

# KIC 009715163

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009715163-01	OBS	No	224.399833	291.416977	3.9	1.318	60.9	0.6	2.52	10851	0.61	76.56
009715163-02	OBS	No	383.836129	356.913940	8.3	17.553	40.4	1.5	2.52	10851	0.75	37.43

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009715163-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_ZUMA_TRACKER—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_SATURATED
009715163-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_ZUMA_TRACKER—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_SATURATED

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

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

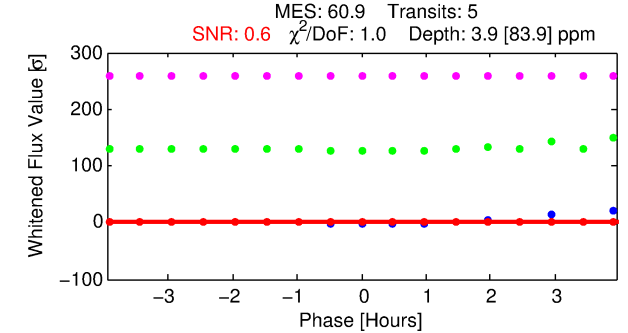
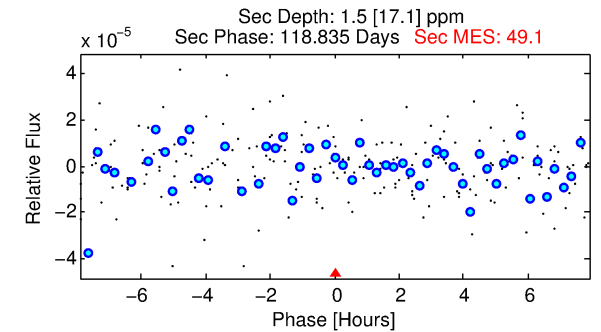
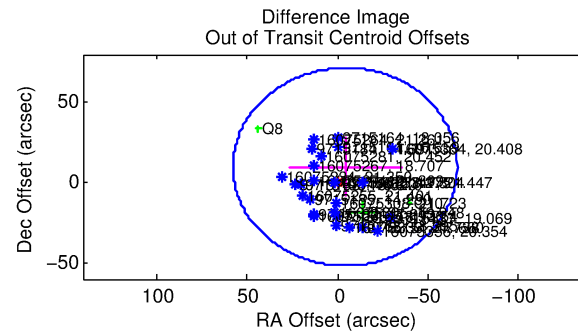
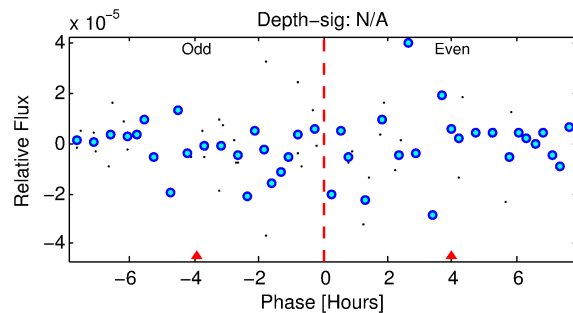
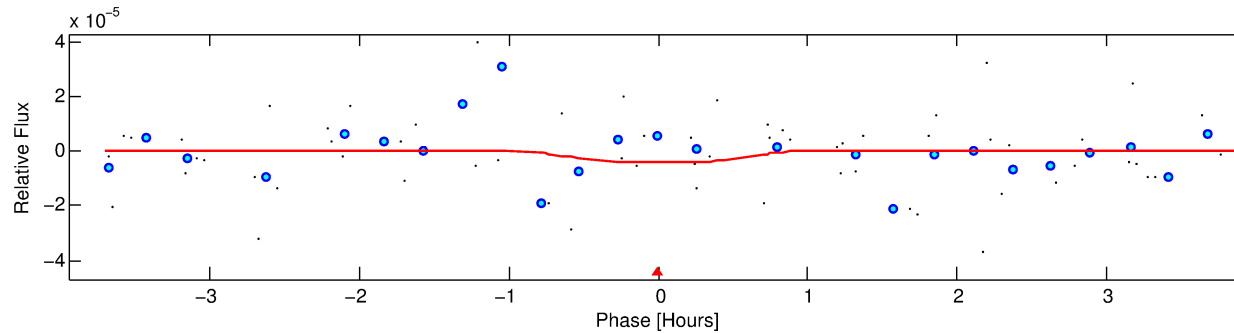
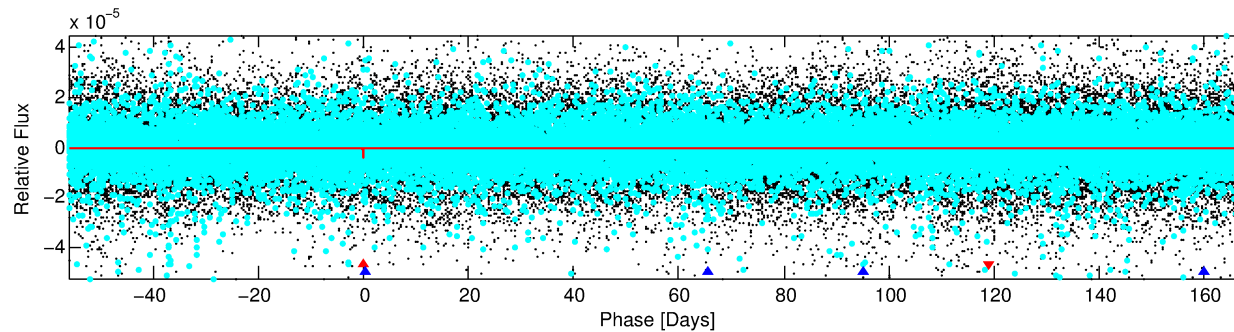
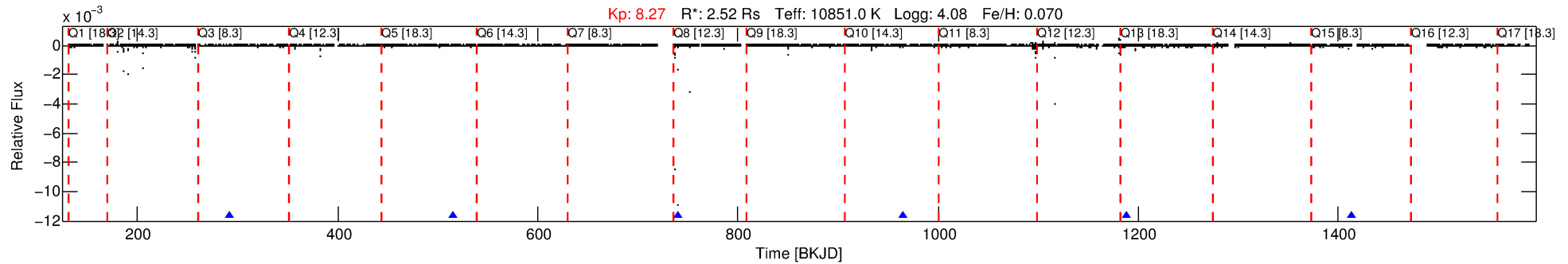
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 009715163-01

No Significant Match Found

# DV One-Page Summary

KIC: 9715163 Candidate: 1 of 2 Period: 224.400 d



## DV Fit Results:

Period = 224.39983 [0.26621] d  
Epoch = 291.4170 [0.8565] BKJD  
Rp/R\* = 0.0022 [0.0780]  
a/R\* = 318.93 [106283.94]  
b = 0.97 [19.18]  
Seff = 76.56 [34.58]  
Teq = 754 [85] K  
Rp = 0.61 [21.48] Re  
a = 1.0162 [0.2823] AU  
Ag = 2279.17 [162778.57] [0.01σ]  
Teffp = 8058 [143870] K [0.05σ]

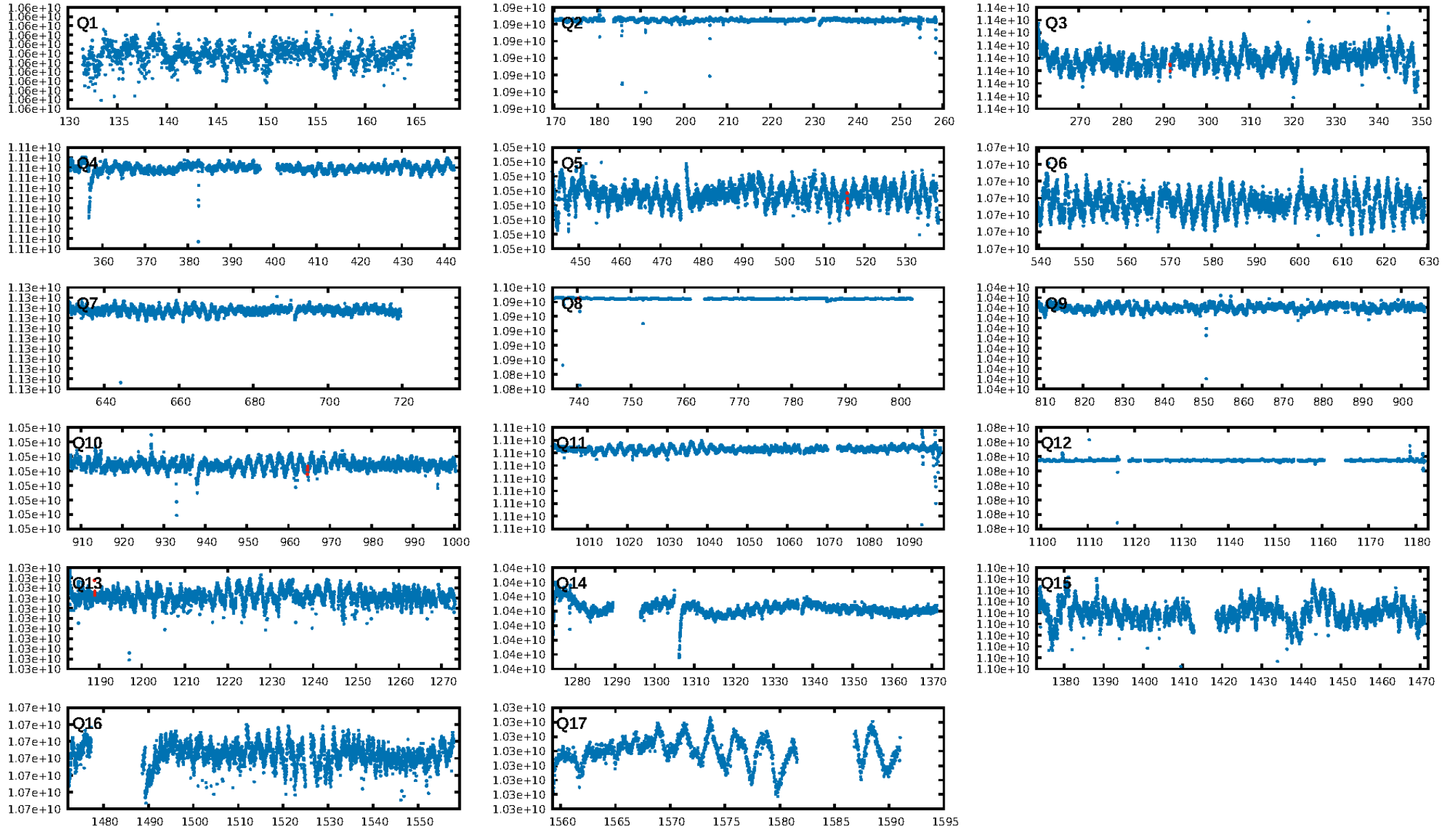
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [217.38σ]  
ModelChiSquare2-sig: 43.7%  
ModelChiSquareGof-sig: 80.0%  
Bootstrap-pfa: 8.01e-12  
RollingBand-fgt: 1.00 [5/5]  
GhostDiagnostic-chr: N/A  
Centroid-sig: N/A  
Centroid-so: N/A  
OotOffset-rm: 10.762 arcsec [0.52σ]  
OotOffset-st: 1/0/1/1 [3]  
KicOffset-rm: 10.734 arcsec [0.46σ]  
KicOffset-st: 1/0/1/1 [3]  
DiffImageQuality-fgm: 0.00 [0/3]  
DiffImageOverlap-fno: 0.75 [3/4]

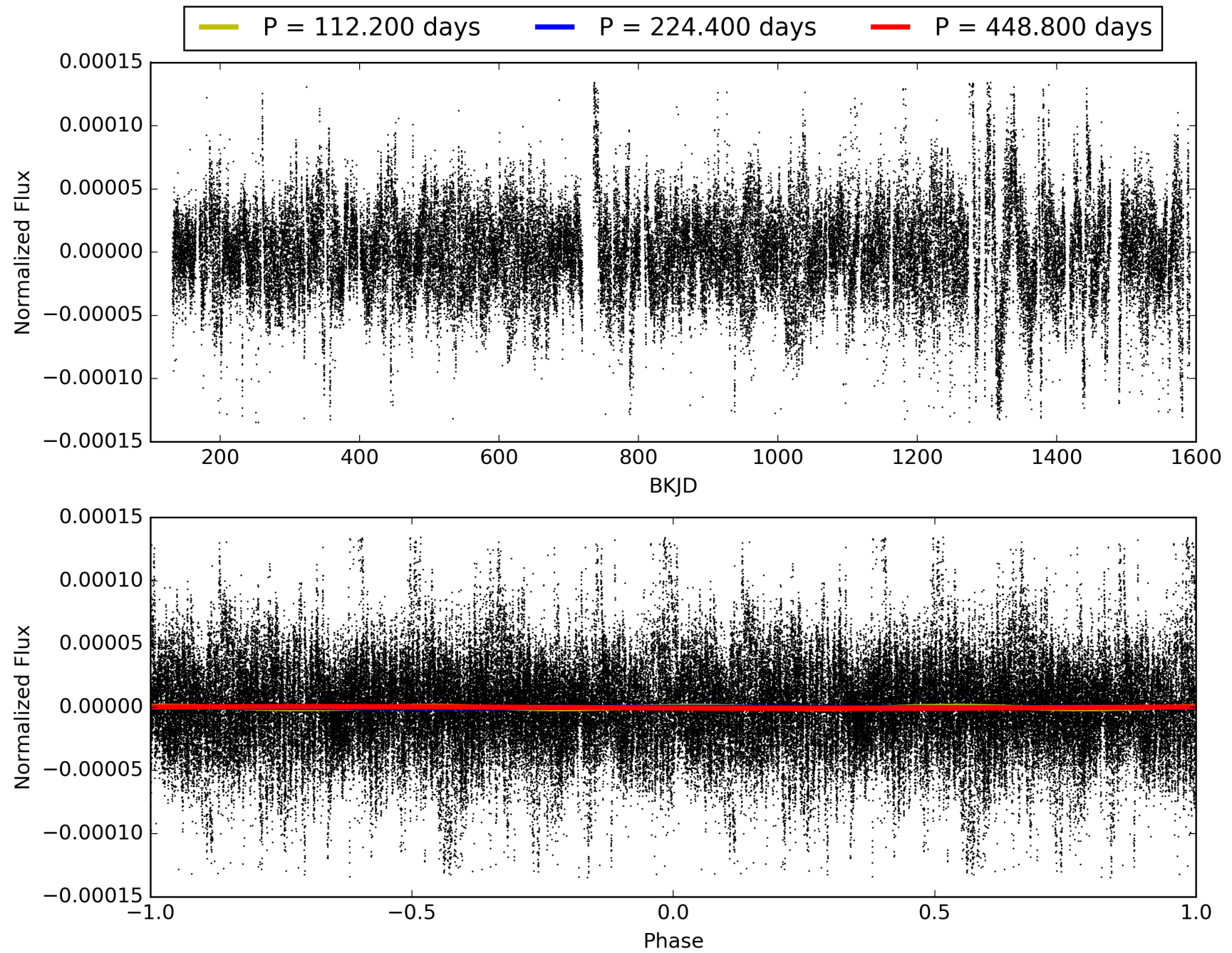
Software Revision: svn-ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 30-Jan-2016 22:32:52 Z

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

# TCE 009715163-01, PDC Light Curves

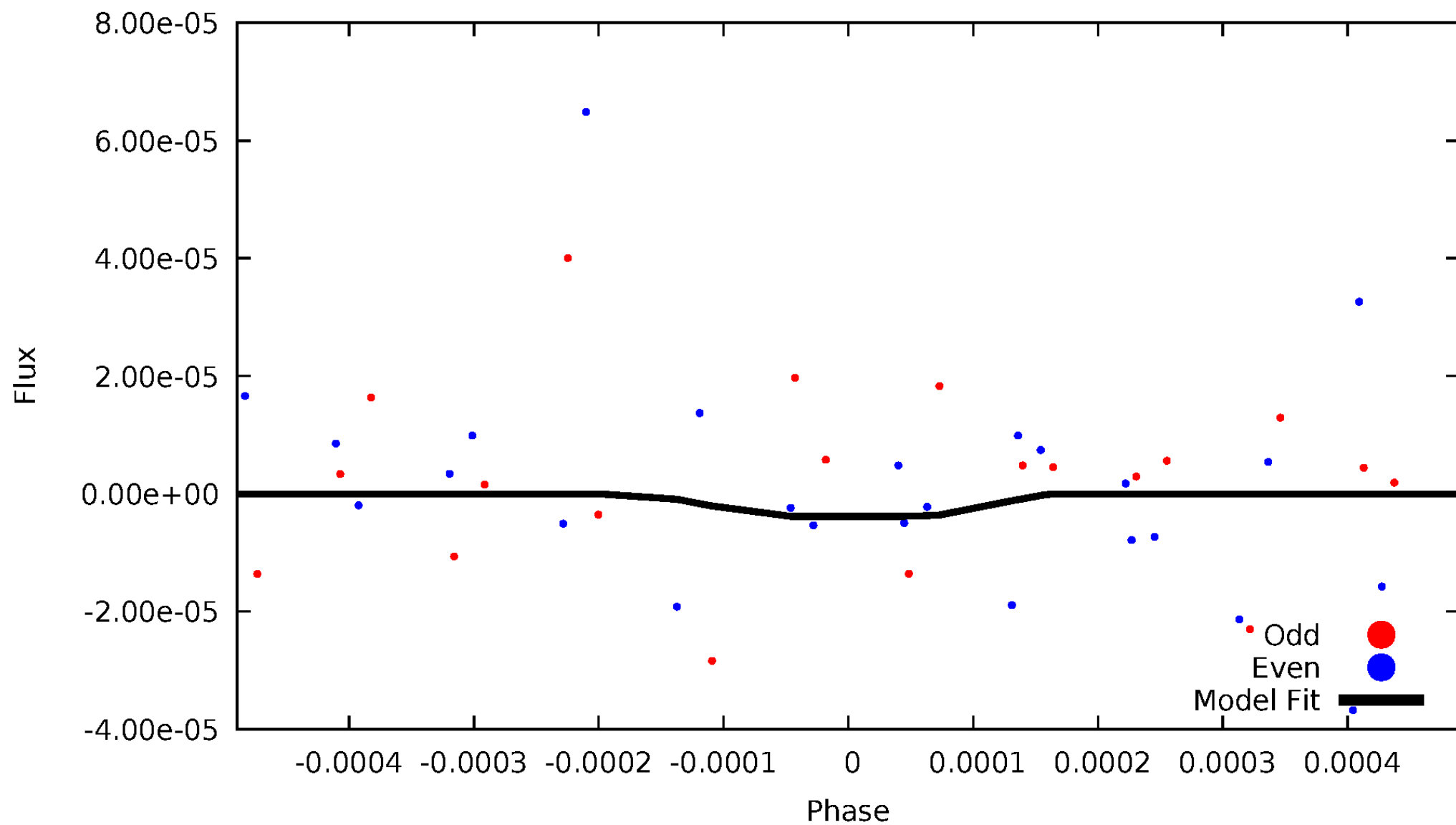


TCE 009715163-01



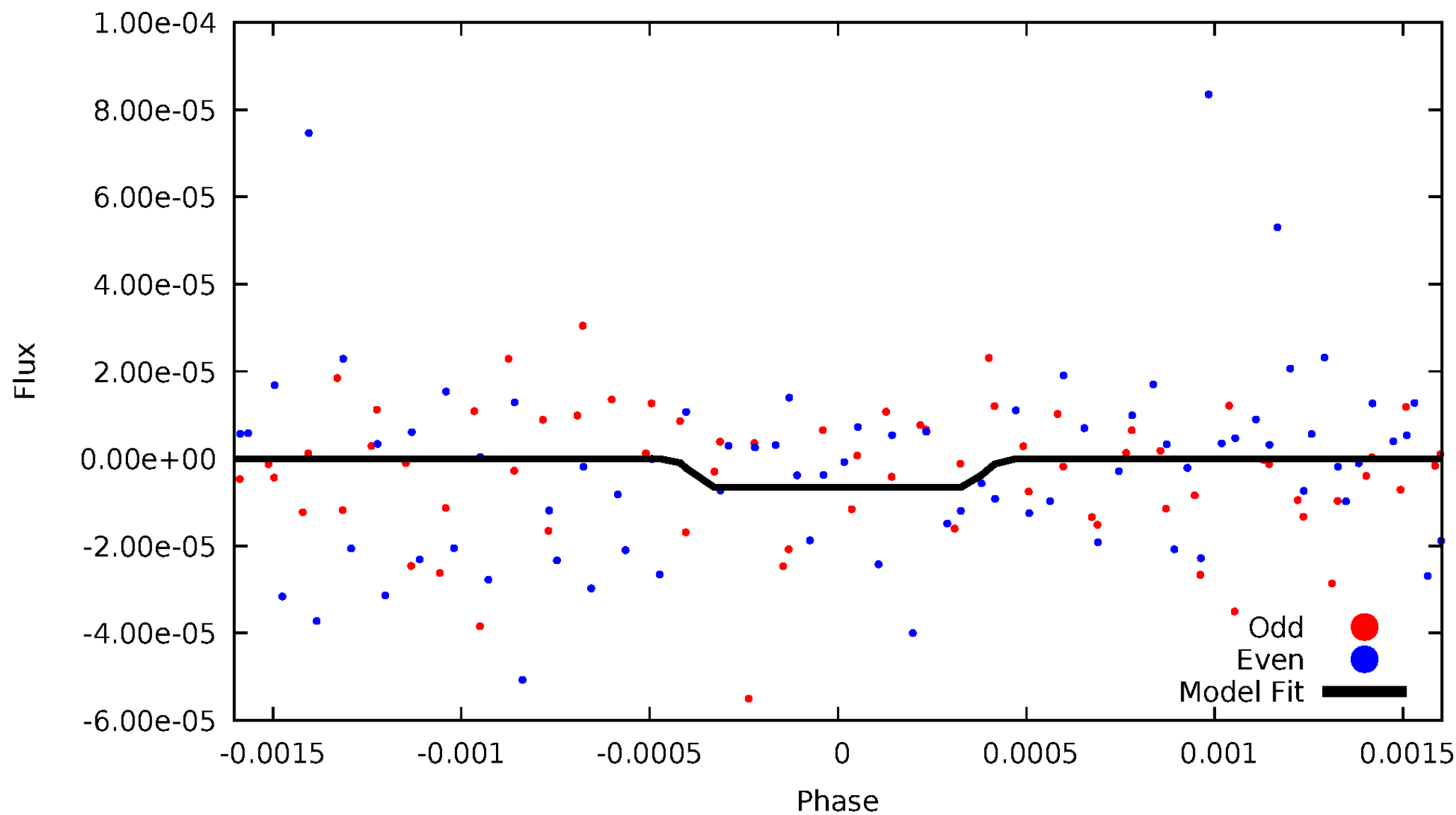
# DV Odd/Even

TCE 009715163-01



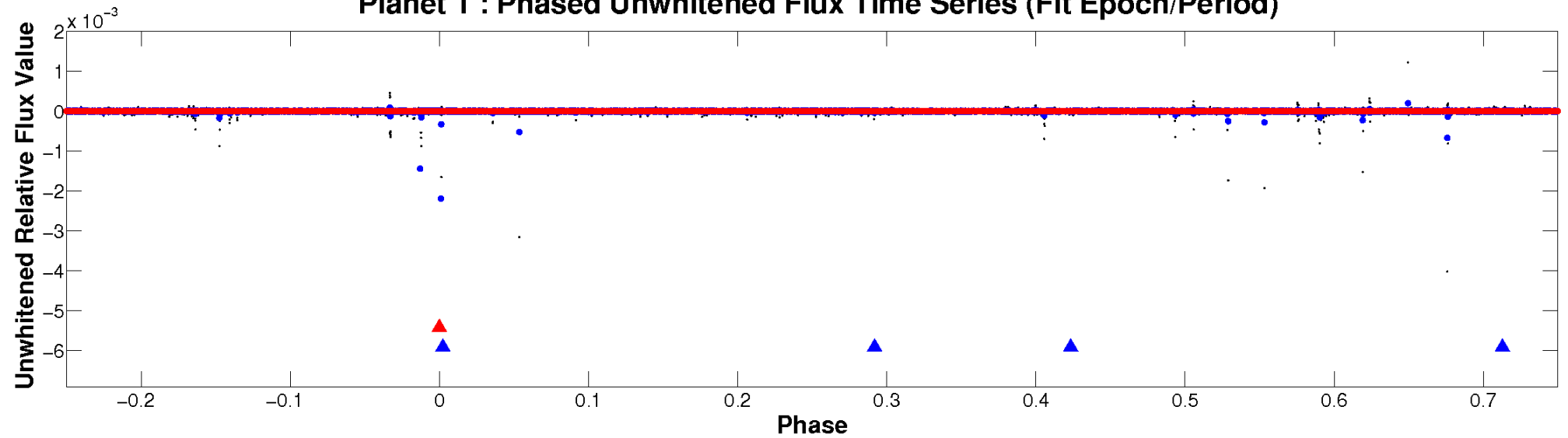
# ALT Odd/Even

TCE 009715163-01

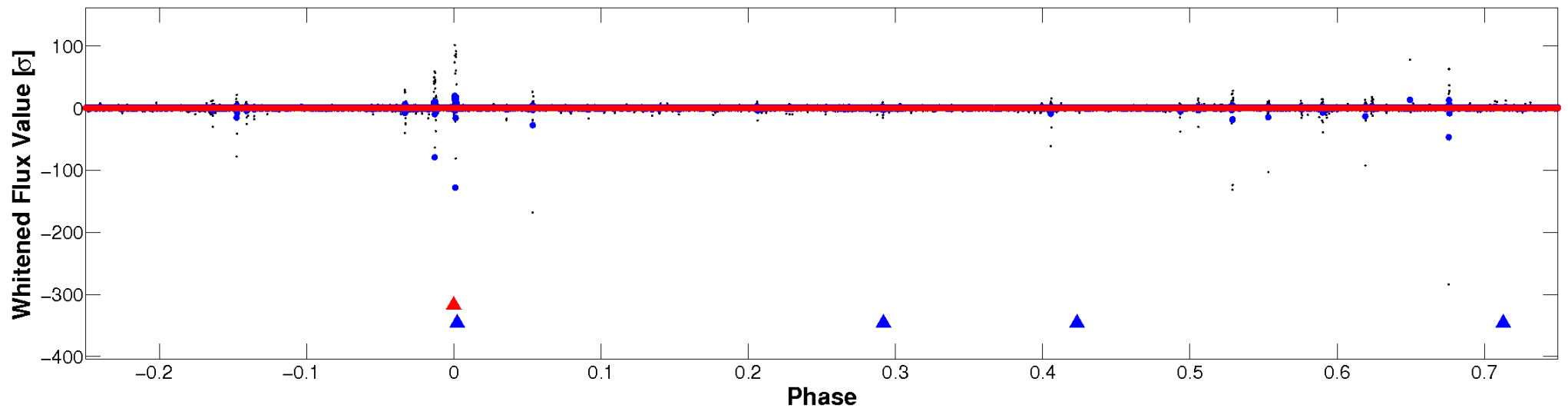


# Non-Whitened Vs. Whitened Light Curve

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

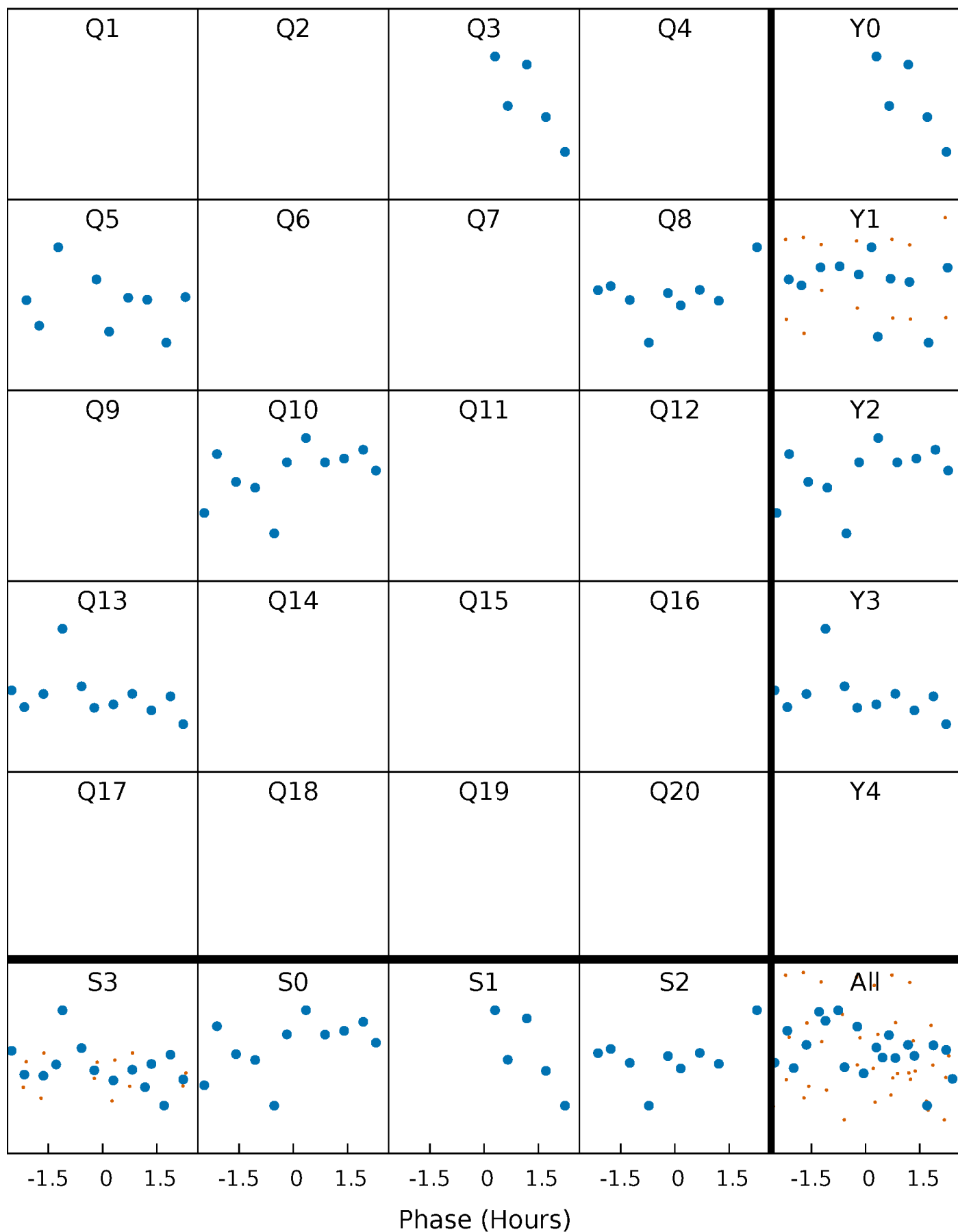


**Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



# PDC Quarter-Phased Transit Curves

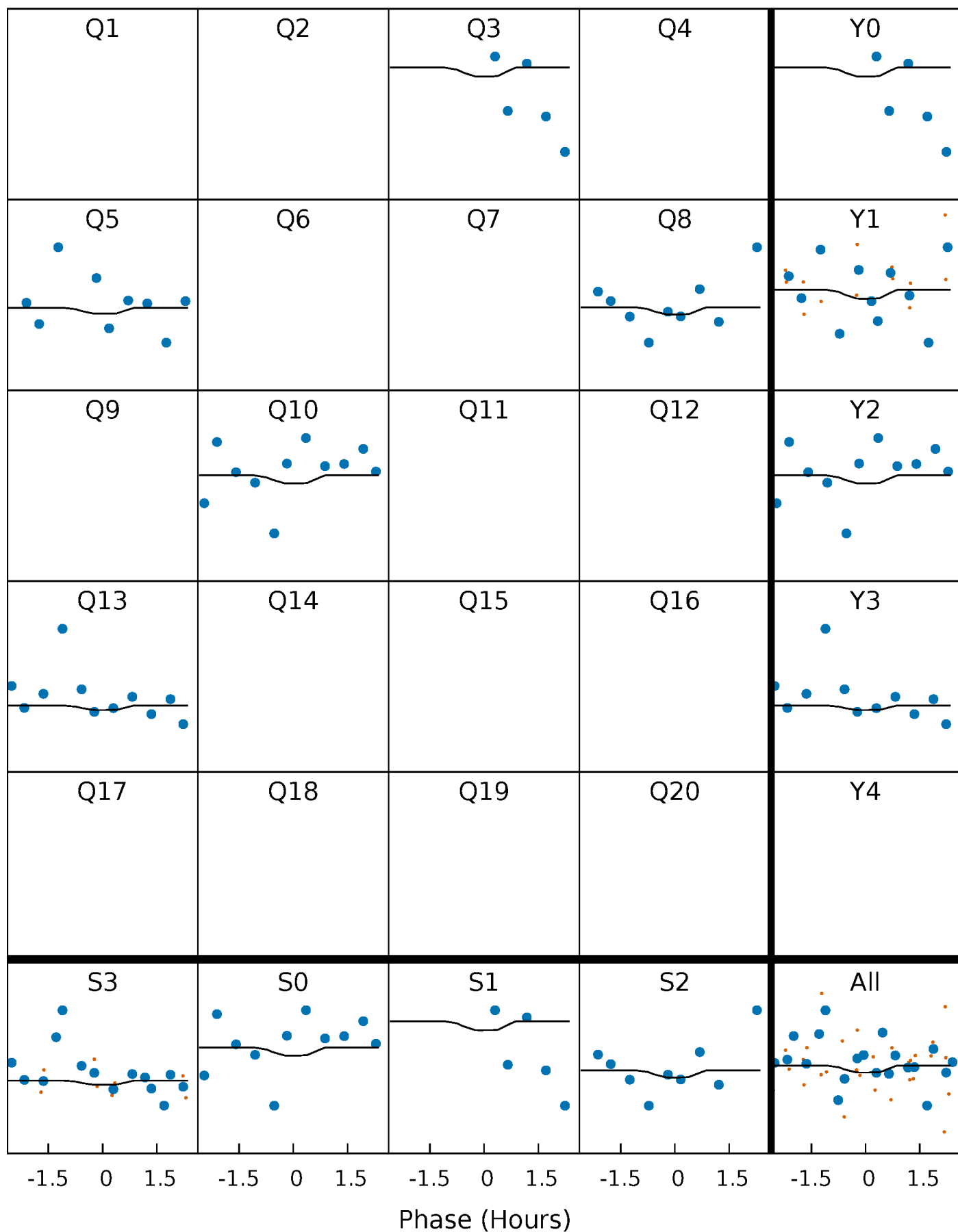
TCE 009715163-01 P=224.399833 Days  $T_0=291.416977$  (BKJD)





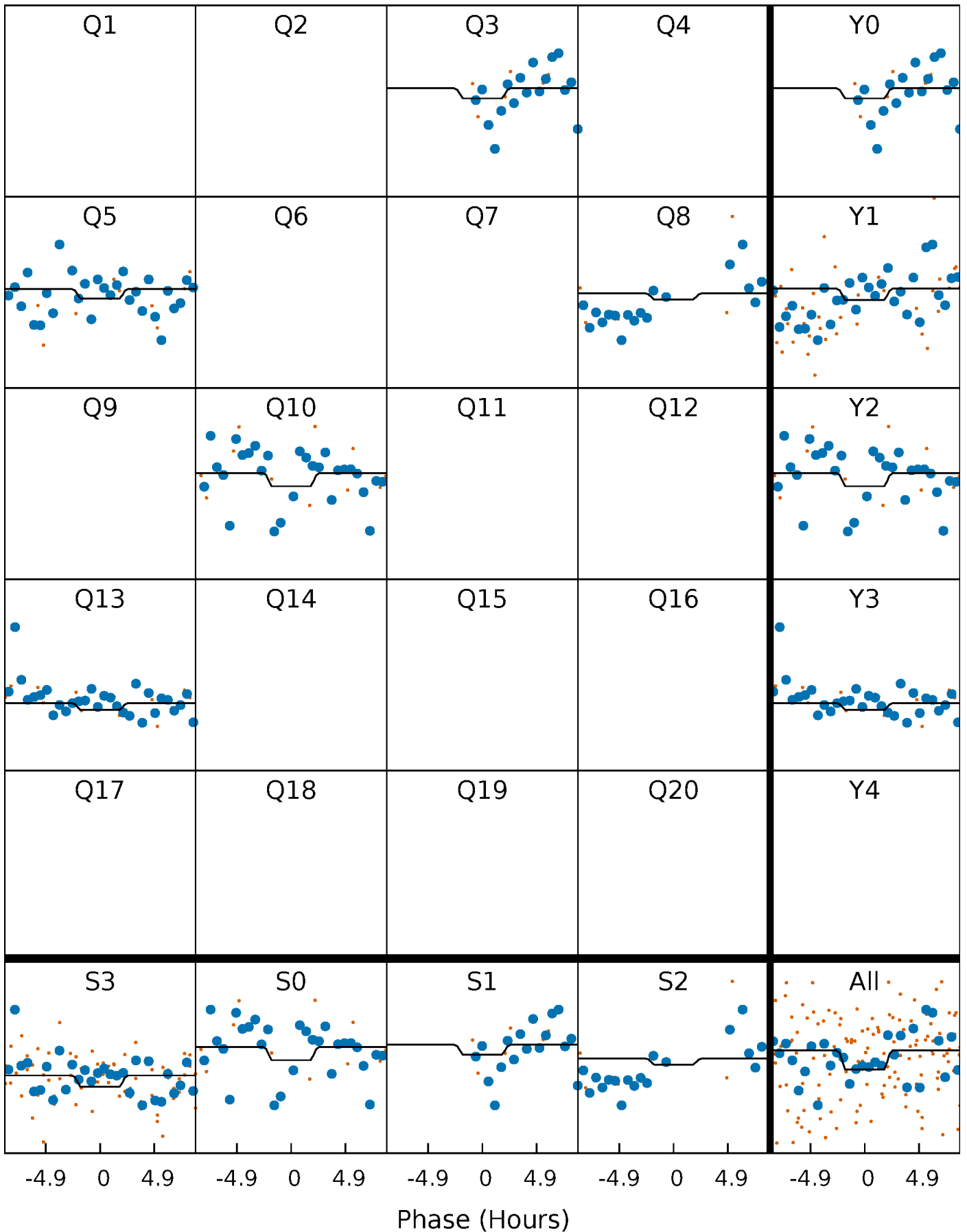
# DV Quarter-Phased Transit Curves

TCE 009715163-01 P=224.399833 Days  $T_0=291.416977$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

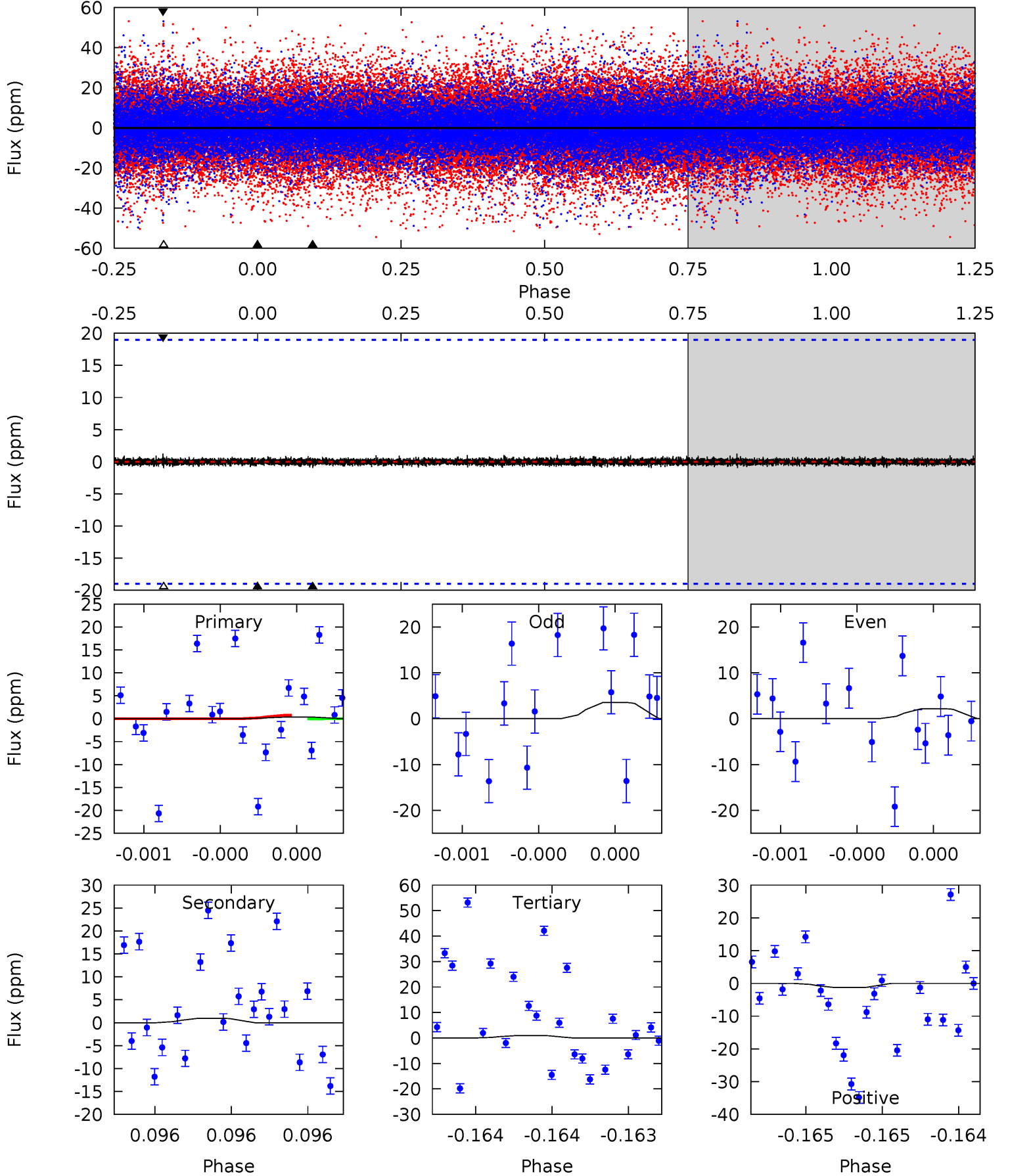
TCE 009715163-01 P=224.455316 Days  $T_0=291.463090$  (BKJD)



# DV Model-Shift Uniqueness Test

009715163-01, P = 224.399833 Days, E = 67.017144 Days

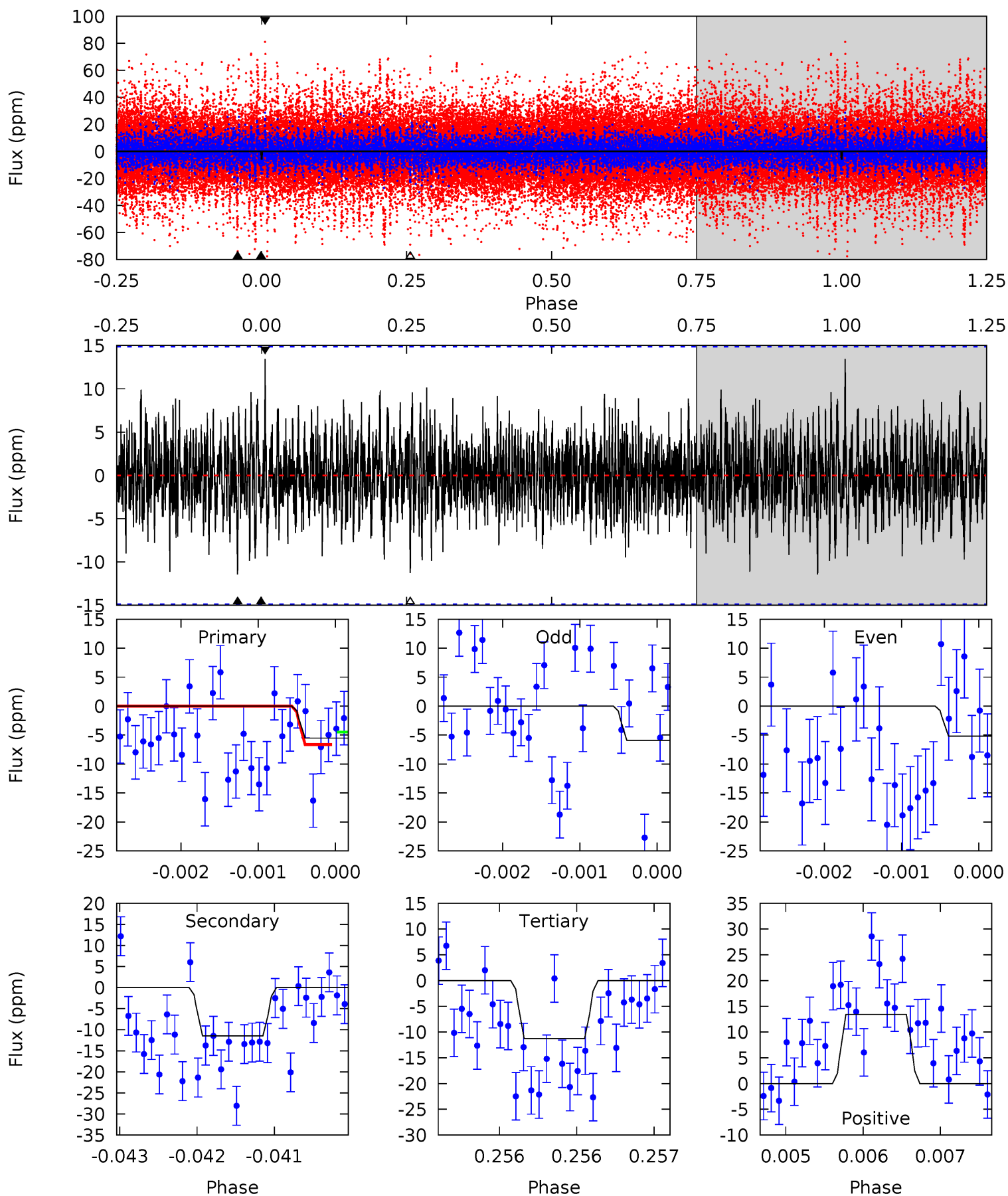
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
0.10	0.28	0.28	0.39	5.67	3.63	0.07	-0.18	-0.28	0.00	-0.10	0.20	-0.46	0.58	0.10



# Alt Model-Shift Uniqueness Test

009715163-01, P = 224.455316 Days, E = 67.007774 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
2.04	4.21	4.15	4.94	5.48	3.34	1.14	-2.12	-2.91	0.06	-0.73	0.13	5.60	0.54	0.39



### Stellar Parameters For KIC 009715163

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$10851^{+304}_{-457}$	$4.078^{+0.236}_{-0.193}$	$0.070^{+0.150}_{-0.600}$	$2.523^{+0.797}_{-0.797}$	$2.781^{+0.289}_{-0.626}$	$0.244^{+0.374}_{-0.132}$
	+3%/-4%	+6%/-5%	+214%/-857%	+32%/-32%	+10%/-23%	+153%/-54%
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 009715163-01 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-1 \pm 3$	$14.63^{+16.52}_{-10.43}$	$1049^{+95}_{-87}$	$2054^{+1000}_{-4687}$	$1.293^{+28.096}_{-9.331}$
Alt.	$-11 \pm 3$	$15.22^{+15.91}_{-10.89}$	$1049^{+86}_{-95}$	$3043^{+1561}_{-566}$	$29^{+293}_{-23}$

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

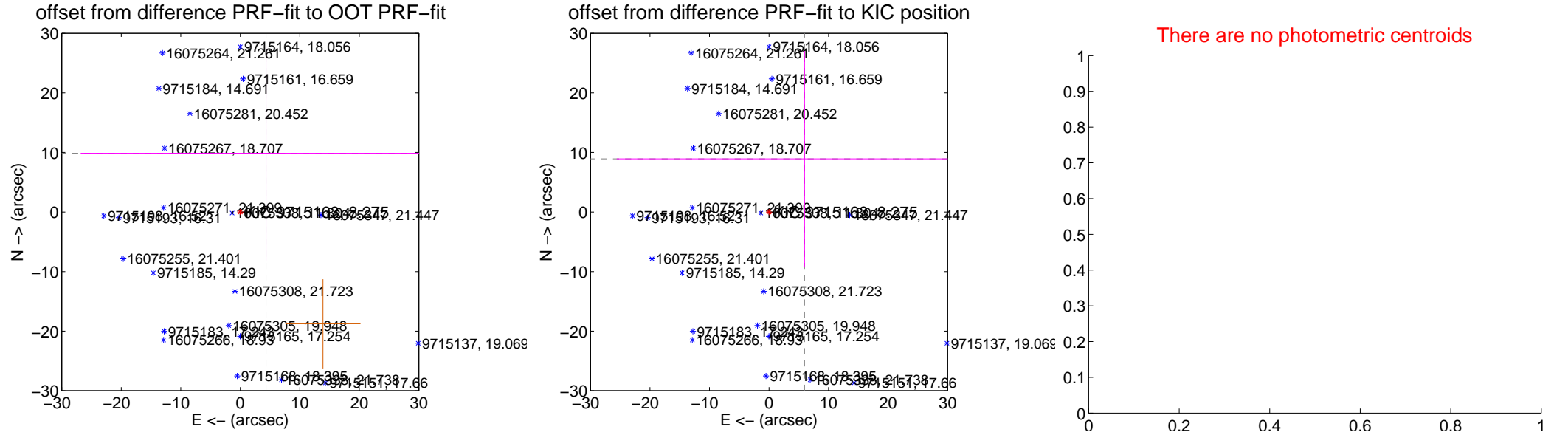
## DV Centroid Data

Supplemental centroid analysis for 009715163-01. **Kepler magnitude: 8.28.** Transit SNR 0.64

There are 0 quarters with good PRF difference image offsets

The OOT PRF centroid is offset from the target star catalog position by about 24.15 arcsec so the offset from difference PRF-fit to OOT-fit may be invalid.

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$10.762 \pm 20.706$	0.52	$-4.325 \pm 31.135$	$9.854 \pm 18.017$
PRF-fit source offset from KIC position	$10.734 \pm 23.119$	0.46	$-5.966 \pm 31.553$	$8.924 \pm 18.122$
photometric centroid source offset	—	—	—	—

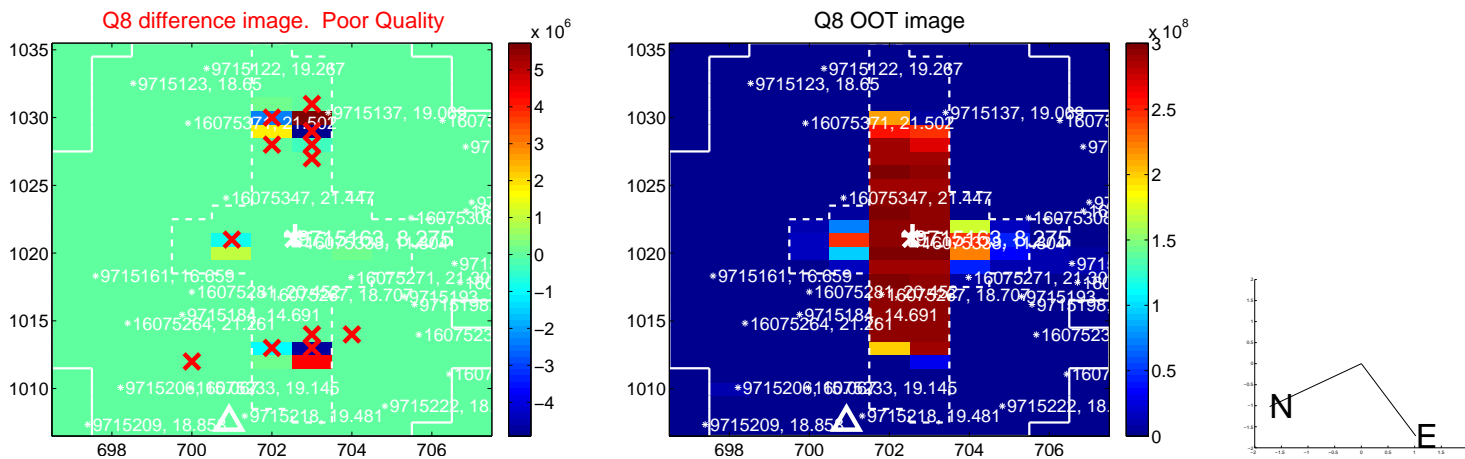
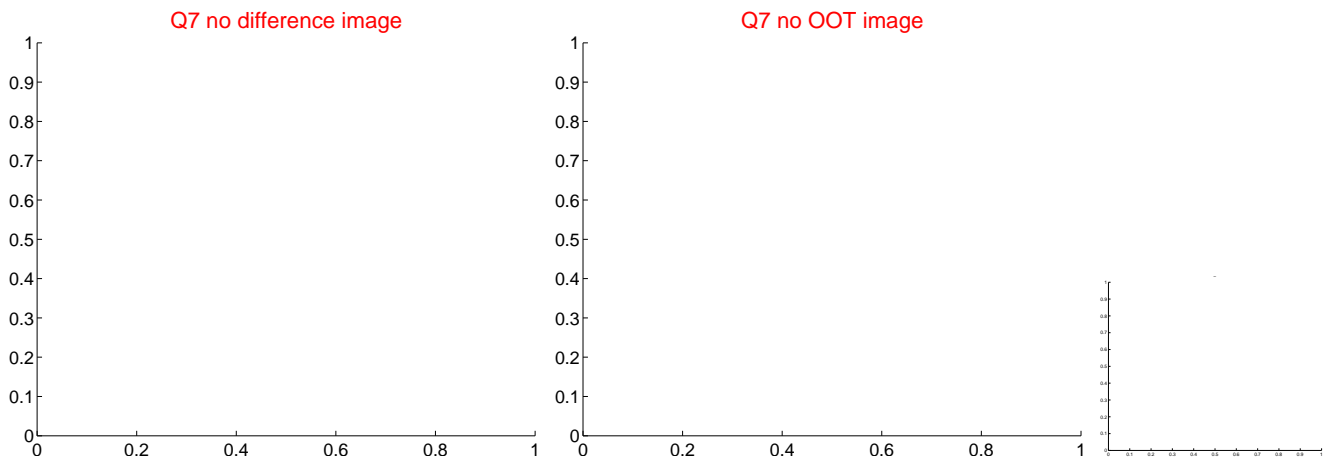
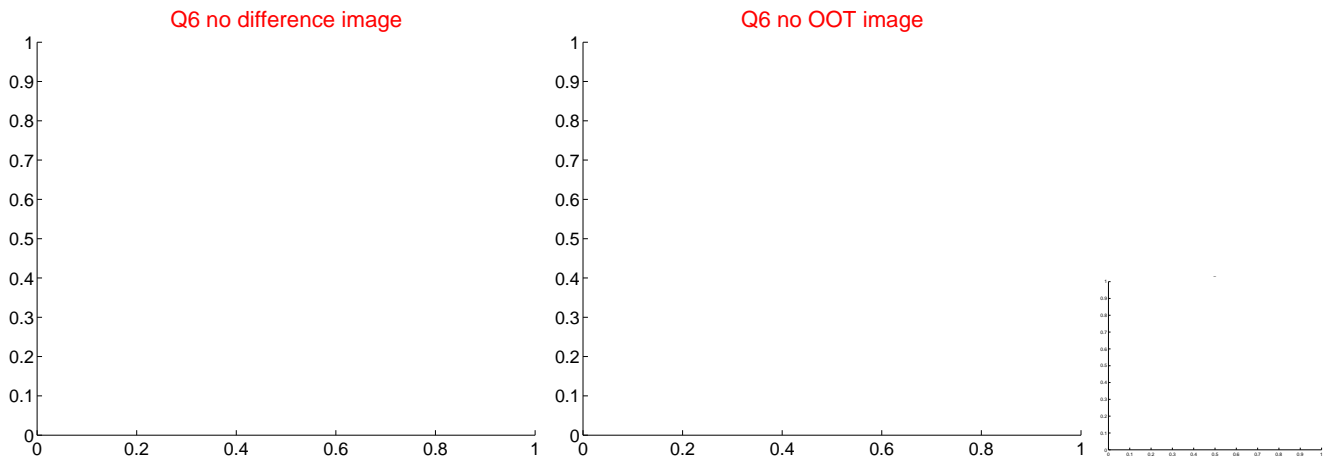
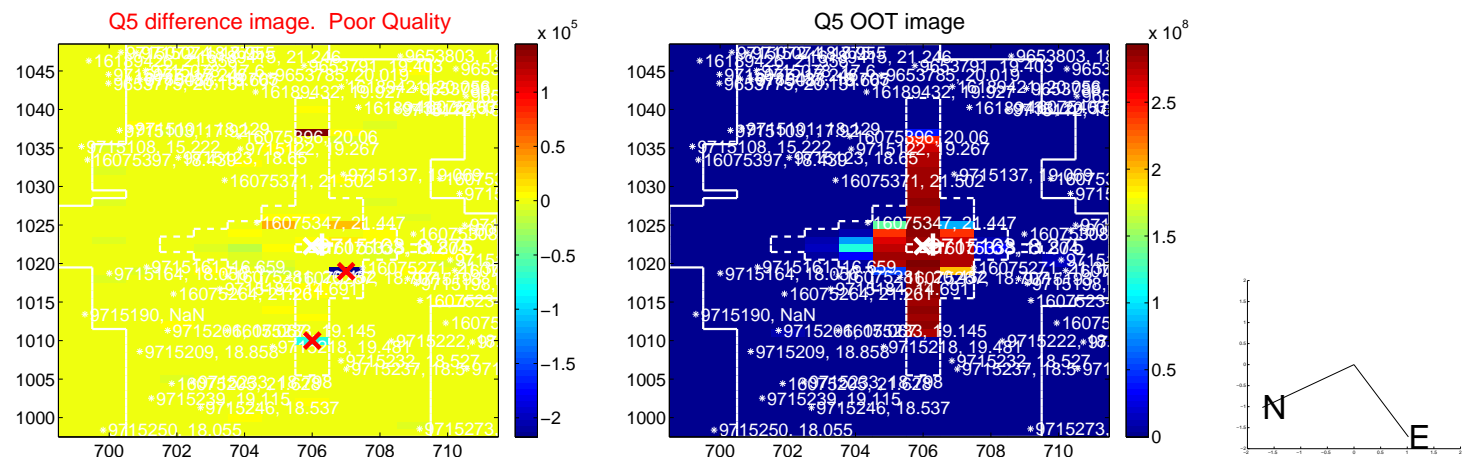


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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



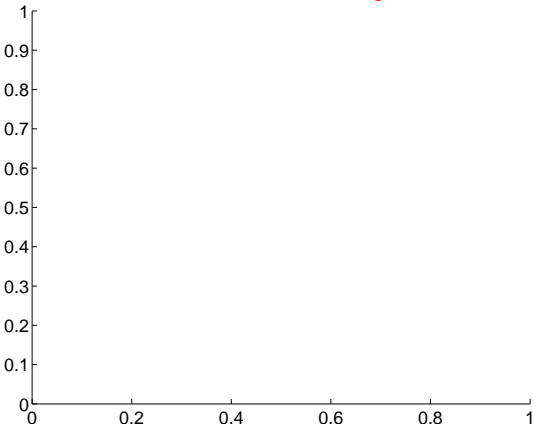
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



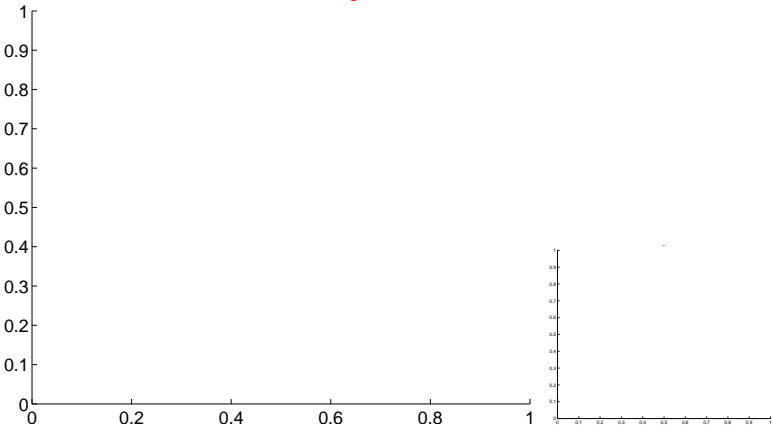


white ×: KIC target position; +: OOT centroid; △: difference centroid. red ✕: large negative pixel value.

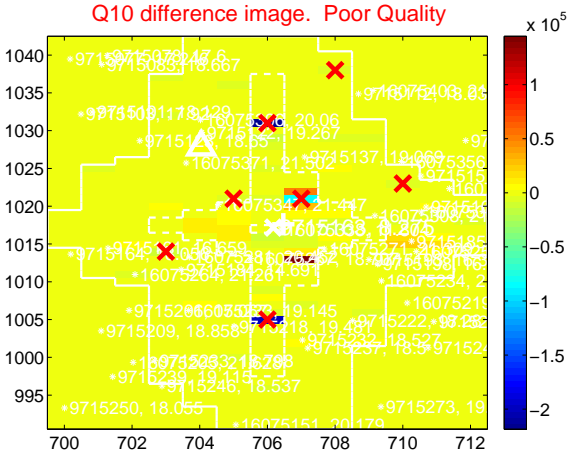
Q9 no difference image



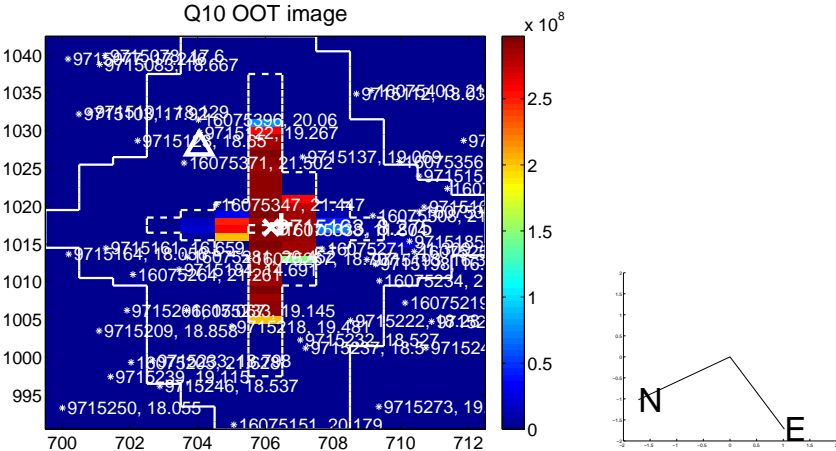
Q9 no OOT image



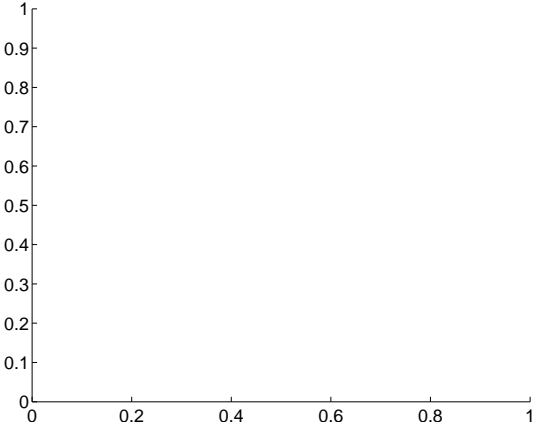
Q10 difference image. Poor Quality



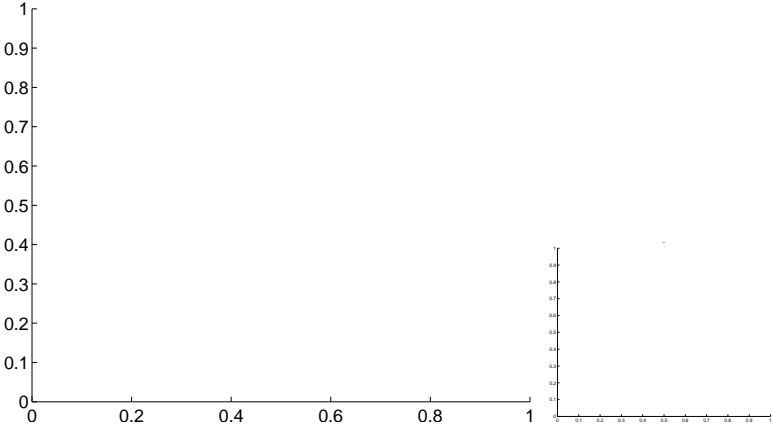
Q10 OOT image



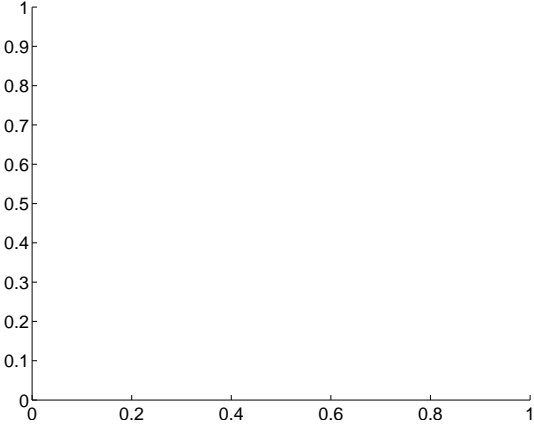
Q11 no difference image



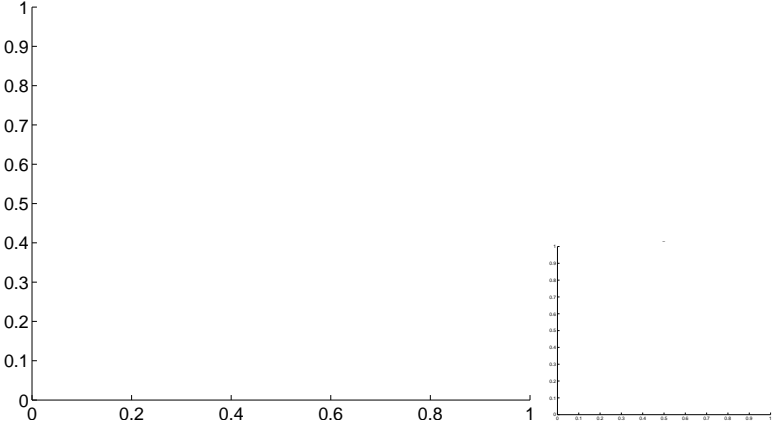
Q11 no OOT image



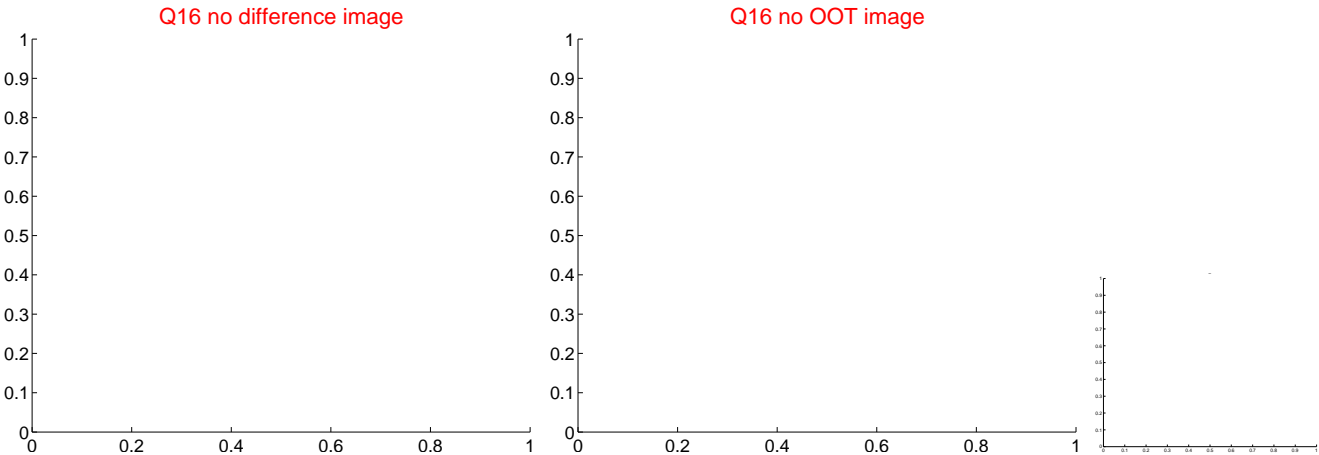
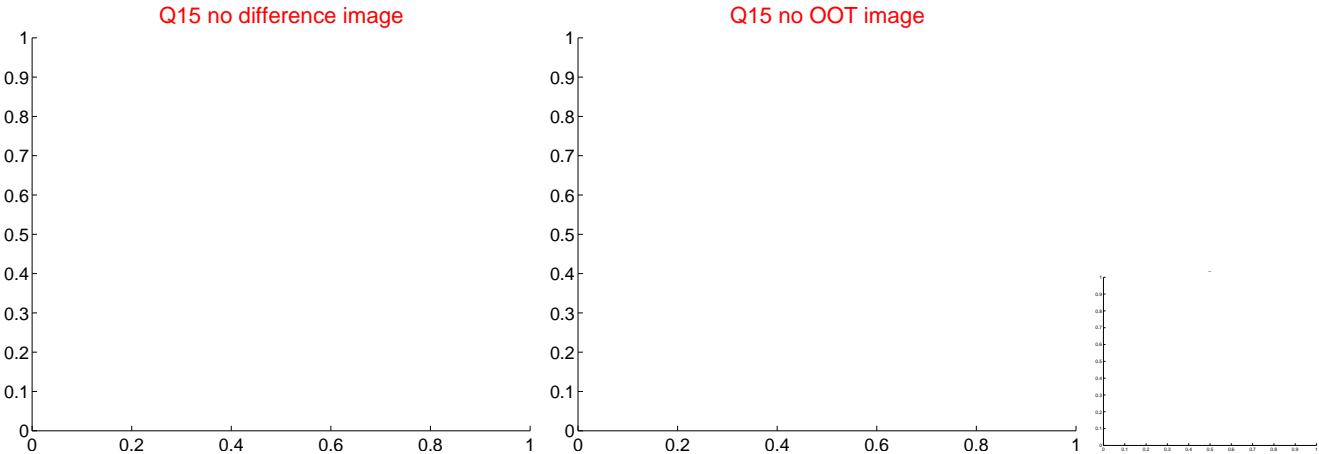
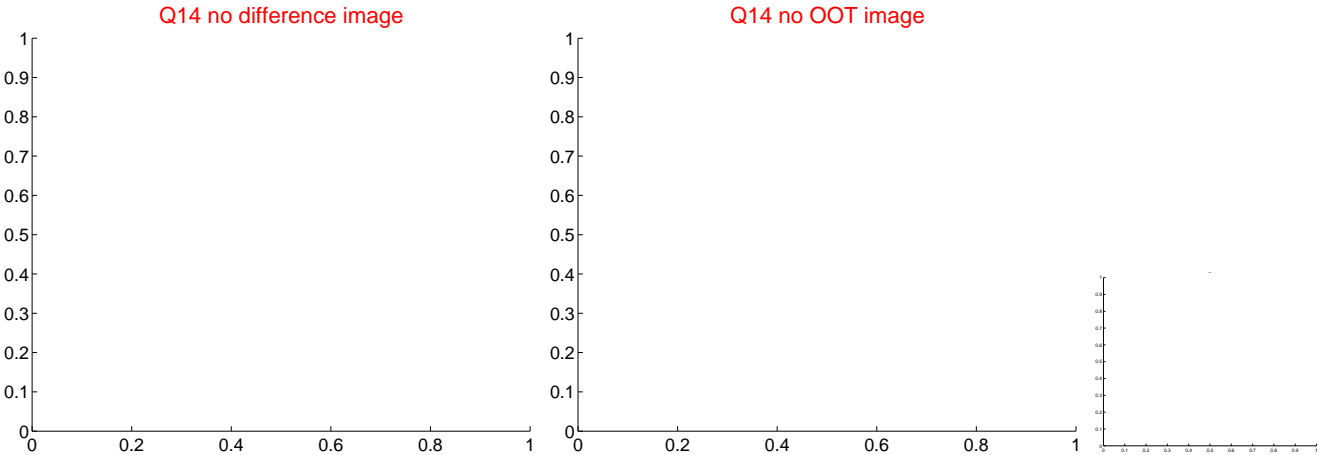
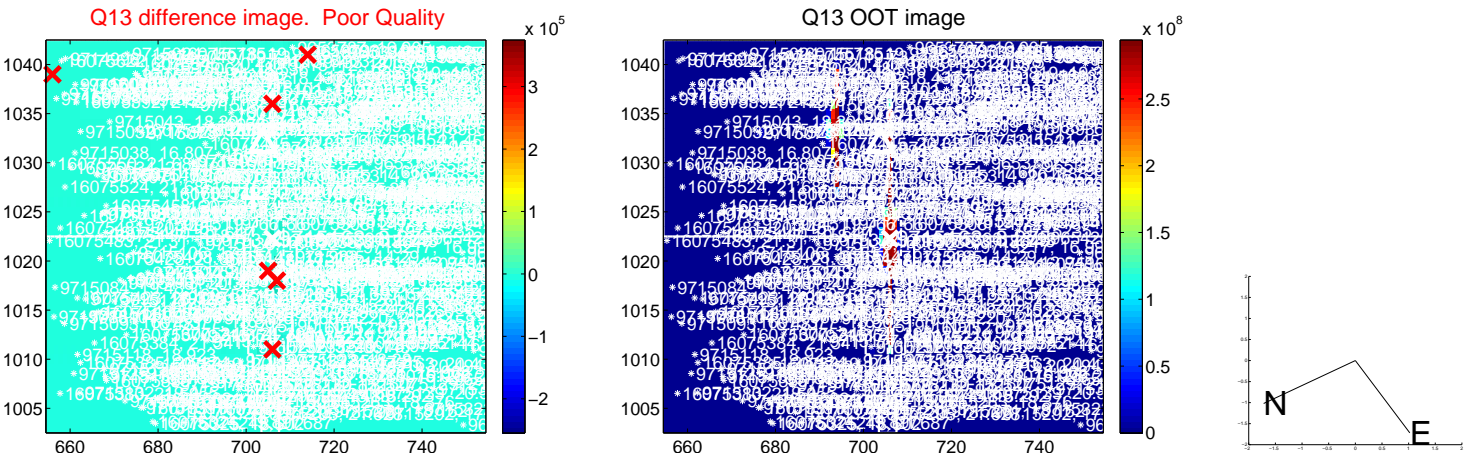
Q12 no difference image



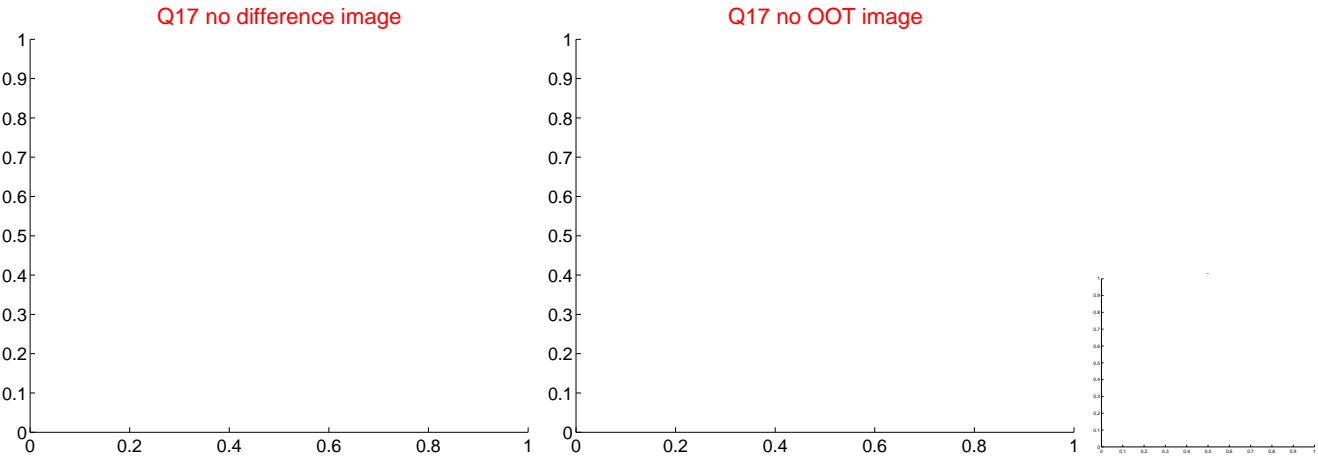
Q12 no OOT image



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

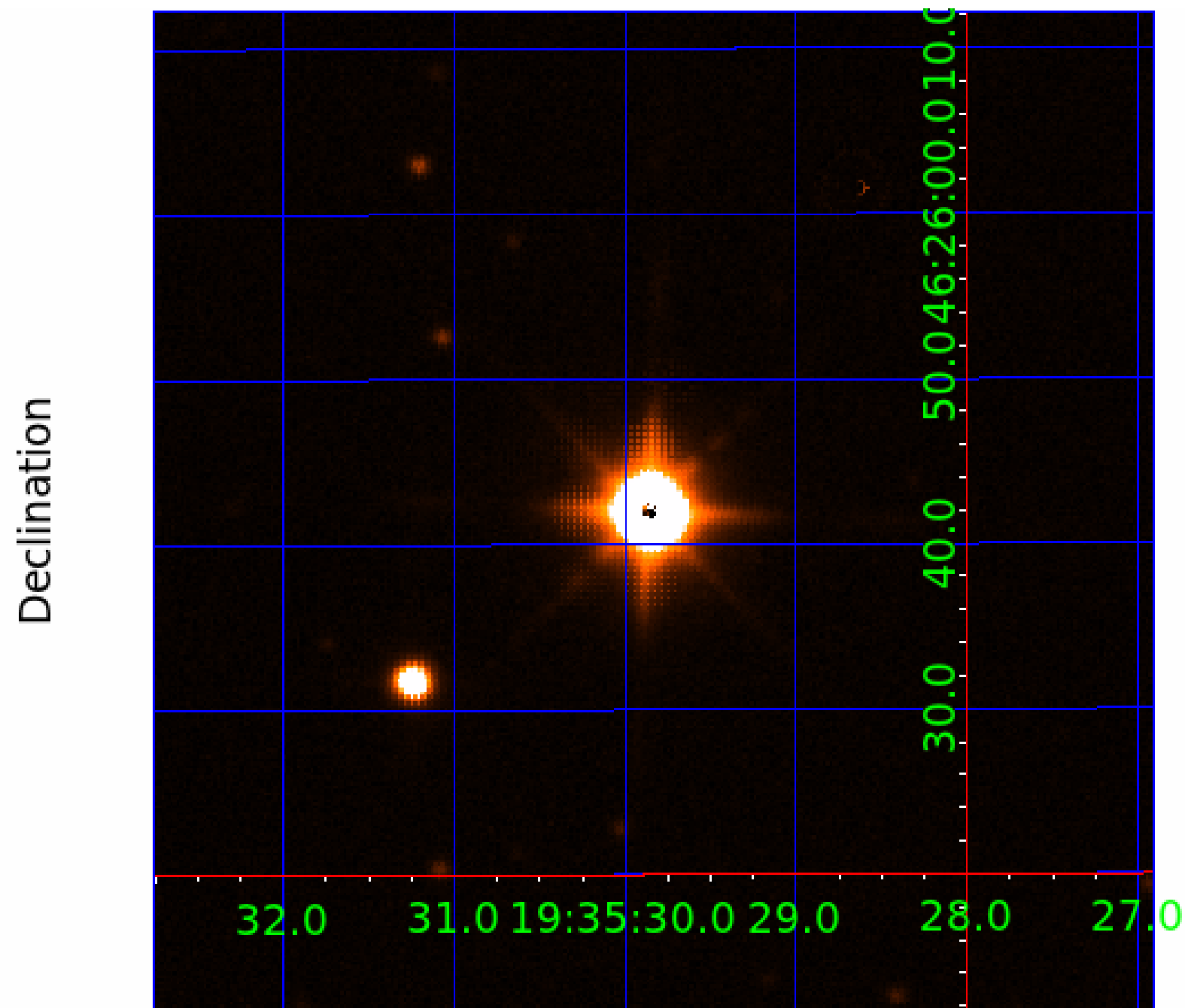


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



folded centroid time series figure for this object.

UKIRT Image



# KIC 009715163

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009715163-01	OBS	No	224.399833	291.416977	3.9	1.318	60.9	0.6	2.52	10851	0.61	76.56
009715163-02	OBS	No	383.836129	356.913940	8.3	17.553	40.4	1.5	2.52	10851	0.75	37.43

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009715163-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_ZUMA_TRACKER—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_SATURATED
009715163-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_ZUMA_TRACKER—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_SATURATED

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

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

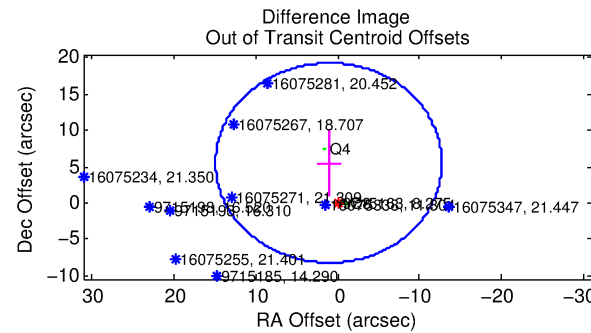
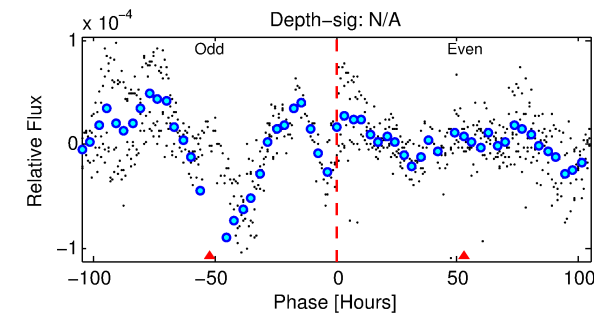
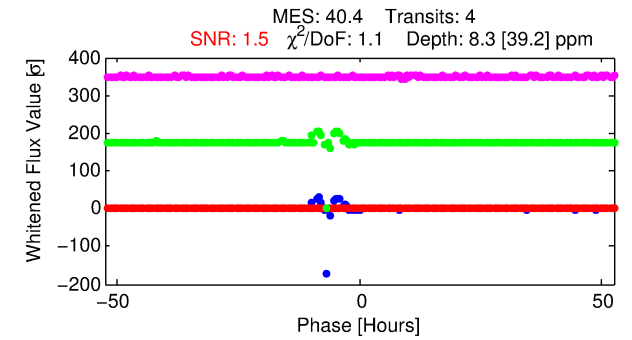
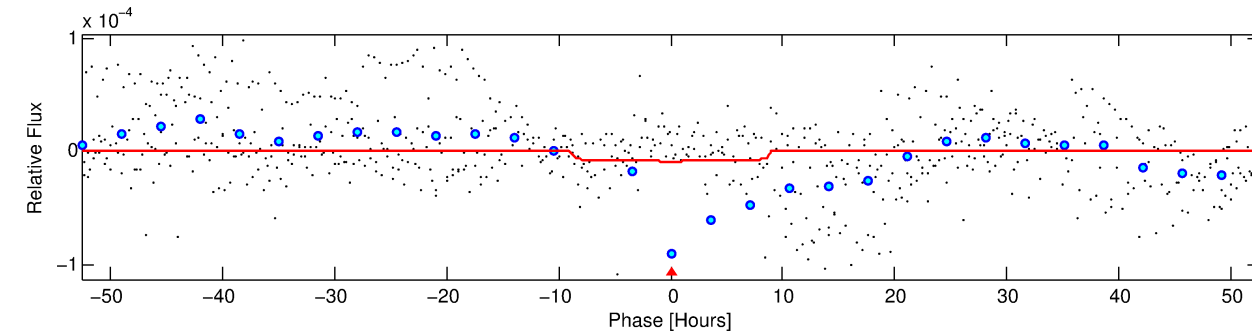
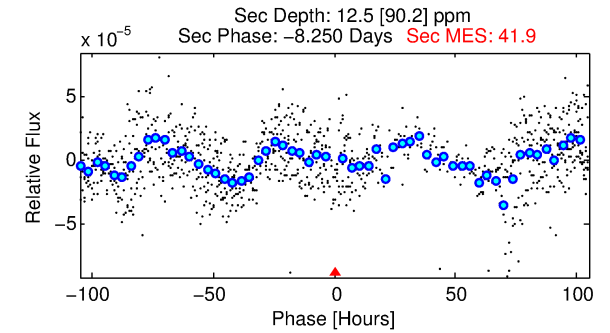
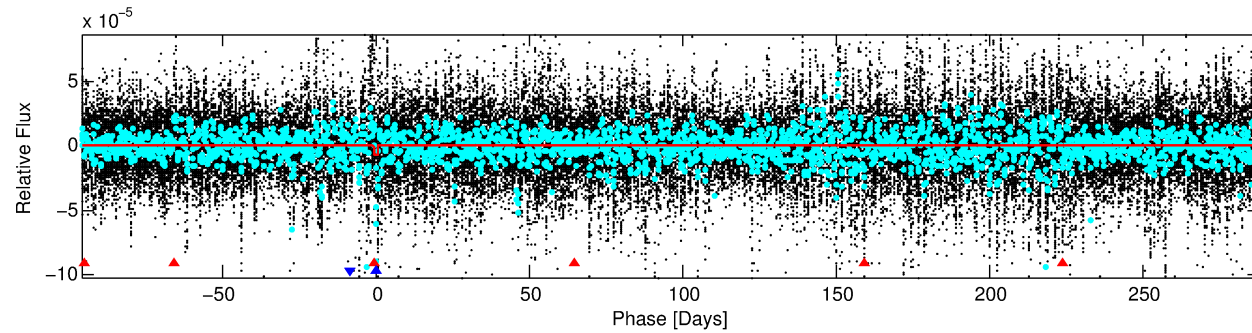
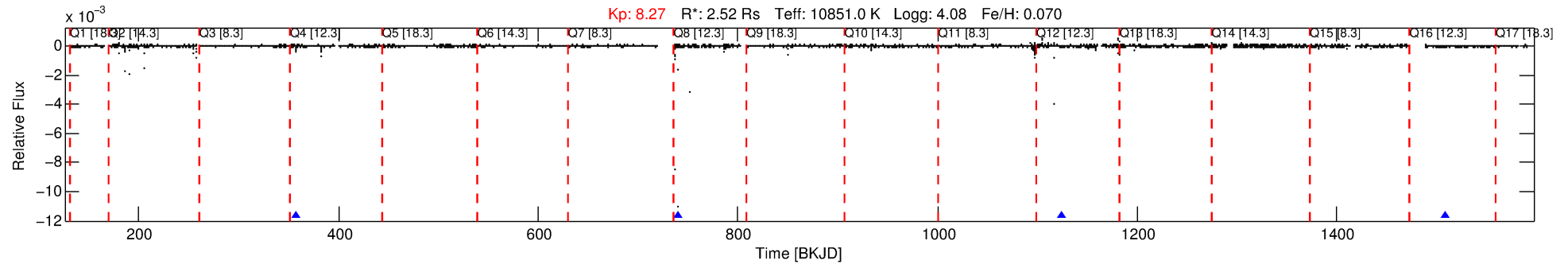
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 009715163-02

No Significant Match Found

# DV One-Page Summary

KIC: 9715163 Candidate: 2 of 2 Period: 383.836 d



## DV Fit Results:

Period = 383.83613 [0.09445] d  
Epoch = 356.9139 [0.1991] BKJD  
Rp/R\* = 0.0027 [0.0389]  
a/R\* = 167.51 [19599.59]  
b = 0.00 [34957.14]  
Seff = 37.43 [16.90]  
Teq = 631 [71] K  
Rp = 0.75 [10.72] Re  
a = 1.4535 [0.4037] AU  
Ag = 25989.00 [767773.57] [0.03σ]  
Teff = 12381 [91434] K [0.13σ]

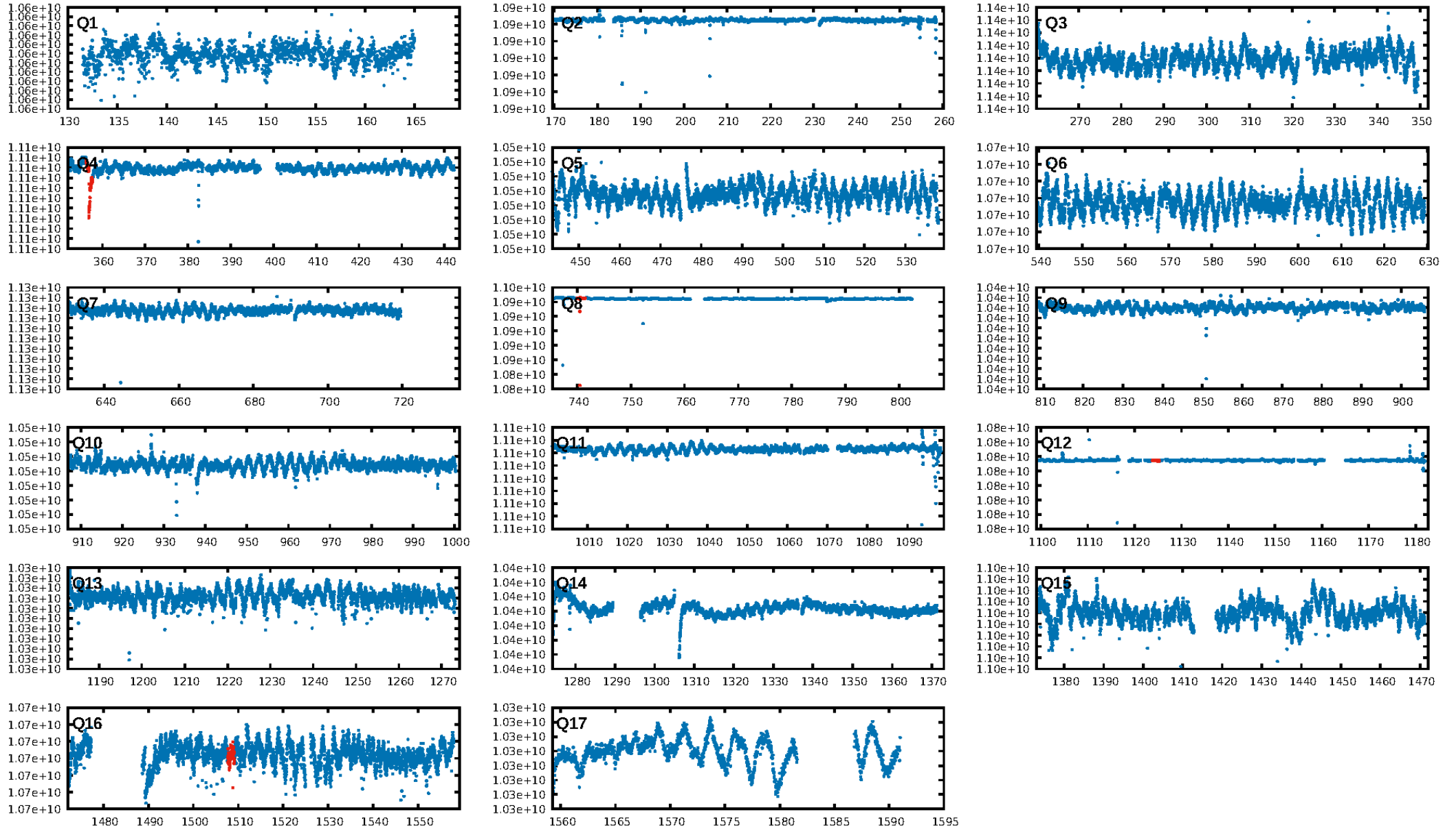
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [217.38σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 0.0%  
ModelChiSquareGof-sig: 99.4%  
Bootstrap-pfa: 7.45e-08  
RollingBand-fgt: 1.00 [4/4]  
GhostDiagnostic-chr: N/A  
Centroid-sig: 1.1%  
Centroid-so: 40.498 arcsec [1.87σ]  
OotOffset-rm: 5.620 arcsec [1.22σ]  
OotOffset-st: 0/0/2/0 [2]  
KicOffset-rm: 4.869 arcsec [1.25σ]  
KicOffset-st: 0/0/2/0 [2]  
DiffImageQuality-fgm: 0.00 [0/2]  
DiffImageOverlap-fno: 0.67 [2/3]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 30-Jan-2016 22:33:00 Z

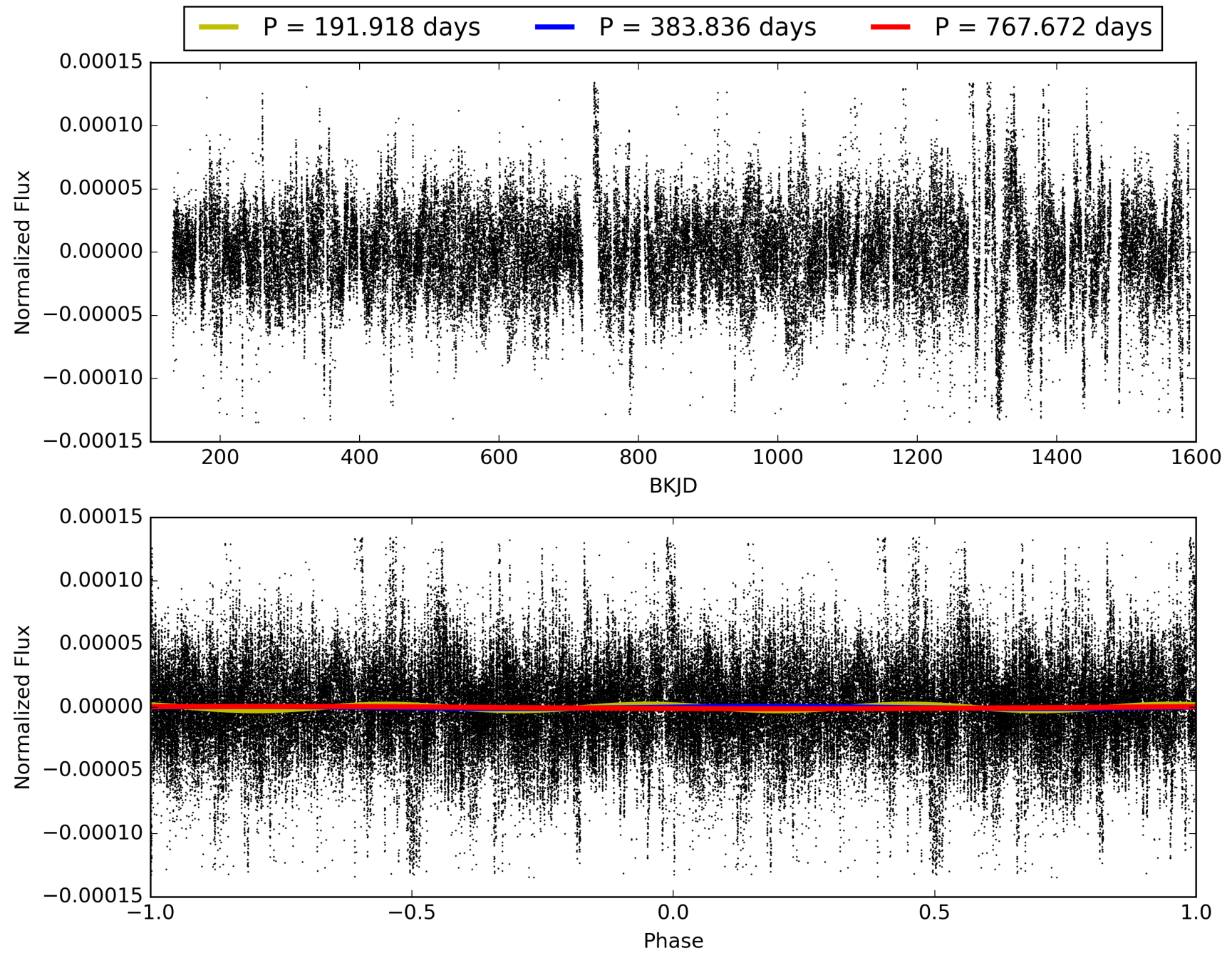
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 009715163-02, PDC Light Curves





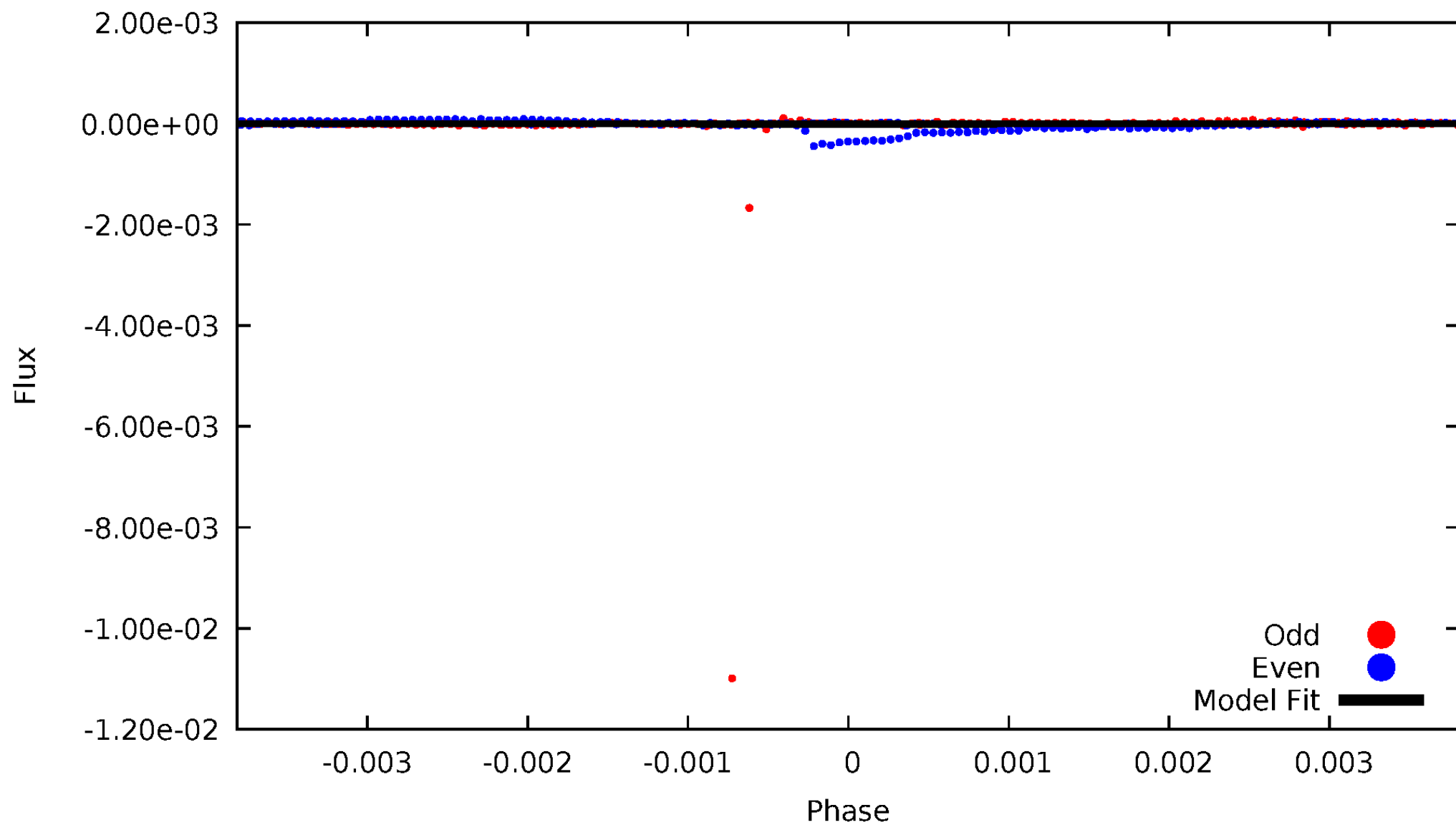
TCE 009715163-02





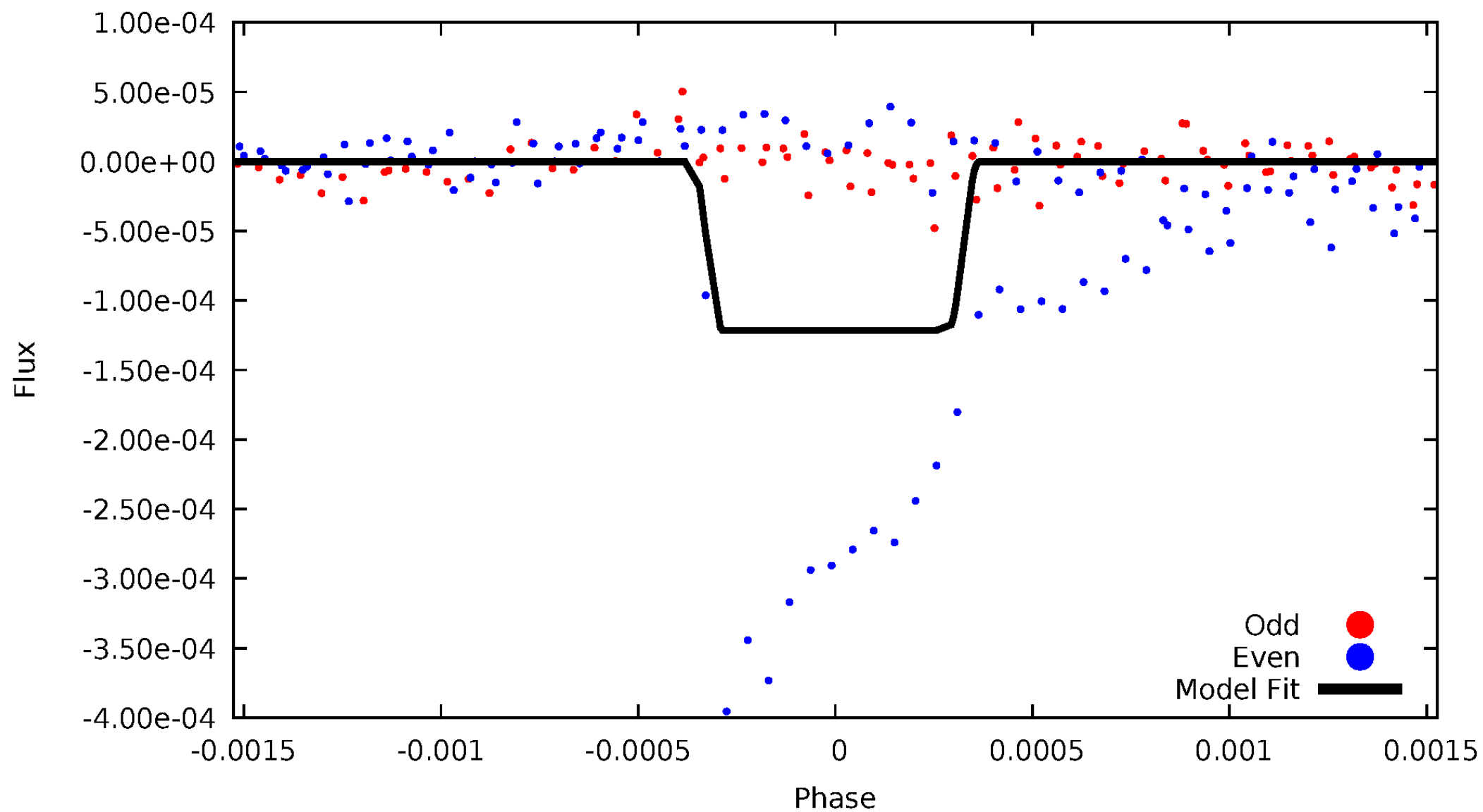
DV Odd/Even

TCE 009715163-02



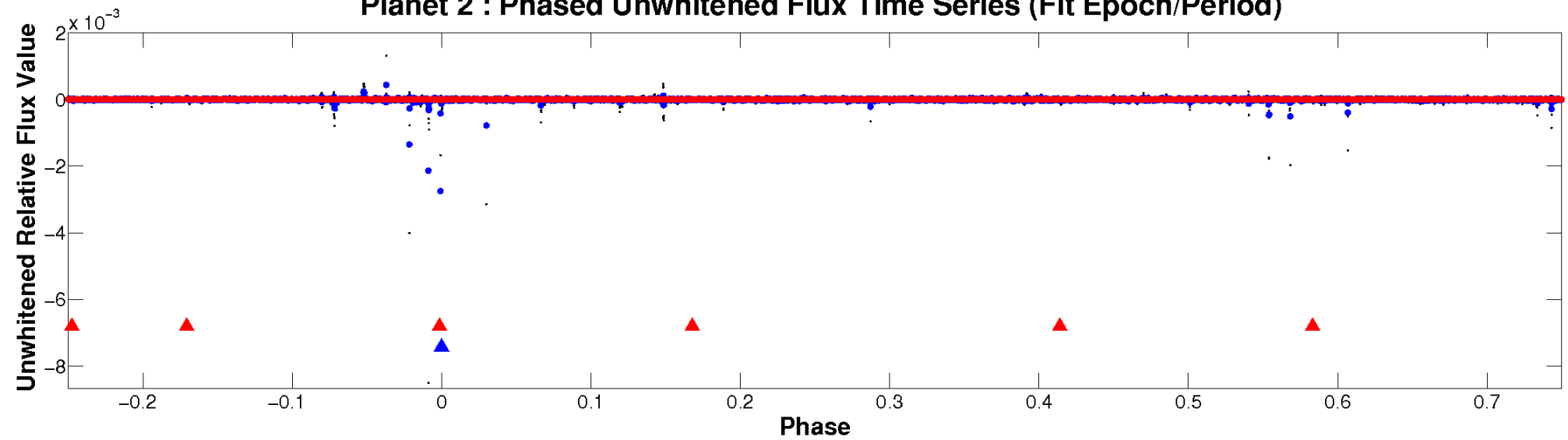
# ALT Odd/Even

TCE 009715163-02

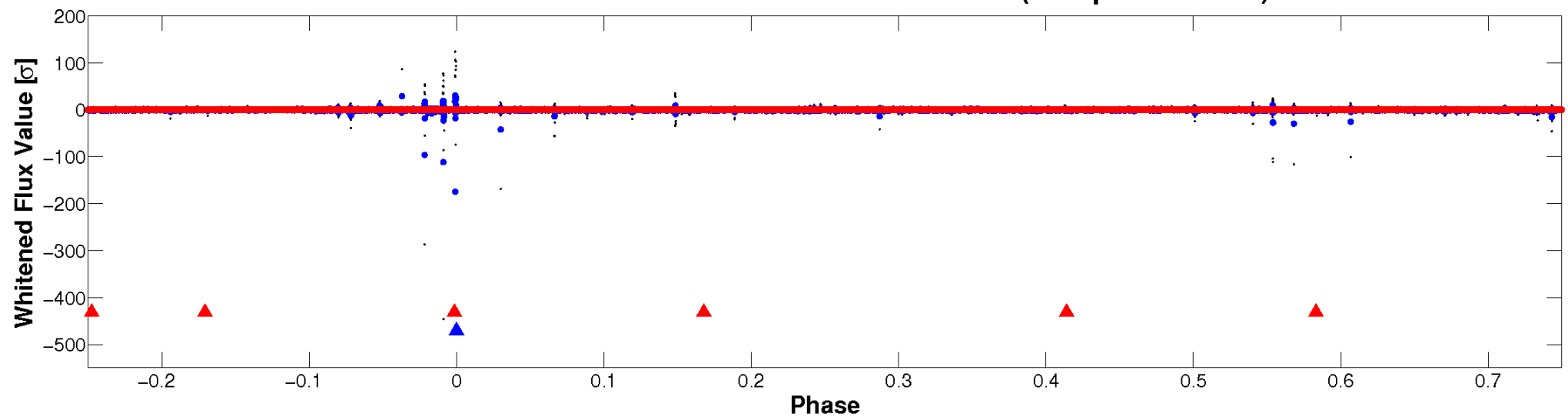


# Non-Whitened Vs. Whitened Light Curve

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

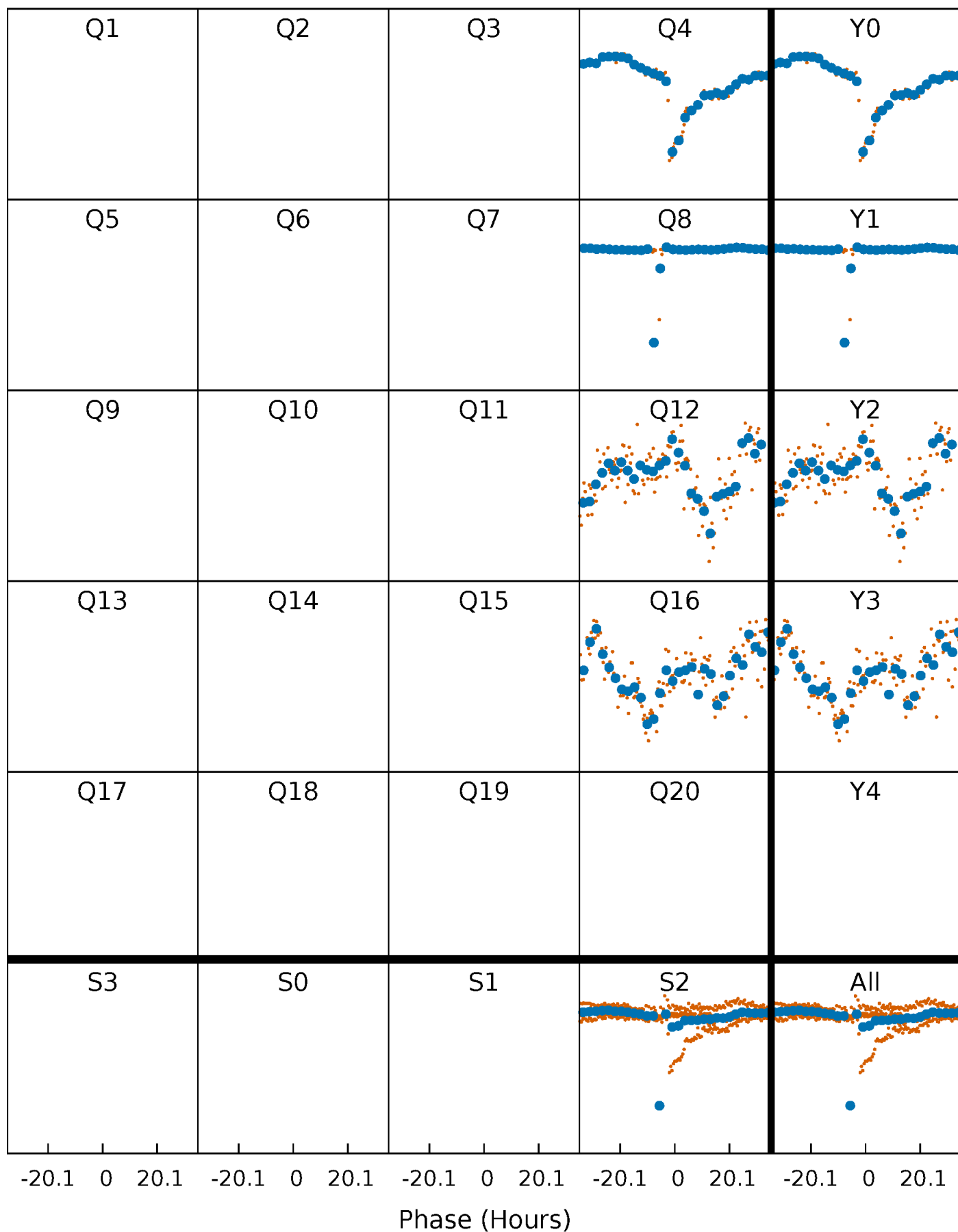


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



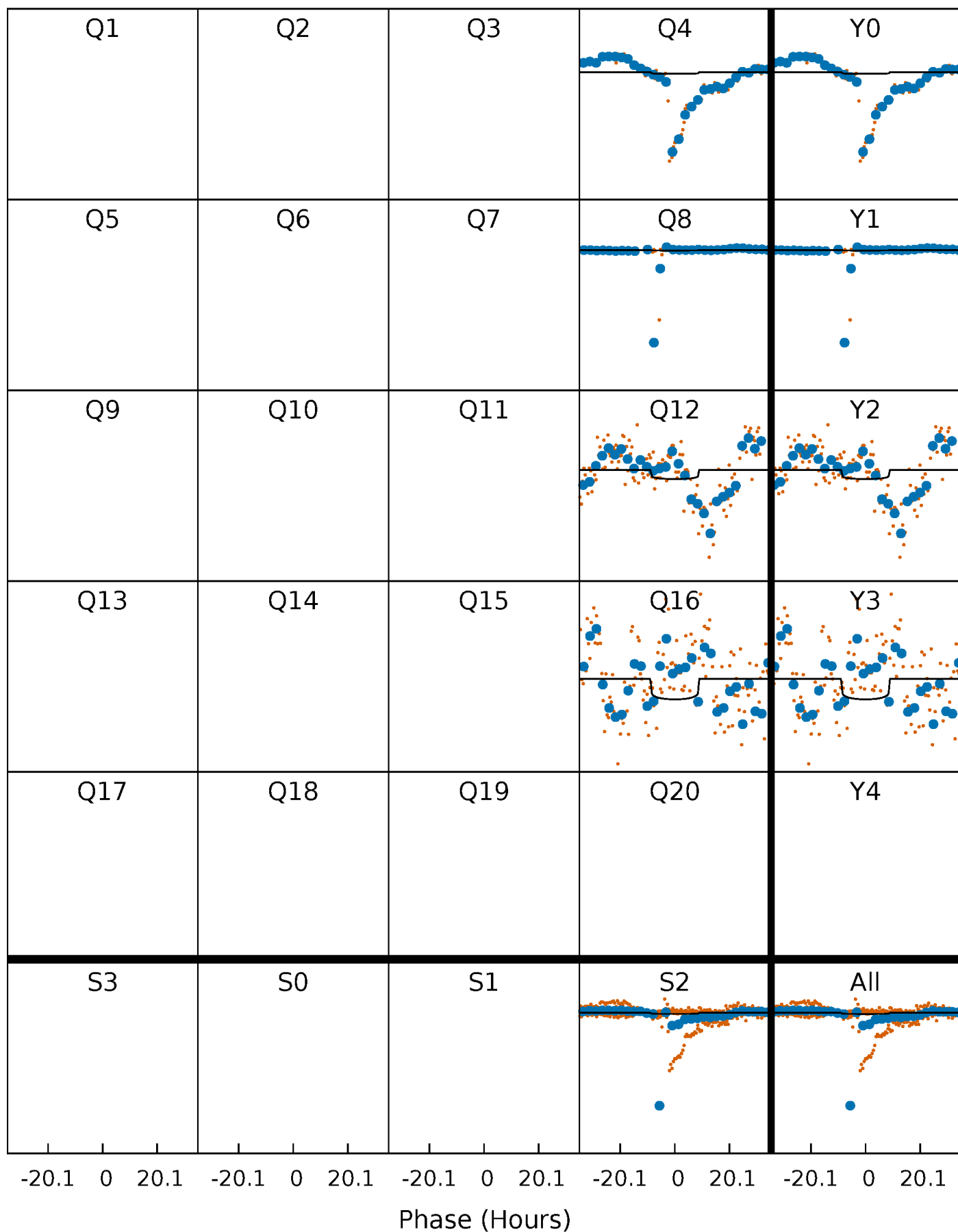
# PDC Quarter-Phased Transit Curves

TCE 009715163-02 P=383.836129 Days  $T_0=356.913940$  (BKJD)



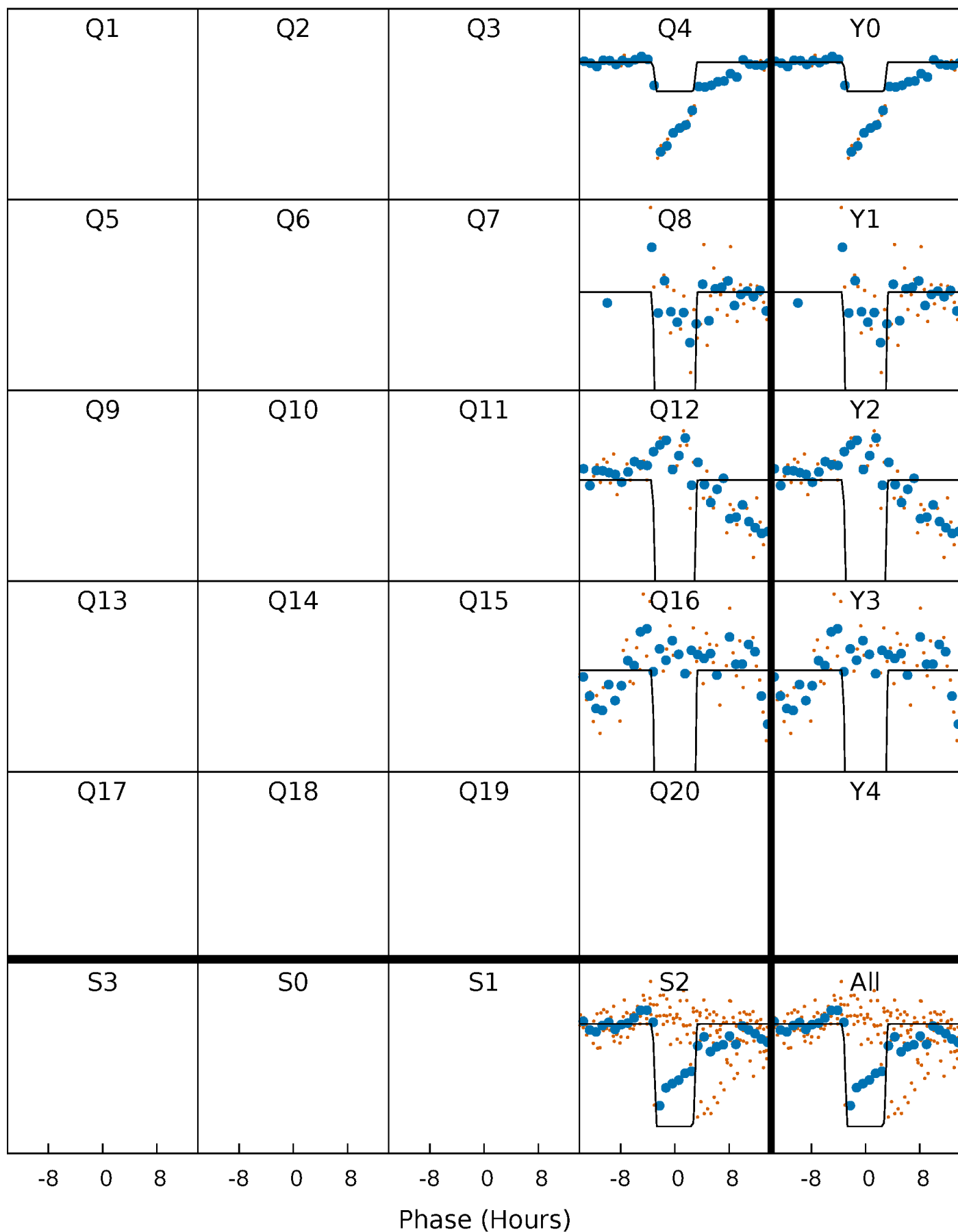
# DV Quarter-Phased Transit Curves

TCE 009715163-02     $P=383.836129$  Days     $T_0=356.913940$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

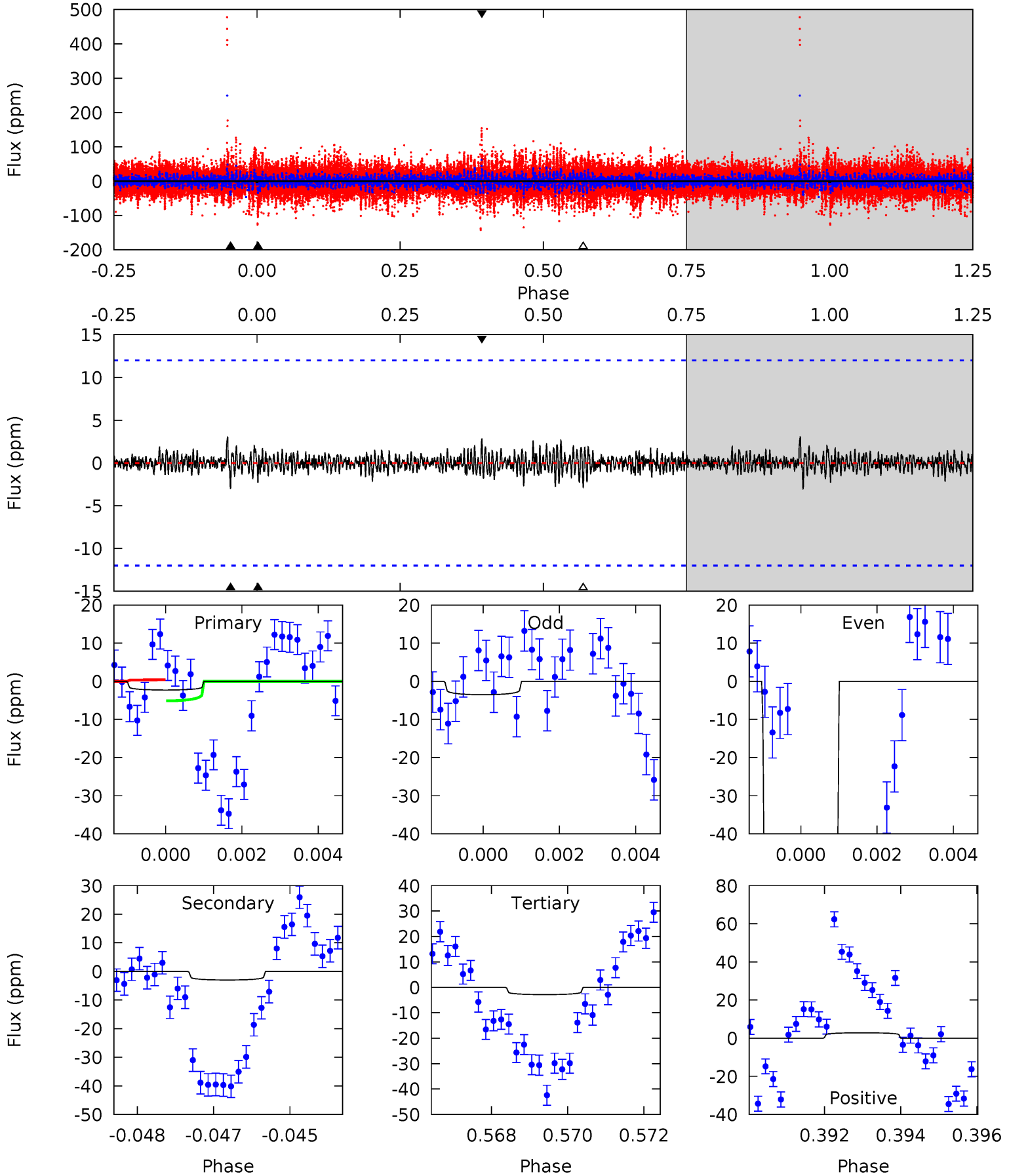
TCE 009715163-02 P=383.846941 Days  $T_0=356.937150$  (BKJD)



# DV Model-Shift Uniqueness Test

009715163-02, P = 383.836129 Days, E = 356.913940 Days

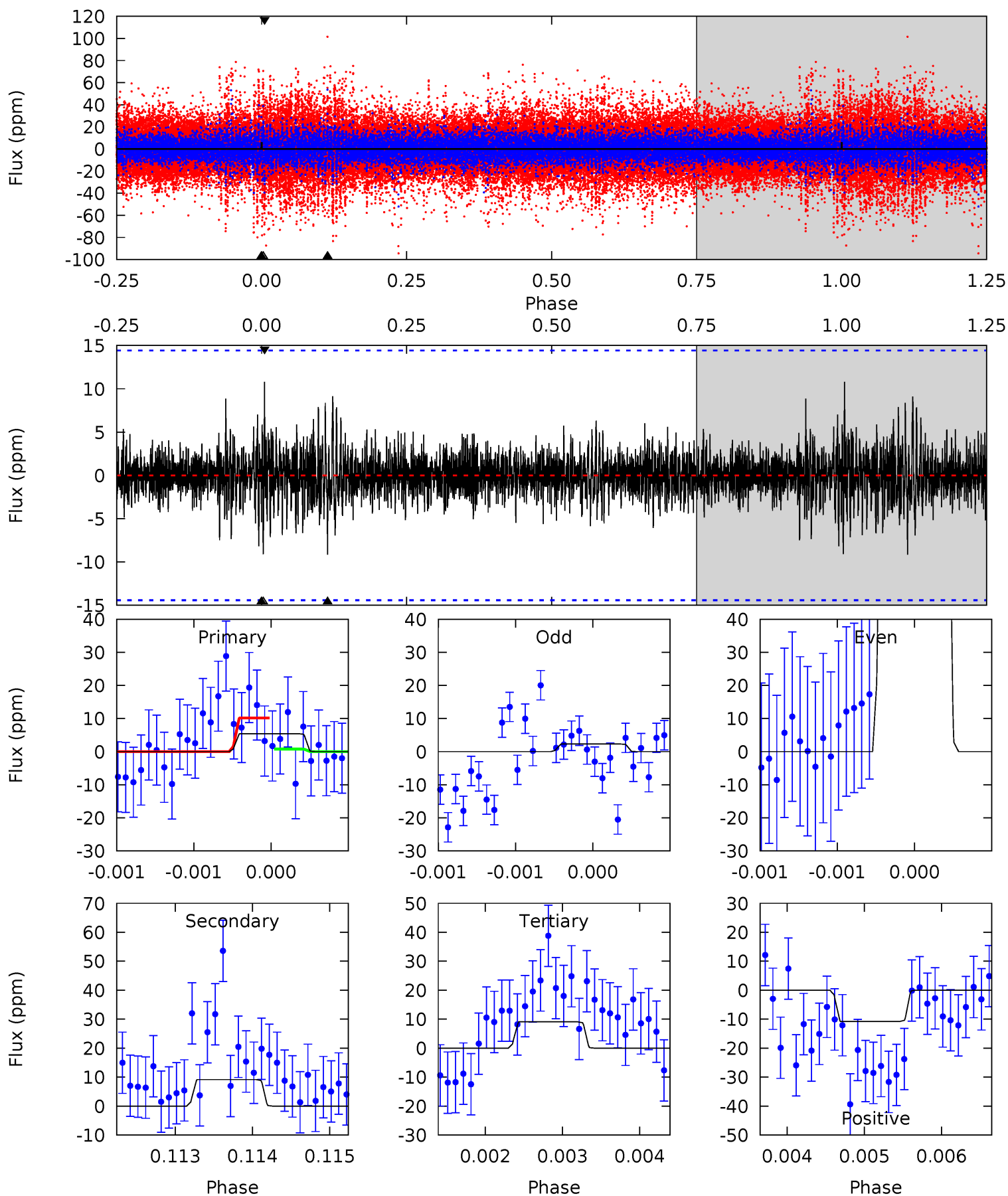
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
1.02	1.34	1.27	1.26	5.33	3.10	0.34	-0.25	-0.24	0.07	0.08	20.8	1.50	0.50	0



# Alt Model-Shift Uniqueness Test

009715163-02, P = 383.846941 Days, E = 356.937150 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	3.49	3.47	4.12	5.51	3.39	0.78	-1.40	-2.05	0.02	-0.63	28.2	25.6	0.54	0





### Stellar Parameters For KIC 009715163

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$10851^{+304}_{-457}$	$4.078^{+0.236}_{-0.193}$	$0.070^{+0.150}_{-0.600}$	$2.523^{+0.797}_{-0.797}$	$2.781^{+0.289}_{-0.626}$	$0.244^{+0.374}_{-0.132}$
	+3%/-4%	+6%/-5%	+214%/-857%	+32%/-32%	+10%/-23%	+153%/-54%
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 009715163-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-3 \pm 2$	$7.04^{+8.02}_{-5.06}$	$872^{+81}_{-75}$	$3014^{+1557}_{-696}$	$55^{+667}_{-48}$
Alt.	$-9 \pm 3$	$7.90^{+8.82}_{-5.45}$	$876^{+74}_{-76}$	$3501^{+2088}_{-654}$	$152^{+1528}_{-117}$

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

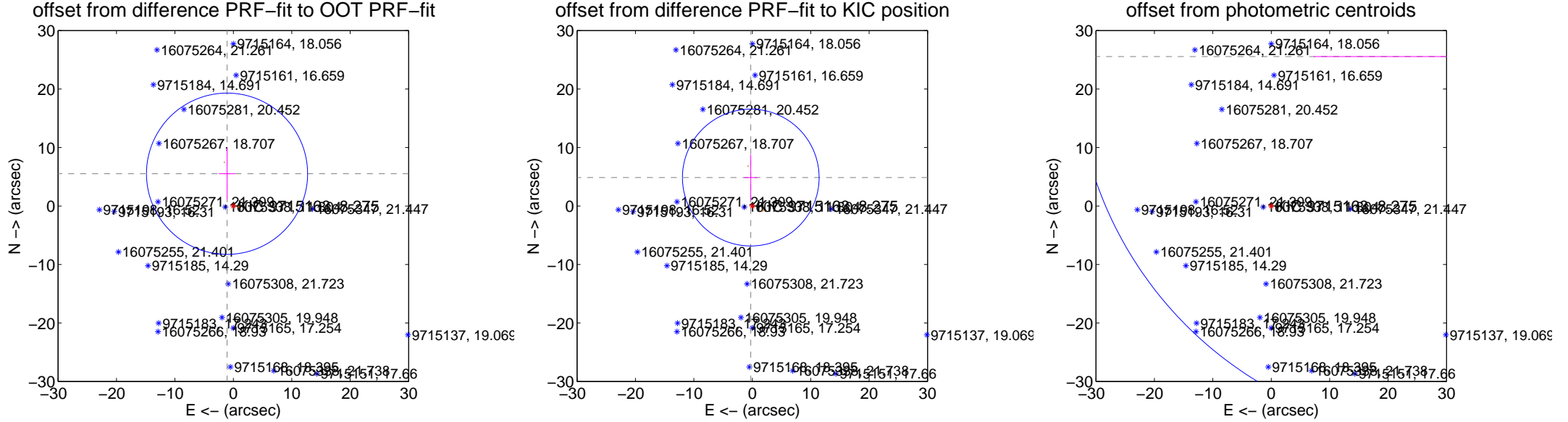
# DV Centroid Data

Supplemental centroid analysis for 009715163-02. **Kepler magnitude: 8.28.** Transit SNR 1.54

**There are 0 quarters with good PRF difference image offsets**

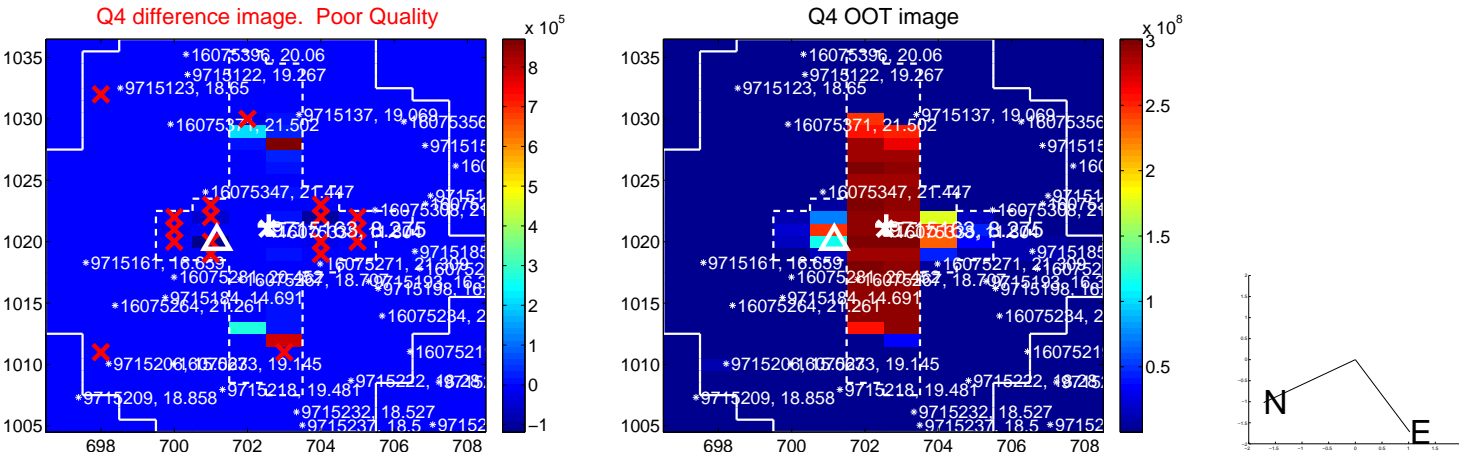
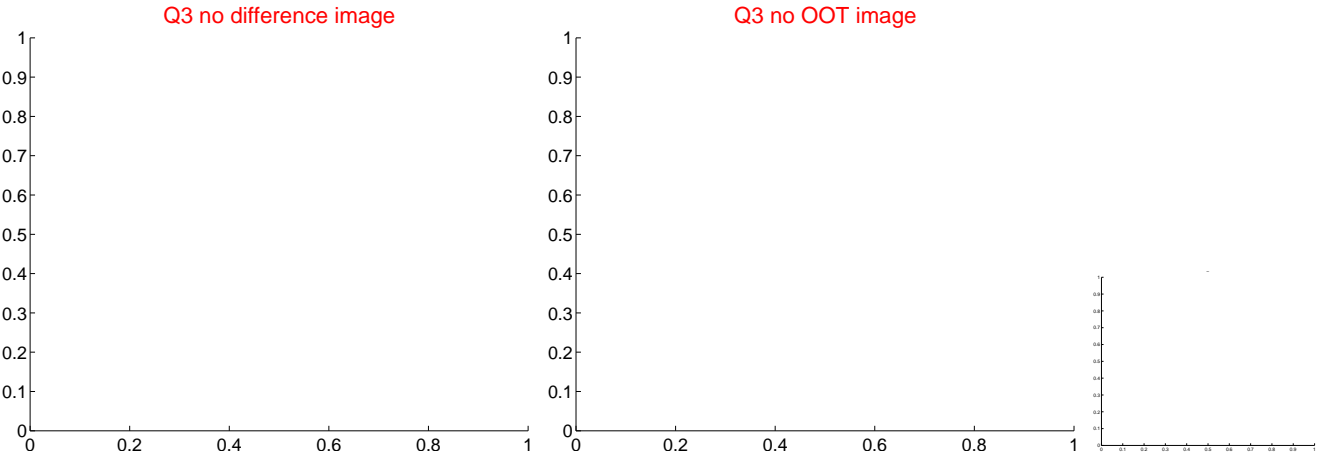
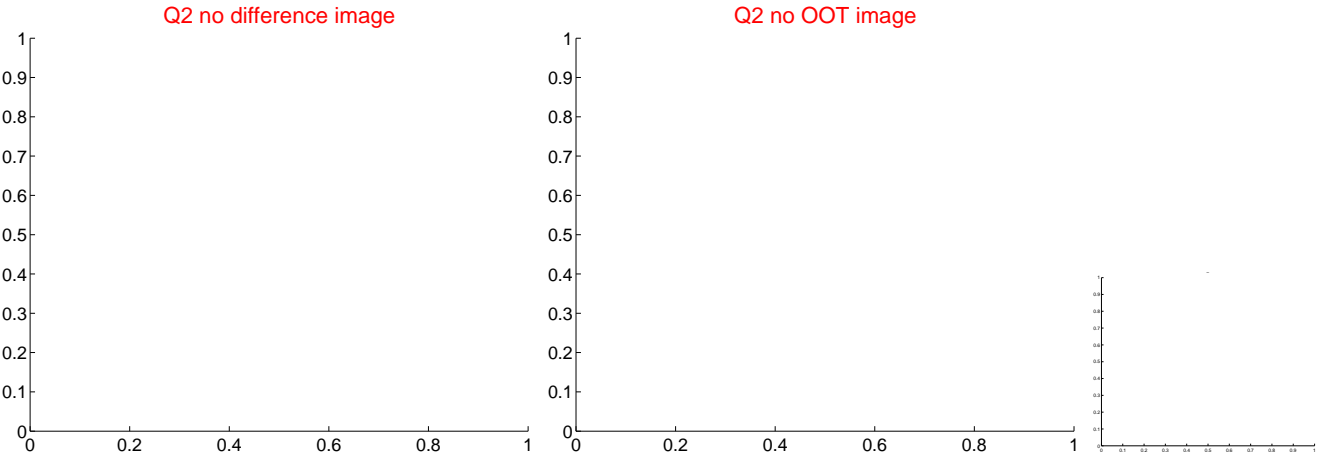
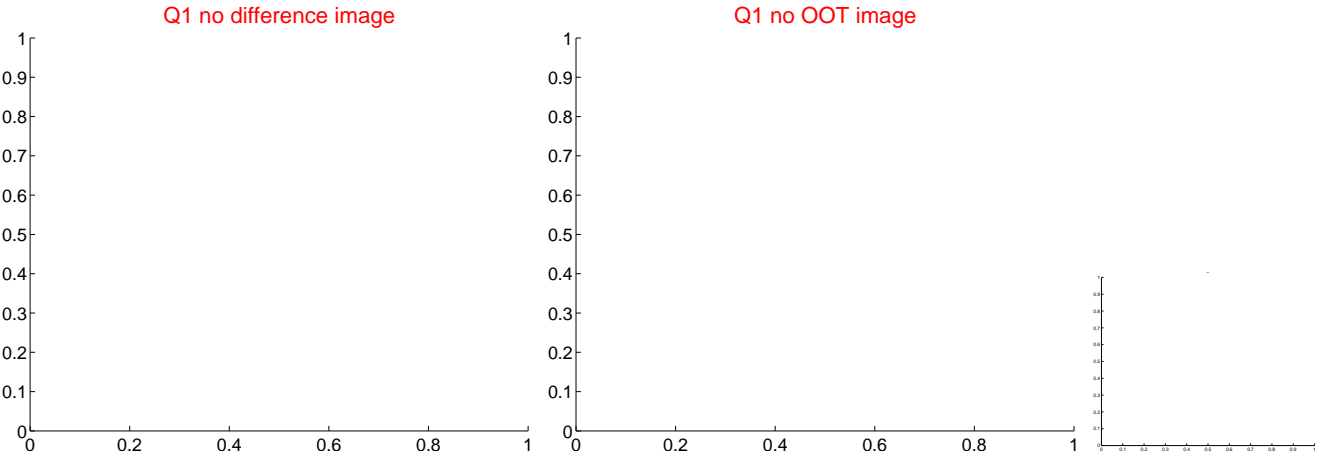
The direct PRF centroid is offset from the target star catalog position by about 1.07 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$5.620 \pm 4.596$	1.22	$1.079 \pm 1.424$	$5.515 \pm 4.404$
PRF-fit source offset from KIC position	$4.869 \pm 3.898$	1.25	$0.261 \pm 1.135$	$4.862 \pm 3.904$
photometric centroid source offset	$40.49 \pm 21.67$	1.87	$-31.42 \pm 24.16$	$25.55 \pm 17.24$



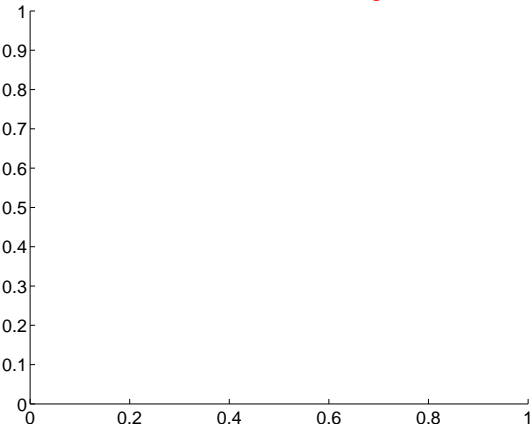
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

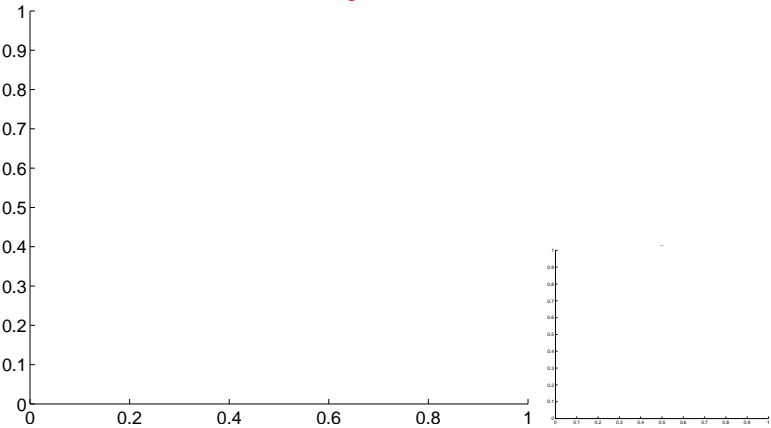


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

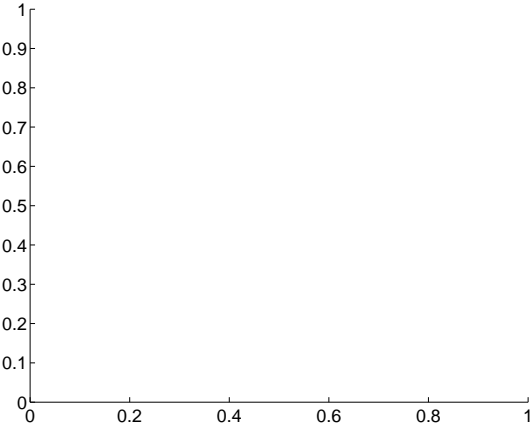
Q5 no difference image



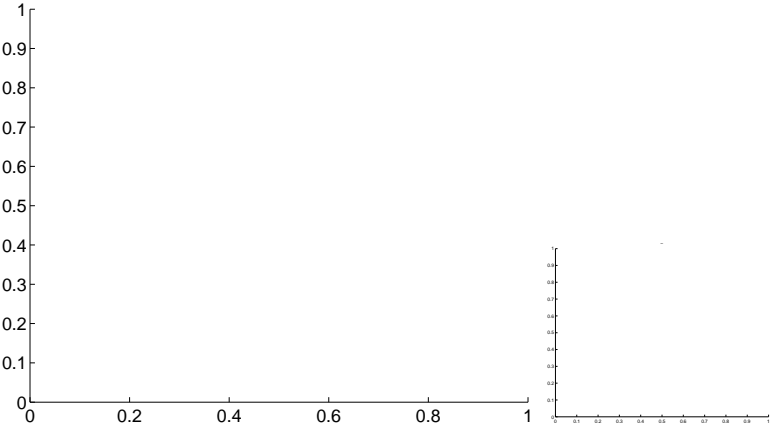
Q5 no OOT image



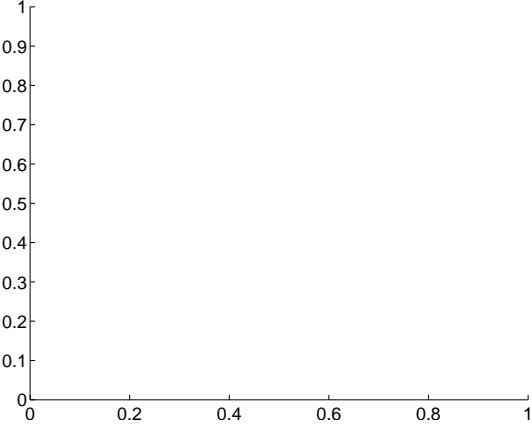
Q6 no difference image



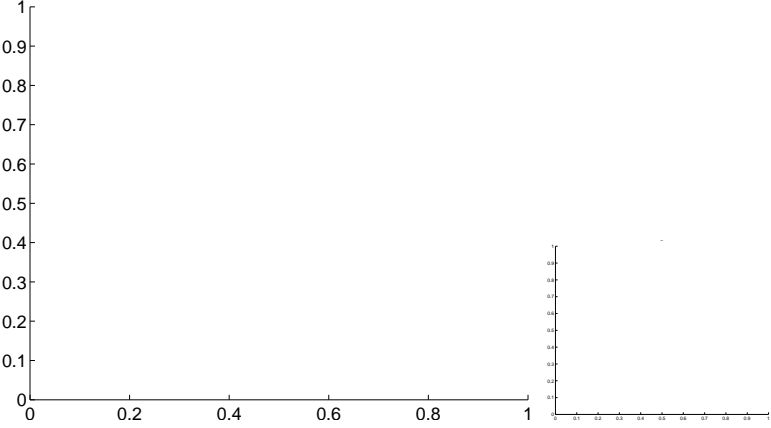
Q6 no OOT image



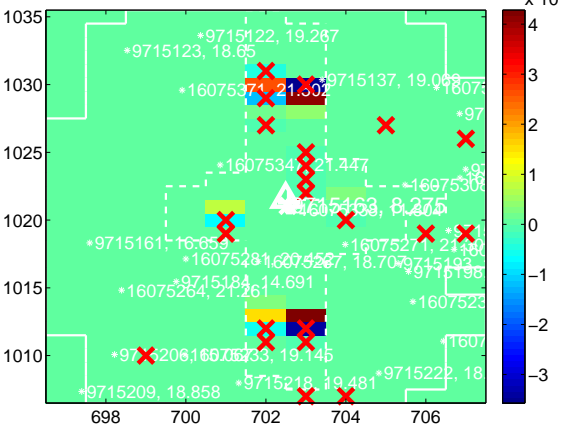
Q7 no difference image



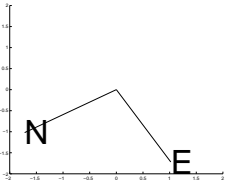
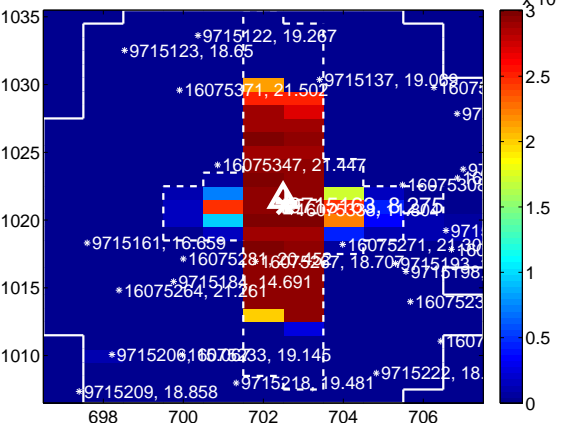
Q7 no OOT image



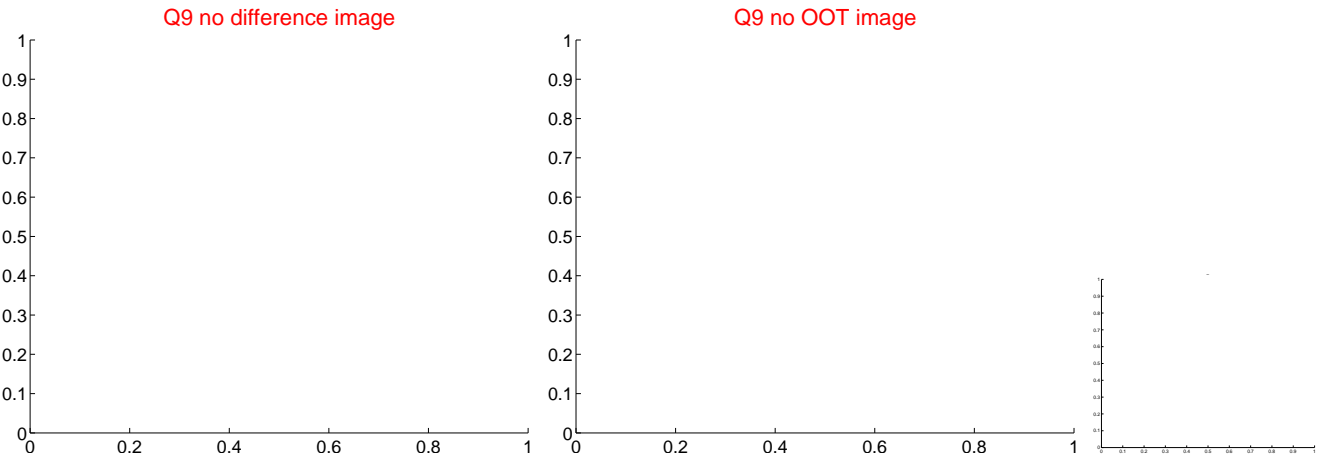
Q8 difference image. Poor Quality



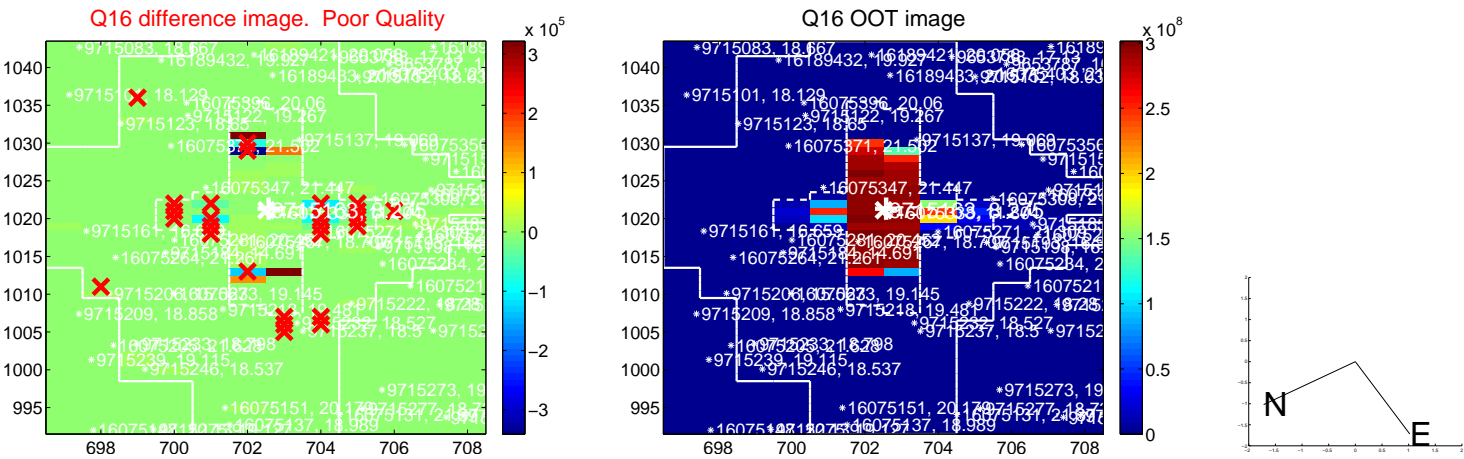
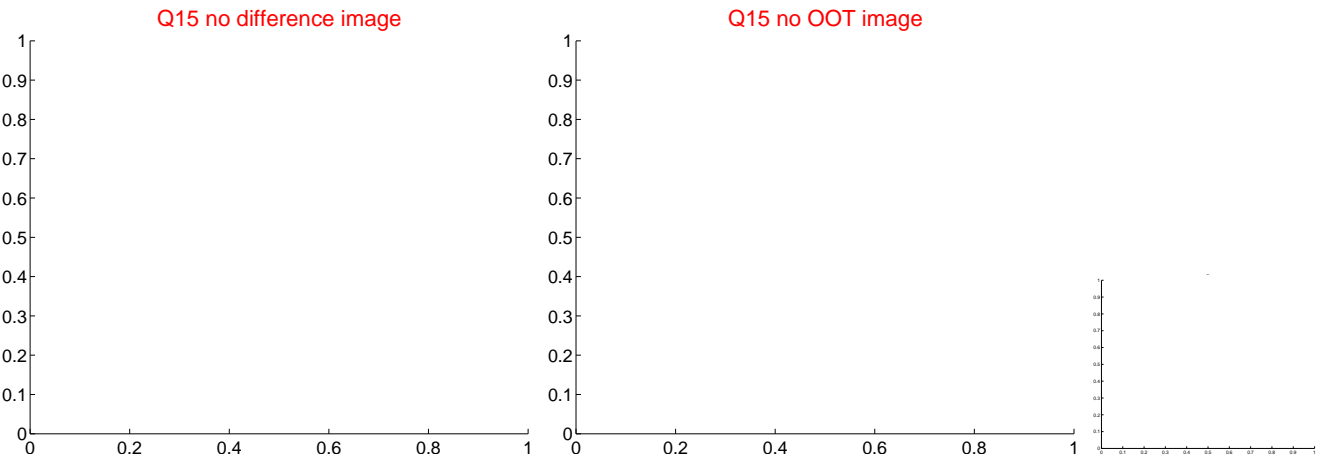
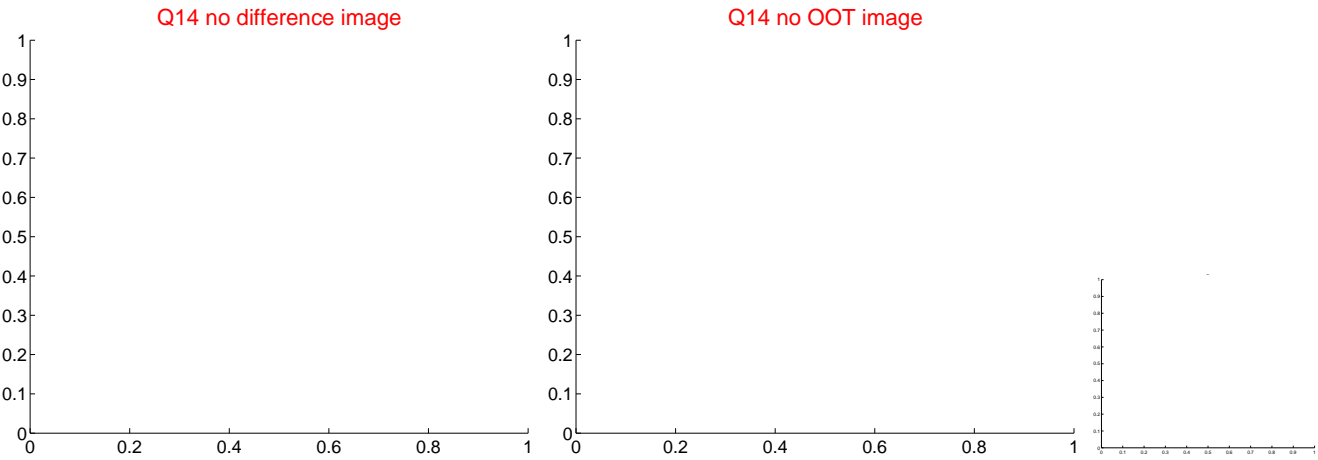
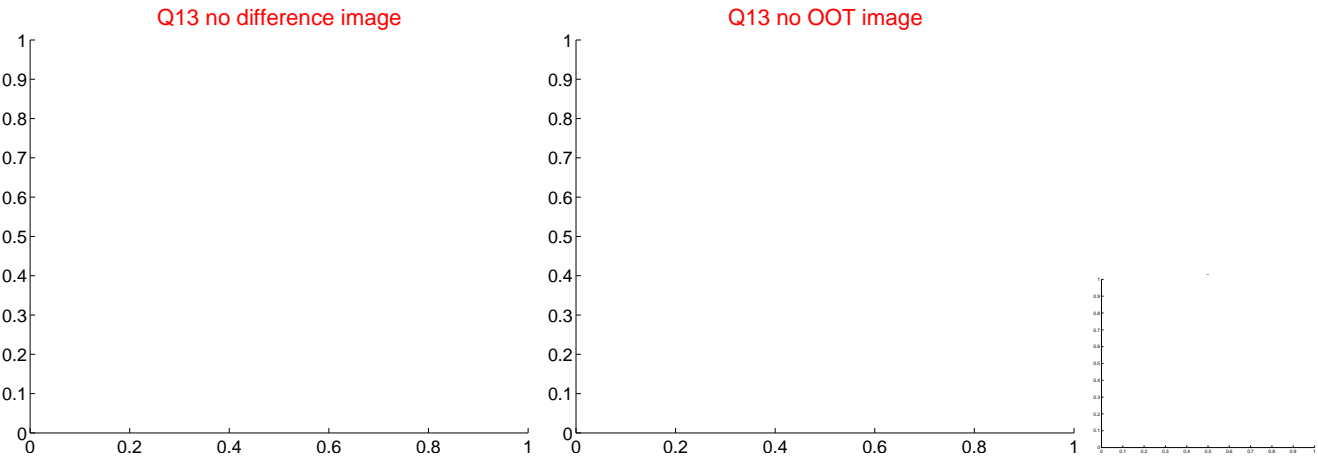
Q8 OOT image



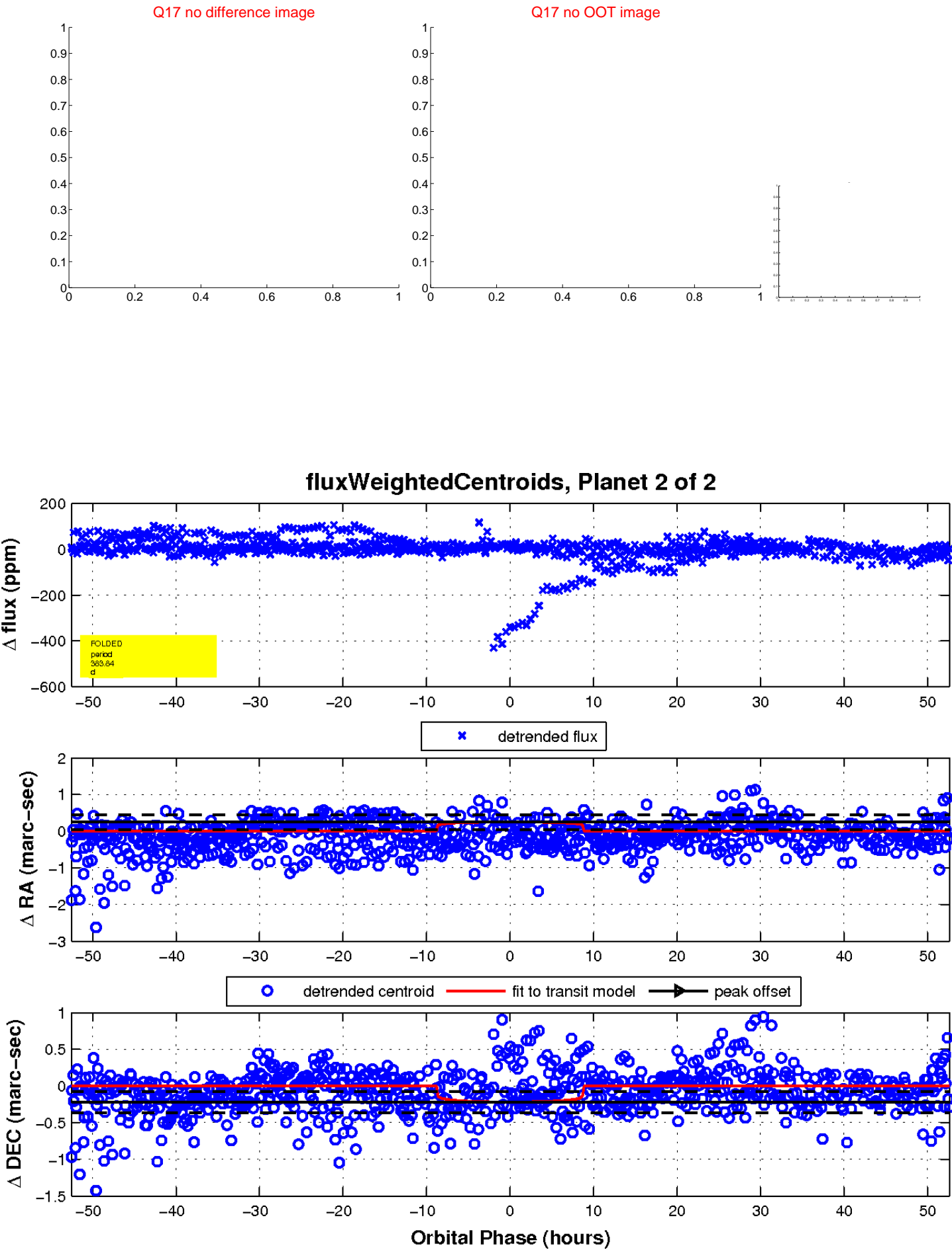
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

