

# KIC 004472809

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
004472809-01	OBS	No	411.497081	365.295357	666.5	6.497	11.0	7.6	2.97	8659	8.33	23.97
004472809-02	OBS	No	526.957366	139.428255	653.1	3.501	8.0	7.4	2.97	8659	8.28	17.24

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
004472809-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
004472809-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_POS_DV—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.

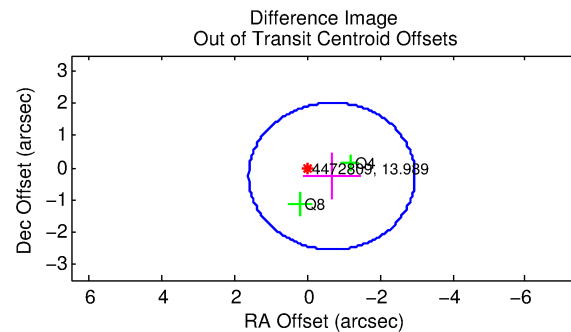
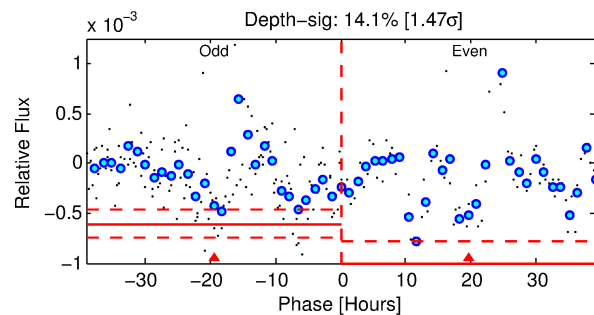
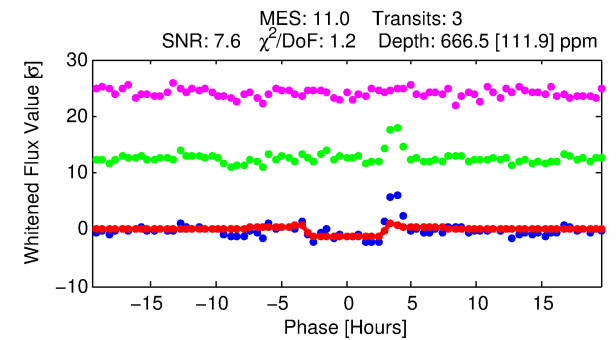
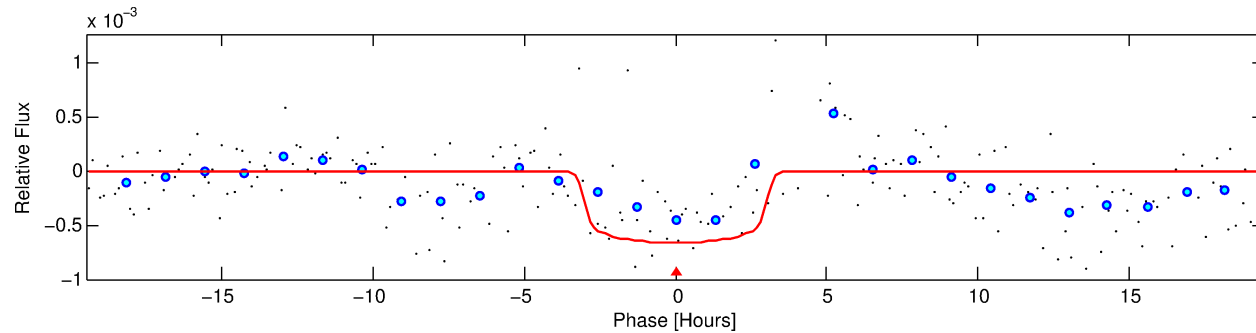
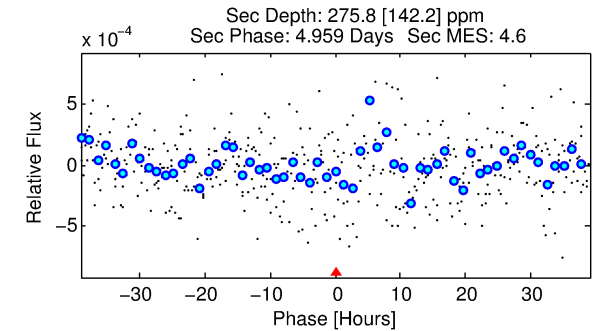
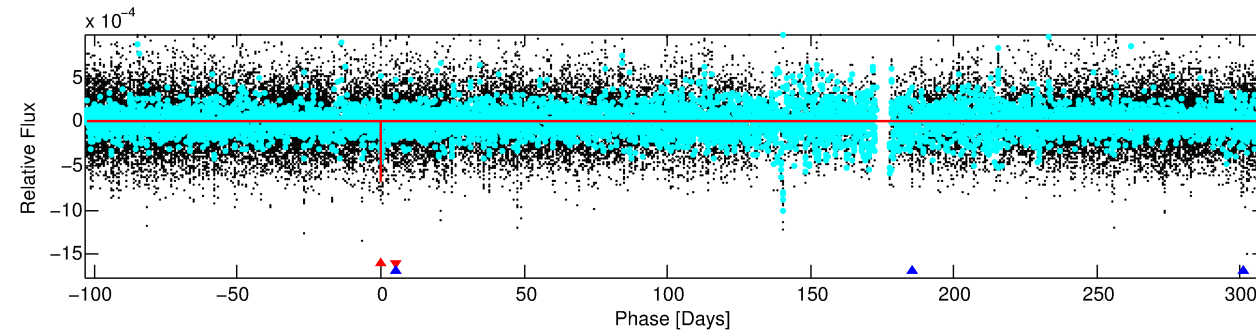
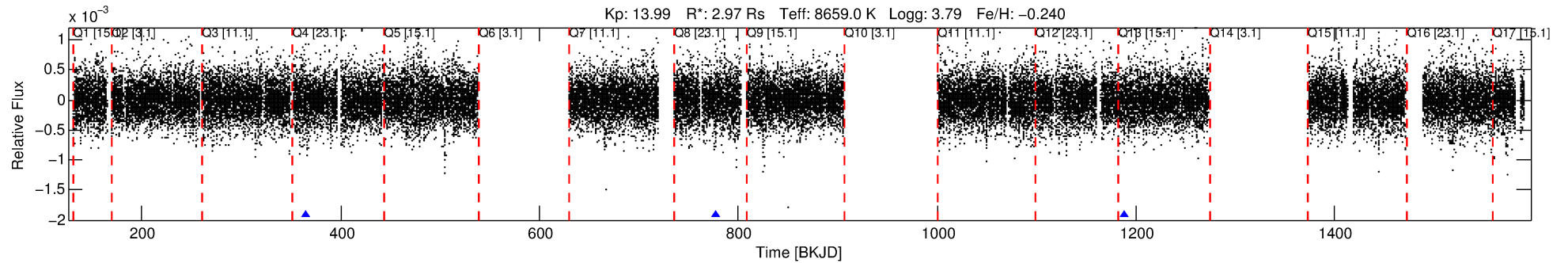
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 004472809-01

No Significant Match Found

# DV One-Page Summary

KIC: 4472809 Candidate: 1 of 2 Period: 411.497 d



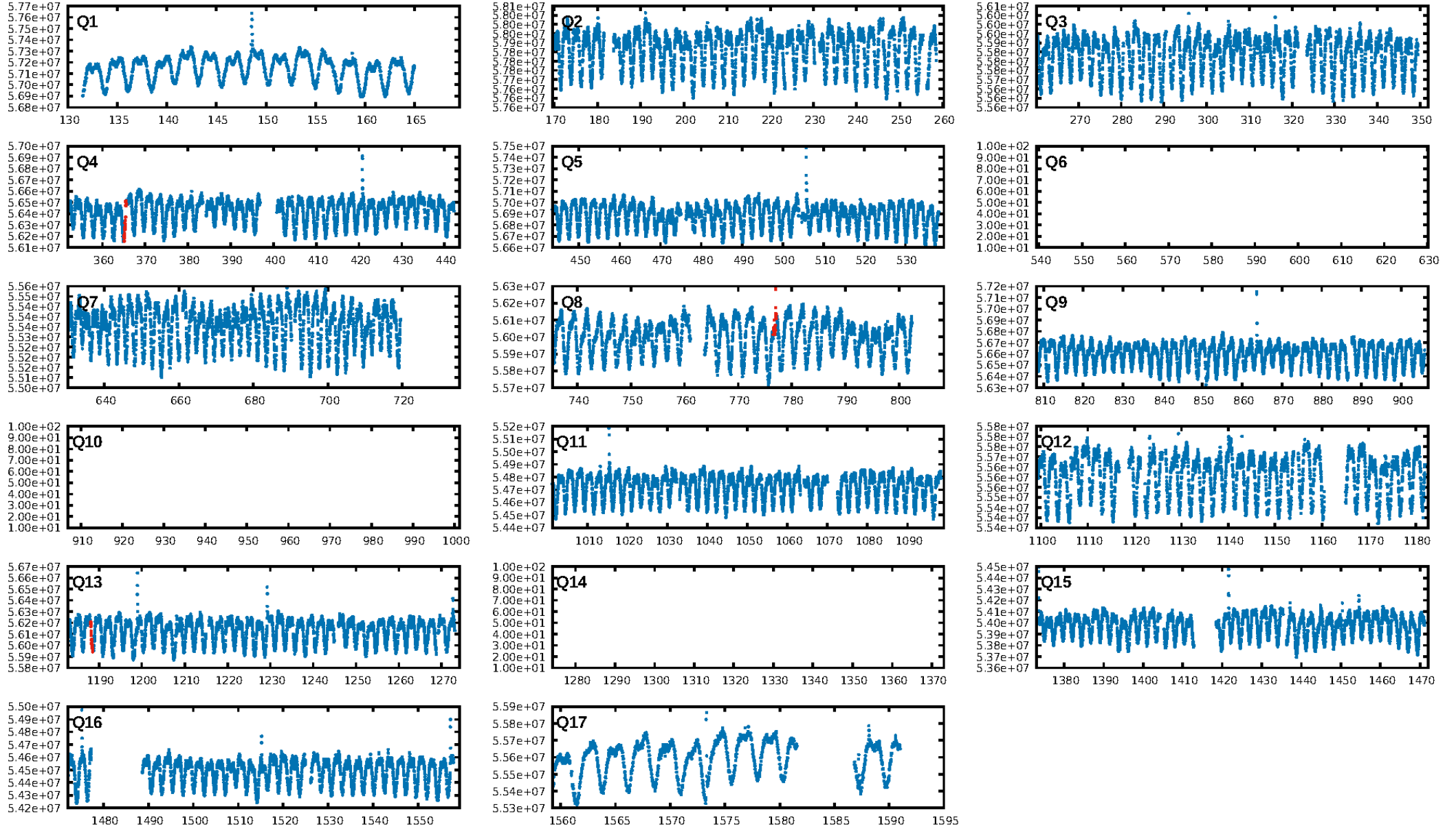
## DV Fit Results:

Period = 411.49708 [0.00724] d  
Epoch = 365.2954 [0.0091] BKJD  
Rp/R\* = 0.0257 [0.0074]  
a/R\* = 340.63 [554.37]  
b = 0.75 [0.98]  
Seff = 23.97 [16.68]  
Teq = 564 [98] K  
Rp = 8.33 [4.29] Re  
a = 1.3627 [0.5679] AU  
Ag = 4062.12 [4162.40] [0.98σ]  
Teffp = 6964 [1381] K [4.62σ]

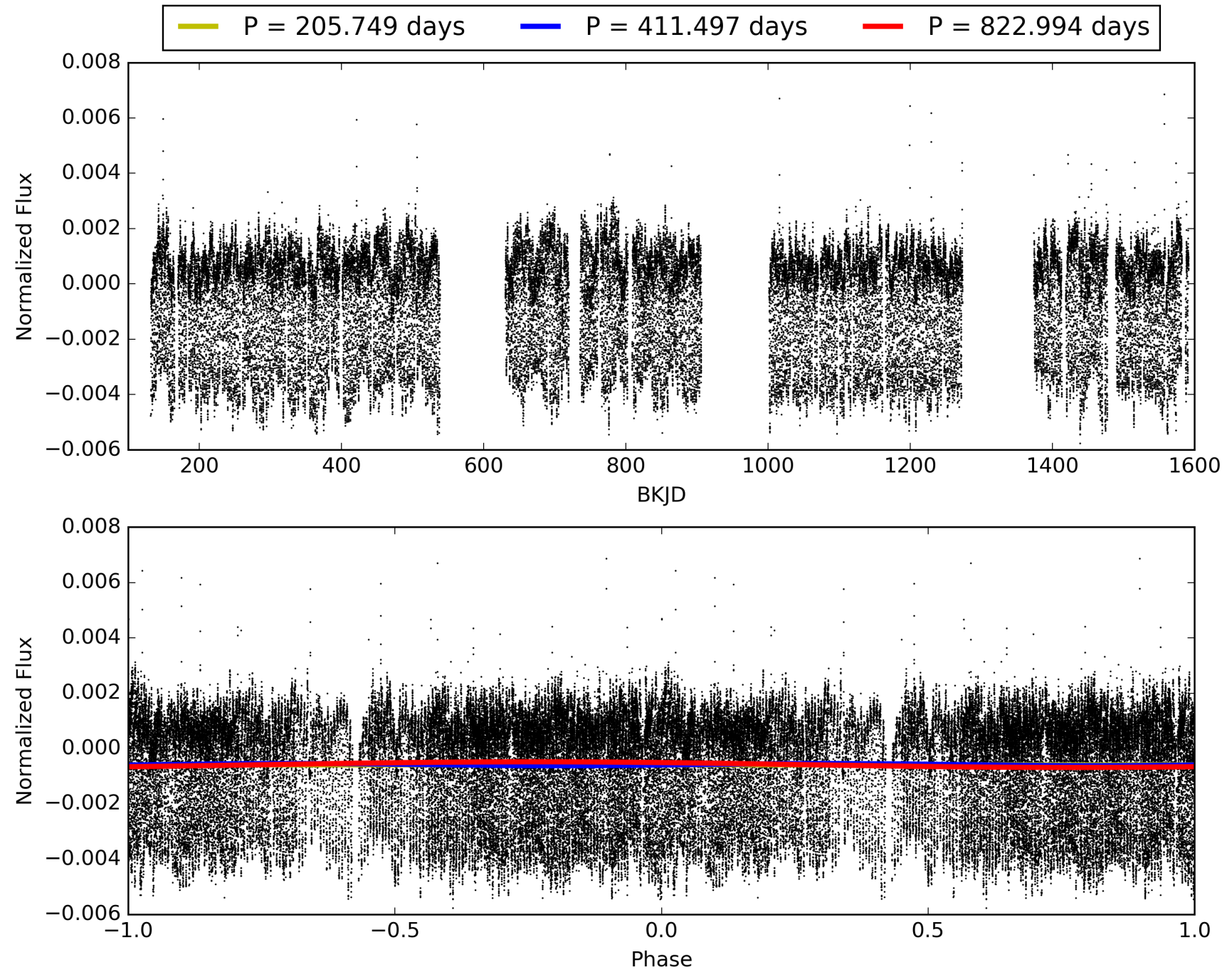
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [375.49σ]  
ModelChiSquare2-sig: 1.7%  
ModelChiSquareGof-sig: 85.3%  
Bootstrap-pfa: 1.25e-14  
RollingBand-fgt: 1.00 [3/3]  
**GhostDiagnostic-chr: 0.8404**  
Centroid-sig: 18.1%  
Centroid-so: 0.904 arcsec [1.14σ]  
OotOffset-rm: 0.727 arcsec [0.95σ]  
OotOffset-st: 0/0/2/0 [2]  
KicOffset-rm: 0.783 arcsec [1.00σ]  
KicOffset-st: 0/0/2/0 [2]  
DiffImageQuality-fgm: 1.00 [2/2]  
DiffImageOverlap-fno: 1.00 [2/2]

# TCE 004472809-01, PDC Light Curves

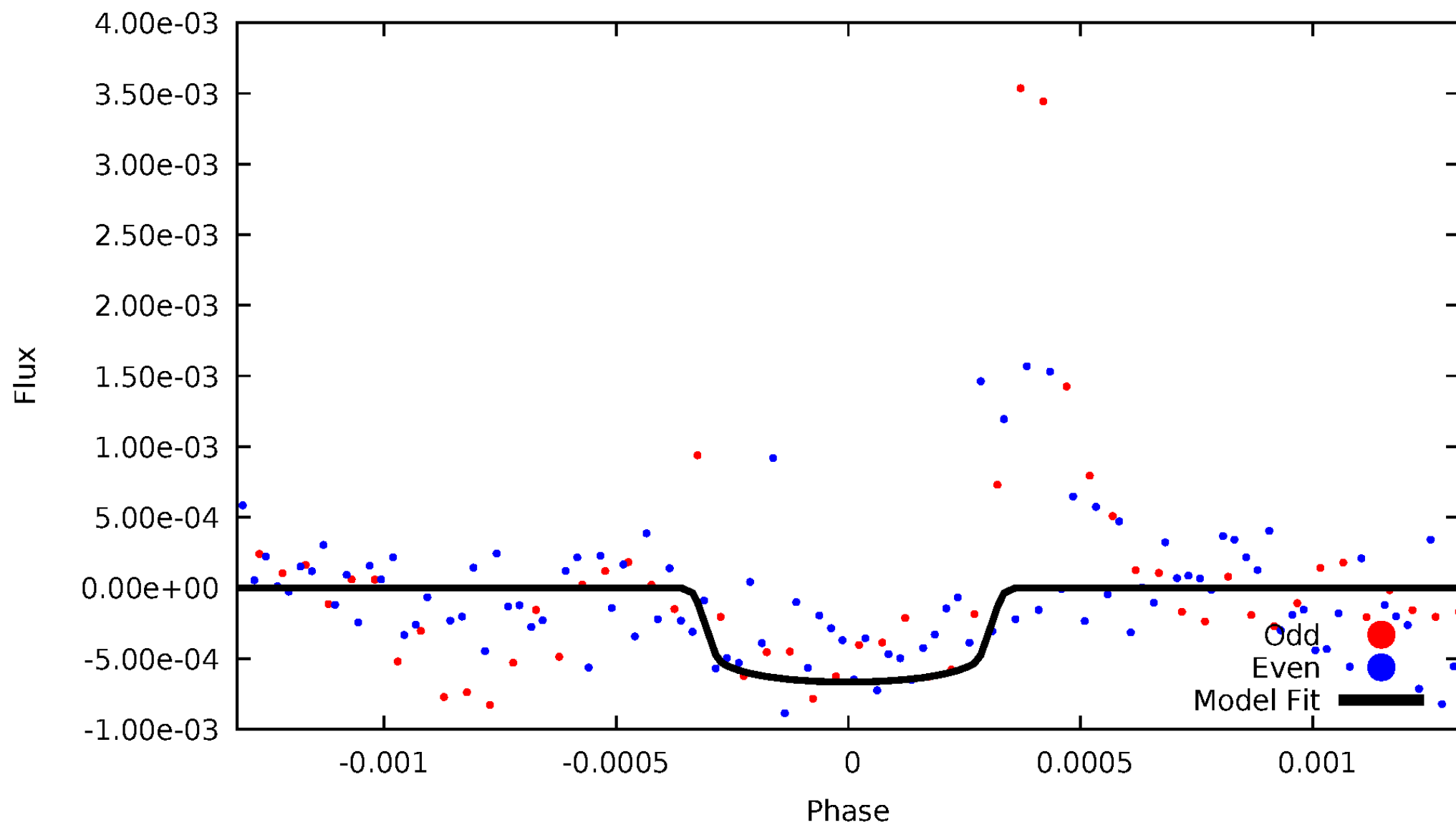


# TCE 004472809-01



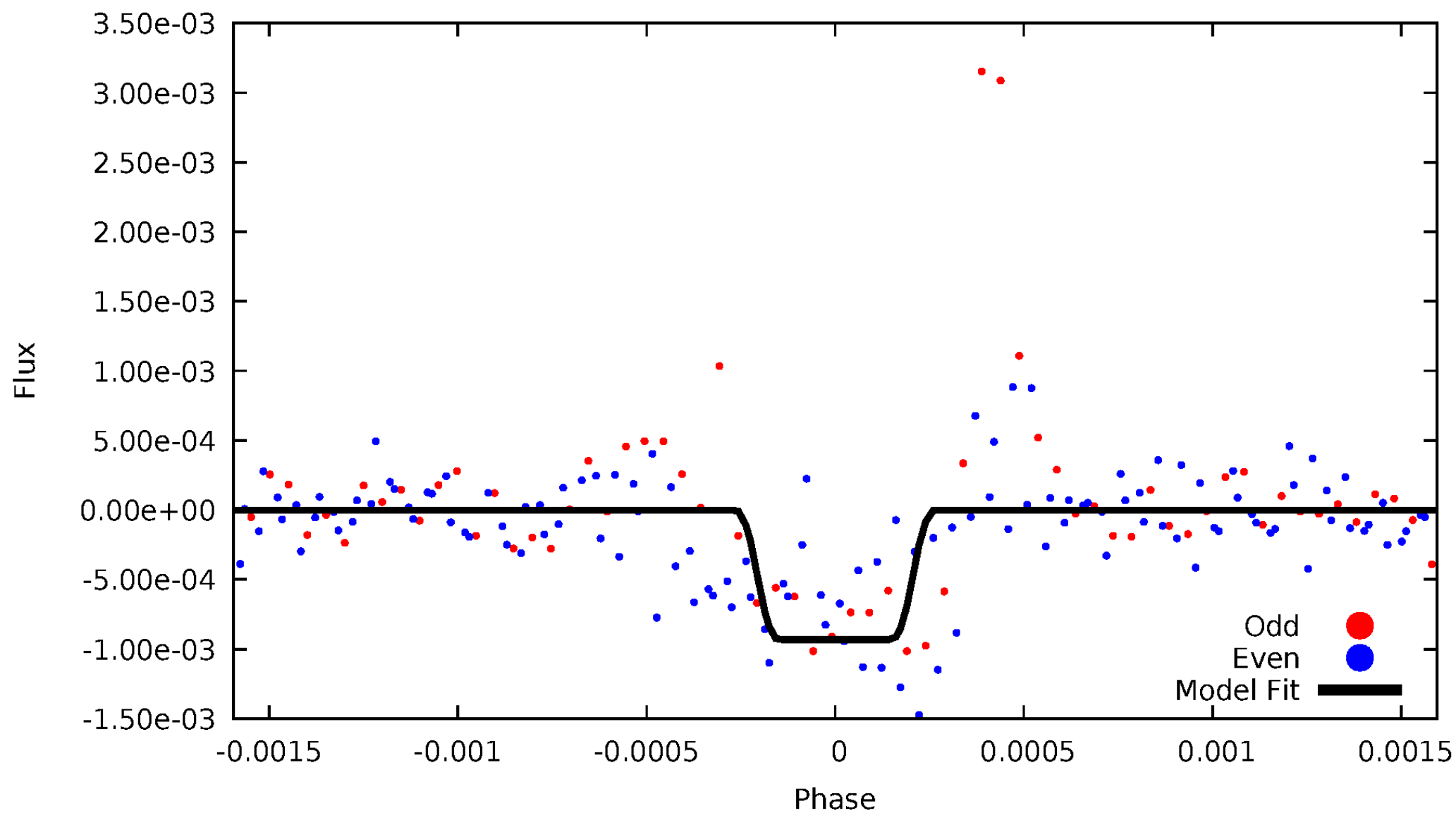
# DV Odd/Even

TCE 004472809-01

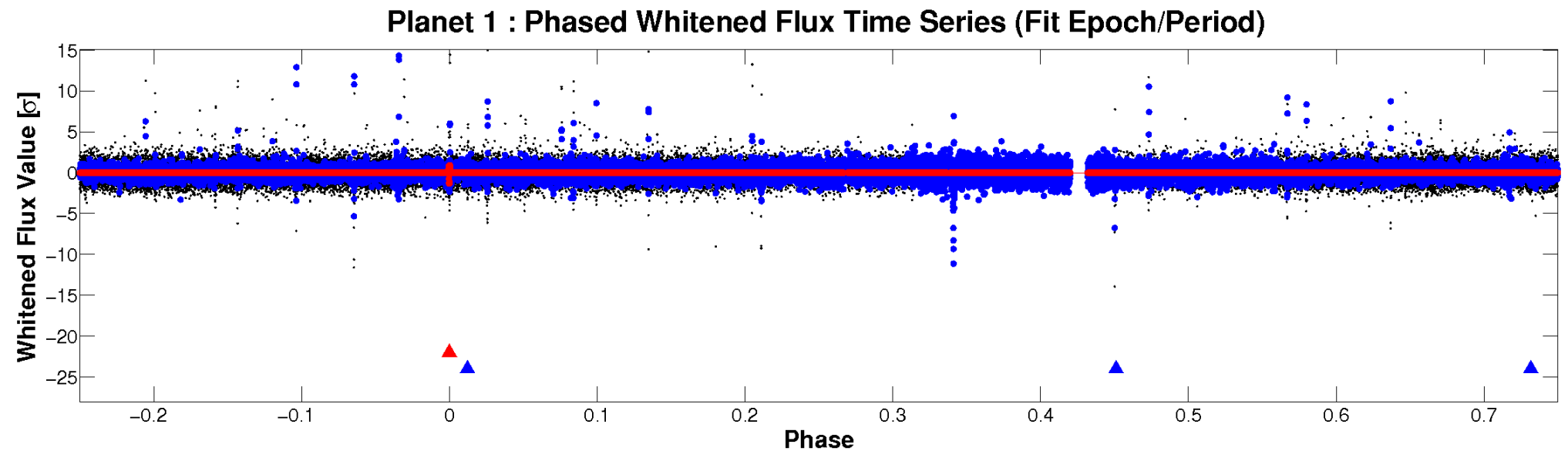
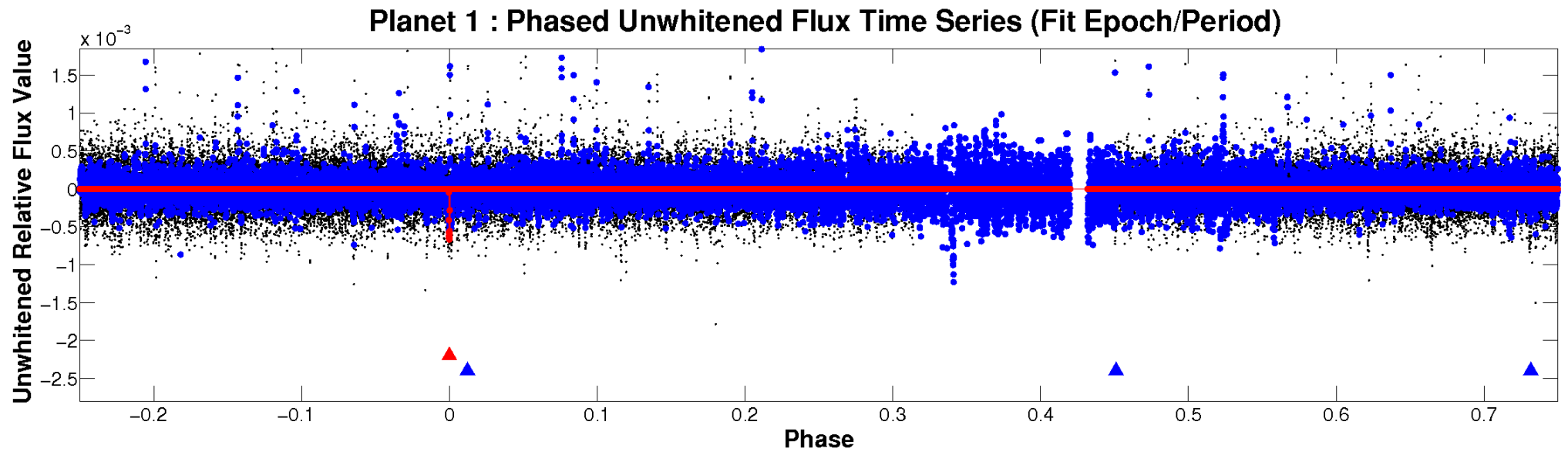


# ALT Odd/Even

TCE 004472809-01

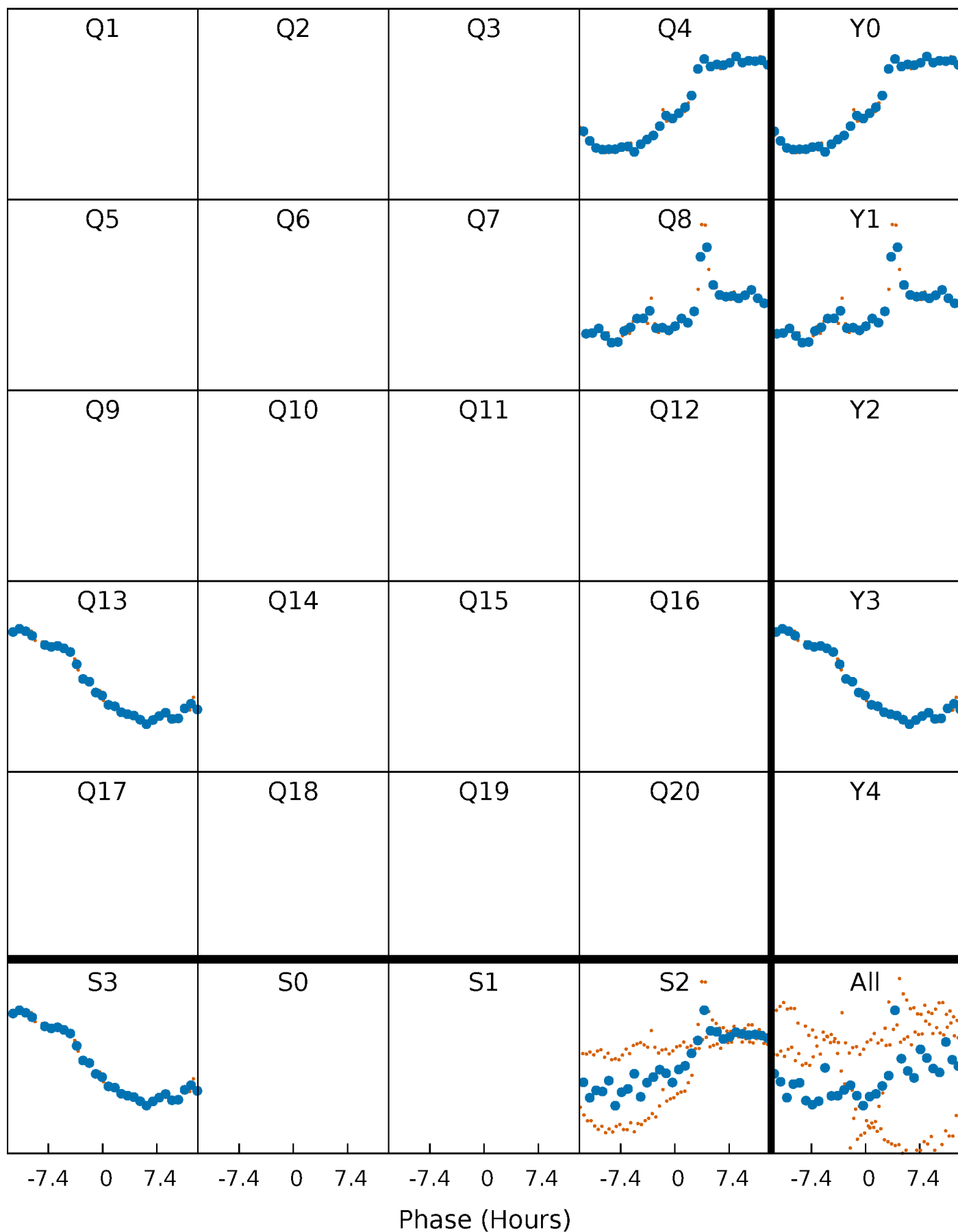


# Non-Whitened Vs. Whitened Light Curve



# PDC Quarter-Phased Transit Curves

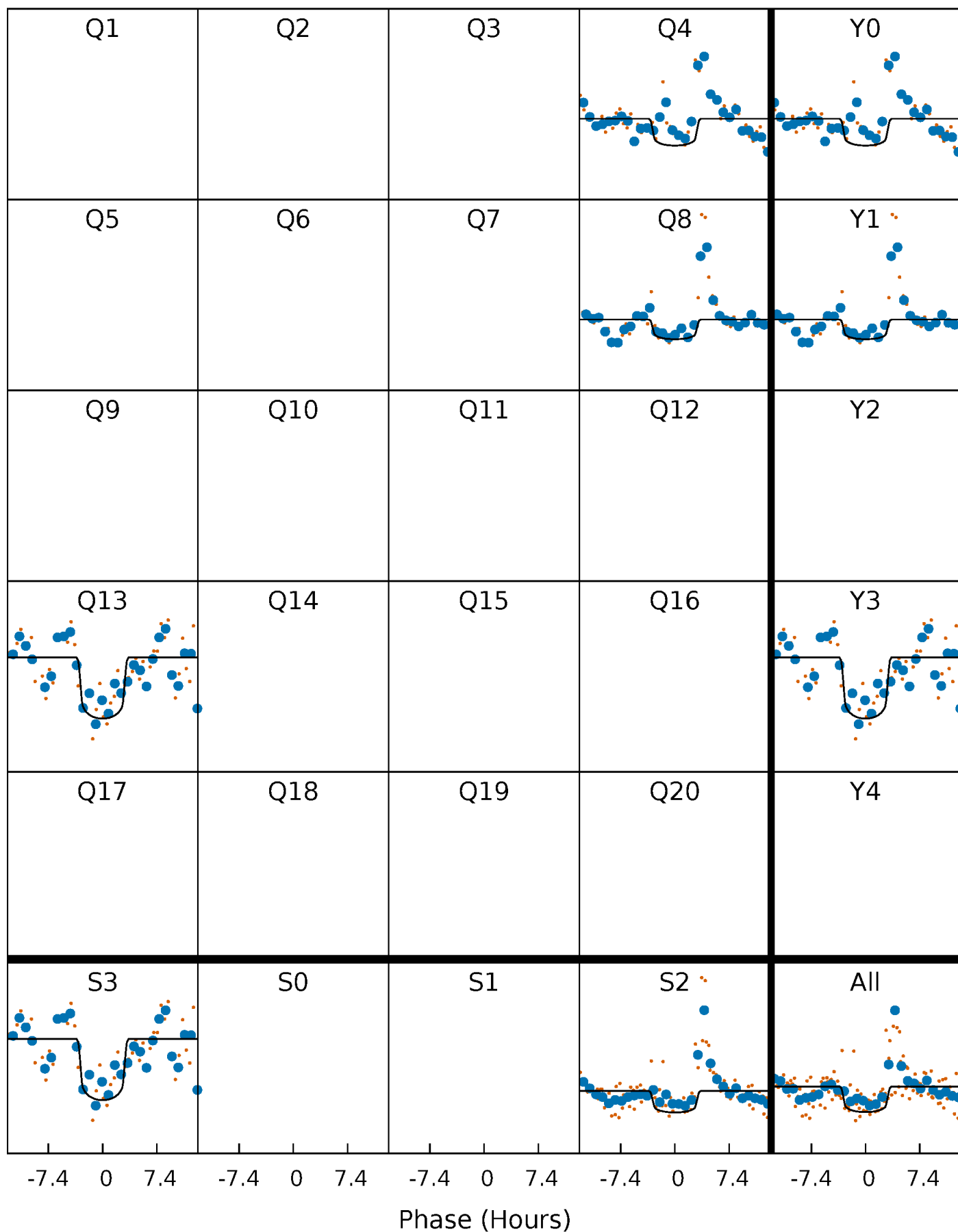
TCE 004472809-01 P=411.497081 Days  $T_0=365.295357$  (BKJD)





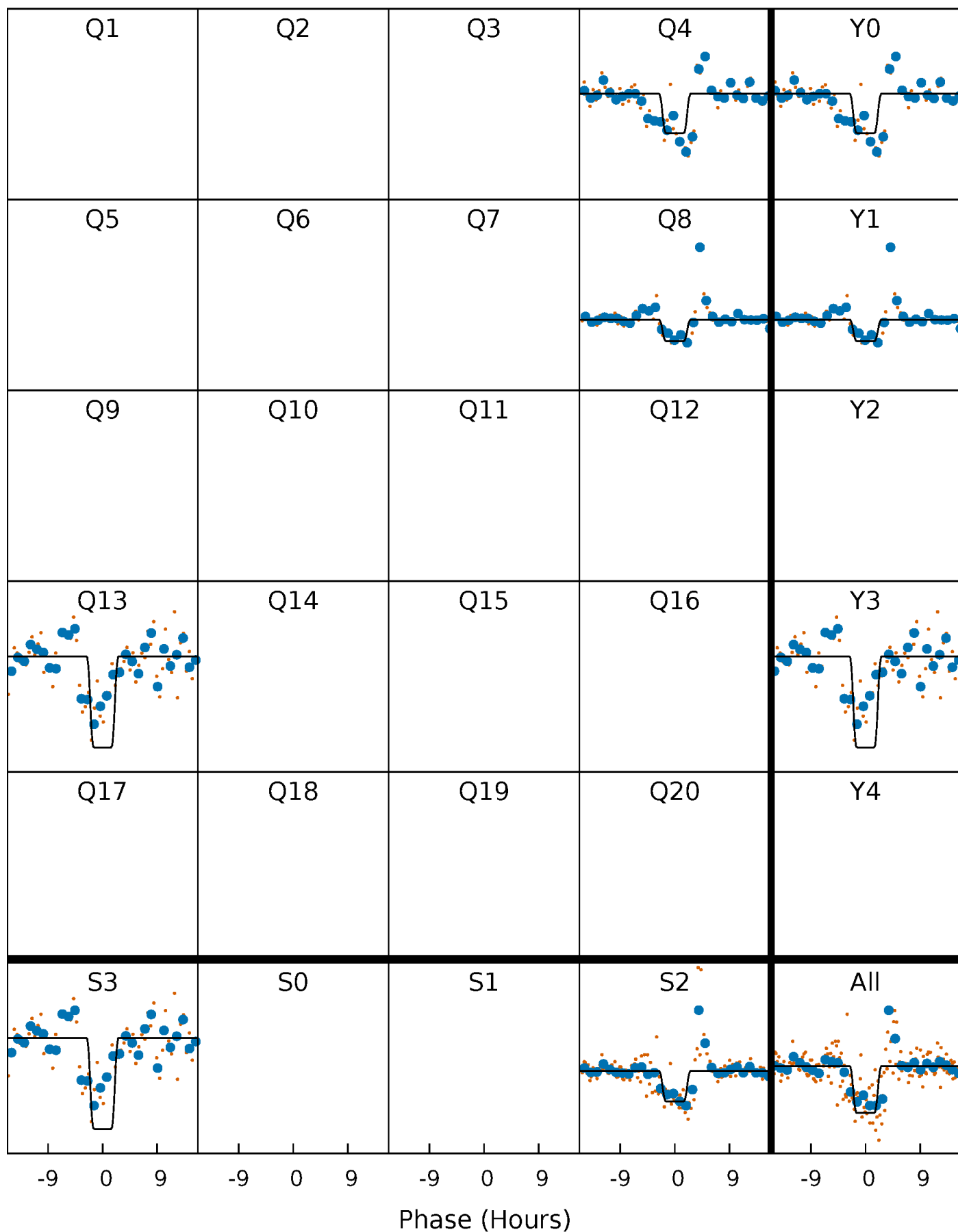
# DV Quarter-Phased Transit Curves

TCE 004472809-01 P=411.497081 Days  $T_0=365.295357$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

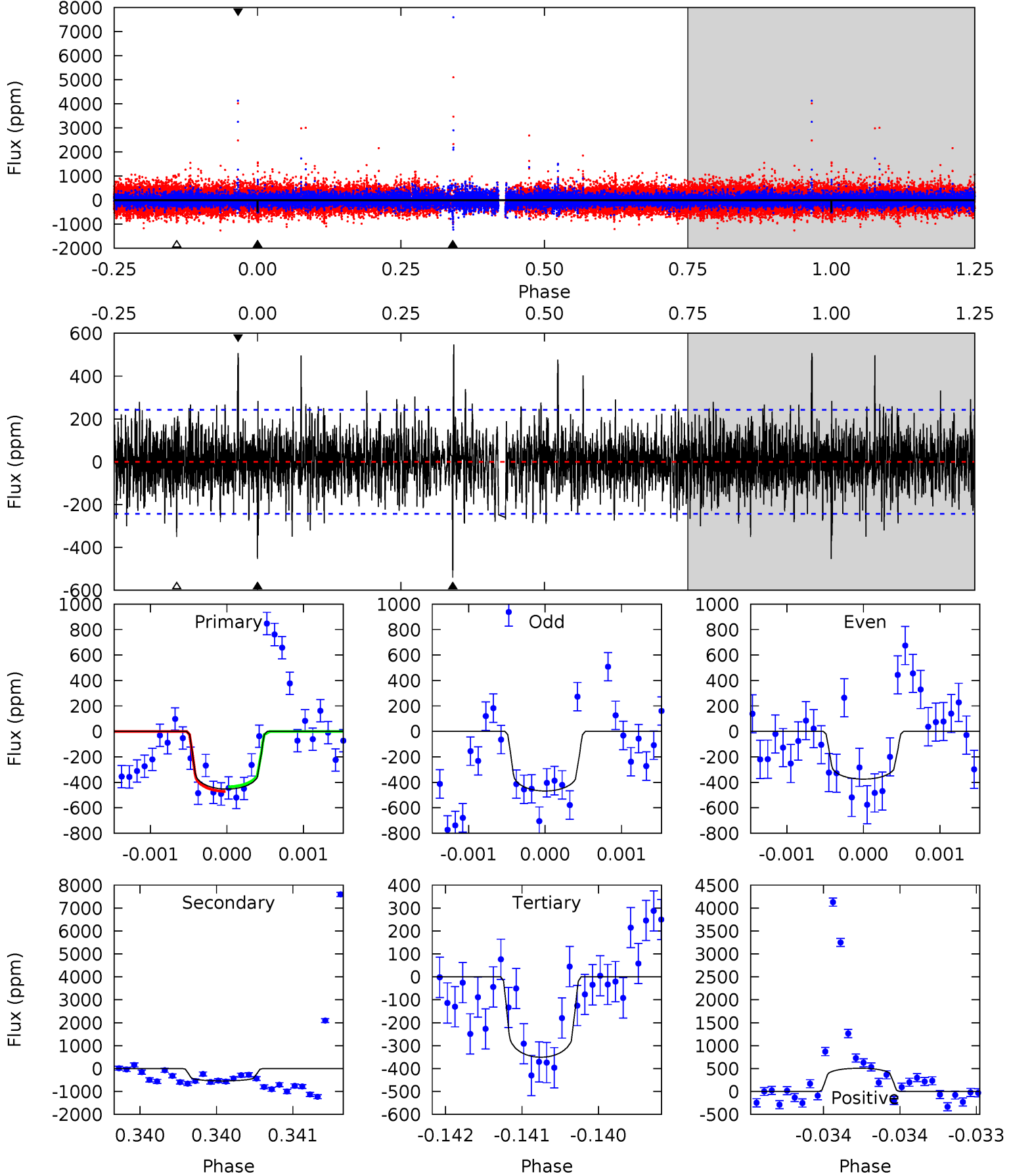
TCE 004472809-01 P=411.525087 Days  $T_0=365.259939$  (BKJD)



# DV Model-Shift Uniqueness Test

004472809-01, P = 411.497081 Days, E = 365.295357 Days

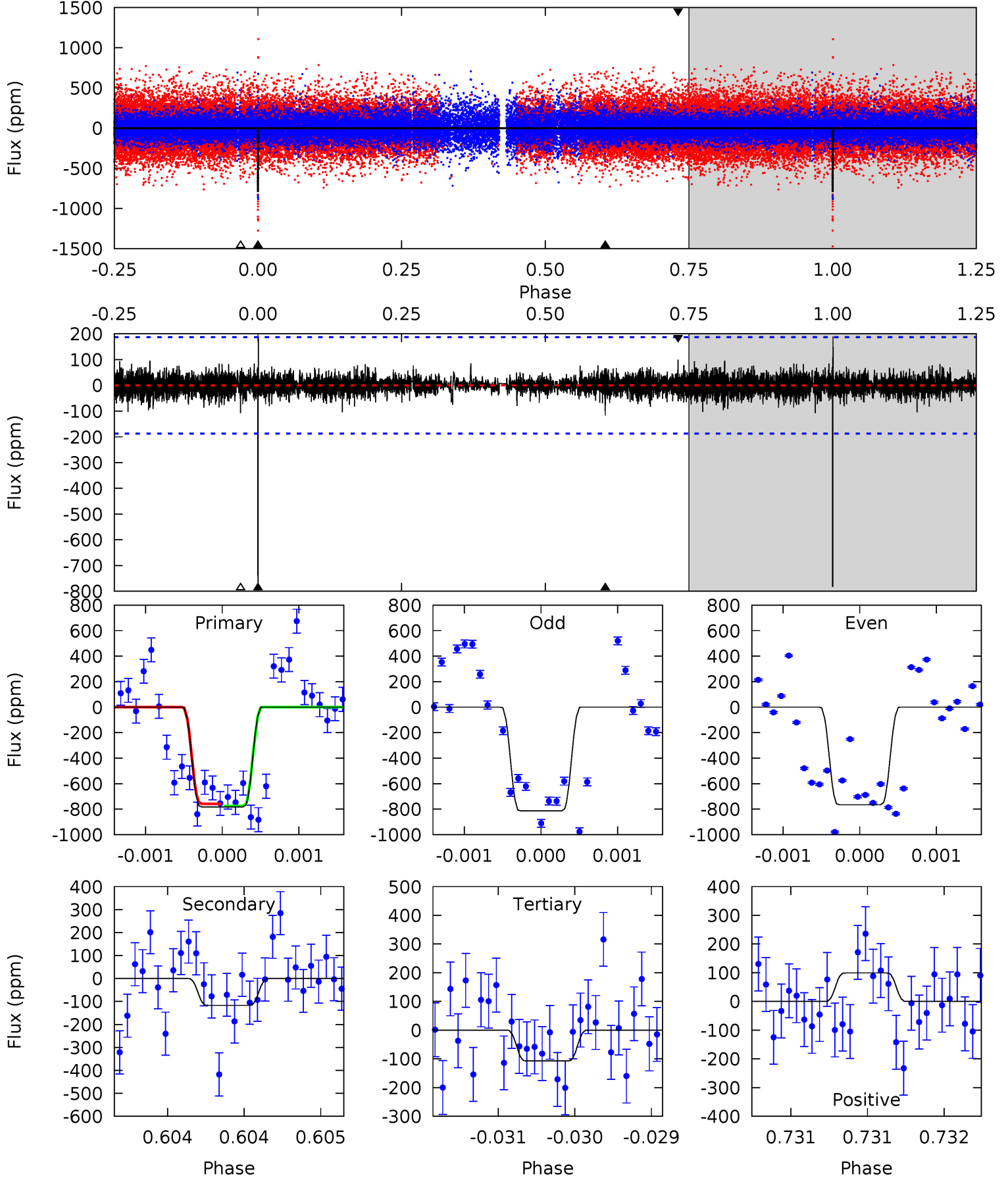
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
10.3	12.3	7.97	11.5	5.52	3.40	2.16	2.32	-1.22	4.31	0.77	0.90	0.78	0.50	0.41



# Alt Model-Shift Uniqueness Test

004472809-01, P = 411.525087 Days, E = 365.259939 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
23.3	3.48	3.19	2.95	5.57	3.47	0.71	20.1	20.3	0.29	0.53	0.67	0.91	0.20	0.25



### Stellar Parameters For KIC 004472809

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$8659^{+237}_{-385}$	$3.791^{+0.397}_{-0.106}$	$-0.240^{+0.350}_{-0.350}$	$2.973^{+0.740}_{-1.268}$	$1.994^{+0.382}_{-0.466}$	$0.107^{+0.369}_{-0.041}$
	+3%/-4%	+10%/-3%	+146%/-146%	+25%/-43%	+19%/-23%	+345%/-38%
Source	KIC0	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 004472809-01 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	$-540 \pm 44$	$7.76^{+2.91}_{-2.76}$	$758^{+59}_{-83}$	$8026^{+2124}_{-1130}$	$9404^{+12028}_{-4382}$
Alt.	$-117 \pm 34$	$9.20^{+2.96}_{-2.90}$	$756^{+62}_{-84}$	$4934^{+783}_{-545}$	$1414^{+1723}_{-716}$

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

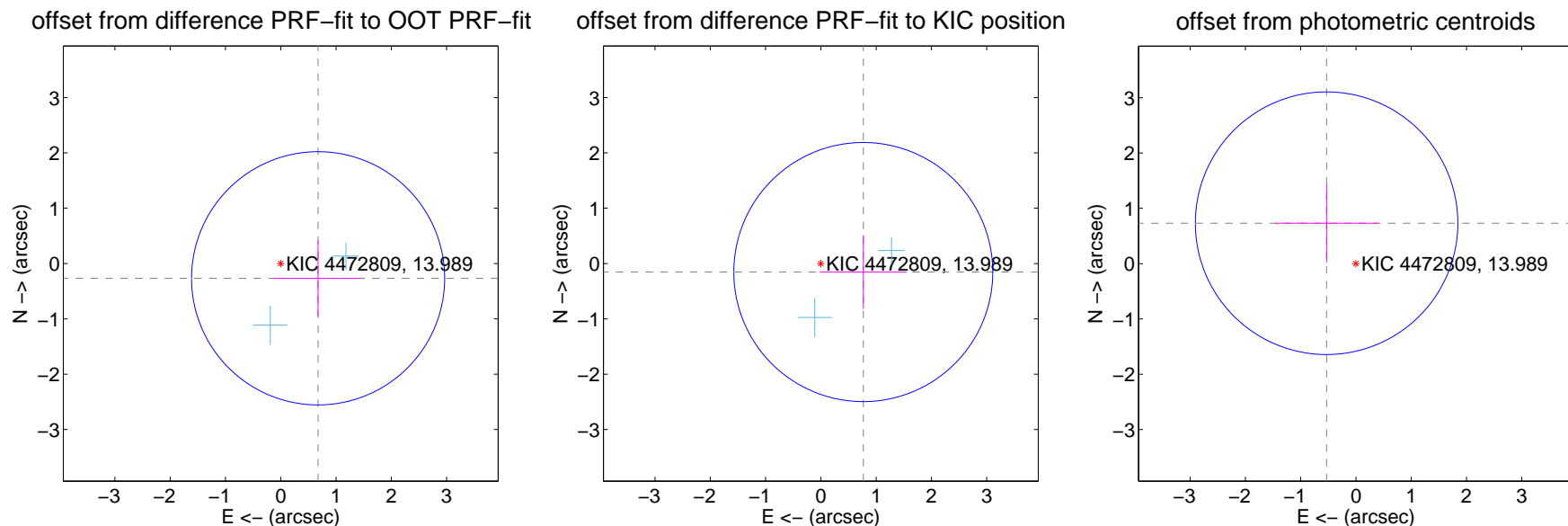
## DV Centroid Data

Supplemental centroid analysis for 004472809-01. Kepler magnitude: 13.99. Transit SNR 7.56

There are 2 quarters with good PRF difference image offsets

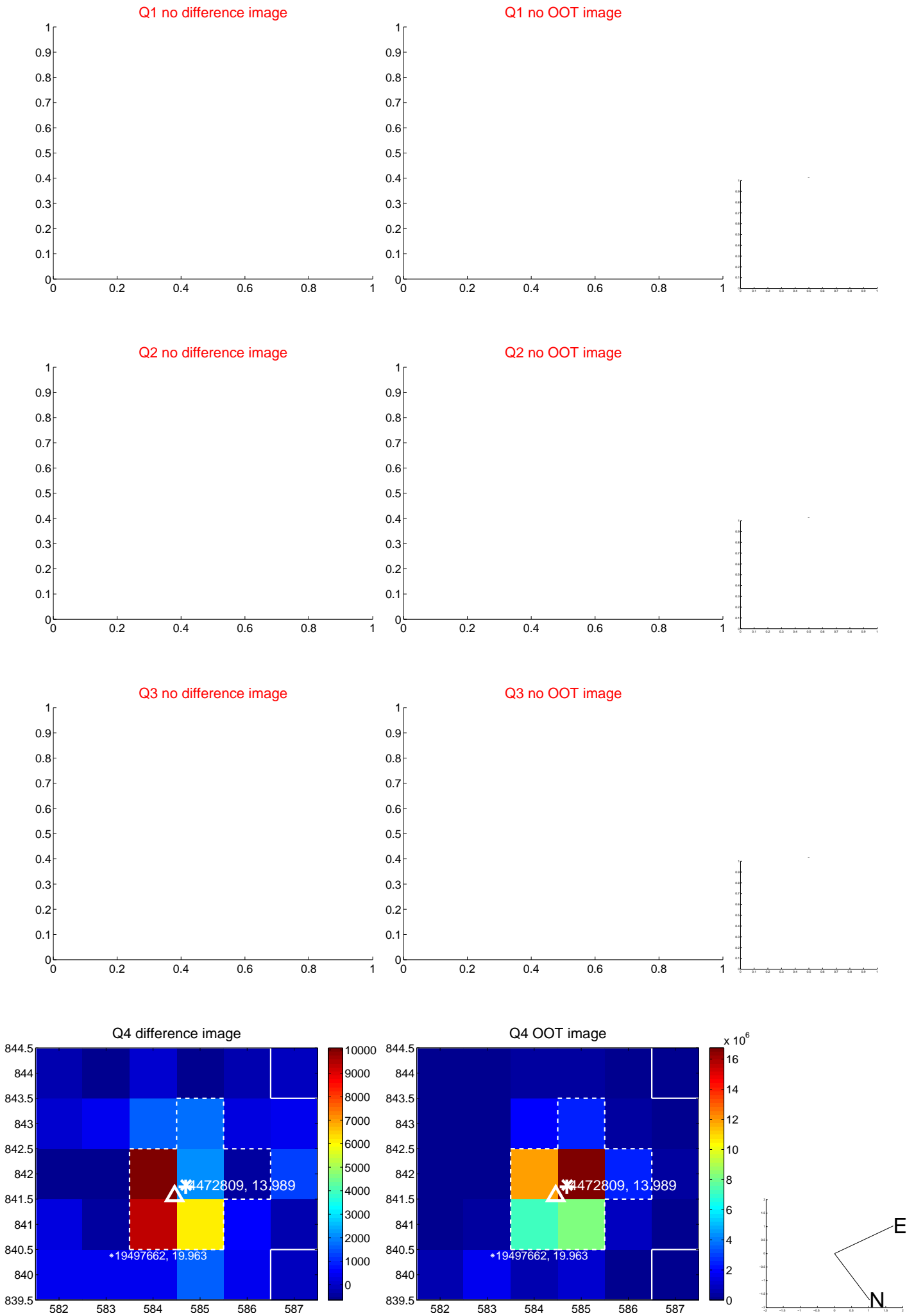
The direct PRF centroid is offset from the target star catalog position by about 0.16 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.727 \pm 0.763$	0.95	$-0.676 \pm 0.775$	$-0.267 \pm 0.685$
PRF-fit source offset from KIC position	$0.783 \pm 0.781$	1.00	$-0.767 \pm 0.785$	$-0.154 \pm 0.664$
photometric centroid source offset	$0.90 \pm 0.79$	1.14	$0.53 \pm 0.93$	$0.73 \pm 0.71$



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

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



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

Q5 no difference image



Q5 no OOT image



Q6 no difference image



Q6 no OOT image



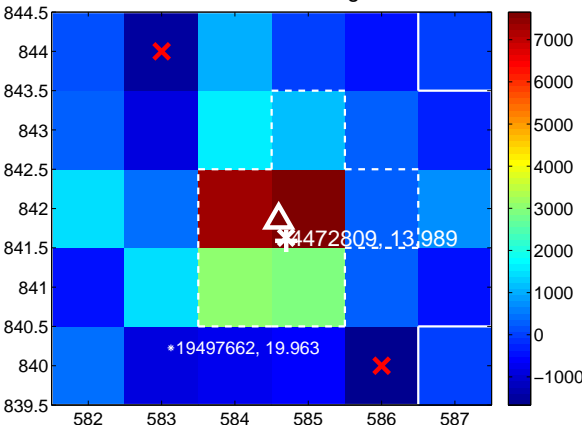
Q7 no difference image



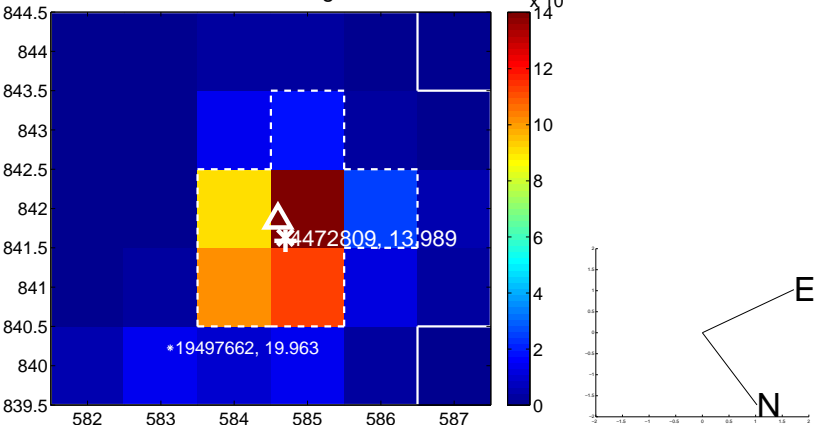
Q7 no OOT image



Q8 difference image



Q8 OOT image





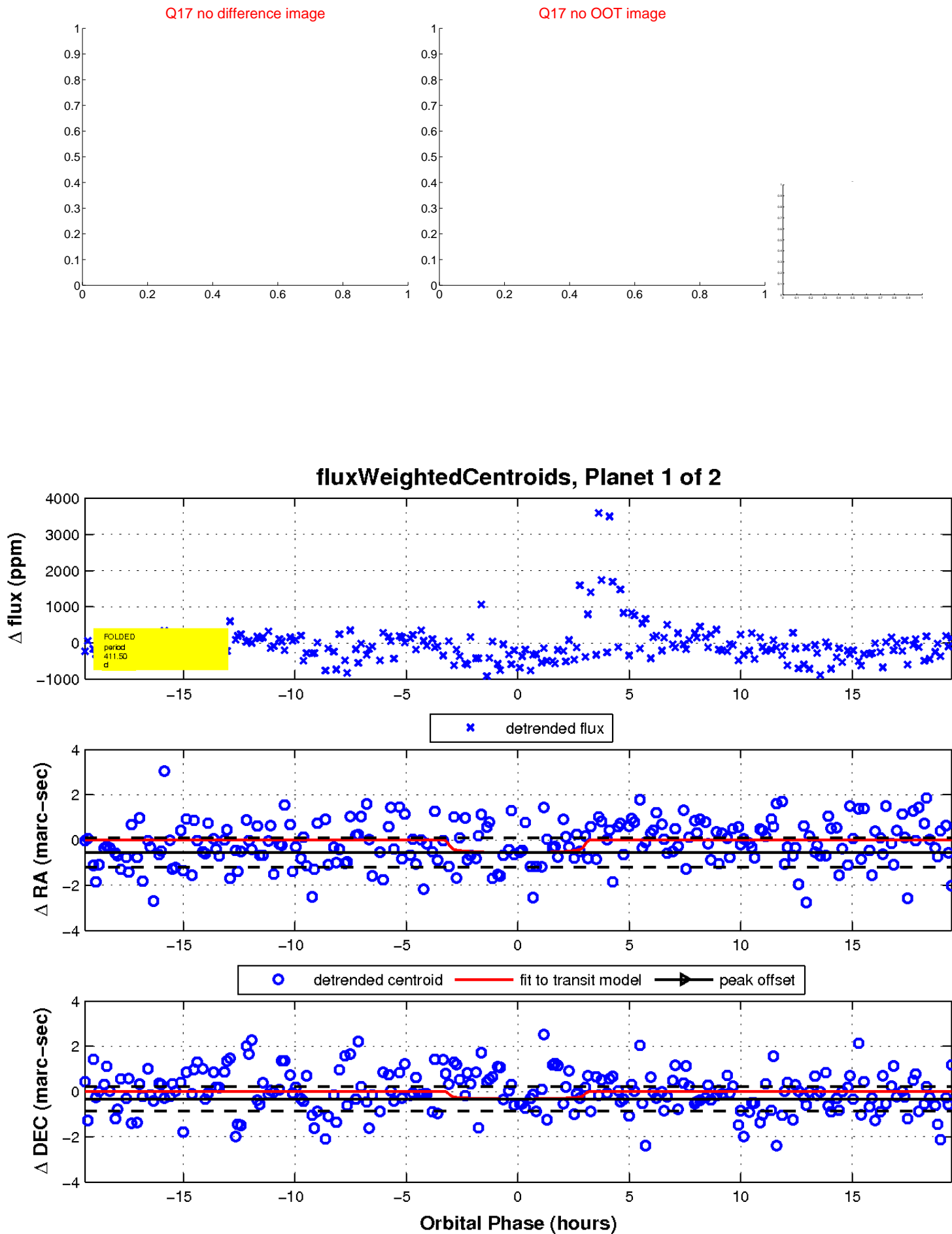
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

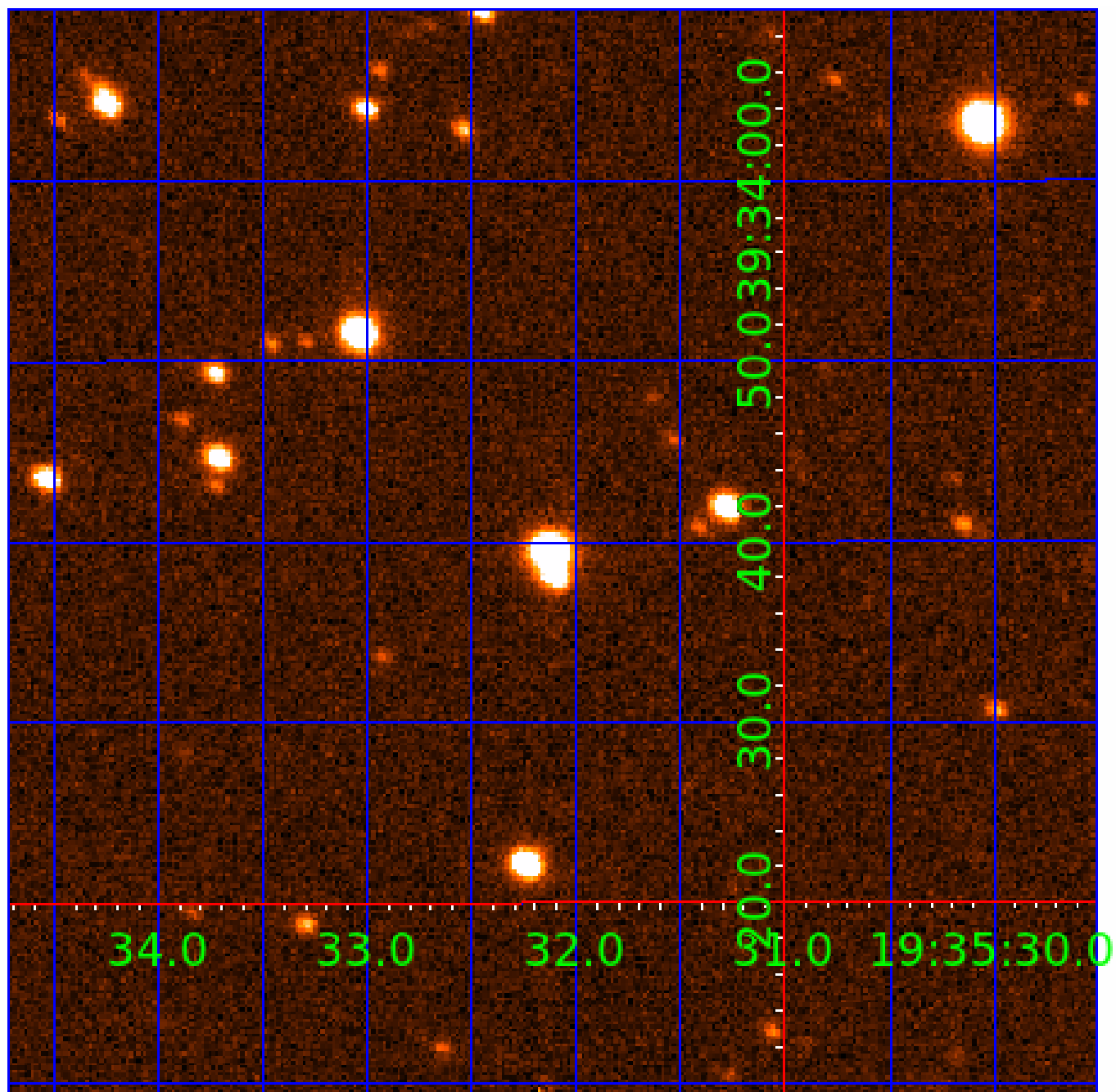


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 004472809

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
004472809-01	OBS	No	411.497081	365.295357	666.5	6.497	11.0	7.6	2.97	8659	8.33	23.97
004472809-02	OBS	No	526.957366	139.428255	653.1	3.501	8.0	7.4	2.97	8659	8.28	17.24

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
004472809-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
004472809-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_POS_DV—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.

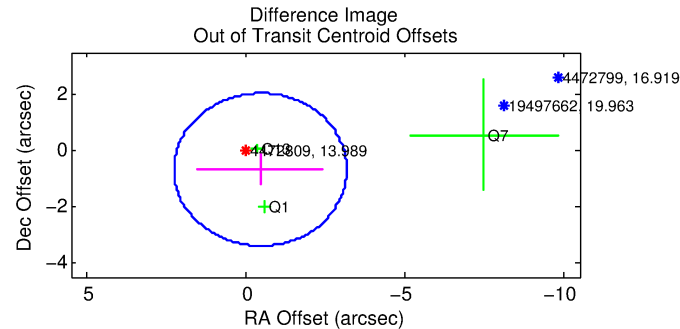
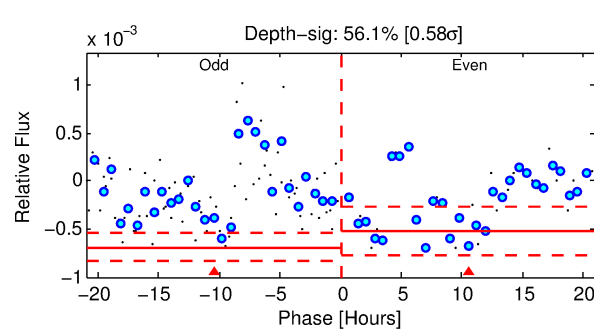
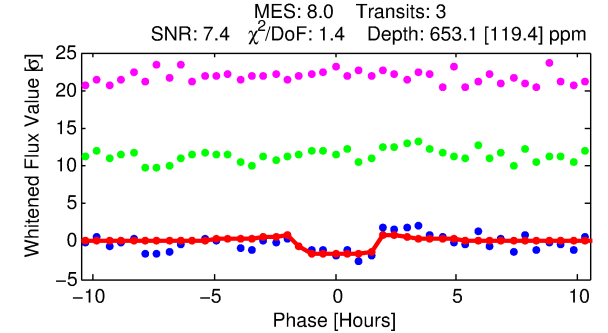
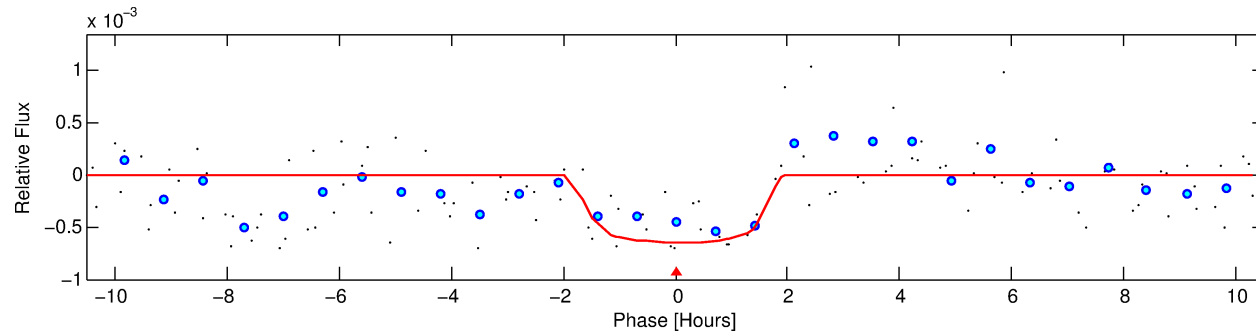
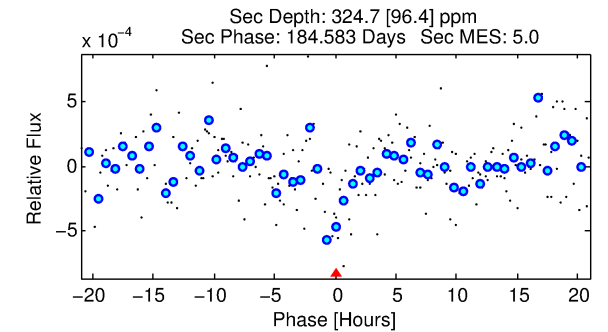
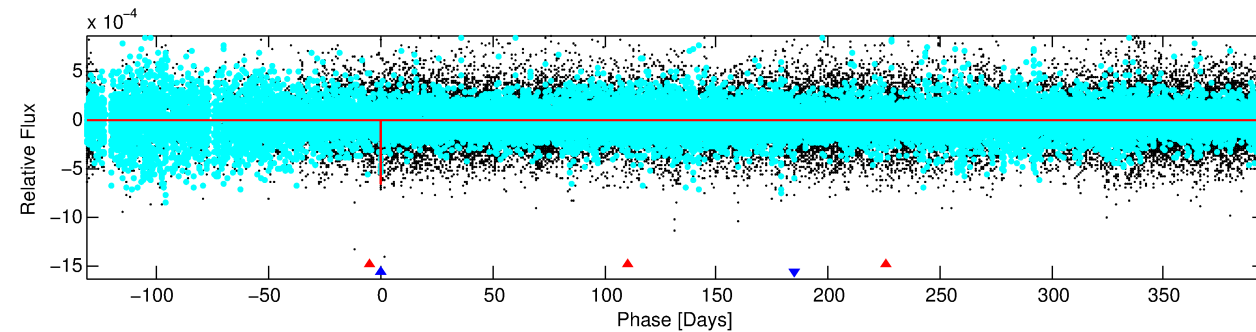
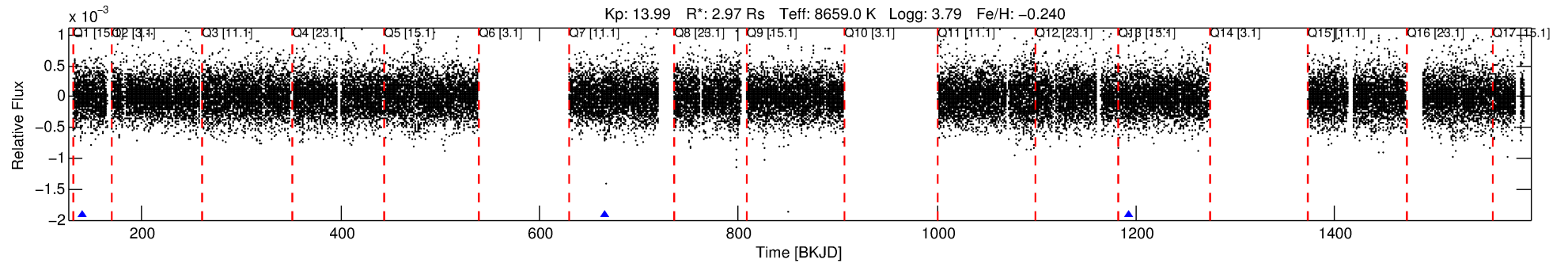
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 004472809-02

No Significant Match Found

# DV One-Page Summary

KIC: 4472809 Candidate: 2 of 2 Period: 526.957 d



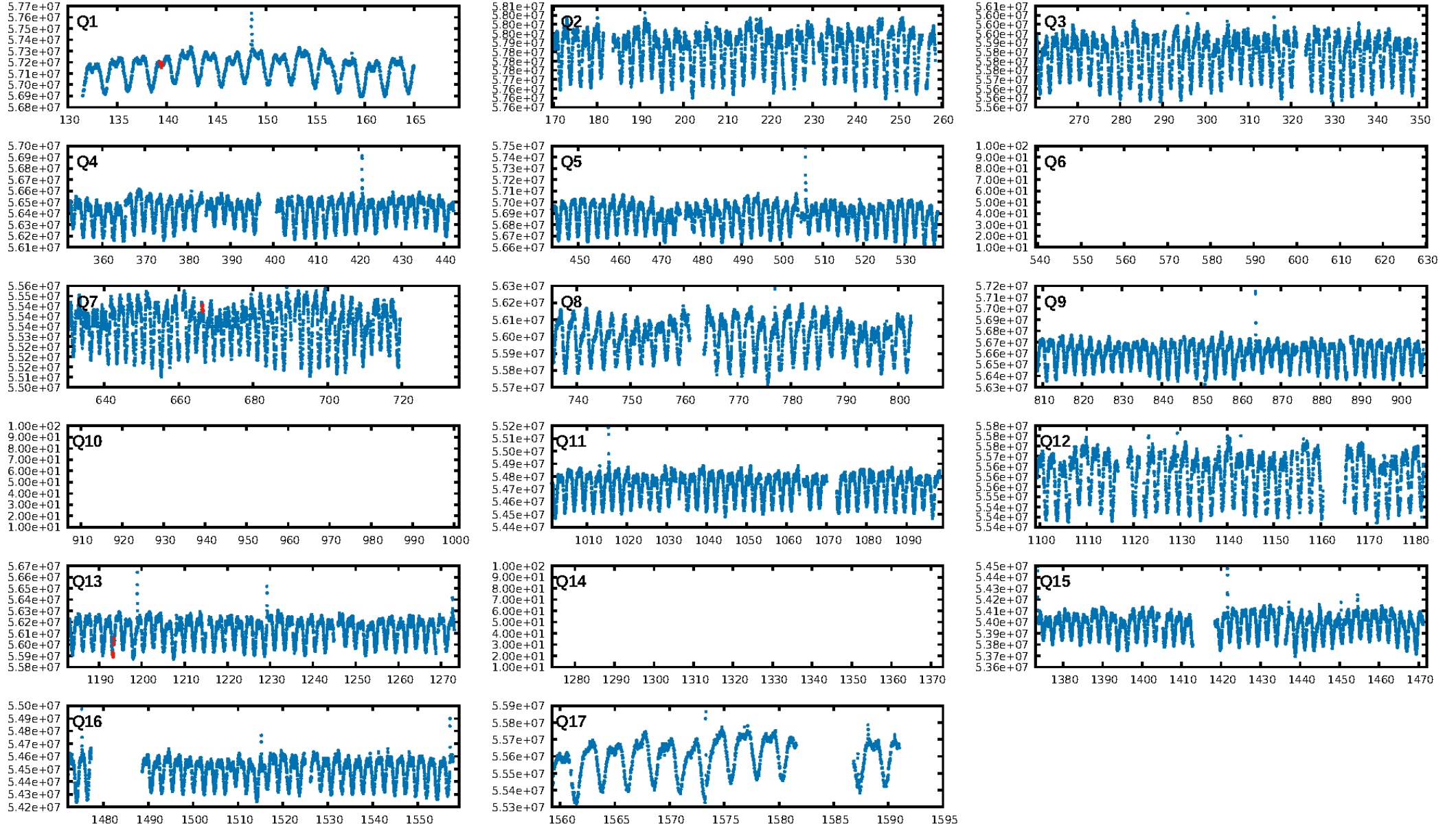
## DV Fit Results:

Period = 526.95737 [0.00604] d  
Epoch = 139.4283 [0.0080] BKJD  
Rp/R\* = 0.0255 [0.0143]  
a/R\* = 788.30 [2701.73]  
b = 0.76 [1.90]  
Seff = 17.24 [11.99]  
Teq = 520 [90] K  
Rp = 8.28 [5.84] Re  
a = 1.6070 [0.6697] AU  
Ag = 6721.84 [9025.74] [0.74 $\sigma$ ]  
Teffp = 7274 [2138] K [3.16 $\sigma$ ]

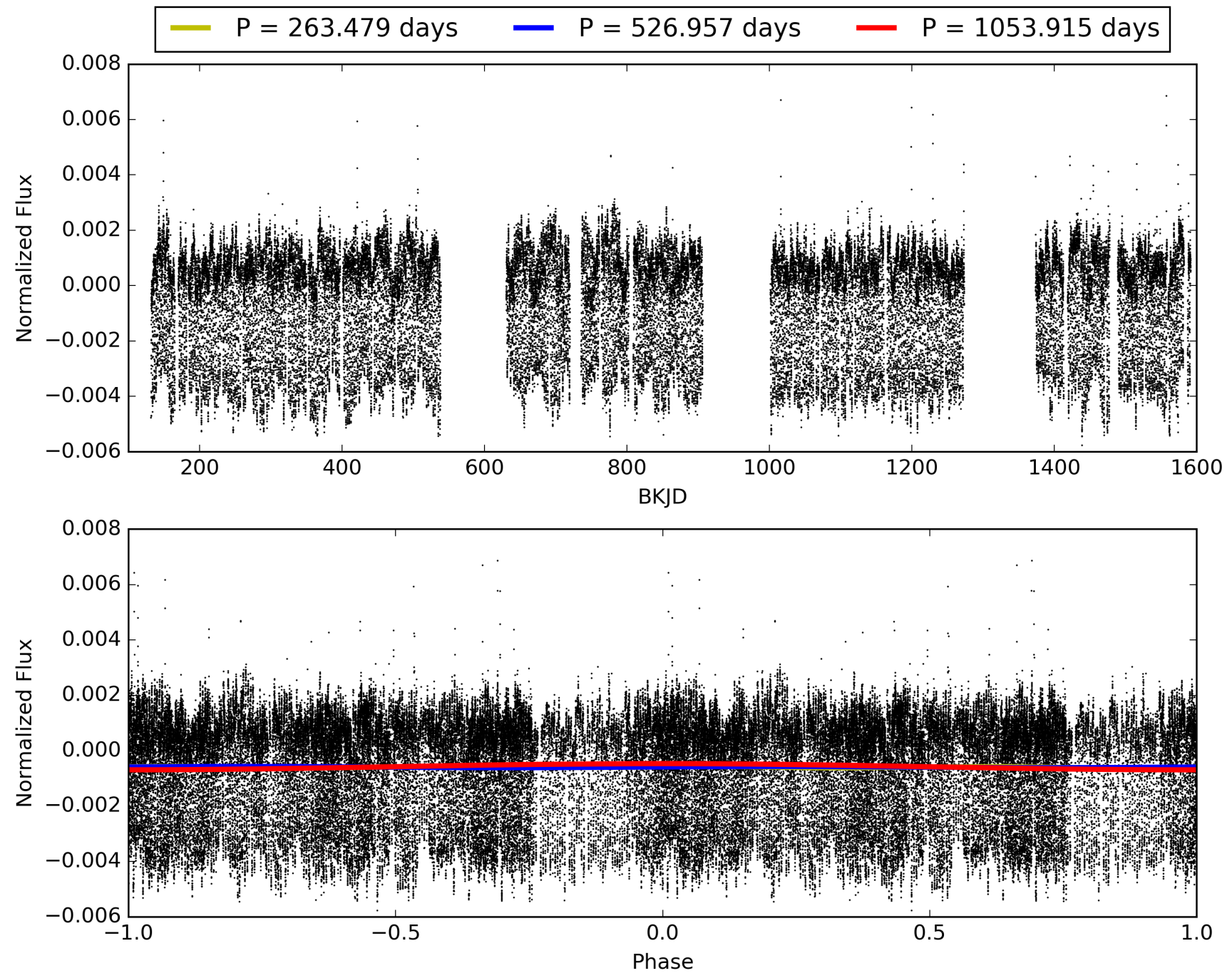
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [375.49 $\sigma$ ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 3.4%  
ModelChiSquareGof-sig: 60.1%  
**Bootstrap-pfa: 1.28e-08**  
RollingBand-fgt: 1.00 [2/2]  
GhostDiagnostic-chr: 1.772  
Centroid-sig: 41.5%  
Centroid-so: 0.997 arcsec [0.96 $\sigma$ ]  
OotOffset-rm: 0.814 arcsec [0.90 $\sigma$ ]  
KicOffset-rm: 0.642 arcsec [0.44 $\sigma$ ]  
OotOffset-st: 0/1/0/2 [3]  
KicOffset-st: 0/1/0/2 [3]  
DiffImageQuality-fgm: 0.33 [1/3]  
DiffImageOverlap-fno: 1.00 [3/3]

# TCE 004472809-02, PDC Light Curves



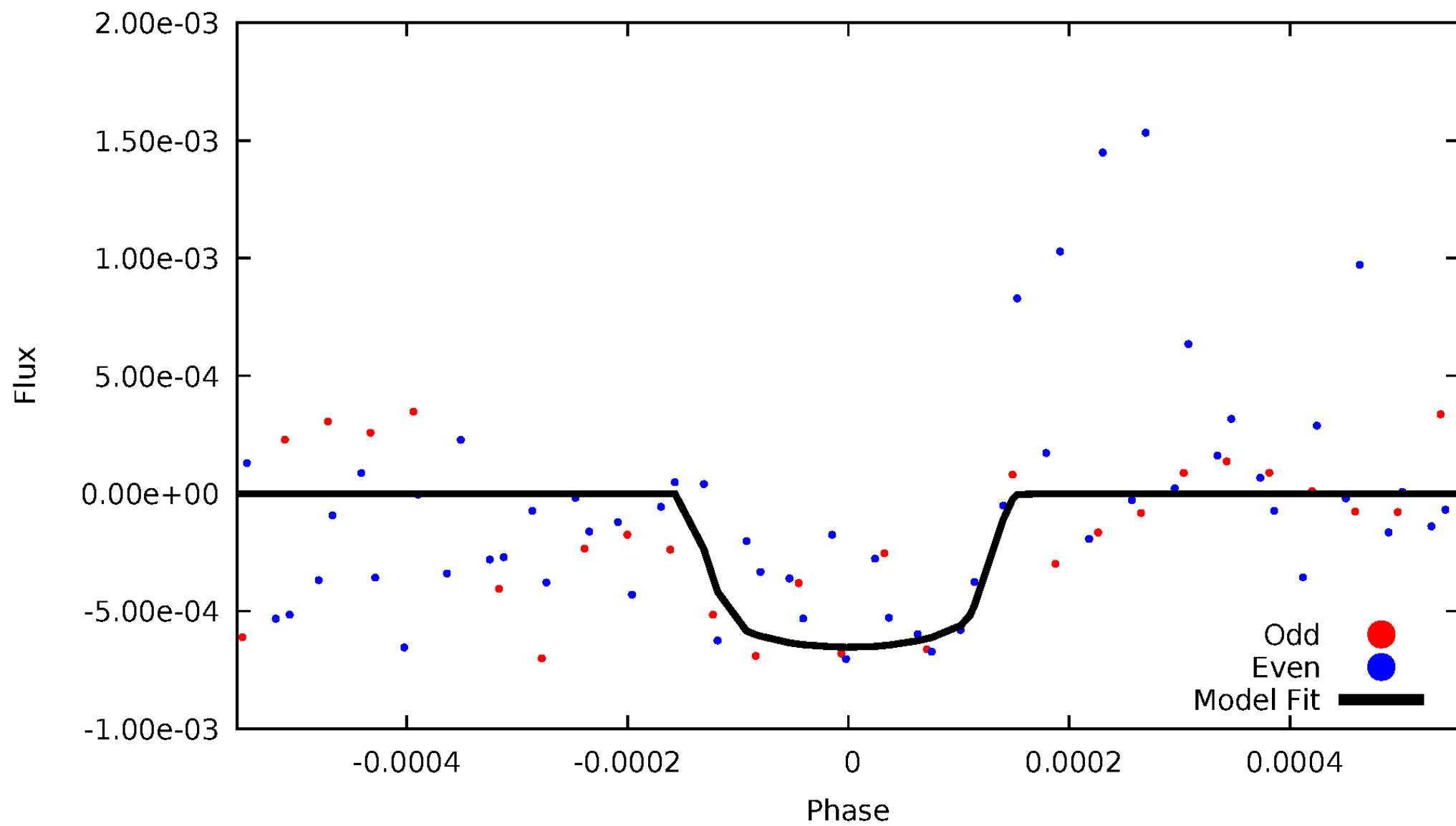
TCE 004472809-02





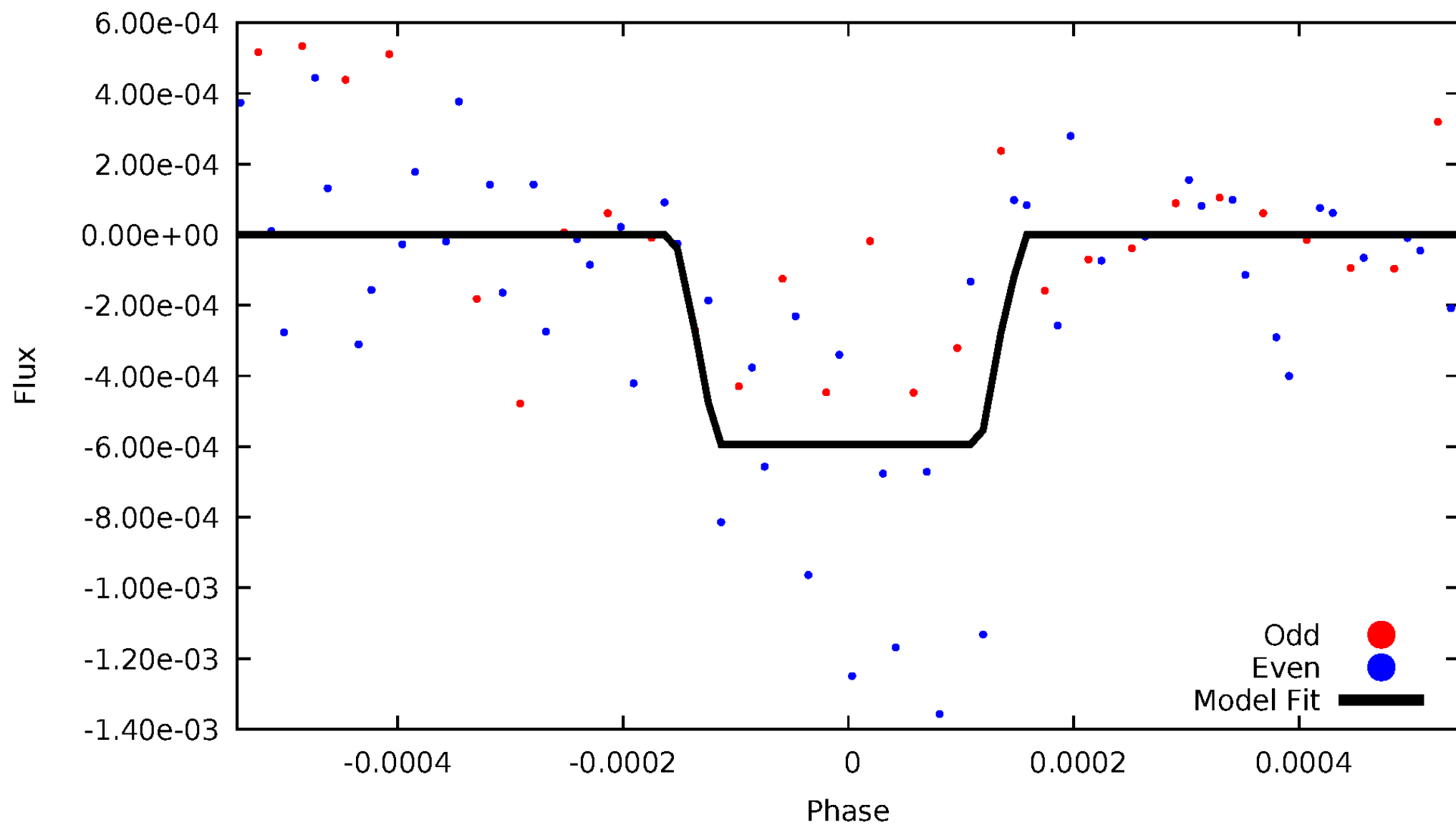
# DV Odd/Even

TCE 004472809-02



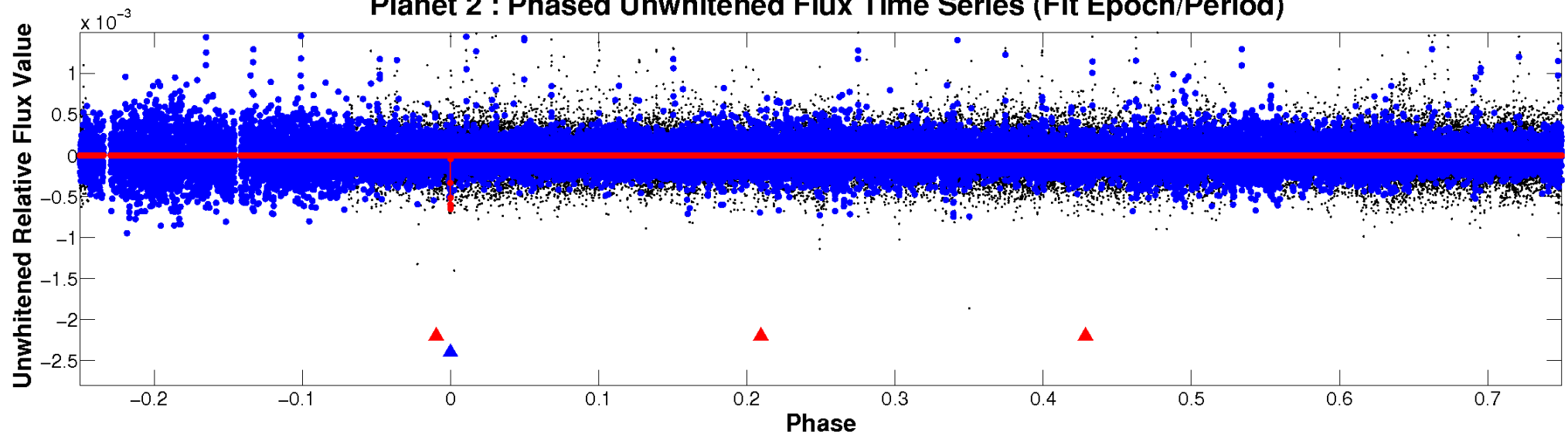
# ALT Odd/Even

TCE 004472809-02

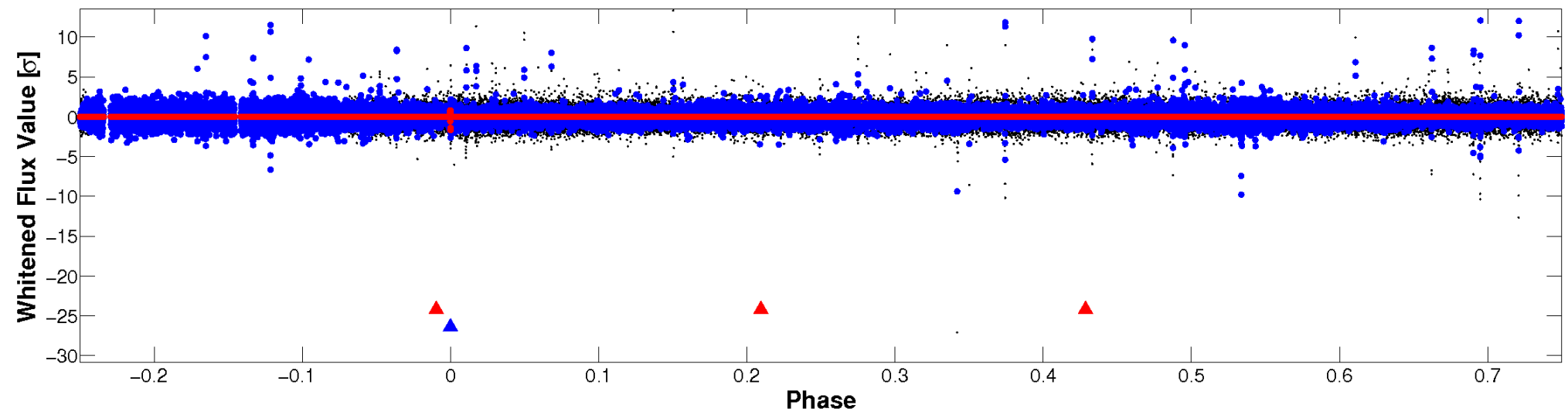


# Non-Whitened Vs. Whitened Light Curve

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

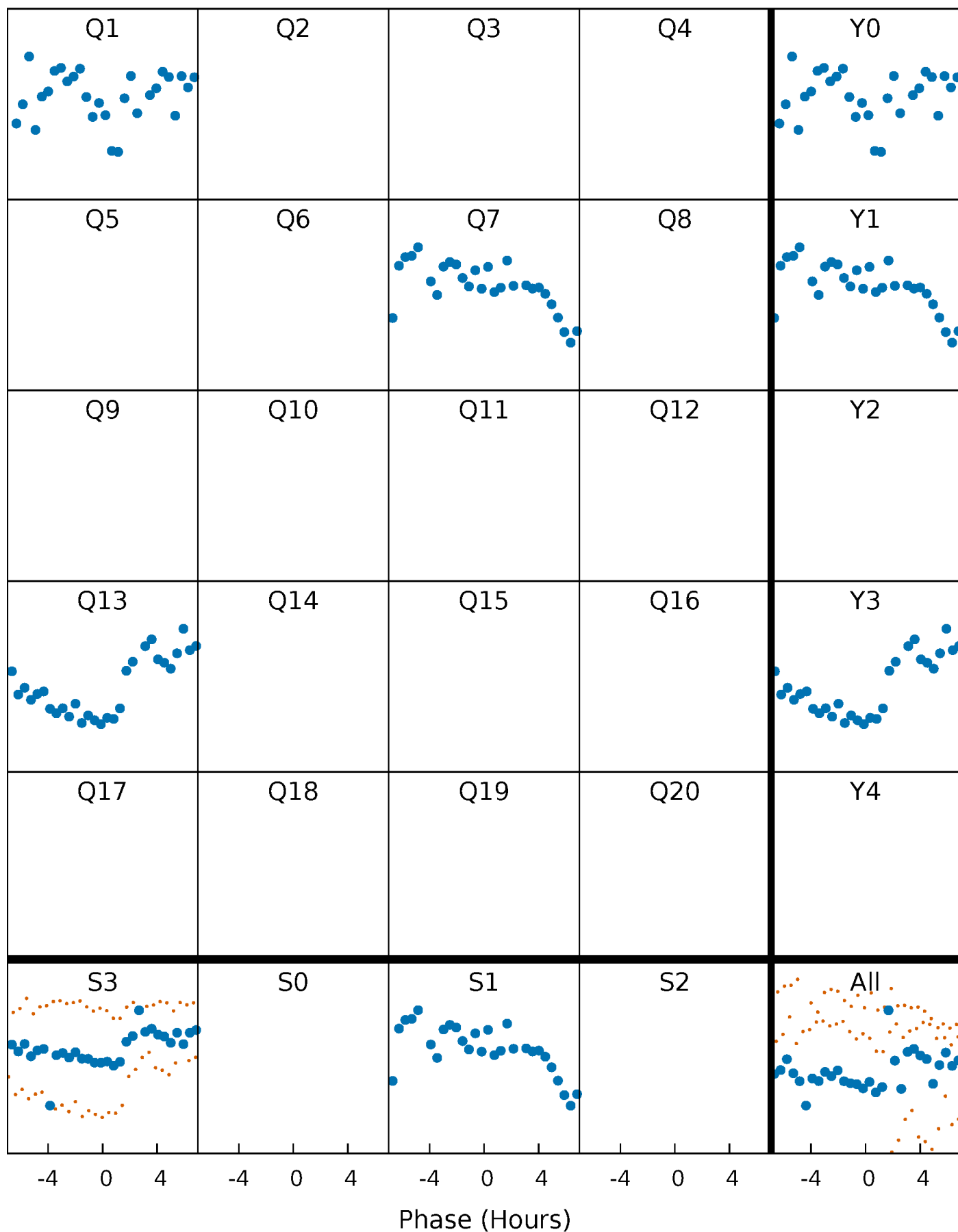


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



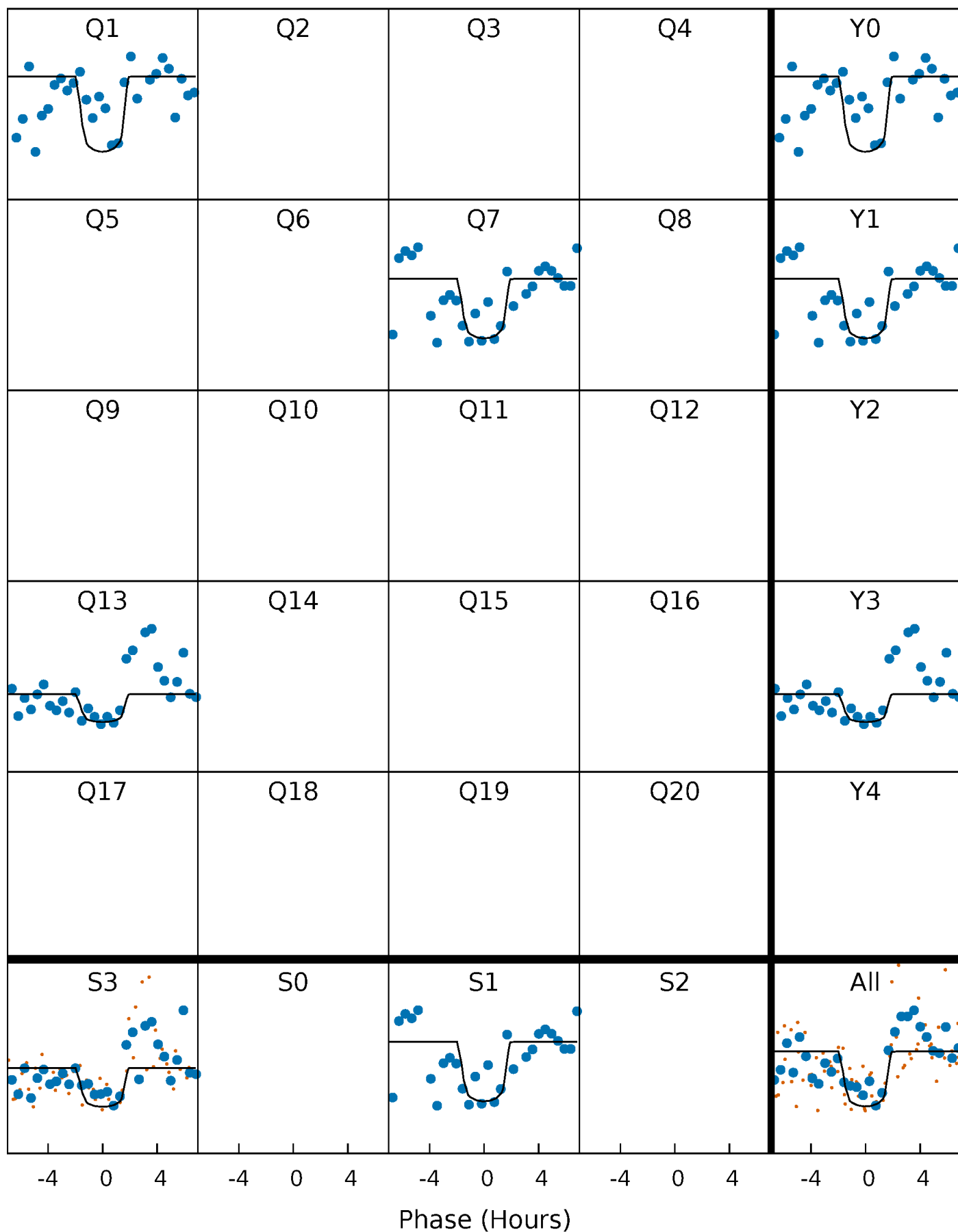
# PDC Quarter-Phased Transit Curves

TCE 004472809-02     $P=526.957366$  Days     $T_0=139.428255$  (BKJD)



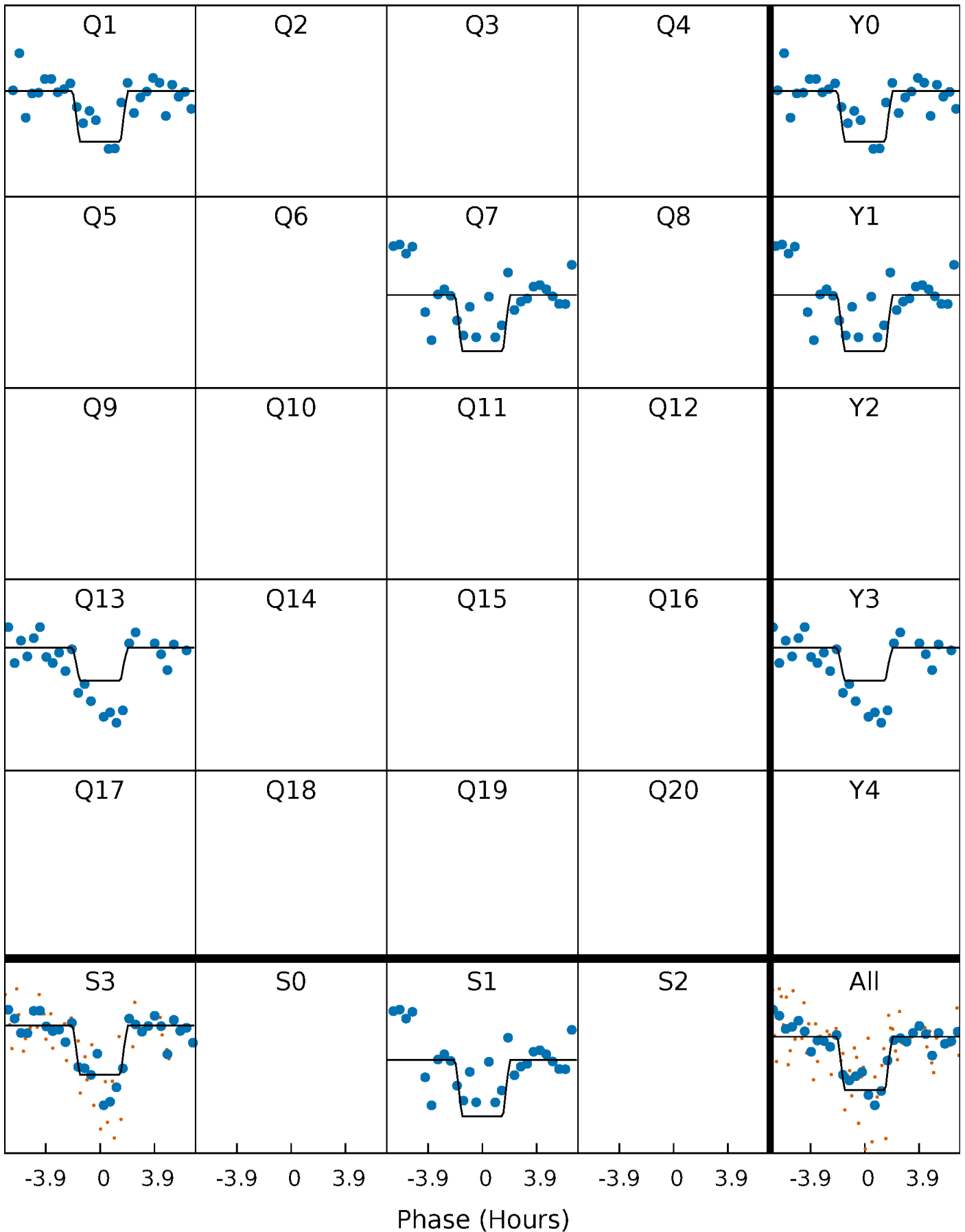
# DV Quarter-Phased Transit Curves

TCE 004472809-02     $P=526.957366$  Days     $T_0=139.428255$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

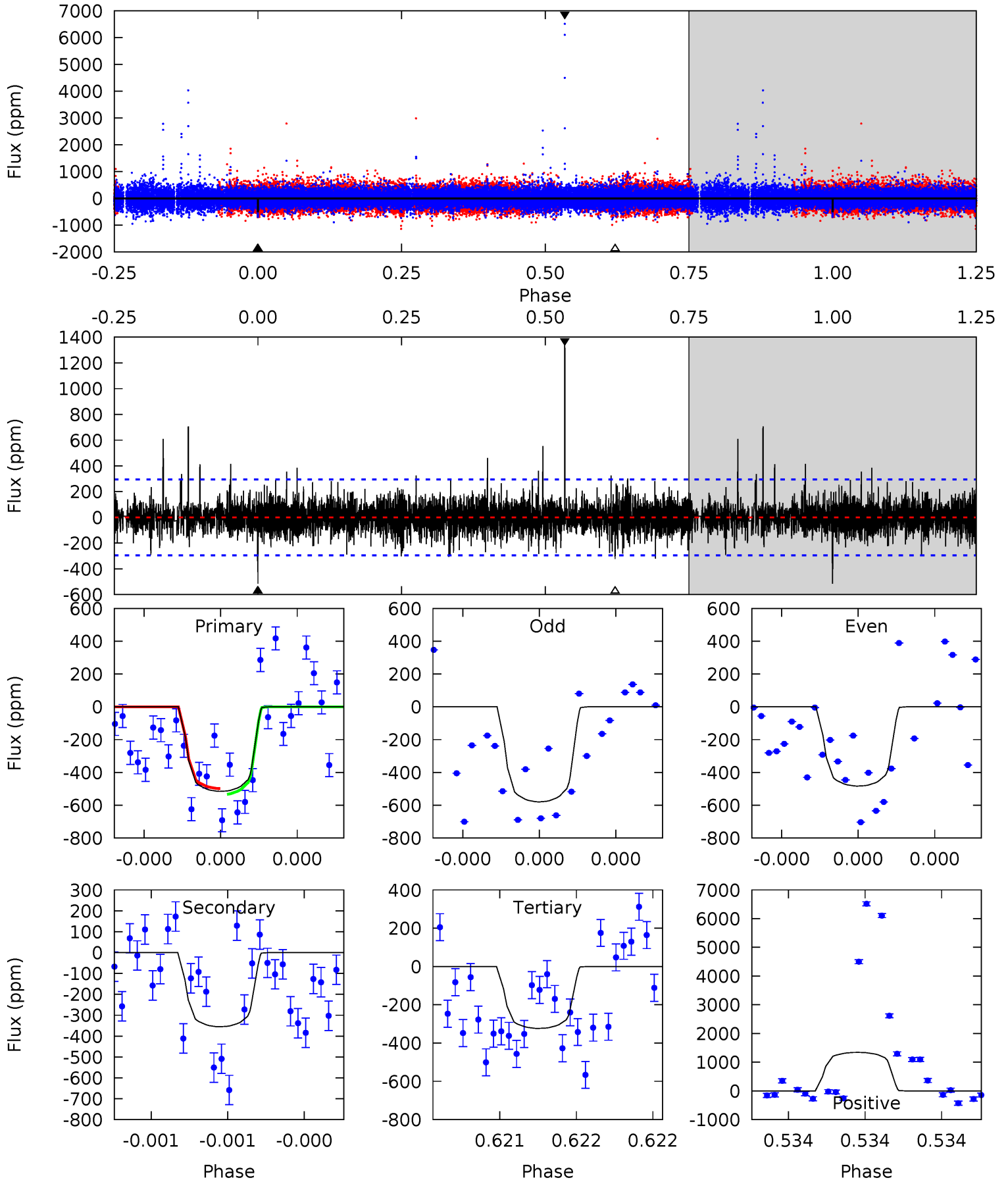
TCE 004472809-02 P=526.947456 Days  $T_0=139.445197$  (BKJD)



# DV Model-Shift Uniqueness Test

004472809-02, P = 526.957366 Days, E = 139.428255 Days

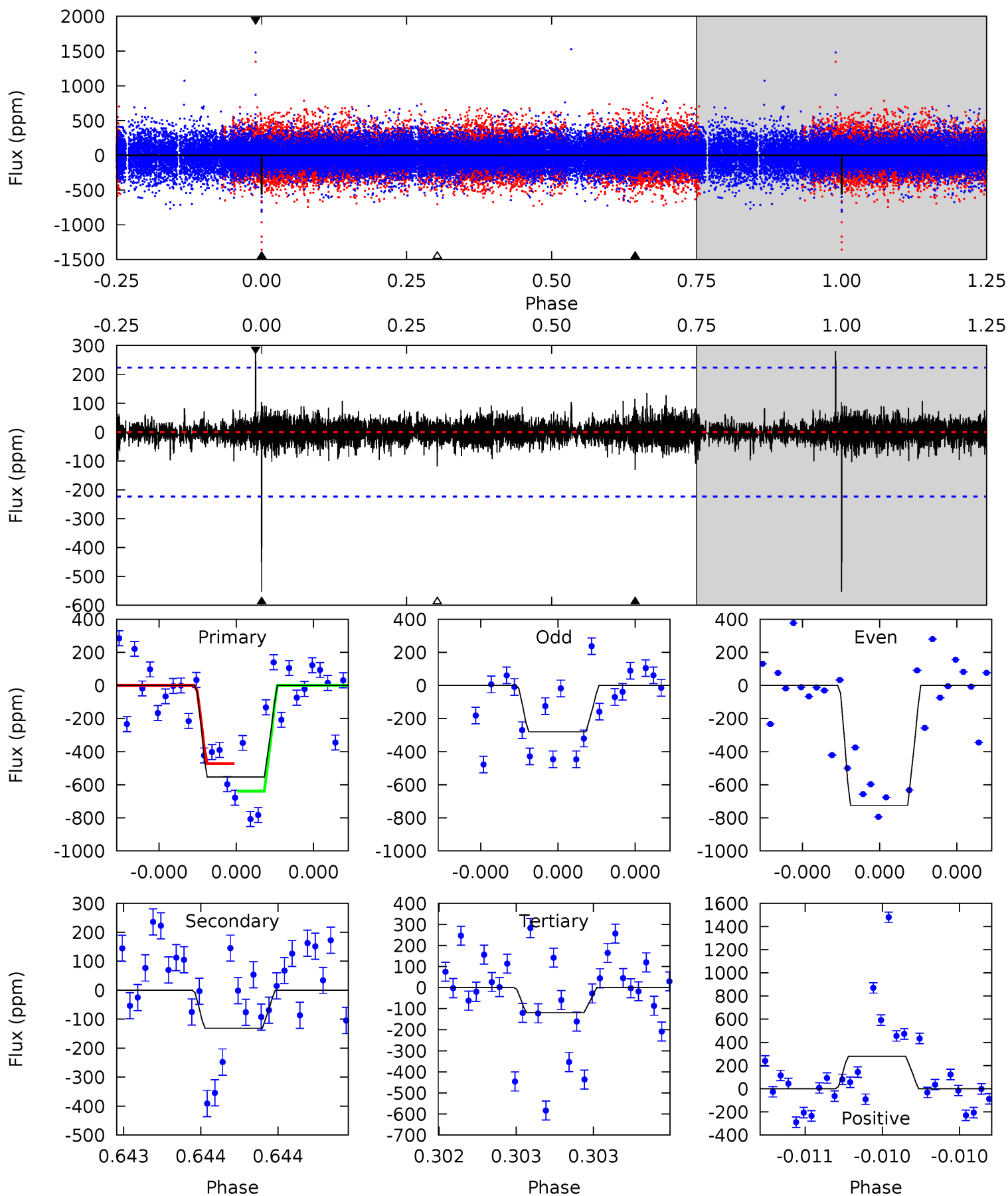
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
9.92	6.84	6.23	25.8	5.67	3.63	1.66	3.70	-15.9	0.61	-19.0	0.84	0.89	0.72	0.34



# Alt Model-Shift Uniqueness Test

004472809-02,  $P = 526.947456$  Days,  $E = 139.445197$  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
14.0	3.33	3.01	7.11	5.66	3.62	0.64	11.0	6.90	0.32	-3.78	5.65	1.50	0.34	2.11





### Stellar Parameters For KIC 004472809

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$8659^{+237}_{-385}$	$3.791^{+0.397}_{-0.106}$	$-0.240^{+0.350}_{-0.350}$	$2.973^{+0.740}_{-1.268}$	$1.994^{+0.382}_{-0.466}$	$0.107^{+0.369}_{-0.041}$
	+3%/-4%	+10%/-3%	+146%/-146%	+25%/-43%	+19%/-23%	+345%/-38%
Source	KIC0	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 004472809-02 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-355 \pm 52$	$7.79^{+4.91}_{-4.10}$	$701^{+55}_{-78}$	$7034^{+4506}_{-1368}$	$8400^{+27931}_{-5217}$
Alt.	$-131 \pm 39$	$7.41^{+4.45}_{-4.16}$	$695^{+58}_{-78}$	$5517^{+2985}_{-980}$	$3482^{+13074}_{-2276}$

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

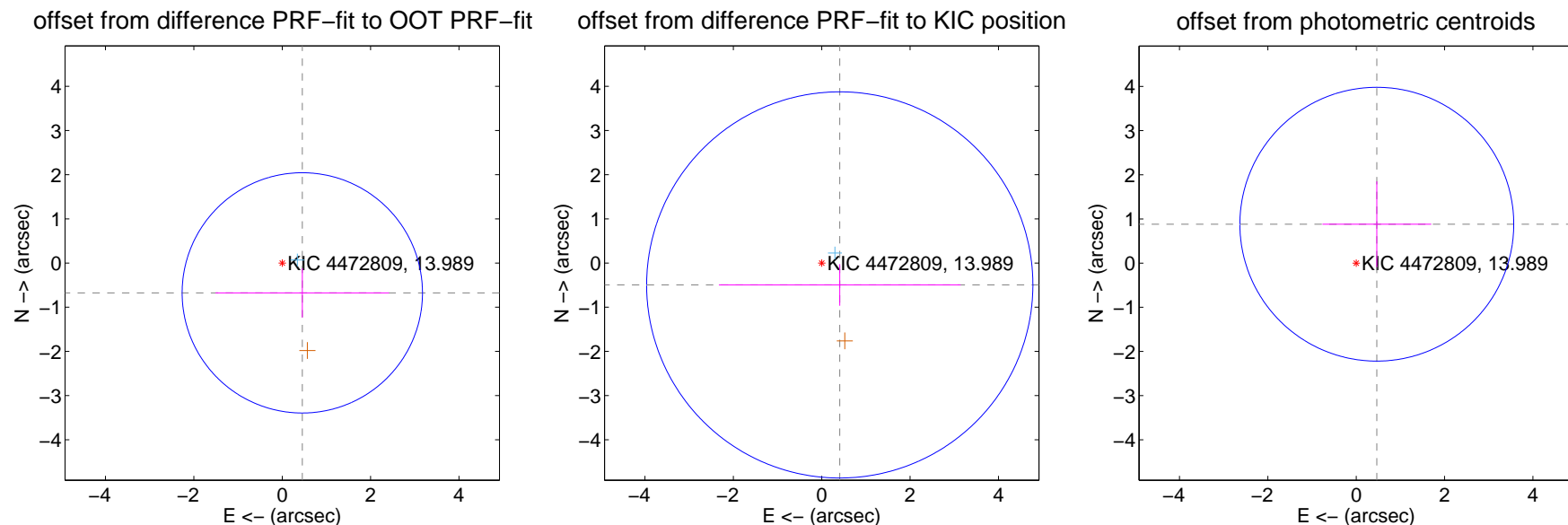
## DV Centroid Data

Supplemental centroid analysis for 004472809-02. Kepler magnitude: 13.99. Transit SNR 7.45

There are 1 quarters with good PRF difference image offsets

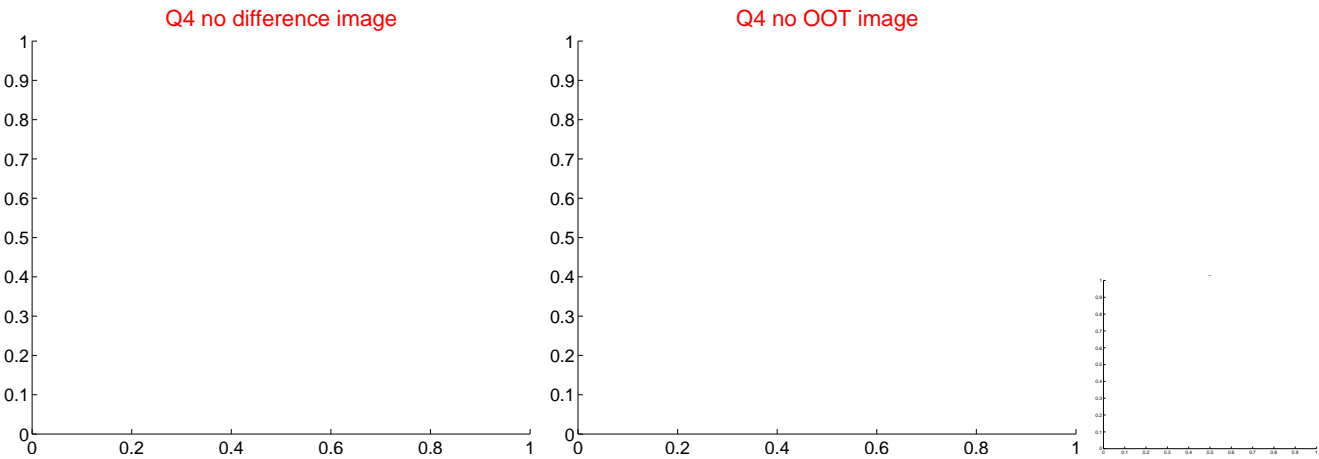
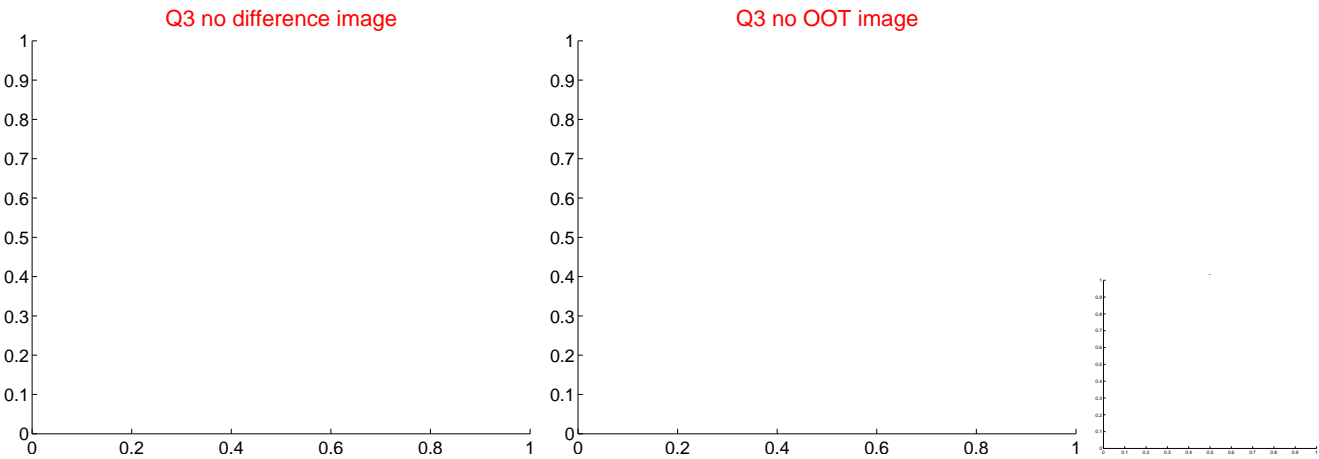
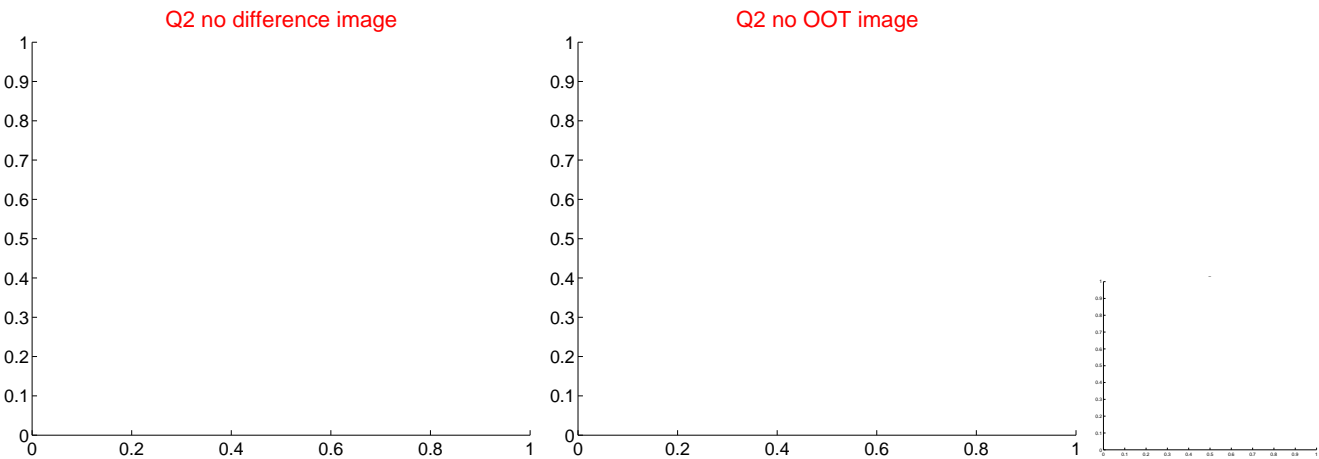
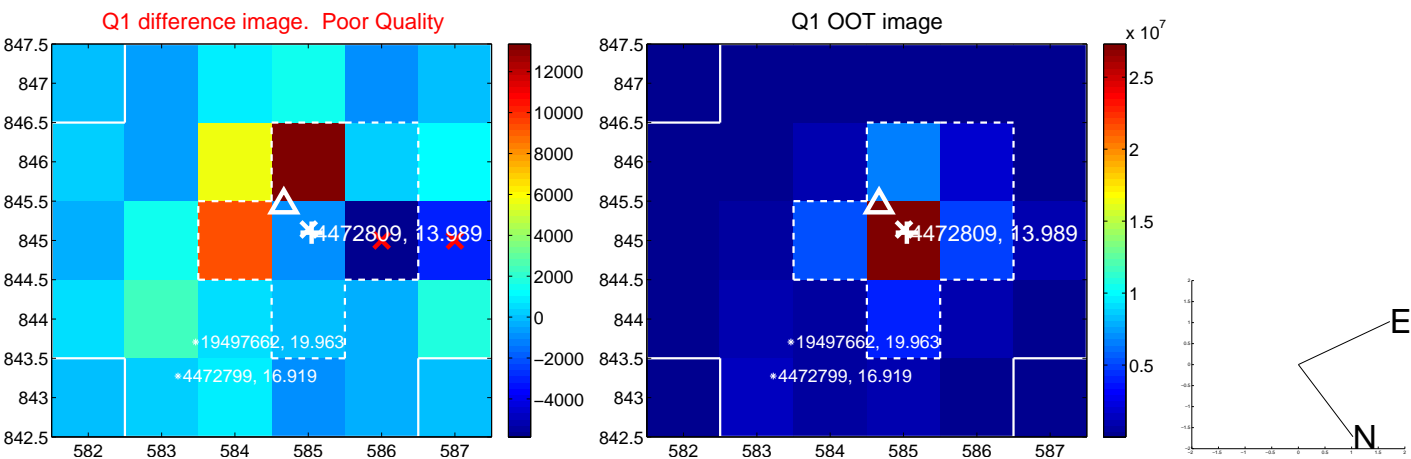
The direct PRF centroid is offset from the target star catalog position by about 0.16 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.814 \pm 0.906$	0.90	$-0.454 \pm 1.962$	$-0.675 \pm 0.556$
PRF-fit source offset from KIC position	$0.642 \pm 1.456$	0.44	$-0.408 \pm 2.735$	$-0.495 \pm 0.471$
photometric centroid source offset	$1.00 \pm 1.03$	0.96	$-0.47 \pm 1.23$	$0.88 \pm 0.97$



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



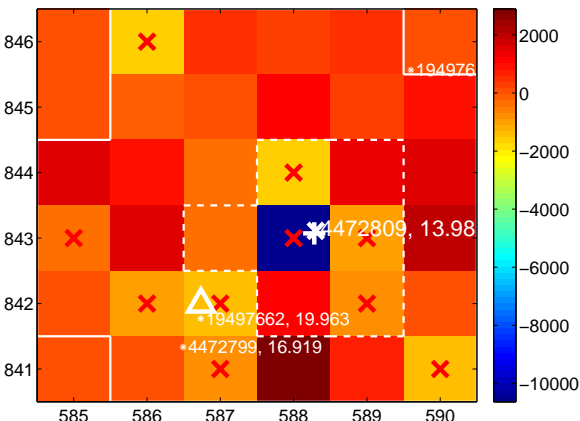
Q6 no difference image



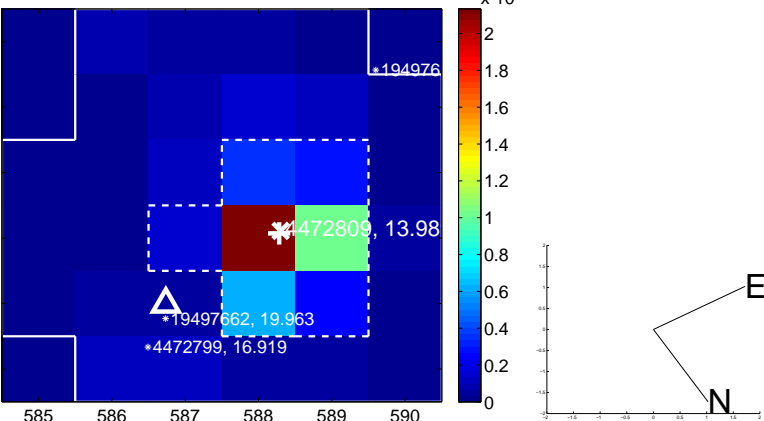
Q6 no OOT image



Q7 difference image. Poor Quality



Q7 OOT image



Q8 no difference image



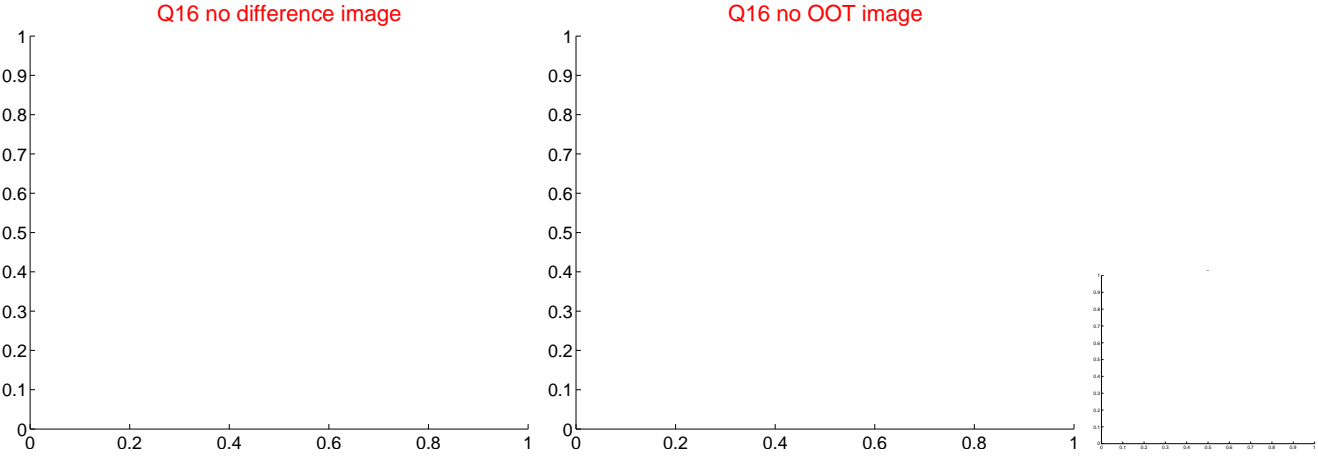
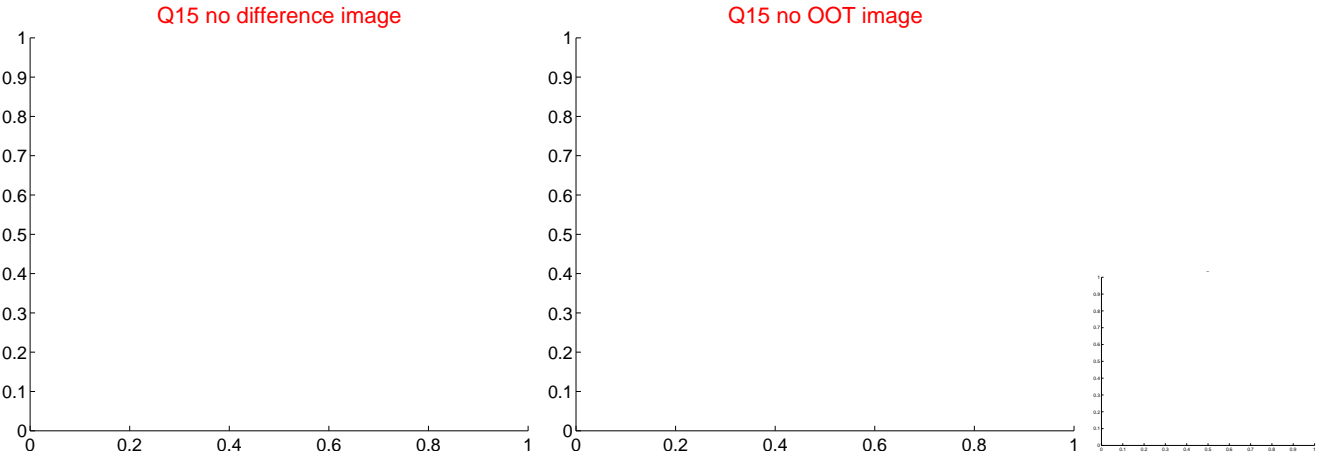
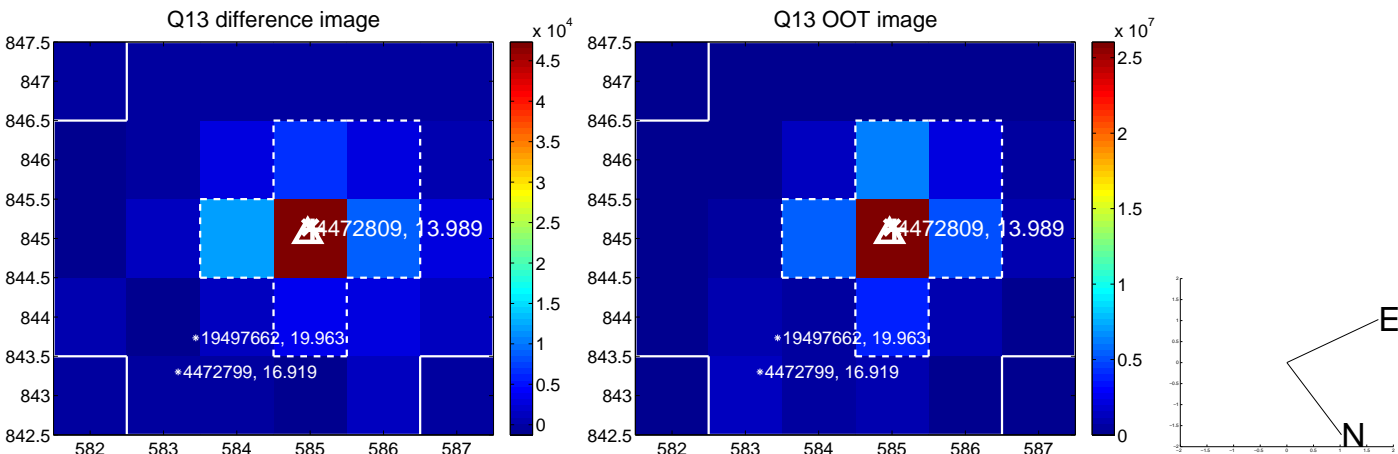
Q8 no OOT image



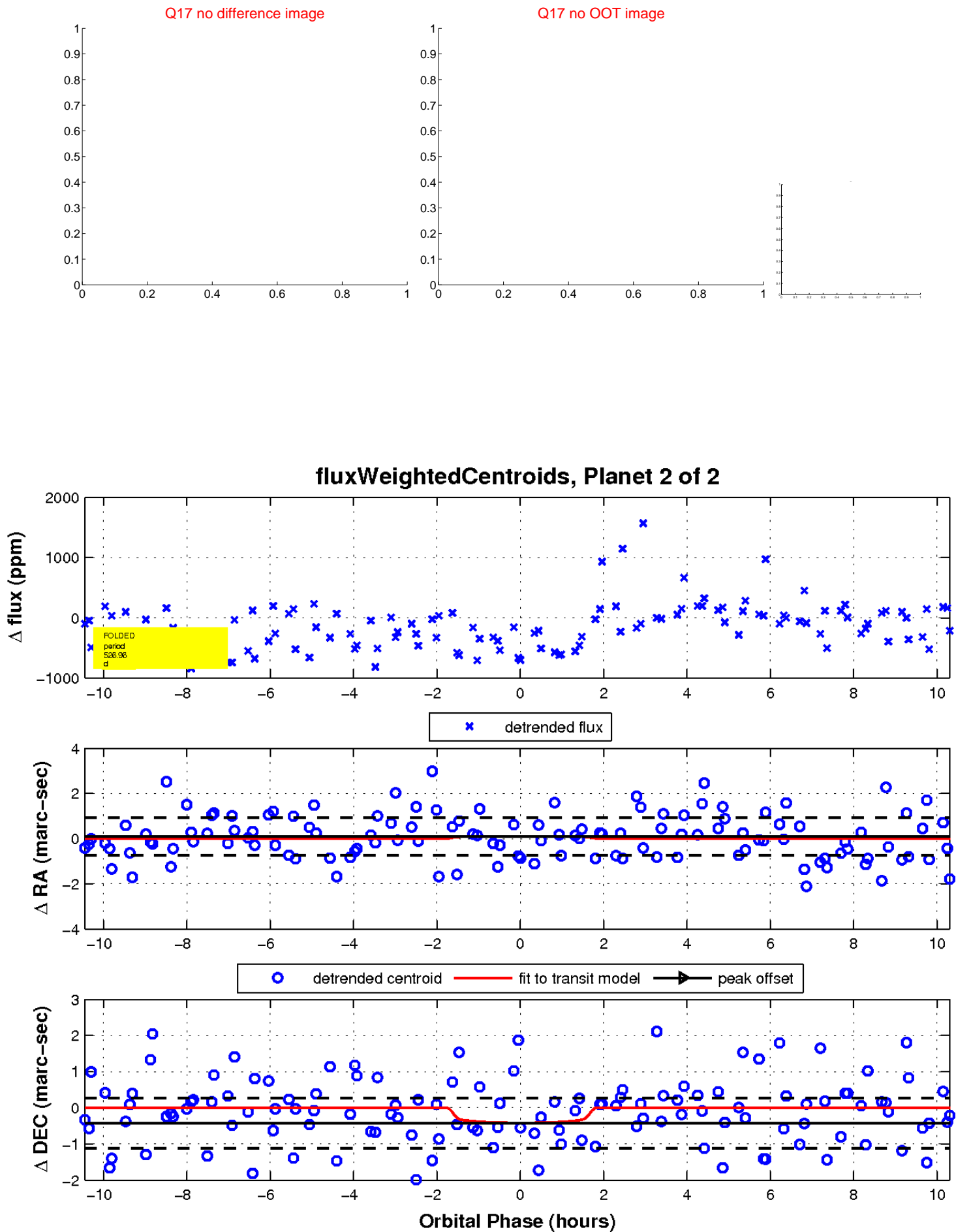
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

