

# KIC 006421480

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
006421480-01	OBS	No	331.882517	393.764037	216.8	1.822	16.2	3.5	1.04	5940	1.83	1.37
006421480-02	OBS	No	321.824752	423.453143	282.0	5.072	10.1	6.7	1.04	5940	1.92	1.43

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
006421480-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_SKYE_TRACKER—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV— INCONSISTENT_TRANS—CENT_FEW_DIFFS
006421480-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—ALL_TRANS_CHASES—MOD_TER_DV—MOD_POS_DV

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

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

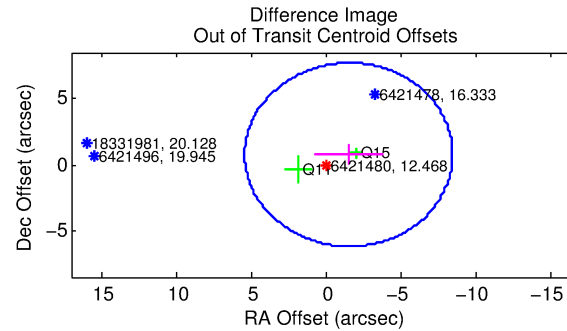
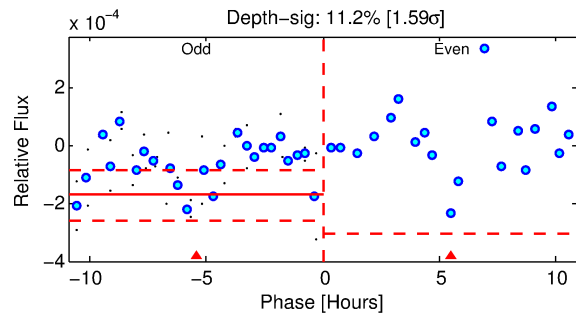
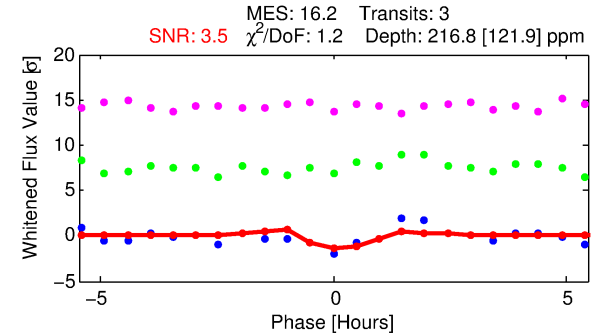
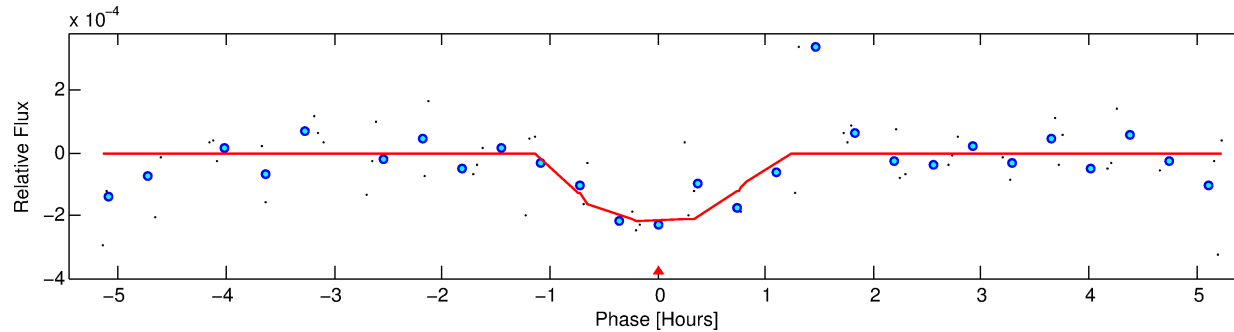
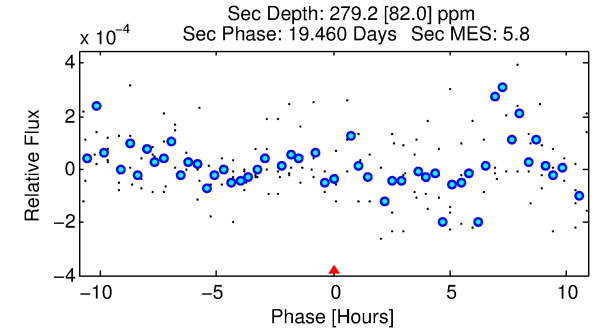
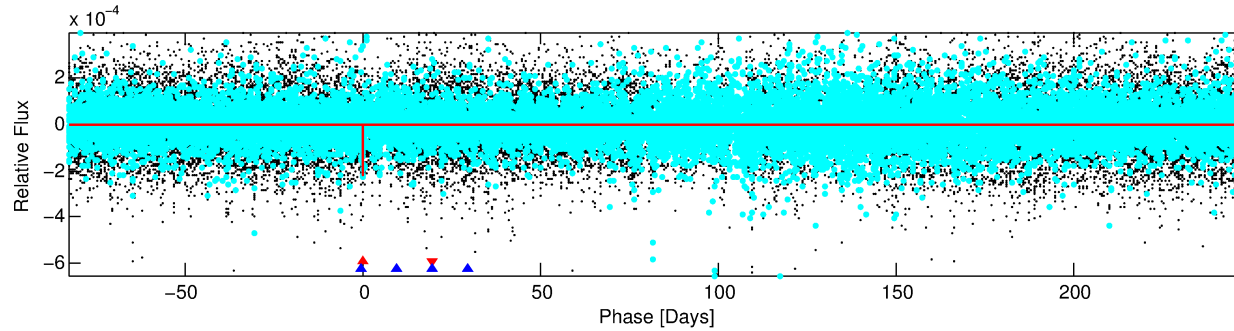
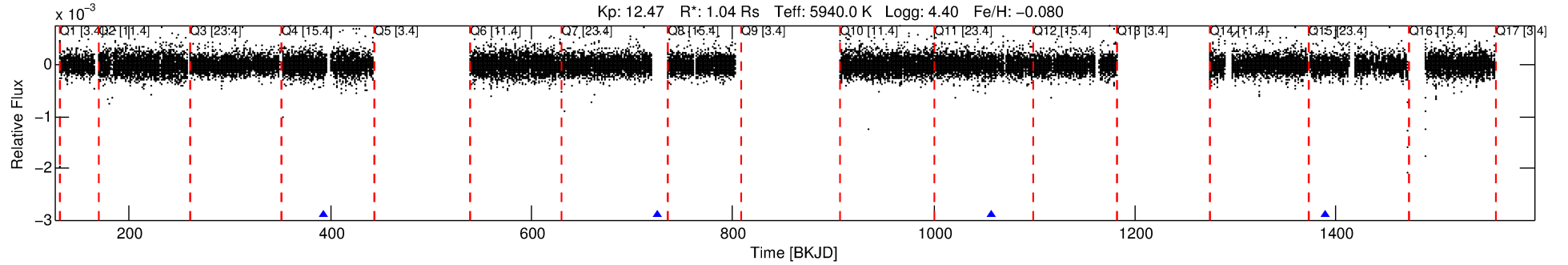
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 006421480-01

No Significant Match Found

# DV One-Page Summary

KIC: 6421480 Candidate: 1 of 2 Period: 331.883 d



## DV Fit Results:

Period = 331.88252 [0.00531] d  
Epoch = 393.7640 [0.0099] BKJD  
Rp/R\* = 0.0162 [0.1098]  
a/R\* = 634.29 [2190.40]  
b = 0.91 [6.81]  
Seff = 1.37 [0.52]  
Teq = 276 [26] K  
Rp = 1.83 [12.45] Re  
a = 0.9372 [0.2310] AU  
Ag = 40186.70 [546080.62] [0.07σ]  
Teffp = 6037 [20503] K [0.28σ]

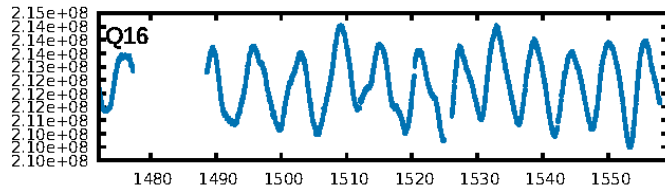
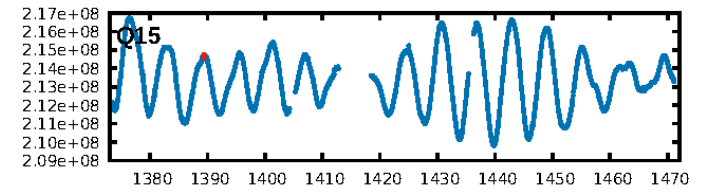
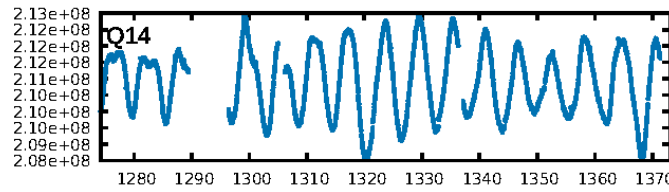
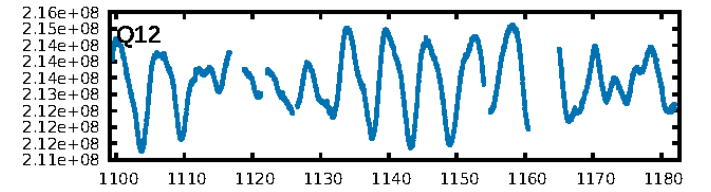
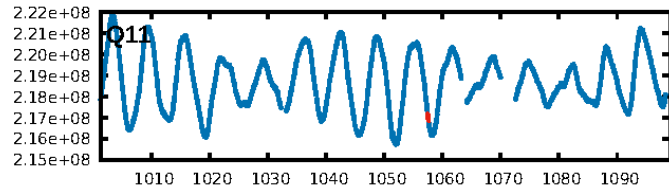
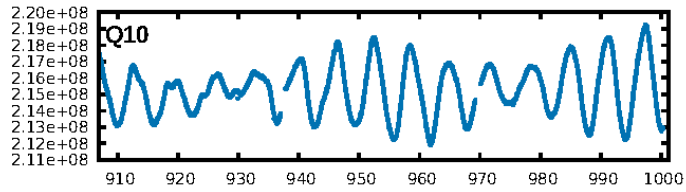
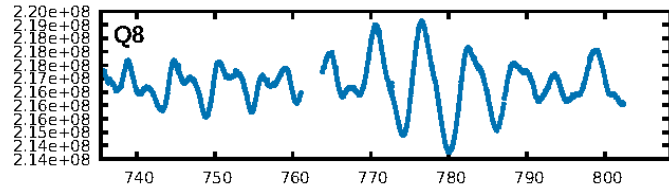
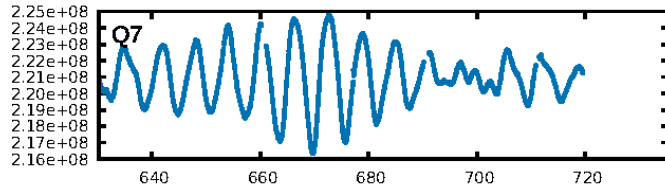
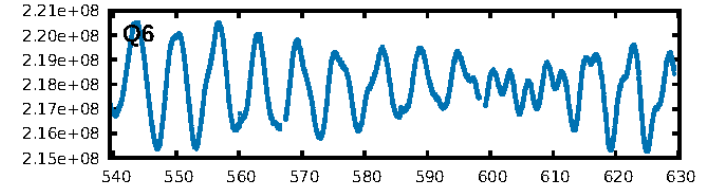
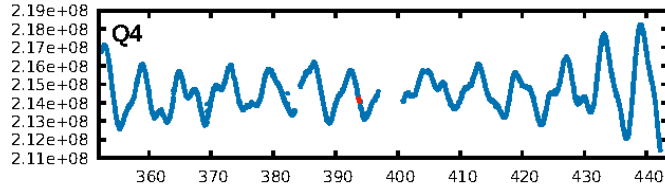
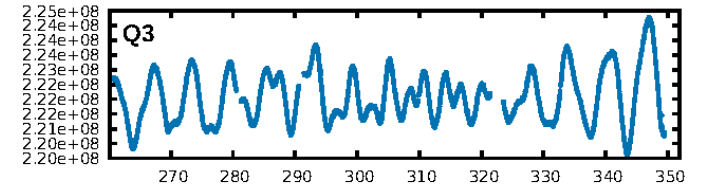
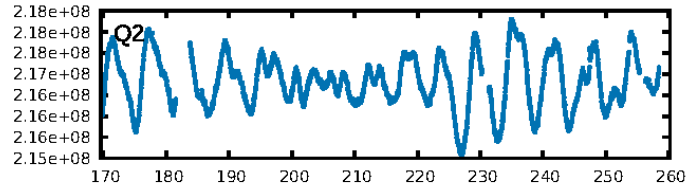
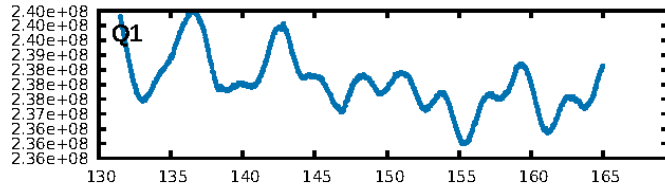
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [44.79σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 2.5%  
ModelChiSquareGof-sig: 66.2%  
Bootstrap-pfa: 5.63e-17  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: 0.6961  
Centroid-sig: 81.2%  
Centroid-so: 1.061 arcsec [0.43σ]  
OotOffset-rm: 1.724 arcsec [0.74σ]  
KicOffset-rm: 1.720 arcsec [1.06σ]  
OotOffset-st: 0/2/0/0 [2]  
KicOffset-st: 0/2/0/0 [2]  
DiffImageQuality-fgm: 0.50 [1/2]  
DiffImageOverlap-fno: 1.00 [3/3]

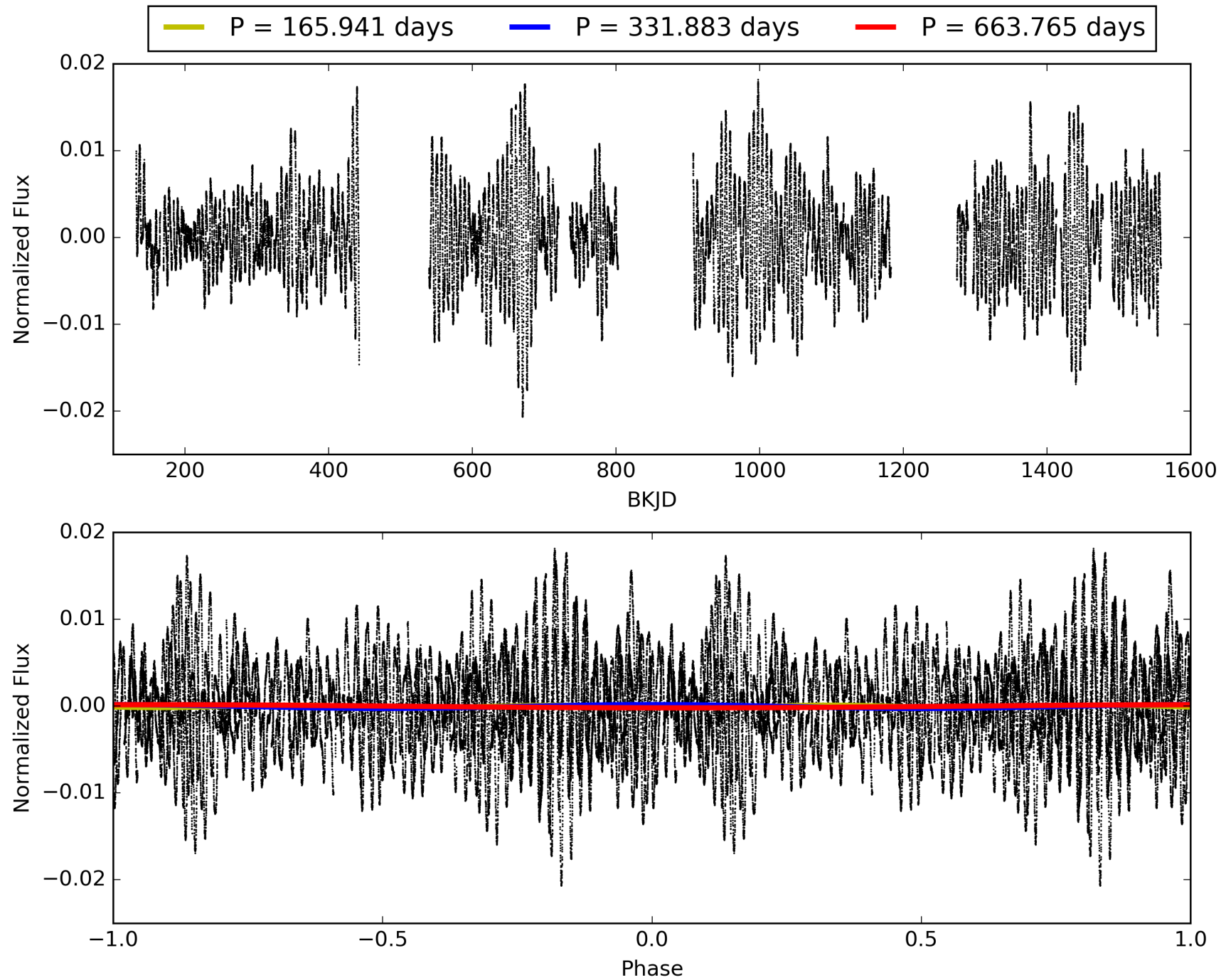
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 04:59:59 Z

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

# TCE 006421480-01, PDC Light Curves

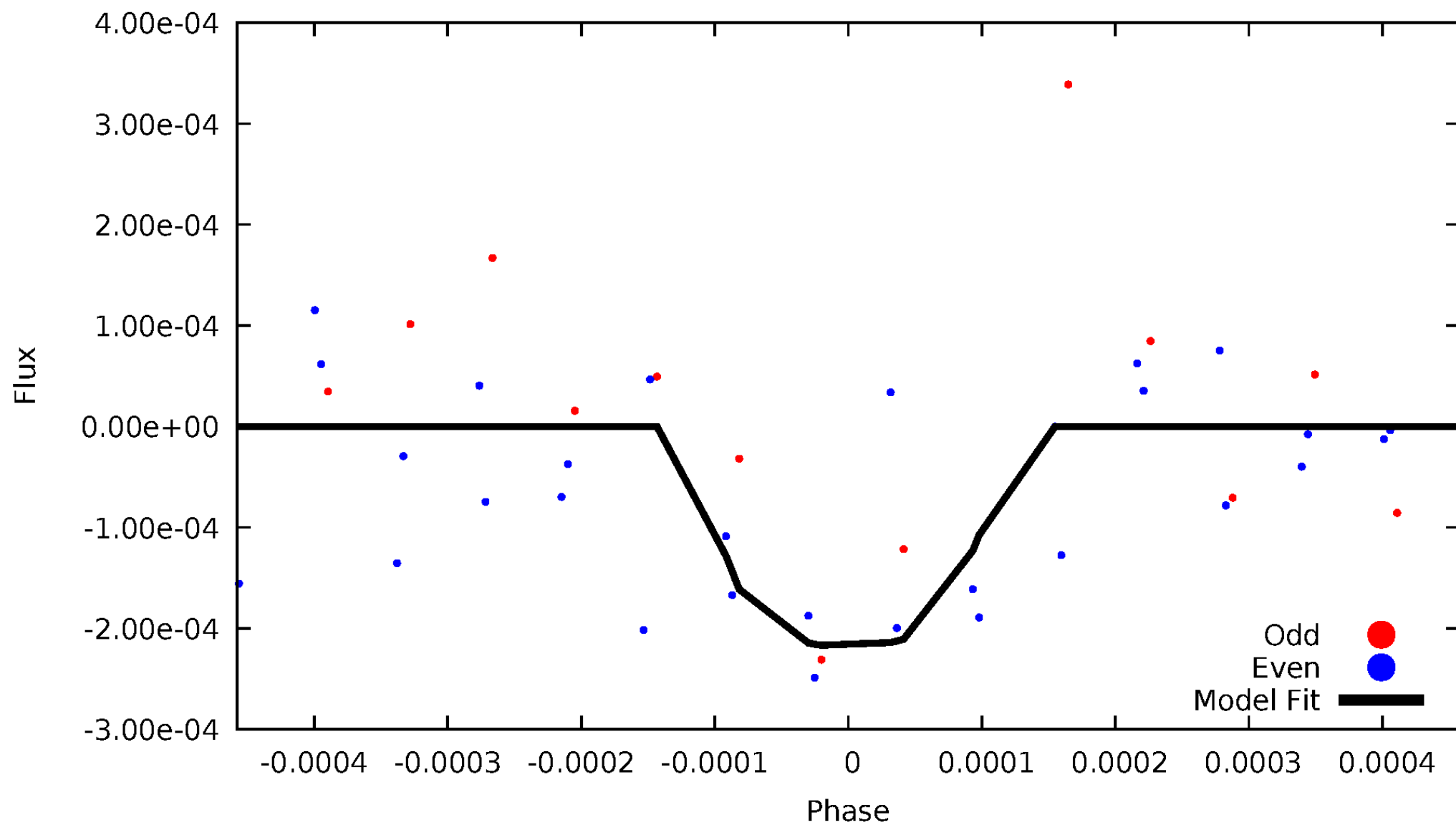


TCE 006421480-01



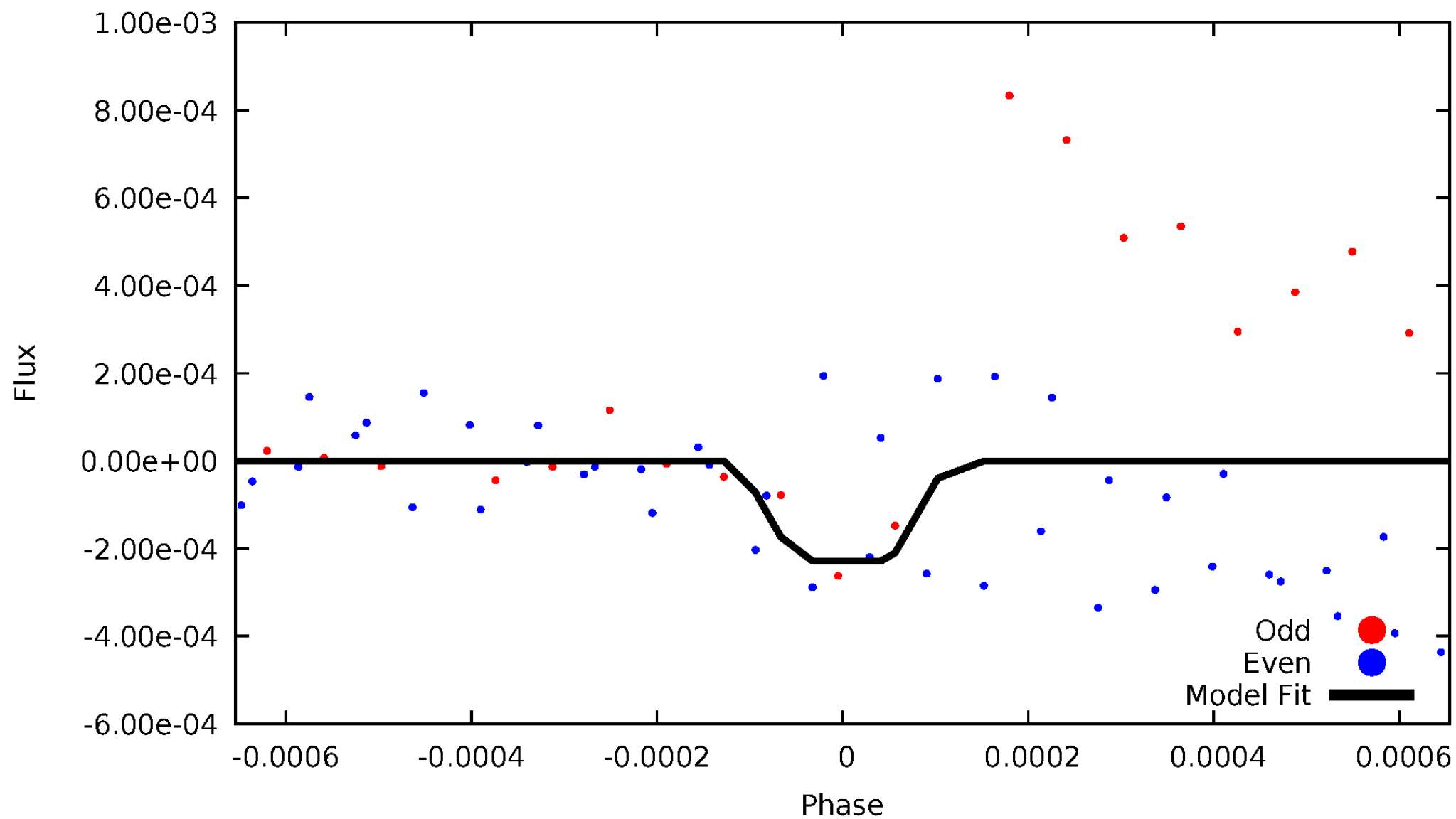
# DV Odd/Even

TCE 006421480-01



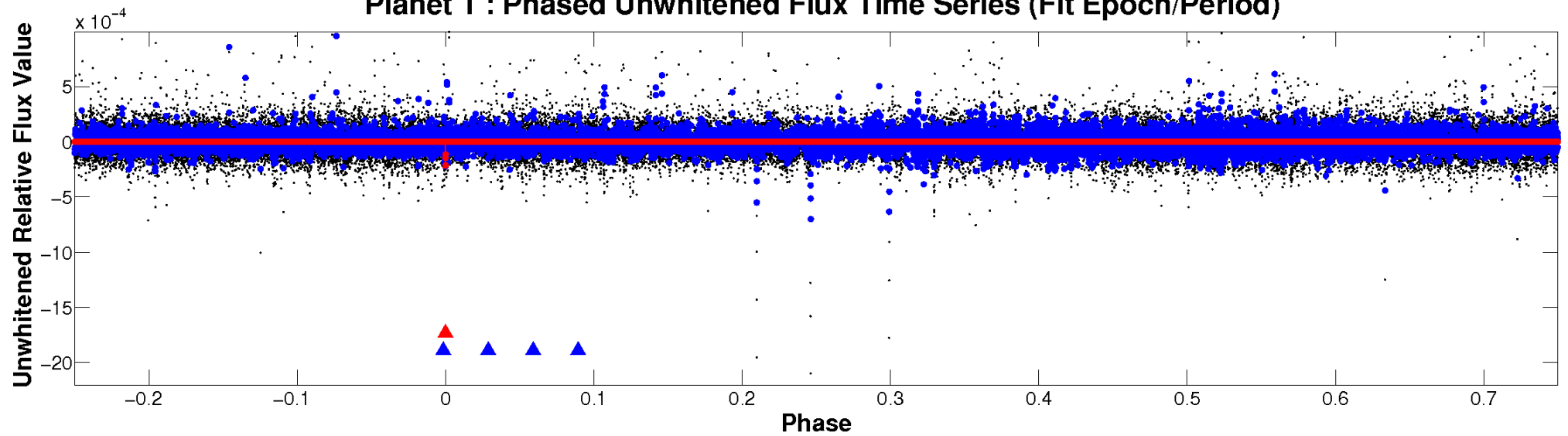
# ALT Odd/Even

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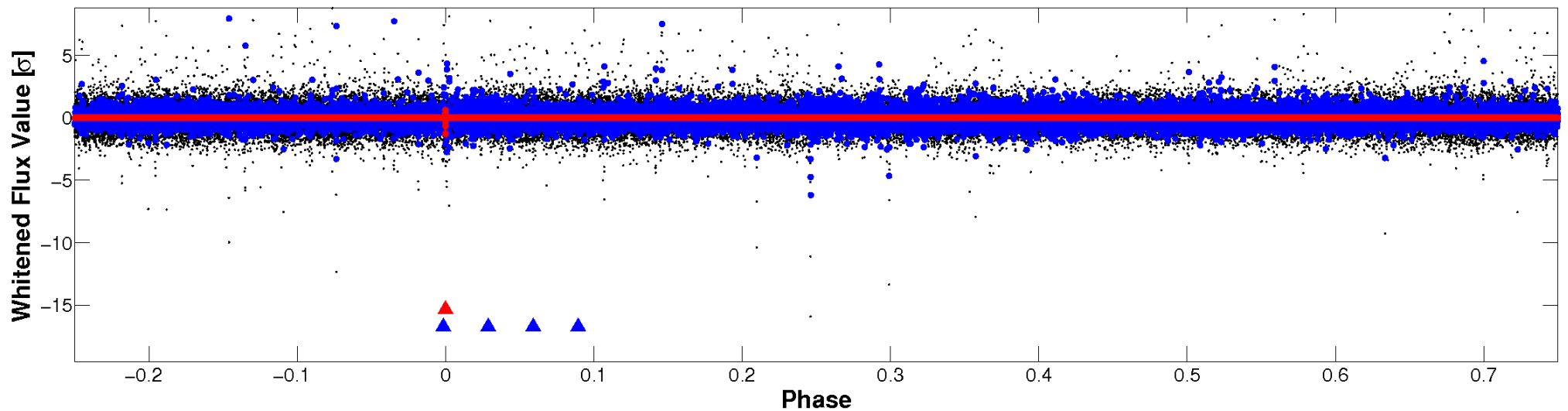


# Non-Whitened Vs. Whitened Light Curve

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

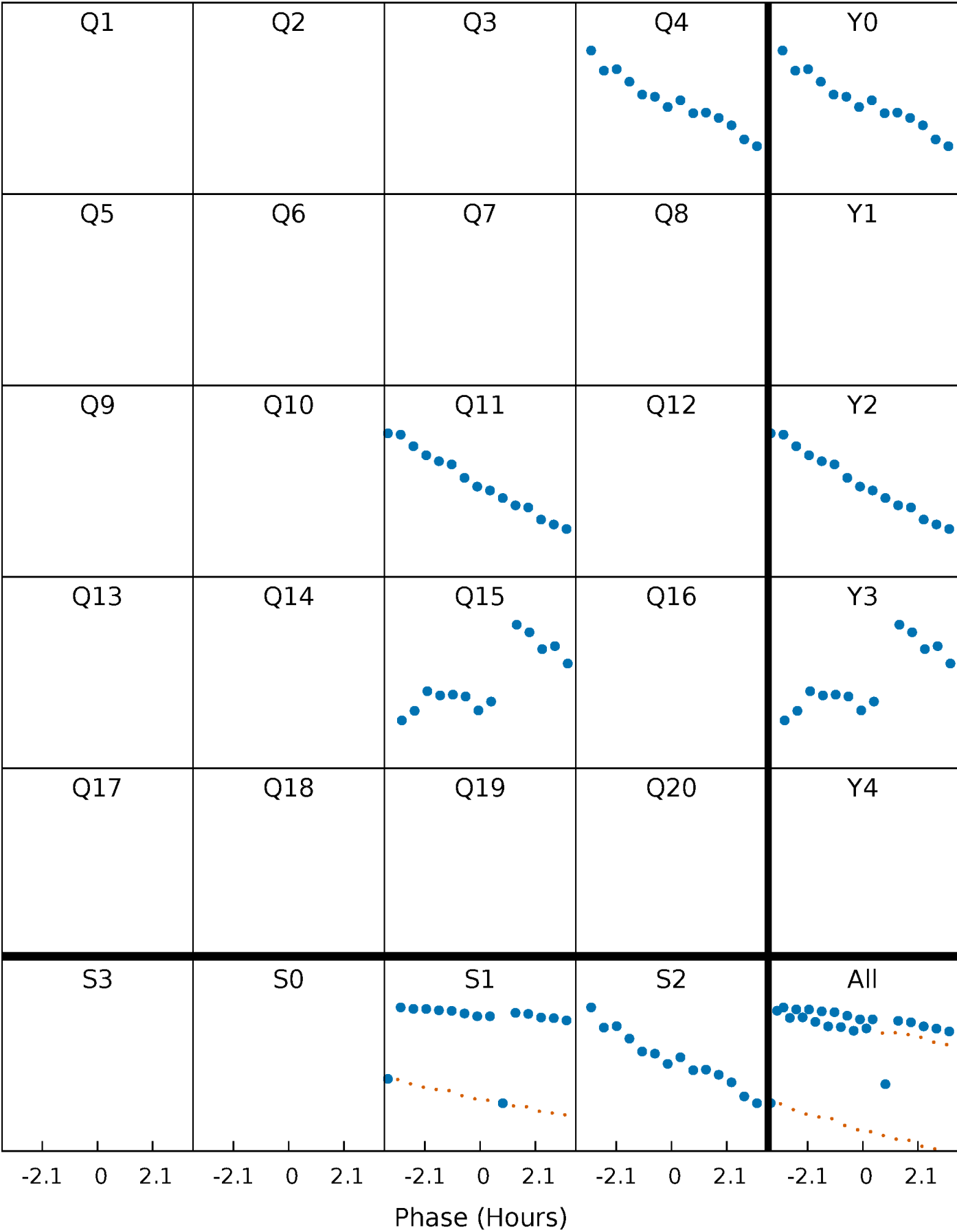


Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)



PDC Quarter-Phased Transit Curves

TCE 006421480-01    P=331.882517 Days    T<sub>0</sub>=393.764037 (BKJD)





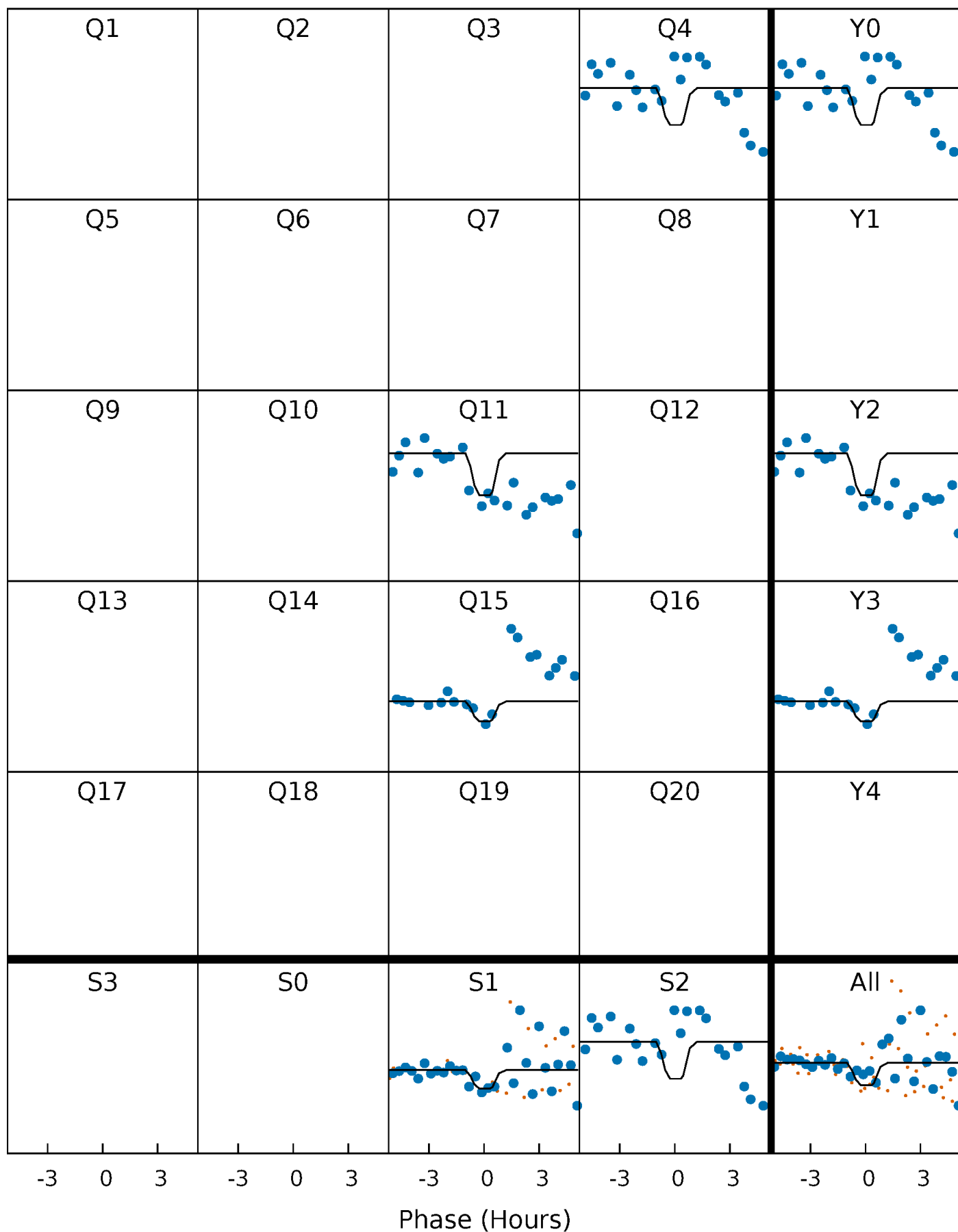
# DV Quarter-Phased Transit Curves

TCE 006421480-01 P=331.882517 Days  $T_0=393.764037$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

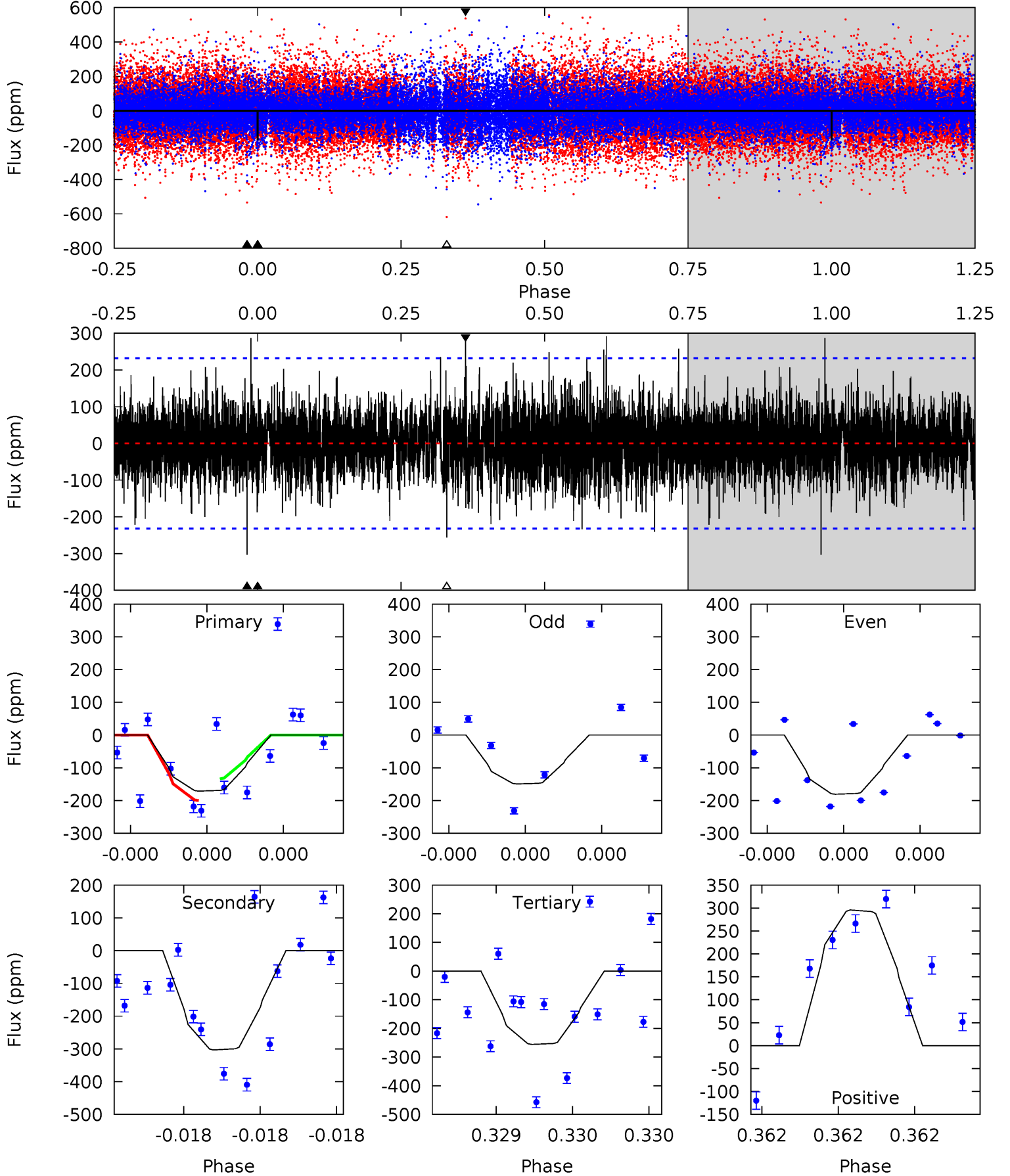
TCE 006421480-01 P=331.875070 Days  $T_0=393.781293$  (BKJD)



# DV Model-Shift Uniqueness Test

006421480-01, P = 331.882517 Days, E = 61.881520 Days

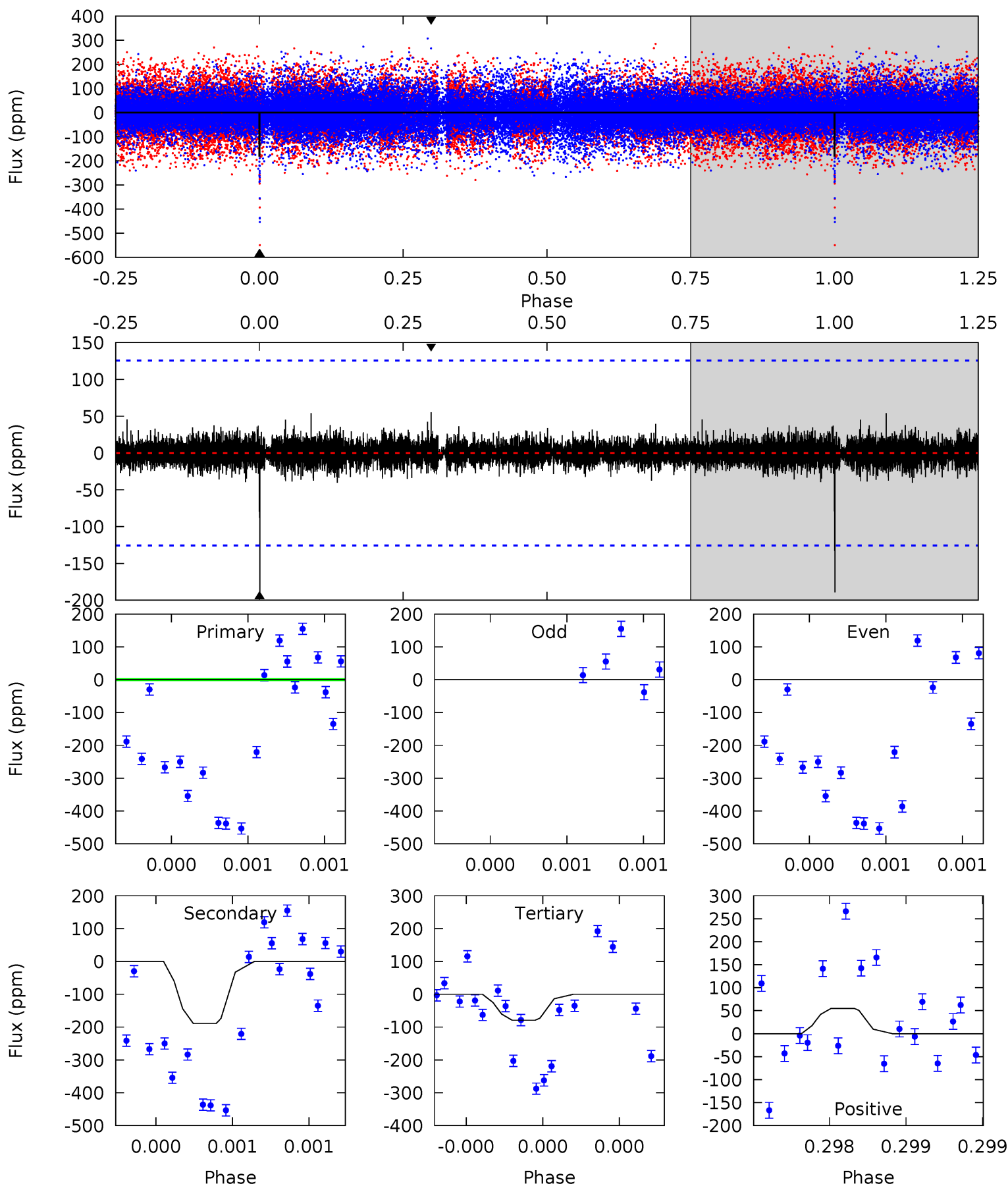
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
4.24	7.52	6.34	7.33	5.74	3.74	1.37	-2.10	-3.09	1.18	0.19	0.37	1.14	0.49	0.83



# Alt Model-Shift Uniqueness Test

006421480-01,  $P = 331.875070$  Days,  $E = 61.906223$  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
8.22	8.57	3.59	2.50	5.70	3.67	0.43	4.63	5.72	4.98	6.07	0.28	0.68	0.23	2.77



### Stellar Parameters For KIC 006421480

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5940^{+140}_{-176}$	$4.404^{+0.090}_{-0.195}$	$-0.080^{+0.300}_{-0.300}$	$1.038^{+0.305}_{-0.131}$	$0.997^{+0.140}_{-0.115}$	$1.256^{+0.581}_{-0.638}$
	+2%/-3%	+2%/-4%	+375%/-375%	+29%/-13%	+14%/-12%	+46%/-51%
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 006421480-01 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-303 \pm 40$	$9.45^{+9.80}_{-6.65}$	$390^{+29}_{-19}$	$3318^{+1857}_{-606}$	$1623^{+16985}_{-1222}$
Alt.	$-189 \pm 22$	$9.48^{+9.73}_{-6.26}$	$389^{+28}_{-18}$	$3074^{+1290}_{-514}$	$1020^{+7764}_{-770}$

$T_{max}$  = 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

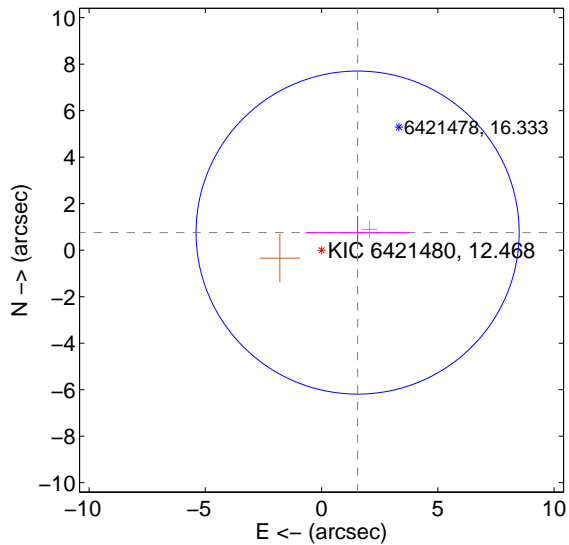
Supplemental centroid analysis for 006421480-01. Kepler magnitude: 12.47. Transit SNR 3.52

There are 1 quarters with good PRF difference image offsets

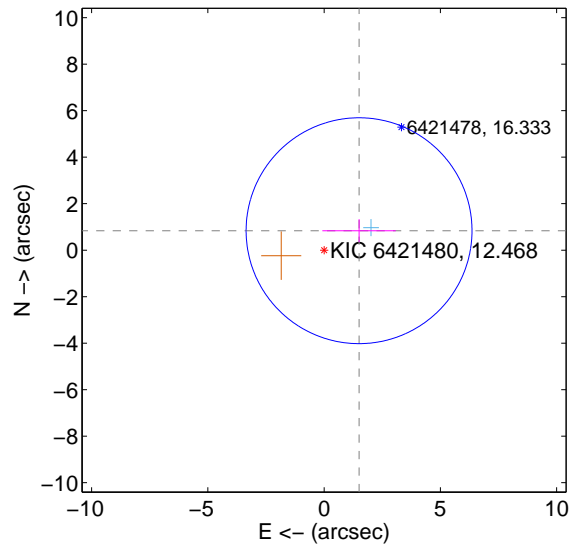
The direct PRF centroid is offset from the target star catalog position by about 0.09 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.724 \pm 2.316$	0.74	$-1.549 \pm 2.229$	$0.756 \pm 0.716$
PRF-fit source offset from KIC position	$1.720 \pm 1.619$	1.06	$-1.503 \pm 1.579$	$0.837 \pm 0.497$
photometric centroid source offset	$1.06 \pm 2.45$	0.43	$-1.06 \pm 2.45$	$-0.00 \pm 2.35$

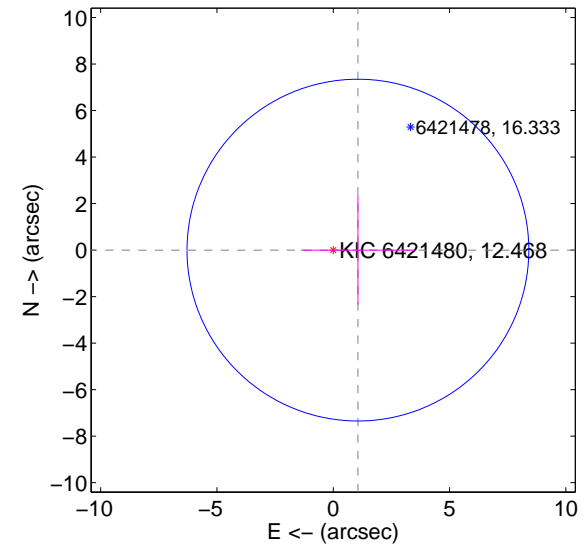
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

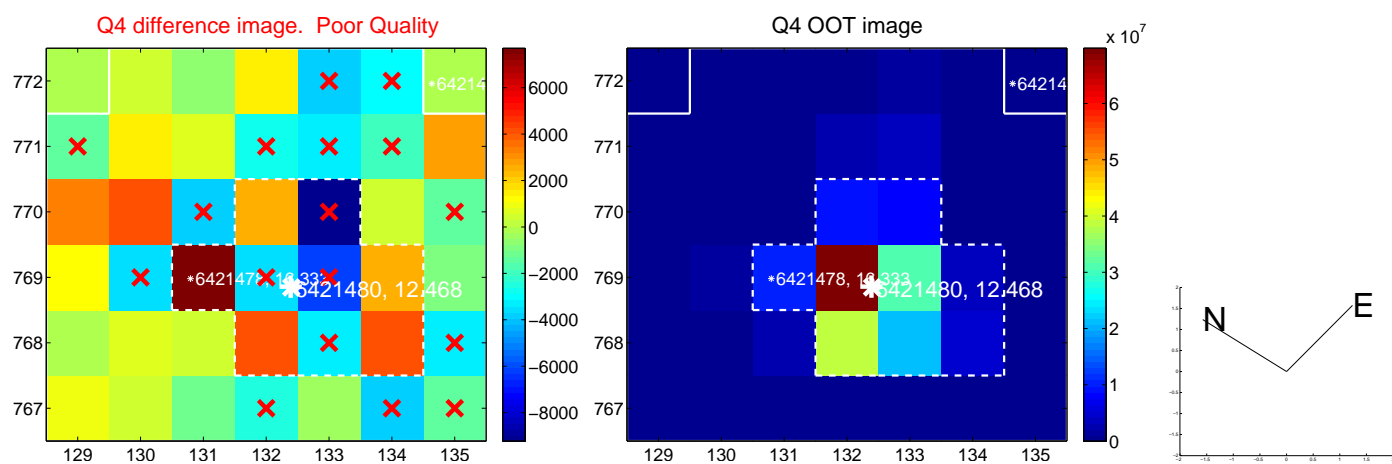
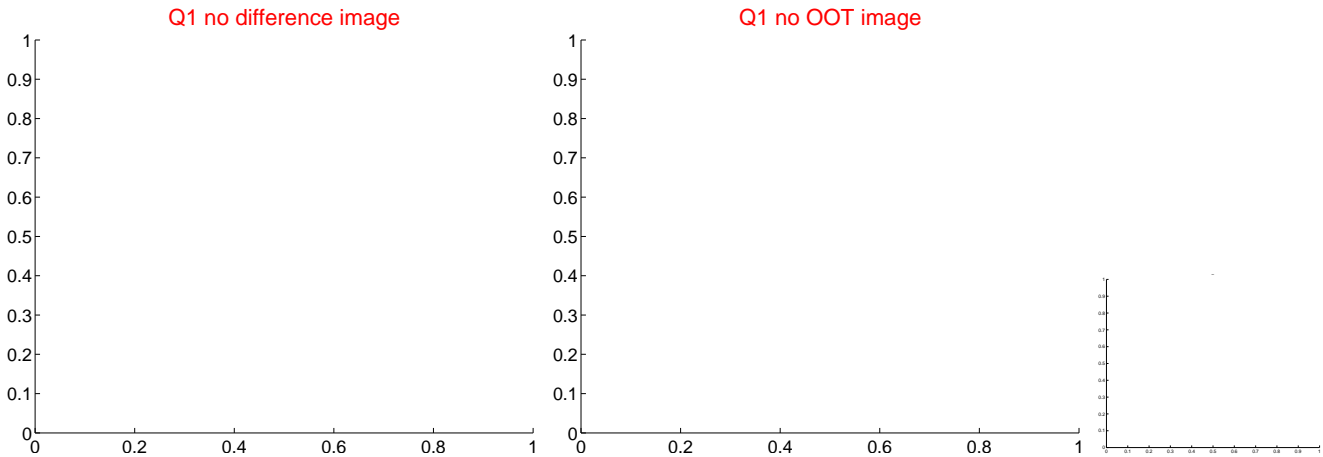


offset from photometric centroids



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

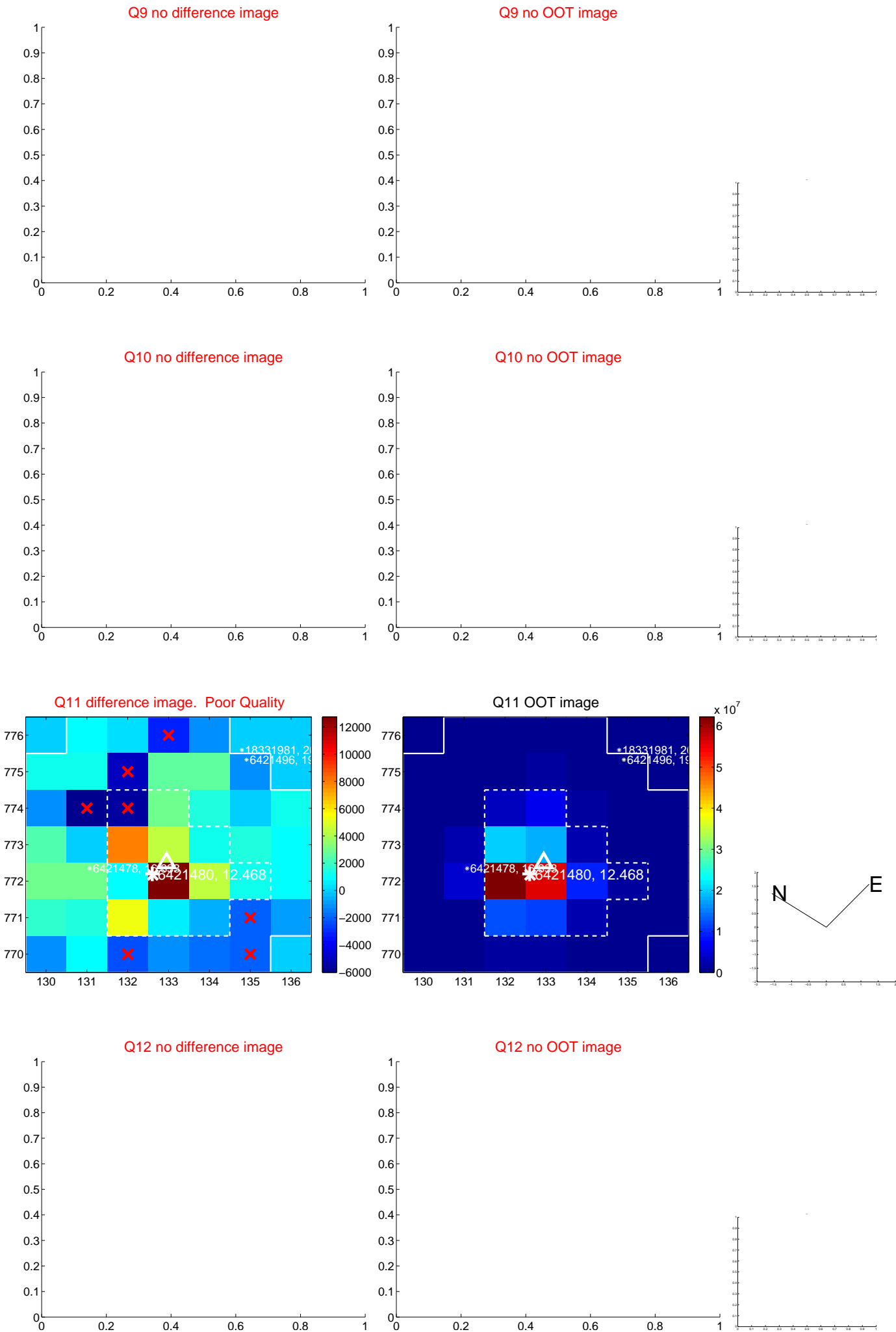


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

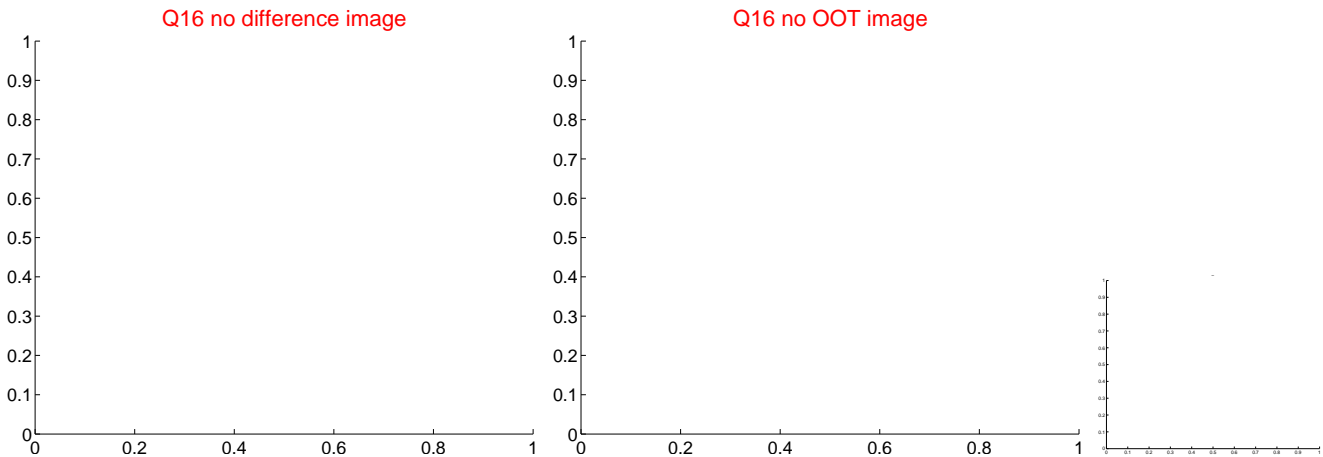
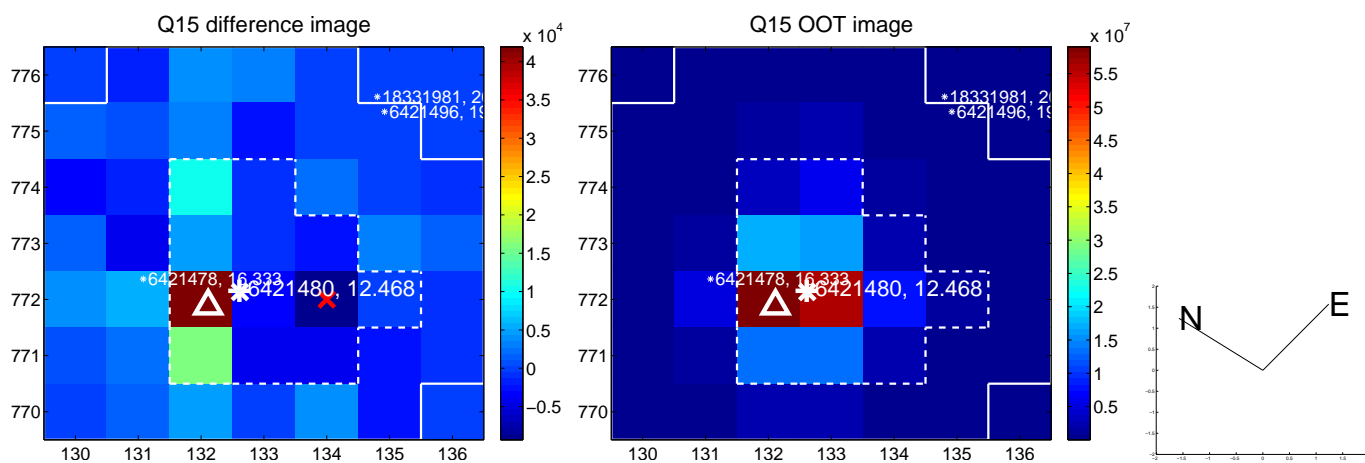
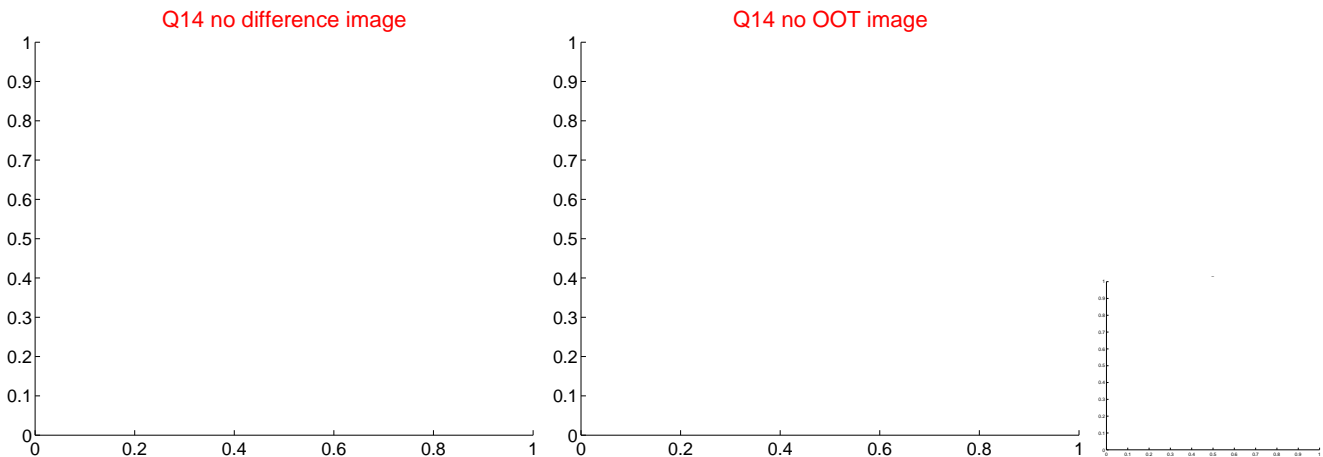




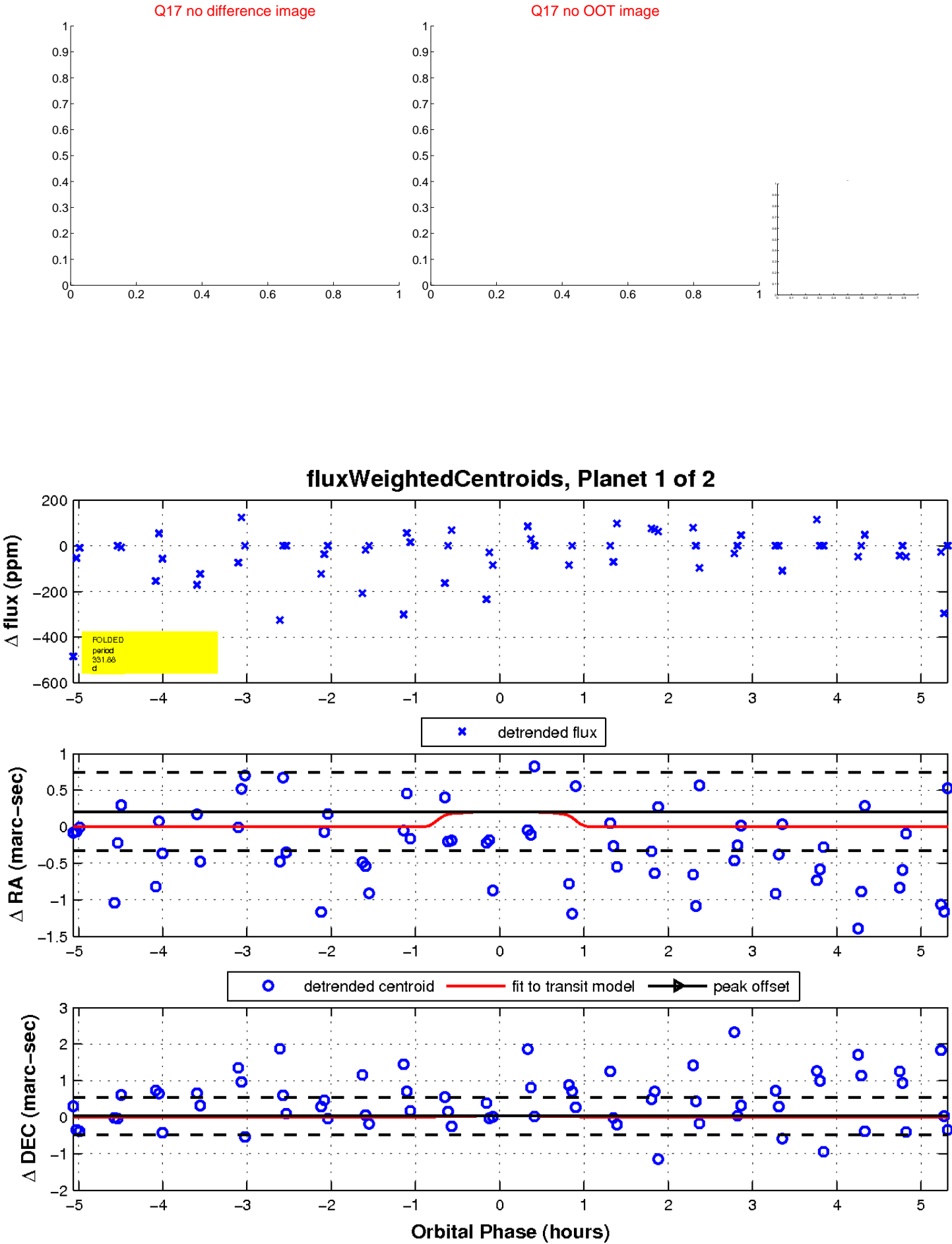
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

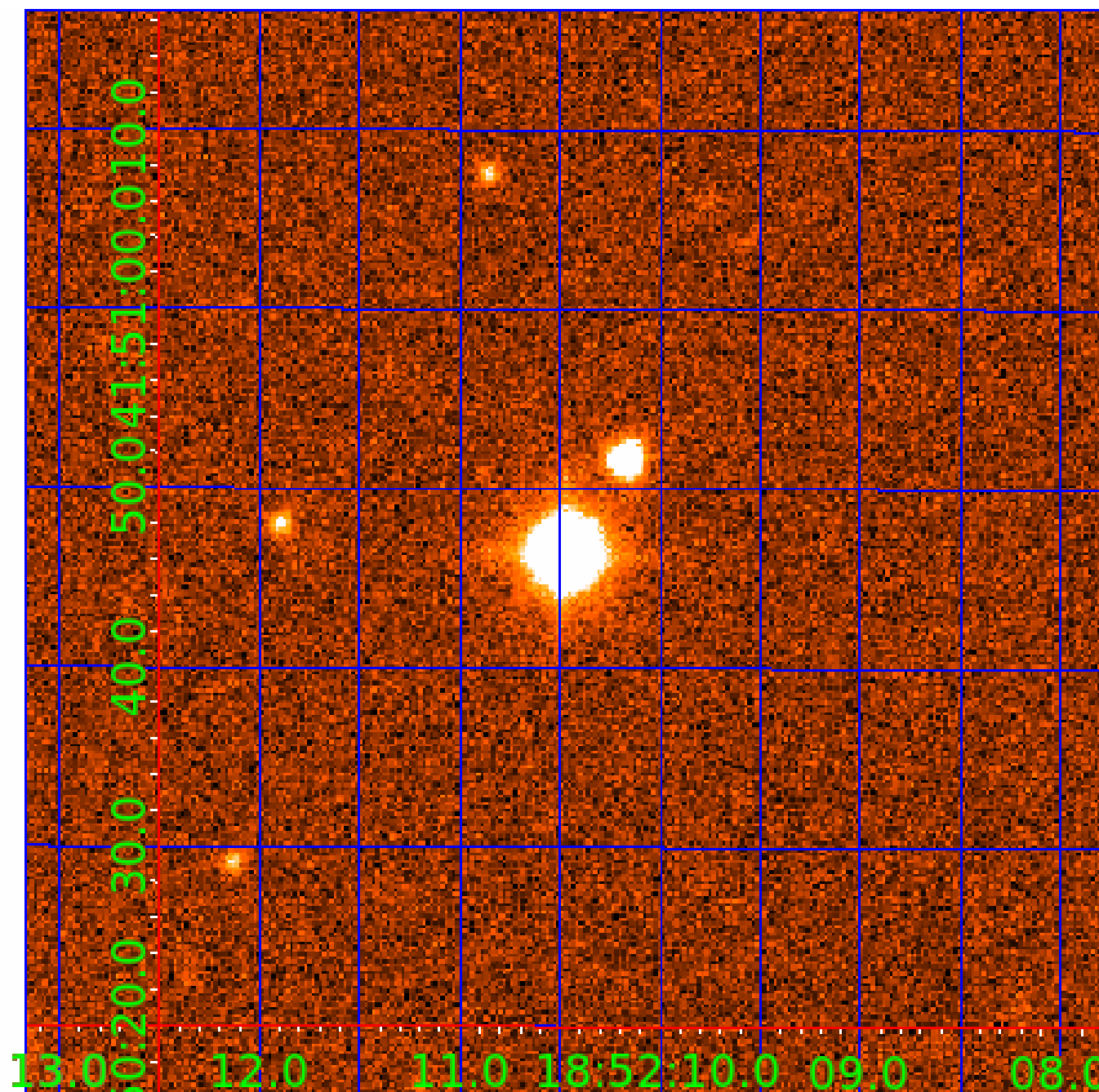


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 006421480

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
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006421480-02	OBS	No	321.824752	423.453143	282.0	5.072	10.1	6.7	1.04	5940	1.92	1.43

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006421480-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—ALL_TRANS_CHASES—MOD_TER_DV—MOD_POS_DV

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

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

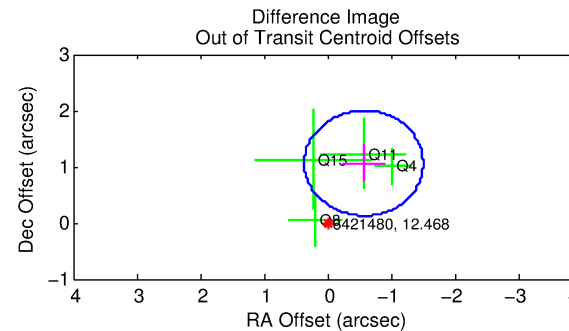
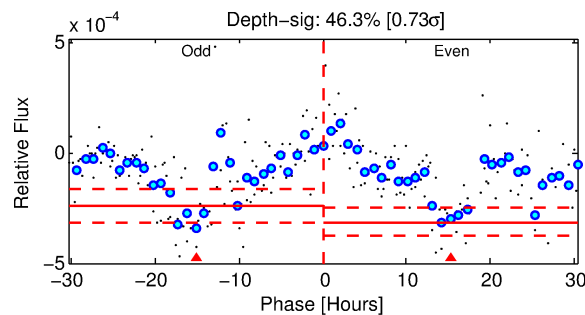
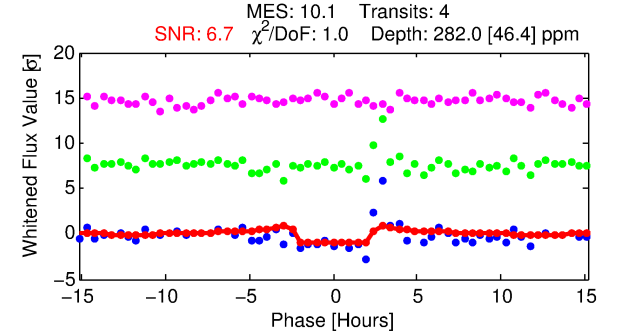
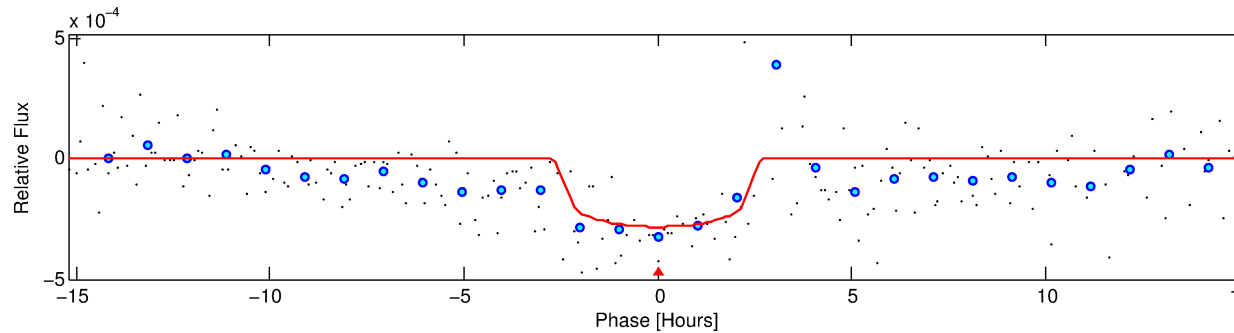
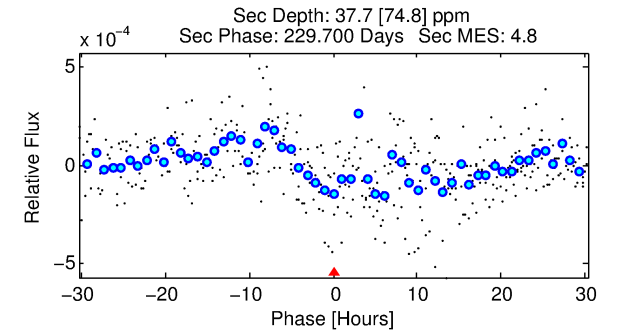
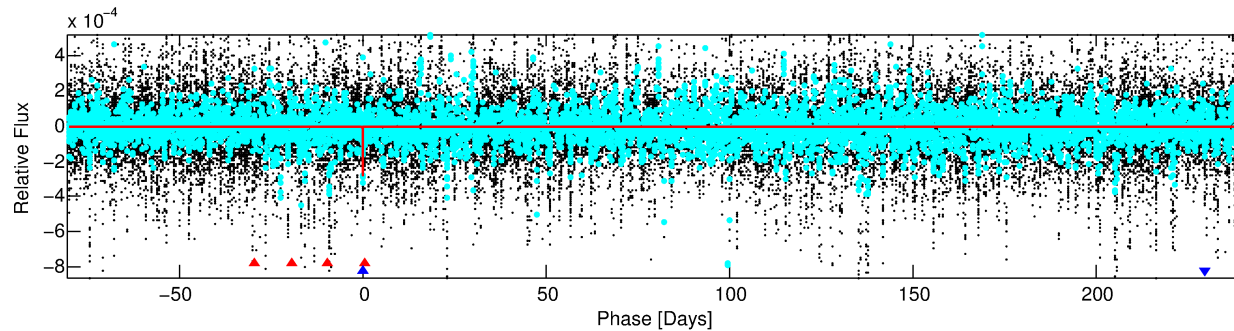
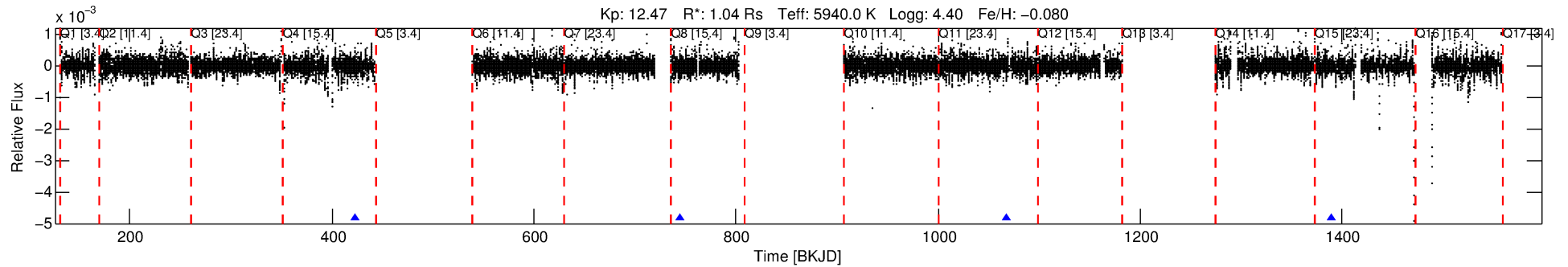
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 006421480-02

No Significant Match Found

# DV One-Page Summary

KIC: 6421480 Candidate: 2 of 2 Period: 321.825 d



## DV Fit Results:

Period = 321.82475 [0.00464] d  
Epoch = 423.4531 [0.0092] BKJD  
Rp/R\* = 0.0170 [0.0091]  
a/R\* = 312.01 [774.27]  
b = 0.79 [1.21]  
Seff = 1.43 [0.54]  
Teq = 279 [26] K  
Rp = 1.92 [1.17] Re  
a = 0.9181 [0.2263] AU  
Ag = 4736.77 [10807.87] [0.44σ]  
Teffp = 3574 [2016] K [1.63σ]

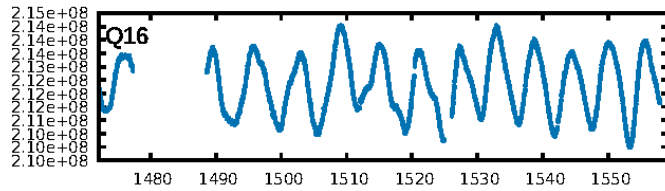
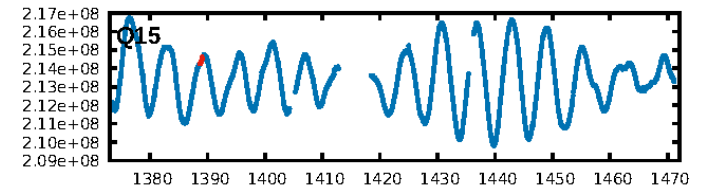
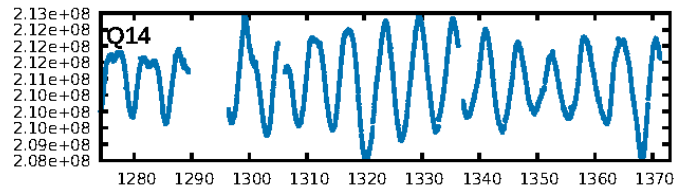
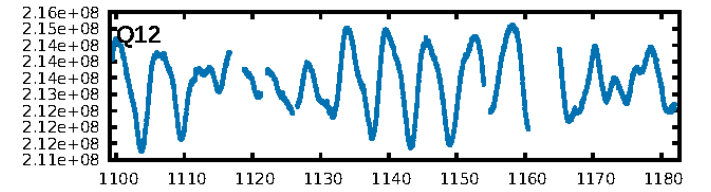
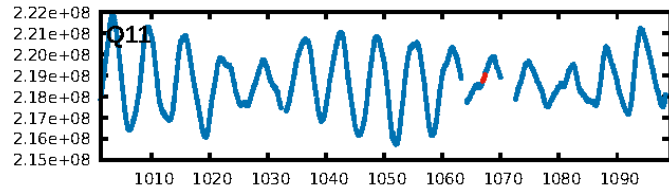
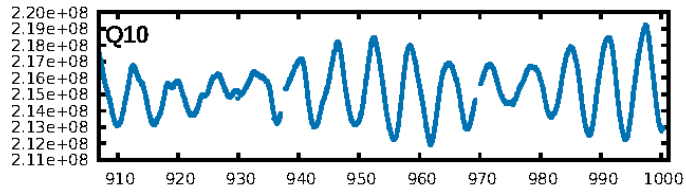
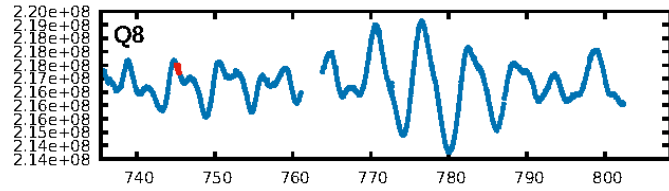
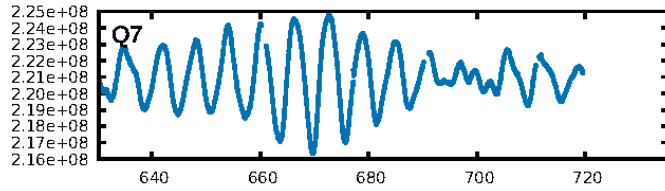
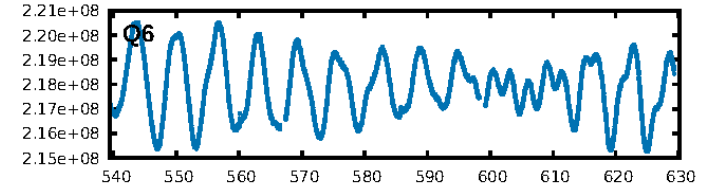
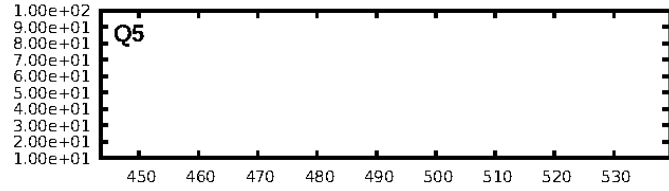
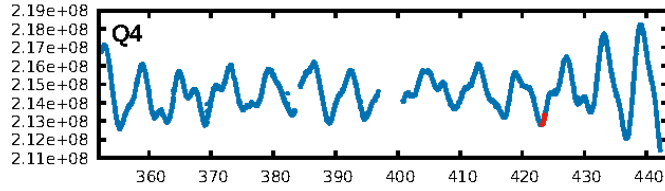
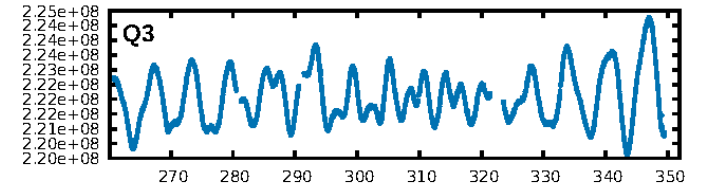
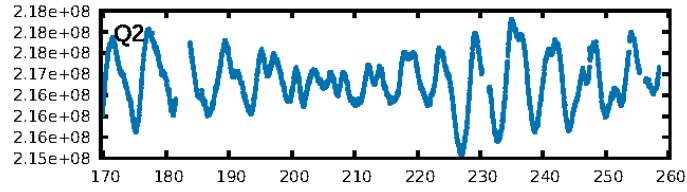
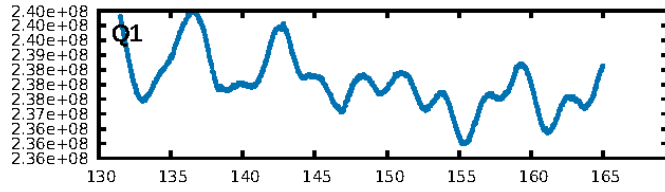
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [44.79σ]  
ModelChiSquare2-sig: 19.9%  
ModelChiSquareGof-sig: 94.7%  
**Bootstrap-pfa: 3.30e-09**  
RollingBand-fgt: 1.00 [4/4]  
GhostDiagnostic-chr: 0.6414  
Centroid-sig: 9.0%  
Centroid-so: 1.091 arcsec [1.00σ]  
**OotOffset-rm: 1.205 arcsec [3.86σ]**  
**KicOffset-rm: 1.263 arcsec [4.05σ]**  
OotOffset-st: 0/2/2/0 [4]  
KicOffset-st: 0/2/2/0 [4]  
DiffImageQuality-fgm: 1.00 [4/4]  
DiffImageOverlap-fno: 0.75 [3/4]

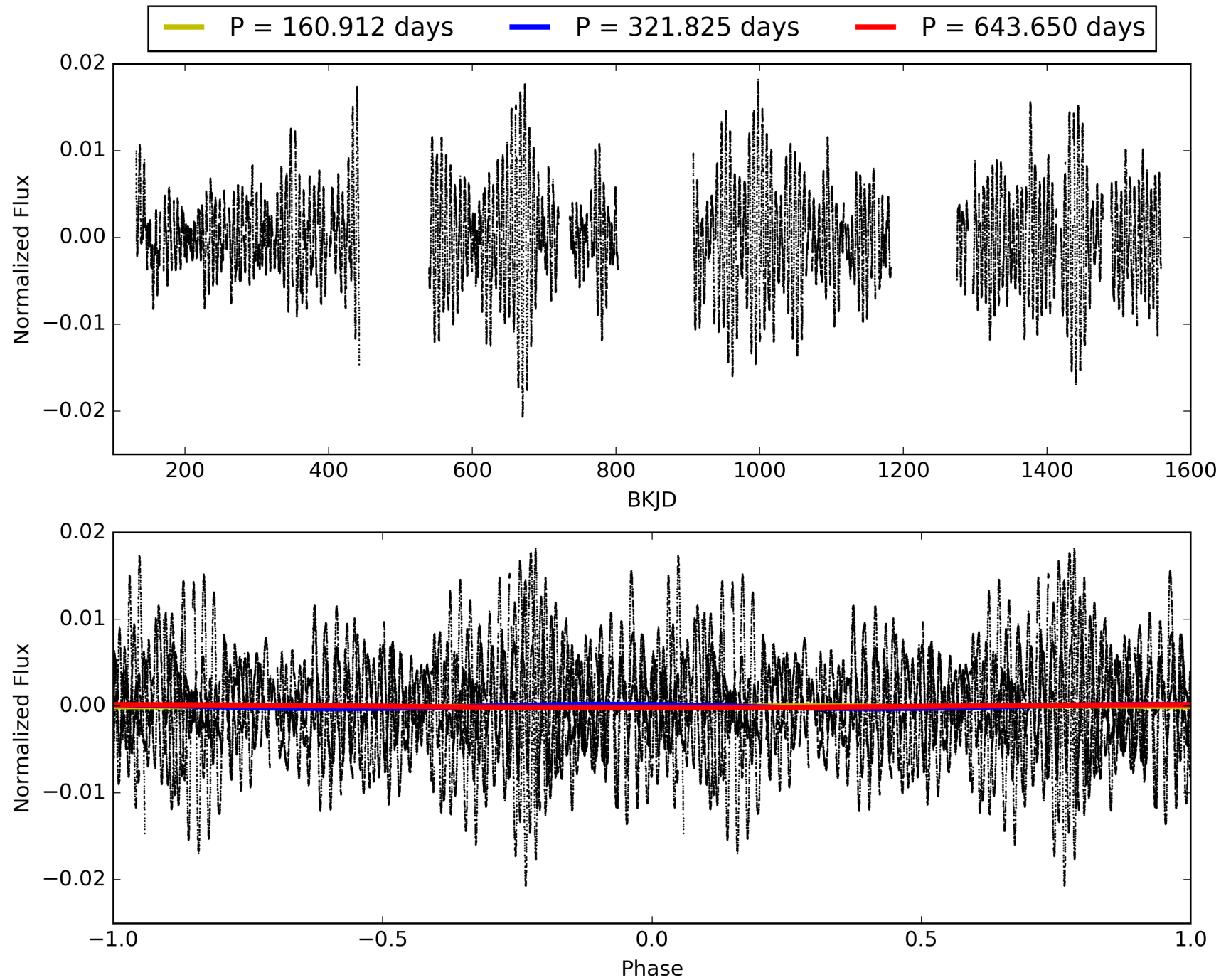
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 05:00:10 Z

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

# TCE 006421480-02, PDC Light Curves



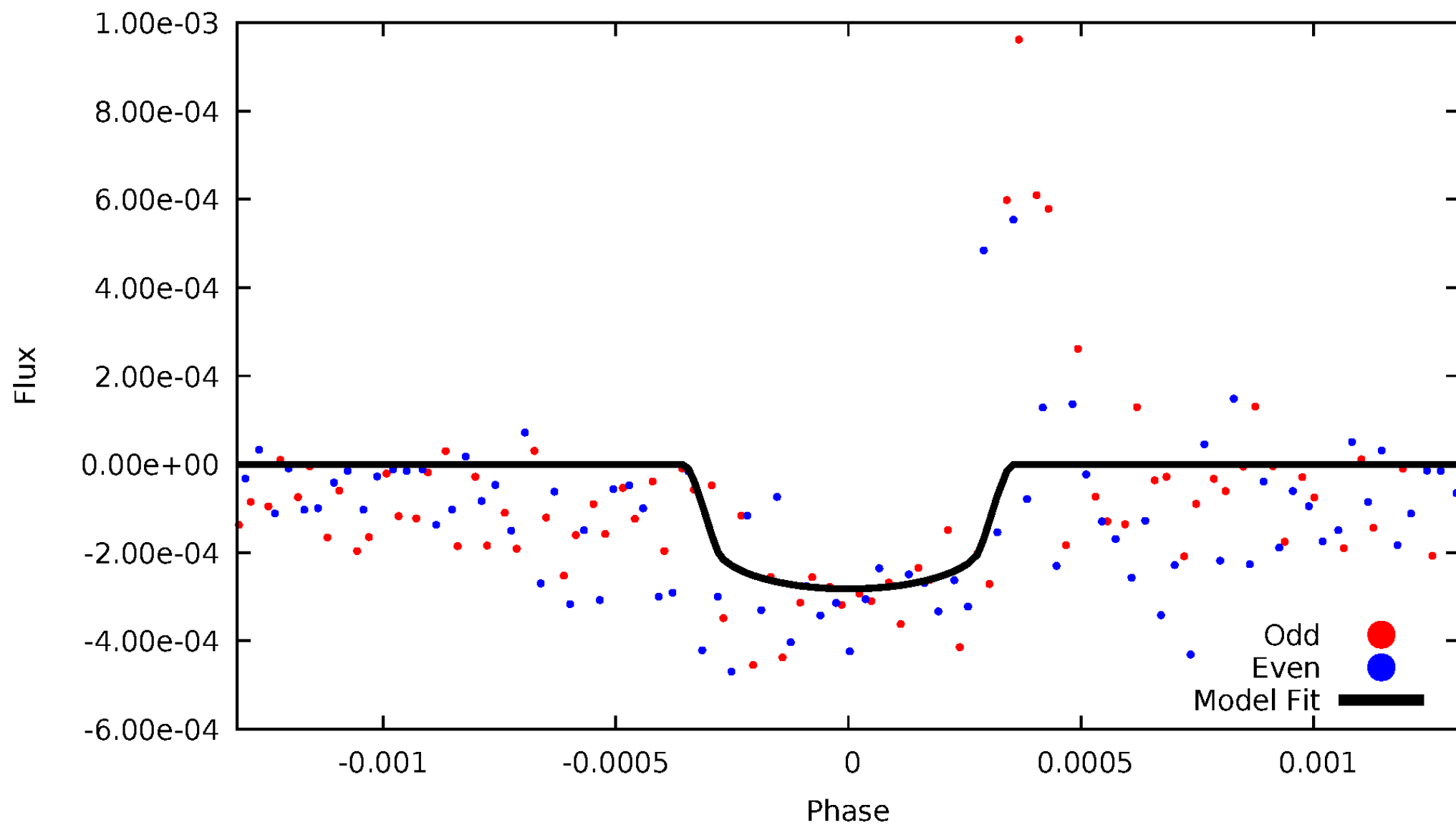
TCE 006421480-02





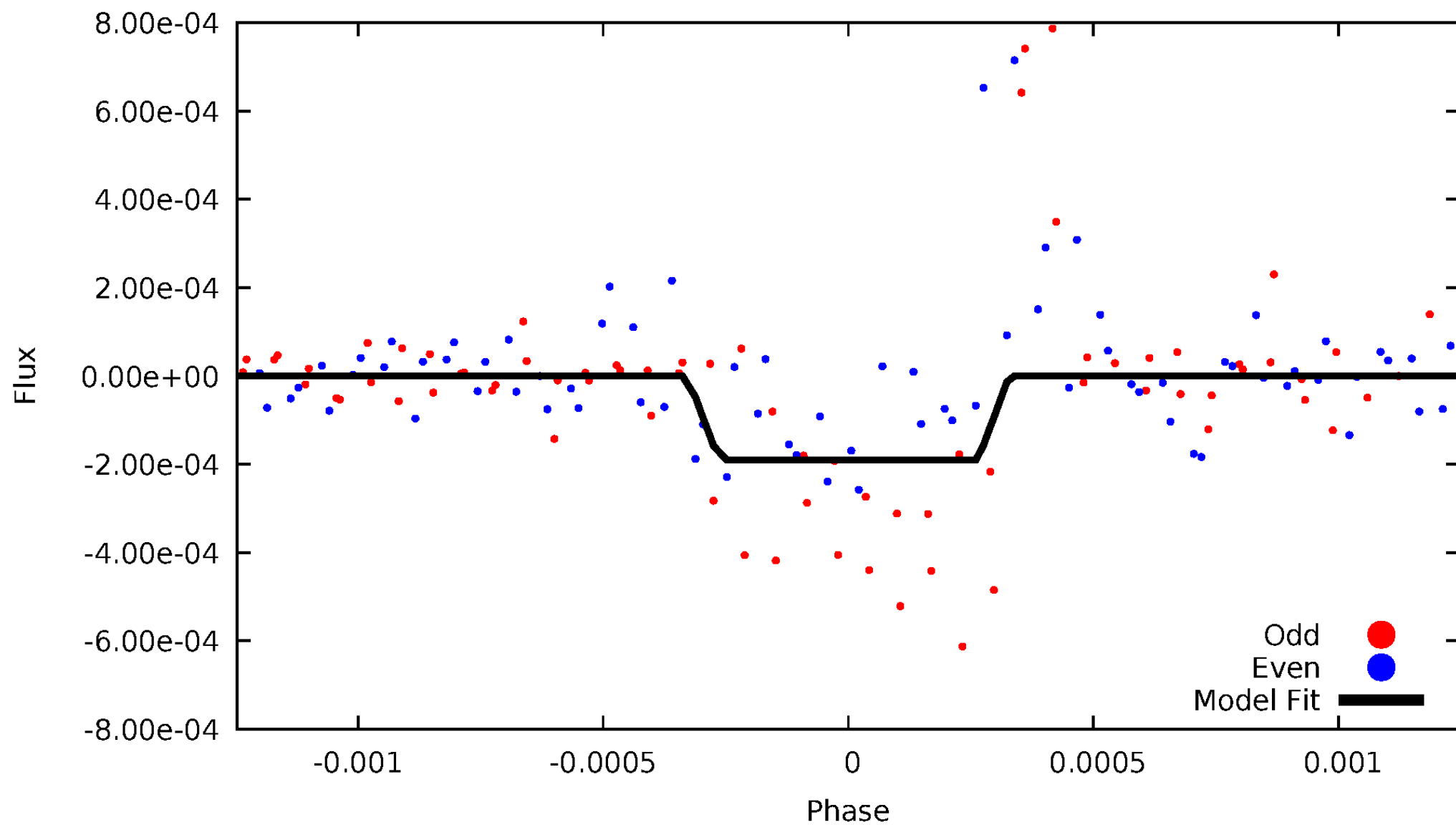
# DV Odd/Even

TCE 006421480-02



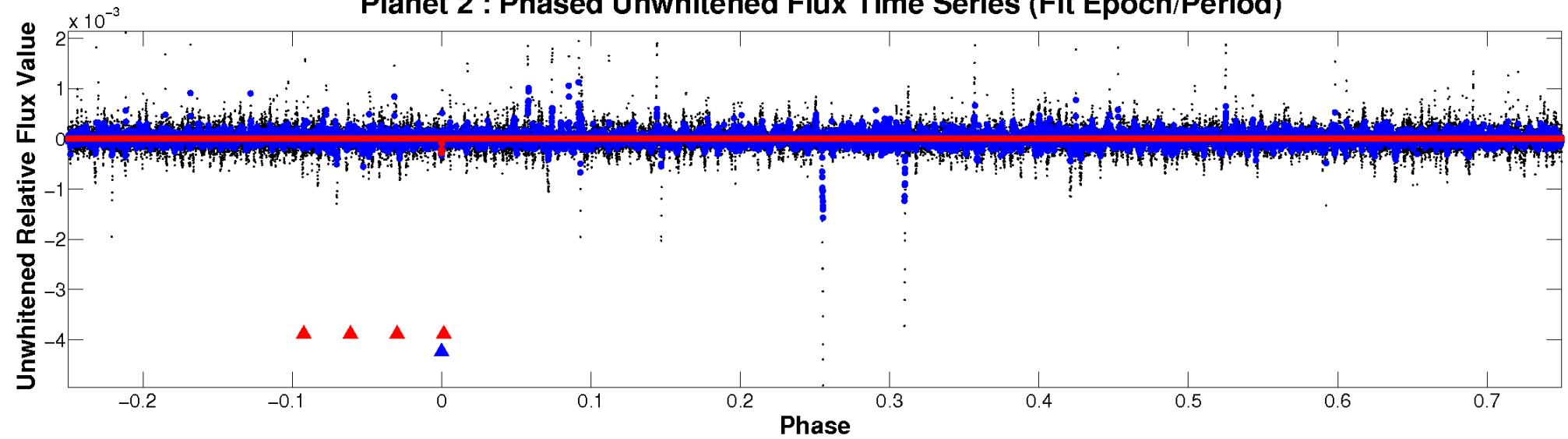
# ALT Odd/Even

TCE 006421480-02

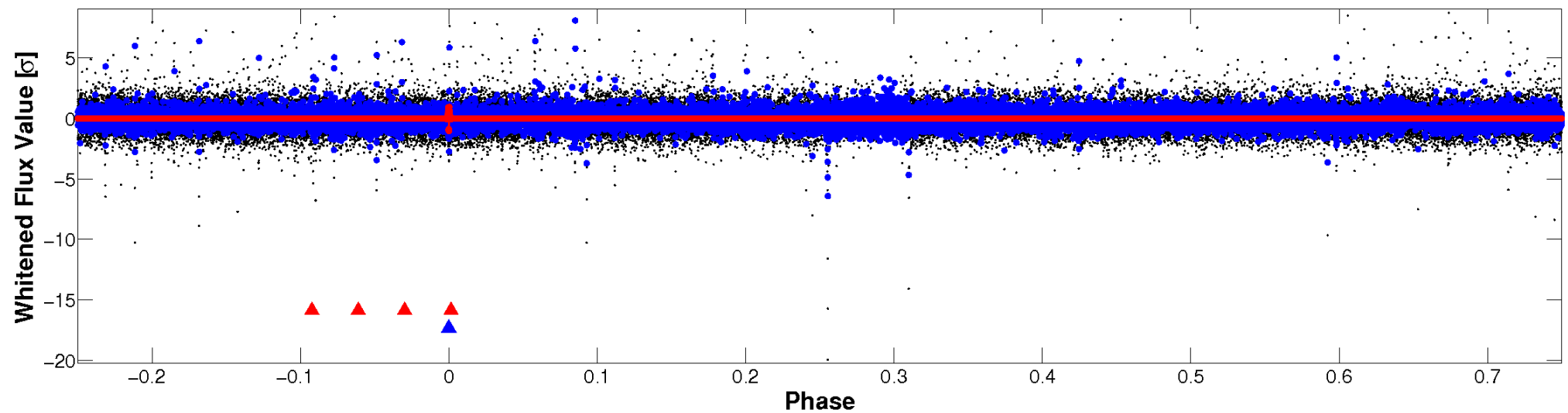


# Non-Whitened Vs. Whitened Light Curve

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

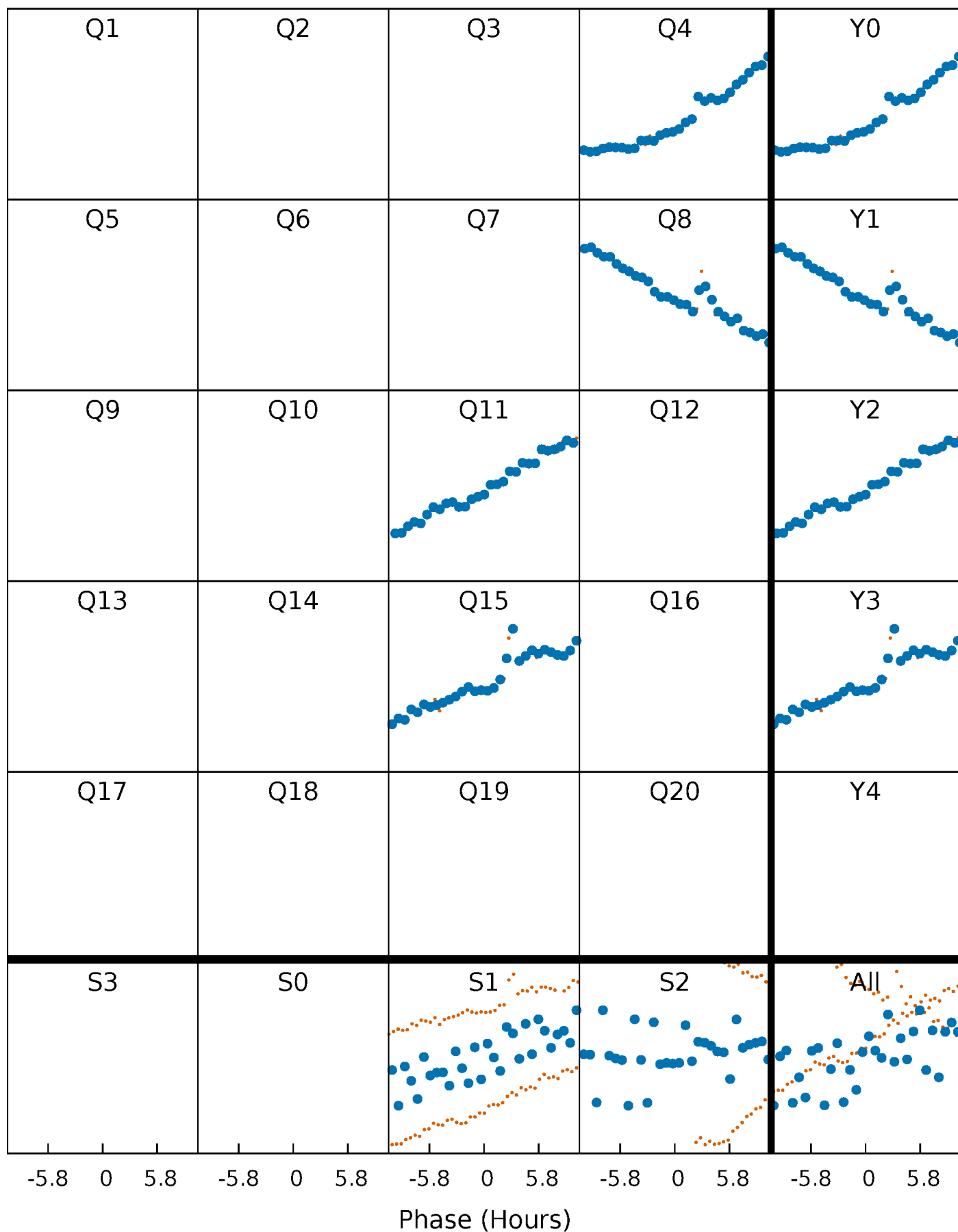


**Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



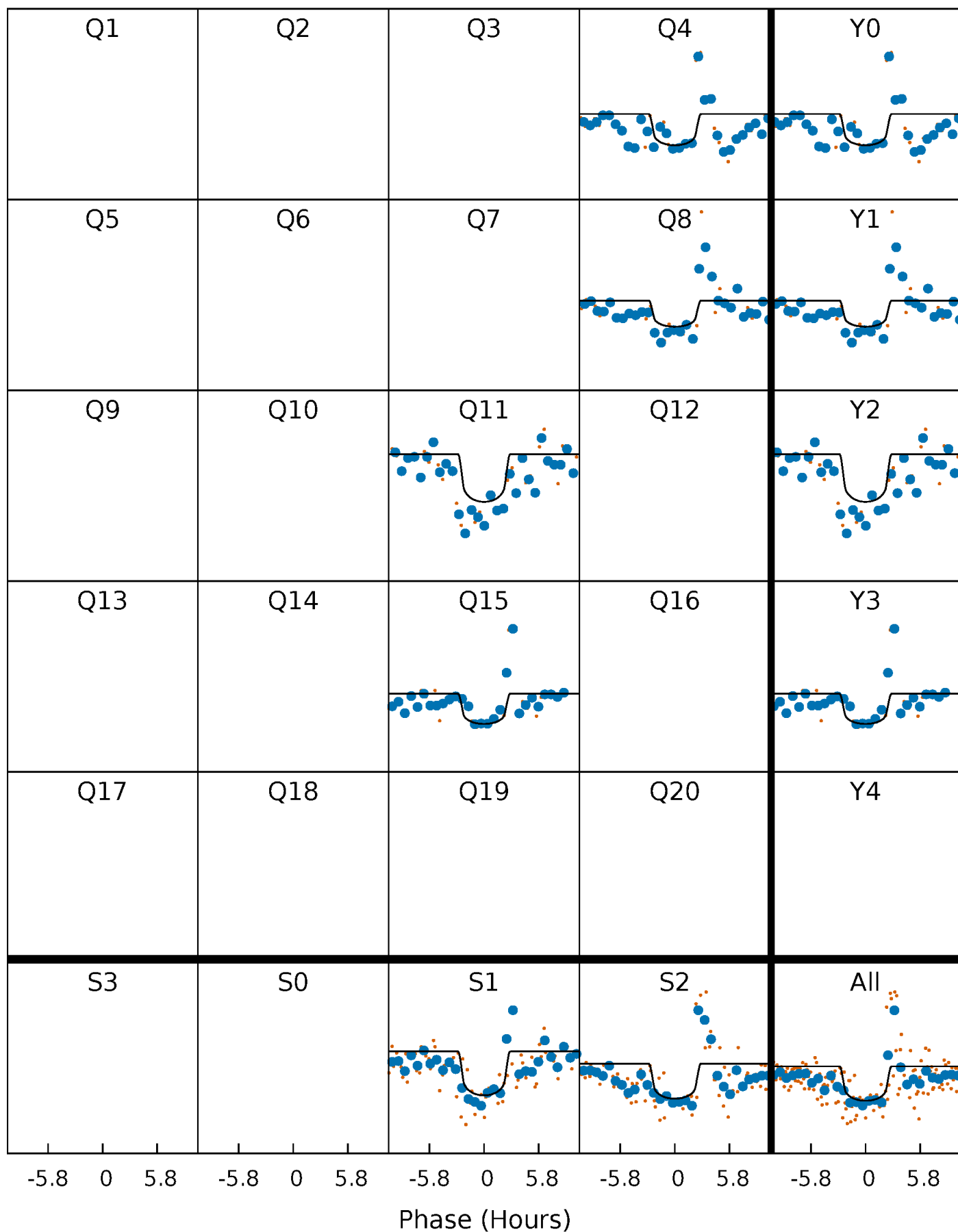
# PDC Quarter-Phased Transit Curves

TCE 006421480-02     $P=321.824752$  Days     $T_0=423.453143$  (BKJD)



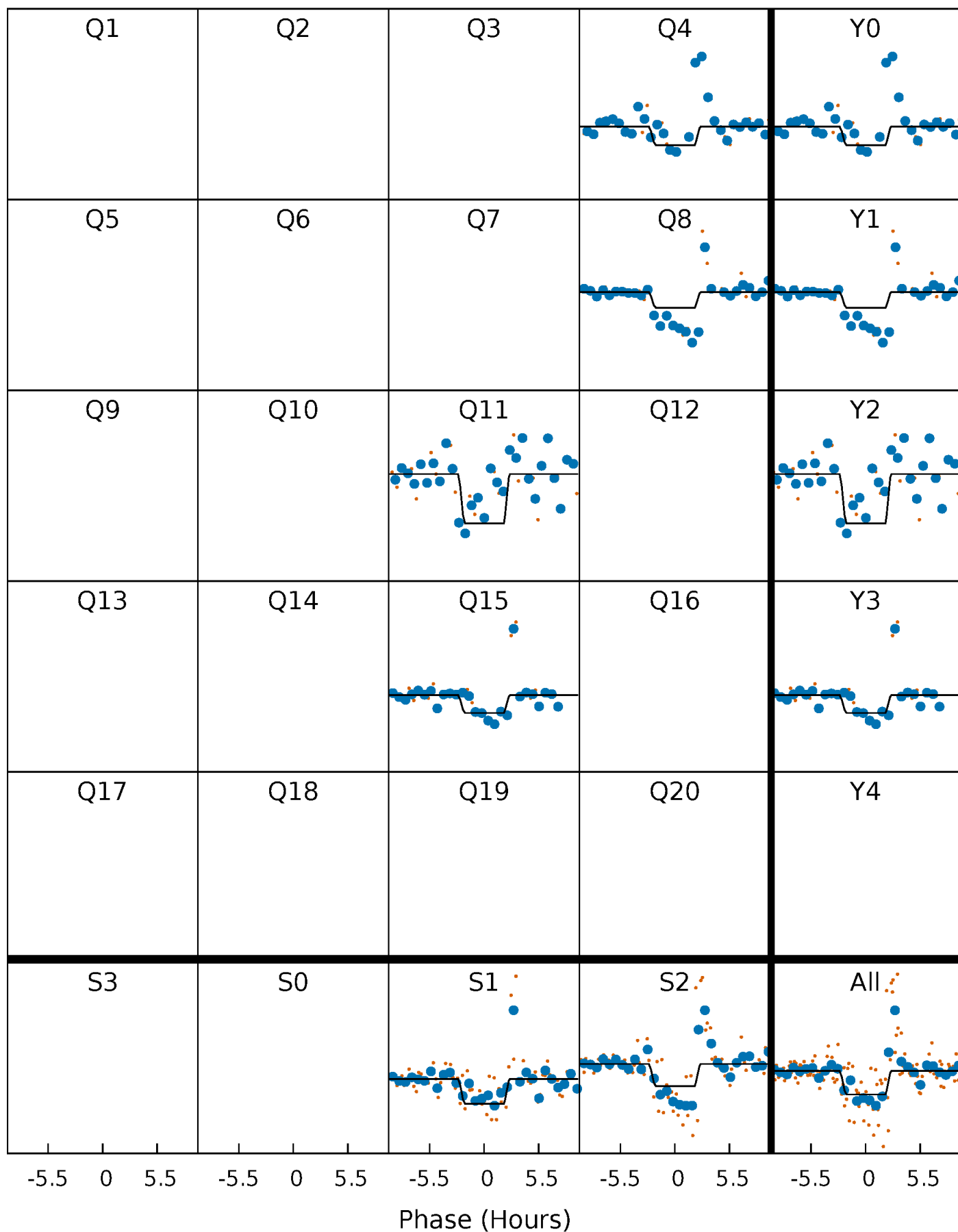
# DV Quarter-Phased Transit Curves

TCE 006421480-02     $P=321.824752$  Days     $T_0=423.453143$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

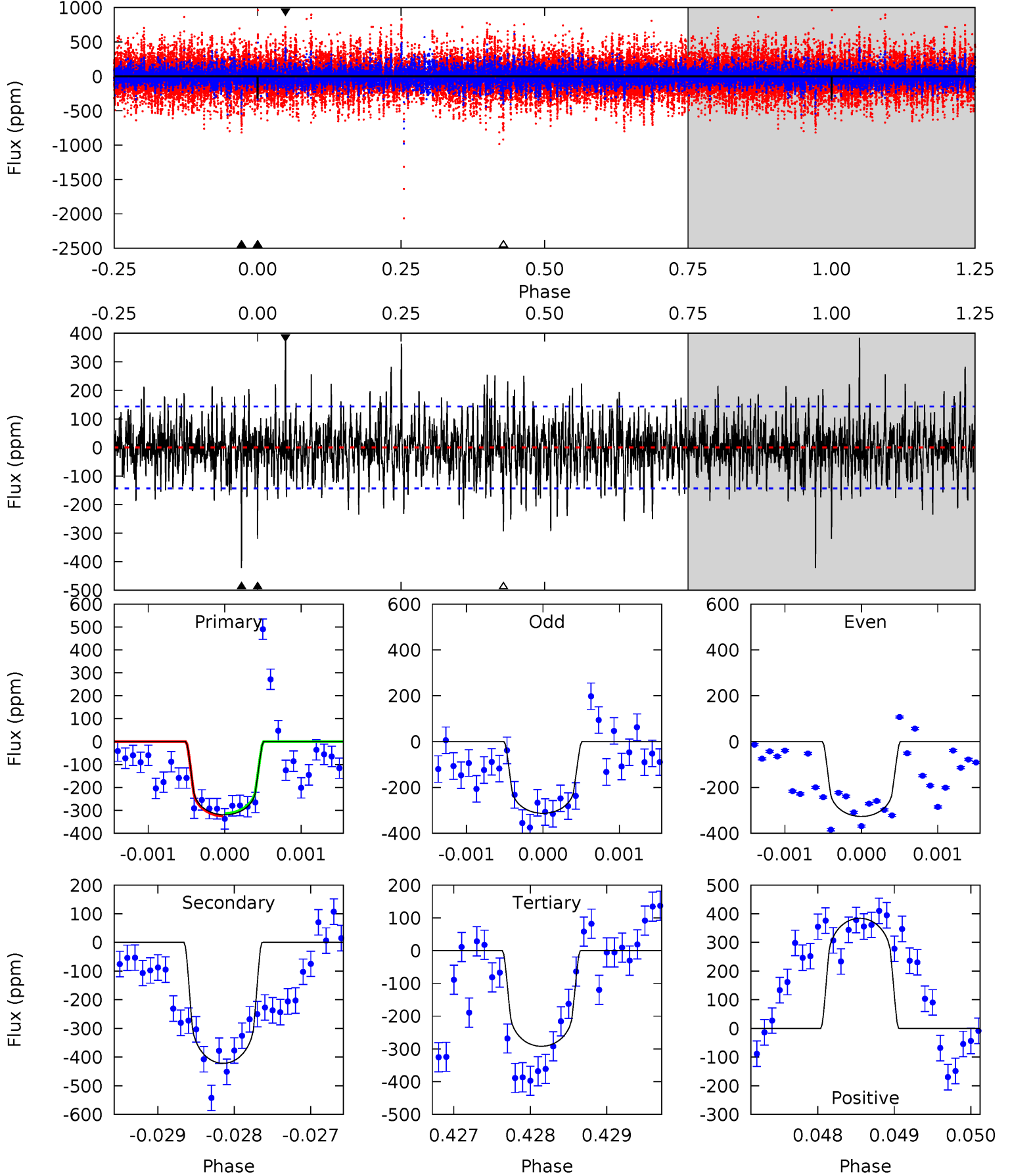
TCE 006421480-02 P=321.821759 Days  $T_0=423.458240$  (BKJD)



# DV Model-Shift Uniqueness Test

006421480-02, P = 321.824752 Days, E = 101.628391 Days

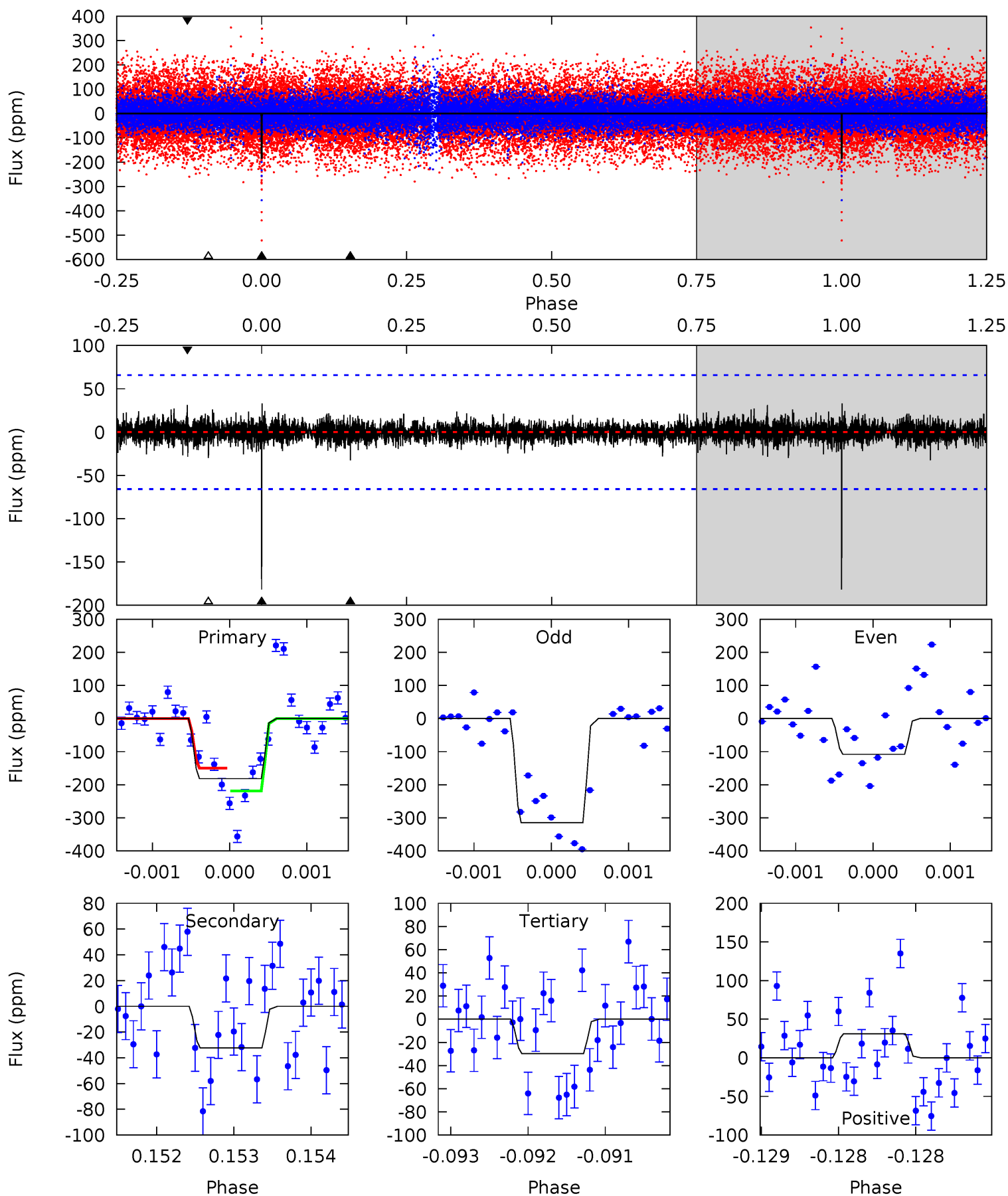
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
12.3	16.2	11.2	14.8	5.51	3.39	2.83	1.06	-2.49	4.99	1.44	0.24	0.97	0.48	0.22



# Alt Model-Shift Uniqueness Test

006421480-02, P = 321.821759 Days, E = 101.636481 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
15.3	2.72	2.50	2.62	5.53	3.42	0.53	12.8	12.7	0.22	0.10	9.22	1.39	0.15	2.90





### Stellar Parameters For KIC 006421480

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5940^{+140}_{-176}$	$4.404^{+0.090}_{-0.195}$	$-0.080^{+0.300}_{-0.300}$	$1.038^{+0.305}_{-0.131}$	$0.997^{+0.140}_{-0.115}$	$1.256^{+0.581}_{-0.638}$
	+2%/-3%	+2%/-4%	+375%/-375%	+29%/-13%	+14%/-12%	+46%/-51%
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 006421480-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-422 \pm 26$	$1.92^{+1.15}_{-0.95}$	$394^{+27}_{-20}$	$6725^{+3315}_{-1414}$	$53316^{+150240}_{-32798}$
Alt.	$-32 \pm 12$	$1.62^{+0.99}_{-0.87}$	$393^{+28}_{-19}$	$4023^{+1523}_{-649}$	$5383^{+20532}_{-3665}$

$T_{max}$  = 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

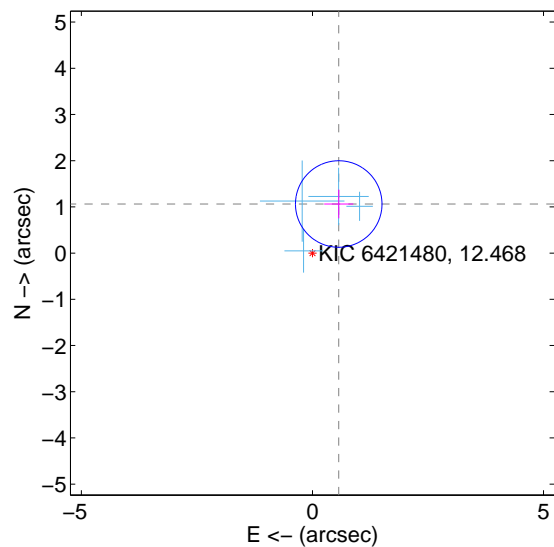
Supplemental centroid analysis for 006421480-02. Kepler magnitude: 12.47. Transit SNR 6.66

There are 4 quarters with good PRF difference image offsets

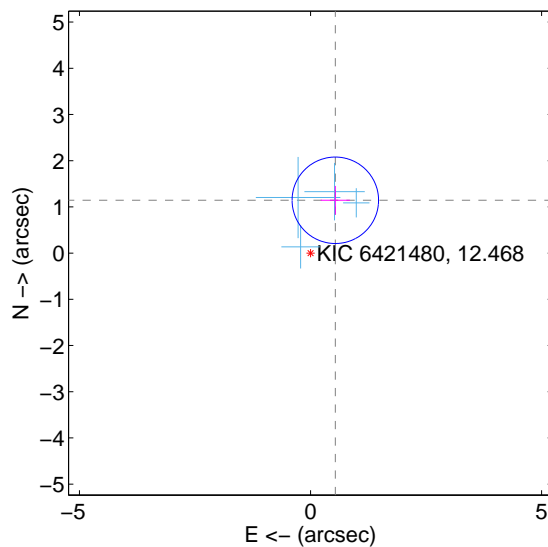
The direct PRF centroid is offset from the target star catalog position by about 0.09 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.205 \pm 0.312$	3.86	$-0.569 \pm 0.315$	$1.062 \pm 0.311$
PRF-fit source offset from KIC position	$1.263 \pm 0.312$	4.05	$-0.537 \pm 0.315$	$1.143 \pm 0.311$
photometric centroid source offset	$1.09 \pm 1.09$	1.00	$0.23 \pm 1.12$	$-1.07 \pm 1.09$

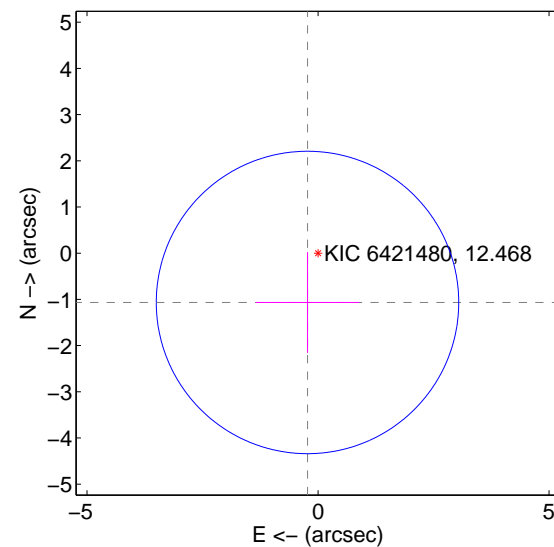
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

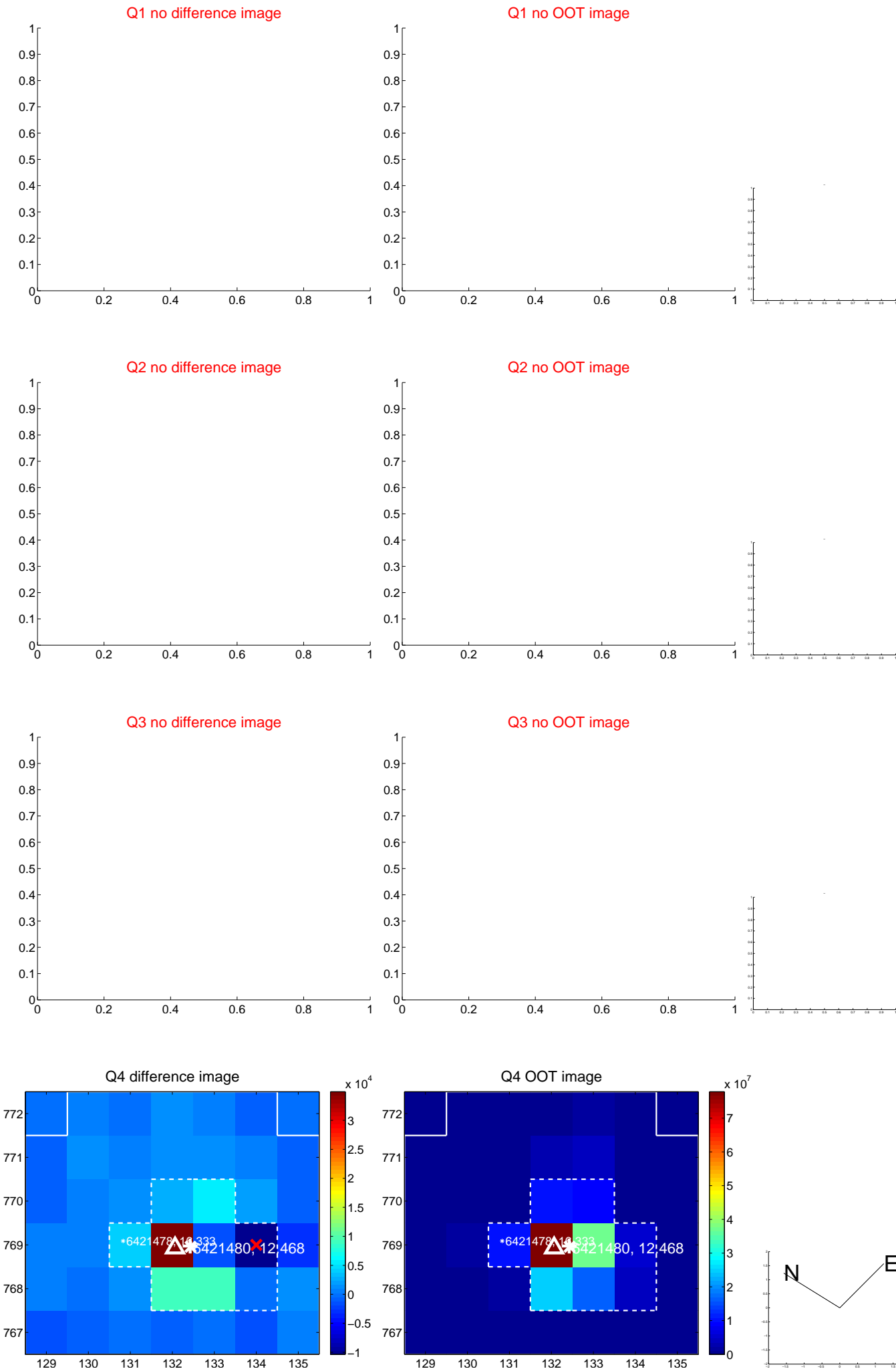


offset from photometric centroids



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.

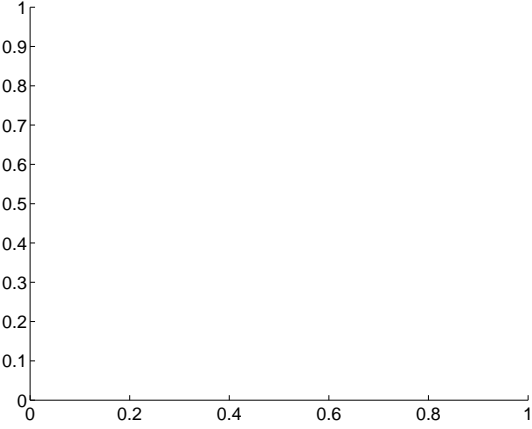
Q5 no difference image



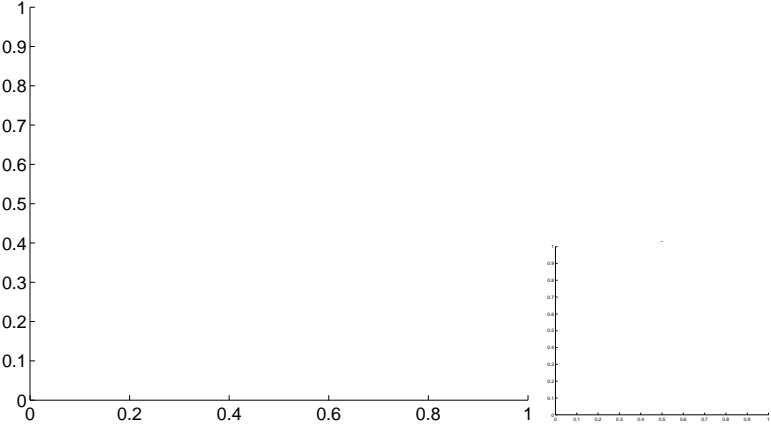
Q5 no OOT image



Q6 no difference image



Q6 no OOT image



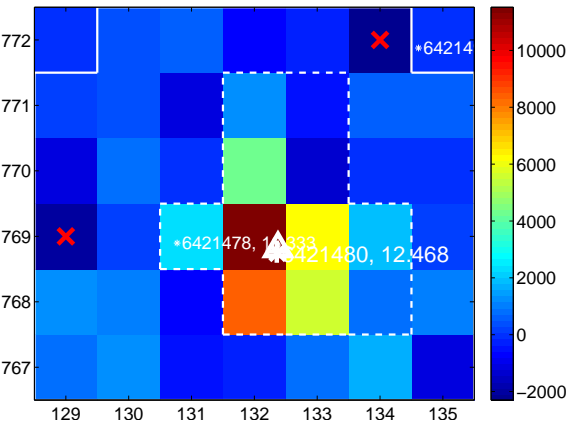
Q7 no difference image



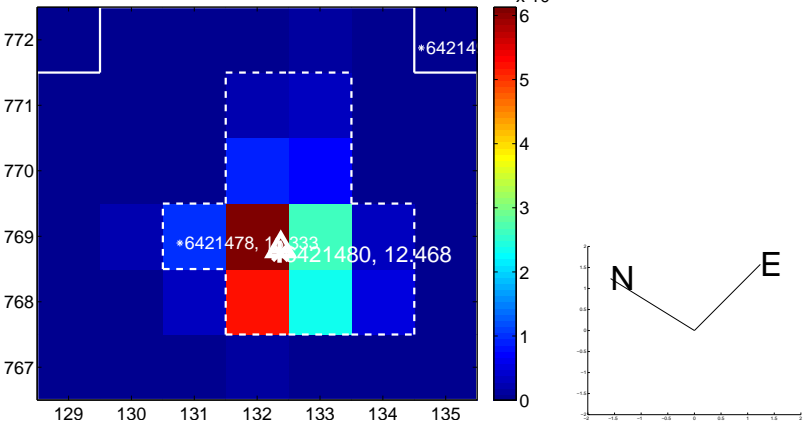
Q7 no OOT image



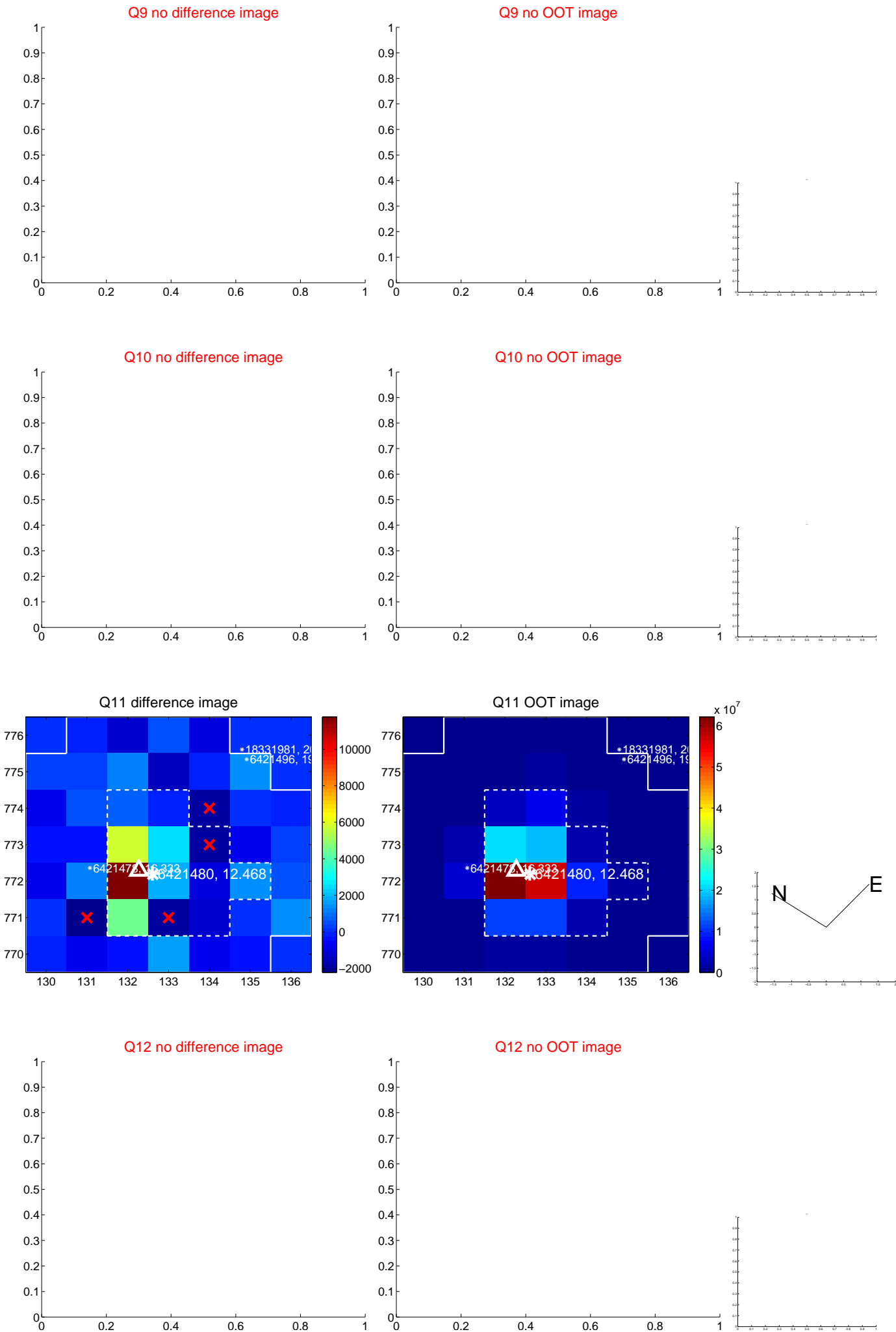
Q8 difference image



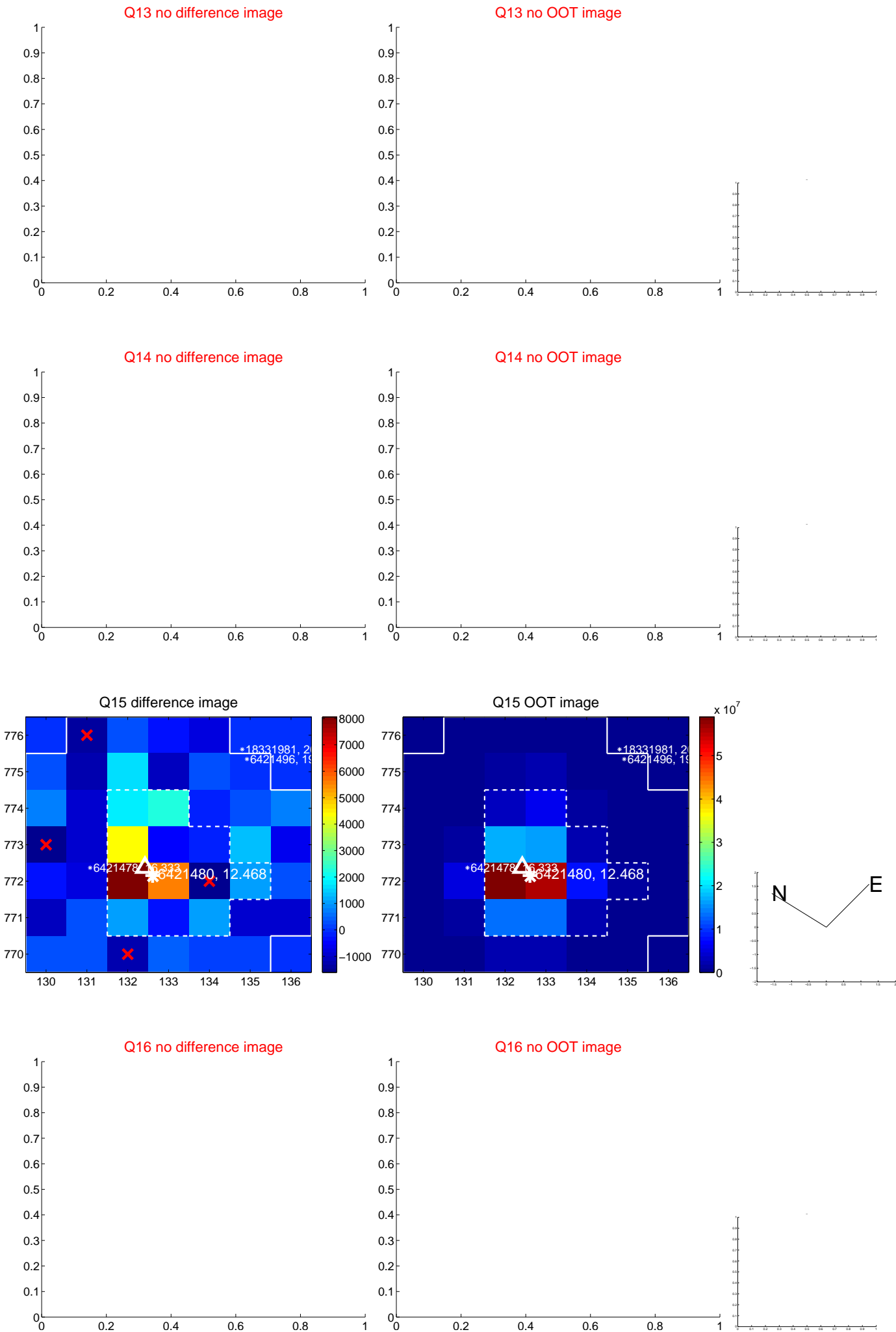
Q8 OOT image



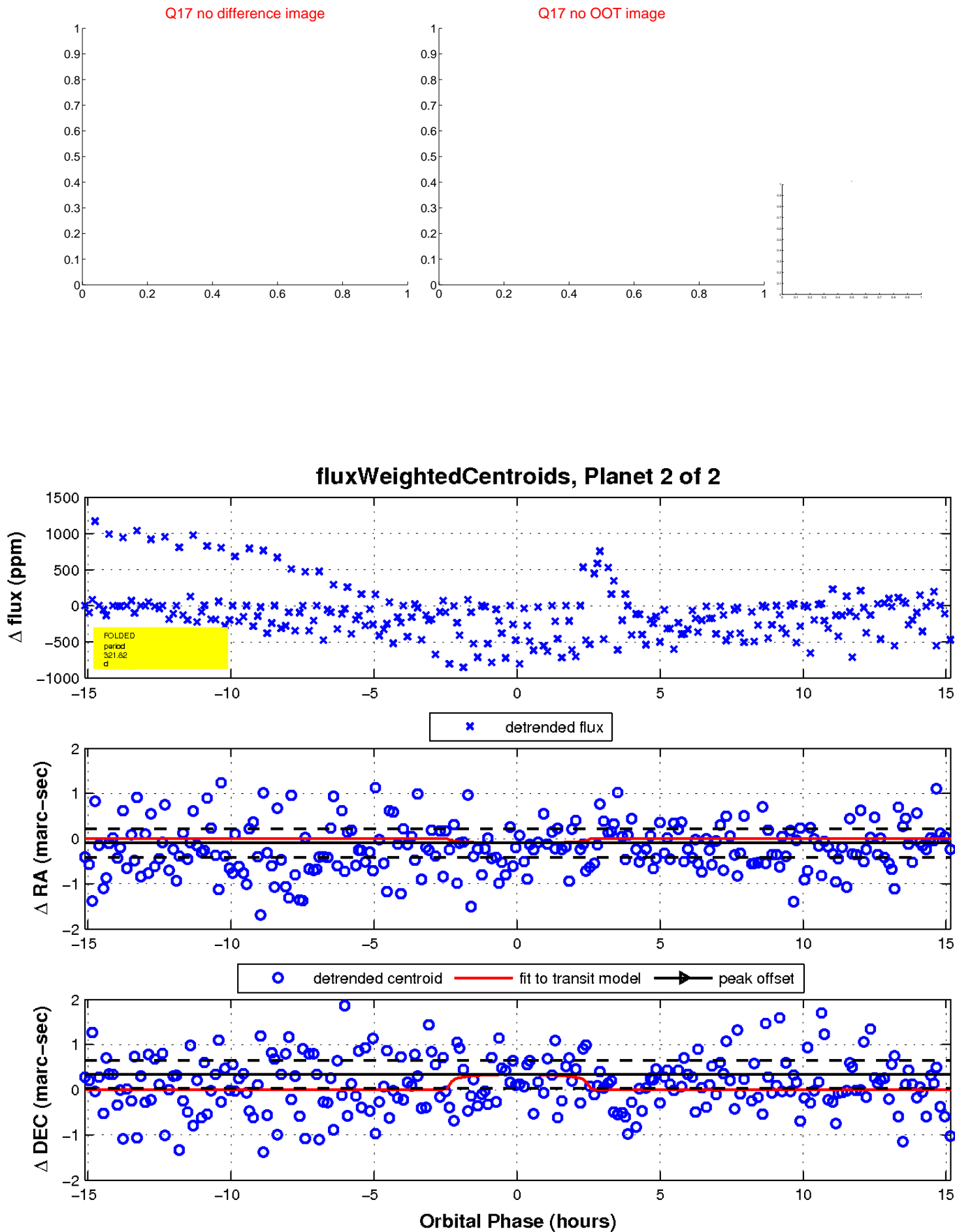
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



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



UKIRT Image

Declination

