

# KIC 010989345

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
010989345-01	OBS	No	2.630764	133.193244	10.6	11.138	8.7	2.7	1.50	6441	0.56	2414.15
010989345-02	OBS	No	663.020155	176.584259	336.4	6.883	8.0	8.5	1.50	6441	3.12	1.52
010989345-03	OBS	No	237.414043	326.142677	325.3	14.174	7.7	8.6	1.50	6441	3.39	5.96
010989345-04	OBS	No	423.567102	344.022902	722.4	35.026	7.8	7.8	1.50	6441	4.94	2.76
010989345-05	OBS	No	128.115026	240.564541	252.7	10.241	7.8	8.2	1.50	6441	2.77	13.57
010989345-07	OBS	No	66.433669	191.136166	129.6	13.221	7.4	5.2	1.50	6441	1.83	32.59
010989345-08	OBS	No	161.346431	265.595466	238.5	7.037	7.2	7.2	1.50	6441	4.56	9.98
010989345-09	OBS	No	276.296890	275.873517	375.6	30.069	7.9	7.5	1.50	6441	3.49	4.87
010989345-10	OBS	No	196.452793	165.569777	243.6	5.231	7.4	8.1	1.50	6441	3.04	7.68

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
010989345-01	OBS	FP	0.00	1	0	0	0	SWEET_NTL—LPP_DV—MOD_NONUNIQ_DV
010989345-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES—ALL_TRANS_CHASES—MOD_NONUNIQ_DV
010989345-03	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—HALO_GHOST
010989345-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
010989345-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—MOD_NONUNIQ_DV
010989345-07	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT
010989345-08	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT
010989345-09	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—CENT_FEW_DIFFS
010989345-10	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT

**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.

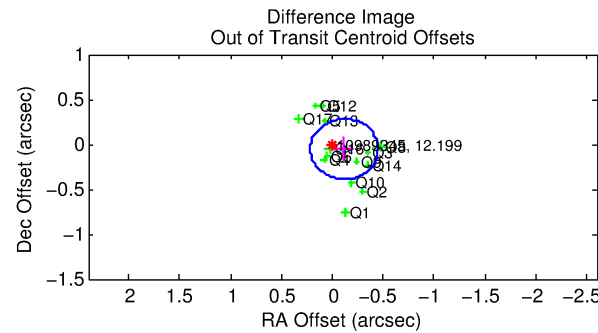
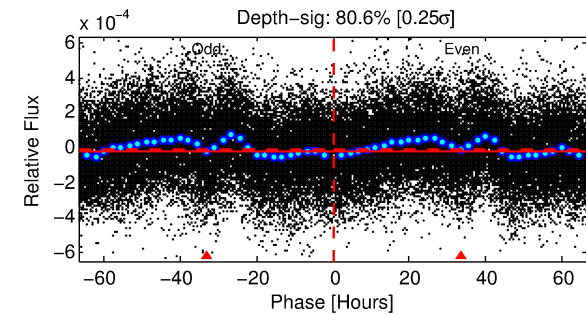
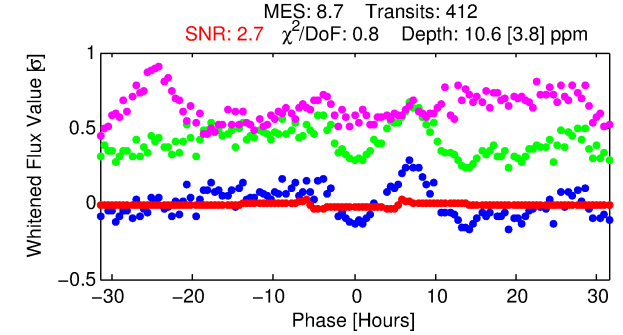
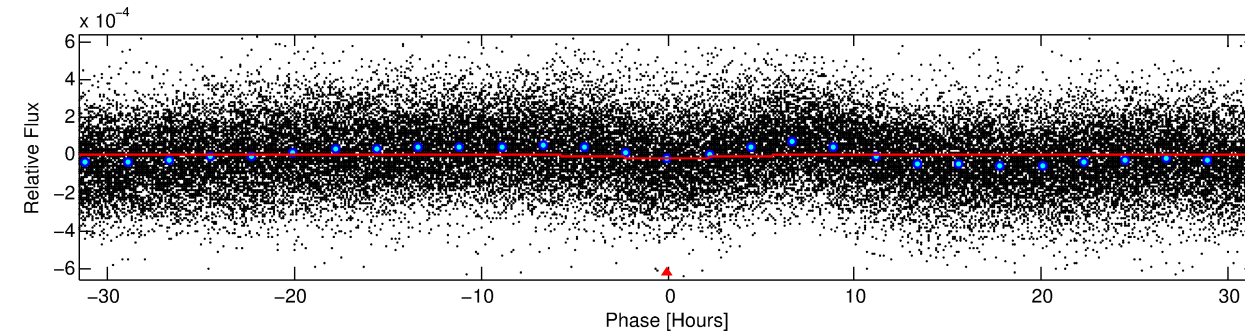
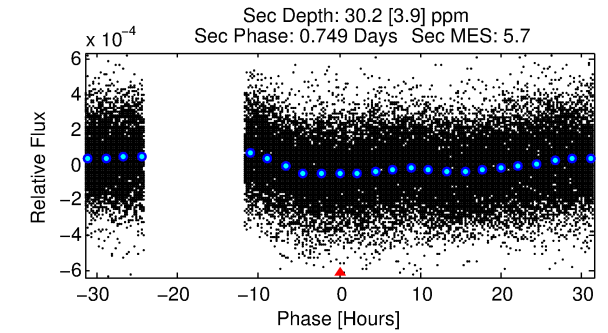
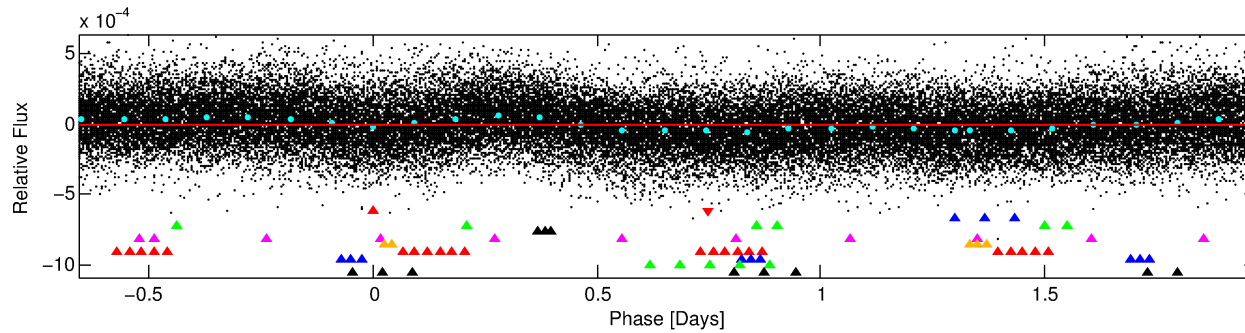
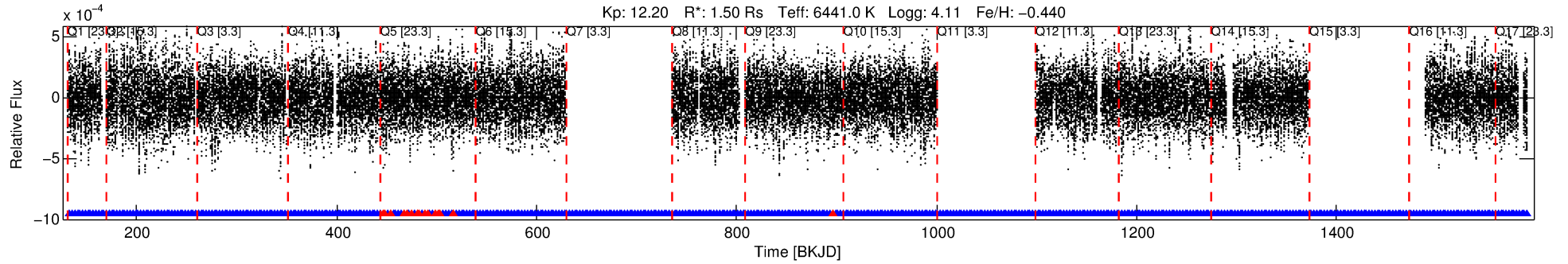
Ephemeris Match Information For 010989345-01

No Significant Match Found



# DV One-Page Summary

KIC: 10989345 Candidate: 1 of 10 Period: 2.631 d



## DV Fit Results:

Period = 2.63076 [0.00007] d  
Epoch = 133.1932 [0.0122] BKJD  
Rp/R\* = 0.0034 [0.0012]  
a/R\* = 1.29 [0.89]  
b = 0.87 [0.49]  
Seff = 2414.15 [1218.45]  
Teq = 1787 [226] K  
Rp = 0.56 [0.26] Re  
a = 0.0380 [0.0114] AU  
Ag = 76.52 [66.25] [1.14σ]  
Teffp = 8173 [1494] K [4.23σ]

## DV Diagnostic Results:

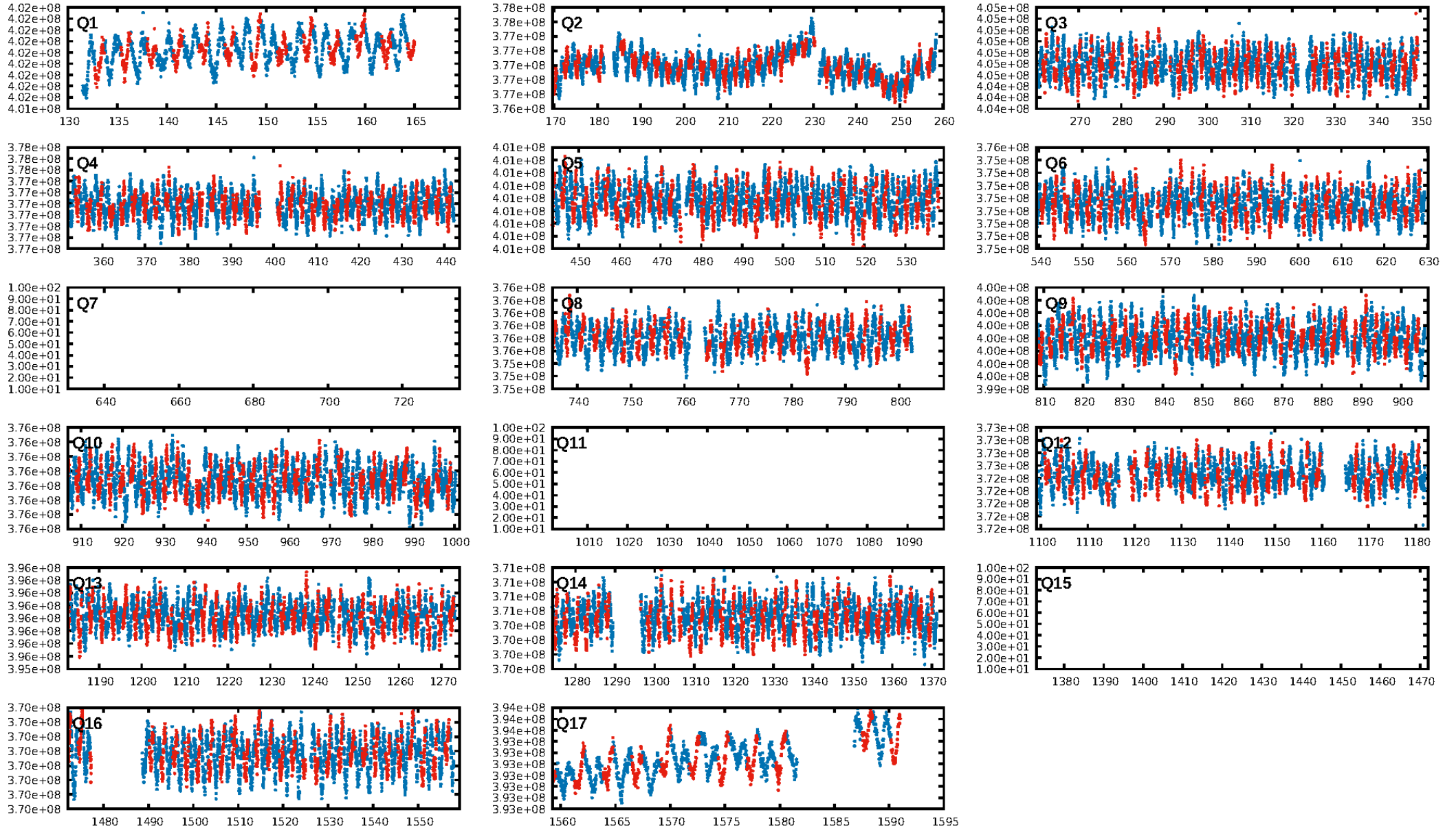
ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [88.58σ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: 7.94e-11  
RollingBand-fgt: 0.96 [373/388]  
GhostDiagnostic-chr: -0.2858  
Centroid-sig: 48.1%  
Centroid-so: 1.103 arcsec [0.77σ]  
OotOffset-rm: 0.128 arcsec [1.15σ]  
OotOffset-st: 4/1/4/5 [14]  
KicOffset-rm: 0.074 arcsec [0.68σ]  
KicOffset-st: 4/1/4/5 [14]  
DiffImageQuality-fgm: 1.00 [14/14]  
DiffImageOverlap-fno: 1.00 [14/14]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 03:39:39 Z

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

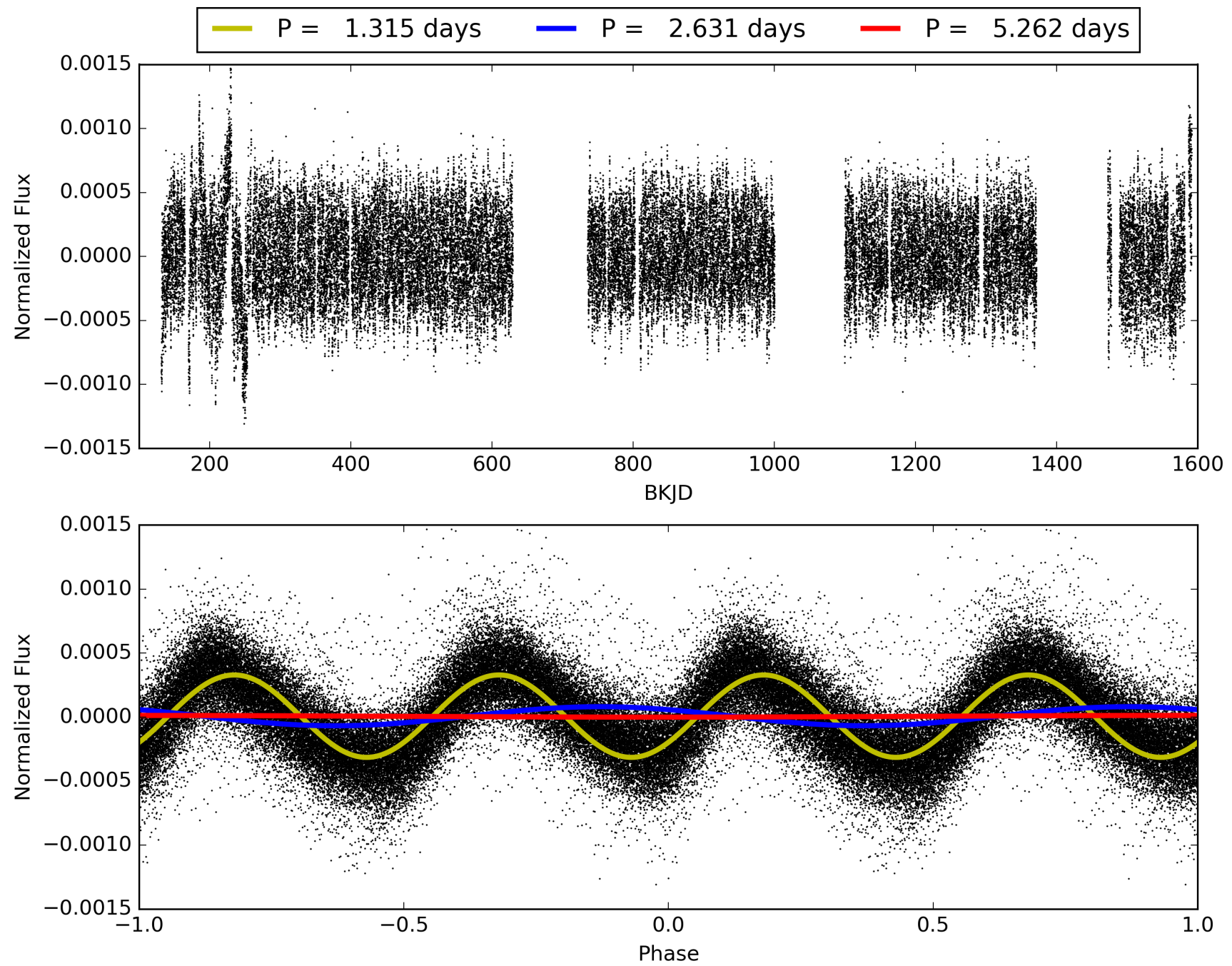


# TCE 010989345-01, PDC Light Curves





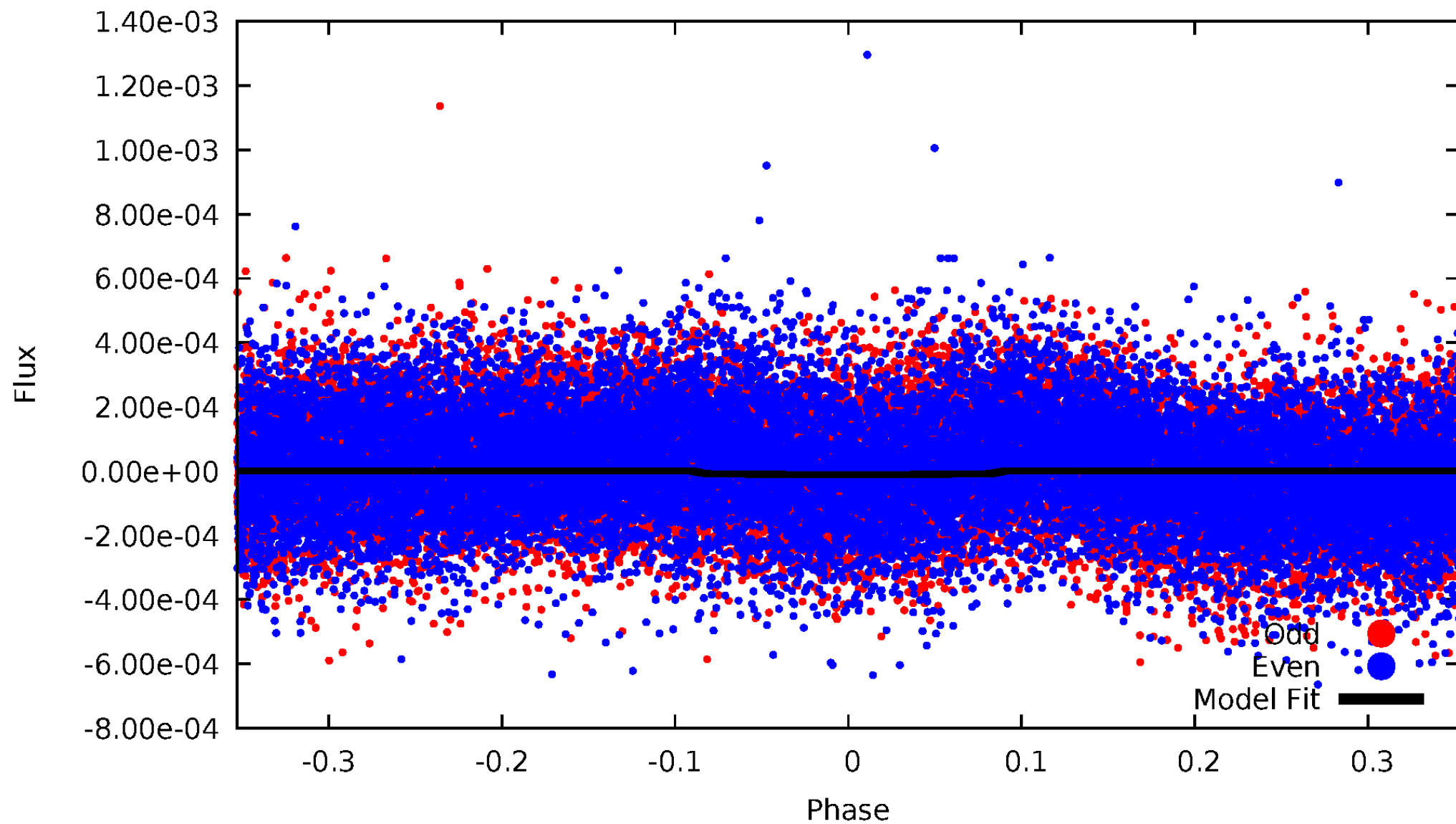
TCE 010989345-01





# DV Odd/Even

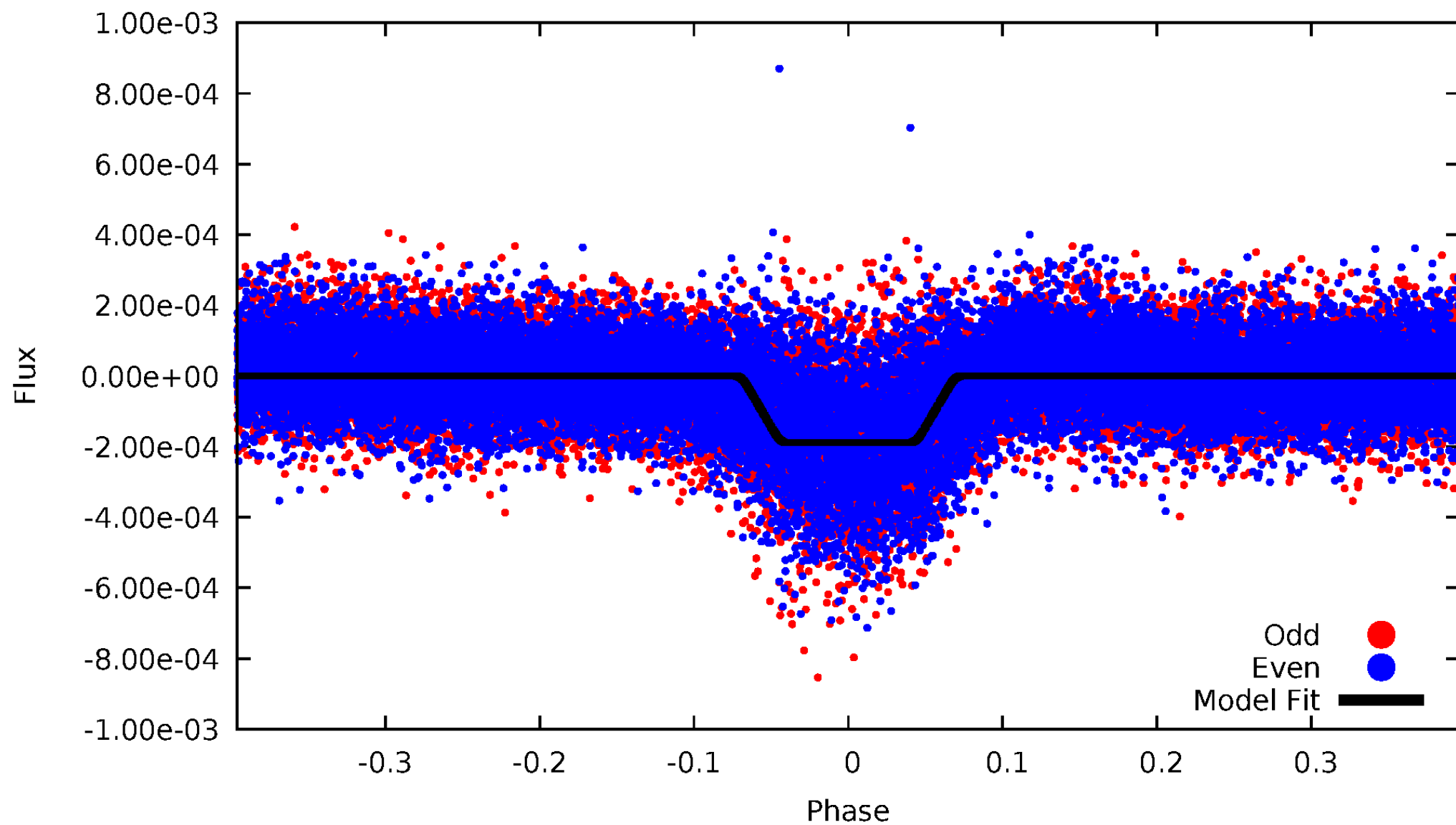
TCE 010989345-01





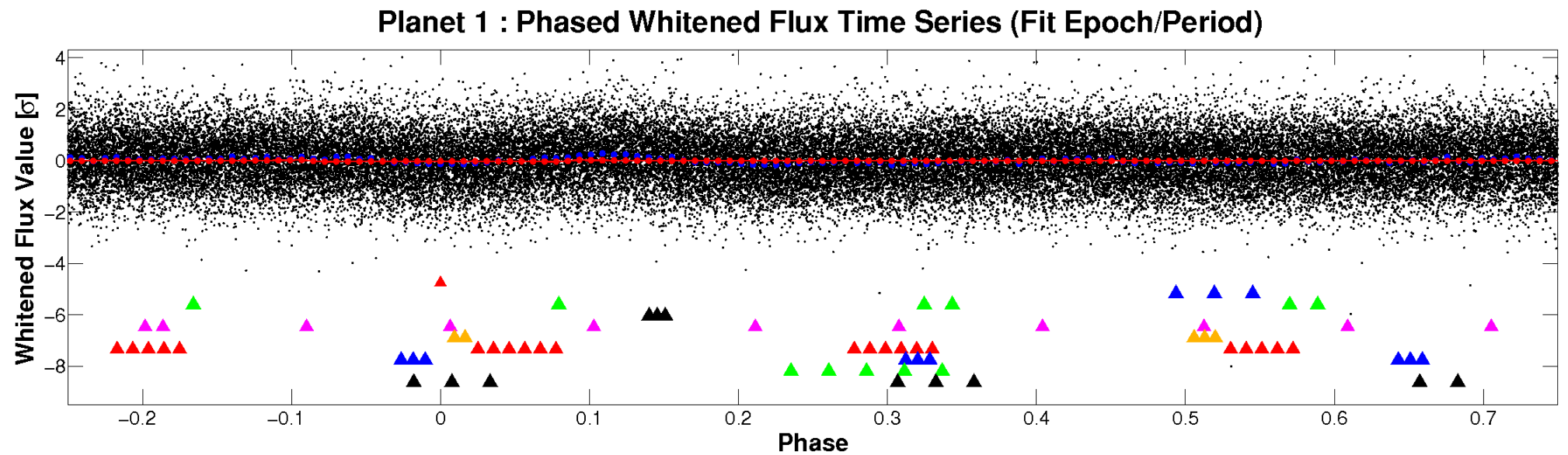
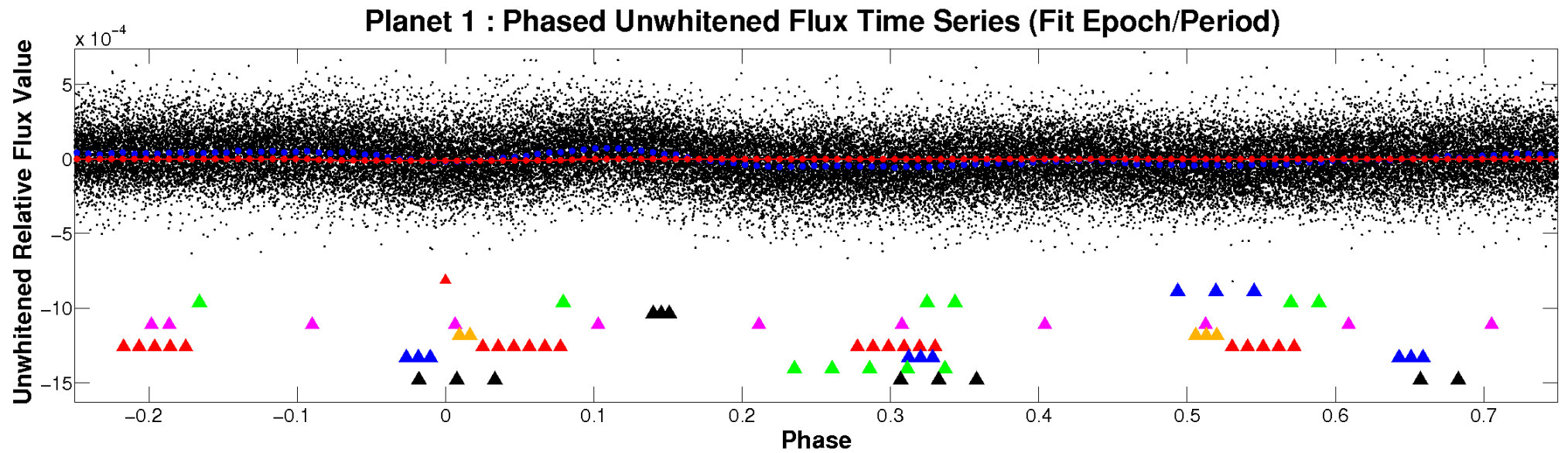
# ALT Odd/Even

TCE 010989345-01





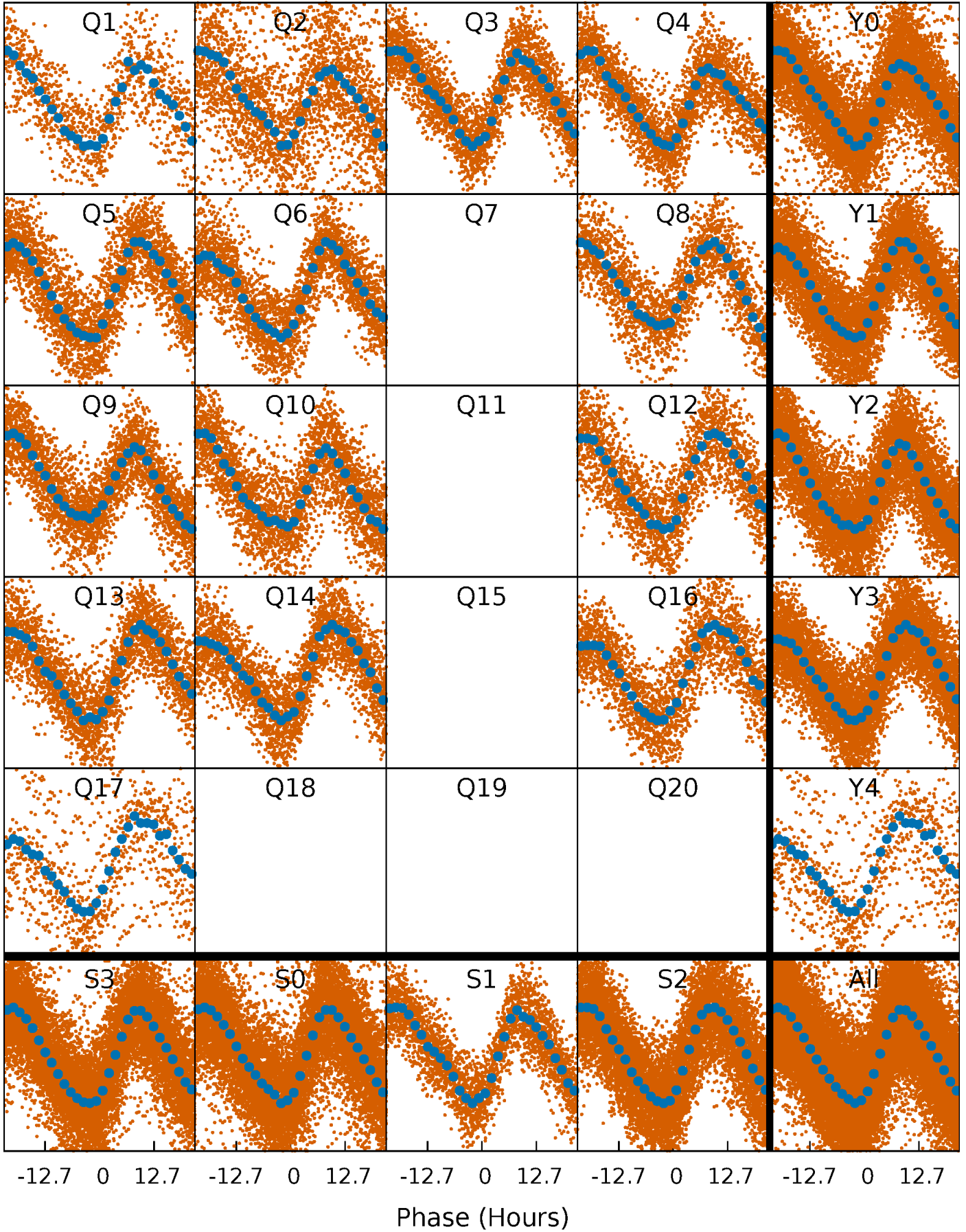
# Non-Whitened Vs. Whitened Light Curve





# PDC Quarter-Phased Transit Curves

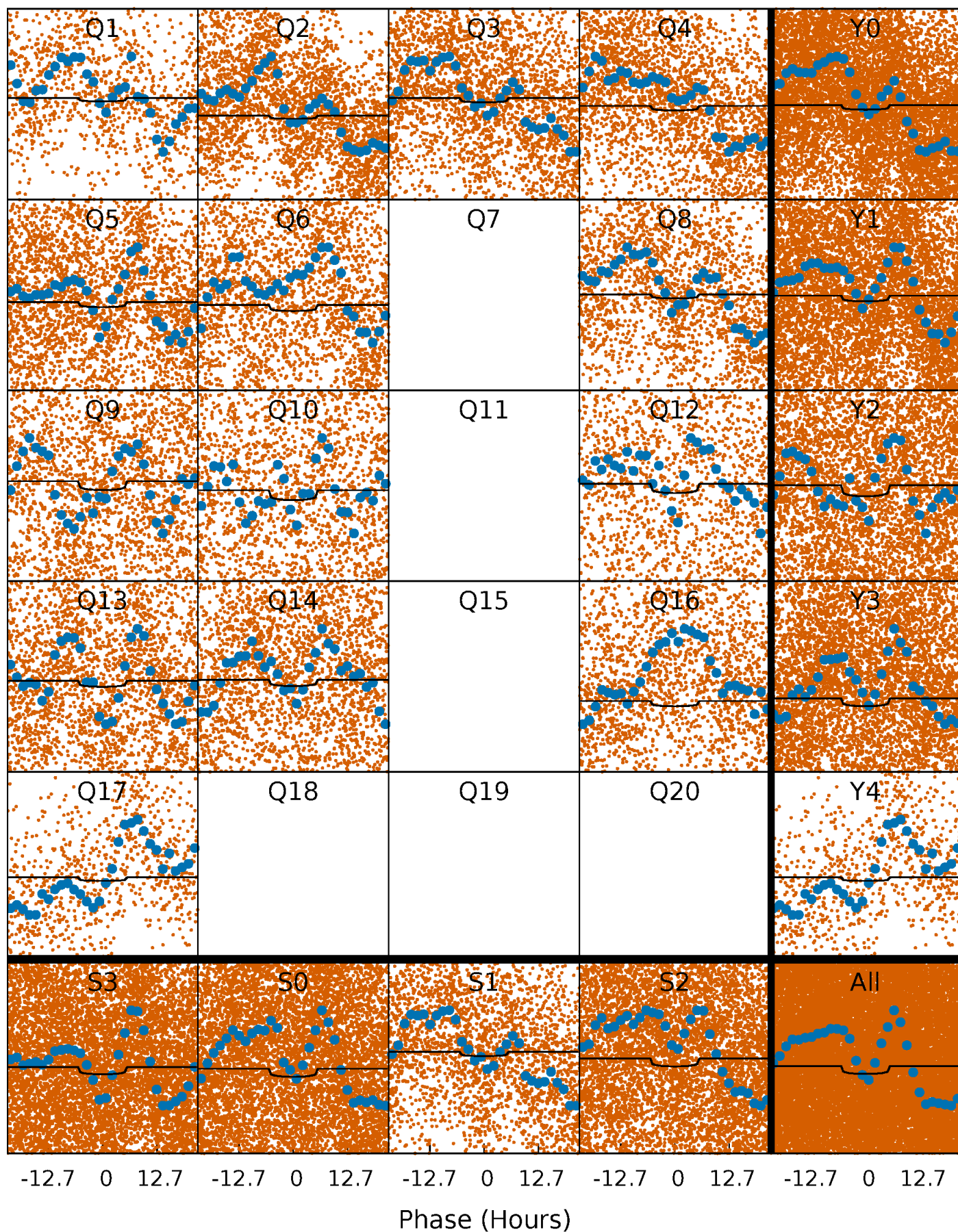
TCE 010989345-01   P= 2.630764 Days    $T_0=133.193244$  (BKJD)





# DV Quarter-Phased Transit Curves

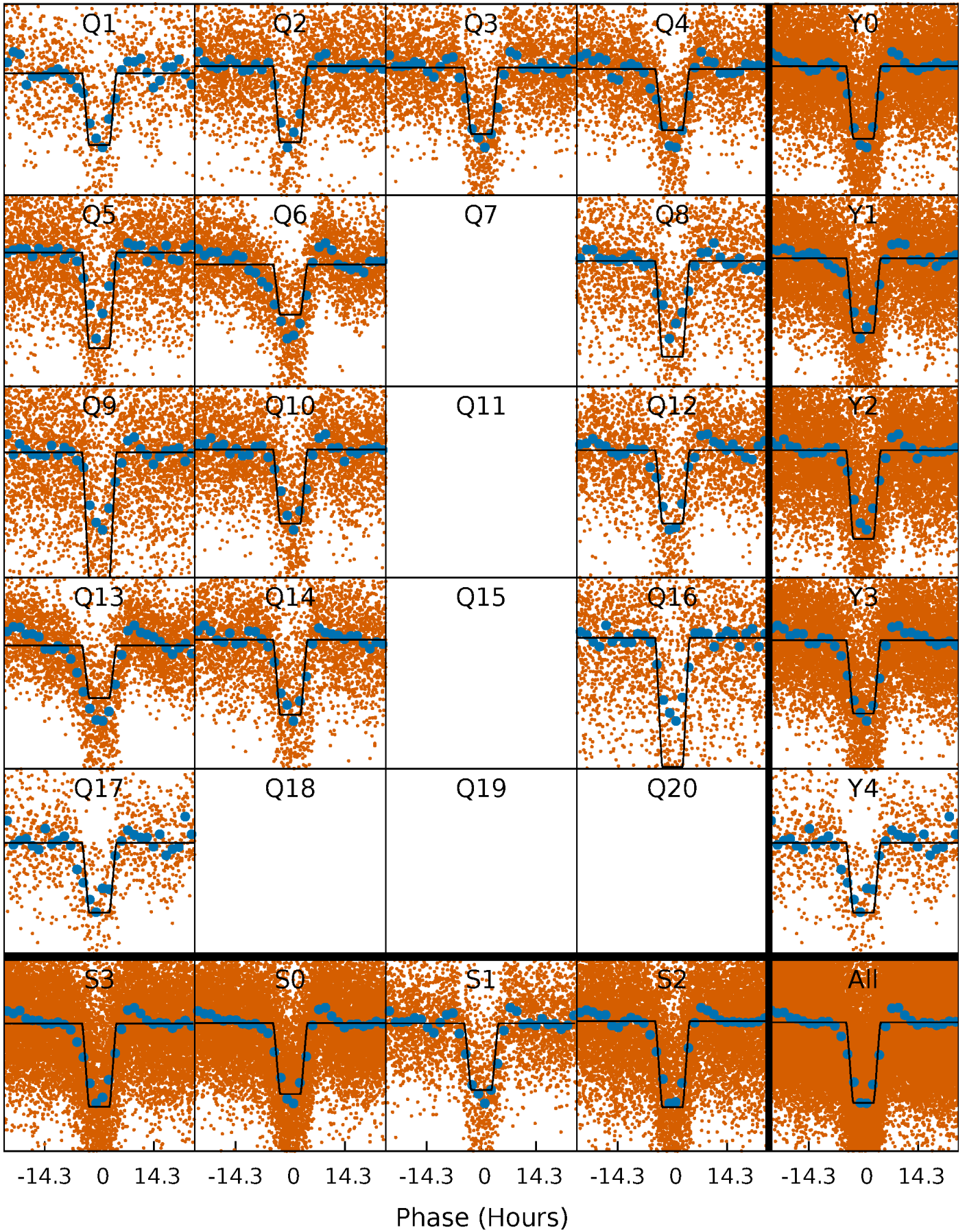
TCE 010989345-01 P= 2.630764 Days  $T_0=133.193244$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

TCE 010989345-01 P= 2.630796 Days  $T_0=133.185434$  (BKJD)

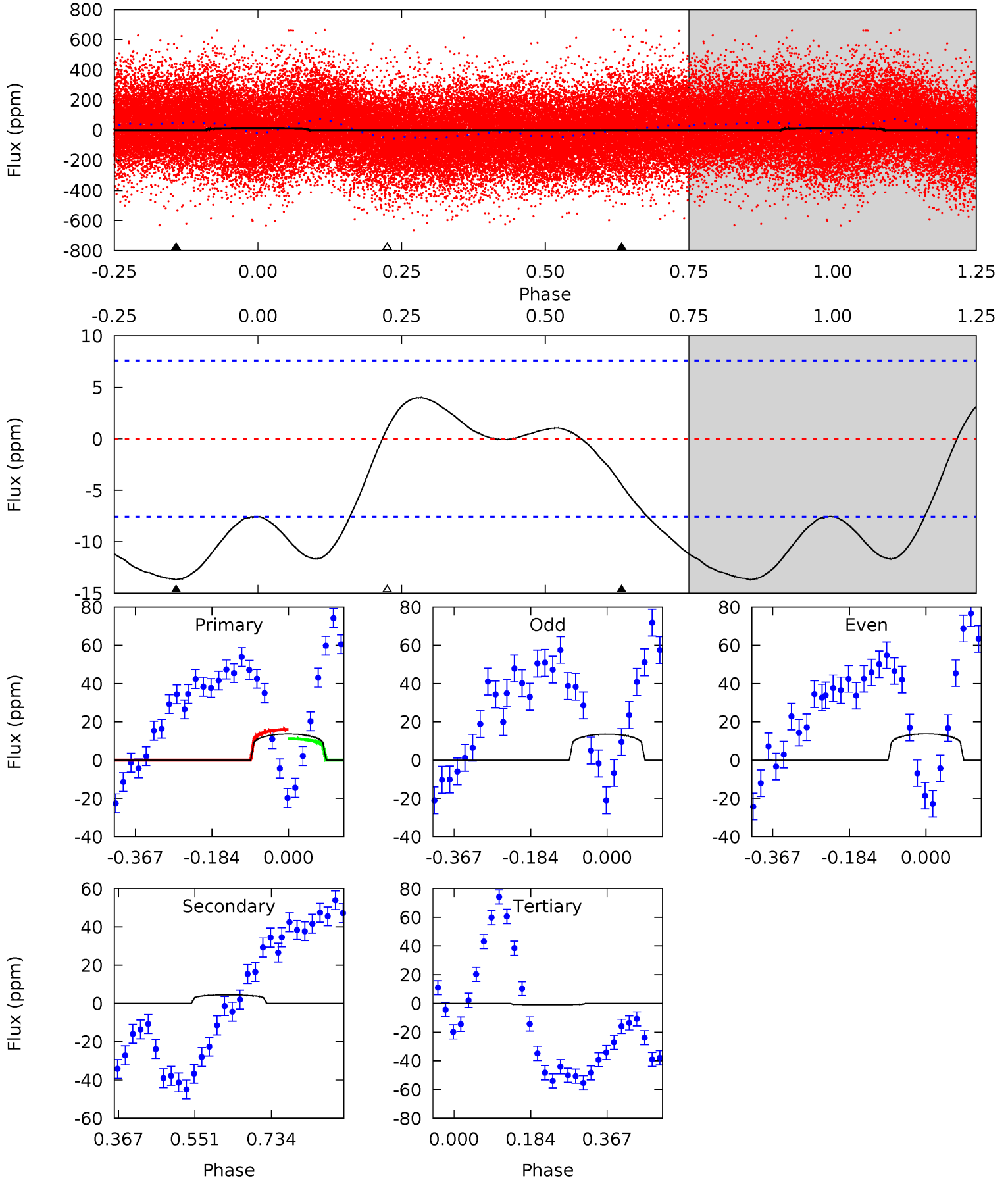




# DV Model-Shift Uniqueness Test

010989345-01, P = 2.630764 Days, E = 130.562480 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
8.00	2.61	-0.59	0	4.44	1.33	3.30	8.58	8.00	3.20	2.61	0.05	1.25	0.23	1.43

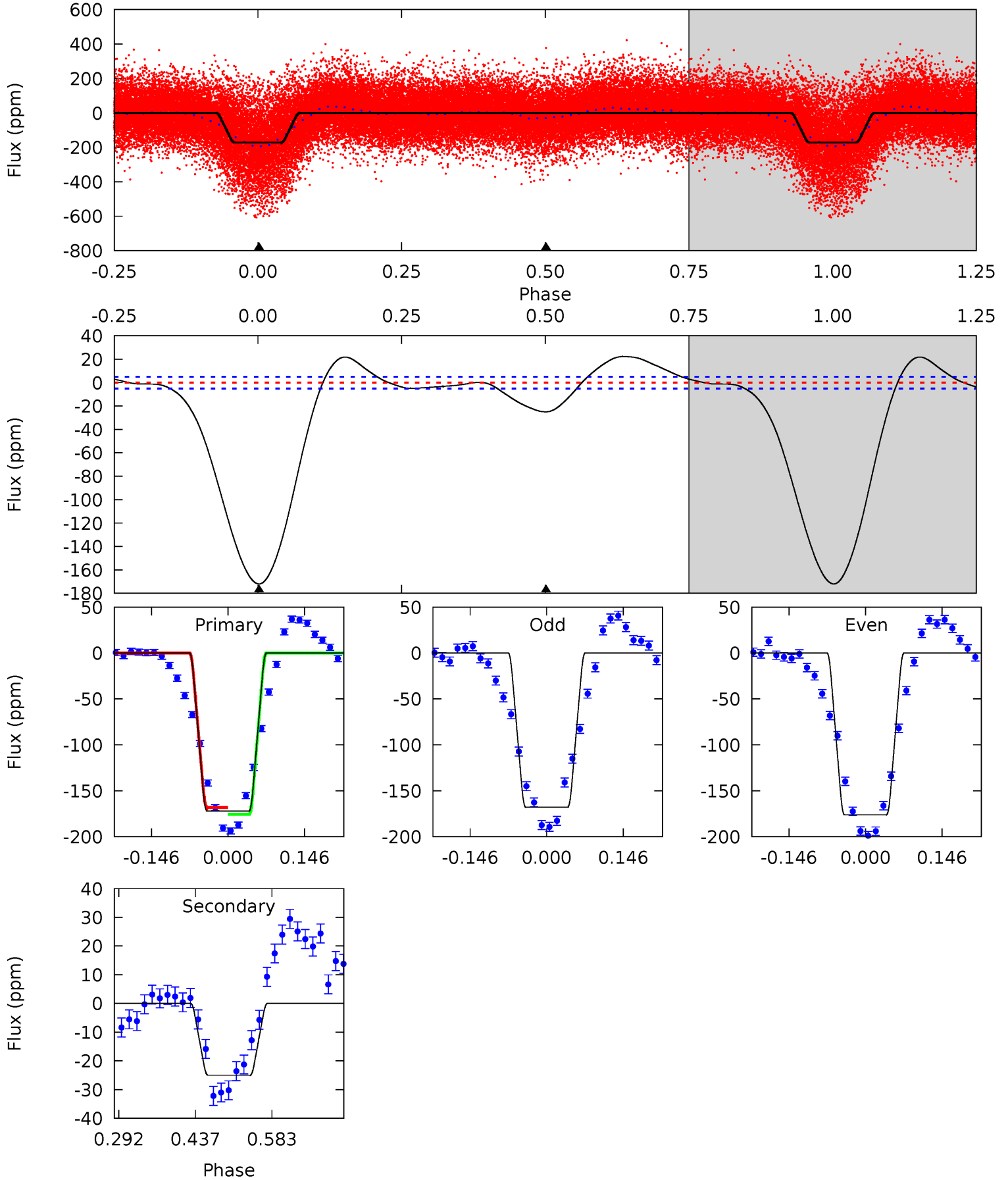




# Alt Model-Shift Uniqueness Test

010989345-01, P = 2.630796 Days, E = 130.554638 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
155.3	22.6	0	0	4.49	1.45	7.91	155.3	155.3	22.6	22.6	3.76	1.02	0.11	3.32





### Stellar Parameters For KIC 010989345

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M$ ( $M_{\odot}$ )	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6441^{+181}_{-227}$	$4.108^{+0.286}_{-0.154}$	$-0.440^{+0.300}_{-0.300}$	$1.504^{+0.421}_{-0.463}$	$1.056^{+0.177}_{-0.133}$	$0.438^{+0.795}_{-0.185}$
	+3%/-4%	+7%/-4%	+68%/-68%	+28%/-31%	+17%/-13%	+182%/-42%
Source	PHO54	PHO54	PHO54	DSEP		

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

### Secondary Eclipse Parameters for KIC 010989345-01 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-4 \pm 2$	$0.54^{+0.21}_{-0.20}$	$2451^{+220}_{-202}$	$5006^{+1324}_{-712}$	$12^{+19}_{-7}$
Alt.	$-25 \pm 1$	$2.20^{+0.39}_{-0.40}$	$2446^{+198}_{-210}$	$4096^{+177}_{-168}$	$4.189^{+1.855}_{-1.144}$

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



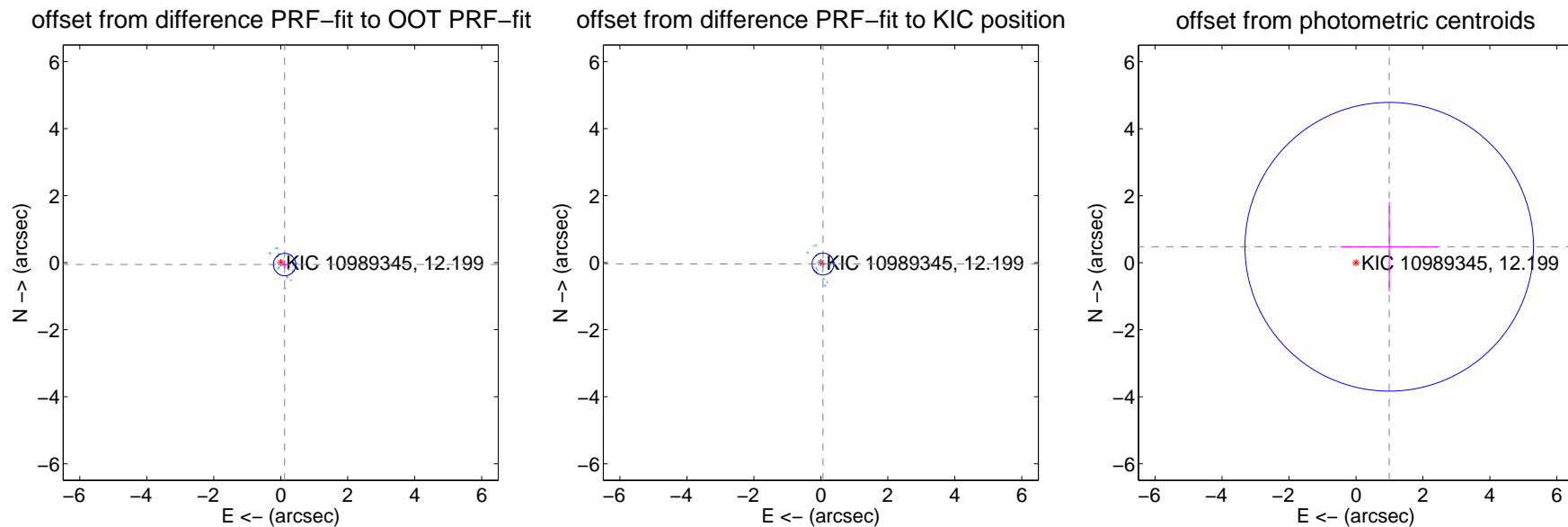
## DV Centroid Data

Supplemental centroid analysis for 010989345-01. Kepler magnitude: 12.20. Transit SNR 2.74

There are 14 quarters with good PRF difference image offsets

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

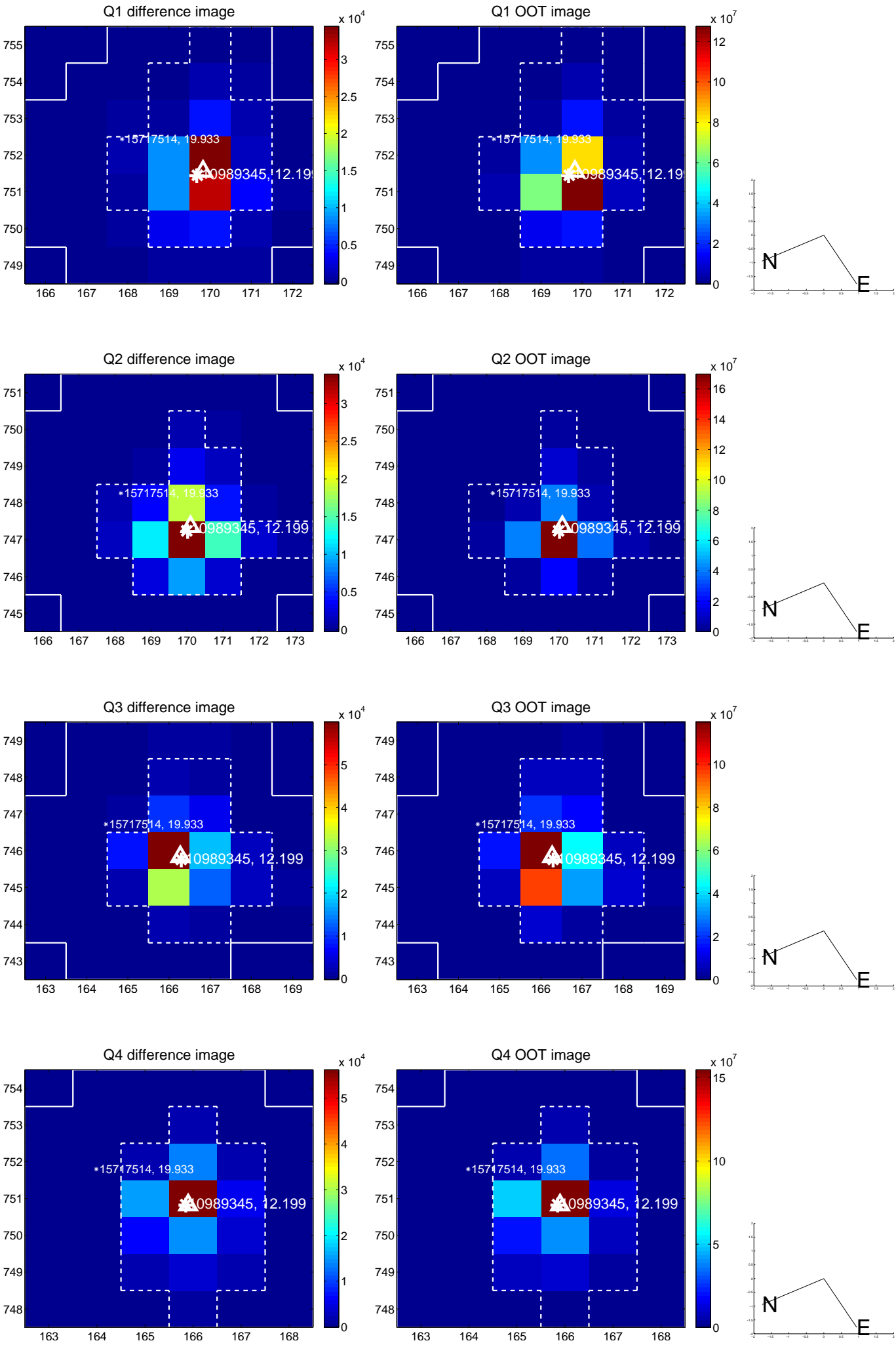
	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.128 \pm 0.111$	1.15	$-0.116 \pm 0.090$	$-0.055 \pm 0.121$
PRF-fit source offset from KIC position	$0.074 \pm 0.109$	0.68	$-0.063 \pm 0.087$	$-0.040 \pm 0.115$
photometric centroid source offset	$1.10 \pm 1.44$	0.77	$-0.99 \pm 1.46$	$0.48 \pm 1.33$



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.

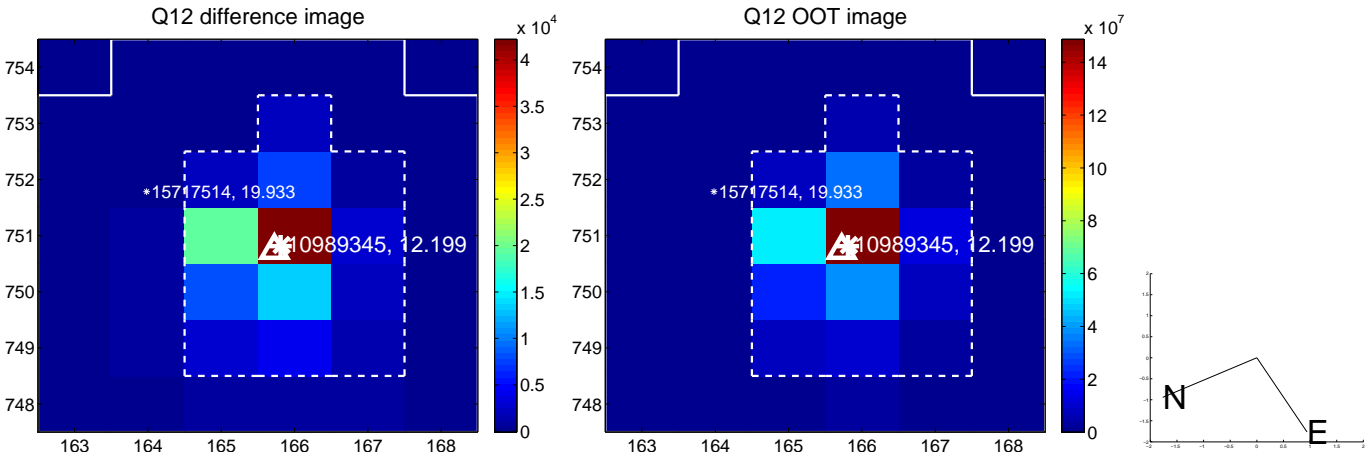
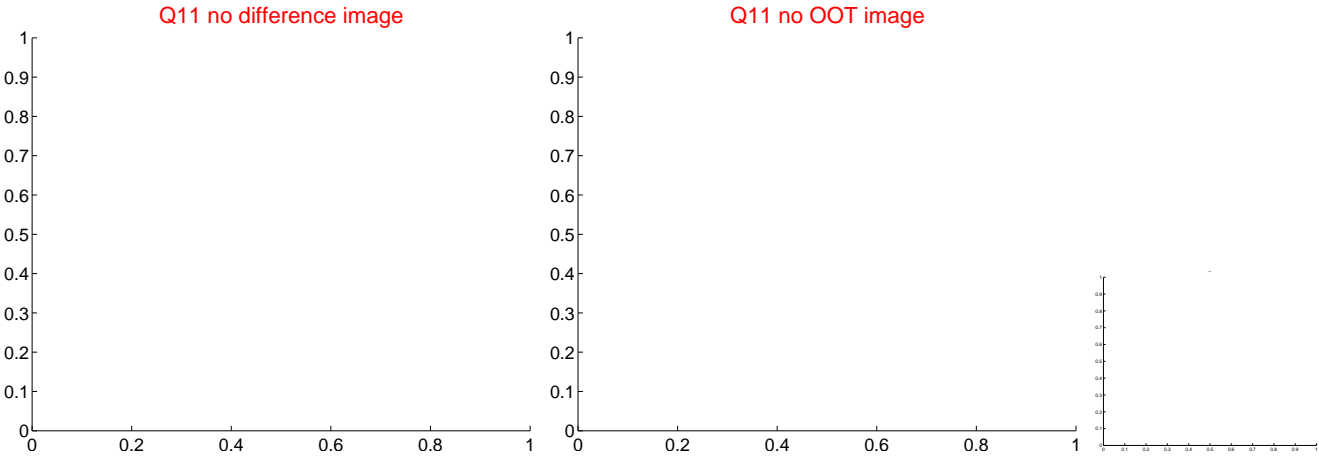
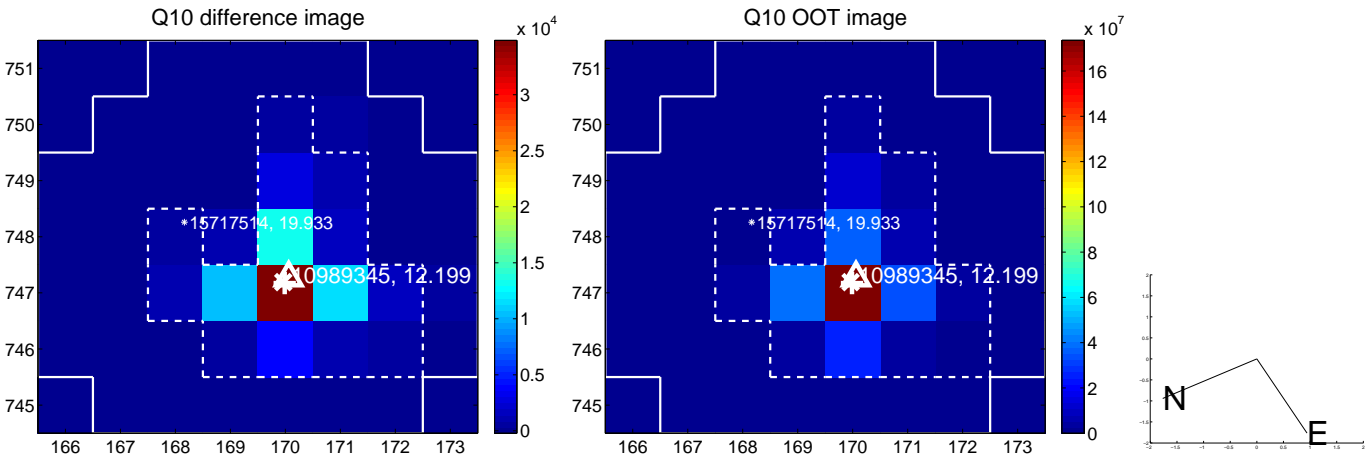
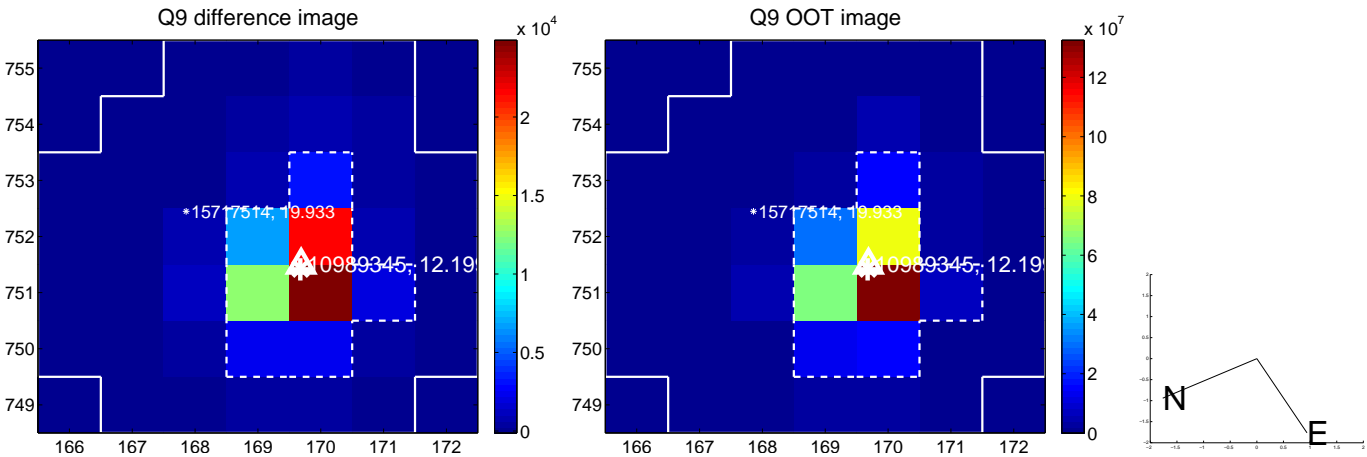






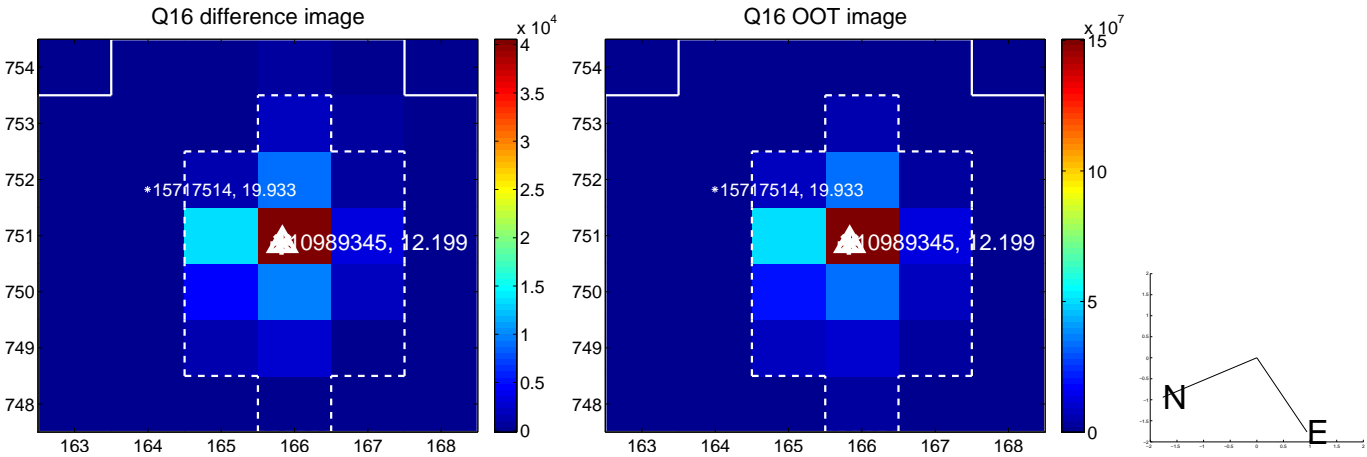
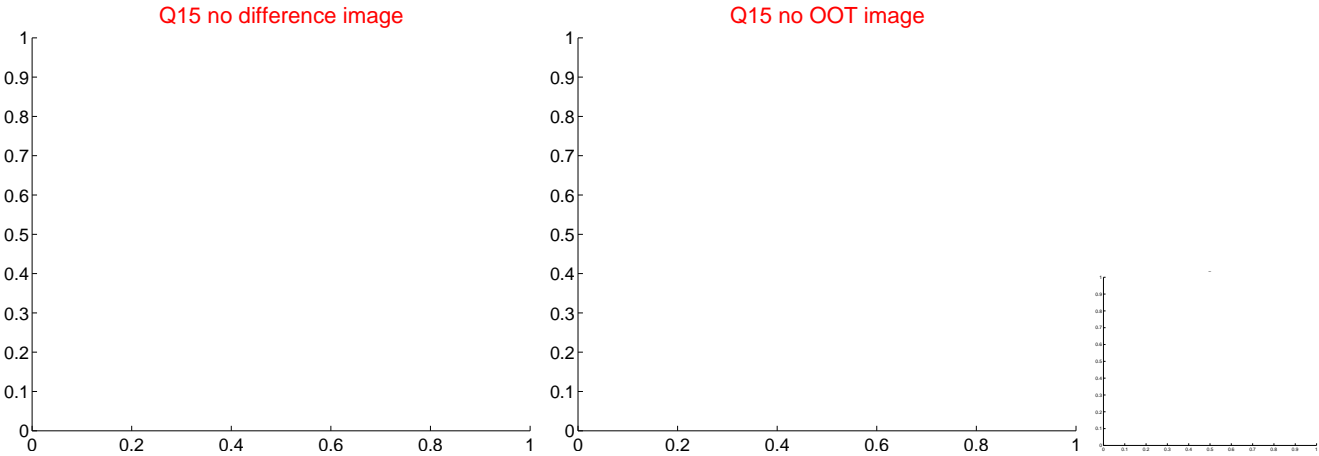
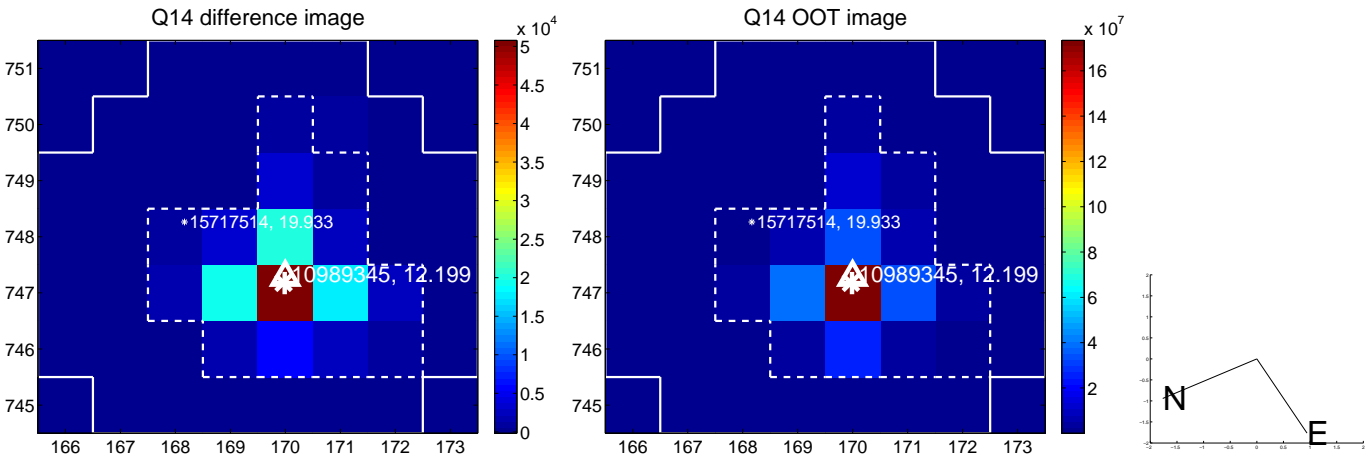
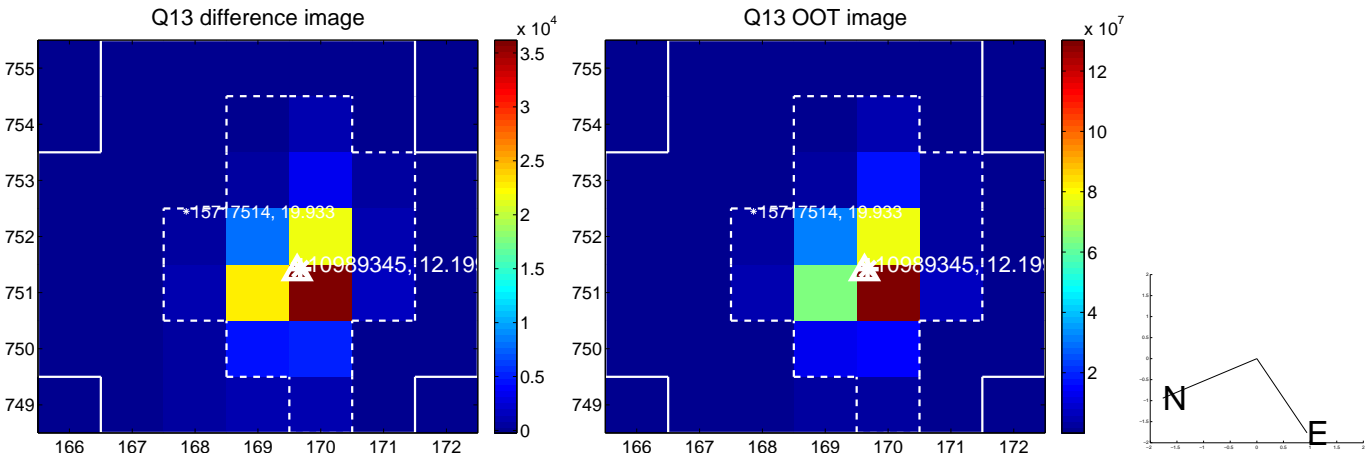


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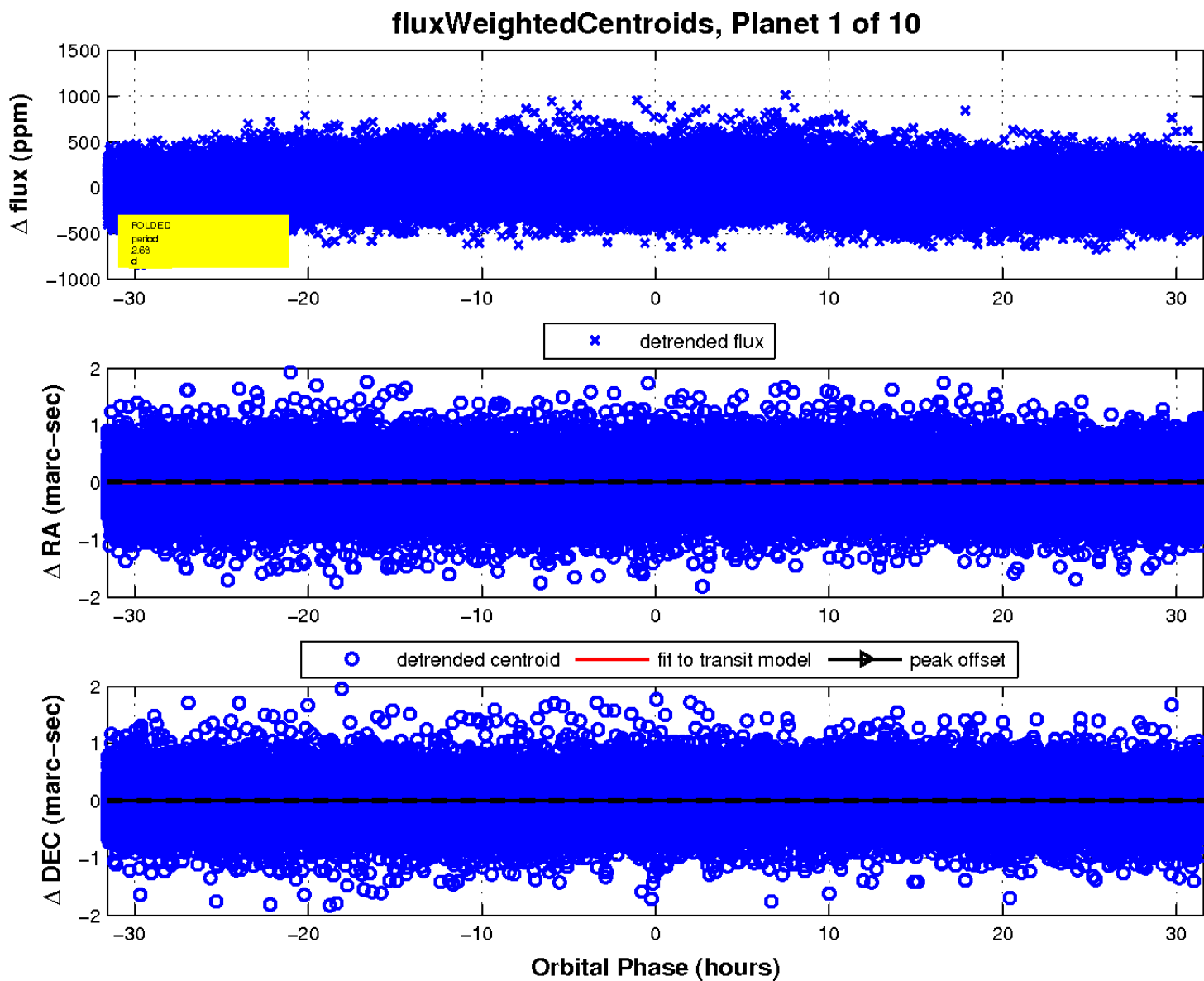
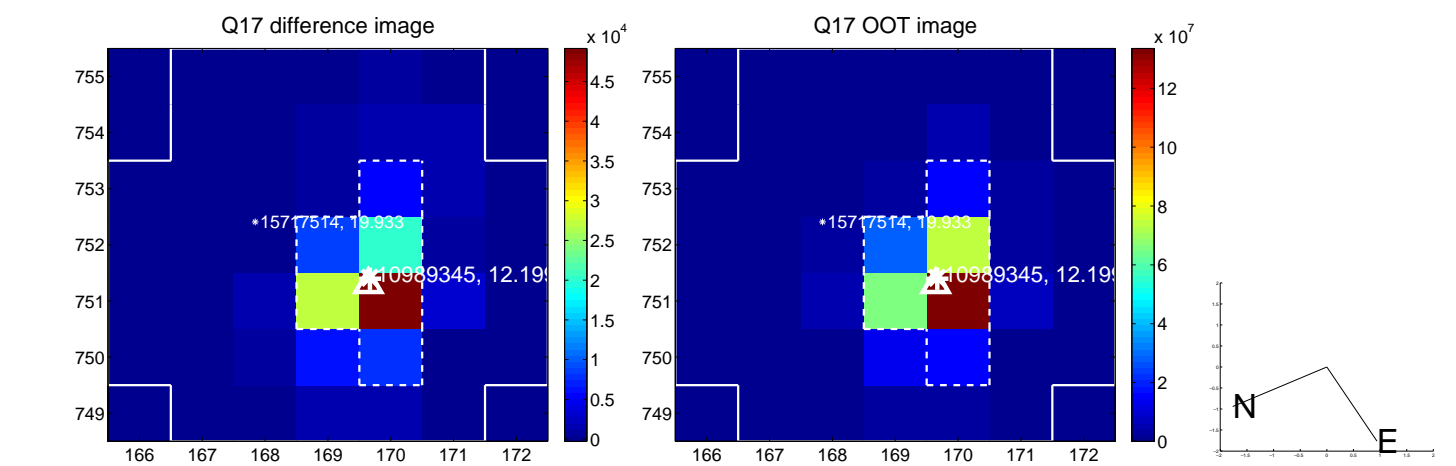


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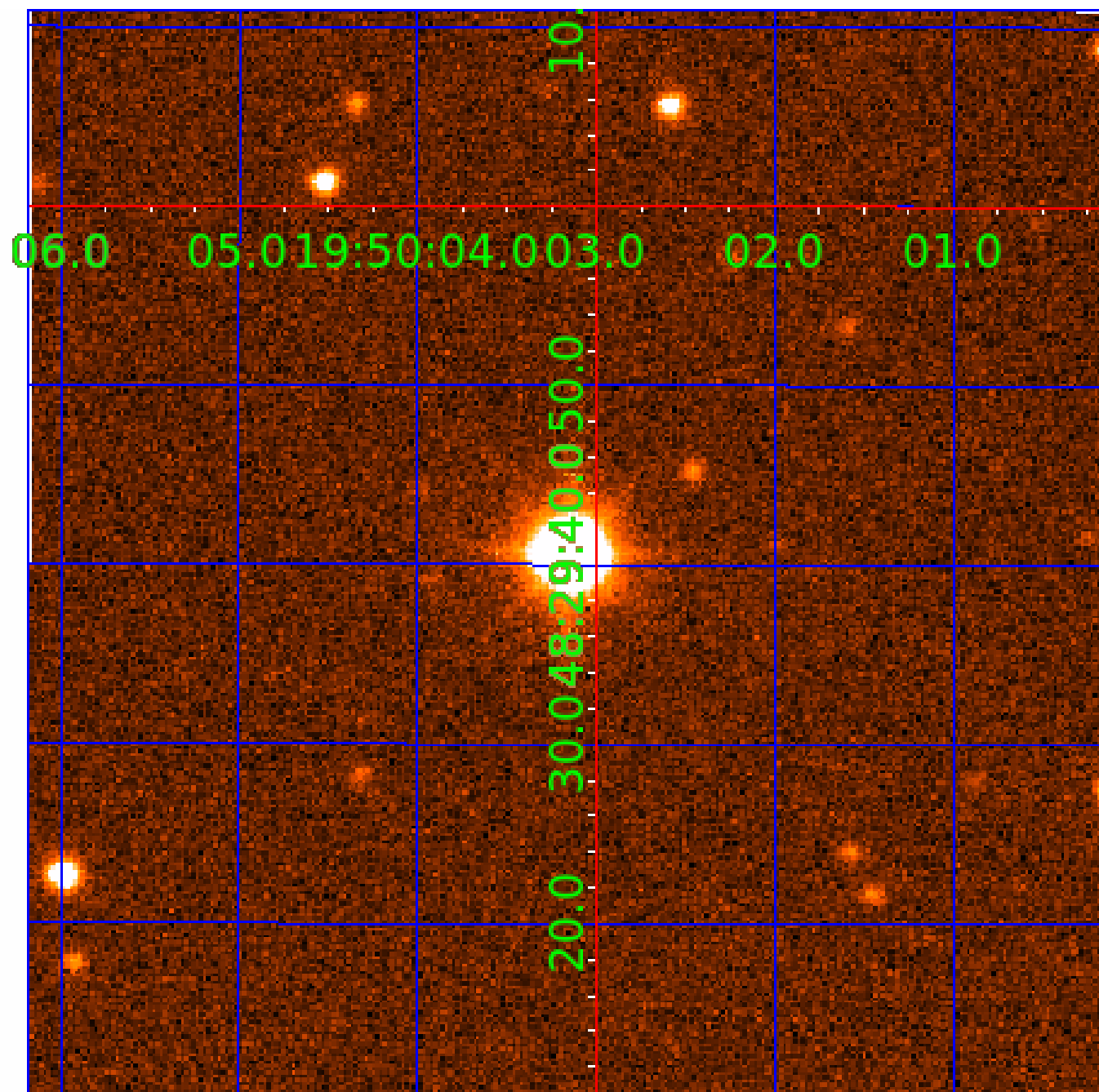
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UKIRT Image

Declination





# KIC 010989345

## Q1-17 DR25 TCE Parameters

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010989345-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES—ALL_TRANS_CHASES—MOD_NONUNIQ_DV
010989345-03	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—HALO_GHOST
010989345-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
010989345-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—MOD_NONUNIQ_DV
010989345-07	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT
010989345-08	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT
010989345-09	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—CENT_FEW_DIFFS
010989345-10	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT

**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.

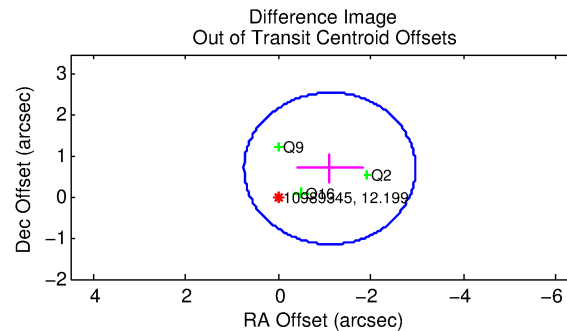
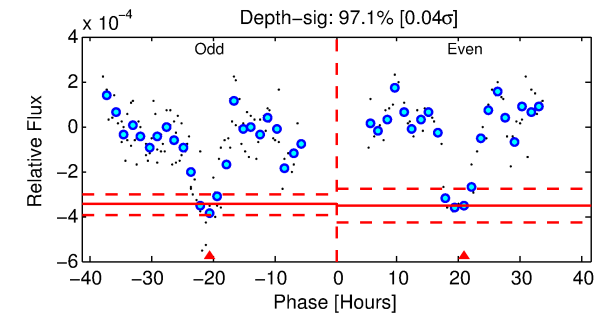
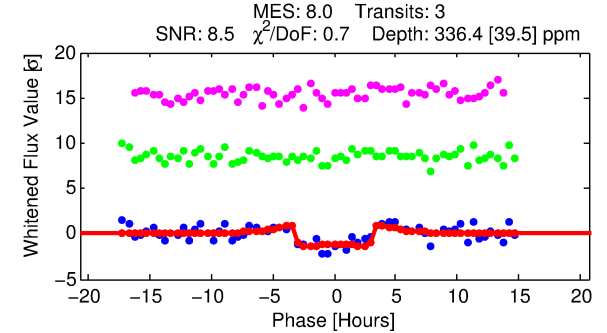
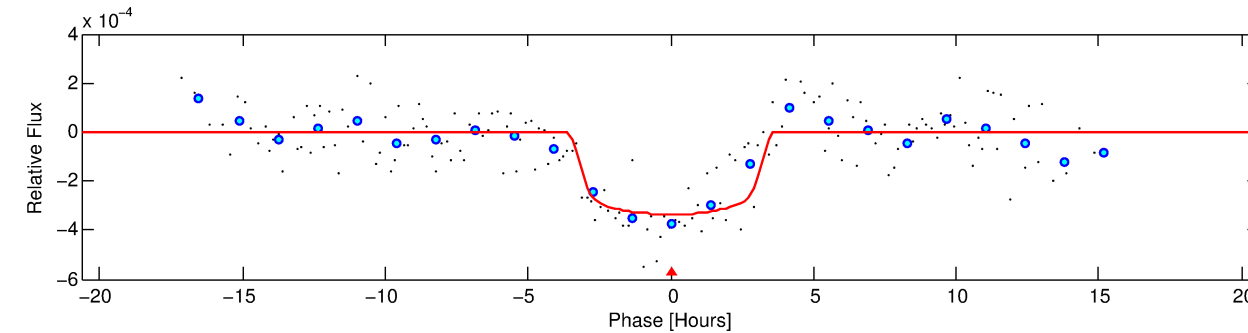
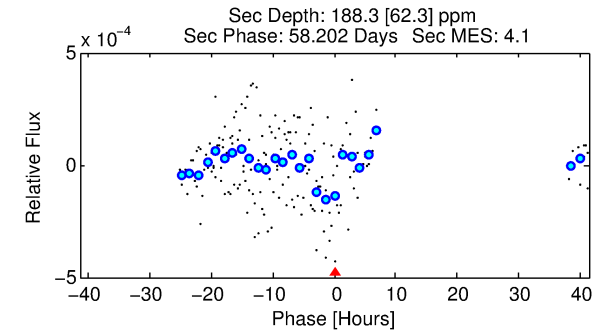
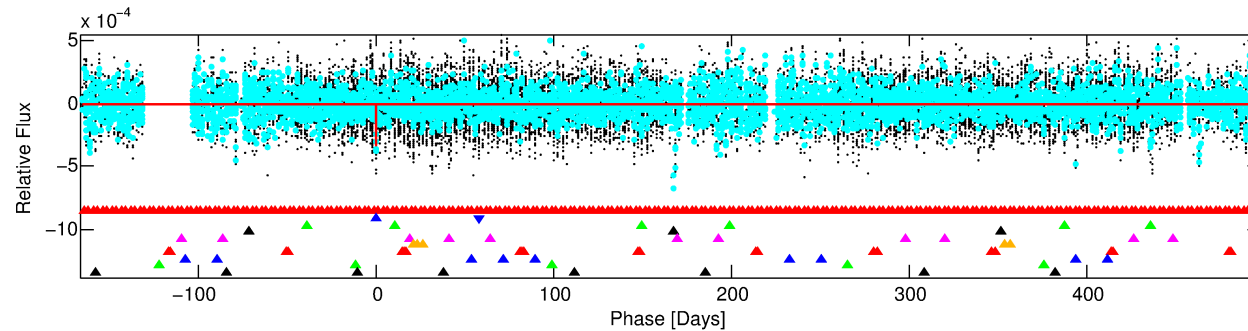
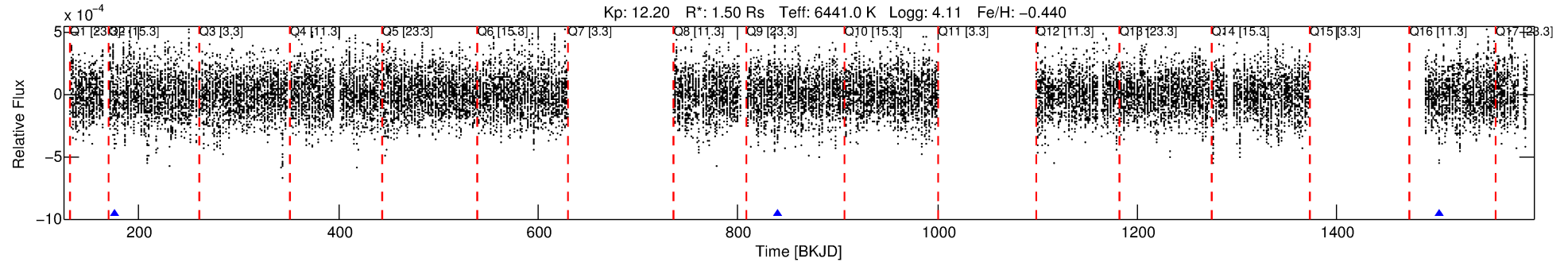
Ephemeris Match Information For 010989345-02

No Significant Match Found



# DV One-Page Summary

KIC: 10989345 Candidate: 2 of 10 Period: 663.020 d



## DV Fit Results:

Period = 663.02015 [0.00538] d  
Epoch = 176.5843 [0.0061] BKJD  
Rp/R\* = 0.0190 [0.0026]  
a/R\* = 410.36 [263.92]  
b = 0.85 [0.21]  
Seff = 1.52 [0.77]  
Teq = 283 [36] K  
Rp = 3.12 [1.05] Re  
a = 1.5166 [0.4558] AU  
Ag = 24437.45 [15855.37] [1.54 $\sigma$ ]  
Teffp = 5470 [621] K [8.34 $\sigma$ ]

## DV Diagnostic Results:

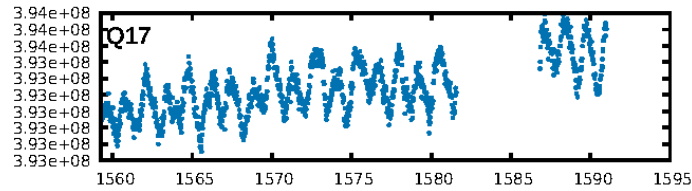
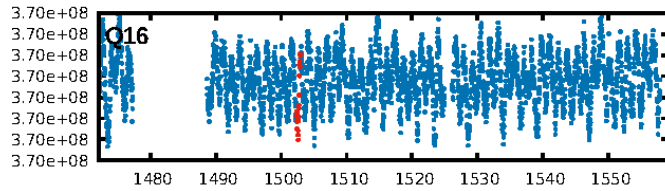
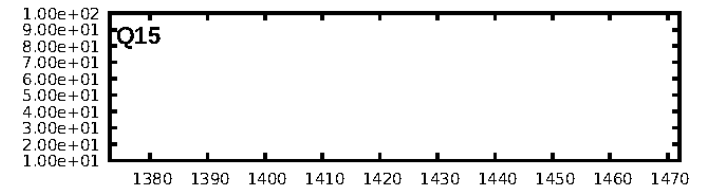
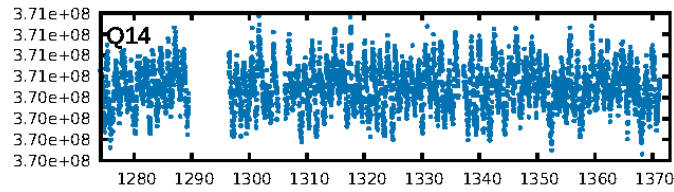
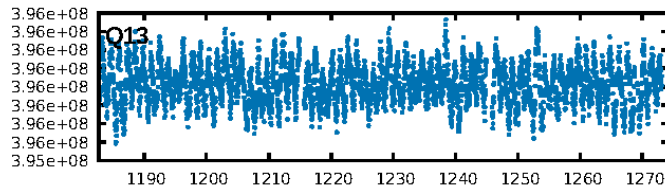
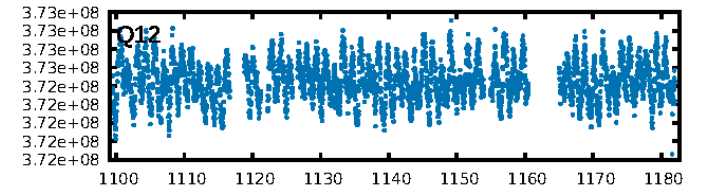
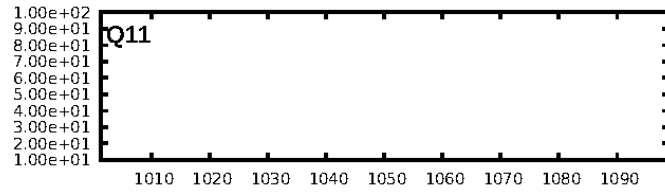
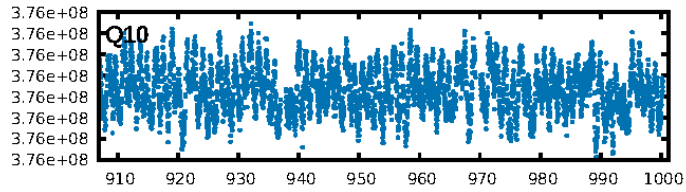
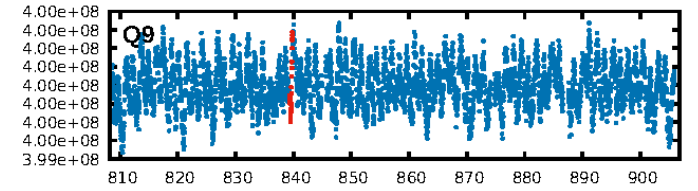
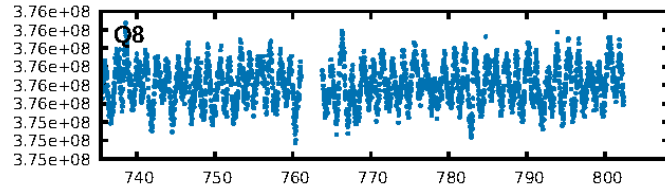
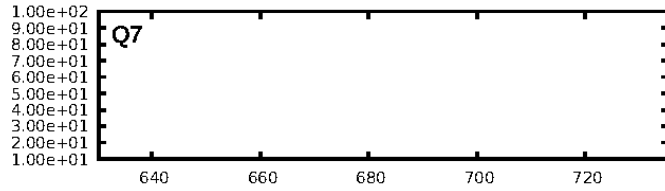
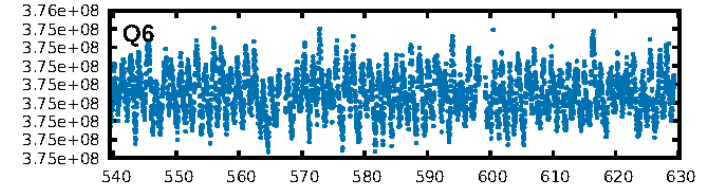
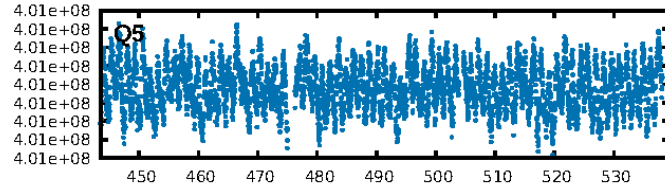
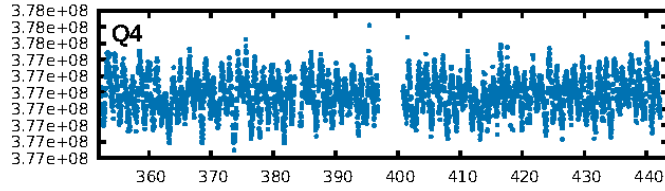
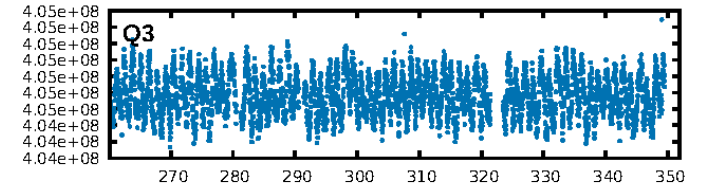
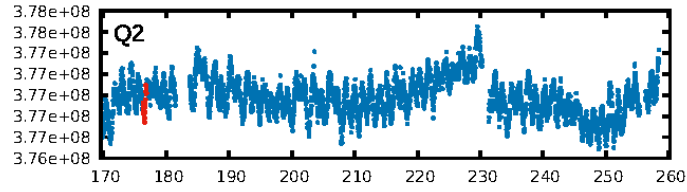
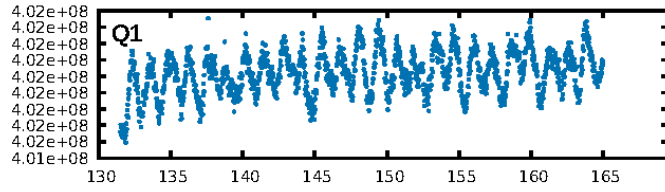
ShortPeriod-sig: 100.0% [161.00 $\sigma$ ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 64.8%  
ModelChiSquareGof-sig: 100.0%  
**Bootstrap-pfa: 1.01e-08**  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: -7.924  
Centroid-sig: 43.8%  
Centroid-so: 0.457 arcsec [0.77 $\sigma$ ]  
OotOffset-rm: 1.318 arcsec [2.13 $\sigma$ ]  
OotOffset-st: 1/0/1/1 [3]  
KicOffset-rm: 1.221 arcsec [2.14 $\sigma$ ]  
KicOffset-st: 1/0/1/1 [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 03:39:52 Z

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

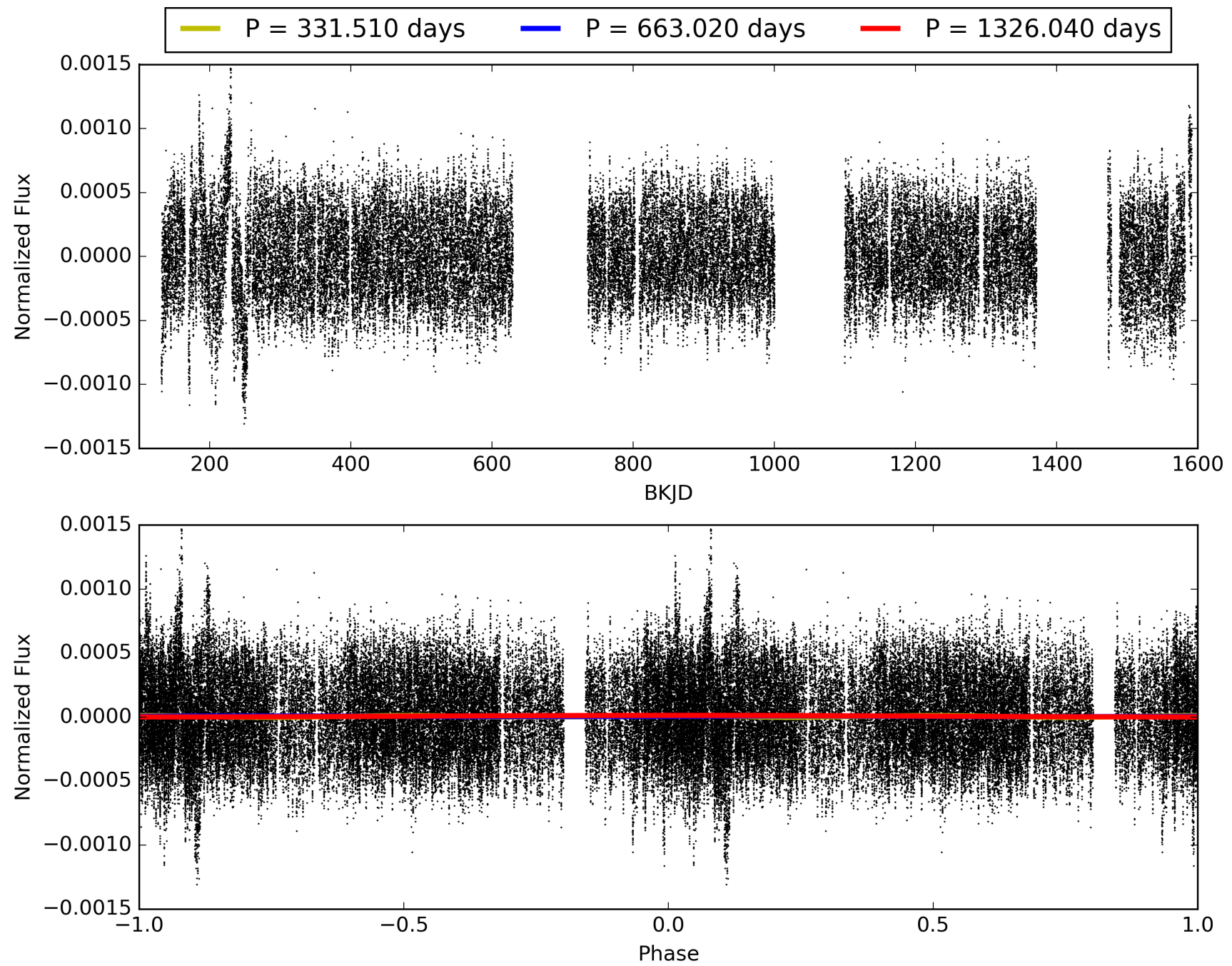


# TCE 010989345-02, PDC Light Curves





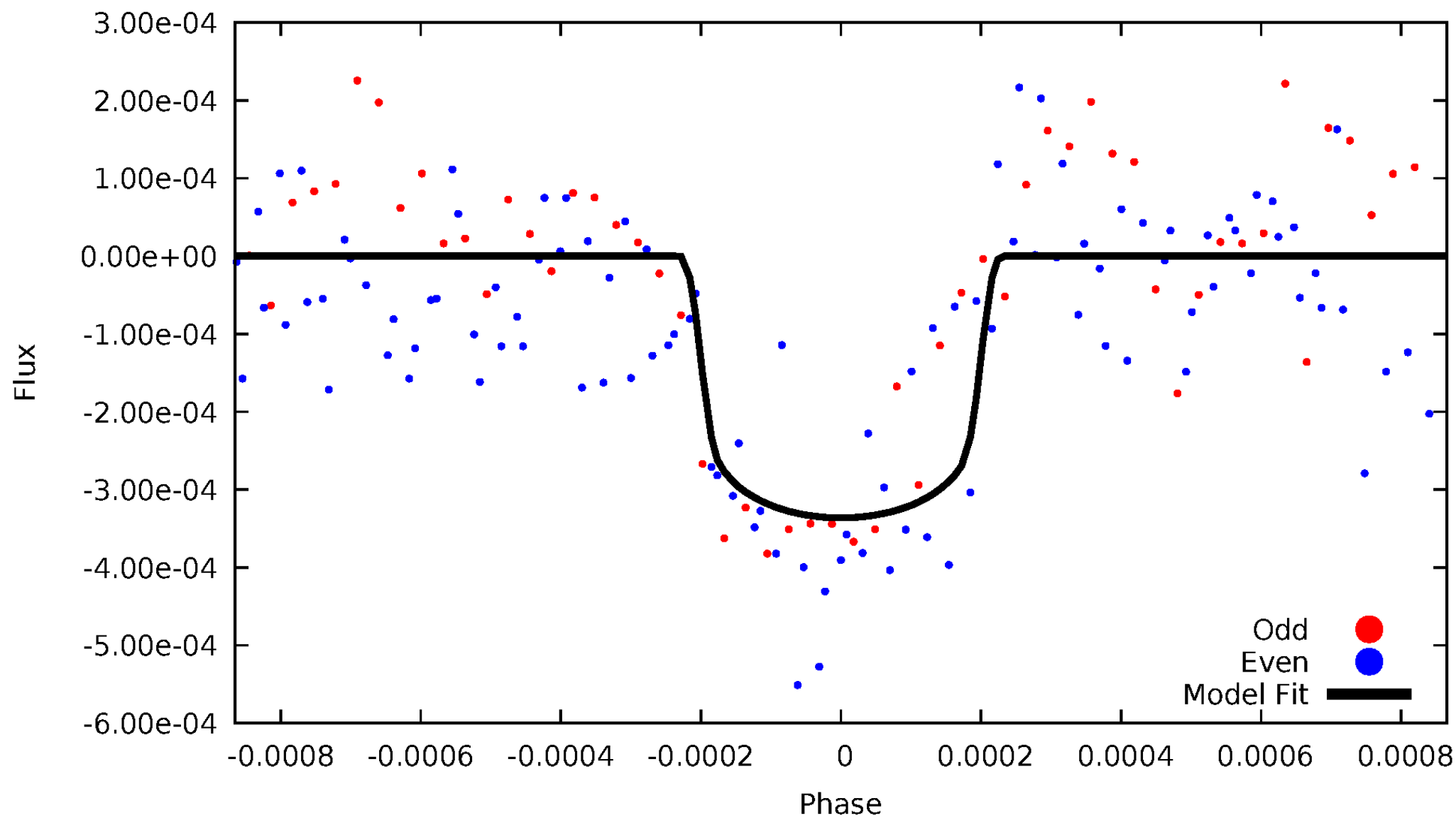
TCE 010989345-02





# DV Odd/Even

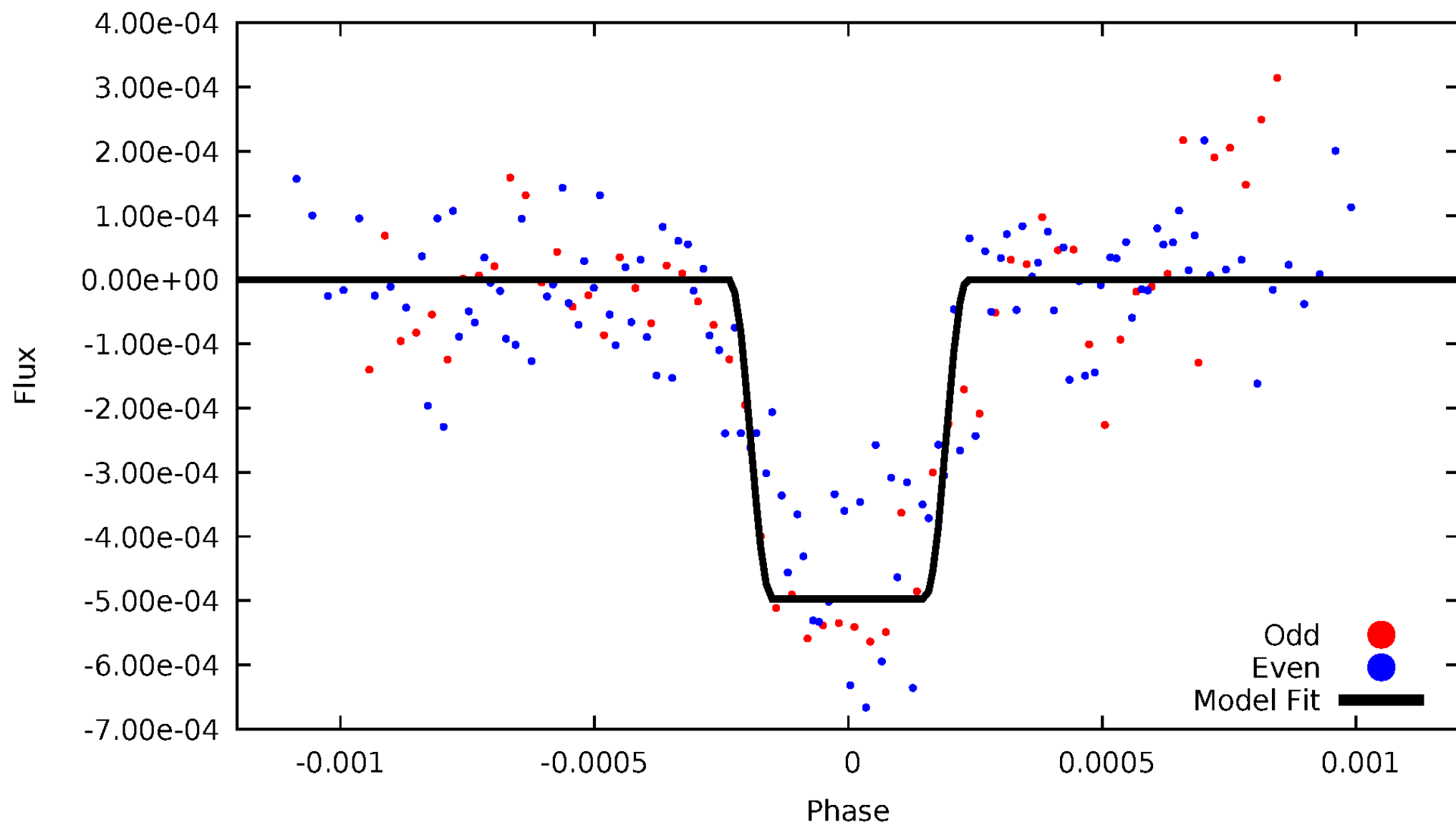
TCE 010989345-02





# ALT Odd/Even

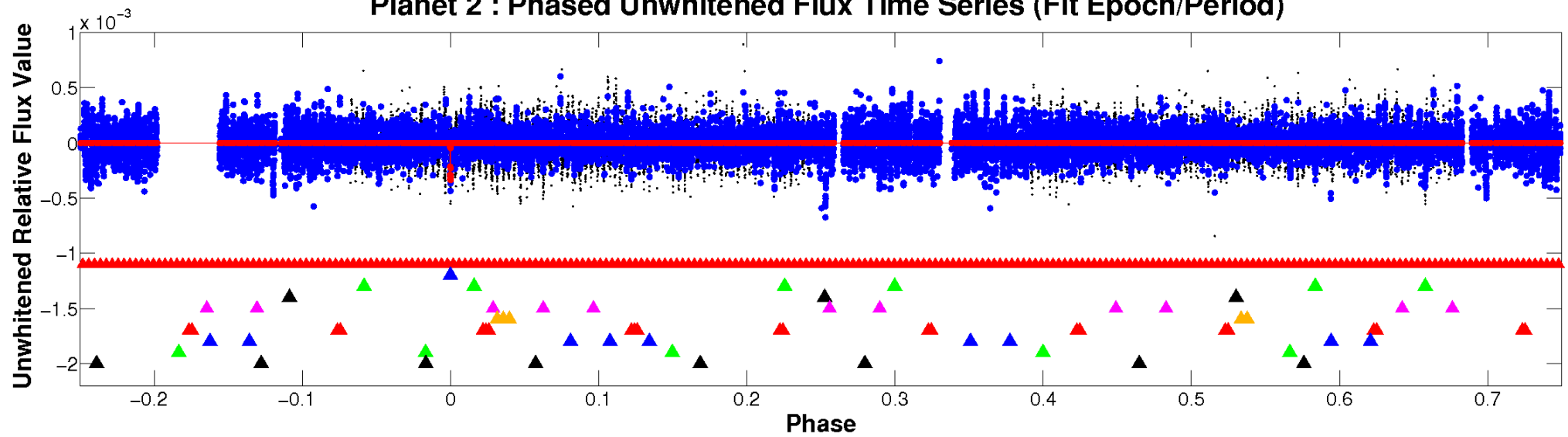
TCE 010989345-02



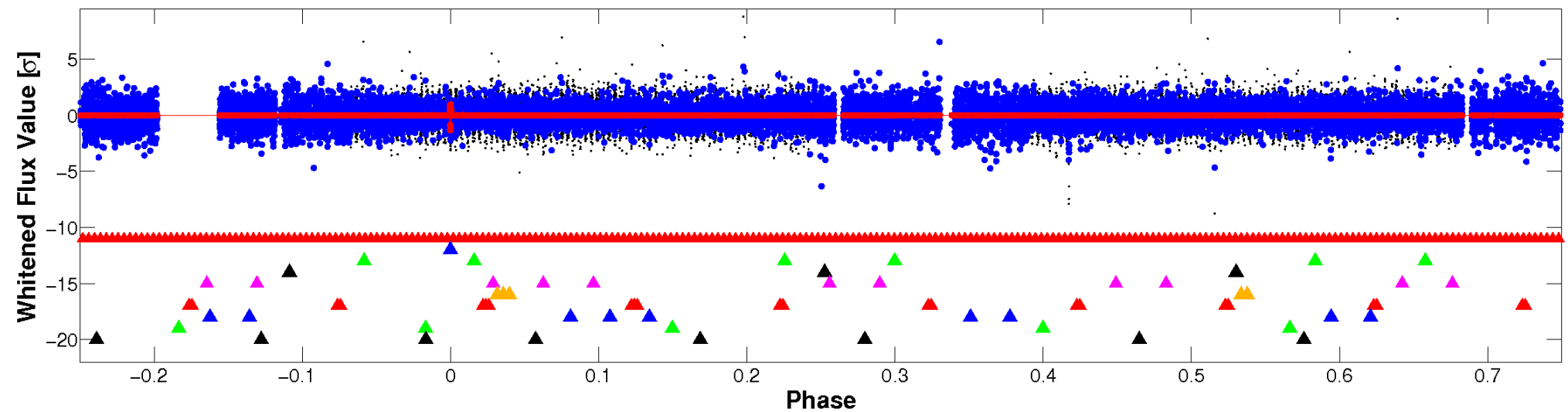


# Non-Whitened Vs. Whitened Light Curve

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



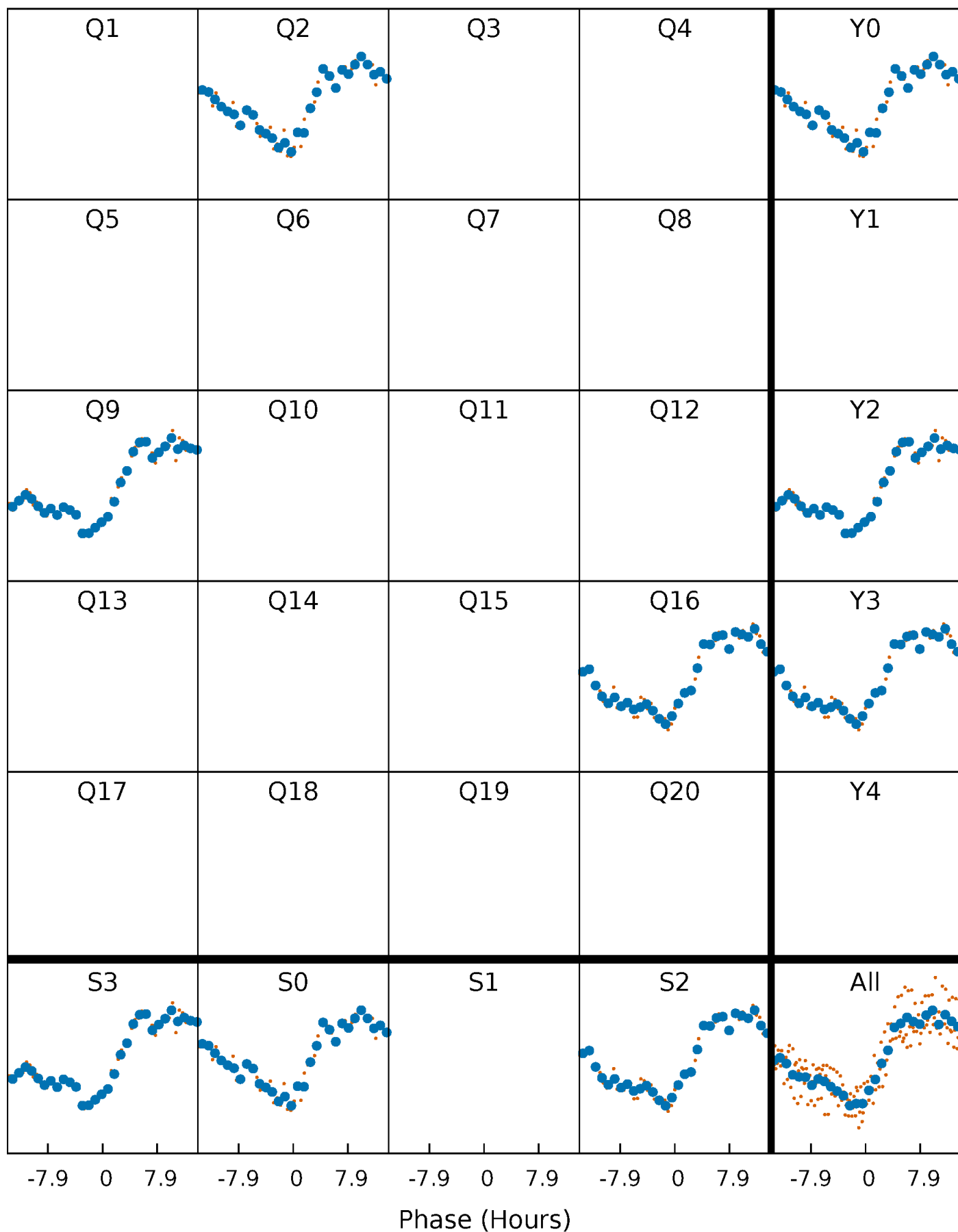
## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)





# PDC Quarter-Phased Transit Curves

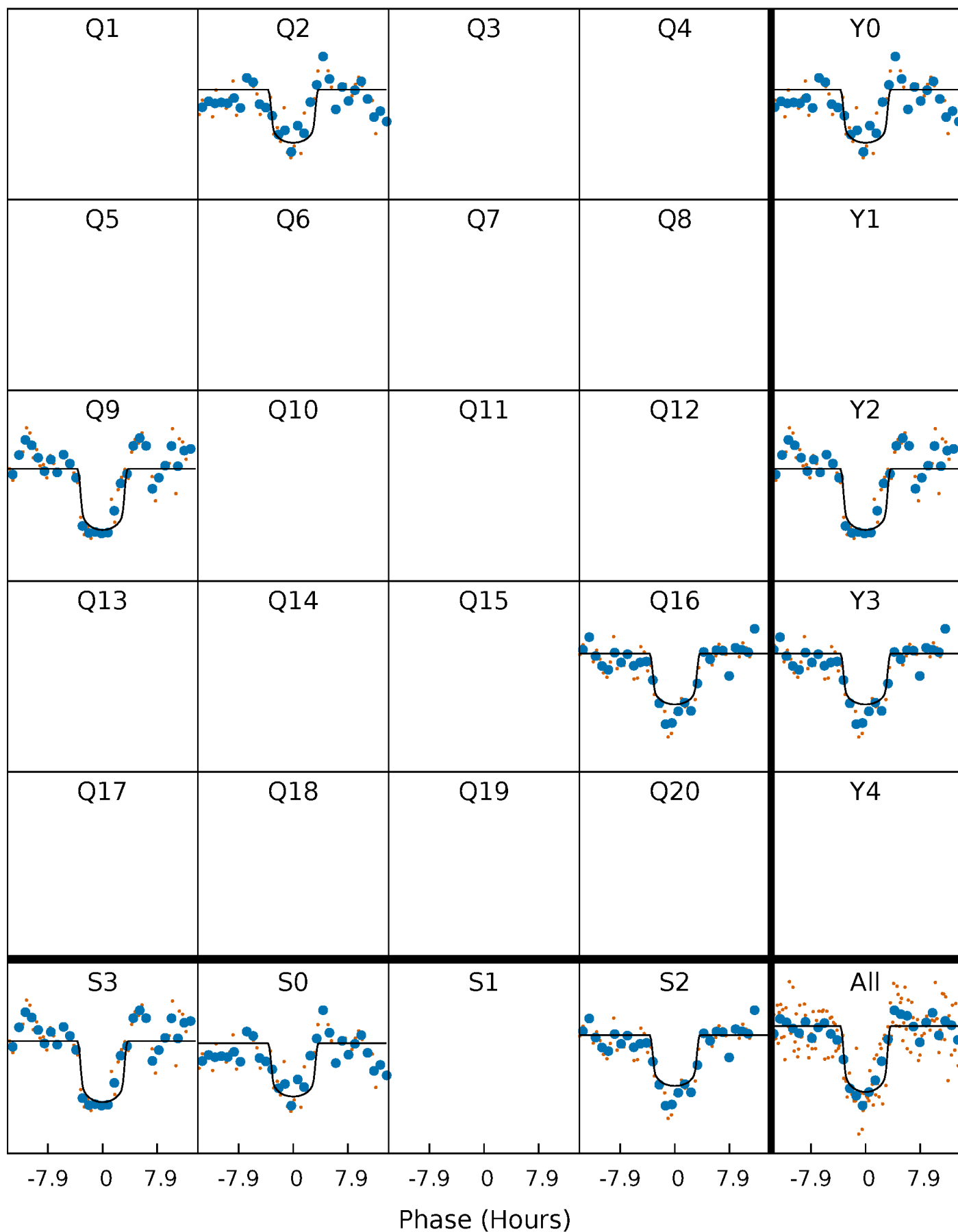
TCE 010989345-02     $P=663.020155$  Days     $T_0=176.584259$  (BKJD)





# DV Quarter-Phased Transit Curves

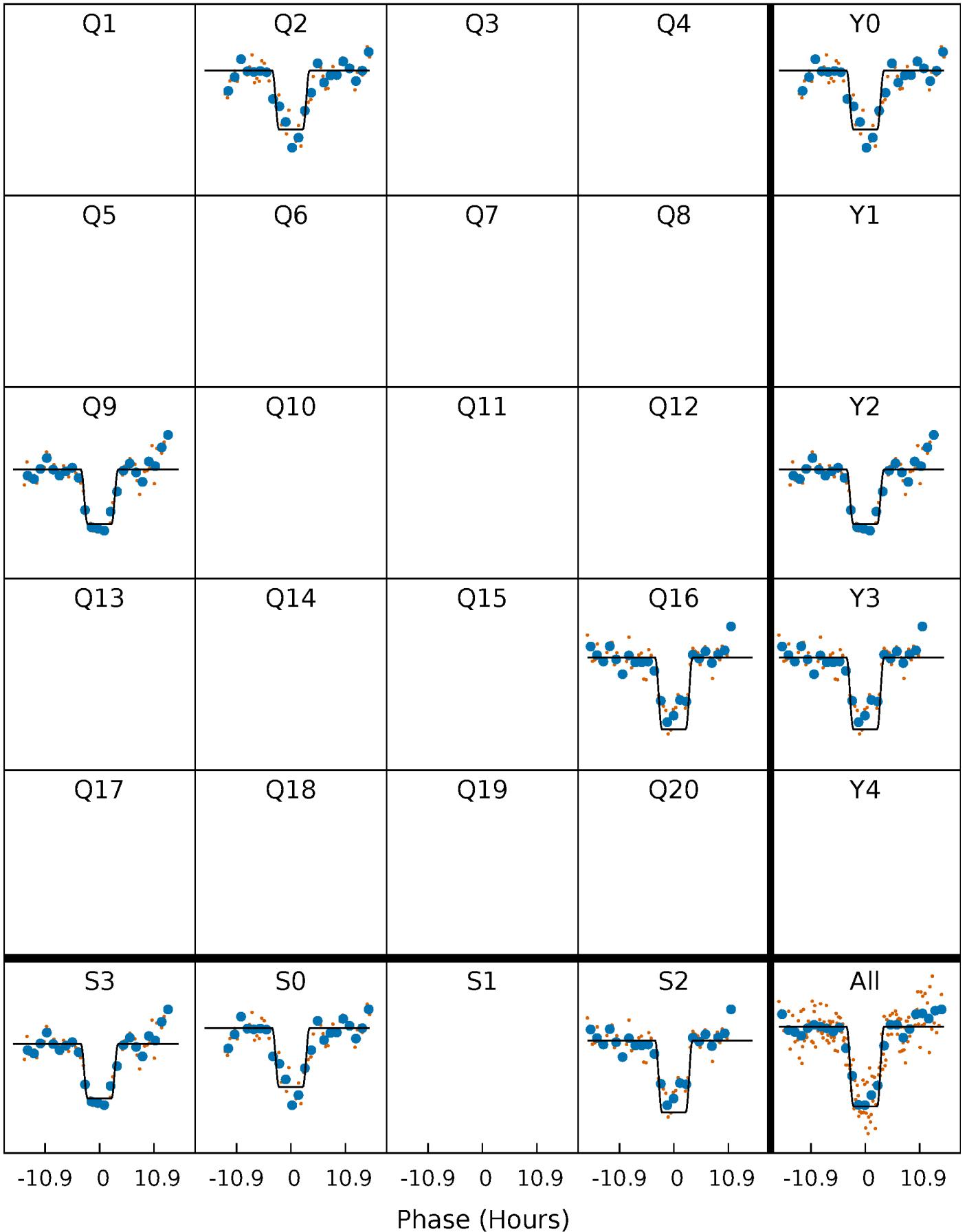
TCE 010989345-02     $P=663.020155$  Days     $T_0=176.584259$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

TCE 010989345-02 P=663.041777 Days  $T_0=176.546237$  (BKJD)

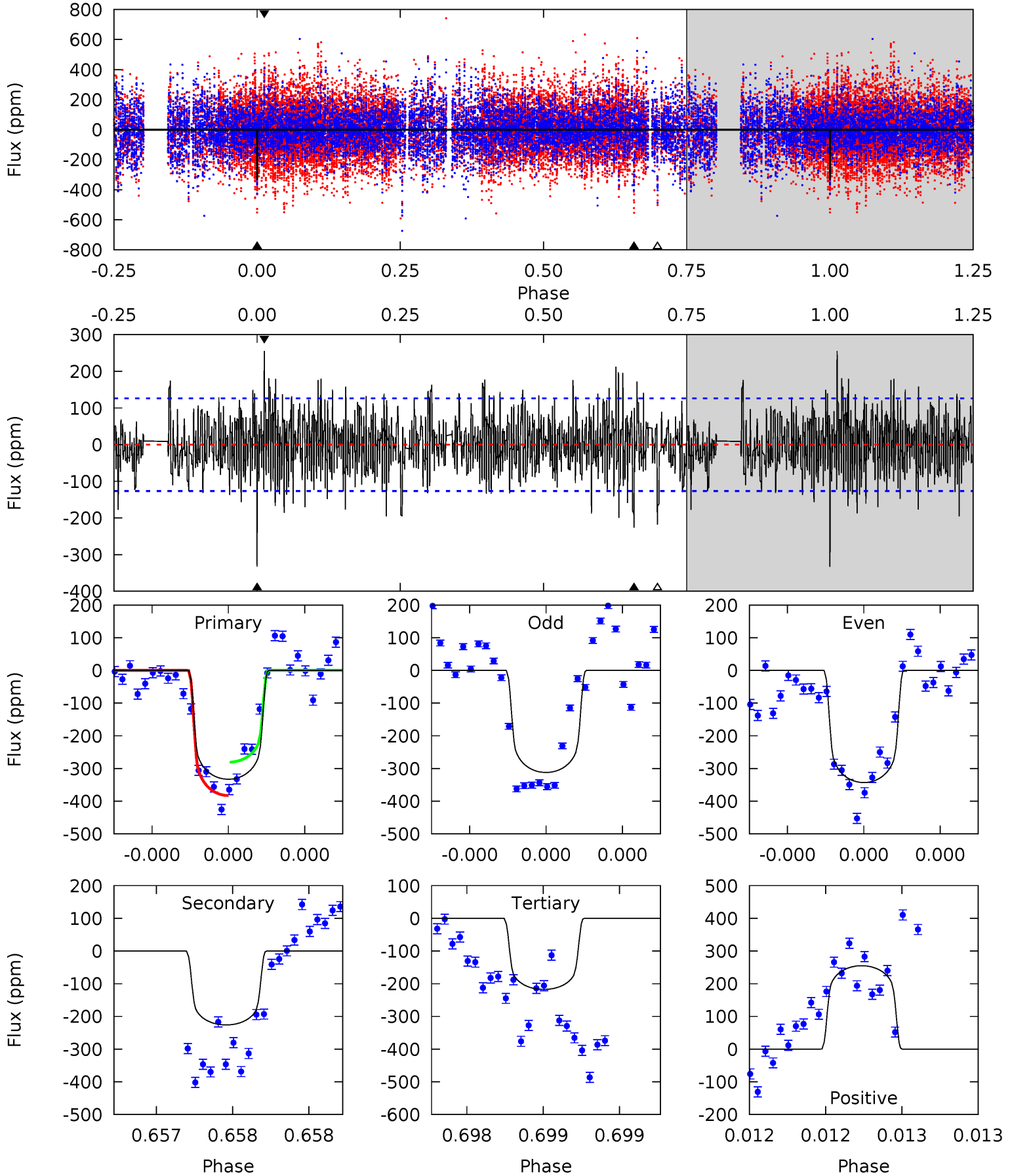




# DV Model-Shift Uniqueness Test

010989345-02, P = 663.020155 Days, E = 176.584259 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
14.7	10.0	9.63	11.3	5.60	3.51	2.77	5.11	3.45	0.38	-1.28	0.65	1.07	0.43	2.27

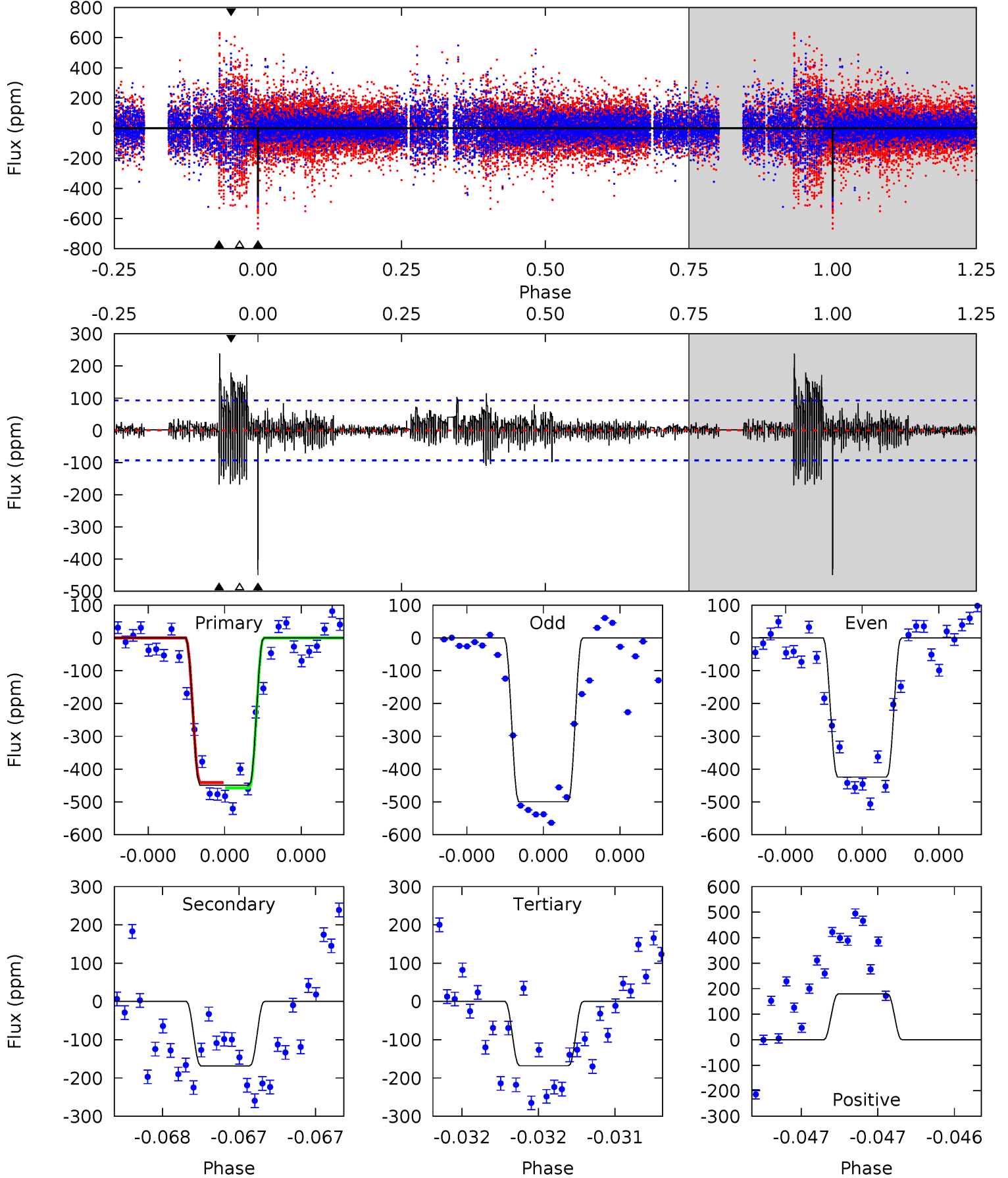




# Alt Model-Shift Uniqueness Test

010989345-02, P = 663.041777 Days, E = 176.546237 Days

Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
26.9	10.1	10.1	10.8	5.59	3.50	1.89	16.8	16.1	0.02	-0.69	2.21	0.93	0.35	0.48





### Stellar Parameters For KIC 010989345

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6441^{+181}_{-227}$	$4.108^{+0.286}_{-0.154}$	$-0.440^{+0.300}_{-0.300}$	$1.504^{+0.421}_{-0.463}$	$1.056^{+0.177}_{-0.133}$	$0.438^{+0.795}_{-0.185}$
	+3%/-4%	+7%/-4%	+68%/-68%	+28%/-31%	+17%/-13%	+182%/-42%
Source	PHO54	PHO54	PHO54	DSEP		

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

### Secondary Eclipse Parameters for KIC 010989345-02 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-226 \pm 23$	$3.02^{+0.69}_{-0.64}$	$389^{+29}_{-32}$	$5736^{+503}_{-391}$	$32188^{+18306}_{-11199}$
Alt.	$-168 \pm 17$	$3.58^{+0.70}_{-0.73}$	$388^{+33}_{-35}$	$4970^{+351}_{-267}$	$17112^{+9296}_{-5261}$

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



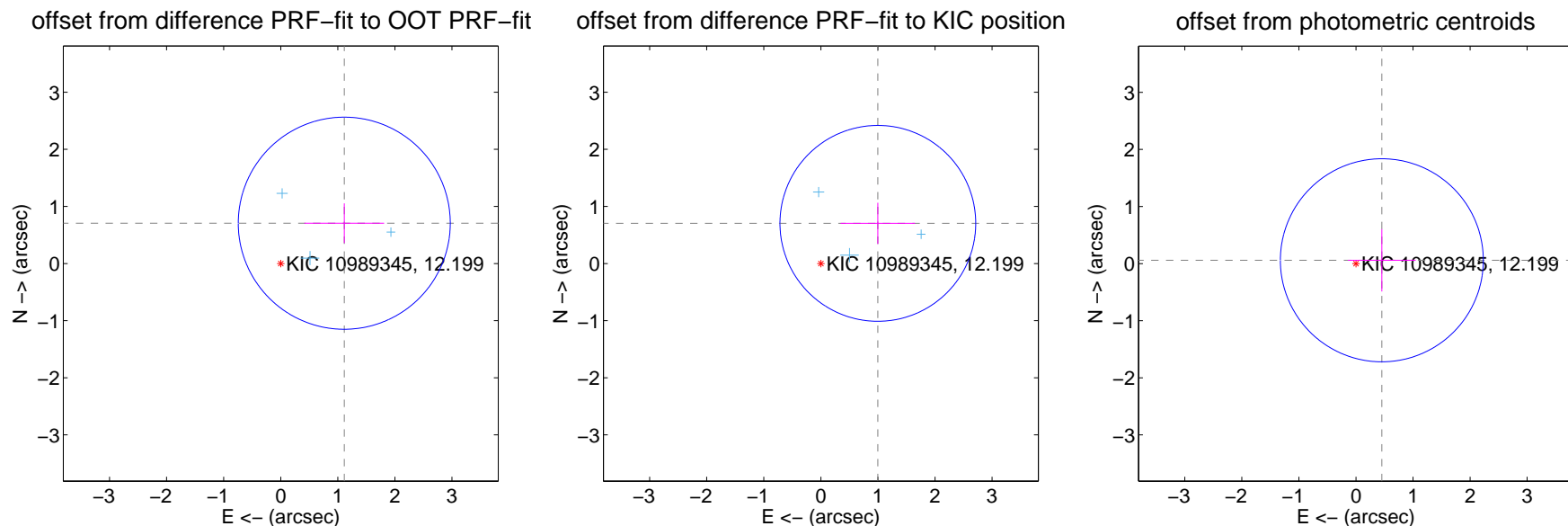
## DV Centroid Data

Supplemental centroid analysis for 010989345-02. Kepler magnitude: 12.20. Transit SNR 8.49

There are 3 quarters with good PRF difference image offsets

The direct PRF centroid is offset from the target star catalog position by about 0.05 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.318 \pm 0.619$	2.13	$-1.113 \pm 0.699$	$0.706 \pm 0.348$
PRF-fit source offset from KIC position	$1.221 \pm 0.572$	2.14	$-0.998 \pm 0.651$	$0.703 \pm 0.361$
photometric centroid source offset	$0.46 \pm 0.59$	0.77	$-0.45 \pm 0.59$	$0.06 \pm 0.55$

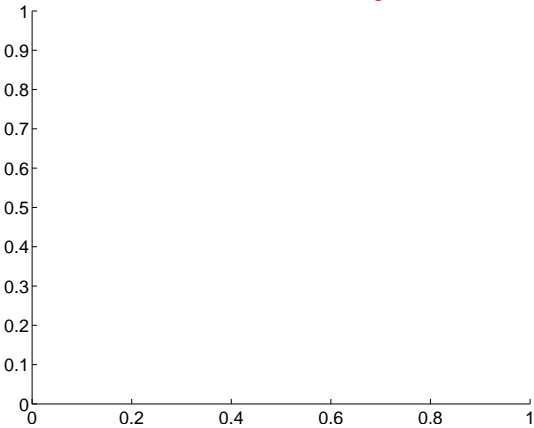


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

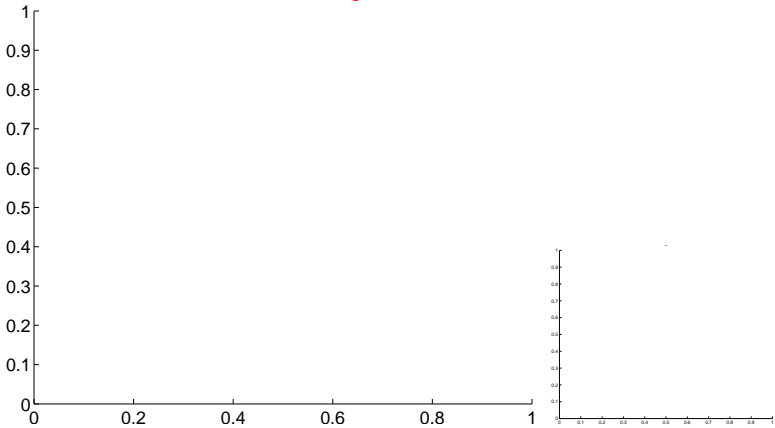


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

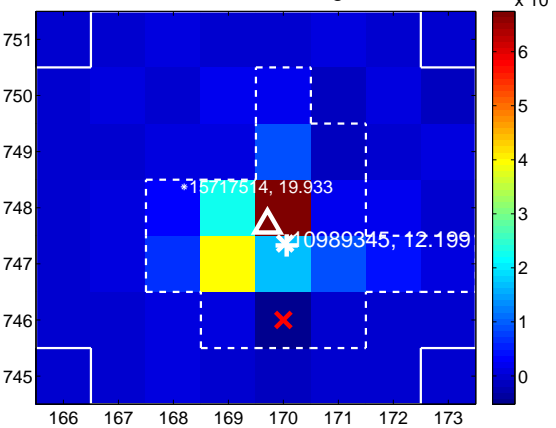
Q1 no difference image



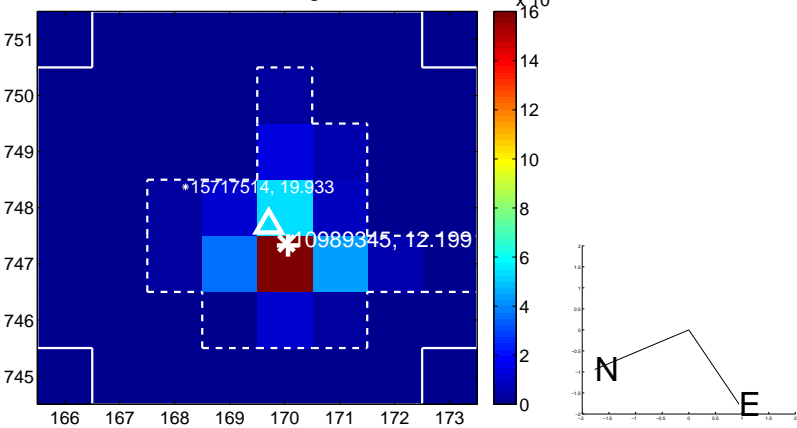
Q1 no OOT image



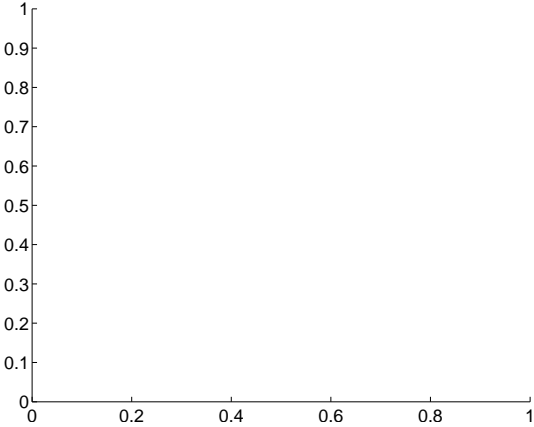
Q2 difference image



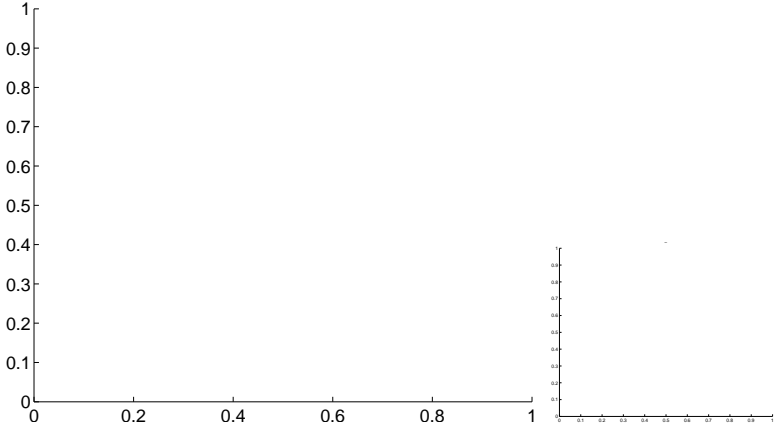
Q2 OOT image



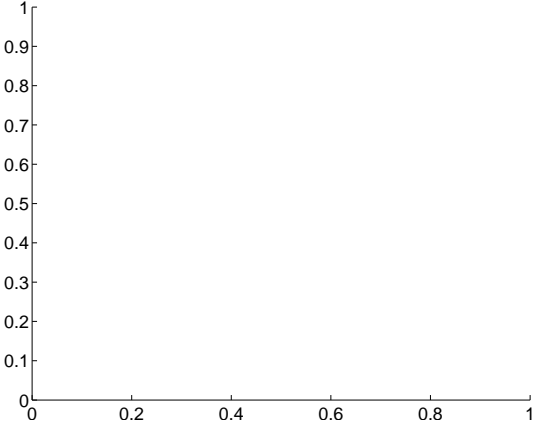
Q3 no difference image



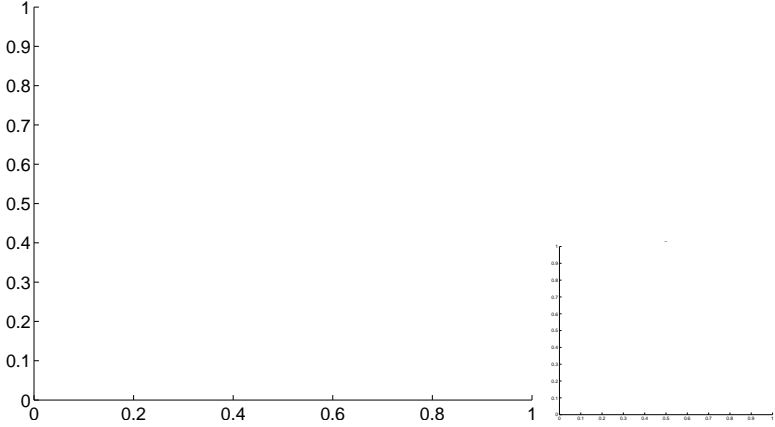
Q3 no OOT image



Q4 no difference image

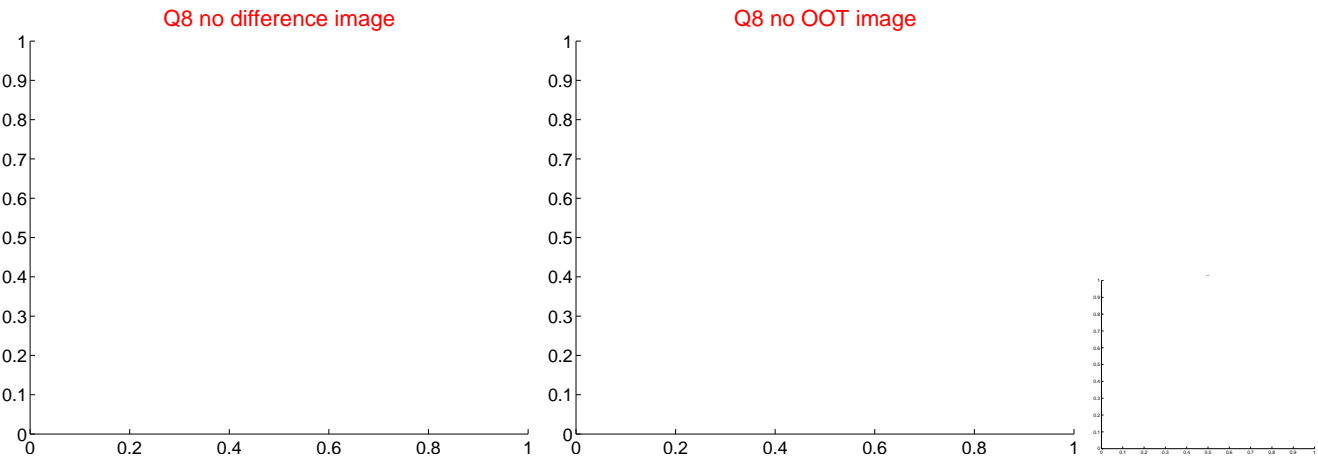
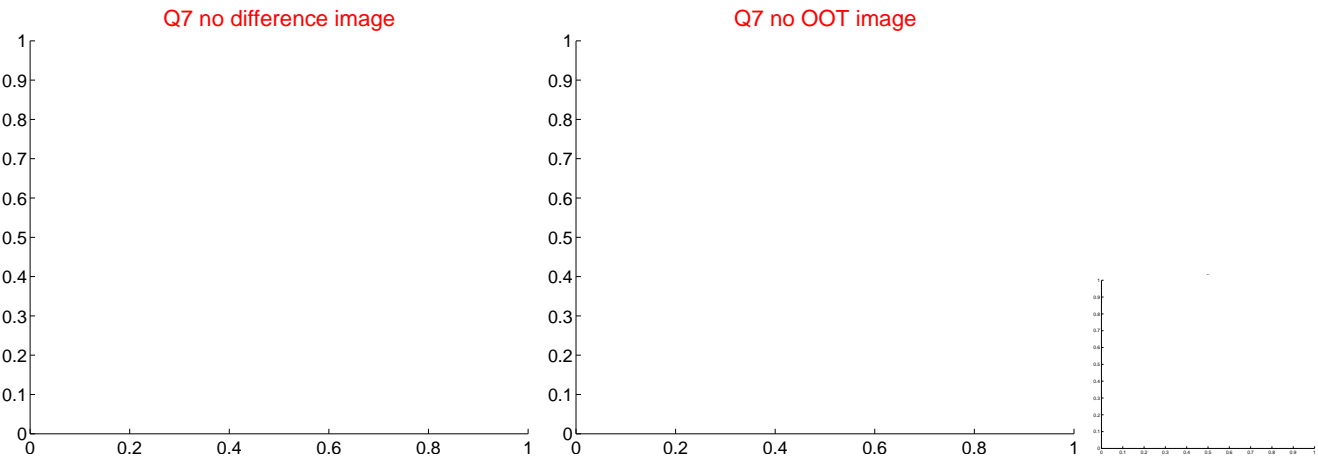
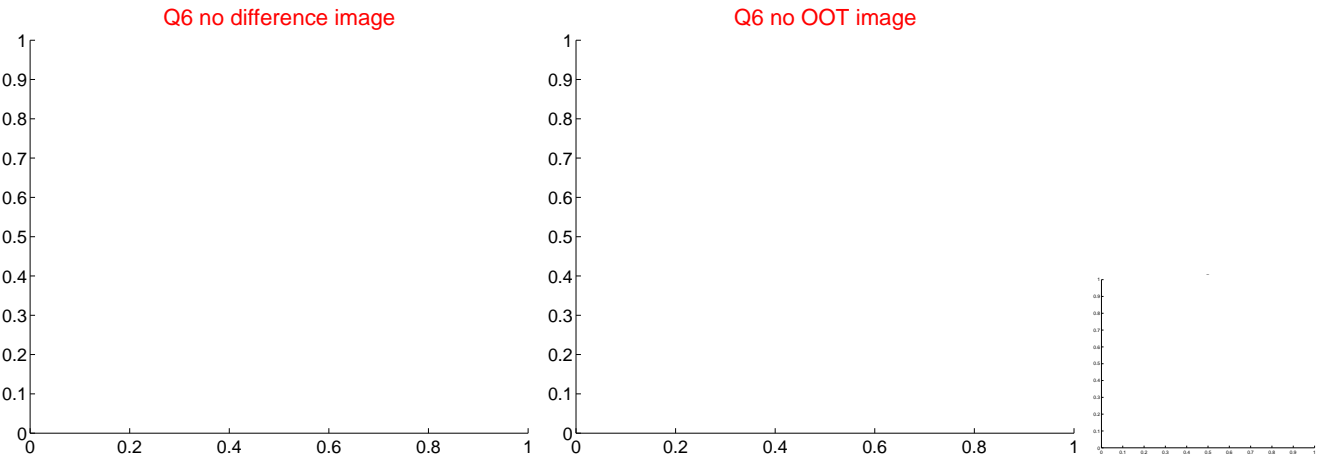
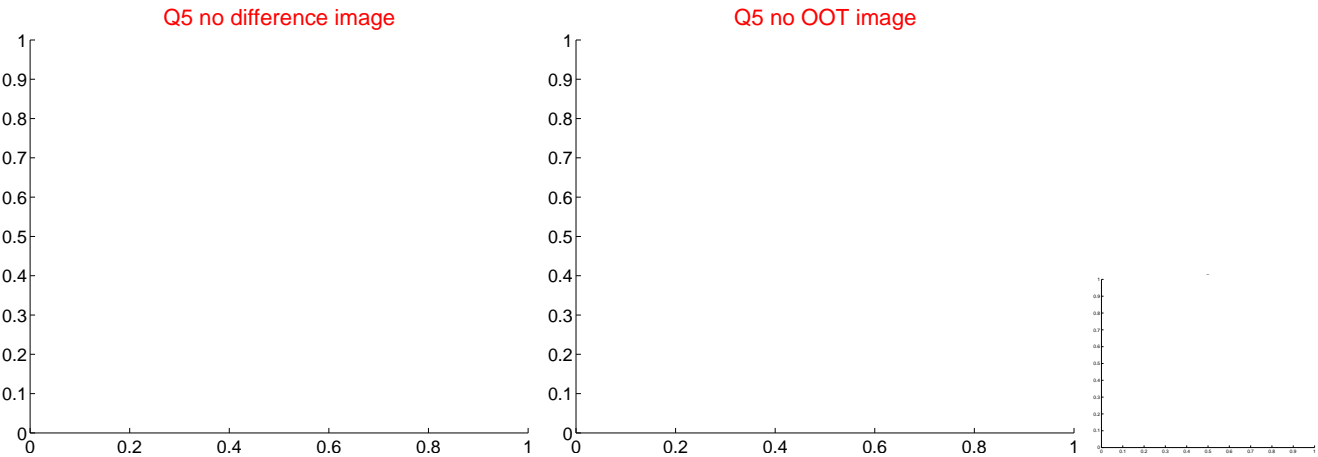


Q4 no OOT image



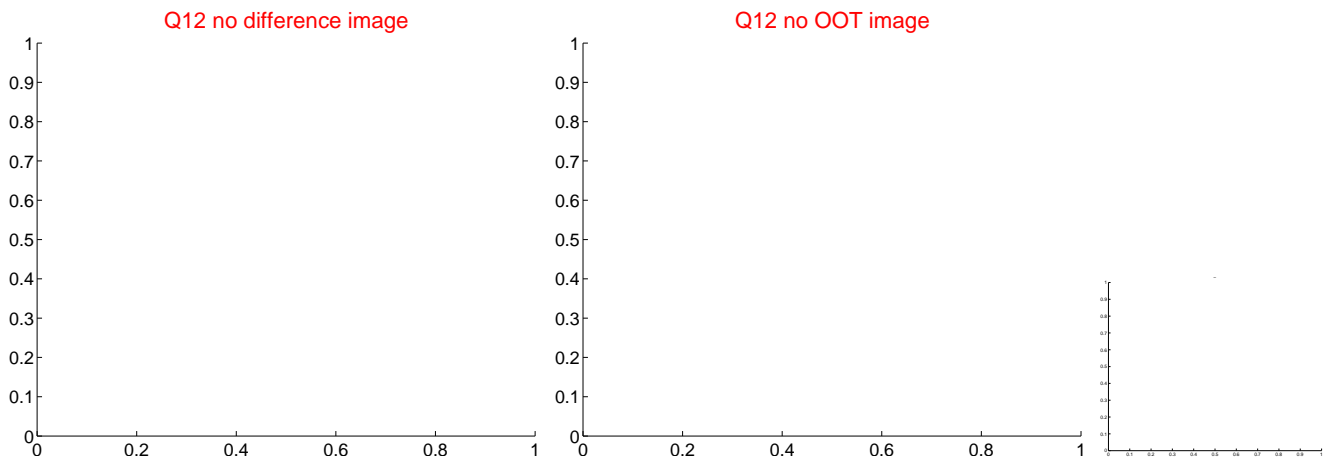
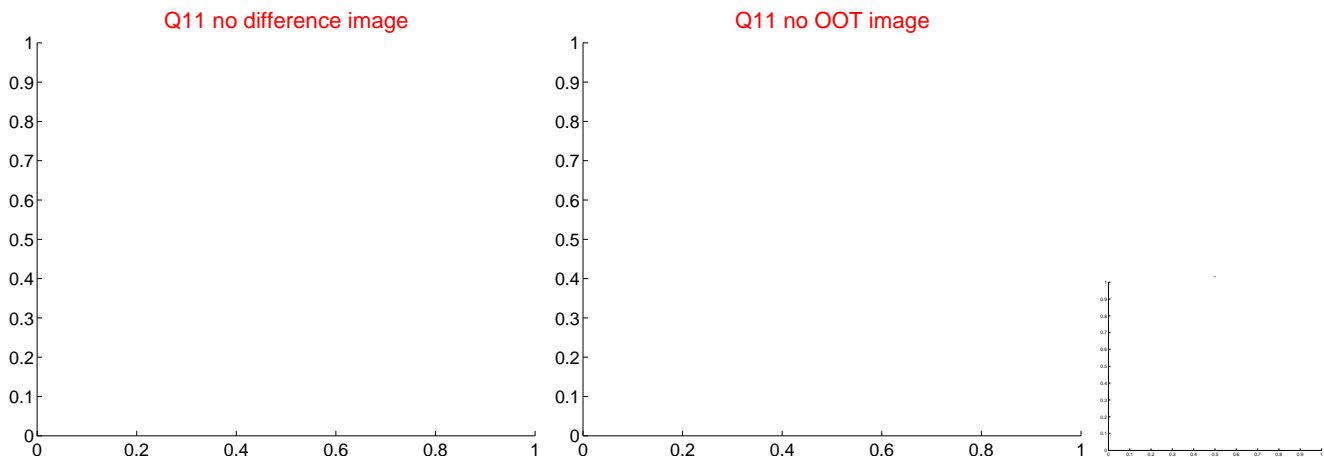
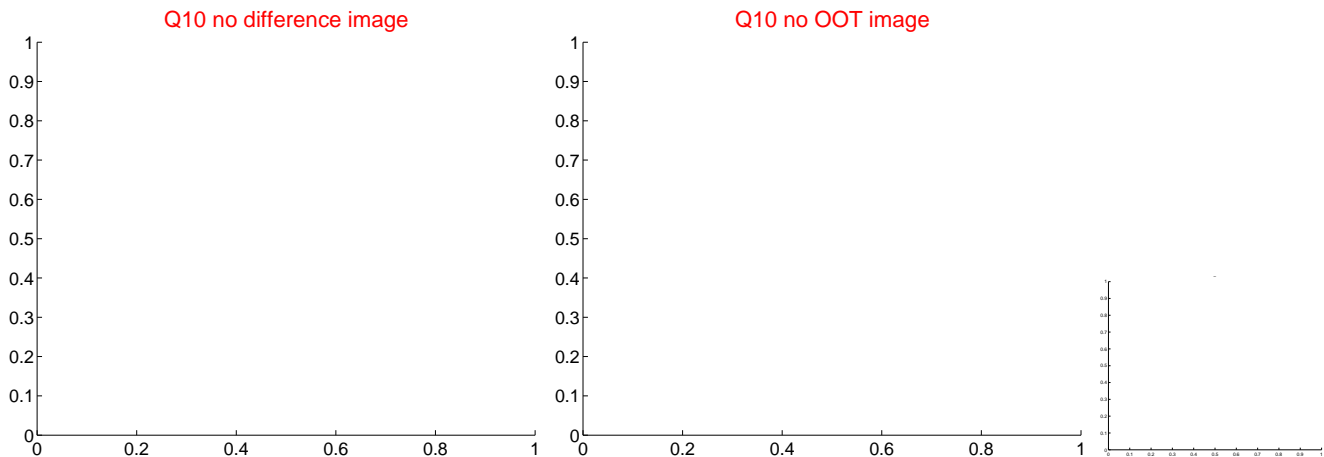
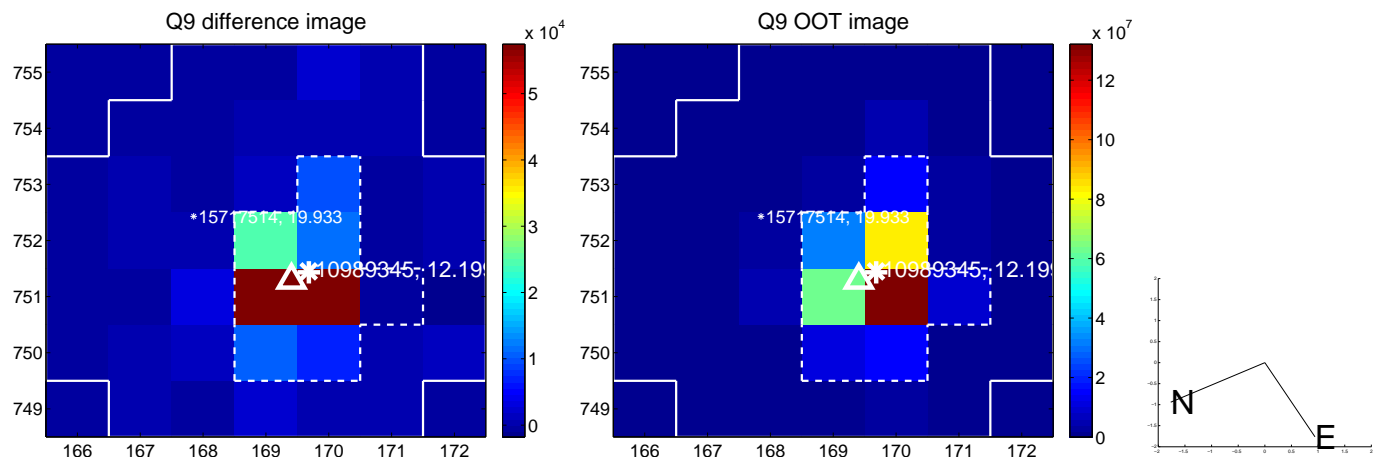


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



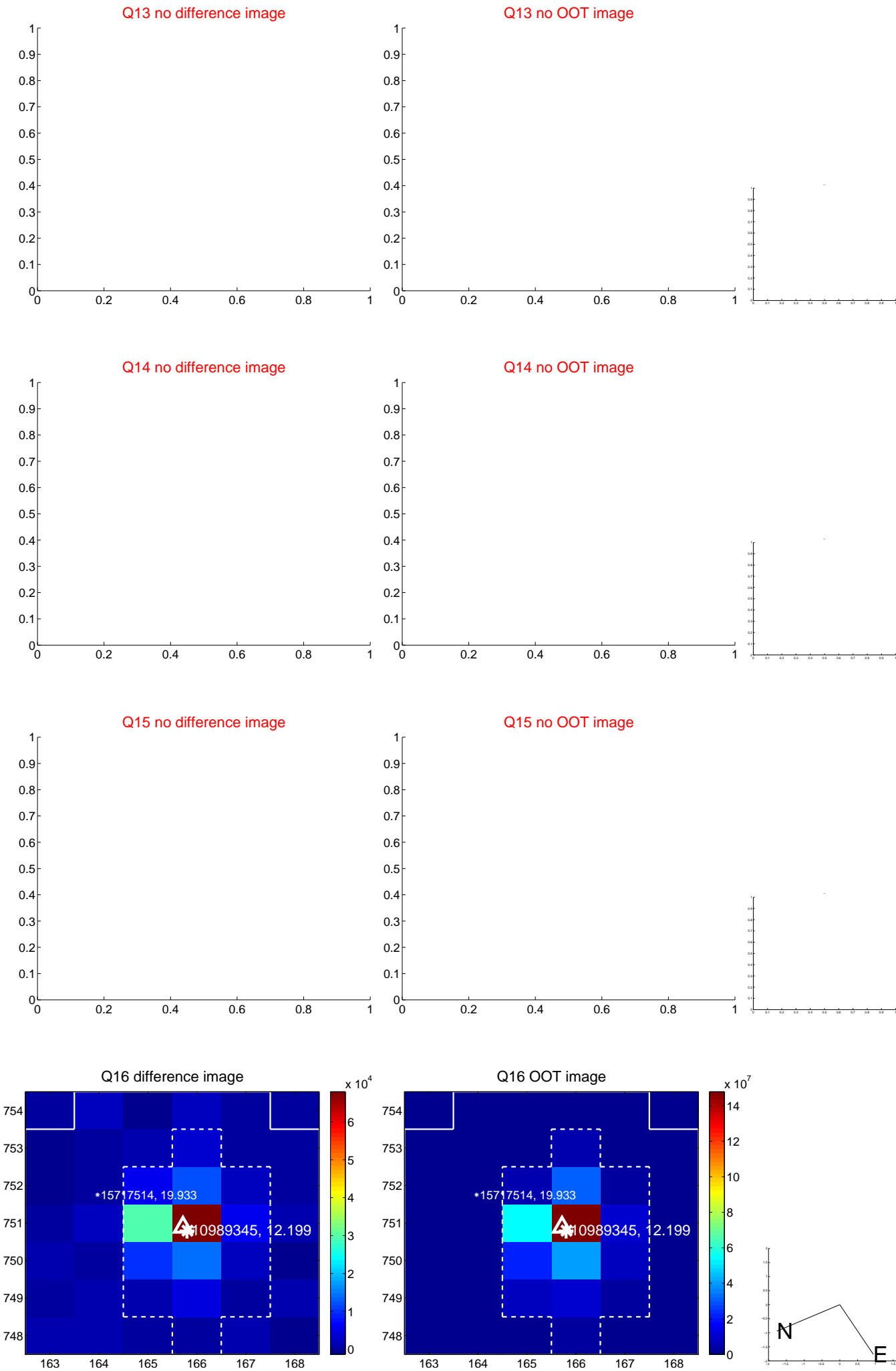


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



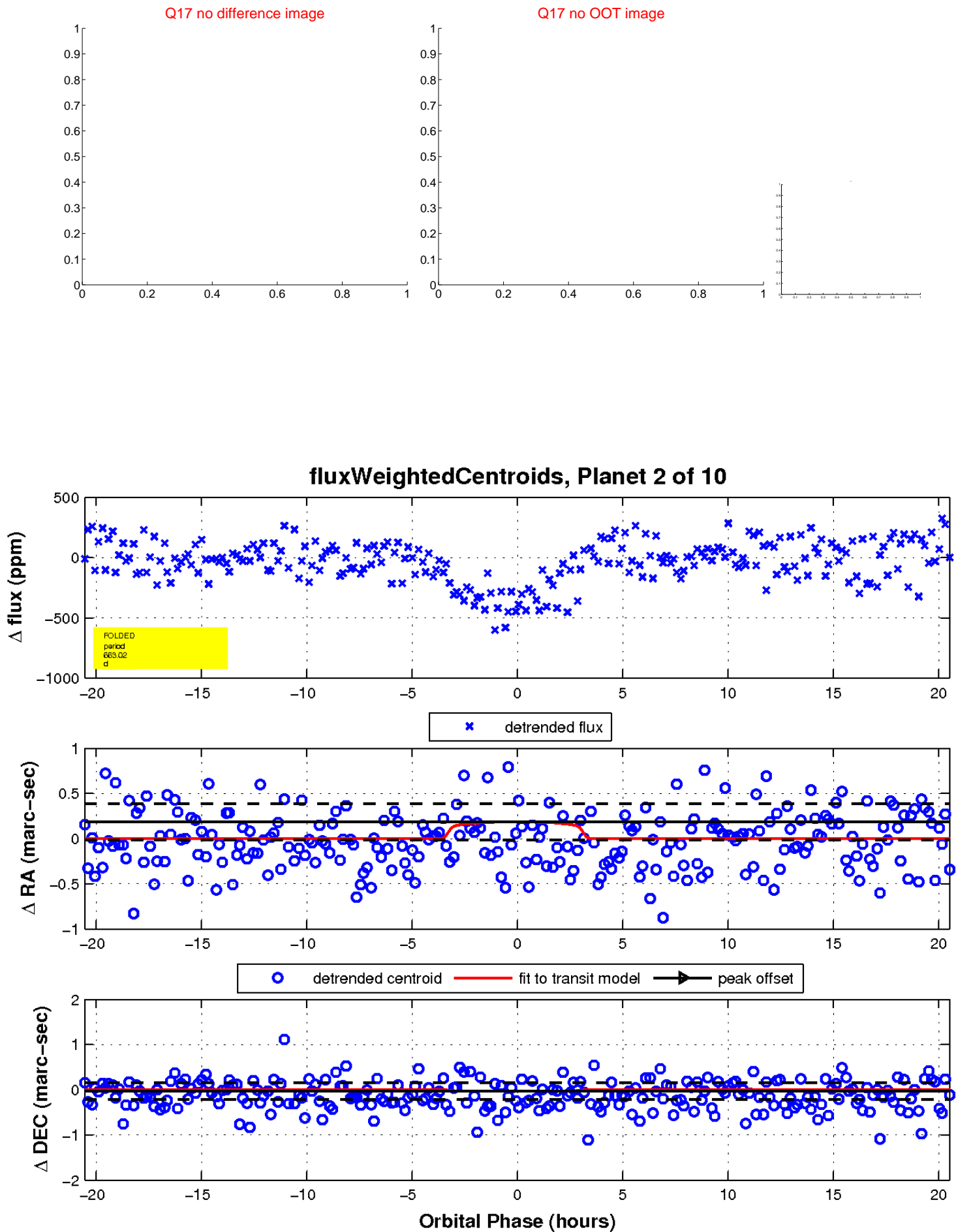


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





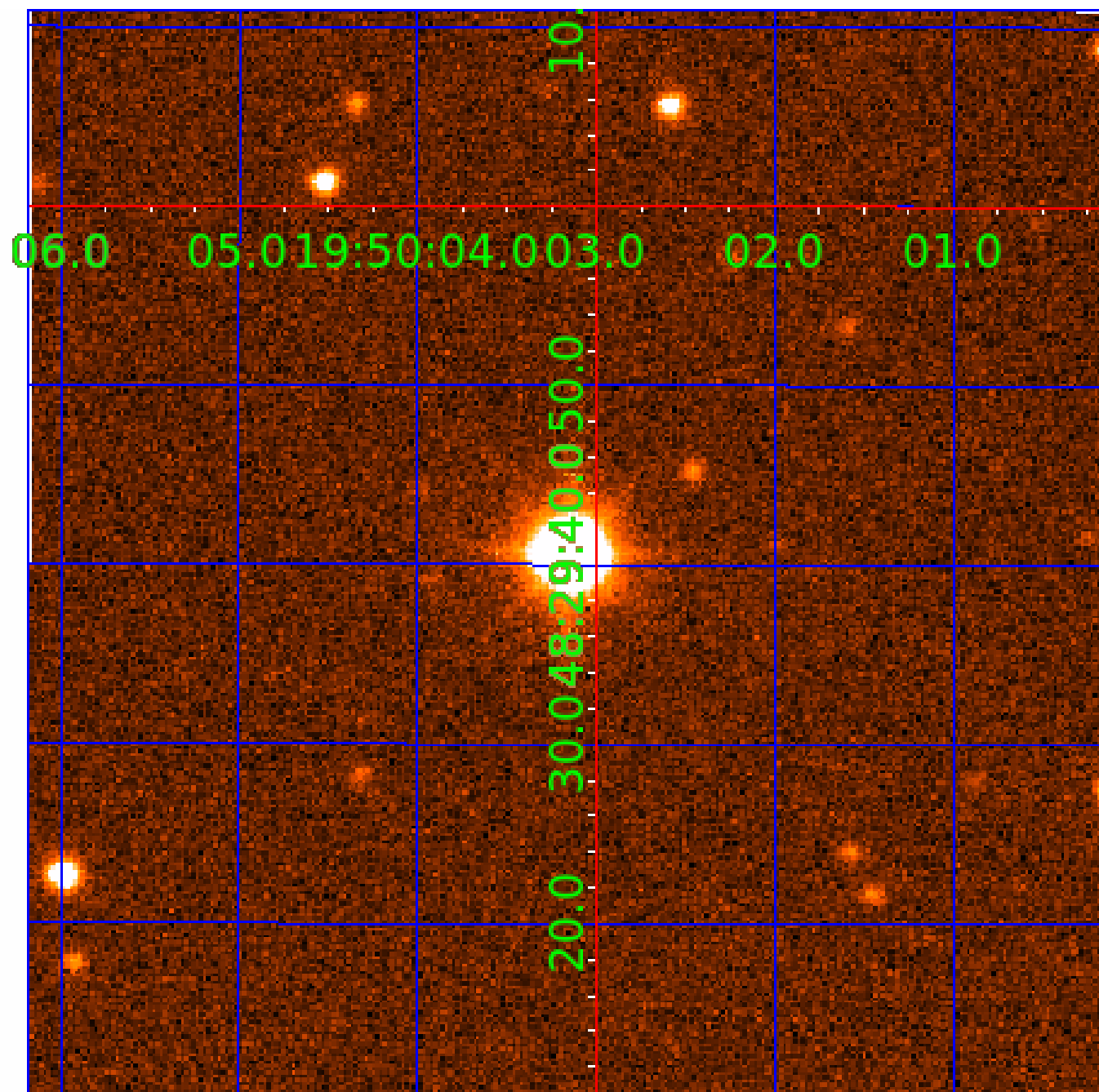
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





UKIRT Image

Declination





# KIC 010989345

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
010989345-01	OBS	No	2.630764	133.193244	10.6	11.138	8.7	2.7	1.50	6441	0.56	2414.15
010989345-02	OBS	No	663.020155	176.584259	336.4	6.883	8.0	8.5	1.50	6441	3.12	1.52
010989345-03	OBS	No	237.414043	326.142677	325.3	14.174	7.7	8.6	1.50	6441	3.39	5.96
010989345-04	OBS	No	423.567102	344.022902	722.4	35.026	7.8	7.8	1.50	6441	4.94	2.76
010989345-05	OBS	No	128.115026	240.564541	252.7	10.241	7.8	8.2	1.50	6441	2.77	13.57
010989345-07	OBS	No	66.433669	191.136166	129.6	13.221	7.4	5.2	1.50	6441	1.83	32.59
010989345-08	OBS	No	161.346431	265.595466	238.5	7.037	7.2	7.2	1.50	6441	4.56	9.98
010989345-09	OBS	No	276.296890	275.873517	375.6	30.069	7.9	7.5	1.50	6441	3.49	4.87
010989345-10	OBS	No	196.452793	165.569777	243.6	5.231	7.4	8.1	1.50	6441	3.04	7.68

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
010989345-01	OBS	FP	0.00	1	0	0	0	SWEET_NTL—LPP_DV—MOD_NONUNIQ_DV
010989345-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES—ALL_TRANS_CHASES—MOD_NONUNIQ_DV
010989345-03	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—HALO_GHOST
010989345-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
010989345-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—MOD_NONUNIQ_DV
010989345-07	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT
010989345-08	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT
010989345-09	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—CENT_FEW_DIFFS
010989345-10	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT

**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.

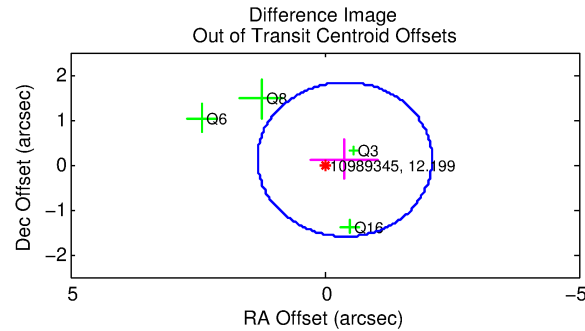
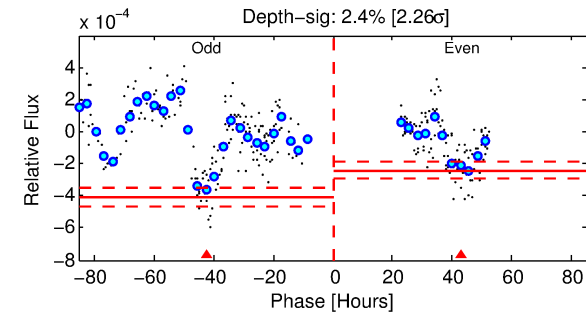
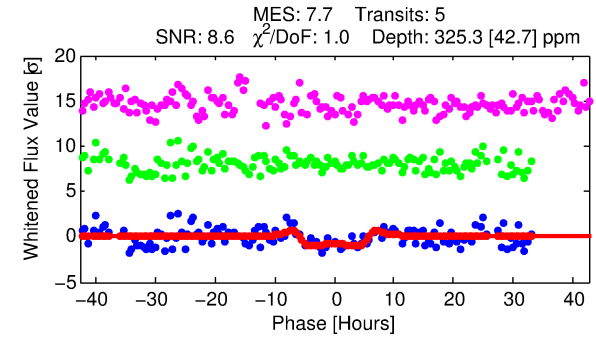
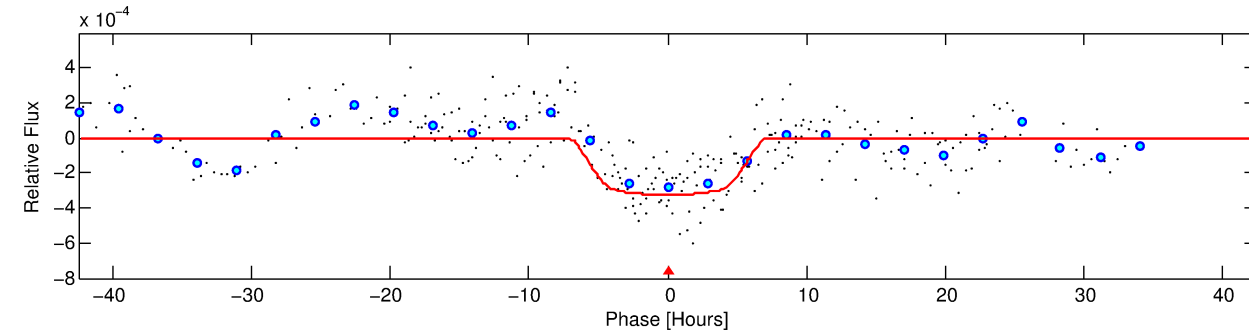
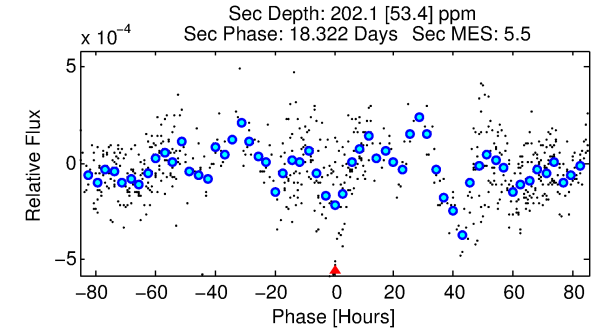
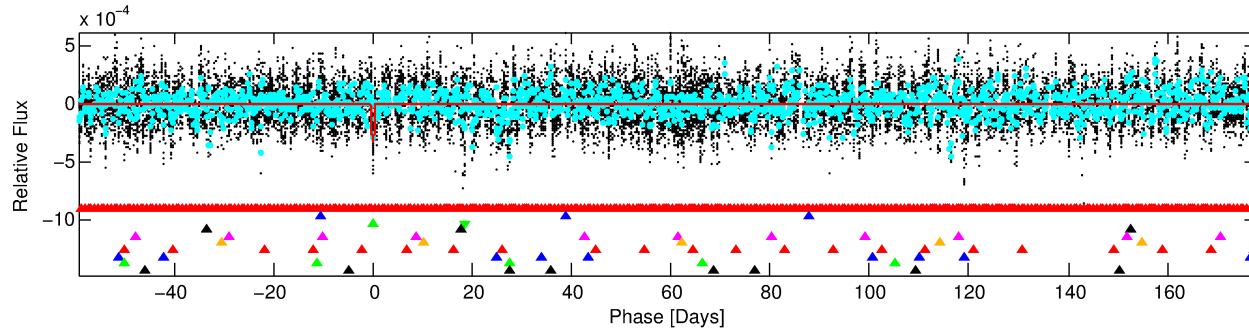
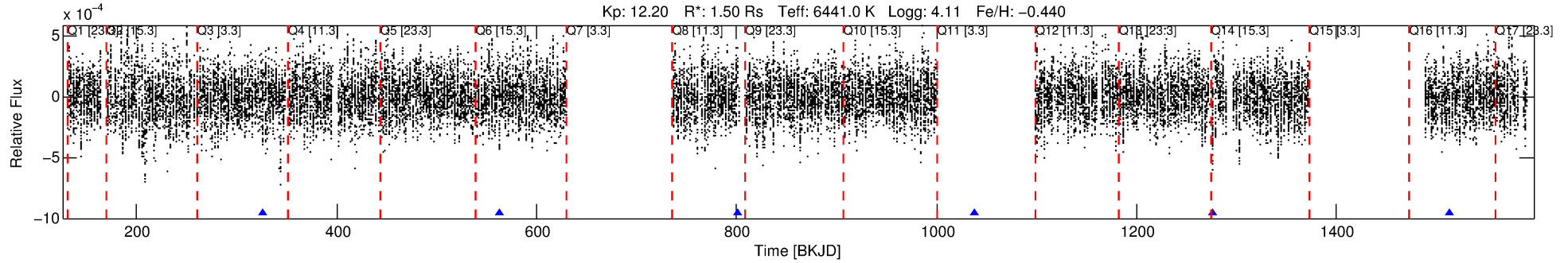
Ephemeris Match Information For 010989345-03

No Significant Match Found



# DV One-Page Summary

KIC: 10989345 Candidate: 3 of 10 Period: 237.414 d



## DV Fit Results:

Period = 237.41404 [0.00536] d  
Epoch = 326.1427 [0.0185] BKJD  
Rp/R\* = 0.0207 [0.0015]  
a/R\* = 45.25 [6.72]  
b = 0.96 [0.01]  
Seff = 5.96 [3.01]  
Teq = 398 [50] K  
Rp = 3.39 [1.07] Re  
a = 0.7648 [0.2298] AU  
Ag = 5647.05 [3225.57] [1.75 $\sigma$ ]  
Teffp = 5341 [445] K [11.03 $\sigma$ ]

## DV Diagnostic Results:

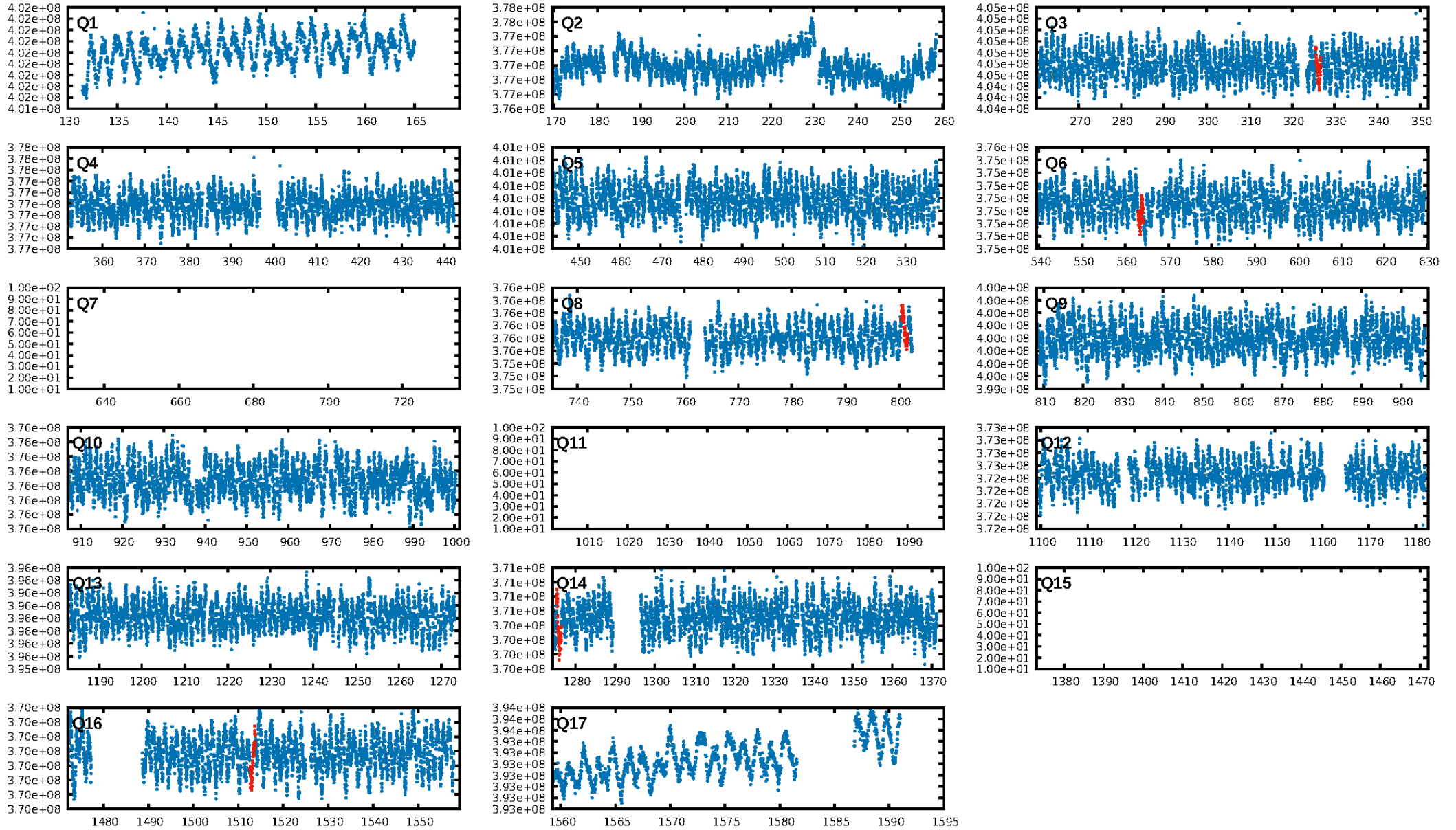
ShortPeriod-sig: 100.0% [65.07 $\sigma$ ]  
LongPeriod-sig: 100.0% [28.07 $\sigma$ ]  
ModelChiSquare2-sig: 3.0%  
ModelChiSquareGof-sig: 100.0%  
**Bootstrap-pfa: 2.29e-08**  
RollingBand-fgt: 1.00 [5/5]  
**GhostDiagnostic-chr: 0.1555**  
Centroid-sig: 1.6%  
Centroid-so: 0.784 arcsec [1.66 $\sigma$ ]  
OotOffset-rm: 0.412 arcsec [0.72 $\sigma$ ]  
OotOffset-st: 1/1/2/0 [4]  
KicOffset-rm: 0.377 arcsec [0.80 $\sigma$ ]  
KicOffset-st: 1/1/2/0 [4]  
DiffImageQuality-fgm: 0.75 [3/4]  
DiffImageOverlap-fno: 0.00 [0/4]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 03:39:57 Z

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

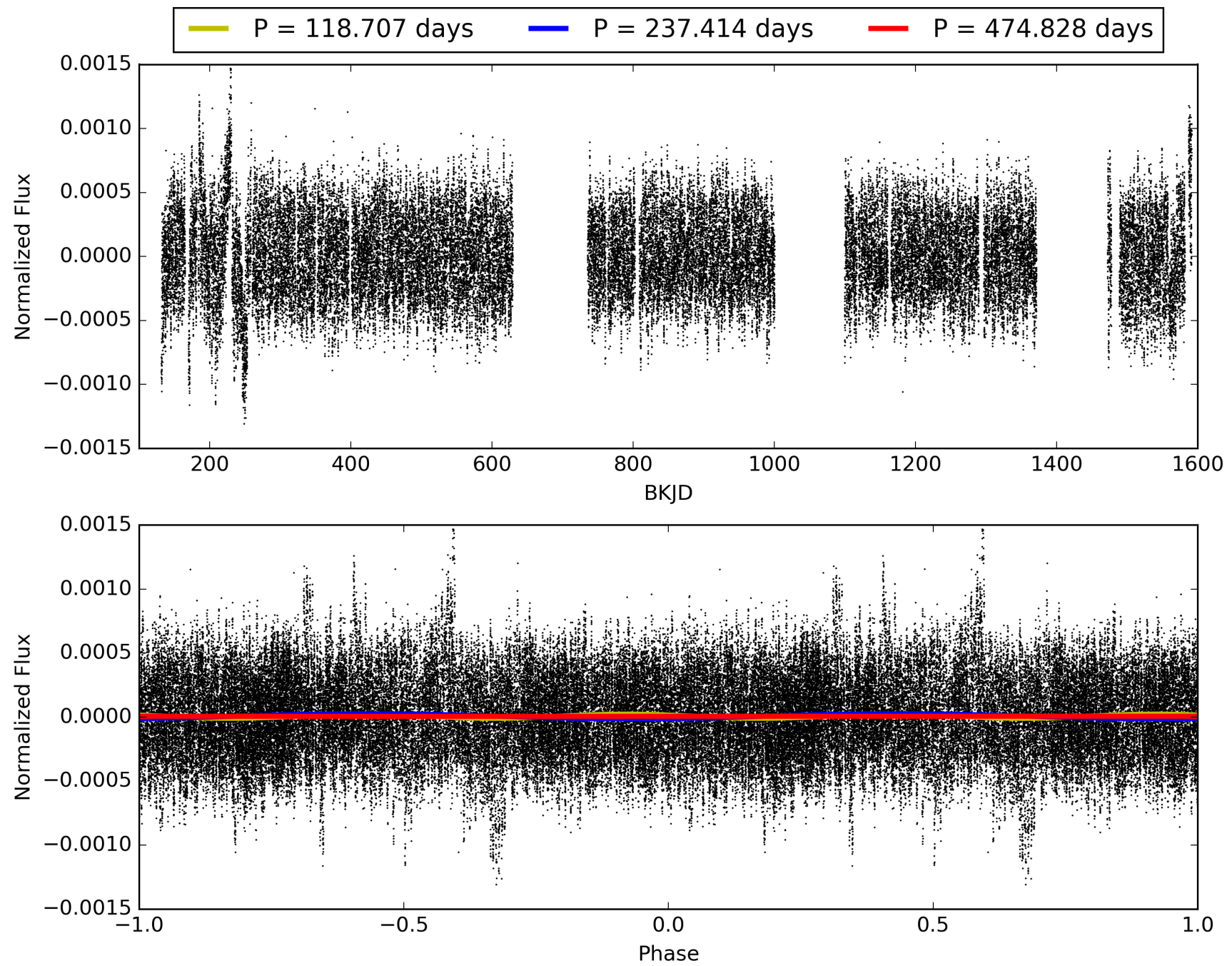


# TCE 010989345-03, PDC Light Curves





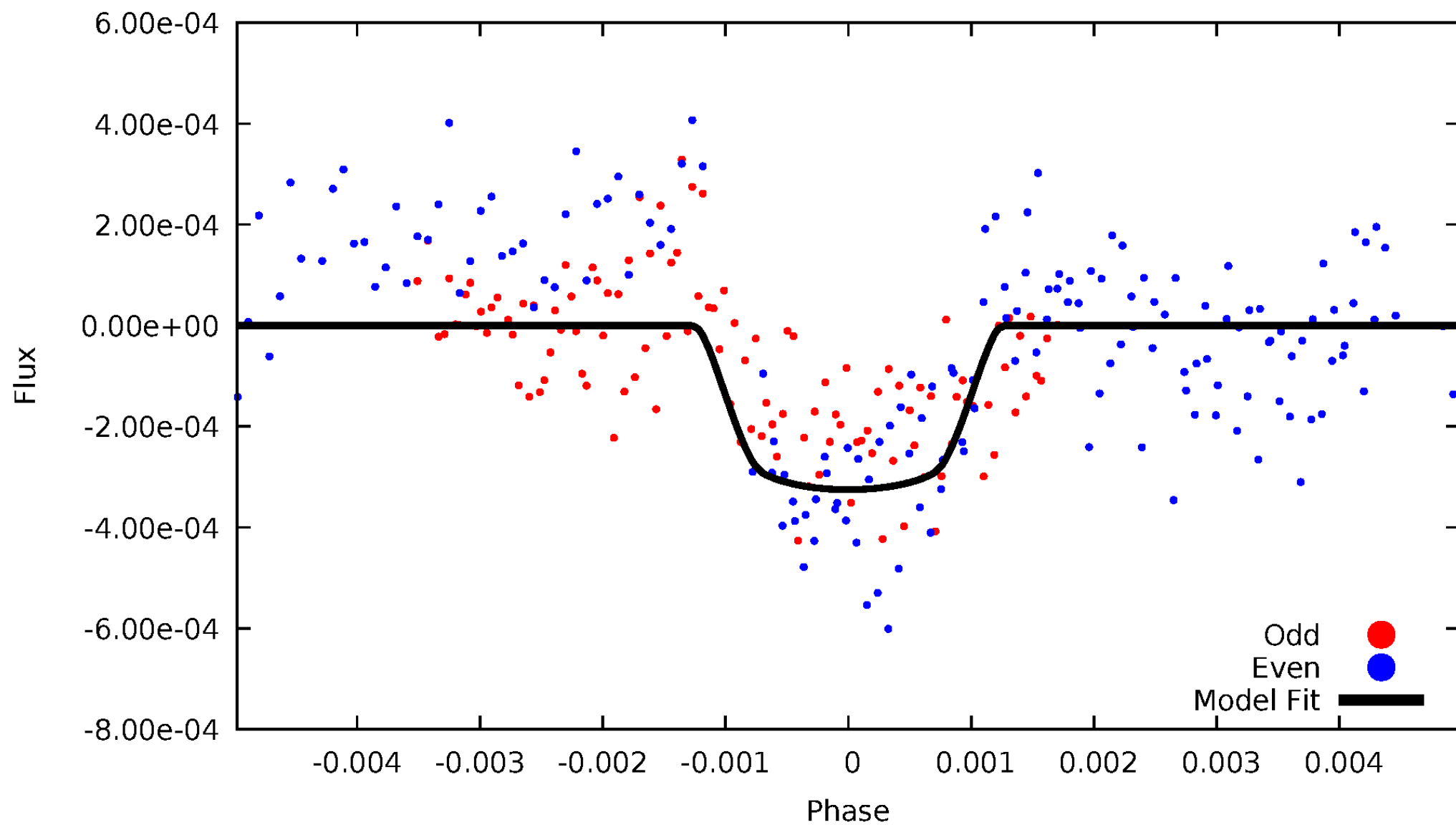
TCE 010989345-03





# DV Odd/Even

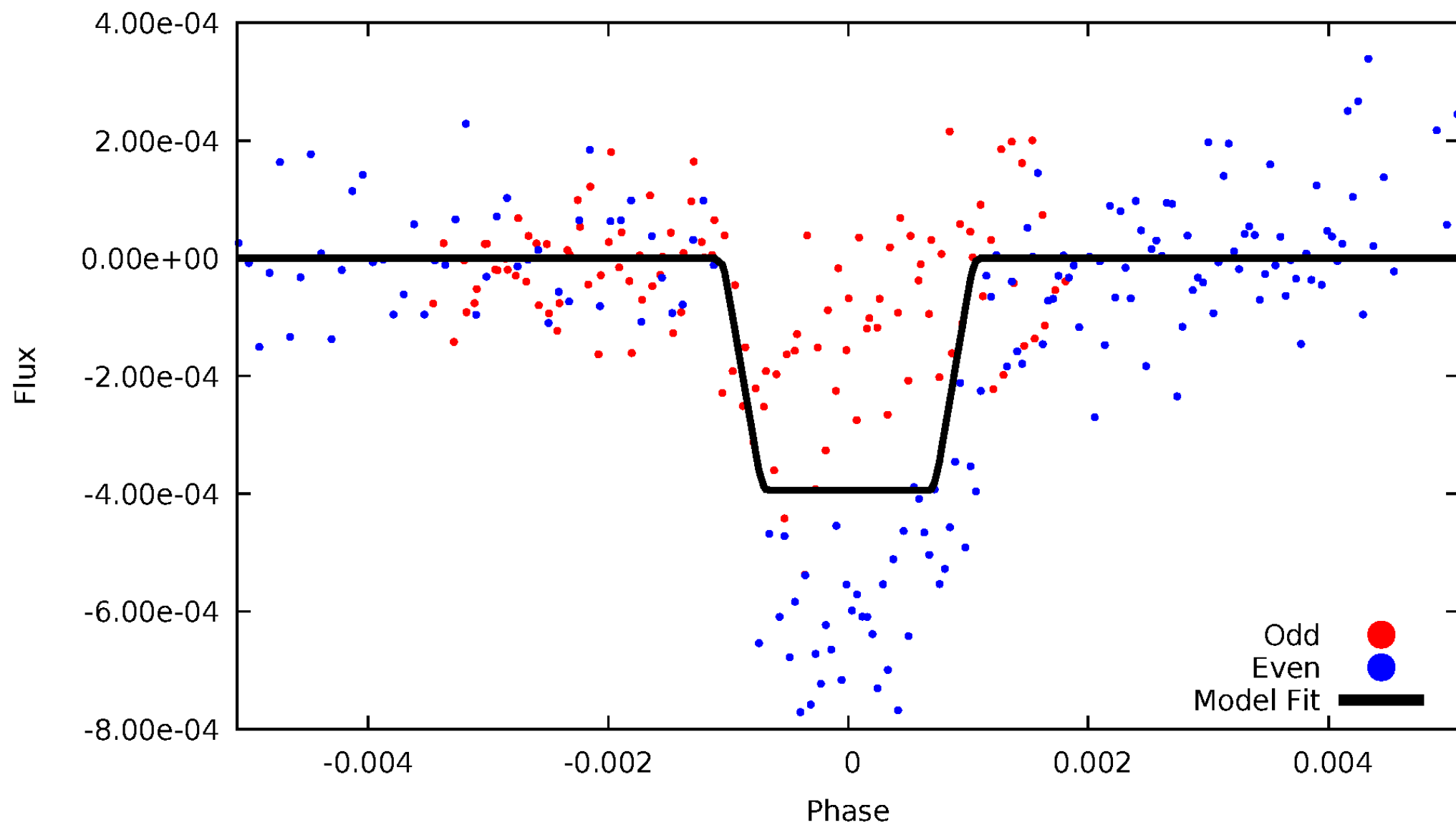
TCE 010989345-03





# ALT Odd/Even

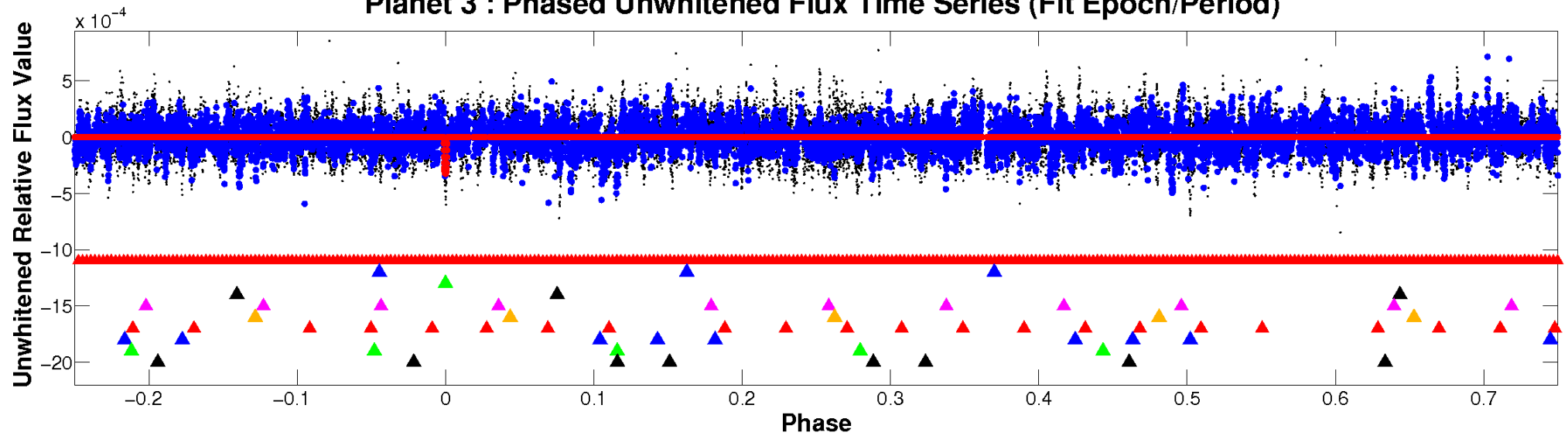
TCE 010989345-03



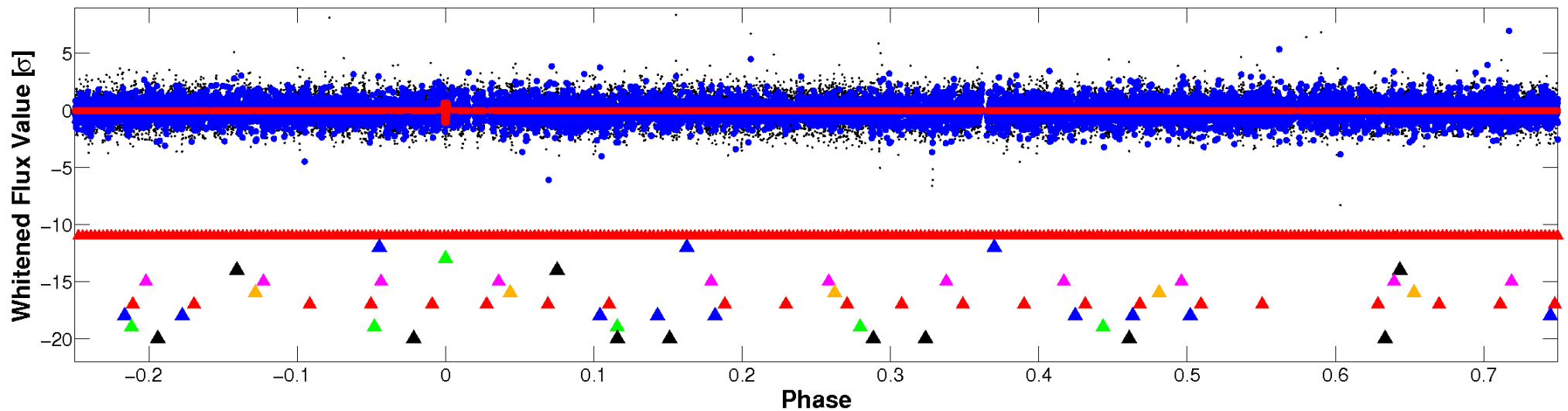


# Non-Whitened Vs. Whitened Light Curve

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



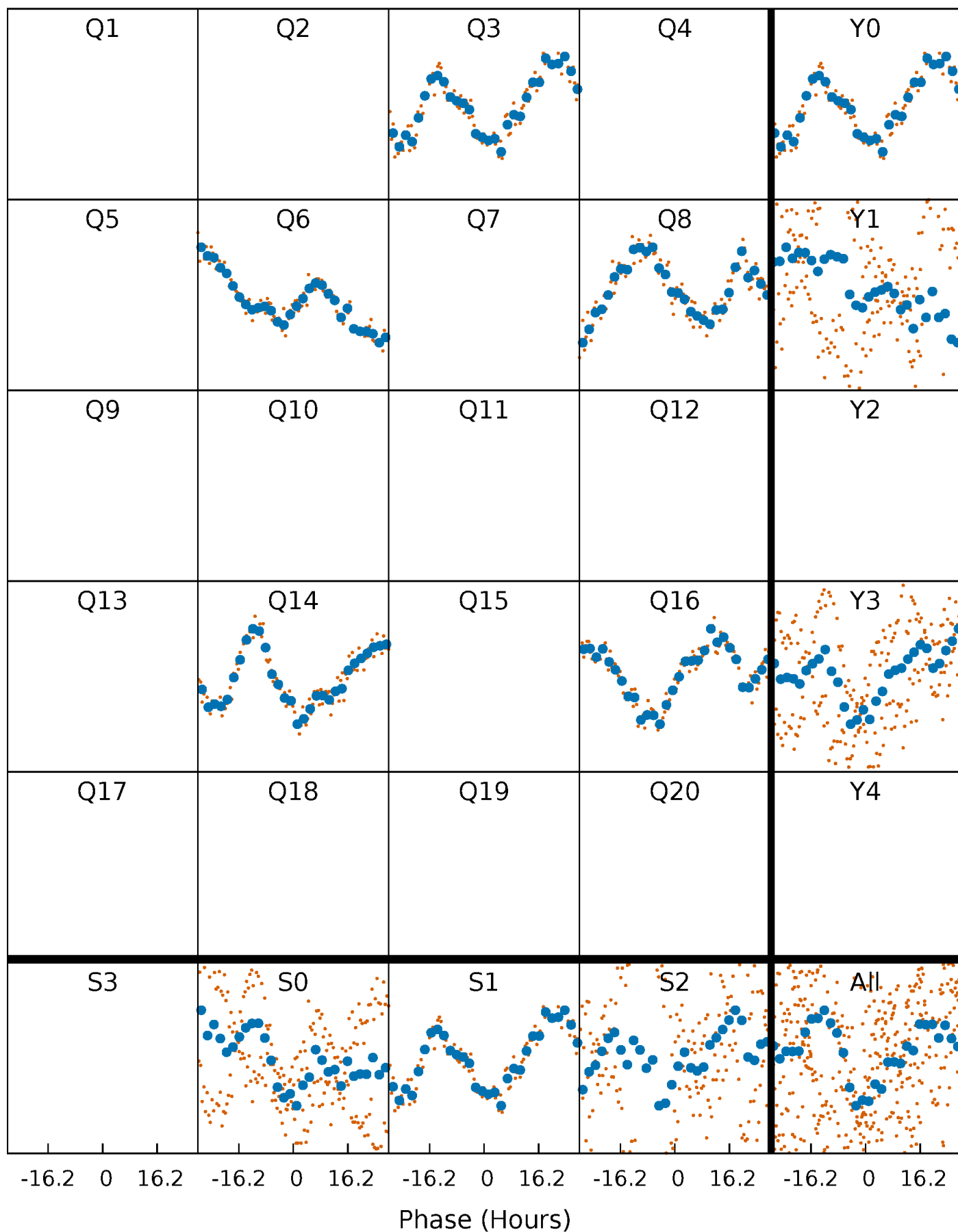
## Planet 3 : Phased Whitened Flux Time Series (Fit Epoch/Period)





# PDC Quarter-Phased Transit Curves

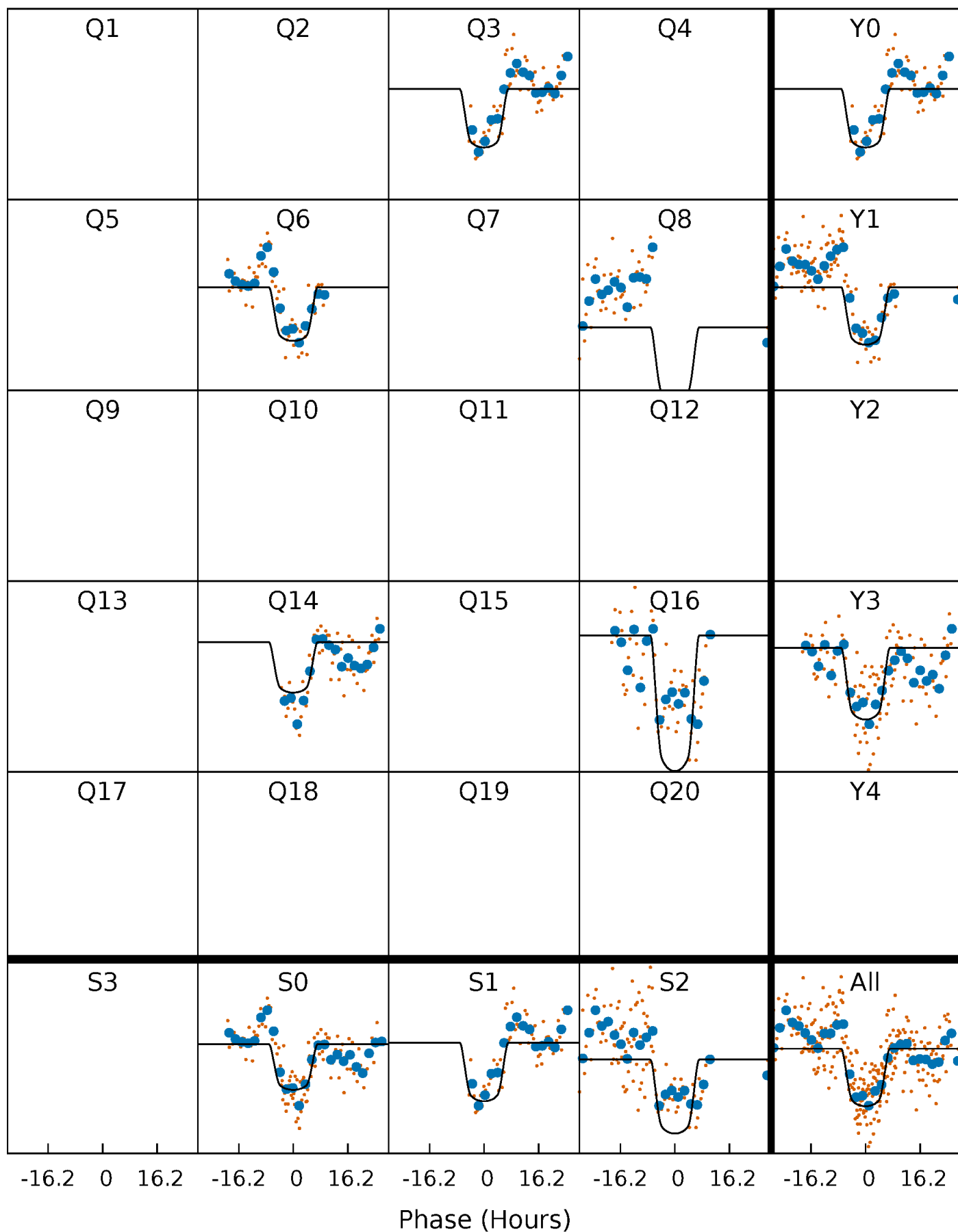
TCE 010989345-03 P=237.414043 Days  $T_0=326.142677$  (BKJD)





# DV Quarter-Phased Transit Curves

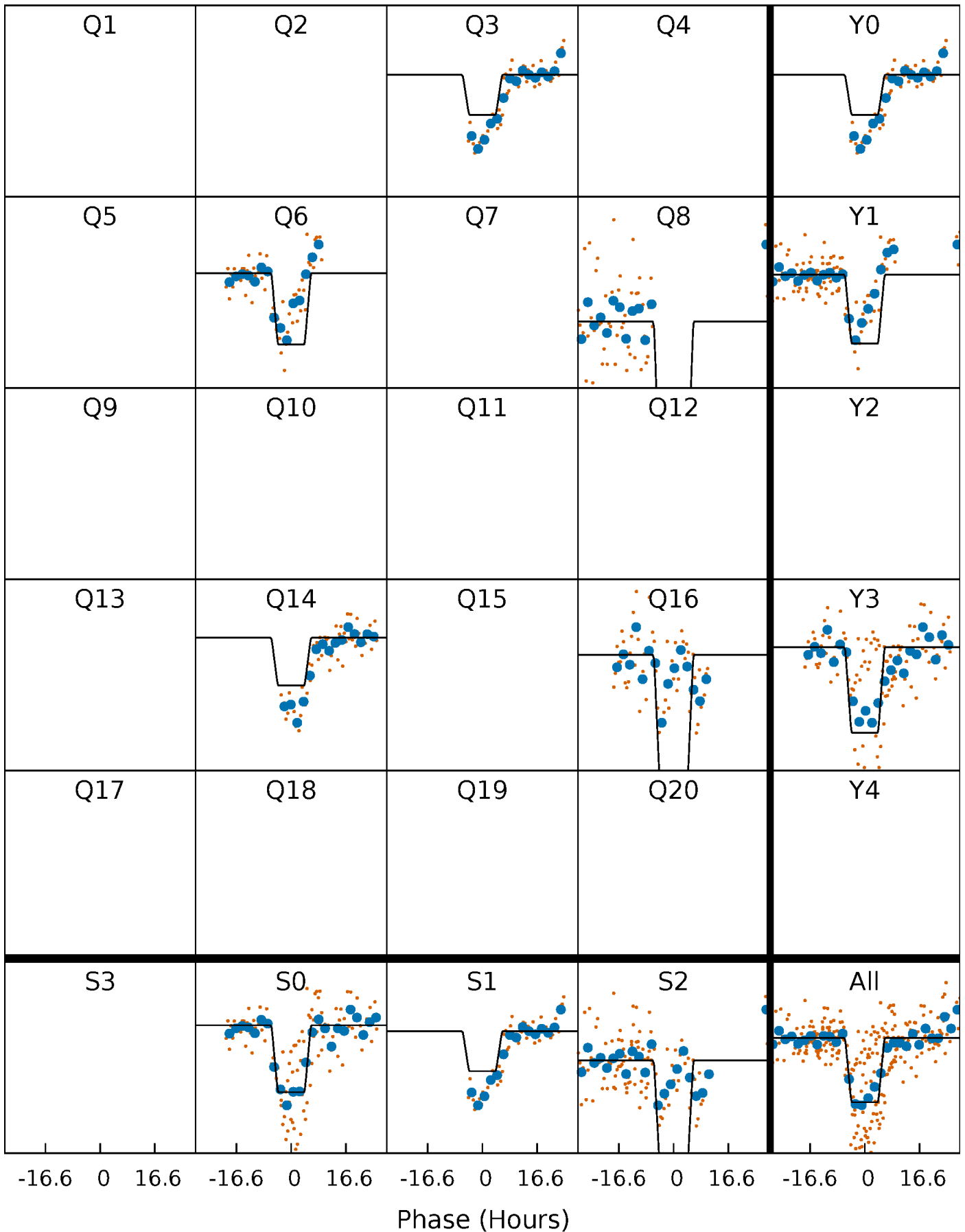
TCE 010989345-03     $P=237.414043$  Days     $T_0=326.142677$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

TCE 010989345-03     $P=237.410722$  Days     $T_0=326.134414$  (BKJD)

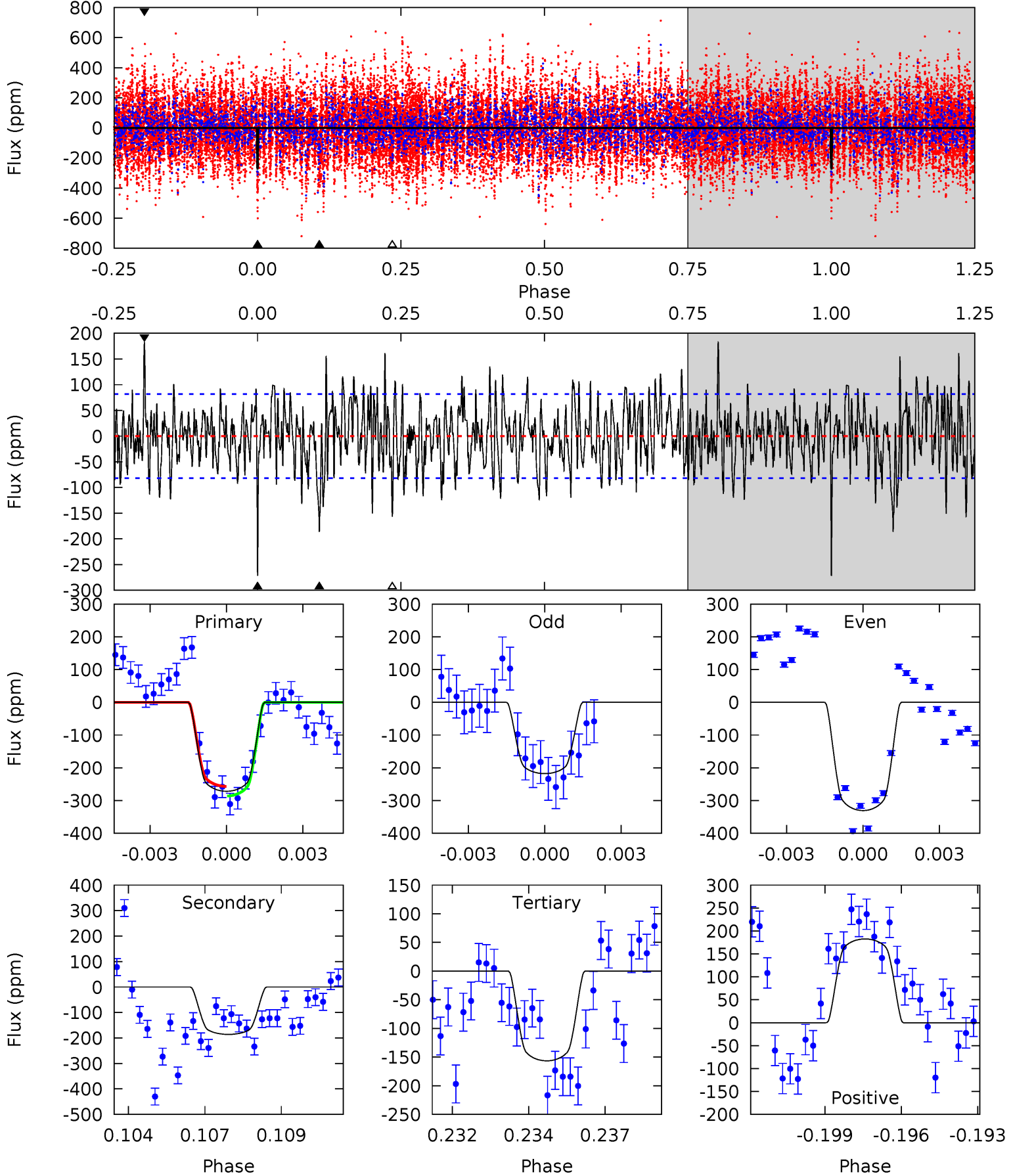




# DV Model-Shift Uniqueness Test

010989345-03, P = 237.414043 Days, E = 88.728634 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
17.6	12.0	10.1	11.8	5.28	3.02	3.37	7.44	5.76	1.90	0.22	3.62	-3.30	0.40	0.95

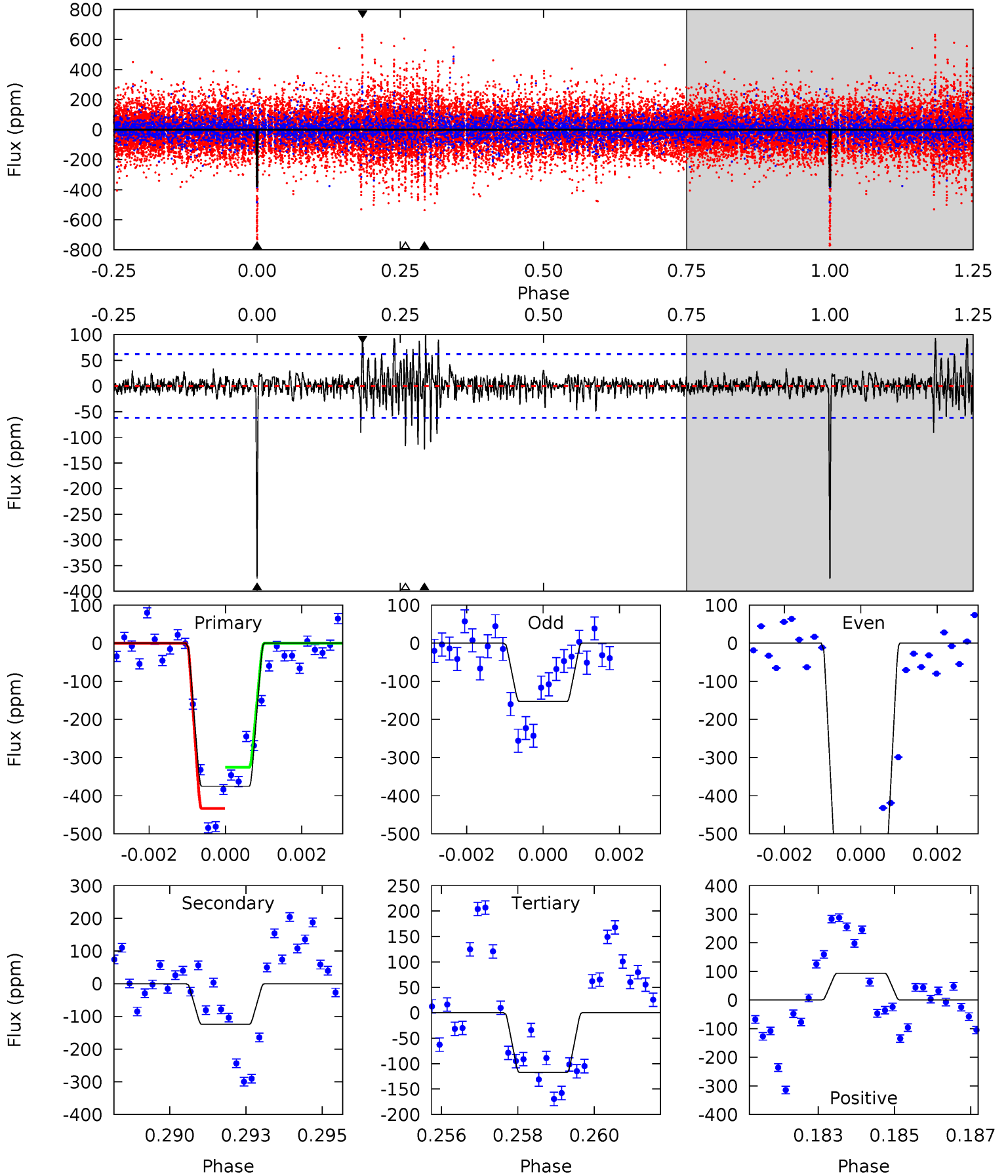




# Alt Model-Shift Uniqueness Test

010989345-03, P = 237.410722 Days, E = 88.723692 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
32.0	10.6	9.99	7.98	5.31	3.07	1.61	22.0	24.0	0.59	2.60	19.1	0.91	0.21	4.63





### Stellar Parameters For KIC 010989345

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6441^{+181}_{-227}$	$4.108^{+0.286}_{-0.154}$	$-0.440^{+0.300}_{-0.300}$	$1.504^{+0.421}_{-0.463}$	$1.056^{+0.177}_{-0.133}$	$0.438^{+0.795}_{-0.185}$
	+3%/-4%	+7%/-4%	+68%/-68%	+28%/-31%	+17%/-13%	+182%/-42%
Source	PHO54	PHO54	PHO54	DSEP		

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

### Secondary Eclipse Parameters for KIC 010989345-03 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-186 \pm 15$	$3.32^{+0.60}_{-0.59}$	$547^{+43}_{-48}$	$5245^{+261}_{-233}$	$5494^{+2515}_{-1543}$
Alt.	$-124 \pm 12$	$3.18^{+0.58}_{-0.58}$	$547^{+45}_{-51}$	$4911^{+231}_{-203}$	$4020^{+2023}_{-1152}$

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



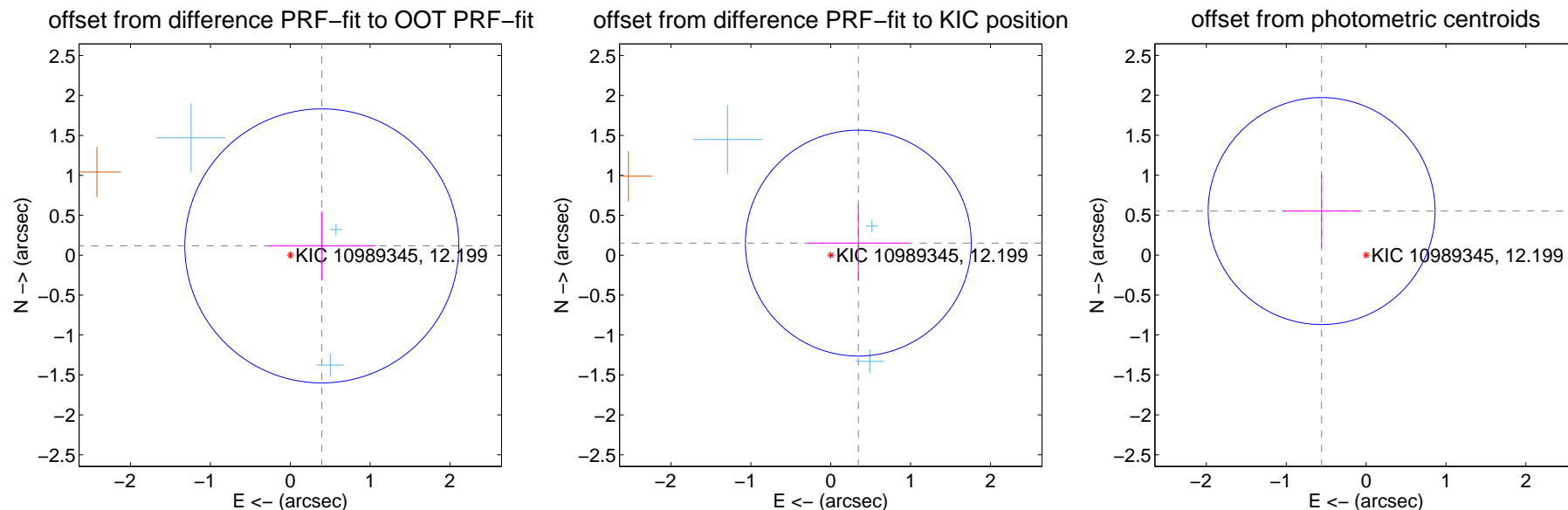
## DV Centroid Data

Supplemental centroid analysis for 010989345-03. Kepler magnitude: 12.20. Transit SNR 8.58

There are 3 quarters with good PRF difference image offsets

The direct PRF centroid is offset from the target star catalog position by about 0.05 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.412 \pm 0.572$	0.72	$-0.395 \pm 0.670$	$0.116 \pm 0.430$
PRF-fit source offset from KIC position	$0.377 \pm 0.471$	0.80	$-0.346 \pm 0.630$	$0.151 \pm 0.470$
photometric centroid source offset	$0.78 \pm 0.47$	1.66	$0.56 \pm 0.49$	$0.55 \pm 0.46$

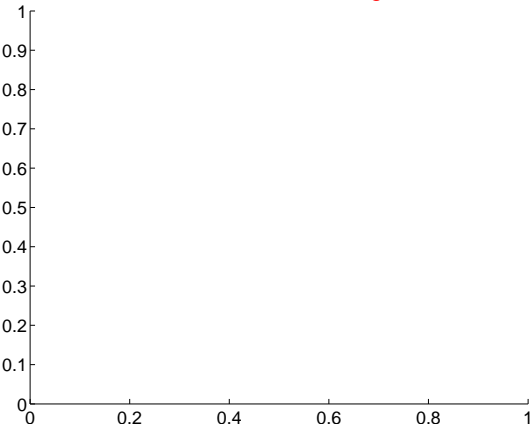


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

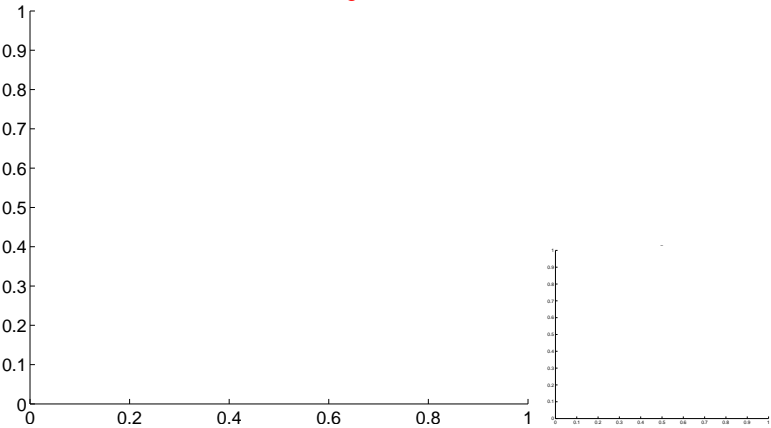


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

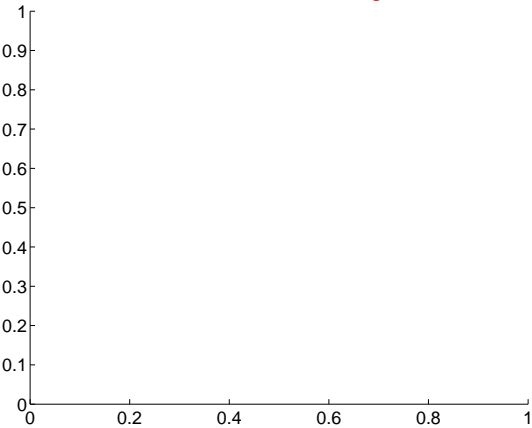
Q1 no difference image



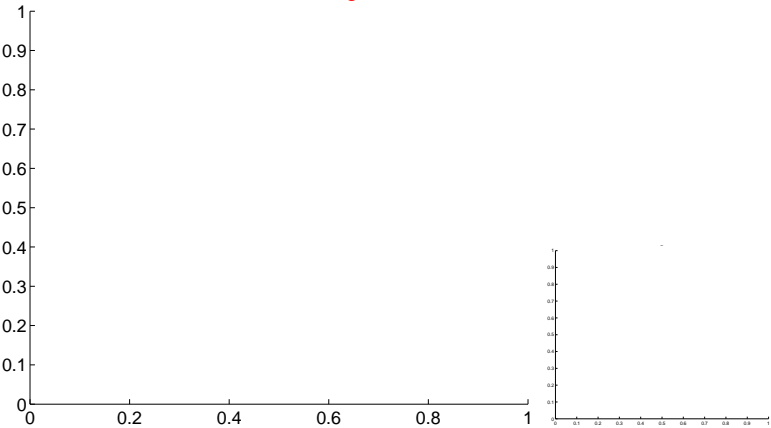
Q1 no OOT image



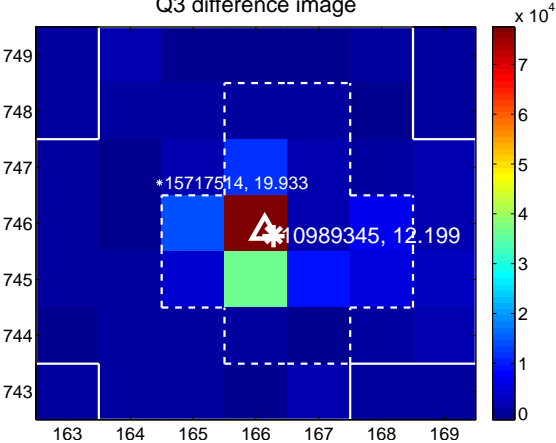
Q2 no difference image



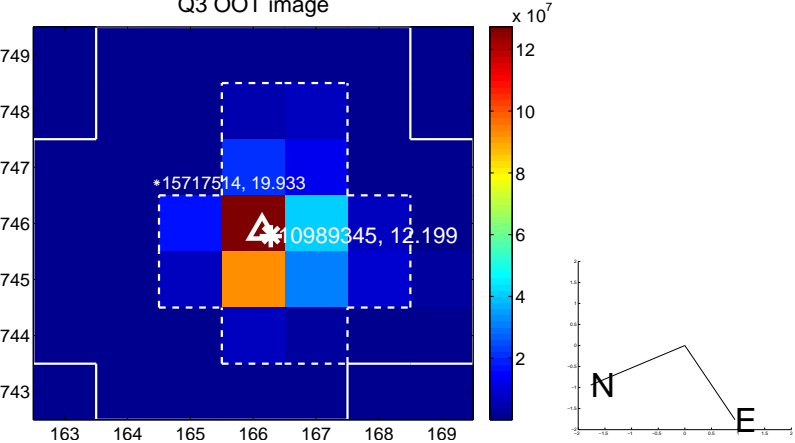
Q2 no OOT image



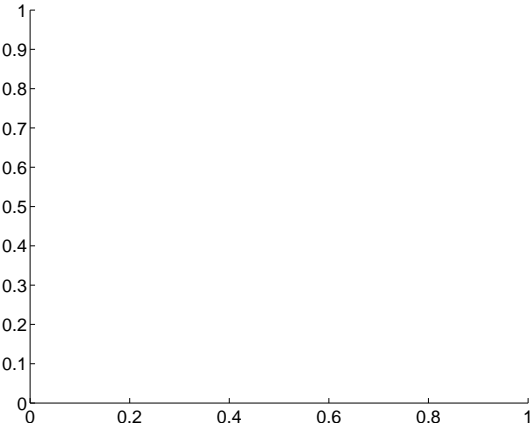
Q3 difference image



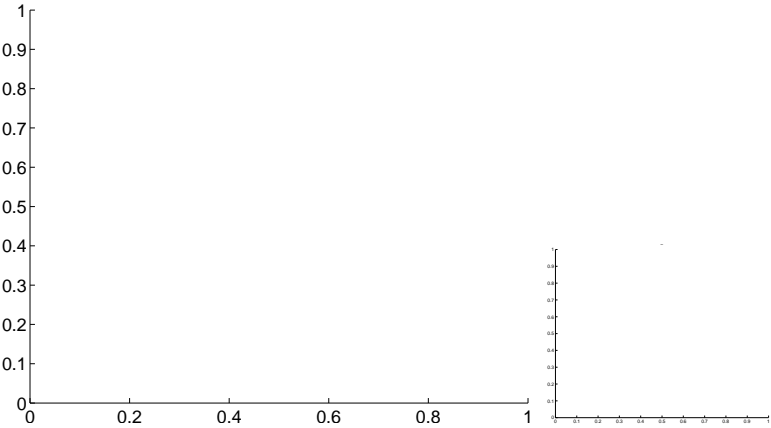
Q3 OOT image



Q4 no difference image

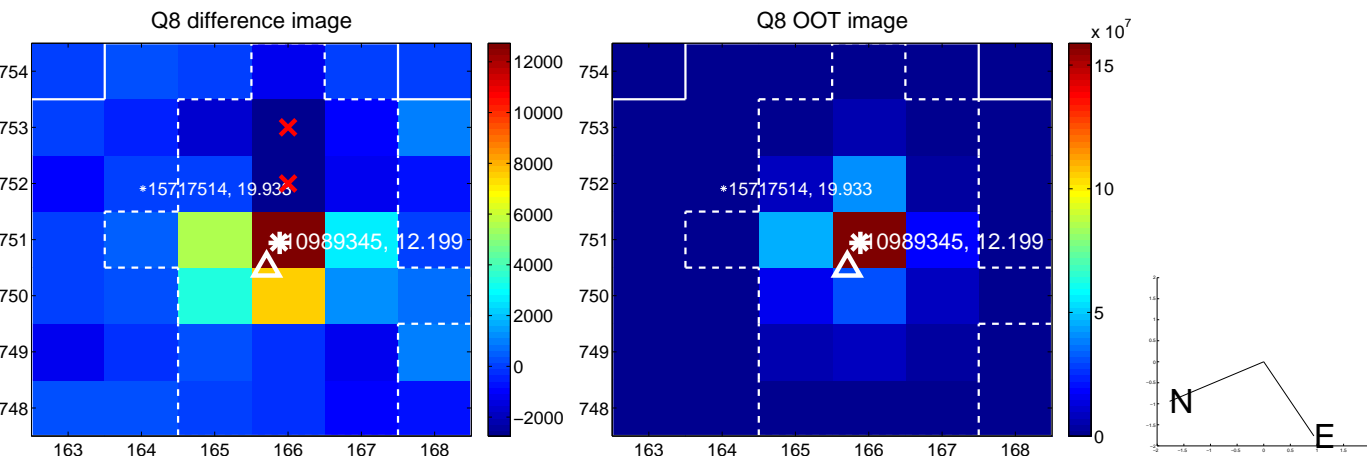
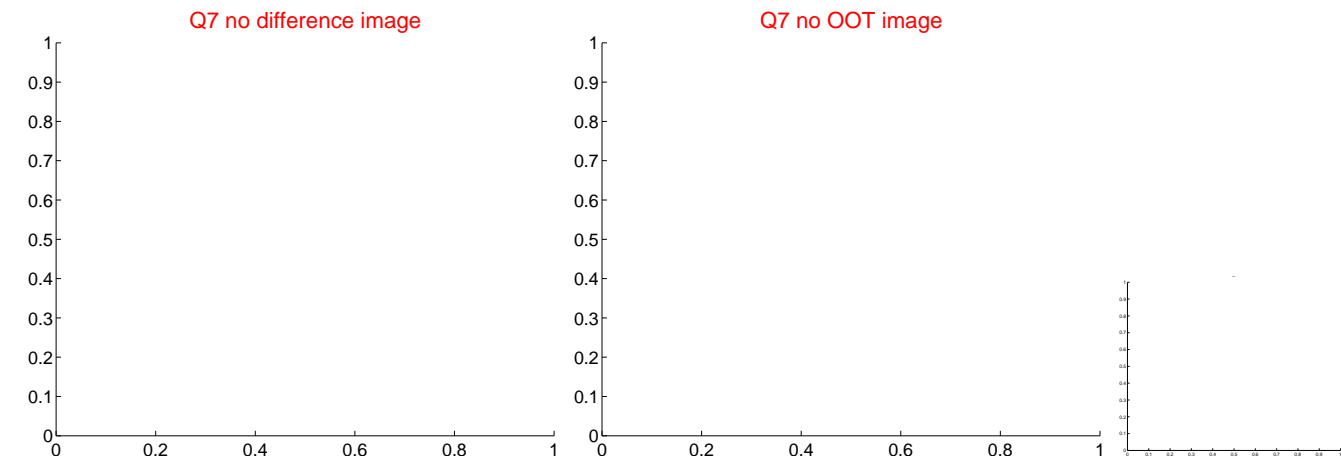
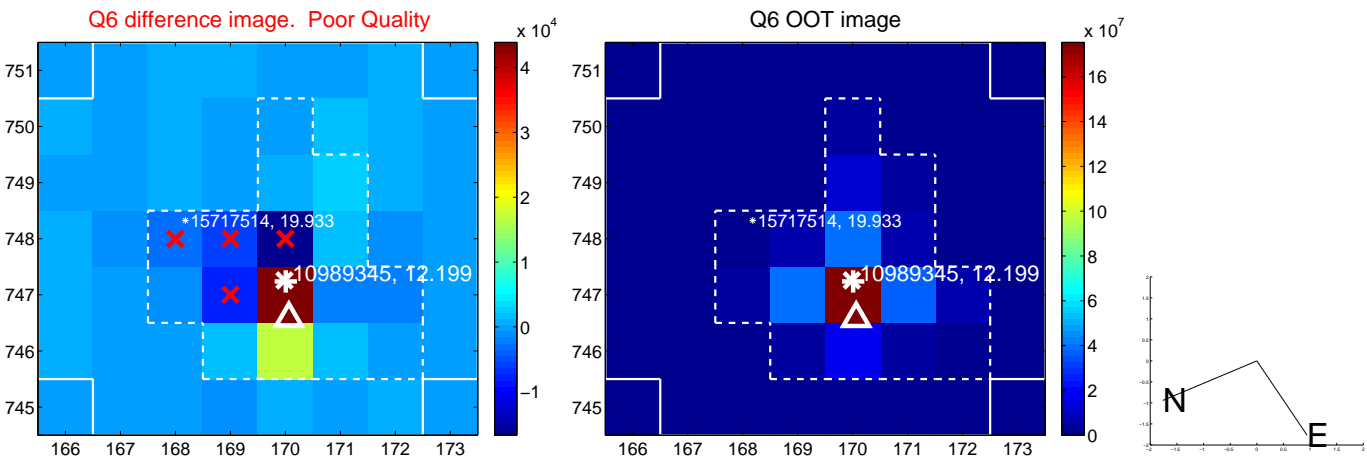
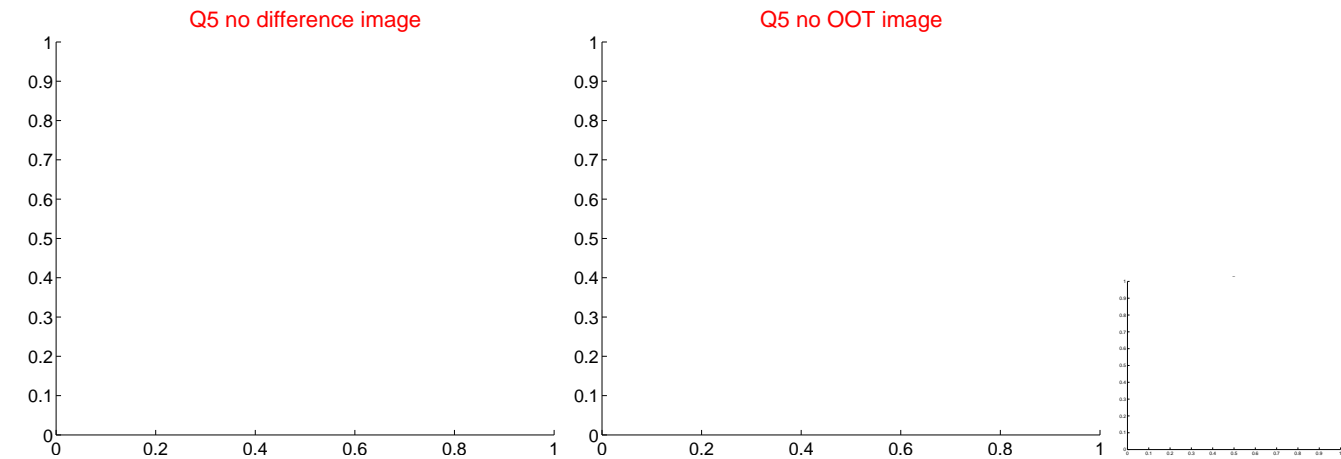


Q4 no OOT image



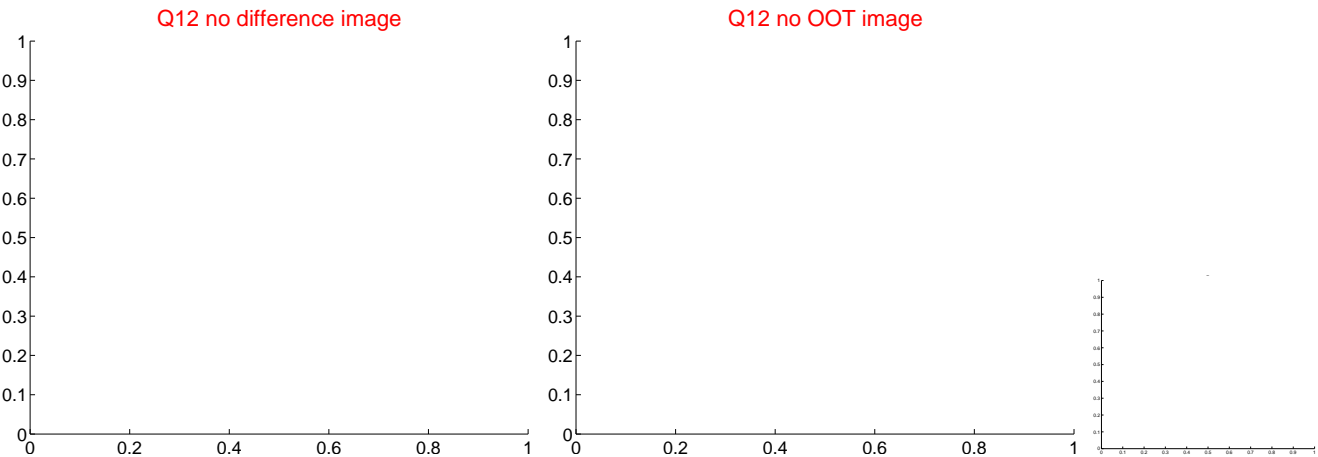
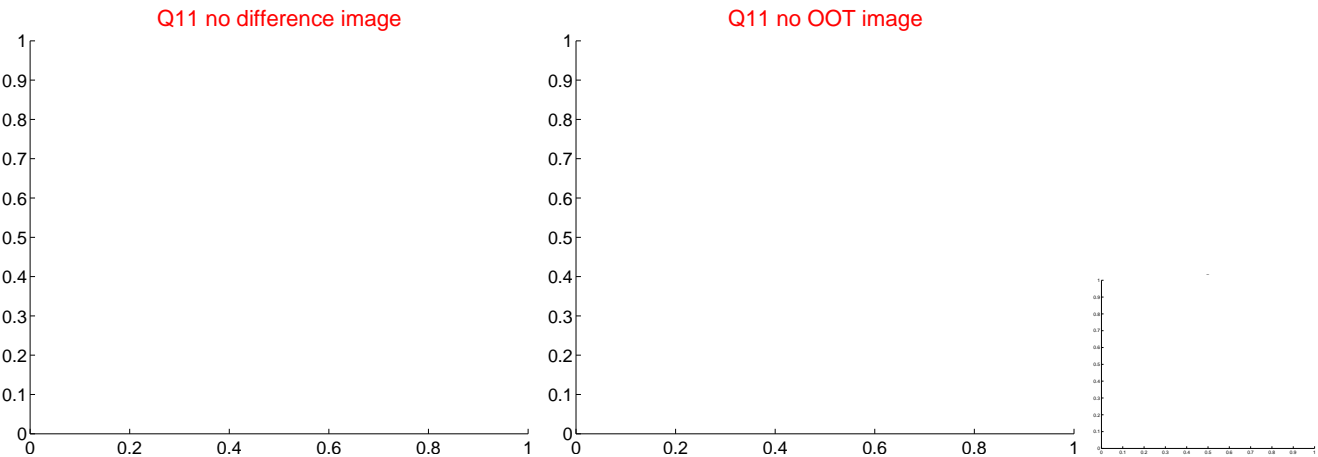
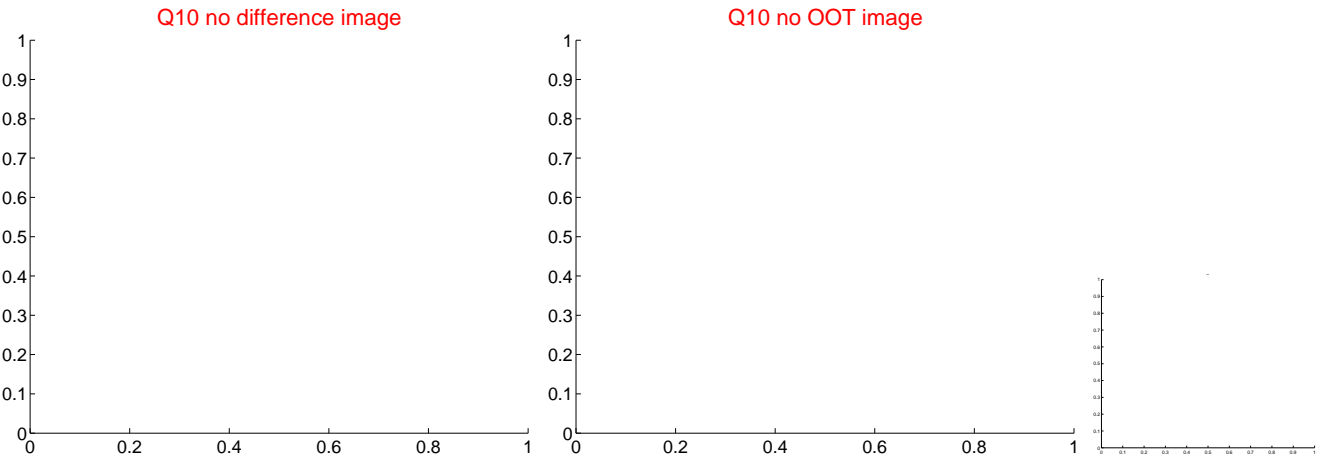
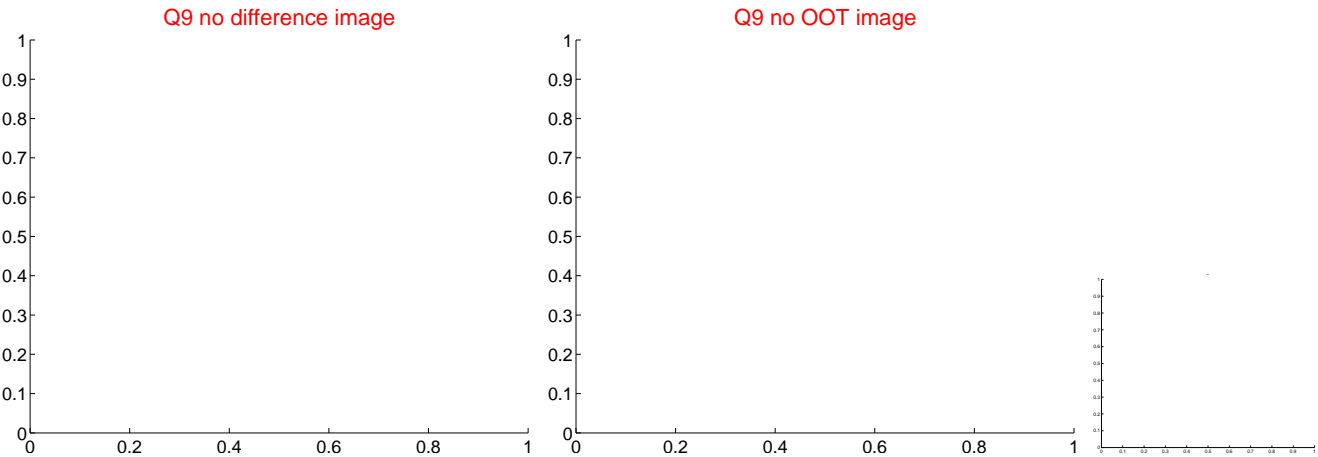


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



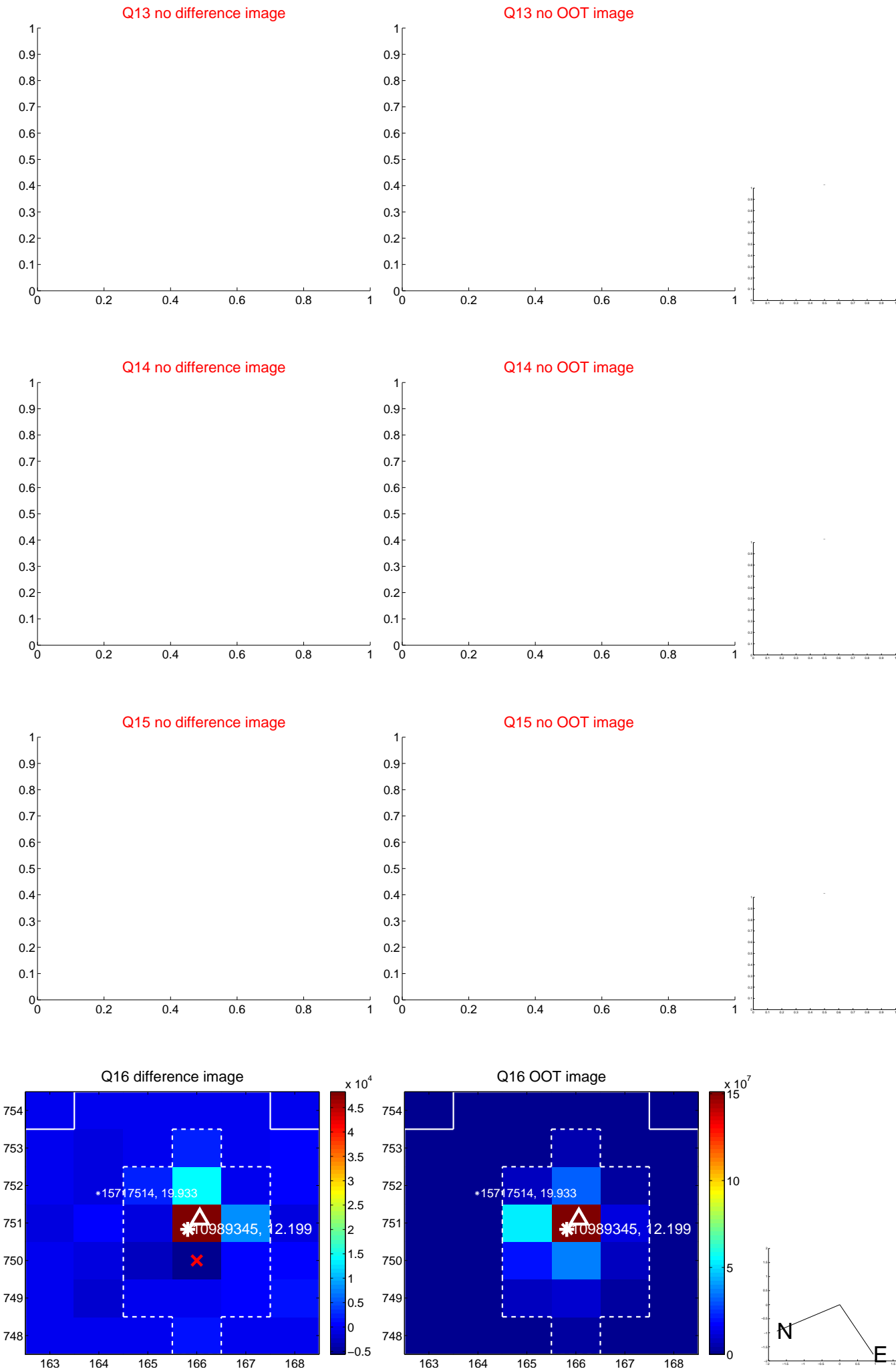


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



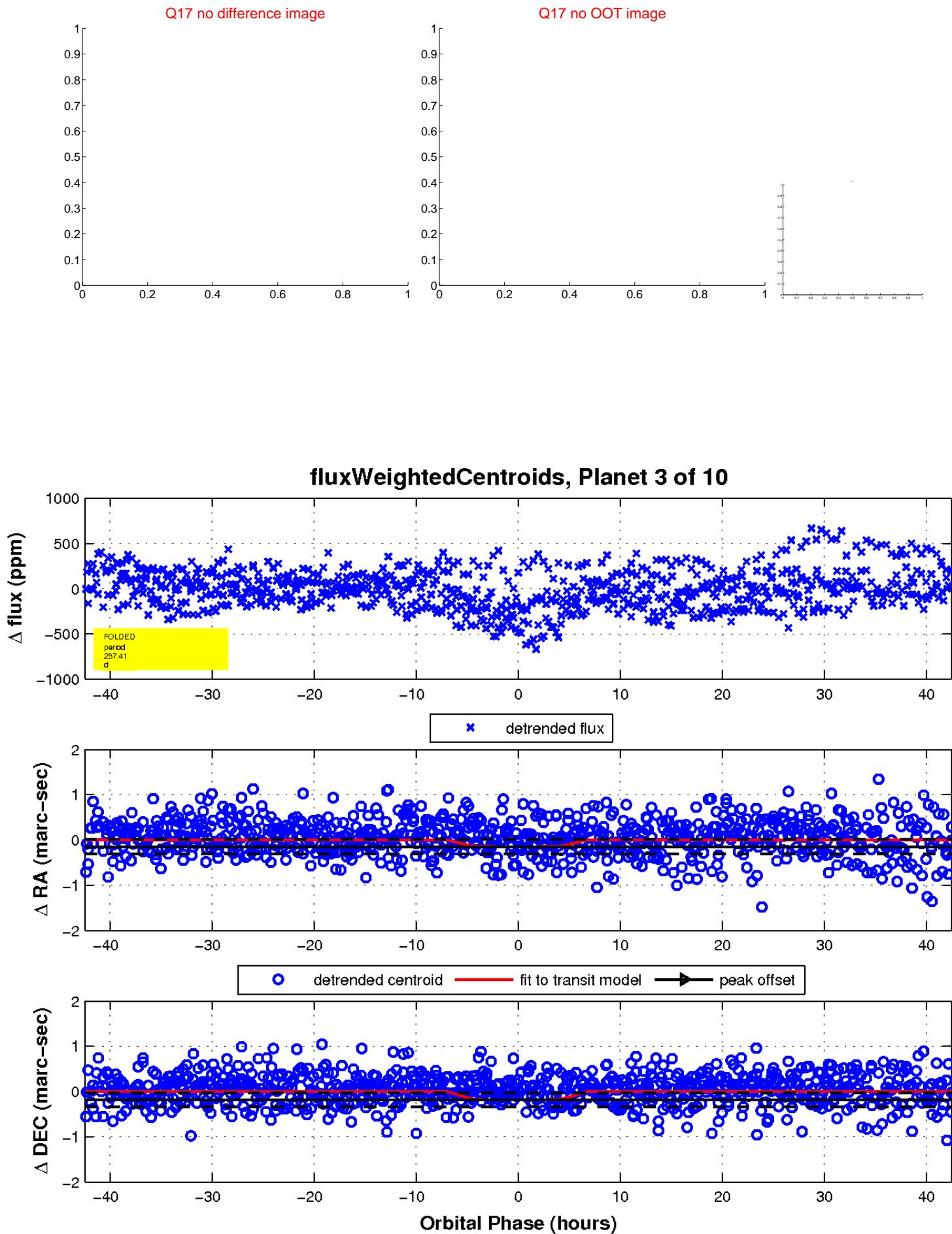


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





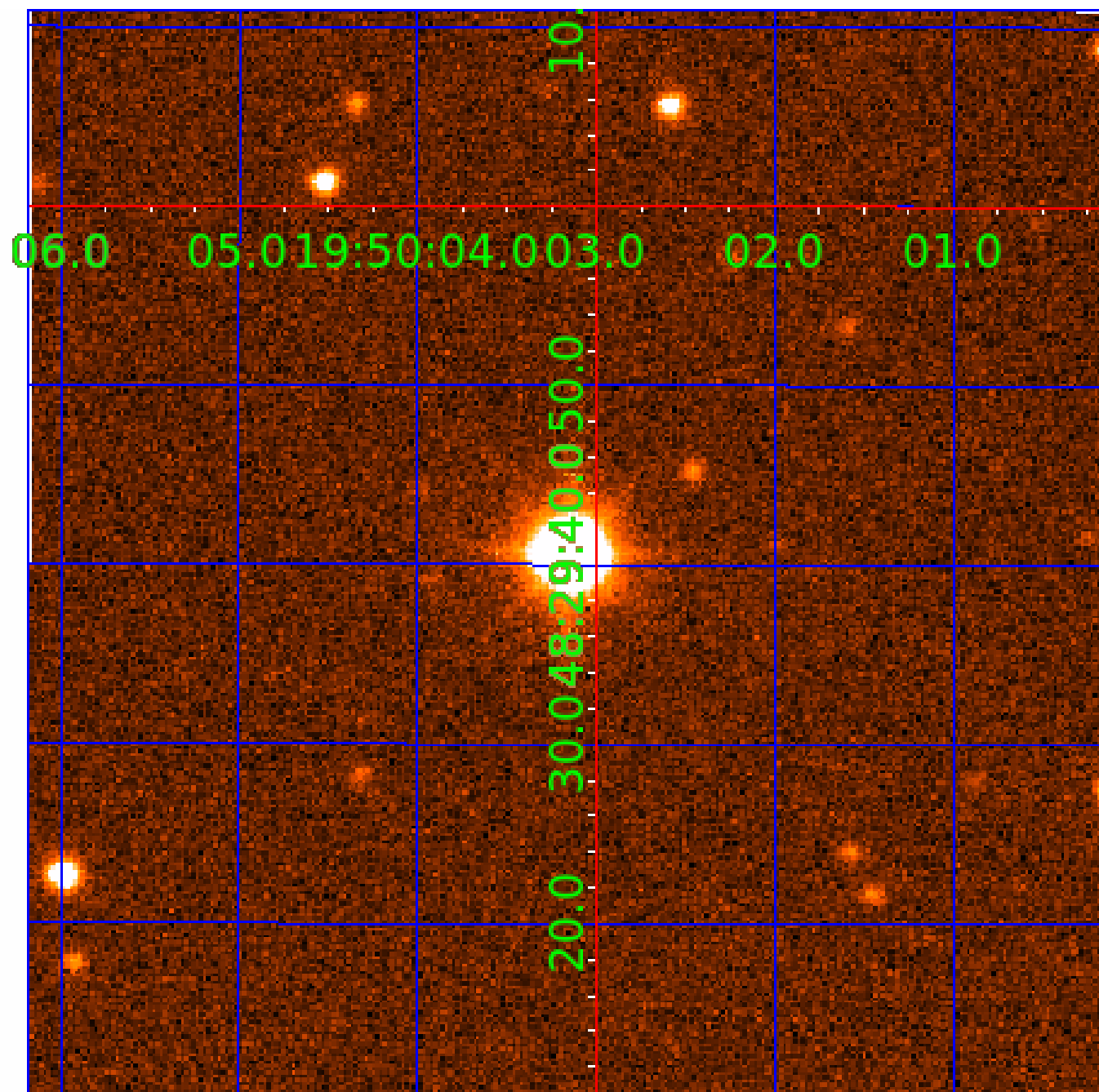
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





UKIRT Image

Declination





# KIC 010989345

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
010989345-01	OBS	No	2.630764	133.193244	10.6	11.138	8.7	2.7	1.50	6441	0.56	2414.15
010989345-02	OBS	No	663.020155	176.584259	336.4	6.883	8.0	8.5	1.50	6441	3.12	1.52
010989345-03	OBS	No	237.414043	326.142677	325.3	14.174	7.7	8.6	1.50	6441	3.39	5.96
010989345-04	OBS	No	423.567102	344.022902	722.4	35.026	7.8	7.8	1.50	6441	4.94	2.76
010989345-05	OBS	No	128.115026	240.564541	252.7	10.241	7.8	8.2	1.50	6441	2.77	13.57
010989345-07	OBS	No	66.433669	191.136166	129.6	13.221	7.4	5.2	1.50	6441	1.83	32.59
010989345-08	OBS	No	161.346431	265.595466	238.5	7.037	7.2	7.2	1.50	6441	4.56	9.98
010989345-09	OBS	No	276.296890	275.873517	375.6	30.069	7.9	7.5	1.50	6441	3.49	4.87
010989345-10	OBS	No	196.452793	165.569777	243.6	5.231	7.4	8.1	1.50	6441	3.04	7.68

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
010989345-01	OBS	FP	0.00	1	0	0	0	SWEET_NTL—LPP_DV—MOD_NONUNIQ_DV
010989345-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES—ALL_TRANS_CHASES—MOD_NONUNIQ_DV
010989345-03	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—HALO_GHOST
010989345-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
010989345-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—MOD_NONUNIQ_DV
010989345-07	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT
010989345-08	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT
010989345-09	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—CENT_FEW_DIFFS
010989345-10	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT

**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.

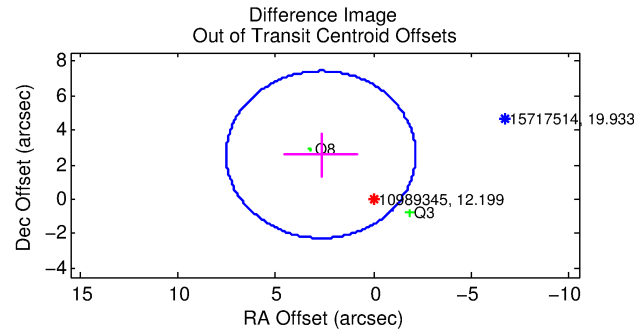
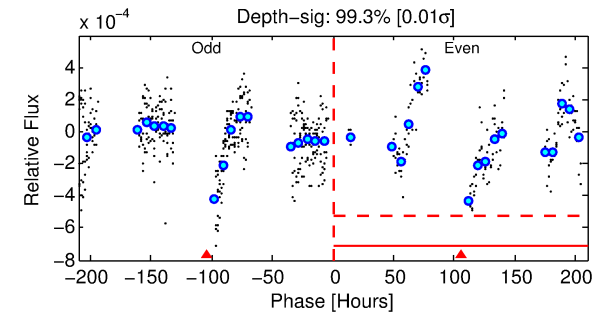
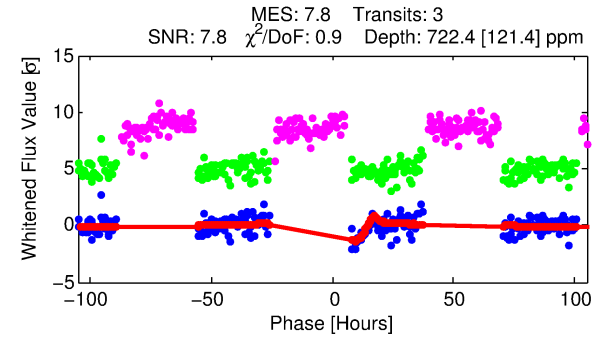
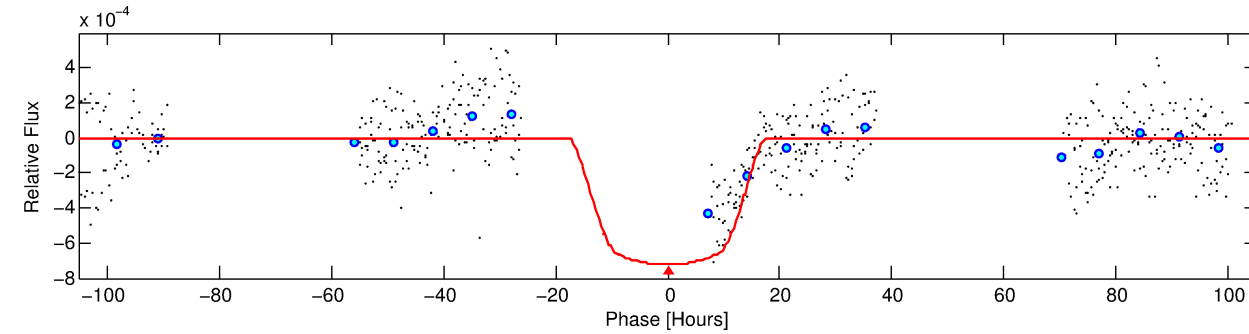
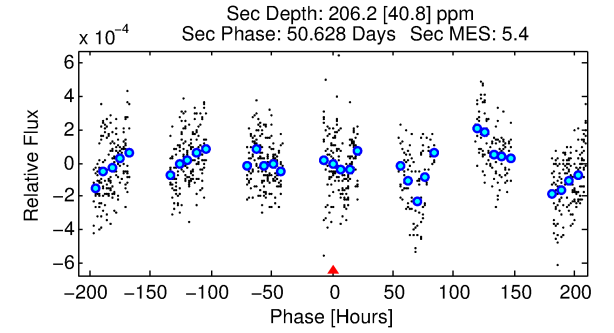
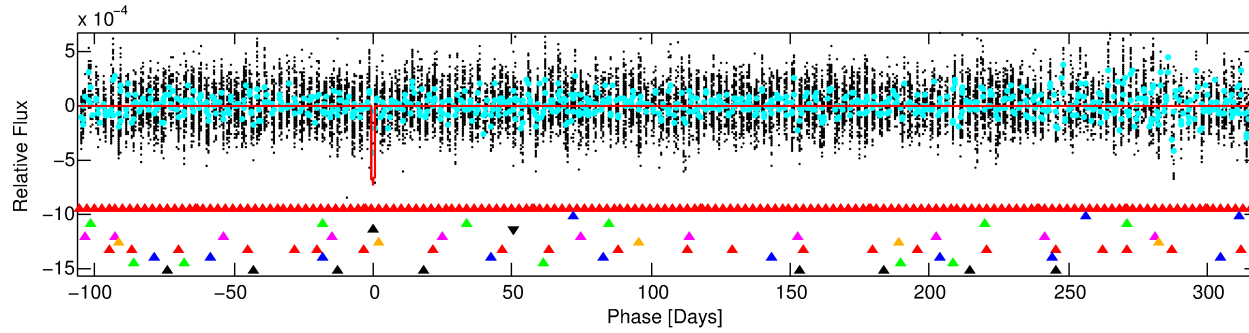
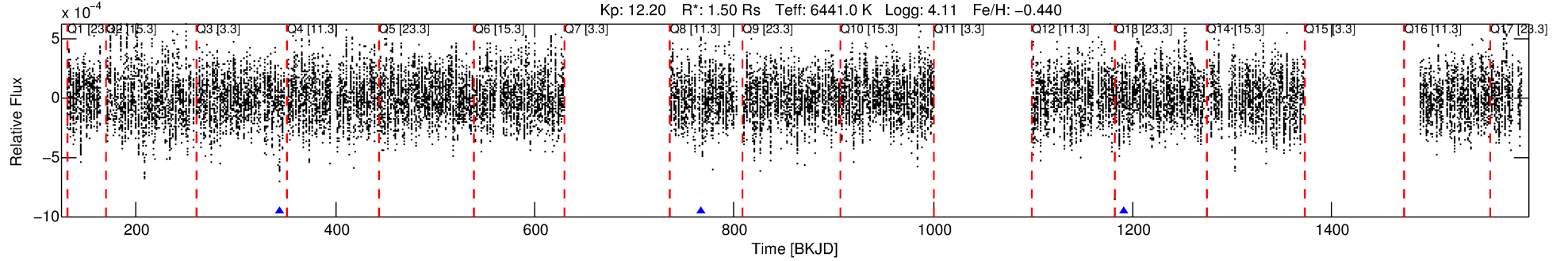
Ephemeris Match Information For 010989345-04

No Significant Match Found



# DV One-Page Summary

KIC: 10989345 Candidate: 4 of 10 Period: 423.567 d



## DV Fit Results:

Period = 423.56710 [0.02378] d  
Epoch = 344.0229 [0.1505] BKJD  
Rp/R\* = 0.0301 [0.0027]  
a/R\* = 38.37 [6.26]  
b = 0.94 [0.02]  
Seff = 2.76 [1.39]  
Teq = 329 [41] K  
Rp = 4.94 [1.58] Re  
a = 1.1250 [0.3381] AU  
Ag = 5873.83 [3249.61] [1.81σ]  
Teffp = 4447 [336] K [12.18σ]

## DV Diagnostic Results:

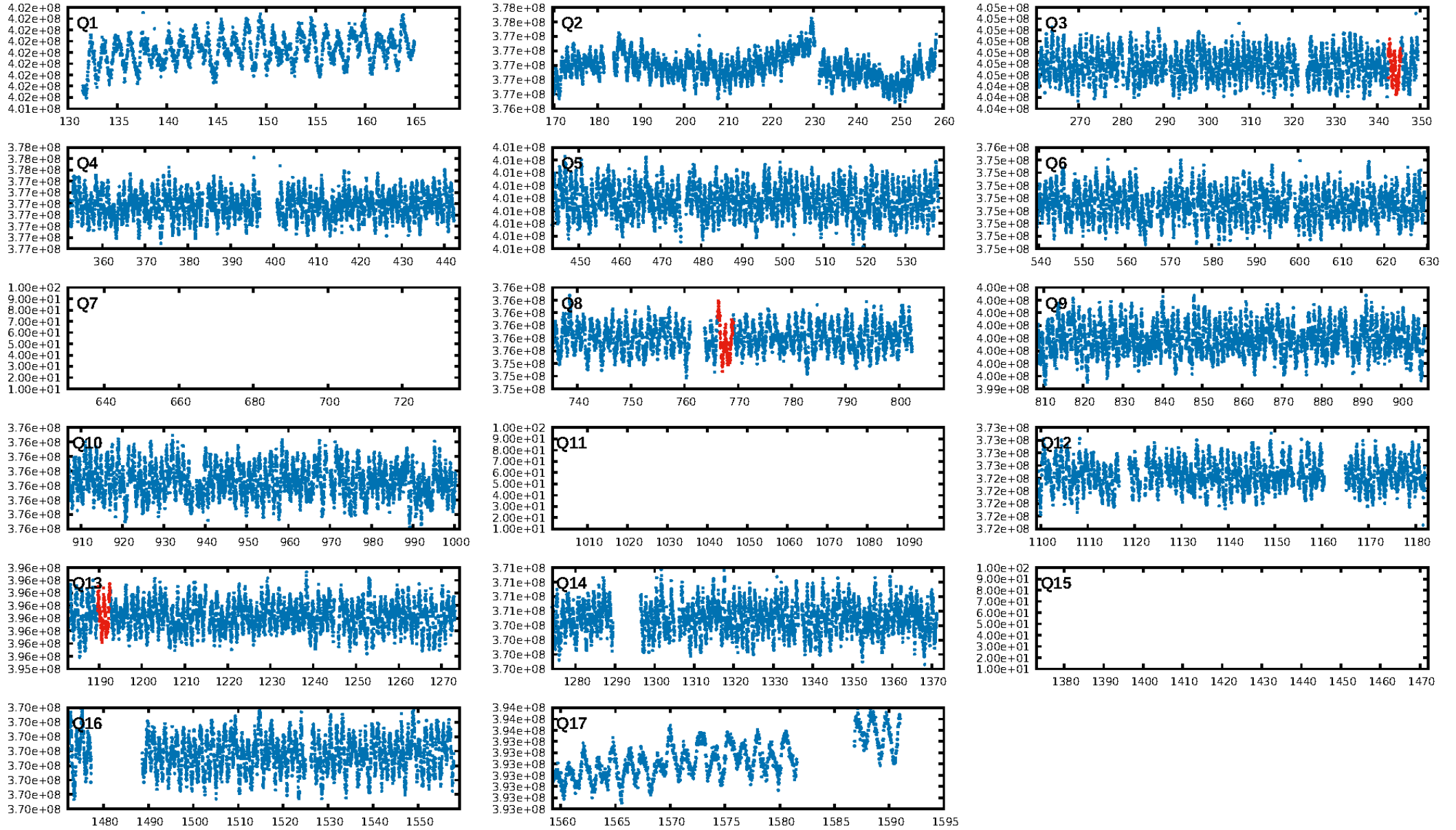
ShortPeriod-sig: 100.0% [59.54σ]  
LongPeriod-sig: 100.0% [161.00σ]  
ModelChiSquare2-sig: 17.2%  
ModelChiSquareGof-sig: 100.0%  
**Bootstrap-pfa: 4.37e-10**  
RollingBand-fgt: 1.00 [3/3]  
**GhostDiagnostic-chr: -0.2779**  
Centroid-sig: 89.7%  
Centroid-so: 0.028 arcsec [0.12σ]  
OotOffset-rm: 3.728 arcsec [2.31σ]  
KicOffset-rm: 3.772 arcsec [2.33σ]  
OotOffset-st: 0/1/1/0 [2]  
KicOffset-st: 0/1/1/0 [2]  
DiffImageQuality-fgm: 0.50 [1/2]  
DiffImageOverlap-fno: 0.00 [0/2]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 03:40:03 Z

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

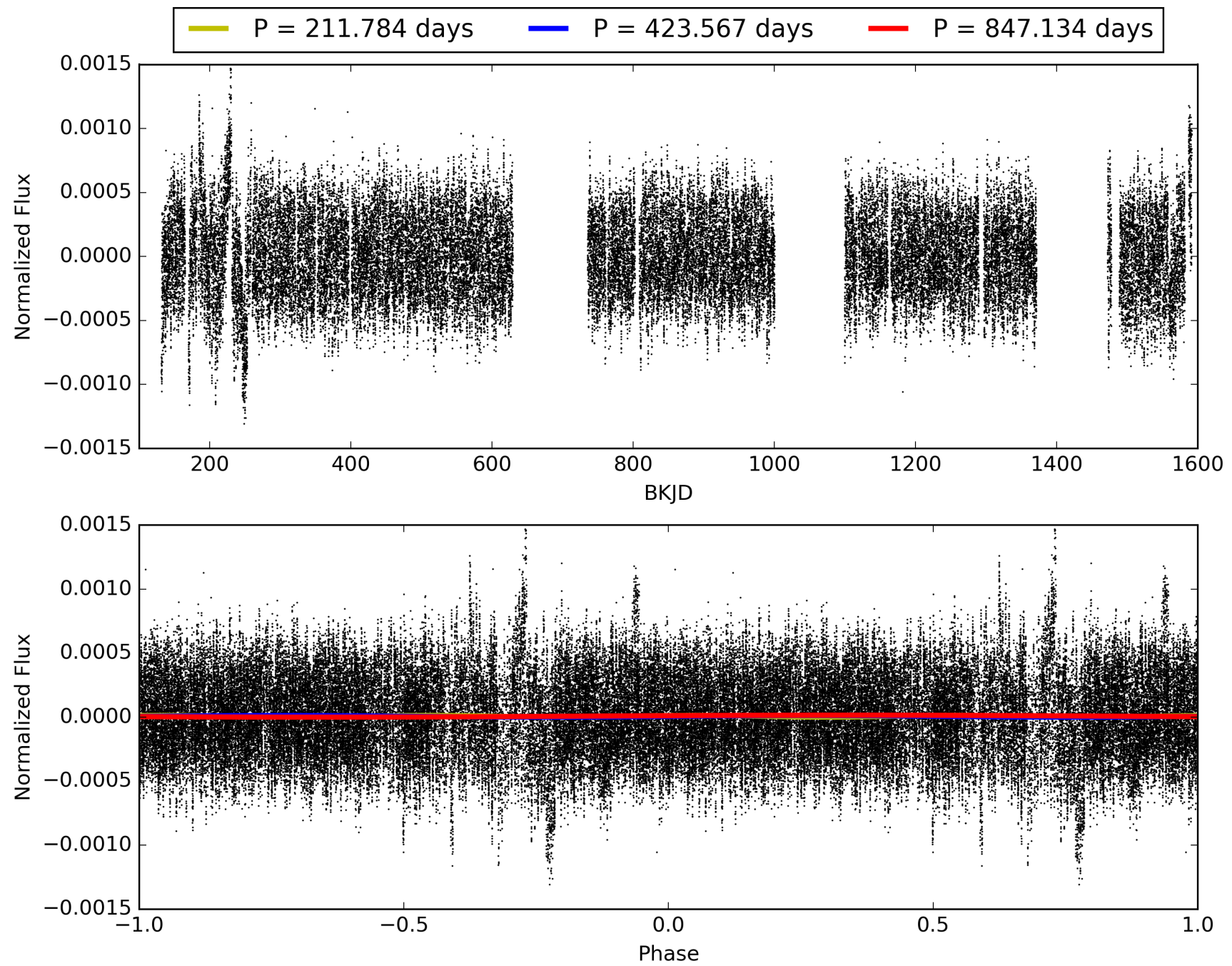


# TCE 010989345-04, PDC Light Curves





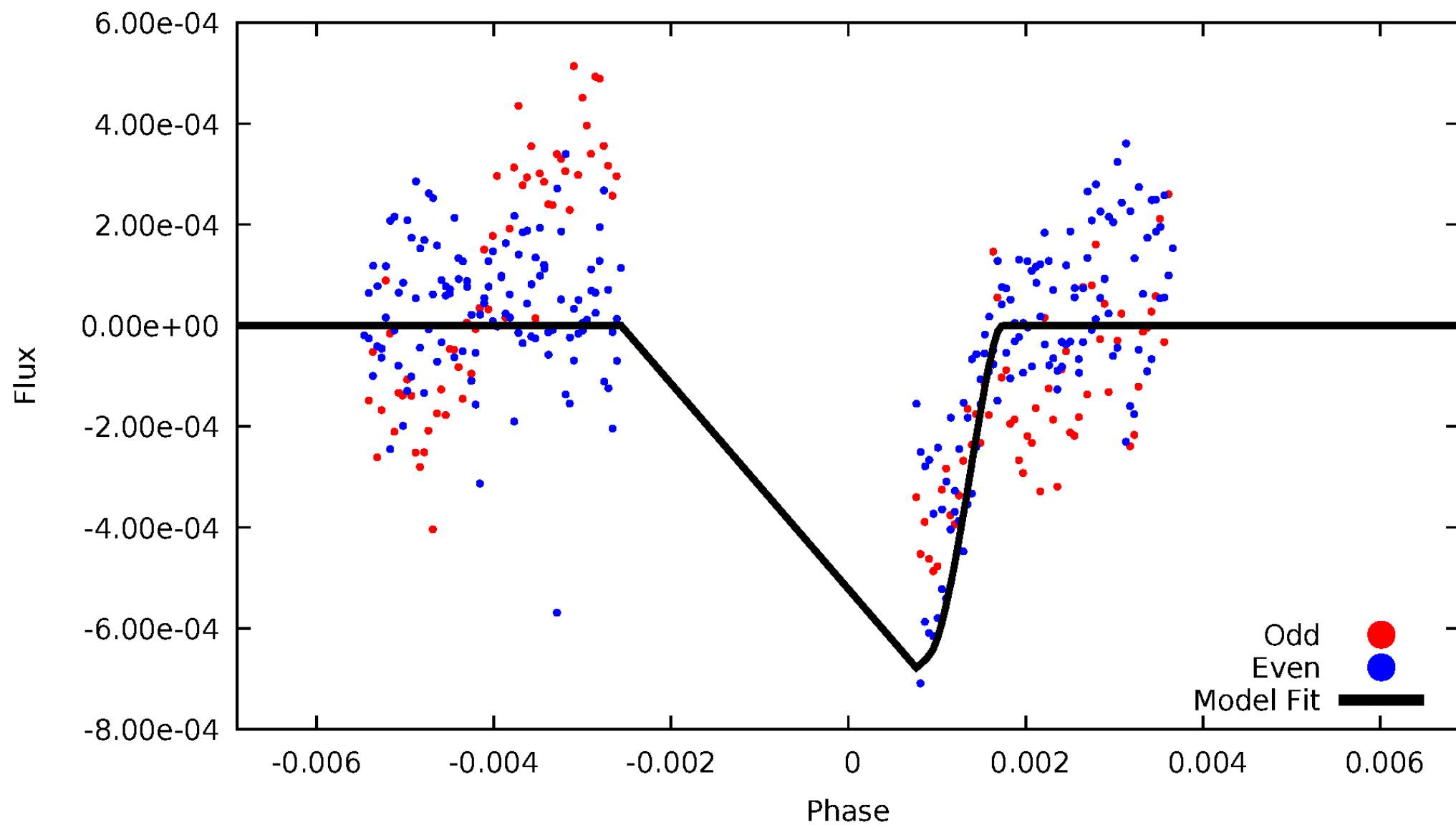
TCE 010989345-04





# DV Odd/Even

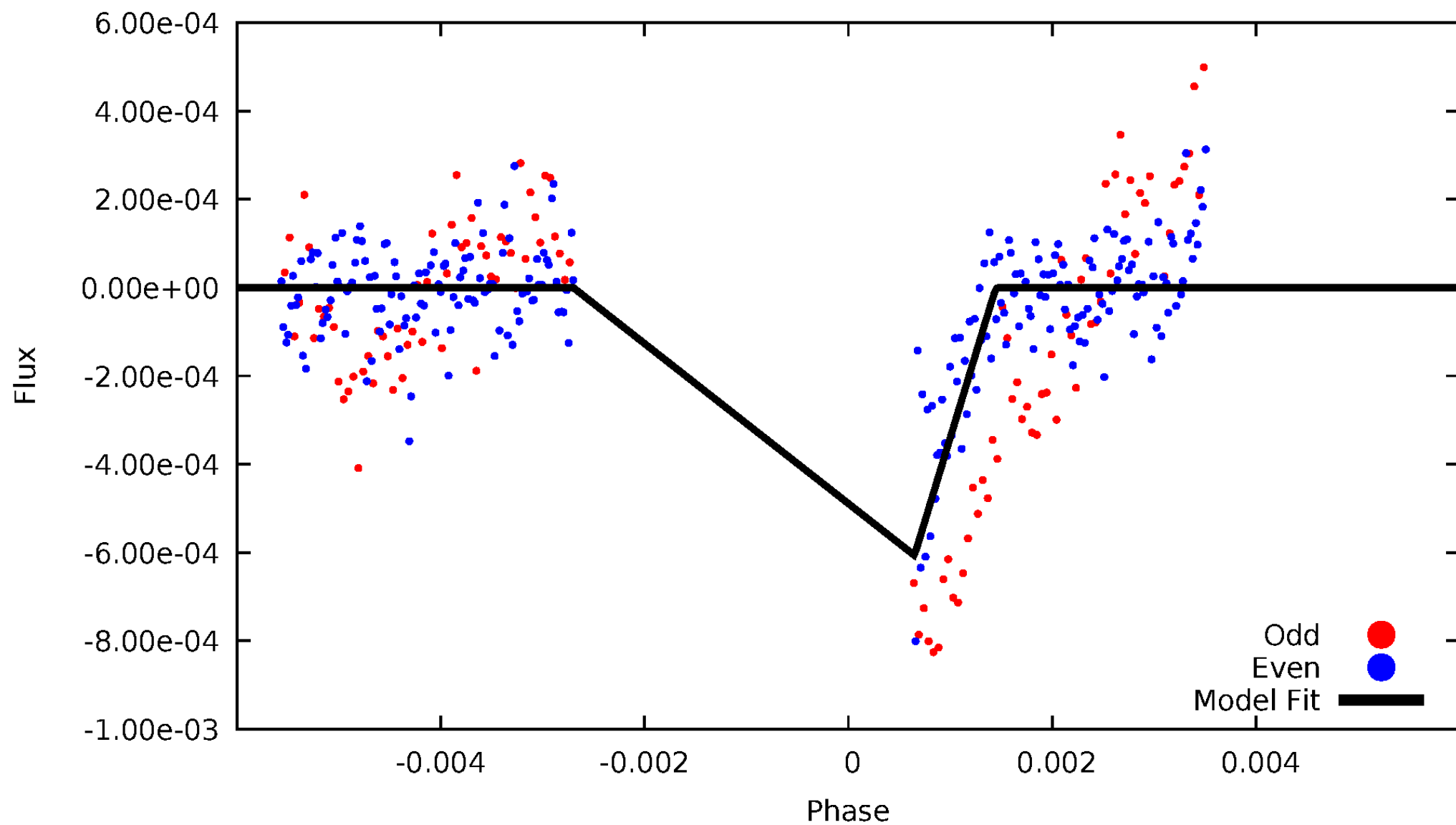
TCE 010989345-04





# ALT Odd/Even

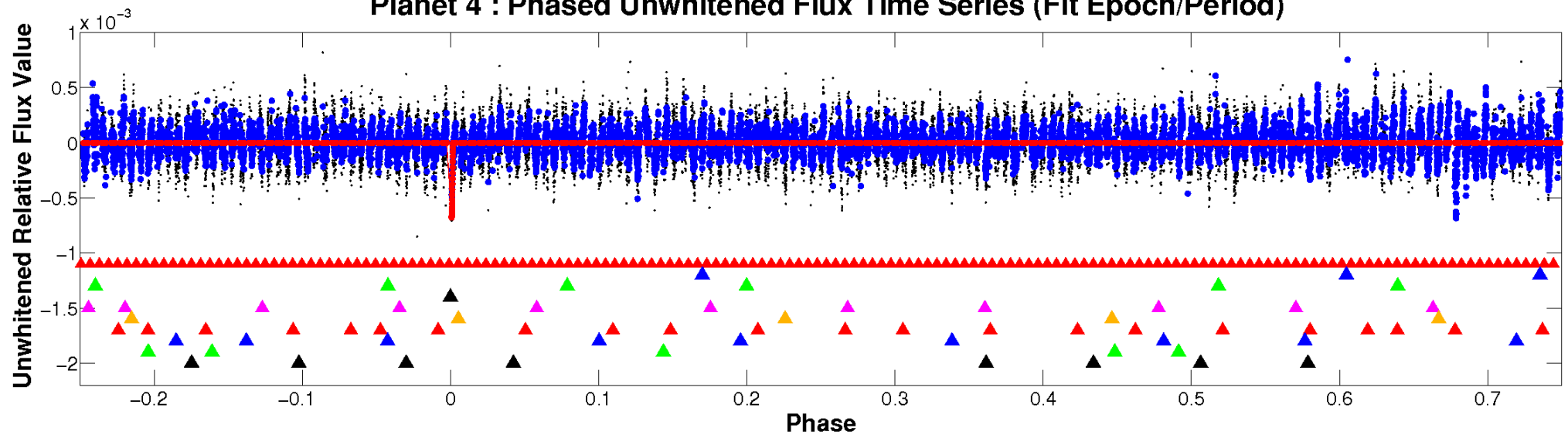
TCE 010989345-04



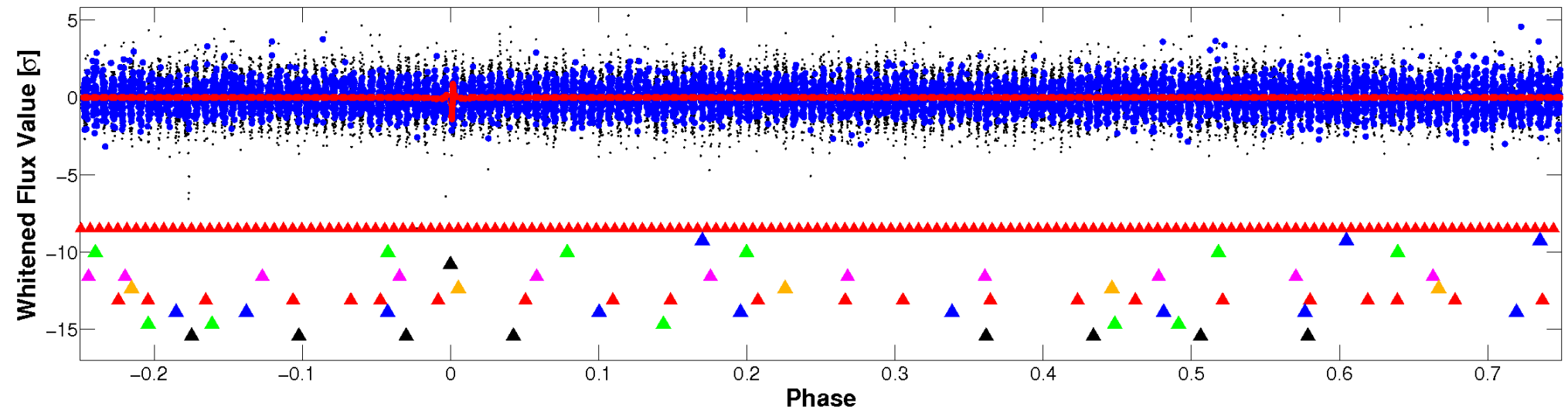


# Non-Whitened Vs. Whitened Light Curve

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



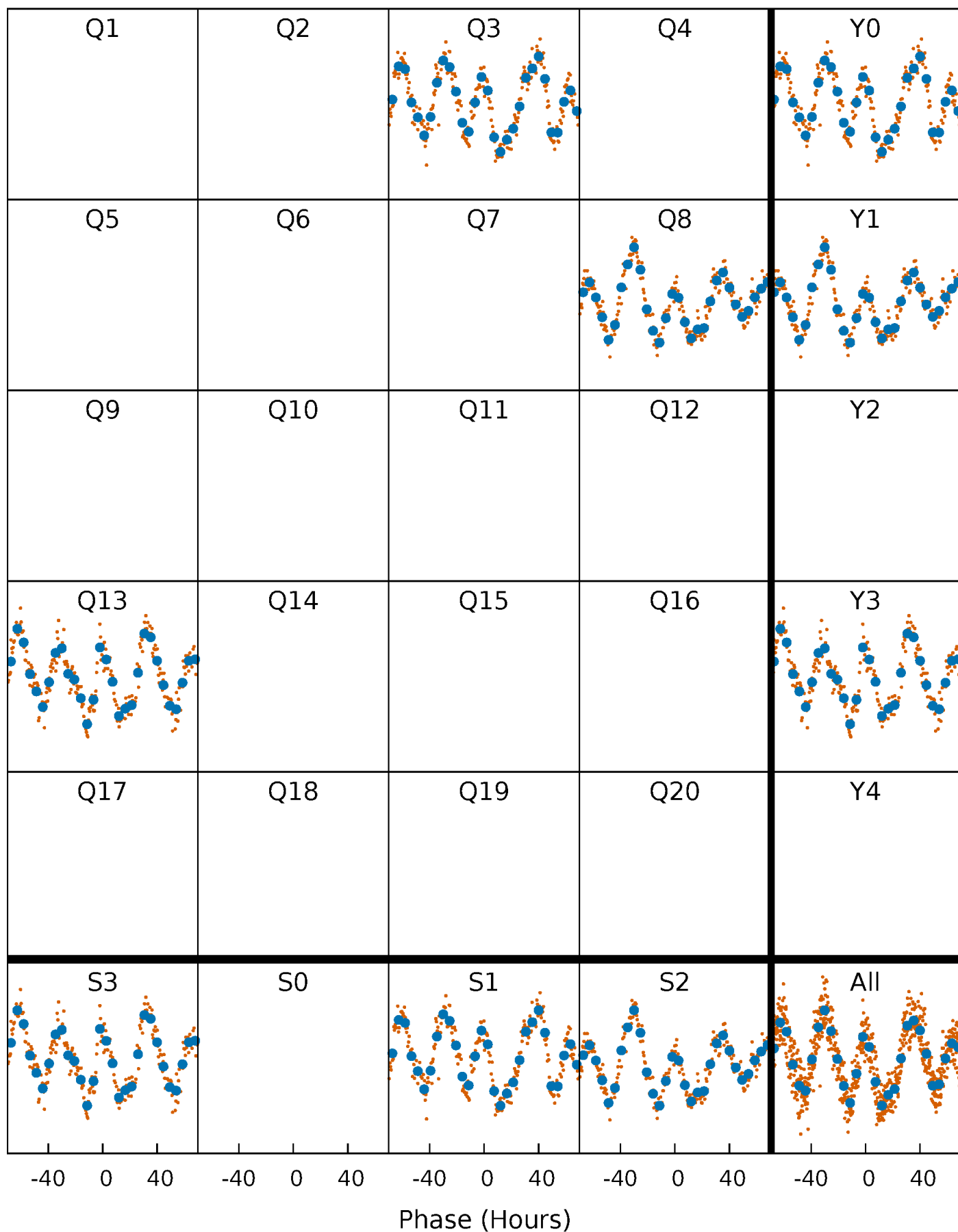
## Planet 4 : Phased Whitened Flux Time Series (Fit Epoch/Period)





# PDC Quarter-Phased Transit Curves

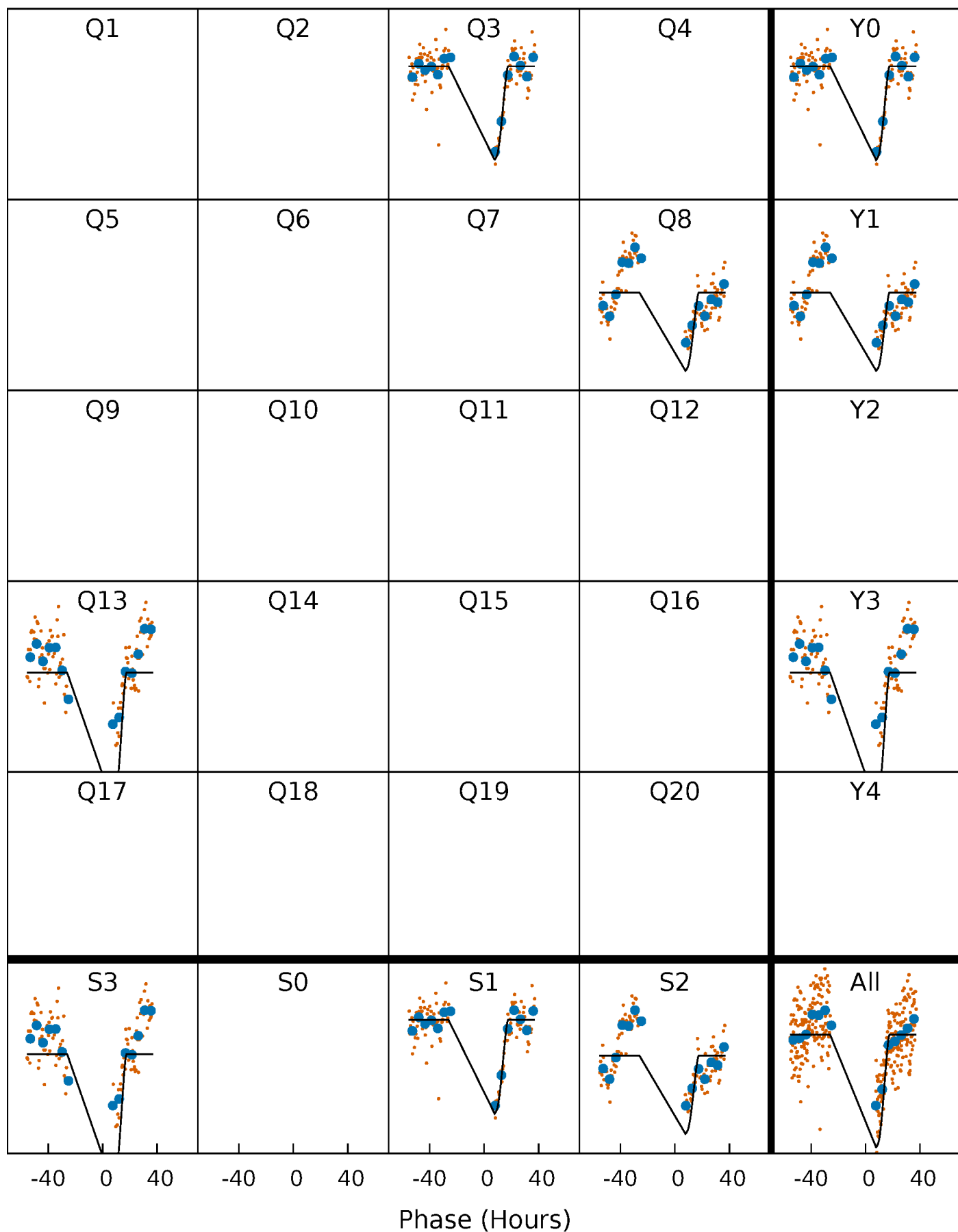
TCE 010989345-04     $P=423.567102$  Days     $T_0=344.022902$  (BKJD)





# DV Quarter-Phased Transit Curves

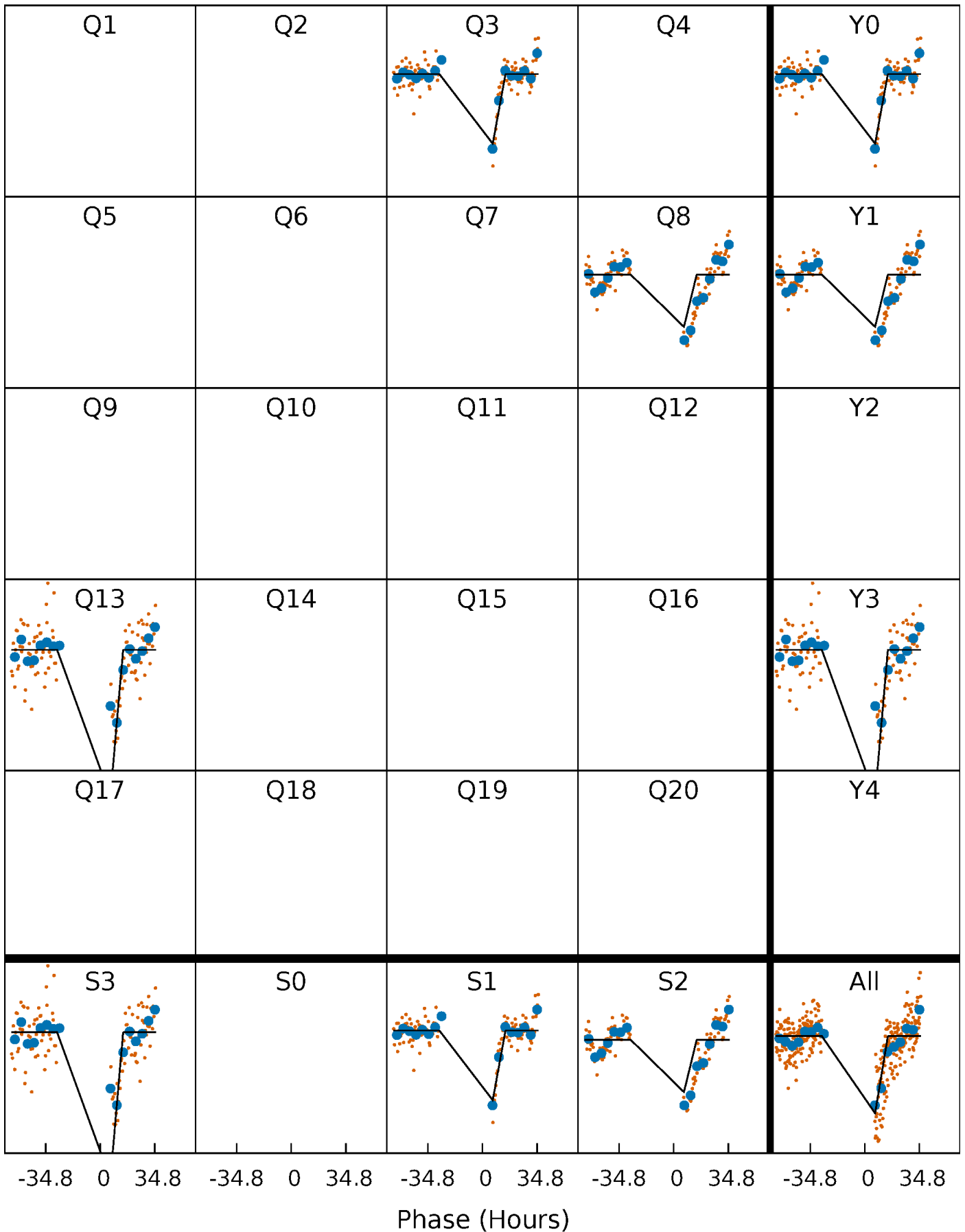
TCE 010989345-04     $P=423.567102$  Days     $T_0=344.022902$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

TCE 010989345-04     $P=423.553643$  Days     $T_0=344.087814$  (BKJD)

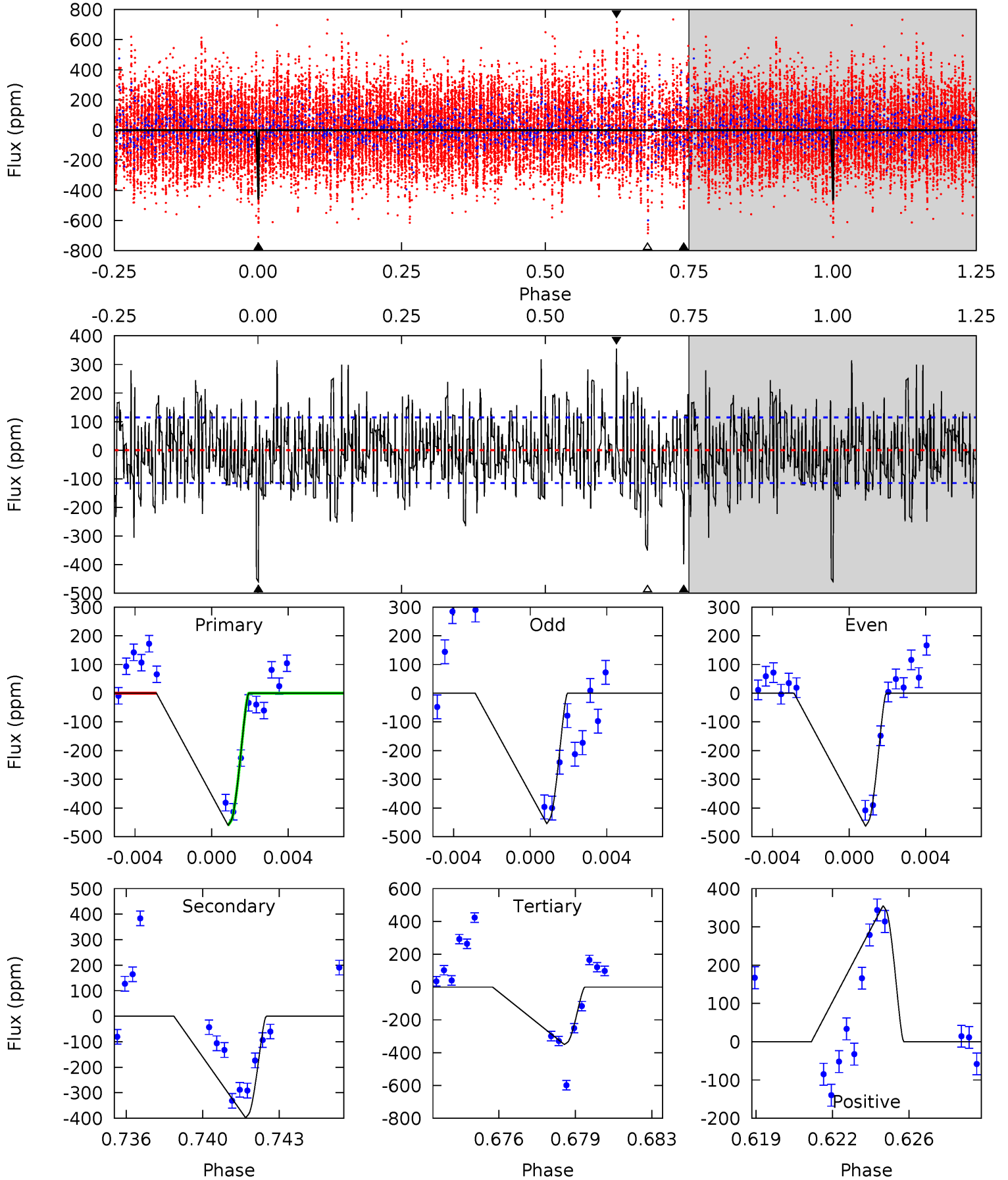




# DV Model-Shift Uniqueness Test

010989345-04, P = 423.567102 Days, E = 344.022902 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
21.0	18.1	15.9	16.2	5.22	2.92	4.30	5.01	4.77	2.17	1.93	0.19	1.03	0.44	0

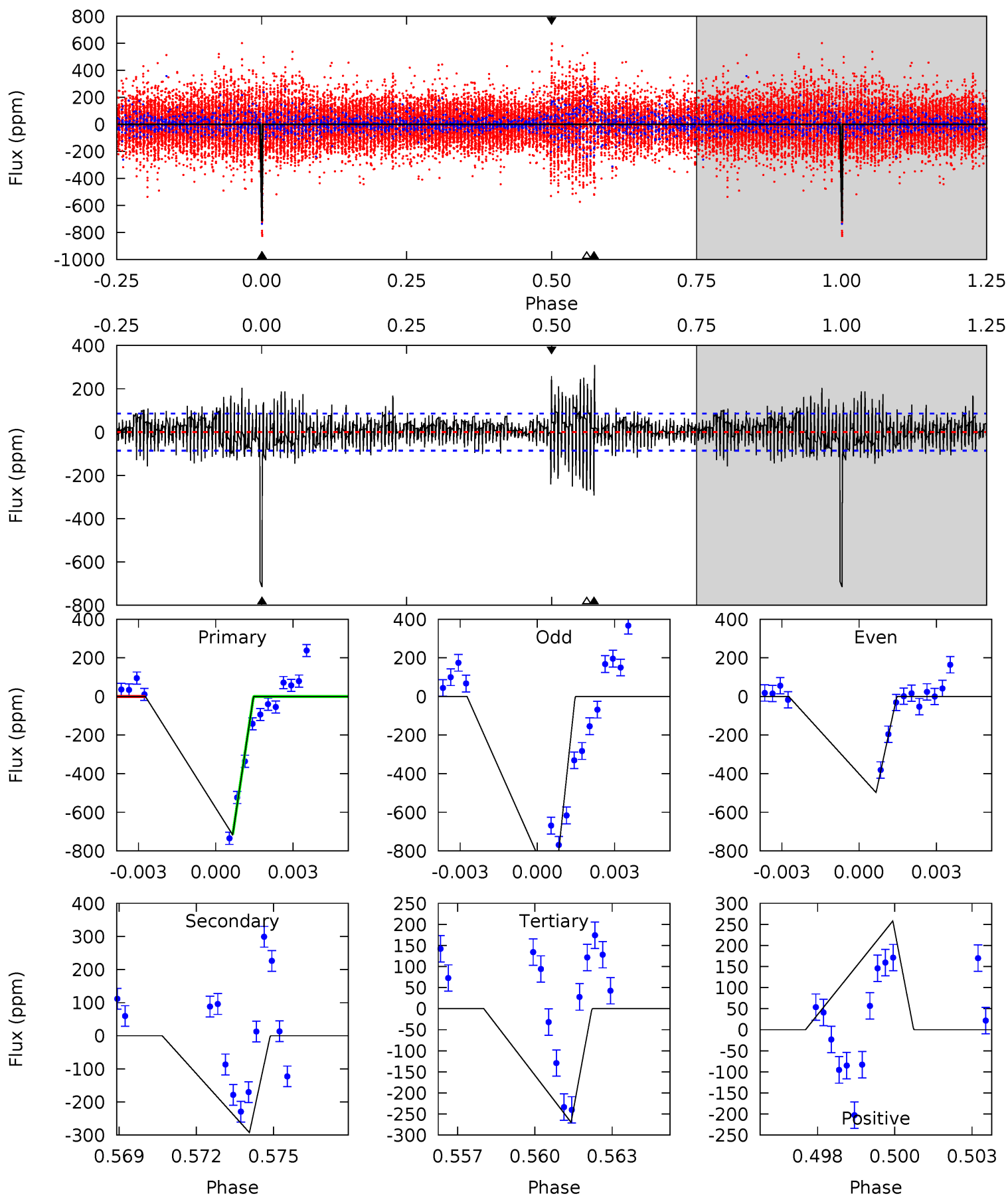




# Alt Model-Shift Uniqueness Test

010989345-04, P = 423.553643 Days, E = 344.087814 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
44.0	18.0	16.6	15.9	5.25	2.97	3.80	27.5	28.2	1.39	2.11	15.5	1.12	0.30	0





### Stellar Parameters For KIC 010989345

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6441^{+181}_{-227}$	$4.108^{+0.286}_{-0.154}$	$-0.440^{+0.300}_{-0.300}$	$1.504^{+0.421}_{-0.463}$	$1.056^{+0.177}_{-0.133}$	$0.438^{+0.795}_{-0.185}$
	+3%/-4%	+7%/-4%	+68%/-68%	+28%/-31%	+17%/-13%	+182%/-42%
Source	PHO54	PHO54	PHO54	DSEP		

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

### Secondary Eclipse Parameters for KIC 010989345-04 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-398 \pm 22$	$4.84^{+0.91}_{-0.86}$	$453^{+36}_{-42}$	$5275^{+304}_{-254}$	$11925^{+5726}_{-3245}$
Alt.	$-292 \pm 16$	$3.96^{+0.83}_{-0.76}$	$453^{+34}_{-39}$	$5373^{+351}_{-292}$	$12985^{+7090}_{-3836}$

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



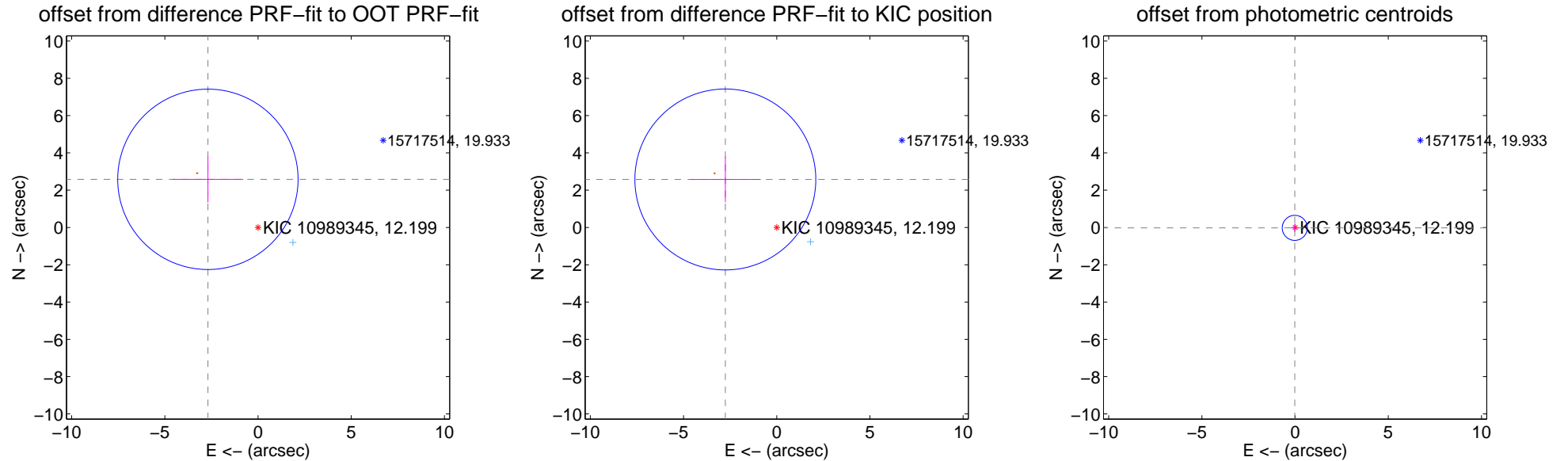
## DV Centroid Data

Supplemental centroid analysis for 010989345-04. Kepler magnitude: 12.20. Transit SNR 7.78

There are 1 quarters with good PRF difference image offsets

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

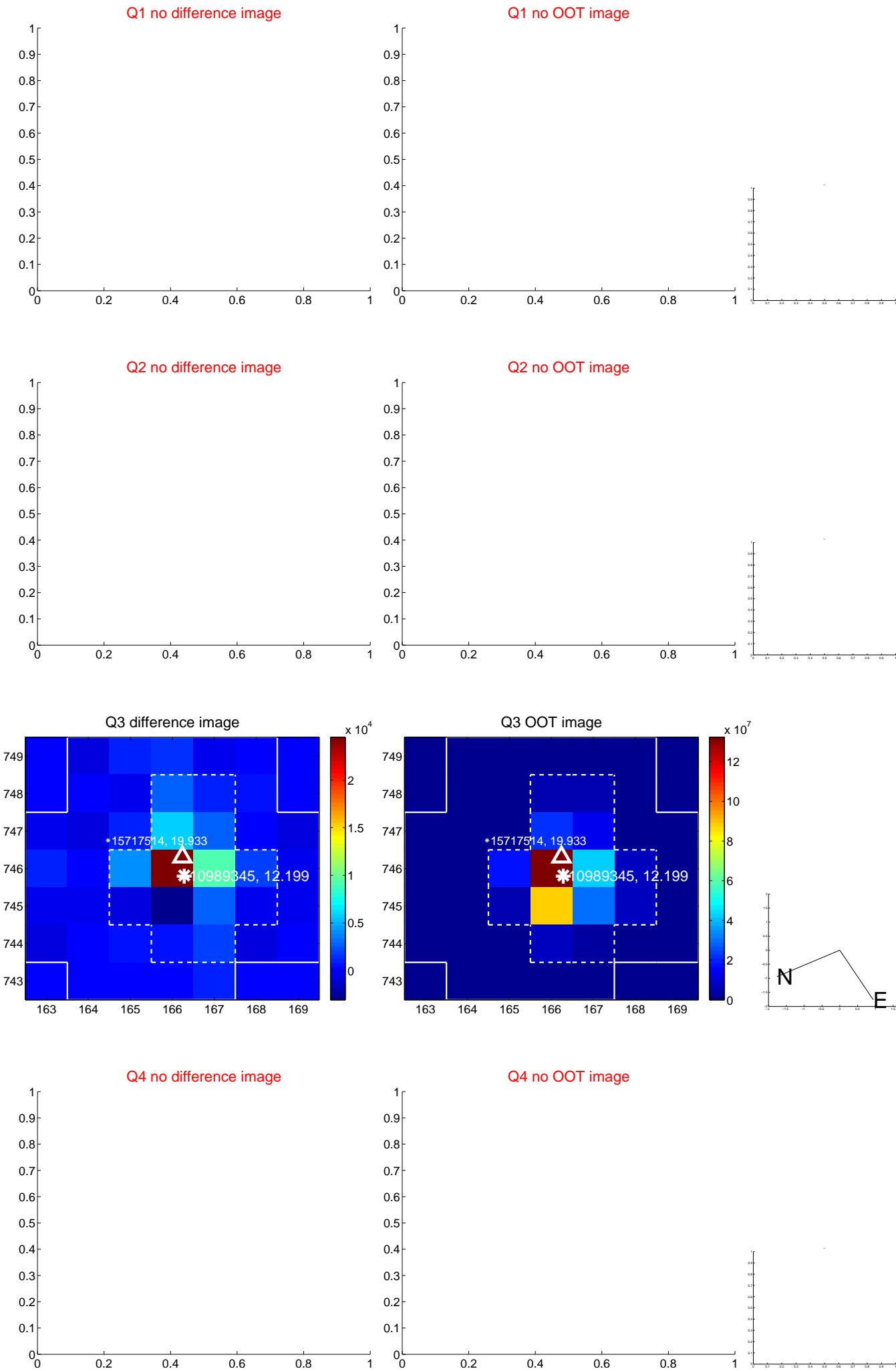
	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$3.728 \pm 1.612$	2.31	$2.690 \pm 1.893$	$2.582 \pm 1.238$
PRF-fit source offset from KIC position	$3.772 \pm 1.617$	2.33	$2.756 \pm 1.897$	$2.575 \pm 1.221$
photometric centroid source offset	$0.03 \pm 0.22$	0.12	$0.02 \pm 0.22$	$-0.02 \pm 0.23$



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.

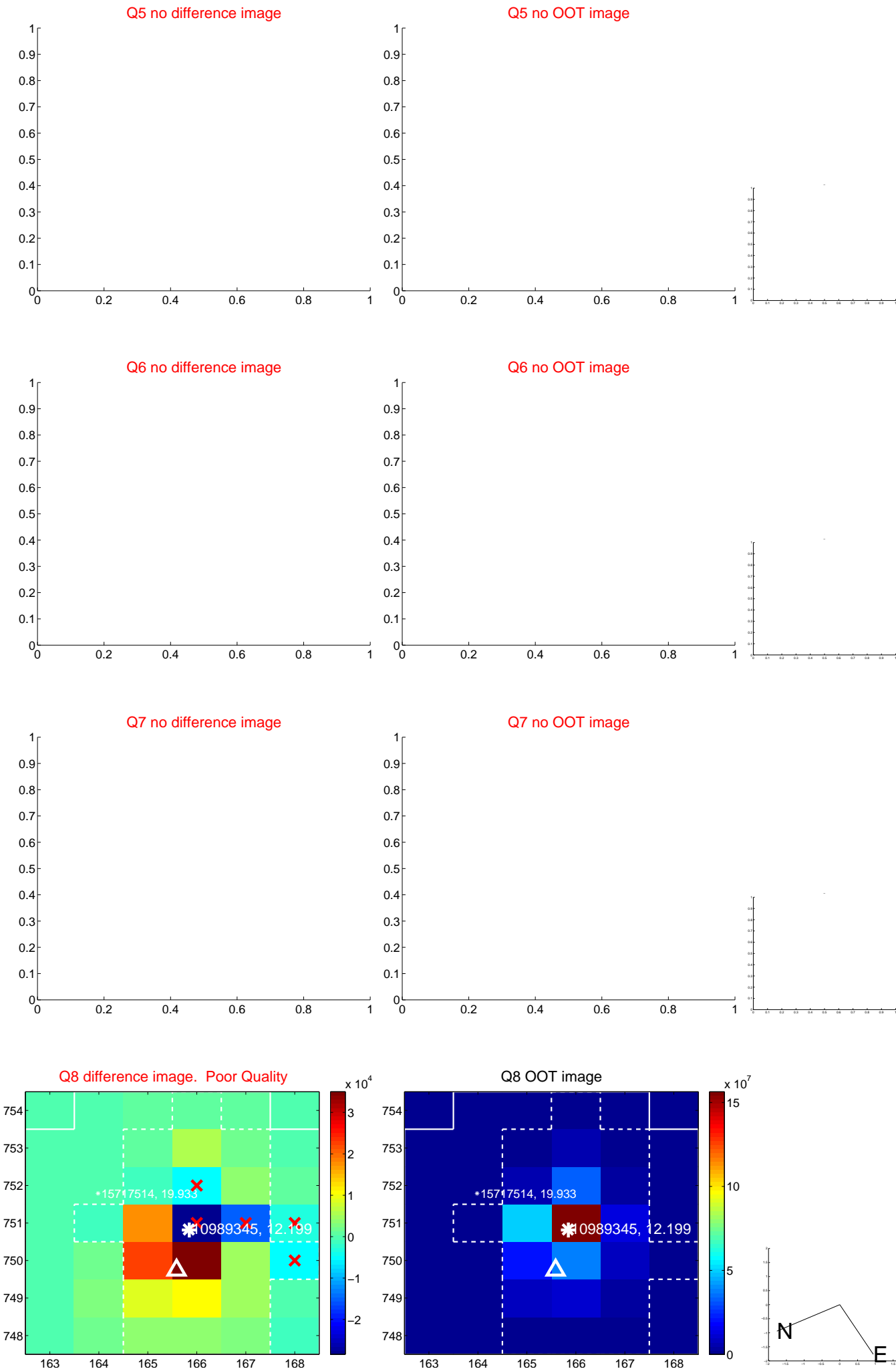


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



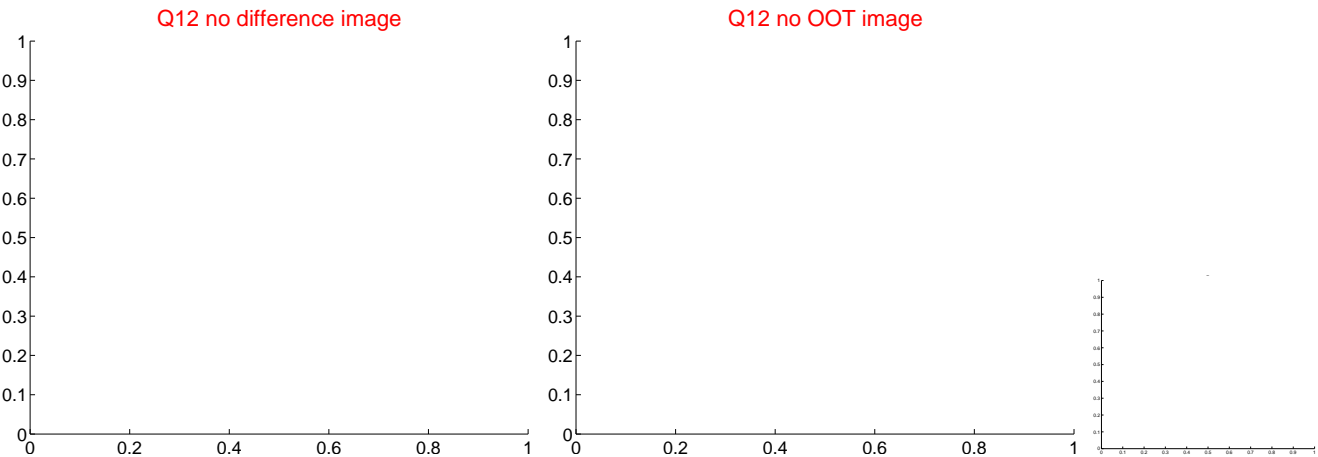
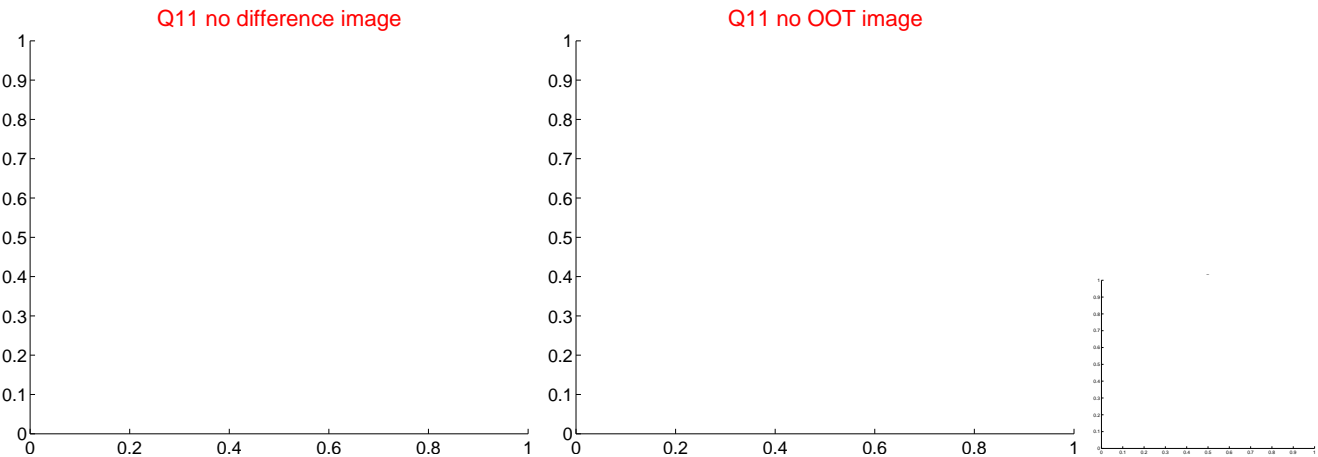
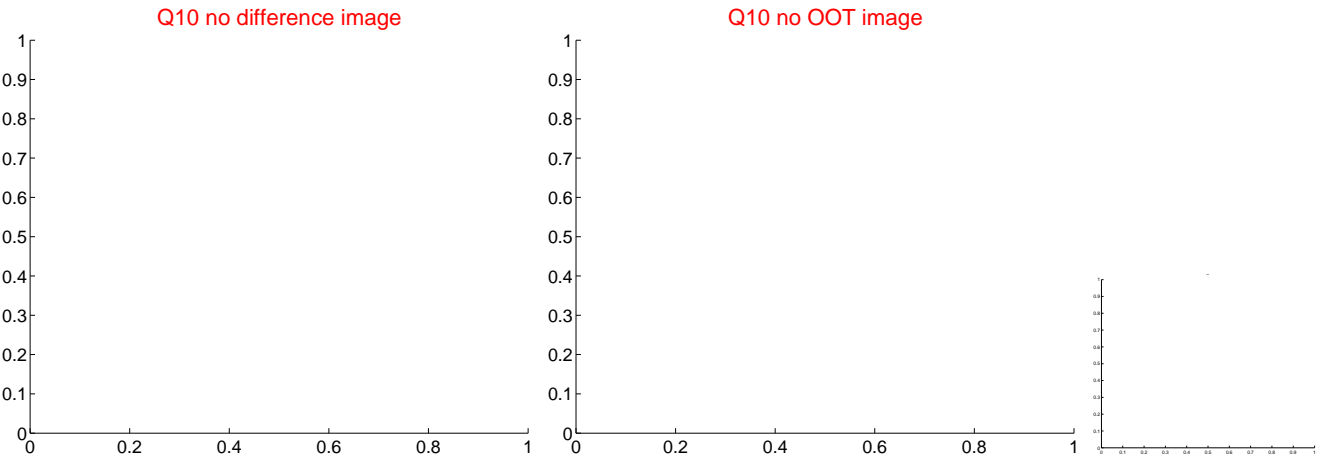
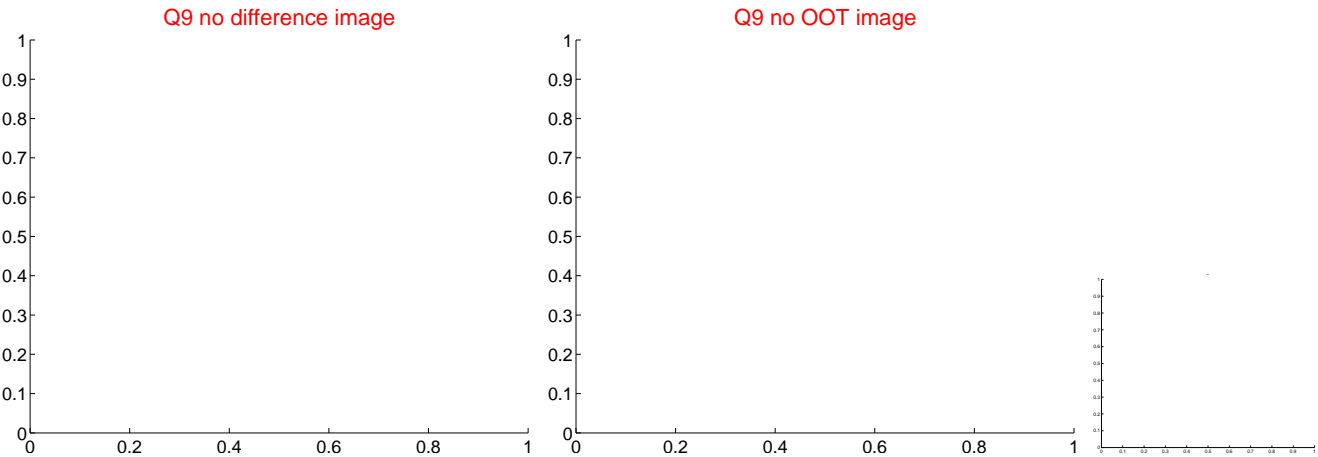


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



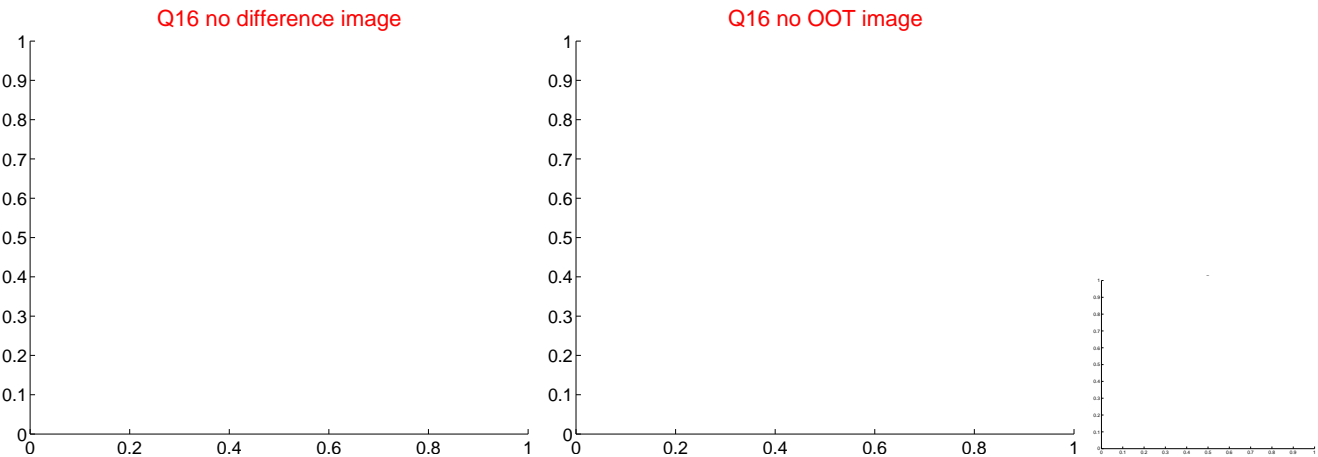
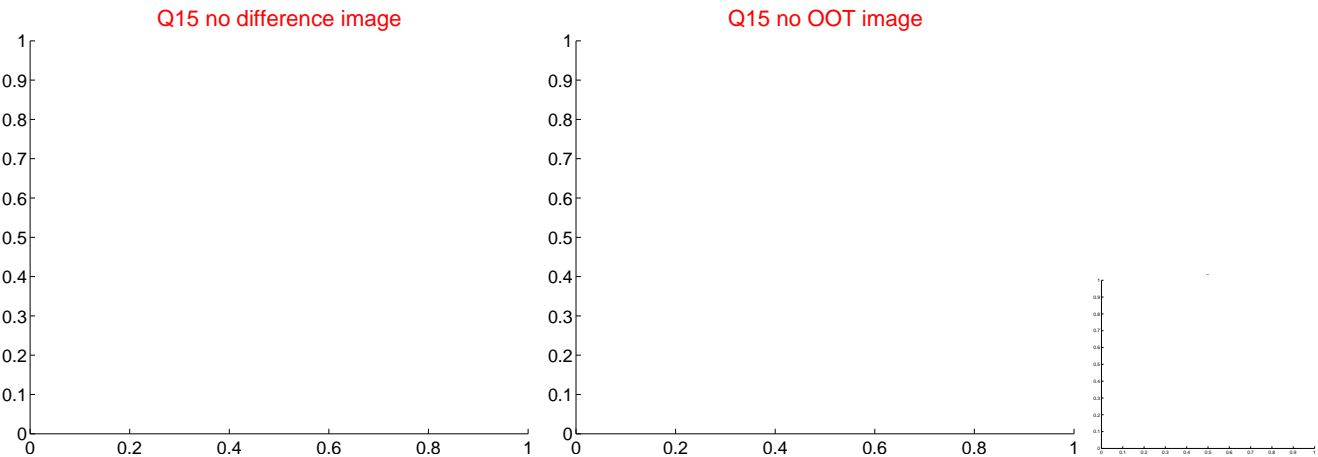
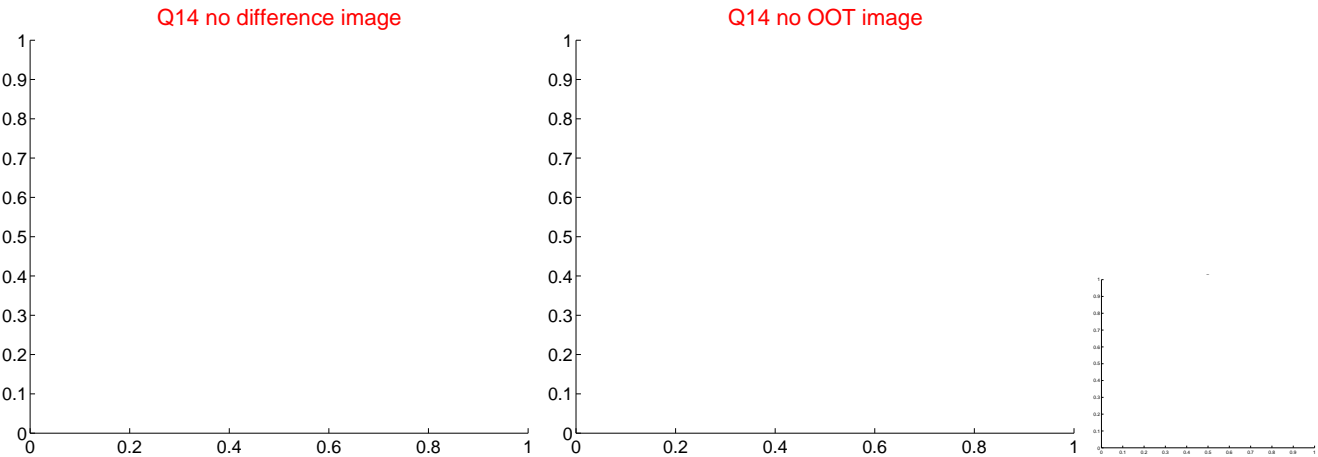
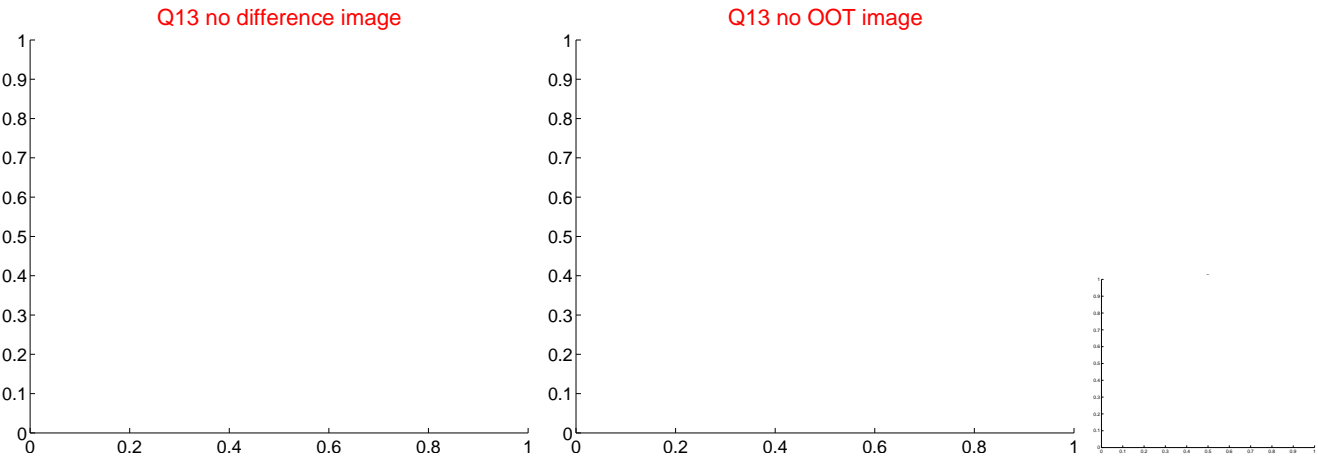


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



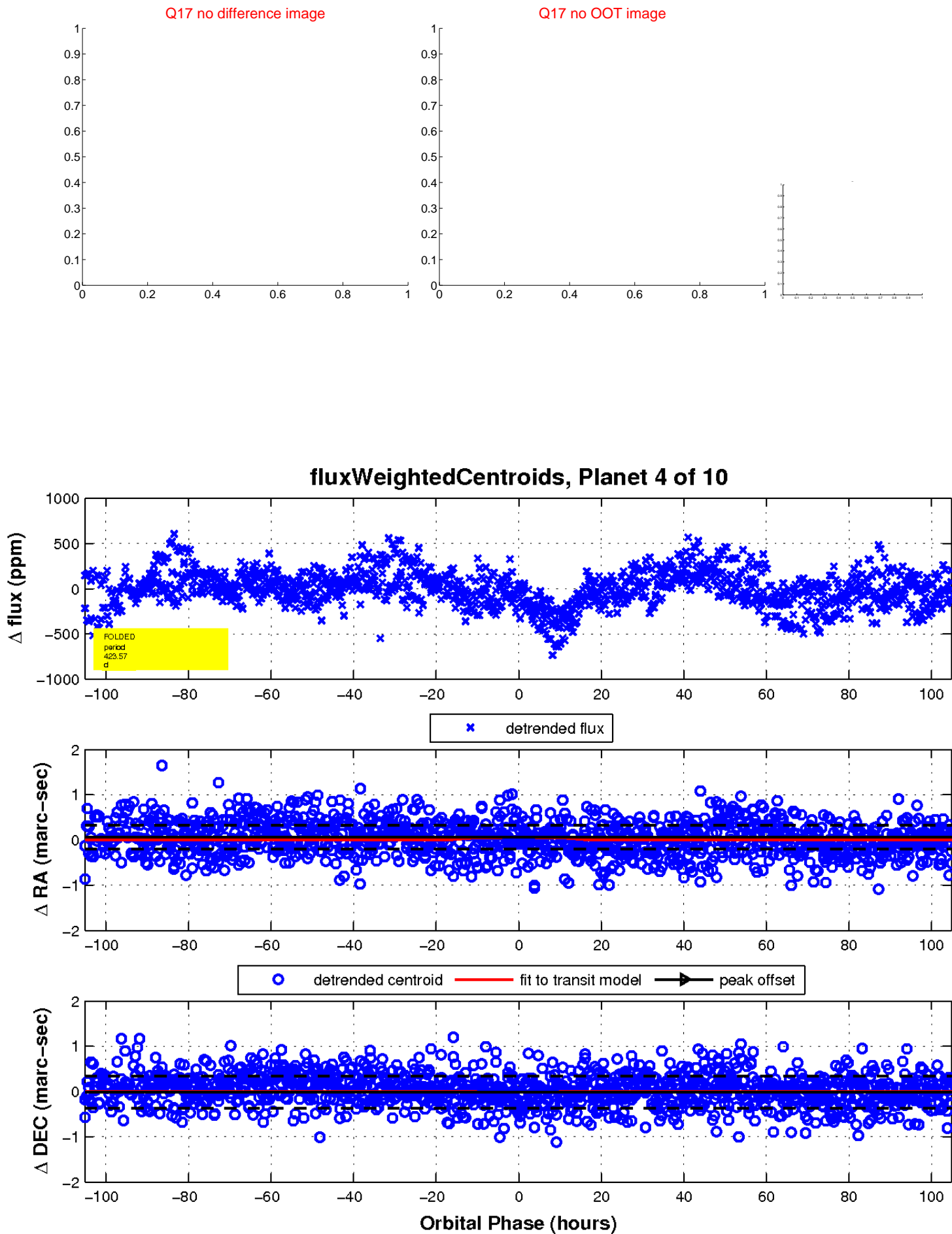


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





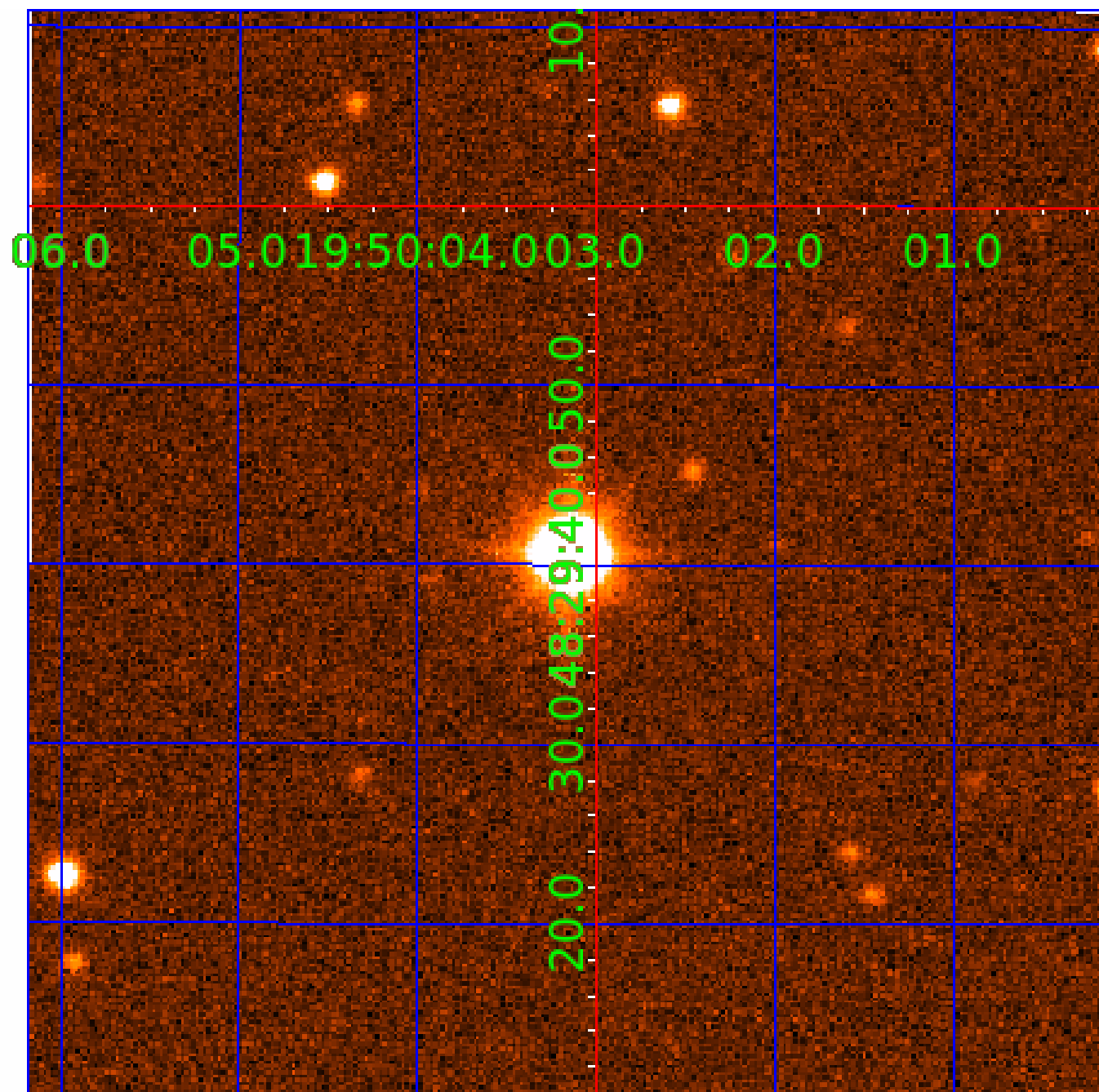
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





UKIRT Image

Declination





# KIC 010989345

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
010989345-01	OBS	No	2.630764	133.193244	10.6	11.138	8.7	2.7	1.50	6441	0.56	2414.15
010989345-02	OBS	No	663.020155	176.584259	336.4	6.883	8.0	8.5	1.50	6441	3.12	1.52
010989345-03	OBS	No	237.414043	326.142677	325.3	14.174	7.7	8.6	1.50	6441	3.39	5.96
010989345-04	OBS	No	423.567102	344.022902	722.4	35.026	7.8	7.8	1.50	6441	4.94	2.76
010989345-05	OBS	No	128.115026	240.564541	252.7	10.241	7.8	8.2	1.50	6441	2.77	13.57
010989345-07	OBS	No	66.433669	191.136166	129.6	13.221	7.4	5.2	1.50	6441	1.83	32.59
010989345-08	OBS	No	161.346431	265.595466	238.5	7.037	7.2	7.2	1.50	6441	4.56	9.98
010989345-09	OBS	No	276.296890	275.873517	375.6	30.069	7.9	7.5	1.50	6441	3.49	4.87
010989345-10	OBS	No	196.452793	165.569777	243.6	5.231	7.4	8.1	1.50	6441	3.04	7.68

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
010989345-01	OBS	FP	0.00	1	0	0	0	SWEET_NTL—LPP_DV—MOD_NONUNIQ_DV
010989345-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES—ALL_TRANS_CHASES—MOD_NONUNIQ_DV
010989345-03	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—HALO_GHOST
010989345-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
010989345-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—MOD_NONUNIQ_DV
010989345-07	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT
010989345-08	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT
010989345-09	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—CENT_FEW_DIFFS
010989345-10	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT

**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.

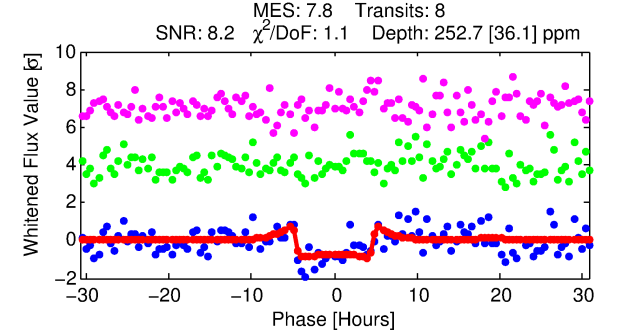
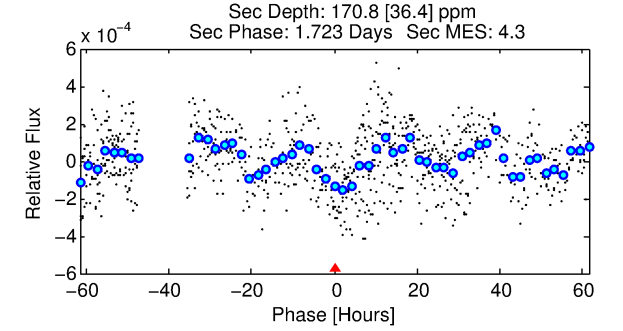
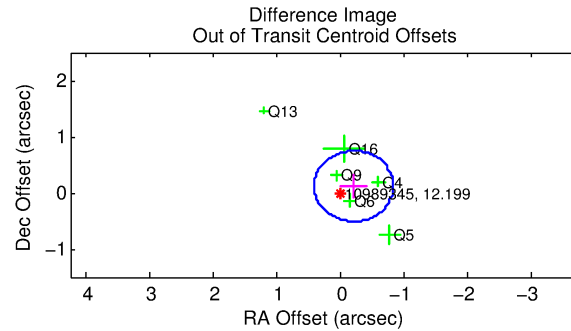
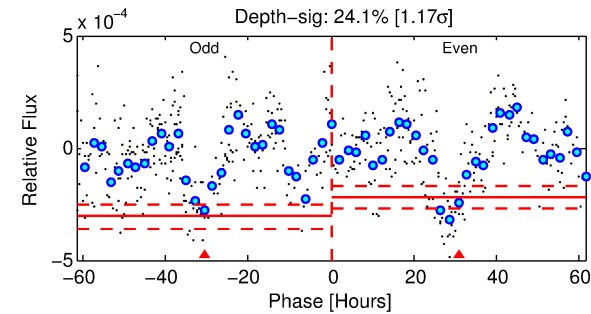
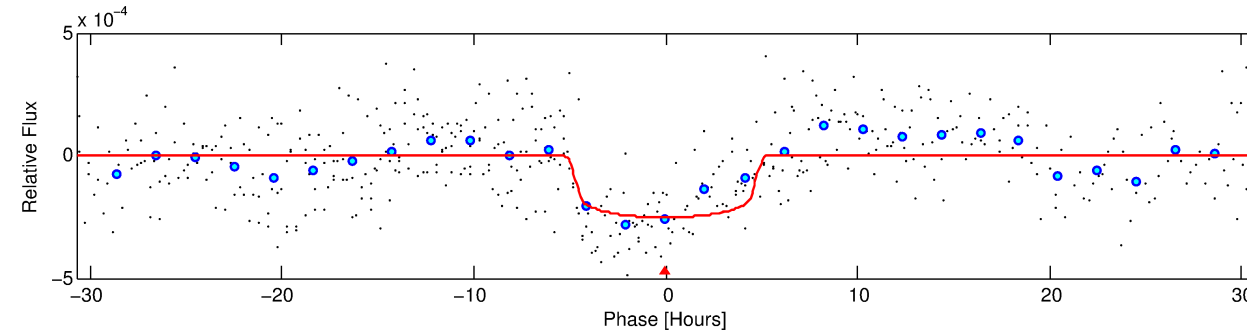
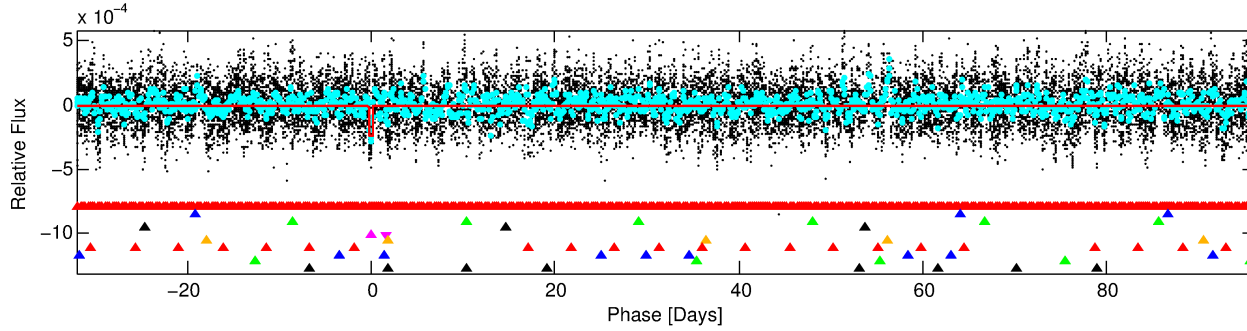
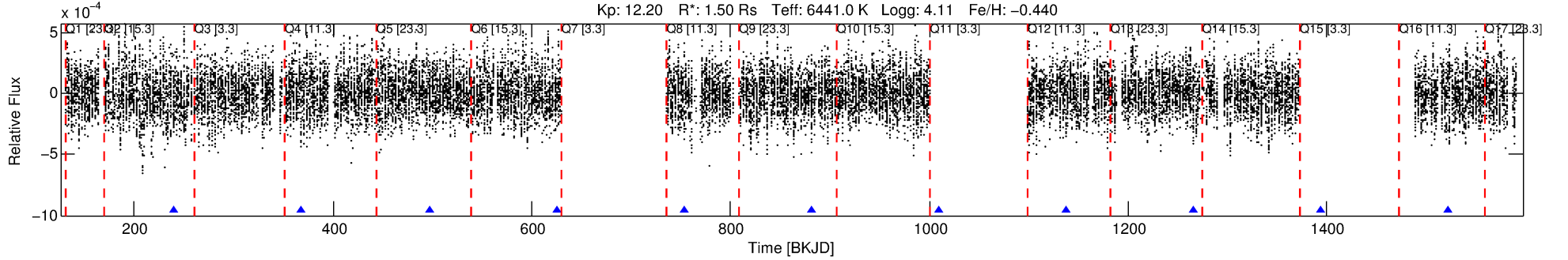
Ephemeris Match Information For 010989345-05

No Significant Match Found



# DV One-Page Summary

KIC: 10989345 Candidate: 5 of 10 Period: 128.115 d



## DV Fit Results:

Period = 128.11503 [0.00193] d  
Epoch = 240.5645 [0.0112] BKJD  
Rp/R\* = 0.0168 [0.0019]  
a/R\* = 47.53 [20.08]  
b = 0.89 [0.10]  
Seff = 13.57 [6.85]  
Teq = 489 [62] K  
Rp = 2.76 [0.91] Re  
a = 0.5069 [0.1523] AU  
Ag = 3159.50 [1816.48] [1.74 $\sigma$ ]  
Teffp = 5674 [482] K [10.66 $\sigma$ ]

## DV Diagnostic Results:

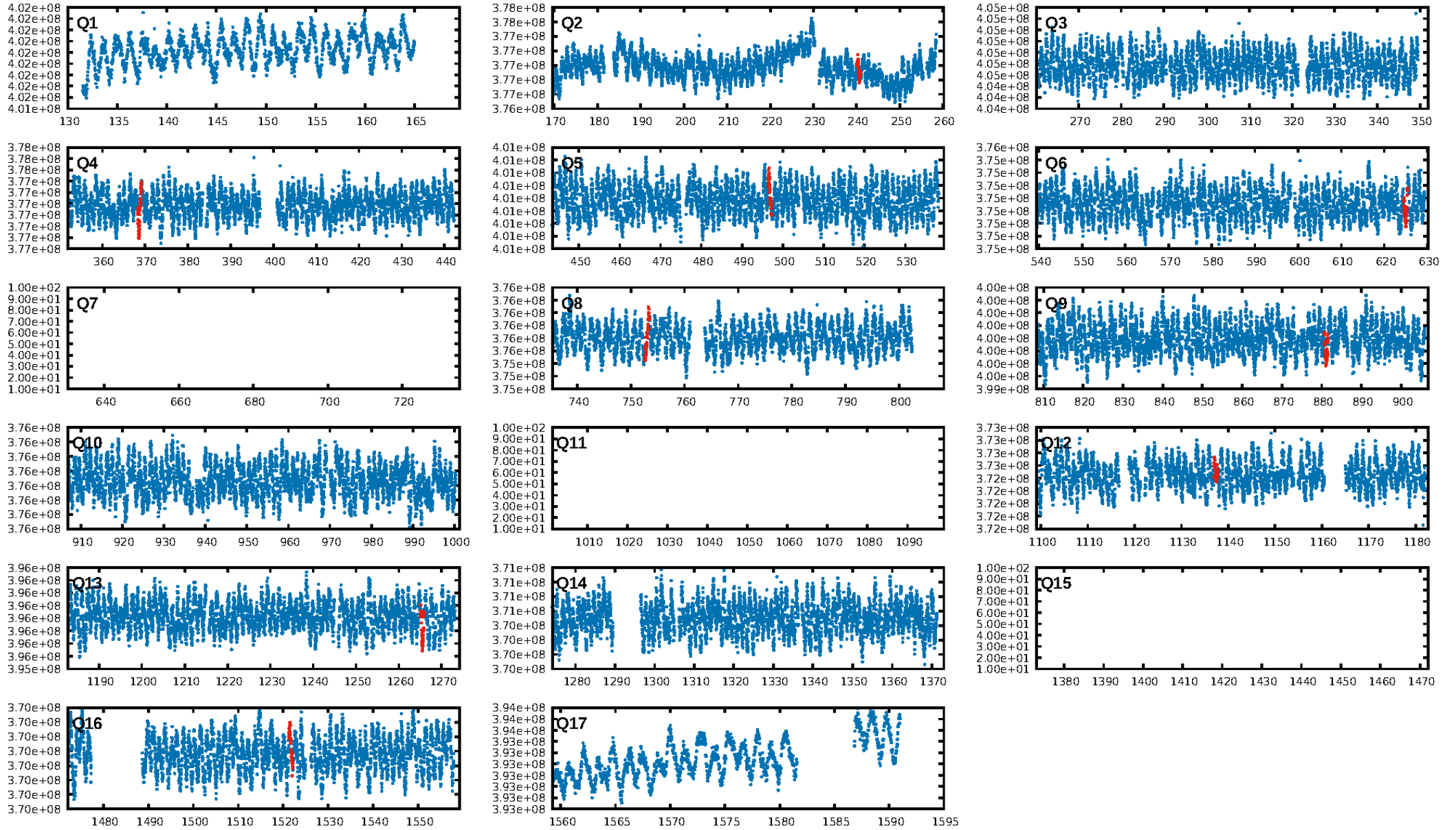
ShortPeriod-sig: 100.0% [88.52 $\sigma$ ]  
LongPeriod-sig: 100.0% [64.19 $\sigma$ ]  
ModelChiSquare2-sig: 78.8%  
ModelChiSquareGof-sig: 100.0%  
**Bootstrap-pfa: 1.19e-08**  
RollingBand-fgt: 1.00 [8/8]  
GhostDiagnostic-chr: 1.413  
Centroid-sig: 1.6%  
Centroid-so: 0.650 arcsec [1.50 $\sigma$ ]  
OotOffset-rm: 0.236 arcsec [1.13 $\sigma$ ]  
KicOffset-rm: 0.260 arcsec [1.32 $\sigma$ ]  
OotOffset-st: 1/0/2/3 [6]  
KicOffset-st: 1/0/2/3 [6]  
DiffImageQuality-fgm: 0.67 [4/6]  
DiffImageOverlap-fno: 0.33 [3/9]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 03:40:07 Z

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

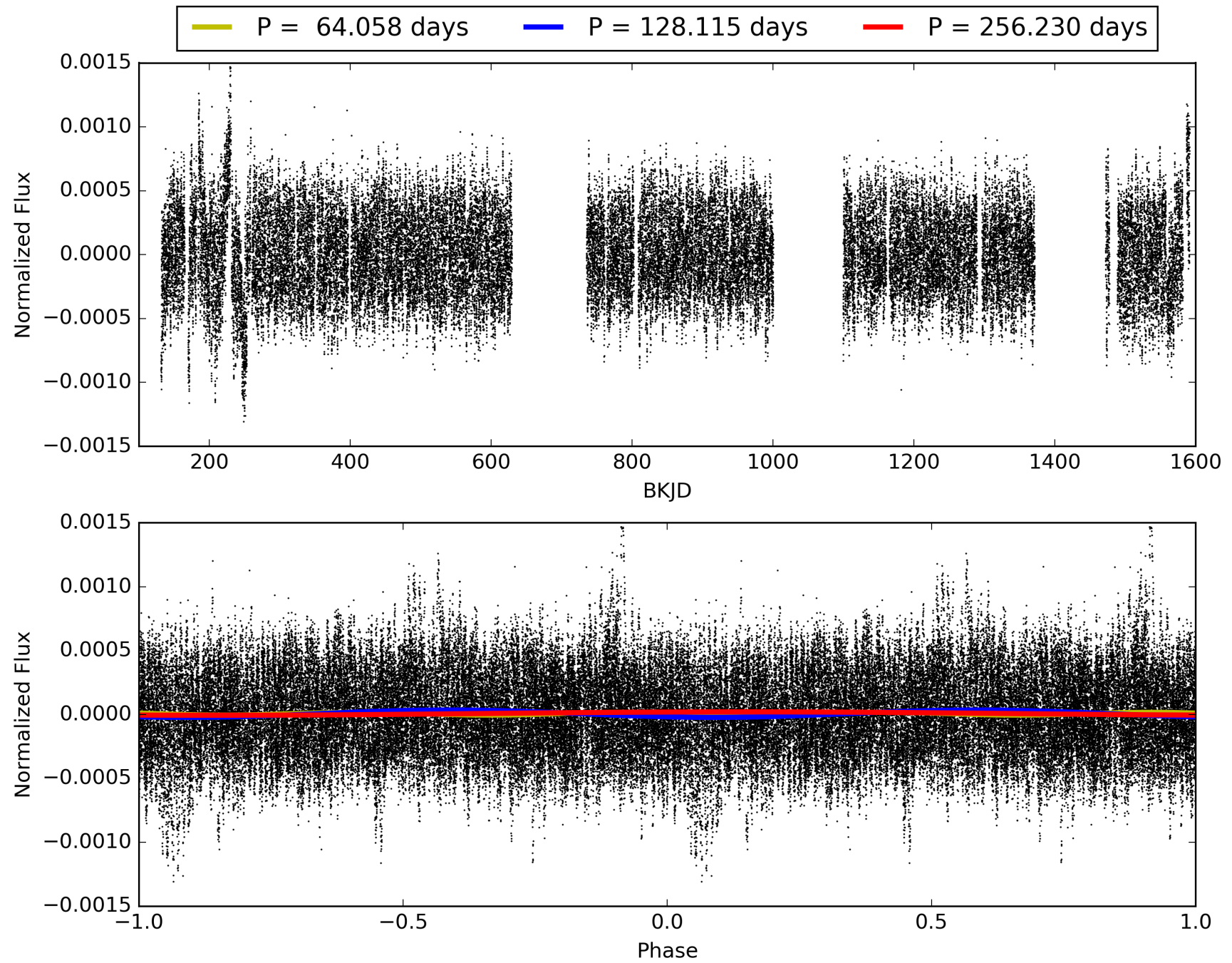


# TCE 010989345-05, PDC Light Curves





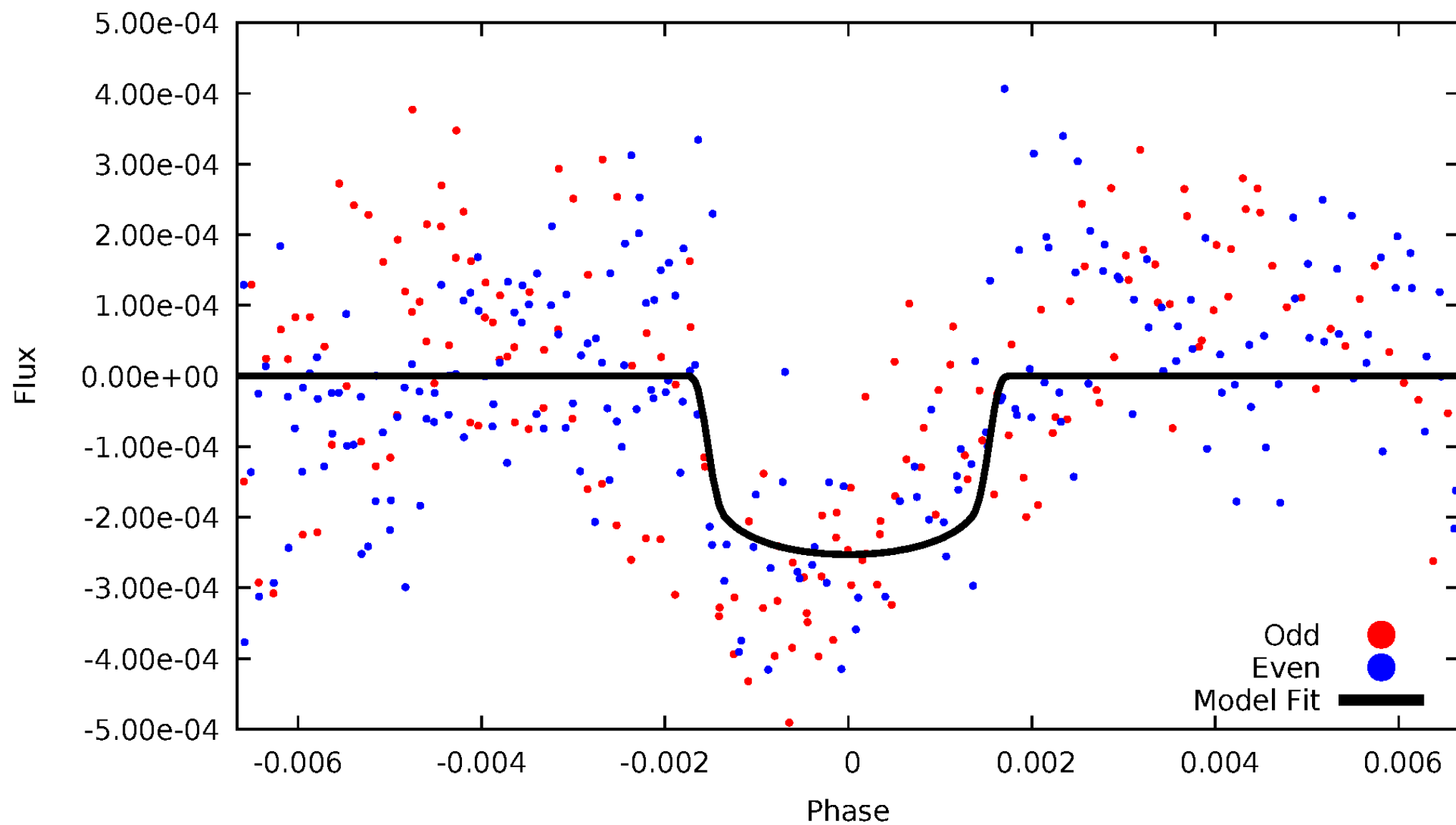
# TCE 010989345-05





# DV Odd/Even

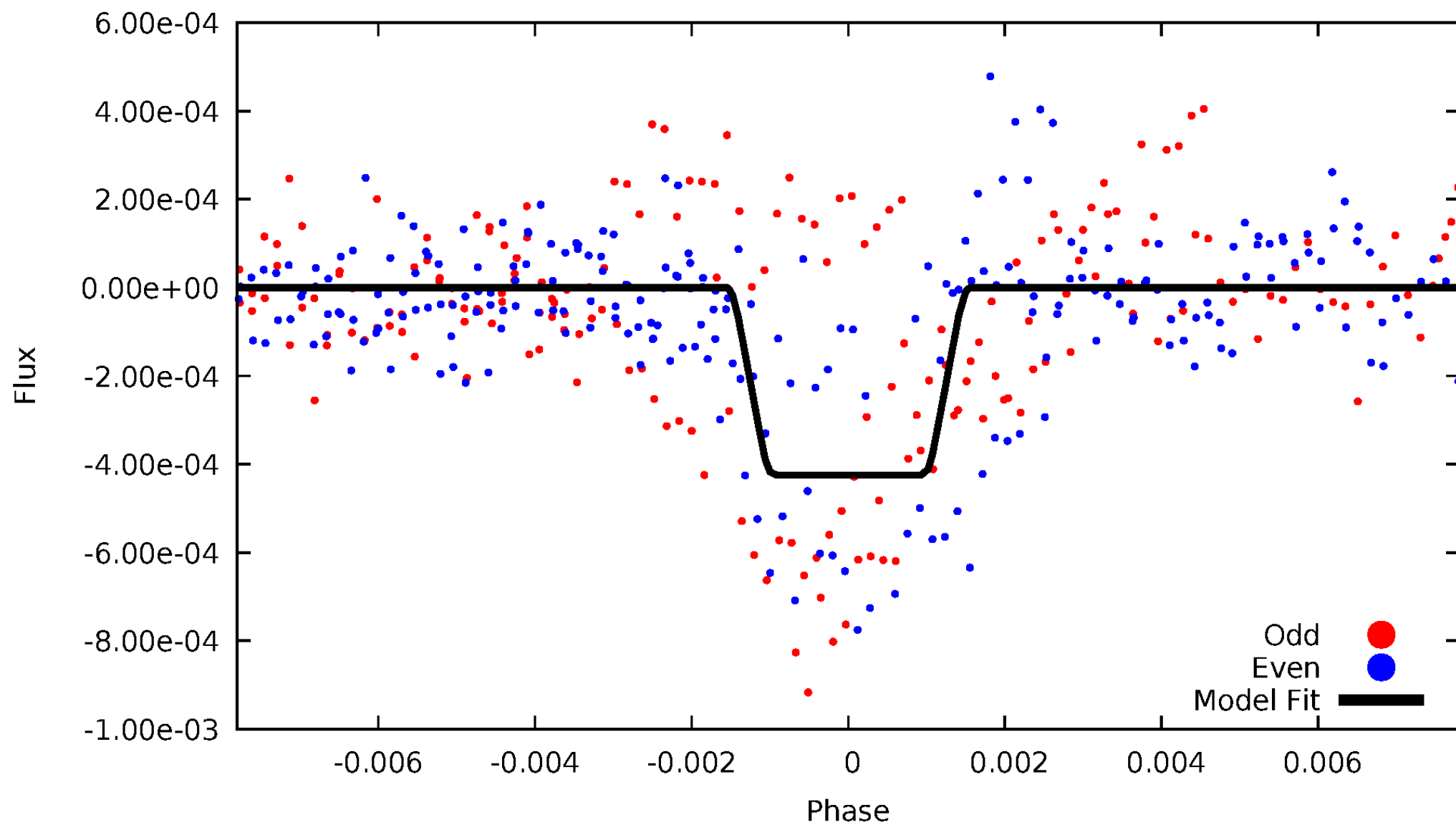
TCE 010989345-05





# ALT Odd/Even

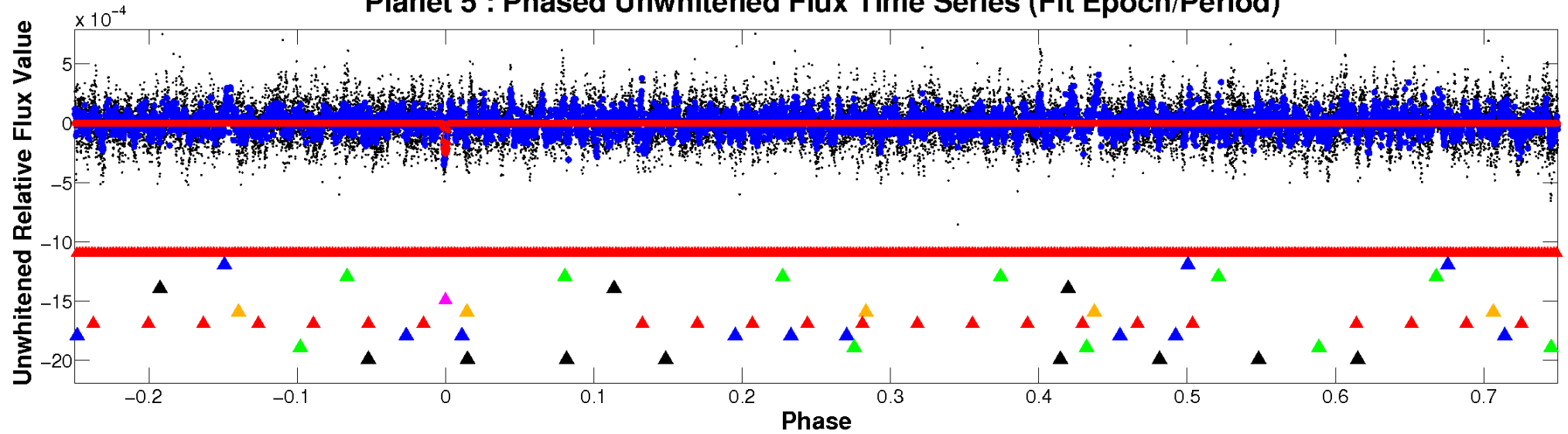
TCE 010989345-05



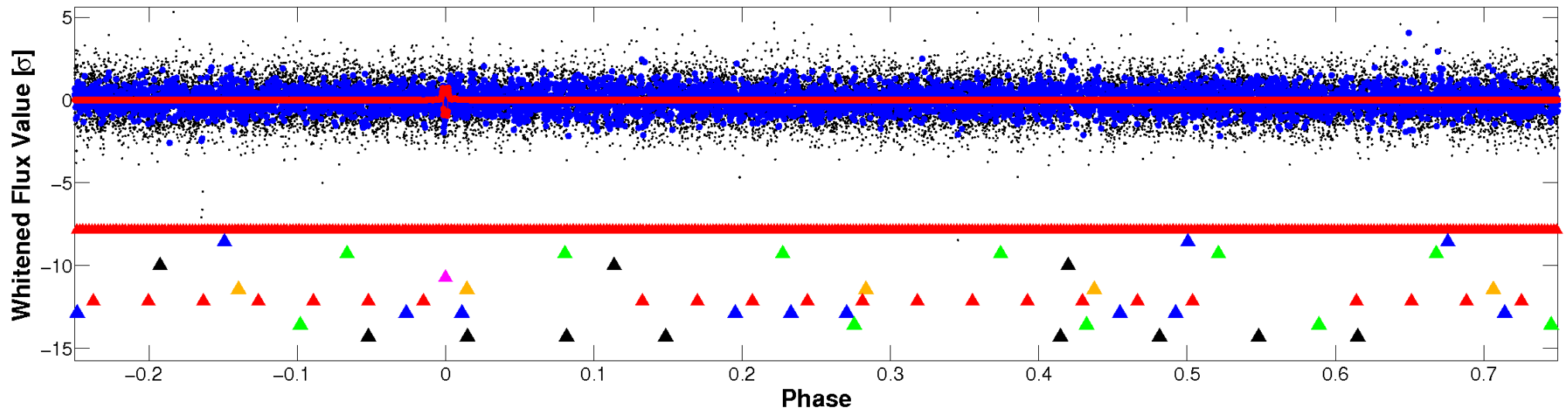


# Non-Whitened Vs. Whitened Light Curve

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



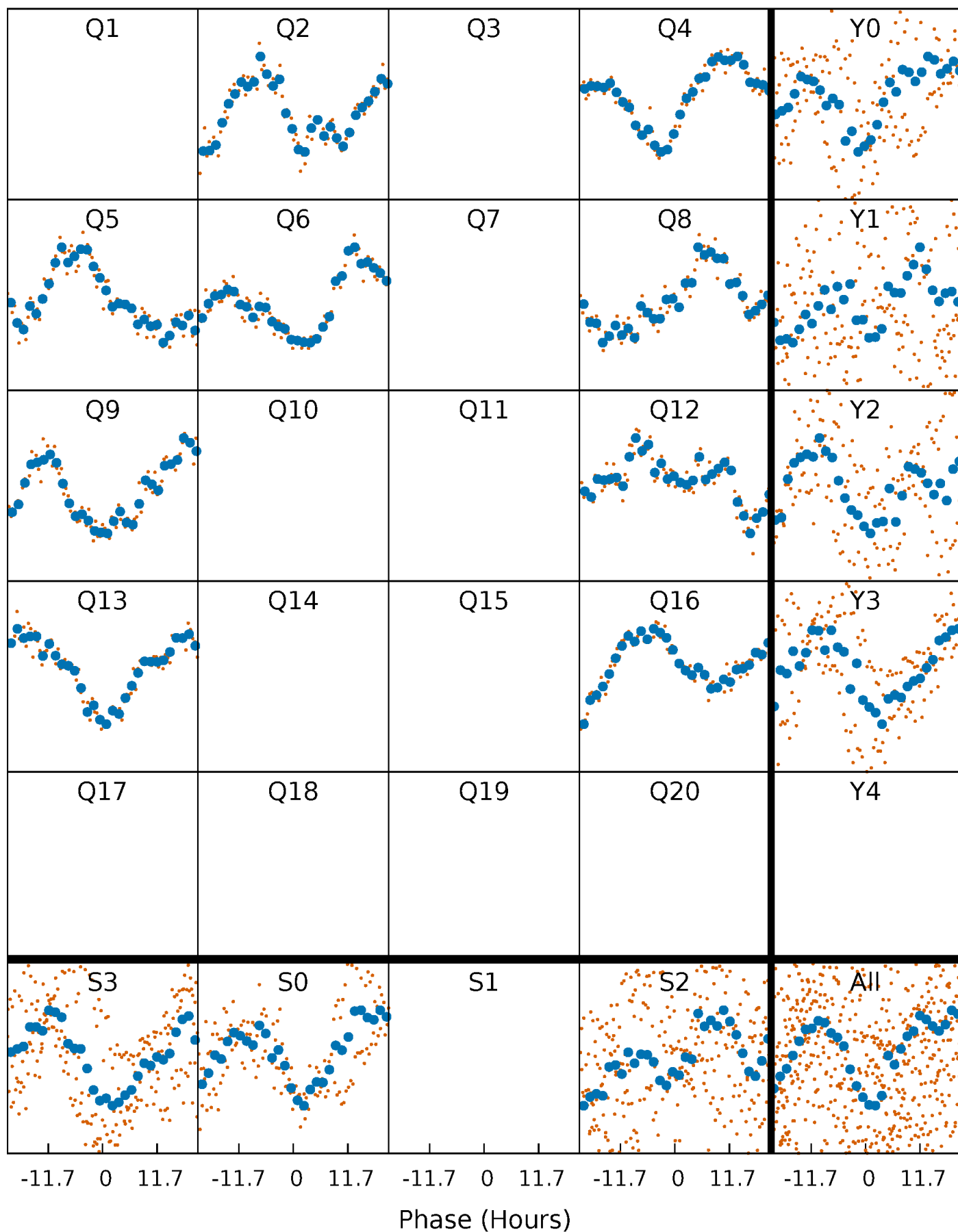
Planet 5 : Phased Whitened Flux Time Series (Fit Epoch/Period)





# PDC Quarter-Phased Transit Curves

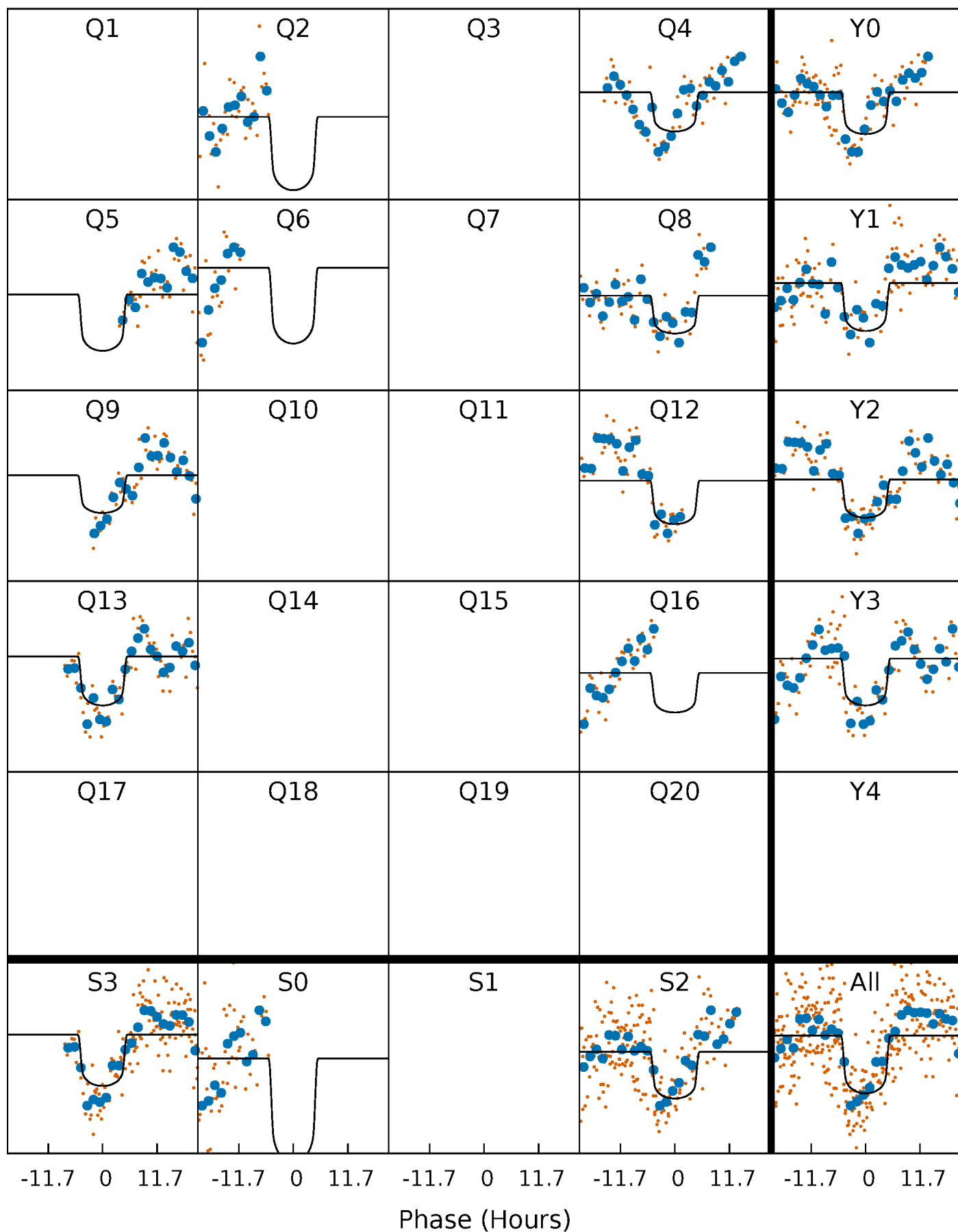
TCE 010989345-05     $P=128.115026$  Days     $T_0=240.564541$  (BKJD)





# DV Quarter-Phased Transit Curves

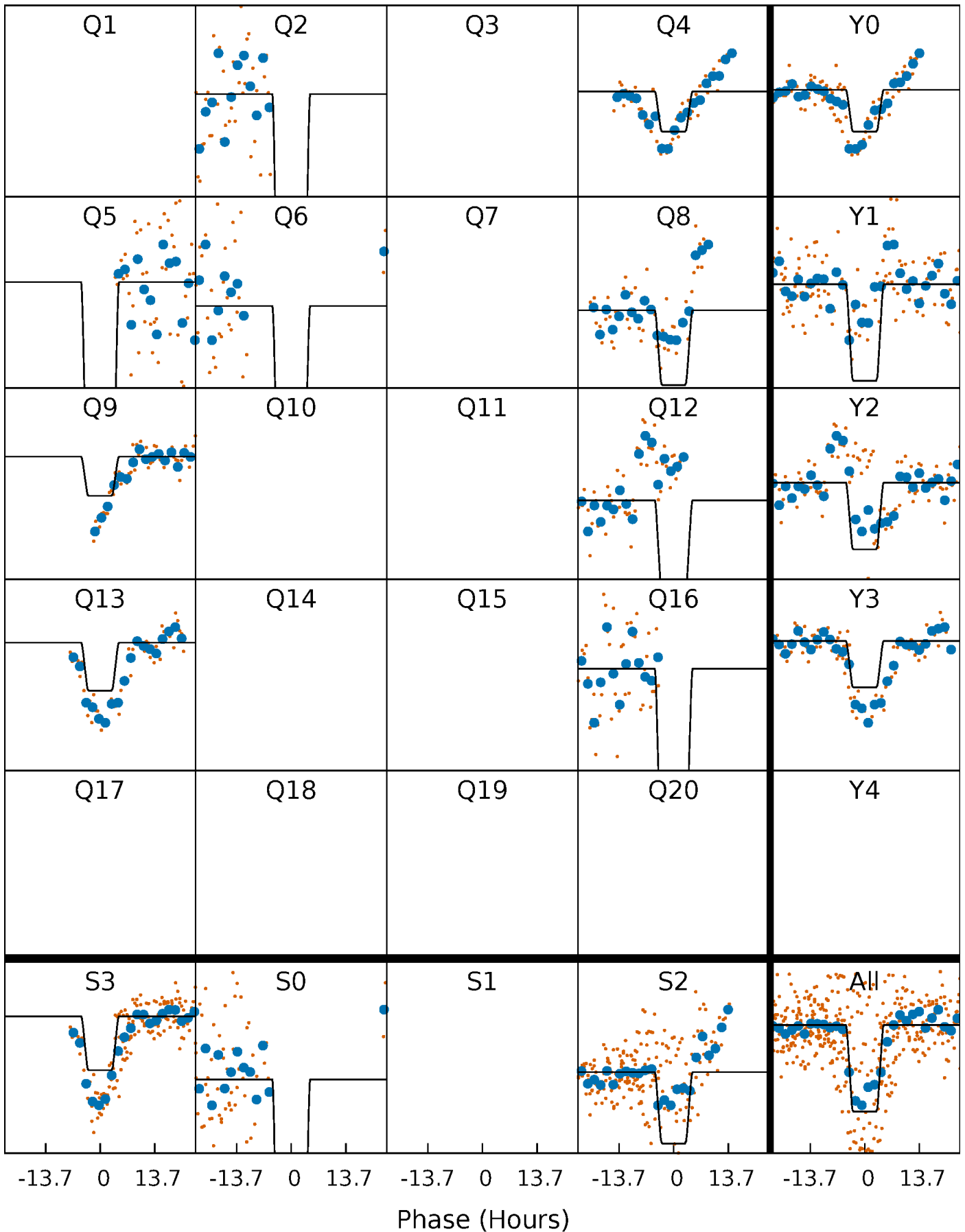
TCE 010989345-05     $P=128.115026$  Days     $T_0=240.564541$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

TCE 010989345-05   P=128.112368 Days    $T_0=240.561018$  (BKJD)

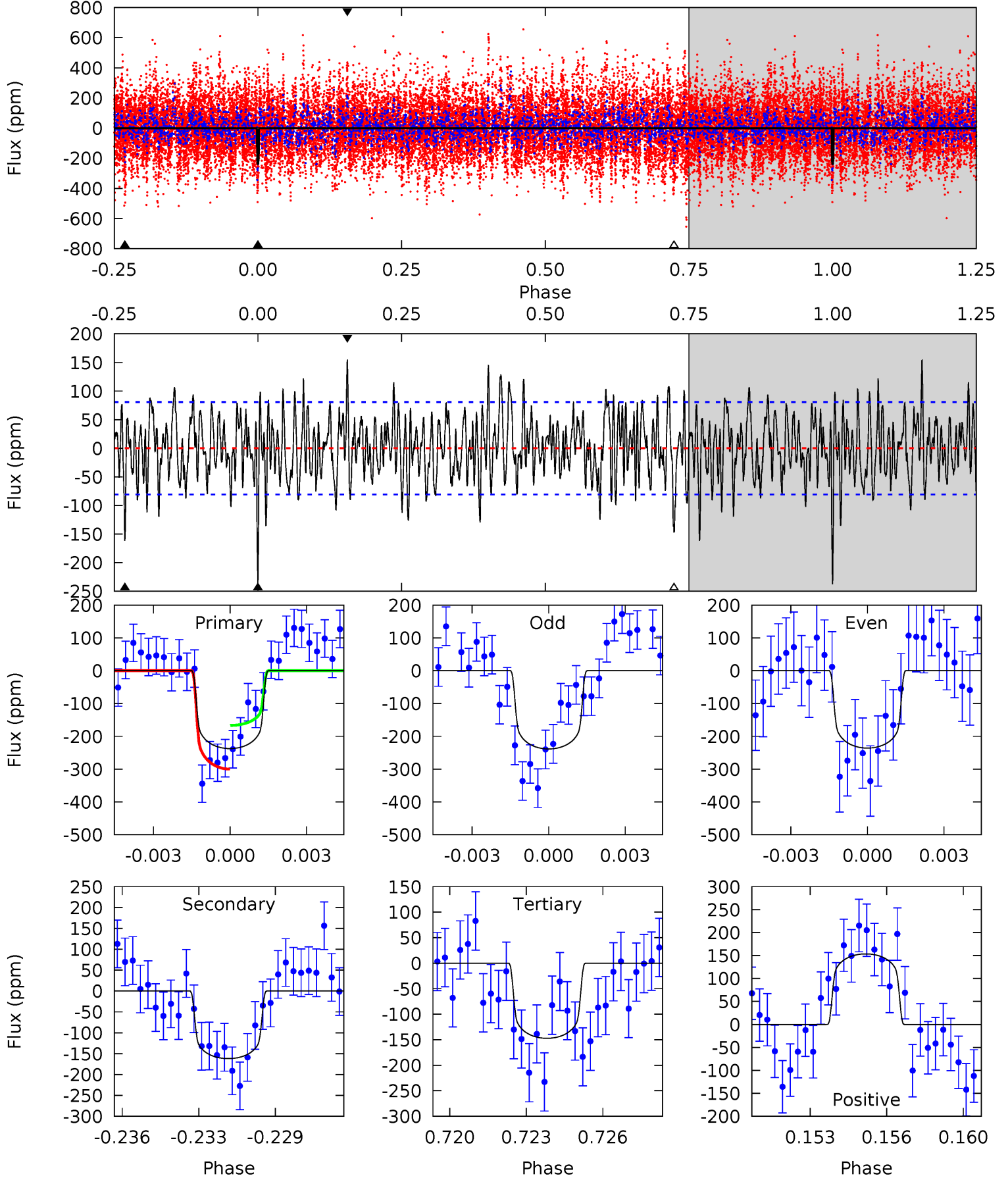




# DV Model-Shift Uniqueness Test

010989345-05, P = 128.115026 Days, E = 112.449515 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
15.4	10.5	9.52	9.93	5.23	2.92	3.11	5.84	5.43	0.95	0.54	0.09	0.63	0.39	4.32

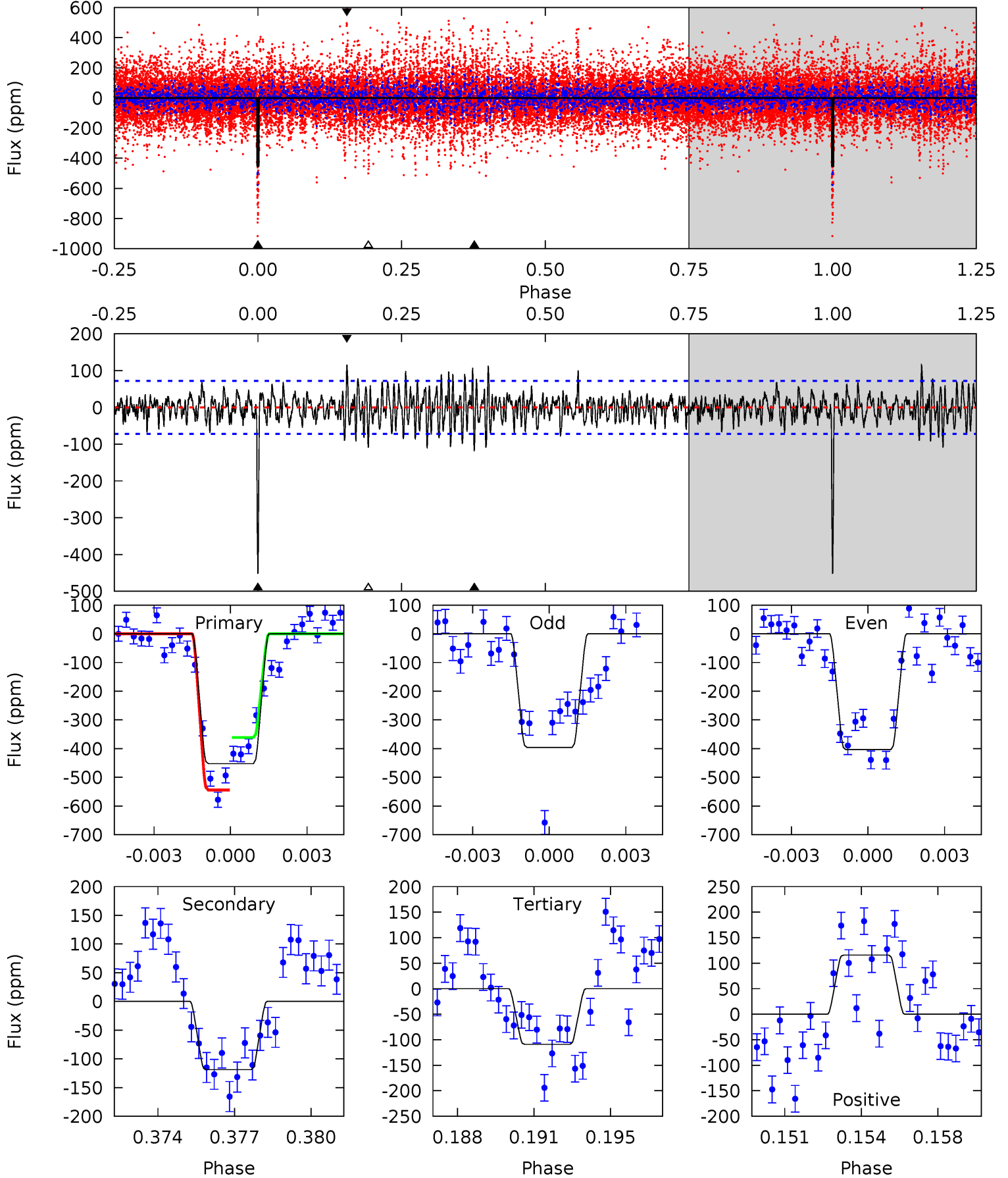




# Alt Model-Shift Uniqueness Test

010989345-05, P = 128.112368 Days, E = 112.448650 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
33.0	8.66	7.95	8.44	5.25	2.96	2.23	25.0	24.5	0.71	0.22	0.29	1.71	0.20	6.56





### Stellar Parameters For KIC 010989345

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6441^{+181}_{-227}$	$4.108^{+0.286}_{-0.154}$	$-0.440^{+0.300}_{-0.300}$	$1.504^{+0.421}_{-0.463}$	$1.056^{+0.177}_{-0.133}$	$0.438^{+0.795}_{-0.185}$
	+3%/-4%	+7%/-4%	+68%/-68%	+28%/-31%	+17%/-13%	+182%/-42%
Source	PHO54	PHO54	PHO54	DSEP		

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

### Secondary Eclipse Parameters for KIC 010989345-05 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-162 \pm 15$	$2.68^{+0.54}_{-0.47}$	$672^{+53}_{-59}$	$5592^{+356}_{-320}$	$3189^{+1569}_{-998}$
Alt.	$-119 \pm 14$	$3.33^{+0.60}_{-0.60}$	$672^{+59}_{-55}$	$4795^{+247}_{-216}$	$1566^{+732}_{-485}$

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



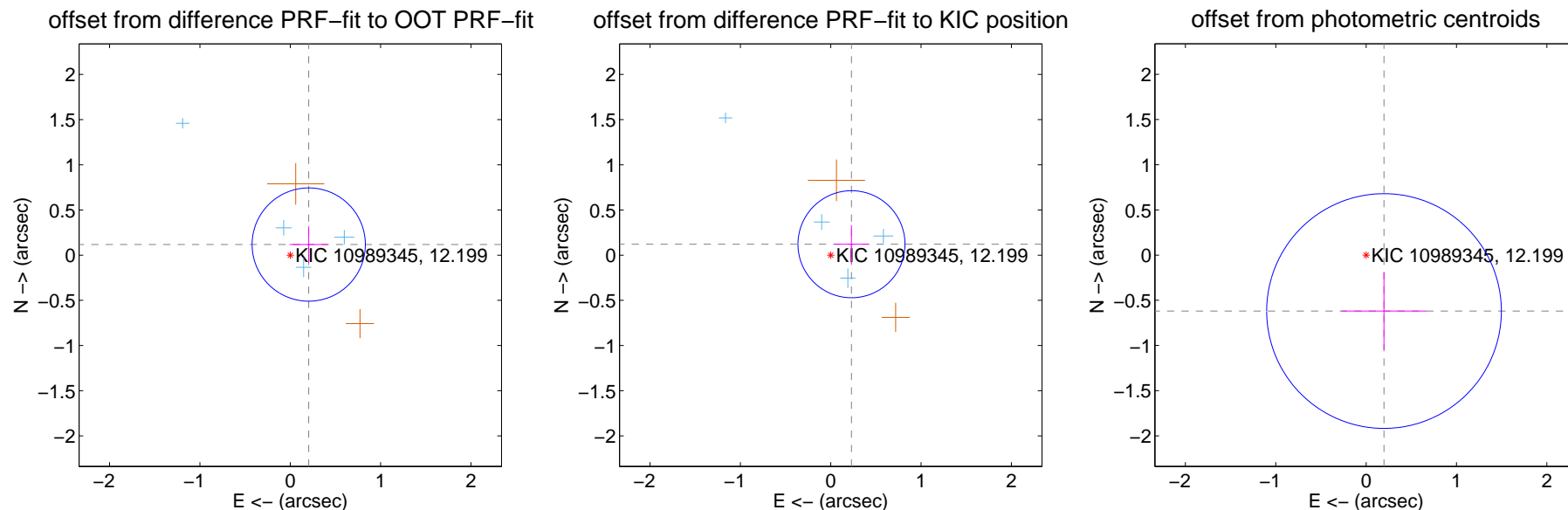
## DV Centroid Data

Supplemental centroid analysis for 010989345-05. Kepler magnitude: 12.20. Transit SNR 8.17

There are 4 quarters with good PRF difference image offsets

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

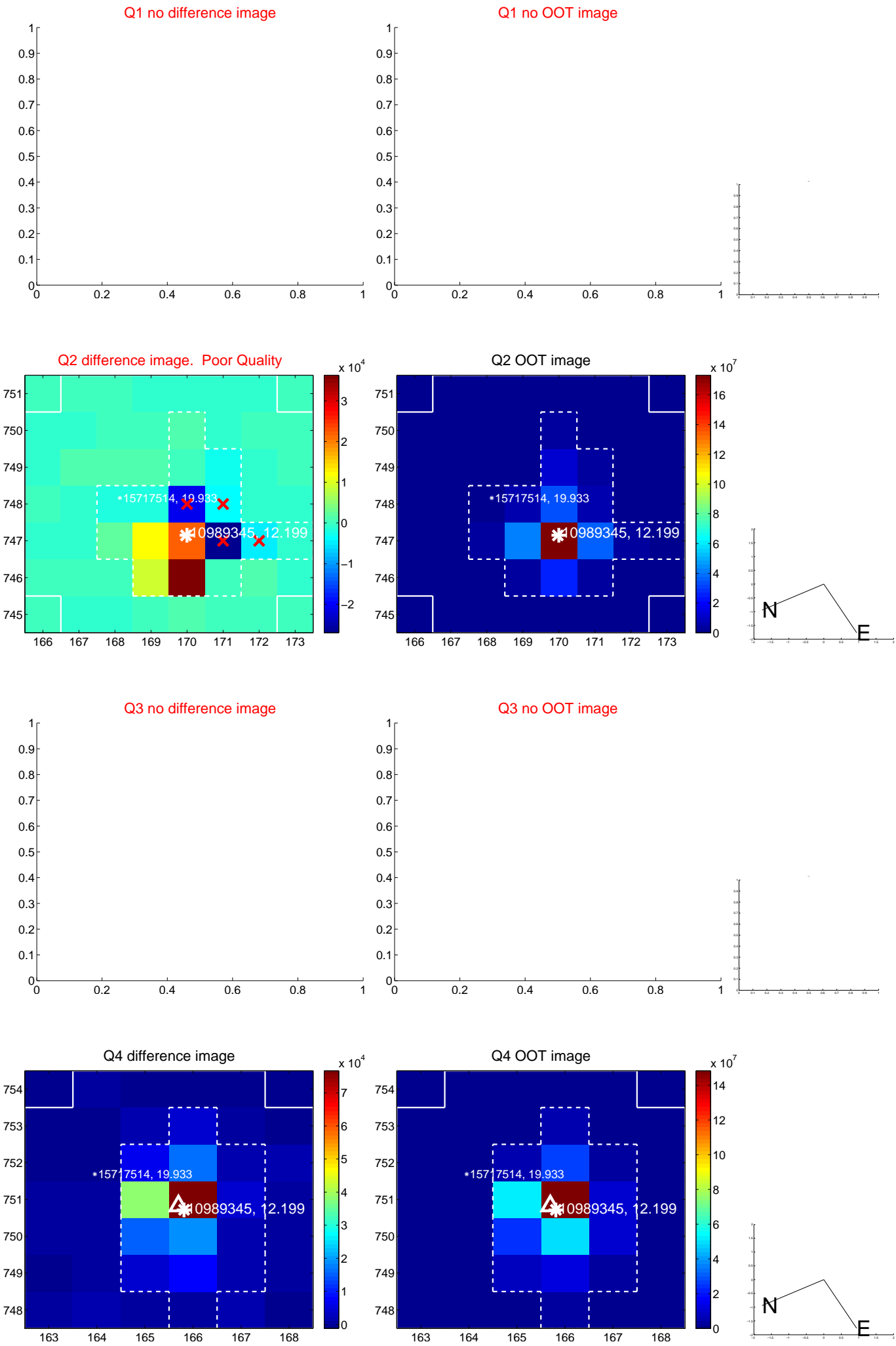
	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.236 \pm 0.209$	1.13	$-0.204 \pm 0.211$	$0.117 \pm 0.202$
PRF-fit source offset from KIC position	$0.260 \pm 0.197$	1.32	$-0.230 \pm 0.193$	$0.121 \pm 0.212$
photometric centroid source offset	$0.65 \pm 0.43$	1.50	$-0.20 \pm 0.47$	$-0.62 \pm 0.43$



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.

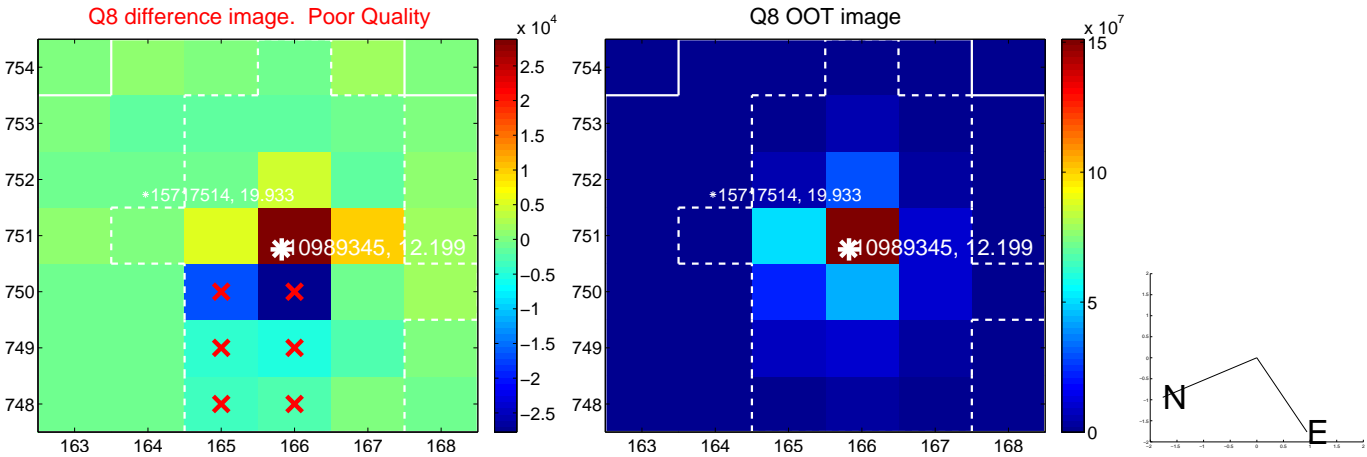
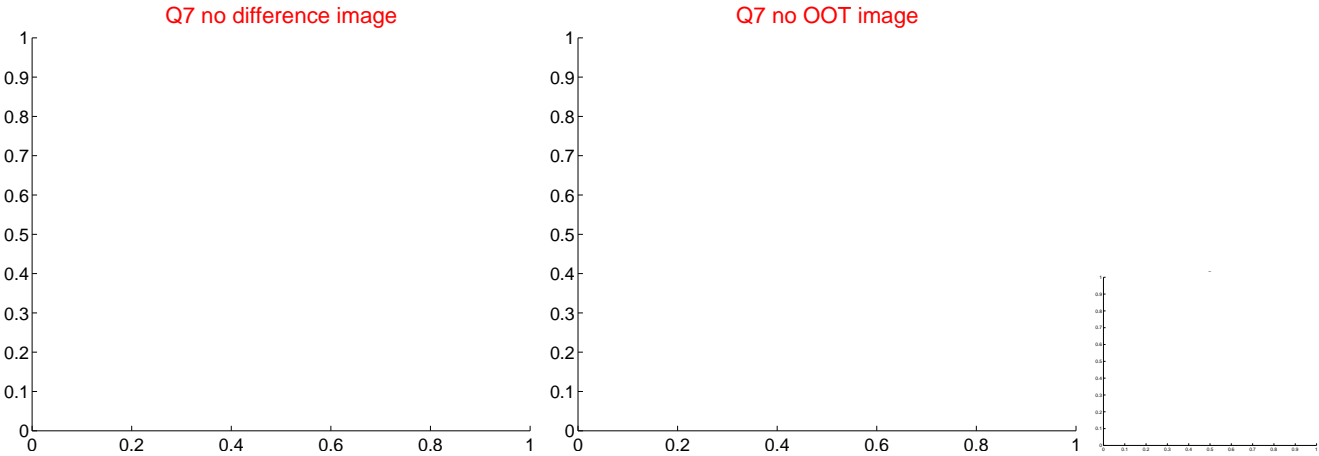
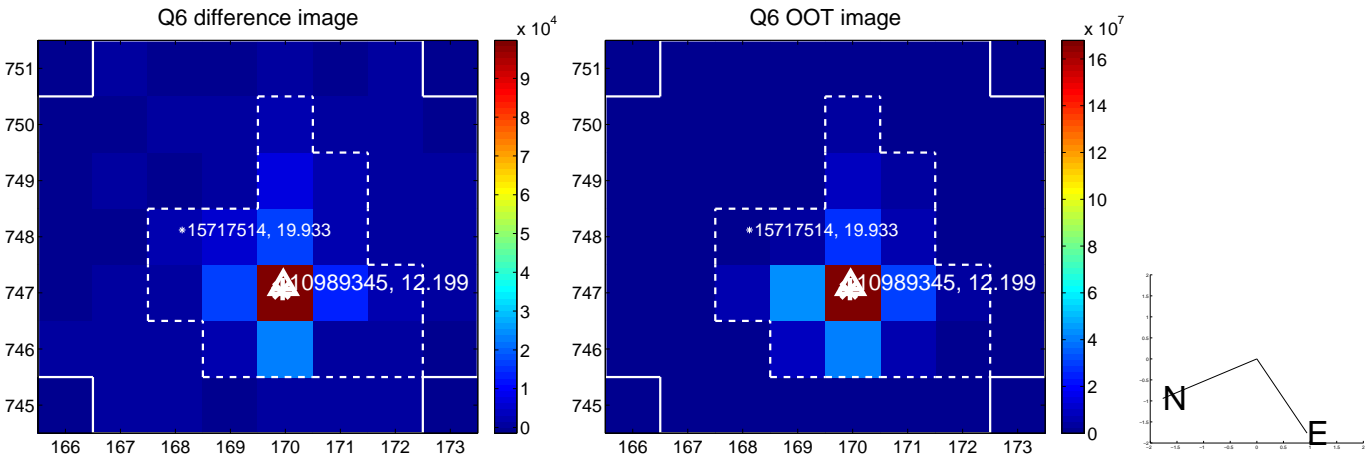
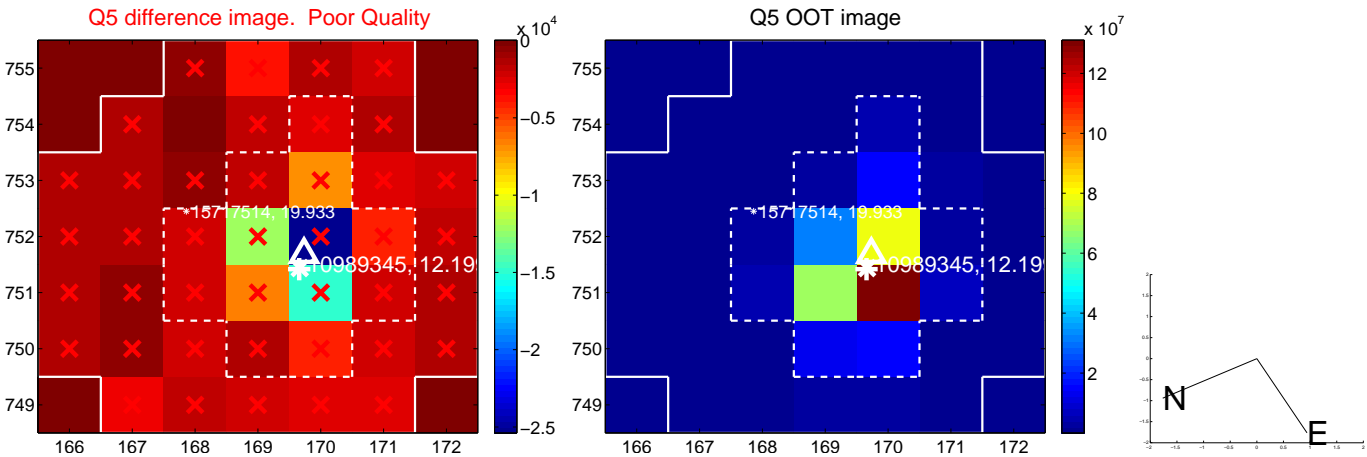


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



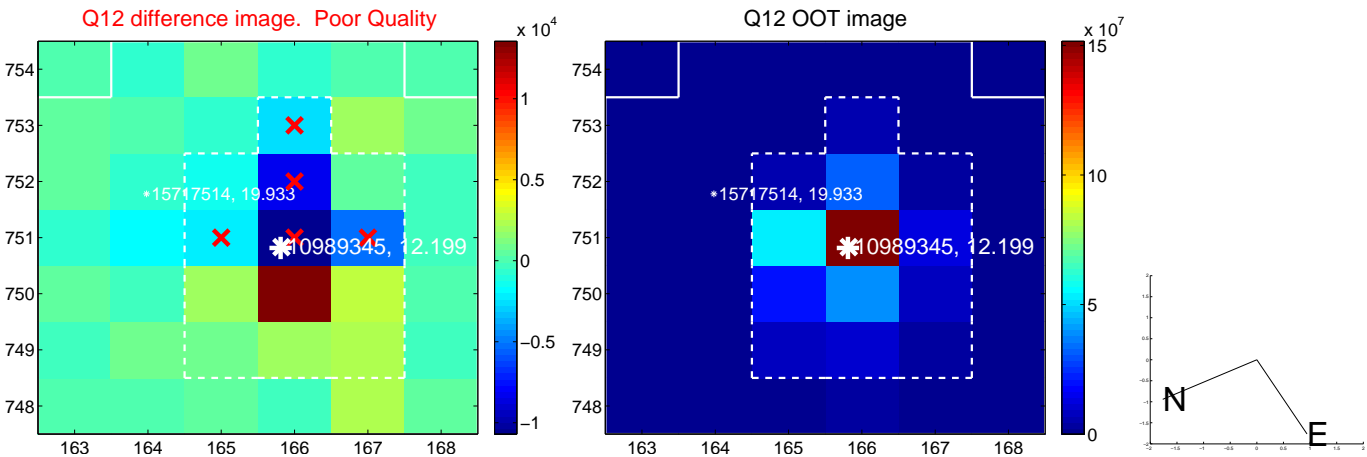
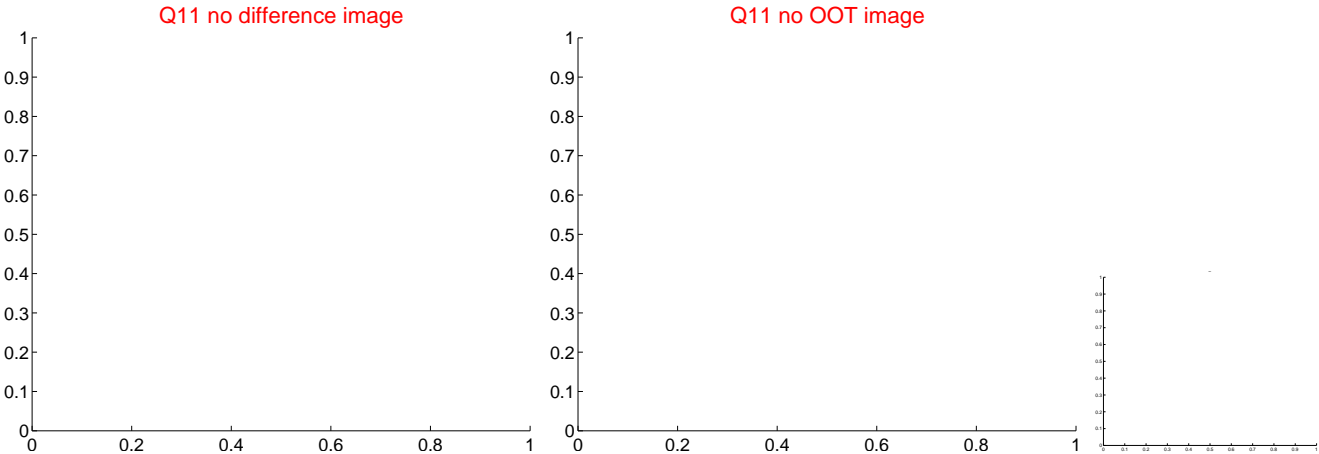
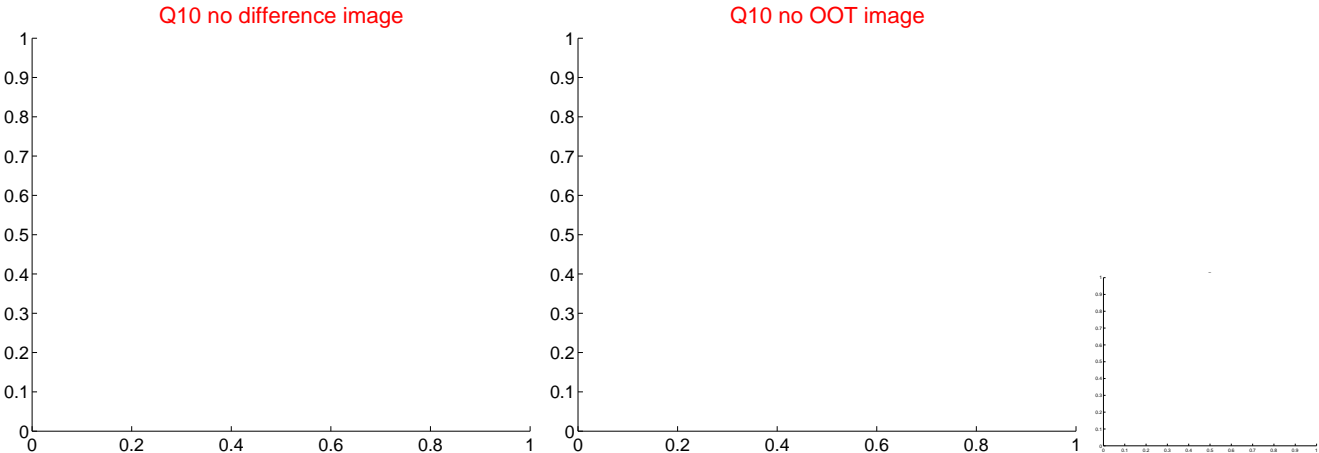
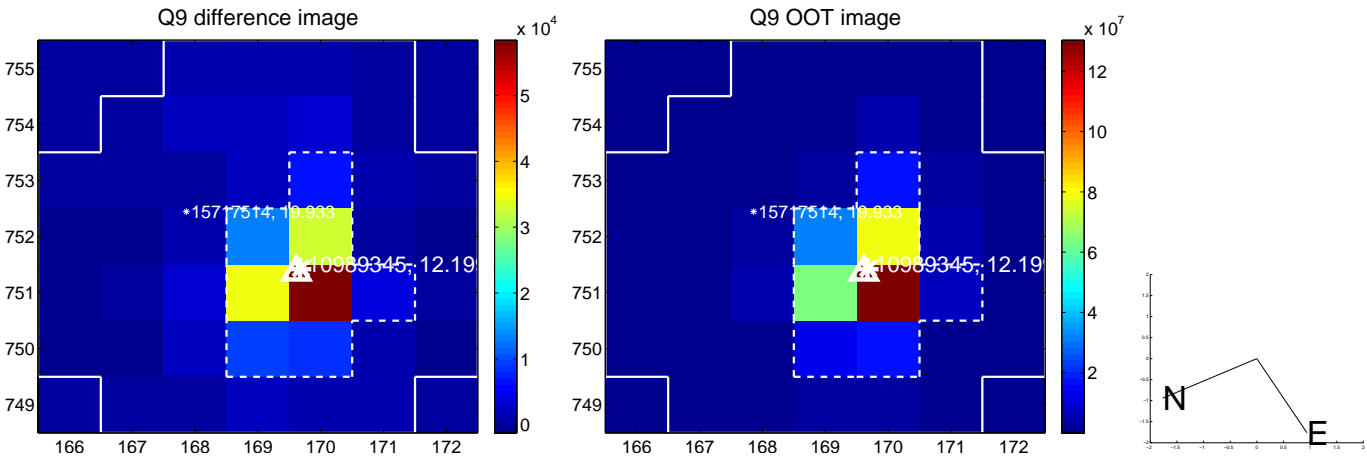


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



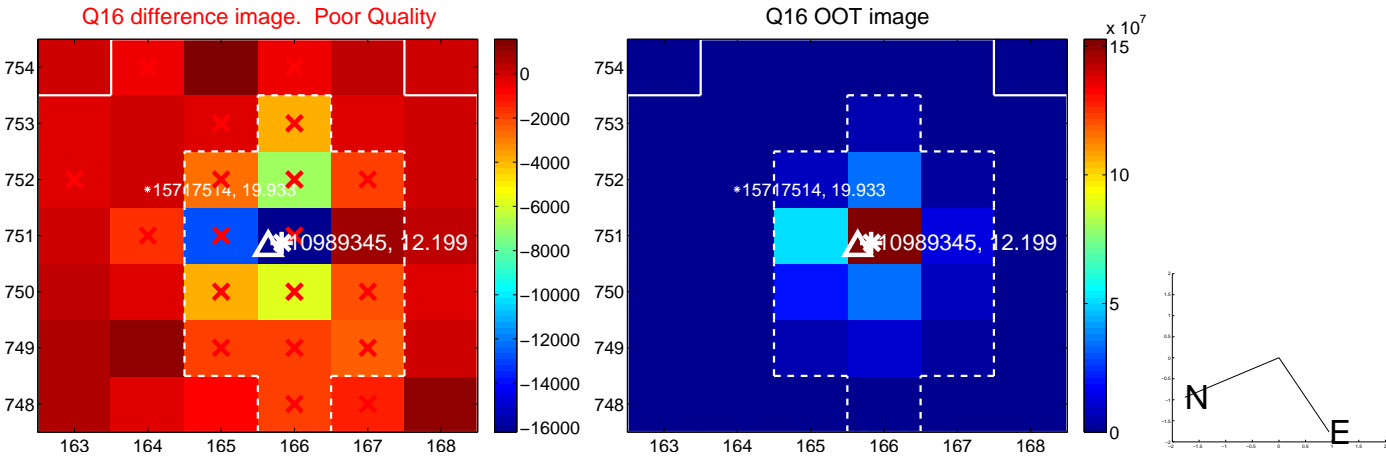
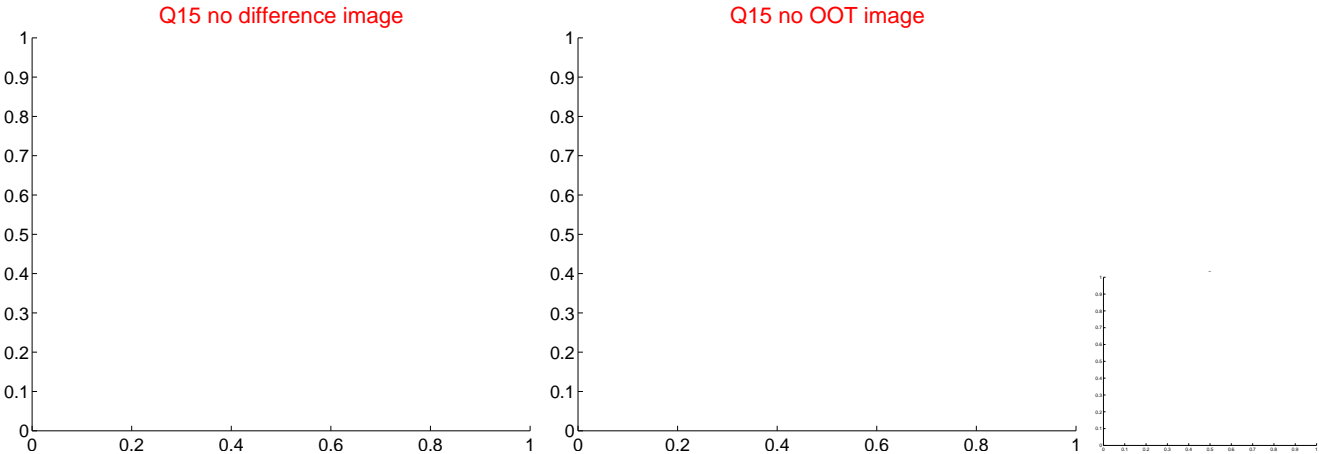
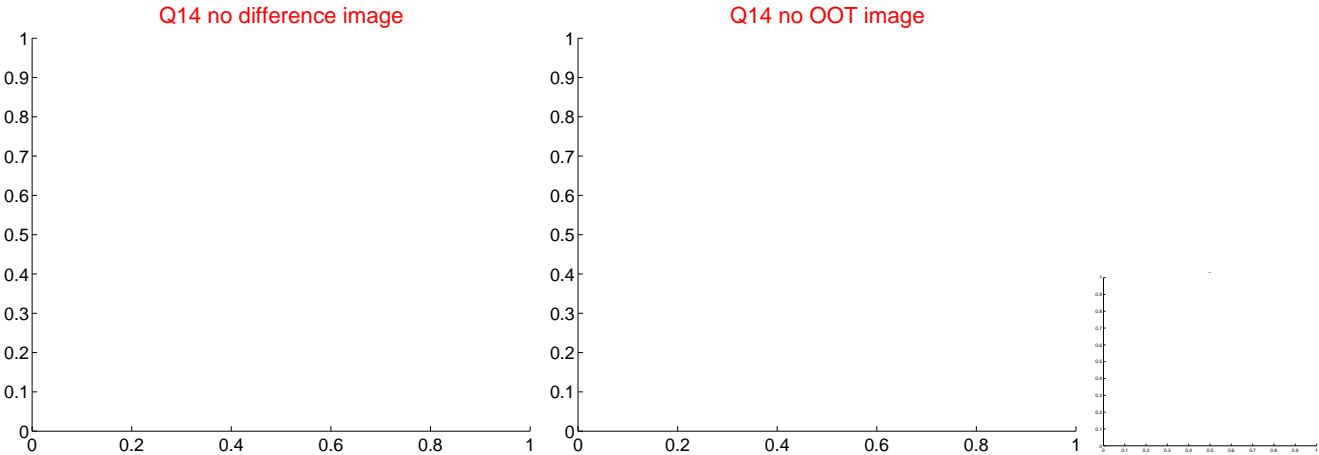
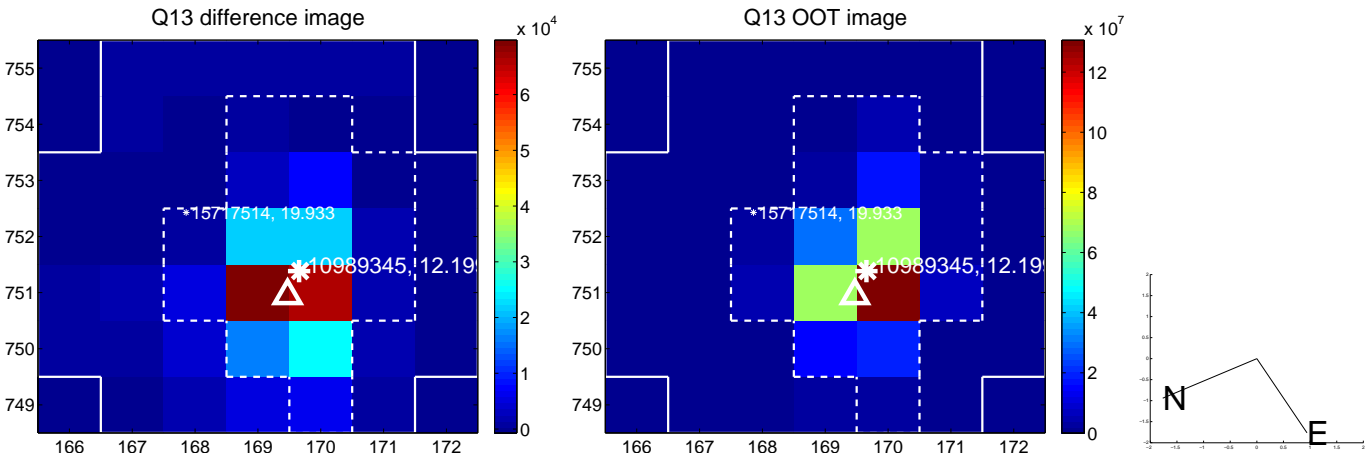


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



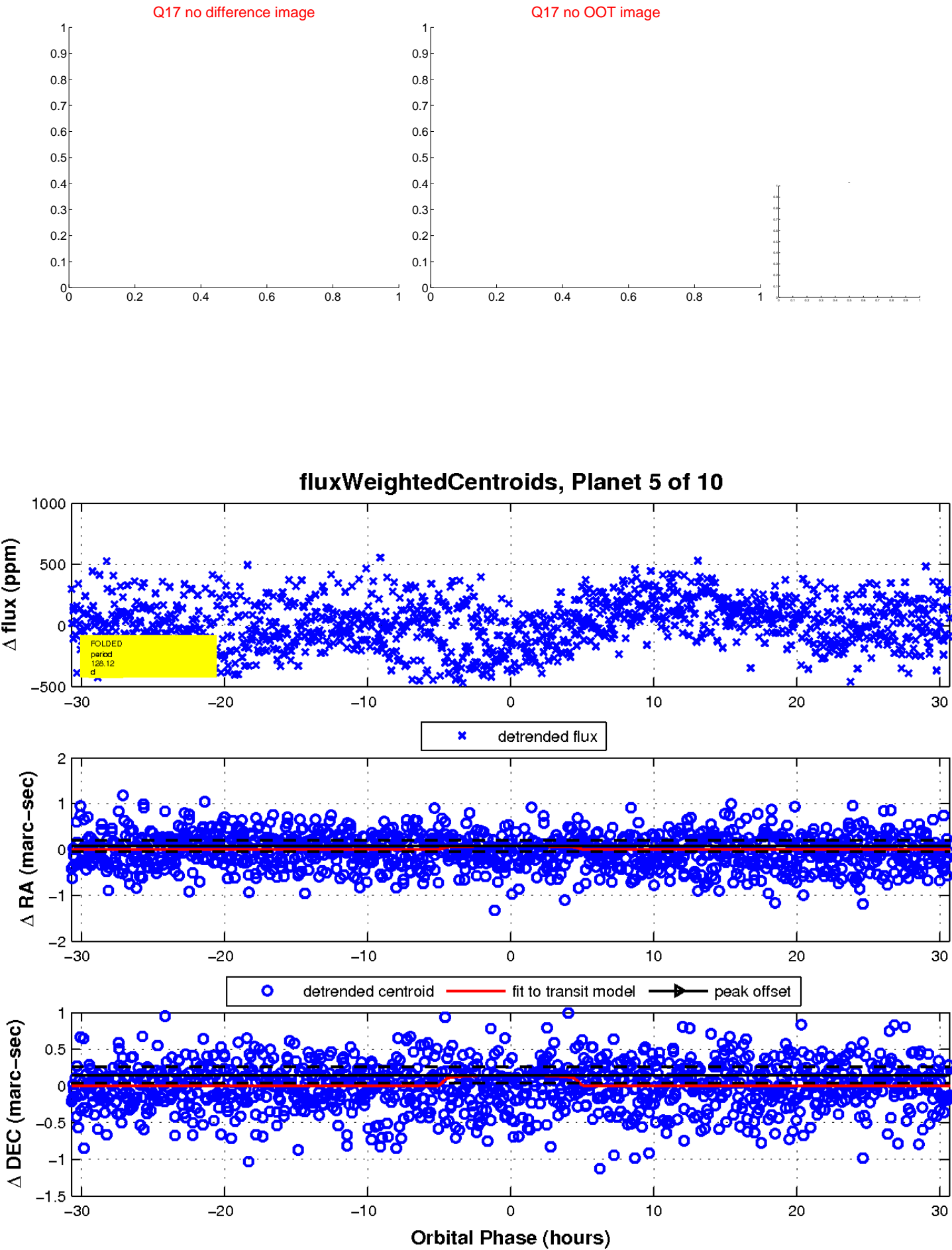


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





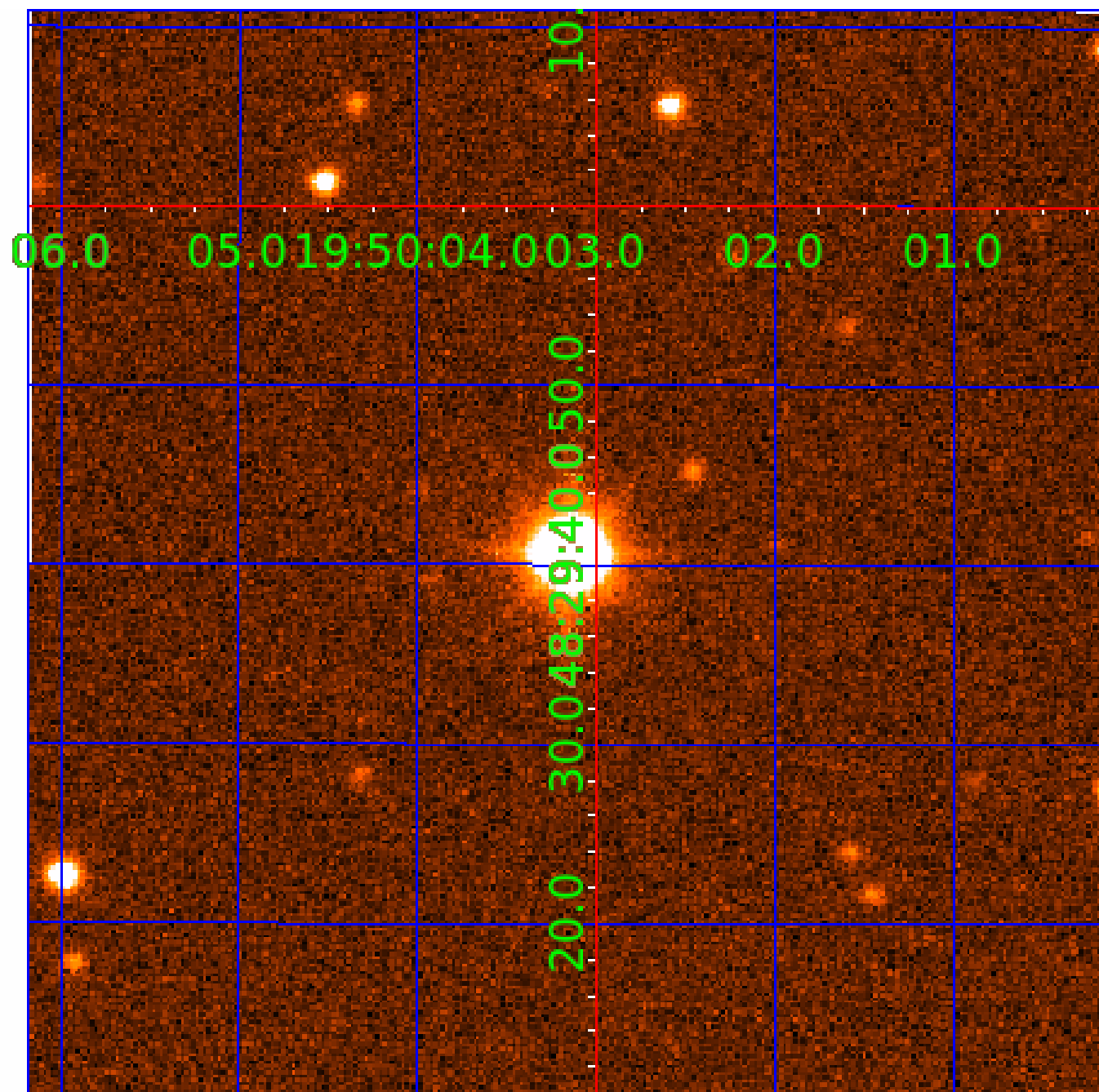
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





UKIRT Image

Declination





# KIC 010989345

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
010989345-01	OBS	No	2.630764	133.193244	10.6	11.138	8.7	2.7	1.50	6441	0.56	2414.15
010989345-02	OBS	No	663.020155	176.584259	336.4	6.883	8.0	8.5	1.50	6441	3.12	1.52
010989345-03	OBS	No	237.414043	326.142677	325.3	14.174	7.7	8.6	1.50	6441	3.39	5.96
010989345-04	OBS	No	423.567102	344.022902	722.4	35.026	7.8	7.8	1.50	6441	4.94	2.76
010989345-05	OBS	No	128.115026	240.564541	252.7	10.241	7.8	8.2	1.50	6441	2.77	13.57
010989345-07	OBS	No	66.433669	191.136166	129.6	13.221	7.4	5.2	1.50	6441	1.83	32.59
010989345-08	OBS	No	161.346431	265.595466	238.5	7.037	7.2	7.2	1.50	6441	4.56	9.98
010989345-09	OBS	No	276.296890	275.873517	375.6	30.069	7.9	7.5	1.50	6441	3.49	4.87
010989345-10	OBS	No	196.452793	165.569777	243.6	5.231	7.4	8.1	1.50	6441	3.04	7.68

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
010989345-01	OBS	FP	0.00	1	0	0	0	SWEET_NTL—LPP_DV—MOD_NONUNIQ_DV
010989345-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES—ALL_TRANS_CHASES—MOD_NONUNIQ_DV
010989345-03	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—HALO_GHOST
010989345-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
010989345-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—MOD_NONUNIQ_DV
010989345-07	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT
010989345-08	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT
010989345-09	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—CENT_FEW_DIFFS
010989345-10	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT

**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.

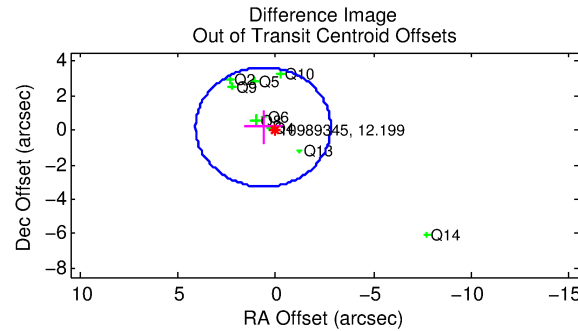
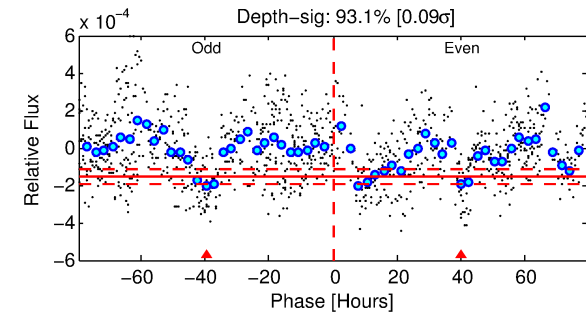
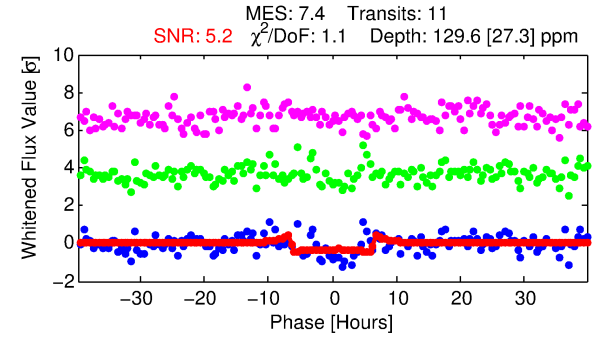
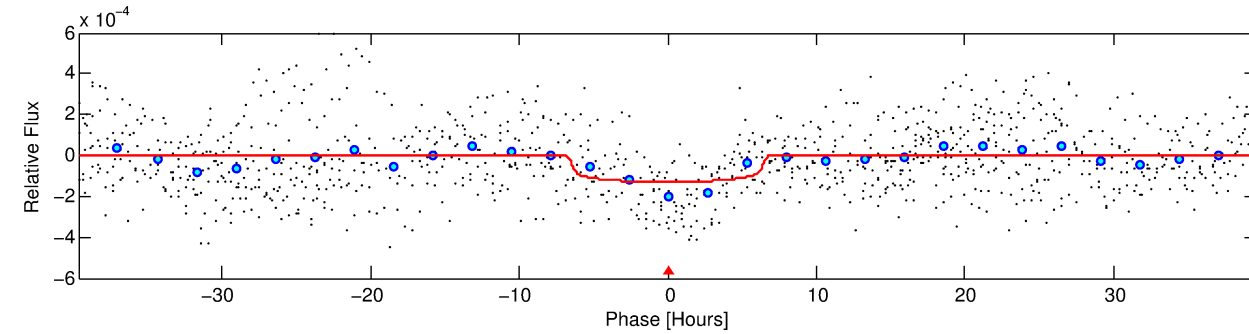
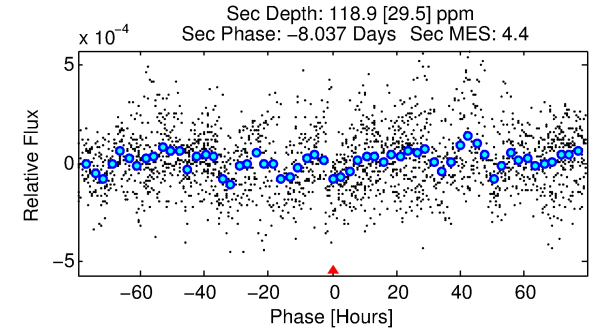
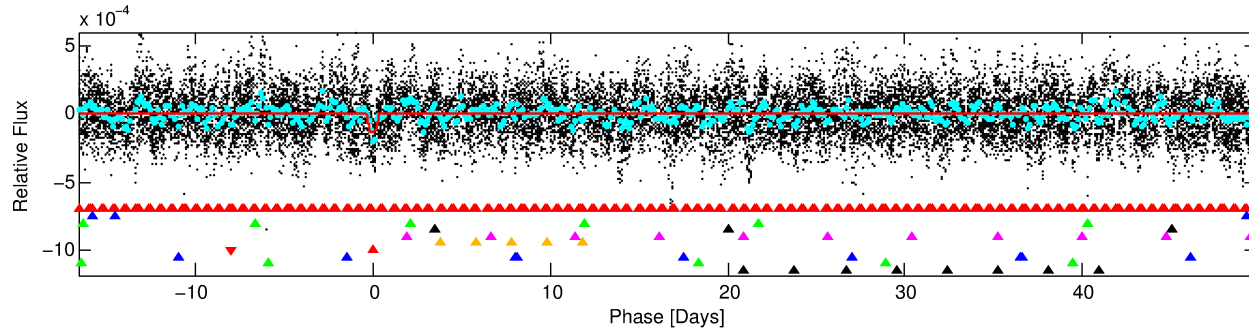
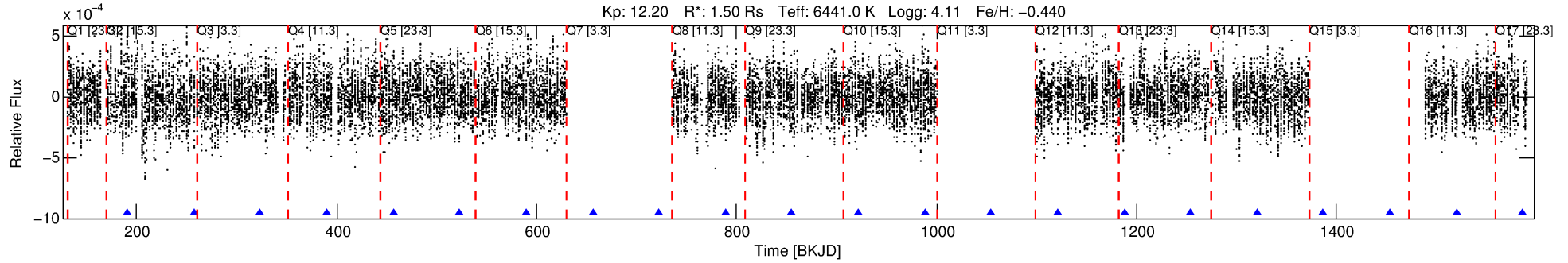
Ephemeris Match Information For 010989345-07

No Significant Match Found



# DV One-Page Summary

KIC: 10989345 Candidate: 7 of 10 Period: 66.434 d



## DV Fit Results:

Period = 66.43367 [0.00160] d  
Epoch = 191.1362 [0.0153] BKJD  
Rp/R\* = 0.0112 [0.0037]  
a/R\* = 27.89 [46.51]  
b = 0.70 [1.20]  
Seff = 32.59 [16.45]  
Teff = 609 [77] K  
Rp = 1.83 [0.82] Re  
a = 0.3272 [0.0983] AU  
Ag = 2080.41 [1770.28] [1.17σ]  
Teffp = 6361 [1135] K [5.06σ]

## DV Diagnostic Results:

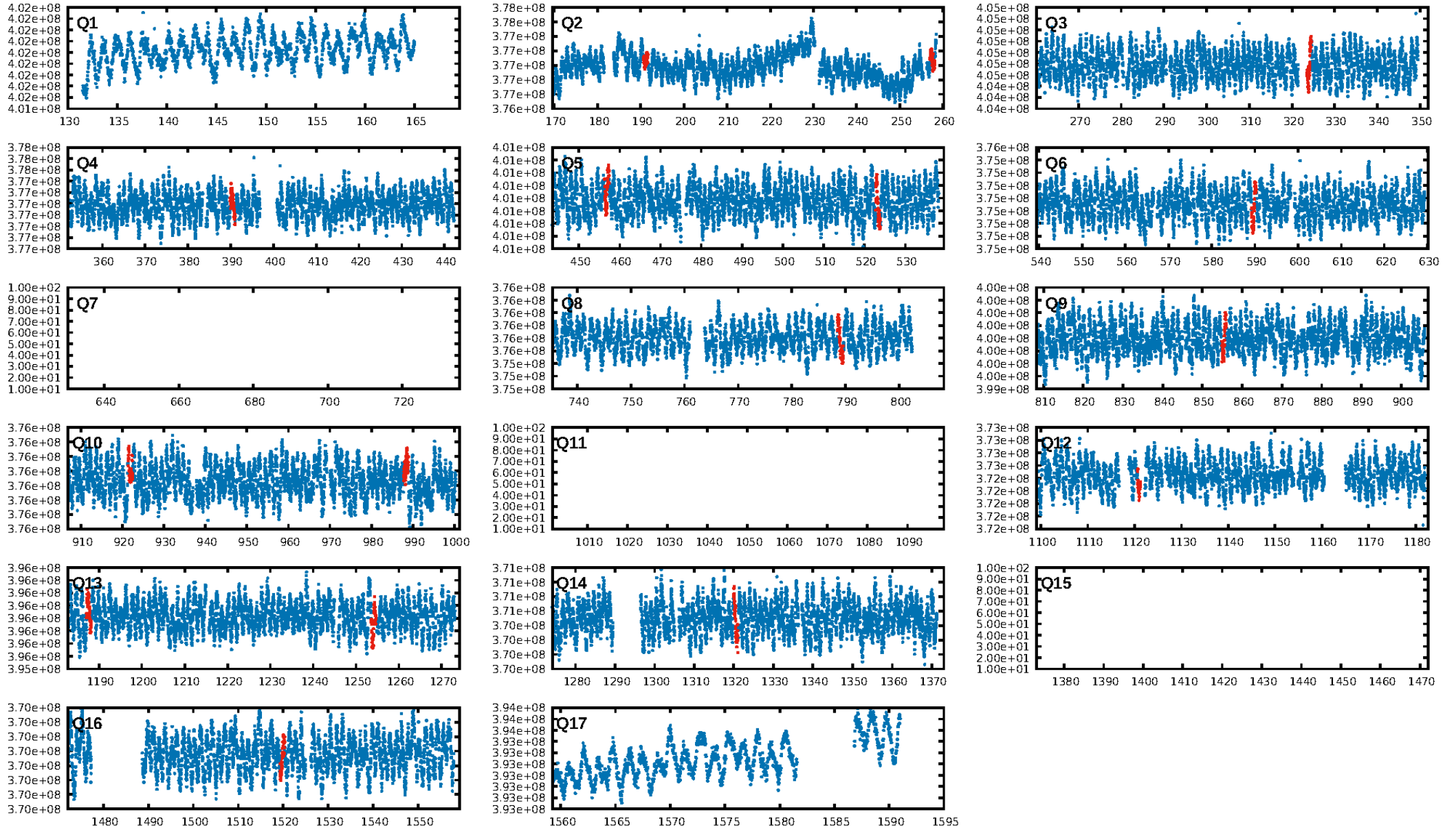
ShortPeriod-sig: 100.0% [88.58σ]  
LongPeriod-sig: 100.0% [88.52σ]  
ModelChiSquare2-sig: 69.7%  
ModelChiSquareGof-sig: 100.0%  
**Bootstrap-pfa: 5.17e-08**  
RollingBand-fgt: 1.00 [11/11]  
GhostDiagnostic-chr: -3.443  
Centroid-sig: 78.4%  
Centroid-so: 0.261 arcsec [0.40σ]  
OotOffset-rm: 0.666 arcsec [0.58σ]  
OotOffset-st: 4/0/2/3 [9]  
KicOffset-rm: 0.719 arcsec [0.66σ]  
KicOffset-st: 4/0/2/3 [9]  
DiffImageQuality-fgm: 0.33 [3/9]  
DiffImageOverlap-fno: 0.10 [1/10]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 03:40:17 Z

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

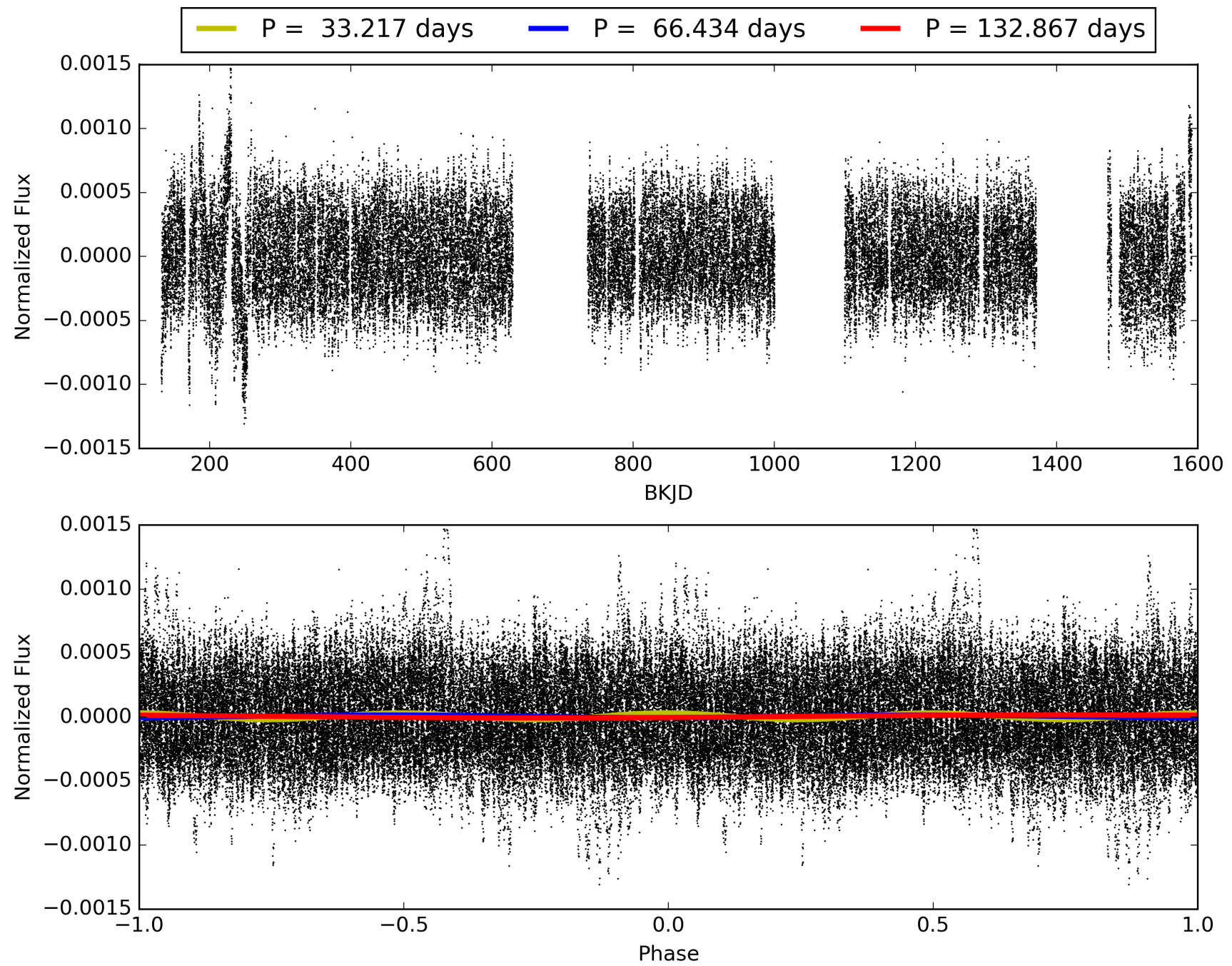


# TCE 010989345-07, PDC Light Curves





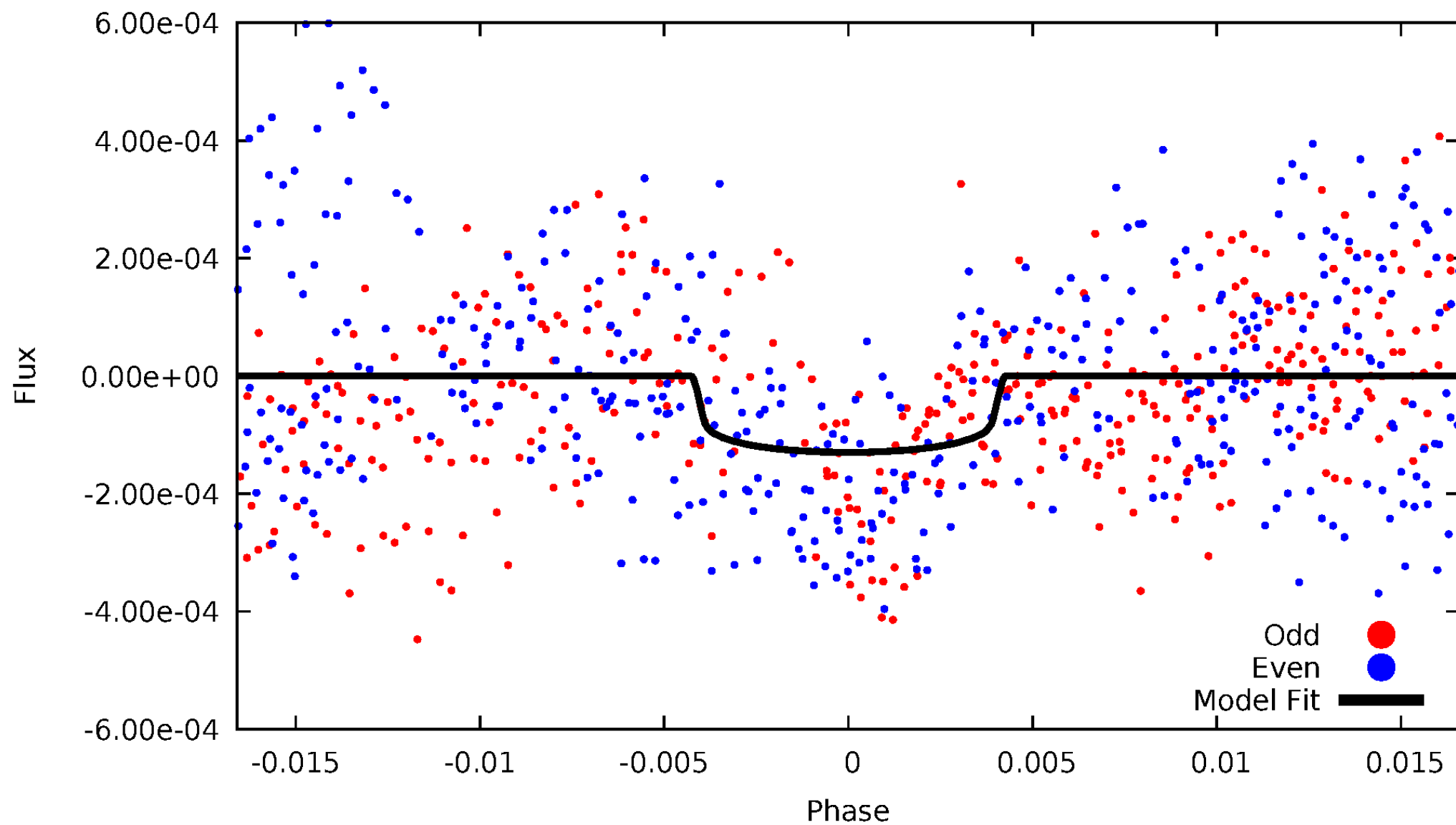
TCE 010989345-07





# DV Odd/Even

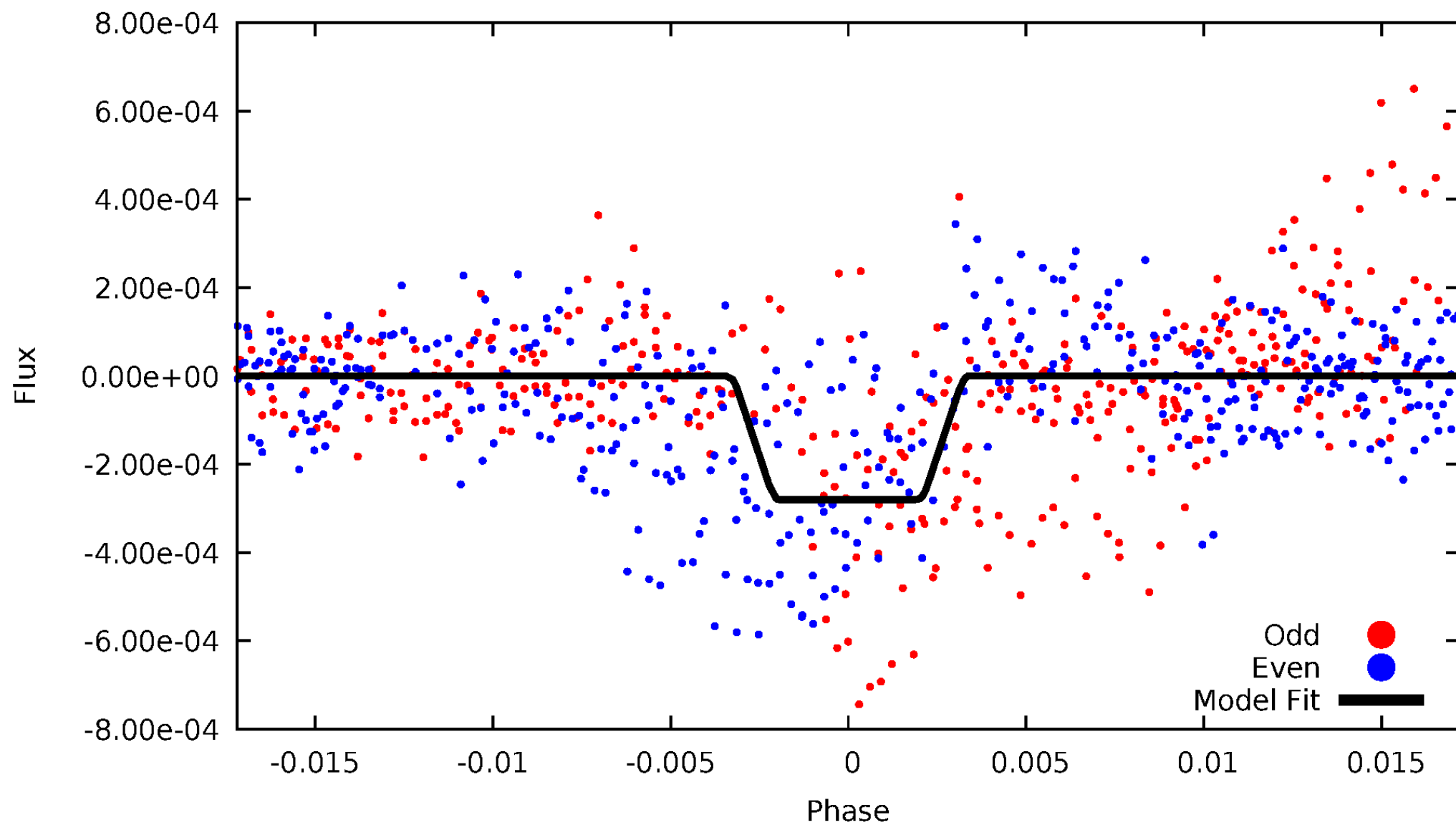
TCE 010989345-07





# ALT Odd/Even

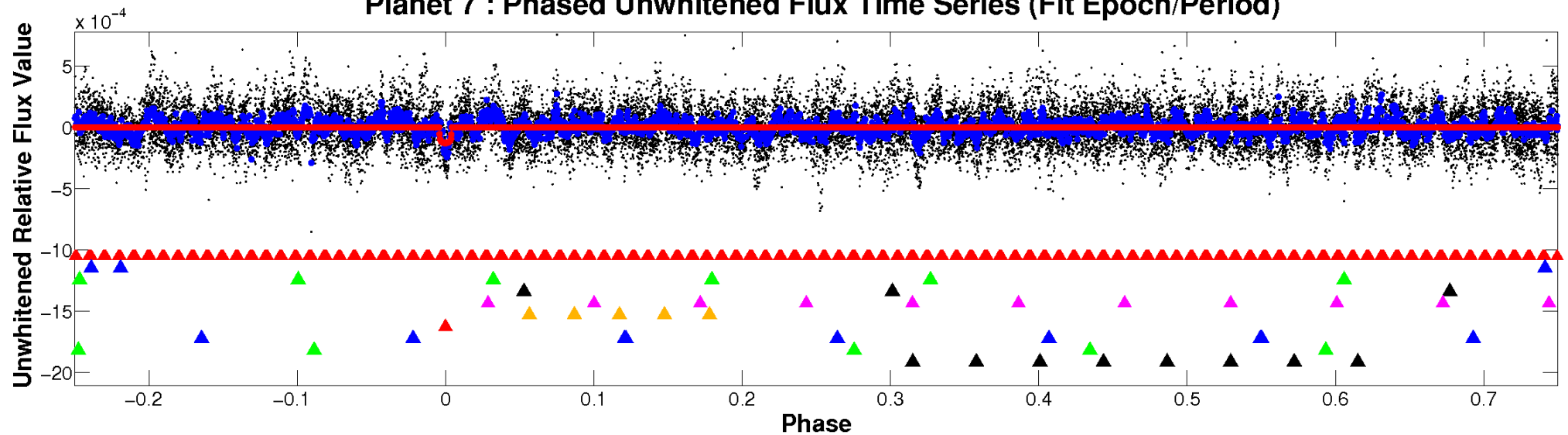
TCE 010989345-07



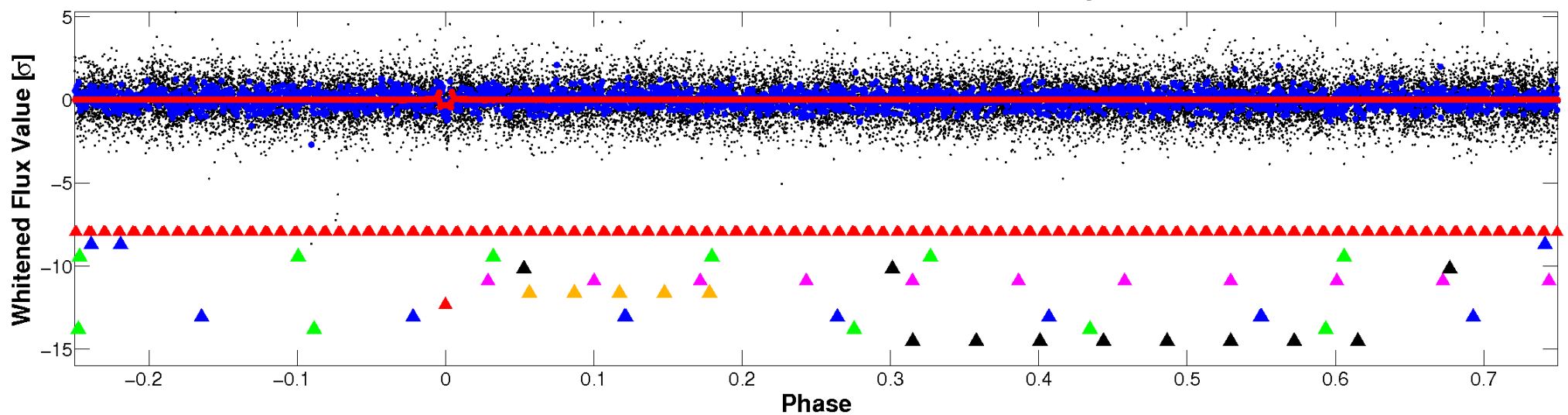


# Non-Whitened Vs. Whitened Light Curve

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



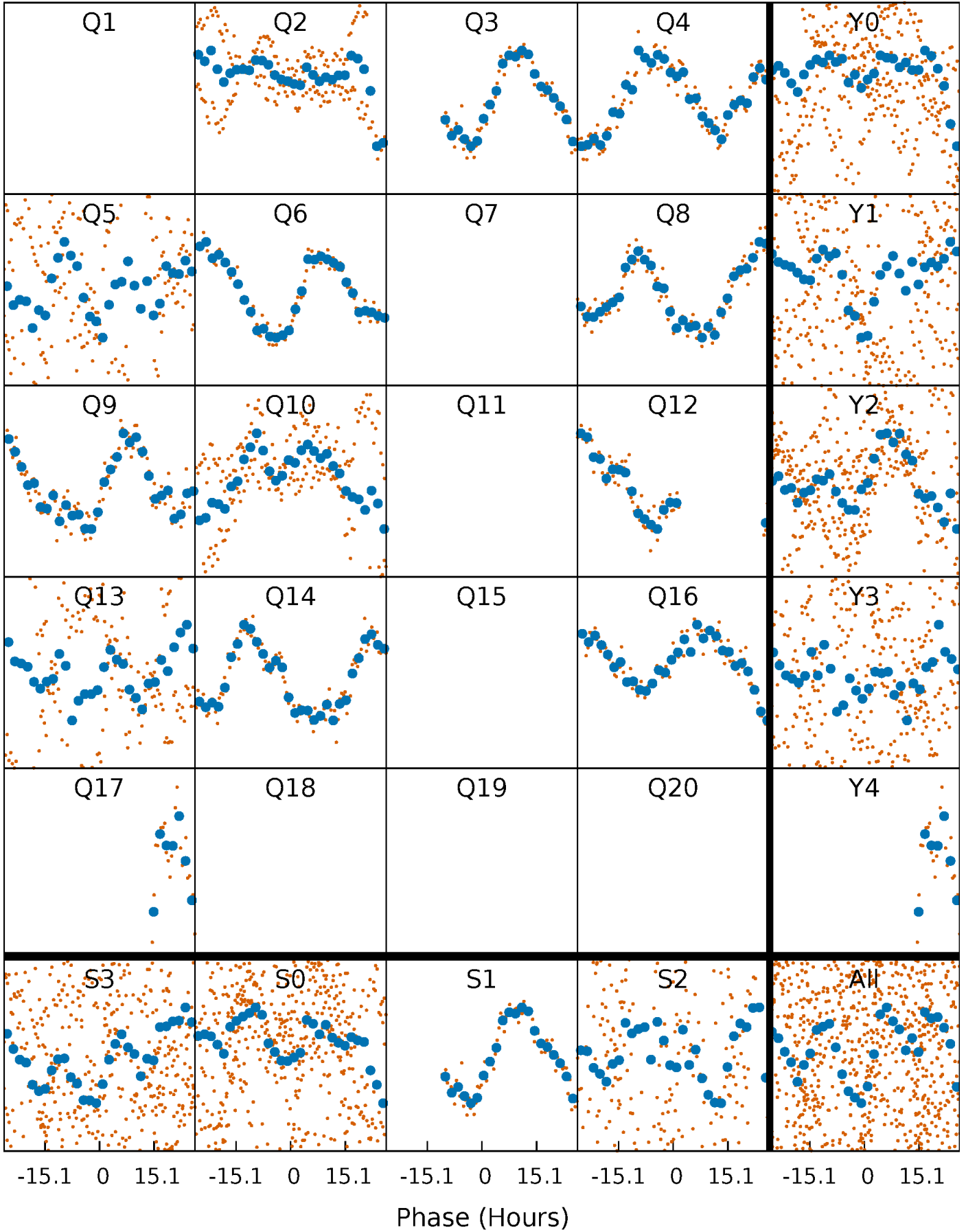
## Planet 7 : Phased Whitened Flux Time Series (Fit Epoch/Period)





# PDC Quarter-Phased Transit Curves

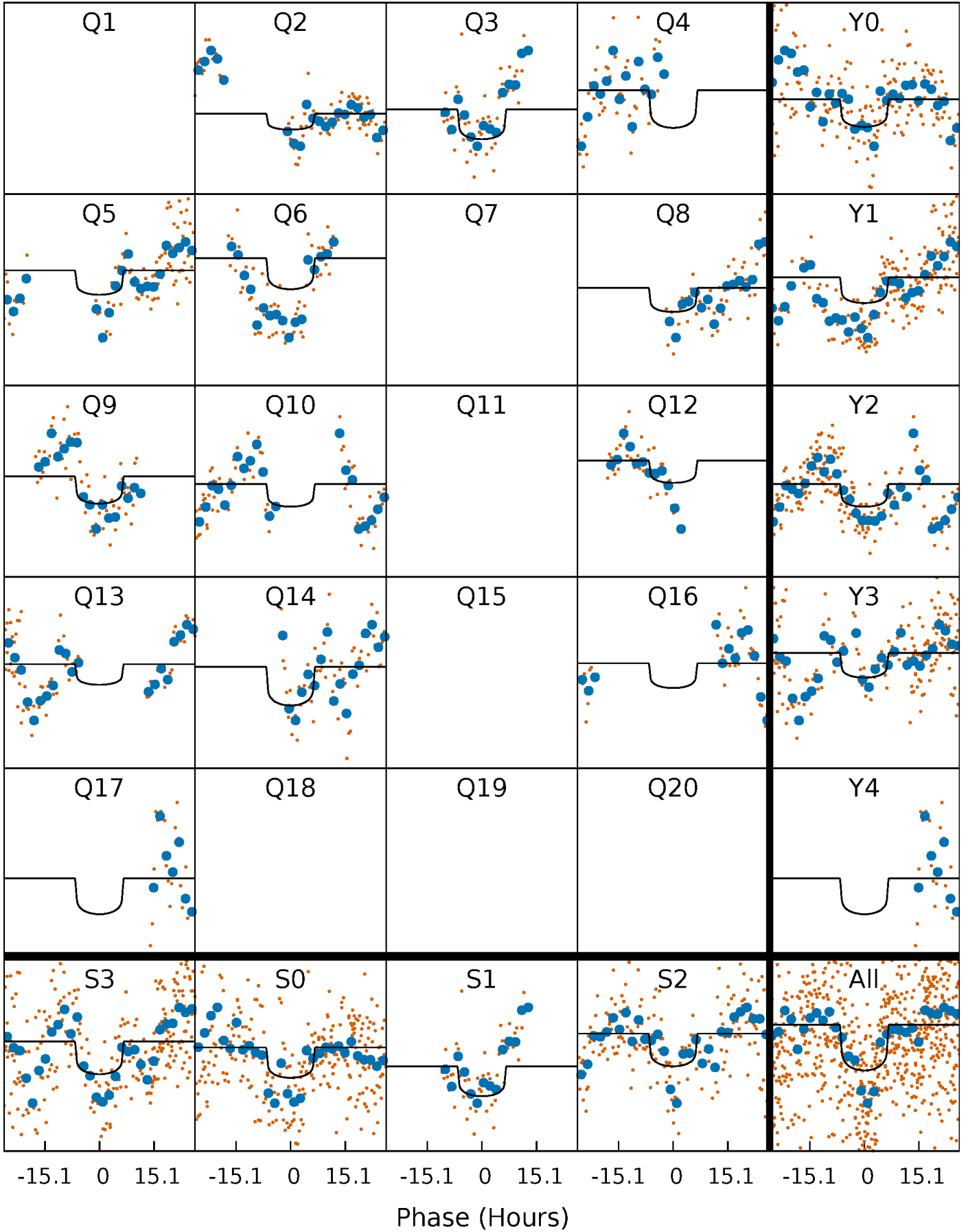
TCE 010989345-07     $P = 66.433669$  Days     $T_0 = 191.136166$  (BKJD)





# DV Quarter-Phased Transit Curves

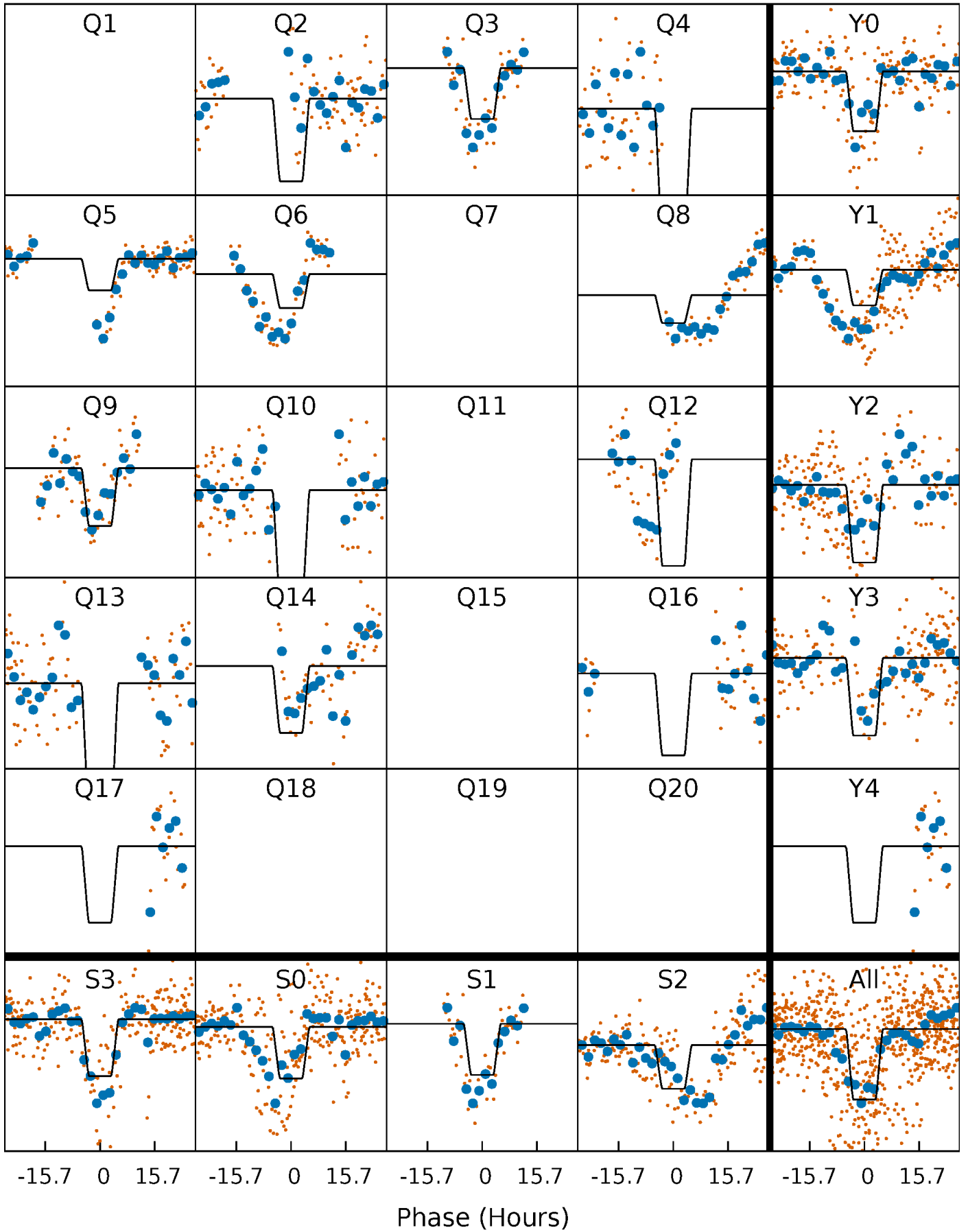
TCE 010989345-07 P= 66.433669 Days  $T_0=191.136166$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

TCE 010989345-07 P= 66.435181 Days  $T_0=191.130797$  (BKJD)

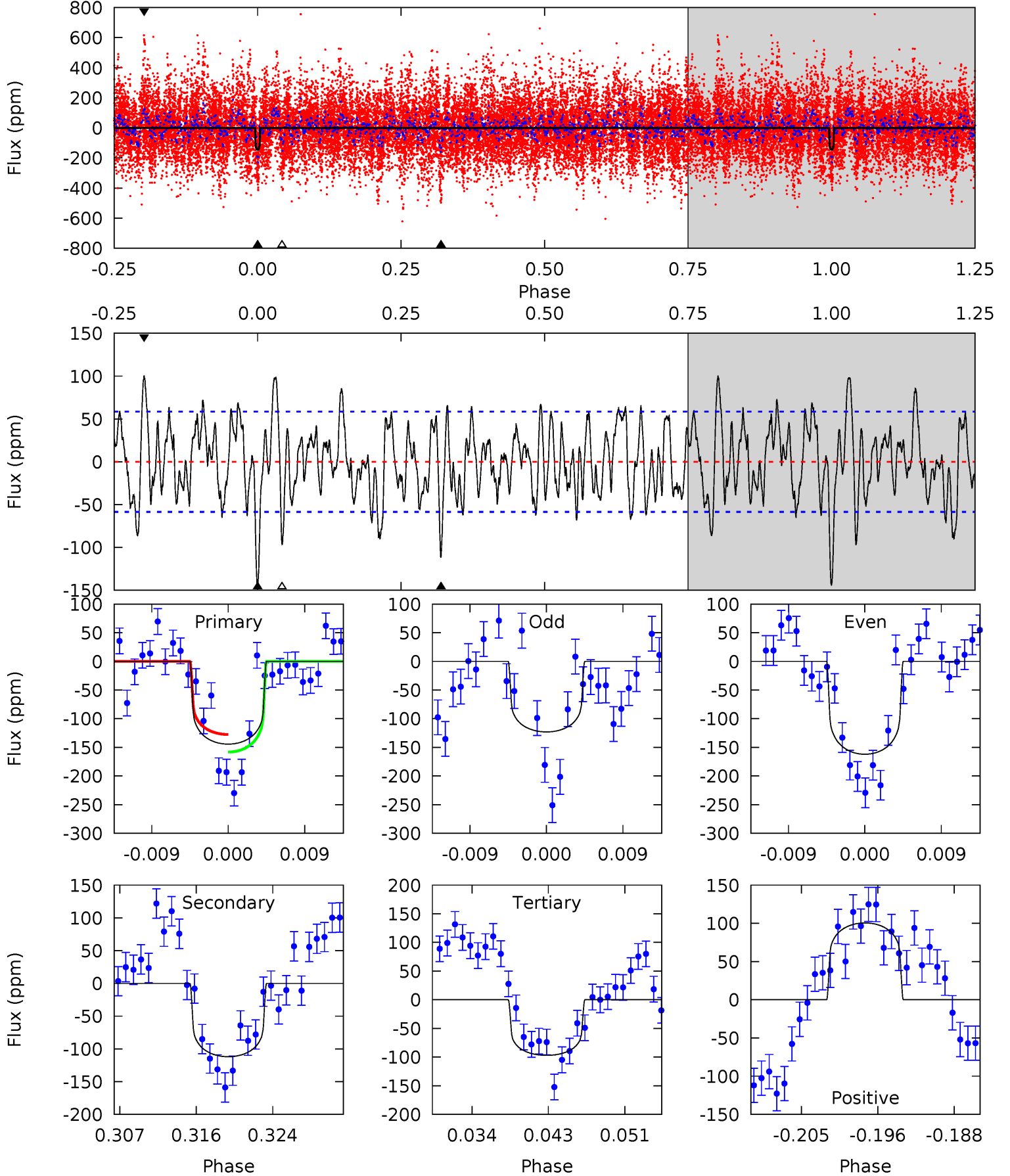




# DV Model-Shift Uniqueness Test

010989345-07, P = 66.433669 Days, E = 124.702497 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
12.5	9.68	8.39	8.69	5.06	2.63	3.14	4.10	3.79	1.29	0.99	1.69	0.85	0.41	1.32

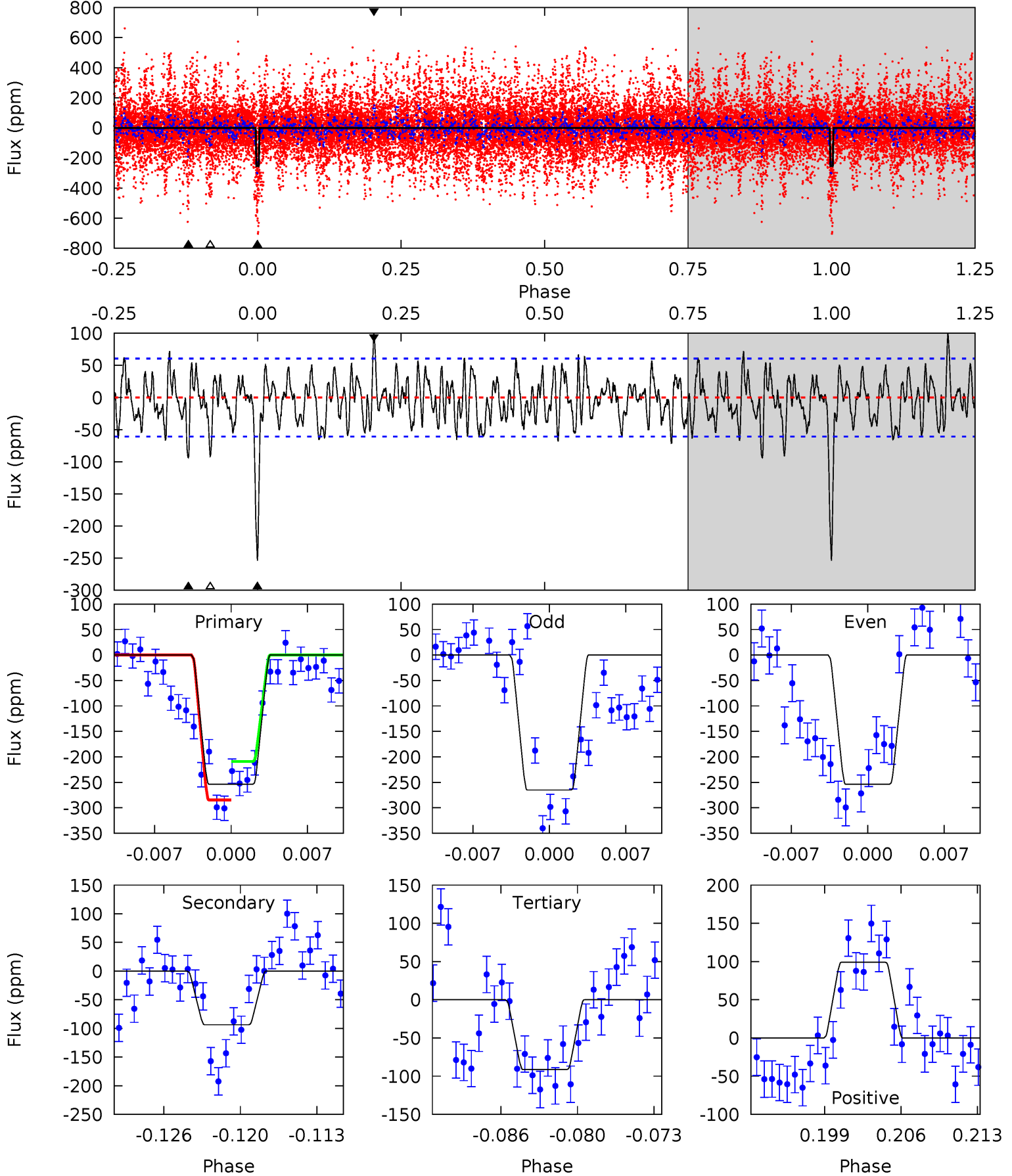




# Alt Model-Shift Uniqueness Test

010989345-07, P = 66.435181 Days, E = 124.695616 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
21.4	7.89	7.69	8.35	5.10	2.71	2.46	13.7	13.0	0.20	-0.46	0.46	1.08	0.28	3.16





### Stellar Parameters For KIC 010989345

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6441^{+181}_{-227}$	$4.108^{+0.286}_{-0.154}$	$-0.440^{+0.300}_{-0.300}$	$1.504^{+0.421}_{-0.463}$	$1.056^{+0.177}_{-0.133}$	$0.438^{+0.795}_{-0.185}$
	+3%/-4%	+7%/-4%	+68%/-68%	+28%/-31%	+17%/-13%	+182%/-42%
Source	PHO54	PHO54	PHO54	DSEP		

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

### Secondary Eclipse Parameters for KIC 010989345-07 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	$-112 \pm 12$	$1.78^{+0.69}_{-0.65}$	$843^{+63}_{-77}$	$6235^{+1597}_{-826}$	$2086^{+3025}_{-989}$
Alt.	$-94 \pm 12$	$2.67^{+0.82}_{-0.67}$	$839^{+66}_{-76}$	$4954^{+591}_{-431}$	$768^{+648}_{-311}$

$T_{\text{max}}$  = 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

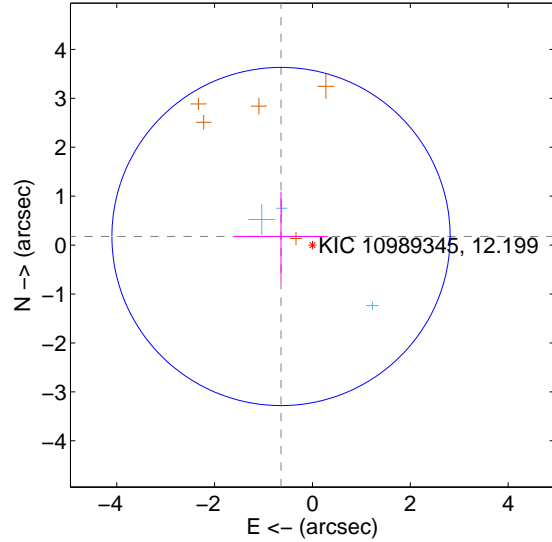
Supplemental centroid analysis for 010989345-07. Kepler magnitude: 12.20. Transit SNR 5.23

There are 3 quarters with good PRF difference image offsets

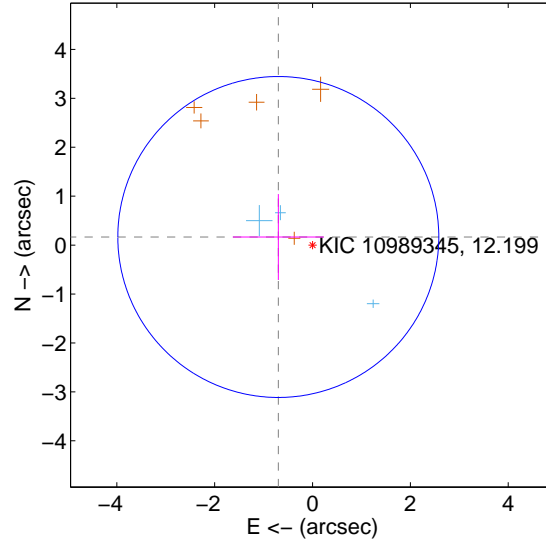
The direct PRF centroid is offset from the target star catalog position by about 0.09 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.666 \pm 1.152$	0.58	$0.642 \pm 0.958$	$0.176 \pm 0.916$
PRF-fit source offset from KIC position	$0.719 \pm 1.093$	0.66	$0.699 \pm 0.930$	$0.166 \pm 0.878$
photometric centroid source offset	$0.26 \pm 0.66$	0.40	$-0.18 \pm 0.68$	$-0.19 \pm 0.63$

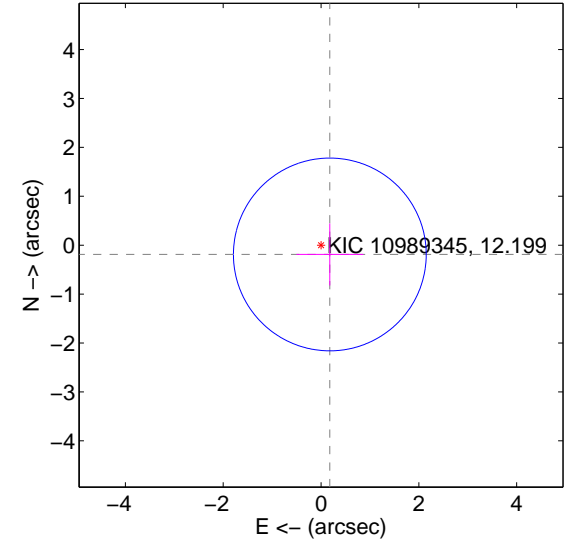
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position



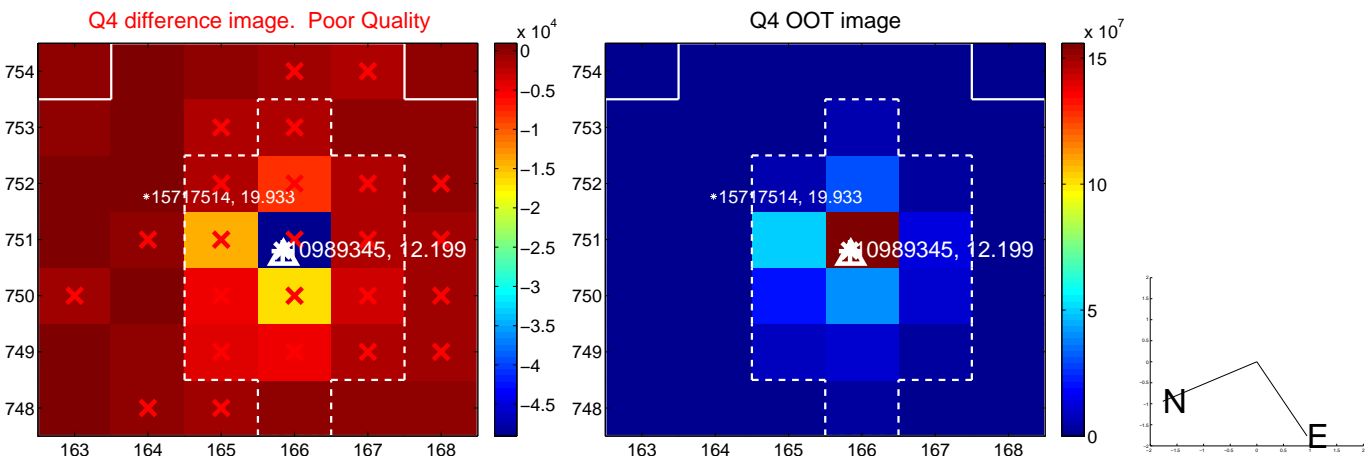
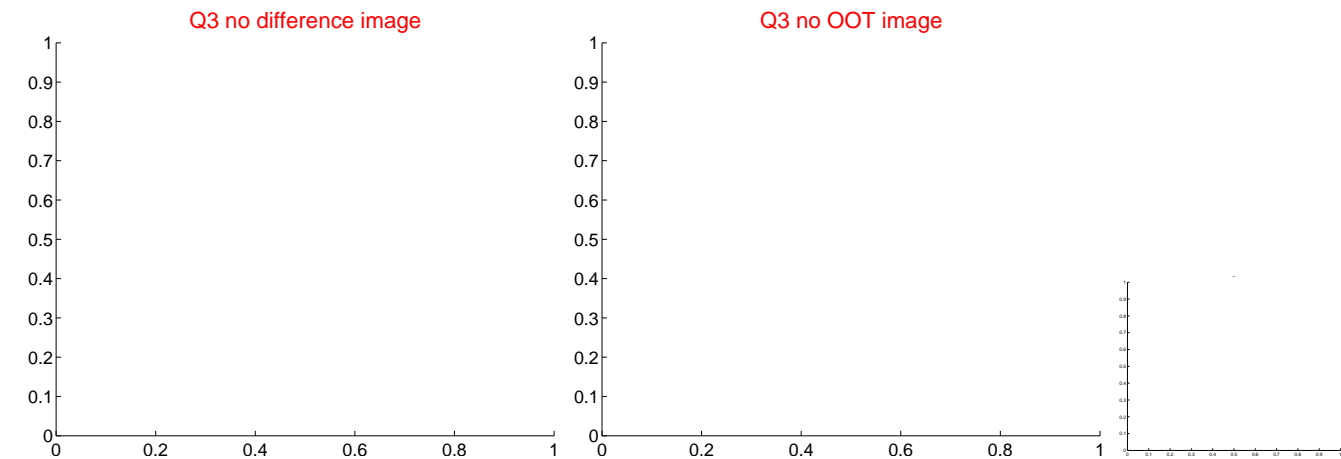
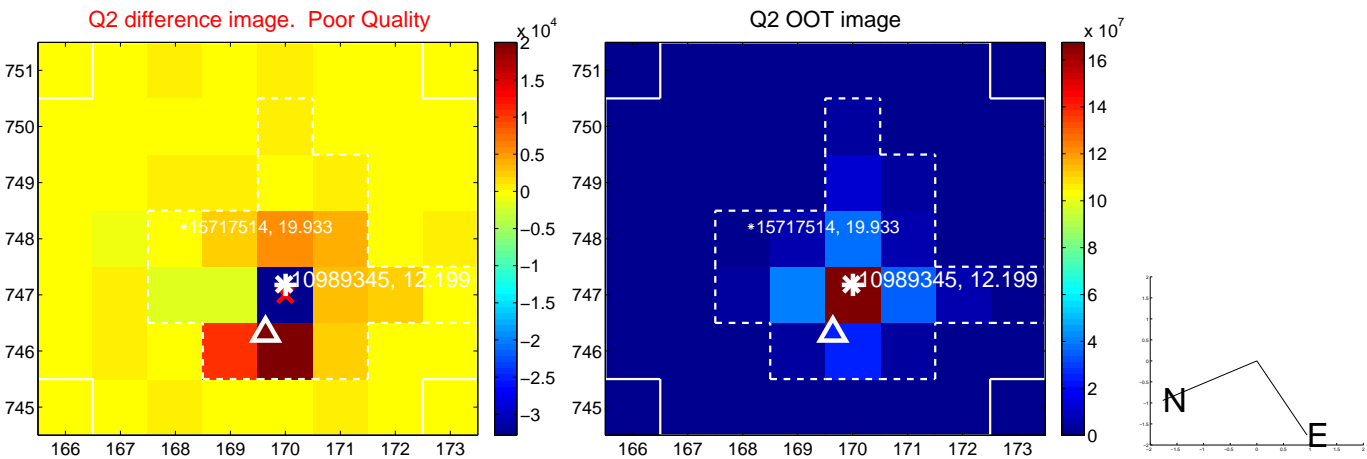
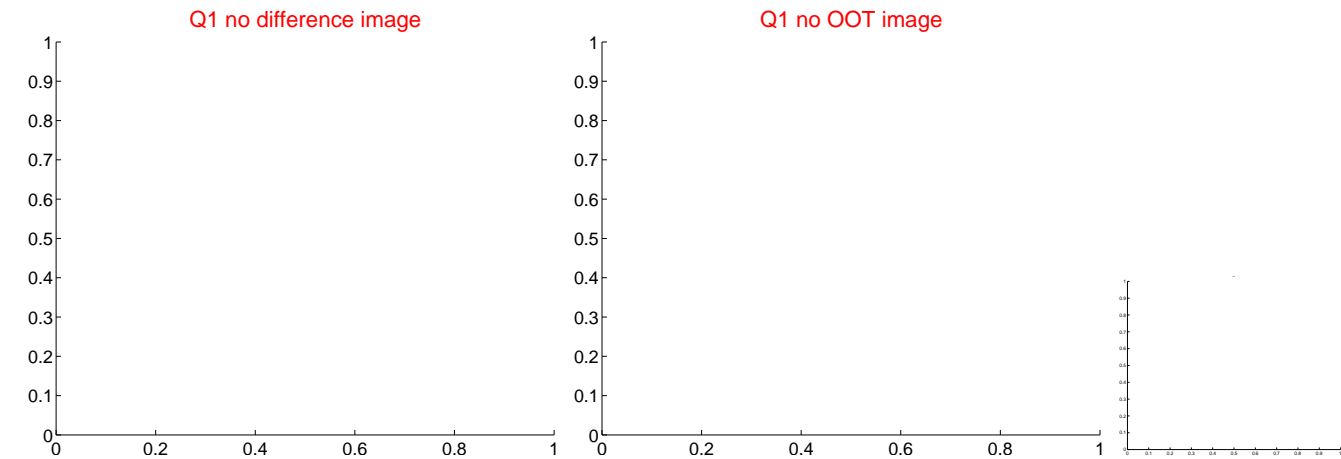
offset from photometric centroids



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.

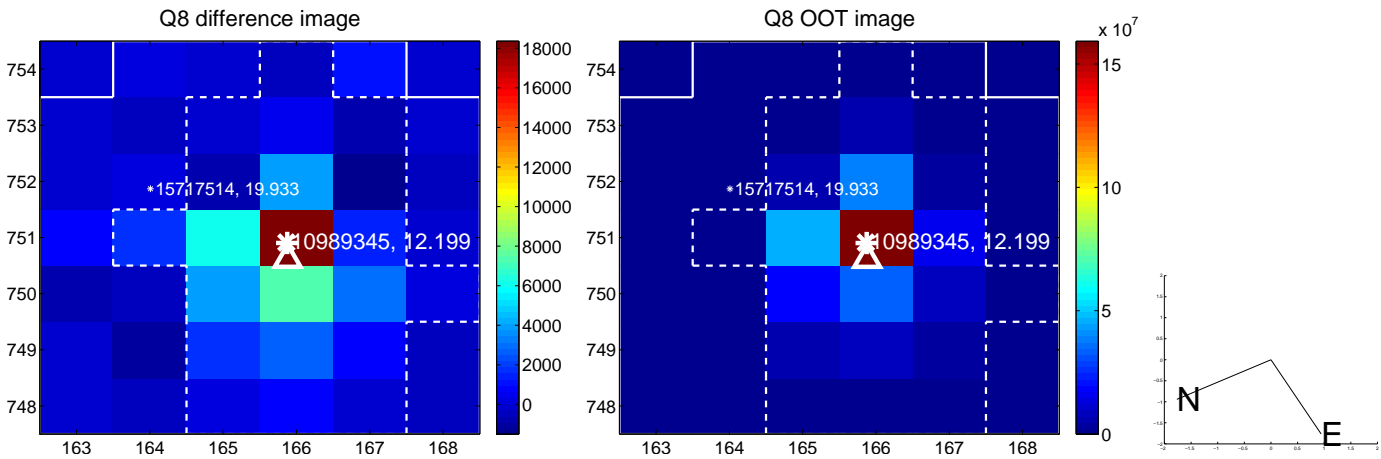
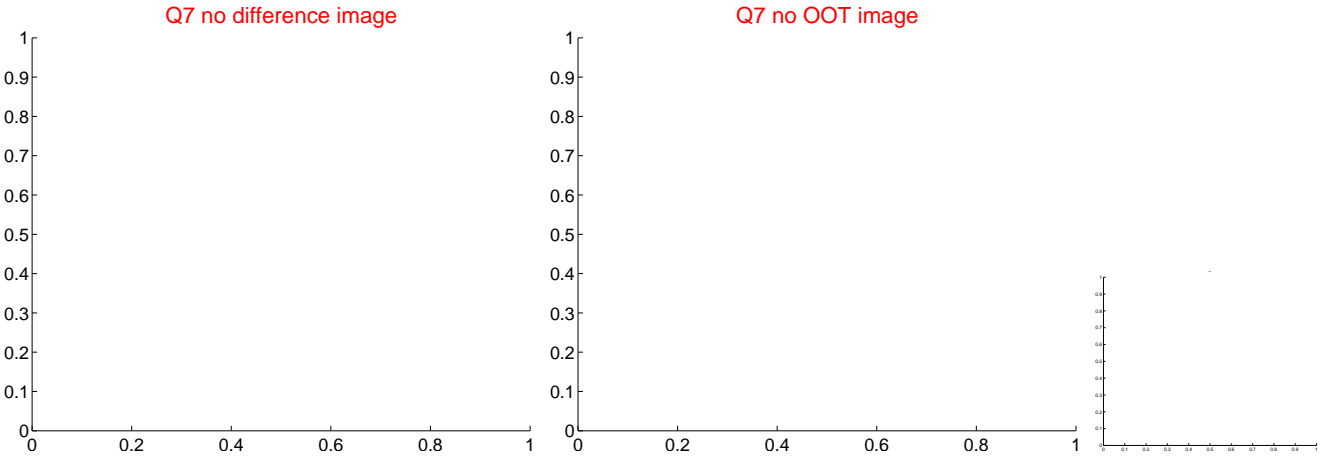
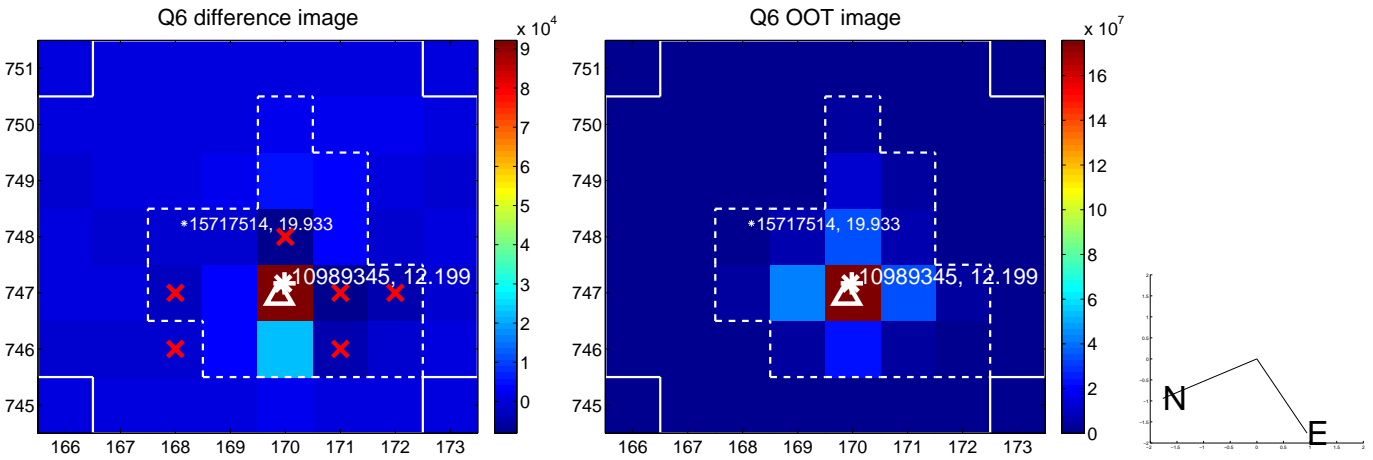
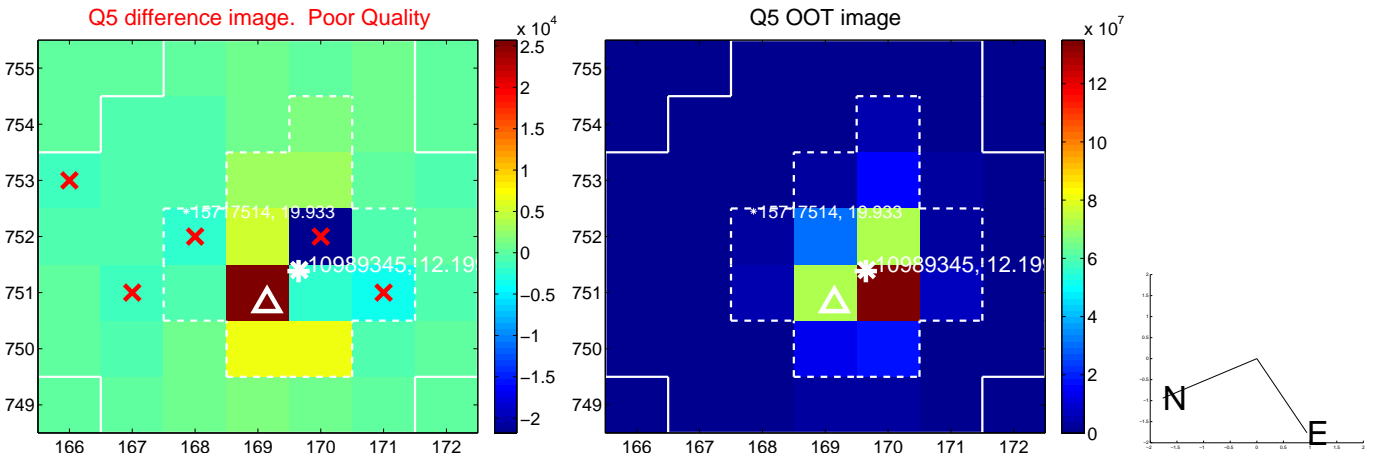


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



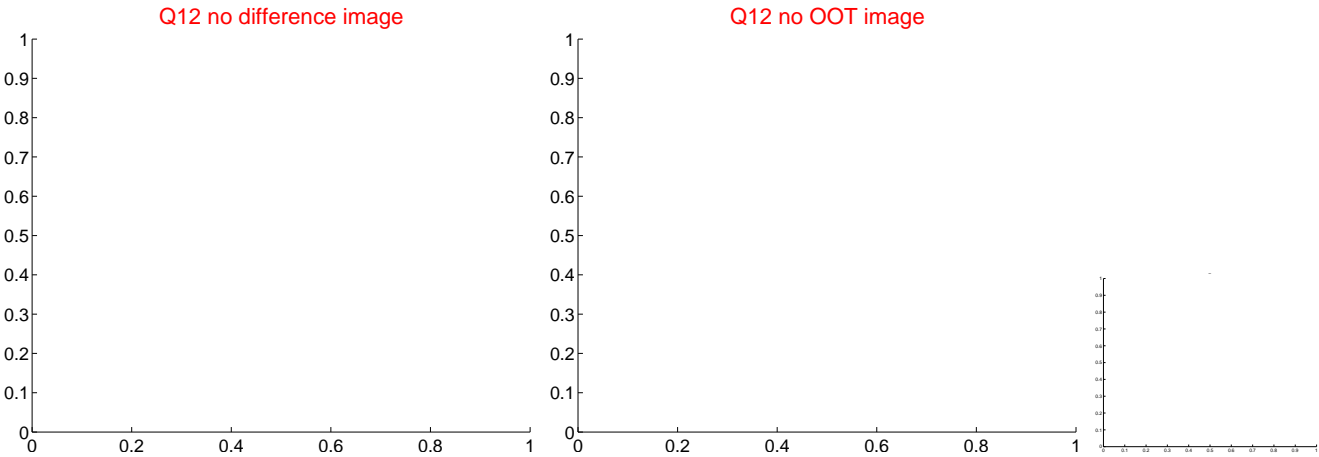
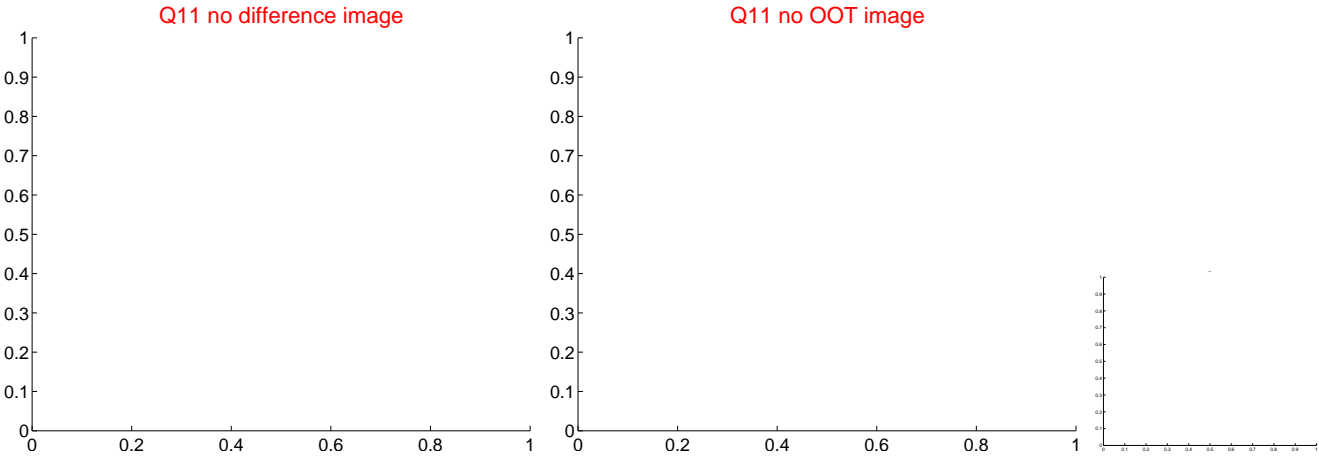
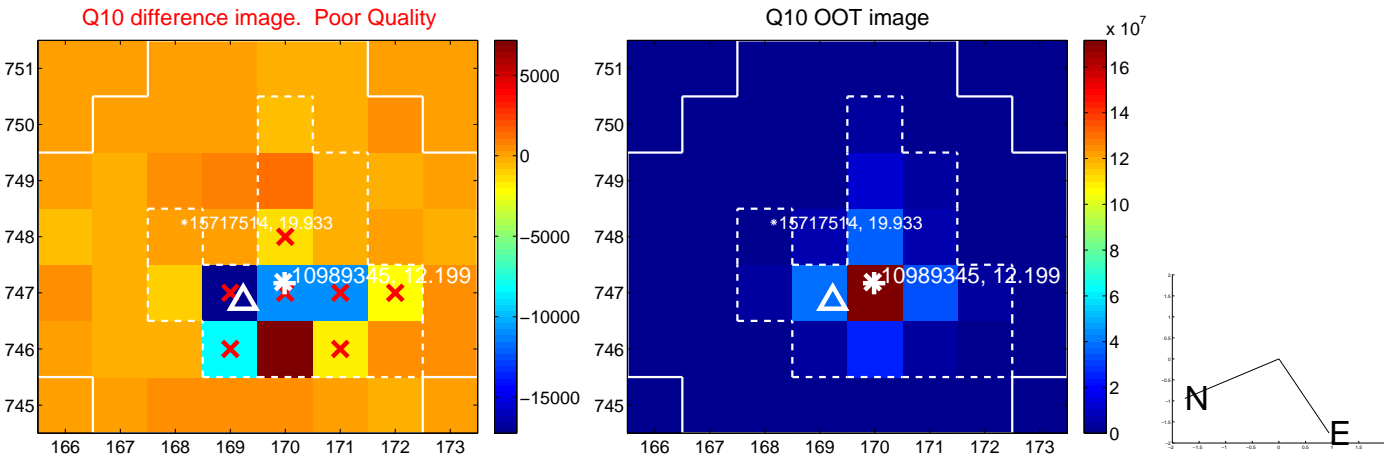
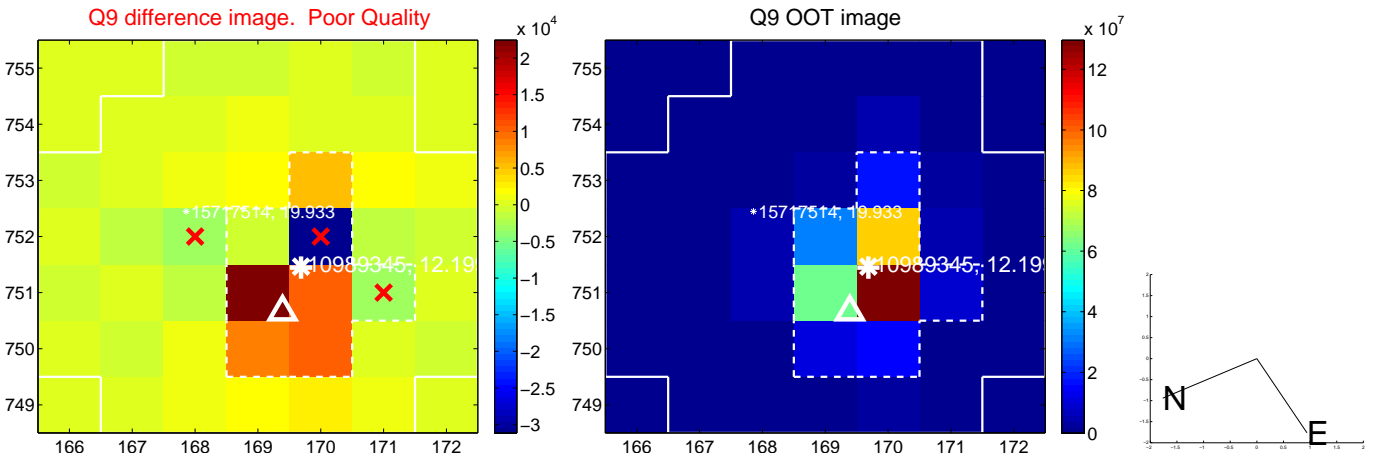


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



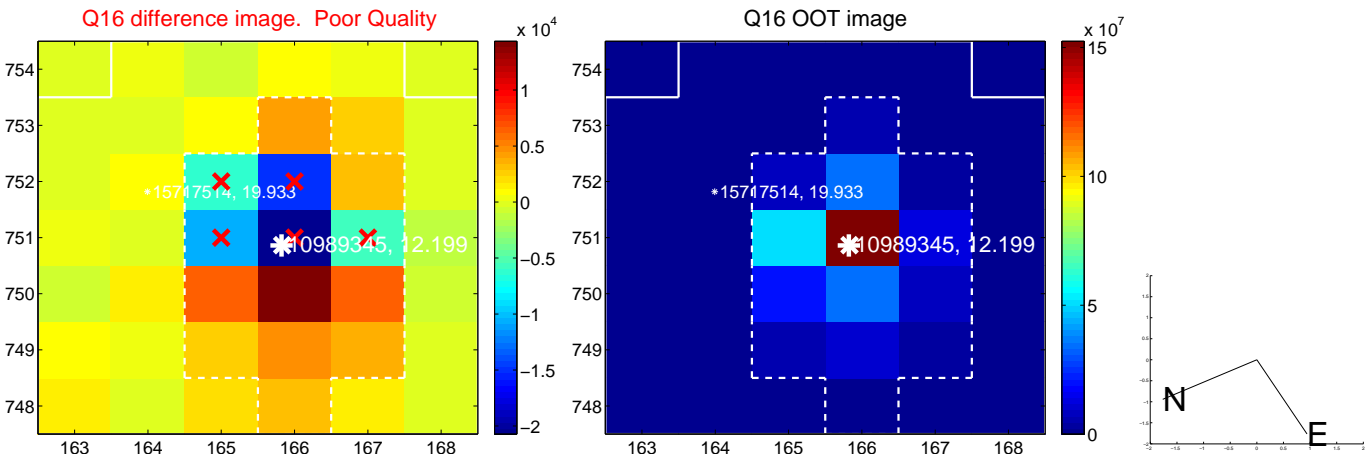
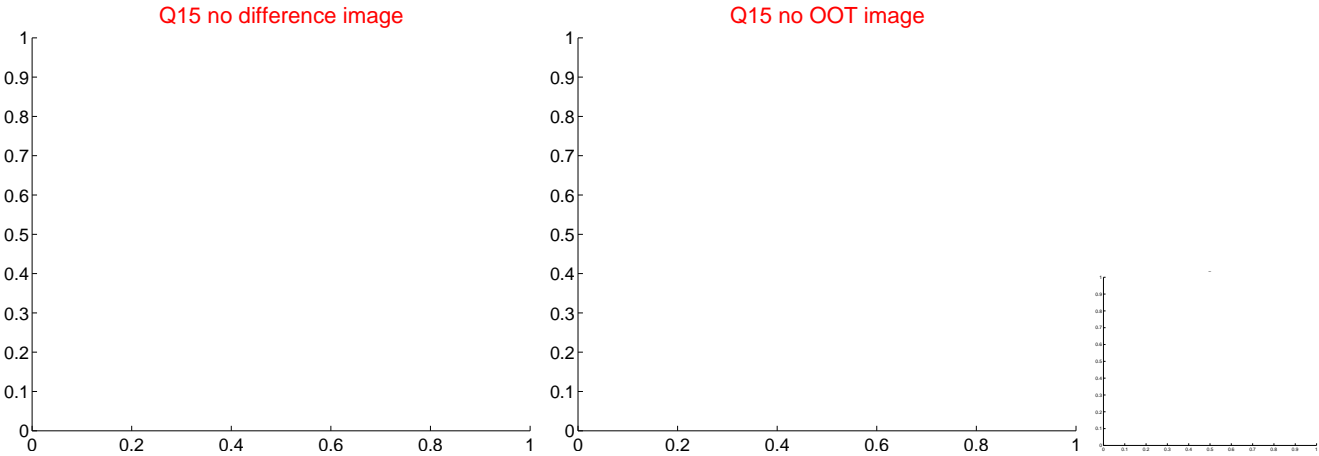
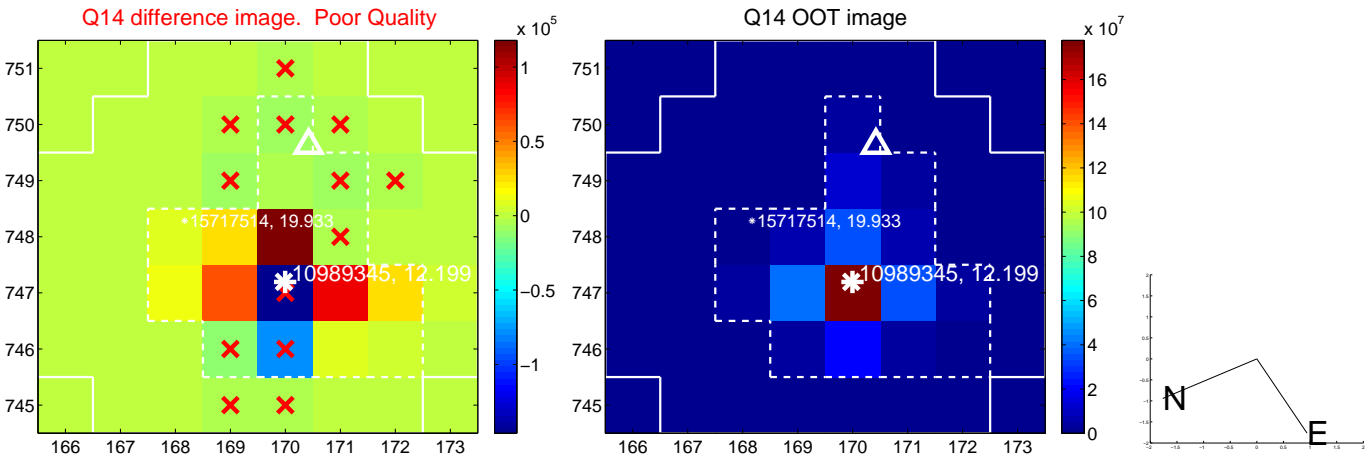
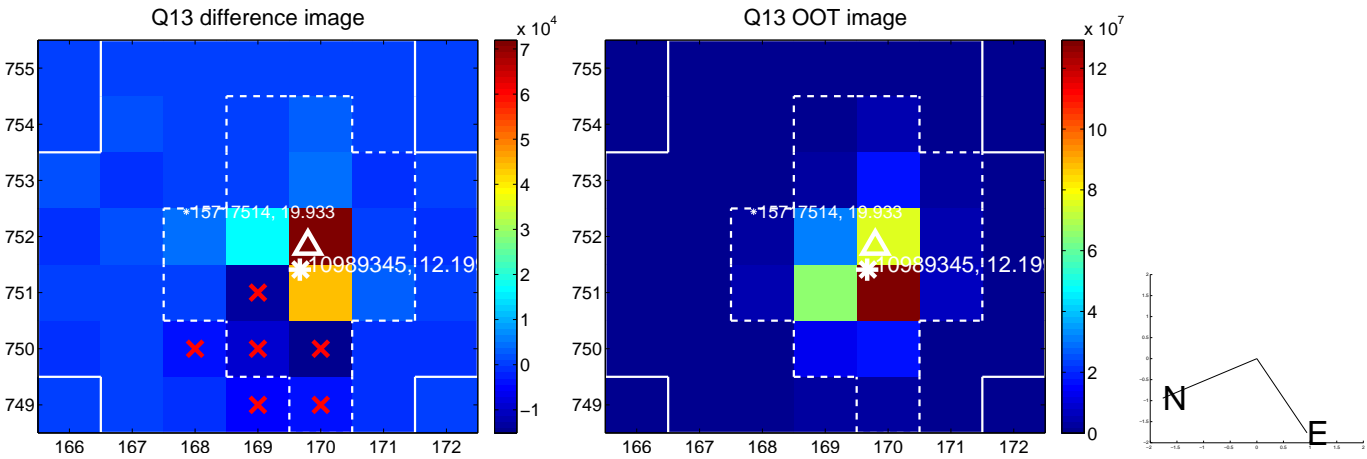


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



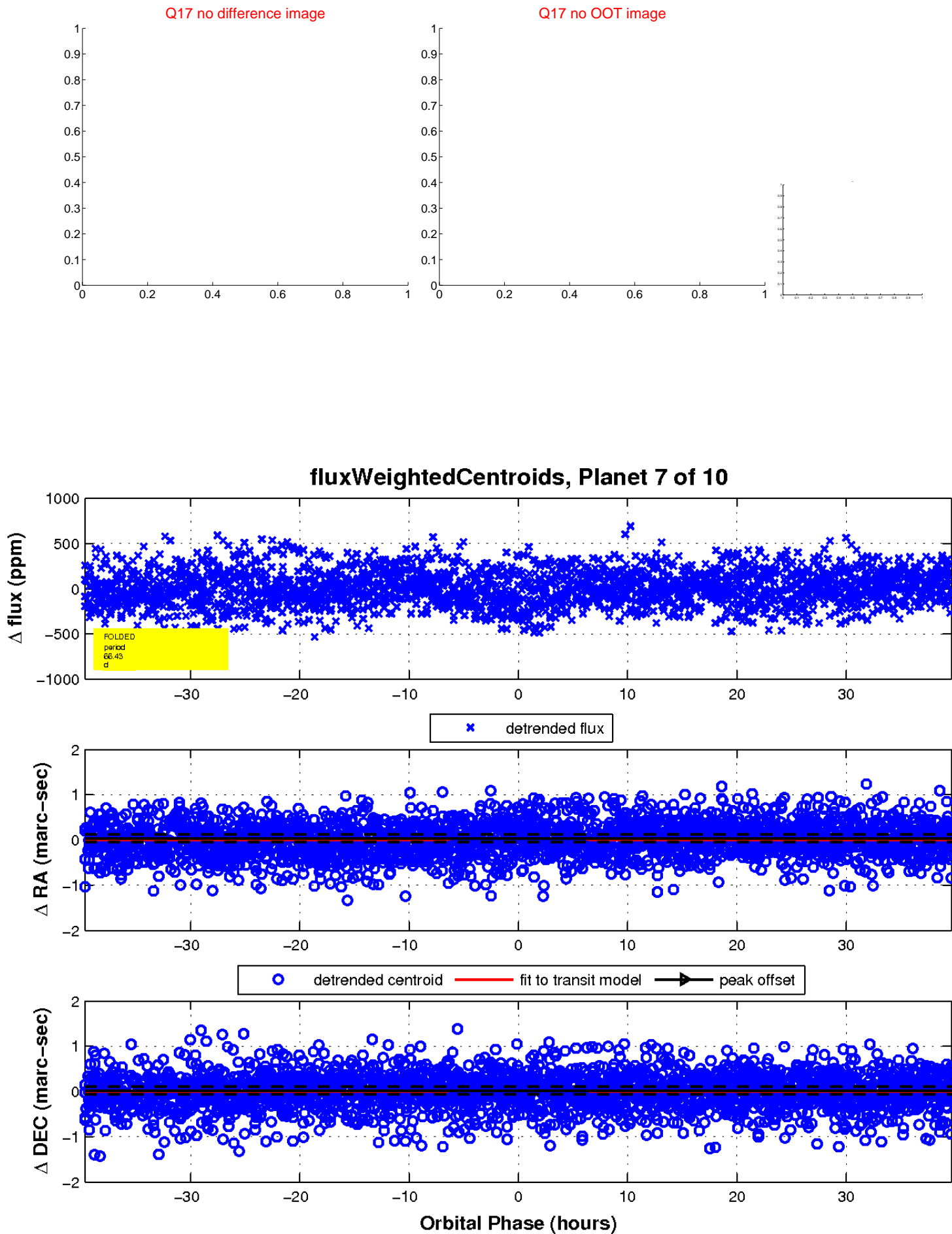


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





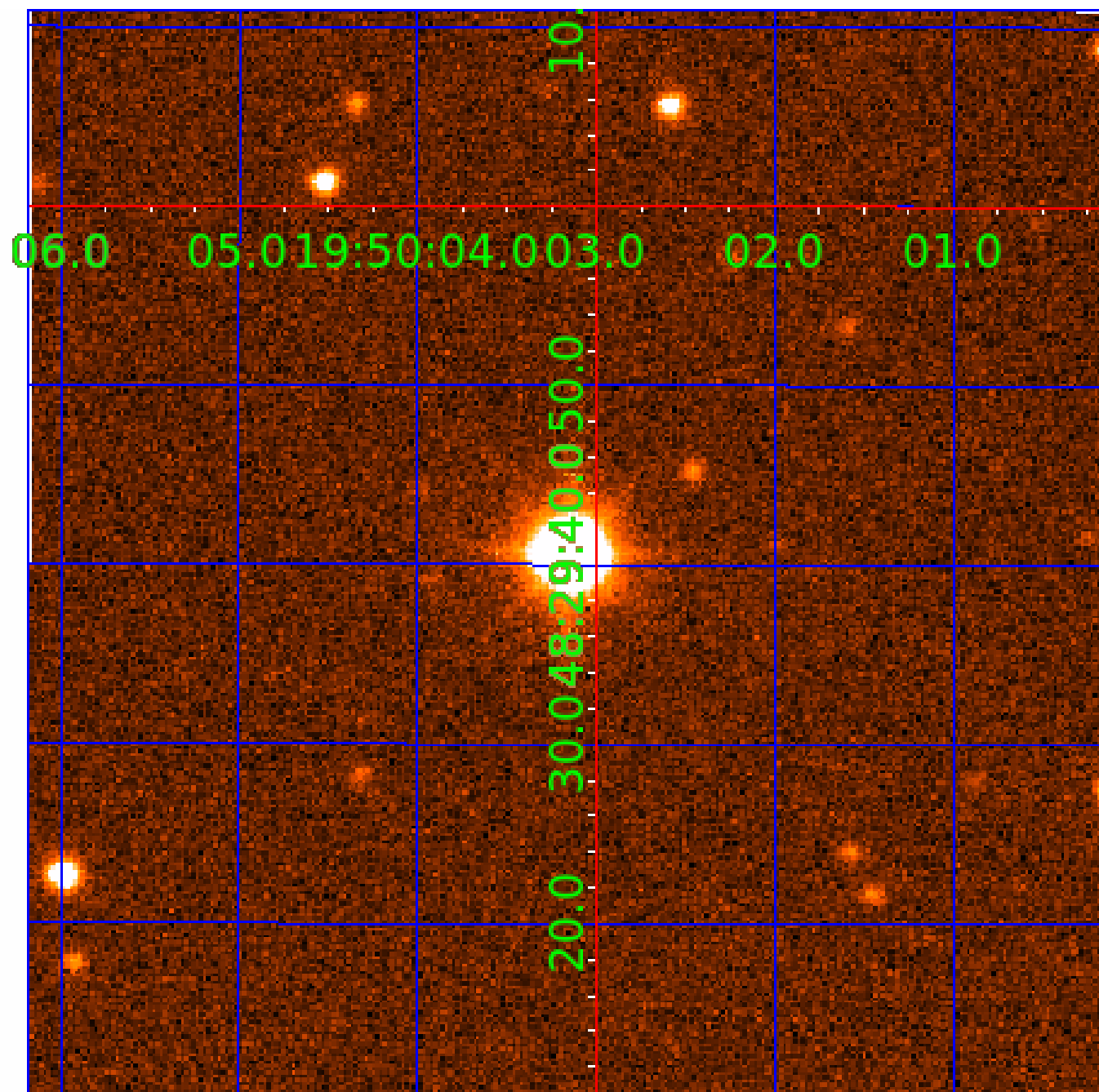
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





UKIRT Image

Declination





# KIC 010989345

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
010989345-01	OBS	No	2.630764	133.193244	10.6	11.138	8.7	2.7	1.50	6441	0.56	2414.15
010989345-02	OBS	No	663.020155	176.584259	336.4	6.883	8.0	8.5	1.50	6441	3.12	1.52
010989345-03	OBS	No	237.414043	326.142677	325.3	14.174	7.7	8.6	1.50	6441	3.39	5.96
010989345-04	OBS	No	423.567102	344.022902	722.4	35.026	7.8	7.8	1.50	6441	4.94	2.76
010989345-05	OBS	No	128.115026	240.564541	252.7	10.241	7.8	8.2	1.50	6441	2.77	13.57
010989345-07	OBS	No	66.433669	191.136166	129.6	13.221	7.4	5.2	1.50	6441	1.83	32.59
010989345-08	OBS	No	161.346431	265.595466	238.5	7.037	7.2	7.2	1.50	6441	4.56	9.98
010989345-09	OBS	No	276.296890	275.873517	375.6	30.069	7.9	7.5	1.50	6441	3.49	4.87
010989345-10	OBS	No	196.452793	165.569777	243.6	5.231	7.4	8.1	1.50	6441	3.04	7.68

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
010989345-01	OBS	FP	0.00	1	0	0	0	SWEET_NTL—LPP_DV—MOD_NONUNIQ_DV
010989345-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES—ALL_TRANS_CHASES—MOD_NONUNIQ_DV
010989345-03	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—HALO_GHOST
010989345-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
010989345-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—MOD_NONUNIQ_DV
010989345-07	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT
010989345-08	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT
010989345-09	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—CENT_FEW_DIFFS
010989345-10	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT

**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.

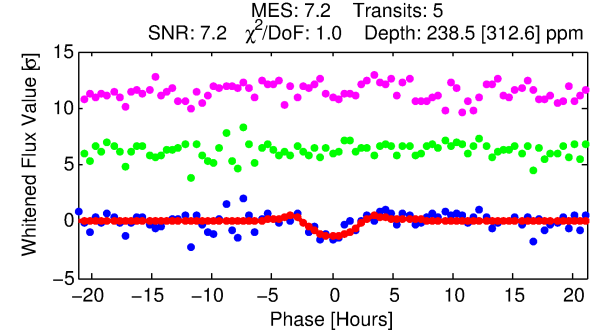
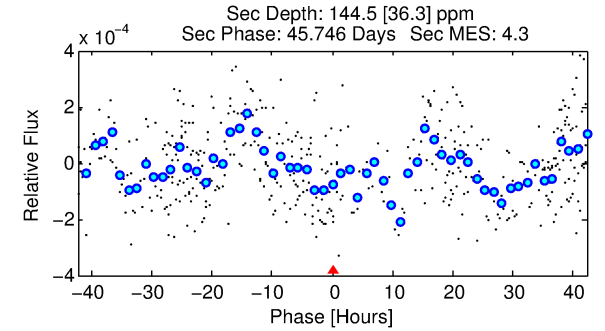
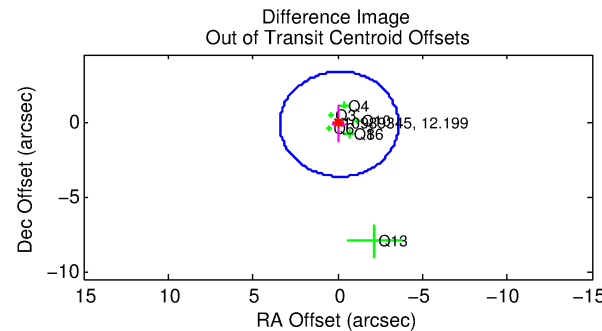
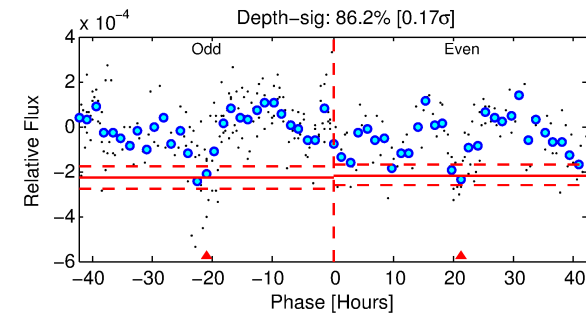
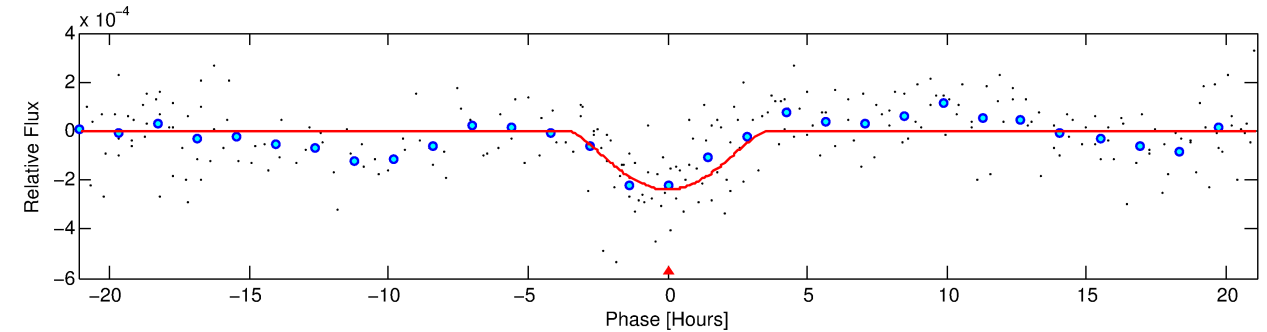
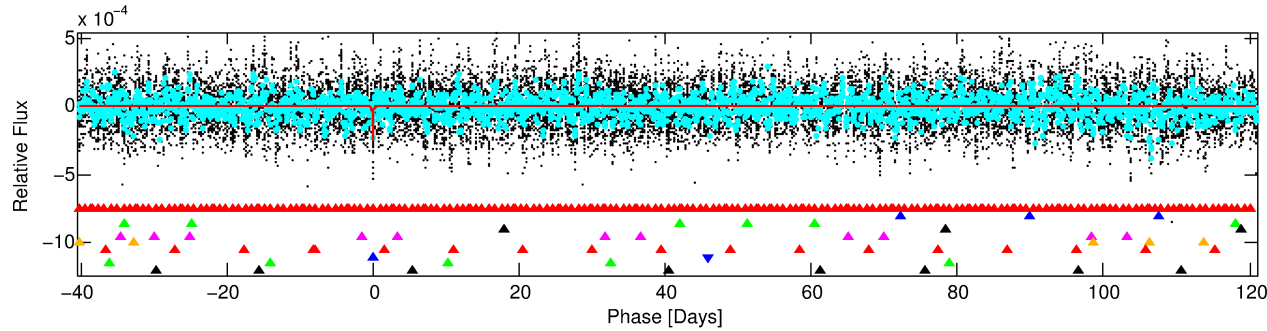
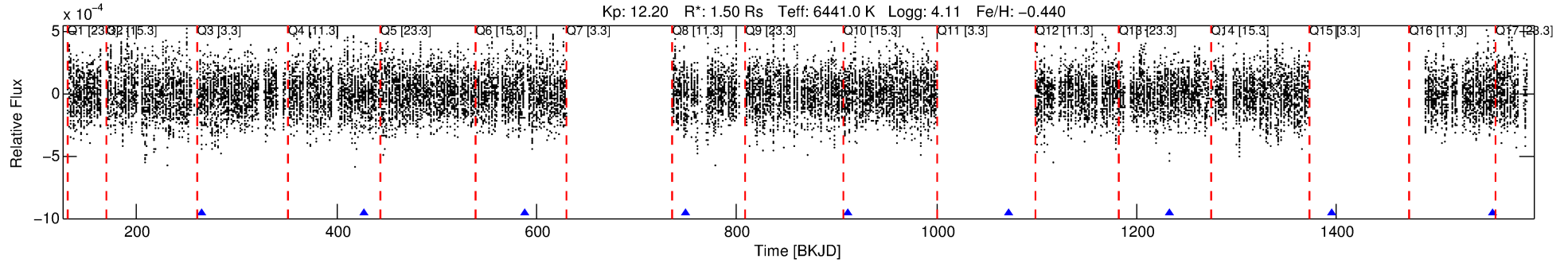
Ephemeris Match Information For 010989345-08

No Significant Match Found



# DV One-Page Summary

KIC: 10989345 Candidate: 8 of 10 Period: 161.346 d



## DV Fit Results:

Period = 161.34643 [0.00477] d  
Epoch = 265.5955 [0.0151] BKJD  
Rp/R\* = 0.0278 [0.0861]  
a/R\* = 41.60 [34.83]  
b = 1.00 [0.10]  
Seff = 9.98 [5.04]  
Teq = 453 [57] K  
Rp = 4.56 [14.21] Re  
a = 0.5912 [0.1776] AU  
Ag = 1334.37 [8301.89] [0.16σ]  
Teffp = 4235 [6569] K [0.58σ]

## DV Diagnostic Results:

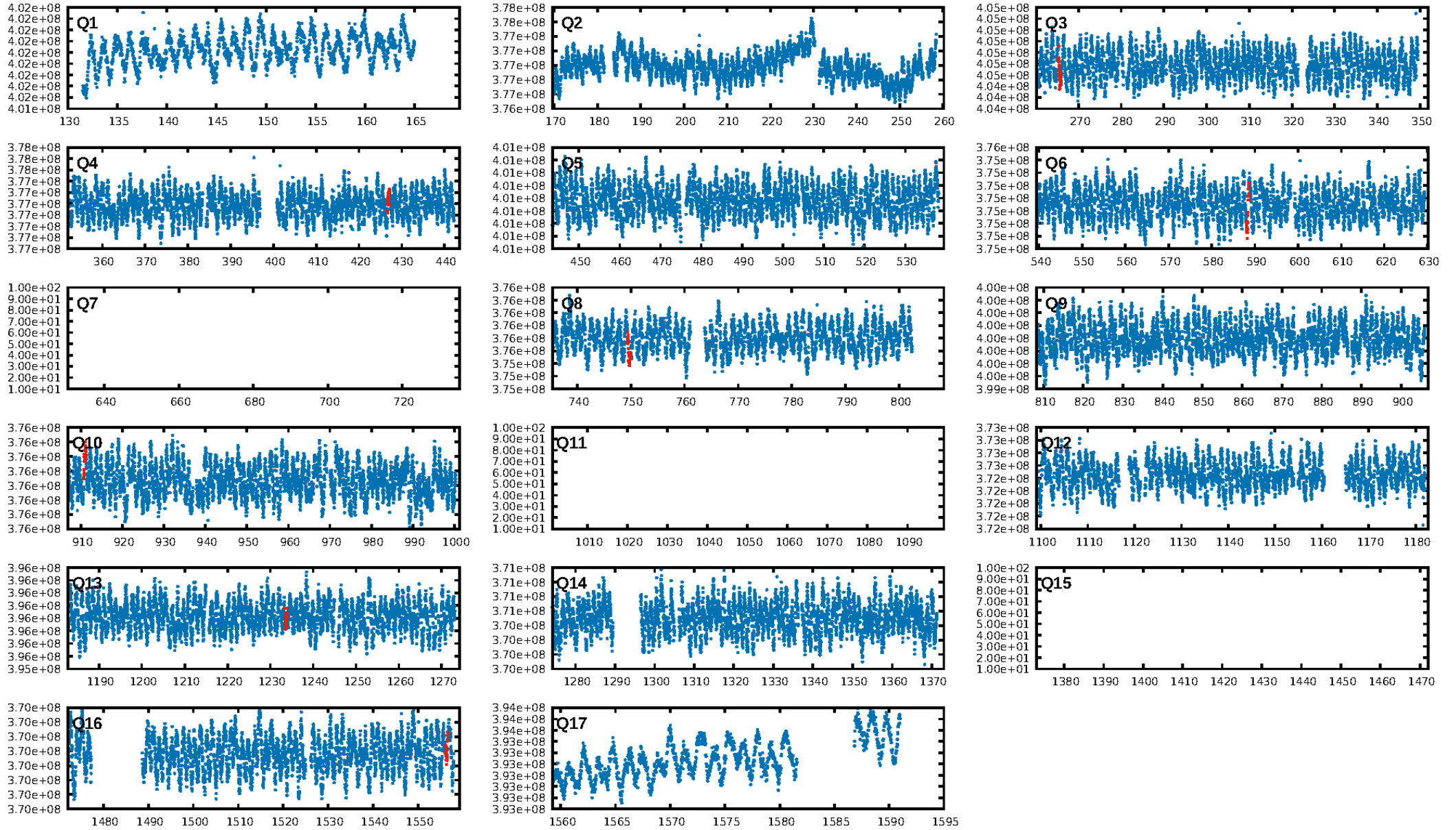
ShortPeriod-sig: 100.0% [64.19σ]  
LongPeriod-sig: 100.0% [96.09σ]  
ModelChiSquare2-sig: 54.1%  
ModelChiSquareGof-sig: 94.9%  
**Bootstrap-pfa: 1.64e-08**  
RollingBand-fgt: 1.00 [5/5]  
GhostDiagnostic-chr: -7.238  
Centroid-sig: 36.5%  
Centroid-so: 0.480 arcsec [0.67σ]  
OotOffset-rm: 0.181 arcsec [0.15σ]  
KicOffset-rm: 0.198 arcsec [0.22σ]  
OotOffset-st: 2/1/3/1 [7]  
KicOffset-st: 2/1/3/1 [7]  
DiffImageQuality-fgm: 0.57 [4/7]  
DiffImageOverlap-fno: 0.71 [5/7]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 03:40:21 Z

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

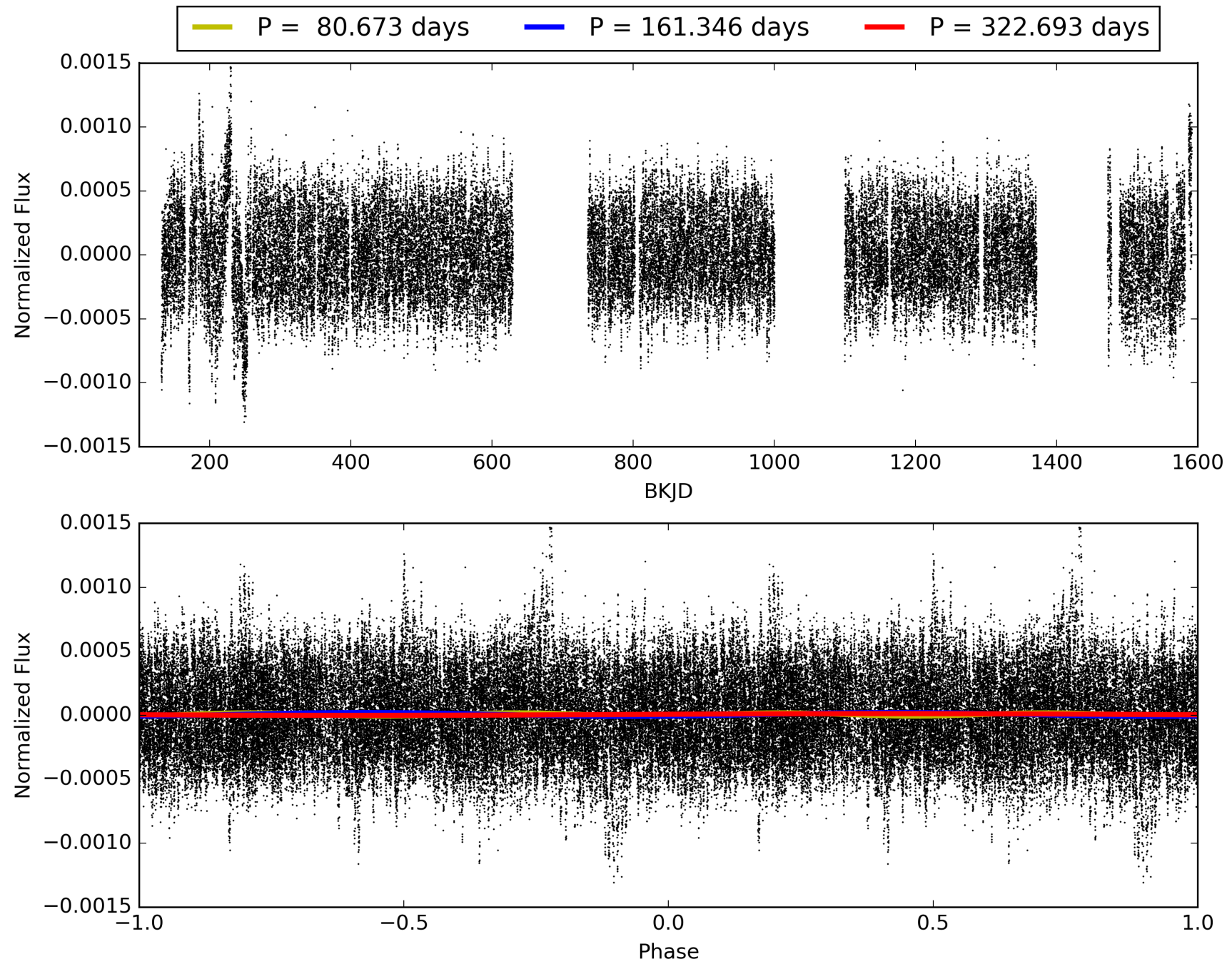


# TCE 010989345-08, PDC Light Curves





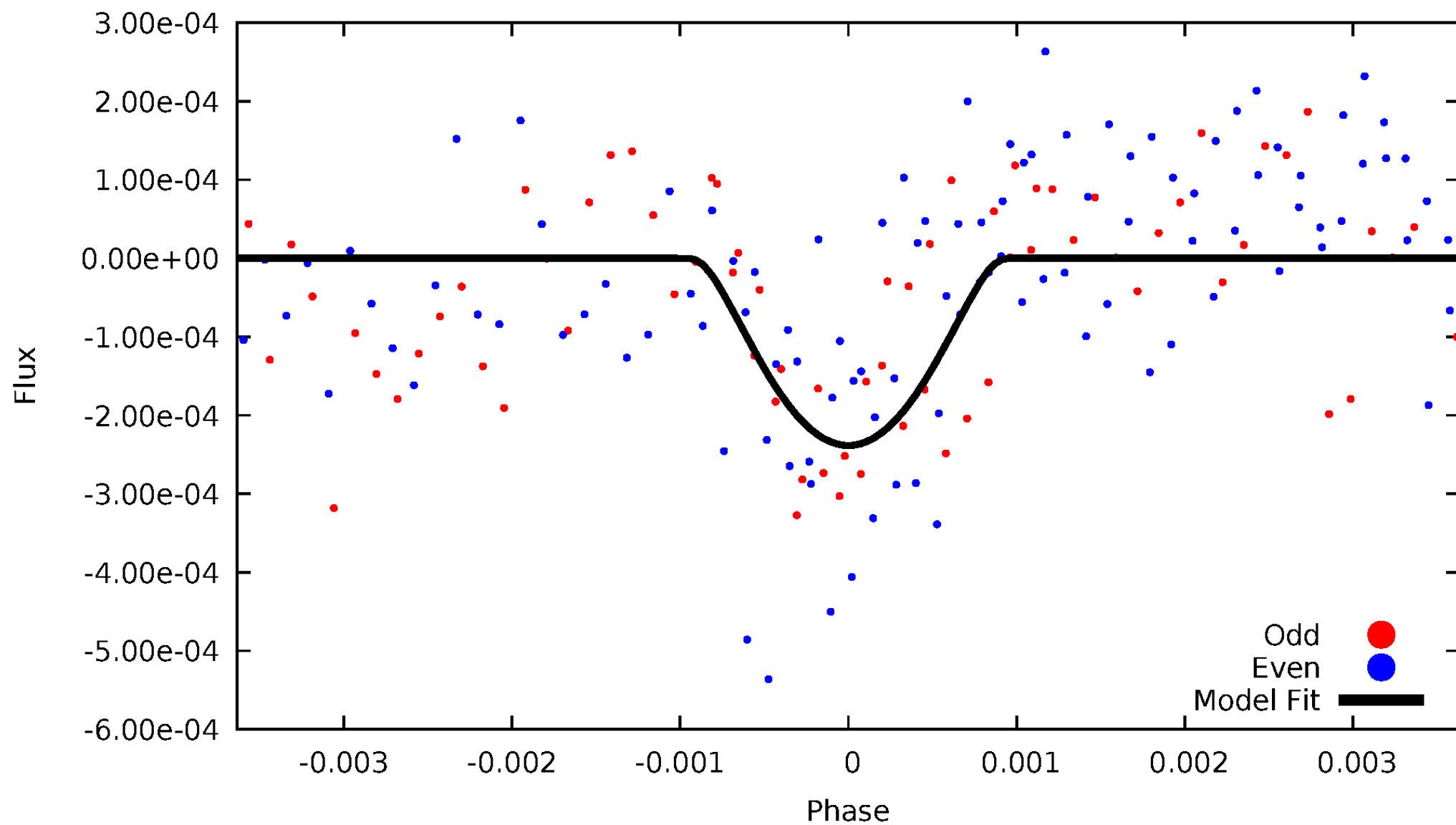
TCE 010989345-08





# DV Odd/Even

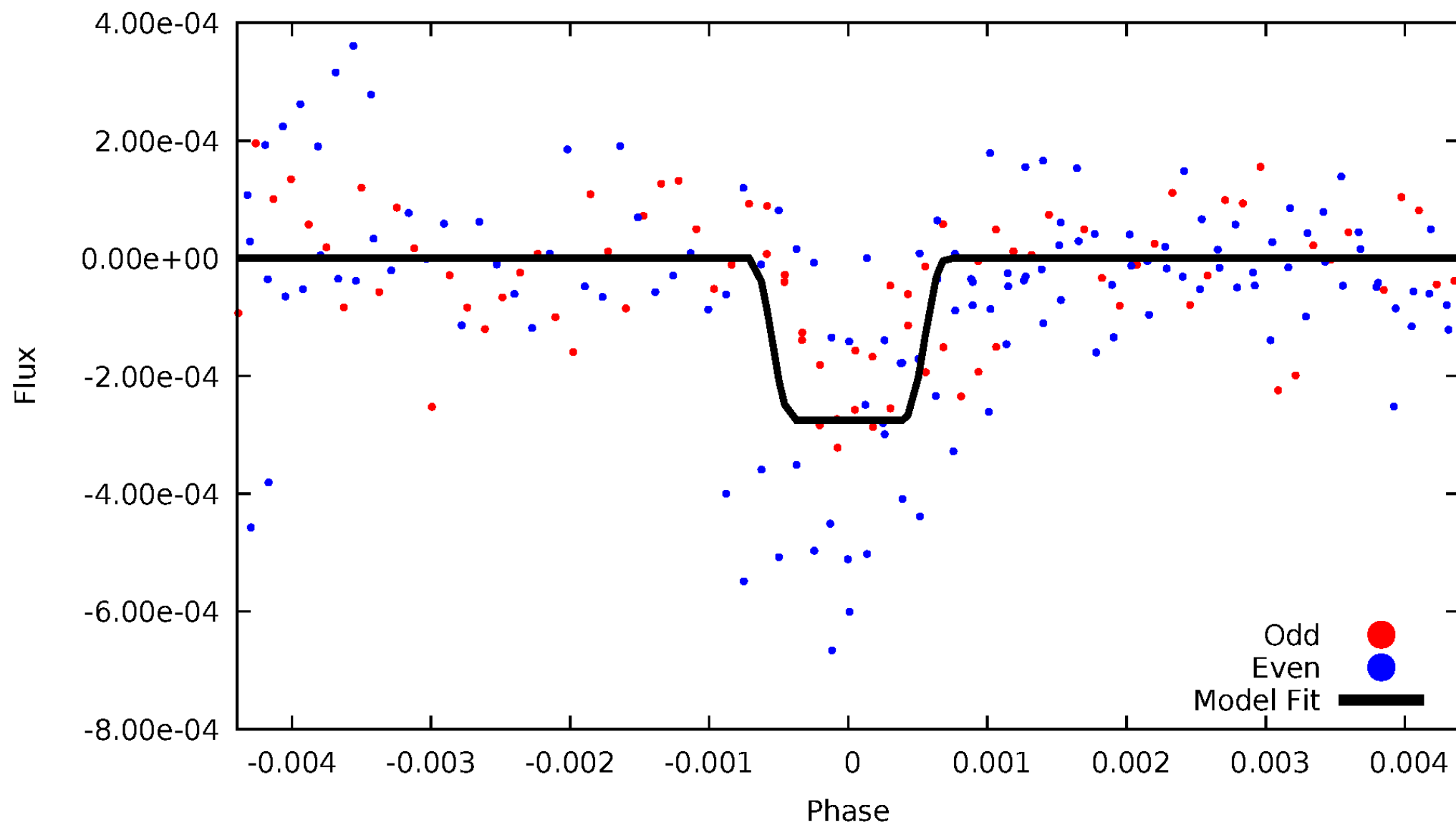
TCE 010989345-08





# ALT Odd/Even

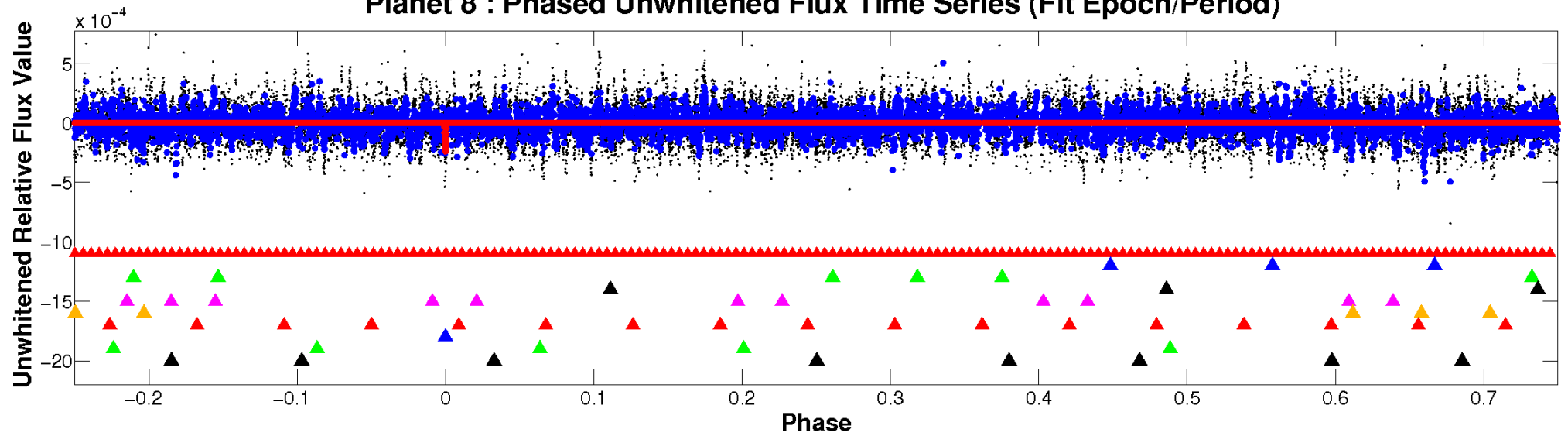
TCE 010989345-08



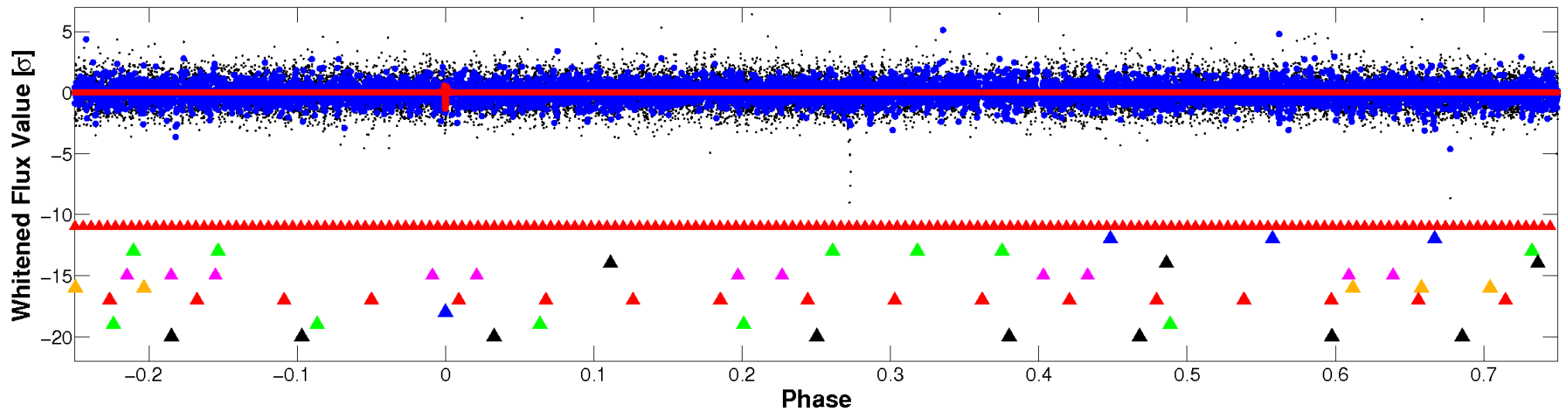


# Non-Whitened Vs. Whitened Light Curve

## Planet 8 : Phased Unwhitened Flux Time Series (Fit Epoch/Period)



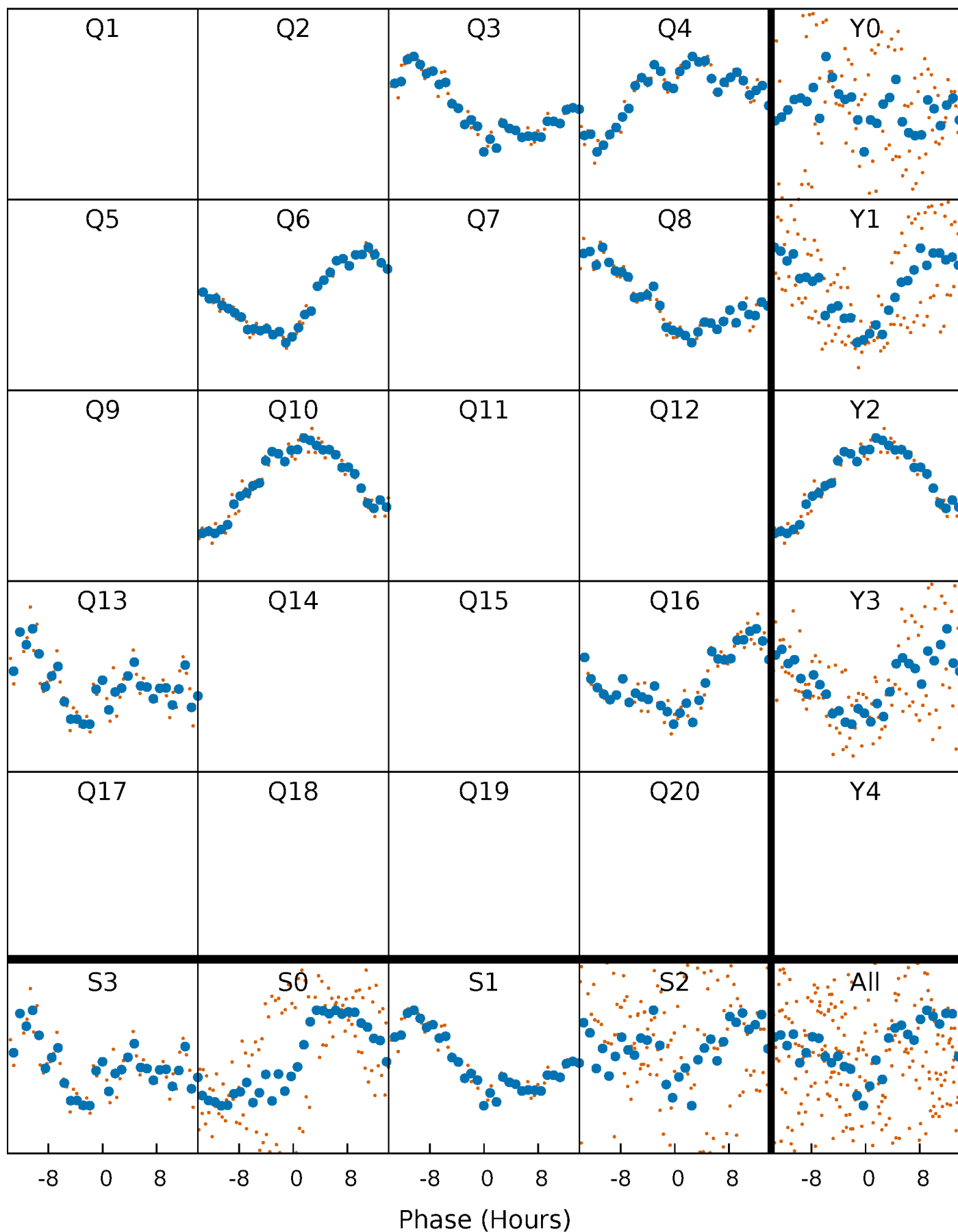
## Planet 8 : Phased Whitened Flux Time Series (Fit Epoch/Period)





# PDC Quarter-Phased Transit Curves

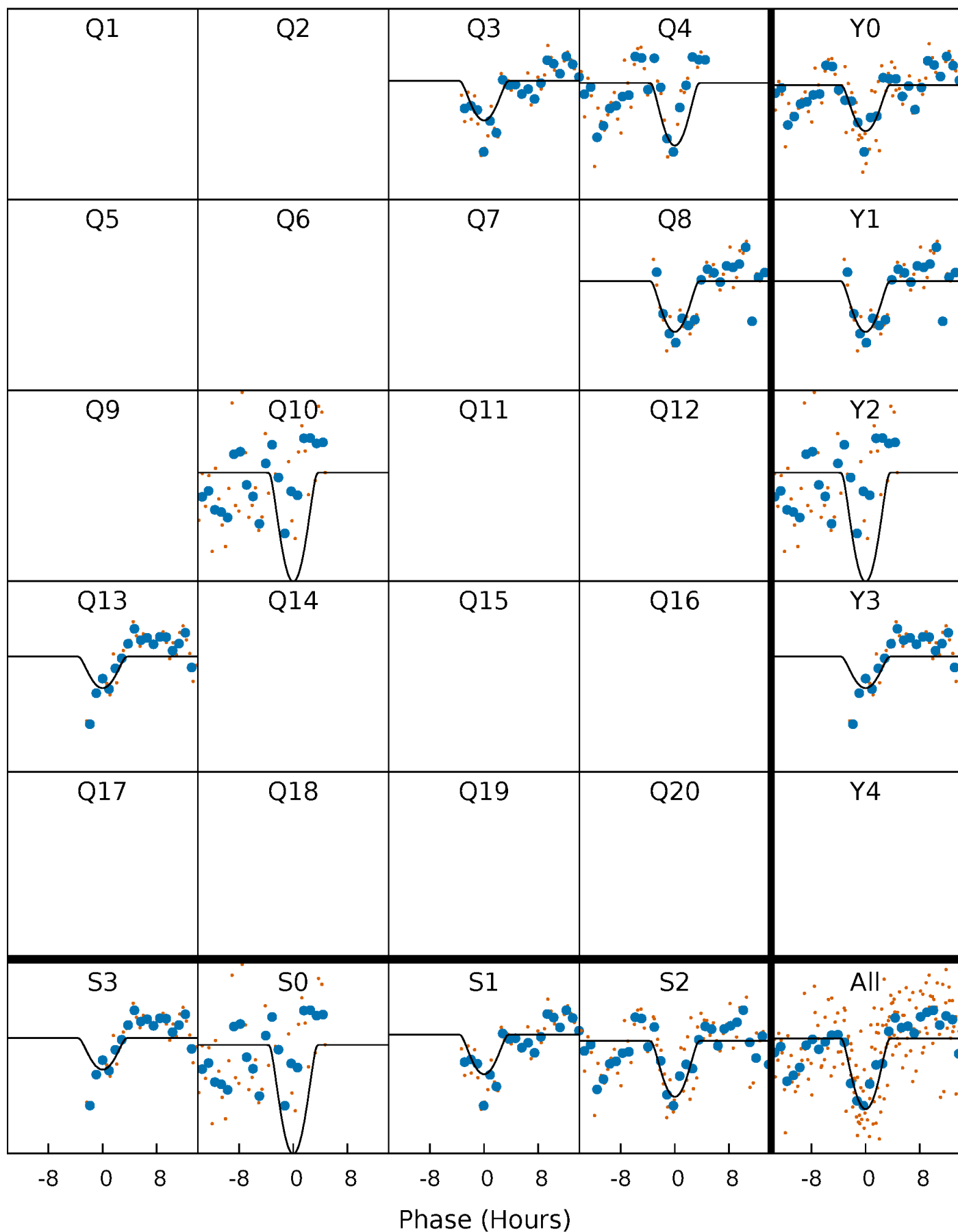
TCE 010989345-08 P=161.346431 Days  $T_0=265.595465$  (BKJD)





# DV Quarter-Phased Transit Curves

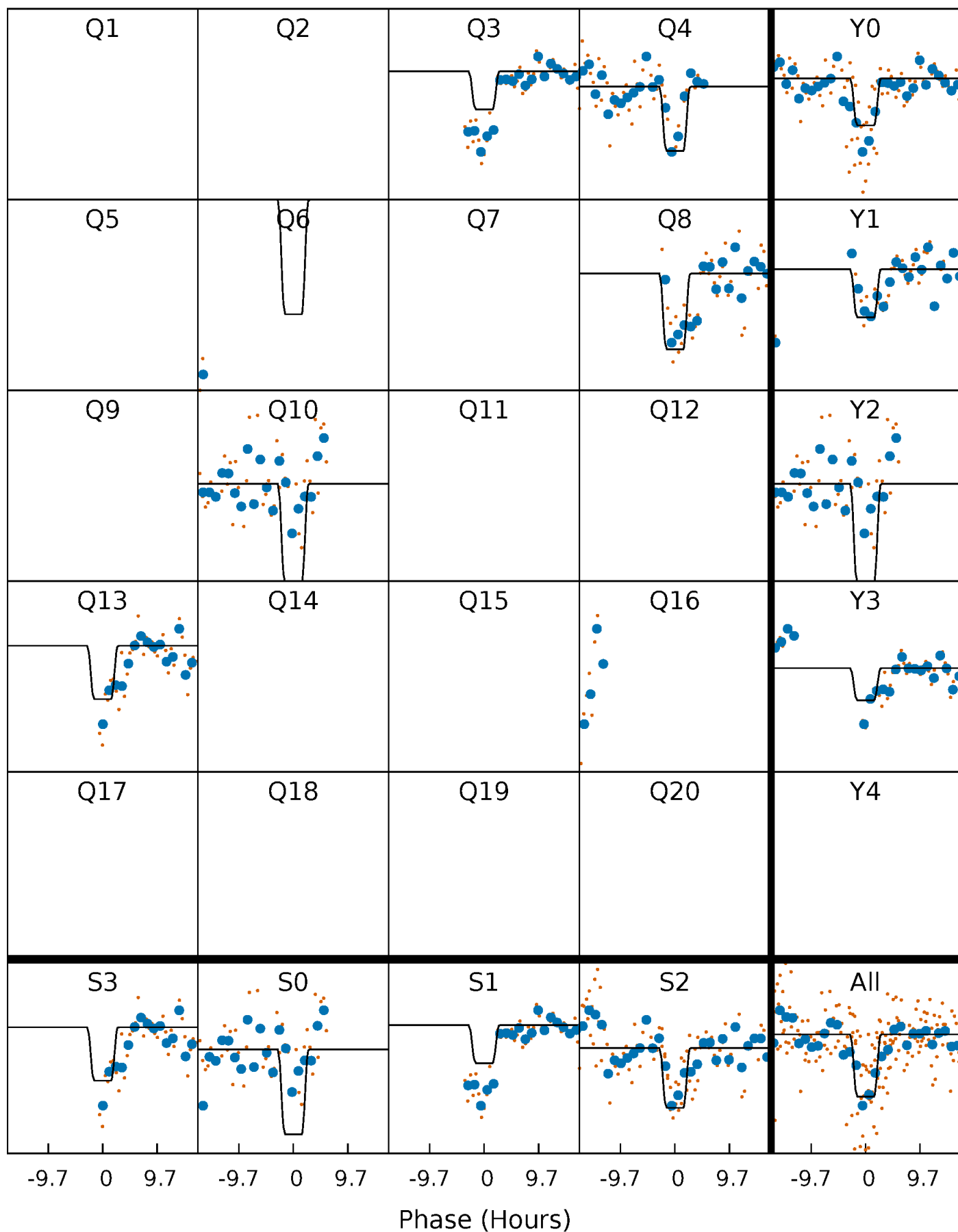
TCE 010989345-08     $P=161.346431$  Days     $T_0=265.595465$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

TCE 010989345-08     $P=161.333416$  Days     $T_0=265.597513$  (BKJD)

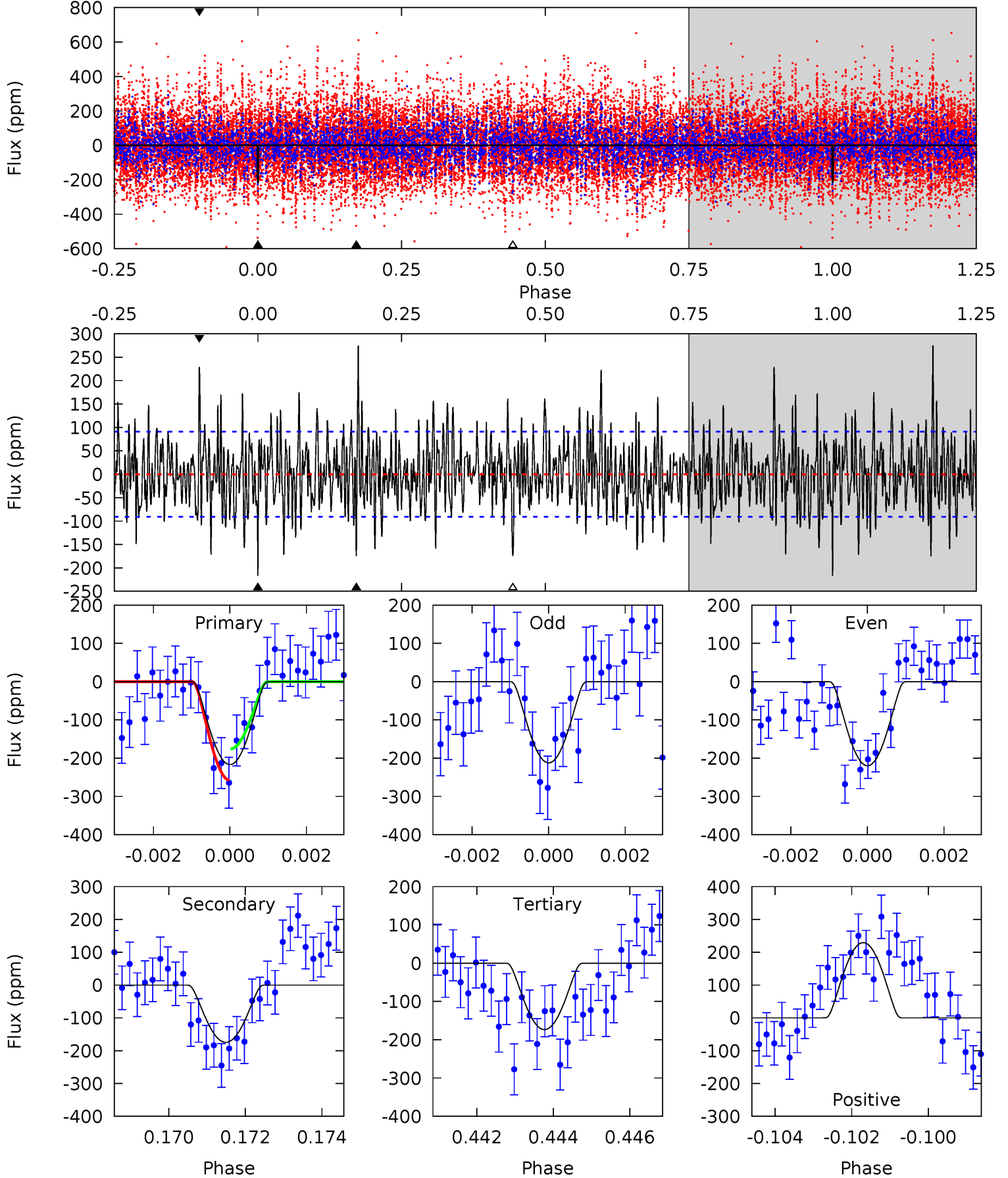




# DV Model-Shift Uniqueness Test

010989345-08, P = 161.346431 Days, E = 104.249034 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	10.2	10.2	13.5	5.33	3.10	3.61	2.55	-0.74	0.06	-3.22	0.22	0.81	0.56	2.39

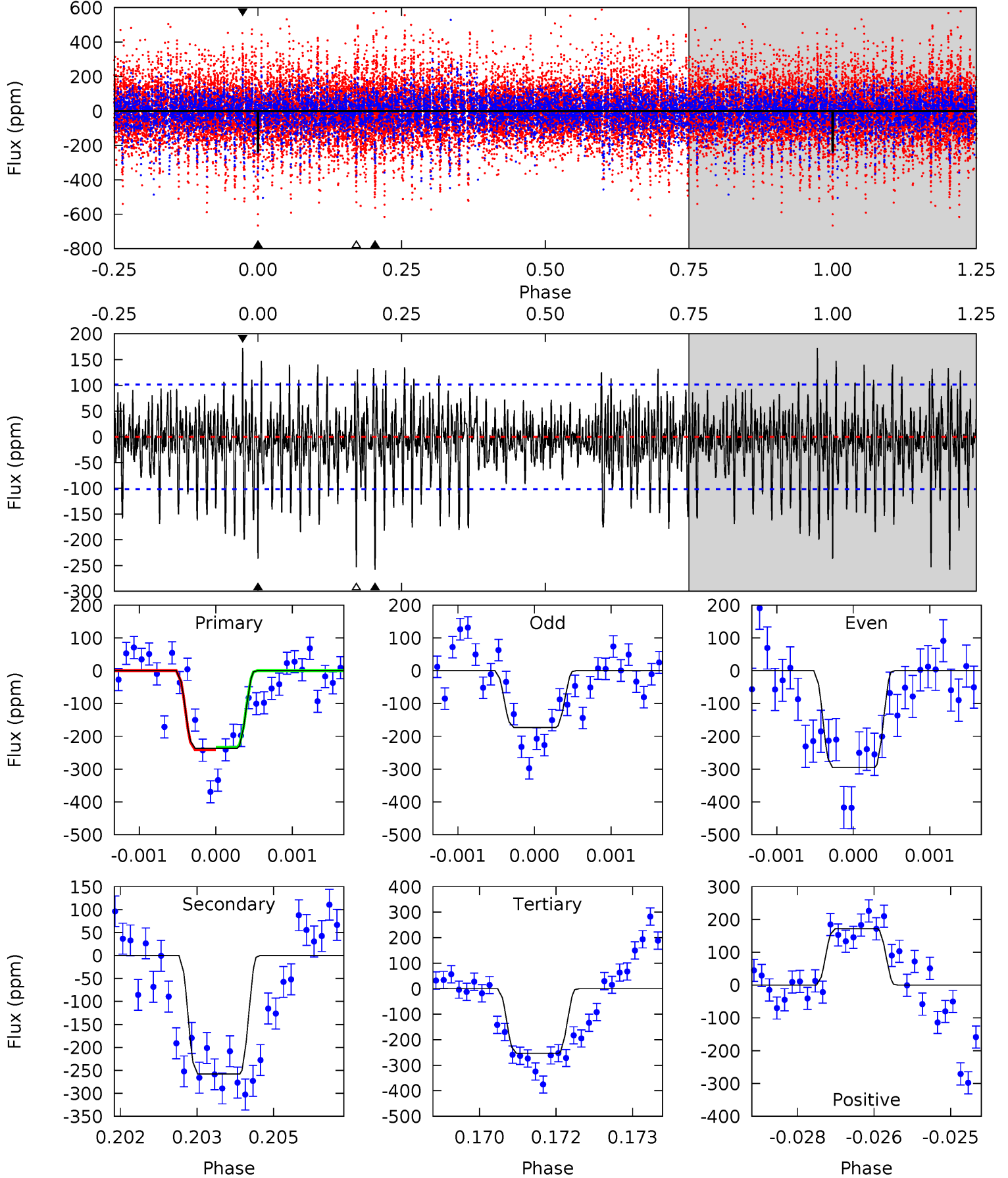




# Alt Model-Shift Uniqueness Test

010989345-08, P = 161.333416 Days, E = 104.264097 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
12.5	13.7	13.4	9.11	5.39	3.20	2.74	-0.88	3.43	0.24	4.56	3.25	1.31	0.40	0.19





### Stellar Parameters For KIC 010989345

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M$ ( $M_{\odot}$ )	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6441^{+181}_{-227}$	$4.108^{+0.286}_{-0.154}$	$-0.440^{+0.300}_{-0.300}$	$1.504^{+0.421}_{-0.463}$	$1.056^{+0.177}_{-0.133}$	$0.438^{+0.795}_{-0.185}$
	+3%/-4%	+7%/-4%	+68%/-68%	+28%/-31%	+17%/-13%	+182%/-42%
Source	PHO54	PHO54	PHO54	DSEP		

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

### Secondary Eclipse Parameters for KIC 010989345-08 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-175 \pm 17$	$11.67^{+11.72}_{-7.90}$	$625^{+47}_{-55}$	$3250^{+1547}_{-533}$	$249^{+2087}_{-186}$
Alt.	$-258 \pm 19$	$10.00^{+11.49}_{-6.84}$	$625^{+48}_{-56}$	$3671^{+2081}_{-764}$	$515^{+4520}_{-407}$

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



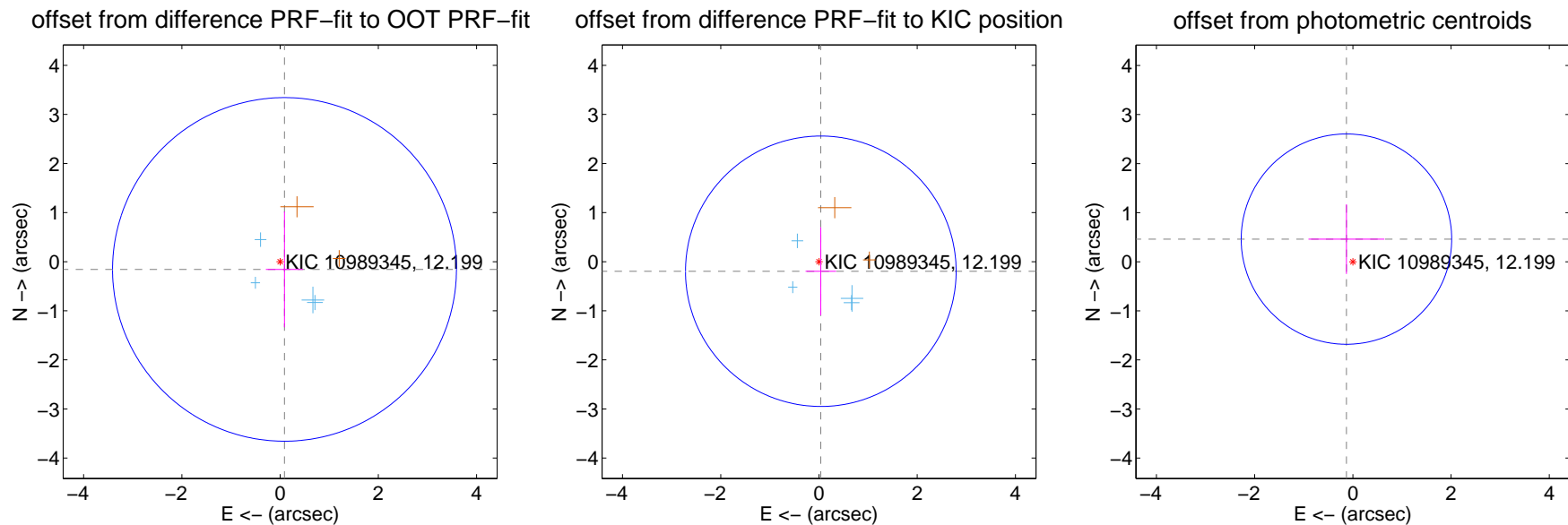
## DV Centroid Data

Supplemental centroid analysis for 010989345-08. Kepler magnitude: 12.20. Transit SNR 7.16

There are 4 quarters with good PRF difference image offsets

The direct PRF centroid is offset from the target star catalog position by about 0.03 arcsec

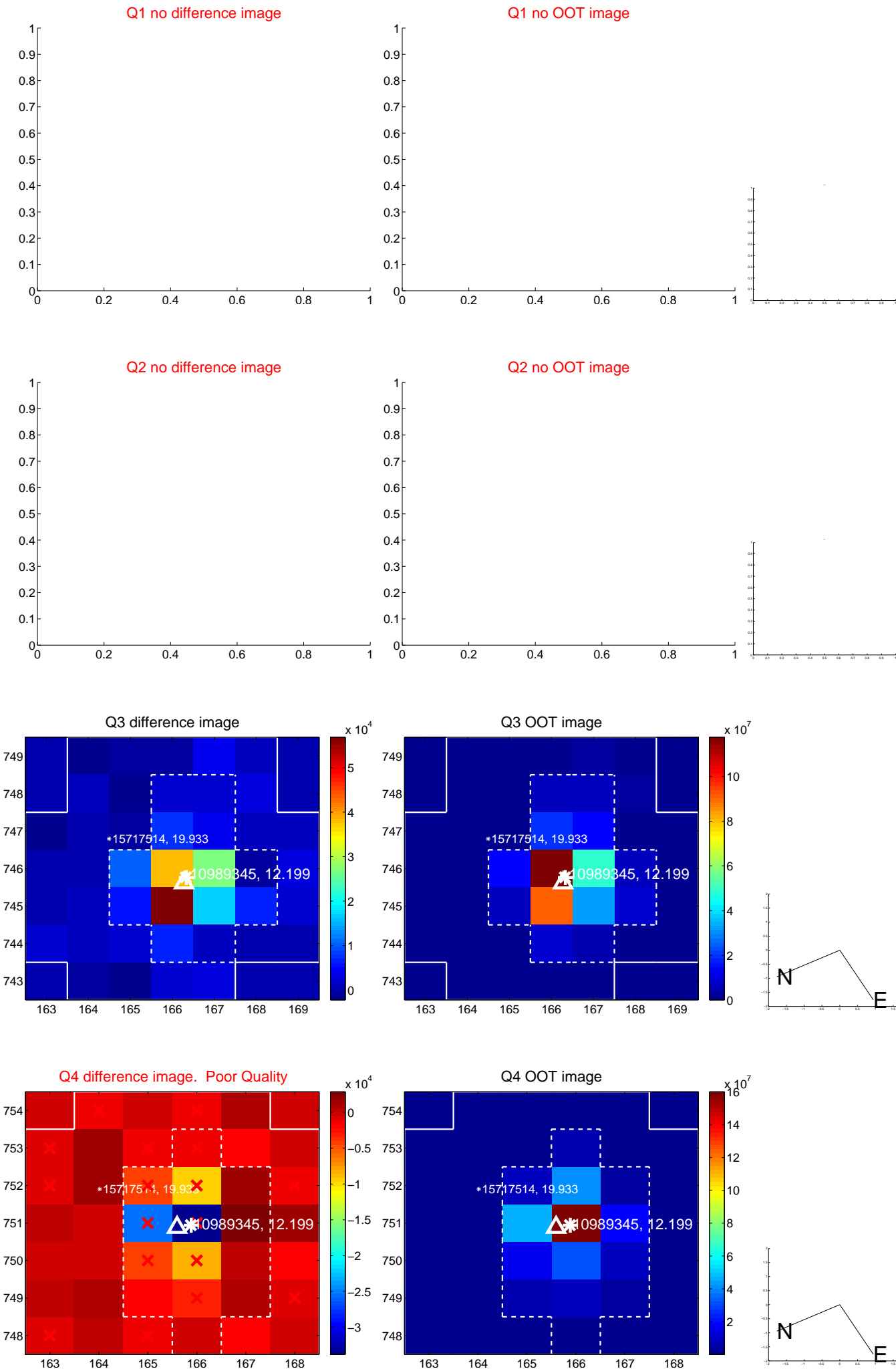
	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.181 \pm 1.167$	0.15	$-0.089 \pm 0.379$	$-0.157 \pm 1.177$
PRF-fit source offset from KIC position	$0.198 \pm 0.918$	0.22	$-0.037 \pm 0.310$	$-0.195 \pm 0.896$
photometric centroid source offset	$0.48 \pm 0.71$	0.67	$0.13 \pm 0.77$	$0.46 \pm 0.71$



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.

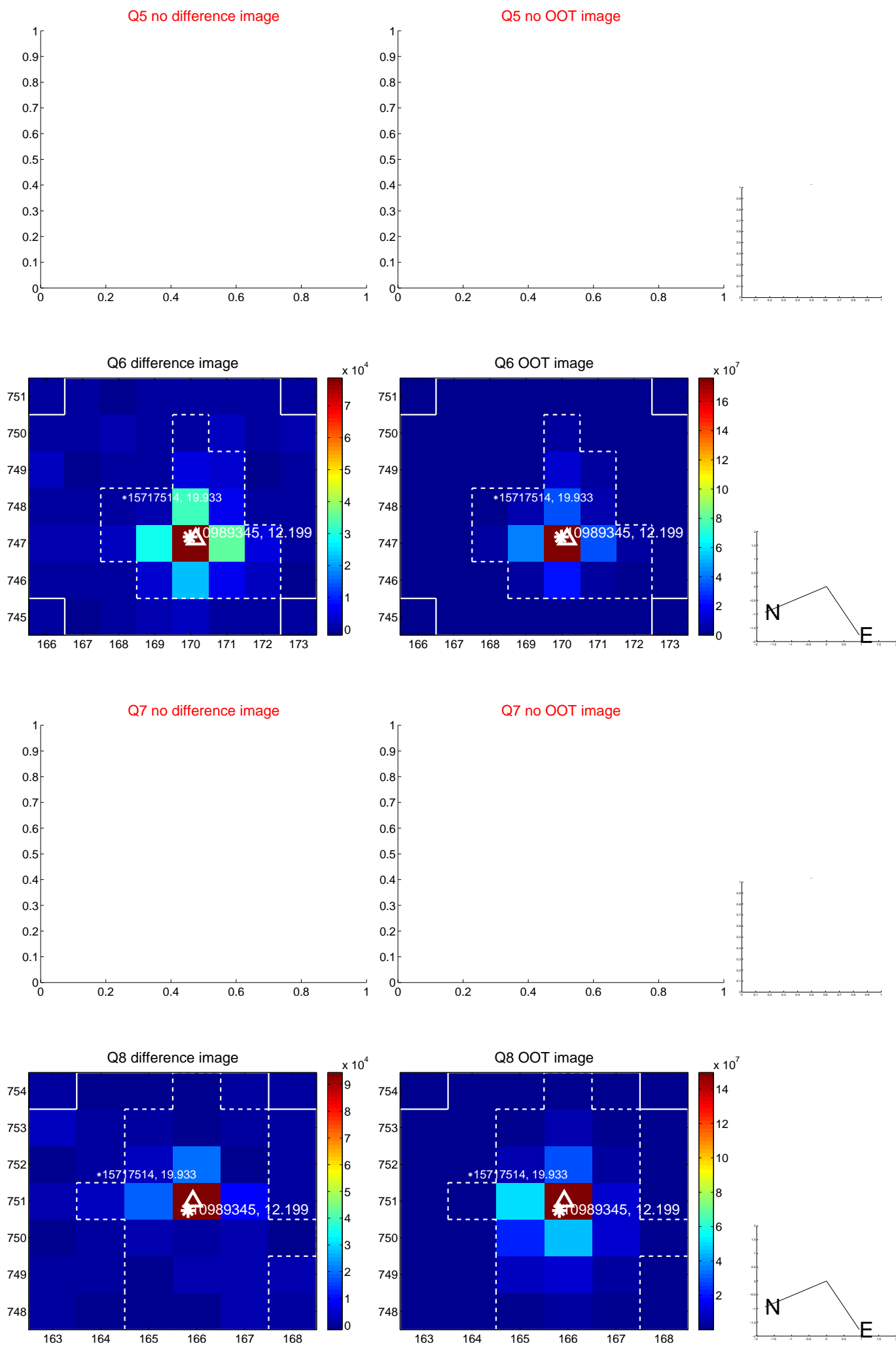


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



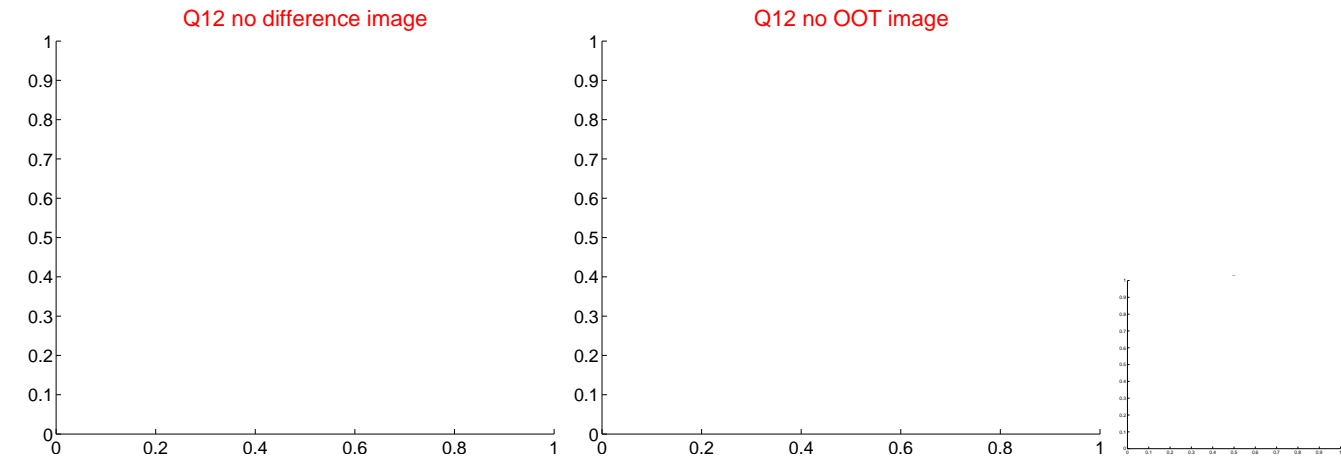
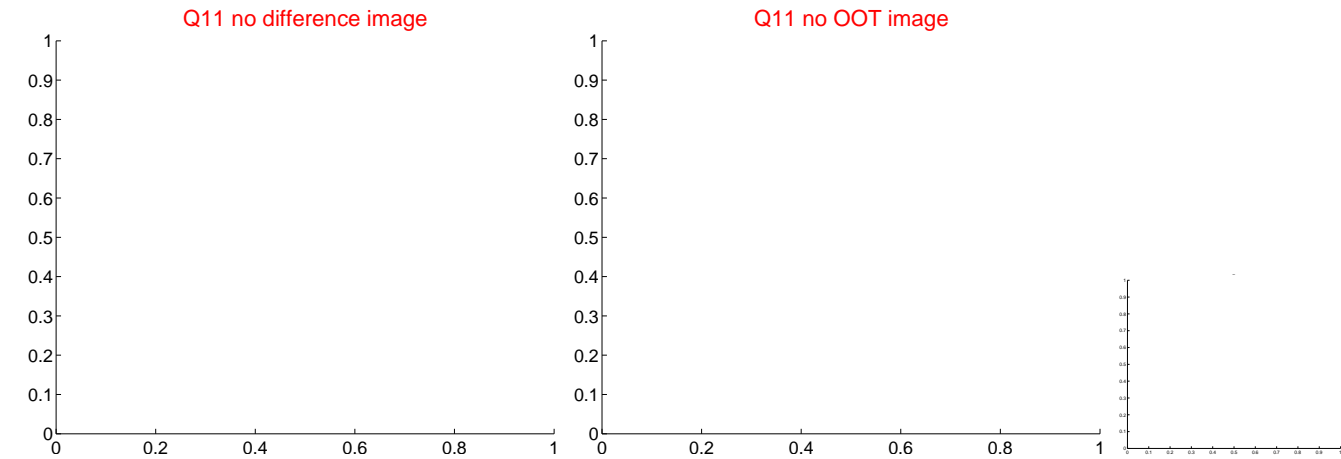
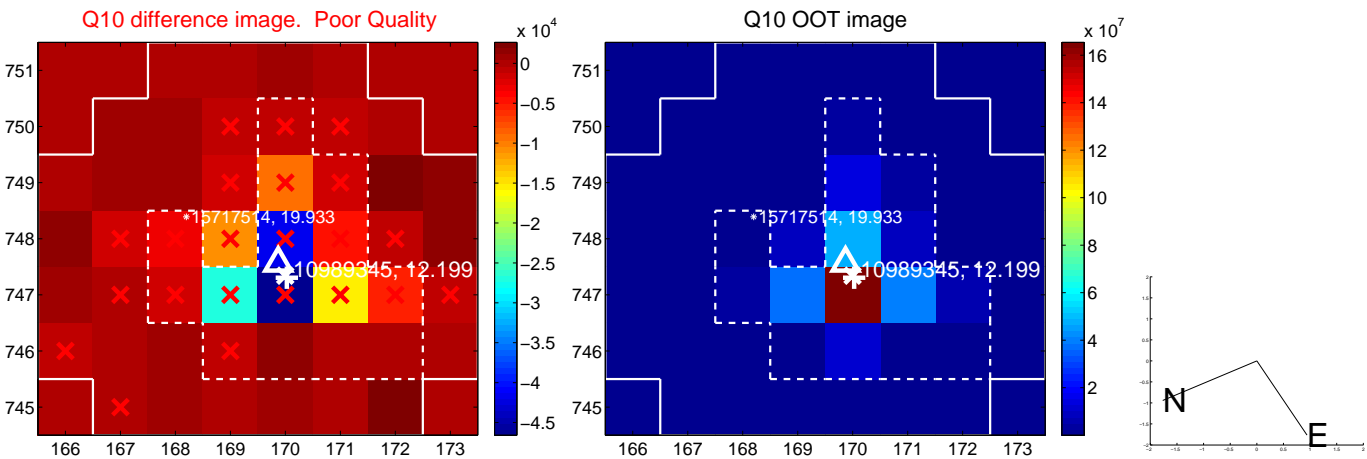
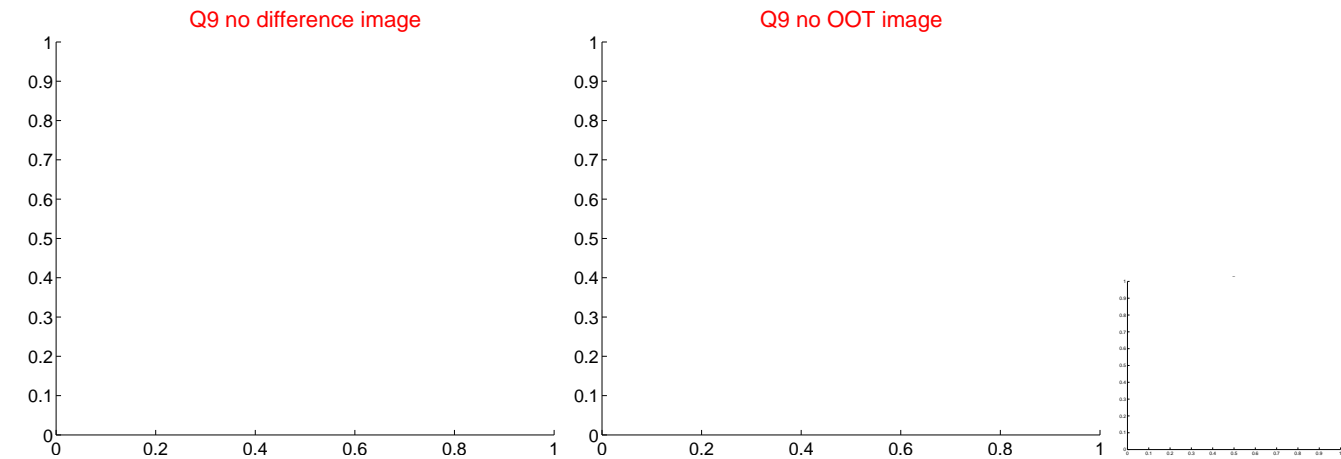


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value



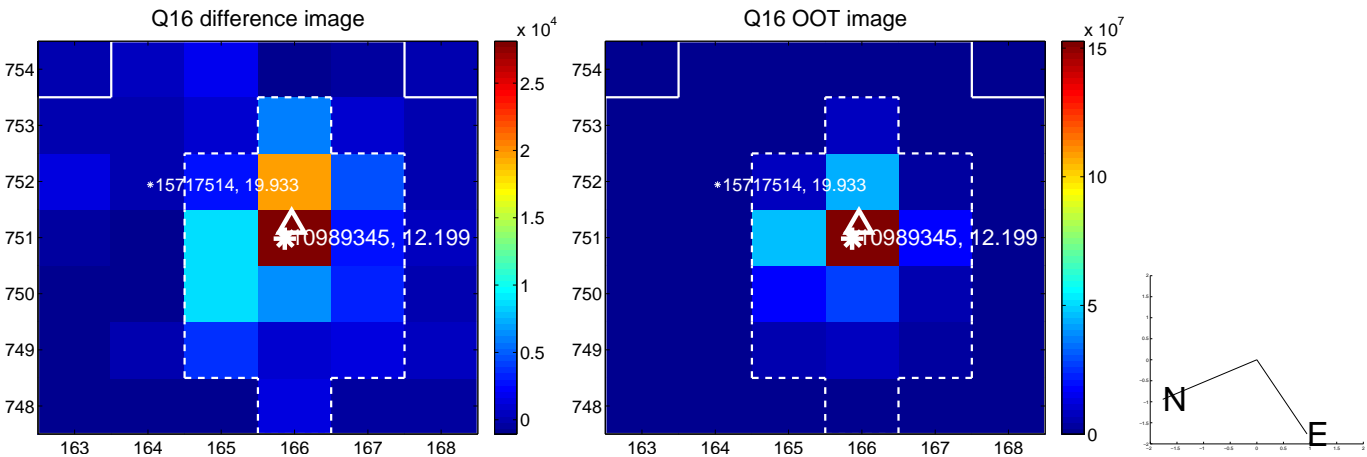
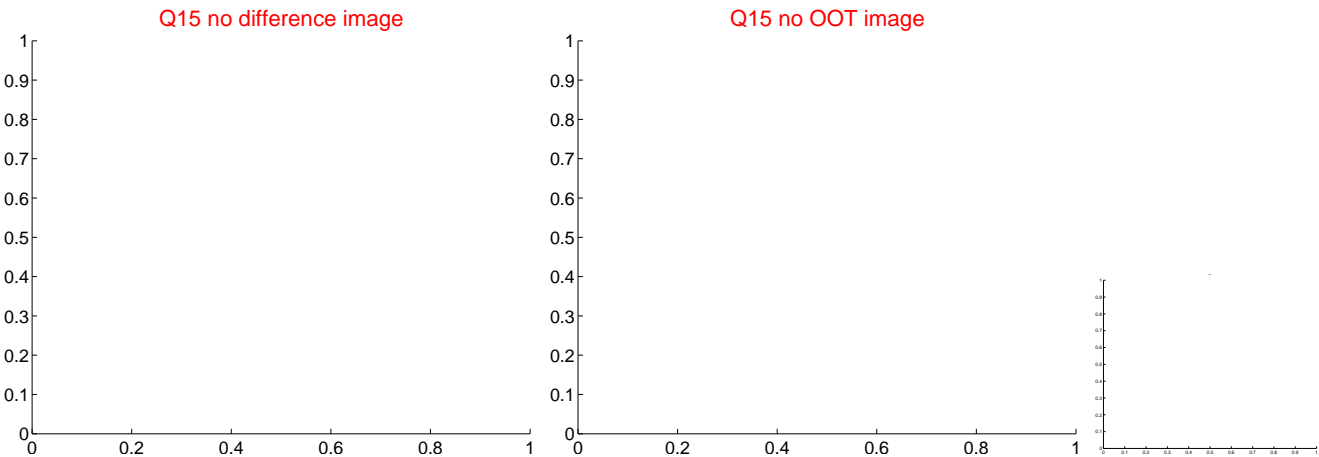
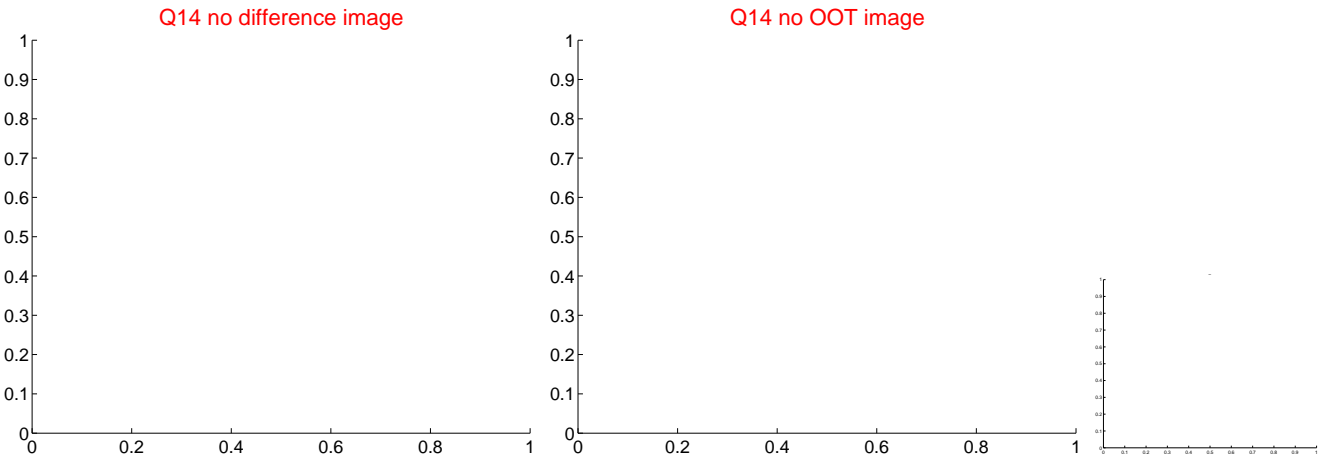
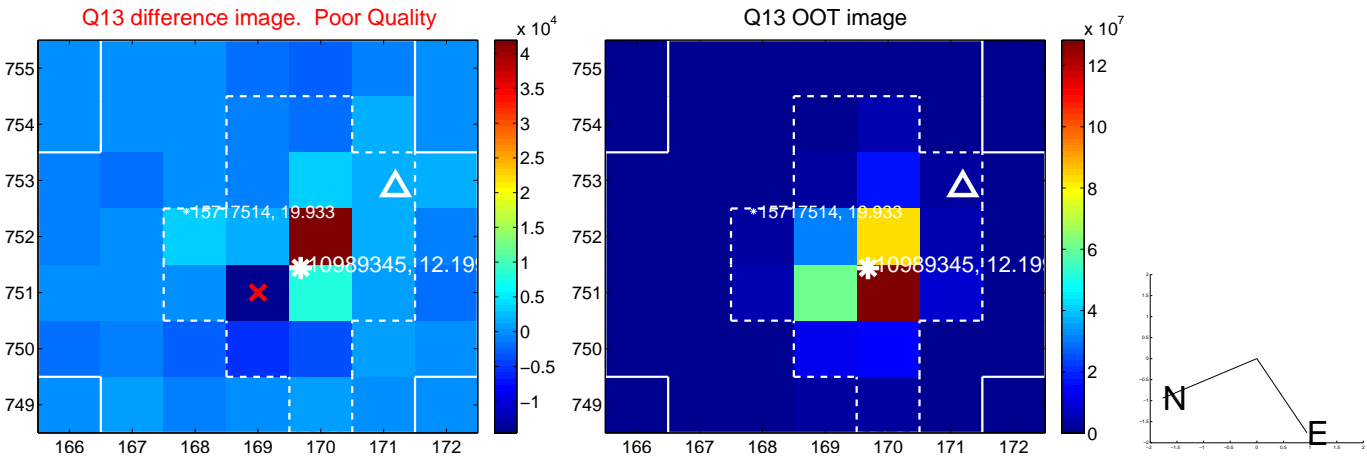


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



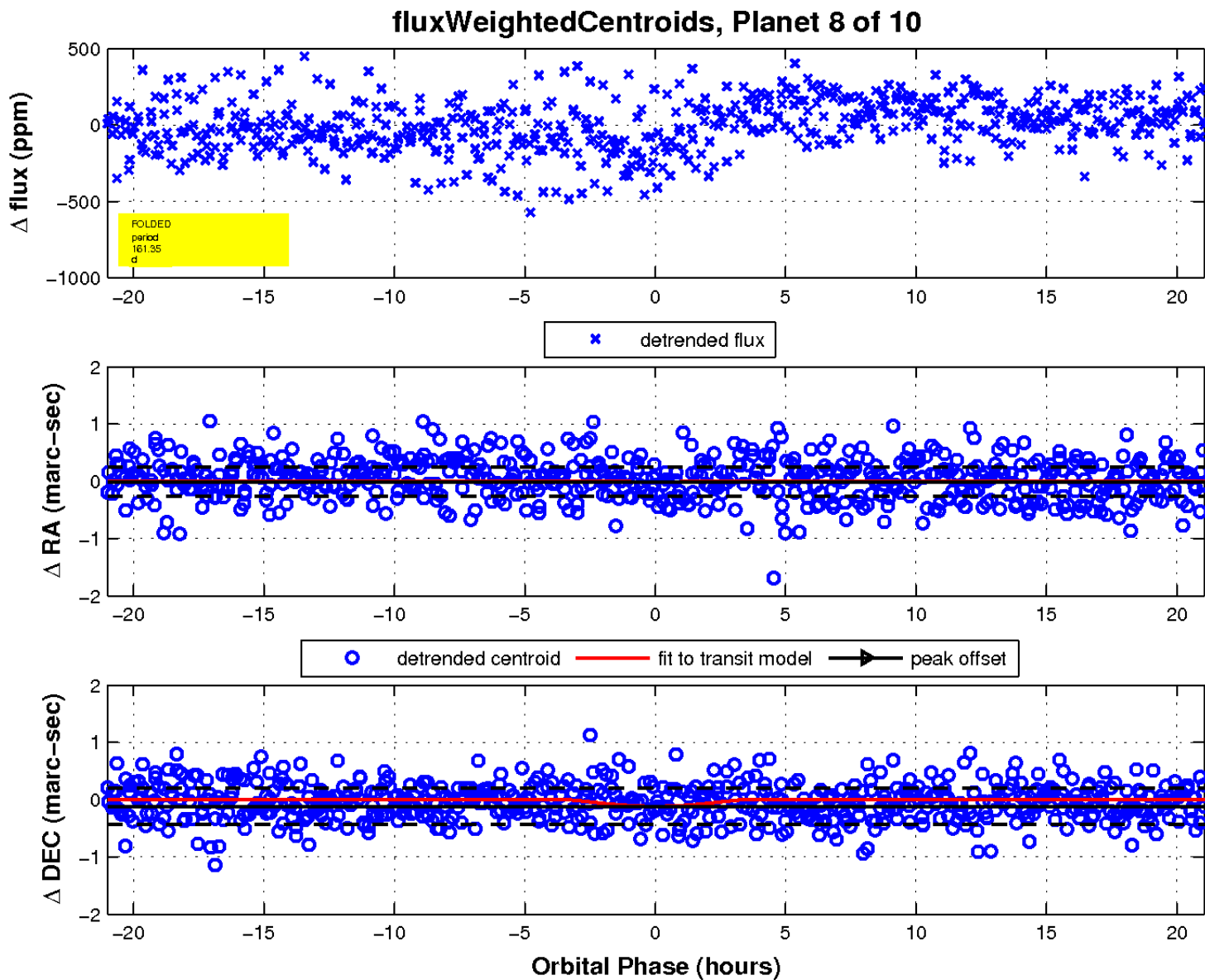
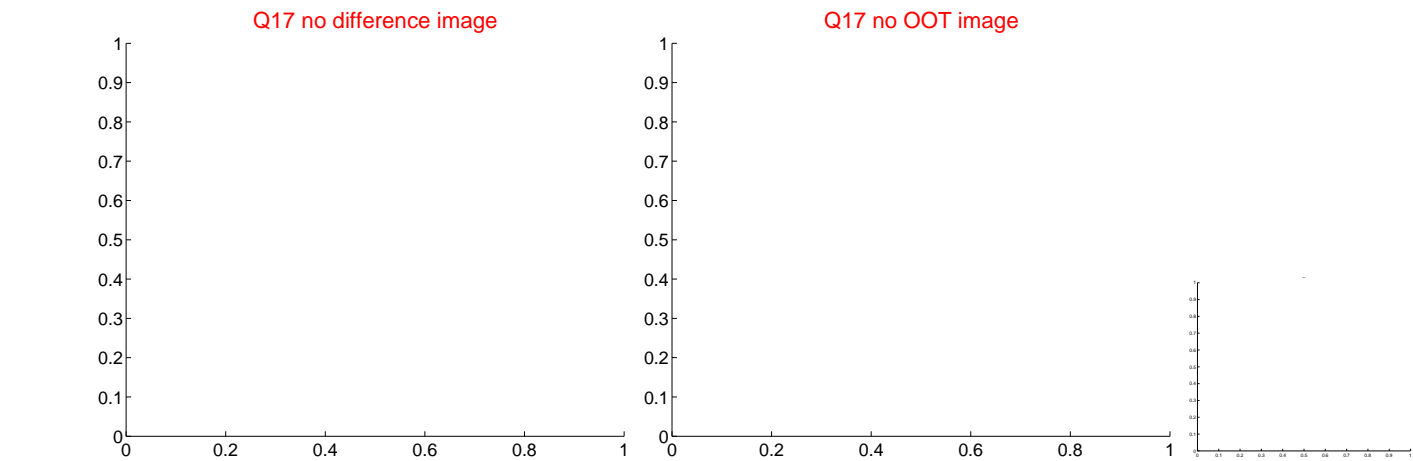


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





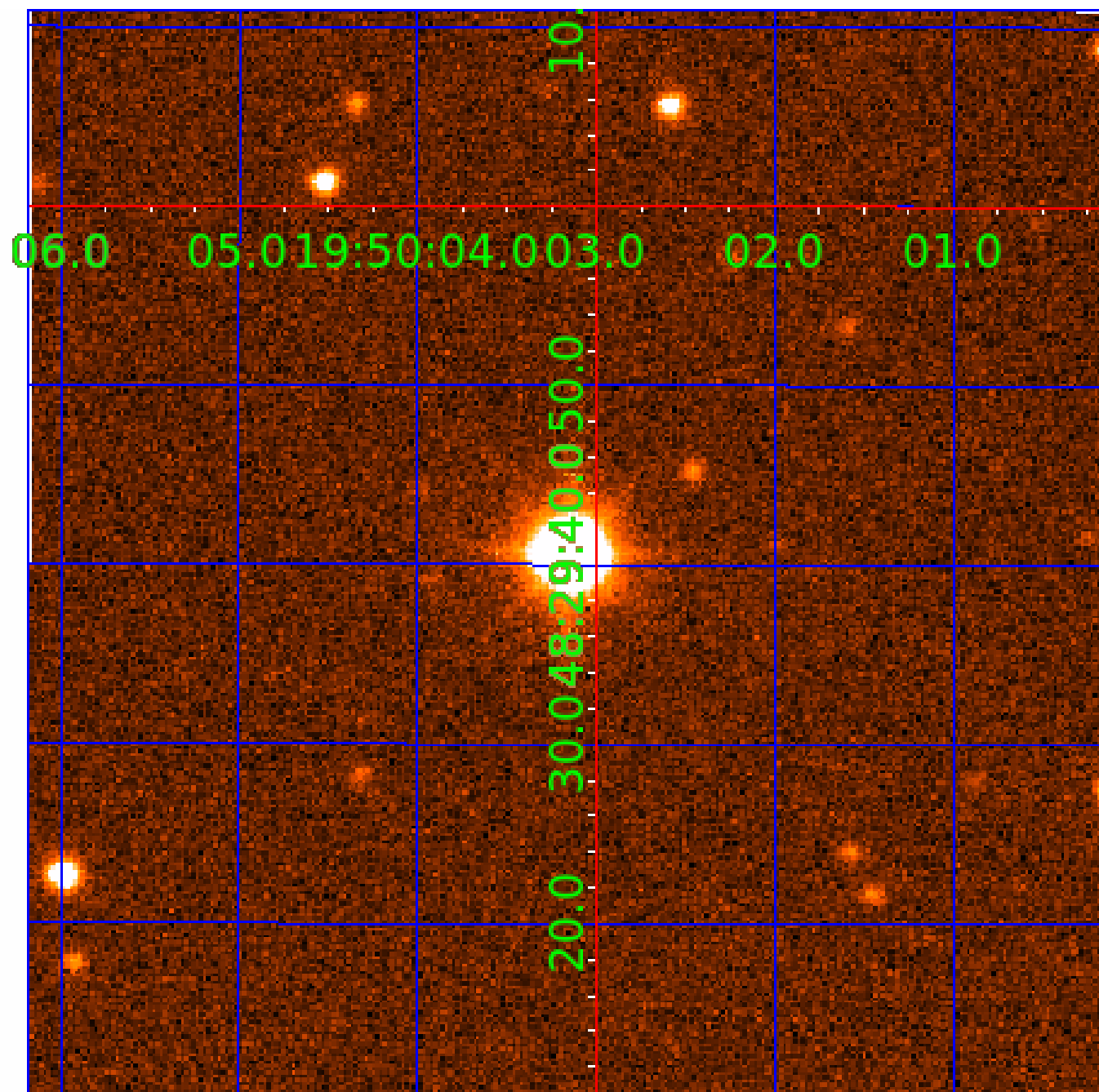
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UKIRT Image

Declination





# KIC 010989345

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010989345-04	OBS	No	423.567102	344.022902	722.4	35.026	7.8	7.8	1.50	6441	4.94	2.76
010989345-05	OBS	No	128.115026	240.564541	252.7	10.241	7.8	8.2	1.50	6441	2.77	13.57
010989345-07	OBS	No	66.433669	191.136166	129.6	13.221	7.4	5.2	1.50	6441	1.83	32.59
010989345-08	OBS	No	161.346431	265.595466	238.5	7.037	7.2	7.2	1.50	6441	4.56	9.98
010989345-09	OBS	No	276.296890	275.873517	375.6	30.069	7.9	7.5	1.50	6441	3.49	4.87
010989345-10	OBS	No	196.452793	165.569777	243.6	5.231	7.4	8.1	1.50	6441	3.04	7.68

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
010989345-01	OBS	FP	0.00	1	0	0	0	SWEET_NTL—LPP_DV—MOD_NONUNIQ_DV
010989345-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES—ALL_TRANS_CHASES—MOD_NONUNIQ_DV
010989345-03	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—HALO_GHOST
010989345-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
010989345-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—MOD_NONUNIQ_DV
010989345-07	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT
010989345-08	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT
010989345-09	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—CENT_FEW_DIFFS
010989345-10	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT

**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.

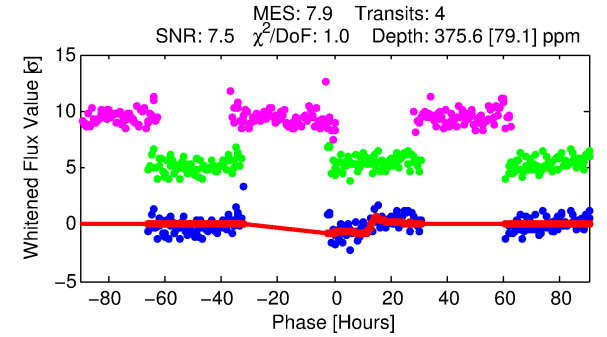
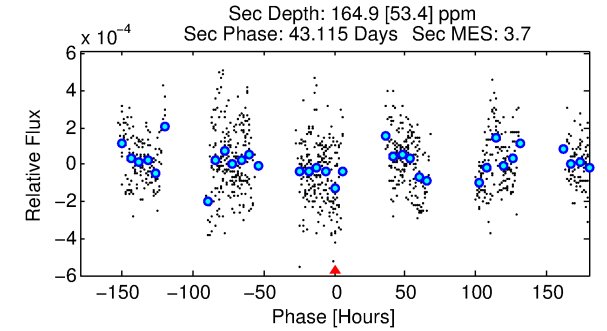
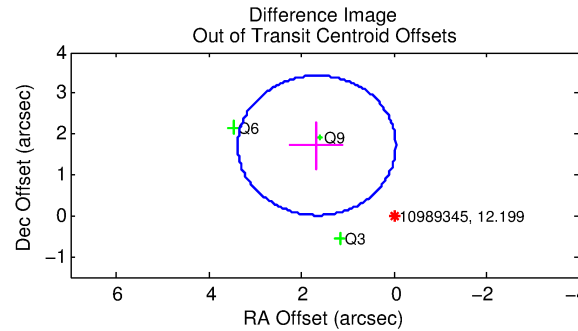
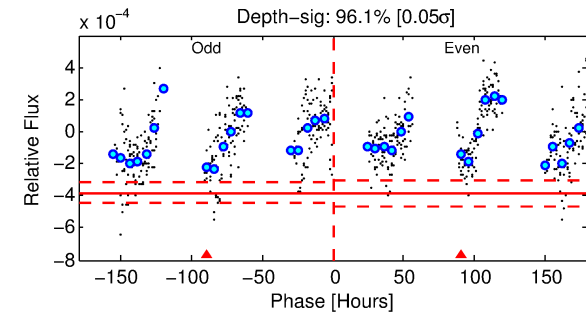
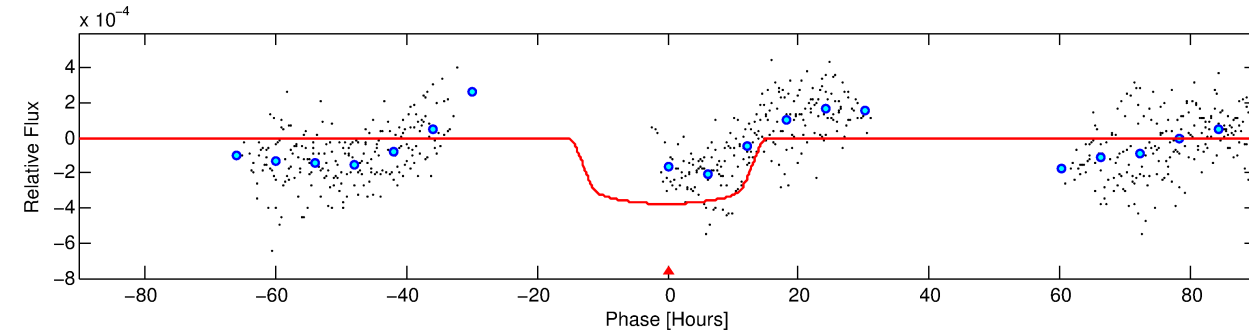
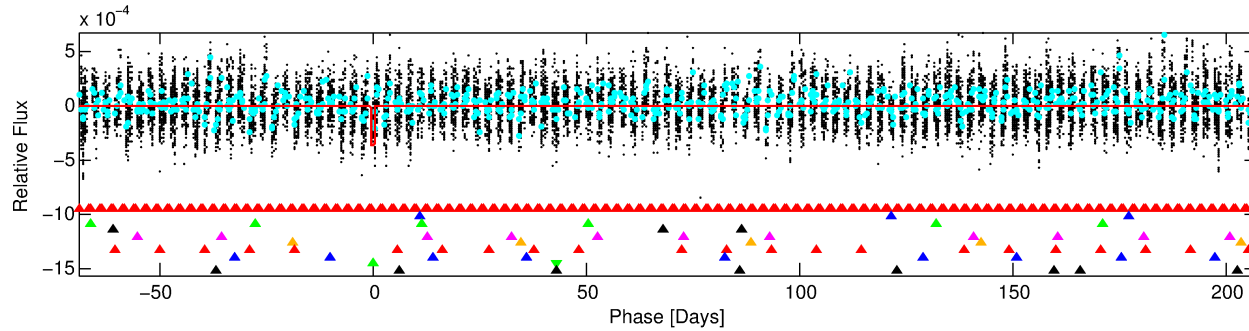
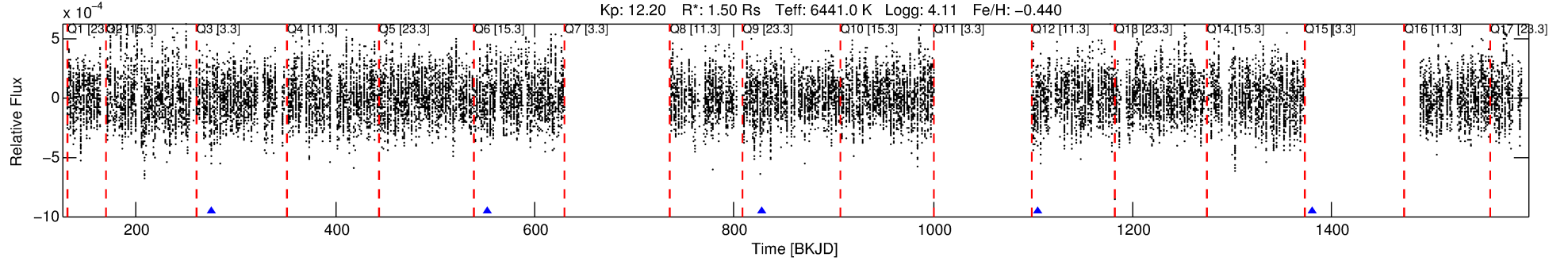
Ephemeris Match Information For 010989345-09

No Significant Match Found



# DV One-Page Summary

KIC: 10989345 Candidate: 9 of 10 Period: 276.297 d



## DV Fit Results:

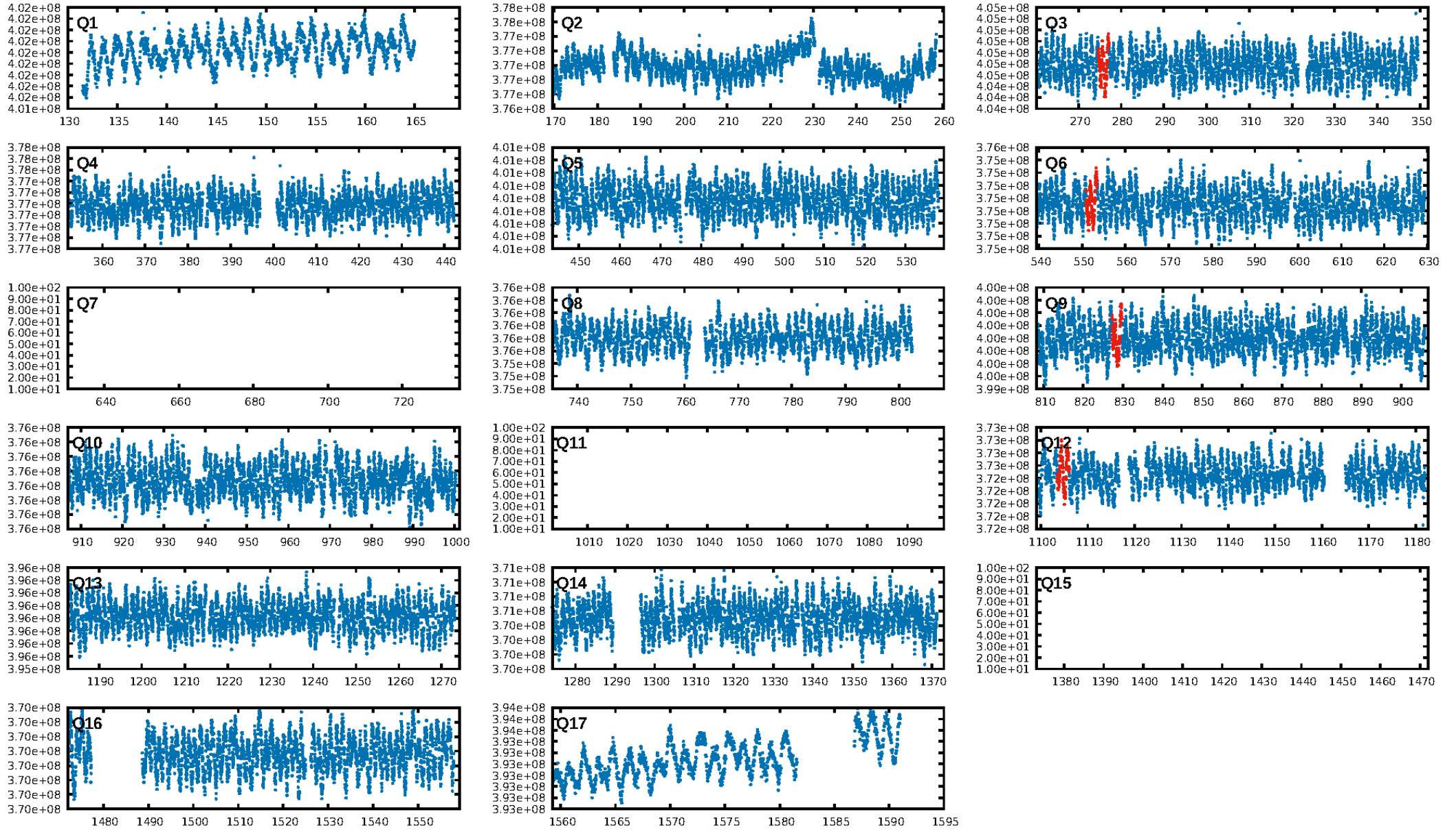
Period = 276.29689 [0.01747] d  
Epoch = 275.8735 [0.2323] BKJD  
Rp/R\* = 0.0213 [0.0022]  
a/R\* = 30.04 [10.69]  
b = 0.93 [0.03]  
Seff = 4.87 [2.46]  
Teff = 379 [48] K  
Rp = 3.49 [1.13] Re  
a = 0.8461 [0.2543] AU  
Ag = 5324.43 [3285.51] [1.62 $\sigma$ ]  
Teffp = 5003 [509] K [9.04 $\sigma$ ]

## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [28.07 $\sigma$ ]  
LongPeriod-sig: 100.0% [39.06 $\sigma$ ]  
ModelChiSquare2-sig: 43.9%  
ModelChiSquareGof-sig: 100.0%  
**Bootstrap-pfa: 9.18e-09**  
RollingBand-fgt: 1.00 [4/4]  
**GhostDiagnostic-chr: 1.602**  
**Centroid-sig: 0.0%**  
Centroid-so: 1.158 arcsec [2.97 $\sigma$ ]  
**OotOffset-rm: 2.396 arcsec [4.21 $\sigma$ ]**  
OotOffset-st: 1/1/0/1 [3]  
KicOffset-rm: 2.453 arcsec [2.59 $\sigma$ ]  
KicOffset-st: 1/1/0/1 [3]  
DiffImageQuality-fgm: 0.67 [2/3]  
DiffImageOverlap-fno: 0.00 [0/3]

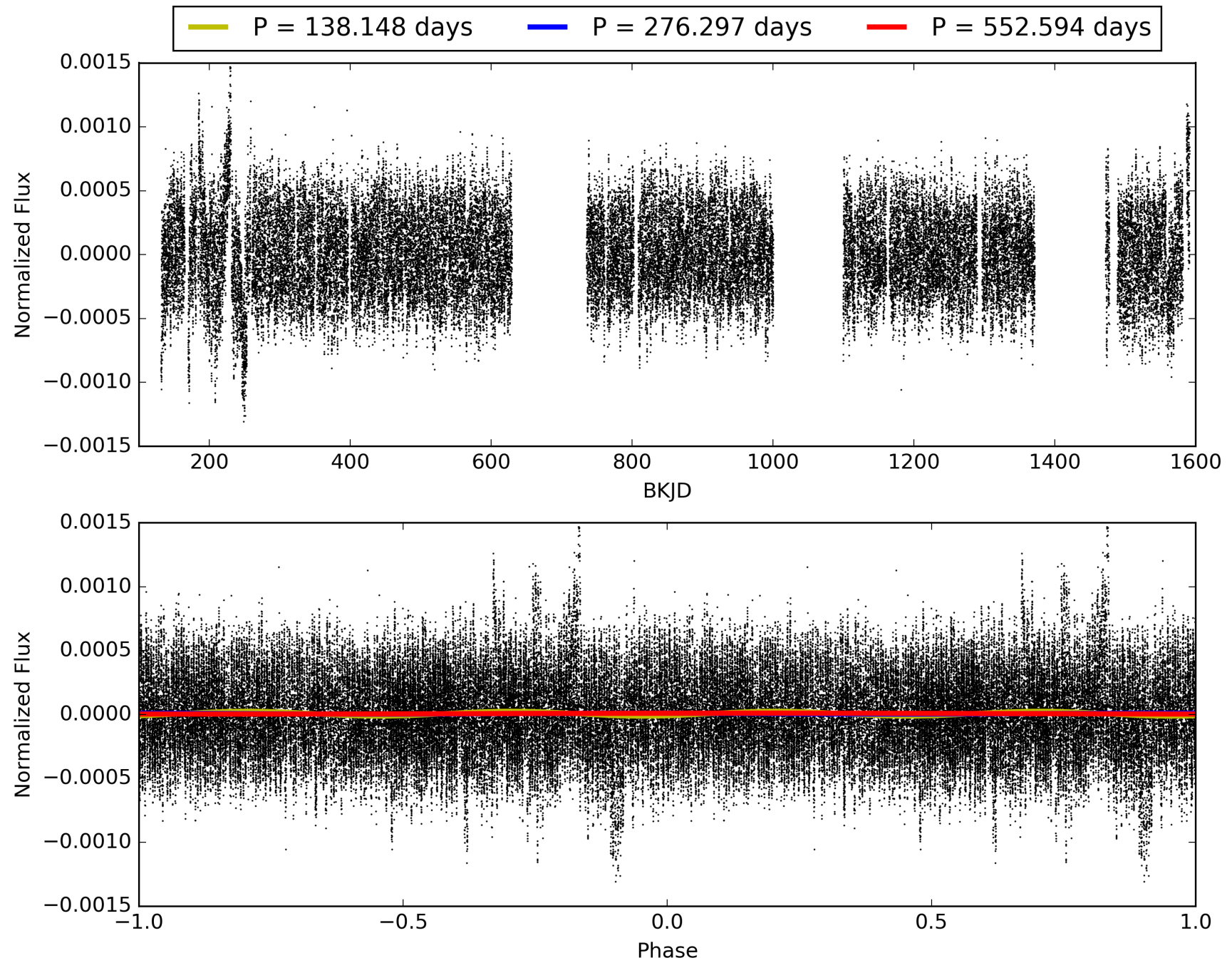


# TCE 010989345-09, PDC Light Curves





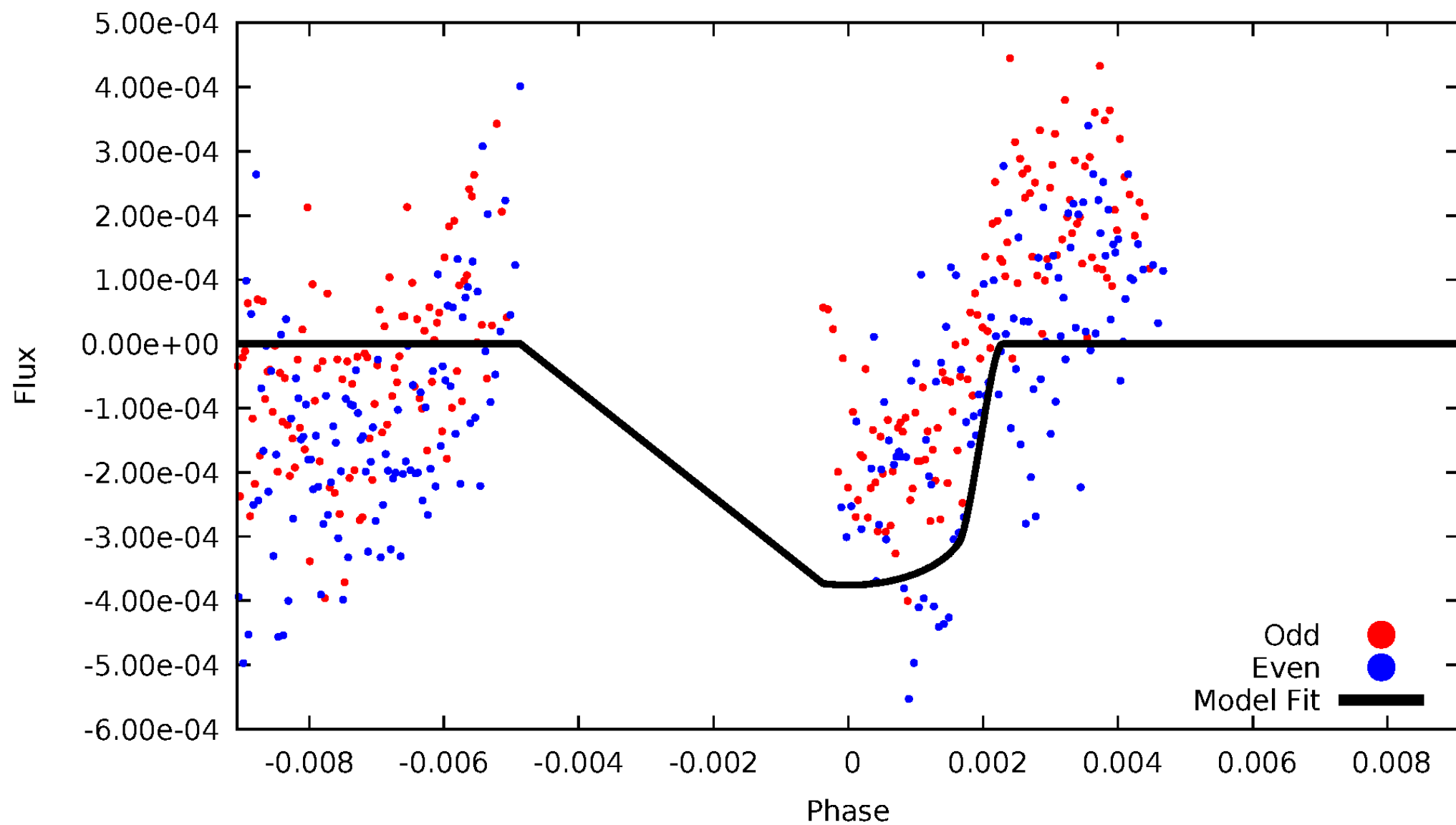
TCE 010989345-09





# DV Odd/Even

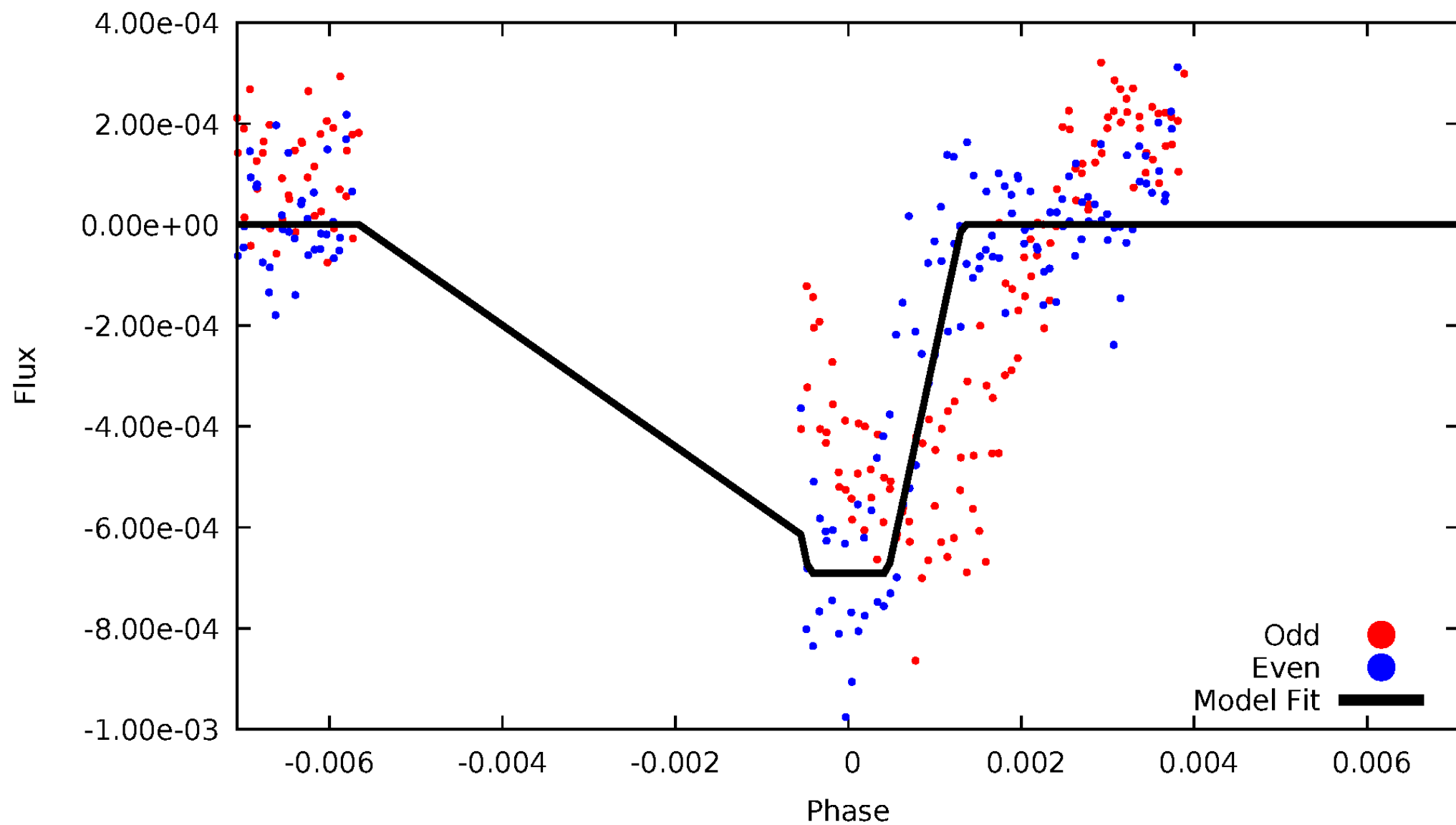
TCE 010989345-09





# ALT Odd/Even

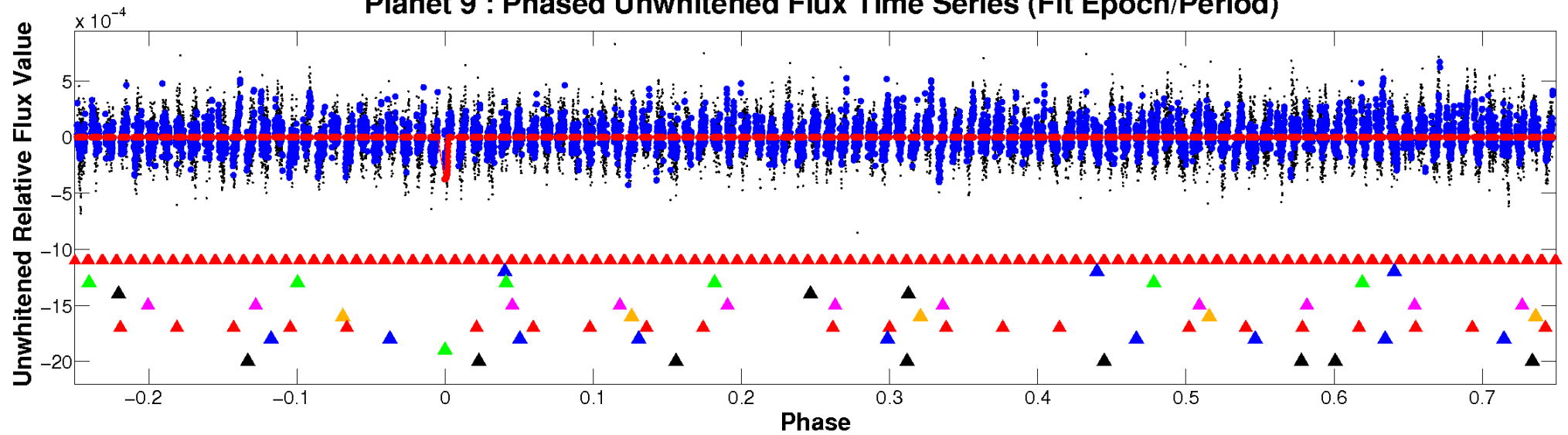
TCE 010989345-09



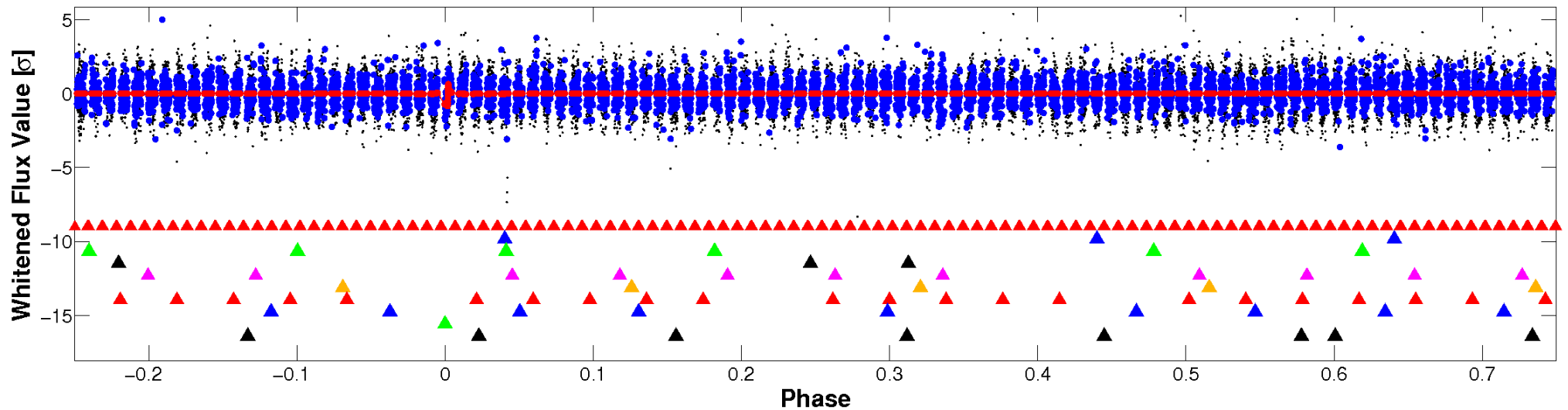


# Non-Whitened Vs. Whitened Light Curve

## Planet 9 : Phased Unwhitened Flux Time Series (Fit Epoch/Period)



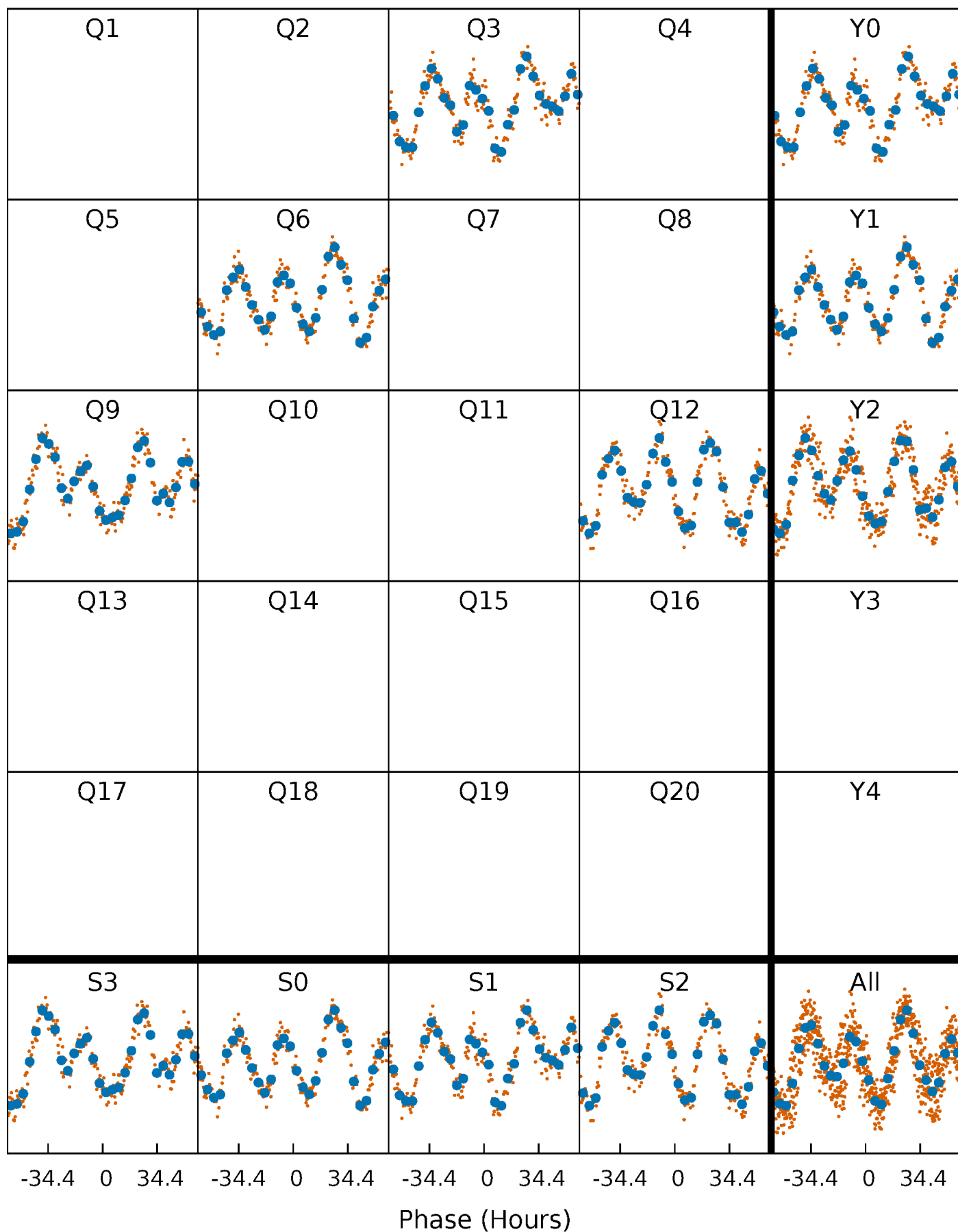
## Planet 9 : Phased Whitened Flux Time Series (Fit Epoch/Period)





# PDC Quarter-Phased Transit Curves

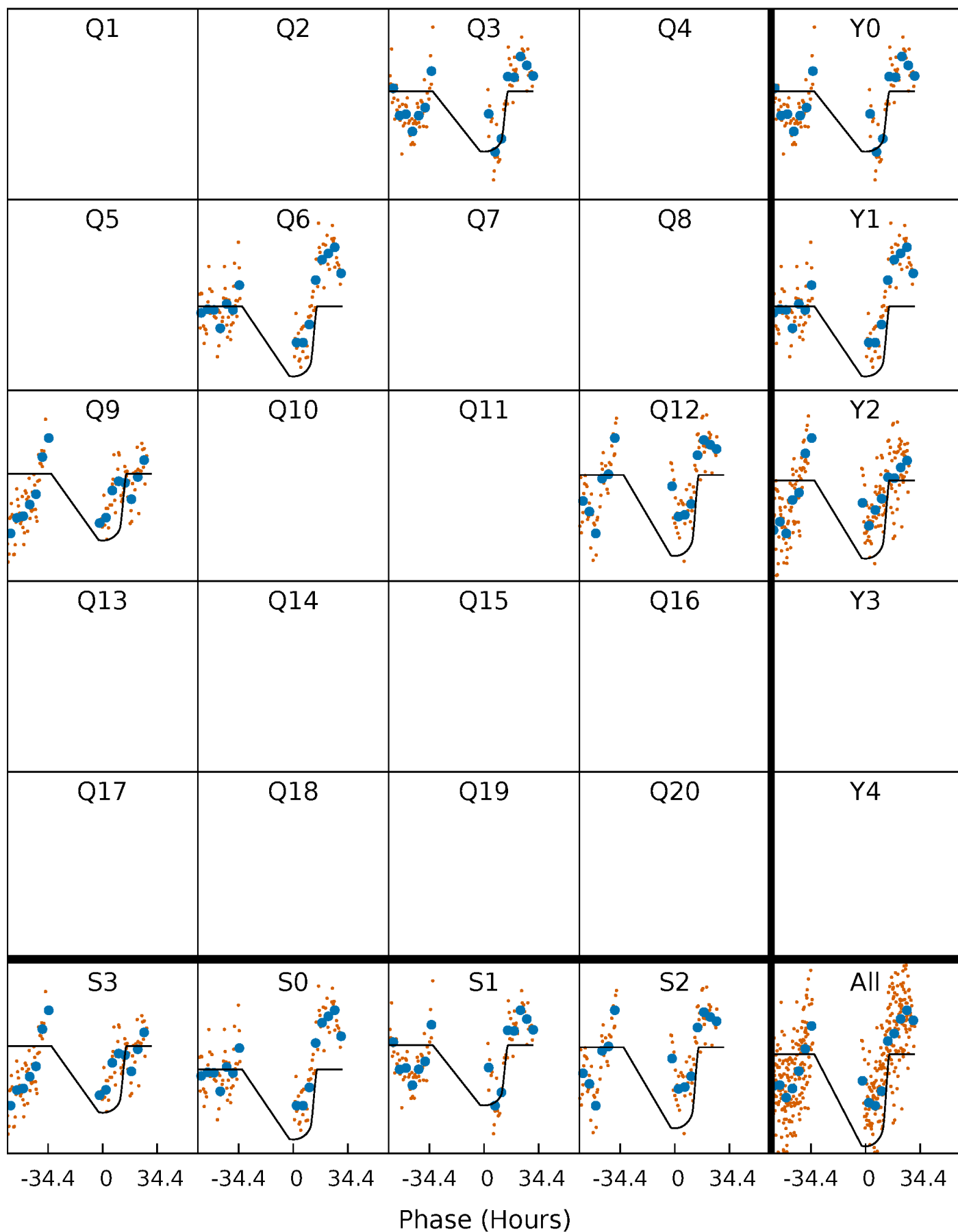
TCE 010989345-09     $P=276.296890$  Days     $T_0=275.873517$  (BKJD)





# DV Quarter-Phased Transit Curves

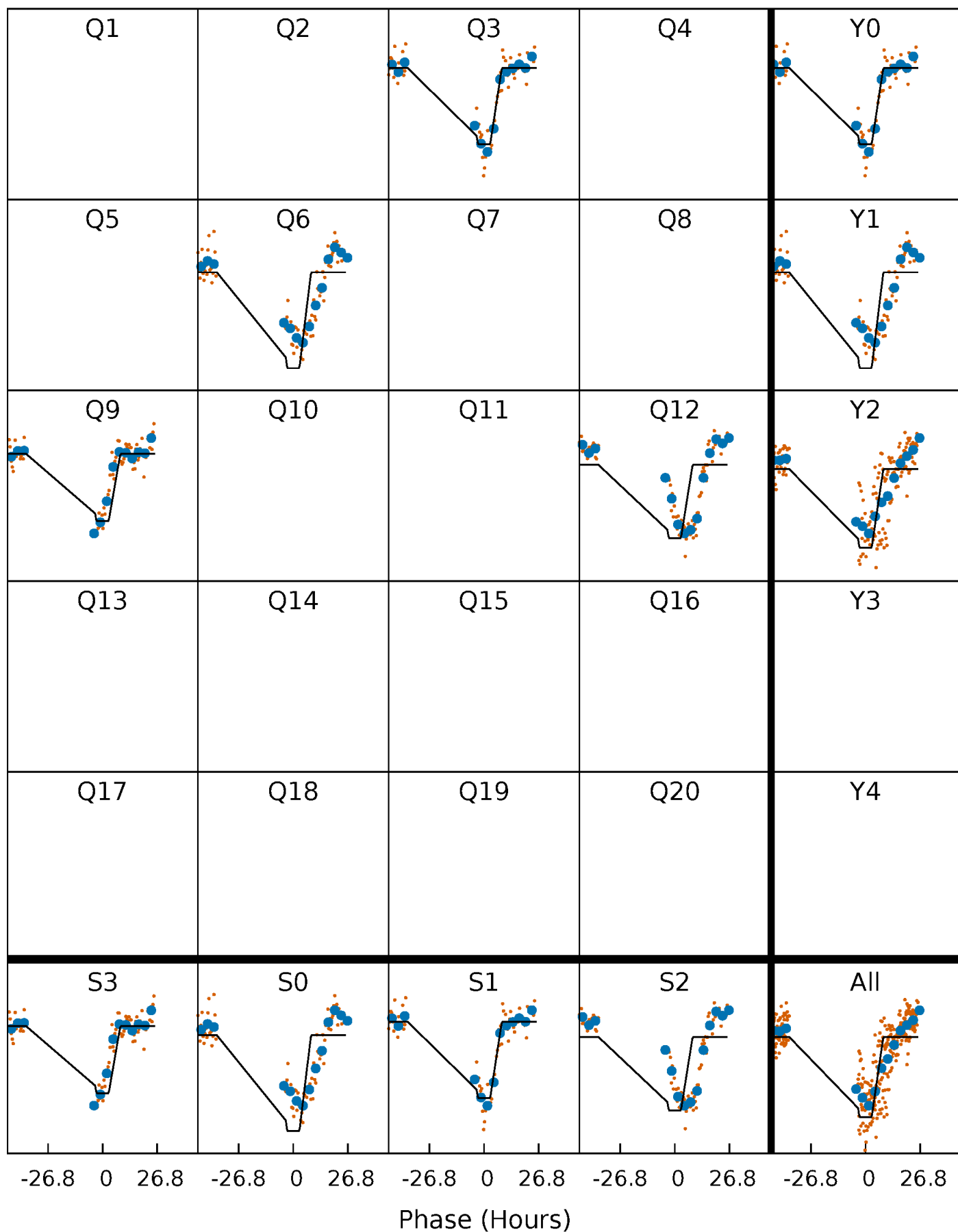
TCE 010989345-09     $P=276.296890$  Days     $T_0=275.873517$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

TCE 010989345-09     $P=276.220864$  Days     $T_0=276.130756$  (BKJD)

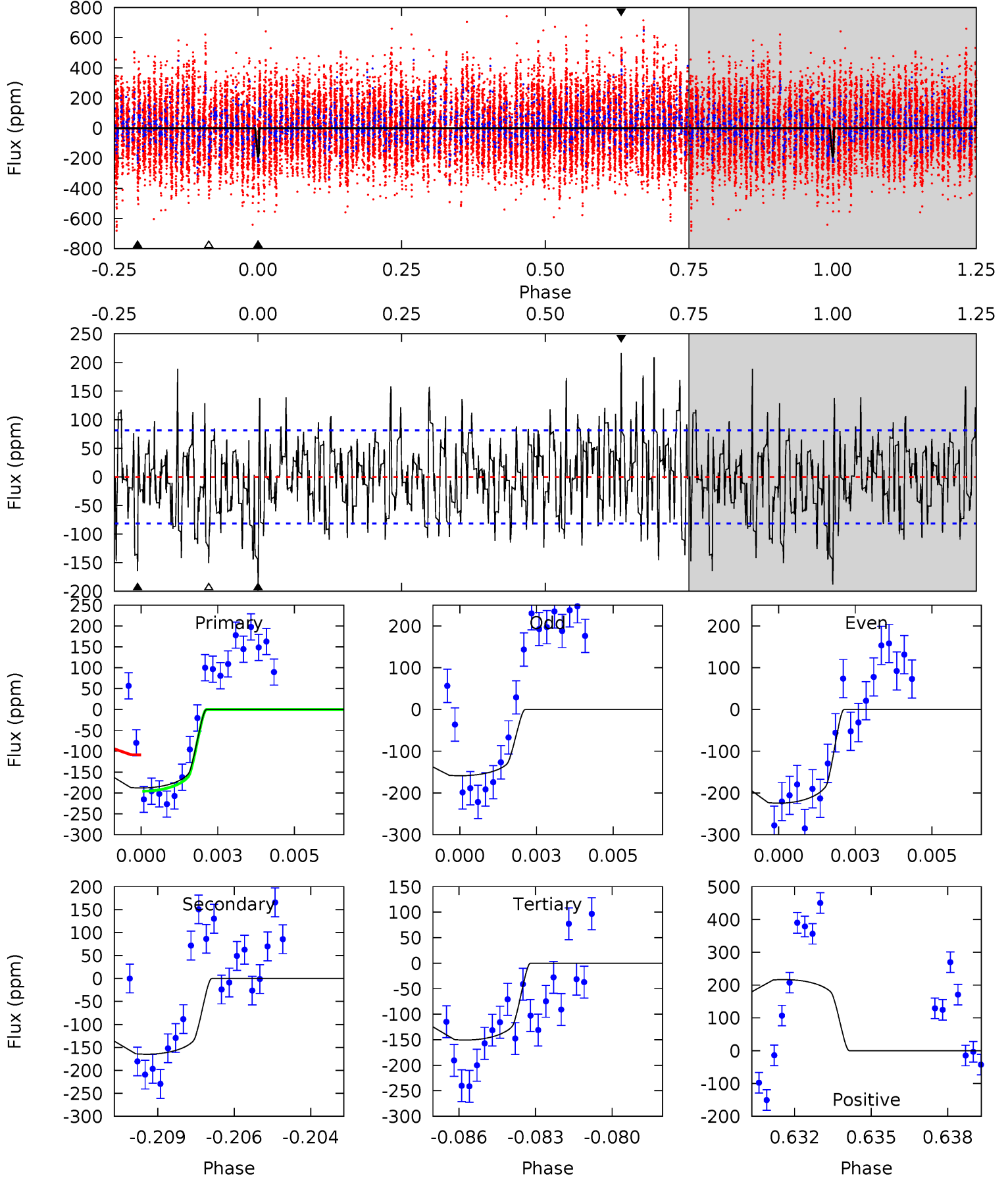




# DV Model-Shift Uniqueness Test

010989345-09, P = 276.296890 Days, E = 275.873517 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
12.2	10.7	9.77	14.1	5.27	3.00	3.72	2.42	-1.86	0.92	-3.36	2.13	1.24	0.54	1.28

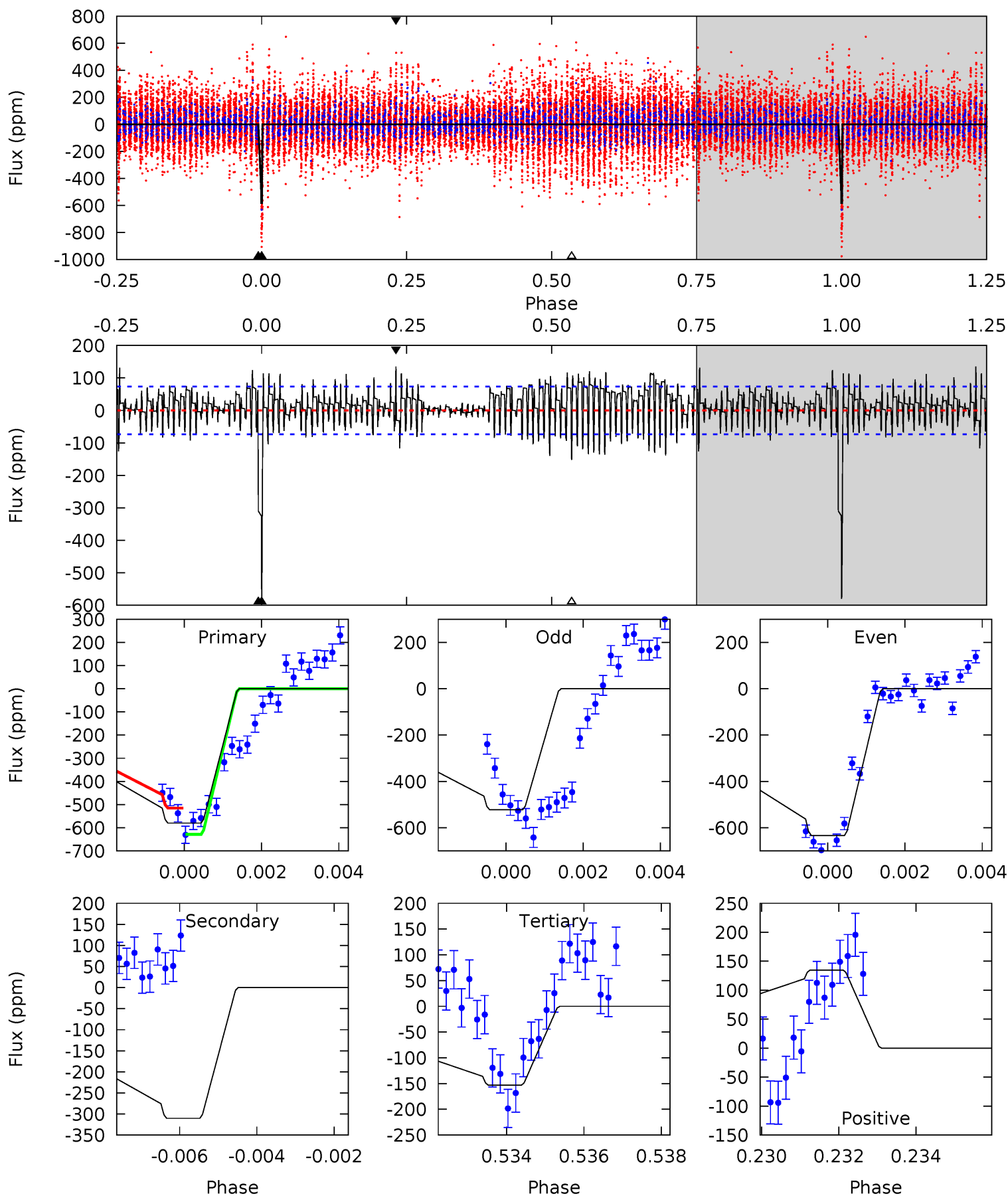




# Alt Model-Shift Uniqueness Test

010989345-09, P = 276.220864 Days, E = 276.130756 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
42.1	22.5	11.1	9.77	5.33	3.10	3.80	31.0	32.3	11.4	12.7	4.02	1.06	0.19	3.71





### Stellar Parameters For KIC 010989345

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6441^{+181}_{-227}$	$4.108^{+0.286}_{-0.154}$	$-0.440^{+0.300}_{-0.300}$	$1.504^{+0.421}_{-0.463}$	$1.056^{+0.177}_{-0.133}$	$0.438^{+0.795}_{-0.185}$
	+3%/-4%	+7%/-4%	+68%/-68%	+28%/-31%	+17%/-13%	+182%/-42%
Source	PHO54	PHO54	PHO54	DSEP		

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

### Secondary Eclipse Parameters for KIC 010989345-09 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-165 \pm 15$	$3.41^{+0.63}_{-0.65}$	$521^{+40}_{-46}$	$5060^{+307}_{-263}$	$5635^{+3035}_{-1611}$
Alt.	$-310 \pm 14$	$4.22^{+0.78}_{-0.69}$	$522^{+41}_{-45}$	$5299^{+252}_{-210}$	$6987^{+2783}_{-2023}$

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



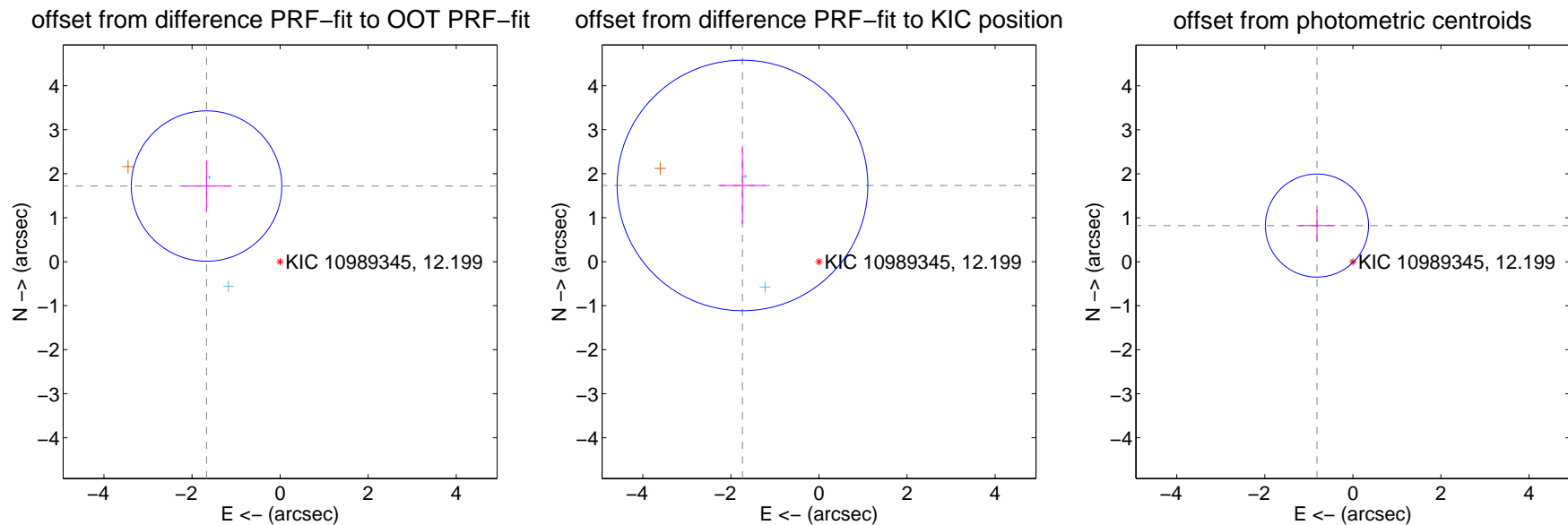
## DV Centroid Data

Supplemental centroid analysis for 010989345-09. Kepler magnitude: 12.20. Transit SNR 7.50

There are 2 quarters with good PRF difference image offsets

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

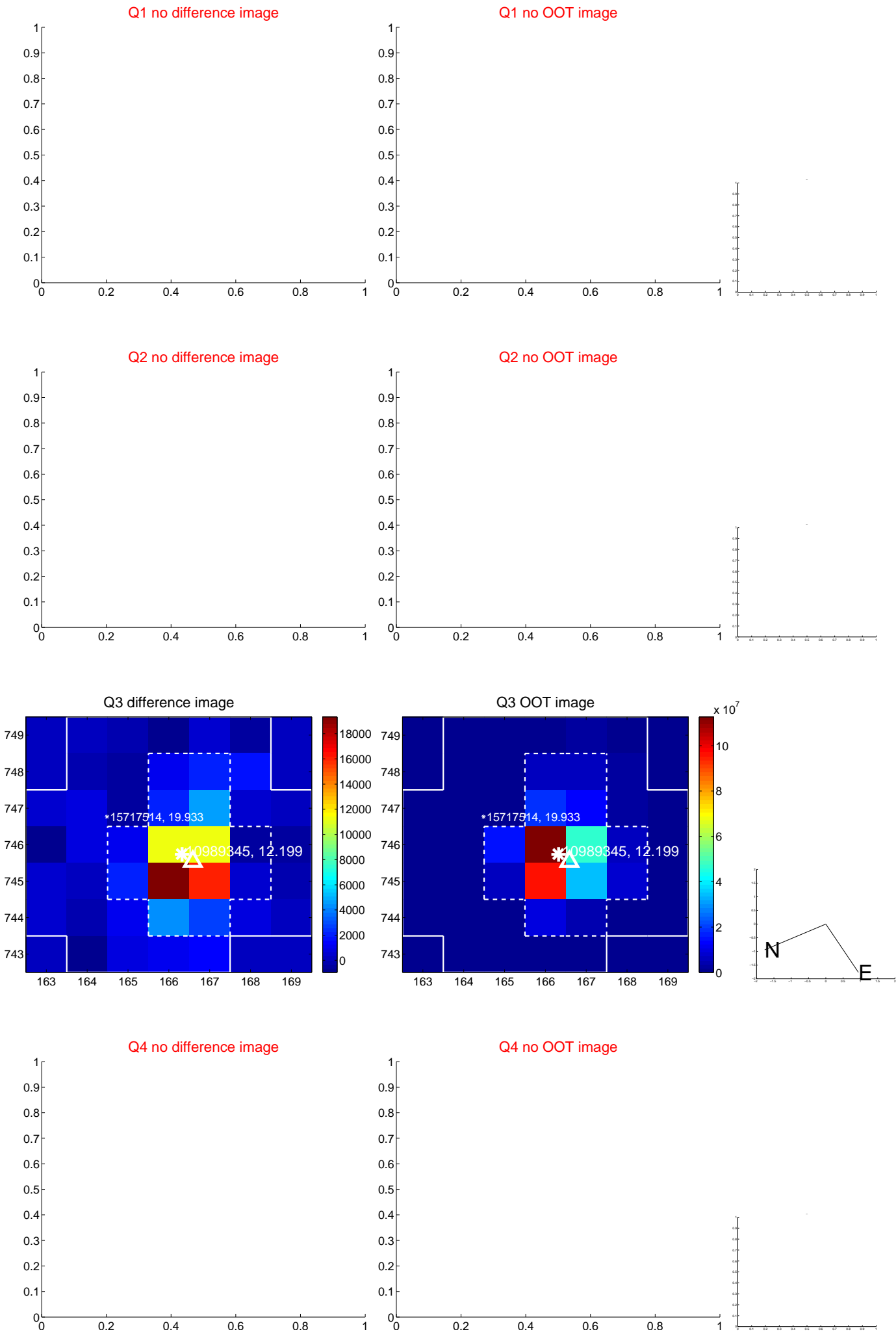
	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	2.396 $\pm$ 0.570	4.21	1.670 $\pm$ 0.563	1.719 $\pm$ 0.575
PRF-fit source offset from KIC position	2.453 $\pm$ 0.949	2.59	1.737 $\pm$ 0.514	1.732 $\pm$ 0.869
photometric centroid source offset	1.16 $\pm$ 0.39	2.97	0.82 $\pm$ 0.42	0.82 $\pm$ 0.36



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.

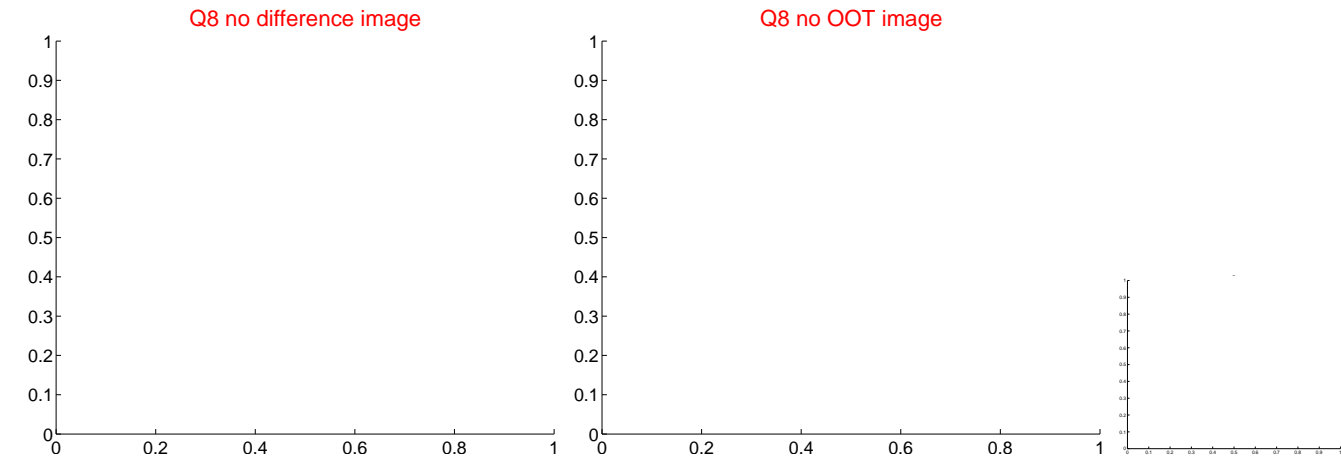
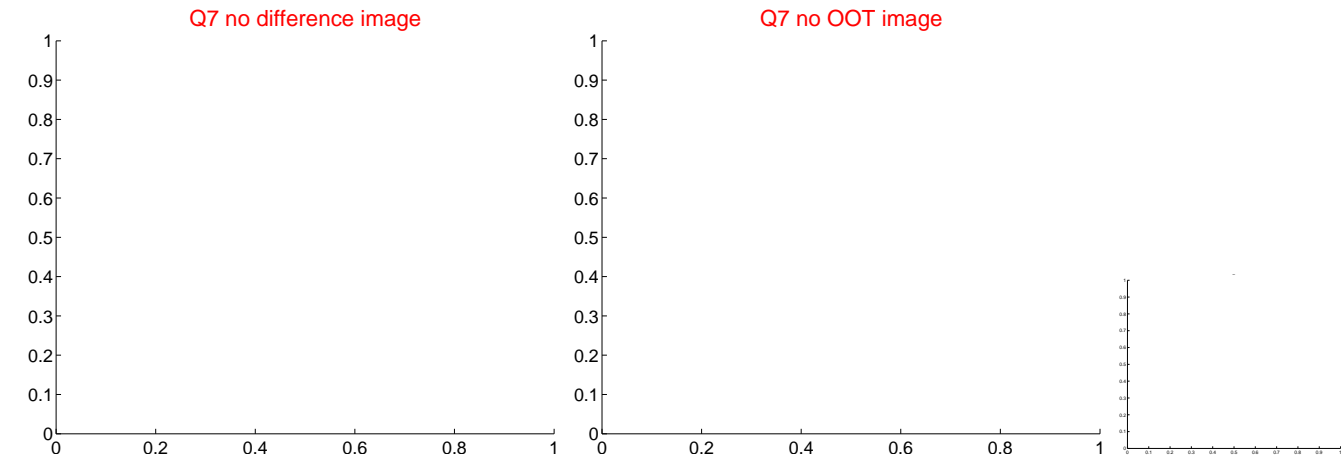
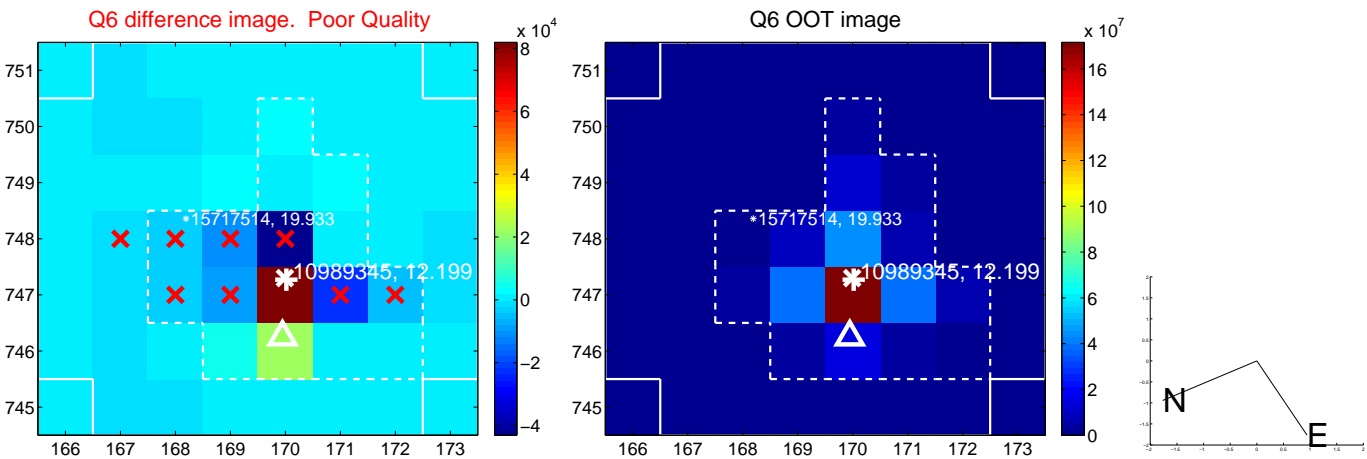
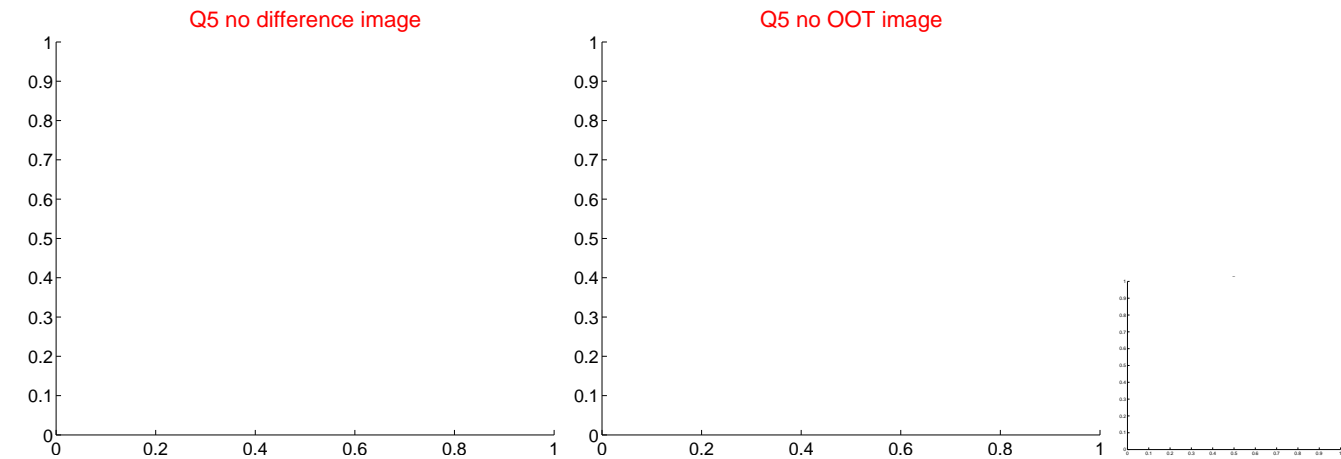


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



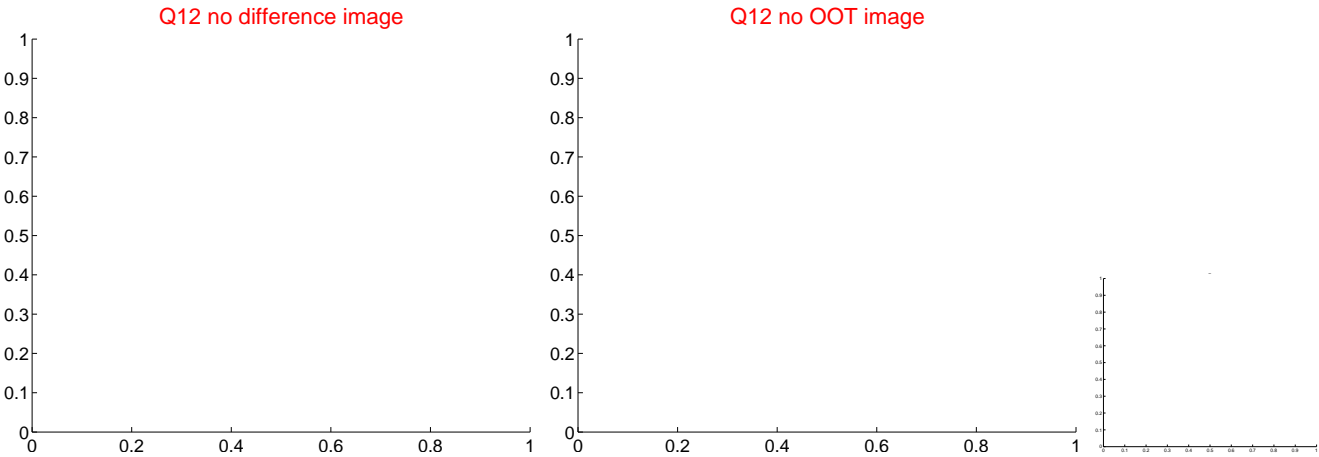
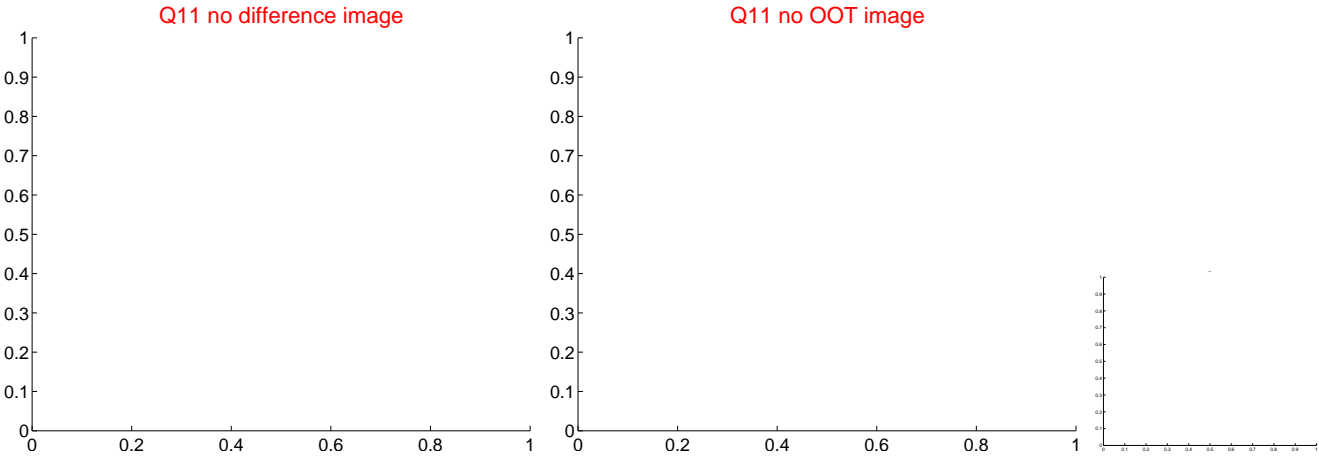
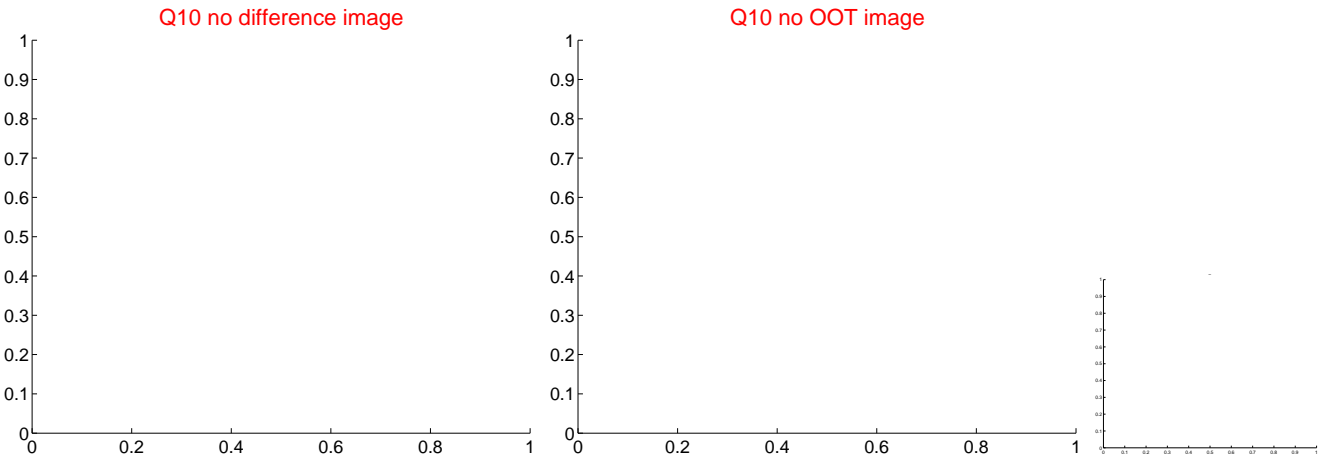
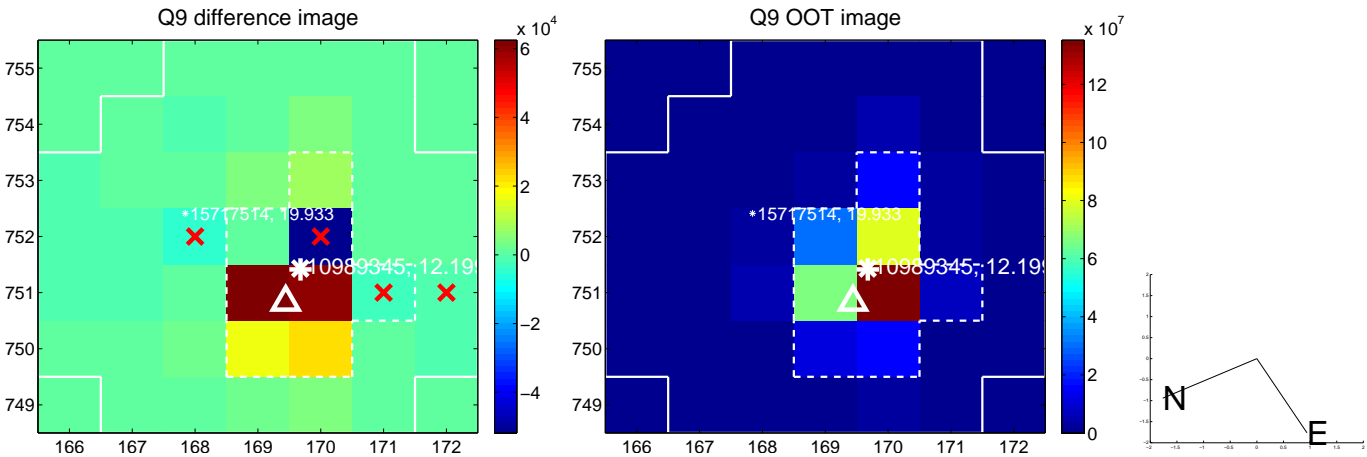


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



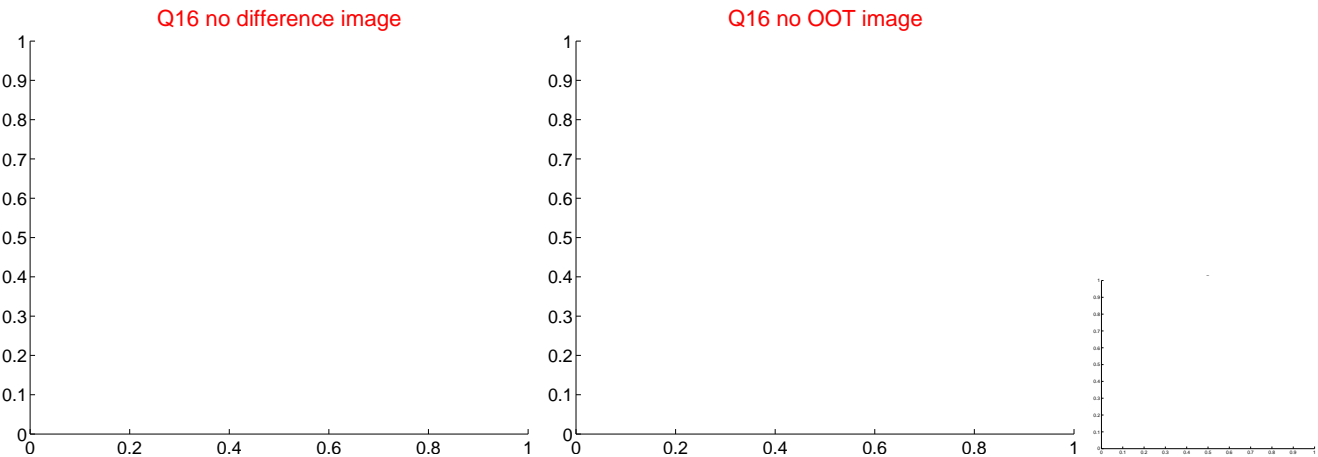
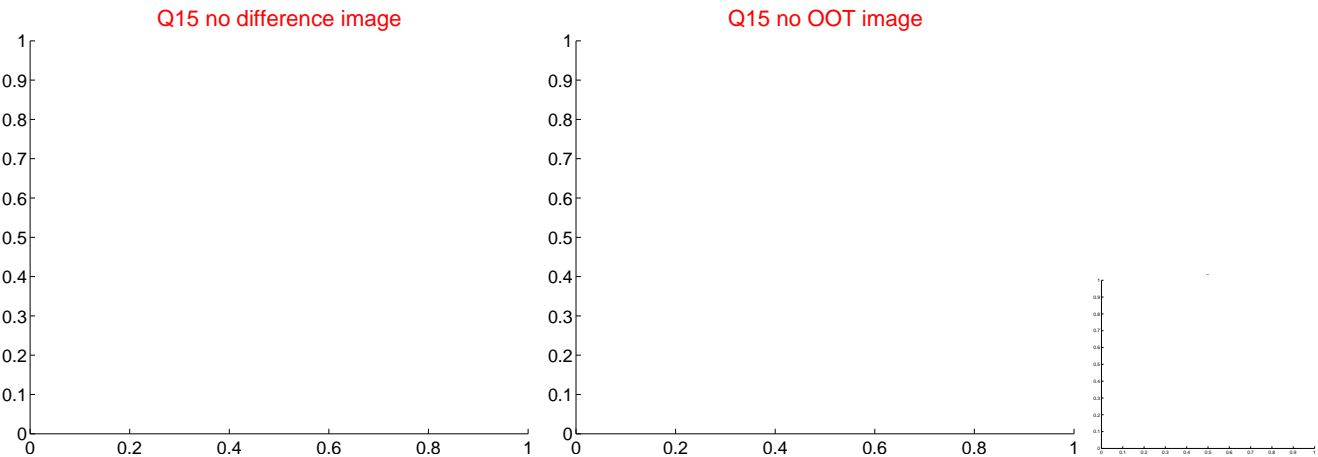
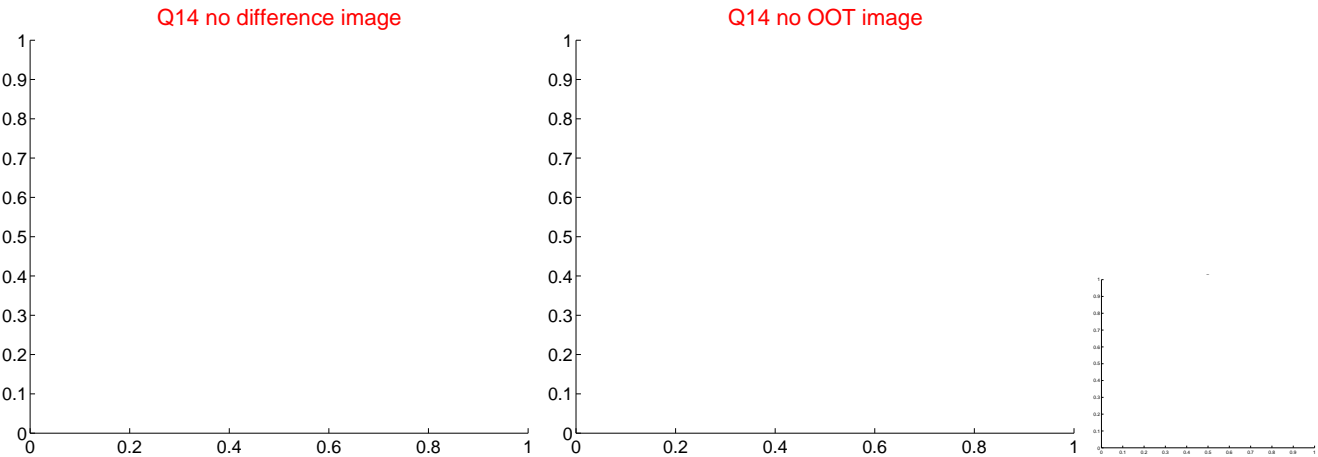
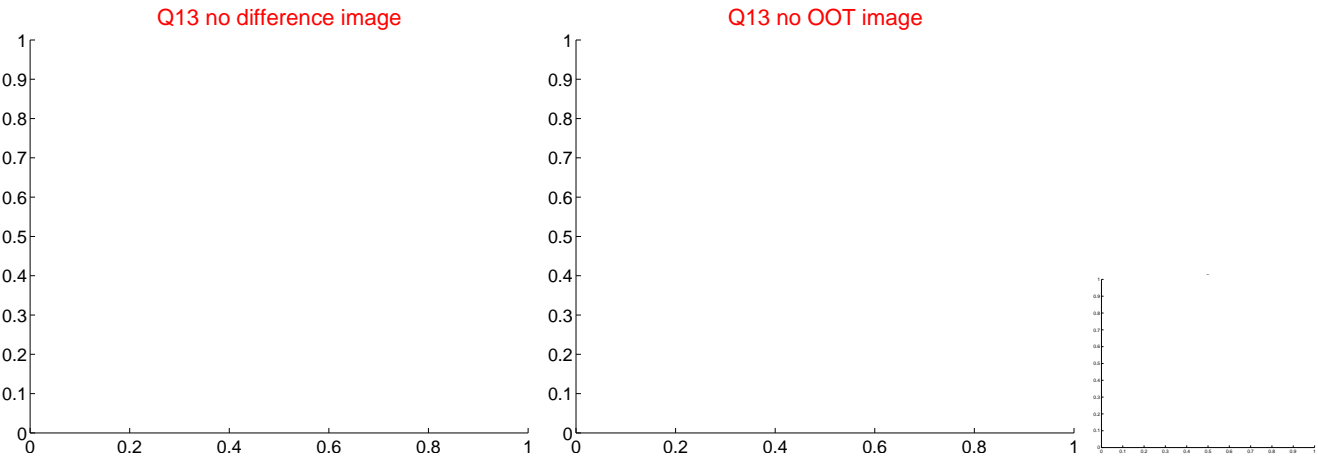


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



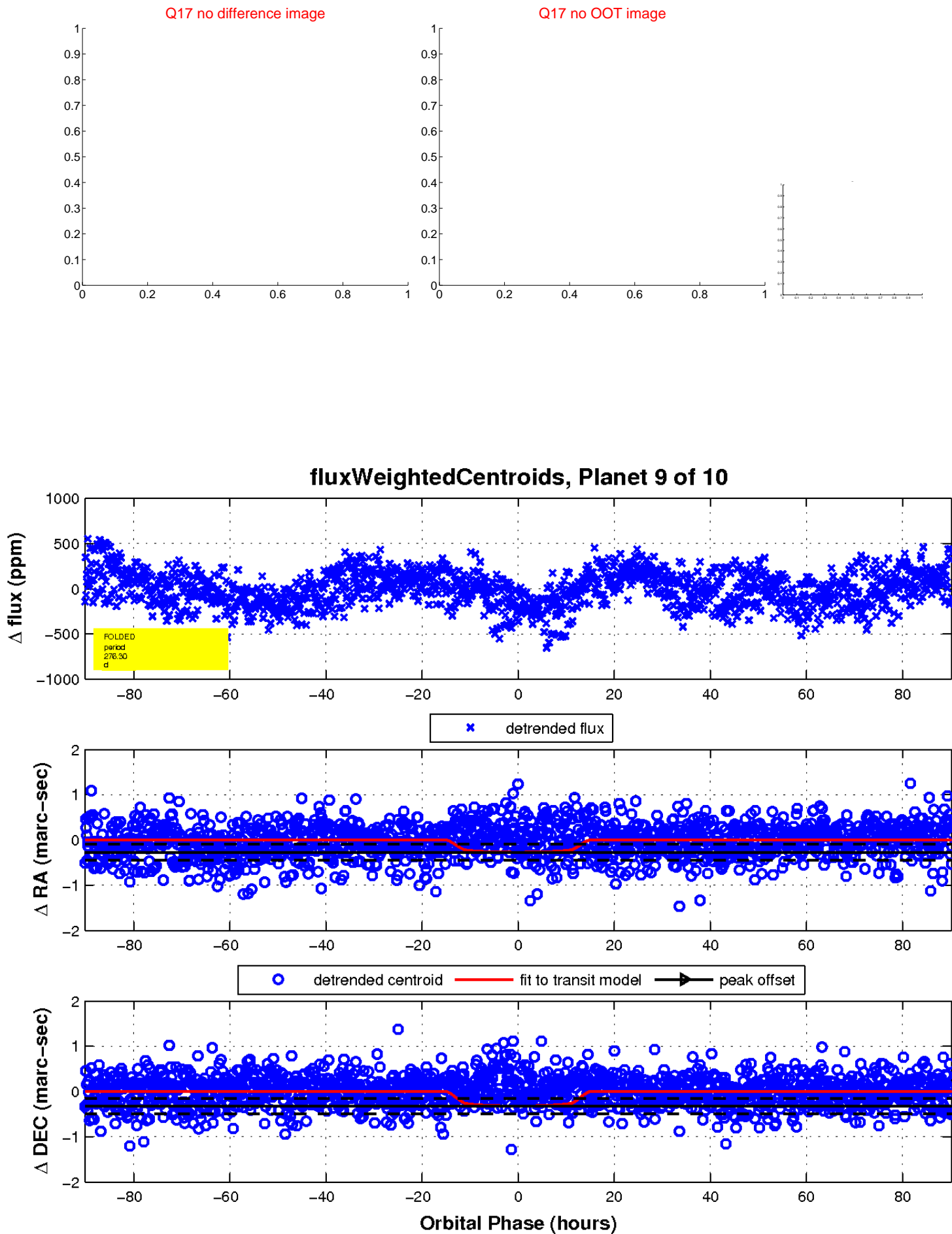


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





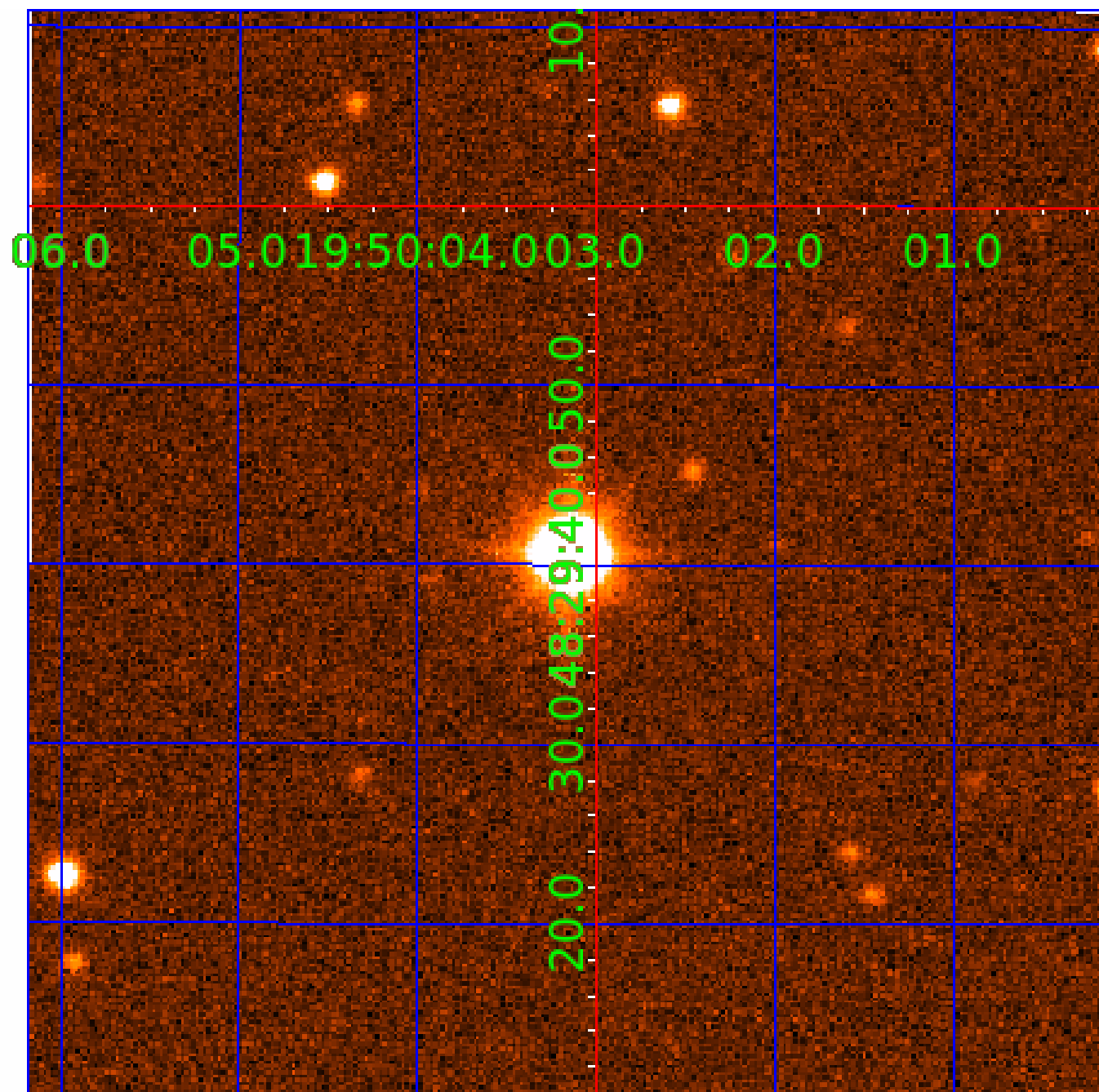
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





UKIRT Image

Declination





# KIC 010989345

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
010989345-01	OBS	No	2.630764	133.193244	10.6	11.138	8.7	2.7	1.50	6441	0.56	2414.15
010989345-02	OBS	No	663.020155	176.584259	336.4	6.883	8.0	8.5	1.50	6441	3.12	1.52
010989345-03	OBS	No	237.414043	326.142677	325.3	14.174	7.7	8.6	1.50	6441	3.39	5.96
010989345-04	OBS	No	423.567102	344.022902	722.4	35.026	7.8	7.8	1.50	6441	4.94	2.76
010989345-05	OBS	No	128.115026	240.564541	252.7	10.241	7.8	8.2	1.50	6441	2.77	13.57
010989345-07	OBS	No	66.433669	191.136166	129.6	13.221	7.4	5.2	1.50	6441	1.83	32.59
010989345-08	OBS	No	161.346431	265.595466	238.5	7.037	7.2	7.2	1.50	6441	4.56	9.98
010989345-09	OBS	No	276.296890	275.873517	375.6	30.069	7.9	7.5	1.50	6441	3.49	4.87
010989345-10	OBS	No	196.452793	165.569777	243.6	5.231	7.4	8.1	1.50	6441	3.04	7.68

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
010989345-01	OBS	FP	0.00	1	0	0	0	SWEET_NTL—LPP_DV—MOD_NONUNIQ_DV
010989345-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES—ALL_TRANS_CHASES—MOD_NONUNIQ_DV
010989345-03	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—HALO_GHOST
010989345-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
010989345-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—MOD_NONUNIQ_DV
010989345-07	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT
010989345-08	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT
010989345-09	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—CENT_FEW_DIFFS
010989345-10	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT

**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.

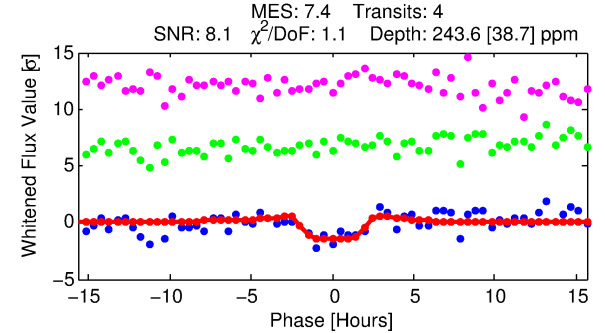
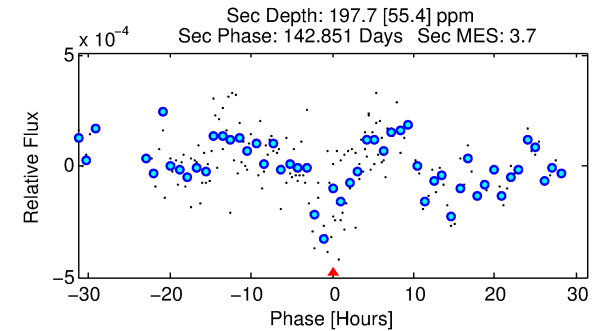
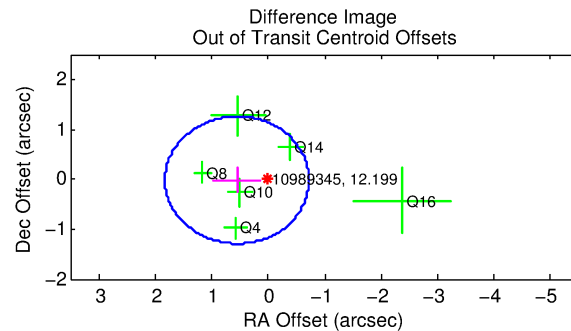
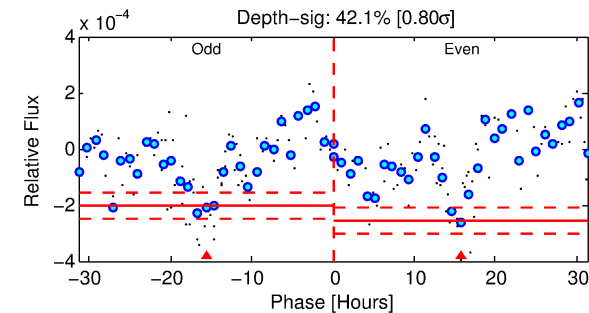
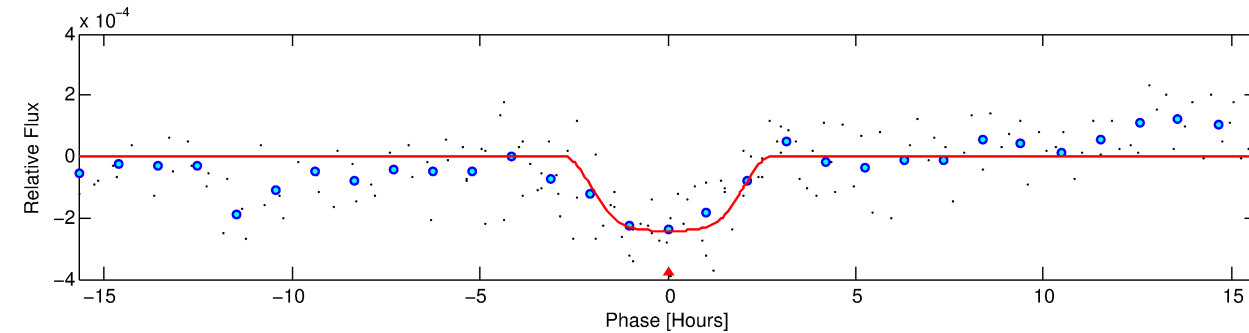
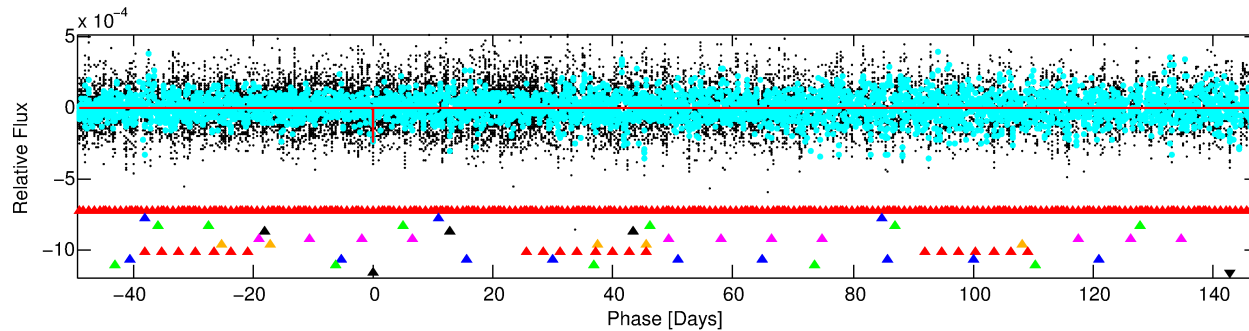
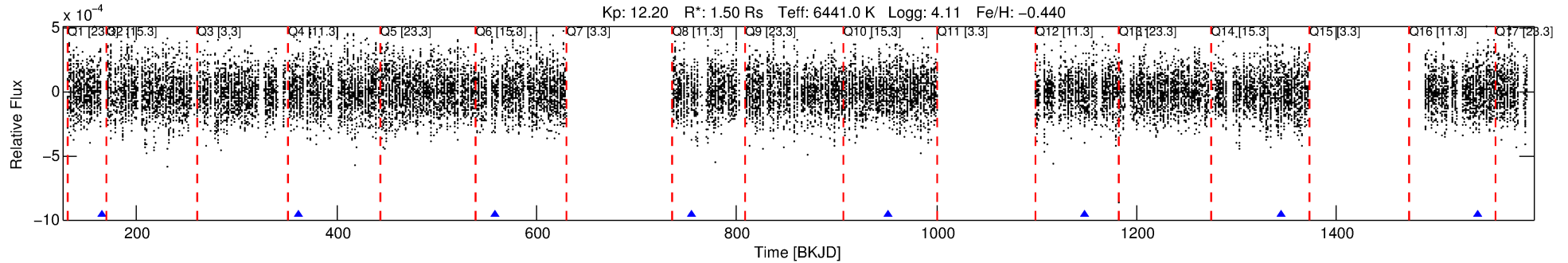
Ephemeris Match Information For 010989345-10

No Significant Match Found



# DV One-Page Summary

KIC: 10989345 Candidate: 10 of 10 Period: 196.453 d



## DV Fit Results:

Period = 196.45279 [0.00418] d  
Epoch = 165.5698 [0.0172] BKJD  
Rp/R\* = 0.0185 [0.0019]  
a/R\* = 87.07 [21.79]  
b = 0.97 [0.01]  
Seff = 7.68 [3.87]  
Teq = 424 [54] K  
Rp = 3.04 [0.98] Re  
a = 0.6741 [0.2026] AU  
Ag = 5356.64 [3184.89] [1.68 $\sigma$ ]  
Teffp = 5614 [522] K [9.88 $\sigma$ ]

## DV Diagnostic Results:

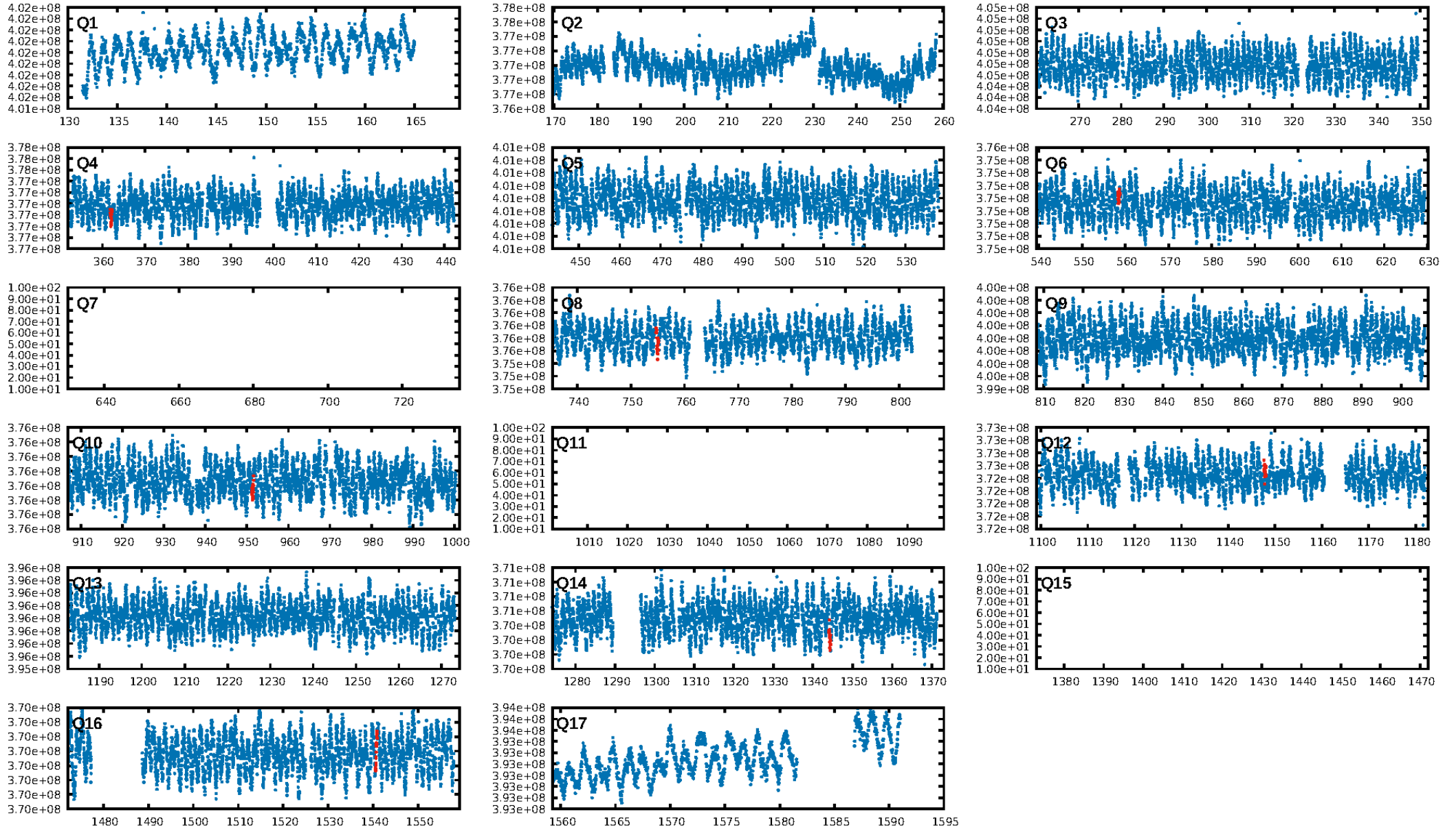
ShortPeriod-sig: 100.0% [96.09 $\sigma$ ]  
LongPeriod-sig: 100.0% [65.07 $\sigma$ ]  
ModelChiSquare2-sig: 98.6%  
ModelChiSquareGof-sig: 83.0%  
**Bootstrap-pfa: 1.32e-08**  
RollingBand-fgt: 1.00 [4/4]  
GhostDiagnostic-chr: -4.618  
Centroid-sig: 82.7%  
Centroid-so: 0.203 arcsec [0.28 $\sigma$ ]  
OotOffset-rm: 0.552 arcsec [1.30 $\sigma$ ]  
KicOffset-rm: 0.597 arcsec [1.45 $\sigma$ ]  
OotOffset-st: 2/0/4/0 [6]  
KicOffset-st: 2/0/4/0 [6]  
DiffImageQuality-fgm: 0.67 [4/6]  
DiffImageOverlap-fno: 0.57 [4/7]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 03:40:31 Z

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

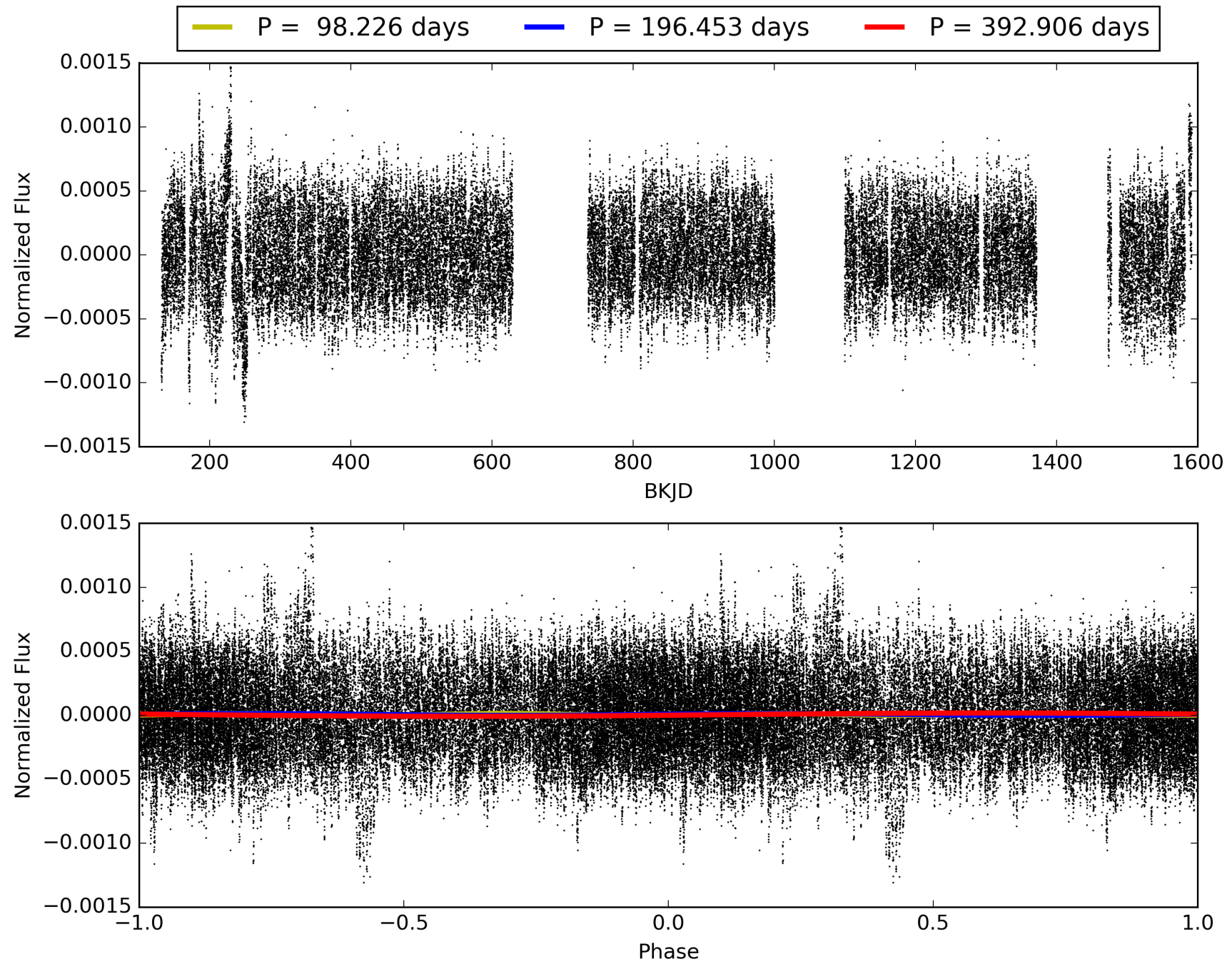


# TCE 010989345-10, PDC Light Curves





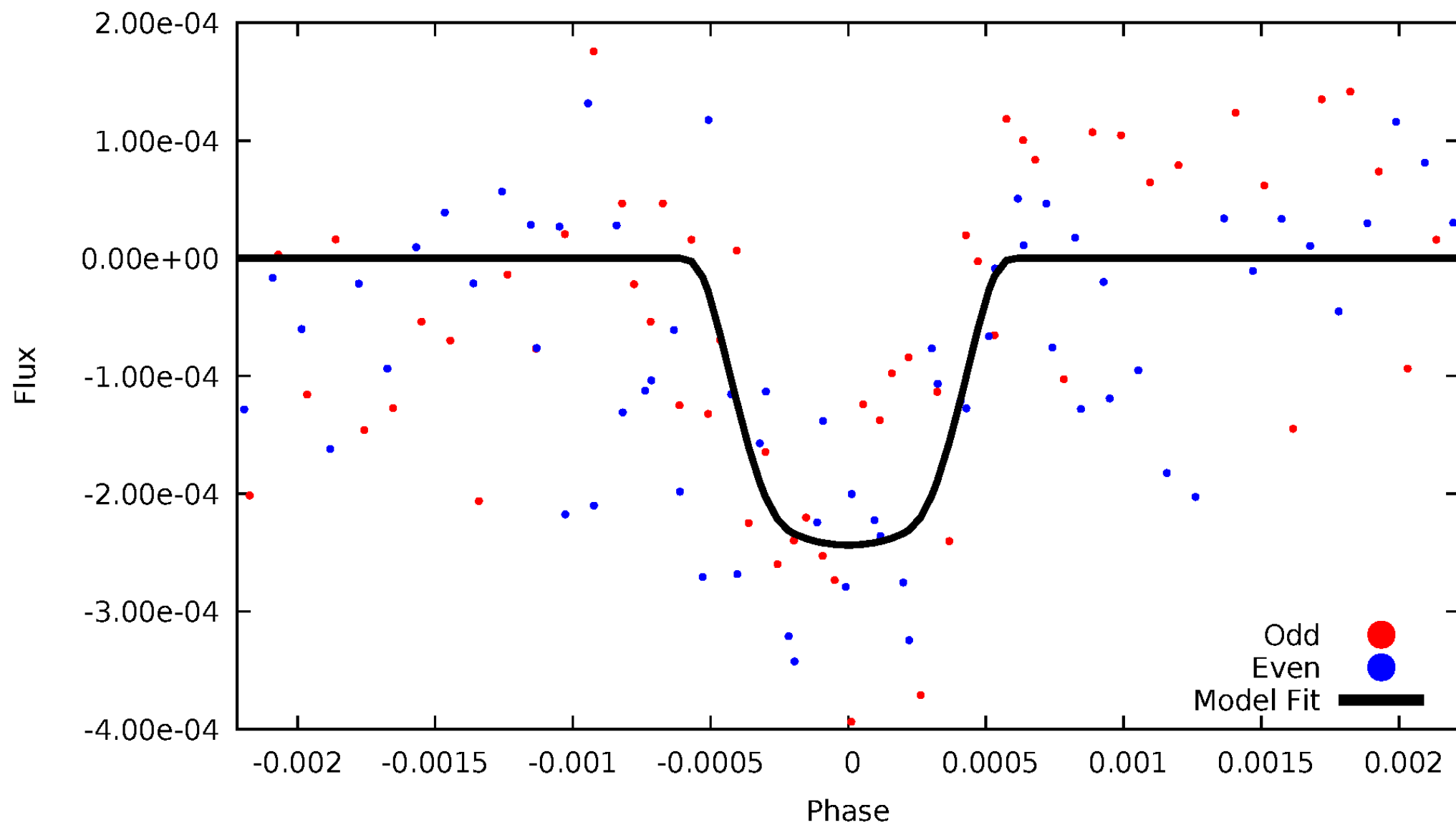
TCE 010989345-10





# DV Odd/Even

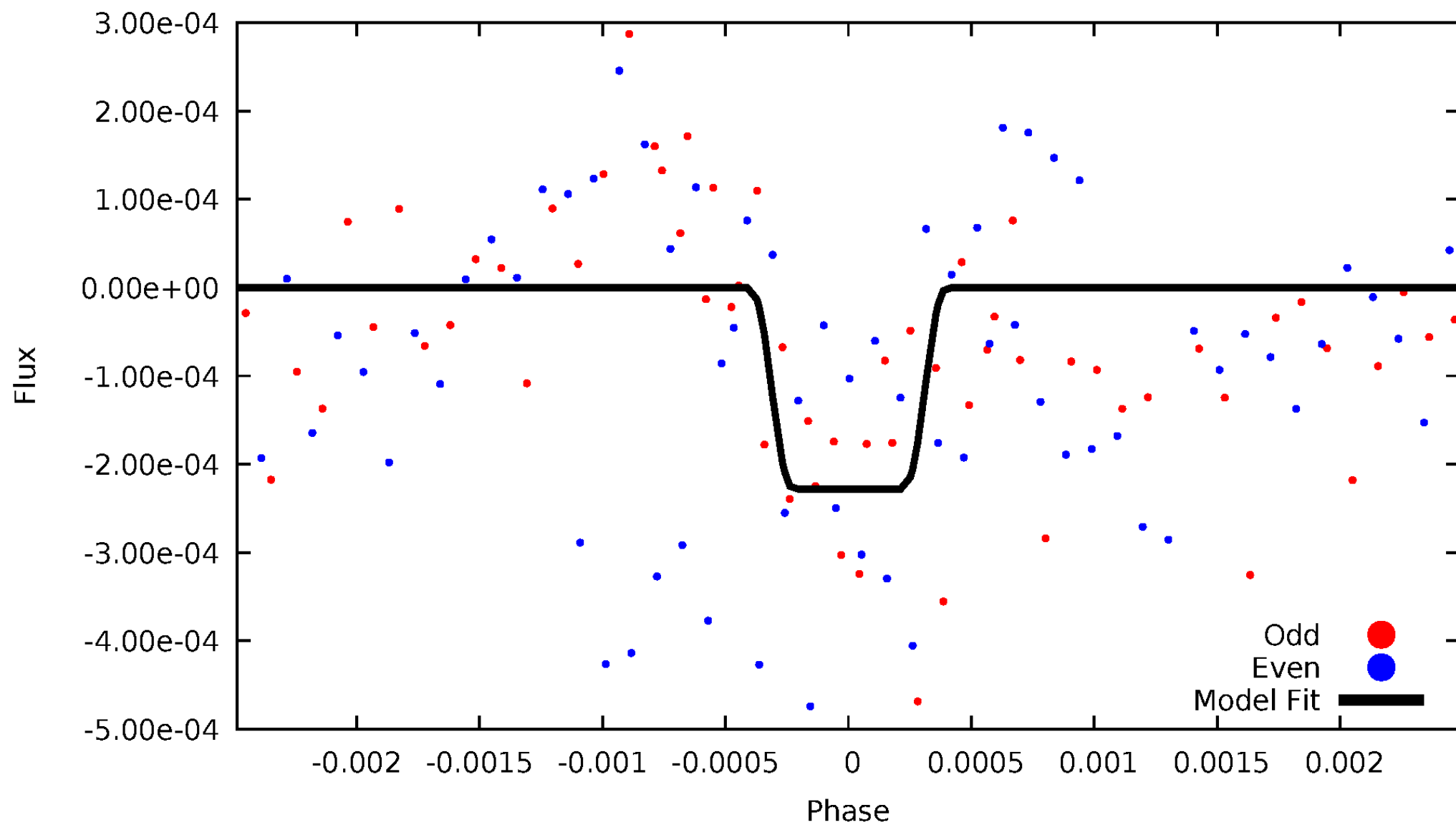
TCE 010989345-10





# ALT Odd/Even

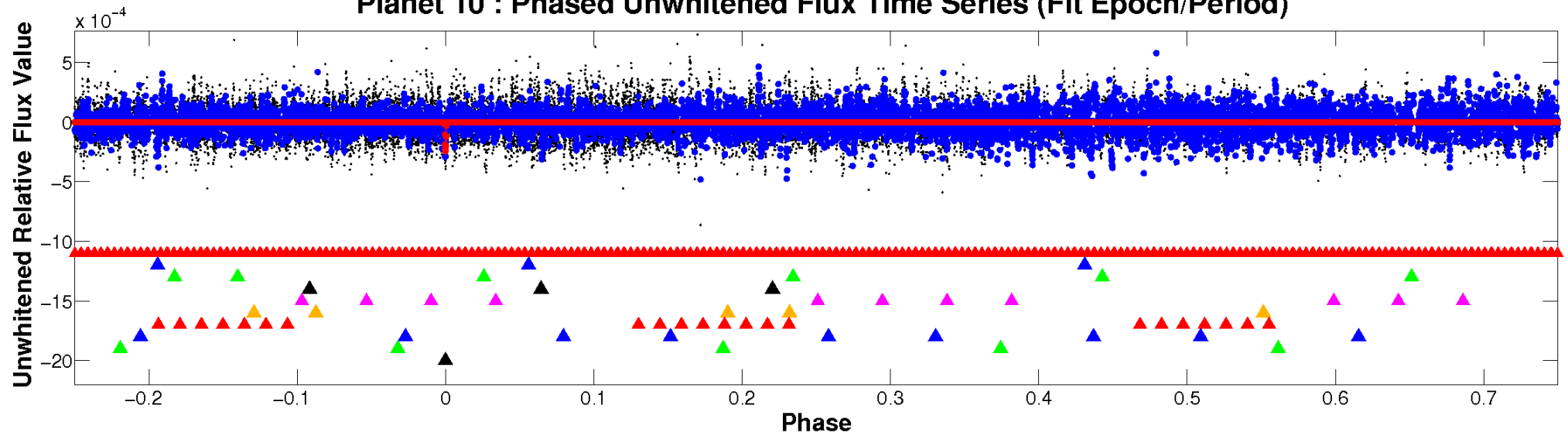
TCE 010989345-10



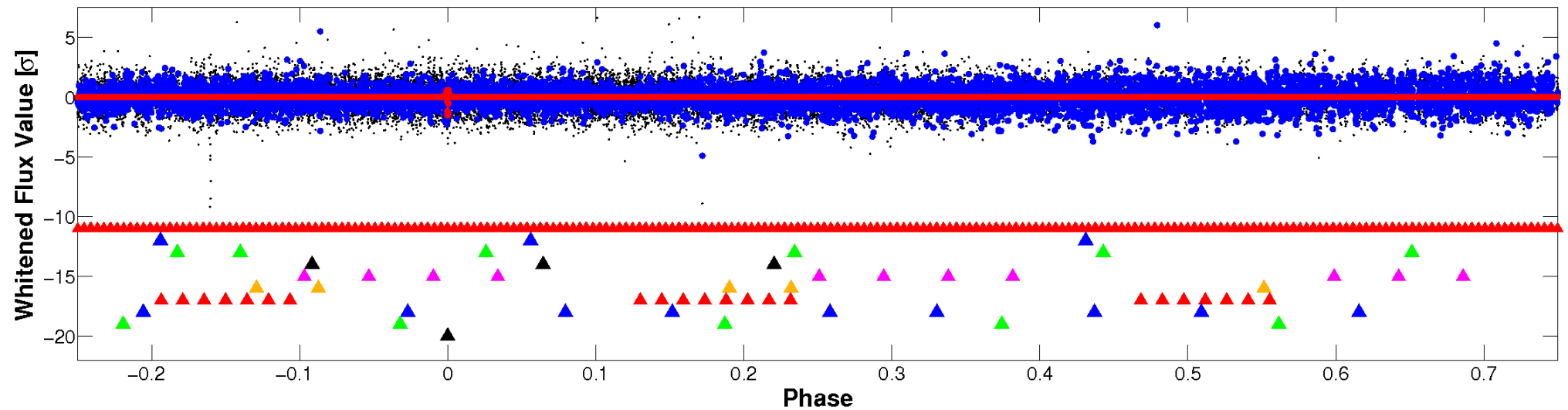


# Non-Whitened Vs. Whitened Light Curve

Planet 10 : Phased Unwhitened Flux Time Series (Fit Epoch/Period)



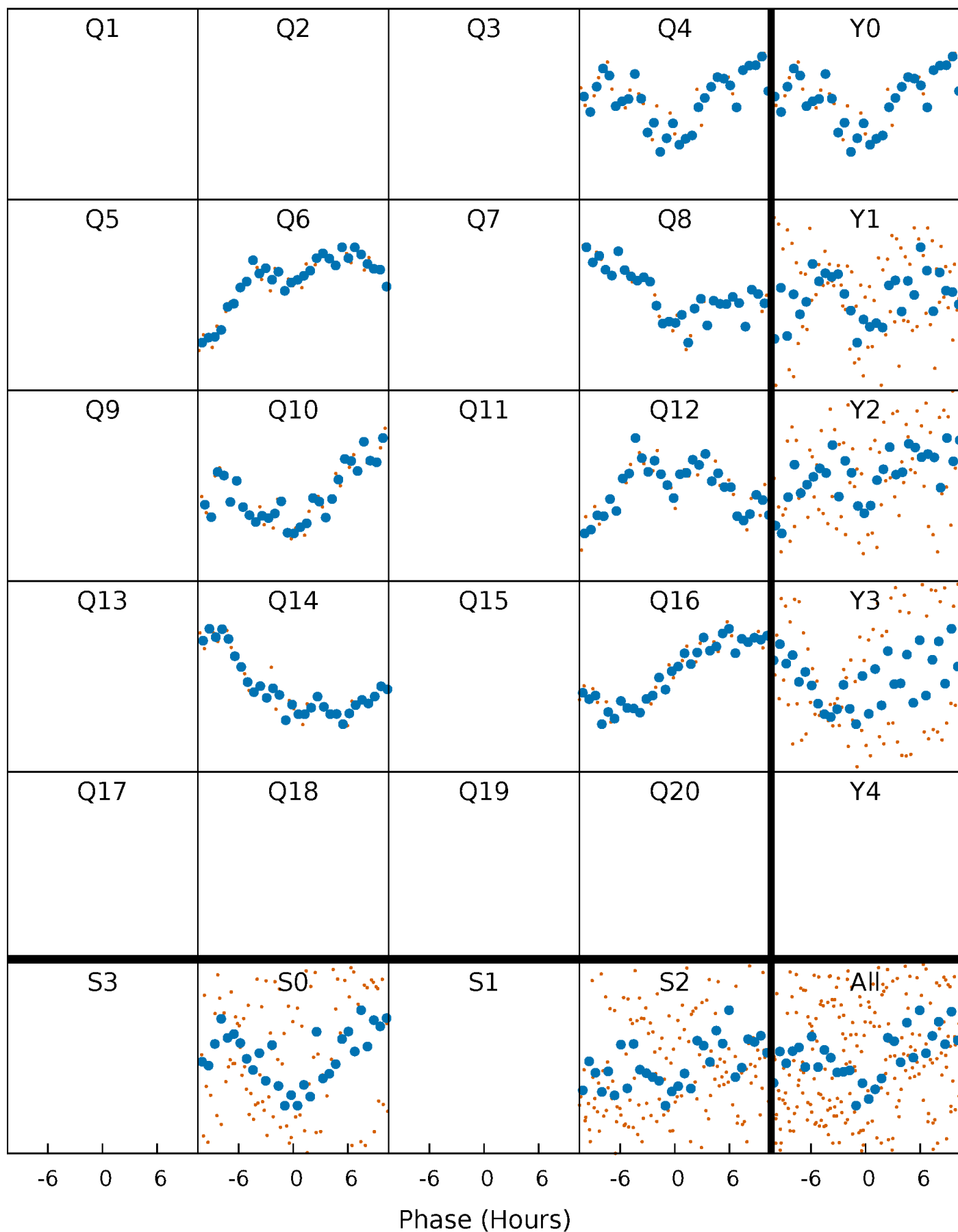
Planet 10 : Phased Whitened Flux Time Series (Fit Epoch/Period)





# PDC Quarter-Phased Transit Curves

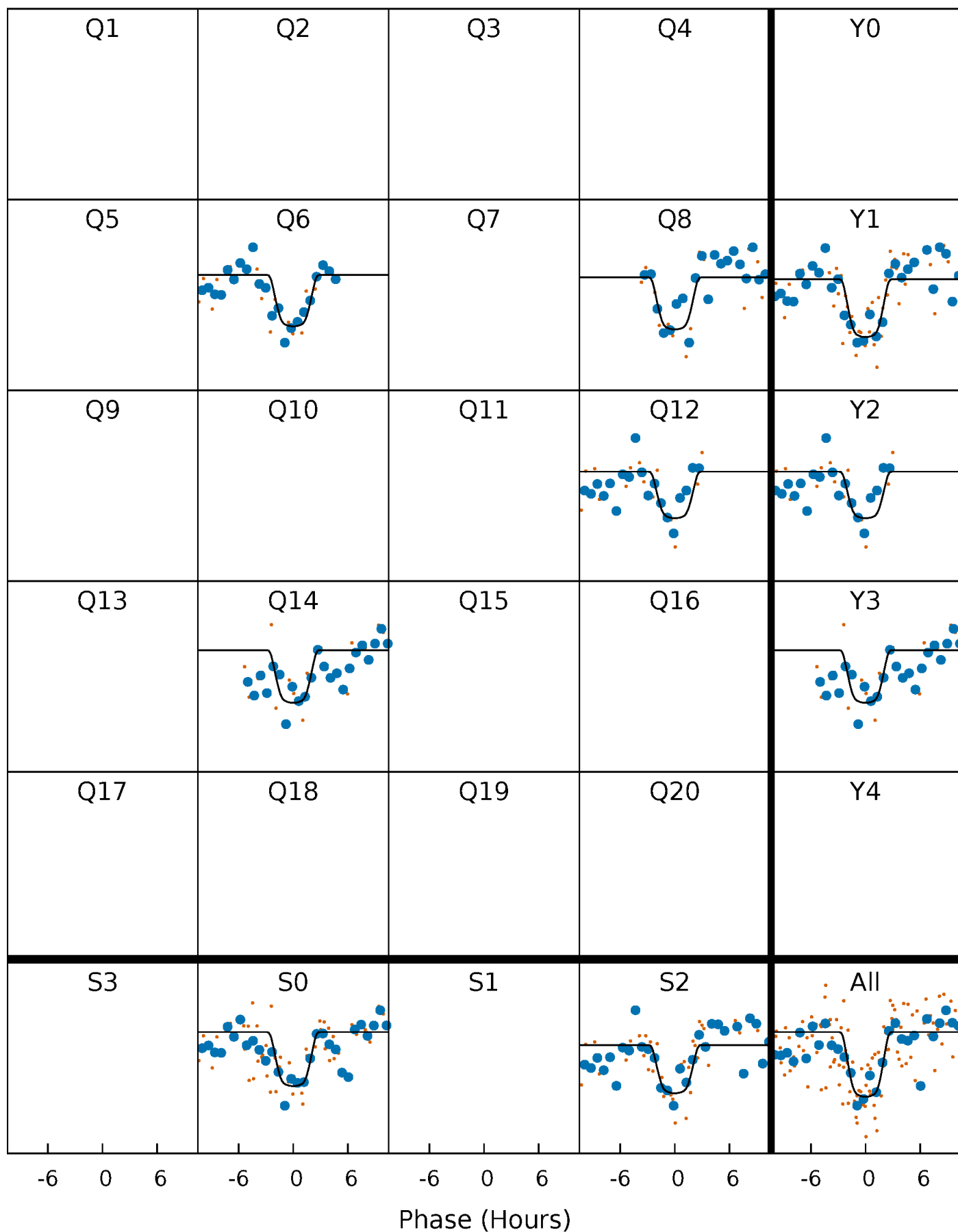
TCE 010989345-10   P=196.452793 Days    $T_0=165.569777$  (BKJD)





# DV Quarter-Phased Transit Curves

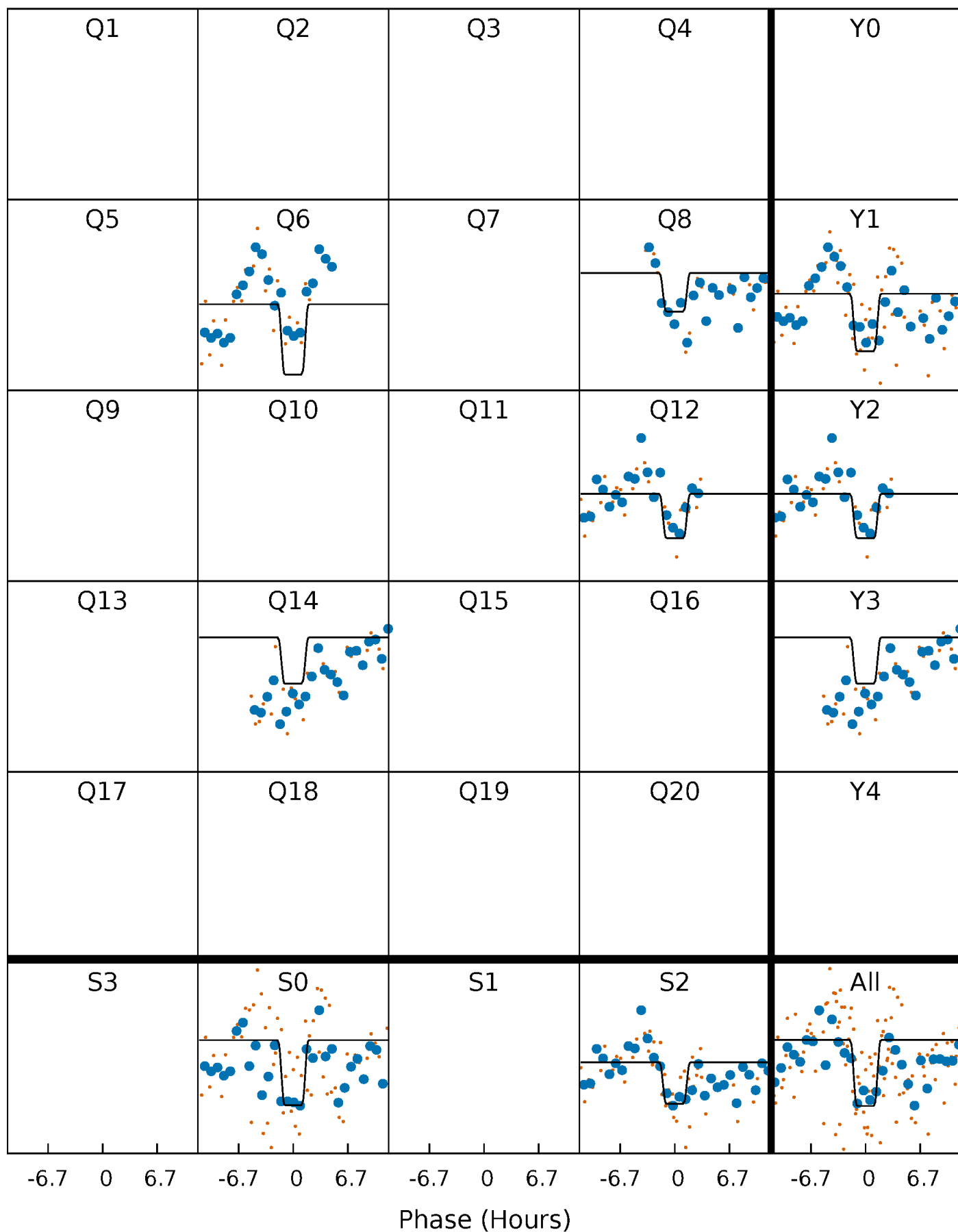
TCE 010989345-10     $P=196.452793$  Days     $T_0=165.569777$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

TCE 010989345-10   P=196.451434 Days    $T_0=165.569876$  (BKJD)

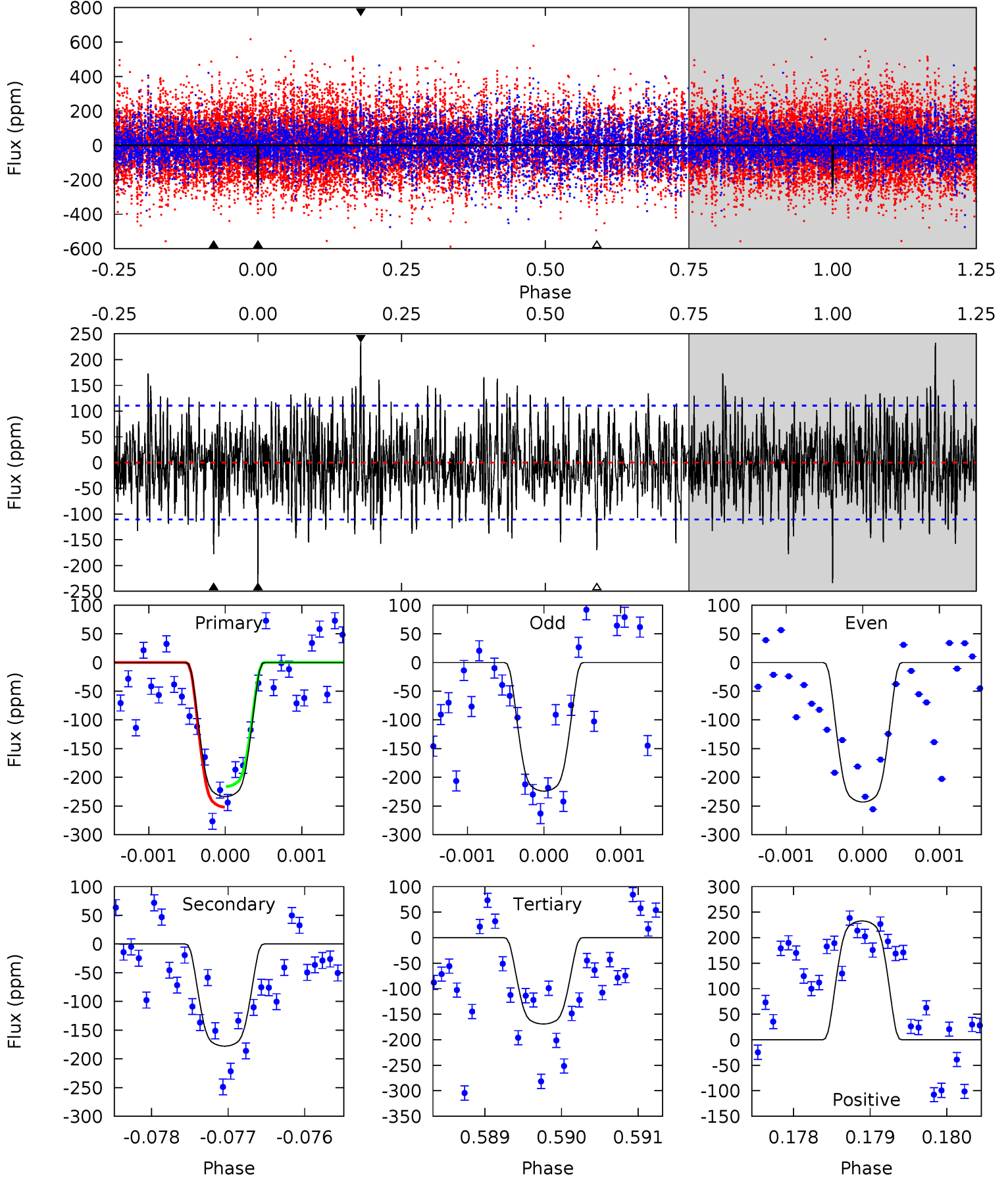




# DV Model-Shift Uniqueness Test

010989345-10, P = 196.452793 Days, E = 165.569777 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	8.71	8.28	11.4	5.42	3.24	2.73	3.16	0.04	0.43	-2.69	0.47	0.96	0.50	0.88

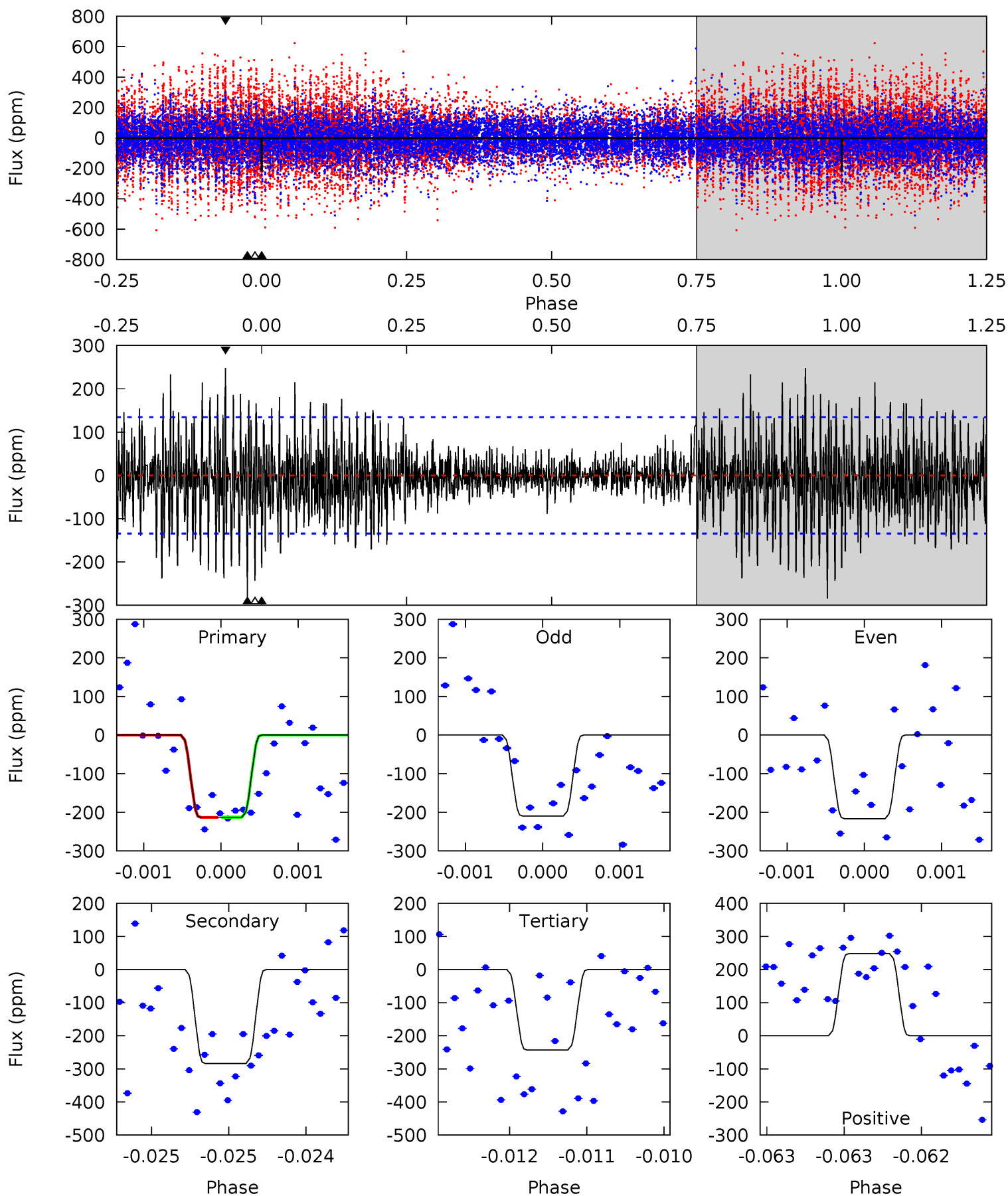




# Alt Model-Shift Uniqueness Test

010989345-10, P = 196.451434 Days, E = 165.569876 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
8.70	11.6	9.94	10.1	5.49	3.36	2.61	-1.23	-1.43	1.66	1.47	0.14	1.01	0.47	0.01





### Stellar Parameters For KIC 010989345

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M$ ( $M_{\odot}$ )	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6441^{+181}_{-227}$	$4.108^{+0.286}_{-0.154}$	$-0.440^{+0.300}_{-0.300}$	$1.504^{+0.421}_{-0.463}$	$1.056^{+0.177}_{-0.133}$	$0.438^{+0.795}_{-0.185}$
	+3%/-4%	+7%/-4%	+68%/-68%	+28%/-31%	+17%/-13%	+182%/-42%
Source	PHO54	PHO54	PHO54	DSEP		

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

### Secondary Eclipse Parameters for KIC 010989345-10 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-178 \pm 20$	$2.92^{+0.65}_{-0.54}$	$583^{+46}_{-51}$	$5483^{+361}_{-327}$	$5218^{+2474}_{-1672}$
Alt.	$-284 \pm 24$	$2.42^{+0.54}_{-0.49}$	$585^{+46}_{-54}$	$6796^{+595}_{-478}$	$12278^{+6699}_{-4133}$

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



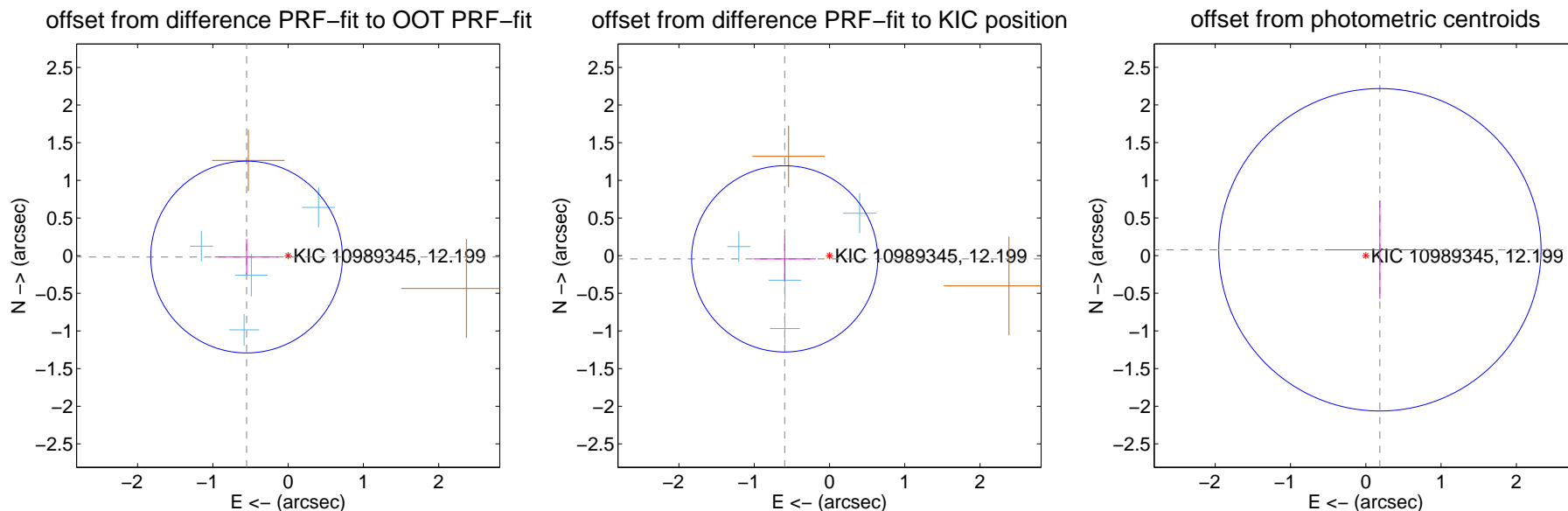
## DV Centroid Data

Supplemental centroid analysis for 010989345-10. Kepler magnitude: 12.20. Transit SNR 8.07

There are 4 quarters with good PRF difference image offsets

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

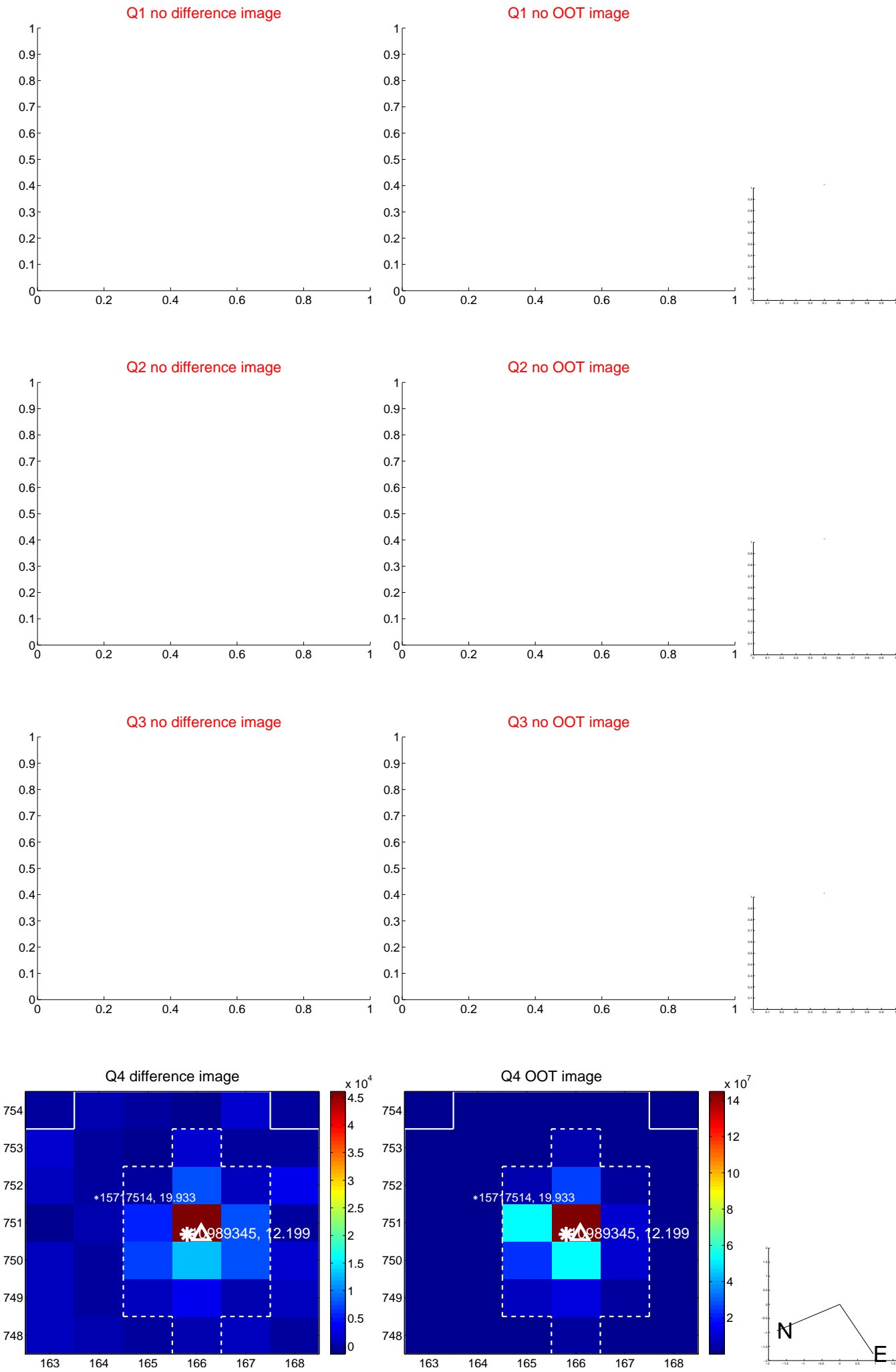
	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.552 \pm 0.425$	1.30	$0.552 \pm 0.424$	$-0.018 \pm 0.238$
PRF-fit source offset from KIC position	$0.597 \pm 0.412$	1.45	$0.595 \pm 0.415$	$-0.043 \pm 0.302$
photometric centroid source offset	$0.20 \pm 0.71$	0.28	$-0.19 \pm 0.72$	$0.08 \pm 0.65$



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.

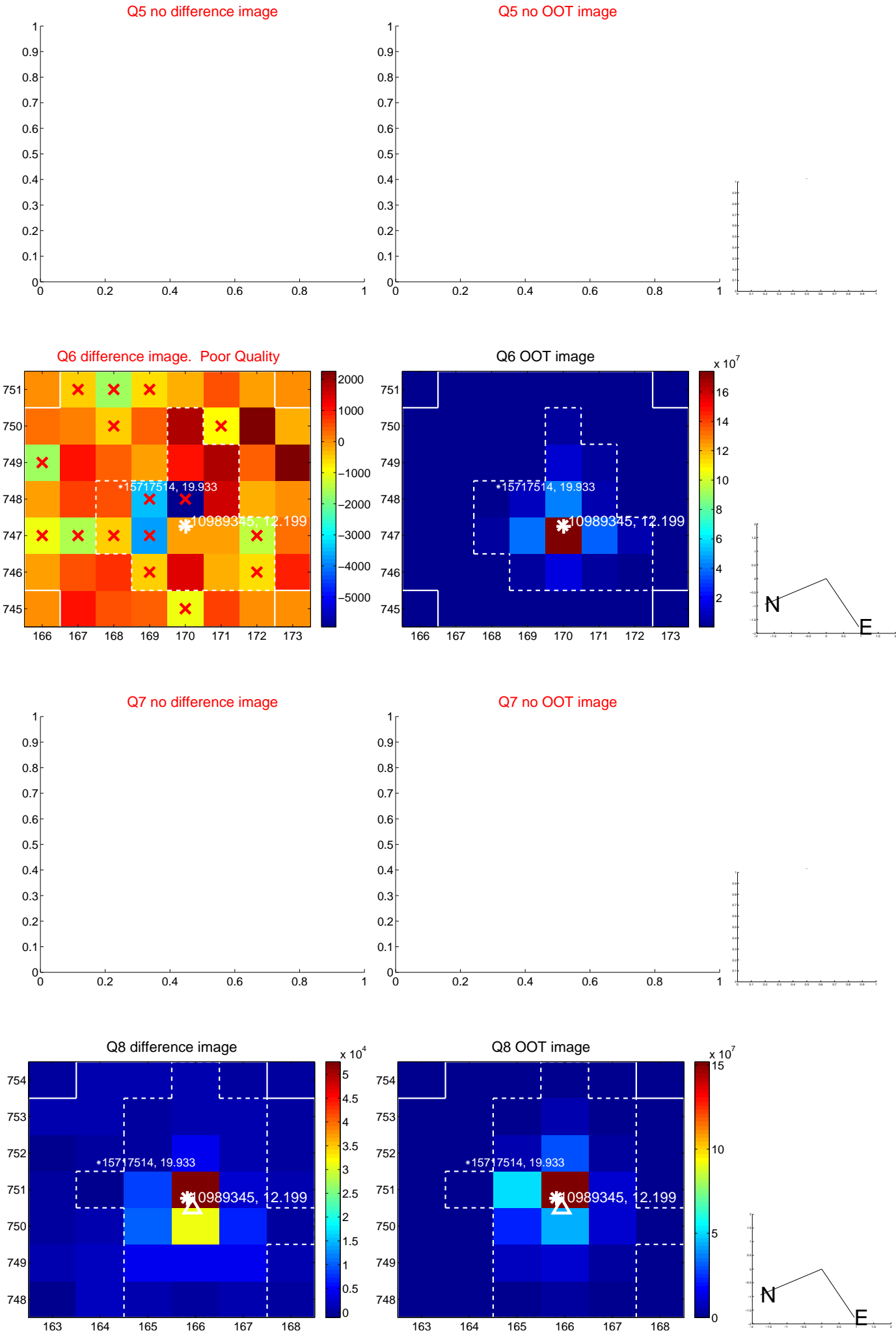


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



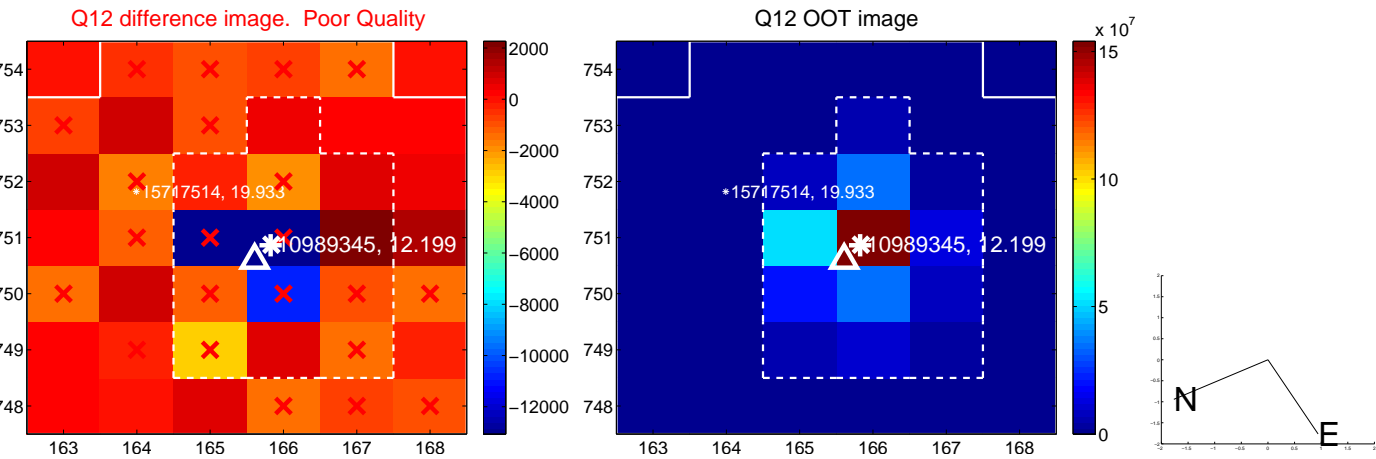
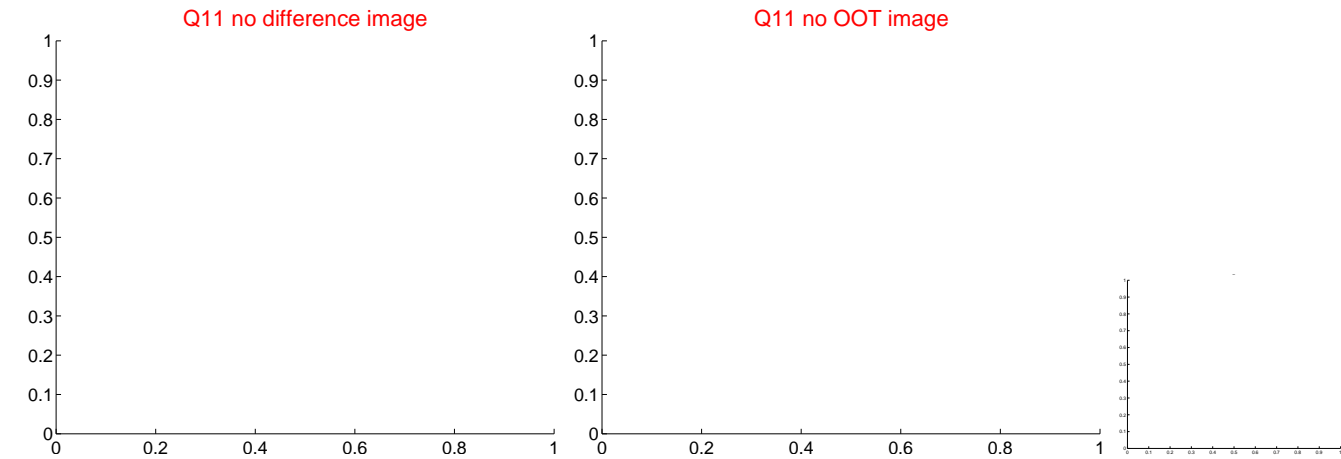
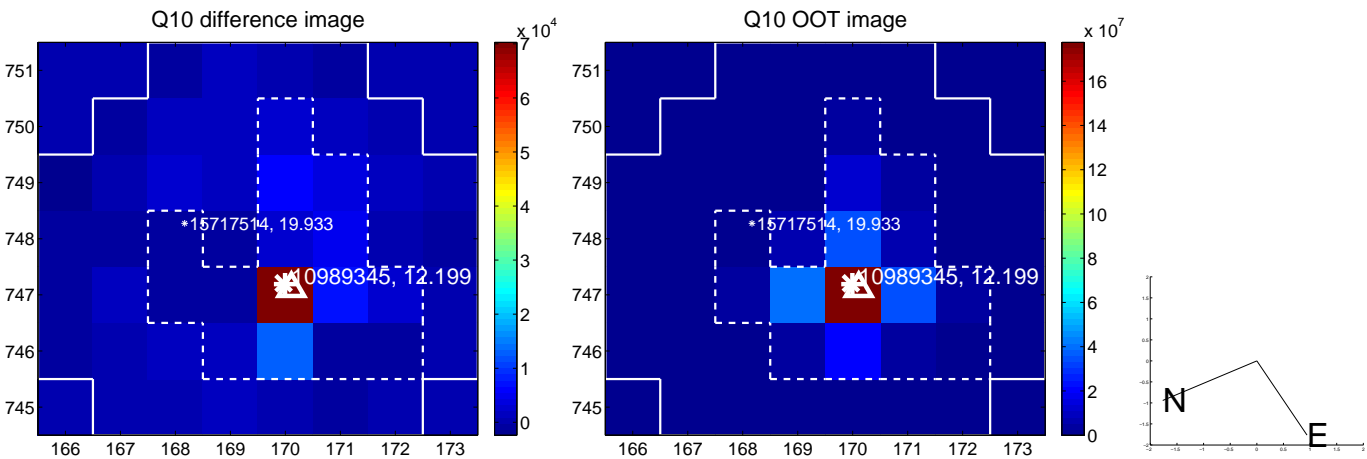
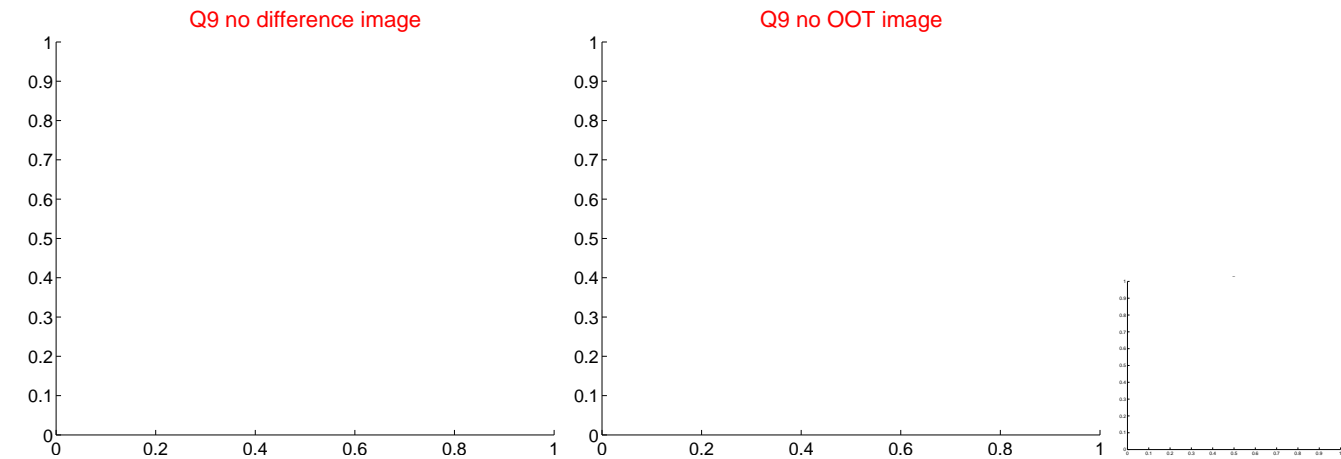


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



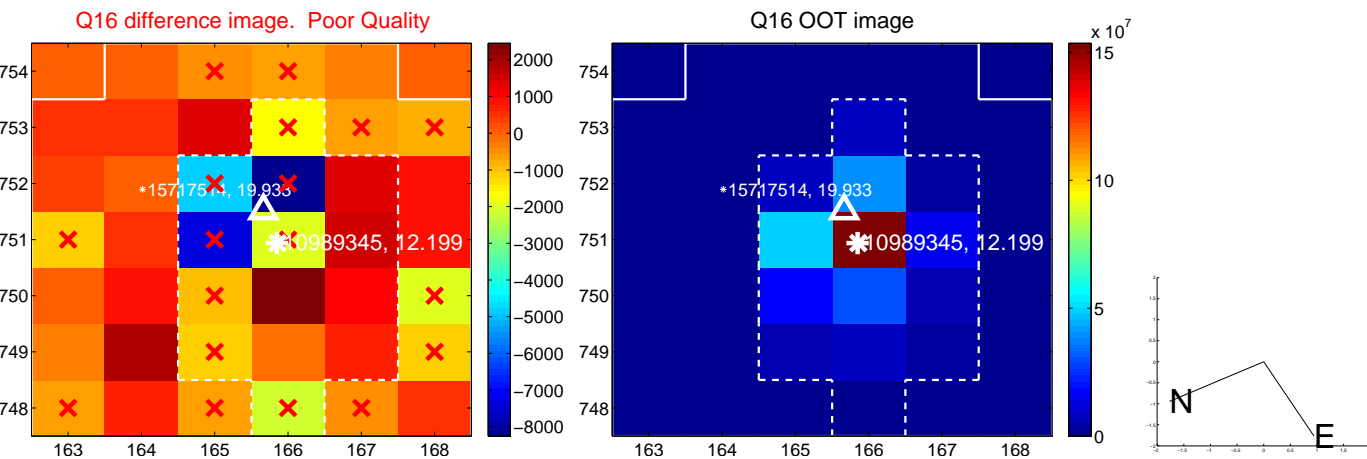
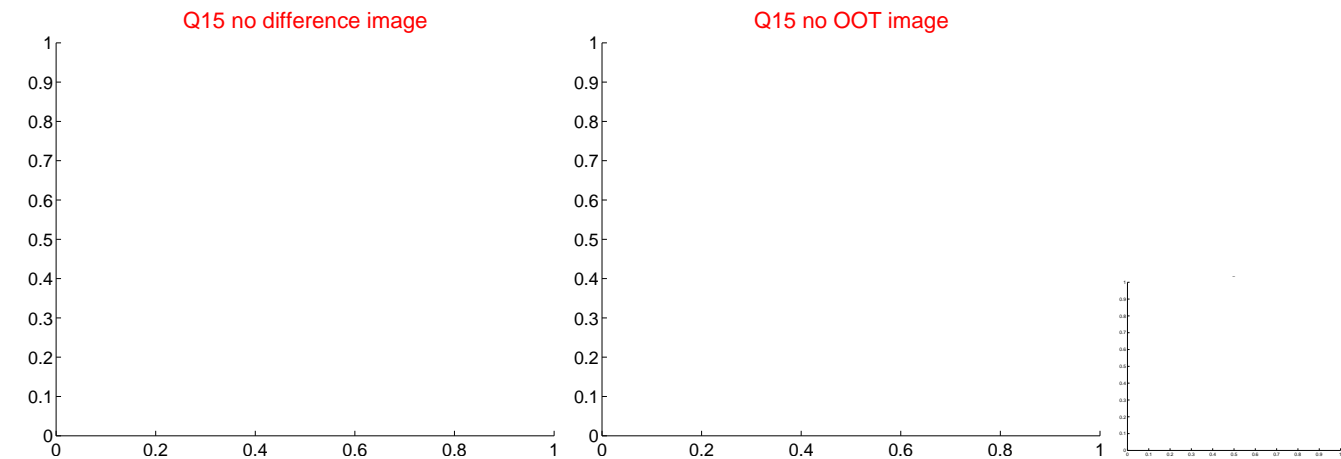
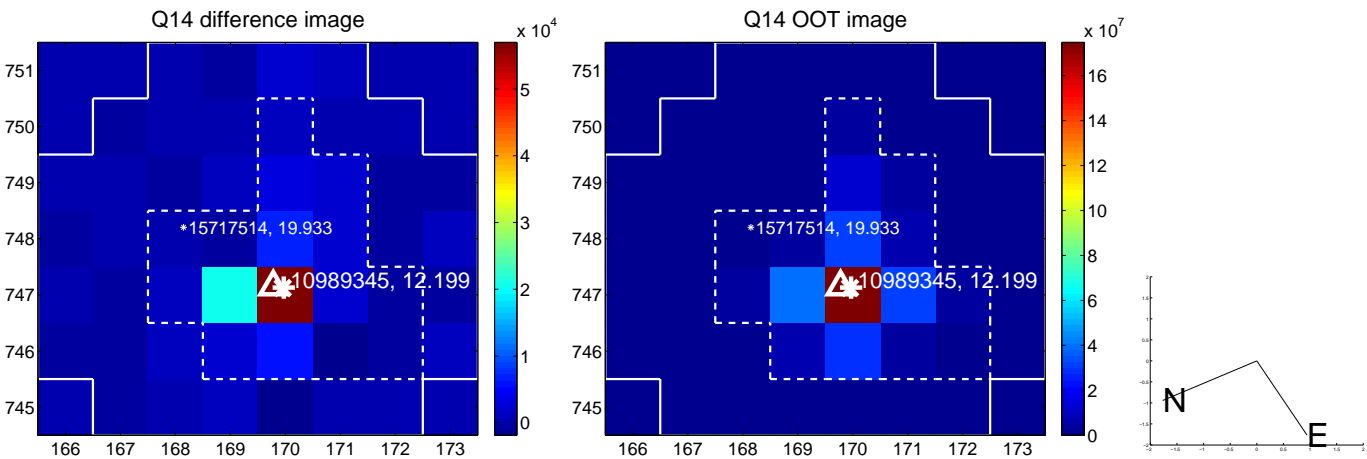
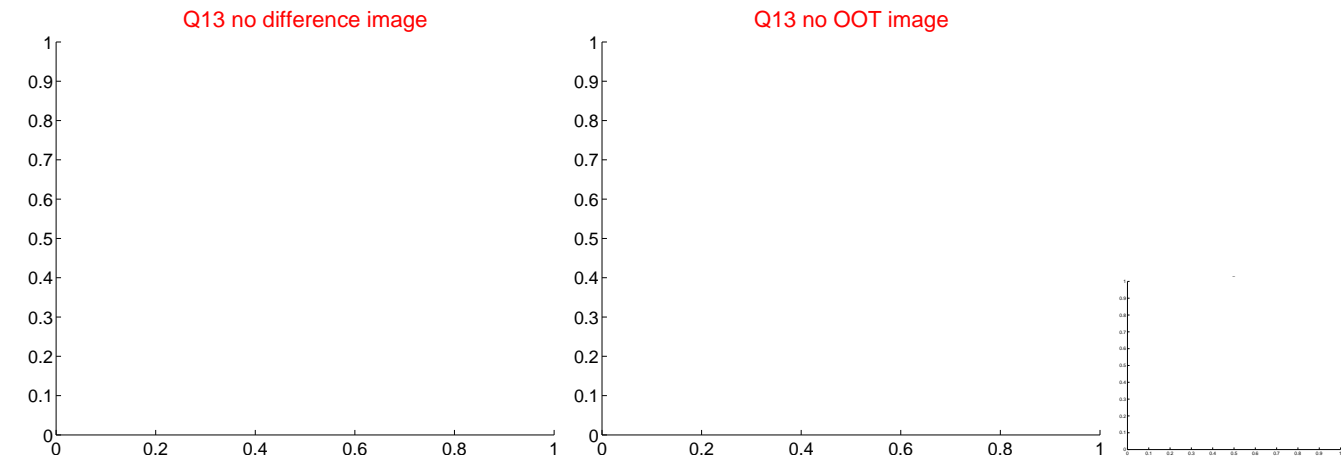


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



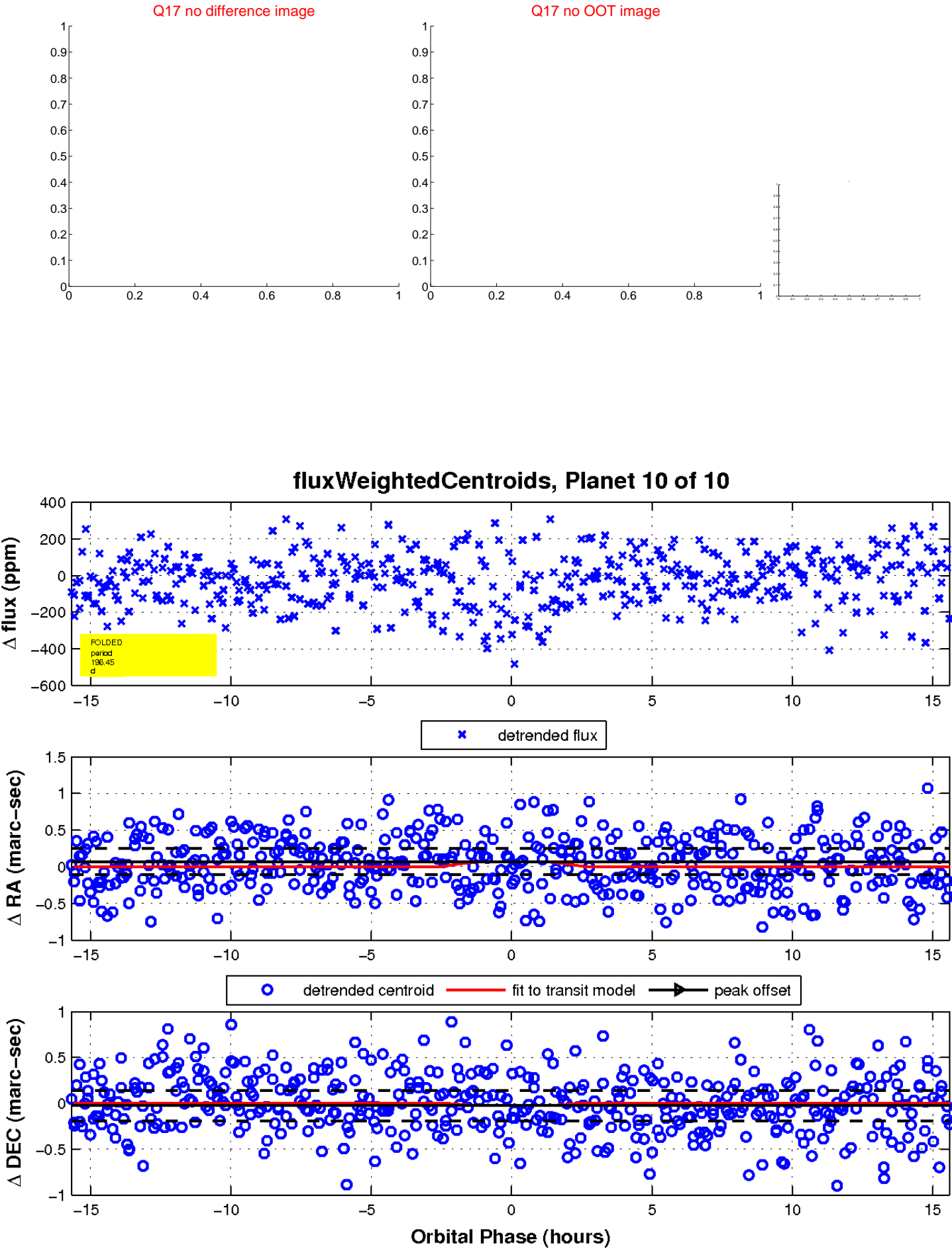


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





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





UKIRT Image

Declination

