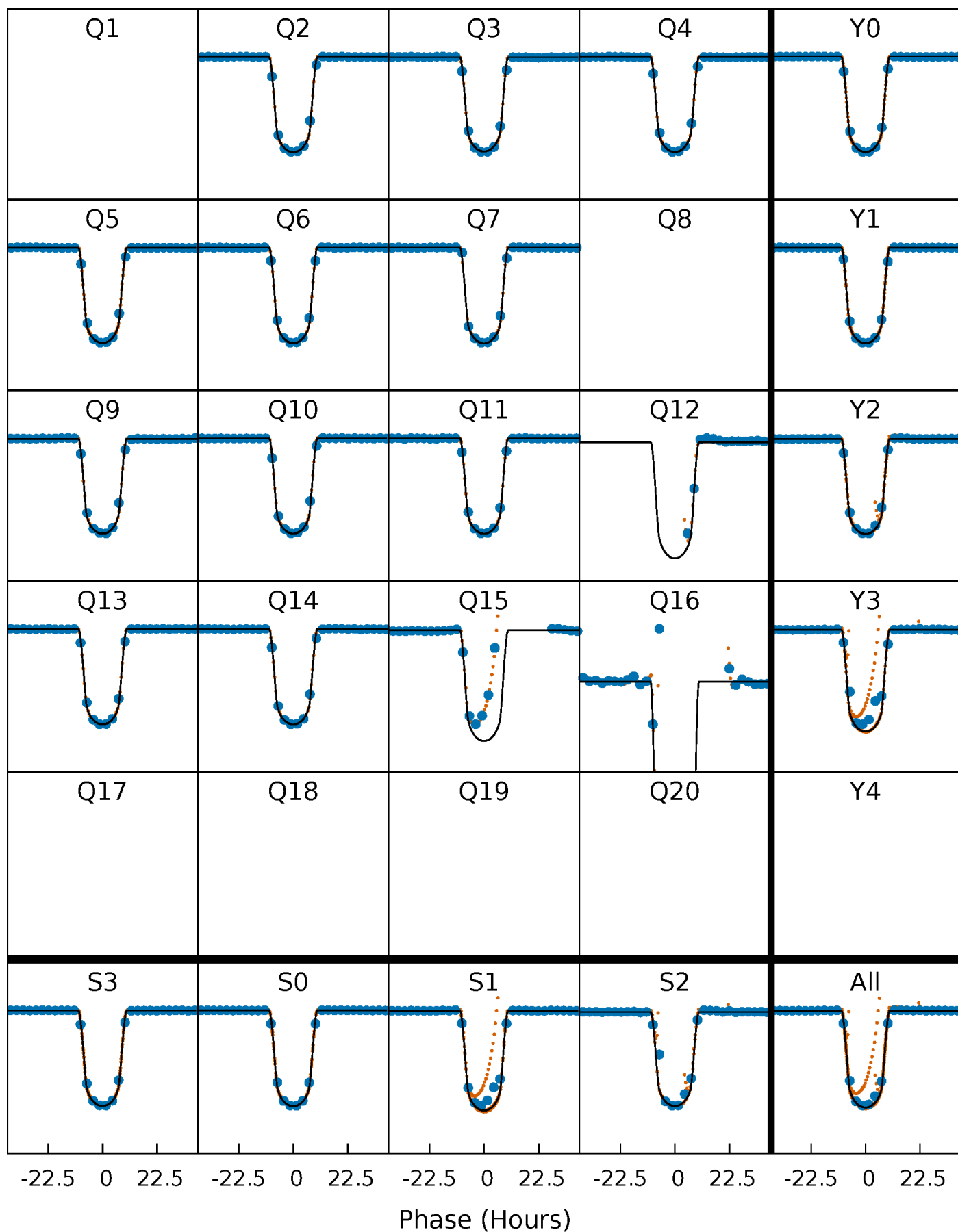
TCE 009528430-01 P= 90.082537 Days  $T_0=173.987623$  (BKJD)





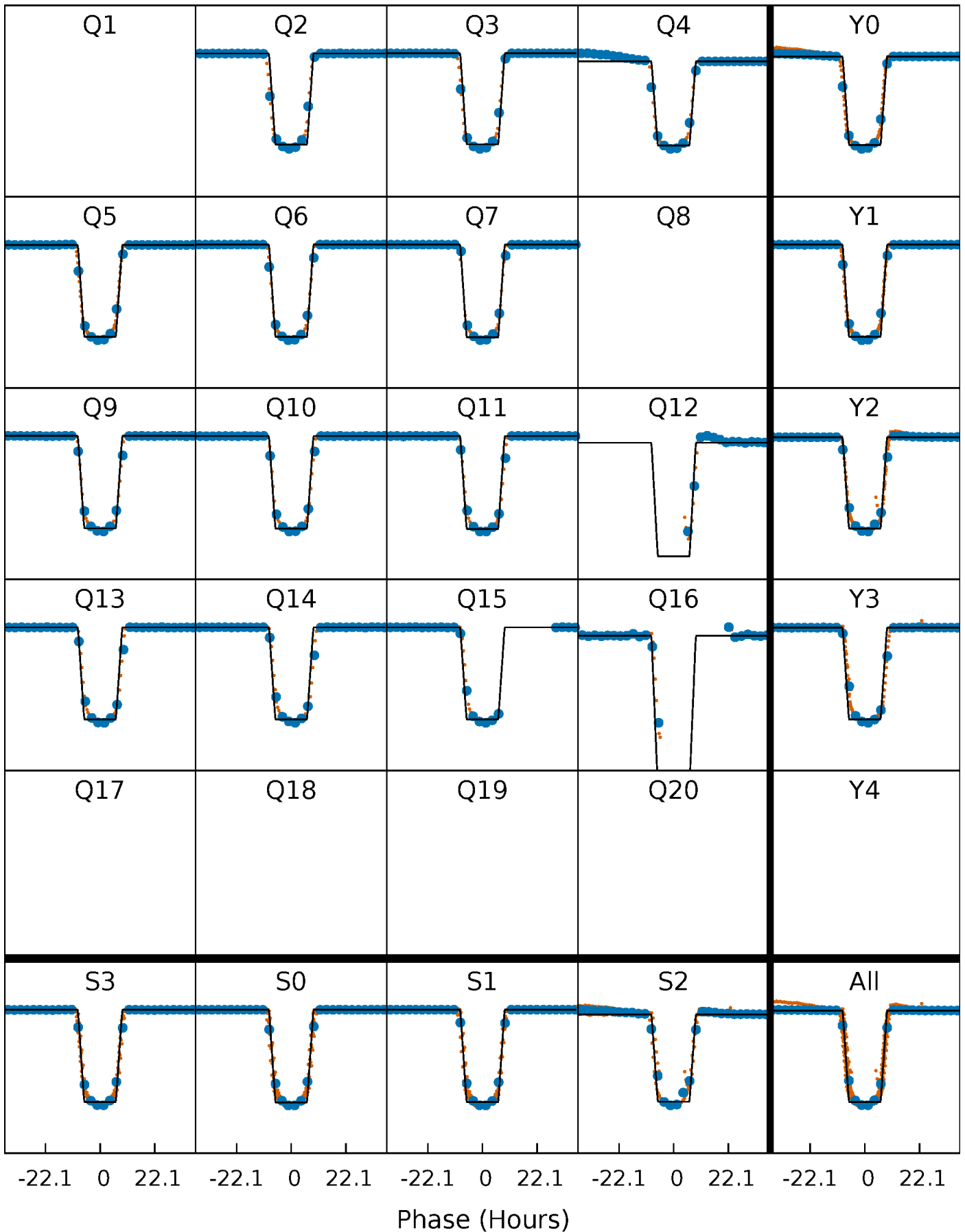
# DV Quarter-Phased Transit Curves

TCE 009528430-01 P= 90.082537 Days  $T_0=173.987623$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

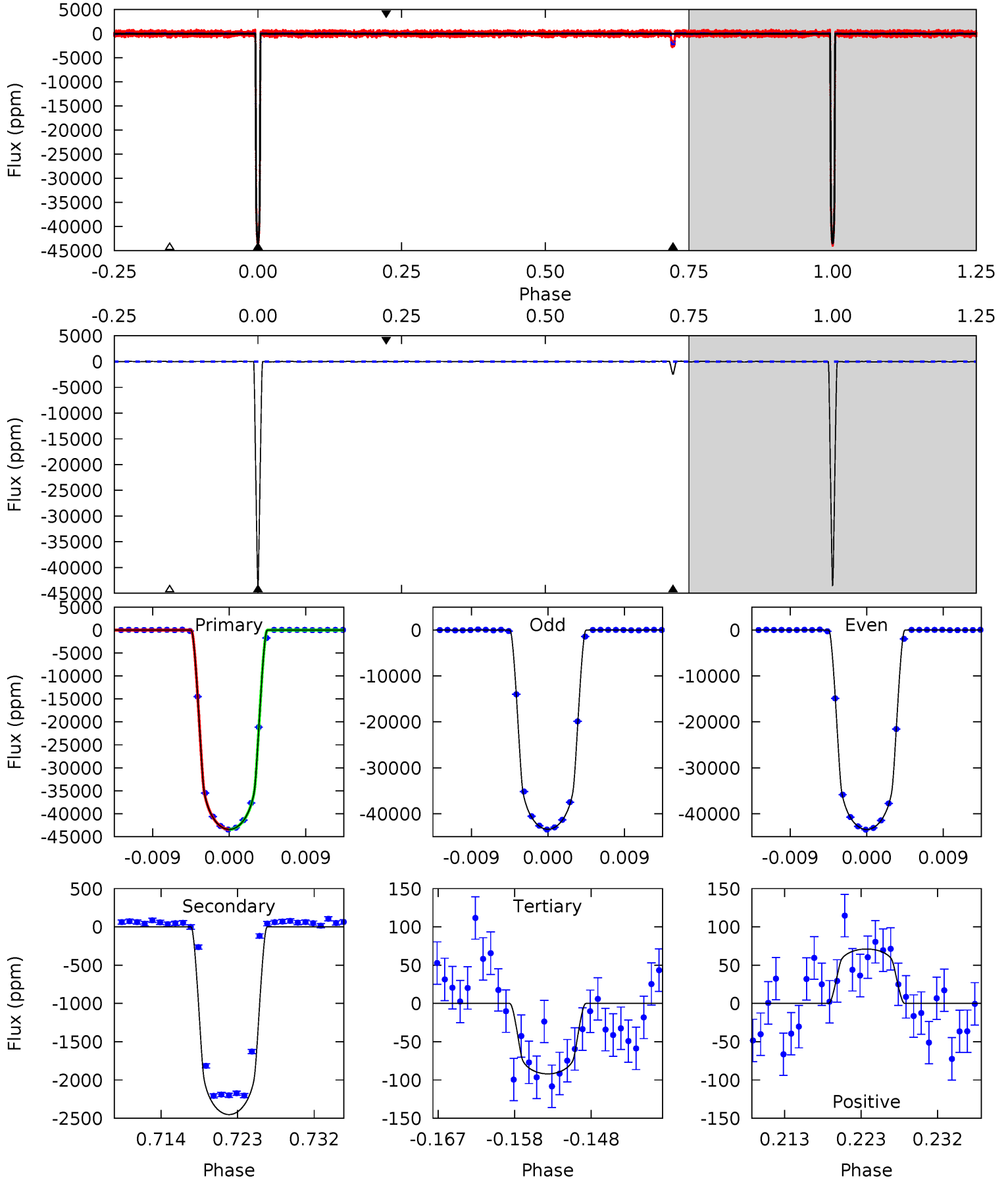
TCE 009528430-01 P= 90.077944 Days  $T_0=174.015473$  (BKJD)



# DV Model-Shift Uniqueness Test

009528430-01, P = 90.082537 Days, E = 83.905086 Days

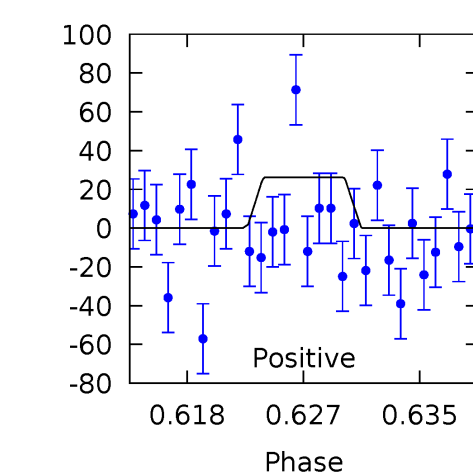
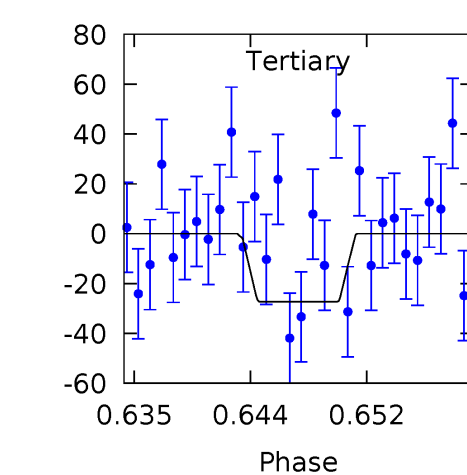
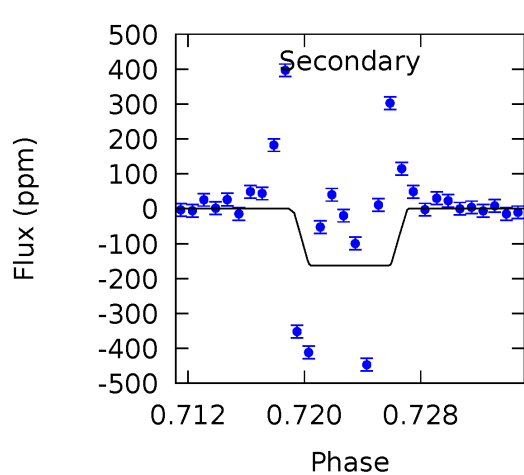
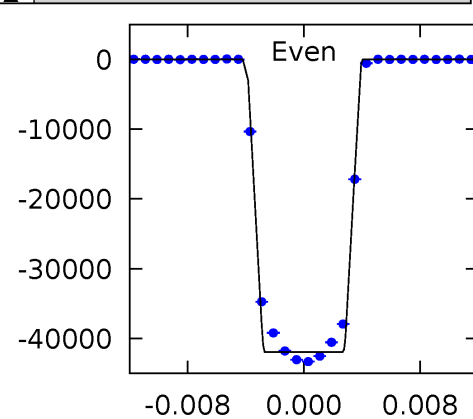
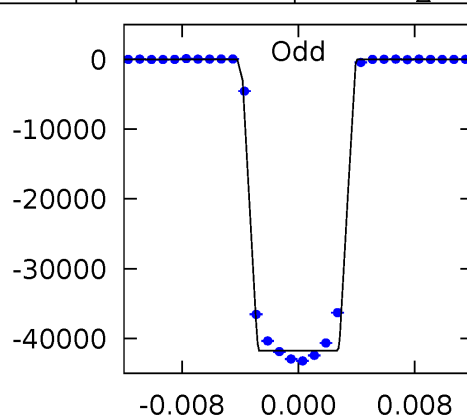
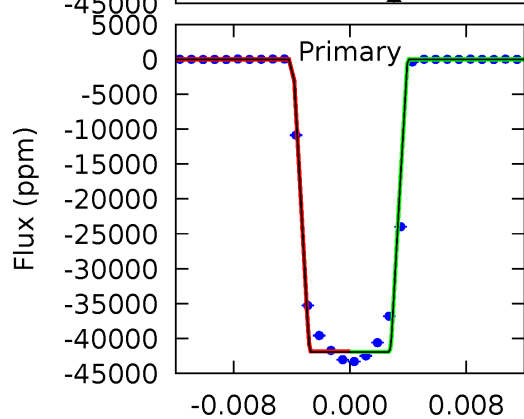
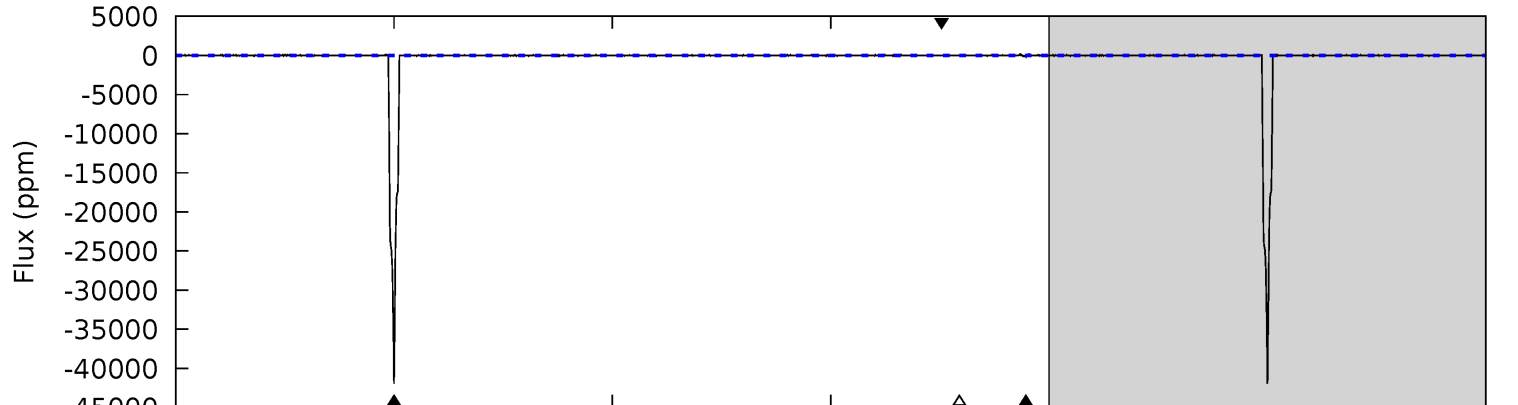
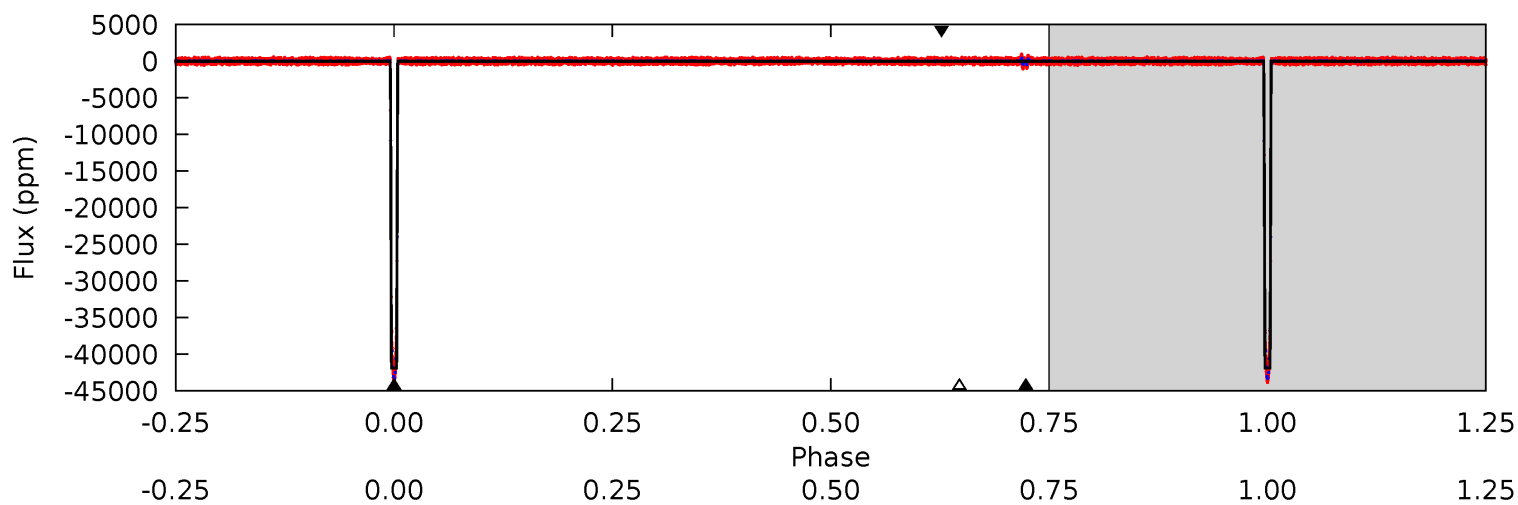
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
5101	288.0	10.8	8.36	5.04	2.60	3.48	5090	5093	277.2	279.7	3.09	0.90	0.00	1.23



# Alt Model-Shift Uniqueness Test

009528430-01, P = 90.077944 Days, E = 83.937529 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
4717	18.3	3.07	2.94	5.06	2.63	0.83	4714	4714	15.2	15.4	10.1	0.96	0.00	3.20



### Stellar Parameters For KIC 009528430

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6523^{+176}_{-176}$	$3.835^{+0.292}_{-0.097}$	$-0.200^{+0.300}_{-0.250}$	$2.343^{+0.438}_{-0.813}$	$1.371^{+0.233}_{-0.233}$	$0.150^{+0.276}_{-0.046}$
	+3%/-3%	+8%/-3%	+150%/-125%	+19%/-35%	+17%/-17%	+184%/-31%
Source	PHO1	FLK73	KIC0	DSEP		

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

### Secondary Eclipse Parameters for KIC 009528430-01 / KOI 3489.01

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-2451 \pm 9$	$48.95^{+5.35}_{-8.74}$	$920^{+55}_{-78}$	$3715^{+63}_{-65}$	$112^{+44}_{-20}$
Alt.	$-163 \pm 9$	$51.57^{+5.78}_{-9.67}$	$915^{+55}_{-78}$	$2474^{+36}_{-36}$	$6.615^{+2.885}_{-1.199}$

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

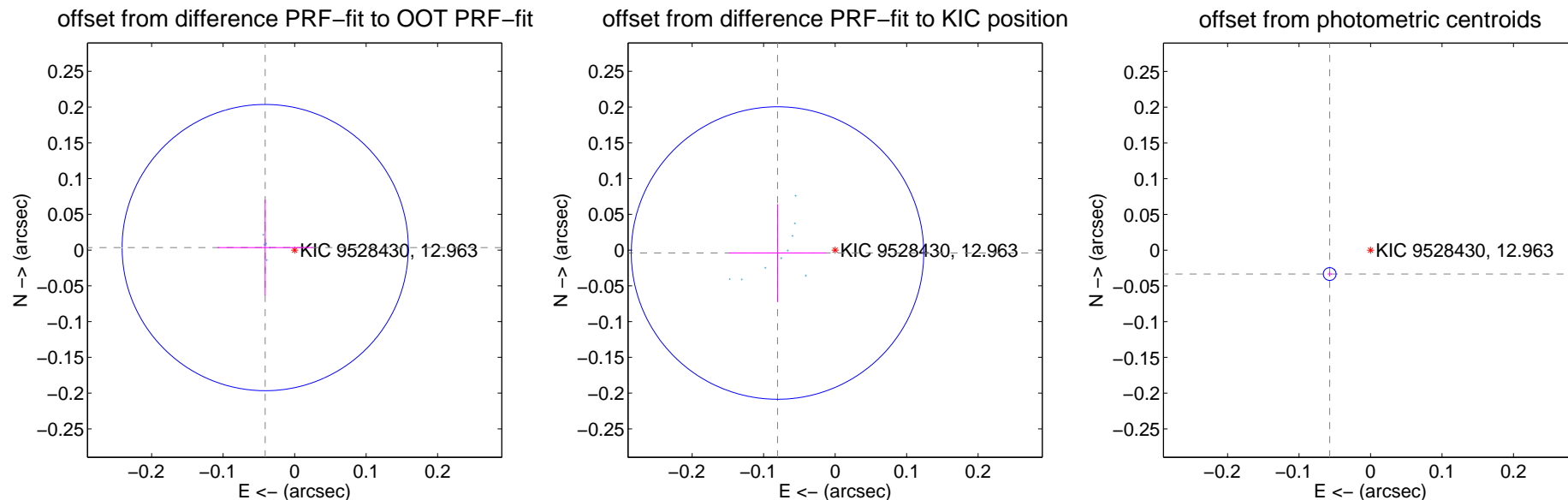
## DV Centroid Data

Supplemental centroid analysis for 009528430-01. Kepler magnitude: 12.96. Transit SNR 2153.84

There are 9 quarters with good PRF difference image offsets

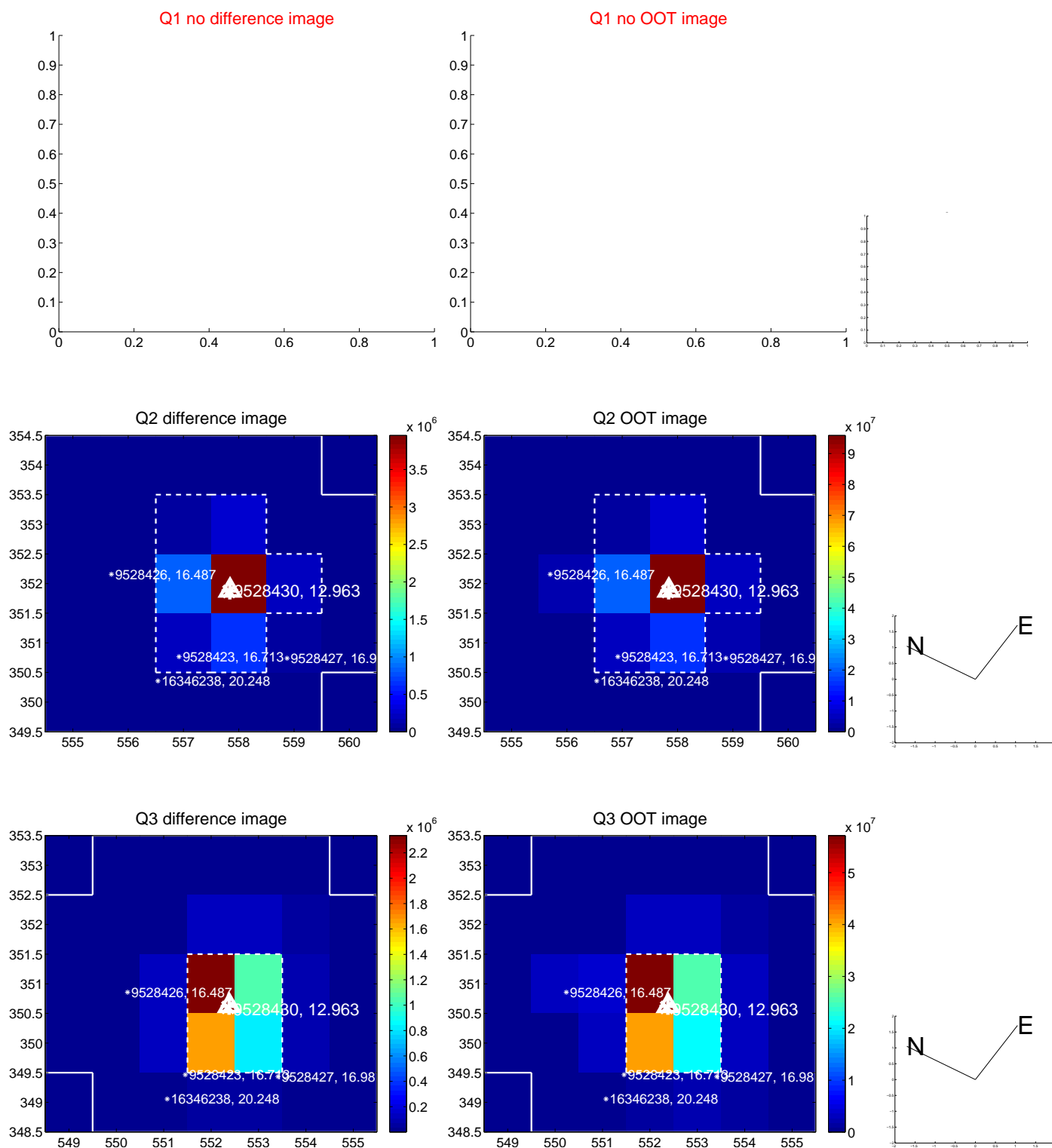
The direct PRF centroid is offset from the target star catalog position by about 0.04 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.041 \pm 0.067$	0.62	$0.041 \pm 0.067$	$0.003 \pm 0.067$
PRF-fit source offset from KIC position	$0.081 \pm 0.068$	1.18	$0.081 \pm 0.068$	$-0.004 \pm 0.068$
photometric centroid source offset	$0.07 \pm 0.00$	<b>22.23</b>	$0.06 \pm 0.00$	$-0.03 \pm 0.00$

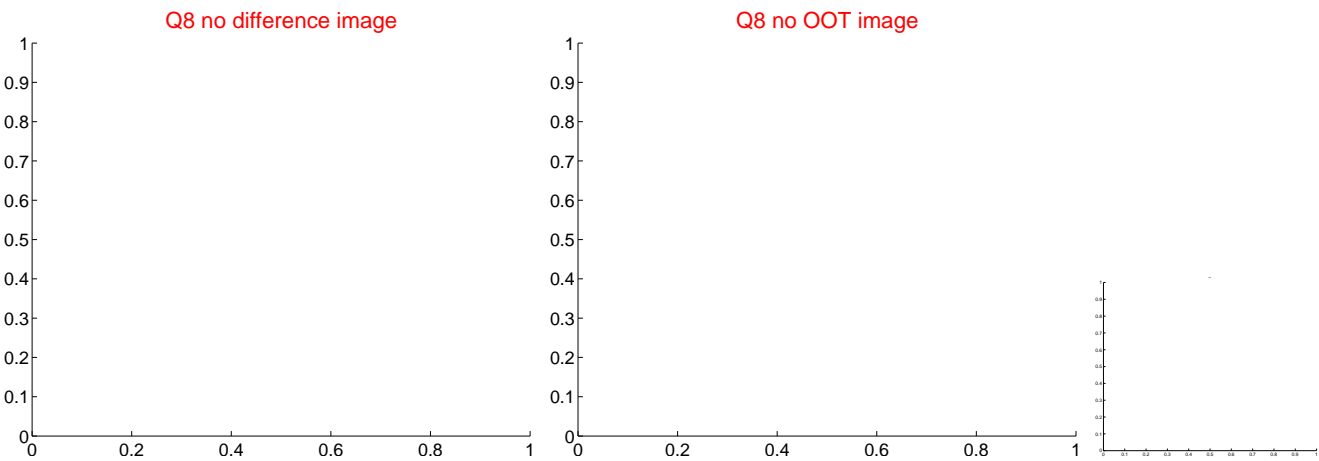
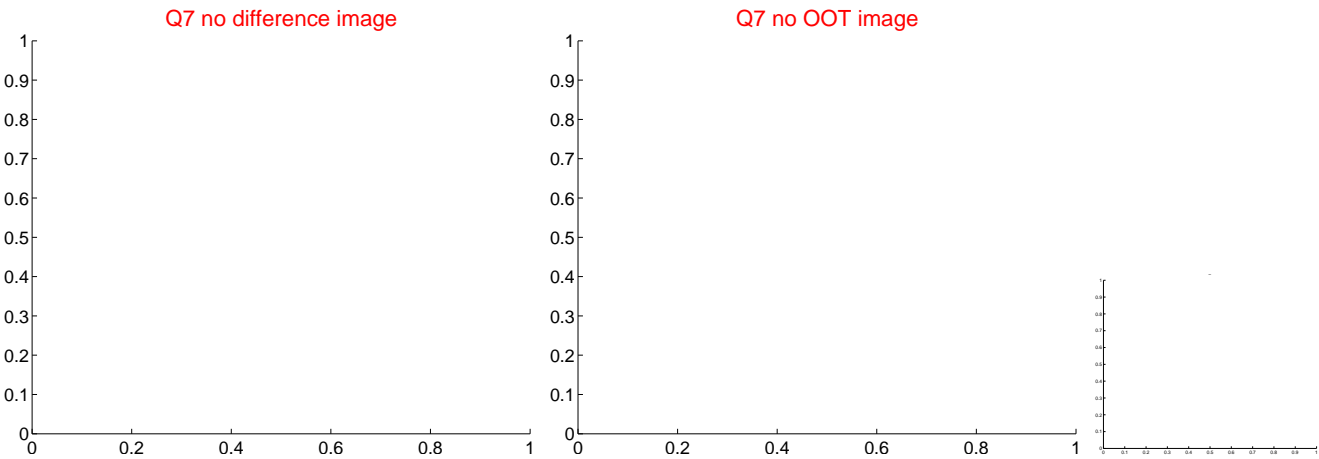
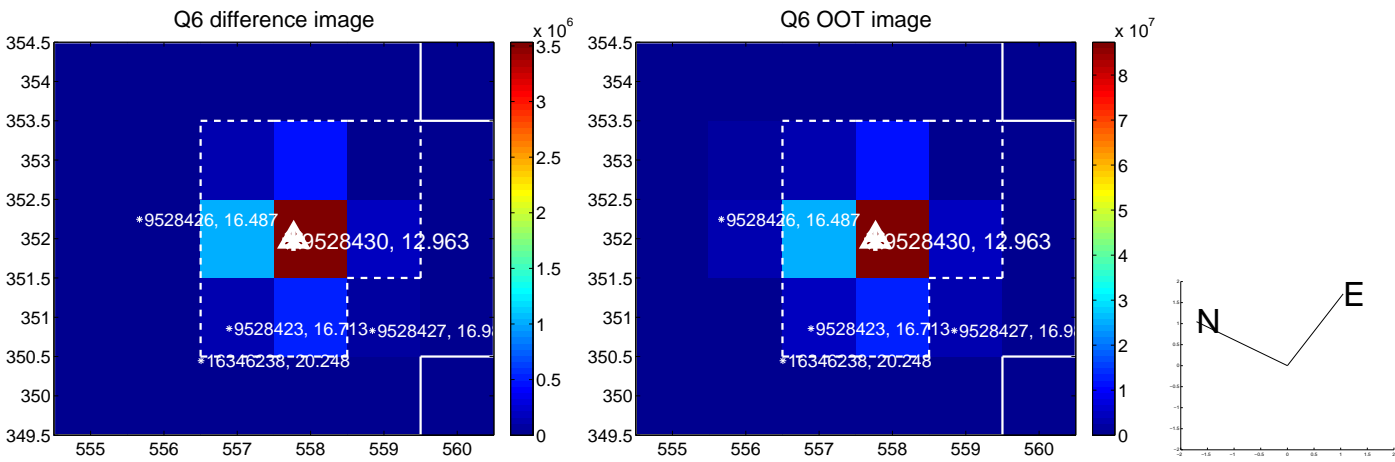
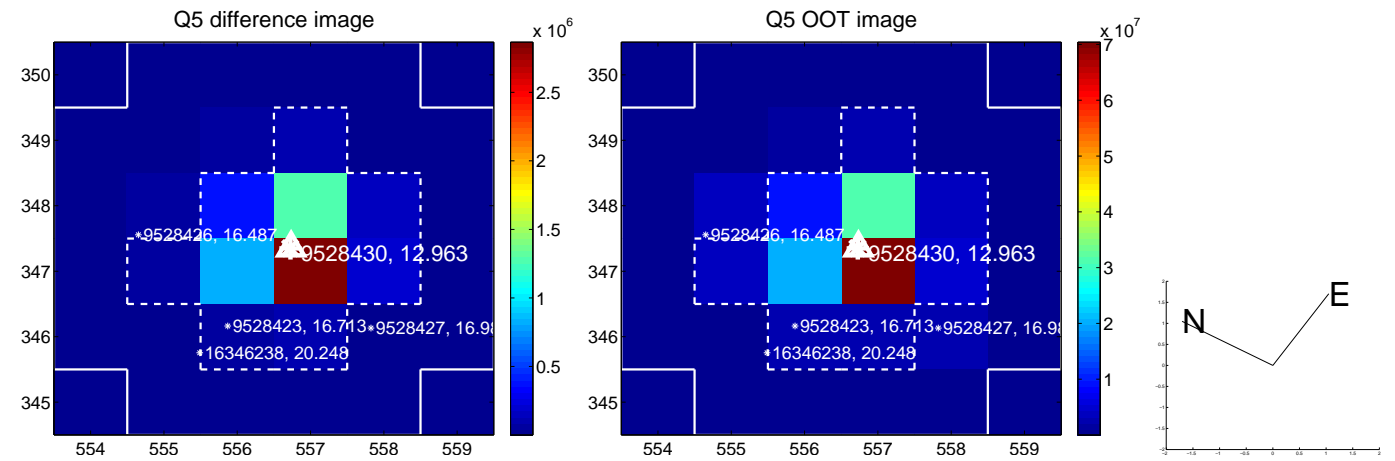


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

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

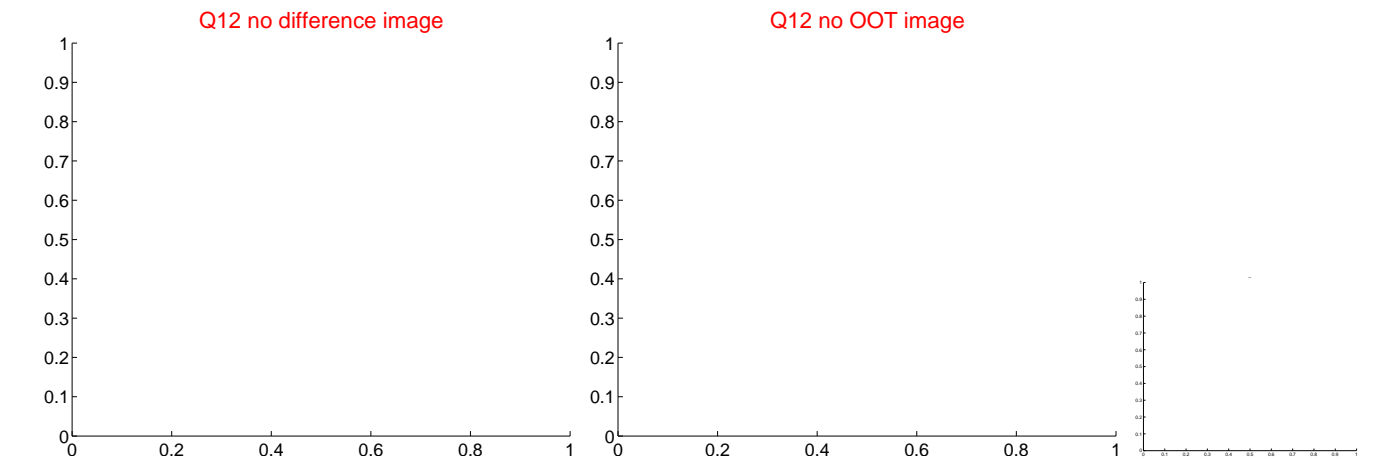
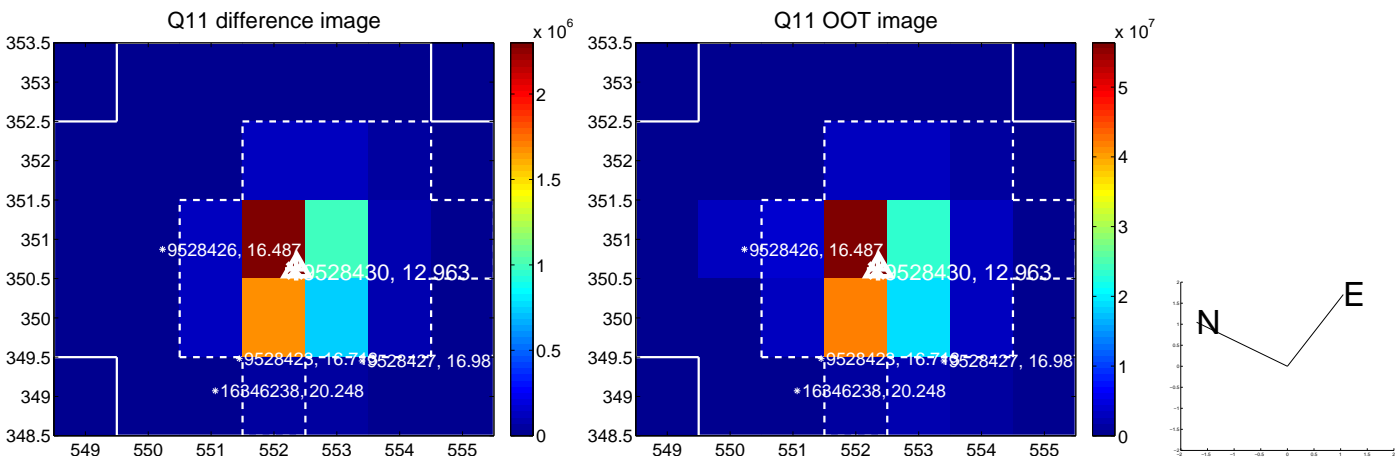
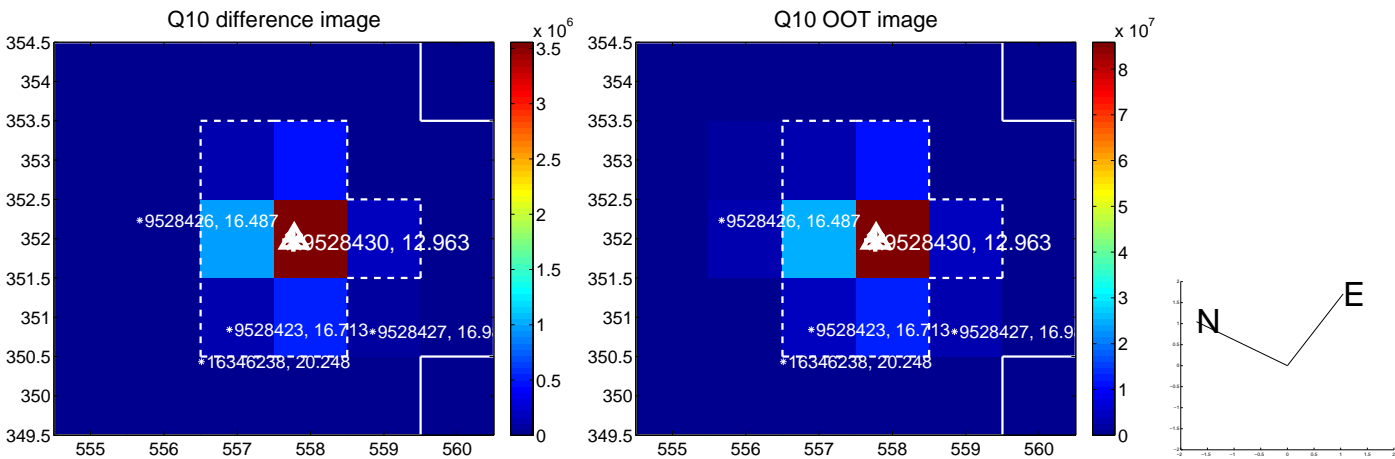
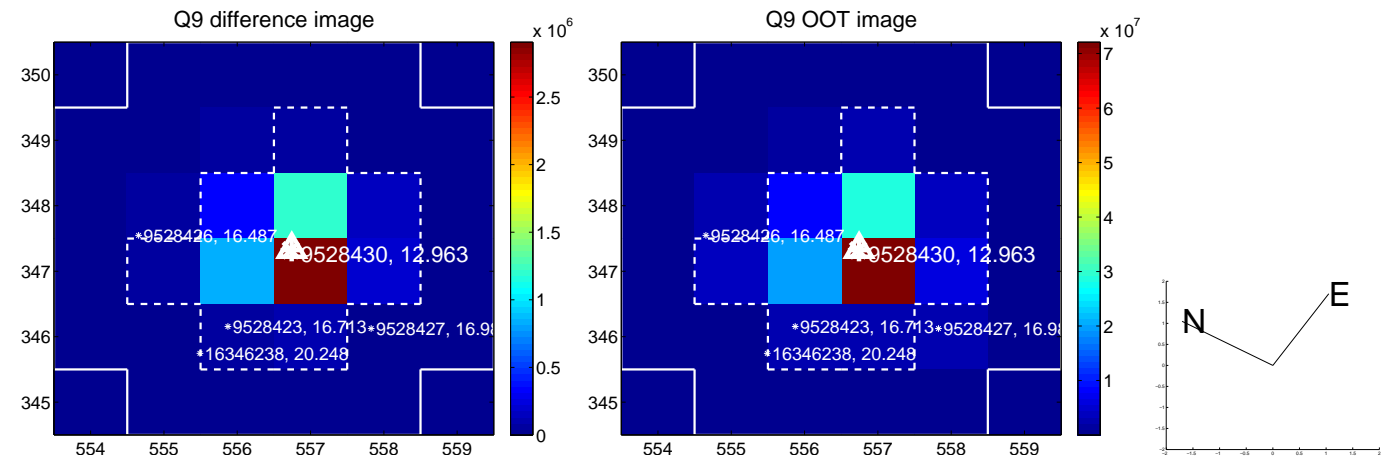


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

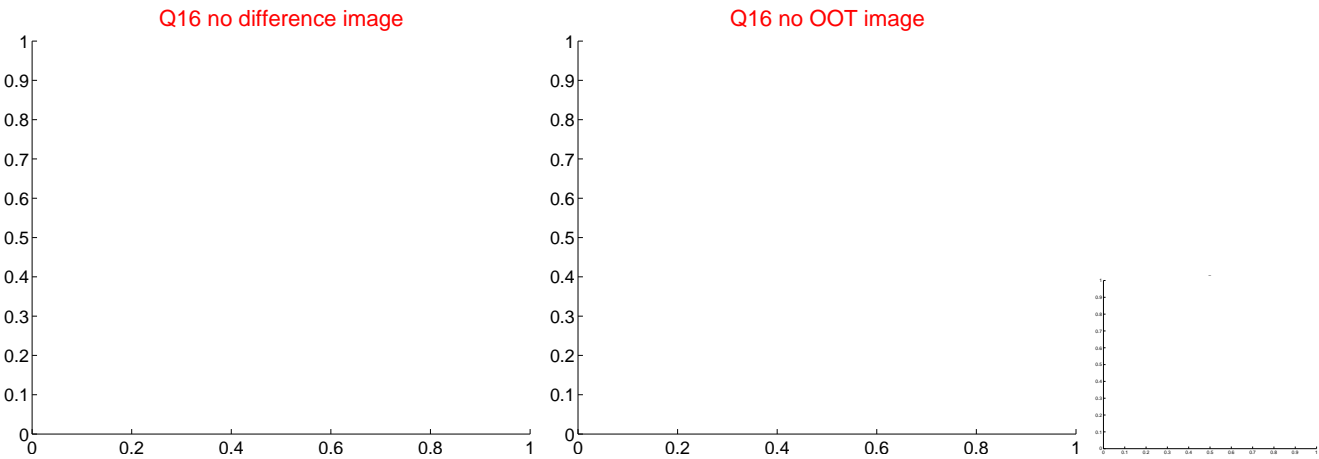
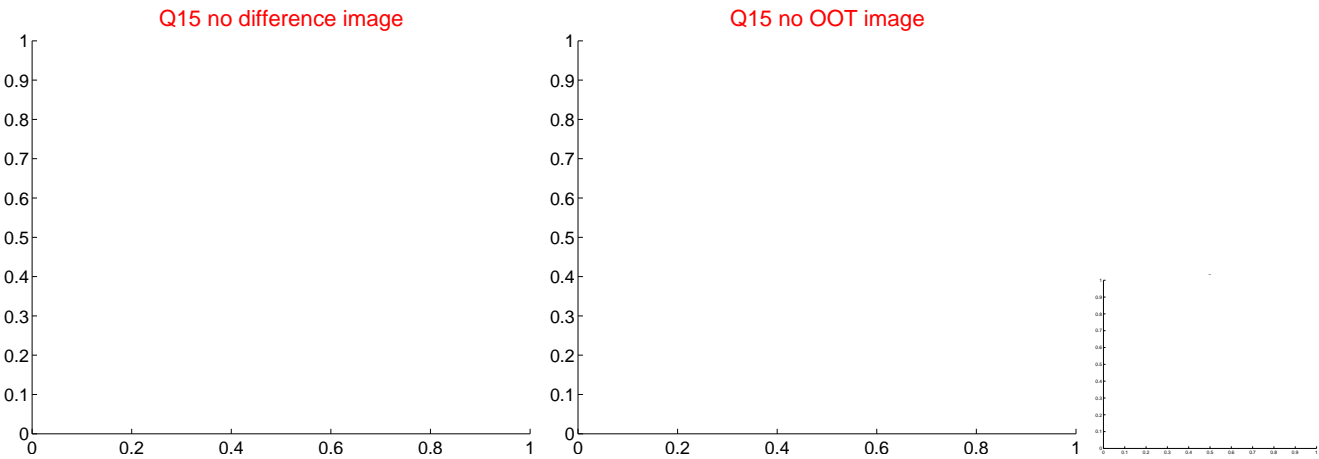
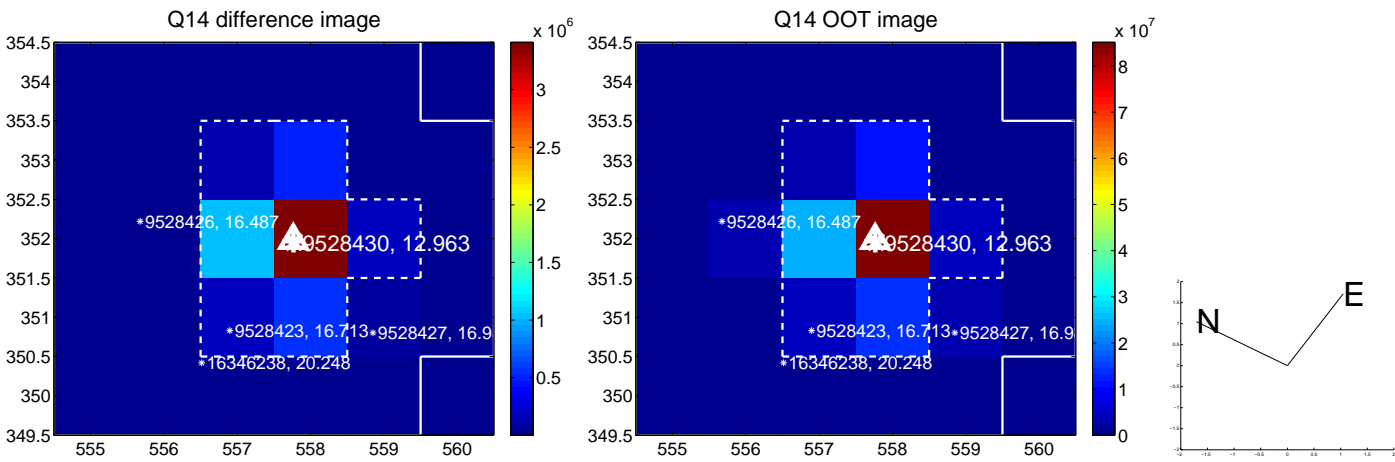
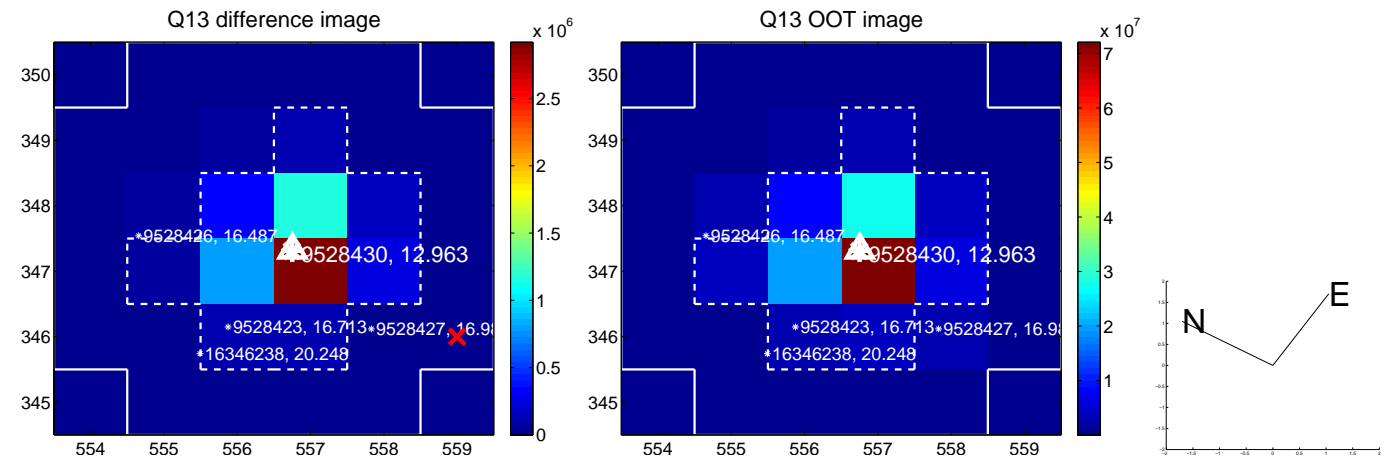




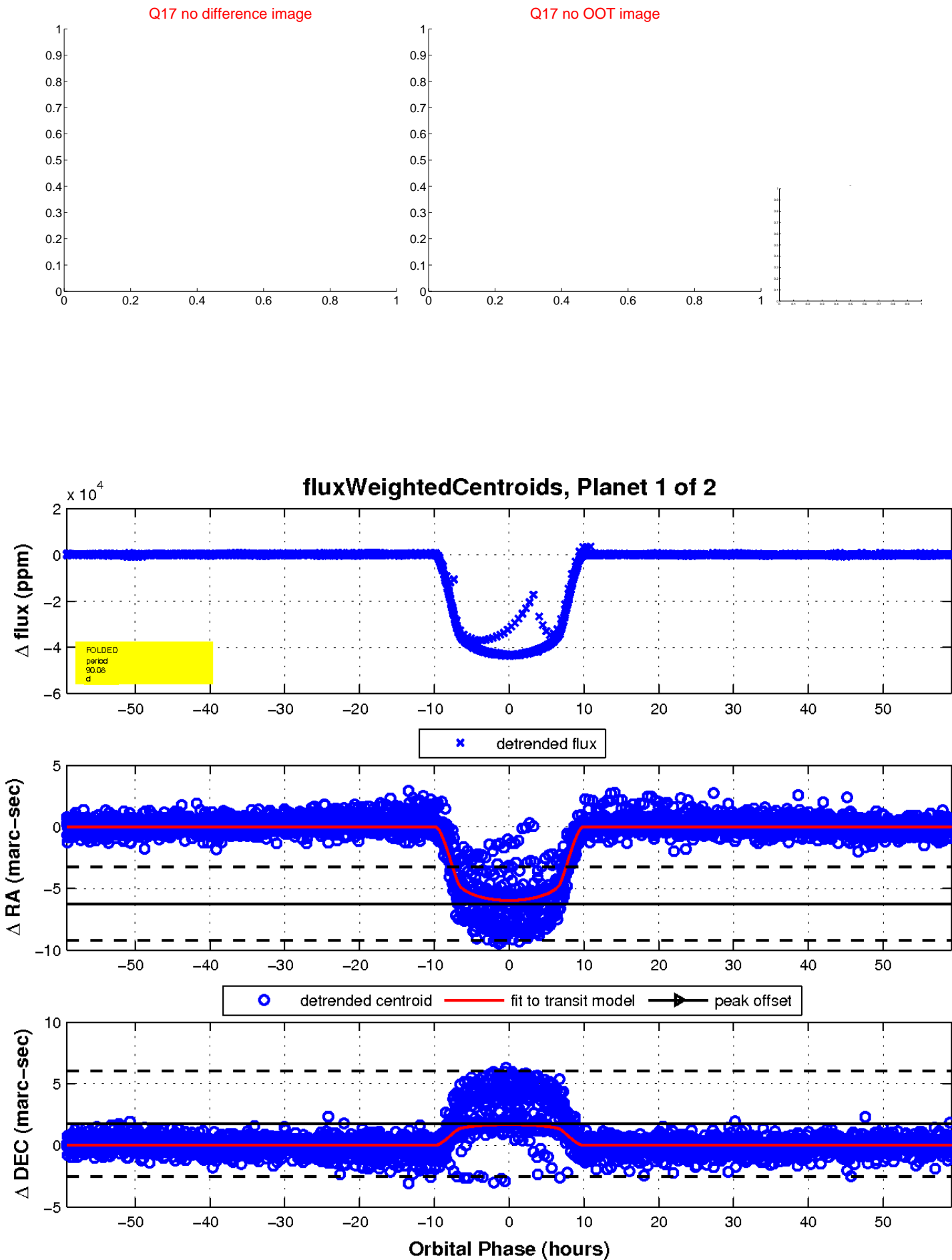
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

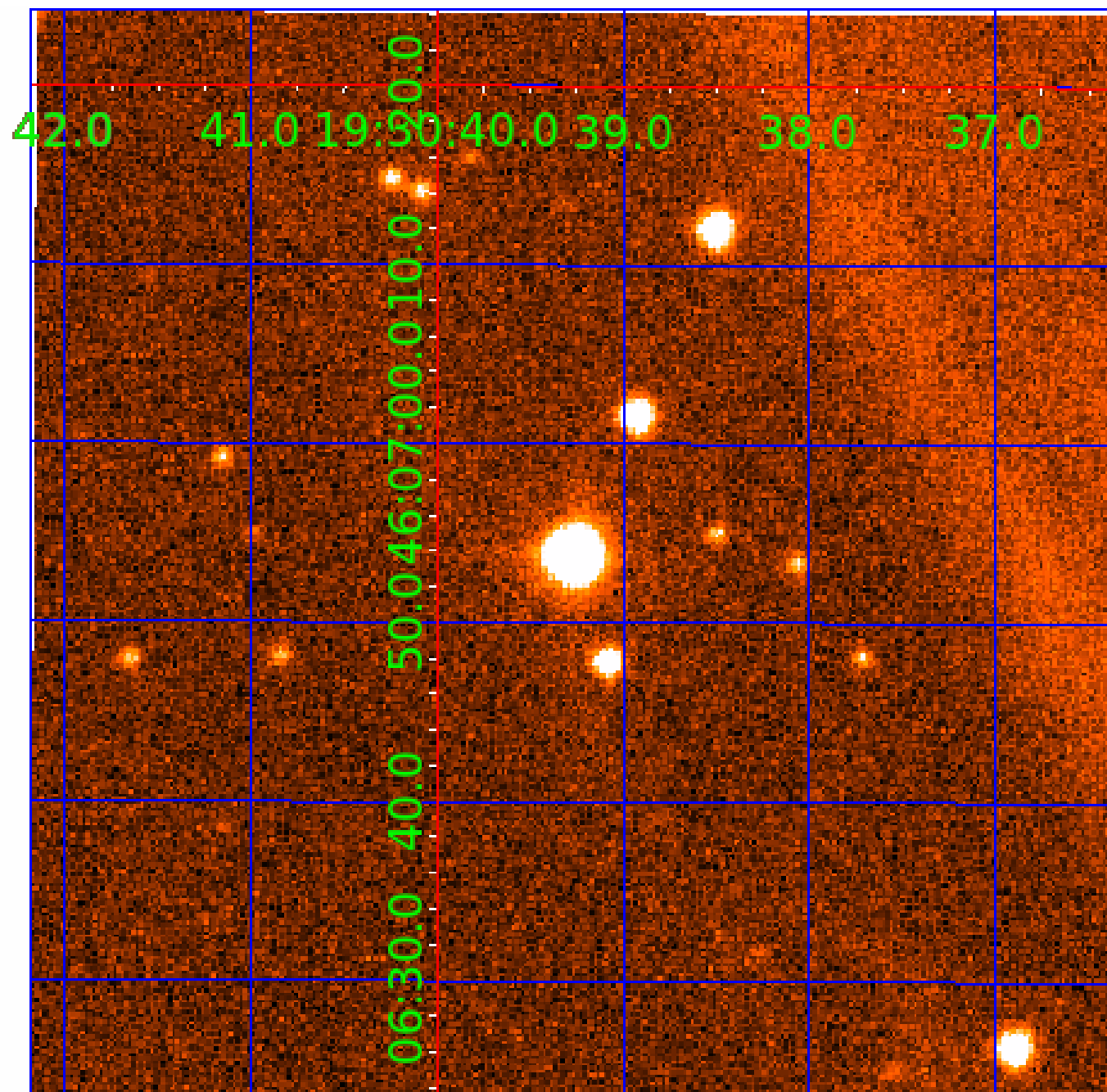


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 009528430

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009528430-01	OBS	3489.01	90.082537	173.987623	43411.8	19.721	2006.5	2153.8	2.34	6523	49.20	46.67
009528430-02	OBS	No	90.082780	148.949760	2363.0	16.303	140.0	148.0	2.34	6523	12.73	46.67

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009528430-01	OBS	FP	0.00	0	1	0	0	MOD_SEC_DV—MOD_SEC_ALT—HAS_SEC_TCE
009528430-02	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.

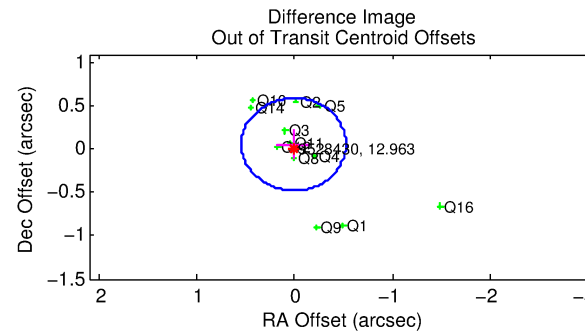
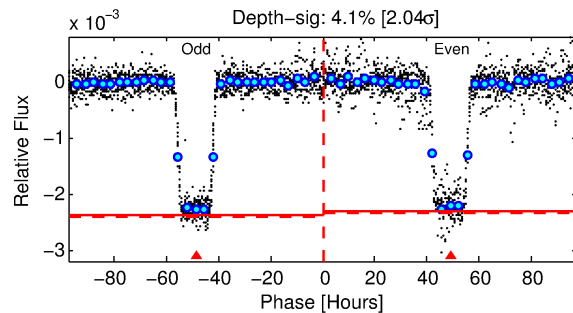
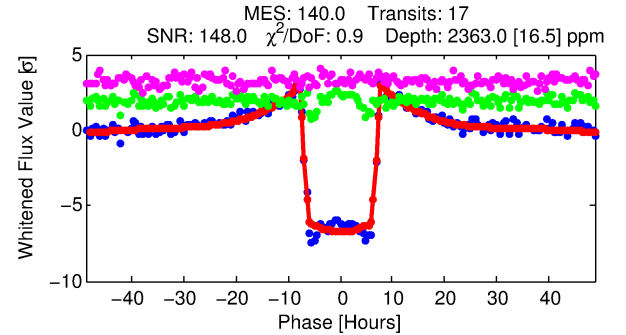
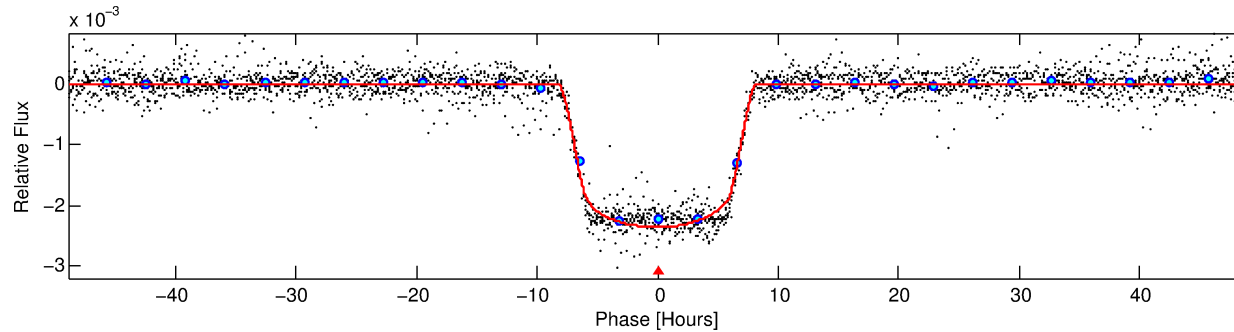
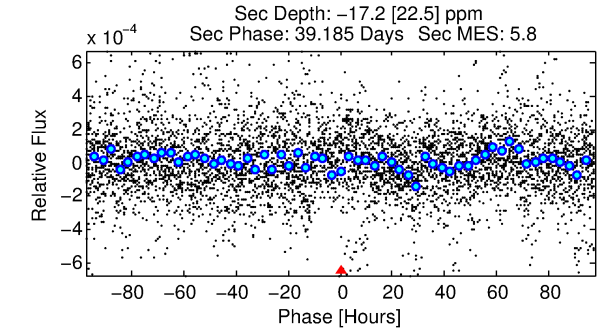
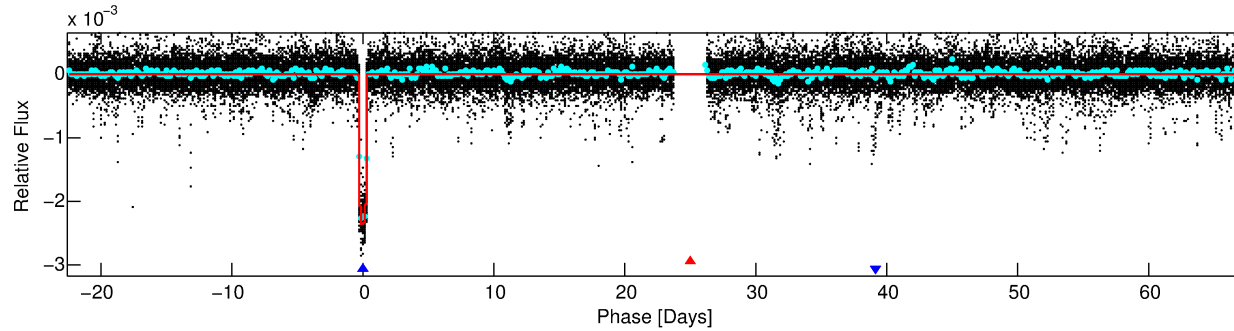
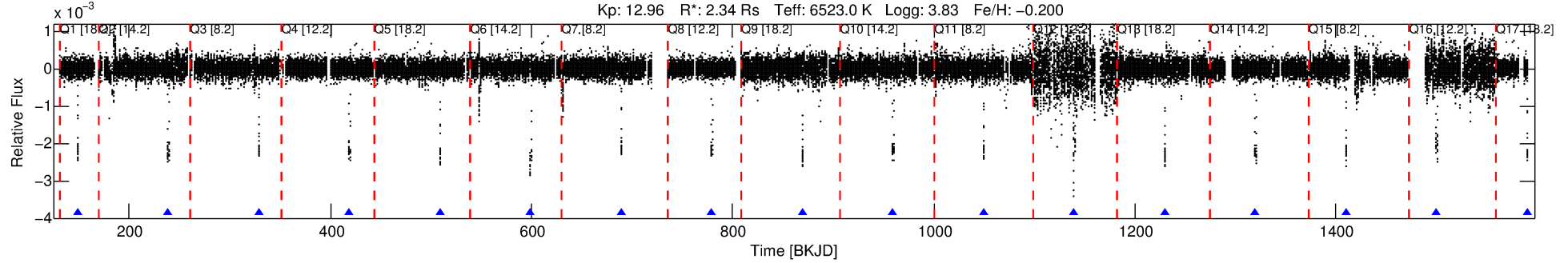
## Ephemeris Match Information For 009528430-02

No Significant Match Found

# DV One-Page Summary

KIC: 9528430 Candidate: 2 of 2 Period: 90.083 d  
KOI: K03489 Corr: No Ephemeris Match

Kp: 12.96 R\*: 2.34 Rs Teff: 6523.0 K Logg: 3.83 Fe/H: -0.200



## DV Fit Results:

Period = 90.08278 [0.00015] d  
Epoch = 148.9498 [0.0013] BKJD  
Rp/R\* = 0.0498 [0.0002]  
a/R\* = 27.35 [0.42]  
b = 0.83 [0.01]  
Seff = 46.67 [24.07]  
Teq = 666 [86] K  
Rp = 12.73 [4.42] Re  
a = 0.4368 [0.1407] AU  
Ag = N/A  
Teffp = N/A

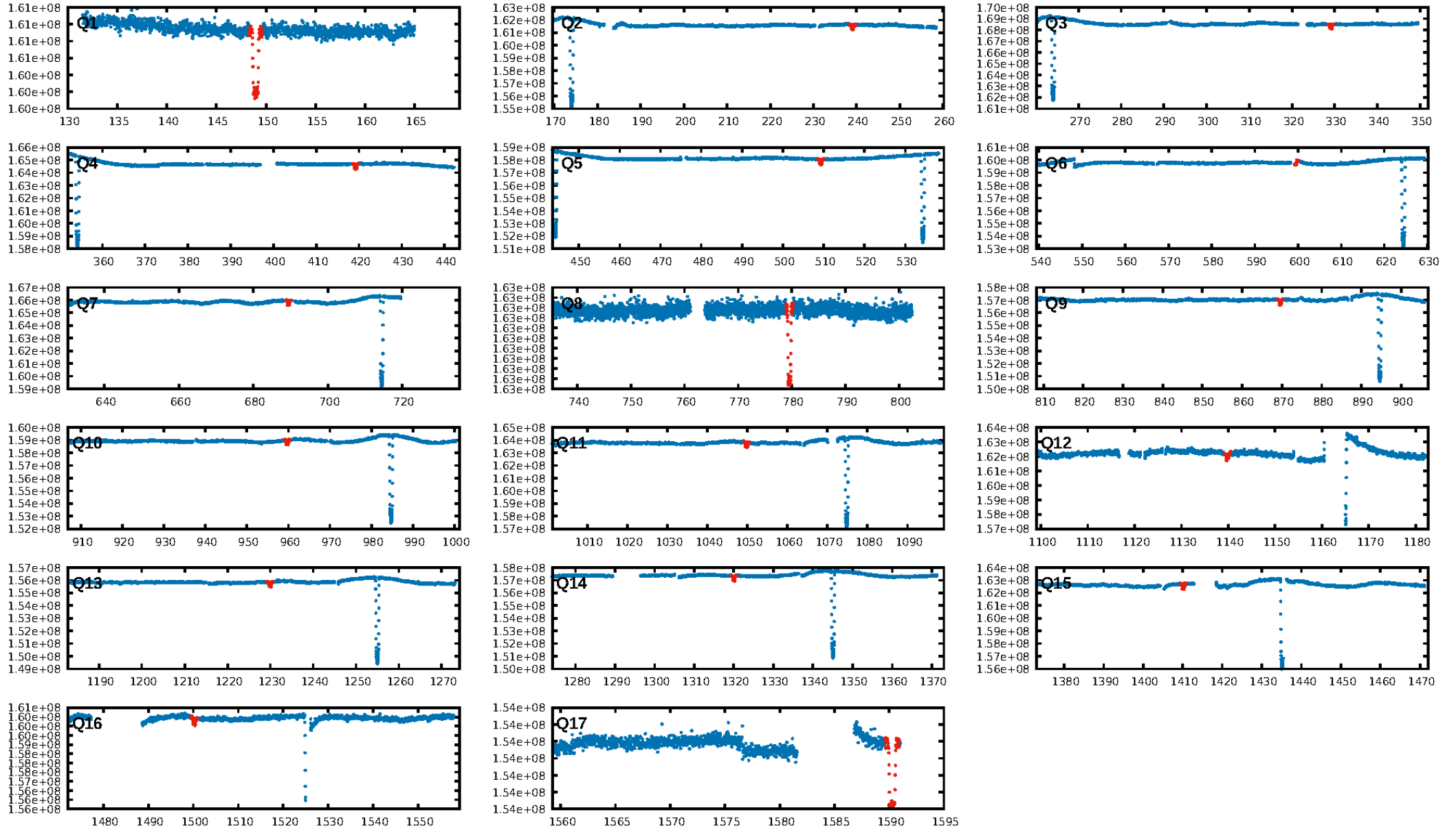
## DV Diagnostic Results:

ShortPeriod-sig: 0.0% [0.00σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 3.1%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 0.00e+00  
RollingBand-fgt: 1.00 [15/15]  
GhostDiagnostic-chr: 4.945  
Centroid-sig: 6.4%  
Centroid-so: 0.010 arcsec [0.19σ]  
OotOffset-rm: 0.059 arcsec [0.33σ]  
KicOffset-rm: 0.078 arcsec [0.41σ]  
OotOffset-st: 3/2/4/3 [12]  
KicOffset-st: 3/2/4/3 [12]  
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DiffImageOverlap-fno: 1.00 [12/12]

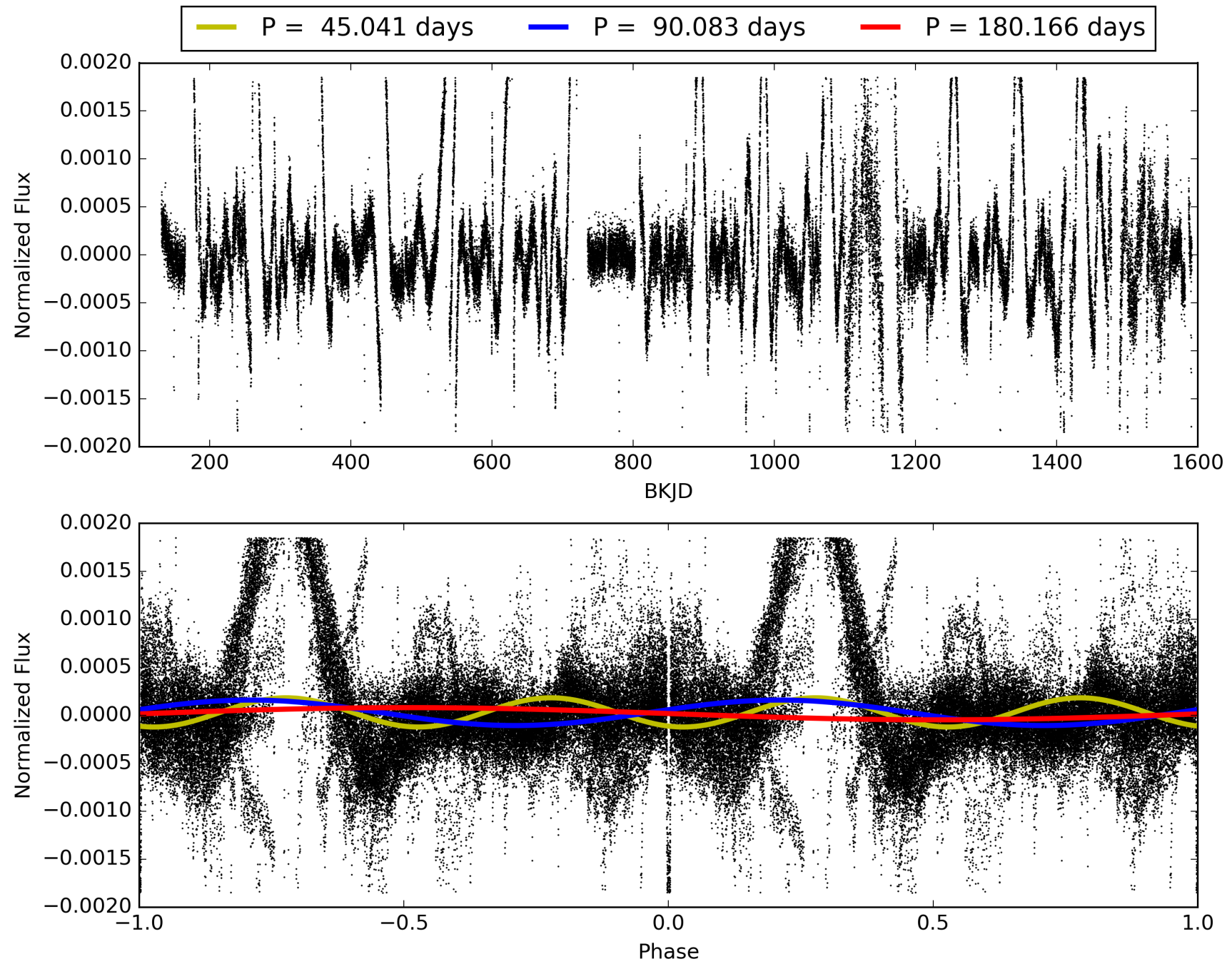
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This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 009528430-02, PDC Light Curves



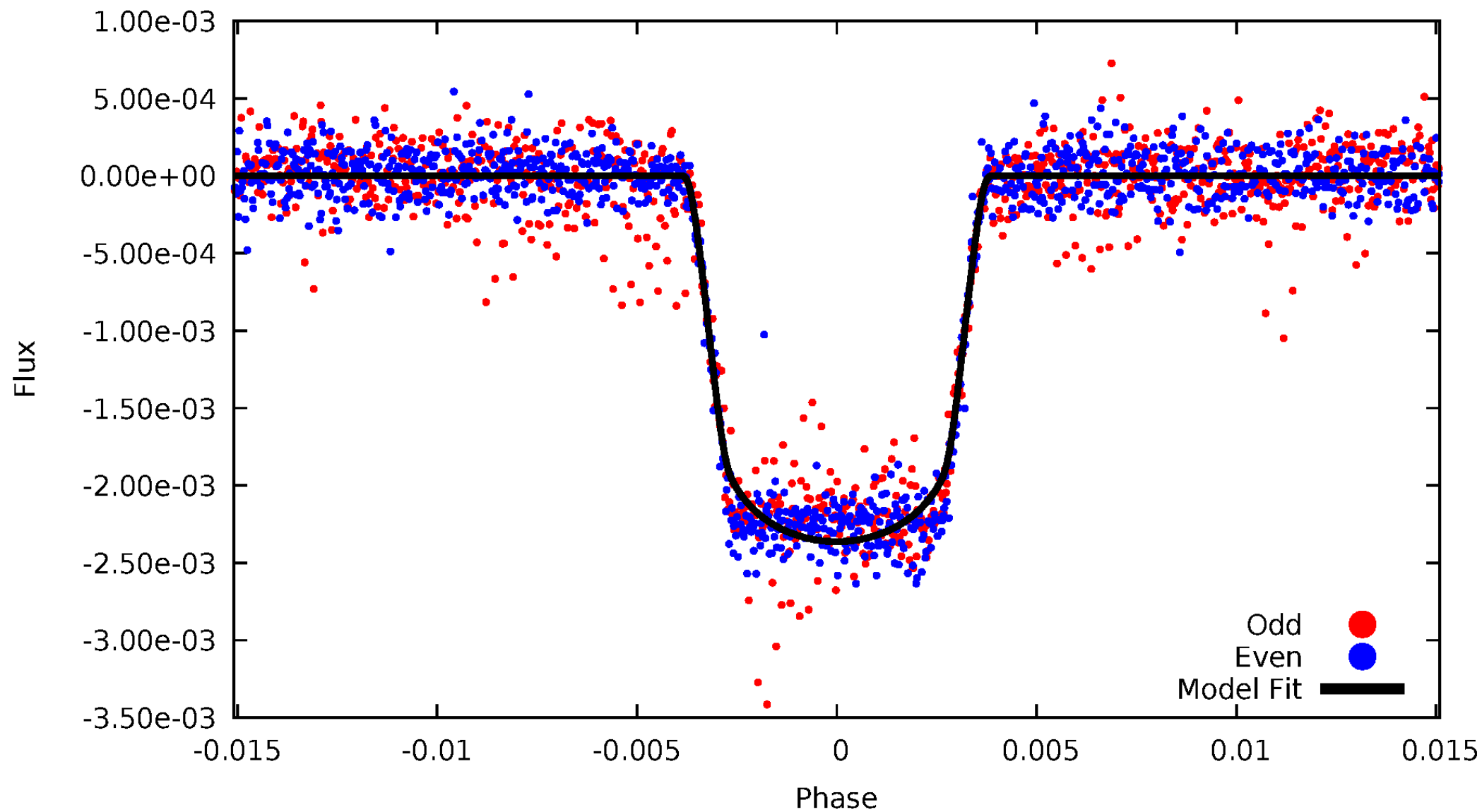
TCE 009528430-02





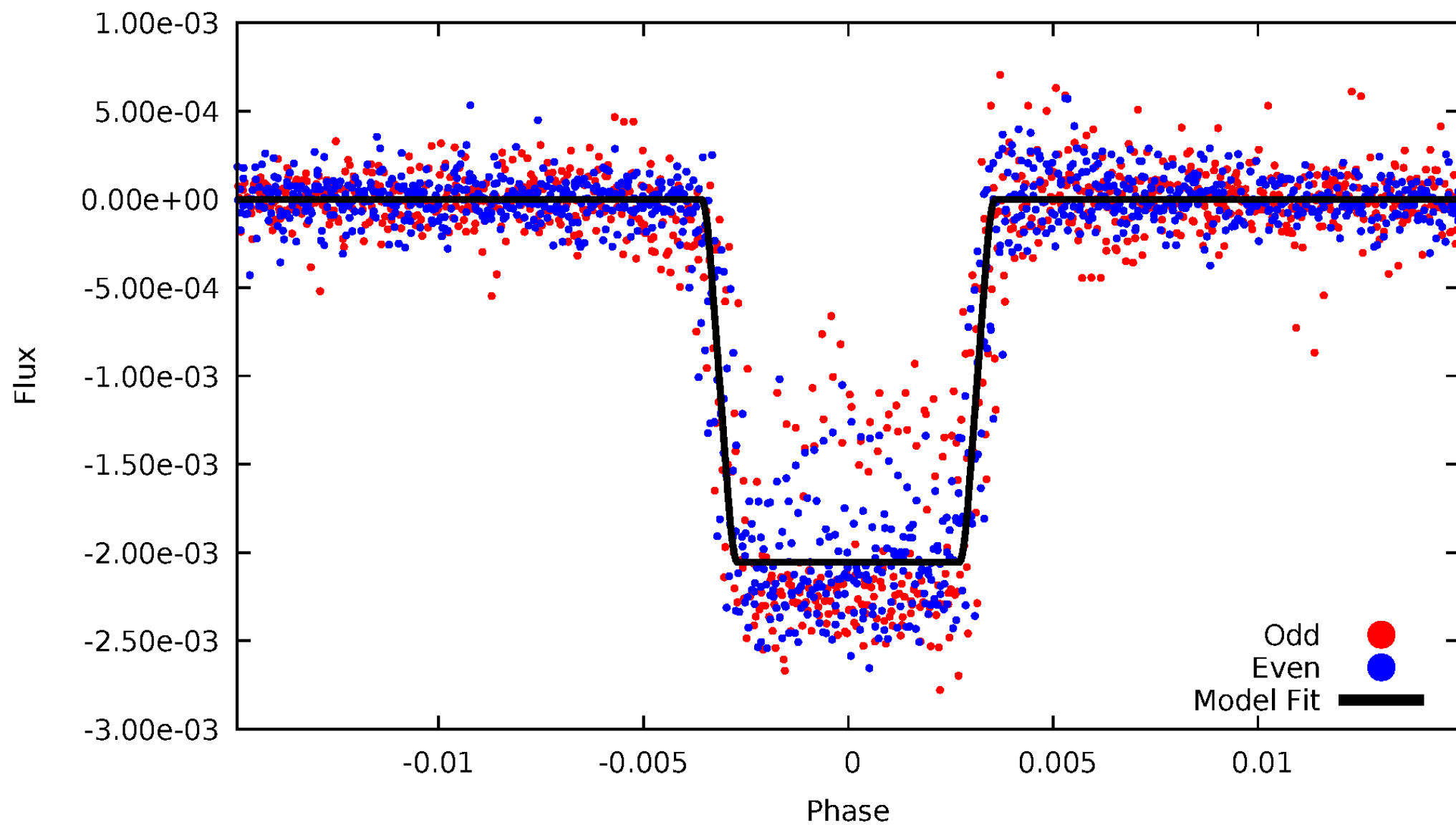
# DV Odd/Even

TCE 009528430-02



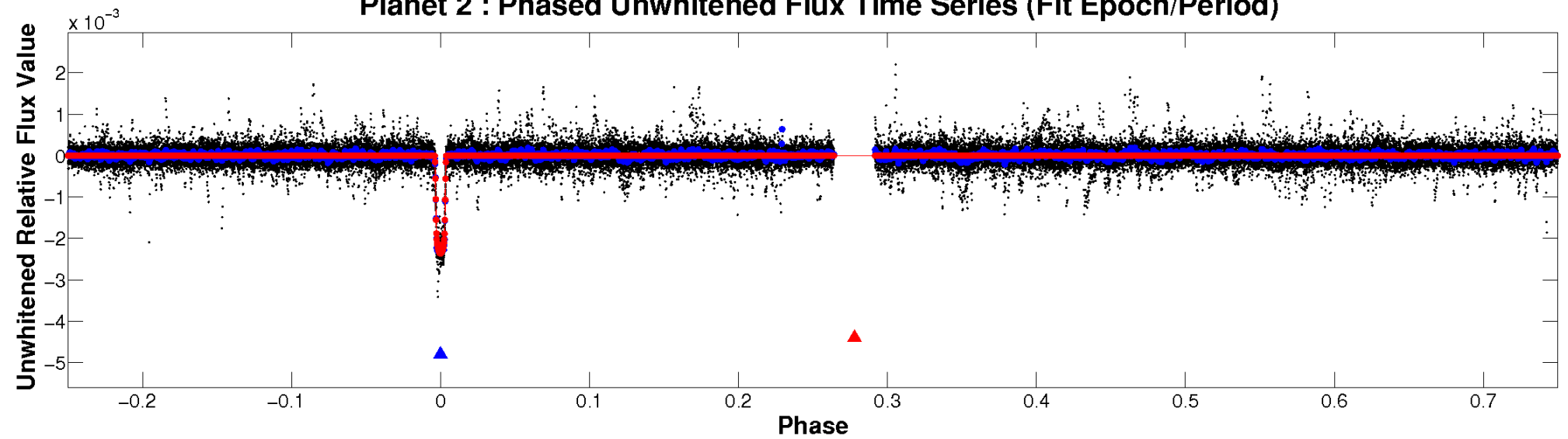
# ALT Odd/Even

TCE 009528430-02

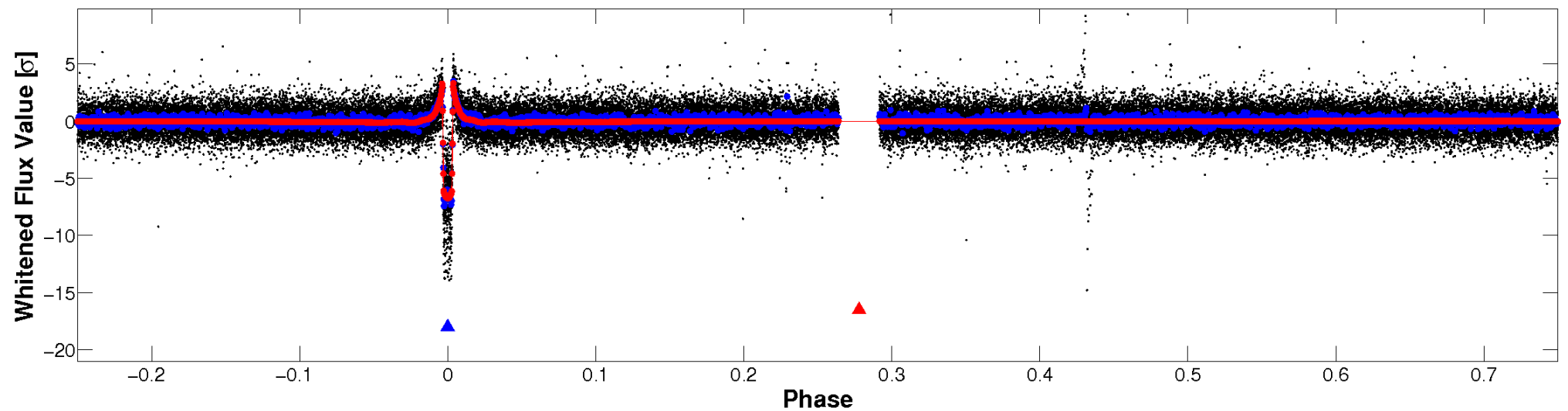


# Non-Whitened Vs. Whitened Light Curve

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

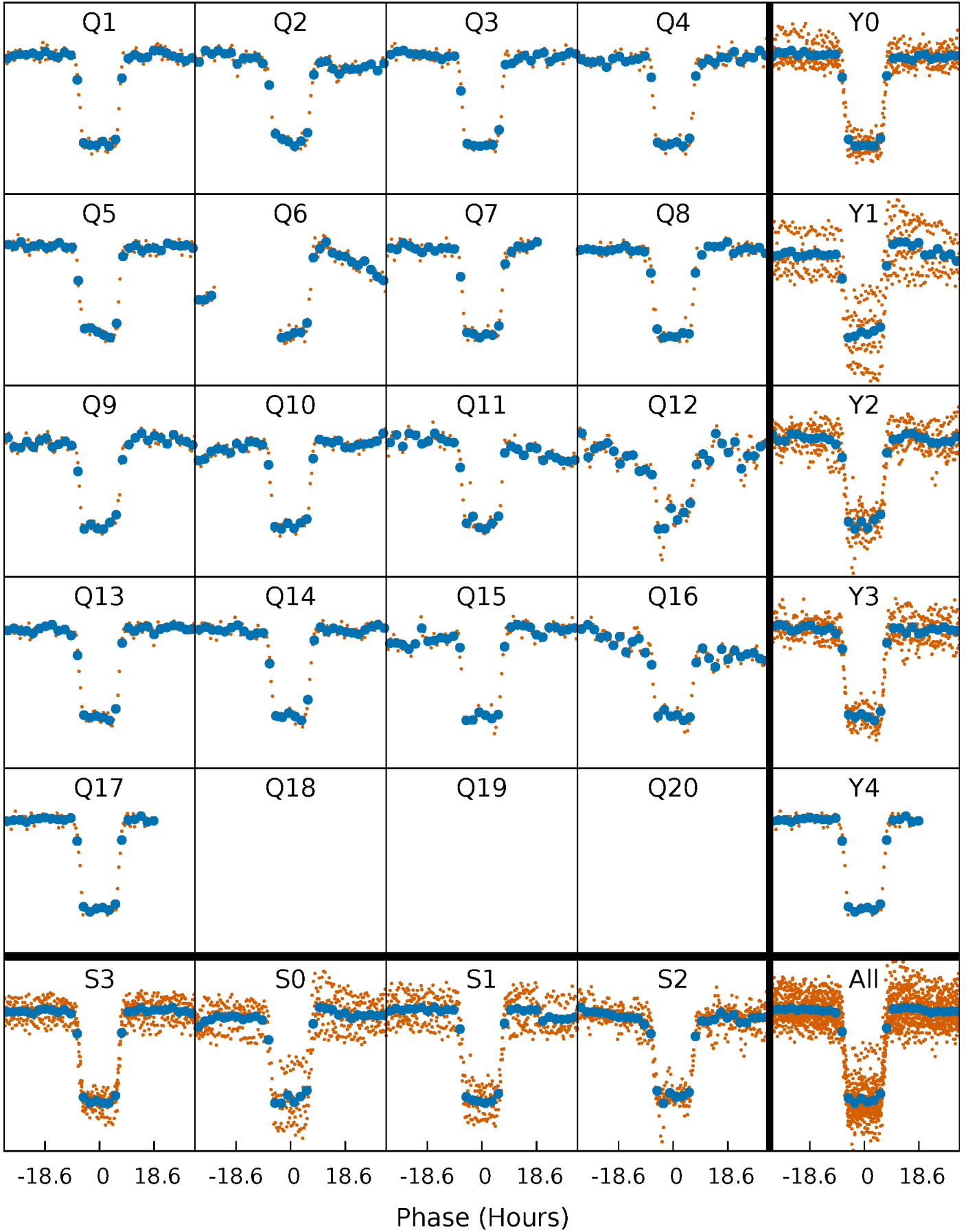


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



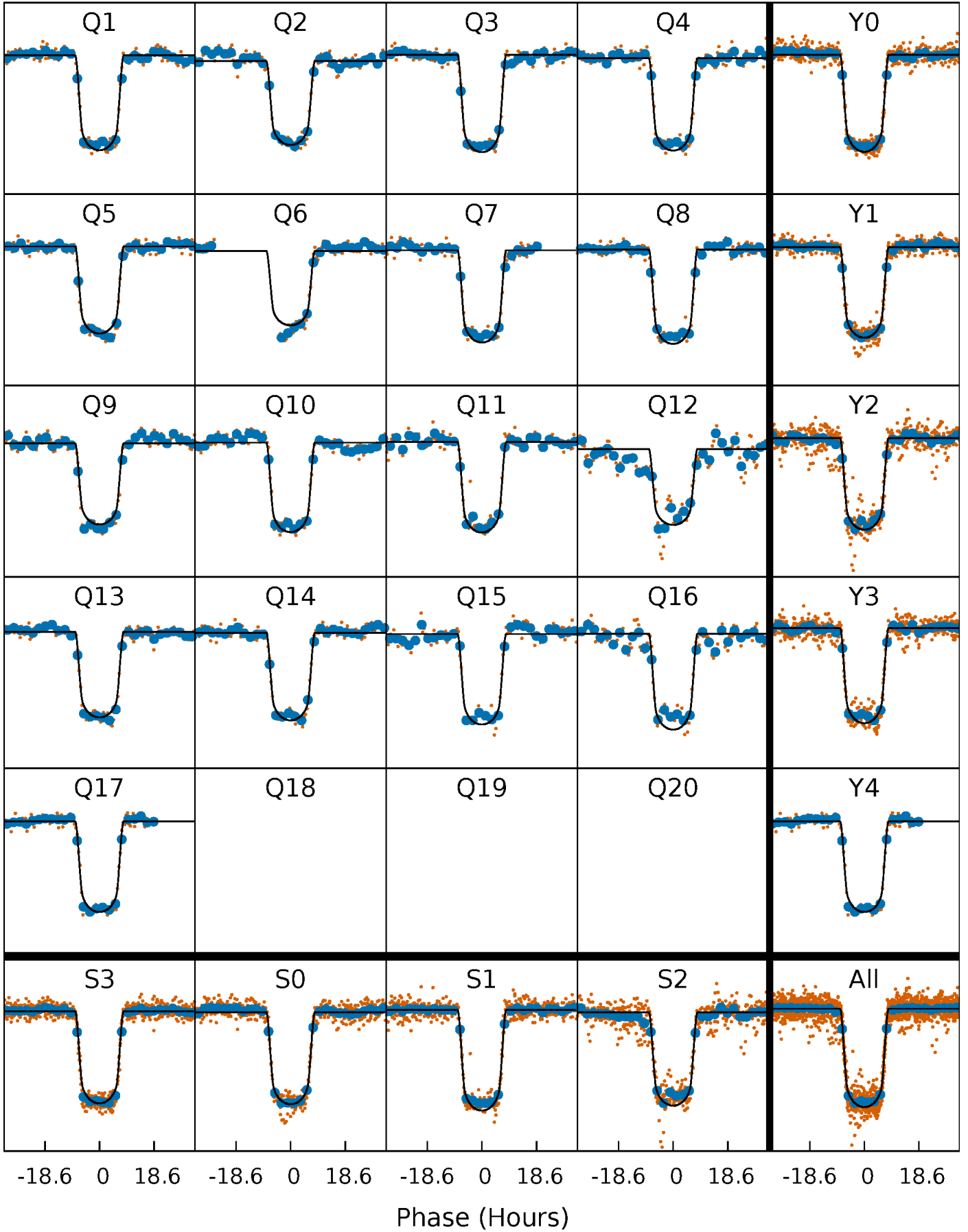
# PDC Quarter-Phased Transit Curves

TCE 009528430-02   P= 90.082780 Days    $T_0=148.949760$  (BKJD)



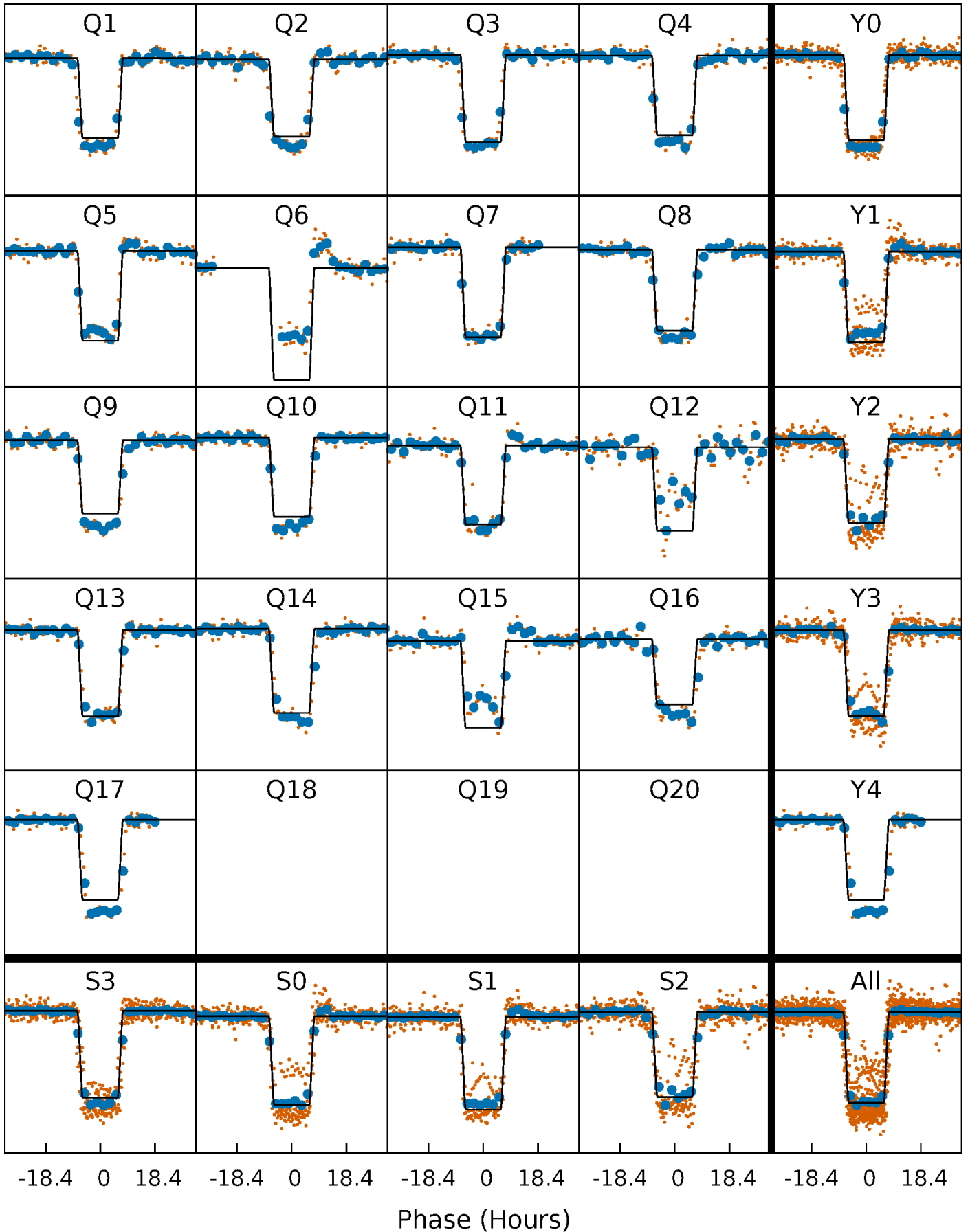
# DV Quarter-Phased Transit Curves

TCE 009528430-02   P= 90.082780 Days    $T_0=148.949760$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

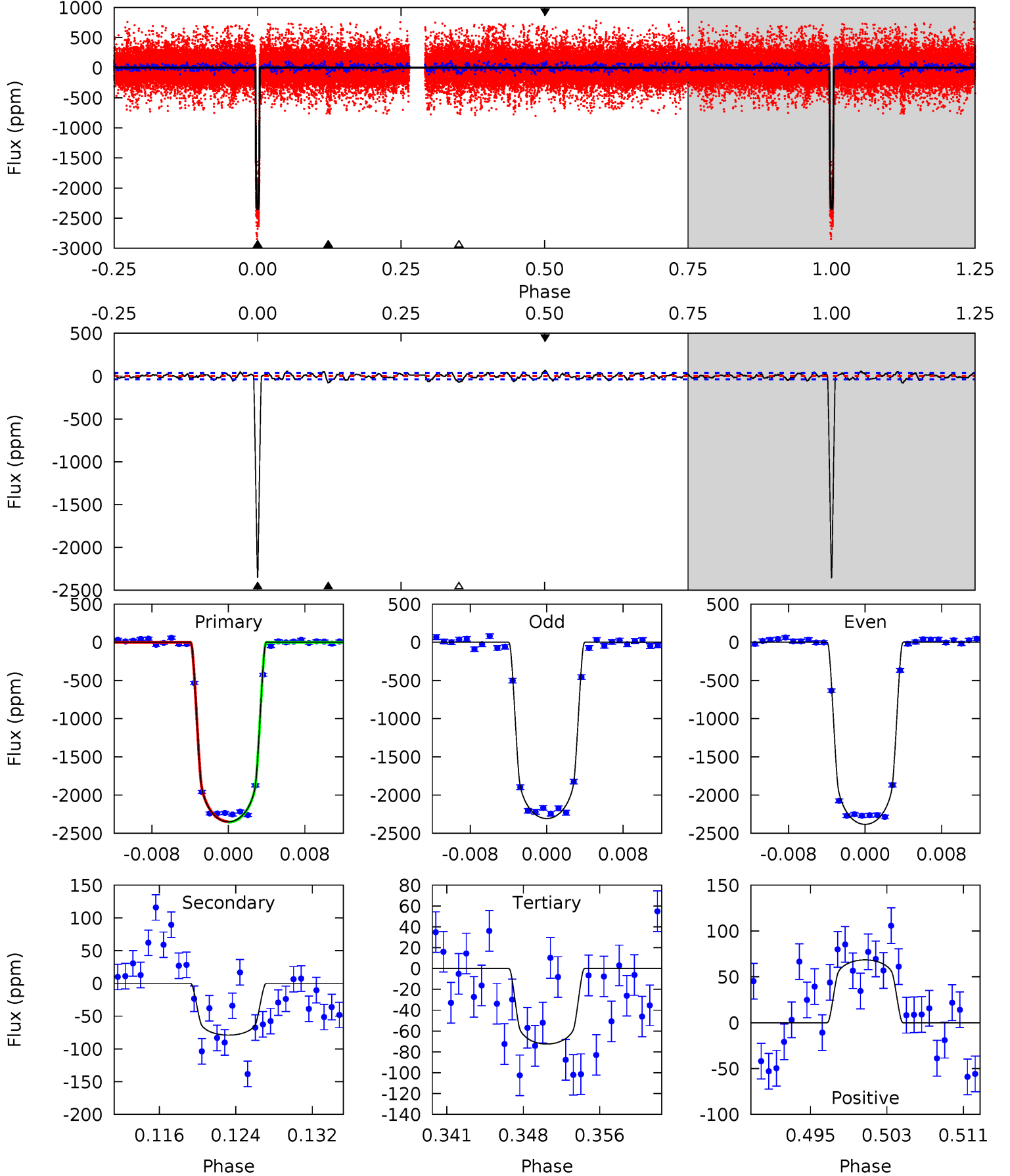
TCE 009528430-02     $P = 90.077944$  Days     $T_0 = 148.985526$  (BKJD)



# DV Model-Shift Uniqueness Test

009528430-02, P = 90.082780 Days, E = 58.866980 Days

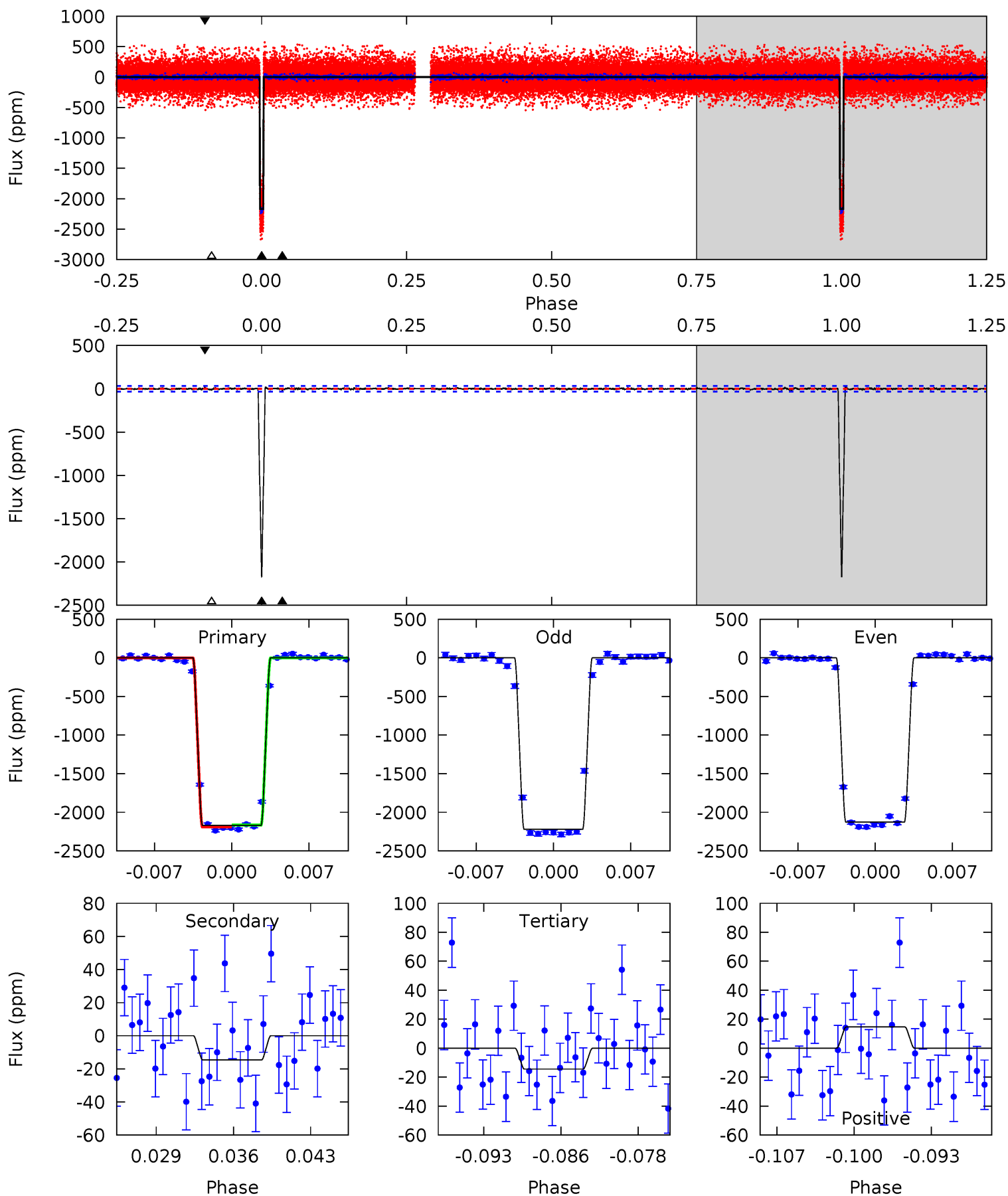
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
309.4	10.4	9.54	9.01	5.08	2.66	3.04	299.8	300.4	0.86	1.39	4.93	1.01	0.03	0.57



# Alt Model-Shift Uniqueness Test

009528430-02, P = 90.077944 Days, E = 58.907582 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
338.8	2.29	2.25	2.29	5.09	2.69	0.64	336.6	336.5	0.04	0.00	7.08	0.95	0.01	1.96





### Stellar Parameters For KIC 009528430

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6523^{+176}_{-176}$	$3.835^{+0.292}_{-0.097}$	$-0.200^{+0.300}_{-0.250}$	$2.343^{+0.438}_{-0.813}$	$1.371^{+0.233}_{-0.233}$	$0.150^{+0.276}_{-0.046}$
	+3%/-3%	+8%/-3%	+150%/-125%	+19%/-35%	+17%/-17%	+184%/-31%
Source	PHO1	FLK73	KIC0	DSEP		

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

### Secondary Eclipse Parameters for KIC 009528430-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-79 \pm 8$	$12.56^{+1.37}_{-2.53}$	$913^{+52}_{-81}$	$3303^{+74}_{-77}$	$55^{+27}_{-12}$
Alt.	$-15 \pm 6$	$11.44^{+1.18}_{-2.03}$	$917^{+54}_{-74}$	$2670^{+137}_{-191}$	$12^{+8}_{-6}$

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

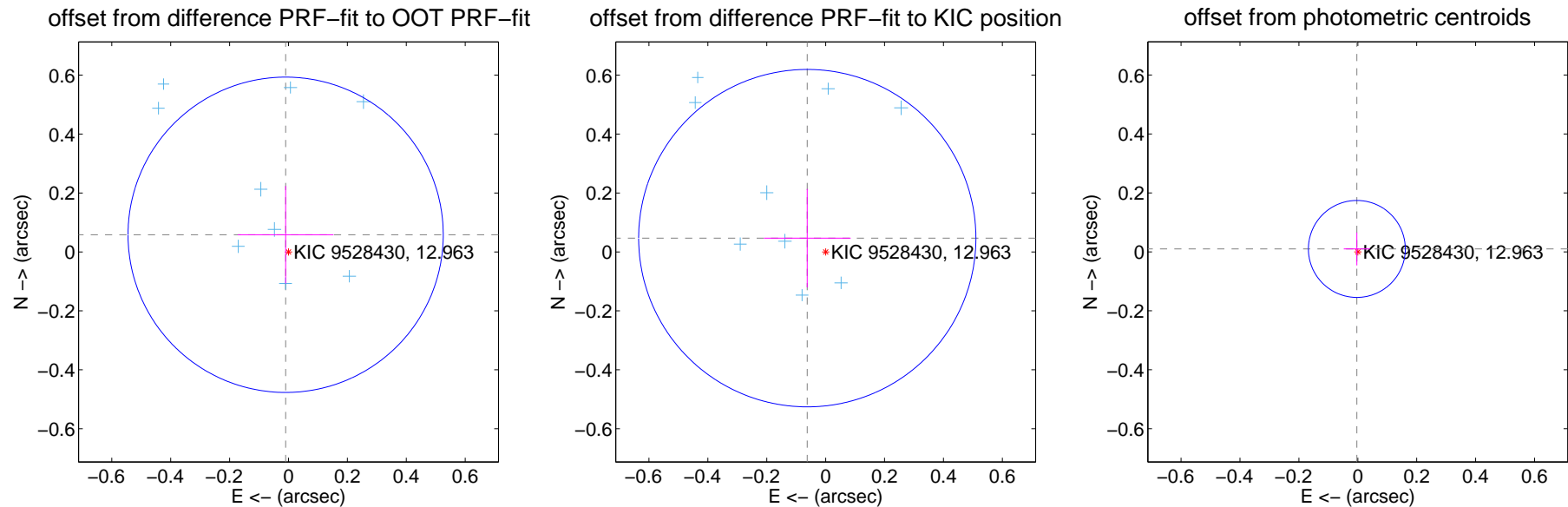
## DV Centroid Data

Supplemental centroid analysis for 009528430-02. Kepler magnitude: 12.96. Transit SNR 147.95

There are 12 quarters with good PRF difference image offsets

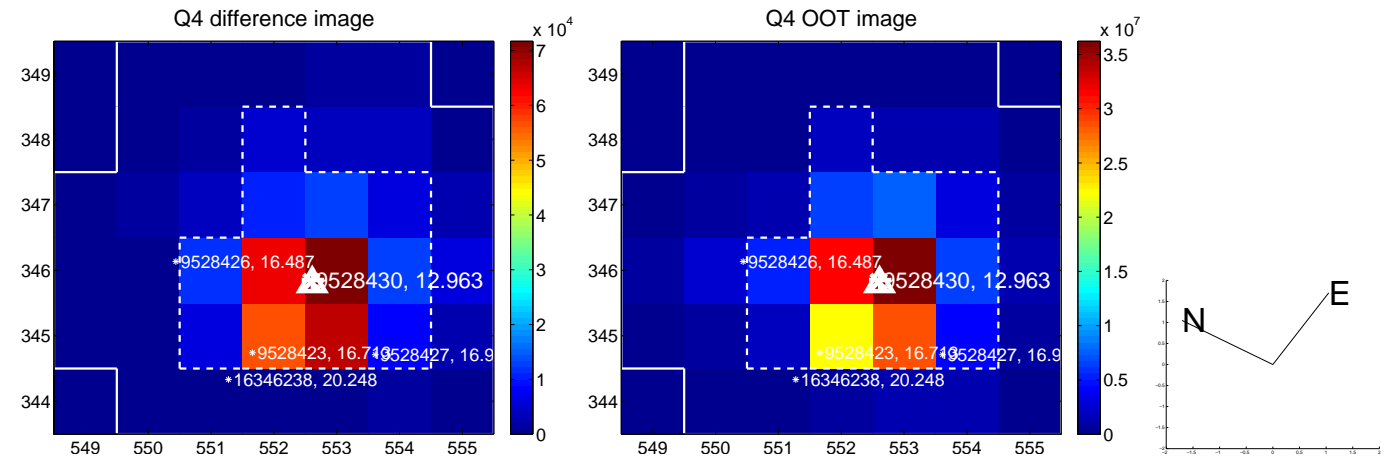
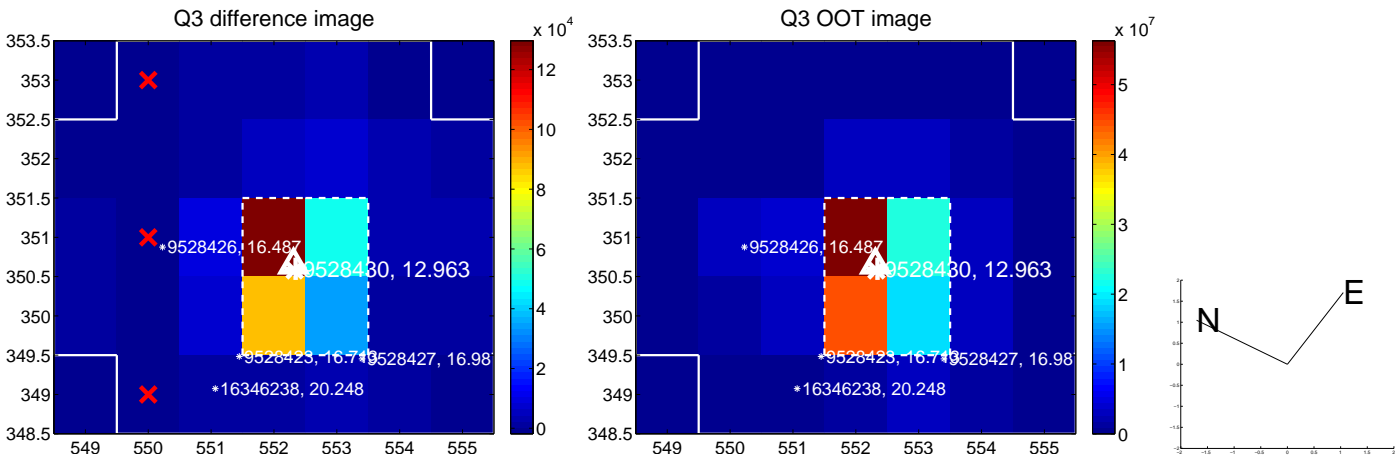
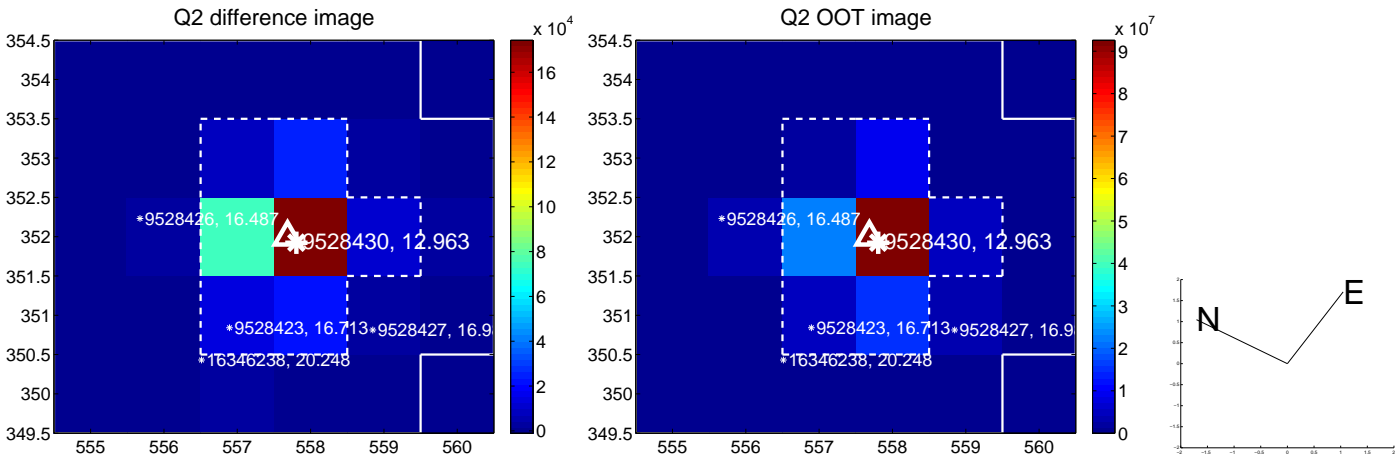
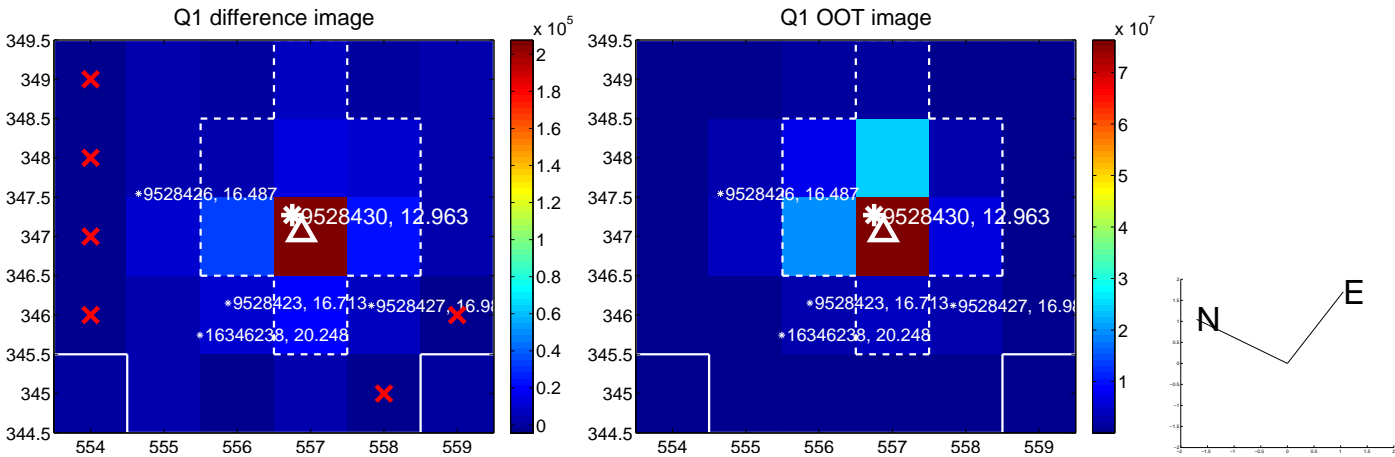
The direct PRF centroid is offset from the target star catalog position by about 0.11 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.059 \pm 0.178$	0.33	$0.010 \pm 0.162$	$0.058 \pm 0.166$
PRF-fit source offset from KIC position	$0.078 \pm 0.191$	0.41	$0.062 \pm 0.147$	$0.047 \pm 0.167$
photometric centroid source offset	$0.01 \pm 0.05$	0.19	$0.00 \pm 0.04$	$0.01 \pm 0.06$

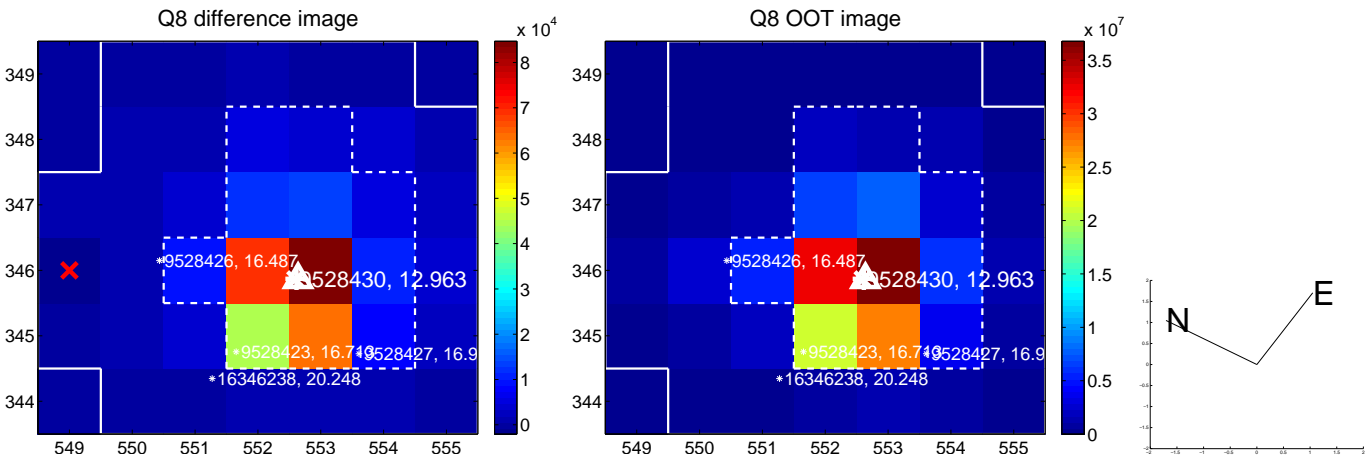
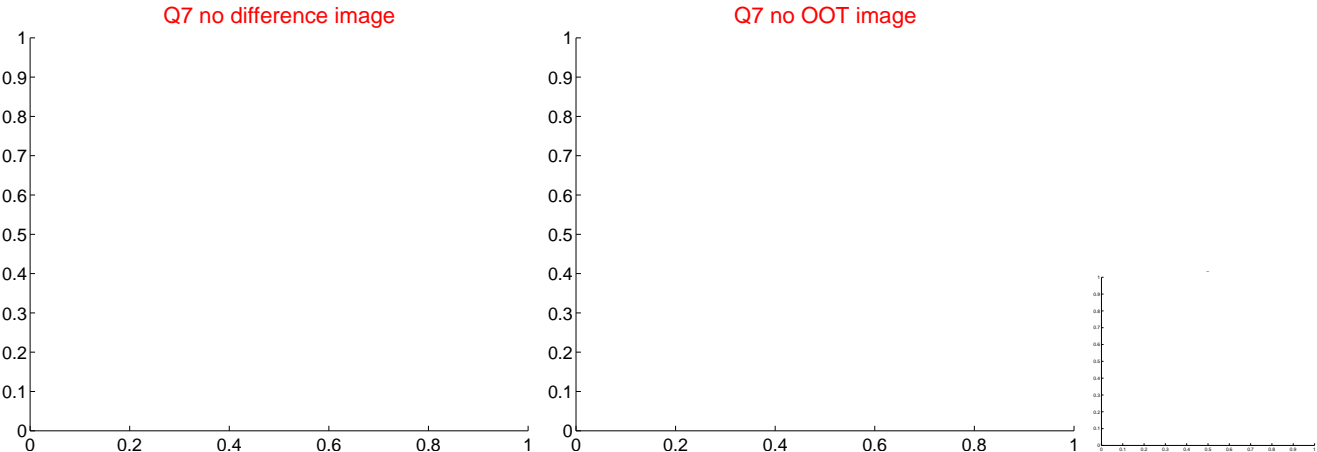
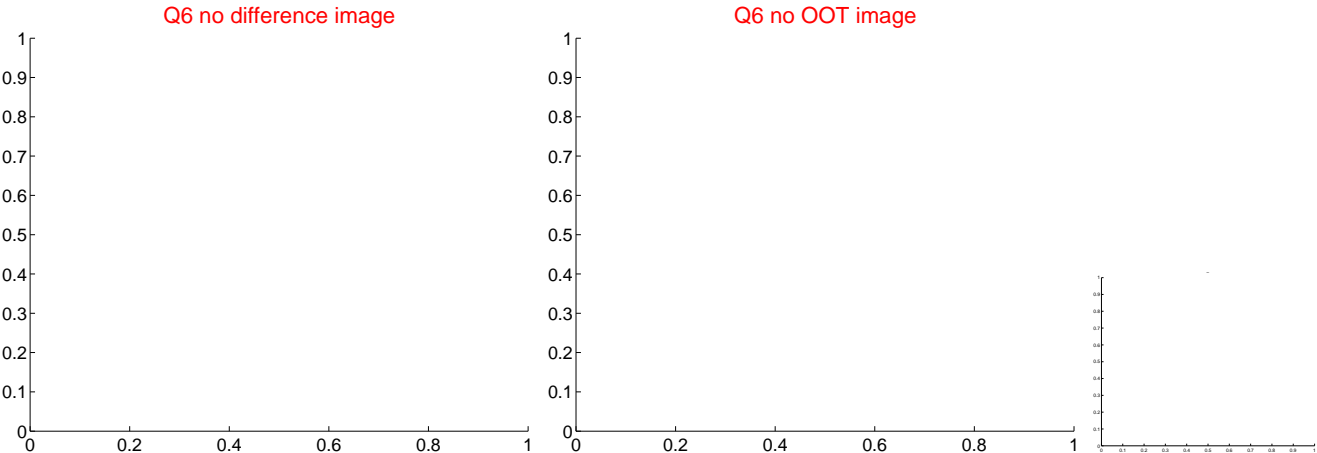
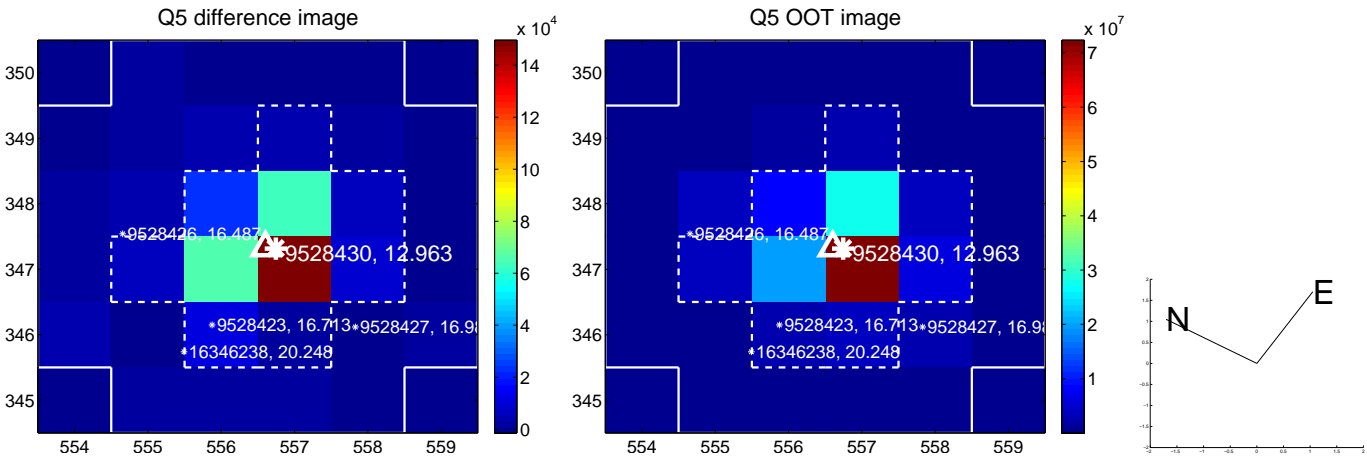


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

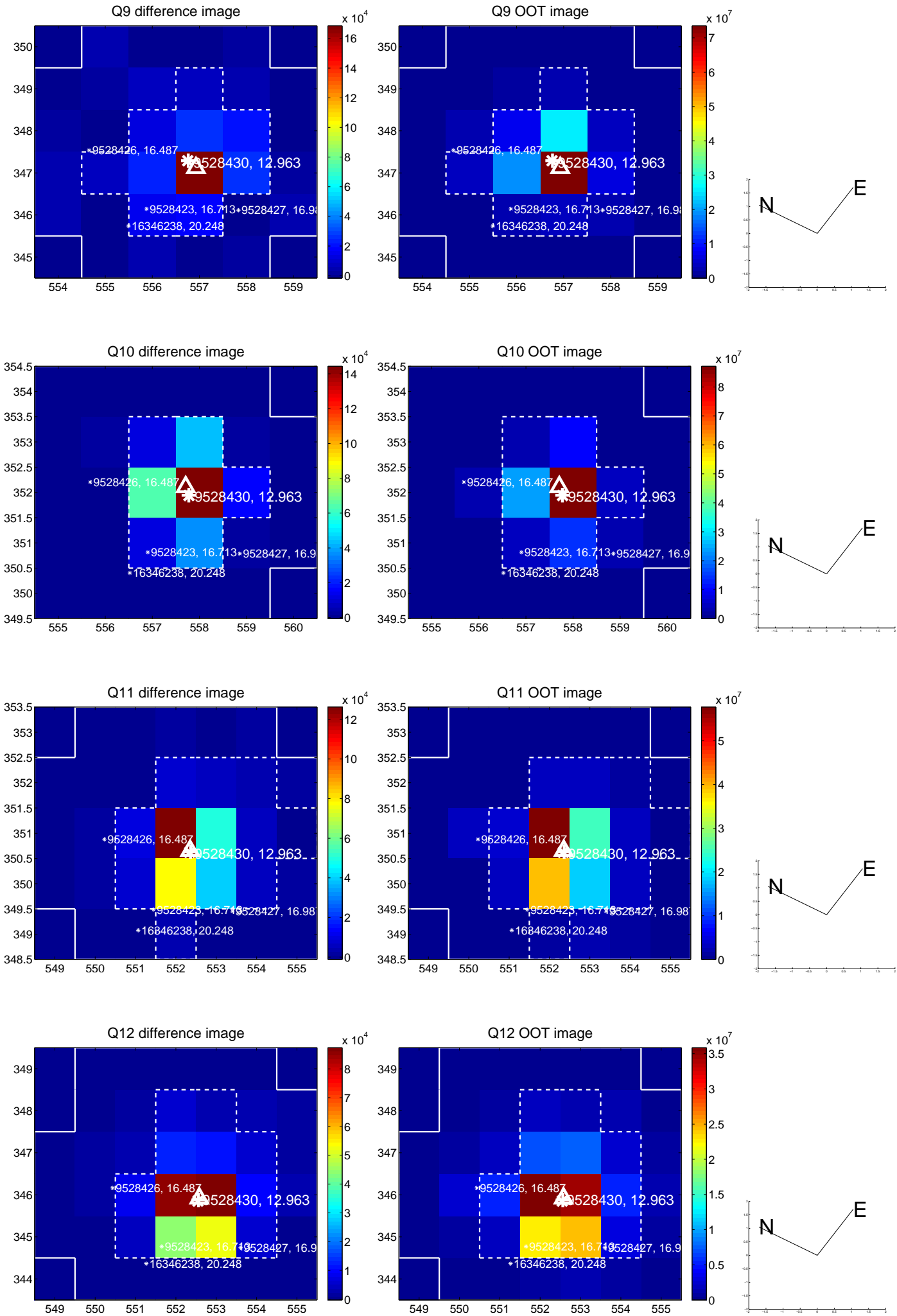
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



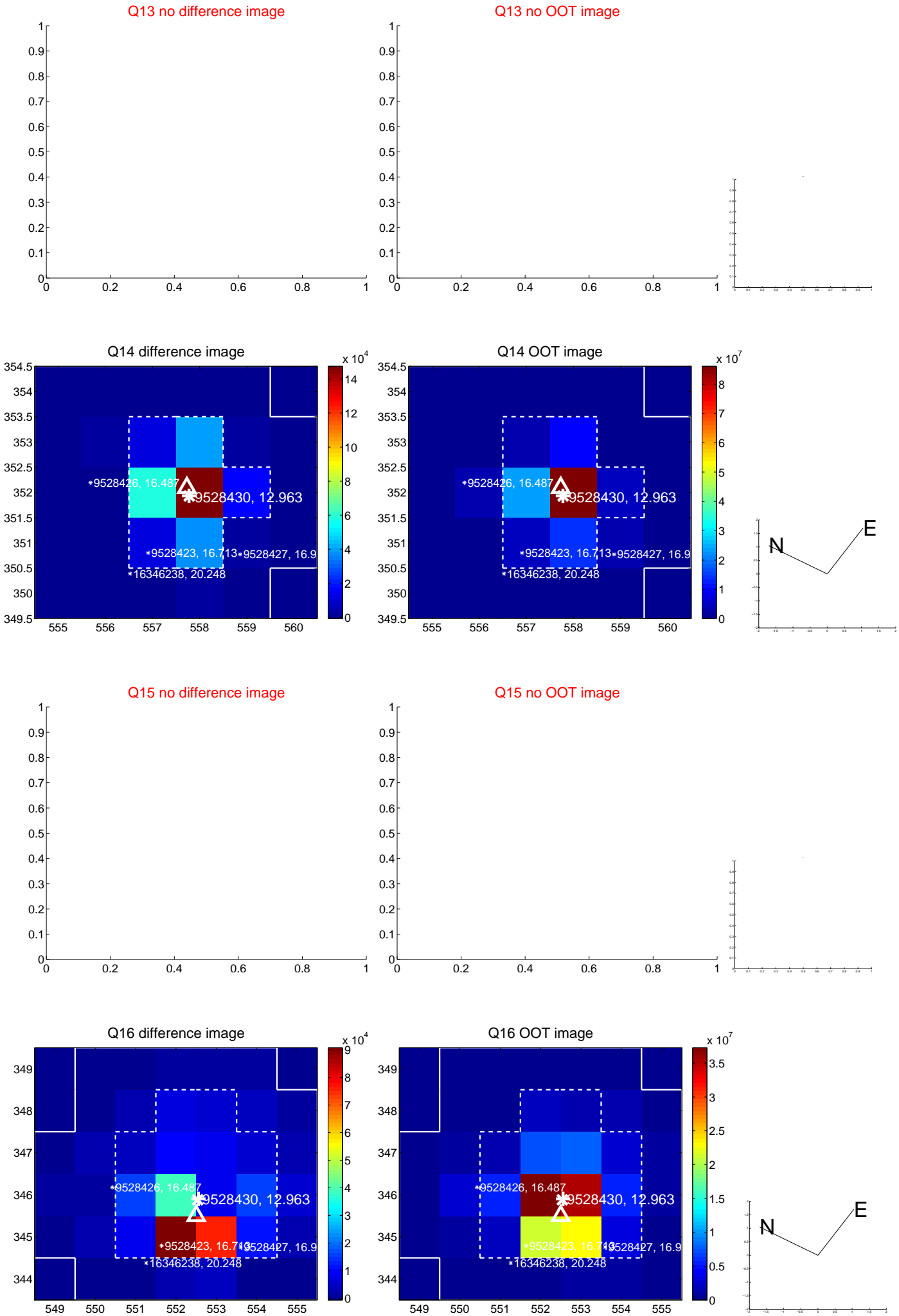
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



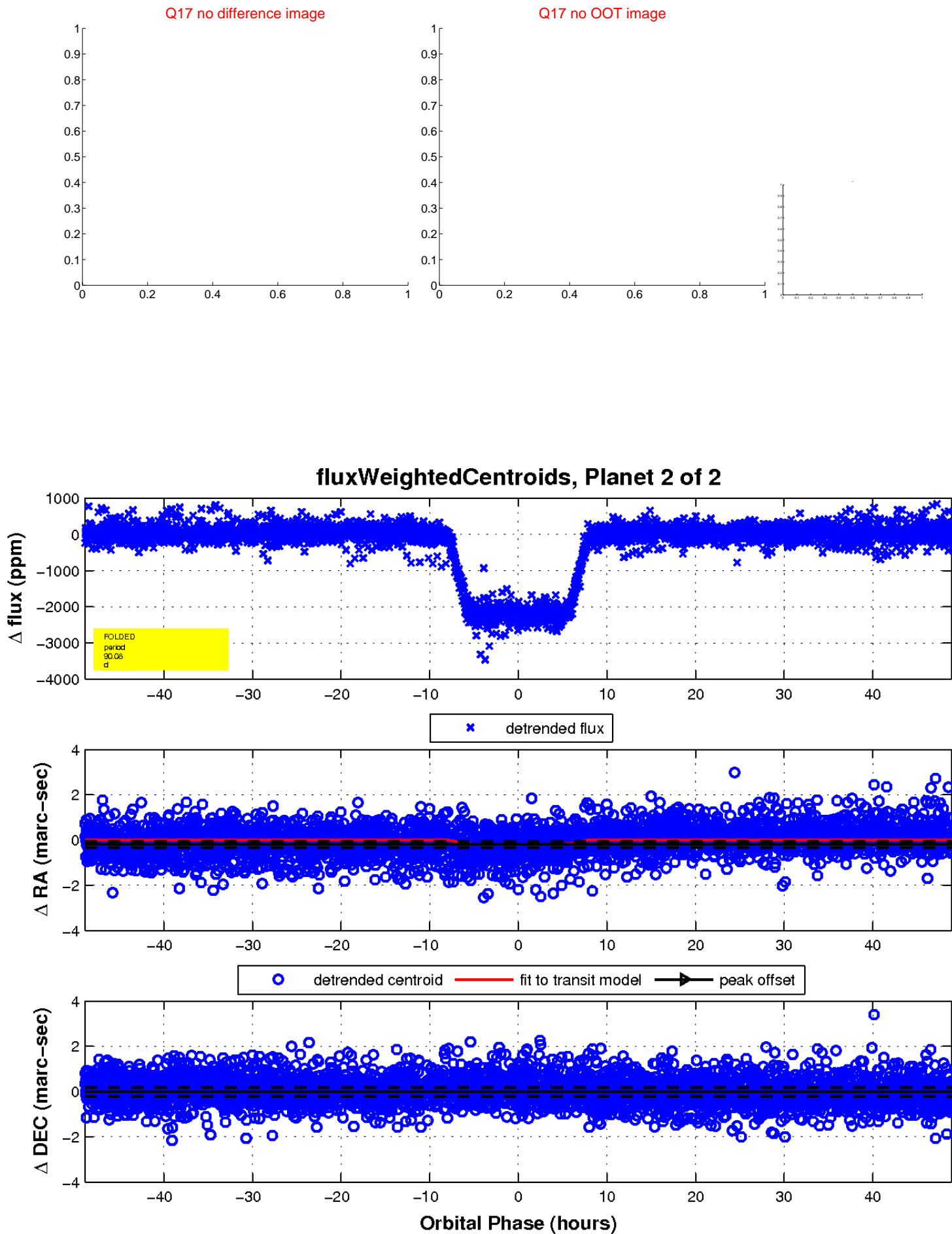
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

