

# KIC 011870769

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
011870769-01	OBS	No	530.431465	143.571979	2411.8	10.954	17.3	7.2	0.40	3522	1.93	0.02
011870769-02	OBS	No	381.681656	163.070370	2069.7	13.441	8.3	7.3	0.40	3522	1.79	0.04
011870769-03	OBS	No	454.735926	205.944564	2624.9	9.291	13.0	7.3	0.40	3522	2.23	0.03
011870769-04	OBS	No	598.601081	301.908347	2870.5	10.518	12.0	7.9	0.40	3522	2.11	0.02

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
011870769-01	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS—HALO_GHOST
011870769-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL—LPP_DV—INCONSISTENT_TRANS—CENT_KIC_POS
011870769-03	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_CHASES—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS—HALO_GHOST
011870769-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_SKYE—LPP_DV—MOD_NONUNIQ_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS

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

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

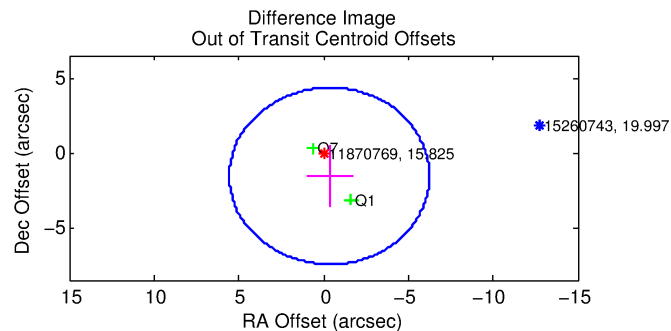
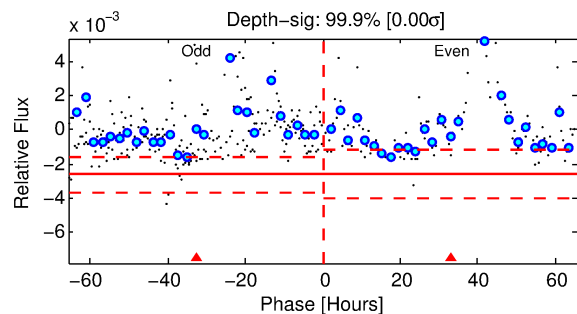
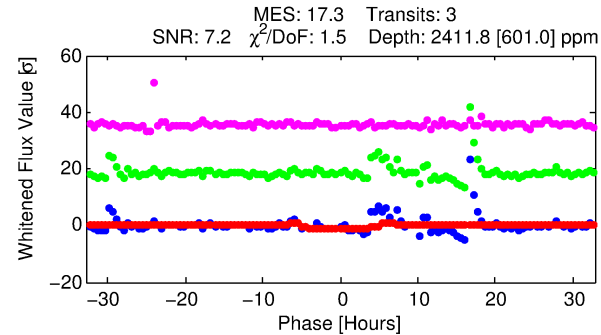
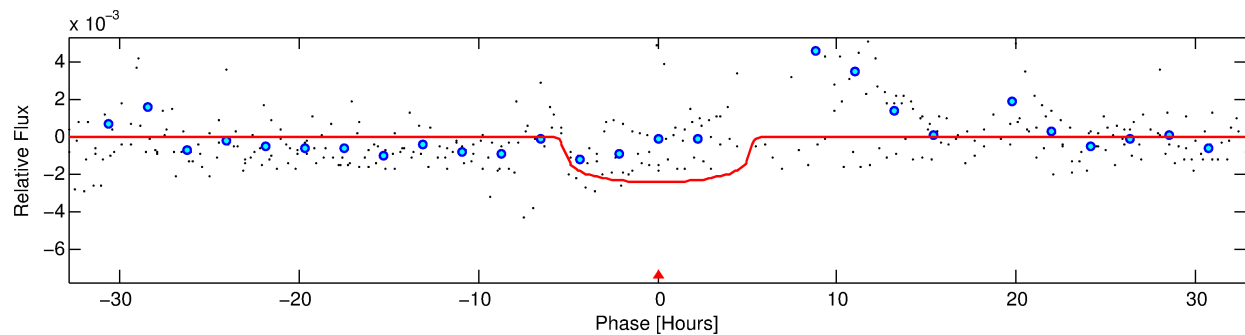
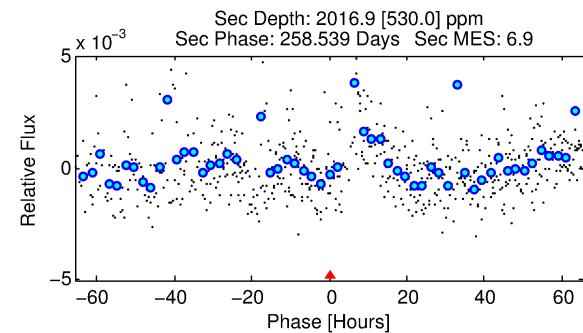
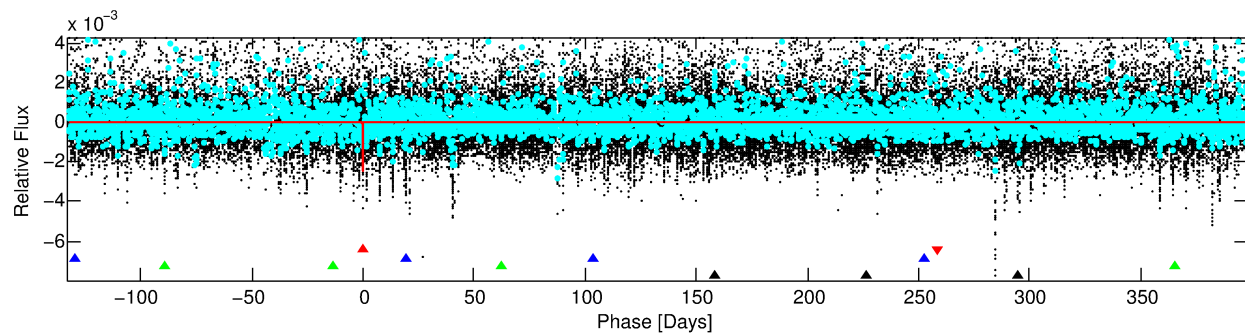
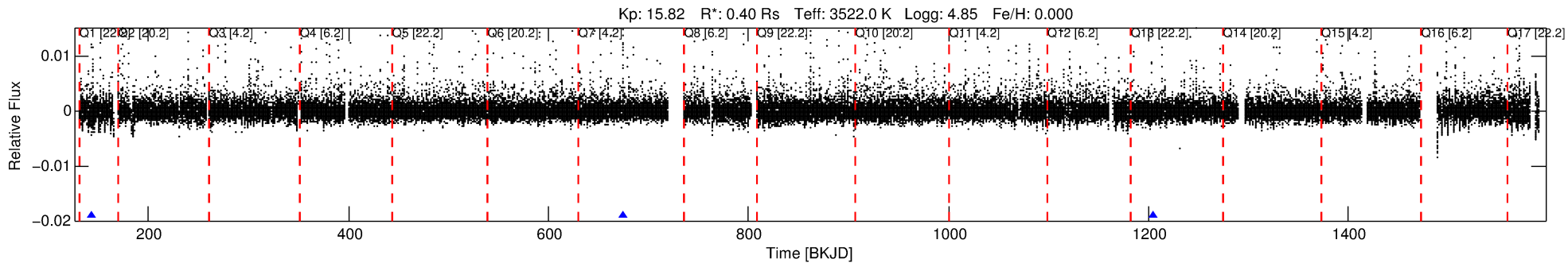
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 011870769-01

No Significant Match Found

# DV One-Page Summary

KIC: 11870769 Candidate: 1 of 4 Period: 530.431 d



## DV Fit Results:

Period = 530.43147 [0.01579] d  
Epoch = 143.5720 [0.0218] BKJD  
Rp/R\* = 0.0443 [0.0245]  
a/R\* = 386.29 [857.51]  
b = 0.01 [288.50]  
Seff = 0.02 [0.00]  
Teq = 101 [3] K  
Rp = 1.93 [1.09] Re  
a = 0.9539 [0.0804] AU  
Ag = 269875.38 [308118.58] [0.88σ]  
Teffp = 3546 [1010] K [3.41σ]

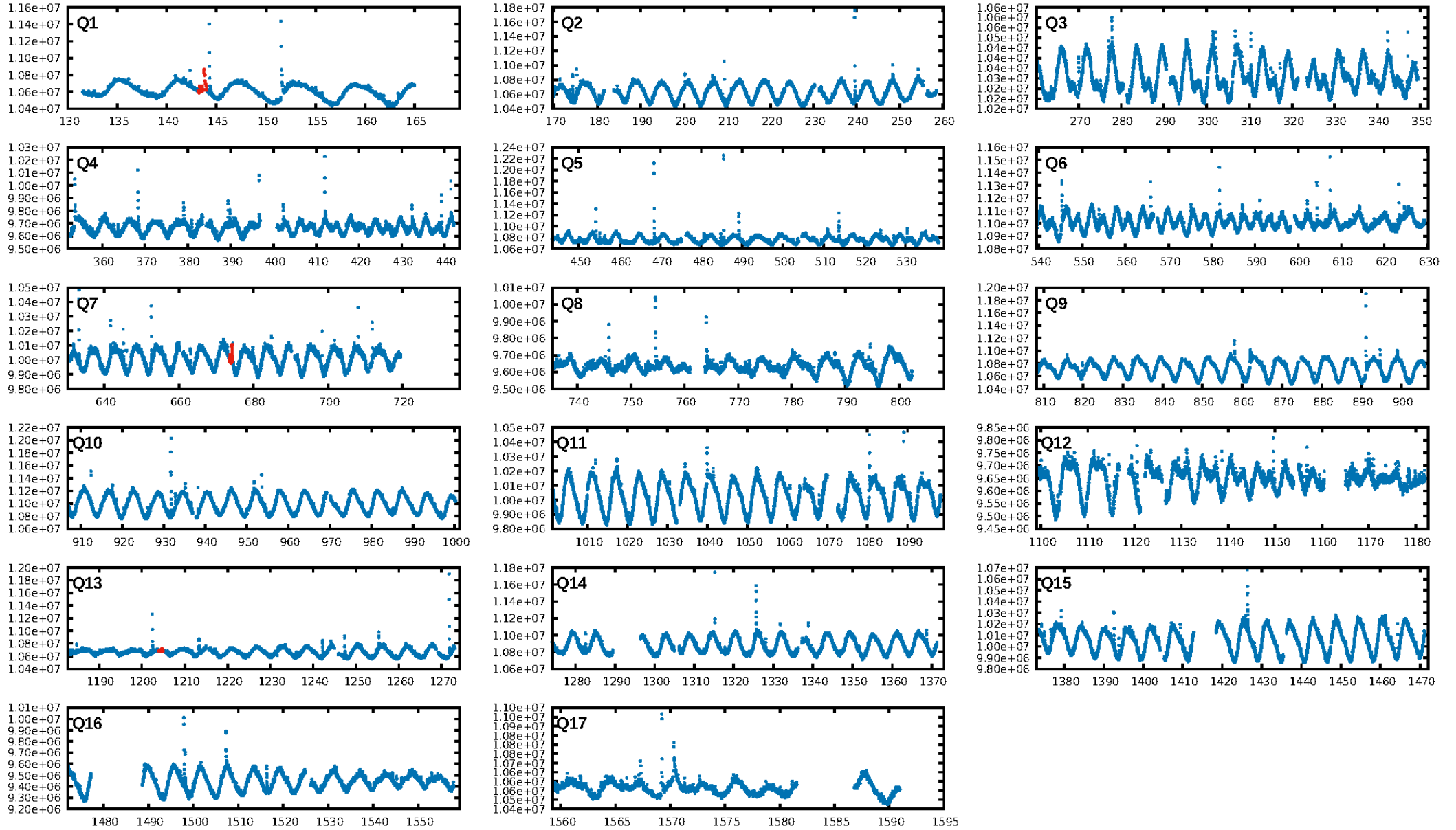
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [126.47σ]  
LongPeriod-sig: 100.0% [107.73σ]  
**ModelChiSquare2-sig: 0.1%**  
ModelChiSquareGof-sig: 90.0%  
Bootstrap-pfa: 9.25e-20  
RollingBand-fgt: 1.00 [2/2]  
**GhostDiagnostic-chr: -0.2003**  
Centroid-sig: 0.3%  
Centroid-so: 0.983 arcsec [1.18σ]  
OotOffset-rm: 1.599 arcsec [0.81σ]  
KicOffset-rm: 1.176 arcsec [0.63σ]  
OotOffset-st: 0/1/0/1 [2]  
KicOffset-st: 0/1/0/1 [2]  
DiffImageQuality-fgm: 1.00 [2/2]  
DiffImageOverlap-fno: 1.00 [3/3]

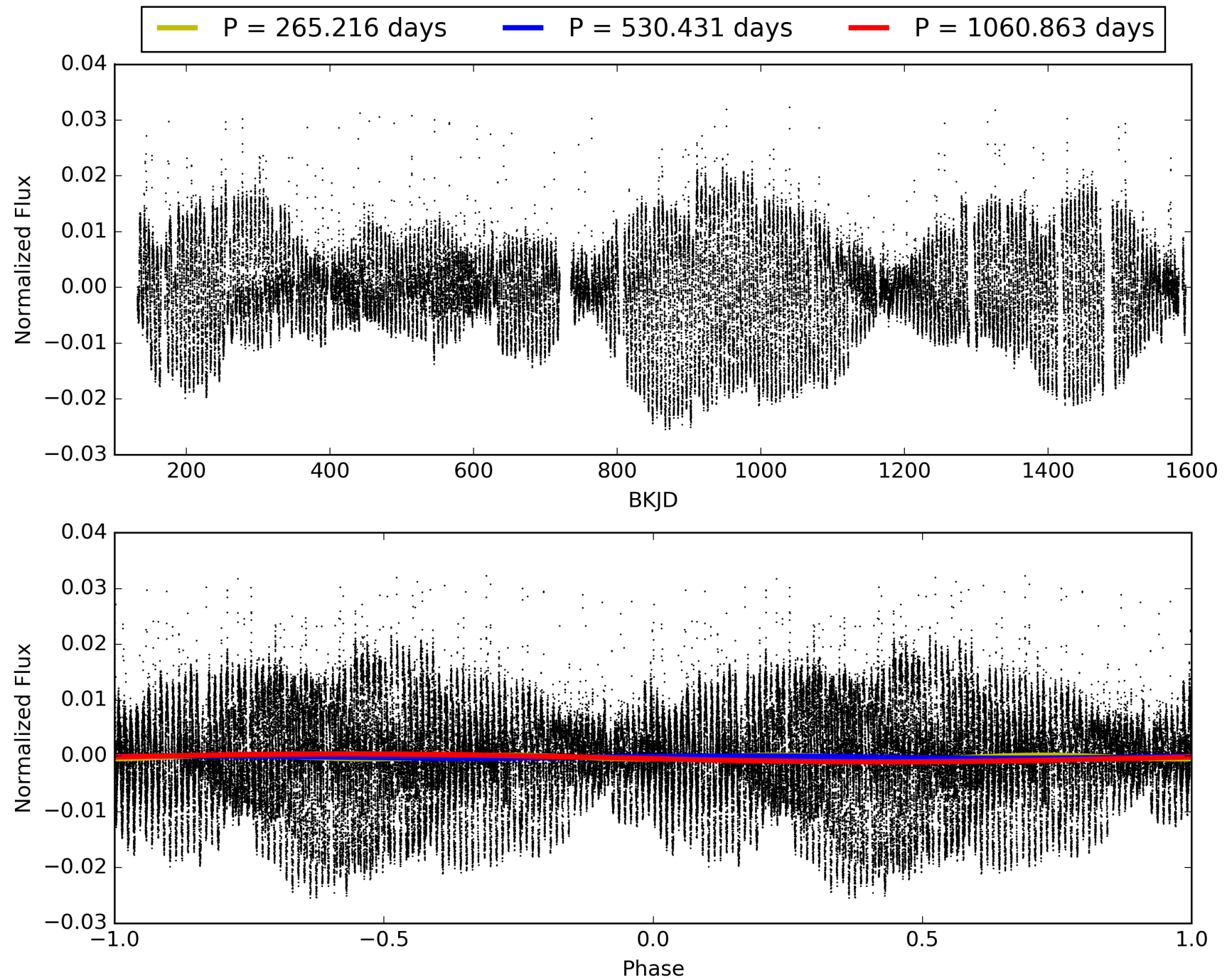
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 29-Jan-2016 21:19:10 Z

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

# TCE 011870769-01, PDC Light Curves



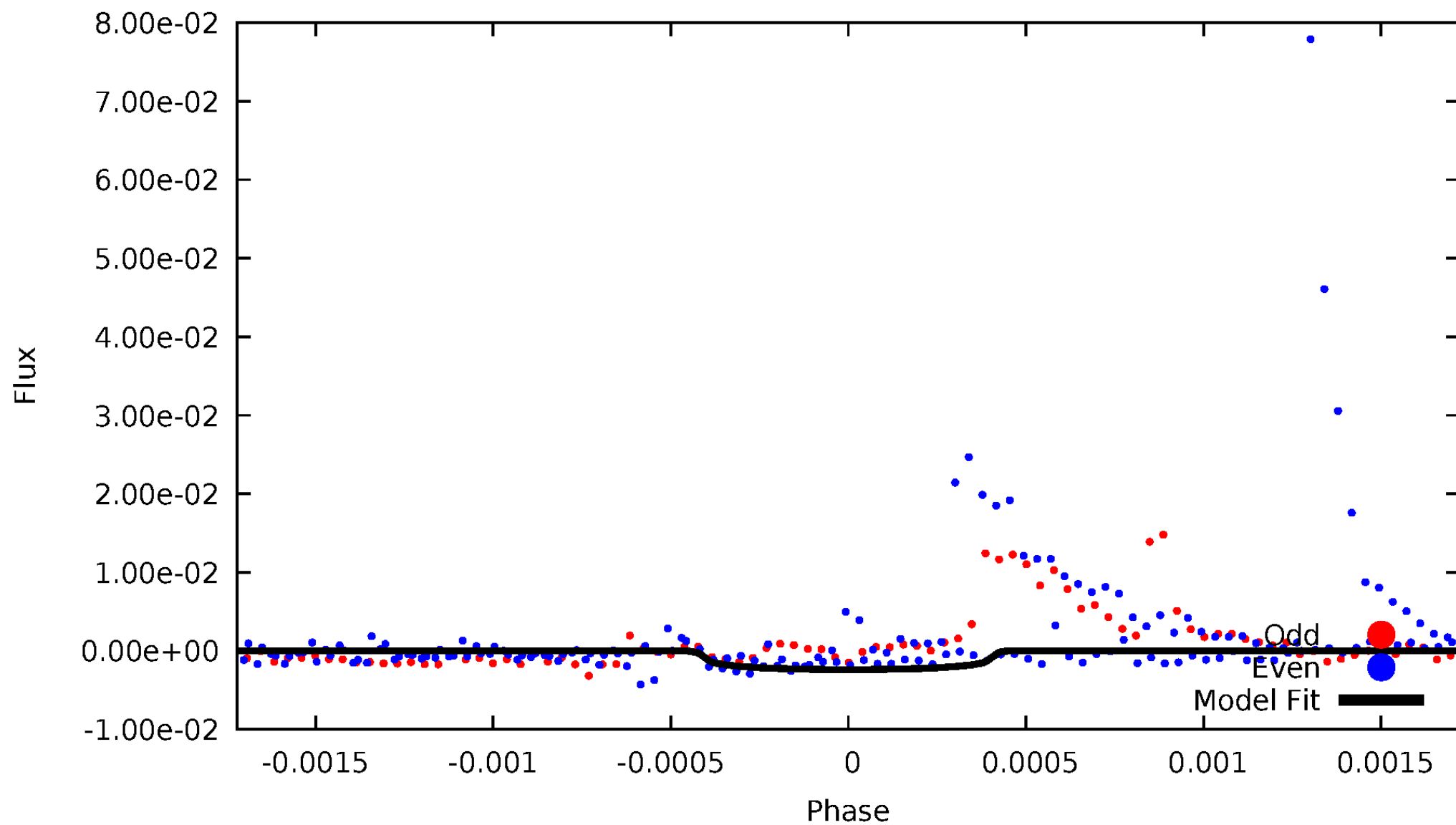
# TCE 011870769-01





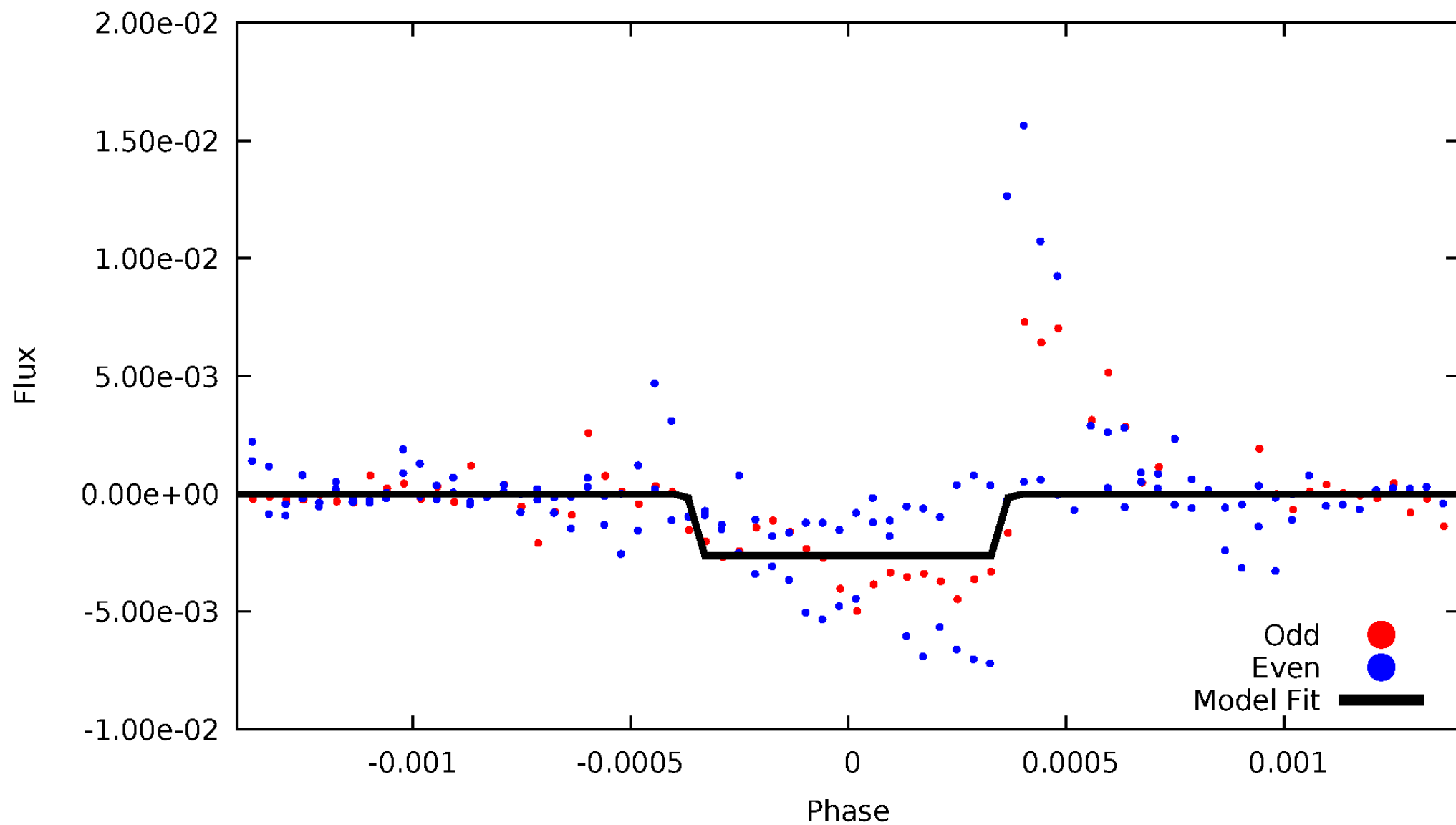
# DV Odd/Even

TCE 011870769-01



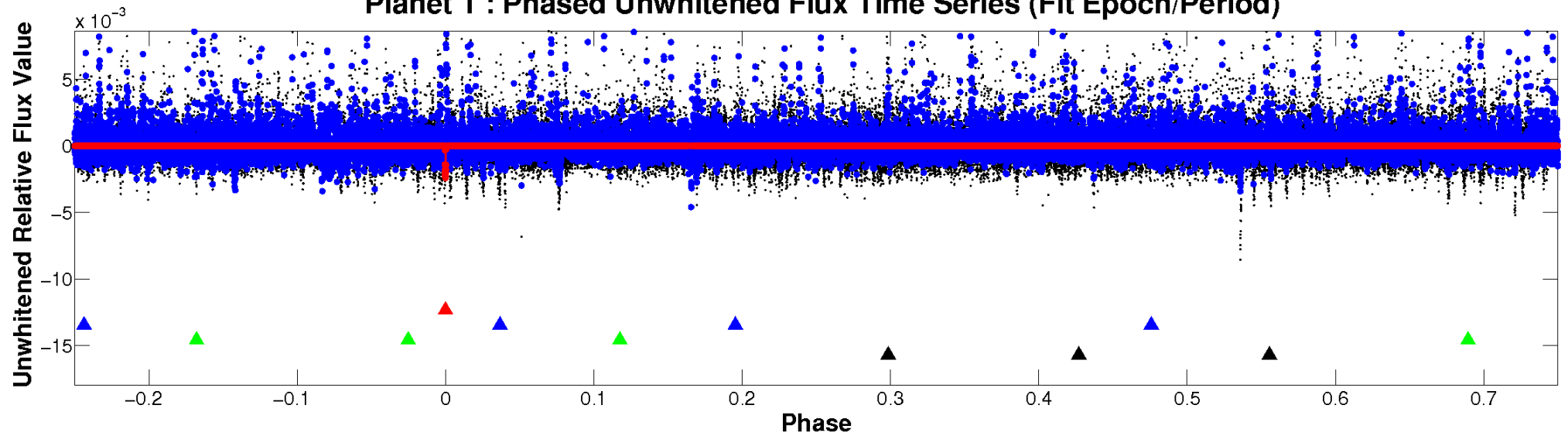
# ALT Odd/Even

TCE 011870769-01

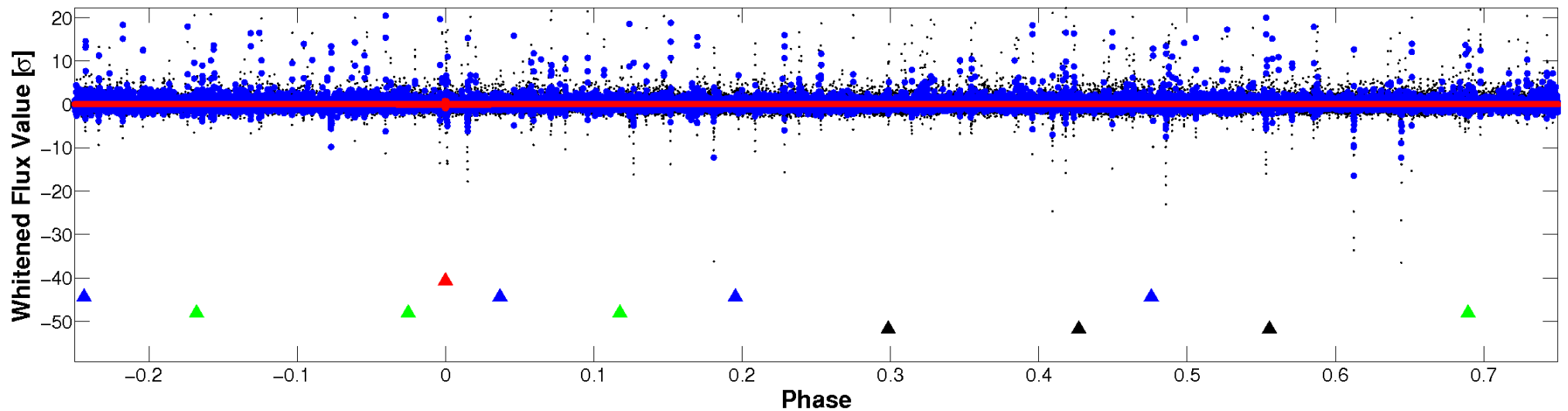


# Non-Whitened Vs. Whitened Light Curve

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

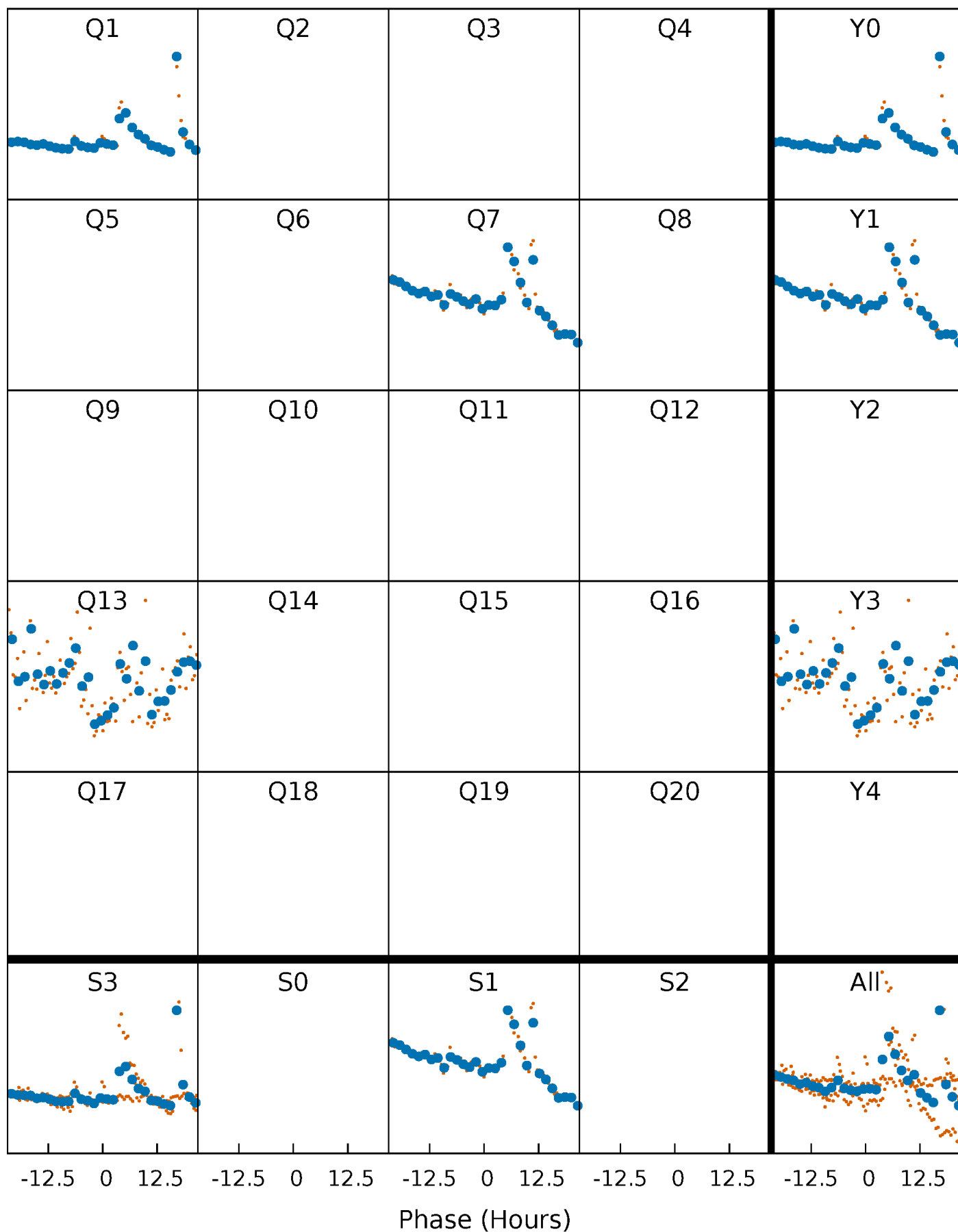


Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)



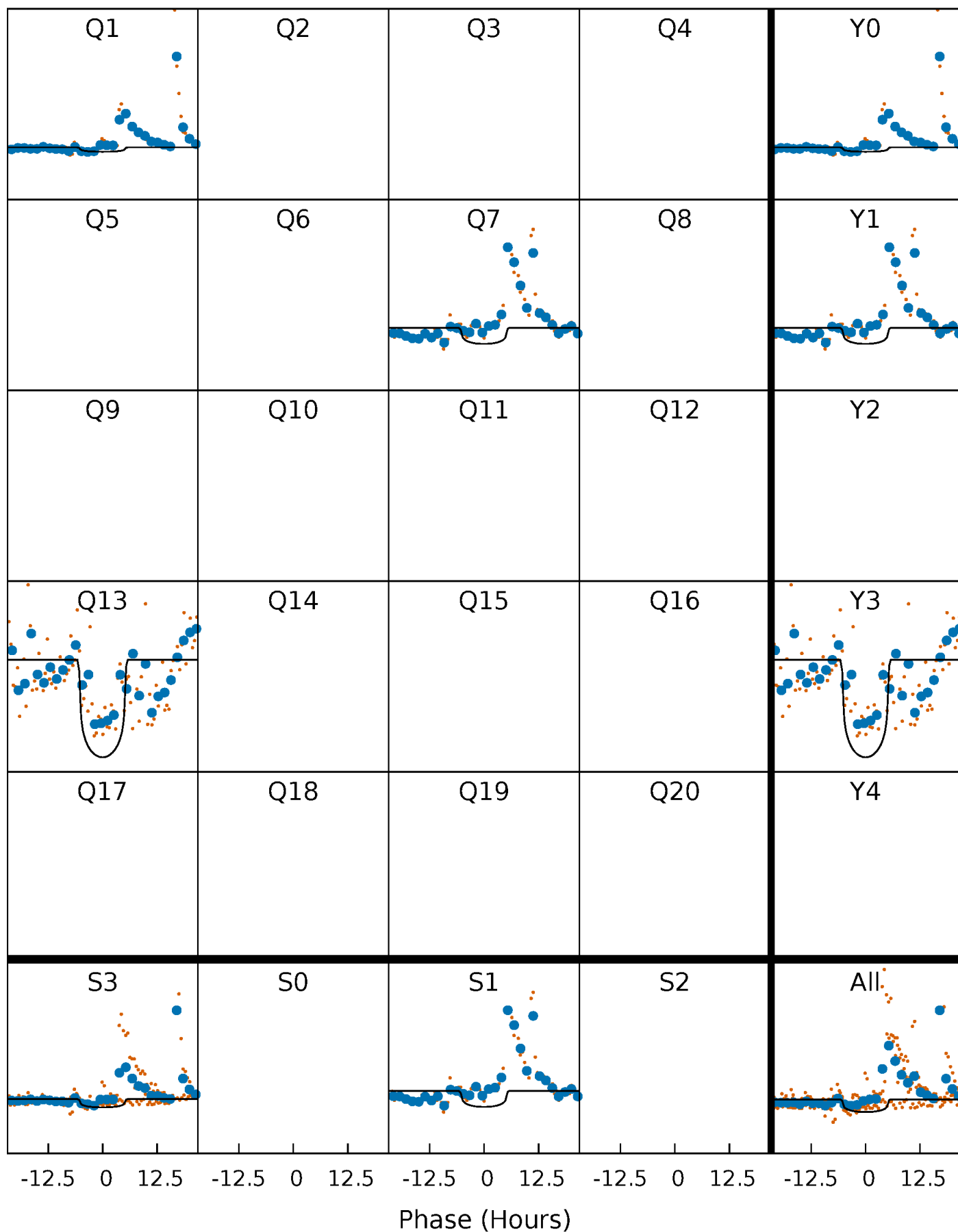
# PDC Quarter-Phased Transit Curves

TCE 011870769-01 P=530.431465 Days  $T_0=143.571979$  (BKJD)



# DV Quarter-Phased Transit Curves

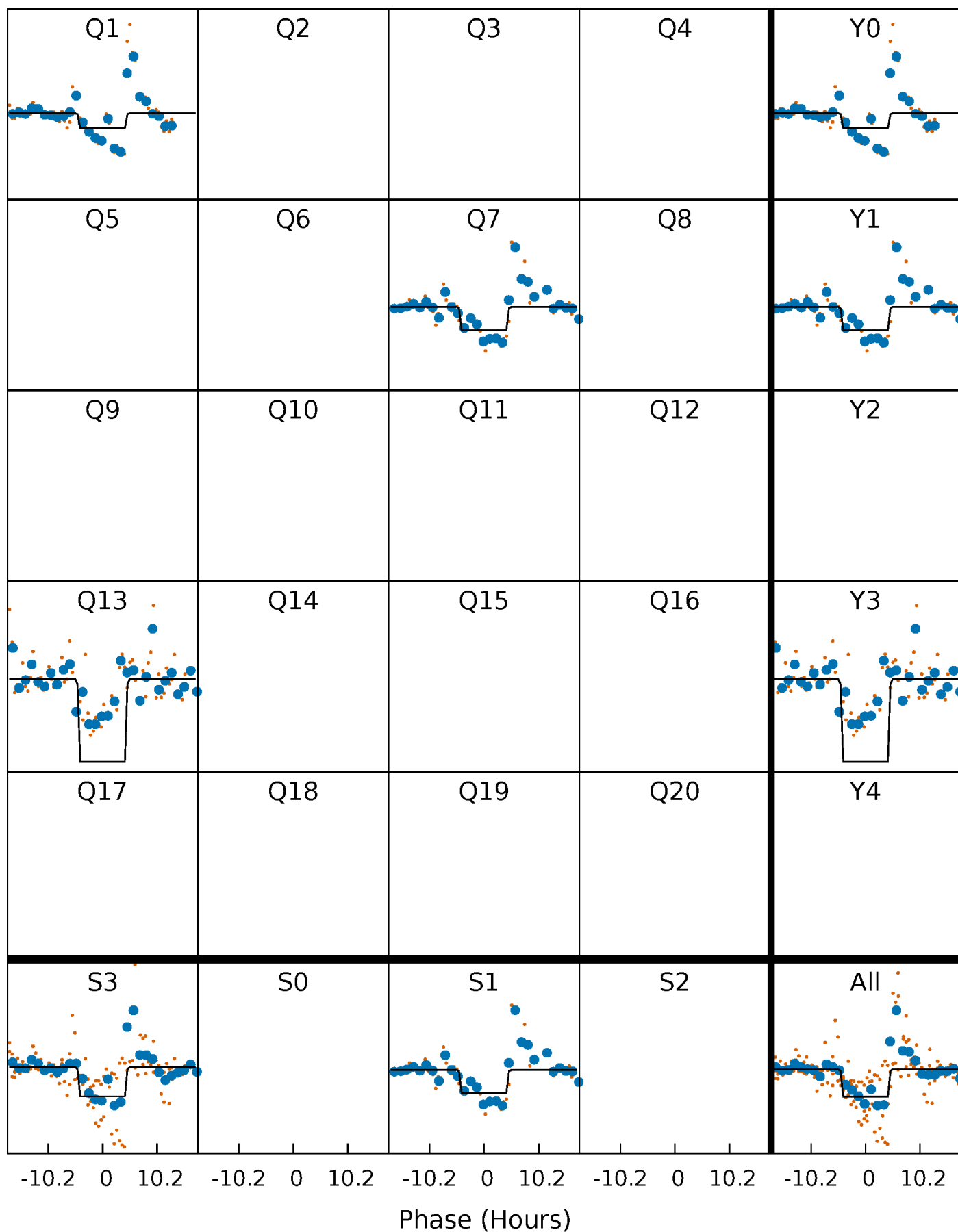
TCE 011870769-01   P=530.431465 Days    $T_0=143.571979$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

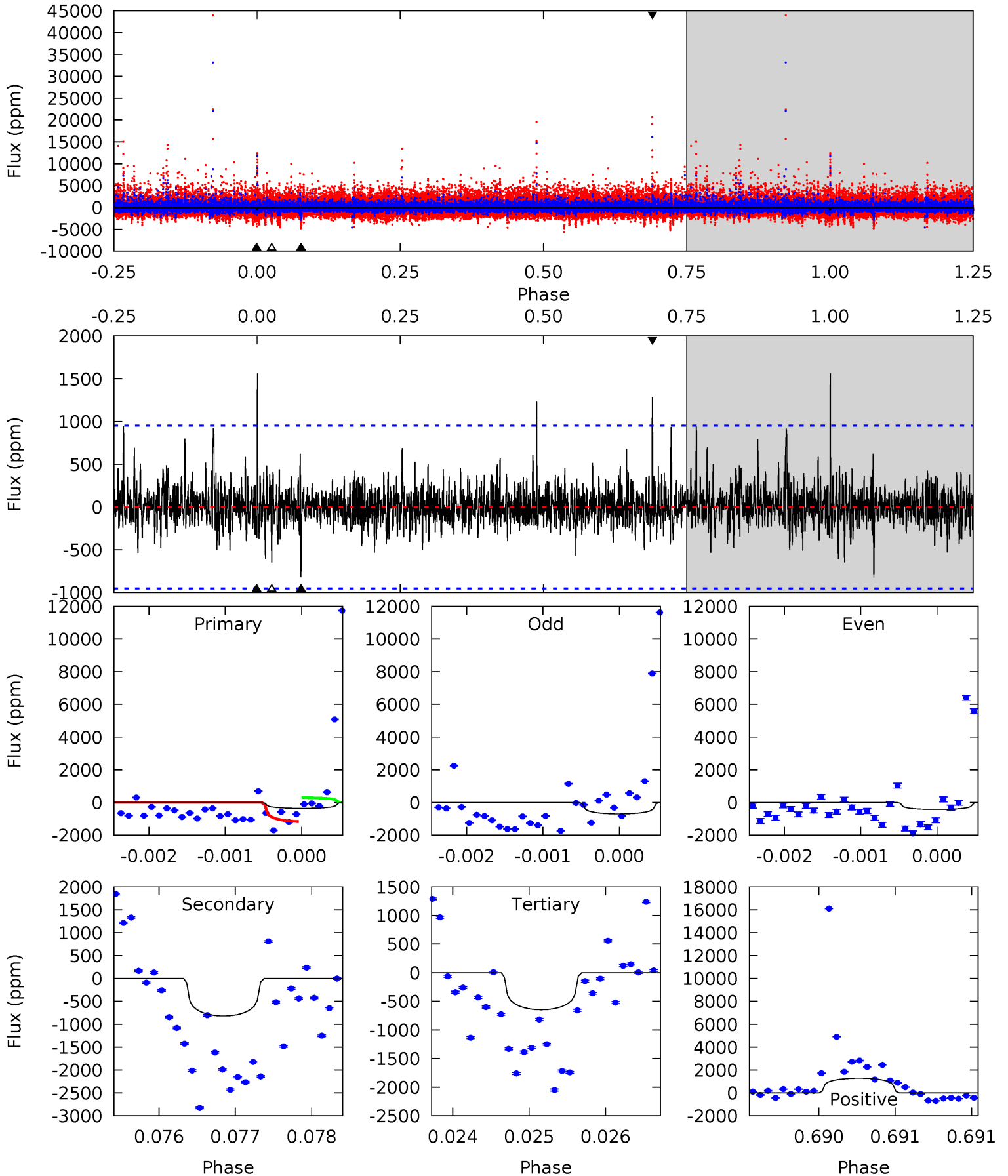
TCE 011870769-01 P=530.455218 Days  $T_0=143.538309$  (BKJD)



# DV Model-Shift Uniqueness Test

011870769-01, P = 530.431465 Days, E = 143.571979 Days

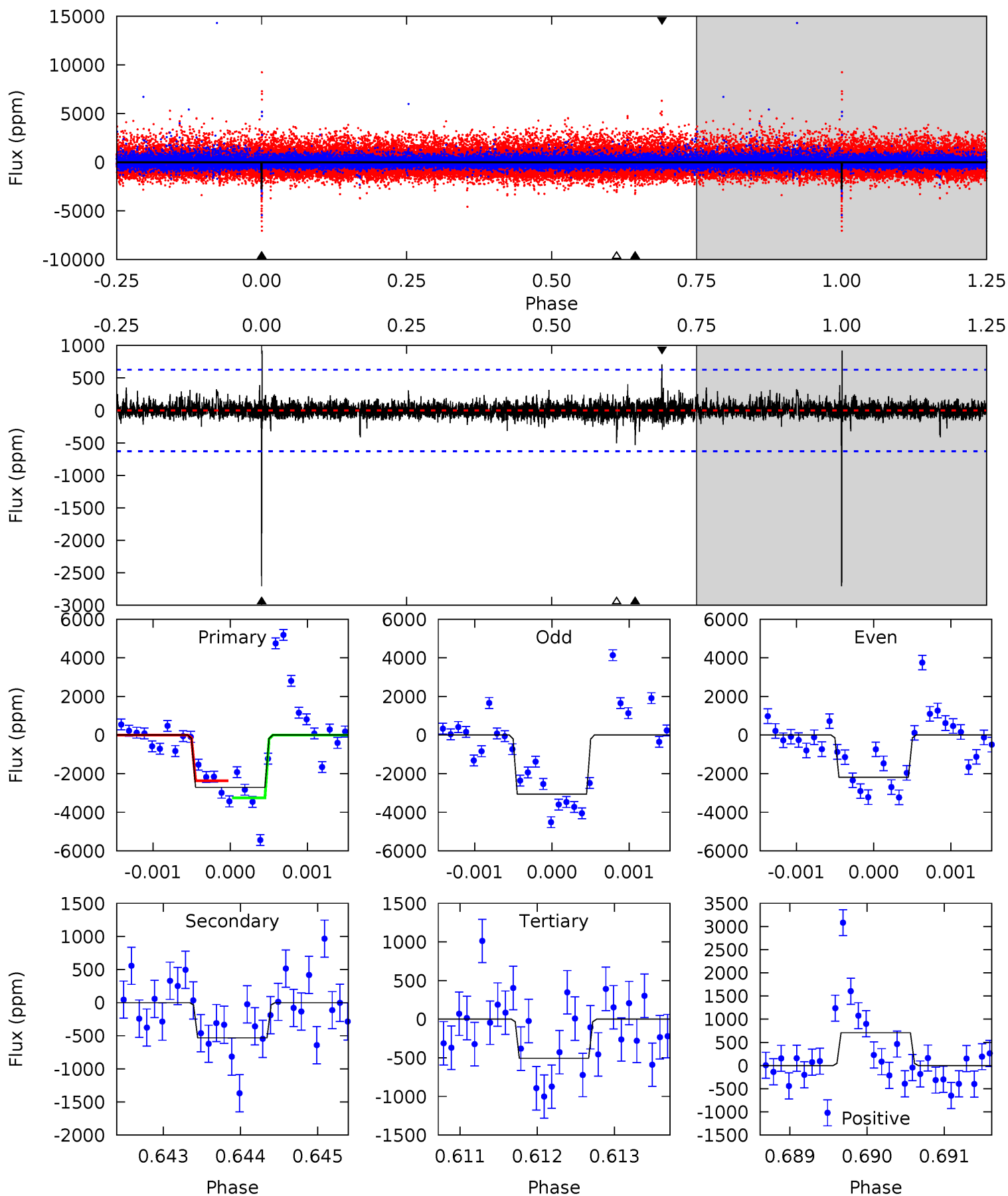
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
2.07	4.71	3.72	7.38	5.48	3.33	1.07	-1.65	-5.31	0.99	-2.67	0.58	1.13	0.66	0



# Alt Model-Shift Uniqueness Test

011870769-01, P = 530.455218 Days, E = 143.538309 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
23.7	4.67	4.43	6.22	5.51	3.38	0.65	19.3	17.5	0.24	-1.55	3.45	0.87	0.25	3.85



### Stellar Parameters For KIC 011870769

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$3522^{+63}_{-71}$	$4.848^{+0.050}_{-0.036}$	$0.000^{+0.100}_{-0.100}$	$0.400^{+0.040}_{-0.045}$	$0.411^{+0.043}_{-0.053}$	$9.054^{+2.575}_{-1.552}$
	+2%/-2%	+1%/-1%	+inf%/-inf%	+10%/-11%	+10%/-13%	+28%/-17%
Source	PHO2	PHO2	PHO2	DSEP		

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

### Secondary Eclipse Parameters for KIC 011870769-01 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	-819±174	$2.00^{+1.00}_{-0.93}$	$140^{+4}_{-4}$	$3047^{+651}_{-336}$	$99843^{+261000}_{-55785}$
Alt.	-532±114	$2.32^{+1.05}_{-1.09}$	$140^{+4}_{-4}$	$2758^{+530}_{-260}$	$50608^{+119807}_{-28171}$

$T_{\text{max}}$  = 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

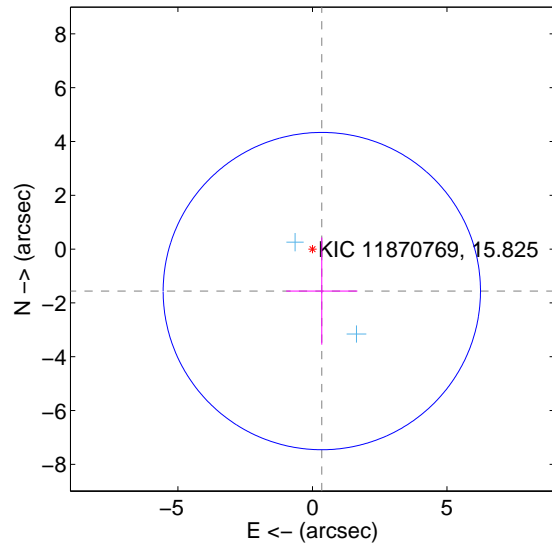
Supplemental centroid analysis for 011870769-01. Kepler magnitude: 15.82. Transit SNR 7.20

There are 2 quarters with good PRF difference image offsets

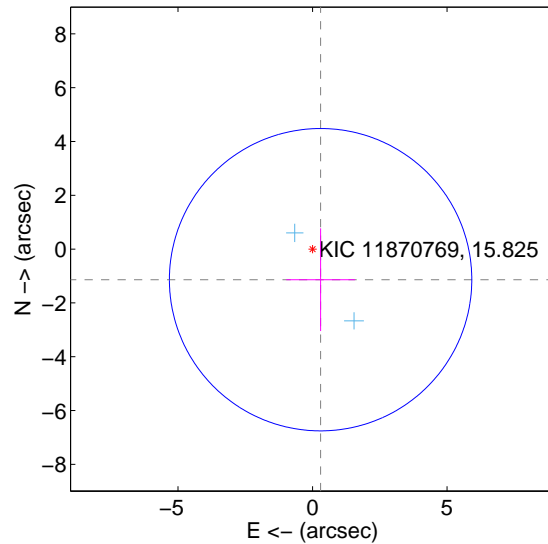
The direct PRF centroid is offset from the target star catalog position by about 0.35 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.599 \pm 1.966$	0.81	$-0.349 \pm 1.324$	$-1.561 \pm 1.992$
PRF-fit source offset from KIC position	$1.176 \pm 1.873$	0.63	$-0.300 \pm 1.277$	$-1.137 \pm 1.908$
photometric centroid source offset	$0.98 \pm 0.84$	1.18	$0.25 \pm 0.67$	$-0.95 \pm 0.85$

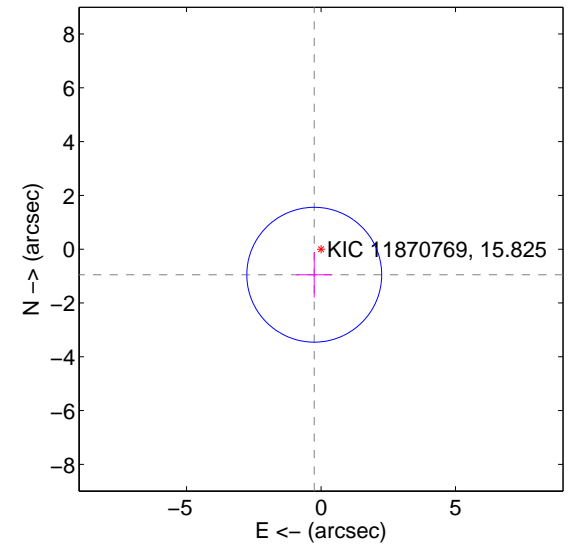
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position



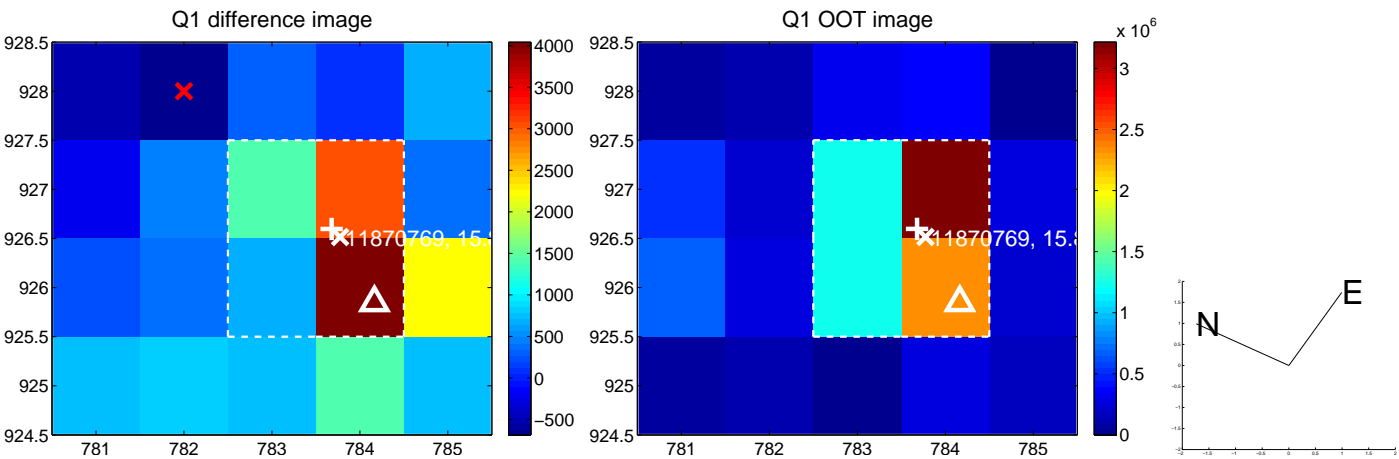
offset from photometric centroids



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



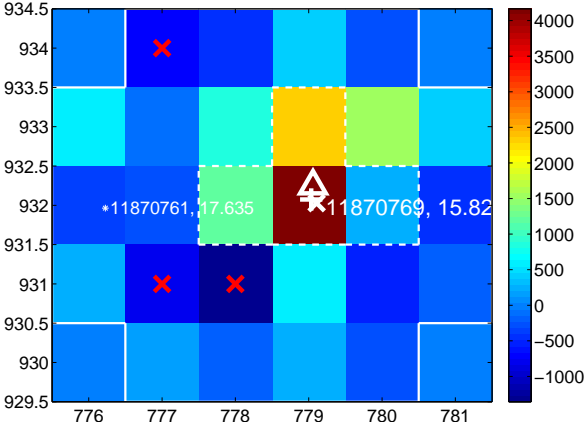
Q6 no difference image



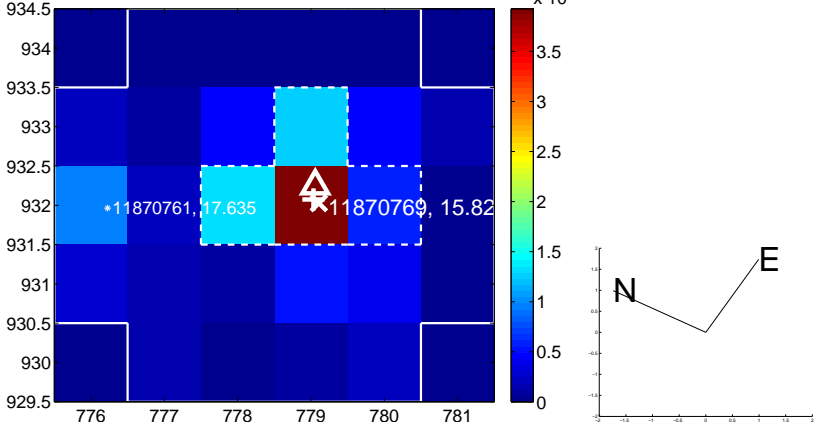
Q6 no OOT image



Q7 difference image



Q7 OOT image



Q8 no difference image



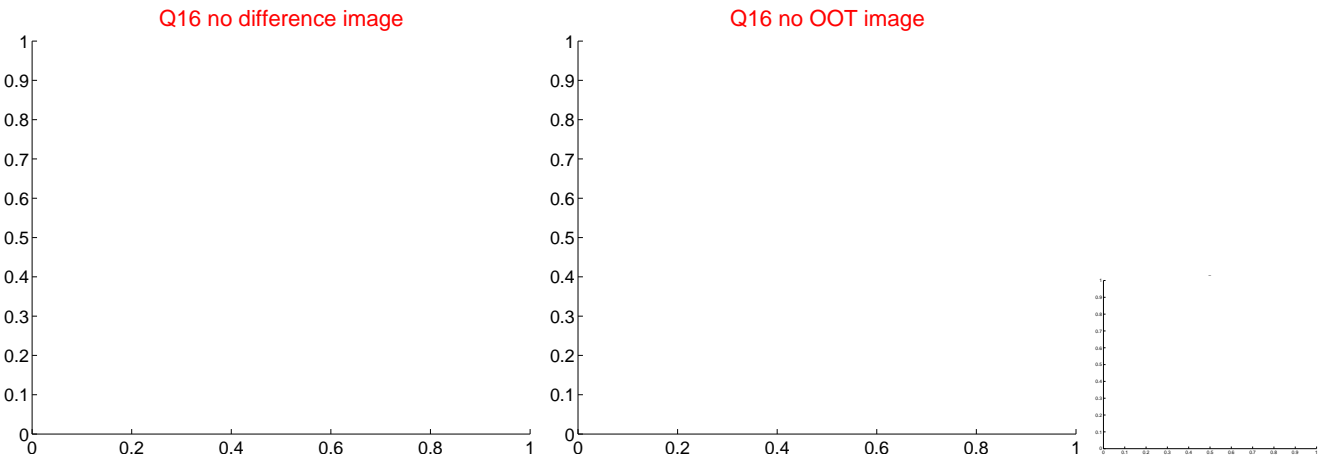
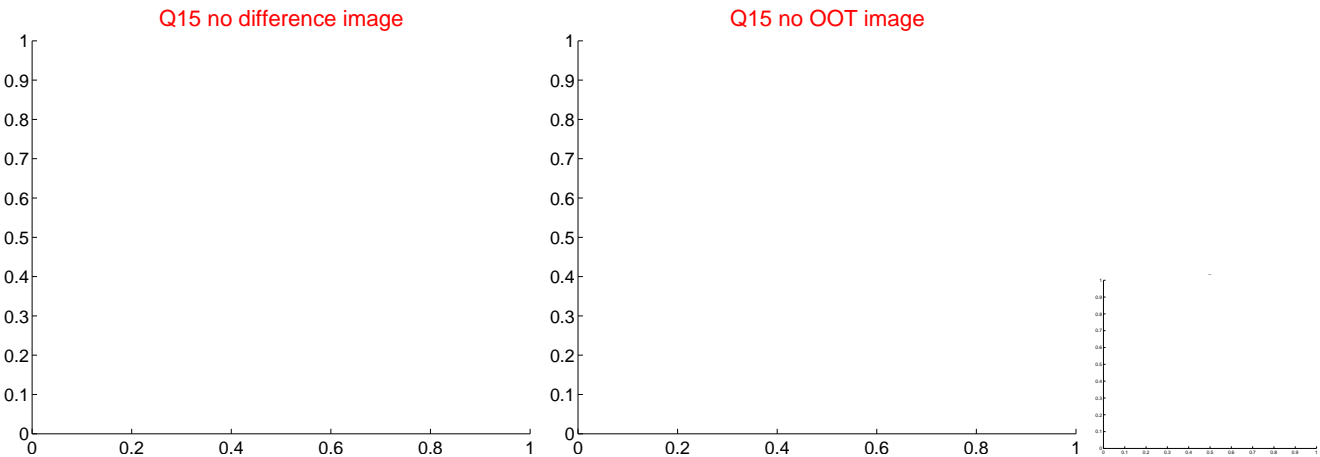
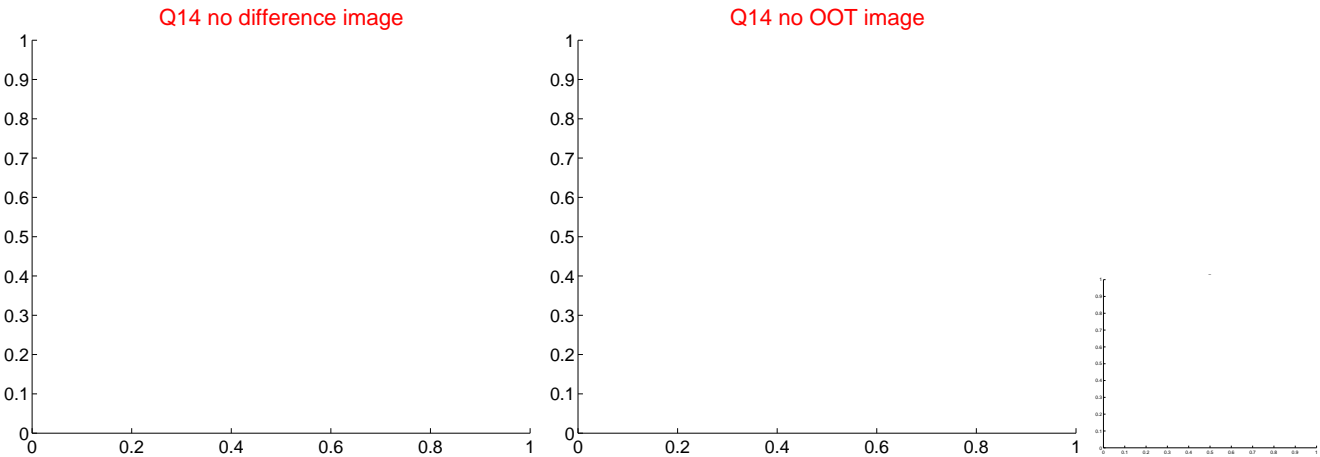
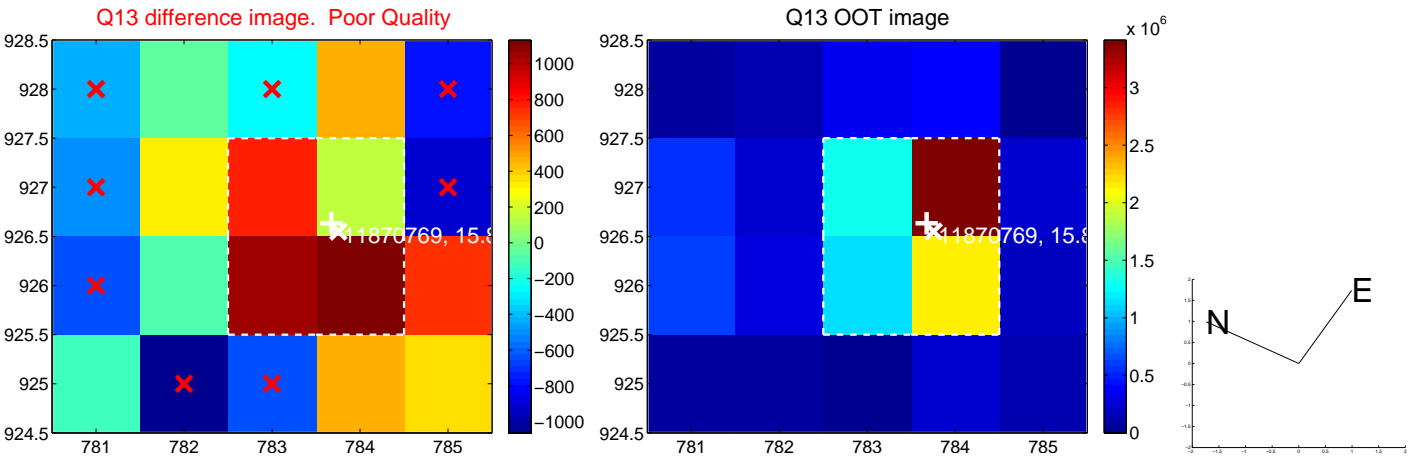
Q8 no OOT image



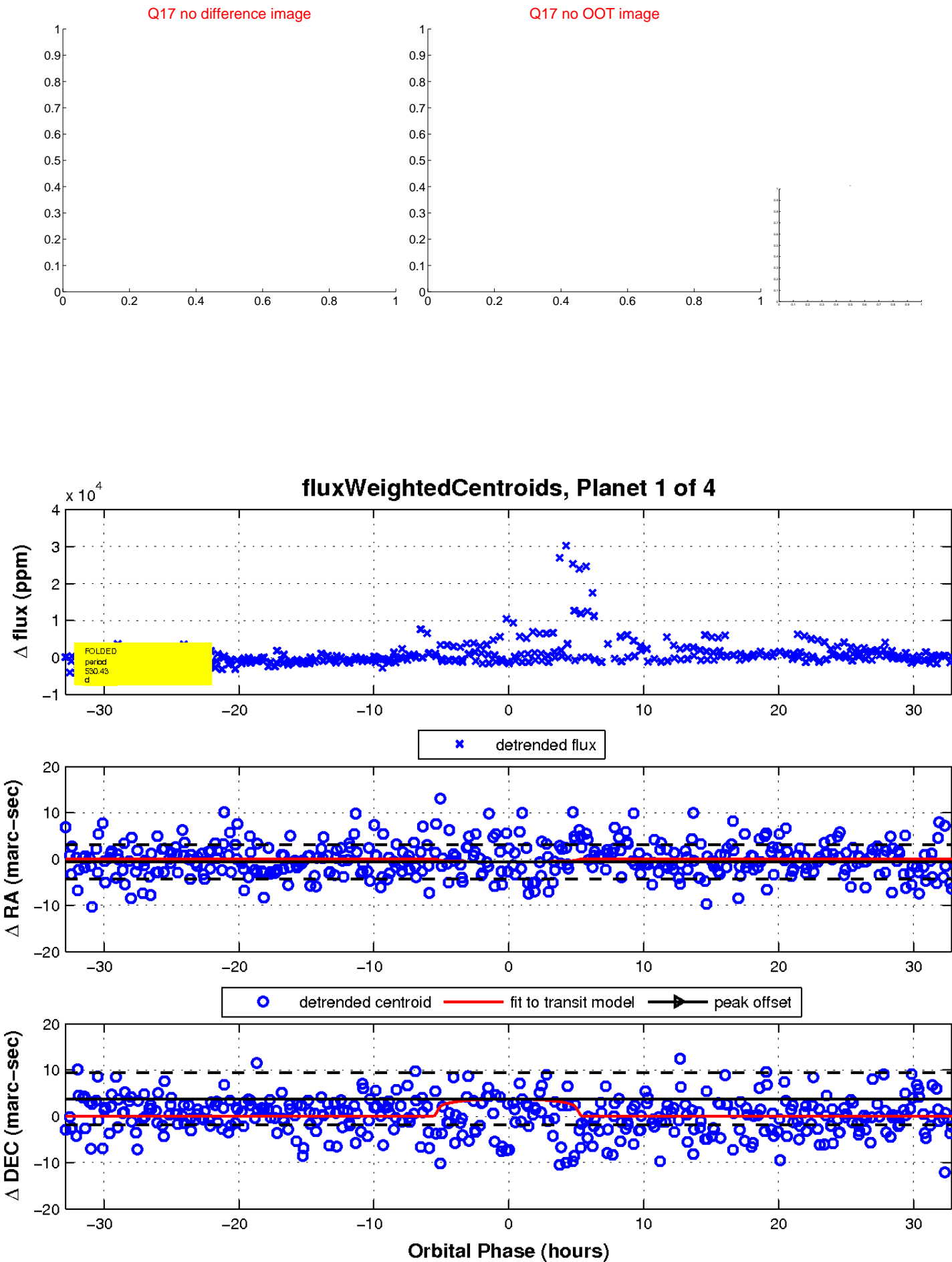
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



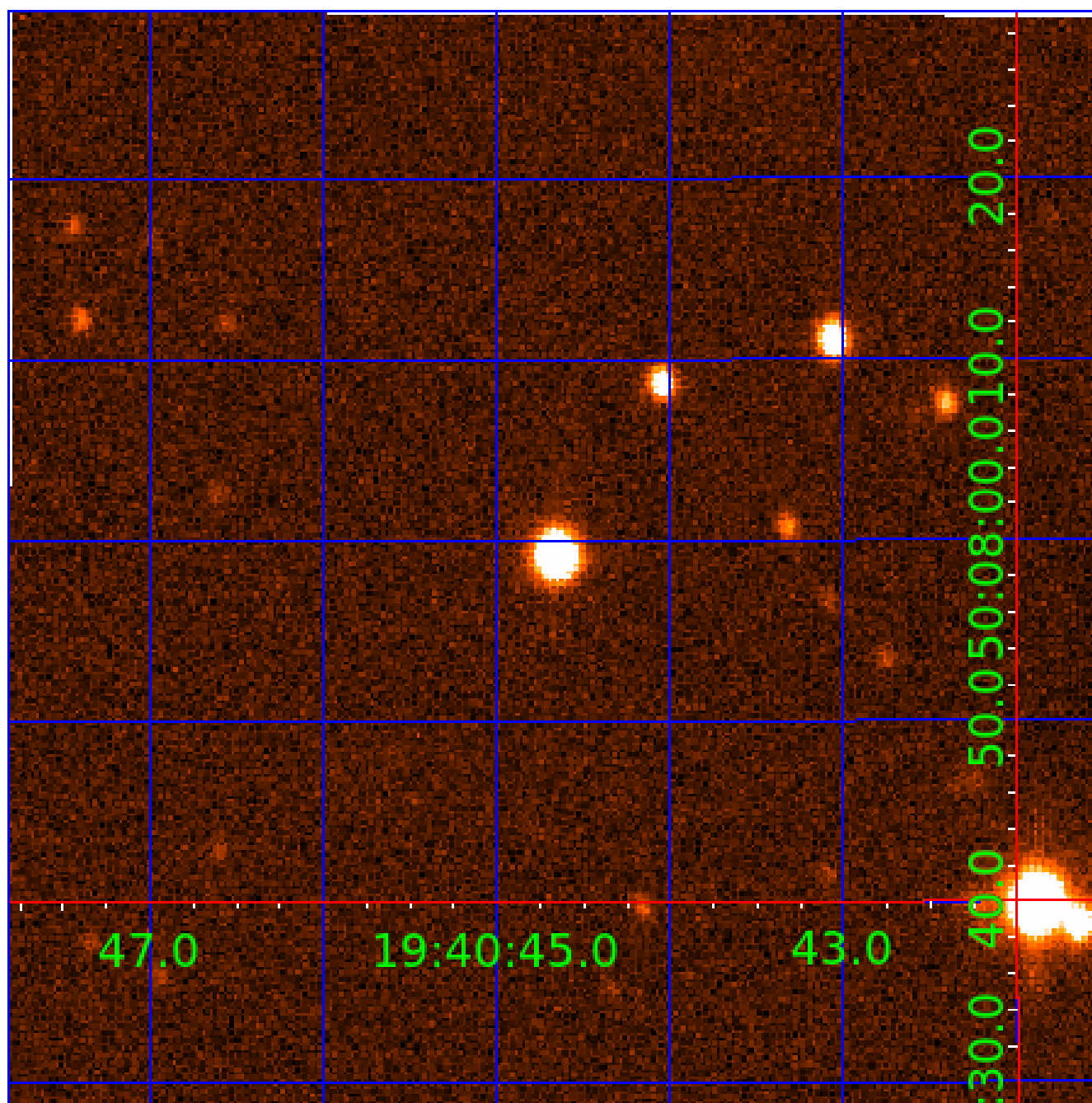
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





UKIRT Image

Declination



# KIC 011870769

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
011870769-01	OBS	No	530.431465	143.571979	2411.8	10.954	17.3	7.2	0.40	3522	1.93	0.02
011870769-02	OBS	No	381.681656	163.070370	2069.7	13.441	8.3	7.3	0.40	3522	1.79	0.04
011870769-03	OBS	No	454.735926	205.944564	2624.9	9.291	13.0	7.3	0.40	3522	2.23	0.03
011870769-04	OBS	No	598.601081	301.908347	2870.5	10.518	12.0	7.9	0.40	3522	2.11	0.02

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
011870769-01	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS—HALO_GHOST
011870769-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL—LPP_DV—INCONSISTENT_TRANS—CENT_KIC_POS
011870769-03	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_CHASES—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS—HALO_GHOST
011870769-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_SKYE—LPP_DV—MOD_NONUNIQ_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS

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

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

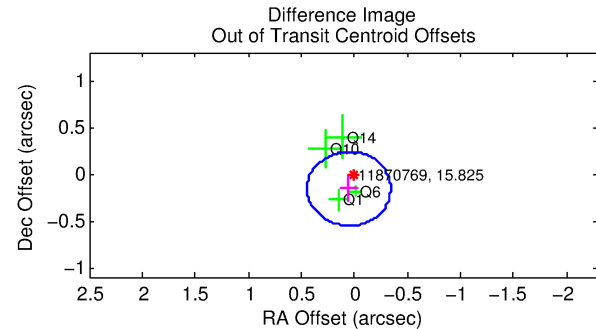
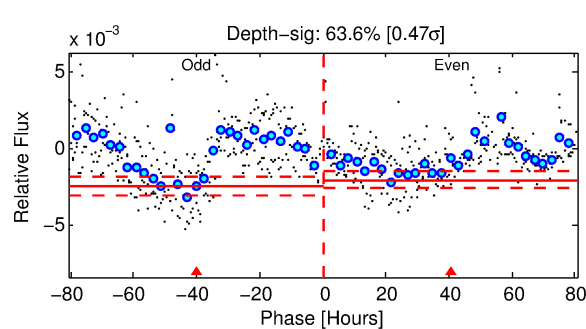
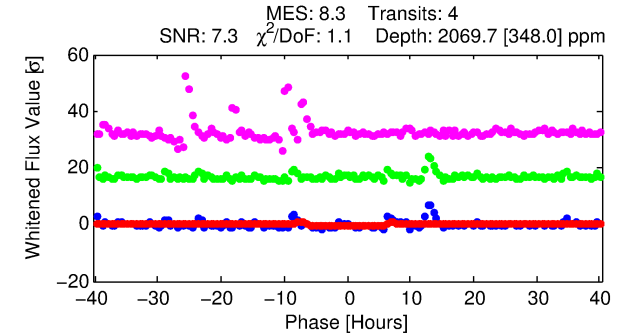
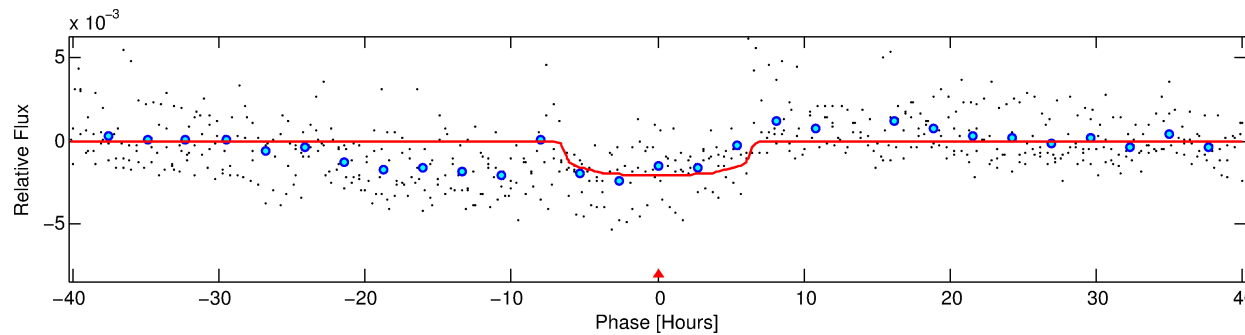
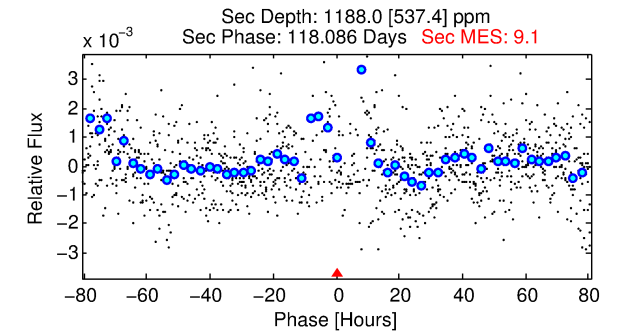
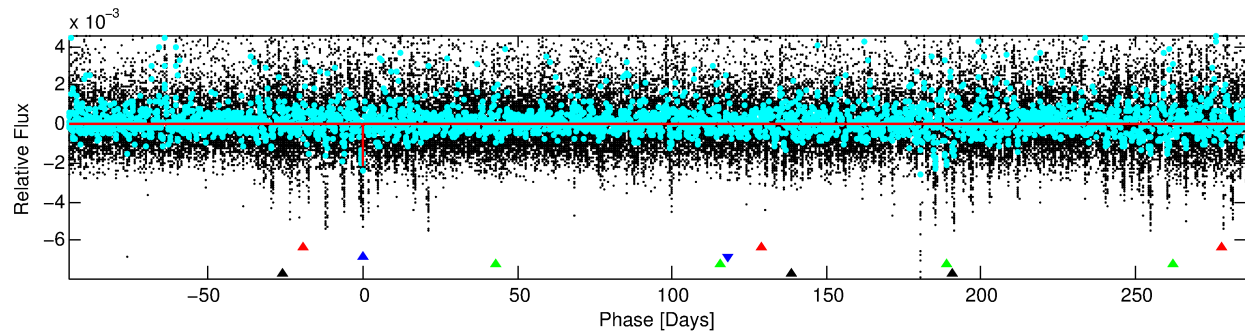
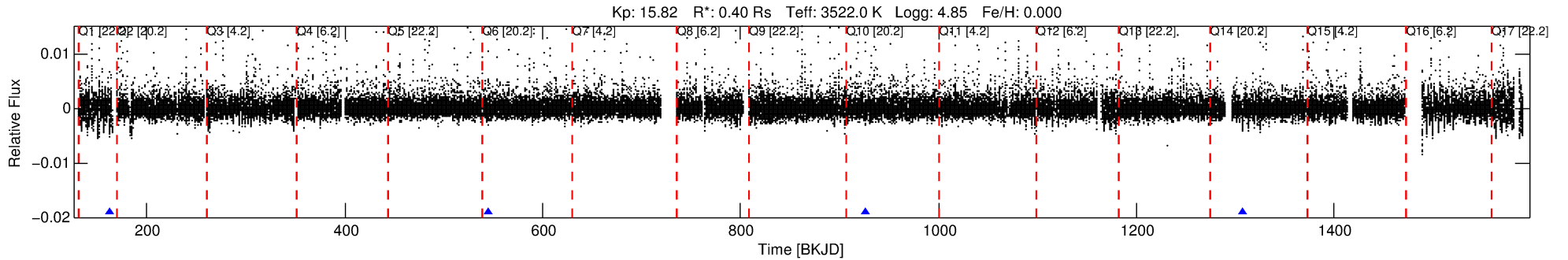
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 011870769-02

No Significant Match Found

# DV One-Page Summary

KIC: 11870769 Candidate: 2 of 4 Period: 381.682 d



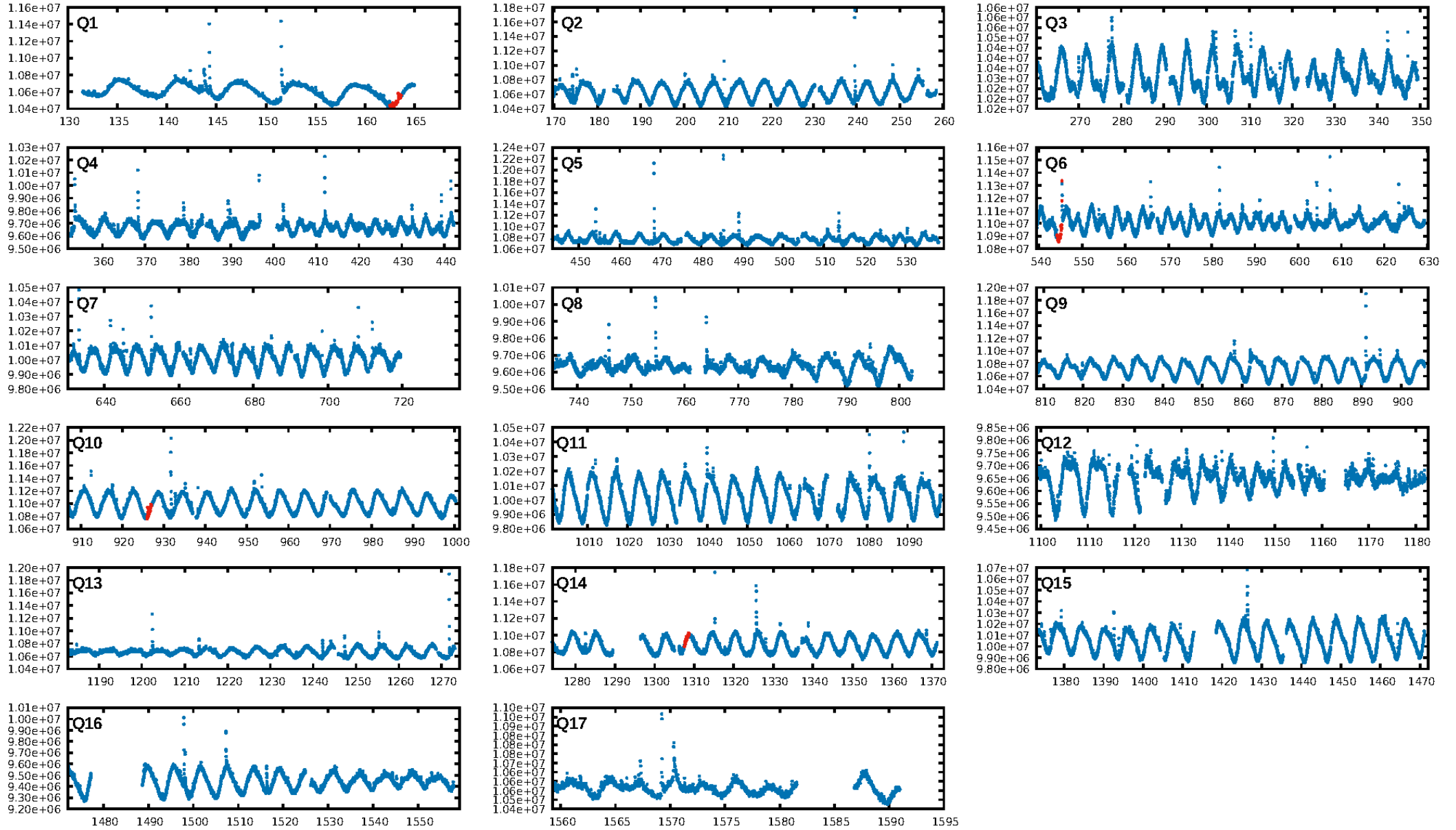
## DV Fit Results:

Period = 381.68166 [0.00798] d  
Epoch = 163.0704 [0.0156] BKJD  
Rp/R\* = 0.0410 [0.0131]  
a/R\* = 225.81 [281.97]  
b = 0.02 [65.96]  
Seff = 0.04 [0.01]  
Teq = 112 [4] K  
Rp = 1.79 [0.61] Re  
a = 0.7660 [0.0645] AU  
Ag = 119436.84 [94269.74] [1.27σ]  
**Teffp = 3227 [634] K [4.91σ]**

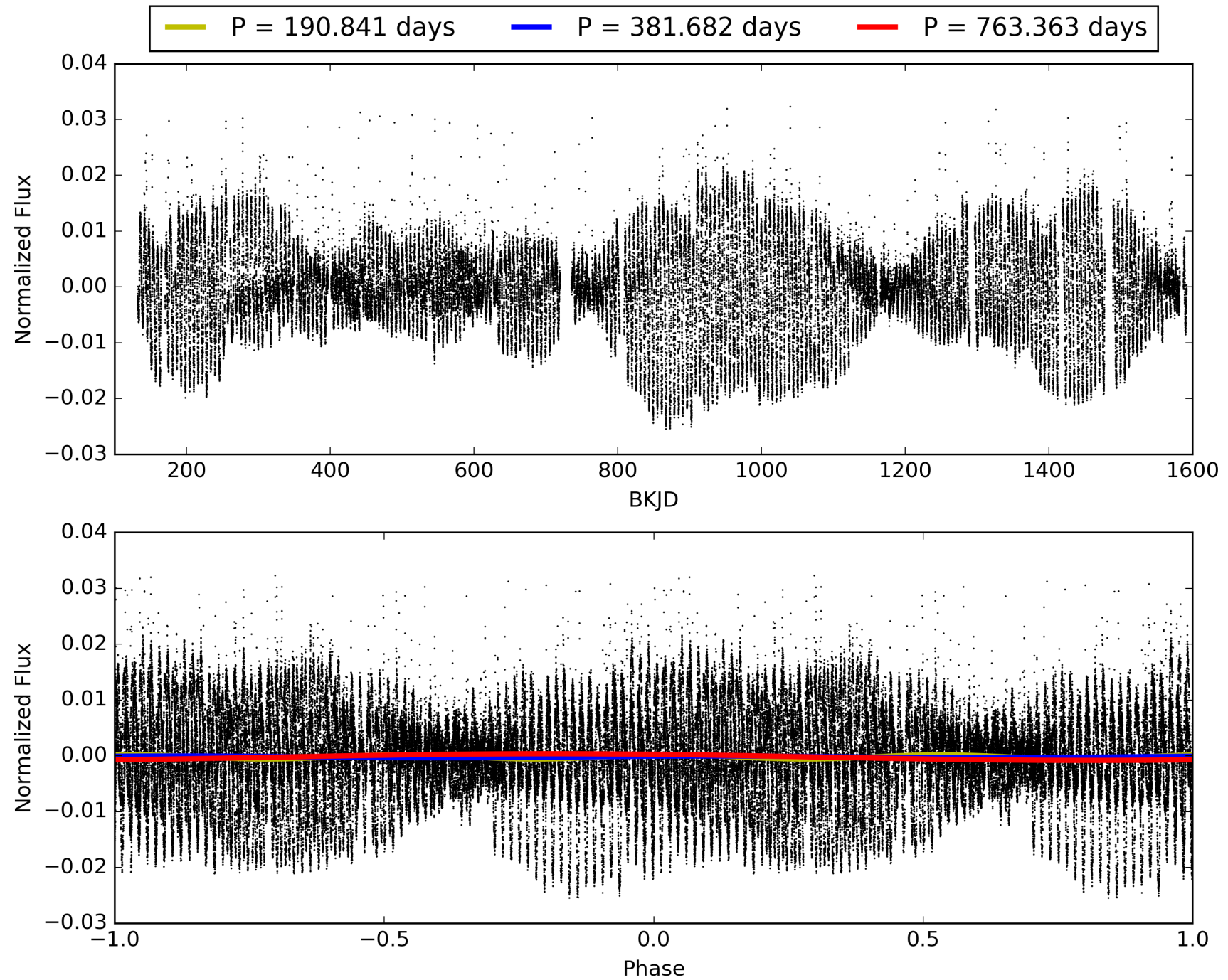
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [107.30σ]  
ModelChiSquare2-sig: 10.8%  
ModelChiSquareGof-sig: 99.9%  
**Bootstrap-pfa: 8.61e-08**  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: 2.341  
Centroid-sig: 7.0%  
Centroid-so: 1.521 arcsec [2.02σ]  
OotOffset-rm: 0.165 arcsec [1.26σ]  
KicOffset-rm: 0.268 arcsec [1.52σ]  
OotOffset-st: 3/0/0/1 [4]  
KicOffset-st: 3/0/0/1 [4]  
DiffImageQuality-fgm: 0.75 [3/4]  
DiffImageOverlap-fno: 1.00 [4/4]

# TCE 011870769-02, PDC Light Curves

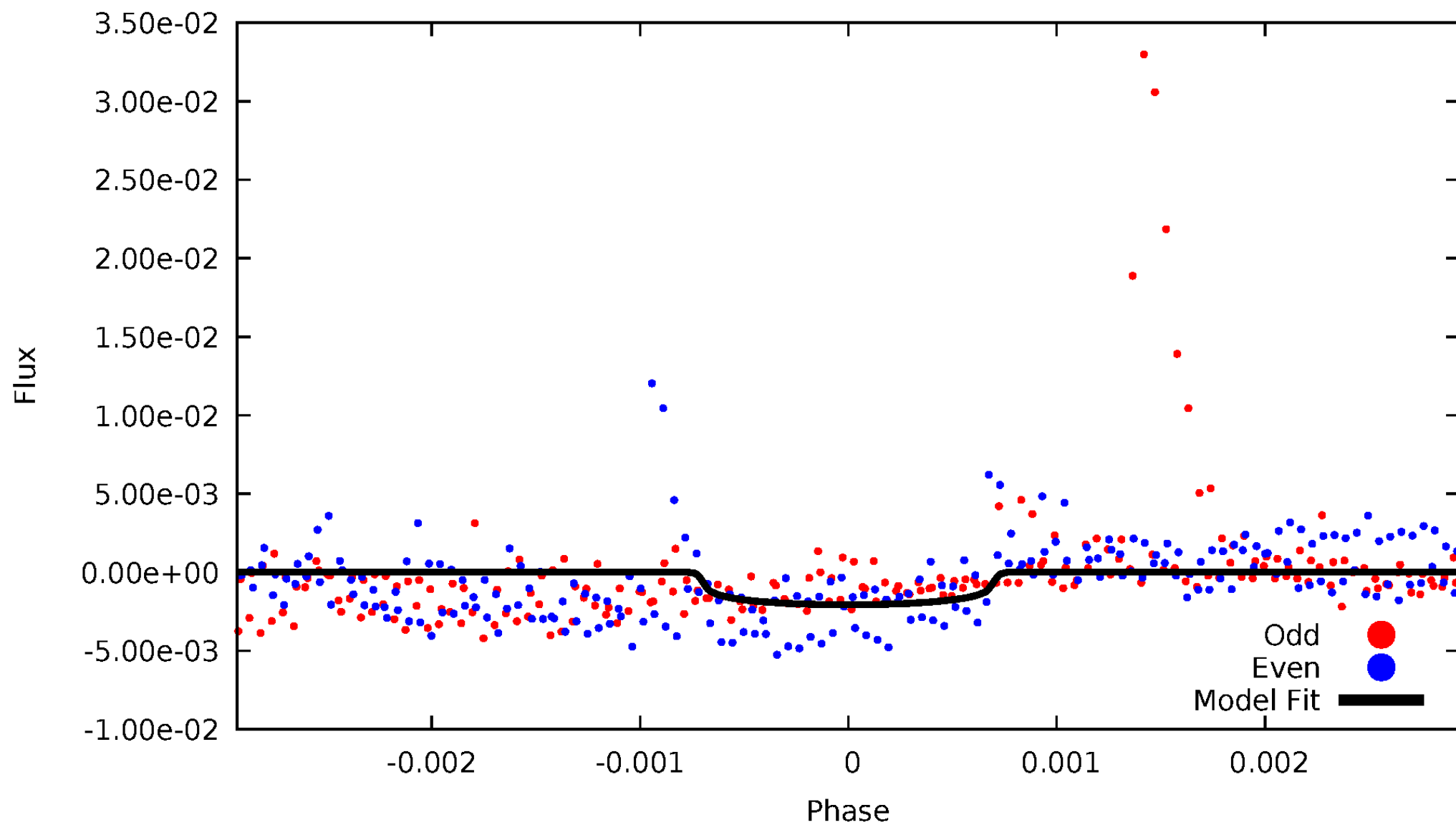


# TCE 011870769-02



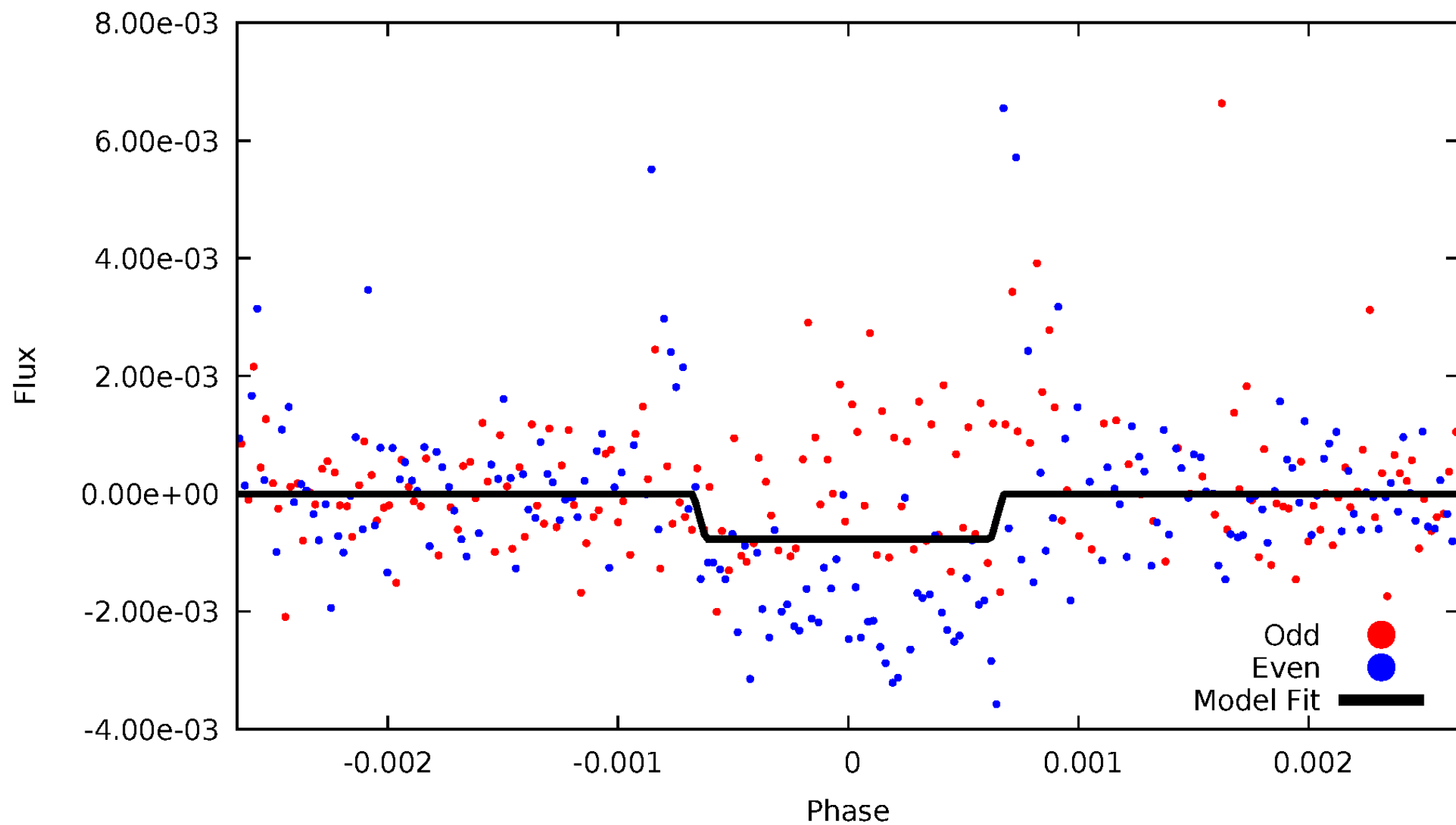
# DV Odd/Even

TCE 011870769-02



# ALT Odd/Even

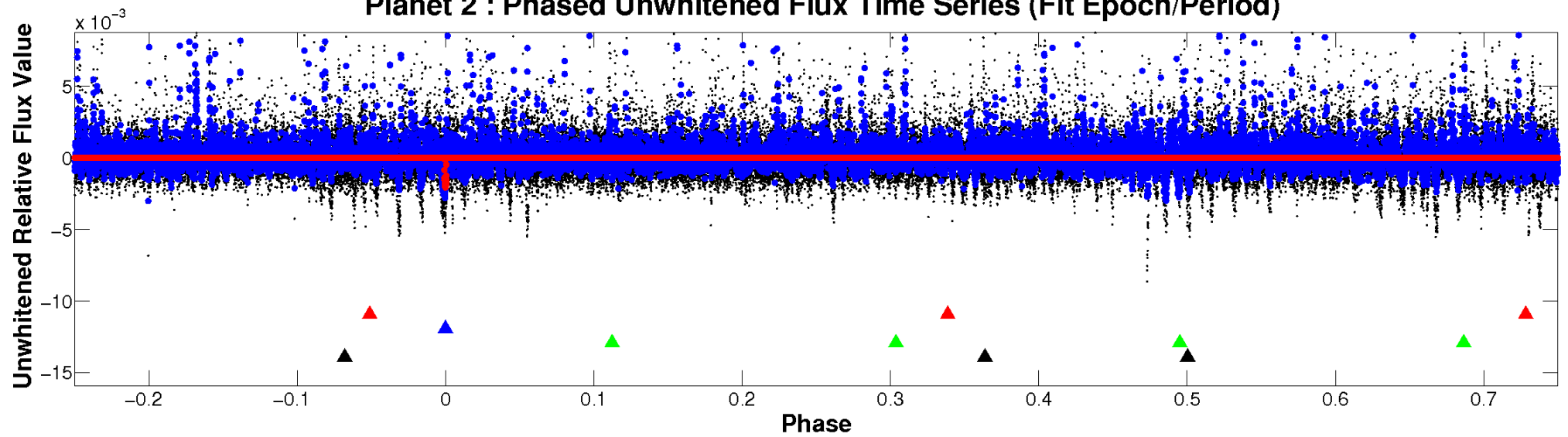
TCE 011870769-02



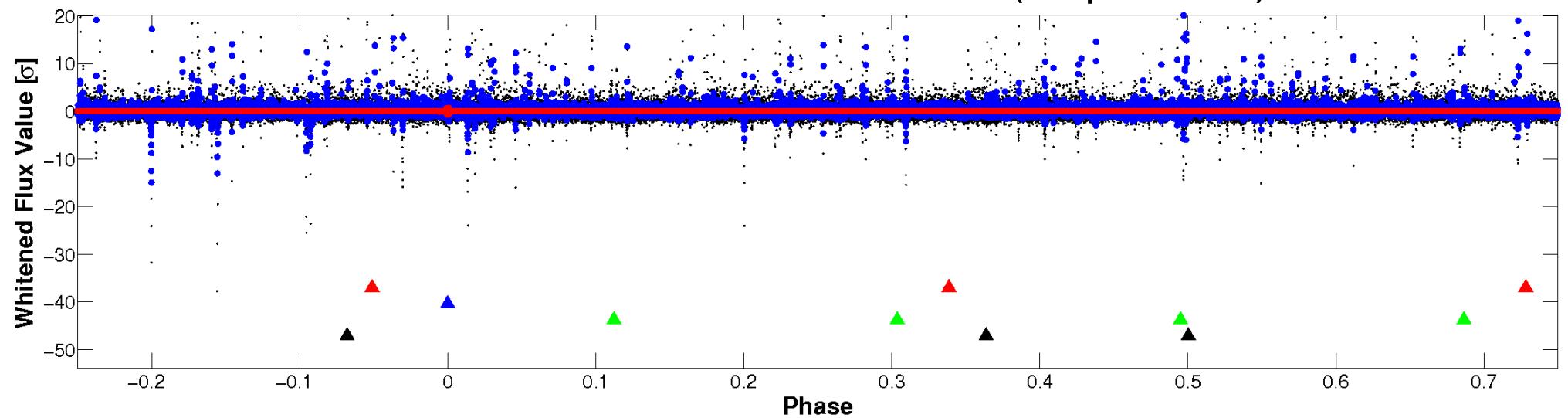


# Non-Whitened Vs. Whitened Light Curve

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



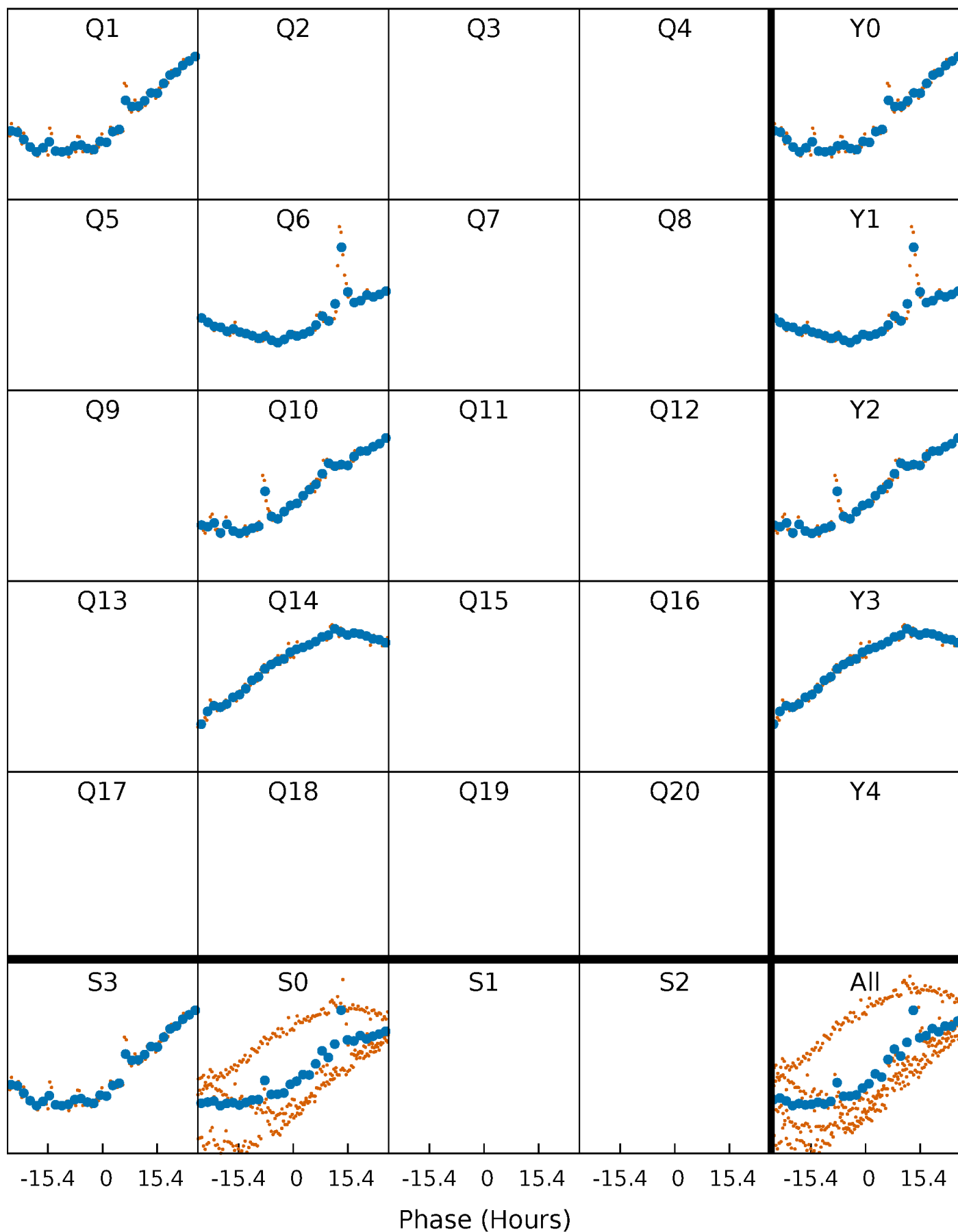
## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)





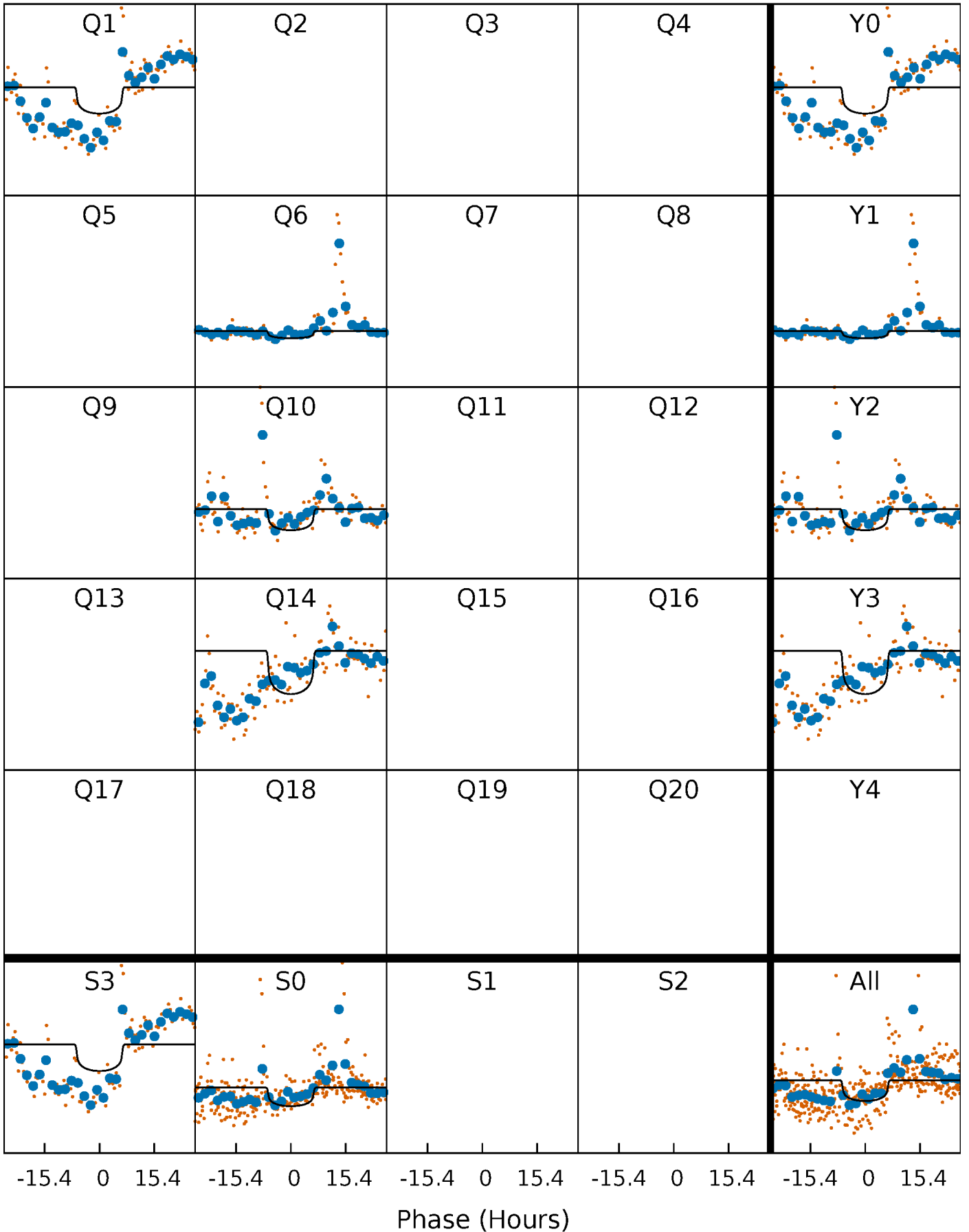
# PDC Quarter-Phased Transit Curves

TCE 011870769-02 P=381.681656 Days  $T_0=163.070370$  (BKJD)



# DV Quarter-Phased Transit Curves

TCE 011870769-02 P=381.681656 Days  $T_0=163.070370$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

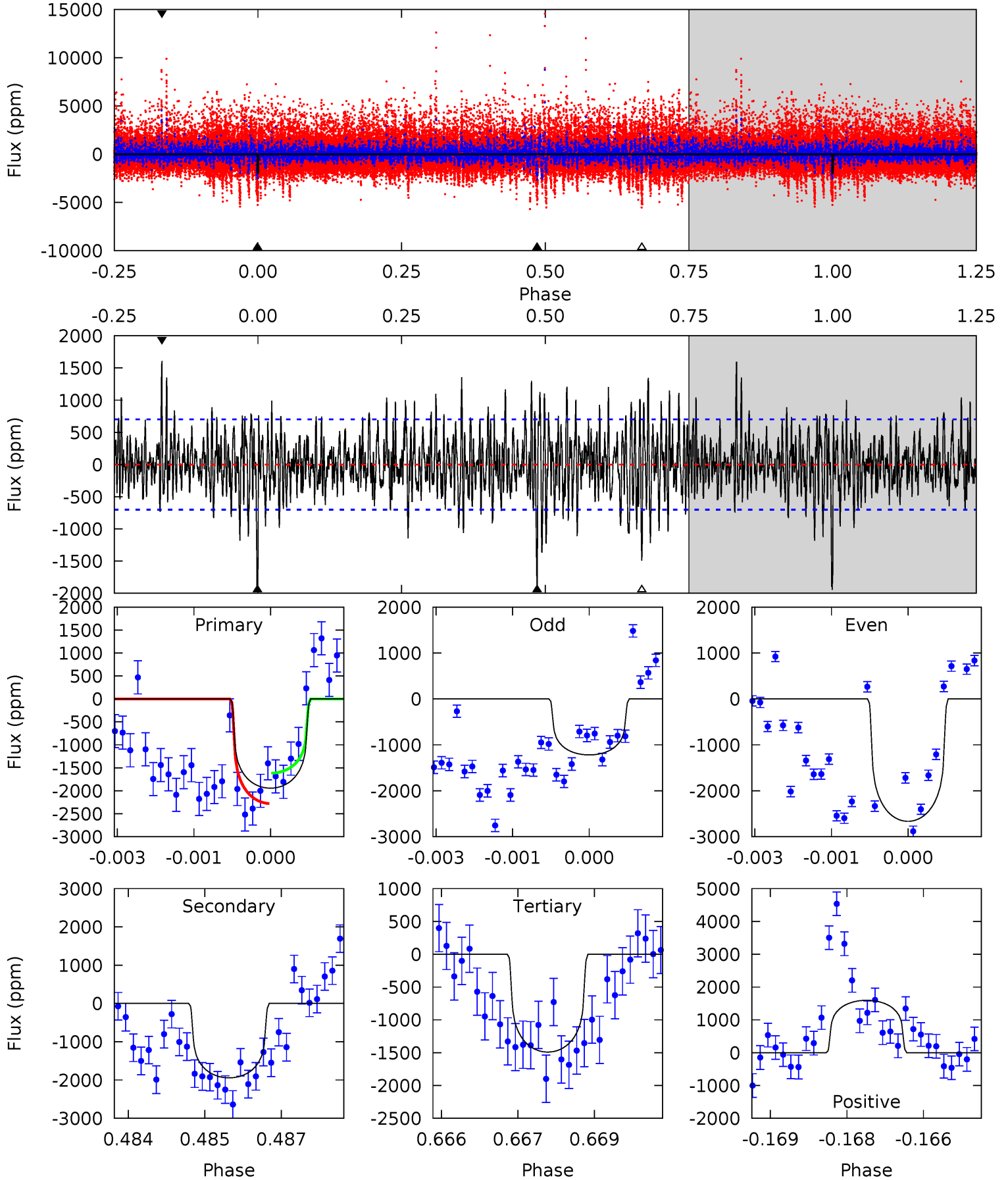
TCE 011870769-02     $P=381.685278$  Days     $T_0=163.070522$  (BKJD)



# DV Model-Shift Uniqueness Test

011870769-02, P = 381.681656 Days, E = 163.070370 Days

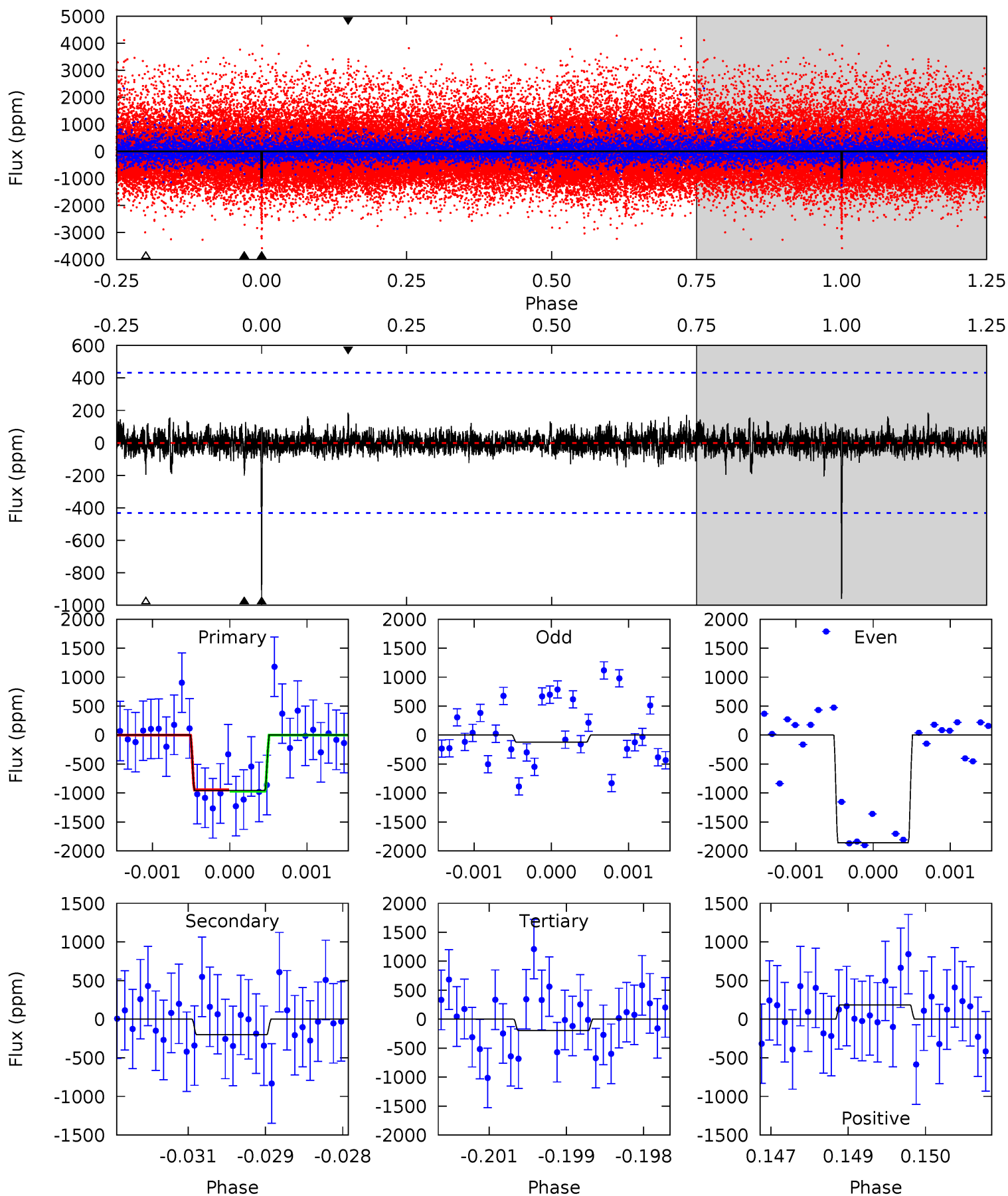
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
14.9	14.9	11.4	12.3	5.38	3.18	3.19	3.48	2.67	3.48	2.67	4.26	1.48	0.45	2.55



# Alt Model-Shift Uniqueness Test

011870769-02, P = 381.685278 Days, E = 163.070522 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
12.0	2.51	2.46	2.32	5.40	3.21	0.50	9.53	9.66	0.06	0.19	10.7	0.79	0.16	0.14



### Stellar Parameters For KIC 011870769

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$3522^{+63}_{-71}$	$4.848^{+0.050}_{-0.036}$	$0.000^{+0.100}_{-0.100}$	$0.400^{+0.040}_{-0.045}$	$0.411^{+0.043}_{-0.053}$	$9.054^{+2.575}_{-1.552}$
	+2%/-2%	+1%/-1%	+inf%/-inf%	+10%/-11%	+10%/-13%	+28%/-17%
Source	PHO2	PHO2	PHO2	DSEP		

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

### Secondary Eclipse Parameters for KIC 011870769-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-1943 \pm 130$	$1.78^{+0.58}_{-0.49}$	$156^{+4}_{-4}$	$3595^{+424}_{-296}$	$194509^{+187506}_{-80104}$
Alt.	$-201 \pm 80$	$1.18^{+0.59}_{-0.56}$	$156^{+4}_{-4}$	$2877^{+643}_{-314}$	$45140^{+125103}_{-27256}$

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

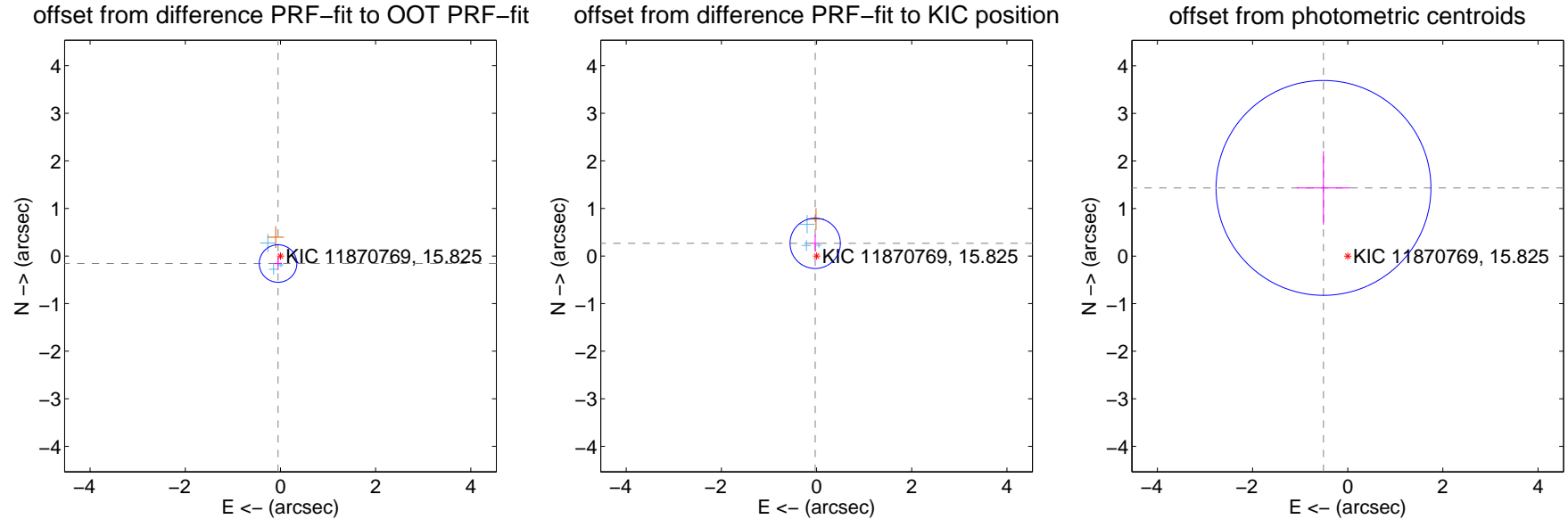
## DV Centroid Data

Supplemental centroid analysis for 011870769-02. Kepler magnitude: 15.82. Transit SNR 7.27

There are 3 quarters with good PRF difference image offsets

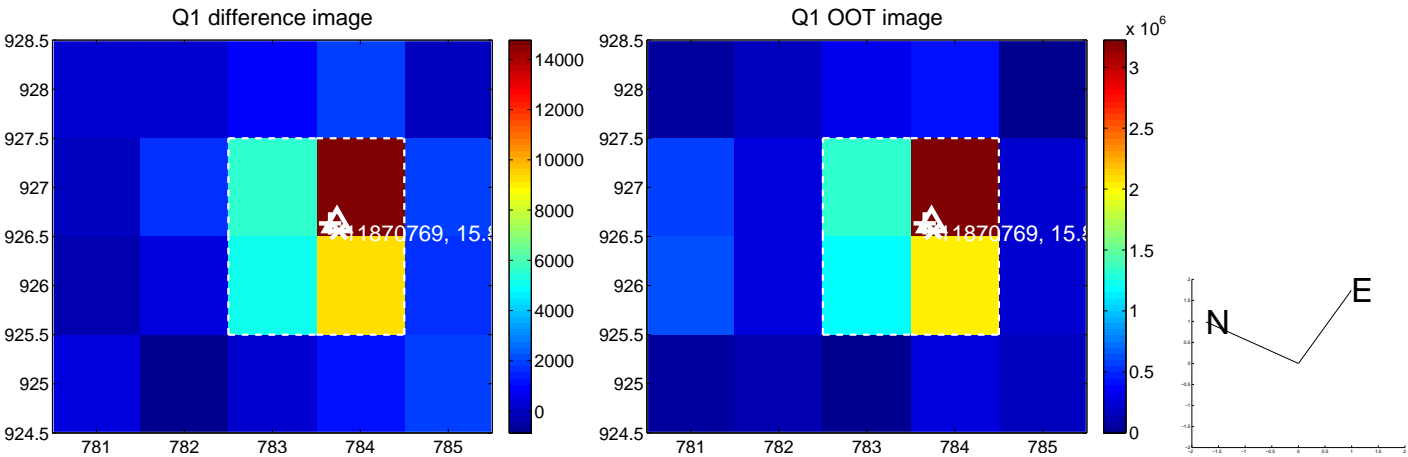
The direct PRF centroid is offset from the target star catalog position by about 0.39 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.165 \pm 0.132$	1.26	$0.050 \pm 0.079$	$-0.158 \pm 0.138$
PRF-fit source offset from KIC position	$0.268 \pm 0.176$	1.52	$0.029 \pm 0.077$	$0.267 \pm 0.177$
photometric centroid source offset	$1.52 \pm 0.75$	2.02	$0.51 \pm 0.56$	$1.43 \pm 0.77$



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.

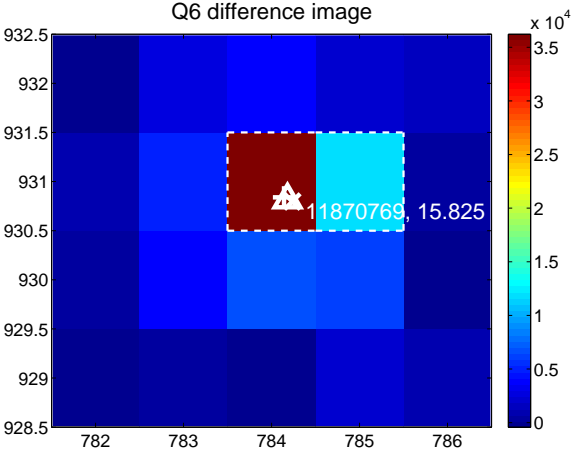
Q5 no difference image



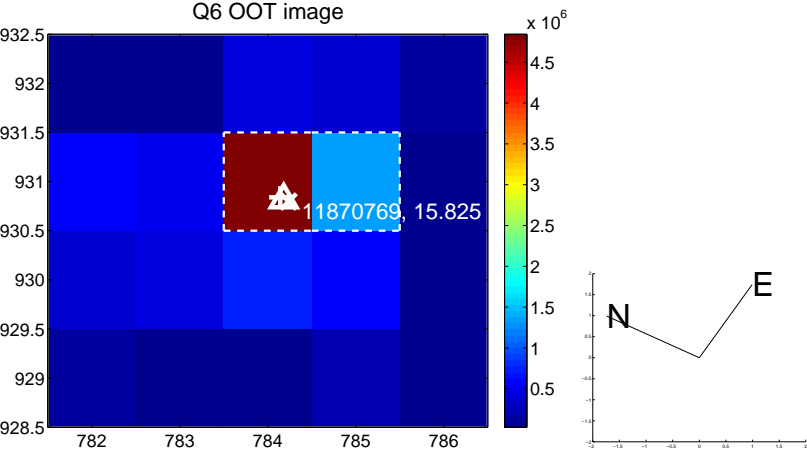
Q5 no OOT image



Q6 difference image



Q6 OOT image



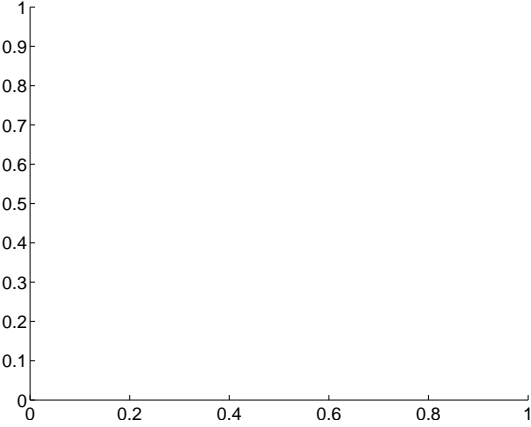
Q7 no difference image



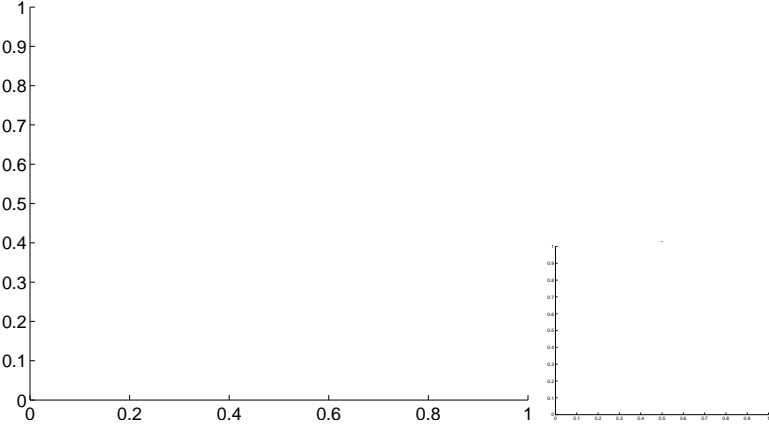
Q7 no OOT image



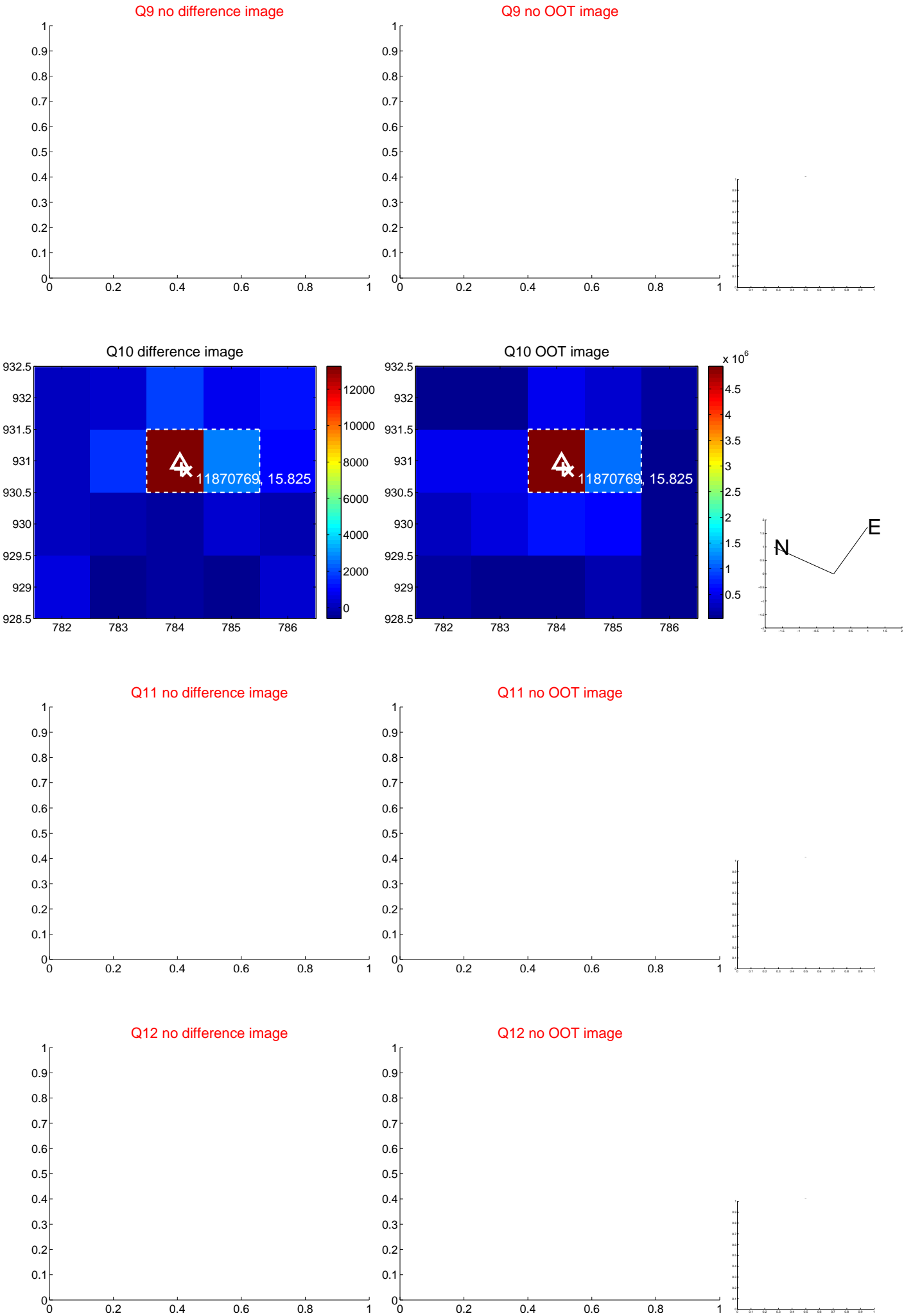
Q8 no difference image



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.

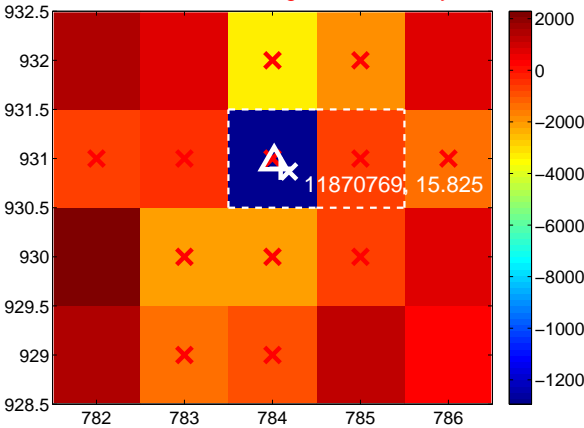
Q13 no difference image



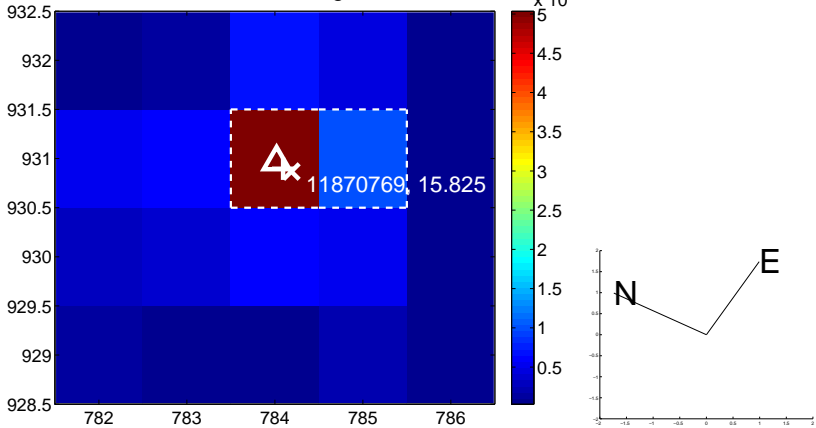
Q13 no OOT image



Q14 difference image. Poor Quality



Q14 OOT image



Q15 no difference image



Q15 no OOT image



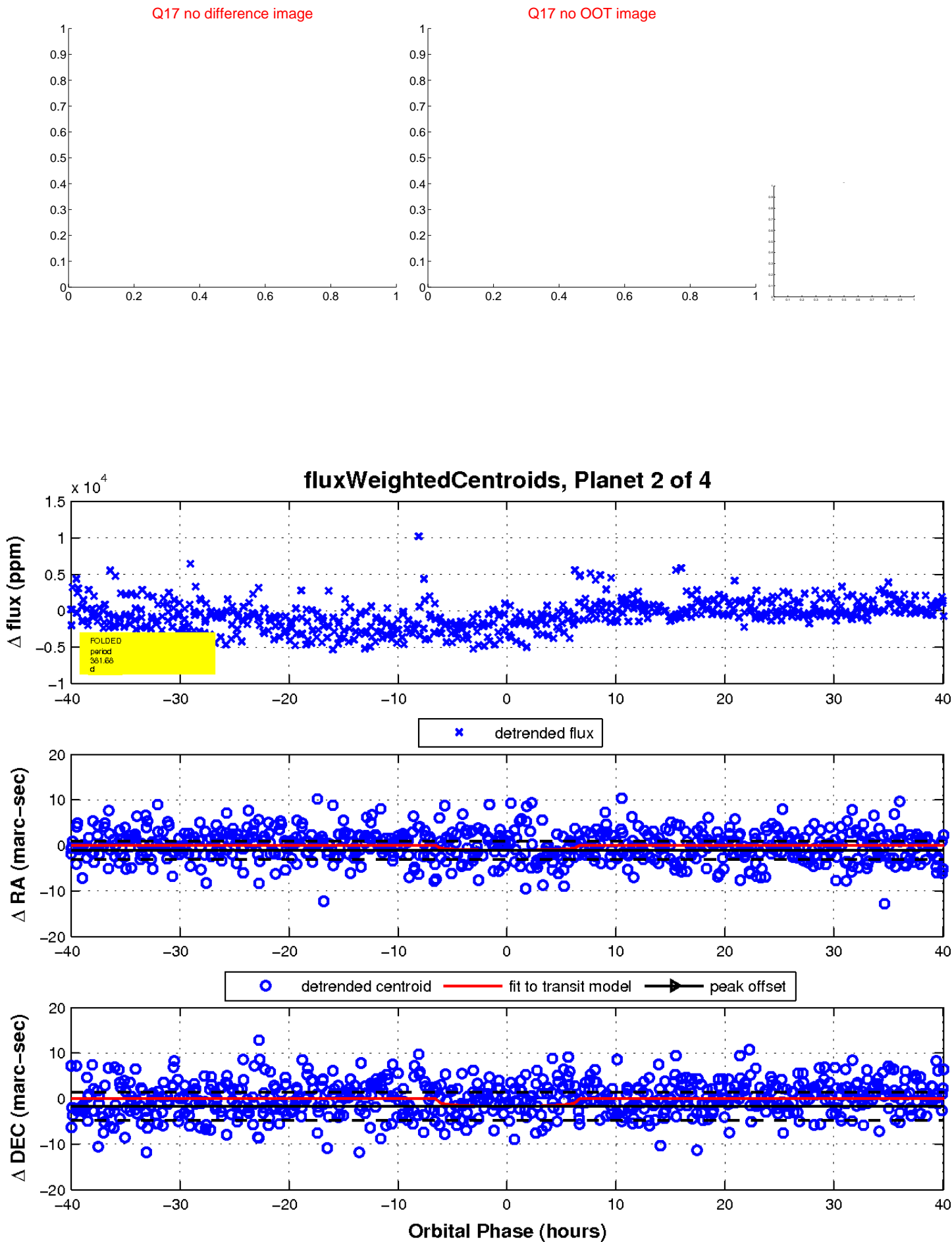
Q16 no difference image



Q16 no OOT image

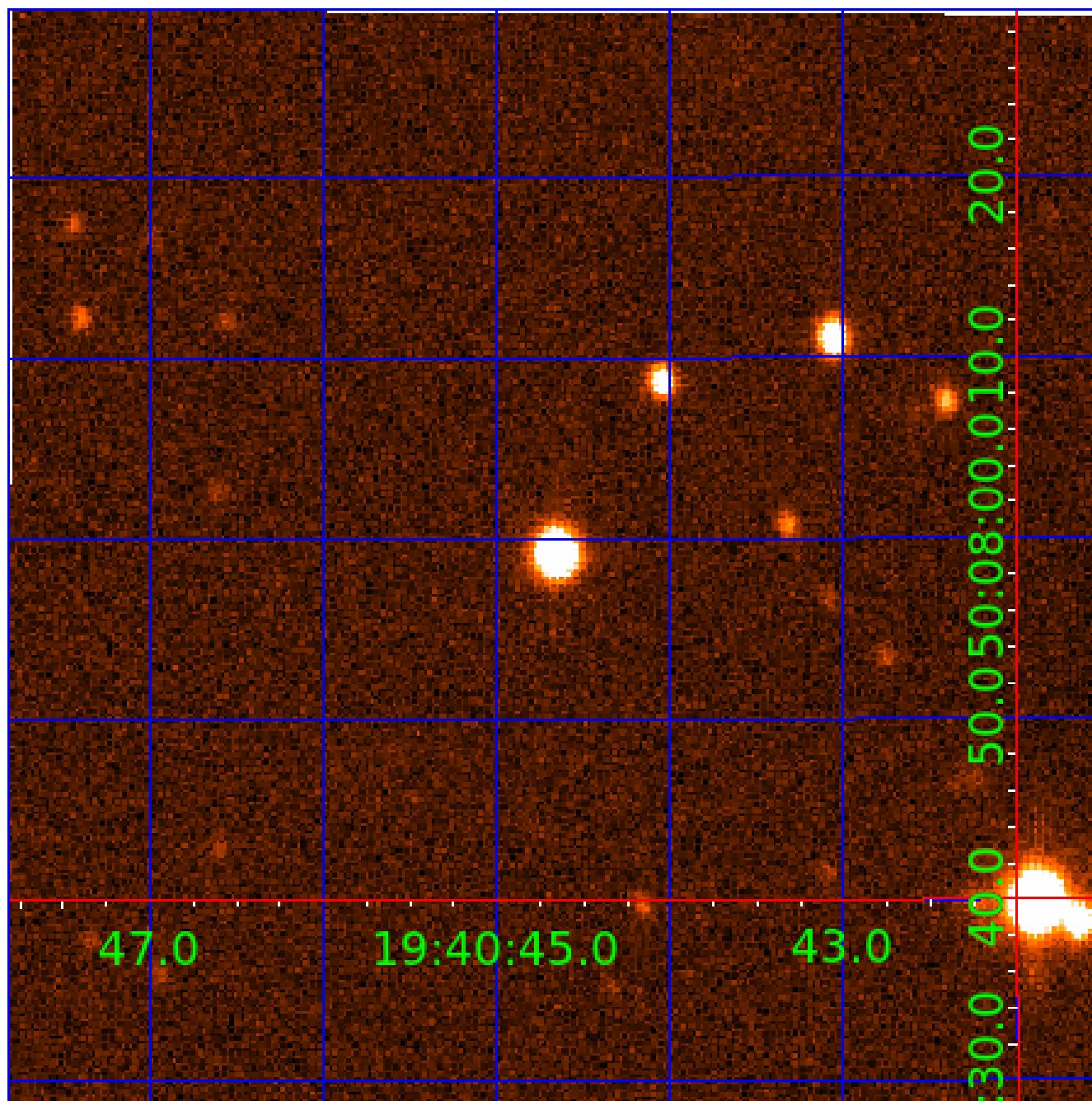


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 011870769

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
011870769-01	OBS	No	530.431465	143.571979	2411.8	10.954	17.3	7.2	0.40	3522	1.93	0.02
011870769-02	OBS	No	381.681656	163.070370	2069.7	13.441	8.3	7.3	0.40	3522	1.79	0.04
011870769-03	OBS	No	454.735926	205.944564	2624.9	9.291	13.0	7.3	0.40	3522	2.23	0.03
011870769-04	OBS	No	598.601081	301.908347	2870.5	10.518	12.0	7.9	0.40	3522	2.11	0.02

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
011870769-01	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS—HALO_GHOST
011870769-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL—LPP_DV—INCONSISTENT_TRANS—CENT_KIC_POS
011870769-03	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_CHASES—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS—HALO_GHOST
011870769-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_SKYE—LPP_DV—MOD_NONUNIQ_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS

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

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

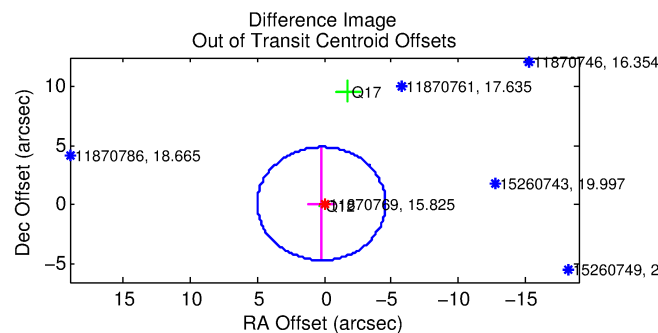
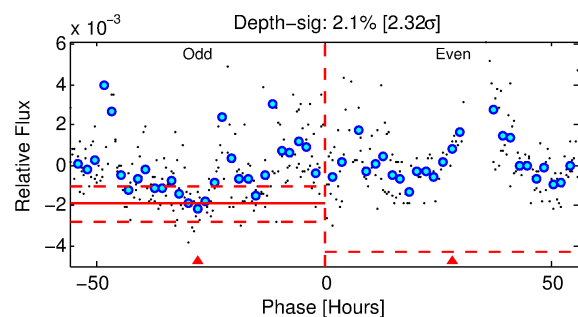
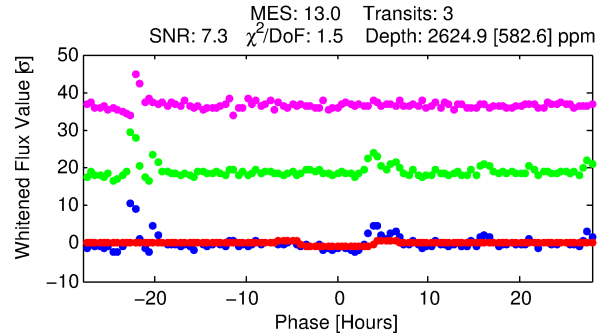
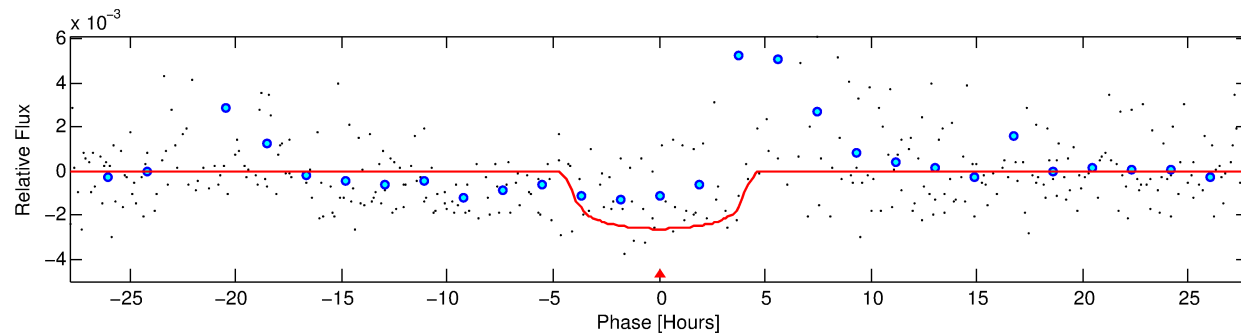
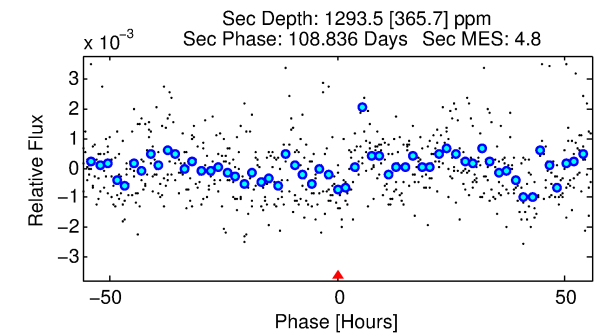
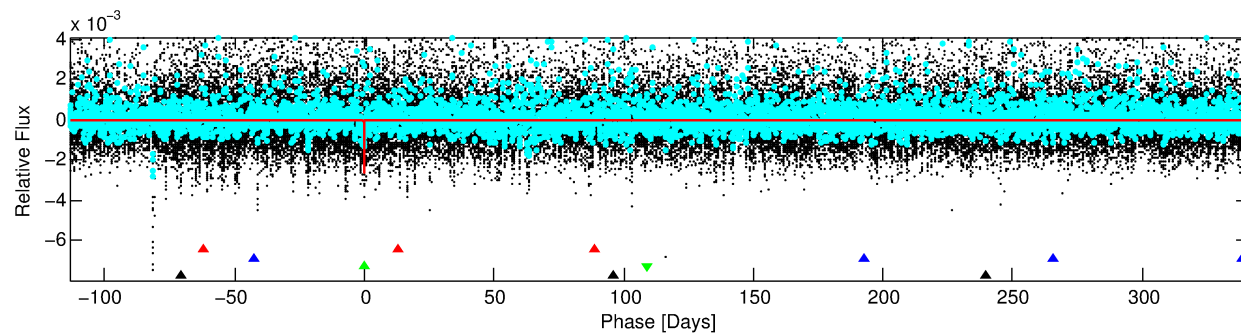
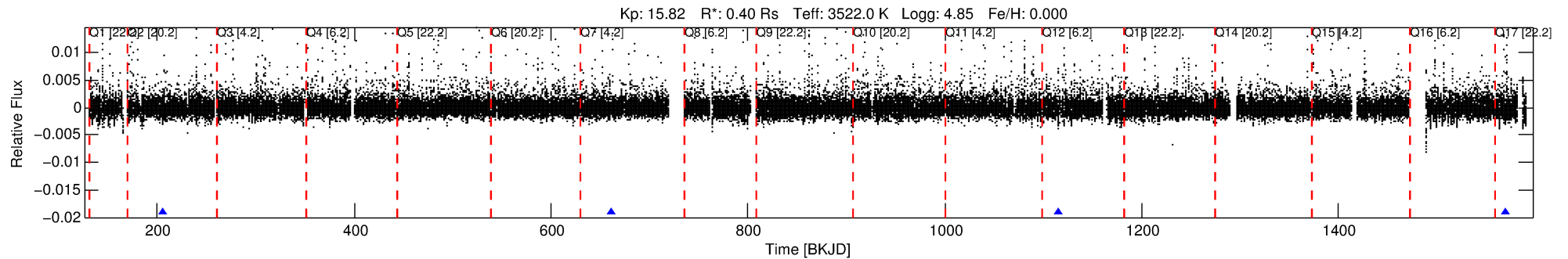
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 011870769-03

No Significant Match Found

# DV One-Page Summary

KIC: 11870769 Candidate: 3 of 4 Period: 454.736 d



DV Fit Results:

Period = 454.73593 [0.00922] d  
Epoch = 205.9446 [0.0200] BKJD  
Rp/R\* = 0.0512 [0.0111]  
a/R\* = 270.98 [186.13]  
b = 0.76 [0.38]  
Seff = 0.03 [0.00]  
Teq = 106 [4] K  
Rp = 2.23 [0.55] Re  
a = 0.8608 [0.0725] AU  
Ag = 105748.54 [55905.20] [1.89σ]  
Teff = 2953 [387] K [7.36σ]

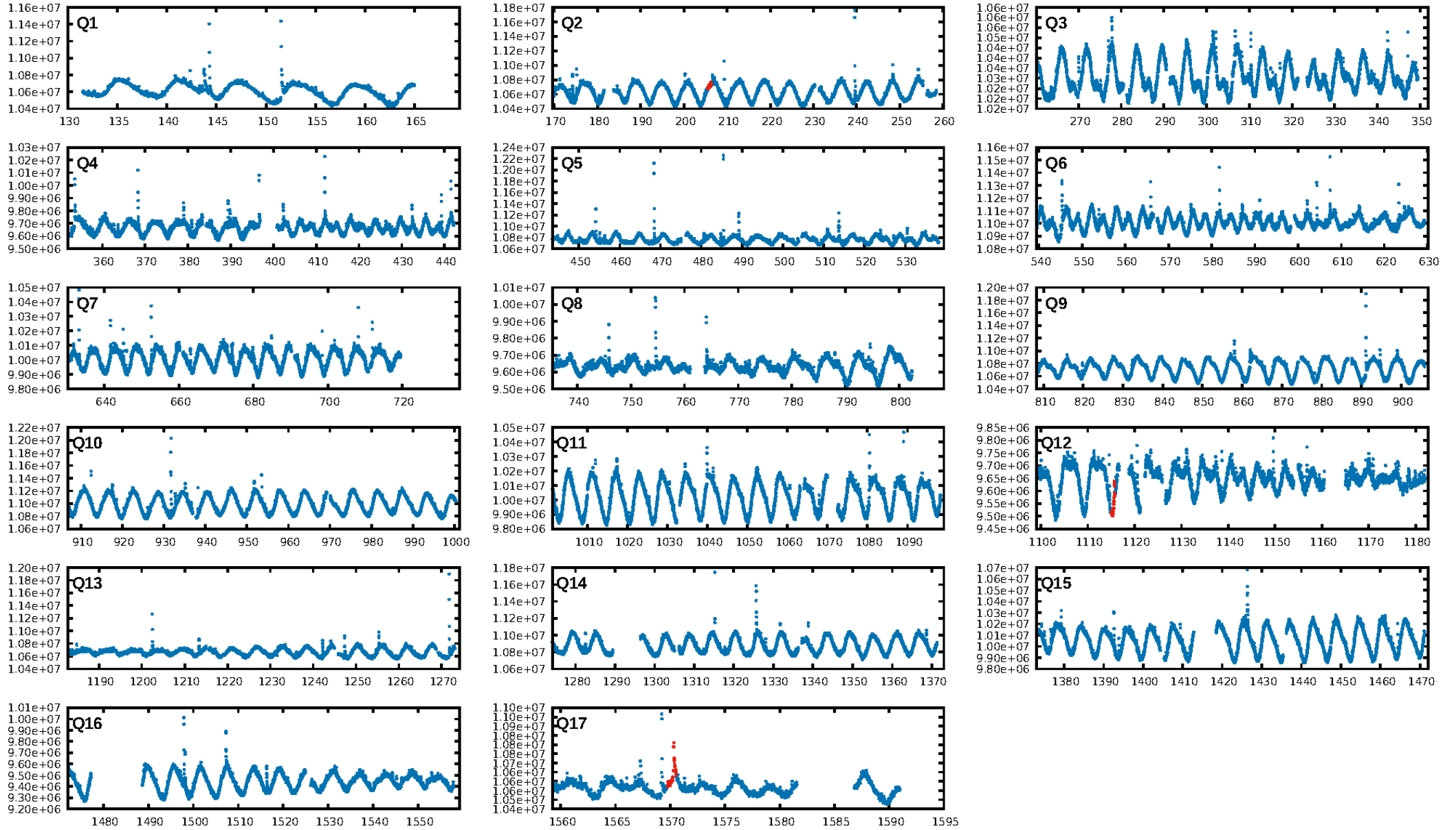
DV Diagnostic Results:

ShortPeriod-sig: 100.0% [107.30σ]  
LongPeriod-sig: 100.0% [126.47σ]  
ModelChiSquare2-sig: 0.7%  
ModelChiSquareGof-sig: 88.0%  
Bootstrap-pfa: 1.81e-14  
RollingBand-fgt: 1.00 [2/2]  
**GhostDiagnostic-chr: -0.165**  
Centroid-sig: 3.1%  
Centroid-so: 1.066 arcsec [1.42σ]  
OotOffset-rm: 0.239 arcsec [0.15σ]  
KicOffset-rm: 0.564 arcsec [0.15σ]  
OotOffset-st: 0/0/1/1 [2]  
KicOffset-st: 0/0/1/1 [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: 29-Jan-2016 21:19:29 Z

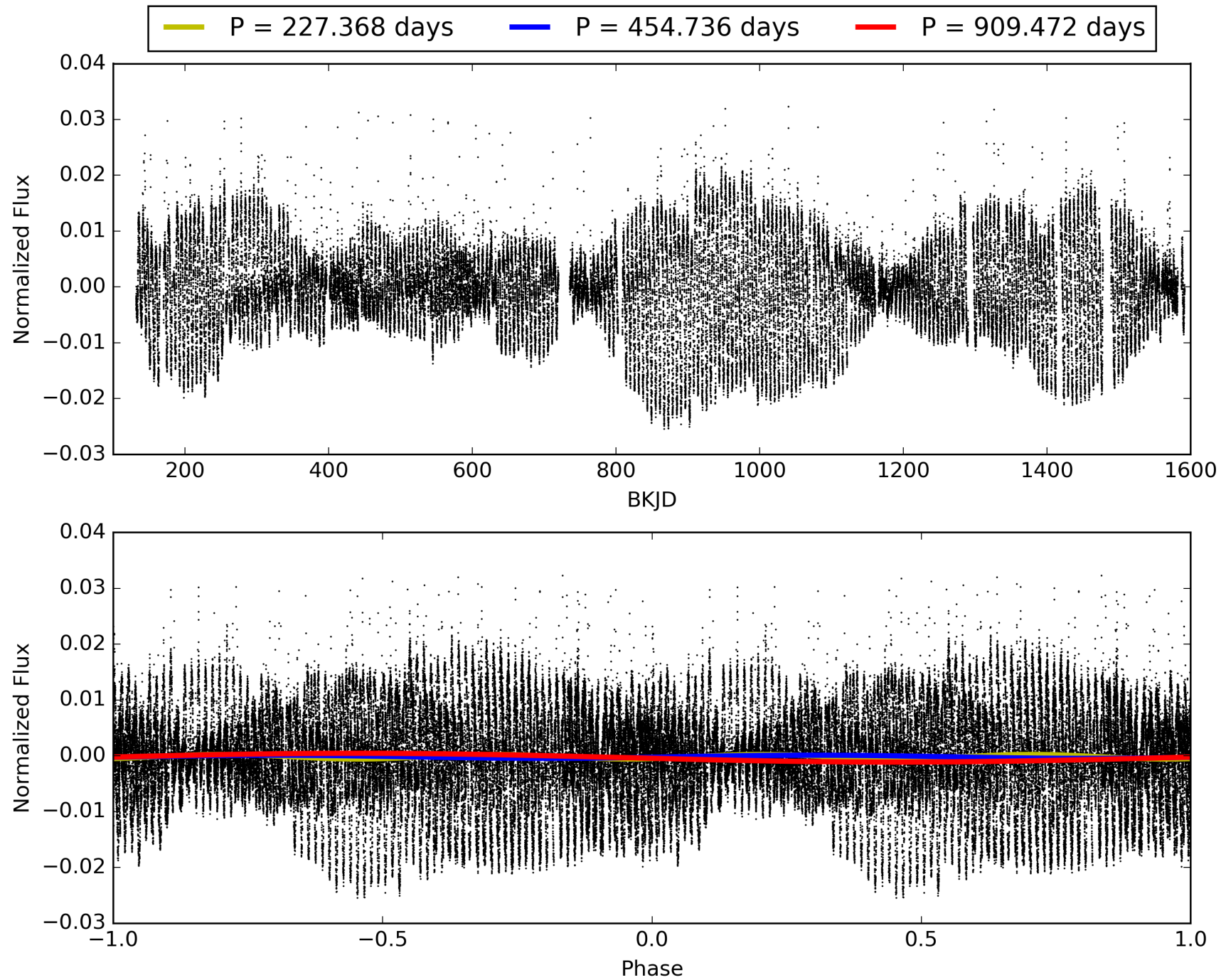
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 011870769-03, PDC Light Curves



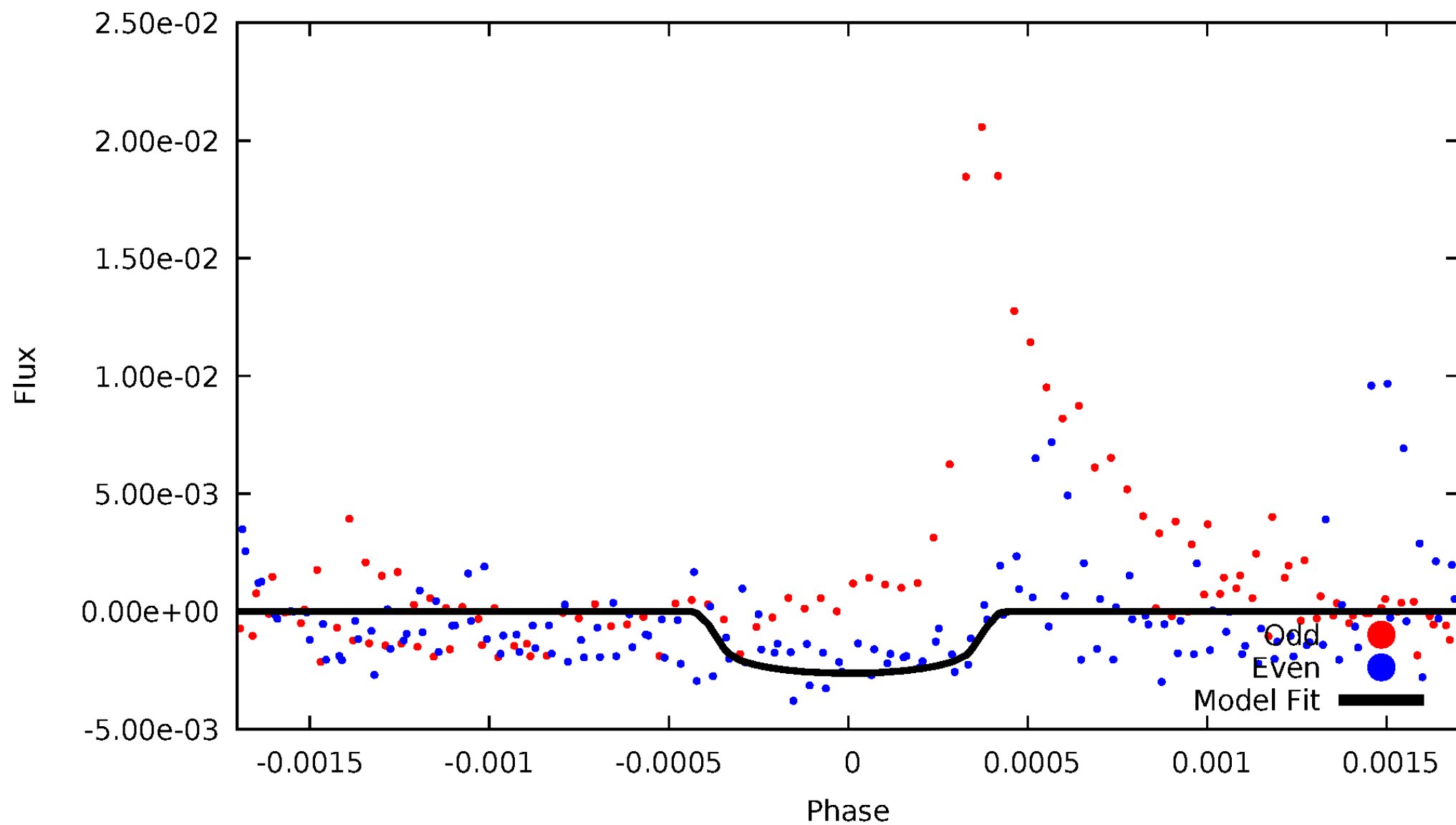


# TCE 011870769-03



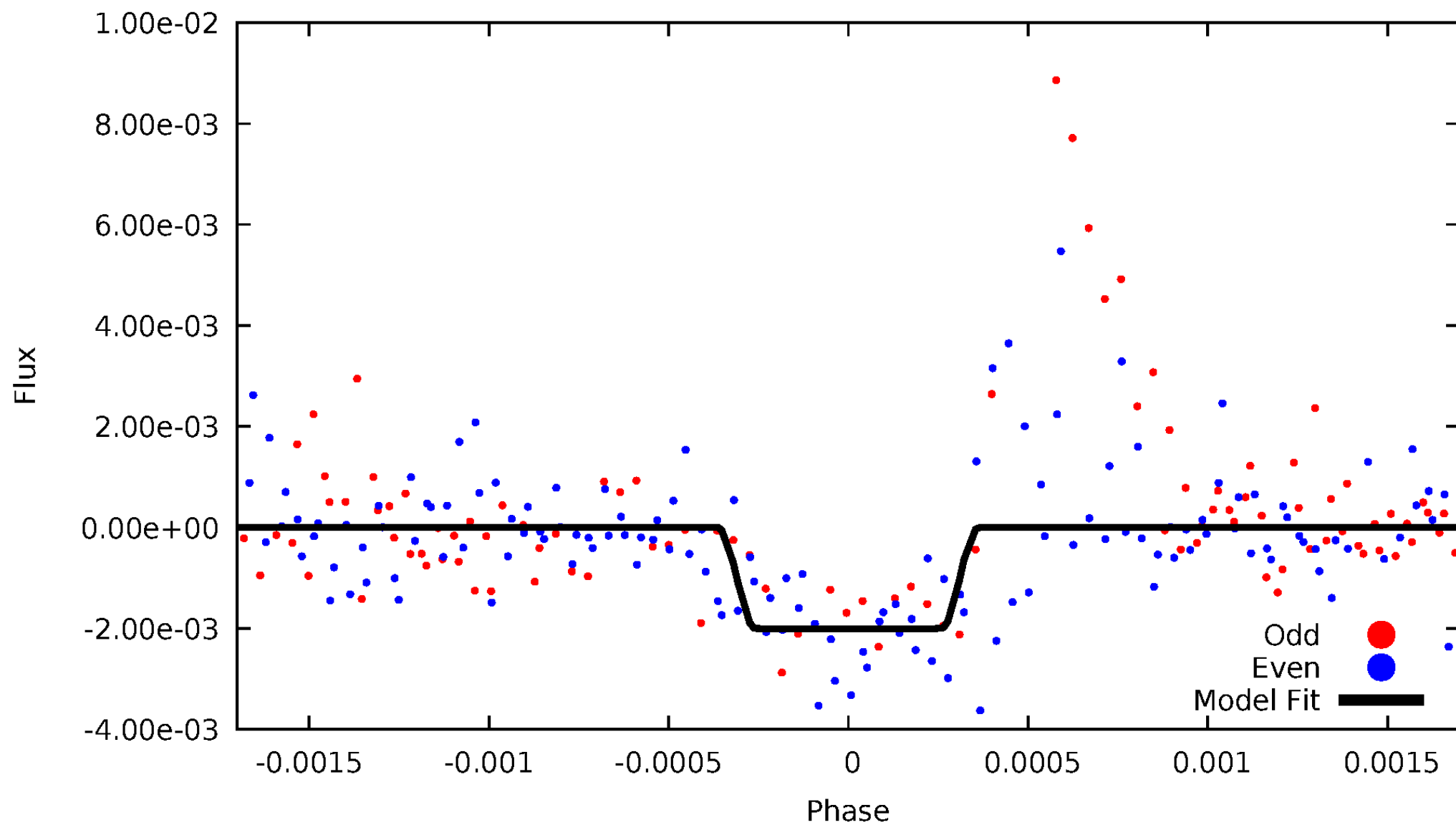
# DV Odd/Even

TCE 011870769-03

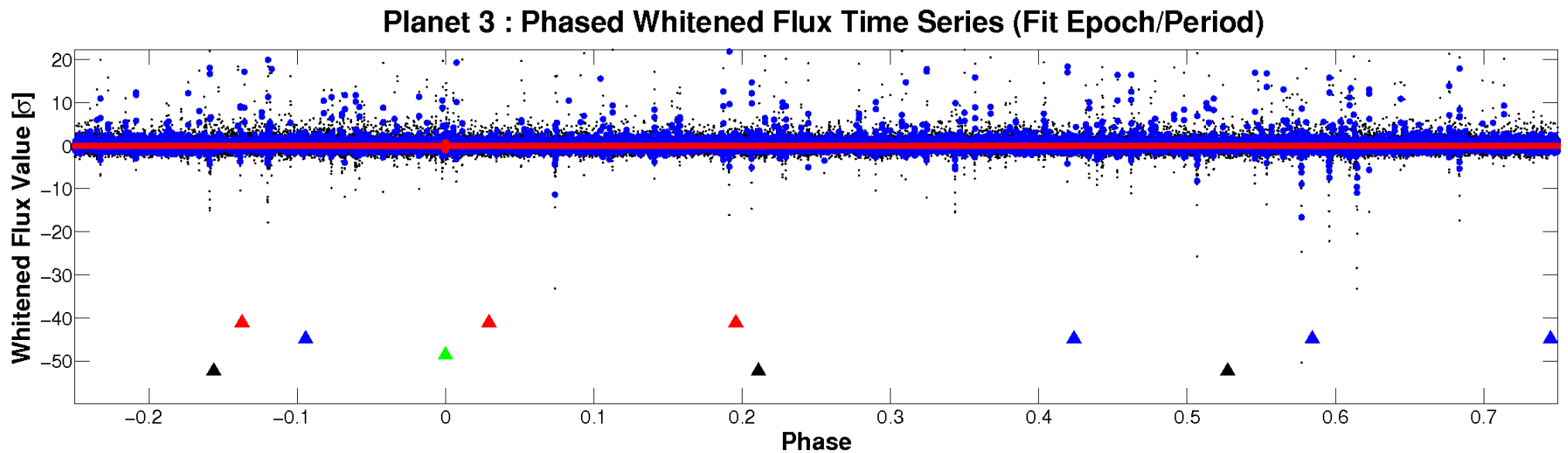
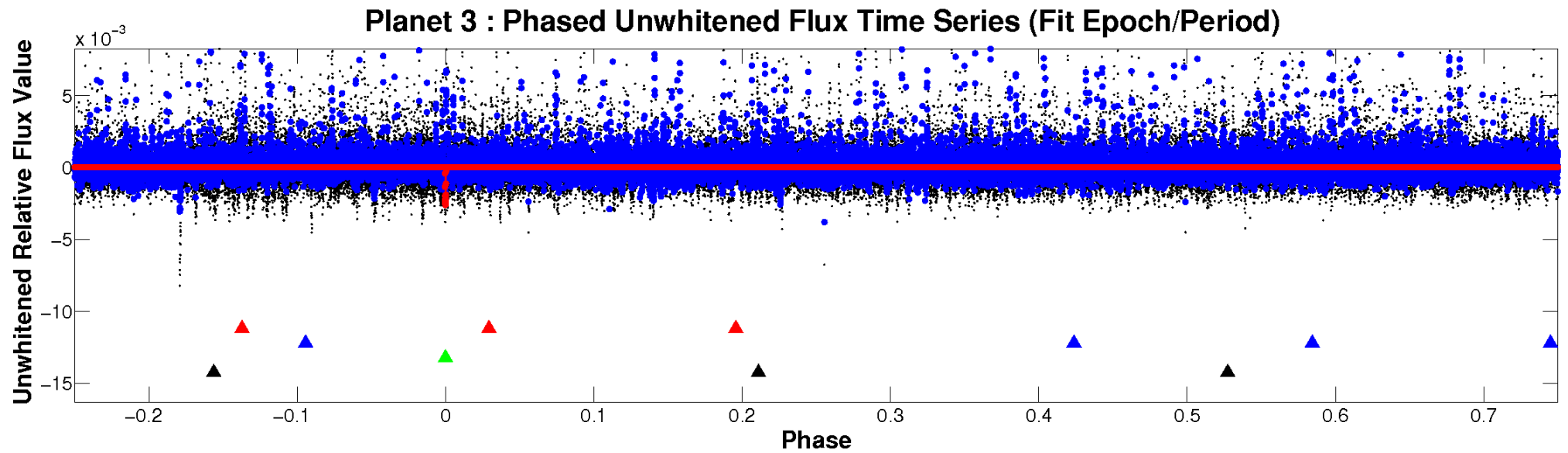


# ALT Odd/Even

TCE 011870769-03

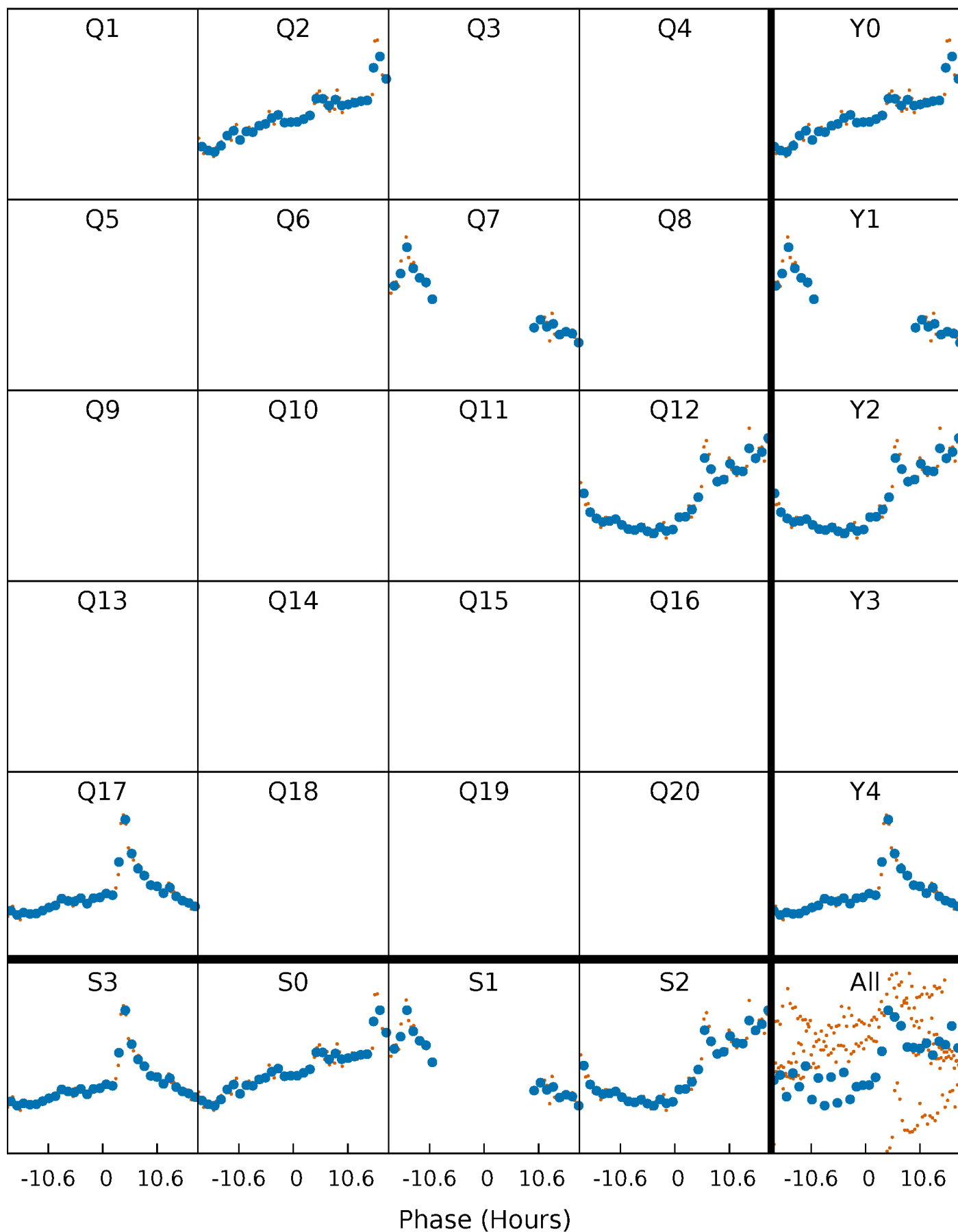


# Non-Whitened Vs. Whitened Light Curve



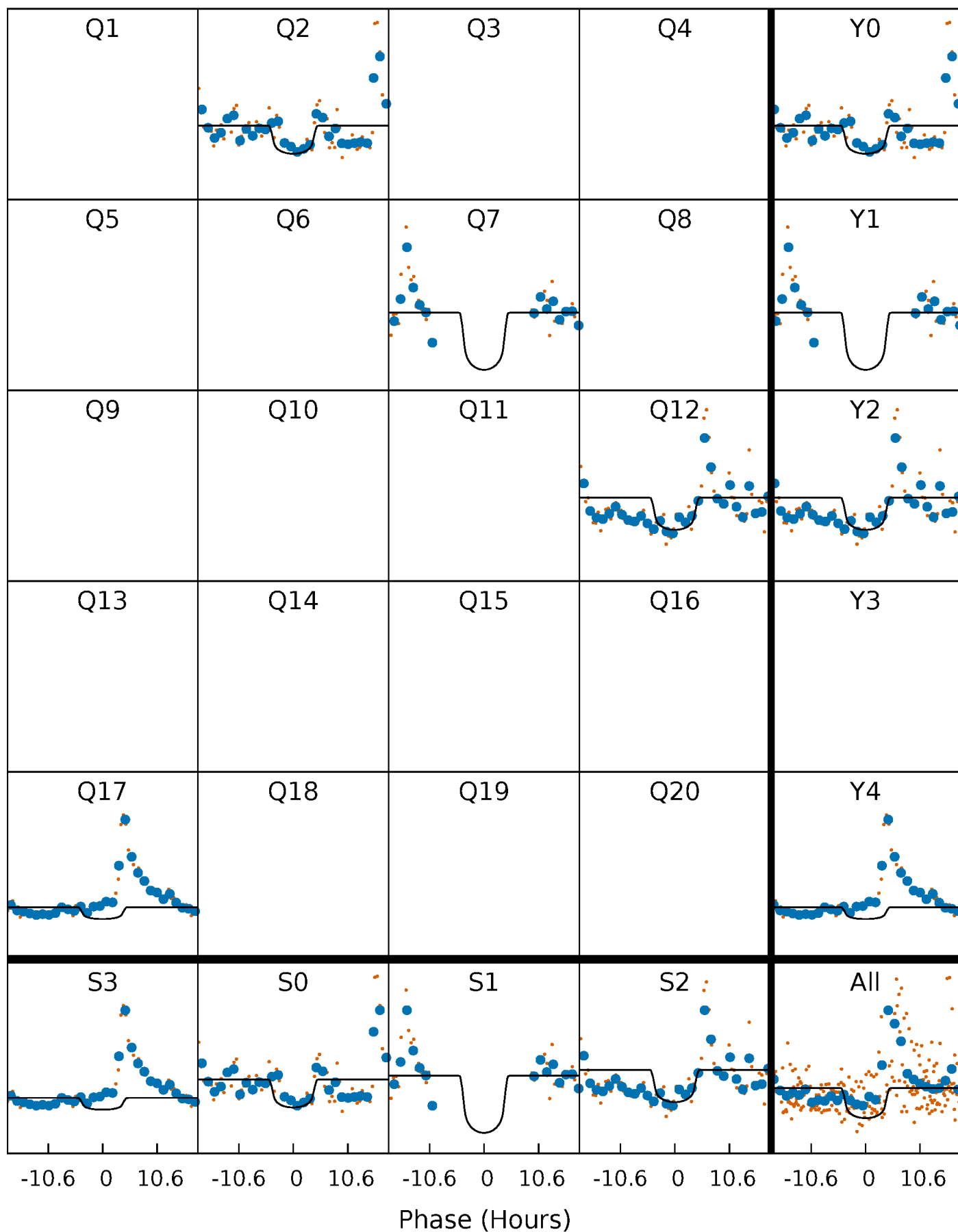
# PDC Quarter-Phased Transit Curves

TCE 011870769-03 P=454.735926 Days  $T_0=205.944564$  (BKJD)



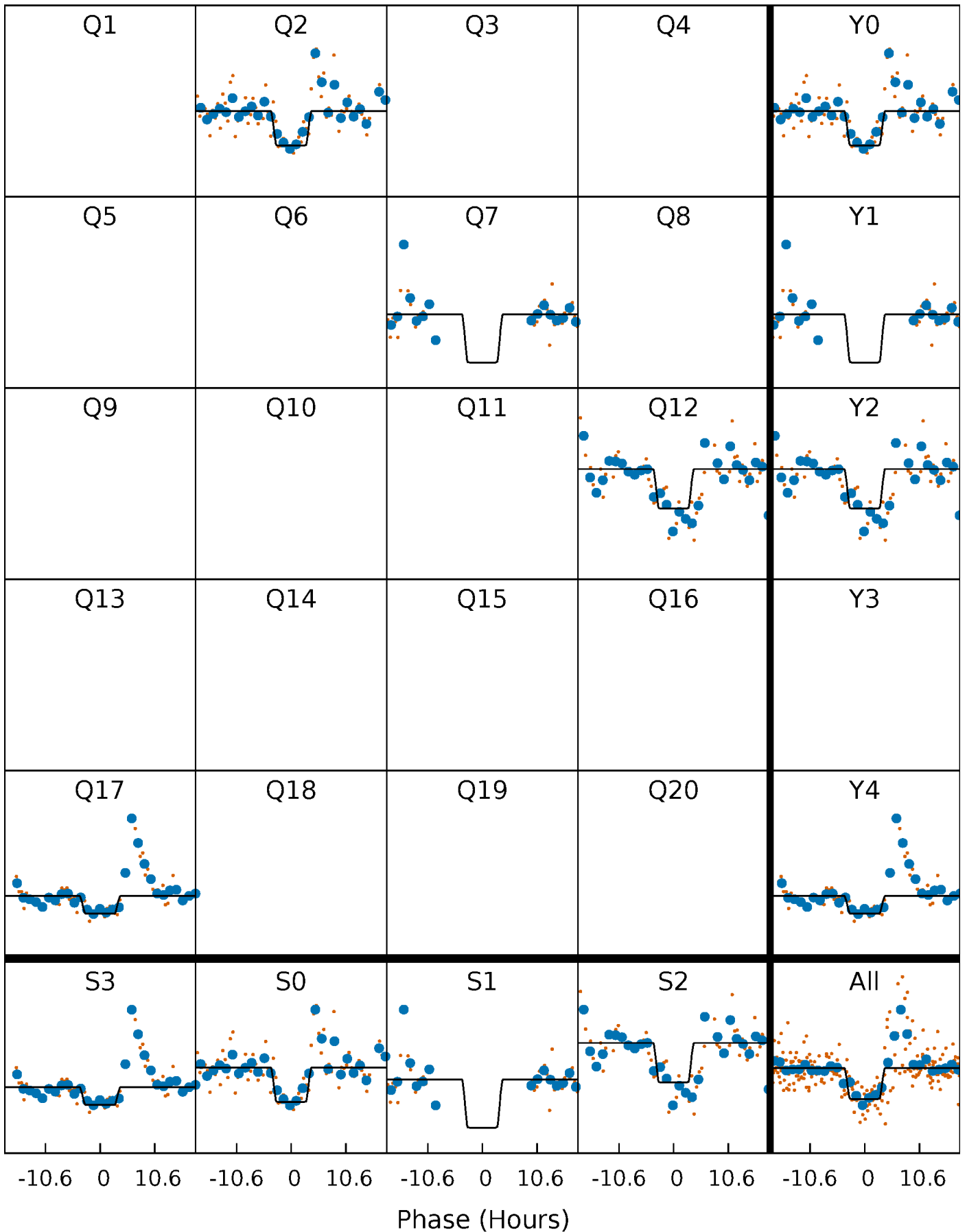
# DV Quarter-Phased Transit Curves

TCE 011870769-03 P=454.735926 Days  $T_0=205.944564$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

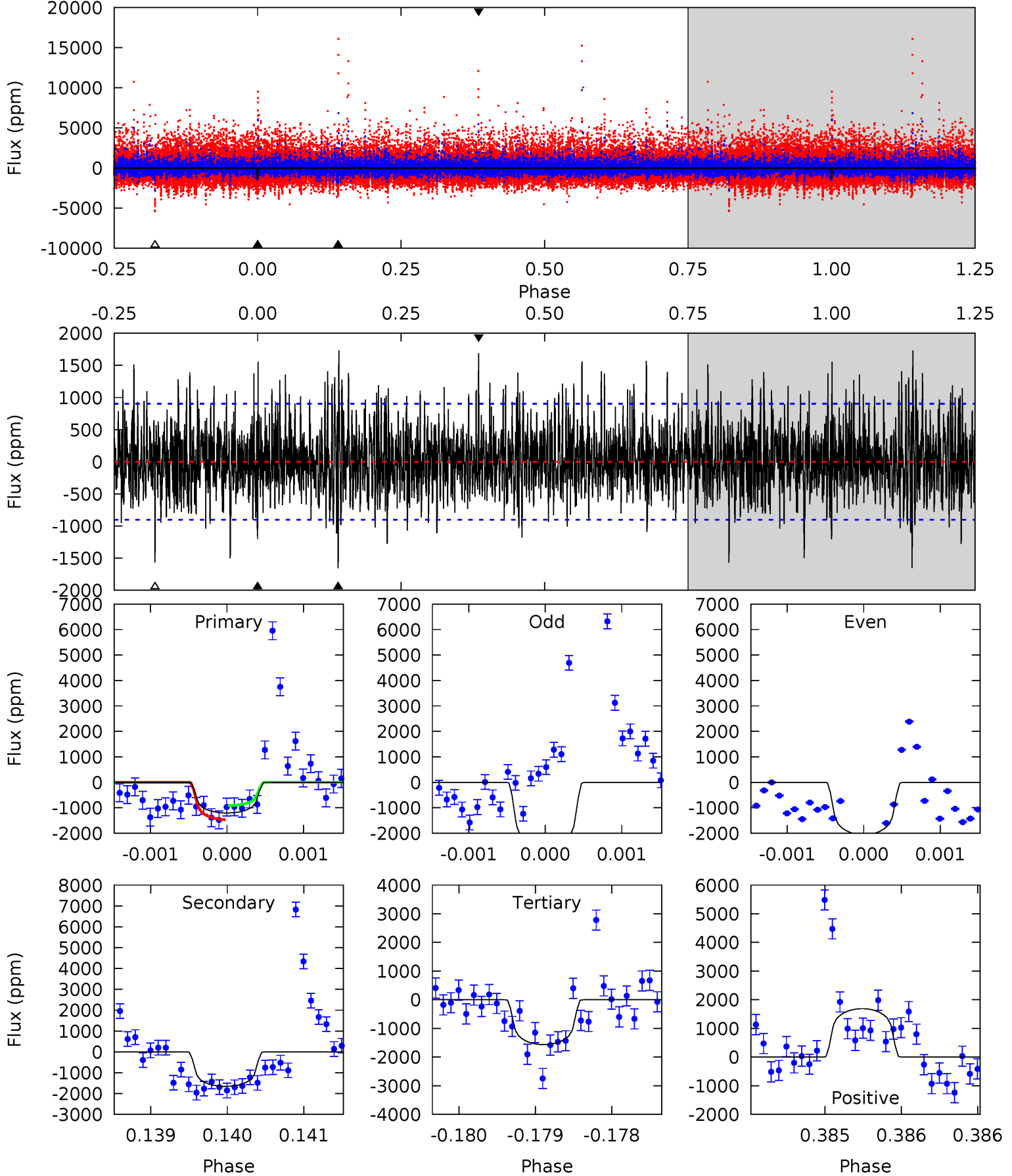
TCE 011870769-03     $P=454.714822$  Days     $T_0=205.954871$  (BKJD)



# DV Model-Shift Uniqueness Test

011870769-03, P = 454.735926 Days, E = 205.944564 Days

Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
7.29	10.0	9.48	10.2	5.47	3.32	2.52	-2.19	-2.94	0.55	-0.19	1.18	0.29	0.51	1.68

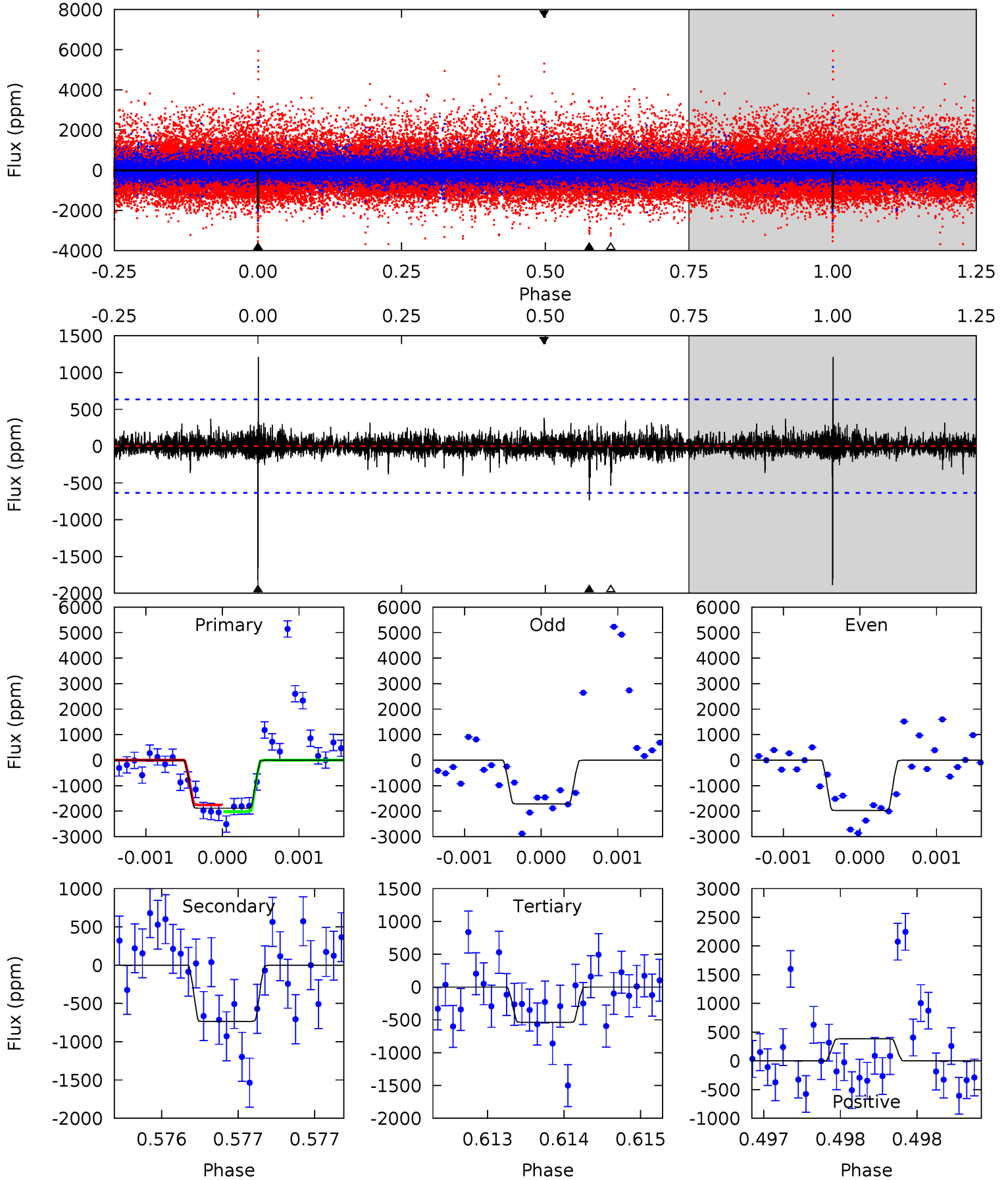




# Alt Model-Shift Uniqueness Test

011870769-03, P = 454.714822 Days, E = 205.954871 Days

Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
16.4	6.38	4.67	3.33	5.51	3.38	0.70	11.7	13.0	1.71	3.05	1.04	1.10	0.39	1.15



### Stellar Parameters For KIC 011870769

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$3522^{+63}_{-71}$	$4.848^{+0.050}_{-0.036}$	$0.000^{+0.100}_{-0.100}$	$0.400^{+0.040}_{-0.045}$	$0.411^{+0.043}_{-0.053}$	$9.054^{+2.575}_{-1.552}$
	+2%/-2%	+1%/-1%	+inf%/-inf%	+10%/-11%	+10%/-13%	+28%/-17%
Source	PHO2	PHO2	PHO2	DSEP		

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

### Secondary Eclipse Parameters for KIC 011870769-03 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-1656 \pm 165$	$2.21^{+0.50}_{-0.49}$	$147^{+4}_{-4}$	$3281^{+272}_{-202}$	$136317^{+92266}_{-44080}$
Alt.	$-736 \pm 115$	$1.96^{+0.51}_{-0.52}$	$148^{+4}_{-4}$	$3019^{+282}_{-199}$	$77115^{+69617}_{-29582}$

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

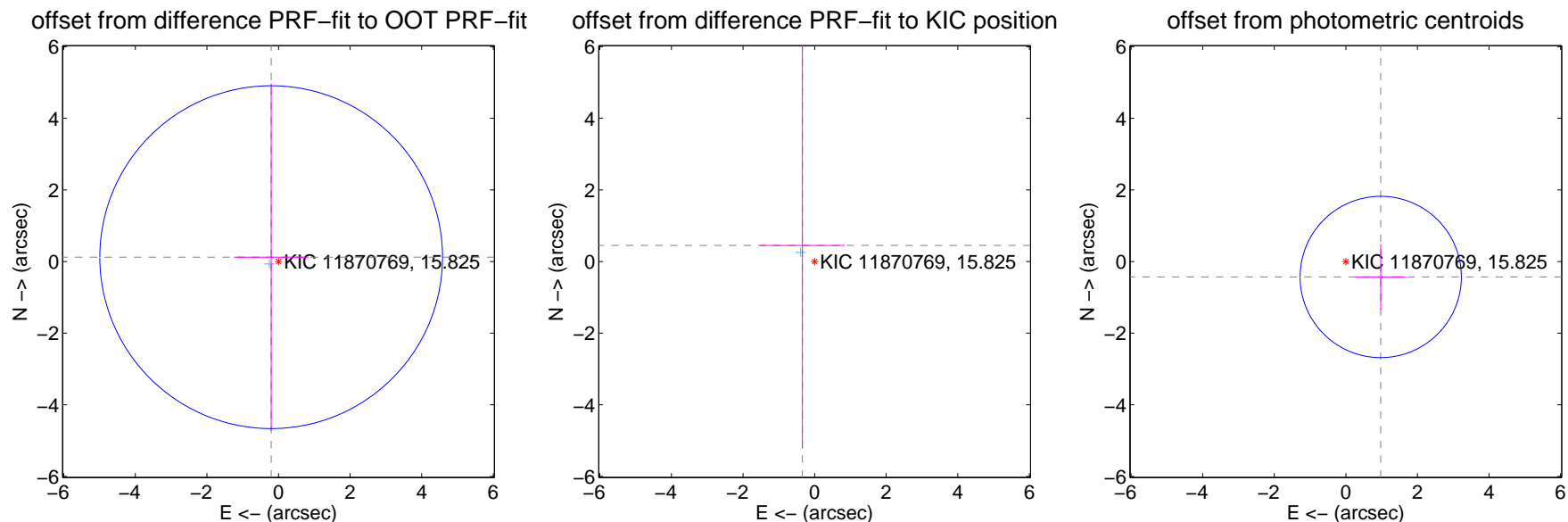
## DV Centroid Data

Supplemental centroid analysis for 011870769-03. Kepler magnitude: 15.82. Transit SNR 7.35

There are 1 quarters with good PRF difference image offsets

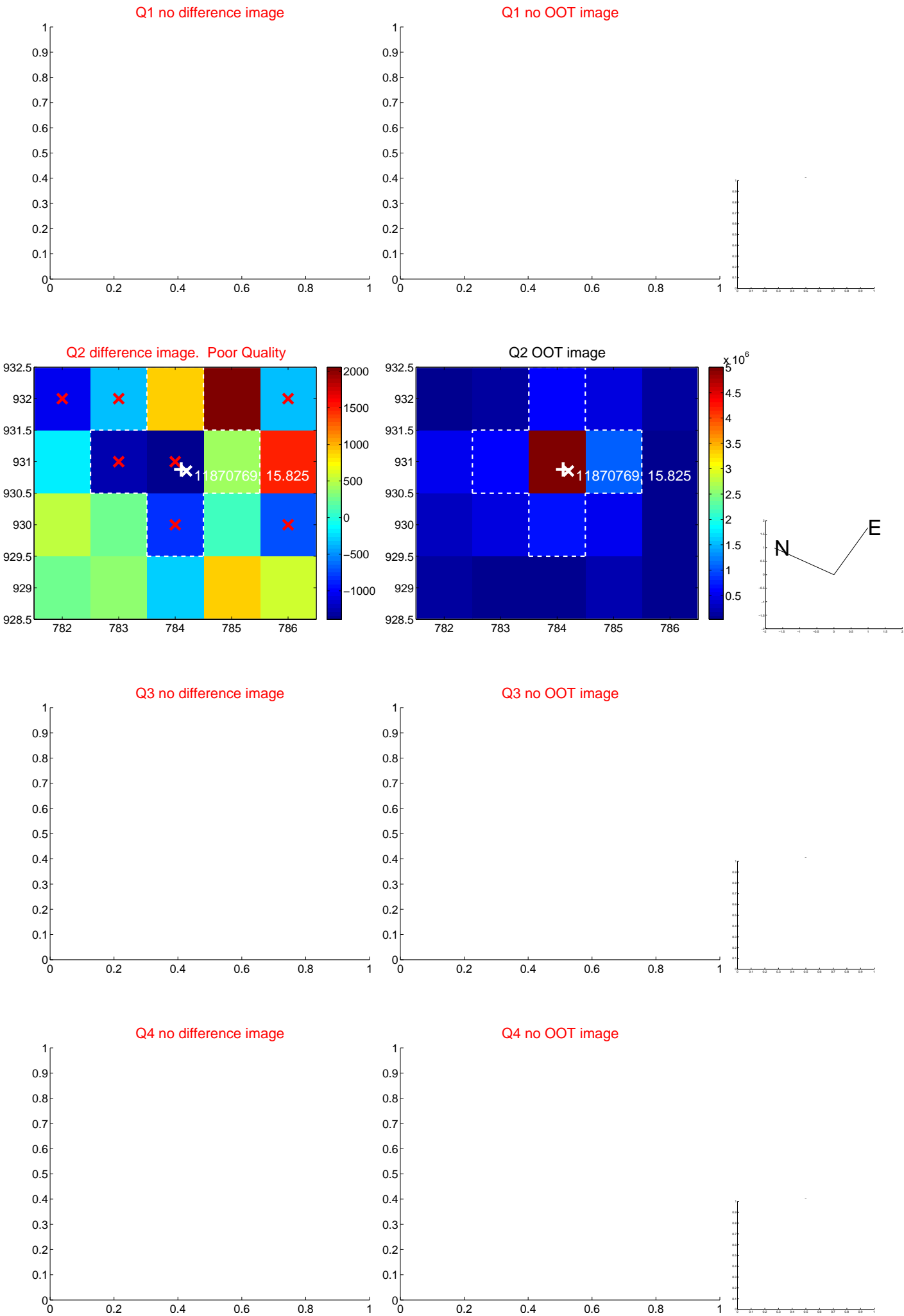
The direct PRF centroid is offset from the target star catalog position by about 0.47 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.239 \pm 1.596$	0.15	$0.205 \pm 1.037$	$0.122 \pm 4.851$
PRF-fit source offset from KIC position	$0.564 \pm 3.802$	0.15	$0.341 \pm 1.191$	$0.450 \pm 5.671$
photometric centroid source offset	$1.07 \pm 0.75$	1.42	$-0.97 \pm 0.71$	$-0.43 \pm 0.91$



Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three- $\sigma$ . Red \*: target star. Blue \*: Other stars. Text next to a star gives its KIC ID and kepmag. KIC IDs > 15,000,000 are from the UKIRT catalog.

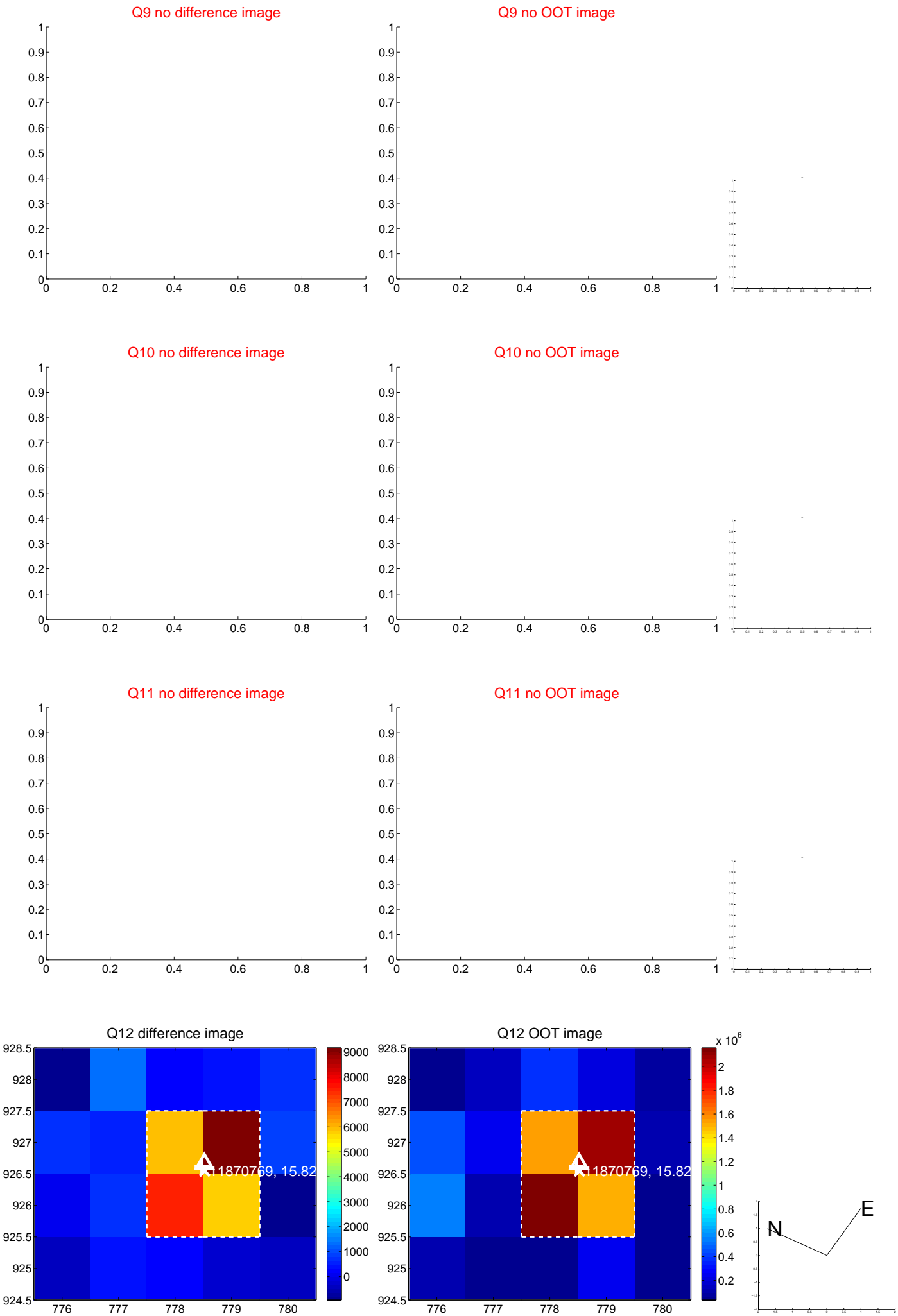
white ×: KIC target position; +: OOT centroid; △: difference centroid. red ×: large negative pixel value.



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



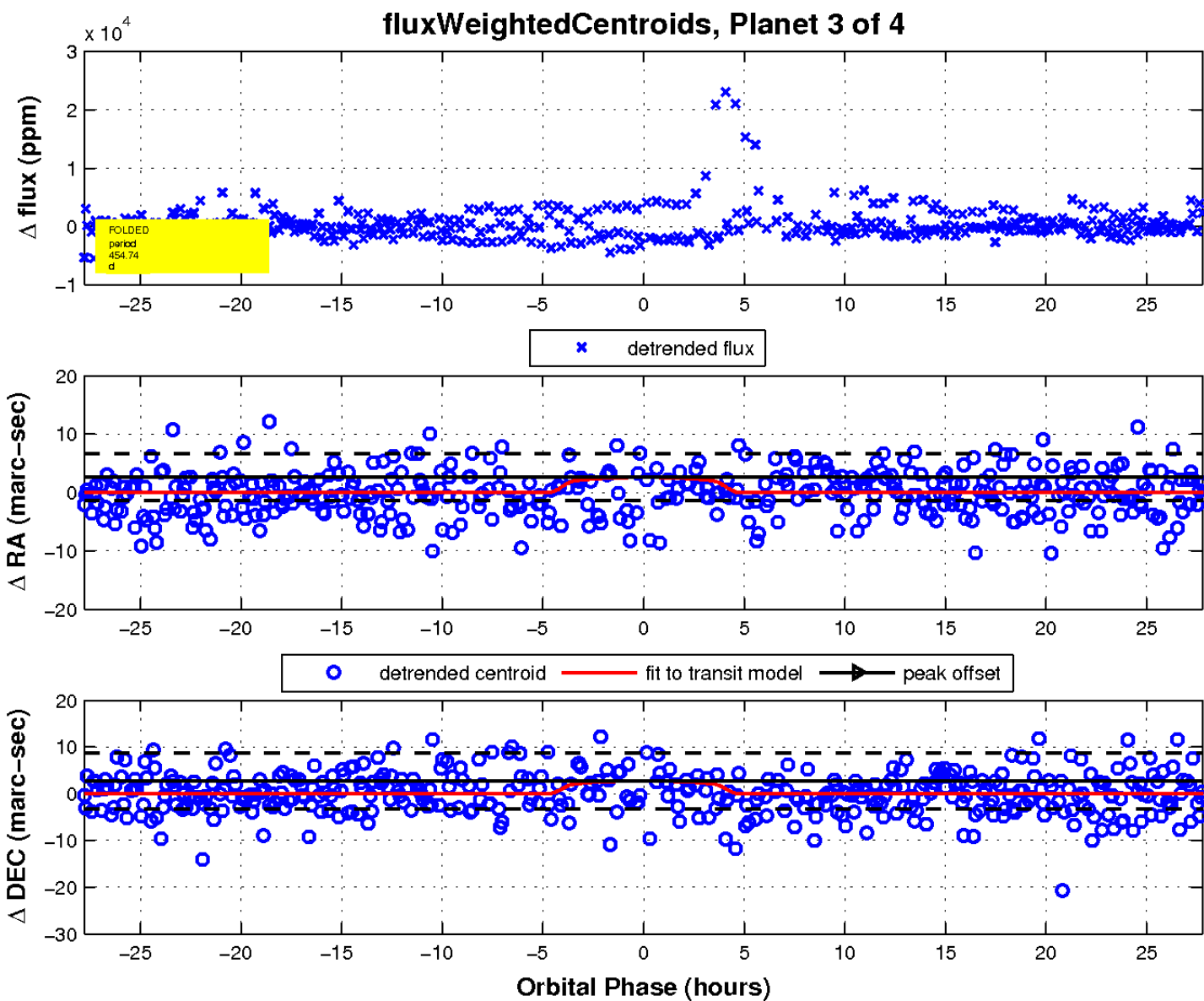
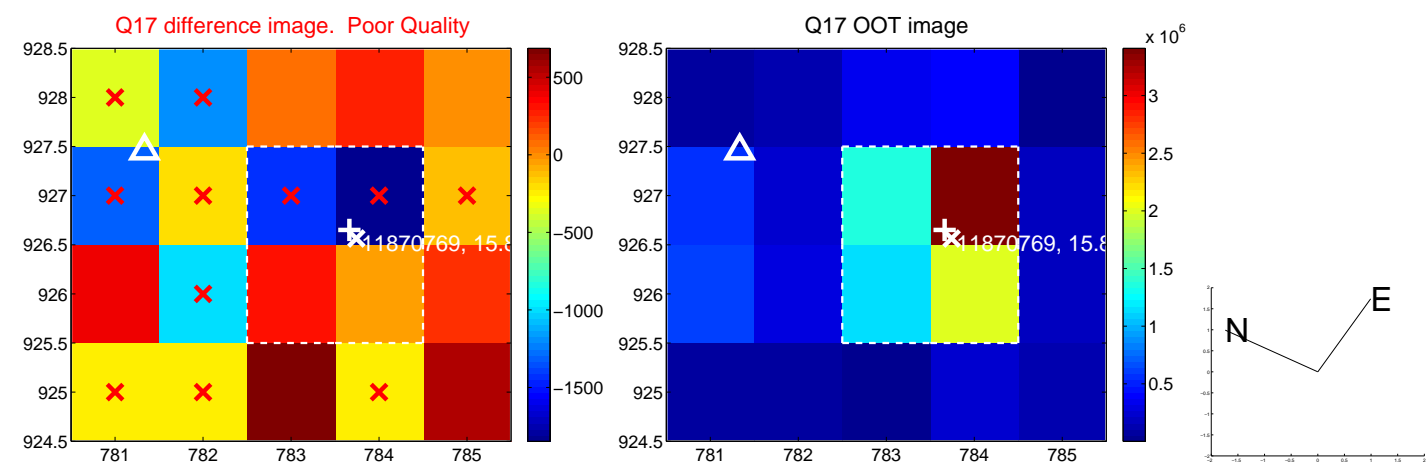
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



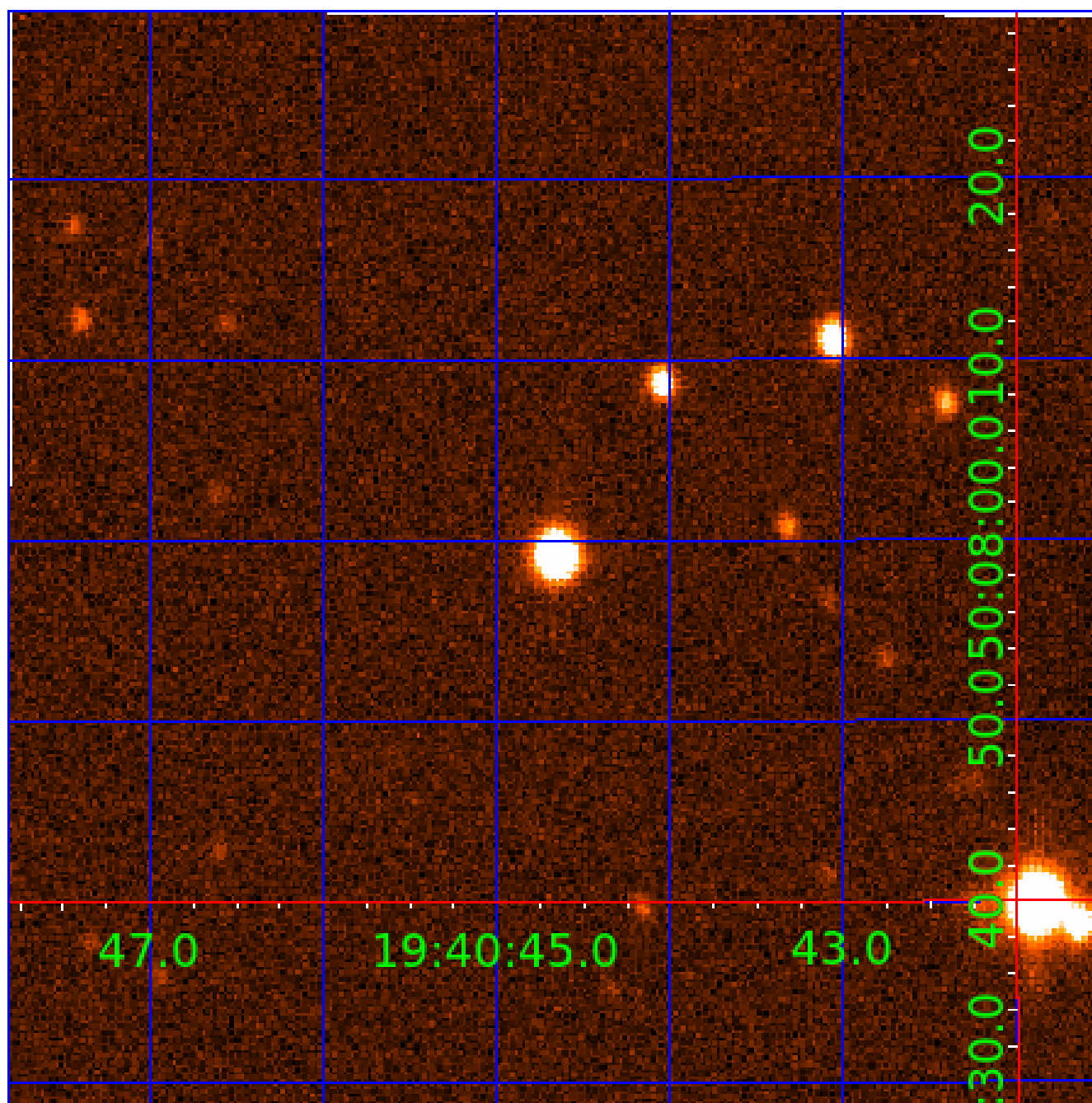
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





UKIRT Image

Declination



# KIC 011870769

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
011870769-01	OBS	No	530.431465	143.571979	2411.8	10.954	17.3	7.2	0.40	3522	1.93	0.02
011870769-02	OBS	No	381.681656	163.070370	2069.7	13.441	8.3	7.3	0.40	3522	1.79	0.04
011870769-03	OBS	No	454.735926	205.944564	2624.9	9.291	13.0	7.3	0.40	3522	2.23	0.03
011870769-04	OBS	No	598.601081	301.908347	2870.5	10.518	12.0	7.9	0.40	3522	2.11	0.02

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
011870769-01	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS—HALO_GHOST
011870769-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL—LPP_DV—INCONSISTENT_TRANS—CENT_KIC_POS
011870769-03	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_CHASES—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS—HALO_GHOST
011870769-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_SKYE—LPP_DV—MOD_NONUNIQ_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS

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

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

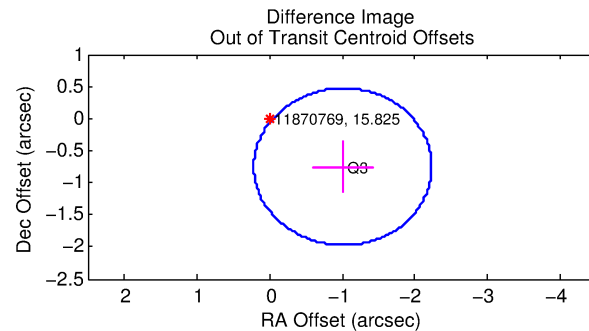
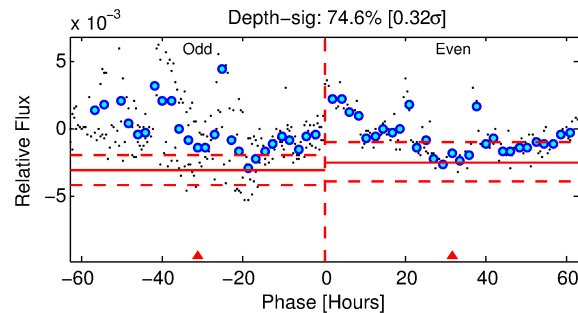
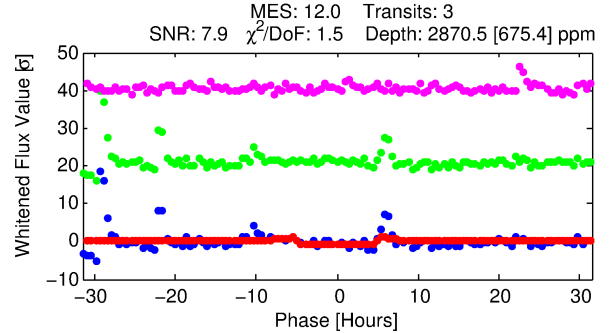
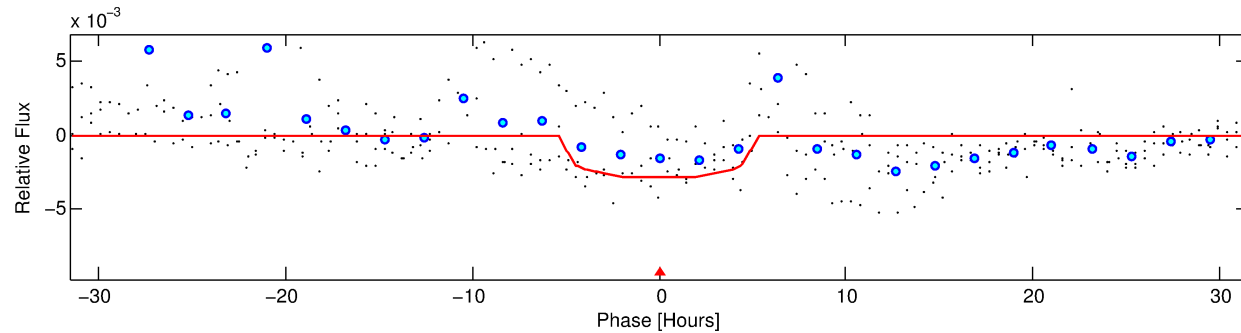
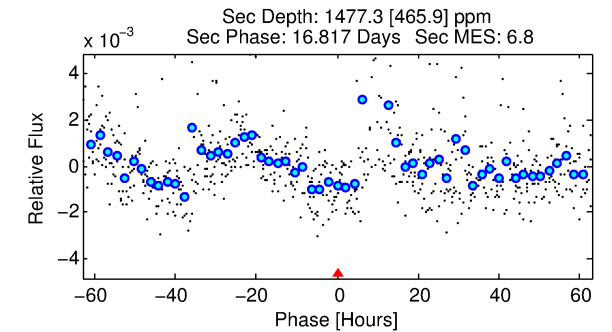
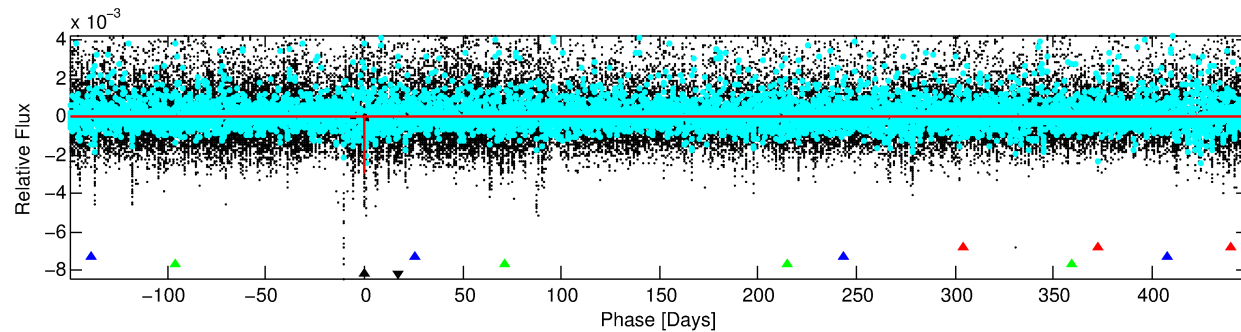
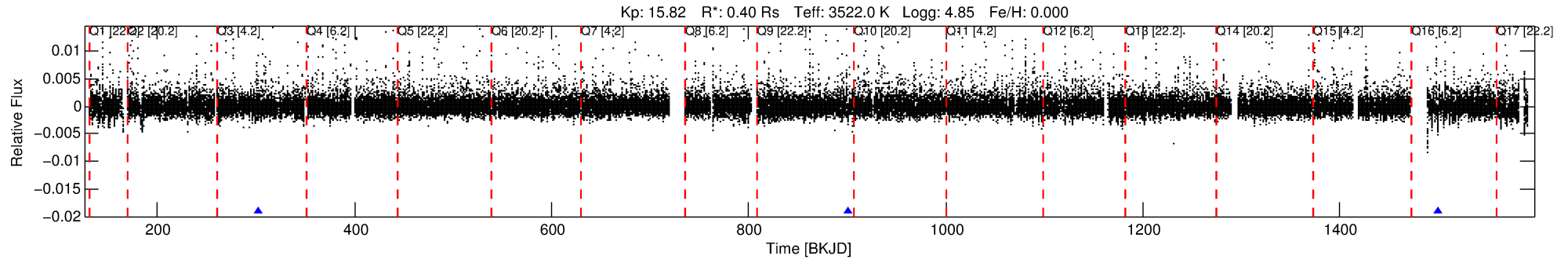
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 011870769-04

No Significant Match Found

# DV One-Page Summary

KIC: 11870769 Candidate: 4 of 4 Period: 598.601 d



## DV Fit Results:

Period = 598.60108 [0.01035] d  
Epoch = 301.9083 [0.0133] BKJD  
Rp/R\* = 0.0484 [0.0434]  
a/R\* = 453.23 [1663.31]  
b = 0.11 [32.36]  
Seff = 0.02 [0.00]  
Teq = 97 [3] K  
Rp = 2.11 [1.91] Re  
a = 1.0339 [0.0871] AU  
Ag = 194562.88 [354628.74] [0.55σ]  
Teffp = 3138 [1429] K [2.13σ]

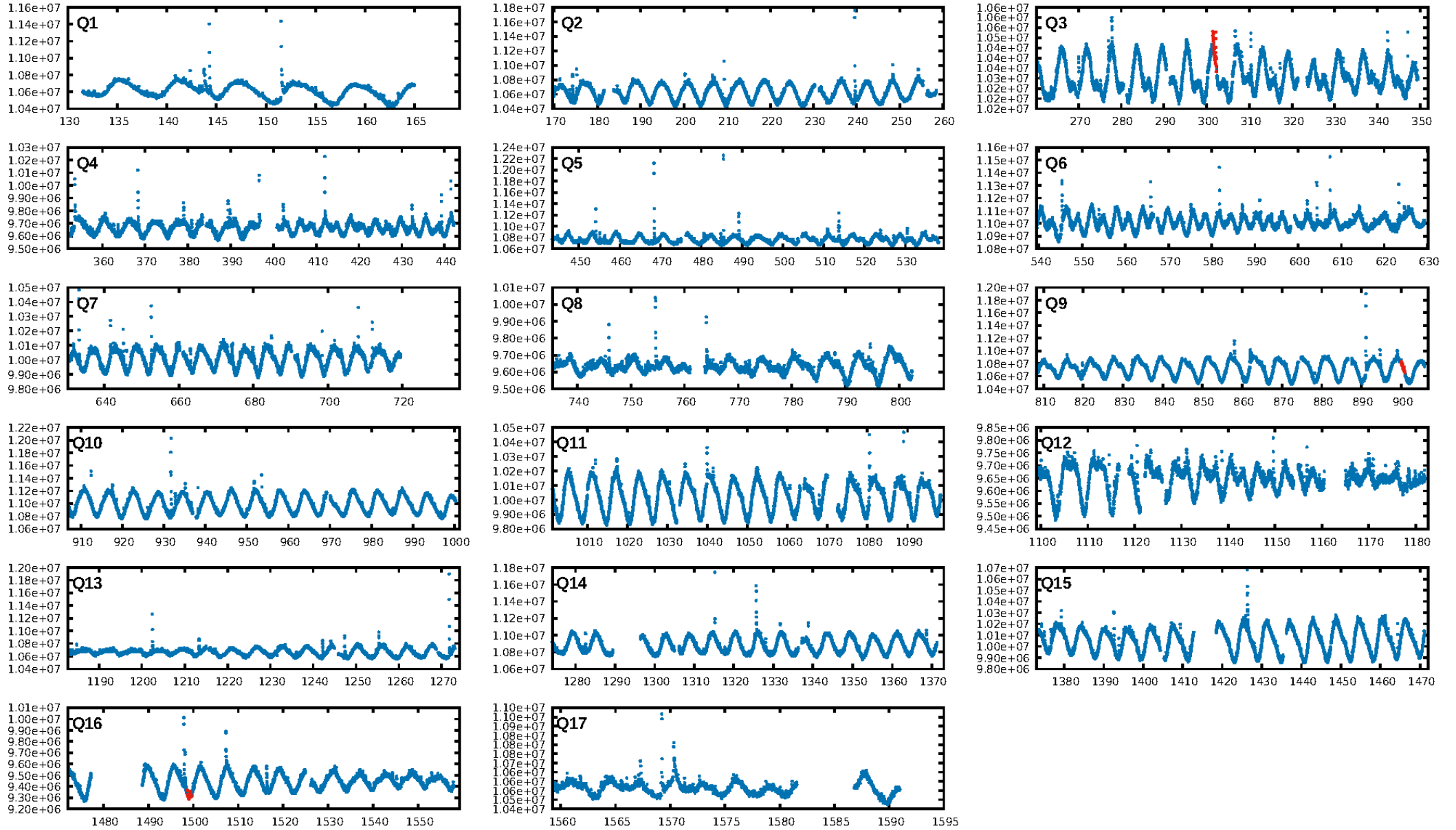
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [107.73σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 26.8%  
ModelChiSquareGof-sig: 80.8%  
**Bootstrap-pfa: 4.38e-12**  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: 1.641  
Centroid-sig: 42.1%  
Centroid-so: 1.090 arcsec [1.51σ]  
**OotOffset-rm: 1.259 arcsec [3.09σ]**  
KicOffset-rm: 1.137 arcsec [2.75σ]  
OotOffset-st: 0/1/0/0 [1]  
KicOffset-st: 0/1/0/0 [1]  
DiffImageQuality-fgm: 0.00 [0/1]  
DiffImageOverlap-fno: 1.00 [2/2]

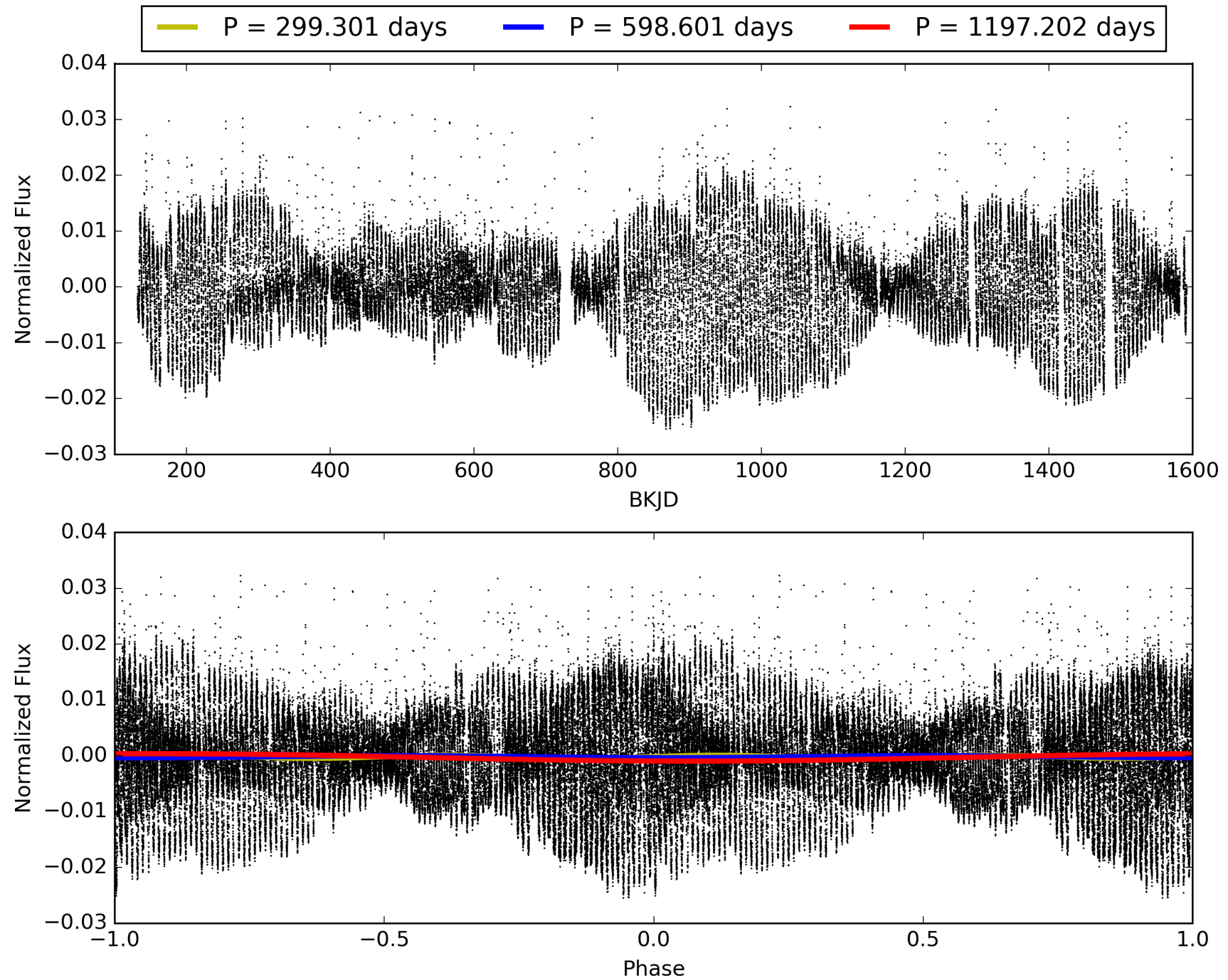
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 29-Jan-2016 21:19:40 Z

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

# TCE 011870769-04, PDC Light Curves

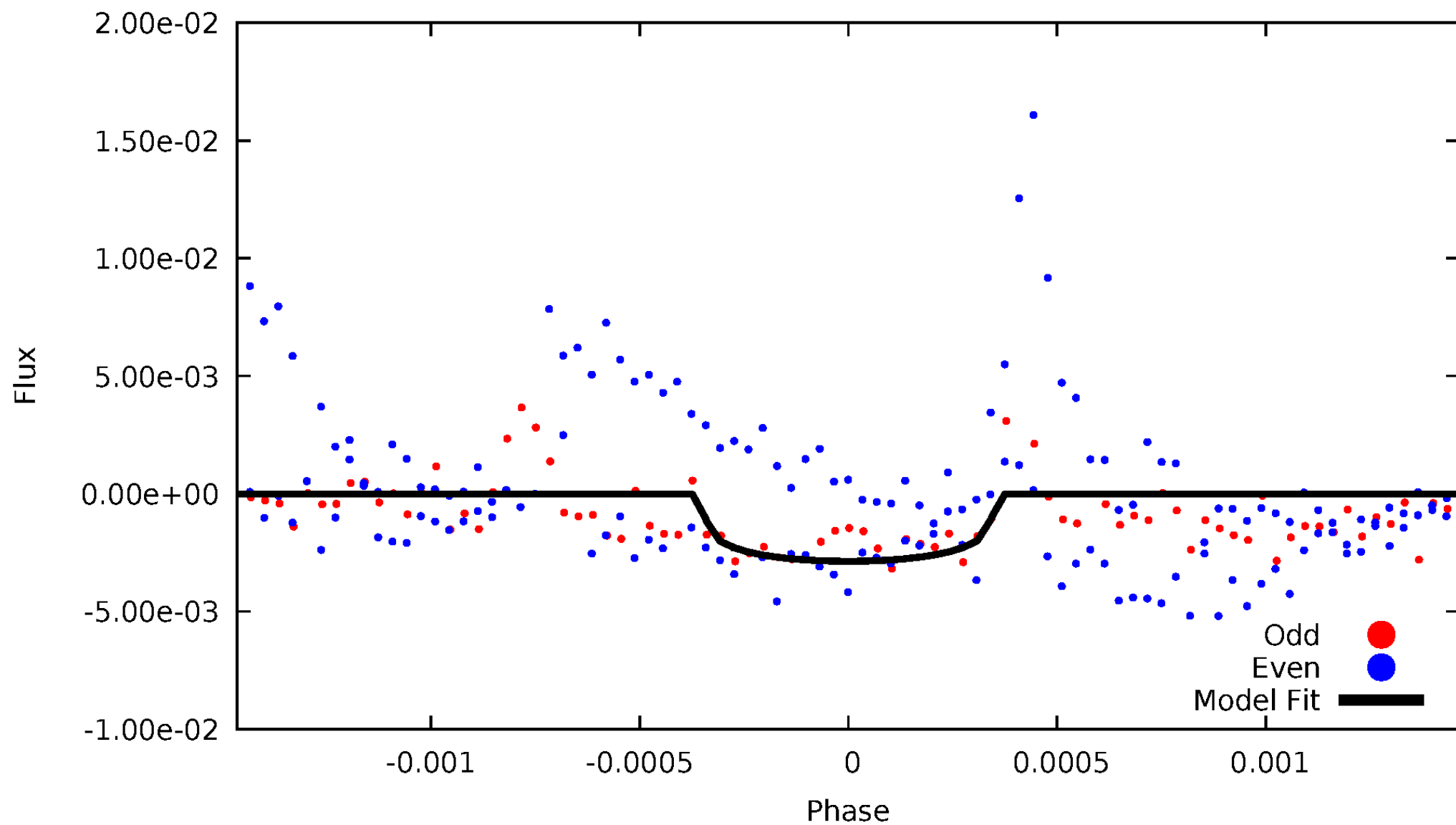


# TCE 011870769-04



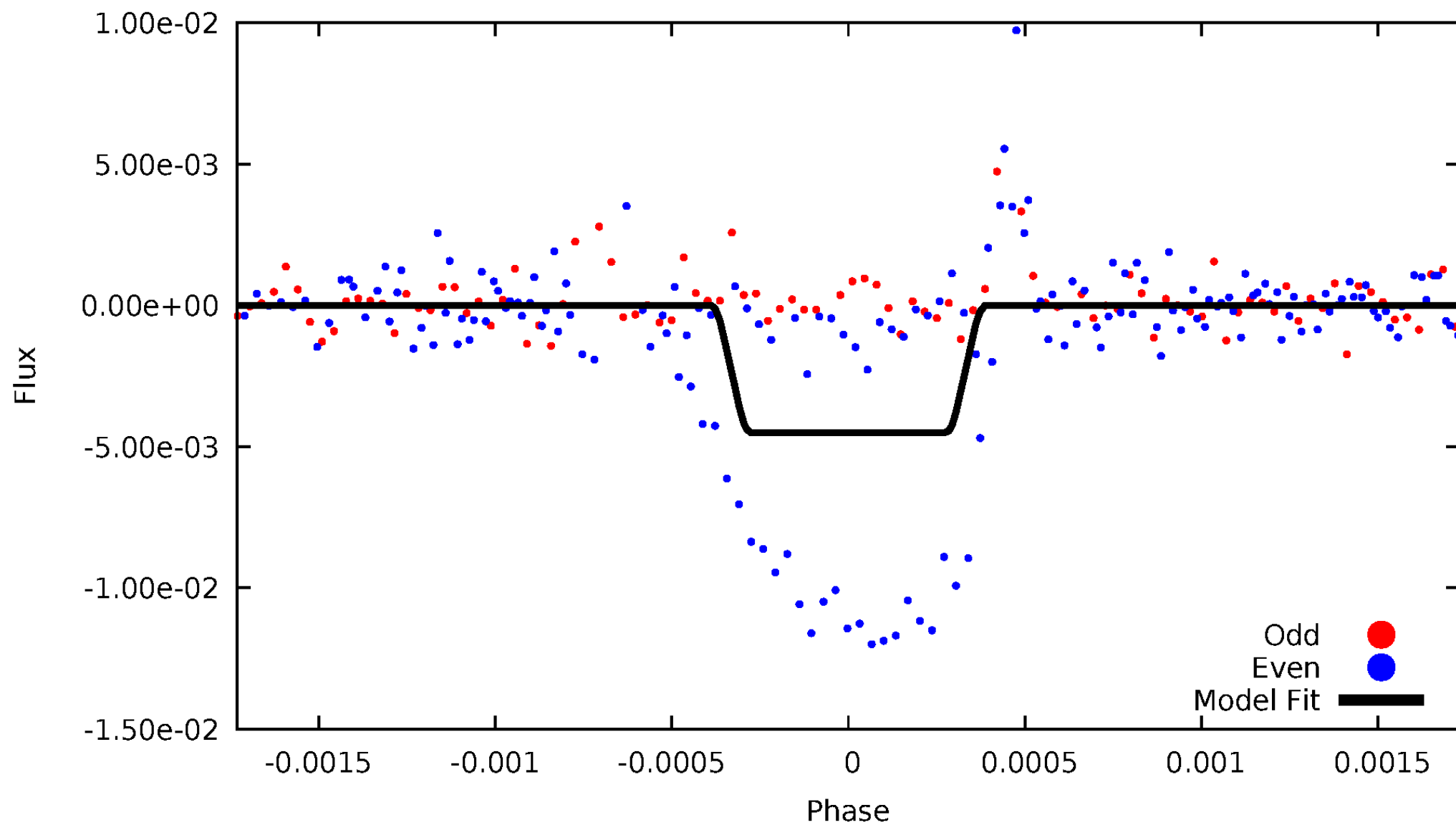
# DV Odd/Even

TCE 011870769-04



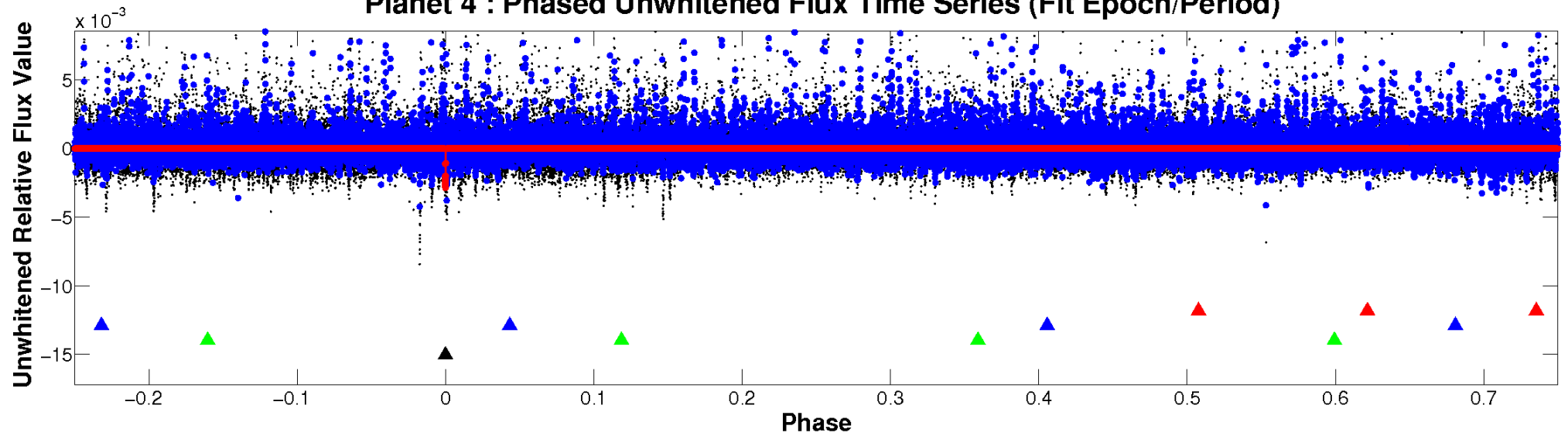
# ALT Odd/Even

TCE 011870769-04

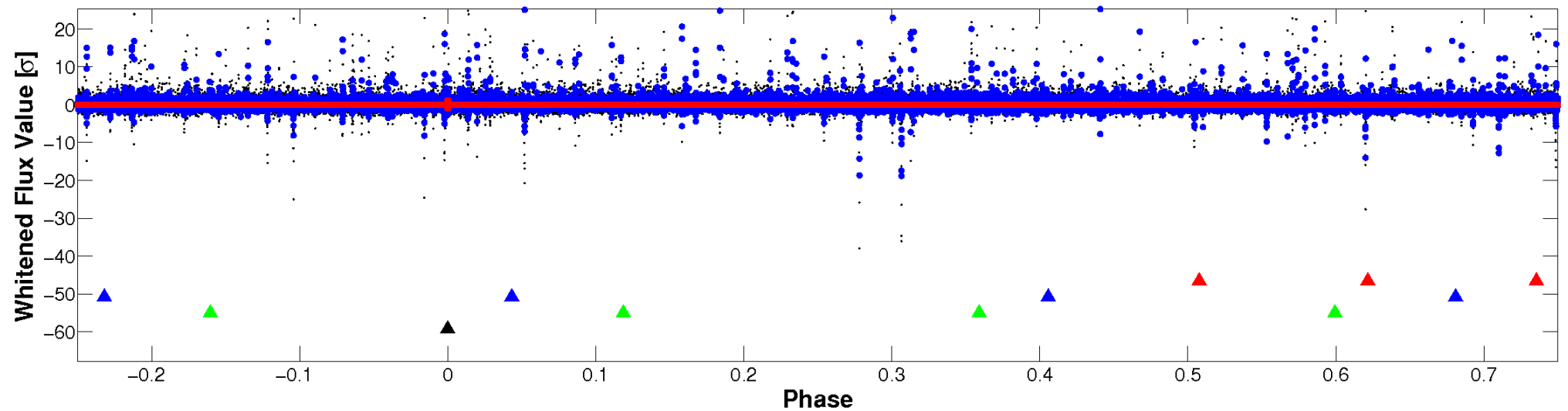


# Non-Whitened Vs. Whitened Light Curve

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



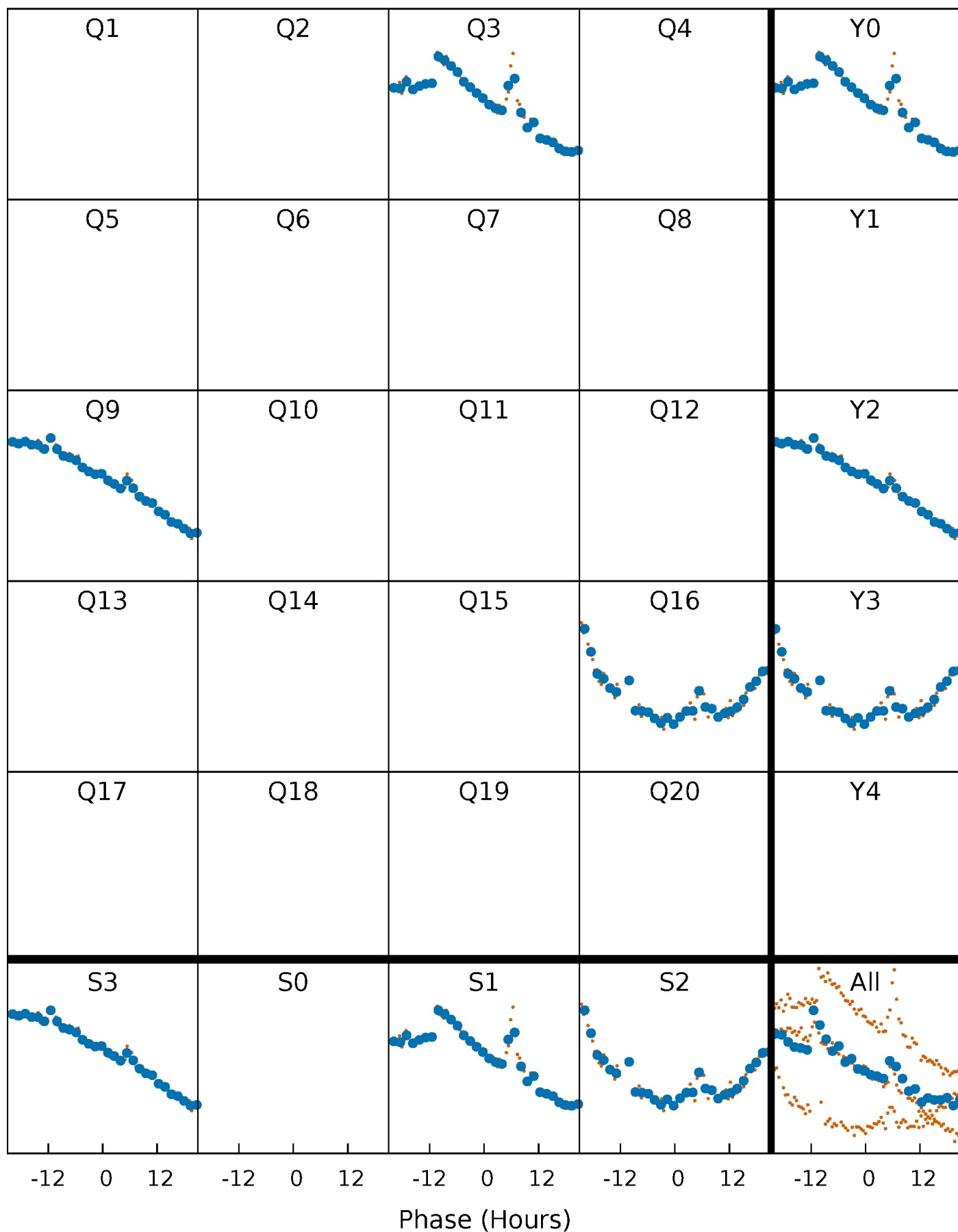
## Planet 4 : Phased Whitened Flux Time Series (Fit Epoch/Period)





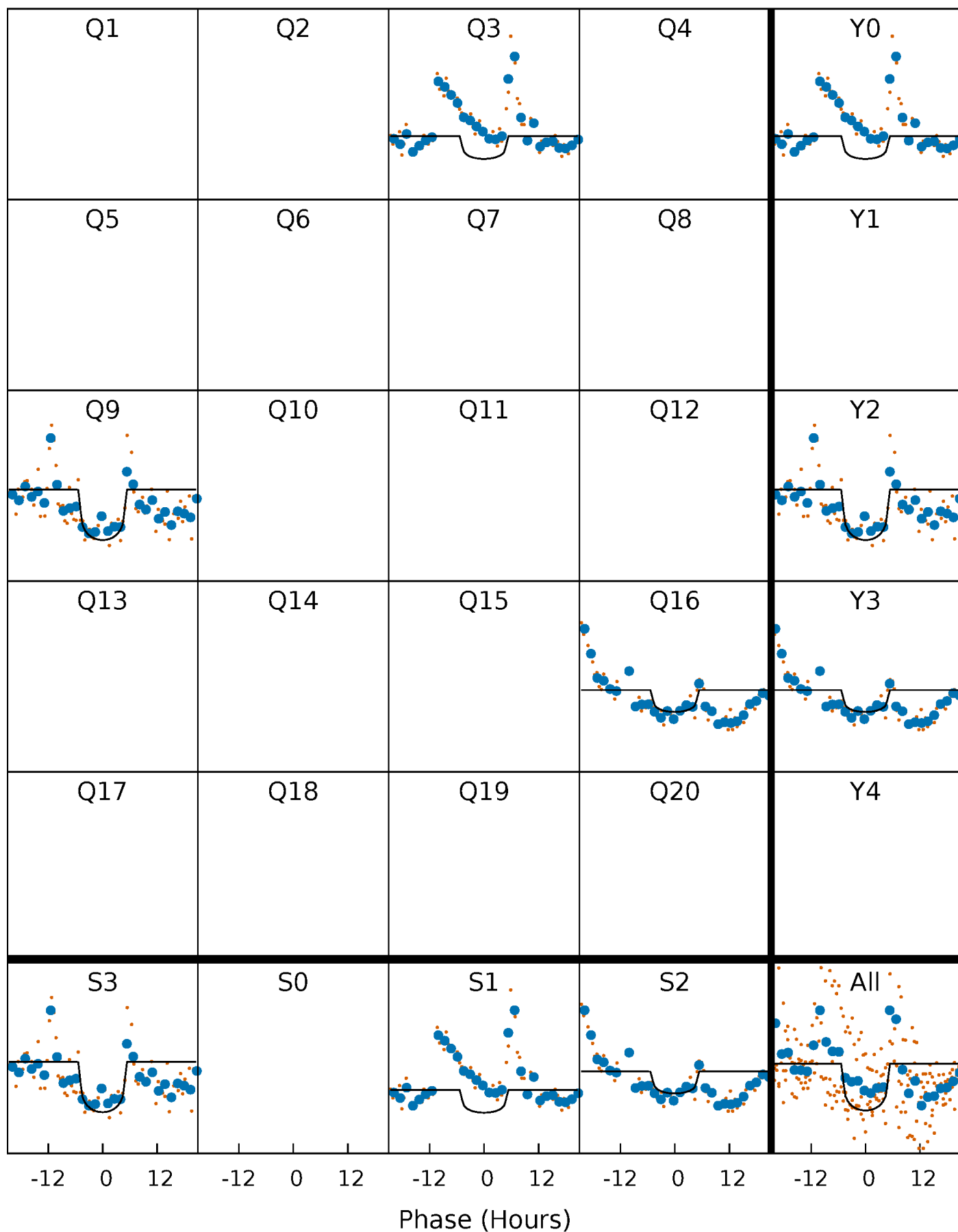
# PDC Quarter-Phased Transit Curves

TCE 011870769-04 P=598.601081 Days  $T_0=301.908347$  (BKJD)



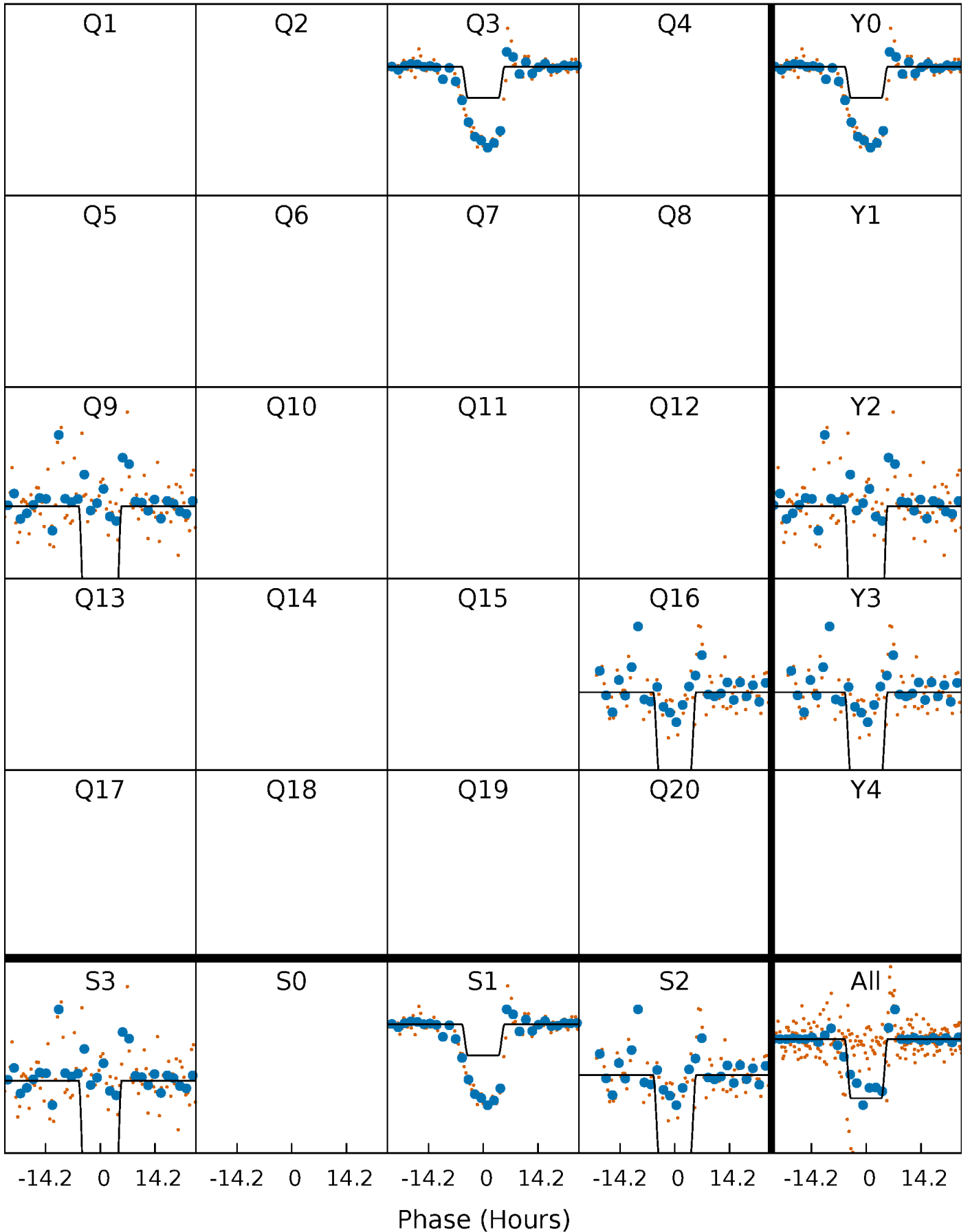
# DV Quarter-Phased Transit Curves

TCE 011870769-04 P=598.601081 Days  $T_0=301.908347$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

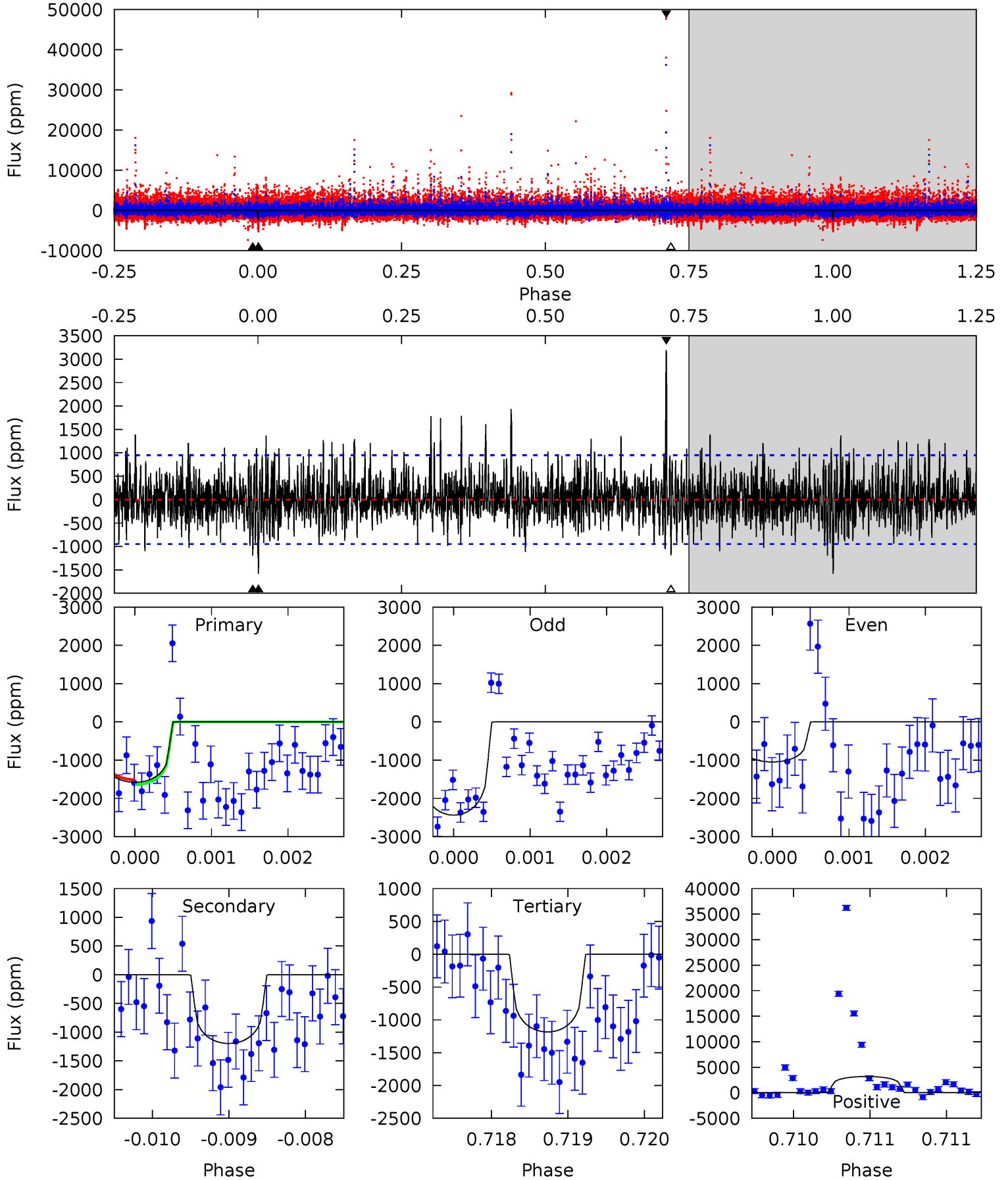
TCE 011870769-04     $P=598.594329$  Days     $T_0=301.889014$  (BKJD)



# DV Model-Shift Uniqueness Test

011870769-04, P = 598.601081 Days, E = 301.908347 Days

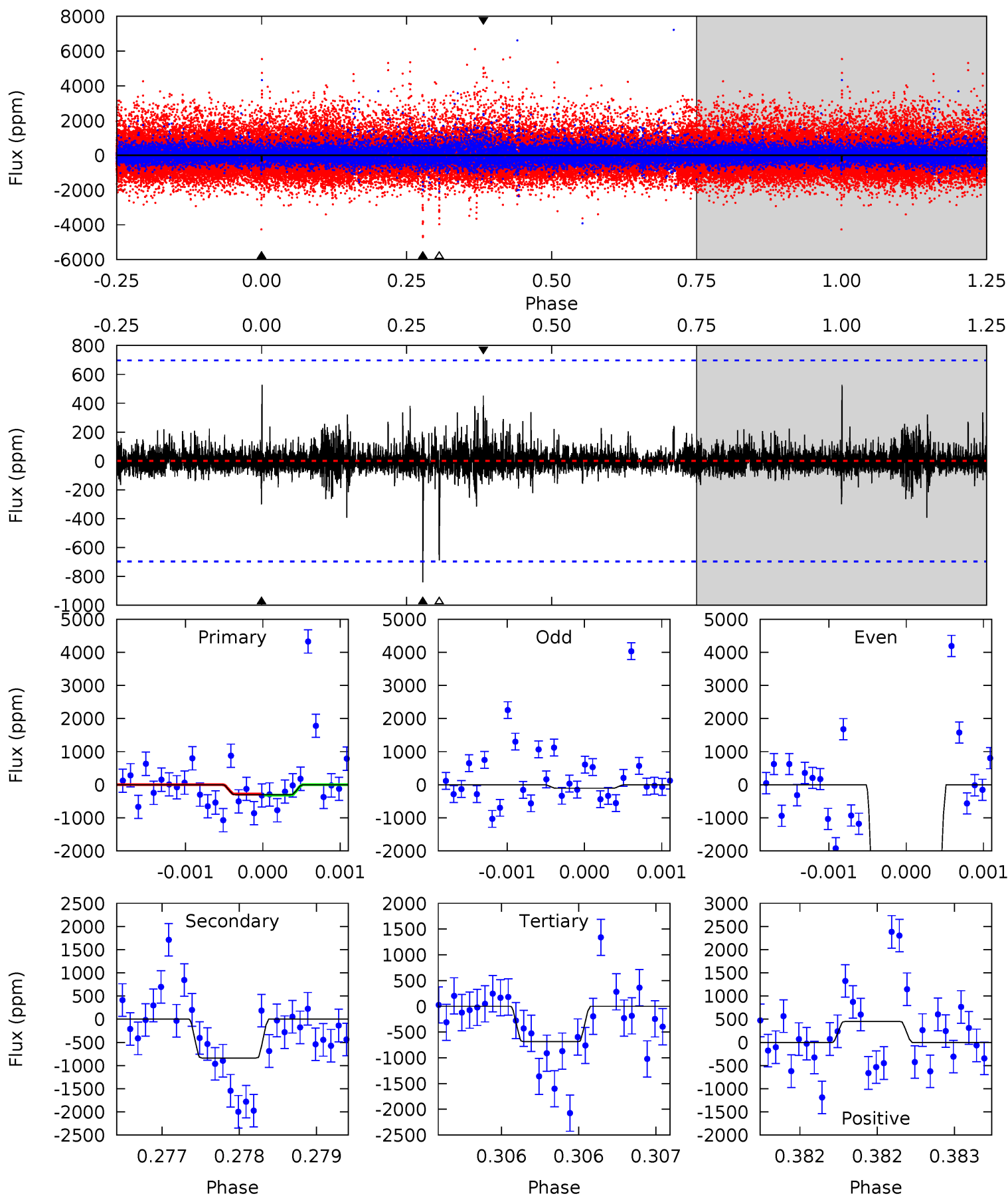
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
9.17	6.95	6.88	18.5	5.50	3.37	2.27	2.30	-9.36	0.07	-11.6	2.58	0.63	0.67	0.38



# Alt Model-Shift Uniqueness Test

011870769-04, P = 598.594329 Days, E = 301.889014 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
2.37	6.62	5.43	3.57	5.50	3.37	0.49	-3.06	-1.20	1.19	3.06	27.7	5.34	0.39	0



### Stellar Parameters For KIC 011870769

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$3522^{+63}_{-71}$	$4.848^{+0.050}_{-0.036}$	$0.000^{+0.100}_{-0.100}$	$0.400^{+0.040}_{-0.045}$	$0.411^{+0.043}_{-0.053}$	$9.054^{+2.575}_{-1.552}$
	+2%/-2%	+1%/-1%	+inf%/-inf%	+10%/-11%	+10%/-13%	+28%/-17%
Source	PHO2	PHO2	PHO2	DSEP		

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

### Secondary Eclipse Parameters for KIC 011870769-04 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-1197 \pm 172$	$2.43^{+1.74}_{-1.48}$	$134^{+4}_{-4}$	$3043^{+1080}_{-404}$	$120203^{+659537}_{-79464}$
Alt.	$-839 \pm 127$	$2.99^{+1.73}_{-1.68}$	$135^{+4}_{-4}$	$2734^{+740}_{-297}$	$52885^{+237412}_{-30930}$

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

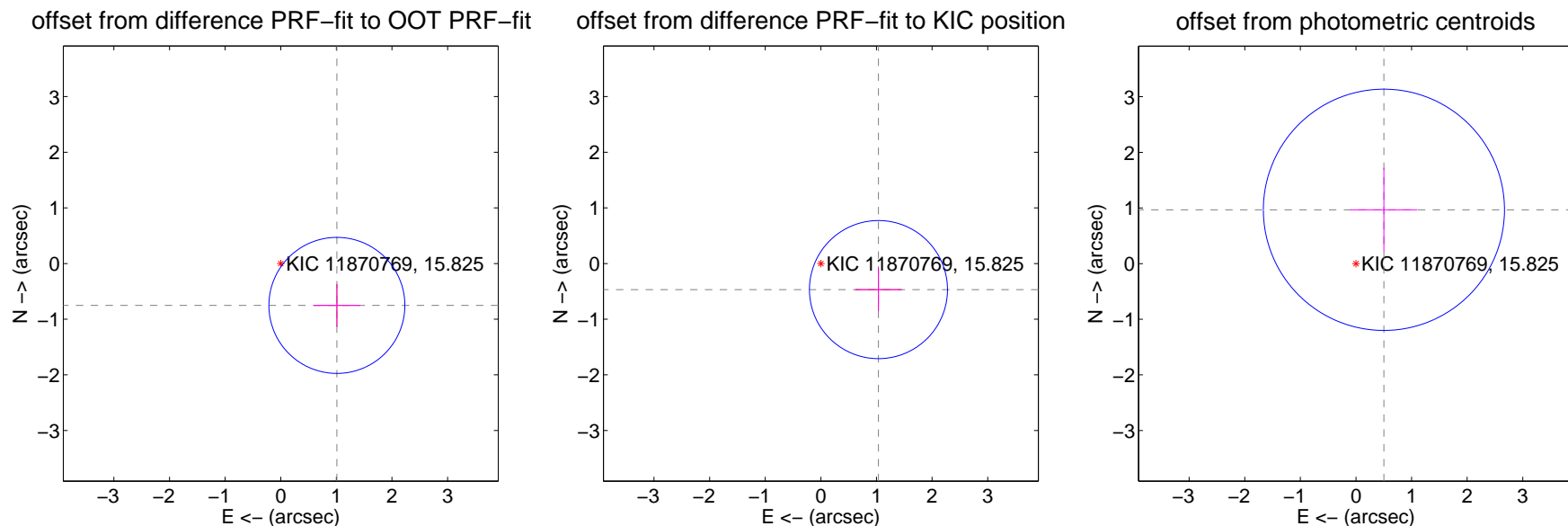
## DV Centroid Data

Supplemental centroid analysis for 011870769-04. Kepler magnitude: 15.82. Transit SNR 7.89

There are 0 quarters with good PRF difference image offsets

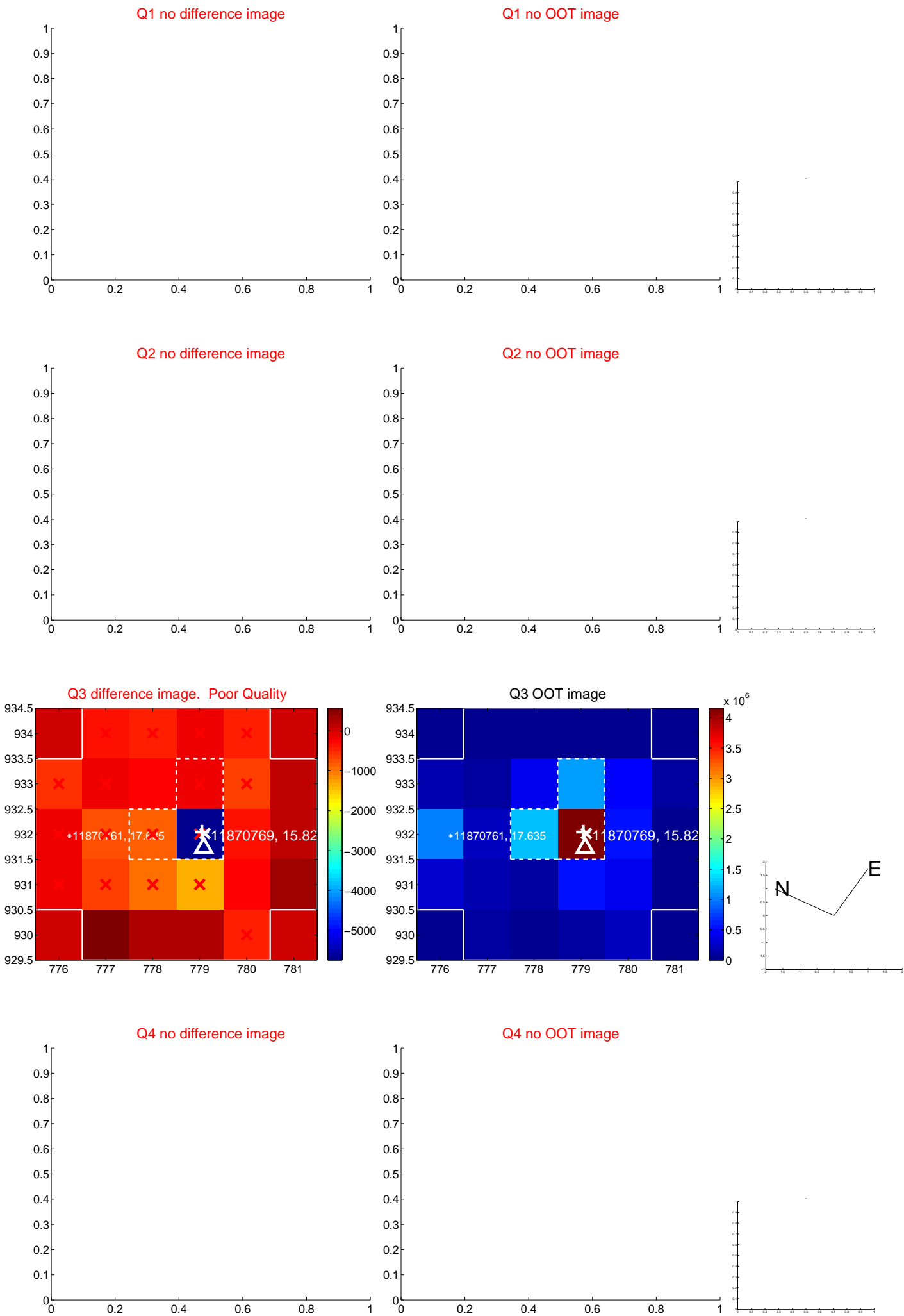
The direct PRF centroid is offset from the target star catalog position by about 0.29 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.259 \pm 0.407$	3.09	$-1.009 \pm 0.419$	$-0.752 \pm 0.385$
PRF-fit source offset from KIC position	$1.137 \pm 0.414$	2.75	$-1.036 \pm 0.419$	$-0.468 \pm 0.385$
photometric centroid source offset	$1.09 \pm 0.72$	1.51	$-0.50 \pm 0.60$	$0.97 \pm 0.75$



Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three- $\sigma$ . Red \*: target star. Blue \*: Other stars. Text next to a star gives its KIC ID and kepmag. KIC IDs > 15,000,000 are from the UKIRT catalog.

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

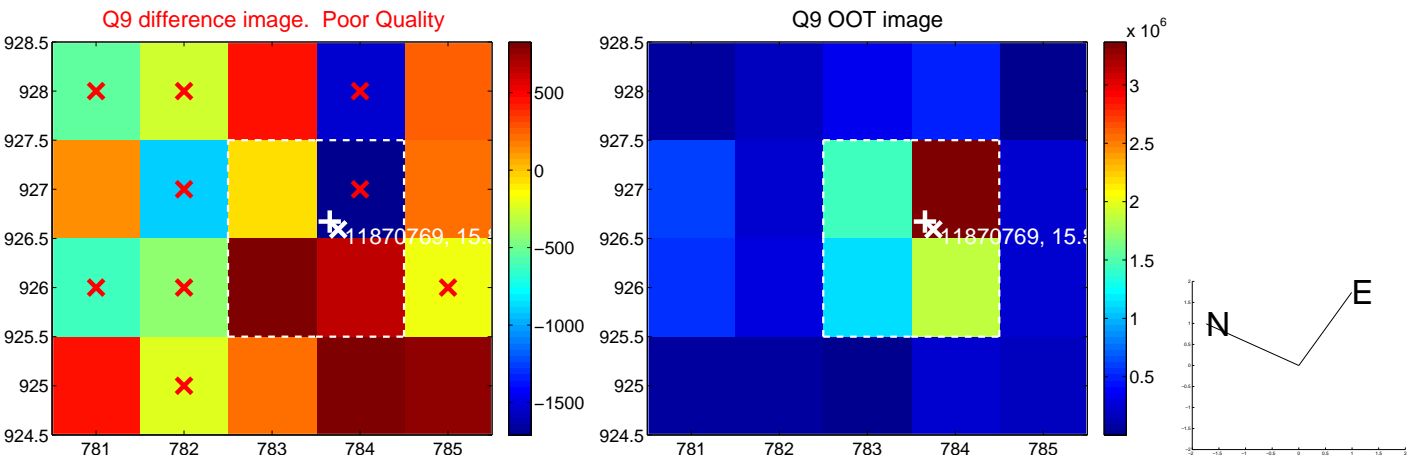




white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



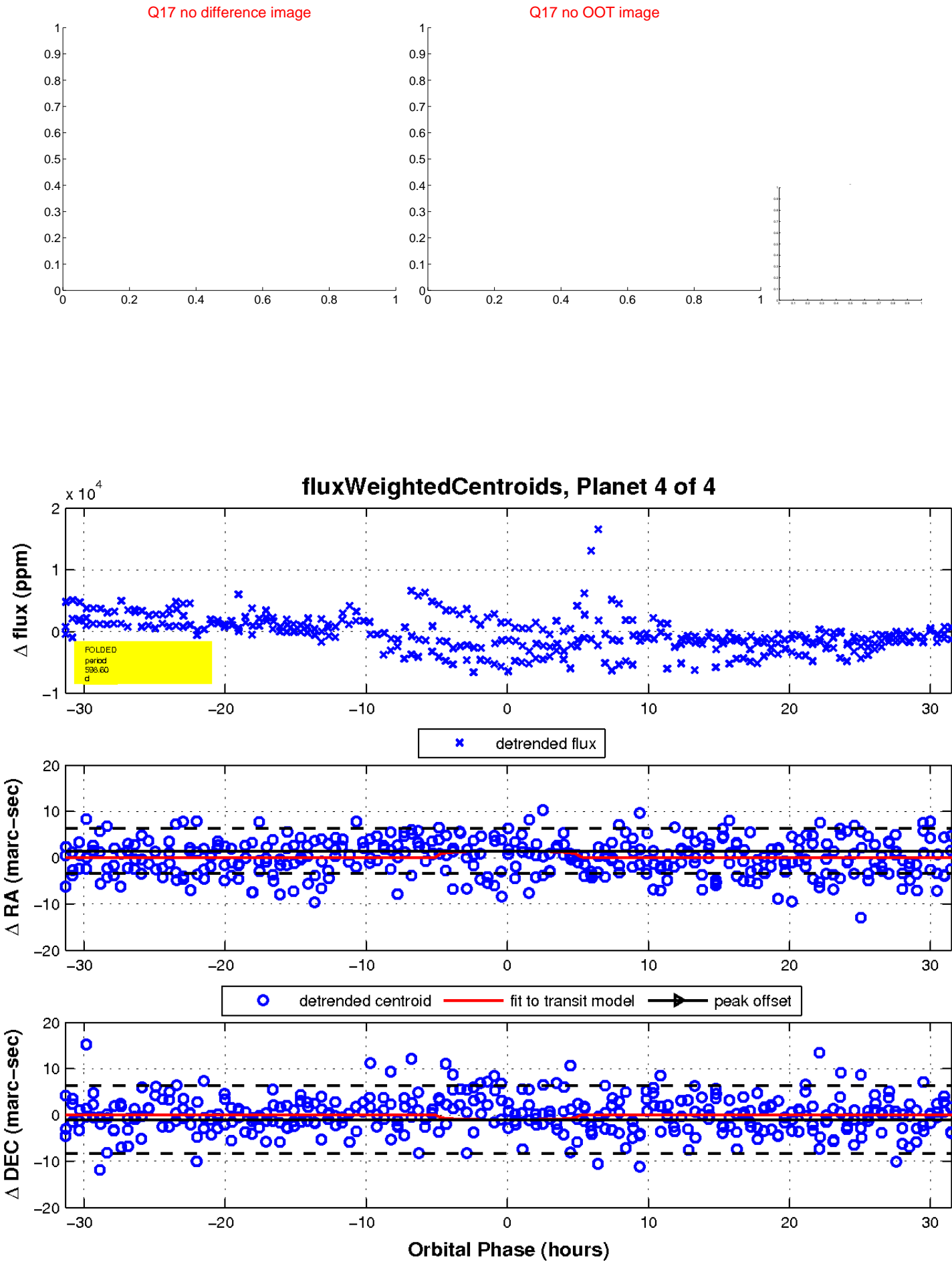
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



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



UKIRT Image

Declination

