

# KIC 009880382

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009880382-01	OBS	No	477.630839	177.908397	1268.9	5.150	12.3	7.0	0.65	4972	2.27	0.22
009880382-02	OBS	No	358.917094	373.790403	1425.1	6.016	10.1	6.8	0.65	4972	3.04	0.32

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009880382-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009880382-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—ALL_TRANS_CHASES—INCONSISTENT_TRANS—CENT_FEW_DIFFS

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

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

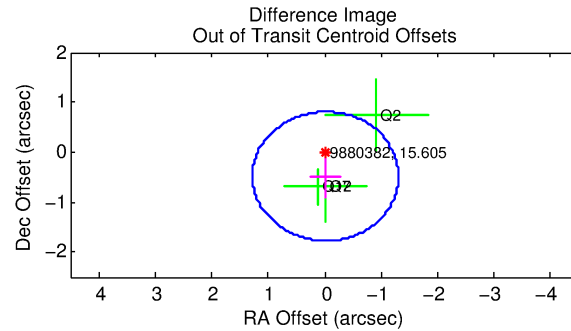
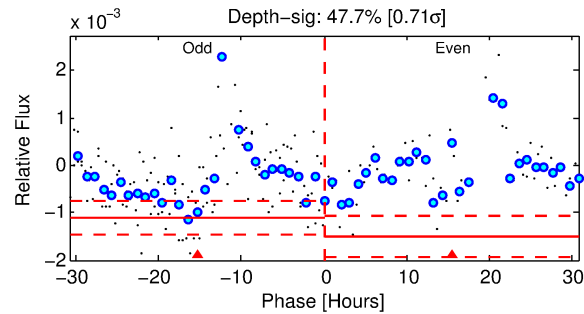
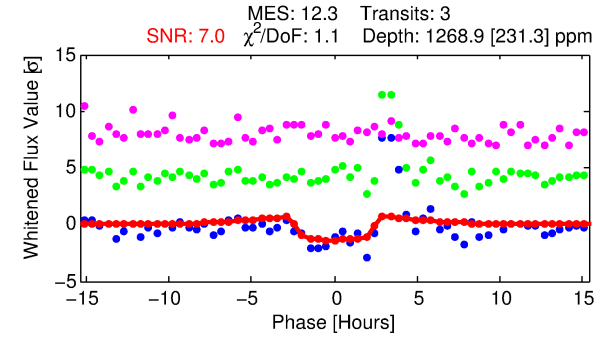
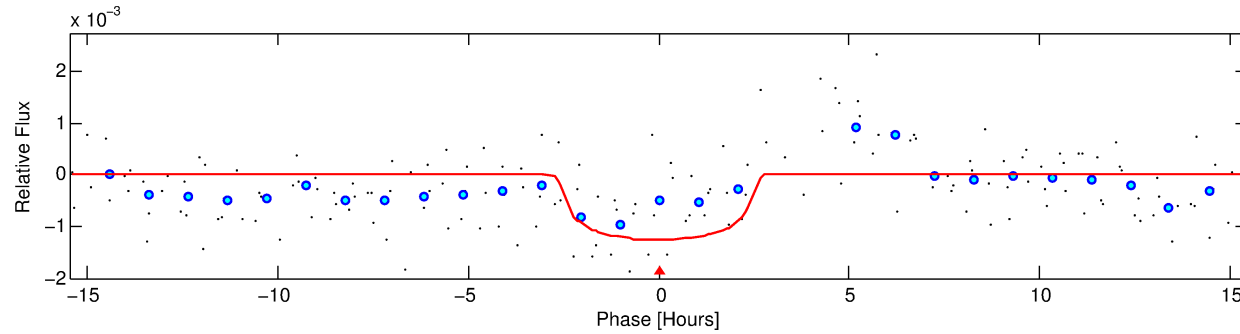
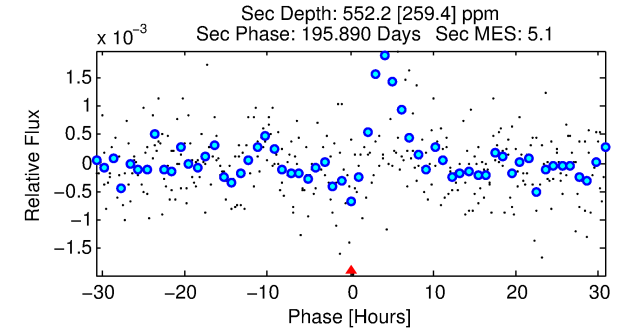
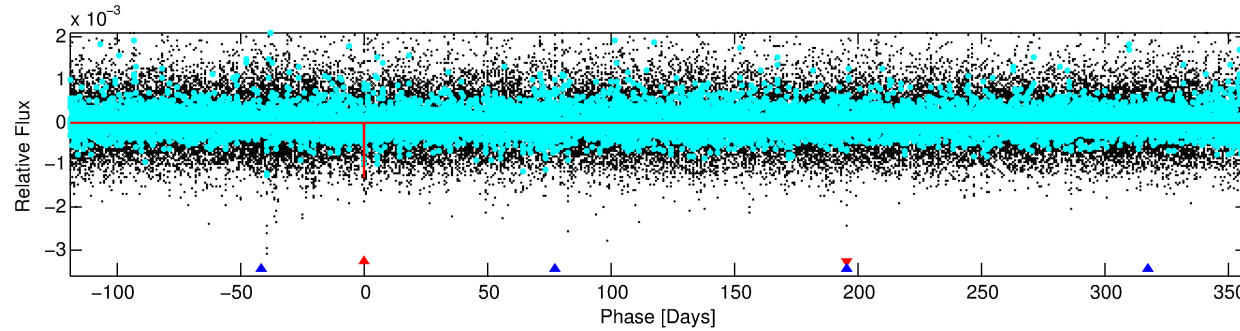
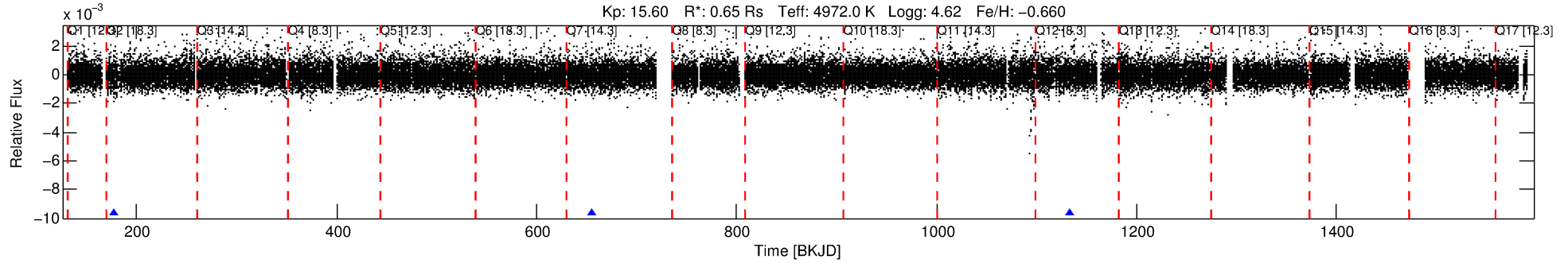
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 009880382-01

No Significant Match Found

# DV One-Page Summary

KIC: 9880382 Candidate: 1 of 2 Period: 477.631 d



## DV Fit Results:

Period = 477.63084 [0.00844] d  
Epoch = 177.9084 [0.0119] BKJD  
Rp/R\* = 0.0323 [0.0653]  
a/R\* = 694.30 [5189.13]  
b = 0.32 [20.79]  
Seff = 0.22 [0.04]  
Teq = 174 [8] K  
Rp = 2.27 [4.60] Re  
a = 1.0260 [0.0780] AU  
Ag = 61841.31 [251817.24] [0.25σ]  
Teffp = 4240 [4317] K [0.94σ]

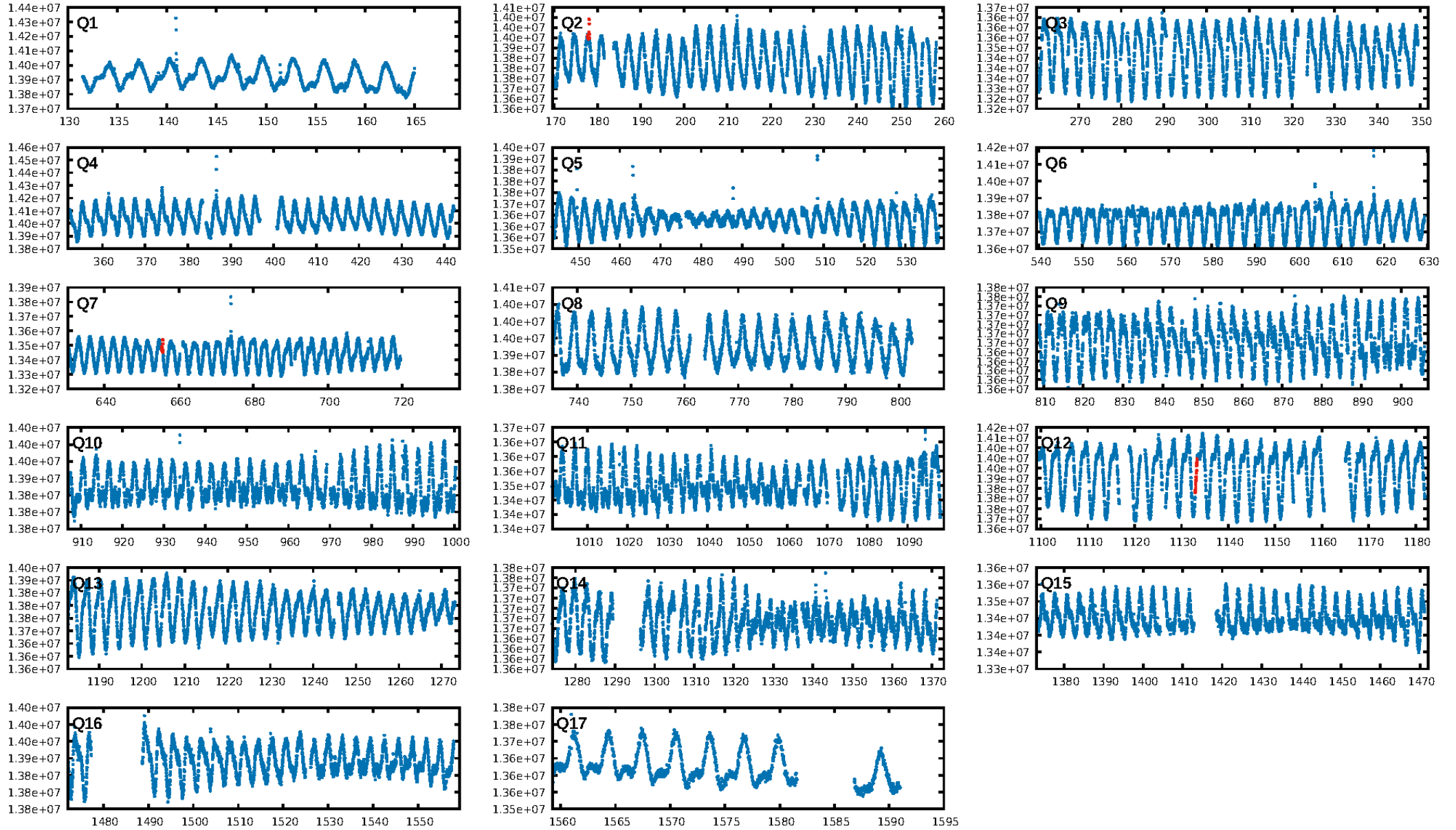
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [359.79σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 0.2%  
ModelChiSquareGof-sig: 48.6%  
Bootstrap-pfa: 2.55e-13  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: -1.388  
Centroid-sig: 20.6%  
Centroid-so: 1.837 arcsec [1.31σ]  
OotOffset-rm: 0.483 arcsec [1.12σ]  
OotOffset-st: 1/1/1/0 [3]  
KicOffset-rm: 0.458 arcsec [0.98σ]  
KicOffset-st: 1/1/1/0 [3]  
DiffImageQuality-fgm: 0.00 [0/3]  
DiffImageOverlap-fno: 1.00 [3/3]

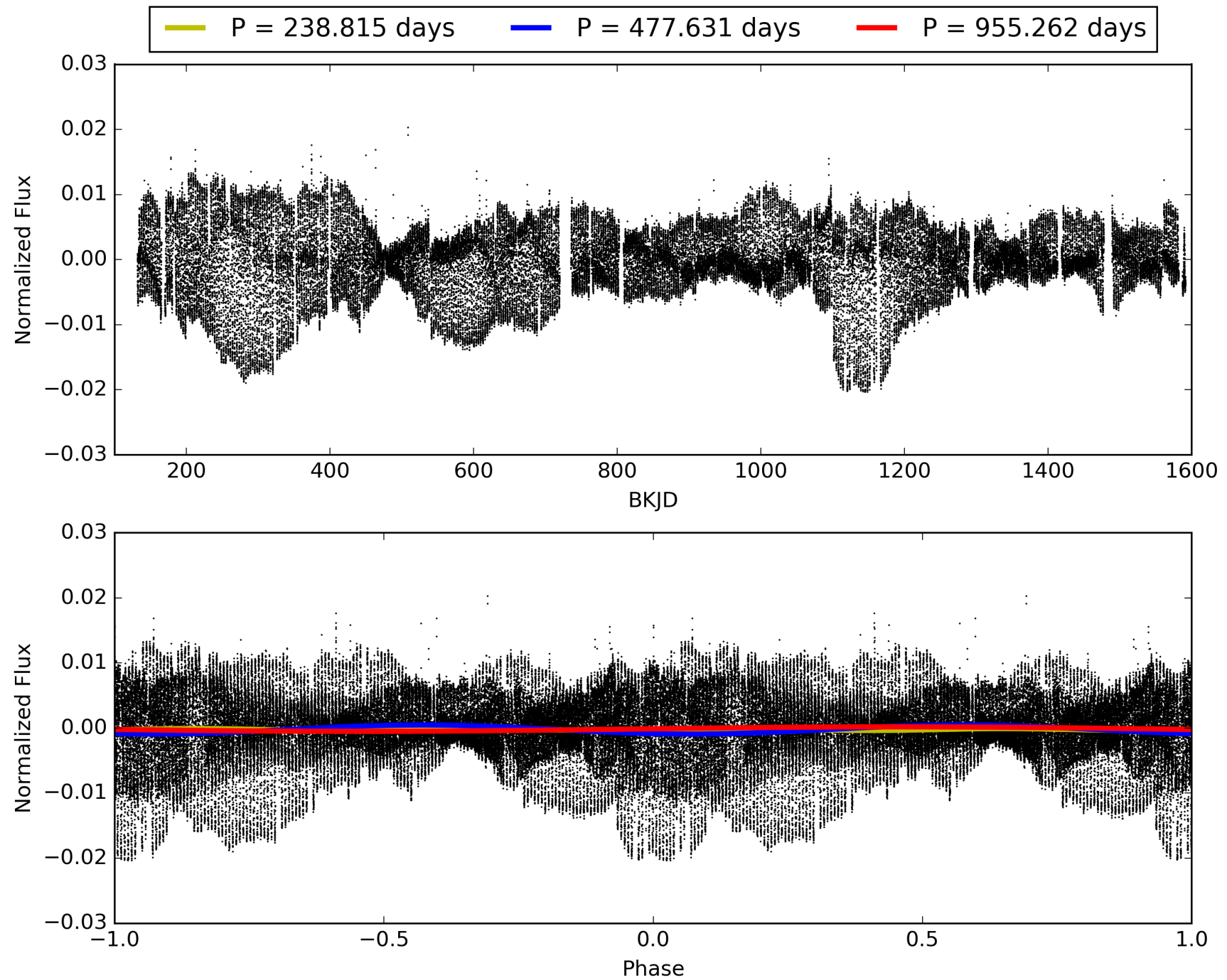
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 29-Jan-2016 11:53:51 Z

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

# TCE 009880382-01, PDC Light Curves

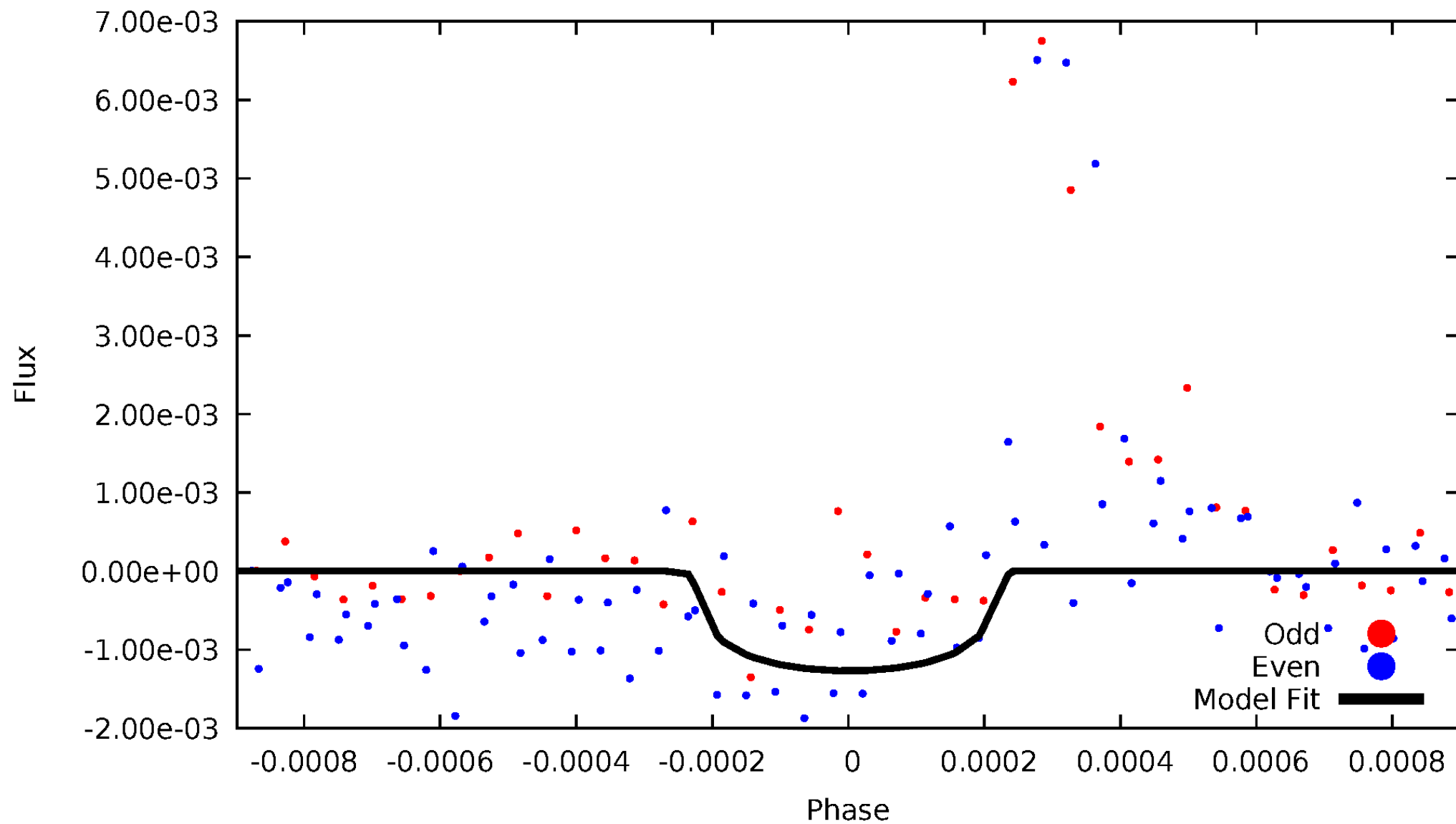


TCE 009880382-01



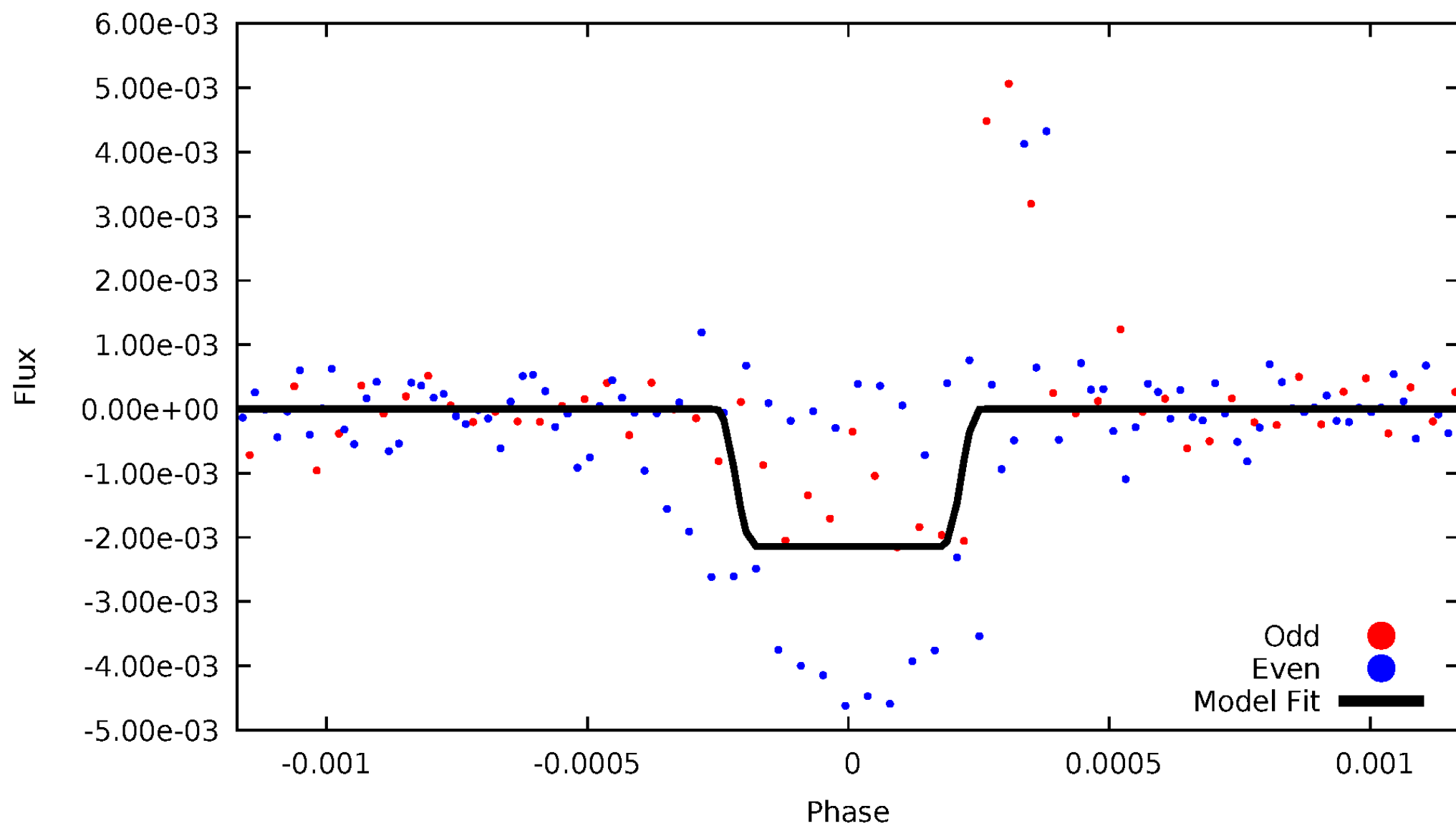
# DV Odd/Even

TCE 009880382-01



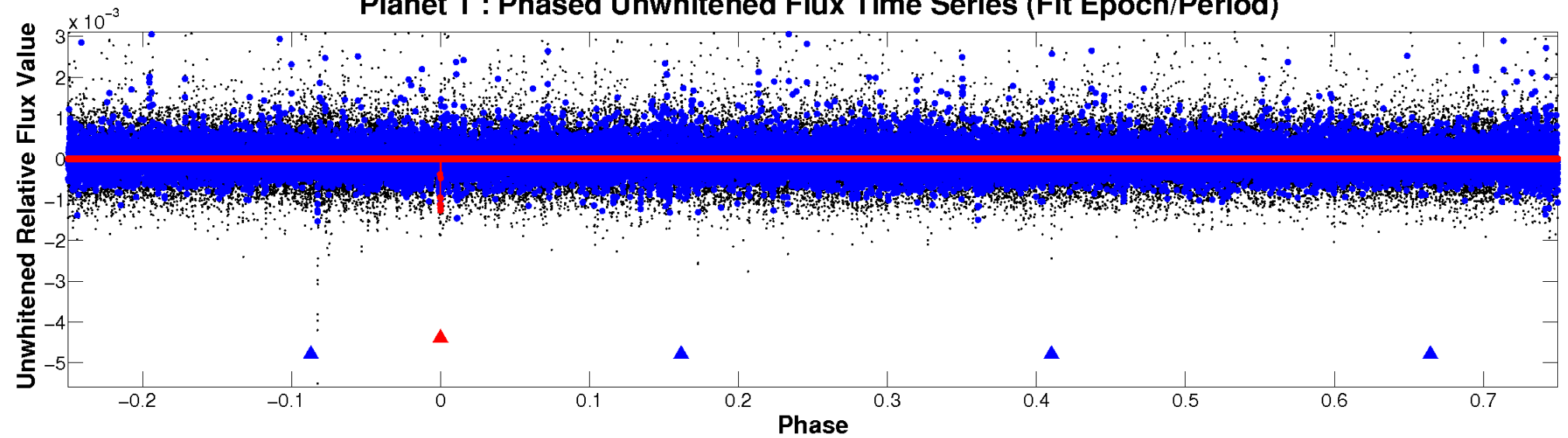
# ALT Odd/Even

TCE 009880382-01

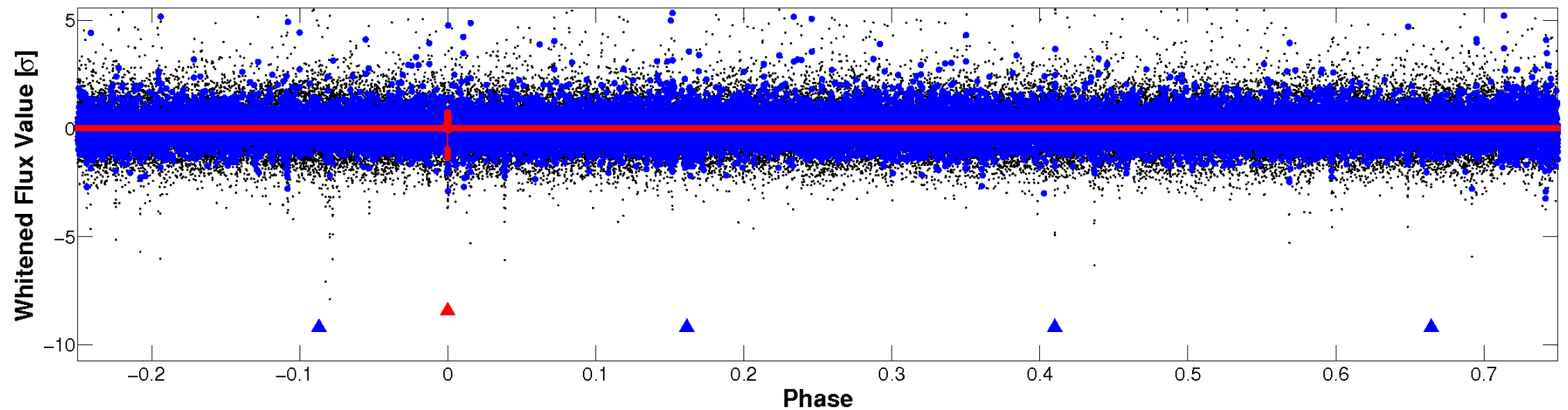


# Non-Whitened Vs. Whitened Light Curve

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

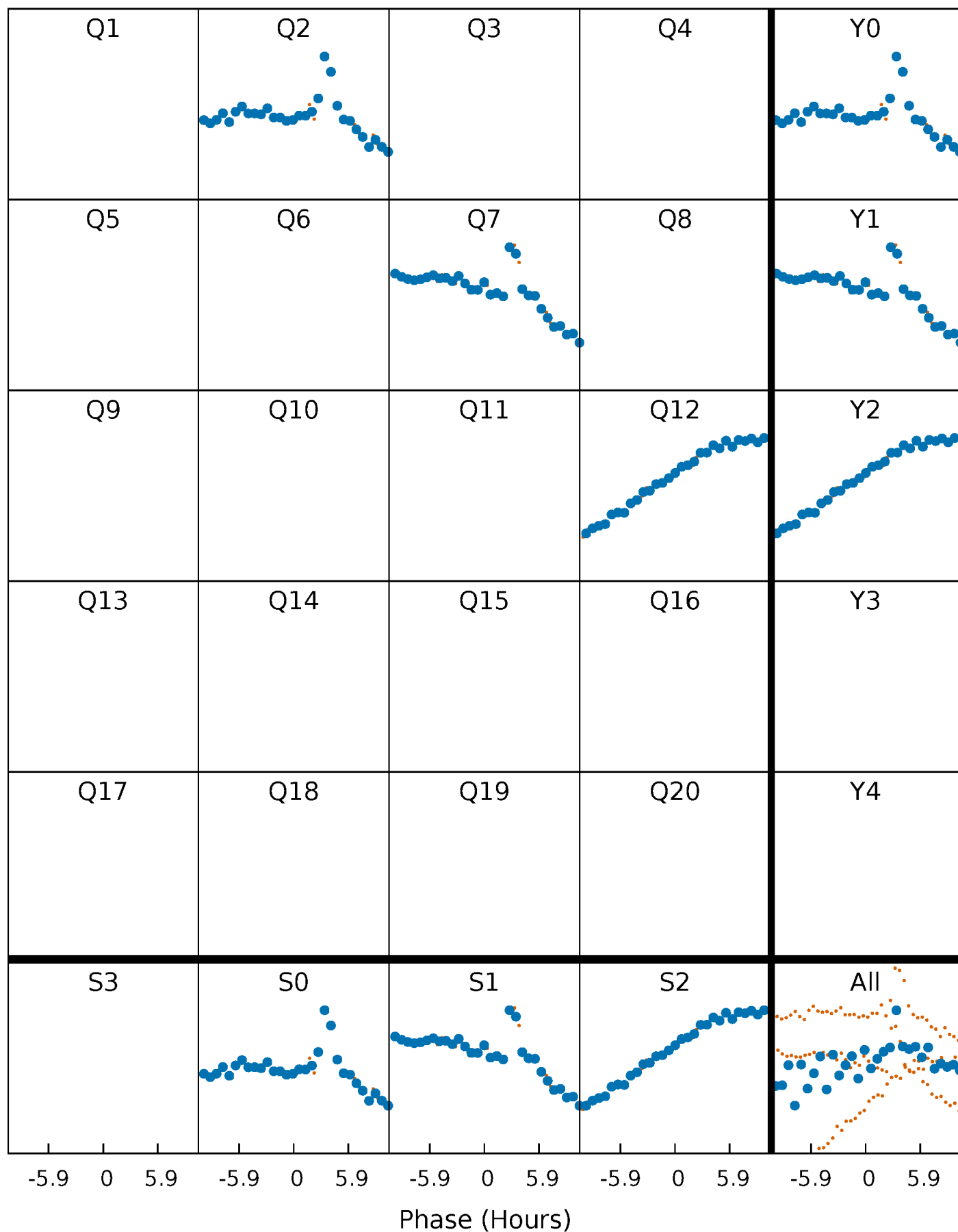


**Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



# PDC Quarter-Phased Transit Curves

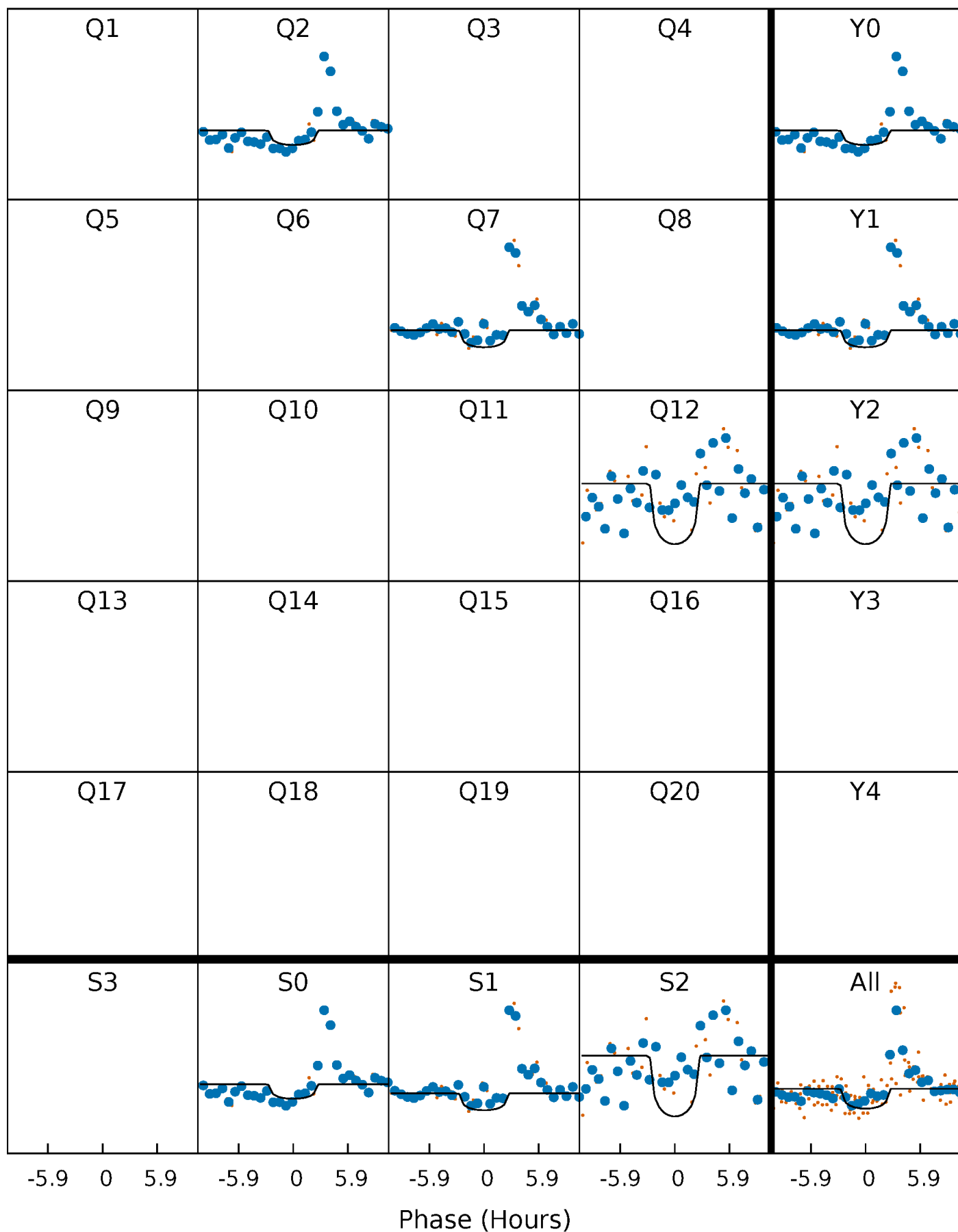
TCE 009880382-01 P=477.630839 Days  $T_0=177.908397$  (BKJD)





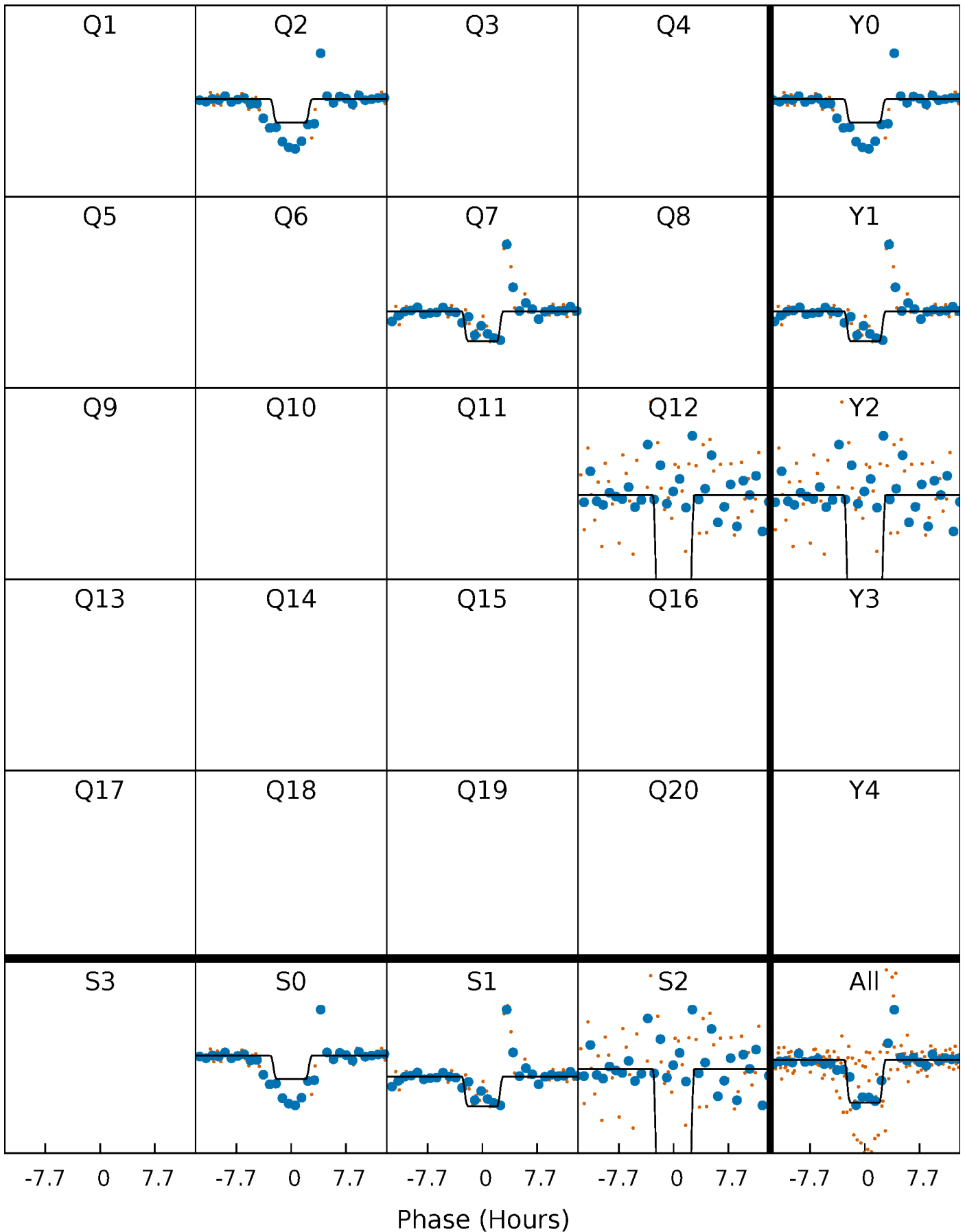
# DV Quarter-Phased Transit Curves

TCE 009880382-01 P=477.630839 Days  $T_0=177.908397$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

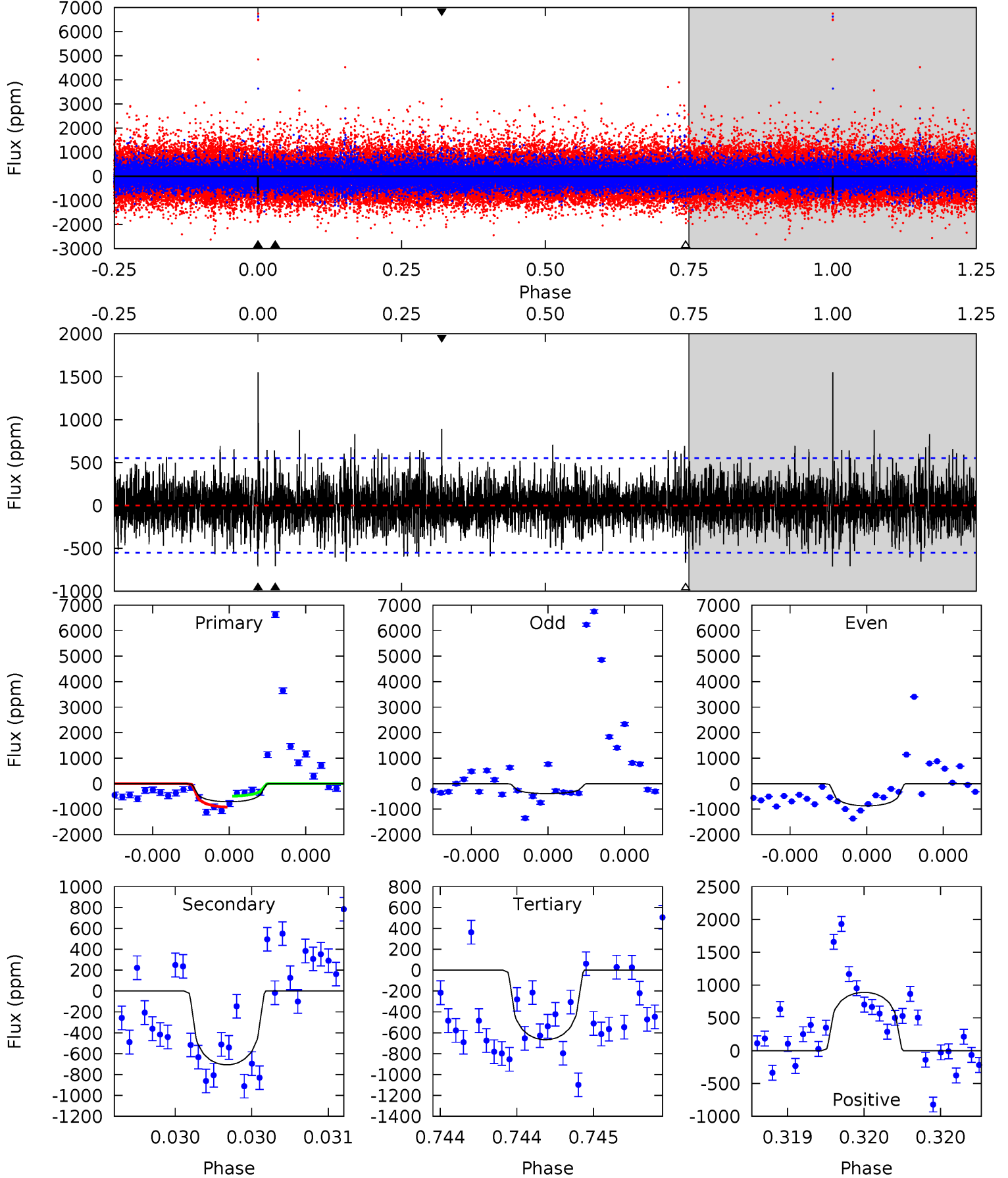
TCE 009880382-01 P=477.648087 Days  $T_0=177.880201$  (BKJD)



# DV Model-Shift Uniqueness Test

009880382-01, P = 477.630839 Days, E = 177.908397 Days

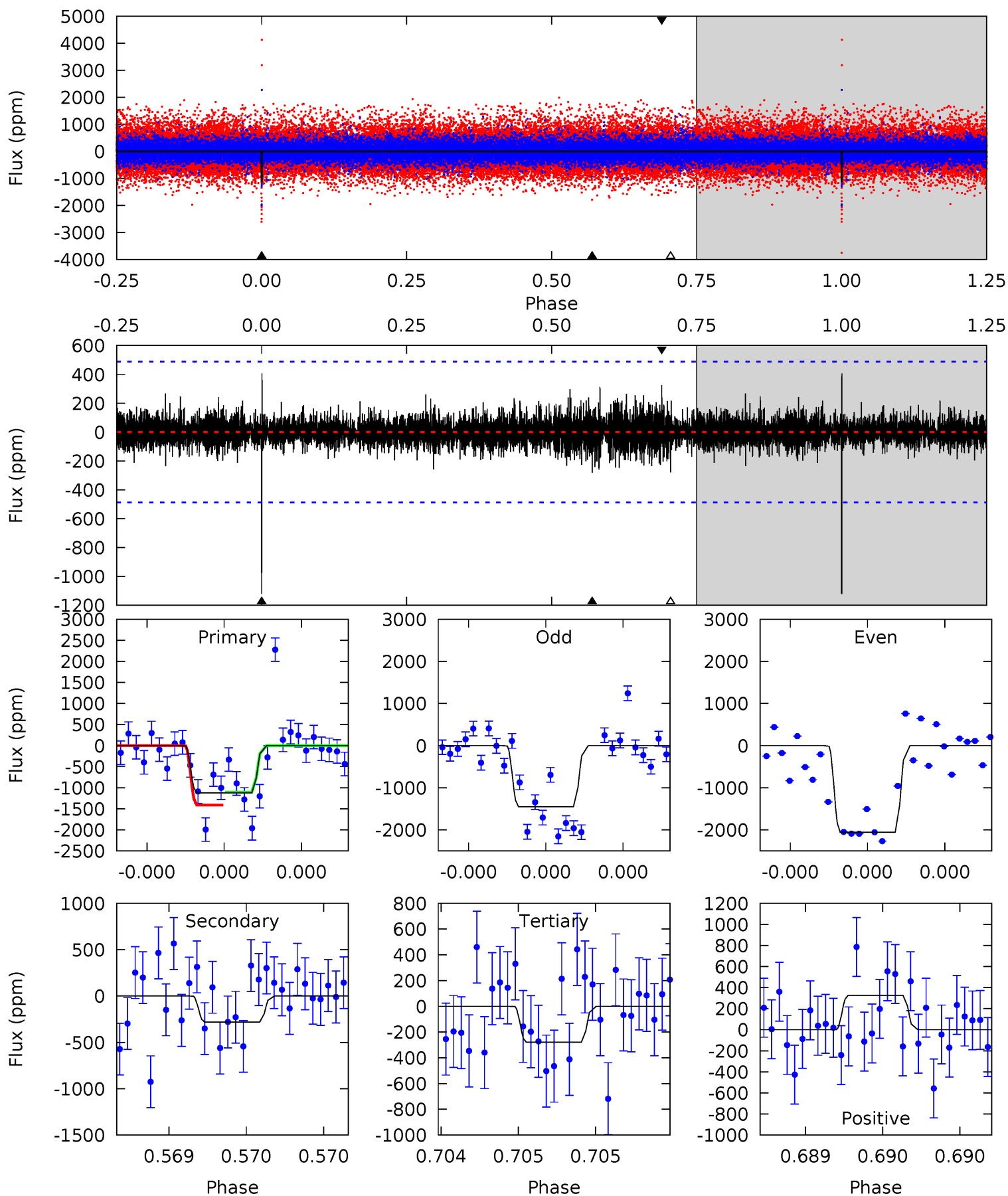
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
7.20	7.16	6.75	9.01	5.58	3.49	1.90	0.45	-1.81	0.41	-1.85	2.23	1.67	0.69	2.19



# Alt Model-Shift Uniqueness Test

009880382-01, P = 477.648087 Days, E = 177.880201 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
12.8	3.22	3.19	3.71	5.57	3.48	0.71	9.61	9.09	0.03	-0.50	3.72	1.23	0.27	1.78



### Stellar Parameters For KIC 009880382

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$4972^{+164}_{-149}$	$4.619^{+0.061}_{-0.039}$	$-0.660^{+0.350}_{-0.300}$	$0.645^{+0.058}_{-0.058}$	$0.630^{+0.074}_{-0.032}$	$3.311^{+0.933}_{-0.505}$
	+3%/-3%	+1%/-1%	+53%/-45%	+9%/-9%	+12%/-5%	+28%/-15%
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 009880382-01 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	$-707 \pm 99$	$4.20^{+3.59}_{-2.87}$	$242^{+9}_{-8}$	$3696^{+2148}_{-649}$	$22835^{+195270}_{-16000}$
Alt.	$-282 \pm 88$	$4.46^{+4.18}_{-2.99}$	$242^{+9}_{-9}$	$3098^{+1375}_{-508}$	$7864^{+62434}_{-5816}$

$T_{\text{max}}$  = 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

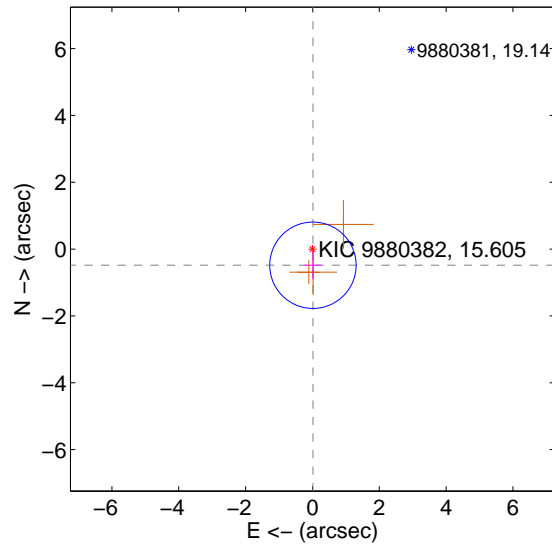
Supplemental centroid analysis for 009880382-01. Kepler magnitude: 15.61. Transit SNR 6.97

There are 0 quarters with good PRF difference image offsets

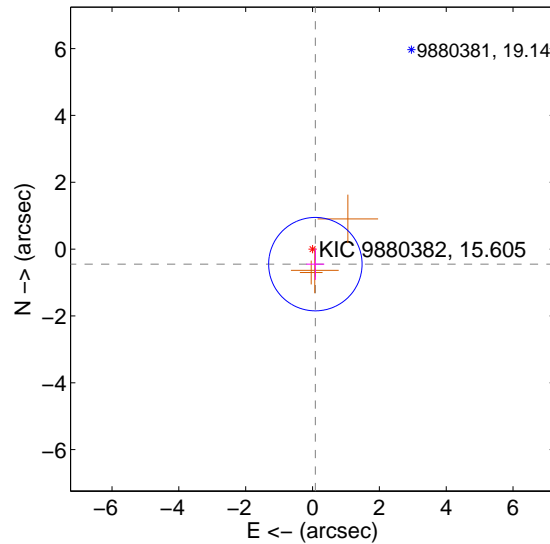
The direct PRF centroid is offset from the target star catalog position by about 0.07 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.483 \pm 0.431$	1.12	$-0.015 \pm 0.252$	$-0.483 \pm 0.431$
PRF-fit source offset from KIC position	$0.458 \pm 0.466$	0.98	$-0.085 \pm 0.268$	$-0.450 \pm 0.471$
photometric centroid source offset	$1.84 \pm 1.40$	1.31	$-1.81 \pm 1.41$	$0.30 \pm 1.12$

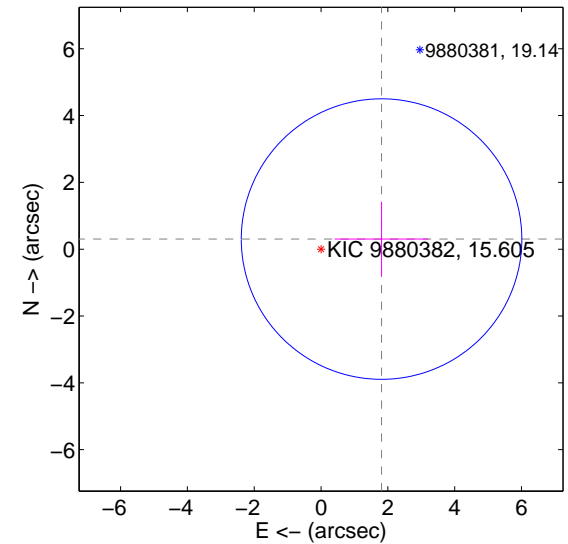
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

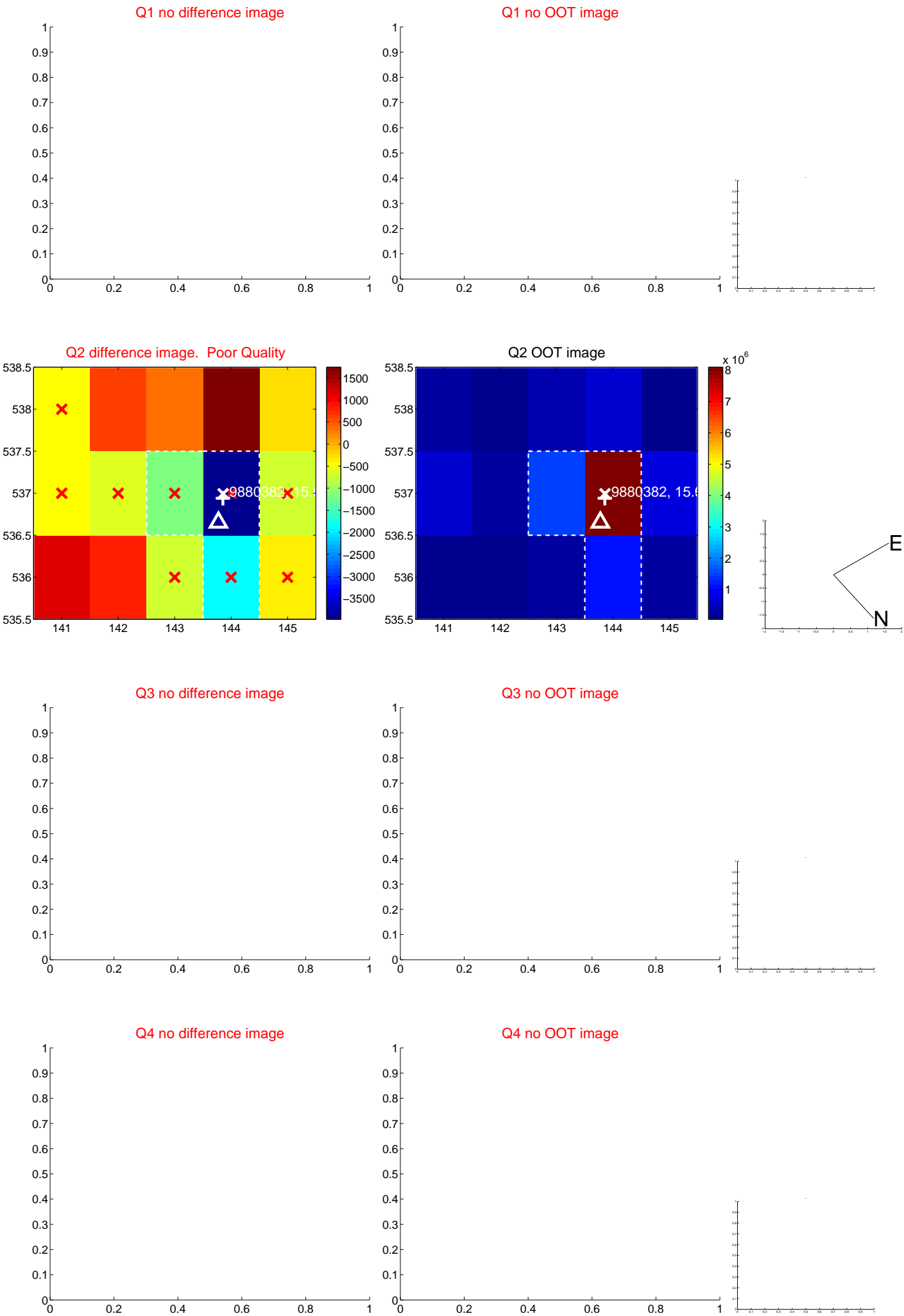


offset from photometric centroids



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 ×: 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.

Q5 no difference image



Q5 no OOT image



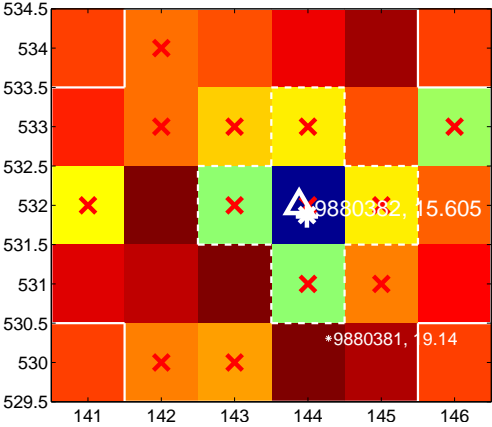
Q6 no difference image



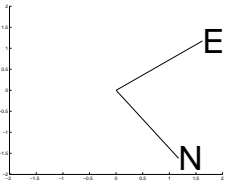
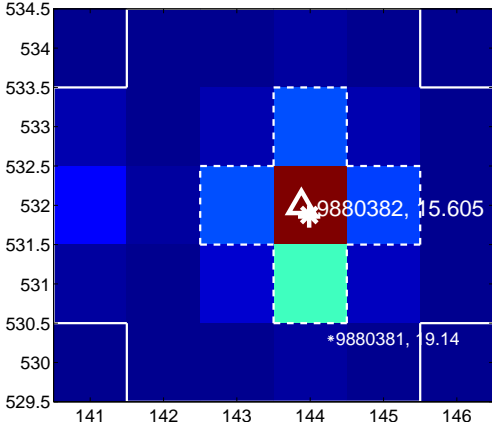
Q6 no OOT image



Q7 difference image. Poor Quality



Q7 OOT image



Q8 no difference image

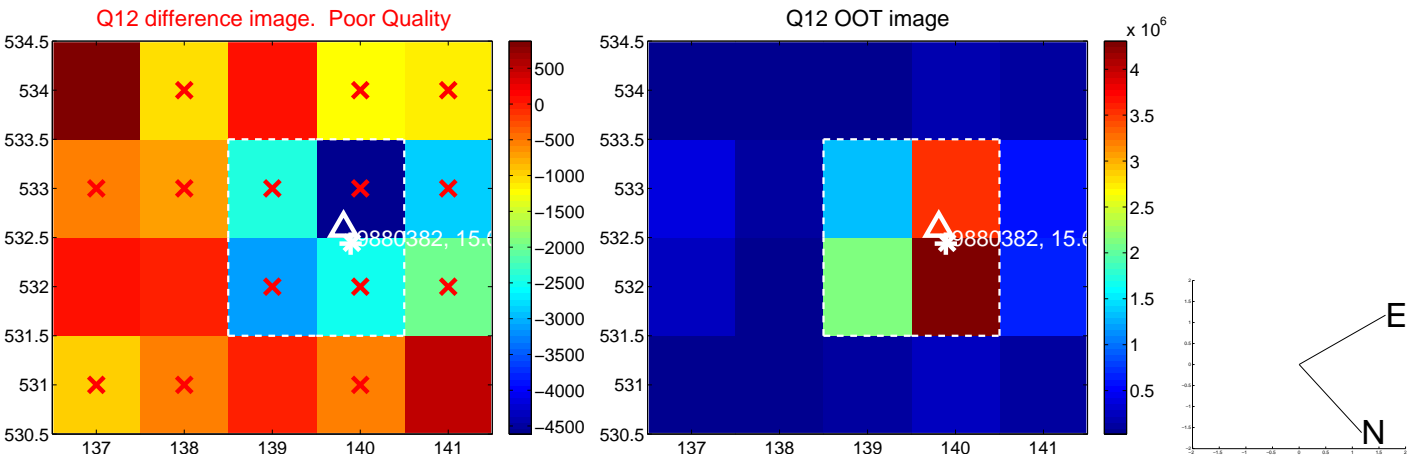


Q8 no OOT image





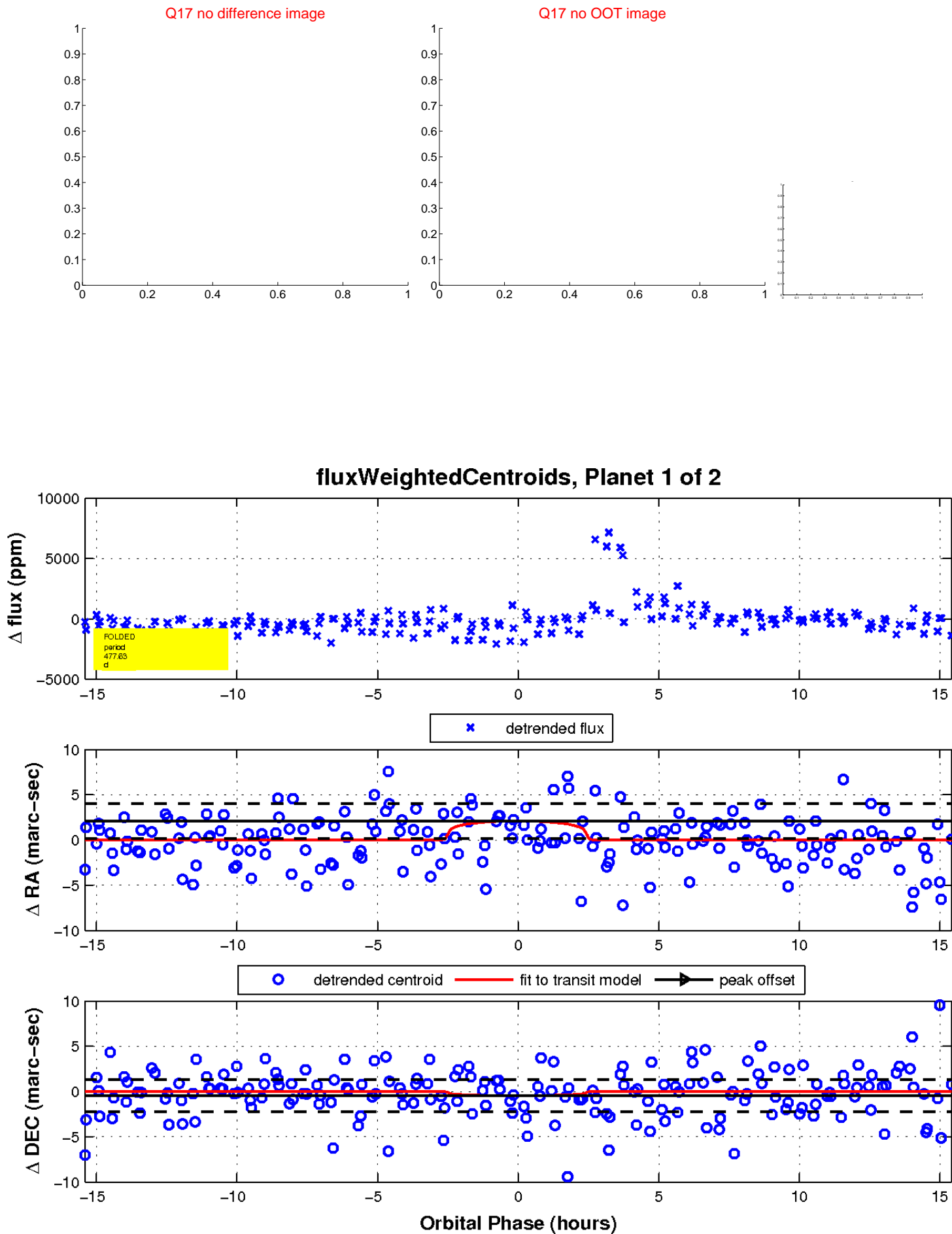
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

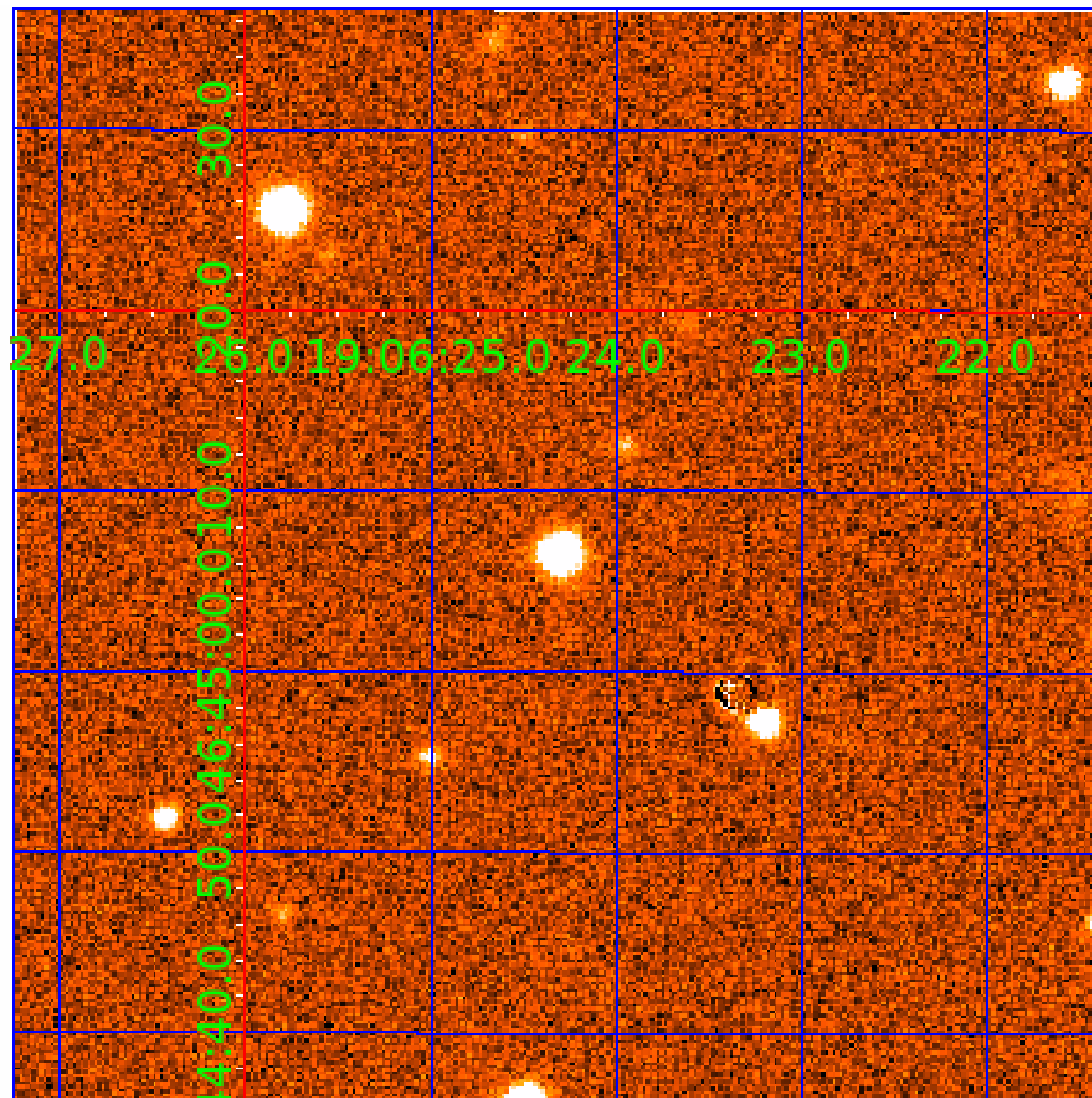


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 009880382

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009880382-01	OBS	No	477.630839	177.908397	1268.9	5.150	12.3	7.0	0.65	4972	2.27	0.22
009880382-02	OBS	No	358.917094	373.790403	1425.1	6.016	10.1	6.8	0.65	4972	3.04	0.32

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009880382-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009880382-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—ALL_TRANS_CHASES—INCONSISTENT_TRANS—CENT_FEW_DIFFS

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

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

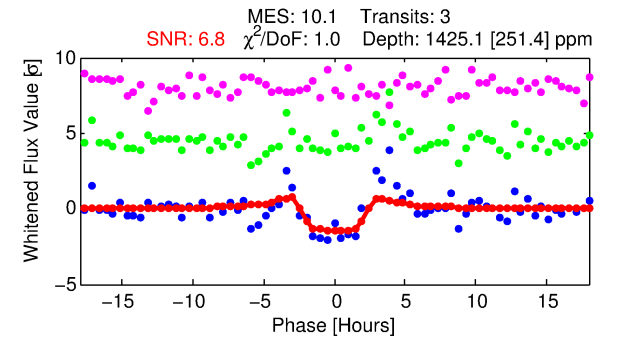
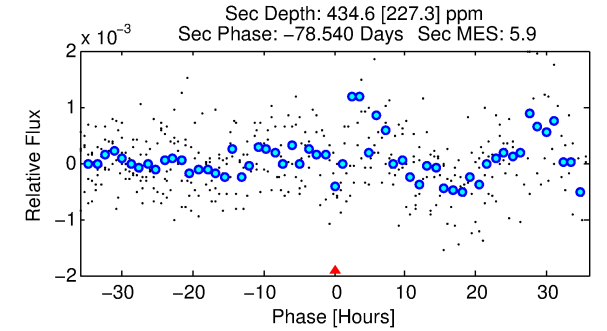
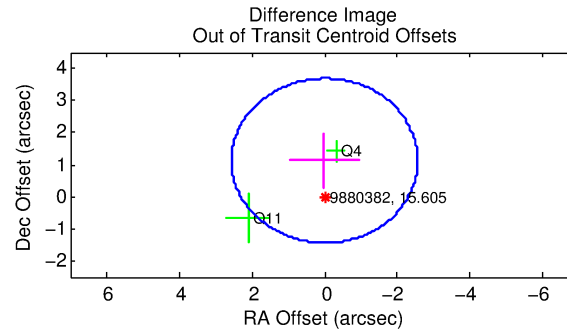
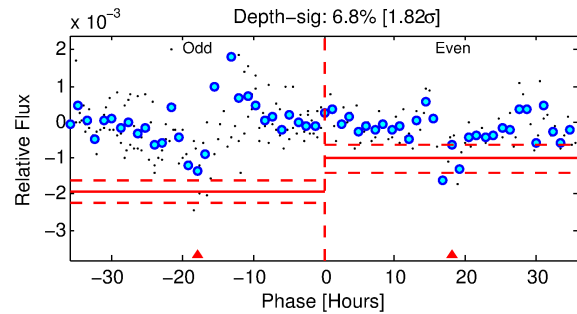
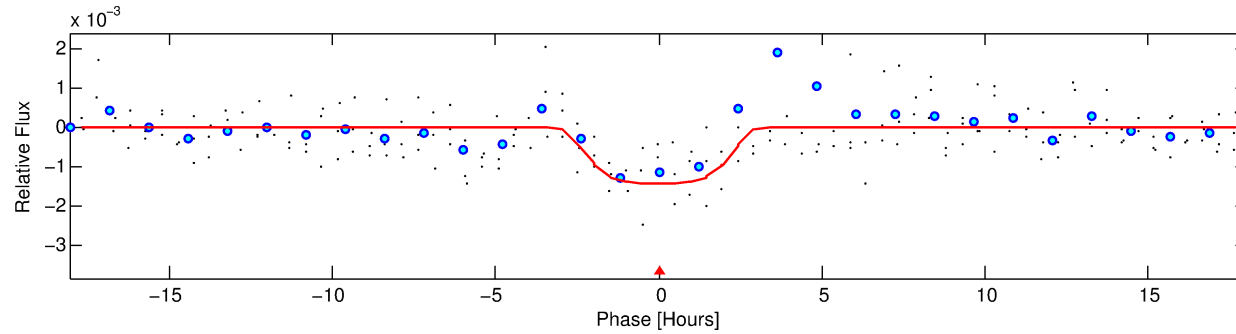
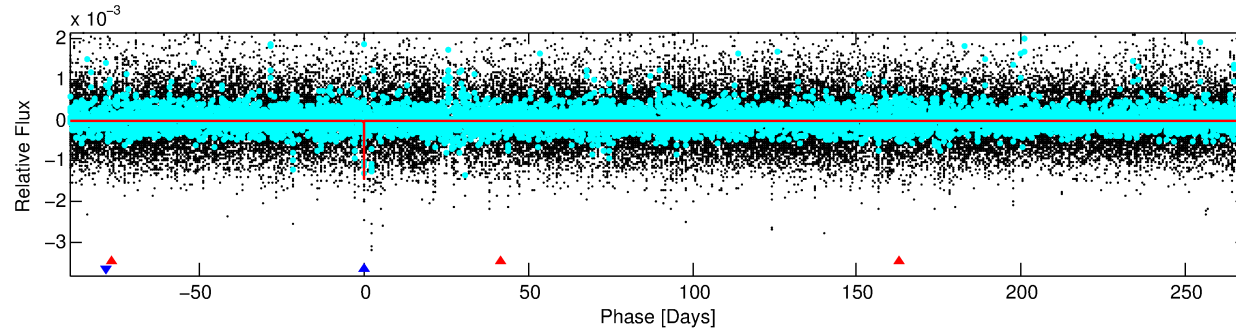
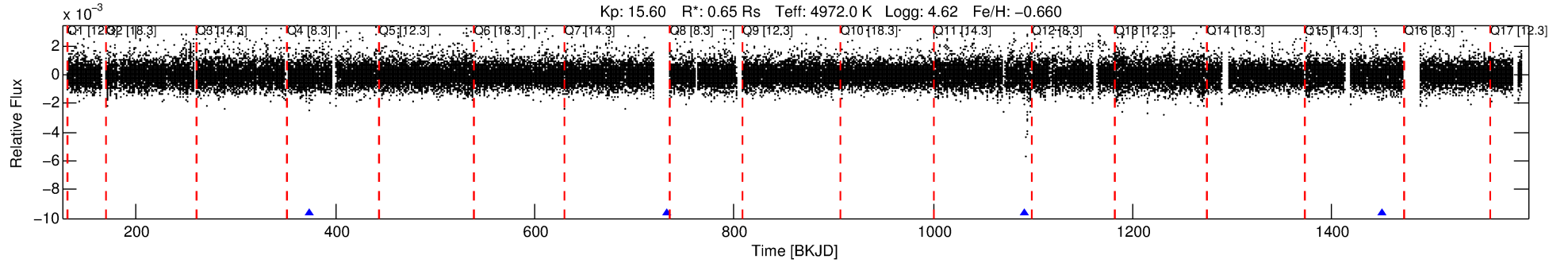
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 009880382-02

No Significant Match Found

# DV One-Page Summary

KIC: 9880382 Candidate: 2 of 2 Period: 358.917 d



## DV Fit Results:

Period = 358.91709 [0.00697] d  
Epoch = 373.7904 [0.0158] BKJD  
Rp/R\* = 0.0432 [0.0062]  
a/R\* = 221.00 [79.64]  
b = 0.92 [0.06]  
Seff = 0.32 [0.05]  
Teq = 191 [8] K  
Rp = 3.04 [0.51] Re  
a = 0.8480 [0.0645] AU  
Ag = 18603.41 [11286.80] [1.65 $\sigma$ ]  
Teffp = 3454 [528] K [6.18 $\sigma$ ]

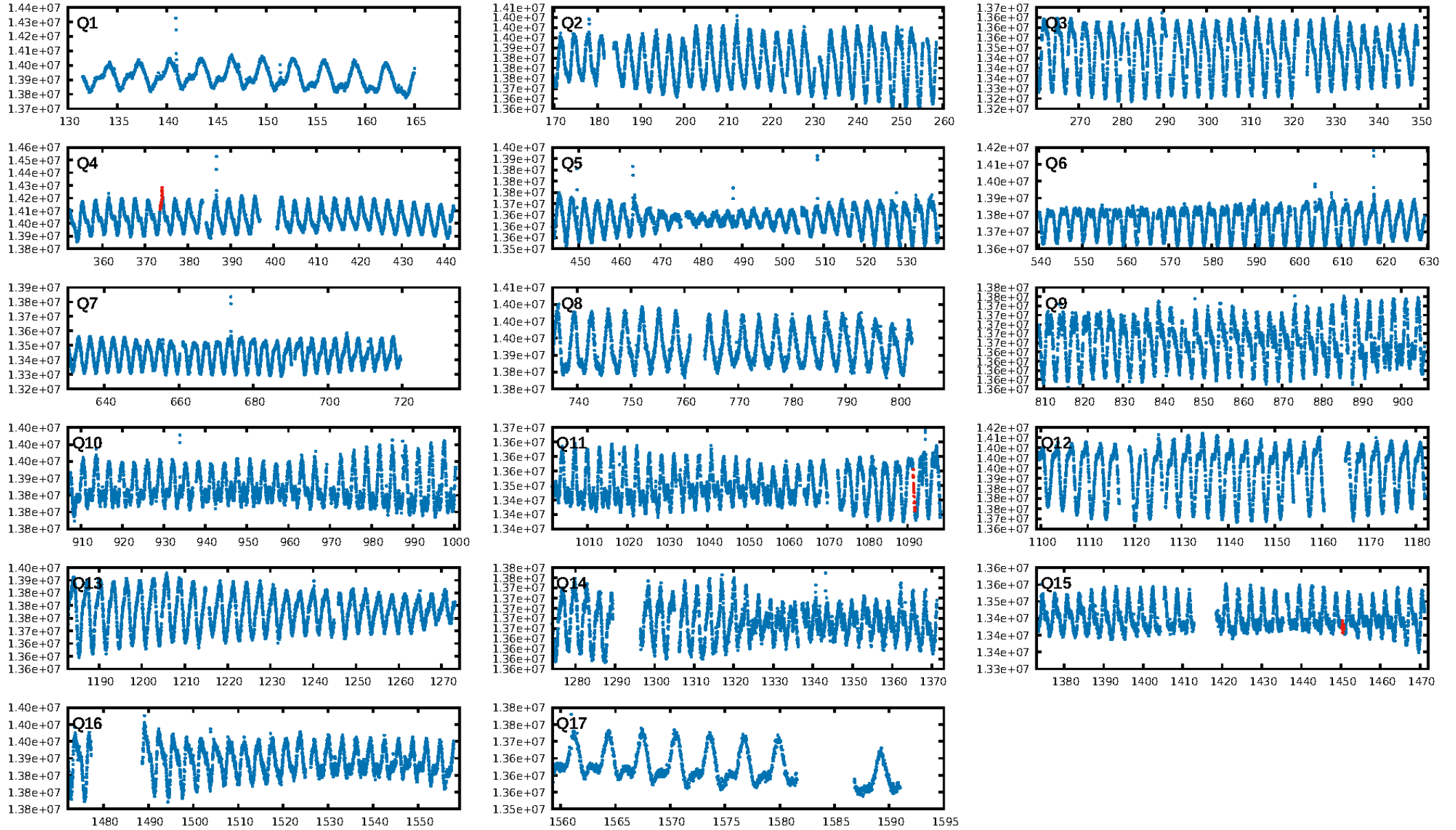
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [359.79 $\sigma$ ]  
ModelChiSquare2-sig: 4.2%  
ModelChiSquareGof-sig: 95.0%  
**Bootstrap-pfa: 9.64e-12**  
RollingBand-fgt: 1.00 [3/3]  
**GhostDiagnostic-chr: 0.9612**  
Centroid-sig: 42.0%  
Centroid-so: 1.336 arcsec [0.93 $\sigma$ ]  
OotOffset-rm: 1.124 arcsec [1.32 $\sigma$ ]  
OotOffset-st: 0/1/1/0 [2]  
KicOffset-rm: 1.111 arcsec [1.37 $\sigma$ ]  
KicOffset-st: 0/1/1/0 [2]  
DiffImageQuality-fgm: 0.50 [1/2]  
DiffImageOverlap-fno: 1.00 [2/2]

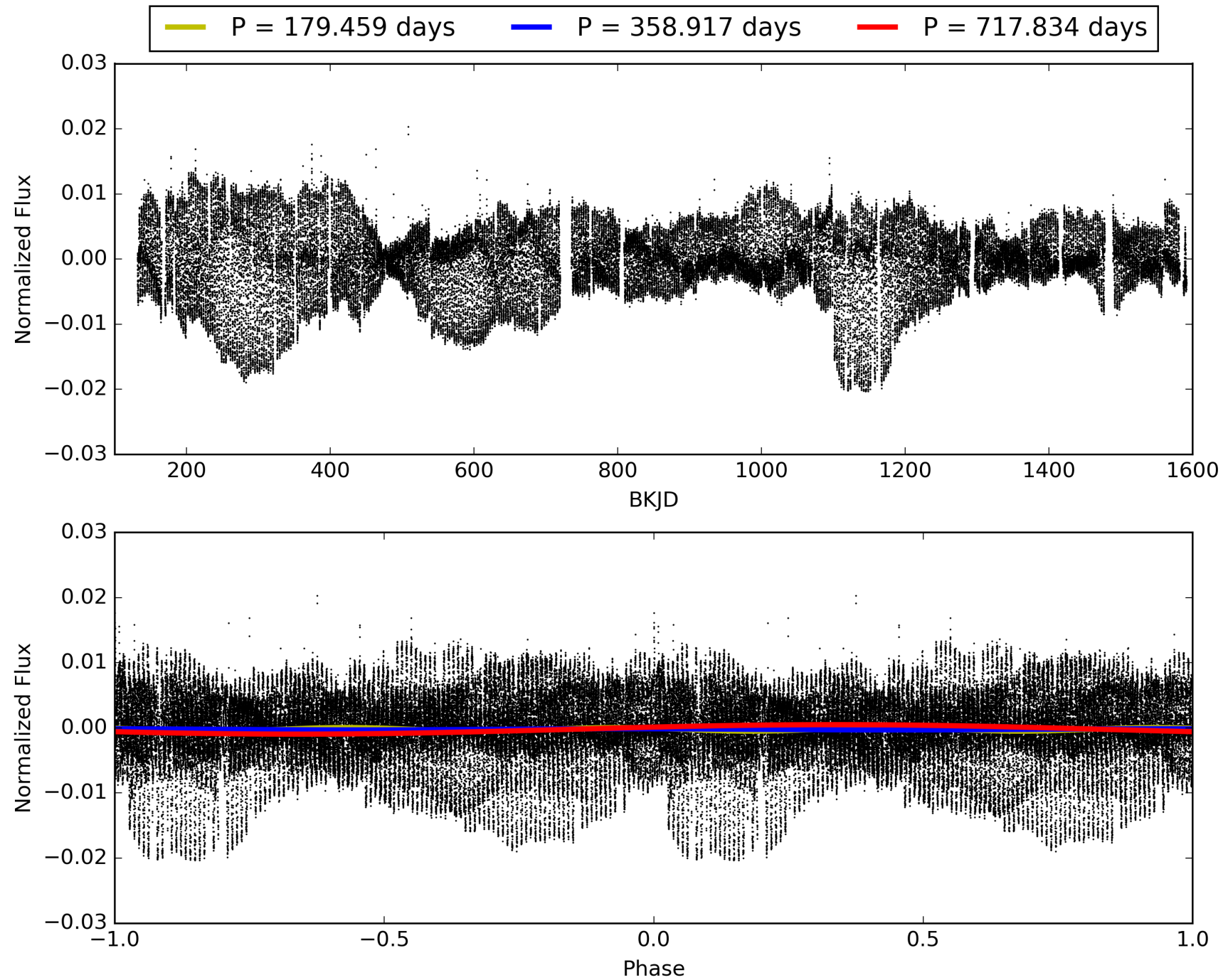
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 29-Jan-2016 11:54:03 Z

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

# TCE 009880382-02, PDC Light Curves



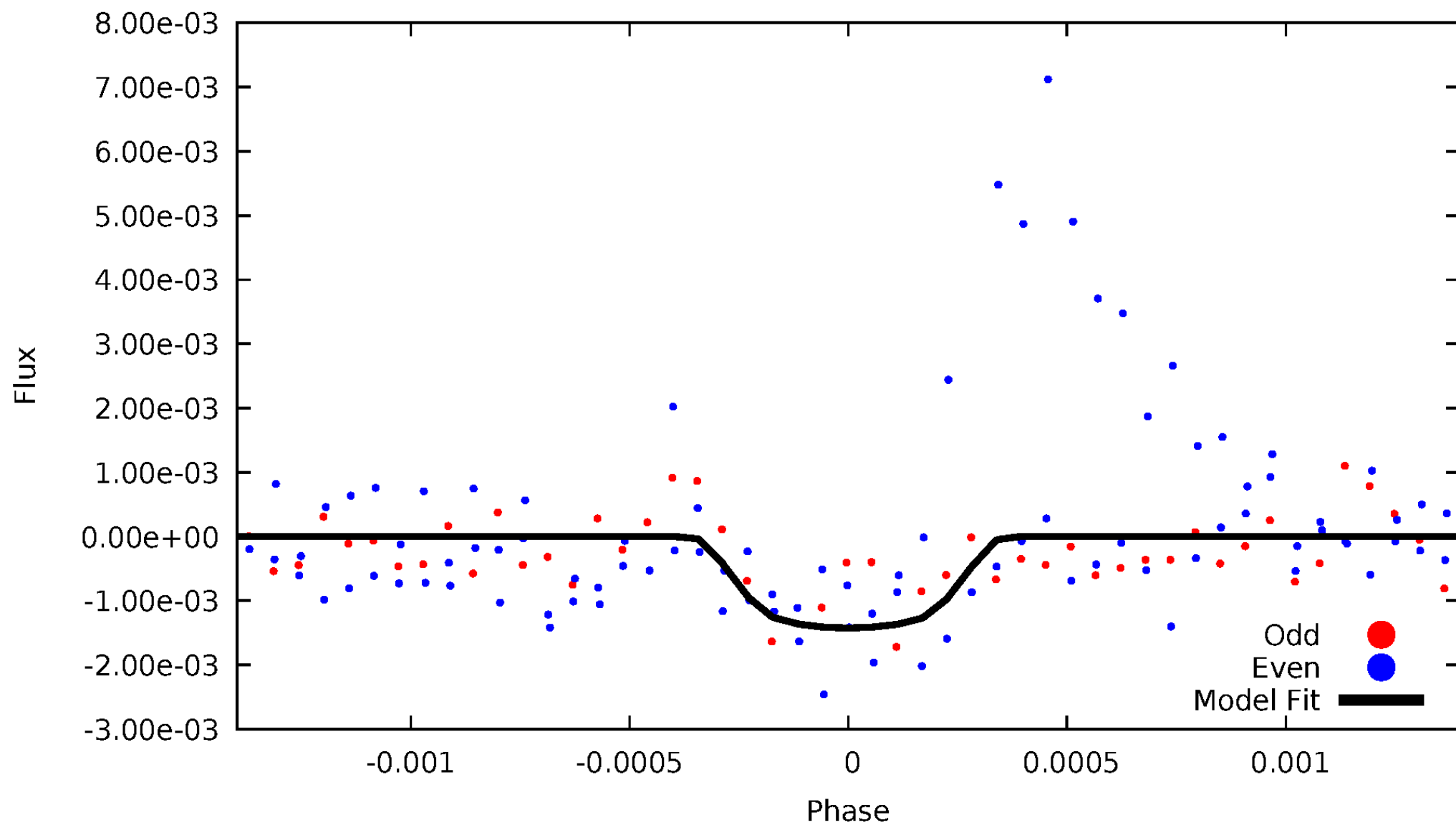
TCE 009880382-02





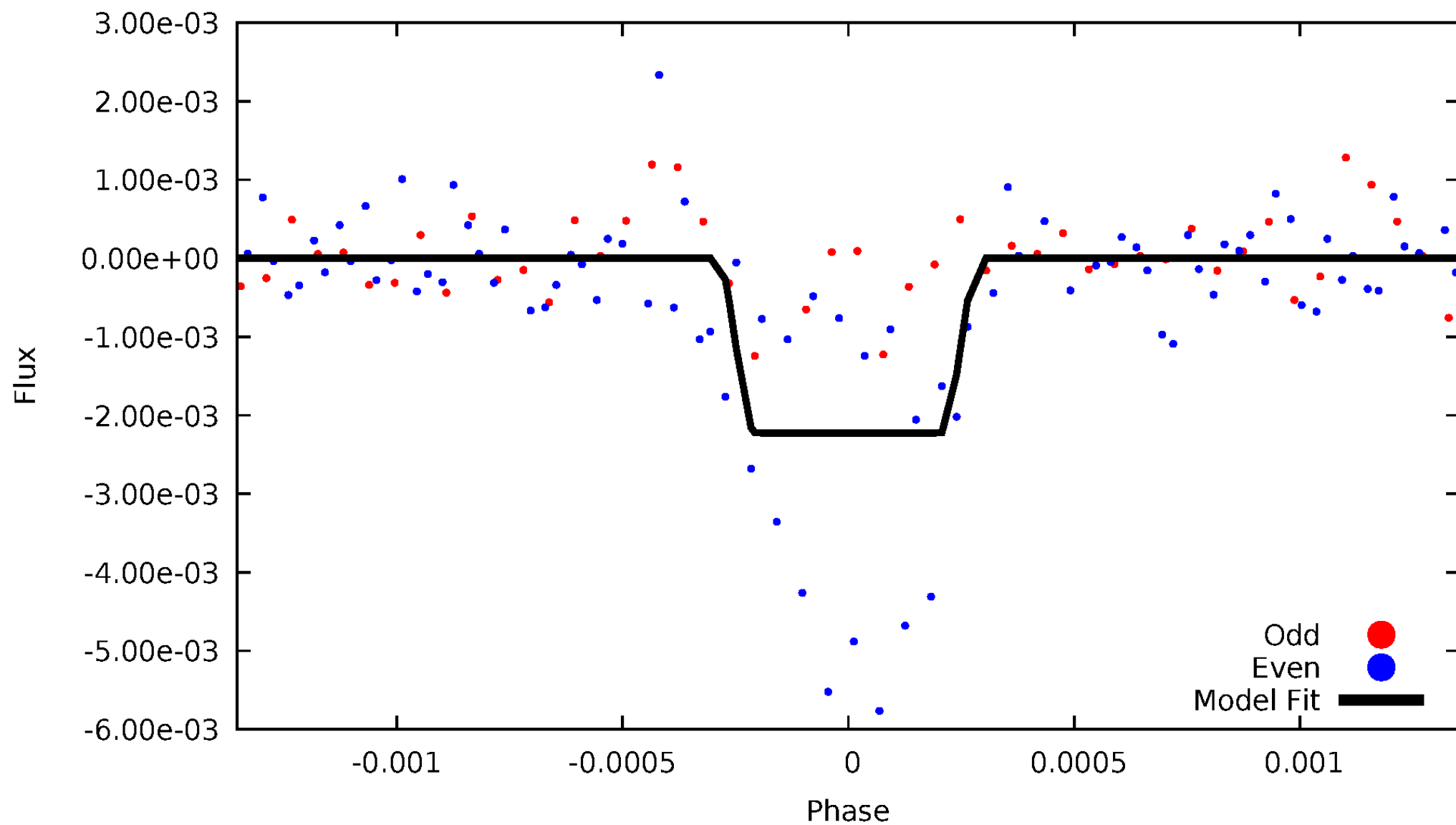
# DV Odd/Even

TCE 009880382-02



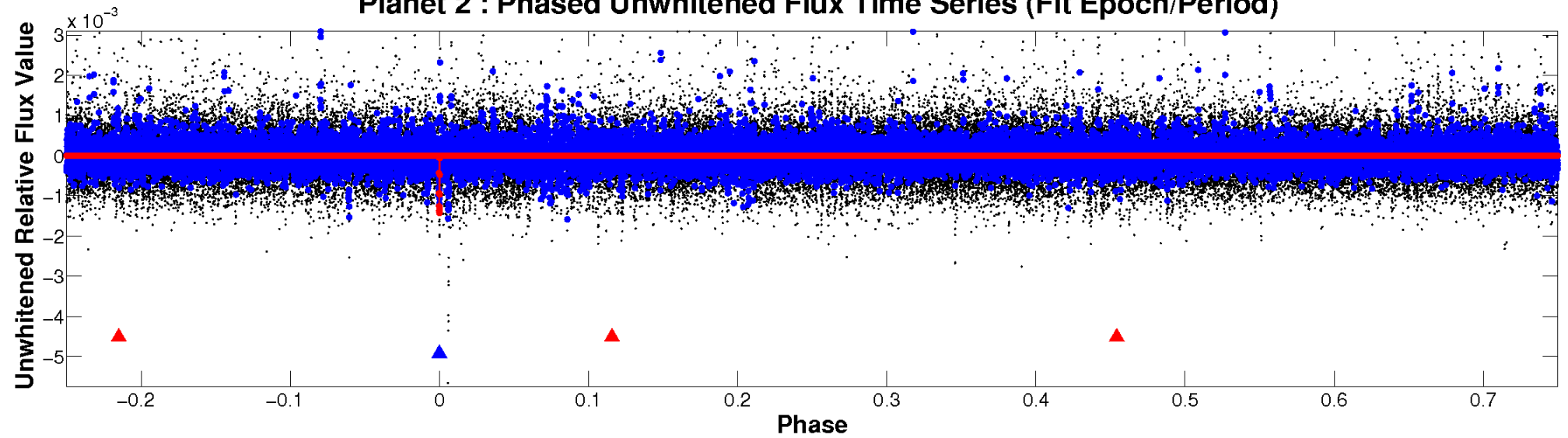
# ALT Odd/Even

TCE 009880382-02

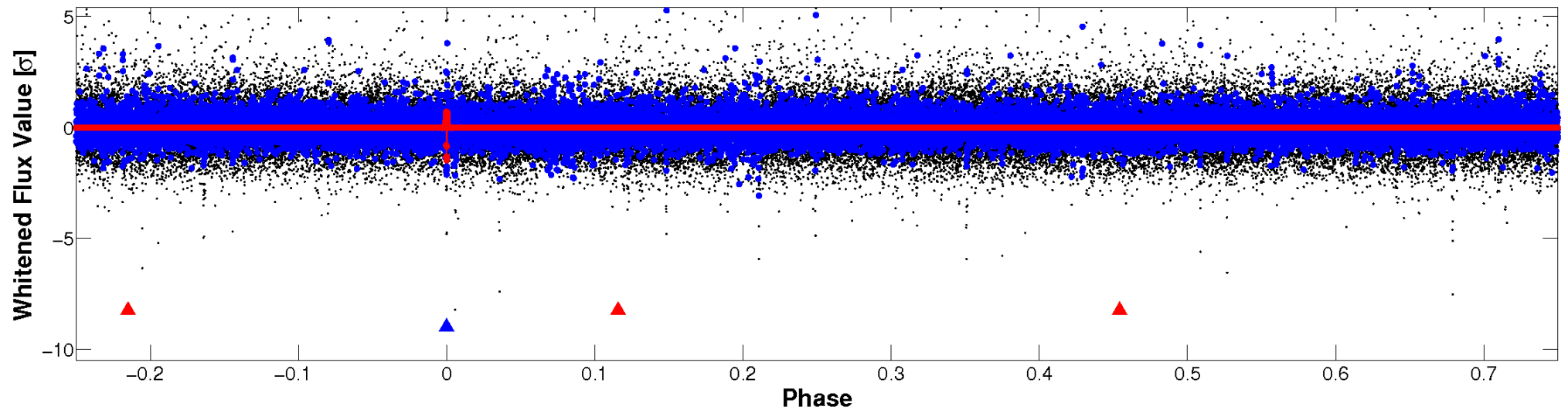


# Non-Whitened Vs. Whitened Light Curve

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

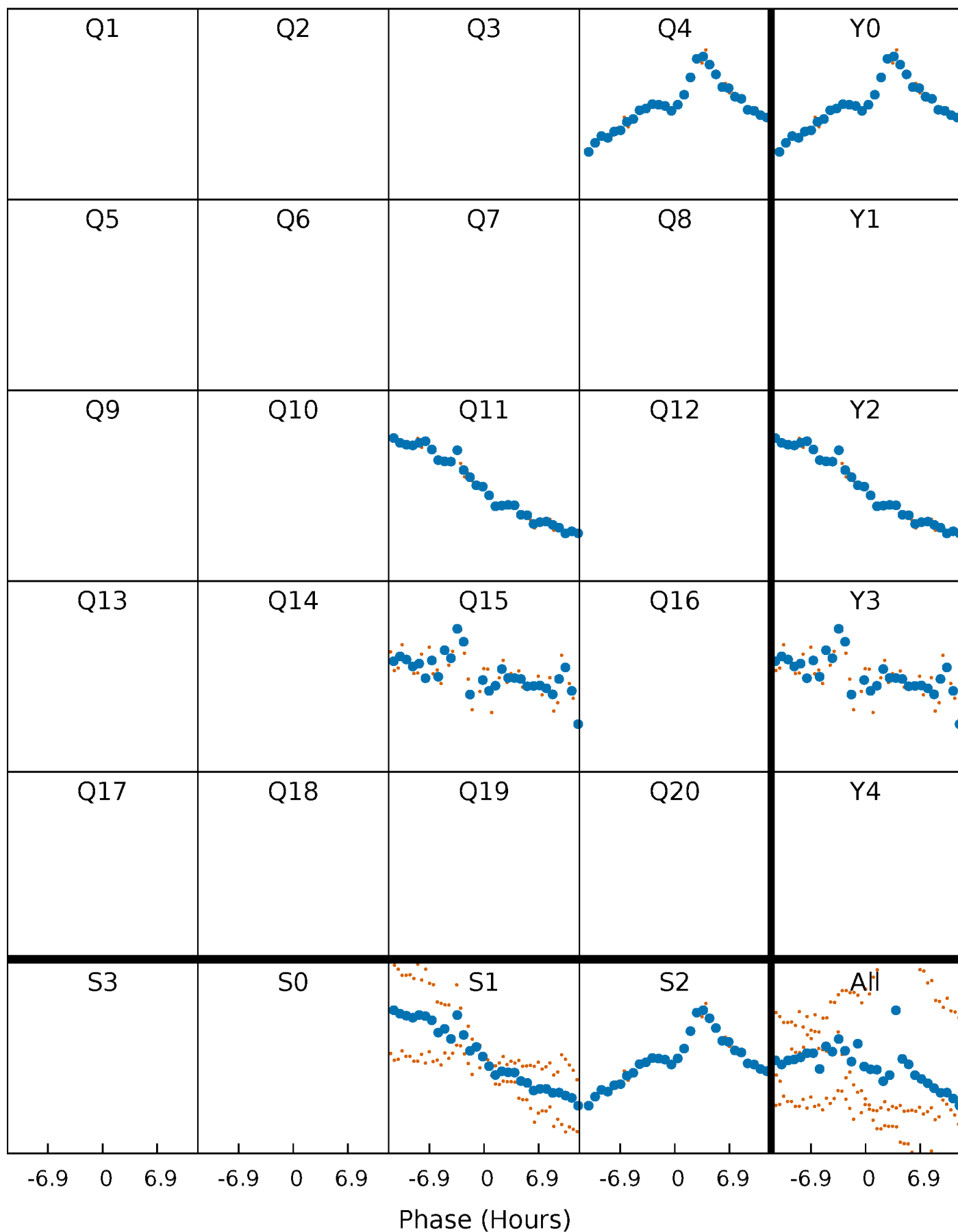


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



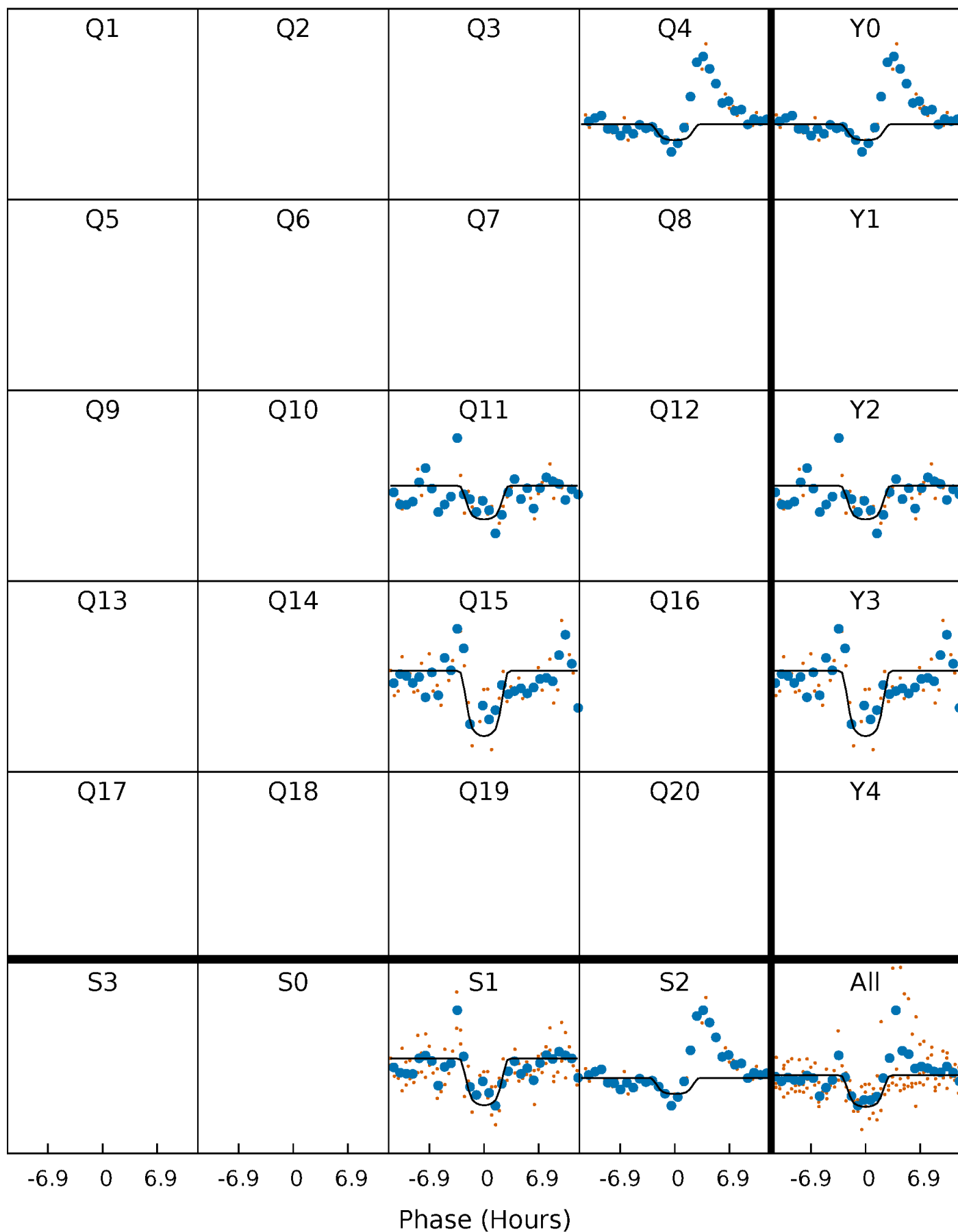
# PDC Quarter-Phased Transit Curves

TCE 009880382-02     $P=358.917094$  Days     $T_0=373.790403$  (BKJD)



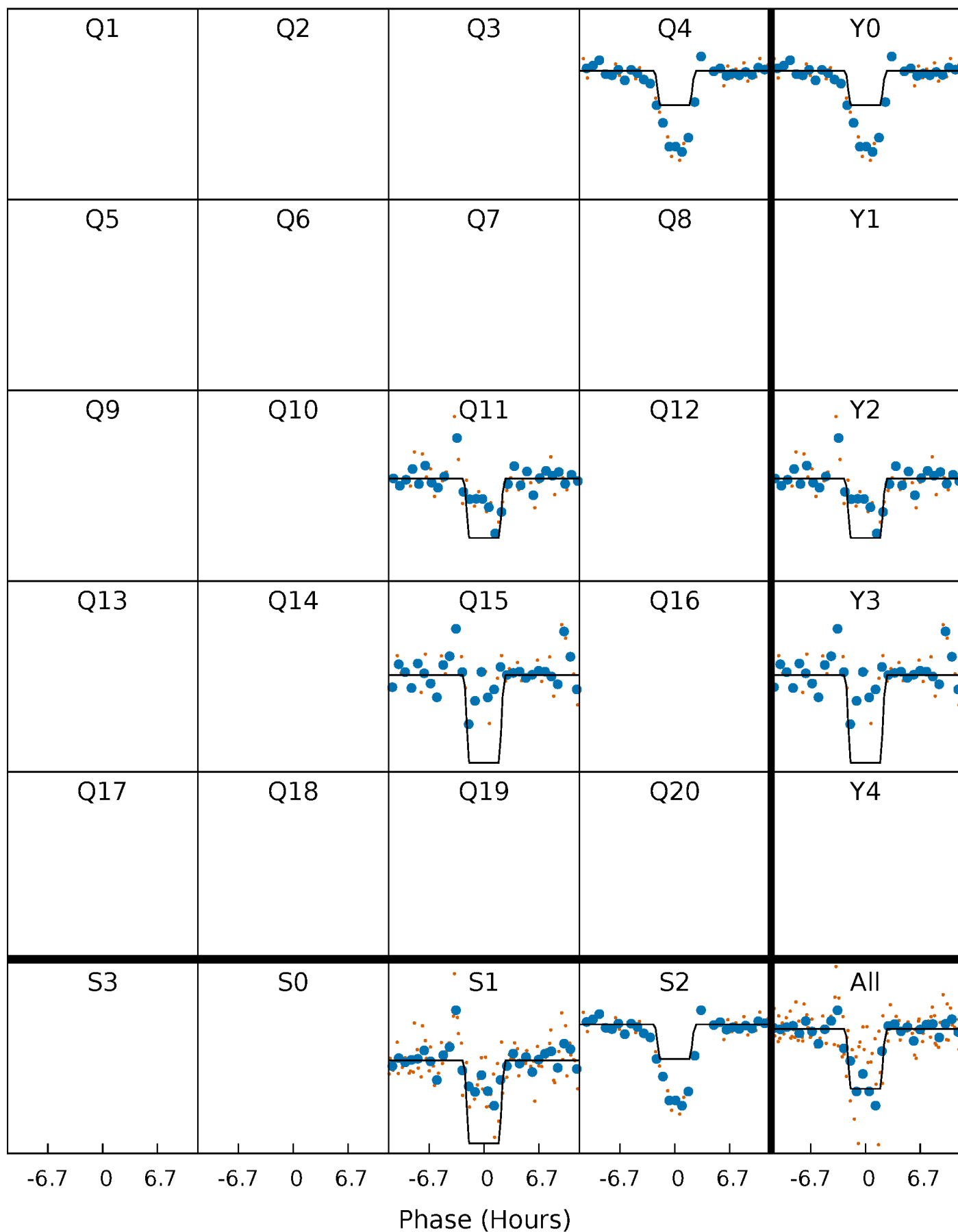
# DV Quarter-Phased Transit Curves

TCE 009880382-02     $P=358.917094$  Days     $T_0=373.790403$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

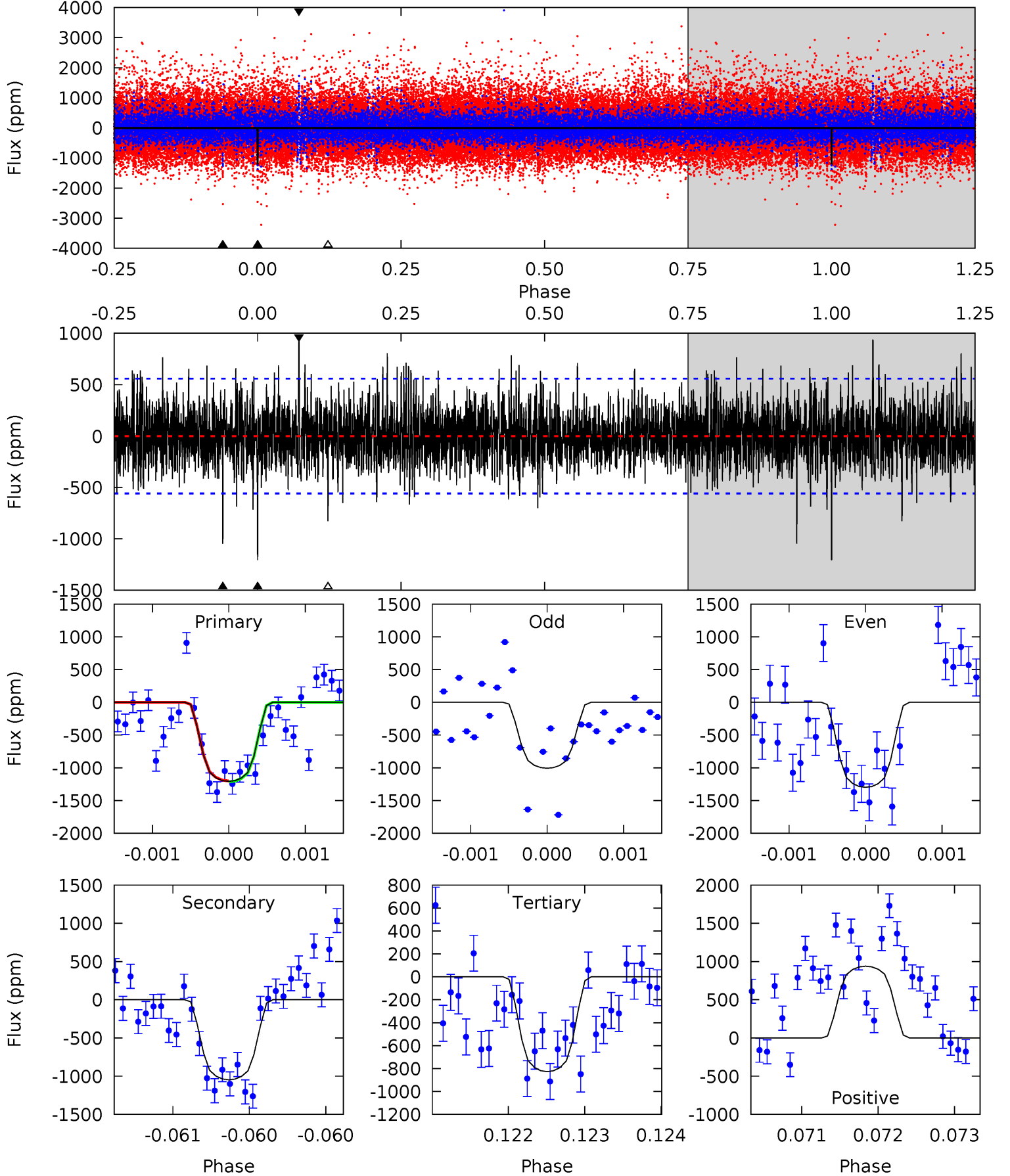
TCE 009880382-02     $P=358.922293$  Days     $T_0=373.786531$  (BKJD)



# DV Model-Shift Uniqueness Test

009880382-02,  $P = 358.917094$  Days,  $E = 14.873309$  Days

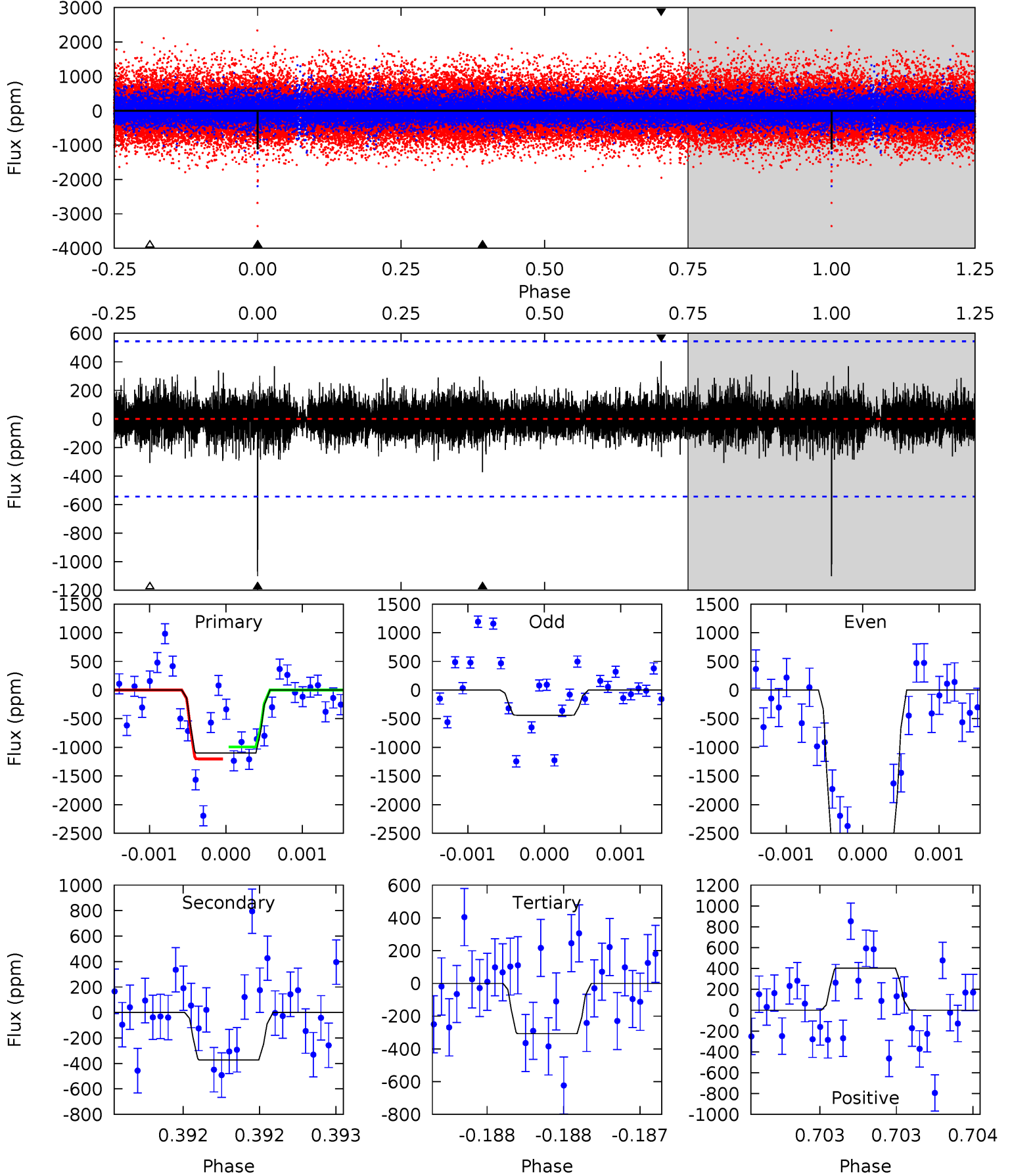
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
11.9	10.3	8.17	9.28	5.52	3.39	1.98	3.76	2.65	2.17	1.07	1.36	1.00	0.44	0.06



# Alt Model-Shift Uniqueness Test

009880382-02, P = 358.922293 Days, E = 14.864238 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
11.3	3.81	3.14	4.13	5.56	3.47	0.78	8.12	7.12	0.67	-0.32	12.4	1.80	0.27	1.07





### Stellar Parameters For KIC 009880382

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$4972^{+164}_{-149}$	$4.619^{+0.061}_{-0.039}$	$-0.660^{+0.350}_{-0.300}$	$0.645^{+0.058}_{-0.058}$	$0.630^{+0.074}_{-0.032}$	$3.311^{+0.933}_{-0.505}$
	+3%/-3%	+1%/-1%	+53%/-45%	+9%/-9%	+12%/-5%	+28%/-15%
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 009880382-02 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	$-1047 \pm 101$	$3.00^{+0.47}_{-0.45}$	$267^{+10}_{-10}$	$4458^{+318}_{-283}$	$46682^{+17347}_{-12845}$
Alt.	$-372 \pm 98$	$3.28^{+0.52}_{-0.42}$	$266^{+10}_{-10}$	$3584^{+218}_{-241}$	$13810^{+5251}_{-4820}$

$T_{\text{max}}$  = 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

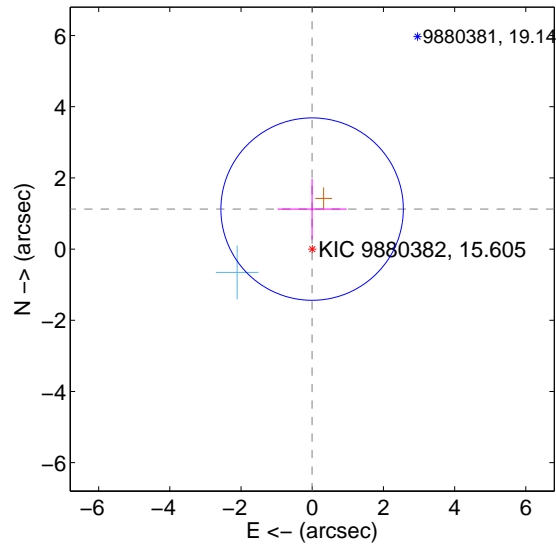
Supplemental centroid analysis for 009880382-02. Kepler magnitude: 15.61. Transit SNR 6.76

There are 1 quarters with good PRF difference image offsets

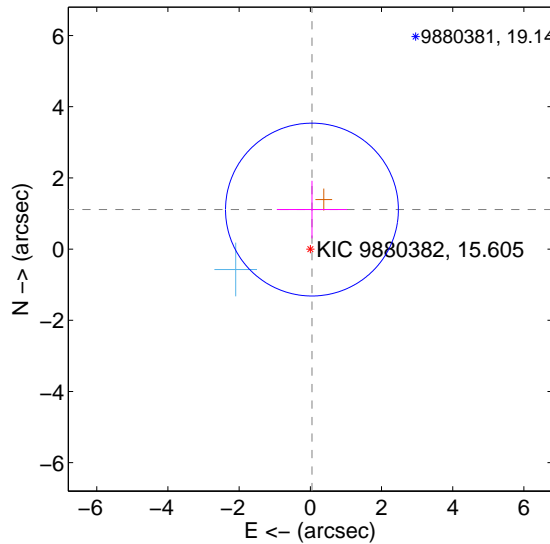
The direct PRF centroid is offset from the target star catalog position by about 0.08 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.124 \pm 0.854$	1.32	$0.004 \pm 0.969$	$1.124 \pm 0.854$
PRF-fit source offset from KIC position	$1.111 \pm 0.809$	1.37	$-0.046 \pm 0.986$	$1.110 \pm 0.809$
photometric centroid source offset	$1.34 \pm 1.44$	0.93	$1.32 \pm 1.45$	$-0.23 \pm 1.25$

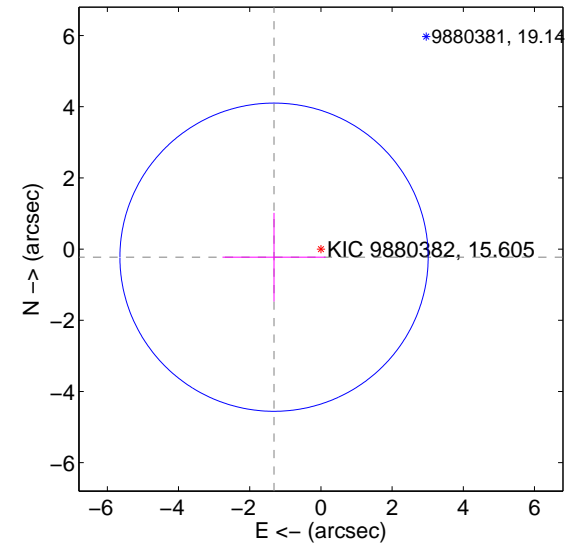
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

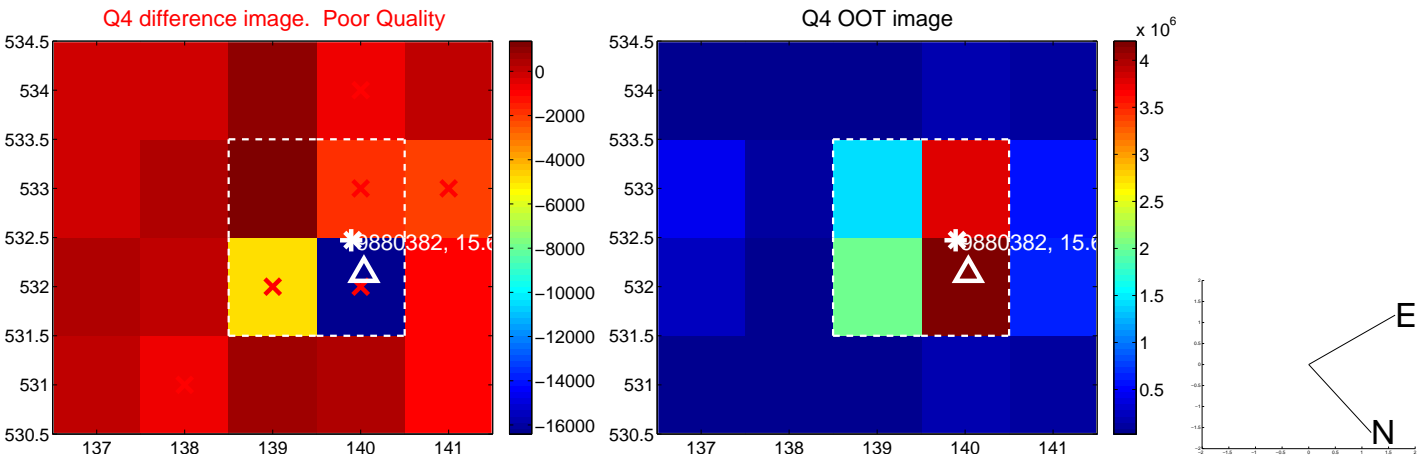


offset from photometric centroids



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

Q9 no difference image



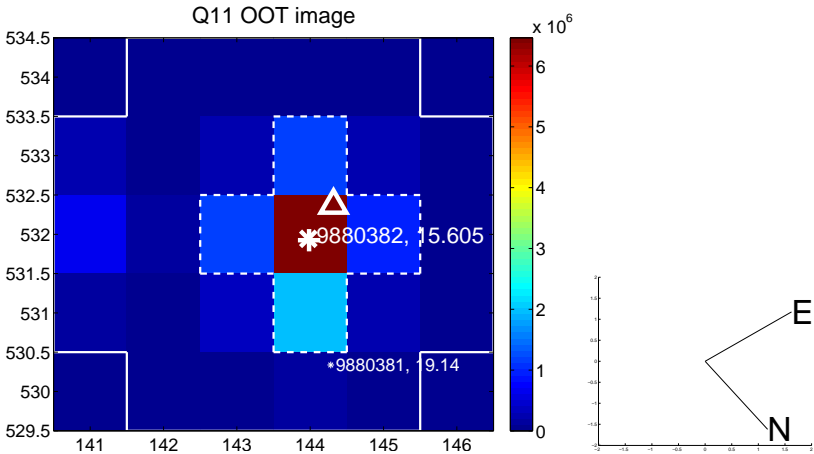
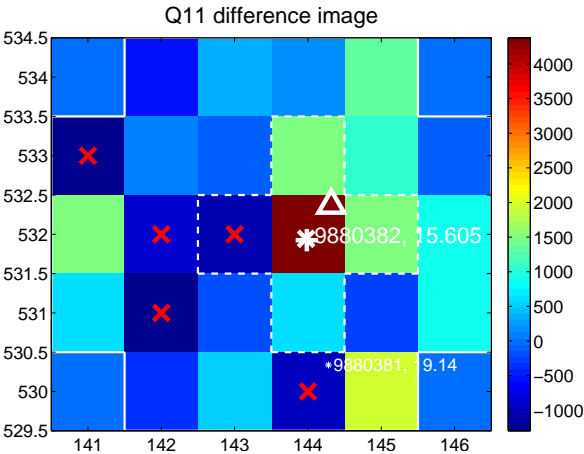
Q9 no OOT image



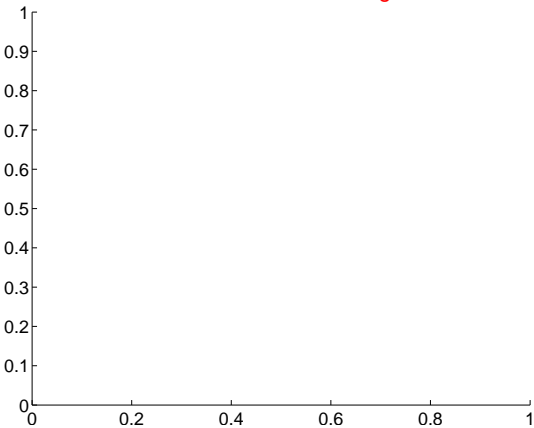
Q10 no difference image



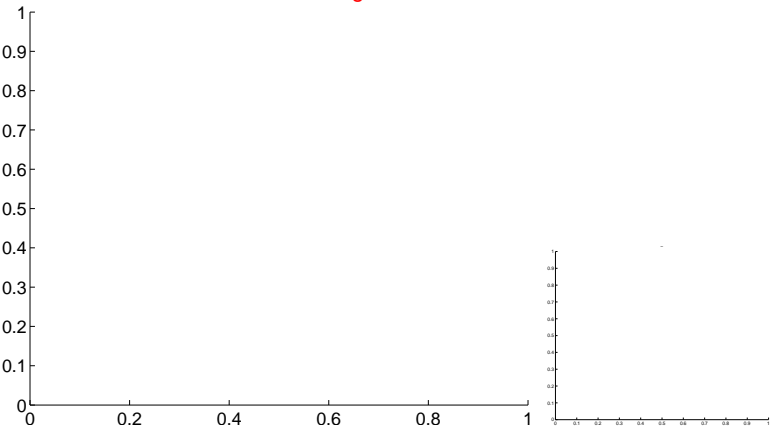
Q10 no OOT image



Q12 no difference image



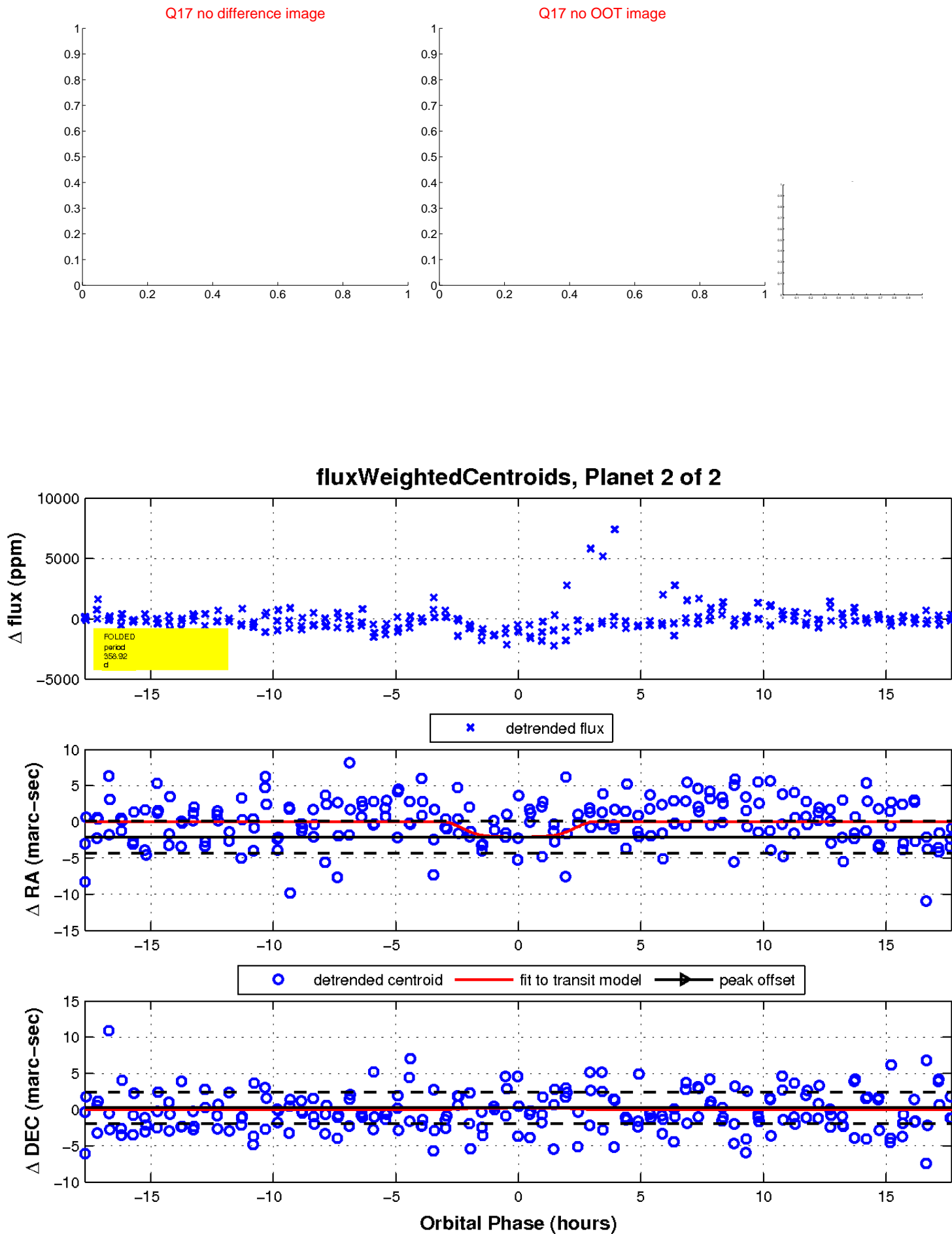
Q12 no OOT image



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

