

# KIC 008651471

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
008651471-01	OBS	No	499.244107	200.933797	1287.9	6.574	14.9	7.8	0.77	5250	3.35	0.33
008651471-02	OBS	No	523.001201	189.787383	496.6	10.681	14.1	2.4	0.77	5250	1.74	0.31
008651471-03	OBS	No	447.422049	562.729561	1449.4	1.441	15.8	7.4	0.77	5250	3.20	0.38
008651471-04	OBS	No	371.515168	286.533858	1056.2	3.025	13.7	7.0	0.77	5250	2.61	0.49
008651471-05	OBS	No	301.489511	259.355139	1255.0	4.352	13.2	7.6	0.77	5250	2.76	0.65
008651471-06	OBS	No	542.143214	470.033782	782.2	3.500	13.1	-1.0	0.77	5250	2.12	0.30

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
008651471-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
008651471-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL_TRACKER—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS
008651471-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_TRACKER—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS
008651471-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_ZUMA_TRACKER—LPP_DV—LPP_ALT—MOD_POS_DV—CENT_KIC_POS
008651471-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
008651471-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_SKYE—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—INCONSISTENT_TRANS—CENT_NOFITS

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

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

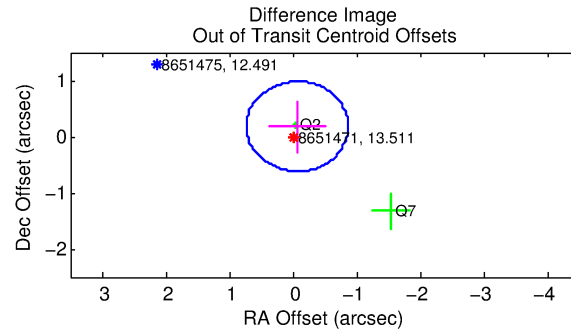
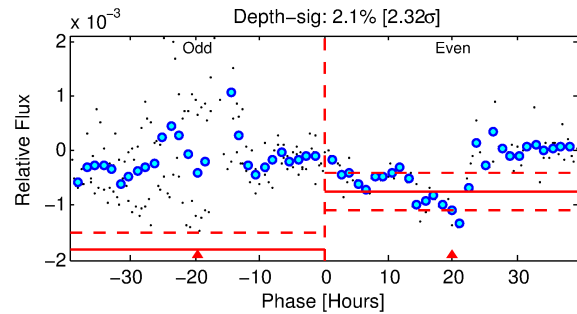
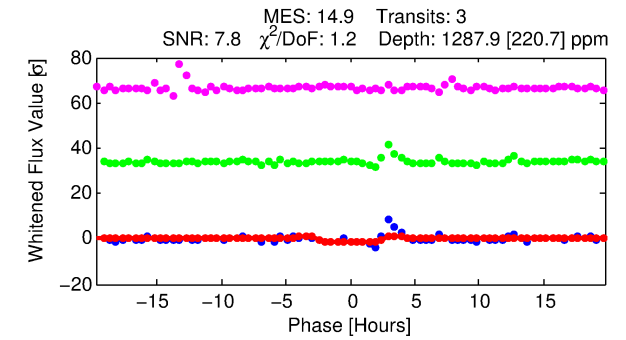
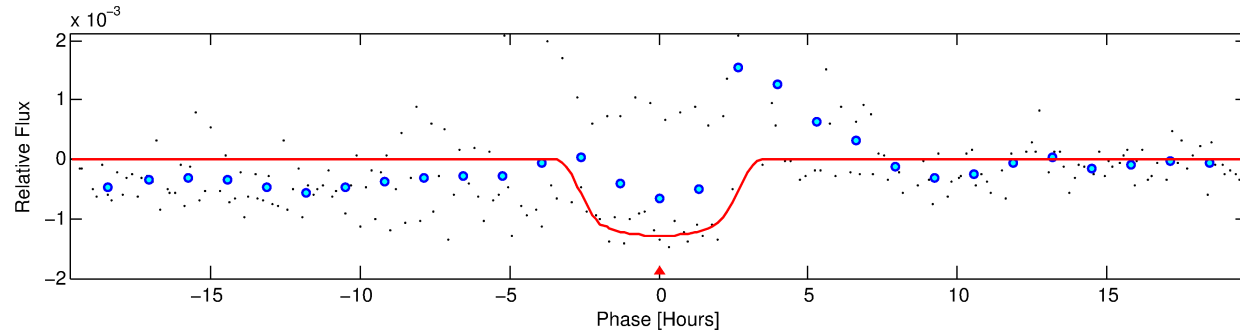
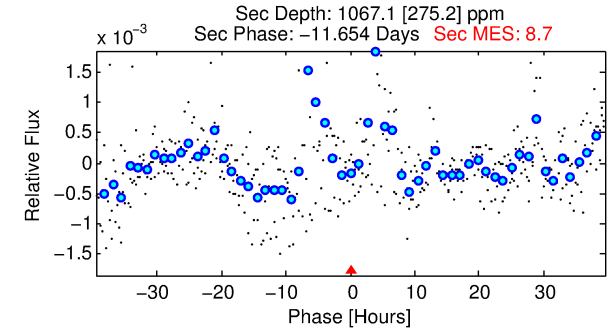
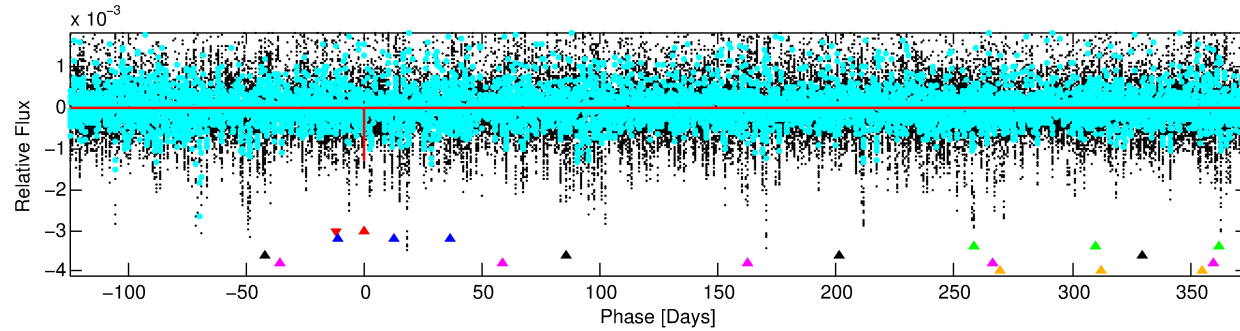
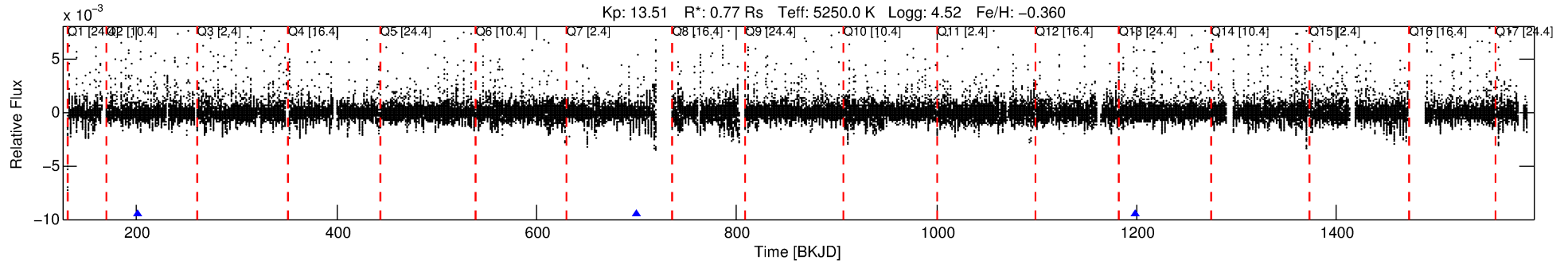
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 008651471-01

No Significant Match Found

# DV One-Page Summary

KIC: 8651471 Candidate: 1 of 6 Period: 499.244 d



## DV Fit Results:

Period = 499.24411 [0.00760] d  
Epoch = 200.9338 [0.0095] BKJD  
Rp/R\* = 0.0398 [0.0046]  
a/R\* = 297.25 [72.37]  
b = 0.90 [0.05]  
Seff = 0.33 [0.07]  
Teq = 193 [10] K  
Rp = 3.35 [0.63] Re  
a = 1.1048 [0.1355] AU  
Ag = 63951.15 [24769.61] [2.58 $\sigma$ ]  
**Teffp = 4757 [435] K [10.50 $\sigma$ ]**

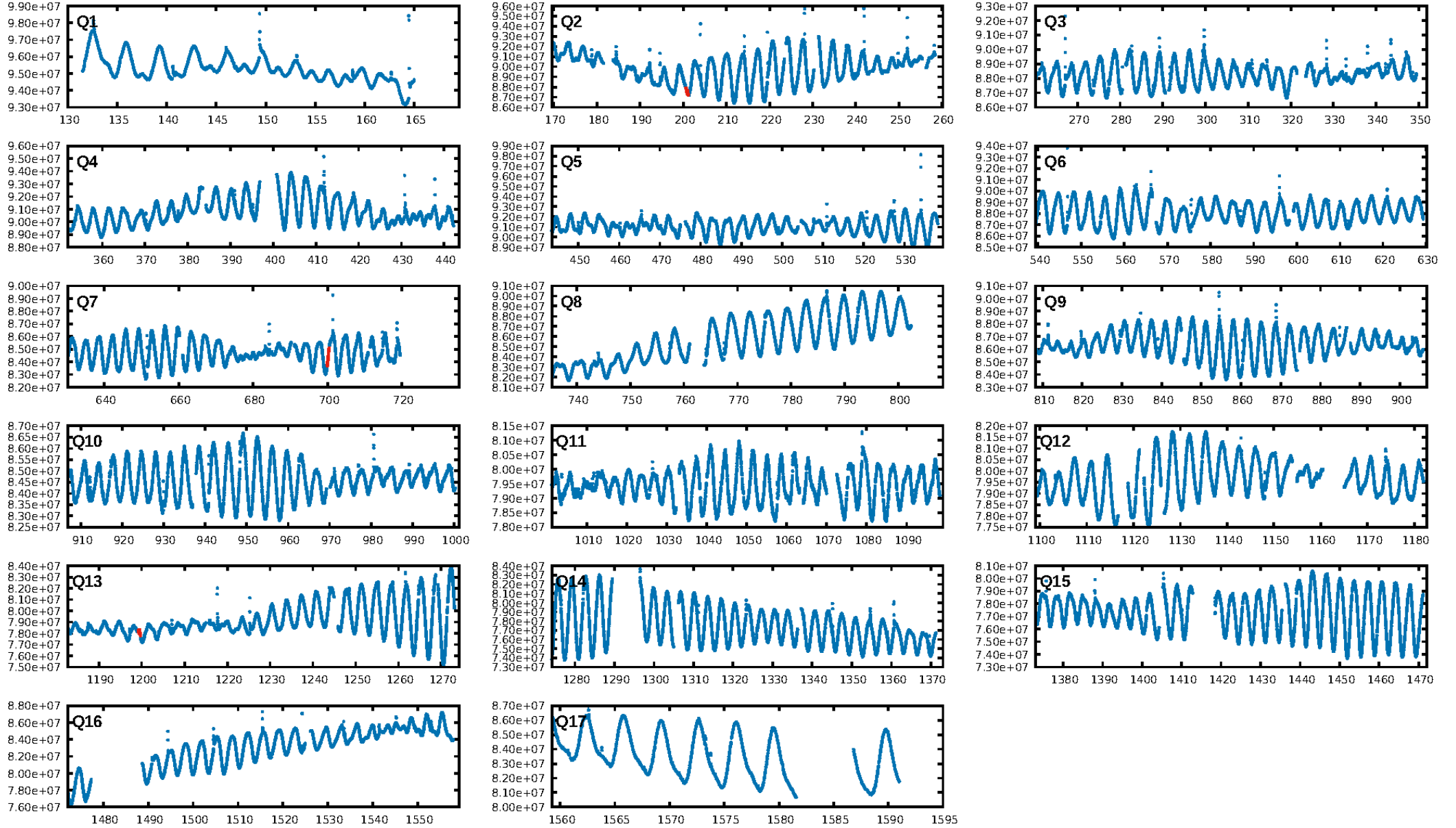
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [184.79 $\sigma$ ]  
LongPeriod-sig: 100.0% [45.46 $\sigma$ ]  
ModelChiSquare2-sig: 1.1%  
ModelChiSquareGof-sig: 97.1%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [3/3]  
**GhostDiagnostic-chr: 0.2648**  
Centroid-sig: N/A  
Centroid-so: 0.259 arcsec [0.27 $\sigma$ ]  
OotOffset-rm: 0.193 arcsec [0.72 $\sigma$ ]  
KicOffset-rm: 0.369 arcsec [1.29 $\sigma$ ]  
OotOffset-st: 1/1/0/0 [2]  
KicOffset-st: 1/1/0/0 [2]  
DiffImageQuality-fgm: 1.00 [2/2]  
DiffImageOverlap-fno: 1.00 [2/2]

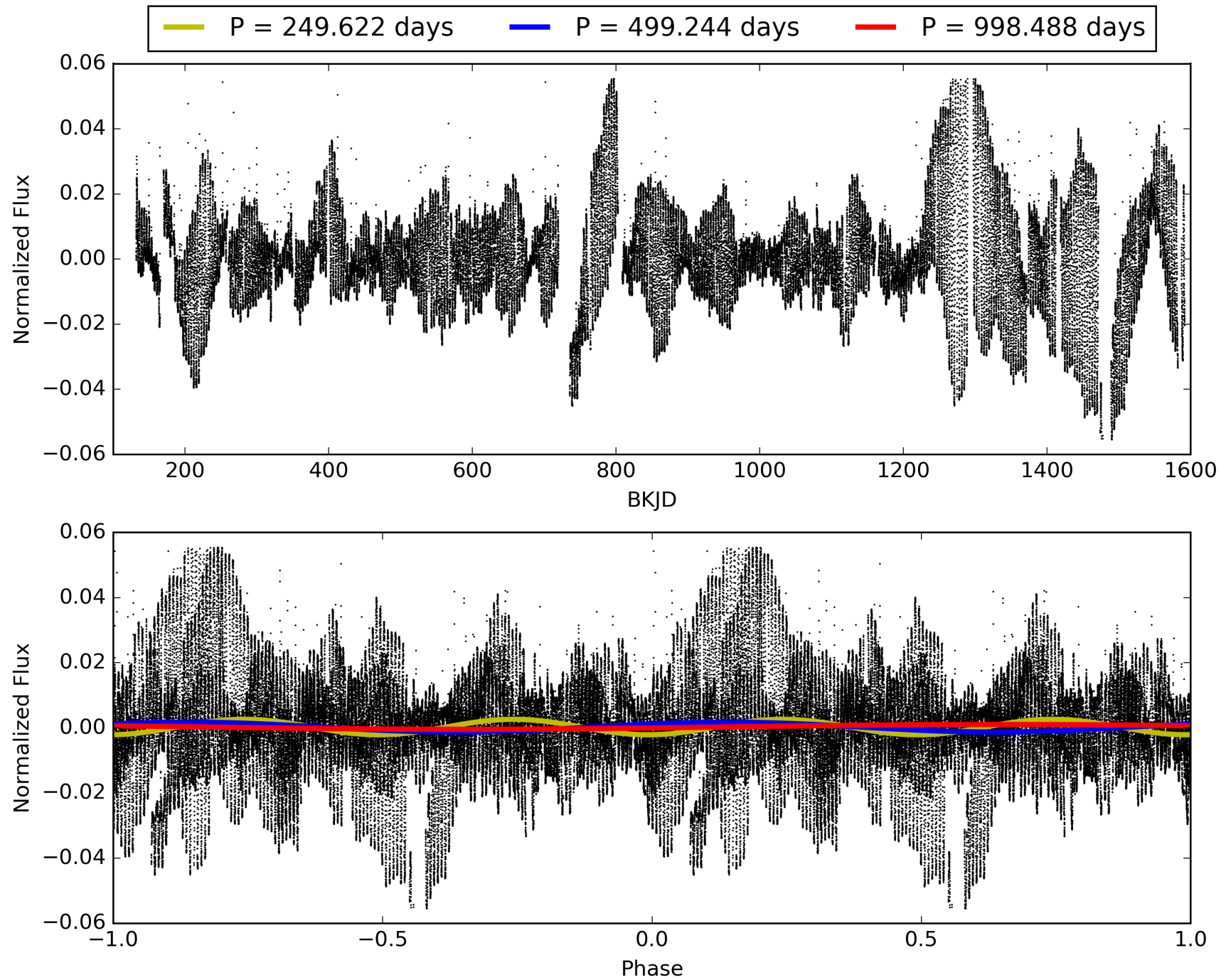
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 05:47:07 Z

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

# TCE 008651471-01, PDC Light Curves



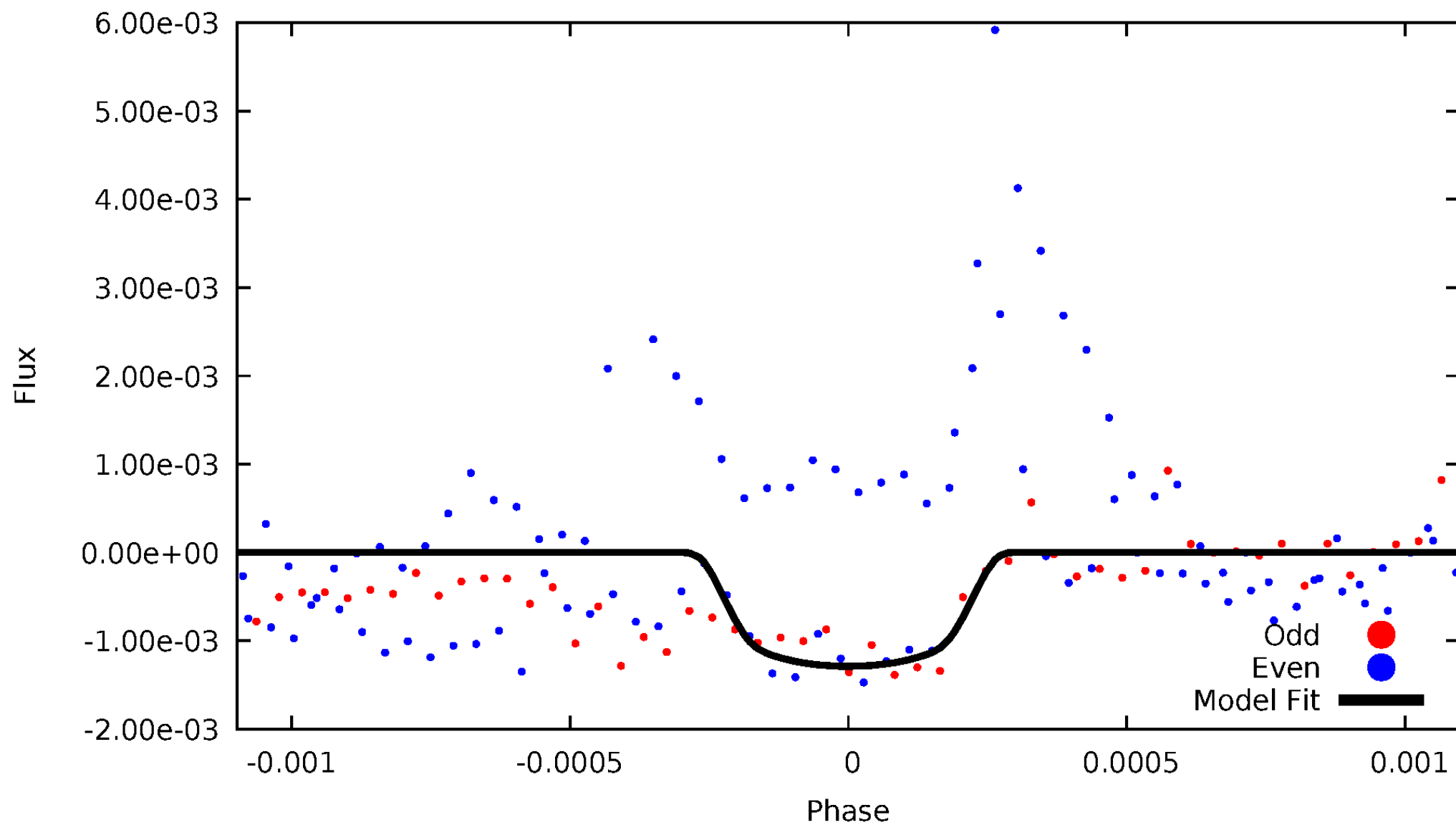
TCE 008651471-01





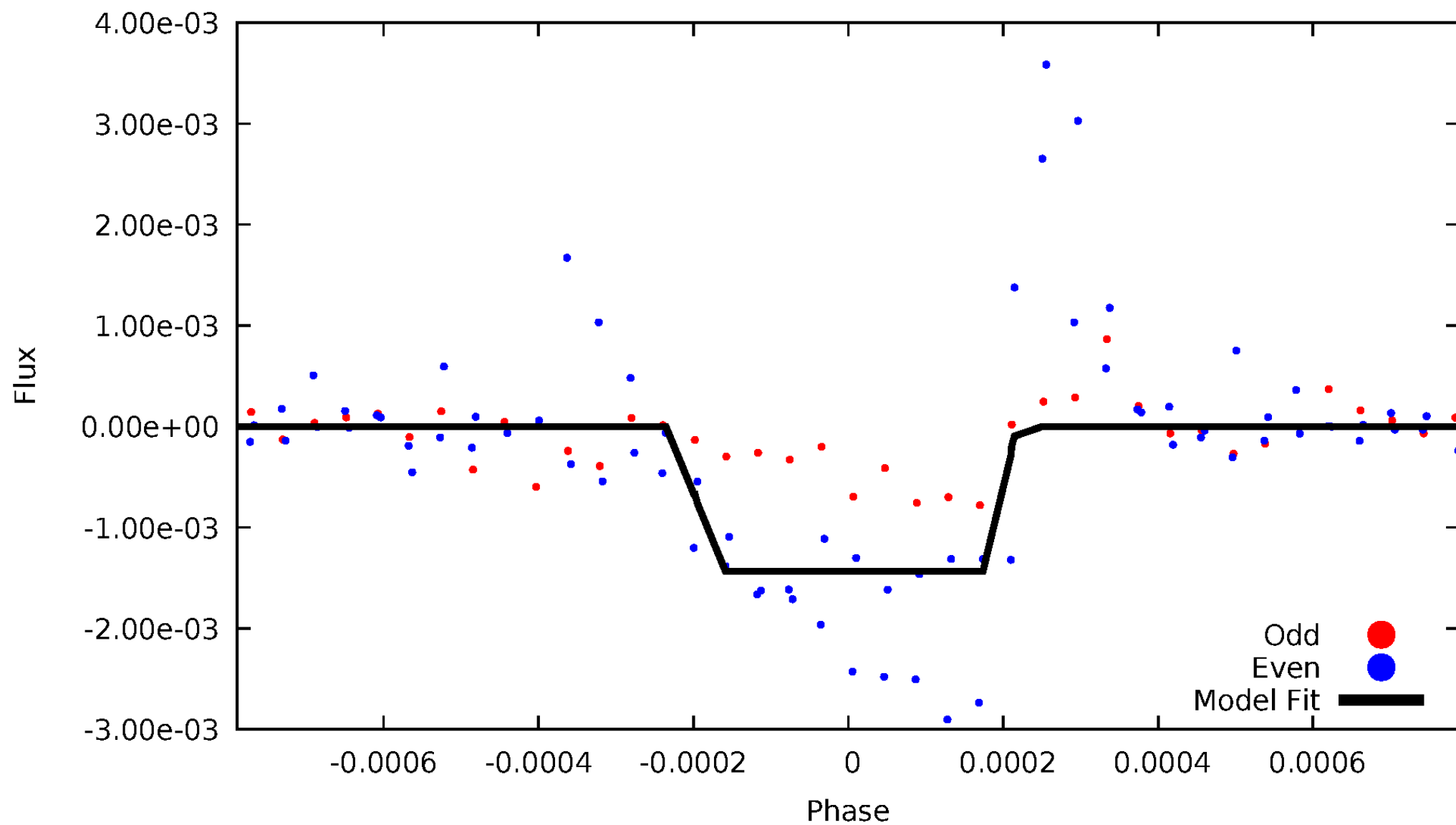
# DV Odd/Even

TCE 008651471-01



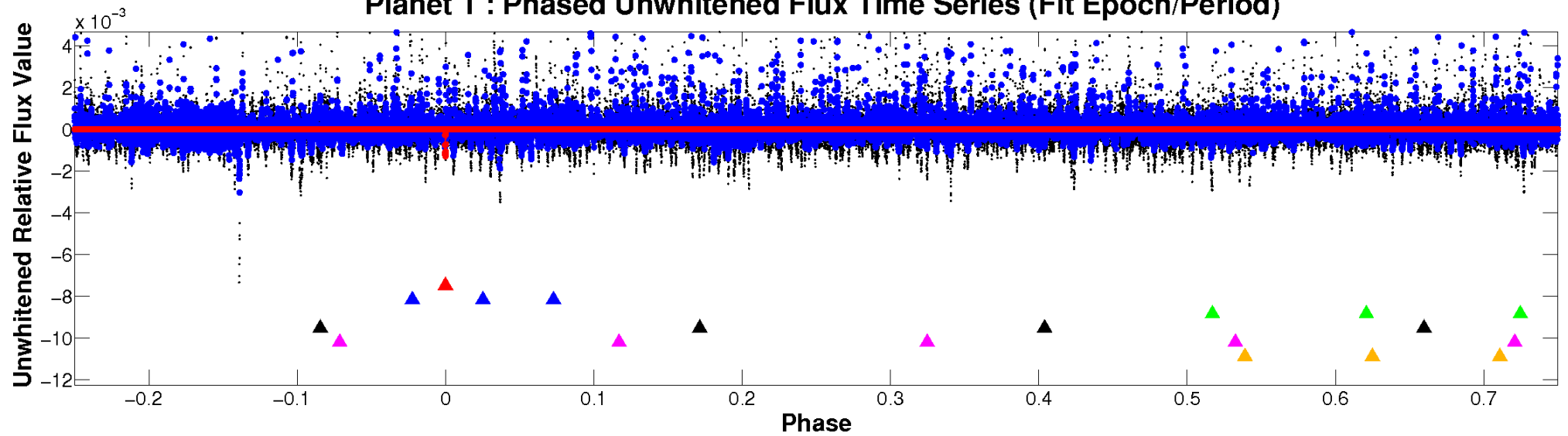
# ALT Odd/Even

TCE 008651471-01

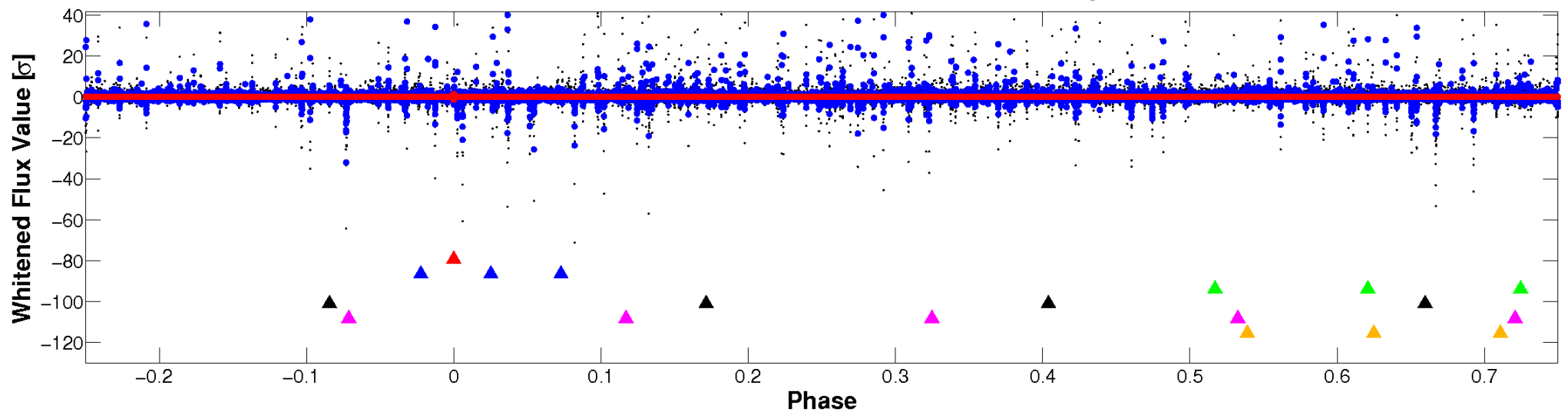


# Non-Whitened Vs. Whitened Light Curve

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

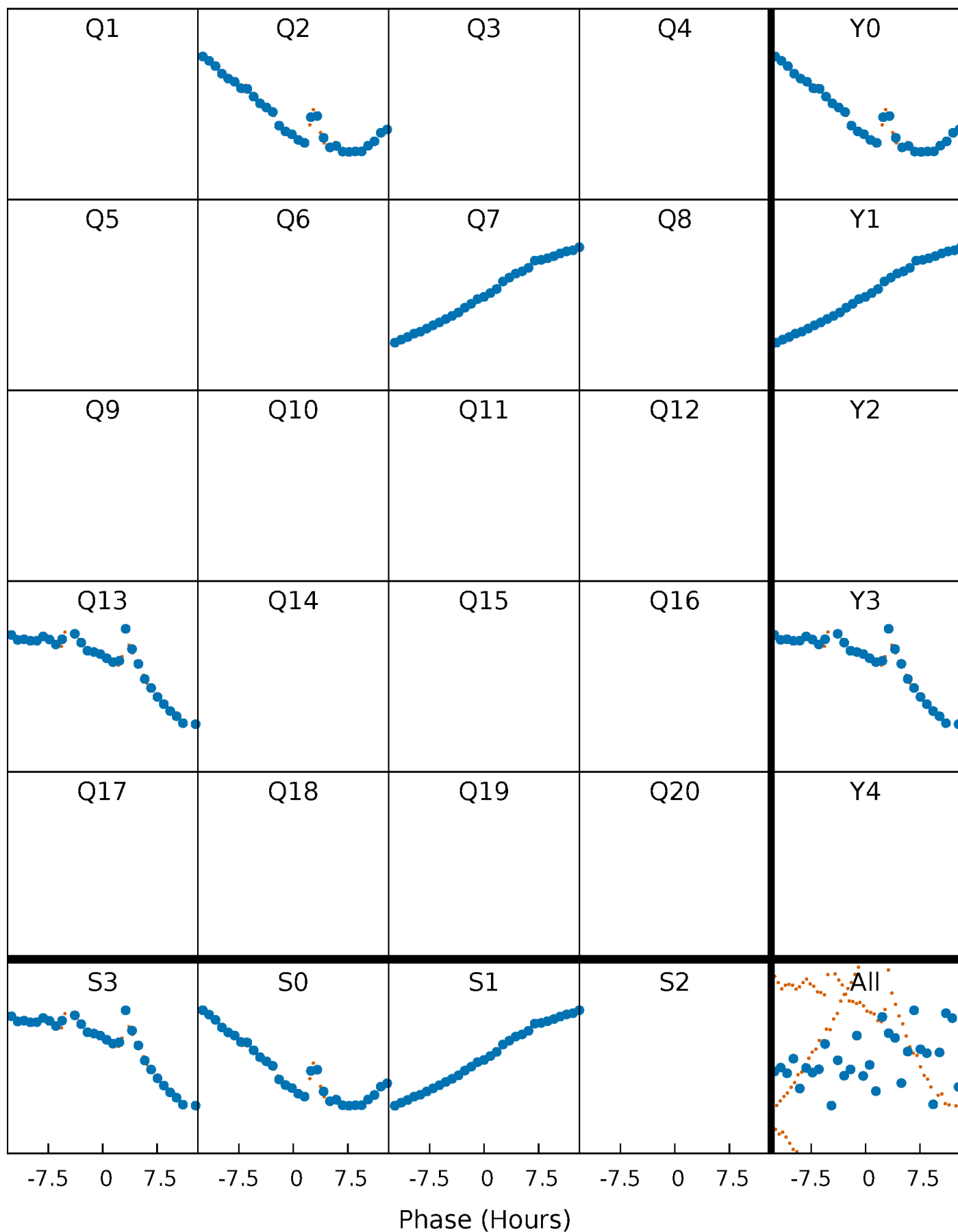


**Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



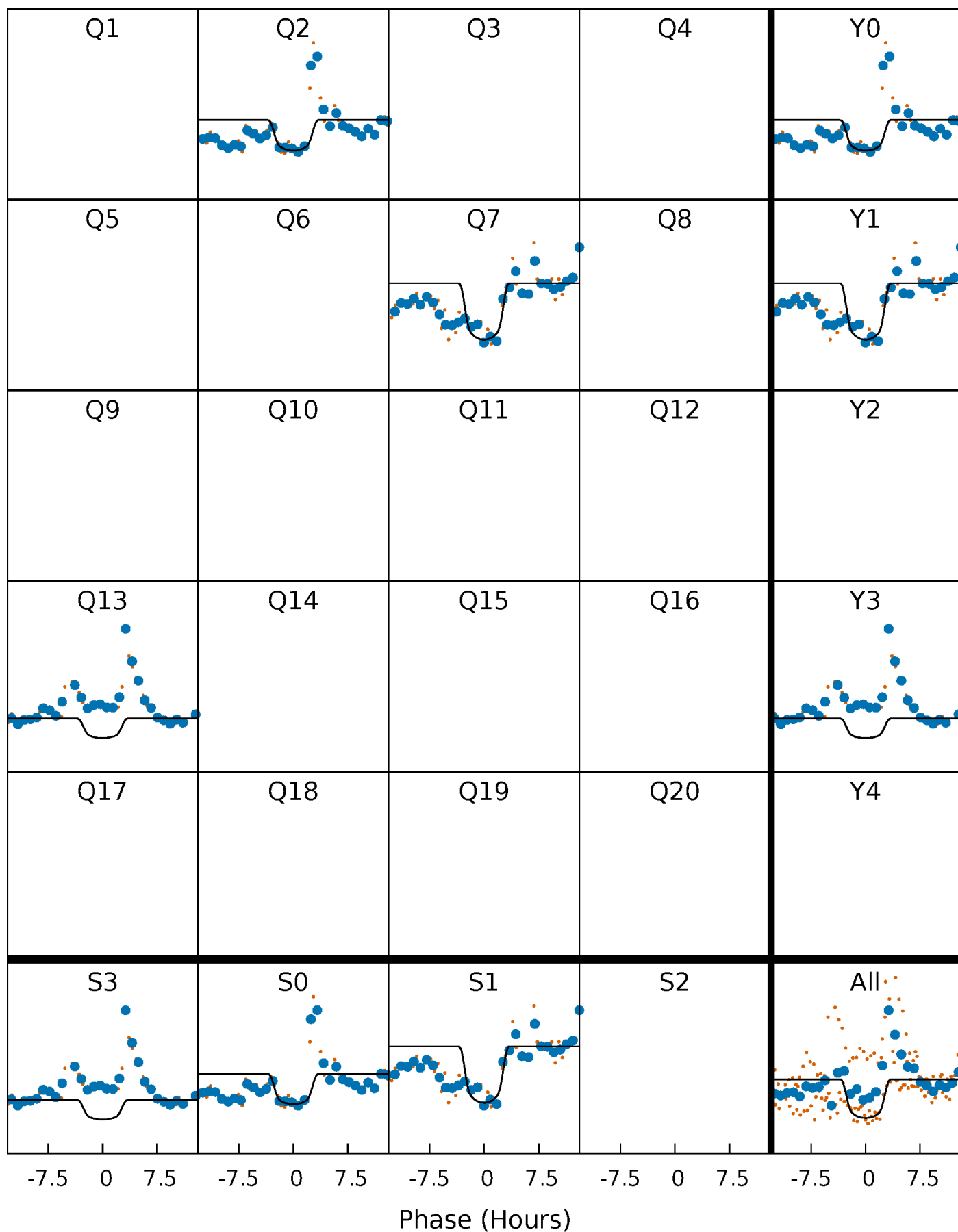
# PDC Quarter-Phased Transit Curves

TCE 008651471-01 P=499.244107 Days  $T_0=200.933797$  (BKJD)



# DV Quarter-Phased Transit Curves

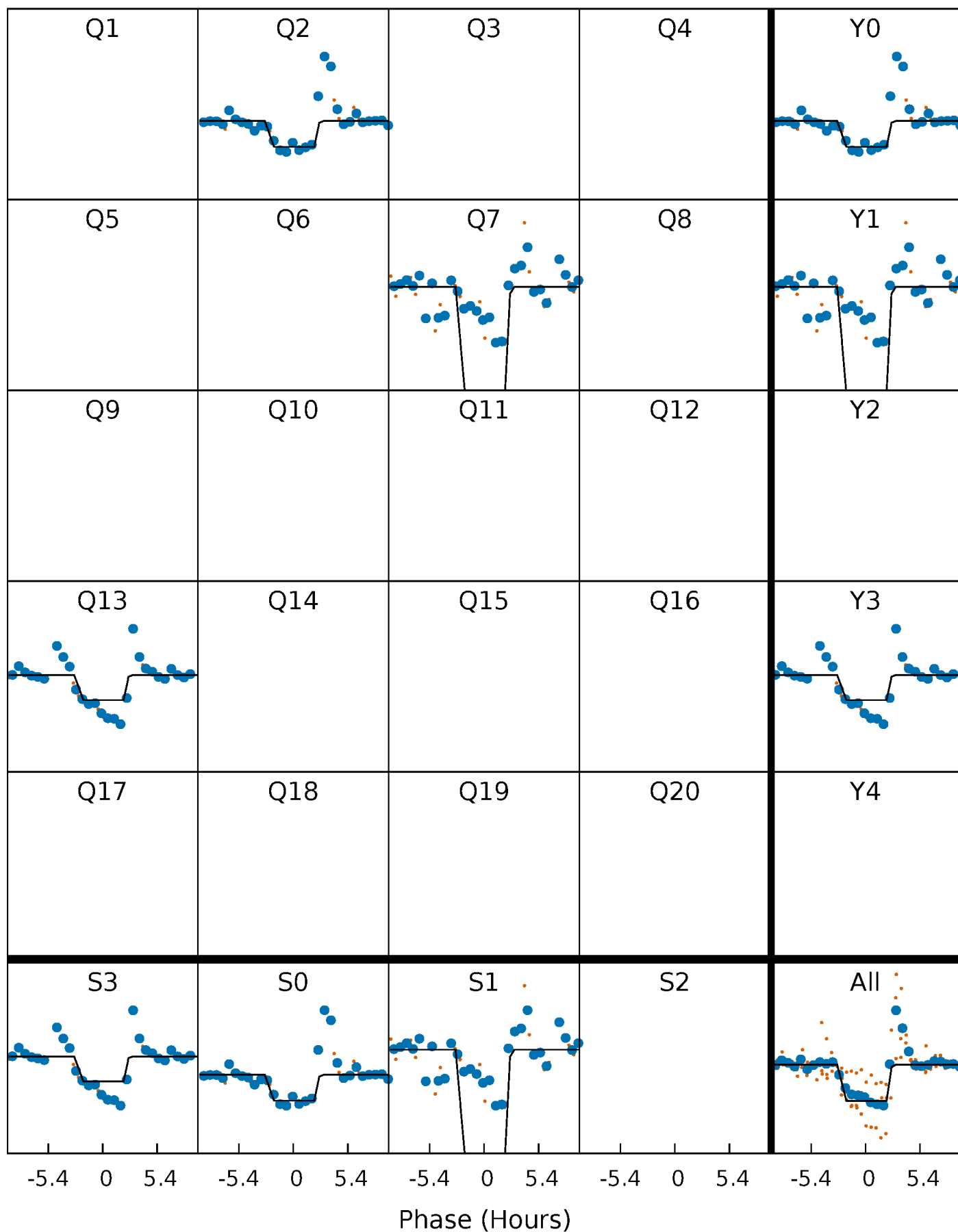
TCE 008651471-01 P=499.244107 Days  $T_0=200.933797$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

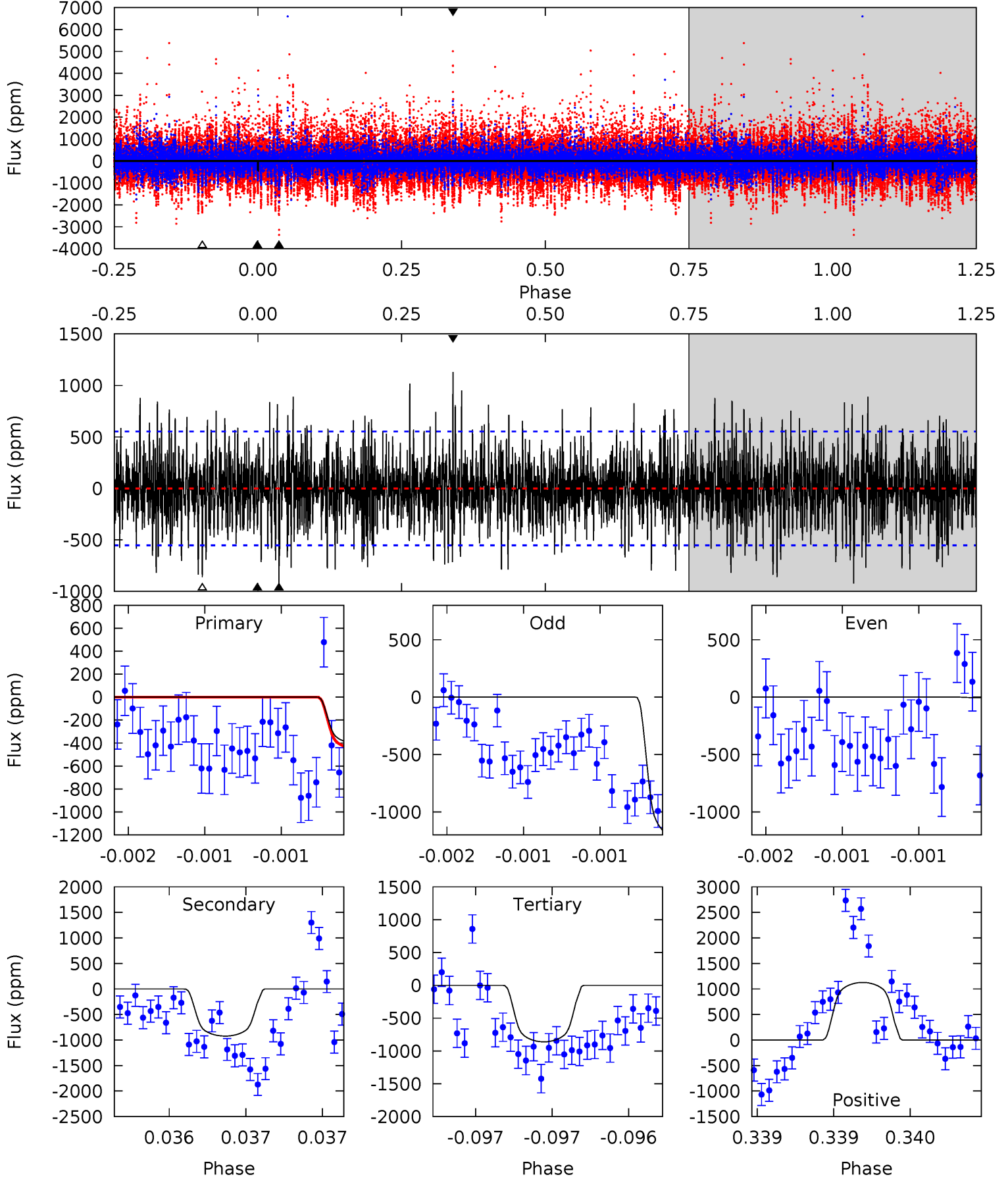
TCE 008651471-01 P=499.253172 Days  $T_0=200.922109$  (BKJD)



# DV Model-Shift Uniqueness Test

008651471-01, P = 499.244107 Days, E = 200.933797 Days

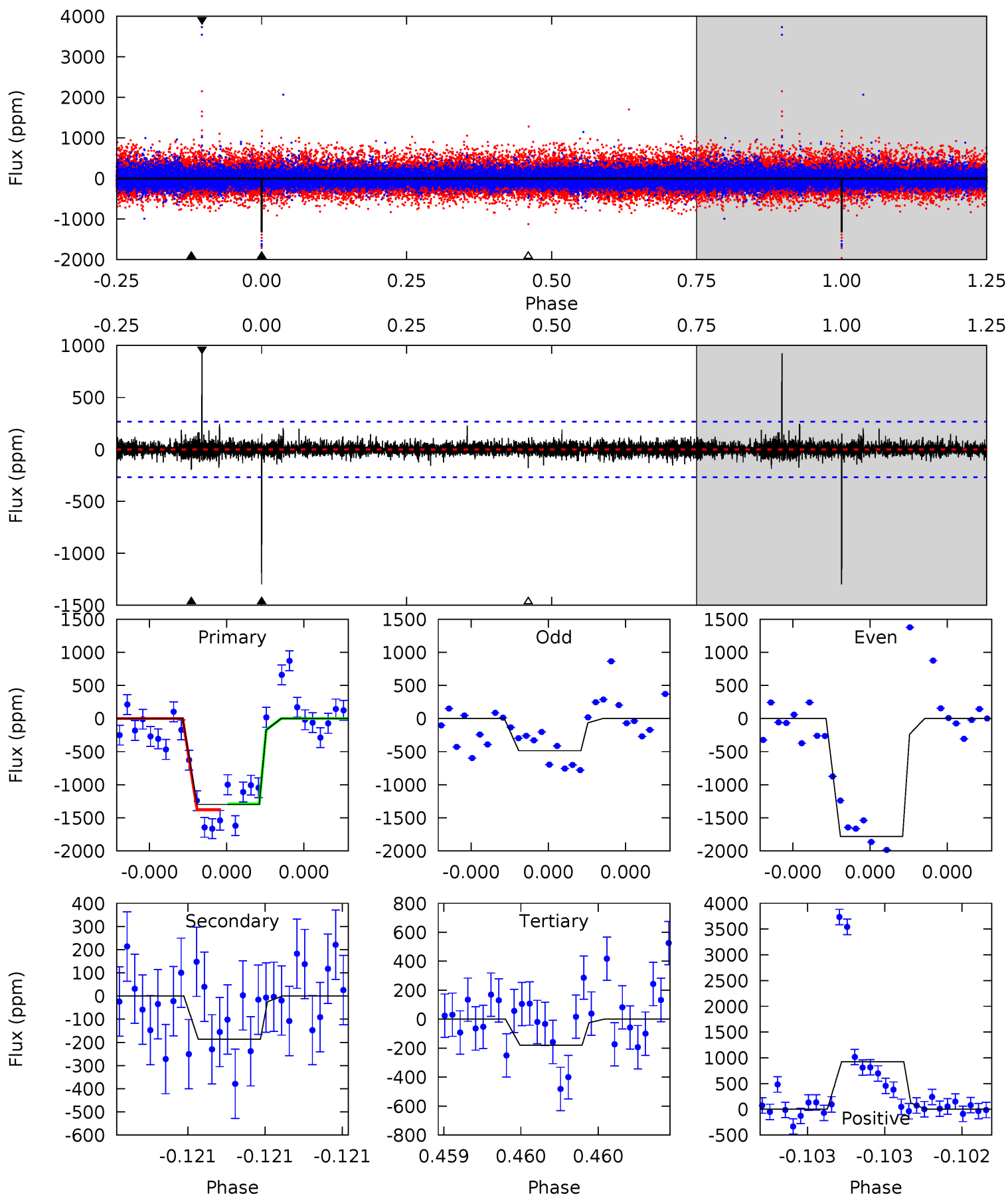
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
4.04	9.27	8.65	11.3	5.55	3.45	2.45	-4.60	-7.29	0.62	-2.06	4.31	0.41	0.55	0.01



# Alt Model-Shift Uniqueness Test

008651471-01, P = 499.253172 Days, E = 200.922109 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
27.2	3.91	3.76	19.4	5.61	3.53	0.75	23.5	7.83	0.15	-15.5	14.7	0.99	0.42	0.96



### Stellar Parameters For KIC 008651471

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M$ ( $M_{\odot}$ )	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$5250^{+158}_{-142}$	$4.522^{+0.085}_{-0.095}$	$-0.360^{+0.350}_{-0.300}$	$0.771^{+0.114}_{-0.085}$	$0.721^{+0.109}_{-0.042}$	$2.217^{+0.883}_{-0.633}$
	+3%/-3%	+2%/-2%	+97%/-83%	+15%/-11%	+15%/-6%	+40%/-29%
Source	PHO1	KIC0	KIC0	DSEP		

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

### Secondary Eclipse Parameters for KIC 008651471-01 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	$-923 \pm 100$	$3.34^{+0.50}_{-0.42}$	$271^{+12}_{-11}$	$4722^{+277}_{-260}$	$56202^{+18830}_{-14206}$
Alt.	$-186 \pm 48$	$3.21^{+0.49}_{-0.44}$	$271^{+13}_{-12}$	$3580^{+225}_{-216}$	$12004^{+5950}_{-3783}$

$T_{\text{max}}$  = 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

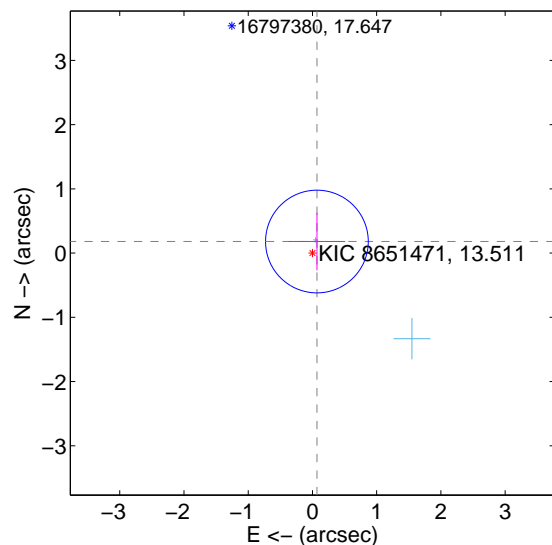
Supplemental centroid analysis for 008651471-01. Kepler magnitude: 13.51. Transit SNR 7.79

There are 2 quarters with good PRF difference image offsets

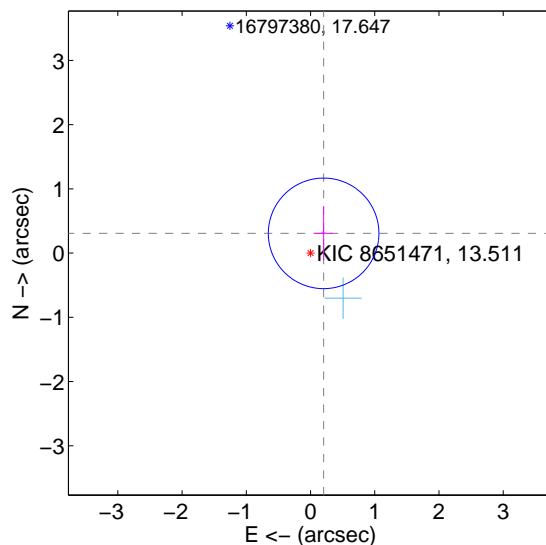
The direct PRF centroid is offset from the target star catalog position by about 1.22 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.193 \pm 0.266$	0.72	$-0.070 \pm 0.439$	$0.180 \pm 0.449$
PRF-fit source offset from KIC position	$0.369 \pm 0.287$	1.29	$-0.204 \pm 0.142$	$0.307 \pm 0.424$
photometric centroid source offset	$0.26 \pm 0.96$	0.27	$-0.08 \pm 1.28$	$-0.24 \pm 0.91$

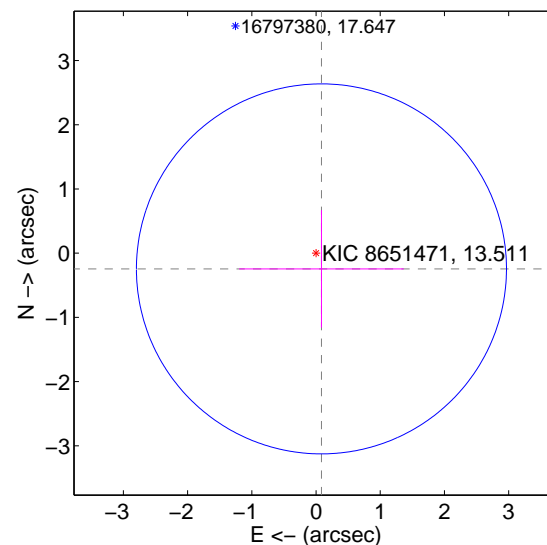
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position



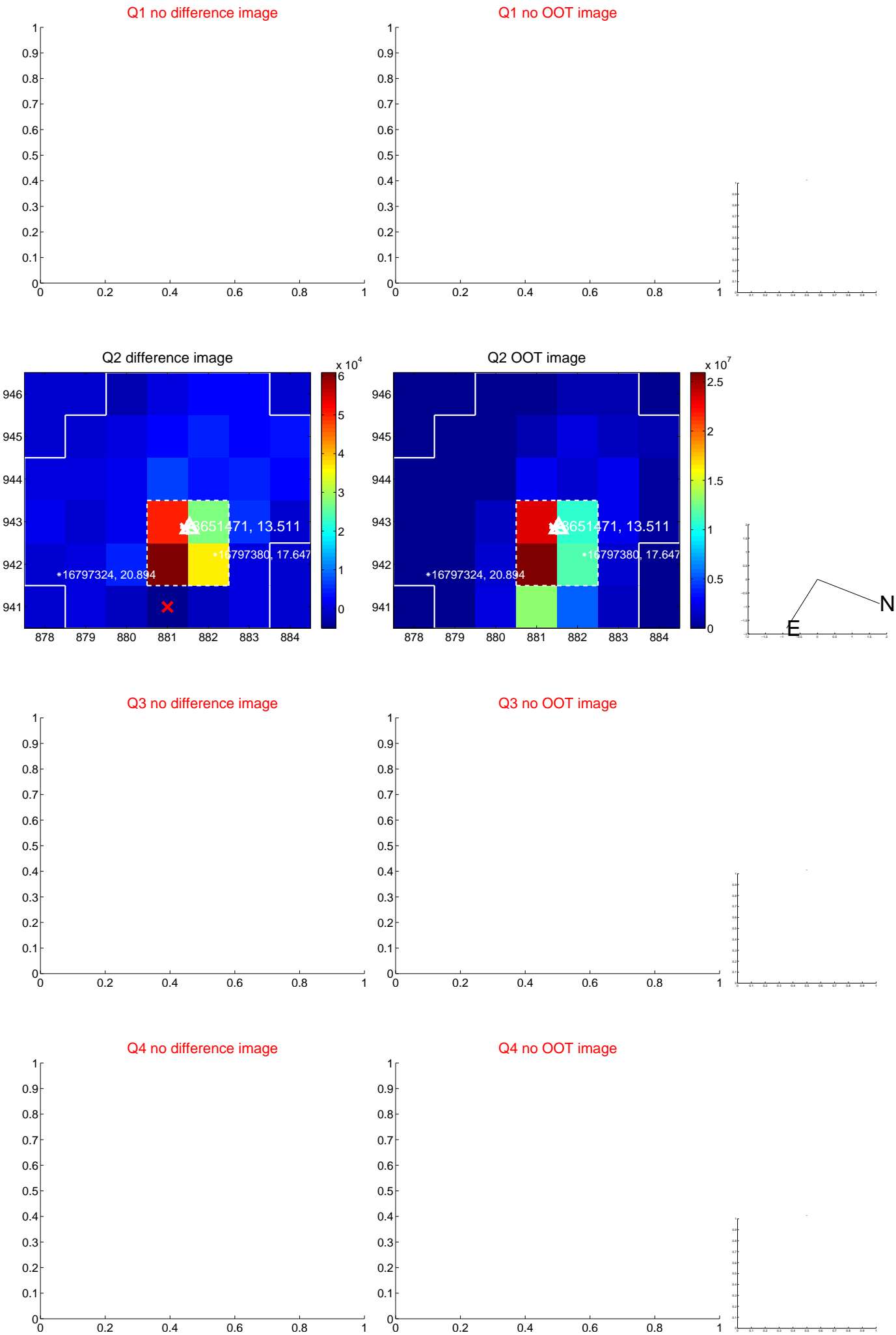
offset from photometric centroids



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.

Q5 no difference image



Q5 no OOT image



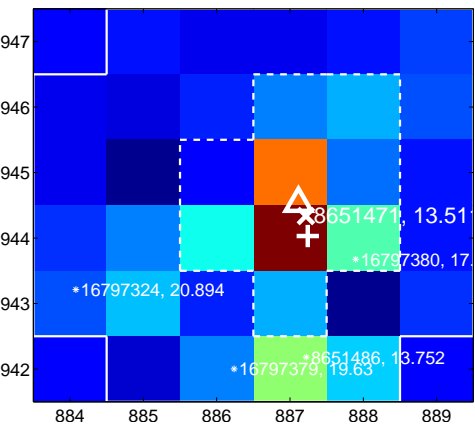
Q6 no difference image



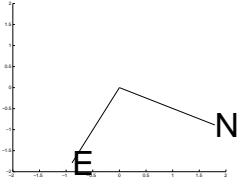
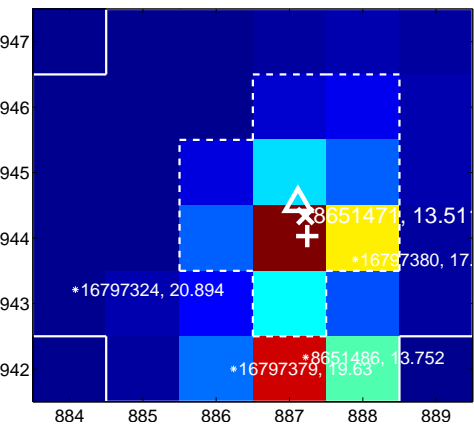
Q6 no OOT image



Q7 difference image



Q7 OOT image



Q8 no difference image



Q8 no OOT image



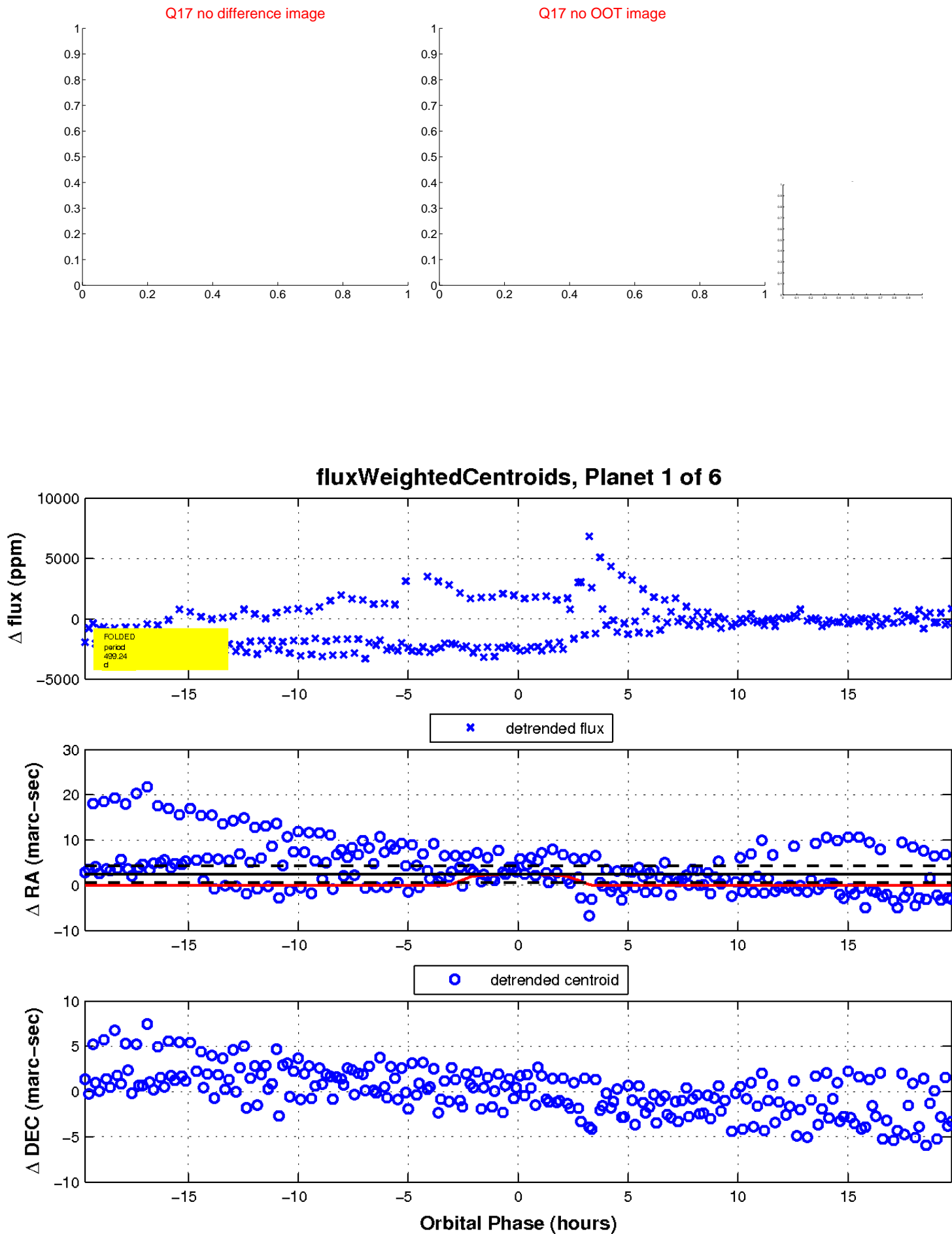
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



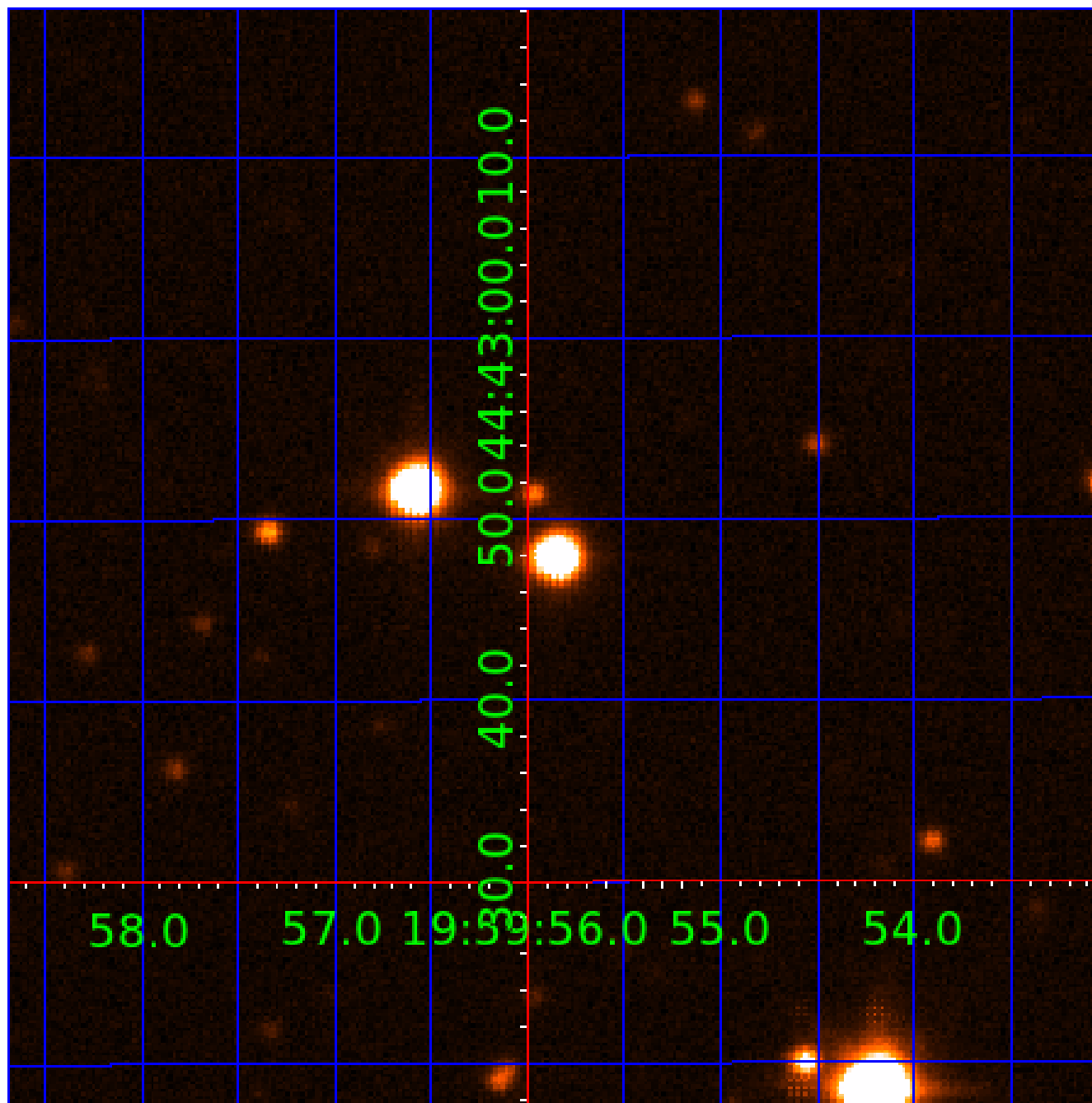
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





UKIRT Image

Declination



# KIC 008651471

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
008651471-01	OBS	No	499.244107	200.933797	1287.9	6.574	14.9	7.8	0.77	5250	3.35	0.33
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008651471-03	OBS	No	447.422049	562.729561	1449.4	1.441	15.8	7.4	0.77	5250	3.20	0.38
008651471-04	OBS	No	371.515168	286.533858	1056.2	3.025	13.7	7.0	0.77	5250	2.61	0.49
008651471-05	OBS	No	301.489511	259.355139	1255.0	4.352	13.2	7.6	0.77	5250	2.76	0.65
008651471-06	OBS	No	542.143214	470.033782	782.2	3.500	13.1	-1.0	0.77	5250	2.12	0.30

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
008651471-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
008651471-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL_TRACKER—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS
008651471-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_TRACKER—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS
008651471-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_ZUMA_TRACKER—LPP_DV—LPP_ALT—MOD_POS_DV—CENT_KIC_POS
008651471-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
008651471-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_SKYE—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—INCONSISTENT_TRANS—CENT_NOFITS

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

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

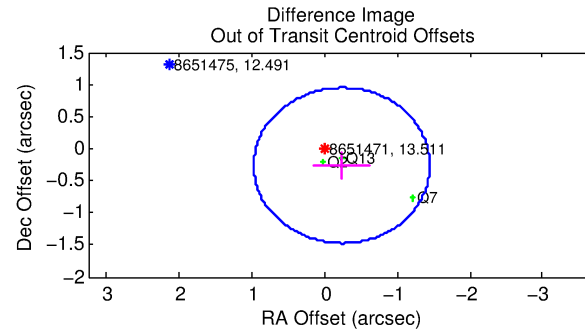
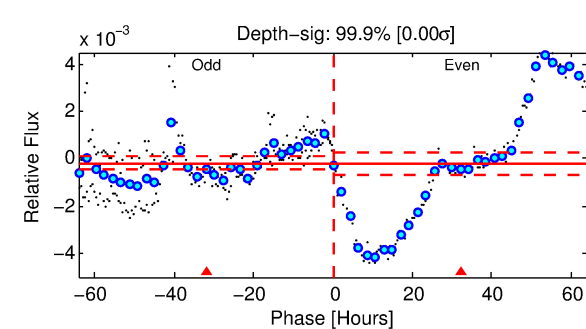
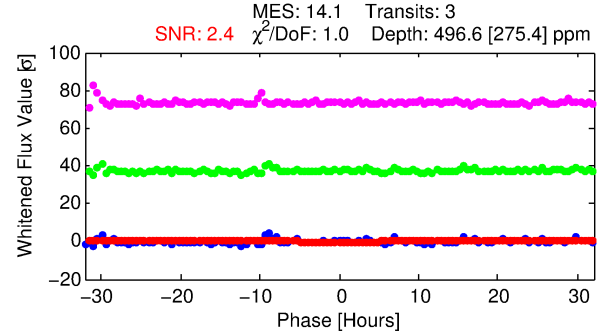
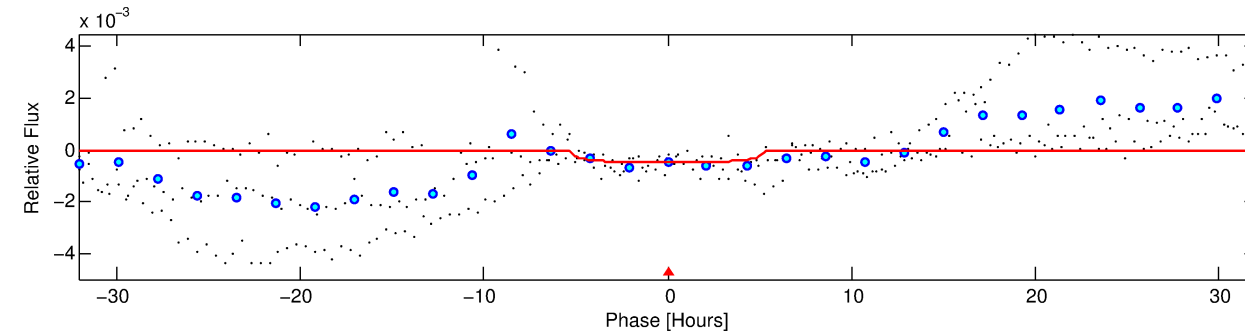
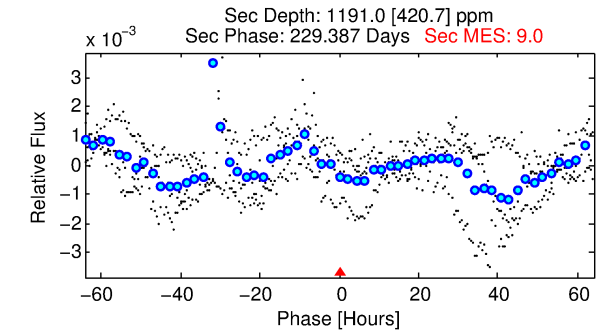
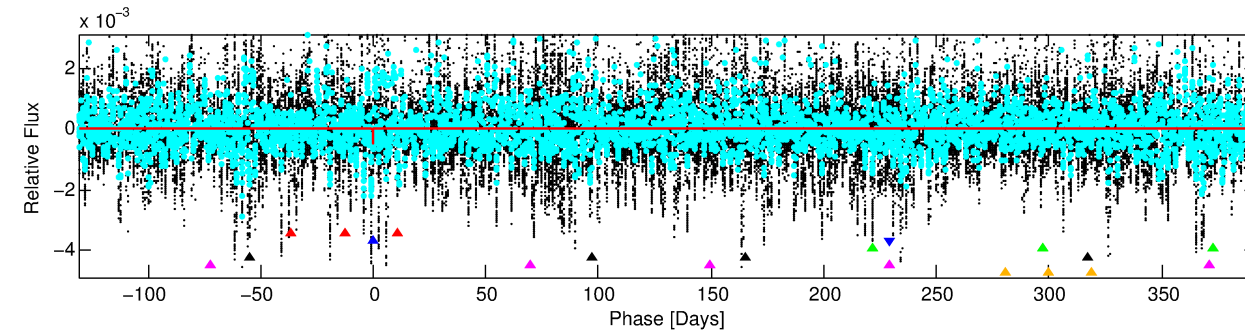
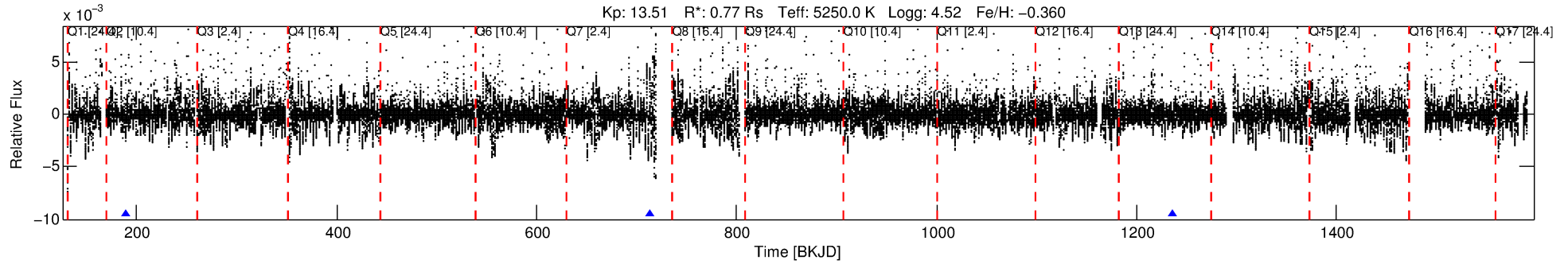
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 008651471-02

No Significant Match Found

# DV One-Page Summary

KIC: 8651471 Candidate: 2 of 6 Period: 523.001 d



## DV Fit Results:

Period = 523.00120 [0.01914] d  
Epoch = 189.7874 [0.0219] BKJD  
Rp/R\* = 0.0207 [0.0270]  
a/R\* = 337.07 [1620.93]  
b = 0.48 [7.77]  
Seff = 0.31 [0.07]  
Teq = 191 [10] K  
Rp = 1.74 [2.29] Re  
a = 1.1396 [0.1397] AU  
Ag = 281473.64 [743773.51] [0.38 $\sigma$ ]  
Teffp = 6784 [4477] K [1.47 $\sigma$ ]

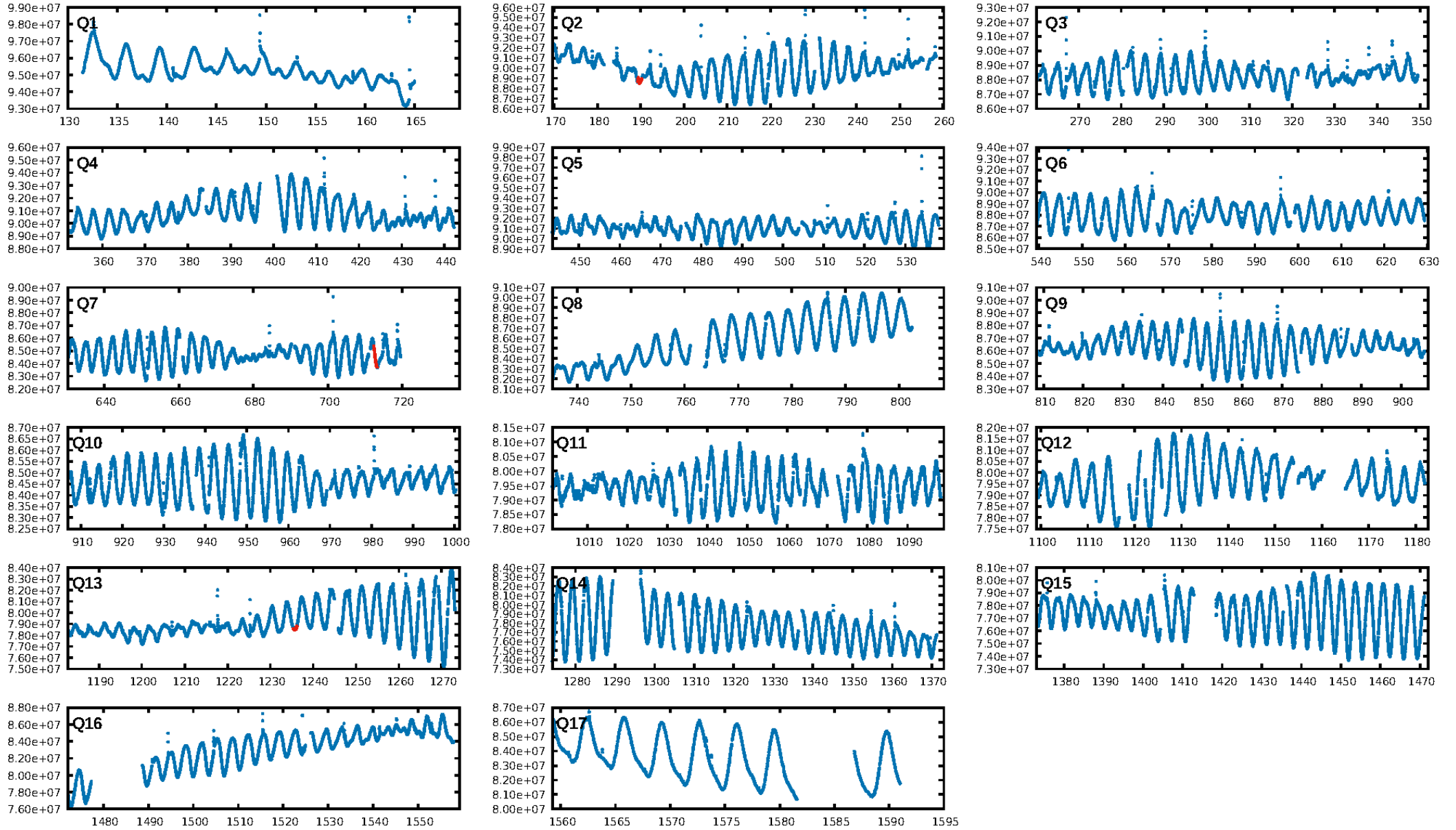
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [45.46 $\sigma$ ]  
LongPeriod-sig: 100.0% [40.87 $\sigma$ ]  
ModelChiSquare2-sig: 65.5%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: -3.238  
Centroid-sig: N/A  
Centroid-so: 3.740 arcsec [1.08 $\sigma$ ]  
OotOffset-rm: 0.356 arcsec [0.88 $\sigma$ ]  
OotOffset-st: 1/1/0/1 [3]  
KicOffset-rm: 0.058 arcsec [0.54 $\sigma$ ]  
KicOffset-st: 1/1/0/1 [3]  
DiffImageQuality-fgm: 1.00 [3/3]  
DiffImageOverlap-fno: 1.00 [3/3]

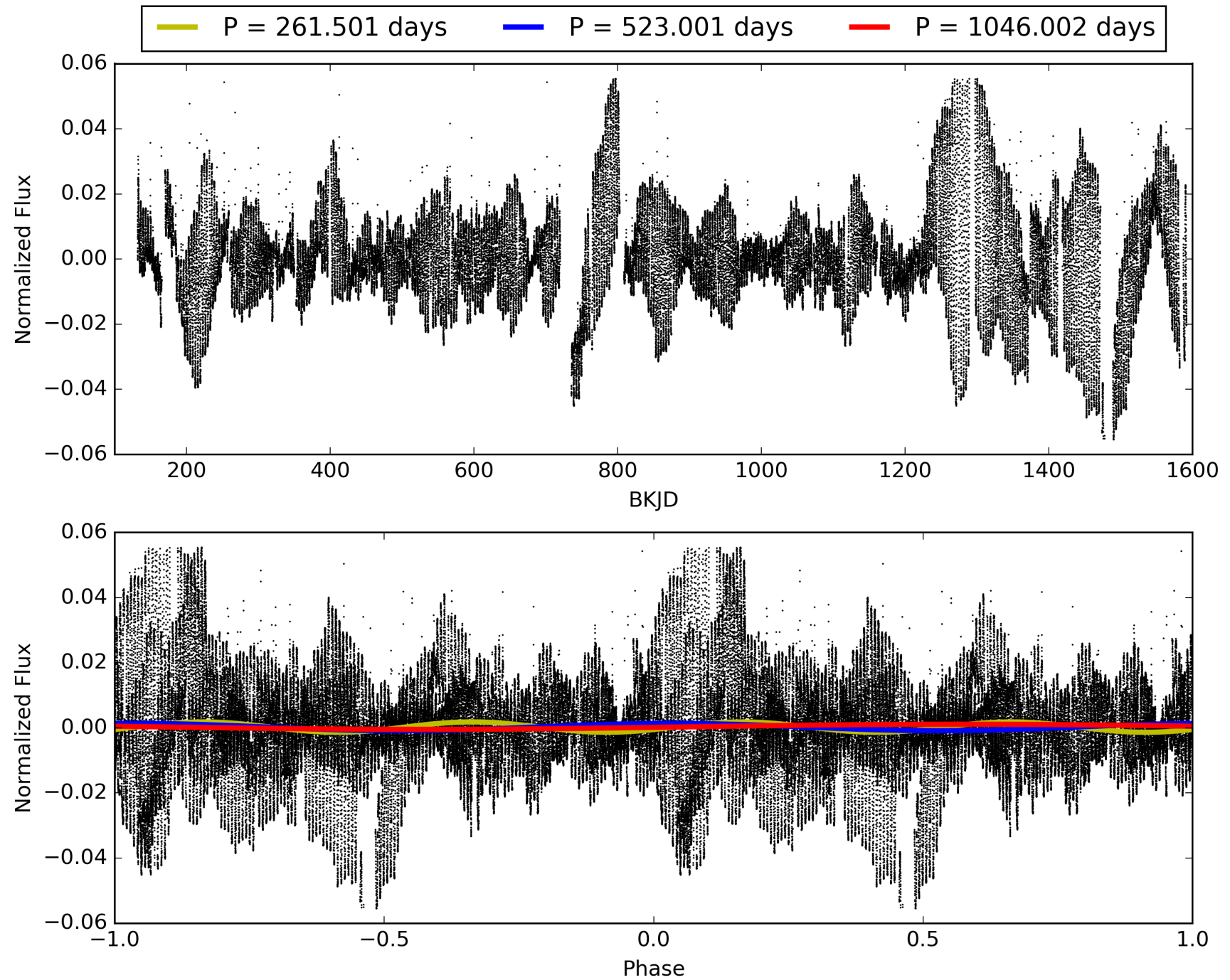
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 05:47:17 Z

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

# TCE 008651471-02, PDC Light Curves



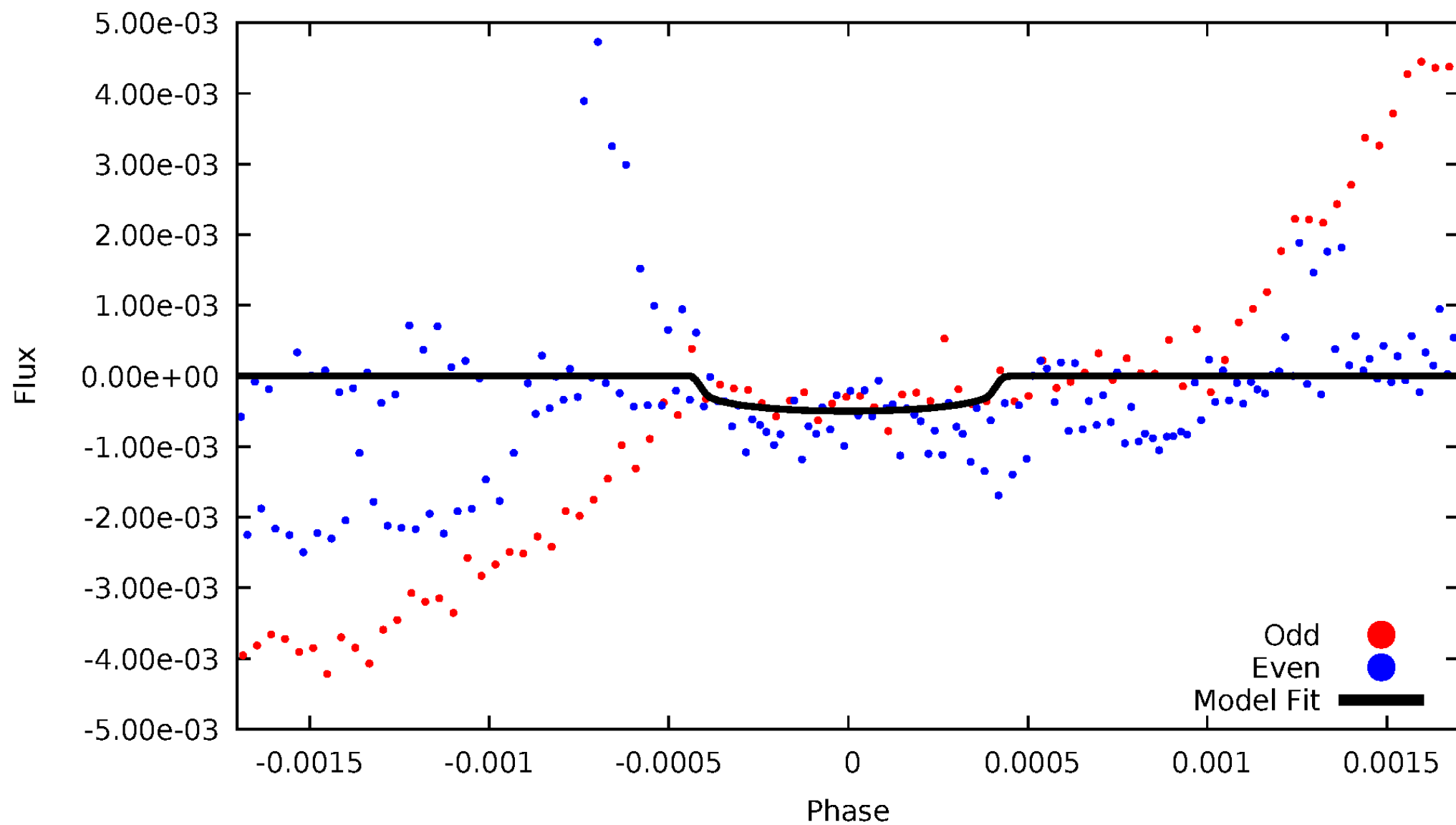
# TCE 008651471-02





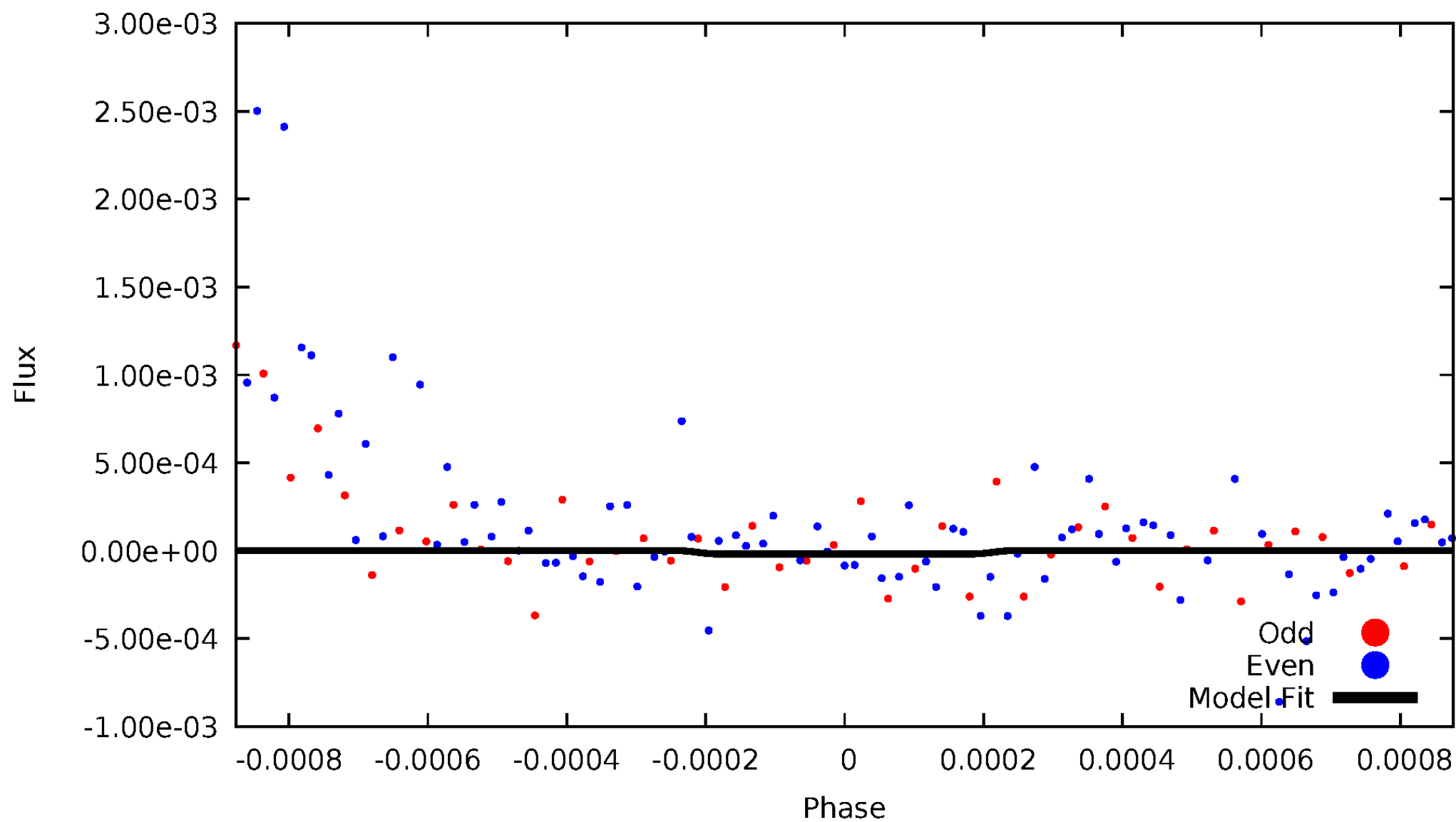
# DV Odd/Even

TCE 008651471-02



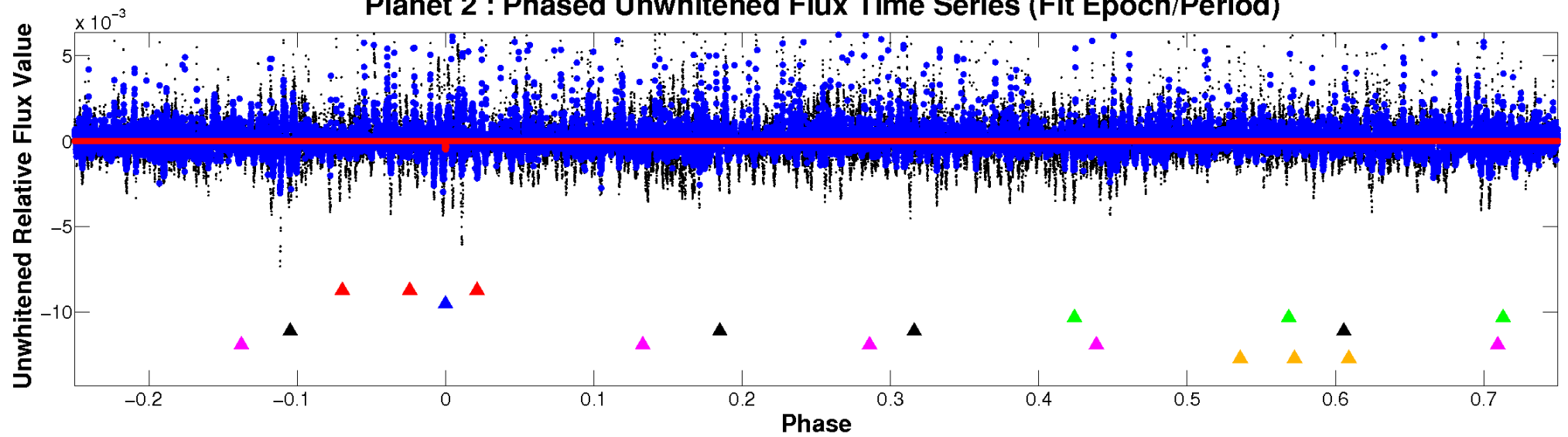
# ALT Odd/Even

TCE 008651471-02

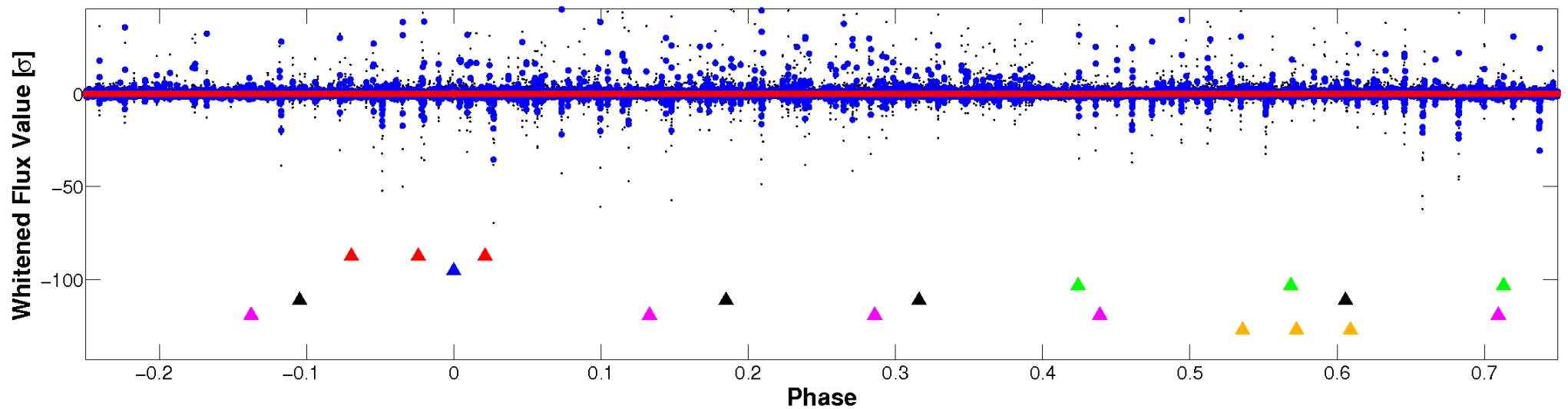


# Non-Whitened Vs. Whitened Light Curve

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

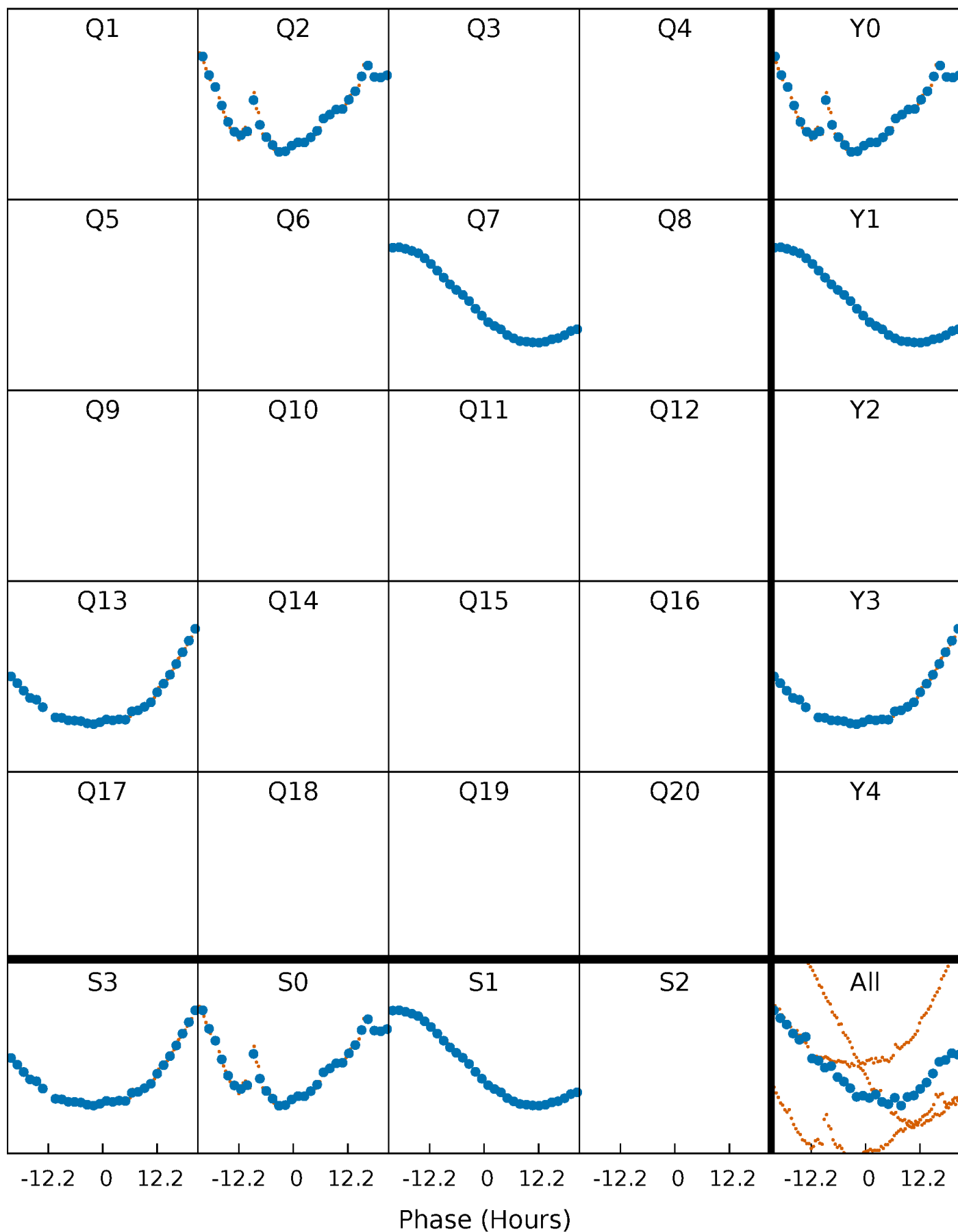


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



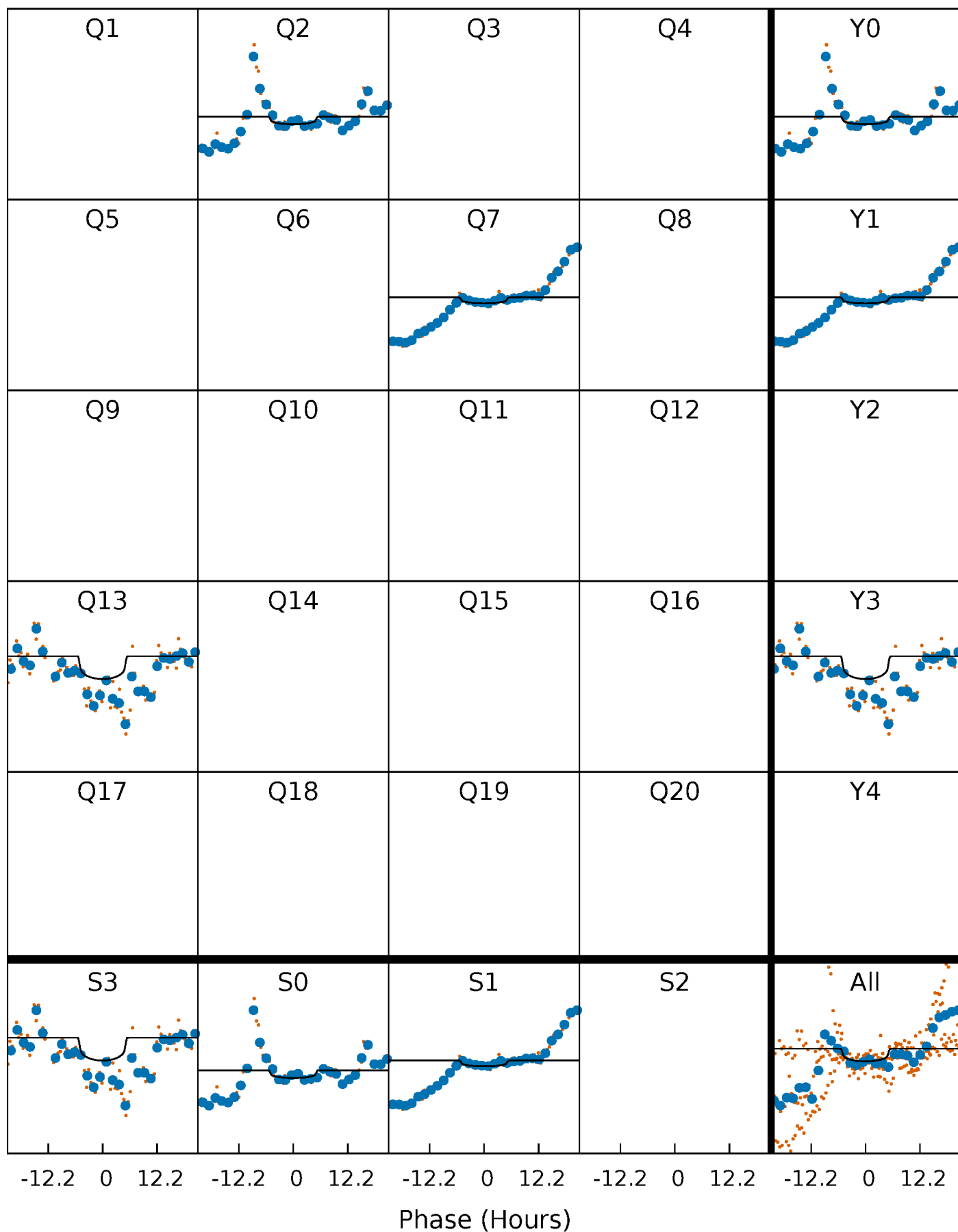
# PDC Quarter-Phased Transit Curves

TCE 008651471-02 P=523.001201 Days  $T_0=189.787383$  (BKJD)



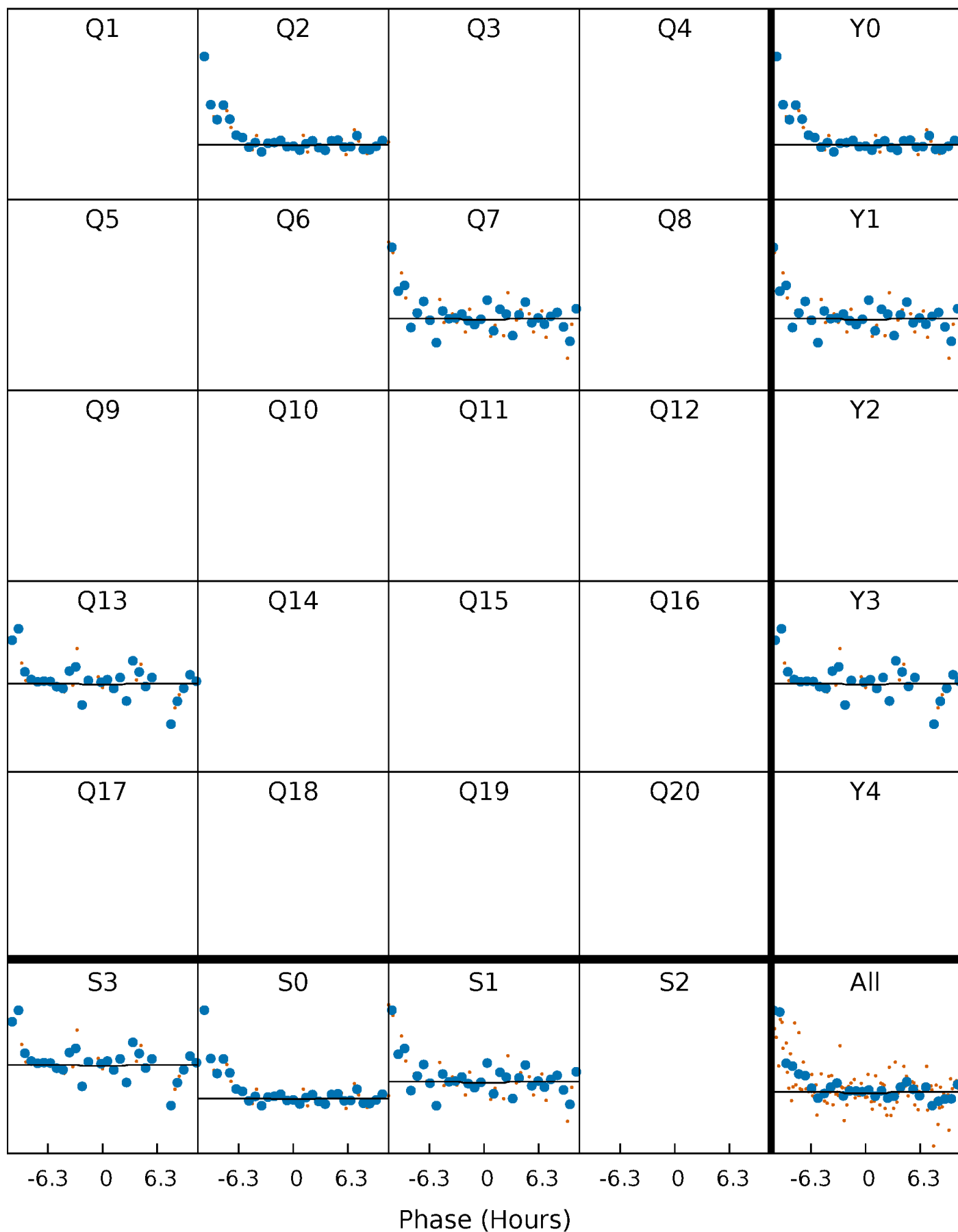
# DV Quarter-Phased Transit Curves

TCE 008651471-02 P=523.001201 Days  $T_0=189.787383$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

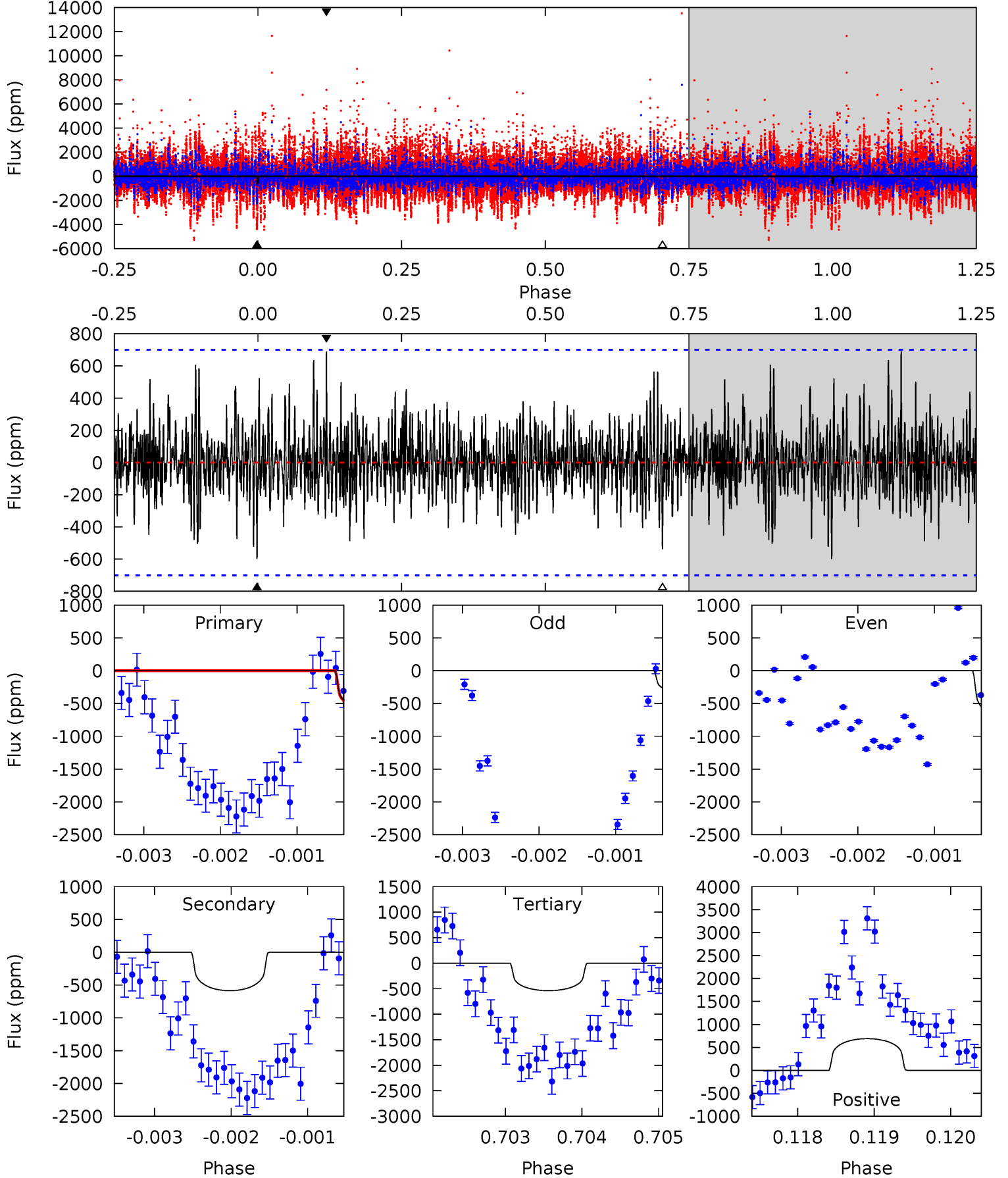
TCE 008651471-02 P=522.561052 Days  $T_0=189.885167$  (BKJD)



# DV Model-Shift Uniqueness Test

008651471-02, P = 523.001201 Days, E = 189.787383 Days

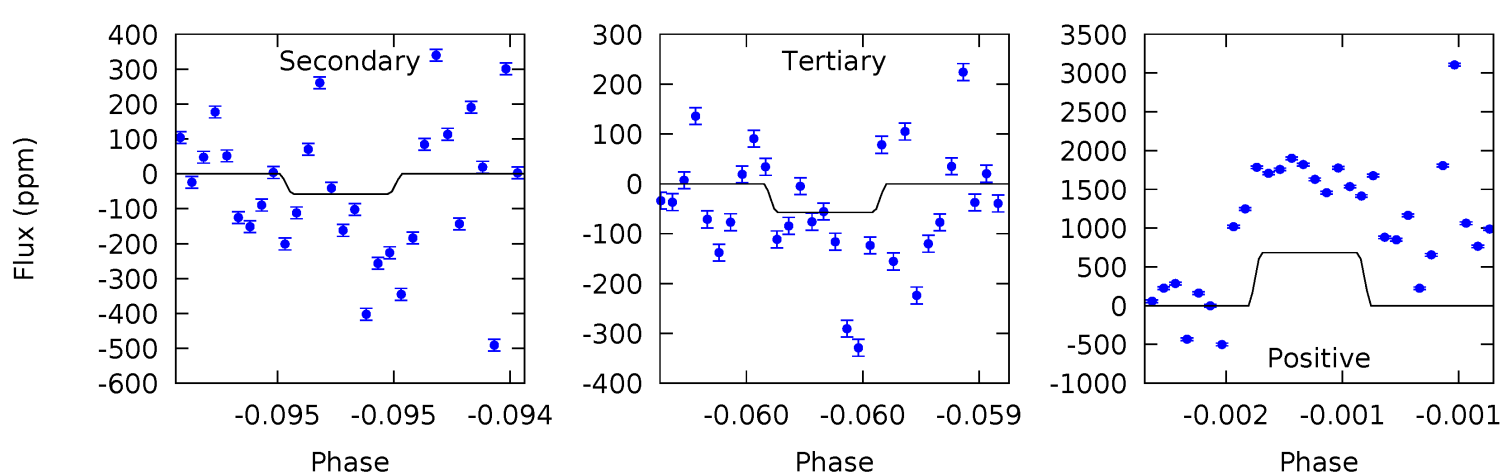
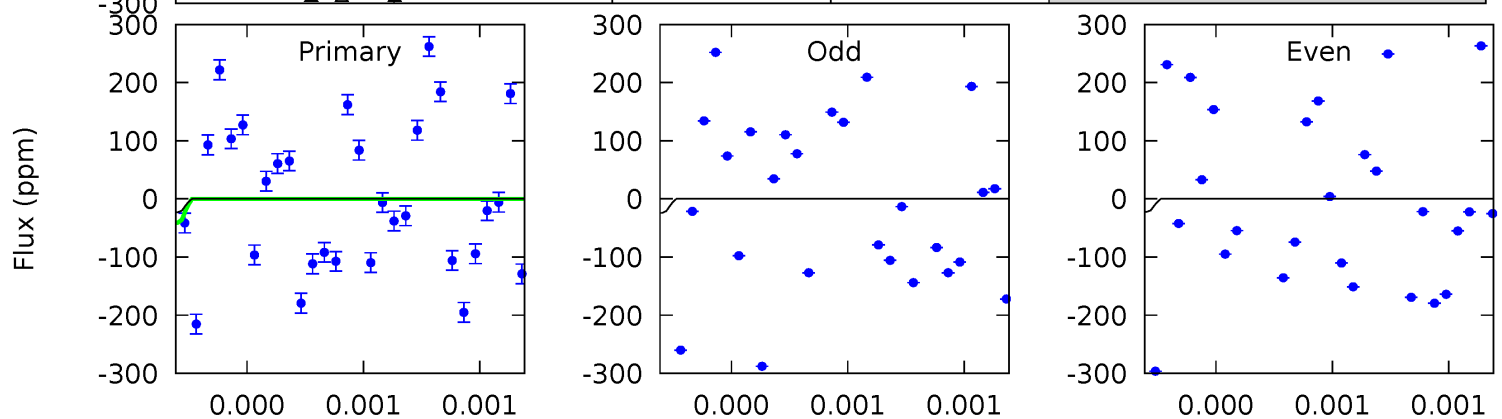
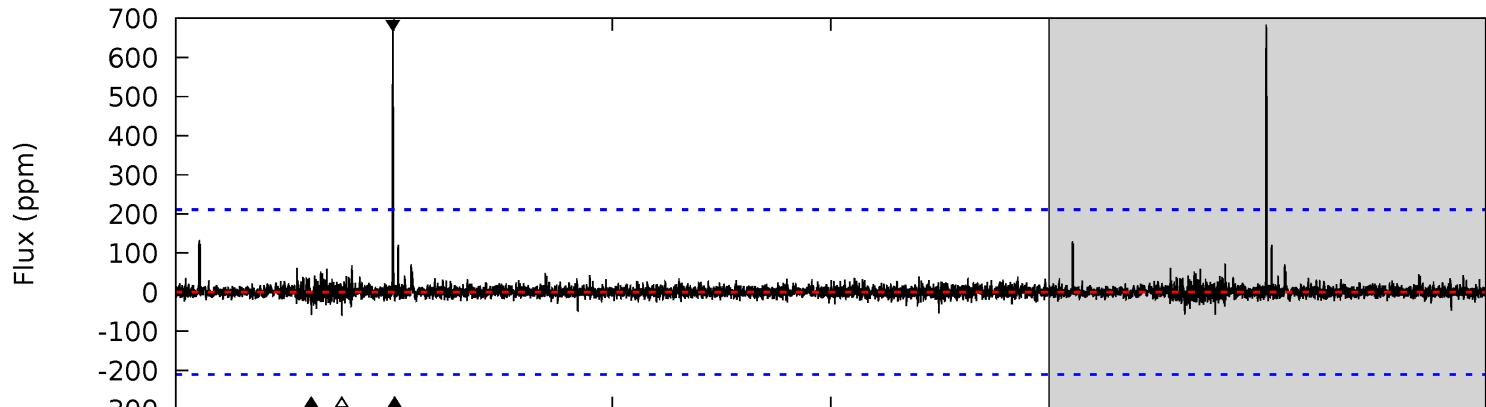
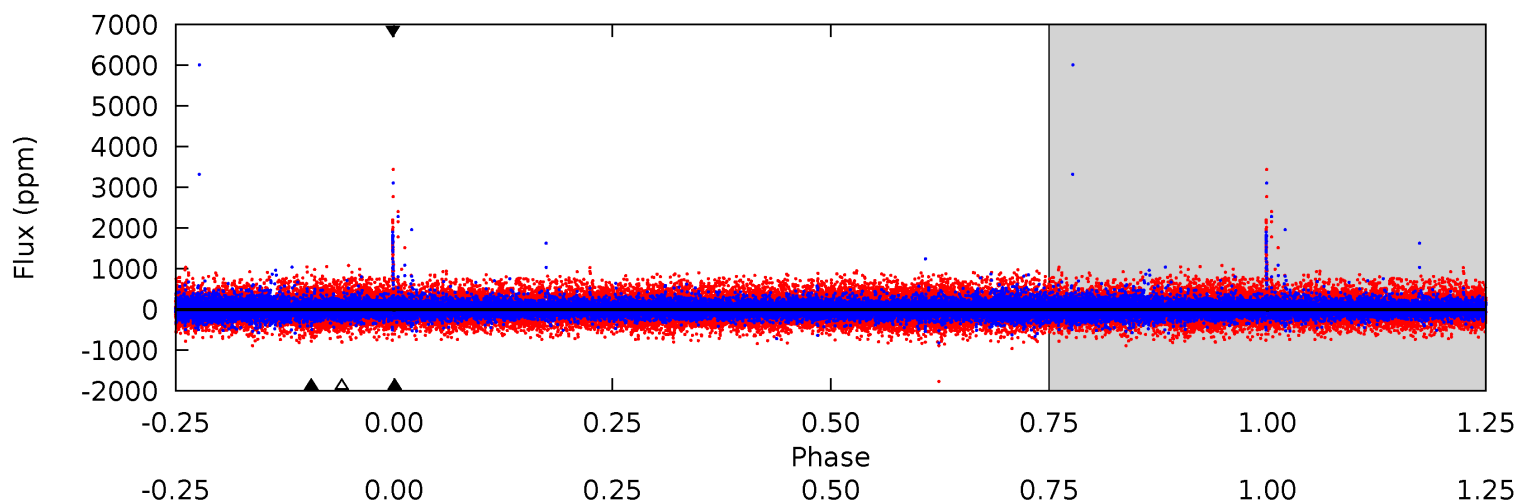
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
4.68	4.58	4.20	5.39	5.47	3.33	1.28	0.48	-0.71	0.37	-0.81	1.21	1.18	0.54	0.08



# Alt Model-Shift Uniqueness Test

008651471-02, P = 522.561052 Days, E = 189.885167 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
0.61	1.53	1.52	18.2	5.59	3.51	0.51	-0.91	-17.5	0.01	-16.6	0.02	0.99	0.92	0.50





### Stellar Parameters For KIC 008651471

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$5250^{+158}_{-142}$	$4.522^{+0.085}_{-0.095}$	$-0.360^{+0.350}_{-0.300}$	$0.771^{+0.114}_{-0.085}$	$0.721^{+0.109}_{-0.042}$	$2.217^{+0.883}_{-0.633}$
	+3%/-3%	+2%/-2%	+97%/-83%	+15%/-11%	+15%/-6%	+40%/-29%
Source	PHO1	KIC0	KIC0	DSEP		

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

### Secondary Eclipse Parameters for KIC 008651471-02 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	$-586 \pm 128$	$2.62^{+2.08}_{-1.55}$	$266^{+13}_{-11}$	$4737^{+2526}_{-954}$	$62955^{+289520}_{-44213}$
Alt.	$-58 \pm 38$	$1.66^{+1.74}_{-1.11}$	$268^{+12}_{-11}$	$3576^{+2146}_{-861}$	$12652^{+124064}_{-10727}$

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

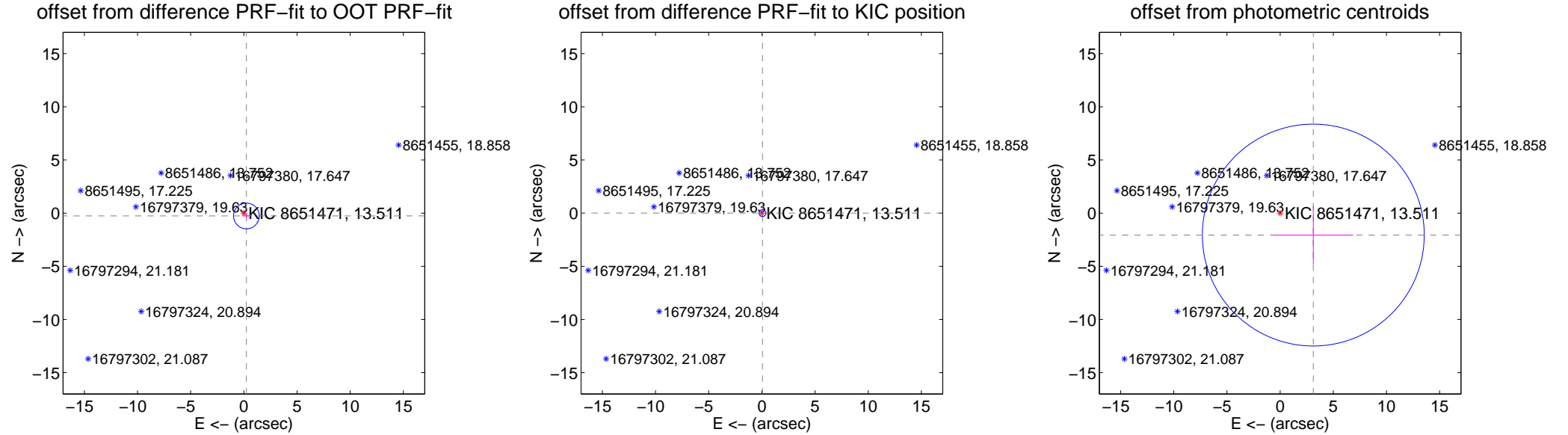
## DV Centroid Data

Supplemental centroid analysis for 008651471-02. Kepler magnitude: 13.51. Transit SNR 2.37

There are 3 quarters with good PRF difference image offsets

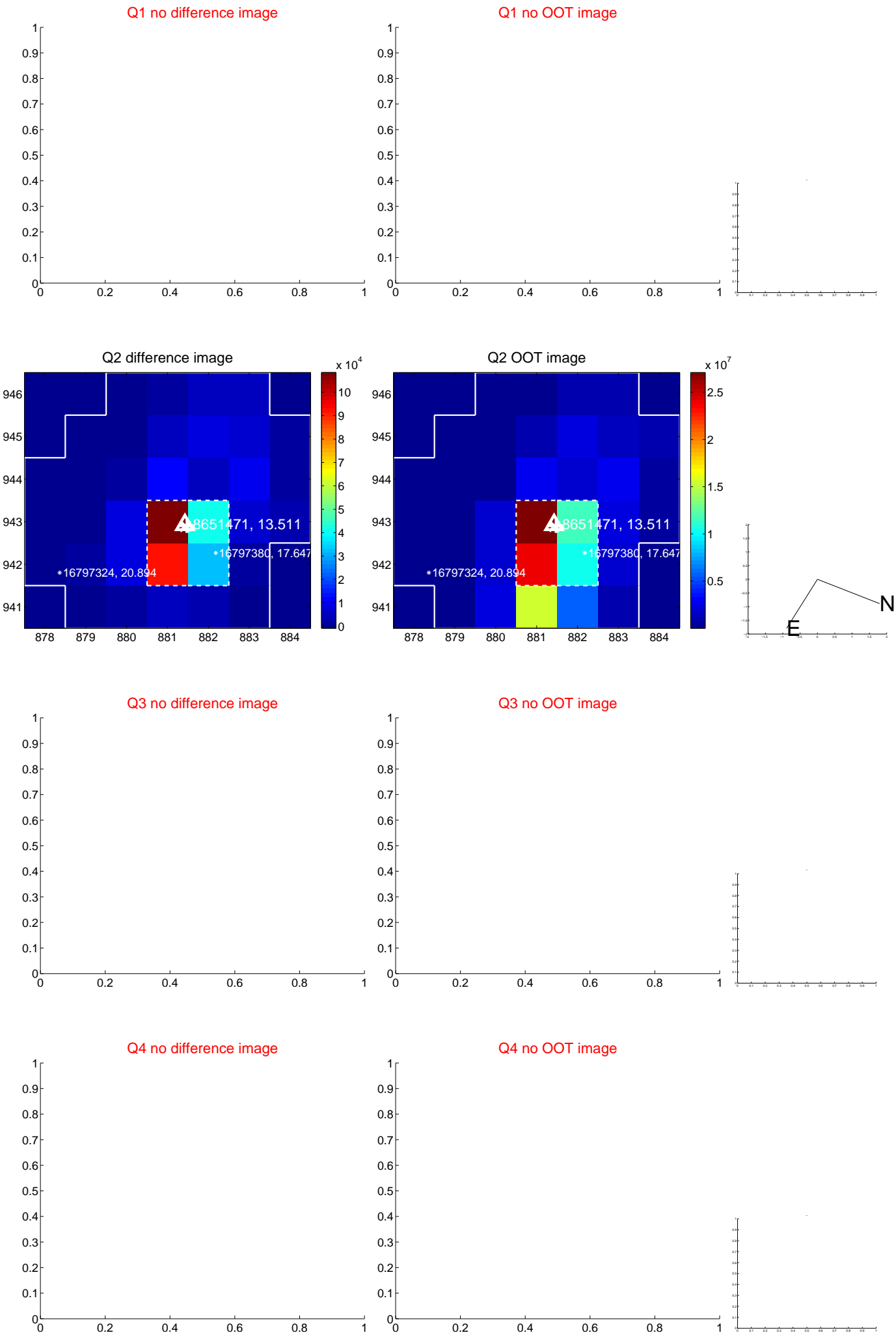
The direct PRF centroid is offset from the target star catalog position by about 0.48 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.356 \pm 0.404$	0.88	$-0.239 \pm 0.377$	$-0.264 \pm 0.213$
PRF-fit source offset from KIC position	$0.058 \pm 0.108$	0.54	$-0.058 \pm 0.108$	$0.003 \pm 0.124$
photometric centroid source offset	$3.74 \pm 3.48$	1.08	$-3.12 \pm 3.75$	$-2.06 \pm 2.74$

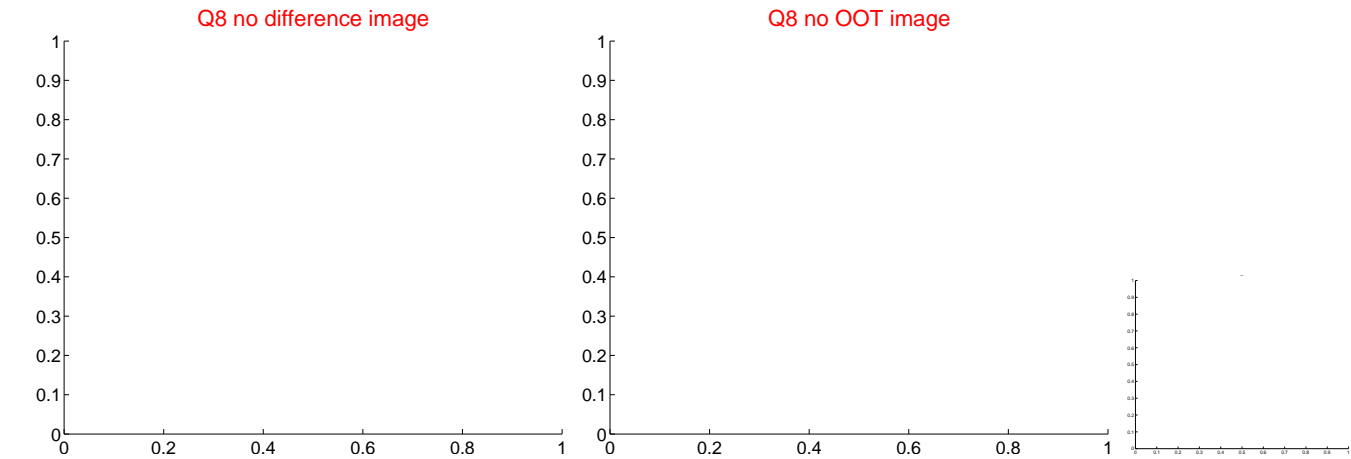
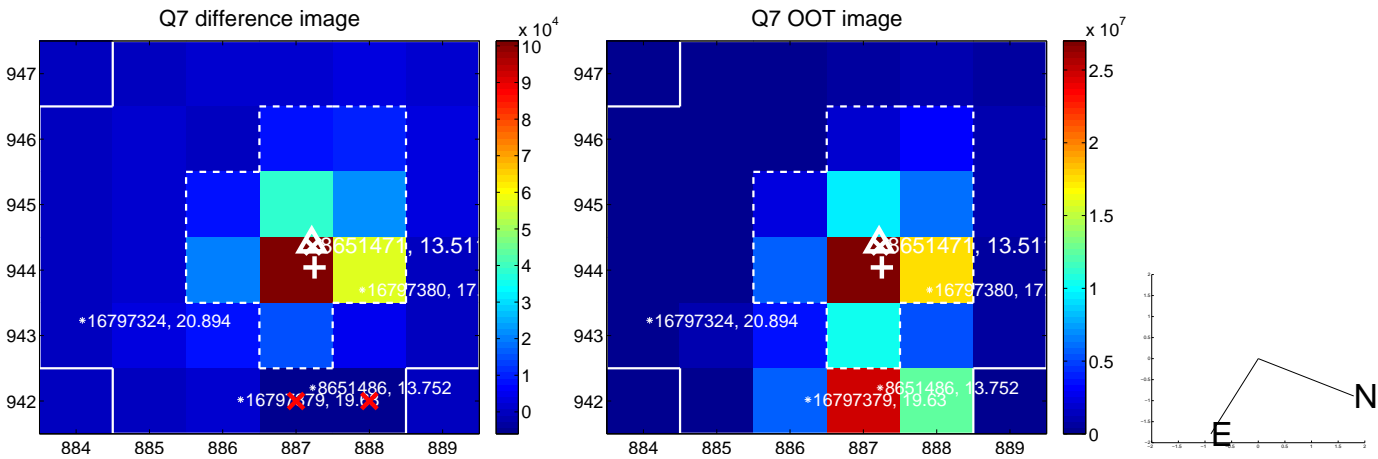
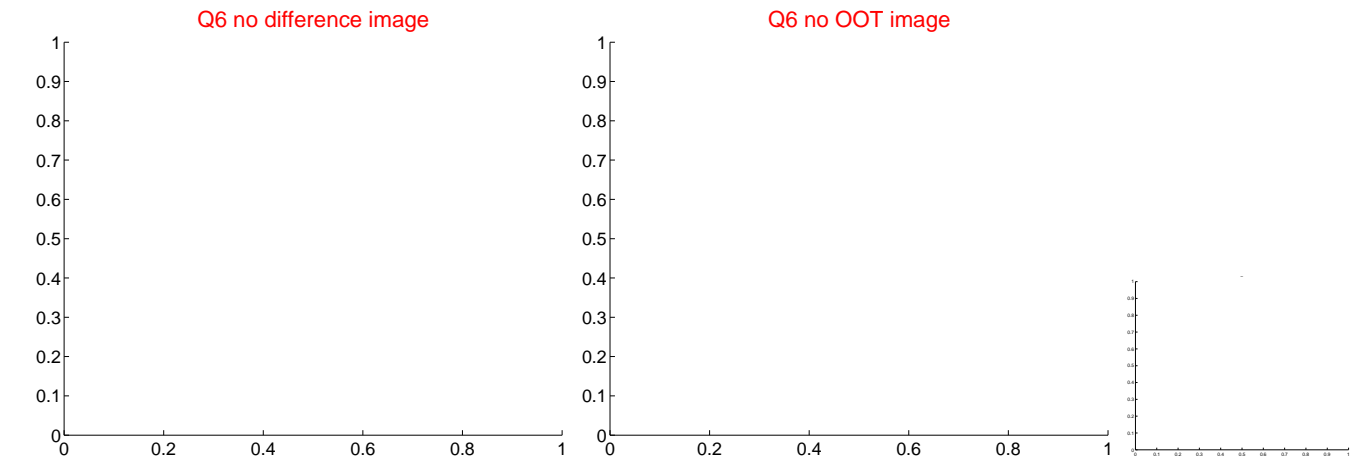
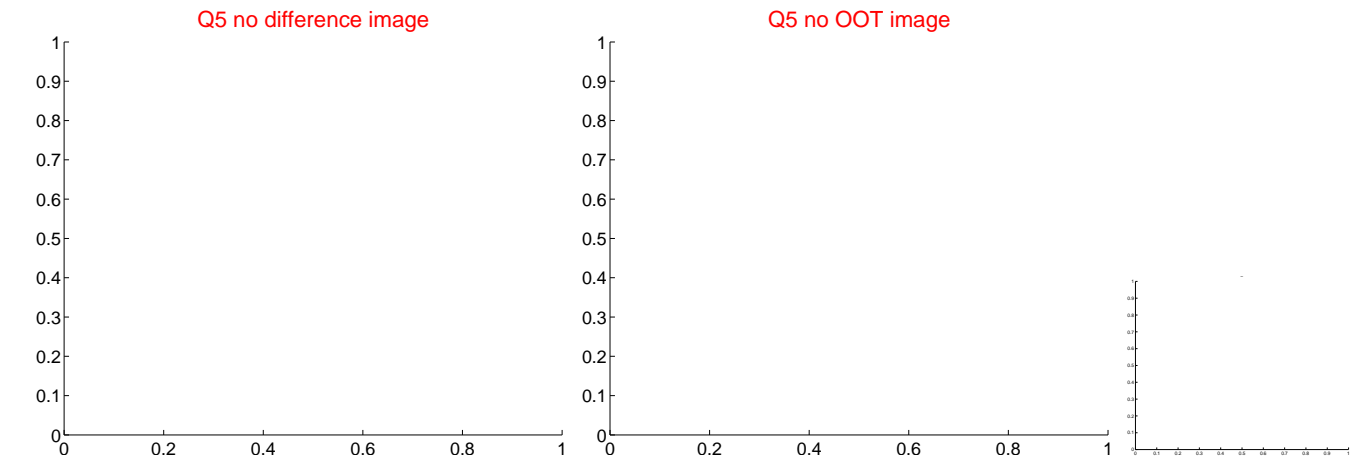


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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



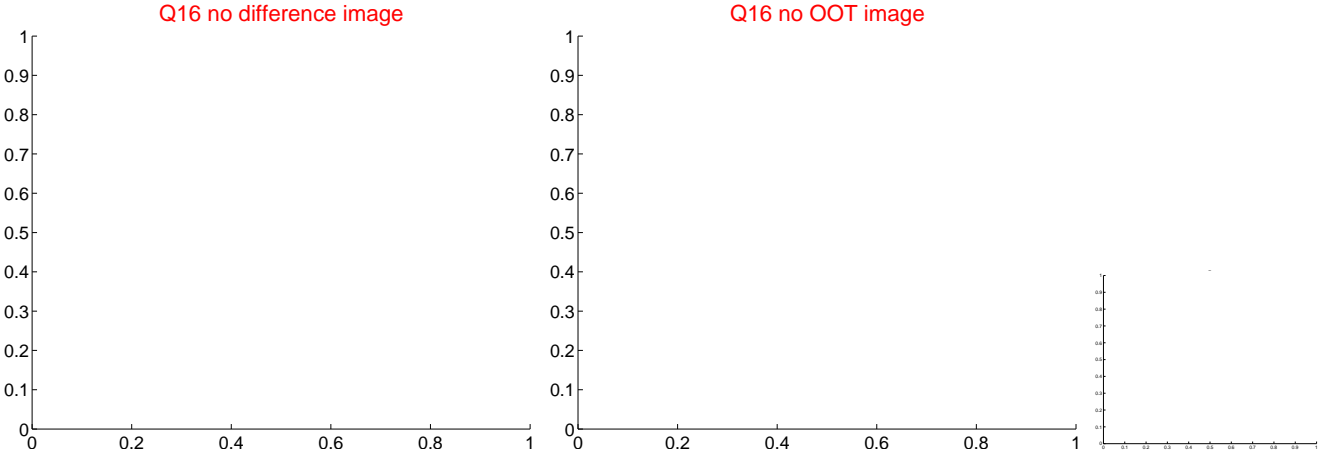
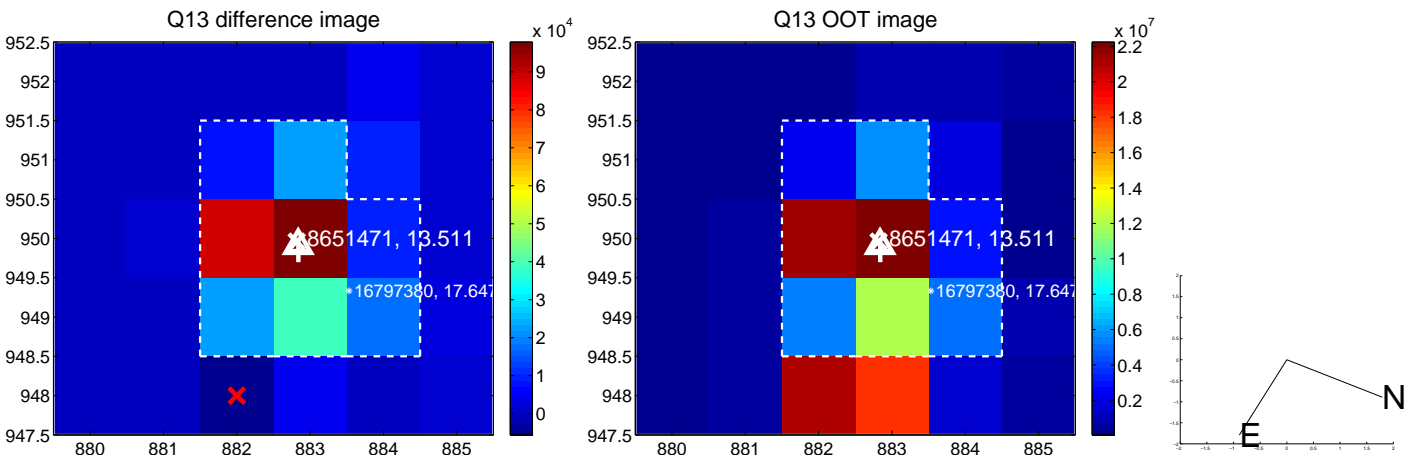
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



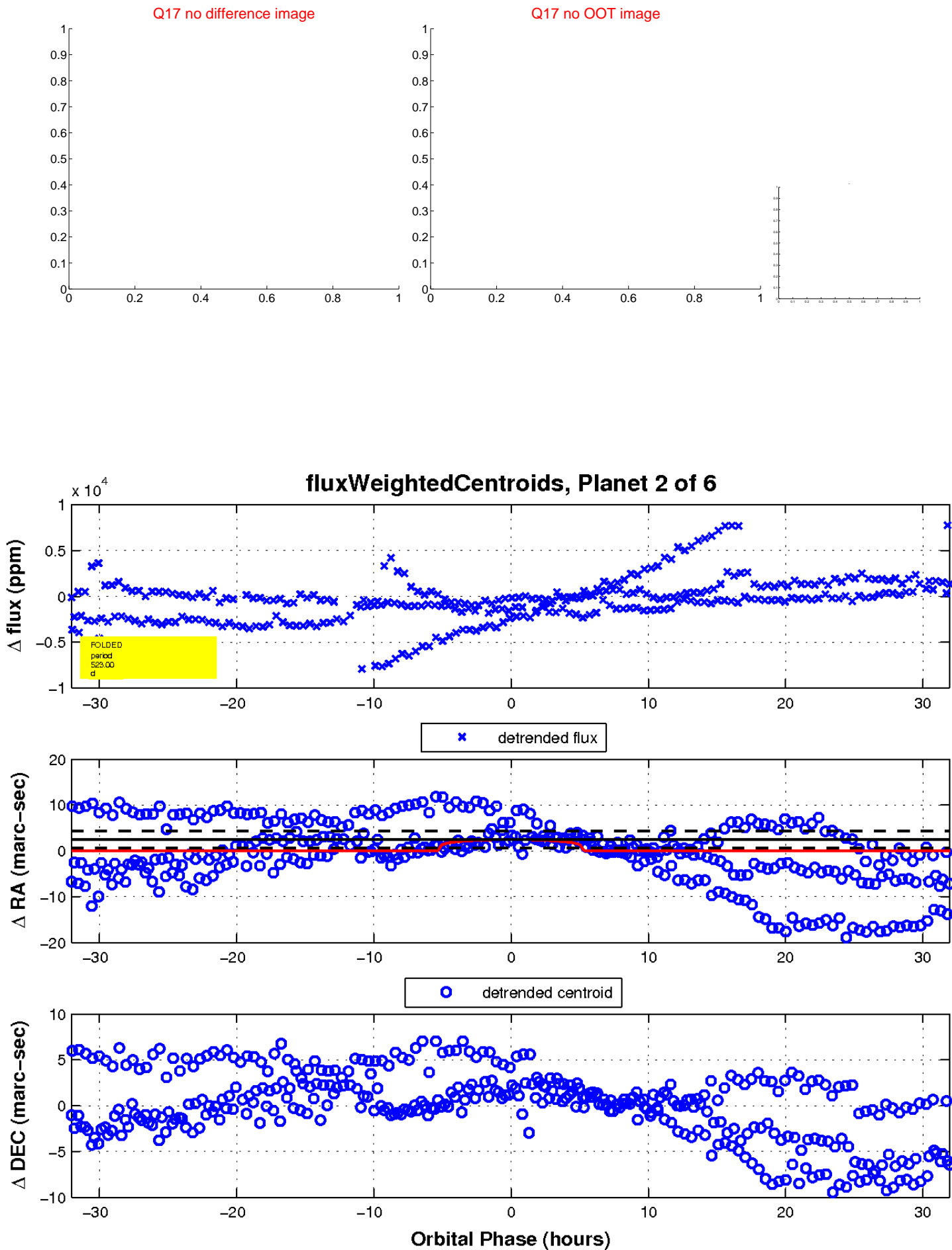
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

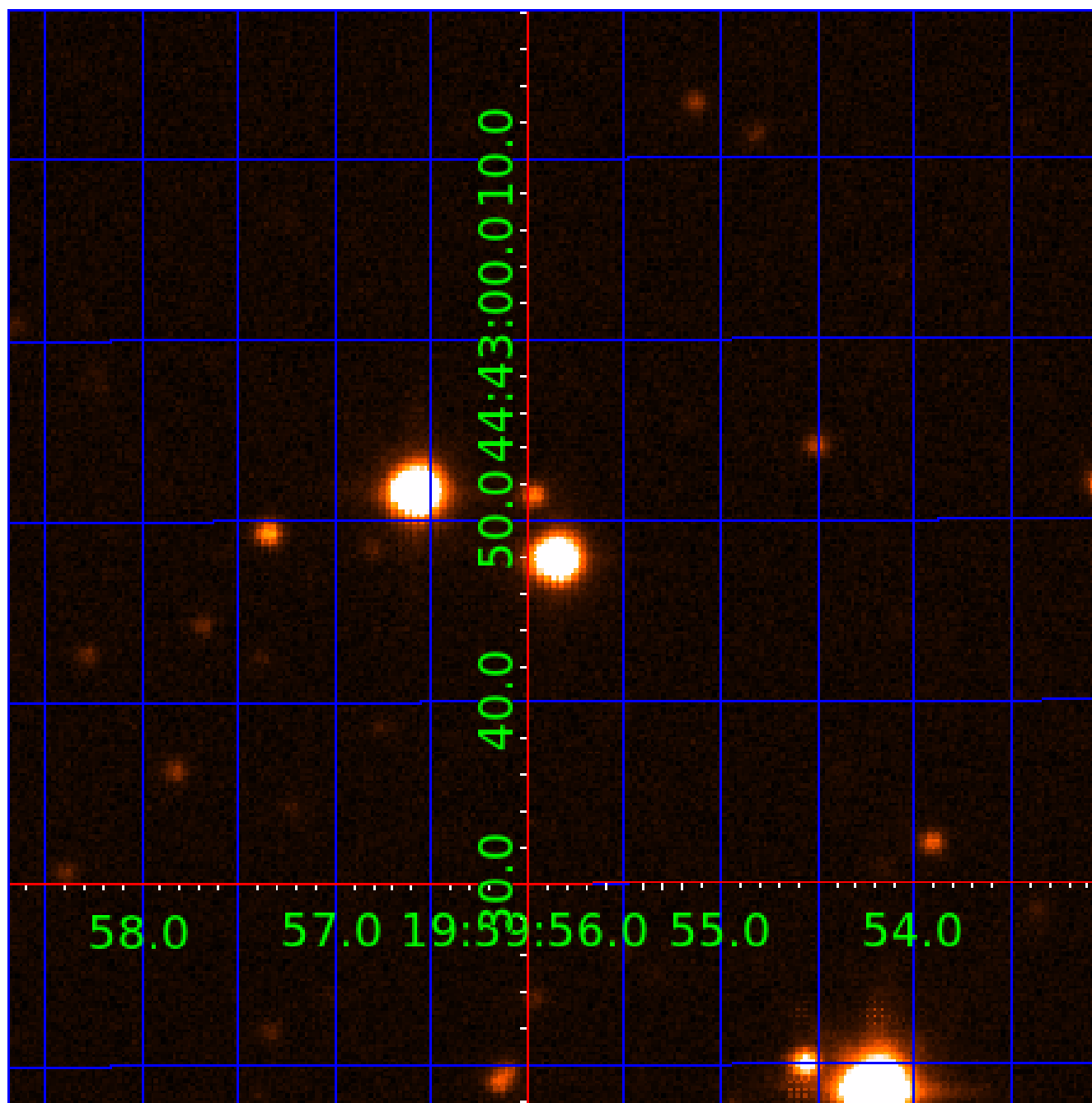


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination





# KIC 008651471

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
008651471-01	OBS	No	499.244107	200.933797	1287.9	6.574	14.9	7.8	0.77	5250	3.35	0.33
008651471-02	OBS	No	523.001201	189.787383	496.6	10.681	14.1	2.4	0.77	5250	1.74	0.31
008651471-03	OBS	No	447.422049	562.729561	1449.4	1.441	15.8	7.4	0.77	5250	3.20	0.38
008651471-04	OBS	No	371.515168	286.533858	1056.2	3.025	13.7	7.0	0.77	5250	2.61	0.49
008651471-05	OBS	No	301.489511	259.355139	1255.0	4.352	13.2	7.6	0.77	5250	2.76	0.65
008651471-06	OBS	No	542.143214	470.033782	782.2	3.500	13.1	-1.0	0.77	5250	2.12	0.30

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
008651471-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
008651471-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL_TRACKER—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS
008651471-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_TRACKER—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS
008651471-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_ZUMA_TRACKER—LPP_DV—LPP_ALT—MOD_POS_DV—CENT_KIC_POS
008651471-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
008651471-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_SKYE—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—INCONSISTENT_TRANS—CENT_NOFITS

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

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

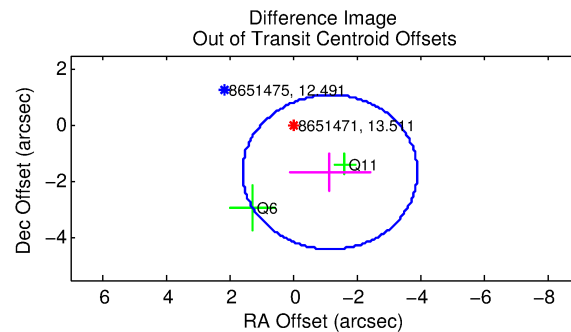
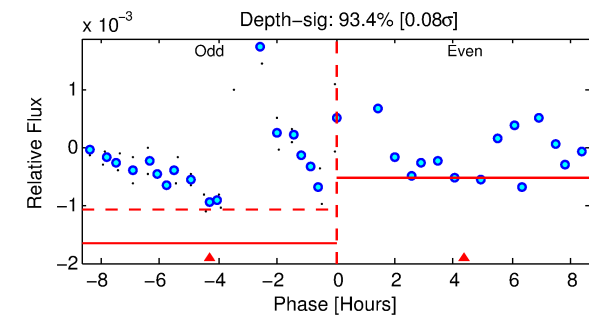
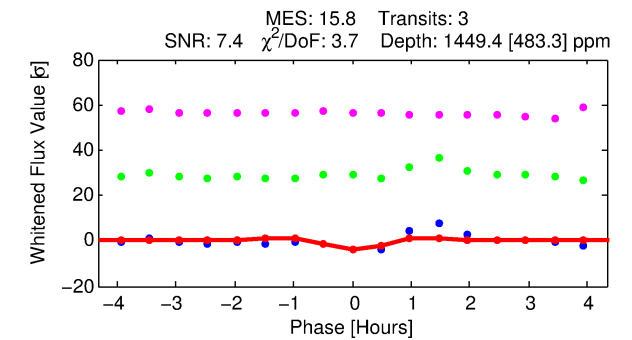
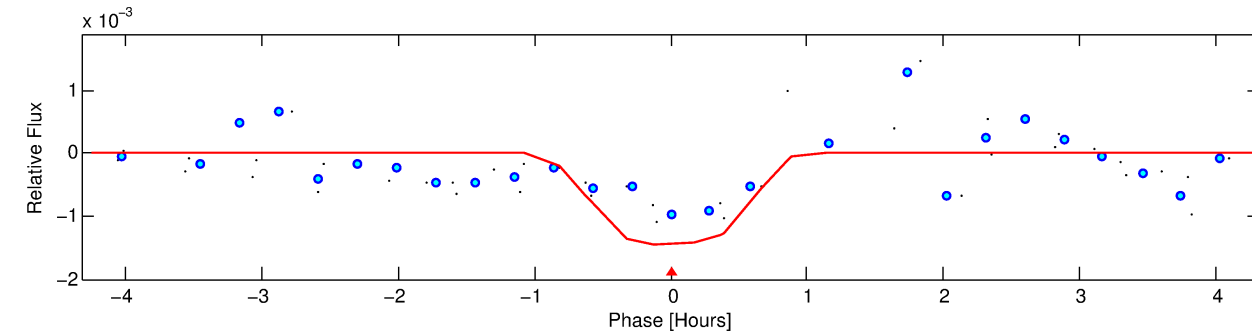
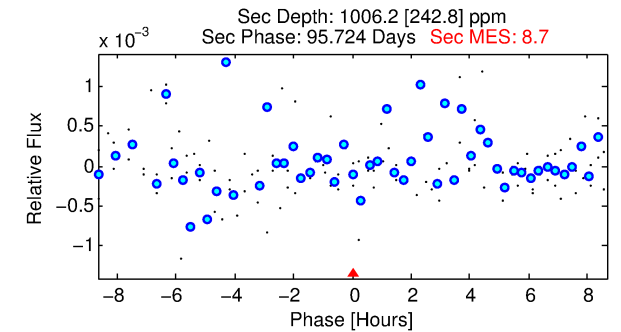
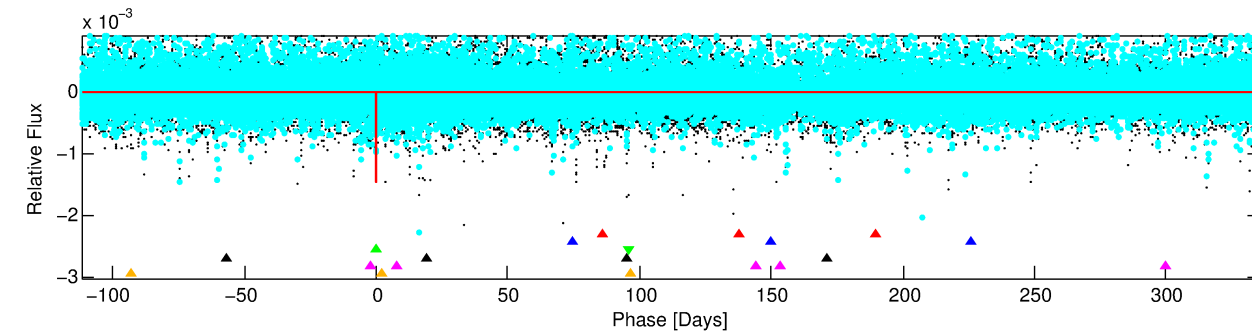
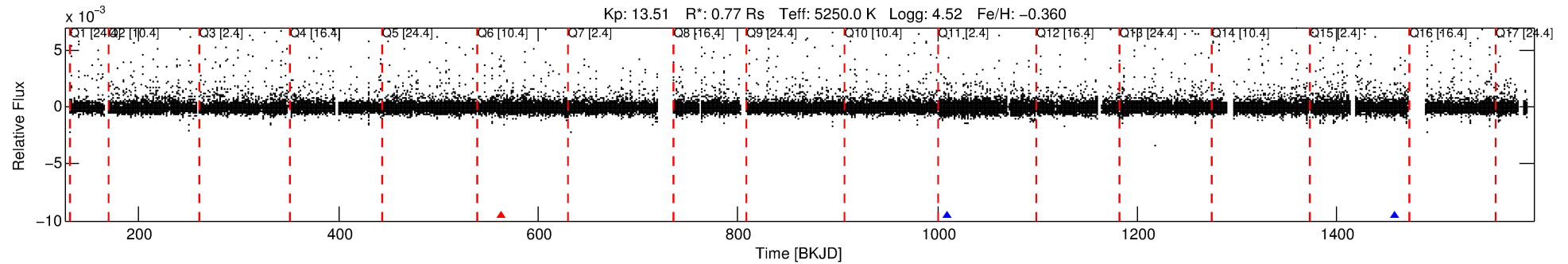
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 008651471-03

No Significant Match Found

# DV One-Page Summary

KIC: 8651471 Candidate: 3 of 6 Period: 447.422 d



## DV Fit Results:

Period = 447.42205 [0.00596] d  
Epoch = 562.7296 [0.0077] BKJD  
Rp/R\* = 0.0380 [0.0934]  
a/R\* = 1742.37 [16446.97]  
b = 0.73 [6.08]  
Seff = 0.38 [0.08]  
Teq = 201 [11] K  
Rp = 3.20 [7.87] Re  
a = 1.0269 [0.1259] AU  
Ag = 57102.83 [281152.60] [0.20 $\sigma$ ]  
Teffp = 4796 [5902] K [0.78 $\sigma$ ]

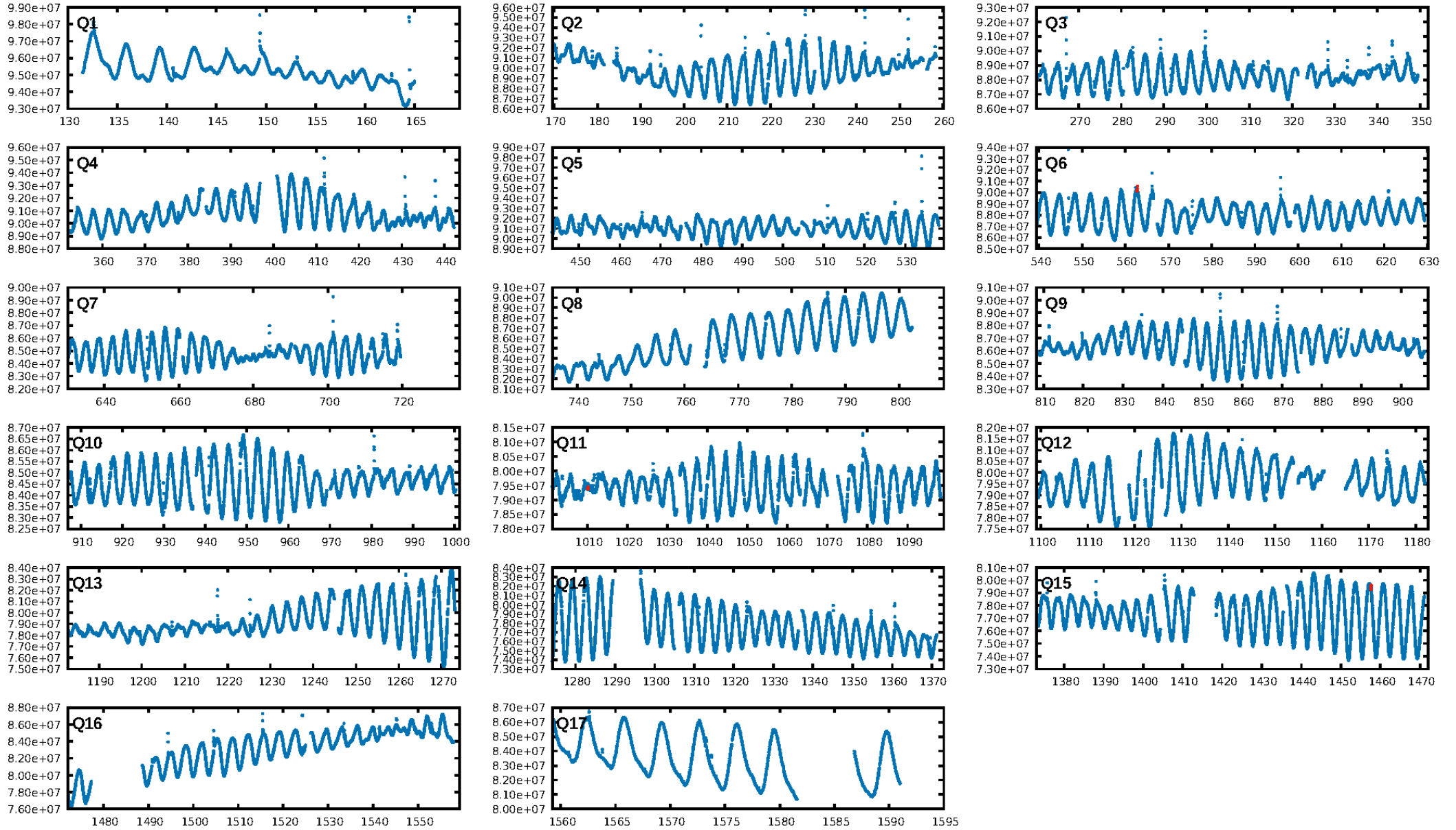
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [543.69 $\sigma$ ]  
LongPeriod-sig: 100.0% [184.79 $\sigma$ ]  
ModelChiSquare2-sig: 3.2%  
ModelChiSquareGof-sig: 58.9%  
Bootstrap-pfa: N/A  
**RollingBand-fgt: 0.67 [2/3]**  
GhostDiagnostic-chr: 1.64  
Centroid-sig: N/A  
Centroid-so: 0.672 arcsec [0.63 $\sigma$ ]  
OotOffset-rm: 2.030 arcsec [2.22 $\sigma$ ]  
KicOffset-rm: 1.089 arcsec [1.22 $\sigma$ ]  
OotOffset-st: 1/1/0/0 [2]  
KicOffset-st: 1/1/0/0 [2]  
DiffImageQuality-fgm: 0.50 [1/2]  
DiffImageOverlap-fno: 1.00 [3/3]

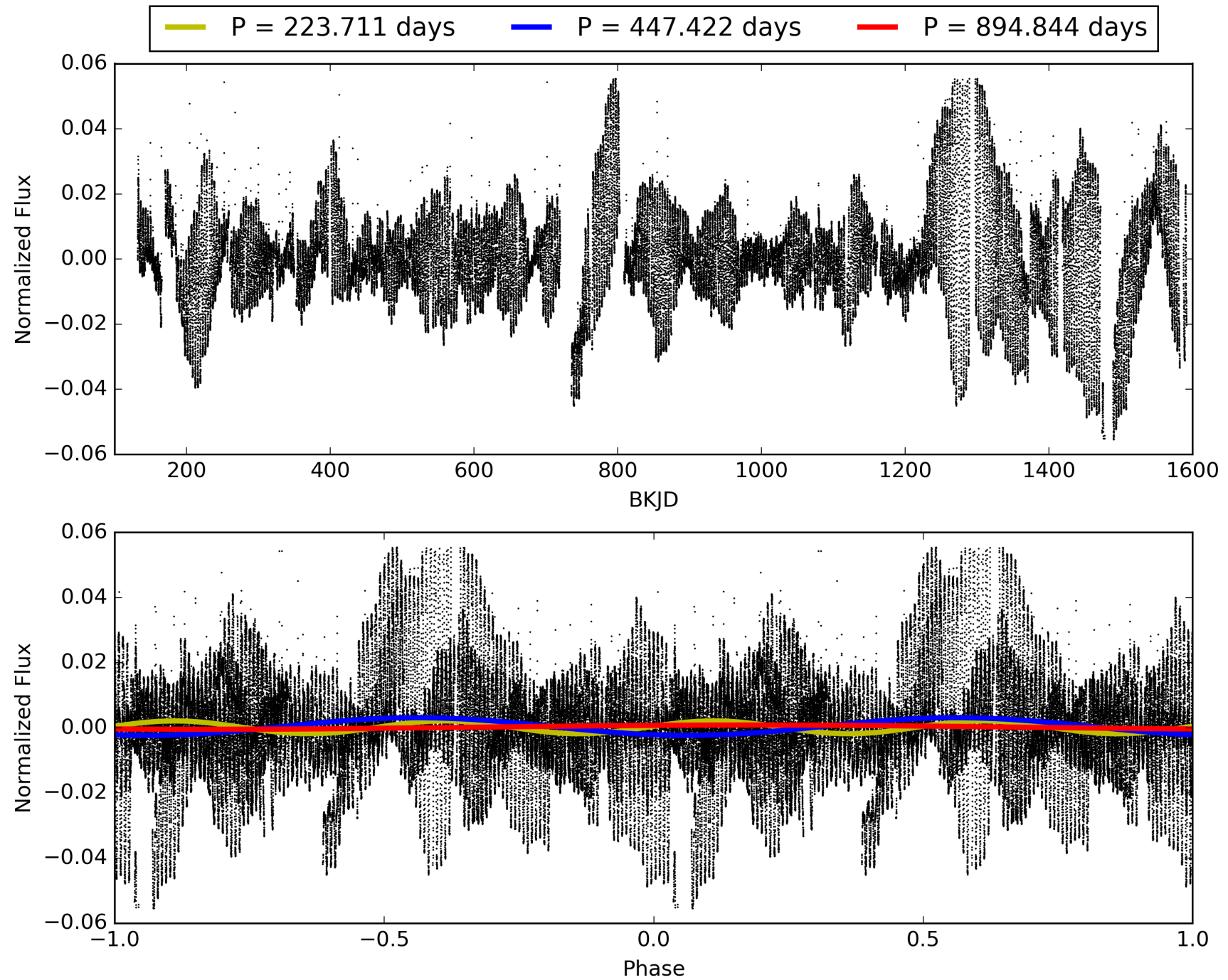
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 05:47:53 Z

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

# TCE 008651471-03, PDC Light Curves

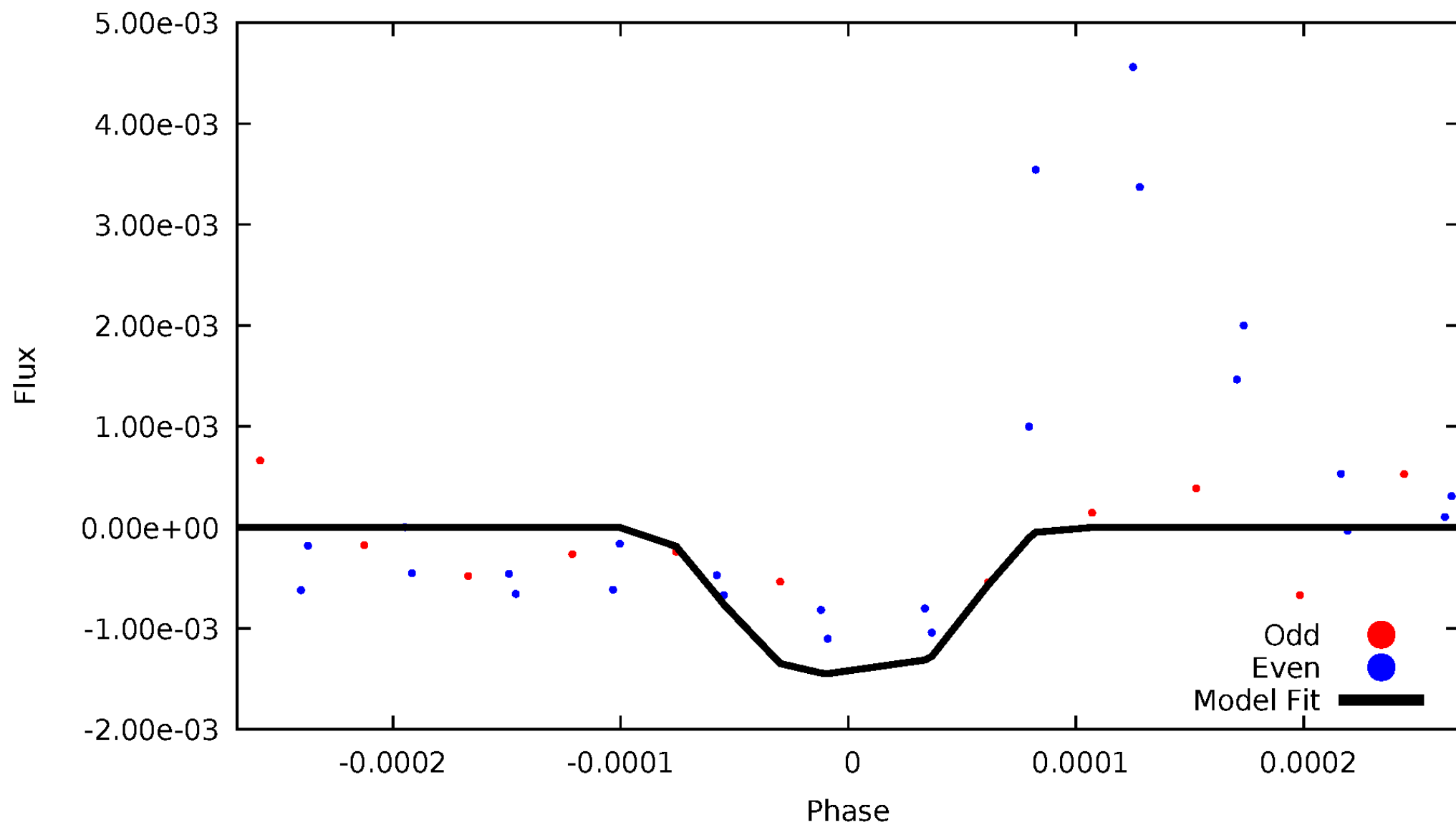


TCE 008651471-03



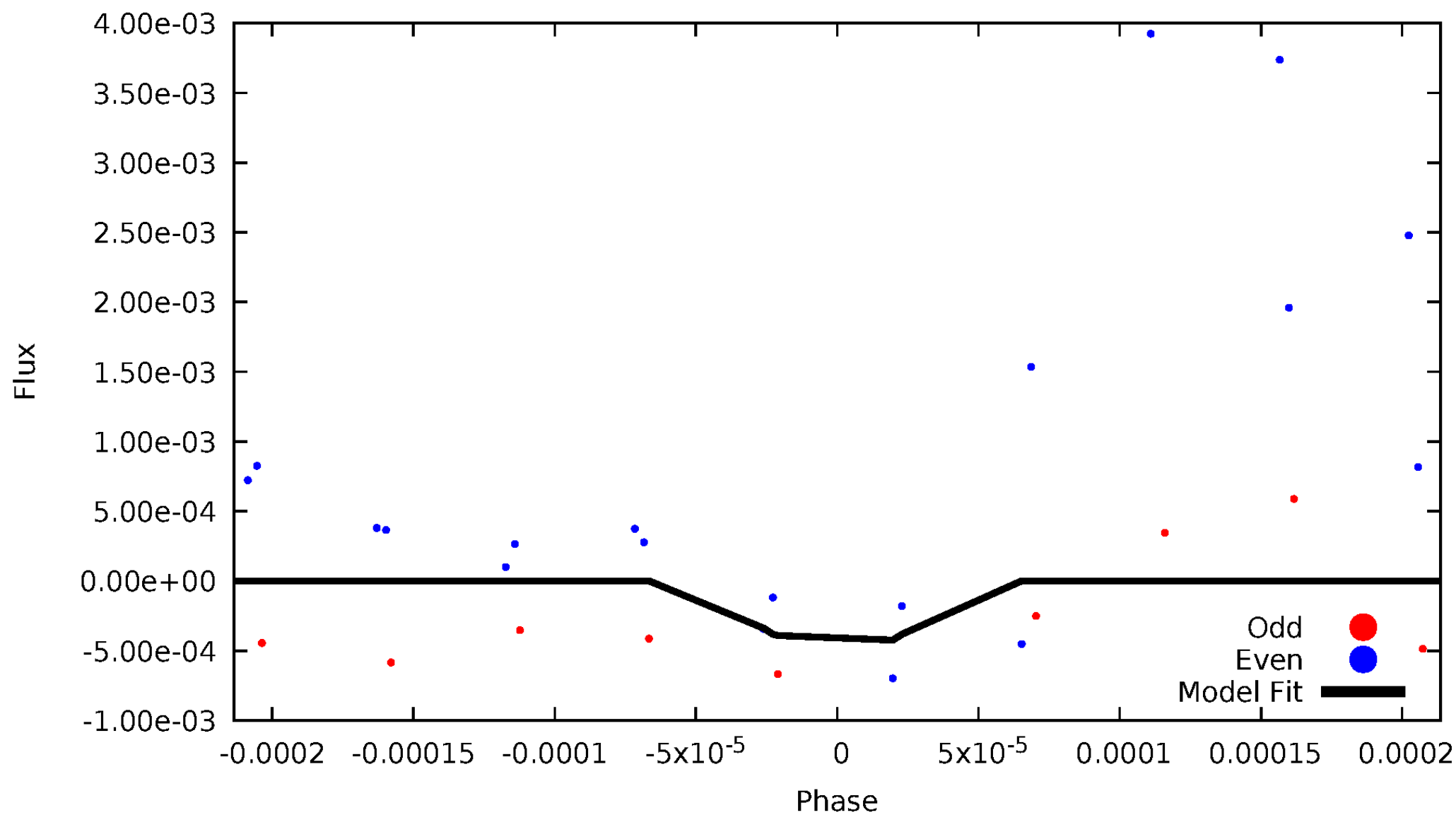
# DV Odd/Even

TCE 008651471-03



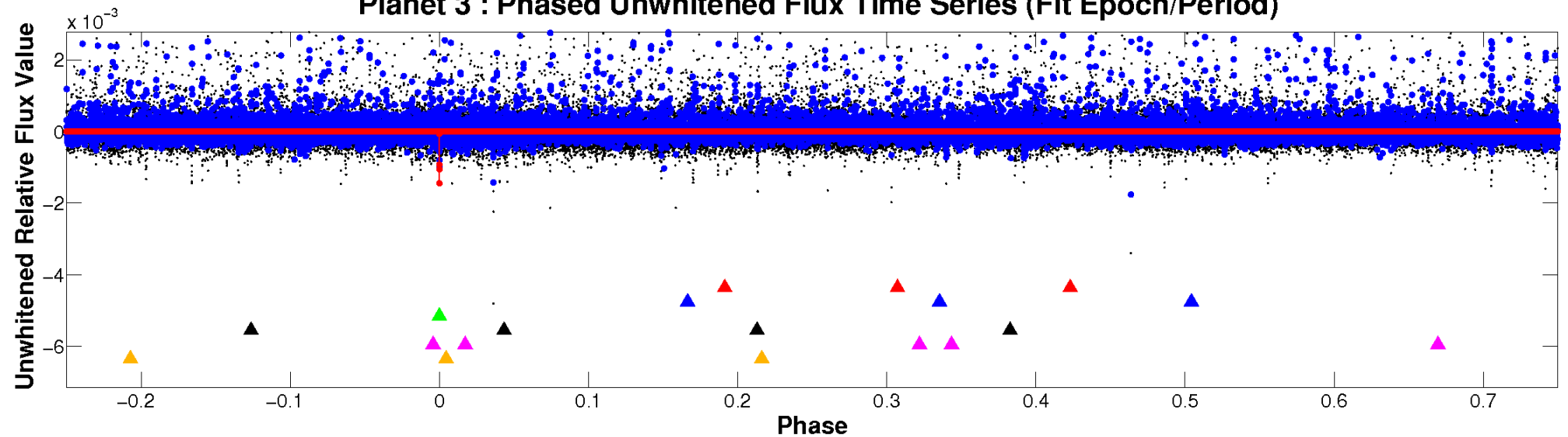
# ALT Odd/Even

TCE 008651471-03

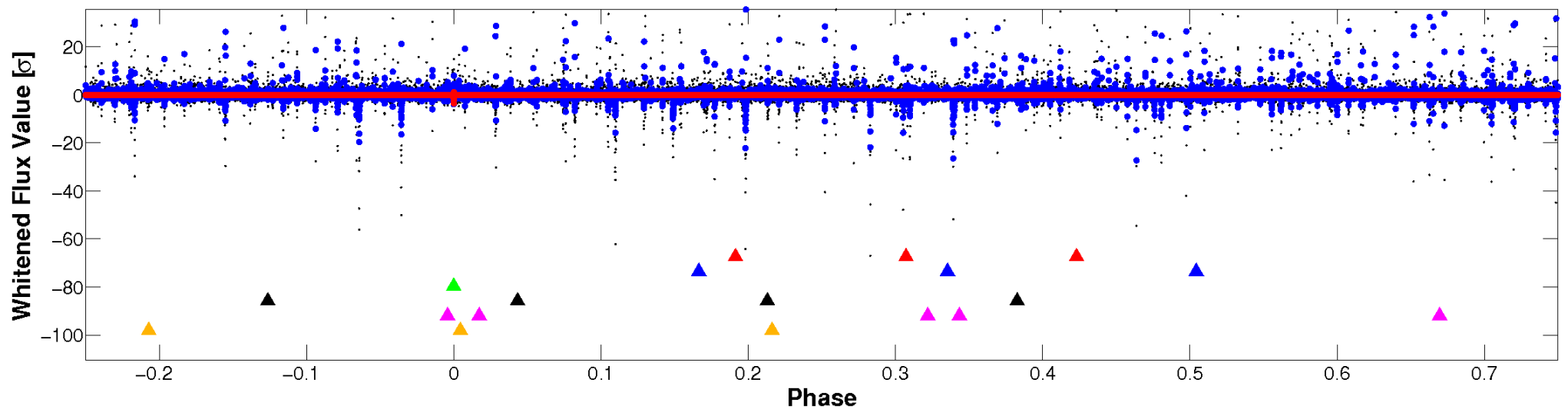


# Non-Whitened Vs. Whitened Light Curve

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

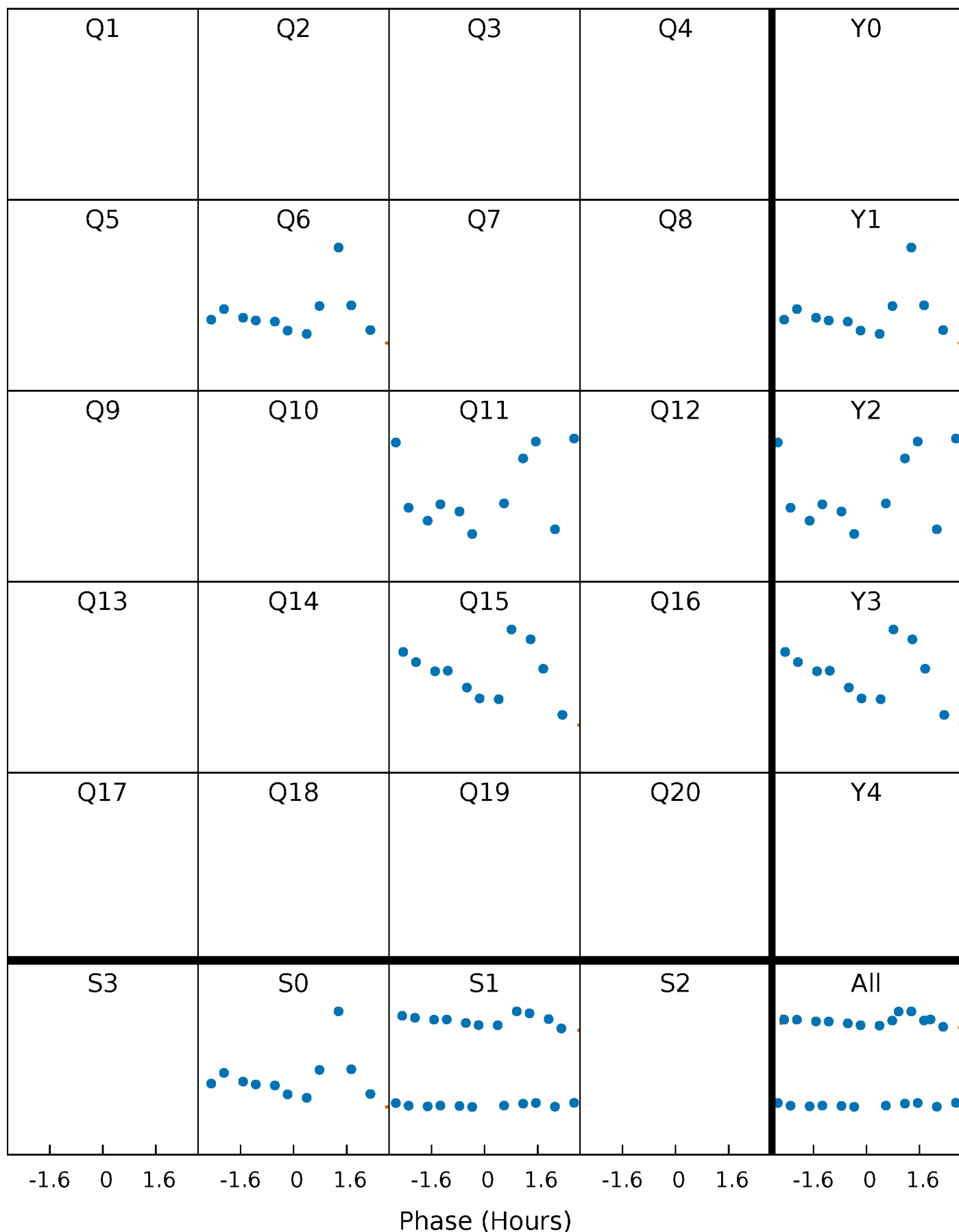


## Planet 3 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

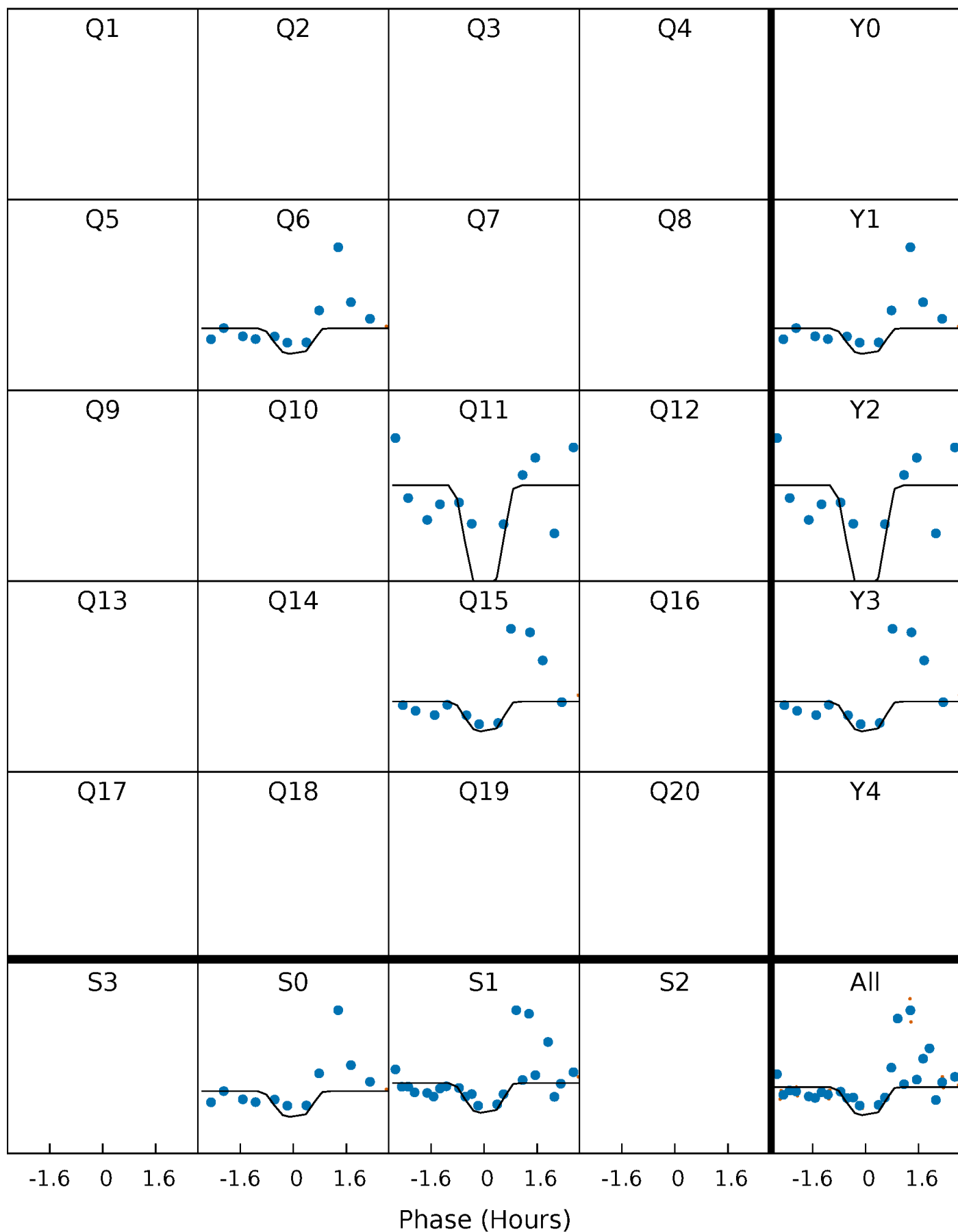
TCE 008651471-03 P=447.422049 Days  $T_0=562.729562$  (BKJD)





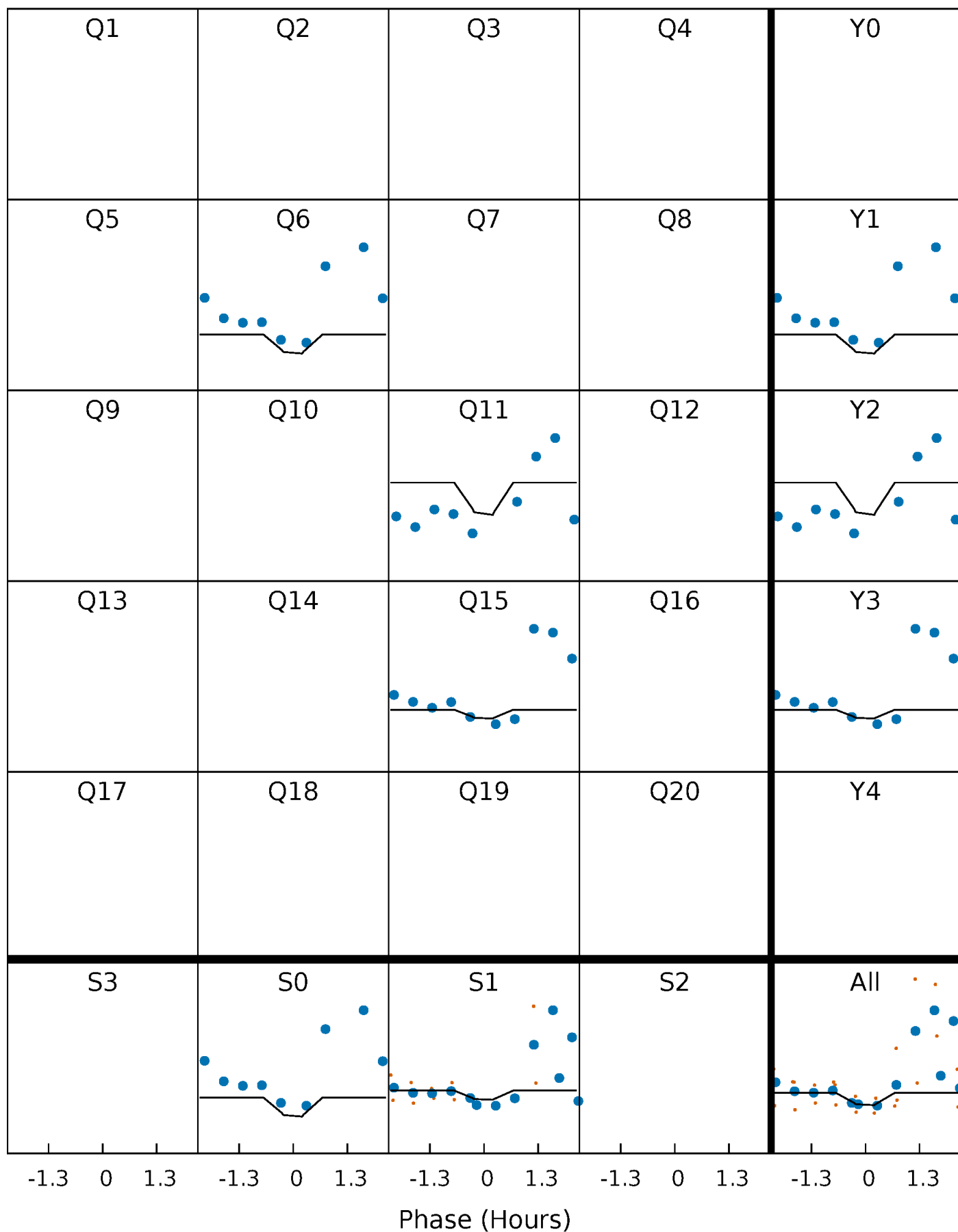
# DV Quarter-Phased Transit Curves

TCE 008651471-03     $P=447.422049$  Days     $T_0=562.729562$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

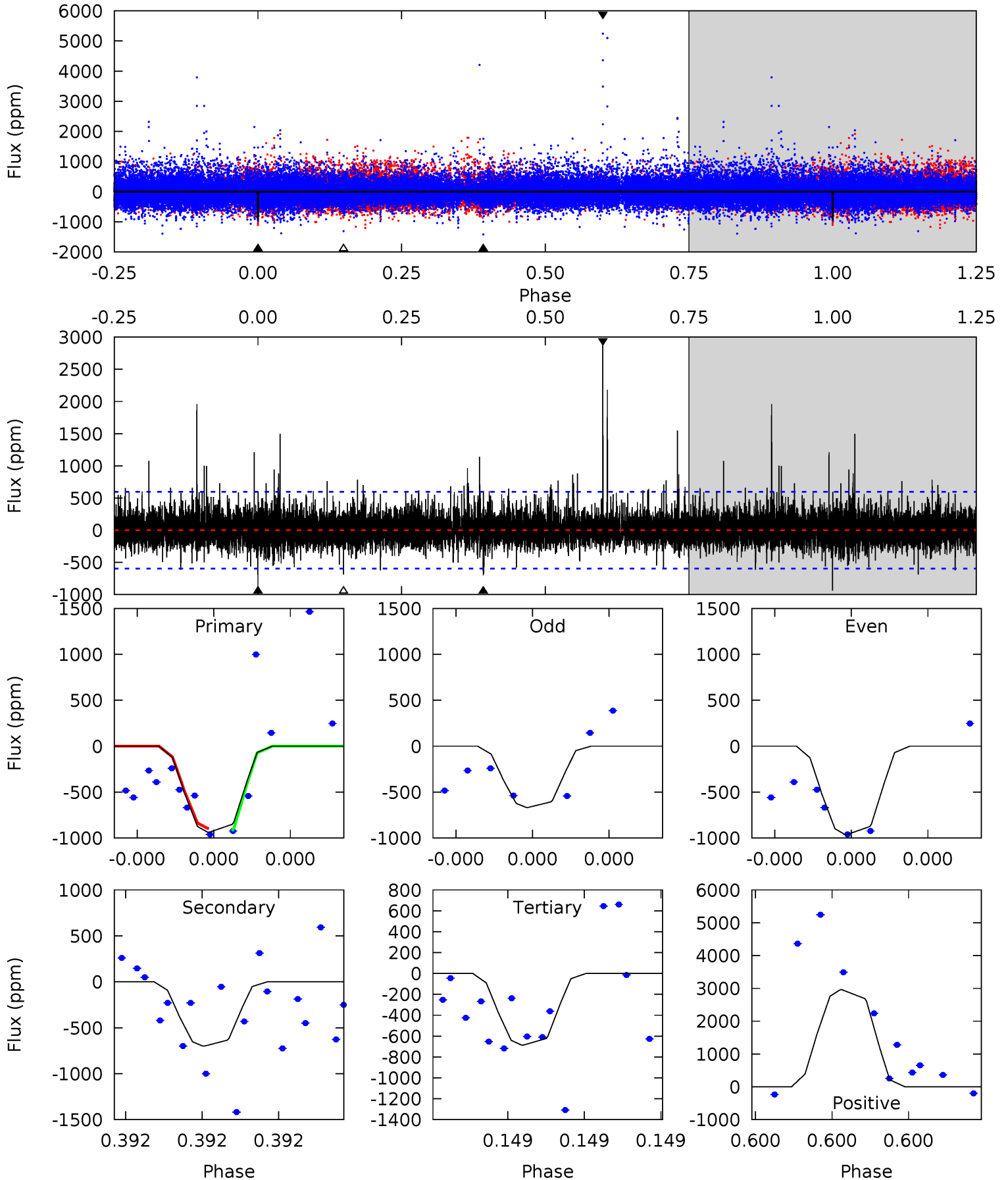
TCE 008651471-03 P=447.413230 Days  $T_0=562.734363$  (BKJD)



# DV Model-Shift Uniqueness Test

008651471-03, P = 447.422049 Days, E = 115.307513 Days

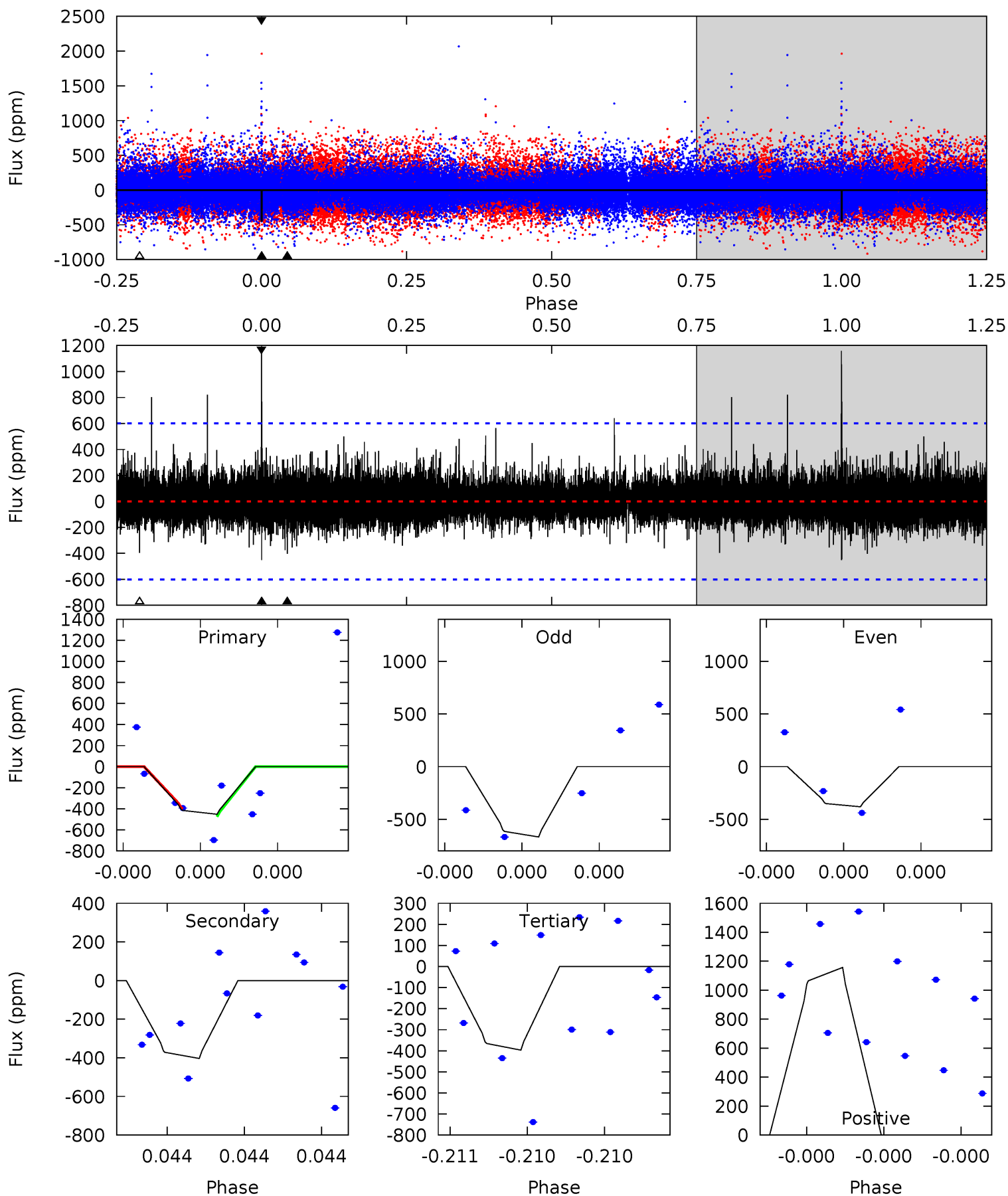
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
9.11	6.80	6.67	28.8	5.79	3.81	1.53	2.43	-19.7	0.12	-22.0	0.58	1.06	0.76	0.12



# Alt Model-Shift Uniqueness Test

008651471-03, P = 447.413230 Days, E = 115.321133 Days

Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
4.41	3.93	3.87	11.3	5.86	3.91	0.88	0.54	-6.87	0.07	-7.34	1.20	1.00	0.72	0.37



### Stellar Parameters For KIC 008651471

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$5250^{+158}_{-142}$	$4.522^{+0.085}_{-0.095}$	$-0.360^{+0.350}_{-0.300}$	$0.771^{+0.114}_{-0.085}$	$0.721^{+0.109}_{-0.042}$	$2.217^{+0.883}_{-0.633}$
	+3%/-3%	+2%/-2%	+97%/-83%	+15%/-11%	+15%/-6%	+40%/-29%
Source	PHO1	KIC0	KIC0	DSEP		

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

### Secondary Eclipse Parameters for KIC 008651471-03 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-701 \pm 103$	$6.91^{+6.40}_{-4.79}$	$281^{+13}_{-12}$	$3467^{+1908}_{-603}$	$8867^{+82378}_{-6531}$
Alt.	$-403 \pm 103$	$6.14^{+6.32}_{-4.36}$	$280^{+12}_{-11}$	$3266^{+1763}_{-600}$	$6003^{+64838}_{-4605}$

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

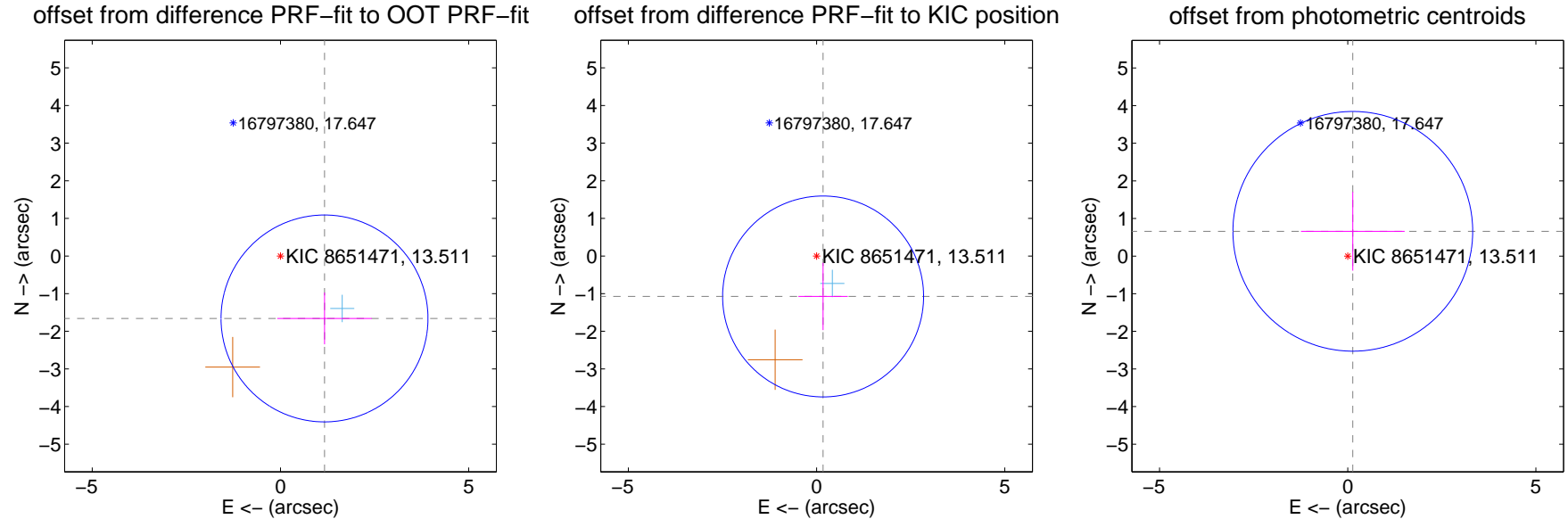
## DV Centroid Data

Supplemental centroid analysis for 008651471-03. Kepler magnitude: 13.51. Transit SNR 7.41

There are 1 quarters with good PRF difference image offsets

The direct PRF centroid is offset from the target star catalog position by about 1.39 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$2.030 \pm 0.916$	2.22	$-1.170 \pm 1.255$	$-1.659 \pm 0.688$
PRF-fit source offset from KIC position	$1.089 \pm 0.890$	1.22	$-0.173 \pm 0.657$	$-1.075 \pm 0.895$
photometric centroid source offset	$0.67 \pm 1.06$	0.63	$-0.14 \pm 1.38$	$0.66 \pm 1.05$



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.

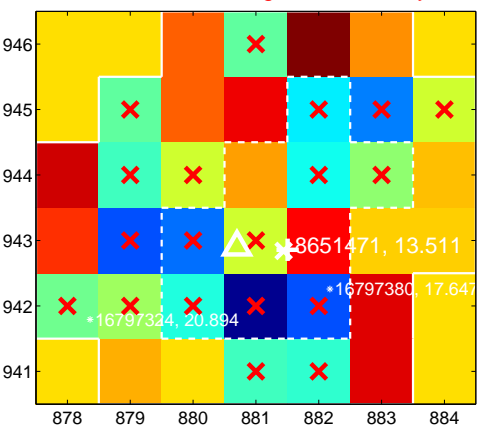
Q5 no difference image



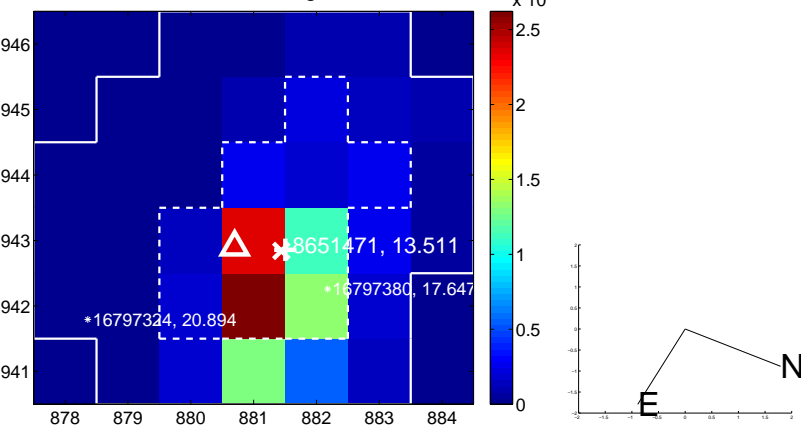
Q5 no OOT image



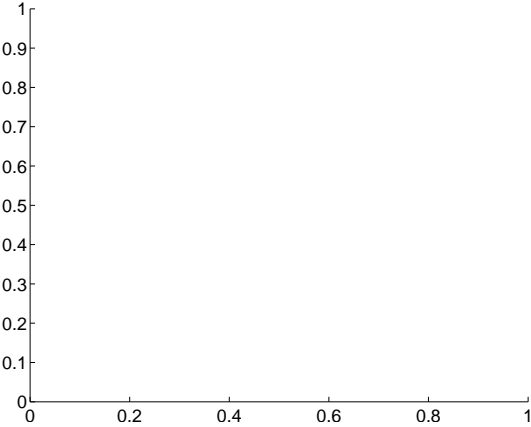
Q6 difference image. Poor Quality



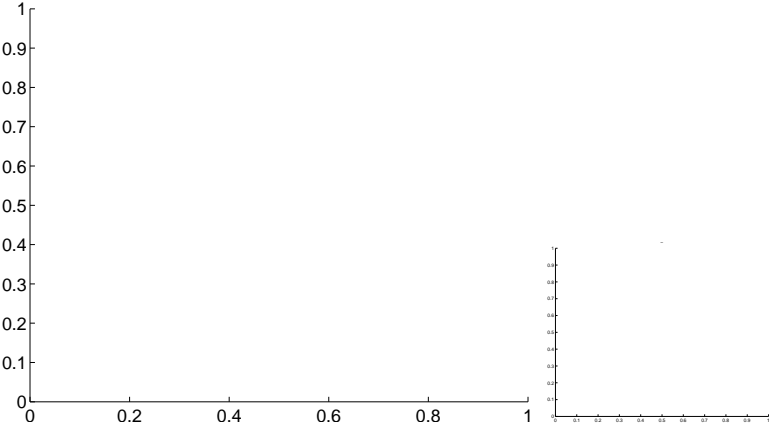
Q6 OOT image



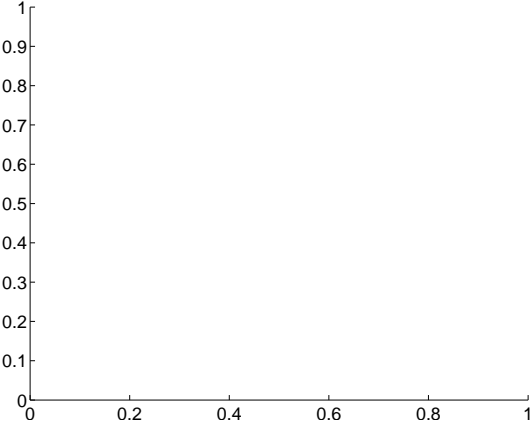
Q7 no difference image



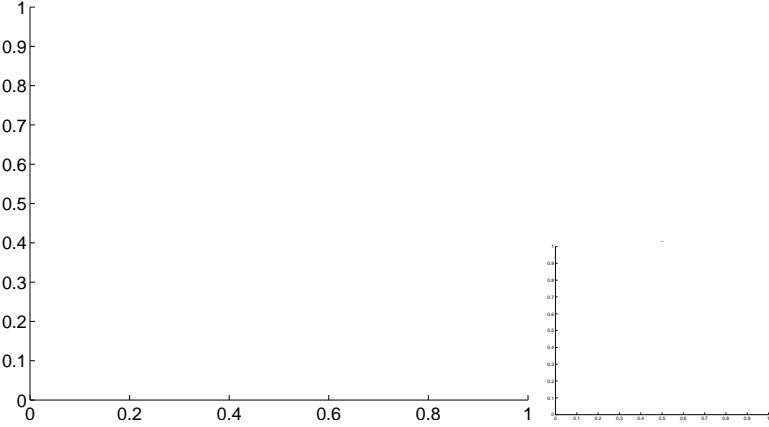
Q7 no OOT image



Q8 no difference image

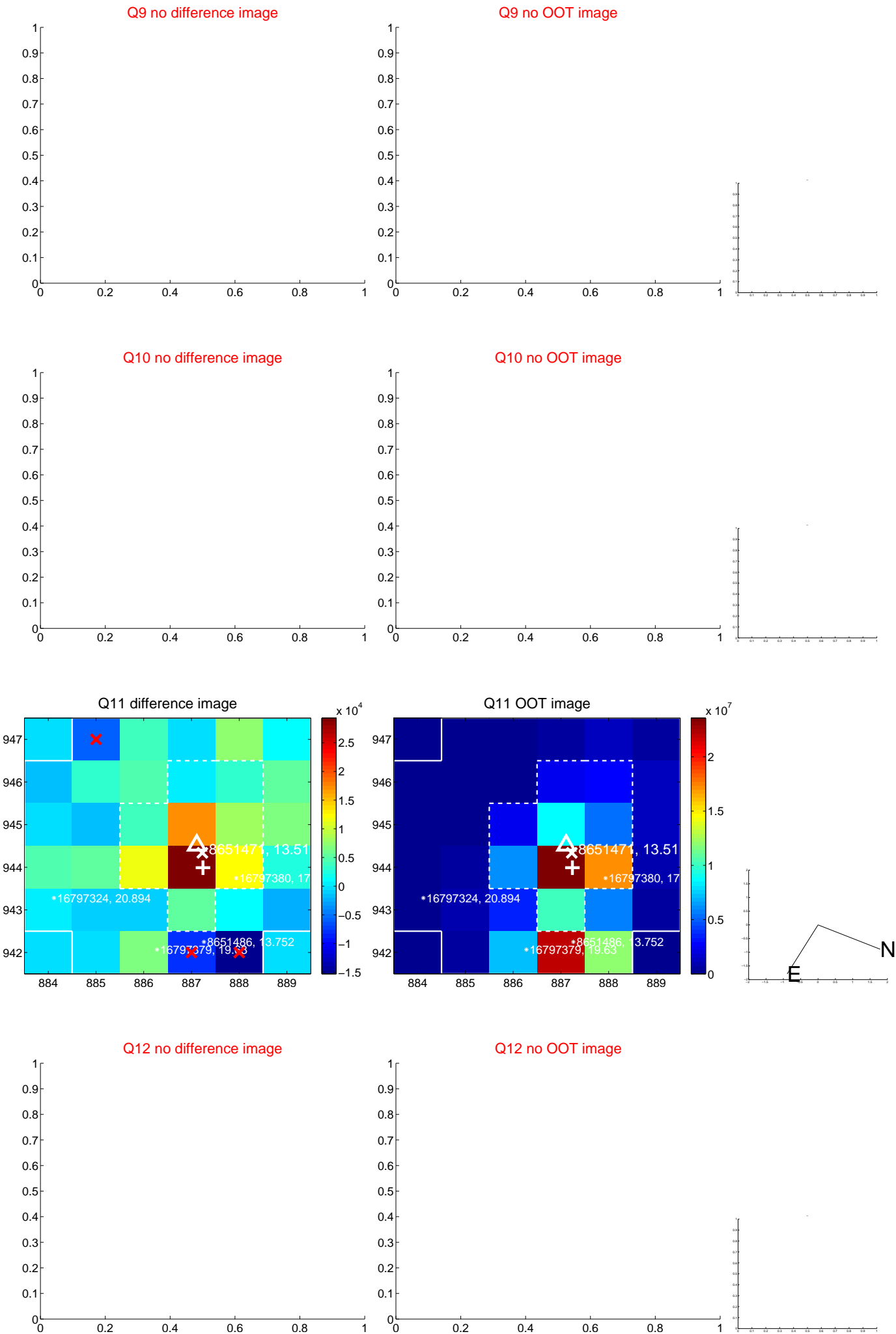


Q8 no OOT image

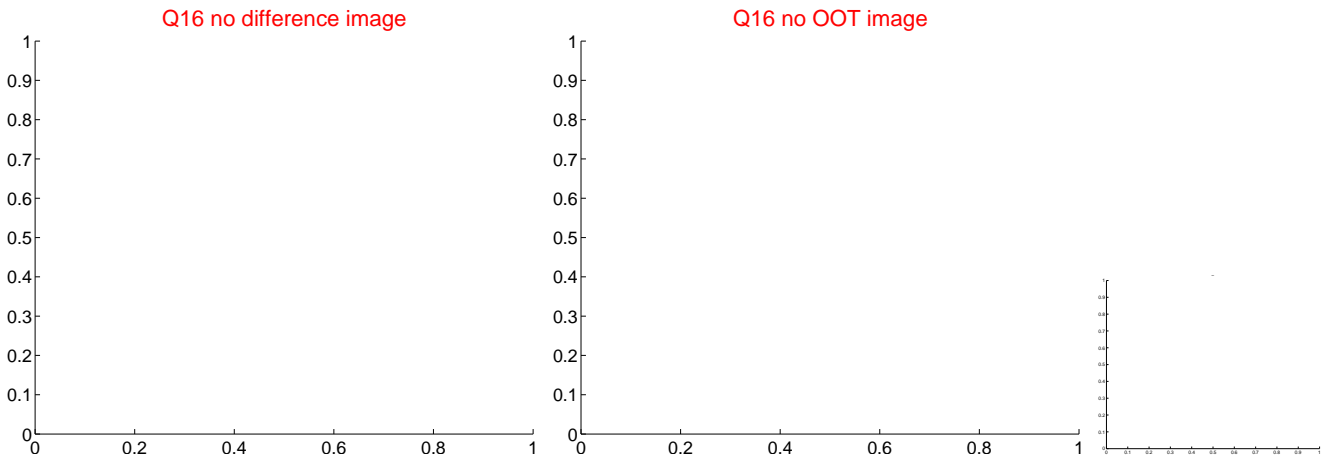
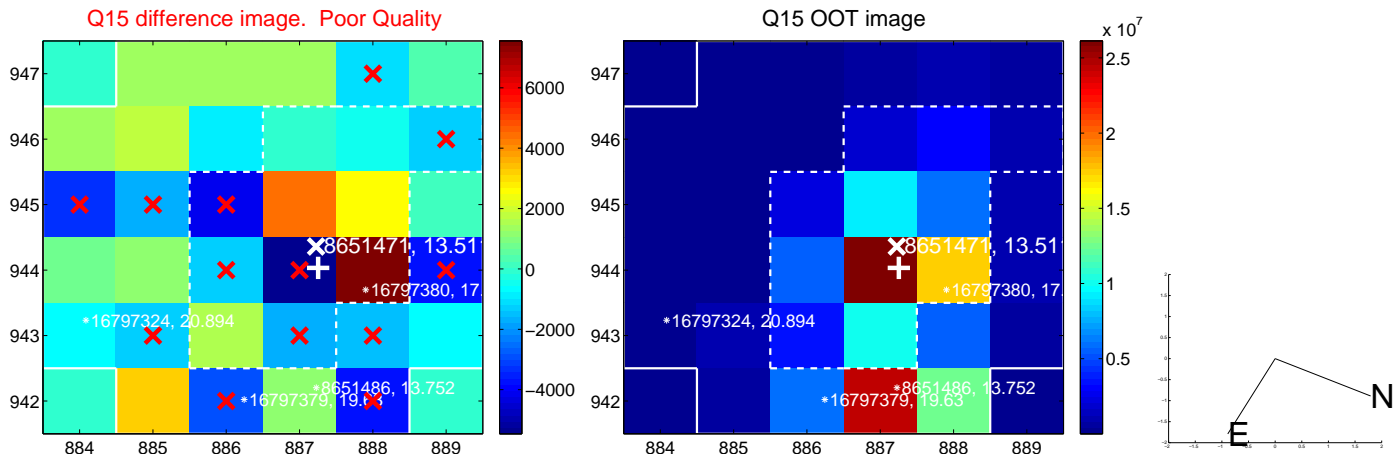
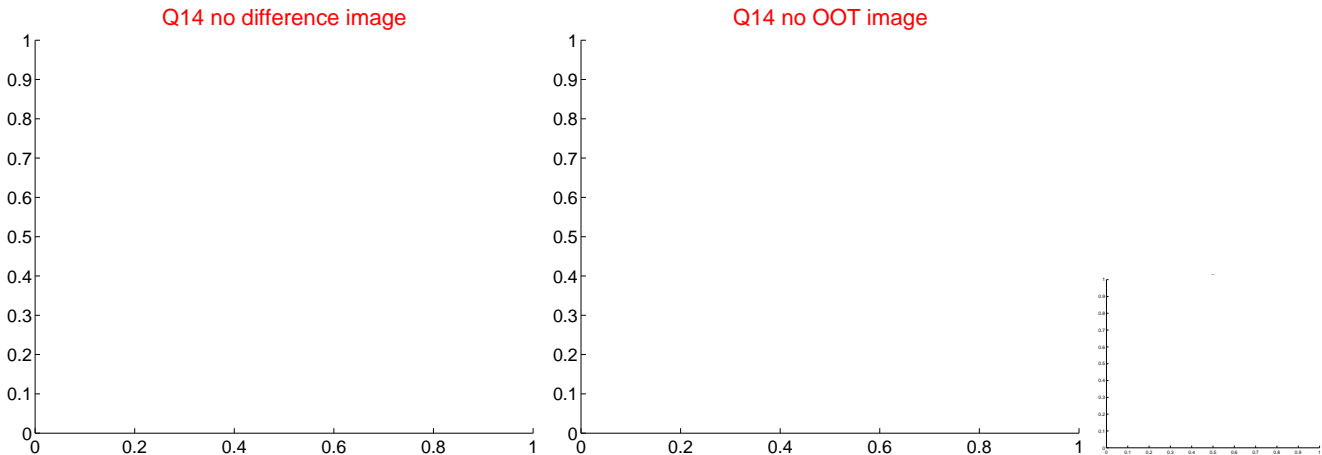
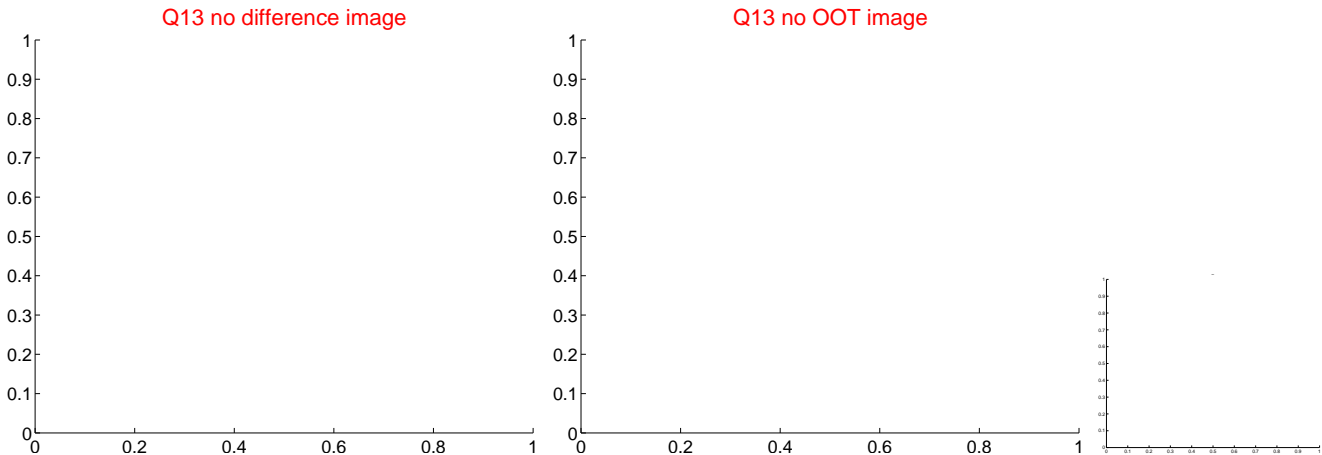




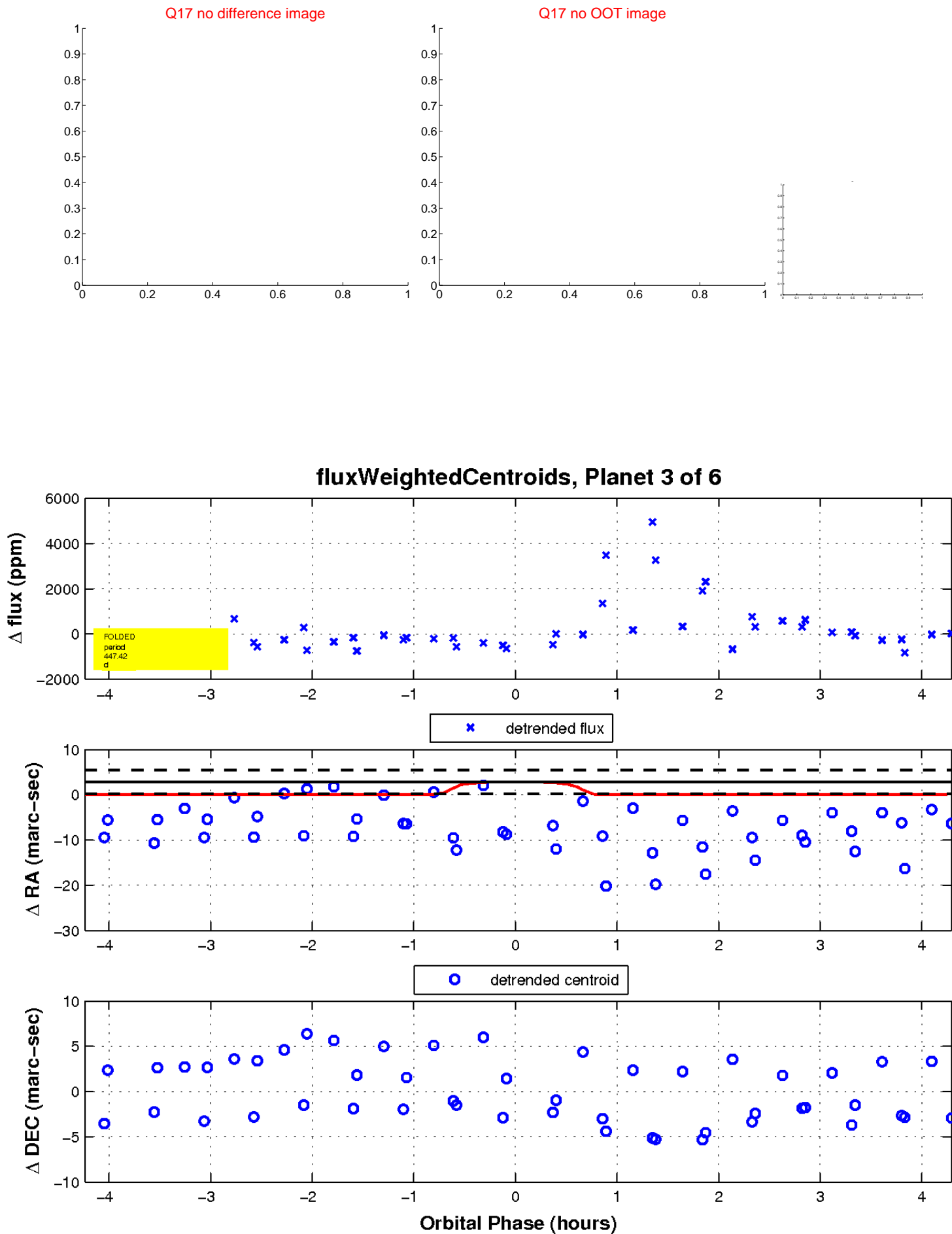
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

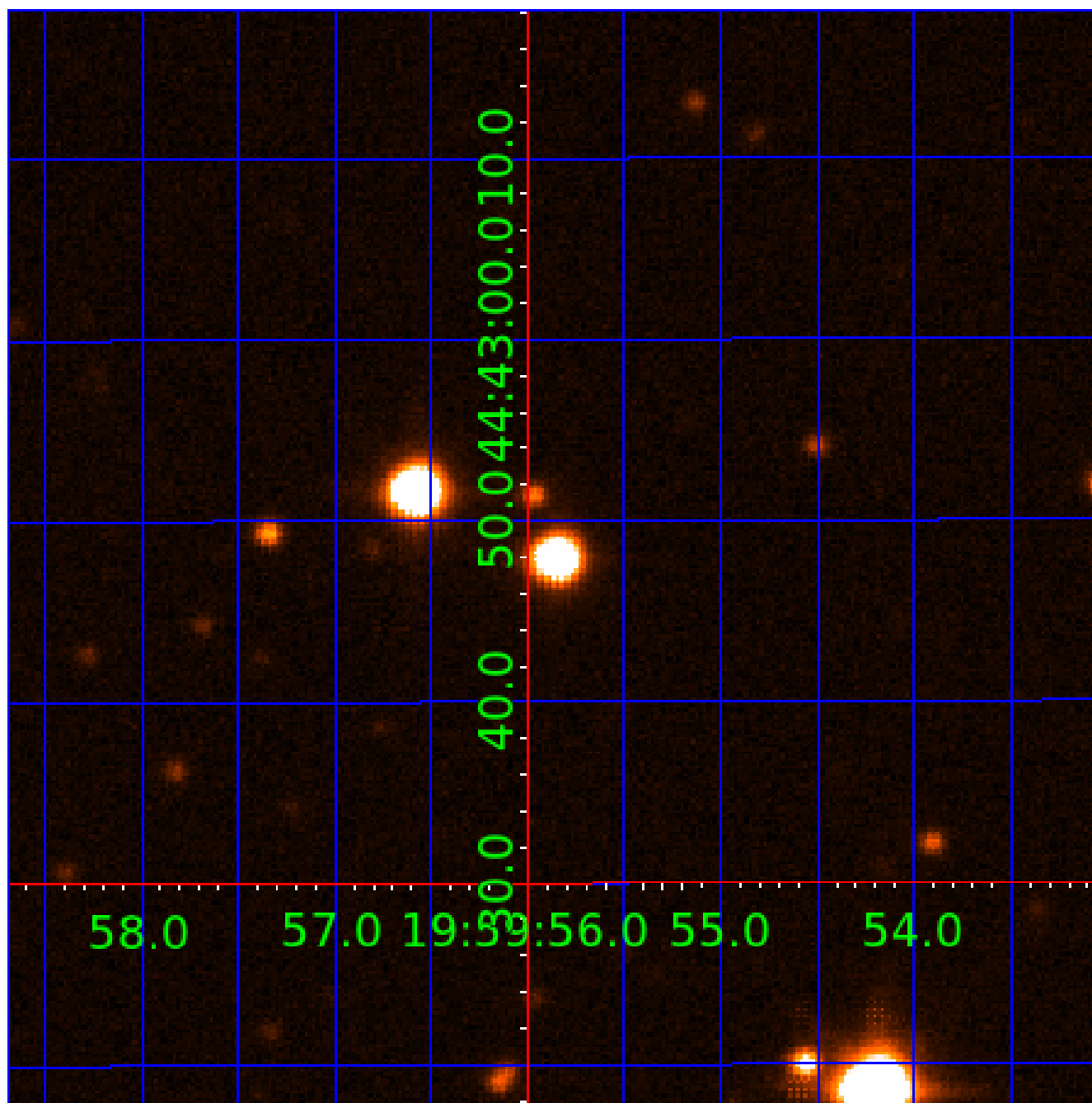


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 008651471

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
008651471-01	OBS	No	499.244107	200.933797	1287.9	6.574	14.9	7.8	0.77	5250	3.35	0.33
008651471-02	OBS	No	523.001201	189.787383	496.6	10.681	14.1	2.4	0.77	5250	1.74	0.31
008651471-03	OBS	No	447.422049	562.729561	1449.4	1.441	15.8	7.4	0.77	5250	3.20	0.38
008651471-04	OBS	No	371.515168	286.533858	1056.2	3.025	13.7	7.0	0.77	5250	2.61	0.49
008651471-05	OBS	No	301.489511	259.355139	1255.0	4.352	13.2	7.6	0.77	5250	2.76	0.65
008651471-06	OBS	No	542.143214	470.033782	782.2	3.500	13.1	-1.0	0.77	5250	2.12	0.30

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
008651471-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
008651471-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL_TRACKER—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS
008651471-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_TRACKER—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS
008651471-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_ZUMA_TRACKER—LPP_DV—LPP_ALT—MOD_POS_DV—CENT_KIC_POS
008651471-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
008651471-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_SKYE—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—INCONSISTENT_TRANS—CENT_NOFITS

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

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

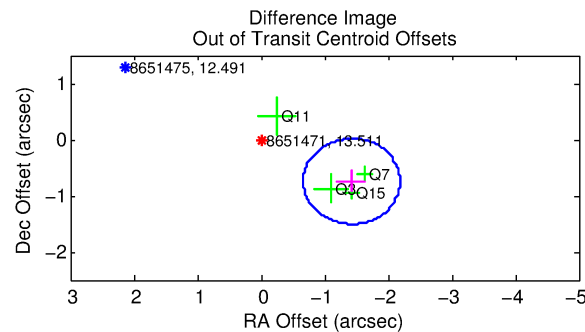
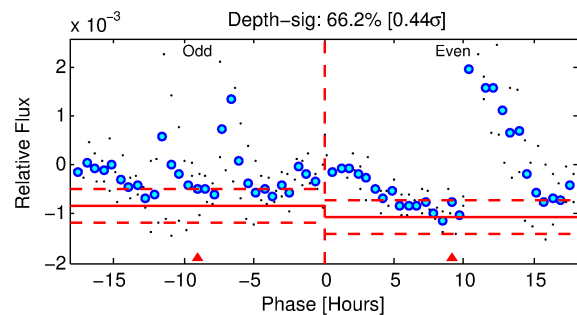
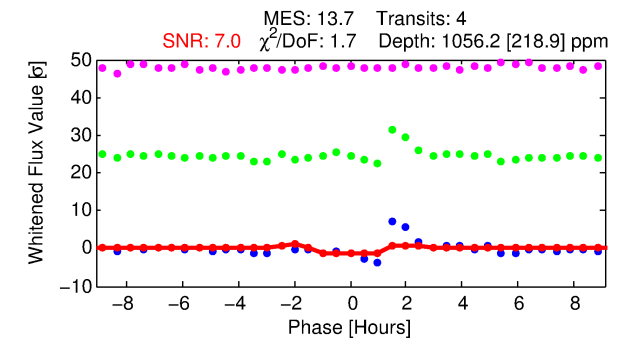
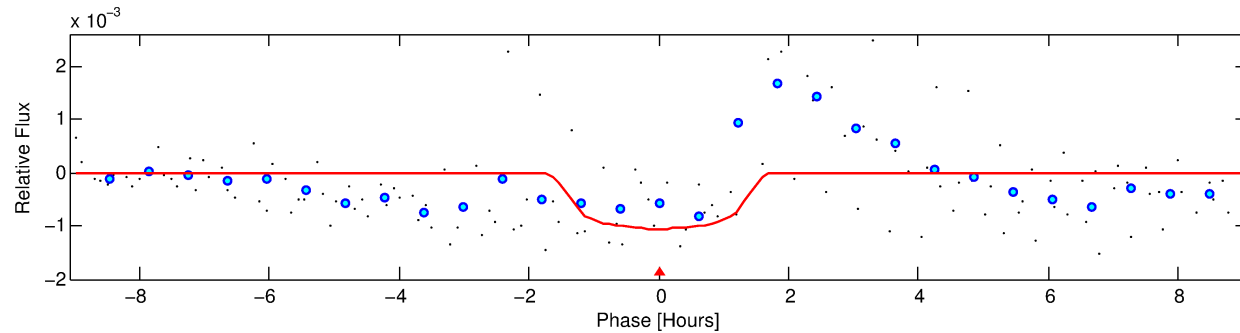
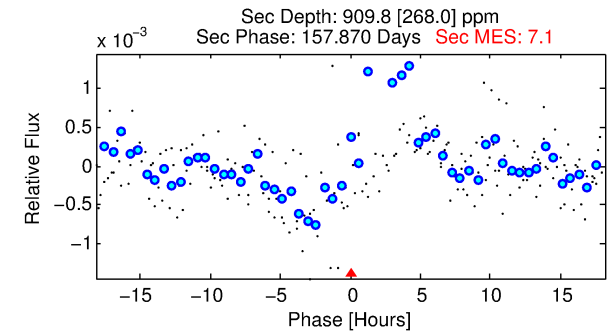
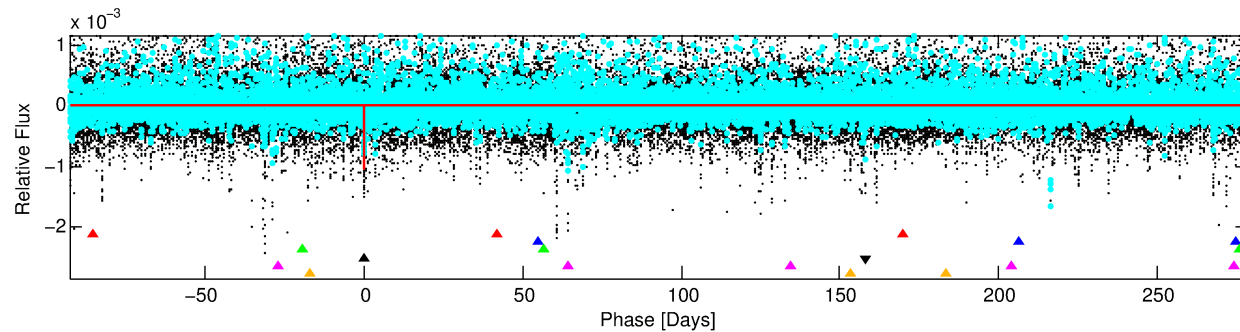
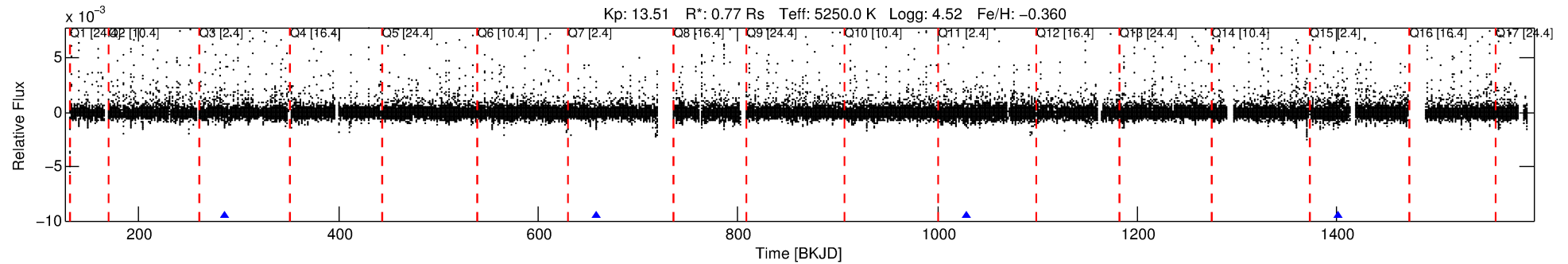
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 008651471-04

No Significant Match Found

# DV One-Page Summary

KIC: 8651471 Candidate: 4 of 6 Period: 371.515 d



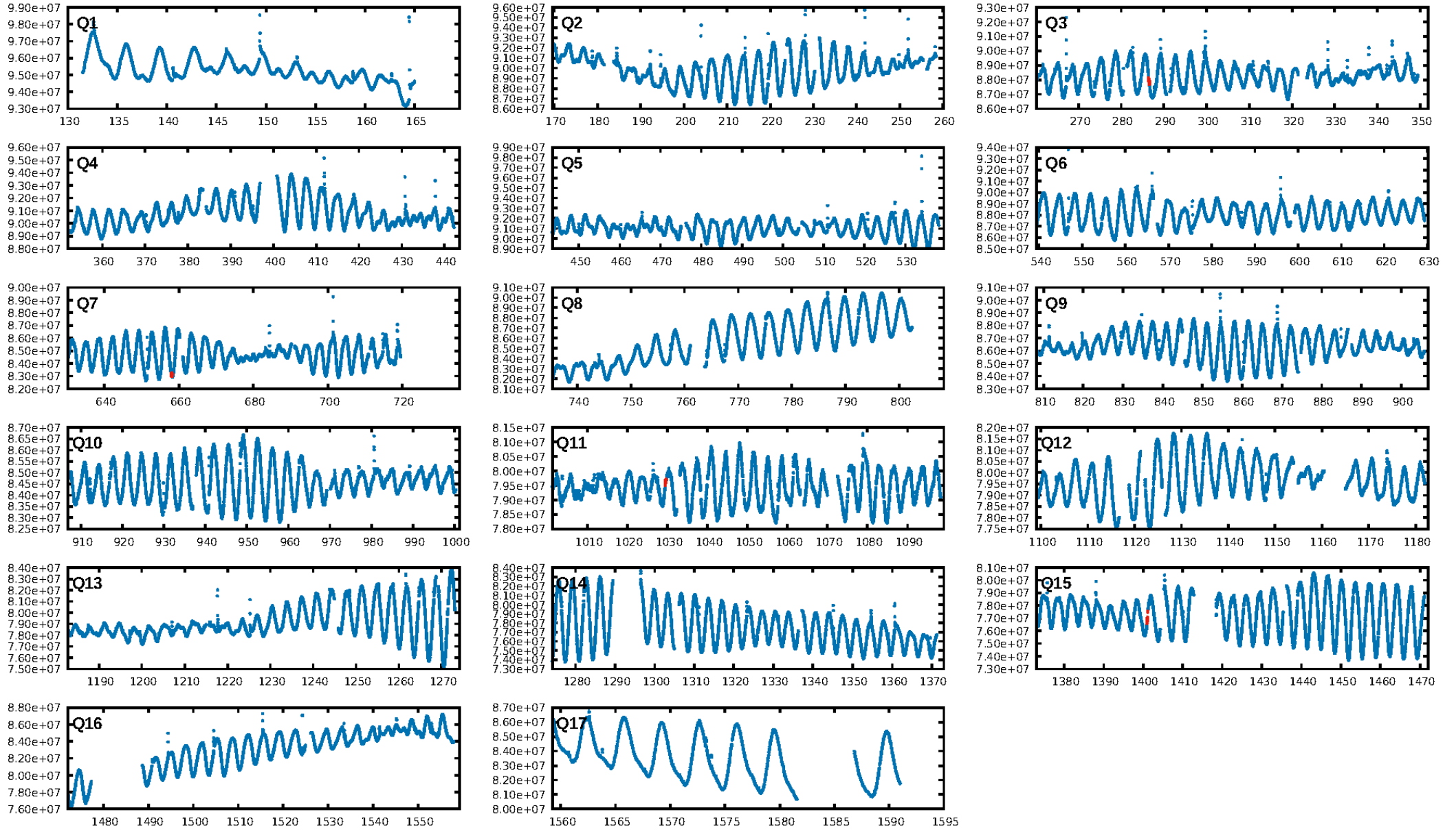
## DV Fit Results:

Period = 371.51517 [0.00416] d  
Epoch = 286.5339 [0.0071] BKJD  
Rp/R\* = 0.0311 [0.0480]  
a/R\* = 773.09 [4596.92]  
b = 0.62 [6.01]  
Seff = 0.49 [0.10]  
Teq = 214 [11] K  
Rp = 2.61 [4.05] Re  
a = 0.9072 [0.1112] AU  
Ag = 60364.91 [187652.44] [0.32 $\sigma$ ]  
Teffp = 5174 [4018] K [1.23 $\sigma$ ]

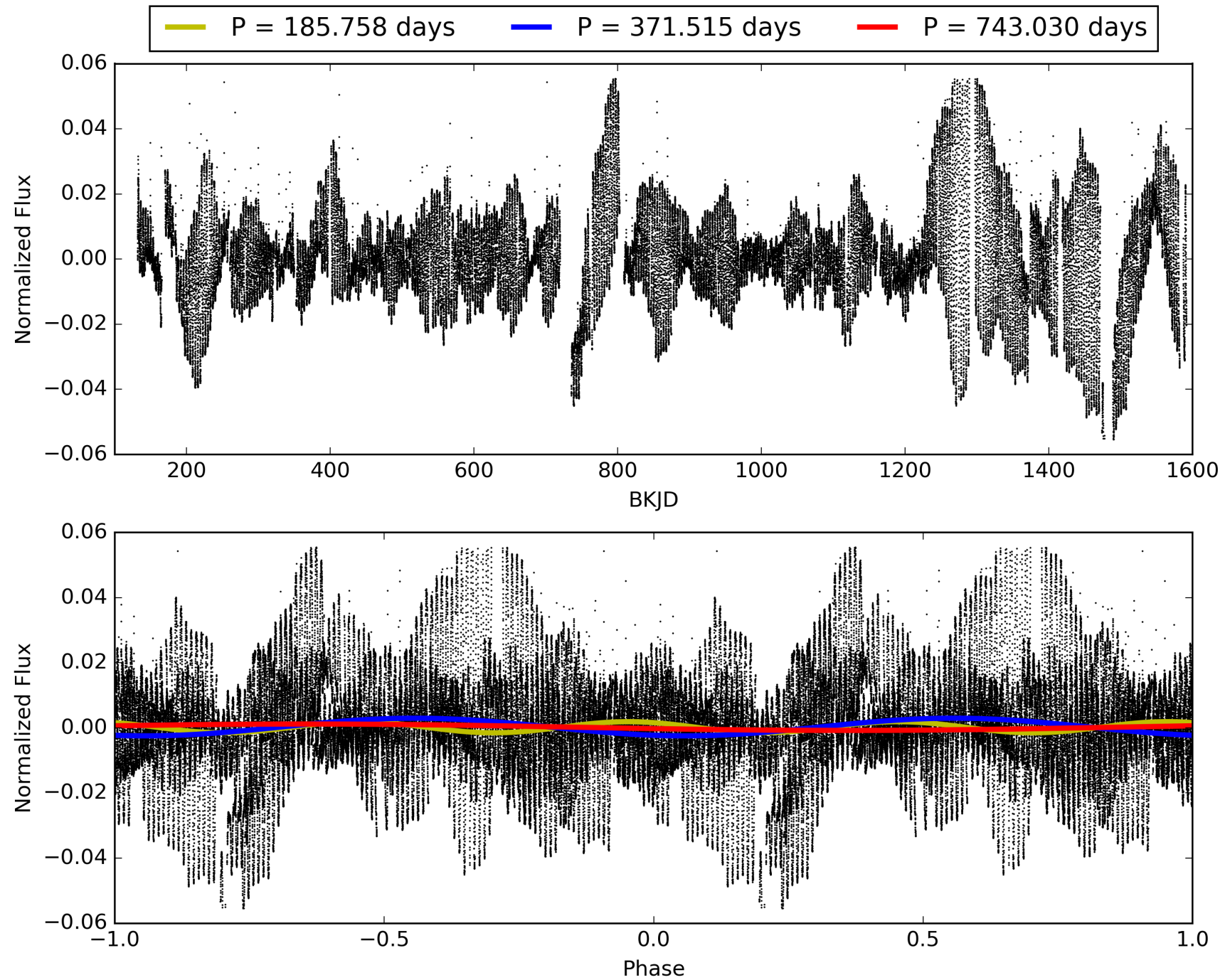
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [317.08 $\sigma$ ]  
LongPeriod-sig: 100.0% [543.69 $\sigma$ ]  
ModelChiSquare2-sig: 5.2%  
ModelChiSquareGof-sig: 31.2%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [4/4]  
GhostDiagnostic-chr: 352.9  
Centroid-sig: N/A  
Centroid-so: 1.196 arcsec [1.09 $\sigma$ ]  
**OotOffset-rm: 1.607 arcsec [6.34 $\sigma$ ]**  
KicOffset-rm: 0.342 arcsec [0.84 $\sigma$ ]  
OotOffset-st: 0/4/0/0 [4]  
KicOffset-st: 0/4/0/0 [4]  
DiffImageQuality-fgm: 0.75 [3/4]  
DiffImageOverlap-fno: 1.00 [4/4]

# TCE 008651471-04, PDC Light Curves



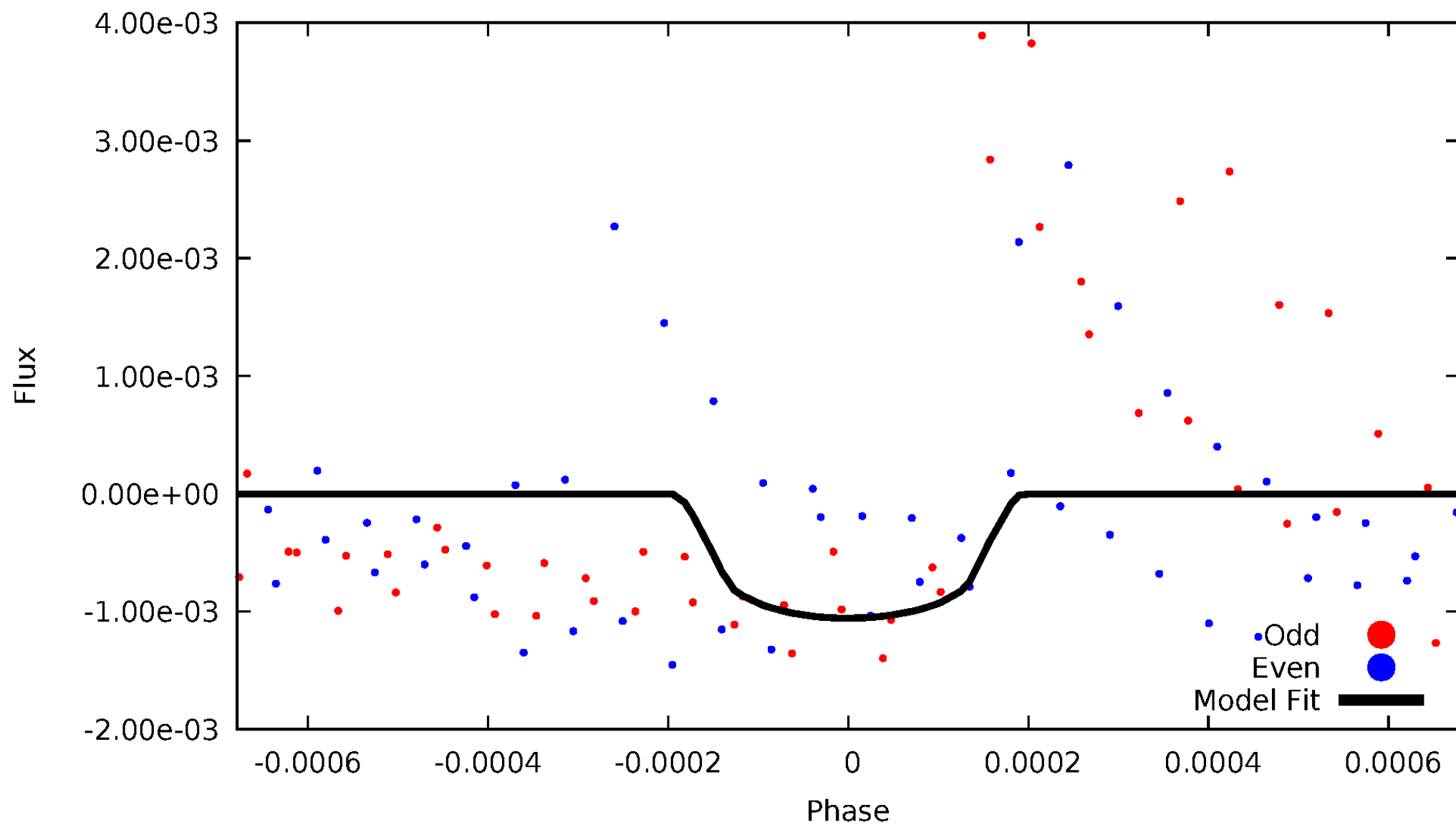
# TCE 008651471-04





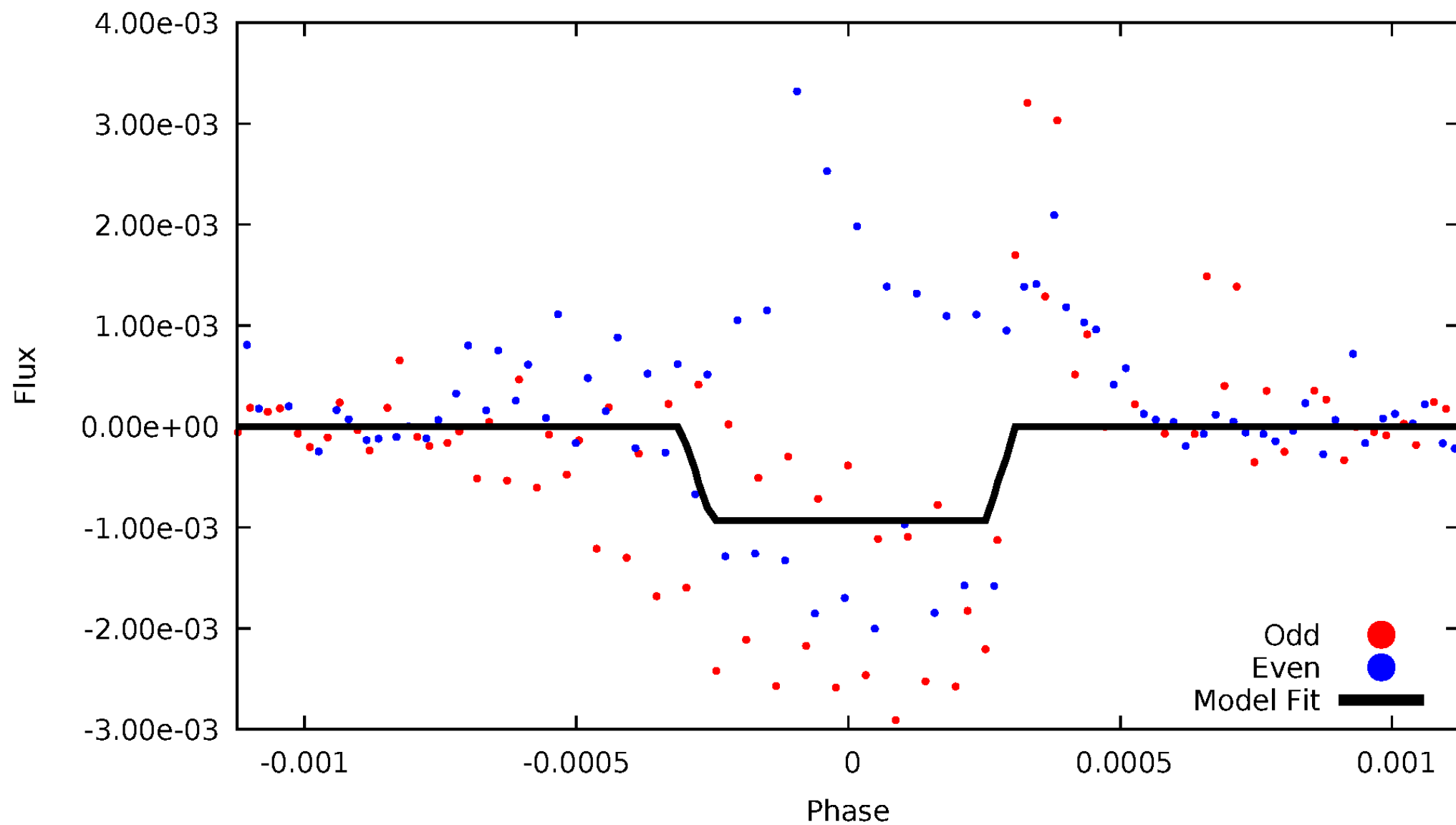
# DV Odd/Even

TCE 008651471-04



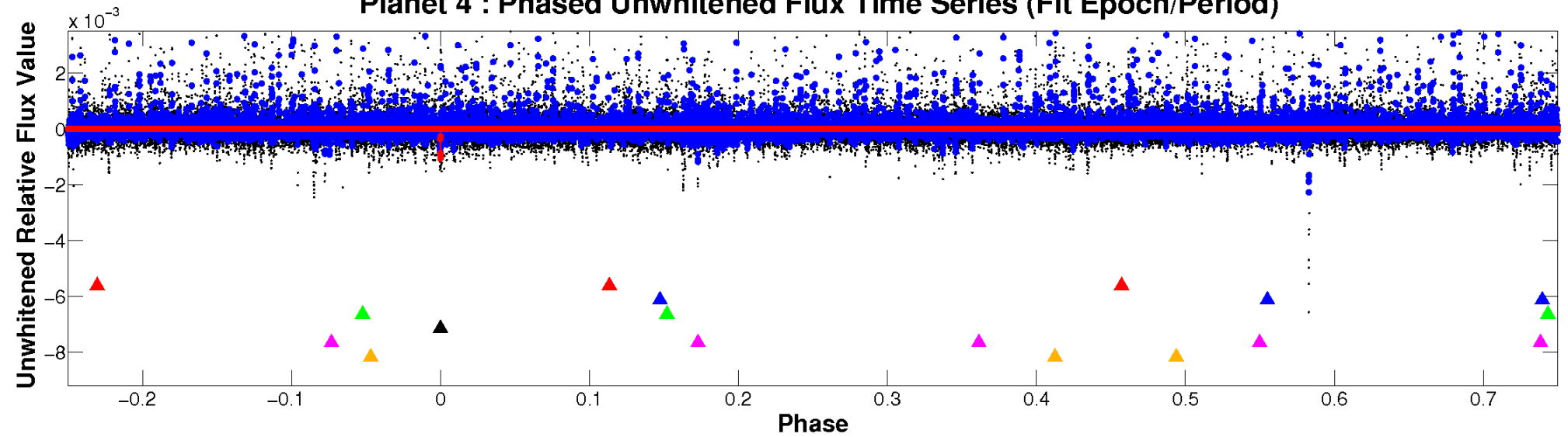
# ALT Odd/Even

TCE 008651471-04

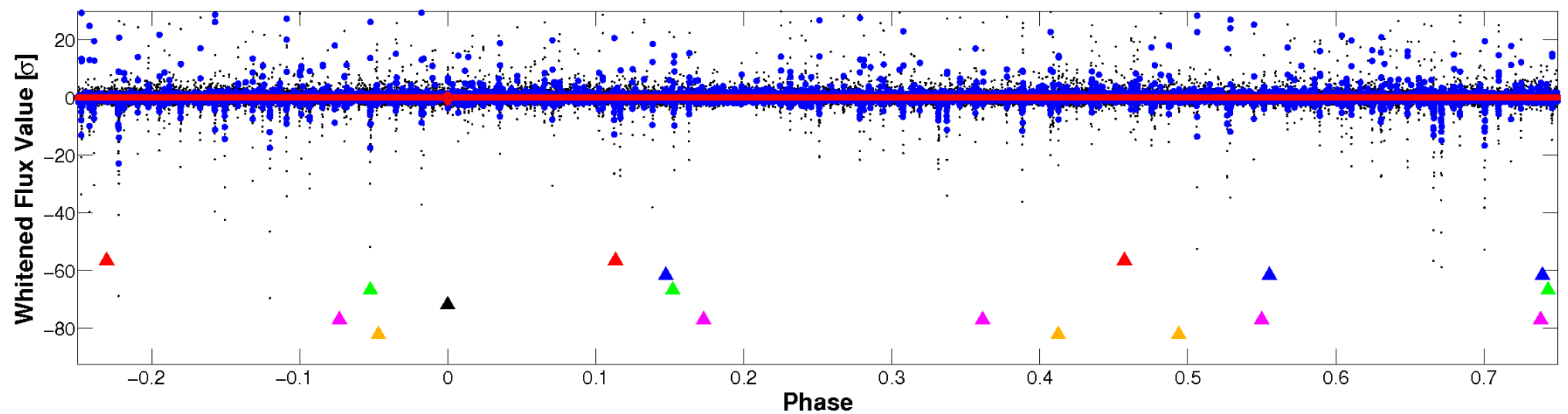


# Non-Whitened Vs. Whitened Light Curve

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

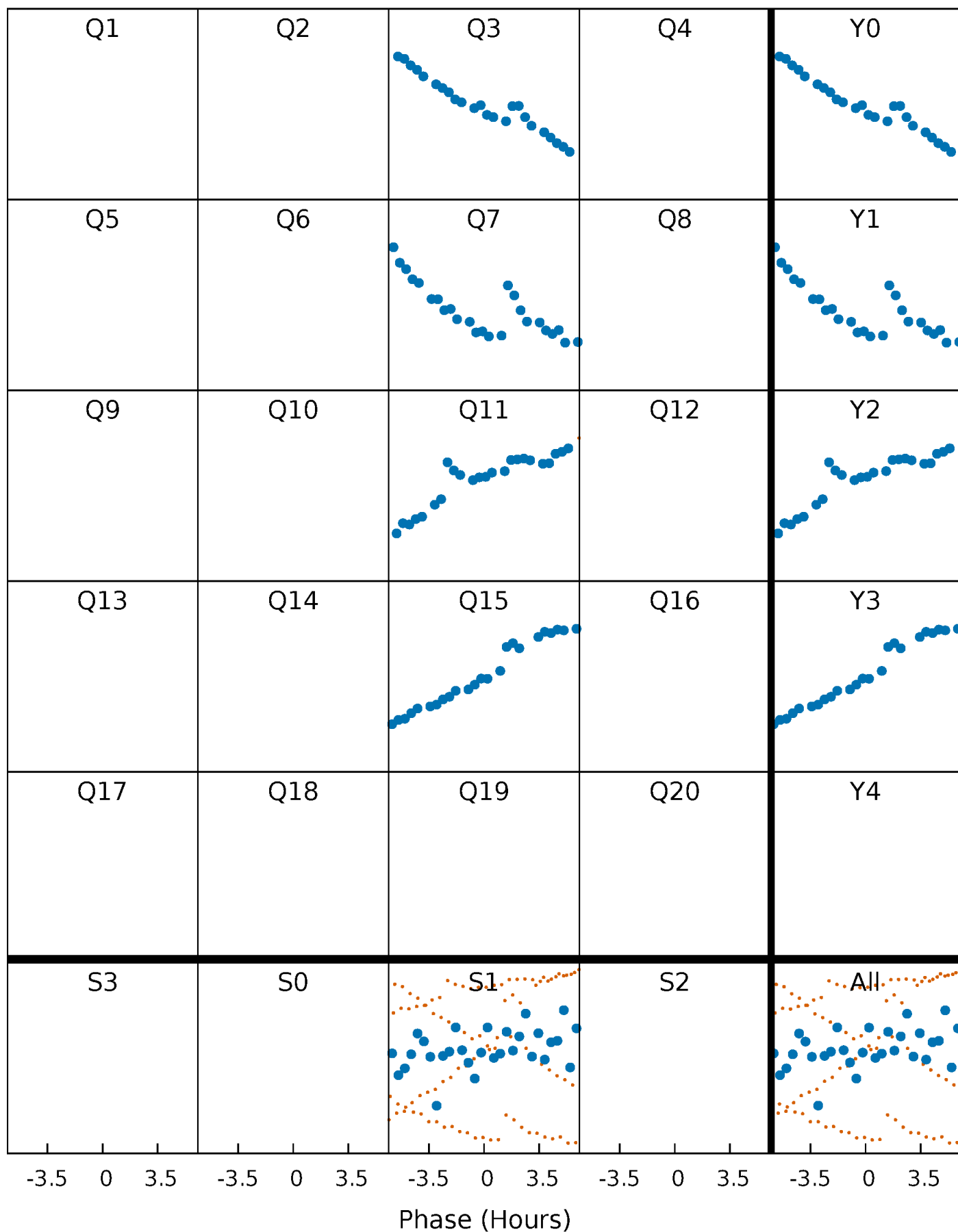


## Planet 4 : Phased Whitened Flux Time Series (Fit Epoch/Period)



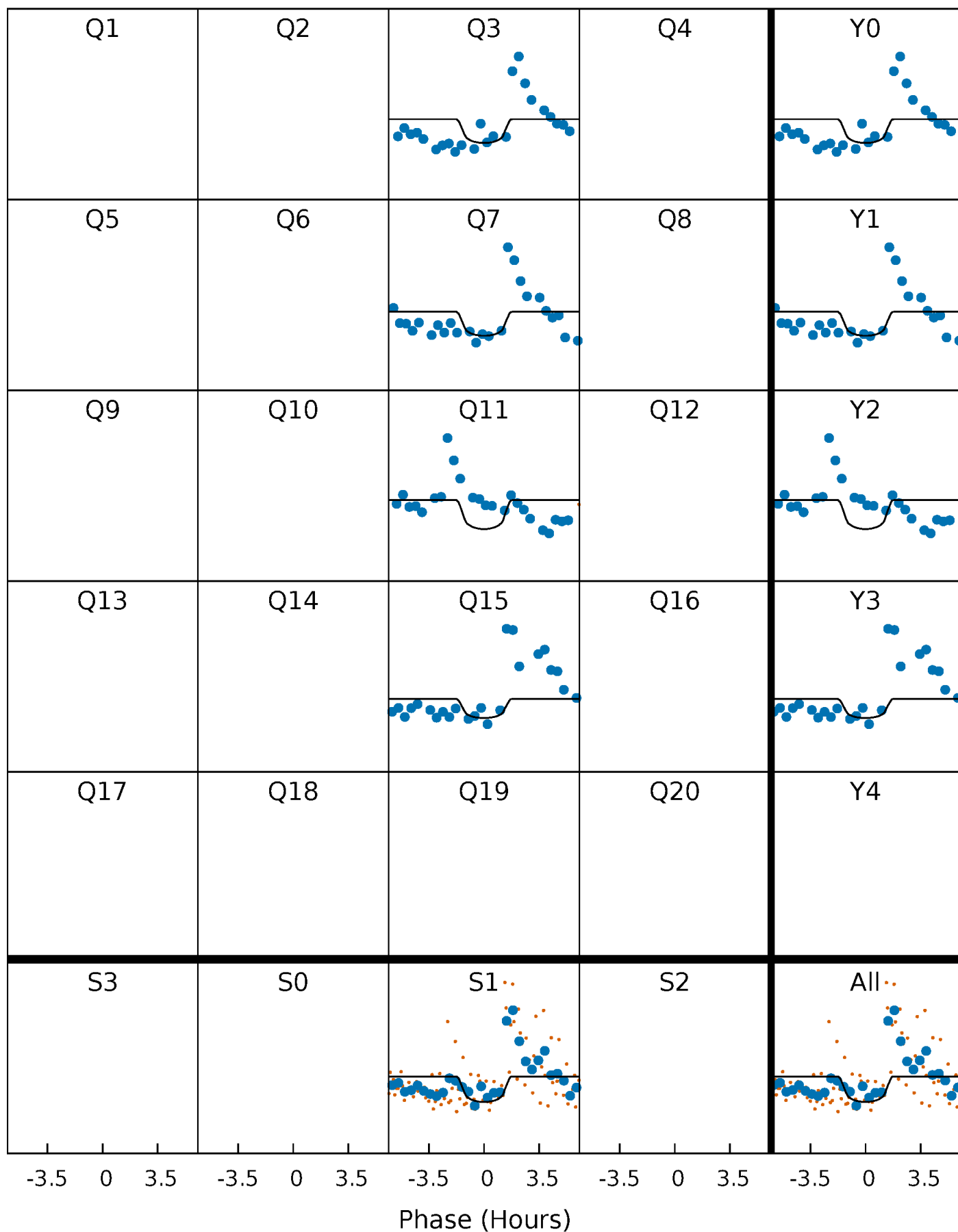
# PDC Quarter-Phased Transit Curves

TCE 008651471-04     $P=371.515169$  Days     $T_0=286.533858$  (BKJD)



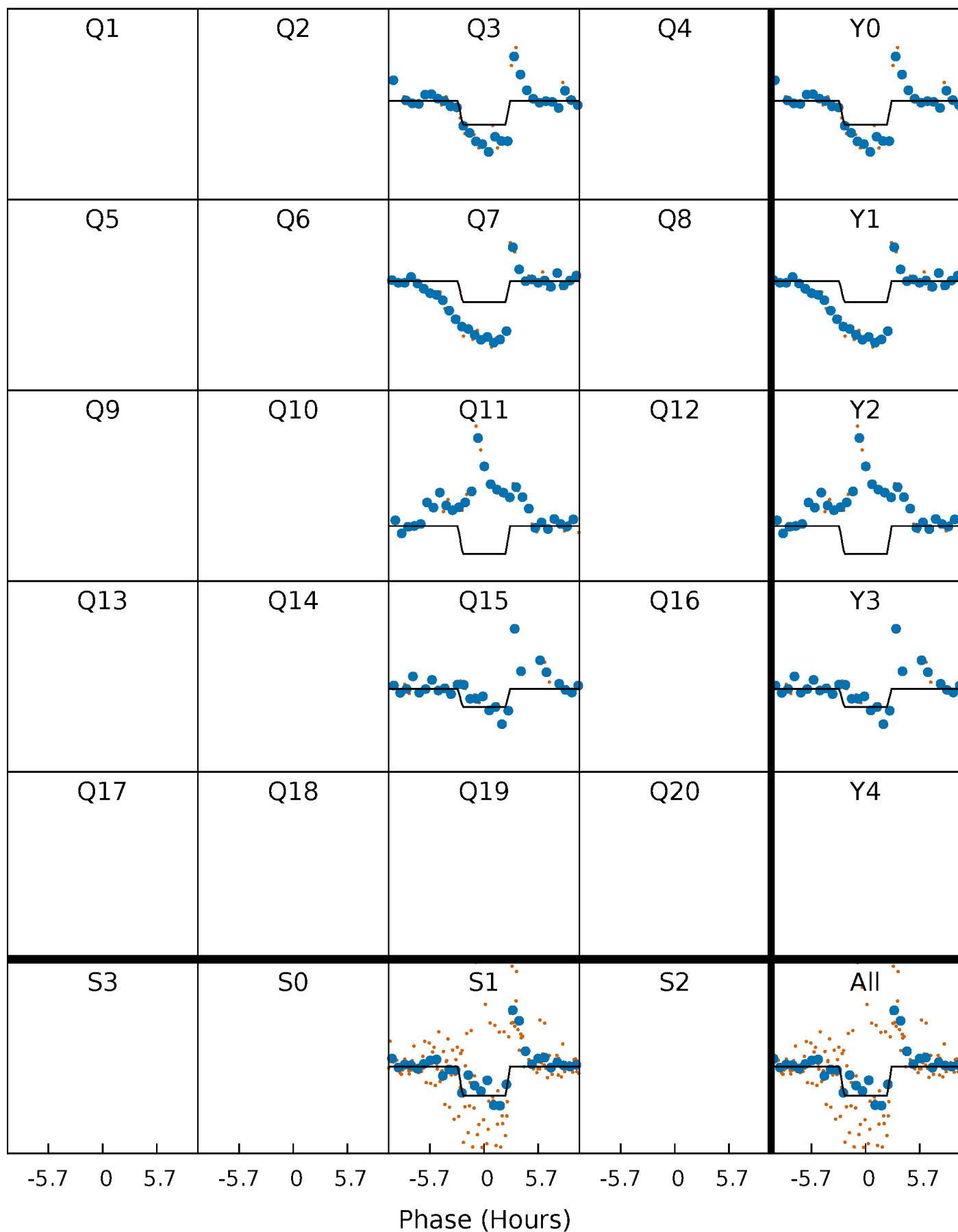
# DV Quarter-Phased Transit Curves

TCE 008651471-04     $P=371.515169$  Days     $T_0=286.533858$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

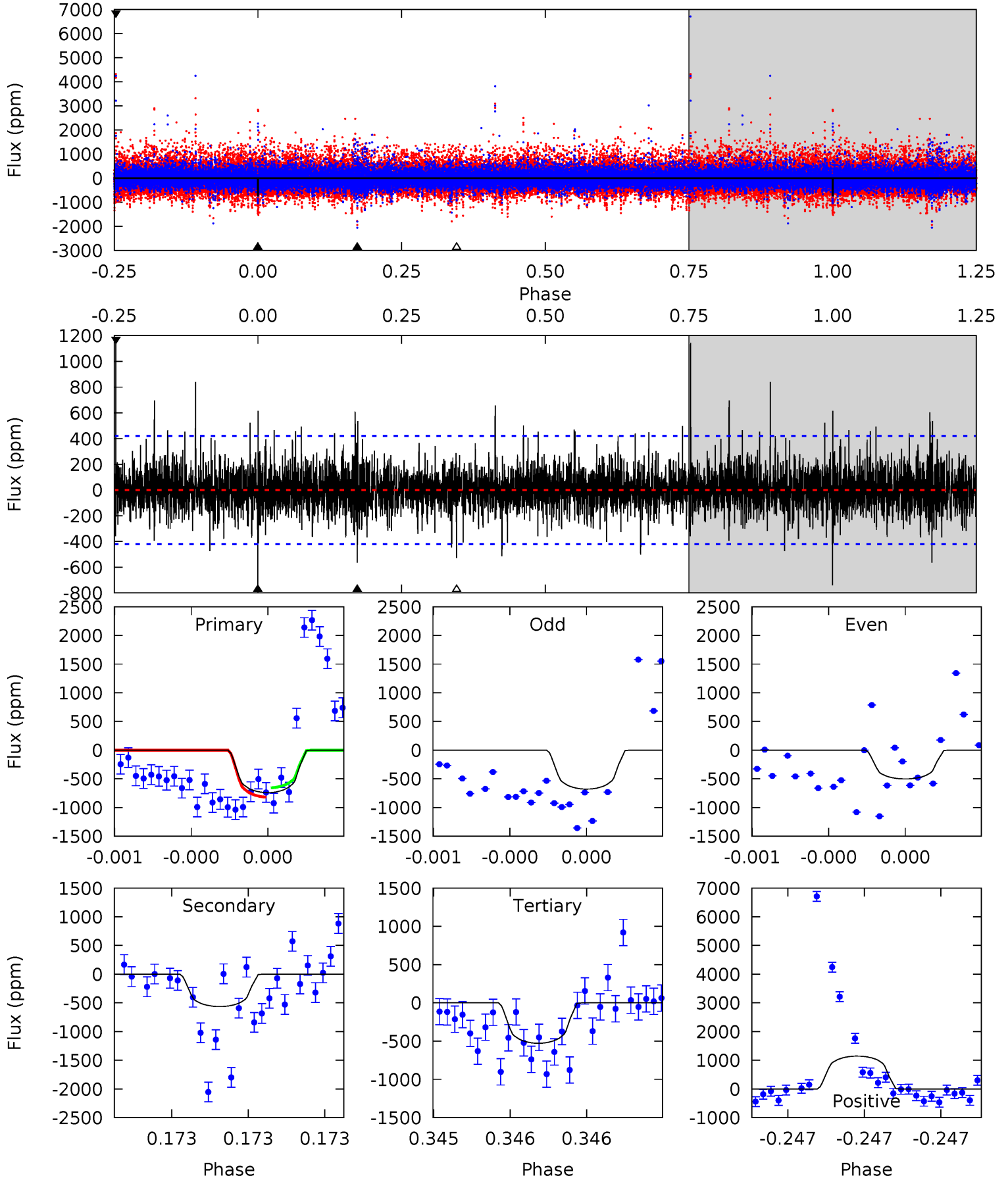
TCE 008651471-04     $P=371.509366$  Days     $T_0=286.484045$  (BKJD)



# DV Model-Shift Uniqueness Test

008651471-04, P = 371.515169 Days, E = 286.533858 Days

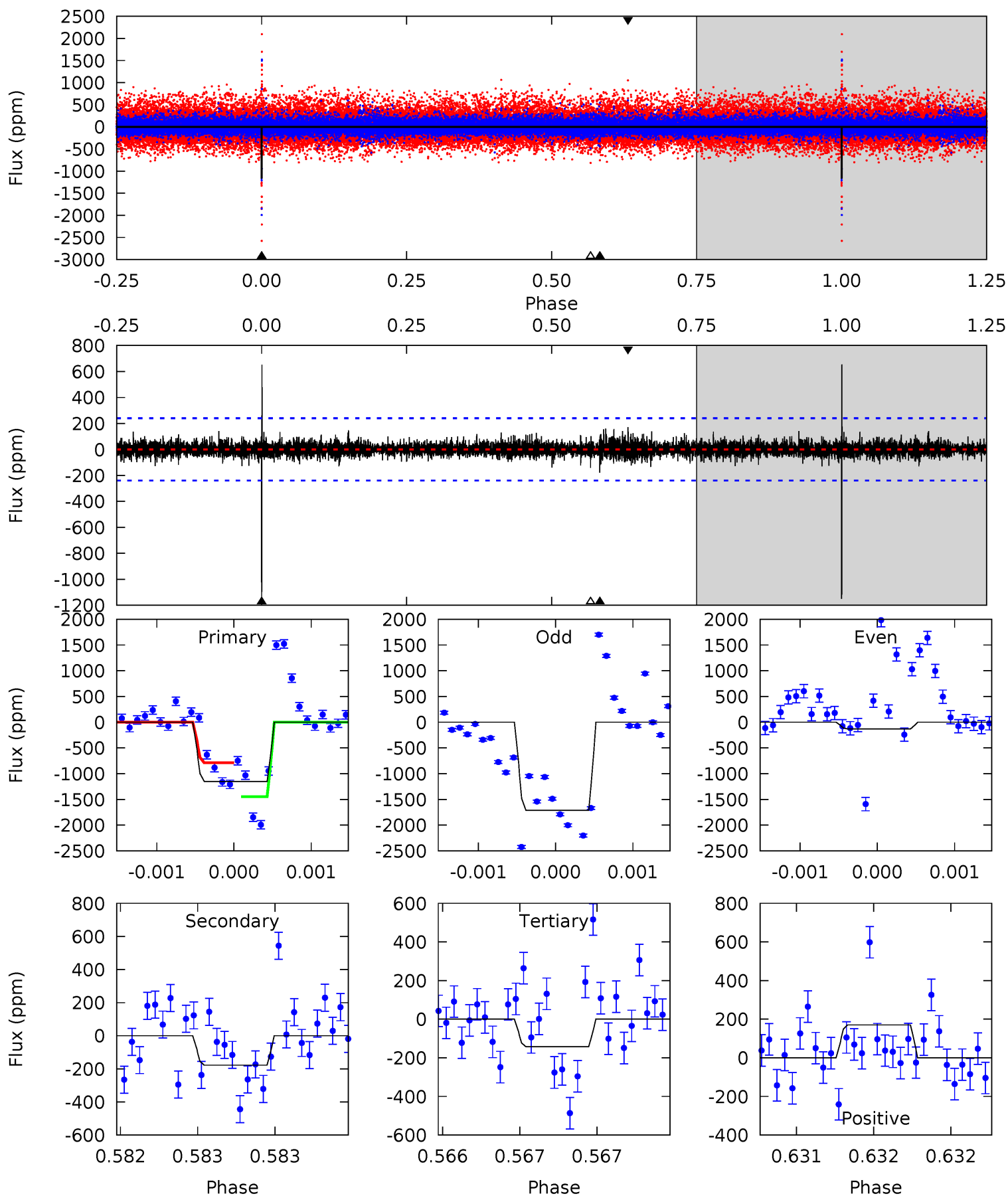
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
9.89	7.53	7.05	15.3	5.62	3.56	1.56	2.84	-5.39	0.48	-7.75	0.81	0.87	0.61	1.09



# Alt Model-Shift Uniqueness Test

008651471-04, P = 371.509366 Days, E = 286.484045 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
26.6	4.11	3.28	3.93	5.54	3.44	0.74	23.3	22.7	0.83	0.18	22.8	0.69	0.36	6.97





### Stellar Parameters For KIC 008651471

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5250^{+158}_{-142}$	$4.522^{+0.085}_{-0.095}$	$-0.360^{+0.350}_{-0.300}$	$0.771^{+0.114}_{-0.085}$	$0.721^{+0.109}_{-0.042}$	$2.217^{+0.883}_{-0.633}$
	+3%/-3%	+2%/-2%	+97%/-83%	+15%/-11%	+15%/-6%	+40%/-29%
Source	PHO1	KIC0	KIC0	DSEP		

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

### Secondary Eclipse Parameters for KIC 008651471-04 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-564 \pm 75$	$3.80^{+3.67}_{-2.55}$	$299^{+13}_{-12}$	$4102^{+2331}_{-833}$	$18113^{+138883}_{-13496}$
Alt.	$-178 \pm 43$	$3.87^{+3.57}_{-2.58}$	$300^{+13}_{-12}$	$3338^{+1603}_{-574}$	$5372^{+43722}_{-4016}$

$T_{max}$  = 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

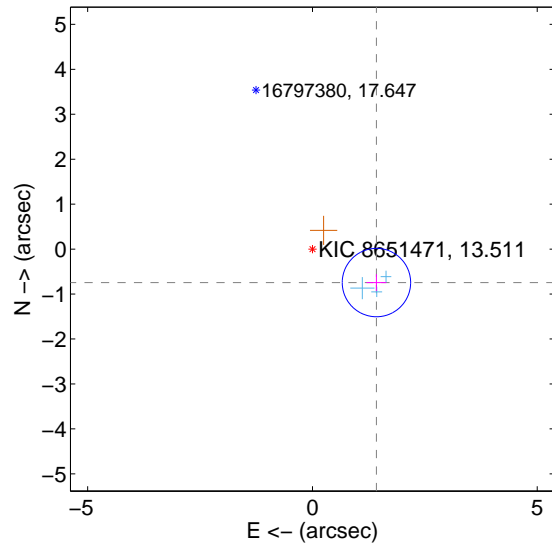
Supplemental centroid analysis for 008651471-04. Kepler magnitude: 13.51. Transit SNR 6.96

There are 3 quarters with good PRF difference image offsets

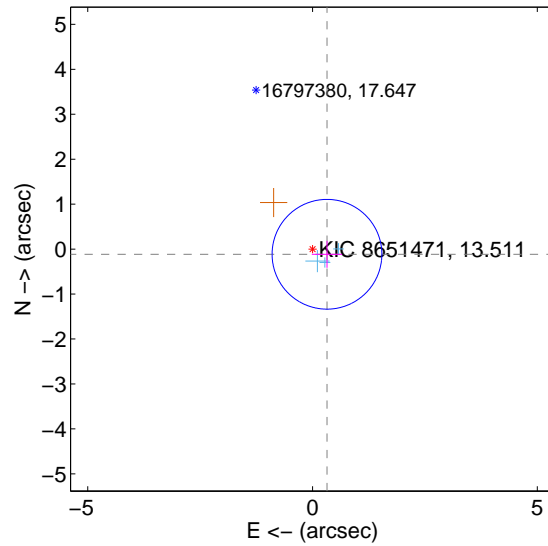
The direct PRF centroid is offset from the target star catalog position by about 1.33 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.607 \pm 0.254$	6.34	$-1.424 \pm 0.221$	$-0.745 \pm 0.186$
PRF-fit source offset from KIC position	$0.342 \pm 0.407$	0.84	$-0.322 \pm 0.337$	$-0.115 \pm 0.300$
photometric centroid source offset	$1.20 \pm 1.10$	1.09	$1.11 \pm 1.12$	$0.45 \pm 0.91$

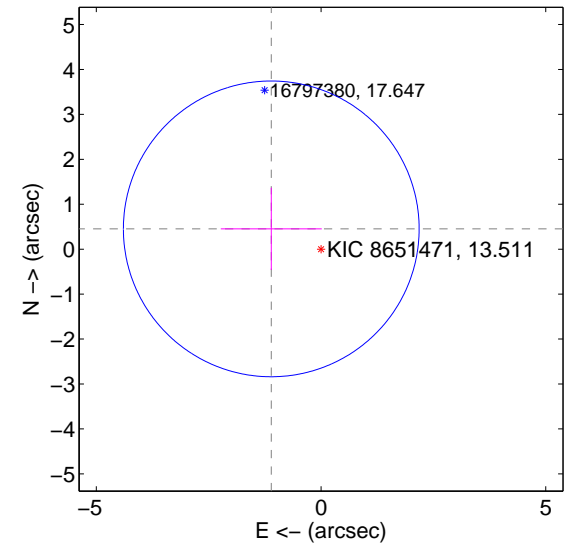
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

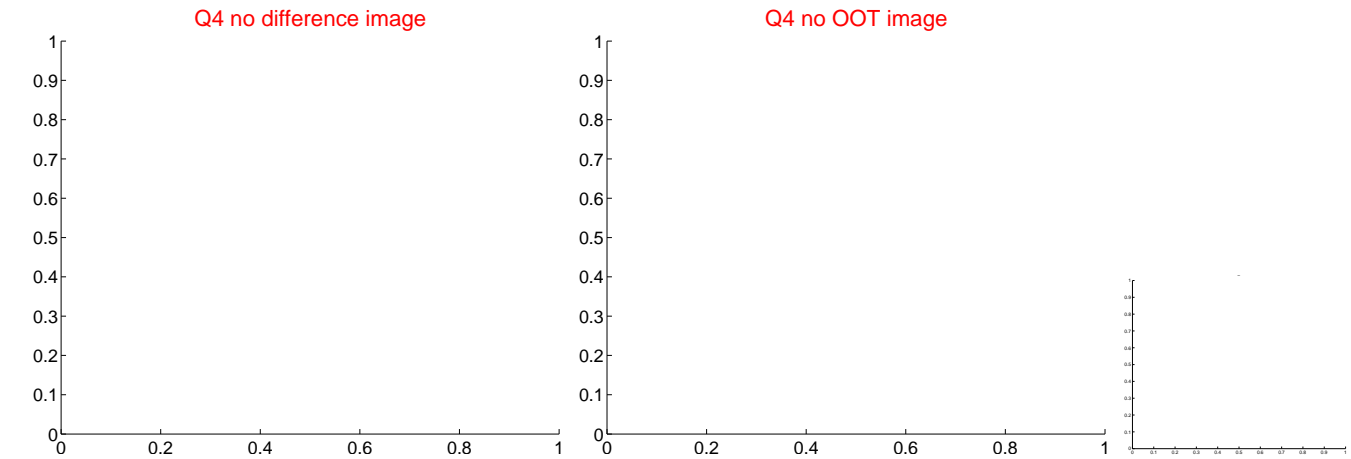
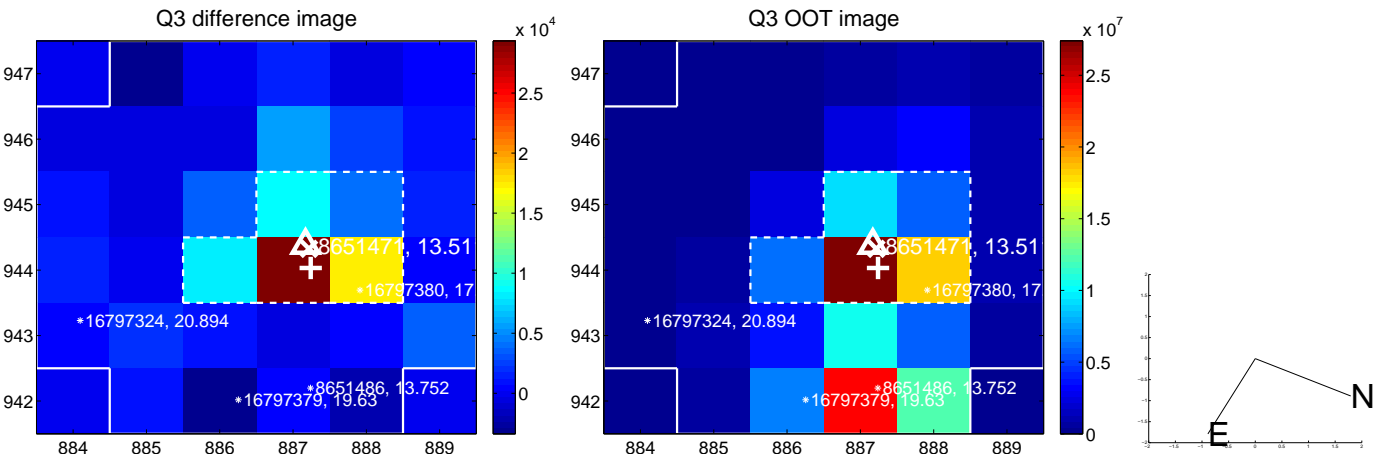
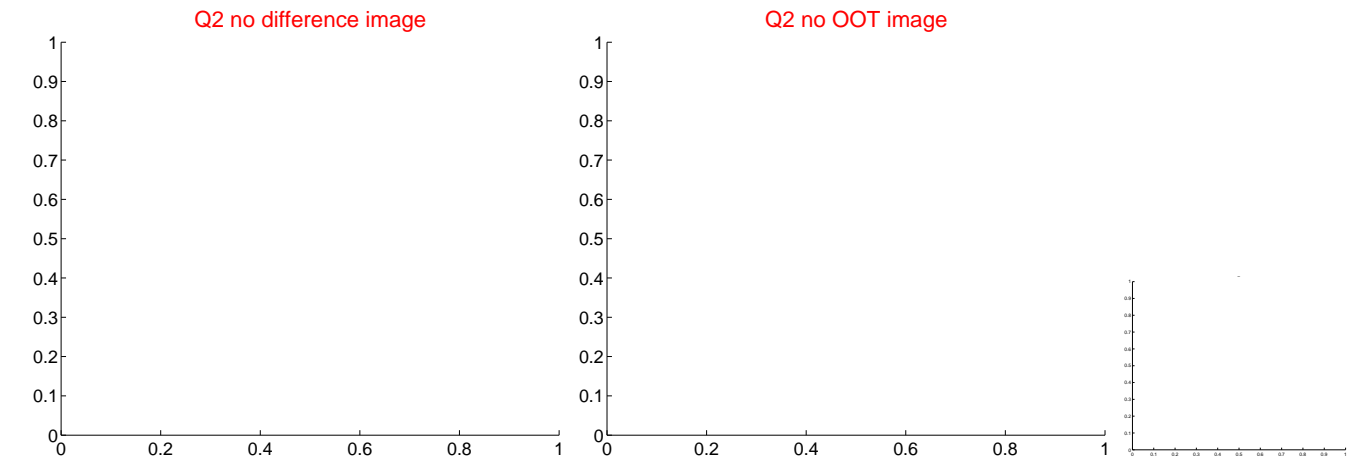
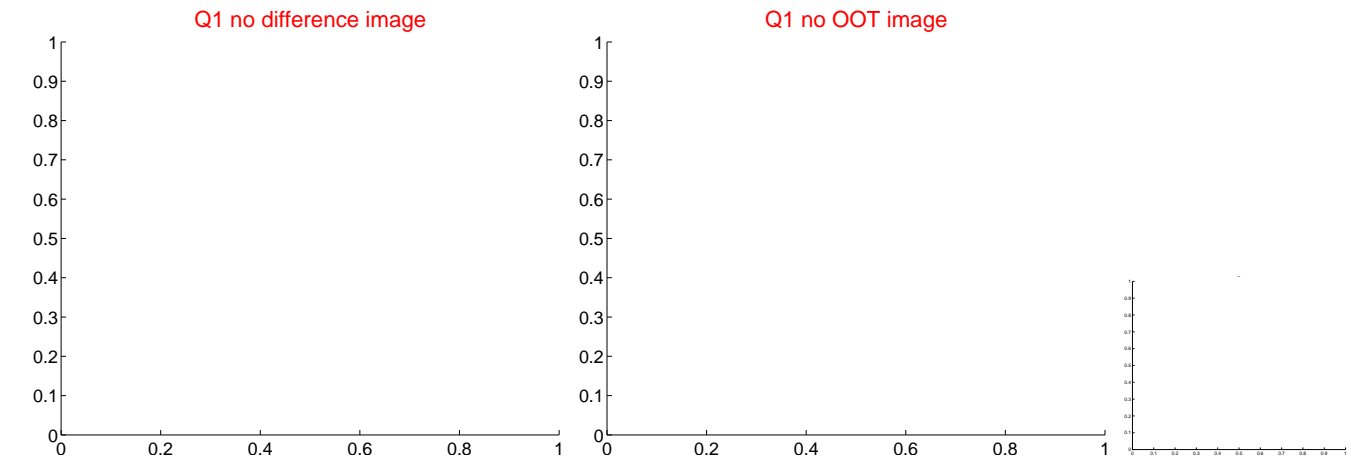


offset from photometric centroids

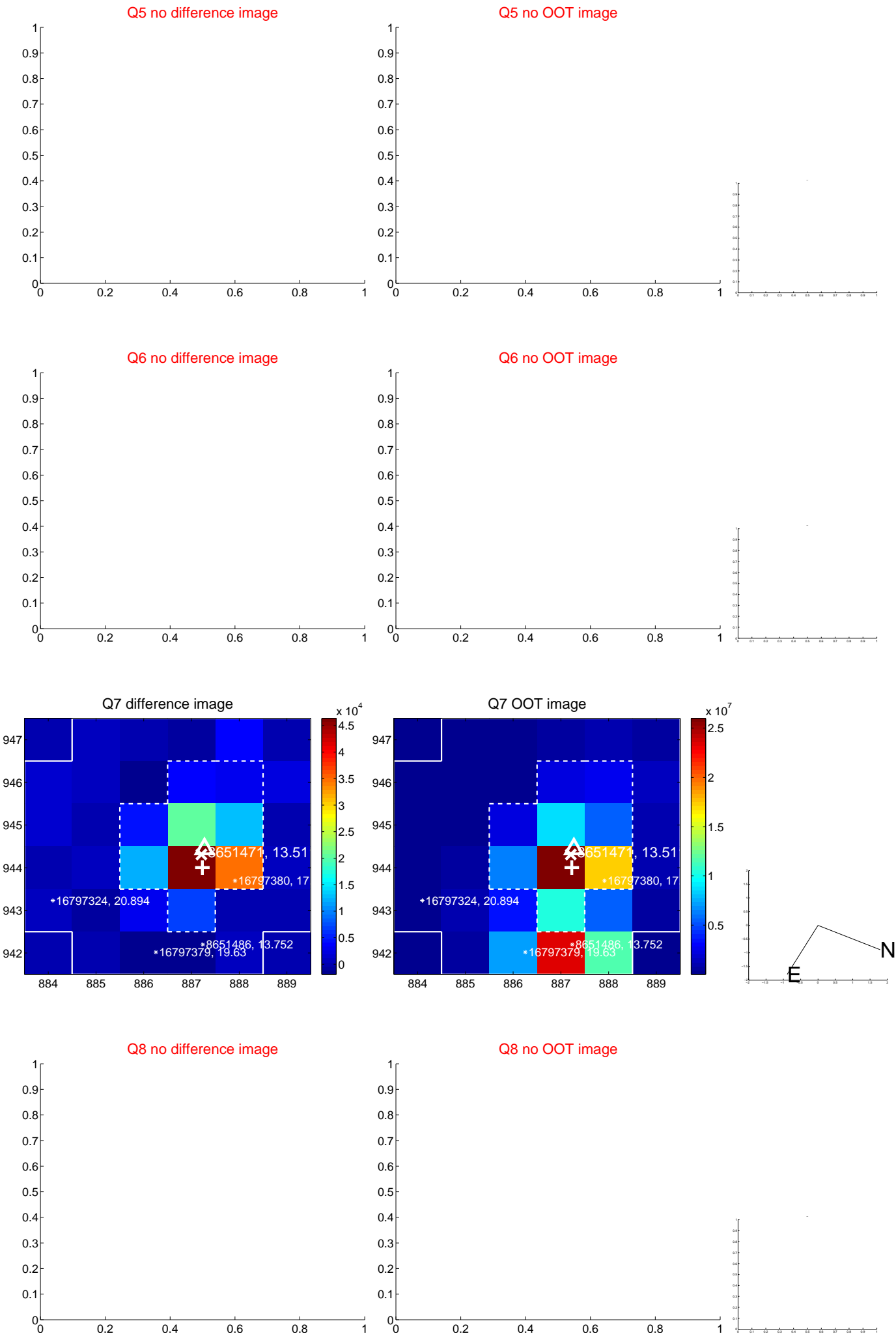


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

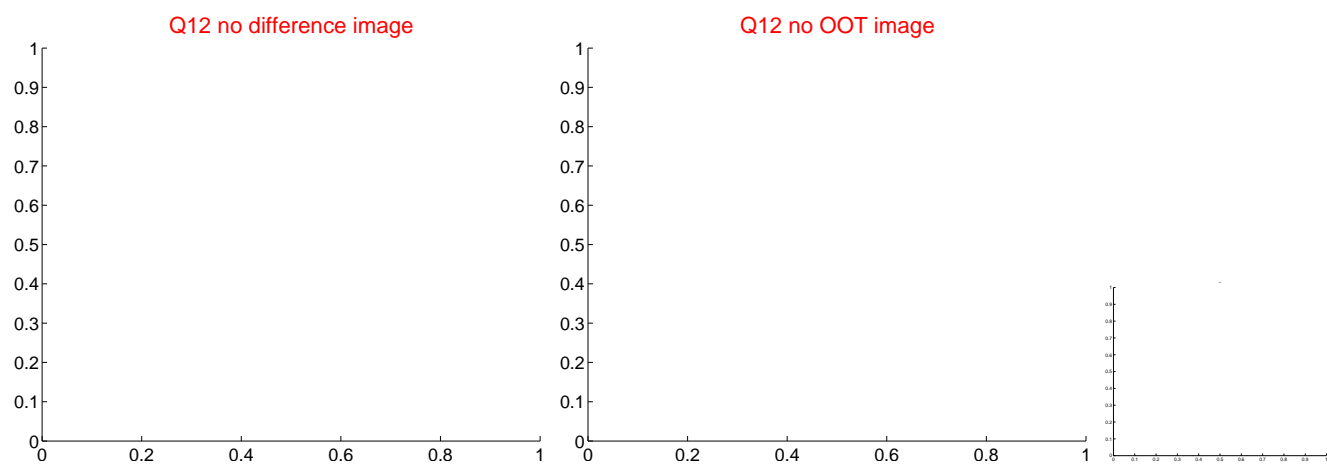
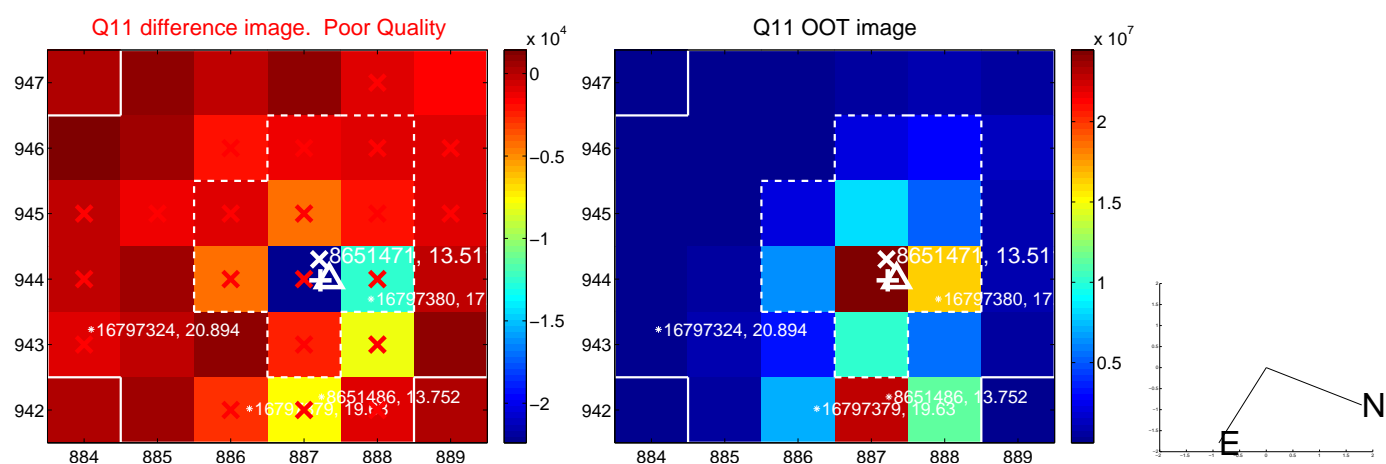
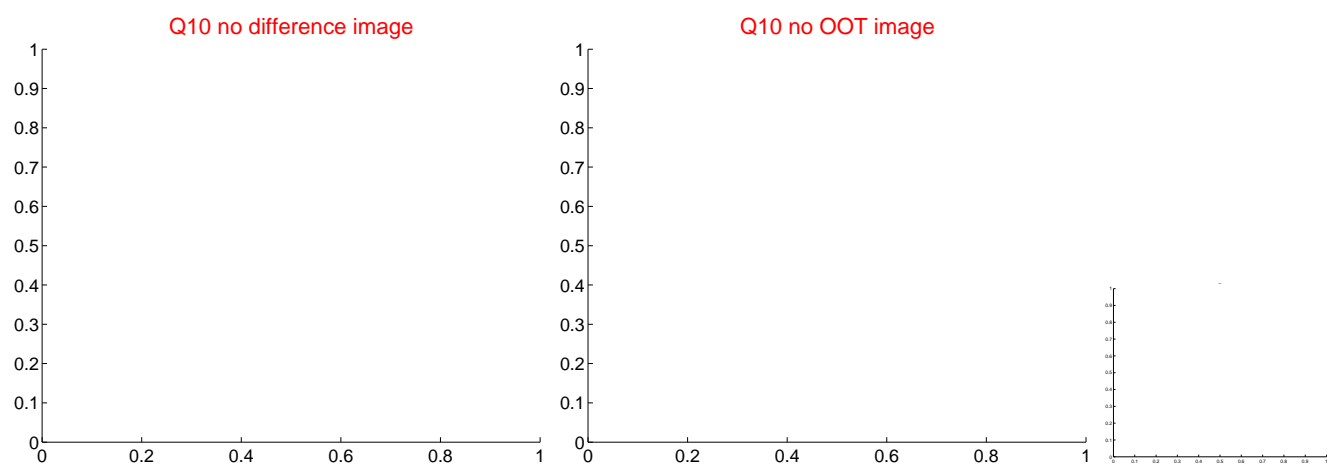
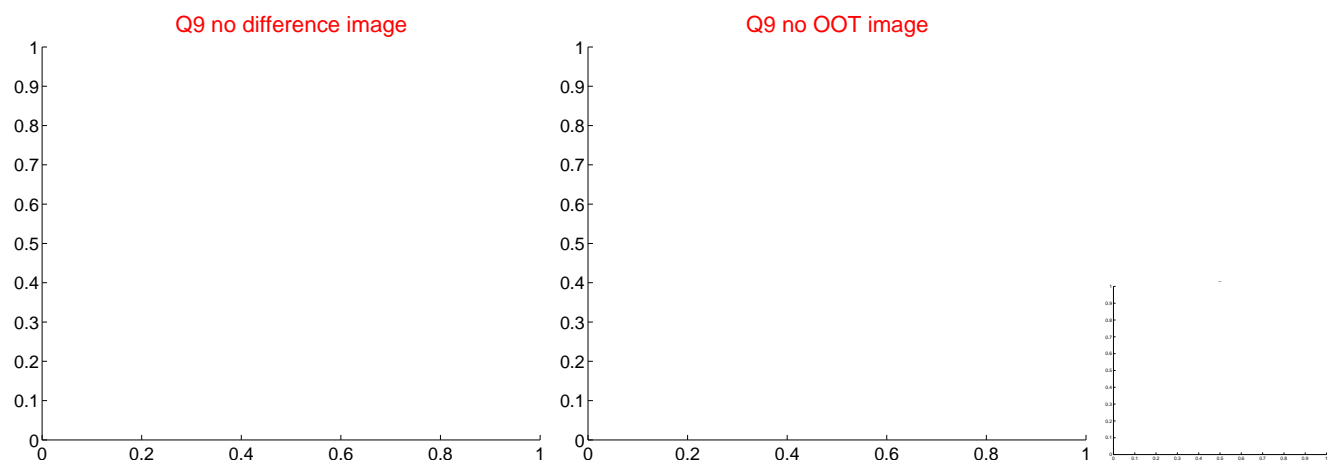
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



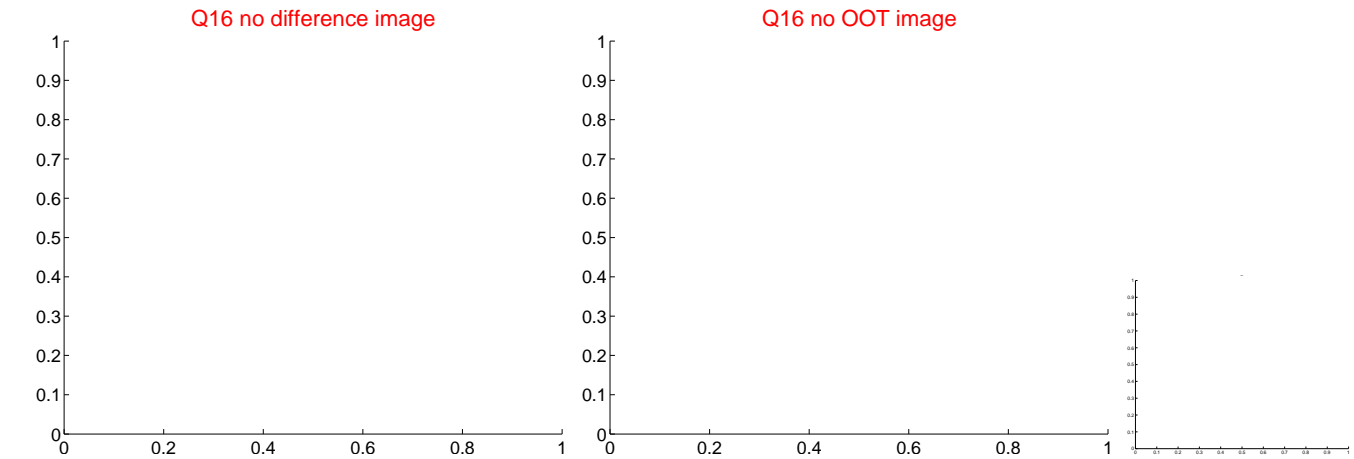
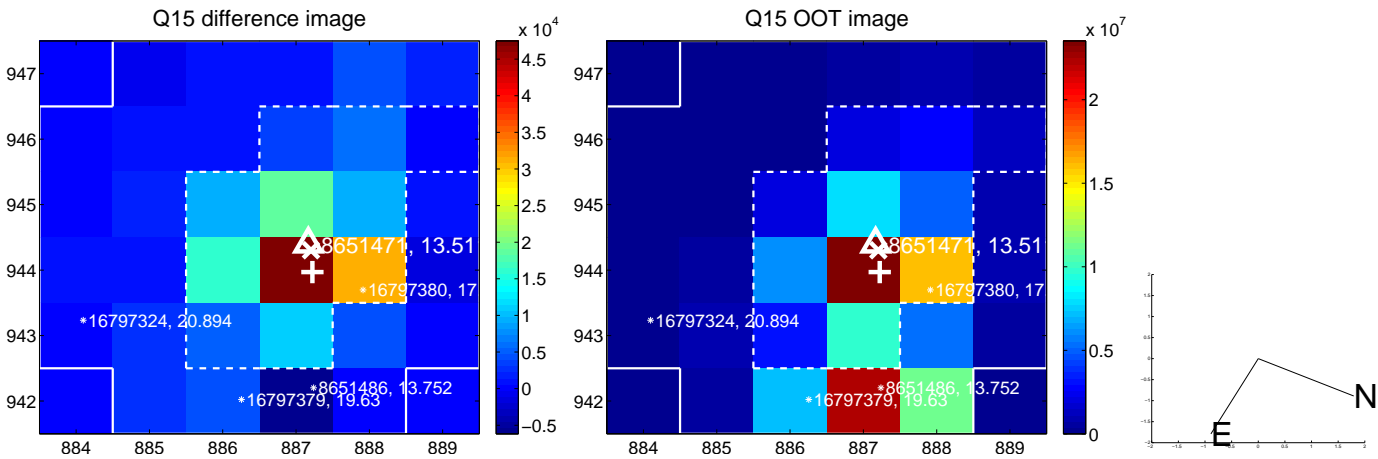
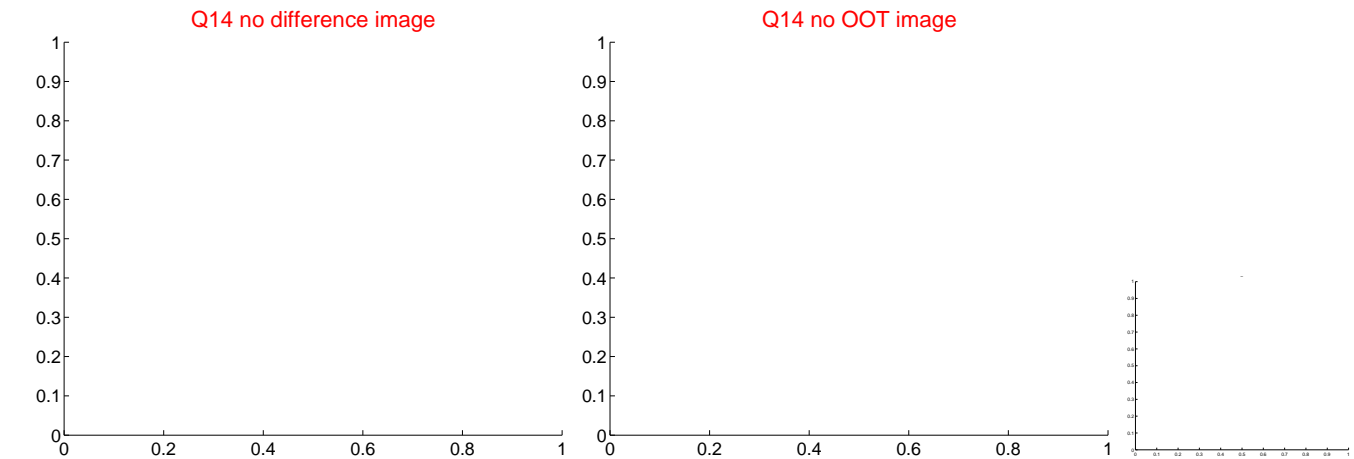
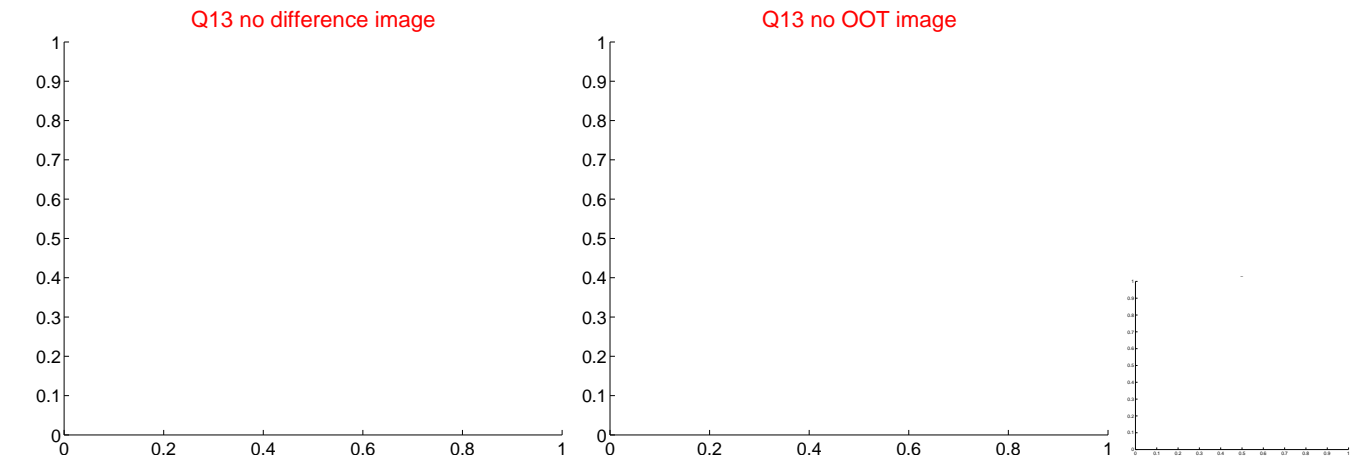
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



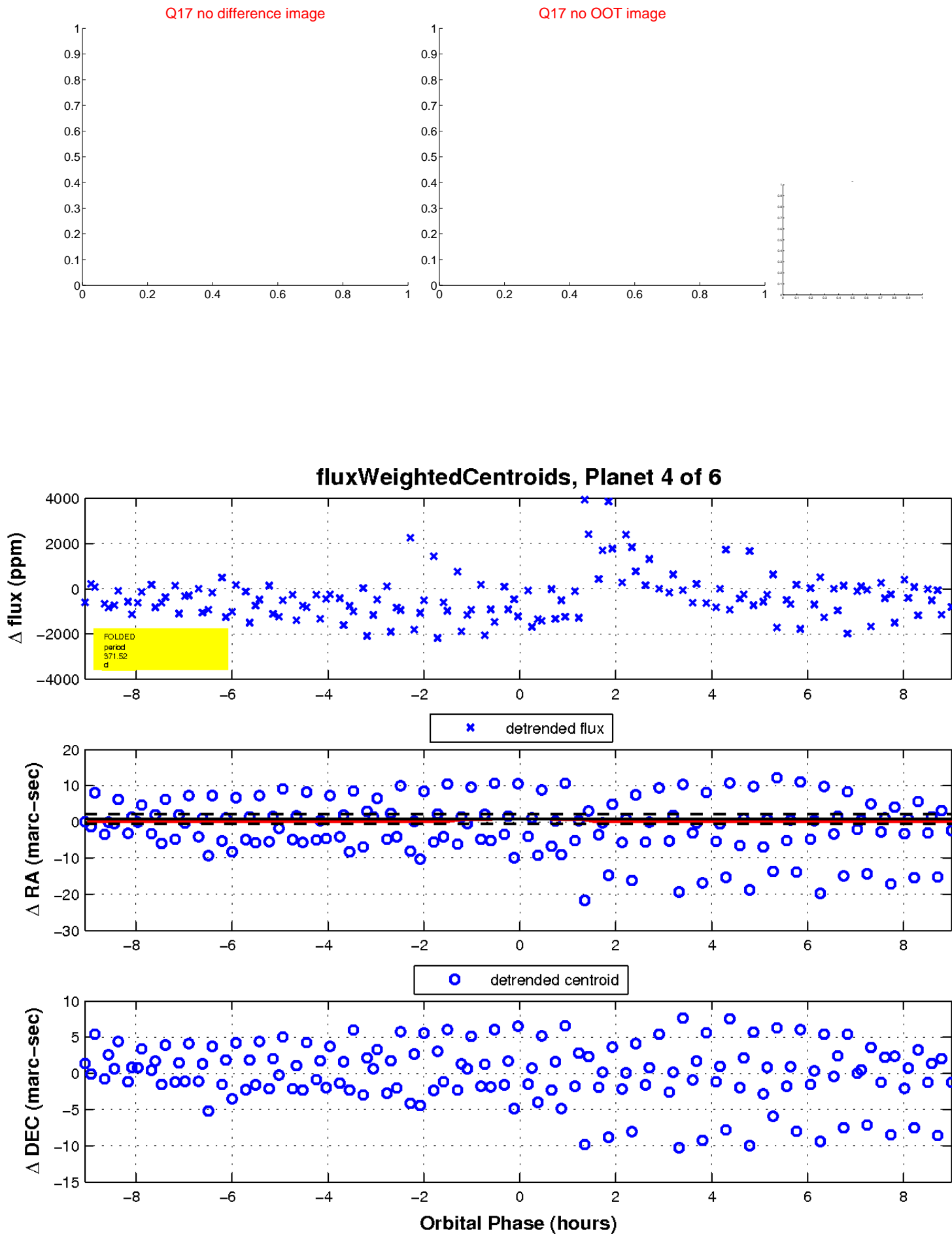
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

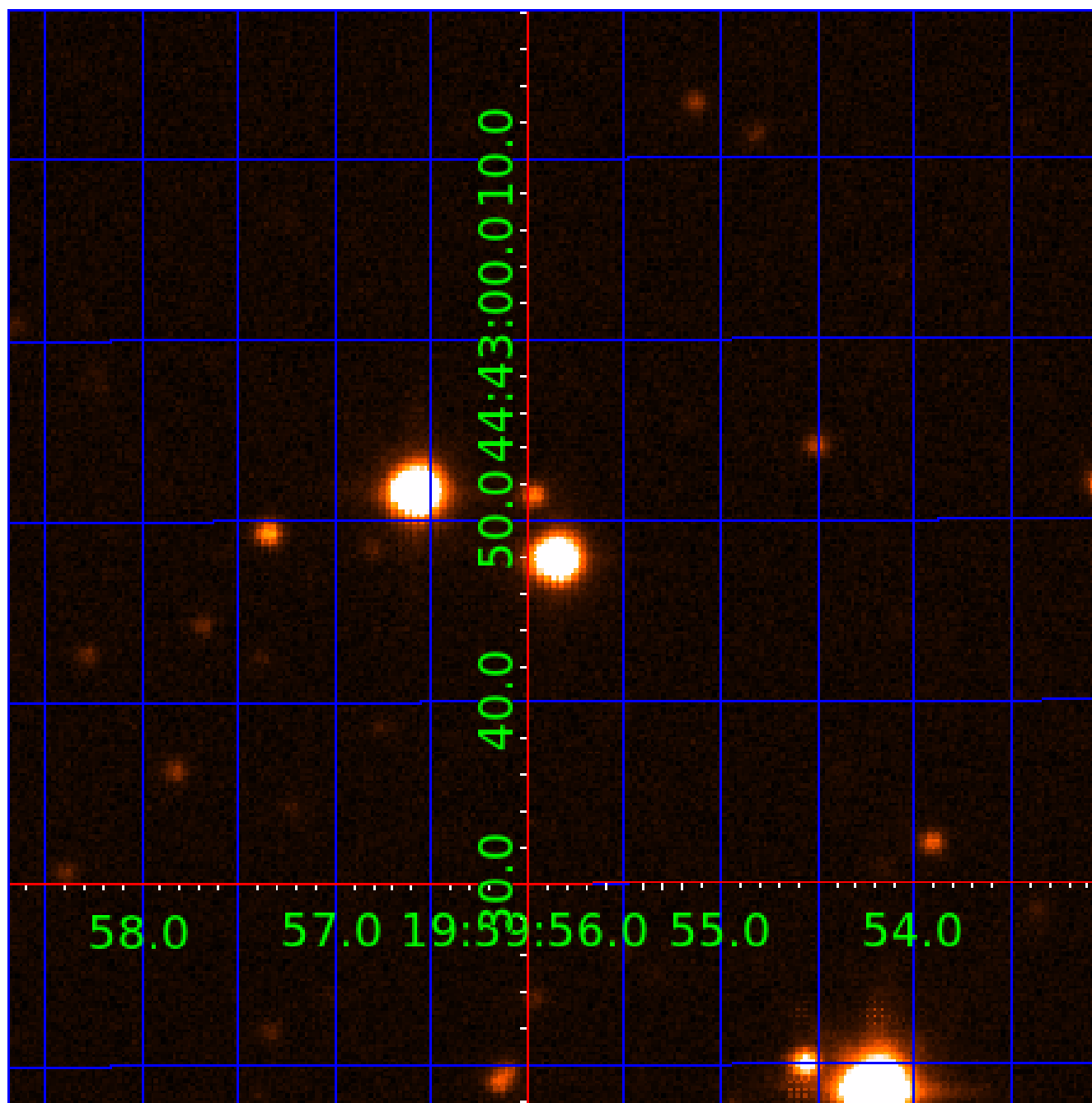


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination





# KIC 008651471

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
008651471-01	OBS	No	499.244107	200.933797	1287.9	6.574	14.9	7.8	0.77	5250	3.35	0.33
008651471-02	OBS	No	523.001201	189.787383	496.6	10.681	14.1	2.4	0.77	5250	1.74	0.31
008651471-03	OBS	No	447.422049	562.729561	1449.4	1.441	15.8	7.4	0.77	5250	3.20	0.38
008651471-04	OBS	No	371.515168	286.533858	1056.2	3.025	13.7	7.0	0.77	5250	2.61	0.49
008651471-05	OBS	No	301.489511	259.355139	1255.0	4.352	13.2	7.6	0.77	5250	2.76	0.65
008651471-06	OBS	No	542.143214	470.033782	782.2	3.500	13.1	-1.0	0.77	5250	2.12	0.30

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
008651471-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
008651471-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL_TRACKER—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS
008651471-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_TRACKER—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS
008651471-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_ZUMA_TRACKER—LPP_DV—LPP_ALT—MOD_POS_DV—CENT_KIC_POS
008651471-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
008651471-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_SKYE—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—INCONSISTENT_TRANS—CENT_NOFITS

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

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

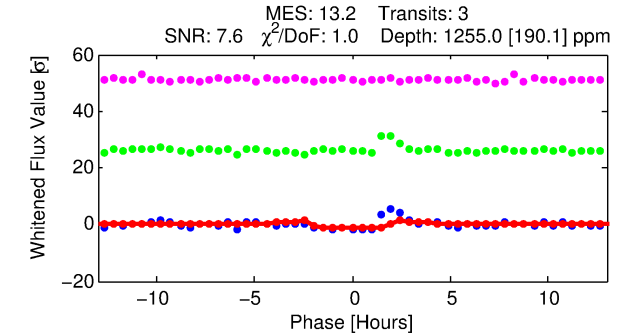
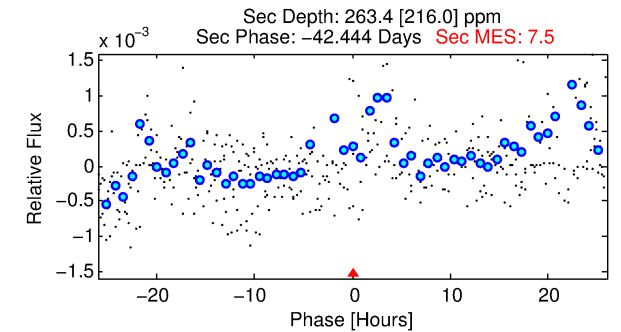
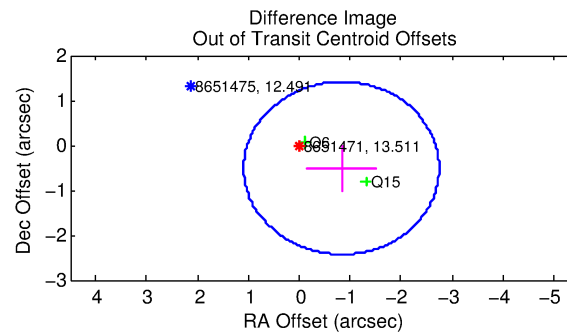
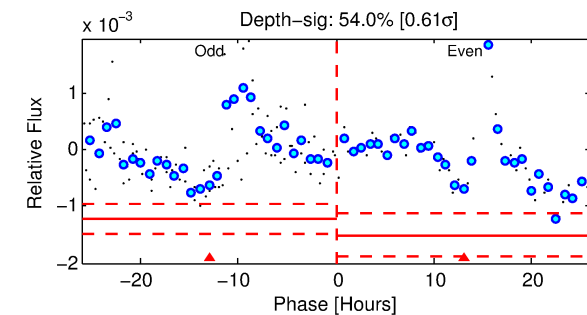
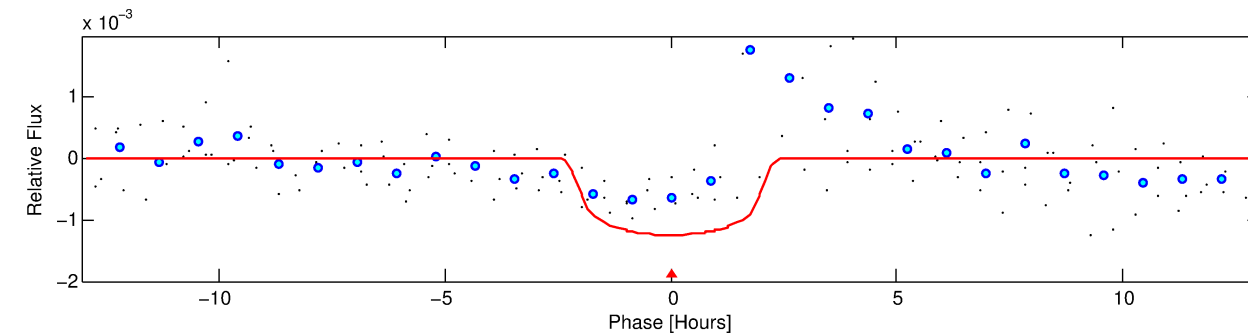
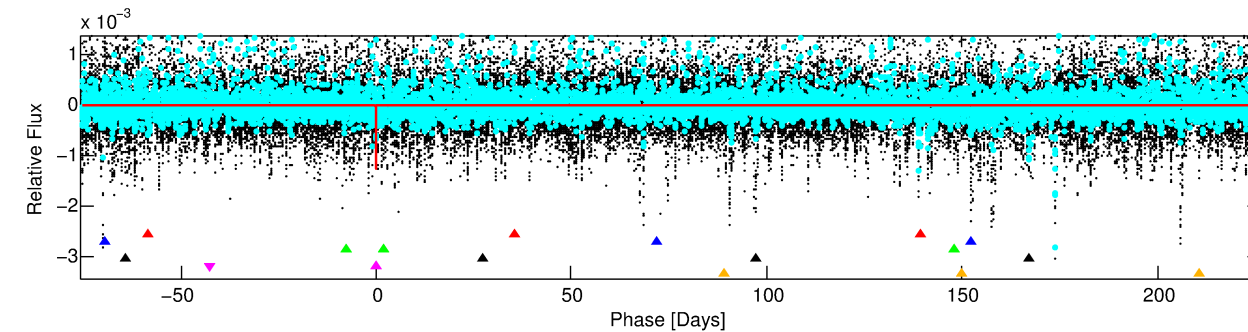
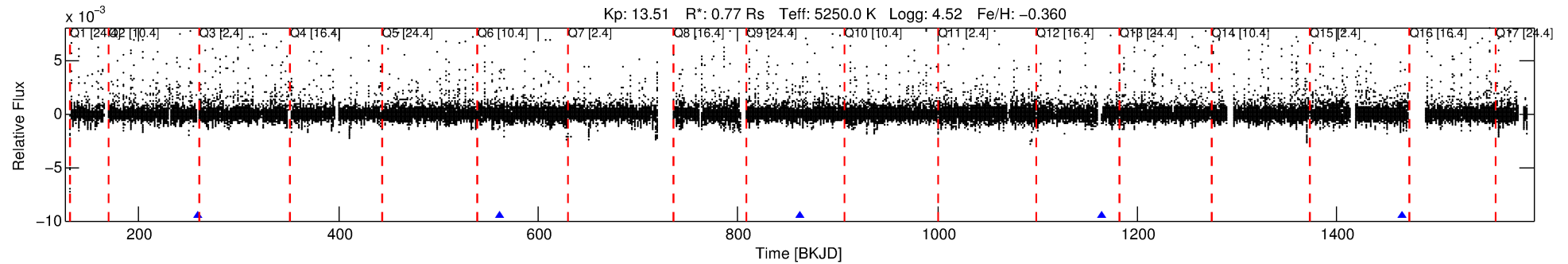
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 008651471-05

No Significant Match Found

# DV One-Page Summary

KIC: 8651471 Candidate: 5 of 6 Period: 301.490 d



## DV Fit Results:

Period = 301.48951 [0.00300] d  
Epoch = 259.3551 [0.0088] BKJD  
Rp/R\* = 0.0328 [0.0451]  
a/R\* = 487.02 [2568.86]  
b = 0.47 [8.91]  
Seff = 0.65 [0.14]  
Teq = 229 [12] K  
Rp = 2.76 [3.81] Re  
a = 0.7893 [0.0968] AU  
Ag = 11845.36 [34007.32] [0.35 $\sigma$ ]  
Teffp = 3692 [2647] K [1.31 $\sigma$ ]

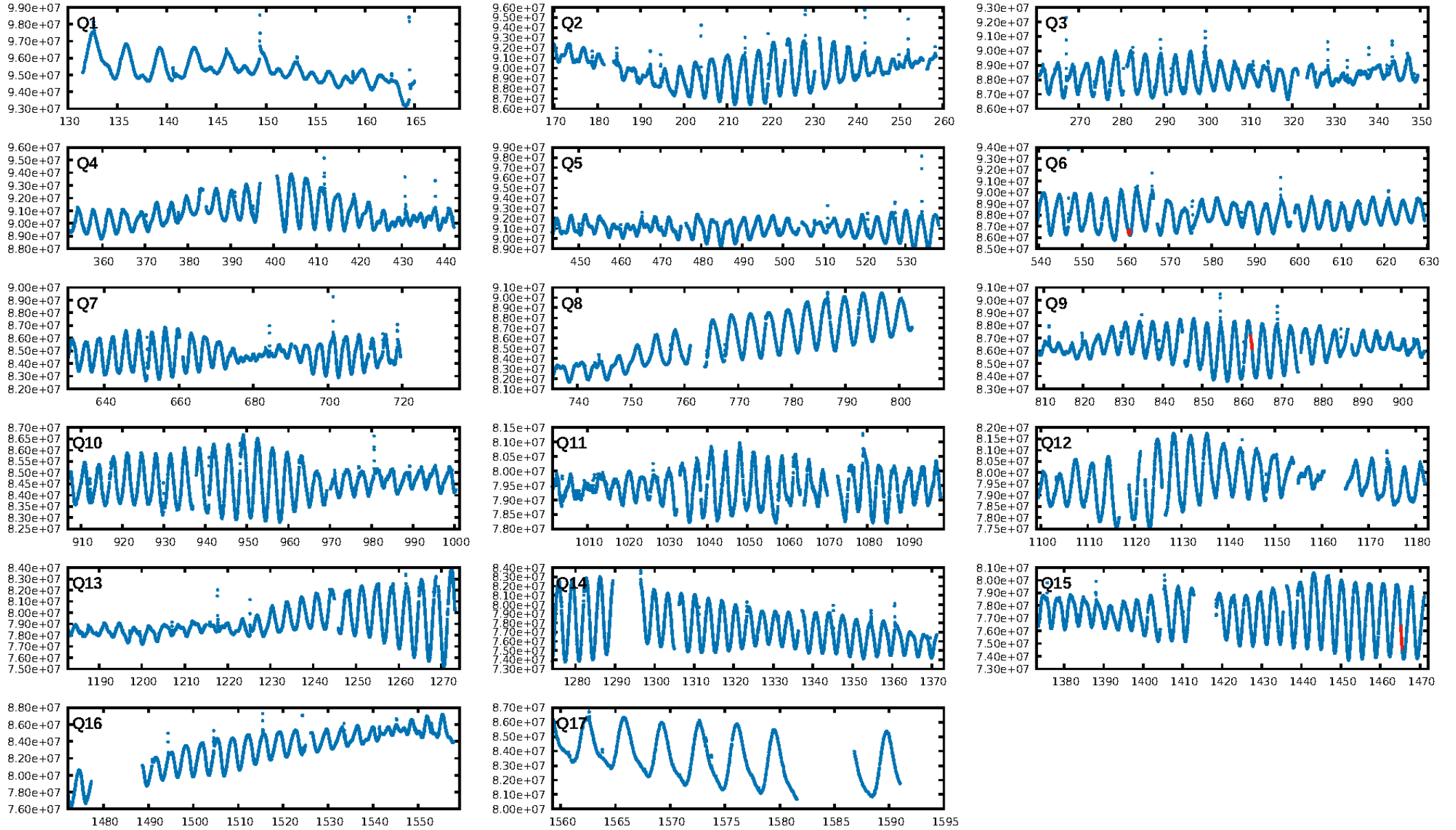
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [317.08 $\sigma$ ]  
ModelChiSquare2-sig: 3.1%  
ModelChiSquareGof-sig: 97.8%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: 1.529  
Centroid-sig: N/A  
Centroid-so: 0.986 arcsec [0.91 $\sigma$ ]  
OotOffset-rm: 0.975 arcsec [1.52 $\sigma$ ]  
OotOffset-st: 1/1/0/0 [2]  
KicOffset-rm: 0.180 arcsec [1.41 $\sigma$ ]  
KicOffset-st: 1/1/0/0 [2]  
DiffImageQuality-fgm: 1.00 [2/2]  
DiffImageOverlap-fno: 1.00 [3/3]

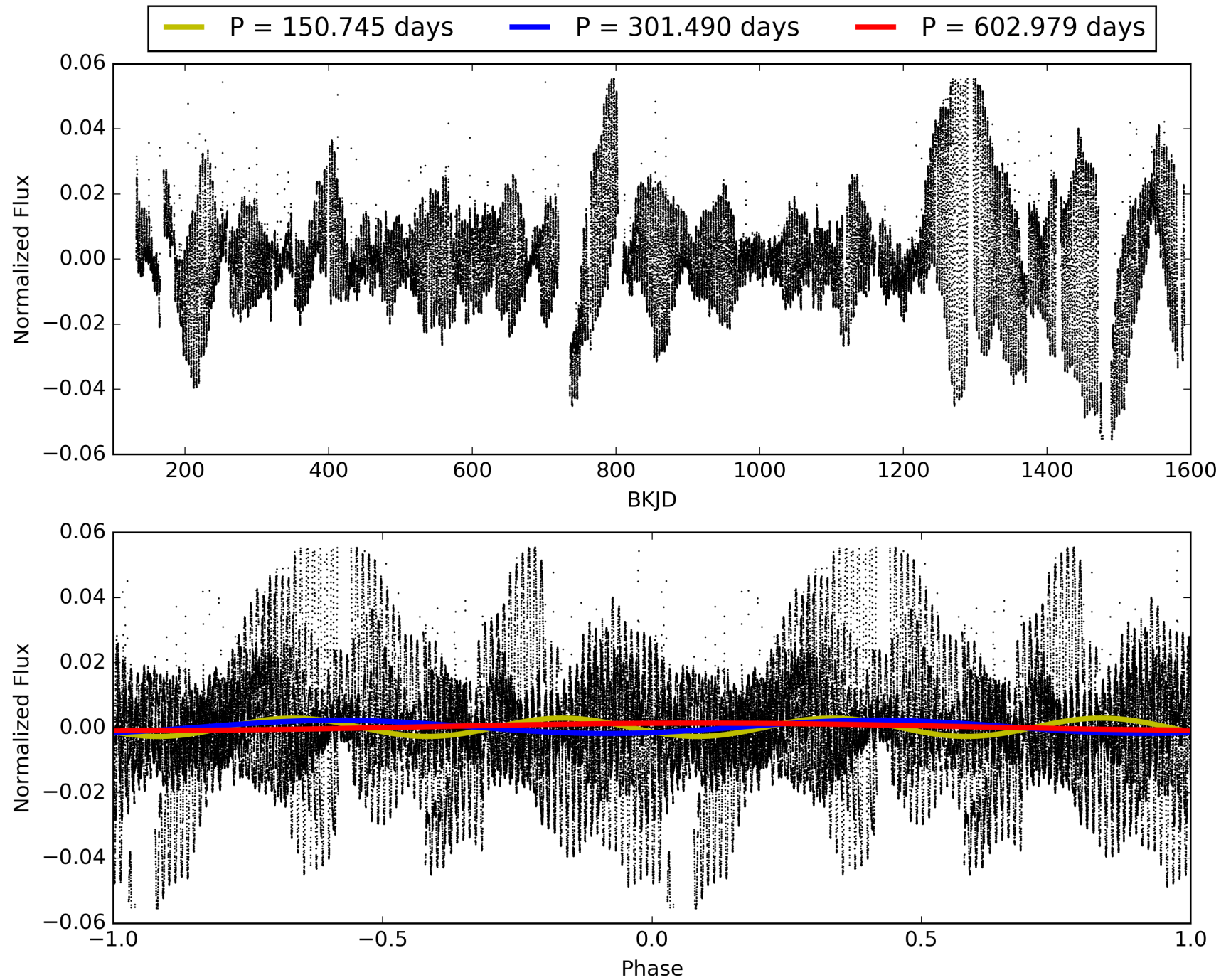
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 05:48:24 Z

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

# TCE 008651471-05, PDC Light Curves

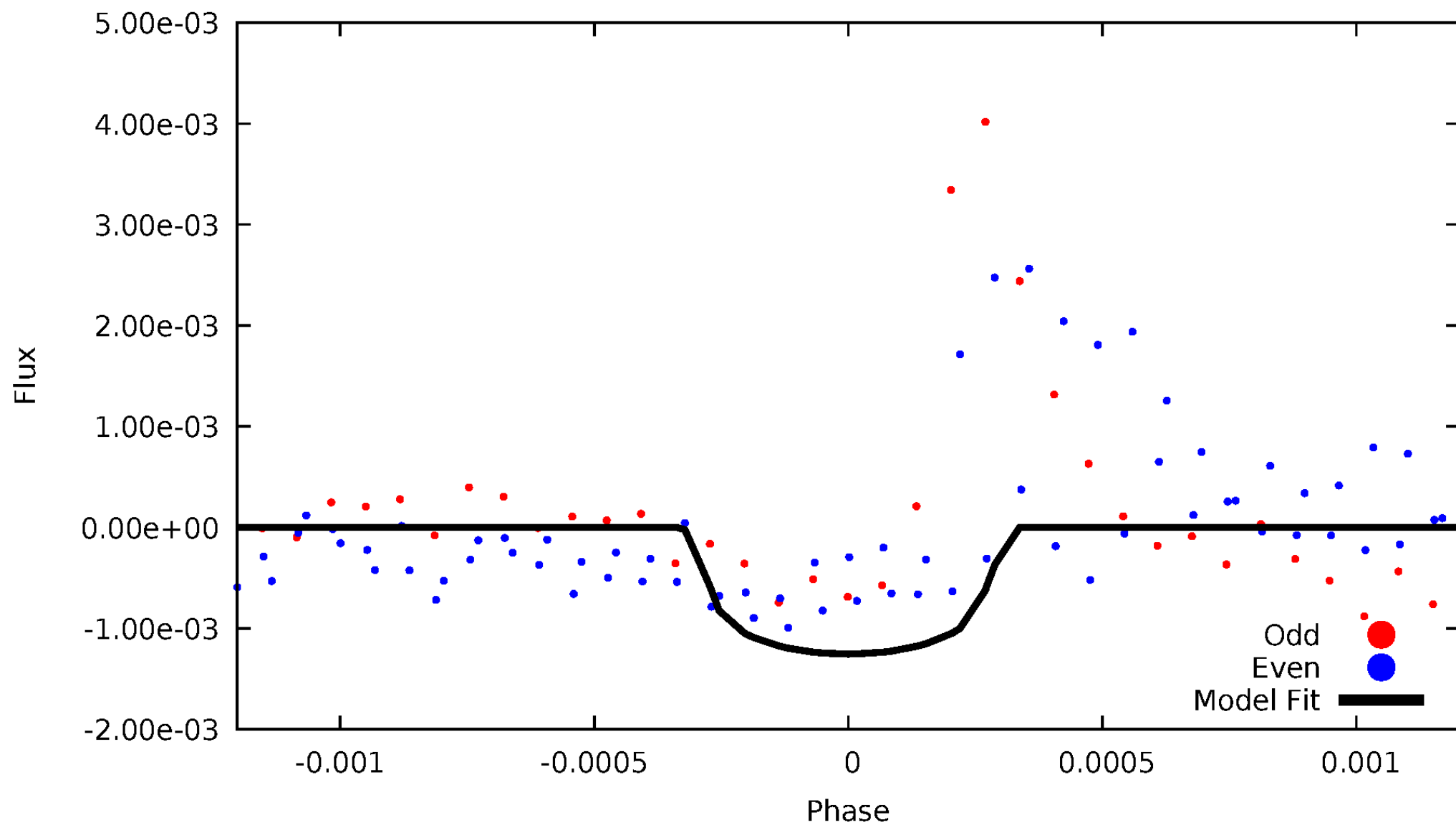


TCE 008651471-05



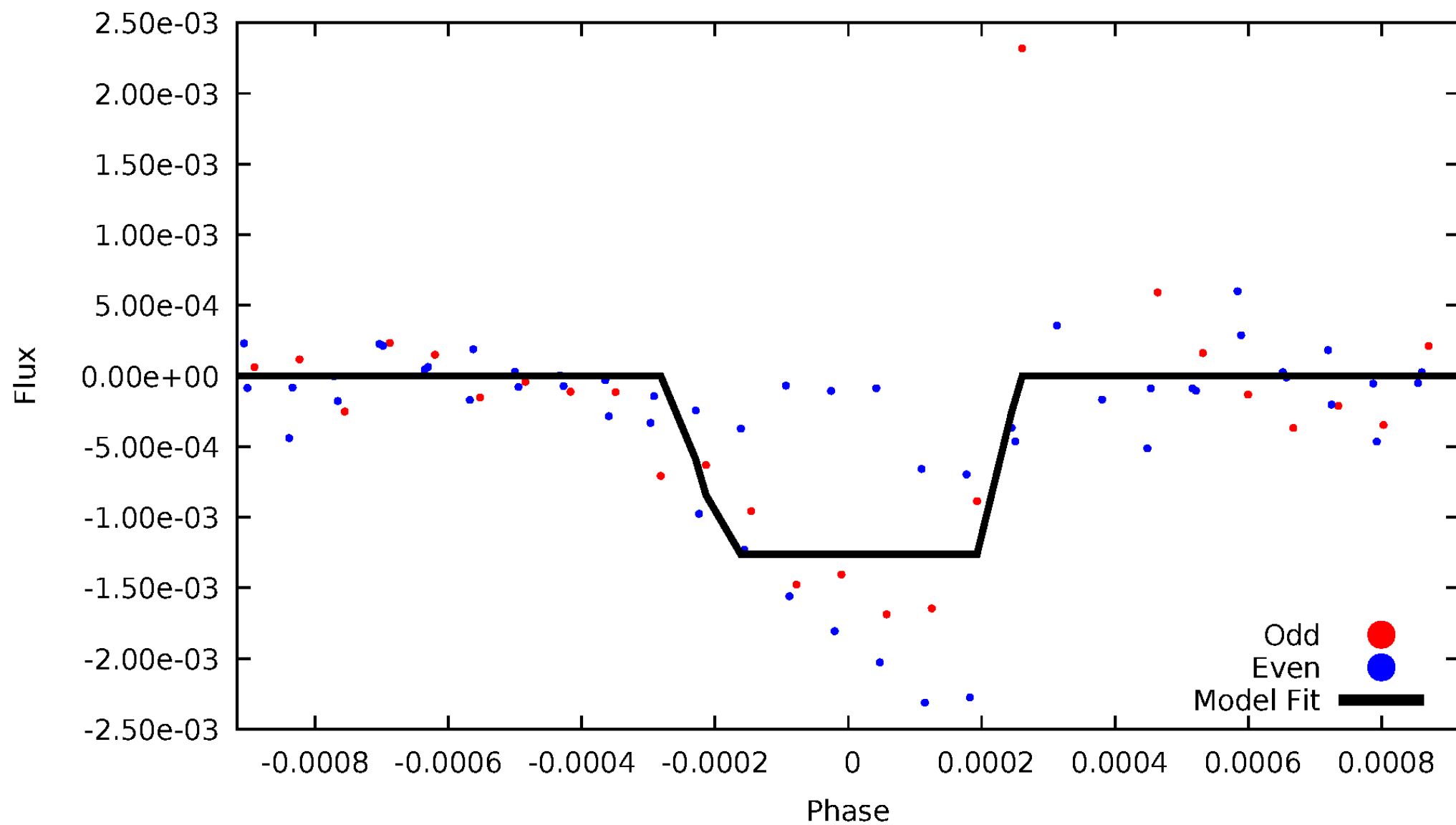
# DV Odd/Even

TCE 008651471-05



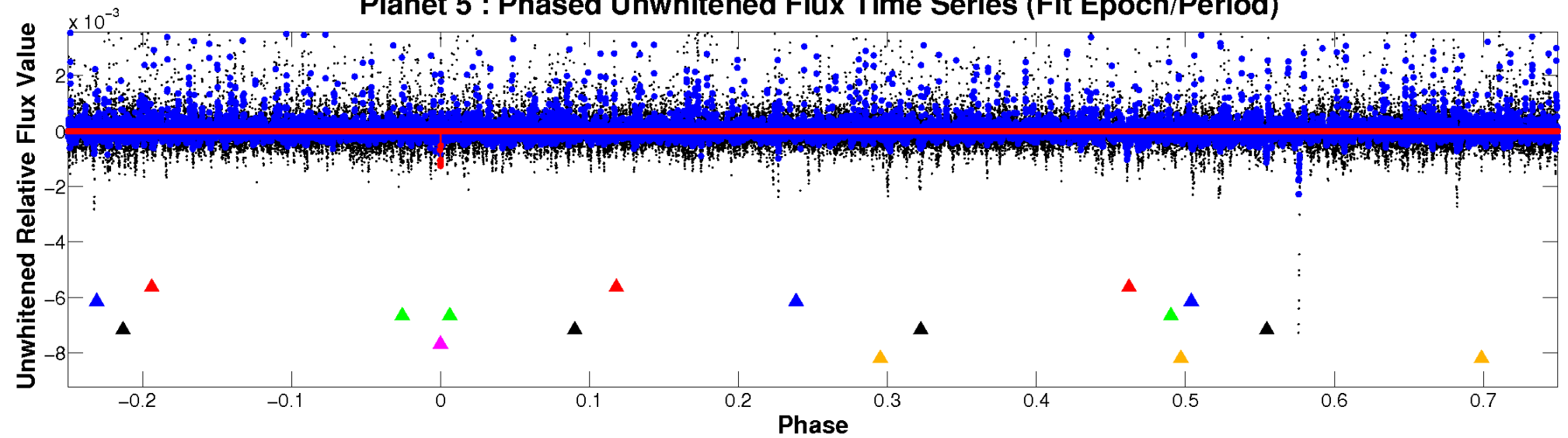
# ALT Odd/Even

TCE 008651471-05

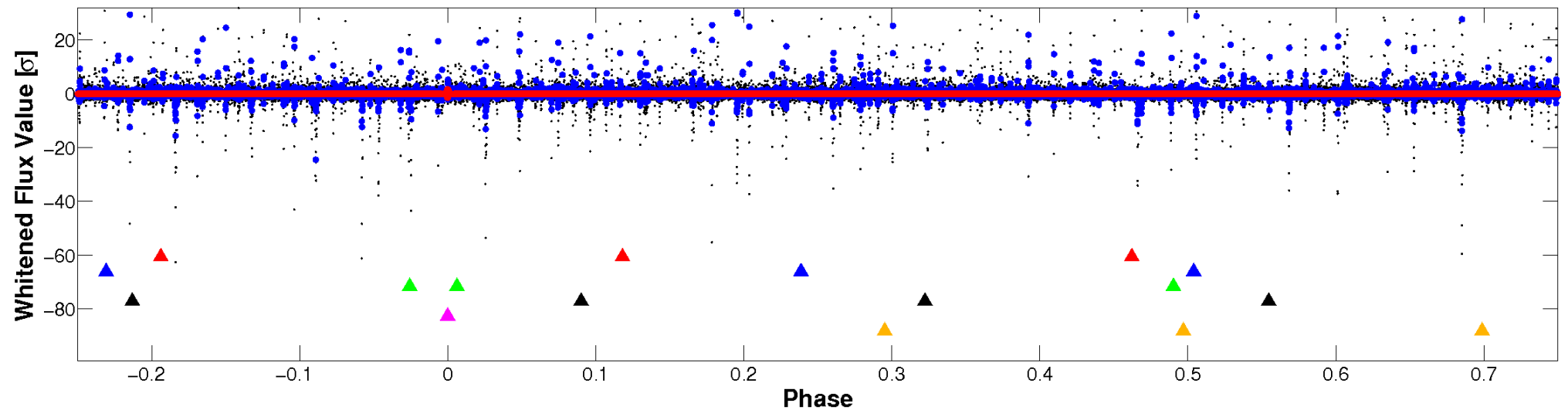


# Non-Whitened Vs. Whitened Light Curve

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

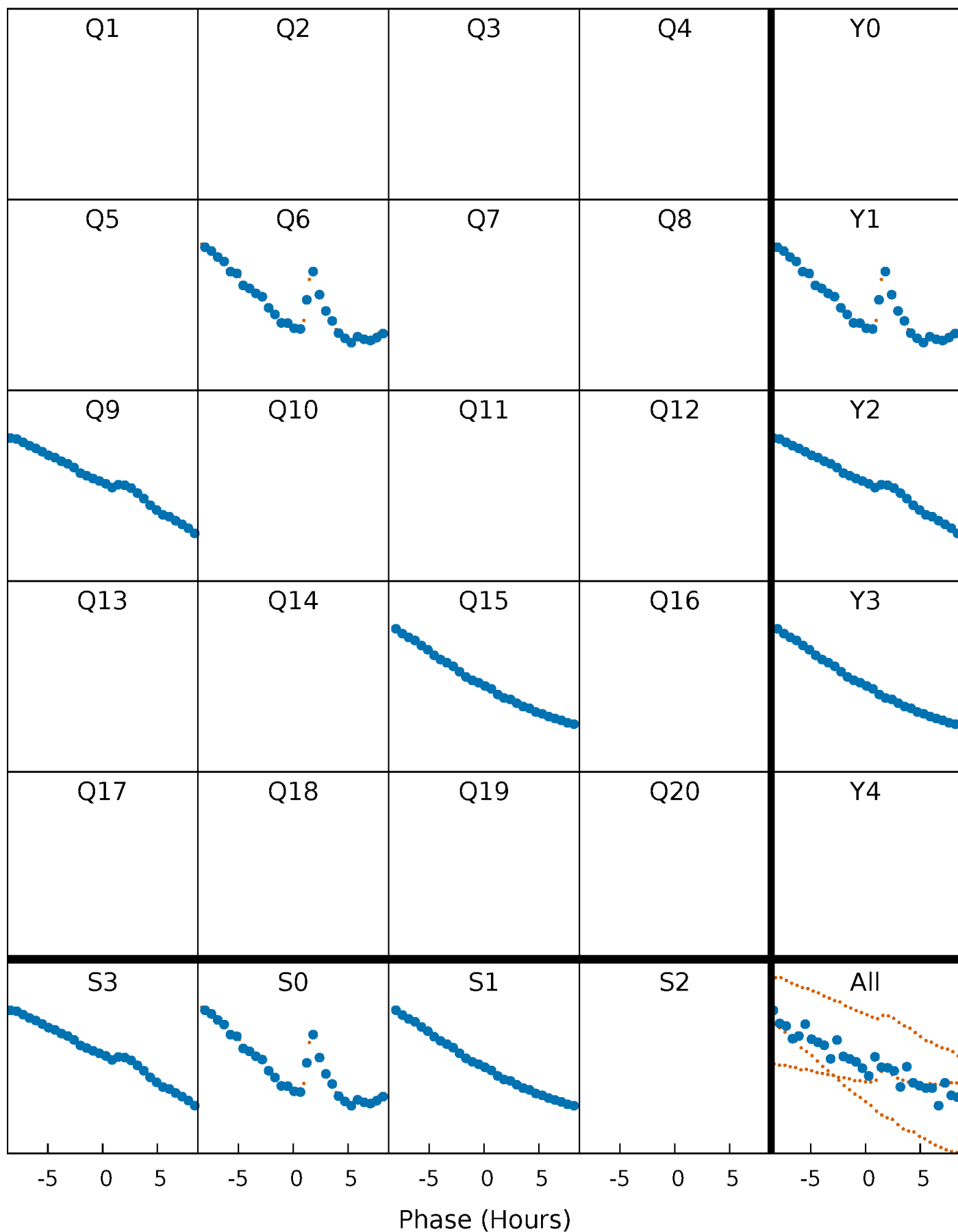


## Planet 5 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

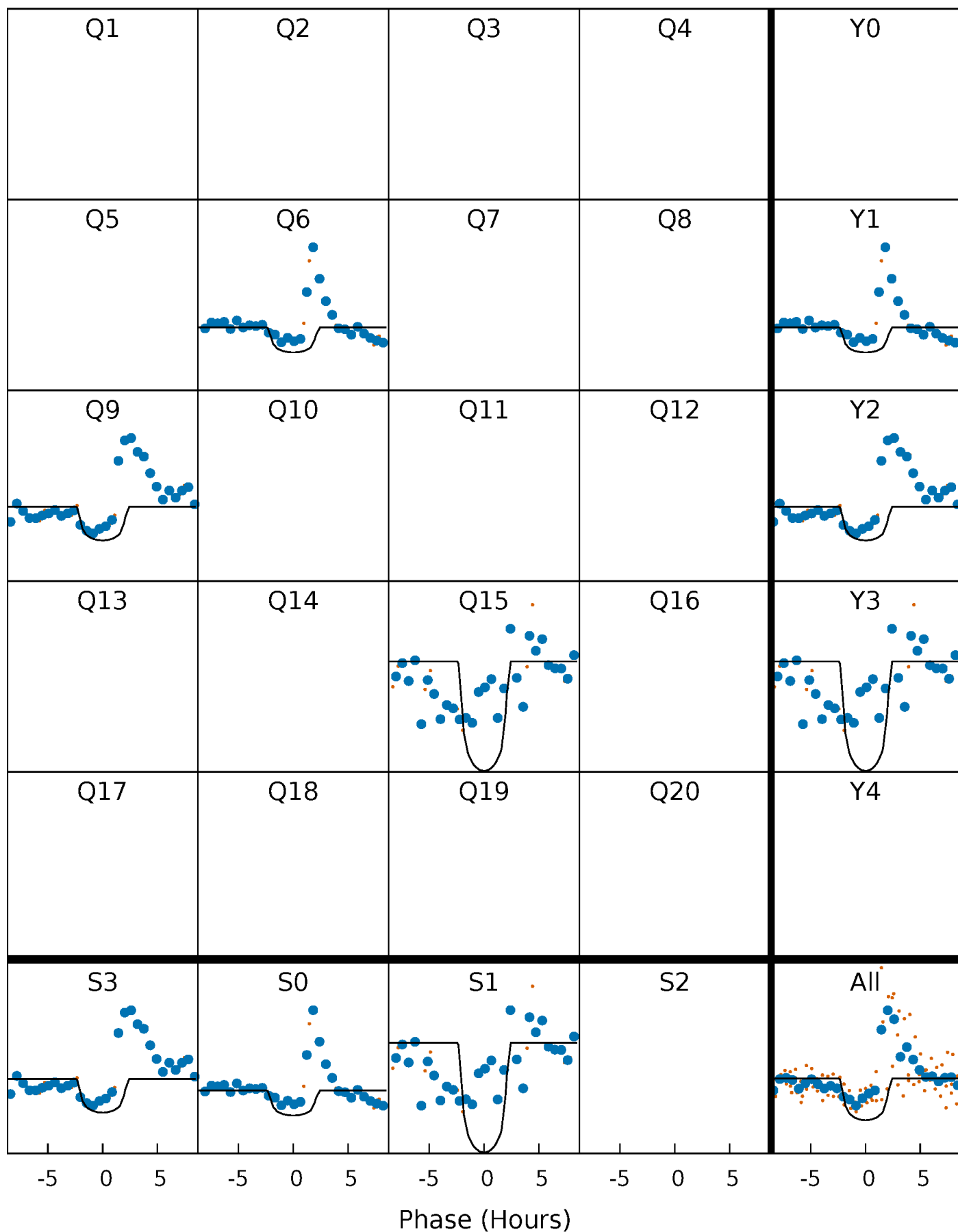
TCE 008651471-05     $P=301.489511$  Days     $T_0=259.355139$  (BKJD)





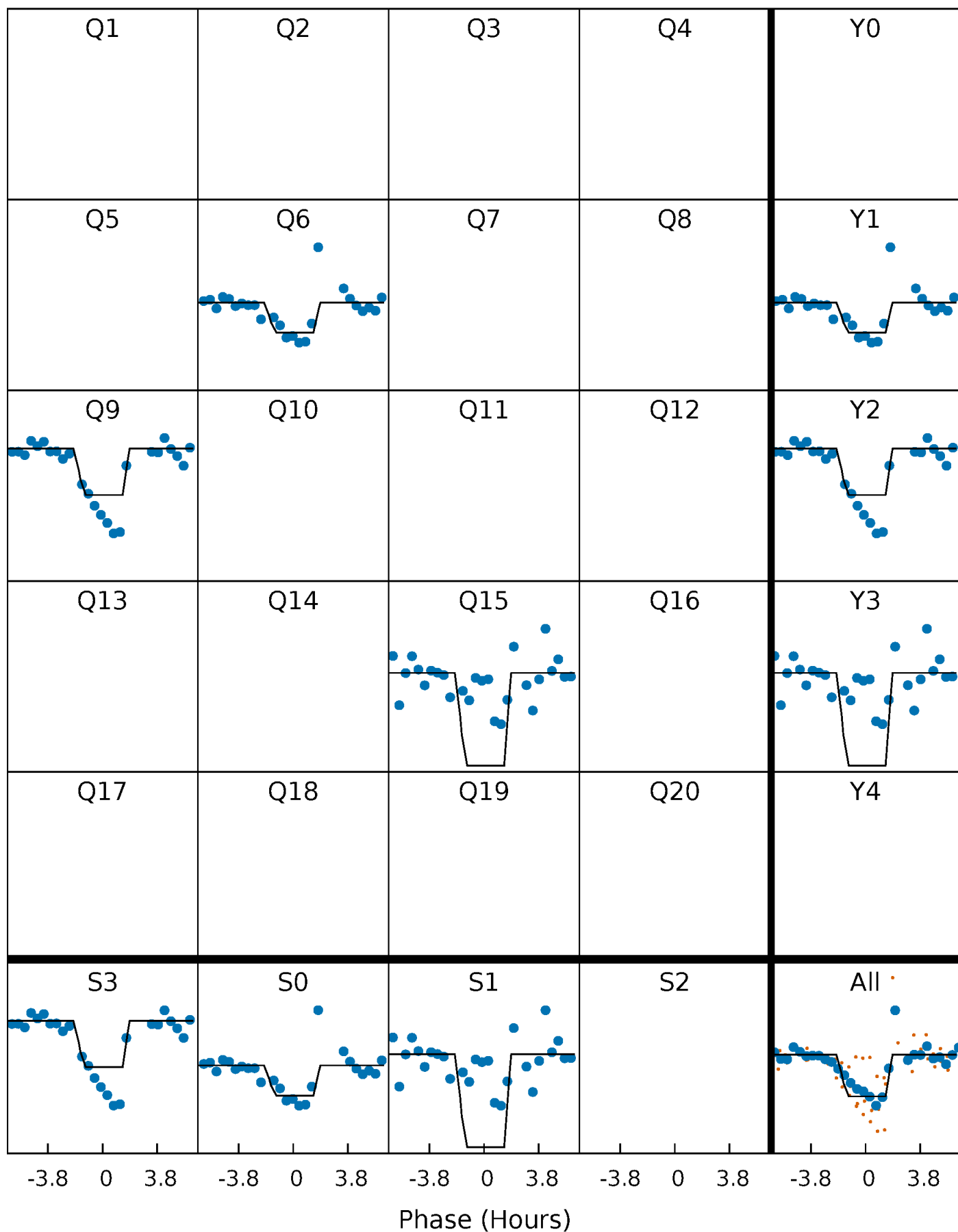
# DV Quarter-Phased Transit Curves

TCE 008651471-05     $P=301.489511$  Days     $T_0=259.355139$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

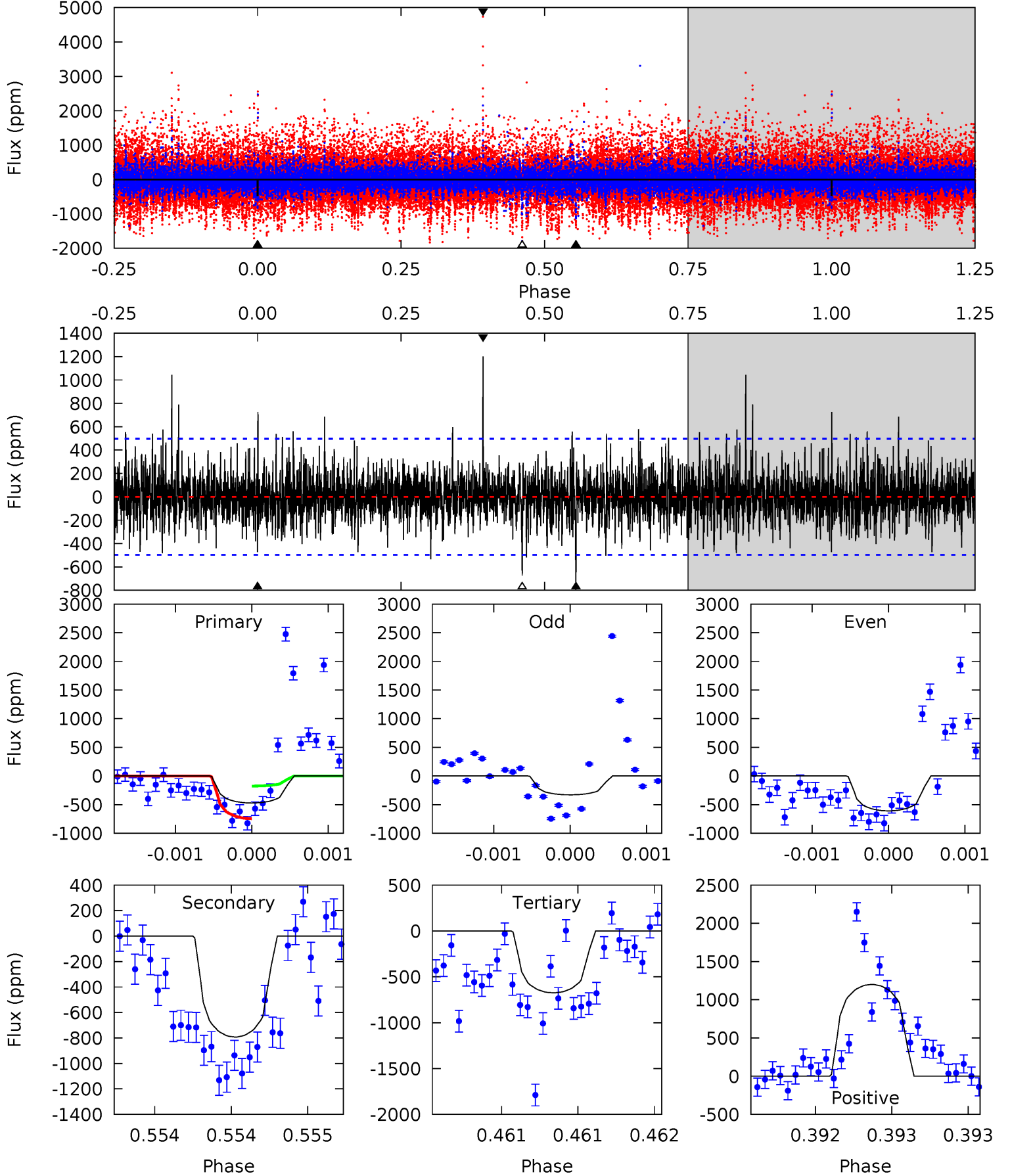
TCE 008651471-05     $P=301.498172$  Days     $T_0=259.328735$  (BKJD)



# DV Model-Shift Uniqueness Test

008651471-05, P = 301.489511 Days, E = 259.355139 Days

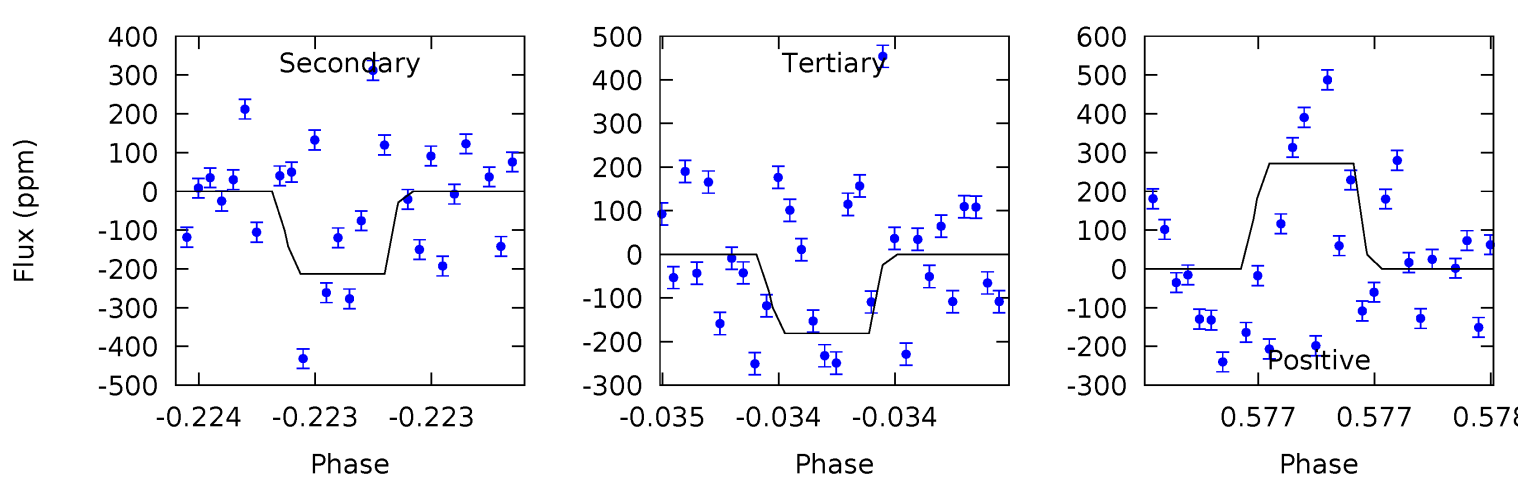
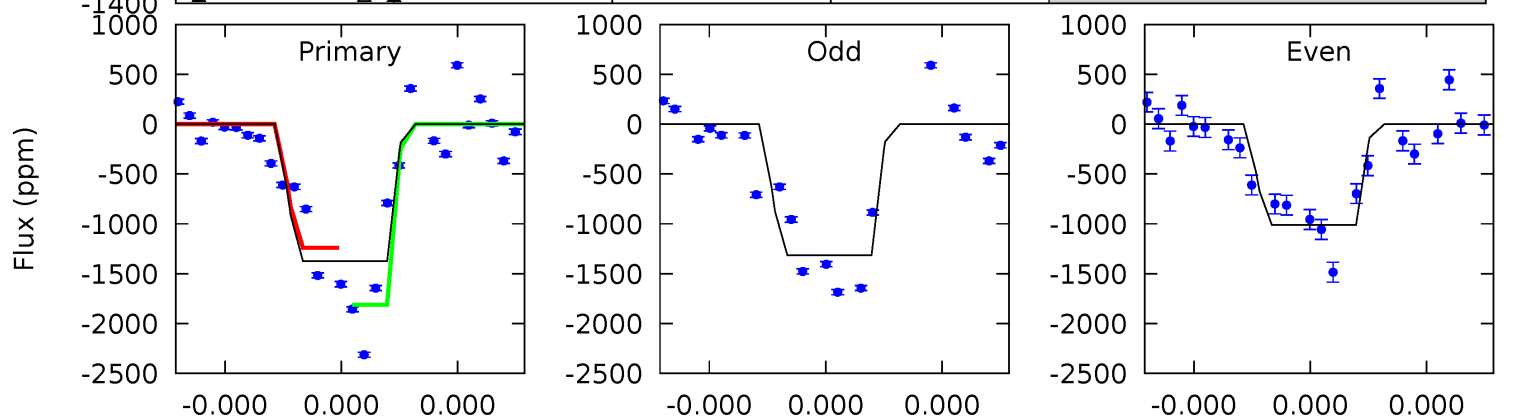
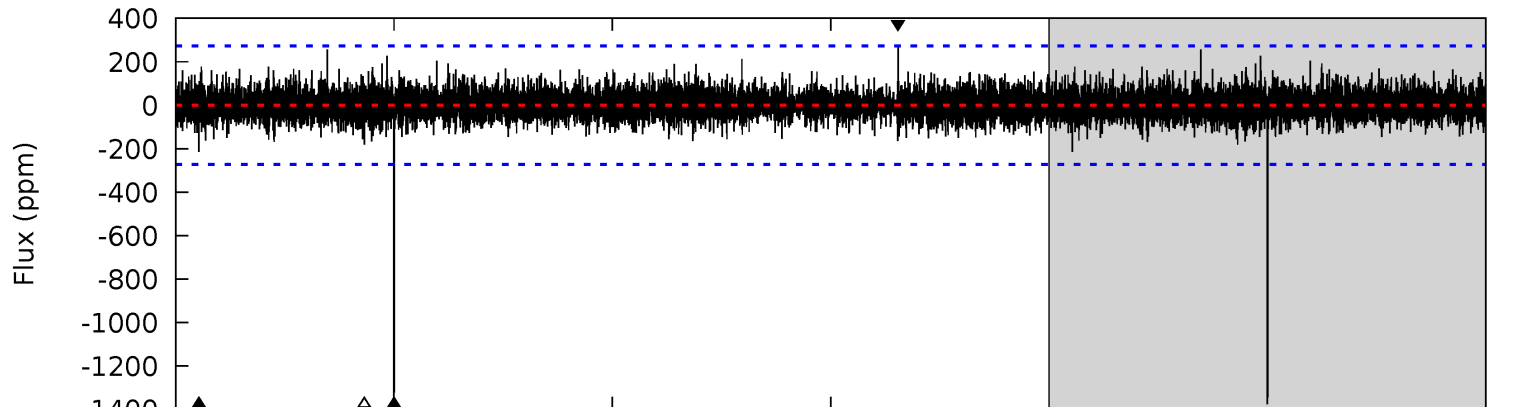
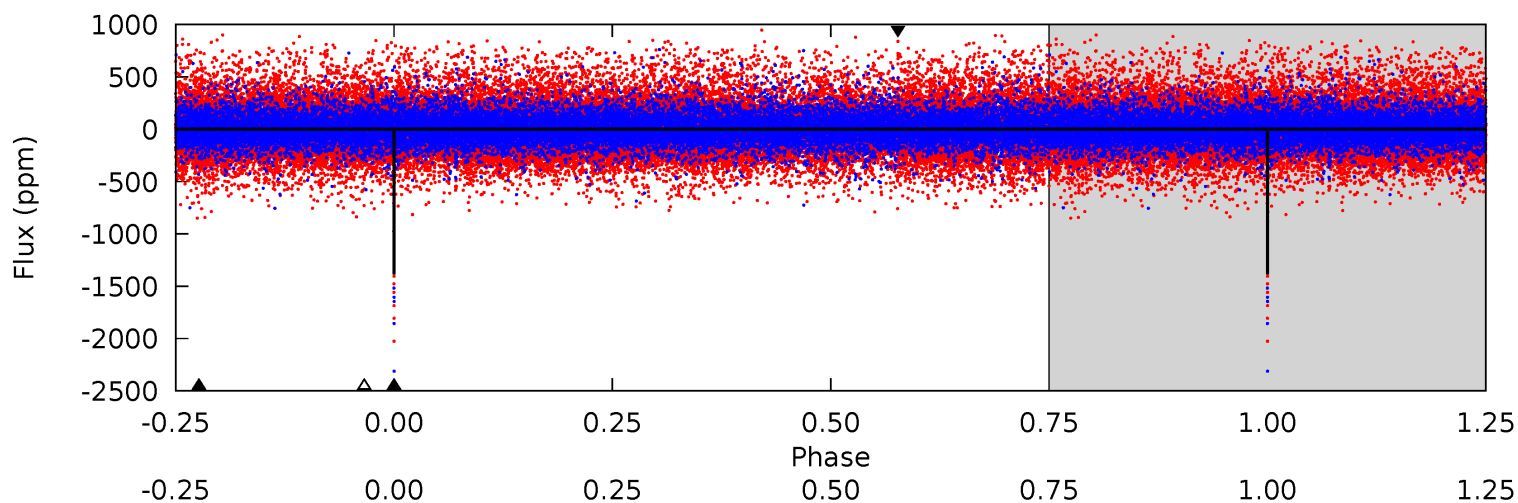
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
5.26	8.84	7.52	13.4	5.54	3.43	1.66	-2.25	-8.12	1.32	-4.54	1.39	0.54	0.60	3.19



# Alt Model-Shift Uniqueness Test

008651471-05, P = 301.498172 Days, E = 259.328735 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
28.1	4.35	3.70	5.56	5.58	3.49	0.94	24.4	22.5	0.65	-1.21	3.14	0.90	0.17	5.86



### Stellar Parameters For KIC 008651471

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$5250^{+158}_{-142}$	$4.522^{+0.085}_{-0.095}$	$-0.360^{+0.350}_{-0.300}$	$0.771^{+0.114}_{-0.085}$	$0.721^{+0.109}_{-0.042}$	$2.217^{+0.883}_{-0.633}$
	+3%/-3%	+2%/-2%	+97%/-83%	+15%/-11%	+15%/-6%	+40%/-29%
Source	PHO1	KIC0	KIC0	DSEP		

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

### Secondary Eclipse Parameters for KIC 008651471-05 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-793 \pm 90$	$4.05^{+3.54}_{-2.76}$	$321^{+16}_{-13}$	$4285^{+2921}_{-845}$	$17115^{+137287}_{-12385}$
Alt.	$-213 \pm 49$	$4.26^{+3.25}_{-2.79}$	$320^{+15}_{-13}$	$3355^{+1523}_{-530}$	$4121^{+29443}_{-2918}$

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

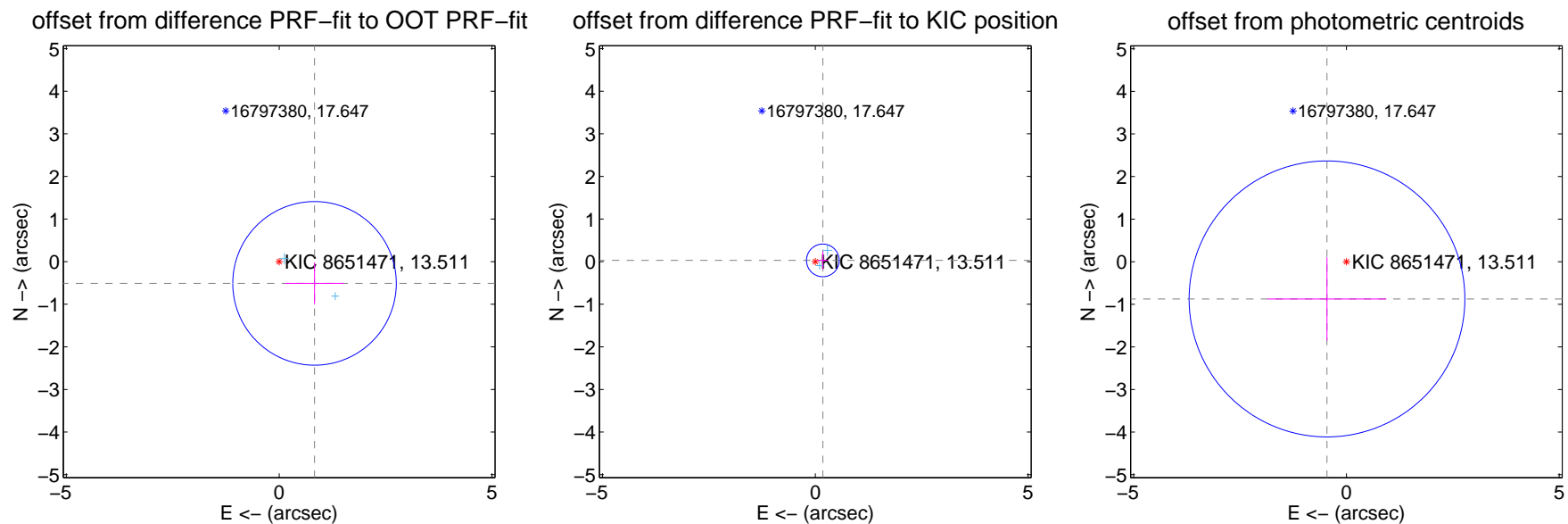
## DV Centroid Data

Supplemental centroid analysis for 008651471-05. Kepler magnitude: 13.51. Transit SNR 7.64

There are 2 quarters with good PRF difference image offsets

The direct PRF centroid is offset from the target star catalog position by about 1.41 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.975 \pm 0.640$	1.52	$-0.831 \pm 0.688$	$-0.510 \pm 0.492$
PRF-fit source offset from KIC position	$0.180 \pm 0.128$	1.41	$-0.178 \pm 0.125$	$0.029 \pm 0.210$
photometric centroid source offset	$0.99 \pm 1.08$	0.91	$0.46 \pm 1.40$	$-0.87 \pm 0.98$

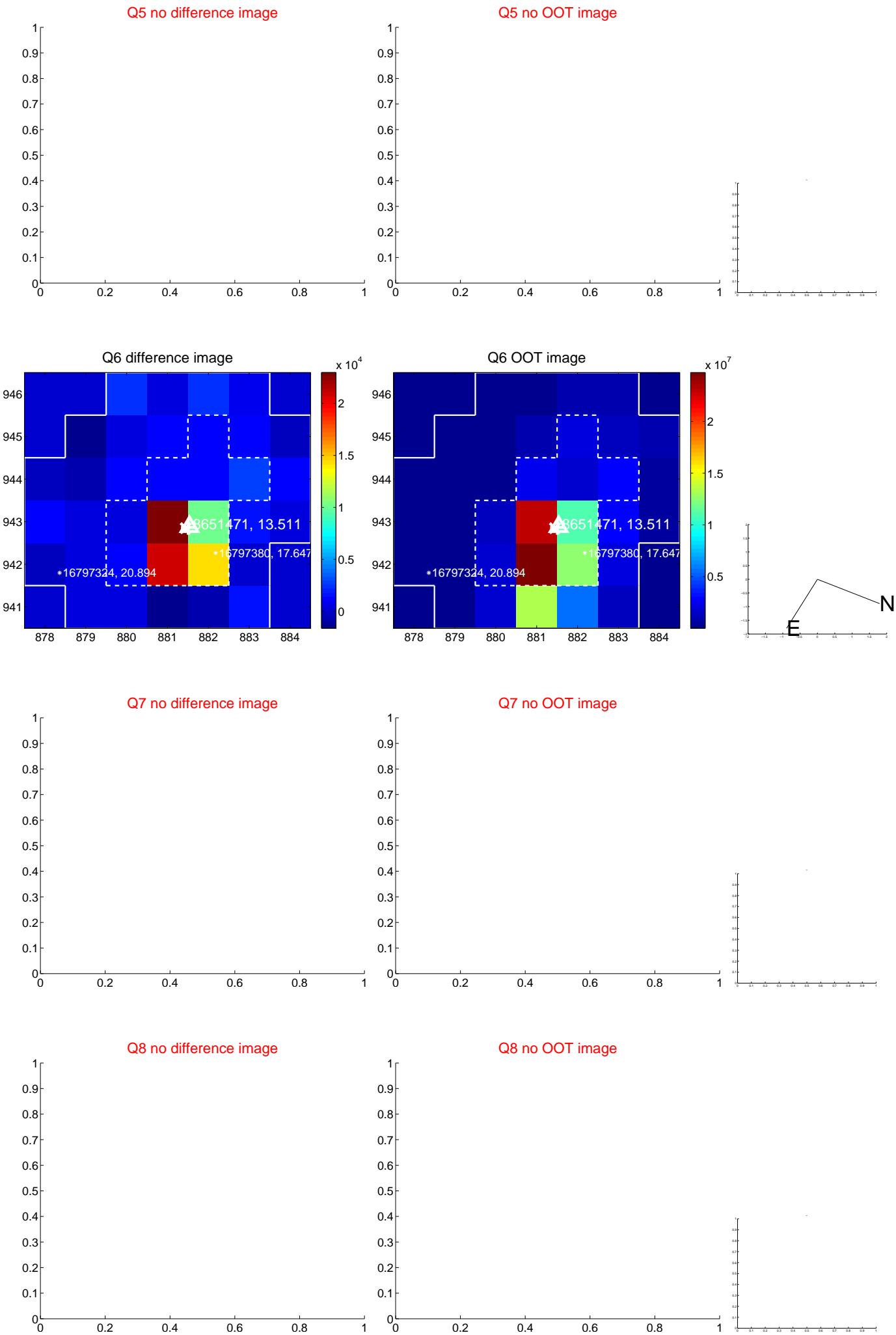


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

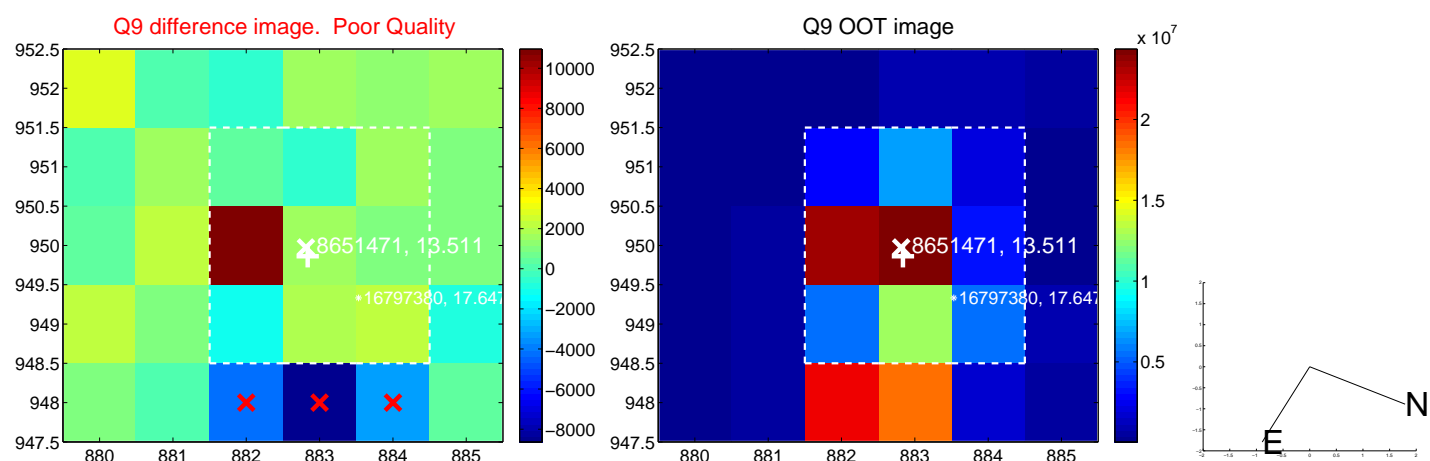


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

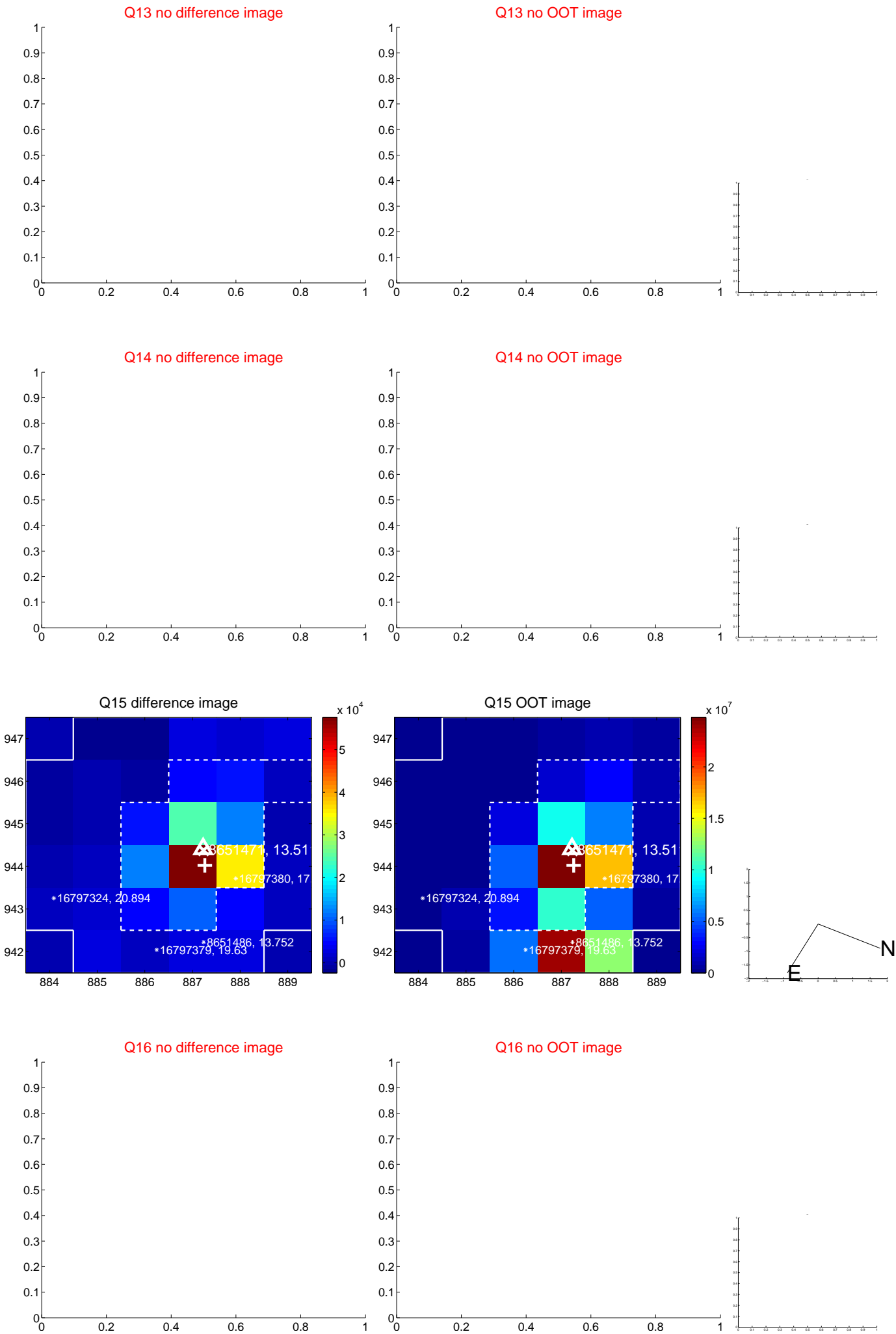




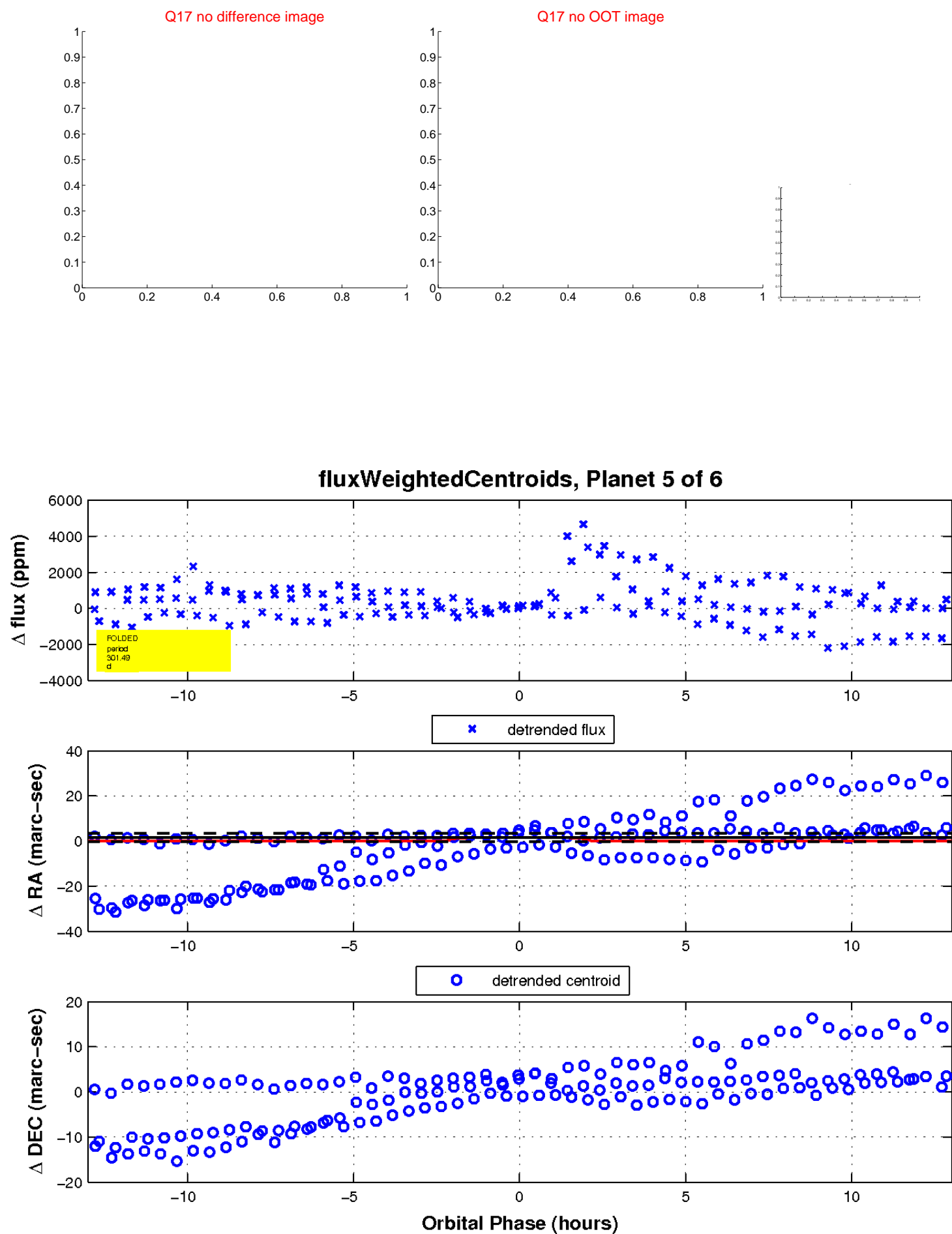
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

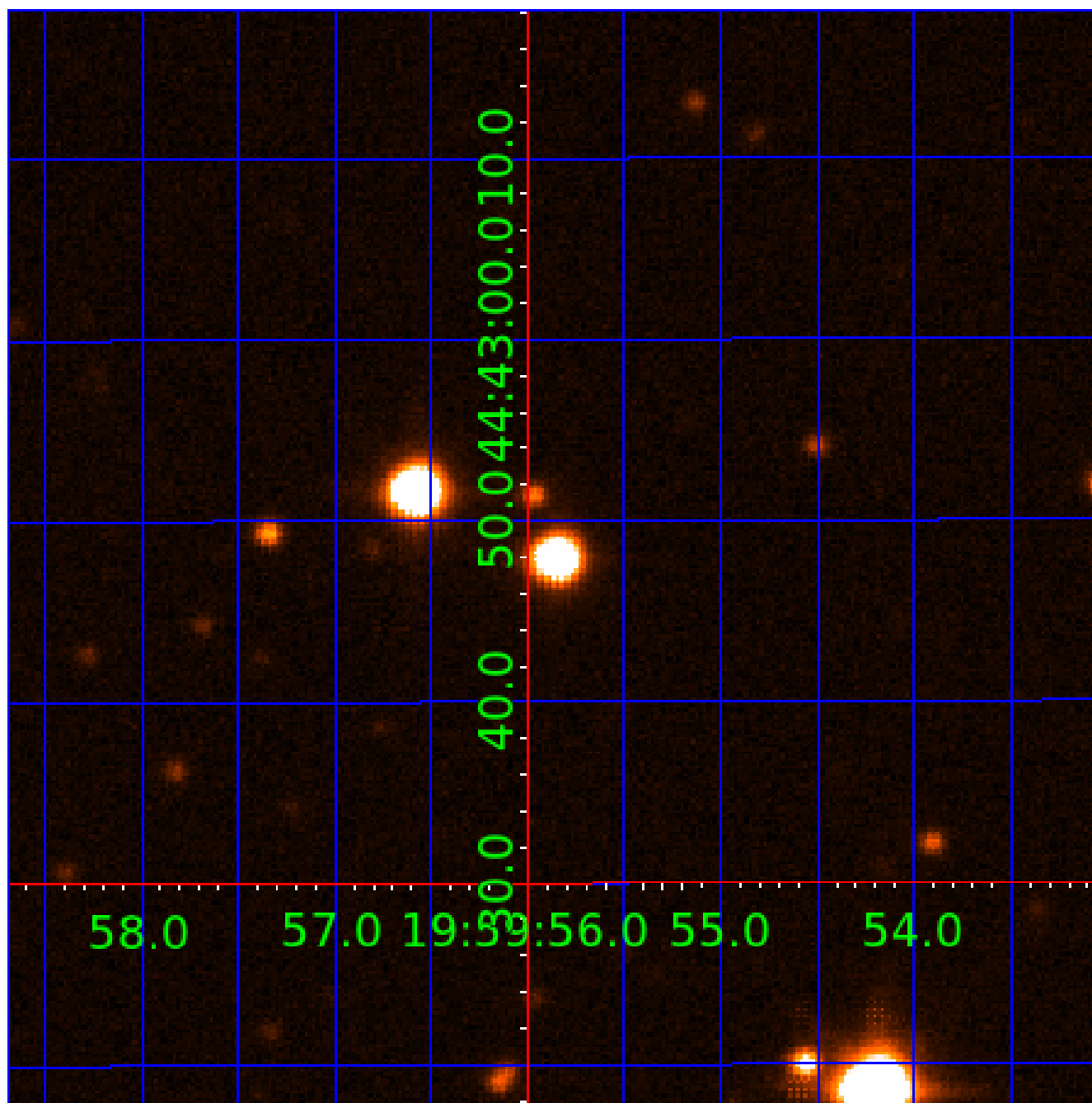


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 008651471

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
008651471-01	OBS	No	499.244107	200.933797	1287.9	6.574	14.9	7.8	0.77	5250	3.35	0.33
008651471-02	OBS	No	523.001201	189.787383	496.6	10.681	14.1	2.4	0.77	5250	1.74	0.31
008651471-03	OBS	No	447.422049	562.729561	1449.4	1.441	15.8	7.4	0.77	5250	3.20	0.38
008651471-04	OBS	No	371.515168	286.533858	1056.2	3.025	13.7	7.0	0.77	5250	2.61	0.49
008651471-05	OBS	No	301.489511	259.355139	1255.0	4.352	13.2	7.6	0.77	5250	2.76	0.65
008651471-06	OBS	No	542.143214	470.033782	782.2	3.500	13.1	-1.0	0.77	5250	2.12	0.30

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
008651471-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
008651471-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL_TRACKER—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS
008651471-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_TRACKER—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS
008651471-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_ZUMA_TRACKER—LPP_DV—LPP_ALT—MOD_POS_DV—CENT_KIC_POS
008651471-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
008651471-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_SKYE—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—INCONSISTENT_TRANS—CENT_NOFITS

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

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

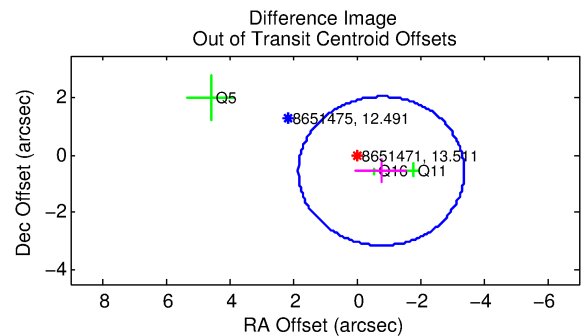
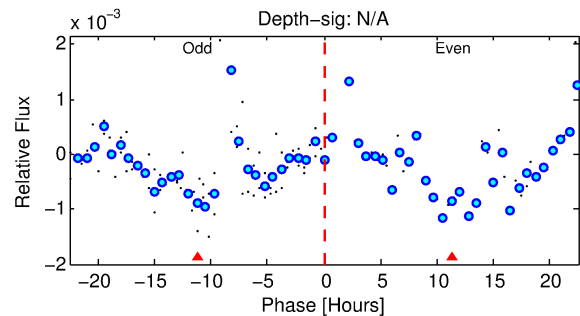
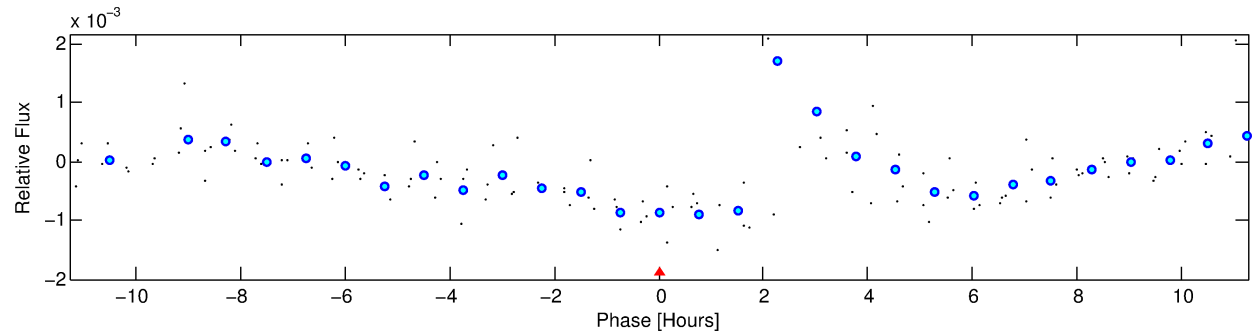
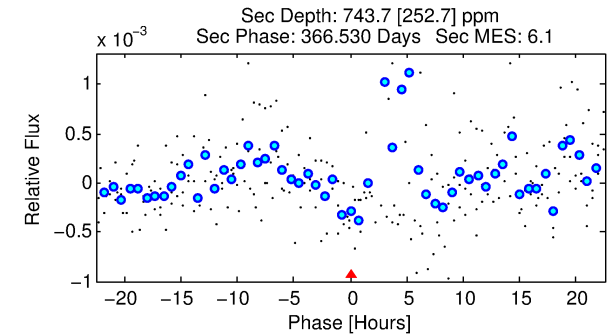
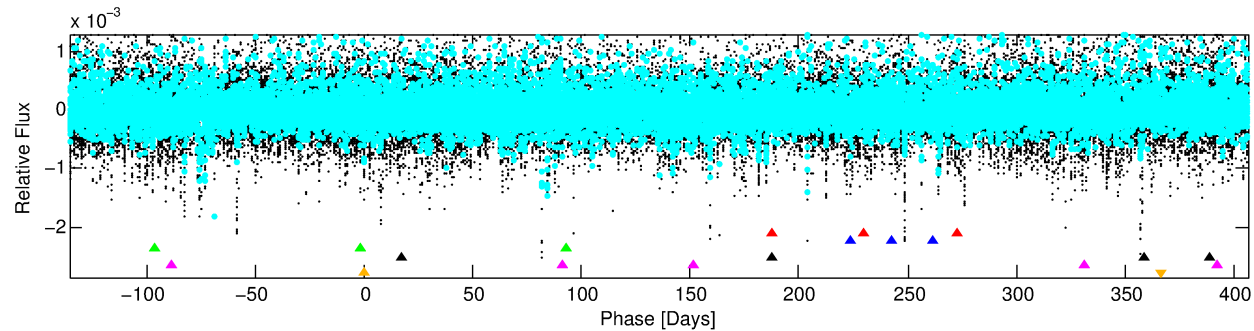
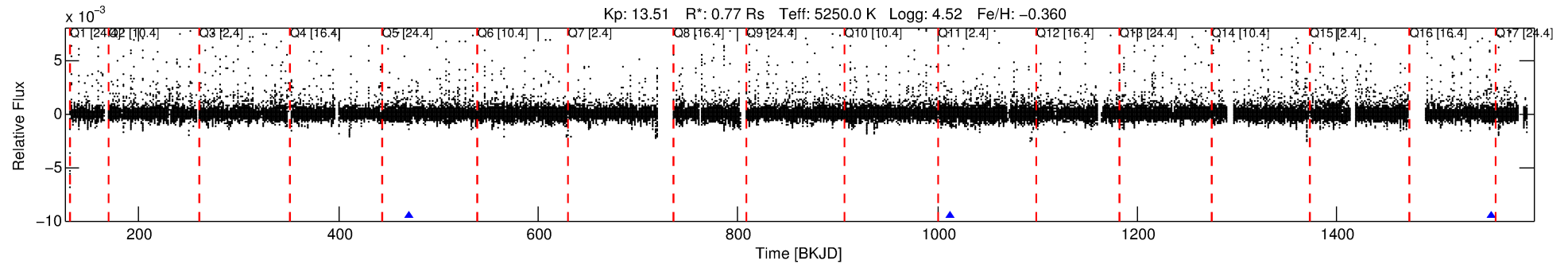
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 008651471-06

No Significant Match Found

# DV One-Page Summary

KIC: 8651471 Candidate: 6 of 6 Period: 542.143 d



## TPS TCE Results:

Period = 542.14321 d  
Epoch = 470.0338 BKJD

DV fit results are unavailable

## DV Diagnostic Results:

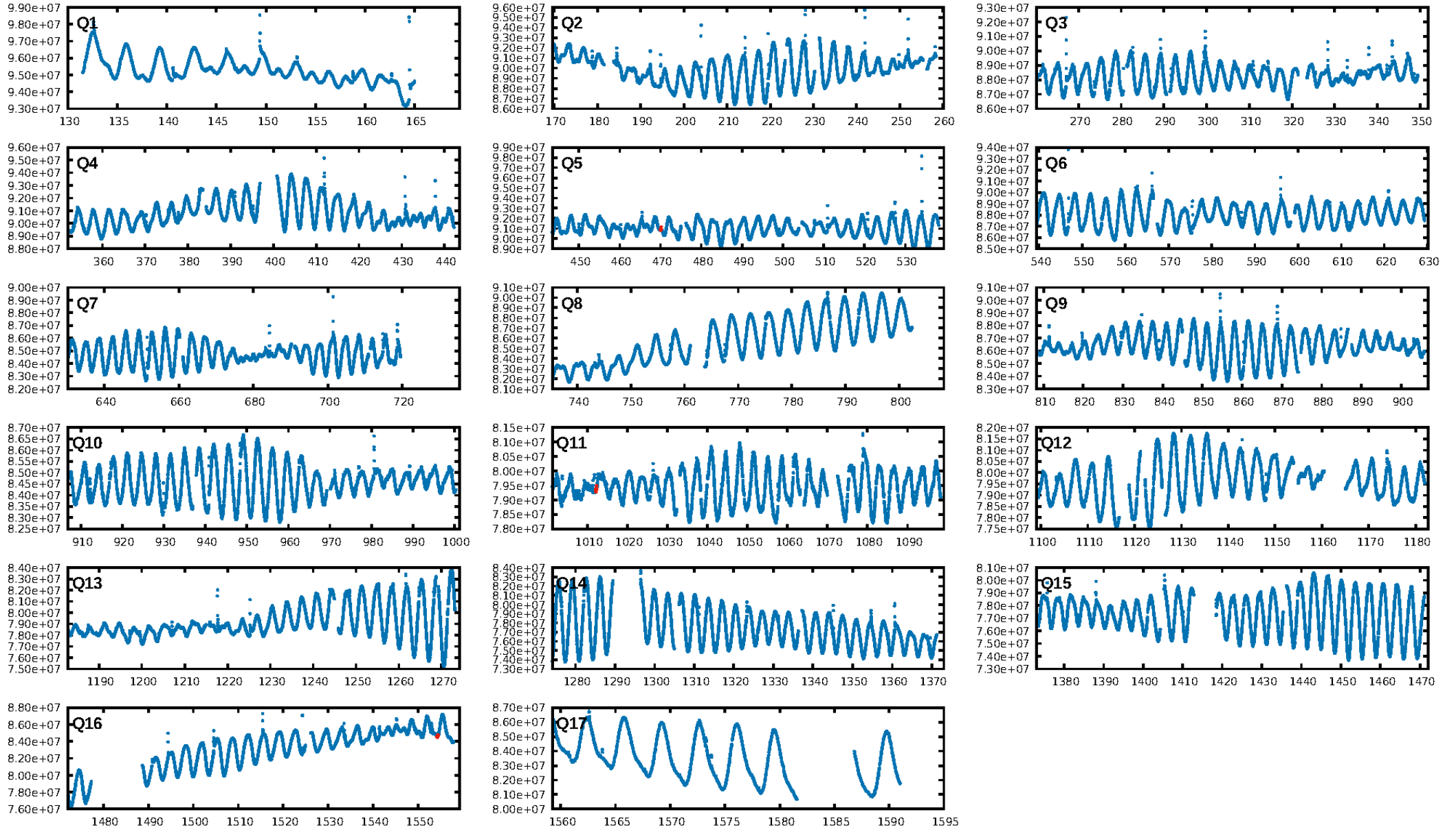
ShortPeriod-sig: 100.0% [40.87 $\sigma$ ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: 3.534

Centroid-sig: N/A  
Centroid-so: 0.727 arcsec [0.49 $\sigma$ ]  
OotOffset-rm: 0.954 arcsec [1.10 $\sigma$ ]  
KicOffset-rm: 0.301 arcsec [0.21 $\sigma$ ]  
OotOffset-st: 0/1/1/1 [3]  
KicOffset-st: 0/1/1/1 [3]  
DiffImageQuality-fgm: 0.67 [2/3]  
DiffImageOverlap-fno: 1.00 [3/3]

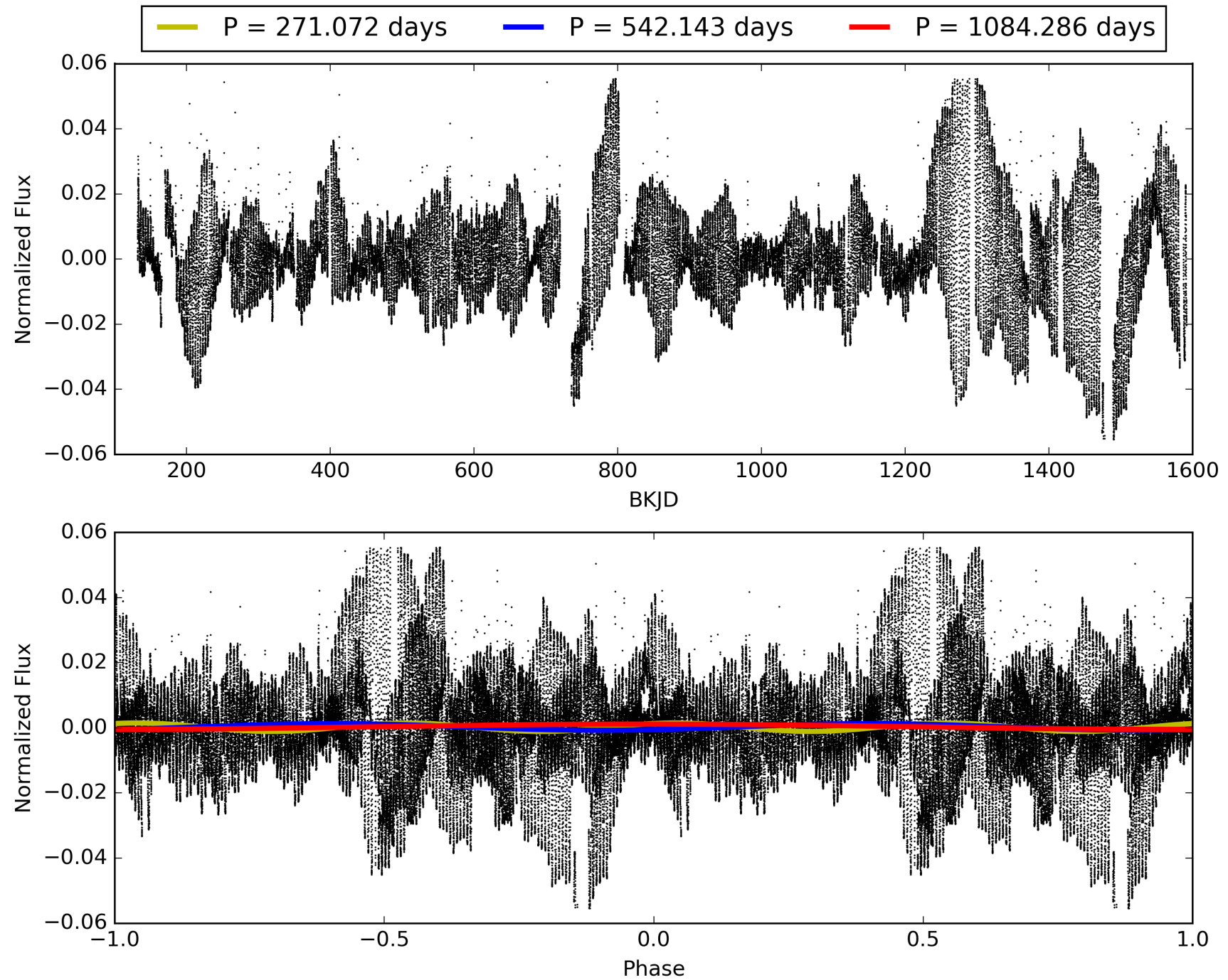
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 05:48:43 Z

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

# TCE 008651471-06, PDC Light Curves



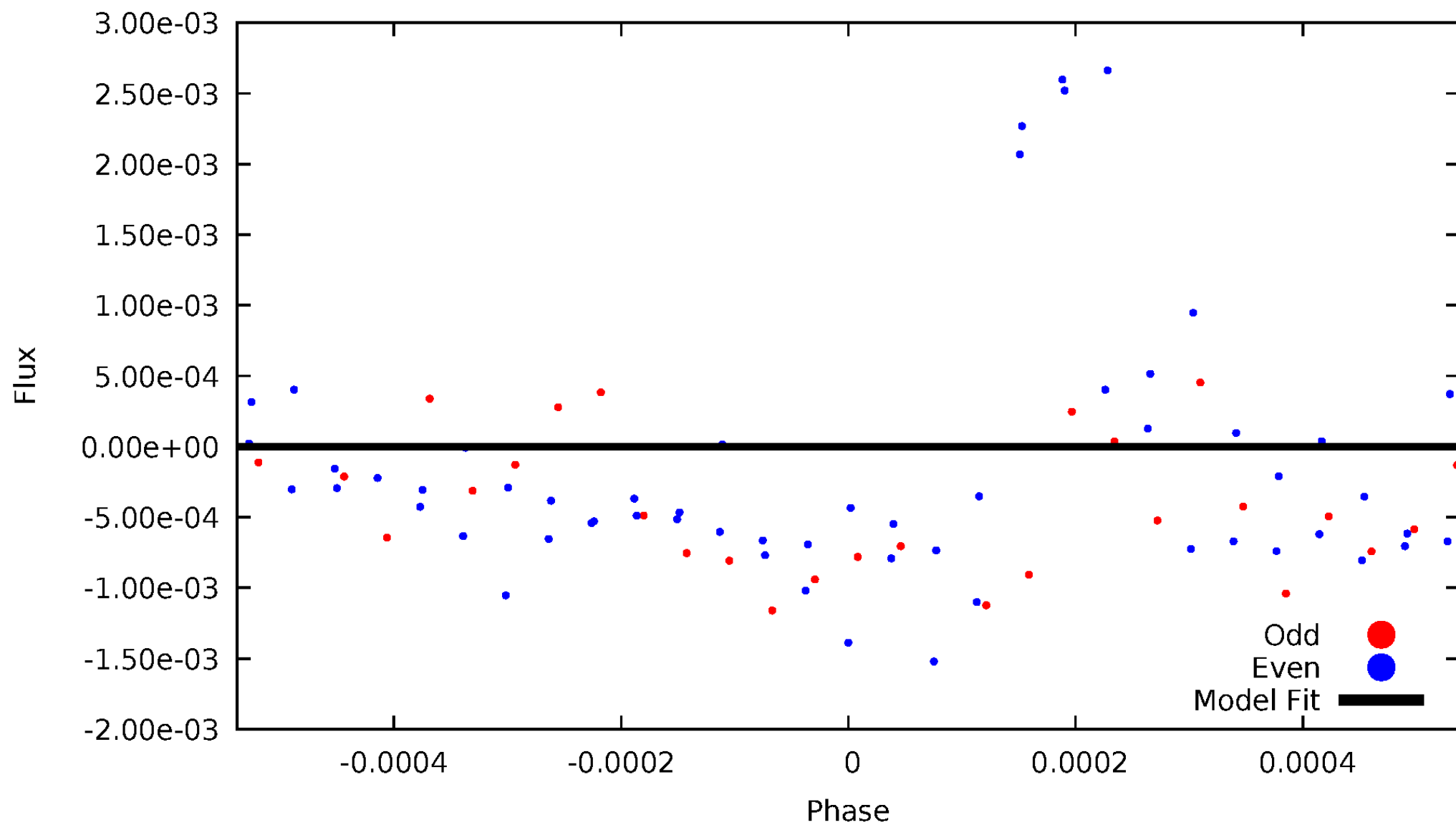
TCE 008651471-06





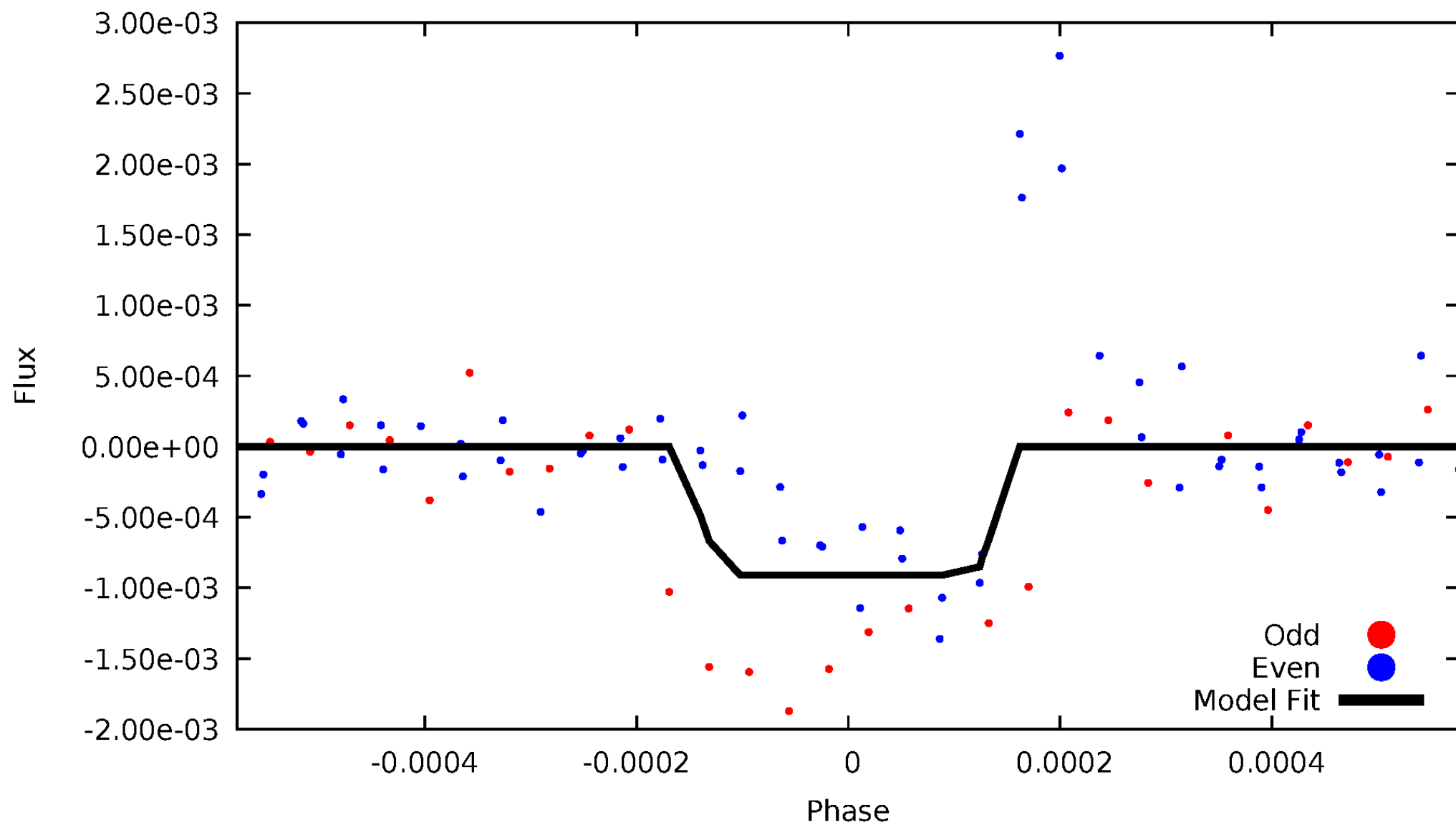
# DV Odd/Even

TCE 008651471-06



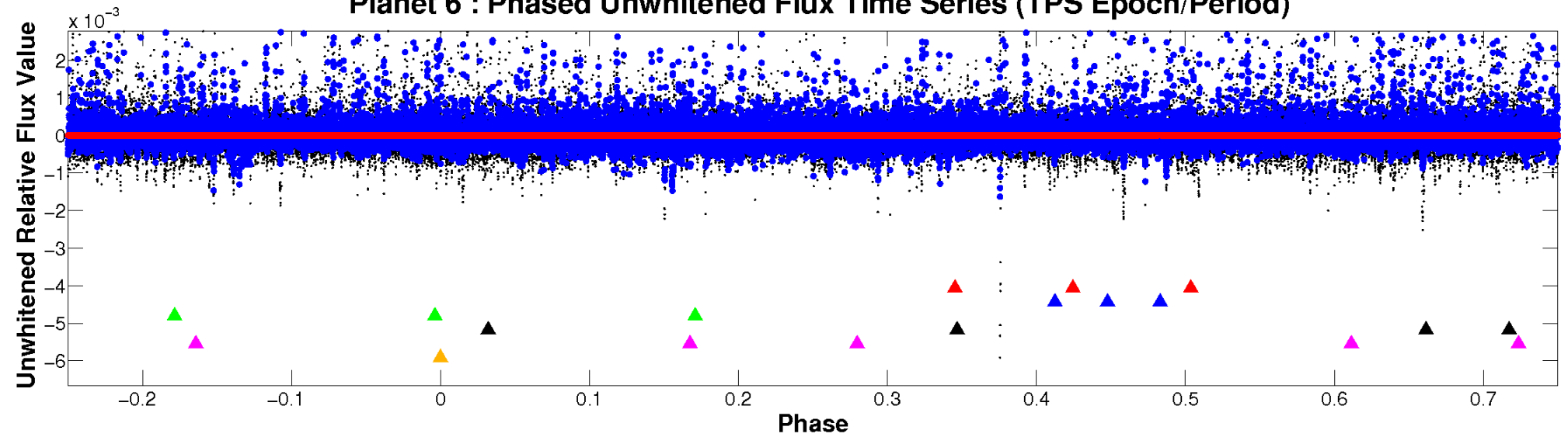
# ALT Odd/Even

TCE 008651471-06



# Non-Whitened Vs. Whitened Light Curve

**Planet 6 : Phased Unwhitened Flux Time Series (TPS Epoch/Period)**

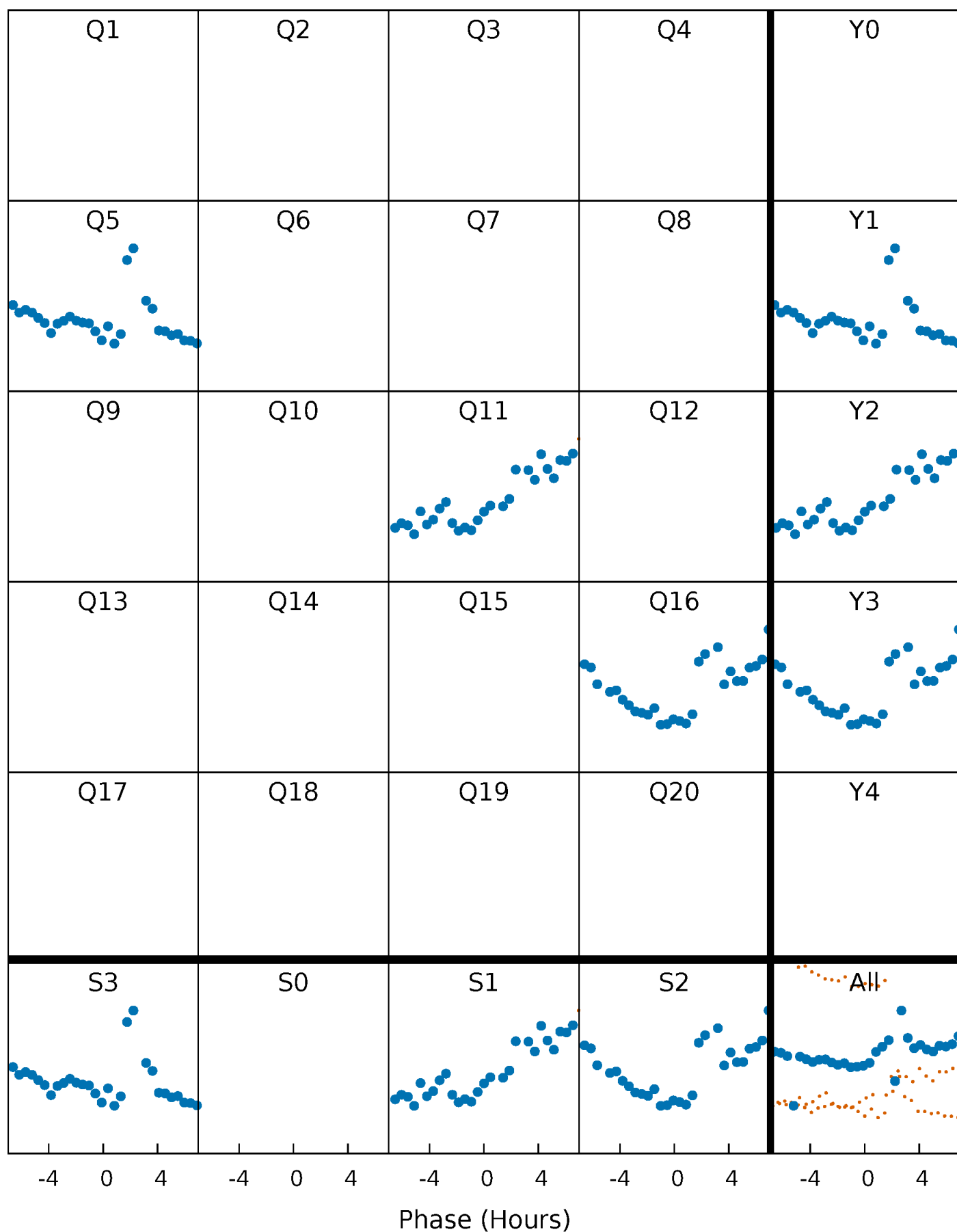


**Planet 6 : Phased Whitened Flux Time Series (TPS Epoch/Period)**



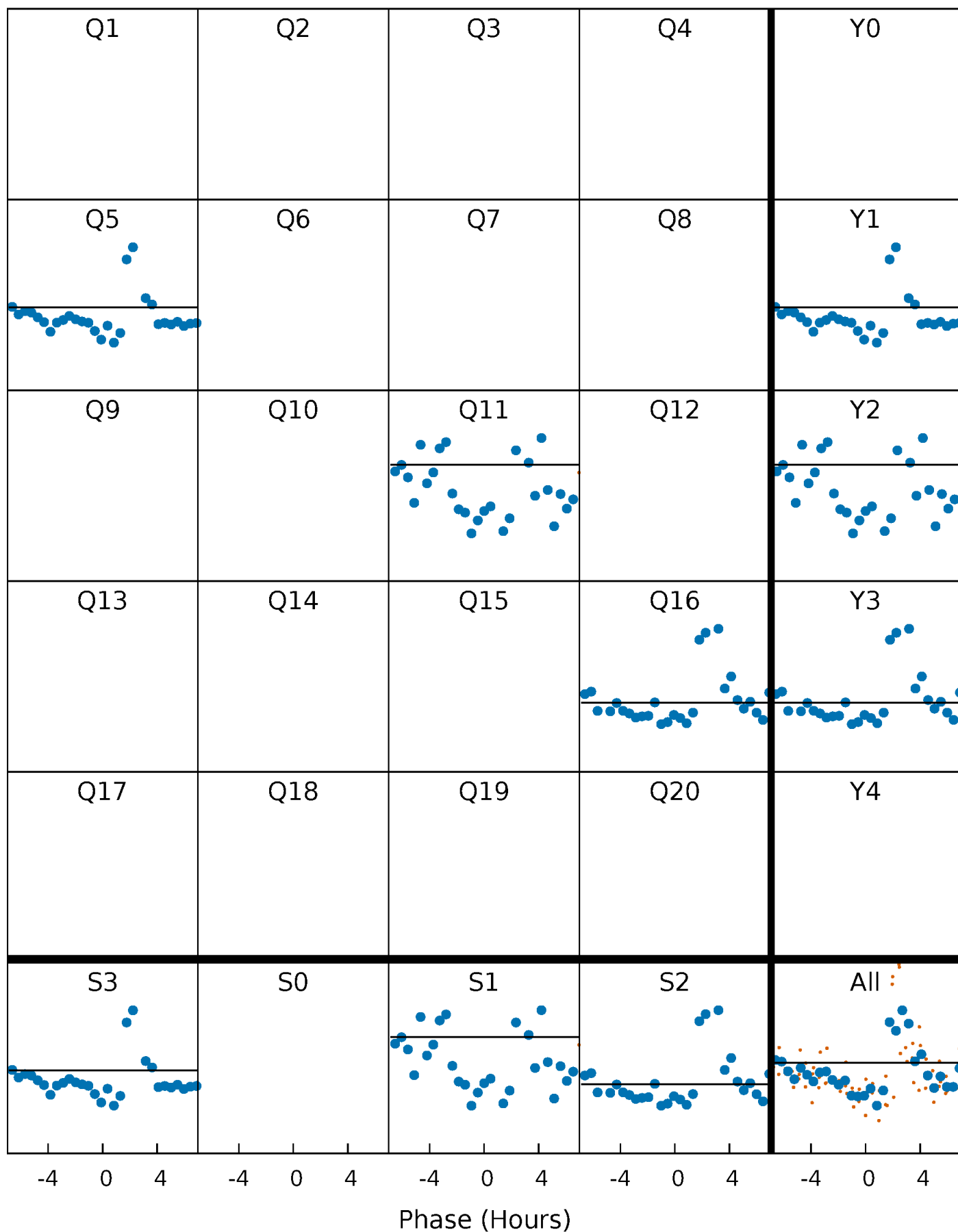
# PDC Quarter-Phased Transit Curves

TCE 008651471-06 P=542.143214 Days  $T_0=470.033782$  (BKJD)



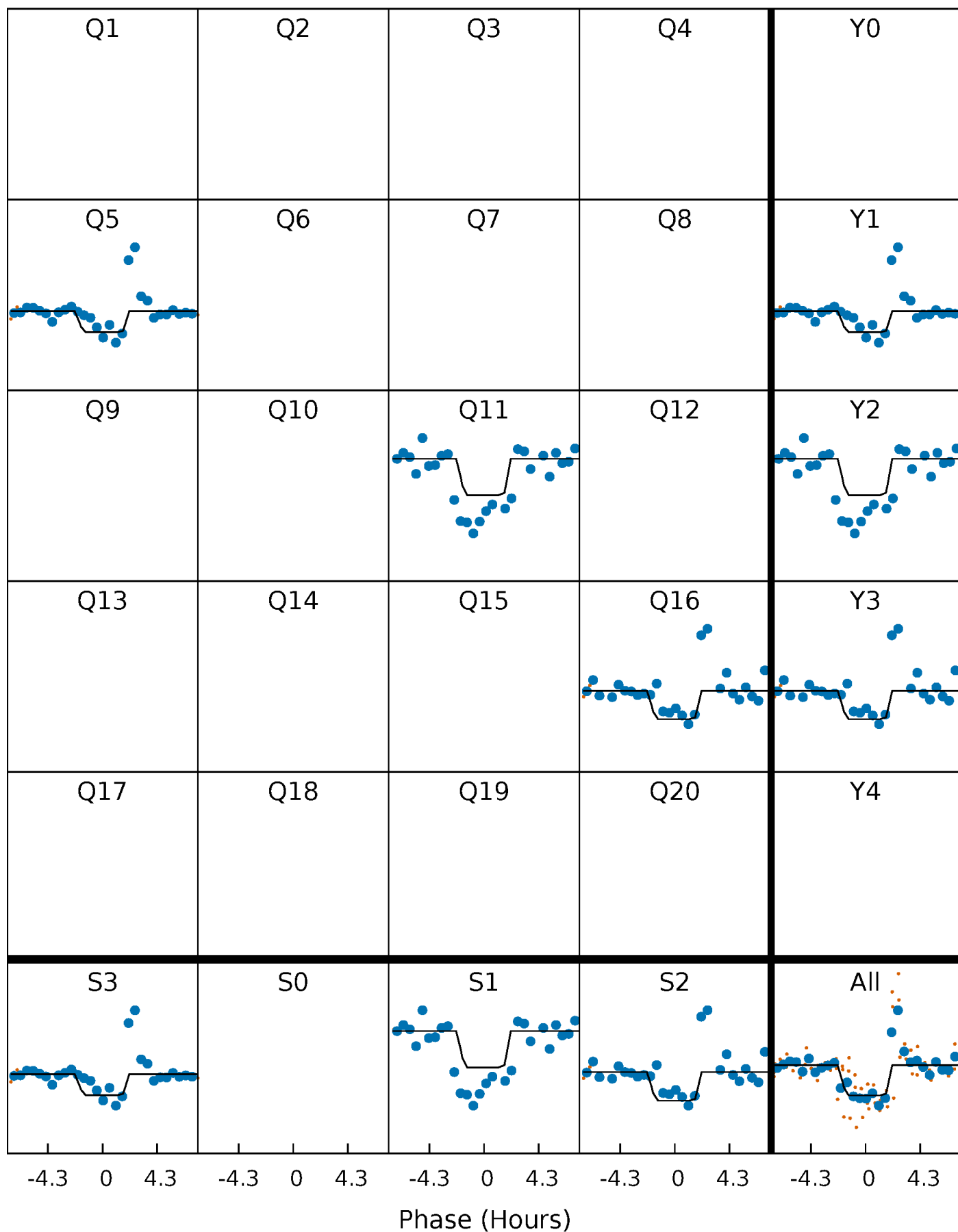
# DV Quarter-Phased Transit Curves

TCE 008651471-06     $P=542.143214$  Days     $T_0=470.033782$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

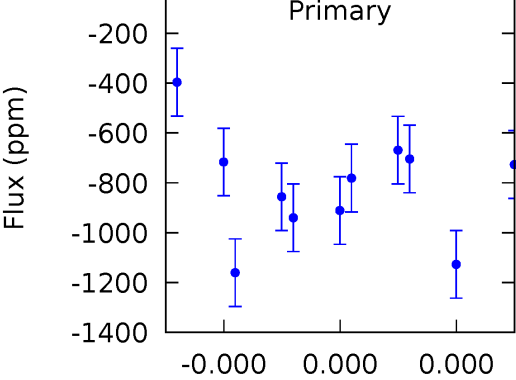
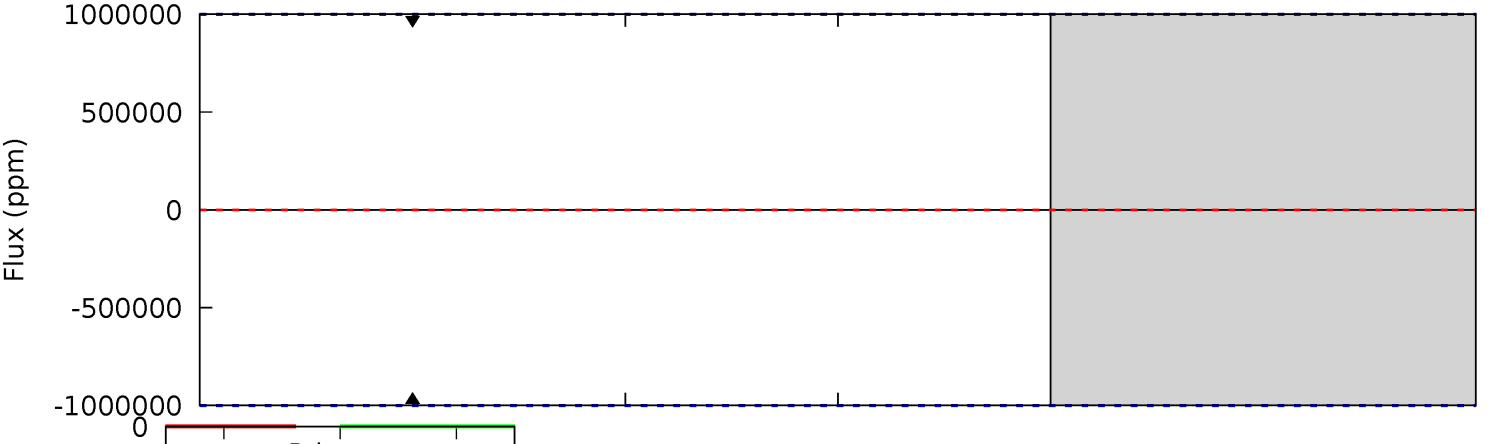
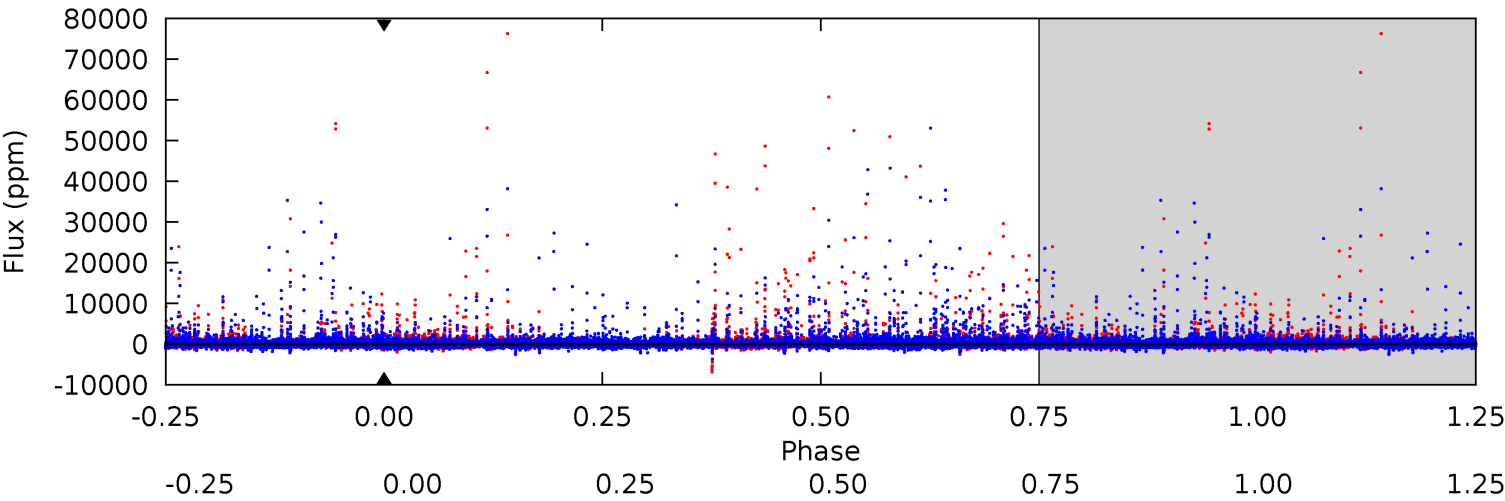
TCE 008651471-06 P=542.143214 Days  $T_0=470.027805$  (BKJD)



# DV Model-Shift Uniqueness Test

008651471-06, P = 542.143214 Days, E = 470.033782 Days

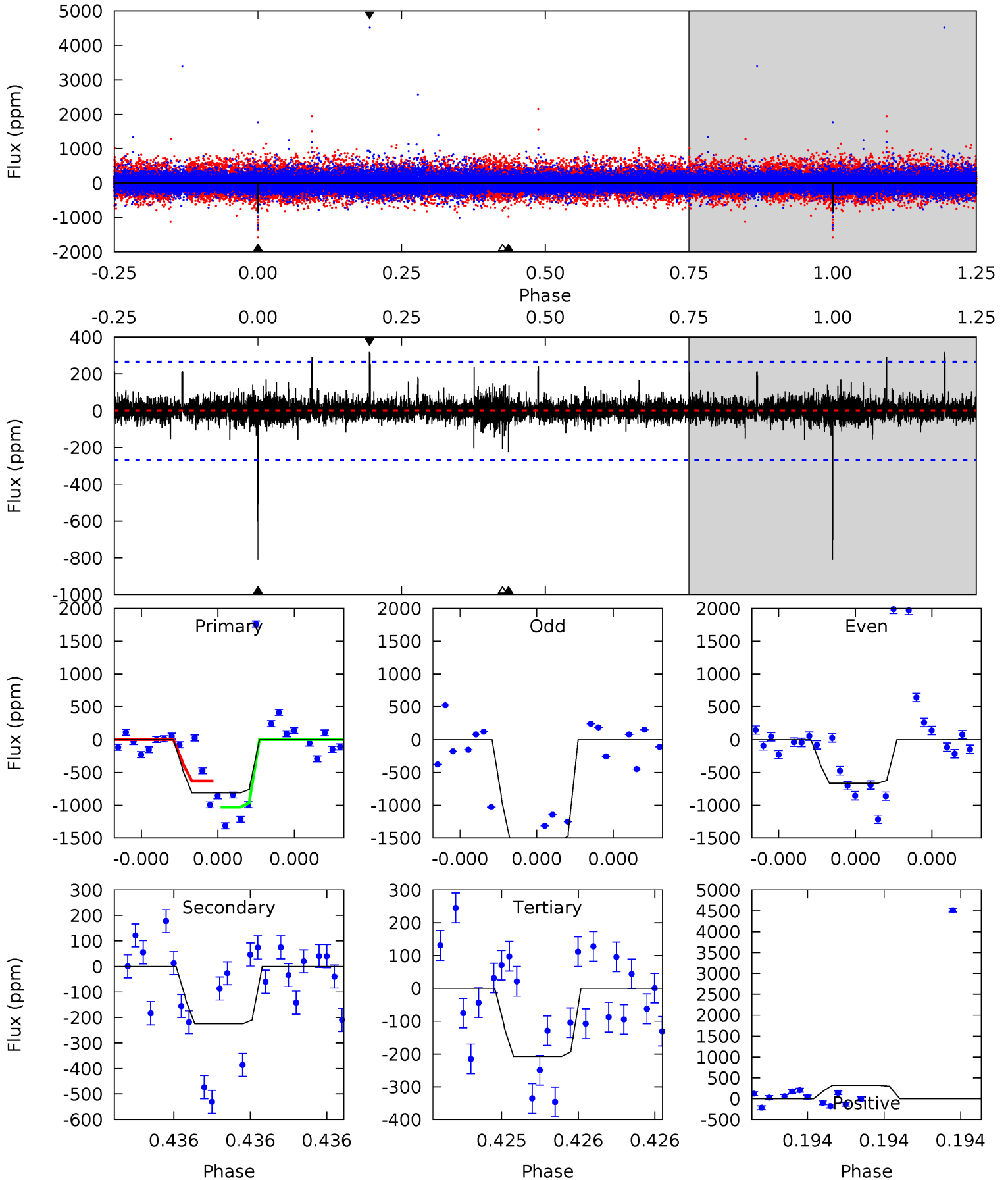
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
0	0	0	0	1.00	1.00	1.00	0	0	0	0	0	0	0	0



# Alt Model-Shift Uniqueness Test

008651471-06, P = 542.143214 Days, E = 470.027805 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
17.2	4.76	4.40	6.75	5.66	3.61	0.68	12.8	10.5	0.36	-1.99	9.07	1.34	0.28	4.04





### Stellar Parameters For KIC 008651471

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5250^{+158}_{-142}$	$4.522^{+0.085}_{-0.095}$	$-0.360^{+0.350}_{-0.300}$	$0.771^{+0.114}_{-0.085}$	$0.721^{+0.109}_{-0.042}$	$2.217^{+0.883}_{-0.633}$
	+3%/-3%	+2%/-2%	+97%/-83%	+15%/-11%	+15%/-6%	+40%/-29%
Source	PHO1	KIC0	KIC0	DSEP		

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

### Secondary Eclipse Parameters for KIC 008651471-06 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$0 \pm 1000000$	$6.34^{+6.38}_{-4.53}$	$263^{+12}_{-12}$	$4497^{+13476}_{-20172}$	$51226^{+3929155}_{-3039872}$
Alt.	$-224 \pm 47$	$6.56^{+6.58}_{-4.71}$	$263^{+12}_{-10}$	$2970^{+1464}_{-506}$	$4012^{+41666}_{-3111}$

$T_{max}$  = 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

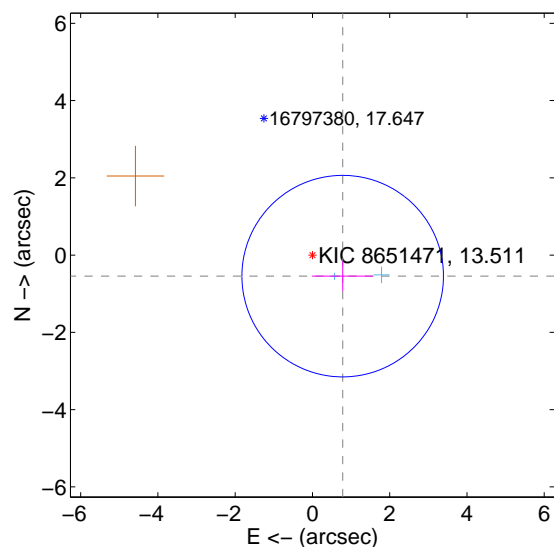
Supplemental centroid analysis for 008651471-06. Kepler magnitude: 13.51. Transit SNR -1.00

There are 2 quarters with good PRF difference image offsets

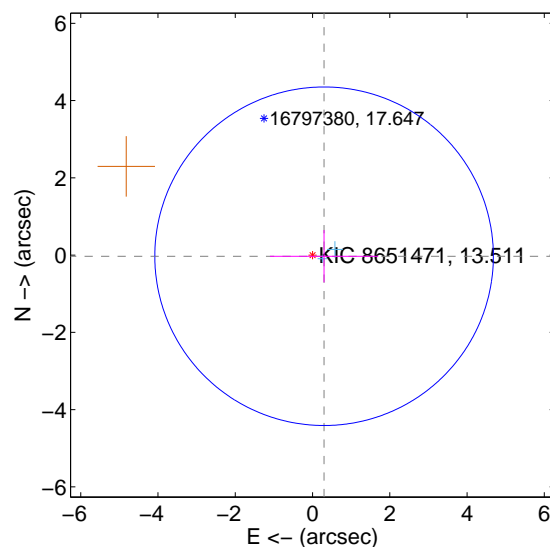
The direct PRF centroid is offset from the target star catalog position by about 0.56 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.954 \pm 0.869$	1.10	$-0.783 \pm 0.797$	$-0.544 \pm 0.387$
PRF-fit source offset from KIC position	$0.301 \pm 1.460$	0.21	$-0.299 \pm 1.401$	$-0.030 \pm 0.676$
photometric centroid source offset	$0.73 \pm 1.50$	0.49	$0.71 \pm 1.51$	$0.14 \pm 0.96$

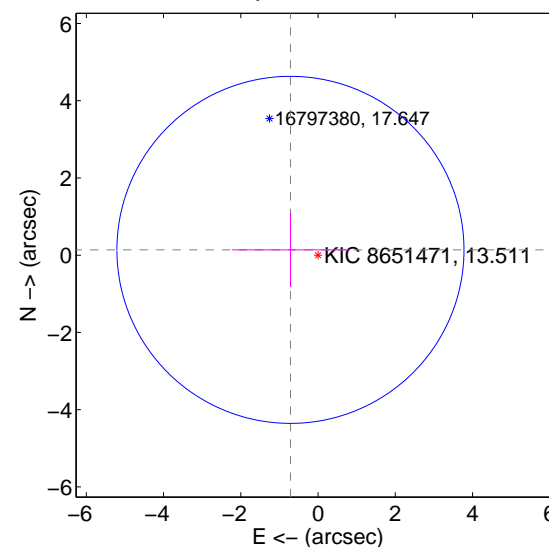
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position



offset from photometric centroids

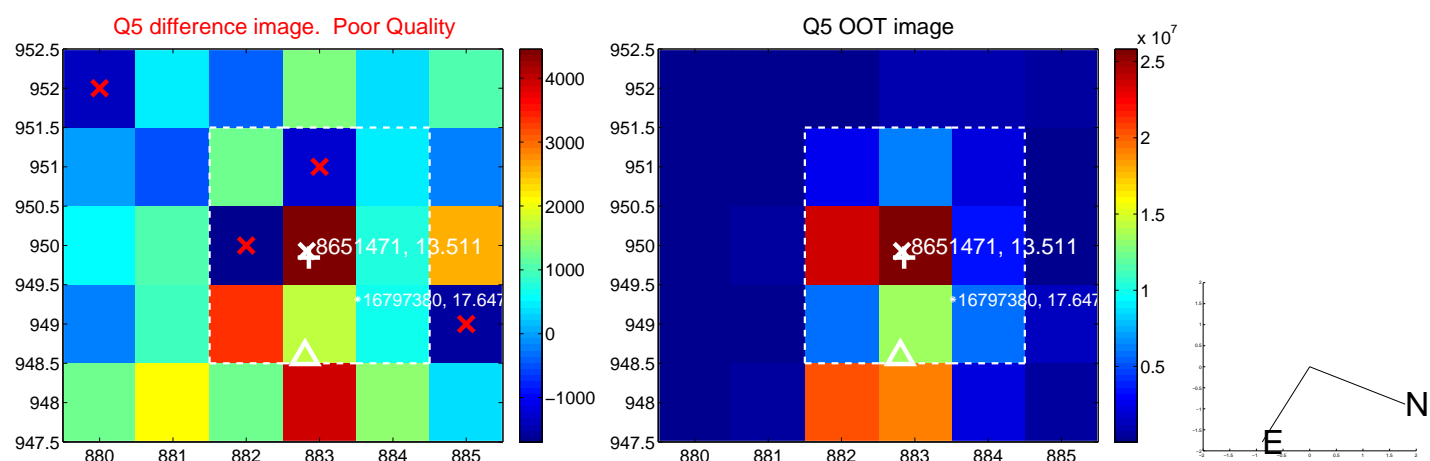


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

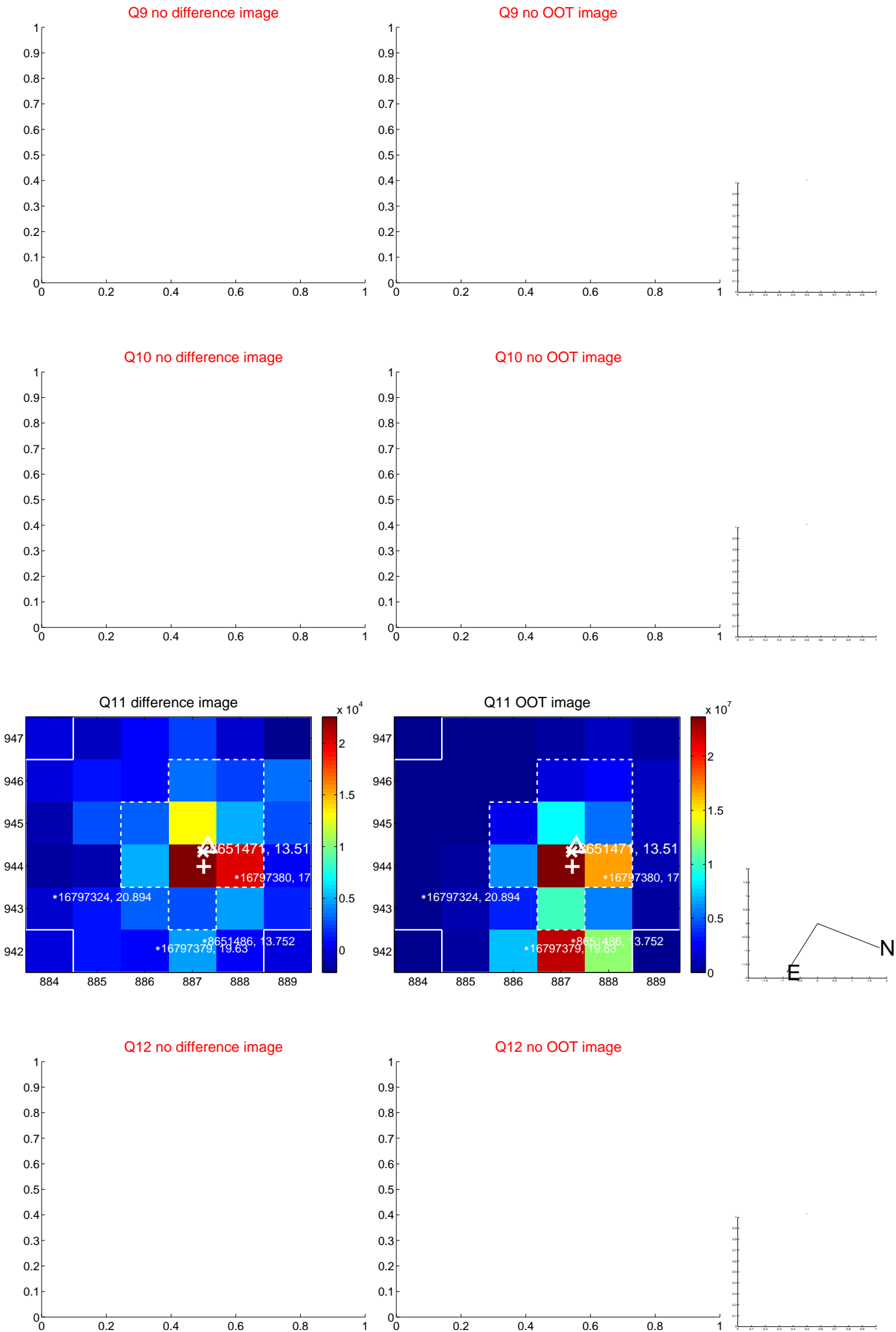
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



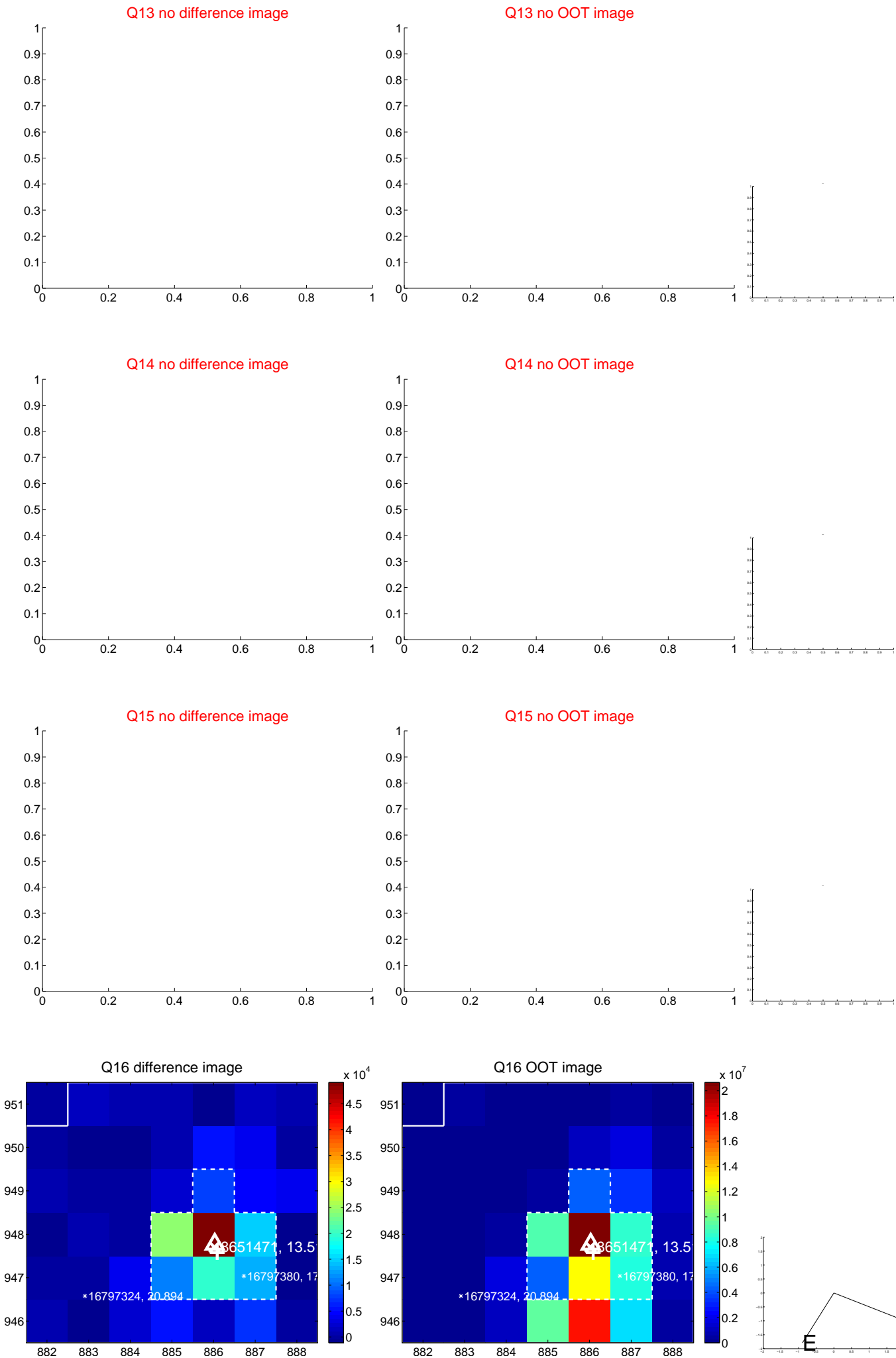
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



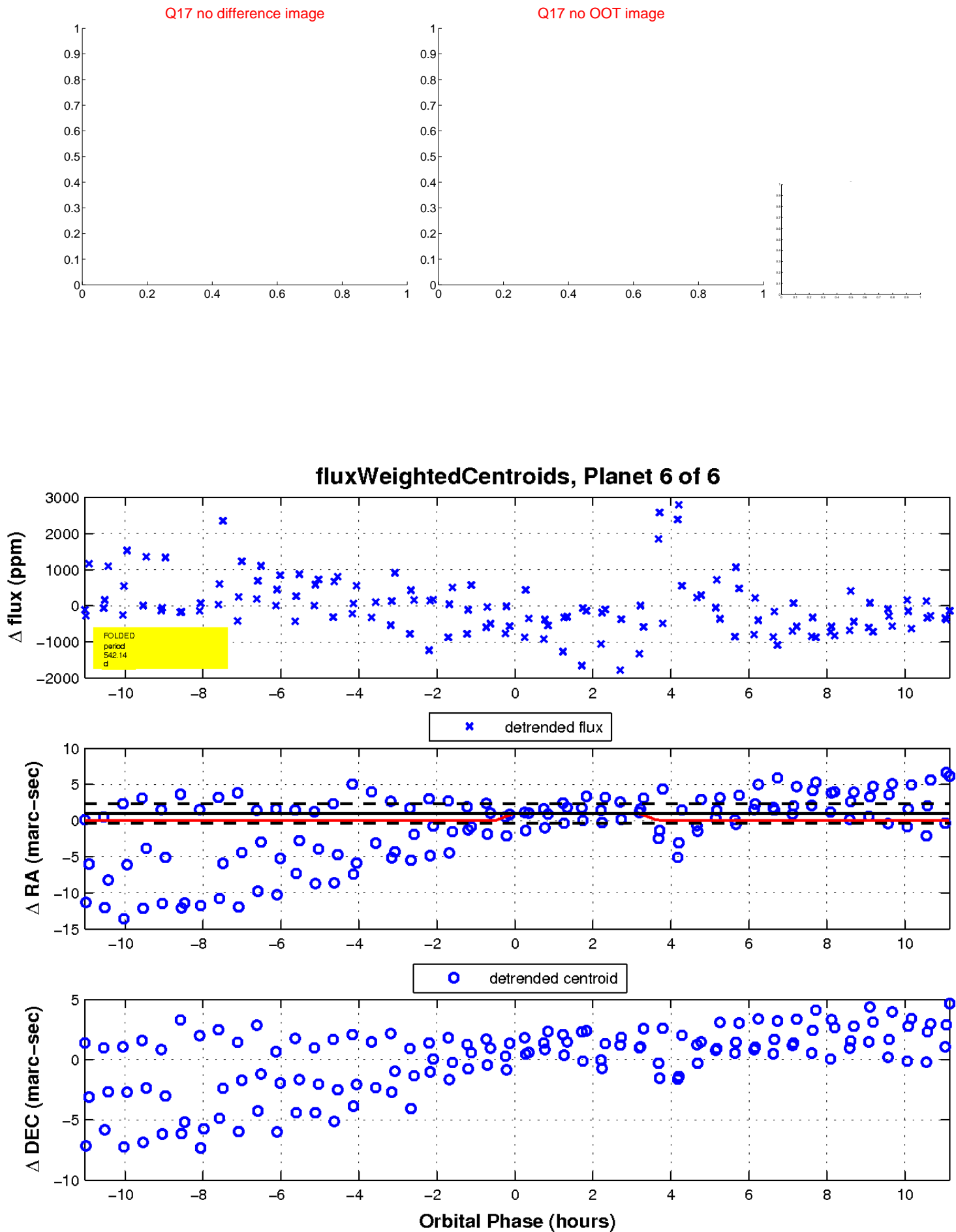
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

