

# KIC 010451317

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
010451317-01	OBS	No	559.062377	304.365759	1397.5	5.111	22.7	12.3	1.95	7262	7.84	4.08
010451317-02	OBS	No	574.174889	207.534363	528.6	18.081	13.7	4.4	1.95	7262	4.64	3.94

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
010451317-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT— INCONSISTENT_TRANS—CENT_FEW_DIFFS
010451317-02	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_CHASES—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT— MOD_POS_ALT—CENT_FEW_DIFFS—HALO_GHOST

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

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

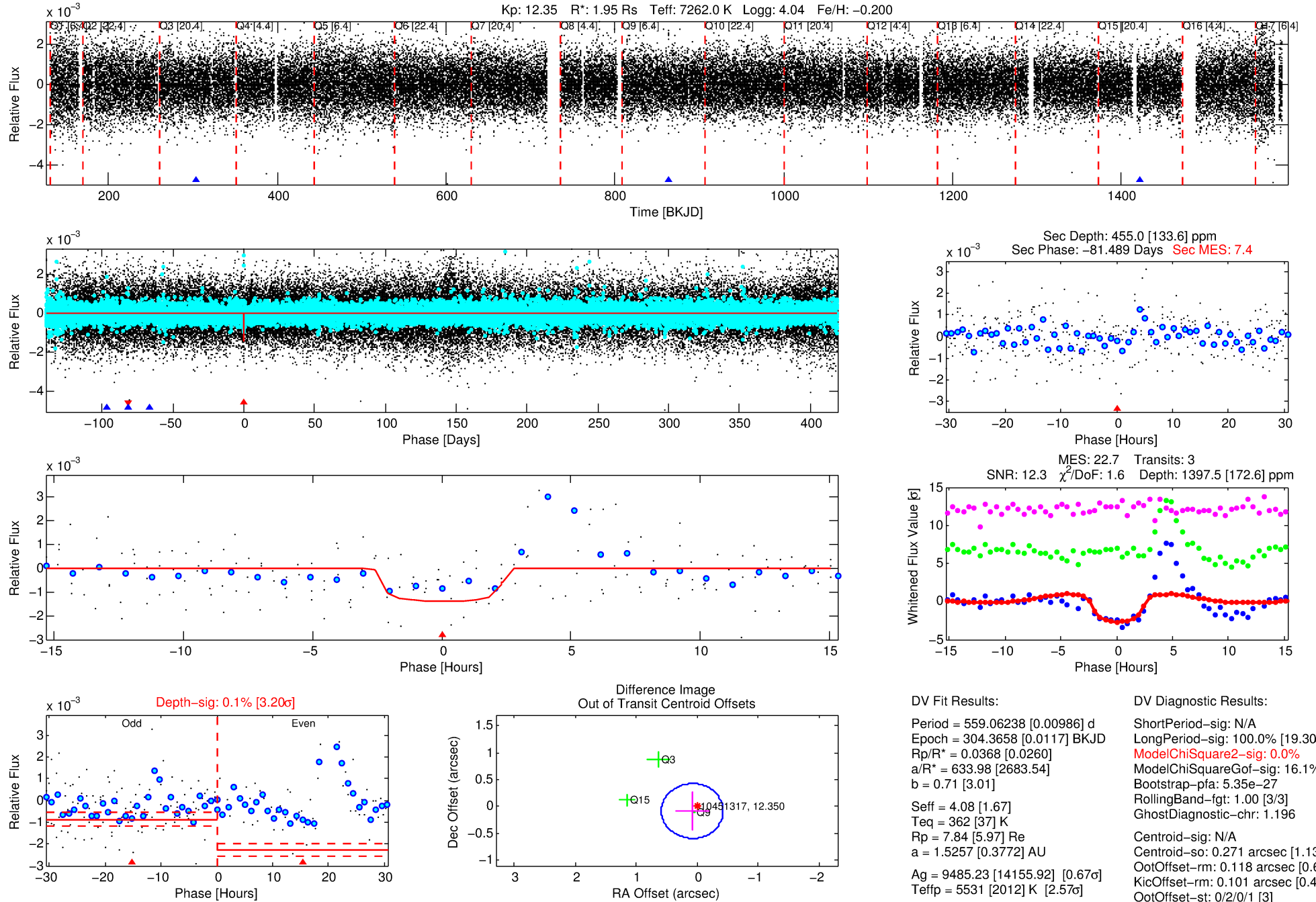
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 010451317-01

No Significant Match Found

# DV One-Page Summary

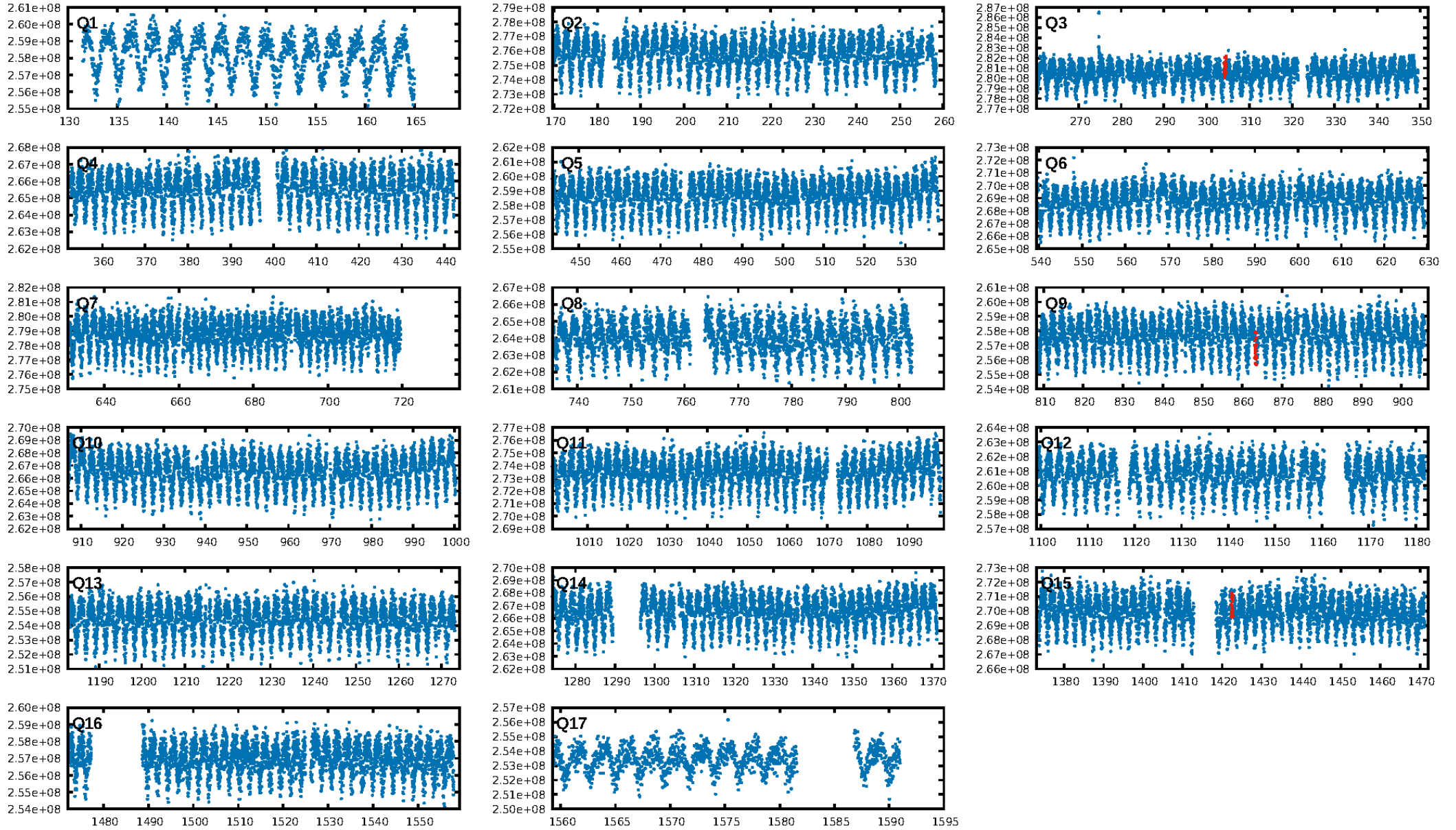
KIC: 10451317 Candidate: 1 of 2 Period: 559.062 d



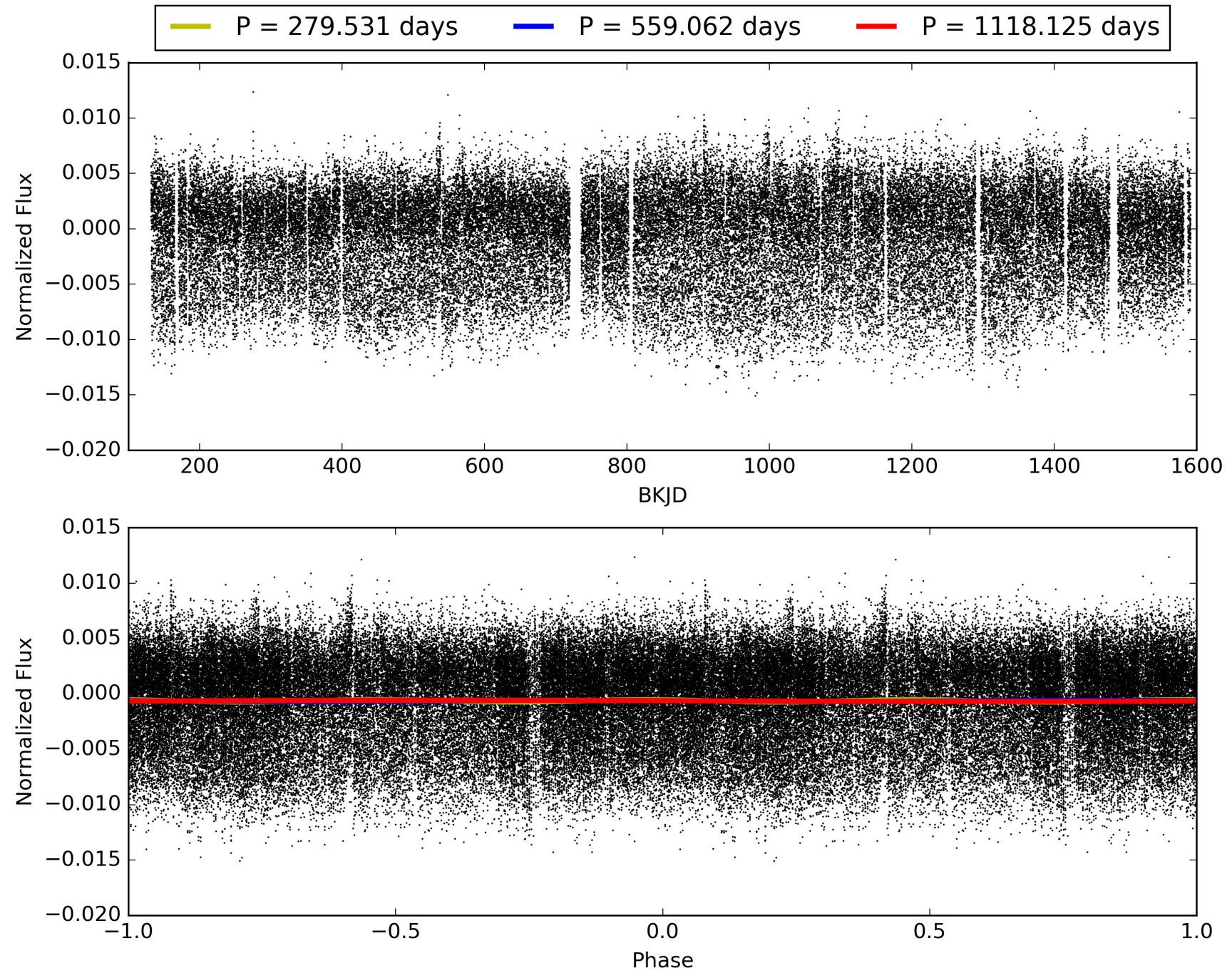
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 11:46:41 Z

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

# TCE 010451317-01, PDC Light Curves

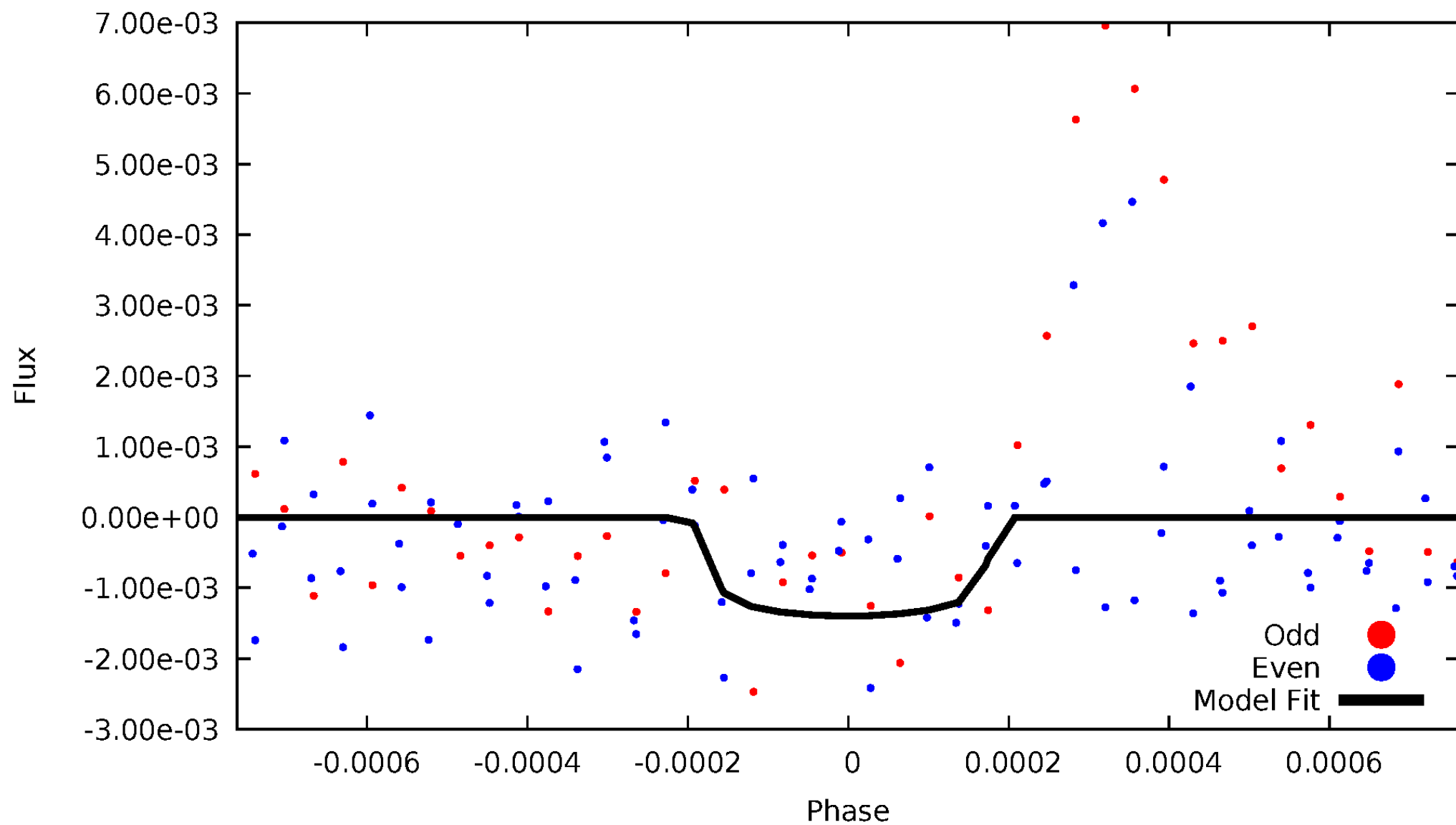


TCE 010451317-01



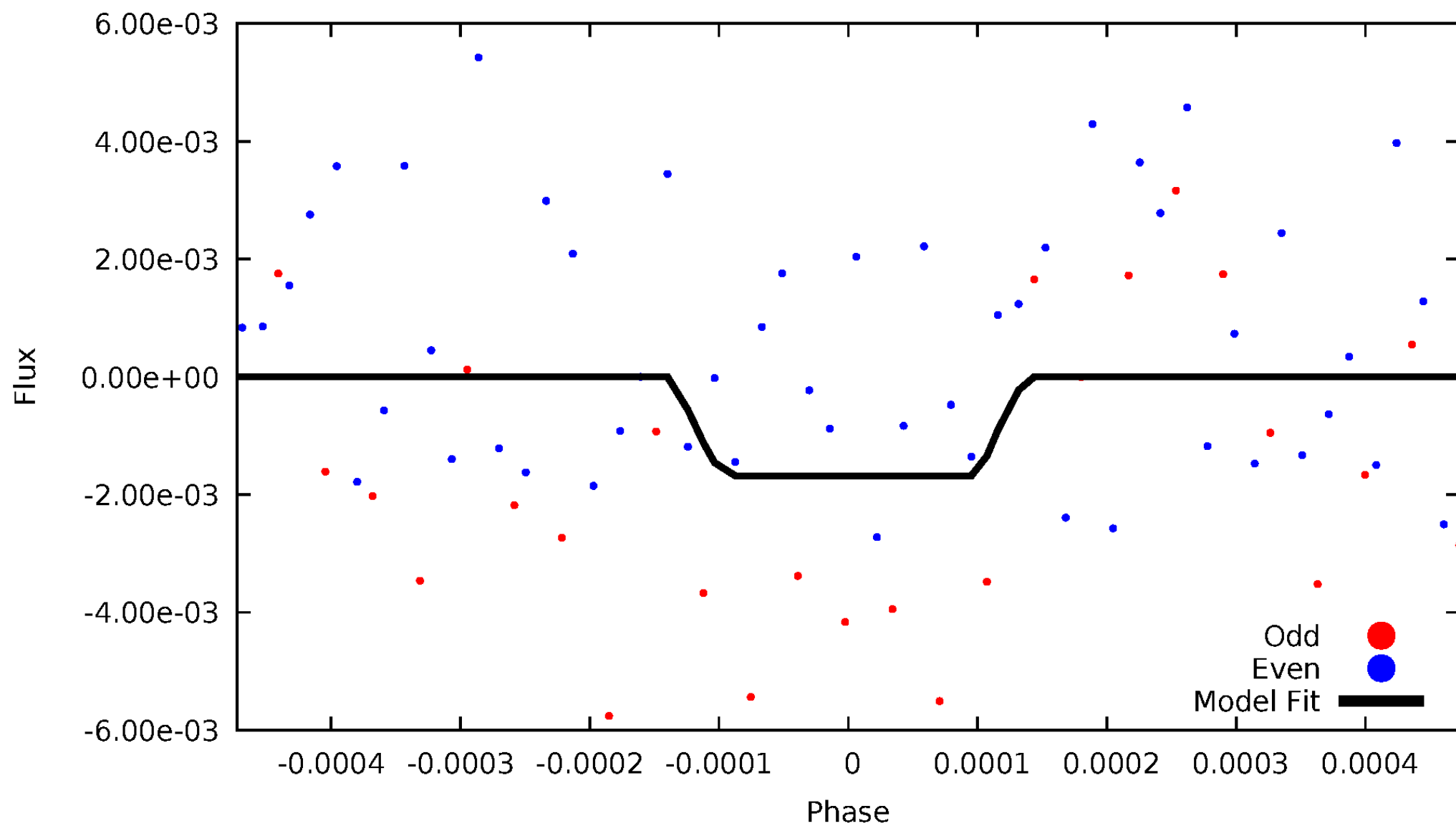
# DV Odd/Even

TCE 010451317-01



# ALT Odd/Even

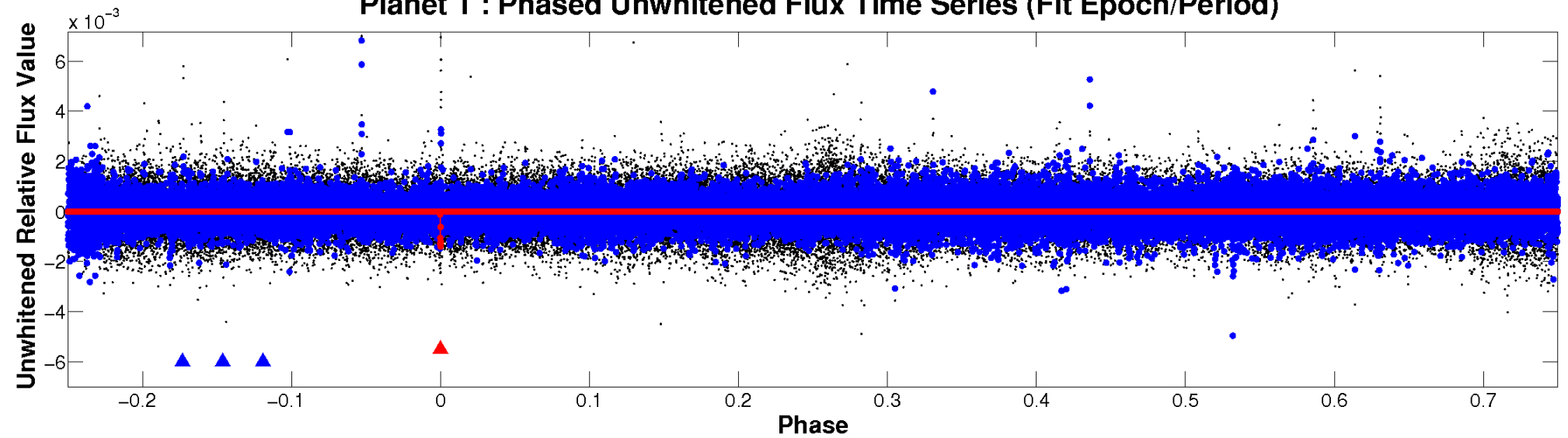
TCE 010451317-01



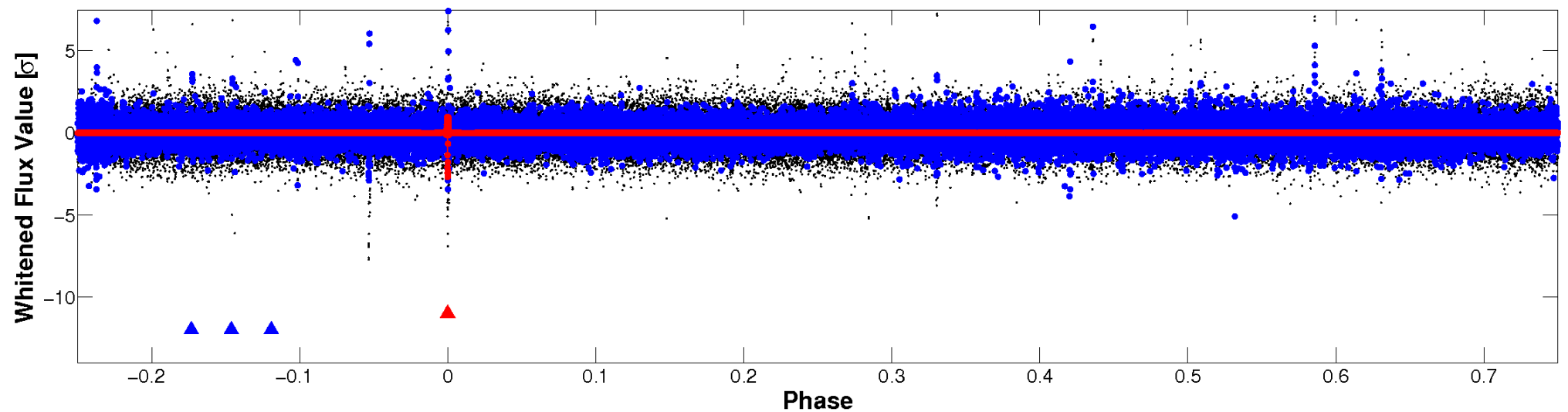


# Non-Whitened Vs. Whitened Light Curve

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

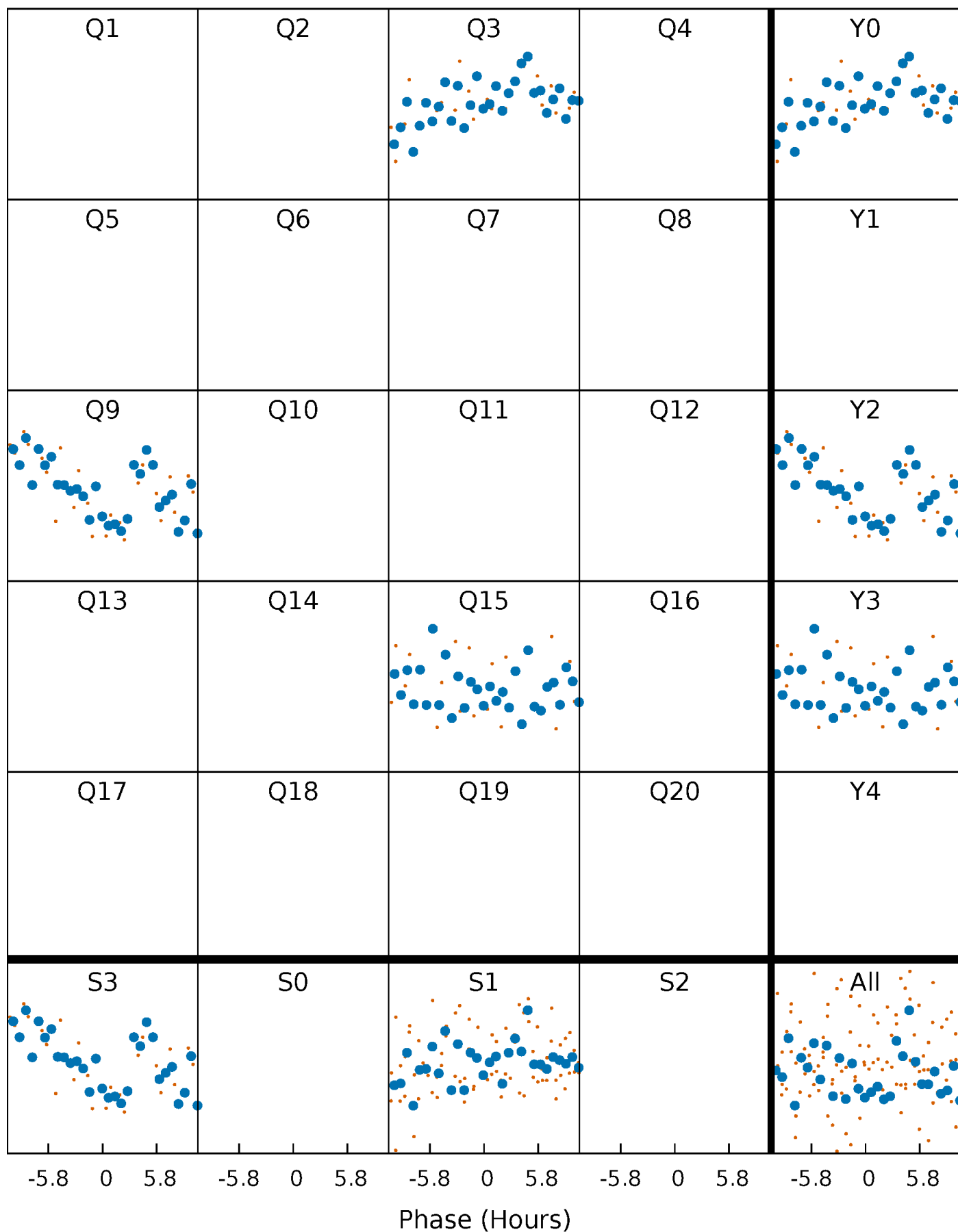


**Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



# PDC Quarter-Phased Transit Curves

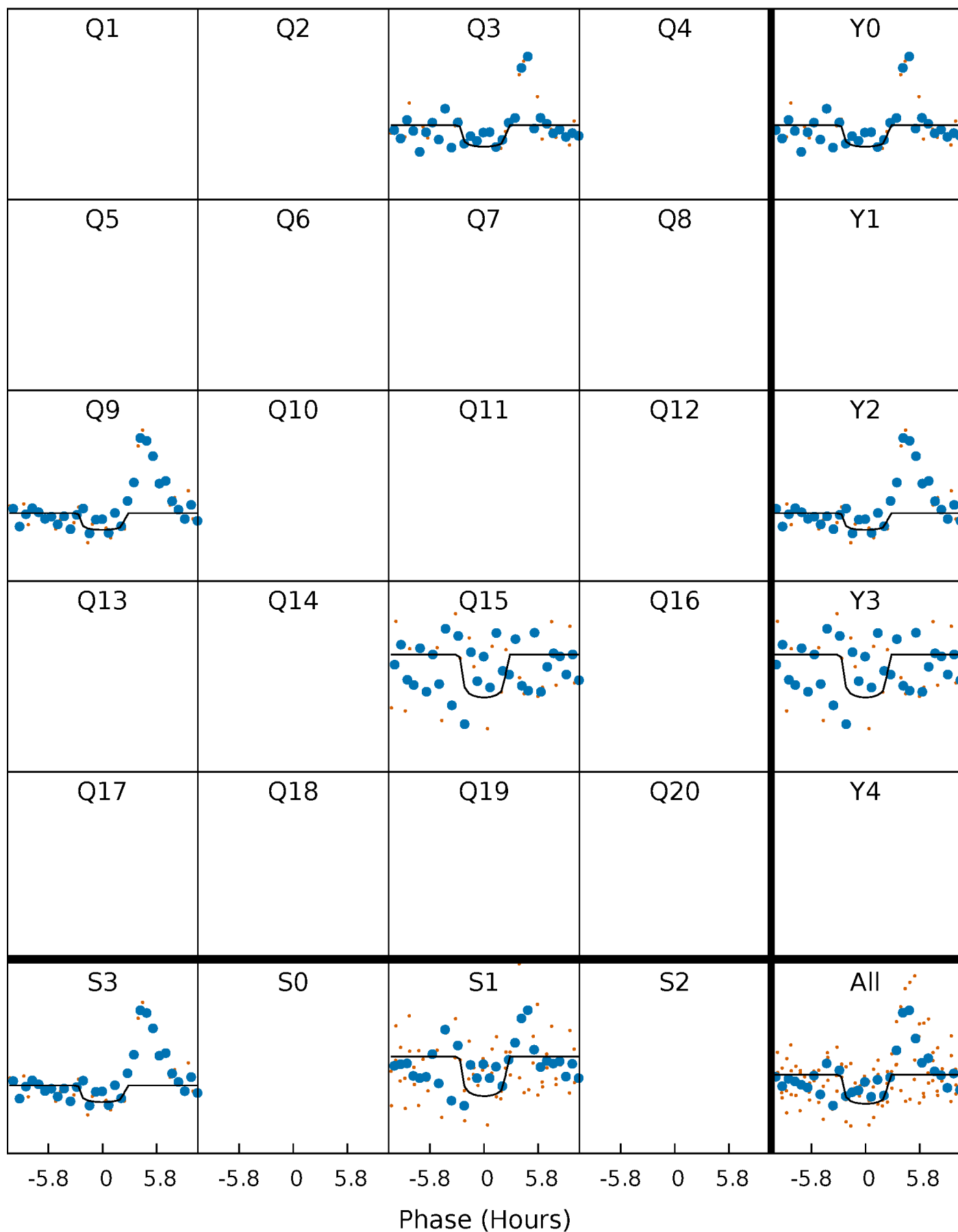
TCE 010451317-01 P=559.062377 Days  $T_0=304.365759$  (BKJD)





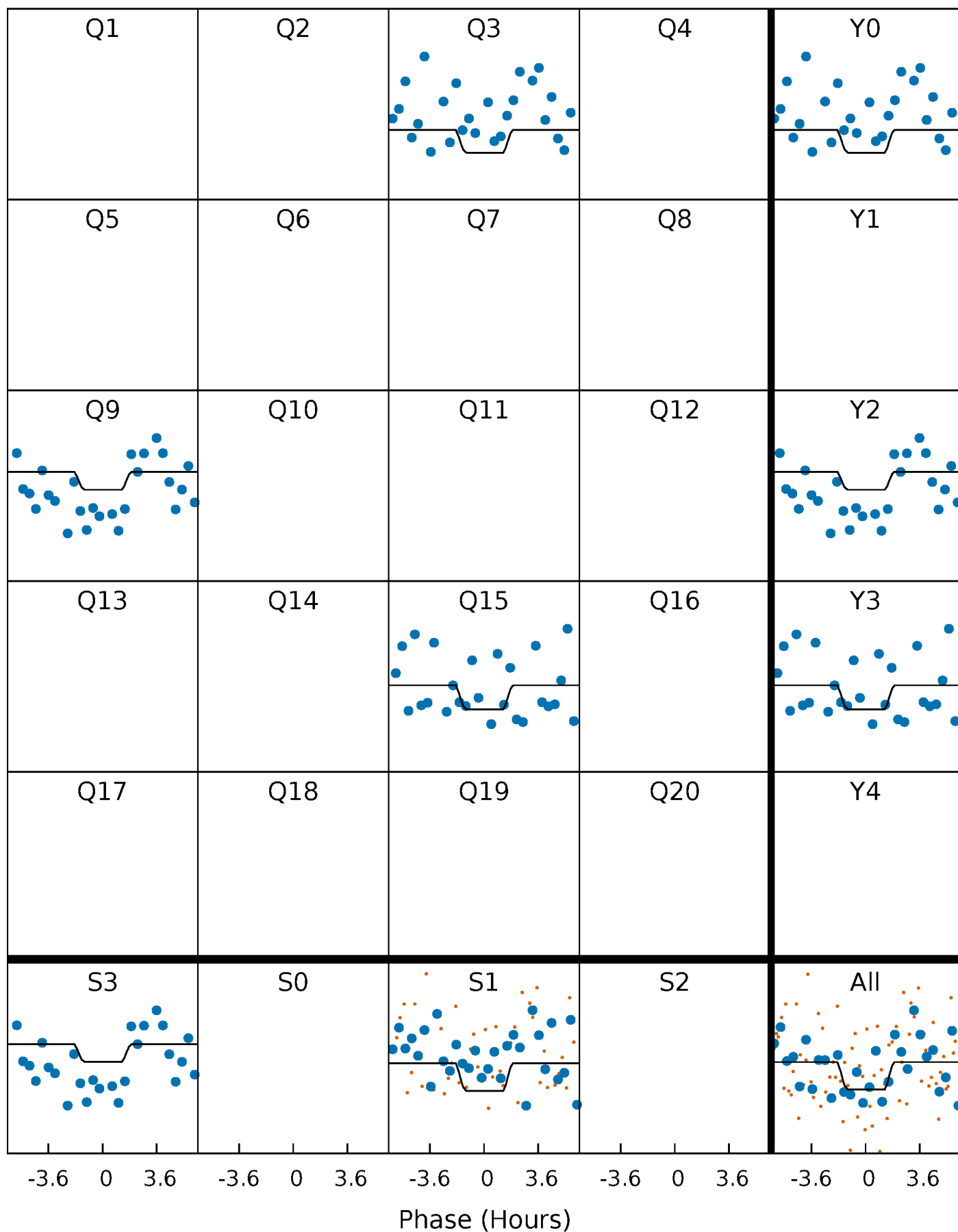
# DV Quarter-Phased Transit Curves

TCE 010451317-01 P=559.062377 Days  $T_0=304.365759$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

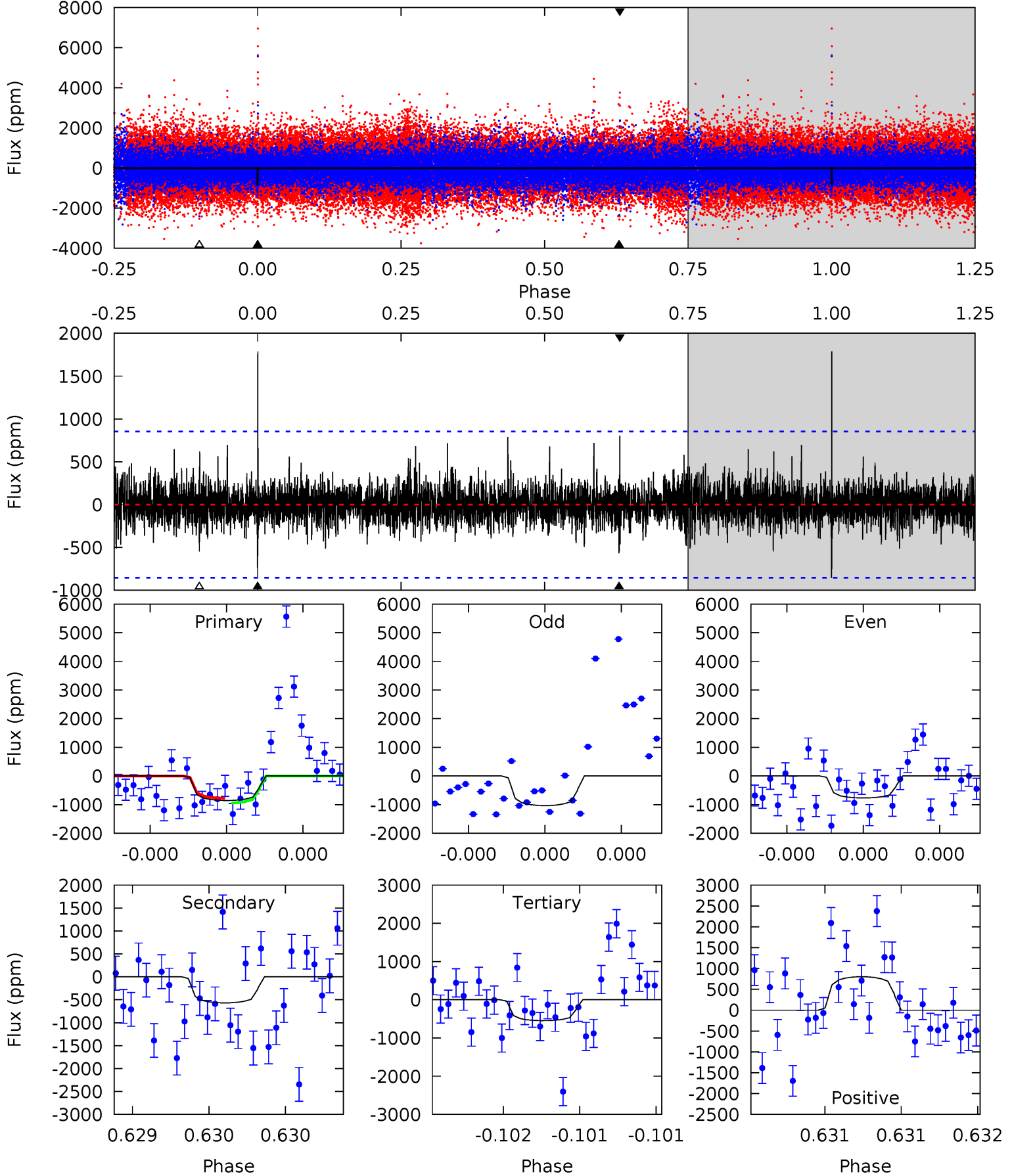
TCE 010451317-01 P=559.069013 Days  $T_0=304.417039$  (BKJD)



# DV Model-Shift Uniqueness Test

010451317-01, P = 559.062377 Days, E = 304.365759 Days

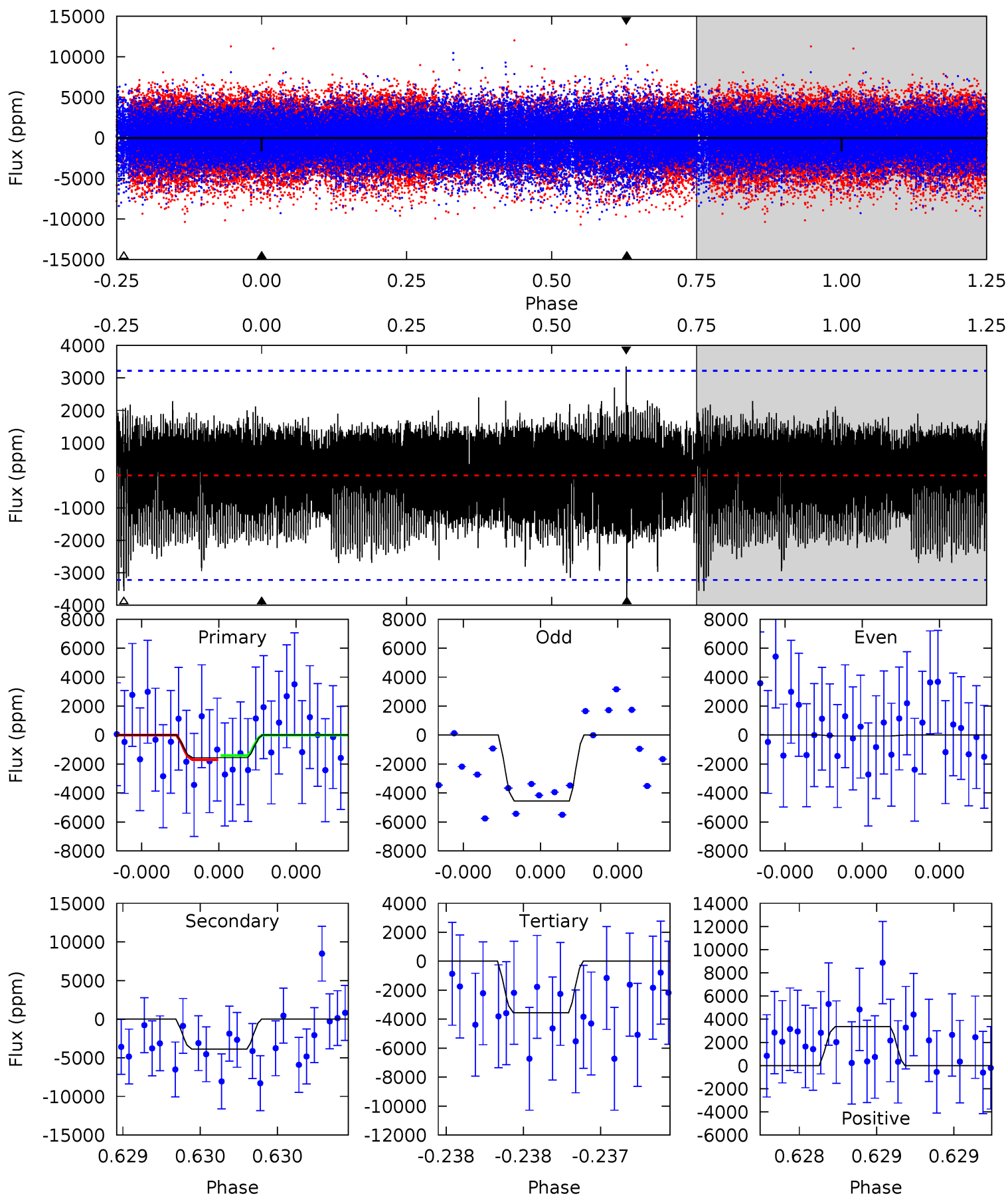
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
5.64	3.74	3.60	5.29	5.61	3.54	0.96	2.04	0.35	0.14	-1.55	0.85	0.94	0.68	0.55



# Alt Model-Shift Uniqueness Test

010451317-01, P = 559.069013 Days, E = 304.417039 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
2.75	6.83	6.28	5.92	5.69	3.66	1.80	-3.53	-3.17	0.55	0.91	3.65	3.58	0.46	0.25



### Stellar Parameters For KIC 010451317

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$7262^{+228}_{-304}$	$4.037^{+0.209}_{-0.171}$	$-0.200^{+0.250}_{-0.350}$	$1.953^{+0.551}_{-0.551}$	$1.512^{+0.224}_{-0.273}$	$0.286^{+0.357}_{-0.140}$
	+3%/-4%	+5%/-4%	+125%/-175%	+28%/-28%	+15%/-18%	+125%/-49%
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 010451317-01 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-568 \pm 152$	$8.41^{+5.16}_{-4.54}$	$504^{+38}_{-41}$	$5493^{+3056}_{-953}$	$10153^{+41278}_{-6432}$
Alt.	$-3867 \pm 566$	$8.92^{+5.53}_{-4.92}$	$504^{+40}_{-41}$	$9303^{+8517}_{-2411}$	$61902^{+239630}_{-37806}$

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

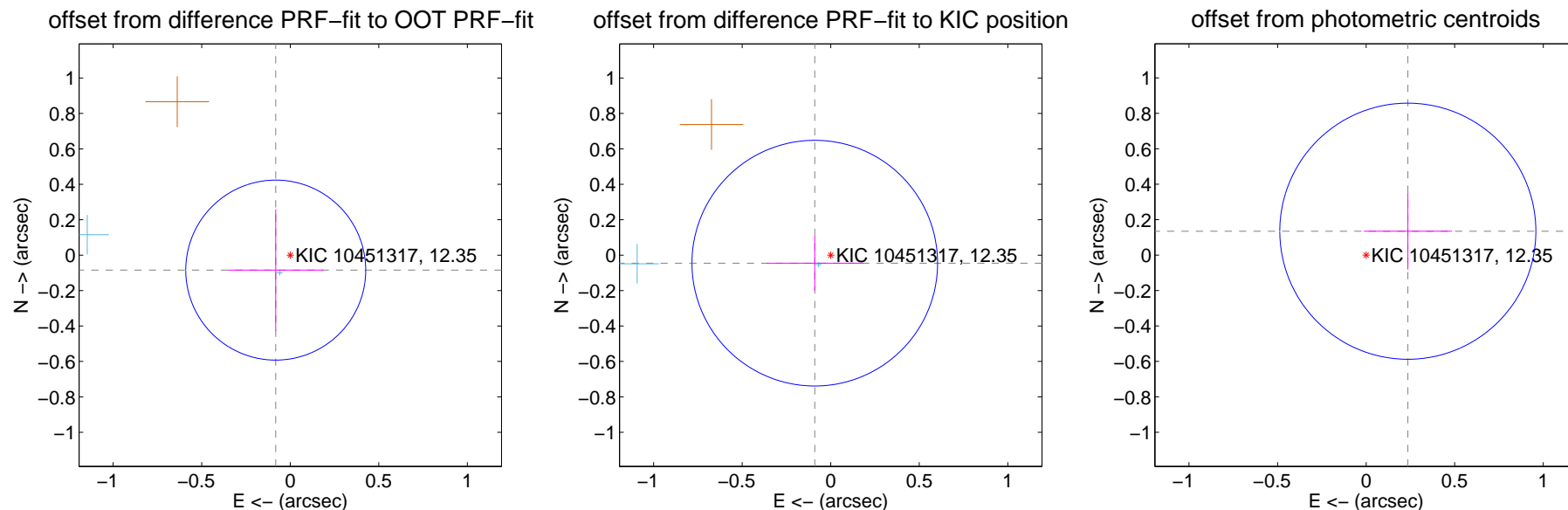
## DV Centroid Data

Supplemental centroid analysis for 010451317-01. Kepler magnitude: 12.35. Transit SNR 12.27

There are 2 quarters with good PRF difference image offsets

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

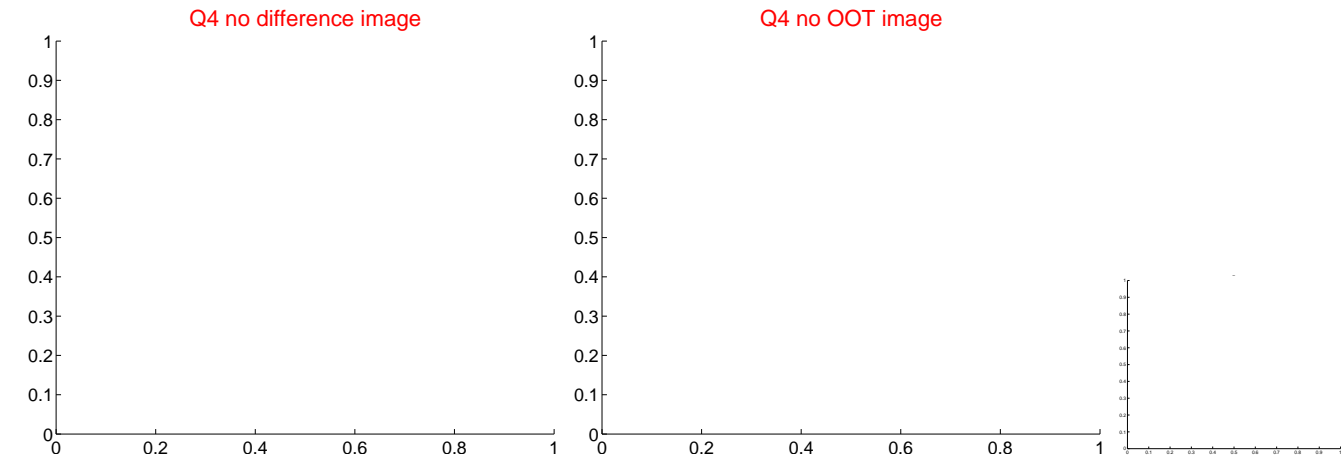
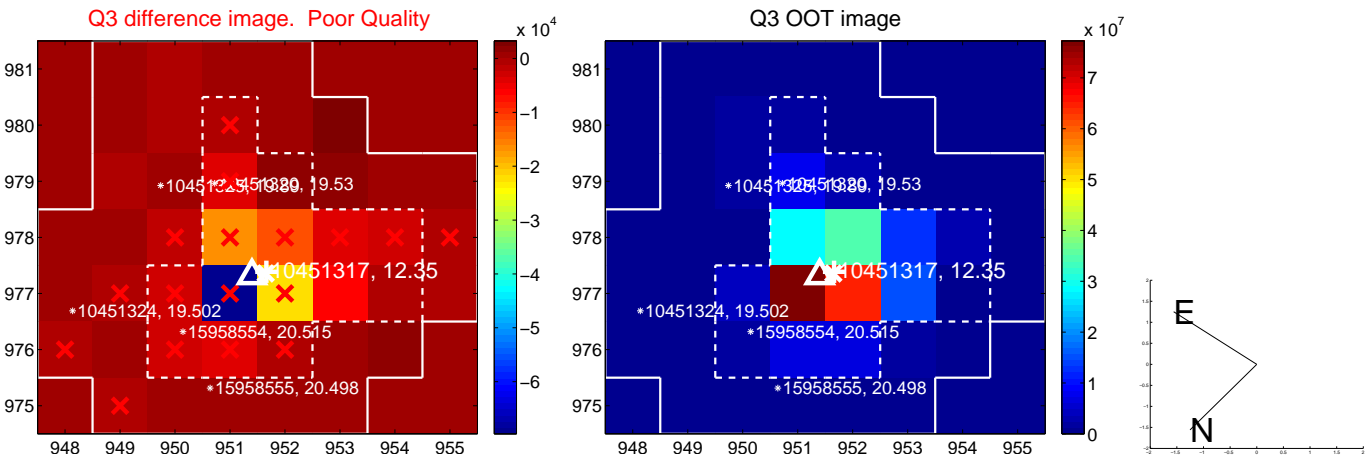
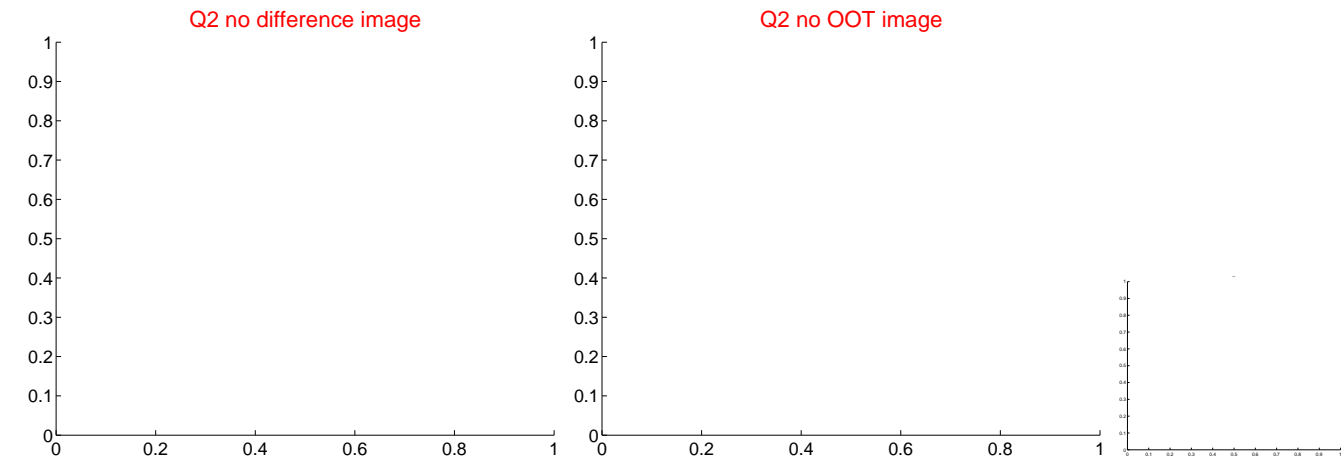
	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.118 \pm 0.169$	0.69	$0.082 \pm 0.269$	$-0.084 \pm 0.343$
PRF-fit source offset from KIC position	$0.101 \pm 0.231$	0.44	$0.090 \pm 0.271$	$-0.045 \pm 0.154$
photometric centroid source offset	$0.27 \pm 0.24$	1.13	$-0.24 \pm 0.25$	$0.13 \pm 0.22$



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



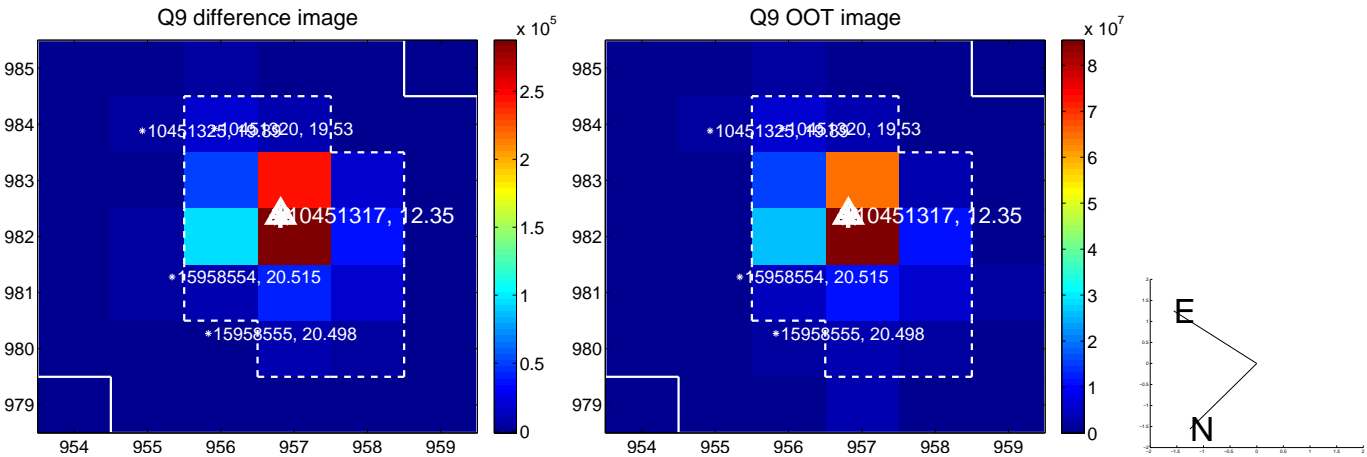
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



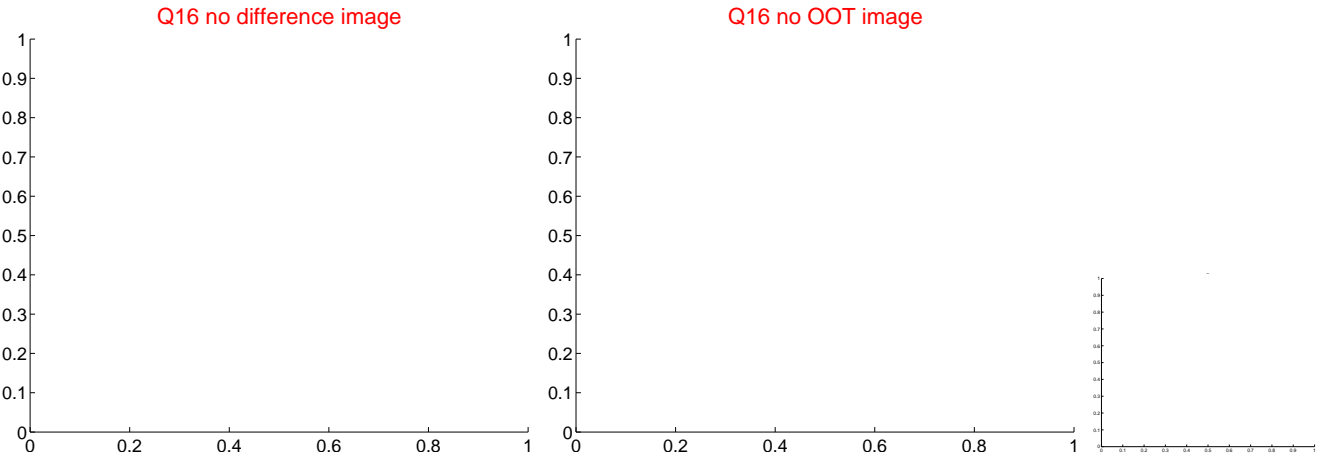
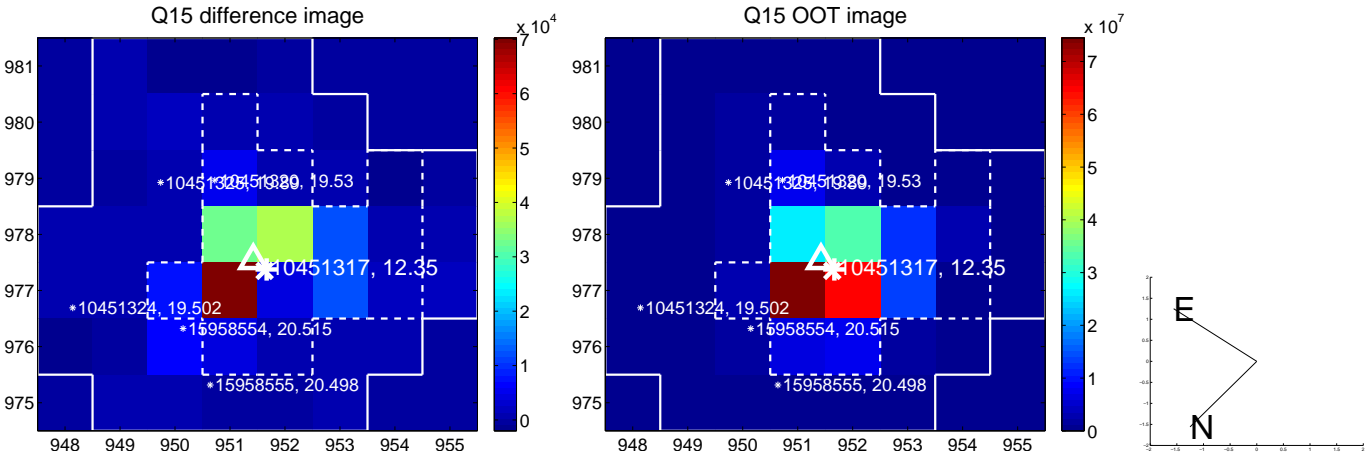
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



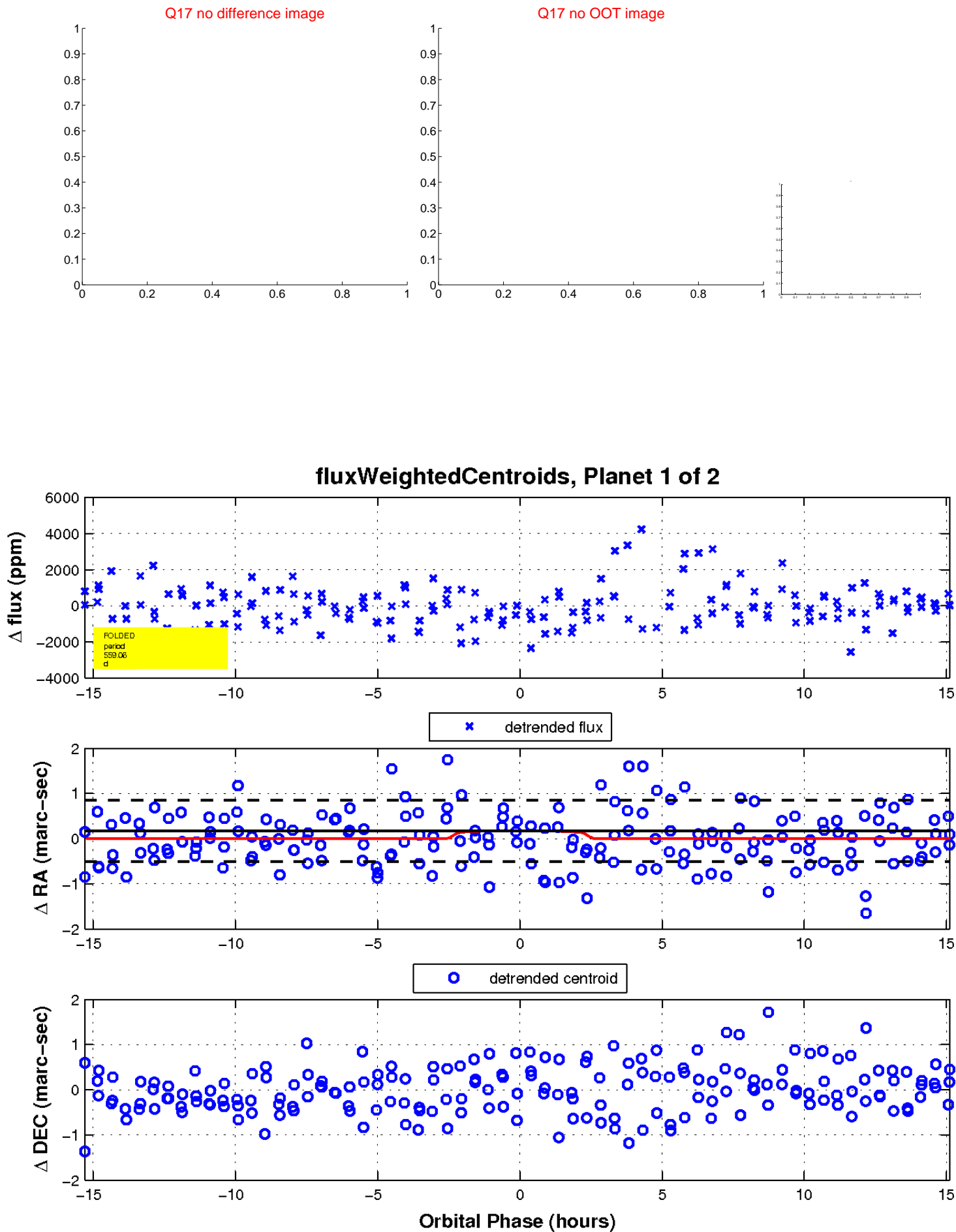
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

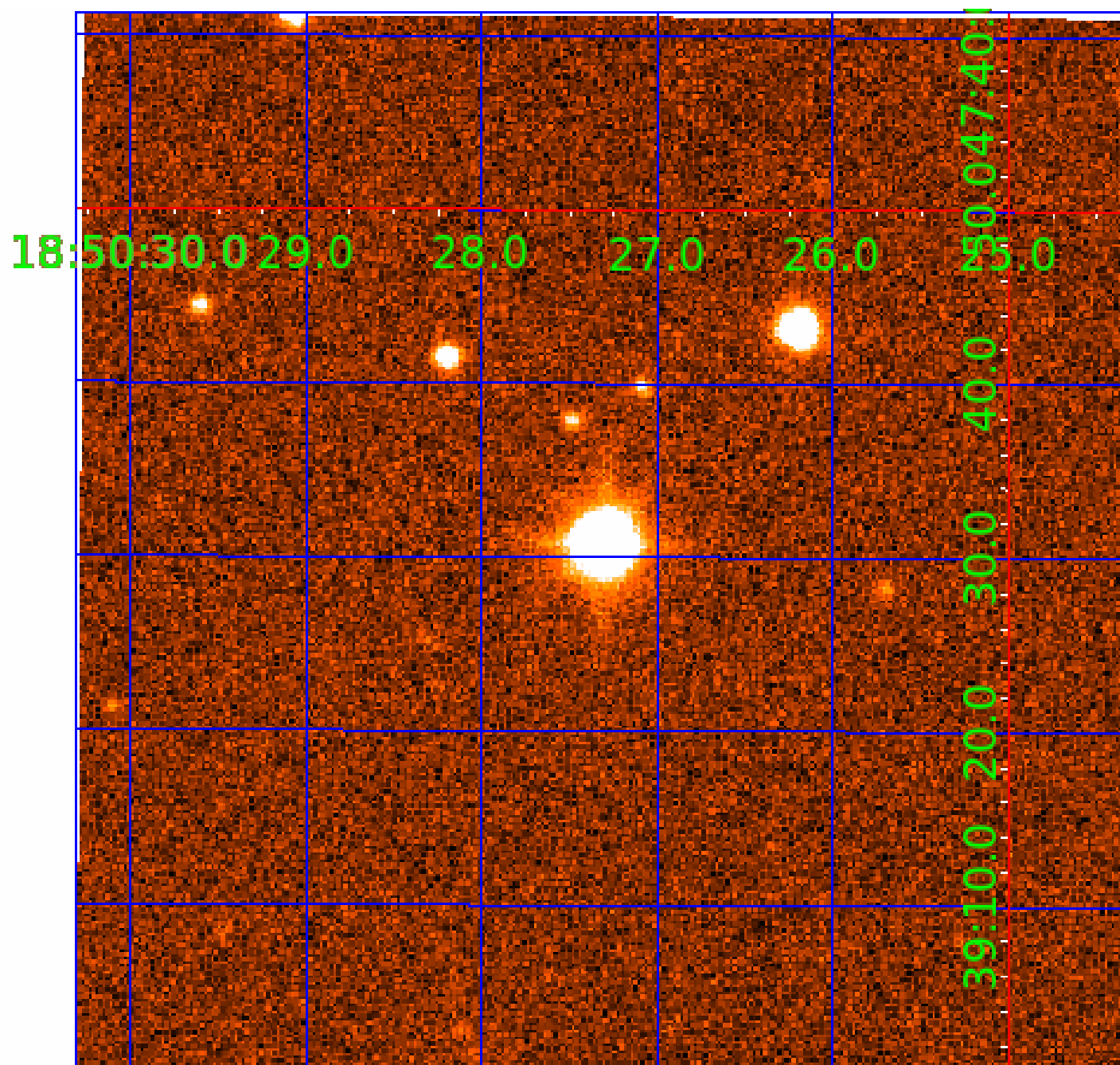


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination





# KIC 010451317

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
010451317-01	OBS	No	559.062377	304.365759	1397.5	5.111	22.7	12.3	1.95	7262	7.84	4.08
010451317-02	OBS	No	574.174889	207.534363	528.6	18.081	13.7	4.4	1.95	7262	4.64	3.94

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
010451317-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT— INCONSISTENT_TRANS—CENT_FEW_DIFFS
010451317-02	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_CHASES—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT— MOD_POS_ALT—CENT_FEW_DIFFS—HALO_GHOST

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

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

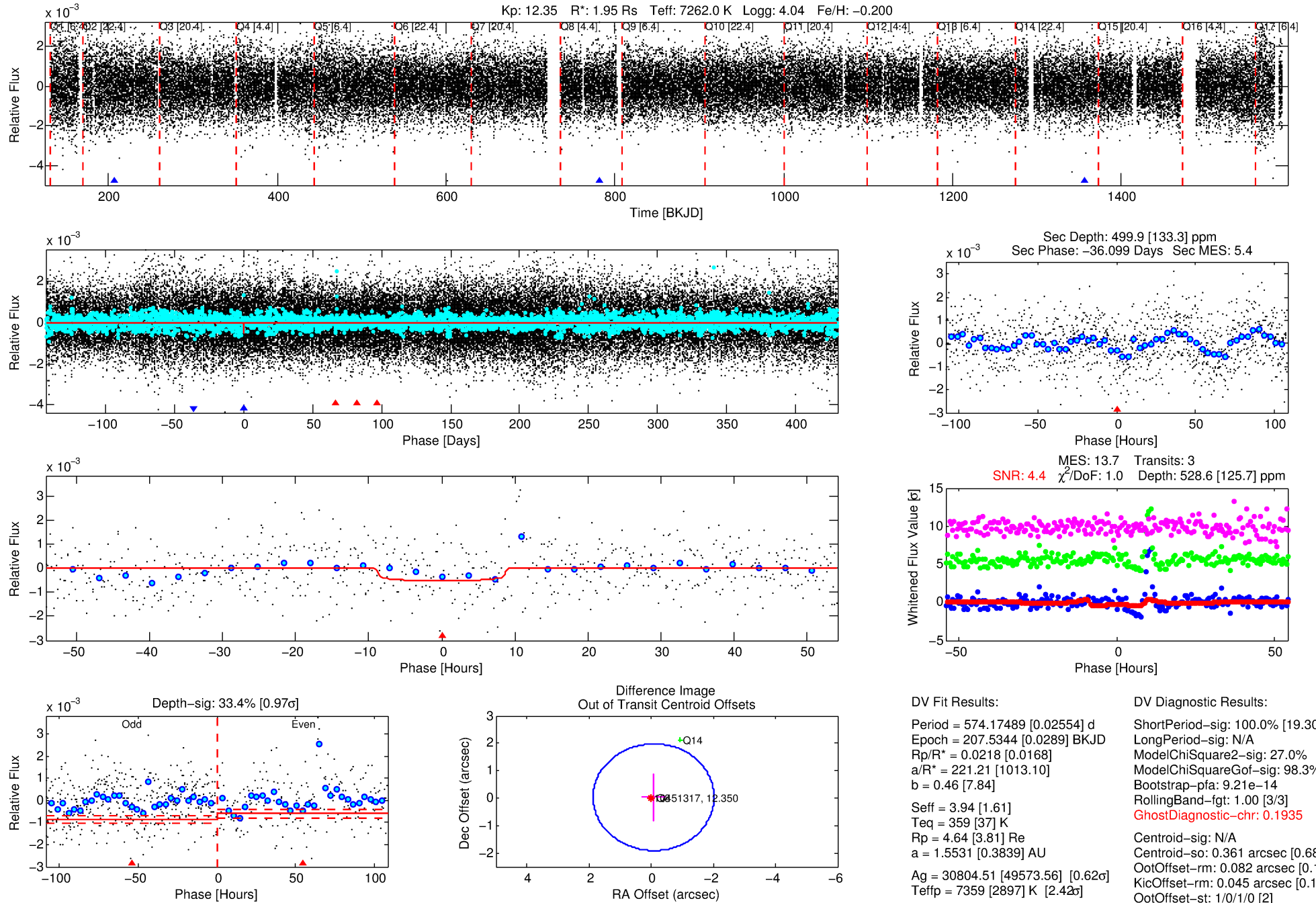
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 010451317-02

No Significant Match Found

# DV One-Page Summary

KIC: 10451317 Candidate: 2 of 2 Period: 574.175 d



## DV Fit Results:

Period = 574.17489 [0.02554] d  
Epoch = 207.5344 [0.0289] BKJD  
Rp/R\* = 0.0218 [0.0168]  
a/R\* = 221.21 [1013.10]  
b = 0.46 [7.84]  
Seff = 3.94 [1.61]  
Teq = 359 [37] K  
Rp = 4.64 [3.81] Re  
a = 1.5531 [0.3839] AU  
Ag = 30804.51 [49573.56] [0.62 $\sigma$ ]  
Teffp = 7359 [2897] K [2.42 $\sigma$ ]

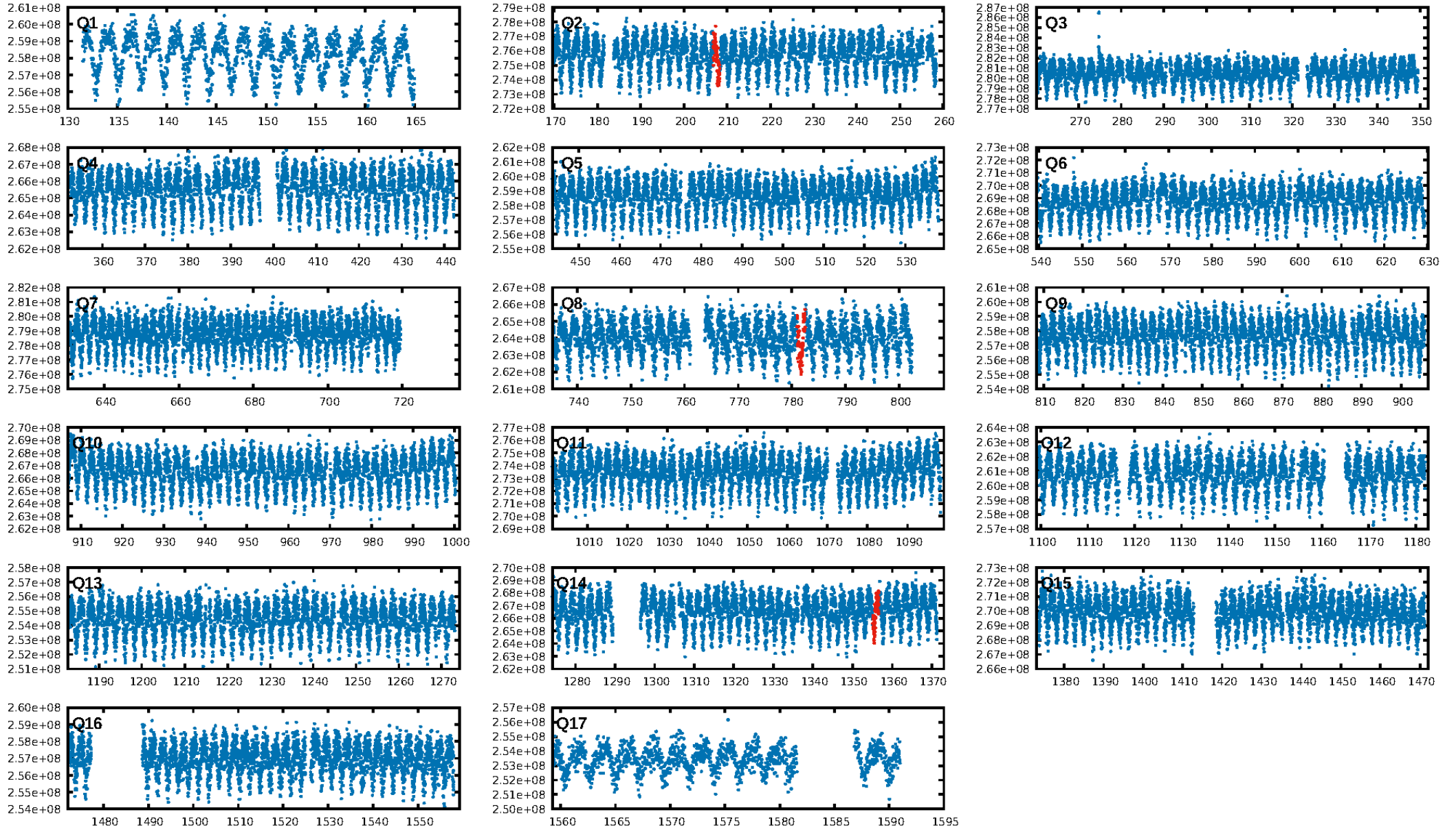
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [19.30 $\sigma$ ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 27.0%  
ModelChiSquareGof-sig: 98.3%  
Bootstrap-pfa: 9.21e-14  
RollingBand-fgt: 1.00 [3/3]  
**GhostDiagnostic-chr: 0.1935**  
Centroid-sig: N/A  
Centroid-so: 0.361 arcsec [0.68 $\sigma$ ]  
OotOffset-rm: 0.082 arcsec [0.13 $\sigma$ ]  
OotOffset-st: 1/0/1/0 [2]  
KicOffset-rm: 0.045 arcsec [0.11 $\sigma$ ]  
KicOffset-st: 1/0/1/0 [2]  
DiffImageQuality-fgm: 1.00 [2/2]  
DiffImageOverlap-fno: 1.00 [3/3]

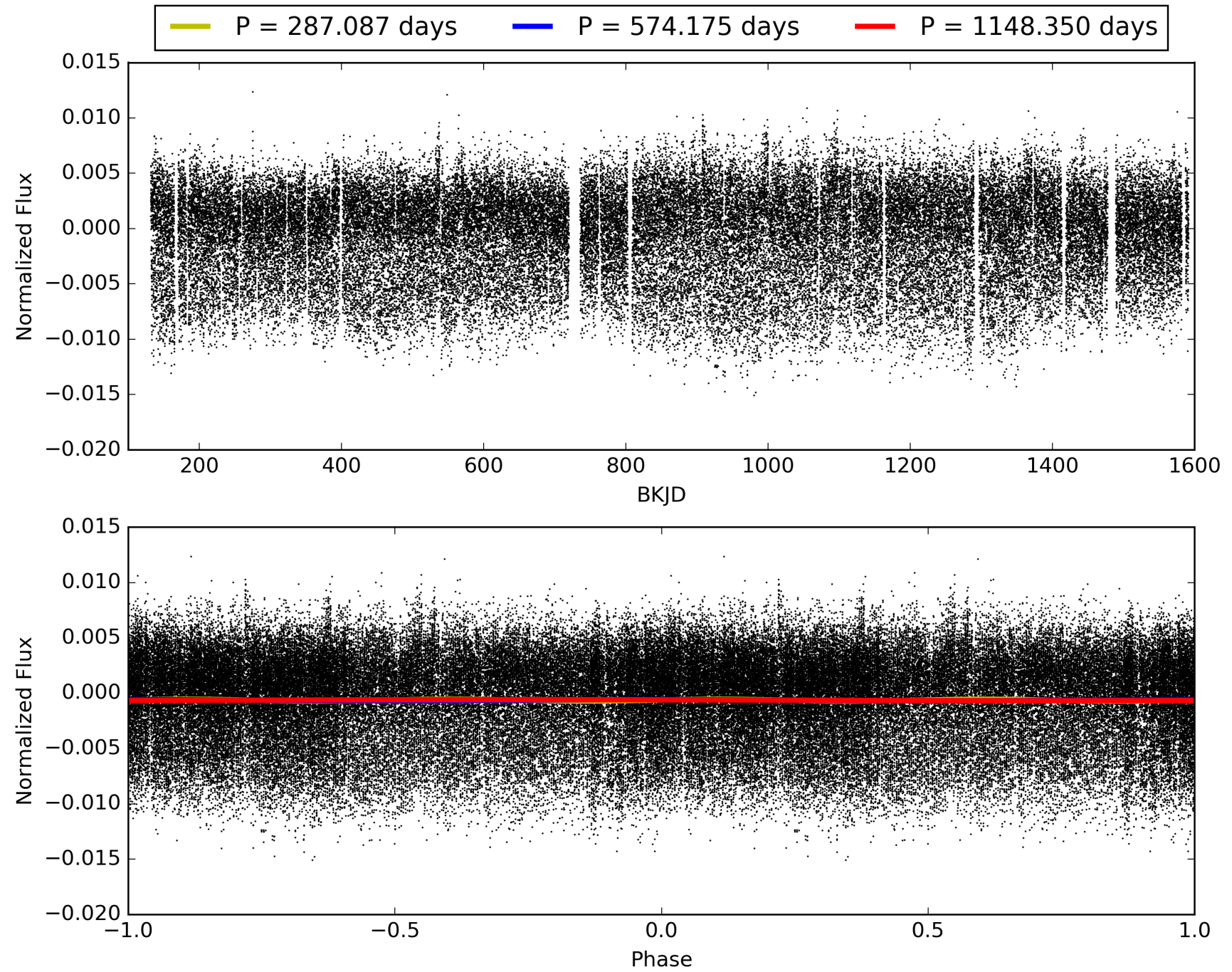
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 11:46:51 Z

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

# TCE 010451317-02, PDC Light Curves



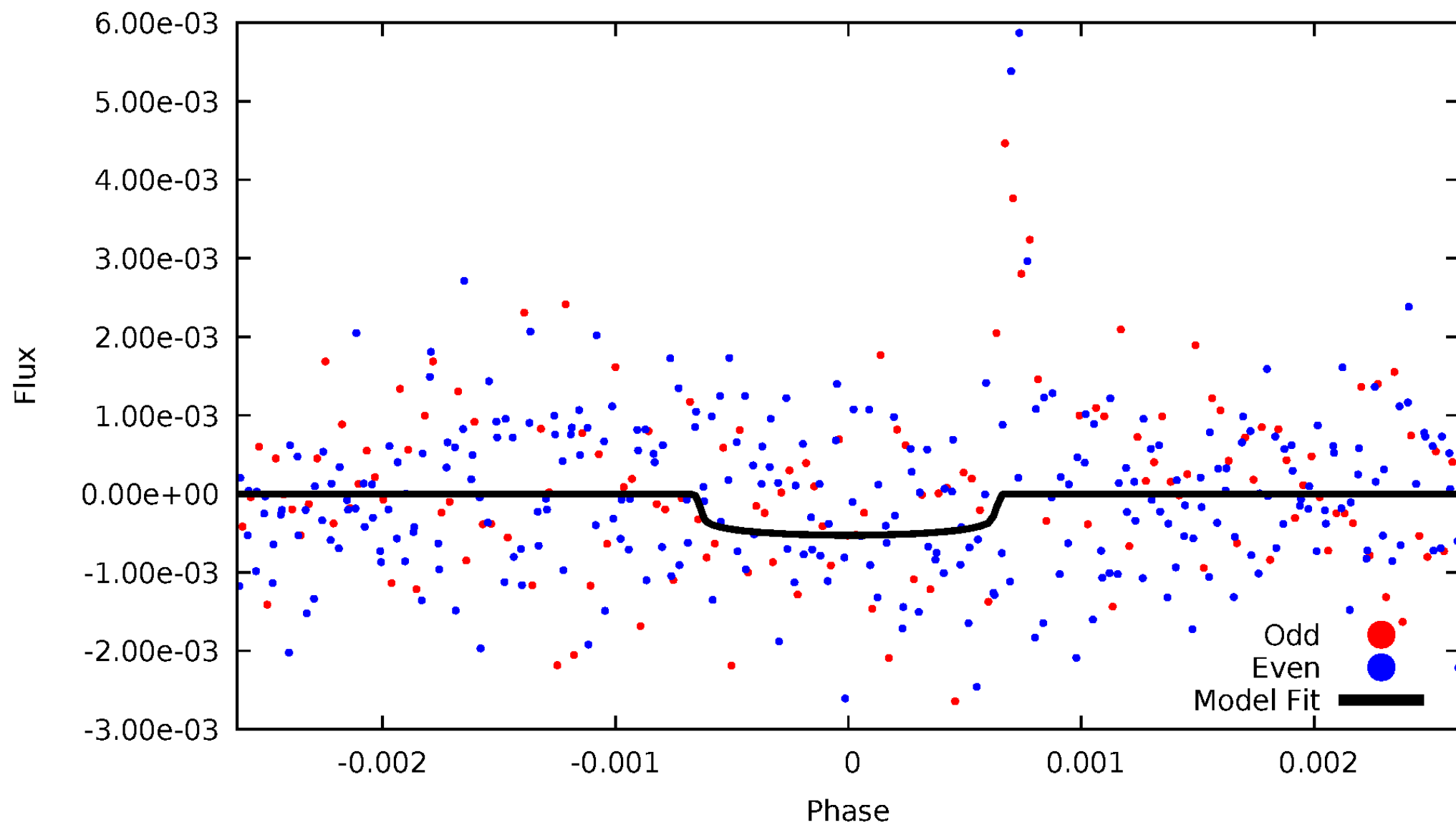
# TCE 010451317-02





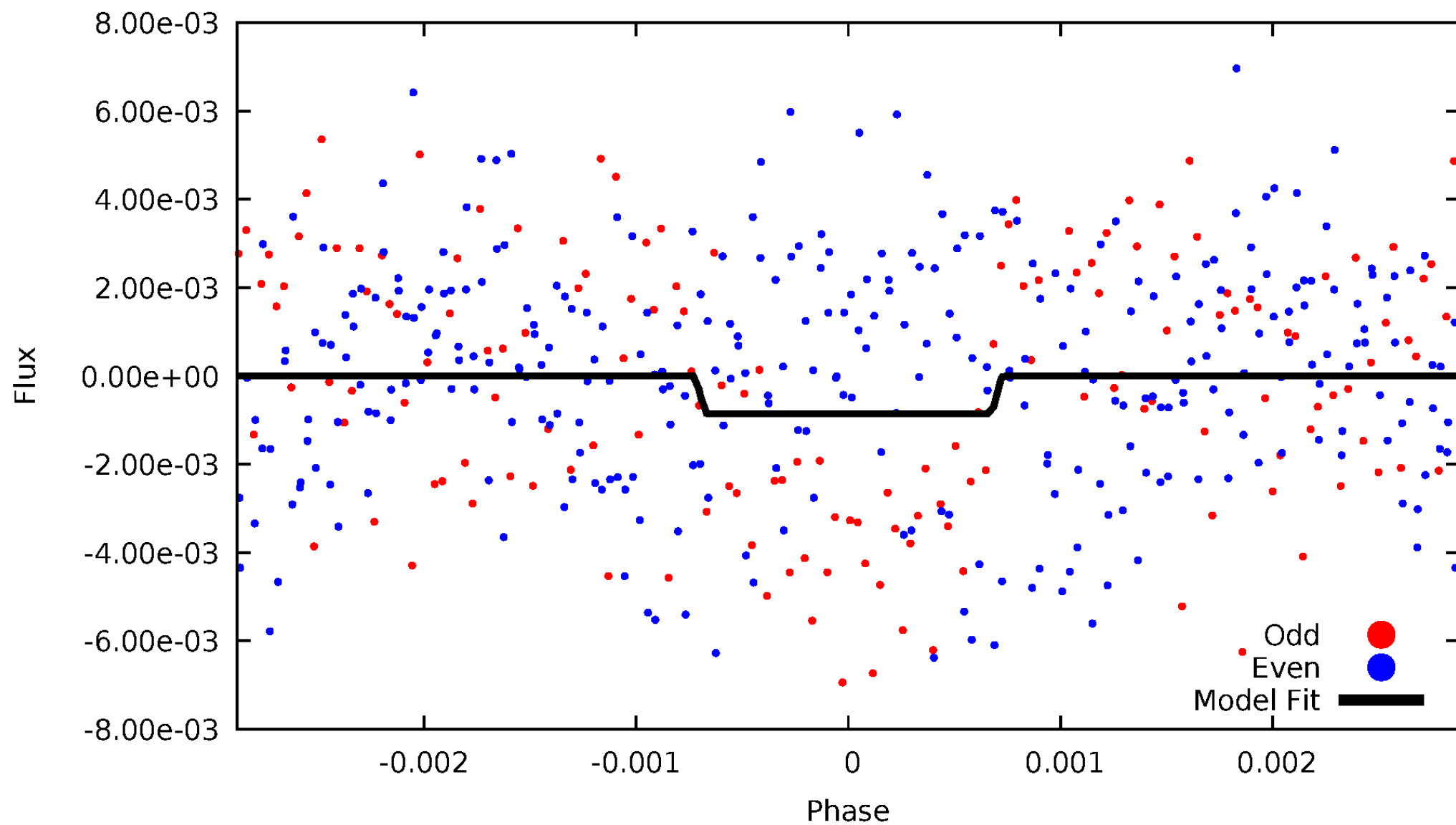
# DV Odd/Even

TCE 010451317-02



# ALT Odd/Even

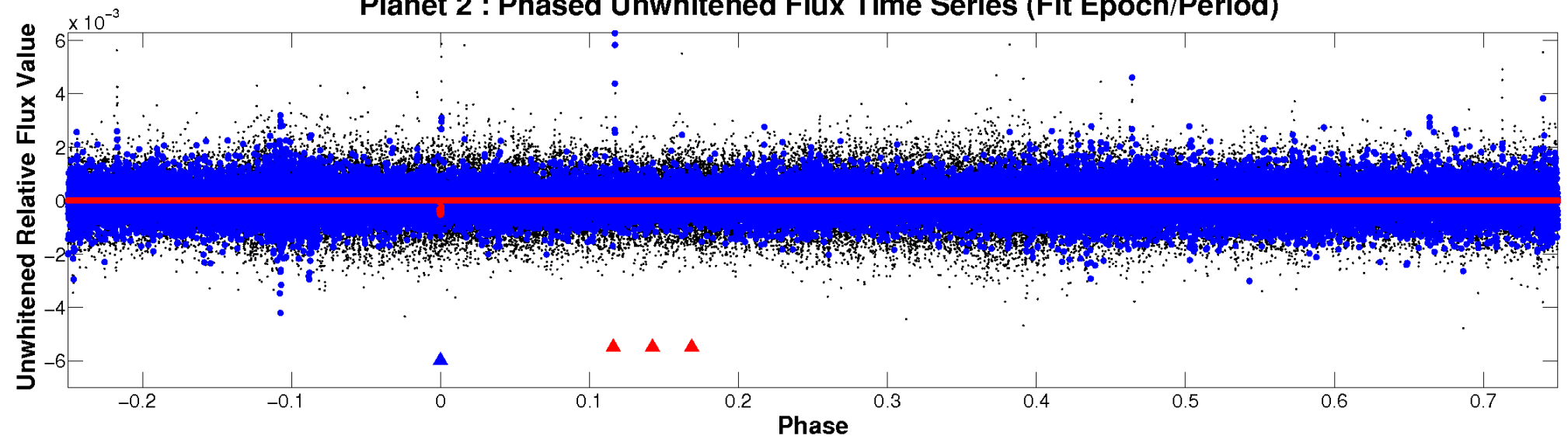
TCE 010451317-02



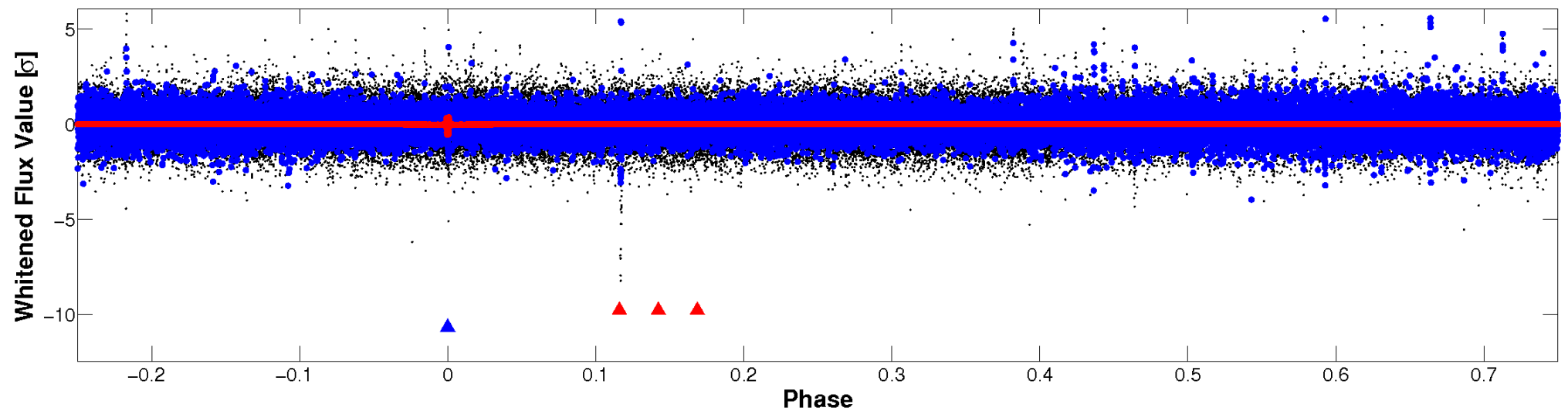


# Non-Whitened Vs. Whitened Light Curve

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

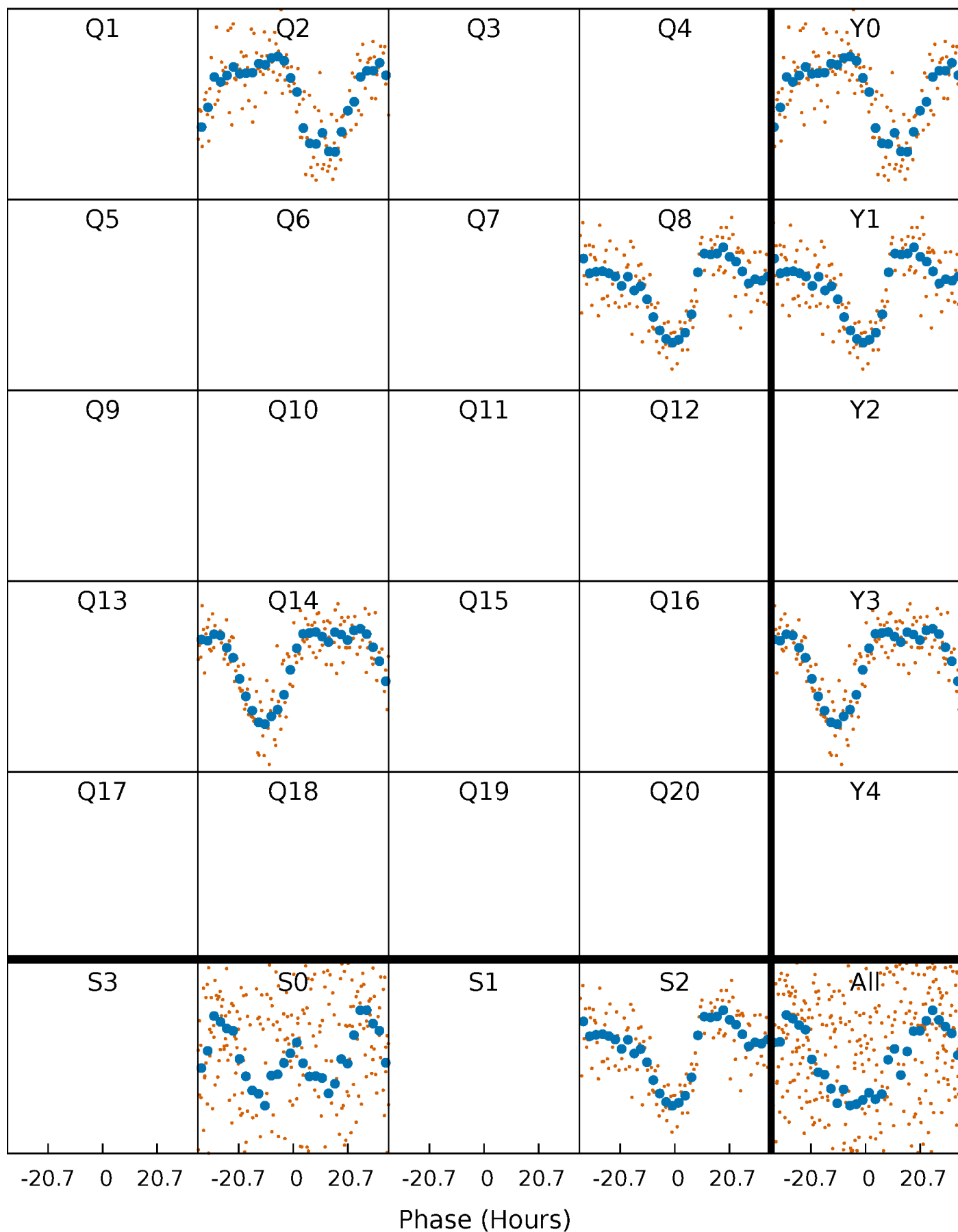


Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



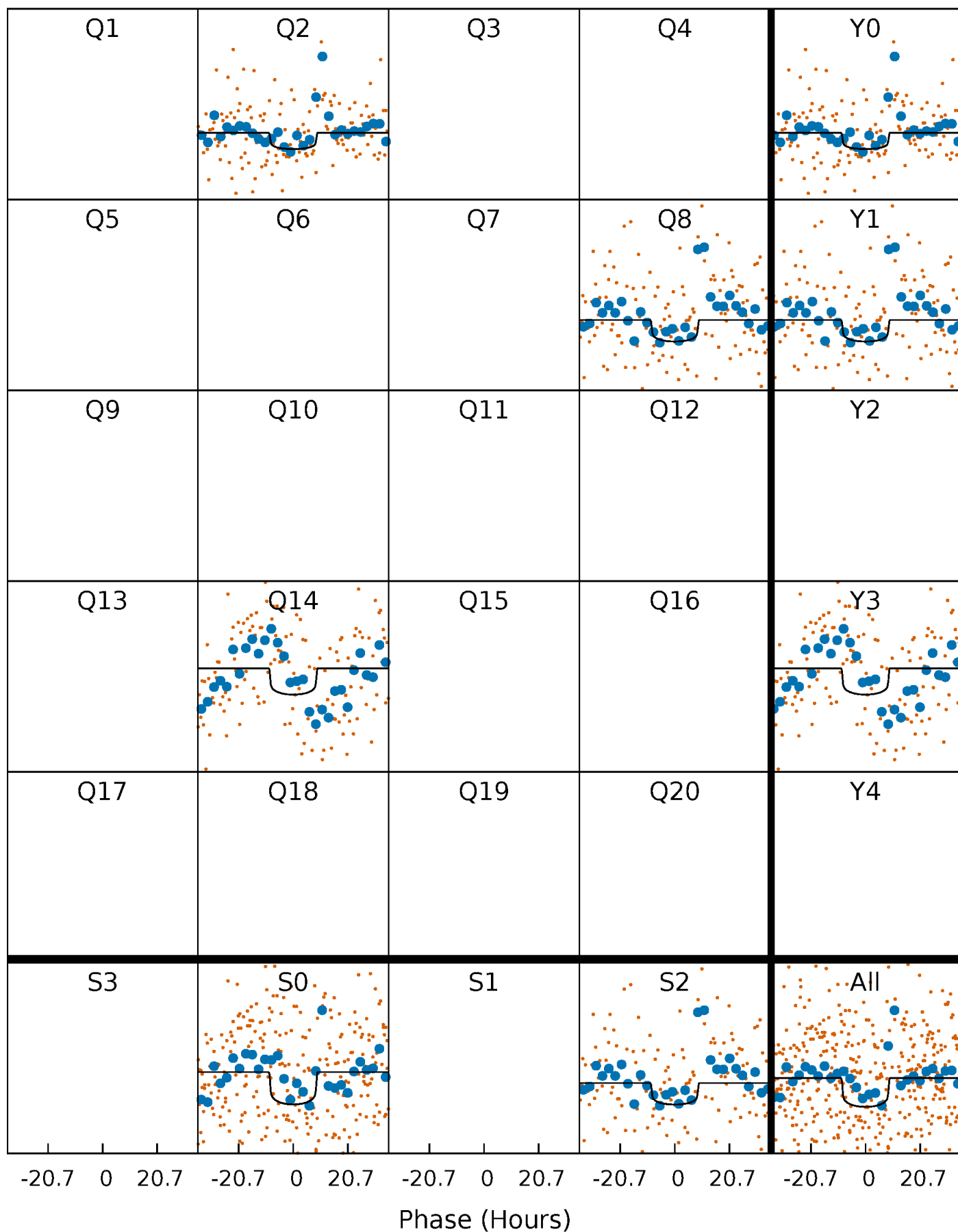
# PDC Quarter-Phased Transit Curves

TCE 010451317-02     $P=574.174889$  Days     $T_0=207.534363$  (BKJD)



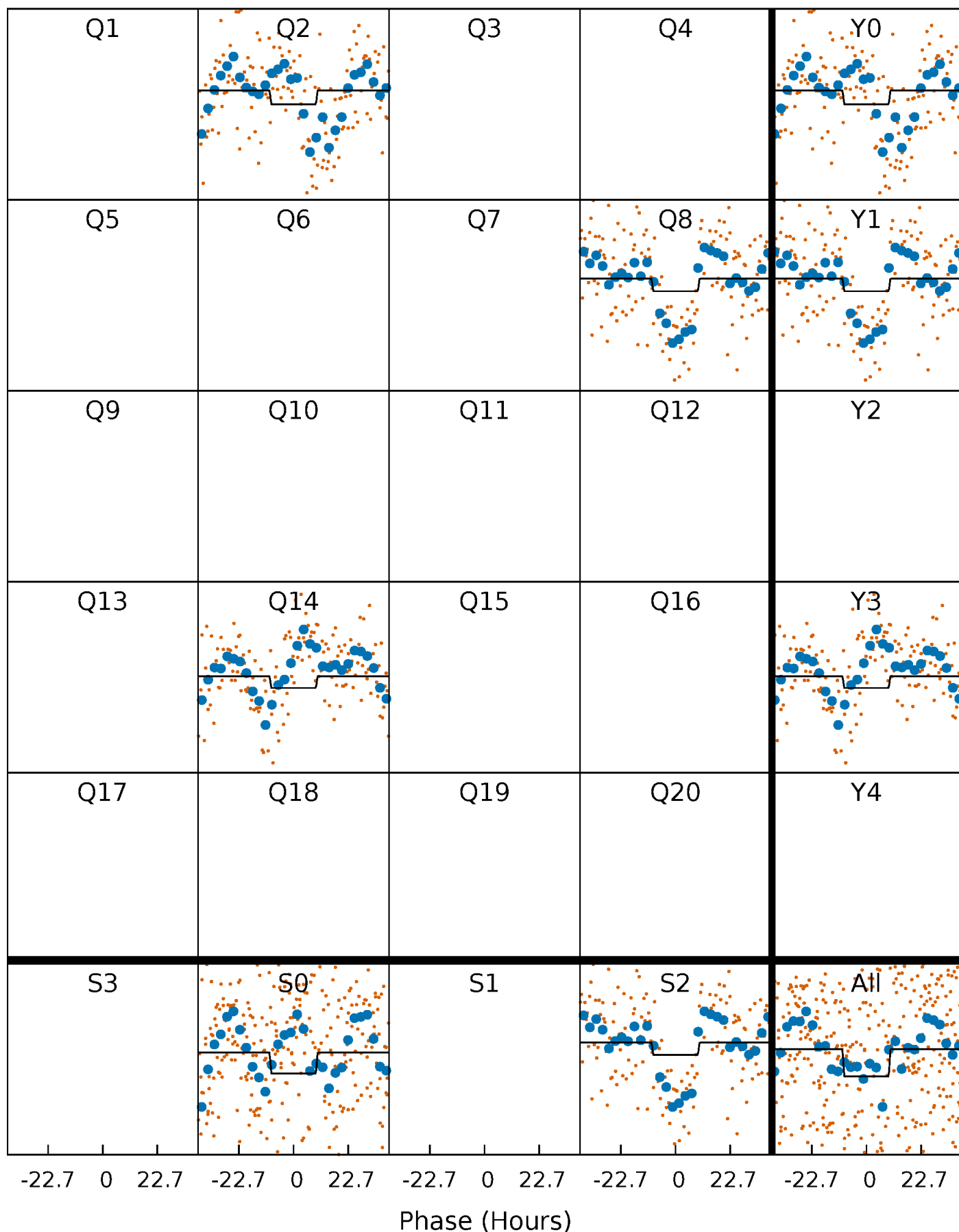
# DV Quarter-Phased Transit Curves

TCE 010451317-02 P=574.174889 Days  $T_0=207.534363$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

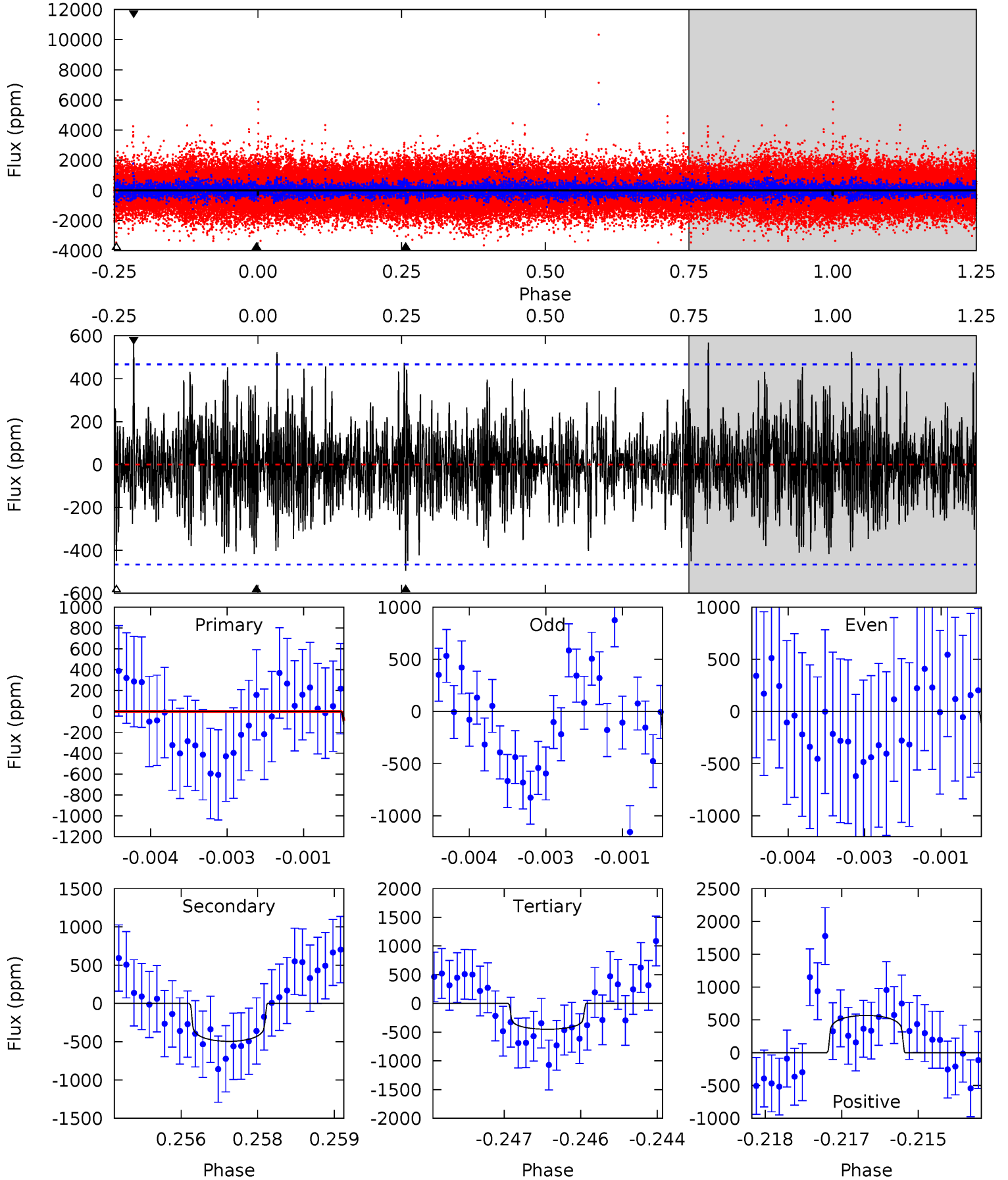
TCE 010451317-02 P=574.183036 Days  $T_0=207.499148$  (BKJD)



# DV Model-Shift Uniqueness Test

010451317-02, P = 574.174889 Days, E = 207.534363 Days

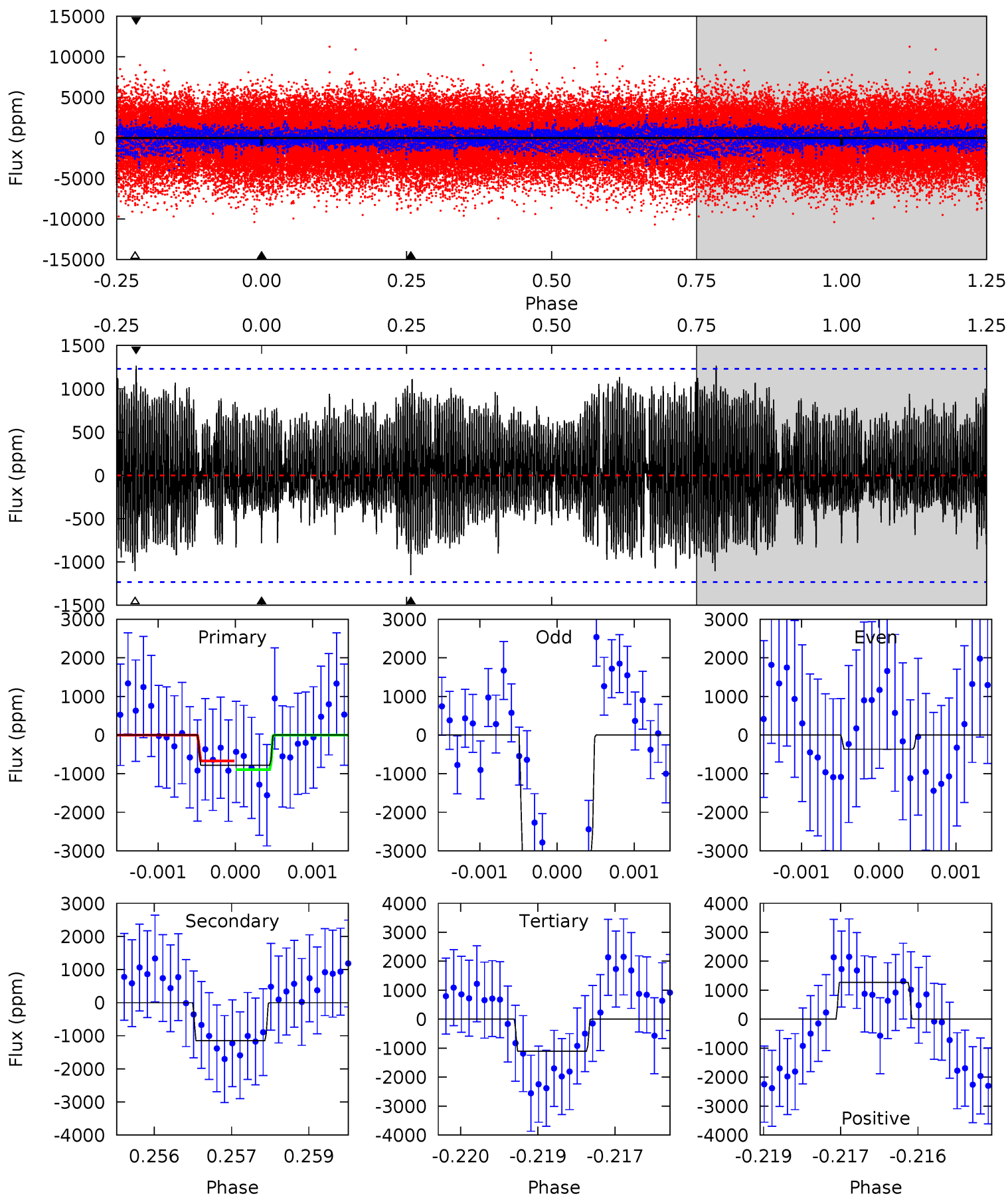
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
3.40	5.74	5.21	6.57	5.40	3.21	1.72	-1.81	-3.18	0.53	-0.84	0.66	0.86	0.53	1.34



# Alt Model-Shift Uniqueness Test

010451317-02, P = 574.183036 Days, E = 207.499148 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
3.42	5.02	4.83	5.54	5.38	3.18	2.05	-1.41	-2.12	0.19	-0.52	5.60	2.45	0.52	0.49





### Stellar Parameters For KIC 010451317

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$7262^{+228}_{-304}$	$4.037^{+0.209}_{-0.171}$	$-0.200^{+0.250}_{-0.350}$	$1.953^{+0.551}_{-0.551}$	$1.512^{+0.224}_{-0.273}$	$0.286^{+0.357}_{-0.140}$
	+3%/-4%	+5%/-4%	+125%/-175%	+28%/-28%	+15%/-18%	+125%/-49%
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 010451317-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-495 \pm 86$	$5.00^{+3.70}_{-2.93}$	$498^{+38}_{-39}$	$6854^{+5803}_{-1569}$	$25069^{+132025}_{-16460}$
Alt.	$-1150 \pm 229$	$6.39^{+3.50}_{-3.12}$	$497^{+42}_{-37}$	$7662^{+4932}_{-1667}$	$35753^{+109337}_{-20568}$

$T_{\text{max}}$  = 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

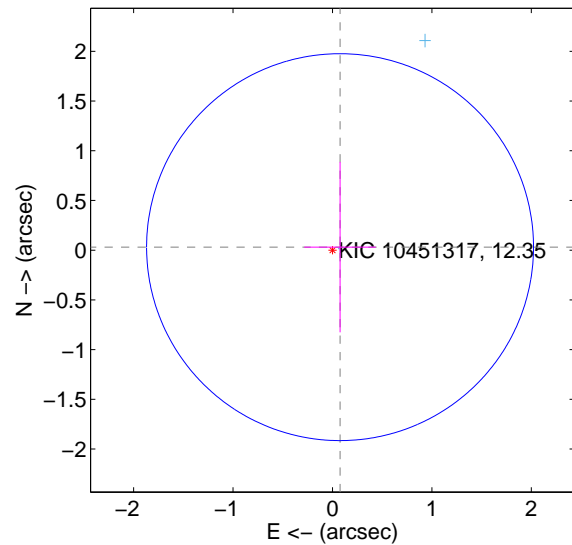
Supplemental centroid analysis for 010451317-02. Kepler magnitude: 12.35. Transit SNR 4.36

There are 2 quarters with good PRF difference image offsets

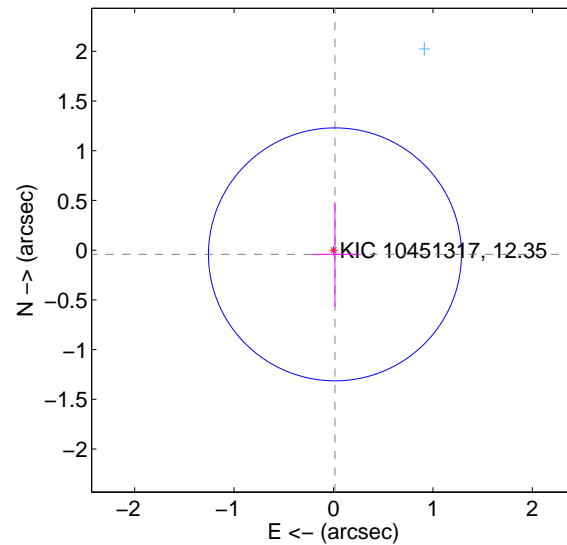
The direct PRF centroid is offset from the target star catalog position by about 0.09 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.082 \pm 0.648$	0.13	$-0.076 \pm 0.360$	$0.030 \pm 0.857$
PRF-fit source offset from KIC position	$0.045 \pm 0.424$	0.11	$-0.014 \pm 0.237$	$-0.042 \pm 0.525$
photometric centroid source offset	$0.36 \pm 0.53$	0.68	$0.36 \pm 0.54$	$-0.05 \pm 0.36$

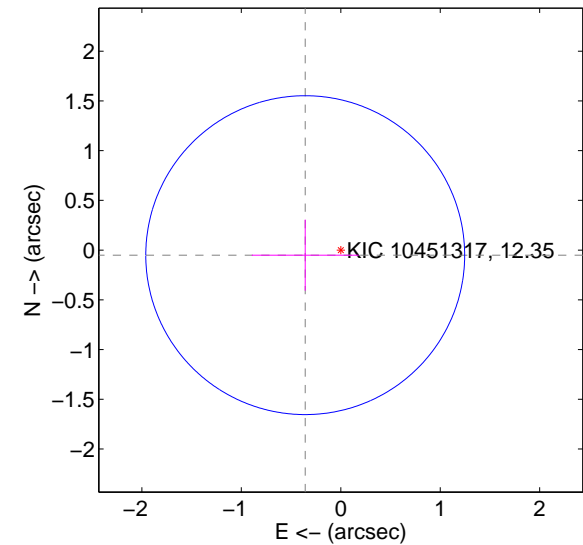
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

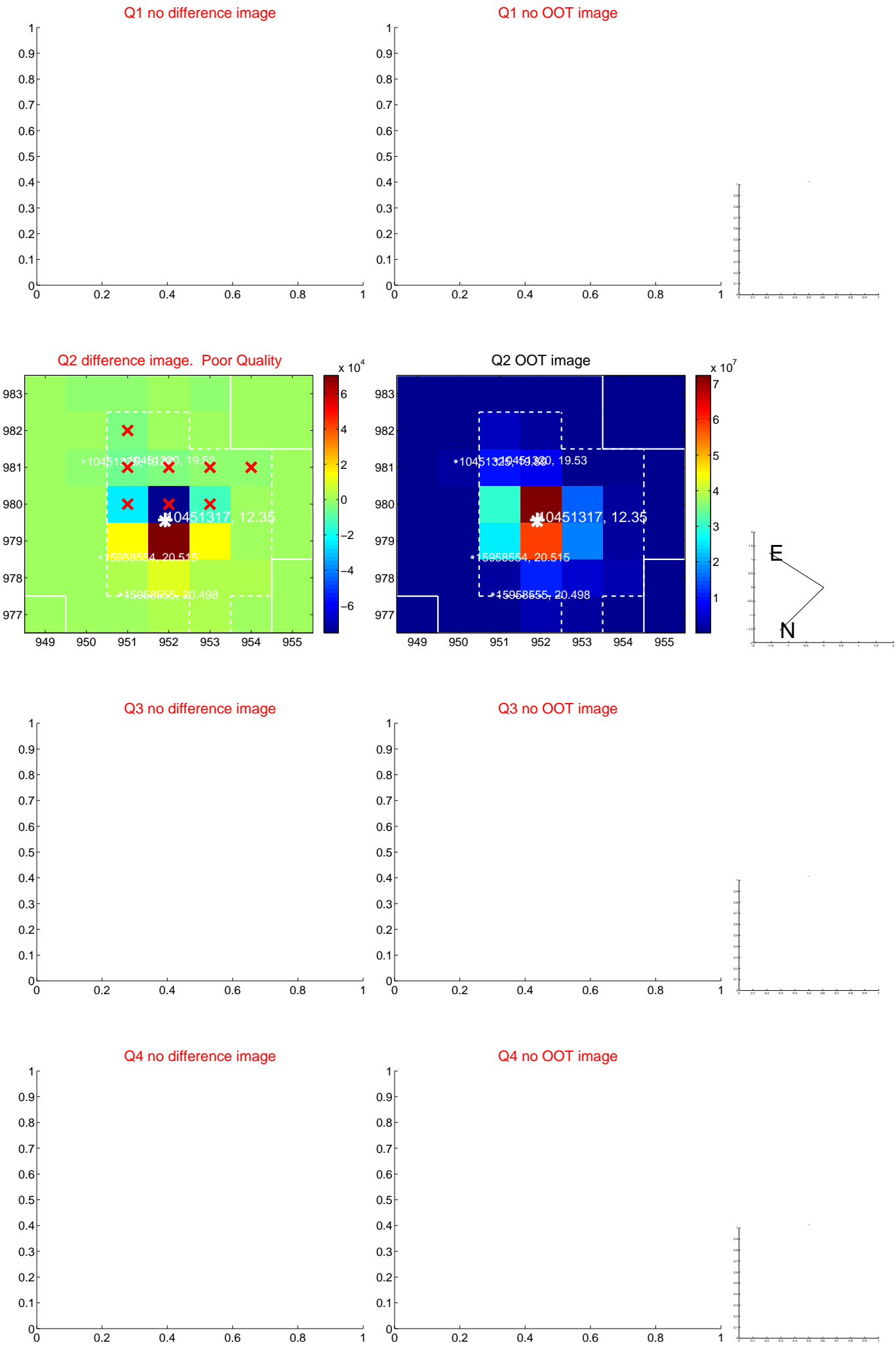


offset from photometric centroids

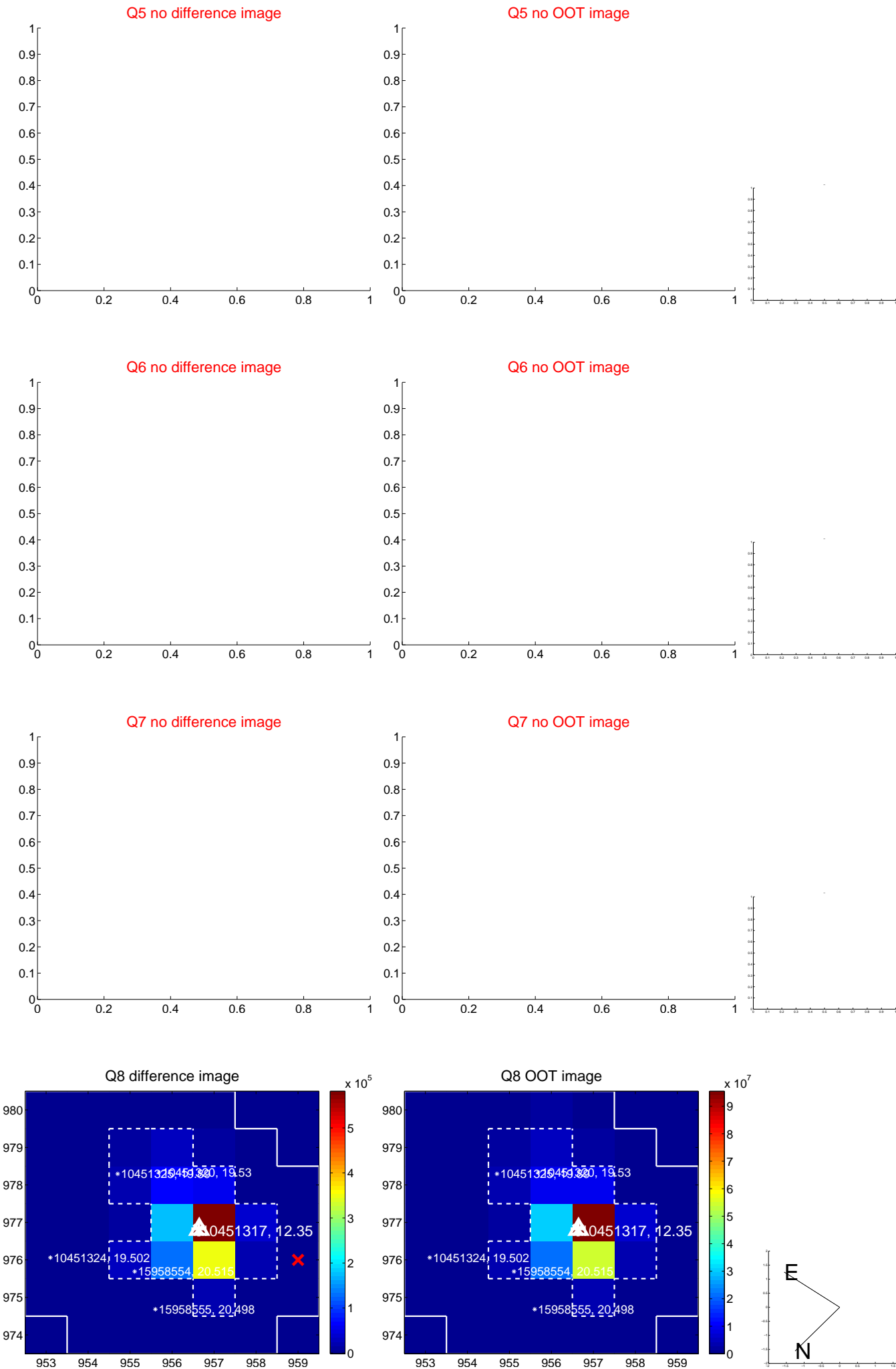


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

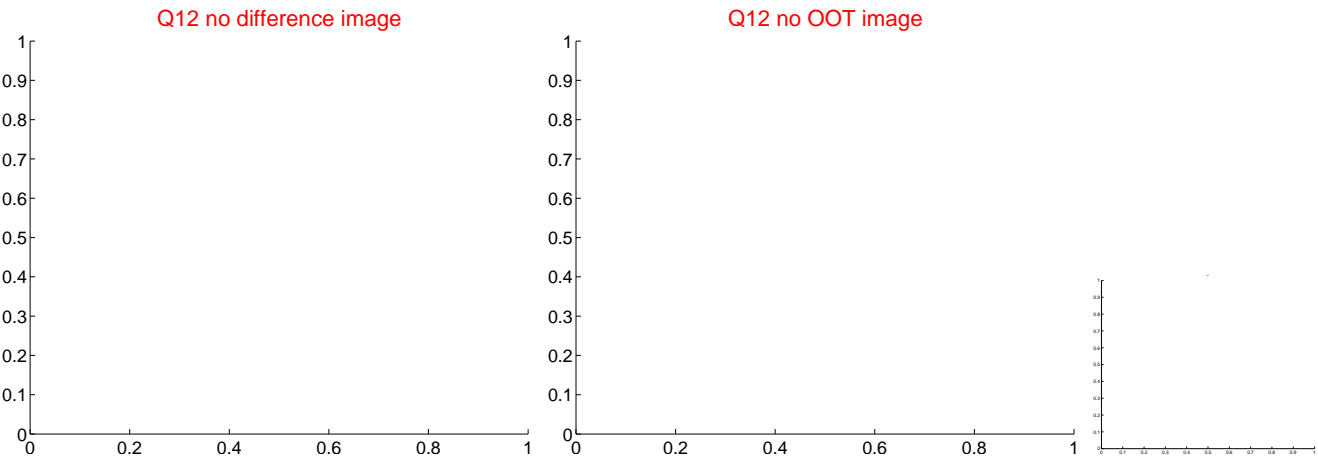
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



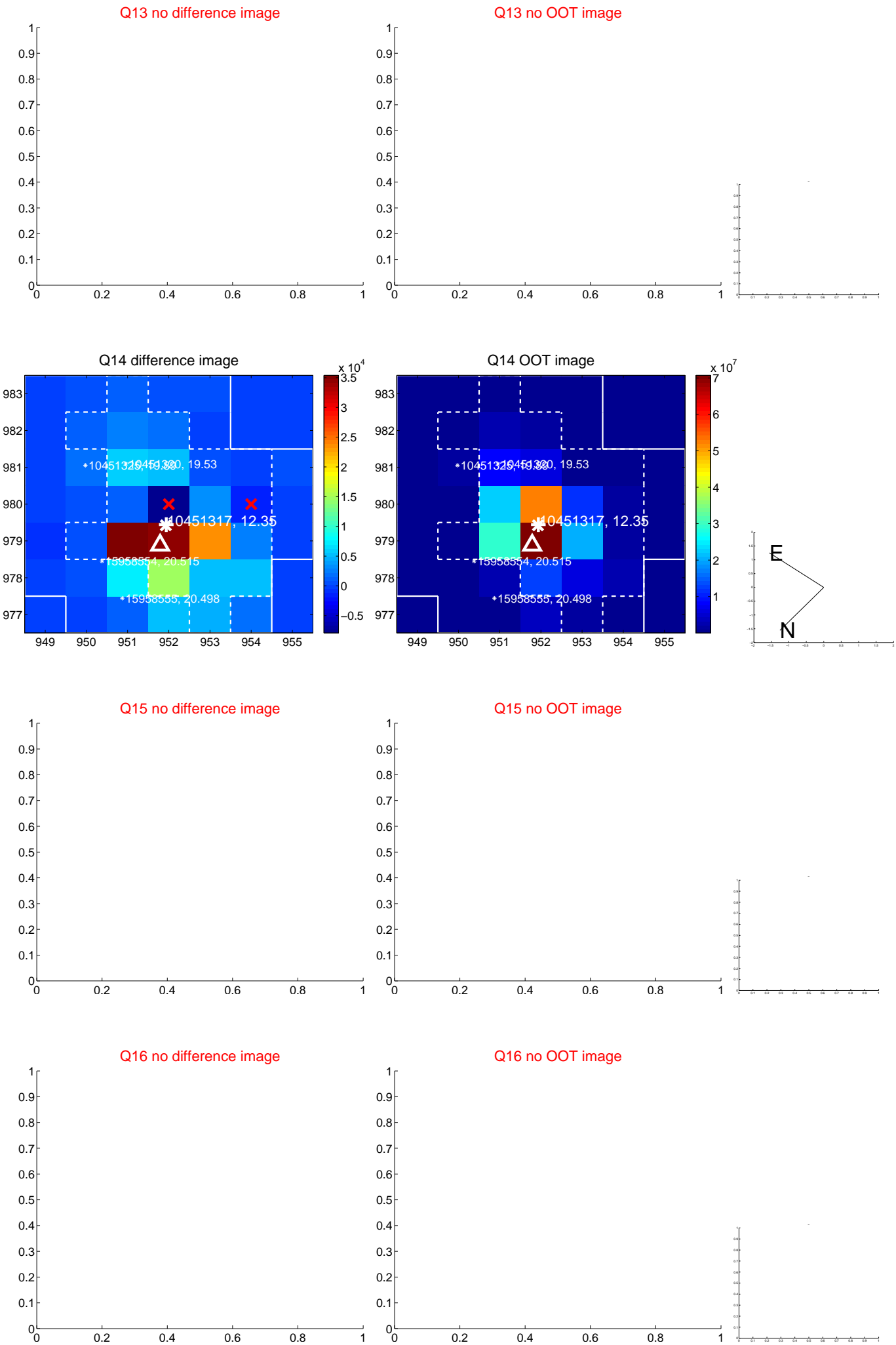
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



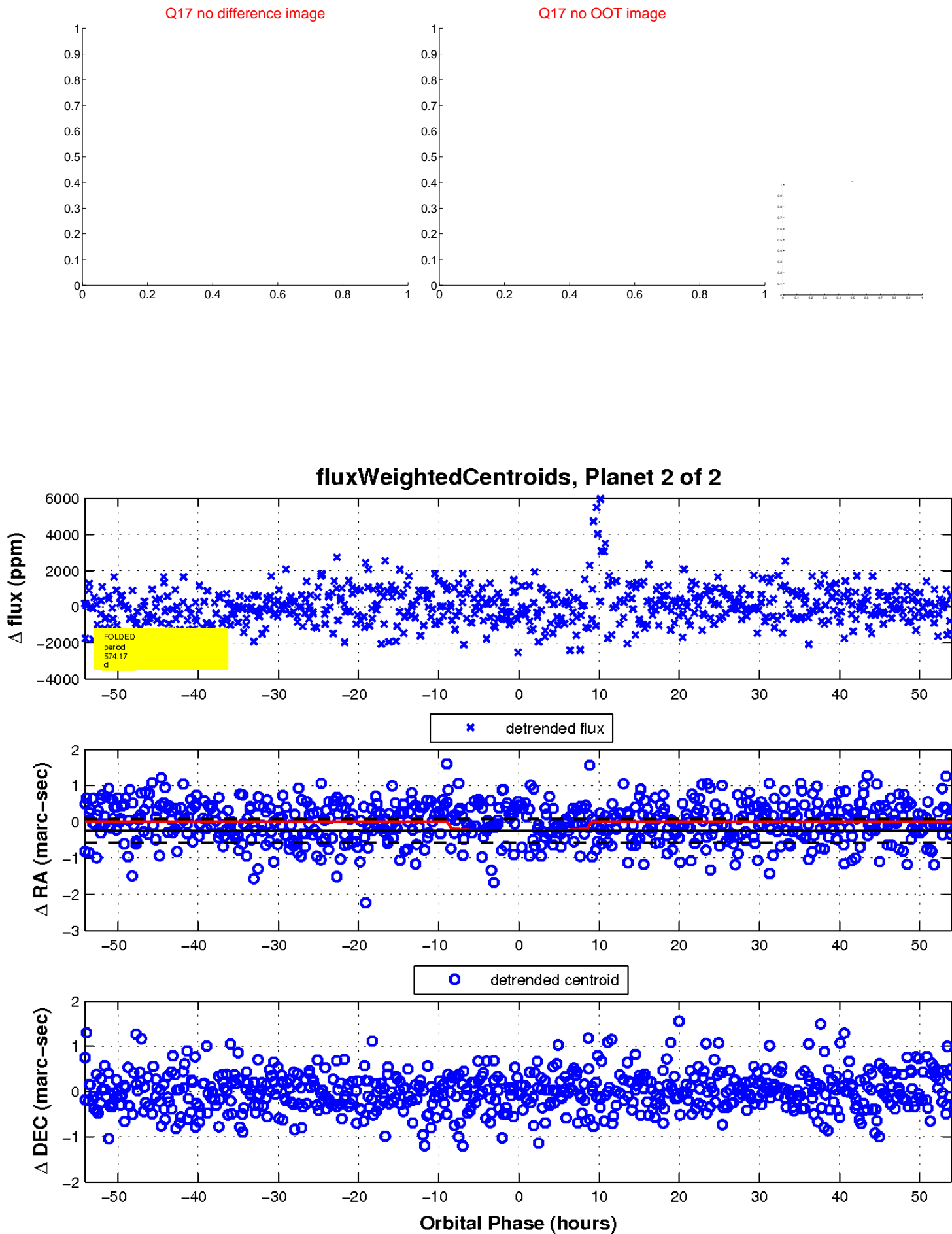
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



white ×: 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

