

# KIC 010989166

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
010989166-01	OBS	No	364.654533	483.543104	599.2	6.203	13.0	13.8	0.99	6137	2.66	1.21
010989166-02	OBS	No	373.132674	449.630666	601.9	6.331	12.6	13.4	0.99	6137	2.52	1.17
010989166-03	OBS	No	364.640890	492.053046	643.4	5.646	11.9	12.8	0.99	6137	2.70	1.21
010989166-04	OBS	No	373.150031	458.076750	648.8	4.835	11.2	11.2	0.99	6137	2.74	1.17
010989166-05	OBS	No	398.554187	466.602819	581.0	5.096	10.5	10.6	0.99	6137	2.39	1.07
010989166-06	OBS	No	195.012731	254.729492	604.3	6.002	9.9	11.2	0.99	6137	2.58	2.78
010989166-07	OBS	No	534.484685	279.855588	369.4	7.477	8.6	7.4	0.99	6137	2.19	0.72

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
010989166-01	OBS	FP	0.00	1	0	1	0	MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_RESOLVED_OFFSET—HALO_GHOST
010989166-02	OBS	FP	0.00	1	0	1	1	MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_RESOLVED_OFFSET—HALO_GHOST—EPHEM_MATCH
010989166-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—SAME_NTL_PERIOD—CENT_FEW_DIFFS
010989166-04	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_MARSHALL—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—SAME_NTL_PERIOD—CENT_RESOLVED_OFFSET—HALO_GHOST
010989166-05	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_CHASES—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS—HALO_GHOST
010989166-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
010989166-07	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_CHASES—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS—HALO_GHOST

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

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

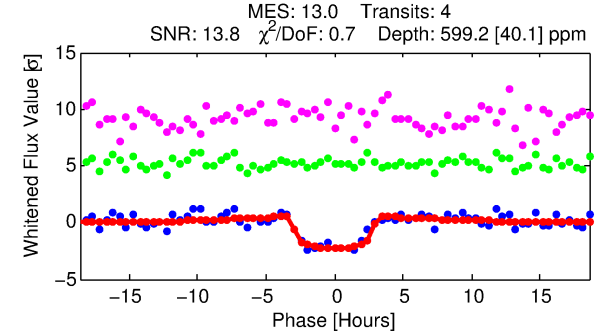
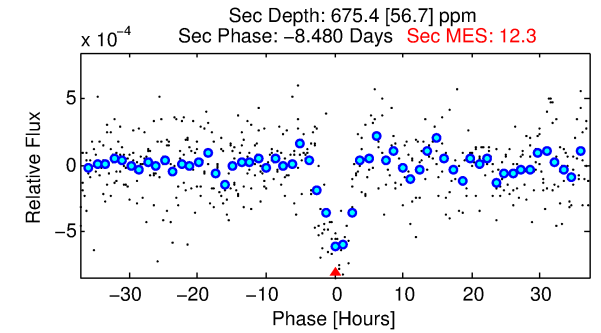
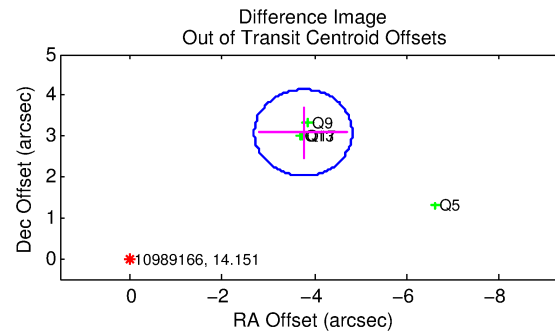
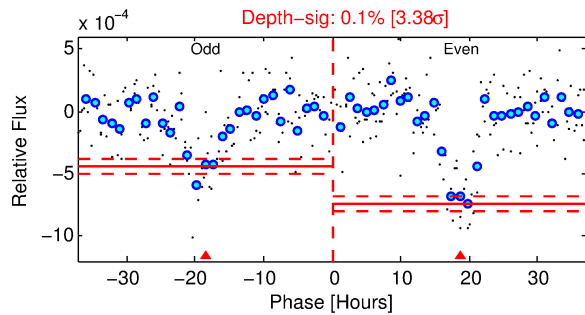
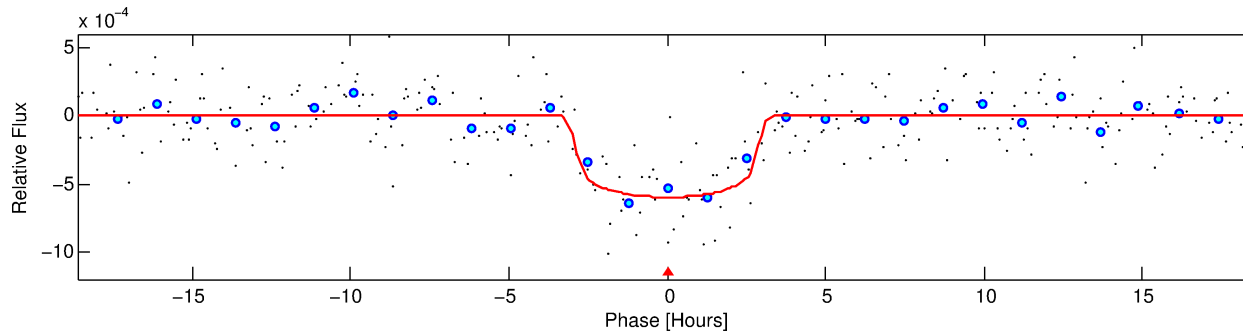
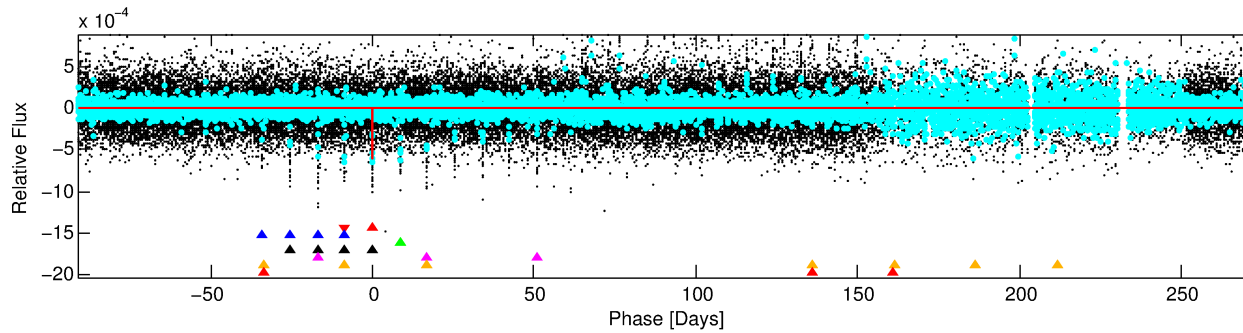
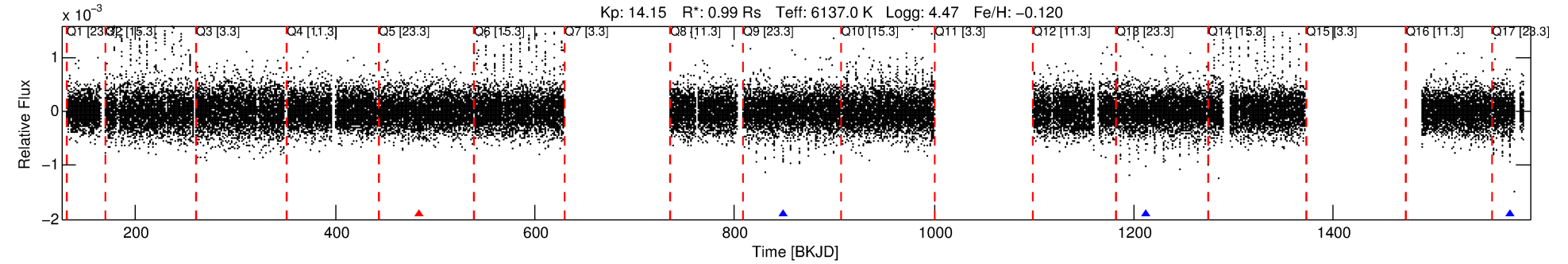
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 010989166-01

No Significant Match Found

# DV One-Page Summary

KIC: 10989166 Candidate: 1 of 7 Period: 364.655 d



## DV Fit Results:

Period = 364.65453 [0.00347] d  
Epoch = 483.5431 [0.0059] BKJD  
Rp/R\* = 0.0245 [0.0090]  
a/R\* = 302.41 [555.46]  
b = 0.77 [0.97]  
Seff = 1.21 [0.49]  
Teq = 267 [27] K  
Rp = 2.66 [1.31] Re  
a = 1.0206 [0.2752] AU  
Ag = 54610.03 [45651.01] [1.20 $\sigma$ ]  
Teffp = 6315 [1189] K [5.09 $\sigma$ ]

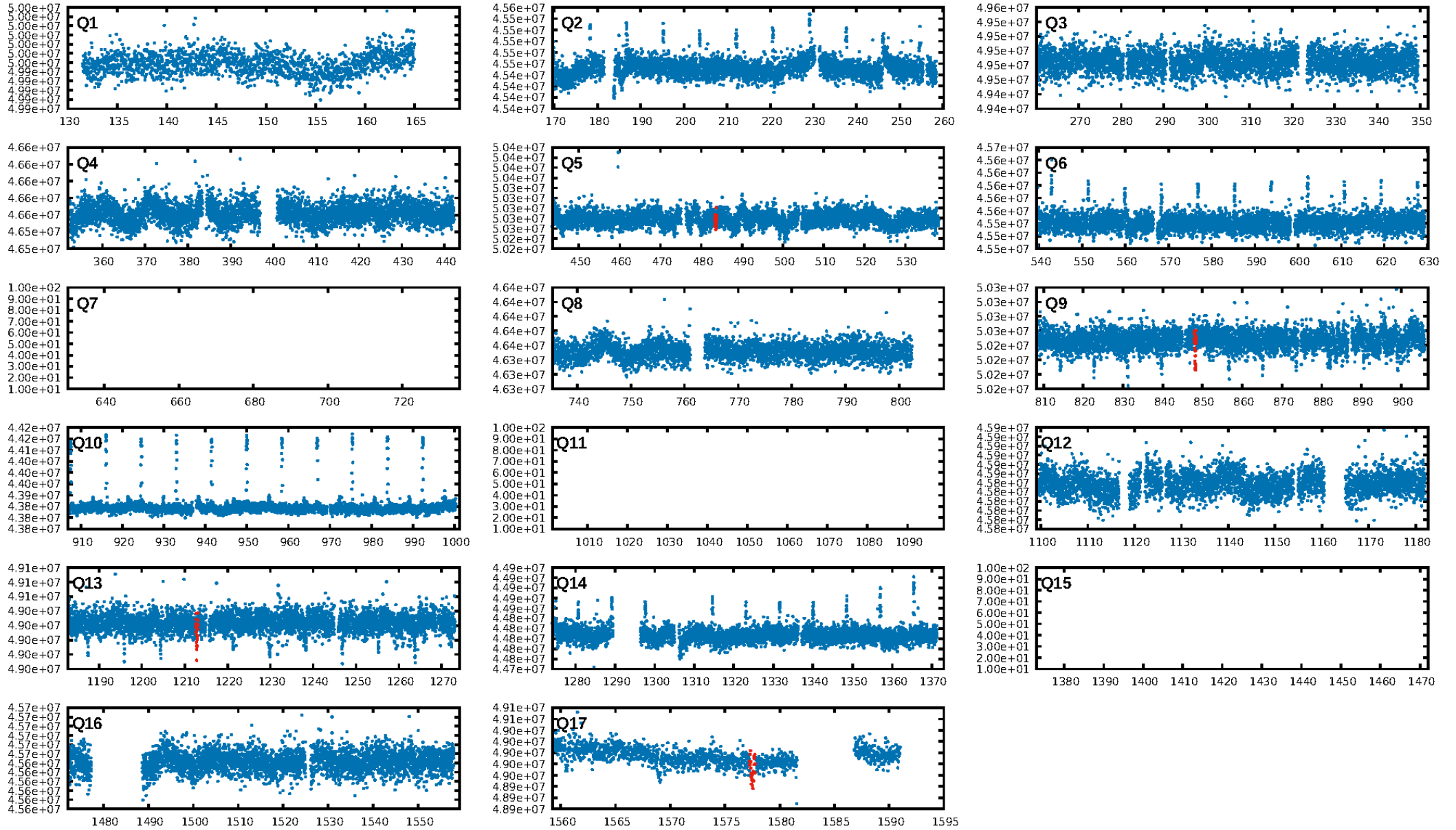
## DV Diagnostic Results:

ShortPeriod-sig: 3.1% [0.04 $\sigma$ ]  
LongPeriod-sig: 100.0% [22.96 $\sigma$ ]  
ModelChiSquare2-sig: 5.6%  
ModelChiSquareGof-sig: 99.7%  
Bootstrap-pfa: 3.61e-16  
RollingBand-fgt: 0.67 [2/3]  
GhostDiagnostic-chr: -0.0894  
Centroid-sig: N/A  
Centroid-so: 9.696 arcsec [7.79 $\sigma$ ]  
OotOffset-rm: 4.862 arcsec [13.81 $\sigma$ ]  
KicOffset-rm: 4.791 arcsec [15.04 $\sigma$ ]  
OotOffset-st: 0/0/0/4 [4]  
KicOffset-st: 0/0/0/4 [4]  
DiffImageQuality-fgm: 1.00 [4/4]  
DiffImageOverlap-fno: 0.75 [3/4]

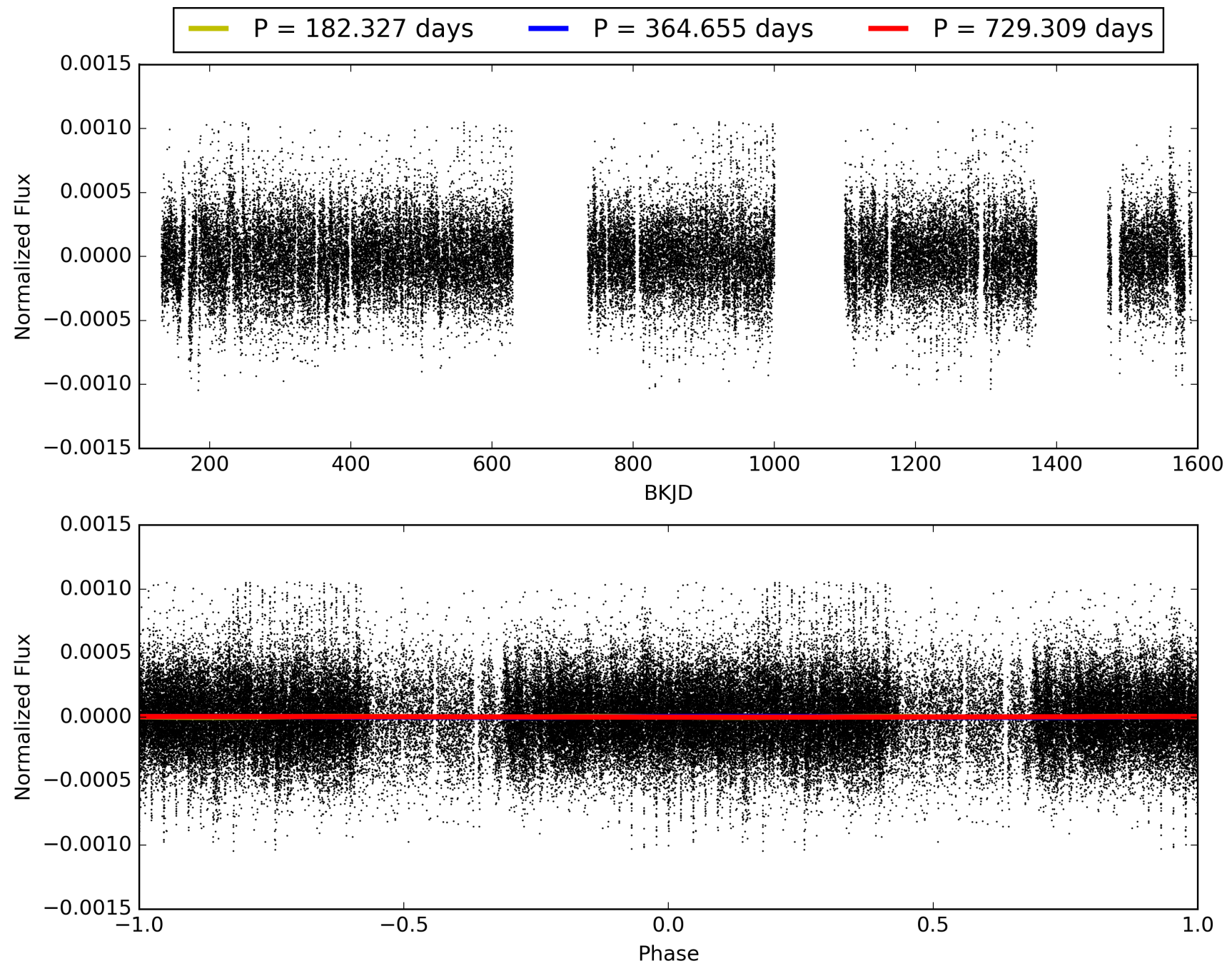
Software Revision: svn-ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 03:59:50 Z

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

# TCE 010989166-01, PDC Light Curves



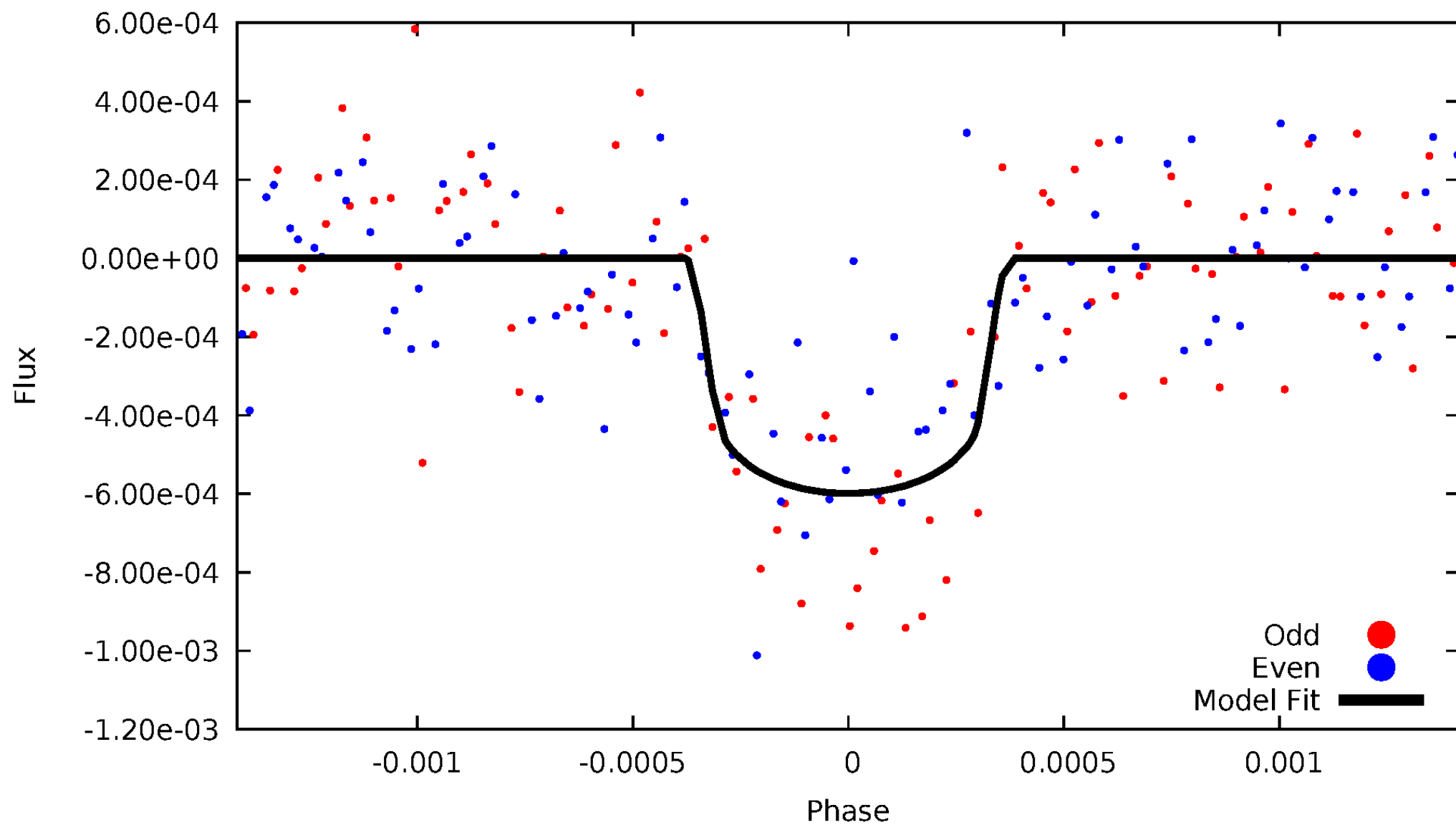
TCE 010989166-01





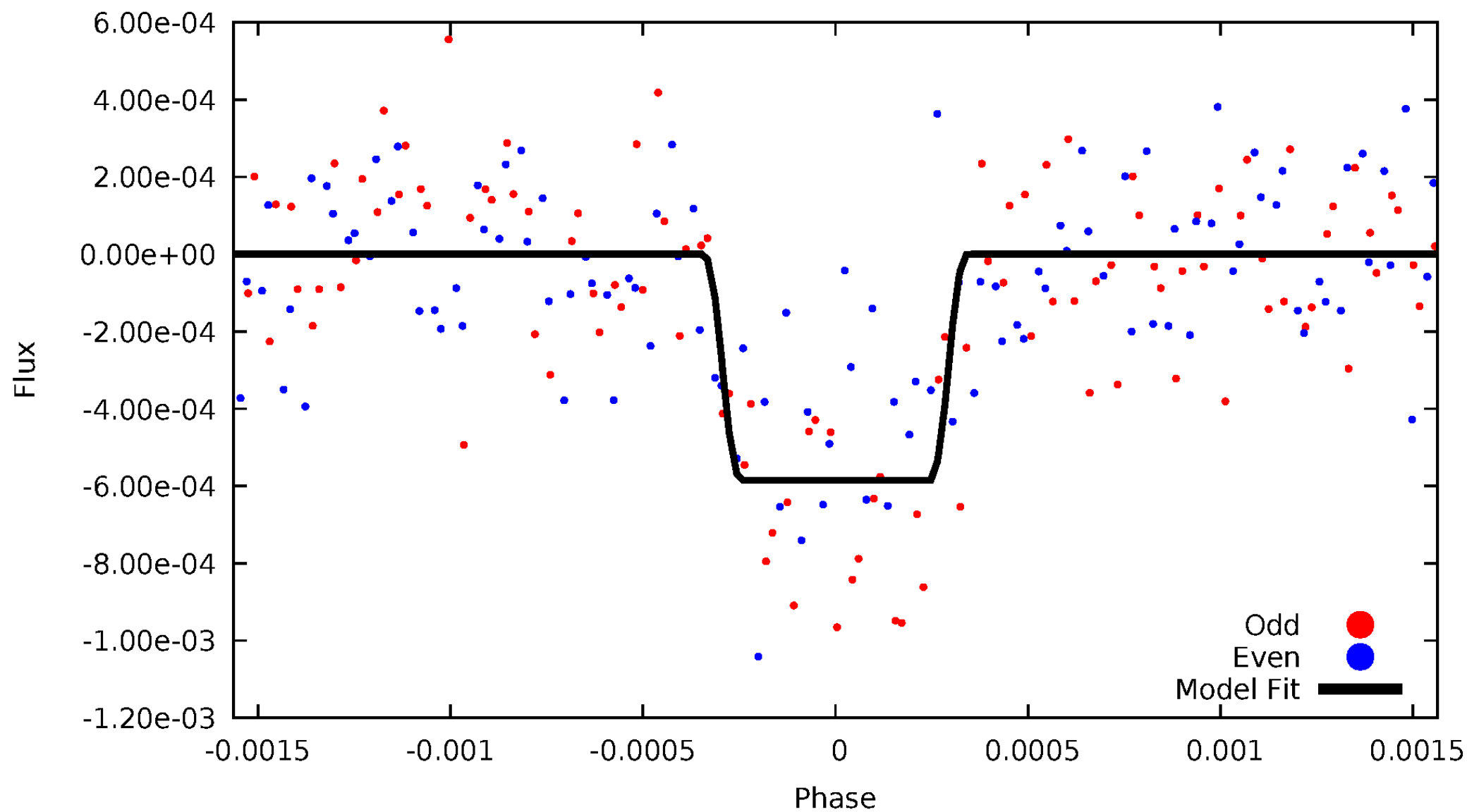
# DV Odd/Even

TCE 010989166-01



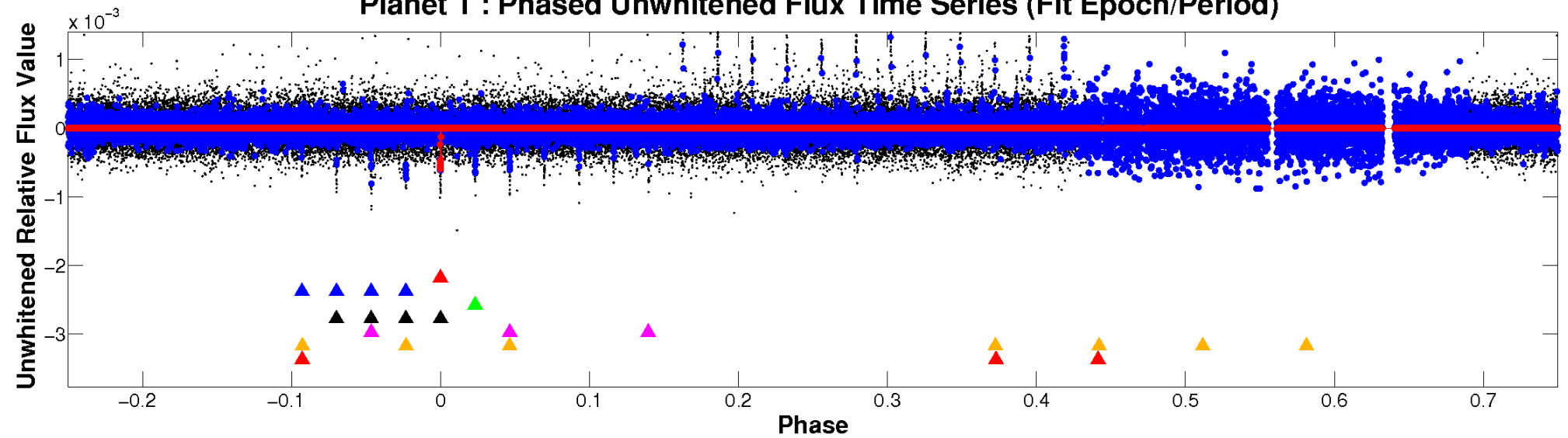
# ALT Odd/Even

TCE 010989166-01

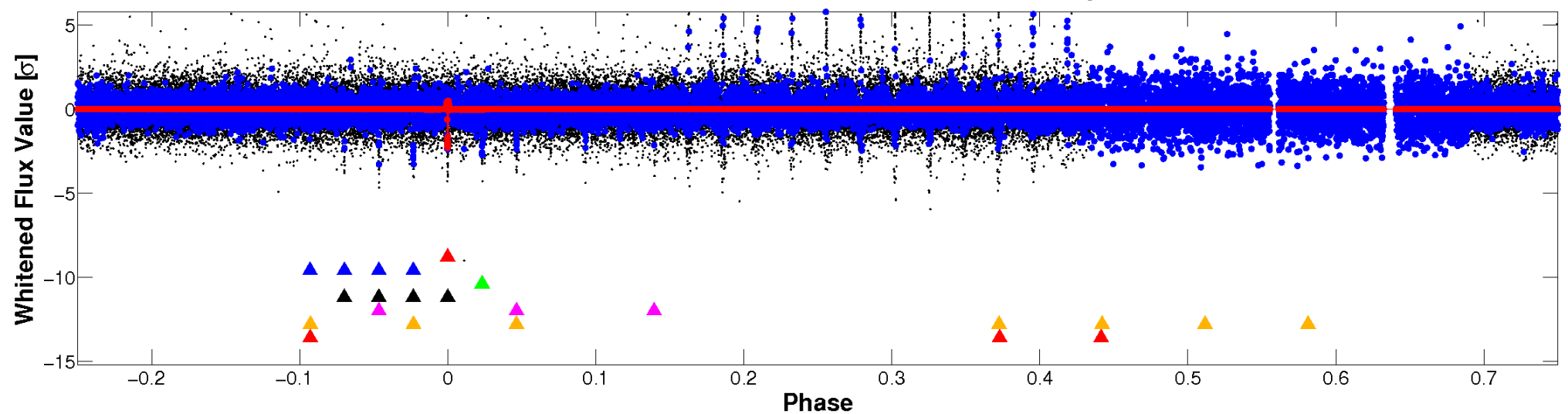


# Non-Whitened Vs. Whitened Light Curve

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

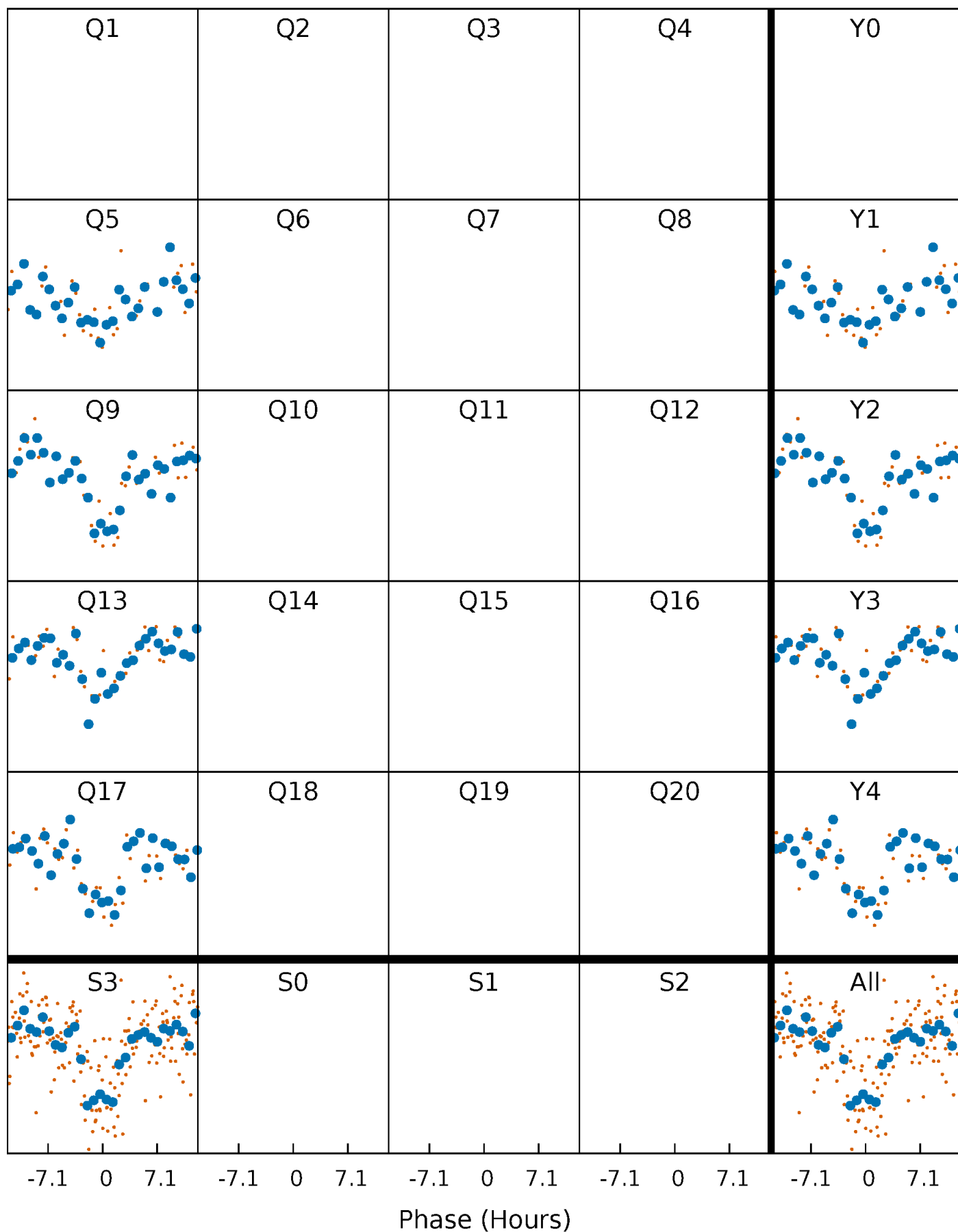


## Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)



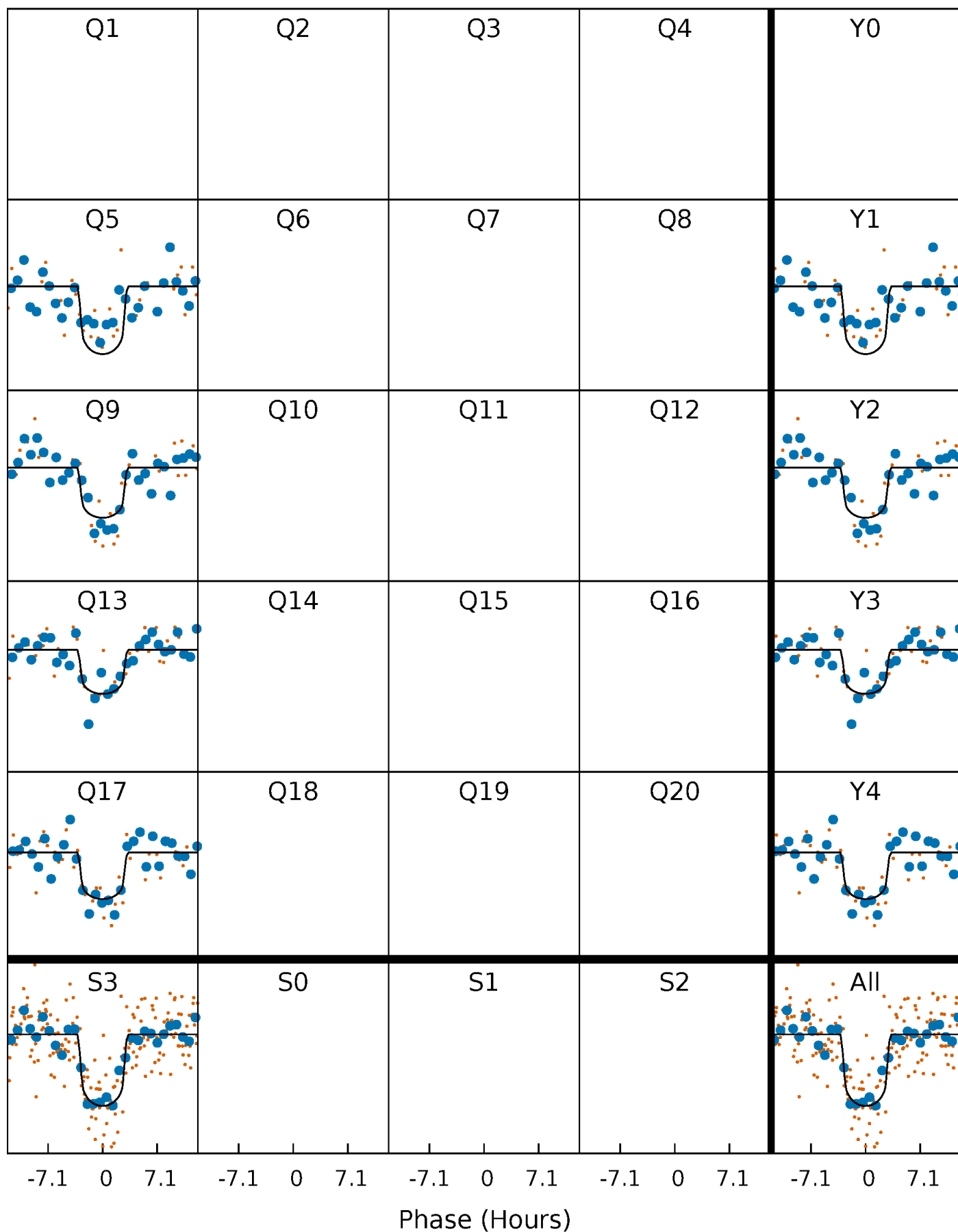
# PDC Quarter-Phased Transit Curves

TCE 010989166-01     $P=364.654533$  Days     $T_0=483.543104$  (BKJD)



# DV Quarter-Phased Transit Curves

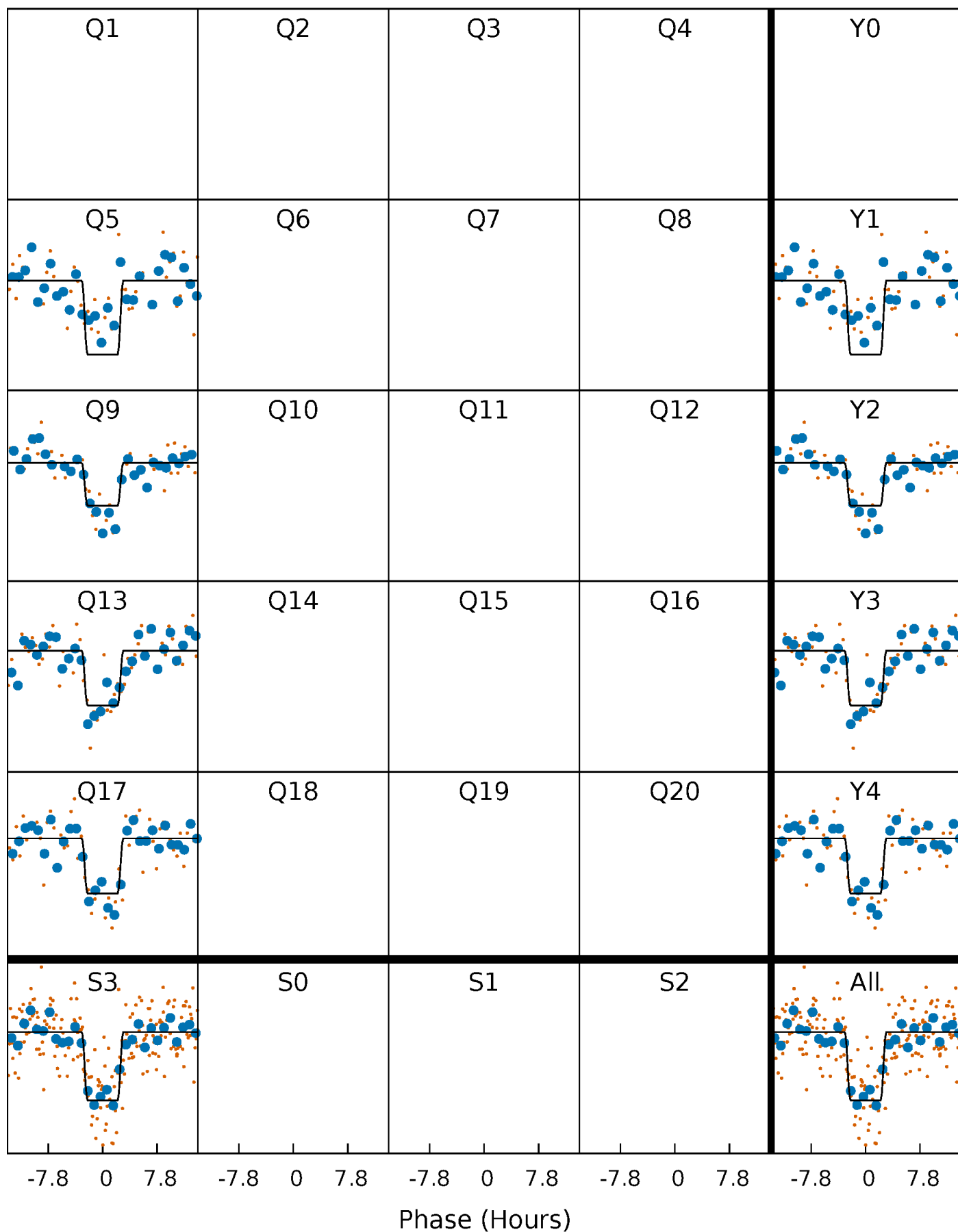
TCE 010989166-01     $P=364.654533$  Days     $T_0=483.543104$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

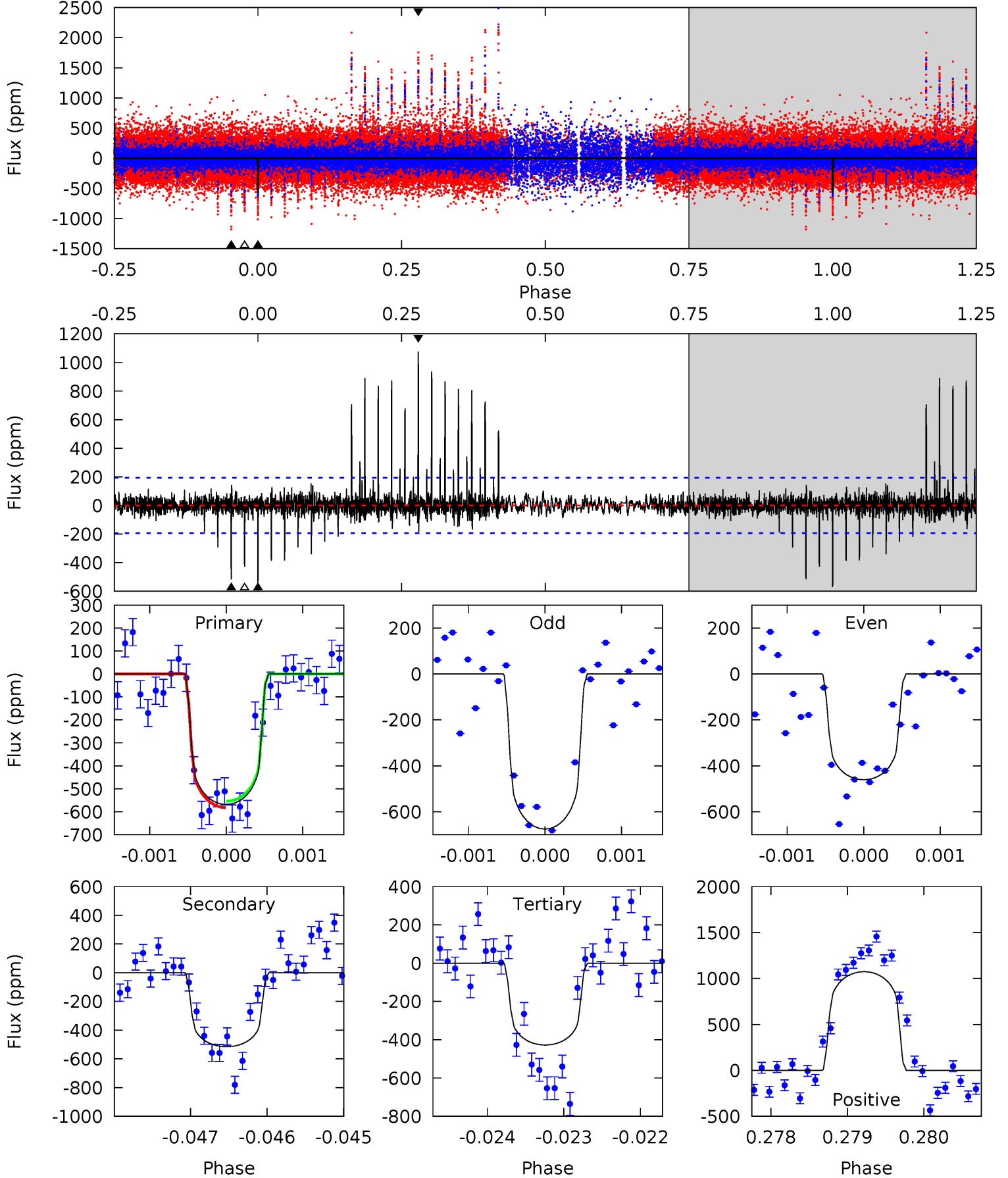
TCE 010989166-01 P=364.650501 Days  $T_0=483.546825$  (BKJD)



# DV Model-Shift Uniqueness Test

010989166-01, P = 364.654533 Days, E = 118.888571 Days

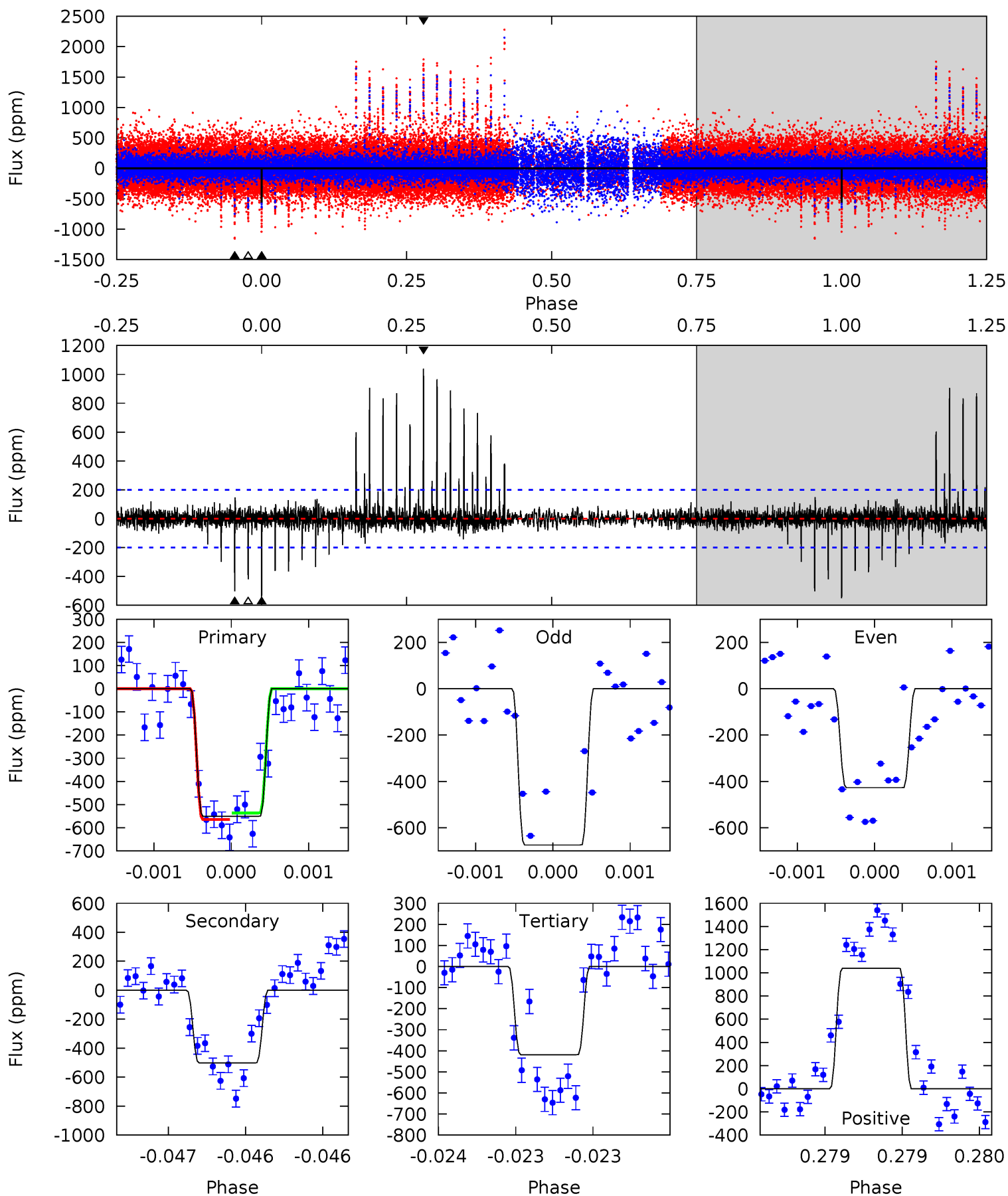
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
16.2	14.7	12.2	30.6	5.51	3.39	2.47	4.00	-14.4	2.50	-15.9	2.11	0.91	0.65	0.40



# Alt Model-Shift Uniqueness Test

010989166-01, P = 364.650501 Days, E = 118.896324 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
15.2	13.9	11.6	28.7	5.53	3.41	2.23	3.65	-13.5	2.30	-14.9	3.44	0.89	0.65	0.39



### Stellar Parameters For KIC 010989166

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6137^{+165}_{-202}$	$4.471^{+0.052}_{-0.208}$	$-0.120^{+0.300}_{-0.300}$	$0.994^{+0.324}_{-0.108}$	$1.067^{+0.139}_{-0.139}$	$1.529^{+0.419}_{-0.782}$
	+3%/-3%	+1%/-5%	+250%/-250%	+33%/-11%	+13%/-13%	+27%/-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 010989166-01 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-515 \pm 35$	$2.81^{+1.23}_{-1.13}$	$382^{+27}_{-19}$	$5920^{+1710}_{-848}$	$36837^{+62676}_{-19162}$
Alt.	$-502 \pm 36$	$2.68^{+1.18}_{-0.94}$	$382^{+29}_{-19}$	$5987^{+1572}_{-868}$	$39132^{+50047}_{-20450}$

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

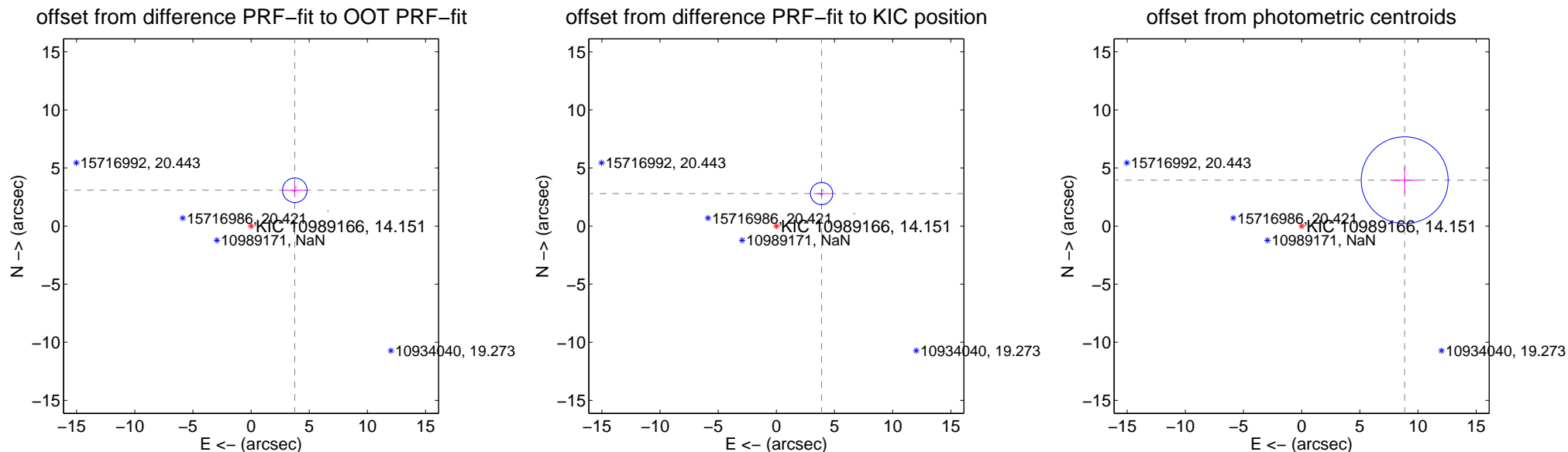
## DV Centroid Data

Supplemental centroid analysis for 010989166-01. Kepler magnitude: 14.15. Transit SNR 13.81

There are 4 quarters with good PRF difference image offsets

The direct PRF centroid is offset from the target star catalog position by about 0.31 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$4.862 \pm 0.352$	13.81	$-3.759 \pm 0.938$	$3.084 \pm 0.606$
PRF-fit source offset from KIC position	$4.791 \pm 0.319$	15.04	$-3.888 \pm 0.676$	$2.799 \pm 0.427$
photometric centroid source offset	$9.70 \pm 1.25$	7.79	$-8.86 \pm 1.27$	$3.95 \pm 1.14$



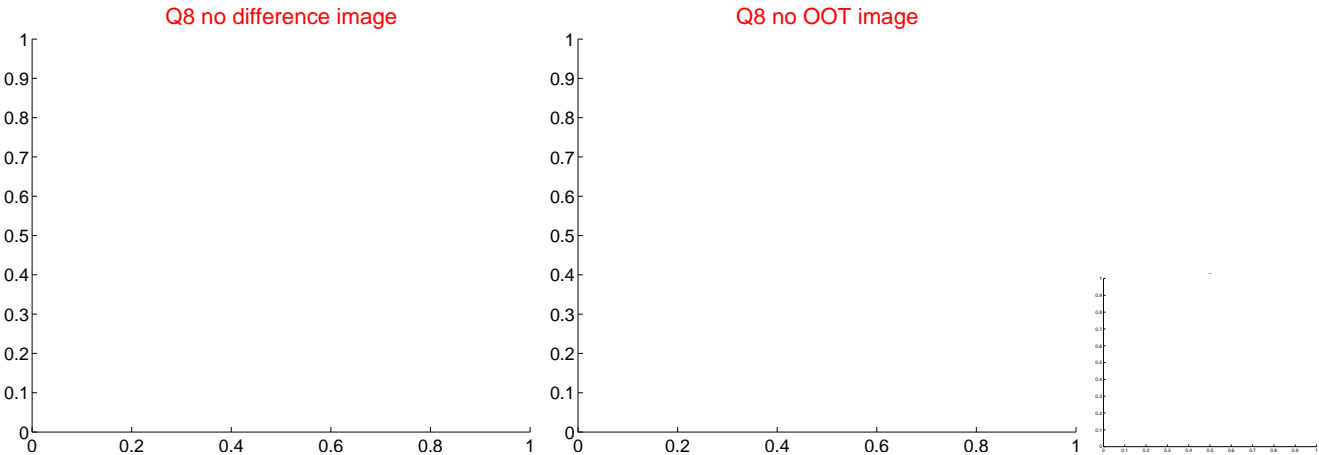
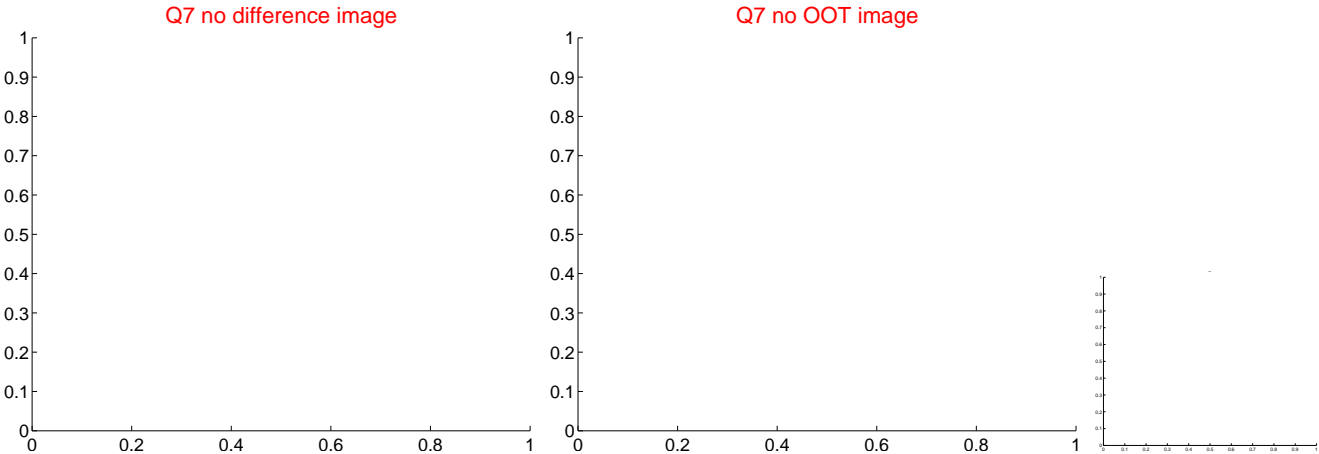
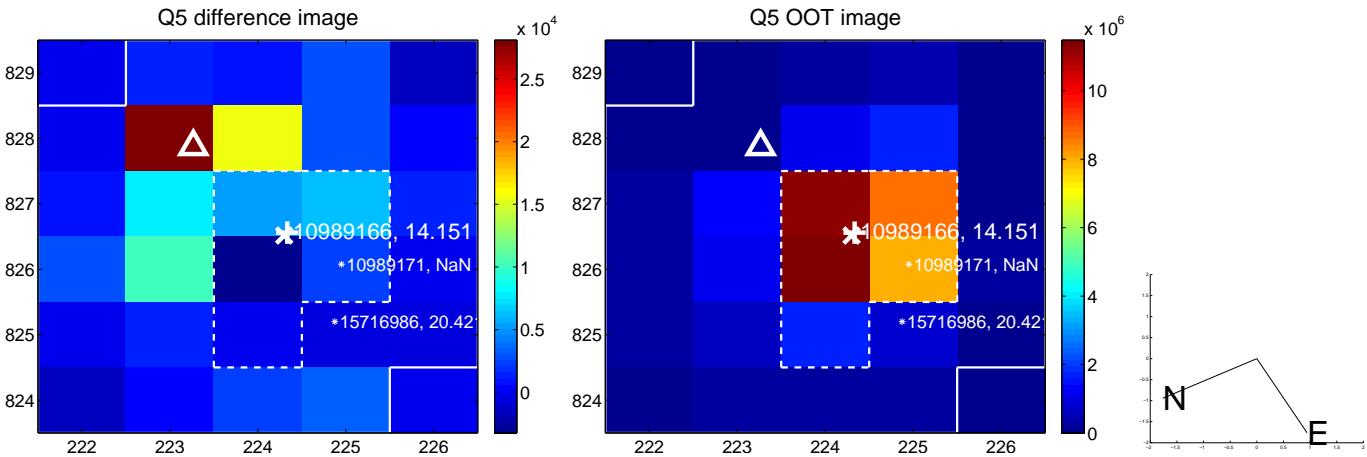
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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



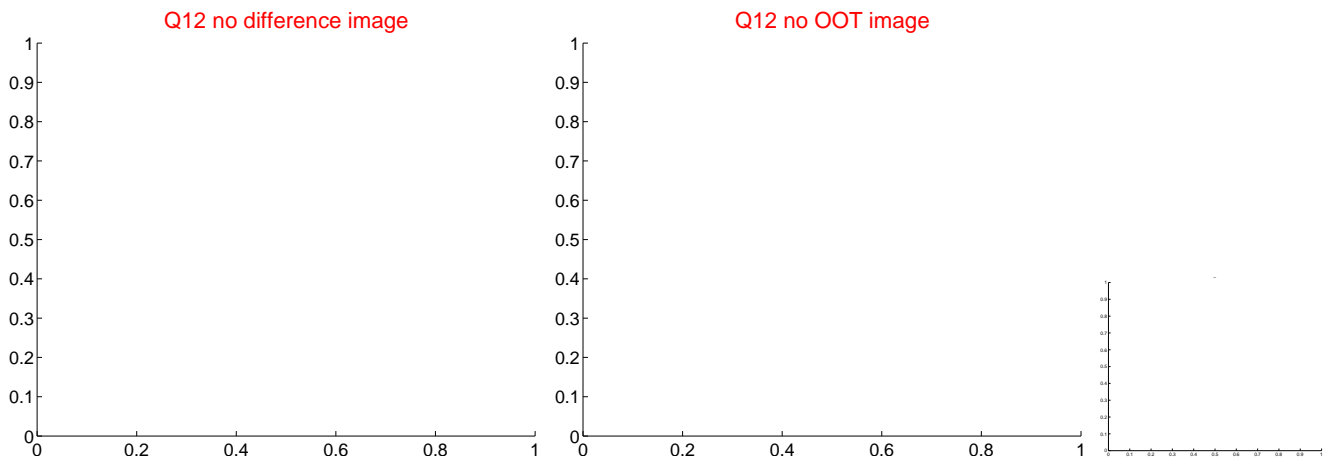
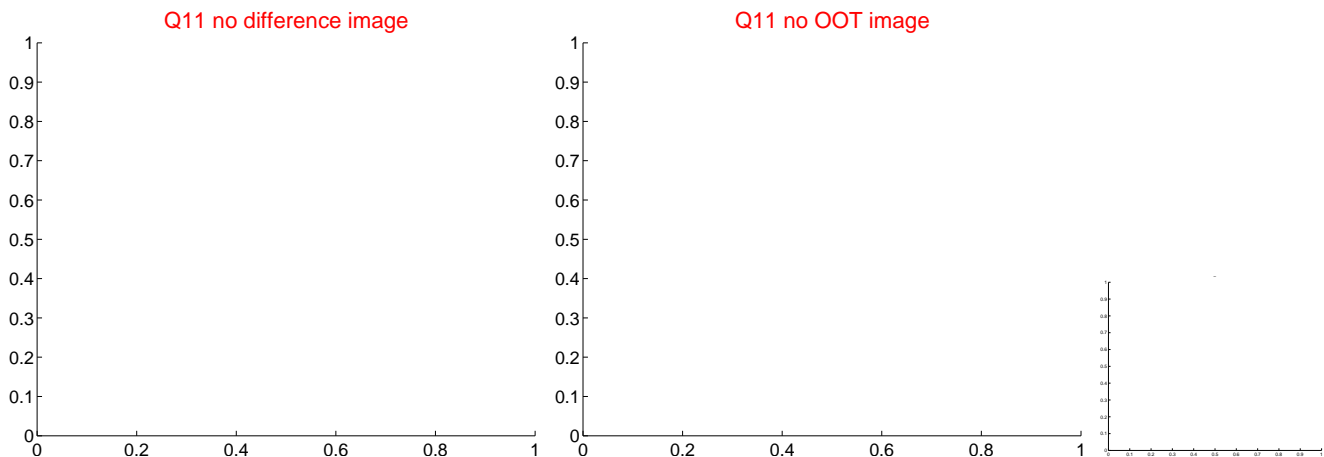
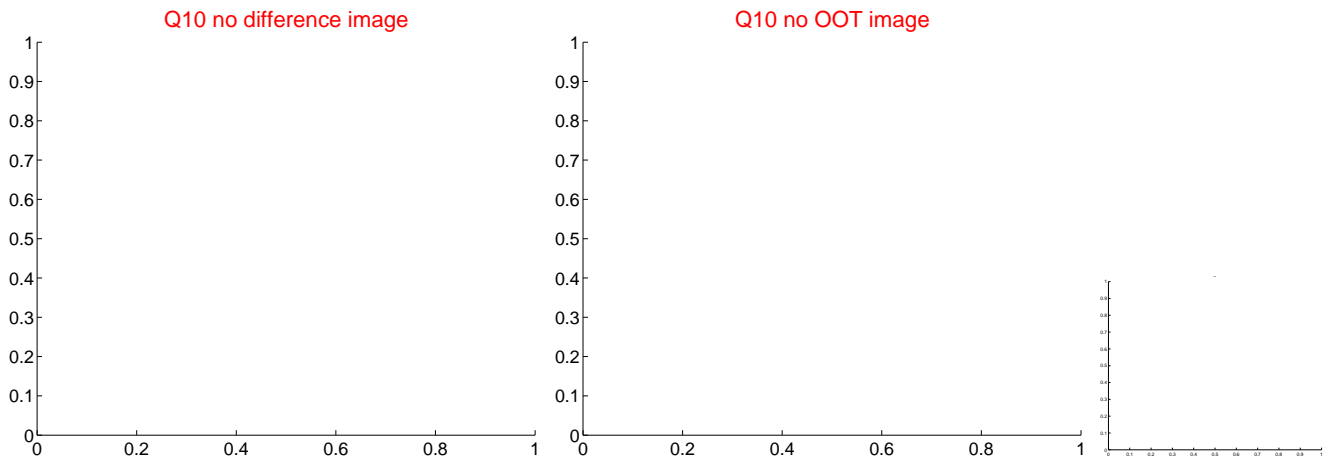
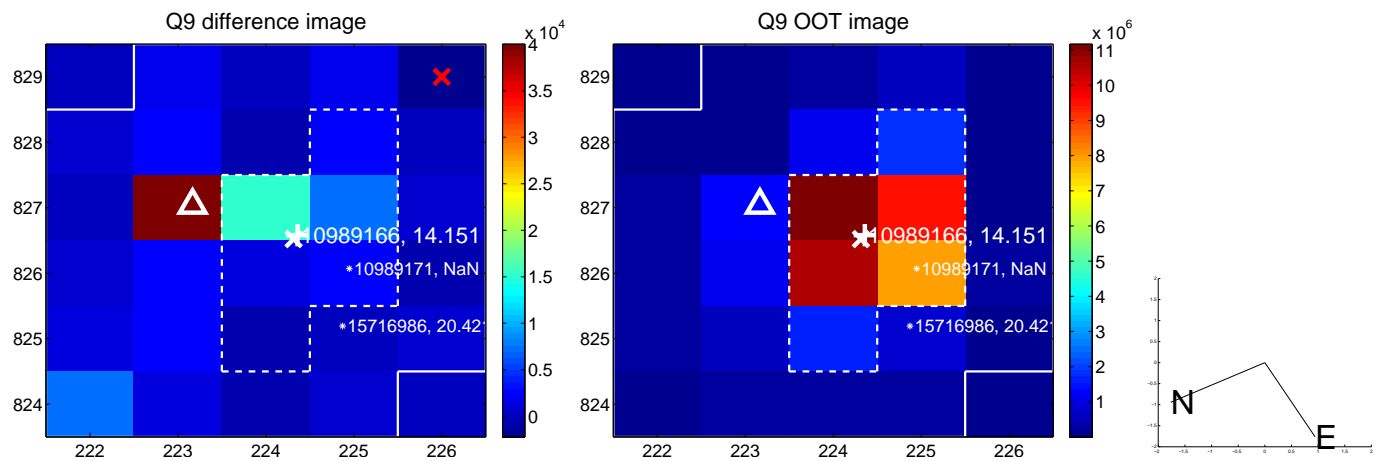
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



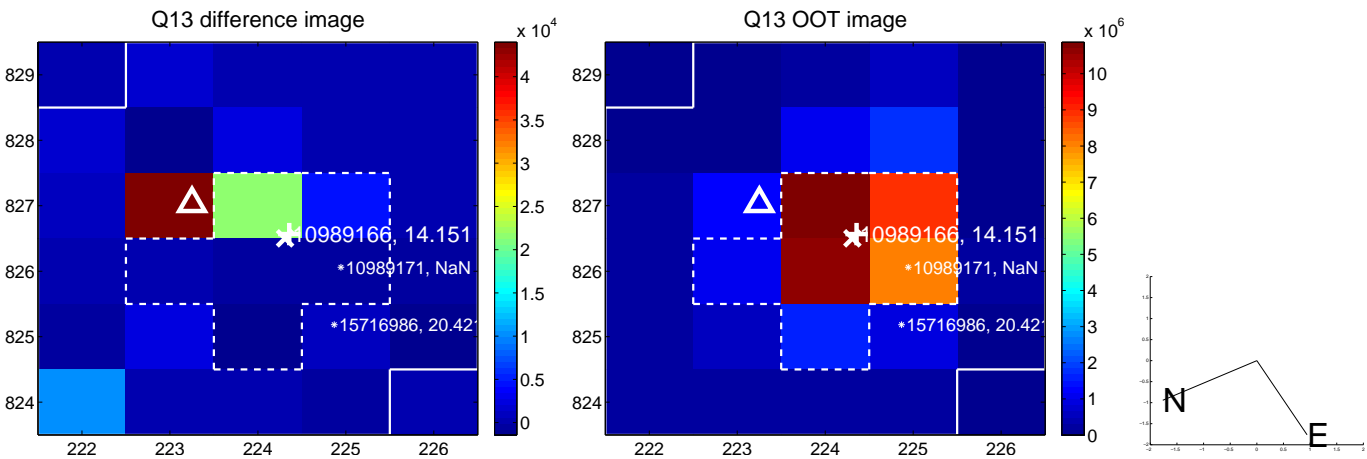
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



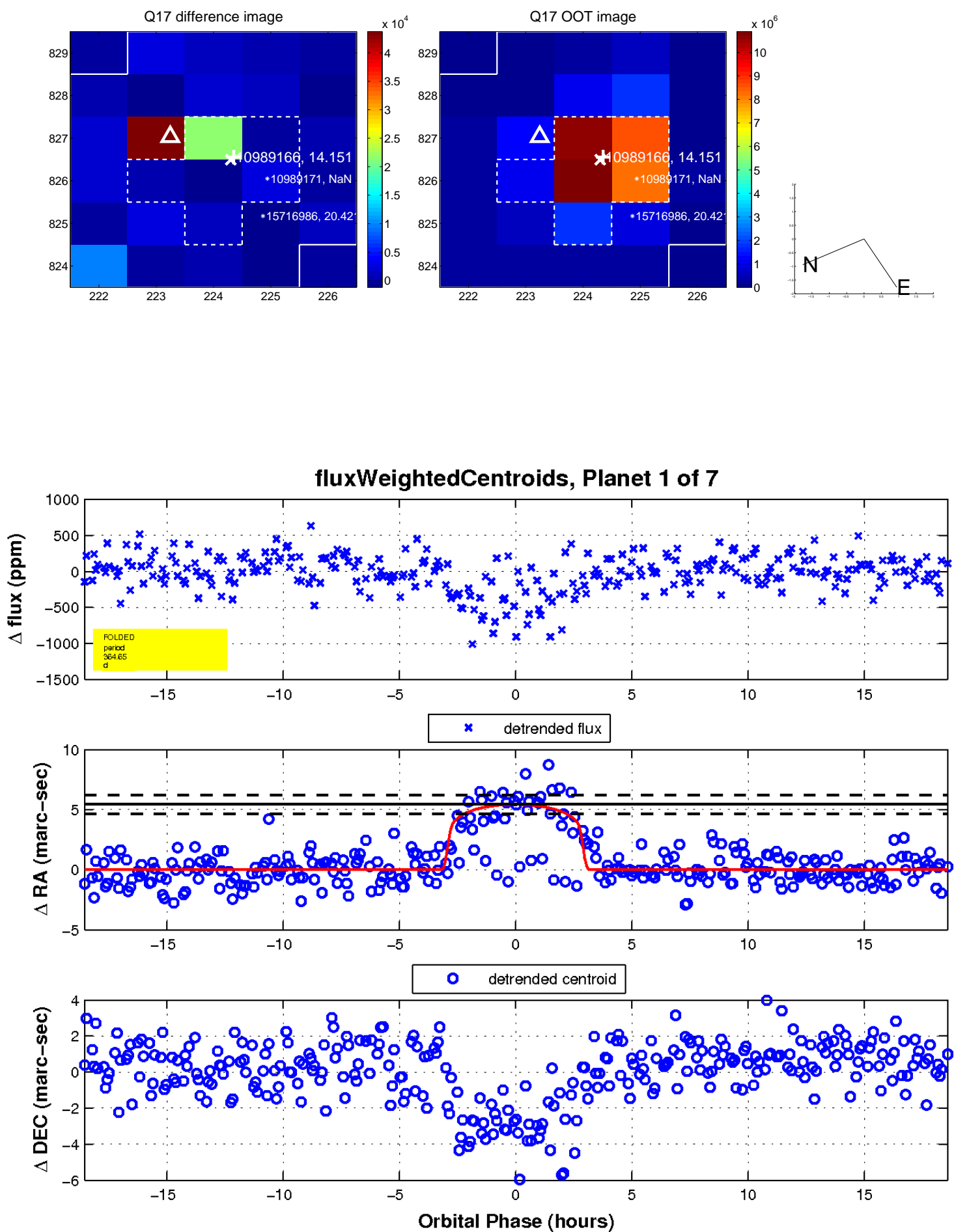
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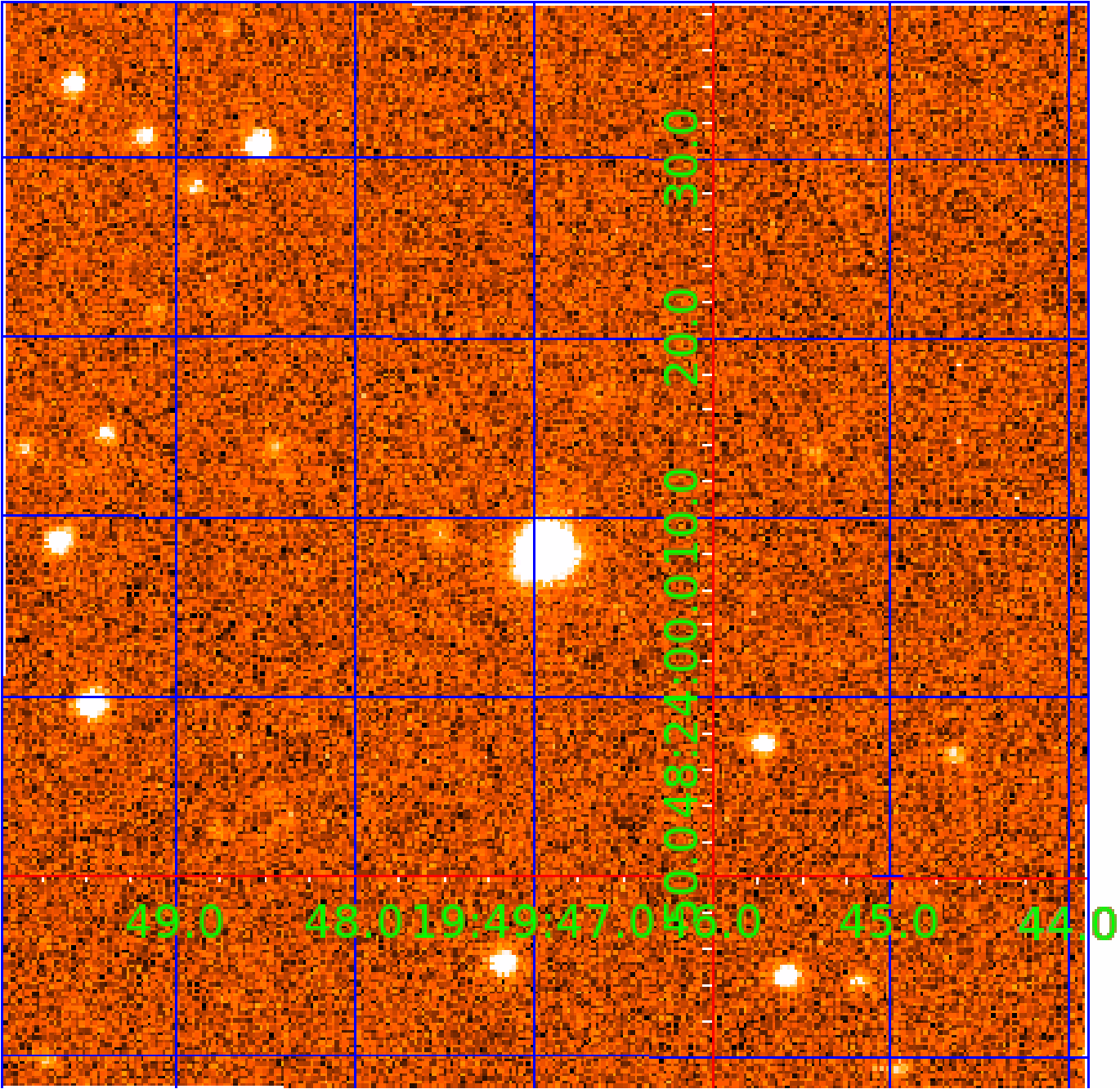
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





UKIRT Image

Declination



# KIC 010989166

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
010989166-01	OBS	No	364.654533	483.543104	599.2	6.203	13.0	13.8	0.99	6137	2.66	1.21
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010989166-02	OBS	FP	0.00	1	0	1	1	MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_RESOLVED_OFFSET—HALO_GHOST—EPHEM_MATCH
010989166-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—SAME_NTL_PERIOD—CENT_FEW_DIFFS
010989166-04	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_MARSHALL—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—SAME_NTL_PERIOD—CENT_RESOLVED_OFFSET—HALO_GHOST
010989166-05	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_CHASES—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS—HALO_GHOST
010989166-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
010989166-07	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_CHASES—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS—HALO_GHOST

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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.

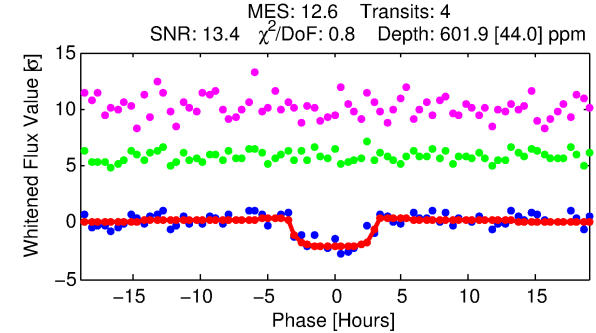
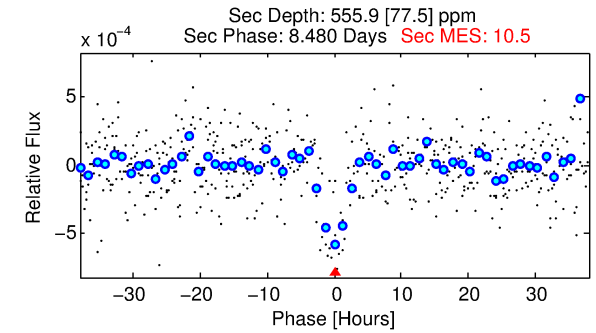
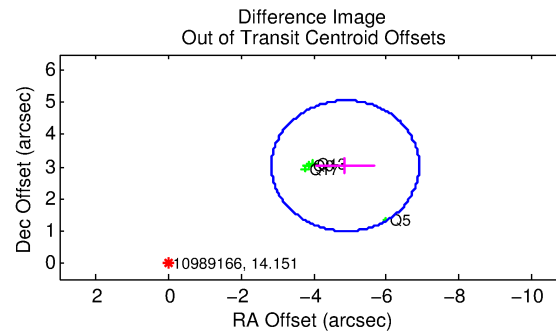
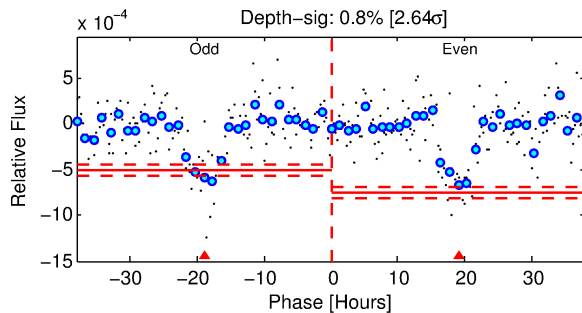
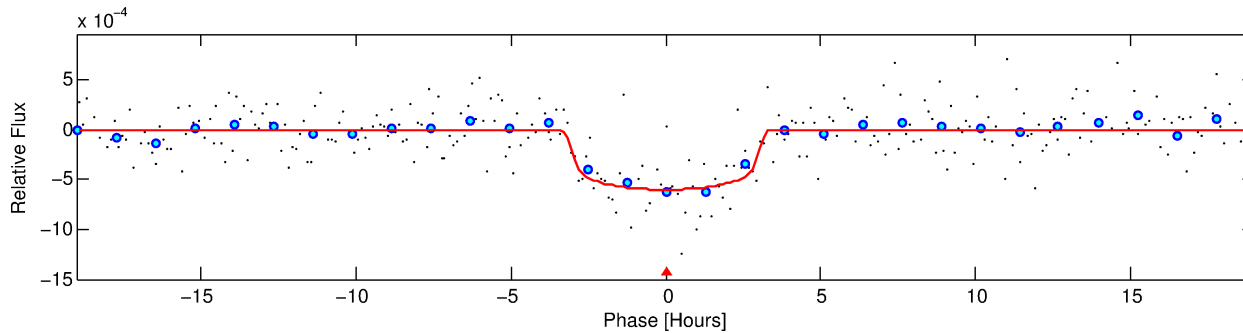
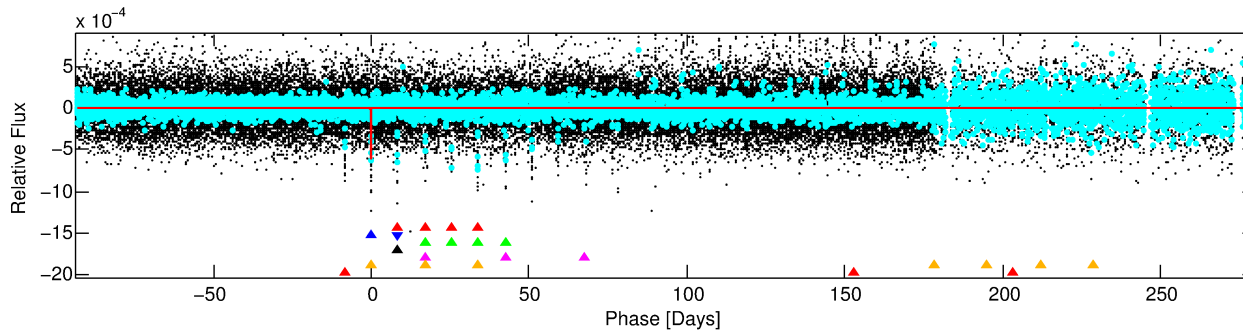
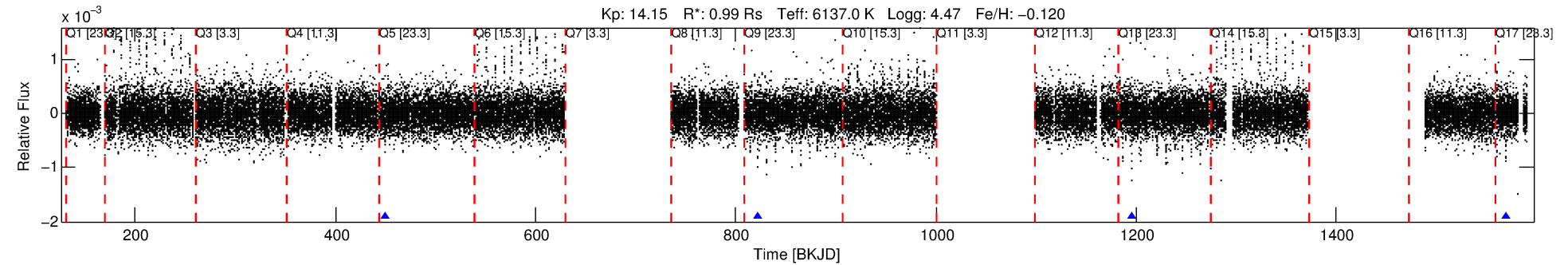
## Ephemeris Match Information For 010989166-02

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	$\sigma_P$	$\sigma_T$
010989166-02	10989166	009851142-pri	9851142	43:1	7066.1	5	3	7.63	14.15	151.33	Cross-Talk	0	2.55	0.14

**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: 10989166 Candidate: 2 of 7 Period: 373.133 d



## DV Fit Results:

Period = 373.13267 [0.00369] d  
Epoch = 449.6307 [0.0070] BKJD  
Rp/R\* = 0.0232 [0.0178]  
a/R\* = 396.26 [1502.22]  
b = 0.52 [5.32]  
Seff = 1.17 [0.48]  
Teq = 265 [27] K  
Rp = 2.52 [2.10] Re  
a = 1.0364 [0.2795] AU  
Ag = 51930.81 [82731.09] [0.63 $\sigma$ ]  
Teffp = 6188 [2400] K [2.47 $\sigma$ ]

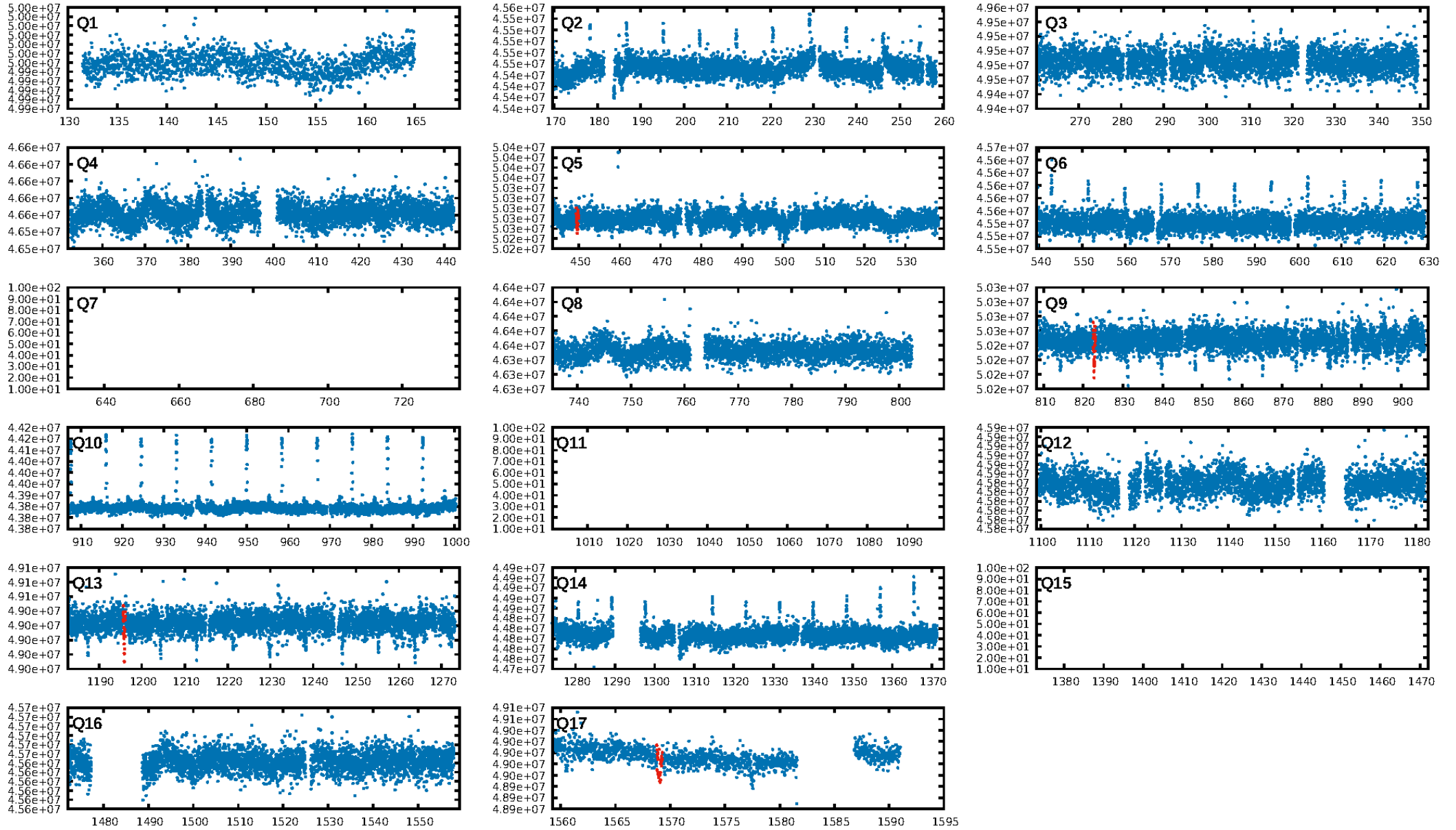
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [22.96 $\sigma$ ]  
LongPeriod-sig: 4.2% [0.05 $\sigma$ ]  
ModelChiSquare2-sig: 9.0%  
ModelChiSquareGof-sig: 99.4%  
Bootstrap-pfa: 1.67e-15  
RollingBand-fgt: 1.00 [3/3]  
**GhostDiagnostic-chr: 0.0546**  
Centroid-sig: N/A  
**Centroid-so: 8.464 arcsec [7.21 $\sigma$ ]**  
**OotOffset-rm: 5.734 arcsec [8.45 $\sigma$ ]**  
**KicOffset-rm: 5.693 arcsec [8.41 $\sigma$ ]**  
OotOffset-st: 0/0/0/4 [4]  
KicOffset-st: 0/0/0/4 [4]  
DiffImageQuality-fgm: 1.00 [4/4]  
DiffImageOverlap-fno: 0.75 [3/4]

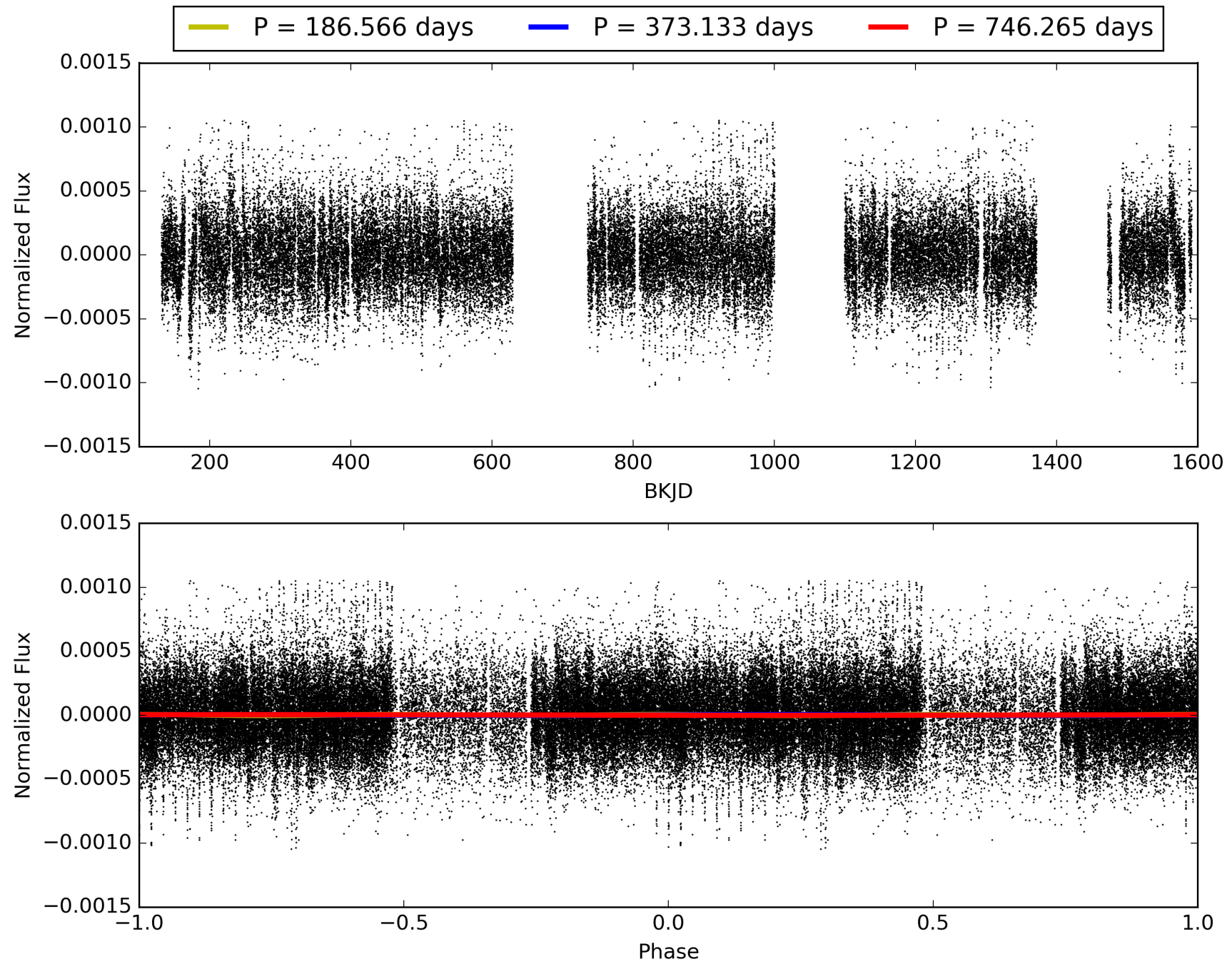
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 04:00:00 Z

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

# TCE 010989166-02, PDC Light Curves



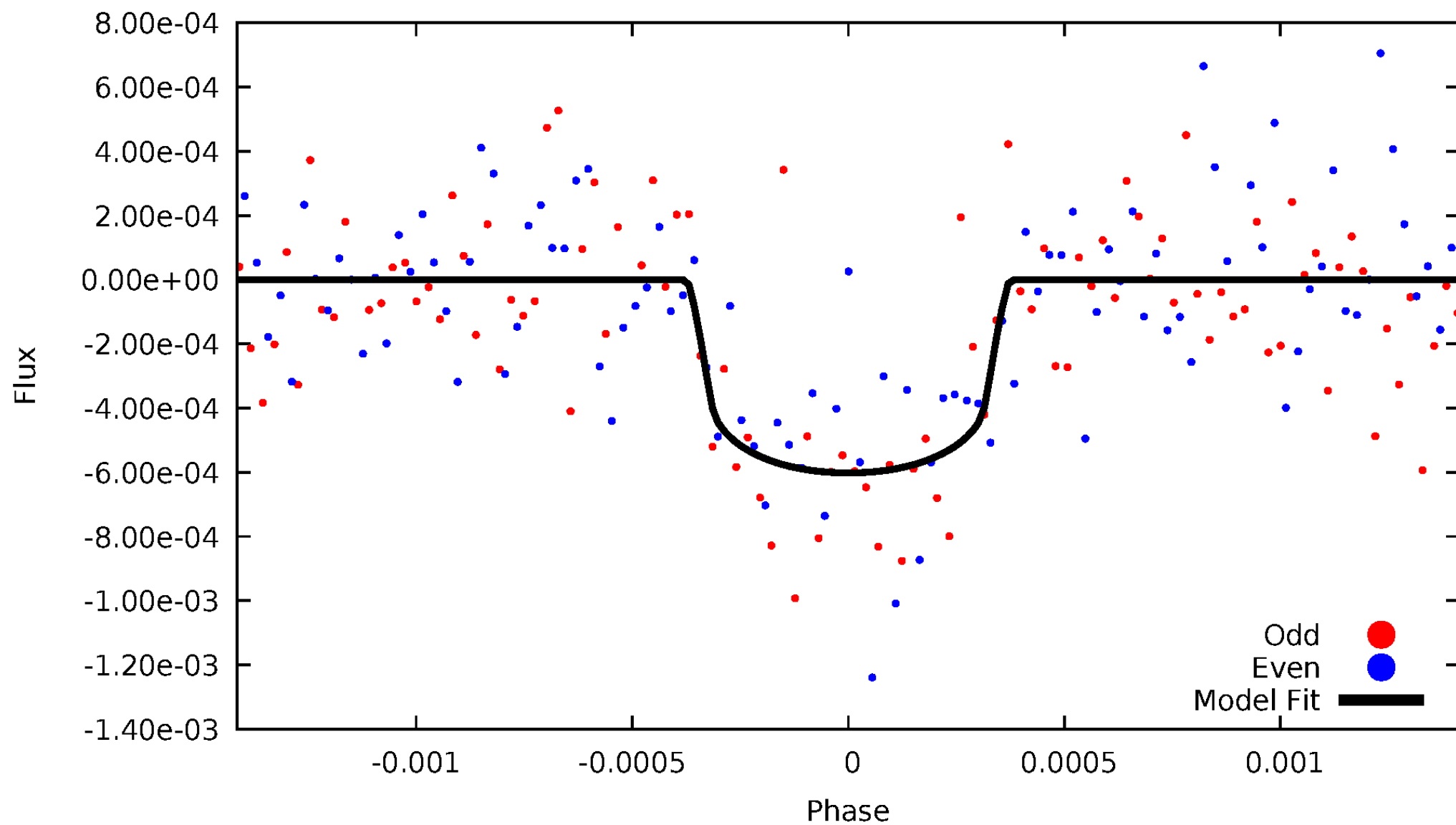
TCE 010989166-02





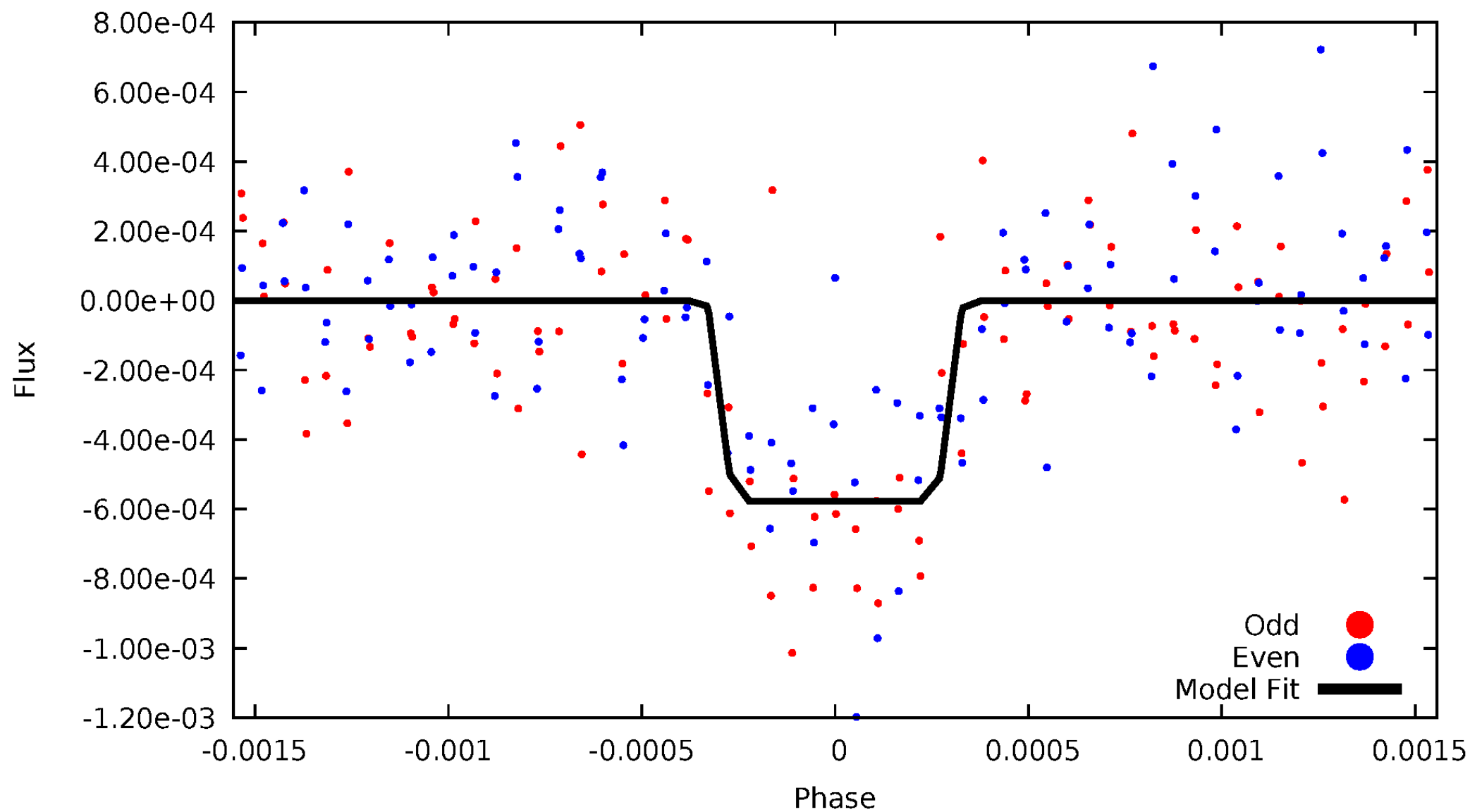
# DV Odd/Even

TCE 010989166-02



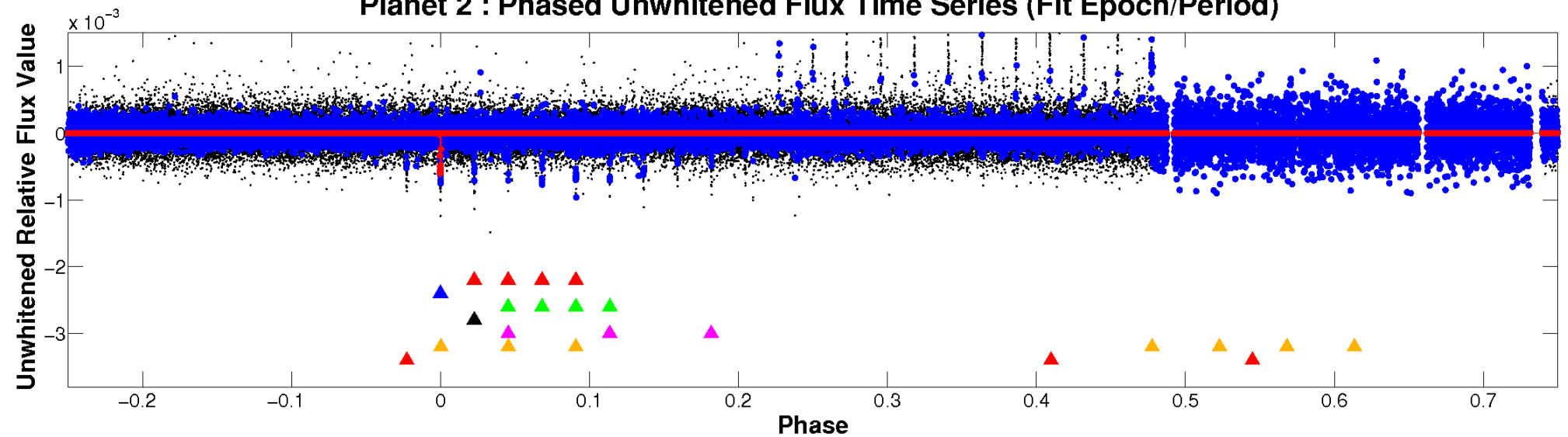
# ALT Odd/Even

TCE 010989166-02

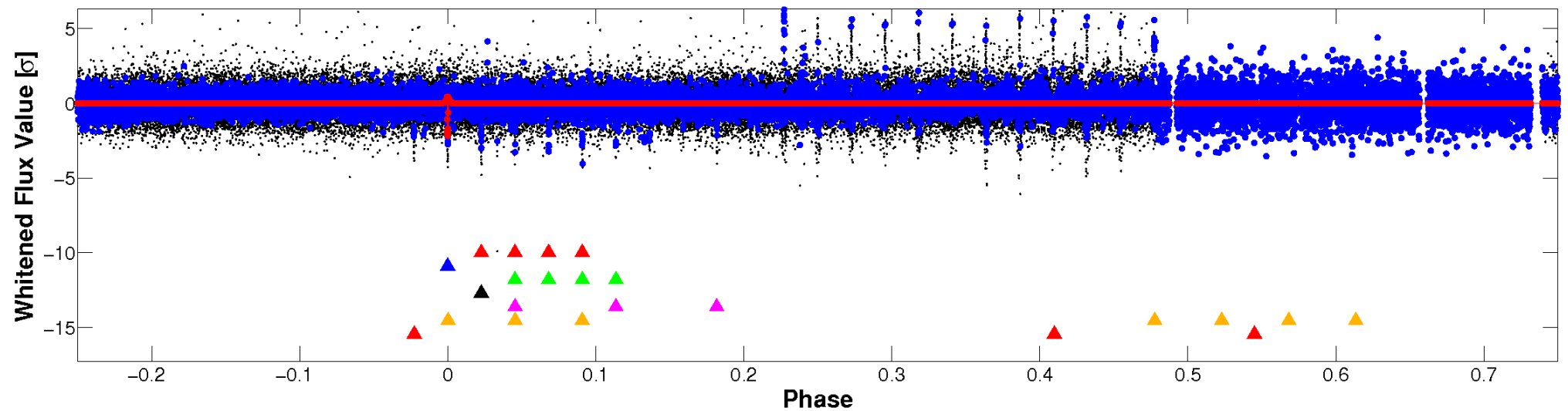


# Non-Whitened Vs. Whitened Light Curve

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

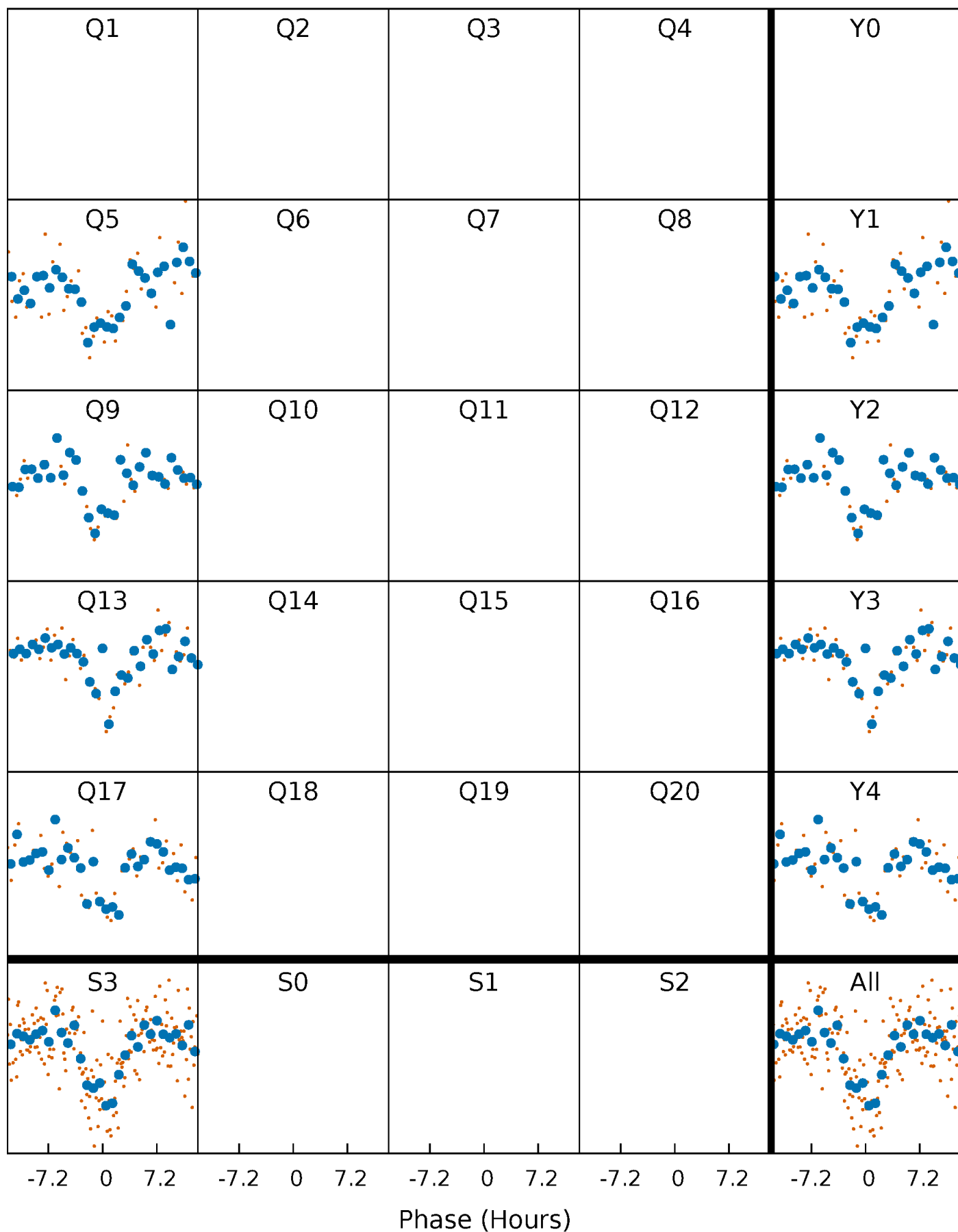


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



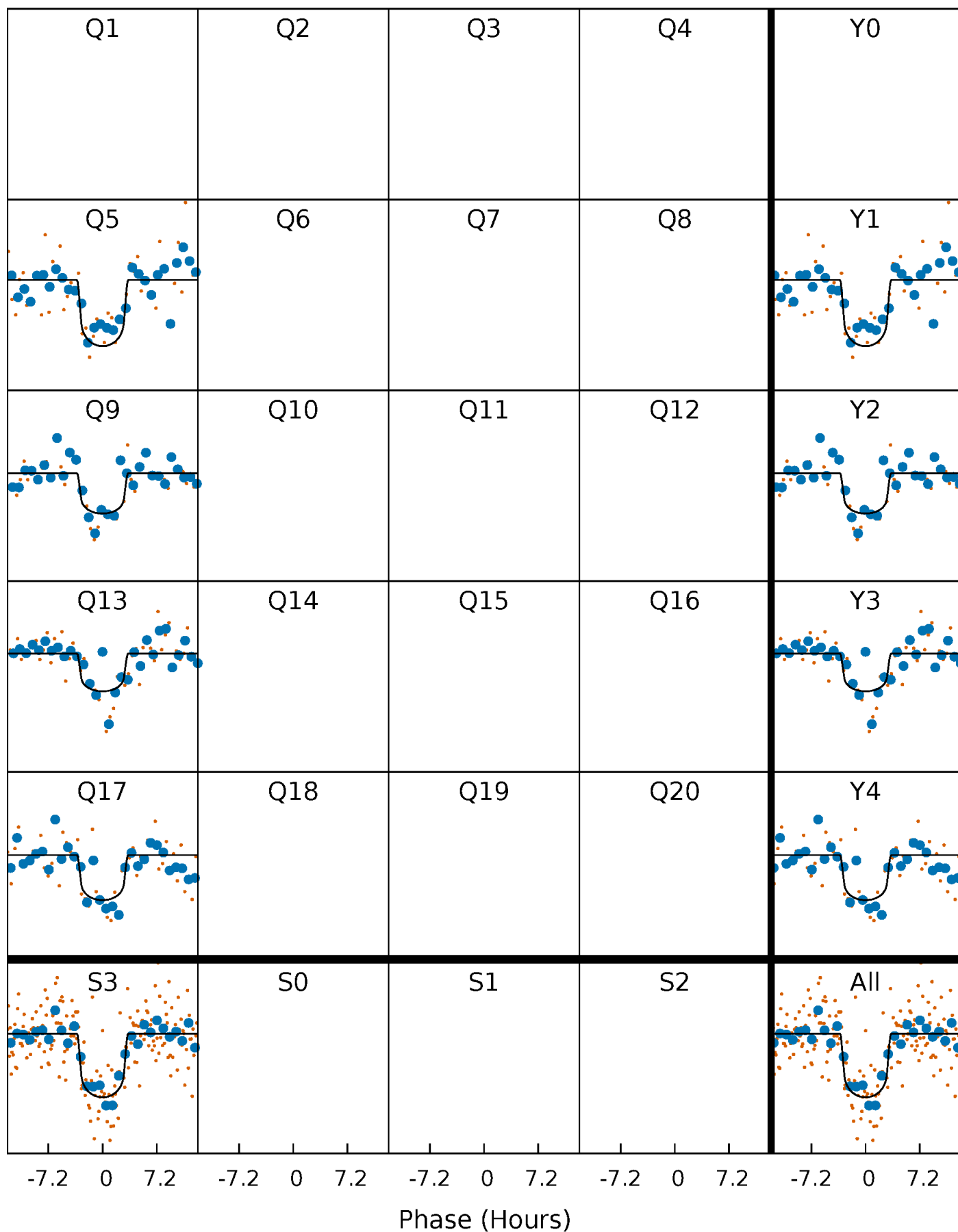
# PDC Quarter-Phased Transit Curves

TCE 010989166-02     $P=373.132674$  Days     $T_0=449.630666$  (BKJD)



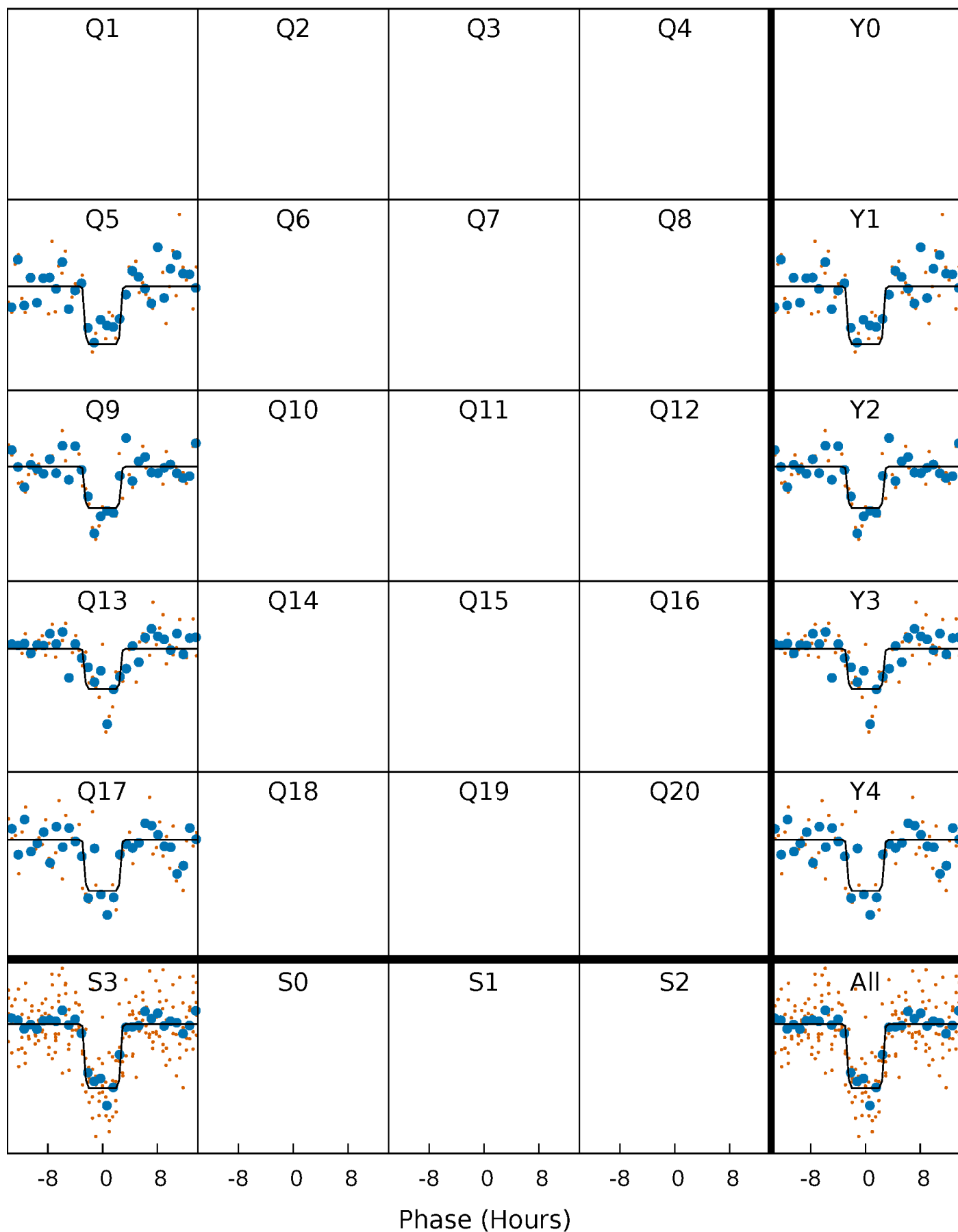
# DV Quarter-Phased Transit Curves

TCE 010989166-02     $P=373.132674$  Days     $T_0=449.630666$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

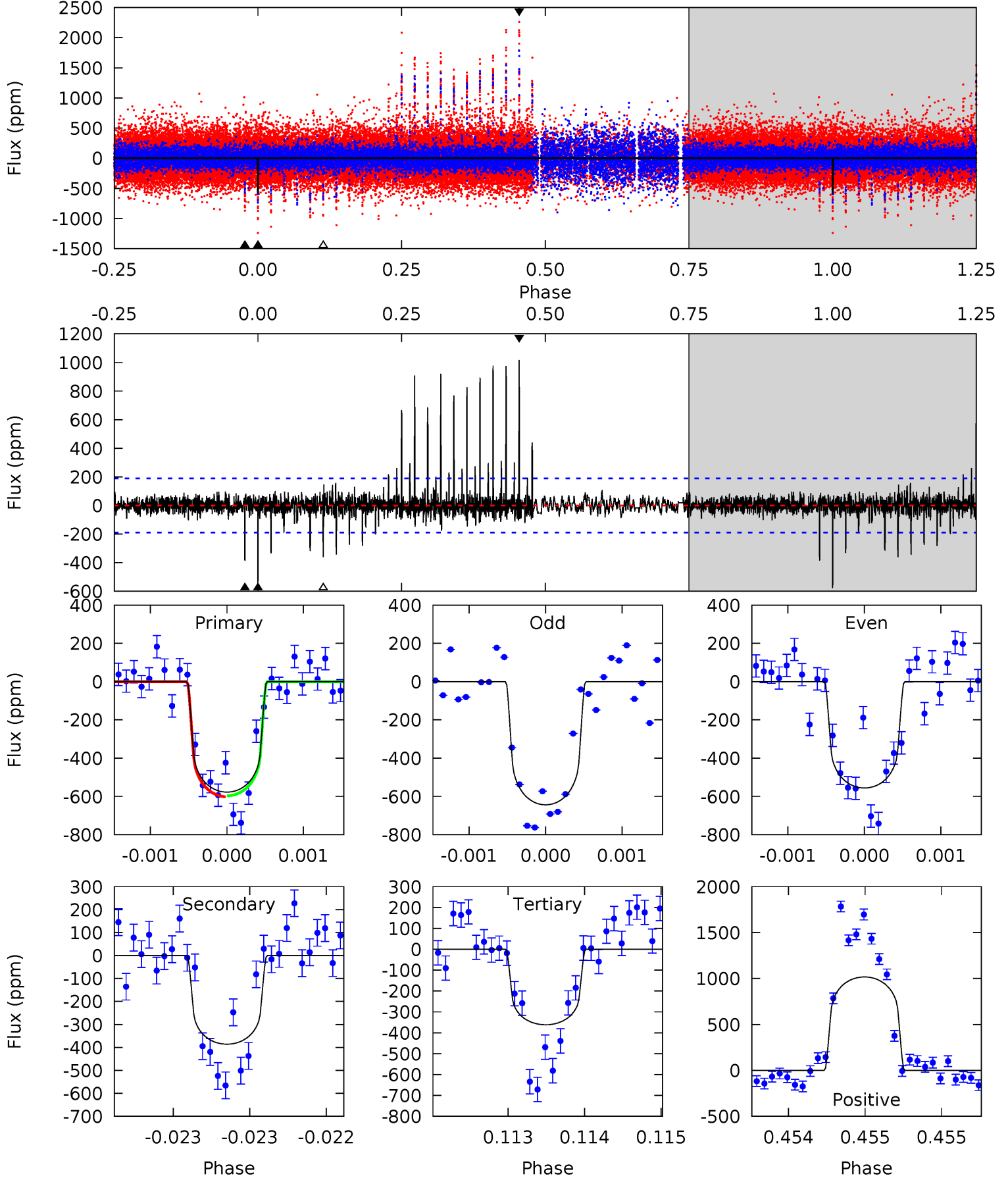
TCE 010989166-02     $P=373.137239$  Days     $T_0=449.621672$  (BKJD)



# DV Model-Shift Uniqueness Test

010989166-02,  $P = 373.132674$  Days,  $E = 76.497992$  Days

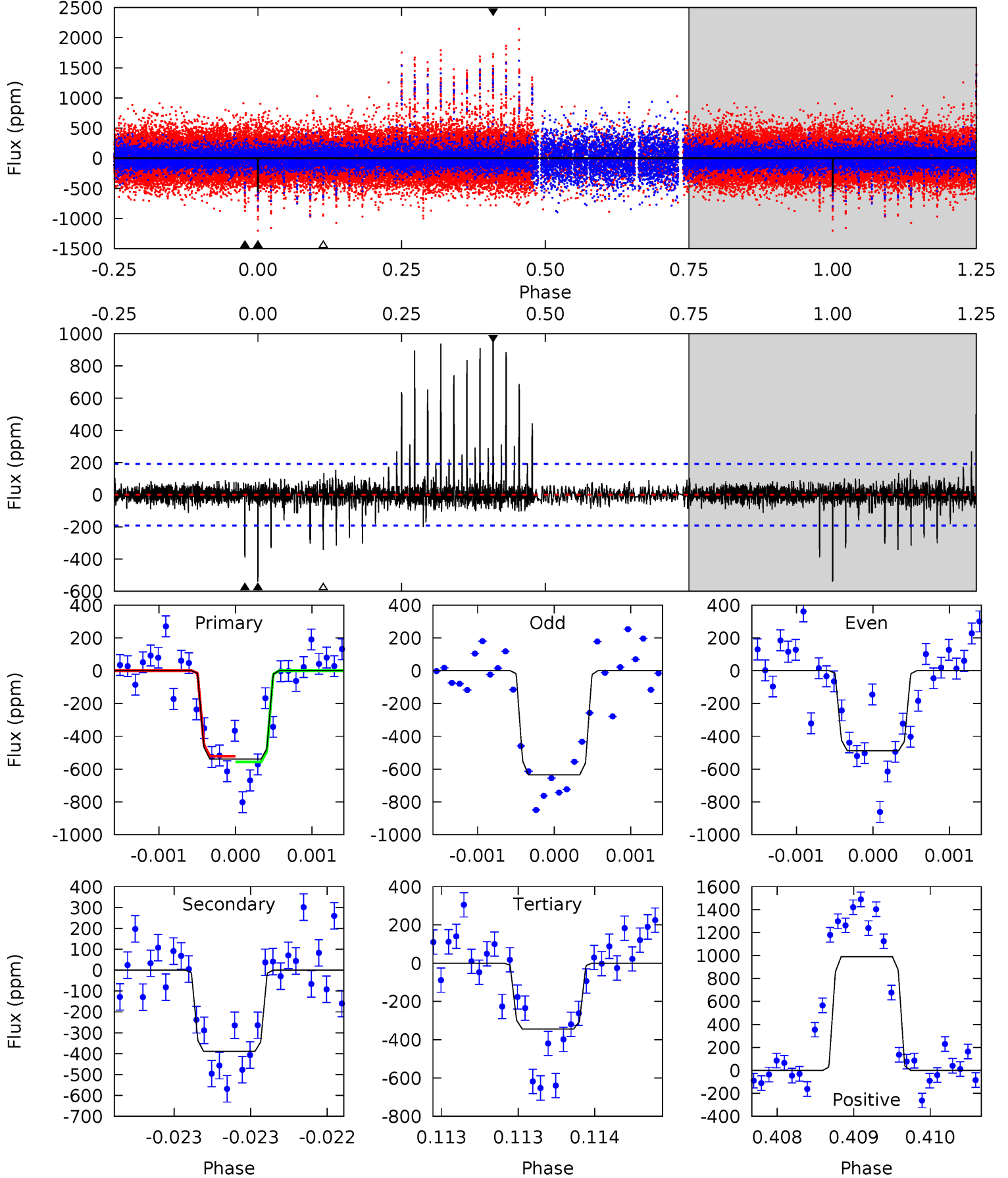
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
16.8	11.2	10.5	29.6	5.51	3.38	2.51	6.29	-12.8	0.71	-18.4	0.85	0.96	0.64	0.07



# Alt Model-Shift Uniqueness Test

010989166-02,  $P = 373.137239$  Days,  $E = 76.484433$  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
15.6	11.2	9.94	28.6	5.52	3.40	2.28	5.62	-13.0	1.30	-17.3	2.06	0.97	0.65	0.52





### Stellar Parameters For KIC 010989166

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6137^{+165}_{-202}$	$4.471^{+0.052}_{-0.208}$	$-0.120^{+0.300}_{-0.300}$	$0.994^{+0.324}_{-0.108}$	$1.067^{+0.139}_{-0.139}$	$1.529^{+0.419}_{-0.782}$
	+3%/-3%	+1%/-5%	+250%/-250%	+33%/-11%	+13%/-13%	+27%/-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 010989166-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-386 \pm 34$	$2.93^{+2.10}_{-1.70}$	$380^{+26}_{-20}$	$5409^{+3363}_{-1078}$	$26427^{+133612}_{-17573}$
Alt.	$-389 \pm 35$	$2.96^{+2.07}_{-1.62}$	$379^{+26}_{-19}$	$5355^{+2728}_{-1014}$	$25828^{+98879}_{-16896}$

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

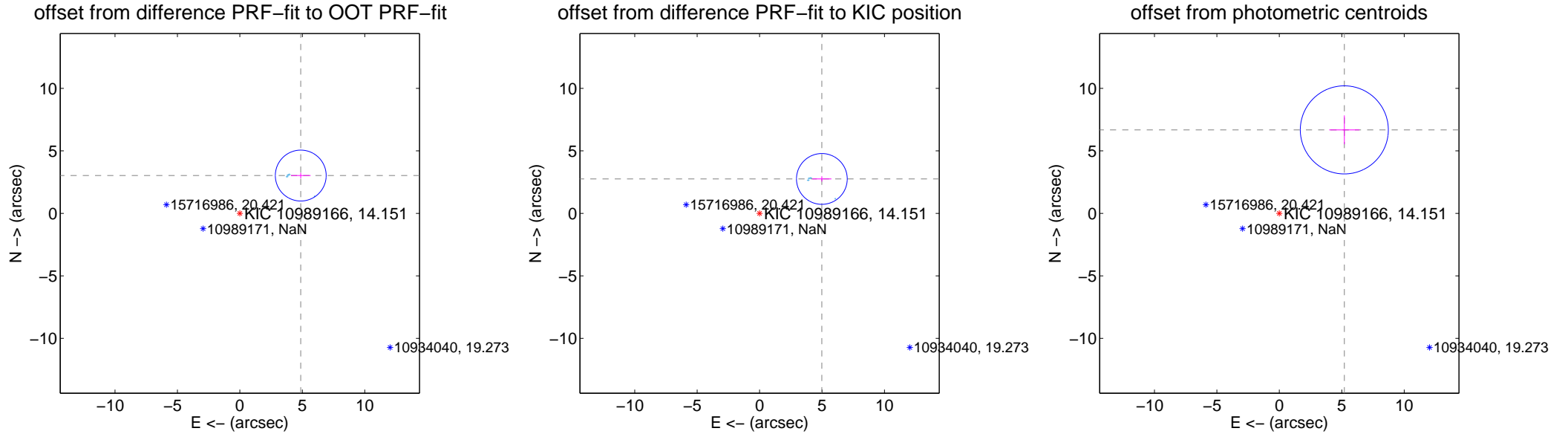
## DV Centroid Data

Supplemental centroid analysis for 010989166-02. Kepler magnitude: 14.15. Transit SNR 13.41

There are 4 quarters with good PRF difference image offsets

The direct PRF centroid is offset from the target star catalog position by about 0.30 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$5.734 \pm 0.679$	8.45	$-4.873 \pm 0.787$	$3.023 \pm 0.220$
PRF-fit source offset from KIC position	$5.693 \pm 0.677$	8.41	$-4.983 \pm 0.765$	$2.754 \pm 0.212$
photometric centroid source offset	$8.46 \pm 1.17$	7.21	$-5.20 \pm 1.21$	$6.68 \pm 1.15$

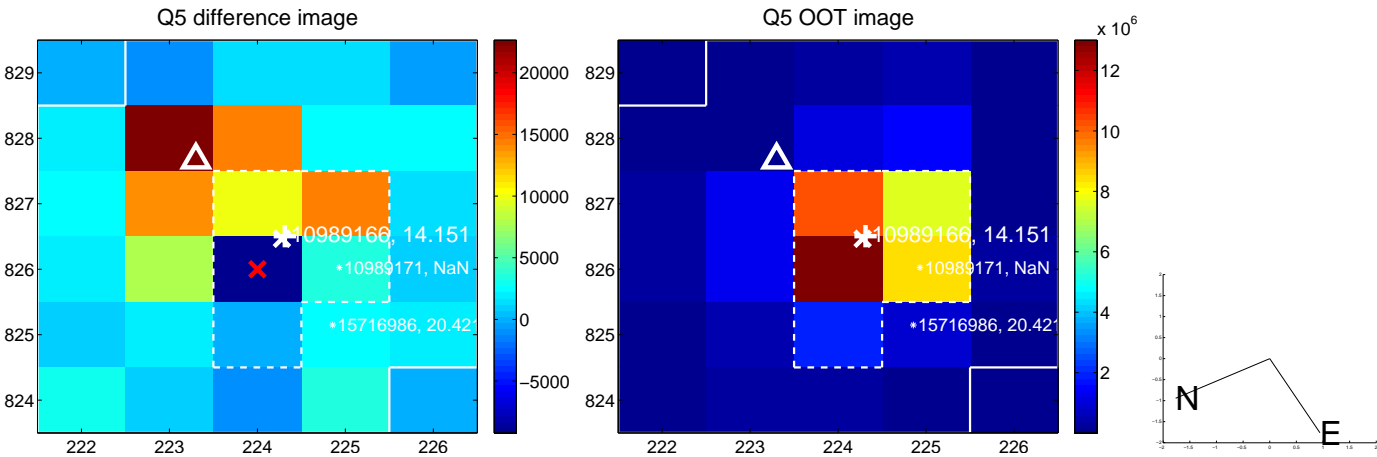


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

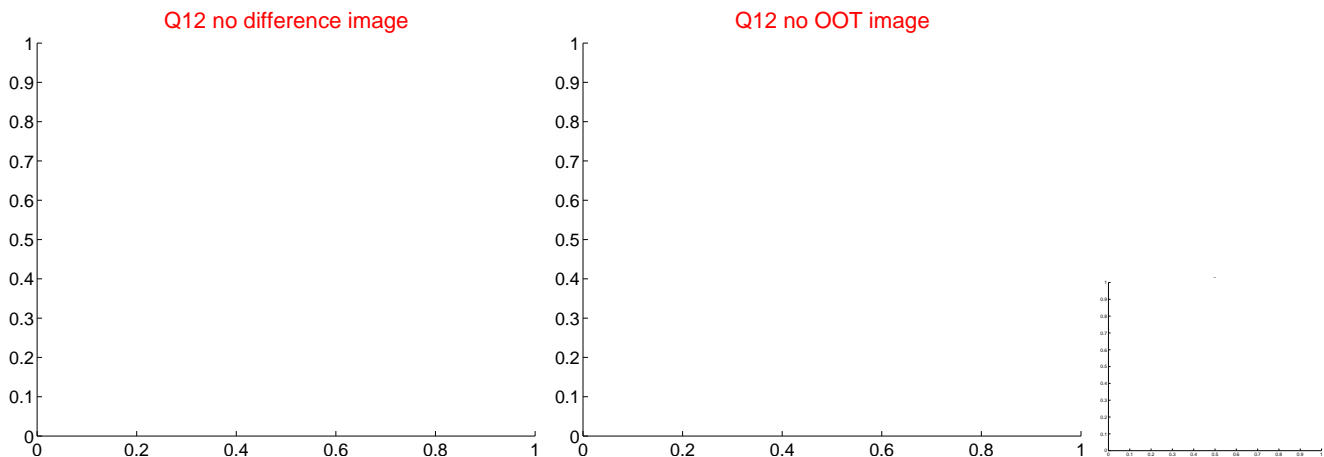
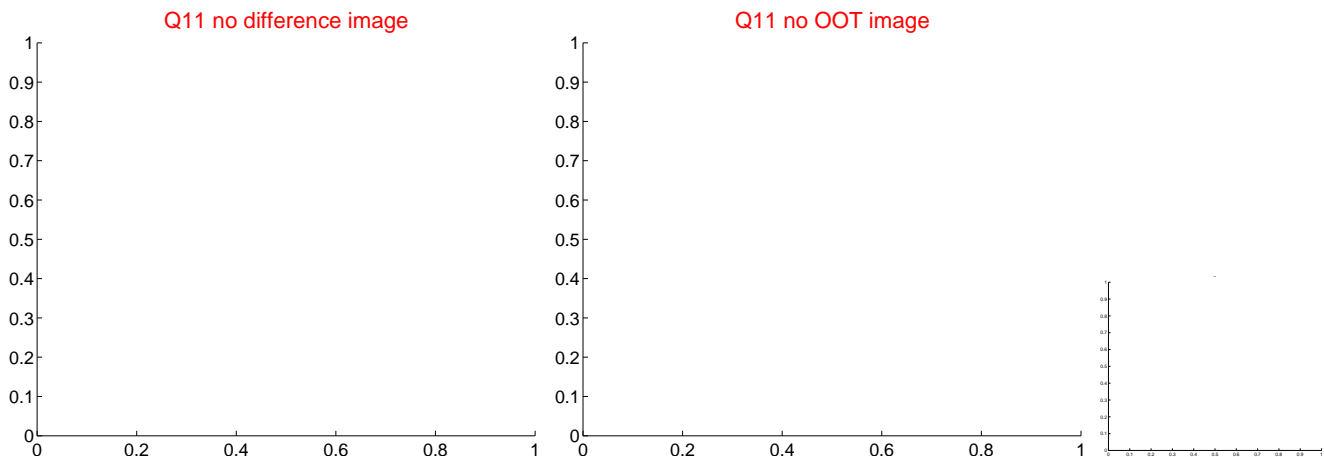
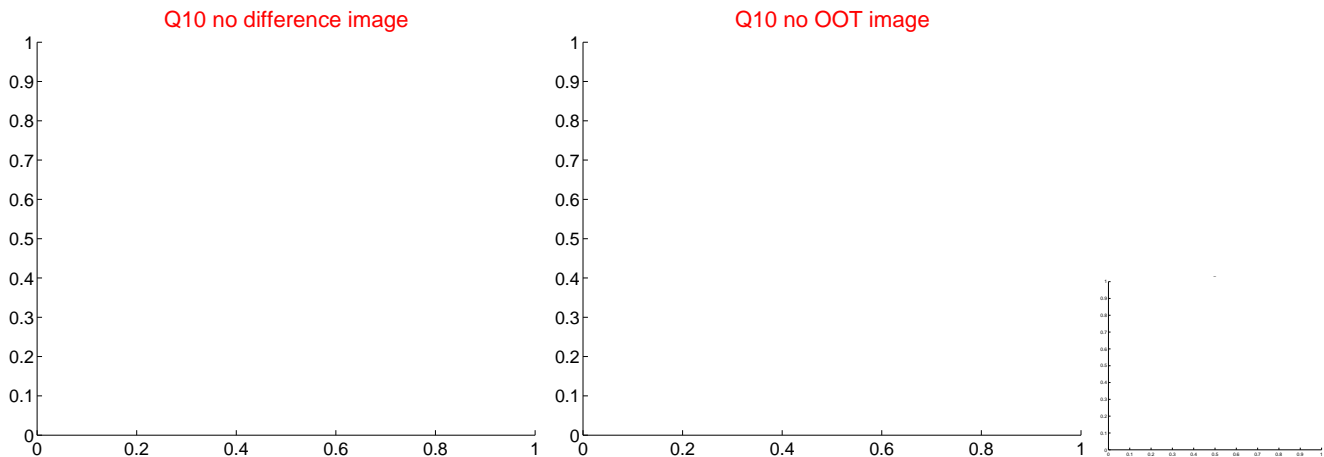
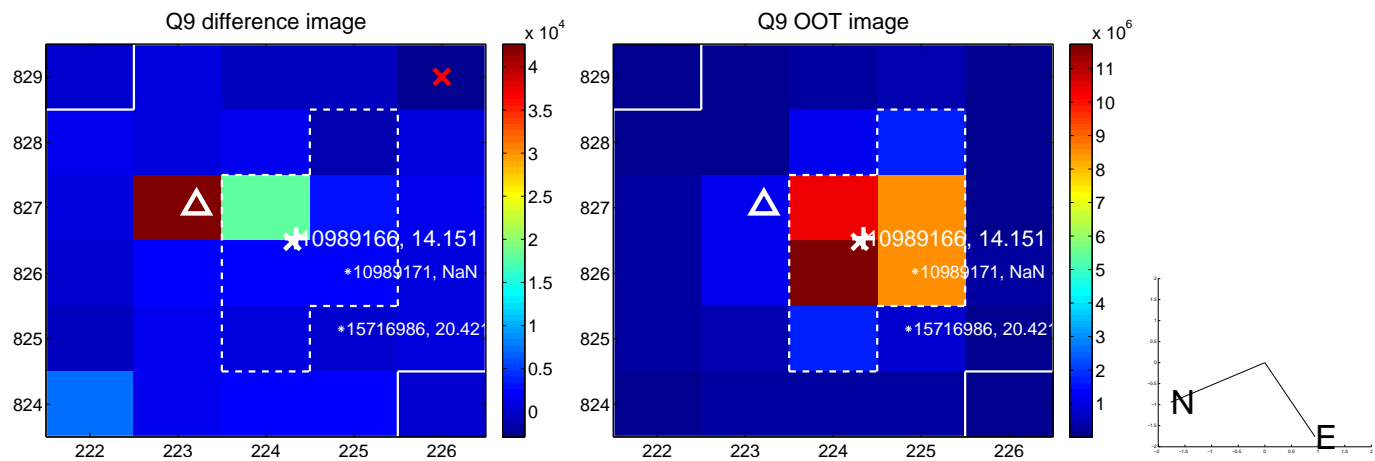
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



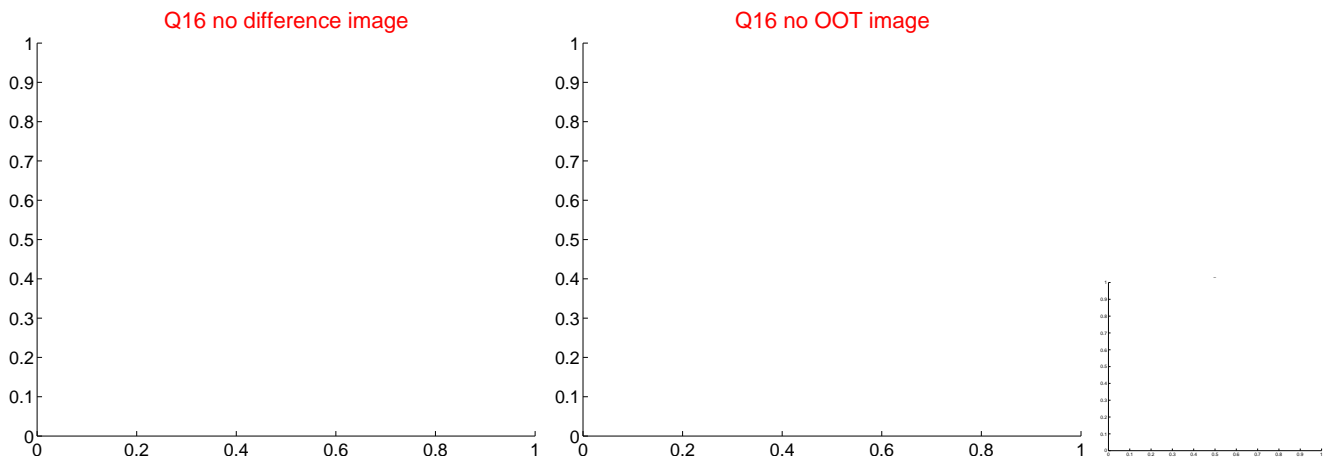
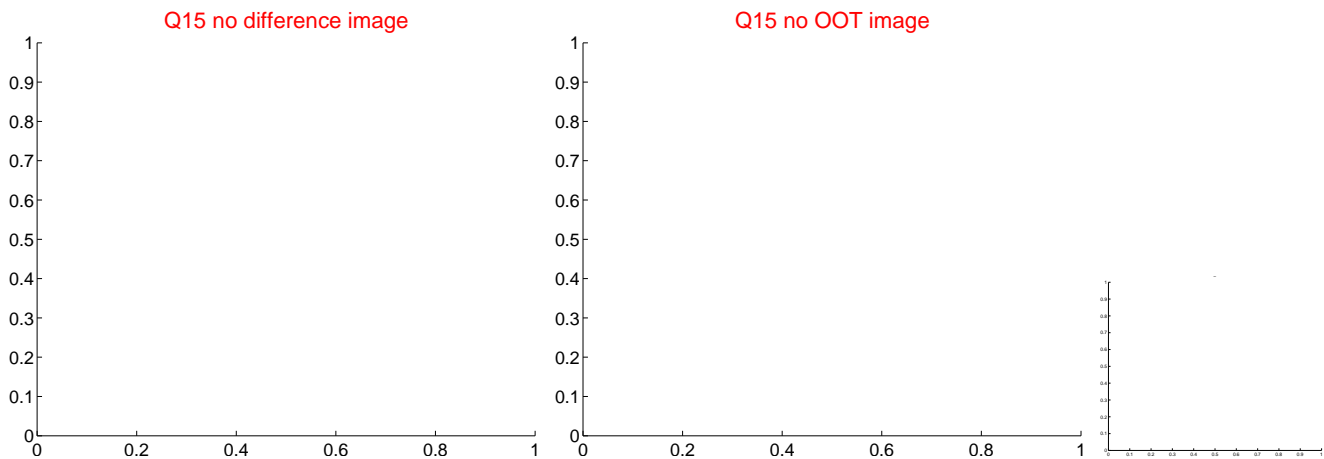
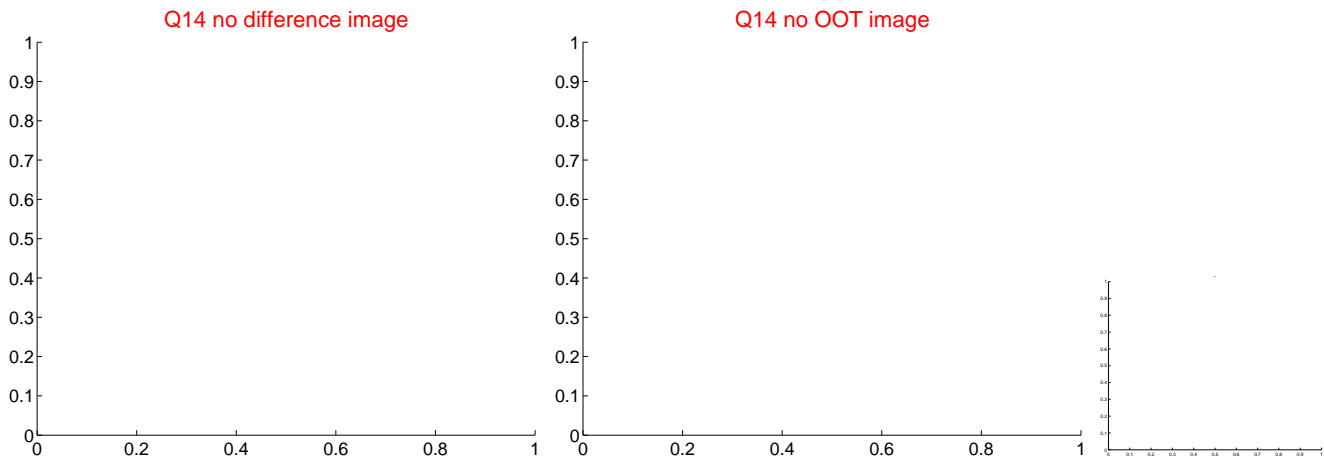
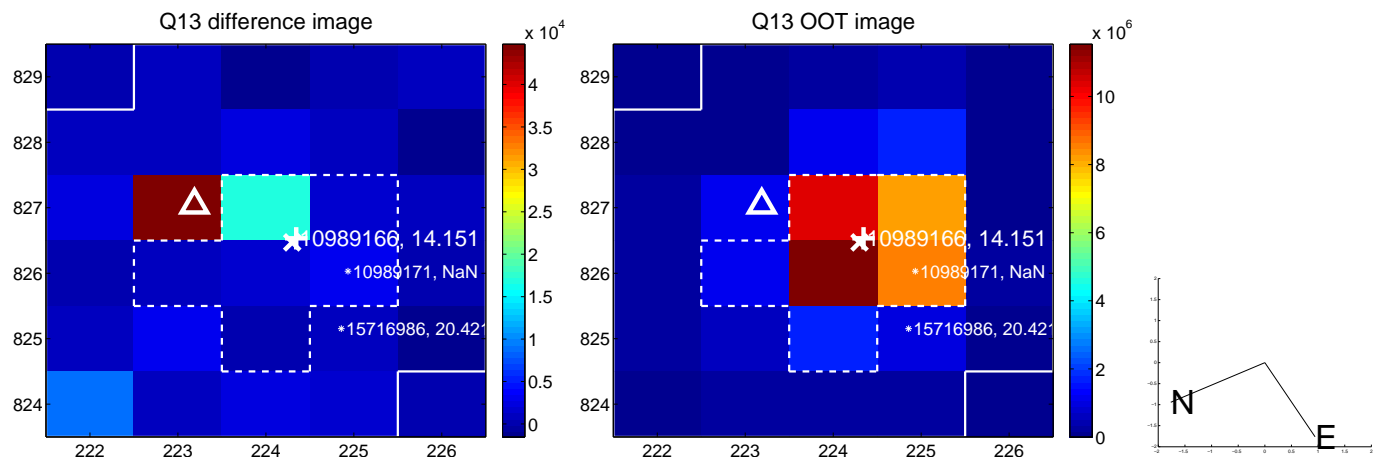
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



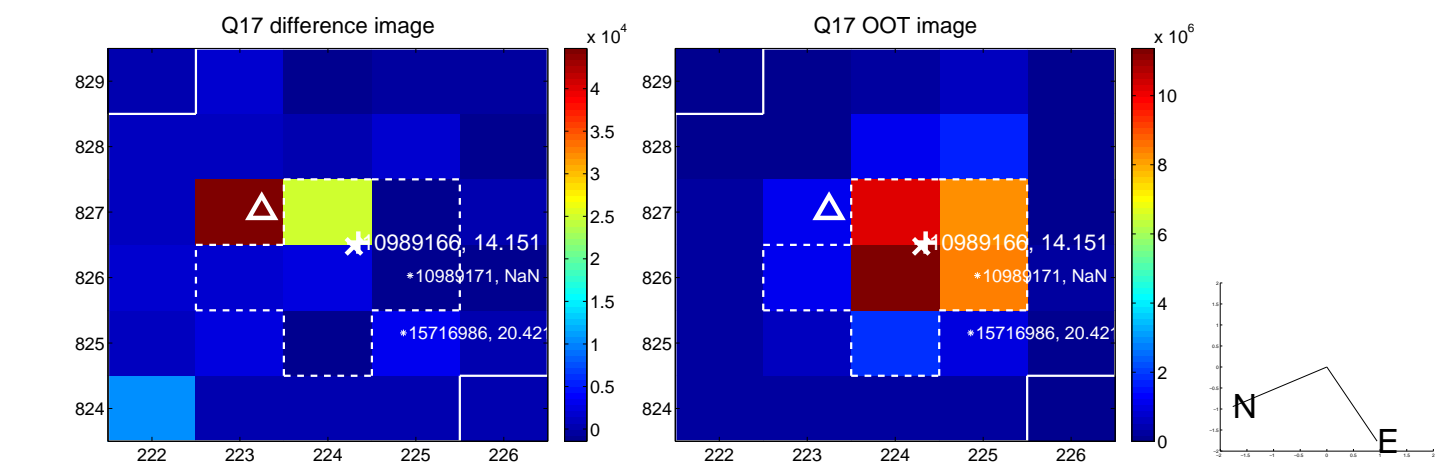
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



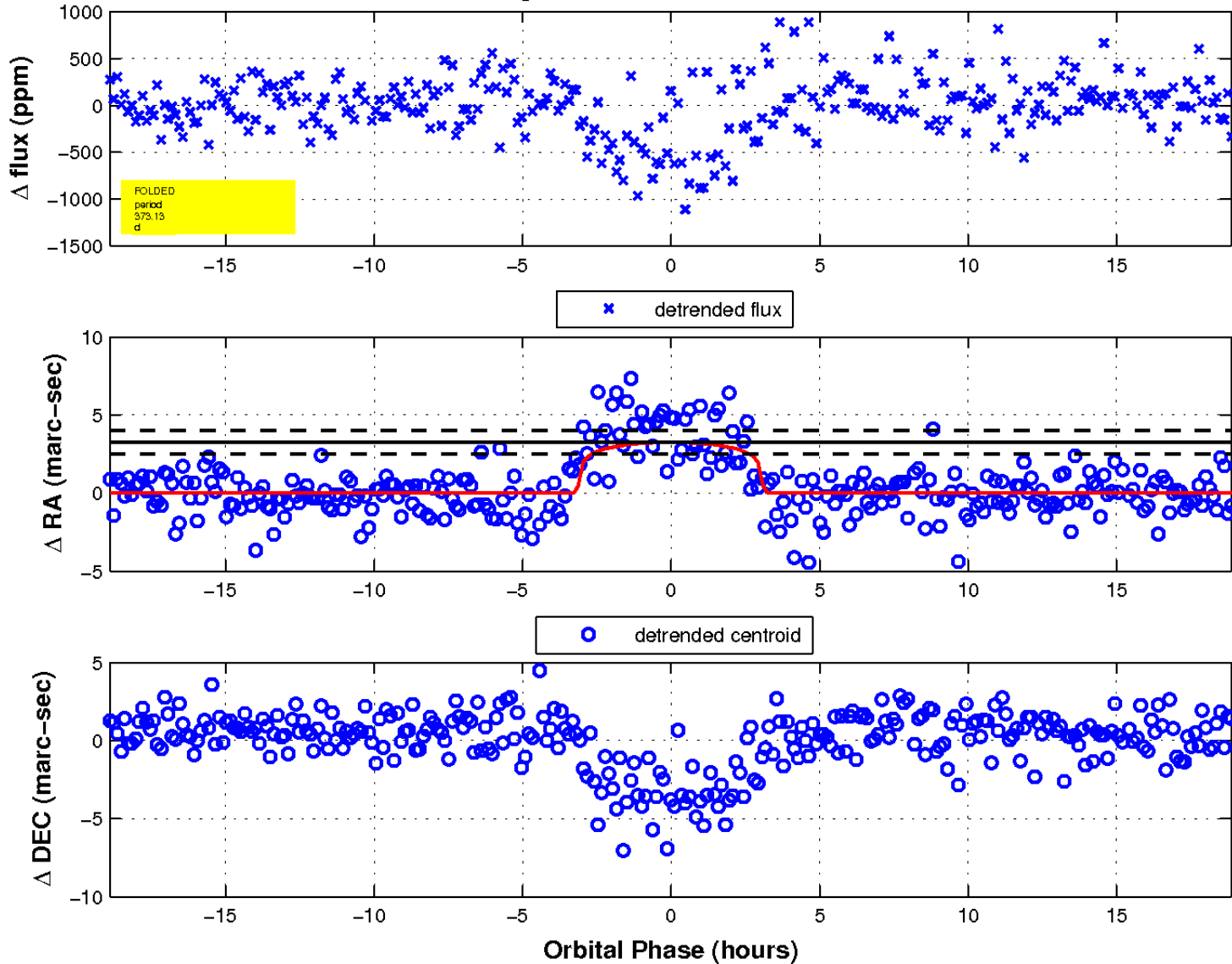
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

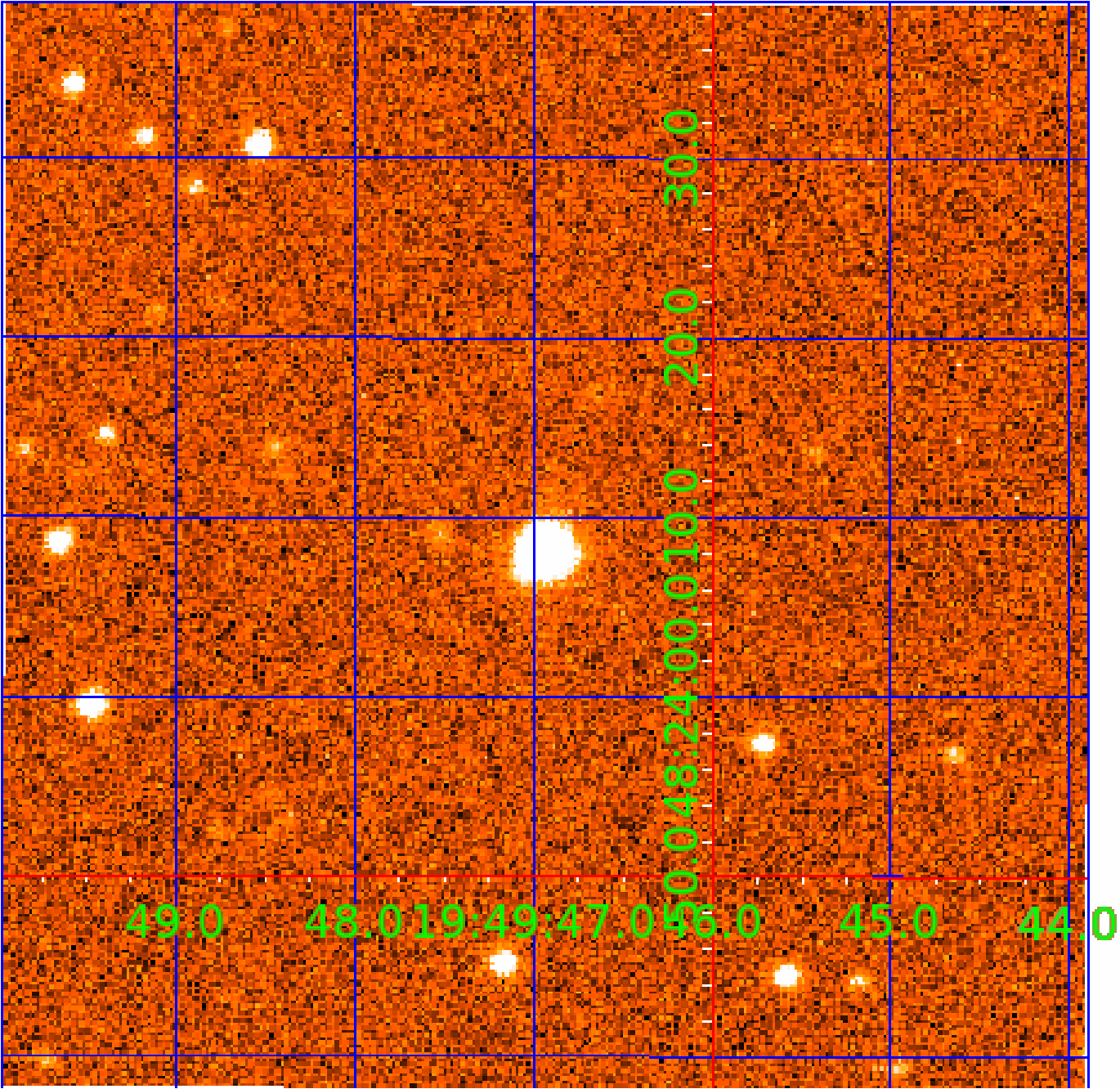


### fluxWeightedCentroids, Planet 2 of 7



UKIRT Image

Declination





# KIC 010989166

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
010989166-01	OBS	No	364.654533	483.543104	599.2	6.203	13.0	13.8	0.99	6137	2.66	1.21
010989166-02	OBS	No	373.132674	449.630666	601.9	6.331	12.6	13.4	0.99	6137	2.52	1.17
010989166-03	OBS	No	364.640890	492.053046	643.4	5.646	11.9	12.8	0.99	6137	2.70	1.21
010989166-04	OBS	No	373.150031	458.076750	648.8	4.835	11.2	11.2	0.99	6137	2.74	1.17
010989166-05	OBS	No	398.554187	466.602819	581.0	5.096	10.5	10.6	0.99	6137	2.39	1.07
010989166-06	OBS	No	195.012731	254.729492	604.3	6.002	9.9	11.2	0.99	6137	2.58	2.78
010989166-07	OBS	No	534.484685	279.855588	369.4	7.477	8.6	7.4	0.99	6137	2.19	0.72

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
010989166-01	OBS	FP	0.00	1	0	1	0	MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_RESOLVED_OFFSET—HALO_GHOST
010989166-02	OBS	FP	0.00	1	0	1	1	MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_RESOLVED_OFFSET—HALO_GHOST—EPHEM_MATCH
010989166-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—SAME_NTL_PERIOD—CENT_FEW_DIFFS
010989166-04	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_MARSHALL—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—SAME_NTL_PERIOD—CENT_RESOLVED_OFFSET—HALO_GHOST
010989166-05	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_CHASES—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS—HALO_GHOST
010989166-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
010989166-07	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_CHASES—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS—HALO_GHOST

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

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

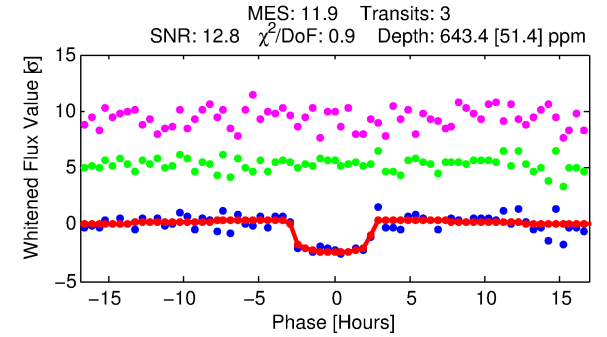
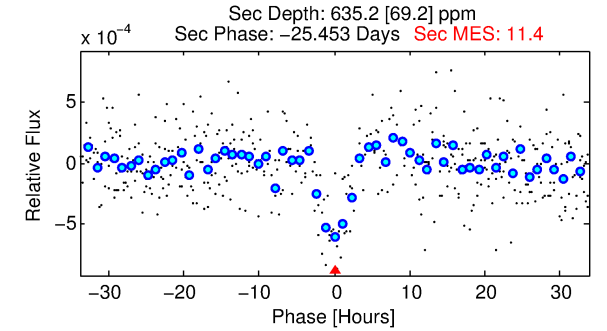
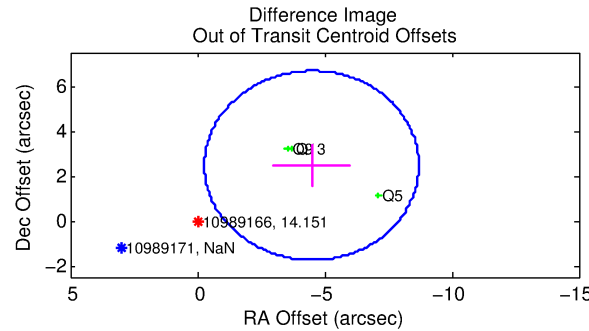
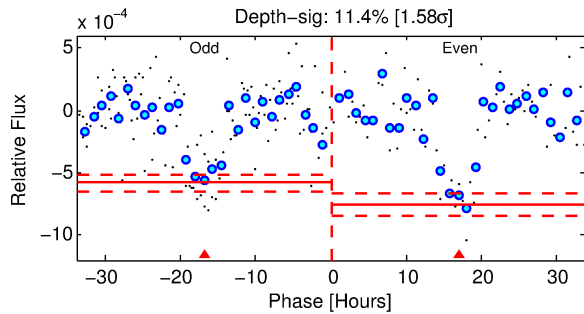
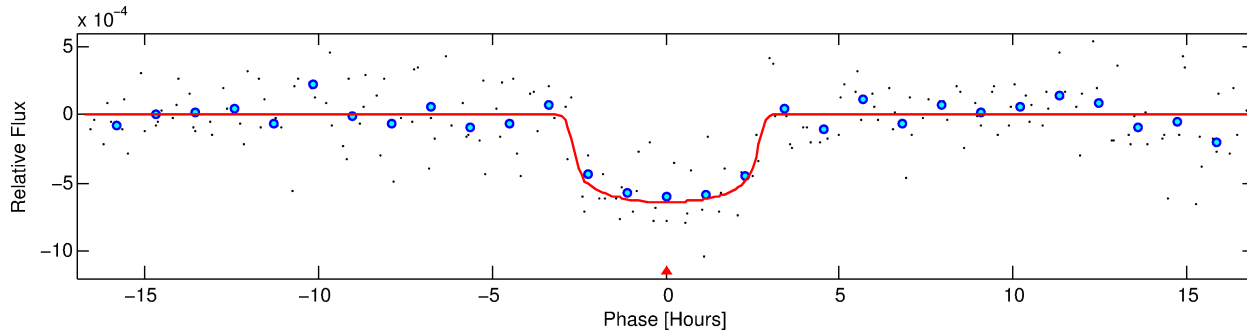
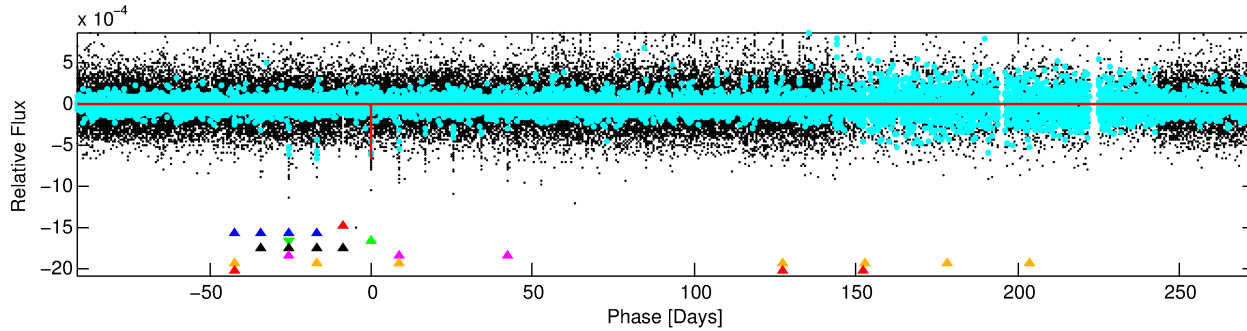
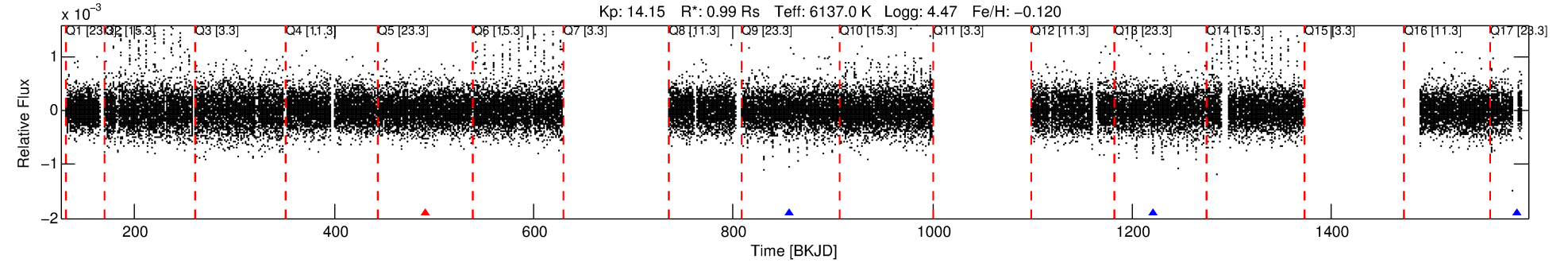
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 010989166-03

No Significant Match Found

# DV One-Page Summary

KIC: 10989166 Candidate: 3 of 7 Period: 364.641 d



## DV Fit Results:

Period = 364.64089 [0.00512] d  
Epoch = 492.0530 [0.0065] BKJD  
Rp/R\* = 0.0249 [0.0130]  
a/R\* = 367.08 [943.40]  
b = 0.70 [1.86]  
Seff = 1.21 [0.49]  
Teq = 267 [27] K  
Rp = 2.70 [1.66] Re  
a = 1.0206 [0.2752] AU  
Ag = 49962.80 [55766.95] [0.90 $\sigma$ ]  
Teffp = 6176 [1630] K [3.63 $\sigma$ ]

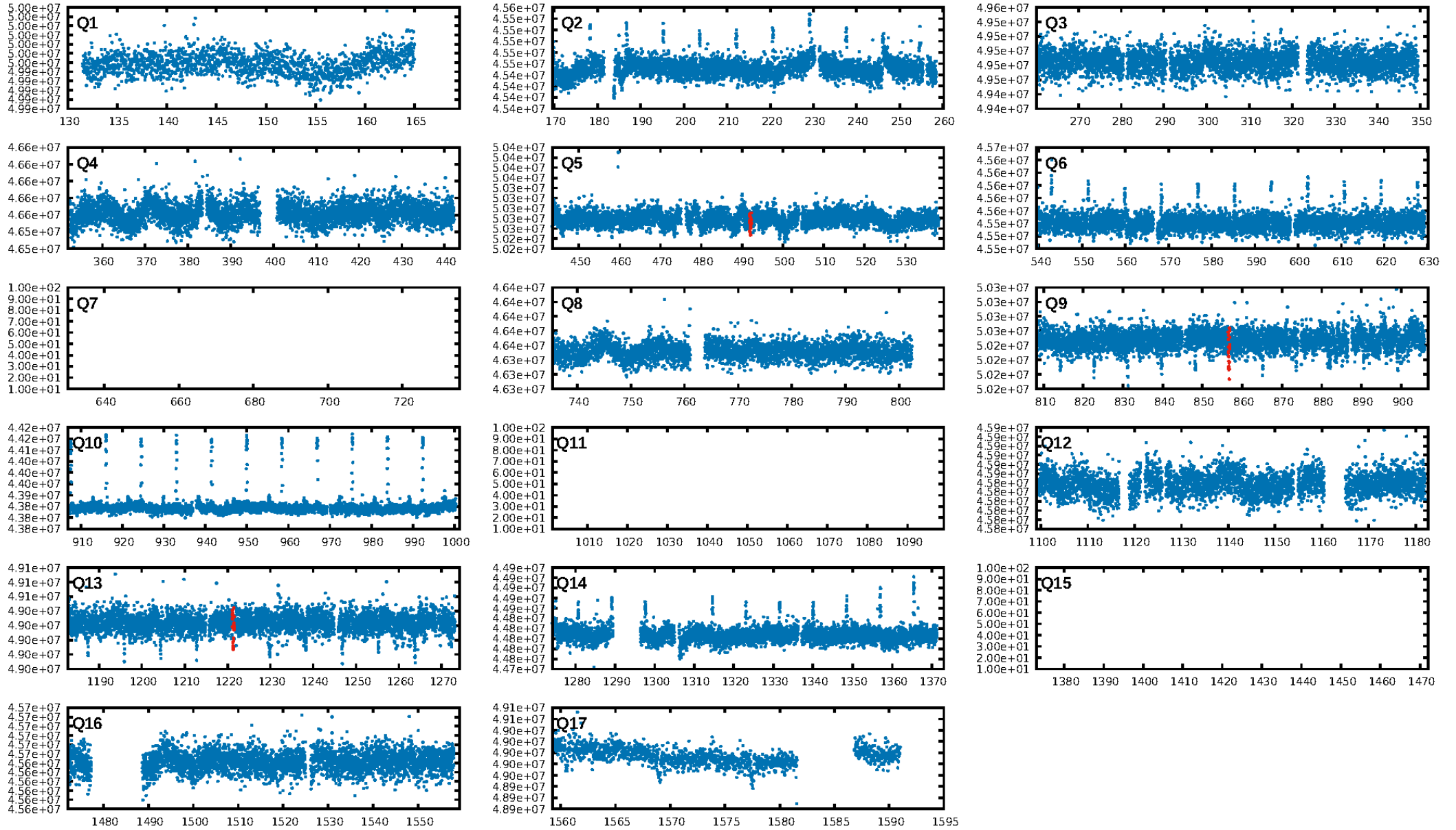
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [494.04 $\sigma$ ]  
LongPeriod-sig: 3.1% [0.04 $\sigma$ ]  
ModelChiSquare2-sig: 5.1%  
ModelChiSquareGof-sig: 98.1%  
Bootstrap-pfa: 7.17e-15  
RollingBand-fgt: 0.67 [2/3]  
GhostDiagnostic-chr: 0.3545  
Centroid-sig: N/A  
Centroid-so: 9.034 arcsec [6.49 $\sigma$ ]  
OotOffset-rm: 5.125 arcsec [3.65 $\sigma$ ]  
KicOffset-rm: 5.130 arcsec [3.68 $\sigma$ ]  
OotOffset-st: 0/0/0/3 [3]  
KicOffset-st: 0/0/0/3 [3]  
DiffImageQuality-fgm: 1.00 [3/3]  
DiffImageOverlap-fno: 1.00 [3/3]

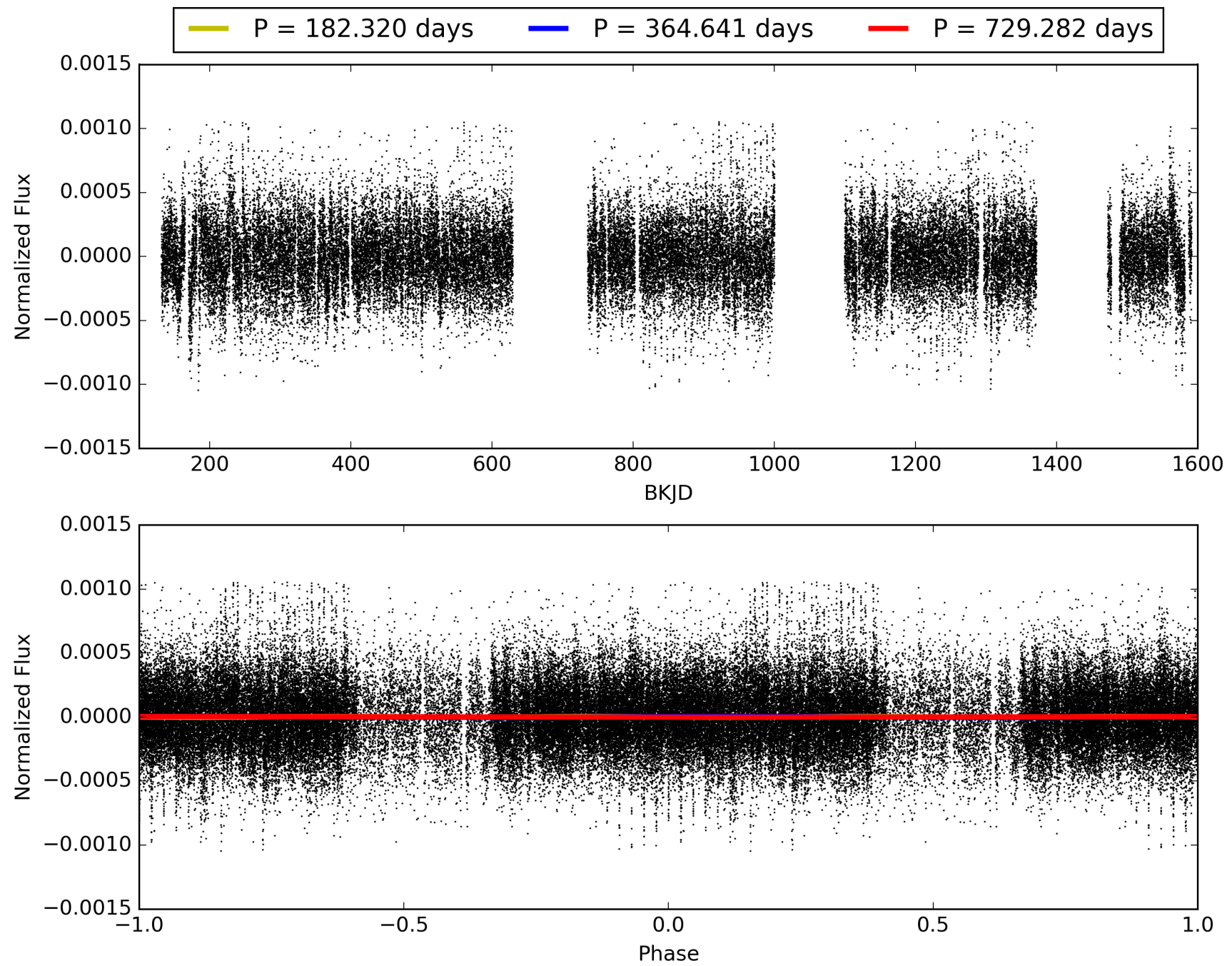
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 04:00:11 Z

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

# TCE 010989166-03, PDC Light Curves

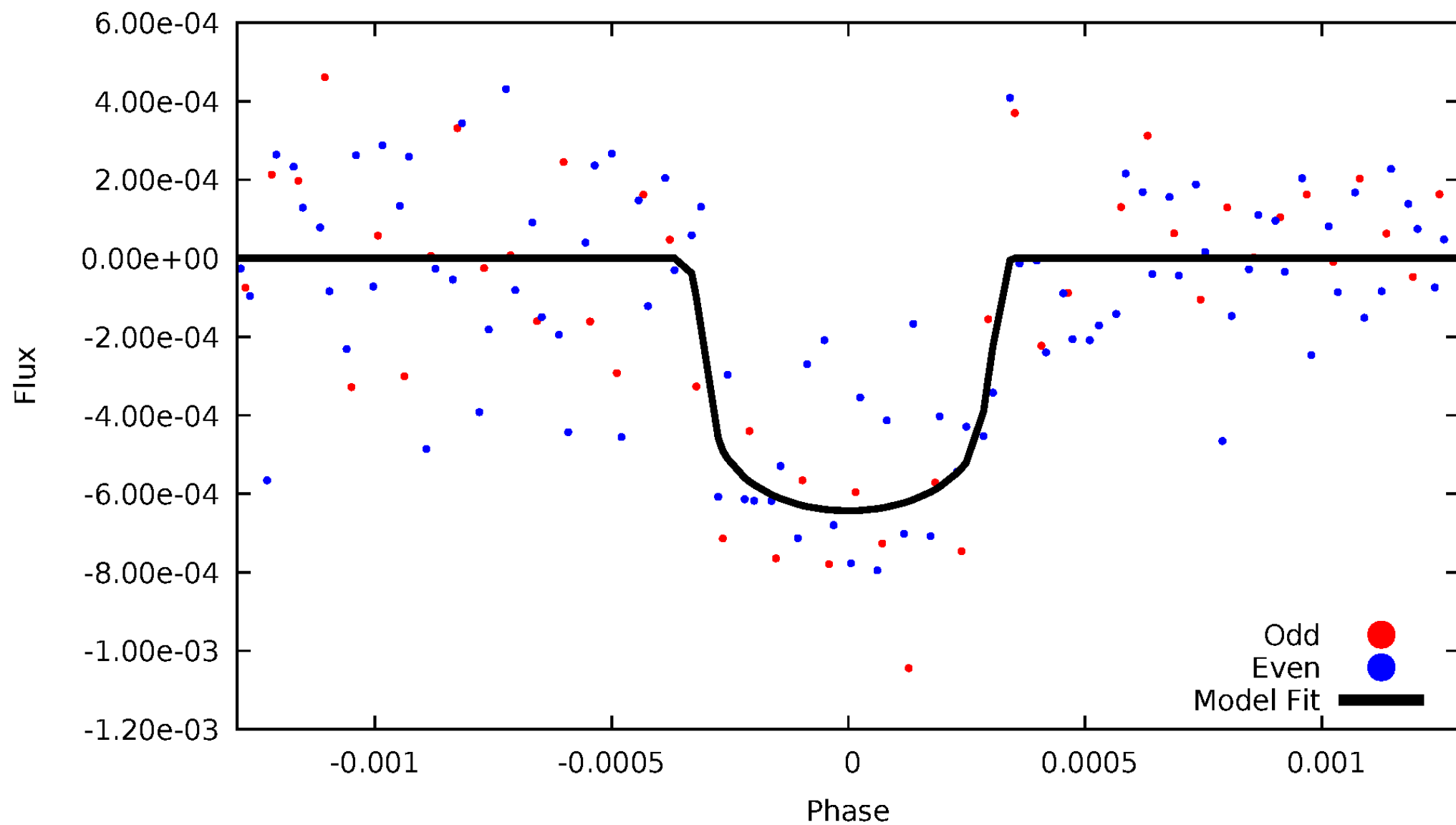


TCE 010989166-03



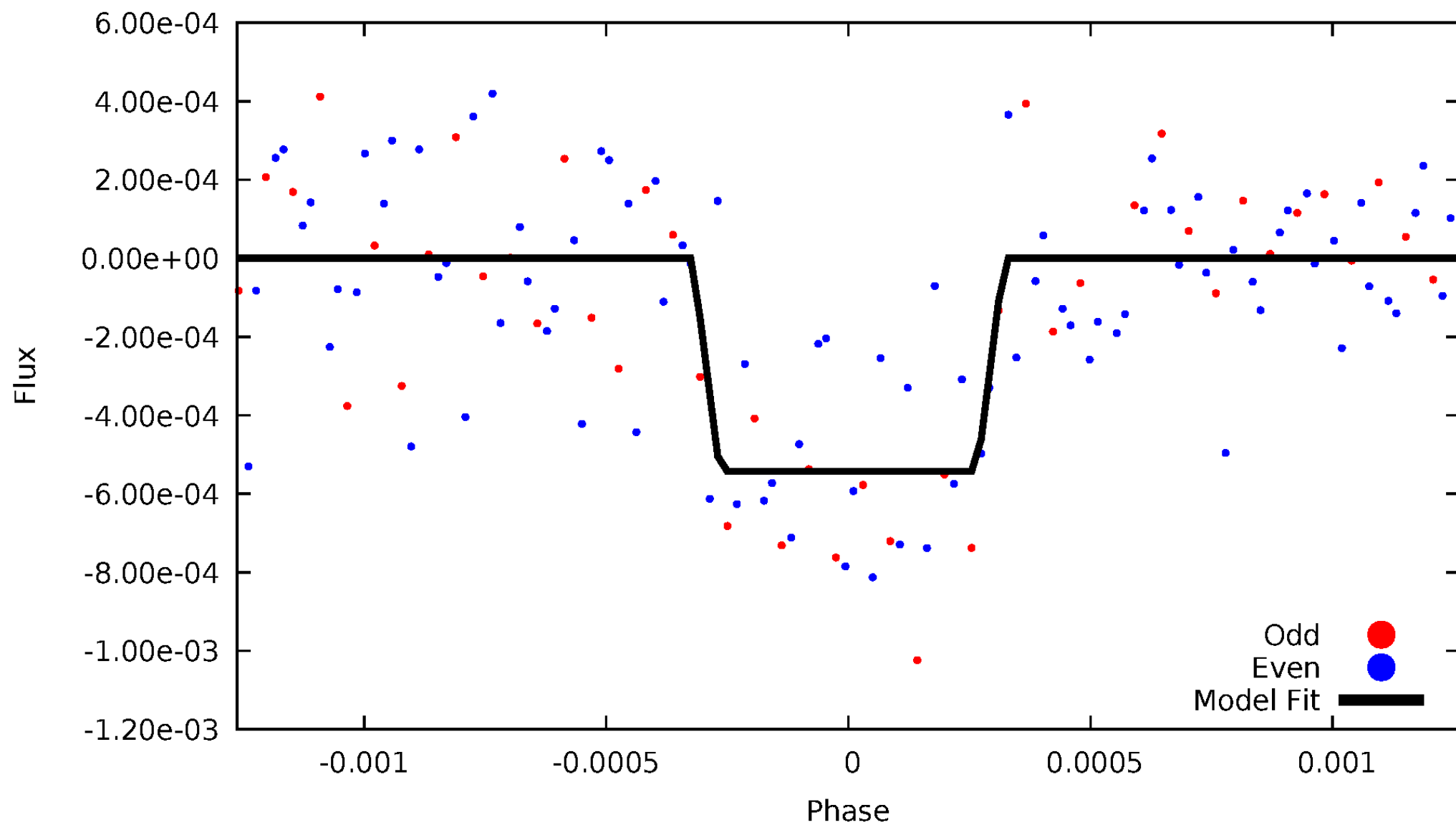
# DV Odd/Even

TCE 010989166-03



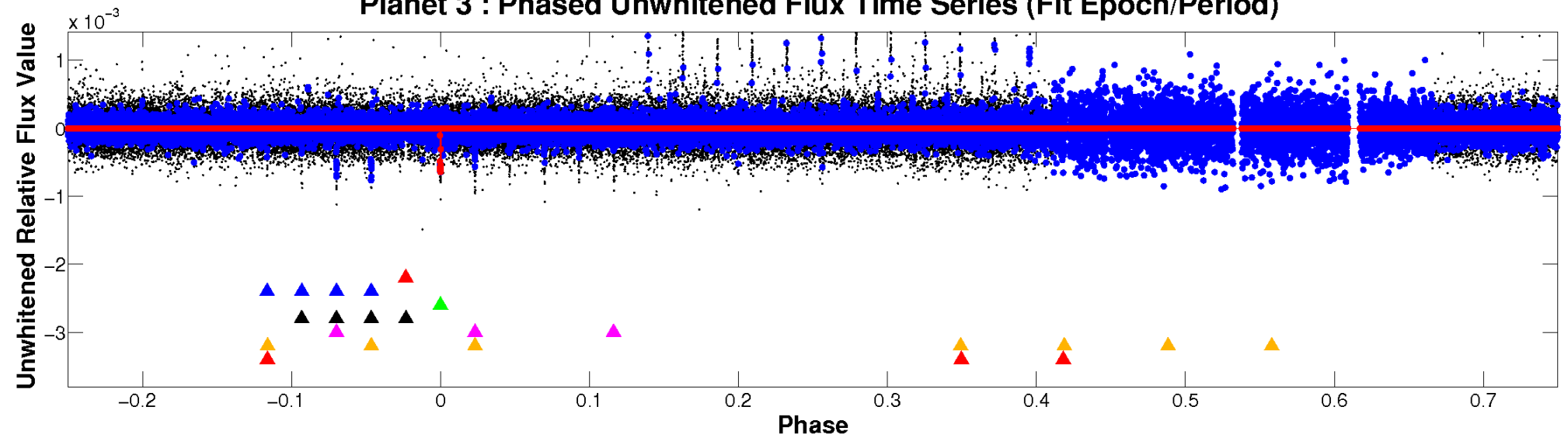
# ALT Odd/Even

TCE 010989166-03

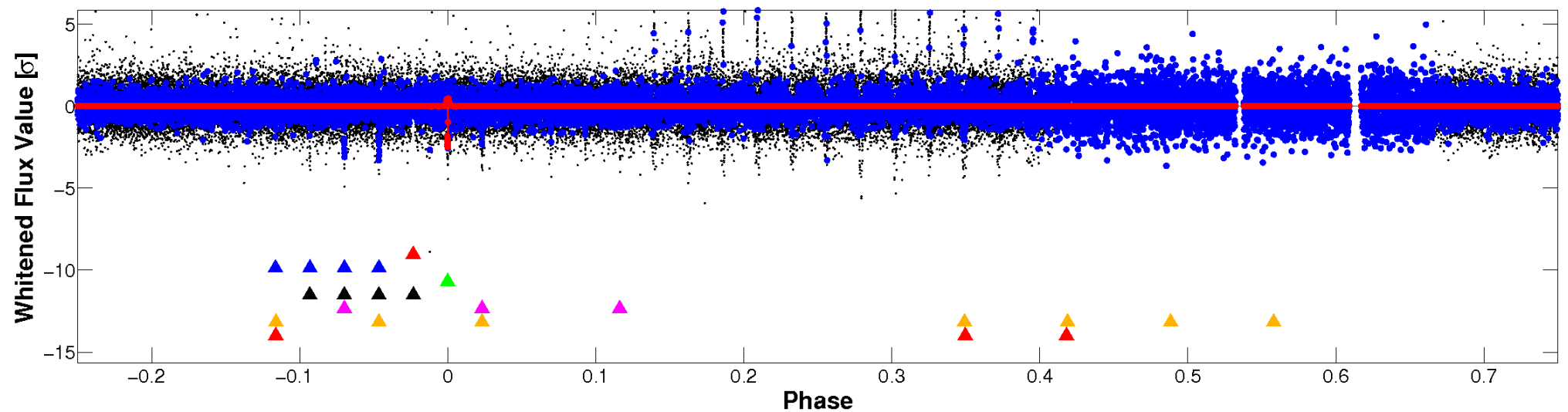


# Non-Whitened Vs. Whitened Light Curve

## Planet 3 : Phased Unwhitened Flux Time Series (Fit Epoch/Period)

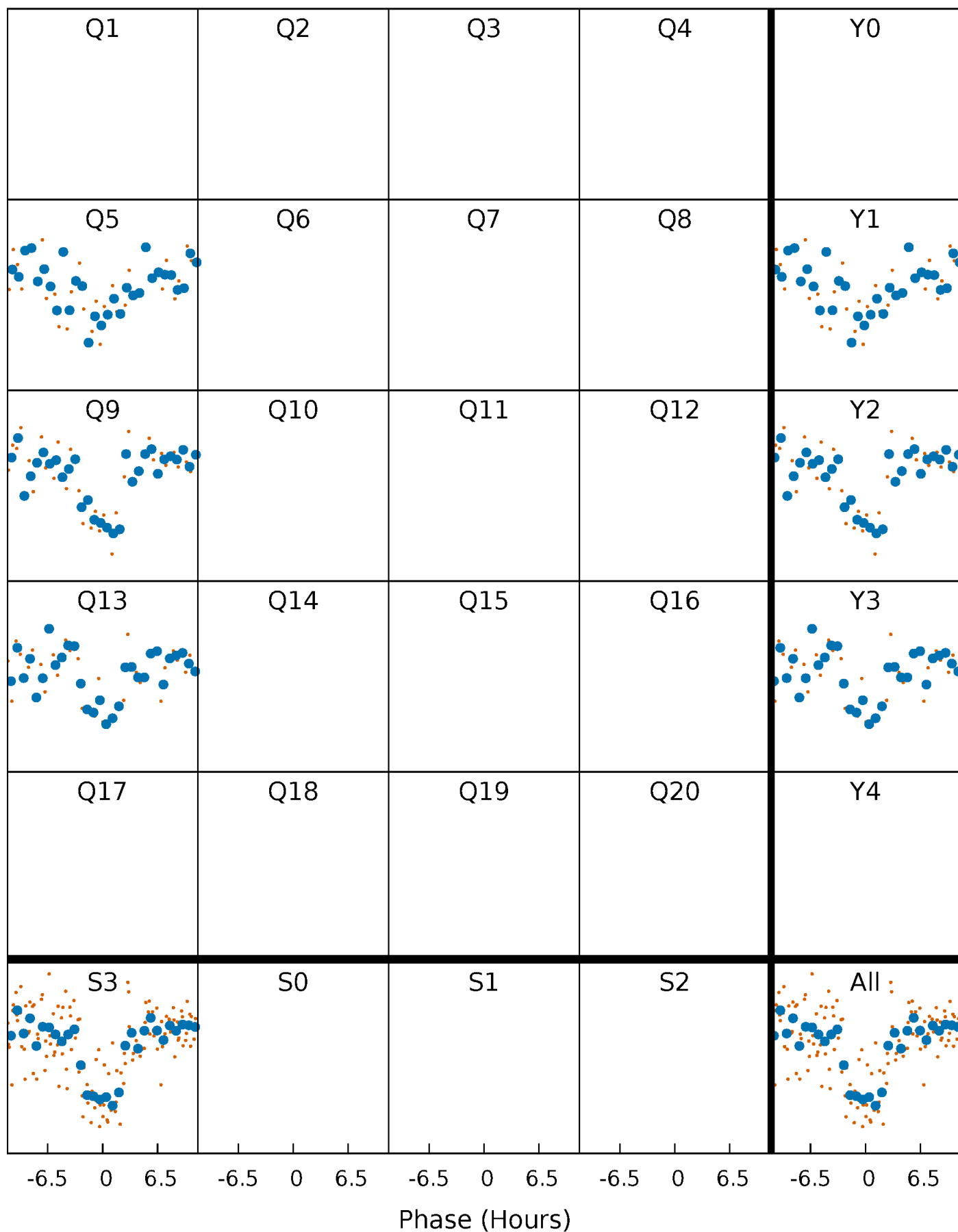


## Planet 3 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

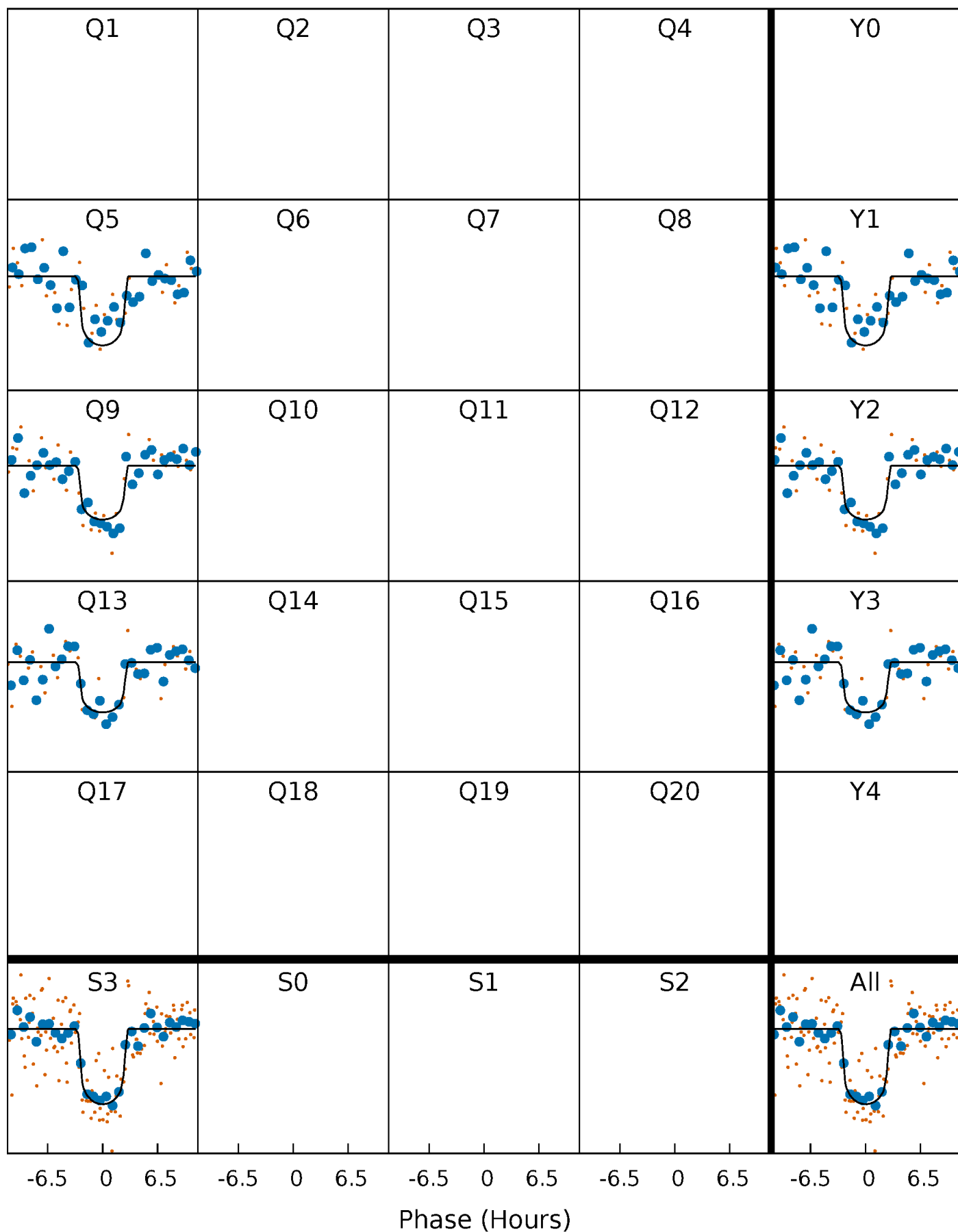
TCE 010989166-03     $P=364.640890$  Days     $T_0=492.053046$  (BKJD)





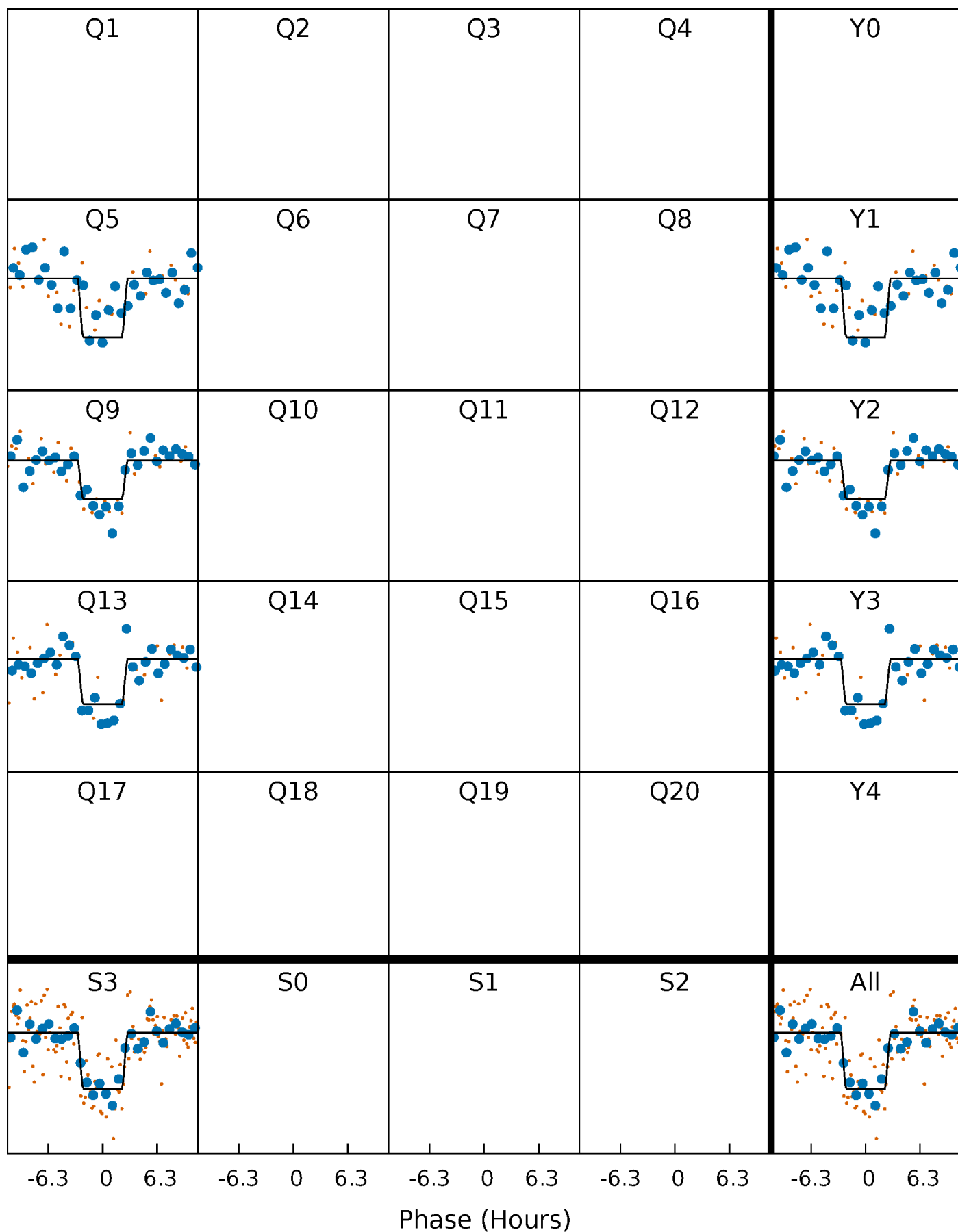
# DV Quarter-Phased Transit Curves

TCE 010989166-03     $P=364.640890$  Days     $T_0=492.053046$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

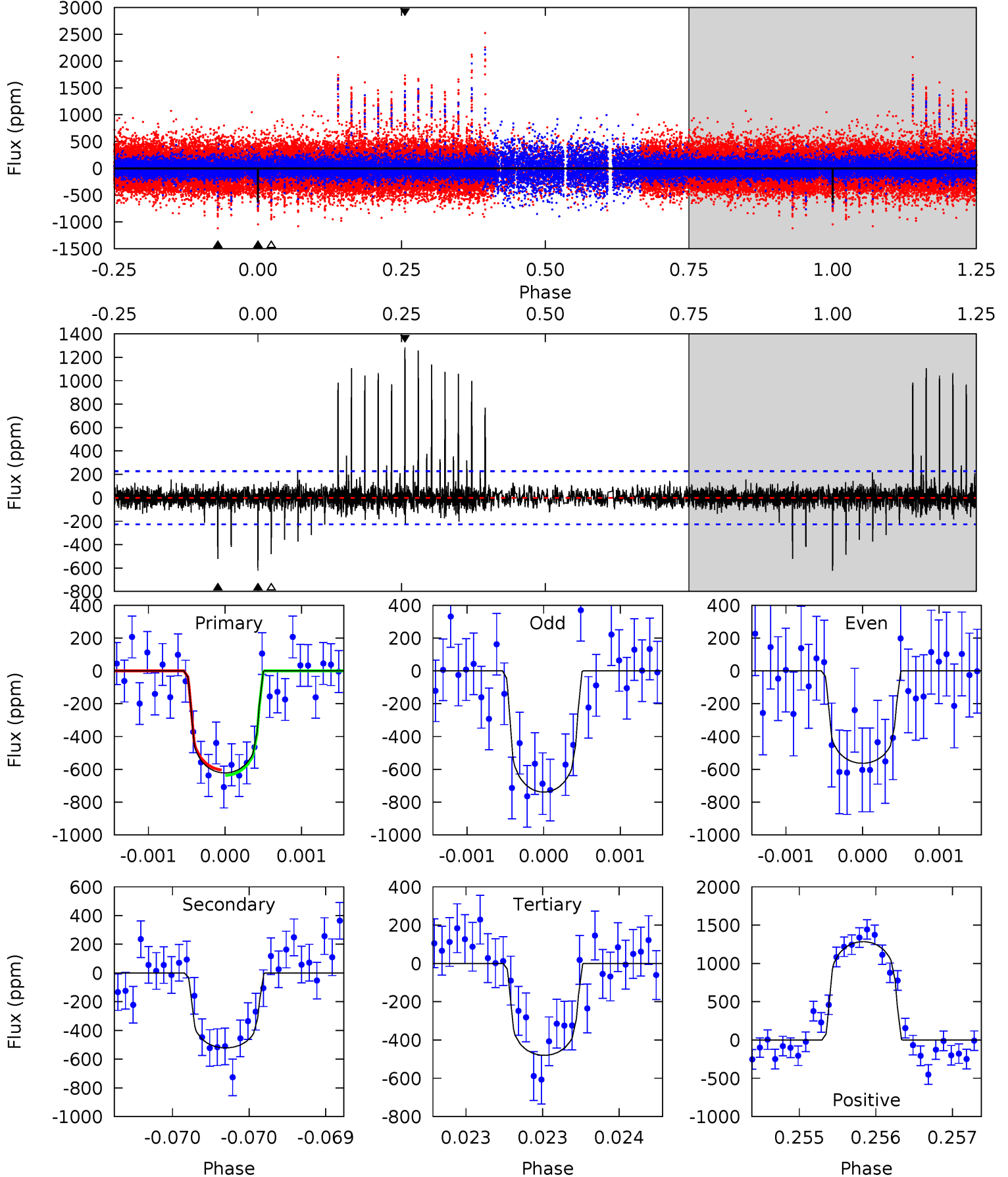
TCE 010989166-03     $P=364.650501$  Days     $T_0=492.037945$  (BKJD)



# DV Model-Shift Uniqueness Test

010989166-03, P = 364.640890 Days, E = 127.412156 Days

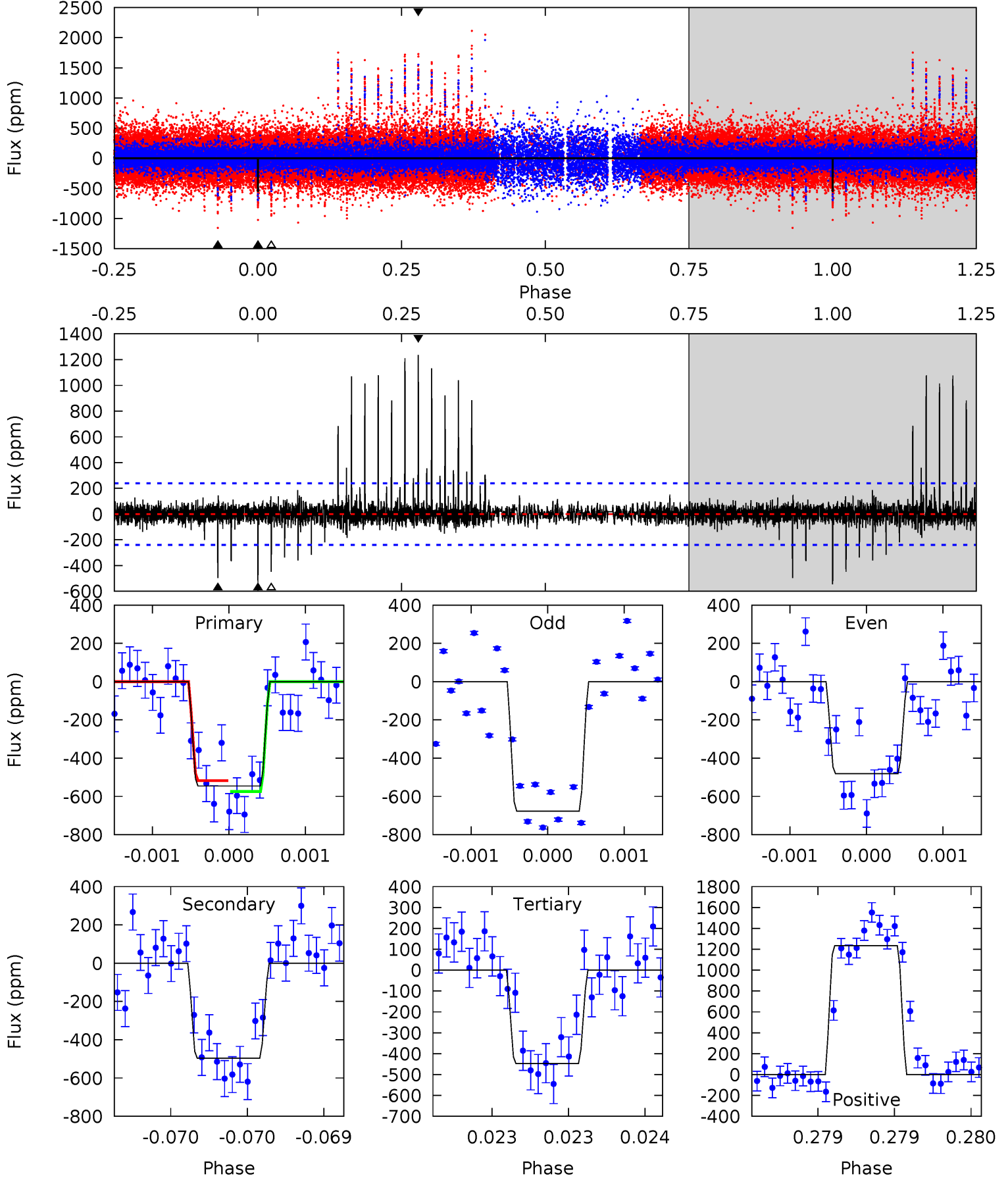
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
15.1	12.7	11.7	31.3	5.52	3.40	2.36	3.46	-16.1	1.01	-18.6	1.29	0.92	0.67	0.40



# Alt Model-Shift Uniqueness Test

010989166-03, P = 364.650501 Days, E = 127.387444 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
12.6	11.5	10.4	28.6	5.54	3.42	2.04	2.28	-16.0	1.13	-17.1	2.09	0.83	0.69	0.67



### Stellar Parameters For KIC 010989166

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6137^{+165}_{-202}$	$4.471^{+0.052}_{-0.208}$	$-0.120^{+0.300}_{-0.300}$	$0.994^{+0.324}_{-0.108}$	$1.067^{+0.139}_{-0.139}$	$1.529^{+0.419}_{-0.782}$
	+3%/-3%	+1%/-5%	+250%/-250%	+33%/-11%	+13%/-13%	+27%/-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 010989166-03 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-522 \pm 41$	$2.84^{+1.61}_{-1.33}$	$381^{+29}_{-19}$	$5935^{+2326}_{-1105}$	$37418^{+93082}_{-22442}$
Alt.	$-496 \pm 43$	$2.82^{+1.49}_{-1.39}$	$381^{+26}_{-18}$	$5864^{+2826}_{-1047}$	$35849^{+100143}_{-21474}$

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

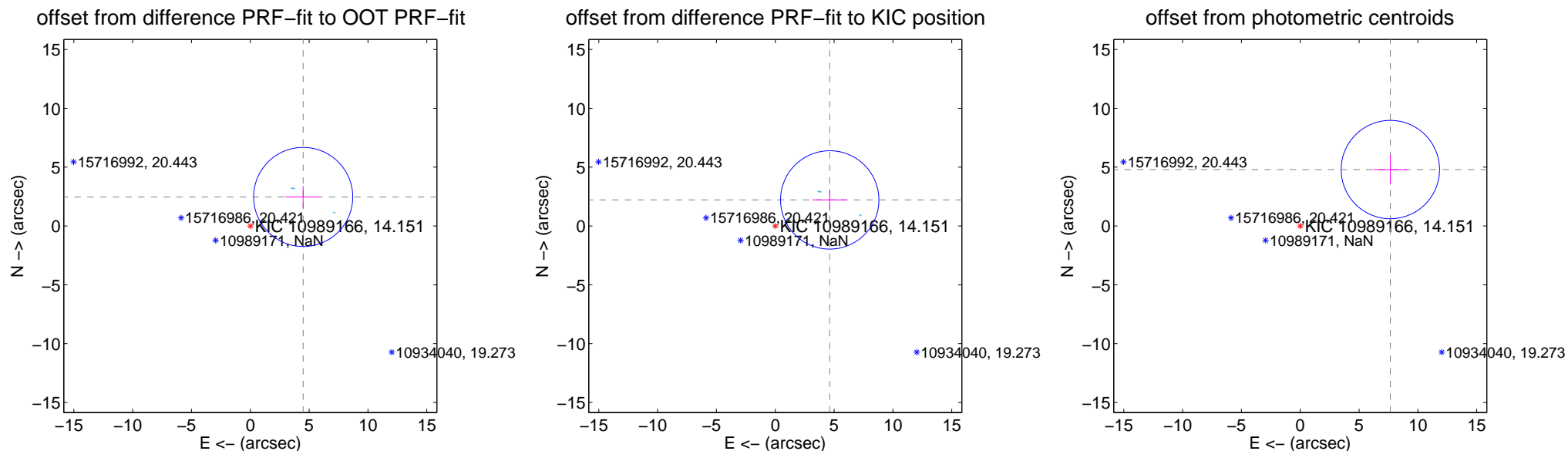
## DV Centroid Data

Supplemental centroid analysis for 010989166-03. Kepler magnitude: 14.15. Transit SNR 12.80

There are 3 quarters with good PRF difference image offsets

The direct PRF centroid is offset from the target star catalog position by about 0.33 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$5.125 \pm 1.404$	3.65	$-4.494 \pm 1.517$	$2.465 \pm 0.934$
PRF-fit source offset from KIC position	$5.130 \pm 1.393$	3.68	$-4.628 \pm 1.481$	$2.215 \pm 0.914$
photometric centroid source offset	$9.03 \pm 1.39$	6.49	$-7.66 \pm 1.44$	$4.79 \pm 1.27$

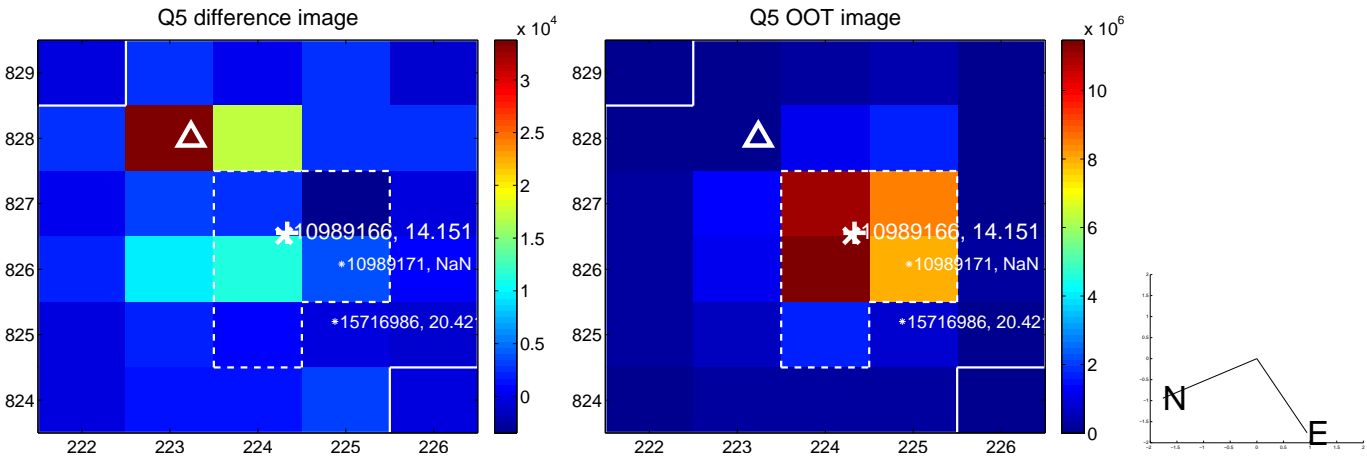


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

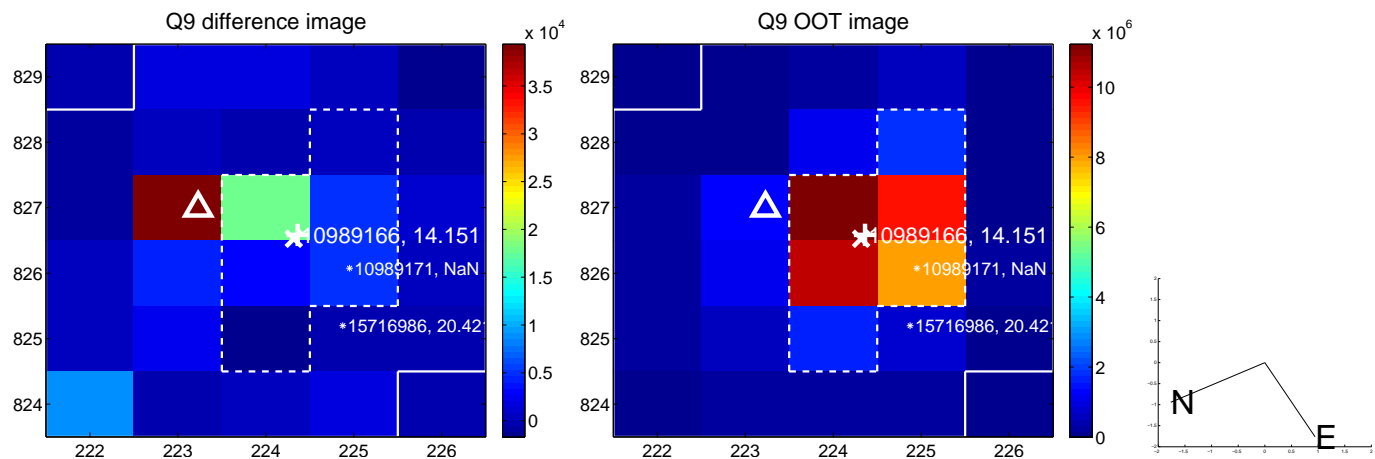


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

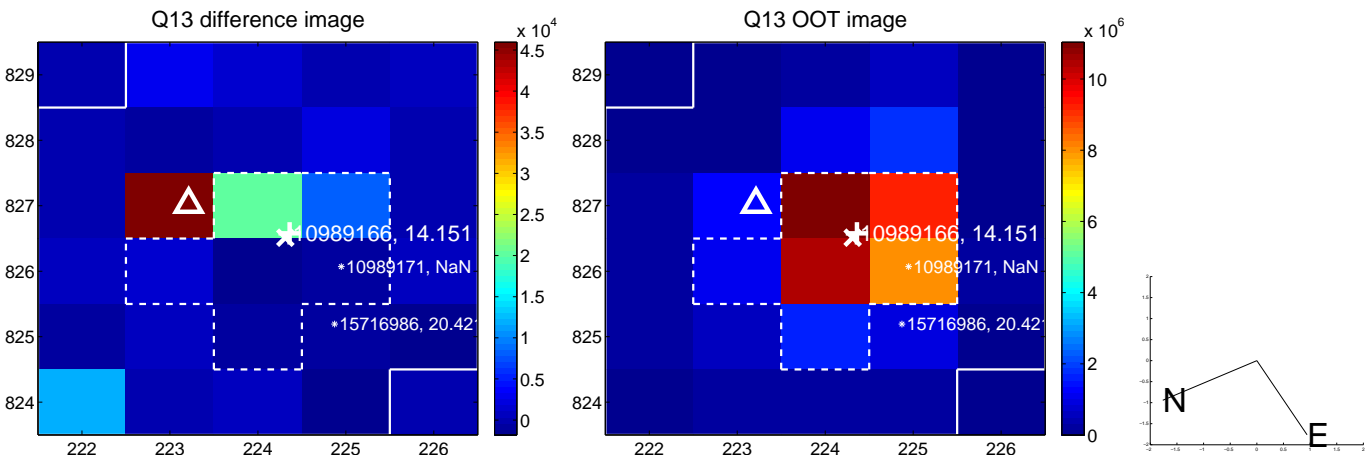




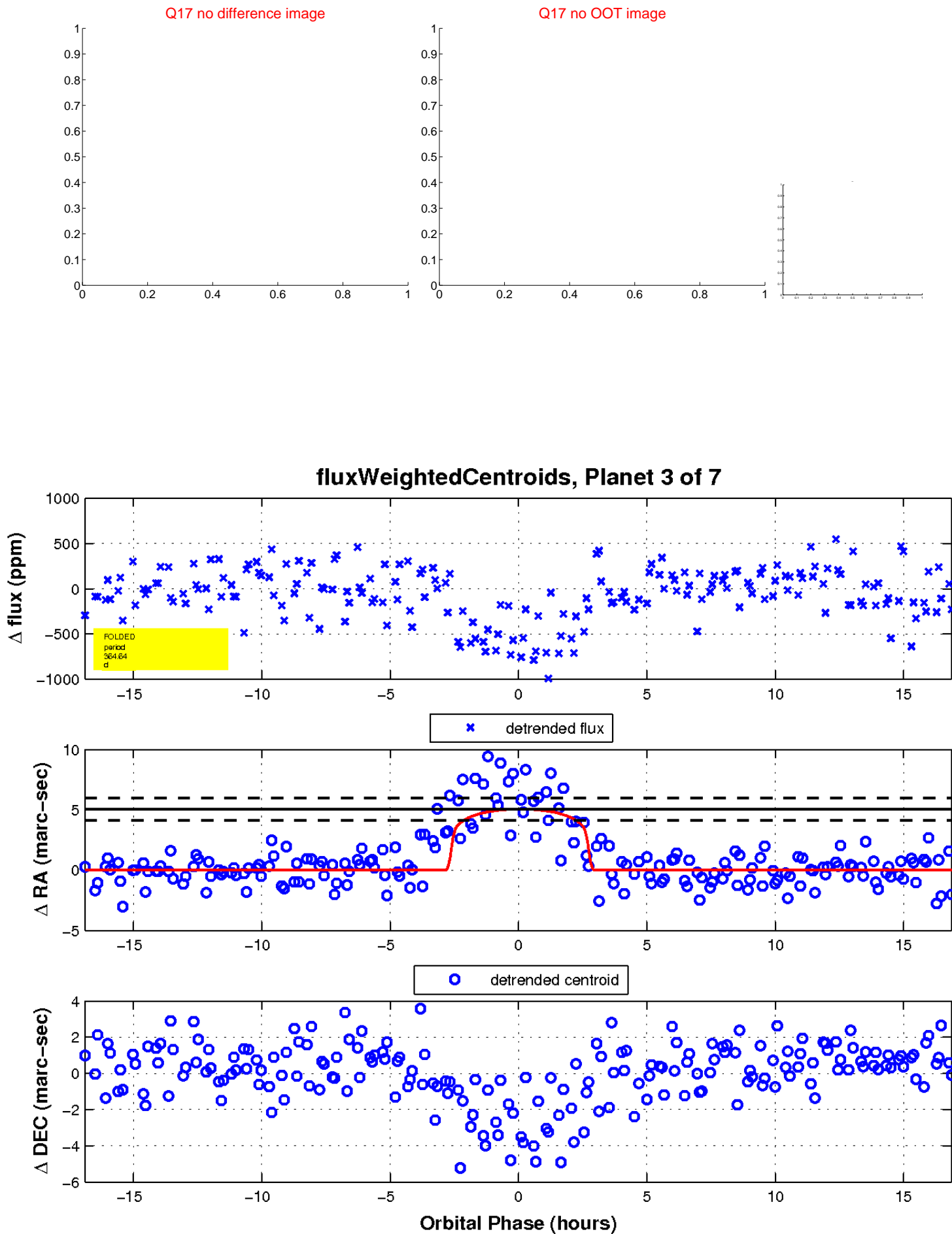
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

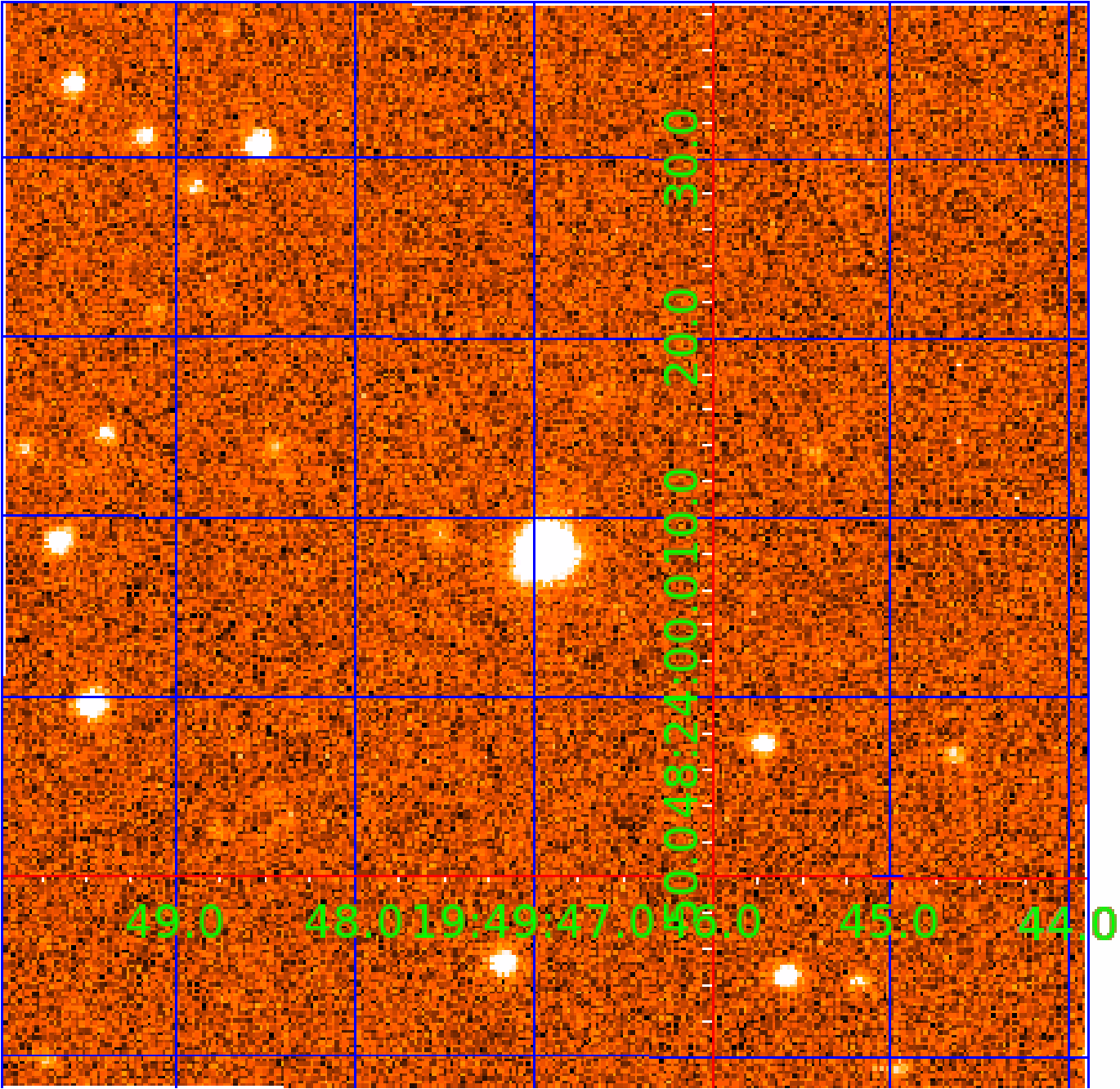


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 010989166

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
010989166-01	OBS	No	364.654533	483.543104	599.2	6.203	13.0	13.8	0.99	6137	2.66	1.21
010989166-02	OBS	No	373.132674	449.630666	601.9	6.331	12.6	13.4	0.99	6137	2.52	1.17
010989166-03	OBS	No	364.640890	492.053046	643.4	5.646	11.9	12.8	0.99	6137	2.70	1.21
010989166-04	OBS	No	373.150031	458.076750	648.8	4.835	11.2	11.2	0.99	6137	2.74	1.17
010989166-05	OBS	No	398.554187	466.602819	581.0	5.096	10.5	10.6	0.99	6137	2.39	1.07
010989166-06	OBS	No	195.012731	254.729492	604.3	6.002	9.9	11.2	0.99	6137	2.58	2.78
010989166-07	OBS	No	534.484685	279.855588	369.4	7.477	8.6	7.4	0.99	6137	2.19	0.72

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
010989166-01	OBS	FP	0.00	1	0	1	0	MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_RESOLVED_OFFSET—HALO_GHOST
010989166-02	OBS	FP	0.00	1	0	1	1	MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_RESOLVED_OFFSET—HALO_GHOST—EPHEM_MATCH
010989166-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—SAME_NTL_PERIOD—CENT_FEW_DIFFS
010989166-04	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_MARSHALL—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—SAME_NTL_PERIOD—CENT_RESOLVED_OFFSET—HALO_GHOST
010989166-05	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_CHASES—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS—HALO_GHOST
010989166-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
010989166-07	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_CHASES—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS—HALO_GHOST

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

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

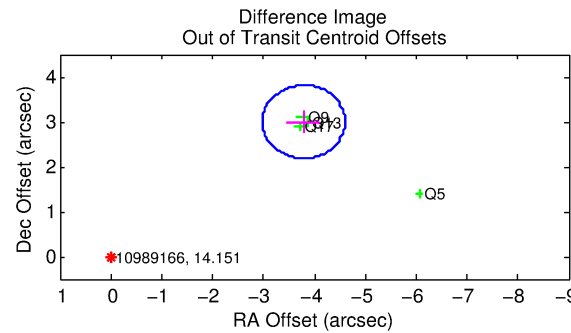
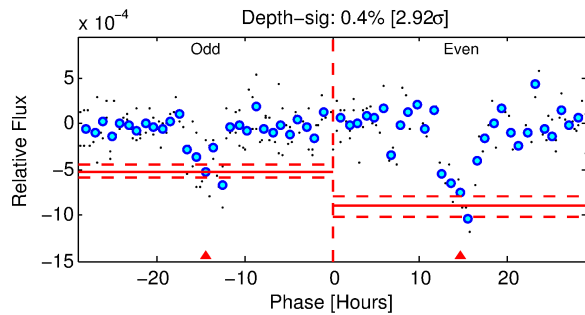
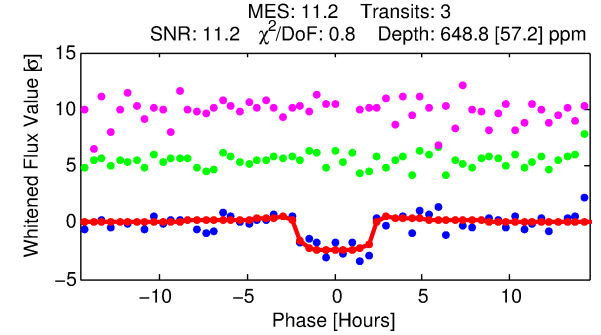
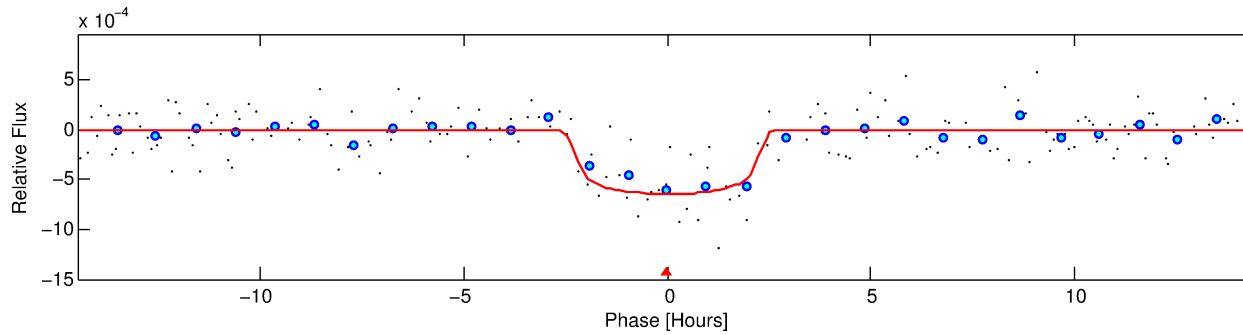
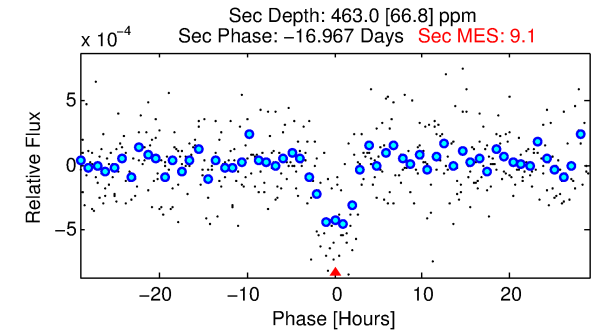
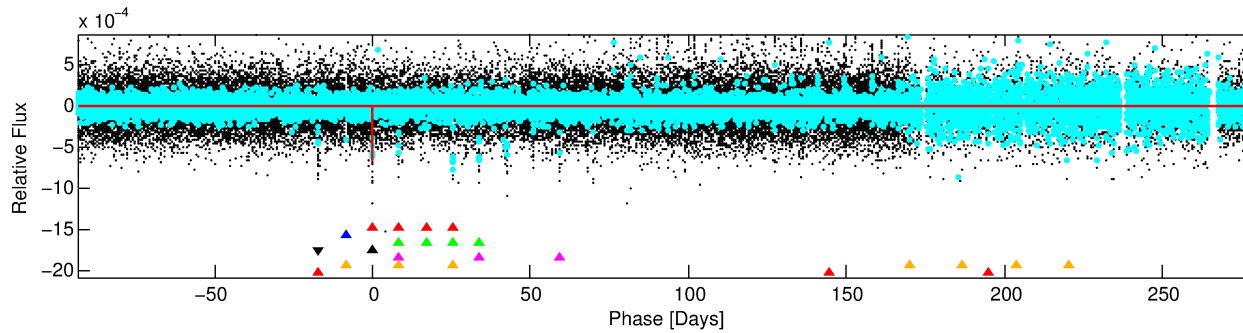
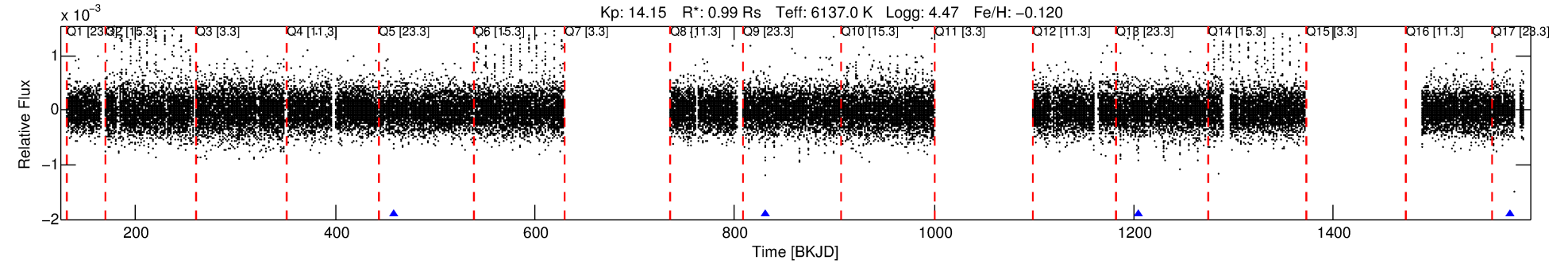
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 010989166-04

No Significant Match Found

# DV One-Page Summary

KIC: 10989166 Candidate: 4 of 7 Period: 373.150 d



## DV Fit Results:

Period = 373.15003 [0.00518] d  
Epoch = 458.0767 [0.0067] BKJD  
Rp/R\* = 0.0252 [0.0118]  
a/R\* = 419.34 [959.79]  
b = 0.74 [1.43]  
Seff = 1.17 [0.48]  
Teq = 265 [27] K  
Rp = 2.74 [1.56] Re  
a = 1.0364 [0.2795] AU  
Ag = 36493.52 [37209.26] [0.98σ]  
Teff = 5666 [1350] K [4.00σ]

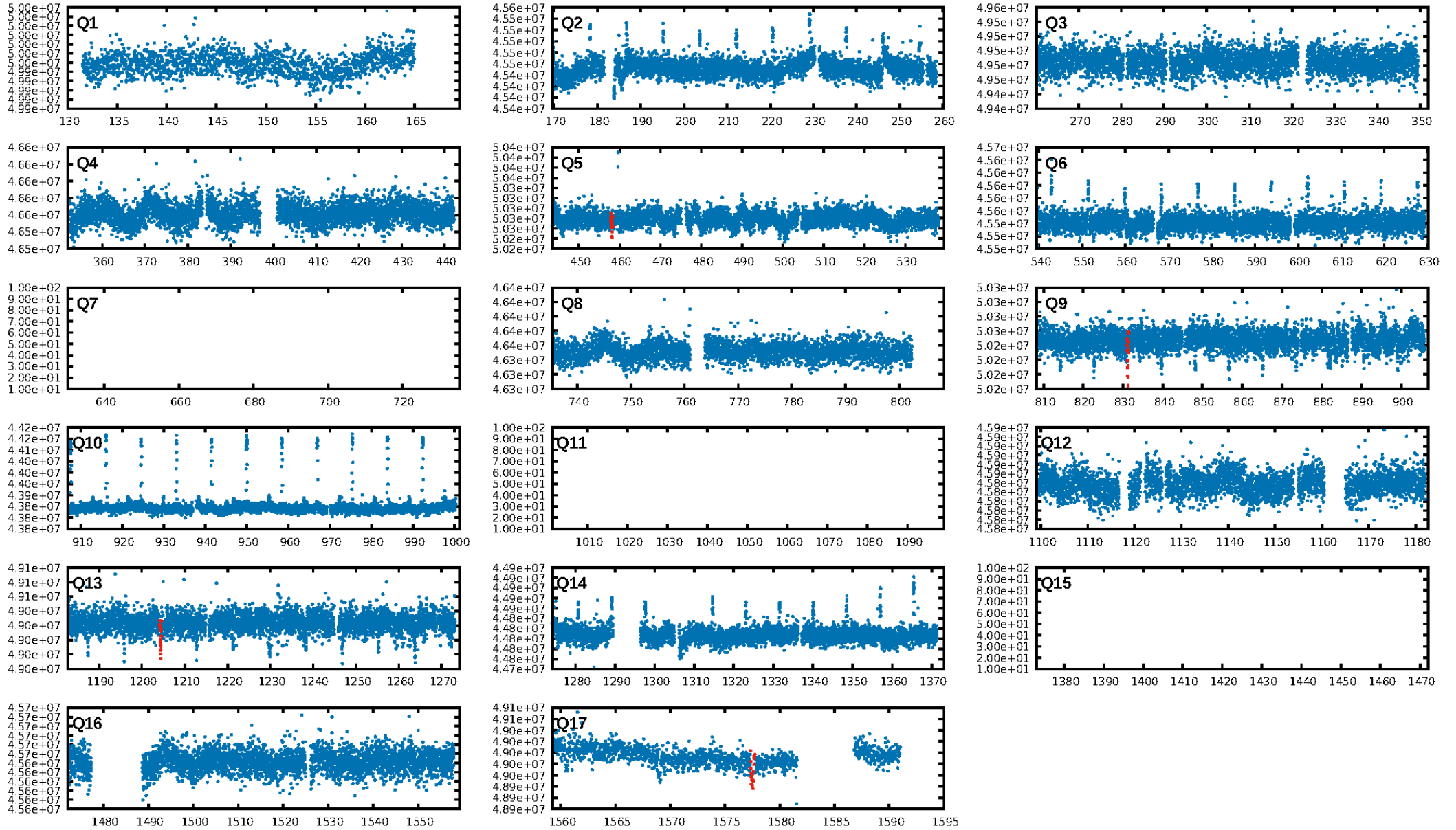
## DV Diagnostic Results:

ShortPeriod-sig: 4.2% [0.05σ]  
LongPeriod-sig: 100.0% [86.80σ]  
ModelChiSquare2-sig: 2.1%  
ModelChiSquareGof-sig: 93.8%  
Bootstrap-pfa: 1.51e-13  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: 0.2012  
Centroid-sig: N/A  
Centroid-so: 8.887 arcsec [6.95σ]  
OotOffset-rm: 4.831 arcsec [17.79σ]  
KicOffset-rm: 4.767 arcsec [17.56σ]  
OotOffset-st: 0/0/0/4 [4]  
KicOffset-st: 0/0/0/4 [4]  
DiffImageQuality-fgm: 1.00 [4/4]  
DiffImageOverlap-fno: 0.75 [3/4]

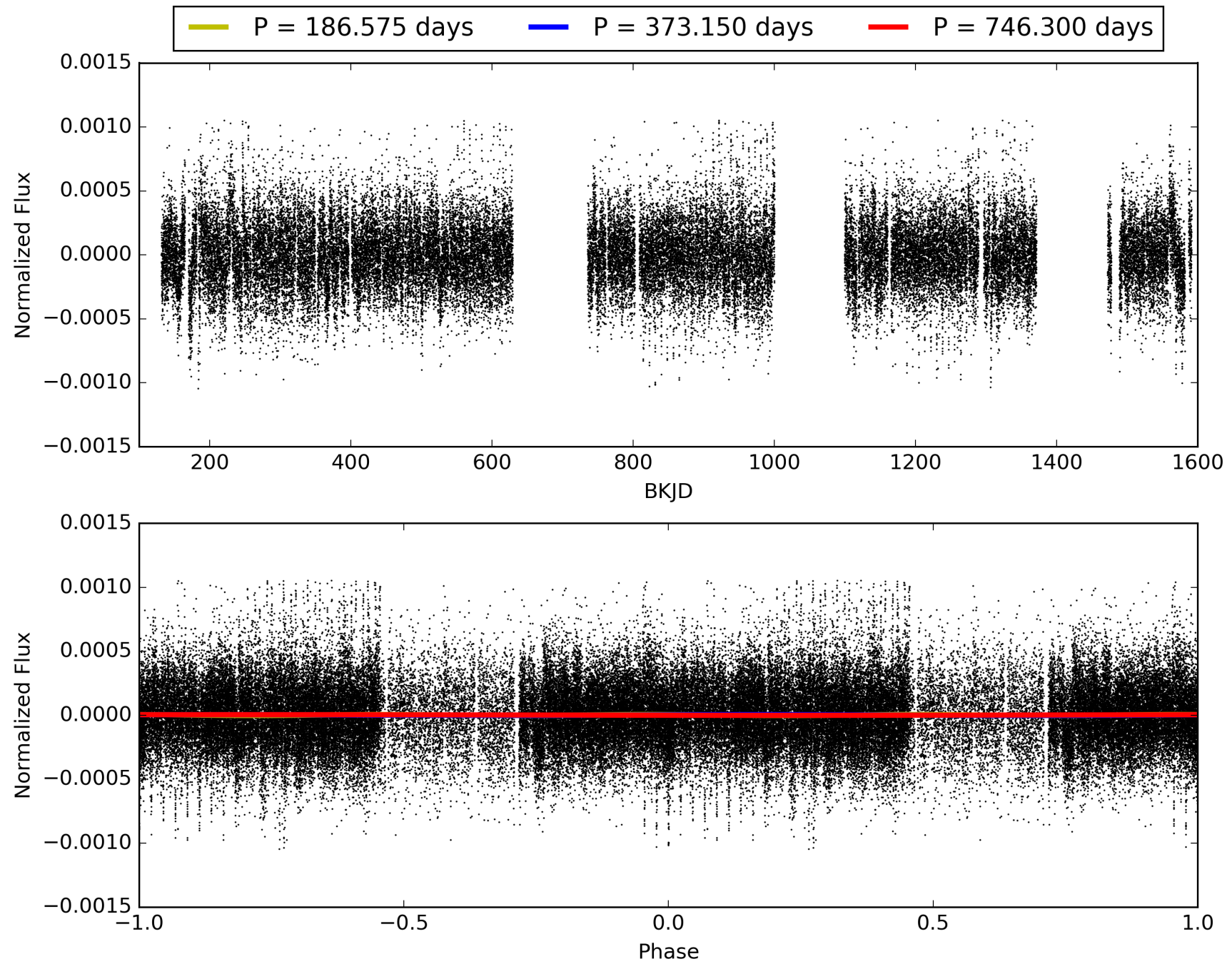
Software Revision: svn-ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 04:00:23 Z

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

# TCE 010989166-04, PDC Light Curves



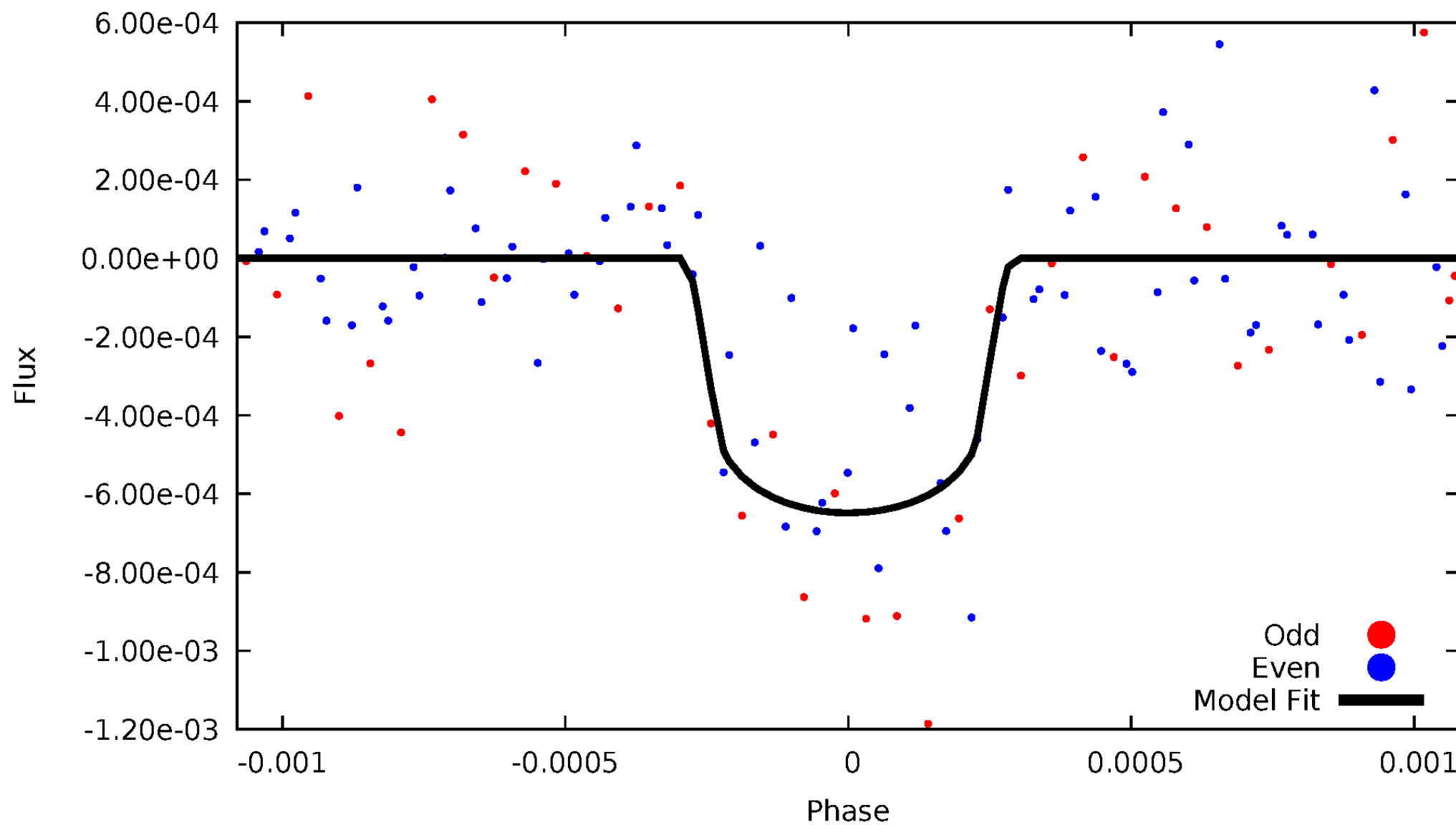
TCE 010989166-04





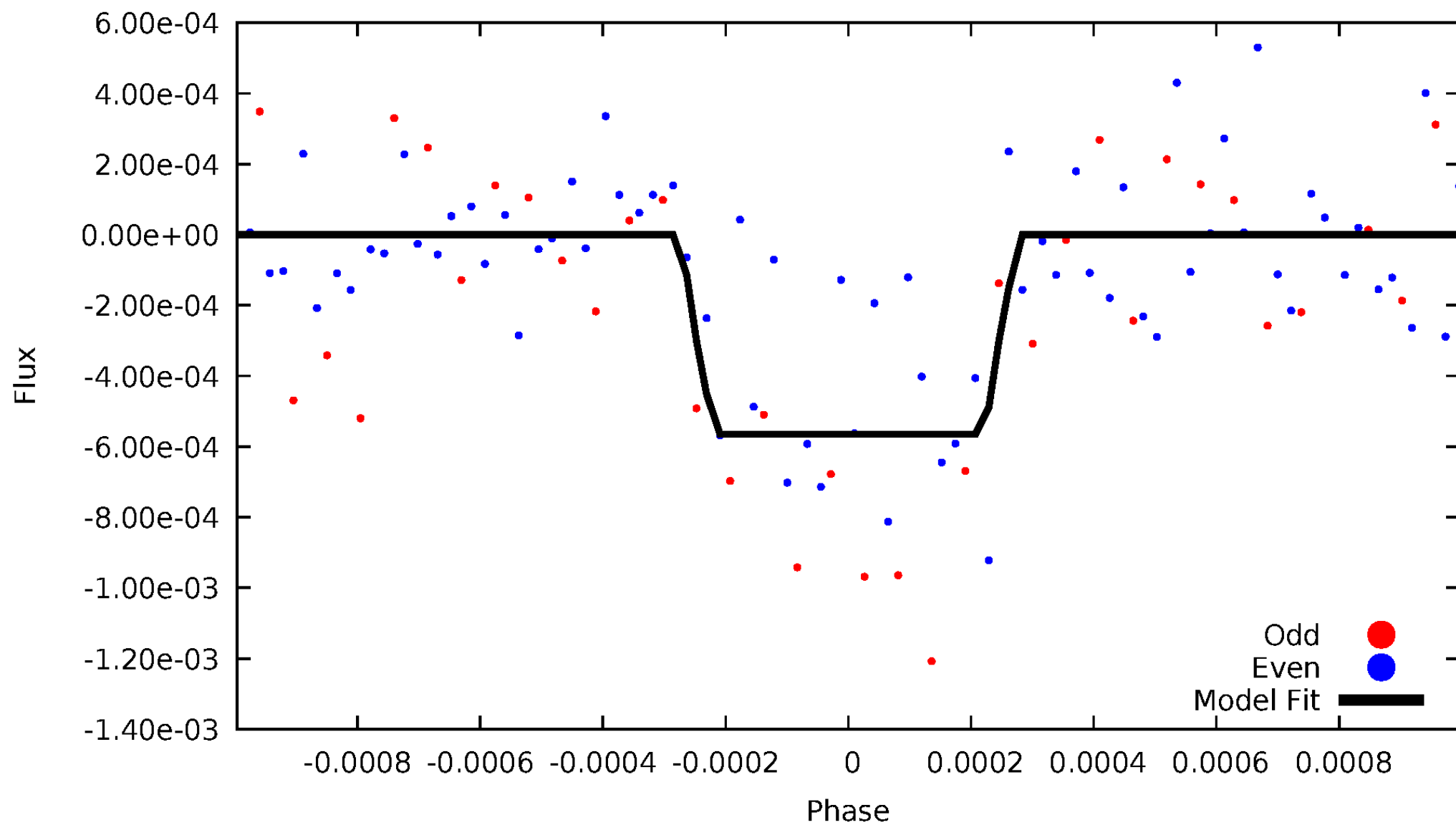
# DV Odd/Even

TCE 010989166-04



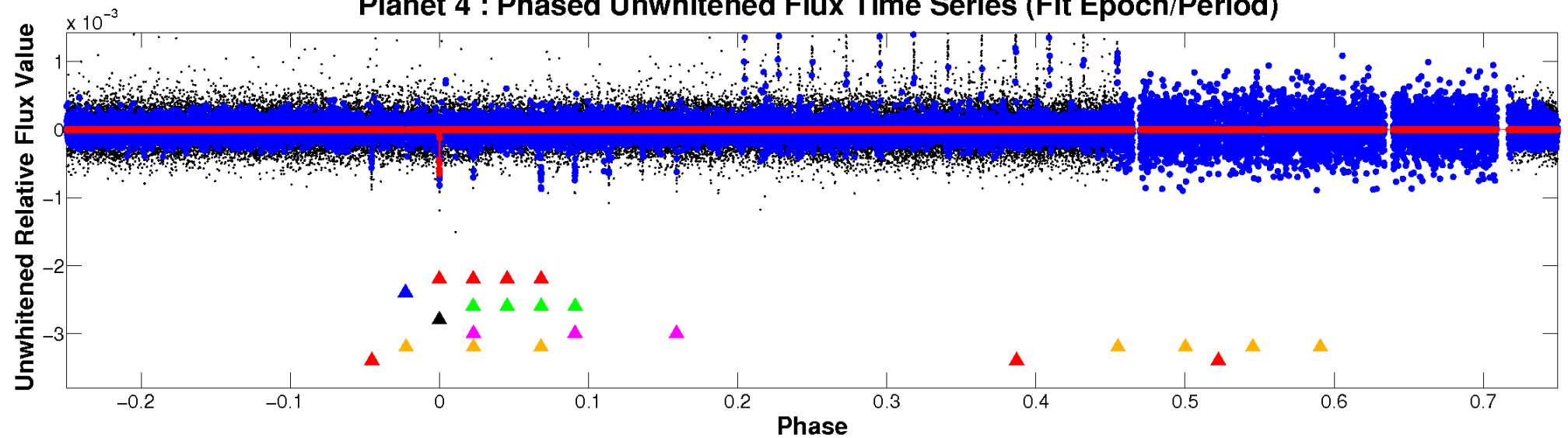
# ALT Odd/Even

TCE 010989166-04

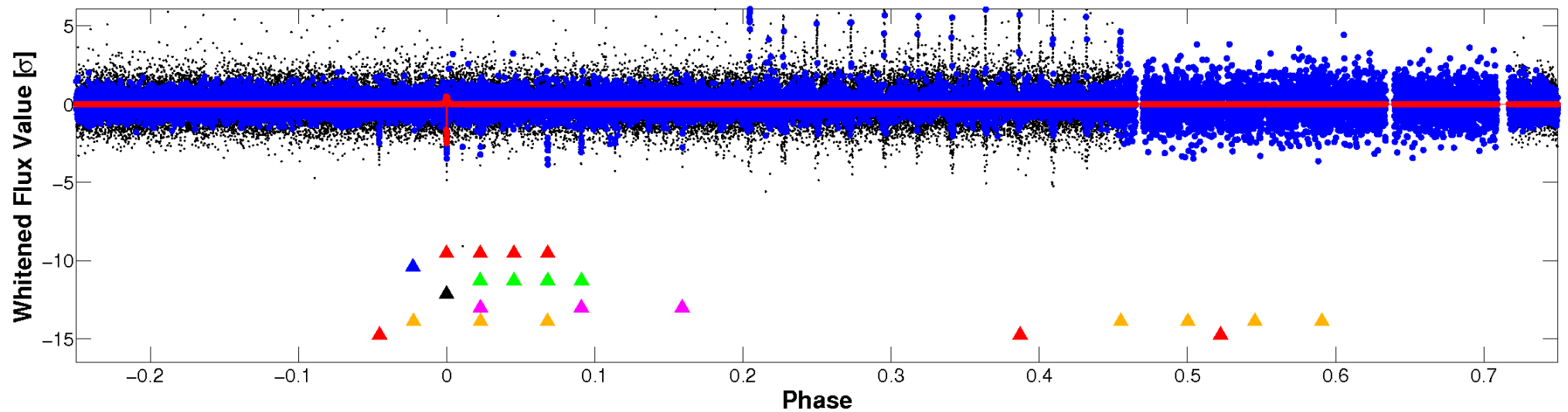


# Non-Whitened Vs. Whitened Light Curve

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

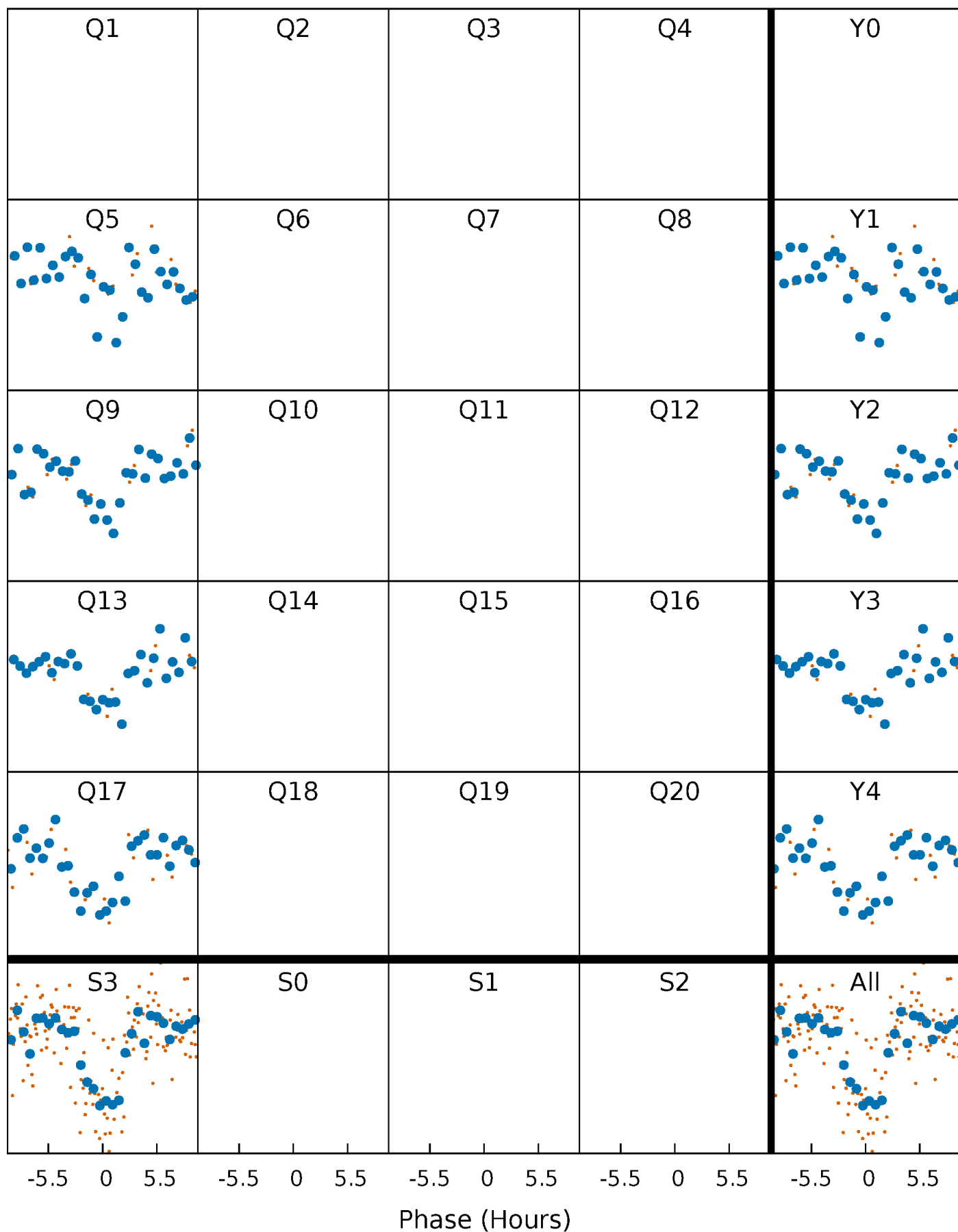


## Planet 4 : Phased Whitened Flux Time Series (Fit Epoch/Period)



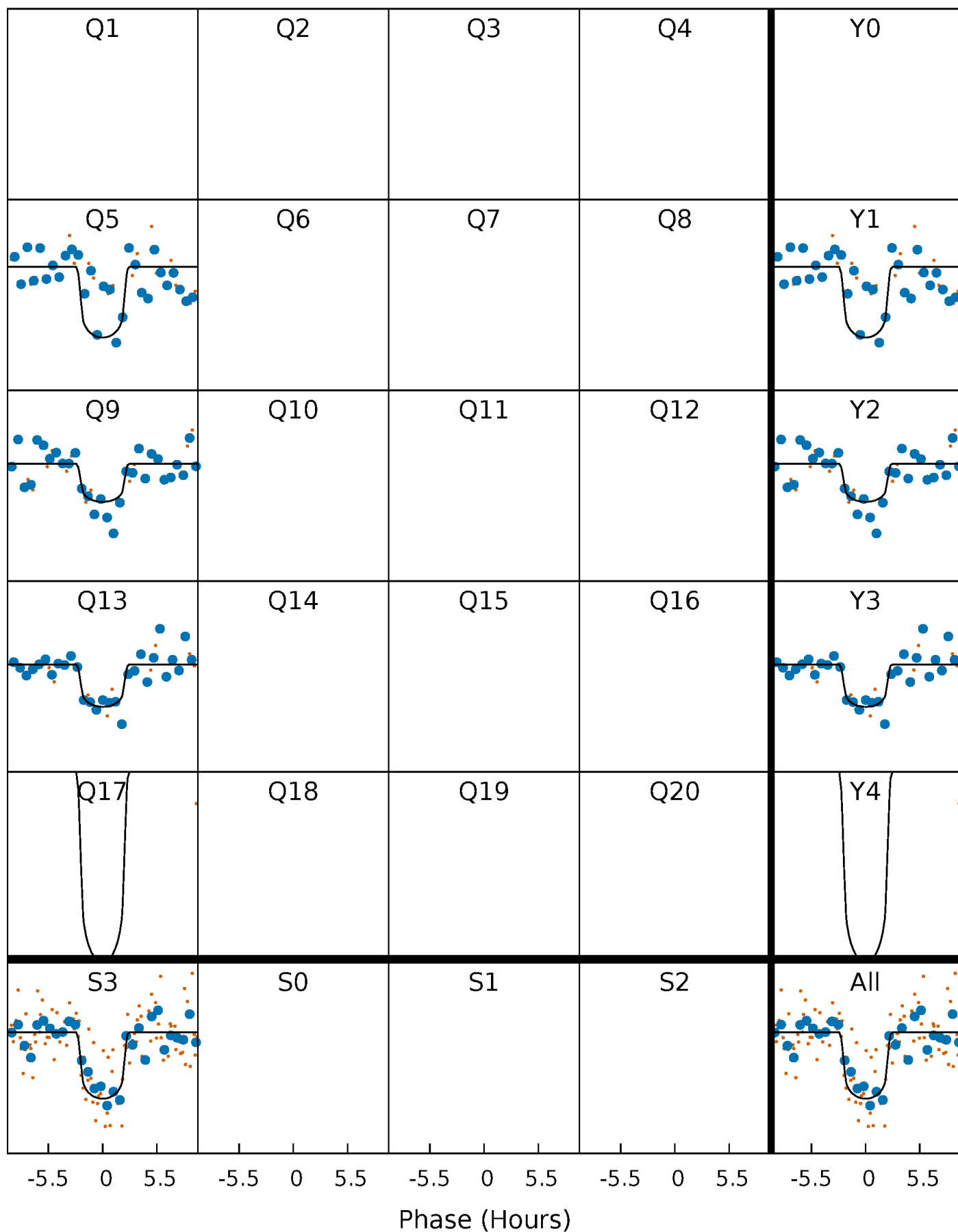
# PDC Quarter-Phased Transit Curves

TCE 010989166-04     $P=373.150031$  Days     $T_0=458.076750$  (BKJD)



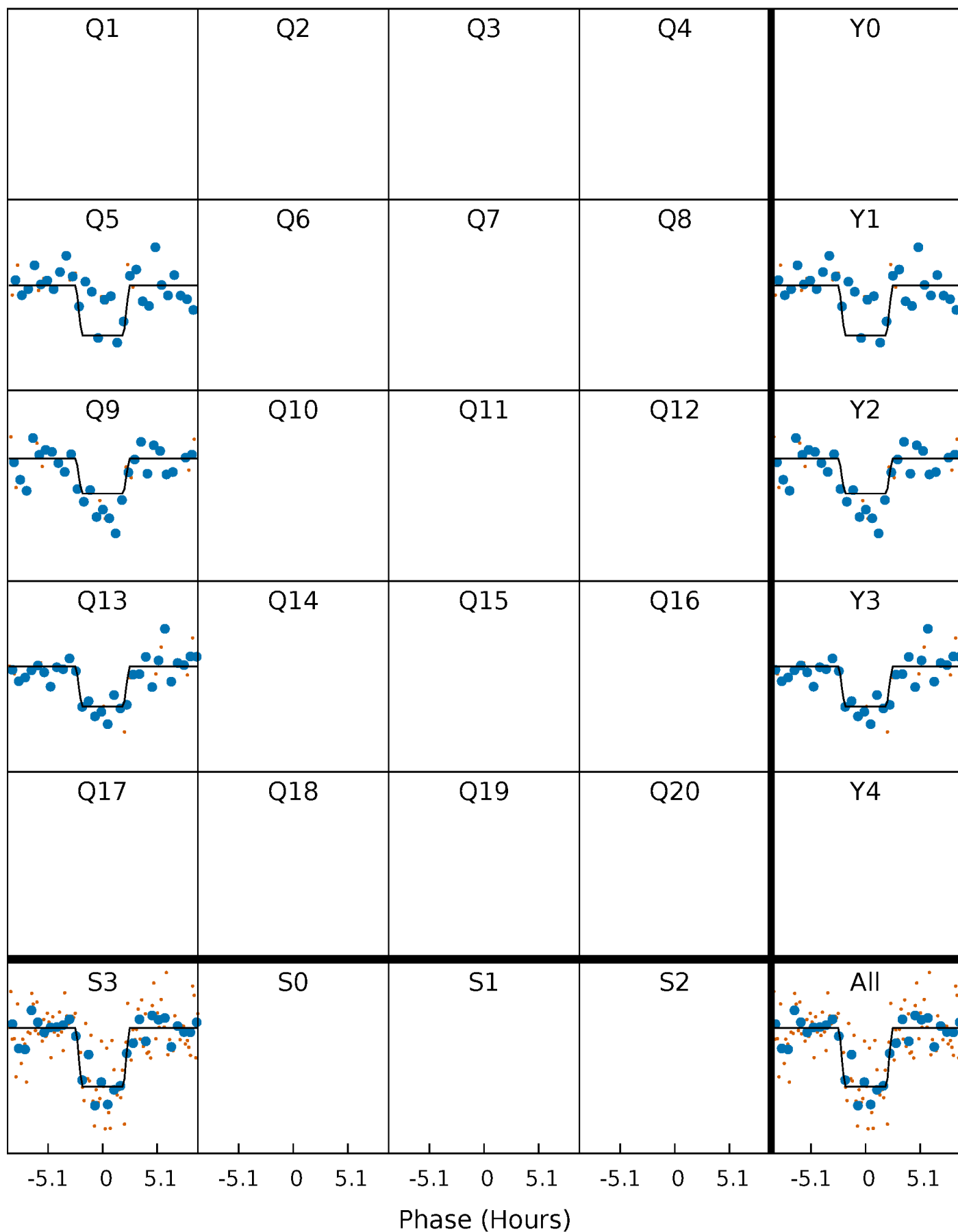
# DV Quarter-Phased Transit Curves

TCE 010989166-04     $P=373.150031$  Days     $T_0=458.076750$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

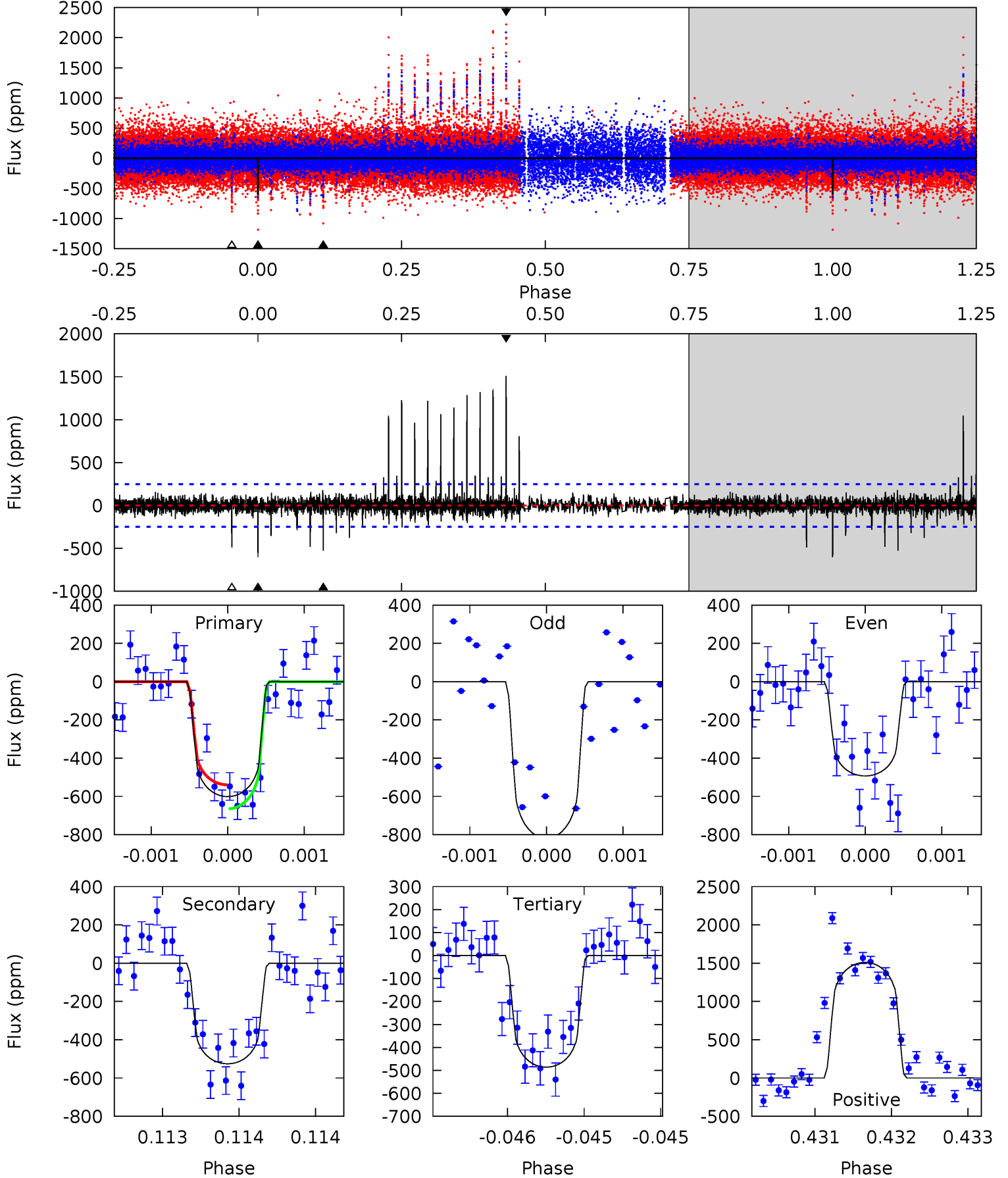
TCE 010989166-04     $P=373.144050$  Days     $T_0=458.084511$  (BKJD)



# DV Model-Shift Uniqueness Test

010989166-04,  $P = 373.150031$  Days,  $E = 84.926719$  Days

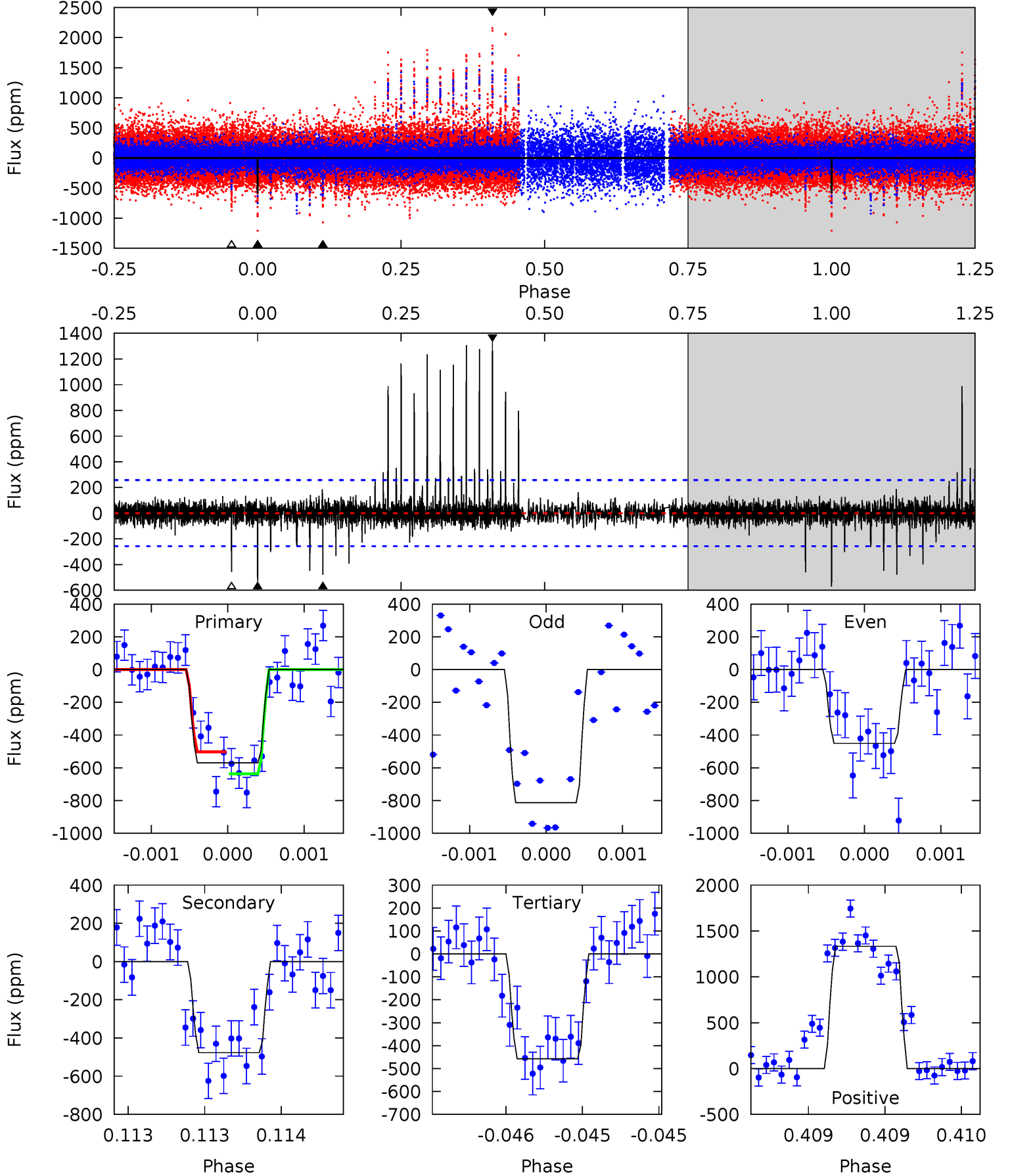
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
13.4	11.8	10.9	33.8	5.55	3.45	2.26	2.57	-20.3	0.88	-22.0	2.10	0.90	0.72	1.42



# Alt Model-Shift Uniqueness Test

010989166-04, P = 373.144050 Days, E = 84.940461 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
12.3	10.3	9.91	28.9	5.56	3.47	2.05	2.43	-16.5	0.41	-18.5	3.59	0.89	0.70	1.48





### Stellar Parameters For KIC 010989166

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M$ ( $M_{\odot}$ )	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6137^{+165}_{-202}$	$4.471^{+0.052}_{-0.208}$	$-0.120^{+0.300}_{-0.300}$	$0.994^{+0.324}_{-0.108}$	$1.067^{+0.139}_{-0.139}$	$1.529^{+0.419}_{-0.782}$
	+3%/-3%	+1%/-5%	+250%/-250%	+33%/-11%	+13%/-13%	+27%/-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 010989166-04 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	$-526 \pm 45$	$2.87^{+1.44}_{-1.34}$	$377^{+31}_{-17}$	$5822^{+2366}_{-917}$	$36925^{+87390}_{-20588}$
Alt.	$-477 \pm 46$	$2.72^{+1.37}_{-1.28}$	$379^{+30}_{-19}$	$5852^{+2435}_{-951}$	$38169^{+96818}_{-22192}$

$T_{\text{max}}$  = 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

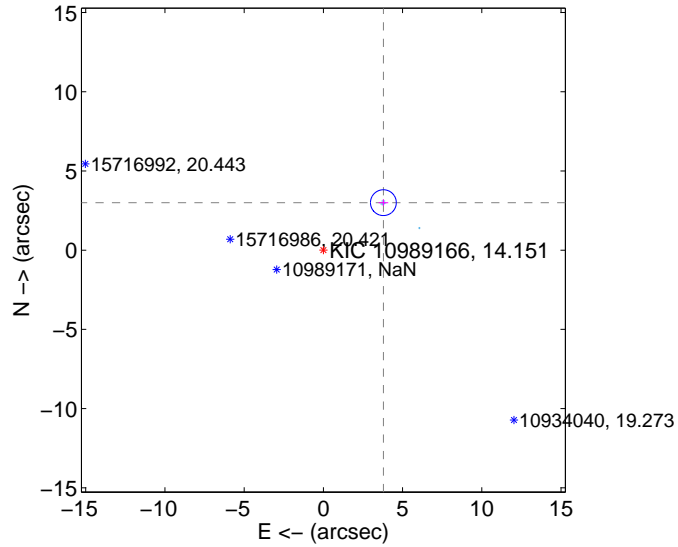
Supplemental centroid analysis for 010989166-04. Kepler magnitude: 14.15. Transit SNR 11.22

There are 4 quarters with good PRF difference image offsets

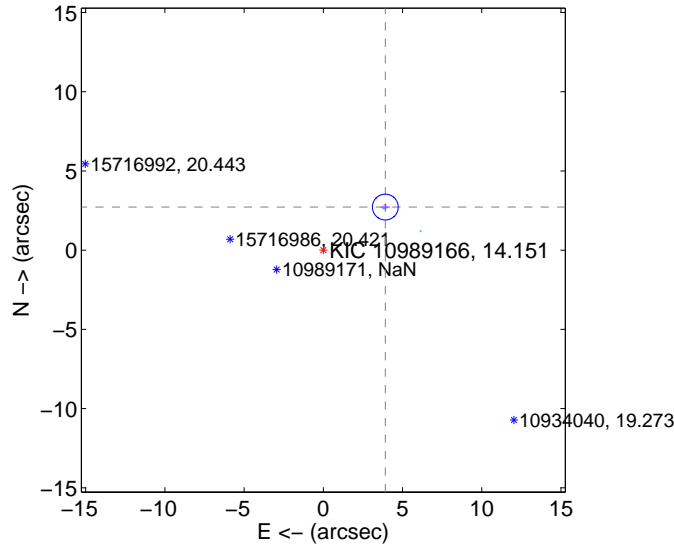
The direct PRF centroid is offset from the target star catalog position by about 0.31 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$4.831 \pm 0.272$	17.79	$-3.788 \pm 0.303$	$2.999 \pm 0.212$
PRF-fit source offset from KIC position	$4.767 \pm 0.271$	17.56	$-3.914 \pm 0.298$	$2.721 \pm 0.206$
photometric centroid source offset	$8.89 \pm 1.28$	6.95	$-8.67 \pm 1.28$	$1.94 \pm 1.21$

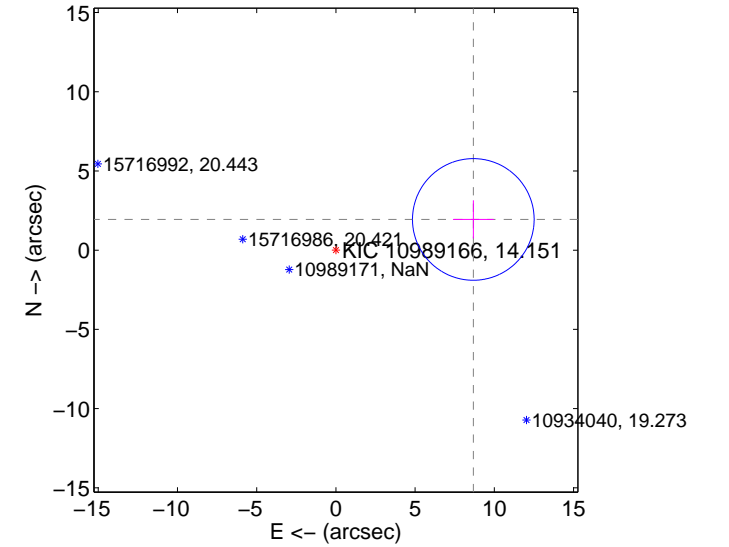
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position



offset from photometric centroids

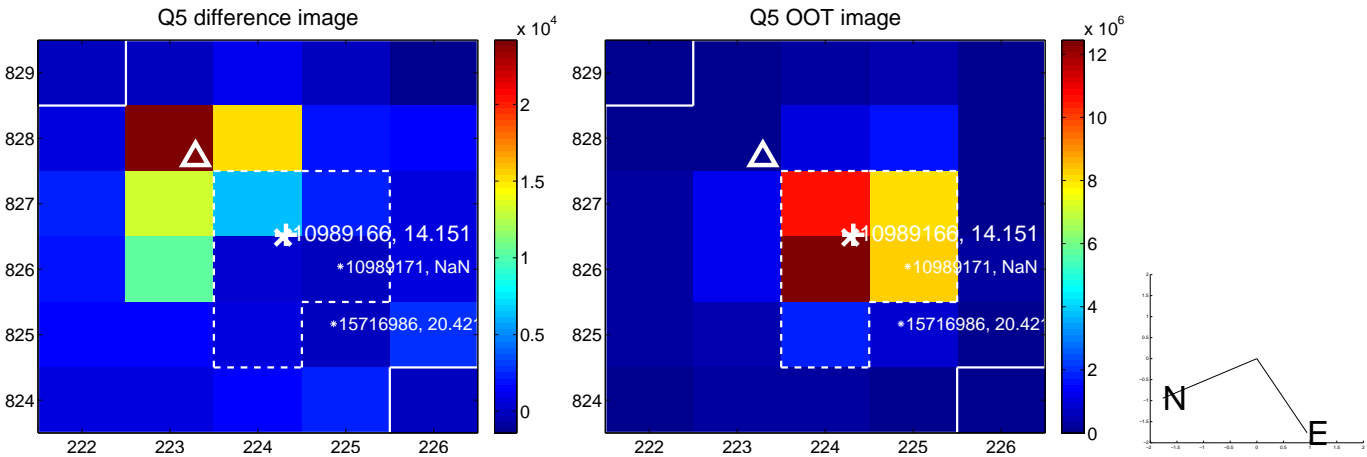


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

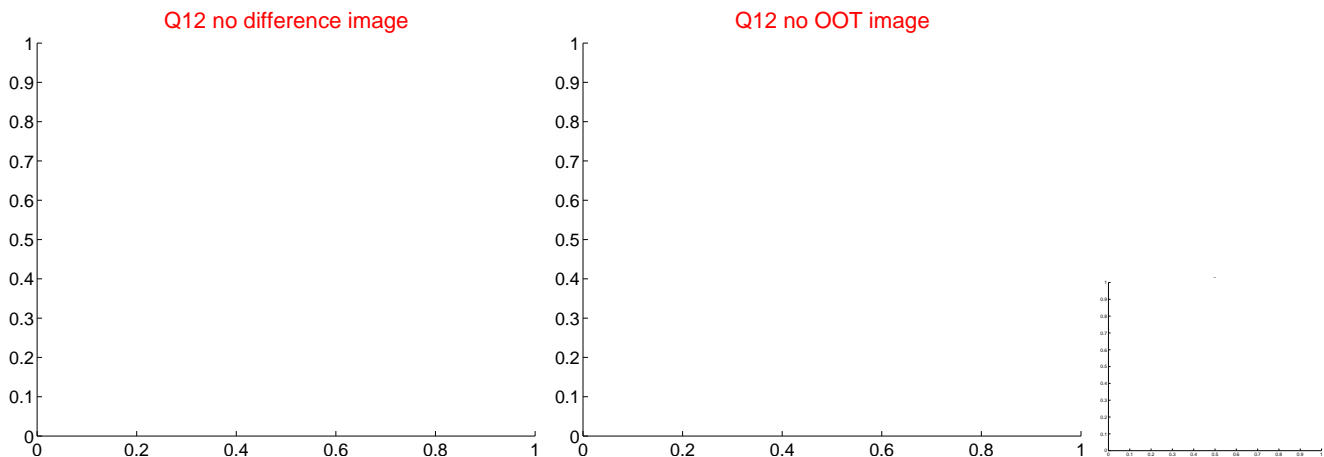
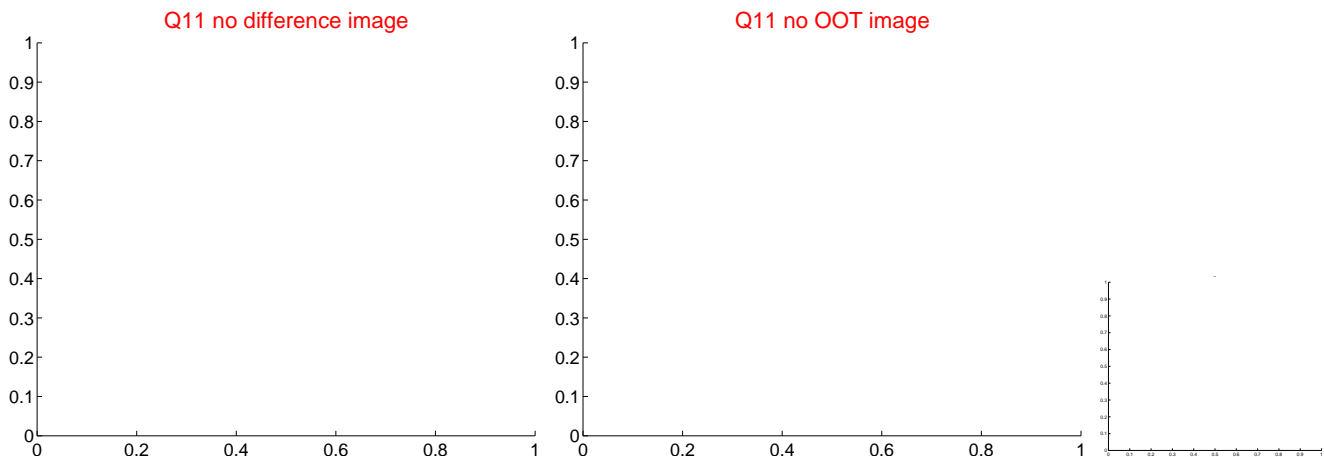
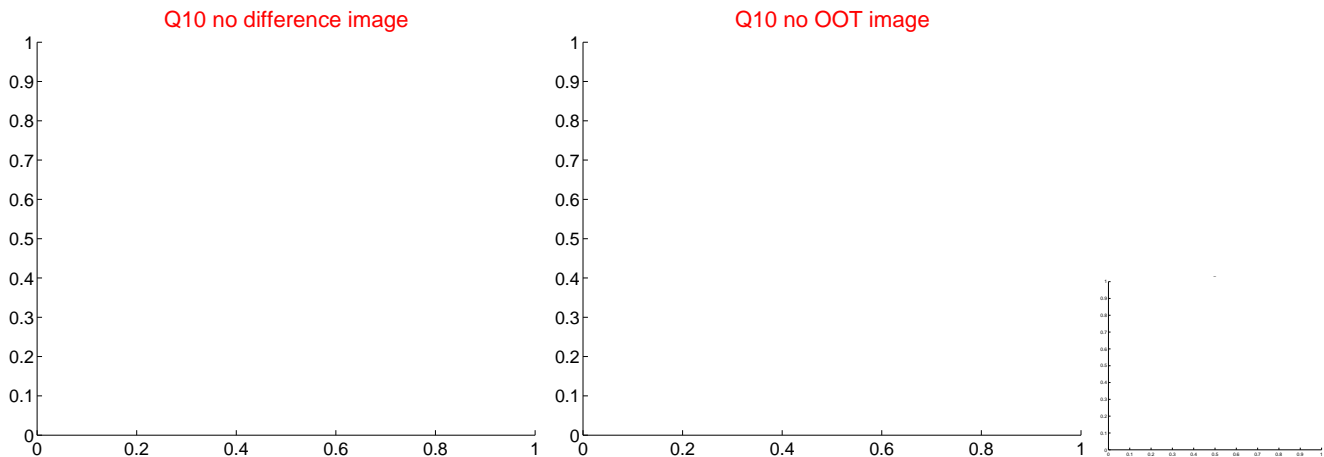
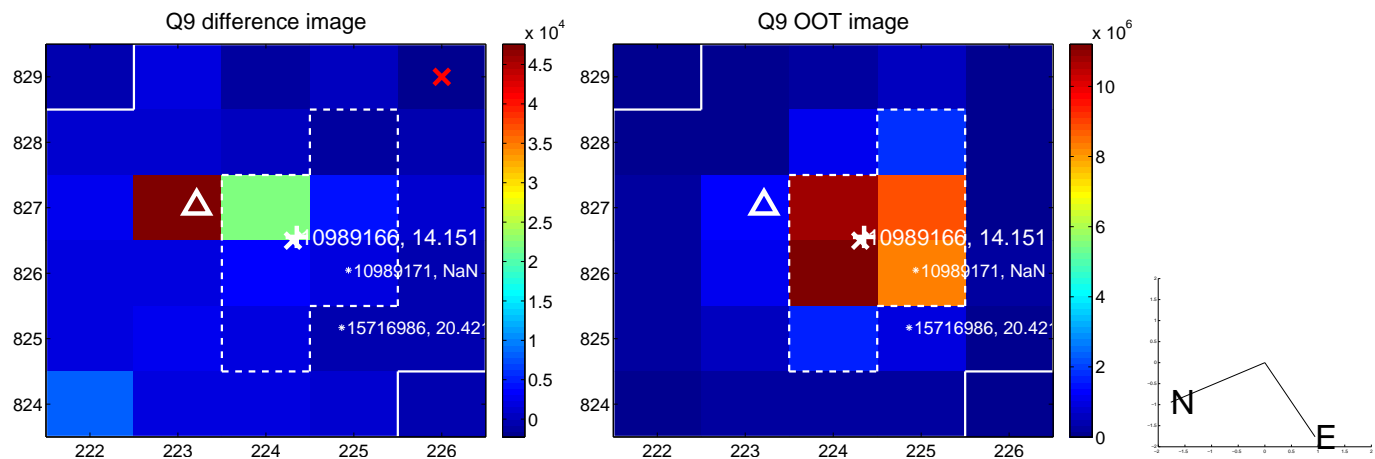
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



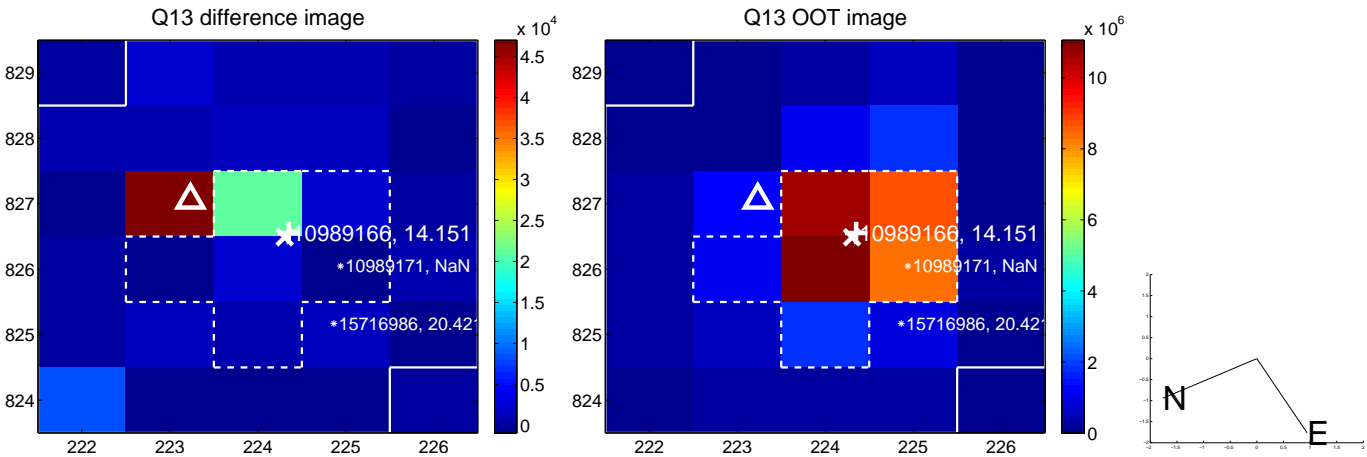
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



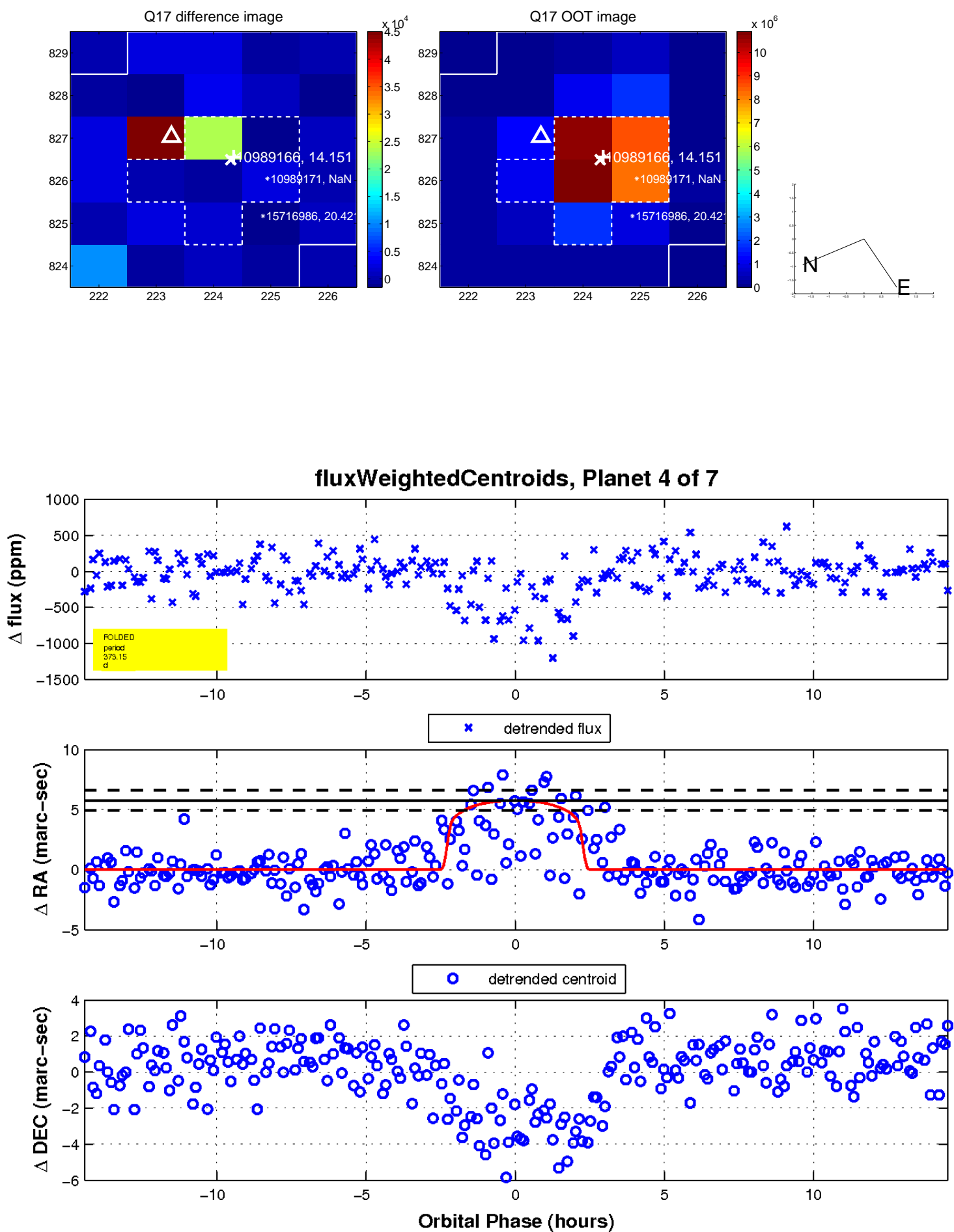
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

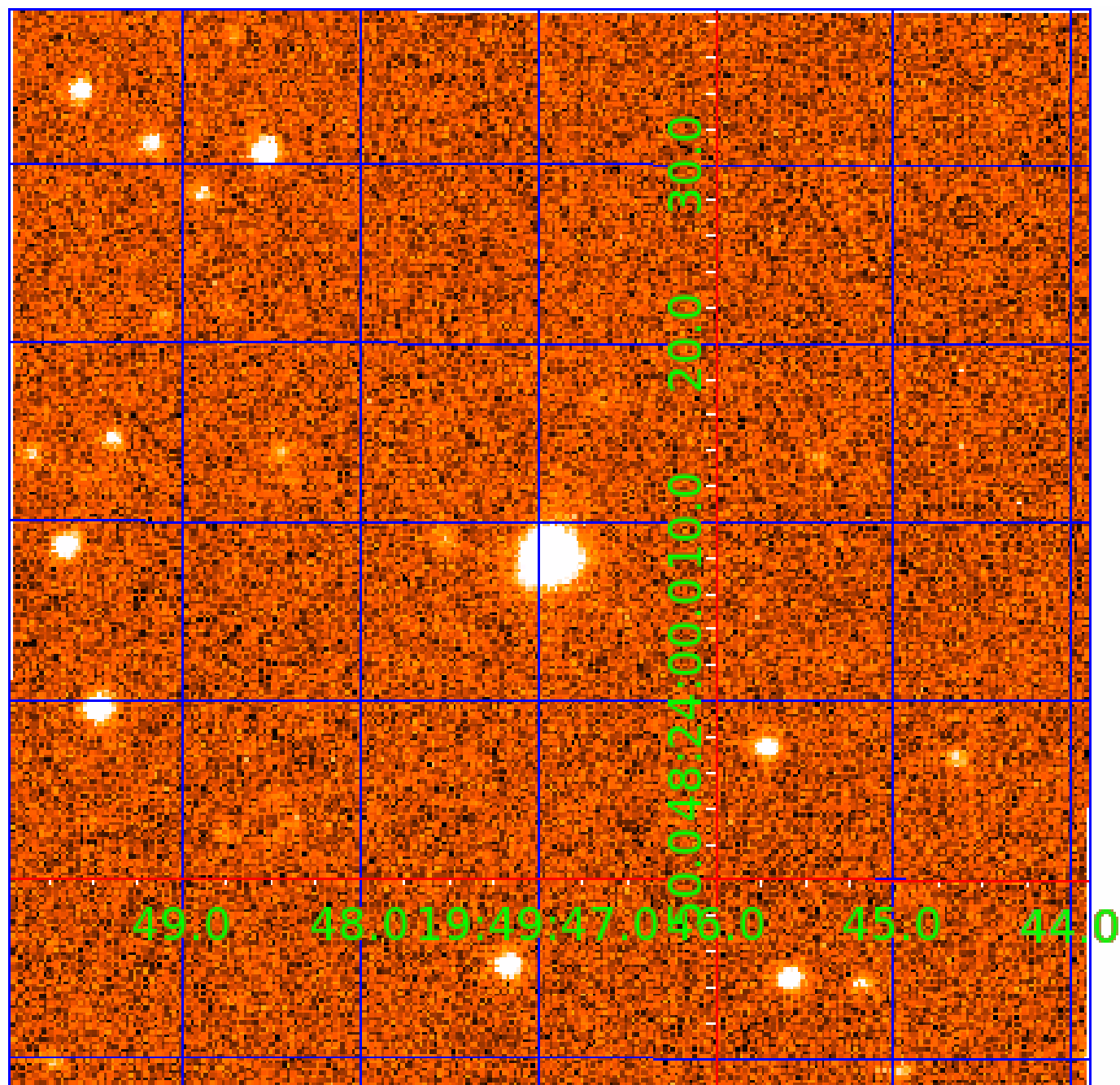


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination





# KIC 010989166

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
010989166-01	OBS	No	364.654533	483.543104	599.2	6.203	13.0	13.8	0.99	6137	2.66	1.21
010989166-02	OBS	No	373.132674	449.630666	601.9	6.331	12.6	13.4	0.99	6137	2.52	1.17
010989166-03	OBS	No	364.640890	492.053046	643.4	5.646	11.9	12.8	0.99	6137	2.70	1.21
010989166-04	OBS	No	373.150031	458.076750	648.8	4.835	11.2	11.2	0.99	6137	2.74	1.17
010989166-05	OBS	No	398.554187	466.602819	581.0	5.096	10.5	10.6	0.99	6137	2.39	1.07
010989166-06	OBS	No	195.012731	254.729492	604.3	6.002	9.9	11.2	0.99	6137	2.58	2.78
010989166-07	OBS	No	534.484685	279.855588	369.4	7.477	8.6	7.4	0.99	6137	2.19	0.72

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
010989166-01	OBS	FP	0.00	1	0	1	0	MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_RESOLVED_OFFSET—HALO_GHOST
010989166-02	OBS	FP	0.00	1	0	1	1	MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_RESOLVED_OFFSET—HALO_GHOST—EPHEM_MATCH
010989166-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—SAME_NTL_PERIOD—CENT_FEW_DIFFS
010989166-04	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_MARSHALL—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—SAME_NTL_PERIOD—CENT_RESOLVED_OFFSET—HALO_GHOST
010989166-05	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_CHASES—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS—HALO_GHOST
010989166-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
010989166-07	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_CHASES—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS—HALO_GHOST

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

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

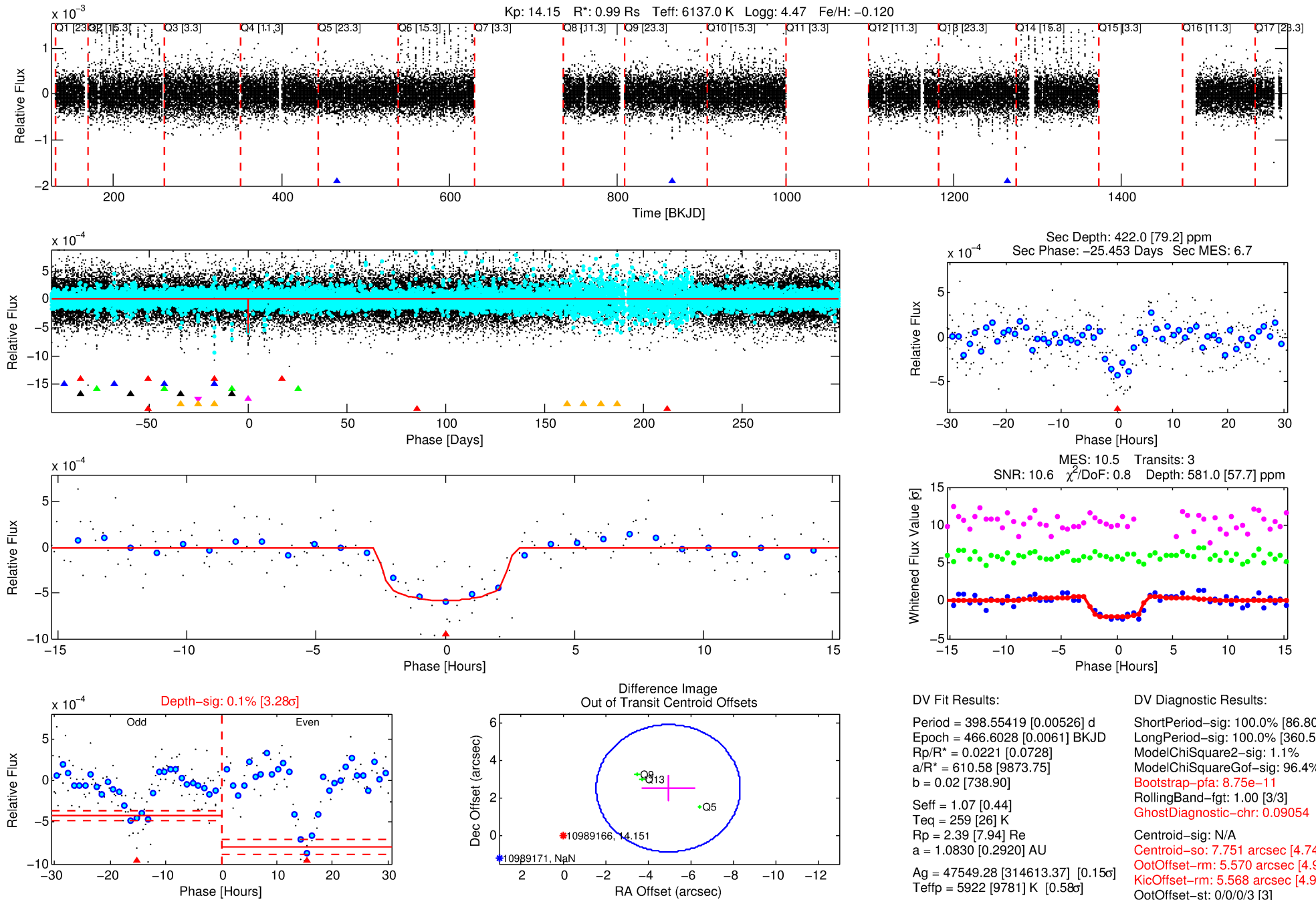
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 010989166-05

No Significant Match Found

# DV One-Page Summary

KIC: 10989166 Candidate: 5 of 7 Period: 398.554 d



## DV Fit Results:

Period = 398.55419 [0.00526] d  
Epoch = 466.6028 [0.0061] BKJD  
Rp/R\* = 0.0221 [0.0728]  
a/R\* = 610.58 [9873.75]  
b = 0.02 [738.90]  
Seff = 1.07 [0.44]  
Teq = 259 [26] K  
Rp = 2.39 [7.94] Re  
a = 1.0830 [0.2920] AU  
Ag = 47549.28 [314613.37] [0.15σ]  
Teffp = 5922 [9781] K [0.58σ]

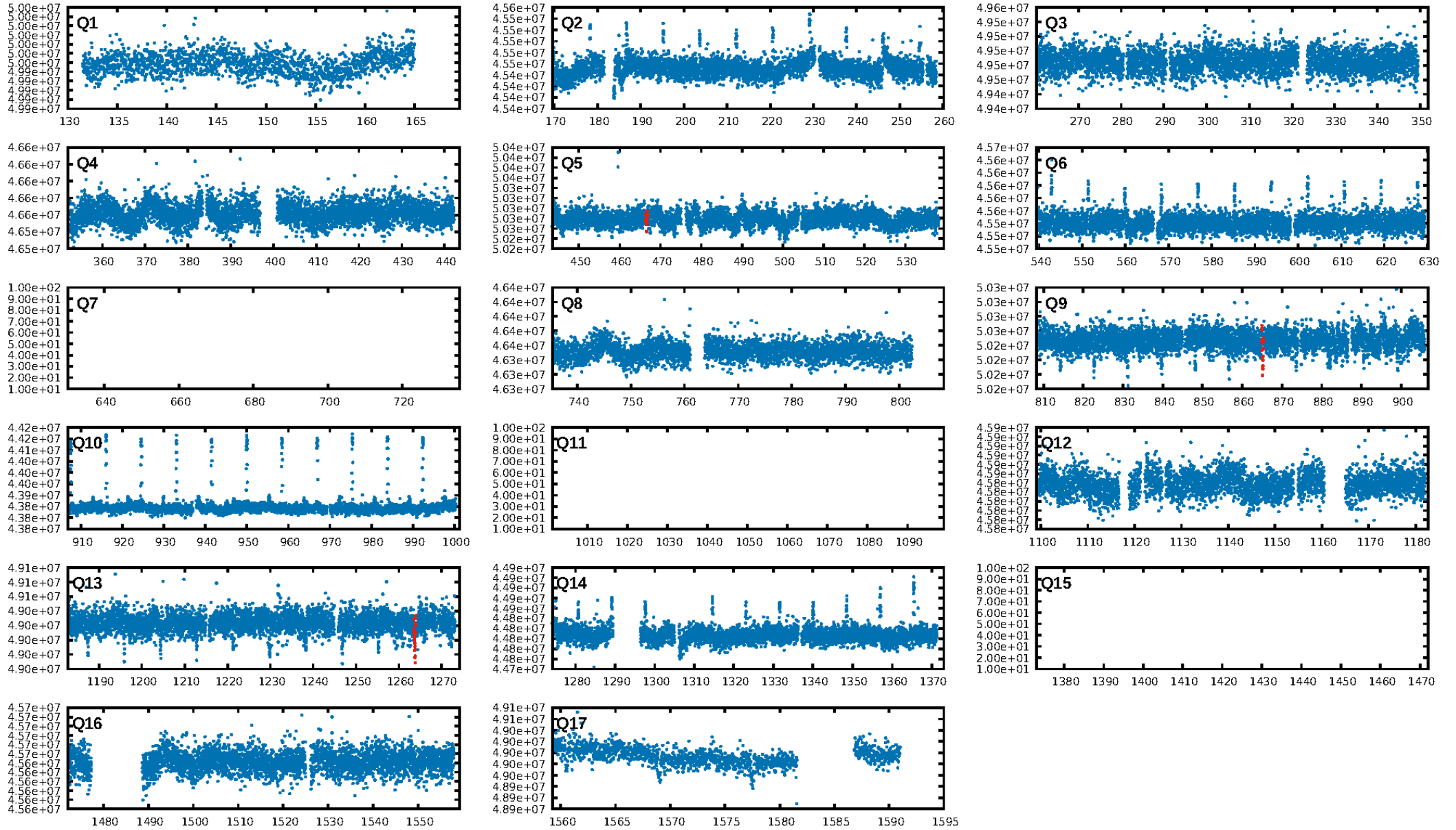
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [86.80σ]  
LongPeriod-sig: 100.0% [360.56σ]  
ModelChiSquare2-sig: 1.1%  
ModelChiSquareGof-sig: 96.4%  
**Bootstrap-pfa: 8.75e-11**  
RollingBand-fgt: 1.00 [3/3]  
**GhostDiagnostic-chr: 0.09054**  
Centroid-sig: N/A  
Centroid-so: 7.751 arcsec [4.74σ]  
OotOffset-rm: 5.570 arcsec [4.93σ]  
KicOffset-rm: 5.568 arcsec [4.99σ]  
OotOffset-st: 0/0/0/3 [3]  
KicOffset-st: 0/0/0/3 [3]  
DiffImageQuality-fgm: 1.00 [3/3]  
DiffImageOverlap-fno: 1.00 [3/3]

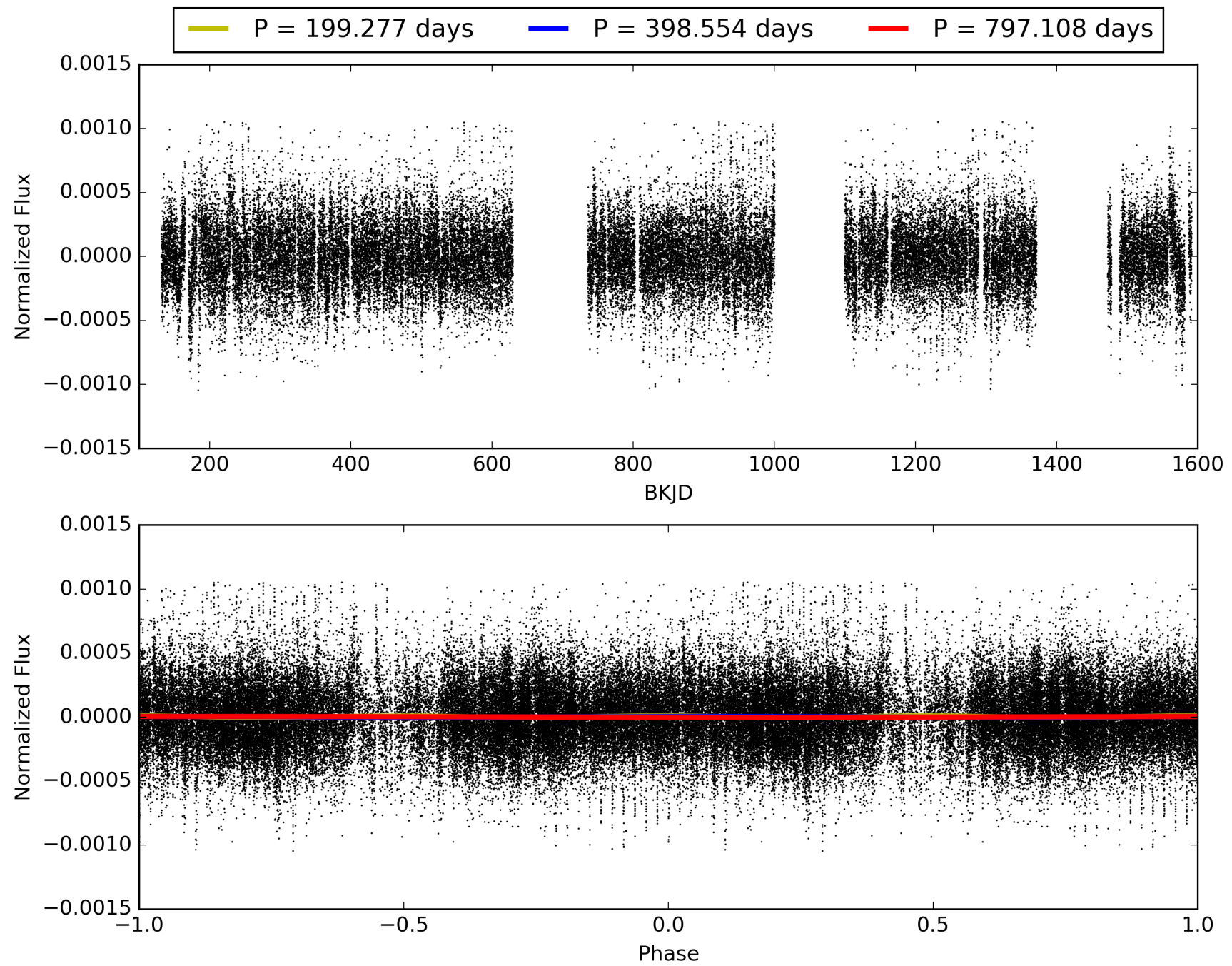
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 04:00:35 Z

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

# TCE 010989166-05, PDC Light Curves

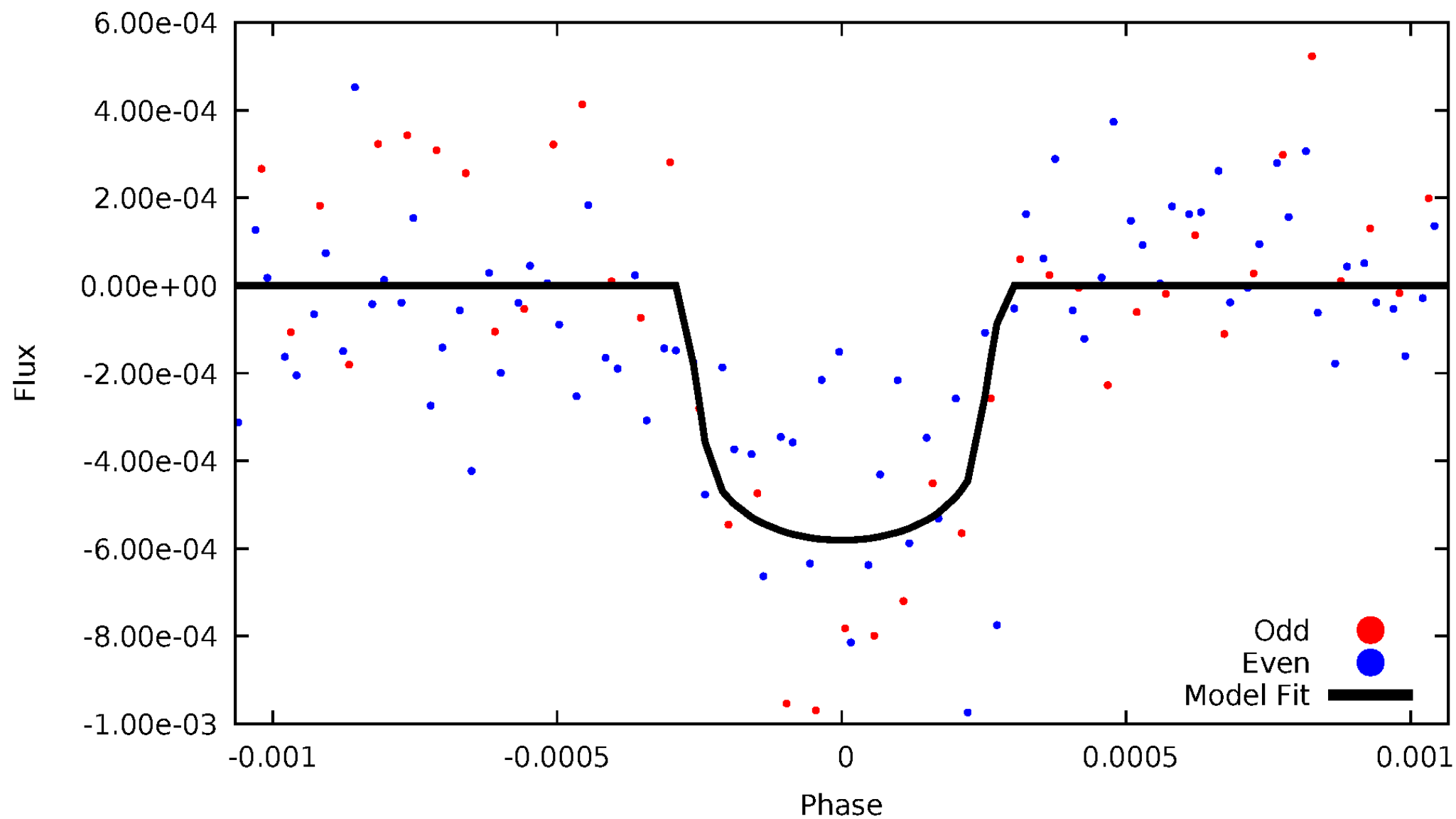


TCE 010989166-05



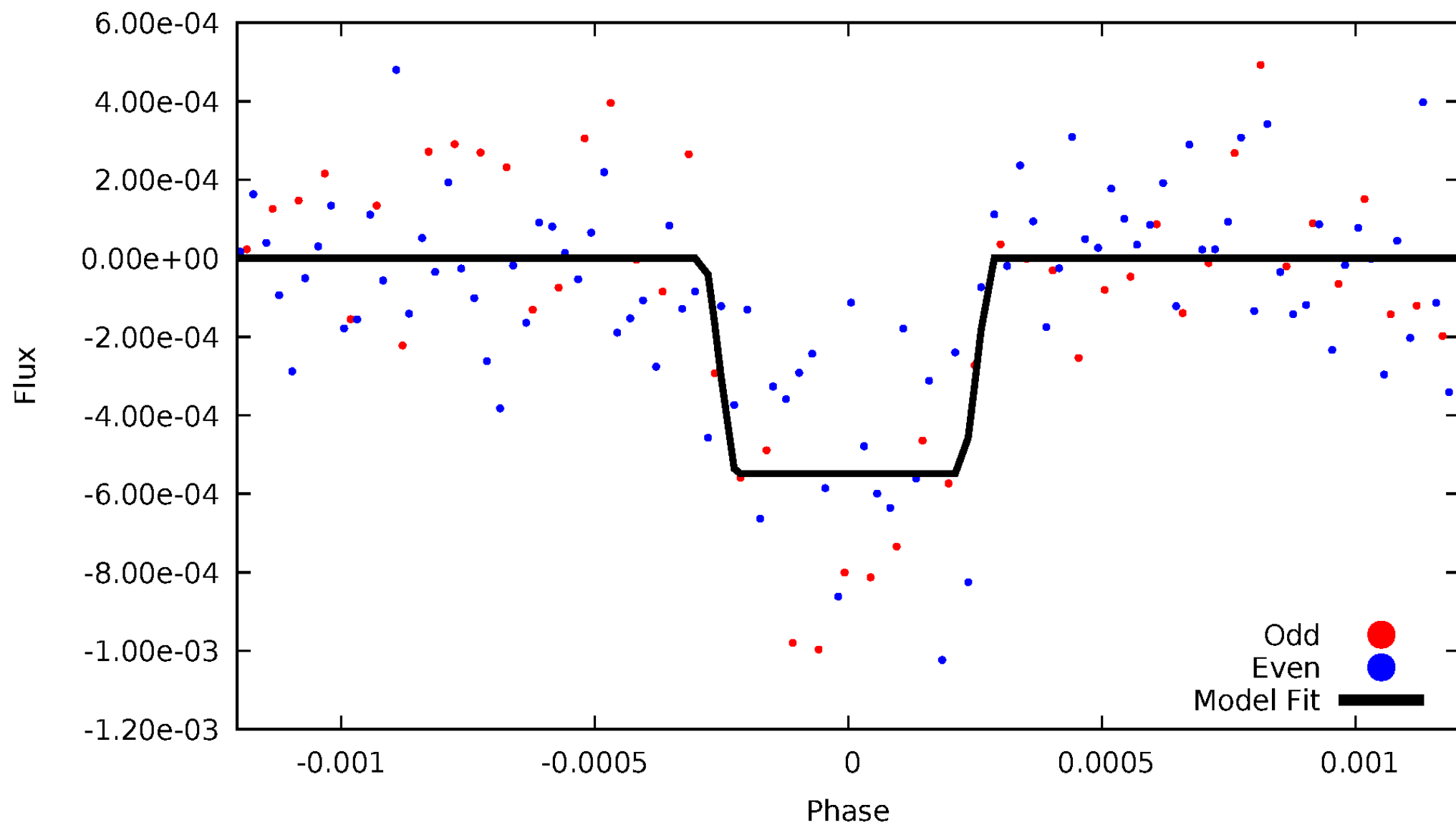
# DV Odd/Even

TCE 010989166-05



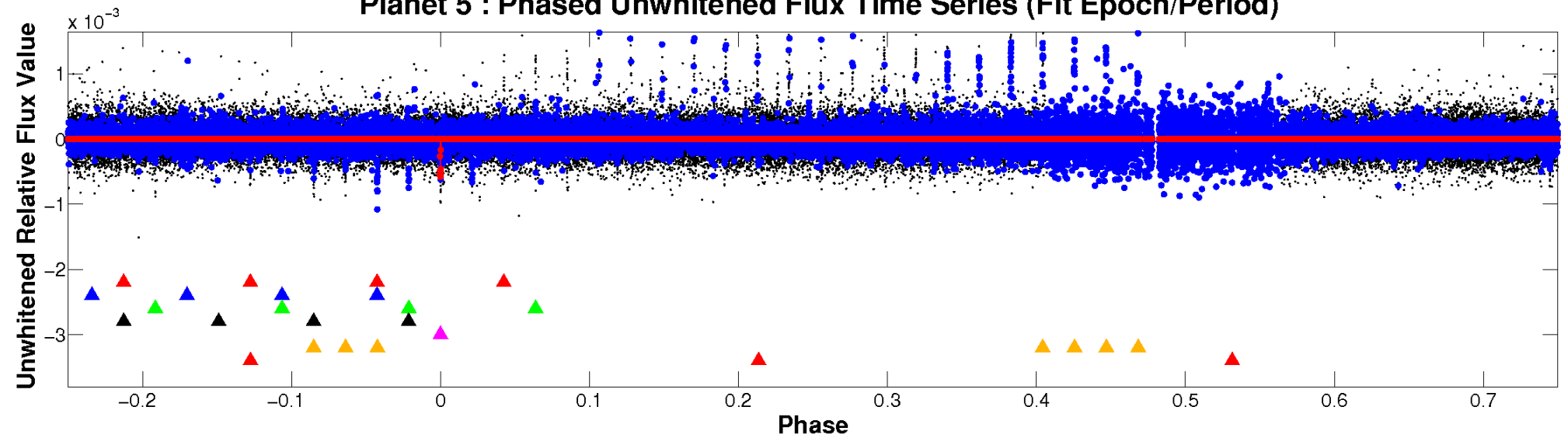
# ALT Odd/Even

TCE 010989166-05

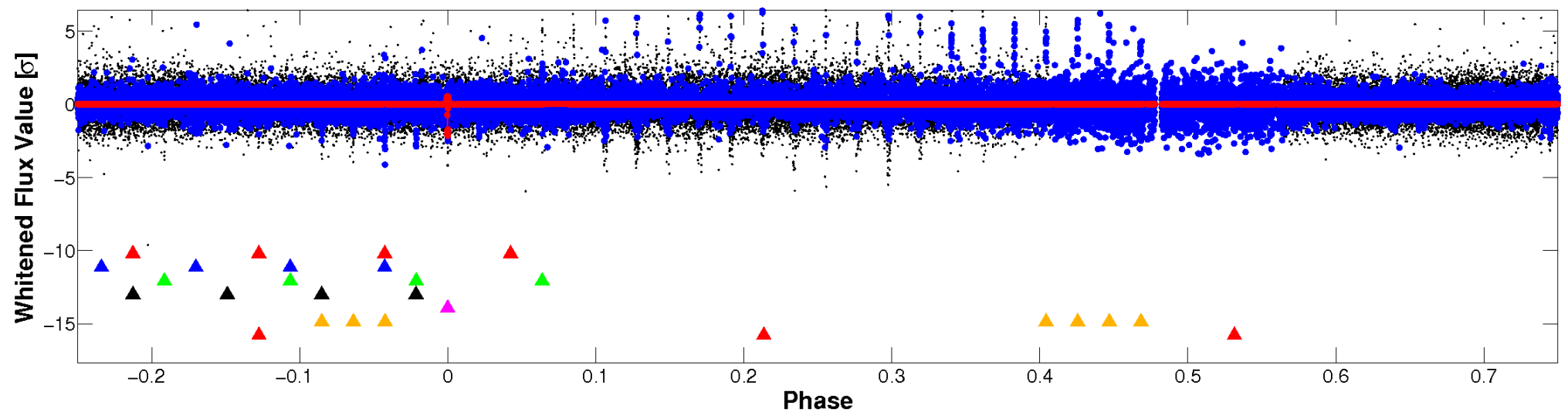


# Non-Whitened Vs. Whitened Light Curve

## Planet 5 : Phased Unwhitened Flux Time Series (Fit Epoch/Period)

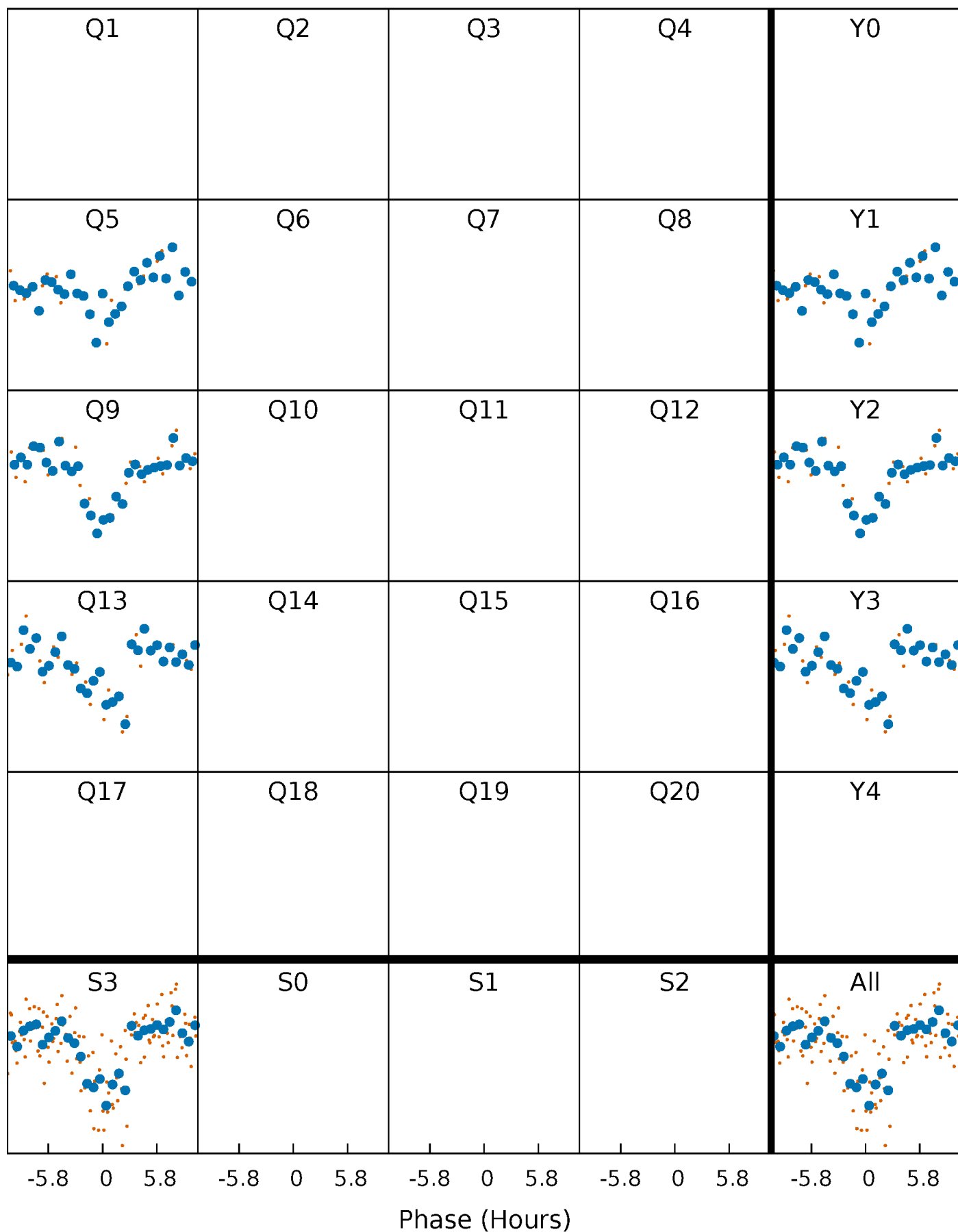


## Planet 5 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

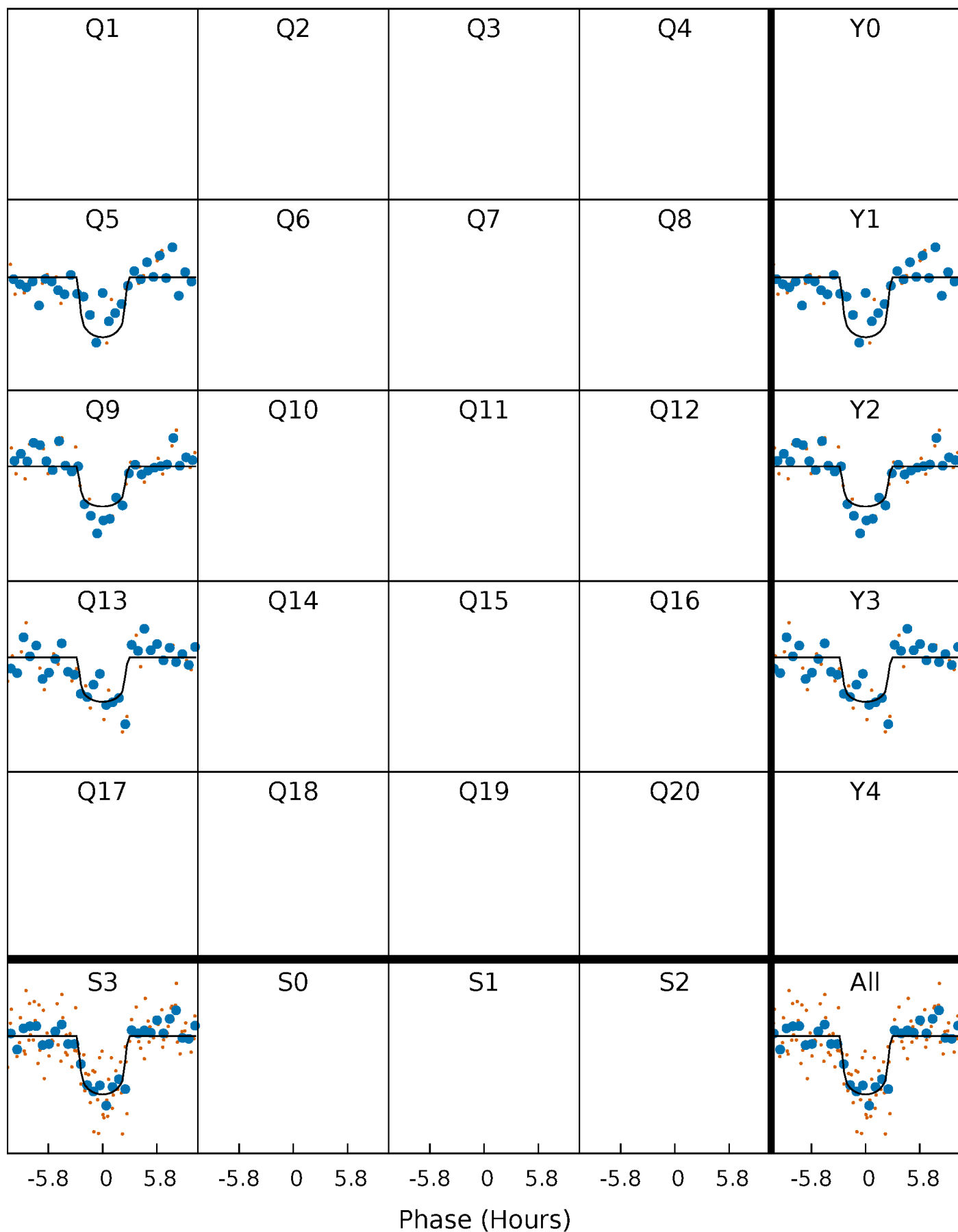
TCE 010989166-05     $P=398.554187$  Days     $T_0=466.602819$  (BKJD)





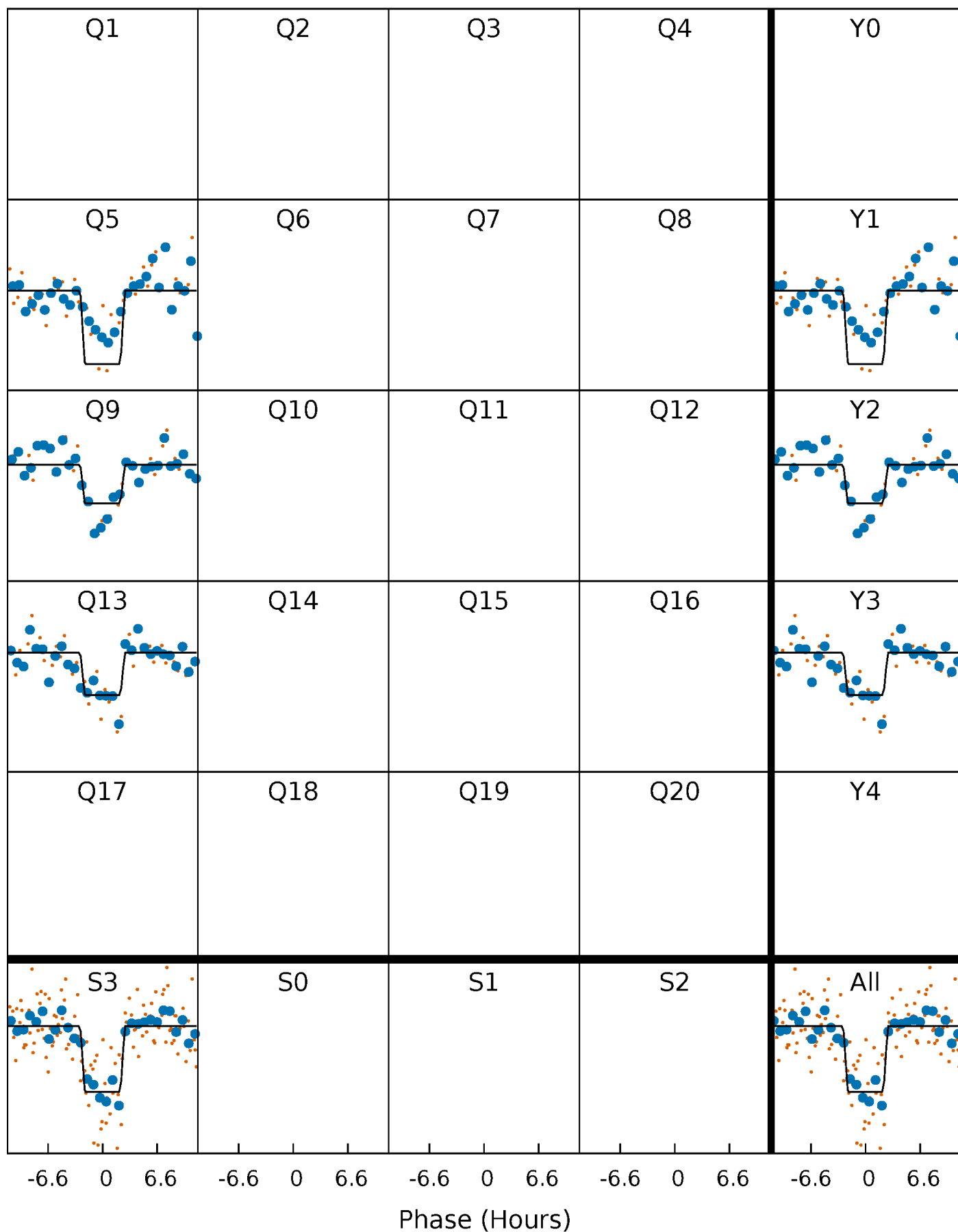
# DV Quarter-Phased Transit Curves

TCE 010989166-05     $P=398.554187$  Days     $T_0=466.602819$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

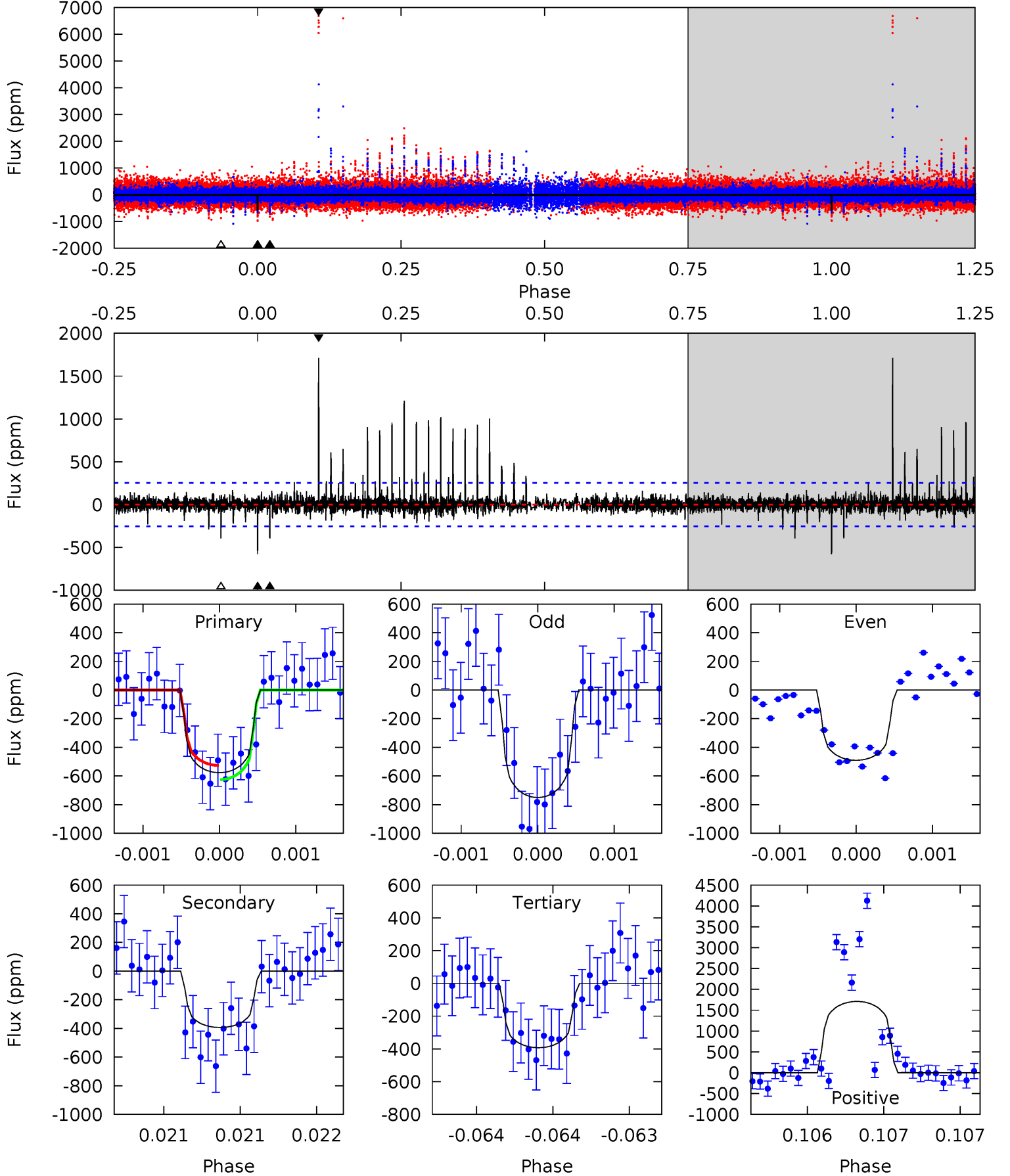
TCE 010989166-05     $P=398.563399$  Days     $T_0=466.598852$  (BKJD)



# DV Model-Shift Uniqueness Test

010989166-05, P = 398.554187 Days, E = 68.048632 Days

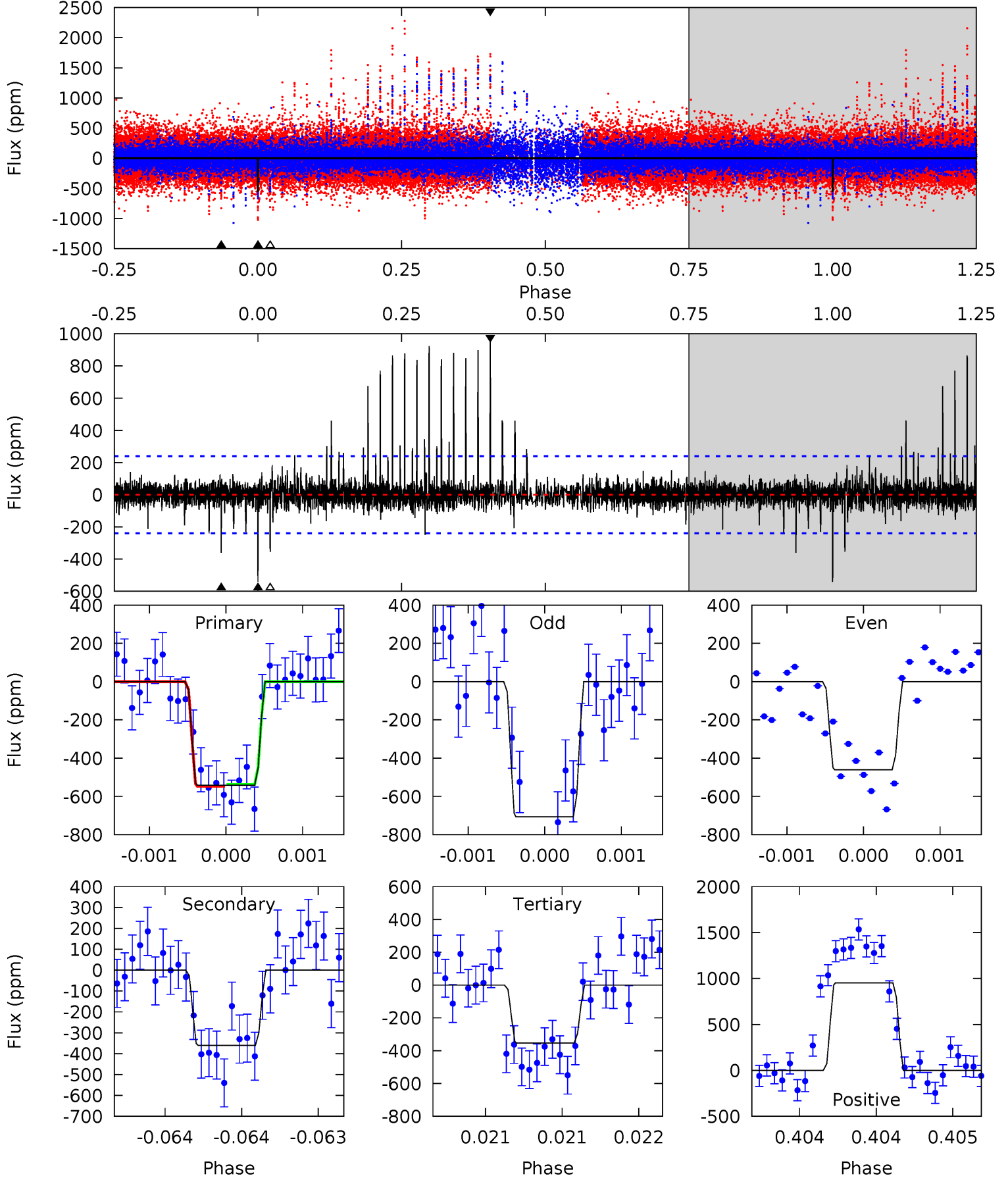
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
12.7	8.67	8.65	37.7	5.55	3.45	2.07	4.06	-24.9	0.02	-29.0	1.71	0.96	0.75	1.10



# Alt Model-Shift Uniqueness Test

010989166-05,  $P = 398.563399$  Days,  $E = 68.035453$  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
12.6	8.36	8.21	22.1	5.55	3.45	1.81	4.37	-9.54	0.15	-13.8	2.62	0.88	0.64	0.11



### Stellar Parameters For KIC 010989166

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6137^{+165}_{-202}$	$4.471^{+0.052}_{-0.208}$	$-0.120^{+0.300}_{-0.300}$	$0.994^{+0.324}_{-0.108}$	$1.067^{+0.139}_{-0.139}$	$1.529^{+0.419}_{-0.782}$
	+3%/-3%	+1%/-5%	+250%/-250%	+33%/-11%	+13%/-13%	+27%/-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 010989166-05 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-394 \pm 45$	$7.00^{+6.51}_{-4.80}$	$371^{+25}_{-19}$	$3866^{+2370}_{-725}$	$5189^{+47468}_{-3872}$
Alt.	$-360 \pm 43$	$6.98^{+6.31}_{-4.89}$	$370^{+29}_{-18}$	$3828^{+2381}_{-694}$	$4813^{+44589}_{-3496}$

$T_{max}$  = 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

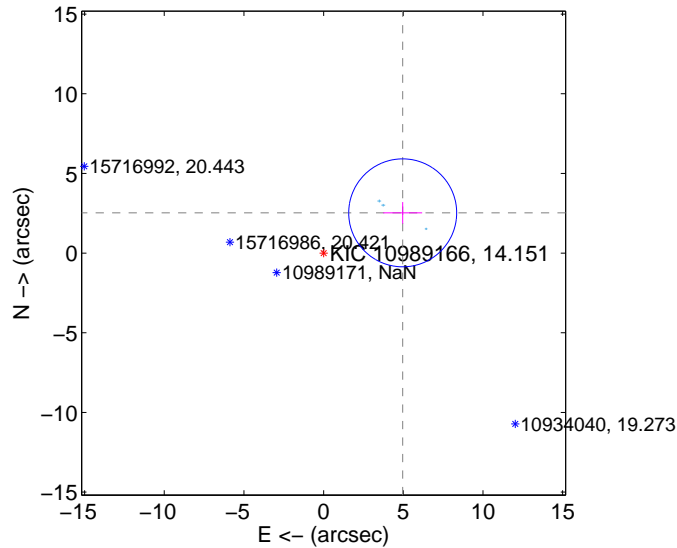
Supplemental centroid analysis for 010989166-05. Kepler magnitude: 14.15. Transit SNR 10.60

There are 3 quarters with good PRF difference image offsets

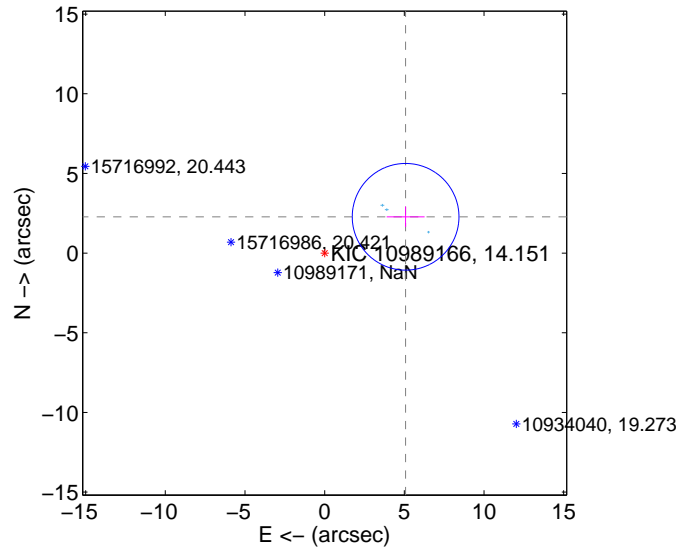
The direct PRF centroid is offset from the target star catalog position by about 0.32 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$5.570 \pm 1.129$	4.93	$-4.964 \pm 1.220$	$2.527 \pm 0.675$
PRF-fit source offset from KIC position	$5.568 \pm 1.116$	4.99	$-5.081 \pm 1.189$	$2.278 \pm 0.642$
photometric centroid source offset	$7.75 \pm 1.64$	4.74	$-6.49 \pm 1.69$	$4.23 \pm 1.51$

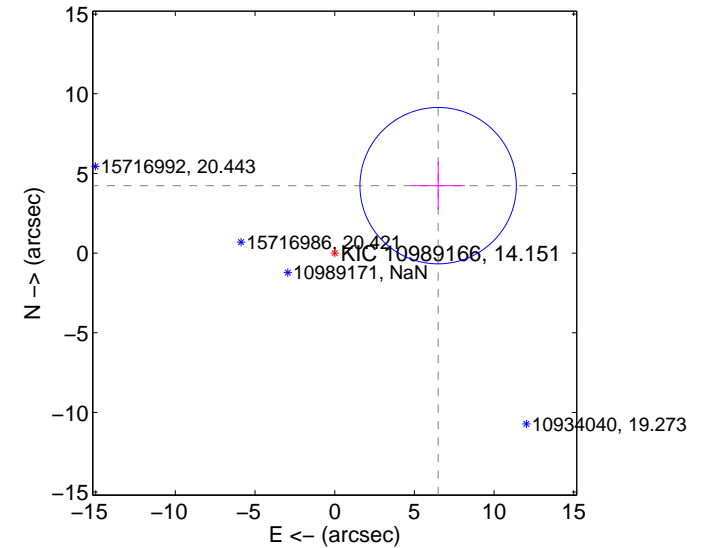
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position



offset from photometric centroids

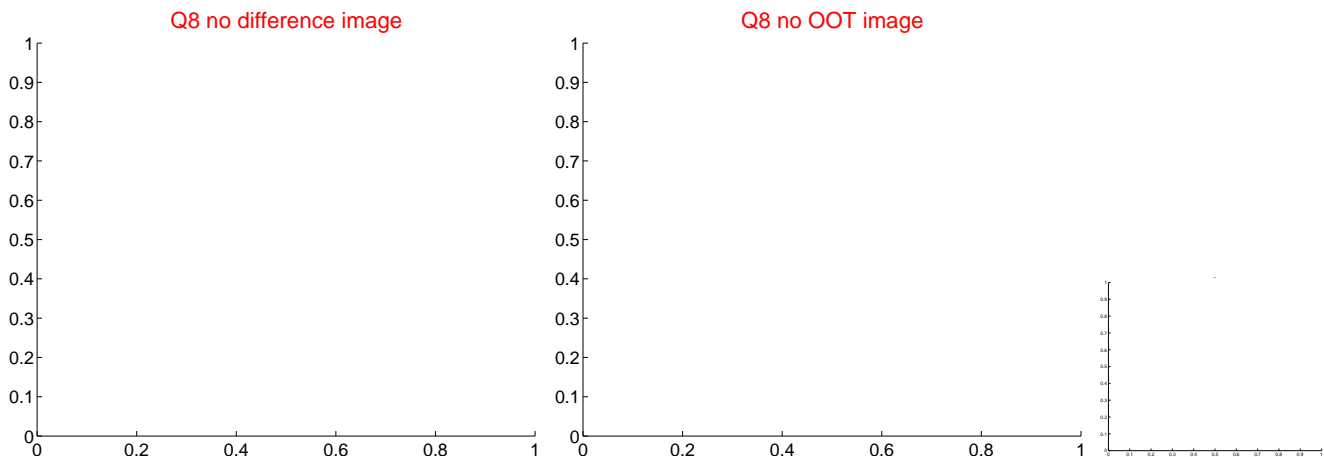
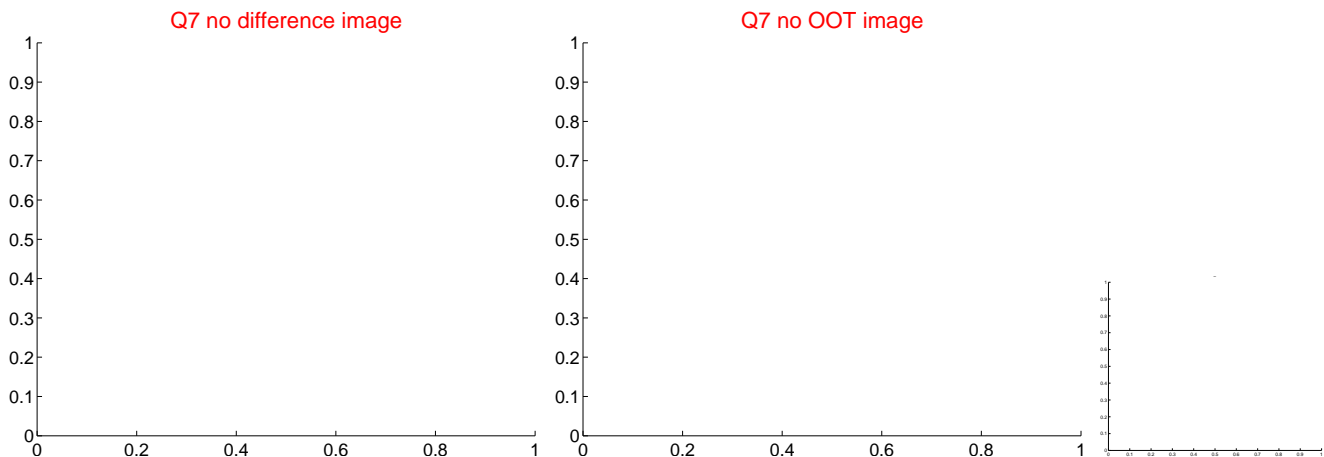
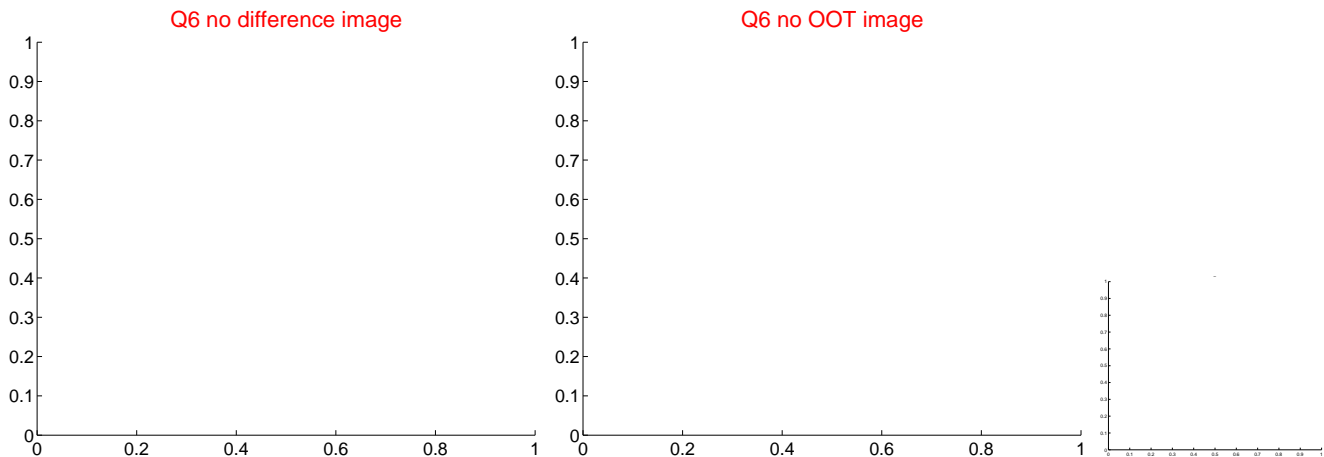
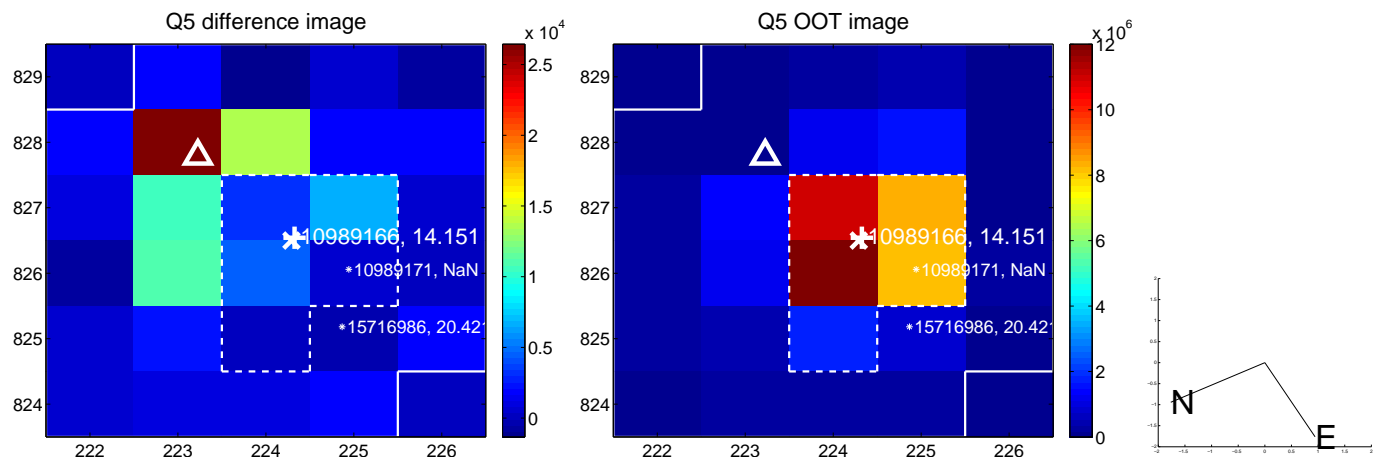


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

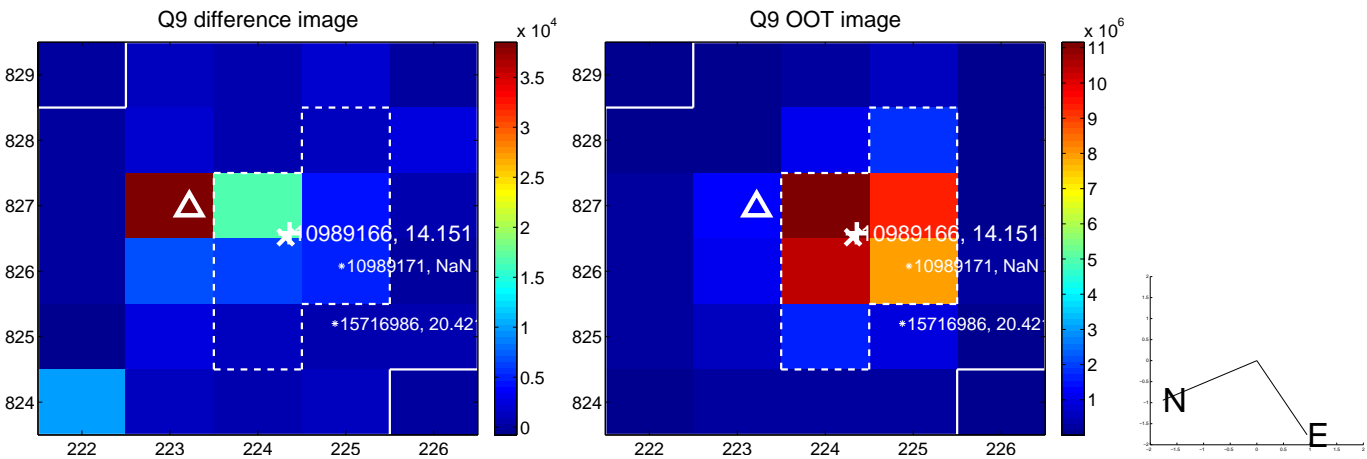


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

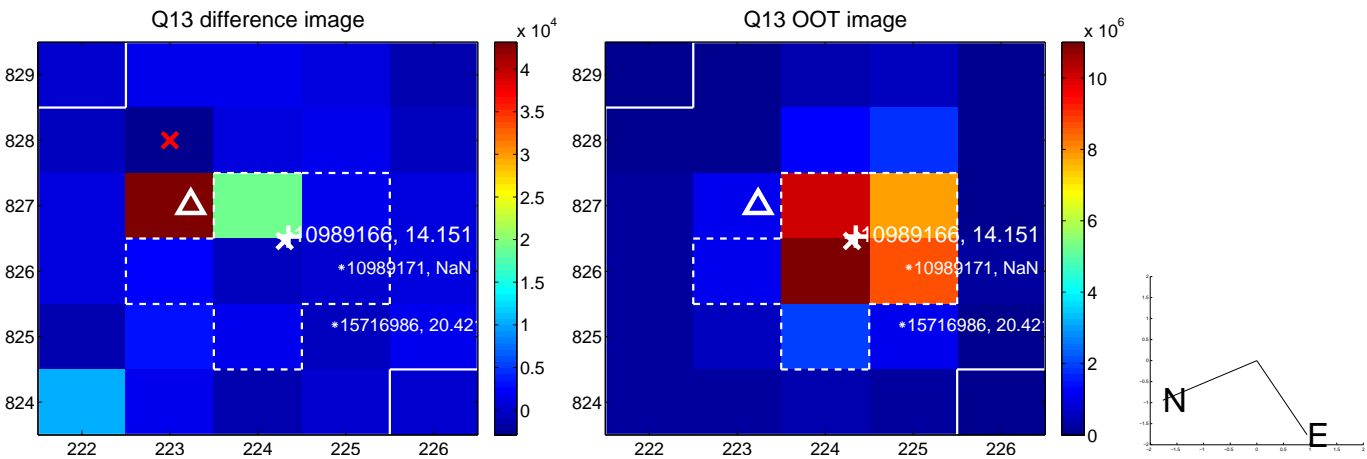




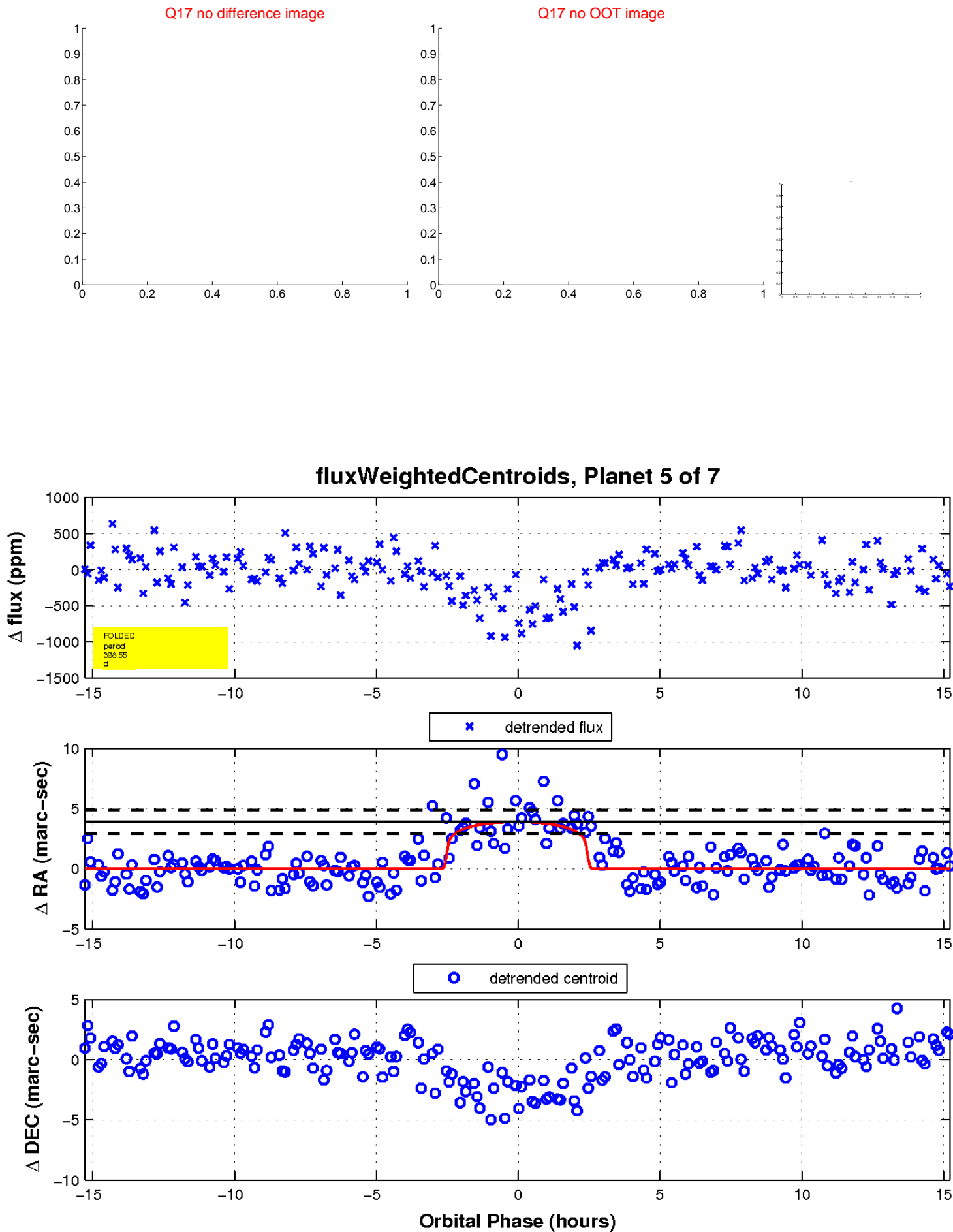
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

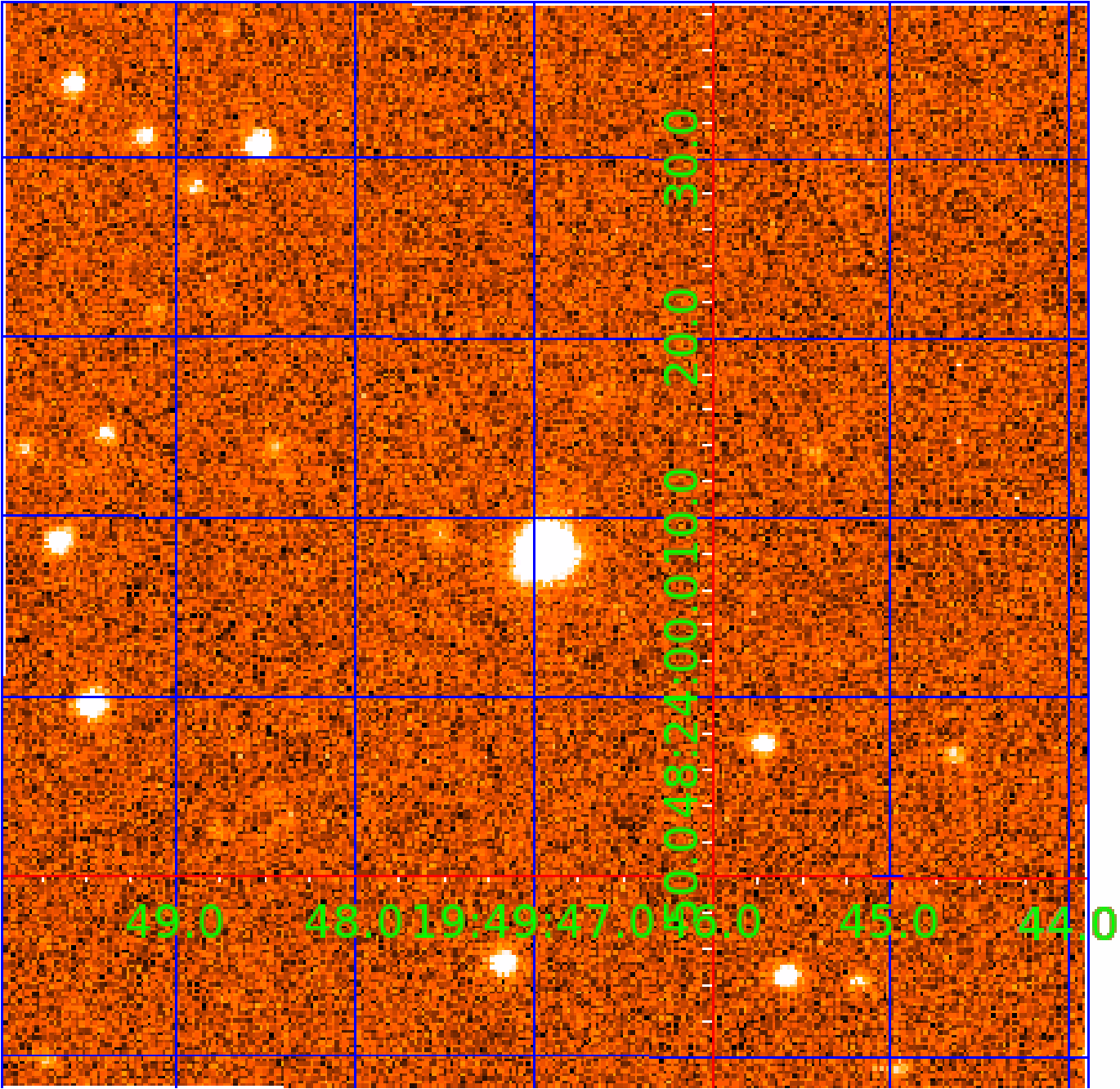


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 010989166

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
010989166-01	OBS	No	364.654533	483.543104	599.2	6.203	13.0	13.8	0.99	6137	2.66	1.21
010989166-02	OBS	No	373.132674	449.630666	601.9	6.331	12.6	13.4	0.99	6137	2.52	1.17
010989166-03	OBS	No	364.640890	492.053046	643.4	5.646	11.9	12.8	0.99	6137	2.70	1.21
010989166-04	OBS	No	373.150031	458.076750	648.8	4.835	11.2	11.2	0.99	6137	2.74	1.17
010989166-05	OBS	No	398.554187	466.602819	581.0	5.096	10.5	10.6	0.99	6137	2.39	1.07
010989166-06	OBS	No	195.012731	254.729492	604.3	6.002	9.9	11.2	0.99	6137	2.58	2.78
010989166-07	OBS	No	534.484685	279.855588	369.4	7.477	8.6	7.4	0.99	6137	2.19	0.72

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
010989166-01	OBS	FP	0.00	1	0	1	0	MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_RESOLVED_OFFSET—HALO_GHOST
010989166-02	OBS	FP	0.00	1	0	1	1	MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_RESOLVED_OFFSET—HALO_GHOST—EPHEM_MATCH
010989166-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—SAME_NTL_PERIOD—CENT_FEW_DIFFS
010989166-04	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_MARSHALL—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—SAME_NTL_PERIOD—CENT_RESOLVED_OFFSET—HALO_GHOST
010989166-05	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_CHASES—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS—HALO_GHOST
010989166-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
010989166-07	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_CHASES—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS—HALO_GHOST

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

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

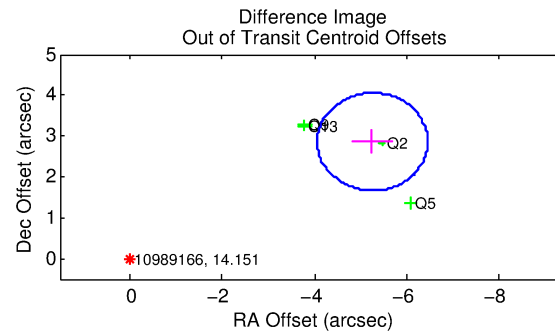
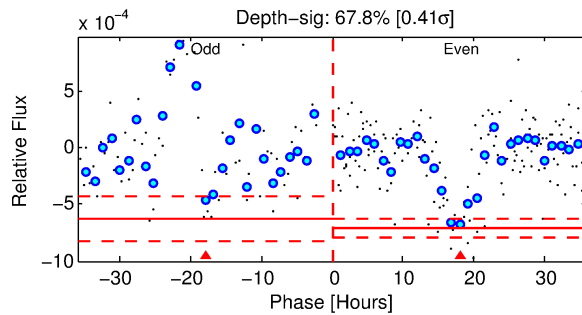
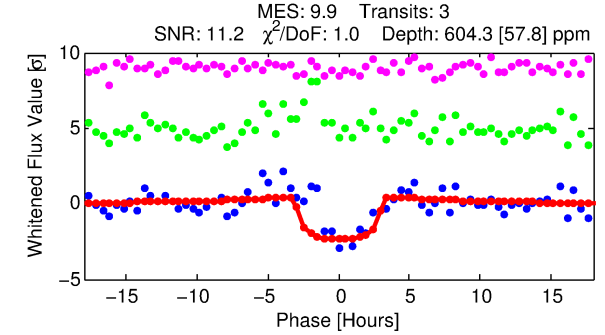
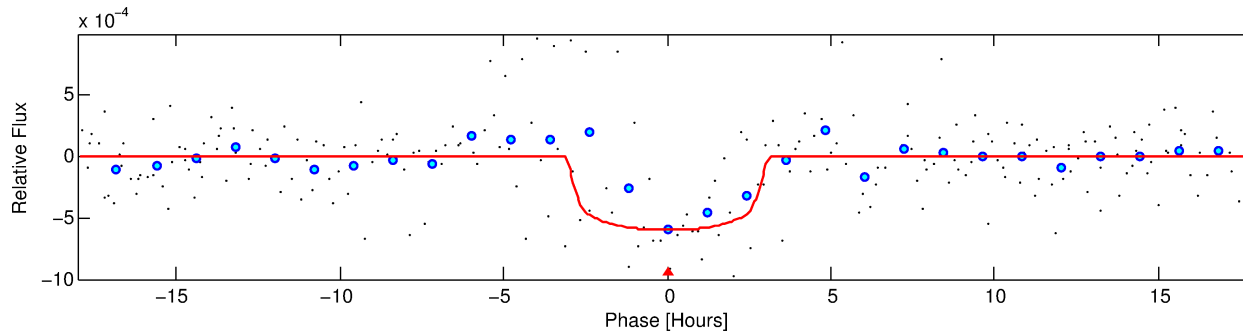
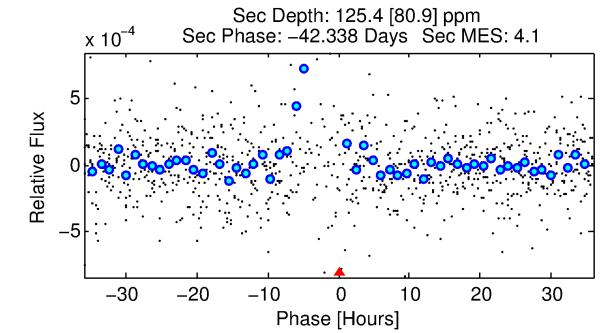
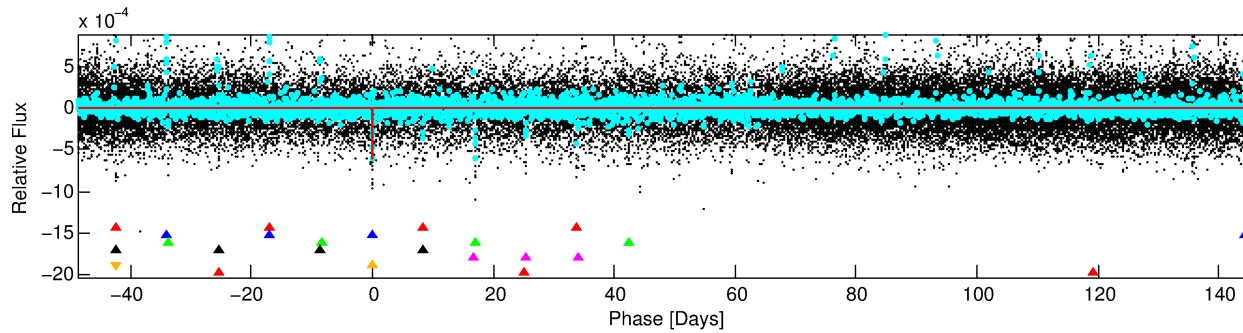
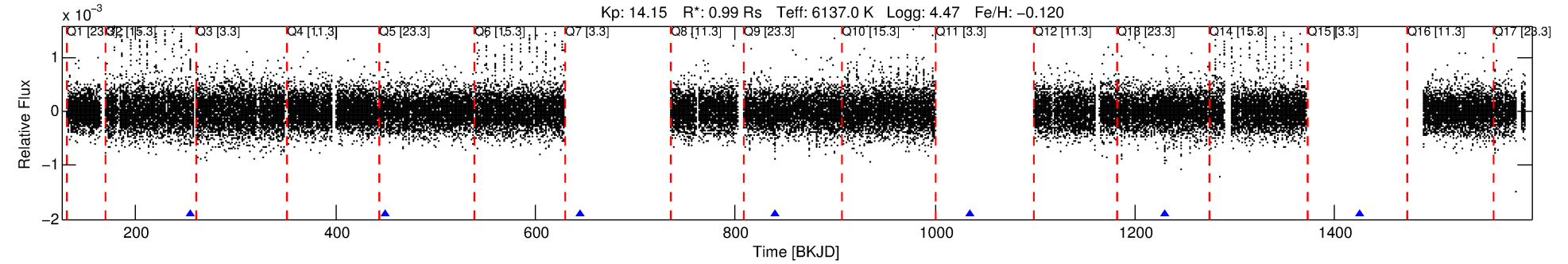
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 010989166-06

No Significant Match Found

# DV One-Page Summary

KIC: 10989166 Candidate: 6 of 7 Period: 195.013 d



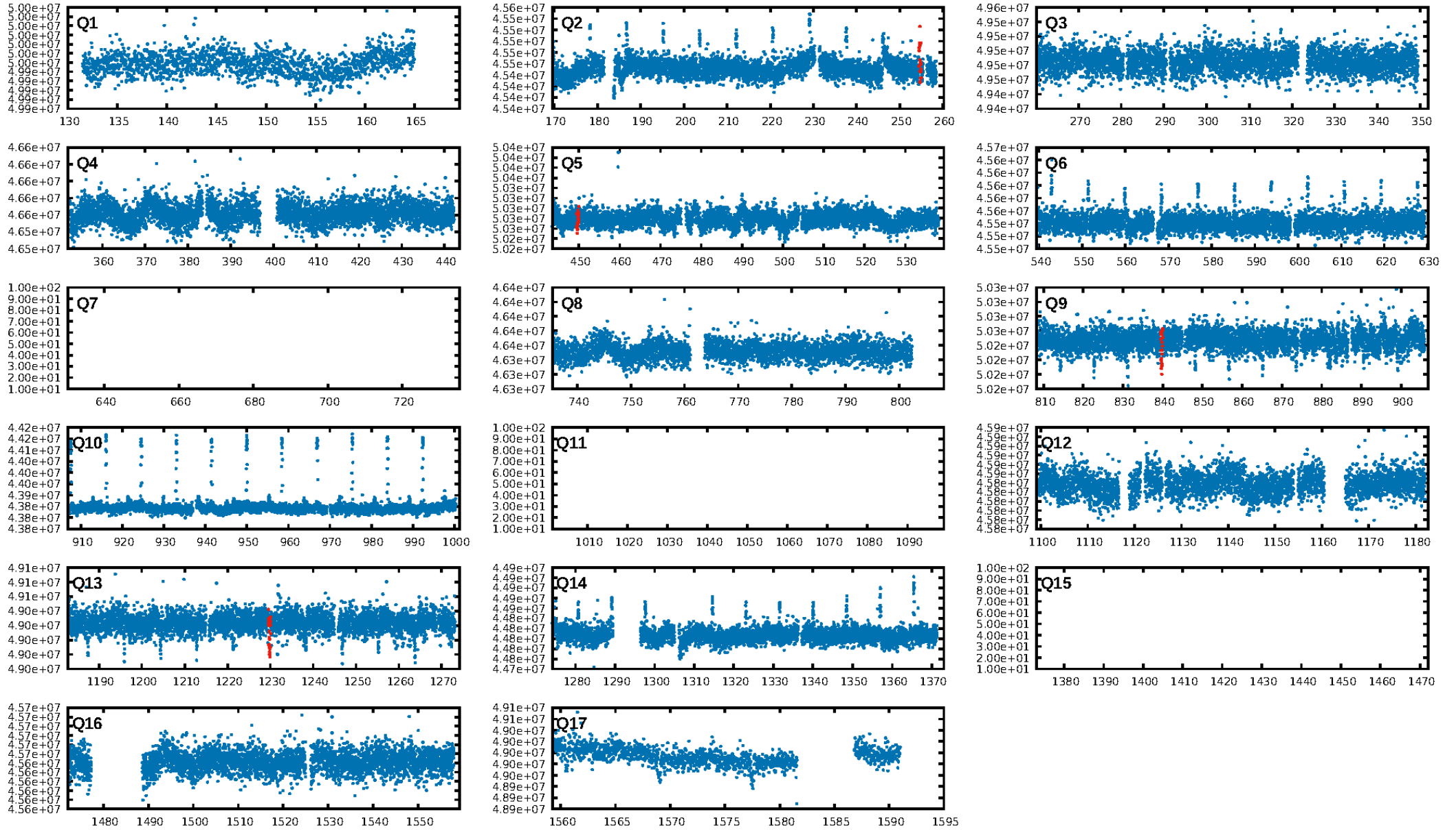
## DV Fit Results:

Period = 195.01273 [0.00267] d  
Epoch = 254.7295 [0.0096] BKJD  
Rp/R\* = 0.0237 [0.0227]  
a/R\* = 197.83 [940.11]  
b = 0.64 [4.37]  
Seff = 2.78 [1.13]  
Teq = 329 [34] K  
Rp = 2.58 [2.60] Re  
a = 0.6725 [0.1813] AU  
Ag = 4701.24 [9670.84] [0.49σ]  
Teffp = 4214 [2133] K [1.82σ]

## DV Diagnostic Results:

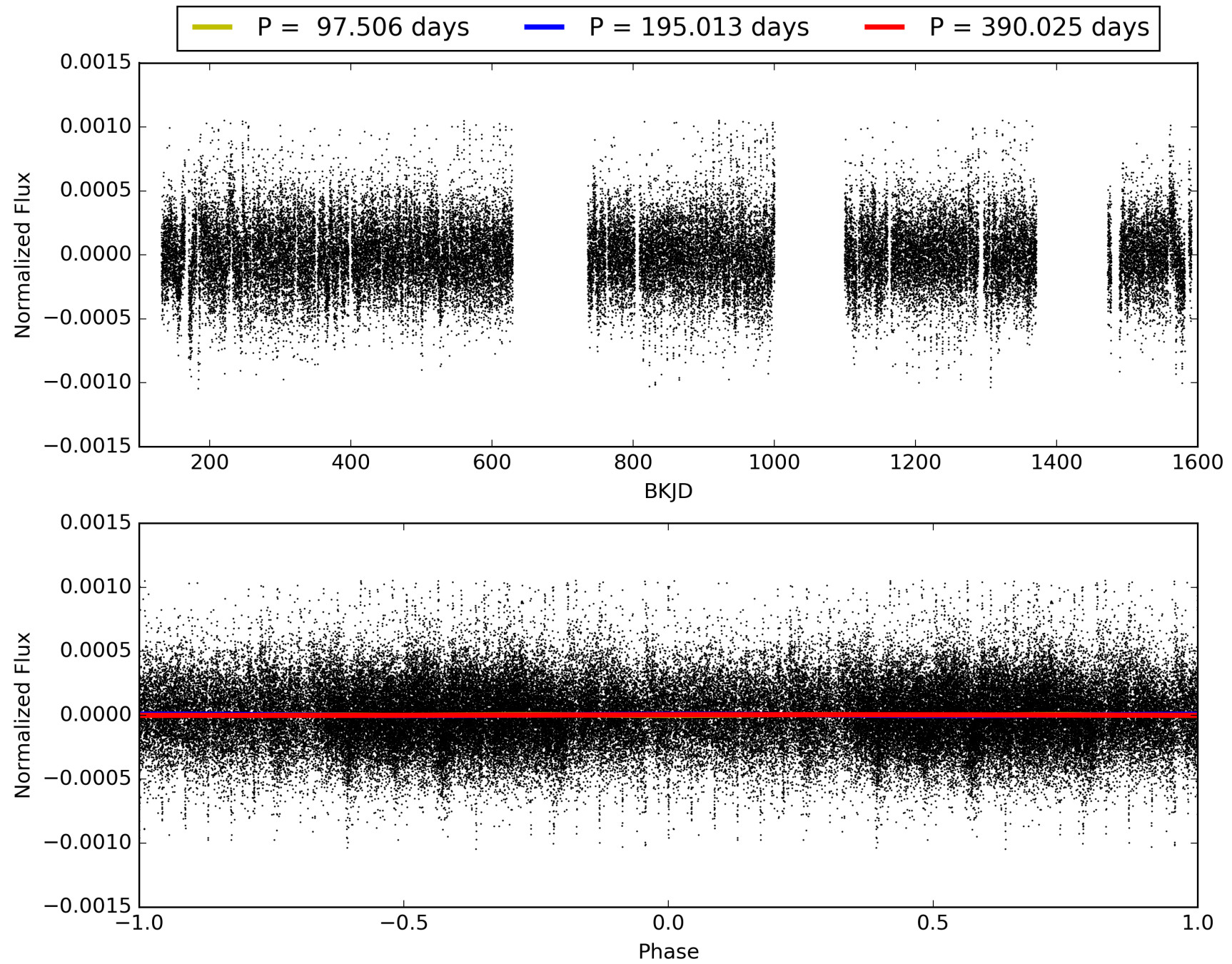
ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [494.04σ]  
ModelChiSquare2-sig: 36.0%  
ModelChiSquareGof-sig: 99.5%  
Bootstrap-pfa: 3.06e-13  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: 0.7238  
Centroid-sig: N/A  
Centroid-so: 5.558 arcsec [4.19σ]  
OotOffset-rm: 5.981 arcsec [15.02σ]  
KicOffset-rm: 5.814 arcsec [14.91σ]  
OotOffset-st: 1/0/0/3 [4]  
KicOffset-st: 1/0/0/3 [4]  
DiffImageQuality-fgm: 0.75 [3/4]  
DiffImageOverlap-fno: 0.75 [3/4]

# TCE 010989166-06, PDC Light Curves





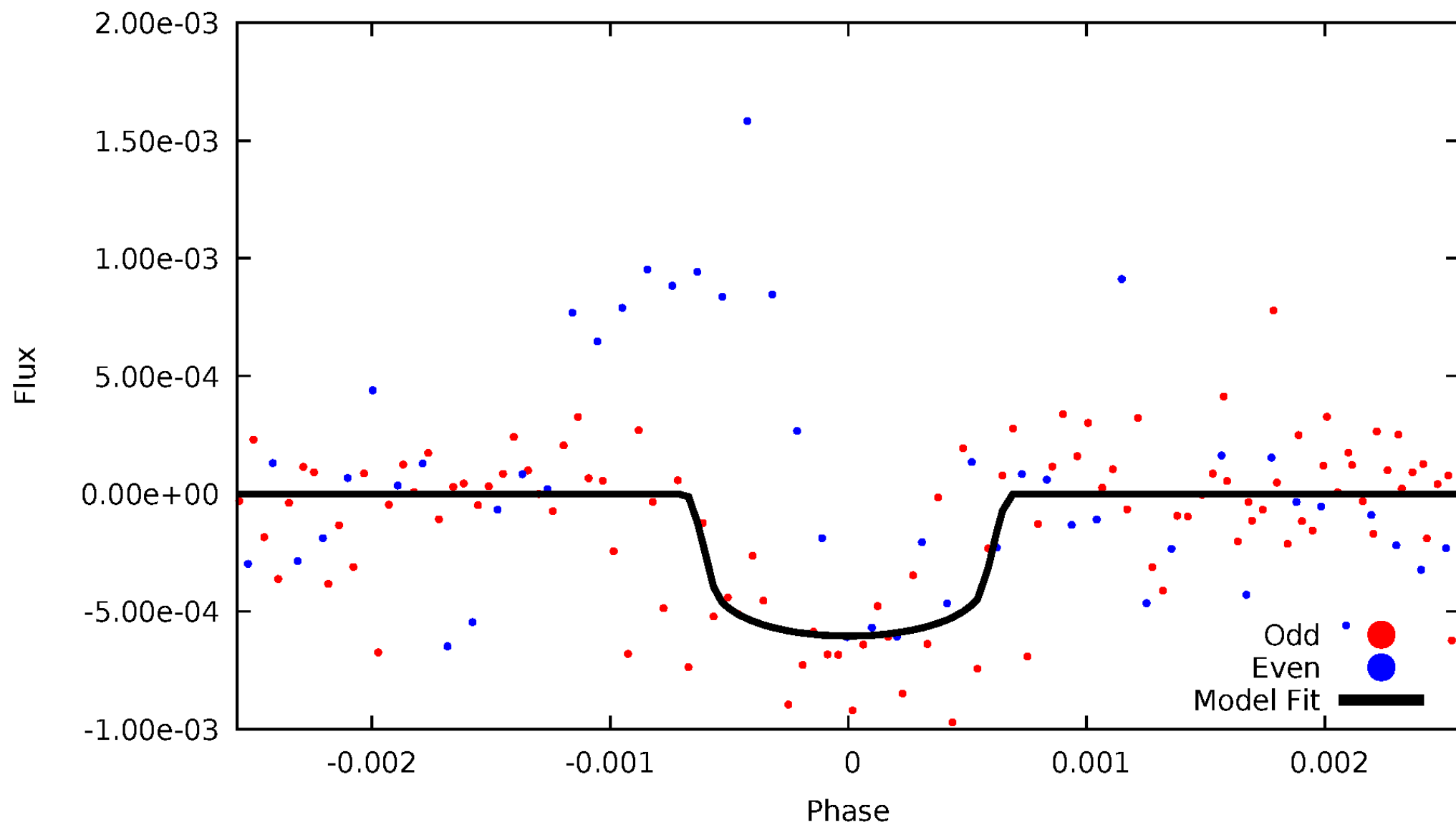
TCE 010989166-06





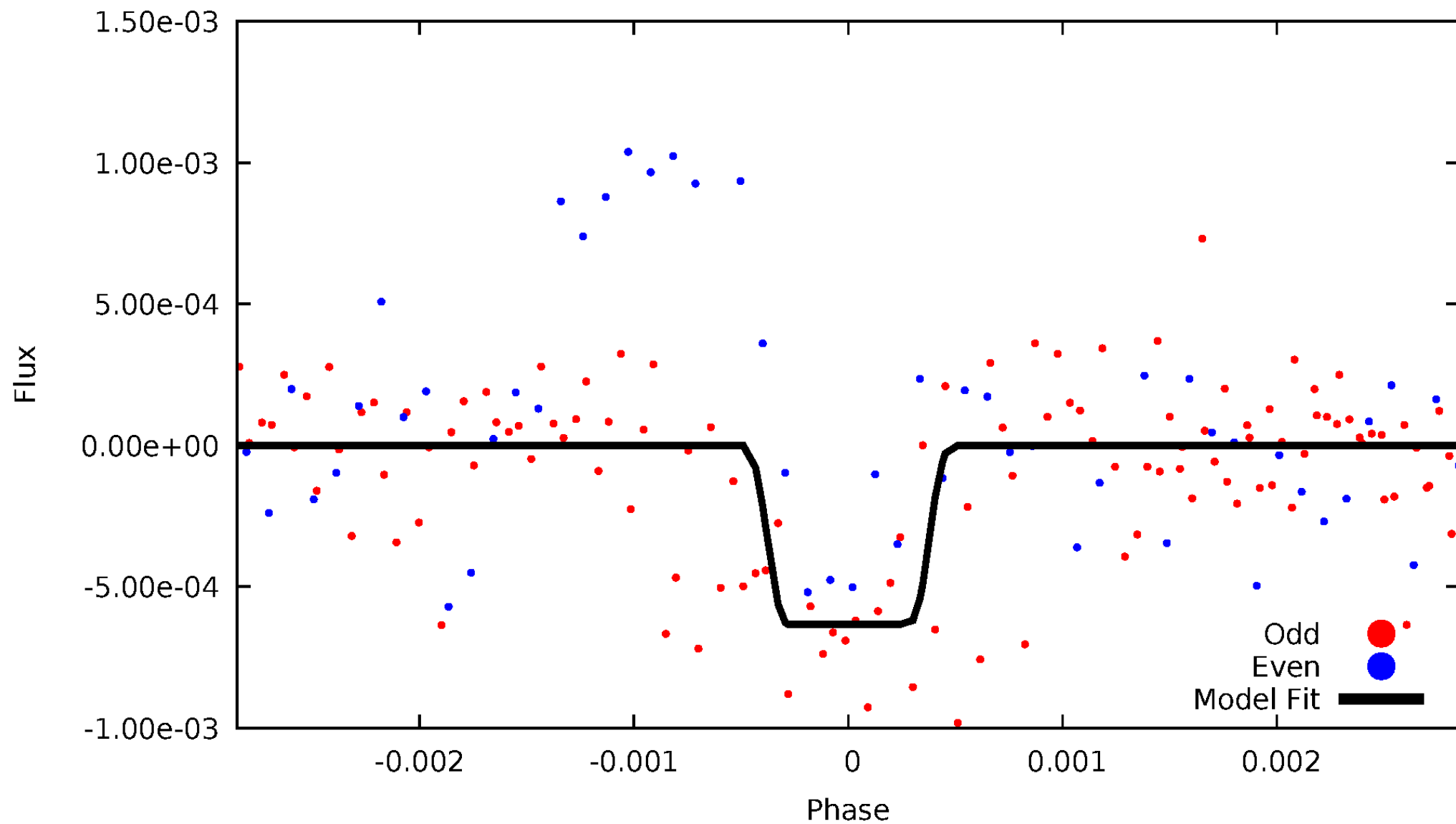
# DV Odd/Even

TCE 010989166-06



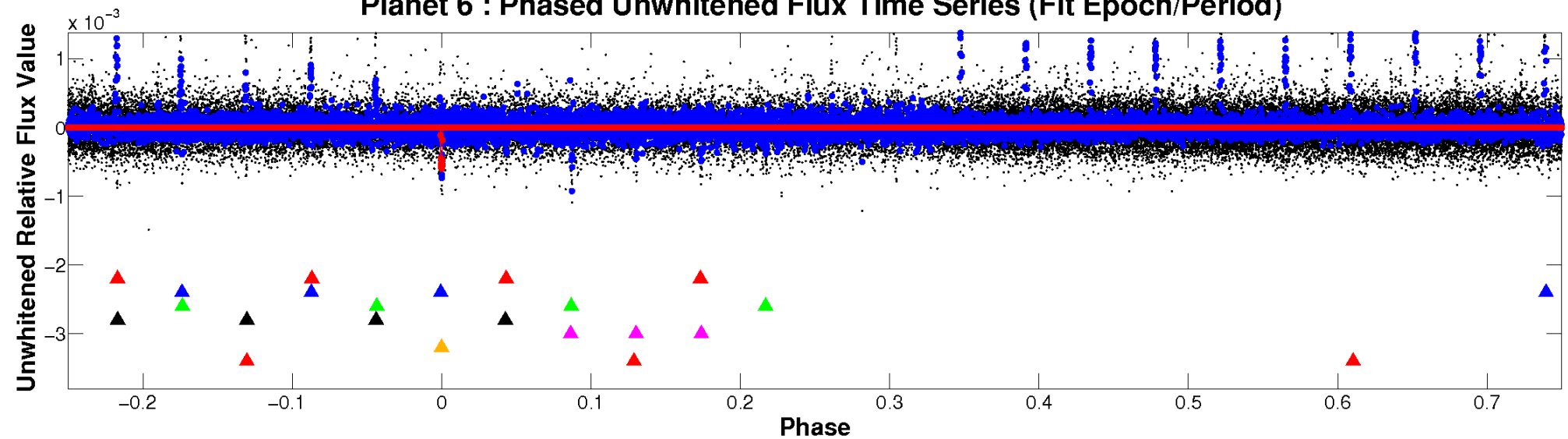
# ALT Odd/Even

TCE 010989166-06

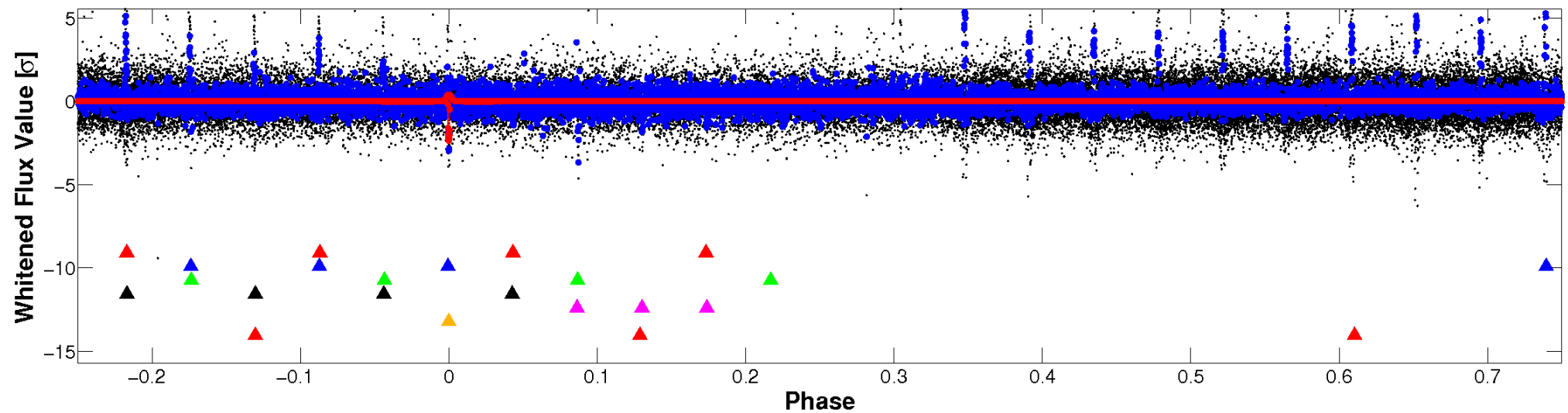


# Non-Whitened Vs. Whitened Light Curve

## Planet 6 : Phased Unwhitened Flux Time Series (Fit Epoch/Period)

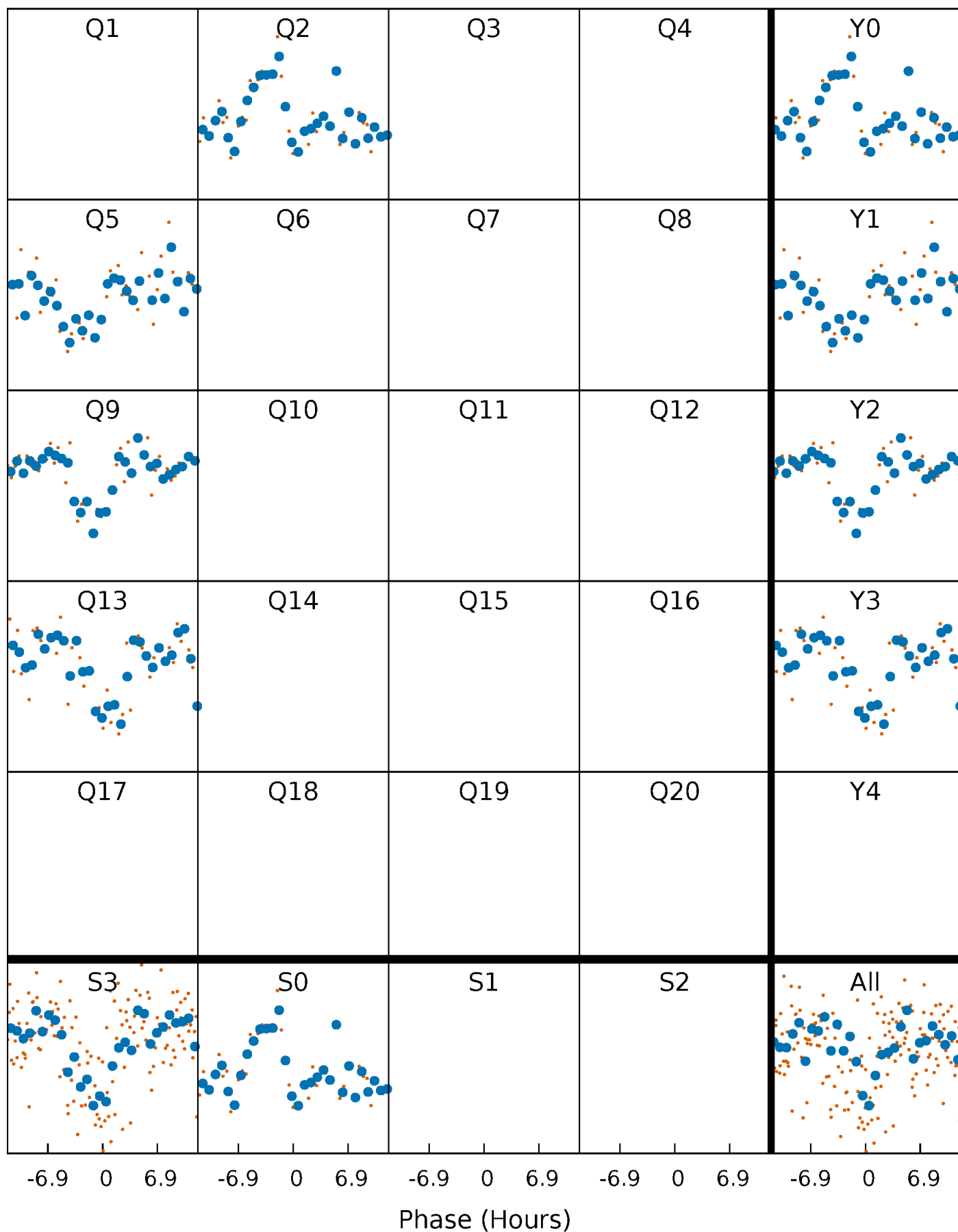


## Planet 6 : Phased Whitened Flux Time Series (Fit Epoch/Period)



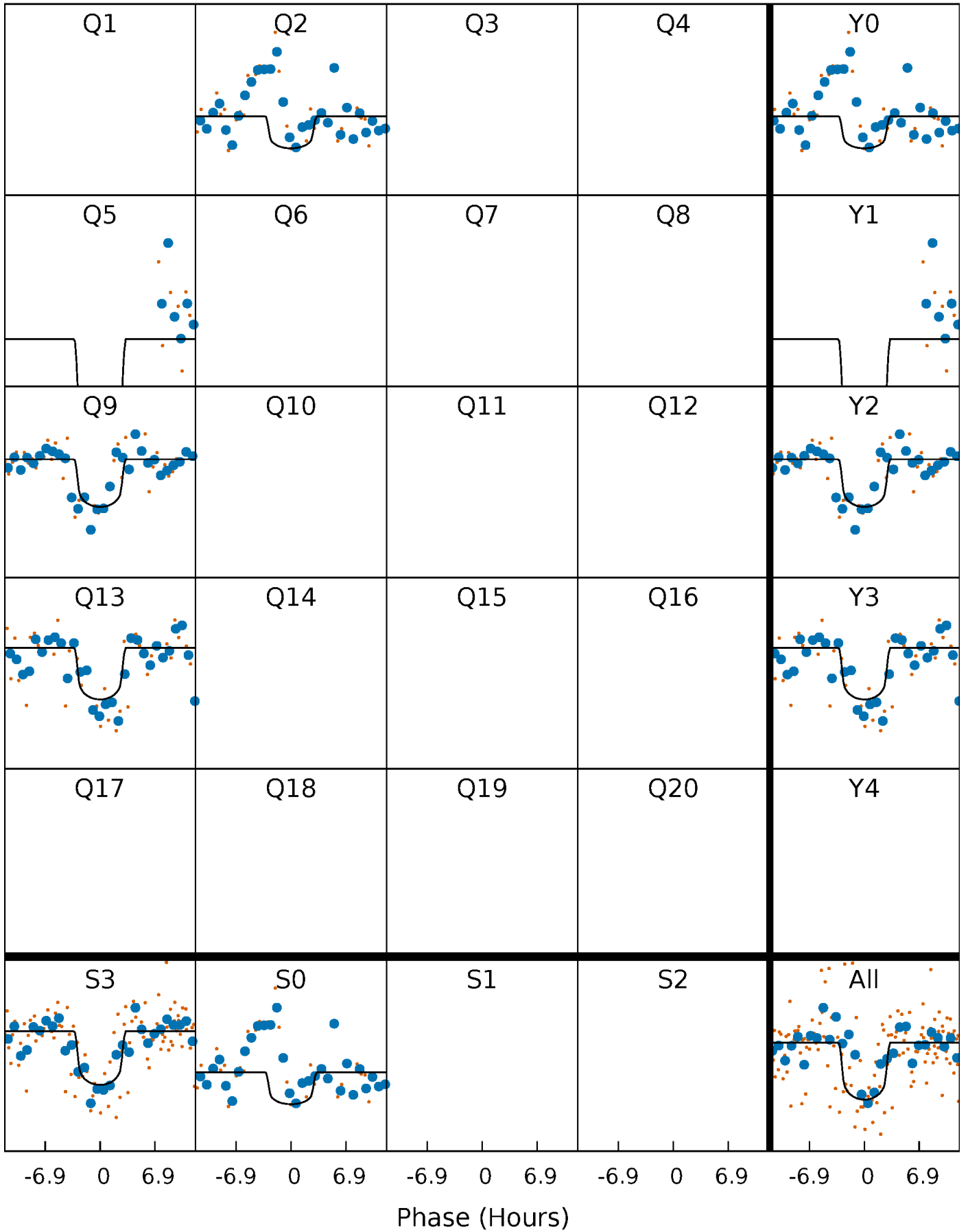
# PDC Quarter-Phased Transit Curves

TCE 010989166-06 P=195.012731 Days  $T_0=254.729492$  (BKJD)



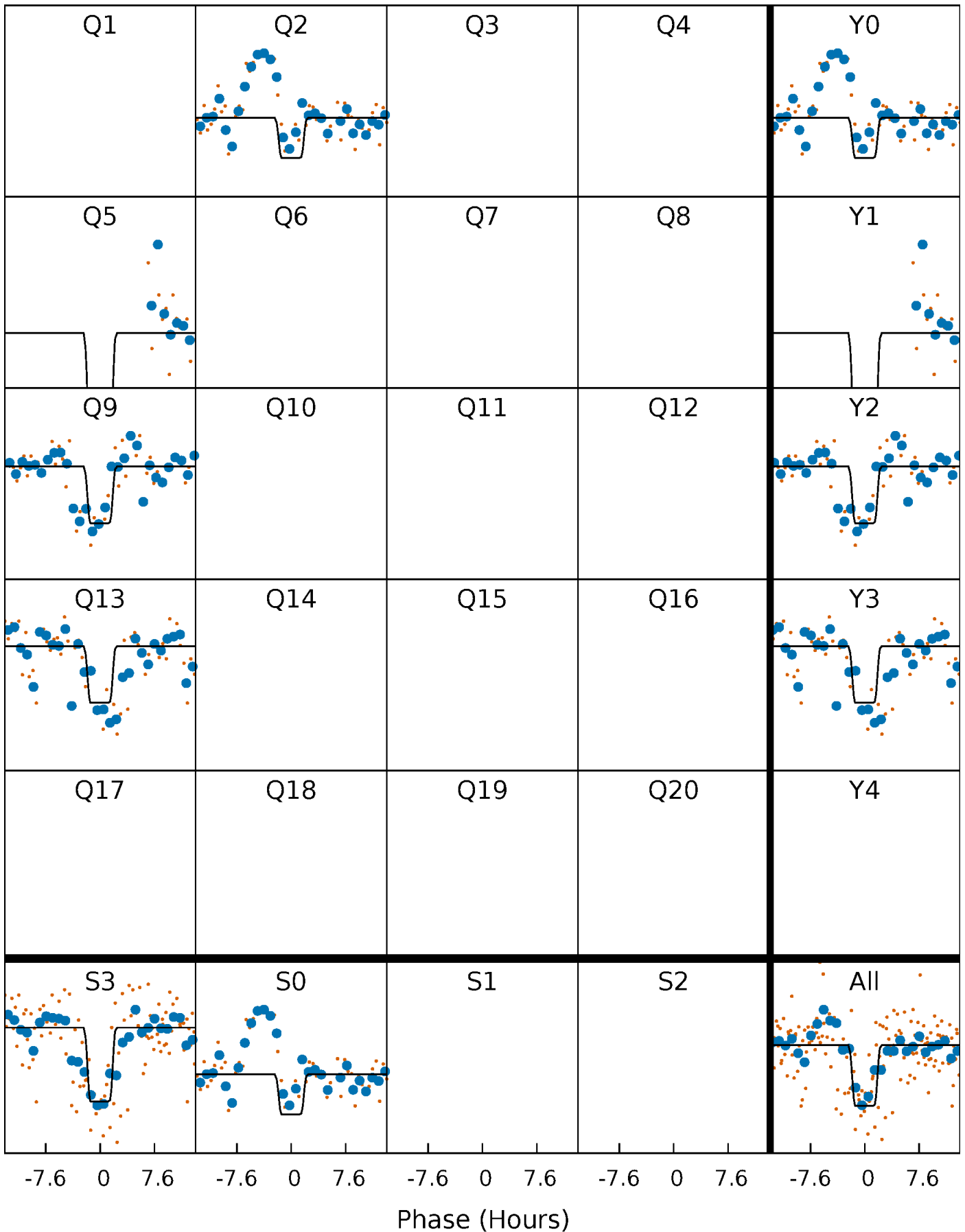
# DV Quarter-Phased Transit Curves

TCE 010989166-06 P=195.012731 Days  $T_0=254.729492$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

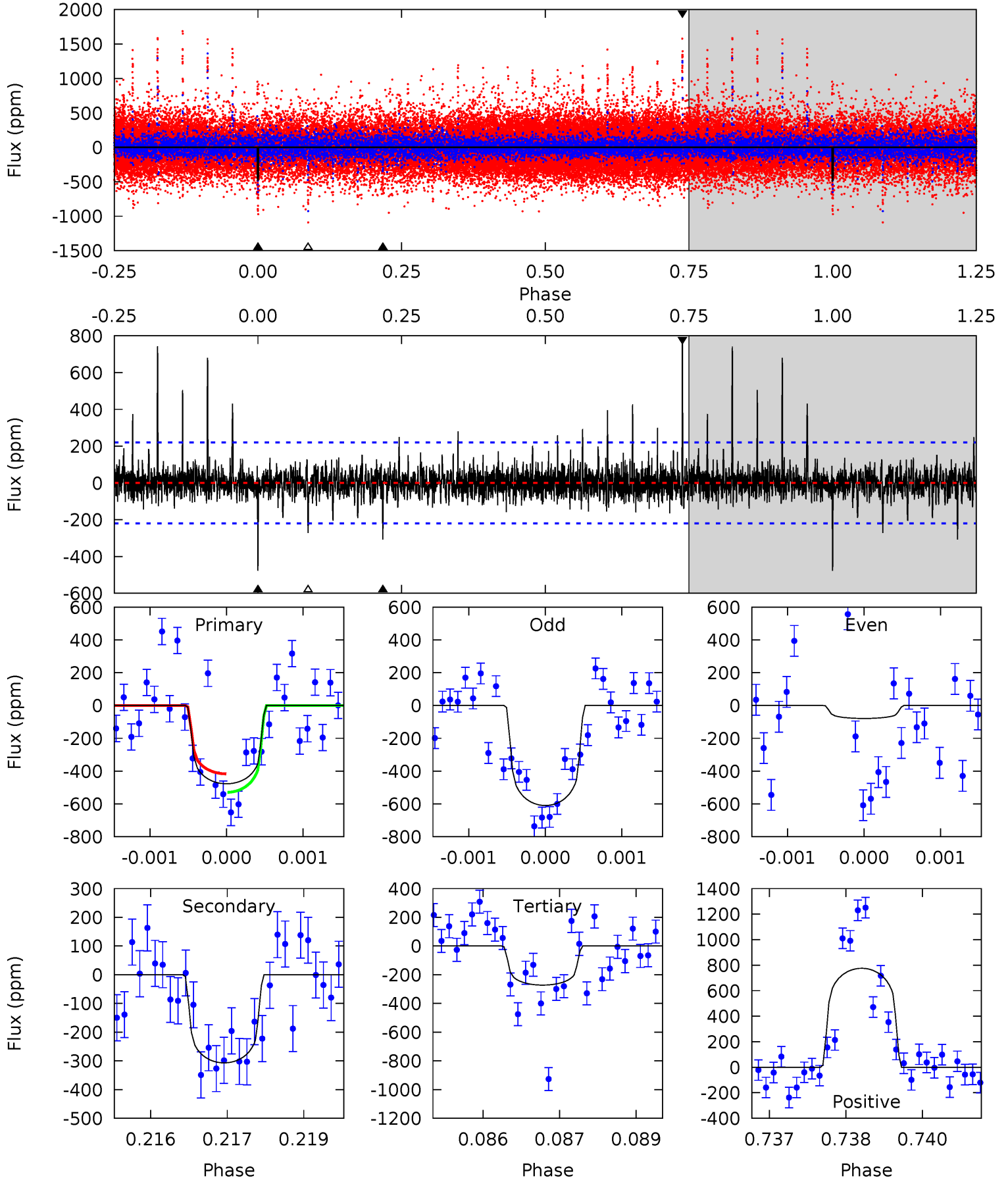
TCE 010989166-06 P=195.002686 Days  $T_0=254.765361$  (BKJD)



# DV Model-Shift Uniqueness Test

010989166-06, P = 195.012731 Days, E = 59.716761 Days

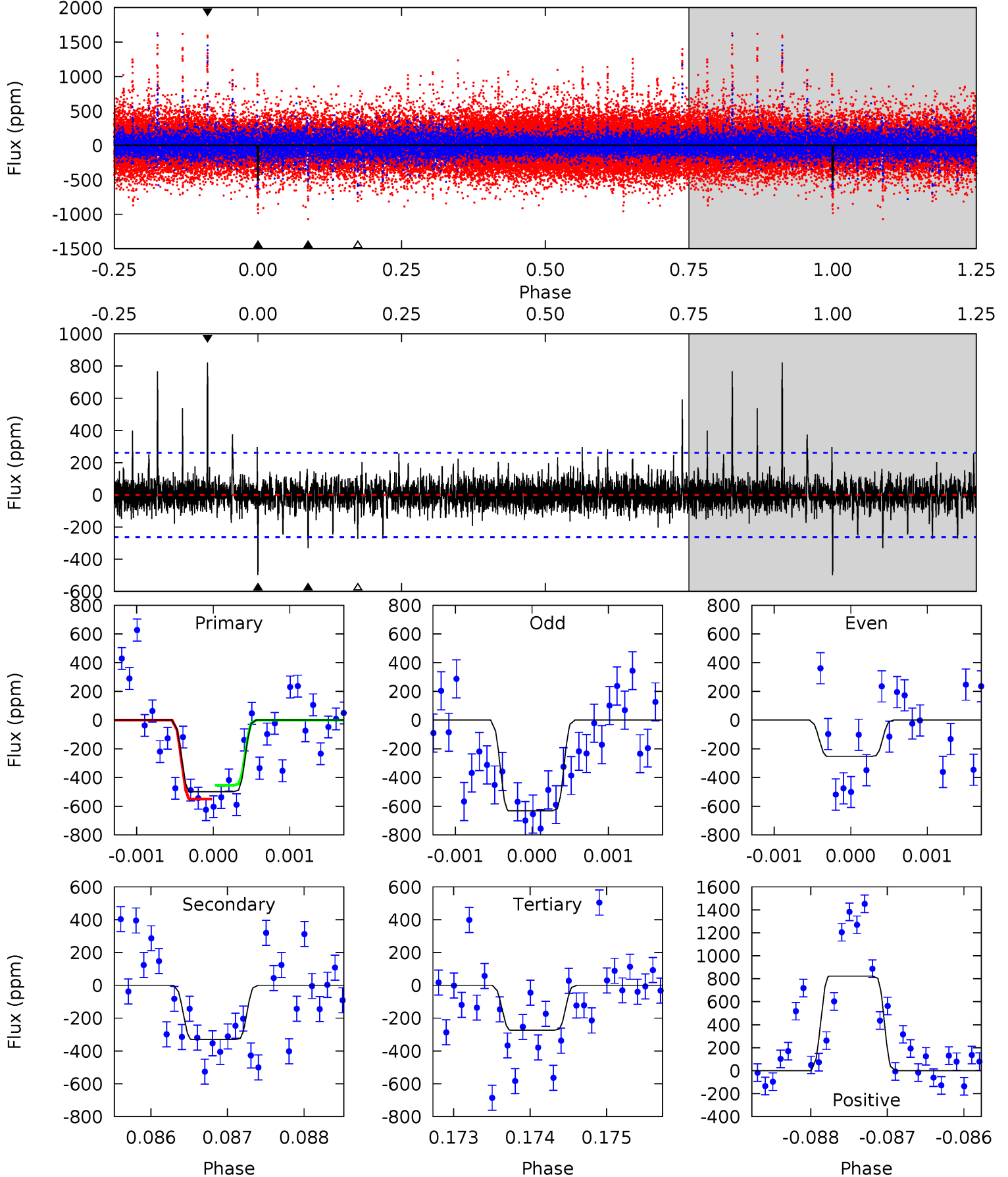
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
11.7	7.53	6.68	19.0	5.40	3.21	1.53	5.03	-7.32	0.85	-11.5	6.10	0.75	0.62	1.38



# Alt Model-Shift Uniqueness Test

010989166-06,  $P = 195.002686$  Days,  $E = 59.762675$  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
10.4	6.91	5.72	17.2	5.47	3.32	1.32	4.72	-6.77	1.19	-10.3	3.49	0.91	0.62	0.98





### Stellar Parameters For KIC 010989166

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6137^{+165}_{-202}$	$4.471^{+0.052}_{-0.208}$	$-0.120^{+0.300}_{-0.300}$	$0.994^{+0.324}_{-0.108}$	$1.067^{+0.139}_{-0.139}$	$1.529^{+0.419}_{-0.782}$
	+3%/-3%	+1%/-5%	+250%/-250%	+33%/-11%	+13%/-13%	+27%/-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 010989166-06 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-307 \pm 41$	$3.19^{+2.69}_{-1.91}$	$473^{+31}_{-25}$	$4926^{+3015}_{-960}$	$7254^{+38631}_{-5037}$
Alt.	$-330 \pm 48$	$3.23^{+2.39}_{-1.96}$	$469^{+32}_{-21}$	$5012^{+2894}_{-989}$	$7938^{+41717}_{-5430}$

$T_{max}$  = 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

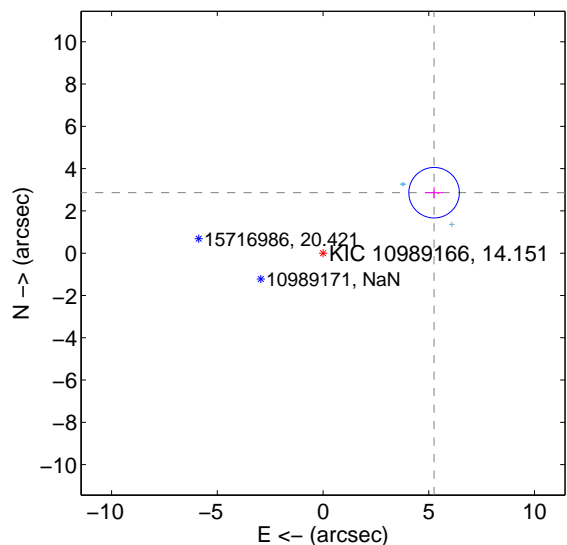
Supplemental centroid analysis for 010989166-06. Kepler magnitude: 14.15. Transit SNR 11.23

There are 3 quarters with good PRF difference image offsets

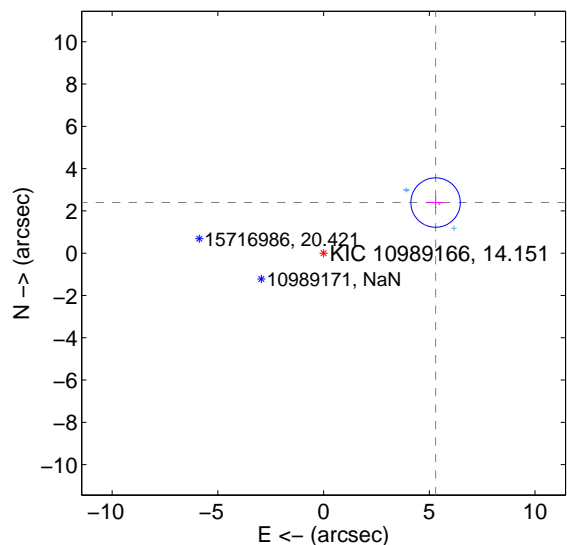
The direct PRF centroid is offset from the target star catalog position by about 0.33 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$5.981 \pm 0.398$	15.02	$-5.253 \pm 0.430$	$2.860 \pm 0.267$
PRF-fit source offset from KIC position	$5.814 \pm 0.390$	14.91	$-5.298 \pm 0.411$	$2.395 \pm 0.264$
photometric centroid source offset	$5.56 \pm 1.33$	4.19	$-4.50 \pm 1.36$	$3.26 \pm 1.27$

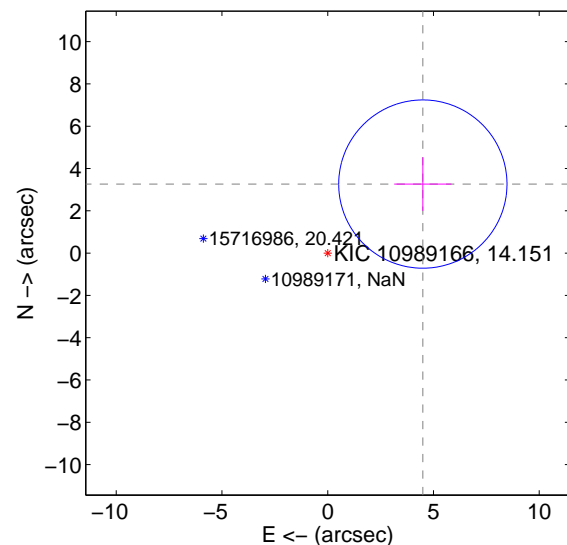
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

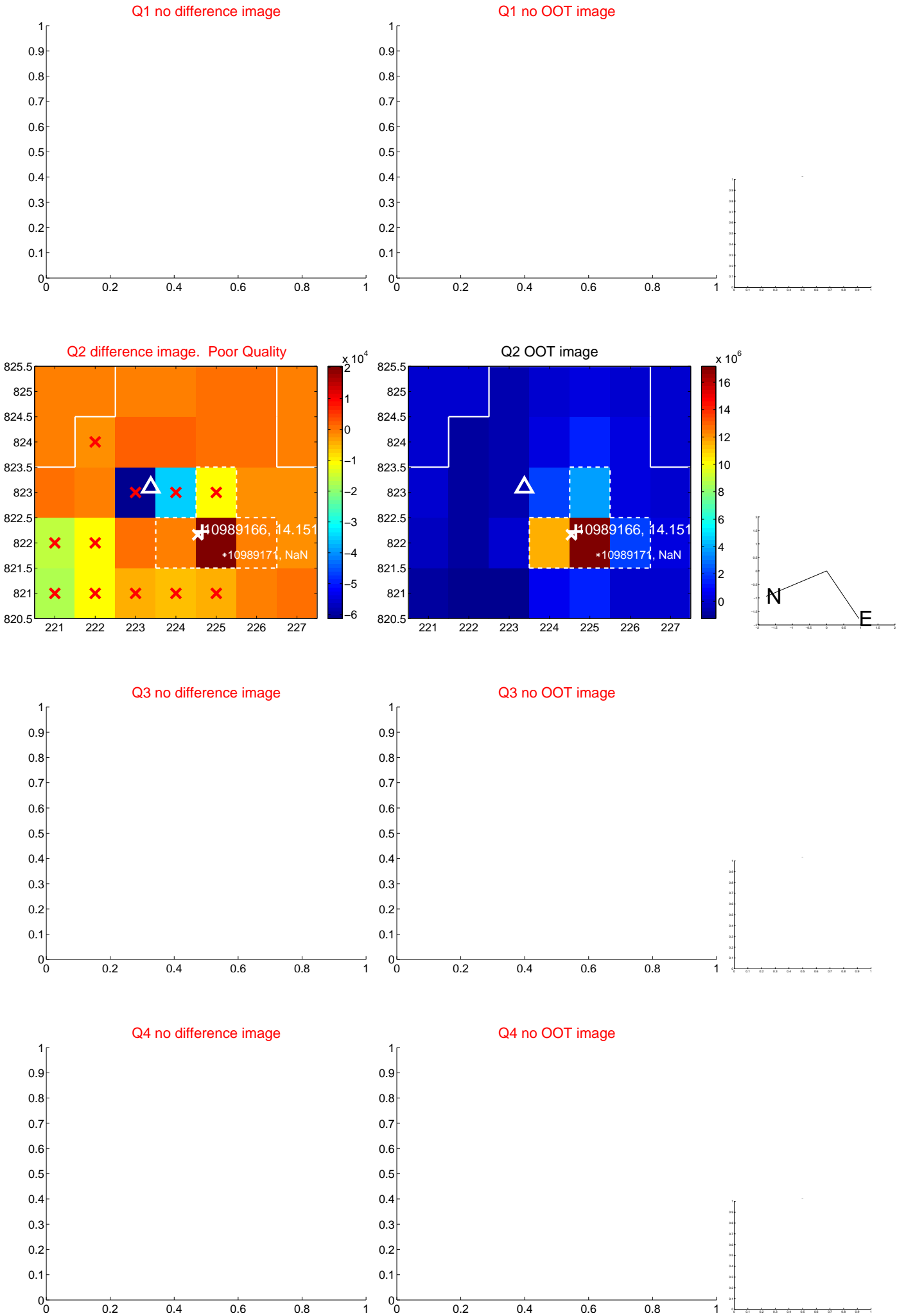


offset from photometric centroids

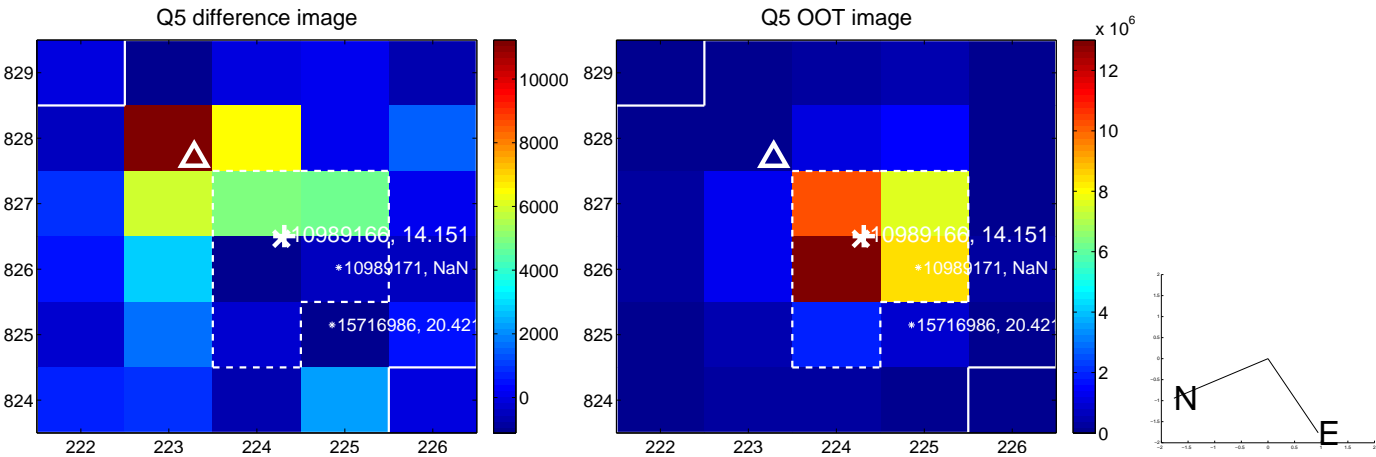


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

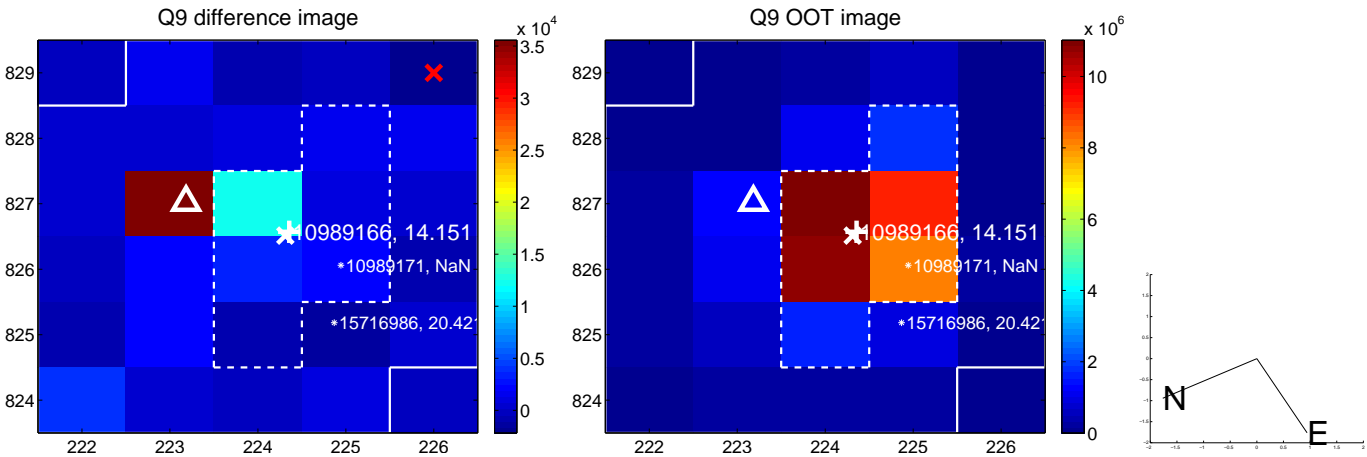
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



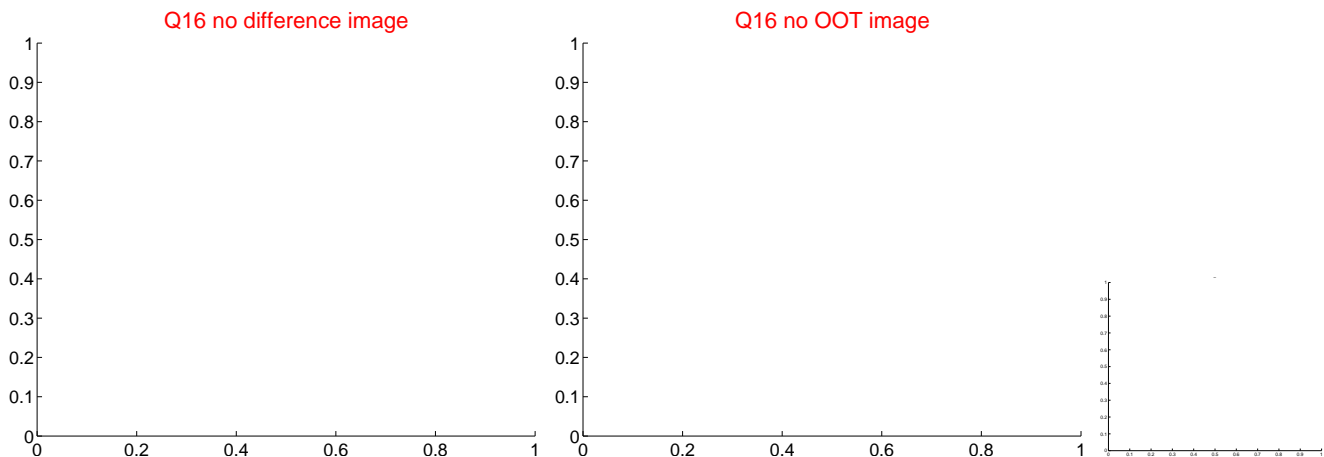
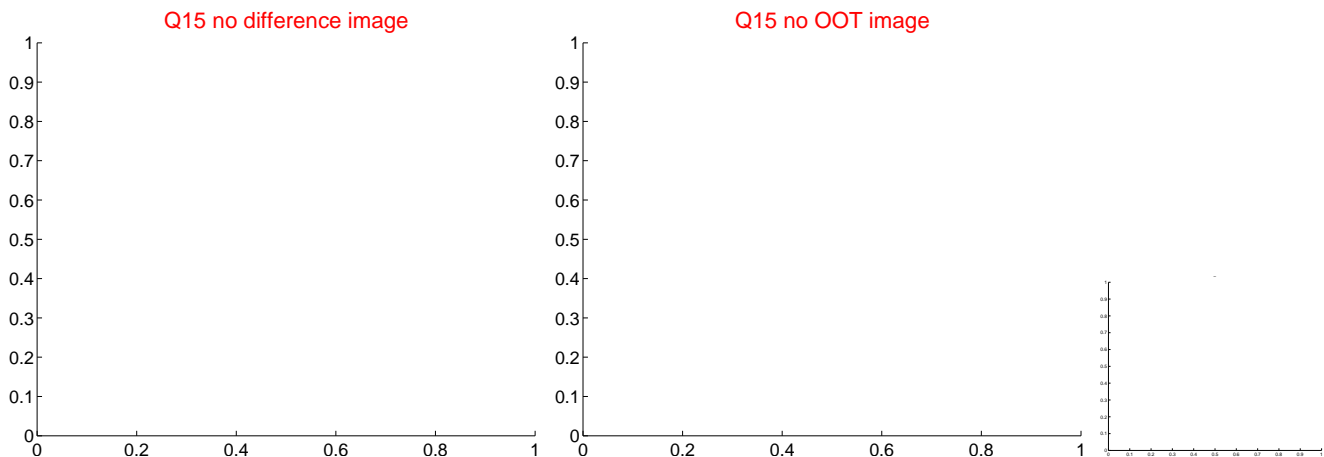
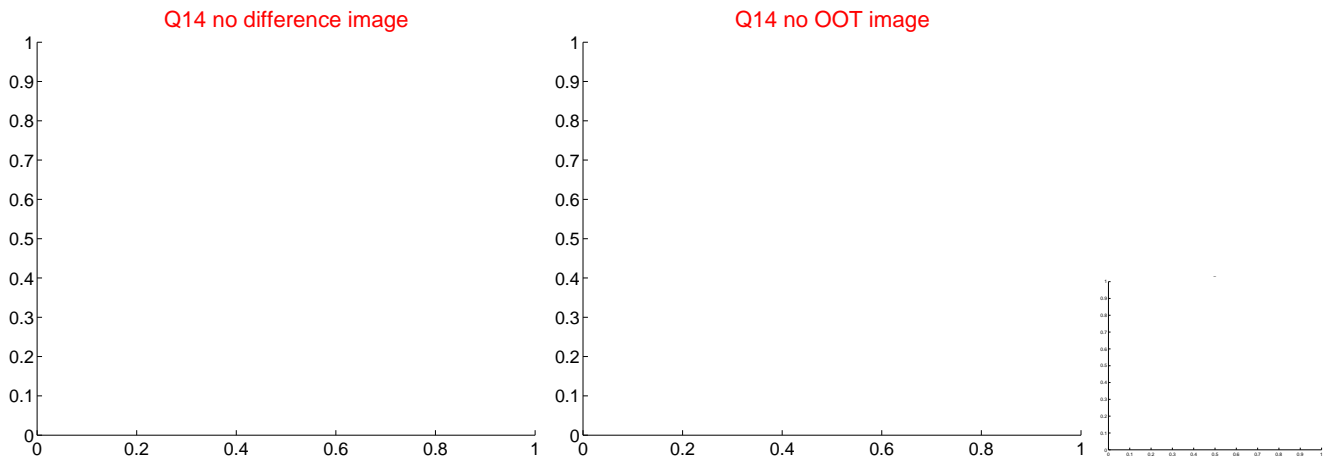
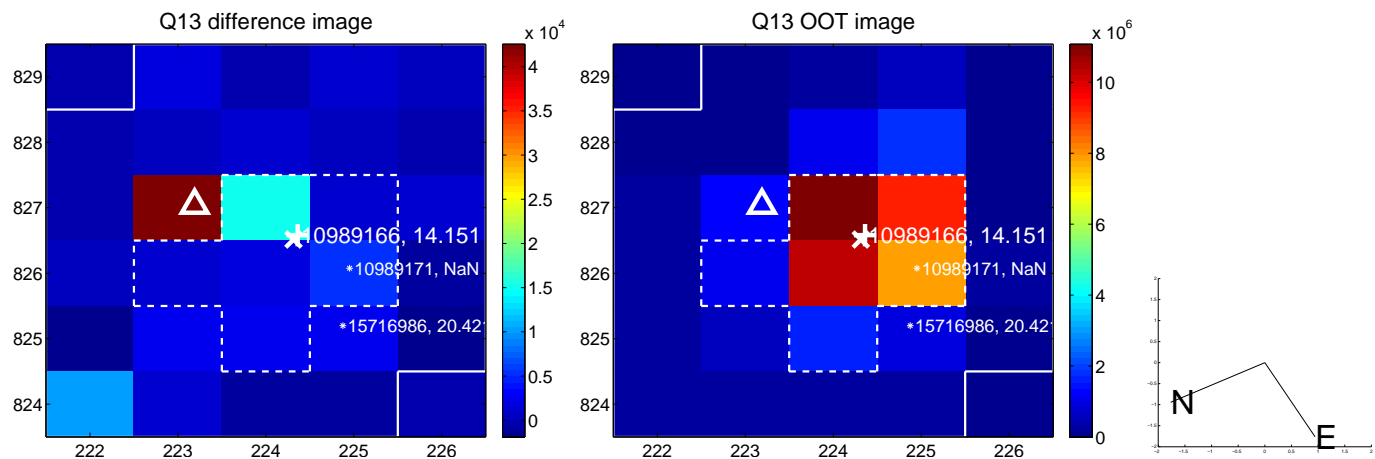
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



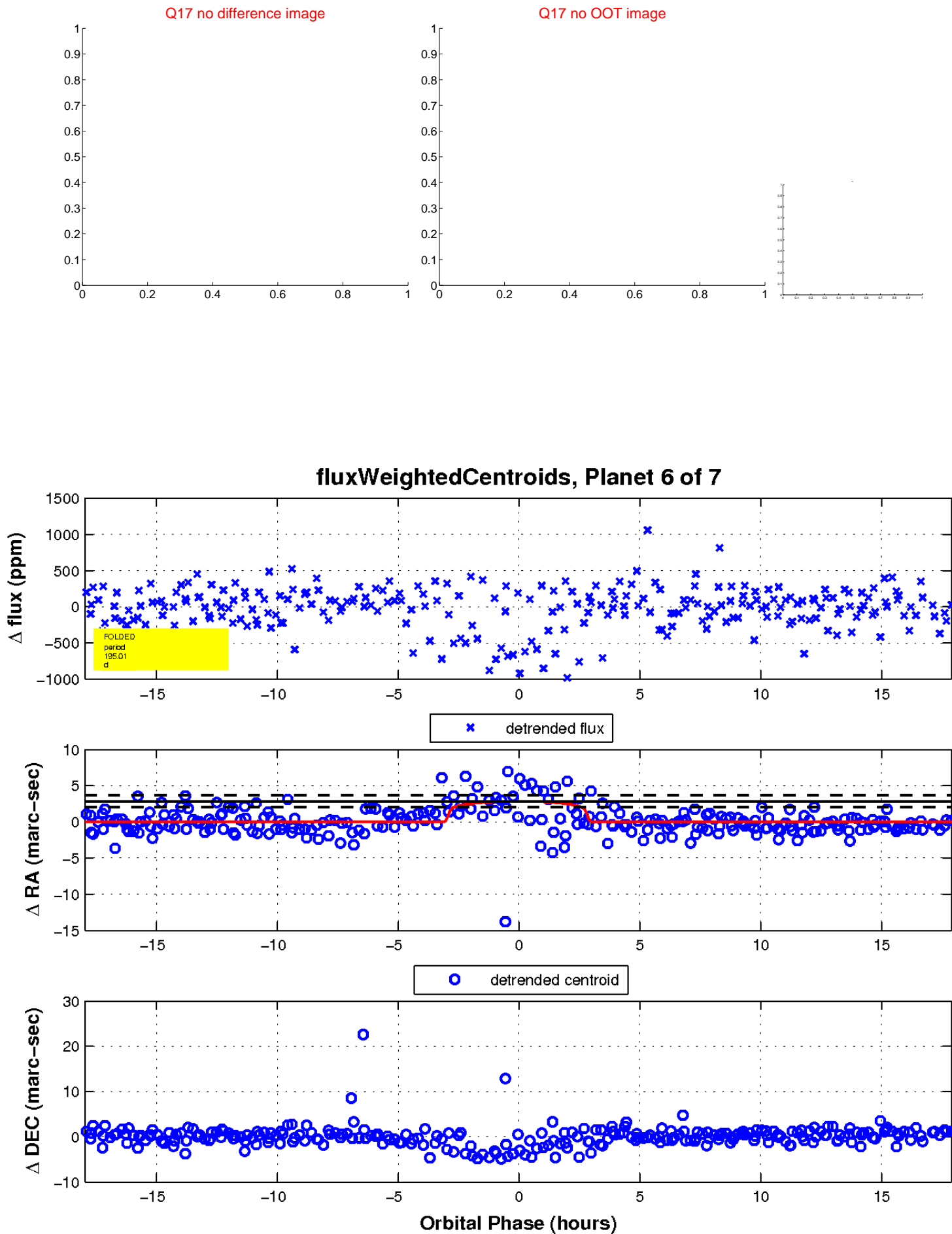
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

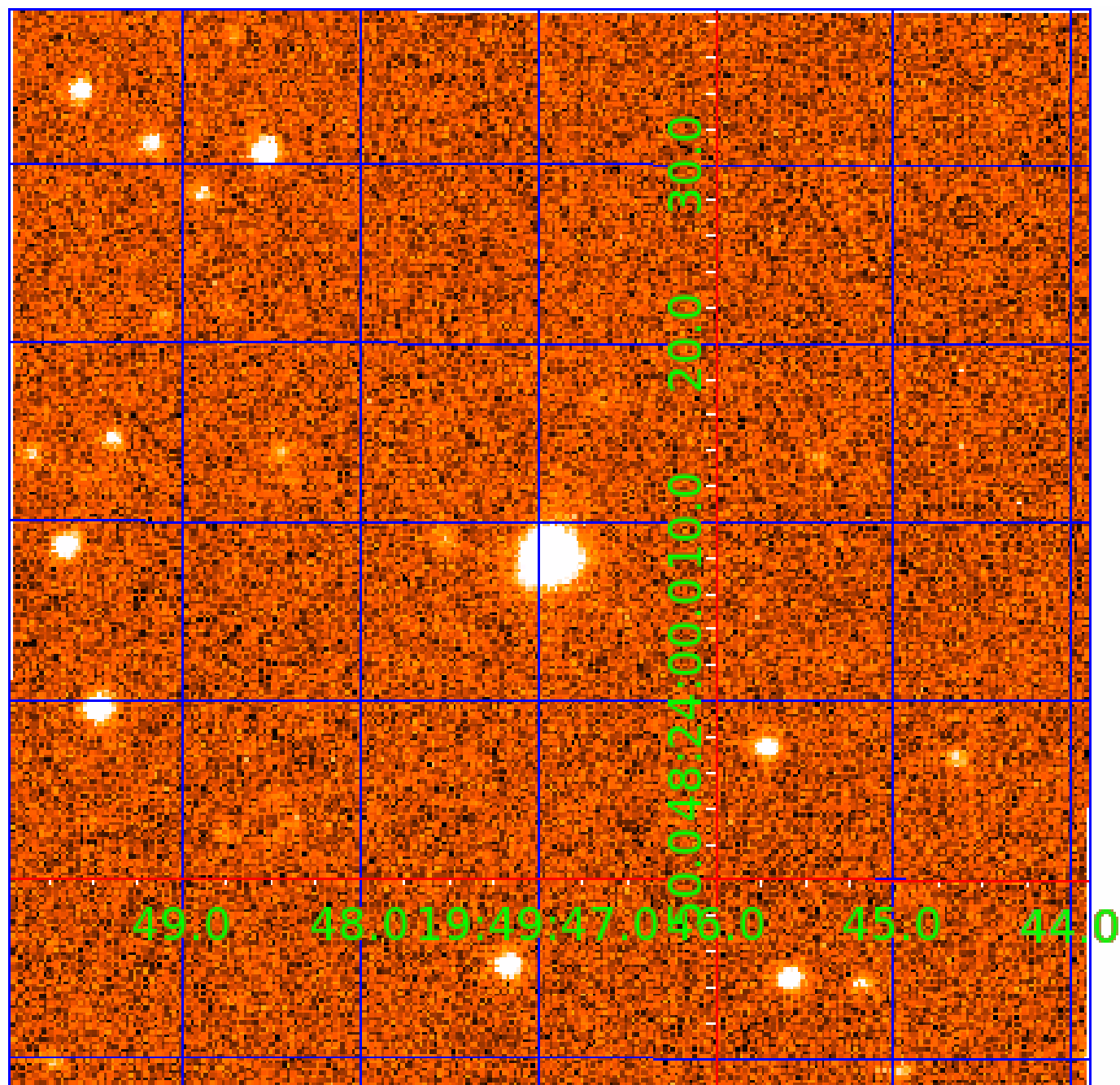


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination





# KIC 010989166

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
010989166-01	OBS	No	364.654533	483.543104	599.2	6.203	13.0	13.8	0.99	6137	2.66	1.21
010989166-02	OBS	No	373.132674	449.630666	601.9	6.331	12.6	13.4	0.99	6137	2.52	1.17
010989166-03	OBS	No	364.640890	492.053046	643.4	5.646	11.9	12.8	0.99	6137	2.70	1.21
010989166-04	OBS	No	373.150031	458.076750	648.8	4.835	11.2	11.2	0.99	6137	2.74	1.17
010989166-05	OBS	No	398.554187	466.602819	581.0	5.096	10.5	10.6	0.99	6137	2.39	1.07
010989166-06	OBS	No	195.012731	254.729492	604.3	6.002	9.9	11.2	0.99	6137	2.58	2.78
010989166-07	OBS	No	534.484685	279.855588	369.4	7.477	8.6	7.4	0.99	6137	2.19	0.72

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
010989166-01	OBS	FP	0.00	1	0	1	0	MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_RESOLVED_OFFSET—HALO_GHOST
010989166-02	OBS	FP	0.00	1	0	1	1	MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_RESOLVED_OFFSET—HALO_GHOST—EPHEM_MATCH
010989166-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—SAME_NTL_PERIOD—CENT_FEW_DIFFS
010989166-04	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_MARSHALL—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—SAME_NTL_PERIOD—CENT_RESOLVED_OFFSET—HALO_GHOST
010989166-05	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_CHASES—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS—HALO_GHOST
010989166-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
010989166-07	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_CHASES—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS—HALO_GHOST

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

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

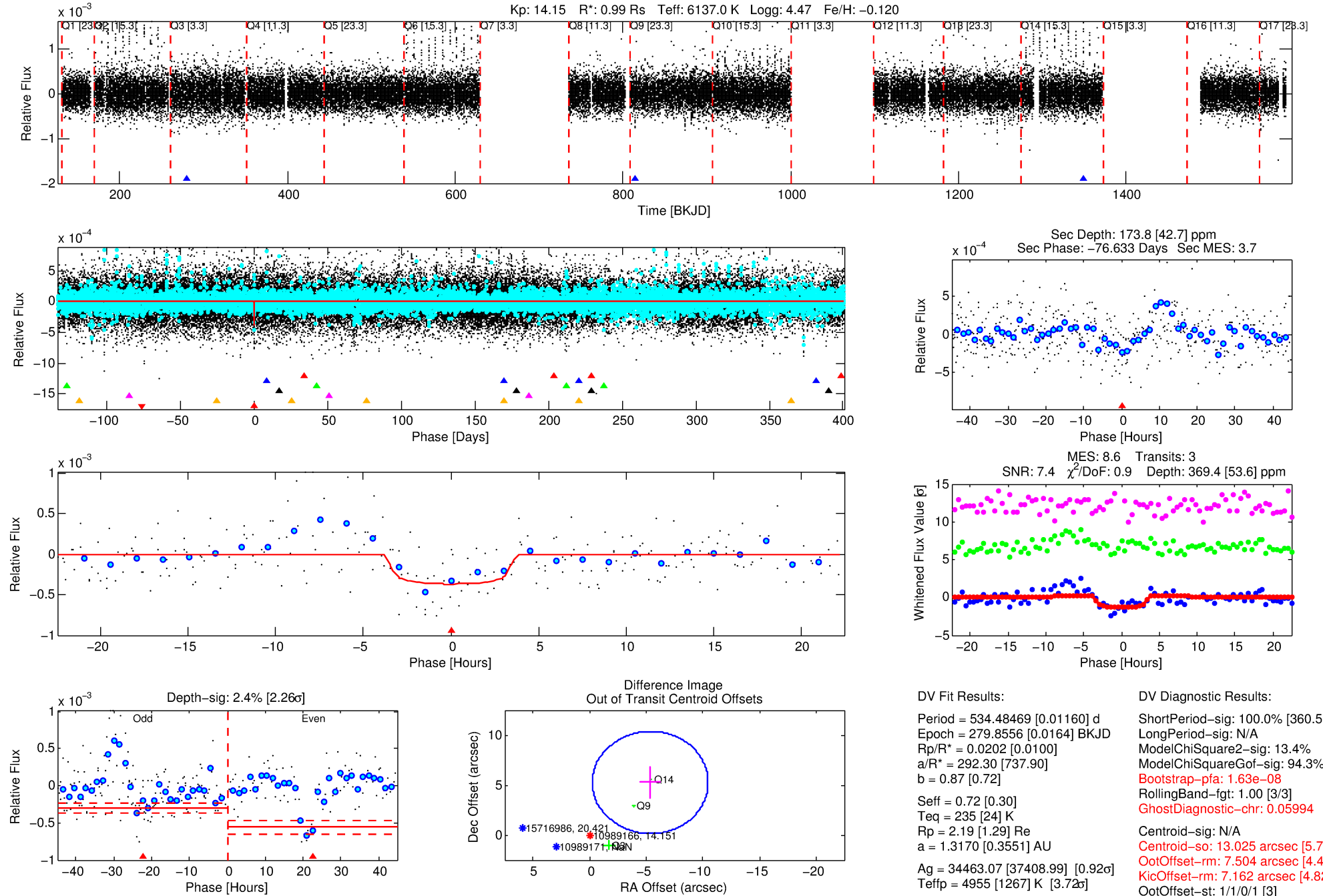
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 010989166-07

No Significant Match Found

# DV One-Page Summary

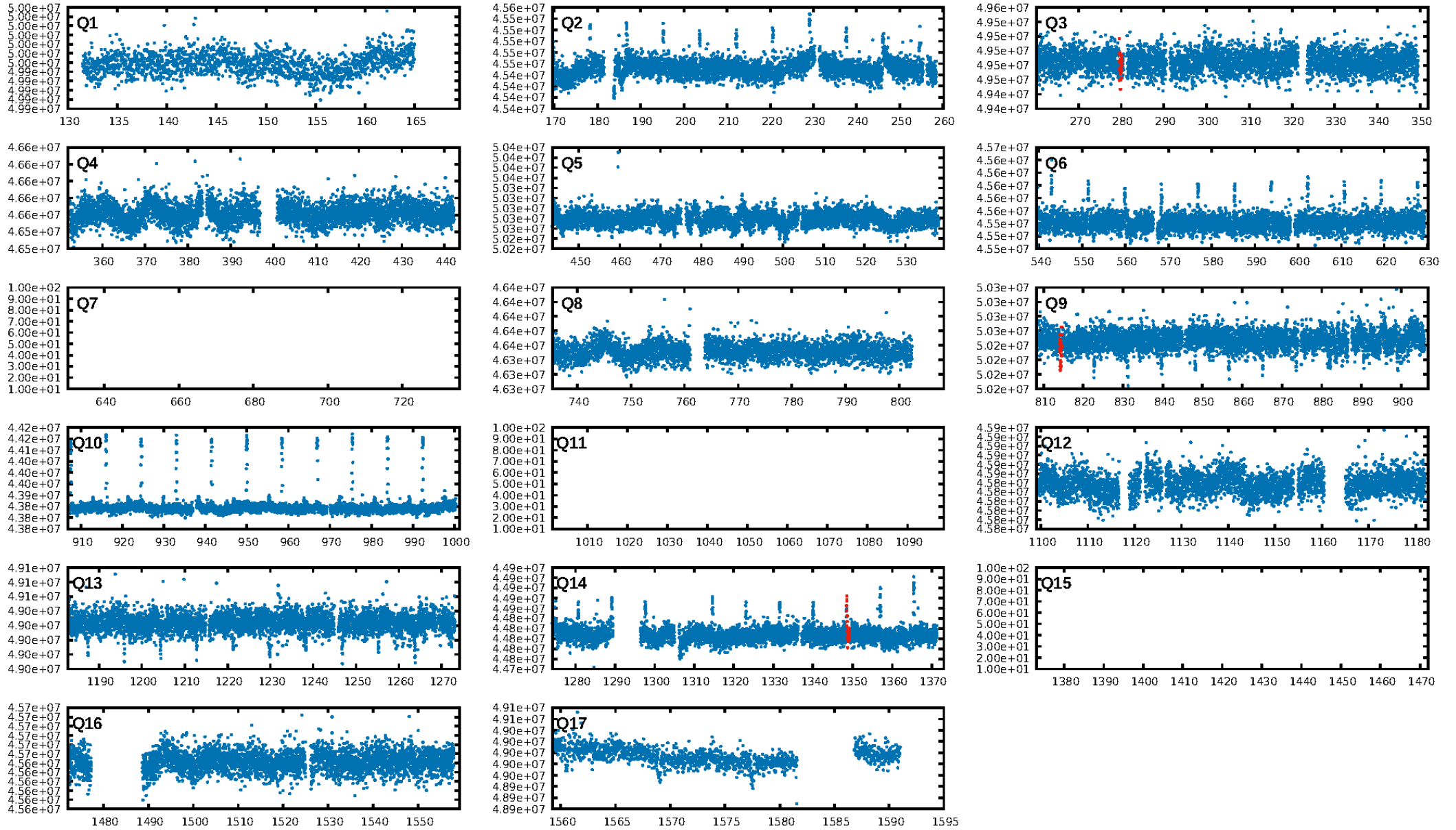
KIC: 10989166 Candidate: 7 of 7 Period: 534.485 d



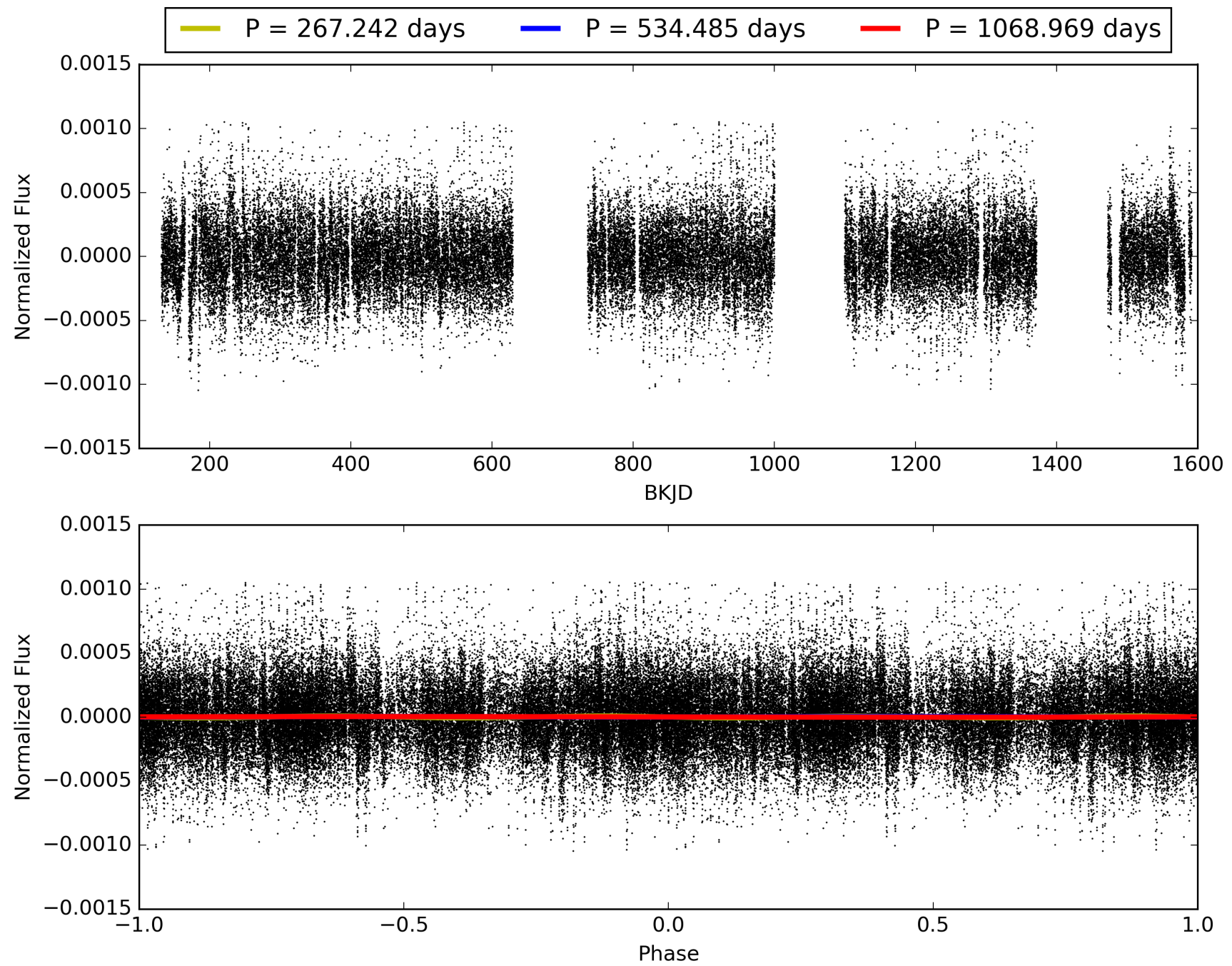
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 04:00:55 Z

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

# TCE 010989166-07, PDC Light Curves

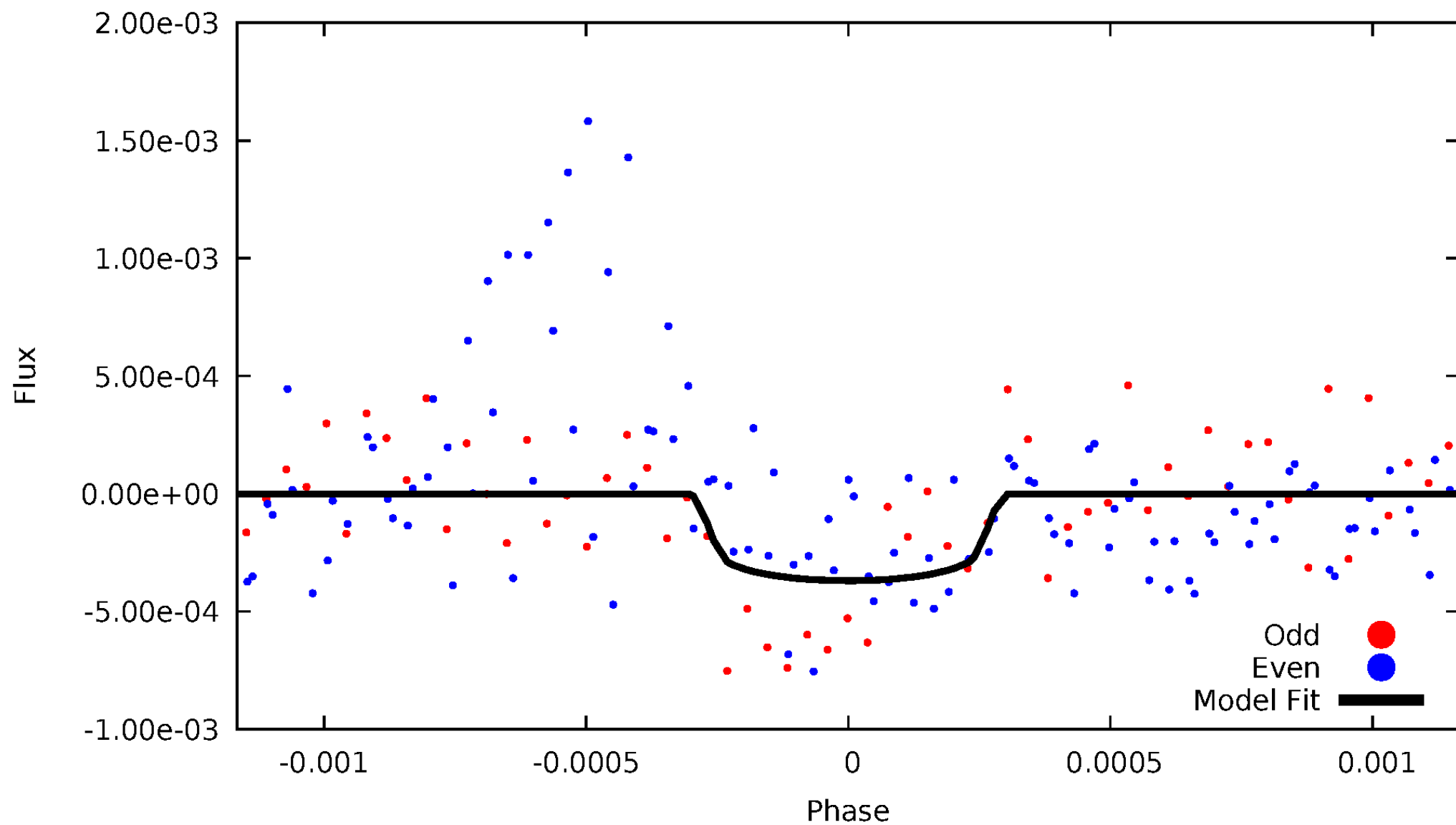


TCE 010989166-07



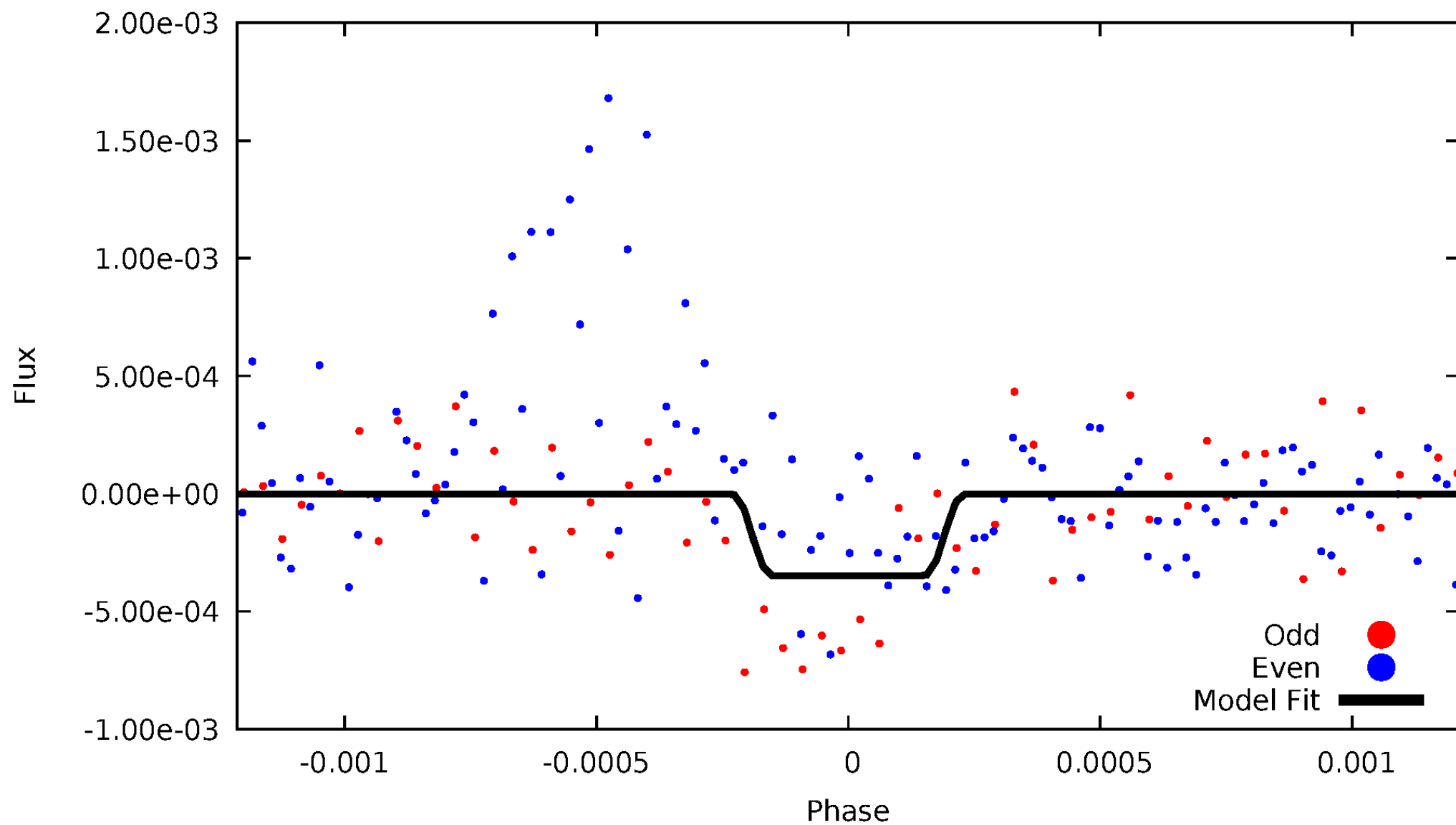
# DV Odd/Even

TCE 010989166-07



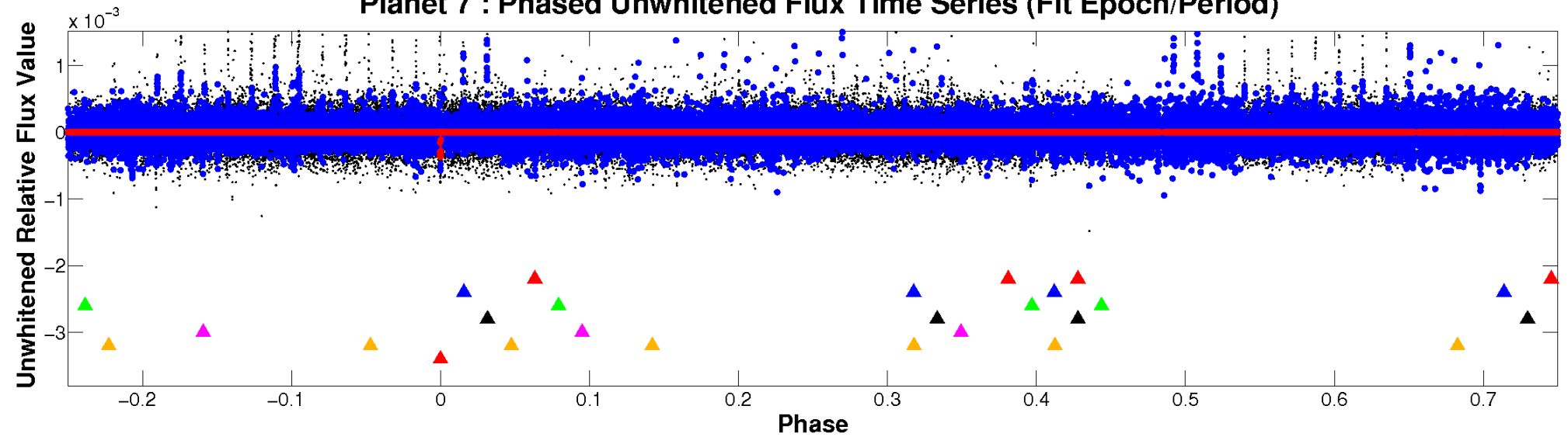
# ALT Odd/Even

TCE 010989166-07

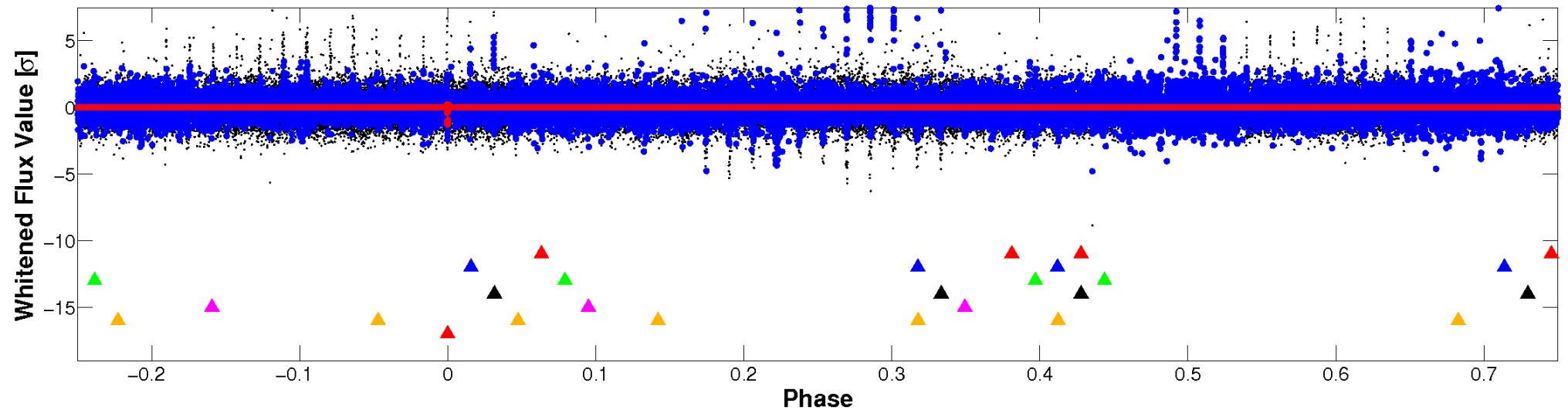


# Non-Whitened Vs. Whitened Light Curve

Planet 7 : Phased Unwhitened Flux Time Series (Fit Epoch/Period)

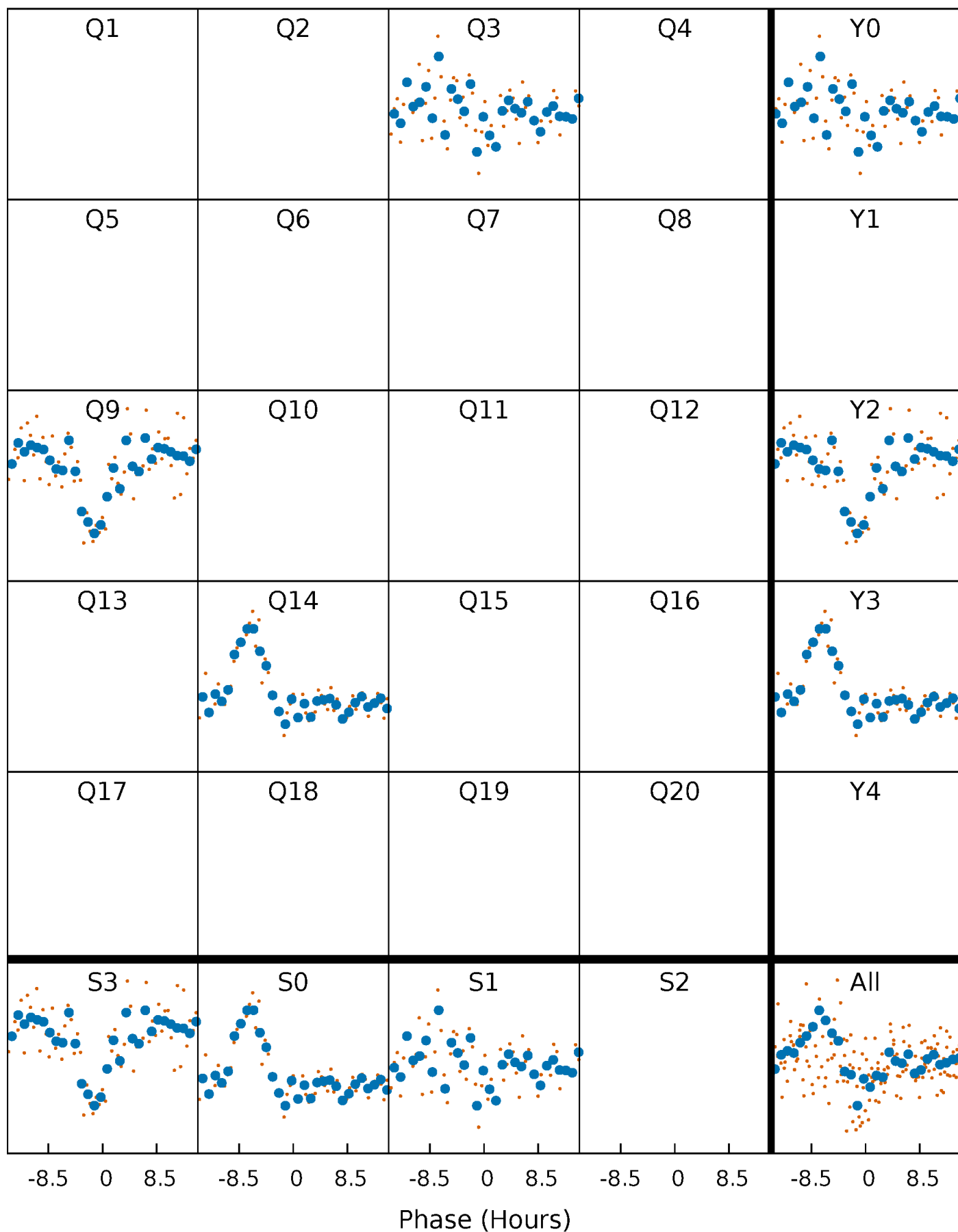


Planet 7 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

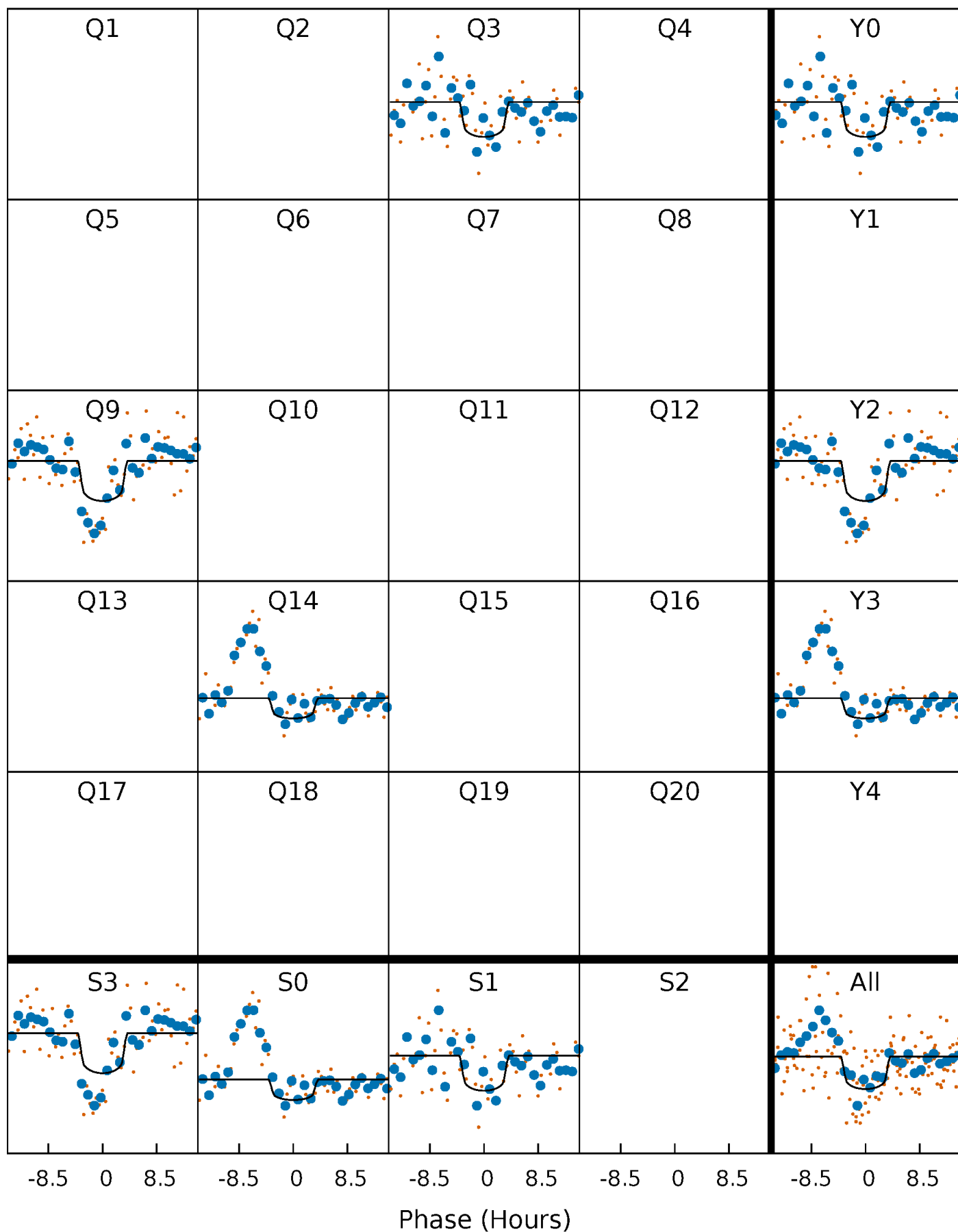
TCE 010989166-07     $P=534.484685$  Days     $T_0=279.855588$  (BKJD)





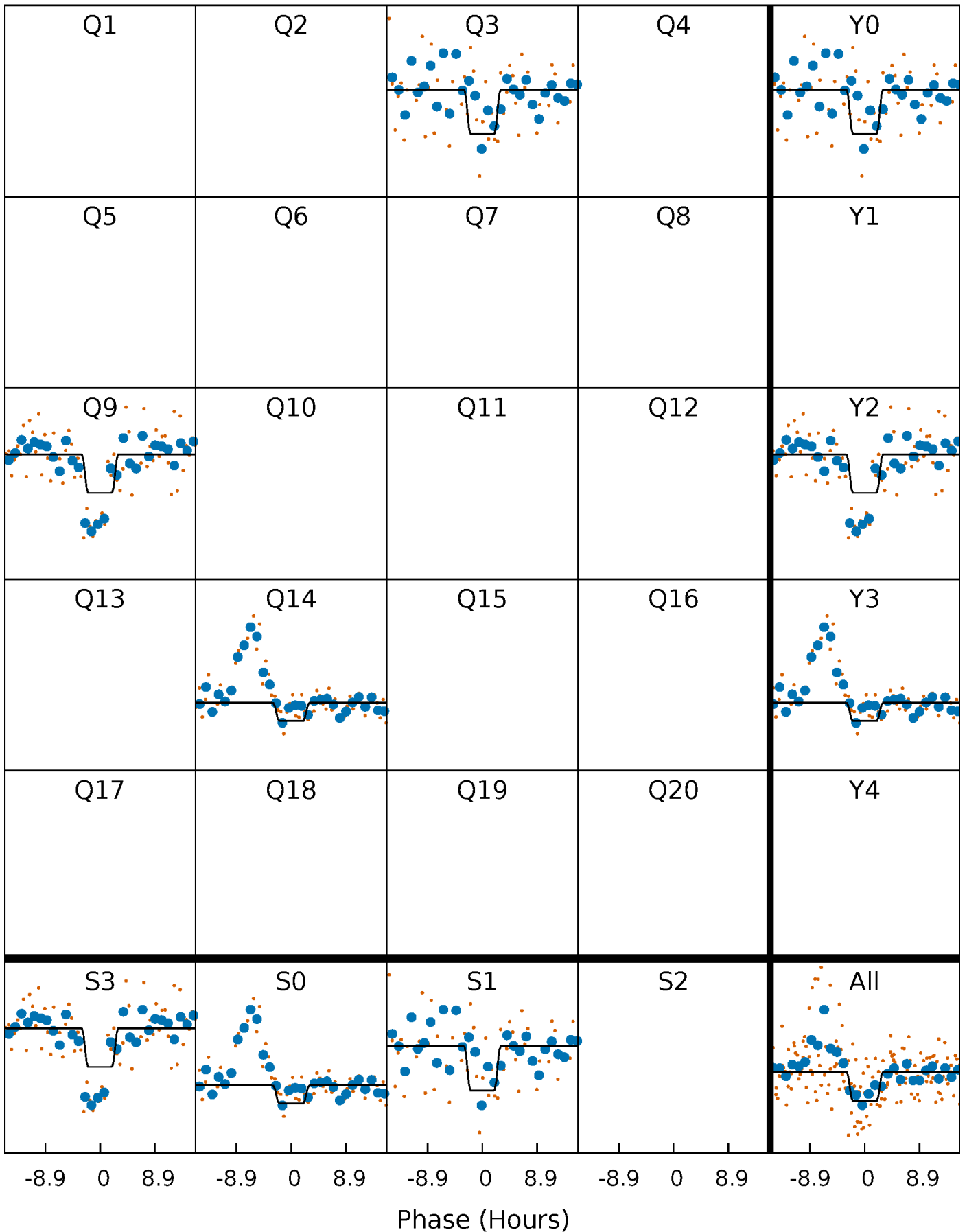
# DV Quarter-Phased Transit Curves

TCE 010989166-07 P=534.484685 Days  $T_0=279.855588$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

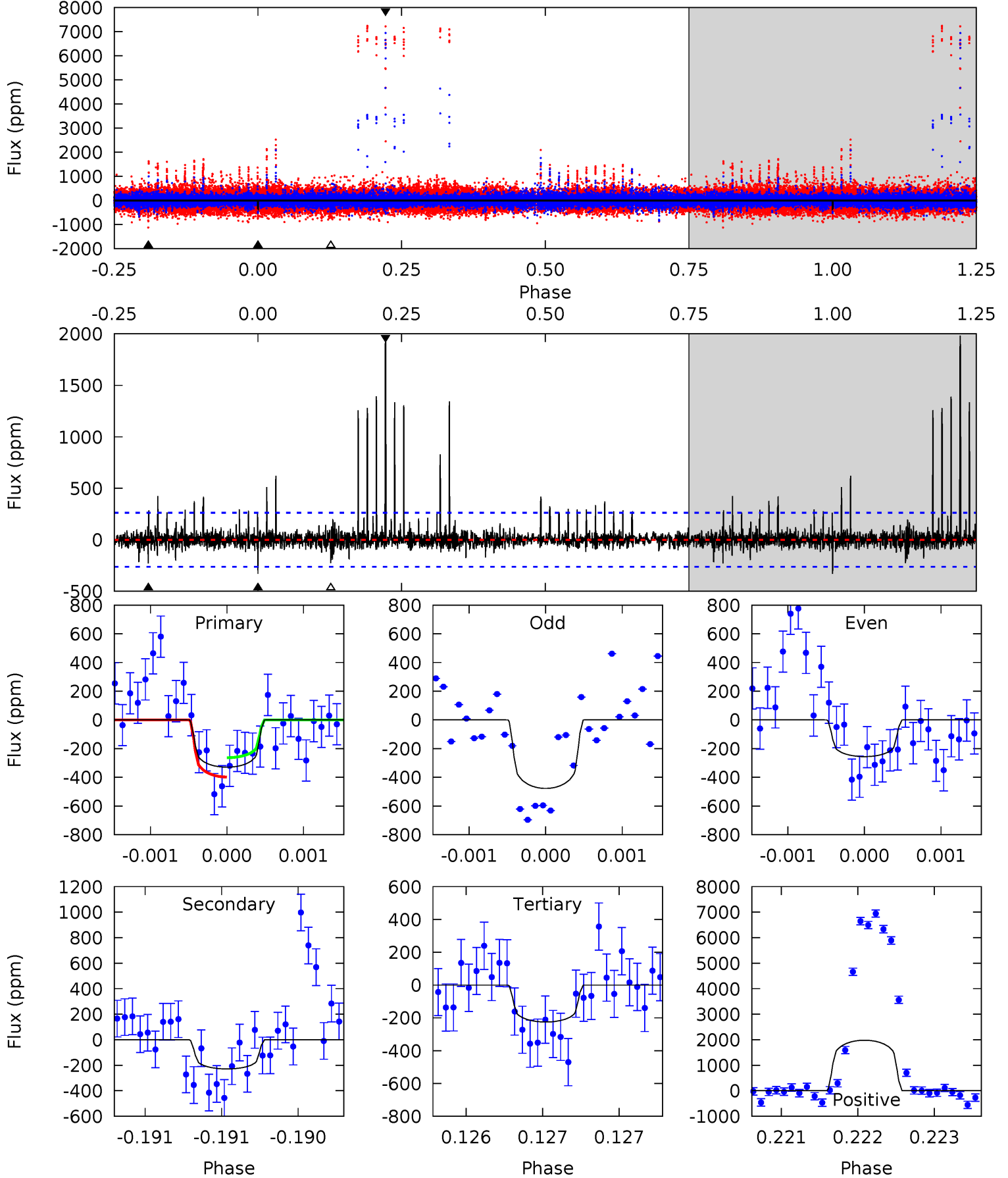
TCE 010989166-07     $P=534.487440$  Days     $T_0=279.839273$  (BKJD)



# DV Model-Shift Uniqueness Test

010989166-07, P = 534.484685 Days, E = 279.855588 Days

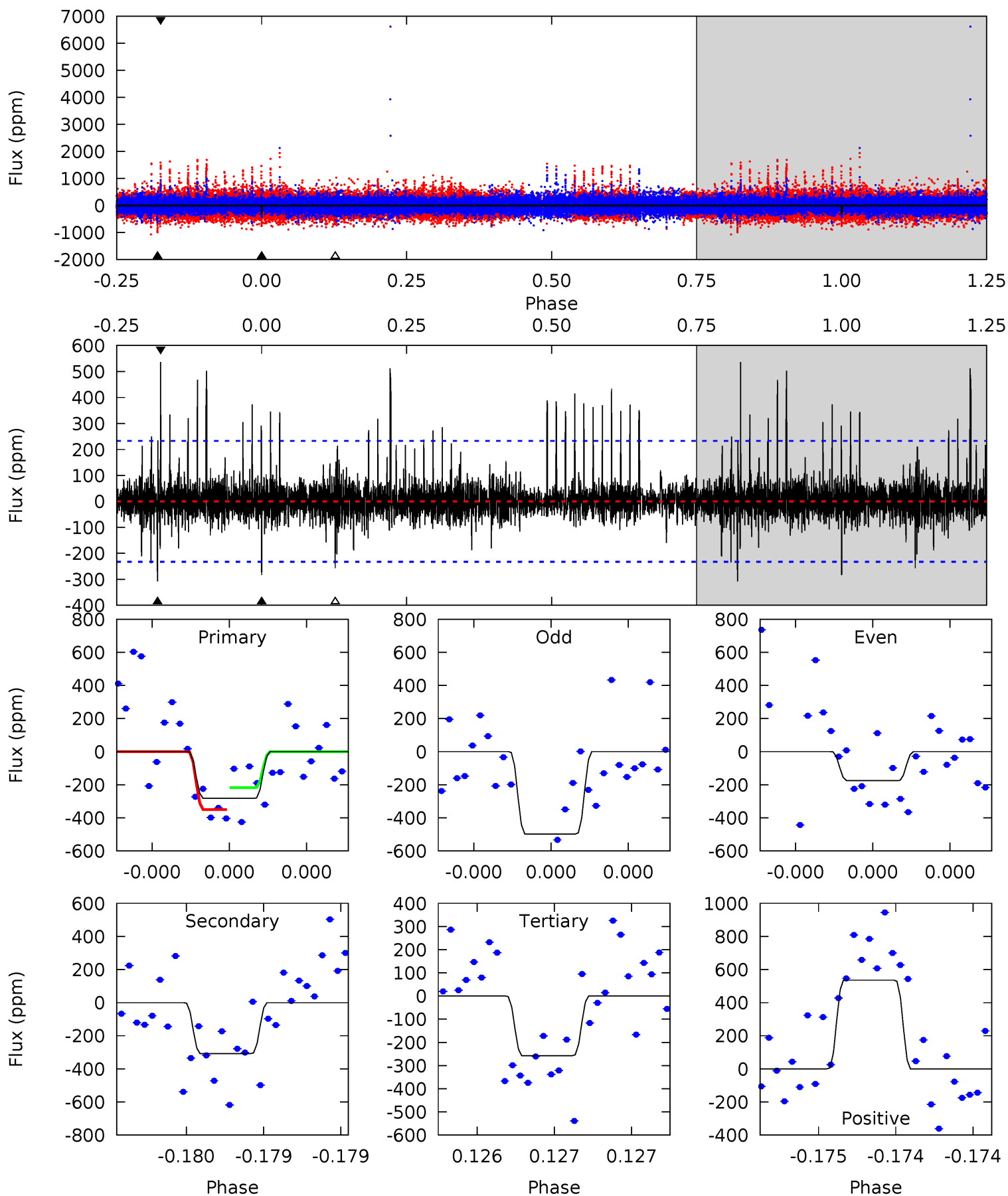
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
6.96	4.83	4.75	41.8	5.54	3.42	2.41	2.21	-34.8	0.08	-37.0	1.42	1.29	0.86	1.45



# Alt Model-Shift Uniqueness Test

010989166-07, P = 534.487440 Days, E = 279.839273 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
6.81	7.41	6.19	12.9	5.60	3.51	1.44	0.62	-6.08	1.21	-5.49	3.26	1.43	0.64	1.59



### Stellar Parameters For KIC 010989166

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6137^{+165}_{-202}$	$4.471^{+0.052}_{-0.208}$	$-0.120^{+0.300}_{-0.300}$	$0.994^{+0.324}_{-0.108}$	$1.067^{+0.139}_{-0.139}$	$1.529^{+0.419}_{-0.782}$
	+3%/-3%	+1%/-5%	+250%/-250%	+33%/-11%	+13%/-13%	+27%/-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 010989166-07 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-229 \pm 47$	$2.39^{+1.13}_{-1.18}$	$336^{+25}_{-16}$	$5261^{+2143}_{-794}$	$36025^{+104182}_{-19194}$
Alt.	$-308 \pm 42$	$2.16^{+1.17}_{-1.07}$	$335^{+25}_{-16}$	$5815^{+2900}_{-943}$	$60971^{+185736}_{-35120}$

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

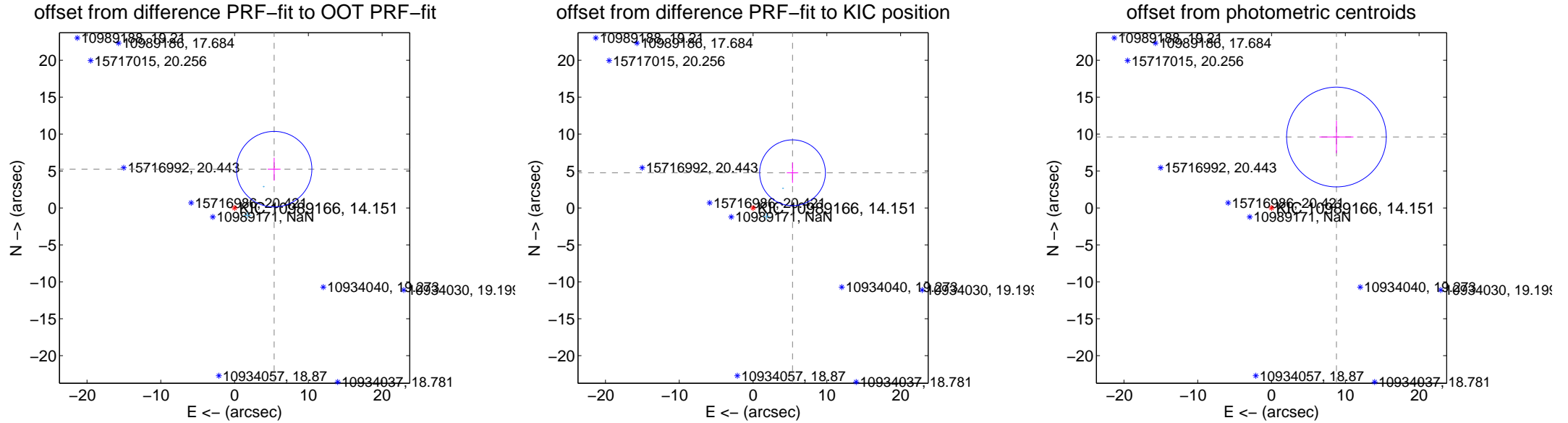
## DV Centroid Data

Supplemental centroid analysis for 010989166-07. Kepler magnitude: 14.15. Transit SNR 7.40

There are 2 quarters with good PRF difference image offsets

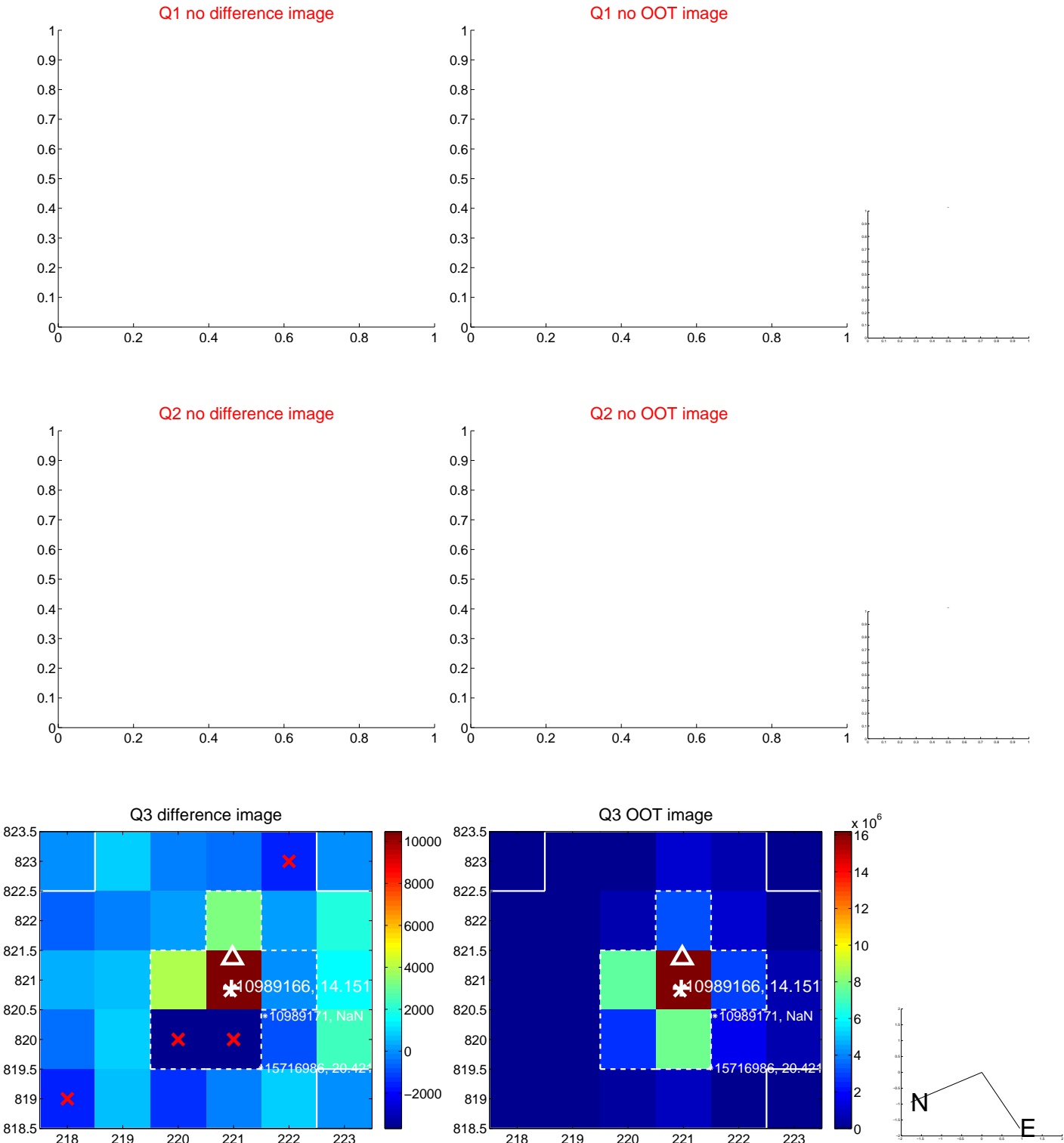
The direct PRF centroid is offset from the target star catalog position by about 0.52 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$7.504 \pm 1.705$	4.40	$-5.362 \pm 0.867$	$5.250 \pm 1.553$
PRF-fit source offset from KIC position	$7.162 \pm 1.486$	4.82	$-5.350 \pm 0.775$	$4.762 \pm 1.366$
photometric centroid source offset	$13.03 \pm 2.25$	5.79	$-8.80 \pm 2.31$	$9.60 \pm 2.20$



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.

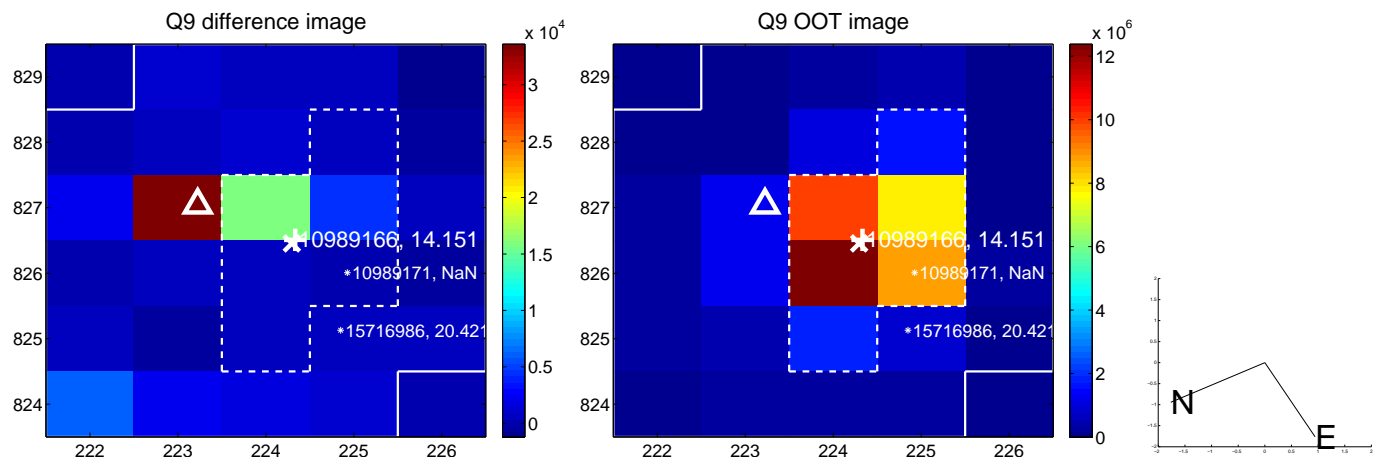


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

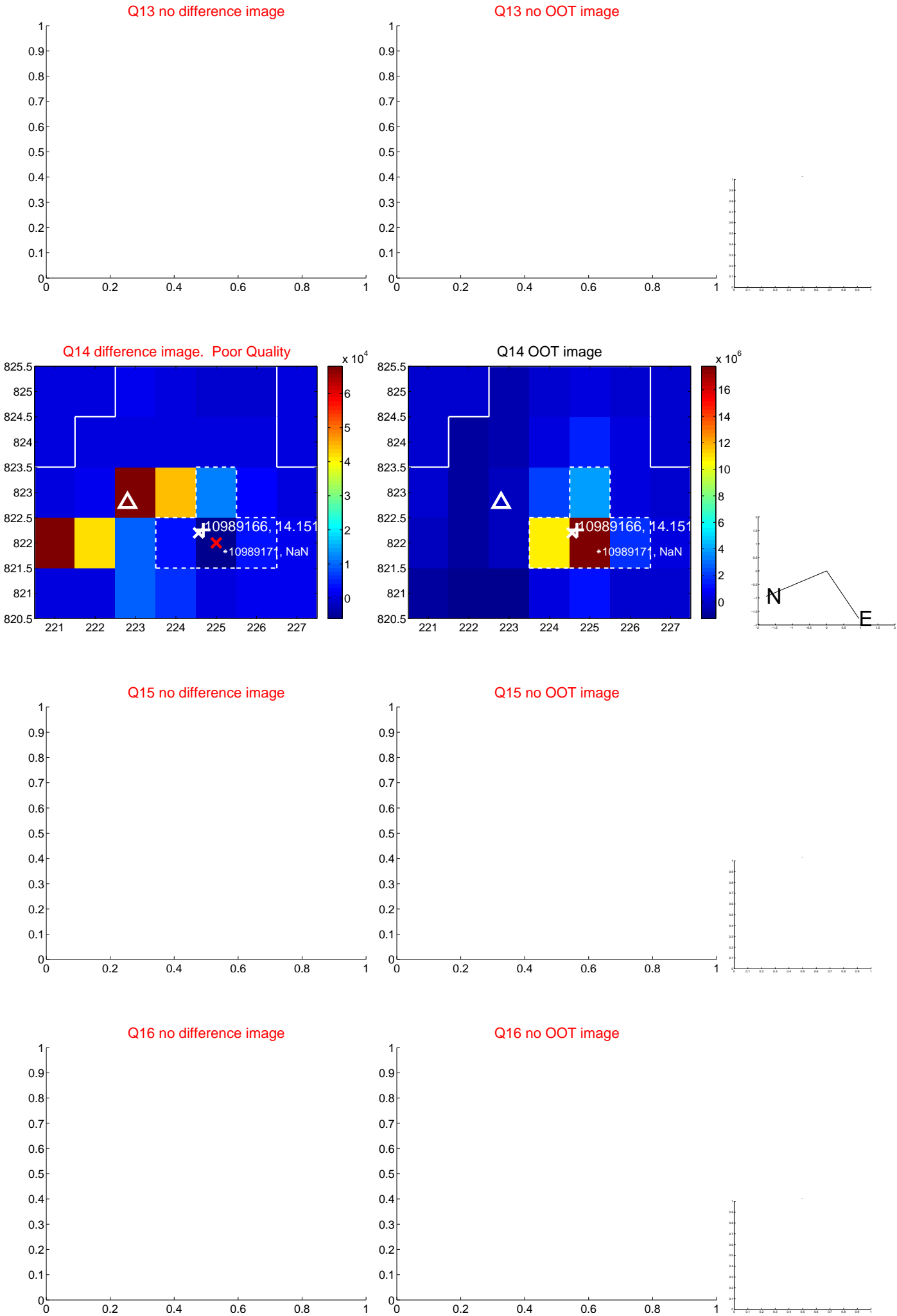




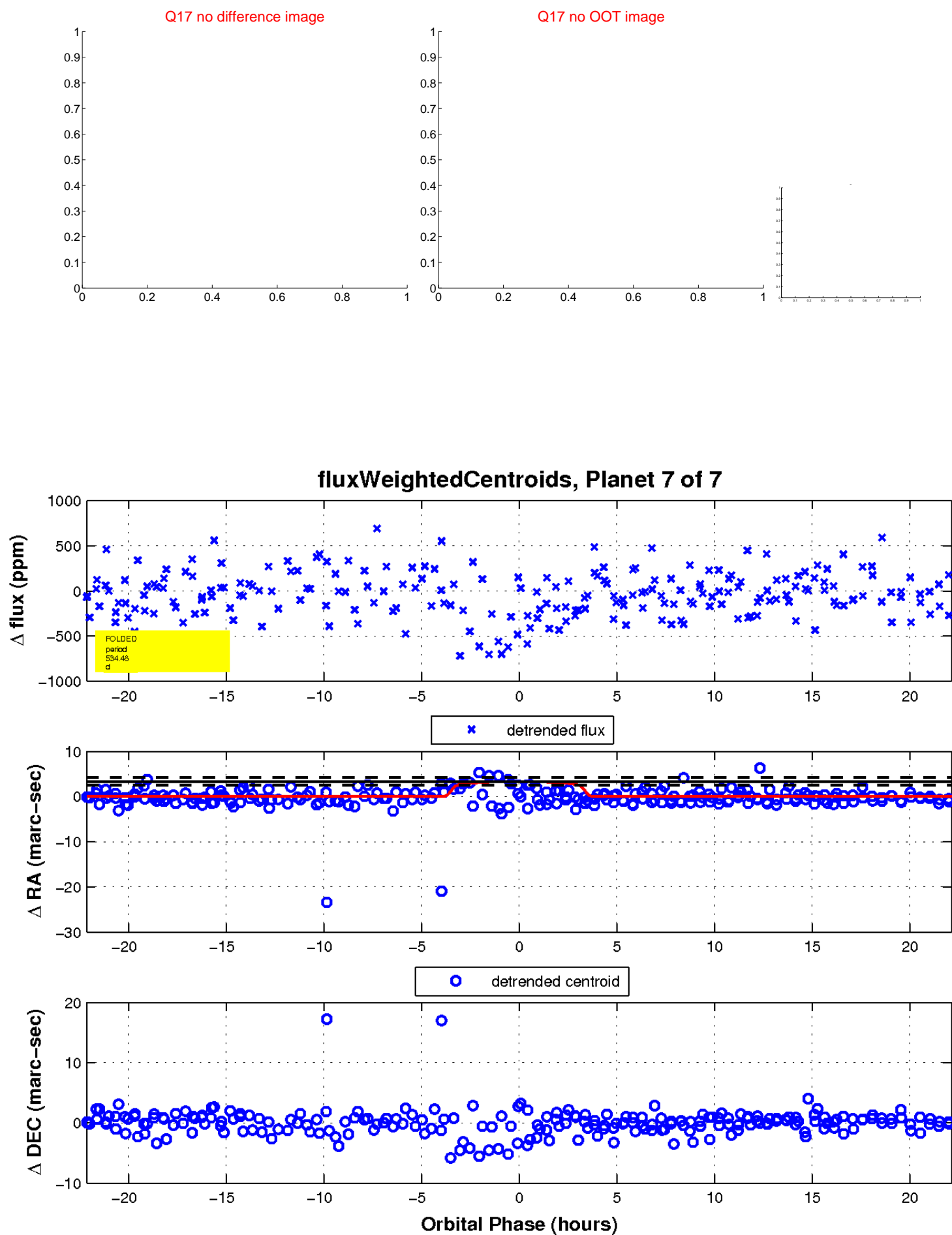
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

