

# KIC 009366989

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009366989-01	OBS	1785.01	1.219020	132.104735	633.1	2.491	580.4	46.9	1.19	5833	4.90	2745.57
009366989-02	OBS	No	0.609682	132.071817	49.7	3.091	9.2	7.6	1.19	5833	0.87	6915.79
009366989-04	OBS	No	85.251562	185.063412	856.5	5.956	7.5	6.7	1.19	5833	4.98	9.53

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009366989-01	OBS	FP	0.00	0	1	1	1	MOD_SEC_ALT—MOD_ODDEVEN_DV—SEASONAL_DEPTH_ALT—CENT_RESOLVED_OFFSET—EPHEM_MATCH
009366989-02	OBS	FP	0.00	1	0	1	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—CENT_RESOLVED_OFFSET—HALO_GHOST
009366989-04	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_RESOLVED_OFFSET—HALO_GHOST

**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 009366989-01

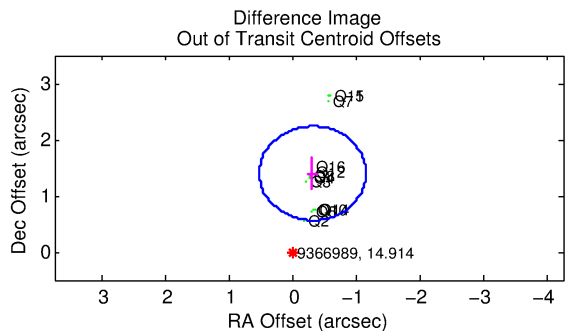
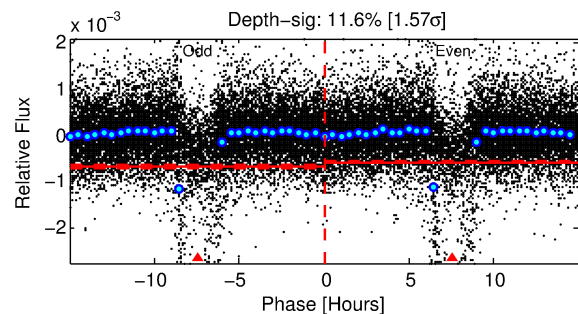
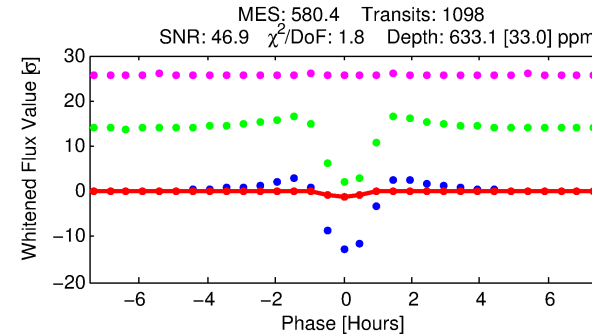
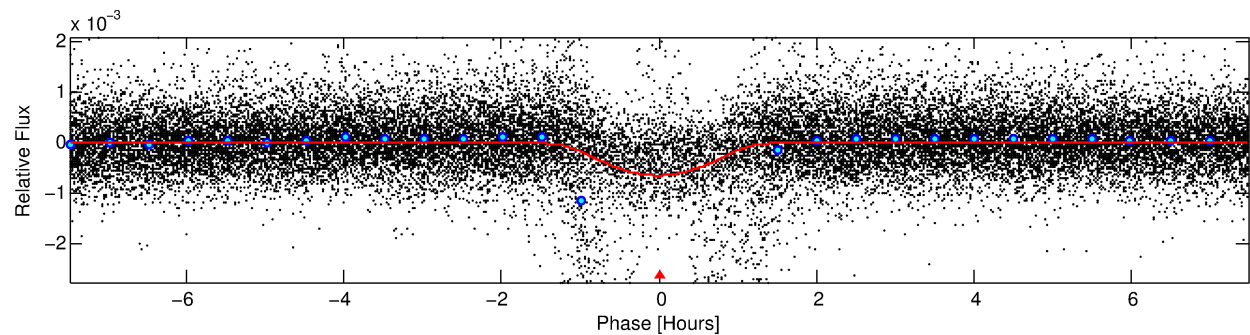
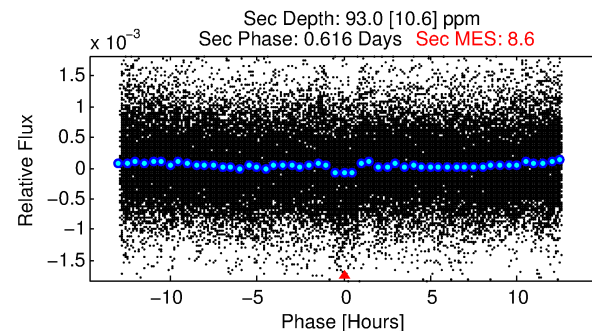
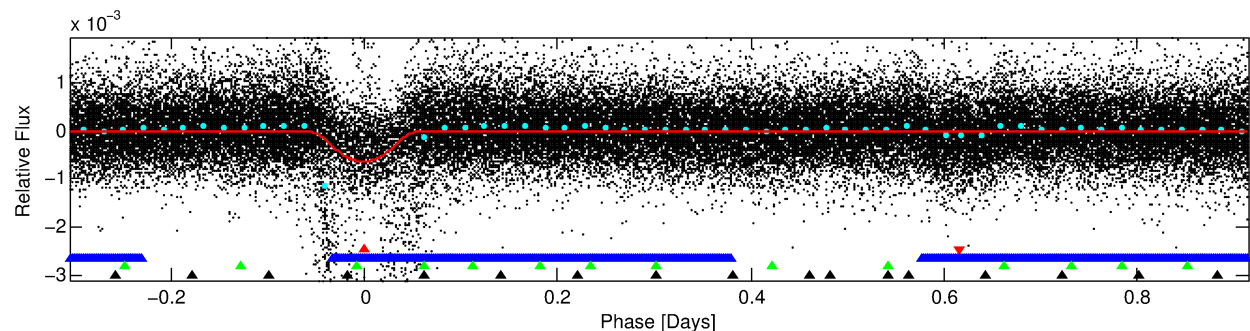
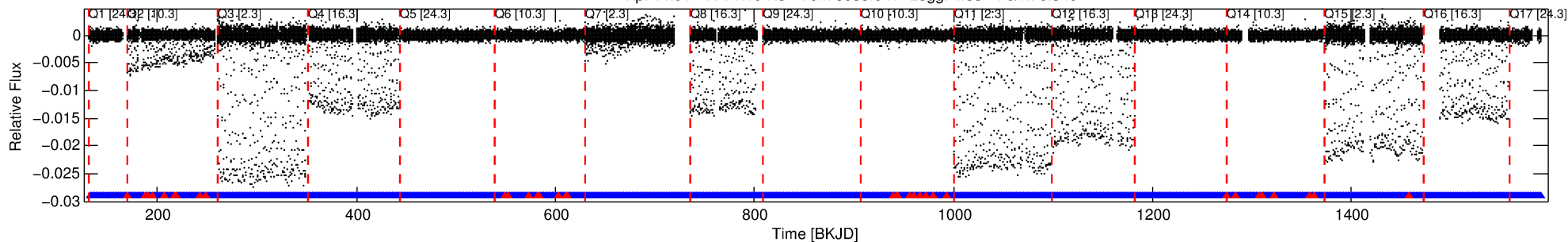
TCE (1)	KIC	Parent (2)	Parent KIC	$P_1:P_2$	Dist ( $''$ )	$\Delta$ Row	$\Delta$ Col	$m_2$	$m_1$	$D_2/D_1$	Mechanism	Flag	$\sigma_P$	$\sigma_T$
009366989-01	9366989	3597.01	9366988	1:1	7.9	1	2	14.37	14.91	155.09	Direct-PRF	0	1.00	0.29

**Notes:**  $P_1:P_2$  is the period ratio. Dist is the distance in arcseconds.  $\Delta$ Row and  $\Delta$ Col are the number of pixels apart in row and column.  $m_2$  and  $m_1$  are the magnitudes of the parent and child.  $D_2/D_1$  is the parent's transit depth divided by the child's.  $\sigma_P$  and  $\sigma_T$  are the significance of the match in period and epoch. For a match to be considered significant  $\sigma_P < 5.0$  and  $\sigma_T < 5.0$ . Matches which have  $\sigma_P$  and  $\sigma_T$  very close to this cutoff should receive extra scrutiny, especially if the period ratio is very large.

# DV One-Page Summary

KIC: 9366989 Candidate: 1 of 4 Period: 1.219 d  
KOI: K01785.01 Corr: 0.923

Kp: 14.91 R\*: 1.19 Rs Teff: 5833.0 K Logg: 4.33 Fe/H: 0.340



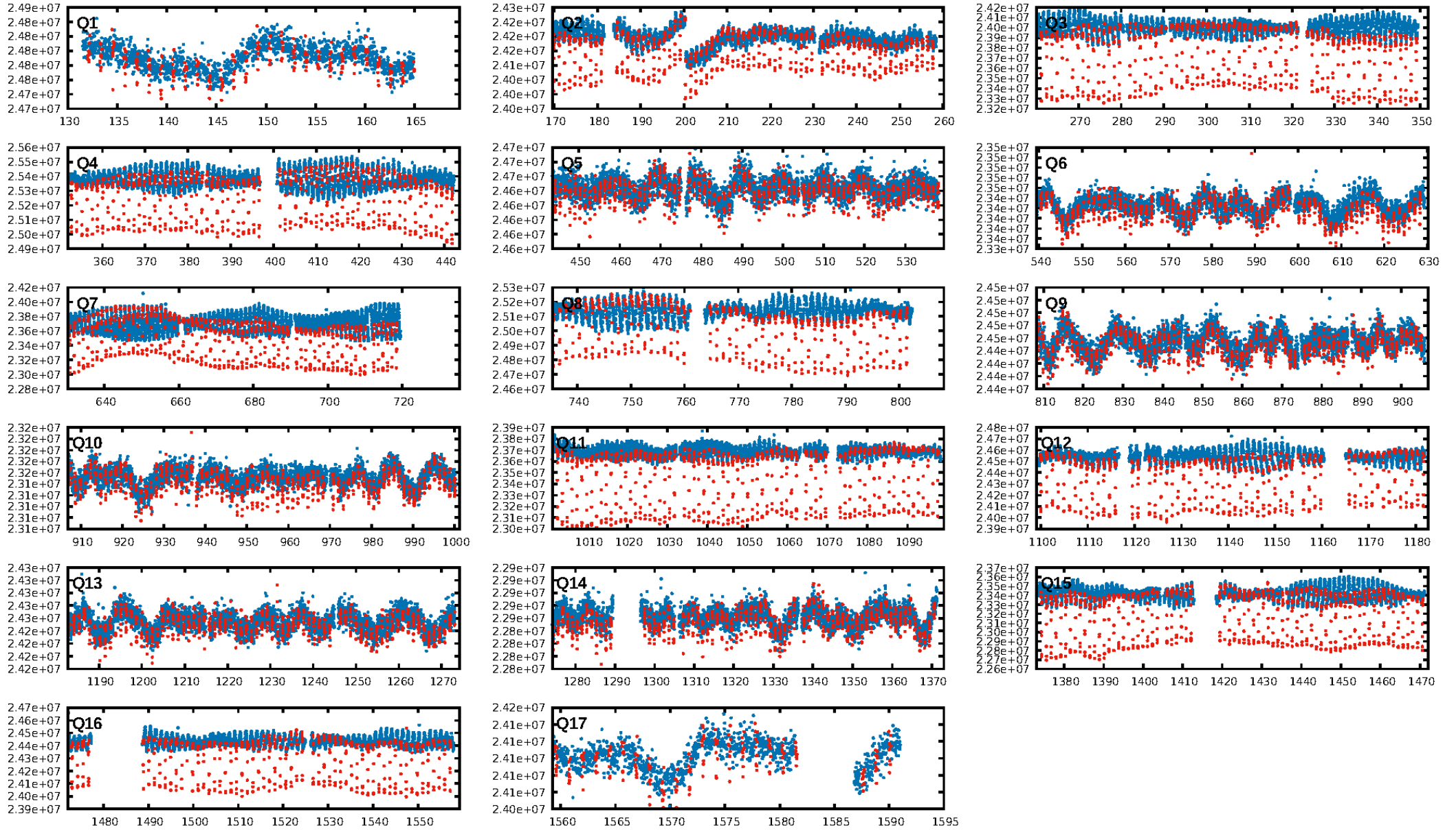
## DV Fit Results:

Period = 1.21902 [0.00000] d  
Epoch = 132.1047 [0.0008] BKJD  
Rp/R\* = 0.0377 [0.0191]  
a/R\* = 1.57 [0.16]  
b = 0.99 [0.03]  
Seff = 2745.57 [1072.04]  
Teq = 1846 [180] K  
Rp = 4.90 [2.86] Re  
a = 0.0232 [0.0058] AU  
Ag = 1.14 [1.24] [0.12σ]  
Teffp = 2951 [758] K [1.42σ]

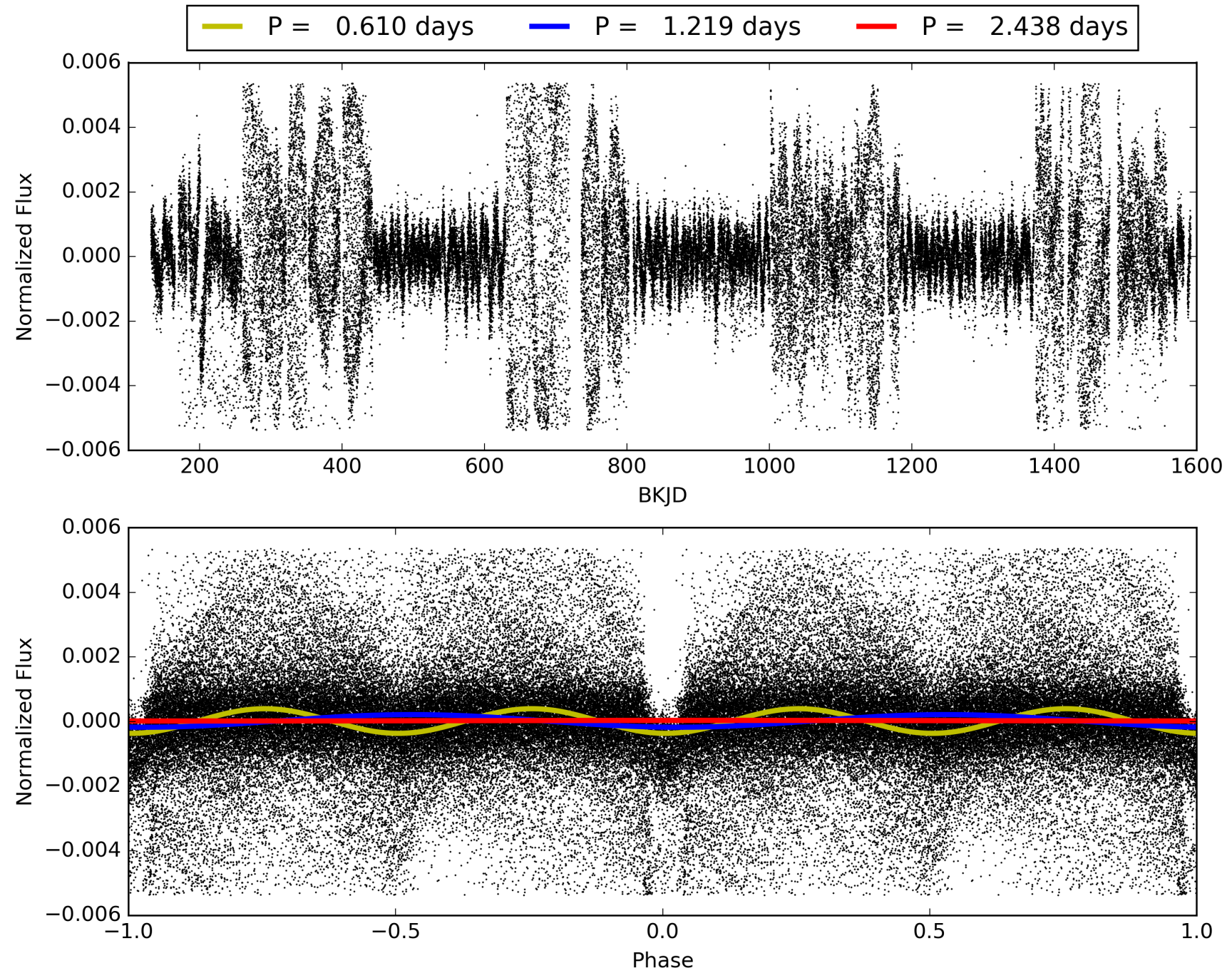
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [3.68σ]  
LongPeriod-sig: 100.0% [312.38σ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: N/A  
RollingBand-fgt: 0.97 [1014/1048]  
GhostDiagnostic-chr: -0.5954  
Centroid-sig: N/A  
Centroid-so: 86.116 arcsec [348.70σ]  
OotOffset-rm: 1.433 arcsec [5.13σ]  
KicOffset-rm: 7.866 arcsec [112.83σ]  
OotOffset-st: 4/4/4/0 [12]  
KicOffset-st: 4/4/4/0 [12]  
DiffImageQuality-fgm: 1.00 [12/12]  
DiffImageOverlap-fno: 0.00 [0/17]

# TCE 009366989-01, PDC Light Curves

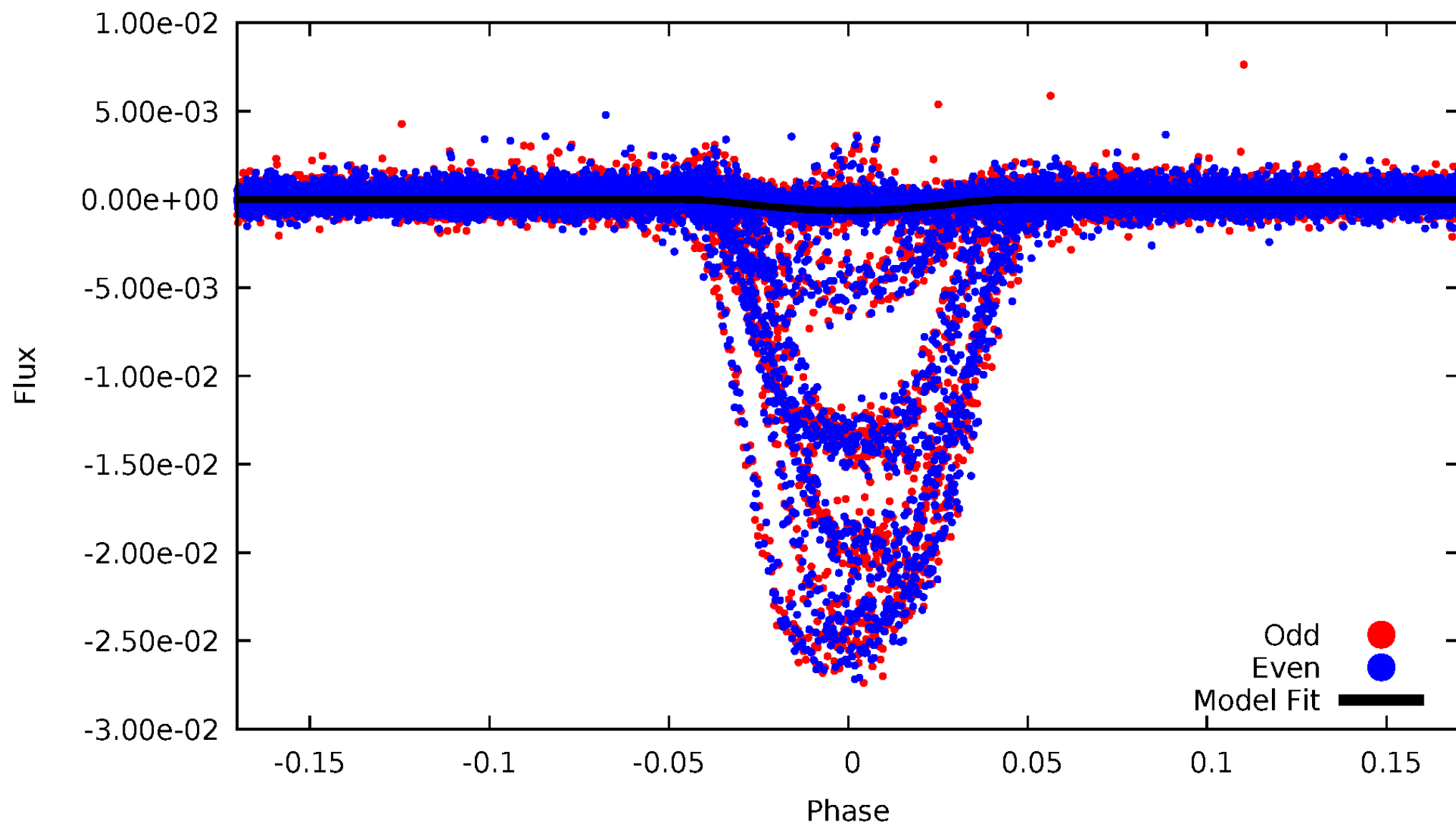


TCE 009366989-01



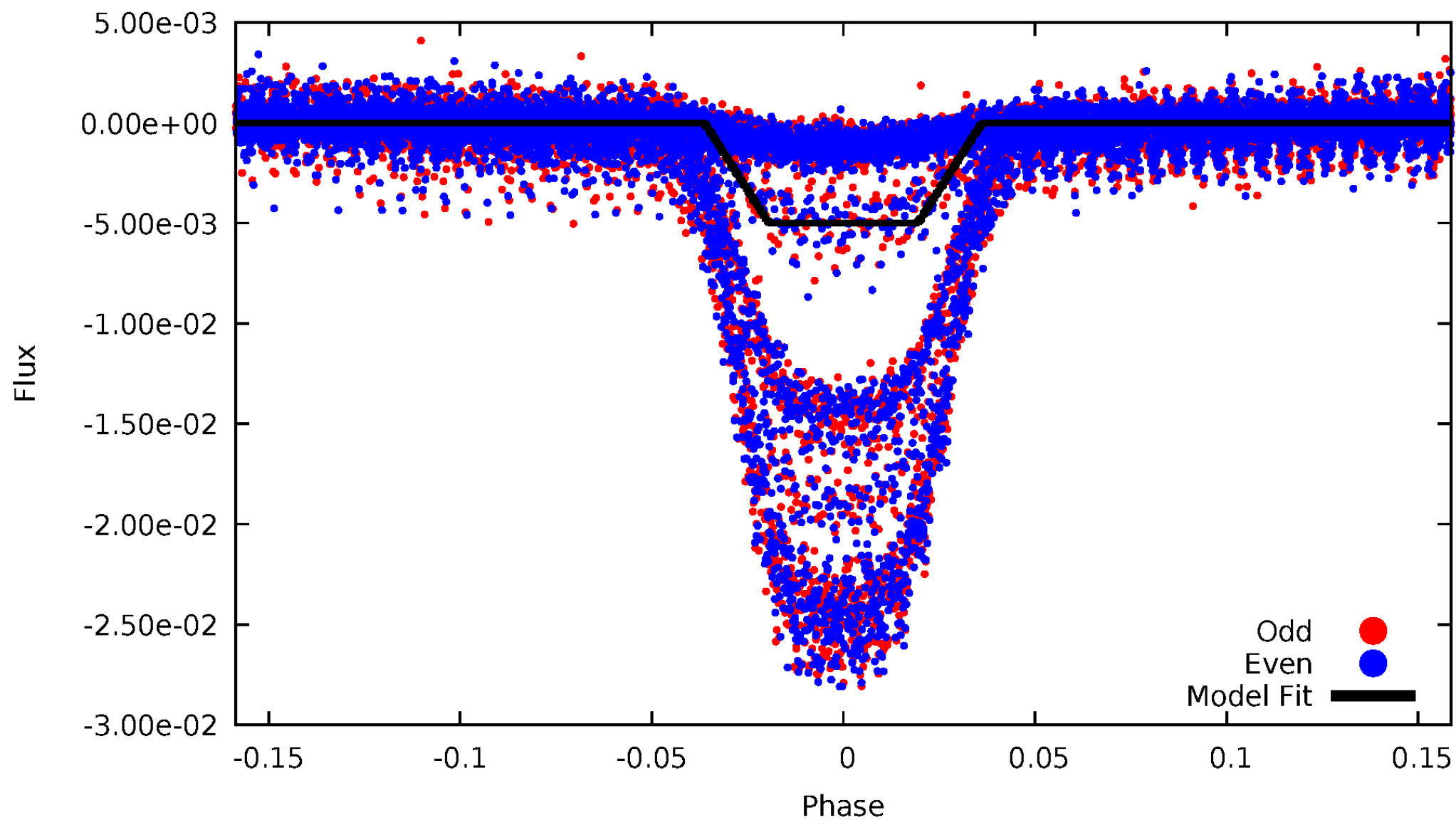
# DV Odd/Even

TCE 009366989-01



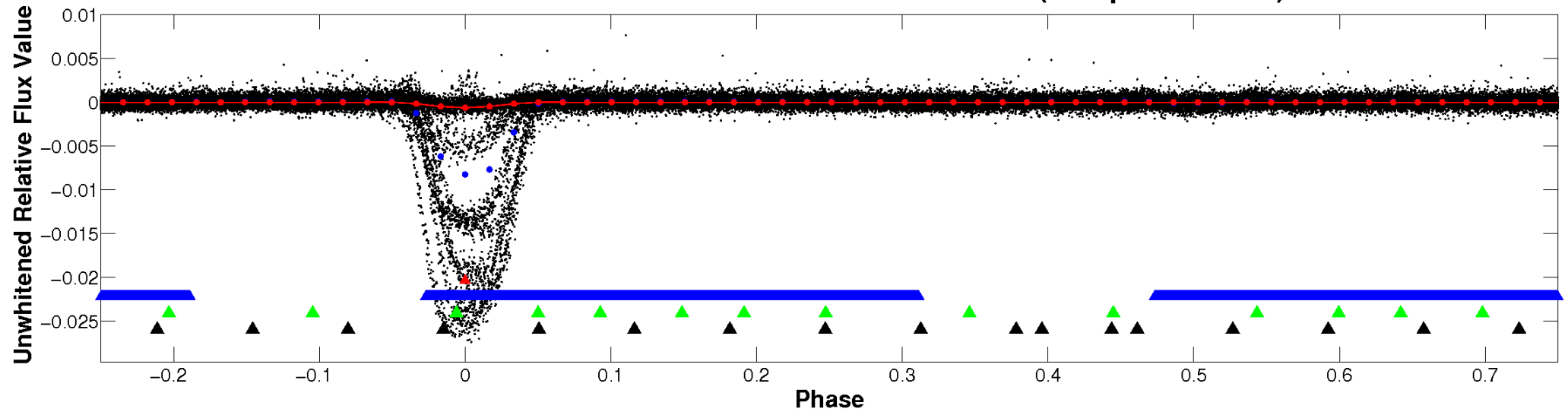
# ALT Odd/Even

TCE 009366989-01

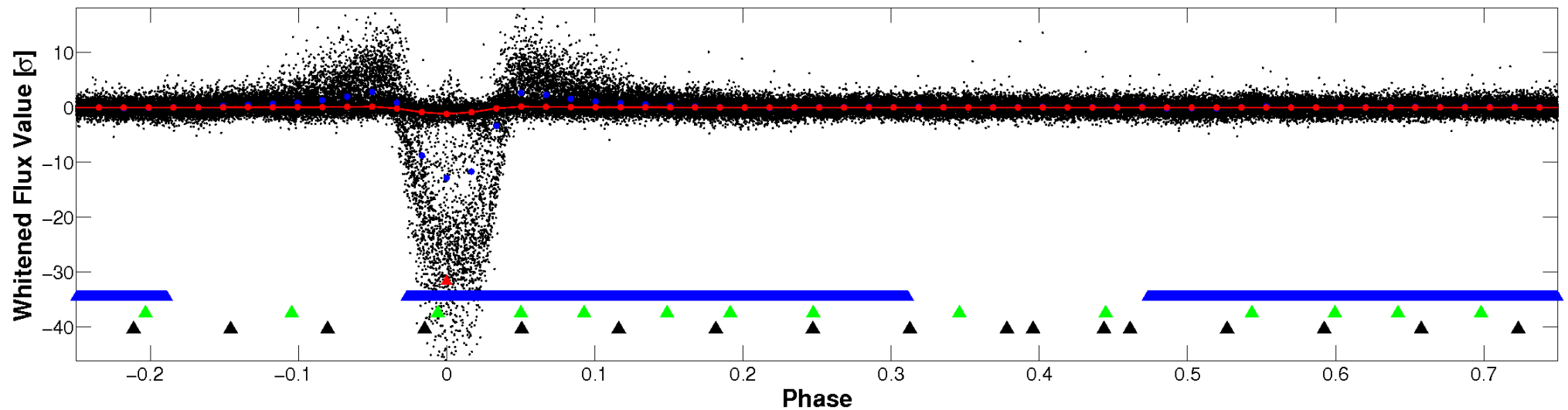


# Non-Whitened Vs. Whitened Light Curve

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

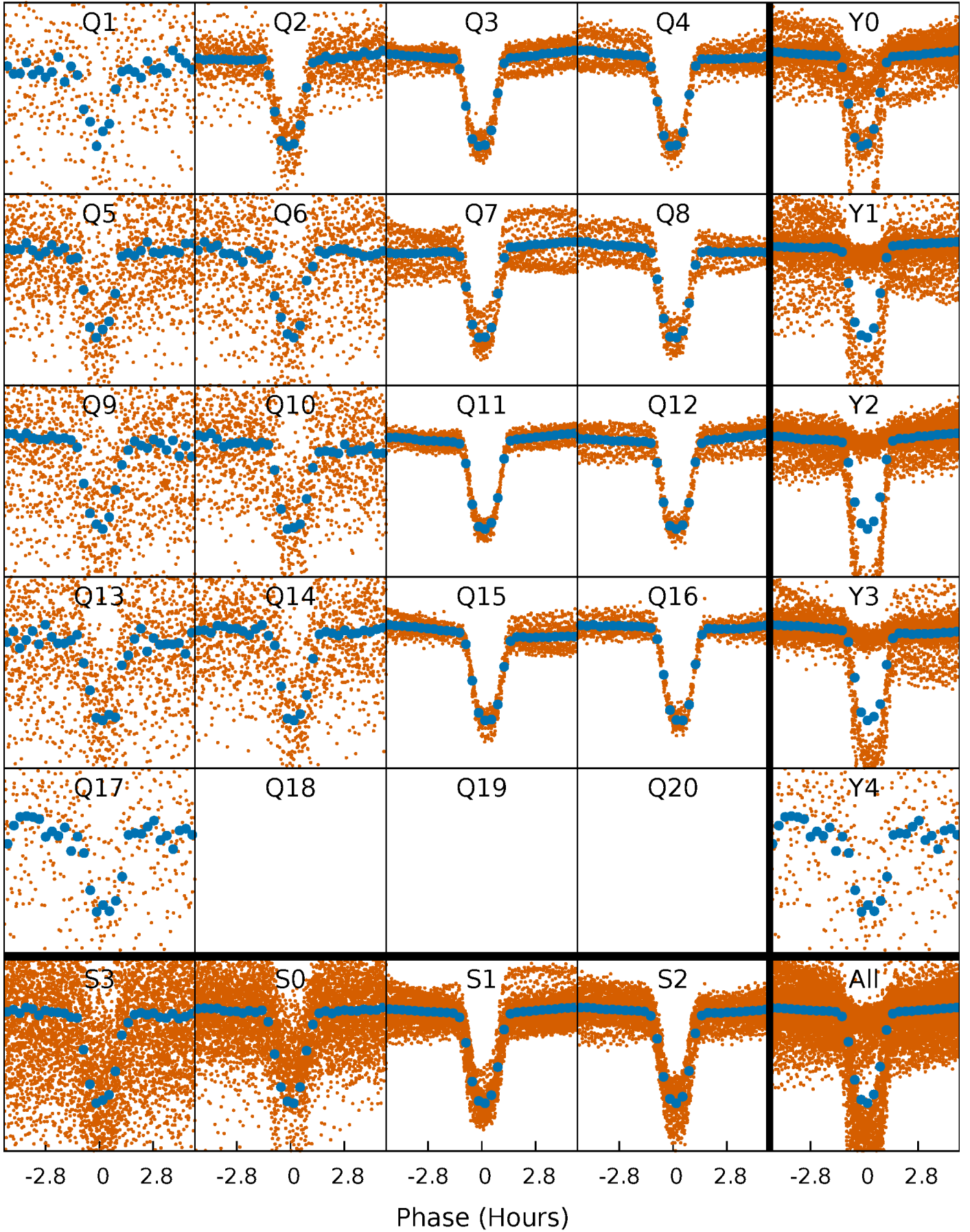


## Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)



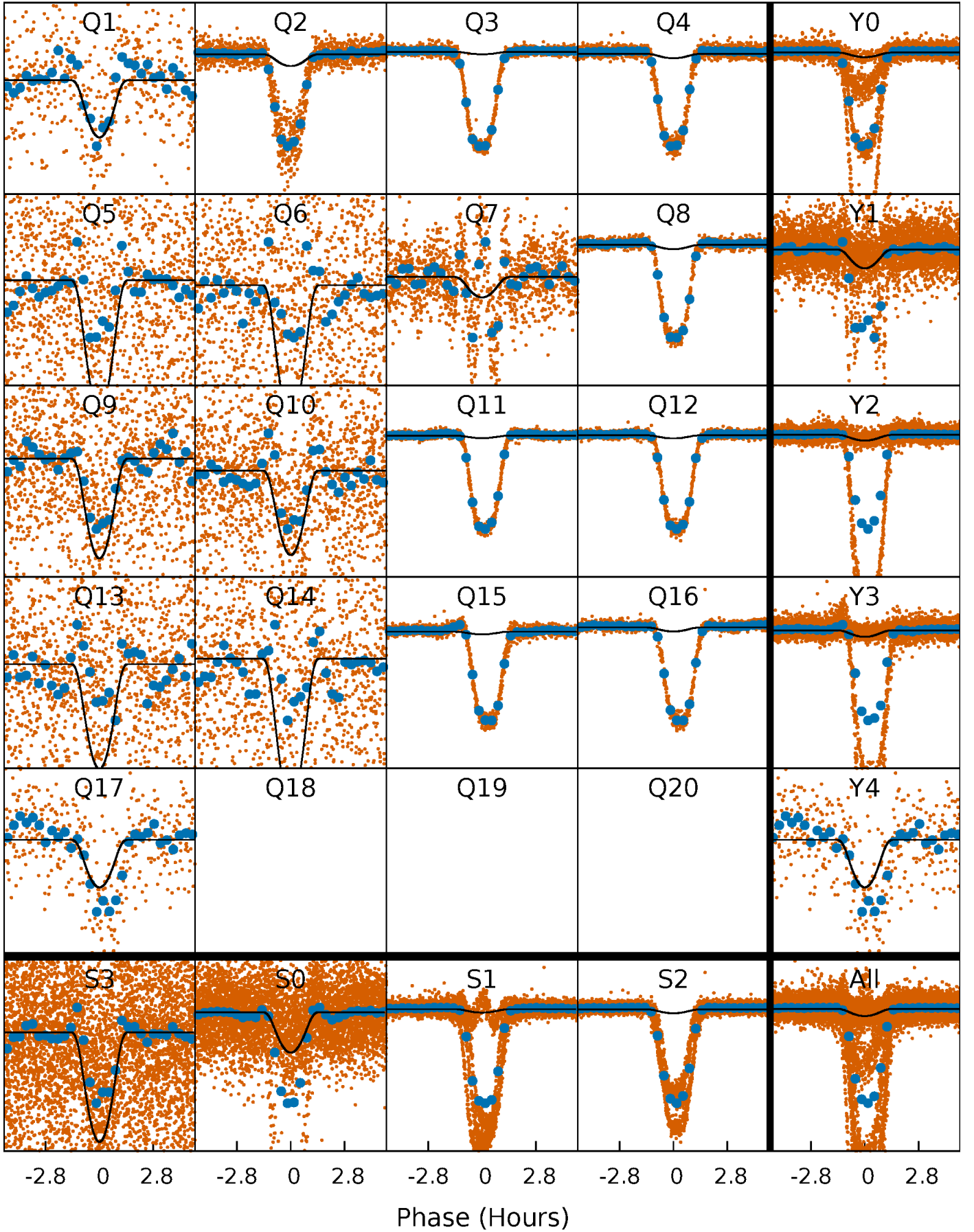
# PDC Quarter-Phased Transit Curves

TCE 009366989-01 P= 1.219020 Days  $T_0=132.104735$  (BKJD)



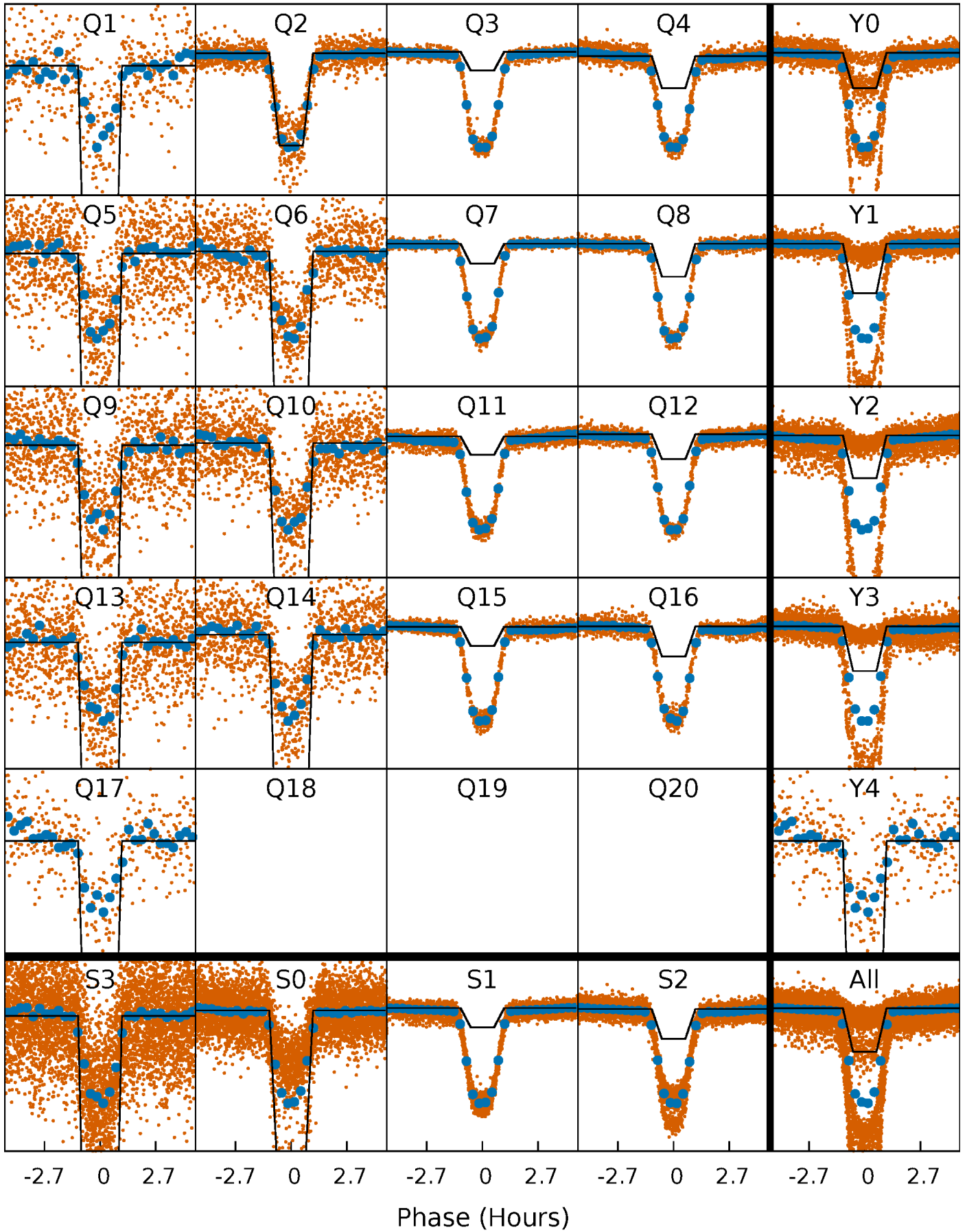
# DV Quarter-Phased Transit Curves

TCE 009366989-01 P= 1.219020 Days  $T_0=132.104735$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

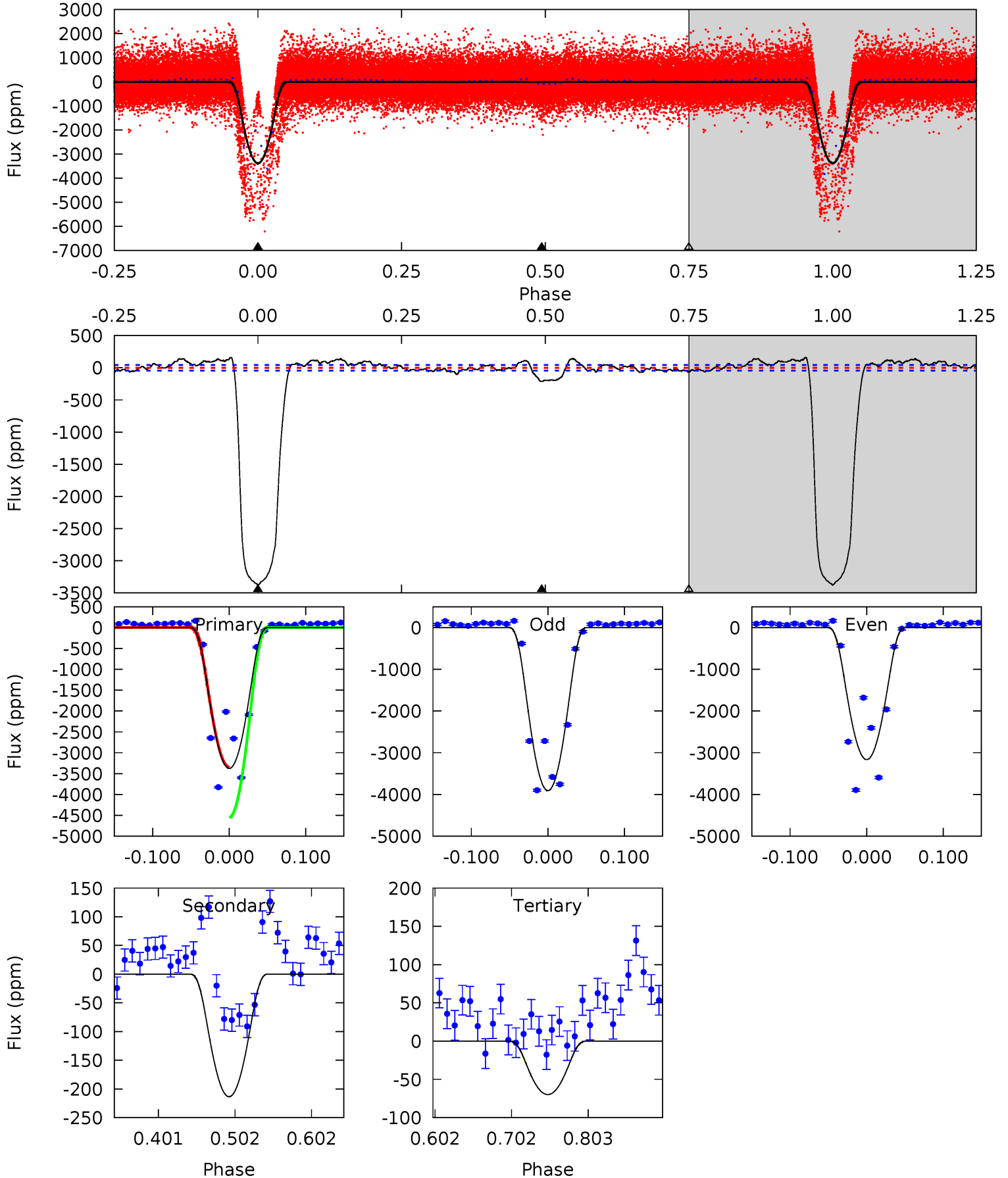
TCE 009366989-01 P= 1.219035 Days  $T_0=132.100148$  (BKJD)



# DV Model-Shift Uniqueness Test

009366989-01, P = 1.219020 Days, E = 130.885715 Days

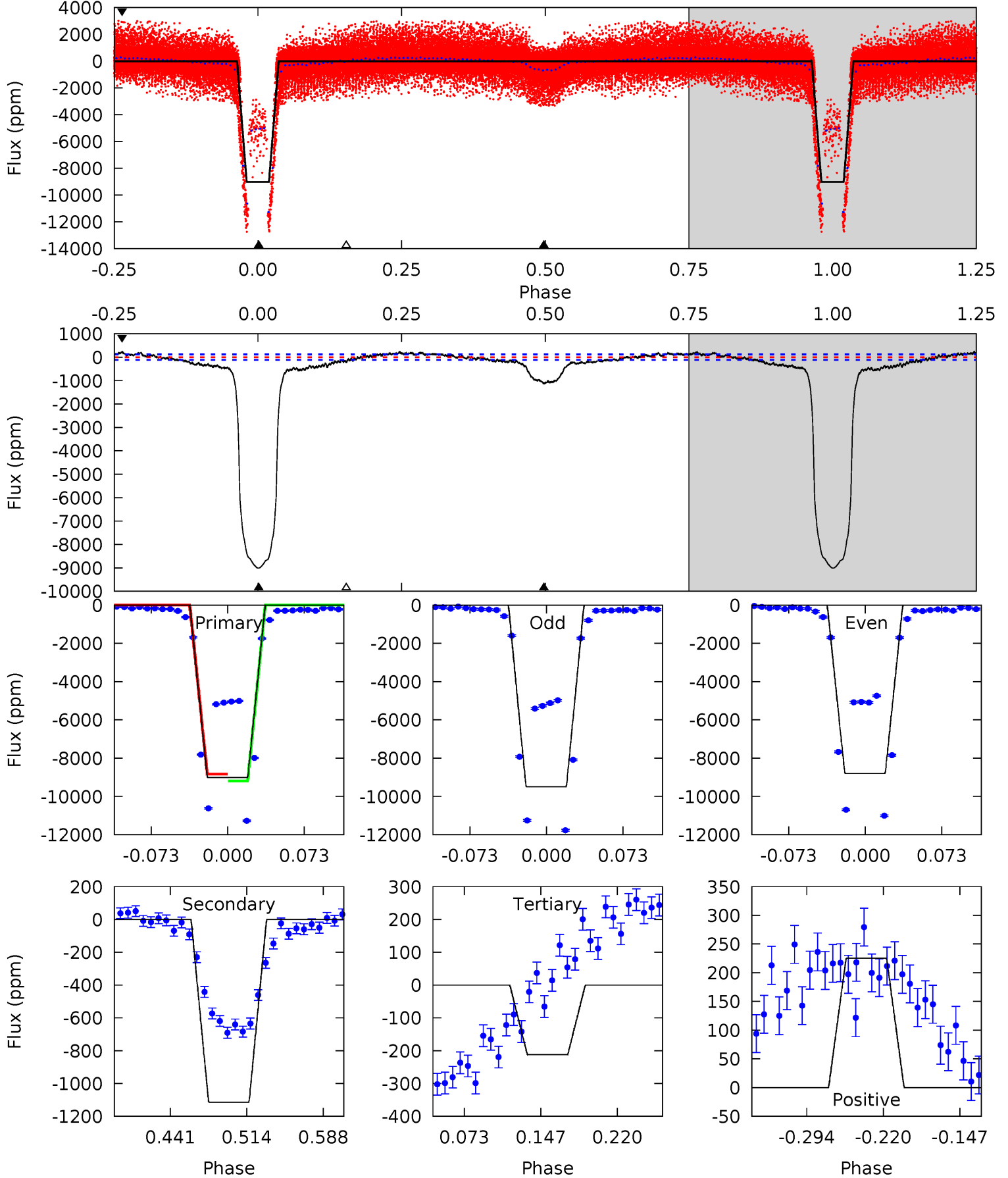
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
351.7	22.2	7.28	0	4.56	1.64	5.69	344.4	351.7	15.0	22.2	38.5	5.51	0.05	0



# Alt Model-Shift Uniqueness Test

009366989-01, P = 1.219035 Days, E = 130.881113 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
356.3	44.0	8.37	8.91	4.63	1.79	6.92	347.9	347.4	35.7	35.1	13.5	1.91	0.02	0



### Stellar Parameters For KIC 009366989

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5833^{+162}_{-203}$	$4.333^{+0.124}_{-0.201}$	$0.340^{+0.100}_{-0.300}$	$1.192^{+0.348}_{-0.188}$	$1.115^{+0.122}_{-0.136}$	$0.927^{+0.562}_{-0.474}$
	+3%/-3%	+3%/-5%	+29%/-88%	+29%/-16%	+11%/-12%	+61%/-51%
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 009366989-01 / KOI 1785.01

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-213 \pm 10$	$5.03^{+2.61}_{-2.30}$	$2595^{+194}_{-166}$	$3849^{+1010}_{-564}$	$2.476^{+5.553}_{-1.409}$
Alt.	$-1114 \pm 25$	$9.47^{+2.88}_{-2.64}$	$2596^{+199}_{-152}$	$4172^{+583}_{-369}$	$3.659^{+3.400}_{-1.499}$

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

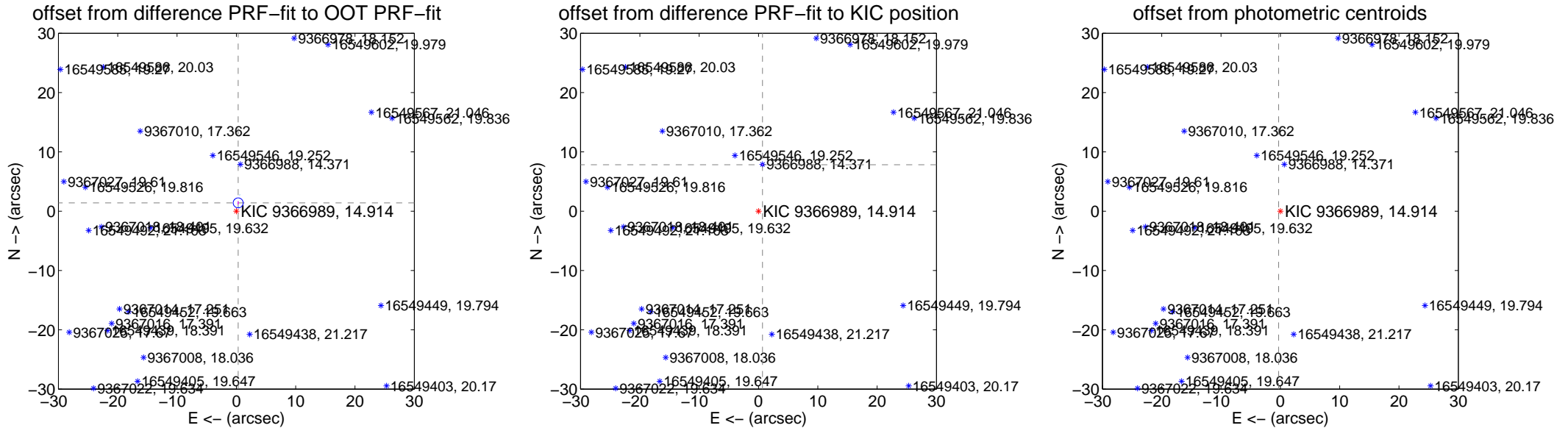
## DV Centroid Data

Supplemental centroid analysis for 009366989-01. Kepler magnitude: 14.91. Transit SNR 46.89

There are 12 quarters with good PRF difference image offsets

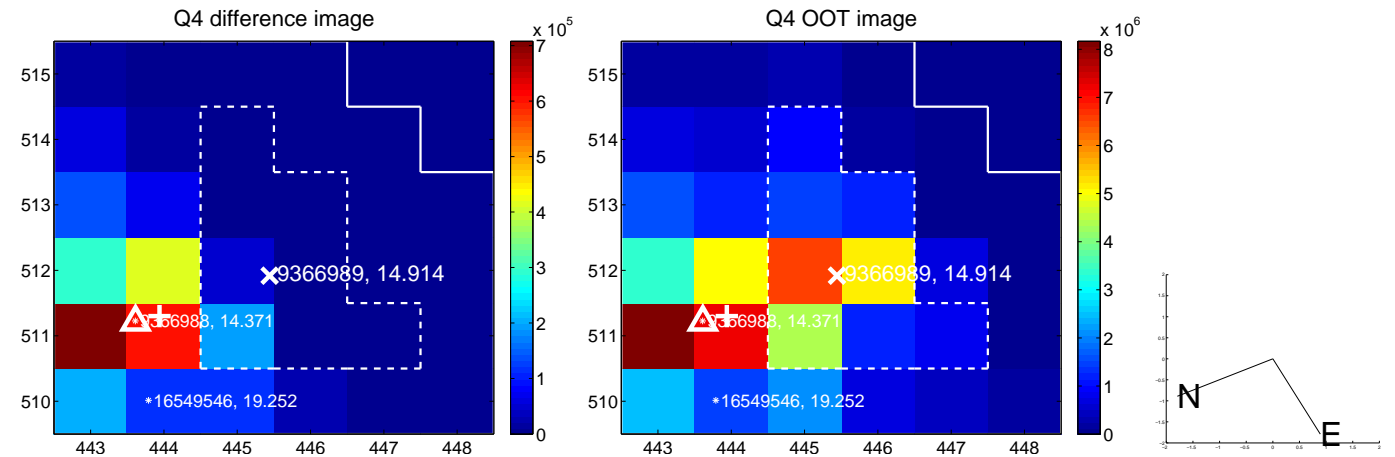
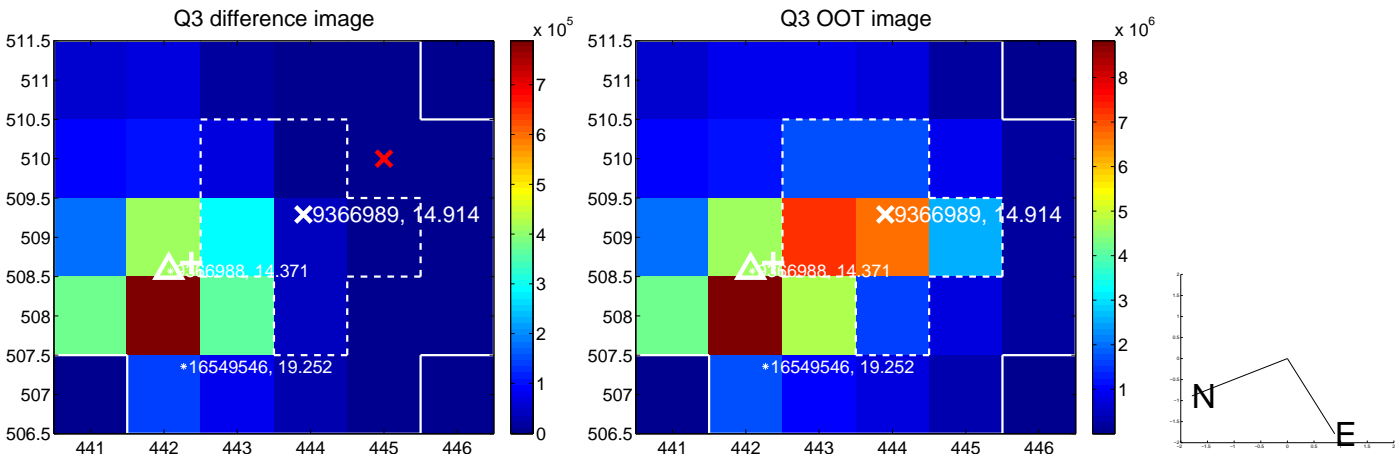
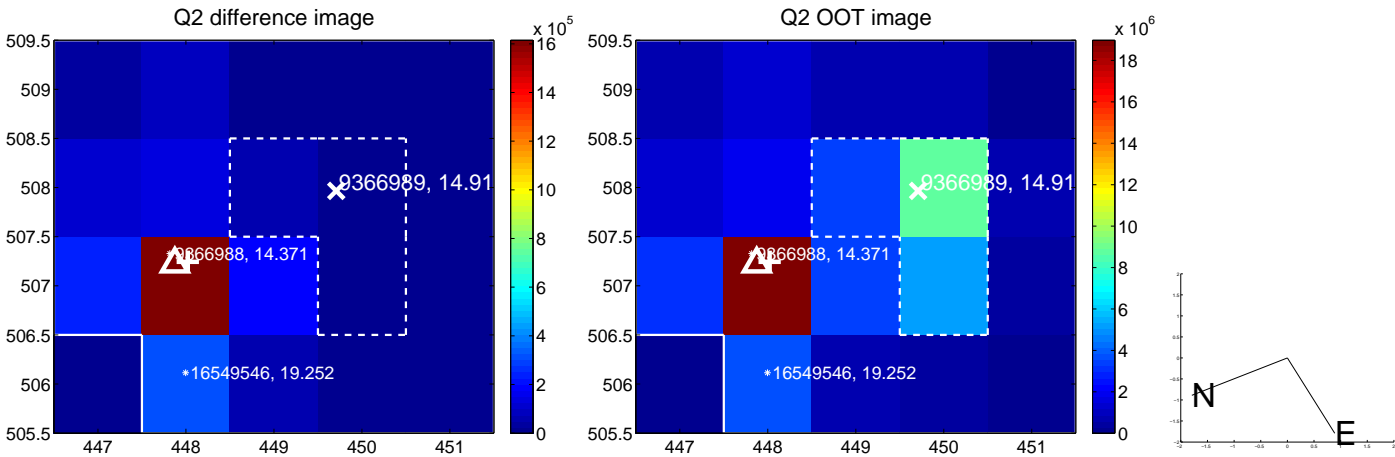
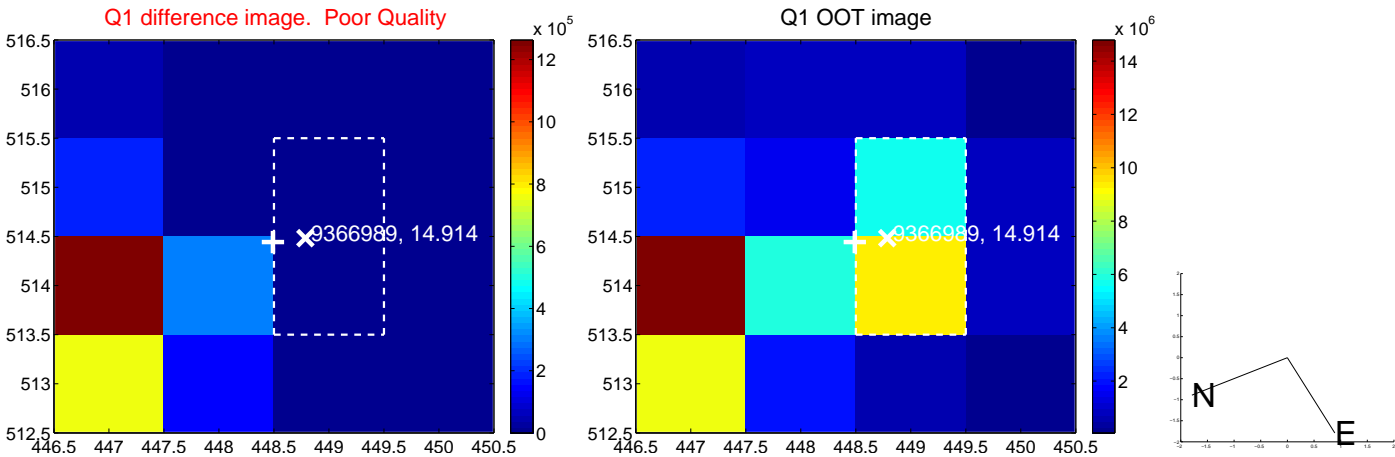
The OOT PRF centroid is offset from the target star catalog position by about 6.28 arcsec so the offset from difference PRF-fit to OOT-fit may be invalid.

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.433 \pm 0.279$	5.13	$-0.307 \pm 0.079$	$1.399 \pm 0.285$
PRF-fit source offset from KIC position	$7.866 \pm 0.070$	112.83	$-0.676 \pm 0.071$	$7.836 \pm 0.070$
photometric centroid source offset	$86.12 \pm 0.25$	348.70	$0.29 \pm 0.15$	$86.12 \pm 0.25$

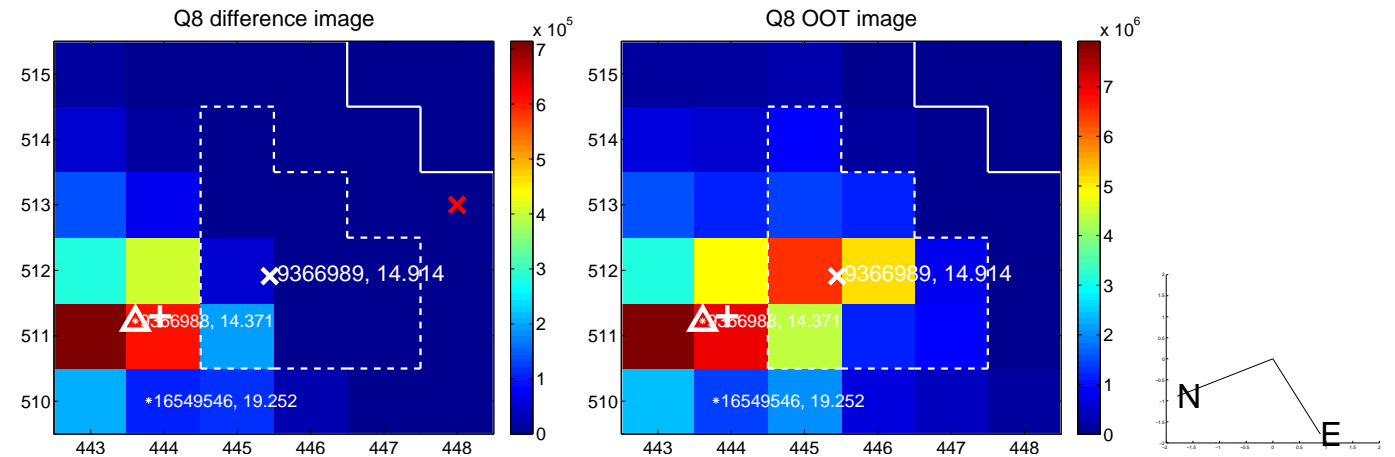
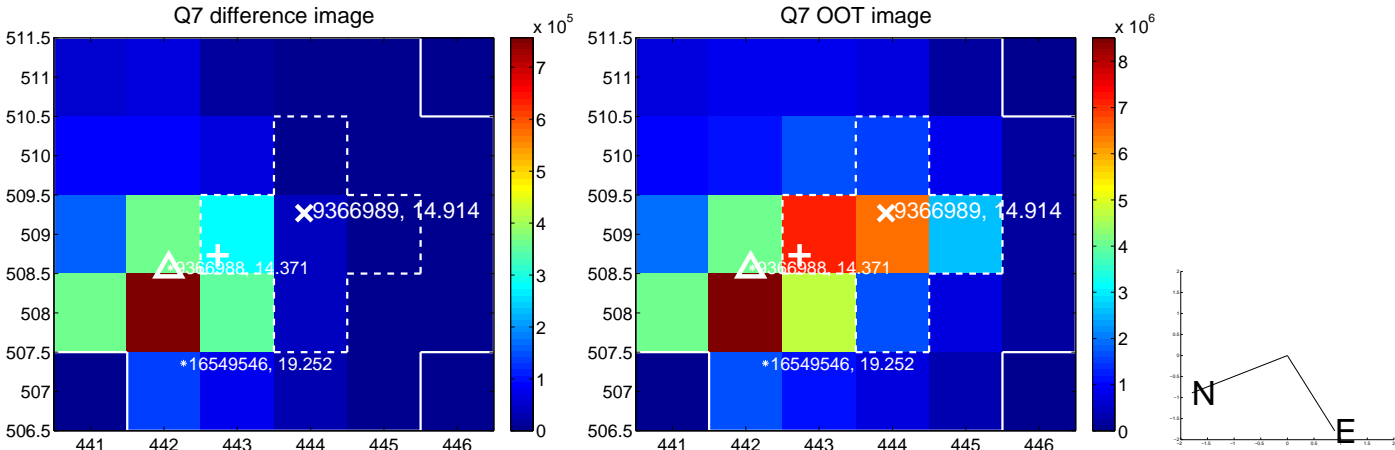
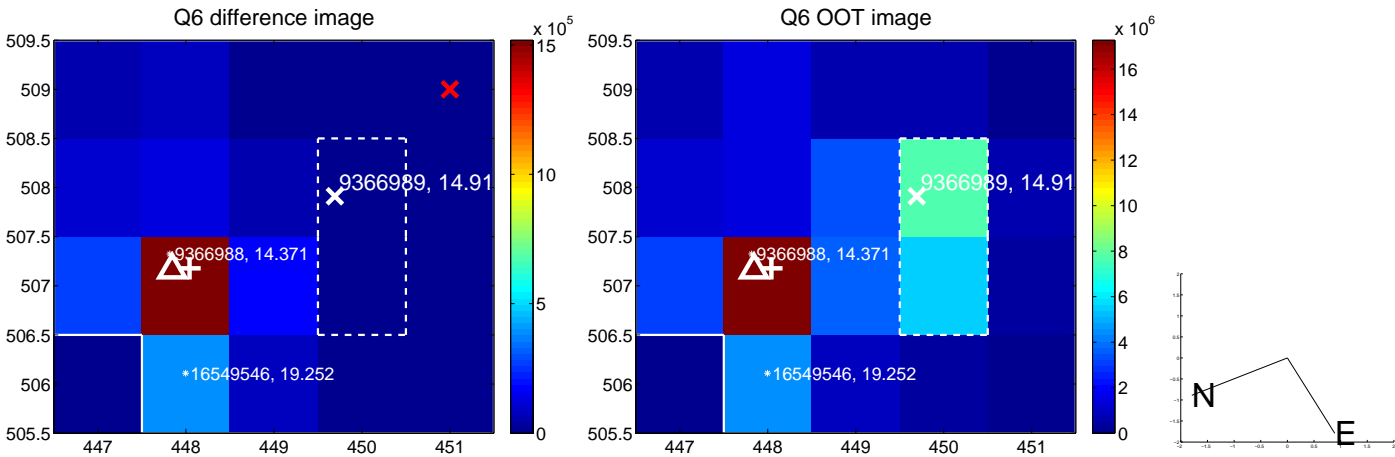
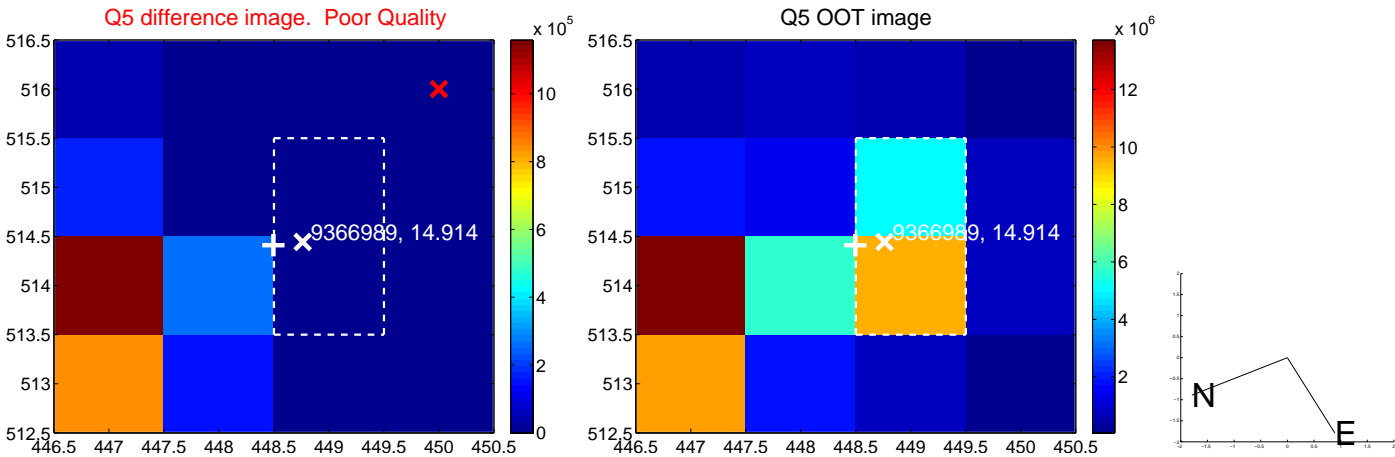


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

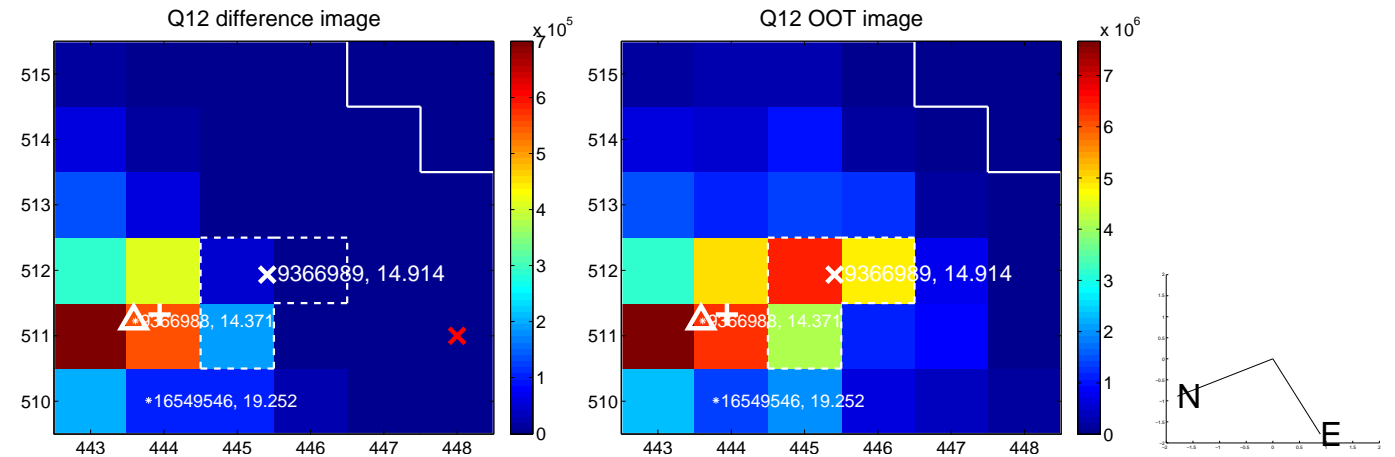
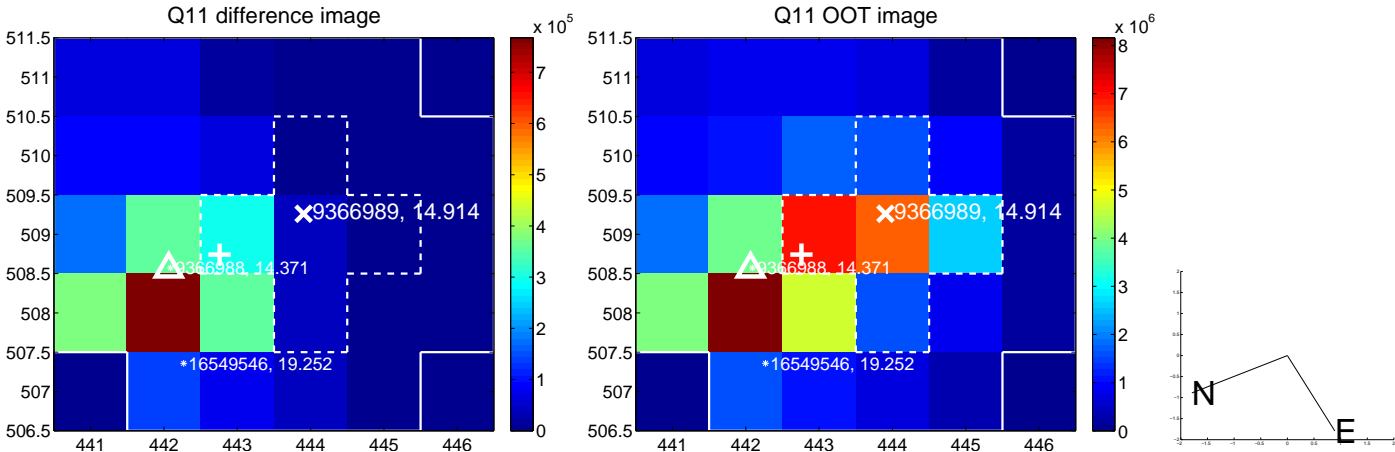
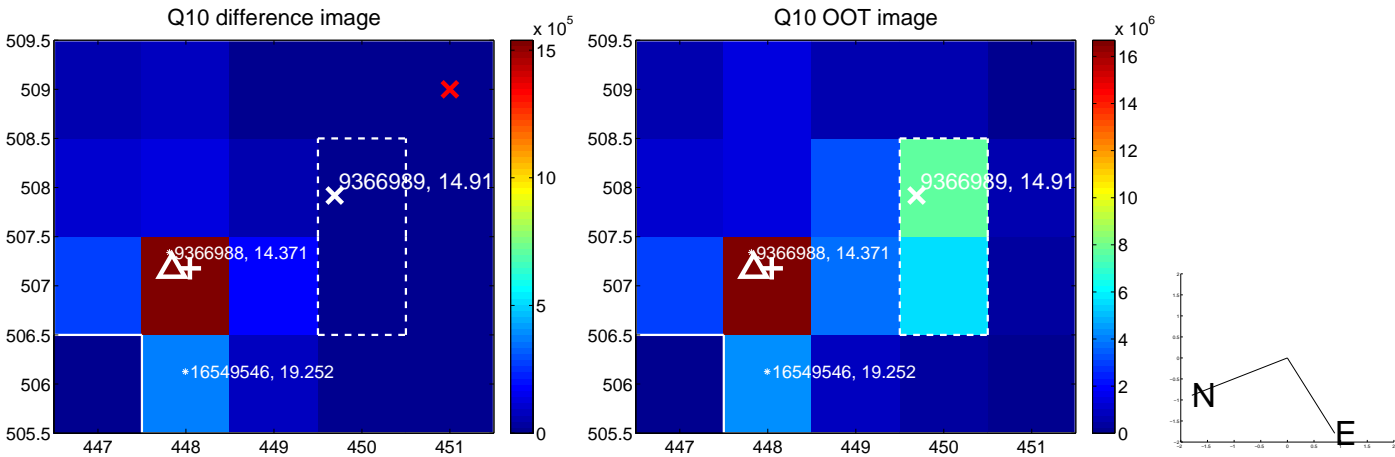
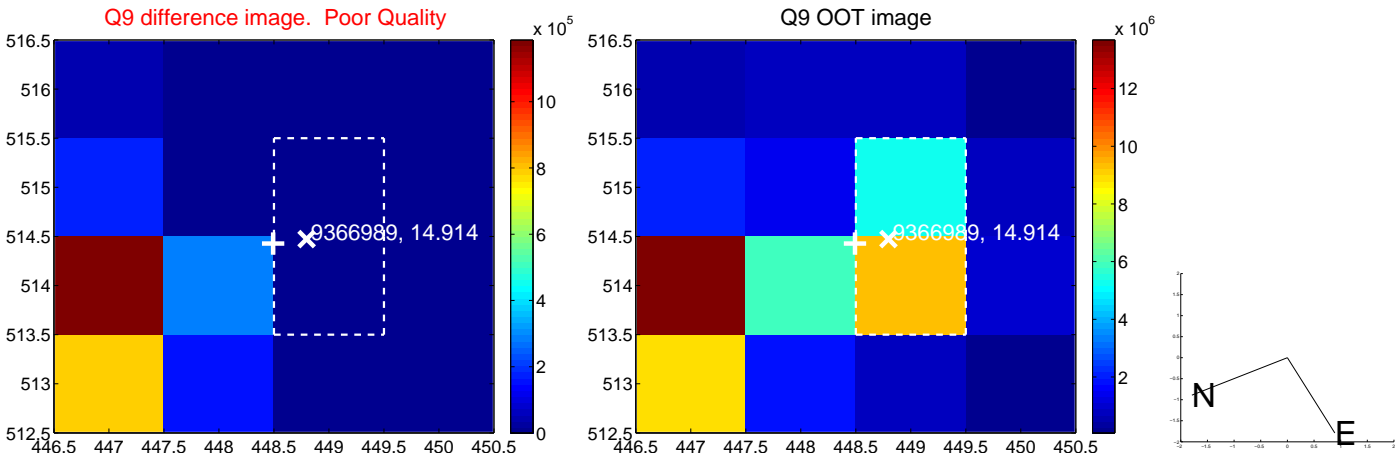
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



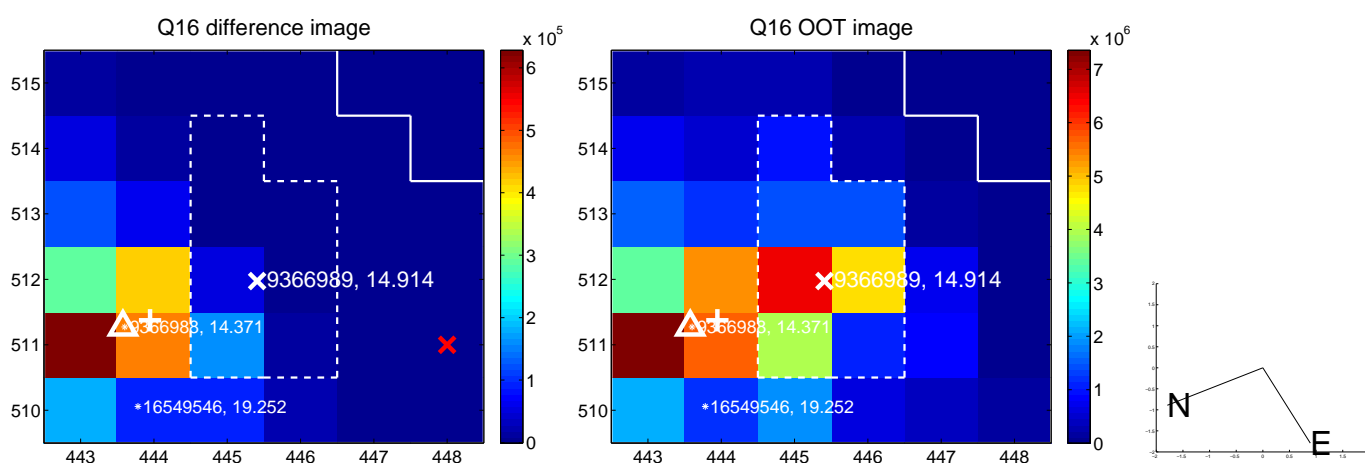
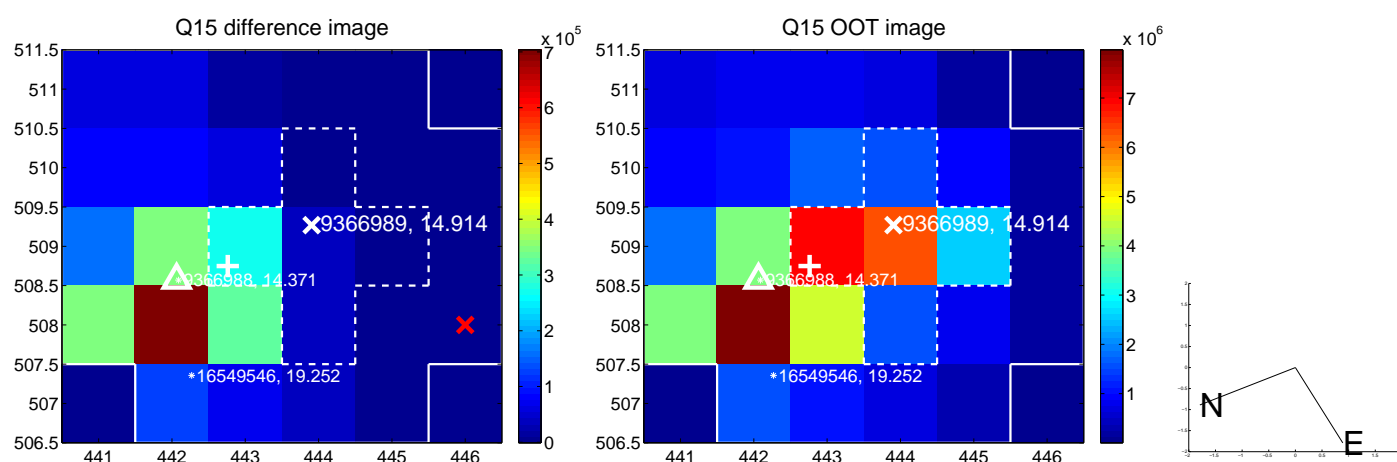
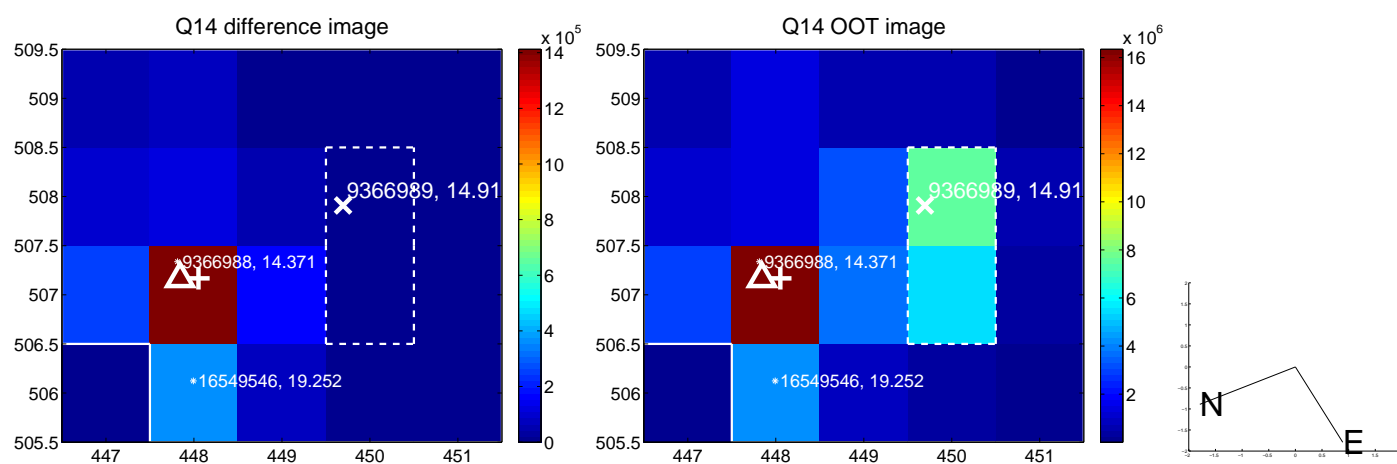
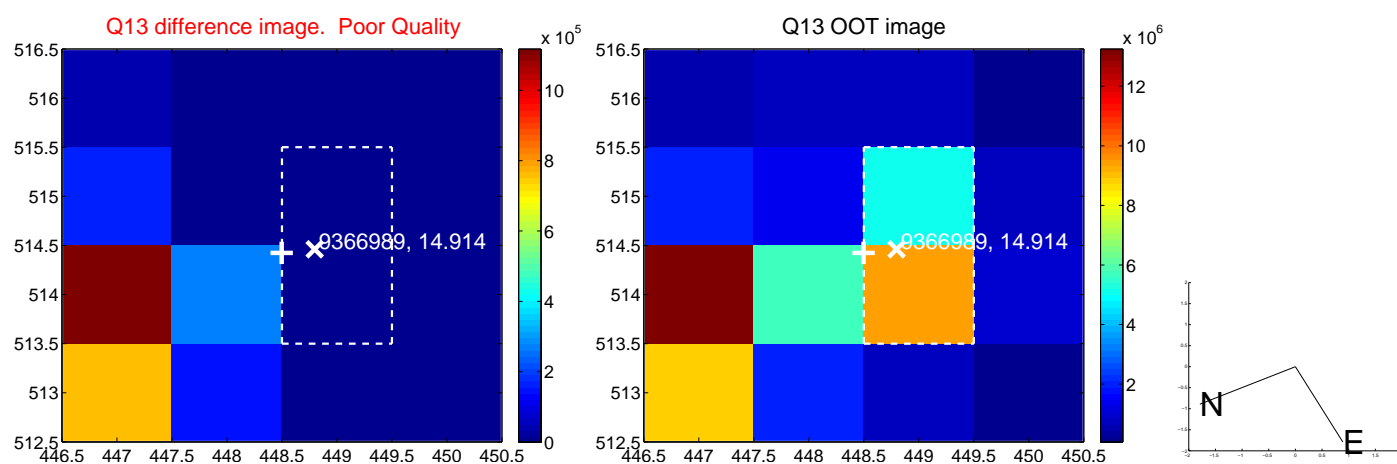
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



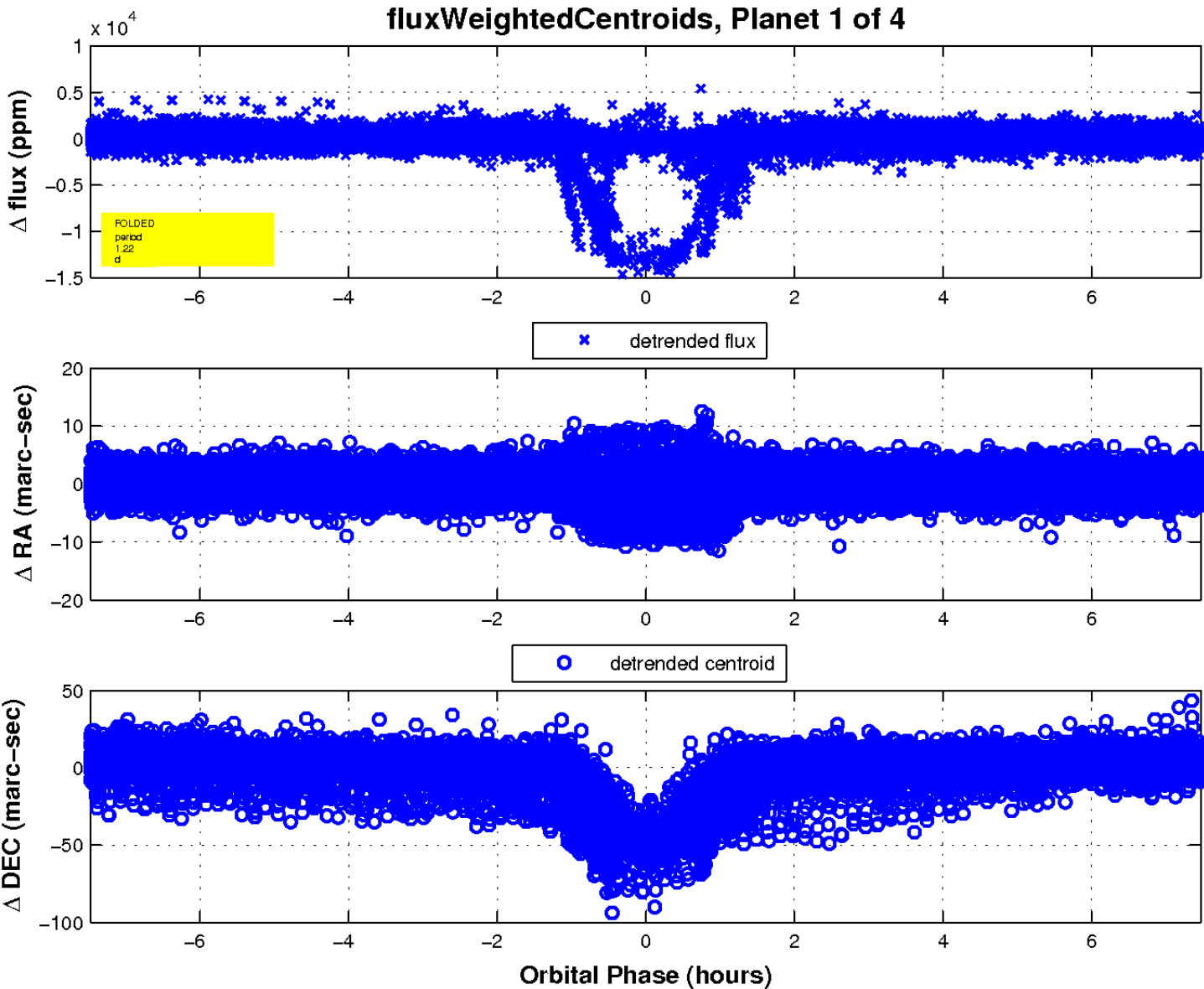
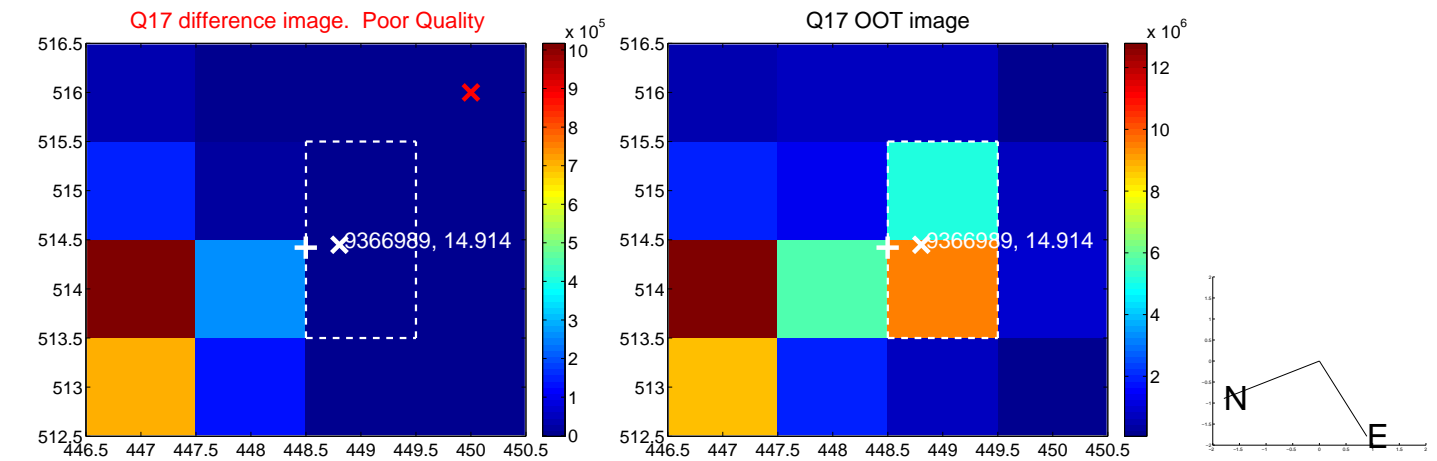
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

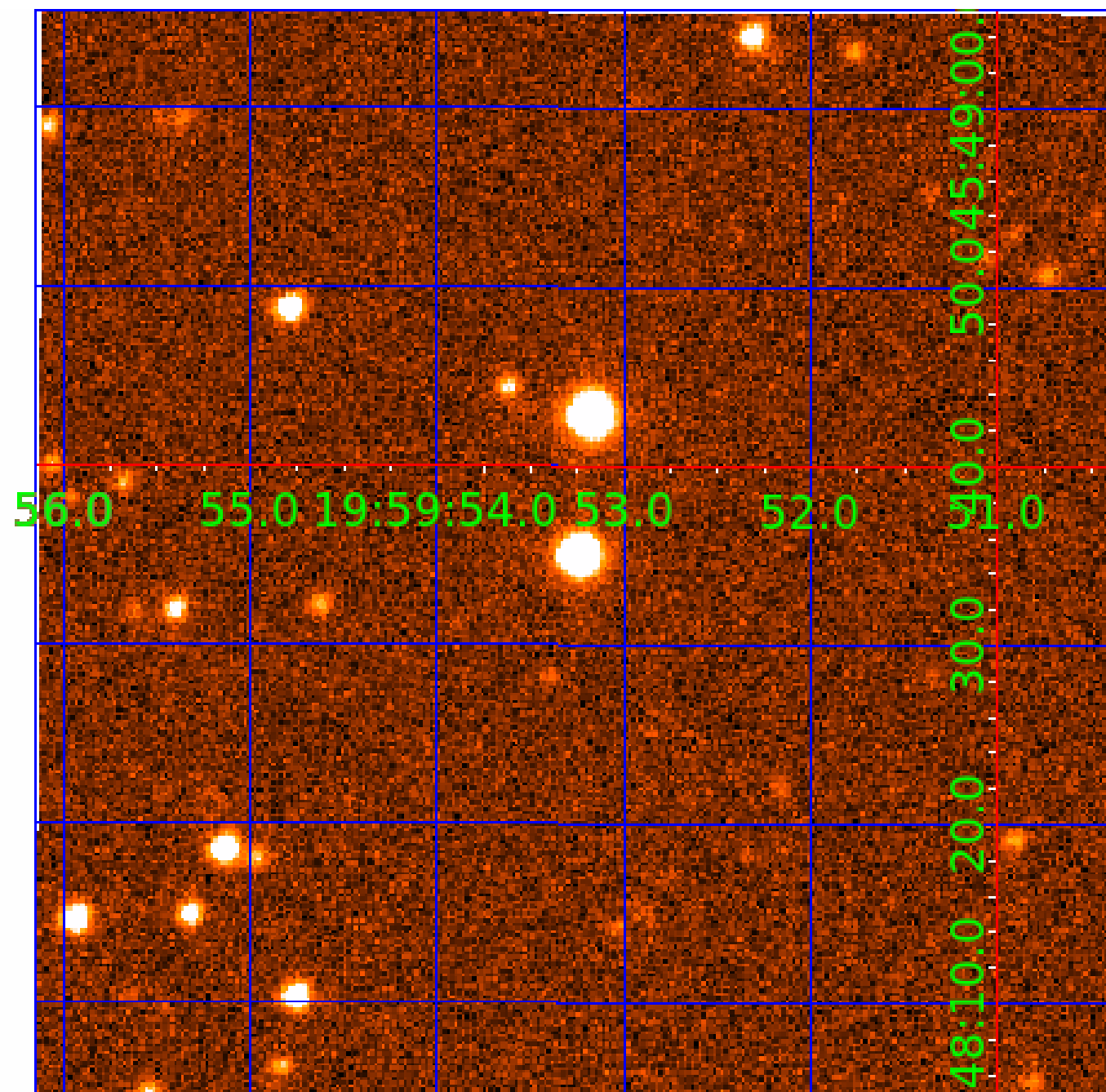


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



# UKIRT Image

Declination



# KIC 009366989

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
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## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009366989-01	OBS	FP	0.00	0	1	1	1	MOD_SEC_ALT—MOD_ODDEVEN_DV—SEASONAL_DEPTH_ALT—CENT_RESOLVED_OFFSET—EPHEM_MATCH
009366989-02	OBS	FP	0.00	1	0	1	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—CENT_RESOLVED_OFFSET—HALO_GHOST
009366989-04	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_RESOLVED_OFFSET—HALO_GHOST

**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.

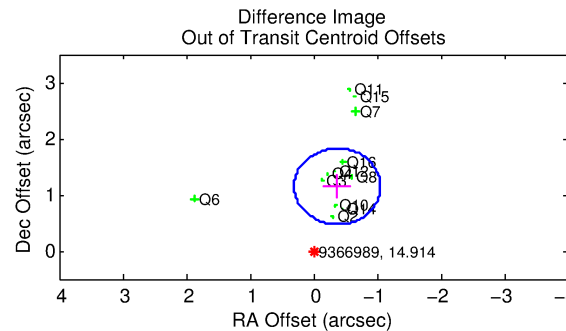
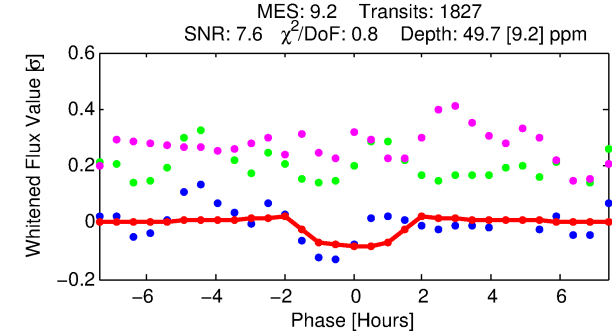
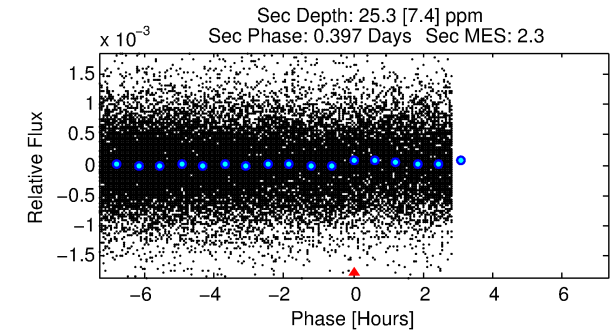
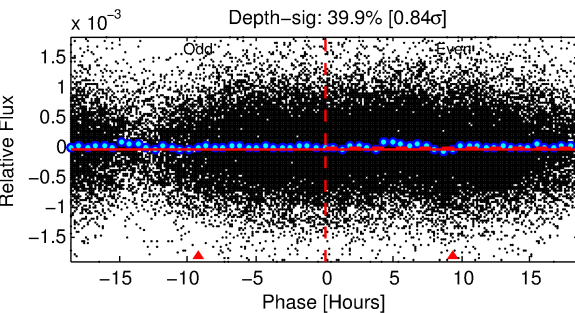
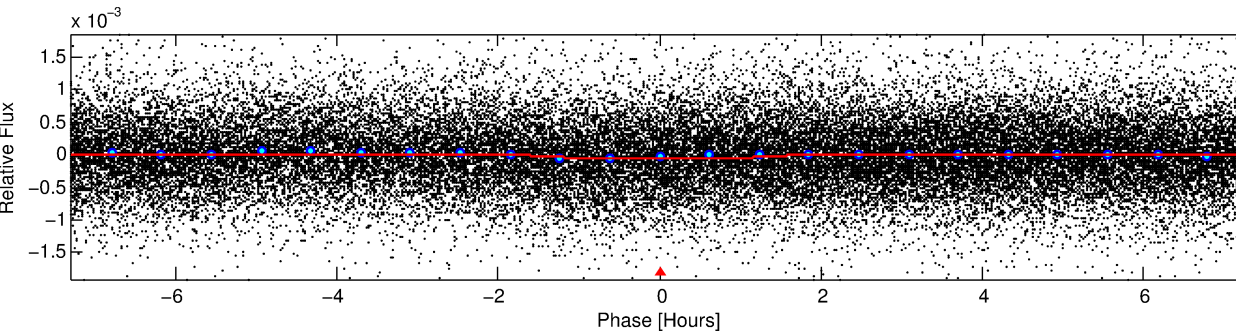
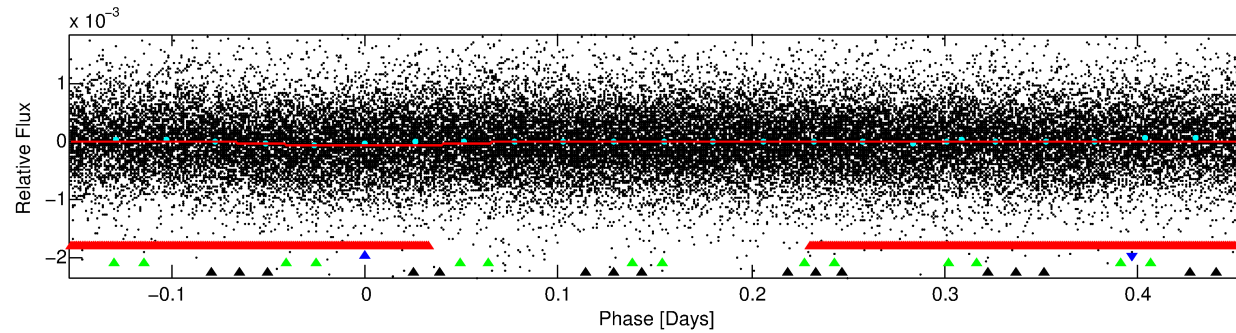
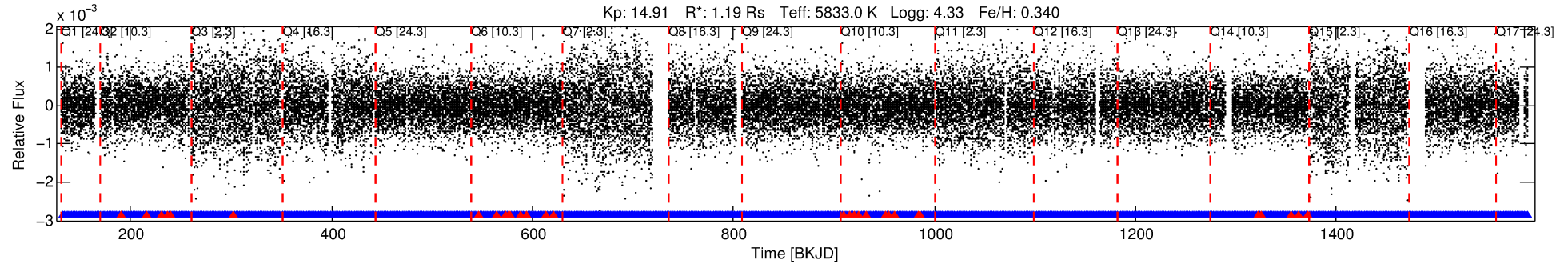
## Ephemeris Match Information For 009366989-02

No Significant Match Found

# DV One-Page Summary

KIC: 9366989 Candidate: 2 of 4 Period: 0.610 d  
KOI: K01785 Corr: No Ephemeris Match

Kp: 14.91 R\*: 1.19 Rs Teff: 5833.0 K Logg: 4.33 Fe/H: 0.340



## DV Fit Results:

Period = 0.60968 [0.00001] d  
Epoch = 132.0718 [0.0043] BKJD  
Rp/R\* = 0.0067 [0.0058]  
a/R\* = 1.46 [2.85]  
b = 0.57 [4.42]  
Seff = 6915.79 [2700.35]  
Teq = 2325 [227] K  
Rp = 0.87 [0.79] Re  
a = 0.0146 [0.0036] AU  
Ag = 3.94 [7.07] [0.42σ]  
Teffp = 5064 [2232] K [1.22σ]

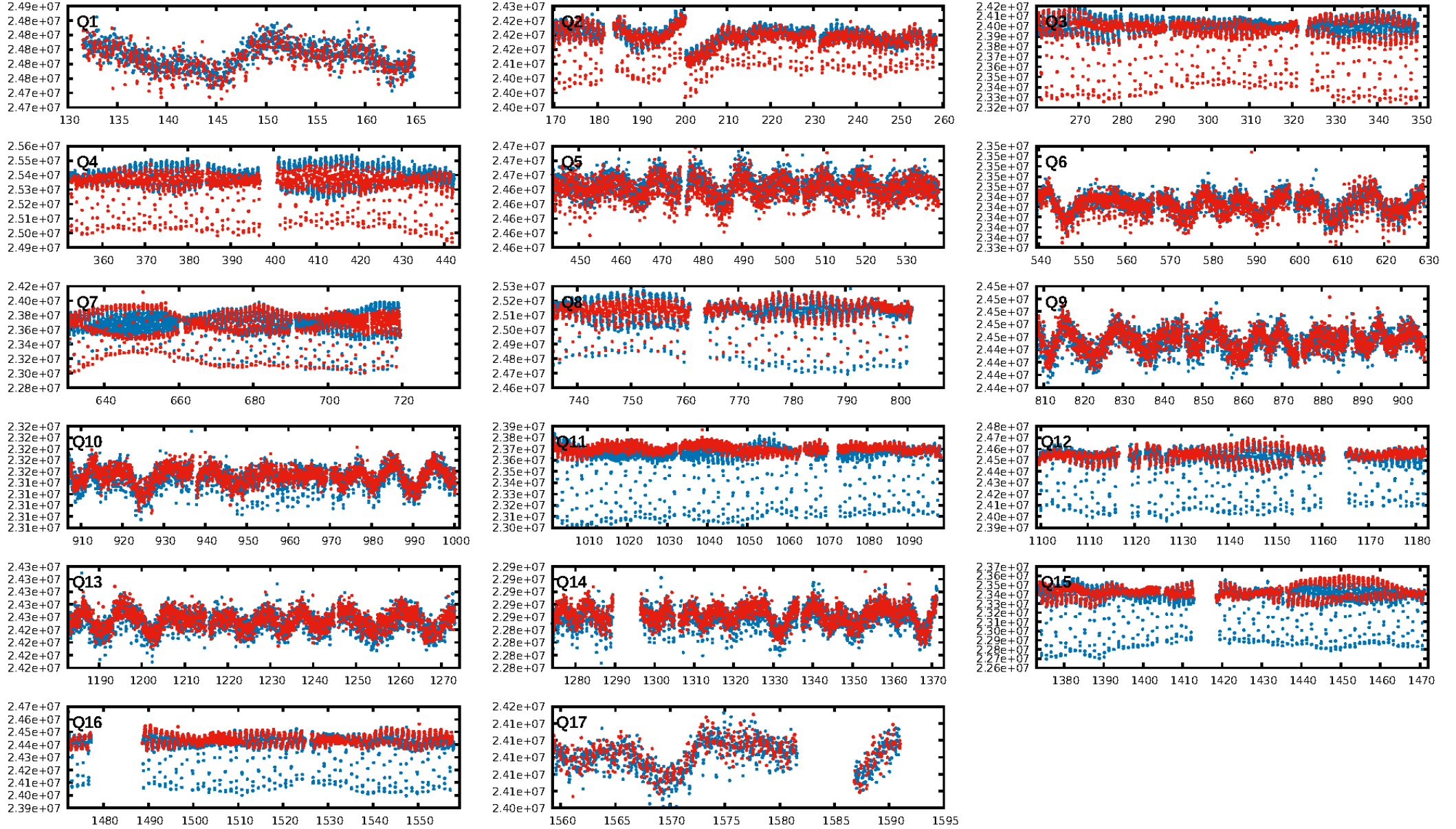
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [3.68σ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: N/A  
RollingBand-fgt: 0.98 [1723/1754]  
GhostDiagnostic-chr: -0.1362  
Centroid-sig: N/A  
Centroid-so: 8.365 arcsec [4.54σ]  
OotOffset-rm: 1.206 arcsec [5.34σ]  
KicOffset-rm: 7.885 arcsec [111.35σ]  
OotOffset-st: 4/4/4/0 [12]  
KicOffset-st: 4/4/4/0 [12]  
DiffImageQuality-fgm: 0.25 [3/12]  
DiffImageOverlap-fno: 0.76 [13/17]

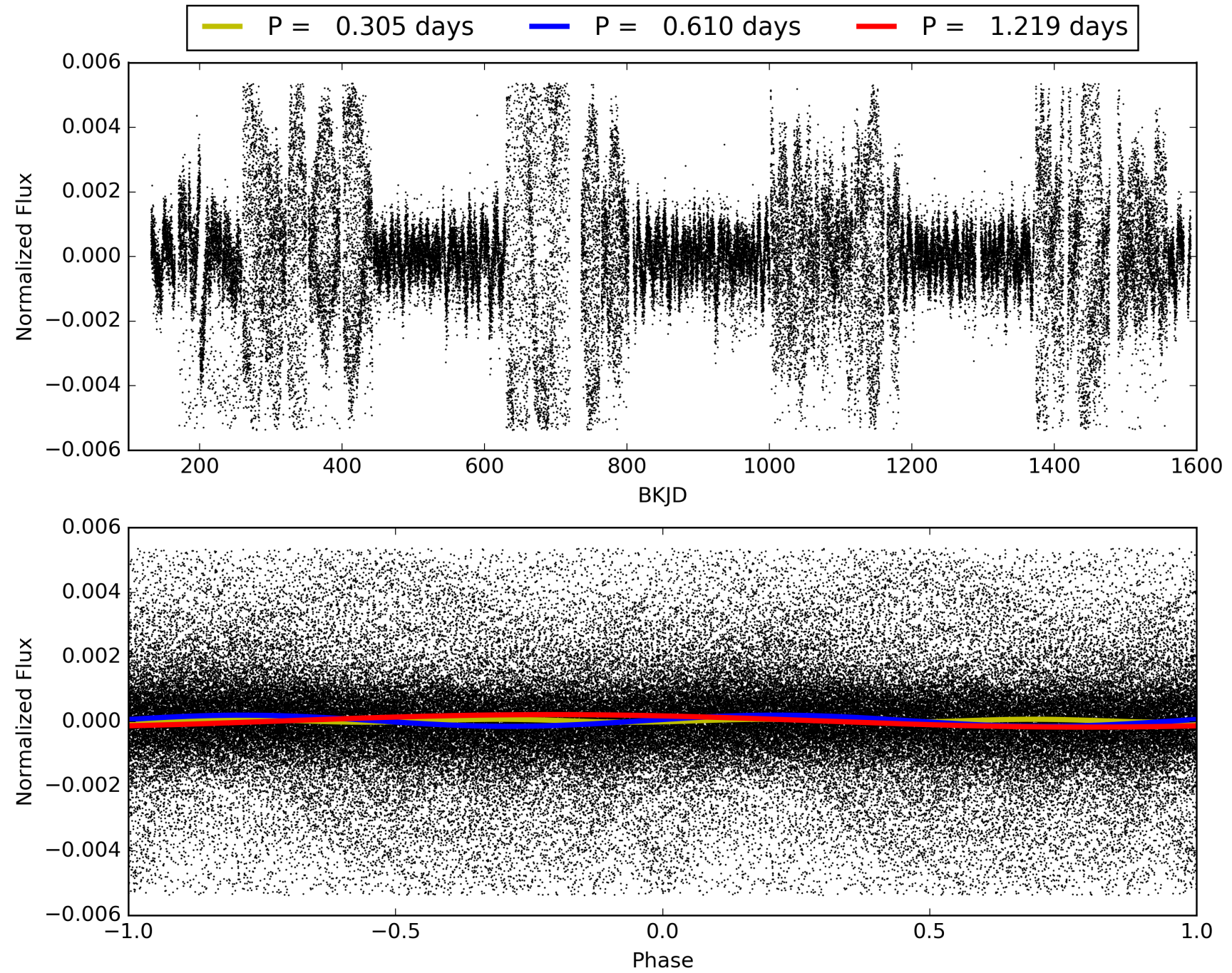
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 14:48:41 Z

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

# TCE 009366989-02, PDC Light Curves

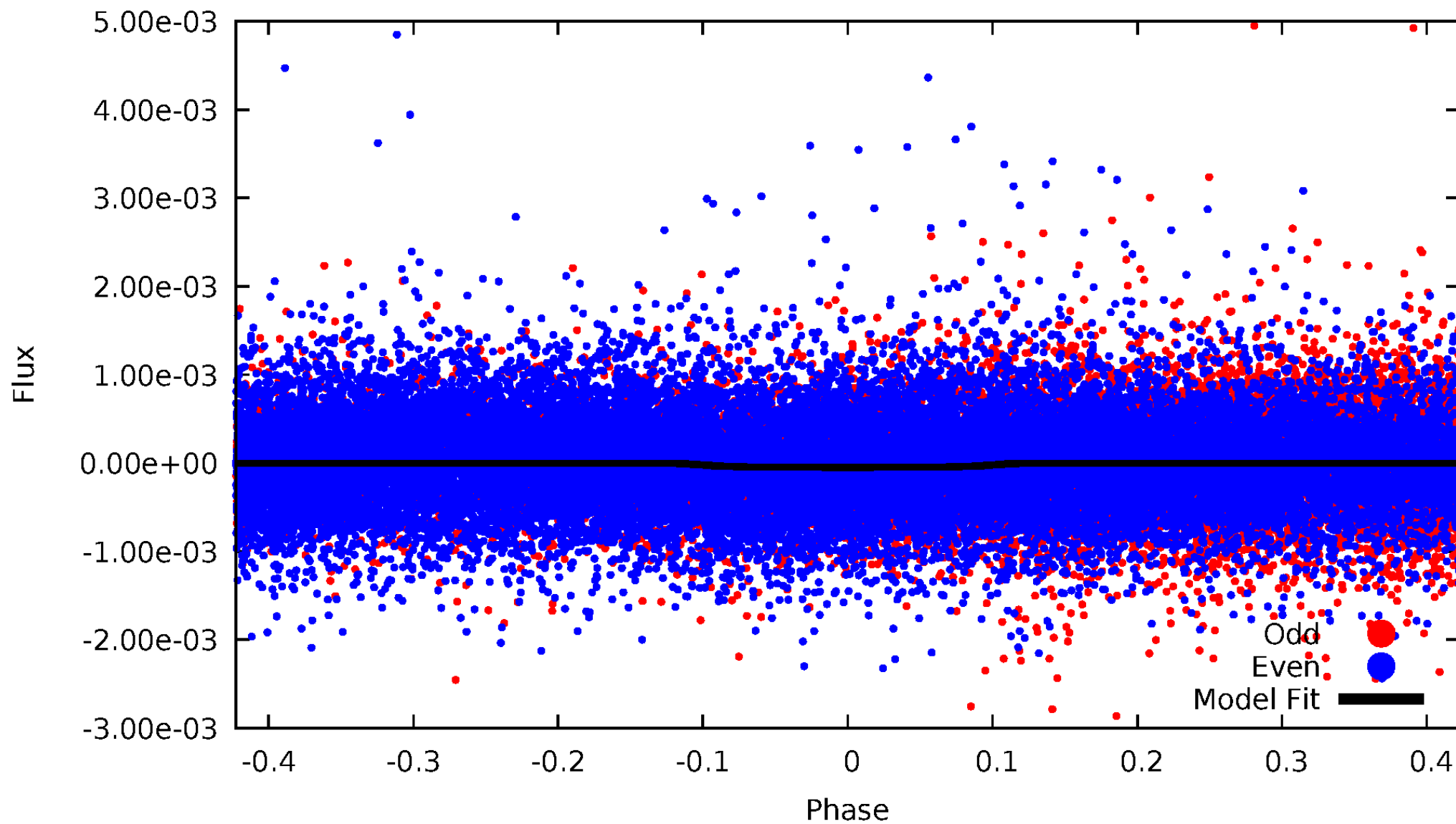


TCE 009366989-02



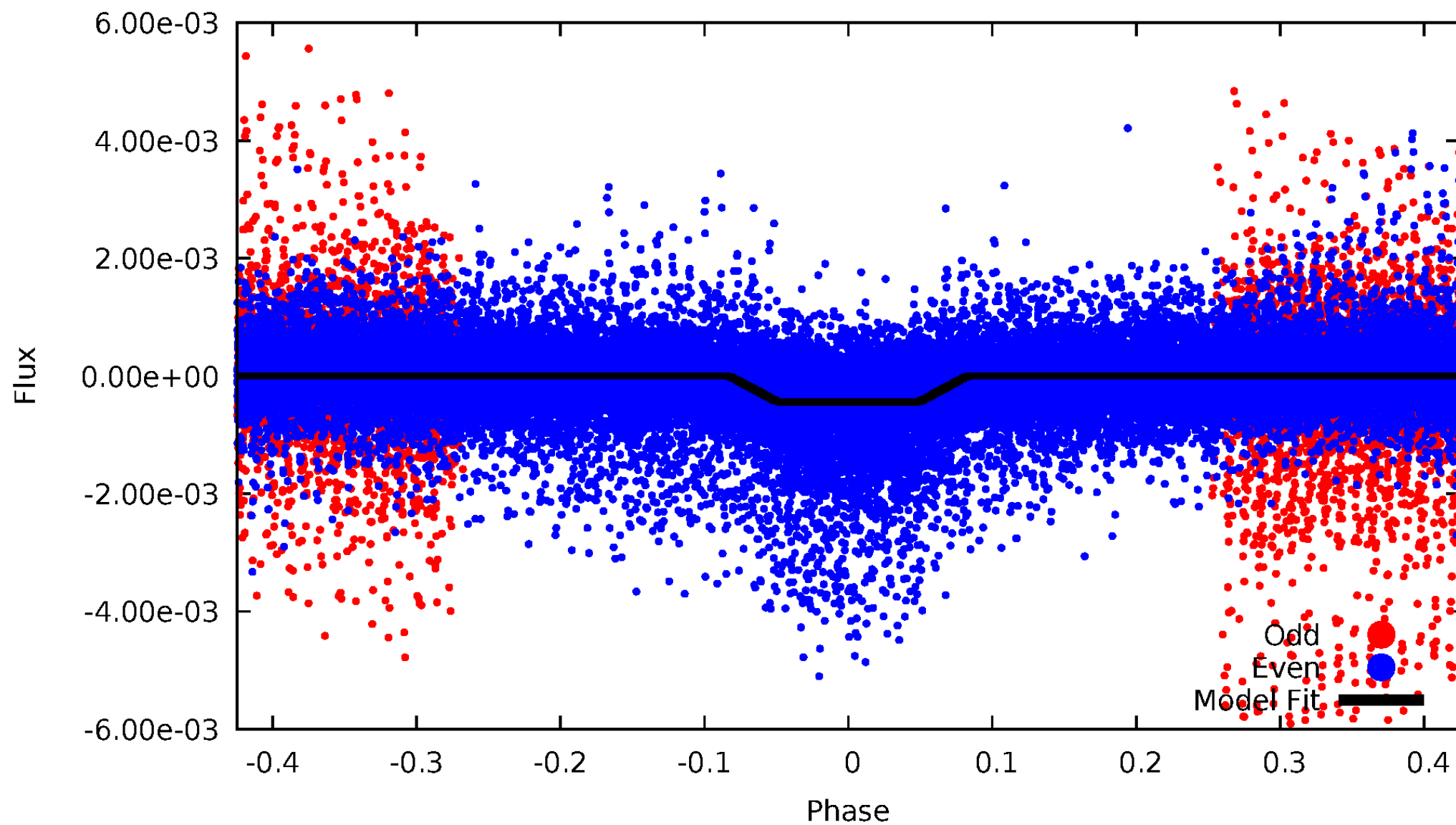
# DV Odd/Even

TCE 009366989-02



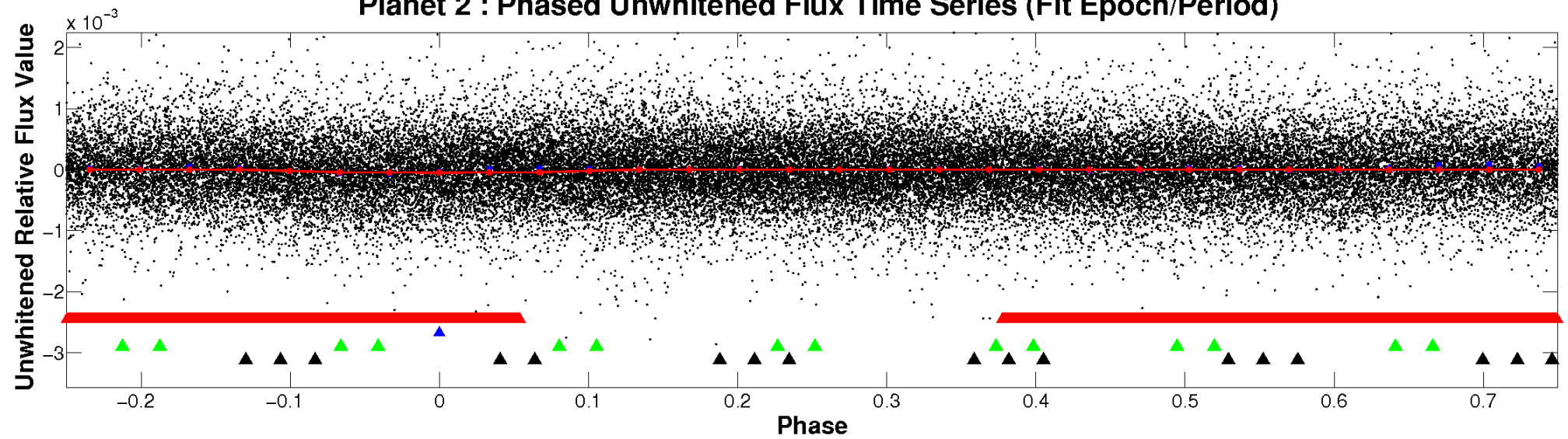
# ALT Odd/Even

TCE 009366989-02

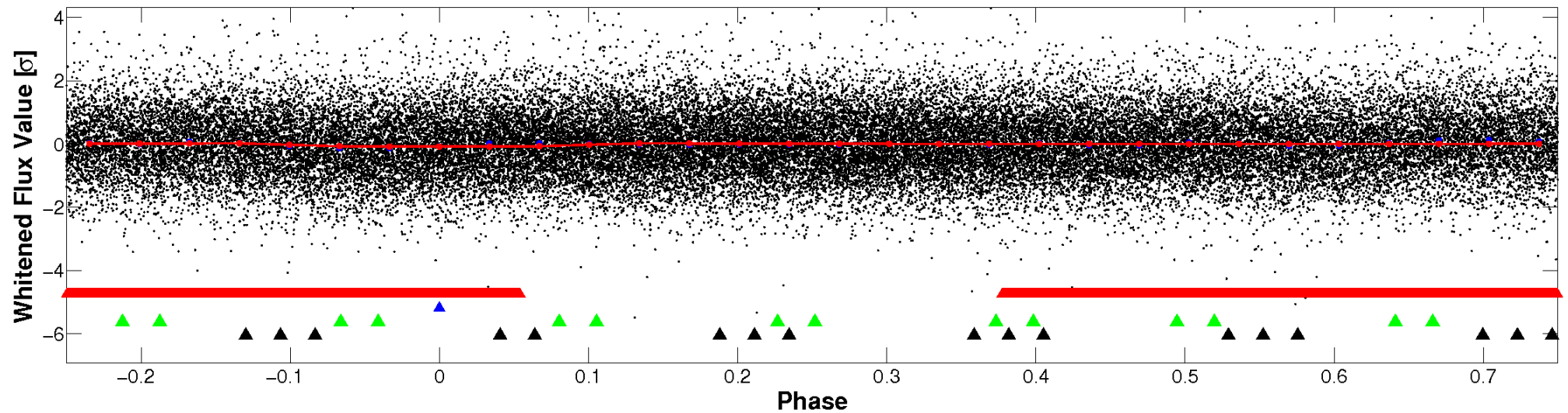


# Non-Whitened Vs. Whitened Light Curve

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

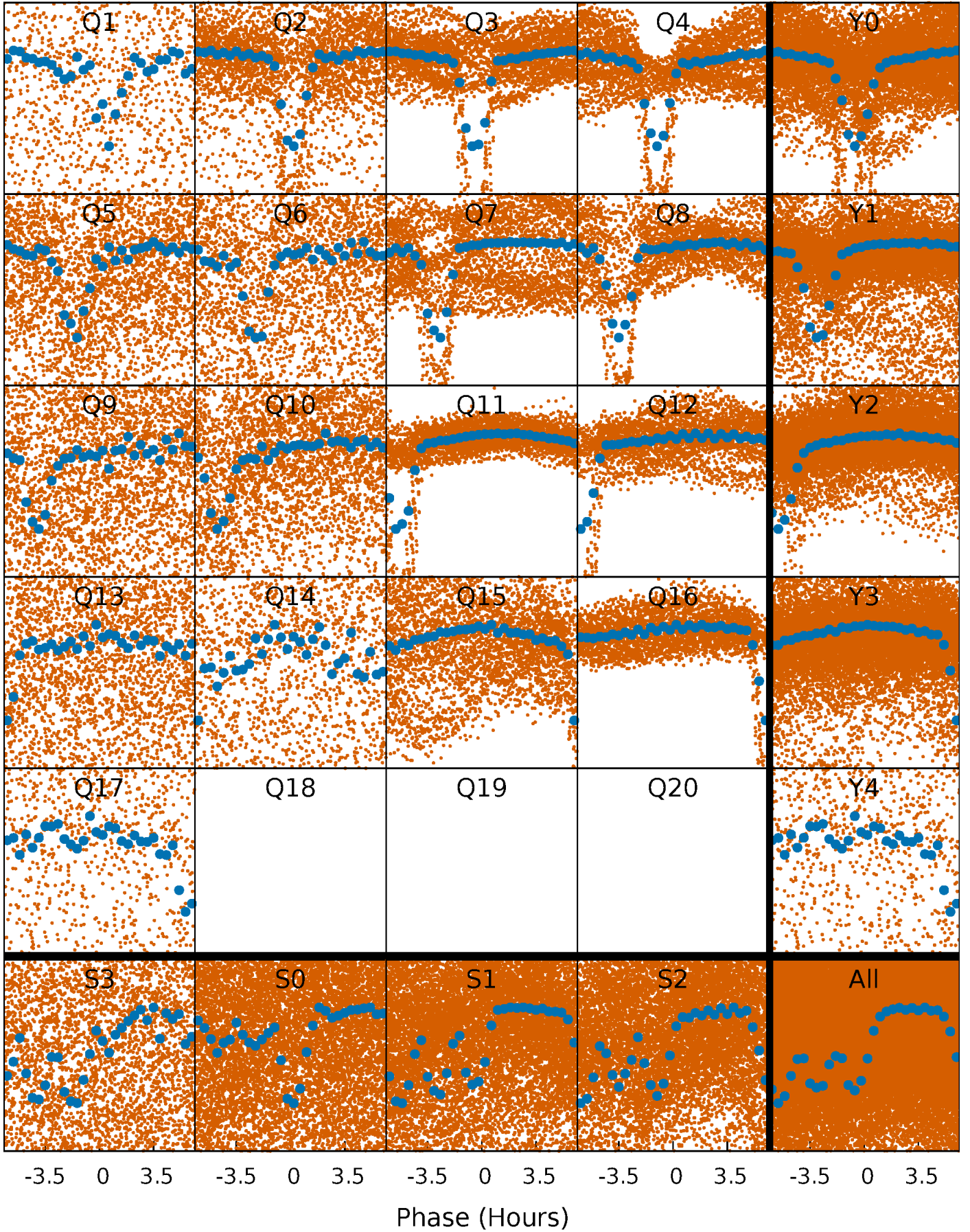


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



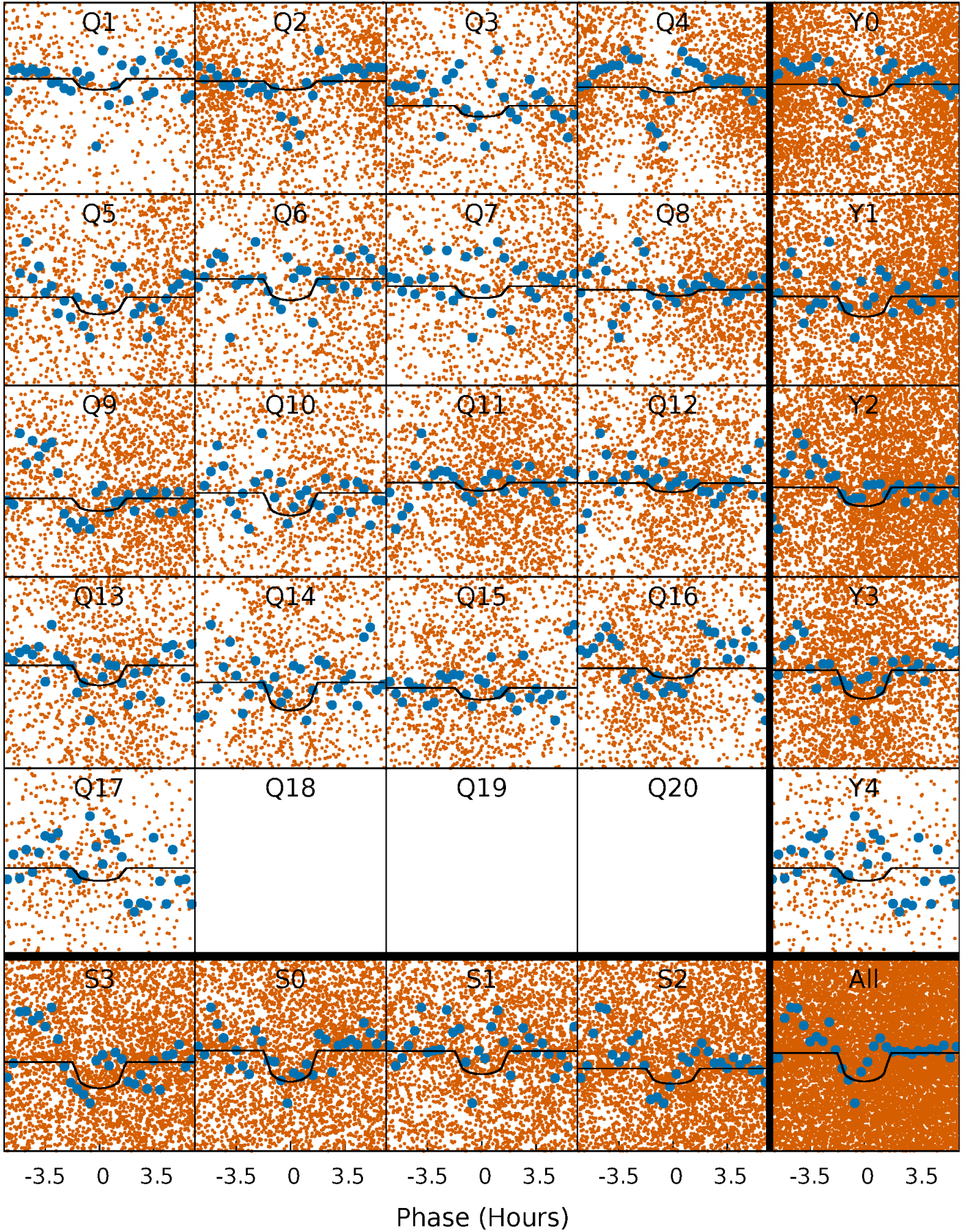
# PDC Quarter-Phased Transit Curves

TCE 009366989-02     $P = 0.609682$  Days     $T_0 = 132.071817$  (BKJD)



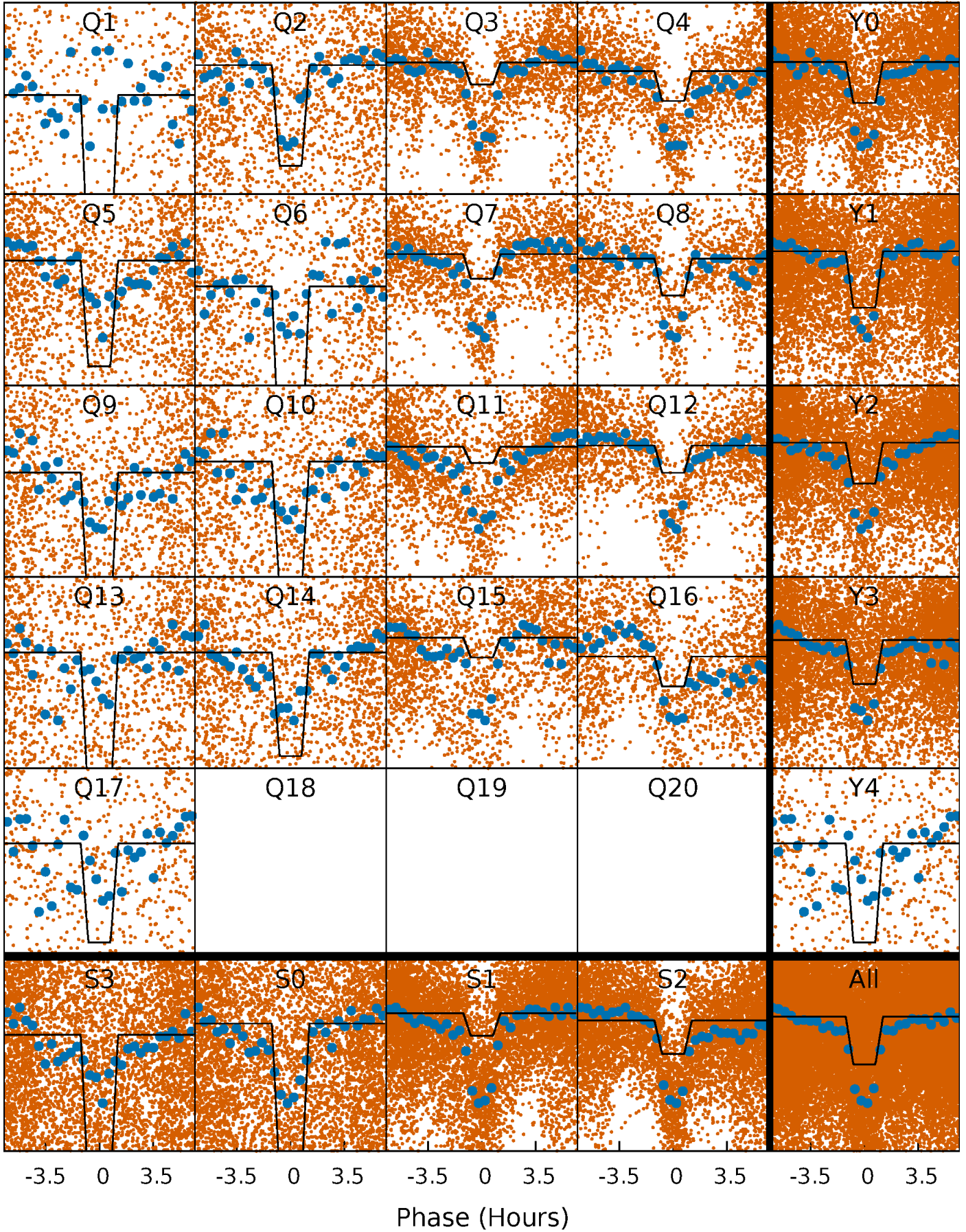
# DV Quarter-Phased Transit Curves

TCE 009366989-02     $P = 0.609682$  Days     $T_0 = 132.071817$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

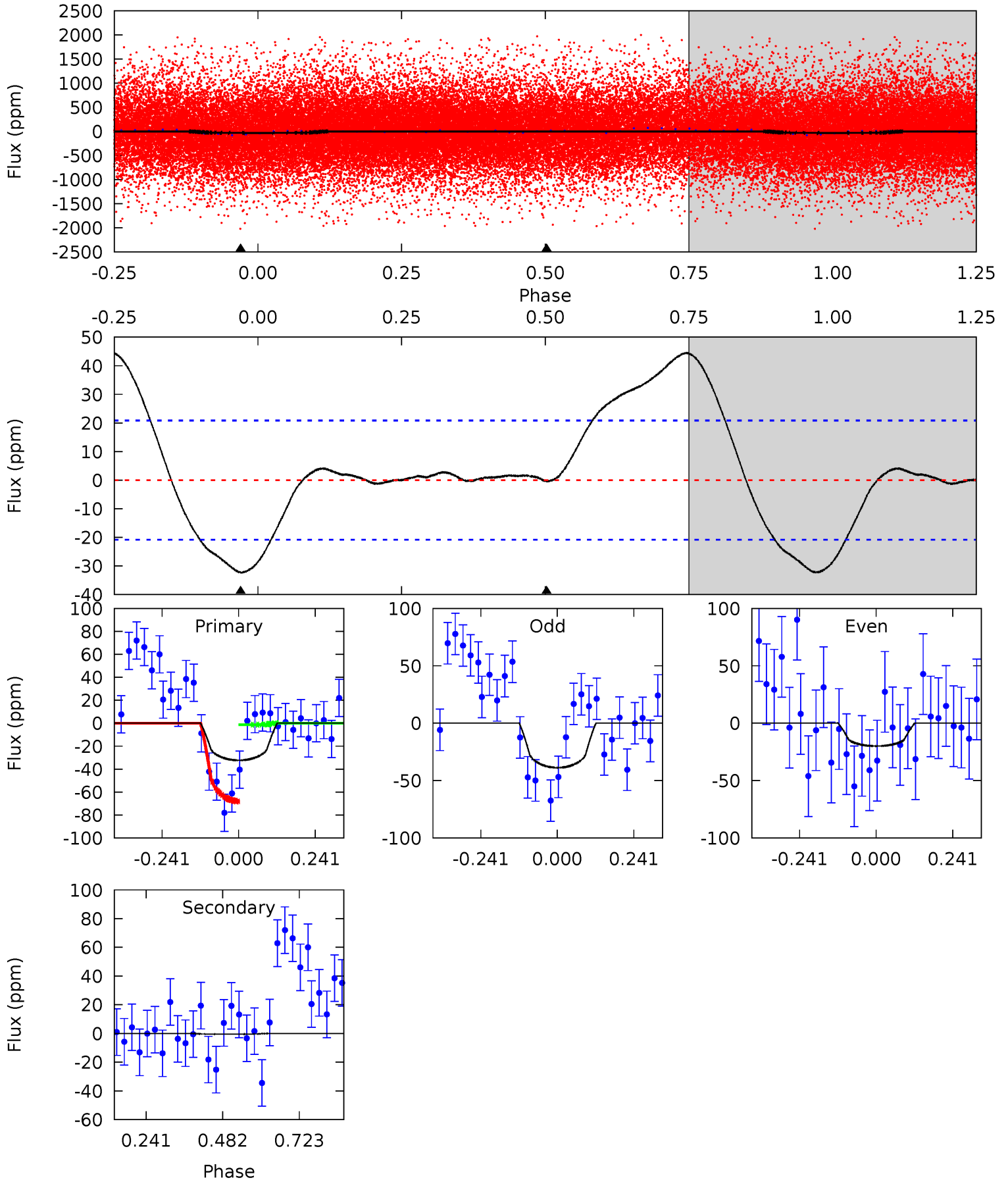
TCE 009366989-02   P= 0.609517 Days    $T_0=132.100061$  (BKJD)



# DV Model-Shift Uniqueness Test

009366989-02, P = 0.609682 Days, E = 131.462135 Days

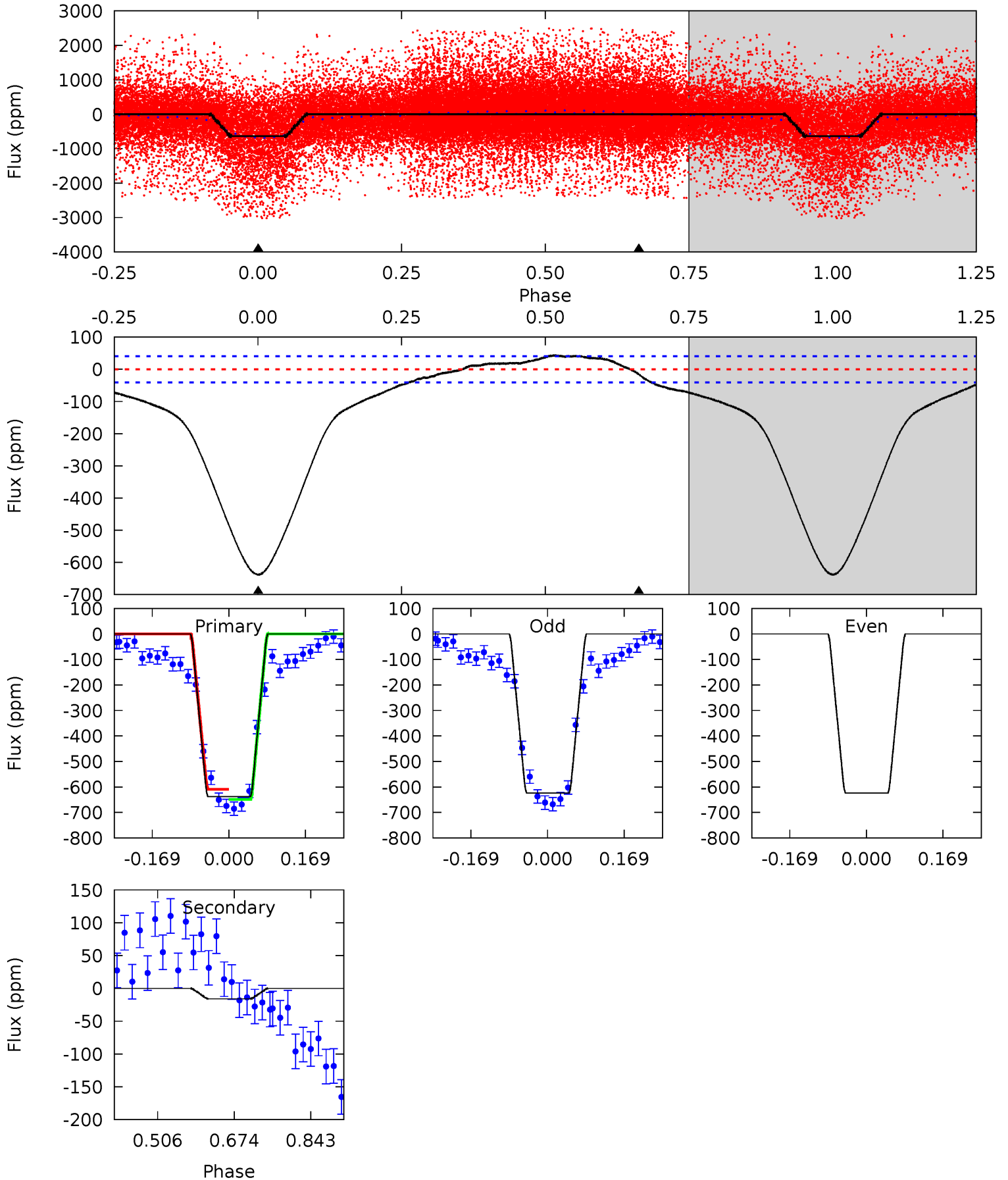
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
6.79	0.09	0	0	4.38	1.17	2.92	6.79	6.79	0.09	0.09	1.93	0.73	0.58	7.06



# Alt Model-Shift Uniqueness Test

009366989-02, P = 0.609517 Days, E = 131.490544 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
69.8	1.74	0	0	4.45	1.38	3.91	69.8	69.8	1.74	1.74	0	1.51	0.06	2.28



### Stellar Parameters For KIC 009366989

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5833^{+162}_{-203}$	$4.333^{+0.124}_{-0.201}$	$0.340^{+0.100}_{-0.300}$	$1.192^{+0.348}_{-0.188}$	$1.115^{+0.122}_{-0.136}$	$0.927^{+0.562}_{-0.474}$
	+3%/-3%	+3%/-5%	+29%/-88%	+29%/-16%	+11%/-12%	+61%/-51%
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 009366989-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-0 \pm 5$	$1.03^{+0.66}_{-0.64}$	$3265^{+254}_{-193}$	$-3179^{+6869}_{-766}$	$0.050^{+1.013}_{-0.714}$
Alt.	$-16 \pm 9$	$2.75^{+0.93}_{-0.80}$	$3271^{+244}_{-199}$	$-2644^{+5848}_{-491}$	$0.228^{+0.357}_{-0.138}$

$T_{max}$  = 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

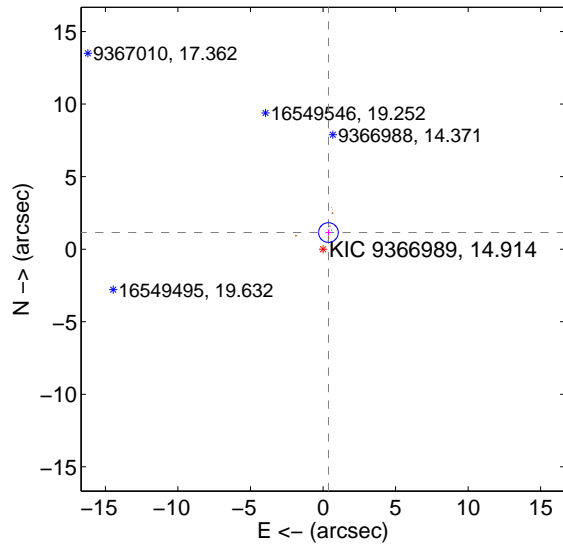
Supplemental centroid analysis for 009366989-02. Kepler magnitude: 14.91. Transit SNR 7.57

There are 3 quarters with good PRF difference image offsets

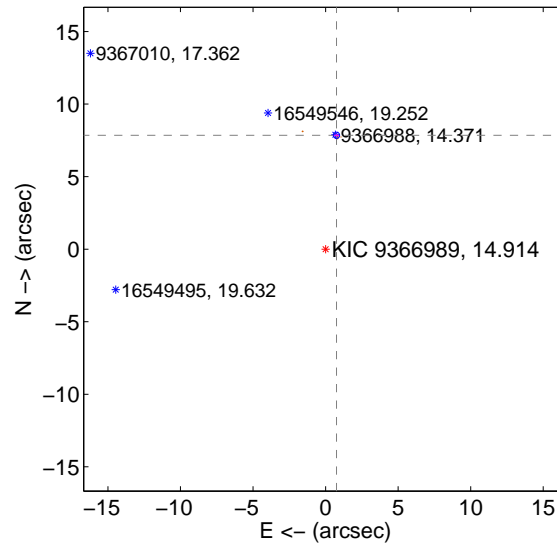
The OOT PRF centroid is offset from the target star catalog position by about 6.23 arcsec so the offset from difference PRF-fit to OOT-fit may be invalid.

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.206 \pm 0.226$	5.34	$-0.373 \pm 0.209$	$1.147 \pm 0.206$
PRF-fit source offset from KIC position	$7.885 \pm 0.071$	111.35	$-0.755 \pm 0.191$	$7.849 \pm 0.074$
photometric centroid source offset	$8.37 \pm 1.84$	4.54	$1.22 \pm 0.97$	$8.28 \pm 1.86$

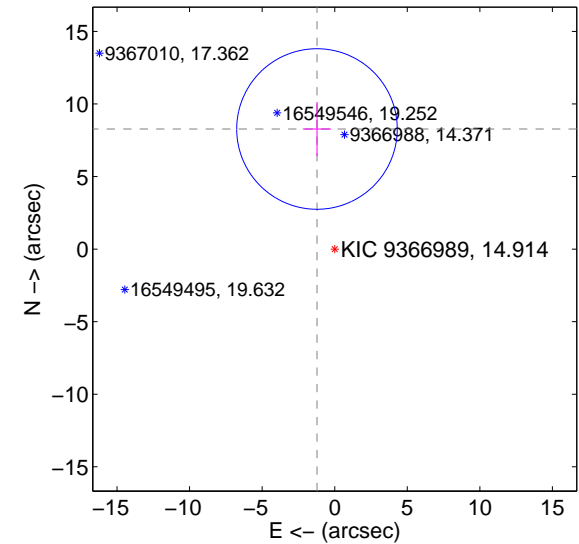
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

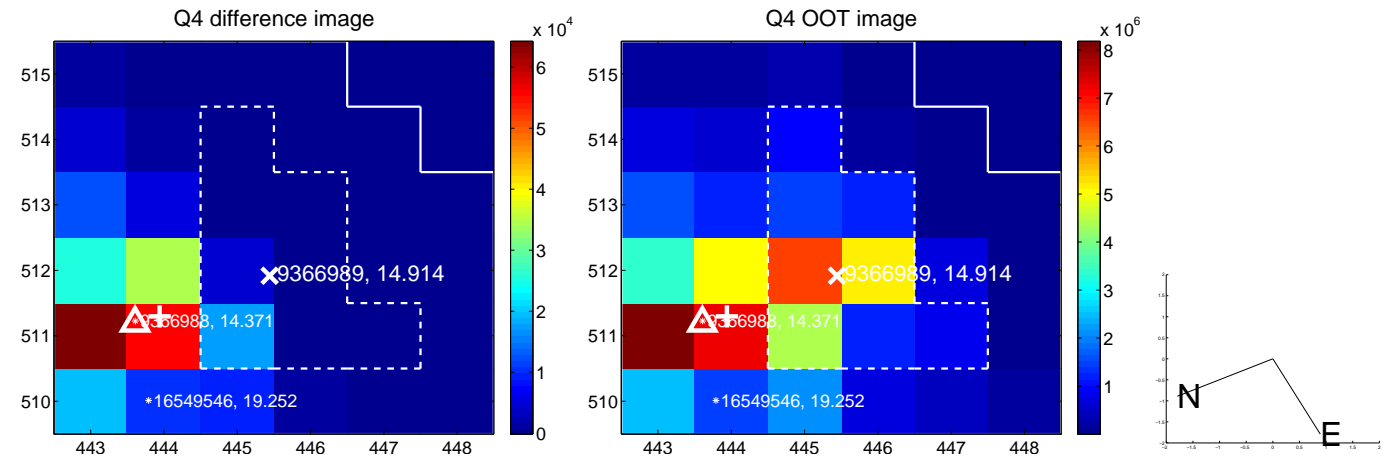
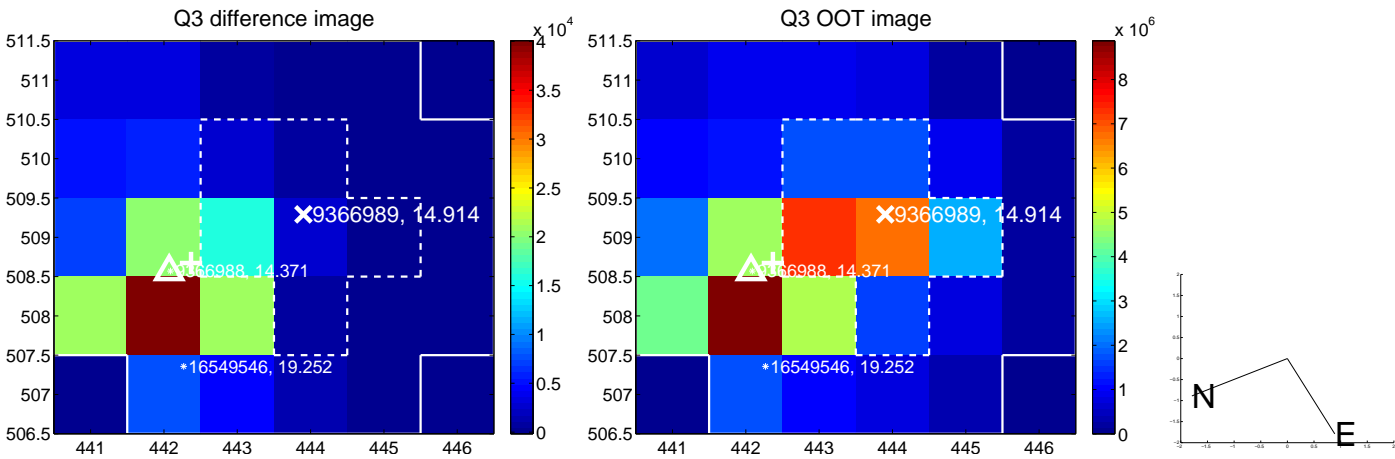
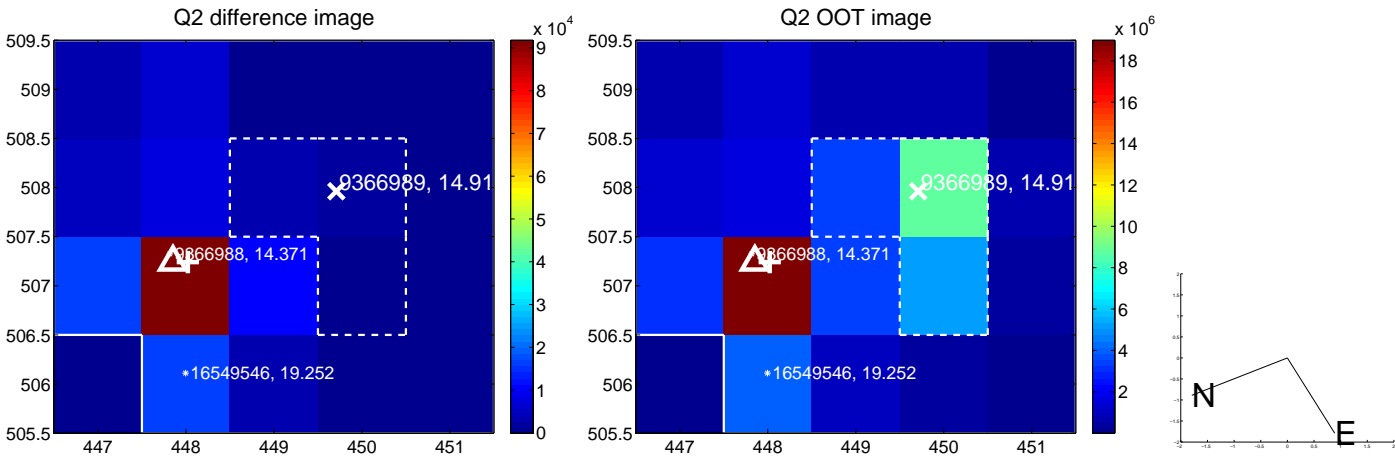
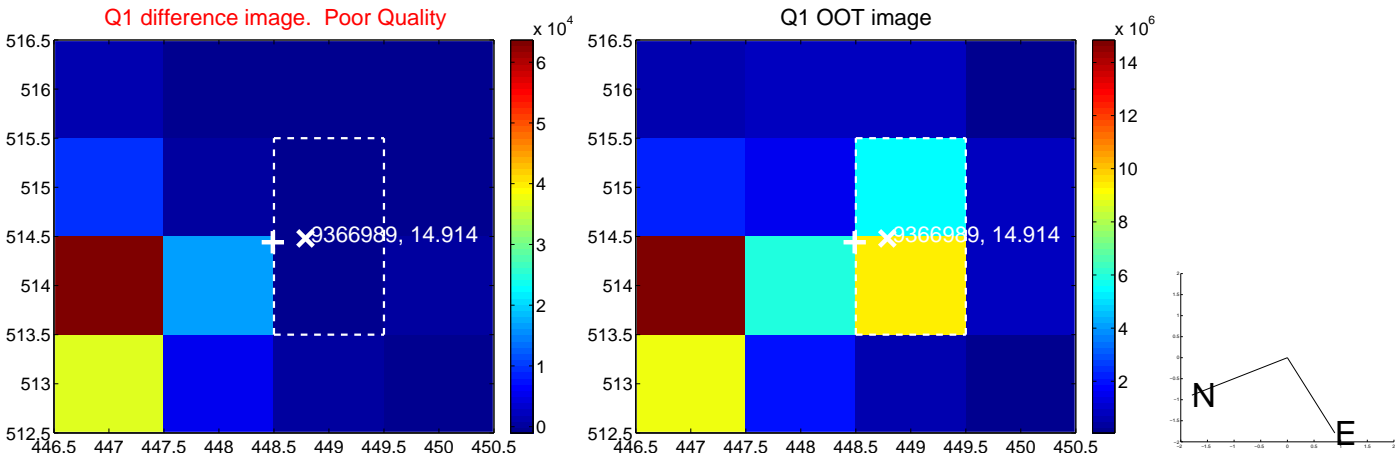


offset from photometric centroids

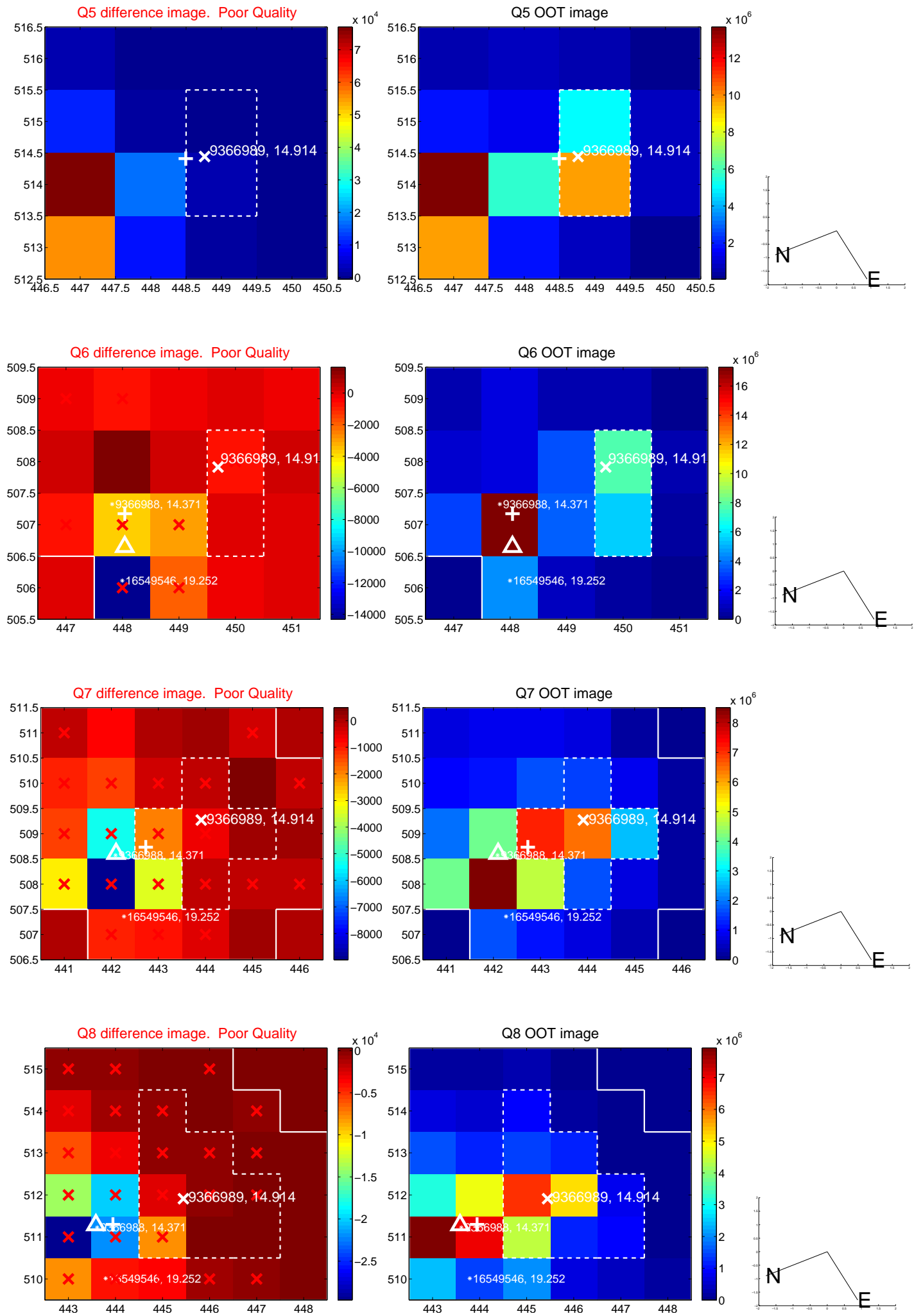


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

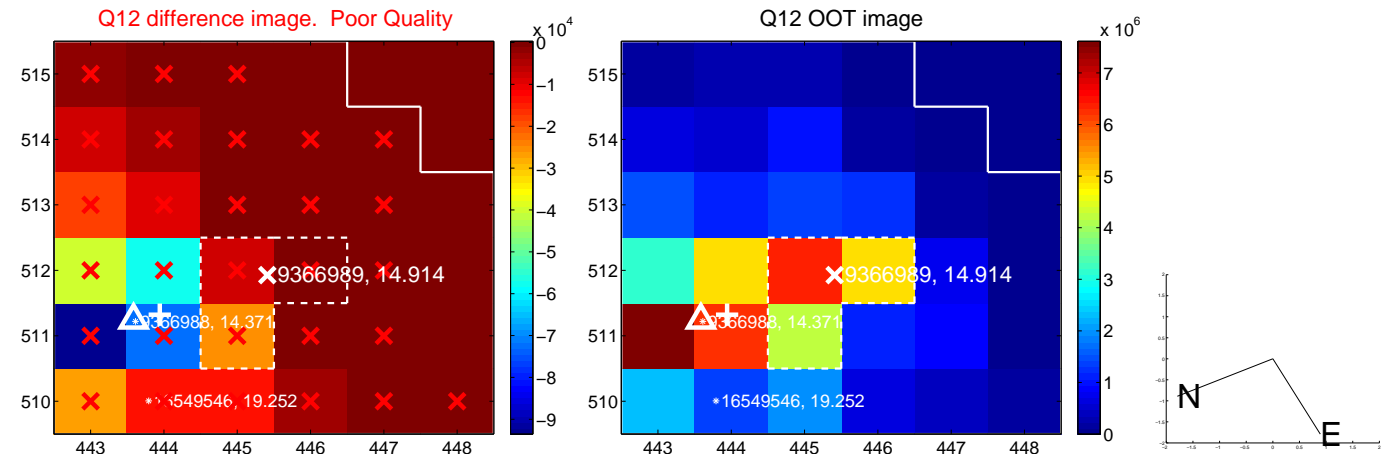
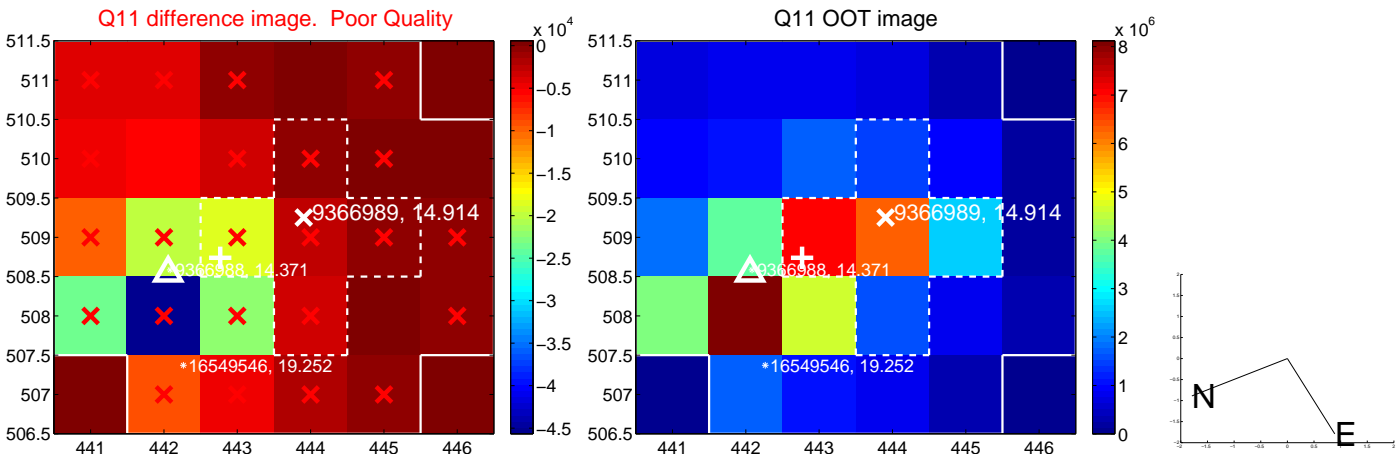
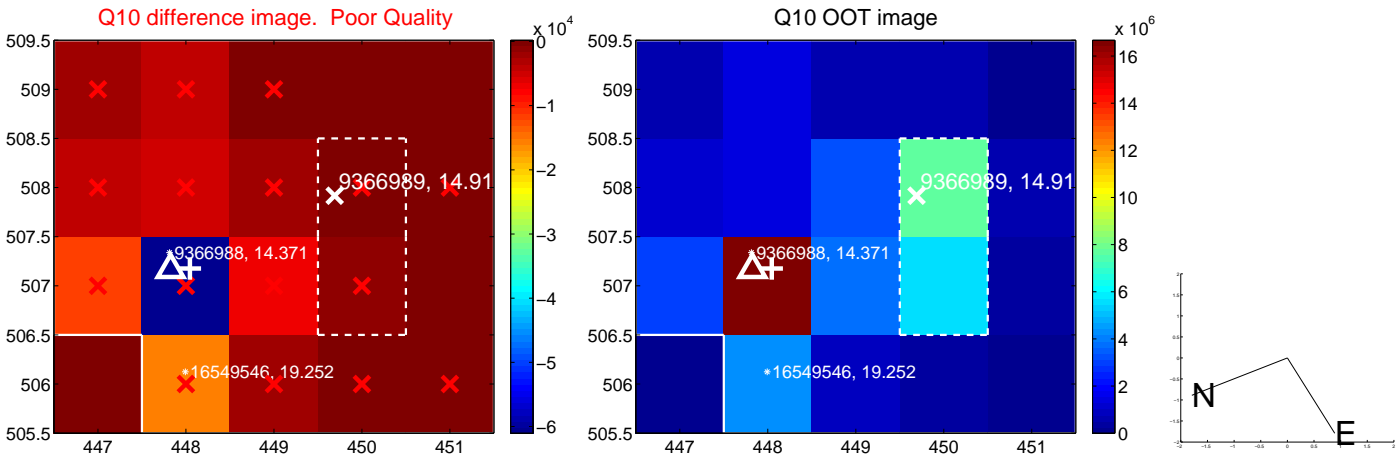
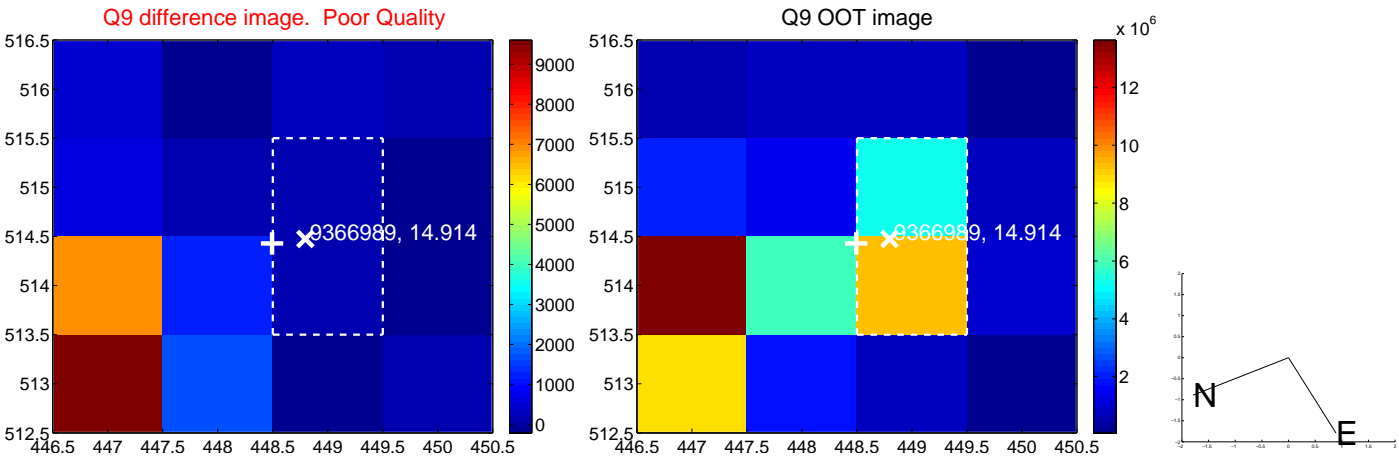
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



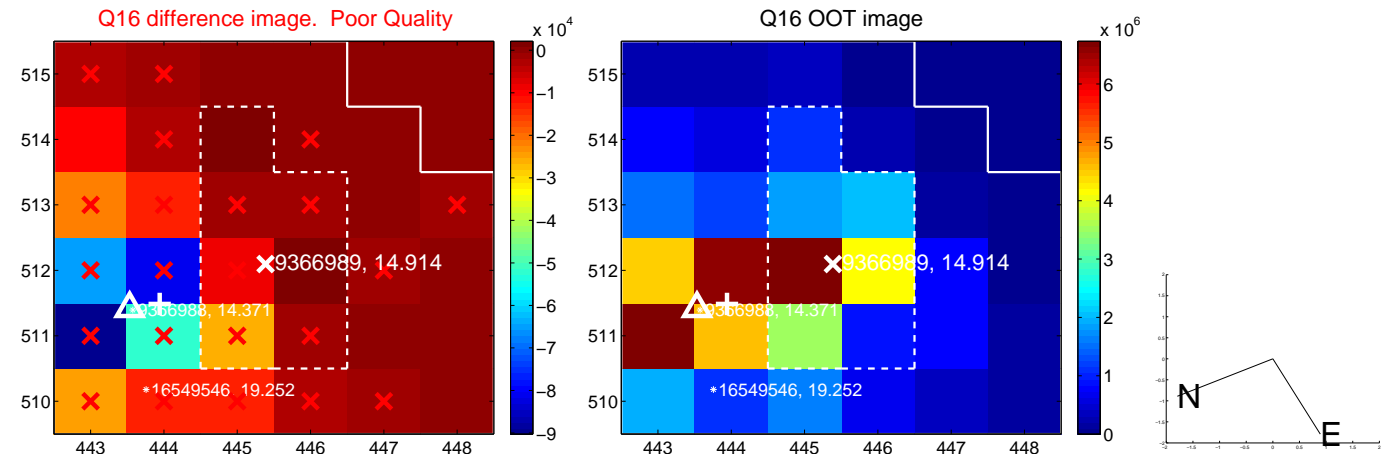
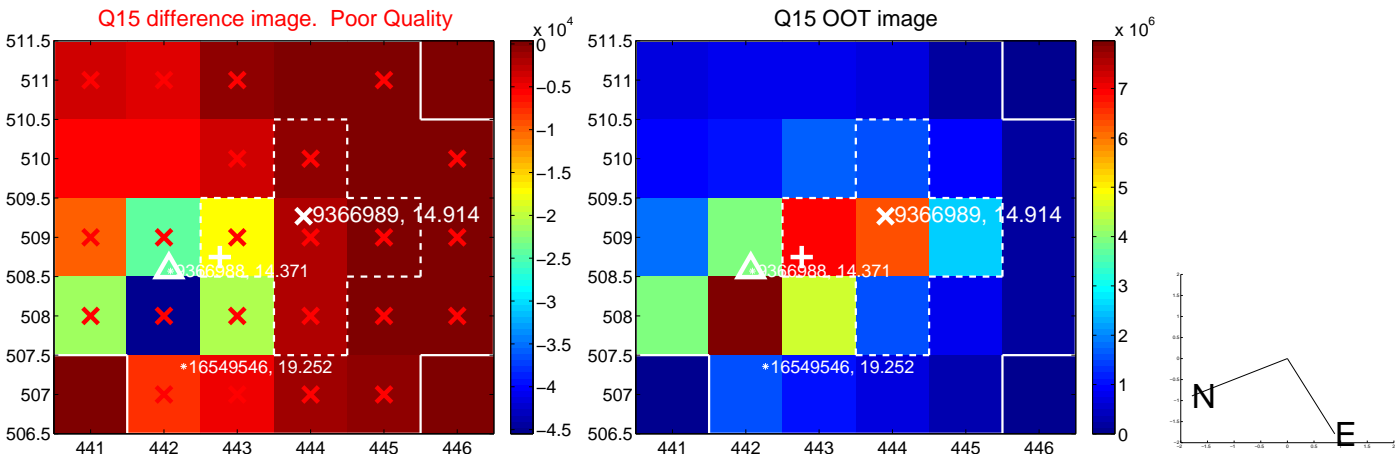
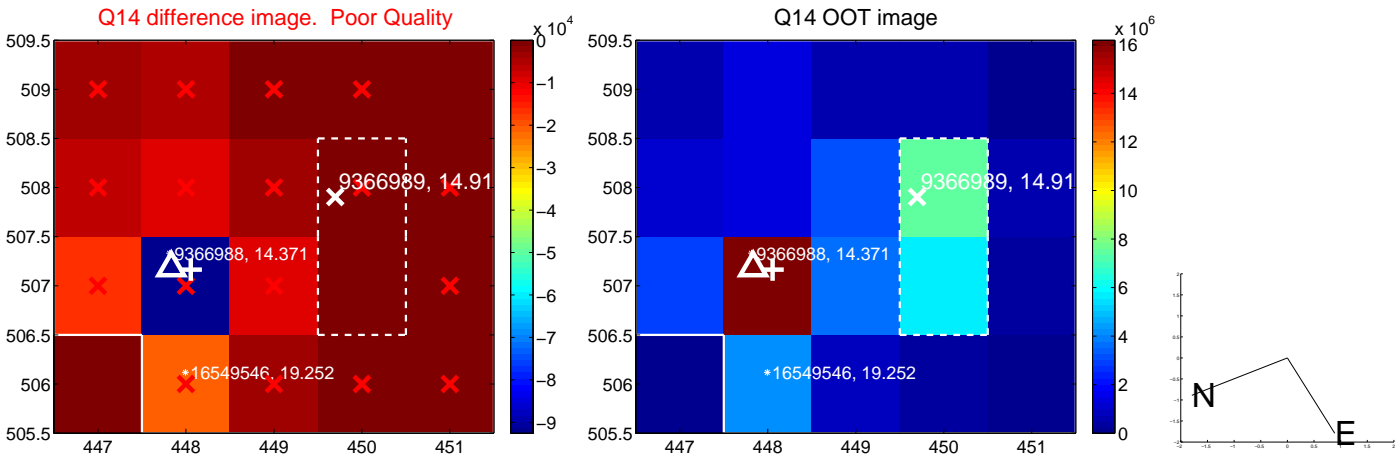
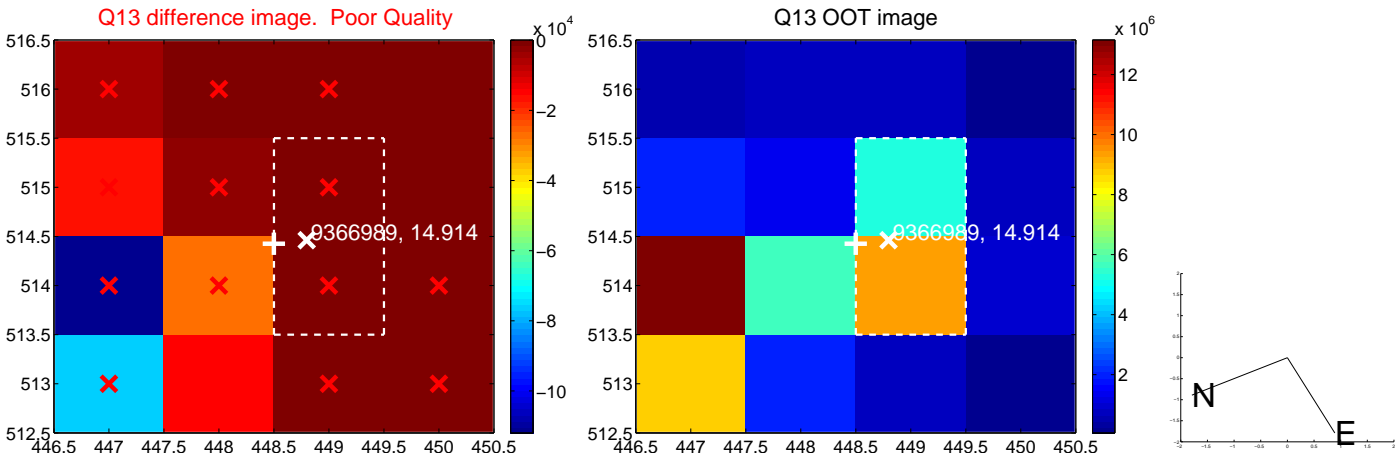
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



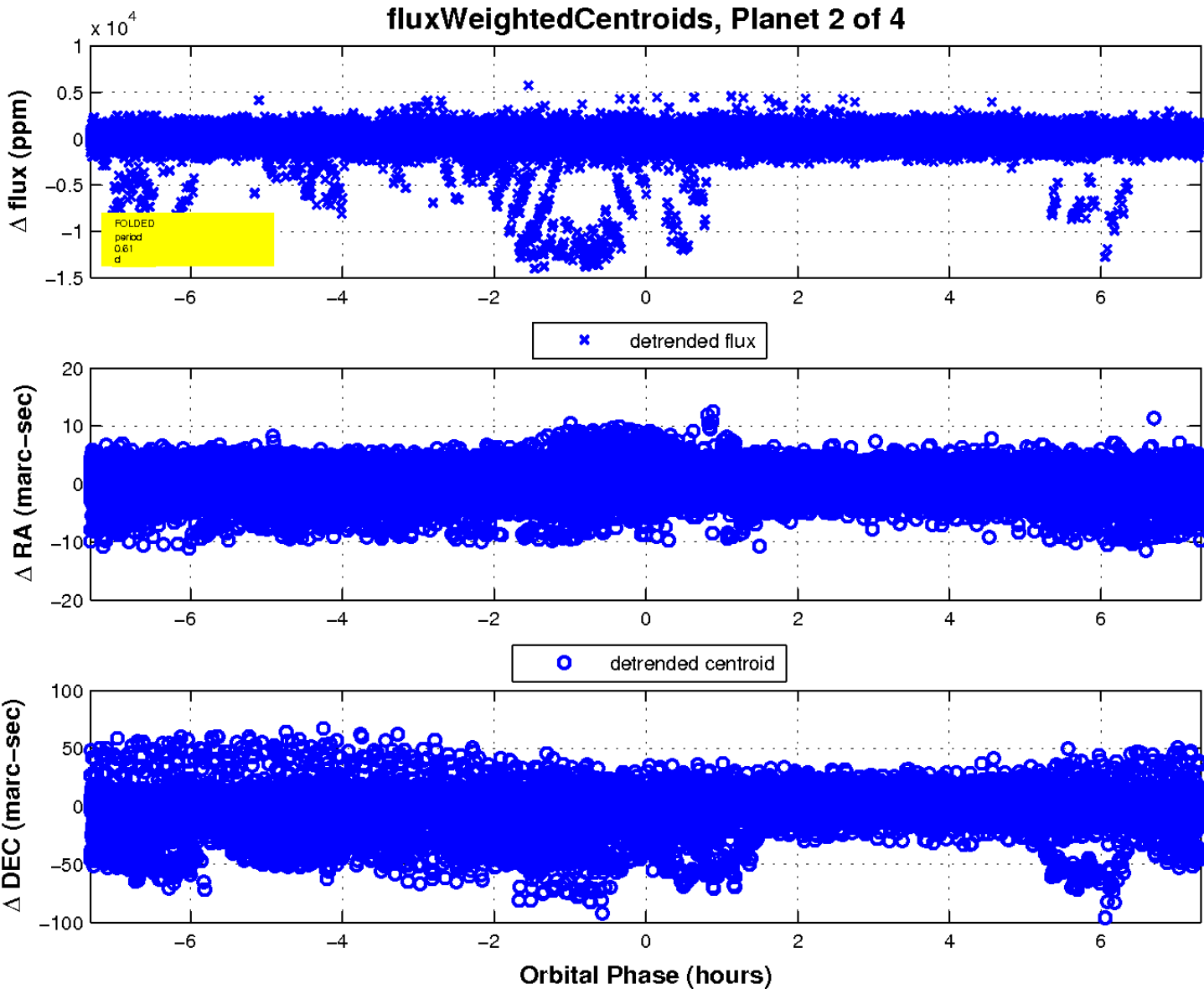
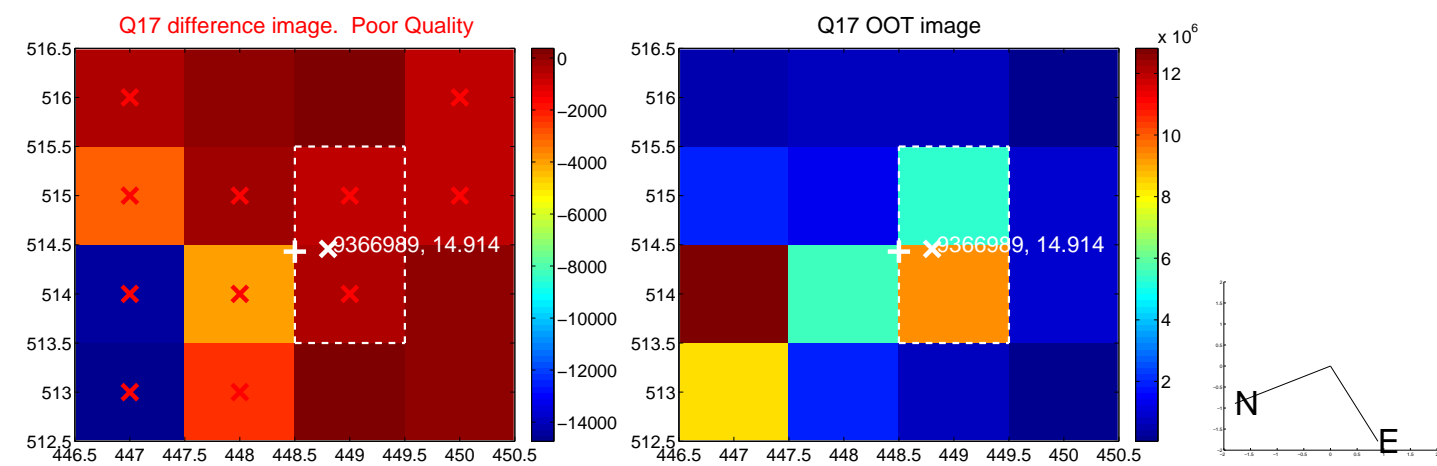
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

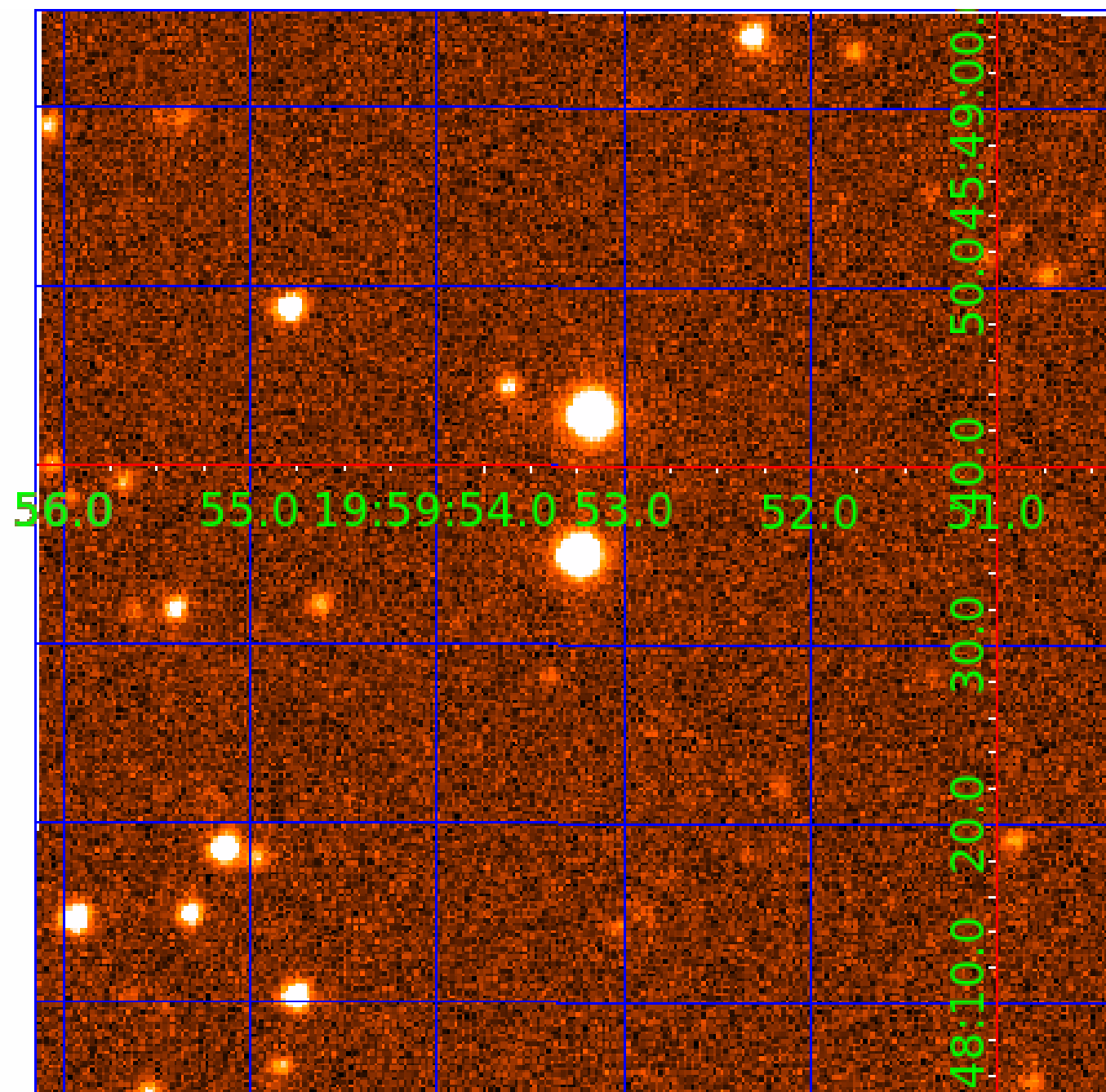


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 009366989

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009366989-01	OBS	1785.01	1.219020	132.104735	633.1	2.491	580.4	46.9	1.19	5833	4.90	2745.57
009366989-02	OBS	No	0.609682	132.071817	49.7	3.091	9.2	7.6	1.19	5833	0.87	6915.79
009366989-04	OBS	No	85.251562	185.063412	856.5	5.956	7.5	6.7	1.19	5833	4.98	9.53

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009366989-01	OBS	FP	0.00	0	1	1	1	MOD_SEC_ALT—MOD_ODDEVEN_DV—SEASONAL_DEPTH_ALT—CENT_RESOLVED_OFFSET—EPHEM_MATCH
009366989-02	OBS	FP	0.00	1	0	1	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—CENT_RESOLVED_OFFSET—HALO_GHOST
009366989-04	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_RESOLVED_OFFSET—HALO_GHOST

**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.

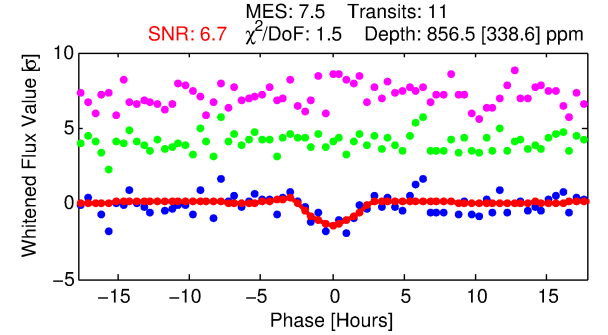
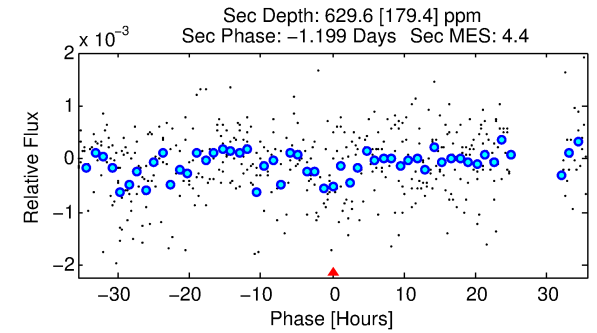
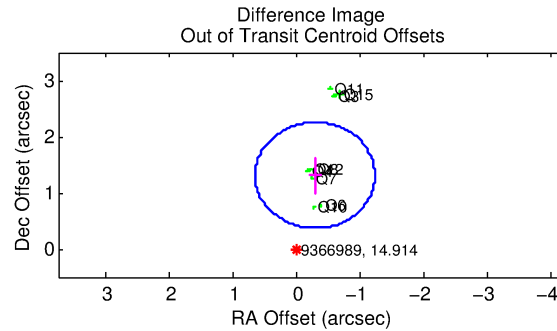
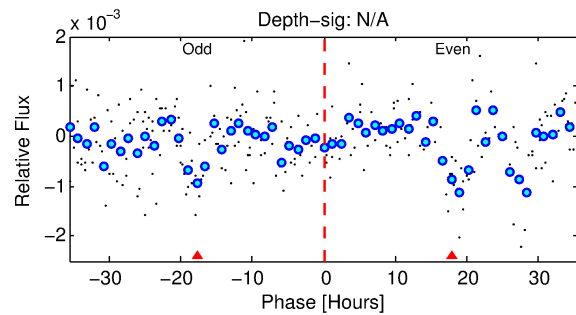
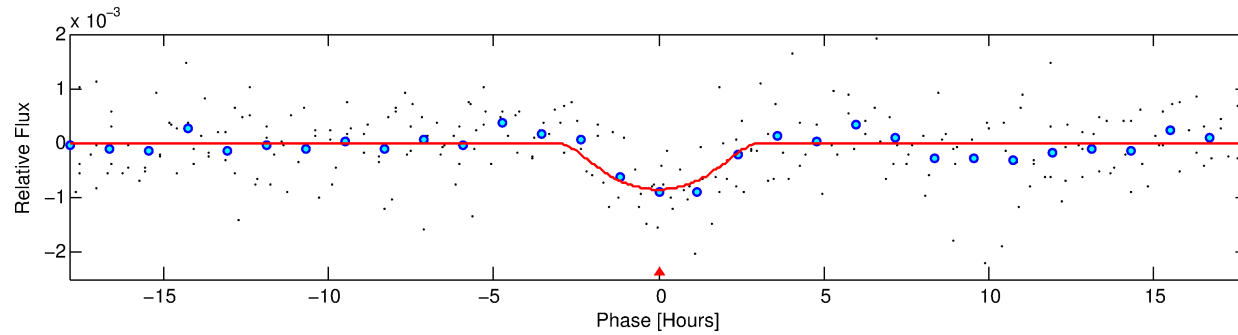
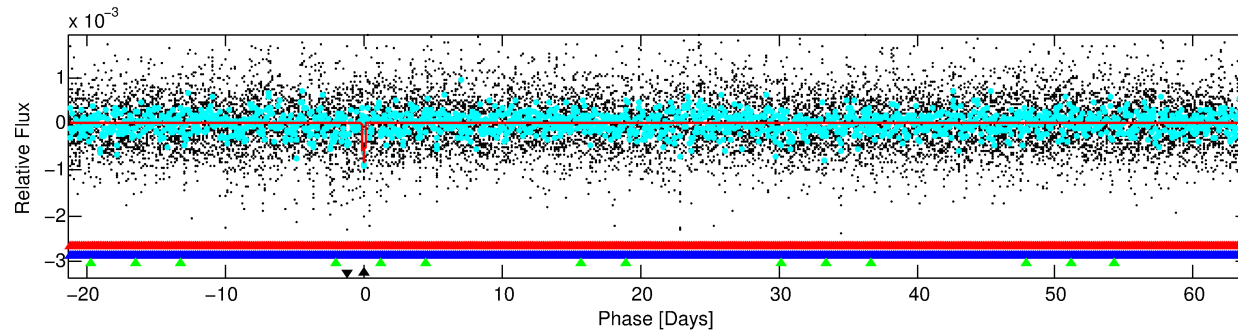
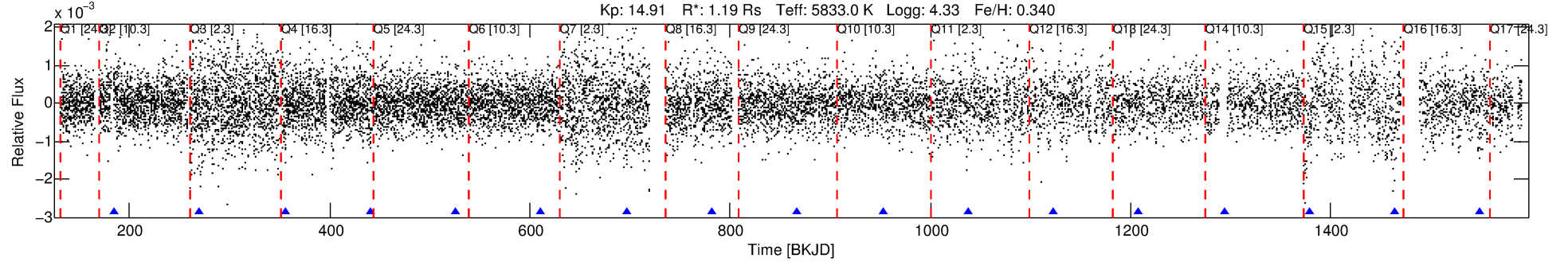
Ephemeris Match Information For 009366989-04

No Significant Match Found

# DV One-Page Summary

KIC: 9366989 Candidate: 4 of 4 Period: 85.252 d  
KOI: K01785 Corr: No Ephemeris Match

Kp: 14.91 R\*: 1.19 Rs Teff: 5833.0 K Logg: 4.33 Fe/H: 0.340



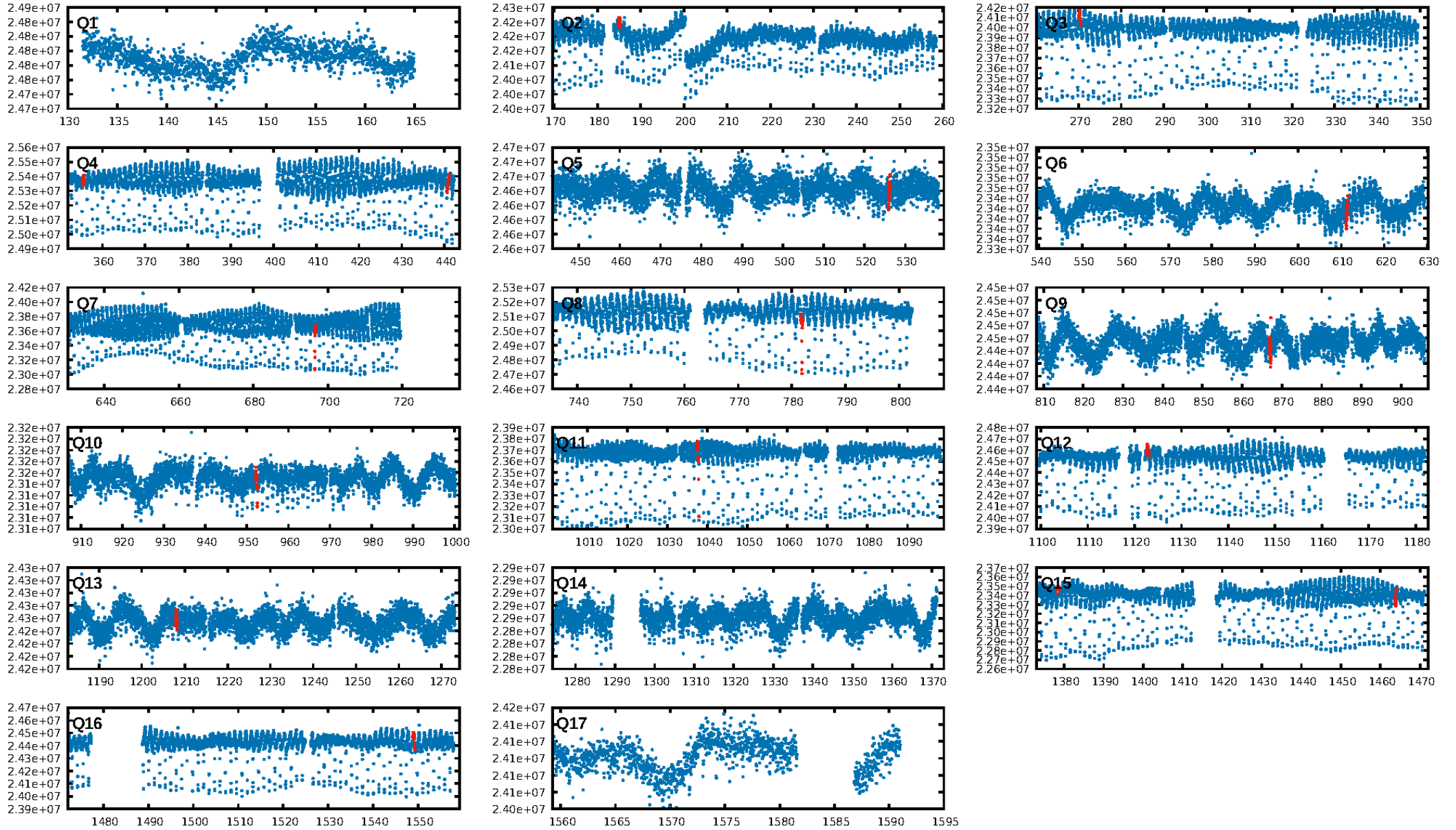
## DV Fit Results:

Period = 85.25156 [0.00242] d  
Epoch = 185.0634 [0.0207] BKJD  
Rp/R\* = 0.0383 [0.0430]  
a/R\* = 39.48 [25.22]  
b = 0.97 [0.10]  
Seff = 9.53 [3.72]  
Teq = 448 [44] K  
Rp = 4.98 [5.78] Re  
a = 0.3933 [0.0977] AU  
Ag = 2162.42 [4965.55] [0.44σ]  
Teff = 4723 [2682] K [1.59σ]

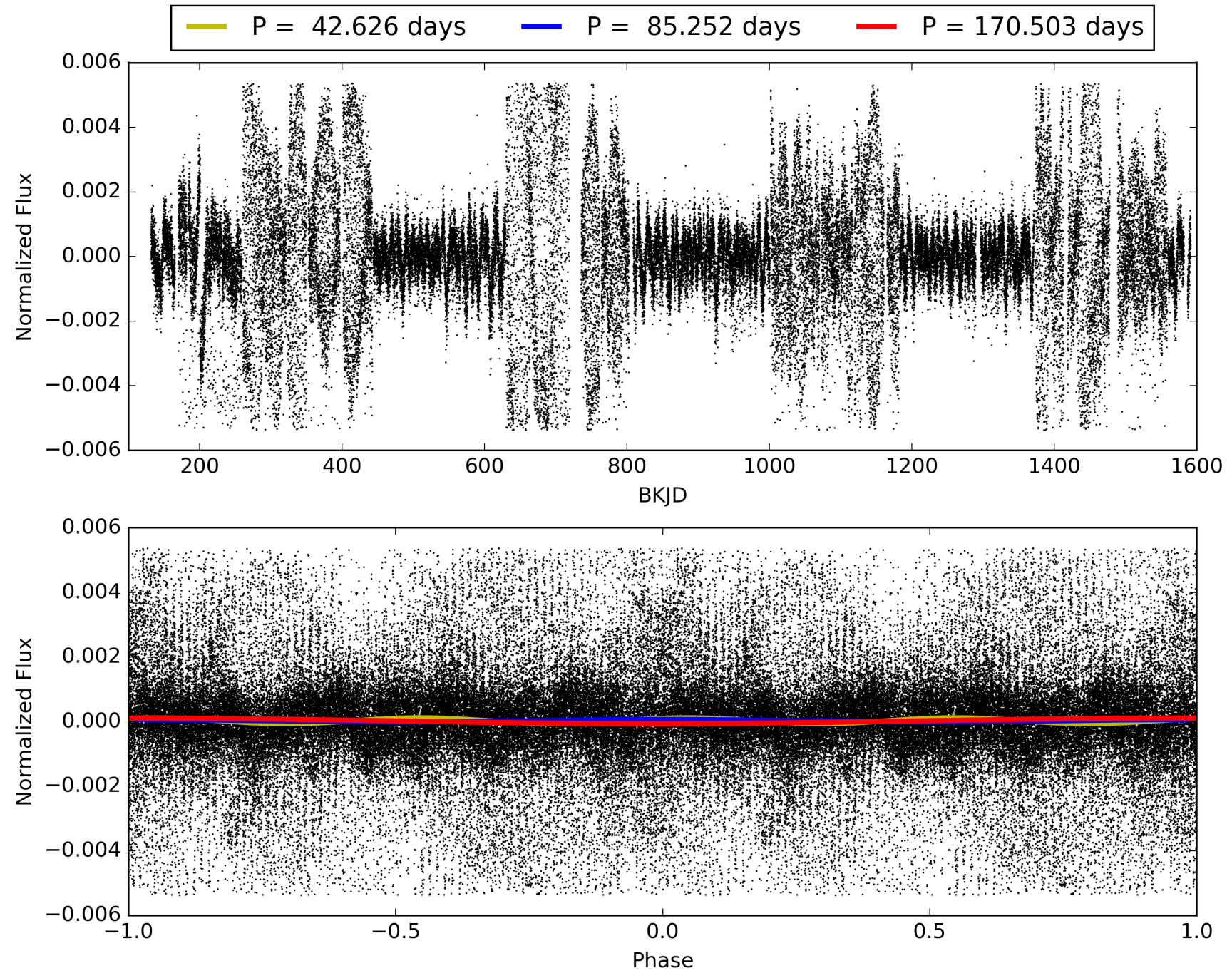
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [312.38σ]  
LongPeriod-sig: 100.0% [68.52σ]  
ModelChiSquare2-sig: 10.9%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [11/11]  
GhostDiagnostic-chr: -0.1887  
Centroid-sig: N/A  
Centroid-so: 4.935 arcsec [3.03σ]  
OotOffset-rm: 1.341 arcsec [4.27σ]  
KicOffset-rm: 7.839 arcsec [114.34σ]  
OotOffset-st: 2/4/3/0 [9]  
KicOffset-st: 2/4/3/0 [9]  
DiffImageQuality-fgm: 0.44 [4/9]  
DiffImageOverlap-fno: 0.00 [0/12]

# TCE 009366989-04, PDC Light Curves

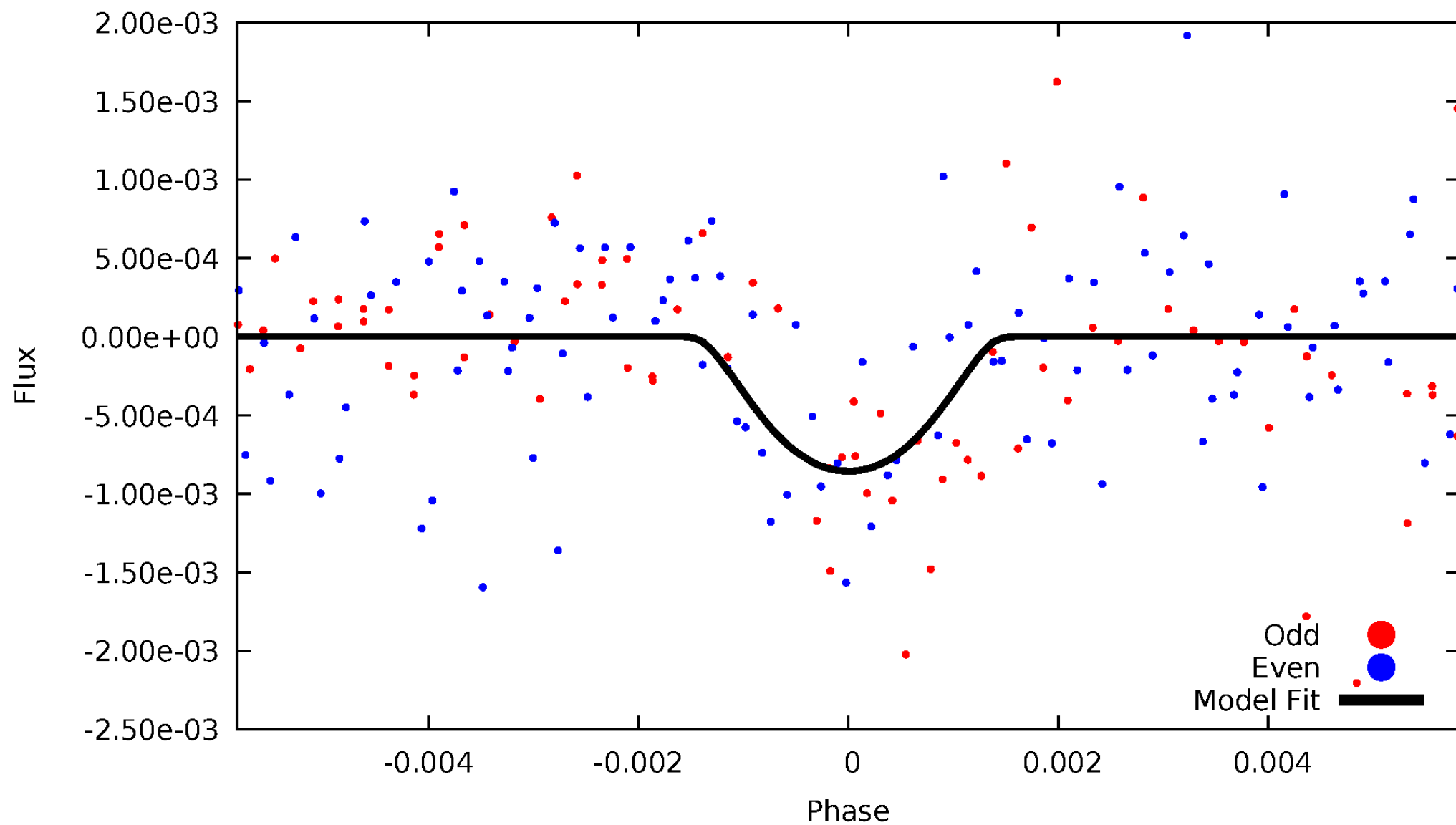


TCE 009366989-04



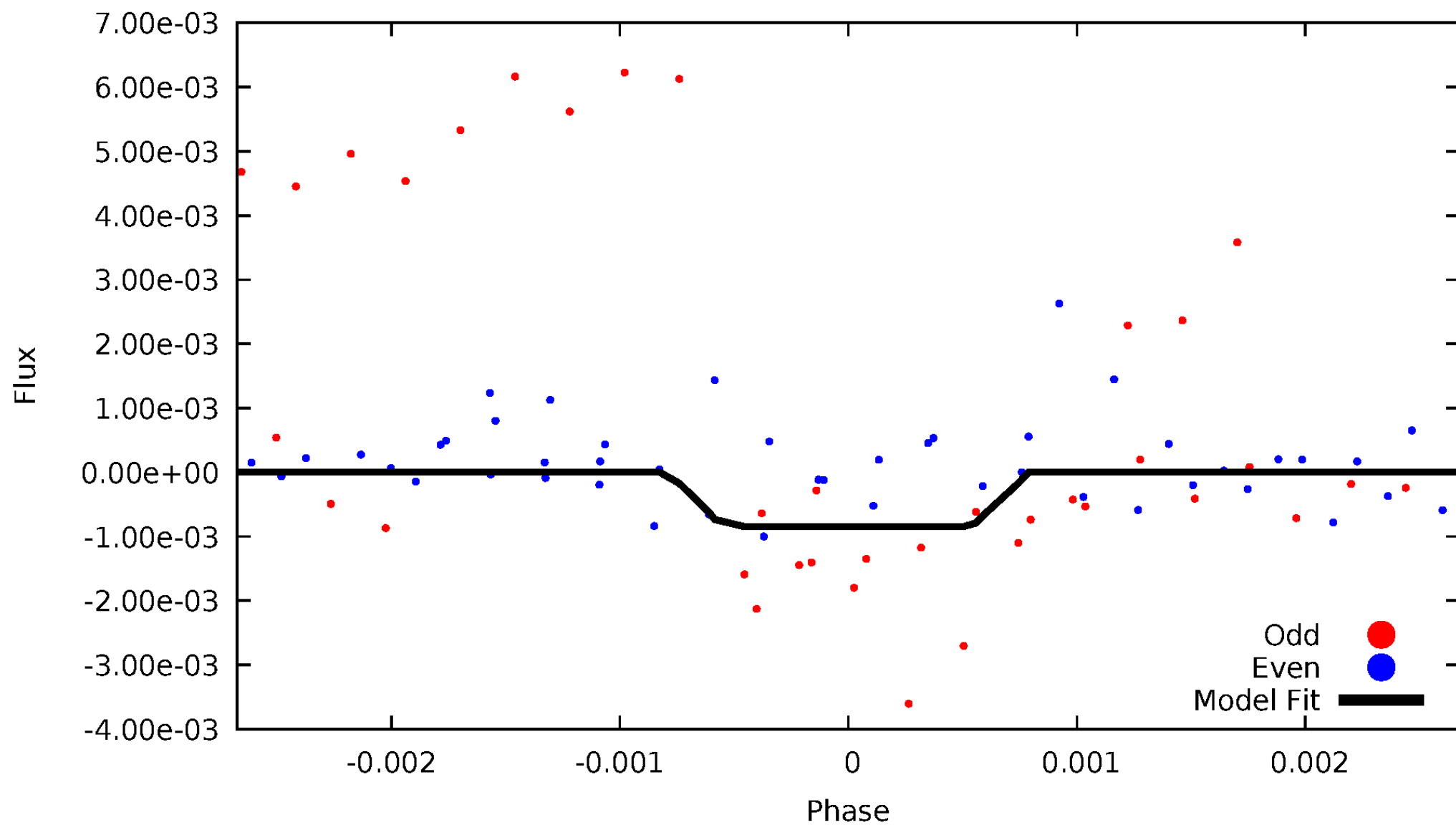
# DV Odd/Even

TCE 009366989-04



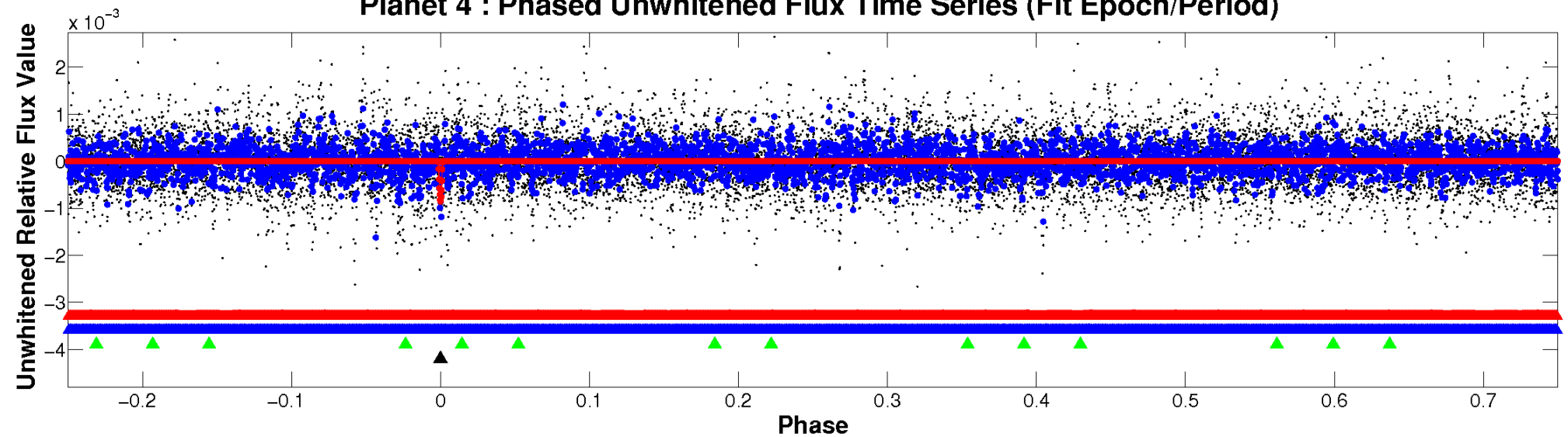
# ALT Odd/Even

TCE 009366989-04

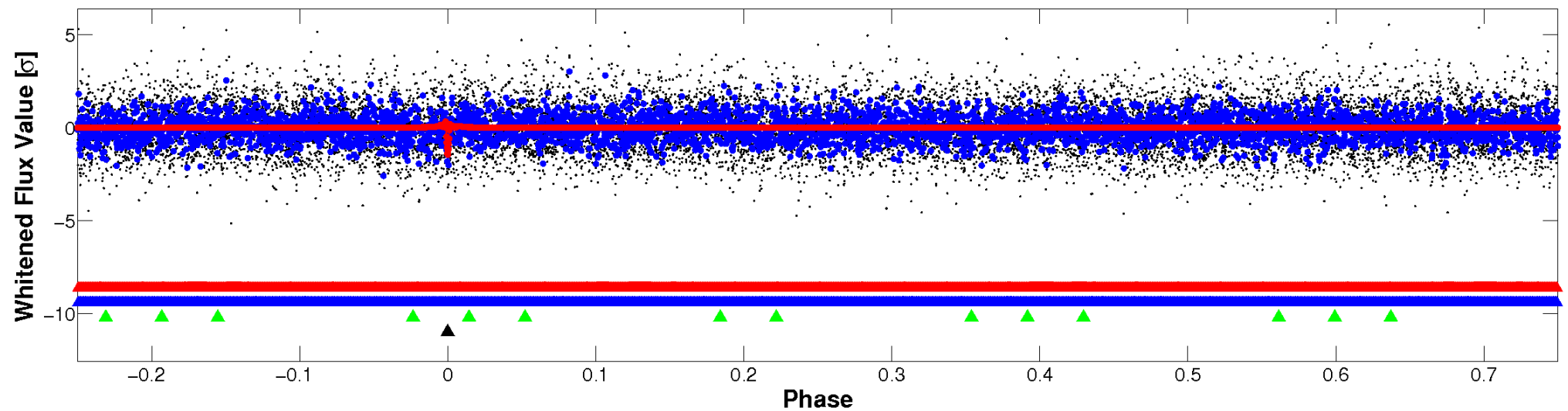


# Non-Whitened Vs. Whitened Light Curve

## Planet 4 : Phased Unwhitened Flux Time Series (Fit Epoch/Period)

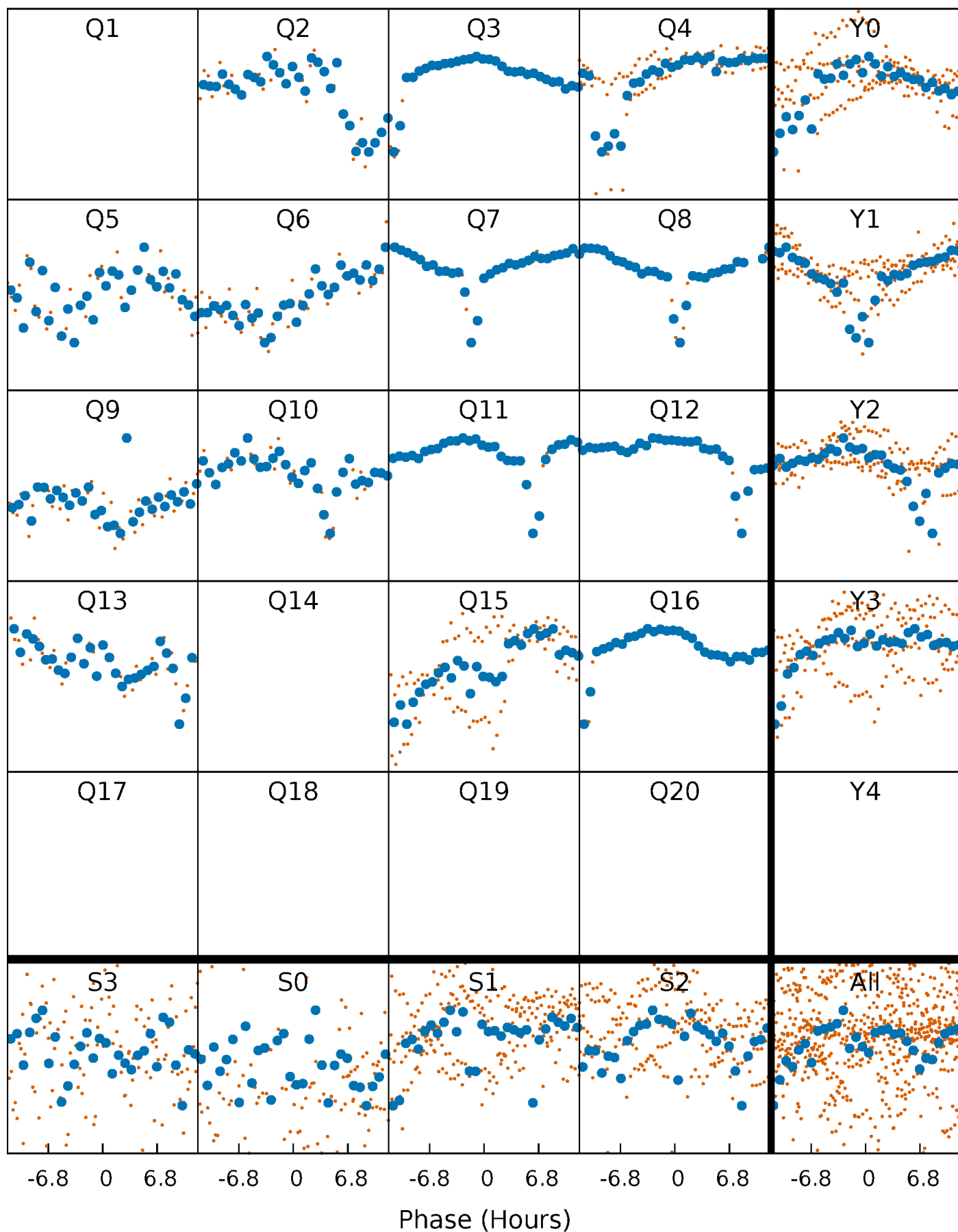


## Planet 4 : Phased Whitened Flux Time Series (Fit Epoch/Period)



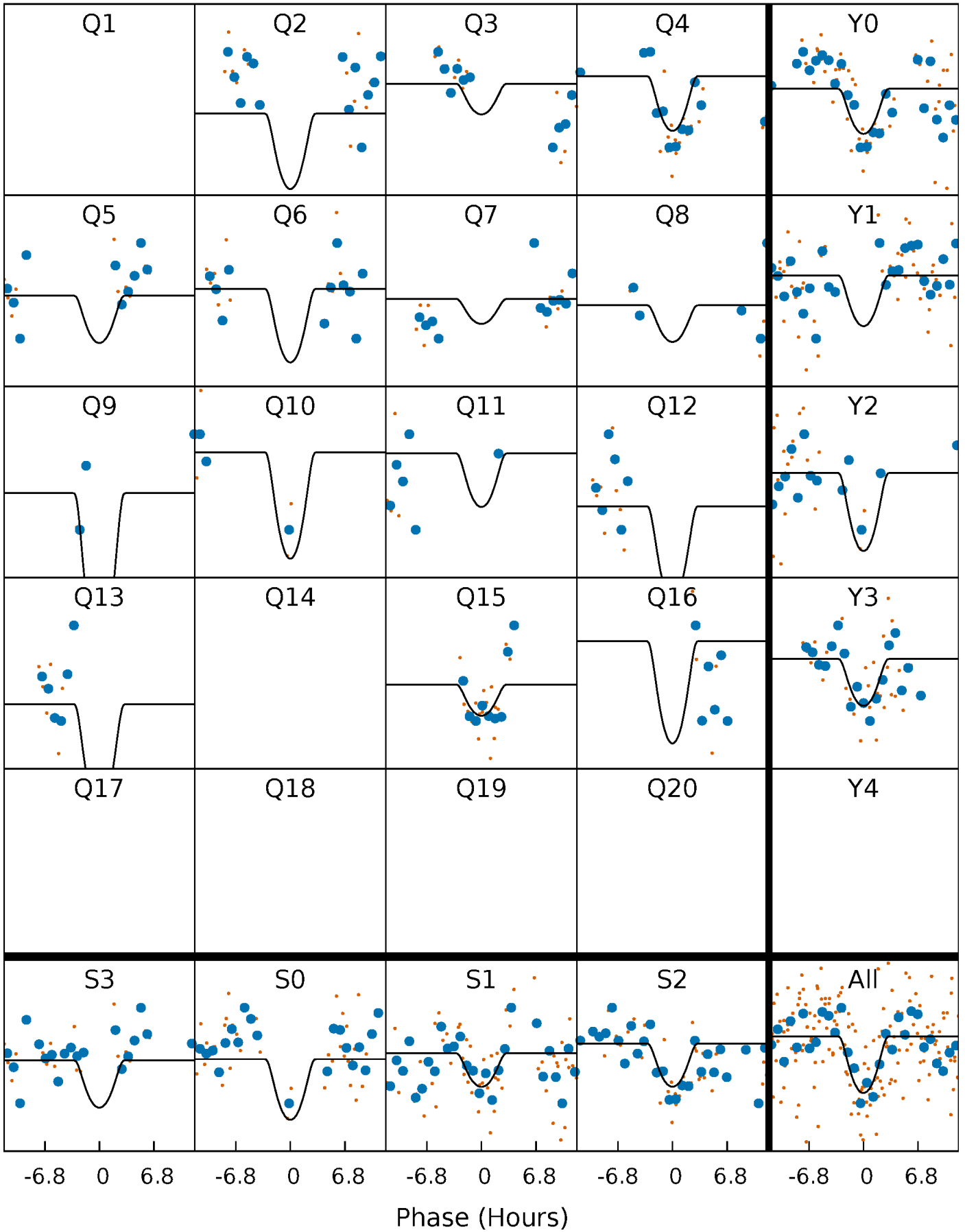
# PDC Quarter-Phased Transit Curves

TCE 009366989-04 P= 85.251562 Days  $T_0=185.063412$  (BKJD)



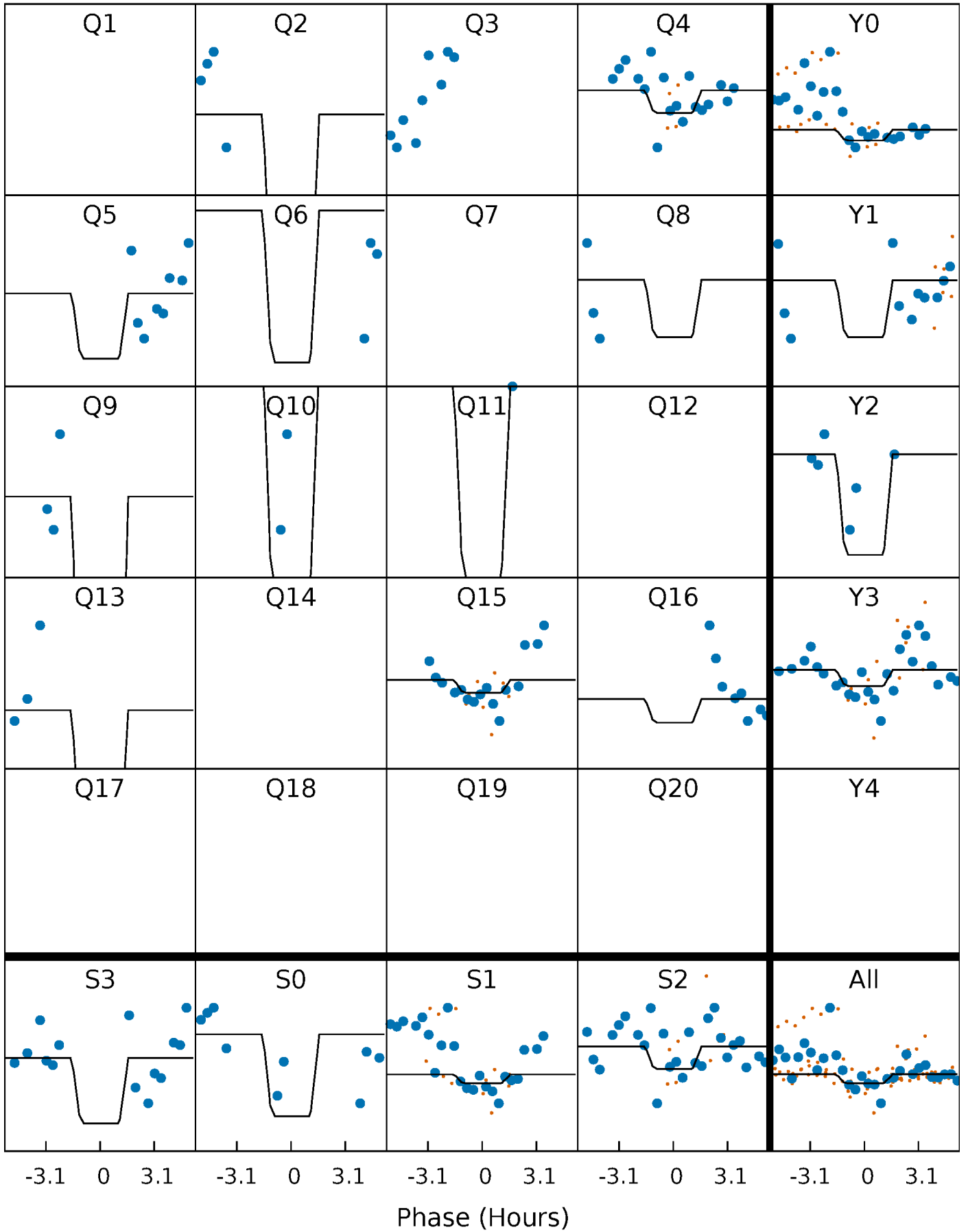
# DV Quarter-Phased Transit Curves

TCE 009366989-04   P= 85.251562 Days    $T_0=185.063412$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

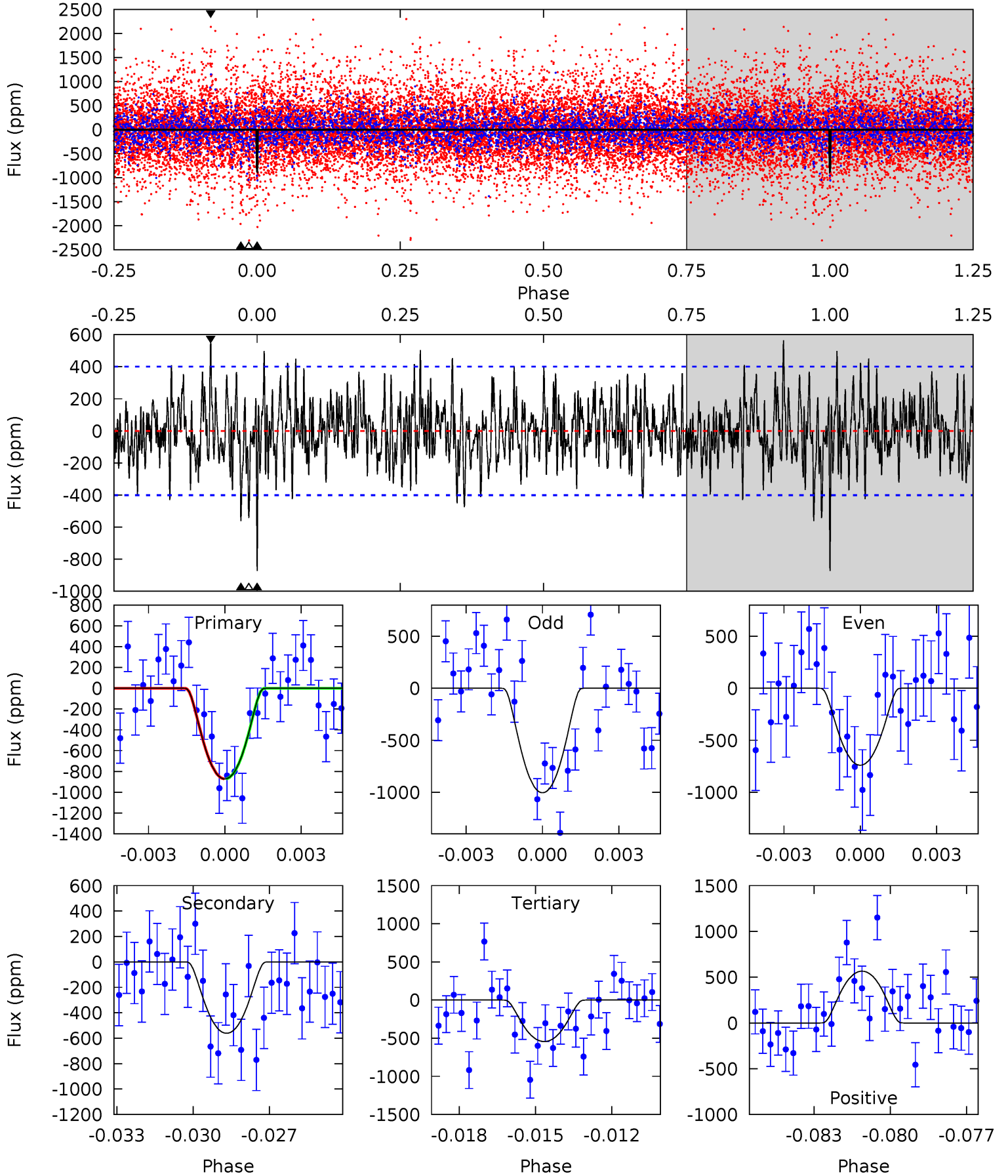
TCE 009366989-04   P= 85.252853 Days    $T_0=185.068093$  (BKJD)



# DV Model-Shift Uniqueness Test

009366989-04, P = 85.251562 Days, E = 99.811850 Days

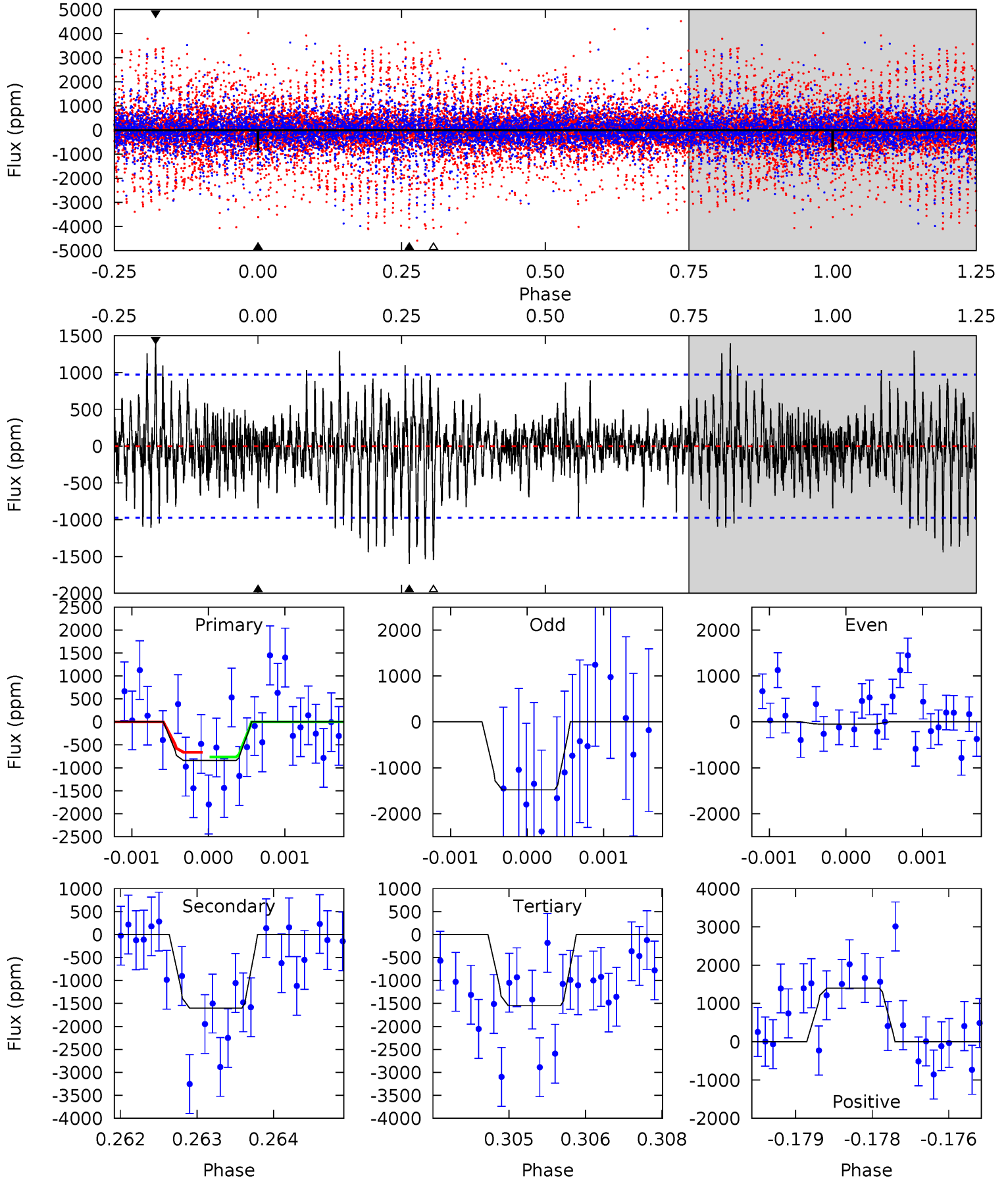
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
11.4	7.36	7.12	7.41	5.25	2.97	2.08	4.31	4.02	0.23	-0.05	1.71	0.08	0.39	0.01



# Alt Model-Shift Uniqueness Test

009366989-04, P = 85.252853 Days, E = 99.815240 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
4.66	8.86	8.56	7.74	5.39	3.19	1.85	-3.90	-3.07	0.30	1.12	2.92	1.71	0.47	0.29



### Stellar Parameters For KIC 009366989

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5833^{+162}_{-203}$	$4.333^{+0.124}_{-0.201}$	$0.340^{+0.100}_{-0.300}$	$1.192^{+0.348}_{-0.188}$	$1.115^{+0.122}_{-0.136}$	$0.927^{+0.562}_{-0.474}$
	+3%/-3%	+3%/-5%	+29%/-88%	+29%/-16%	+11%/-12%	+61%/-51%
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 009366989-04 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-561 \pm 76$	$6.22^{+5.83}_{-3.83}$	$631^{+50}_{-39}$	$4294^{+2251}_{-814}$	$1174^{+7168}_{-850}$
Alt.	$-1599 \pm 181$	$5.86^{+5.34}_{-3.85}$	$629^{+48}_{-37}$	$5510^{+4591}_{-1248}$	$3836^{+27981}_{-2726}$

$T_{\text{max}}$  = 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

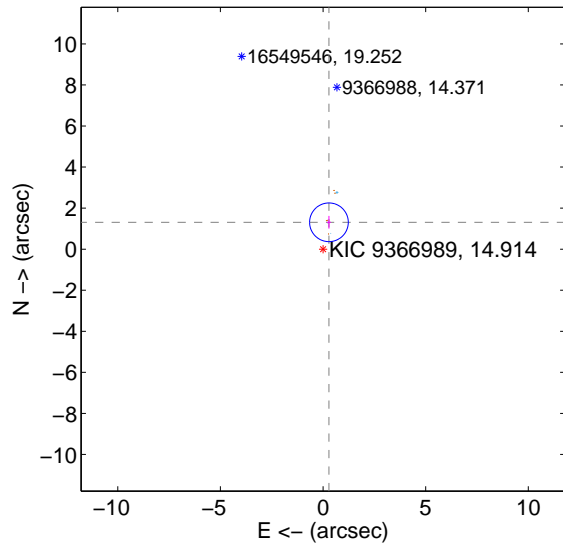
Supplemental centroid analysis for 009366989-04. Kepler magnitude: 14.91. Transit SNR 6.67

There are 4 quarters with good PRF difference image offsets

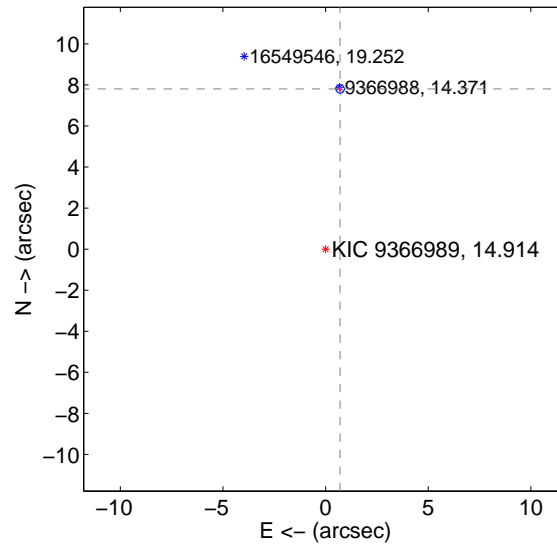
The OOT PRF centroid is offset from the target star catalog position by about 4.94 arcsec so the offset from difference PRF-fit to OOT-fit may be invalid.

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.341 \pm 0.314$	4.27	$-0.288 \pm 0.092$	$1.309 \pm 0.310$
PRF-fit source offset from KIC position	$7.839 \pm 0.069$	114.34	$-0.708 \pm 0.070$	$7.807 \pm 0.069$
photometric centroid source offset	$4.93 \pm 1.63$	3.03	$-0.42 \pm 0.66$	$4.92 \pm 1.63$

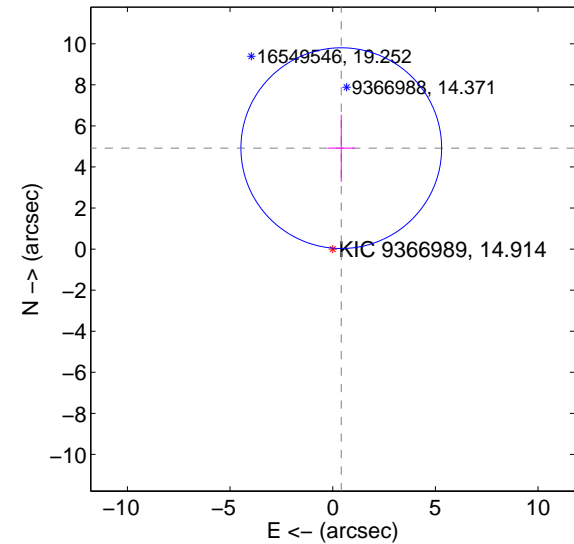
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position



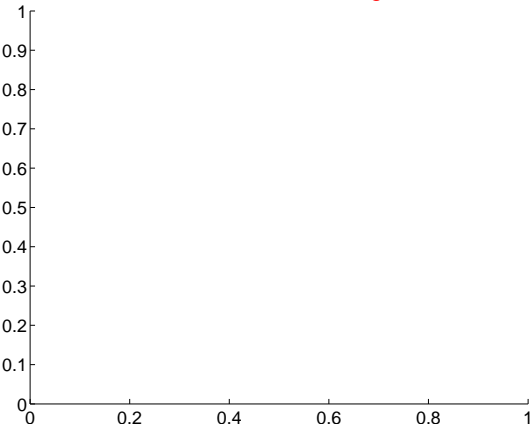
offset from photometric centroids



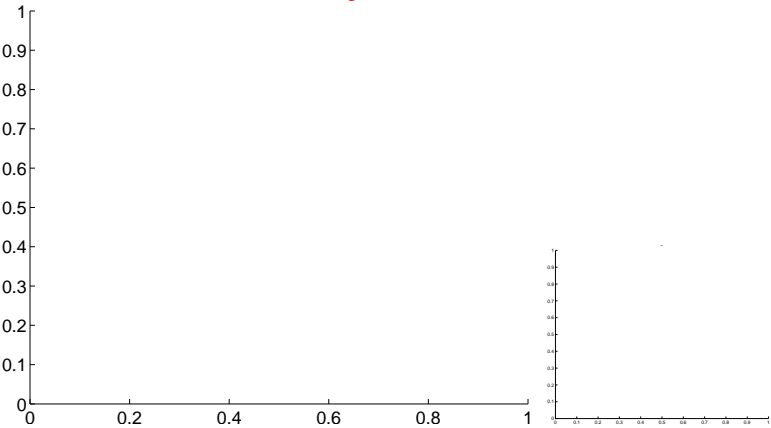
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

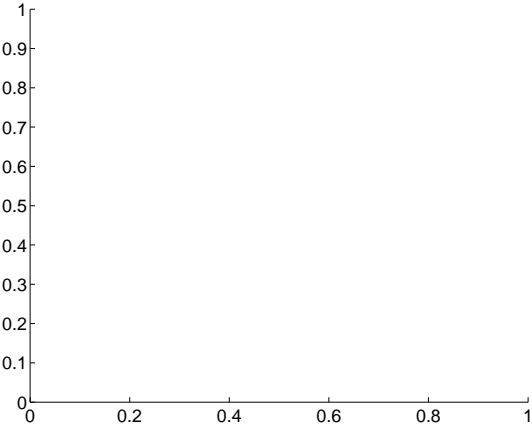
Q1 no difference image



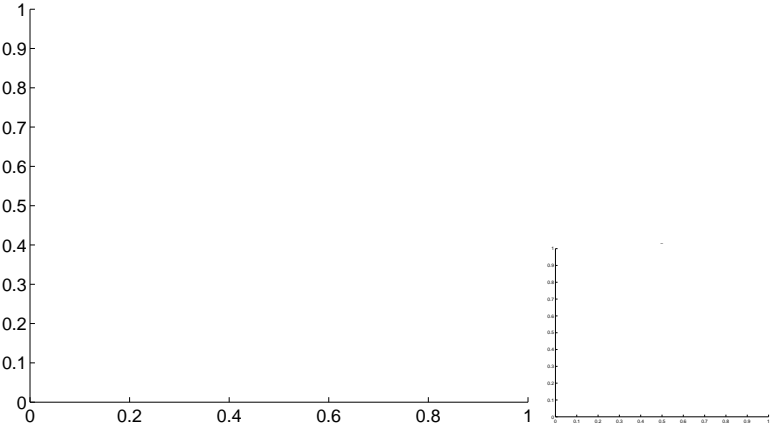
Q1 no OOT image



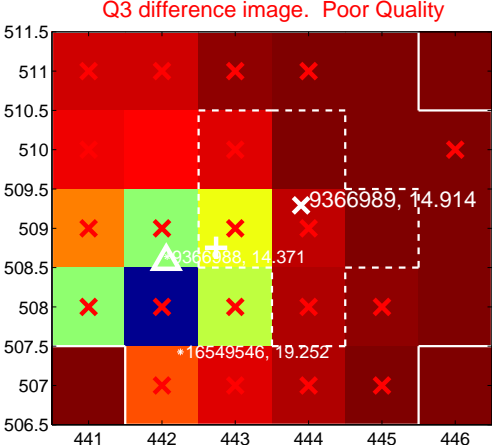
Q2 no difference image



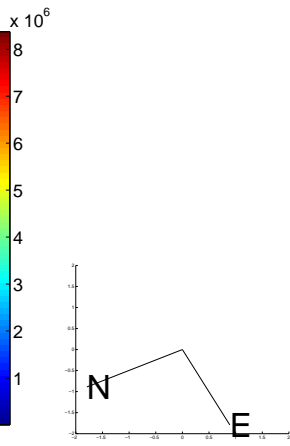
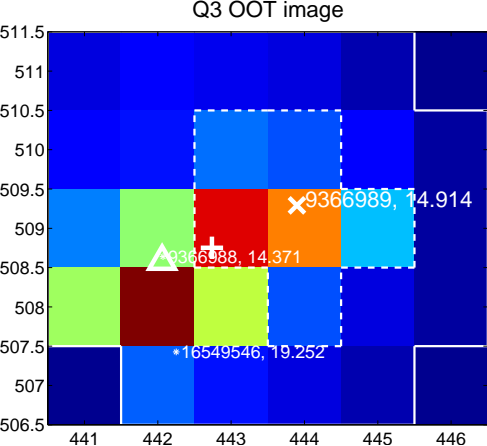
Q2 no OOT image



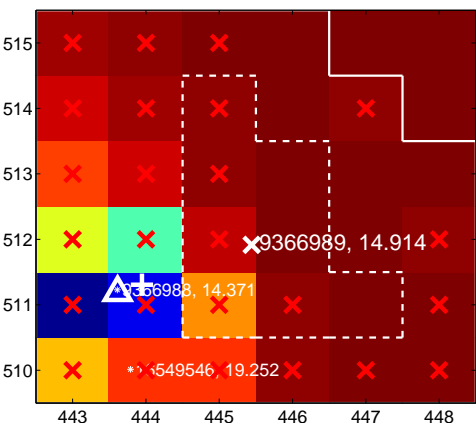
Q3 difference image. Poor Quality



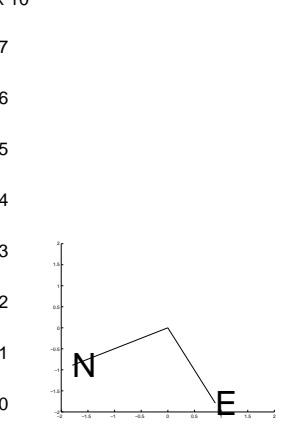
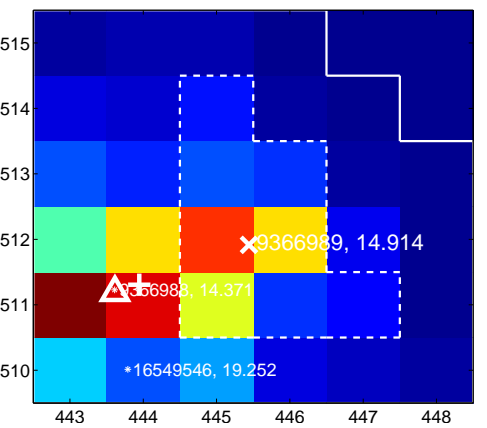
Q3 OOT image



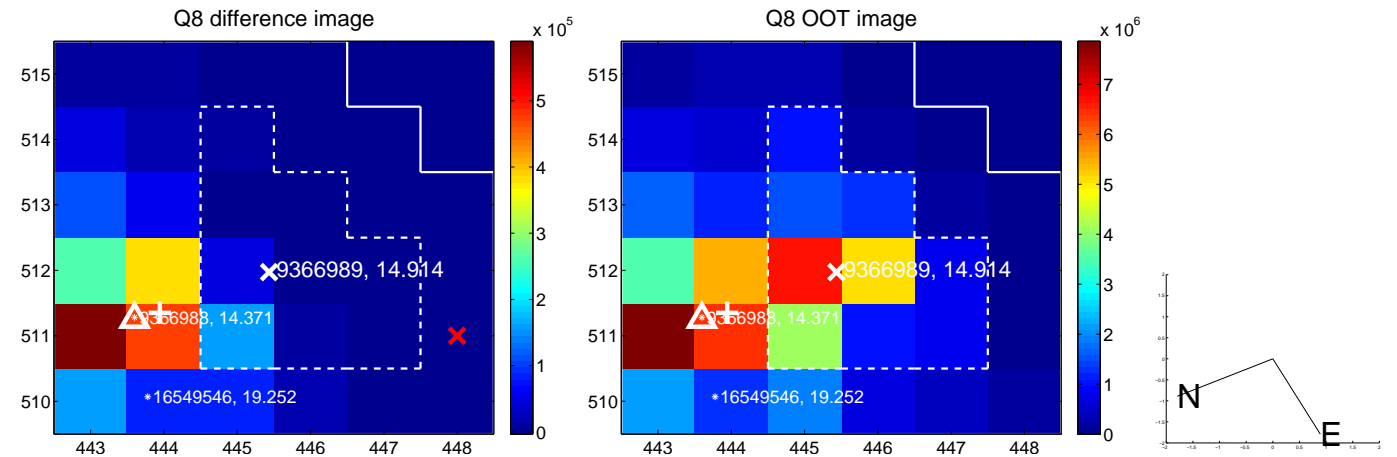
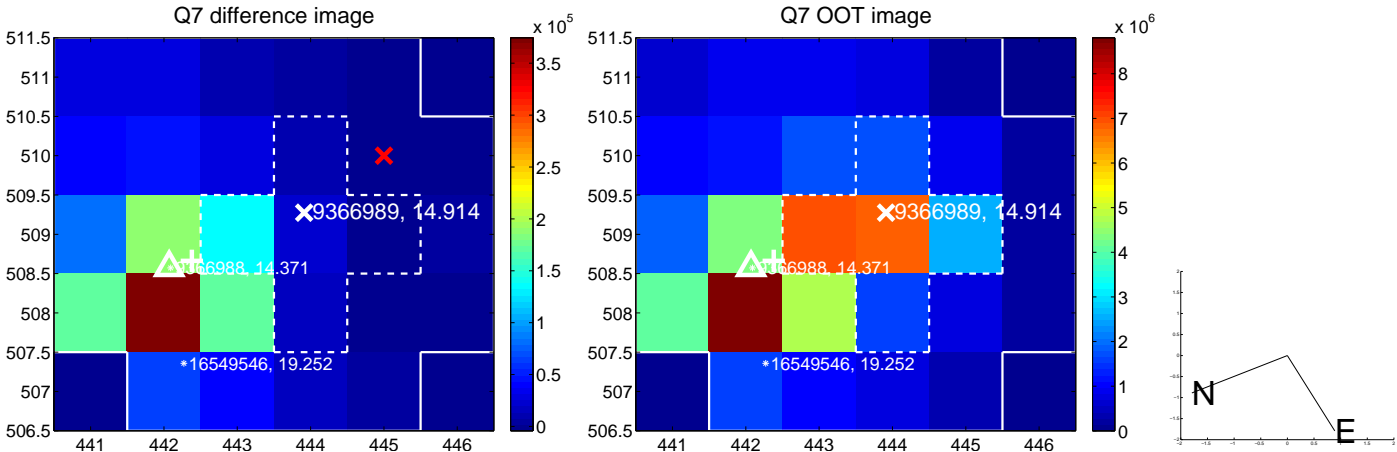
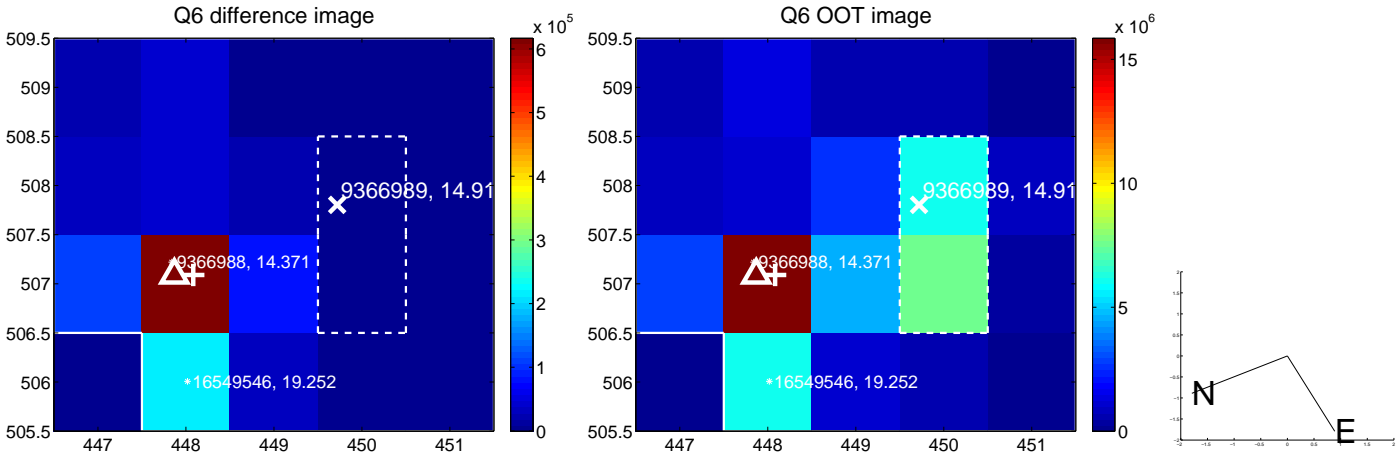
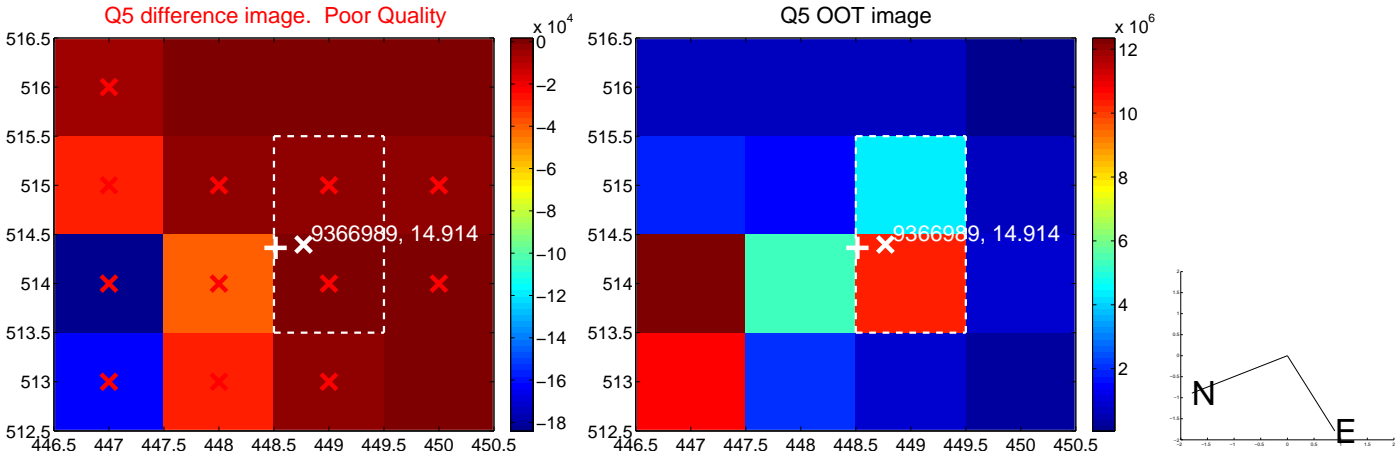
Q4 difference image. Poor Quality



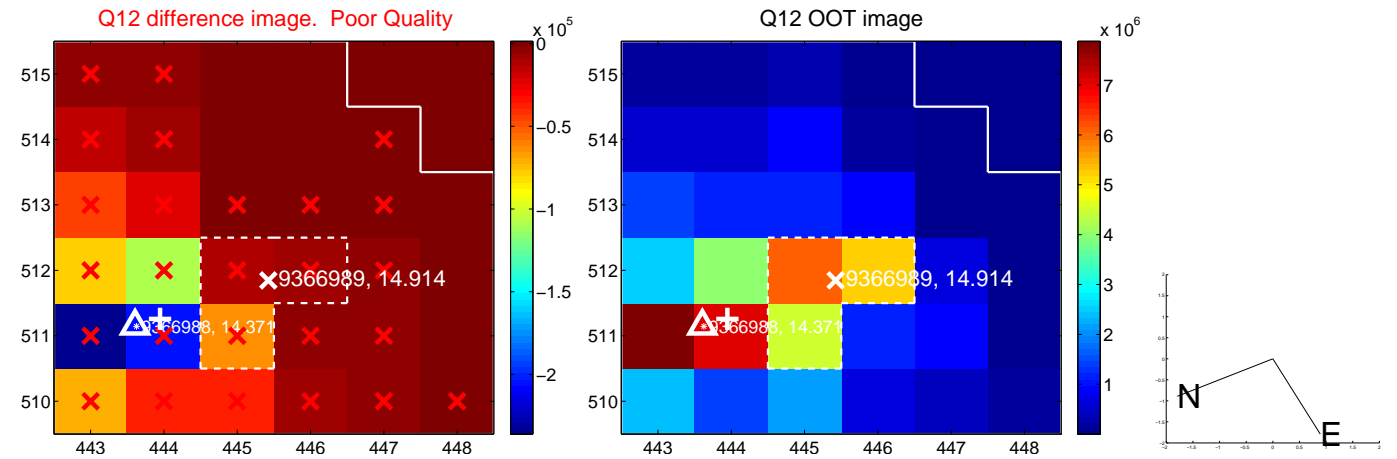
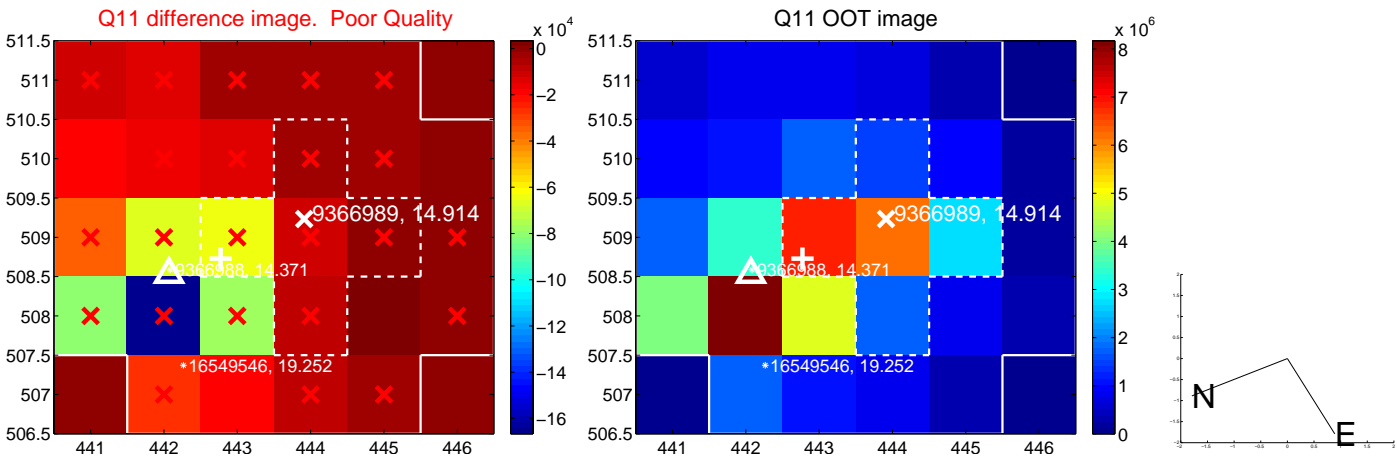
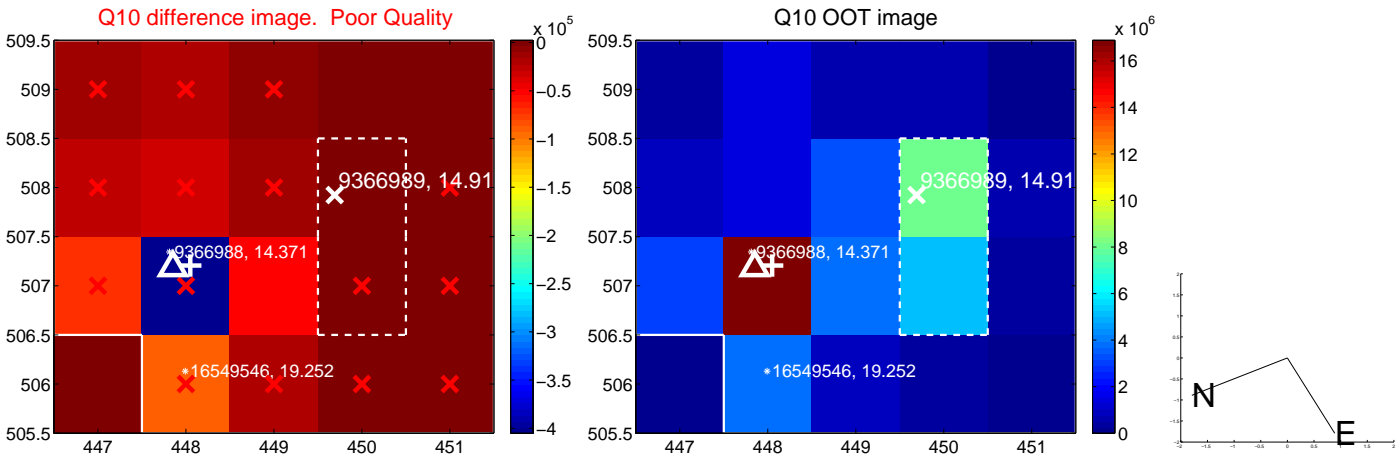
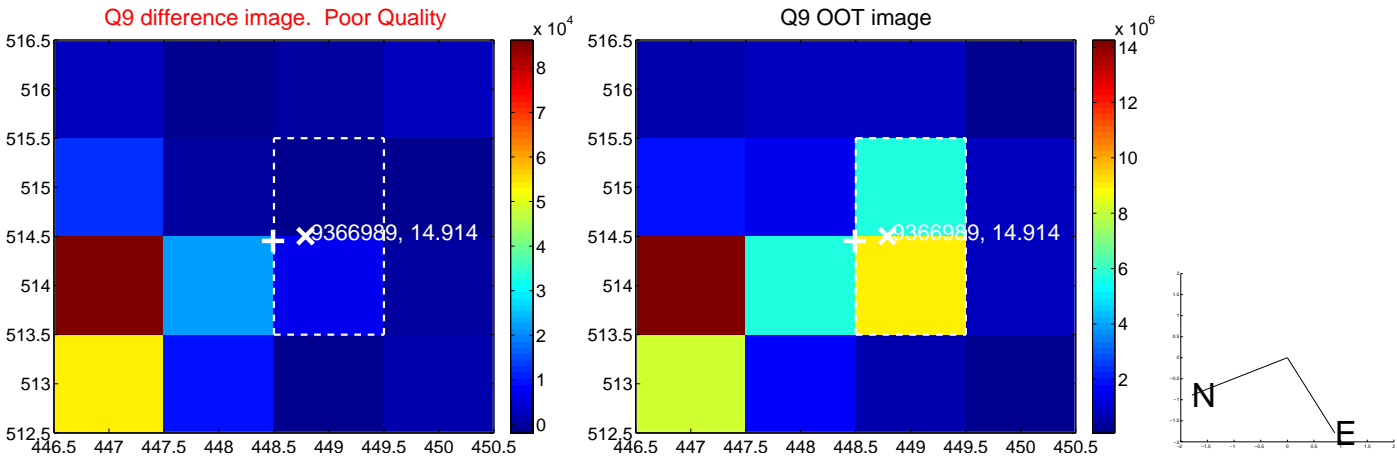
Q4 OOT image



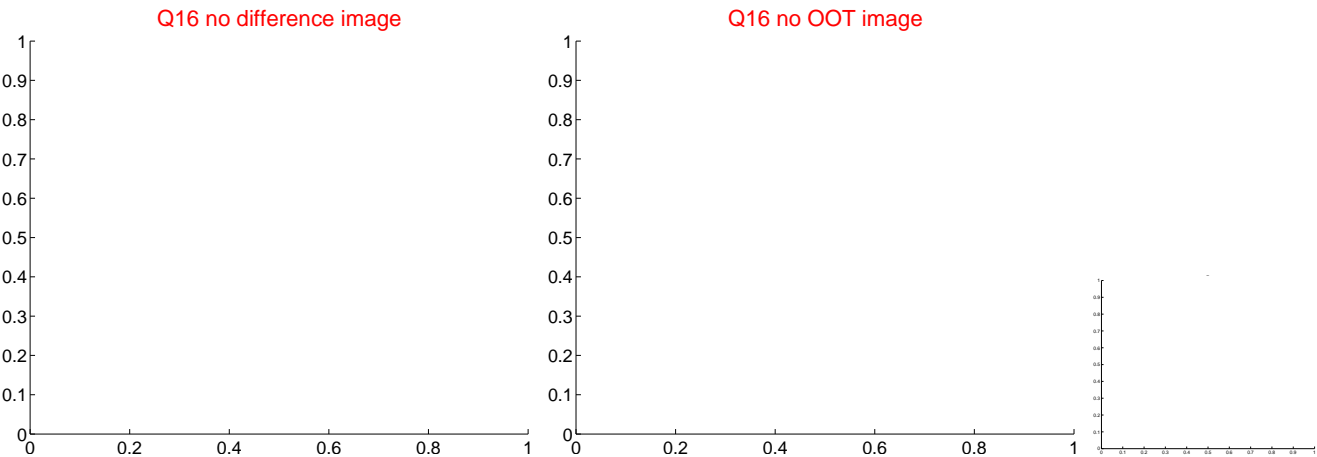
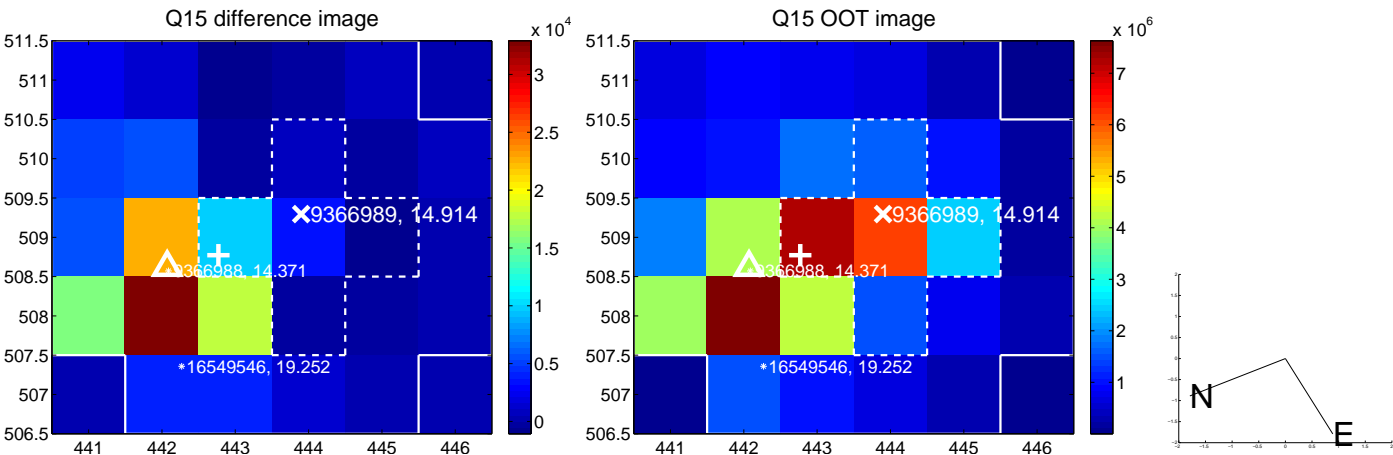
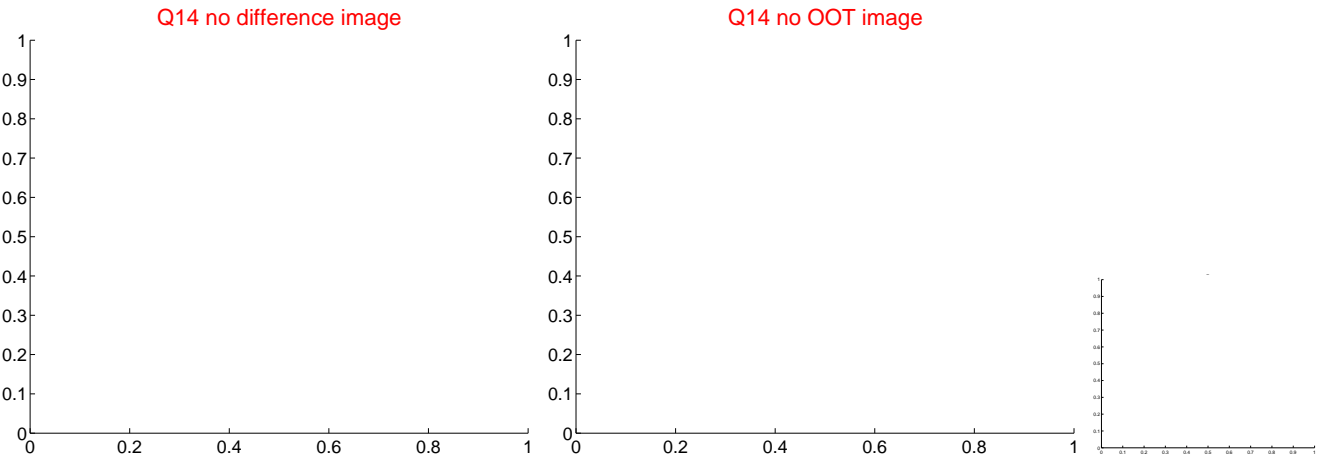
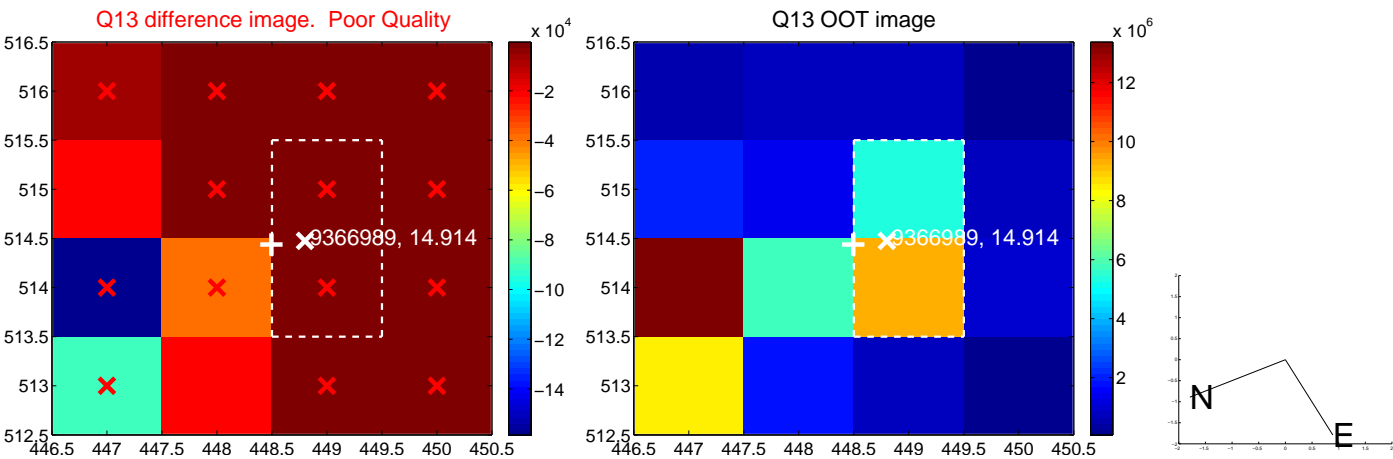
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



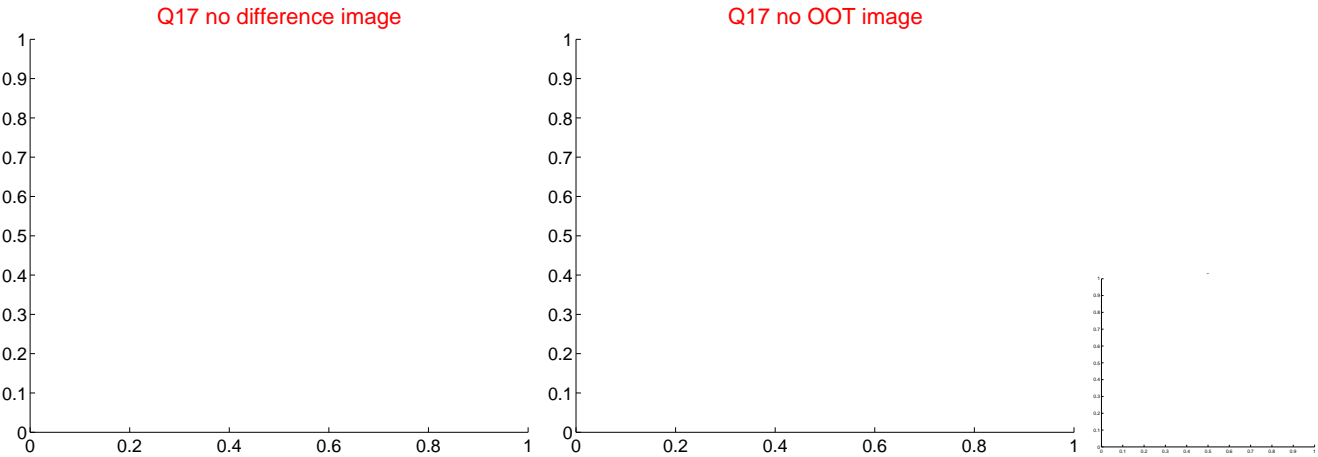
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



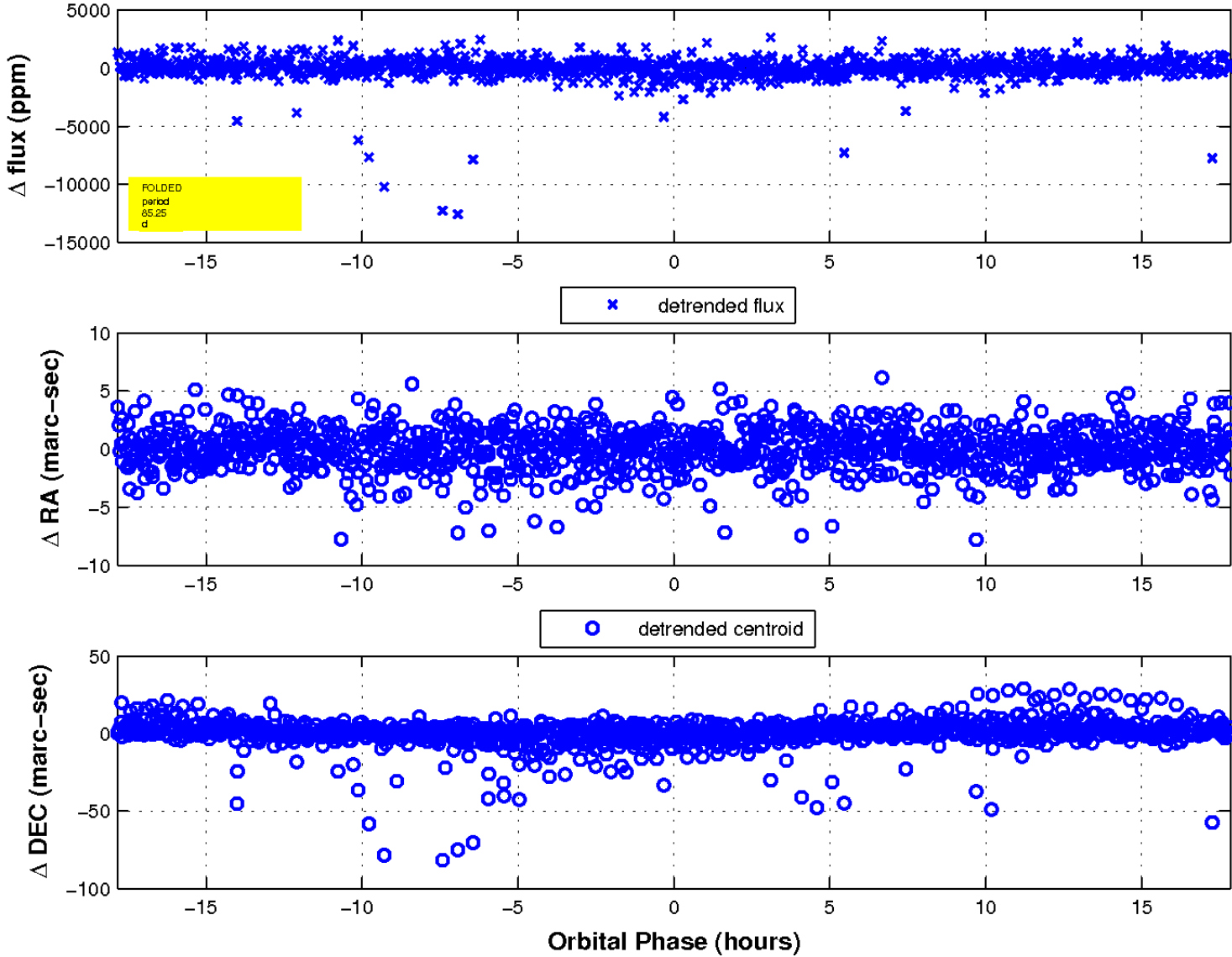
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



fluxWeightedCentroids, Planet 4 of 4



# UKIRT Image

Declination

