

# KIC 006104631

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
006104631-01	OBS	No	377.093279	331.828452	2307.1	5.803	12.0	4.6	0.55	4751	2.60	0.20
006104631-02	OBS	No	398.599912	212.059703	2651.4	3.126	12.2	6.2	0.55	4751	2.87	0.18

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
006104631-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_SKYE—LPP_DV—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
006104631-02	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—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.

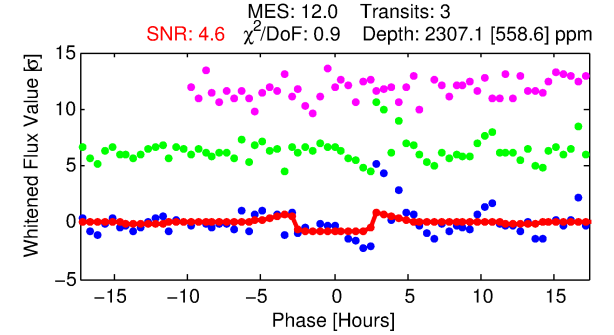
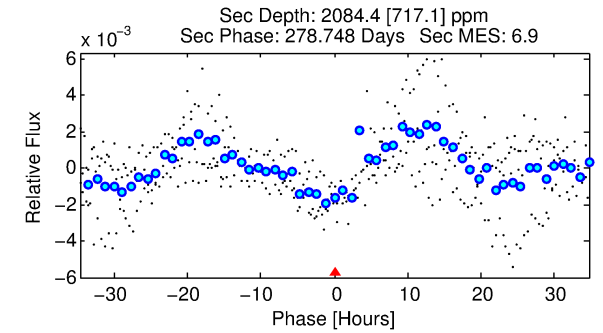
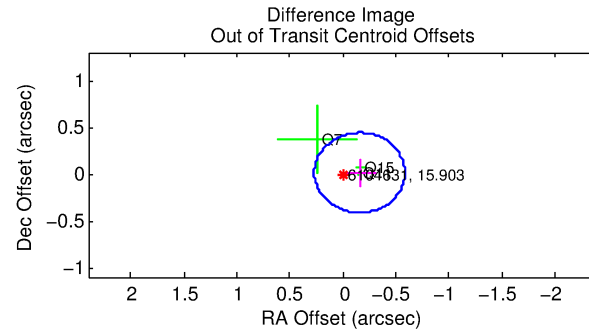
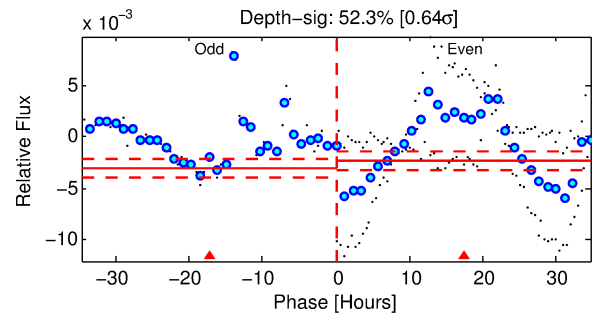
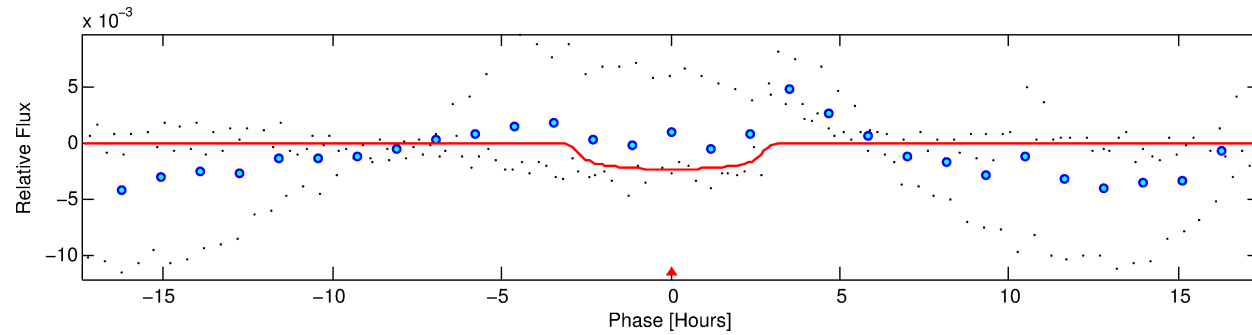
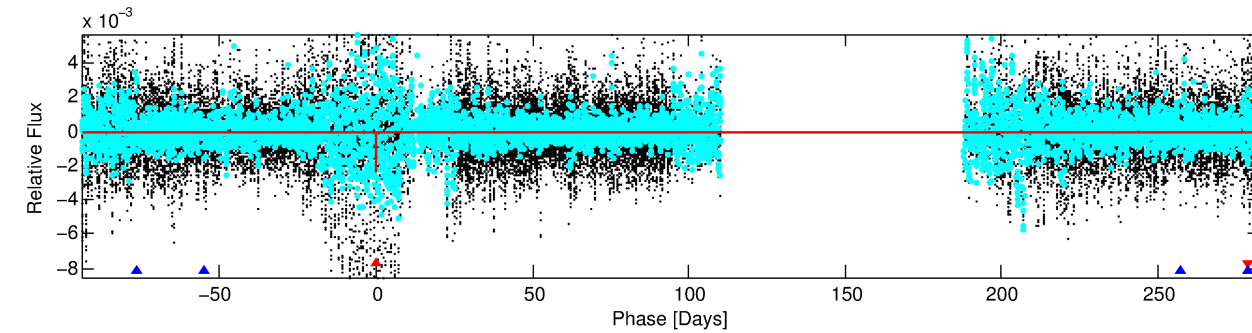
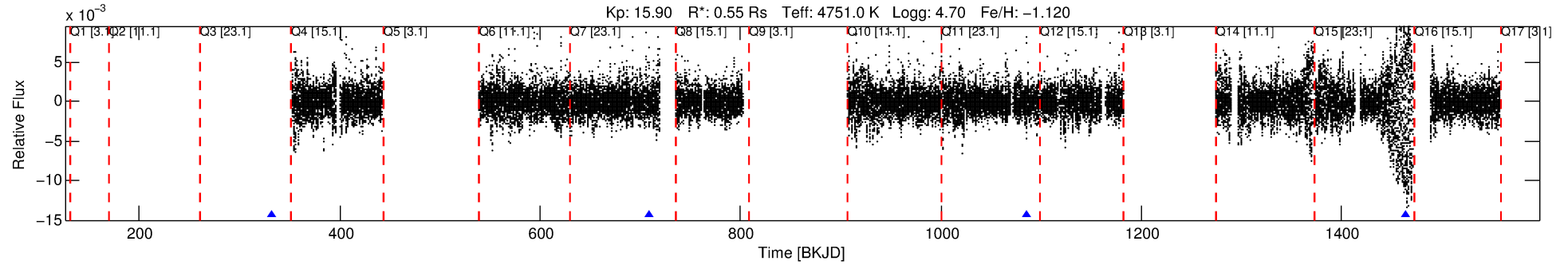
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 006104631-01

No Significant Match Found

# DV One-Page Summary

KIC: 6104631 Candidate: 1 of 2 Period: 377.093 d



## DV Fit Results:

Period = 377.09328 [0.00907] d  
Epoch = 331.8285 [0.0184] BKJD  
Rp/R\* = 0.0431 [0.0588]  
a/R\* = 515.34 [2644.33]  
b = 0.10 [50.32]  
Seff = 0.20 [0.04]  
Teq = 170 [8] K  
Rp = 2.60 [3.56] Re  
a = 0.8401 [0.0511] AU  
Ag = 119335.38 [328295.75] [0.36 $\sigma$ ]  
Teffp = 4891 [3367] K [1.40 $\sigma$ ]

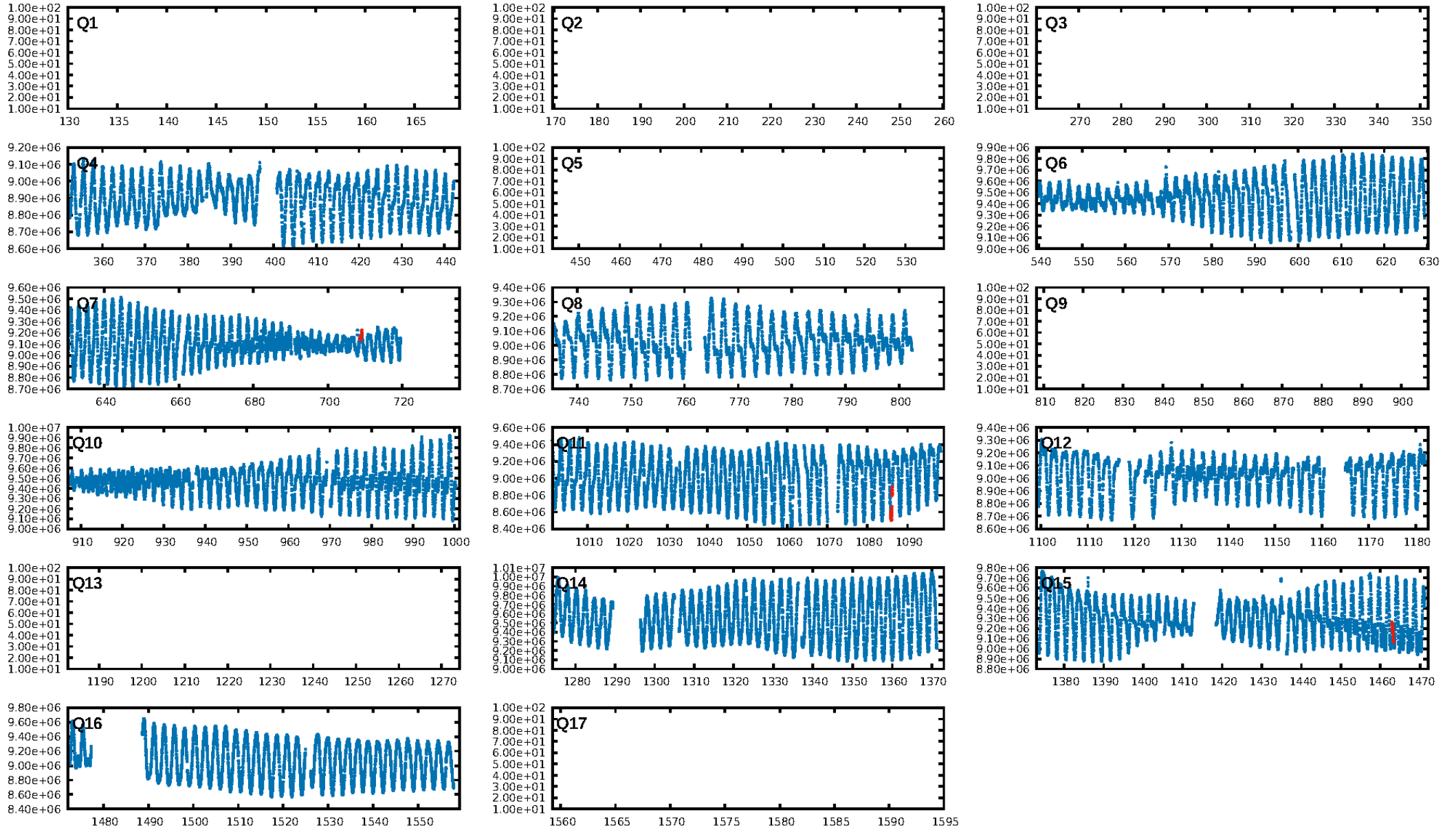
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [78.31 $\sigma$ ]  
ModelChiSquare2-sig: 28.7%  
ModelChiSquareGof-sig: 96.9%  
**Bootstrap-pfa: 1.48e-11**  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: -1.263  
Centroid-sig: 72.1%  
Centroid-so: 0.979 arcsec [0.38 $\sigma$ ]  
OotOffset-rm: 0.159 arcsec [1.12 $\sigma$ ]  
OotOffset-st: 0/3/0/0 [3]  
KicOffset-rm: 0.219 arcsec [1.59 $\sigma$ ]  
KicOffset-st: 0/3/0/0 [3]  
DiffImageQuality-fgm: 0.67 [2/3]  
DiffImageOverlap-fno: 1.00 [3/3]

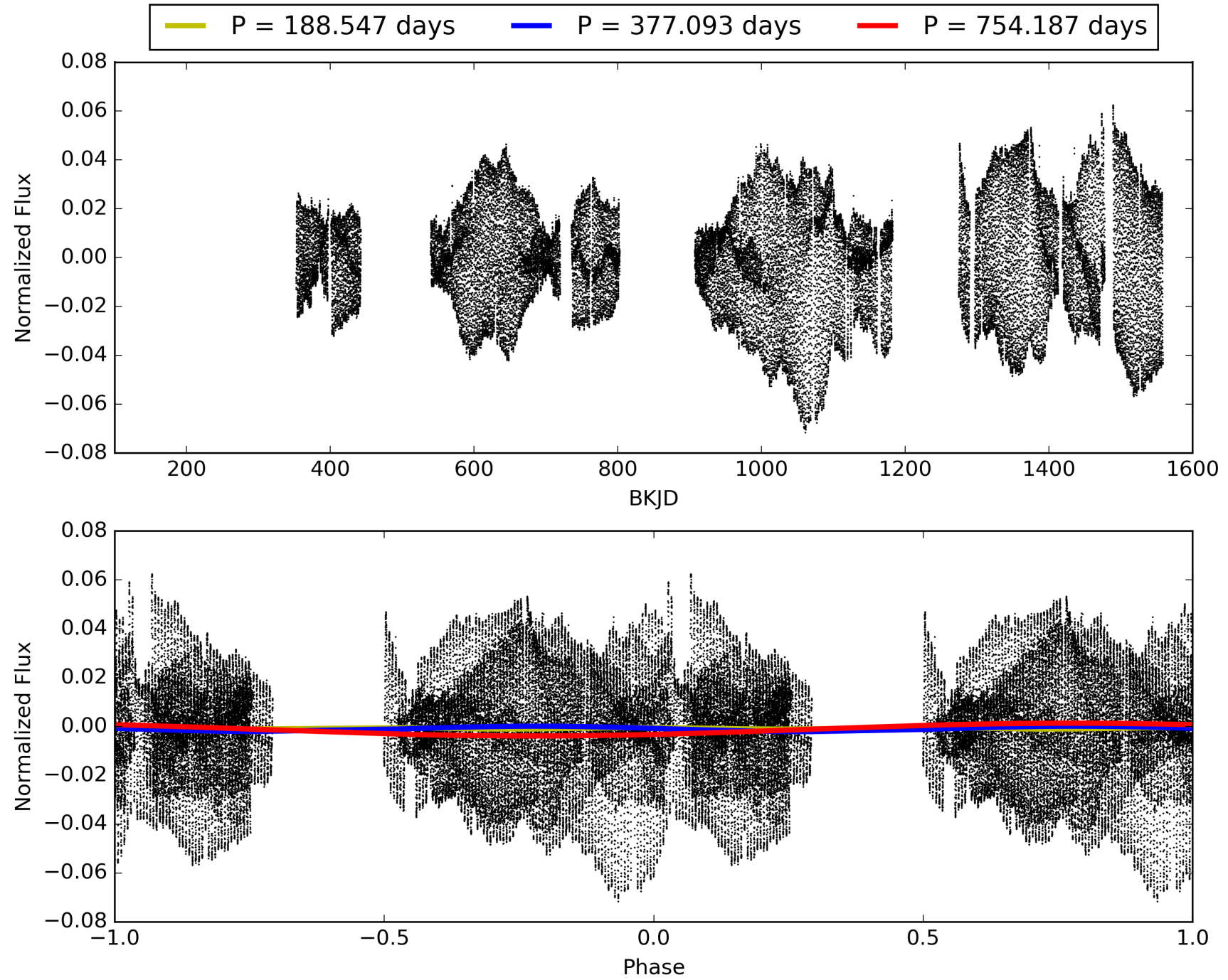
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 04:34:23 Z

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

# TCE 006104631-01, PDC Light Curves

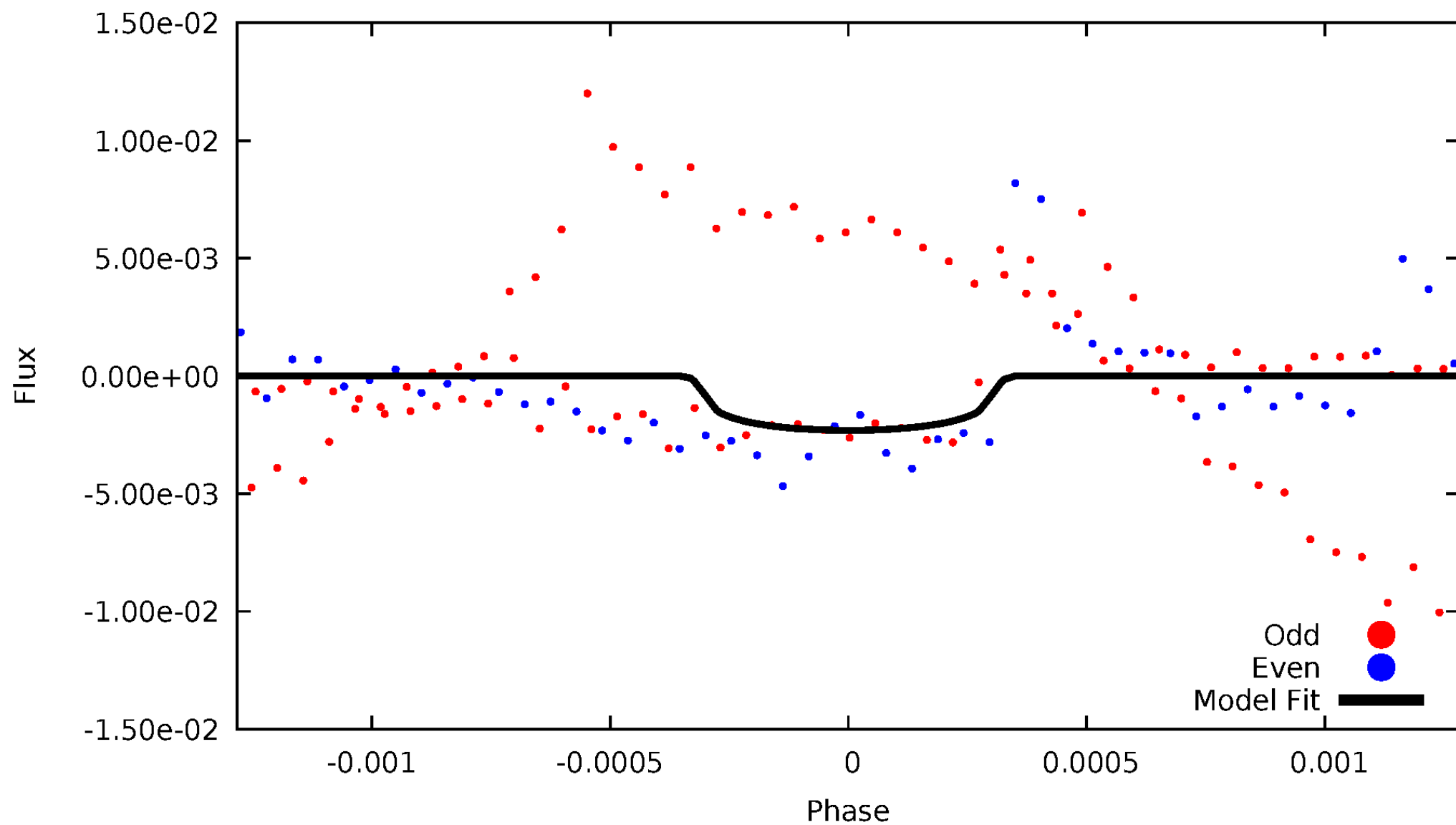


TCE 006104631-01



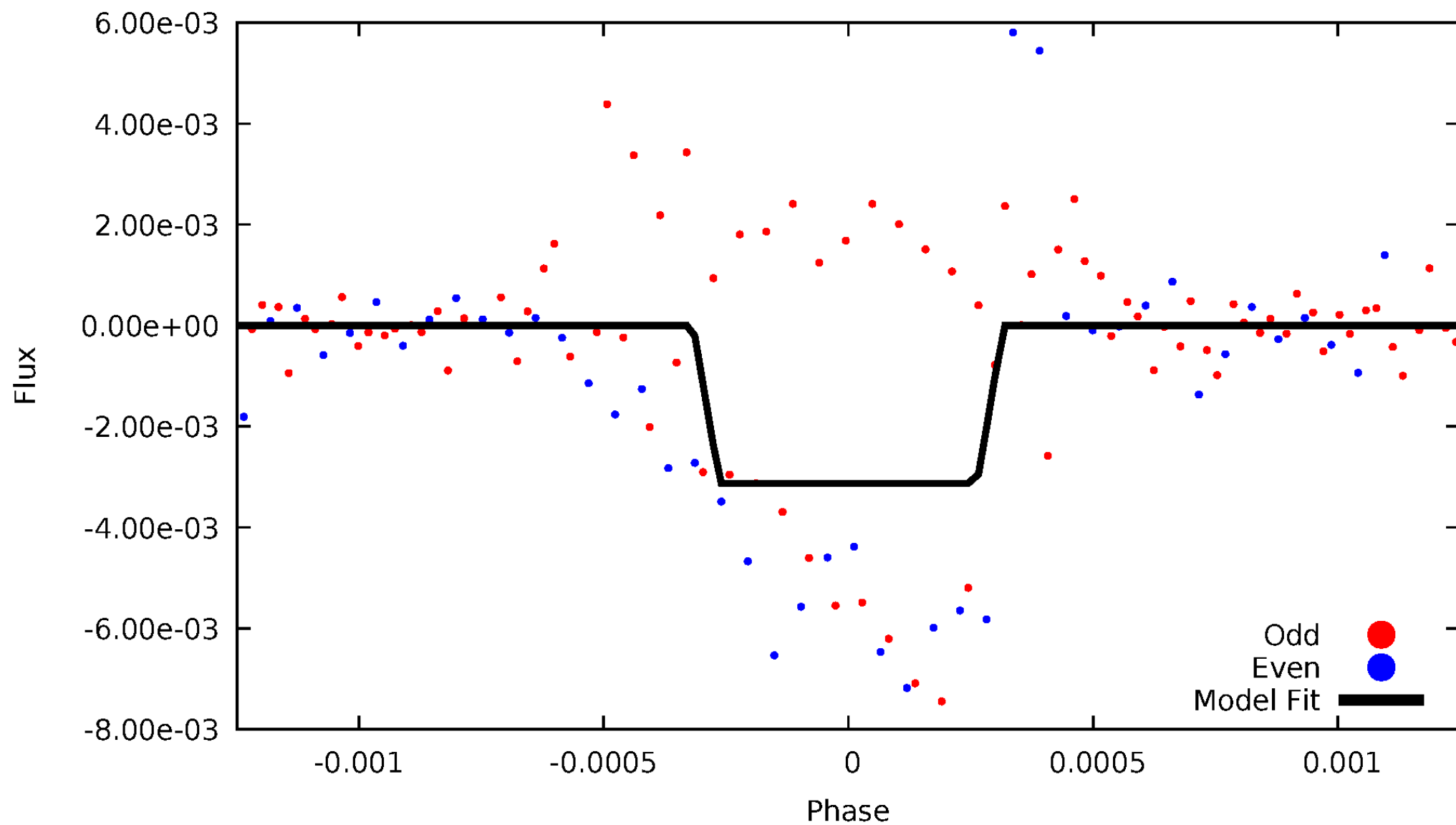
# DV Odd/Even

TCE 006104631-01



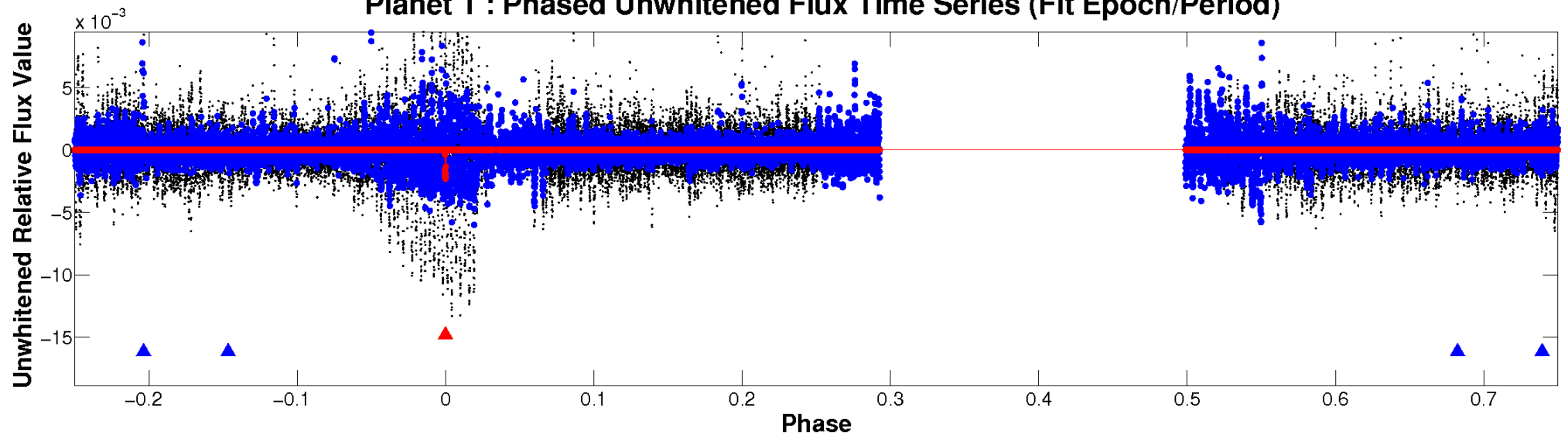
# ALT Odd/Even

TCE 006104631-01

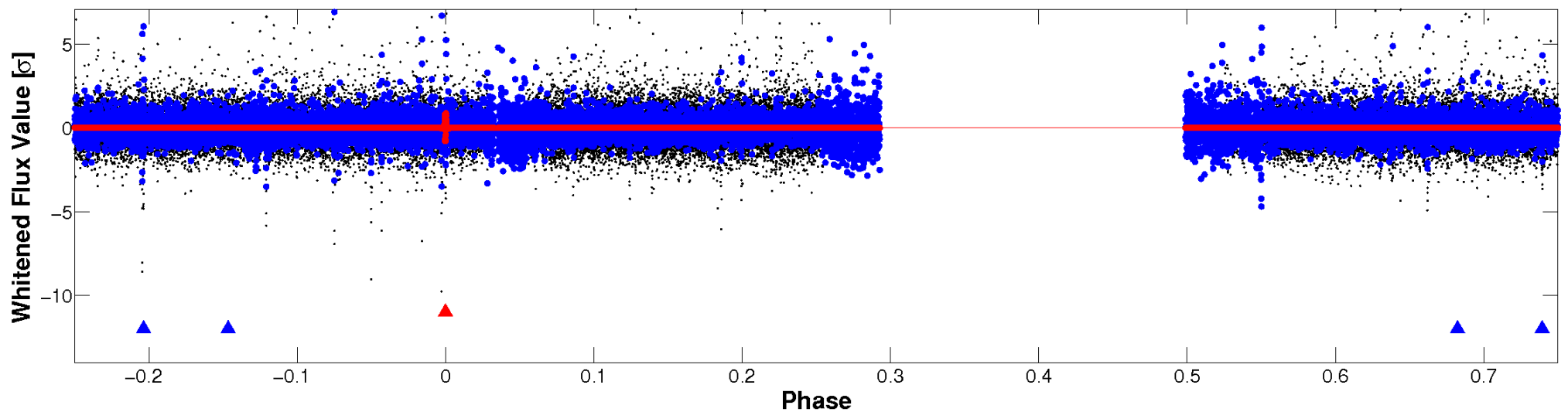


# Non-Whitened Vs. Whitened Light Curve

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

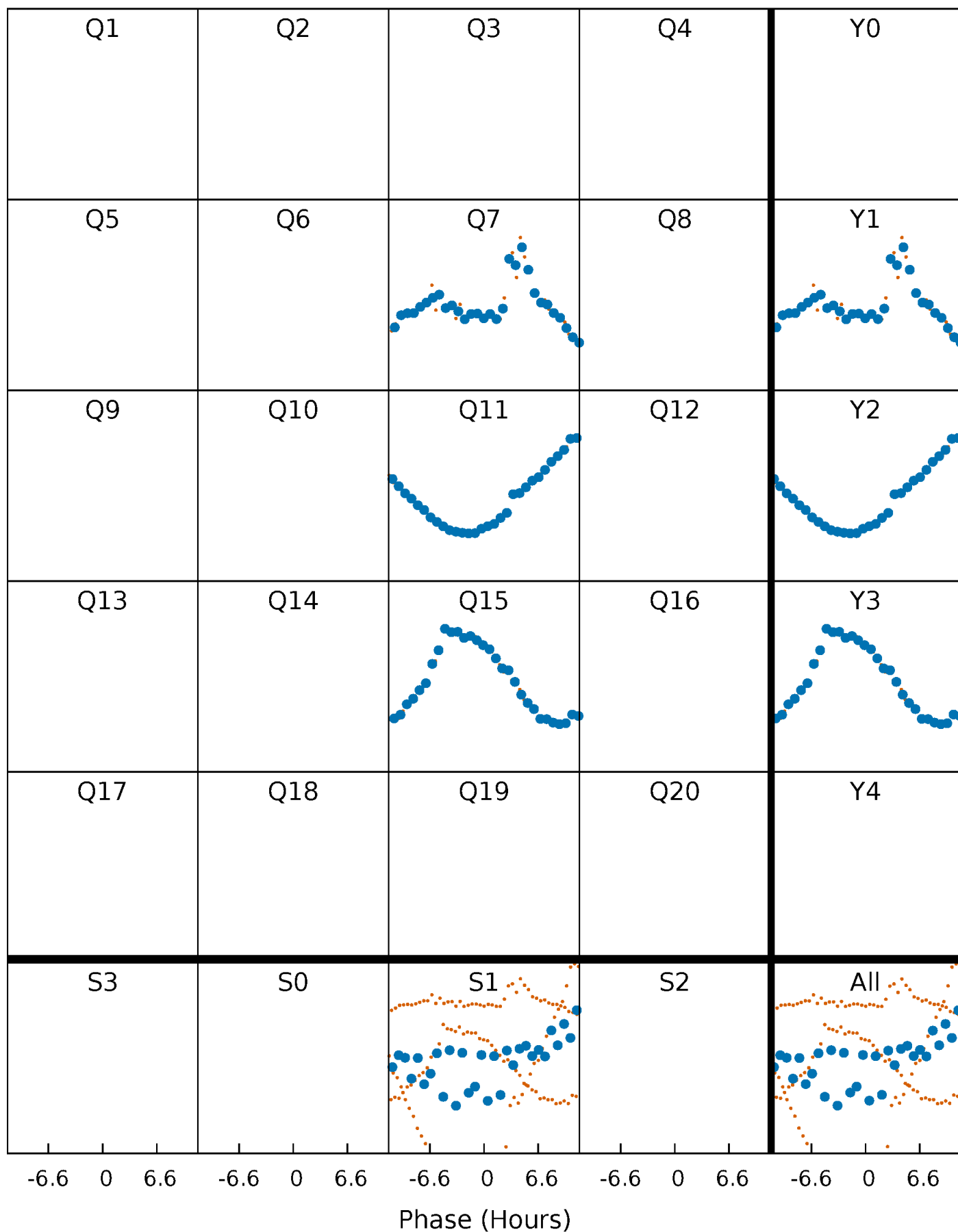


Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

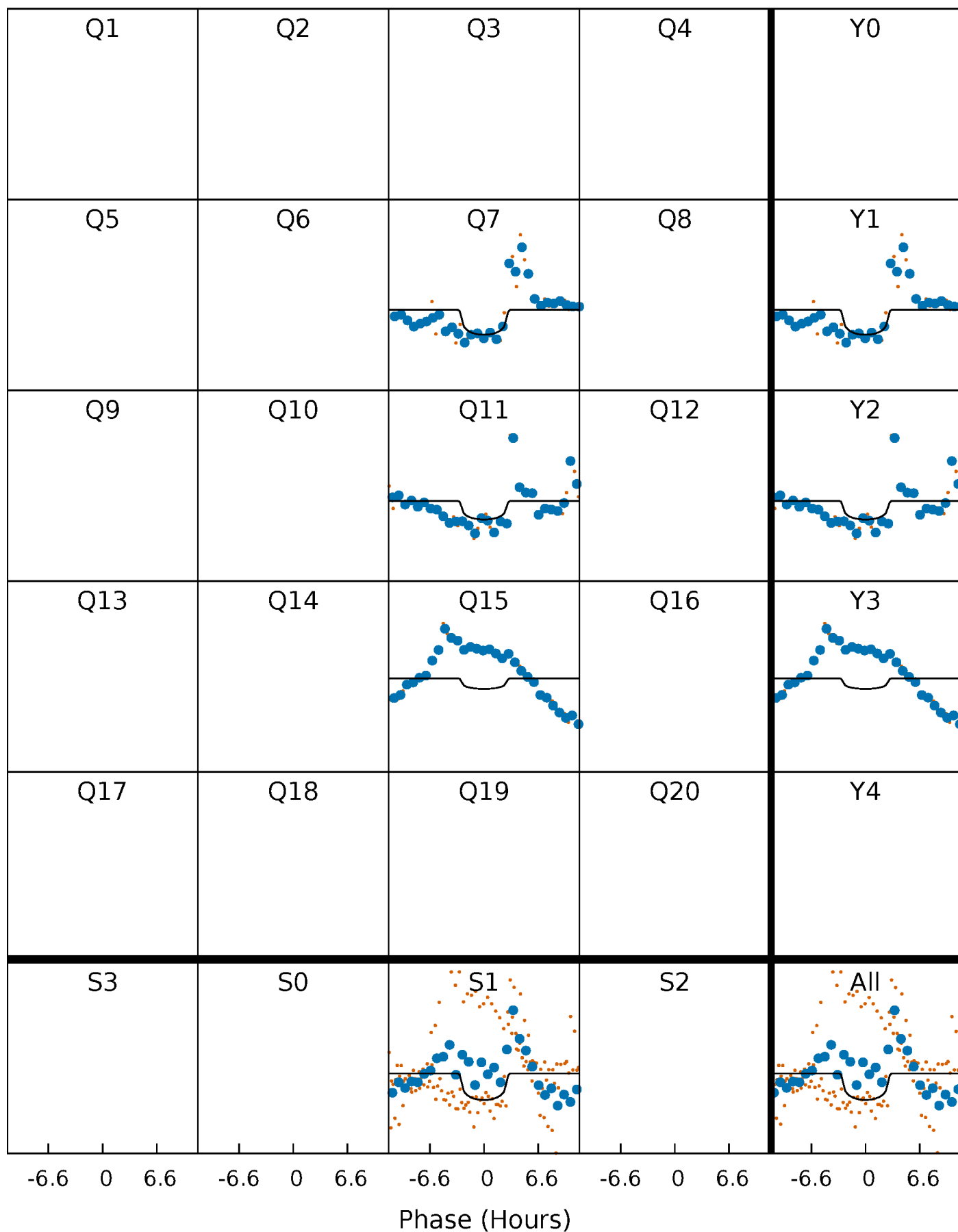
TCE 006104631-01 P=377.093279 Days  $T_0=331.828452$  (BKJD)





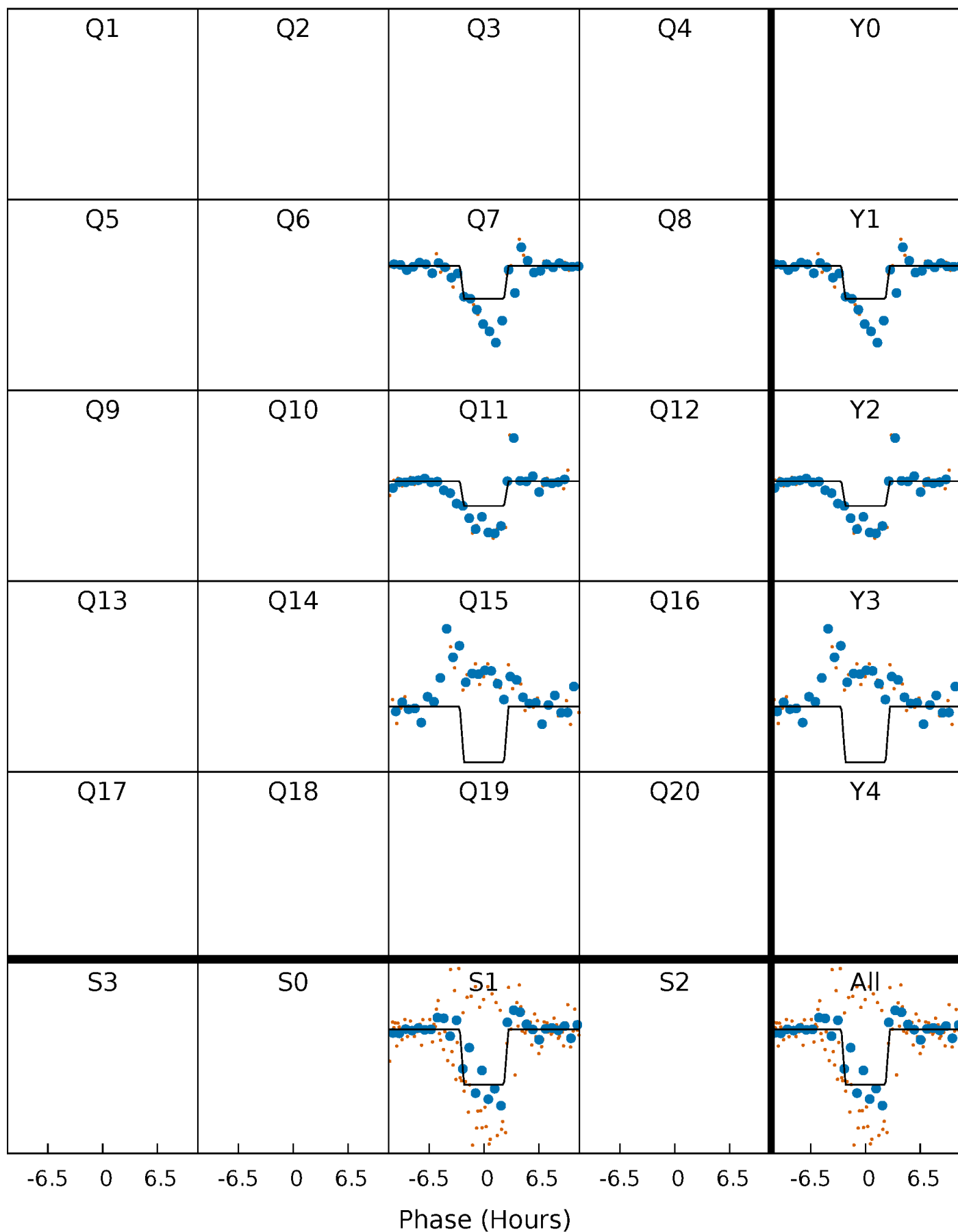
# DV Quarter-Phased Transit Curves

TCE 006104631-01   P=377.093279 Days    $T_0=331.828452$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

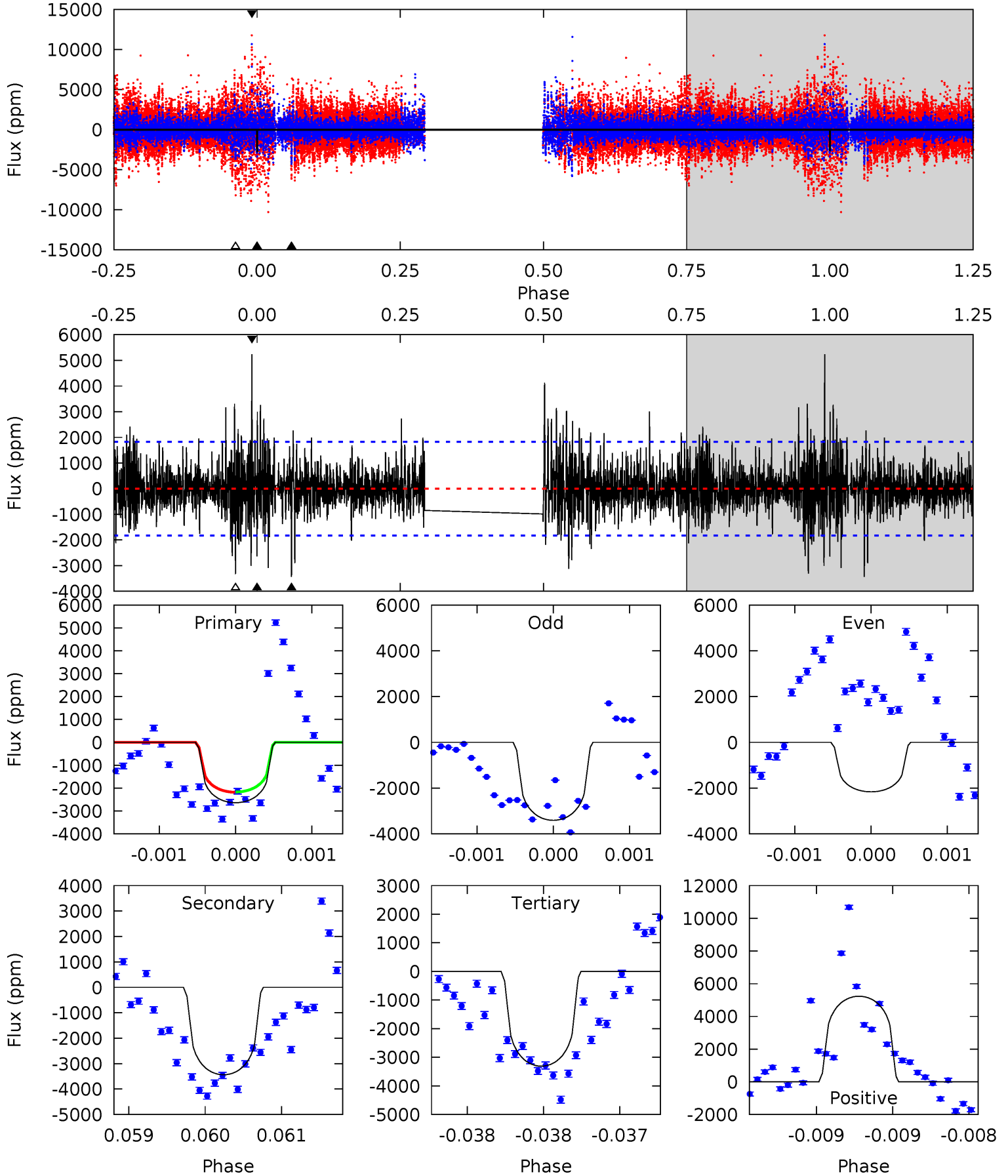
TCE 006104631-01 P=377.087727 Days  $T_0=331.844749$  (BKJD)



# DV Model-Shift Uniqueness Test

006104631-01, P = 377.093279 Days, E = 331.828452 Days

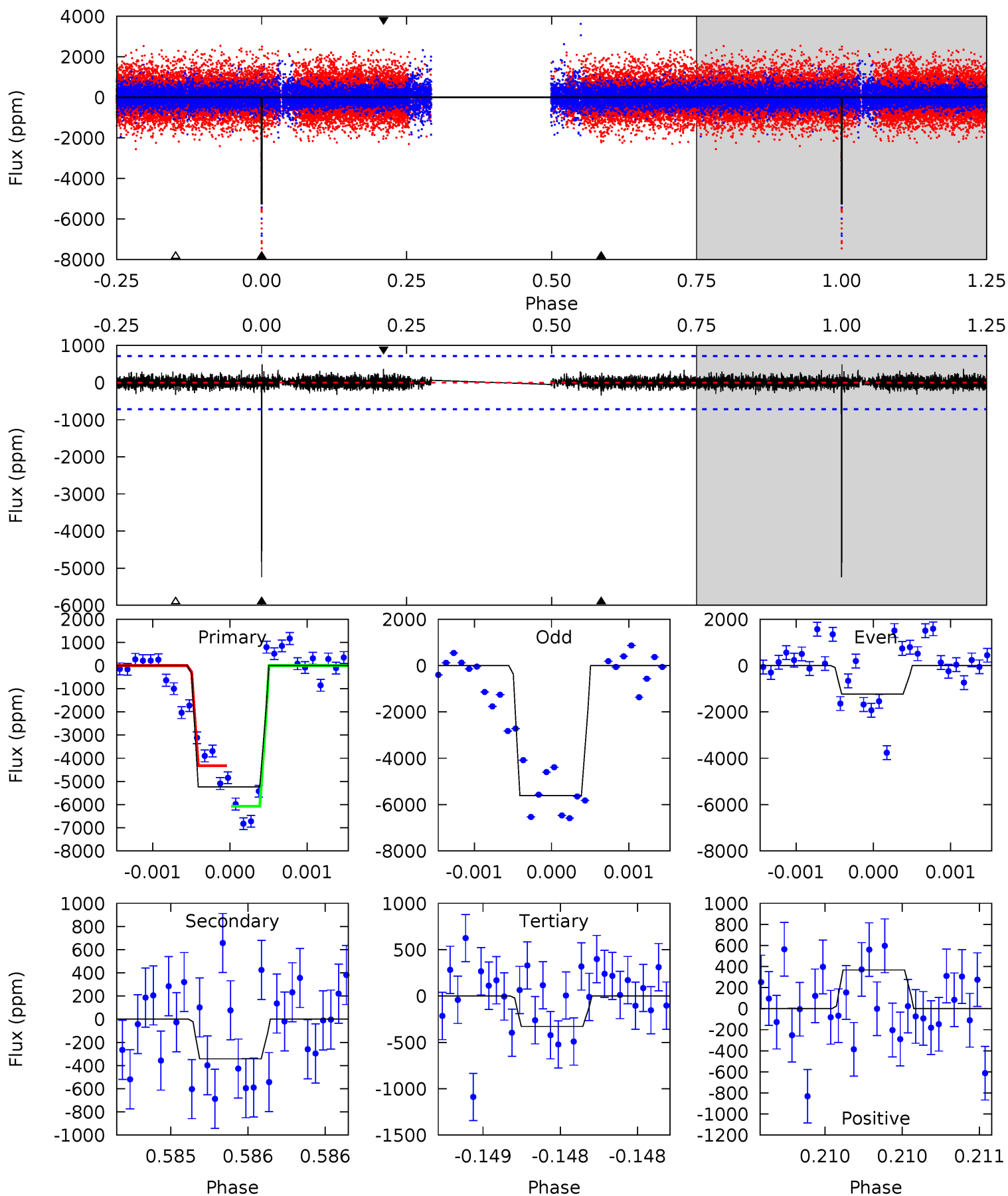
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
7.98	10.4	10.0	15.8	5.52	3.40	2.24	-2.03	-7.85	0.38	-5.43	2.04	-0.12	0.60	0.02



# Alt Model-Shift Uniqueness Test

006104631-01, P = 377.087727 Days, E = 331.844749 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
40.6	2.65	2.54	2.84	5.53	3.42	0.60	38.0	37.7	0.11	-0.19	19.5	0.59	0.09	0



### Stellar Parameters For KIC 006104631

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$4751^{+167}_{-186}$	$4.696^{+0.054}_{-0.027}$	$-1.120^{+0.300}_{-0.300}$	$0.554^{+0.037}_{-0.037}$	$0.555^{+0.040}_{-0.027}$	$4.606^{+0.981}_{-0.556}$
	+4%/-4%	+1%/-1%	+27%/-27%	+7%/-7%	+7%/-5%	+21%/-12%
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 006104631-01 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-3437 \pm 331$	$3.71^{+2.94}_{-2.51}$	$236^{+9}_{-10}$	$4654^{+3392}_{-896}$	$100469^{+814732}_{-69608}$
Alt.	$-343 \pm 129$	$4.17^{+3.04}_{-2.51}$	$236^{+10}_{-10}$	$3018^{+1034}_{-452}$	$7137^{+42938}_{-4901}$

$T_{\text{max}}$  = 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

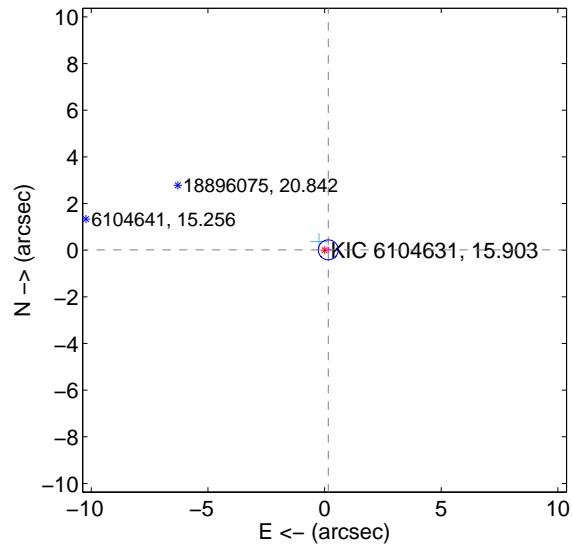
Supplemental centroid analysis for 006104631-01. Kepler magnitude: 15.90. Transit SNR 4.61

There are 2 quarters with good PRF difference image offsets

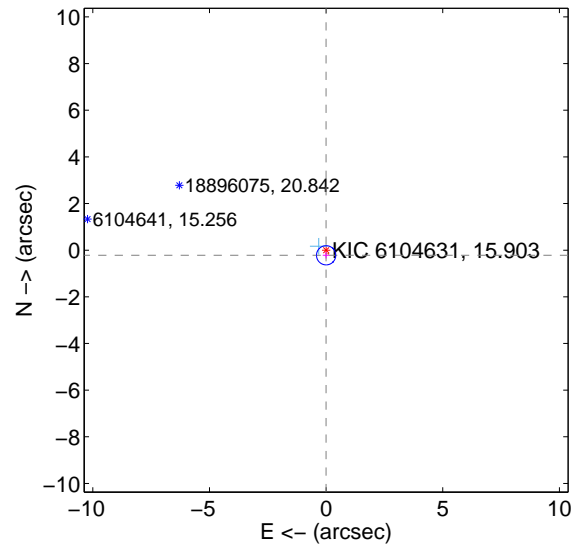
The direct PRF centroid is offset from the target star catalog position by about 0.24 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.159 \pm 0.142$	1.12	$-0.159 \pm 0.142$	$0.014 \pm 0.137$
PRF-fit source offset from KIC position	$0.219 \pm 0.137$	1.59	$0.000 \pm 0.142$	$-0.219 \pm 0.137$
photometric centroid source offset	$0.98 \pm 2.55$	0.38	$0.97 \pm 2.56$	$0.09 \pm 0.68$

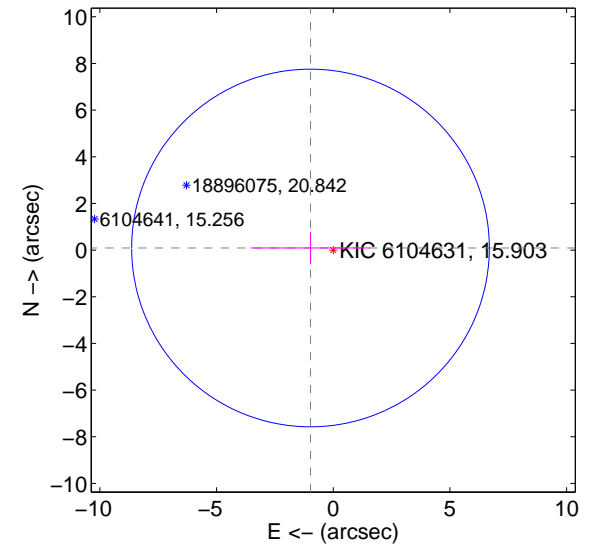
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position



offset from photometric centroids



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

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



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

Q5 no difference image



Q5 no OOT image



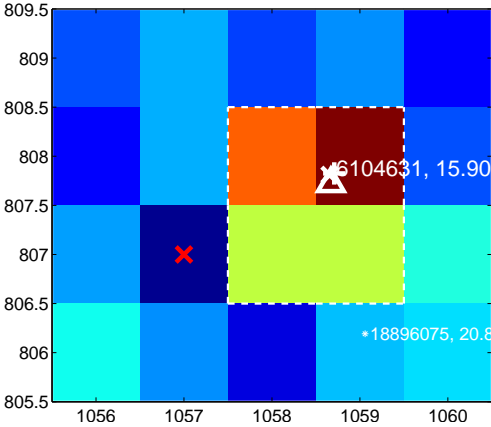
Q6 no difference image



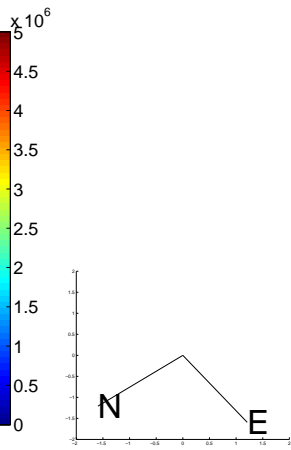
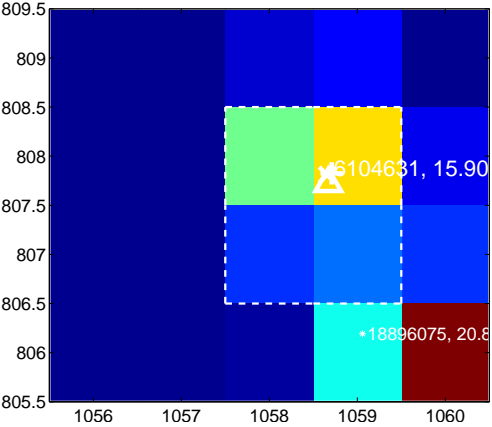
Q6 no OOT image



Q7 difference image



Q7 OOT image



Q8 no difference image



Q8 no OOT image





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

Q9 no difference image



Q9 no OOT image



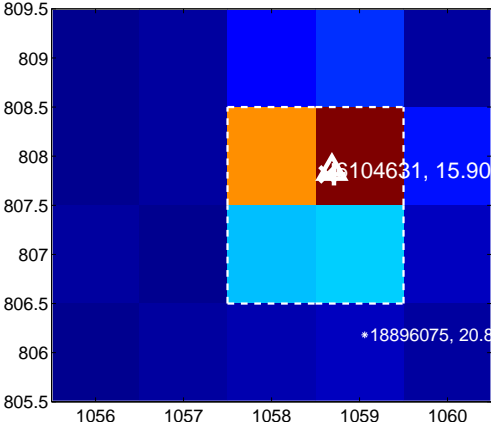
Q10 no difference image



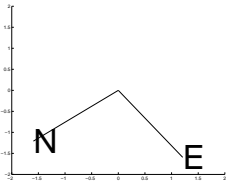
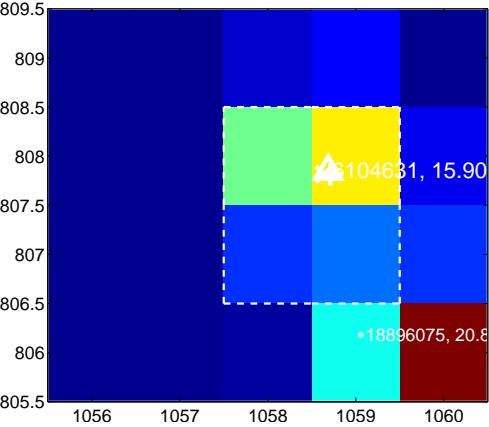
Q10 no OOT image



Q11 difference image



Q11 OOT image



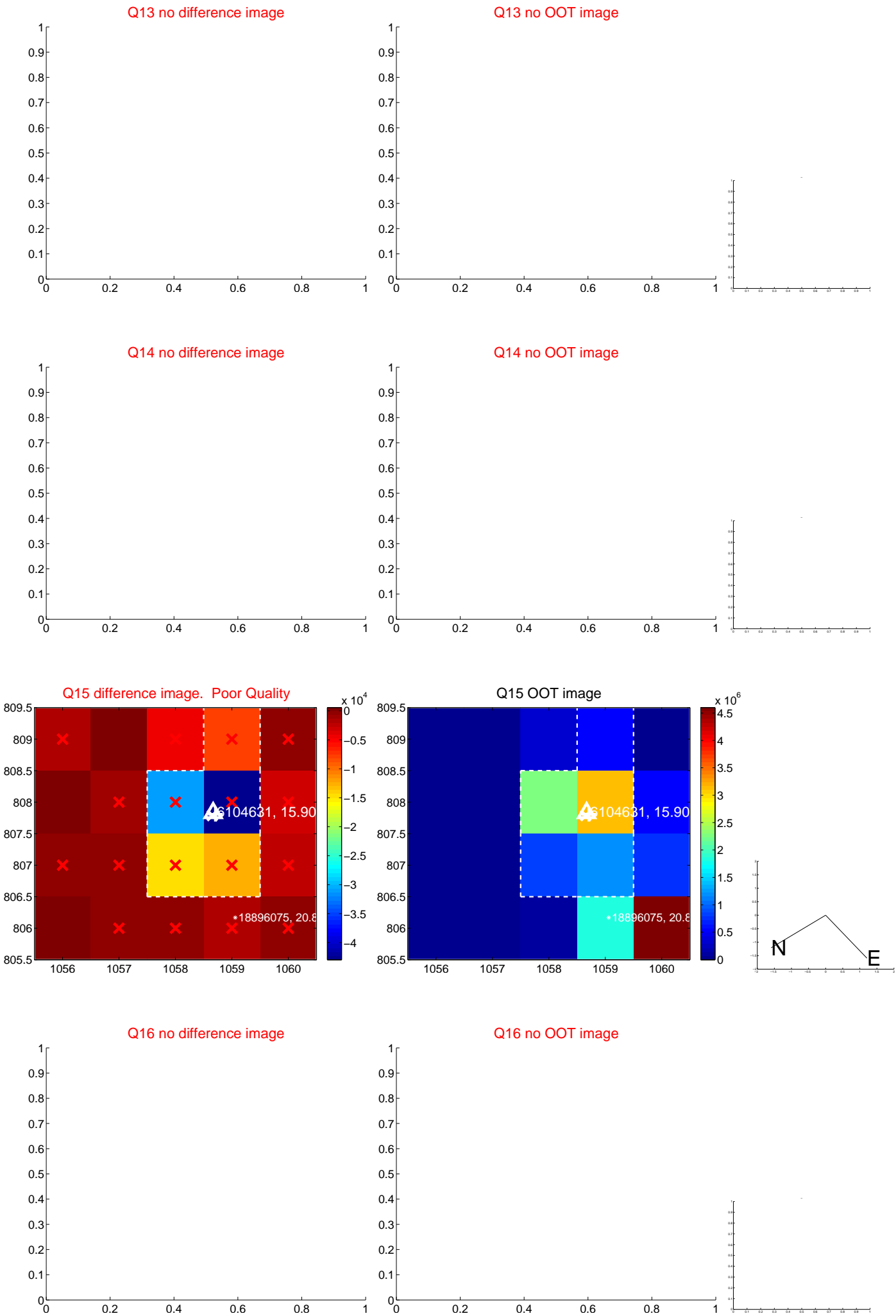
Q12 no difference image



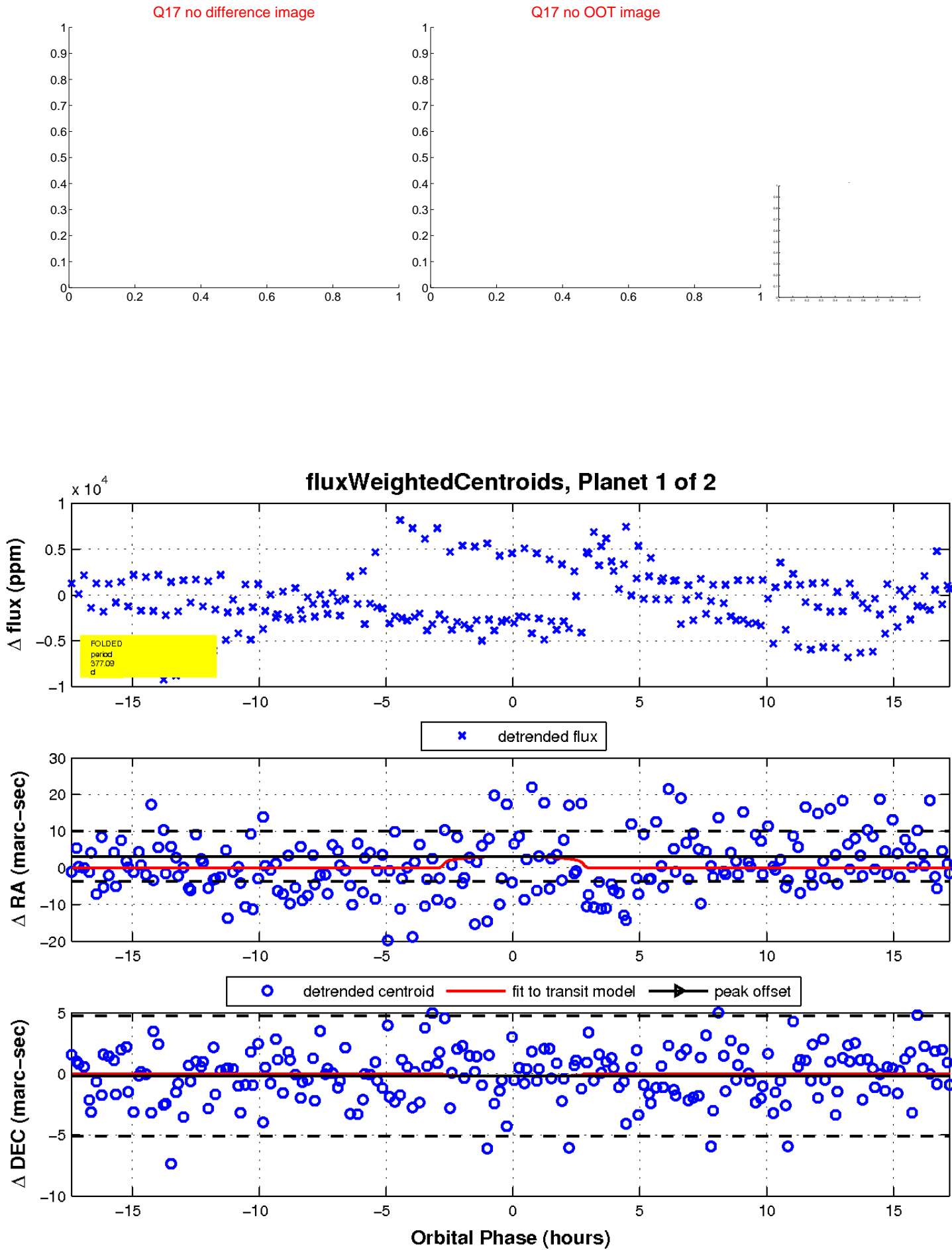
Q12 no OOT image



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

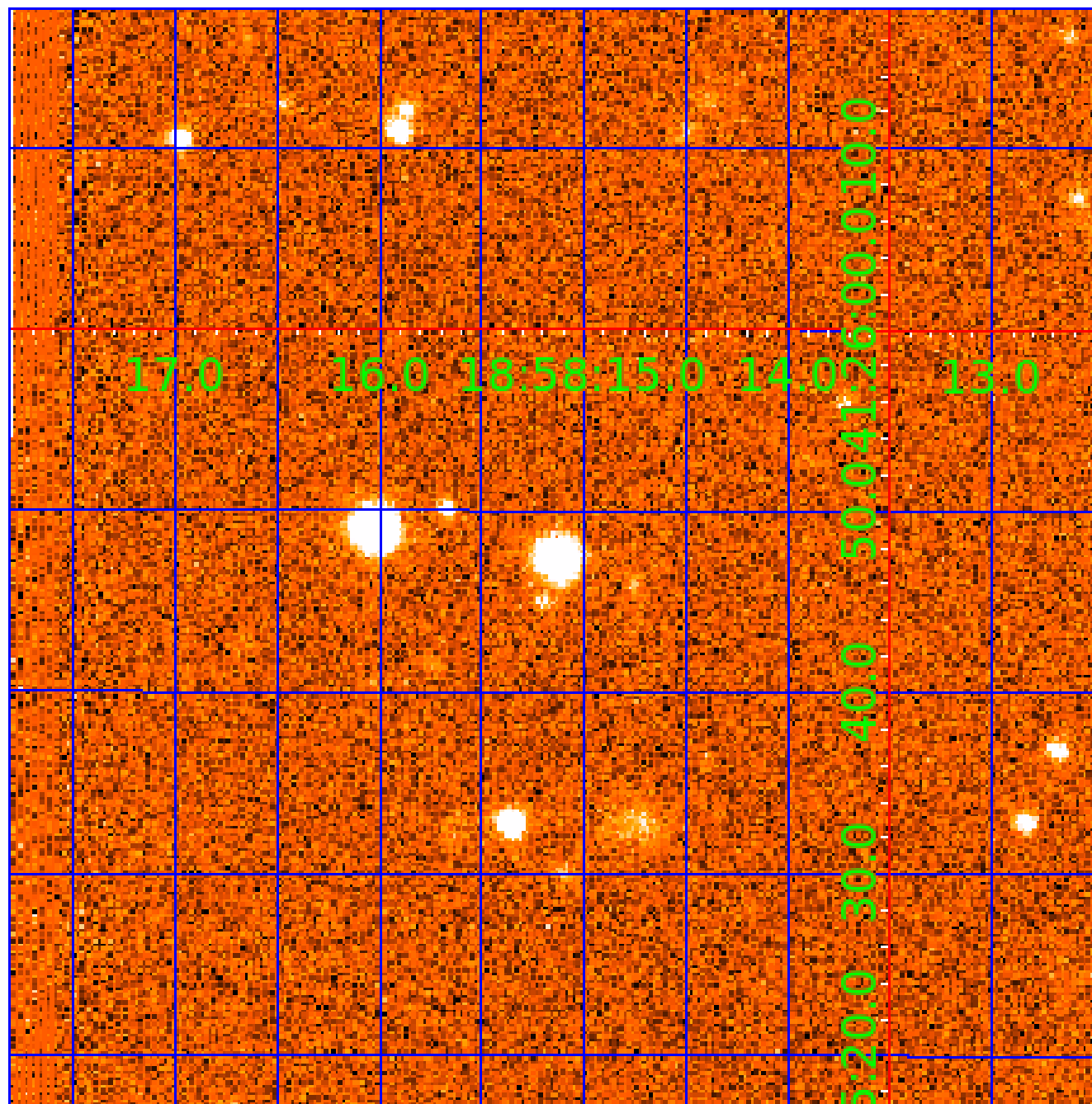


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



# UKIRT Image

Declination



# KIC 006104631

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
006104631-01	OBS	No	377.093279	331.828452	2307.1	5.803	12.0	4.6	0.55	4751	2.60	0.20
006104631-02	OBS	No	398.599912	212.059703	2651.4	3.126	12.2	6.2	0.55	4751	2.87	0.18

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
006104631-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_SKYE—LPP_DV—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
006104631-02	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—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.

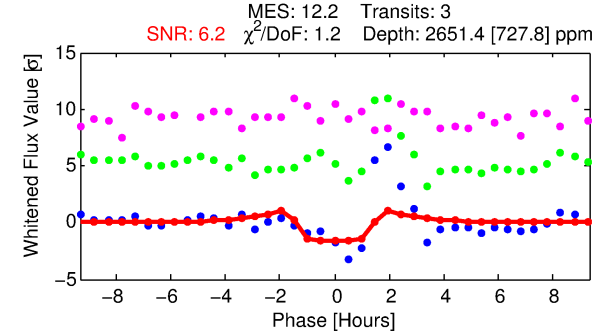
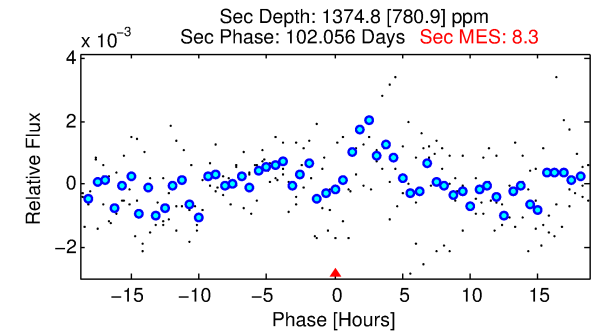
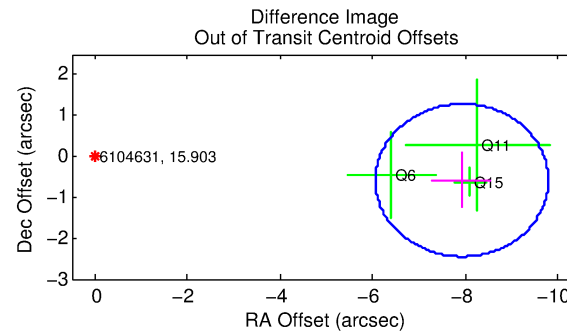
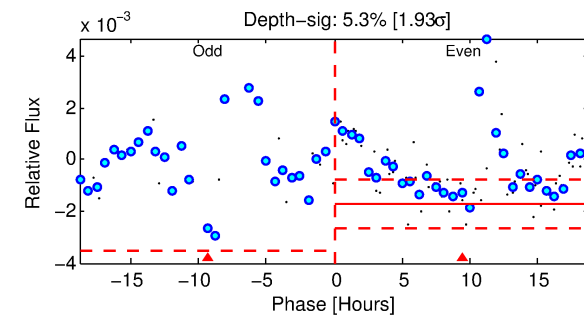
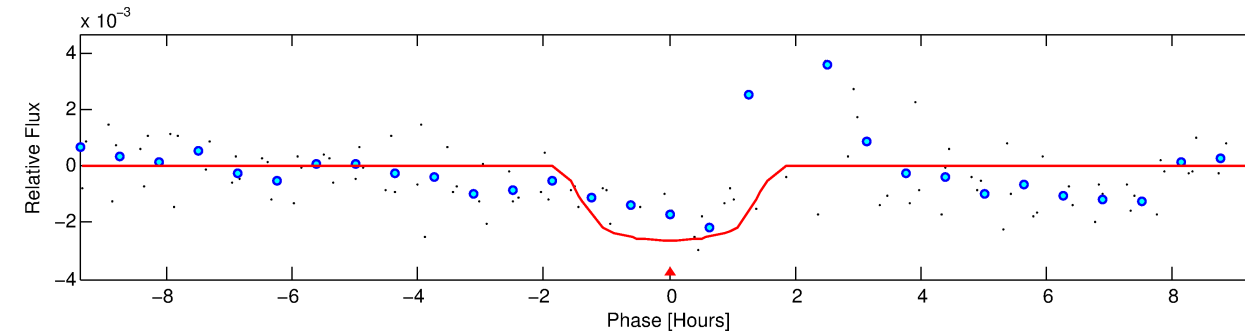
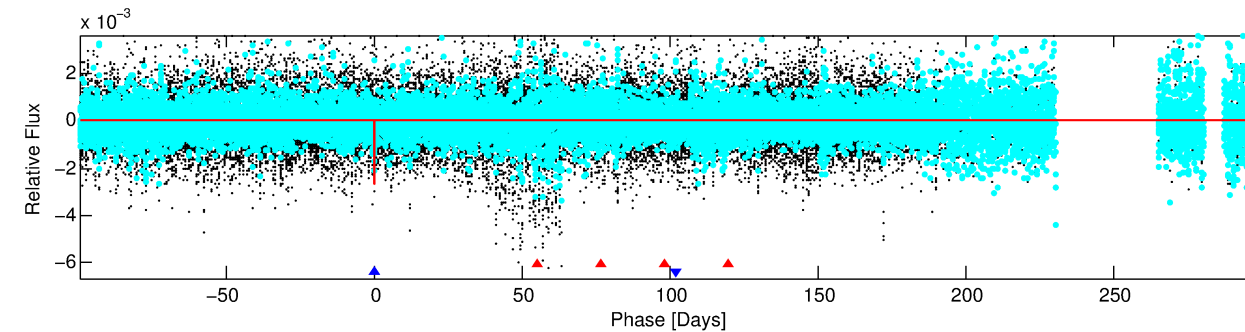
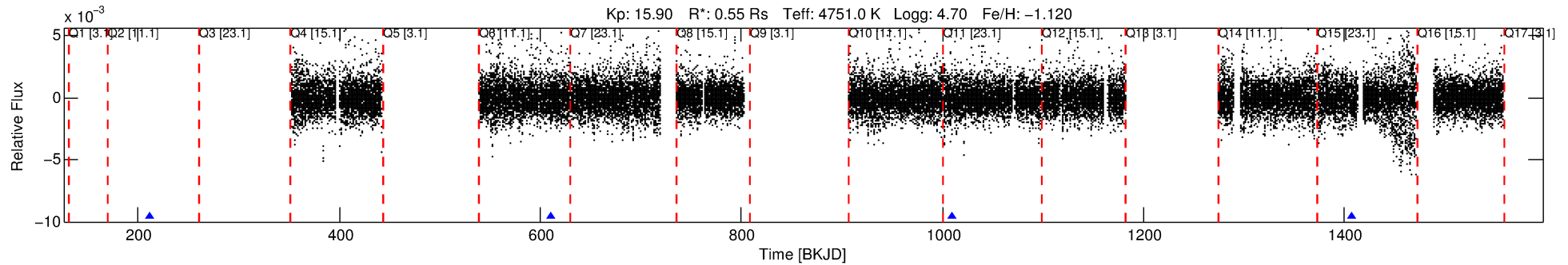
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 006104631-02

No Significant Match Found

# DV One-Page Summary

KIC: 6104631 Candidate: 2 of 2 Period: 398.600 d



## DV Fit Results:

Period = 398.59991 [0.00656] d  
Epoch = 212.0597 [0.0136] BKJD  
Rp/R\* = 0.0474 [0.4256]  
a/R\* = 928.46 [31636.54]  
b = 0.43 [64.61]  
Seff = 0.18 [0.03]  
Teq = 167 [8] K  
Rp = 2.87 [25.73] Re  
a = 0.8718 [0.0530] AU  
Ag = 69974.16 [1256975.89] [0.06 $\sigma$ ]  
Teffp = 4202 [18869] K [0.2 $\sigma$ ]

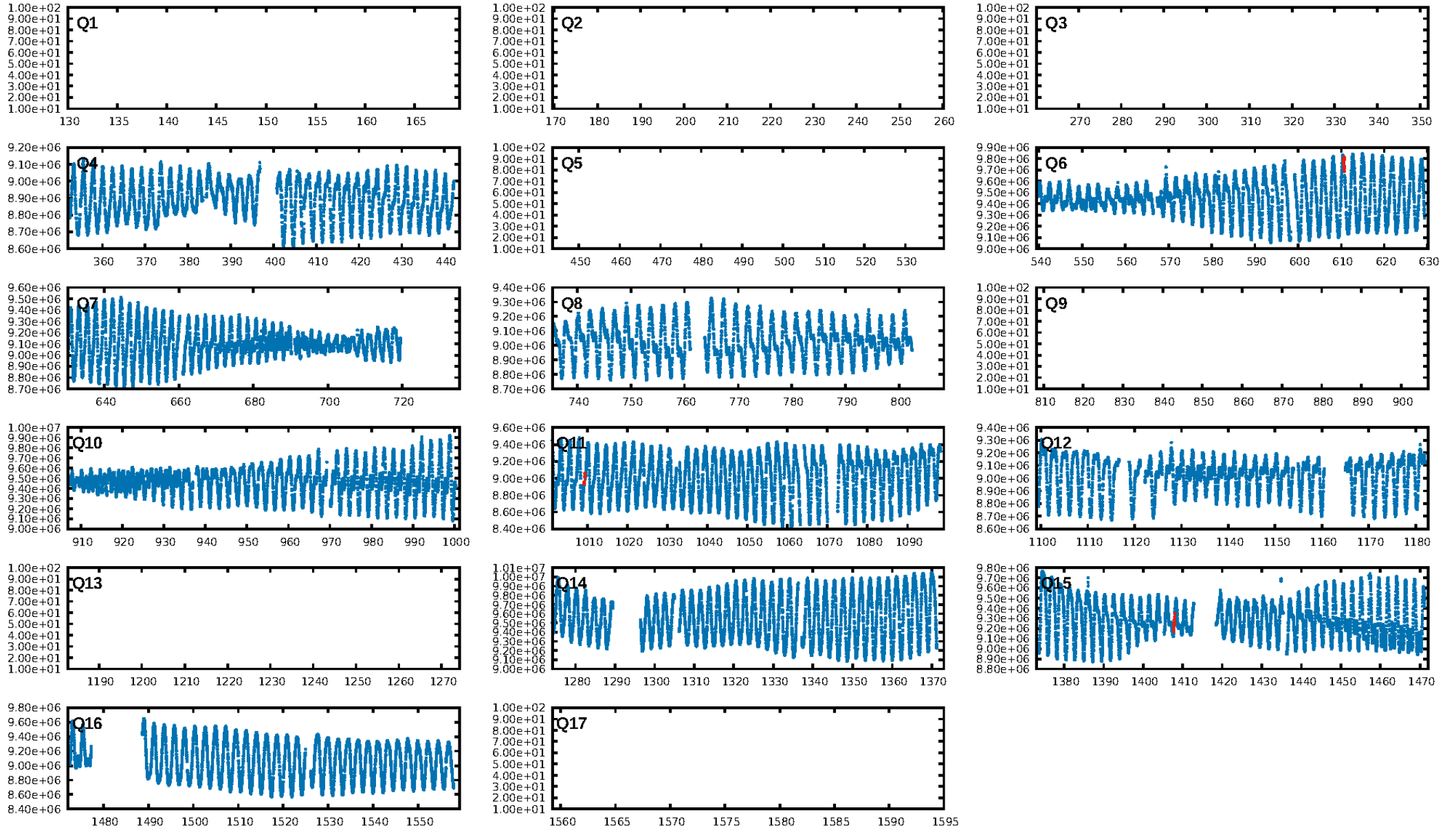
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [78.31 $\sigma$ ]  
LongPeriod-sig: N/A  
**ModelChiSquare2-sig: 0.2%**  
ModelChiSquareGof-sig: 54.7%  
**Bootstrap-pfa: 2.77e-12**  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: 2.777  
Centroid-sig: 30.7%  
Centroid-so: 0.824 arcsec [0.41 $\sigma$ ]  
**OotOffset-rm: 7.947 arcsec [12.76 $\sigma$ ]**  
KicOffset-rm: 0.122 arcsec [0.19 $\sigma$ ]  
OotOffset-st: 1/2/0/0 [3]  
KicOffset-st: 1/2/0/0 [3]  
DiffImageQuality-fgm: 0.33 [1/3]  
DiffImageOverlap-fno: 1.00 [3/3]

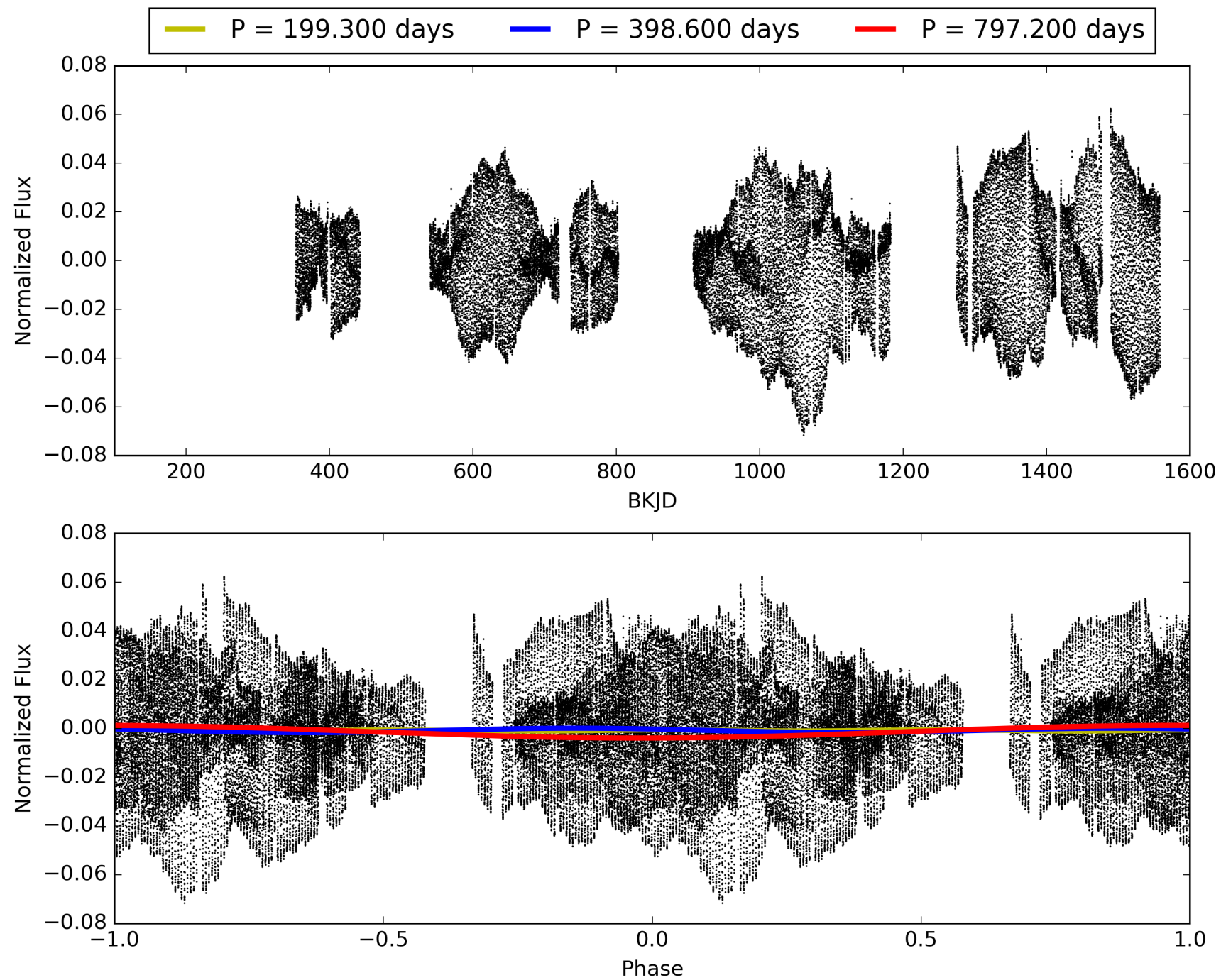
Software Revision: svn-ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 04:34:48 Z

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

# TCE 006104631-02, PDC Light Curves



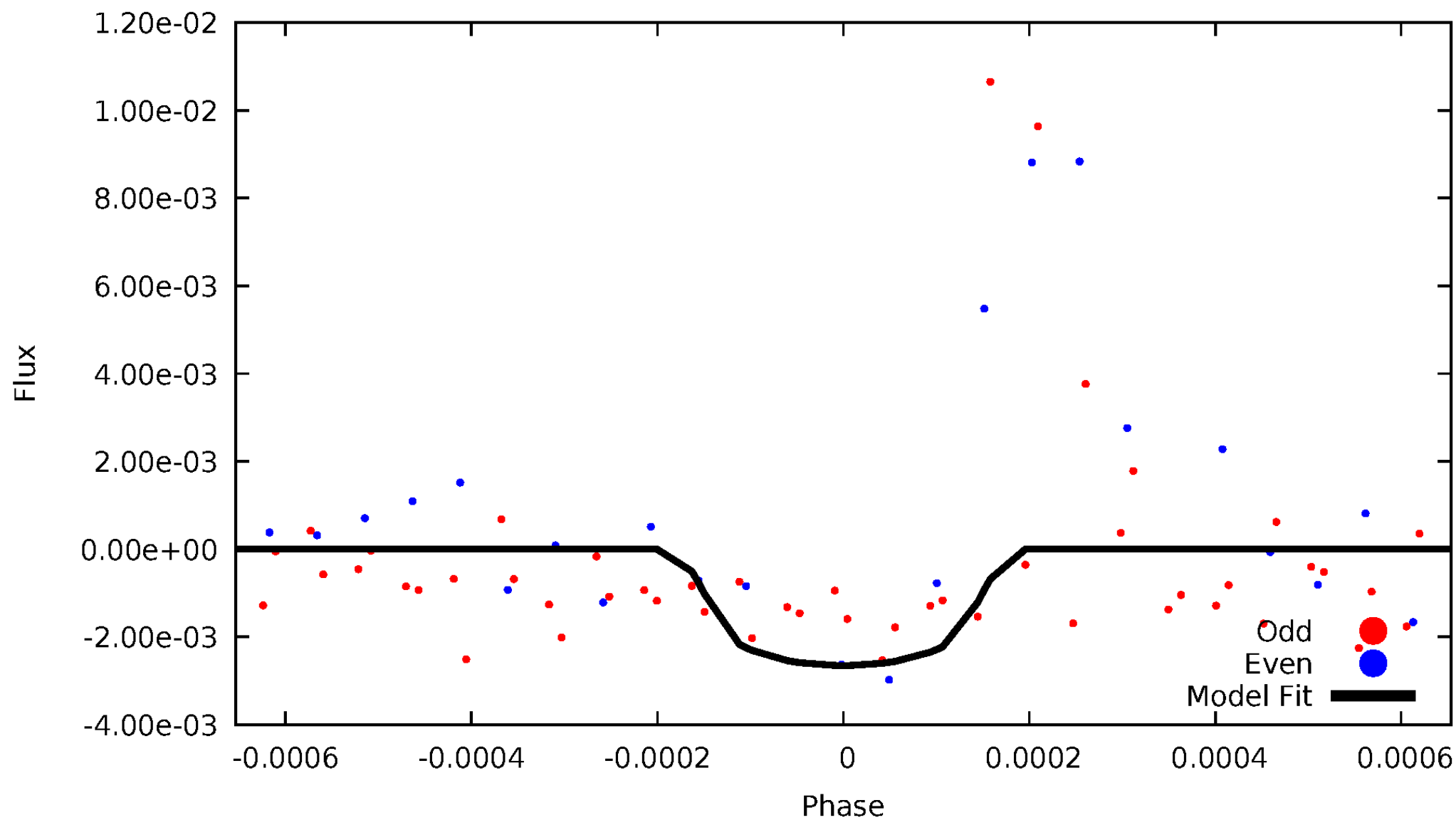
# TCE 006104631-02





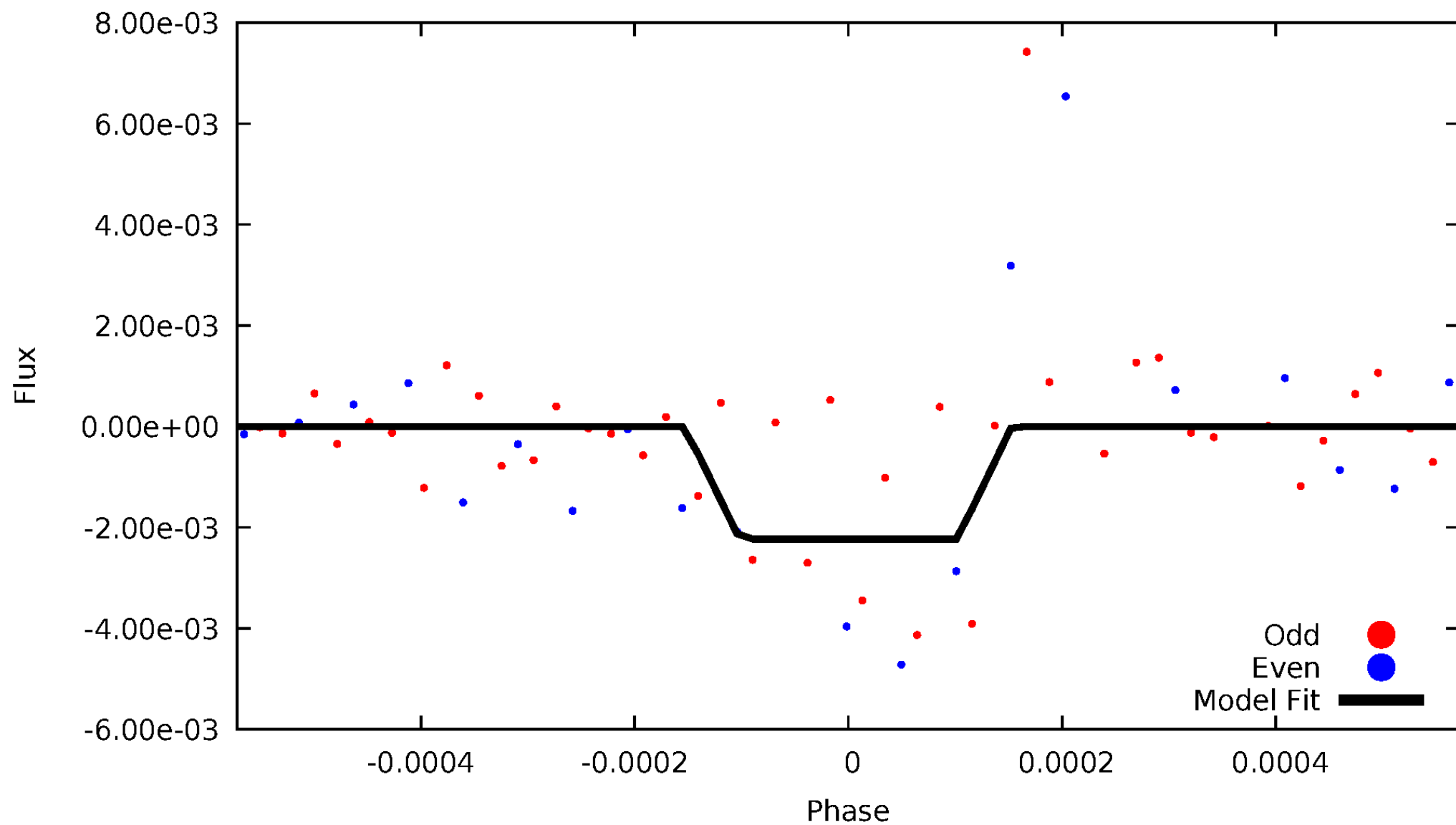
# DV Odd/Even

TCE 006104631-02



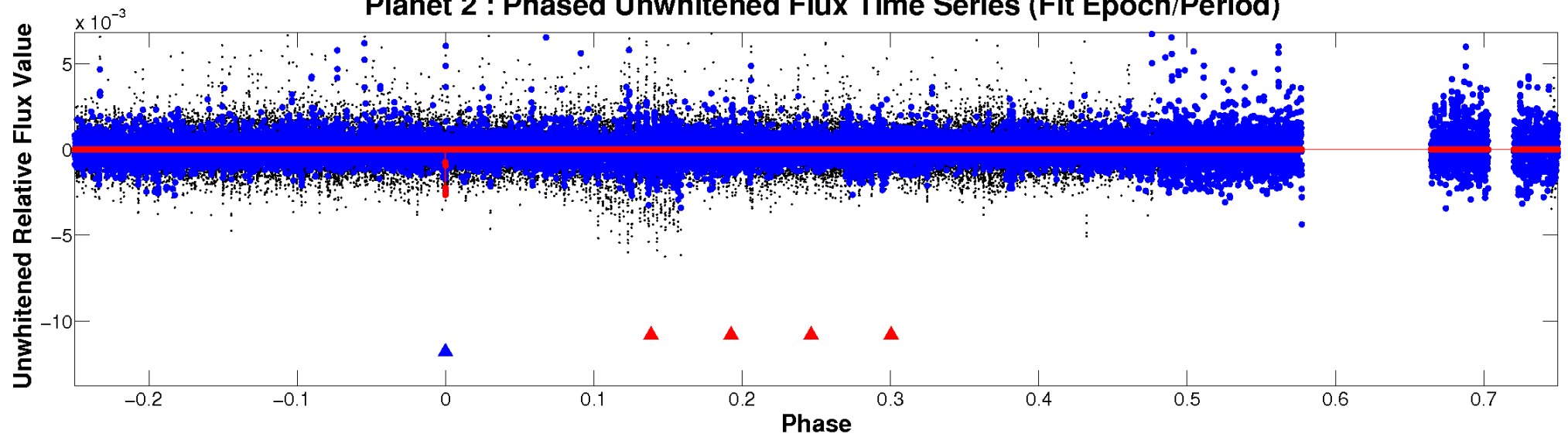
# ALT Odd/Even

TCE 006104631-02

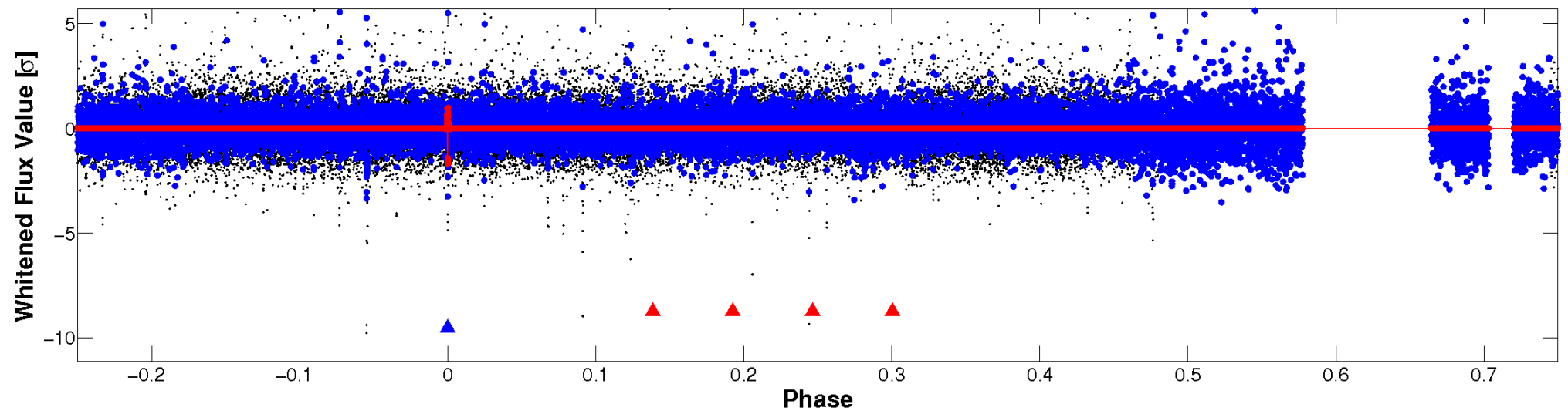


# Non-Whitened Vs. Whitened Light Curve

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

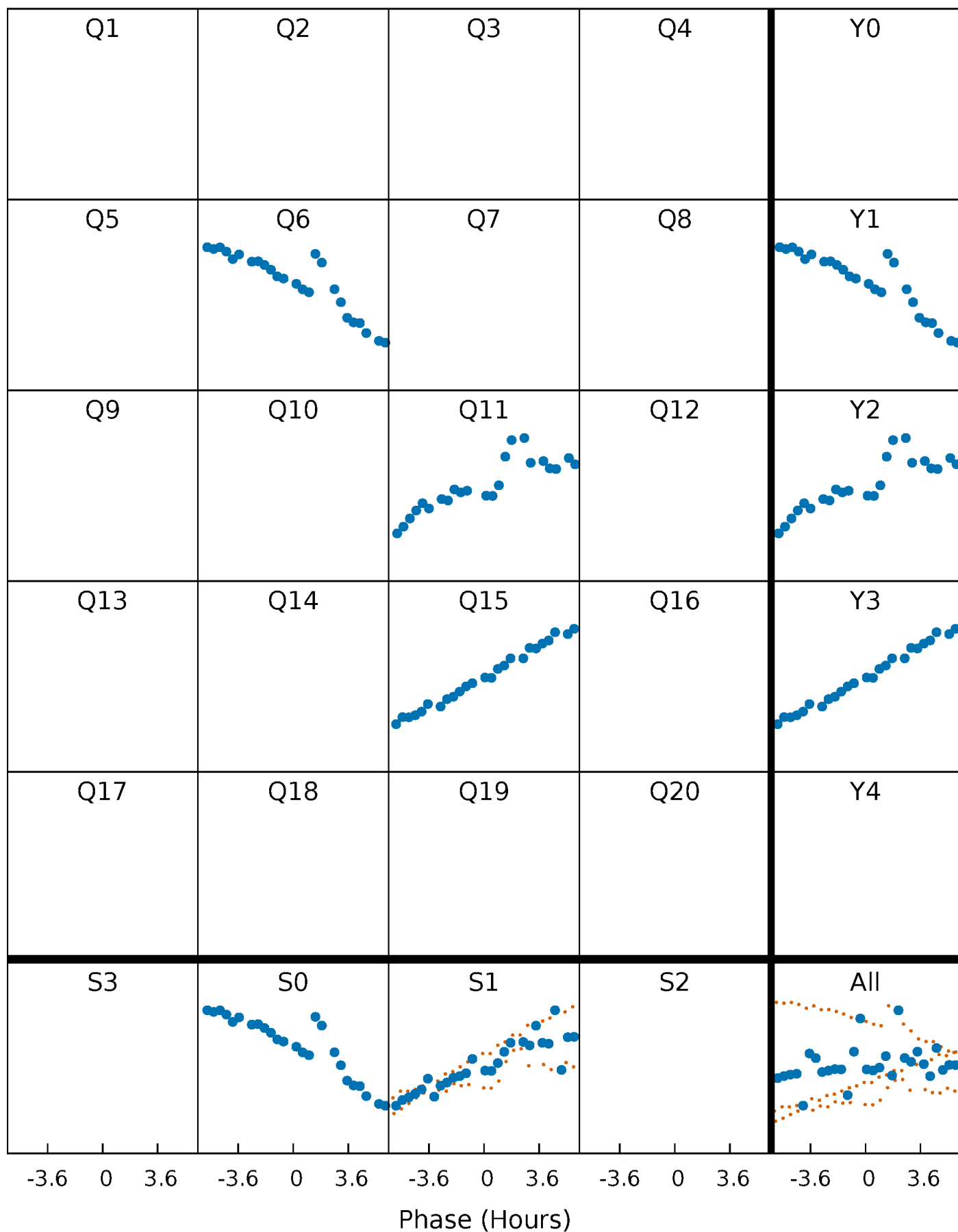


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

TCE 006104631-02     $P=398.599912$  Days     $T_0=212.059703$  (BKJD)



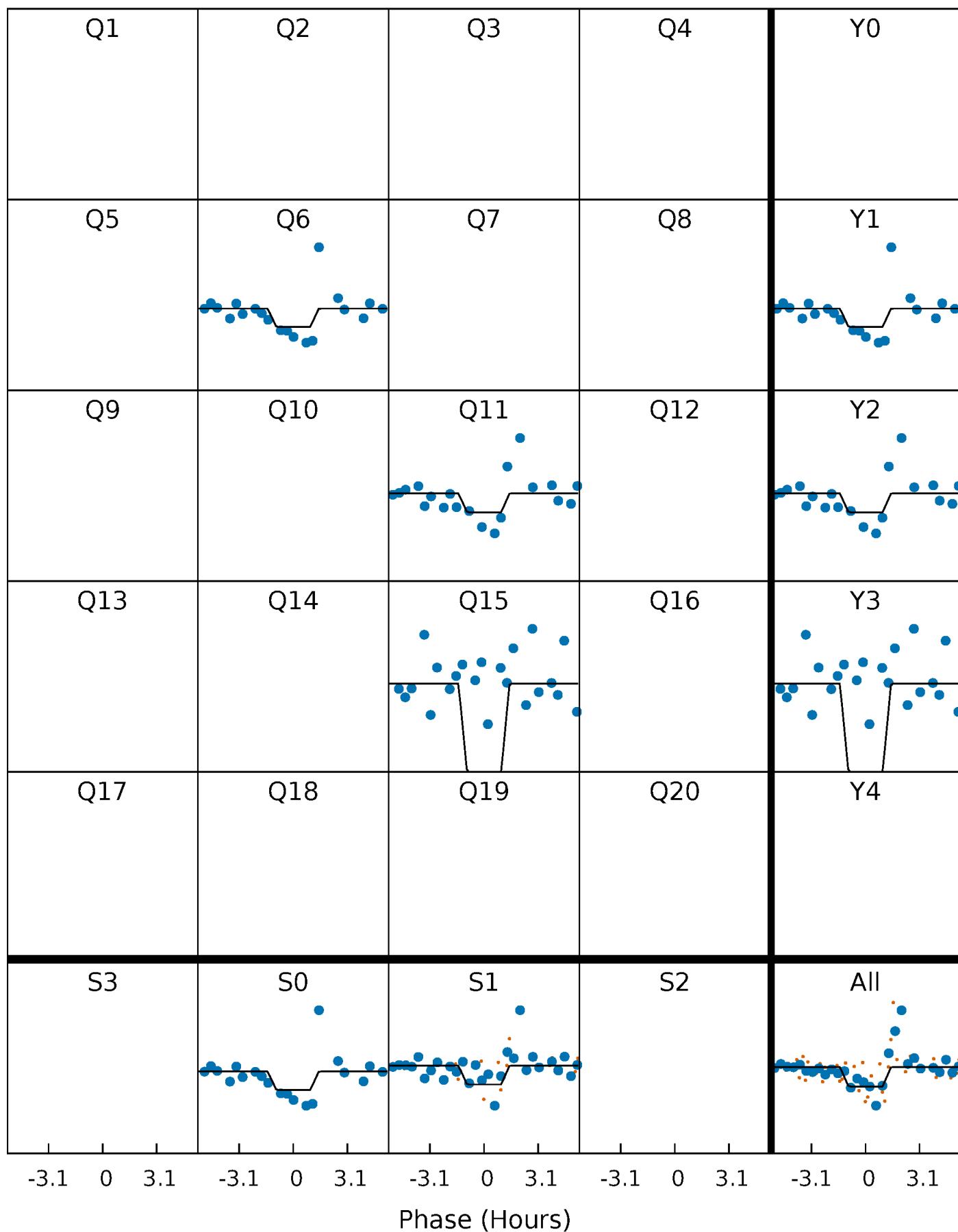
# DV Quarter-Phased Transit Curves

TCE 006104631-02     $P=398.599912$  Days     $T_0=212.059703$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

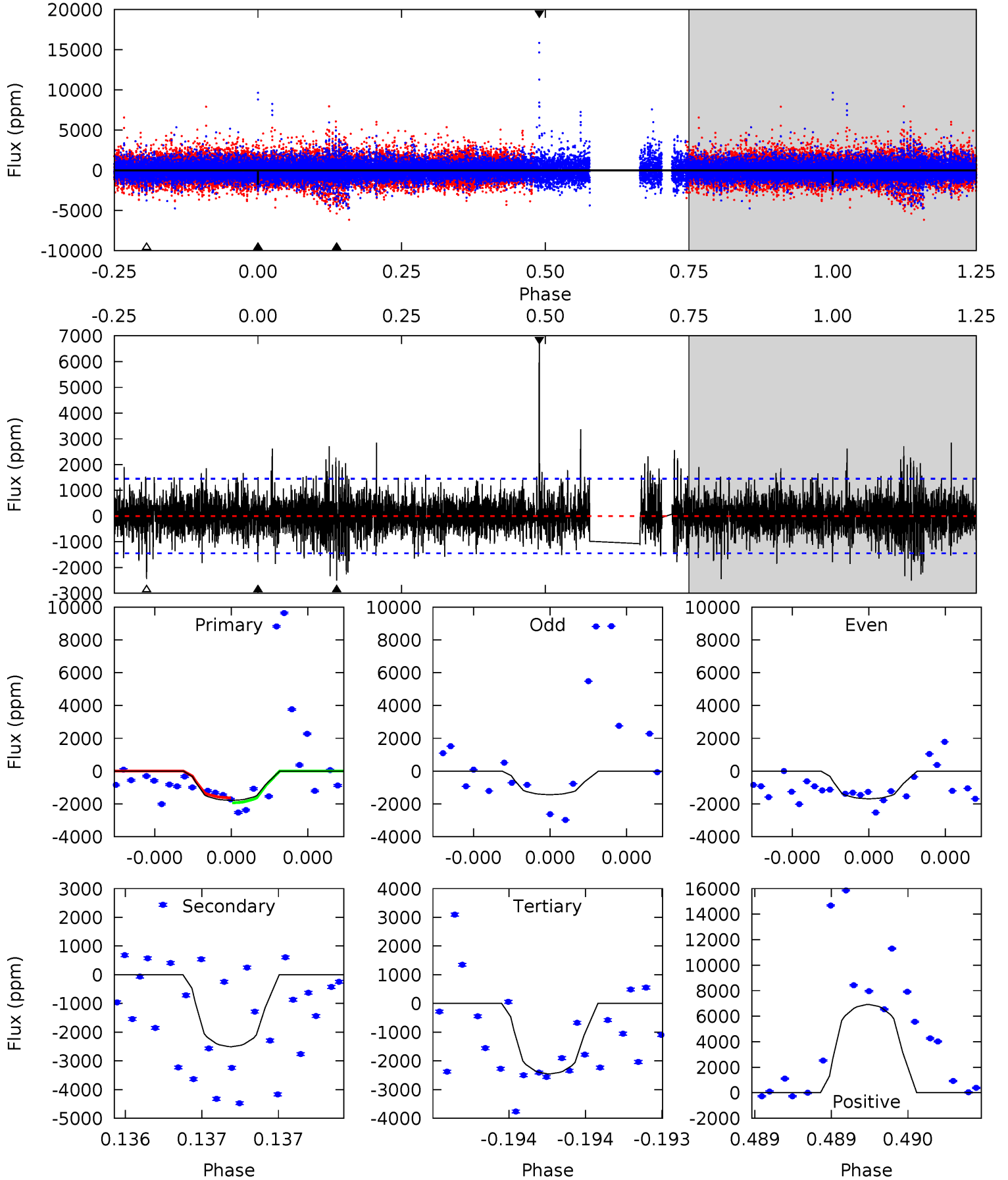
TCE 006104631-02 P=398.603195 Days  $T_0=212.052932$  (BKJD)



# DV Model-Shift Uniqueness Test

006104631-02, P = 398.599912 Days, E = 212.059703 Days

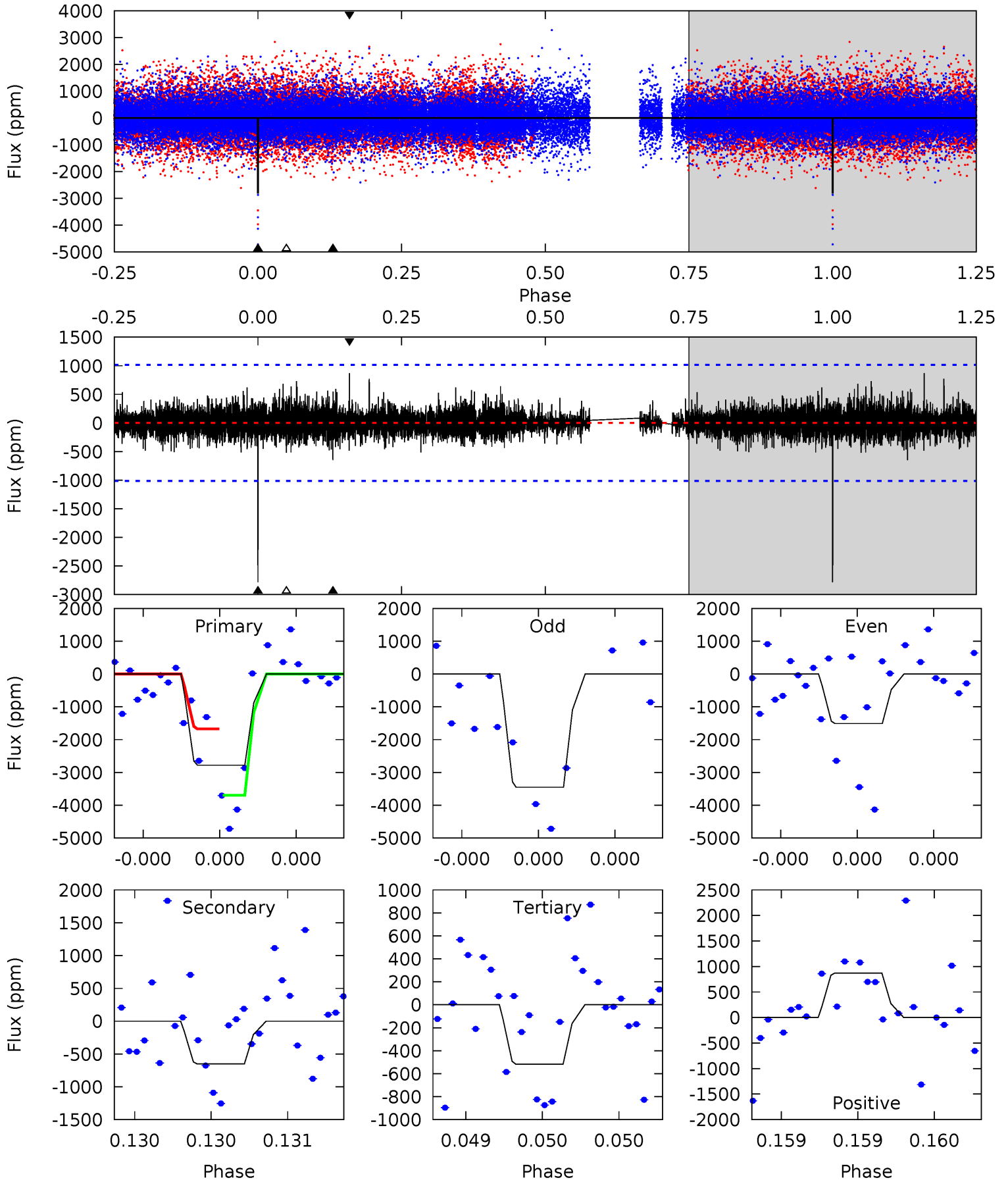
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
6.97	9.78	9.57	27.0	5.65	3.60	2.17	-2.60	-20.0	0.21	-17.2	0.47	0.97	0.73	0.60



# Alt Model-Shift Uniqueness Test

006104631-02, P = 398.603195 Days, E = 212.052932 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
15.5	3.63	2.88	4.84	5.66	3.61	0.77	12.6	10.7	0.75	-1.21	5.70	0.67	0.24	5.83





### Stellar Parameters For KIC 006104631

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$4751^{+167}_{-186}$	$4.696^{+0.054}_{-0.027}$	$-1.120^{+0.300}_{-0.300}$	$0.554^{+0.037}_{-0.037}$	$0.555^{+0.040}_{-0.027}$	$4.606^{+0.981}_{-0.556}$
	+4%/-4%	+1%/-1%	+27%/-27%	+7%/-7%	+7%/-5%	+21%/-12%
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 006104631-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-2507 \pm 256$	$19.10^{+19.22}_{-13.01}$	$232^{+9}_{-9}$	$2649^{+1070}_{-420}$	$2912^{+26641}_{-2188}$
Alt.	$-651 \pm 179$	$18.58^{+18.22}_{-12.90}$	$232^{+9}_{-10}$	$2253^{+808}_{-314}$	$799^{+7325}_{-606}$

$T_{\text{max}}$  = 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

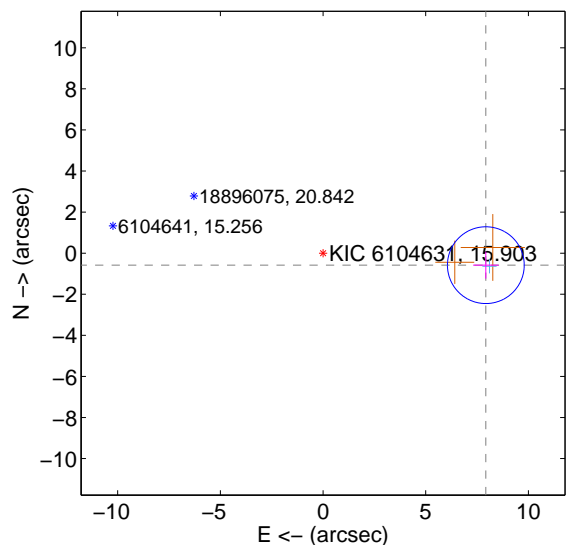
Supplemental centroid analysis for 006104631-02. Kepler magnitude: 15.90. Transit SNR 6.22

There are 1 quarters with good PRF difference image offsets

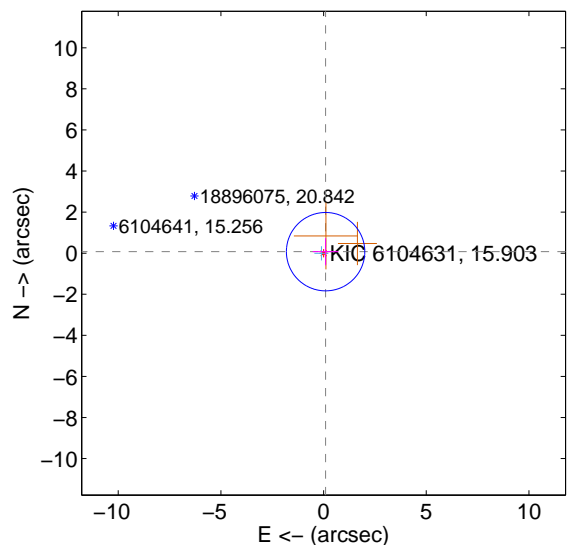
The OOT PRF centroid is offset from the target star catalog position by about 8.23 arcsec so the offset from difference PRF-fit to OOT-fit may be invalid.

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$7.947 \pm 0.623$	12.76	$-7.926 \pm 0.623$	$-0.584 \pm 0.659$
PRF-fit source offset from KIC position	$0.122 \pm 0.636$	0.19	$-0.098 \pm 0.623$	$0.073 \pm 0.659$
photometric centroid source offset	$0.82 \pm 2.01$	0.41	$0.73 \pm 2.25$	$0.39 \pm 0.73$

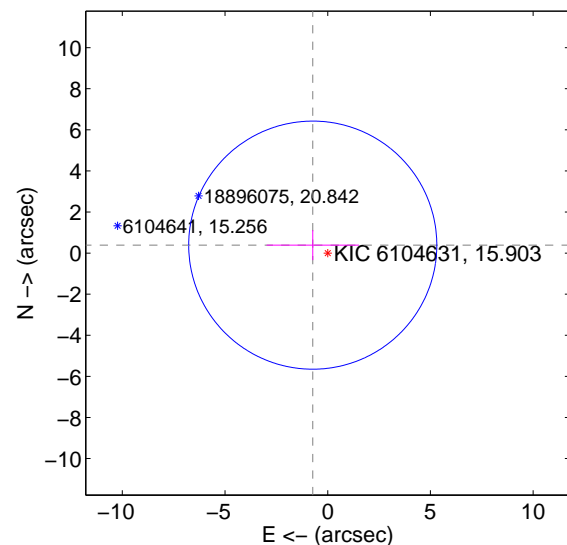
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position



offset from photometric centroids

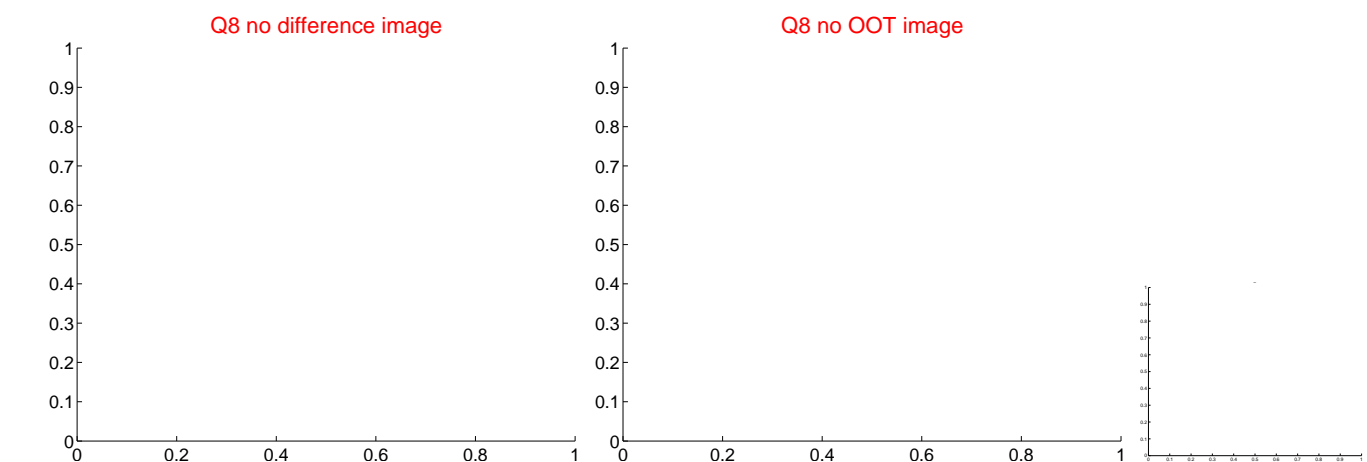
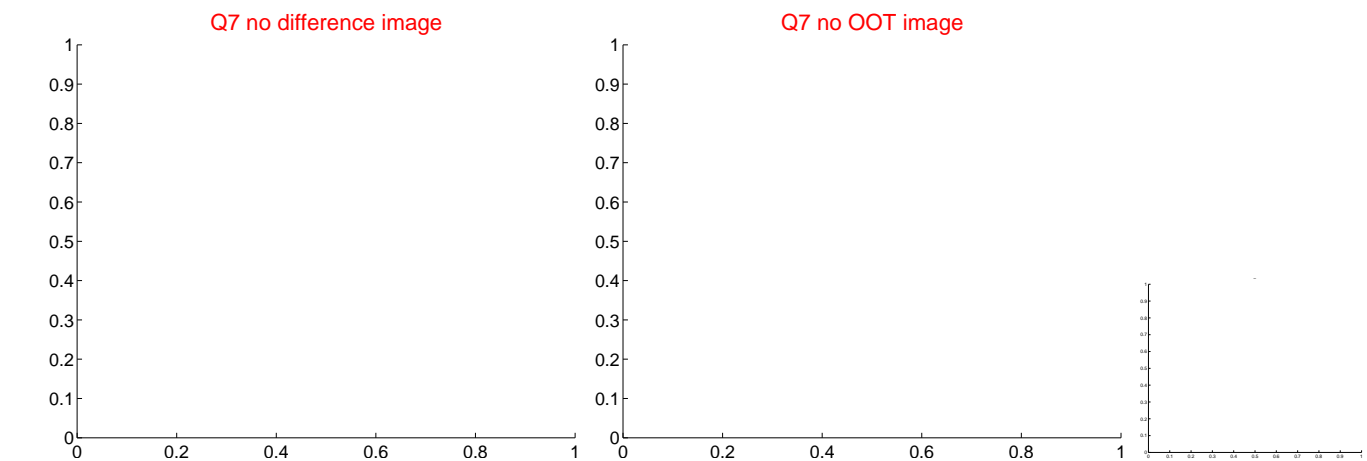
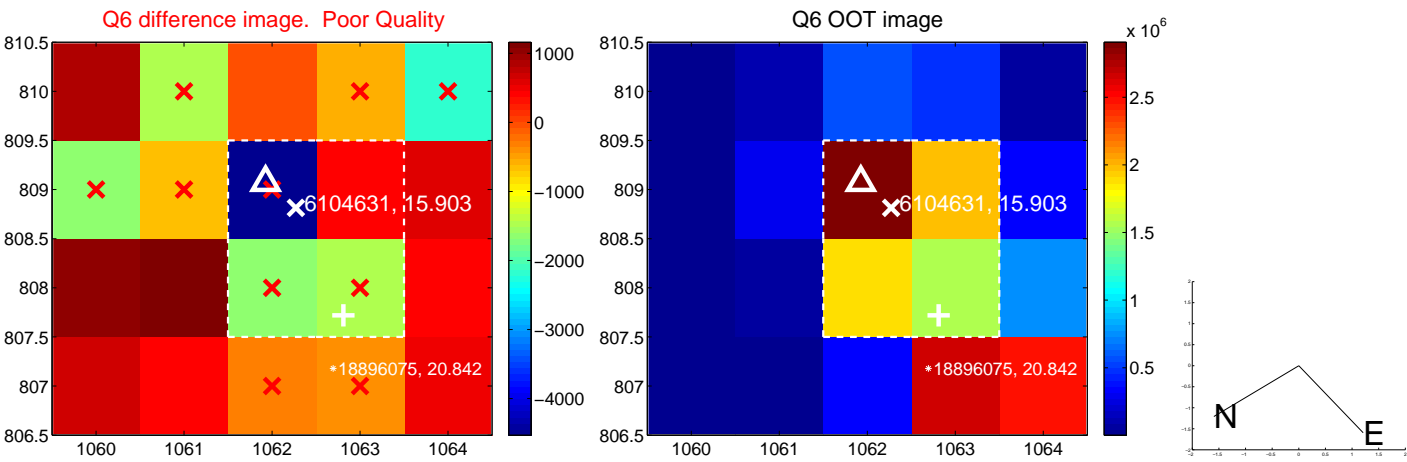
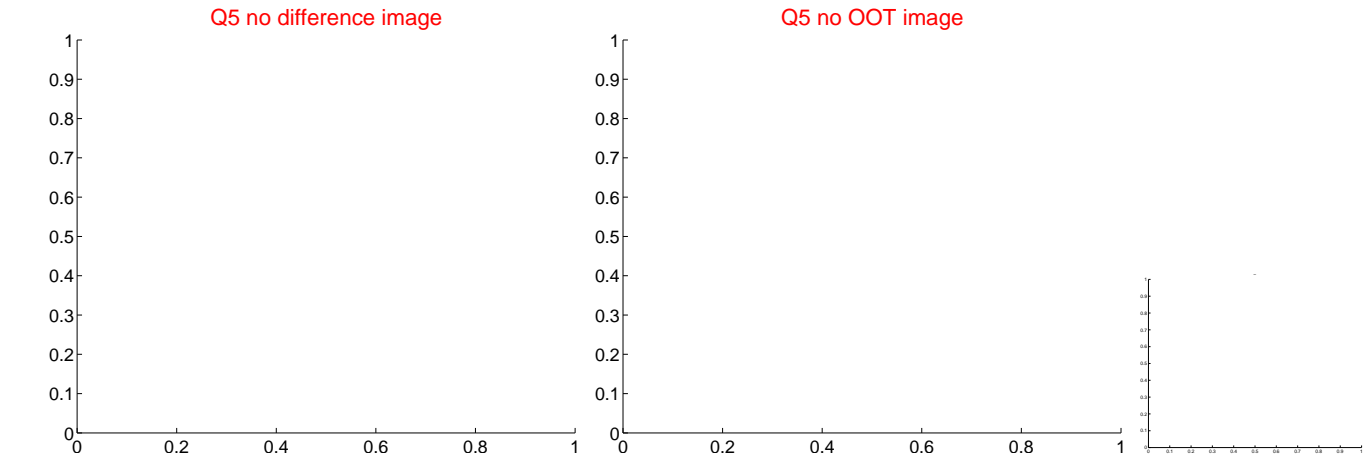


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

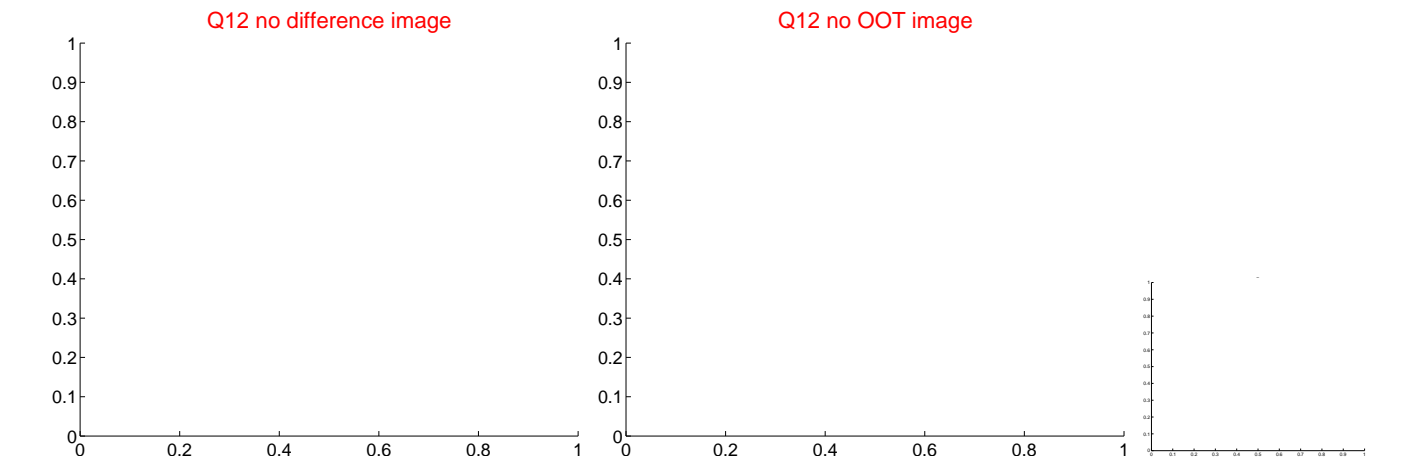
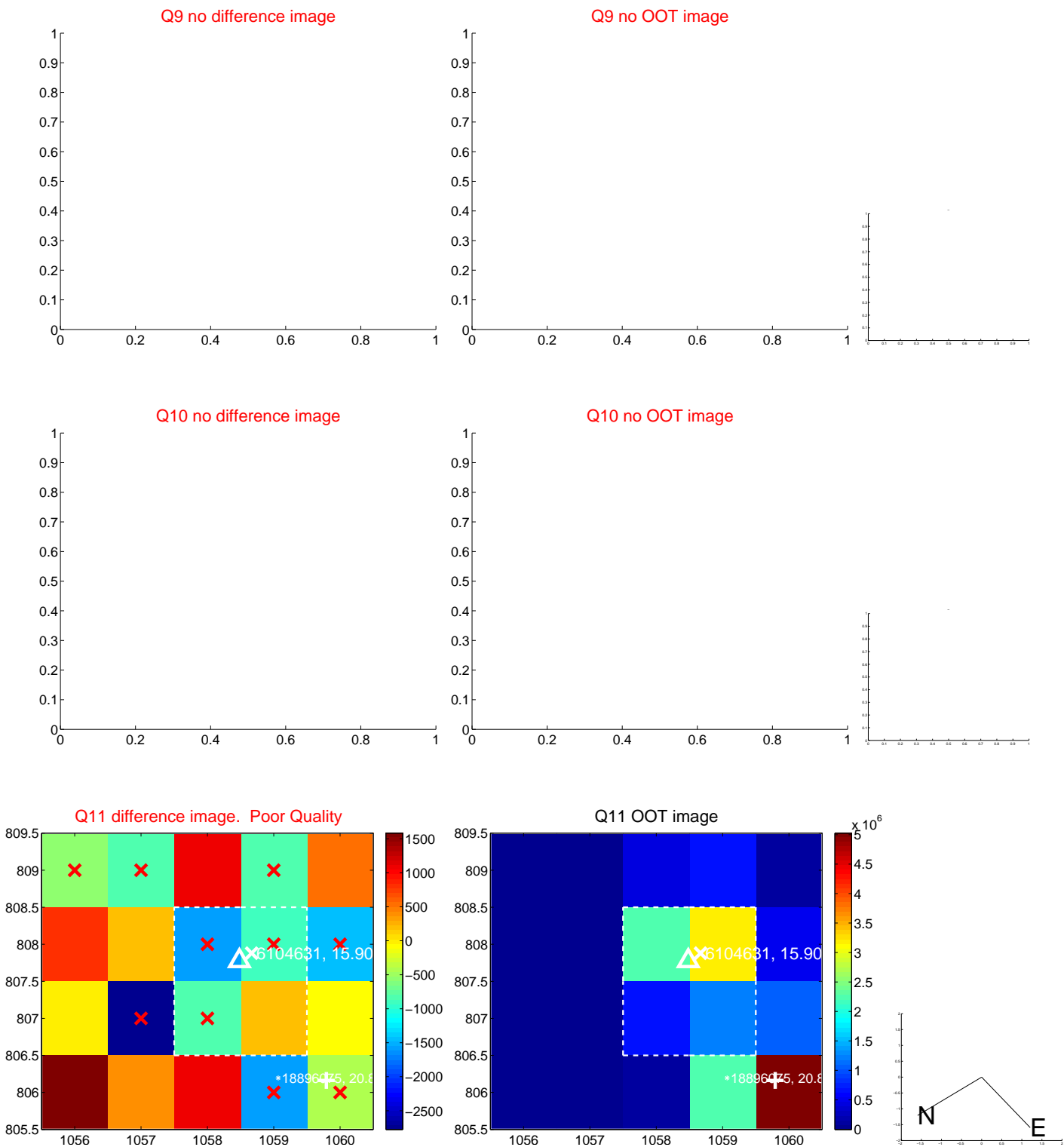
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



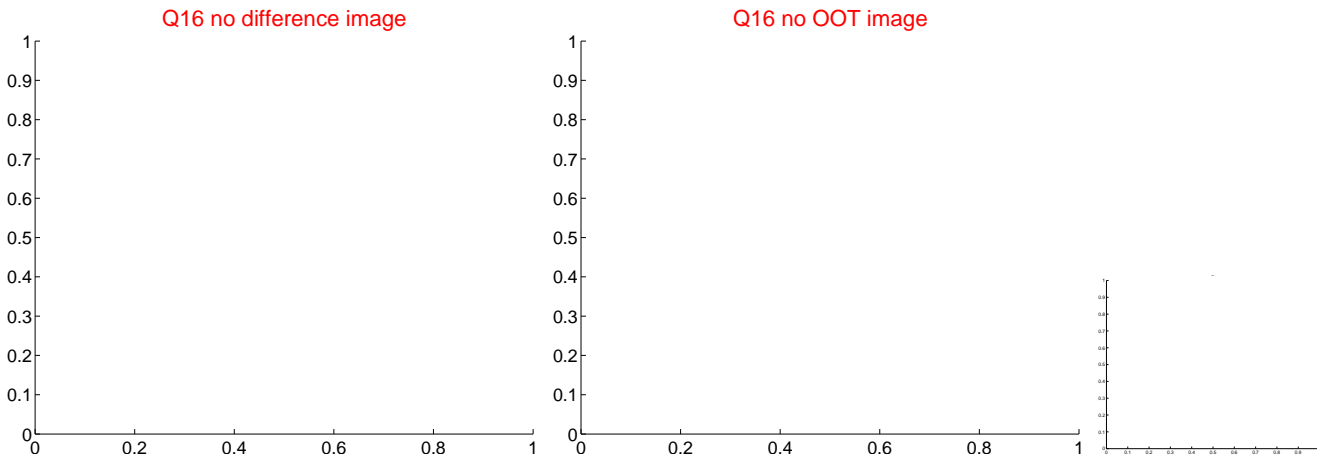
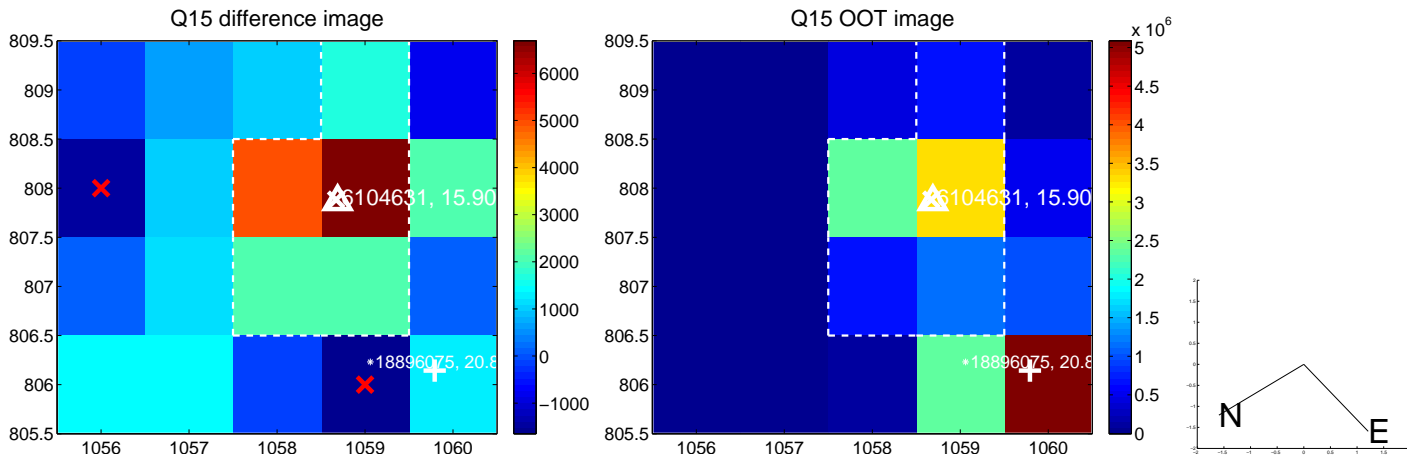
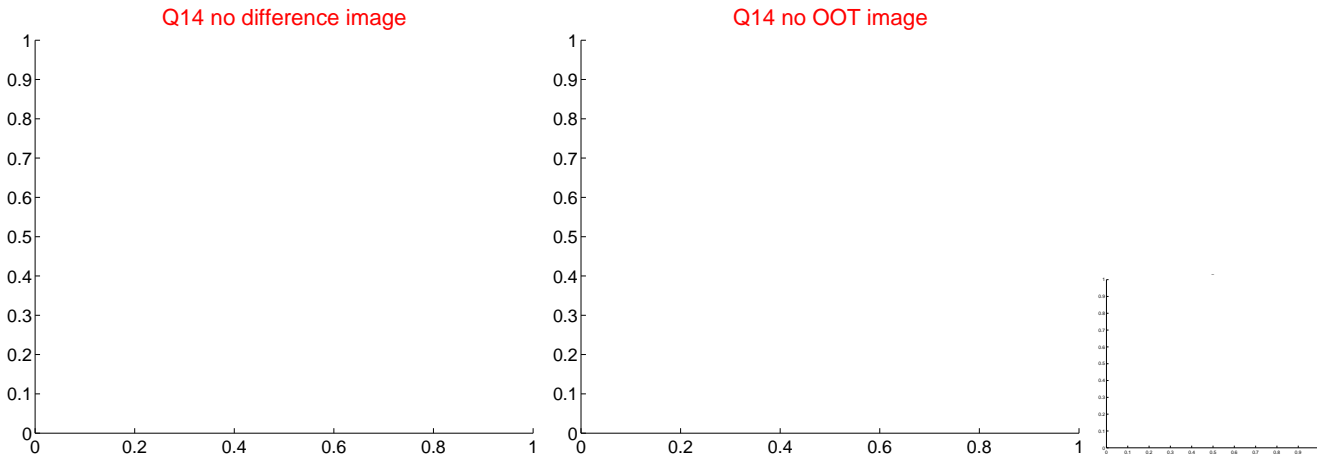
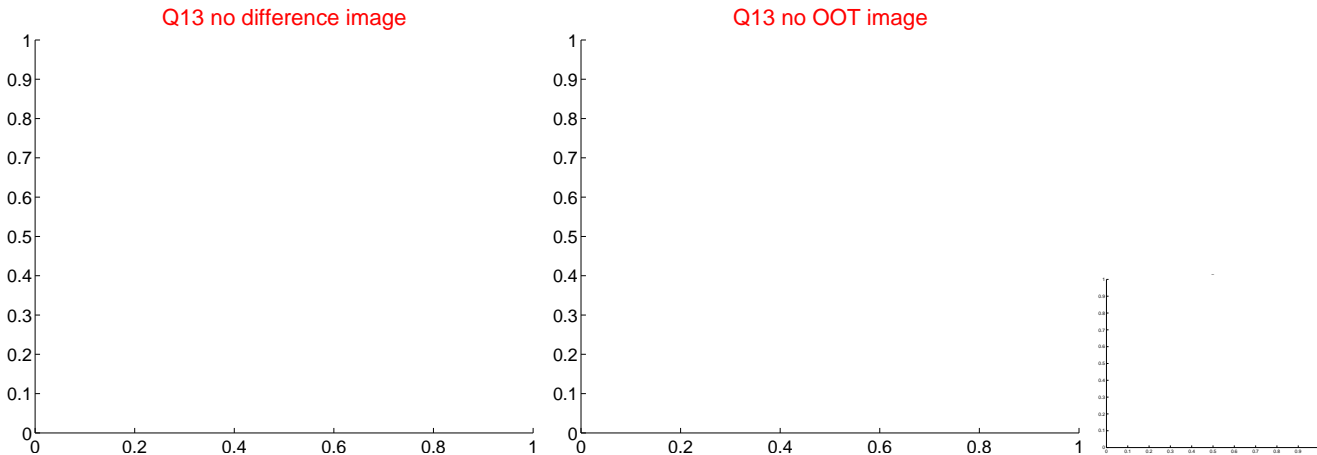
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



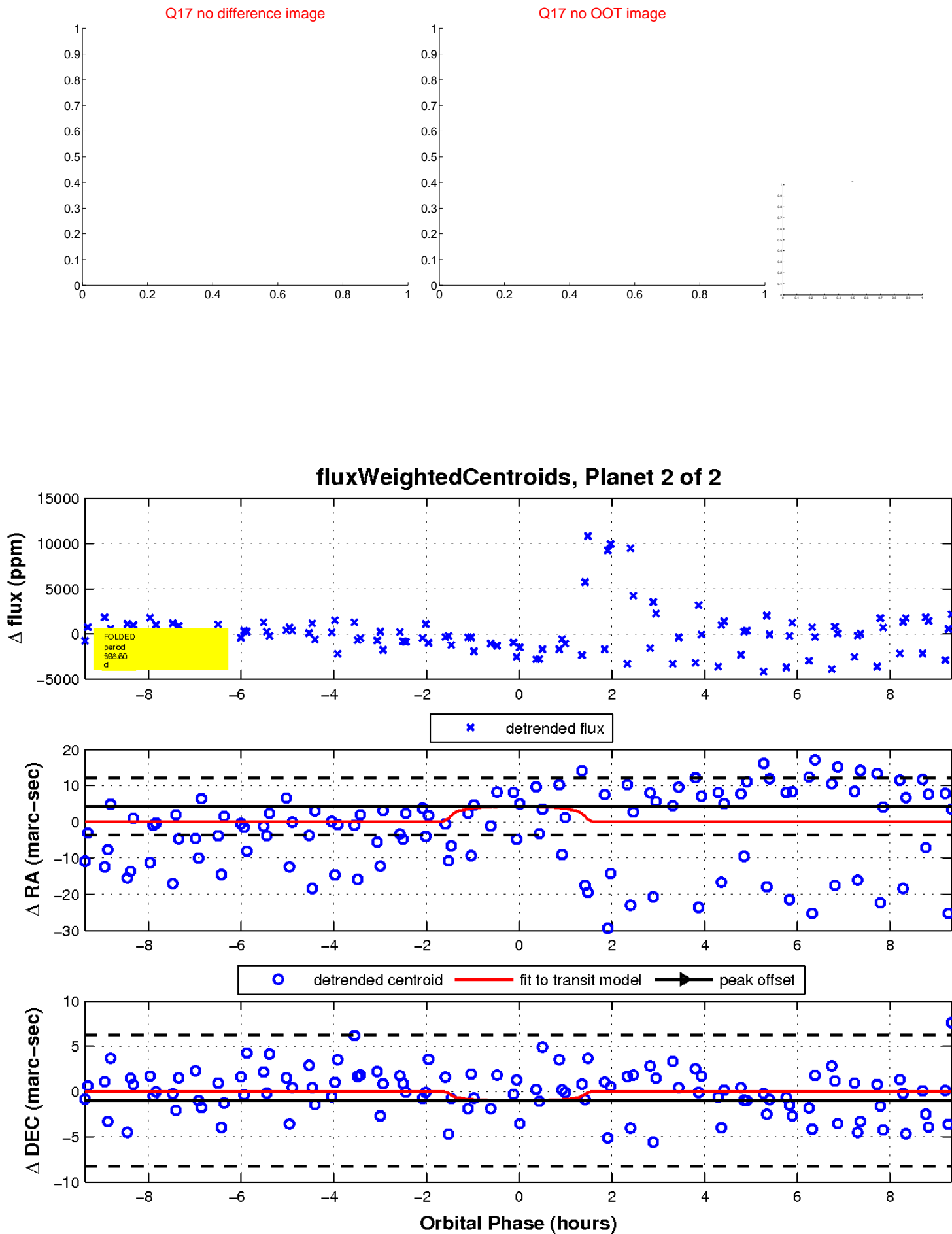
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



# UKIRT Image

Declination

