

# KIC 012785320

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
012785320-01	OBS	0298.01	19.963623	138.383338	270.9	2.652	28.7	31.9	0.79	5250	1.53	23.93
012785320-02	OBS	0298.02	57.383621	170.733280	244.3	4.761	17.4	18.6	0.79	5250	1.70	5.86

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
012785320-01	OBS	PC	1.00	0	0	0	0	CENT_CROWDED
012785320-02	OBS	PC	0.92	0	0	0	0	CENT_CROWDED

**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 012785320-01

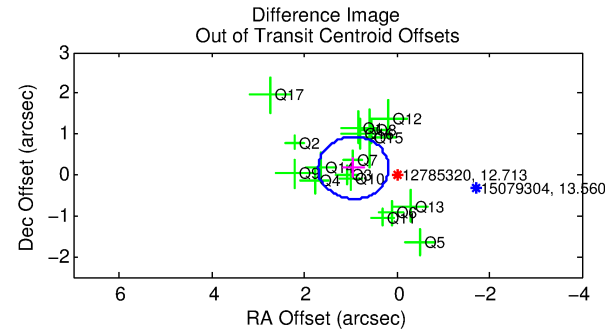
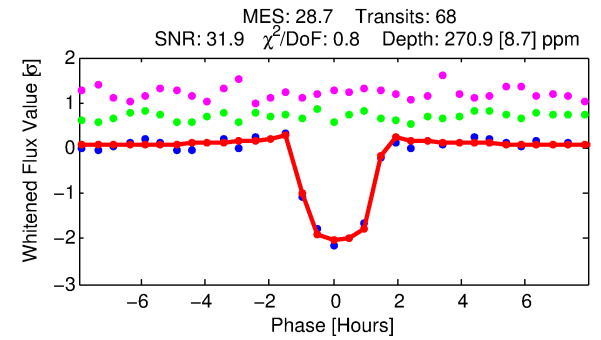
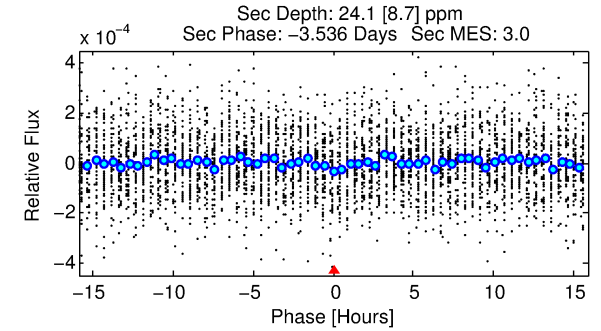
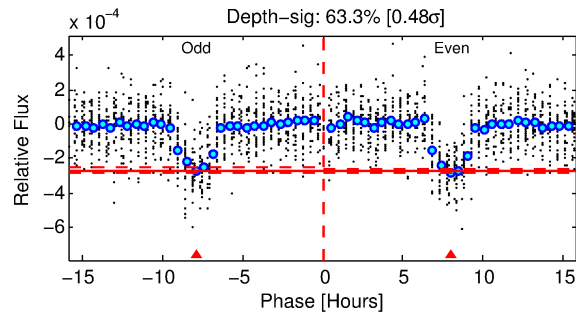
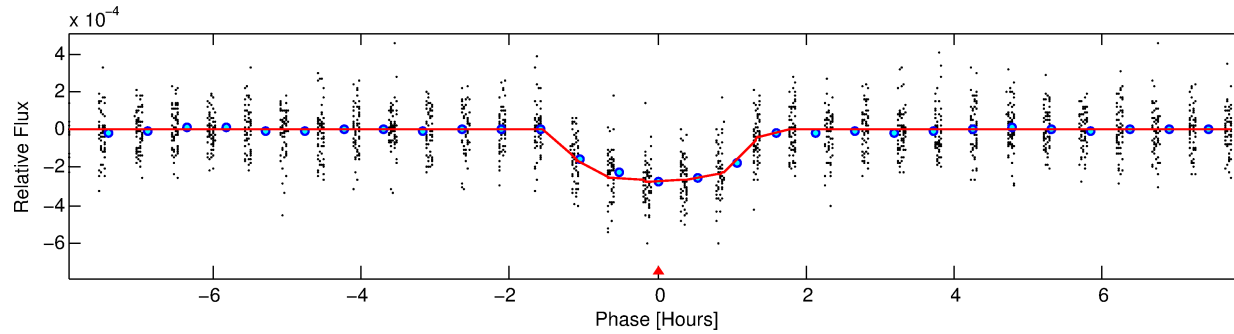
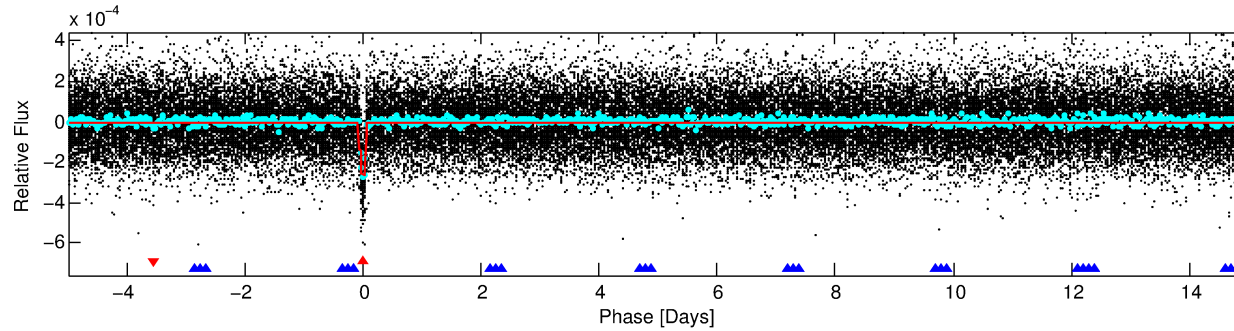
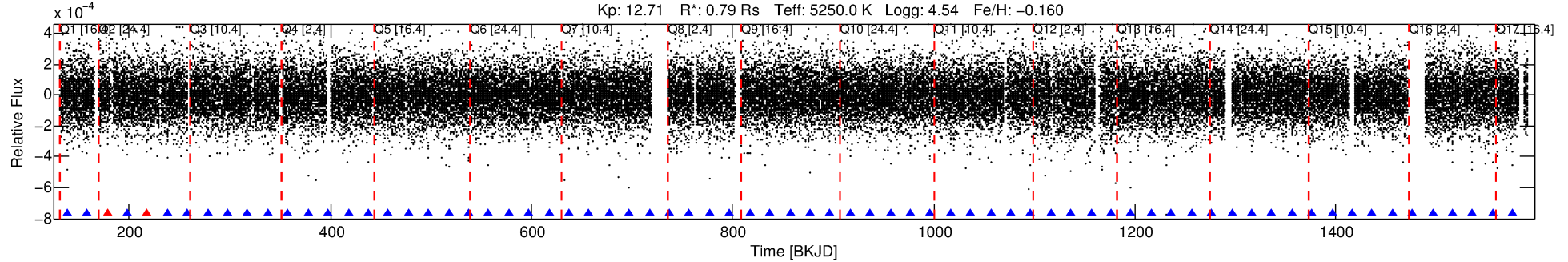
No Significant Match Found

# DV One-Page Summary

KIC: 12785320 Candidate: 1 of 2 Period: 19.964 d

KOI: K00298.01 Corr: 0.965

Kp: 12.71 R\*: 0.79 Rs Teff: 5250.0 K Logg: 4.54 Fe/H: -0.160



## DV Fit Results:

Period = 19.96362 [0.00005] d  
Epoch = 138.3833 [0.0018] BKJD  
Rp/R\* = 0.0178 [0.0072]  
a/R\* = 29.69 [50.30]  
b = 0.88 [0.46]  
Seff = 23.93 [2.85]  
Teq = 564 [17] K  
Rp = 1.54 [0.63] Re  
a = 0.1332 [0.0078] AU  
Ag = 99.72 [88.64] [1.11σ]  
Teffp = 2756 [612] K [3.58σ]

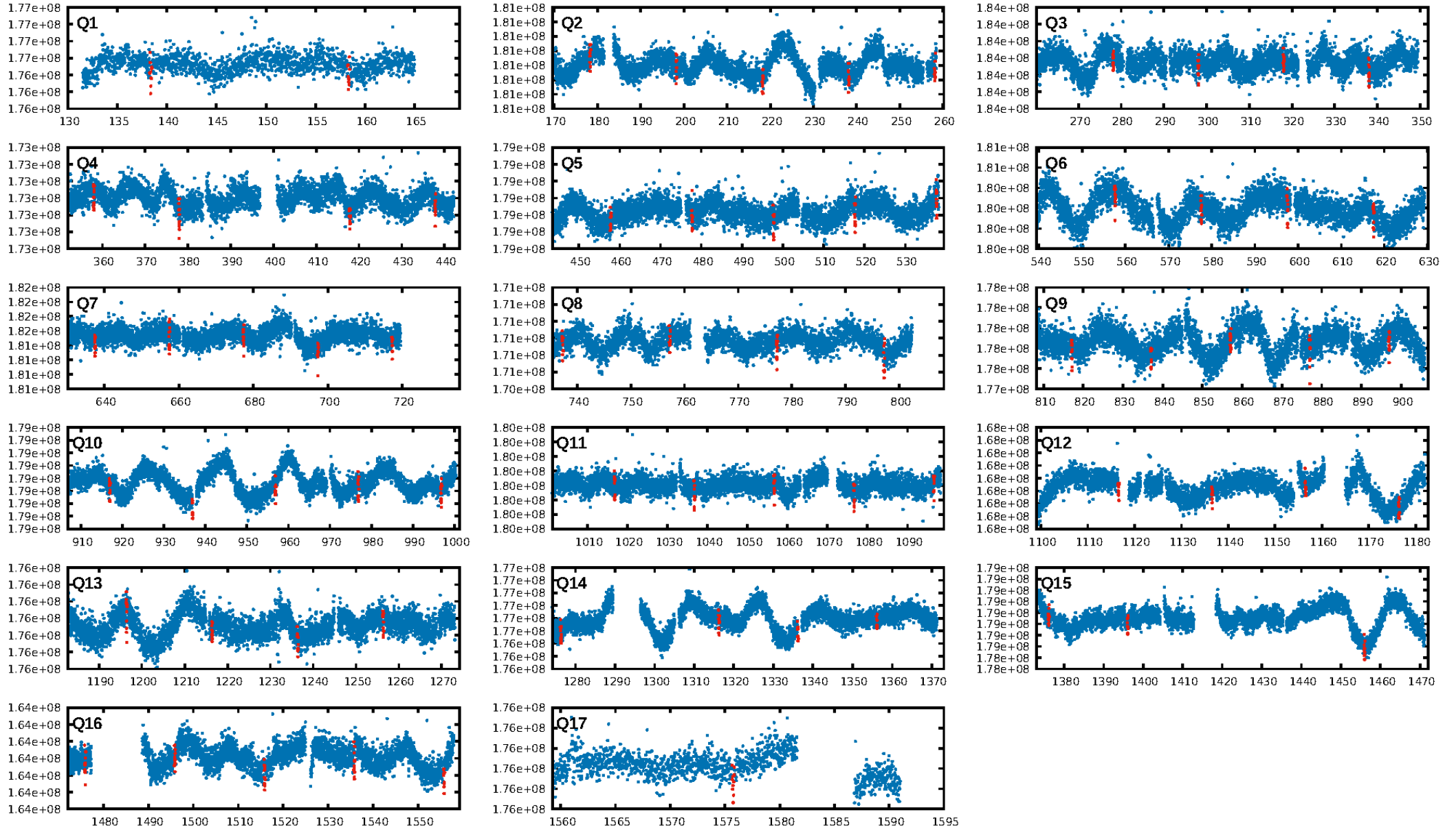
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [164.78σ]  
ModelChiSquare2-sig: 86.5%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 1.17e-173  
RollingBand-fgt: 0.97 [63/65]  
GhostDiagnostic-chr: 20.9  
Centroid-sig: 7.3%  
Centroid-so: 0.518 arcsec [1.11σ]  
**OotOffset-rm: 0.958 arcsec [3.78σ]**  
KicOffset-rm: 0.560 arcsec [2.46σ]  
OotOffset-st: 4/4/4/5 [17]  
KicOffset-st: 4/4/4/5 [17]  
DiffImageQuality-fgm: 0.88 [15/17]  
DiffImageOverlap-fno: 1.00 [17/17]

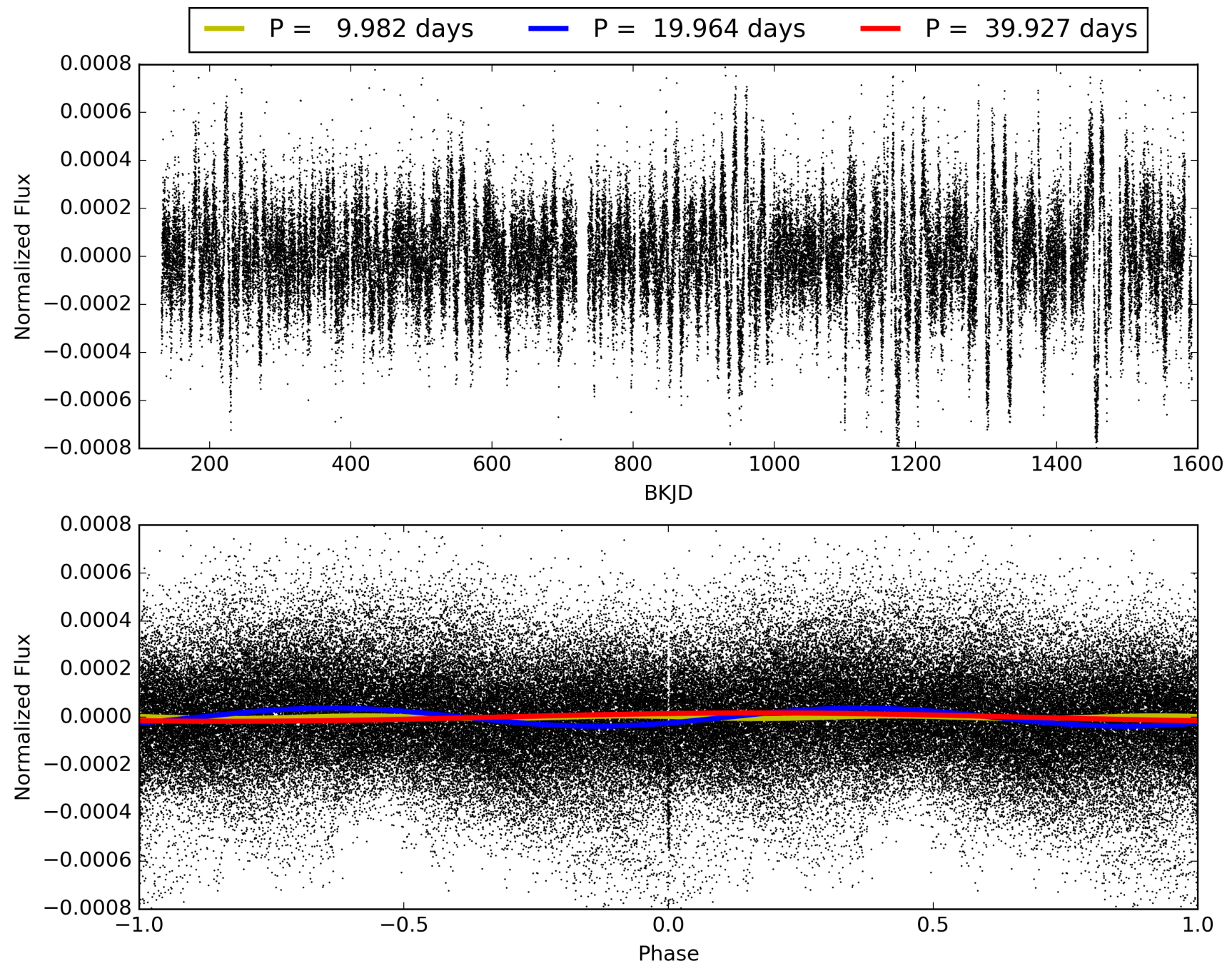
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 29-Jan-2016 00:39:12 Z

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

# TCE 012785320-01, PDC Light Curves

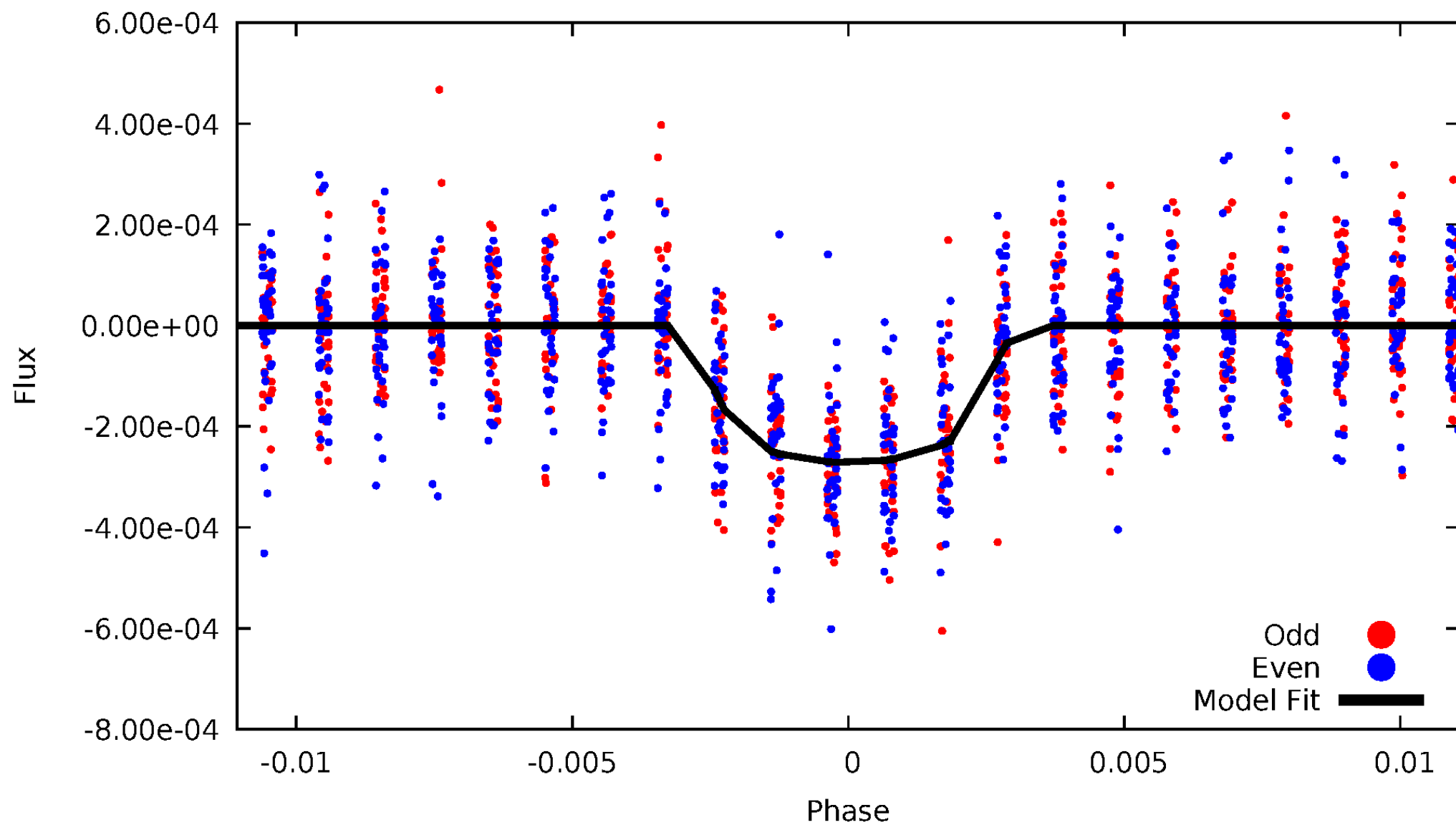


# TCE 012785320-01



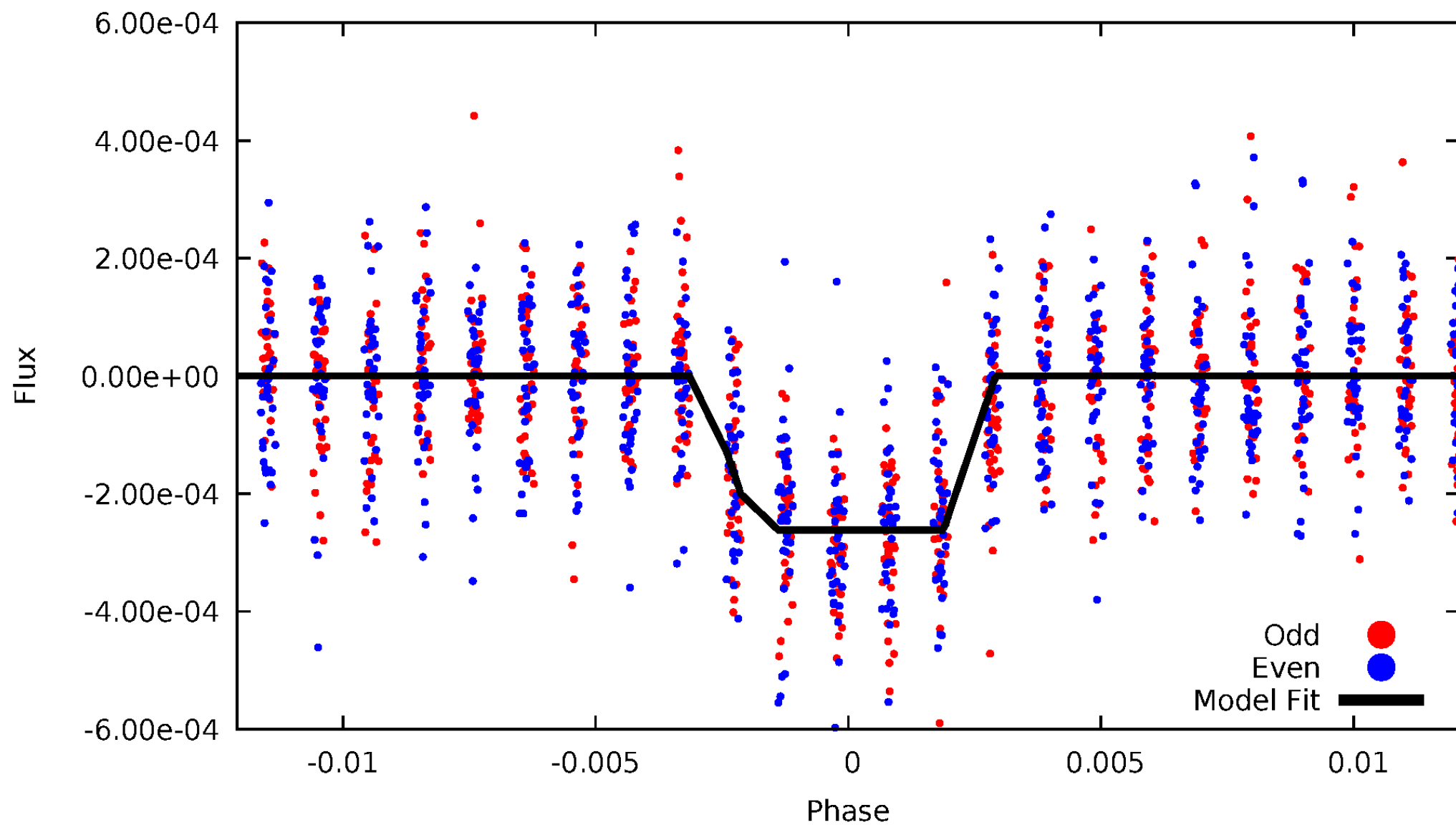
# DV Odd/Even

TCE 012785320-01



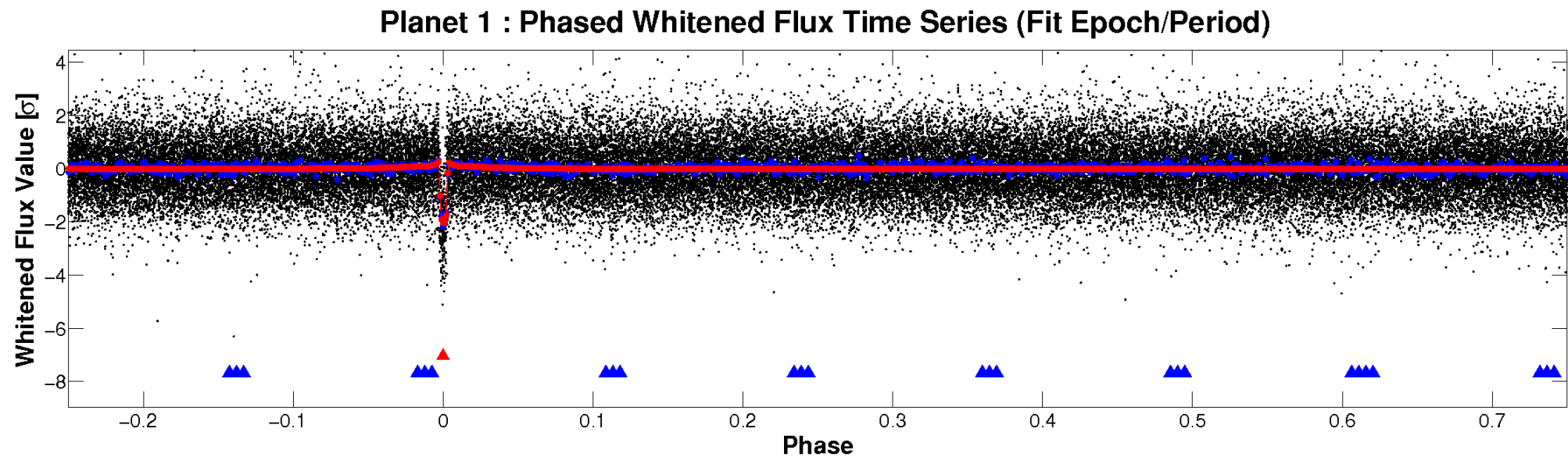
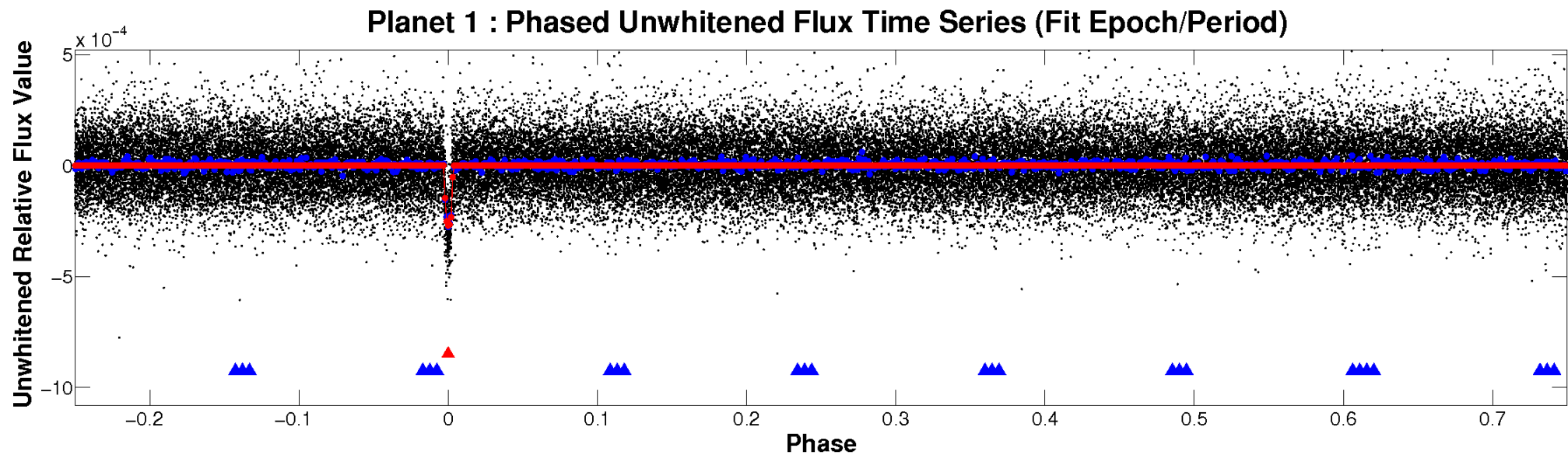
# ALT Odd/Even

TCE 012785320-01



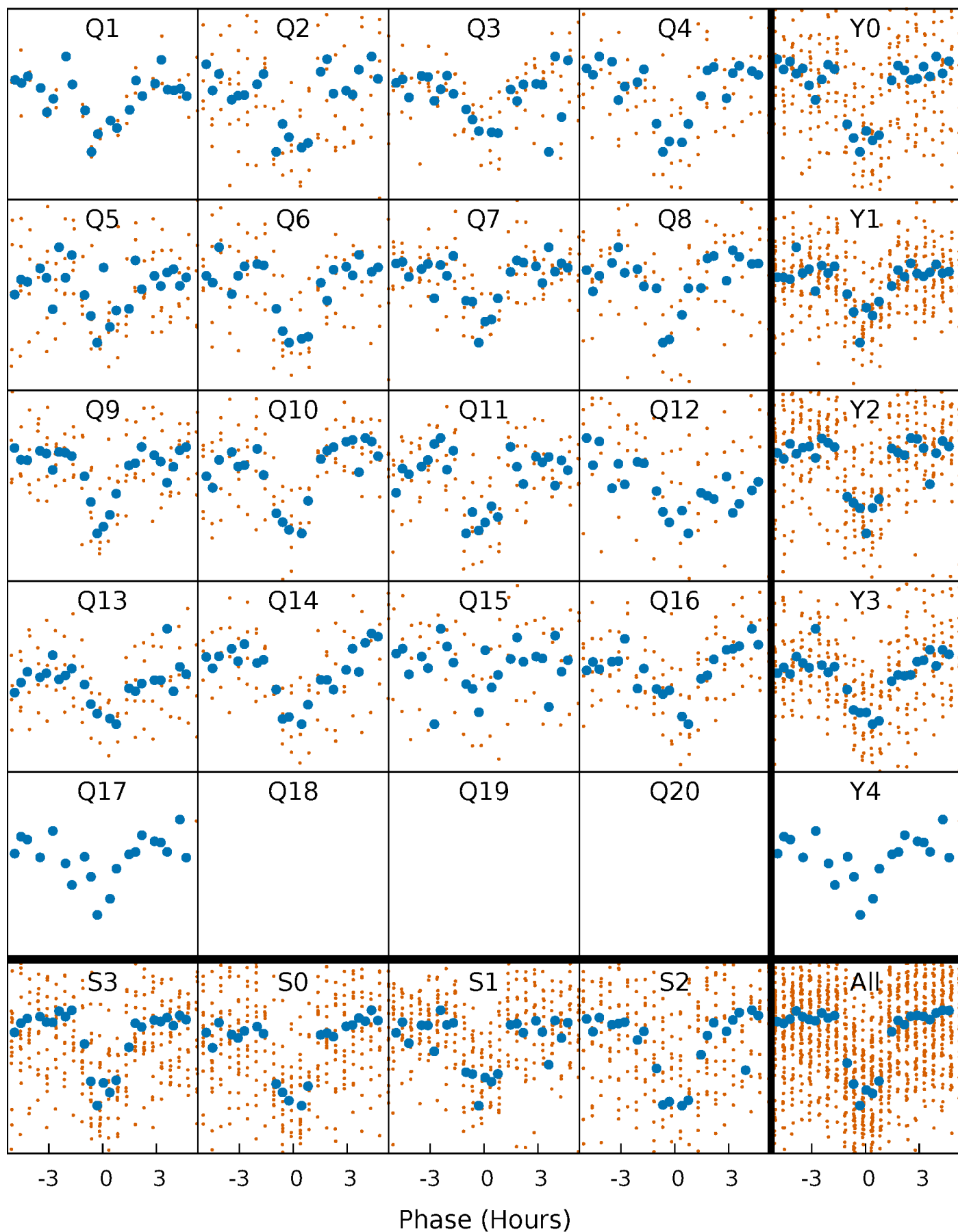


# Non-Whitened Vs. Whitened Light Curve



# PDC Quarter-Phased Transit Curves

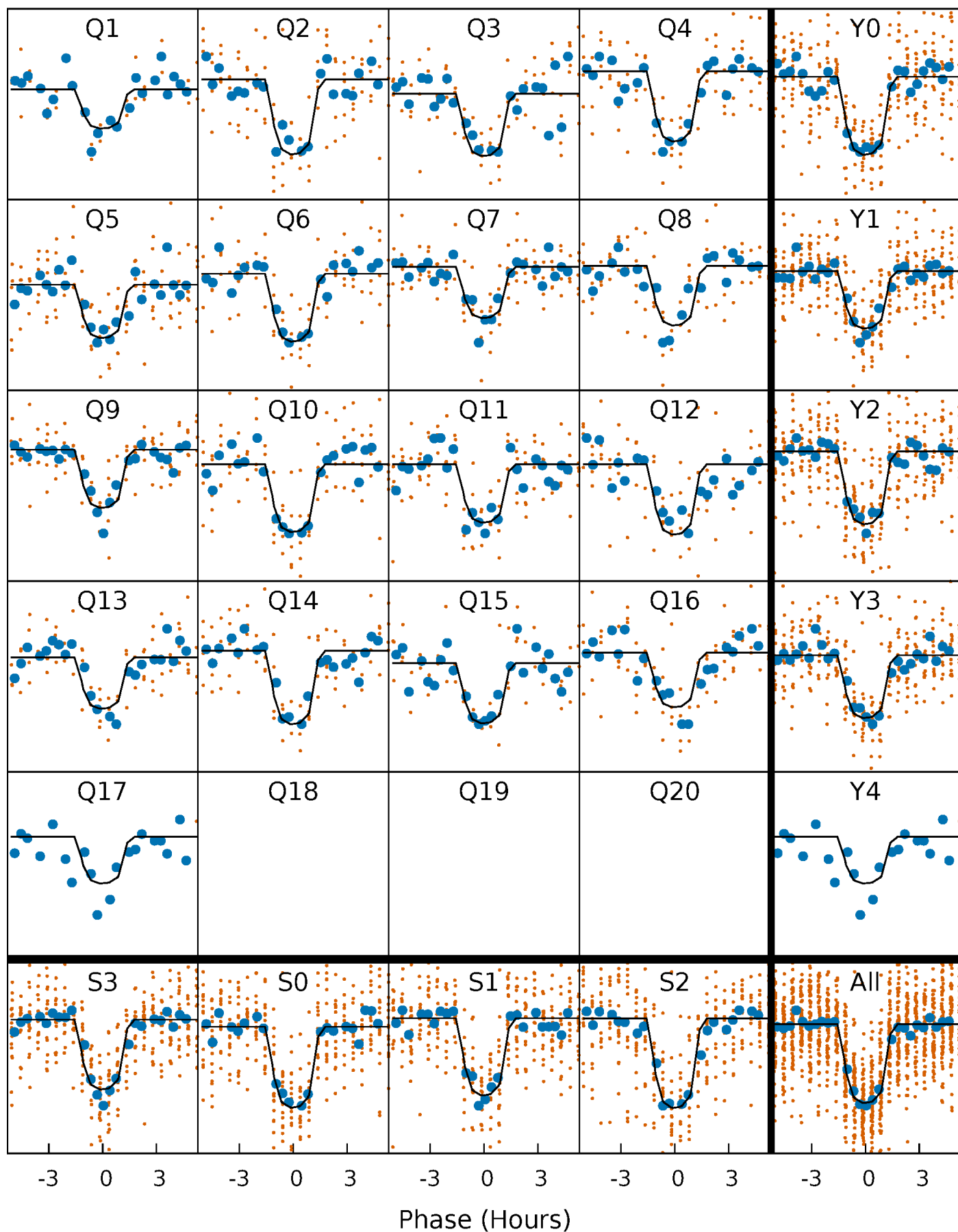
TCE 012785320-01 P= 19.963623 Days  $T_0=138.383338$  (BKJD)





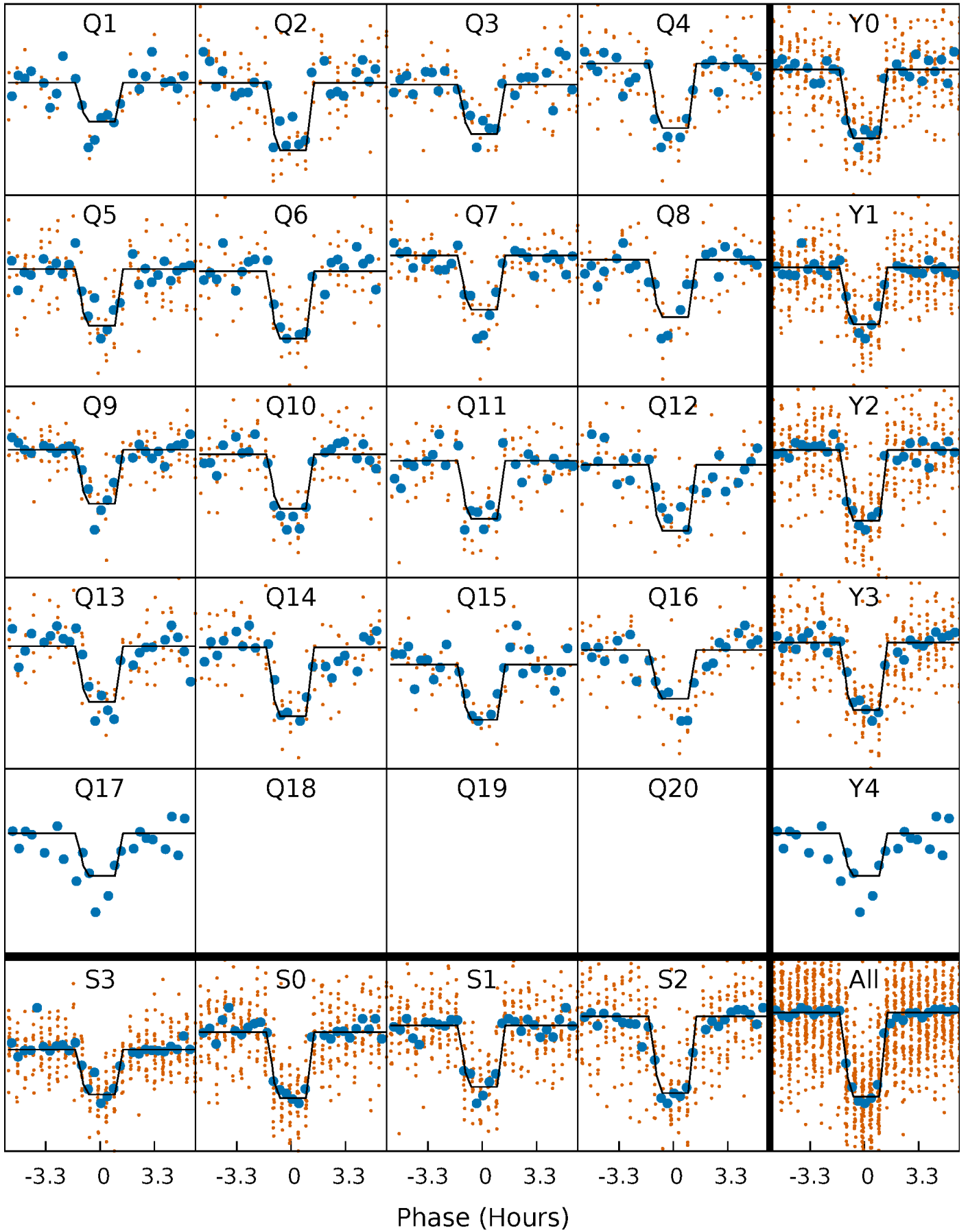
# DV Quarter-Phased Transit Curves

TCE 012785320-01 P= 19.963623 Days  $T_0=138.383338$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

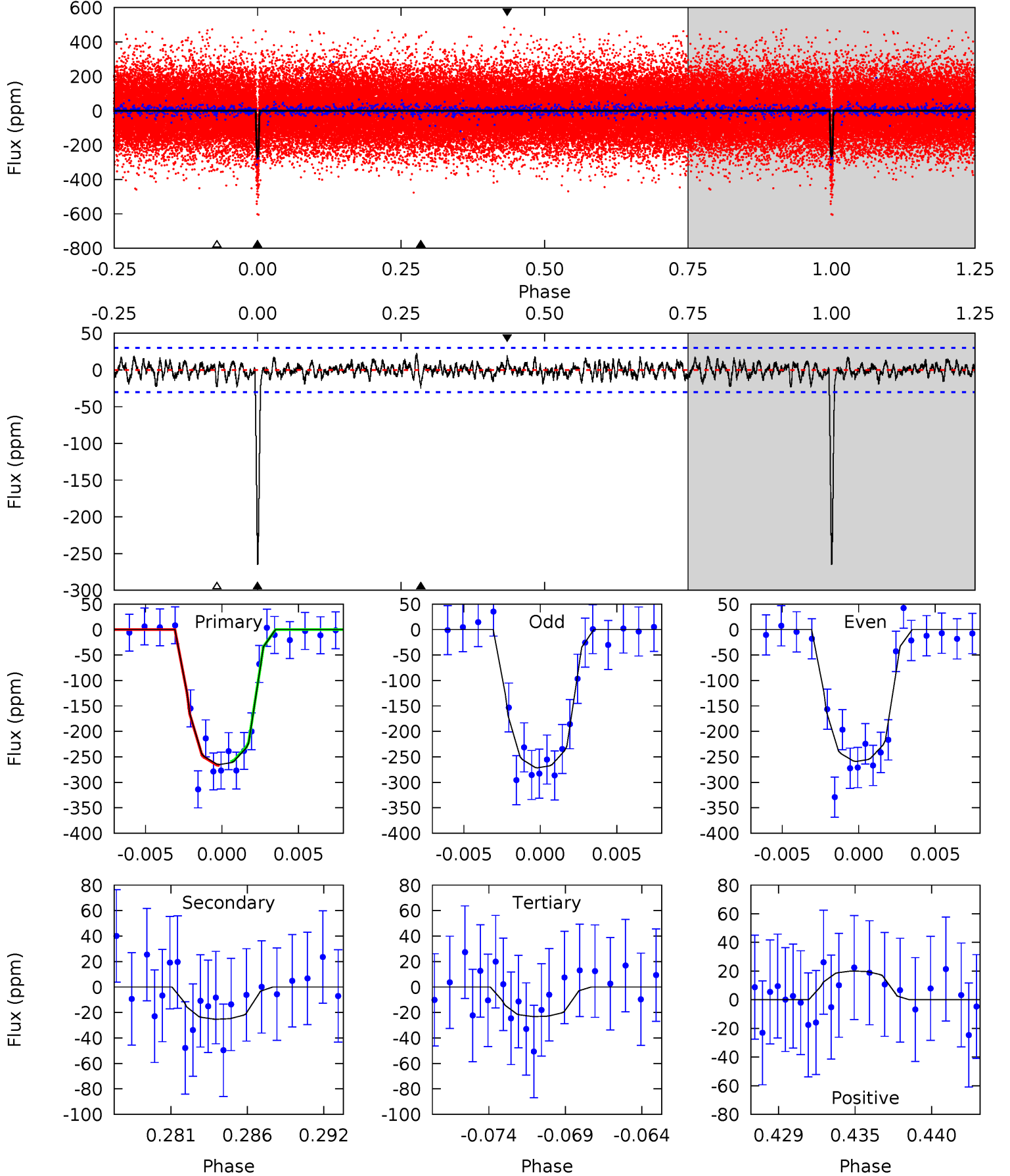
TCE 012785320-01 P= 19.963579 Days  $T_0=138.383578$  (BKJD)



# DV Model-Shift Uniqueness Test

012785320-01,  $P = 19.963623$  Days,  $E = 118.419715$  Days

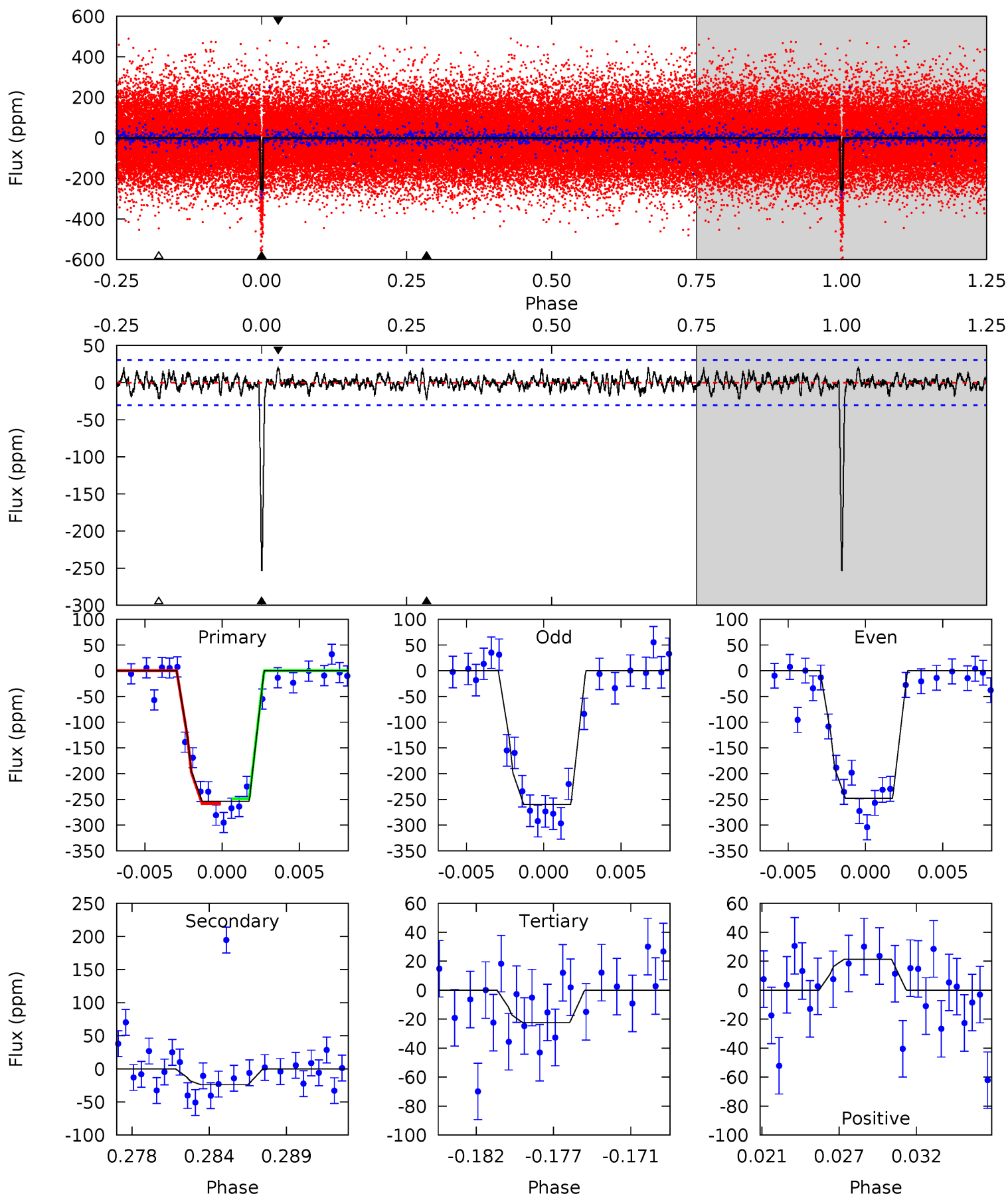
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
45.3	4.32	3.96	3.43	5.15	2.79	1.19	41.3	41.9	0.36	0.89	1.07	1.01	0.08	0.58



# Alt Model-Shift Uniqueness Test

012785320-01,  $P = 19.963579$  Days,  $E = 118.419999$  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
43.0	4.05	3.79	3.63	5.15	2.79	1.14	39.3	39.4	0.26	0.41	1.00	1.04	0.08	0.76



### Stellar Parameters For KIC 012785320

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$5250^{+105}_{-105}$	$4.541^{+0.050}_{-0.045}$	$-0.160^{+0.150}_{-0.150}$	$0.790^{+0.052}_{-0.052}$	$0.790^{+0.052}_{-0.039}$	$2.257^{+0.469}_{-0.355}$
	+2%/-2%	+1%/-1%	+94%/-94%	+7%/-7%	+7%/-5%	+21%/-16%
Source	SPE59	SPE59	SPE59	DSEP		

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

### Secondary Eclipse Parameters for KIC 012785320-01 / KOI 0298.01

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	$-25 \pm 6$	$1.51^{+0.61}_{-0.63}$	$788^{+19}_{-20}$	$3321^{+659}_{-327}$	$107^{+218}_{-54}$
Alt.	$-24 \pm 6$	$1.39^{+0.59}_{-0.63}$	$787^{+20}_{-21}$	$3362^{+735}_{-352}$	$114^{+276}_{-59}$

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

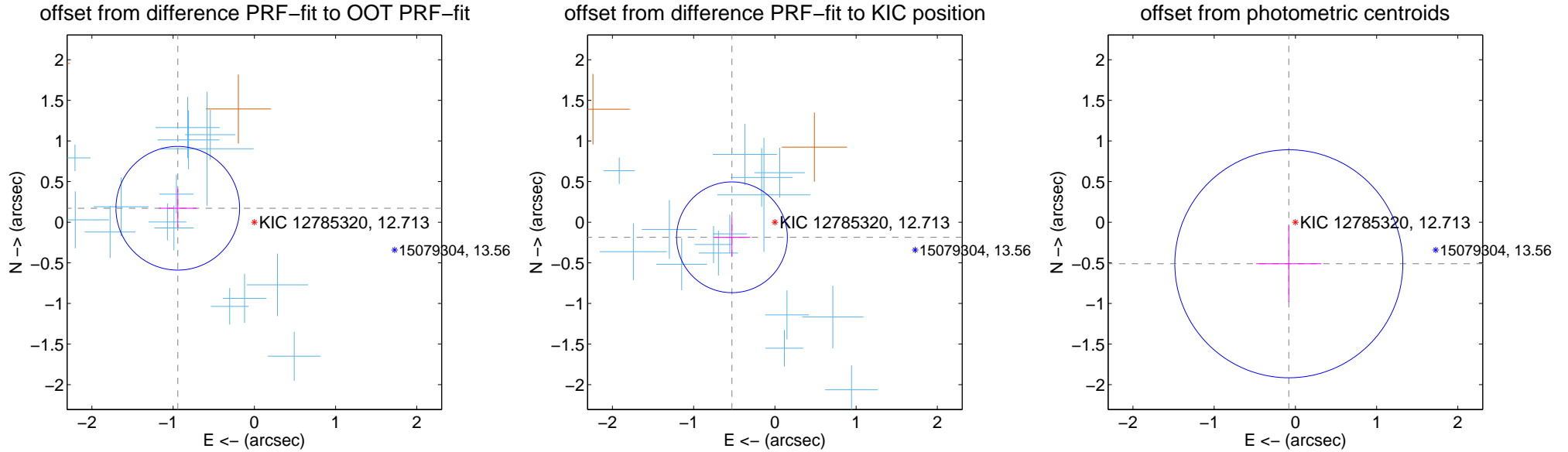
## DV Centroid Data

Supplemental centroid analysis for 012785320-01. Kepler magnitude: 12.71. Transit SNR 31.89

There are 15 quarters with good PRF difference image offsets

The direct PRF centroid is offset from the target star catalog position by about 0.74 arcsec

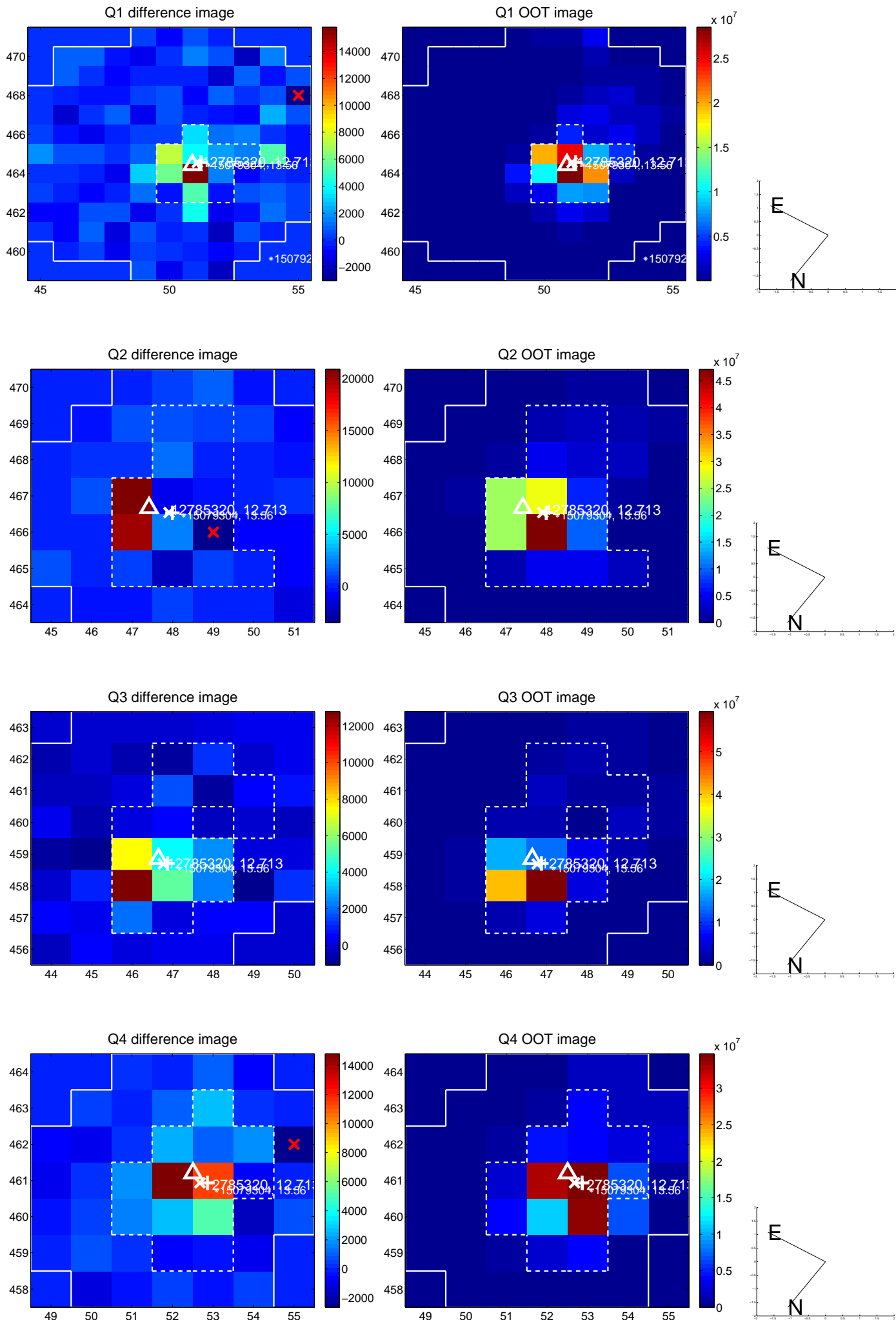
	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.958 \pm 0.254$	$3.78$	$0.943 \pm 0.232$	$0.172 \pm 0.238$
PRF-fit source offset from KIC position	$0.560 \pm 0.227$	$2.46$	$0.528 \pm 0.226$	$-0.186 \pm 0.239$
photometric centroid source offset	$0.52 \pm 0.47$	$1.11$	$0.08 \pm 0.40$	$-0.51 \pm 0.47$



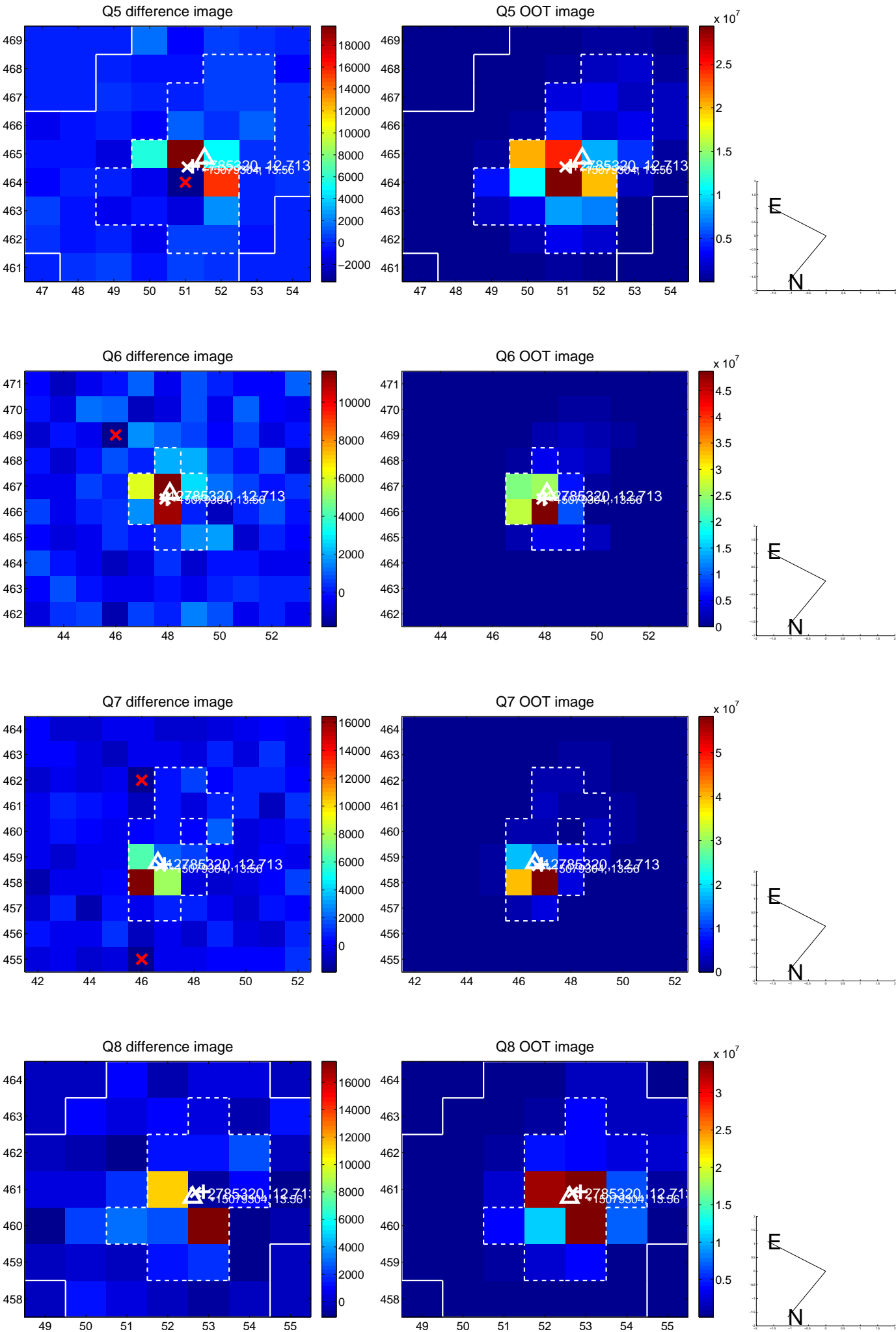
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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



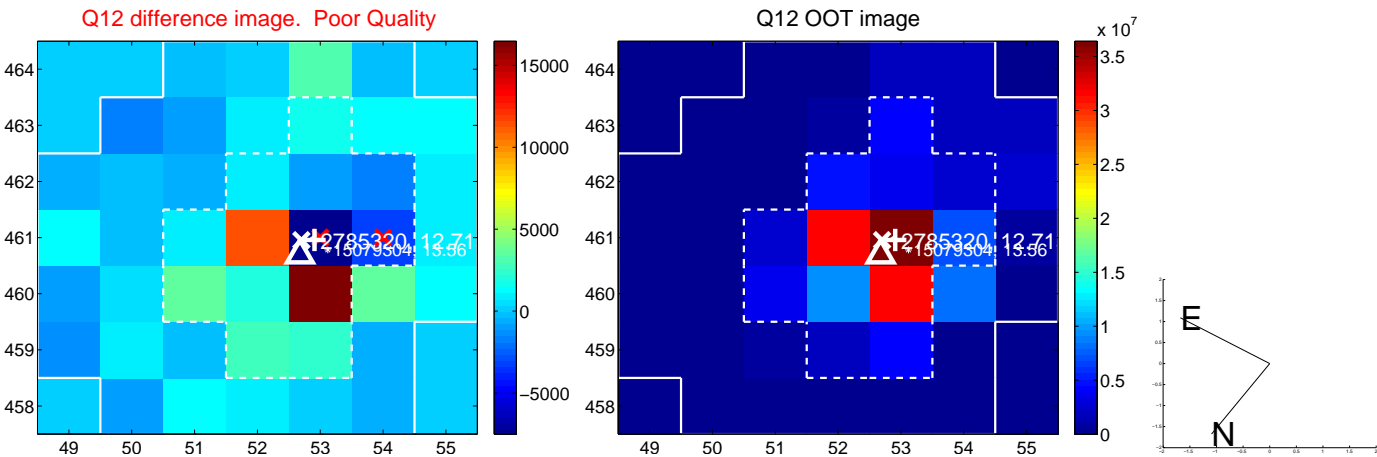
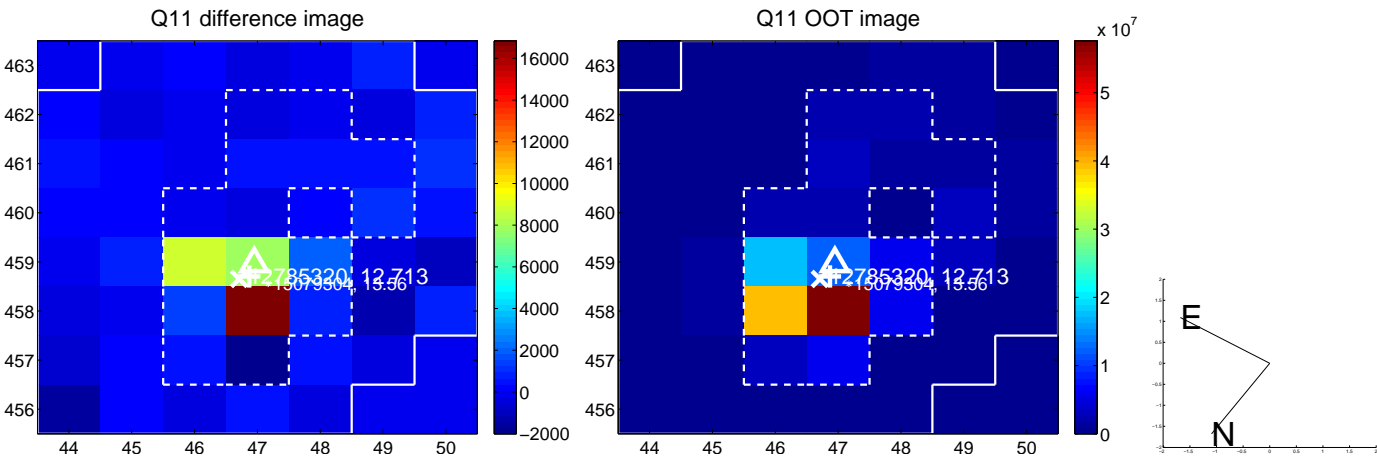
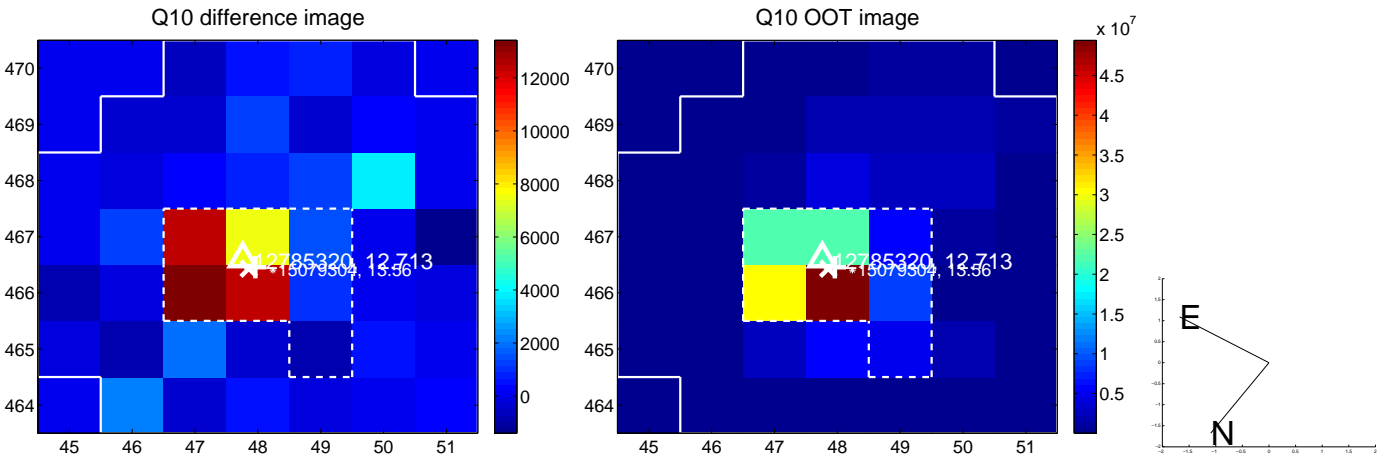
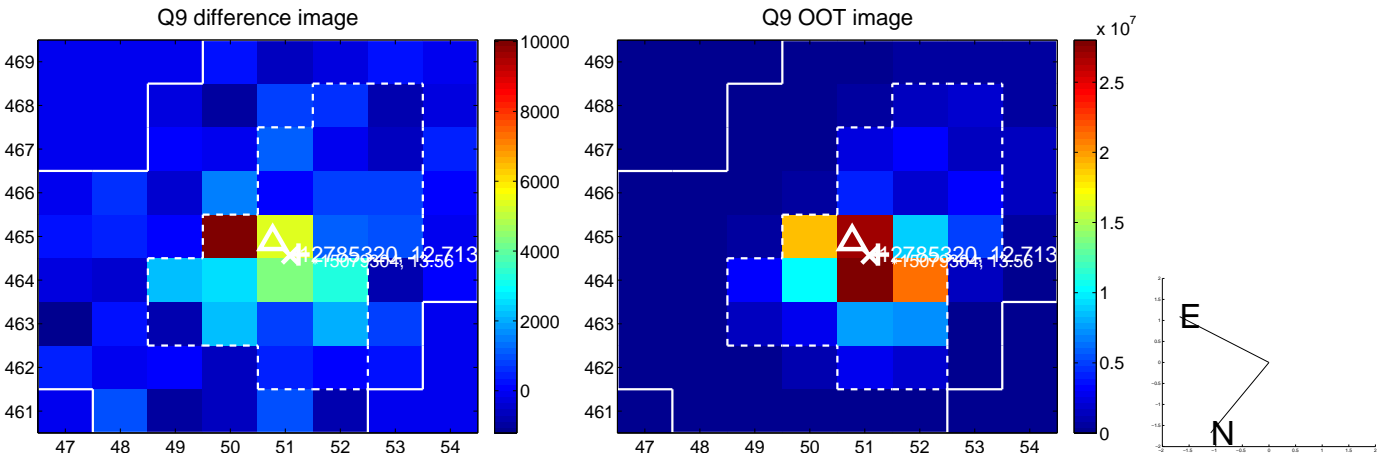
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



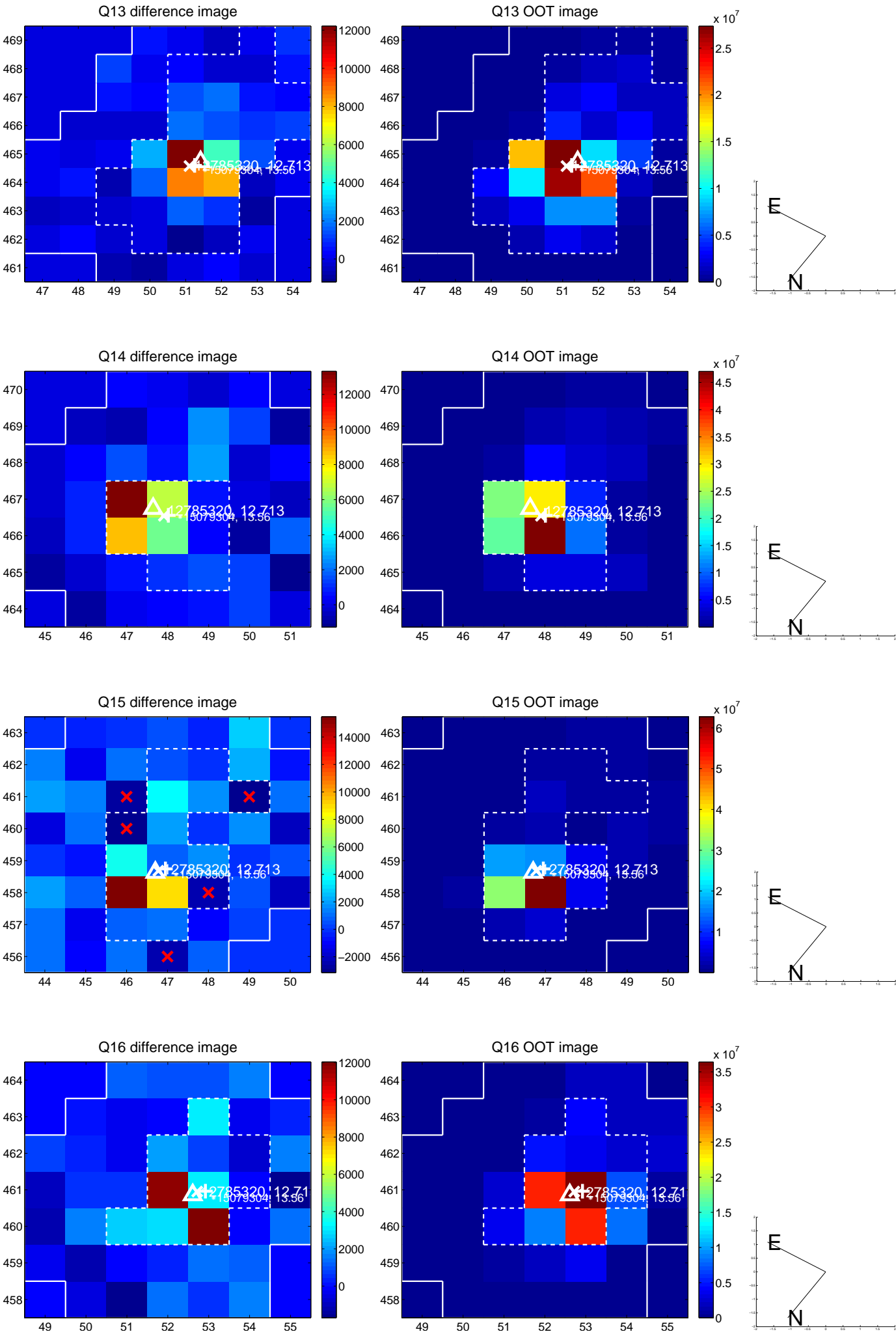
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



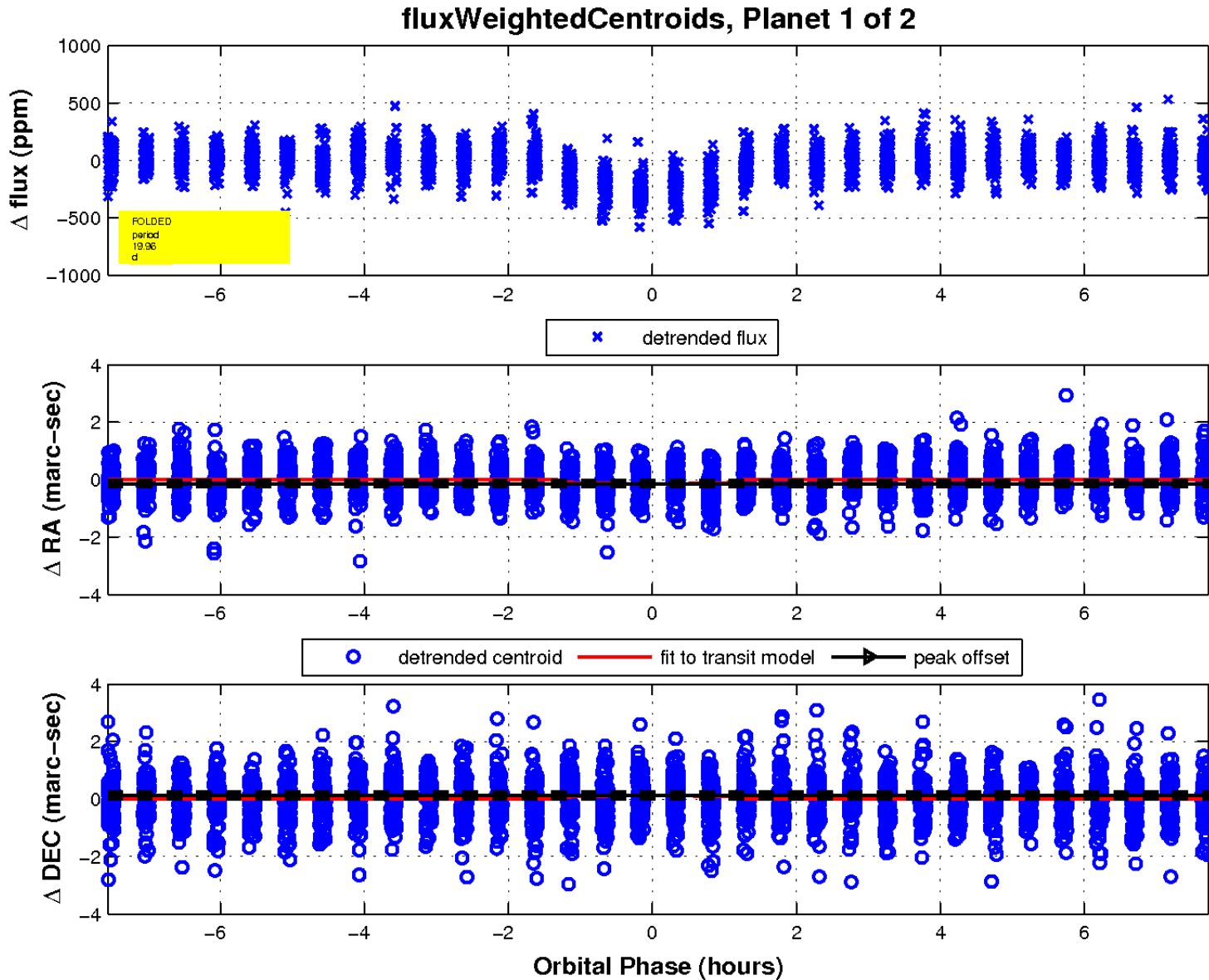
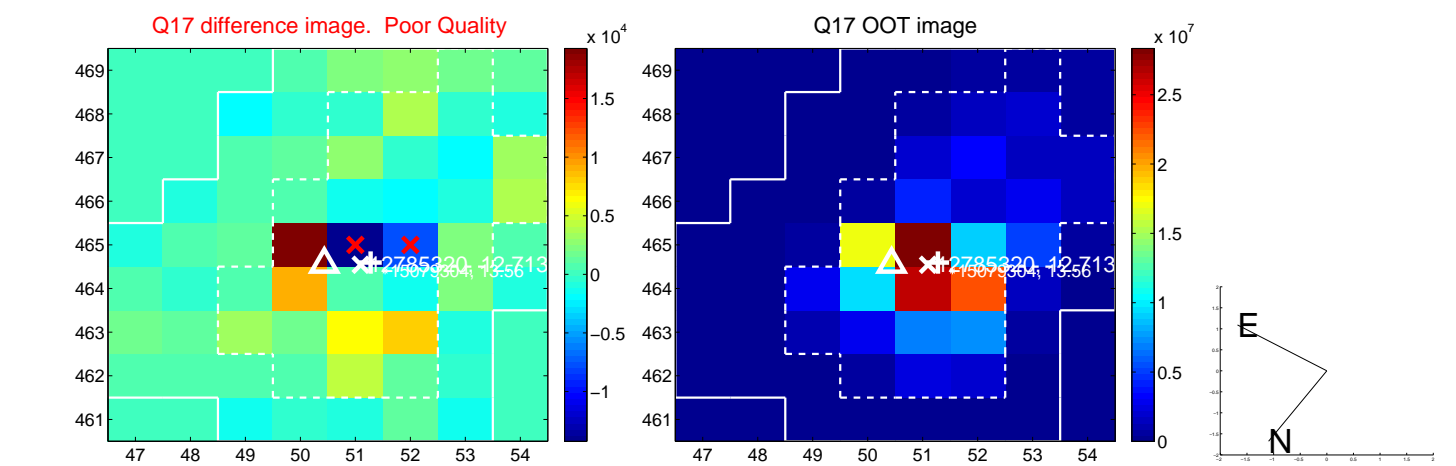
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

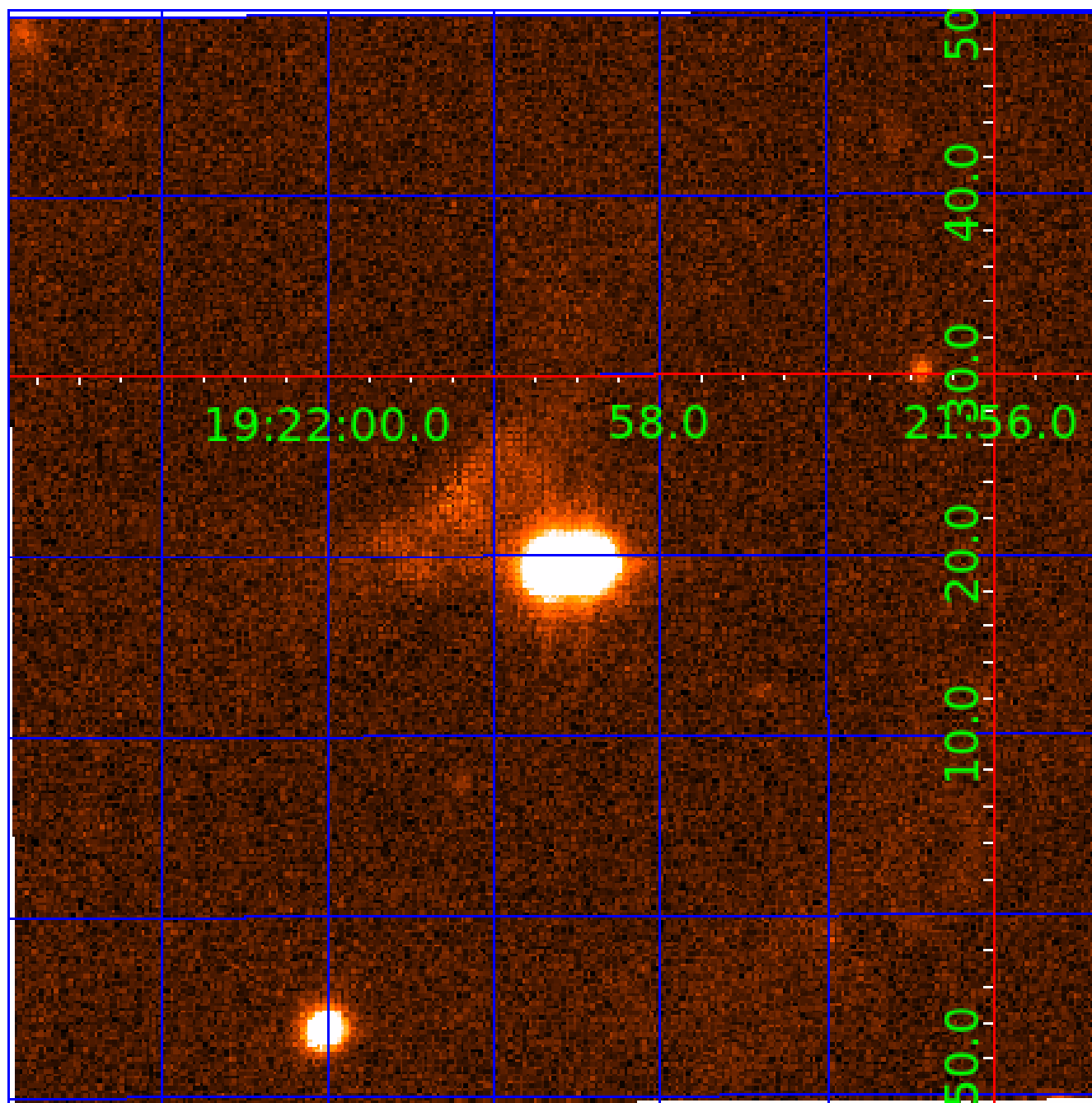


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination





# KIC 012785320

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
012785320-01	OBS	0298.01	19.963623	138.383338	270.9	2.652	28.7	31.9	0.79	5250	1.53	23.93
012785320-02	OBS	0298.02	57.383621	170.733280	244.3	4.761	17.4	18.6	0.79	5250	1.70	5.86

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
012785320-01	OBS	PC	1.00	0	0	0	0	CENT_CROWDED
012785320-02	OBS	PC	0.92	0	0	0	0	CENT_CROWDED

**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 012785320-02

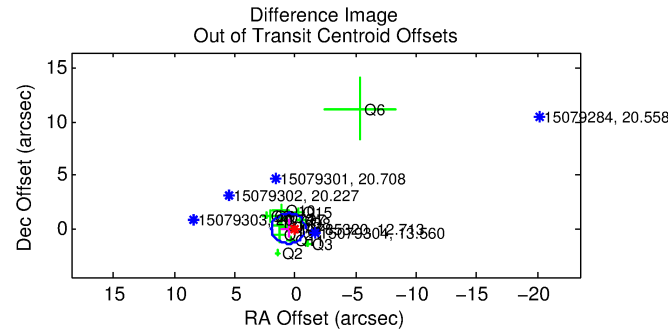
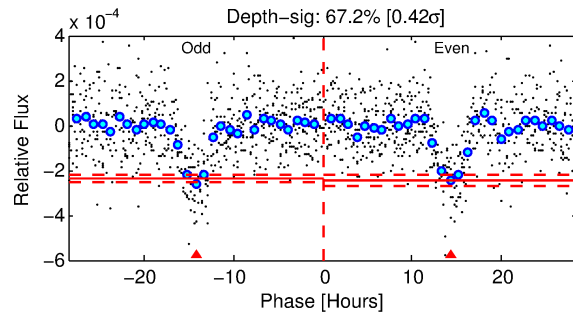
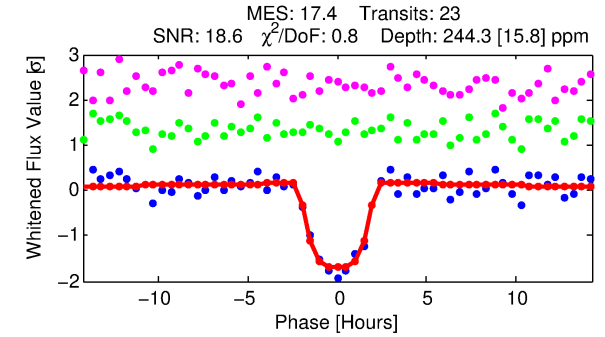
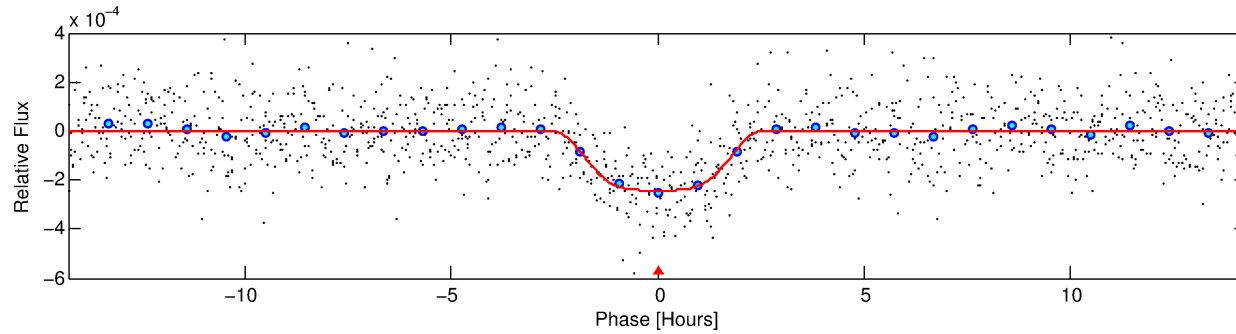
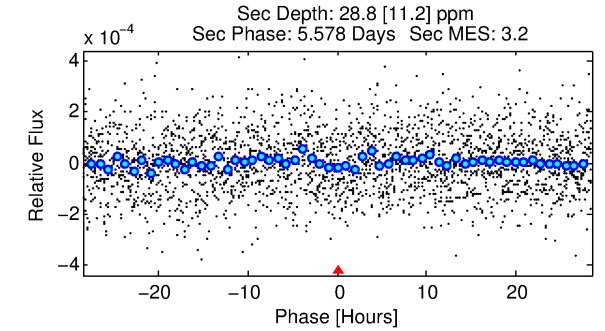
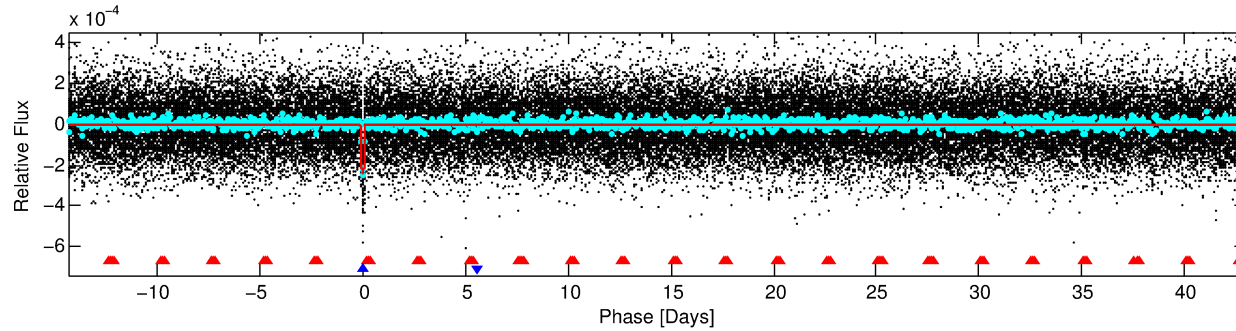
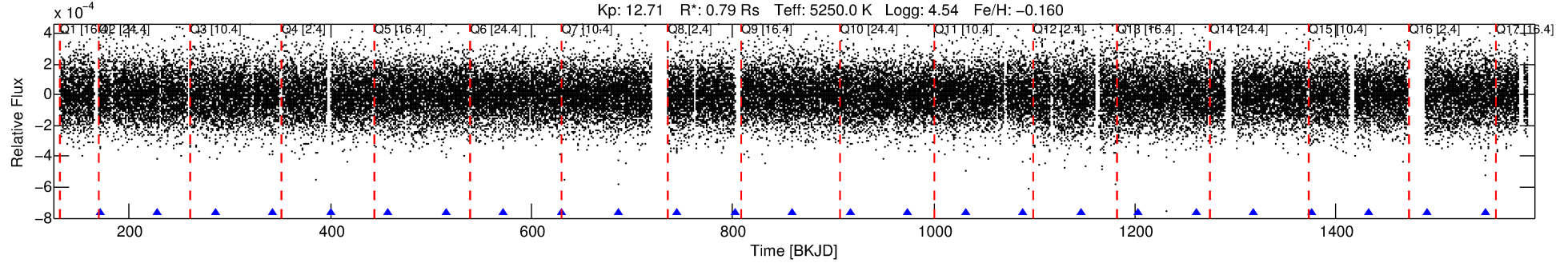
No Significant Match Found

# DV One-Page Summary

KIC: 12785320 Candidate: 2 of 2 Period: 57.384 d

KOI: K00298.02 Corr: 0.858

Kp: 12.71 R\*: 0.79 Rs Teff: 5250.0 K Logg: 4.54 Fe/H: -0.160



## DV Fit Results:

Period = 57.38362 [0.00038] d  
Epoch = 170.7333 [0.0057] BKJD  
Rp/R\* = 0.0197 [0.0010]  
a/R\* = 28.43 [3.68]  
b = 0.97 [0.01]  
Seff = 5.86 [0.70]  
Teq = 397 [12] K  
Rp = 1.70 [0.14] Re  
a = 0.2693 [0.0157] AU  
Ag = 400.14 [164.74] [2.42σ]  
Teffp = 2743 [281] K [8.34σ]

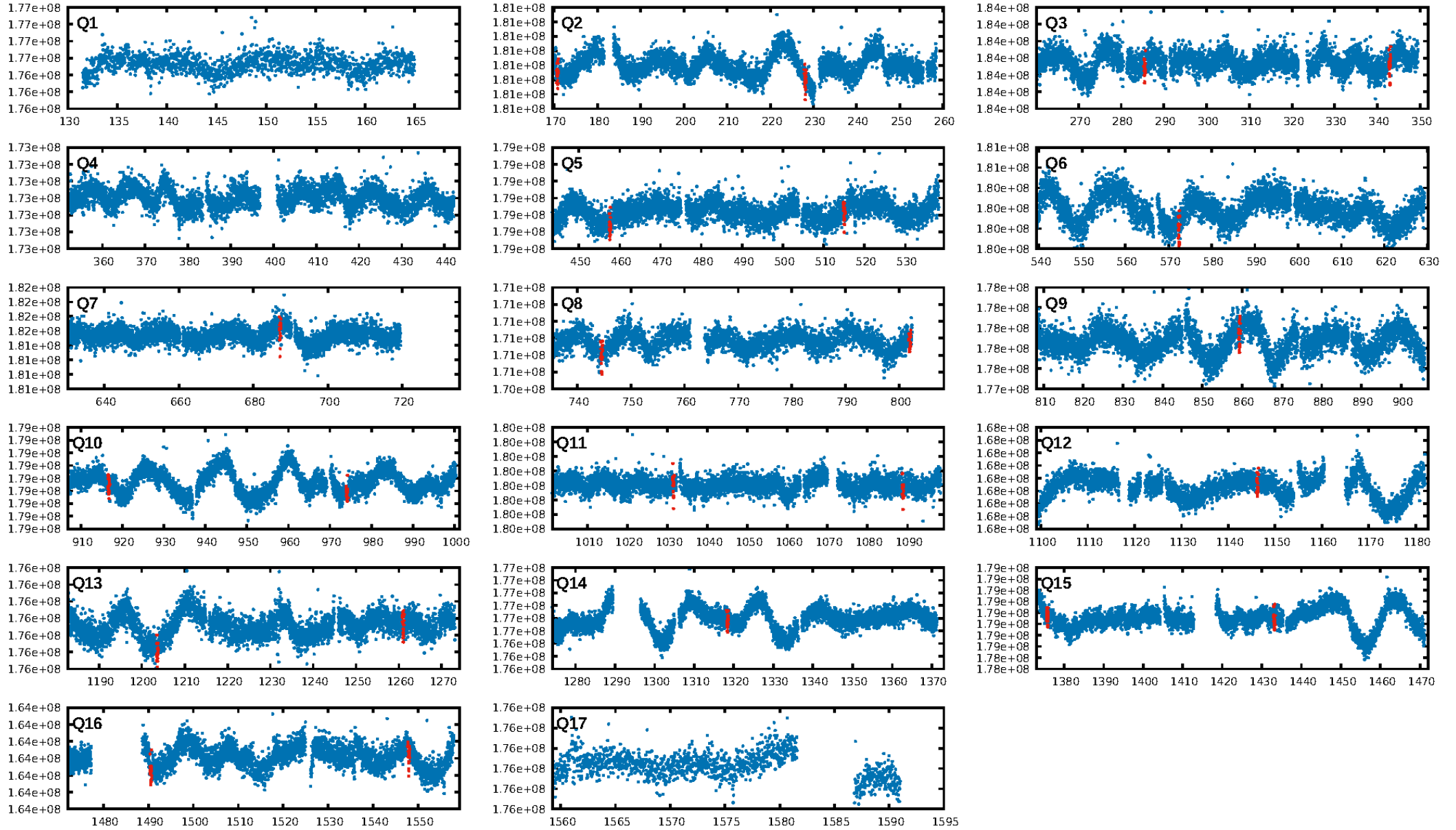
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [164.78σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 94.0%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 6.52e-66  
RollingBand-fgt: 1.00 [23/23]  
GhostDiagnostic-chr: 3.525  
Centroid-sig: 17.6%  
Centroid-so: 0.748 arcsec [1.03σ]  
OotOffset-rm: 0.580 arcsec [1.24σ]  
KicOffset-rm: 0.460 arcsec [0.50σ]  
OotOffset-st: 4/4/3/3 [14]  
KicOffset-st: 4/4/3/3 [14]  
DiffImageQuality-fgm: 0.86 [12/14]  
DiffImageOverlap-fno: 1.00 [14/14]

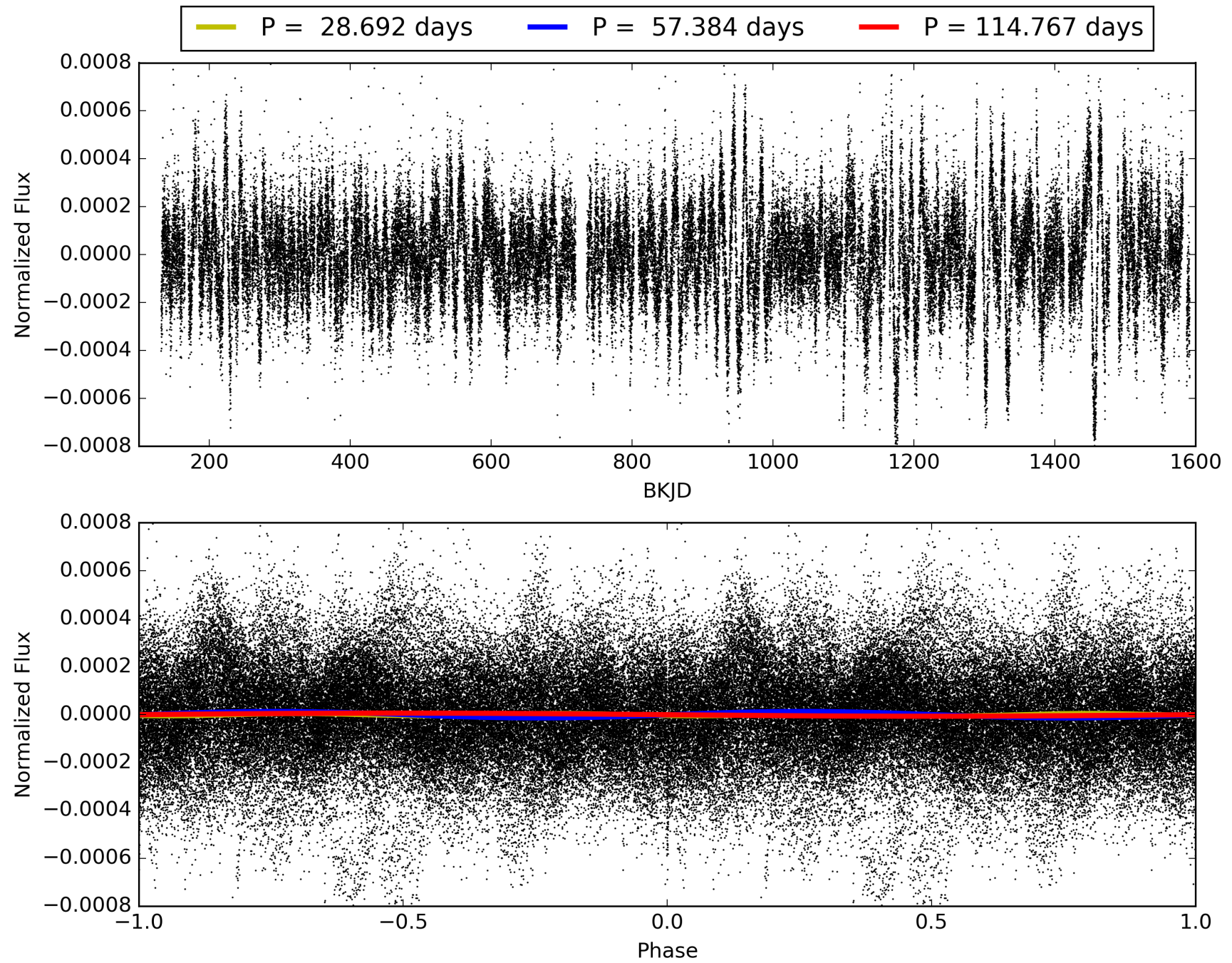
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 29-Jan-2016 00:39:19 Z

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

# TCE 012785320-02, PDC Light Curves

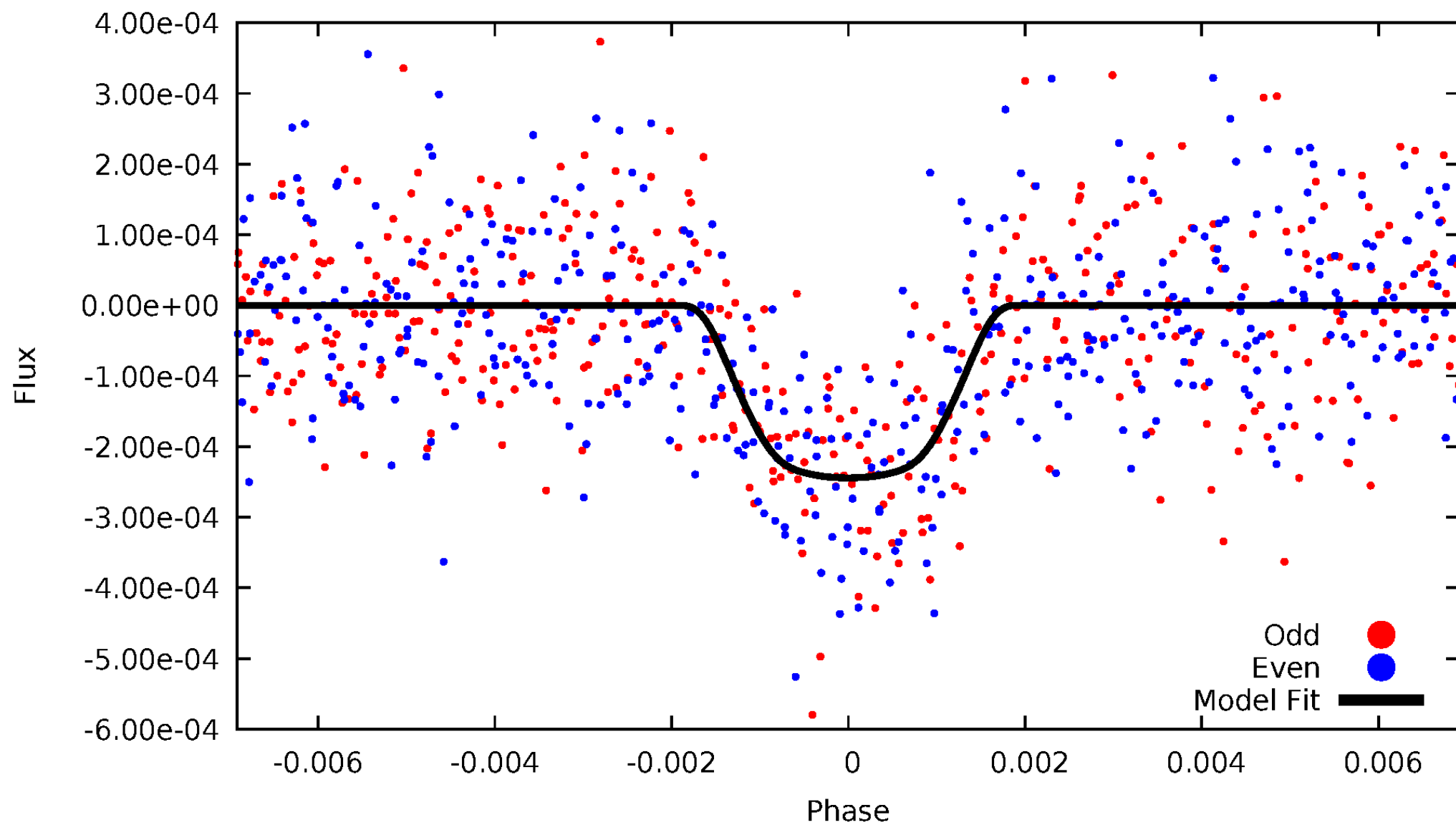


# TCE 012785320-02



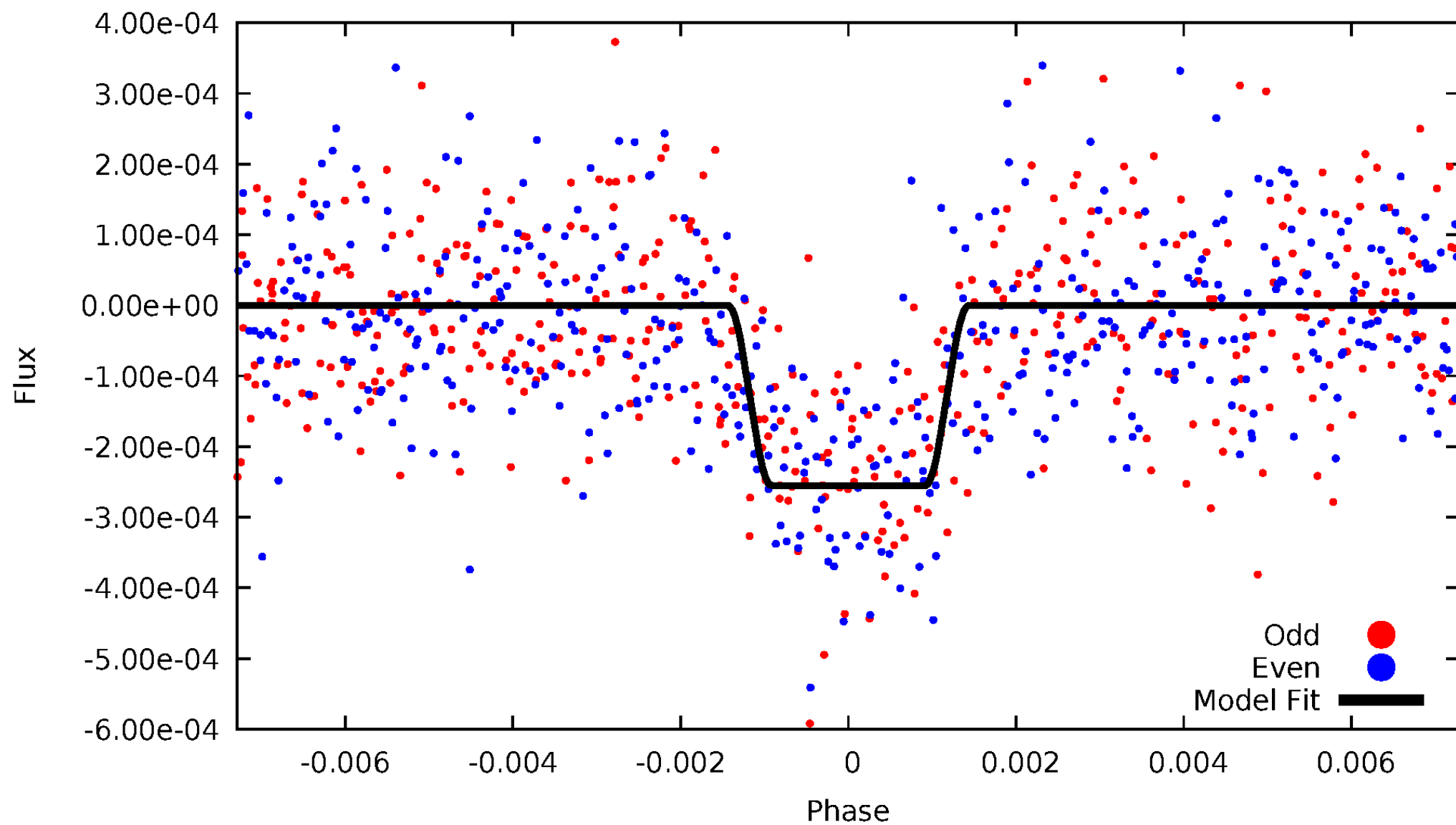
# DV Odd/Even

TCE 012785320-02



# ALT Odd/Even

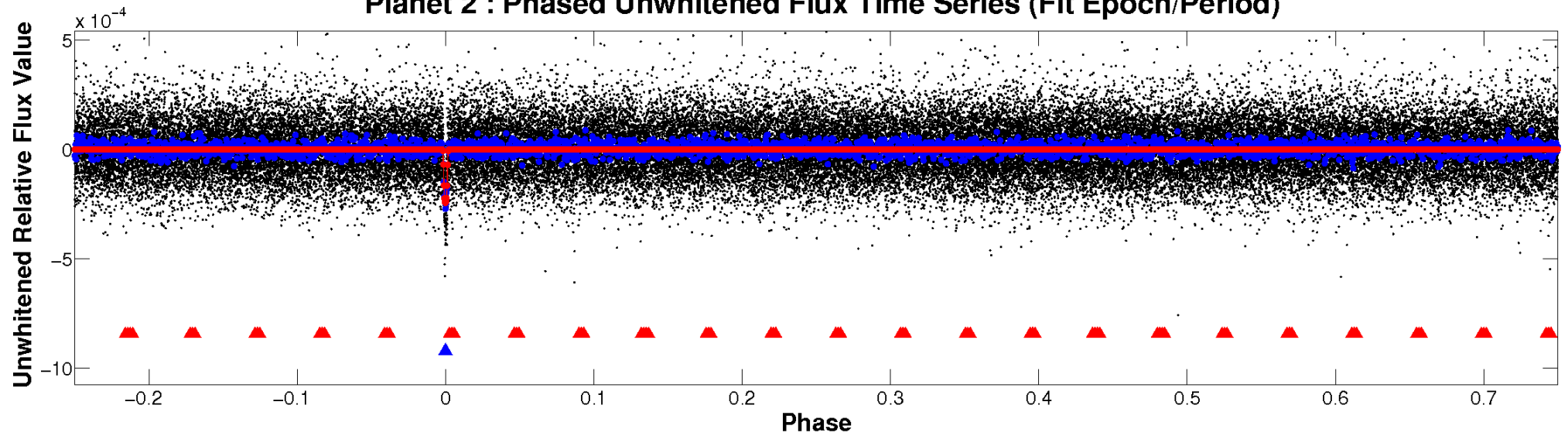
TCE 012785320-02



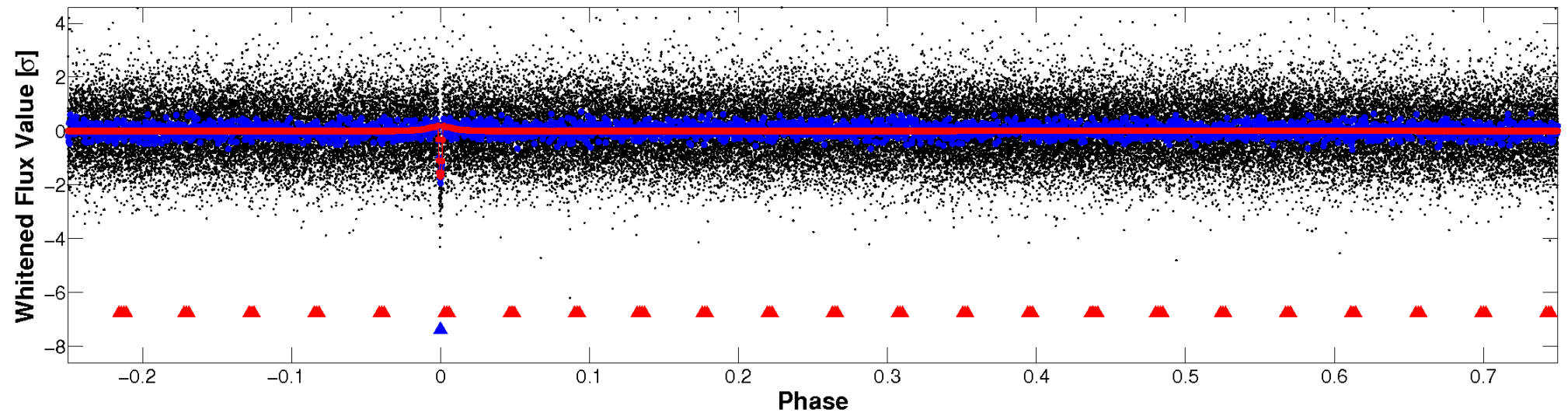


# Non-Whitened Vs. Whitened Light Curve

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

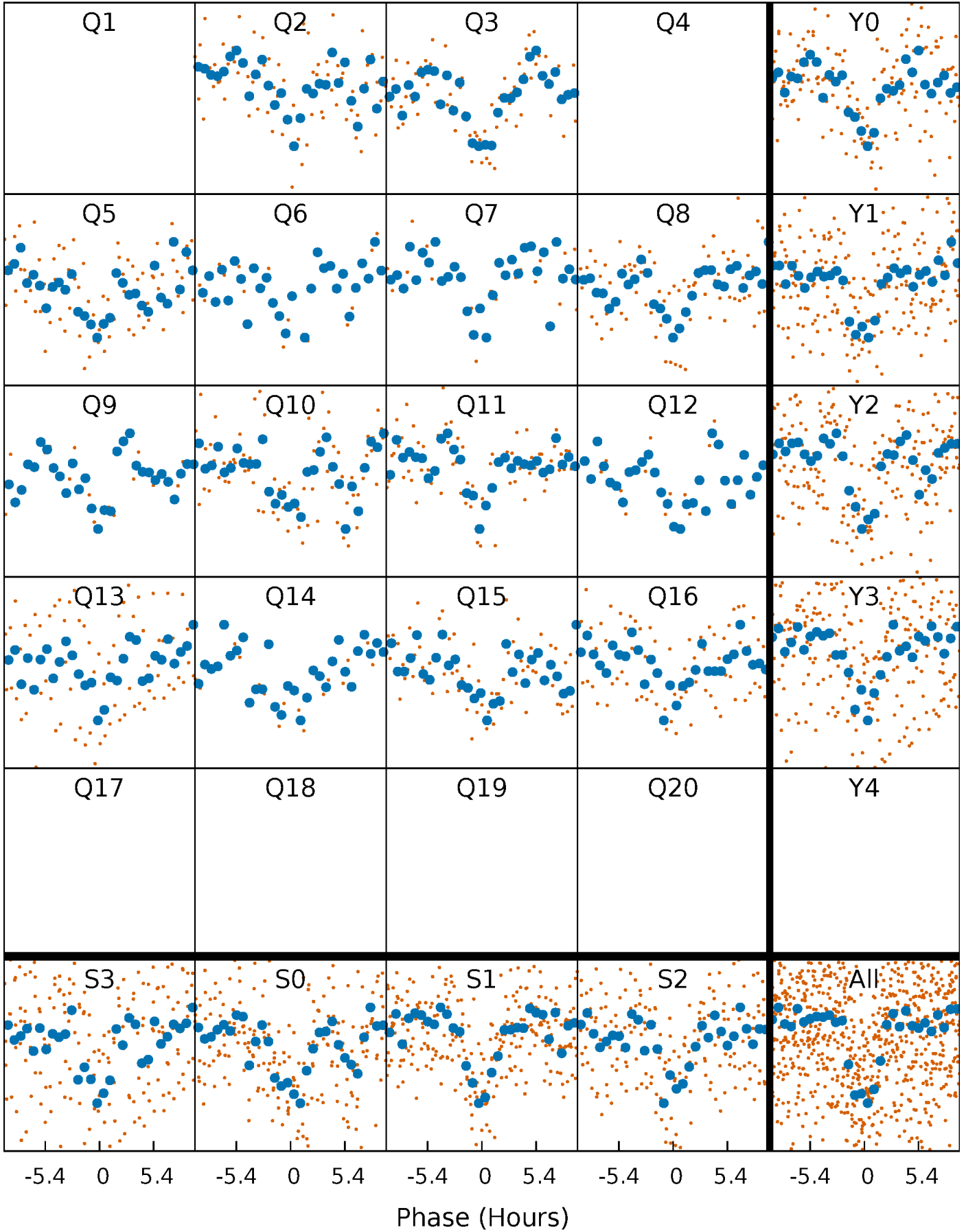


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



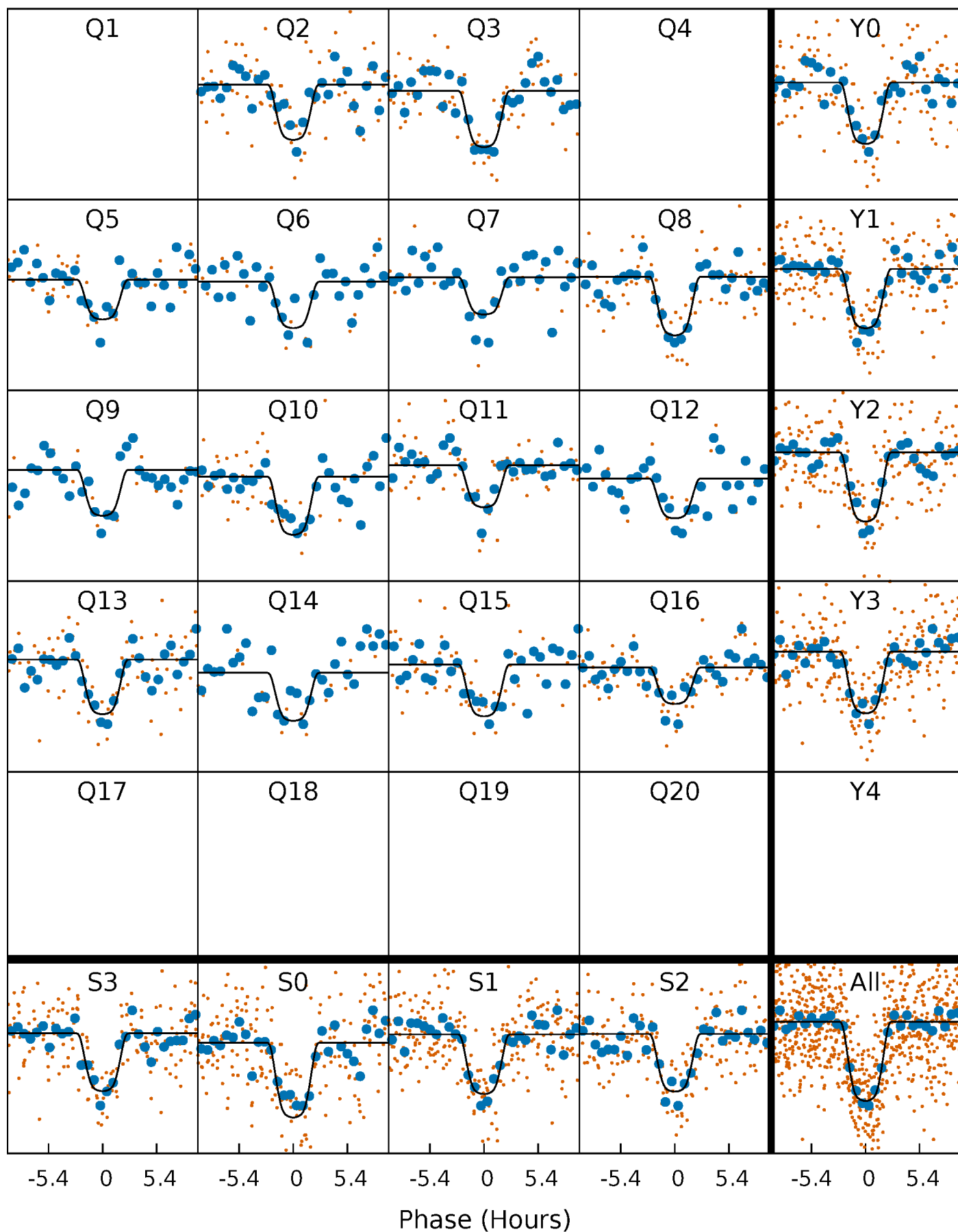
# PDC Quarter-Phased Transit Curves

TCE 012785320-02 P= 57.383621 Days  $T_0=170.733280$  (BKJD)



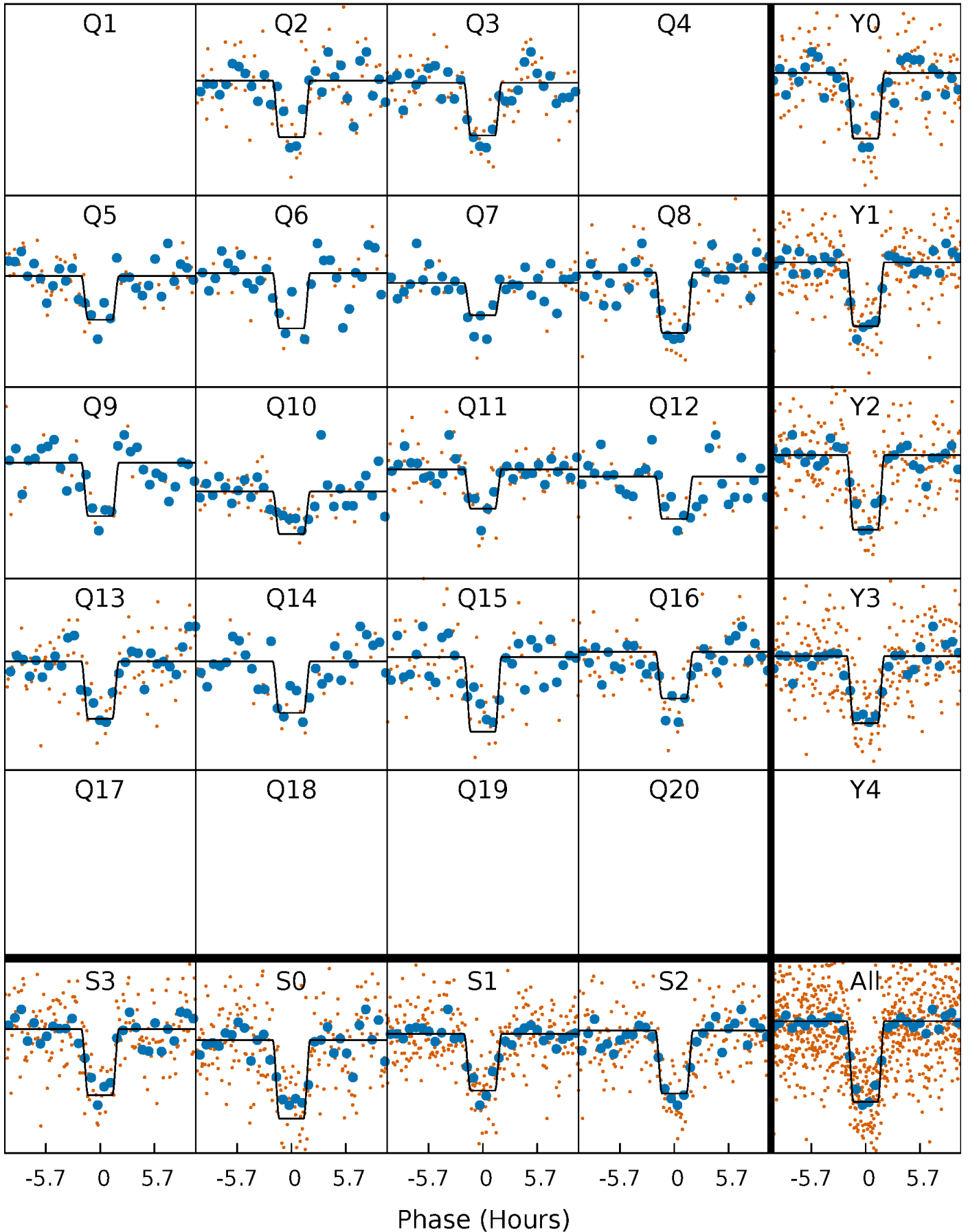
# DV Quarter-Phased Transit Curves

TCE 012785320-02   P= 57.383621 Days    $T_0=170.733280$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

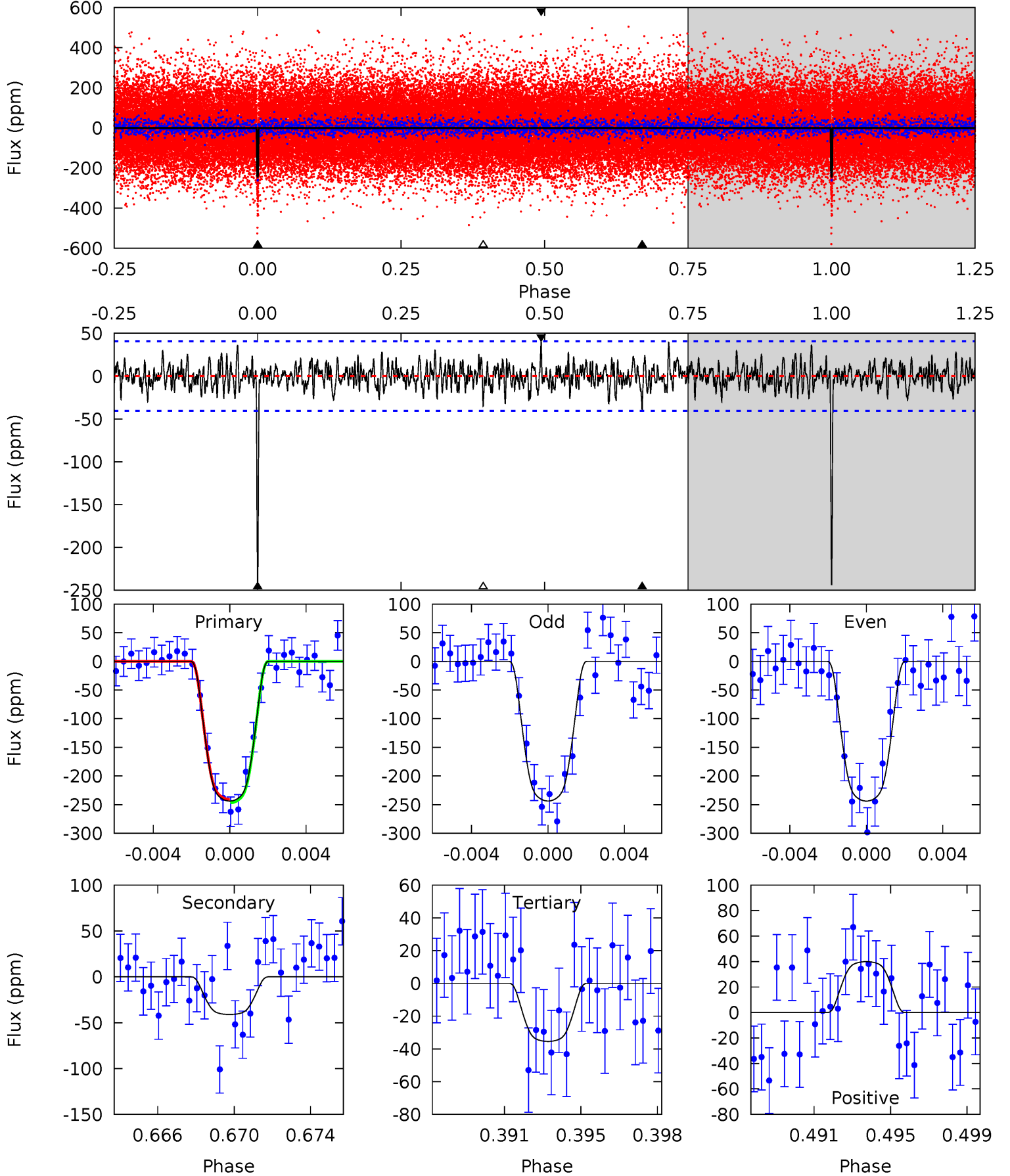
TCE 012785320-02 P= 57.382859 Days  $T_0=170.743194$  (BKJD)



# DV Model-Shift Uniqueness Test

012785320-02,  $P = 57.383621$  Days,  $E = 113.349659$  Days

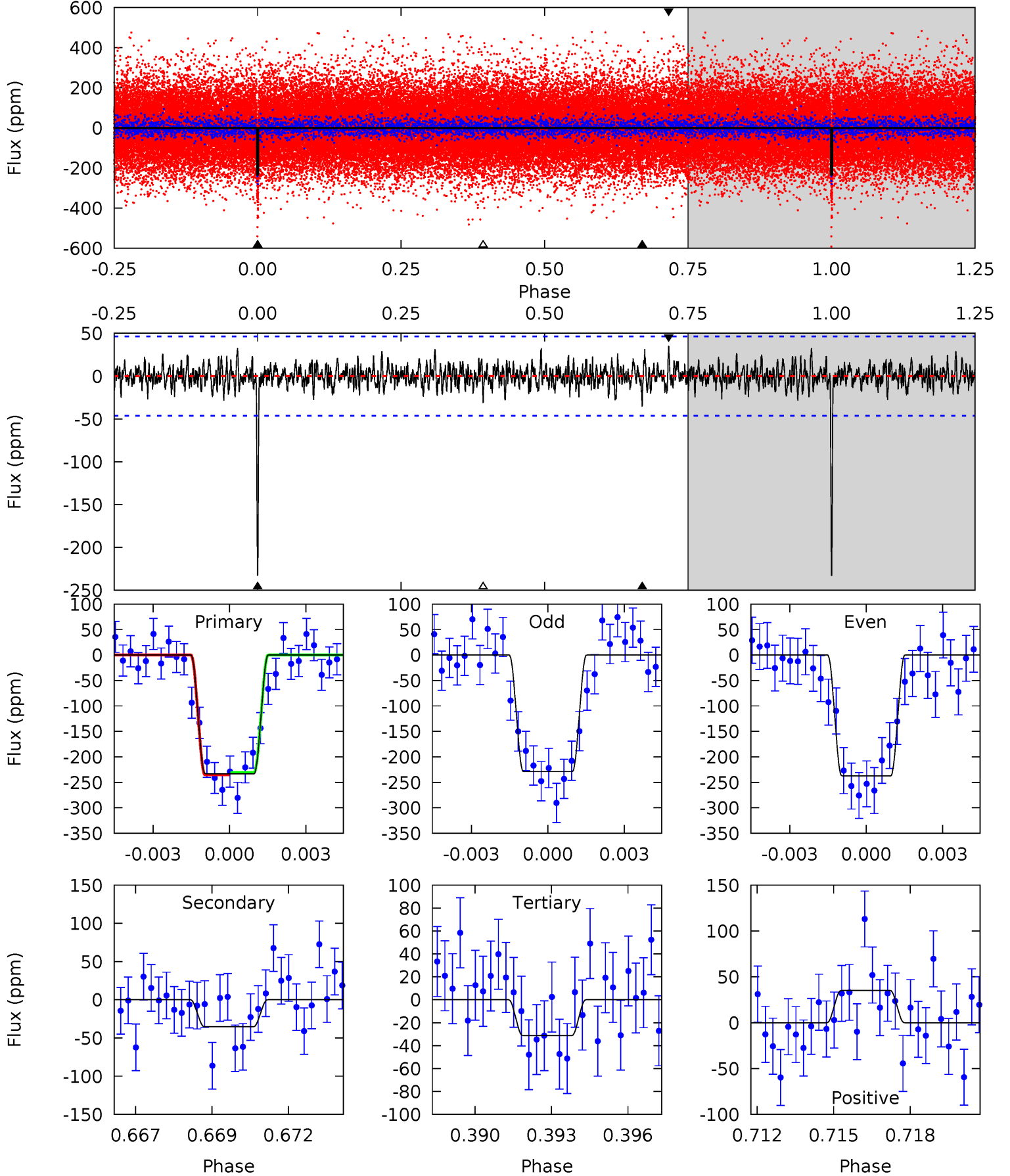
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
31.3	5.28	4.55	5.13	5.21	2.90	1.42	26.8	26.2	0.73	0.15	0.01	1.03	0.14	0.39



# Alt Model-Shift Uniqueness Test

012785320-02,  $P = 57.382859$  Days,  $E = 113.360335$  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
26.5	4.02	3.56	4.00	5.26	2.98	1.10	23.0	22.5	0.46	0.02	0.48	1.00	0.13	0.27





### Stellar Parameters For KIC 012785320

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$5250^{+105}_{-105}$	$4.541^{+0.050}_{-0.045}$	$-0.160^{+0.150}_{-0.150}$	$0.790^{+0.052}_{-0.052}$	$0.790^{+0.052}_{-0.039}$	$2.257^{+0.469}_{-0.355}$
	+2%/-2%	+1%/-1%	+94%/-94%	+7%/-7%	+7%/-5%	+21%/-16%
Source	SPE59	SPE59	SPE59	DSEP		

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

### Secondary Eclipse Parameters for KIC 012785320-02 / KOI 0298.02

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	$-41 \pm 8$	$1.69^{+0.10}_{-0.10}$	$554^{+15}_{-14}$	$3465^{+133}_{-129}$	$568^{+150}_{-114}$
Alt.	$-35 \pm 9$	$1.38^{+0.10}_{-0.10}$	$554^{+16}_{-15}$	$3607^{+173}_{-178}$	$745^{+208}_{-205}$

$T_{\text{max}}$  = 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

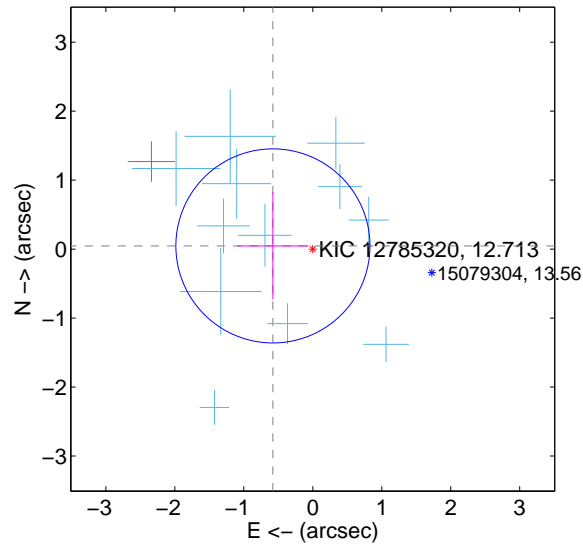
Supplemental centroid analysis for 012785320-02. Kepler magnitude: 12.71. Transit SNR 18.59

There are 12 quarters with good PRF difference image offsets

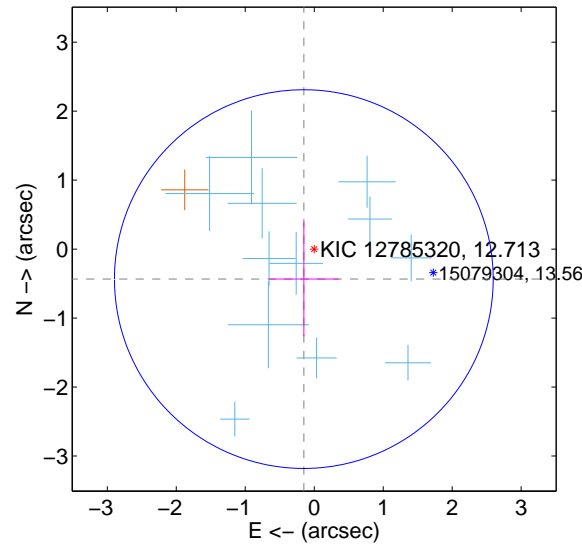
The direct PRF centroid is offset from the target star catalog position by about 0.80 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.580 \pm 0.469$	1.24	$0.578 \pm 0.516$	$0.046 \pm 0.779$
PRF-fit source offset from KIC position	$0.460 \pm 0.915$	0.50	$0.151 \pm 0.504$	$-0.435 \pm 0.830$
photometric centroid source offset	$0.75 \pm 0.73$	1.03	$-0.39 \pm 0.65$	$0.64 \pm 0.75$

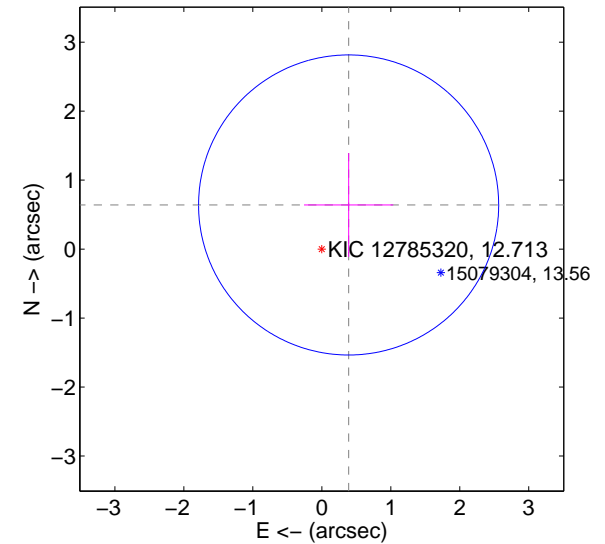
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

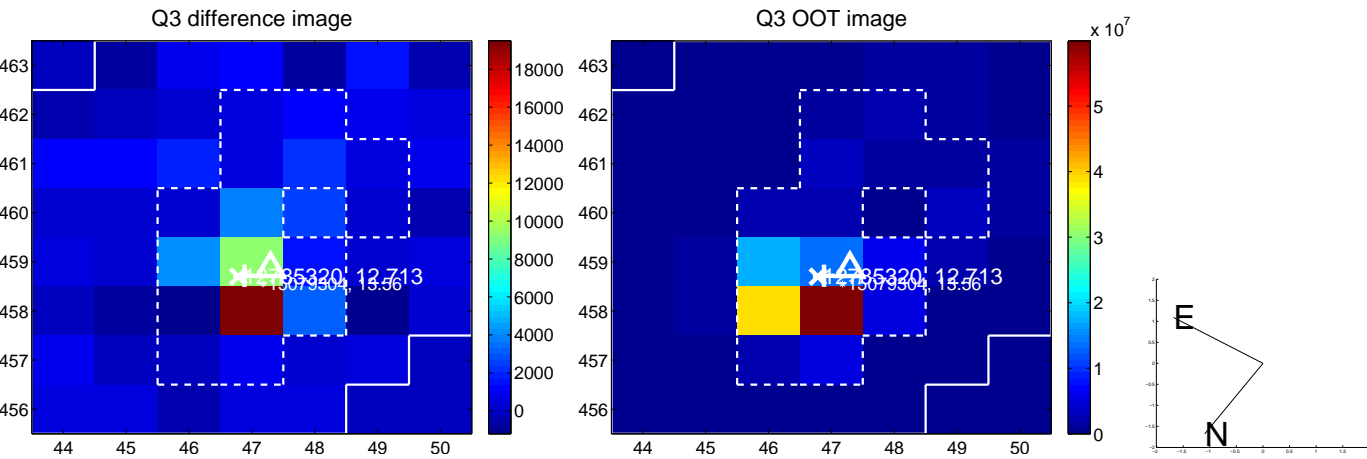
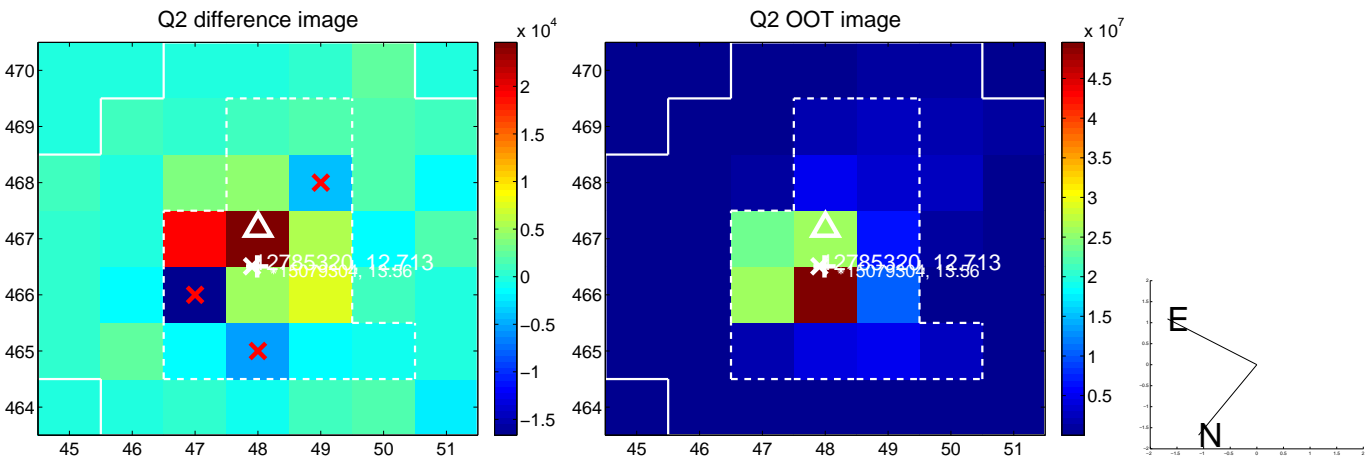


offset from photometric centroids

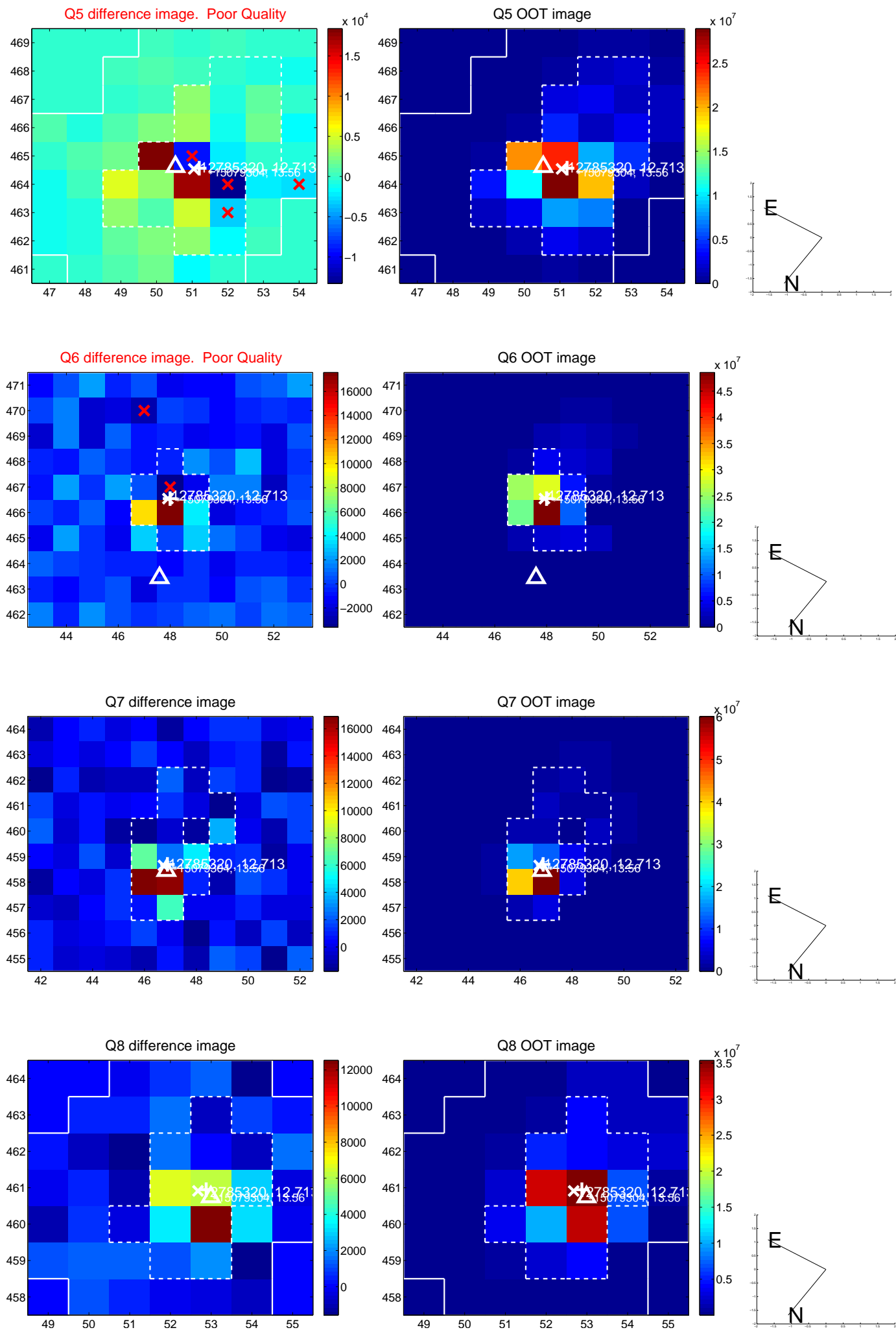


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

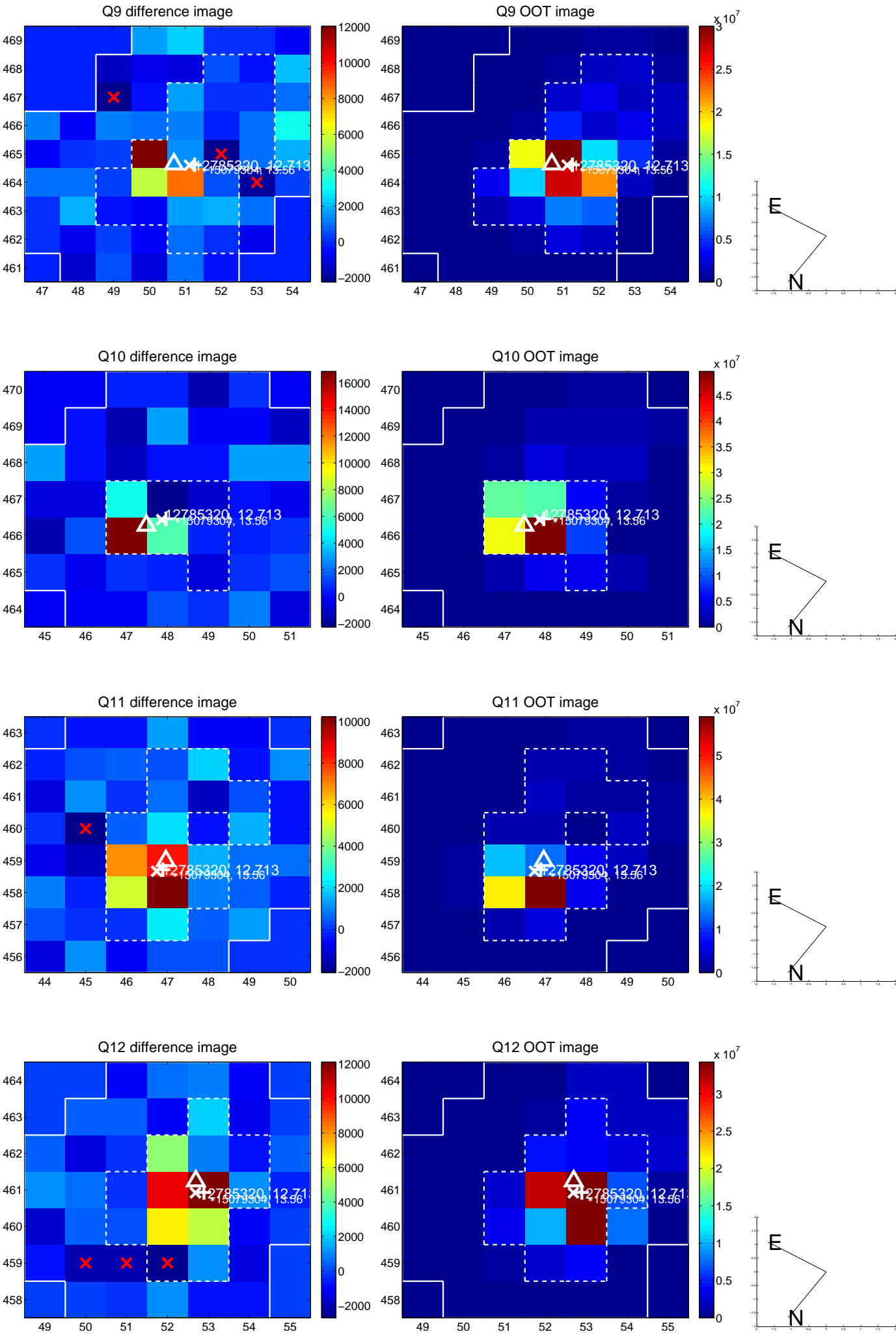
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



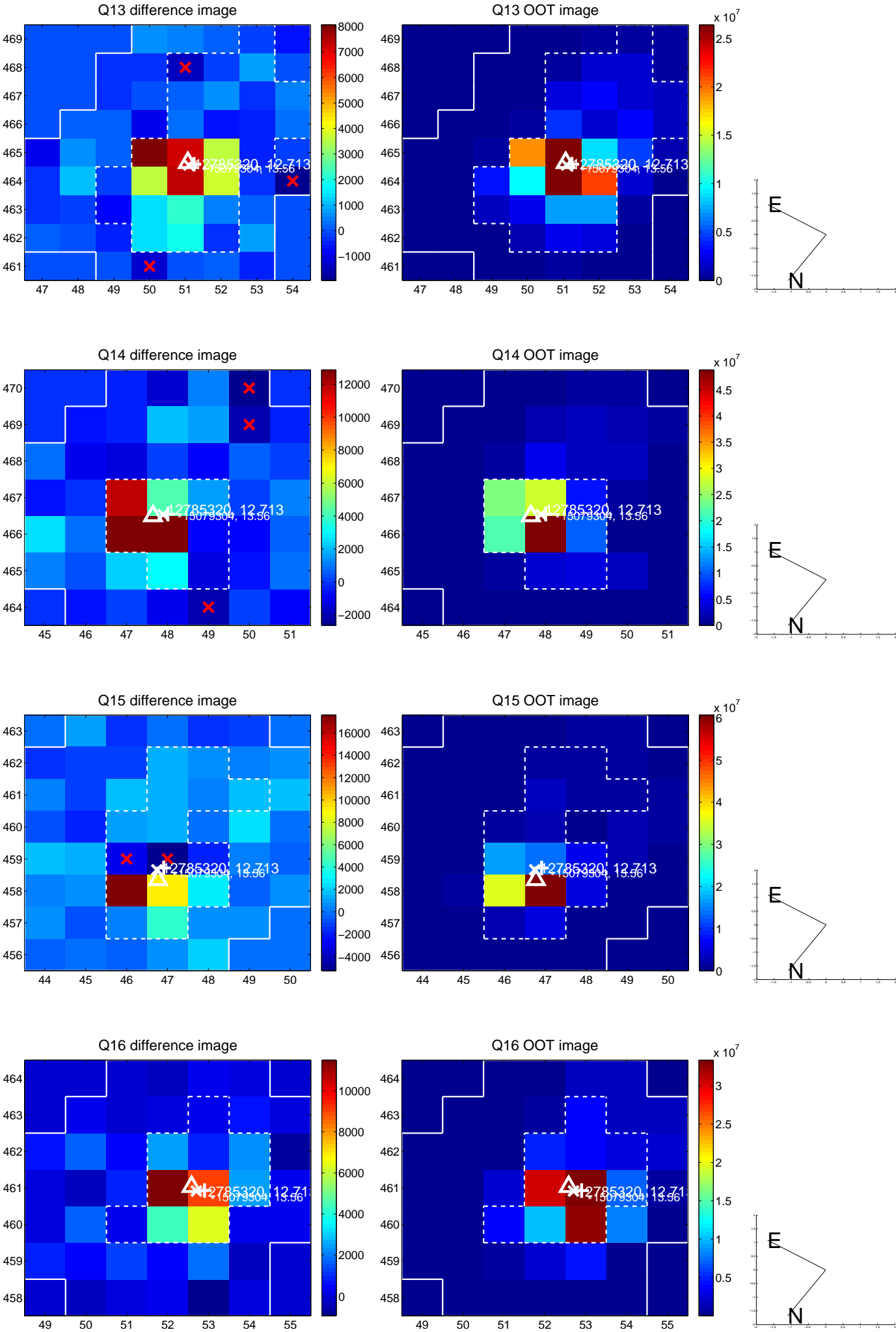
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



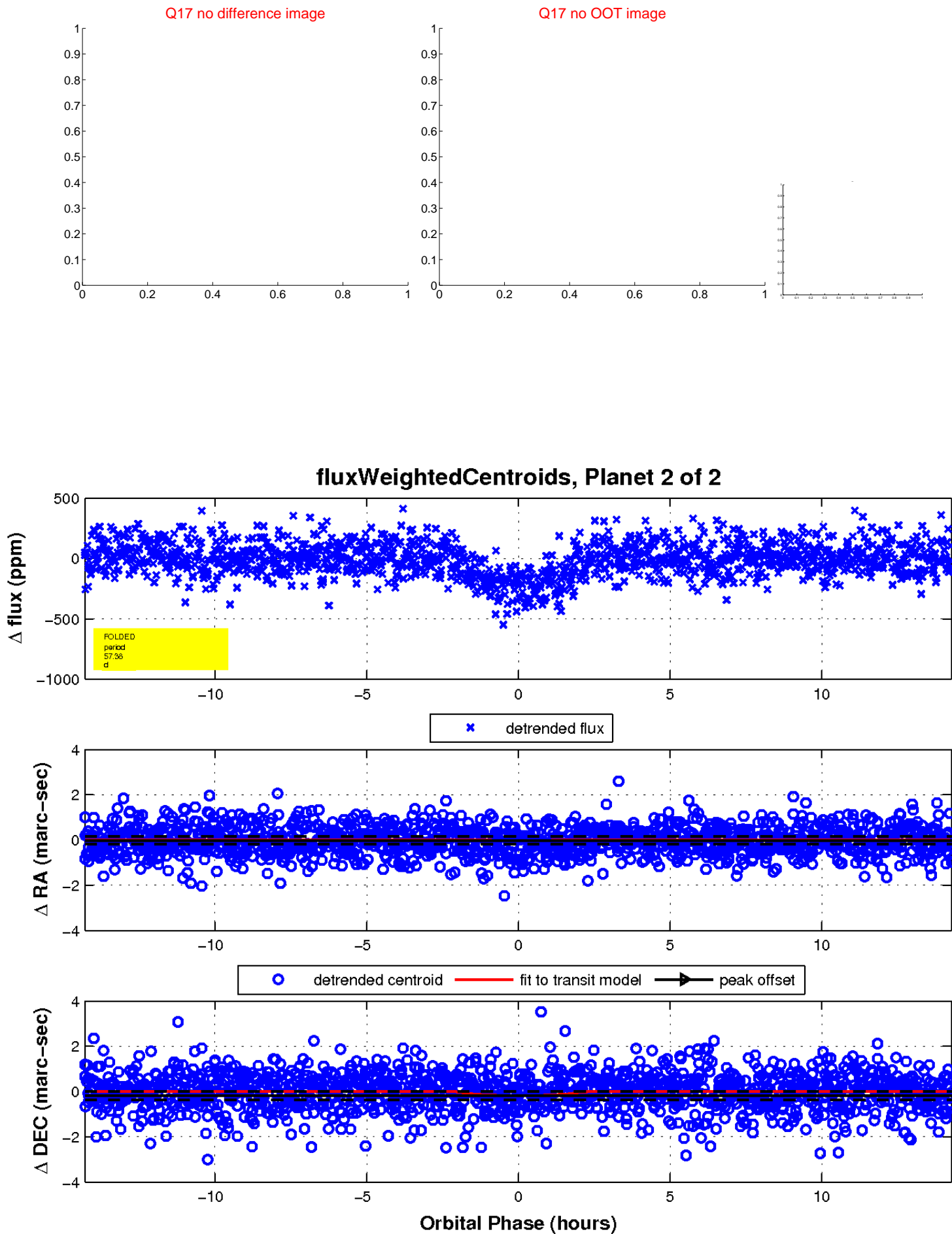
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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UKIRT Image

Declination

