

# KIC 002710323

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
002710323-01	OBS	No	503.629232	419.356794	2033.5	5.158	11.8	5.1	0.53	4831	2.39	0.13
002710323-02	OBS	No	412.505793	314.576855	2353.0	3.538	11.6	6.3	0.53	4831	4.85	0.17

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
002710323-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS
002710323-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_SKYE—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—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.

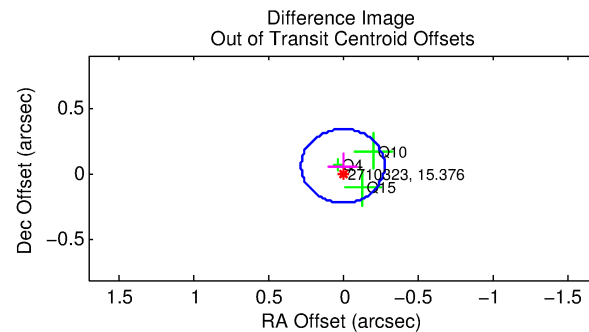
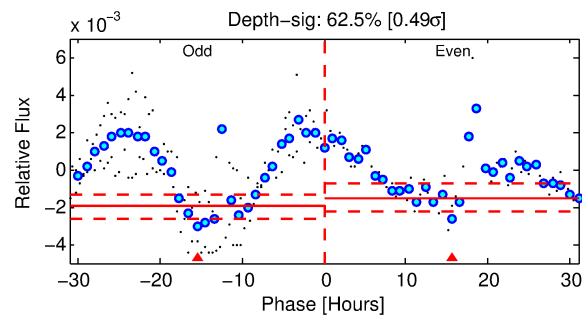
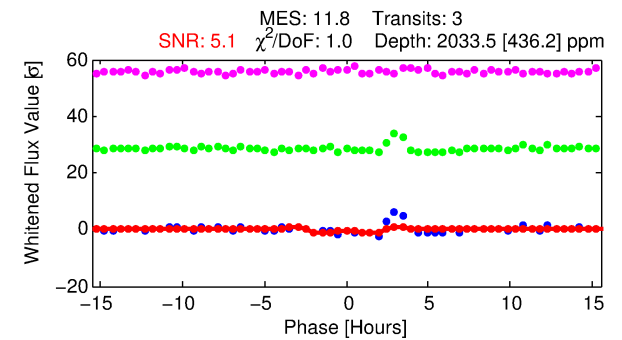
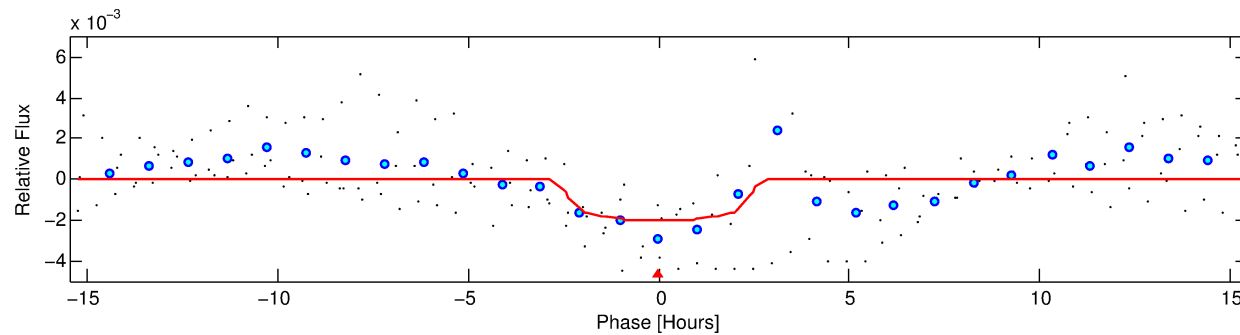
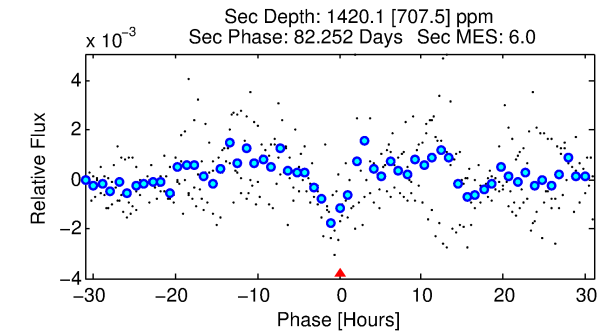
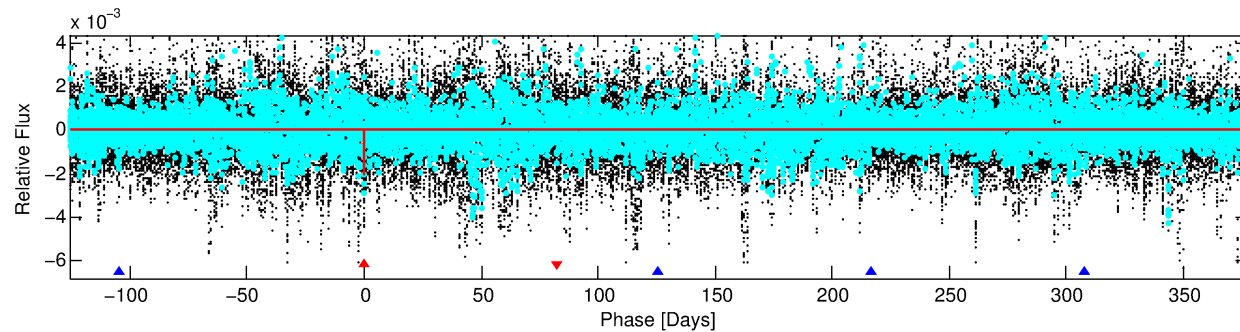
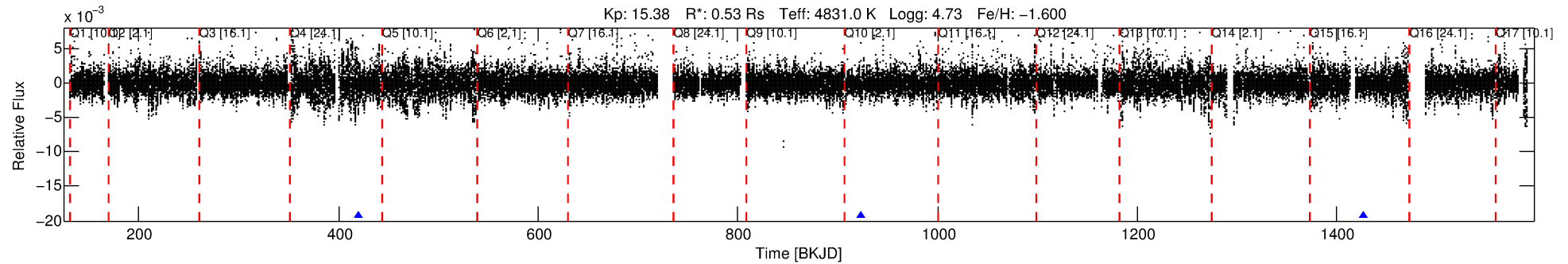
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 002710323-01

No Significant Match Found

# DV One-Page Summary

KIC: 2710323 Candidate: 1 of 2 Period: 503.629 d



## DV Fit Results:

Period = 503.62923 [0.00721] d  
Epoch = 419.3568 [0.0079] BKJD  
Rp/R\* = 0.0417 [0.3411]  
a/R\* = 722.43 [27079.33]  
b = 0.38 [83.86]  
Seff = 0.13 [0.02]  
Teq = 154 [5] K  
Rp = 2.39 [19.54] Re  
a = 1.0090 [0.0494] AU  
Ag = 139240.88 [2277874.30] [0.06 $\sigma$ ]  
Teffp = 4592 [18779] K [0.24 $\sigma$ ]

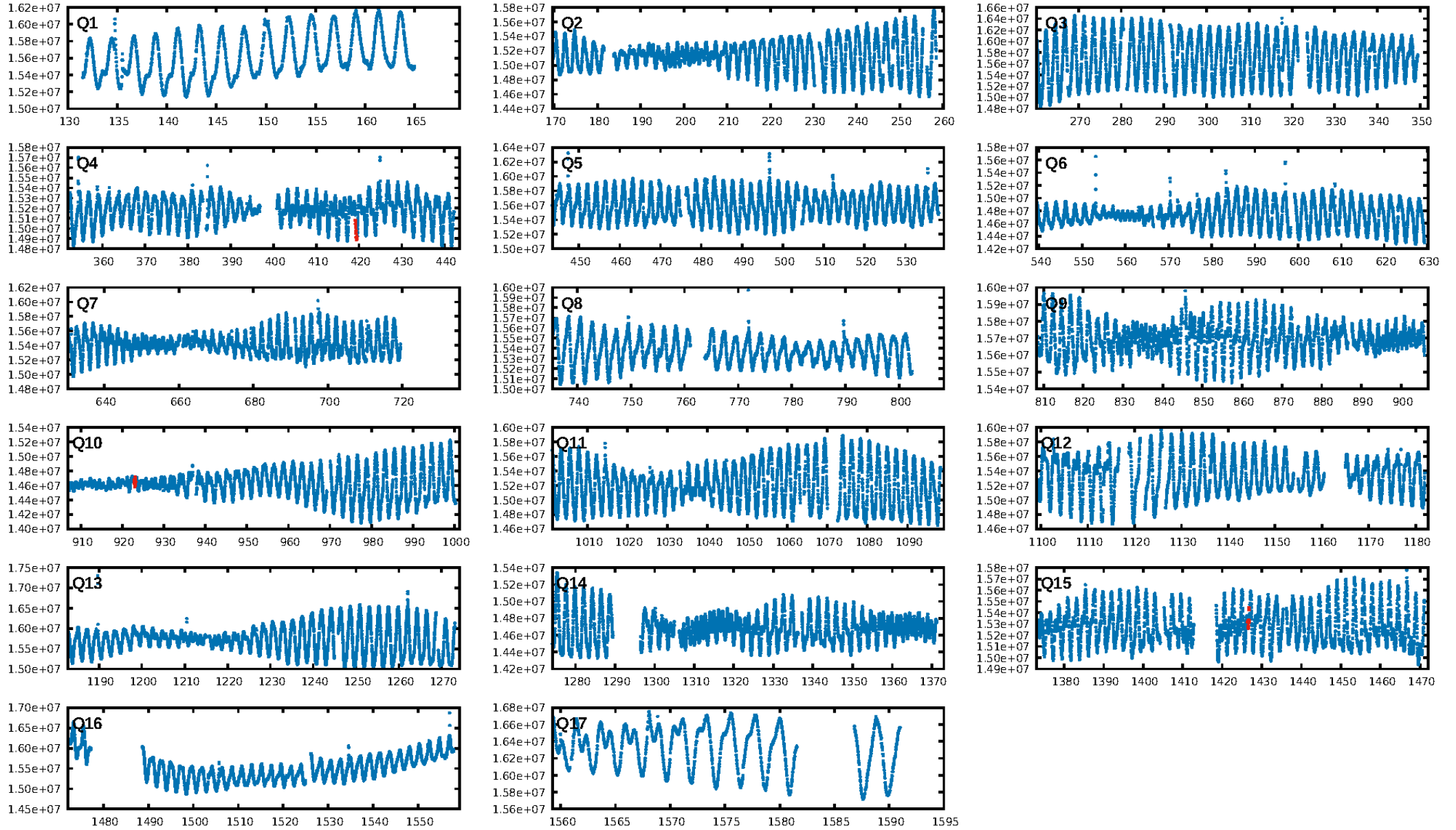
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [349.66 $\sigma$ ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 28.8%  
ModelChiSquareGof-sig: 97.5%  
**Bootstrap-pfa: 9.32e-10**  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: 4.643  
Centroid-sig: N/A  
Centroid-so: 0.870 arcsec [0.77 $\sigma$ ]  
OotOffset-rm: 0.063 arcsec [0.68 $\sigma$ ]  
KicOffset-rm: 0.159 arcsec [1.73 $\sigma$ ]  
OotOffset-st: 1/1/1/0 [3]  
KicOffset-st: 1/1/1/0 [3]  
DiffImageQuality-fgm: 1.00 [3/3]  
DiffImageOverlap-fno: 1.00 [3/3]

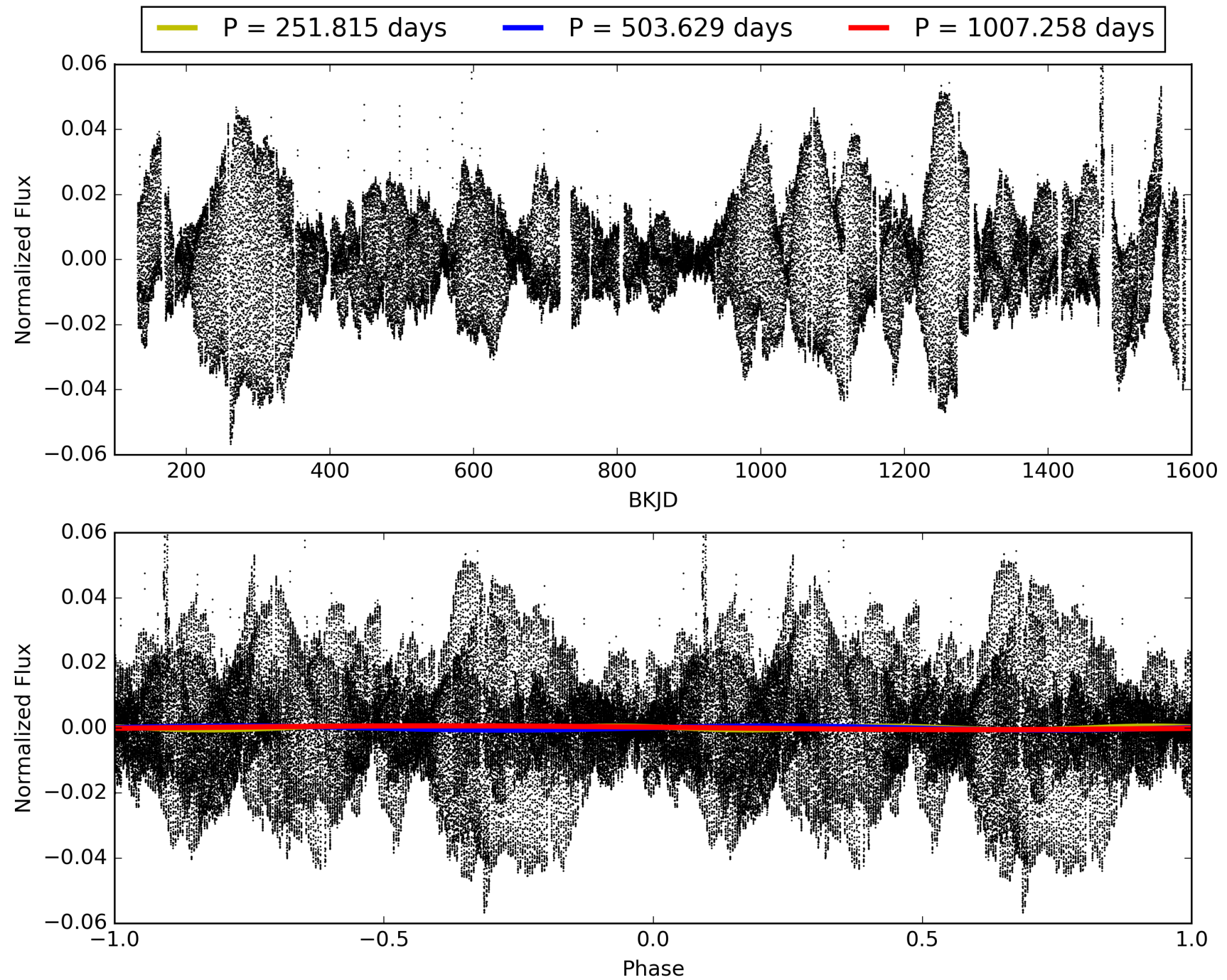
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 07:24:26 Z

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

# TCE 002710323-01, PDC Light Curves

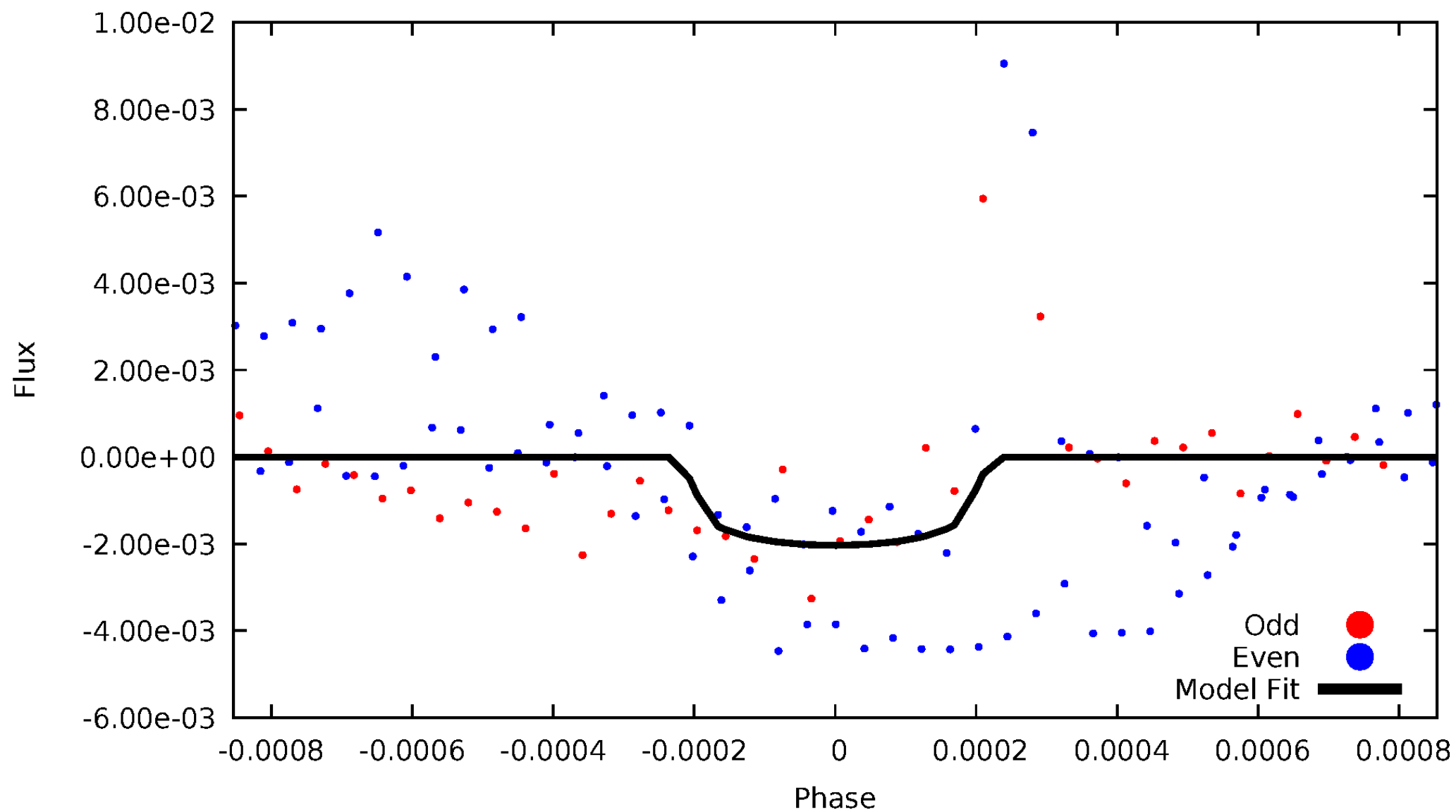


TCE 002710323-01



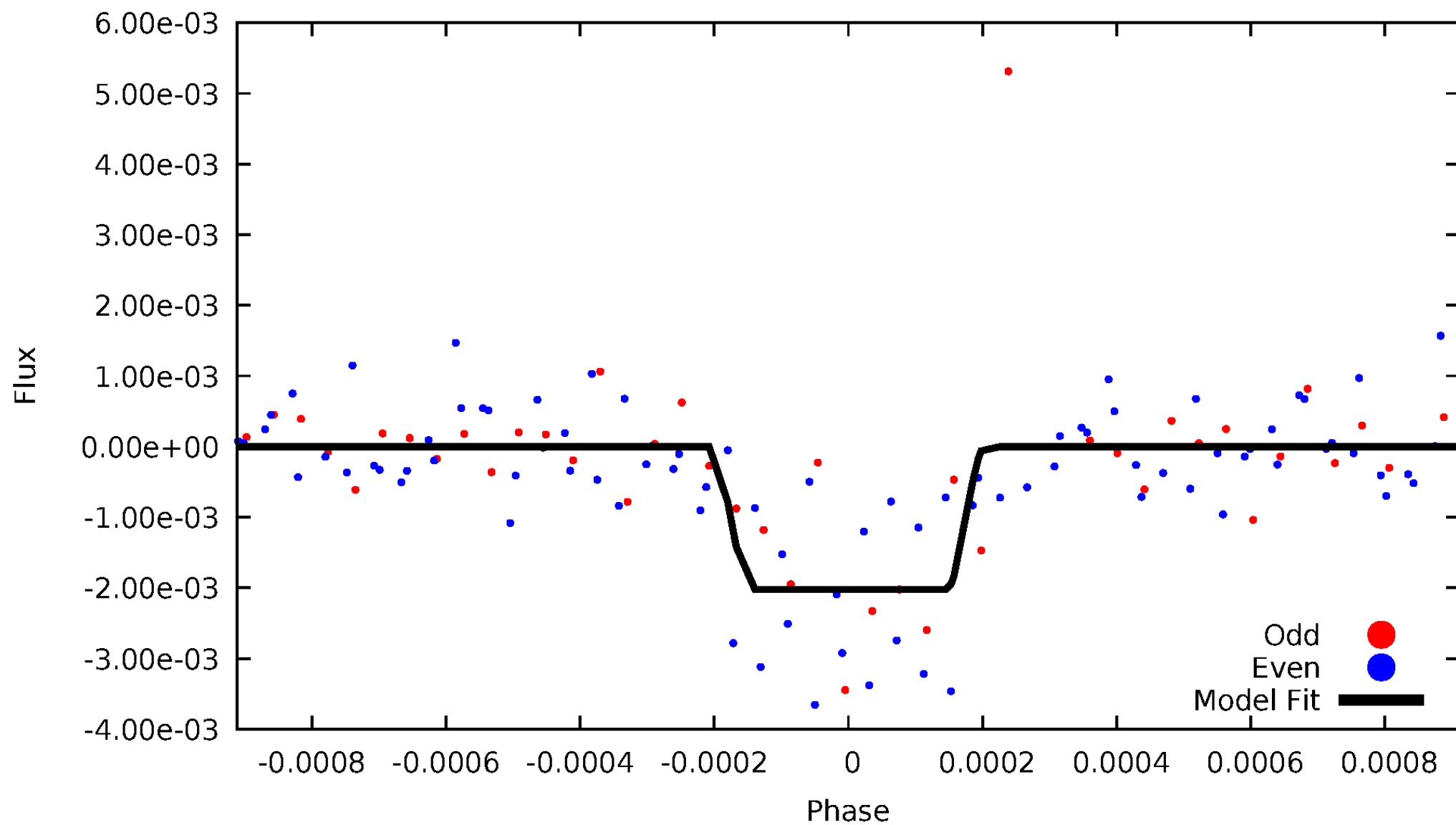
# DV Odd/Even

TCE 002710323-01

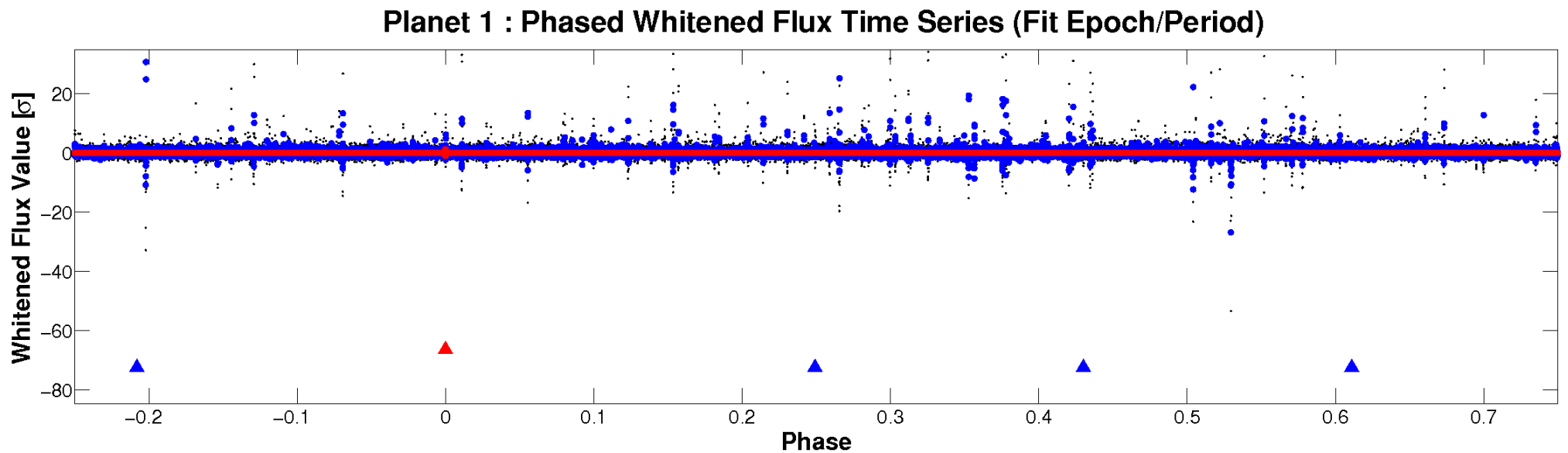
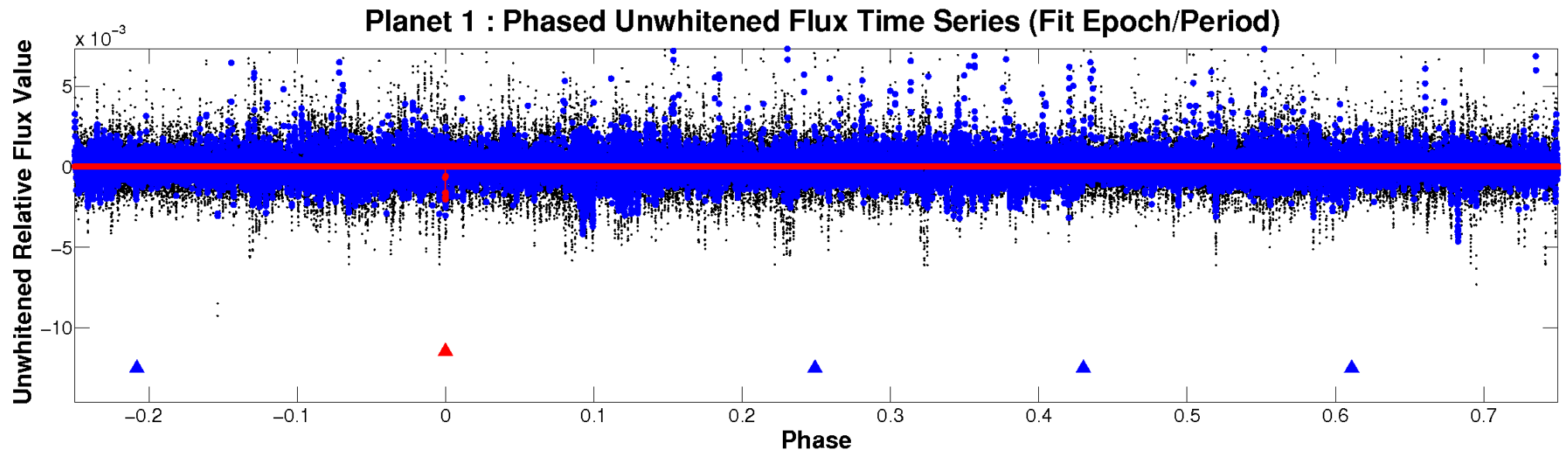


# ALT Odd/Even

TCE 002710323-01



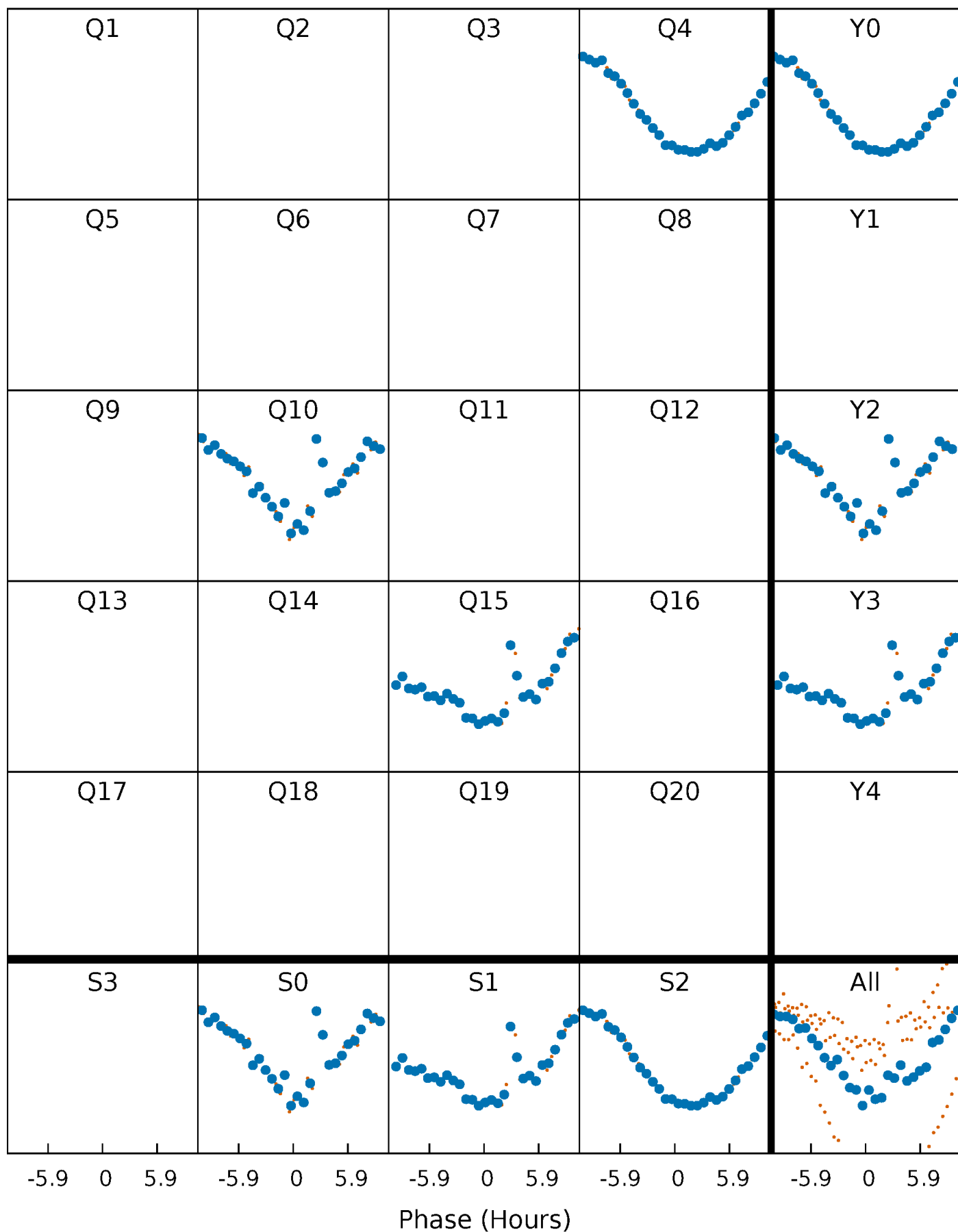
# Non-Whitened Vs. Whitened Light Curve





# PDC Quarter-Phased Transit Curves

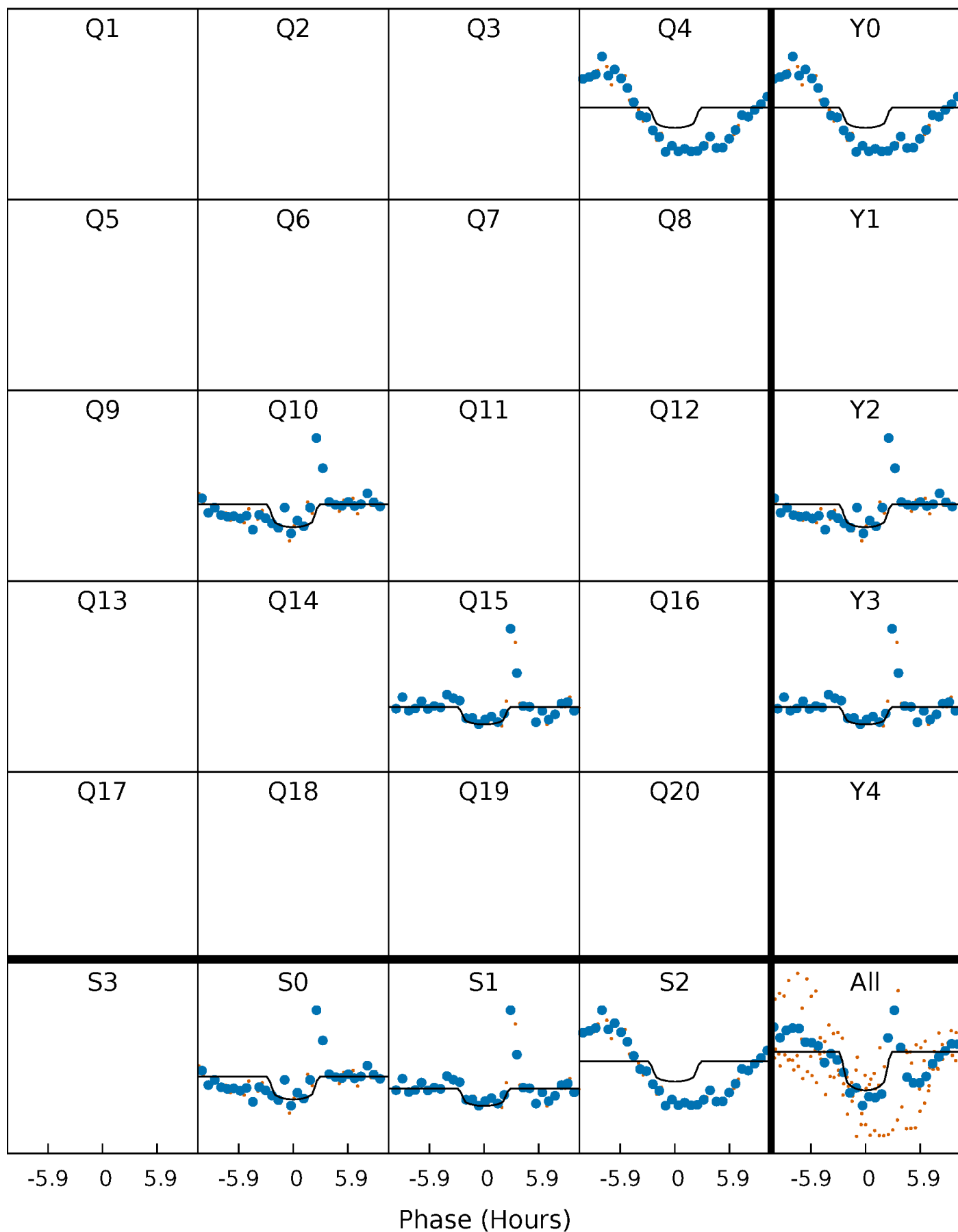
TCE 002710323-01 P=503.629232 Days  $T_0=419.356794$  (BKJD)





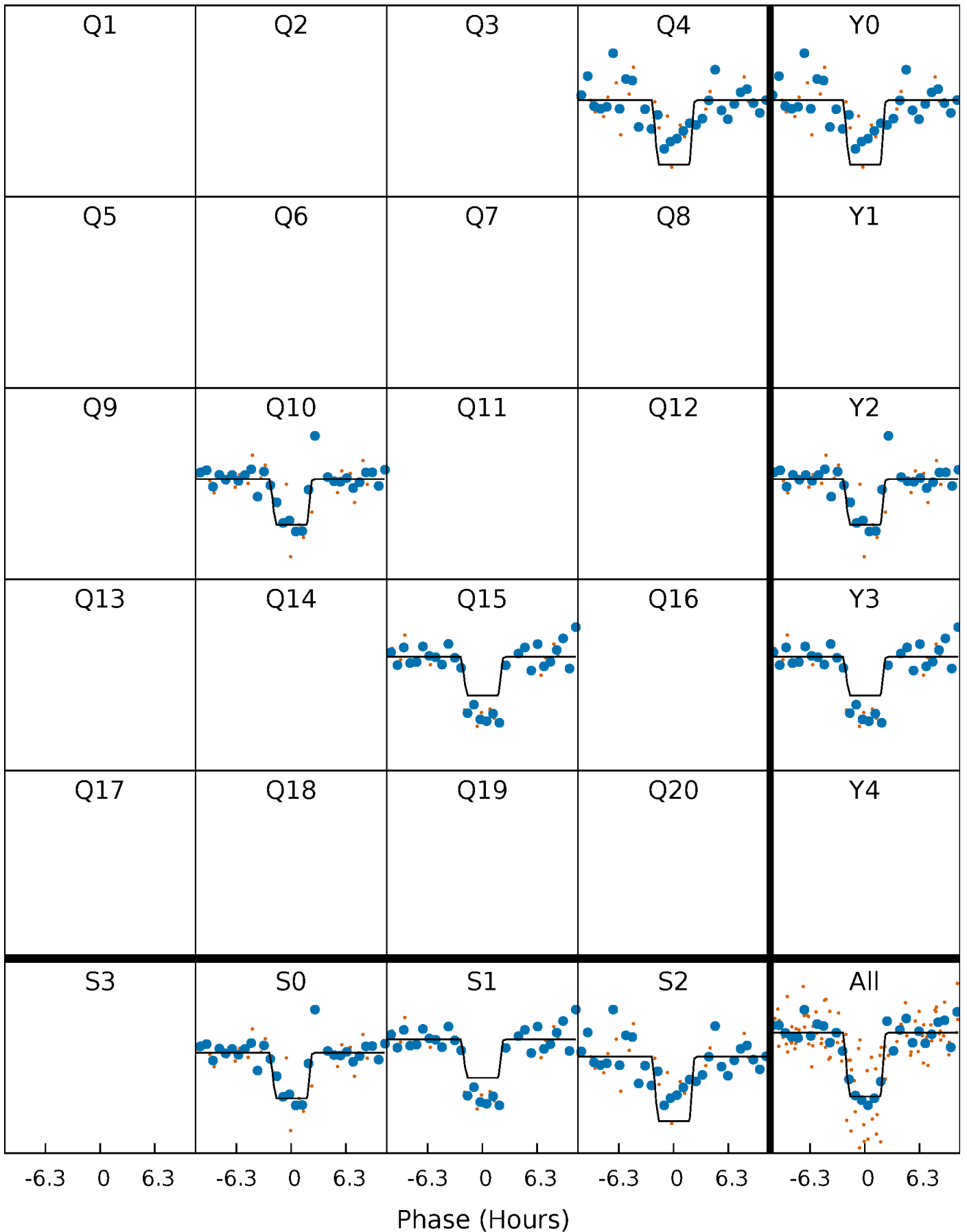
# DV Quarter-Phased Transit Curves

TCE 002710323-01 P=503.629232 Days  $T_0=419.356794$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

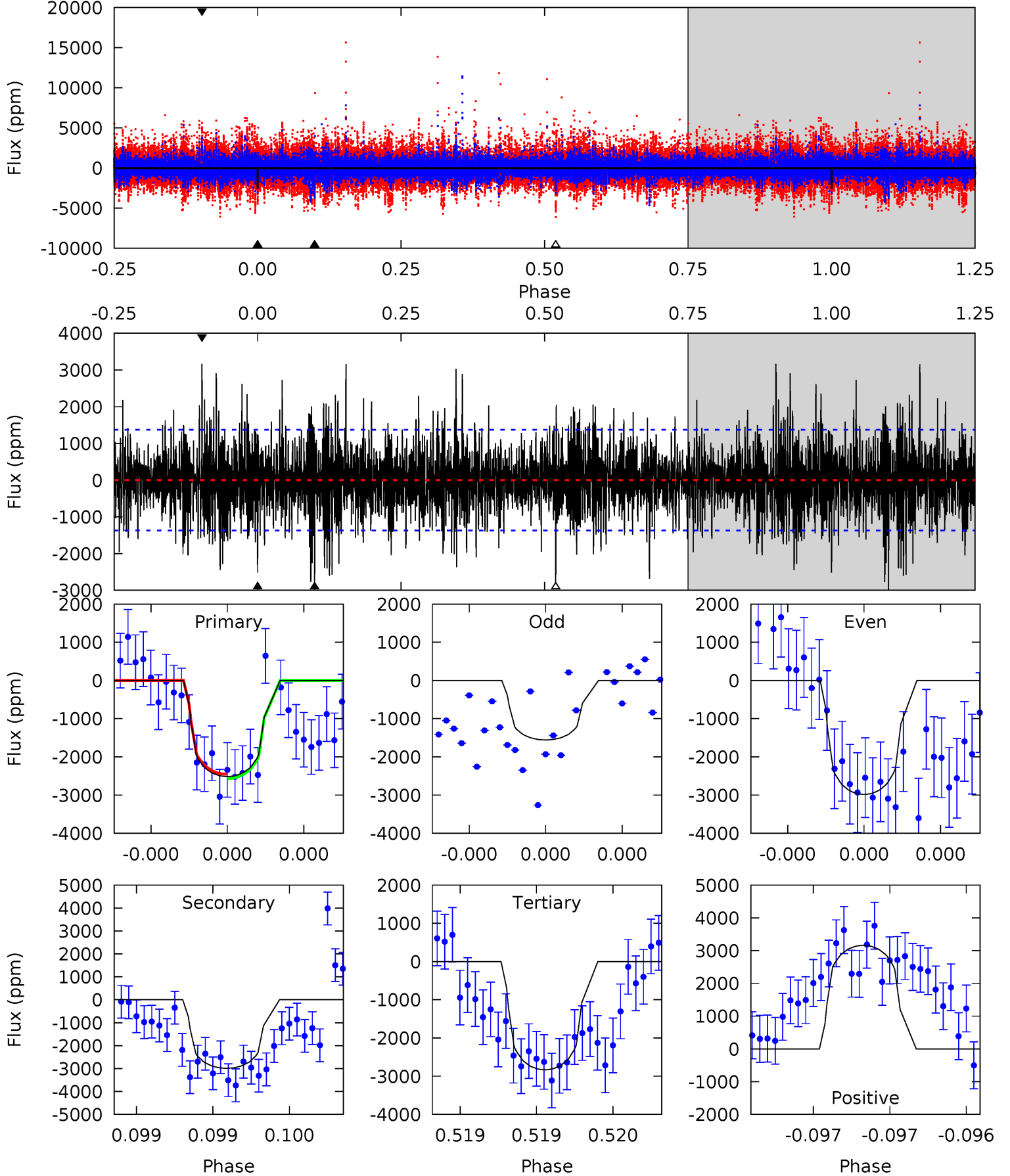
TCE 002710323-01 P=503.646387 Days  $T_0=419.325115$  (BKJD)



# DV Model-Shift Uniqueness Test

002710323-01, P = 503.629232 Days, E = 419.356794 Days

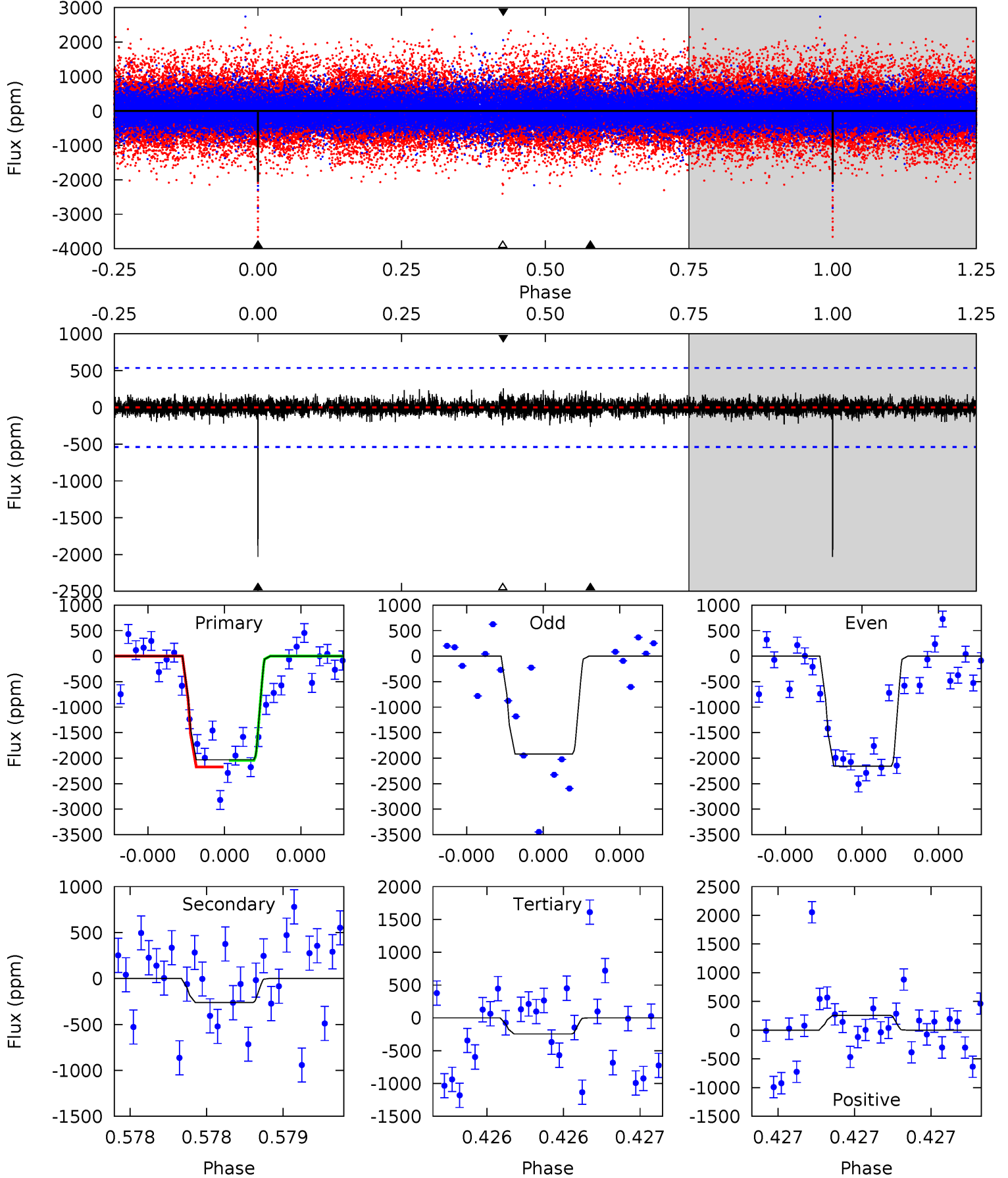
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
10.3	12.2	11.6	12.9	5.61	3.53	2.87	-1.30	-2.64	0.65	-0.69	2.63	1.60	0.51	0.24



# Alt Model-Shift Uniqueness Test

002710323-01, P = 503.646387 Days, E = 419.325115 Days

Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
21.3	2.74	2.56	2.69	5.62	3.56	0.56	18.7	18.6	0.17	0.04	1.13	1.14	0.11	0.65



### Stellar Parameters For KIC 002710323

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$4831^{+145}_{-145}$	$4.730^{+0.042}_{-0.024}$	$-1.600^{+0.300}_{-0.250}$	$0.525^{+0.026}_{-0.029}$	$0.539^{+0.036}_{-0.019}$	$5.256^{+0.867}_{-0.509}$
	+3%/-3%	+1%/-1%	+19%/-16%	+5%/-6%	+7%/-4%	+16%/-10%
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 002710323-01 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-2992 \pm 245$	$14.85^{+14.29}_{-10.81}$	$214^{+7}_{-7}$	$2894^{+1417}_{-470}$	$7758^{+93116}_{-5795}$
Alt.	$-261 \pm 96$	$13.48^{+16.24}_{-9.97}$	$214^{+7}_{-7}$	$2172^{+852}_{-318}$	$772^{+9774}_{-616}$

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

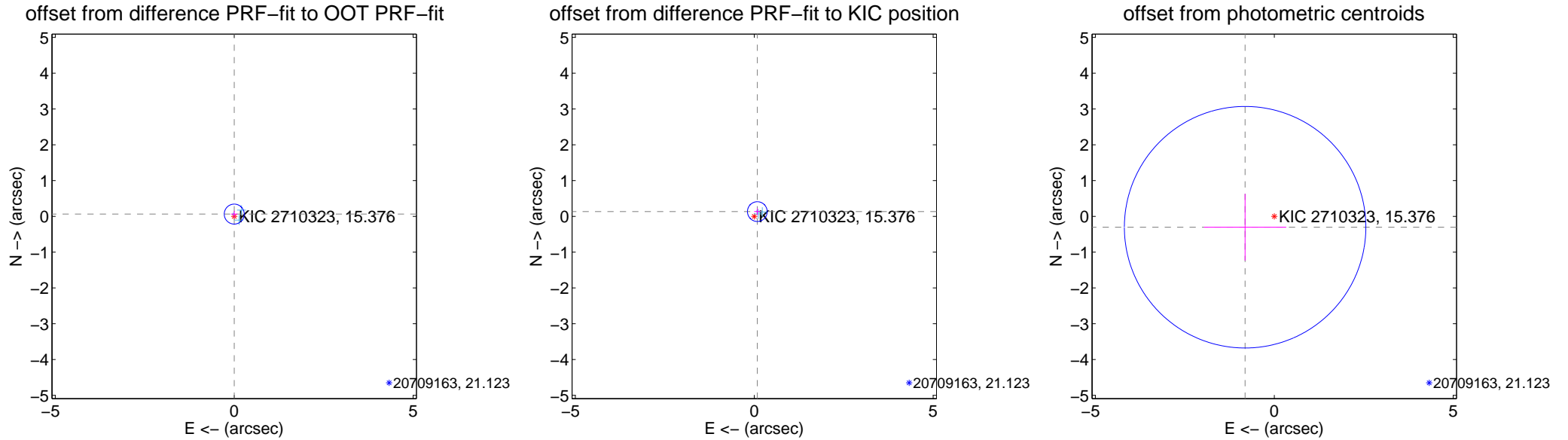
## DV Centroid Data

Supplemental centroid analysis for 002710323-01. Kepler magnitude: 15.38. Transit SNR 5.14

There are 3 quarters with good PRF difference image offsets

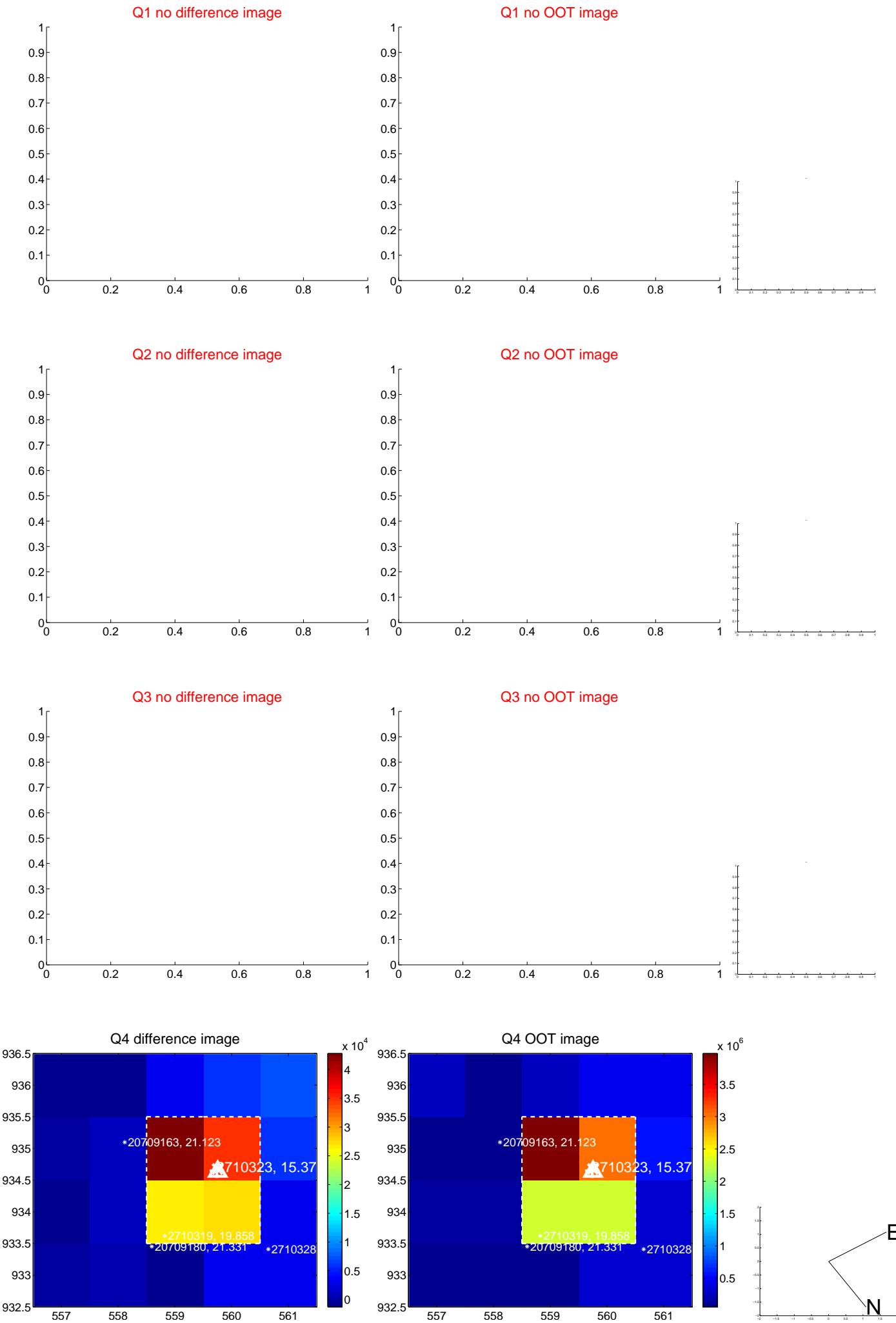
The direct PRF centroid is offset from the target star catalog position by about 0.17 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.063 \pm 0.093$	0.68	$-0.001 \pm 0.089$	$0.063 \pm 0.093$
PRF-fit source offset from KIC position	$0.159 \pm 0.092$	1.73	$-0.086 \pm 0.089$	$0.133 \pm 0.093$
photometric centroid source offset	$0.87 \pm 1.12$	0.77	$0.82 \pm 1.15$	$-0.30 \pm 0.93$



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.

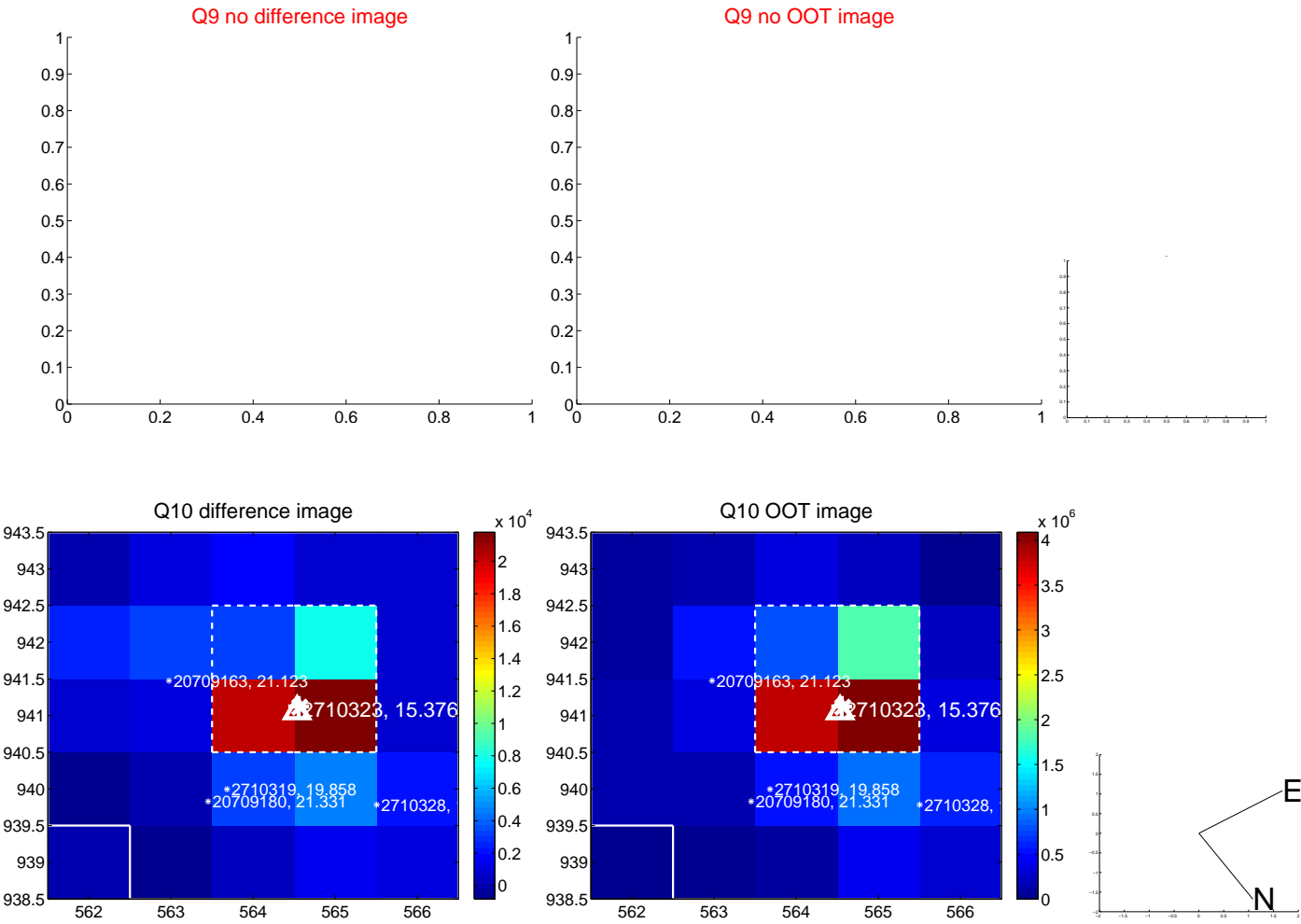




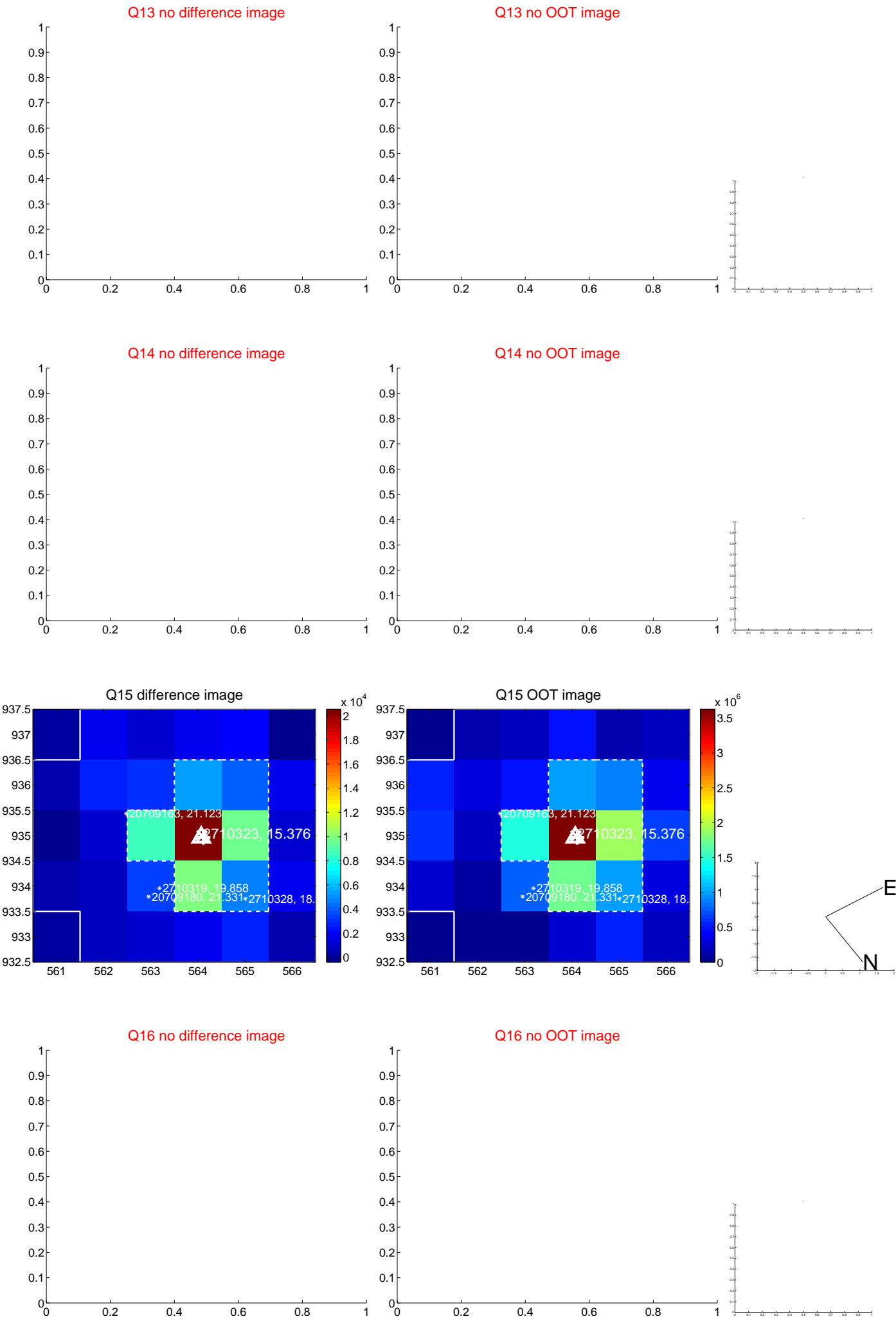
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



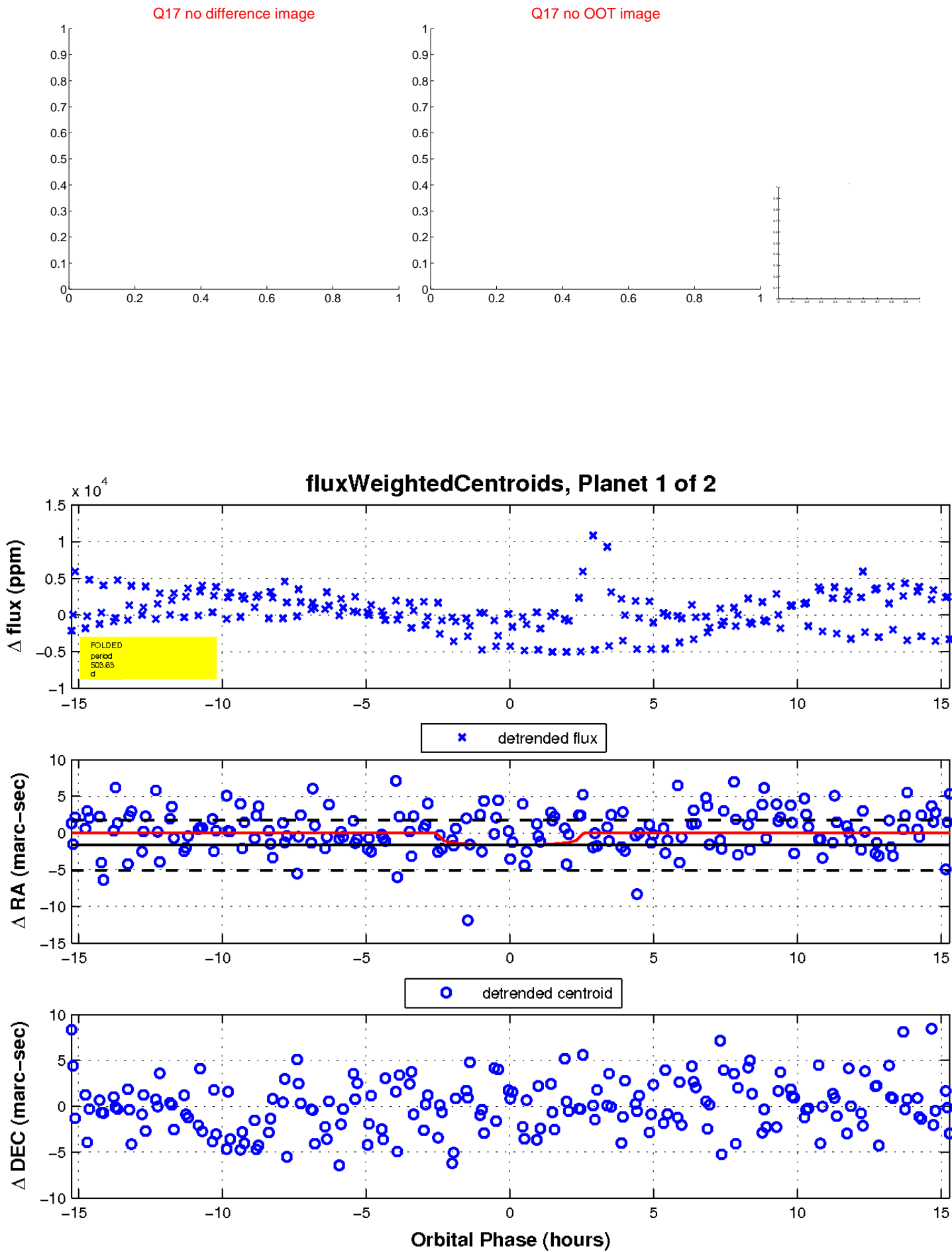
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

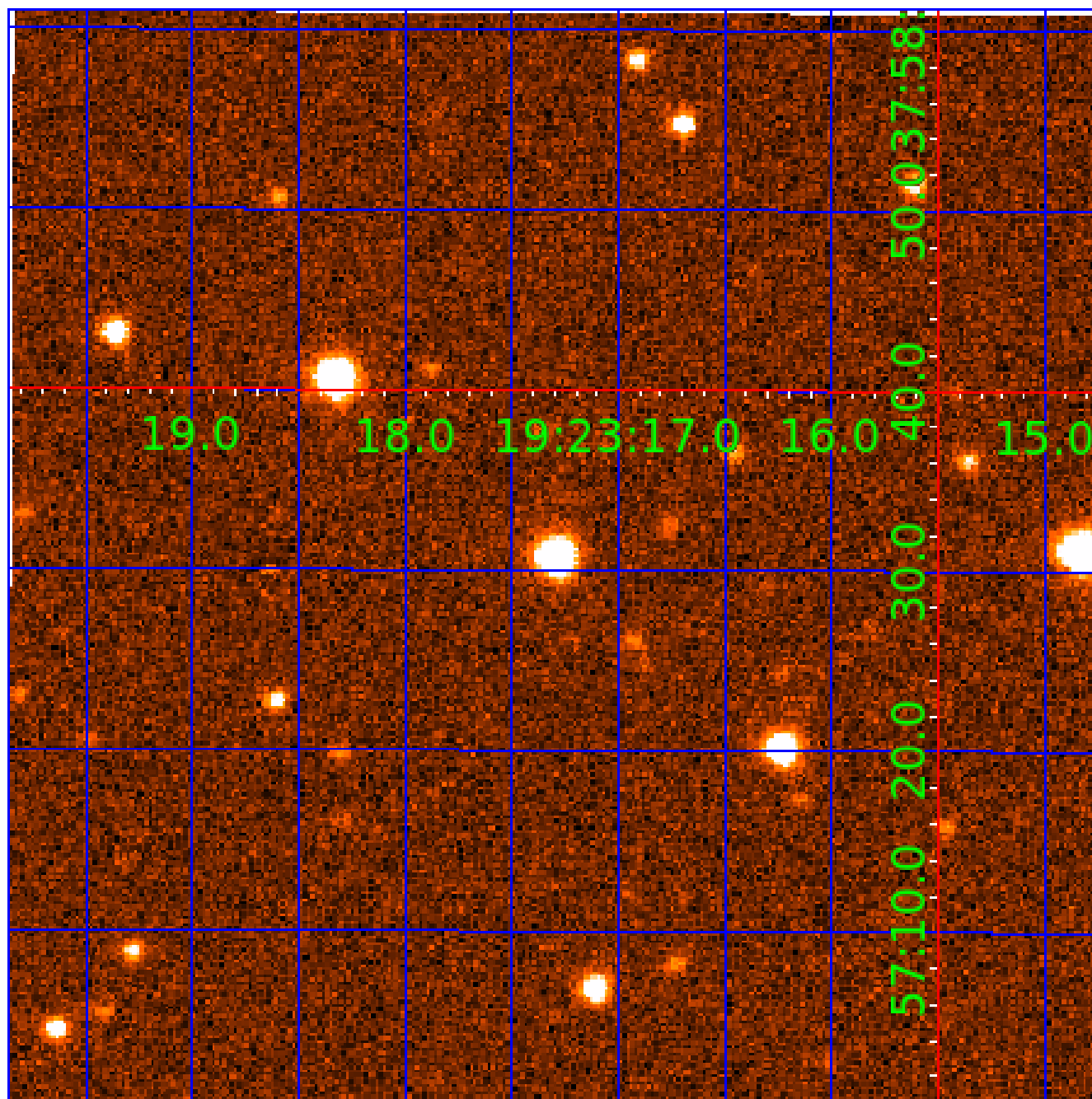


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 002710323

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
002710323-01	OBS	No	503.629232	419.356794	2033.5	5.158	11.8	5.1	0.53	4831	2.39	0.13
002710323-02	OBS	No	412.505793	314.576855	2353.0	3.538	11.6	6.3	0.53	4831	4.85	0.17

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
002710323-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS
002710323-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_SKYE—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—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.

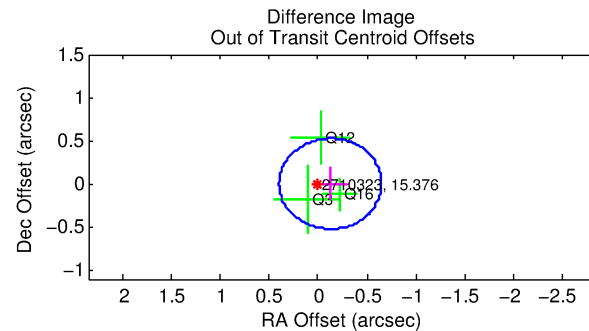
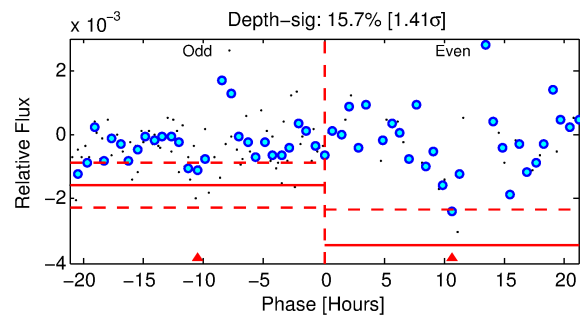
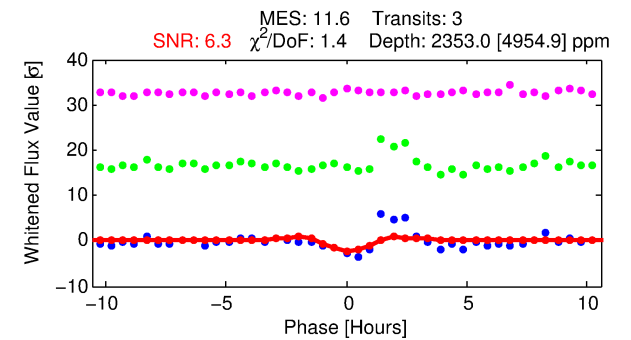
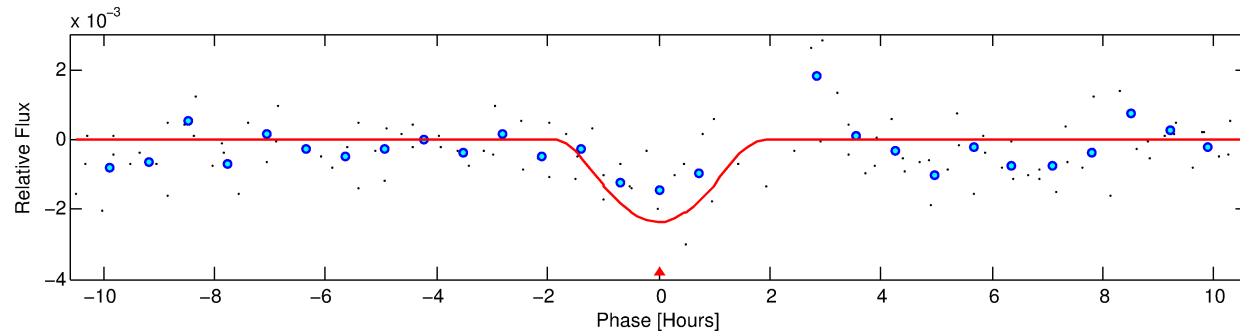
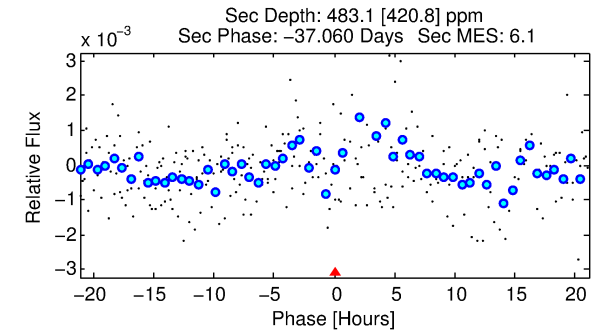
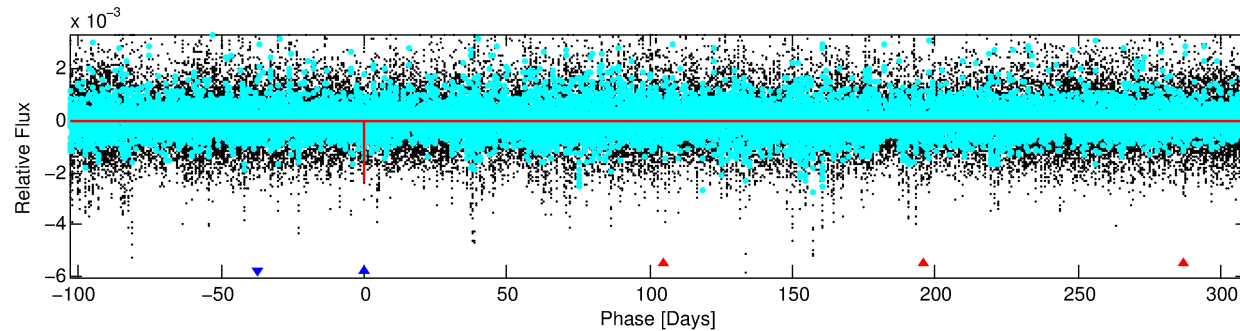
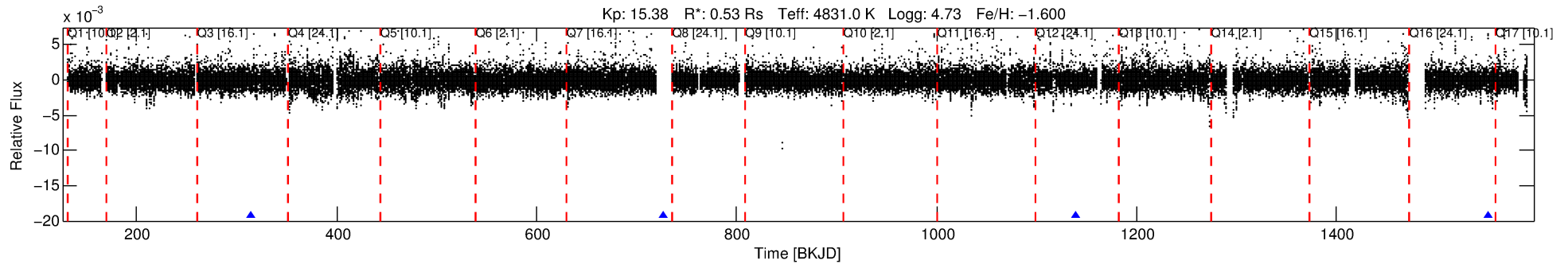
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 002710323-02

No Significant Match Found

# DV One-Page Summary

KIC: 2710323 Candidate: 2 of 2 Period: 412.506 d



## DV Fit Results:

Period = 412.50579 [0.00642] d  
Epoch = 314.5769 [0.0145] BKJD  
Rp/R\* = 0.0847 [0.6040]  
a/R\* = 374.40 [558.70]  
b = 1.00 [0.97]  
Seff = 0.17 [0.02]  
Teq = 164 [6] K  
Rp = 4.85 [34.61] Re  
a = 0.8833 [0.0432] AU  
Ag = 8804.56 [125809.07] [0.07 $\sigma$ ]  
Teffp = 2461 [8791] K [0.26 $\sigma$ ]

## DV Diagnostic Results:

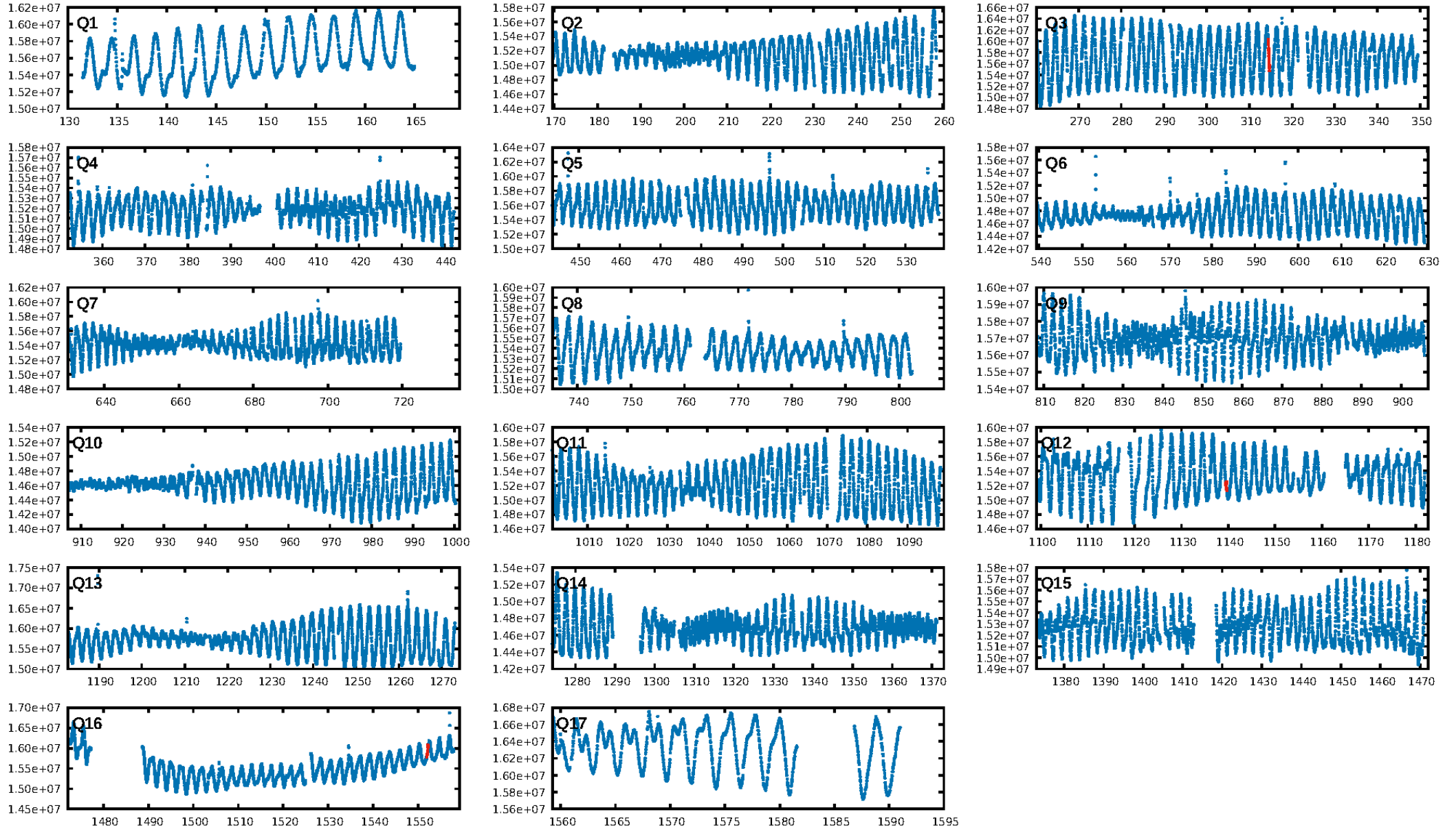
ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [349.66 $\sigma$ ]  
ModelChiSquare2-sig: 8.8%  
ModelChiSquareGof-sig: 67.2%  
**Bootstrap-pfa: 3.80e-10**  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: -1.164  
Centroid-sig: N/A  
Centroid-so: 1.211 arcsec [0.96 $\sigma$ ]  
OotOffset-rm: 0.123 arcsec [0.71 $\sigma$ ]  
OotOffset-st: 0/1/2/0 [3]  
KicOffset-rm: 0.216 arcsec [1.22 $\sigma$ ]  
KicOffset-st: 0/1/2/0 [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 07:24:44 Z

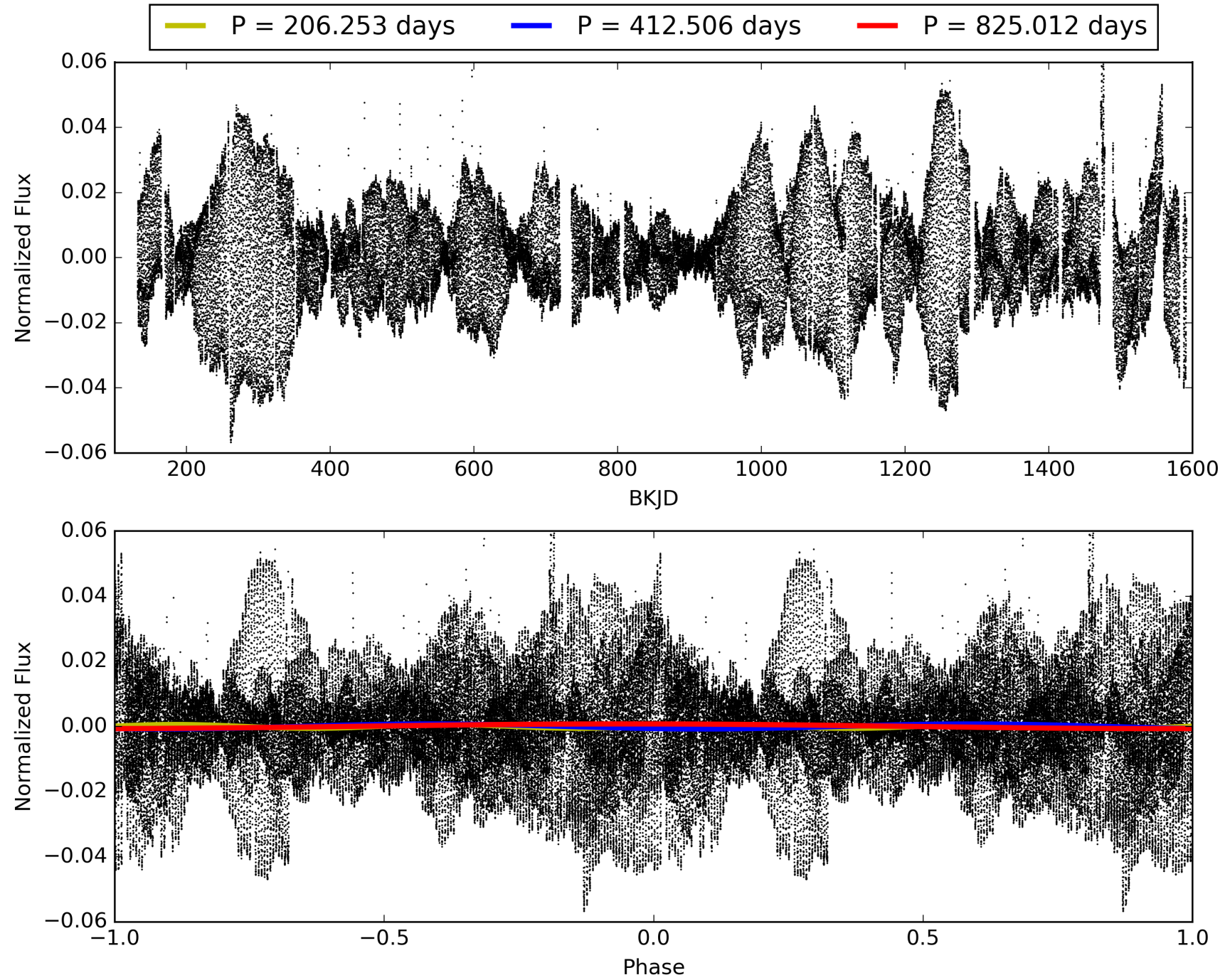
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center



# TCE 002710323-02, PDC Light Curves

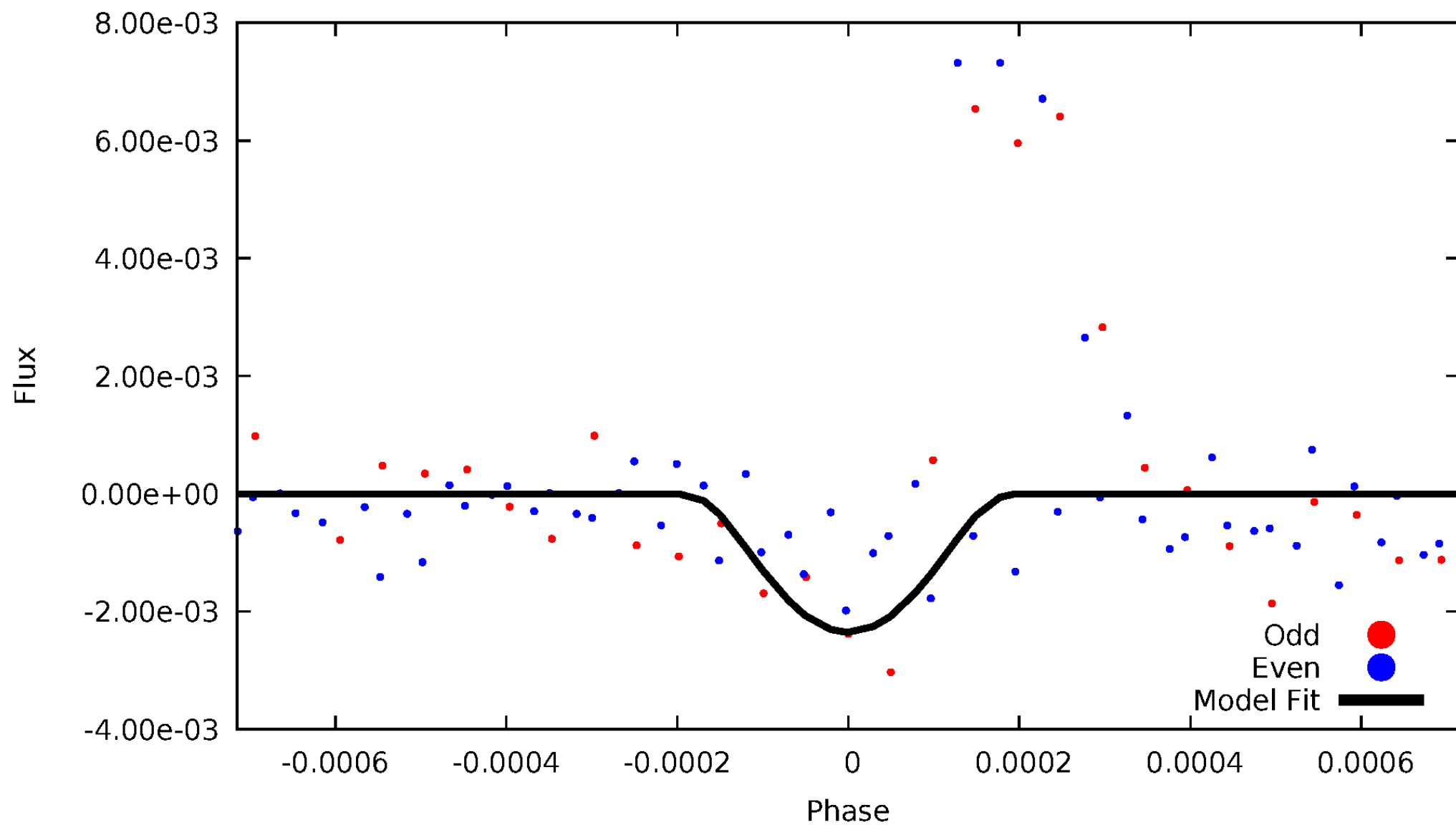


TCE 002710323-02



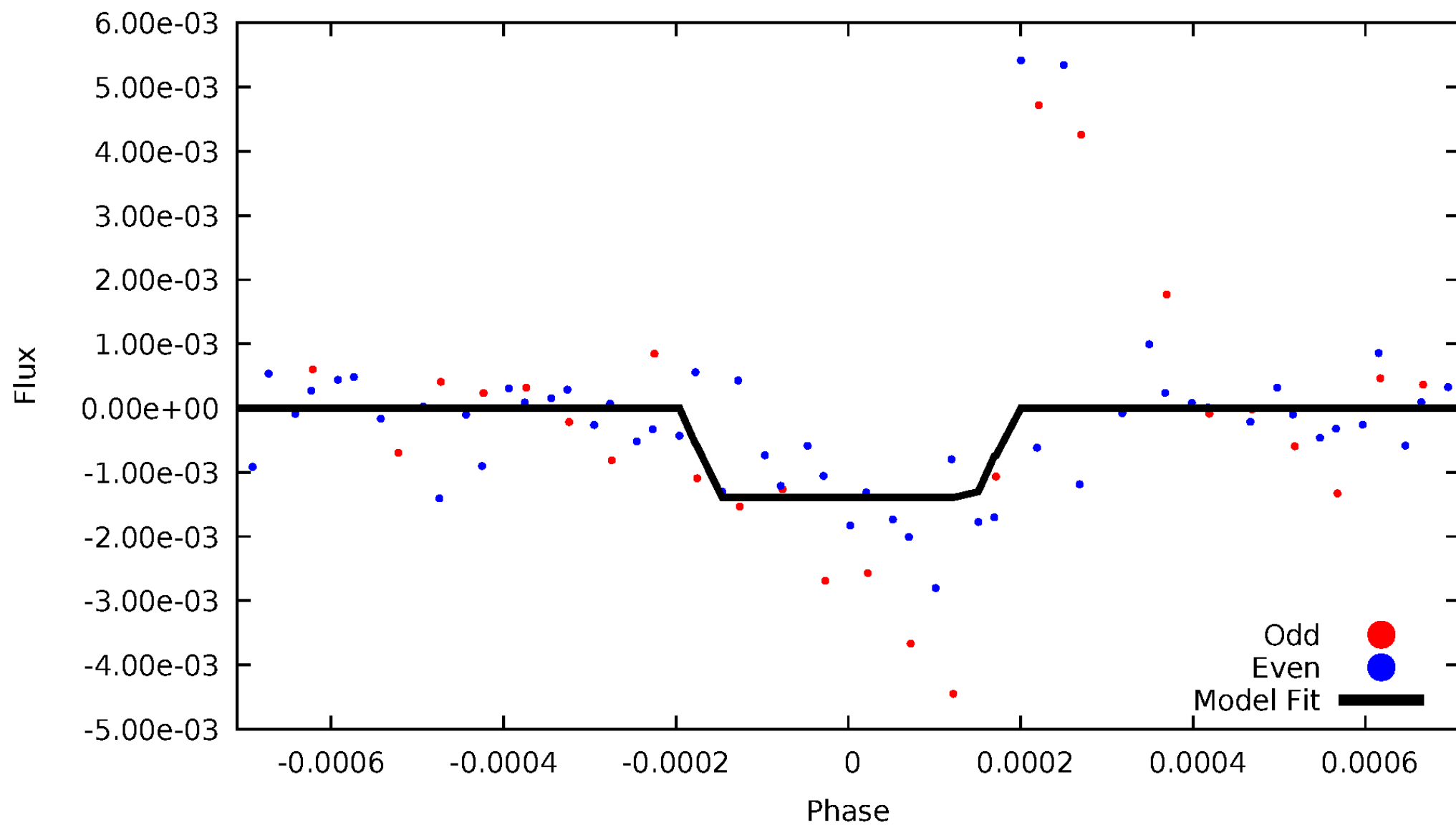
# DV Odd/Even

TCE 002710323-02



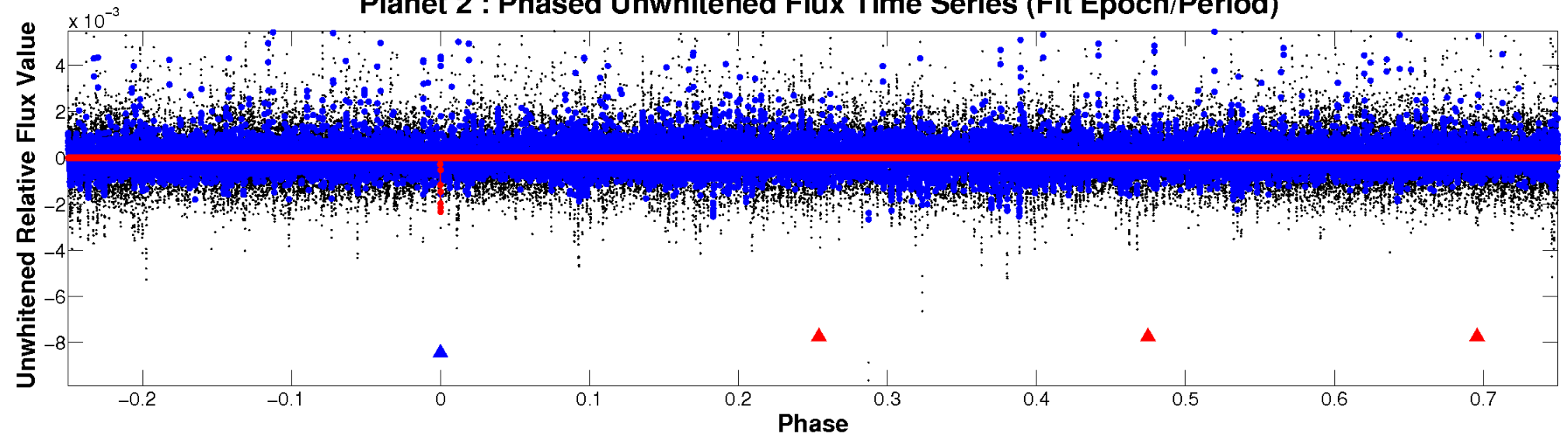
# ALT Odd/Even

TCE 002710323-02

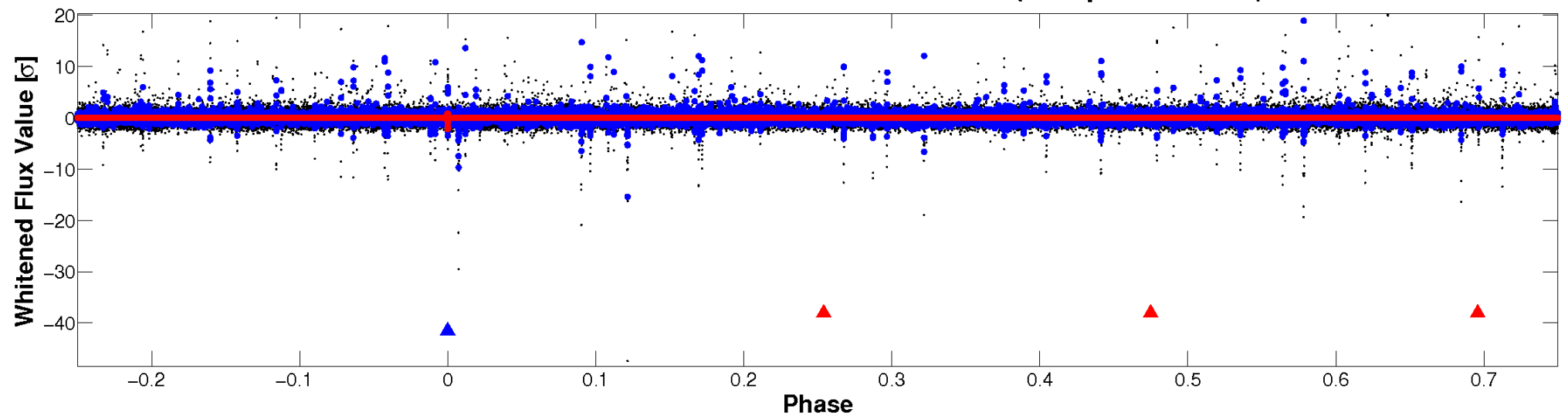


# Non-Whitened Vs. Whitened Light Curve

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

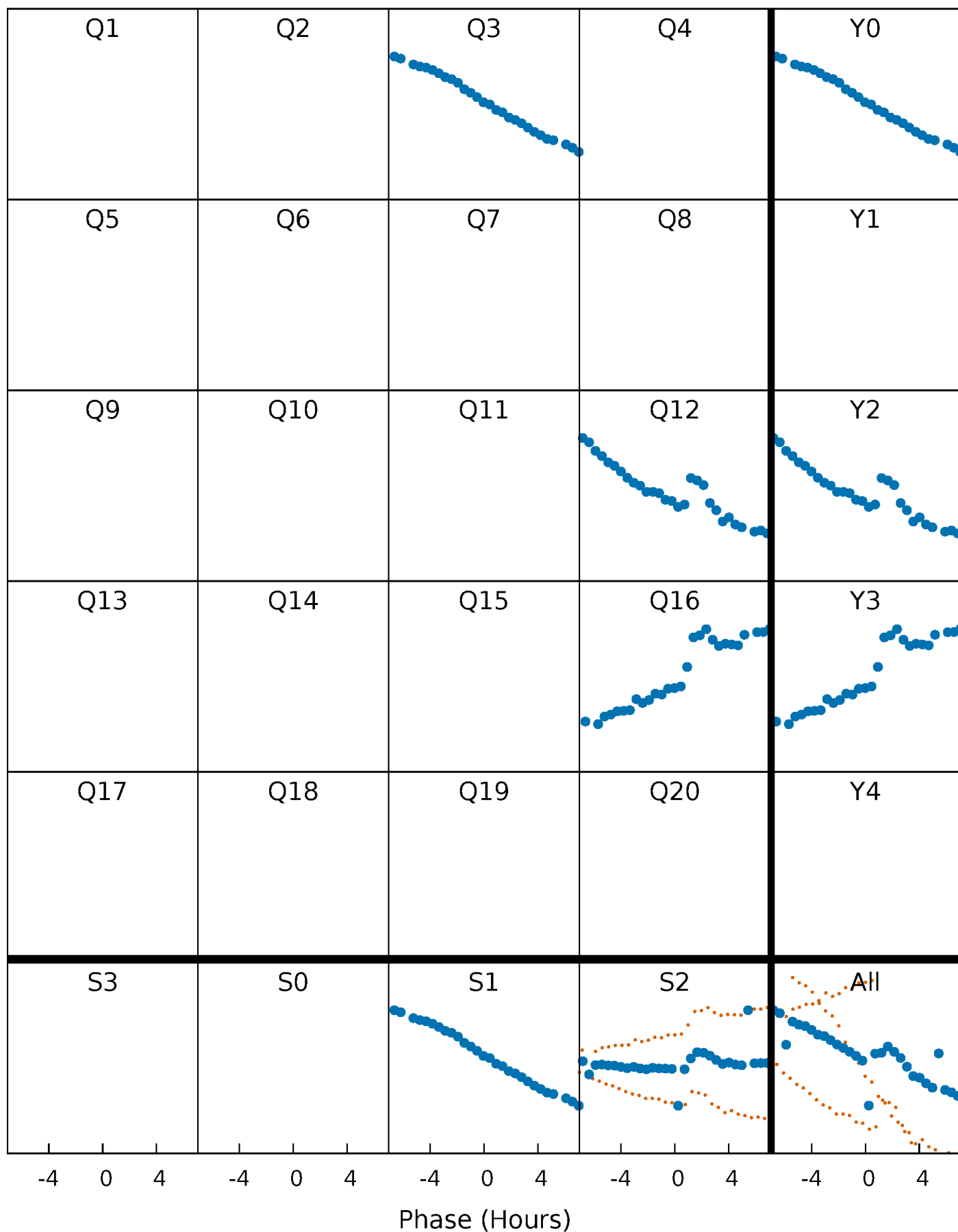


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



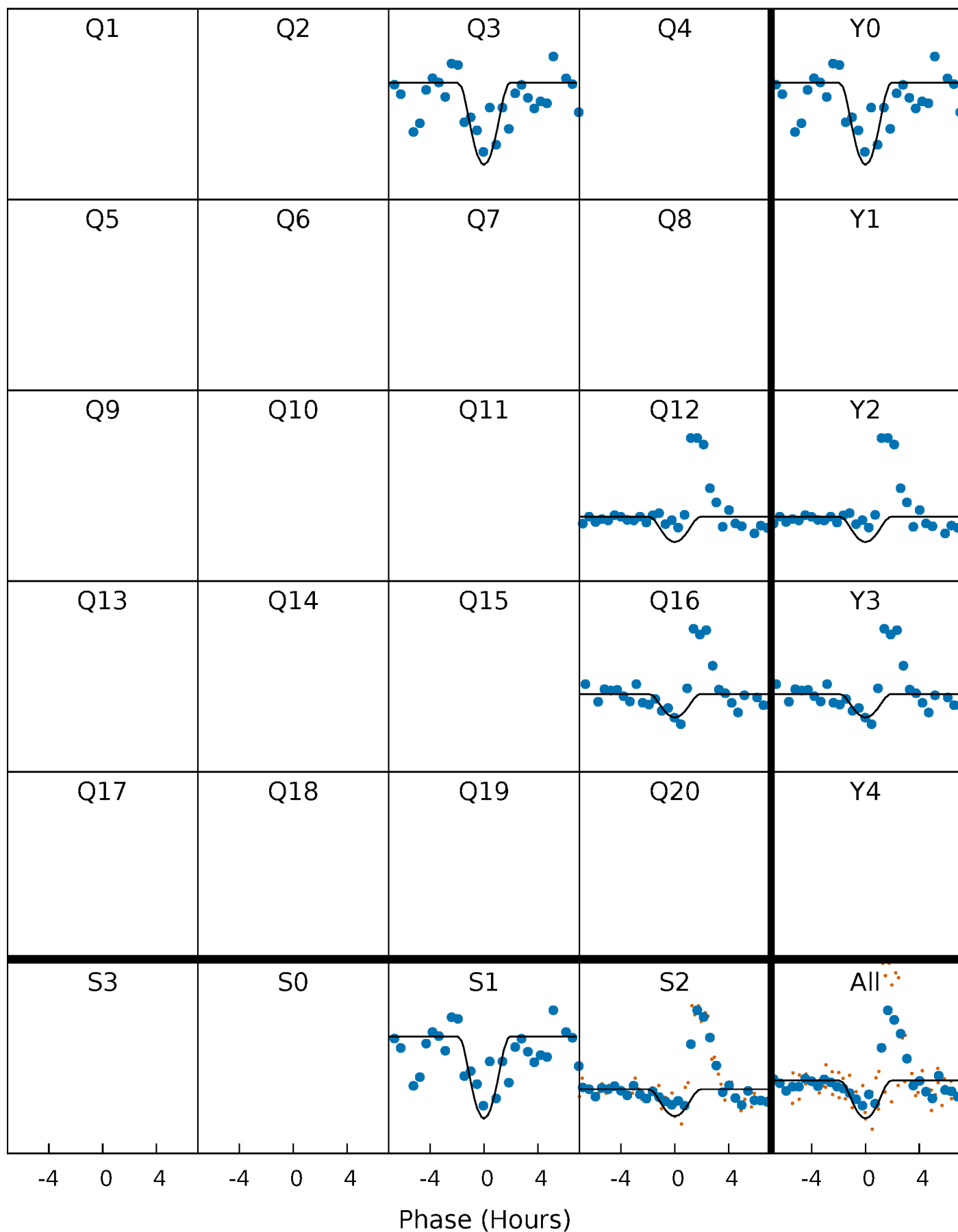
# PDC Quarter-Phased Transit Curves

TCE 002710323-02 P=412.505793 Days  $T_0=314.576855$  (BKJD)



# DV Quarter-Phased Transit Curves

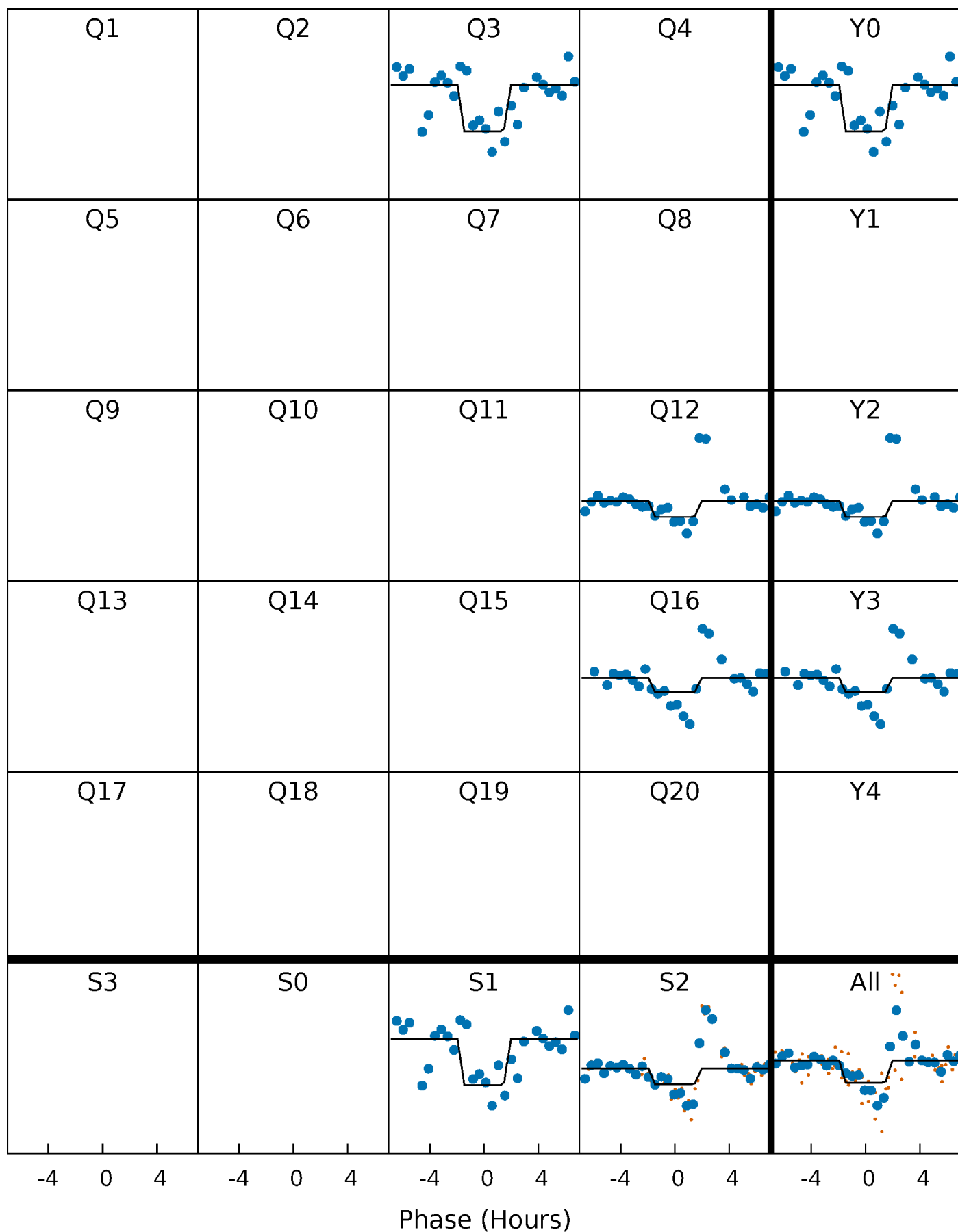
TCE 002710323-02     $P=412.505793$  Days     $T_0=314.576855$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

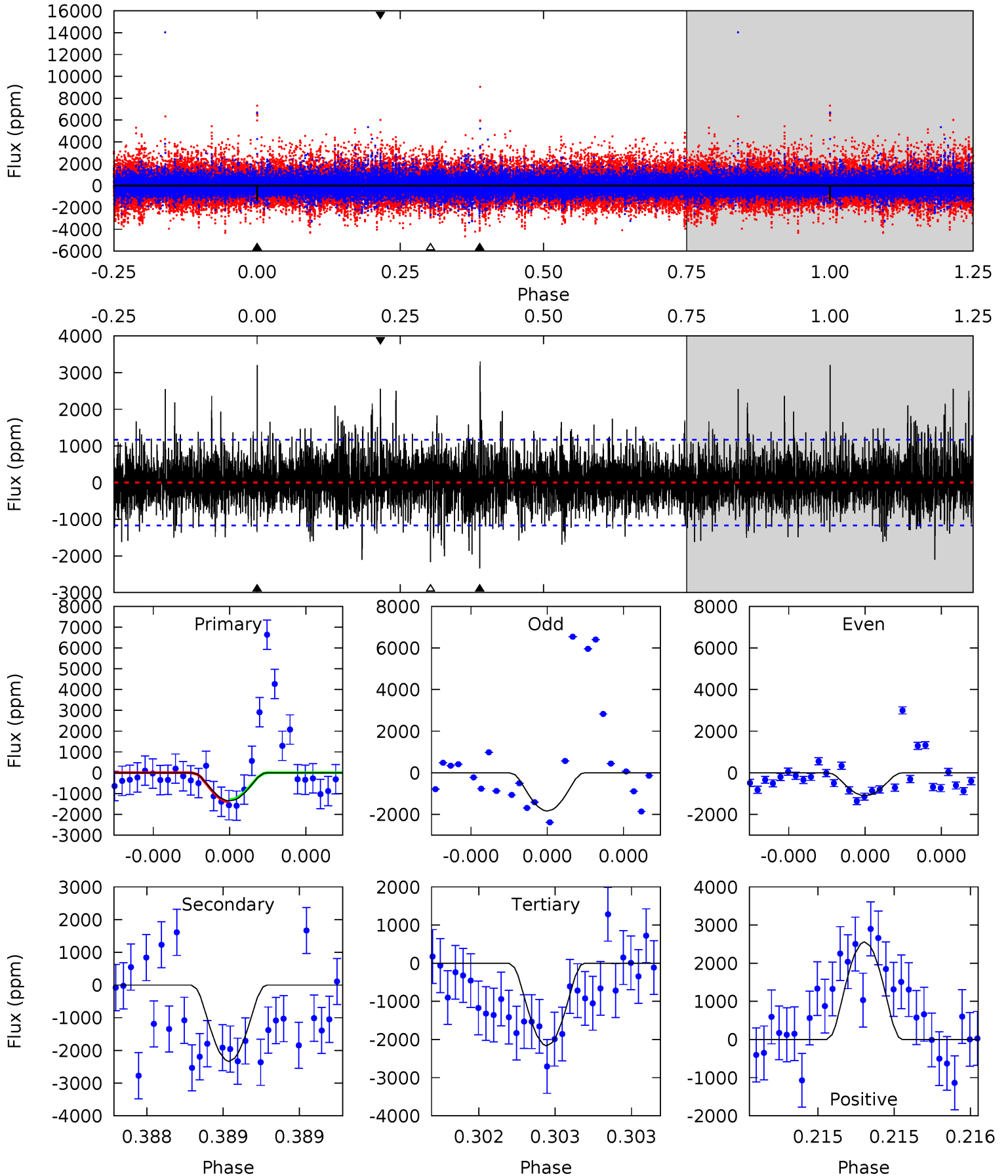
TCE 002710323-02 P=412.505898 Days  $T_0=314.546772$  (BKJD)



# DV Model-Shift Uniqueness Test

002710323-02, P = 412.505793 Days, E = 314.576855 Days

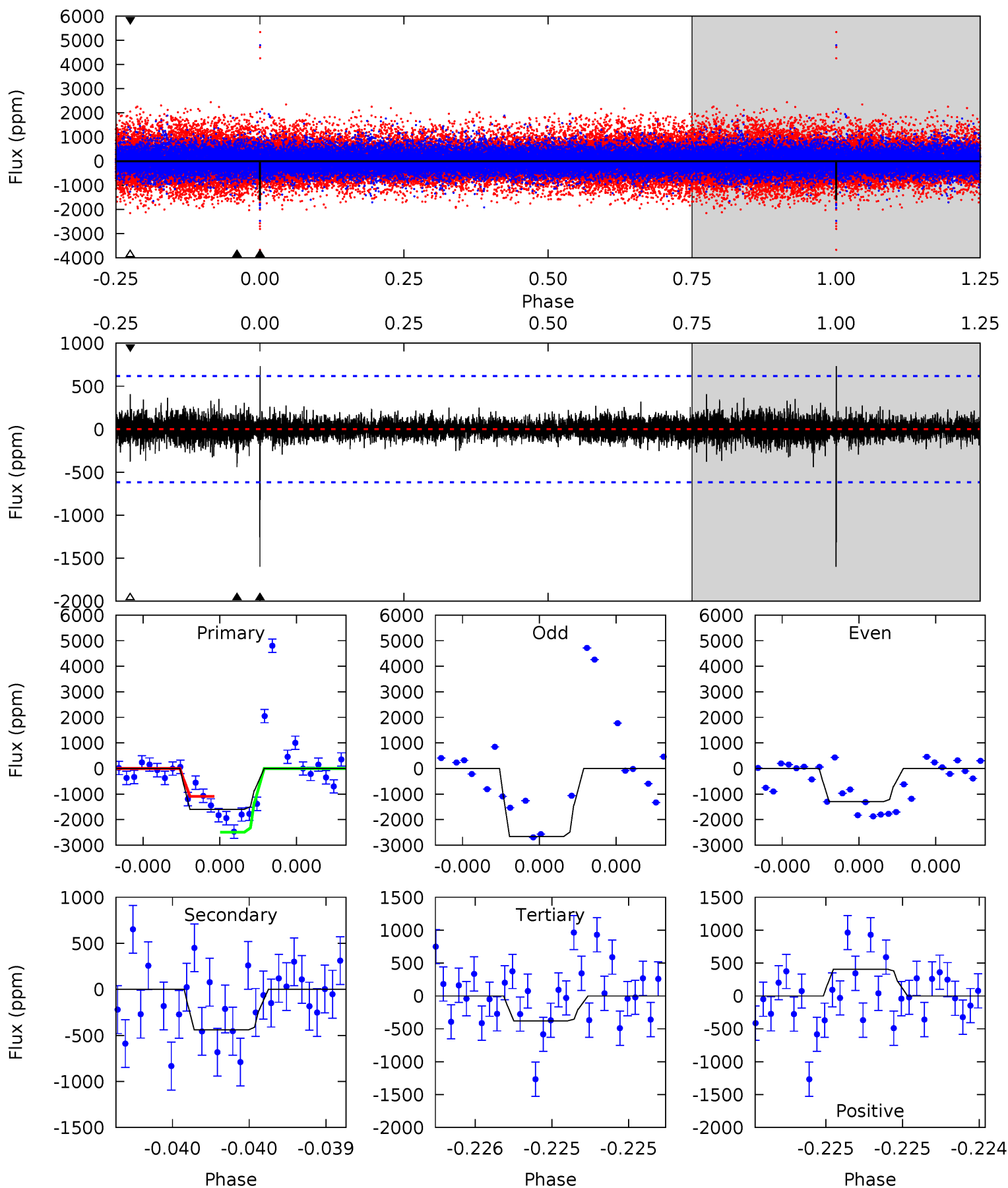
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
6.49	11.2	10.4	12.3	5.61	3.54	2.40	-3.90	-5.78	0.81	-1.07	1.65	0.63	0.59	0.24



# Alt Model-Shift Uniqueness Test

002710323-02, P = 412.505898 Days, E = 314.546772 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
14.6	4.02	3.45	3.70	5.62	3.56	0.64	11.1	10.9	0.57	0.31	6.11	1.13	0.31	6.40



### Stellar Parameters For KIC 002710323

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$4831^{+145}_{-145}$	$4.730^{+0.042}_{-0.024}$	$-1.600^{+0.300}_{-0.250}$	$0.525^{+0.026}_{-0.029}$	$0.539^{+0.036}_{-0.019}$	$5.256^{+0.867}_{-0.509}$
	+3%/-3%	+1%/-1%	+19%/-16%	+5%/-6%	+7%/-4%	+16%/-10%
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 002710323-02 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-2334 \pm 208$	$23.71^{+26.87}_{-16.46}$	$229^{+7}_{-8}$	$2469^{+955}_{-387}$	$1801^{+16763}_{-1400}$
Alt.	$-441 \pm 110$	$25.04^{+21.23}_{-17.24}$	$229^{+7}_{-8}$	$2032^{+643}_{-250}$	$320^{+2833}_{-237}$

$T_{max}$  = 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

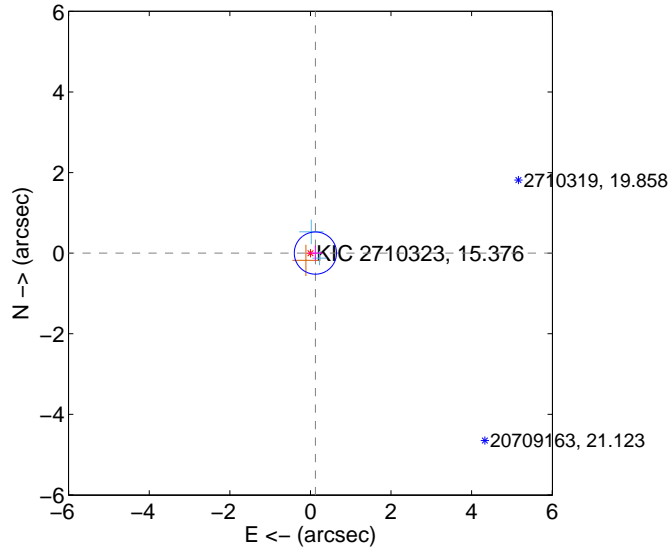
Supplemental centroid analysis for 002710323-02. Kepler magnitude: 15.38. Transit SNR 6.27

There are 2 quarters with good PRF difference image offsets

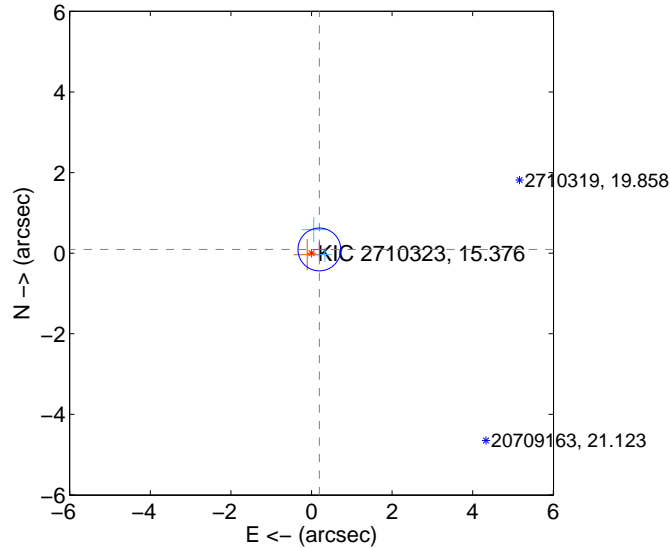
The direct PRF centroid is offset from the target star catalog position by about 0.14 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.123 \pm 0.175$	0.71	$-0.123 \pm 0.175$	$0.002 \pm 0.187$
PRF-fit source offset from KIC position	$0.216 \pm 0.177$	1.22	$-0.195 \pm 0.175$	$0.092 \pm 0.187$
photometric centroid source offset	$1.21 \pm 1.26$	0.96	$0.97 \pm 1.32$	$-0.72 \pm 1.16$

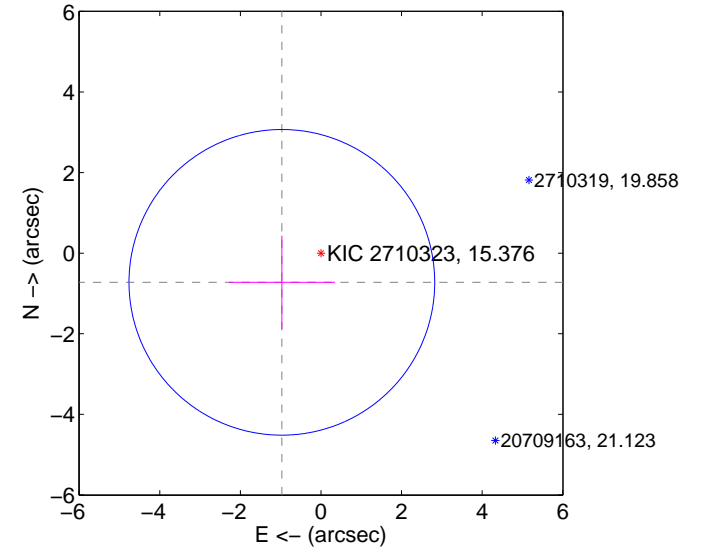
offset from difference PRF-fit to OOT PRF-fit



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.

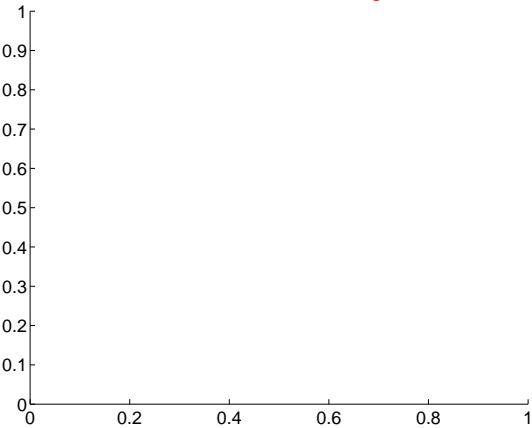
Q1 no difference image



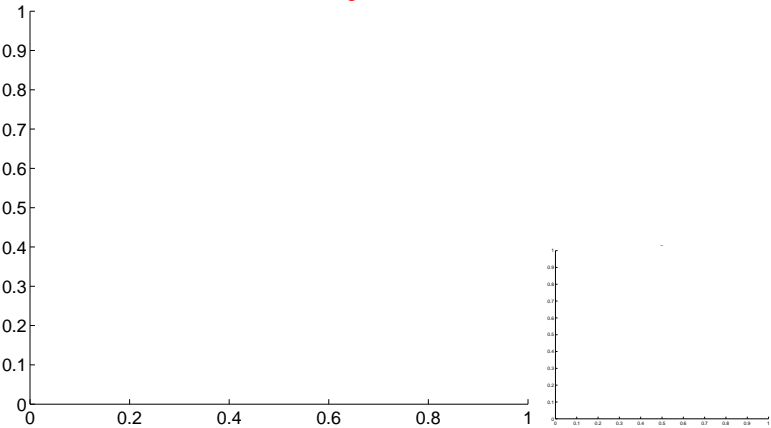
Q1 no OOT image



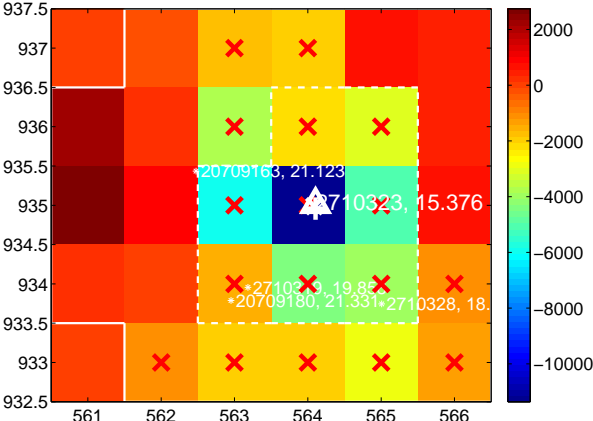
Q2 no difference image



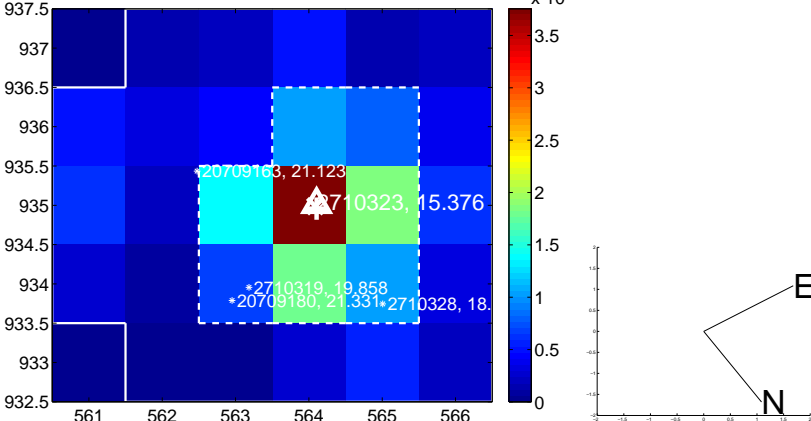
Q2 no OOT image



Q3 difference image. Poor Quality



Q3 OOT image



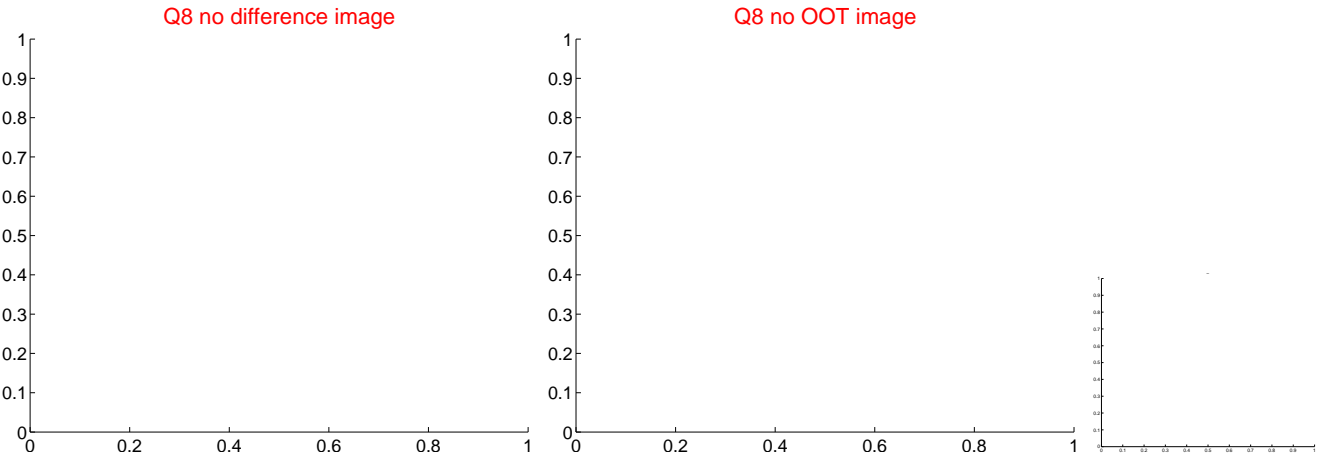
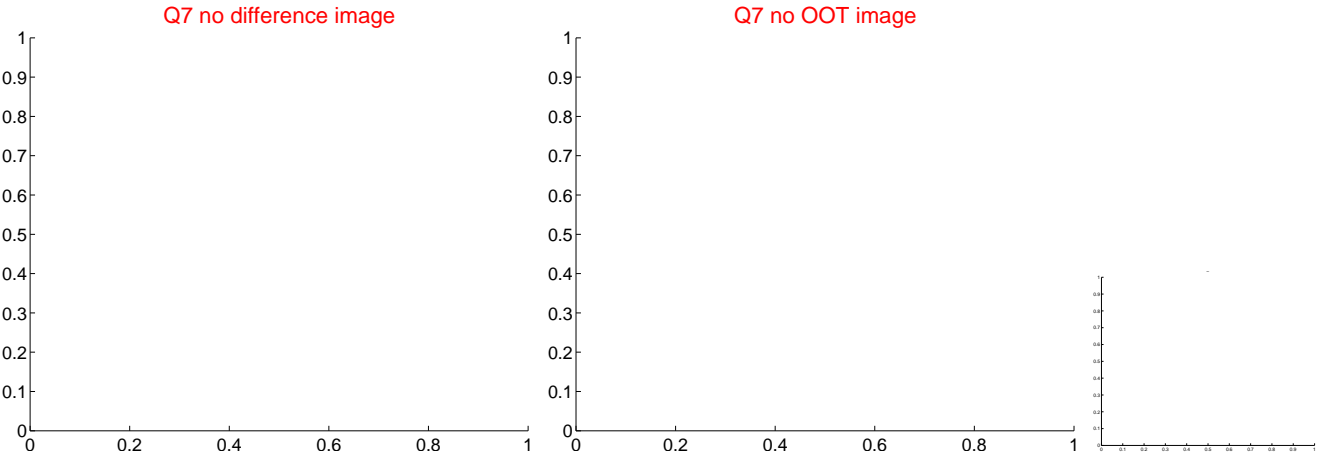
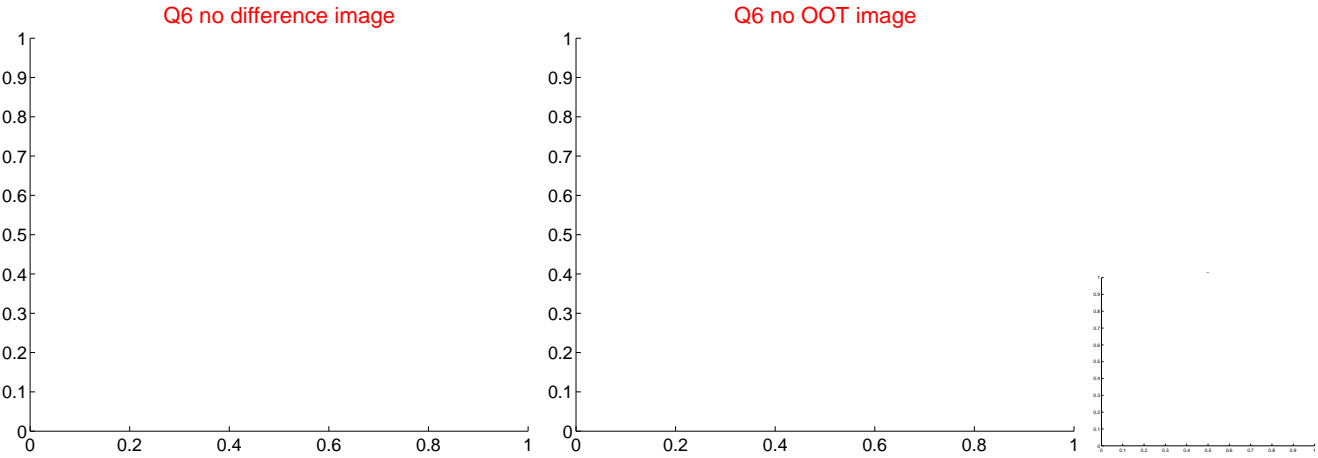
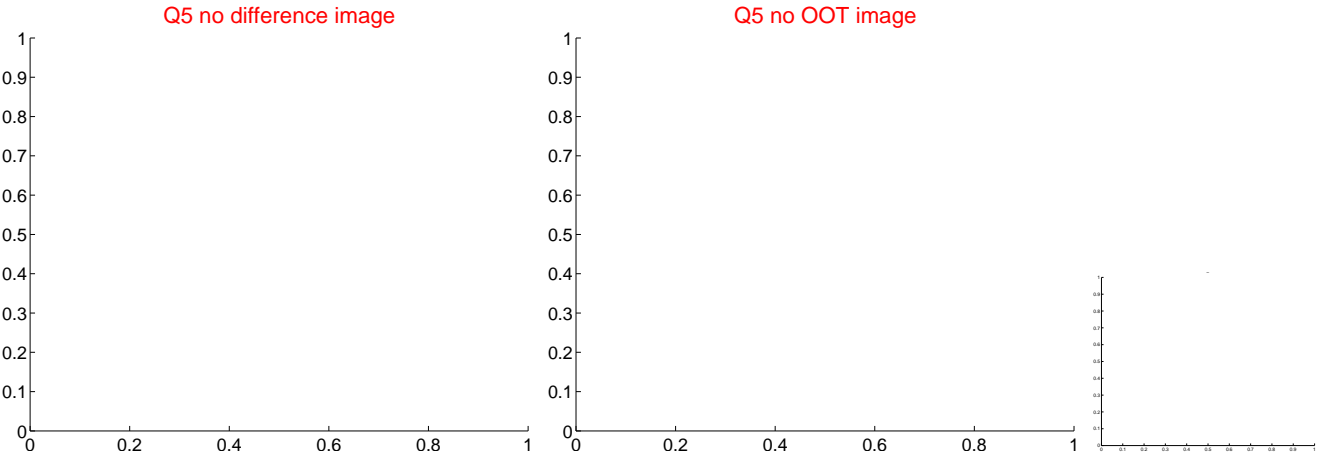
Q4 no difference image



Q4 no OOT image

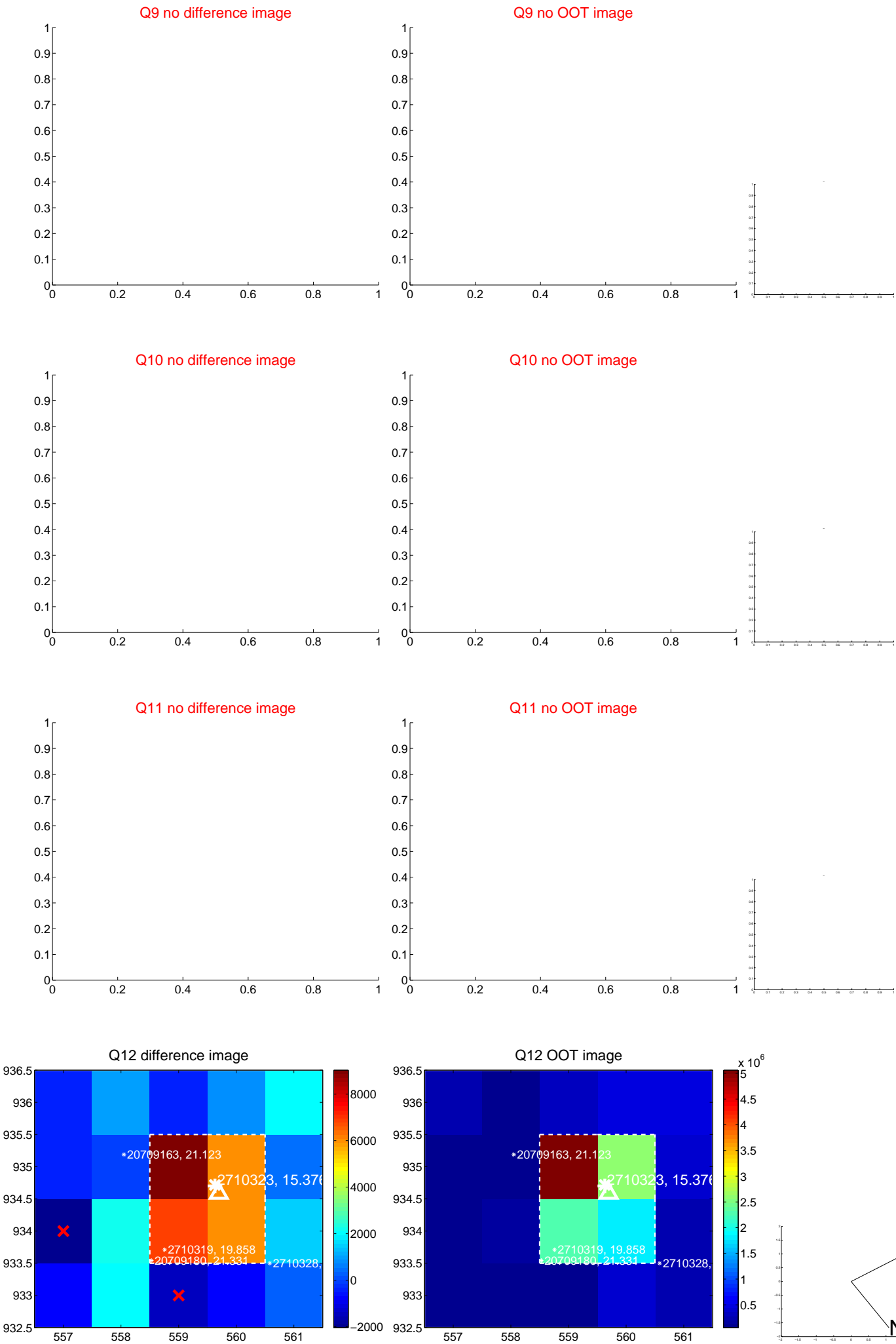


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

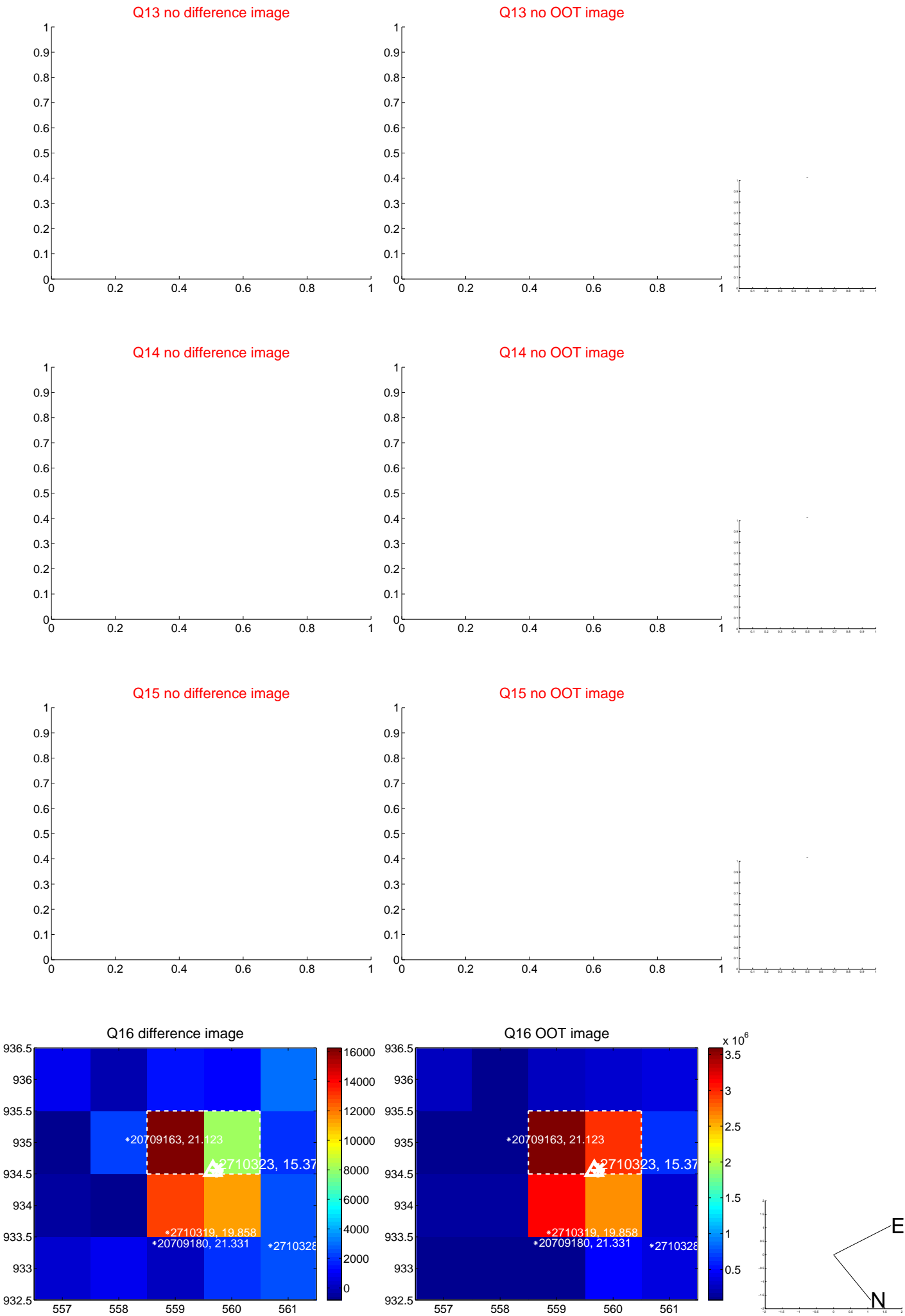




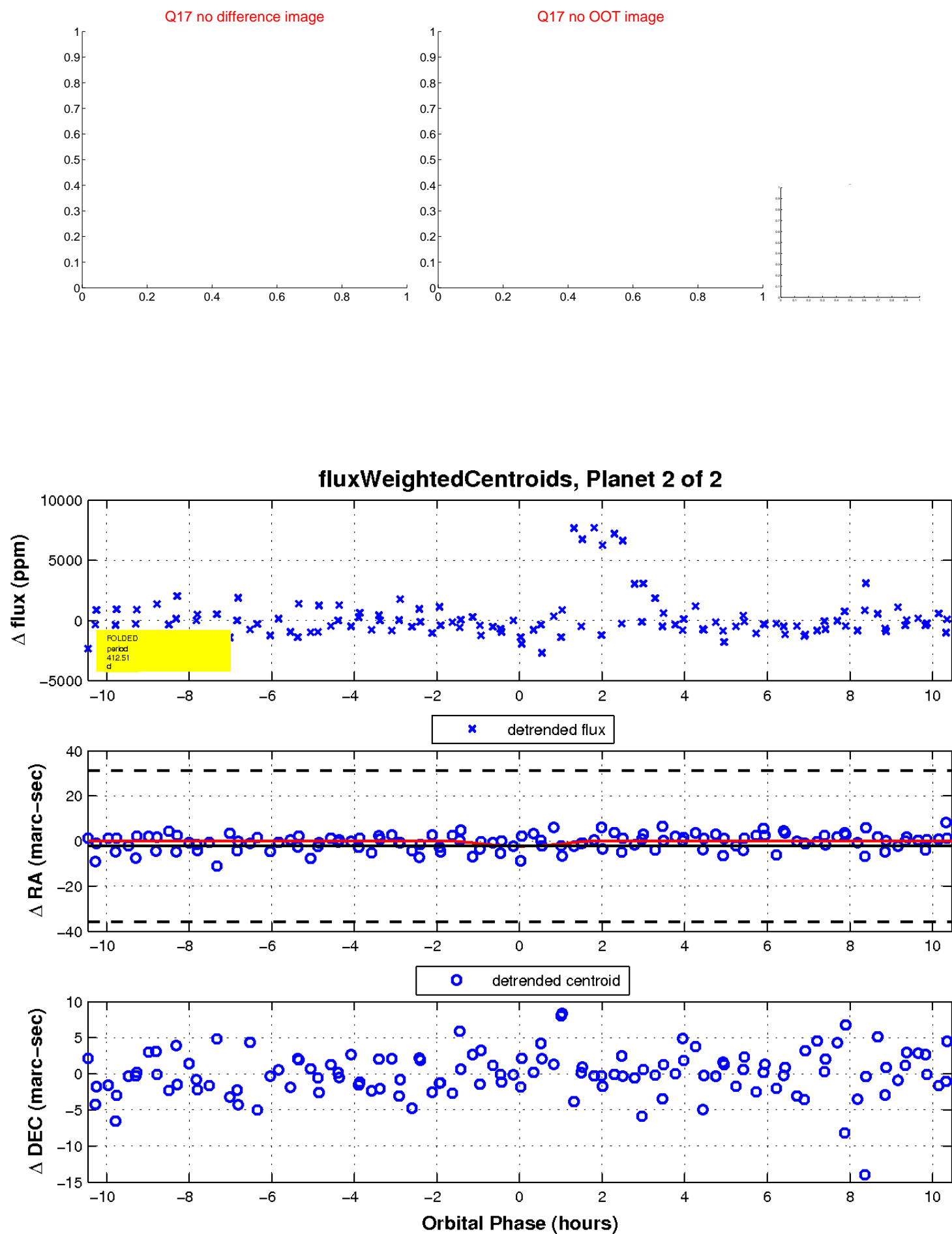
white ×: KIC target position; +: OOT centroid; △: difference centroid. red ✕: large negative pixel value.



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.



UKIRT Image

Declination

