

# KIC 010521496

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
010521496-01	OBS	No	2.607428	133.840582	15.5	11.078	7.9	5.4	2.40	7209	1.01	7234.37
010521496-02	OBS	No	301.684510	255.305314	212.3	20.441	22.9	6.5	2.40	7209	3.63	12.83

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
010521496-01	OBS	FP	0.00	1	0	0	0	LPP_DV
010521496-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_ZUMA—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—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.

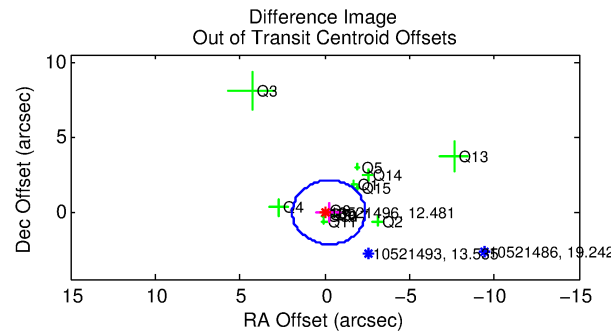
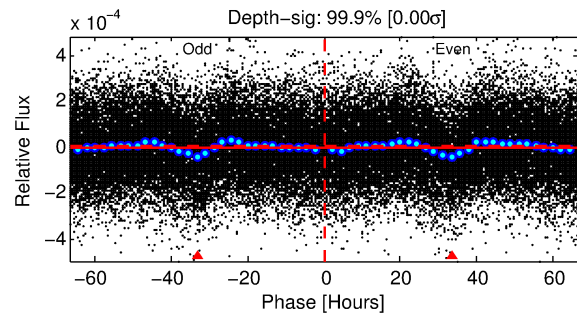
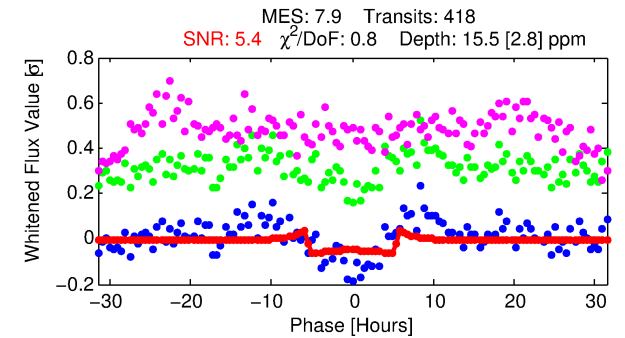
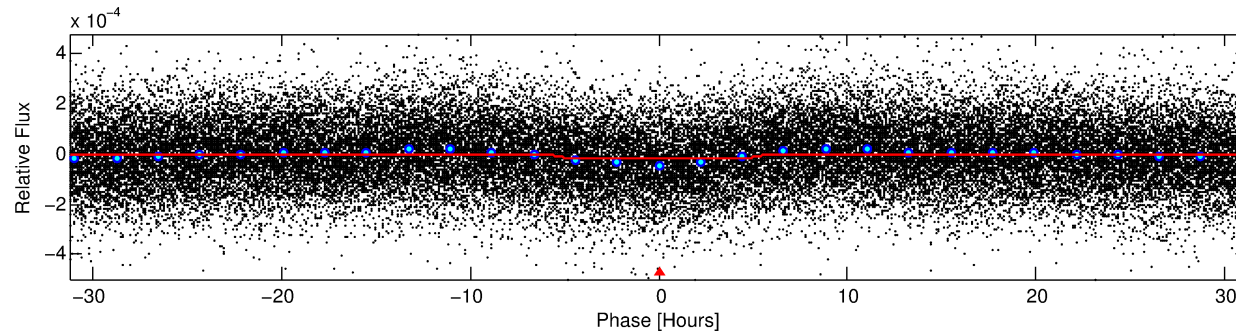
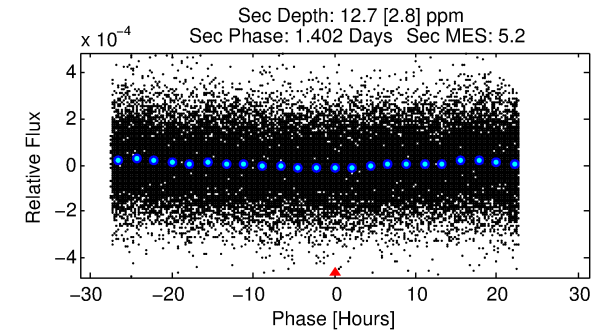
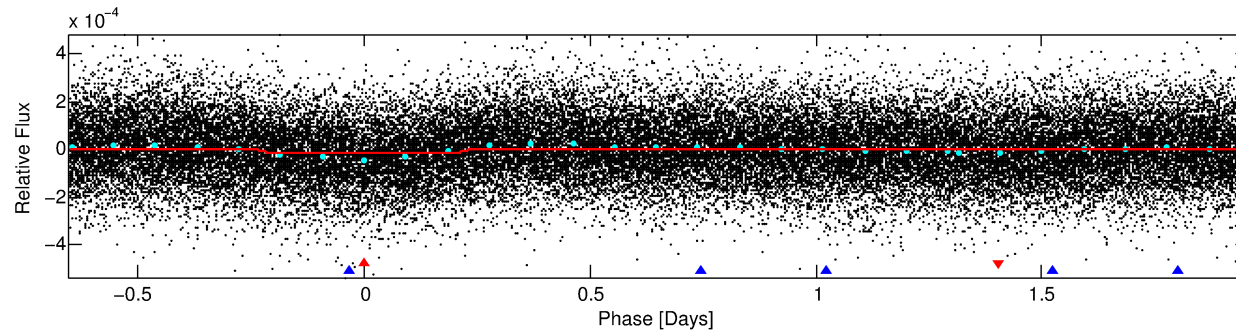
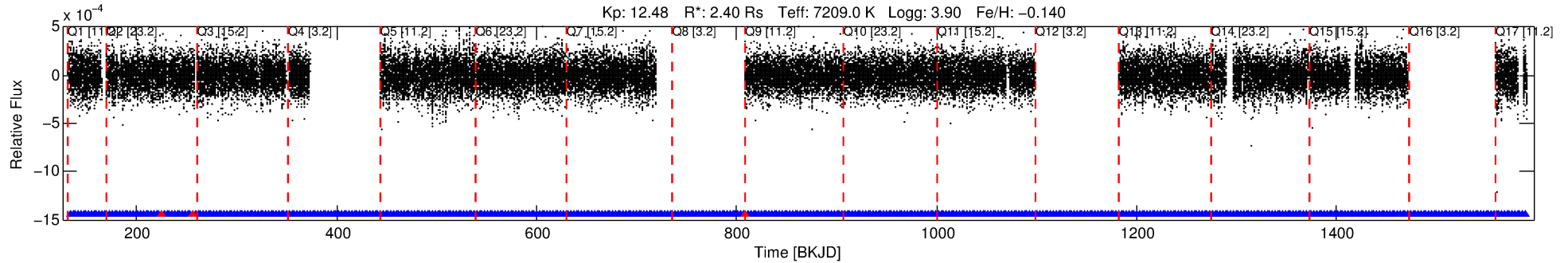
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 010521496-01

No Significant Match Found

# DV One-Page Summary

KIC: 10521496 Candidate: 1 of 2 Period: 2.607 d



## DV Fit Results:

Period = 2.60743 [0.00004] d  
Epoch = 133.8406 [0.0086] BKJD  
Rp/R\* = 0.0039 [0.0012]  
a/R\* = 1.53 [1.54]  
b = 0.71 [1.27]  
Seff = 7234.37 [4037.96]  
Teq = 2352 [328] K  
Rp = 1.01 [0.50] Re  
a = 0.0440 [0.0152] AU  
Ag = 13.20 [11.28] [1.08σ]  
Teffp = 6931 [1183] K [3.73σ]

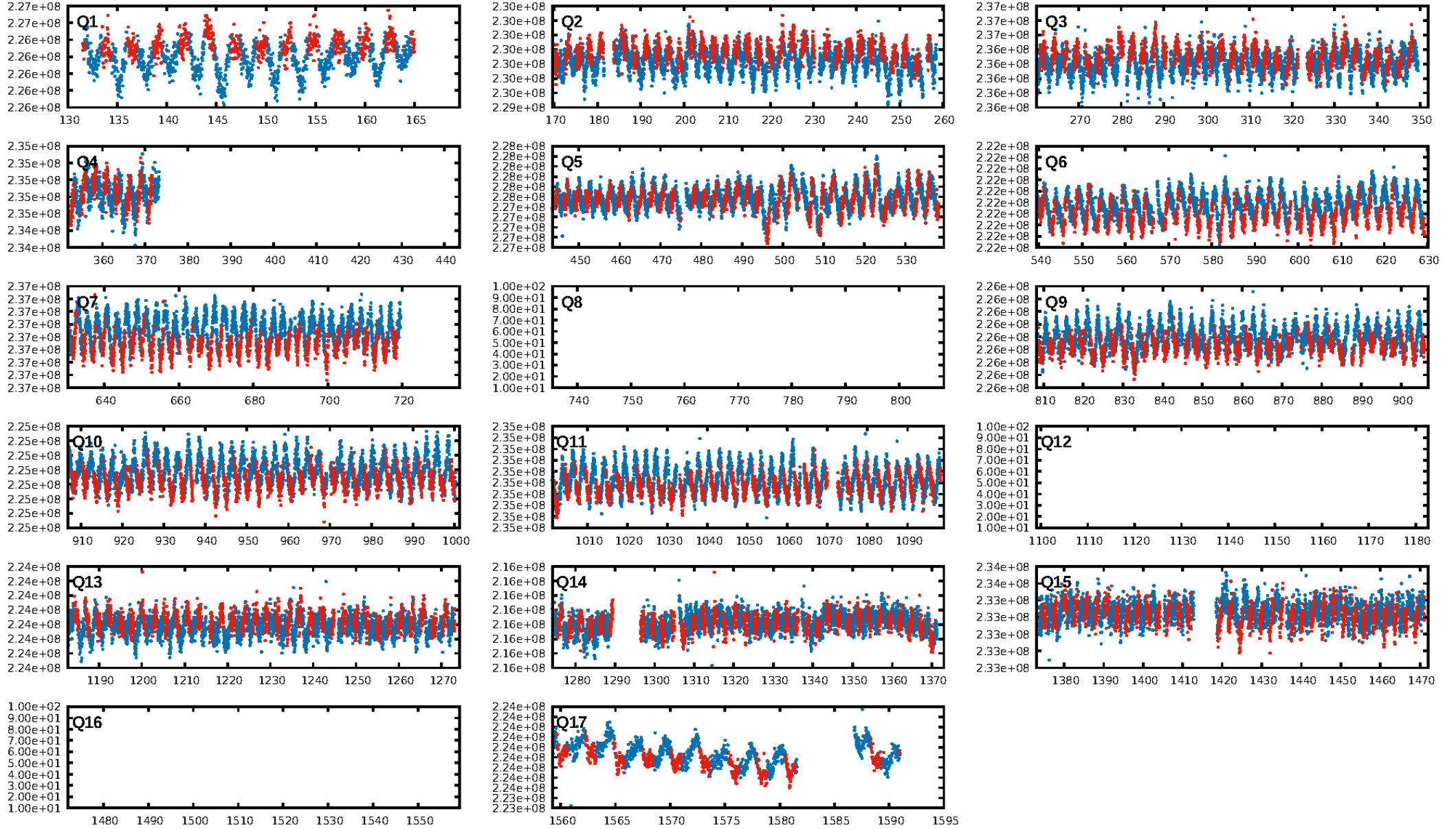
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [308.72σ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
**Bootstrap-pfa: 1.20e-09**  
RollingBand-fgt: 0.99 [384/387]  
GhostDiagnostic-chr: 1.231  
Centroid-sig: 62.7%  
Centroid-so: 0.461 arcsec [0.50σ]  
OotOffset-rm: 0.249 arcsec [0.35σ]  
OotOffset-st: 4/4/1/5 [14]  
KicOffset-rm: 0.195 arcsec [0.27σ]  
KicOffset-st: 4/4/1/5 [14]  
DiffImageQuality-fgm: 0.64 [9/14]  
DiffImageOverlap-fno: 1.00 [14/14]

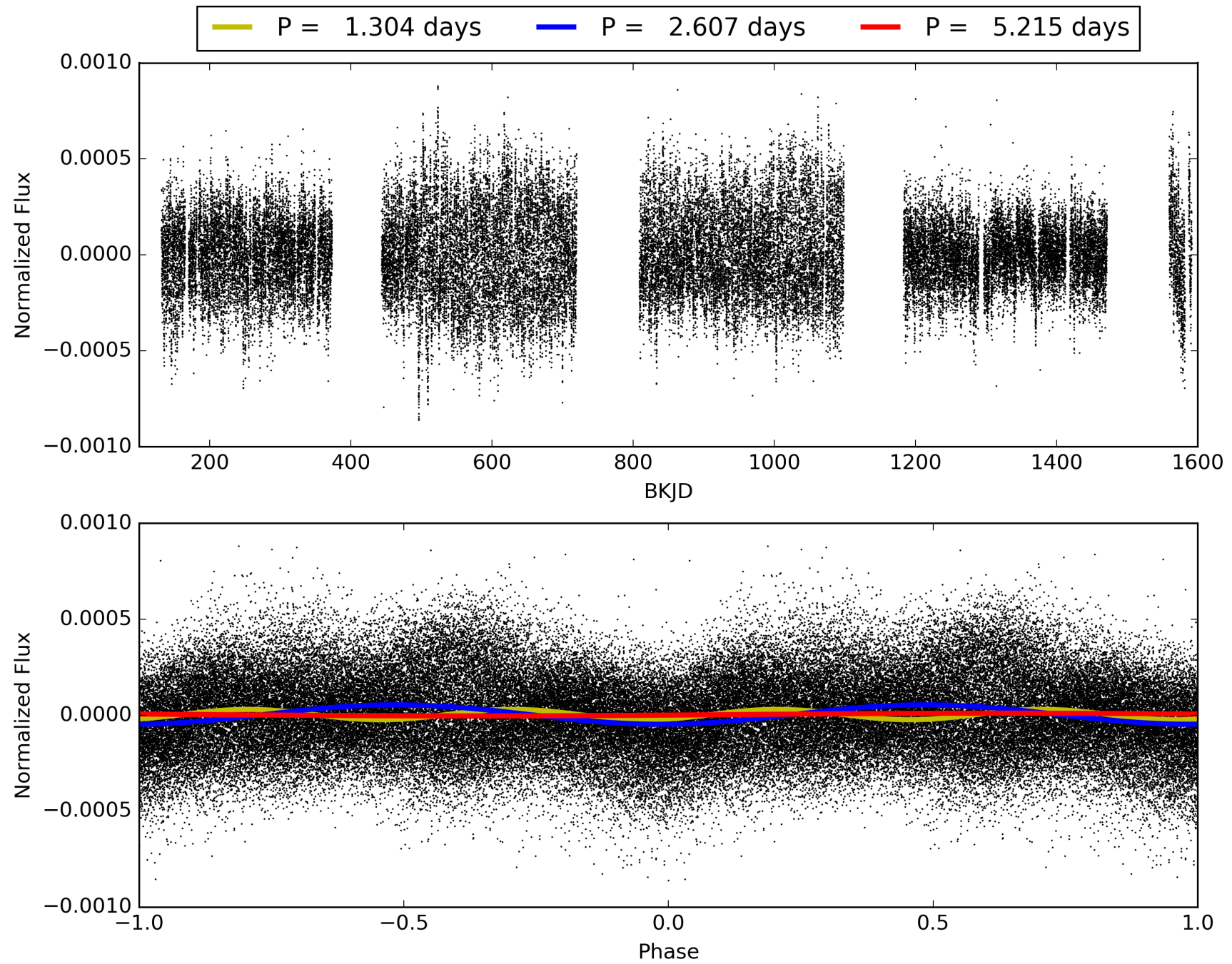
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 28-Jan-2016 23:35:55 Z

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

# TCE 010521496-01, PDC Light Curves

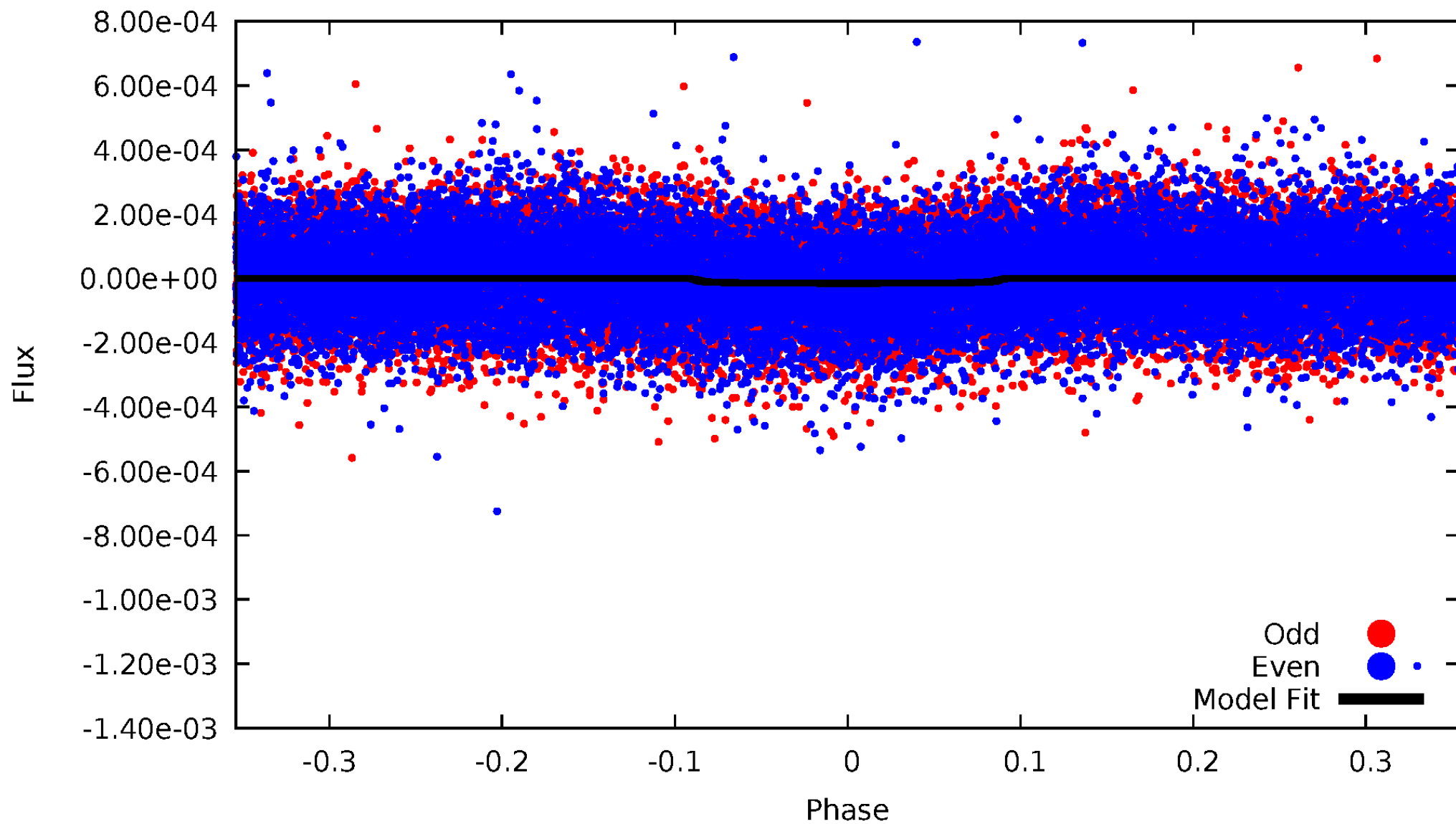


TCE 010521496-01



# DV Odd/Even

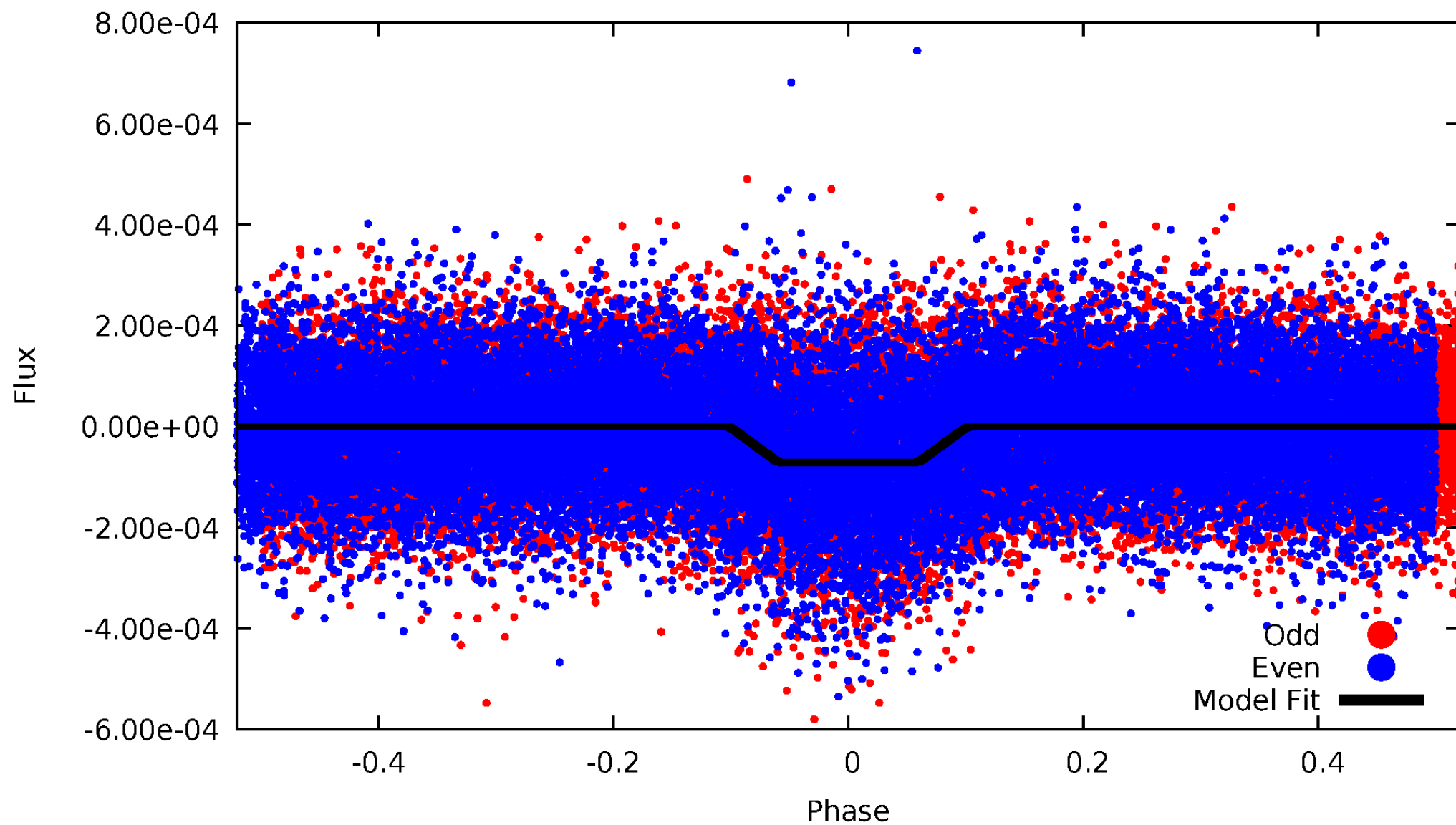
TCE 010521496-01





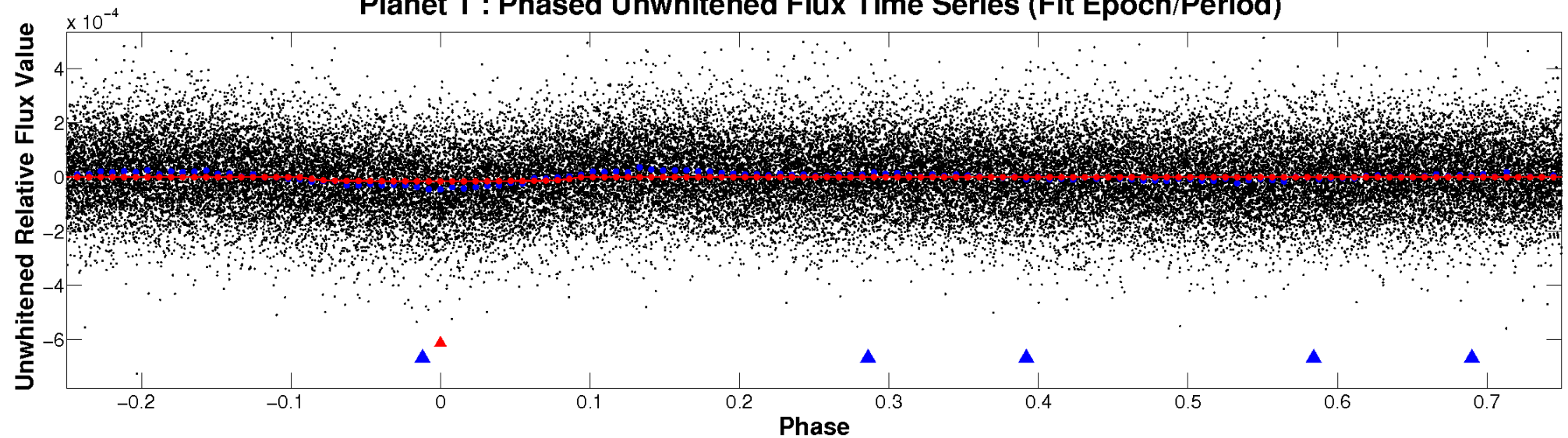
# ALT Odd/Even

TCE 010521496-01

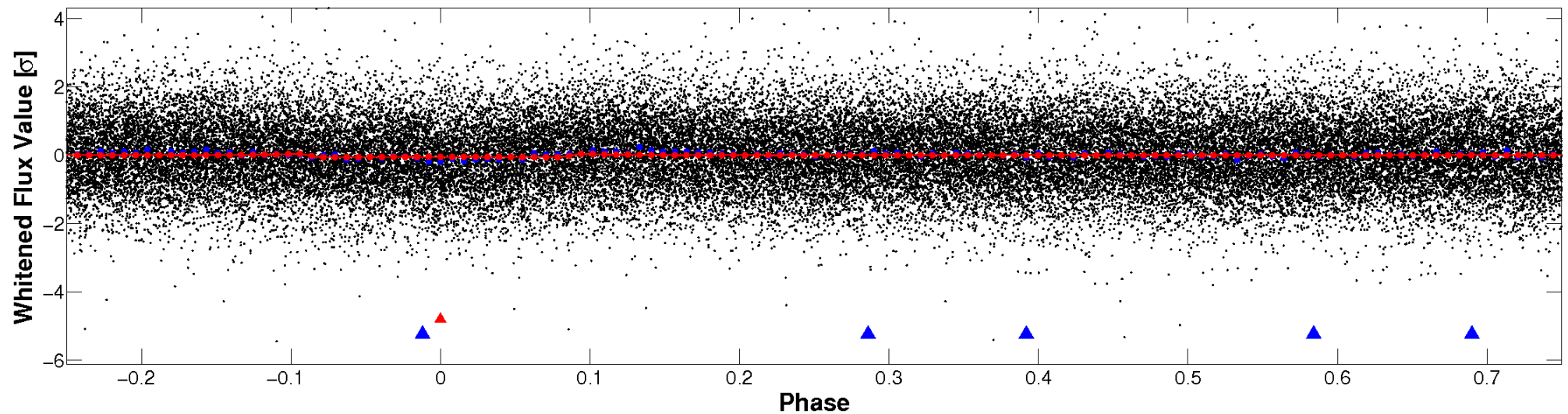


# Non-Whitened Vs. Whitened Light Curve

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

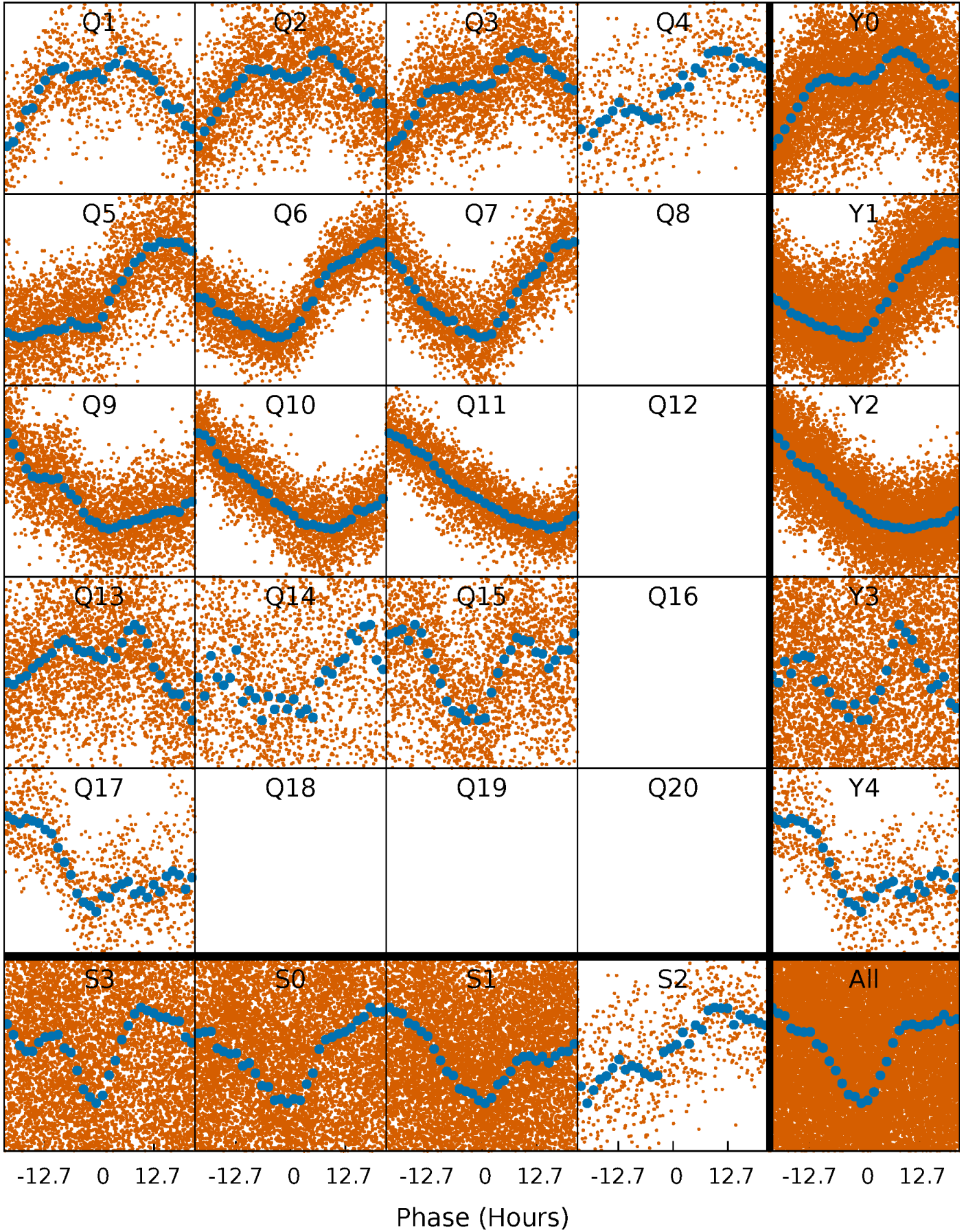


**Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



# PDC Quarter-Phased Transit Curves

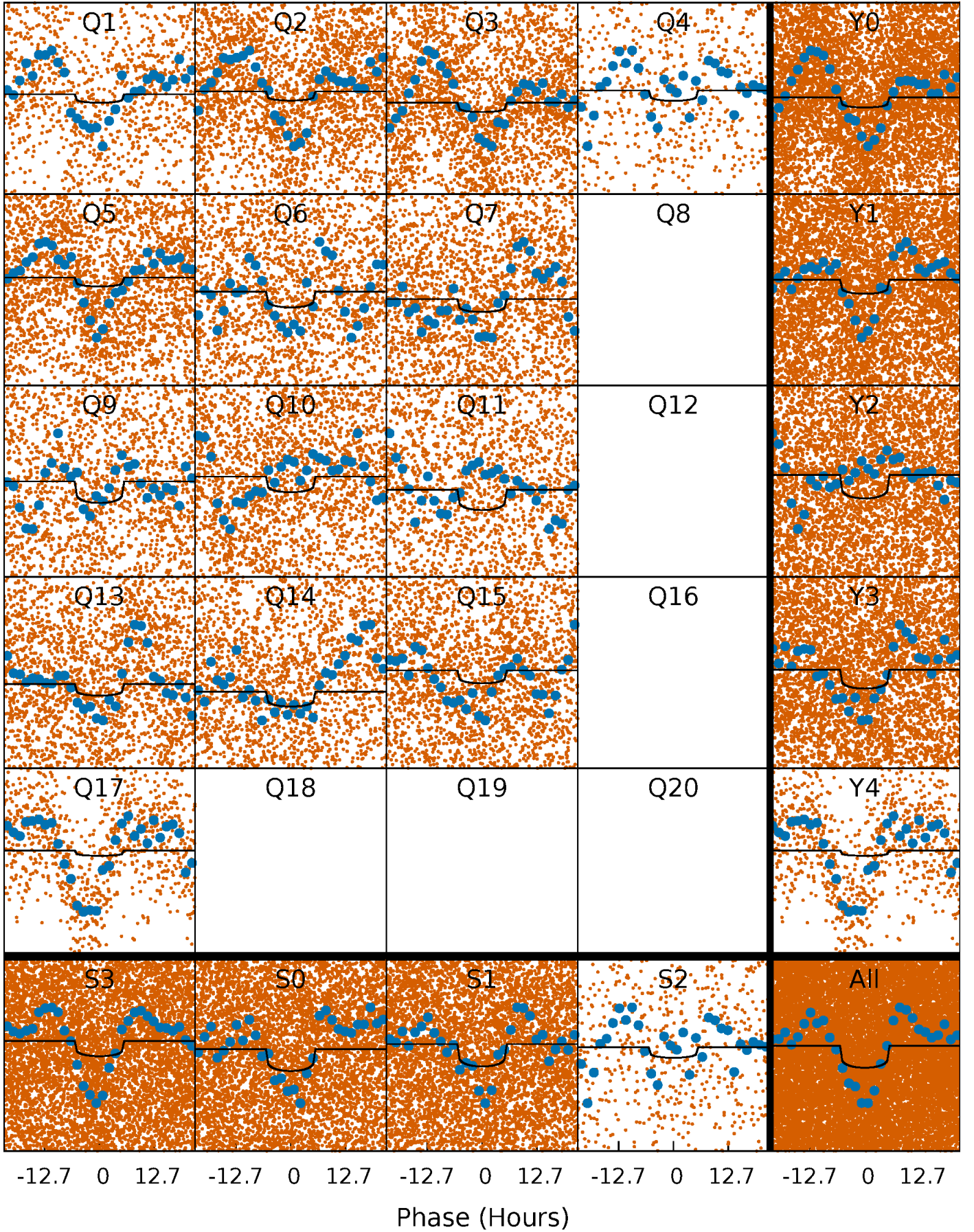
TCE 010521496-01   P= 2.607428 Days    $T_0=133.840582$  (BKJD)





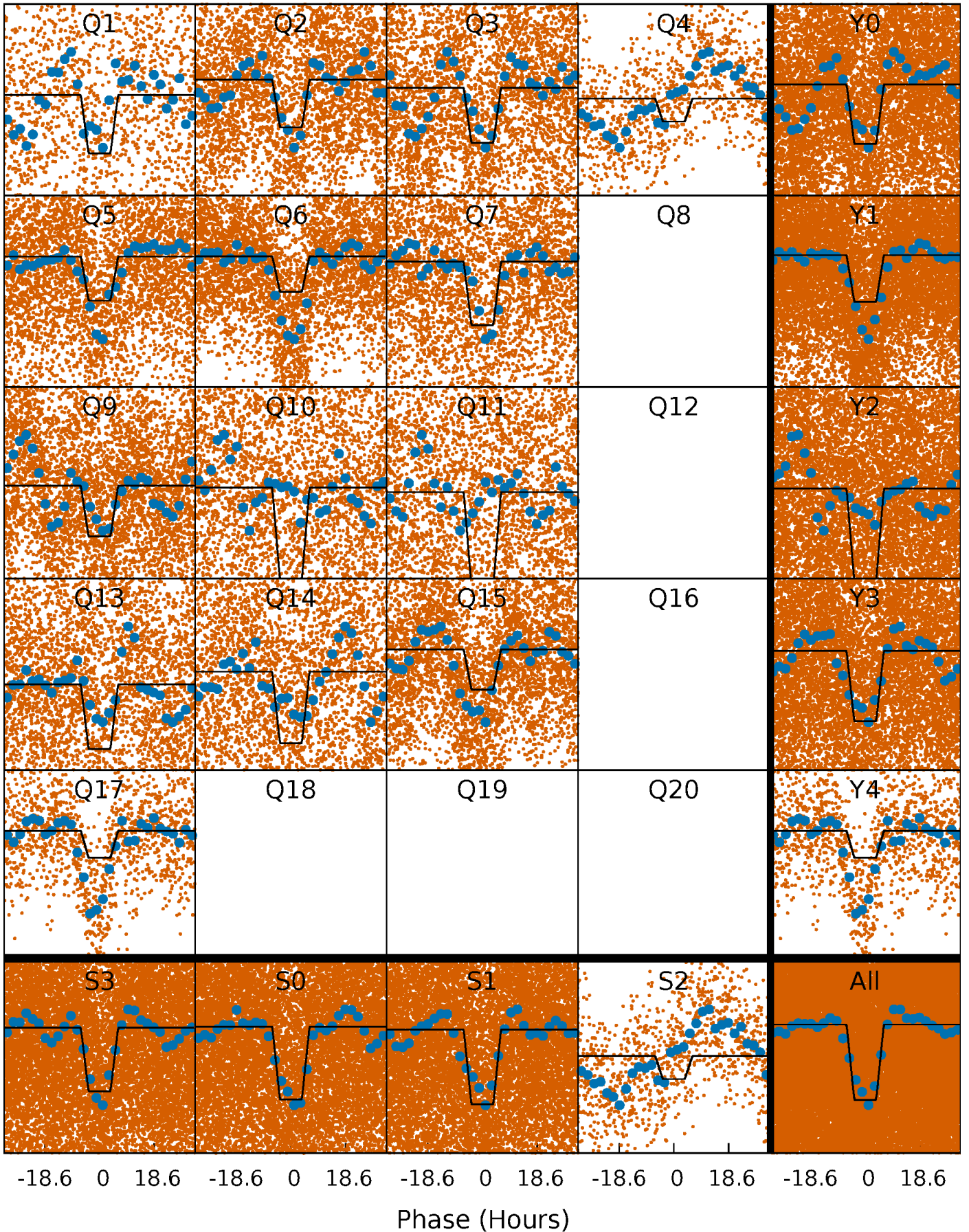
# DV Quarter-Phased Transit Curves

TCE 010521496-01     $P = 2.607428$  Days     $T_0 = 133.840582$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

TCE 010521496-01 P= 2.607362 Days  $T_0=133.822128$  (BKJD)

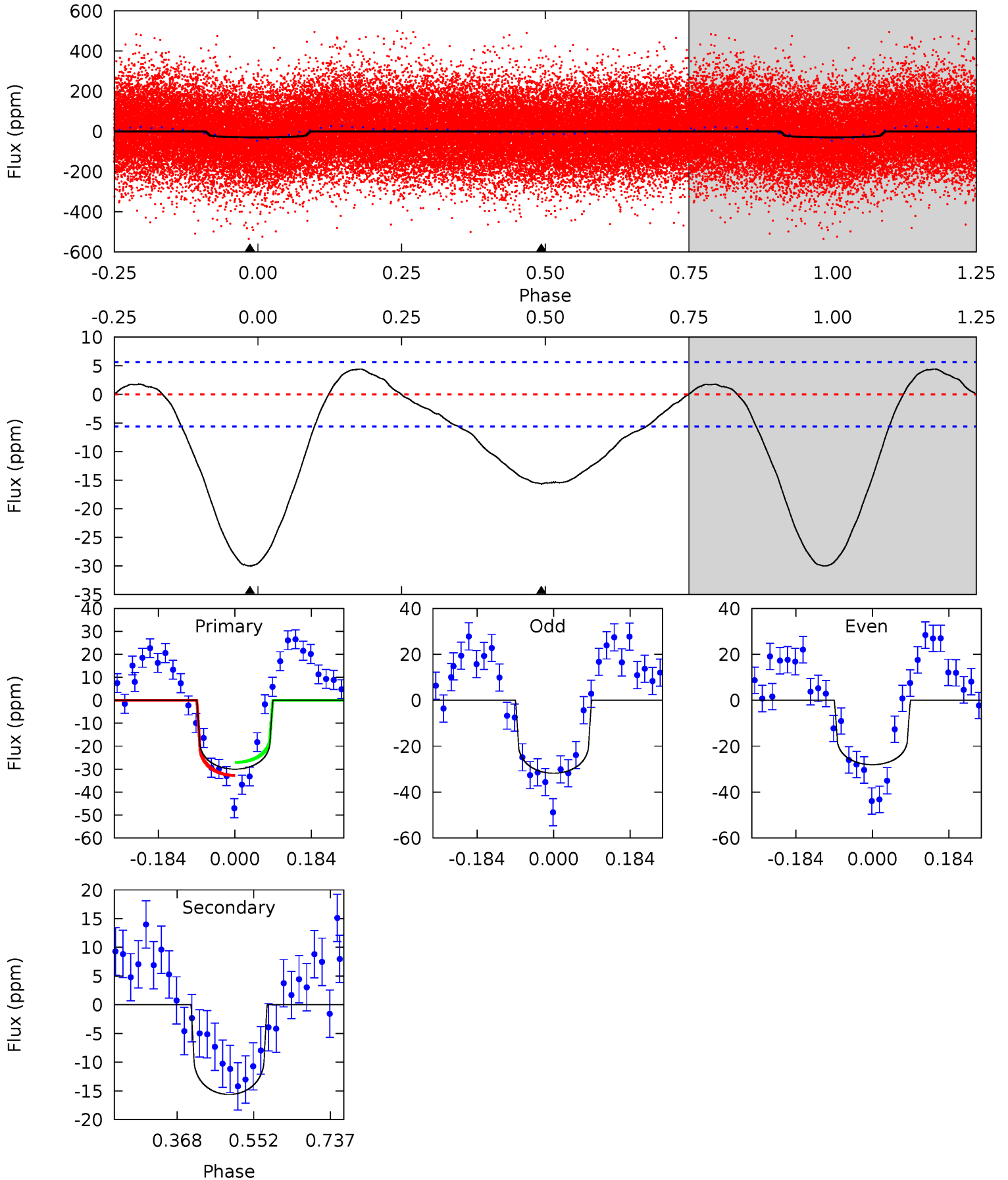




# DV Model-Shift Uniqueness Test

010521496-01, P = 2.607428 Days, E = 131.233154 Days

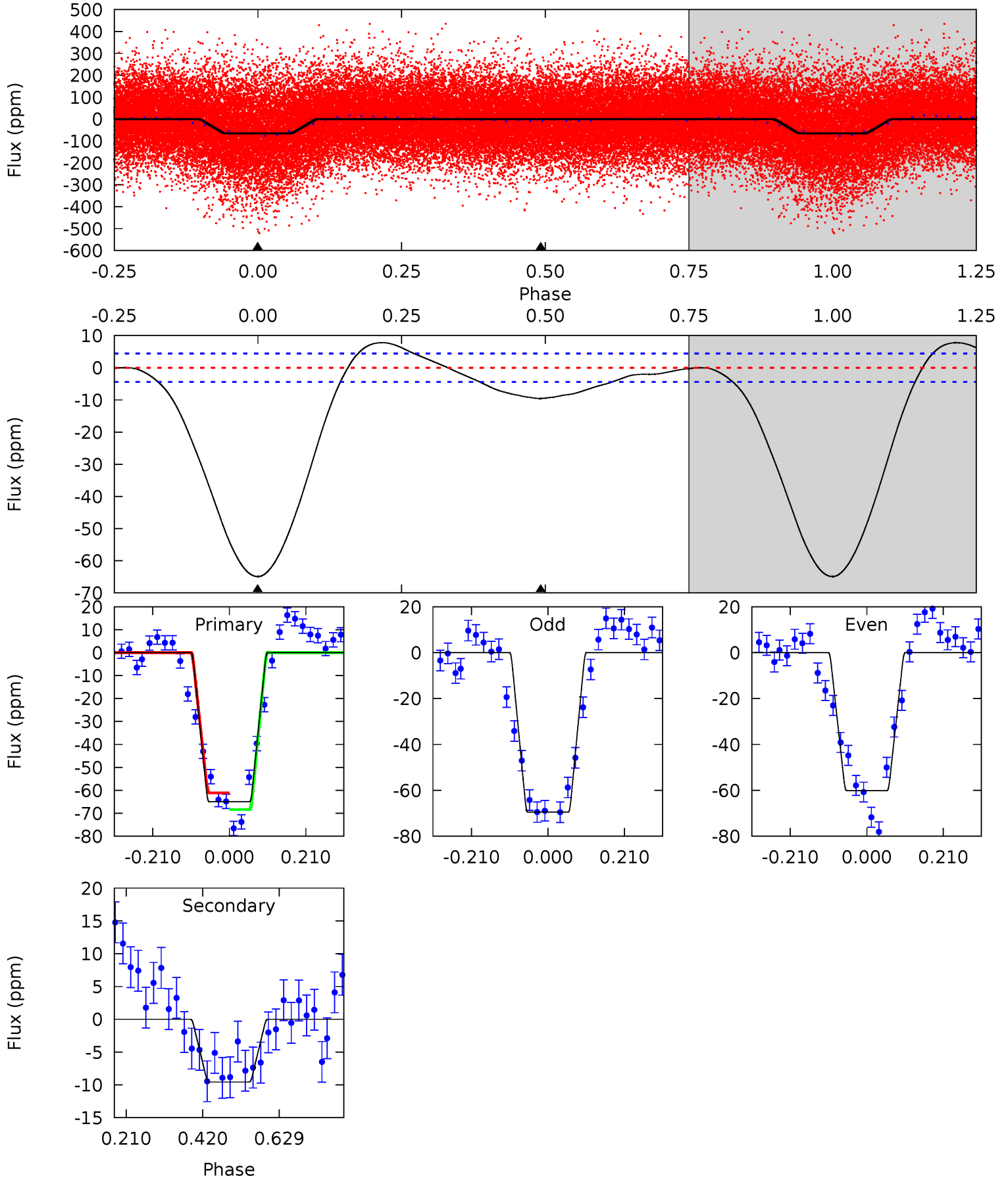
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
23.7	12.3	0	0	4.44	1.33	2.05	23.7	23.7	12.3	12.3	1.47	1.32	0.13	2.24



# Alt Model-Shift Uniqueness Test

010521496-01, P = 2.607362 Days, E = 131.214766 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
64.7	9.53	0	0	4.41	1.25	3.53	64.7	64.7	9.53	9.53	4.69	1.10	0.11	3.62





### Stellar Parameters For KIC 010521496

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$\rho_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$7209^{+201}_{-277}$	$3.898^{+0.308}_{-0.132}$	$-0.140^{+0.250}_{-0.350}$	$2.404^{+0.563}_{-0.915}$	$1.667^{+0.186}_{-0.371}$	$0.169^{+0.365}_{-0.064}$
	+3%/-4%	+8%/-3%	+179%/-250%	+23%/-38%	+11%/-22%	+216%/-38%
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 010521496-01 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-16 \pm 1$	$0.96^{+0.37}_{-0.34}$	$3237^{+236}_{-296}$	$7177^{+1980}_{-1011}$	$18^{+23}_{-8}$
Alt.	$-10 \pm 1$	$2.13^{+0.45}_{-0.48}$	$3224^{+252}_{-292}$	$4370^{+350}_{-303}$	$2.238^{+1.420}_{-0.736}$

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

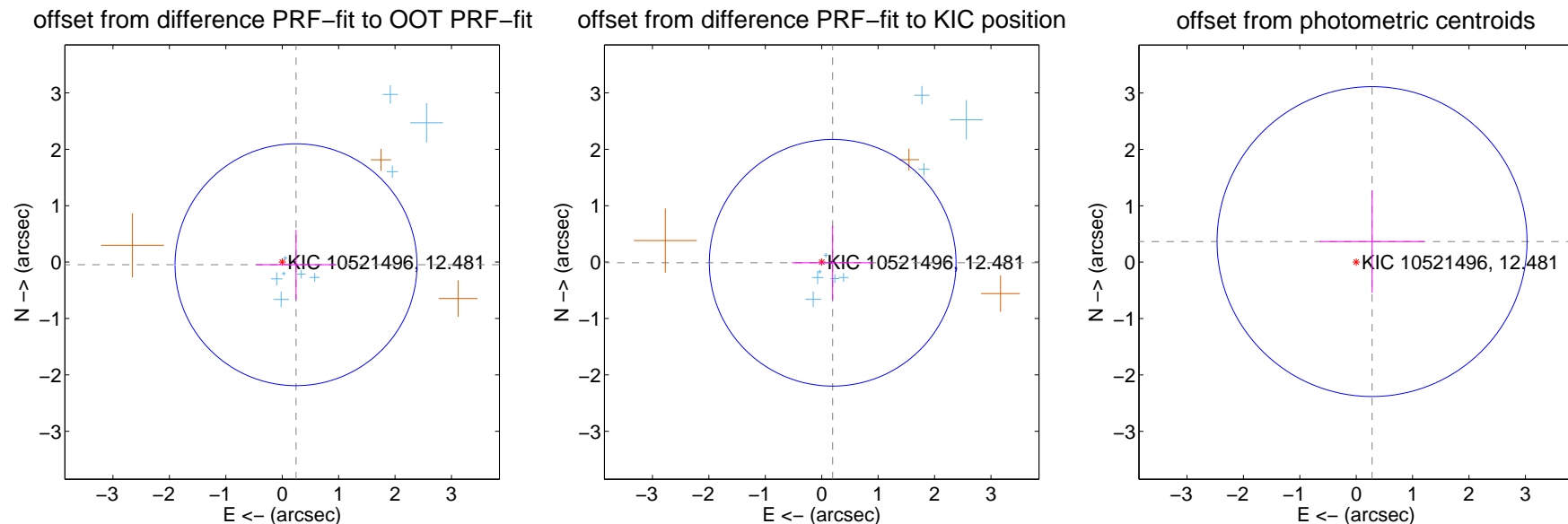
## DV Centroid Data

Supplemental centroid analysis for 010521496-01. Kepler magnitude: 12.48. Transit SNR 5.42

There are 9 quarters with good PRF difference image offsets

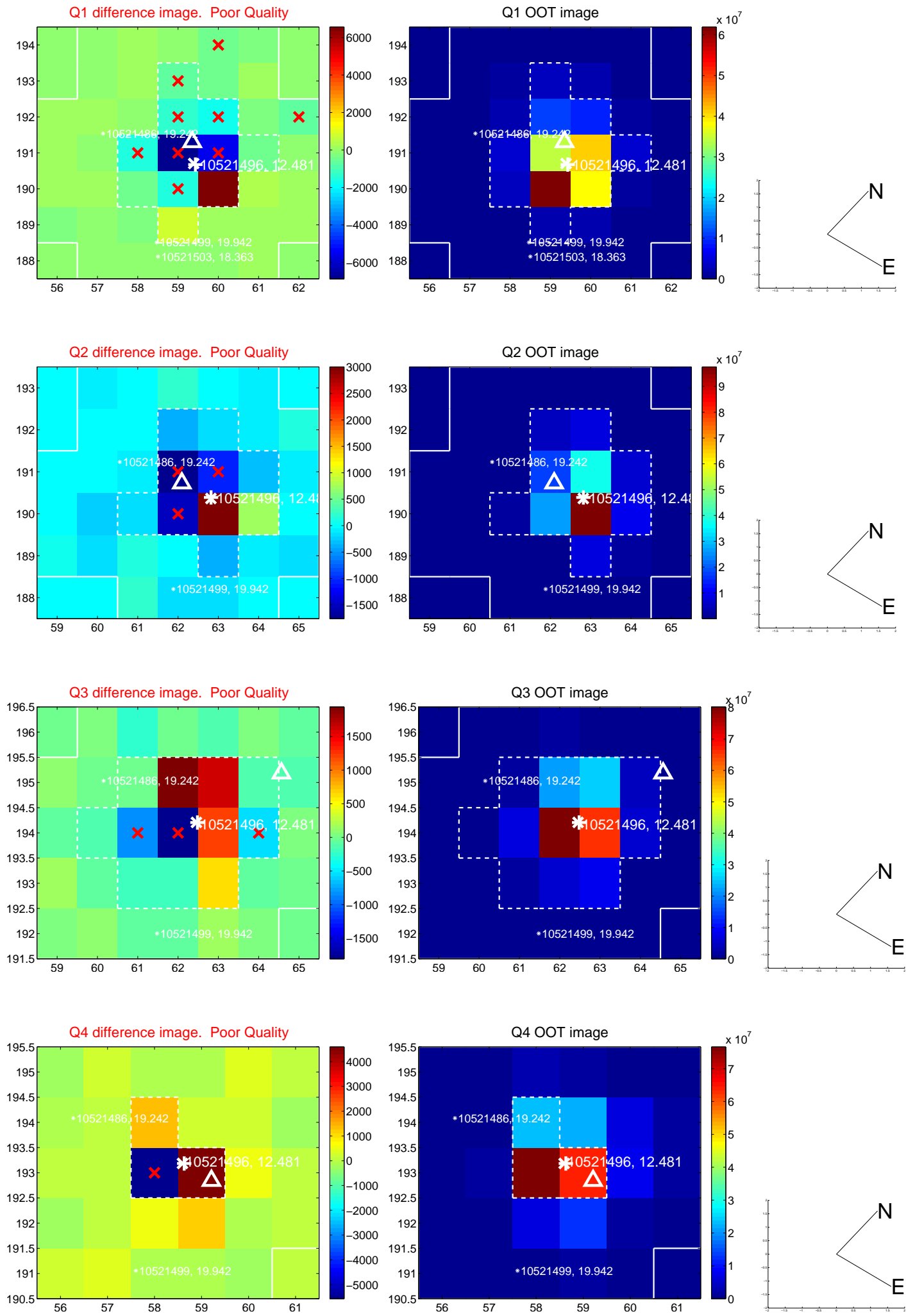
The direct PRF centroid is offset from the target star catalog position by about 0.19 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.249 \pm 0.715$	0.35	$-0.245 \pm 0.703$	$-0.047 \pm 0.617$
PRF-fit source offset from KIC position	$0.195 \pm 0.729$	0.27	$-0.194 \pm 0.721$	$-0.012 \pm 0.659$
photometric centroid source offset	$0.46 \pm 0.92$	0.50	$-0.28 \pm 0.93$	$0.37 \pm 0.91$

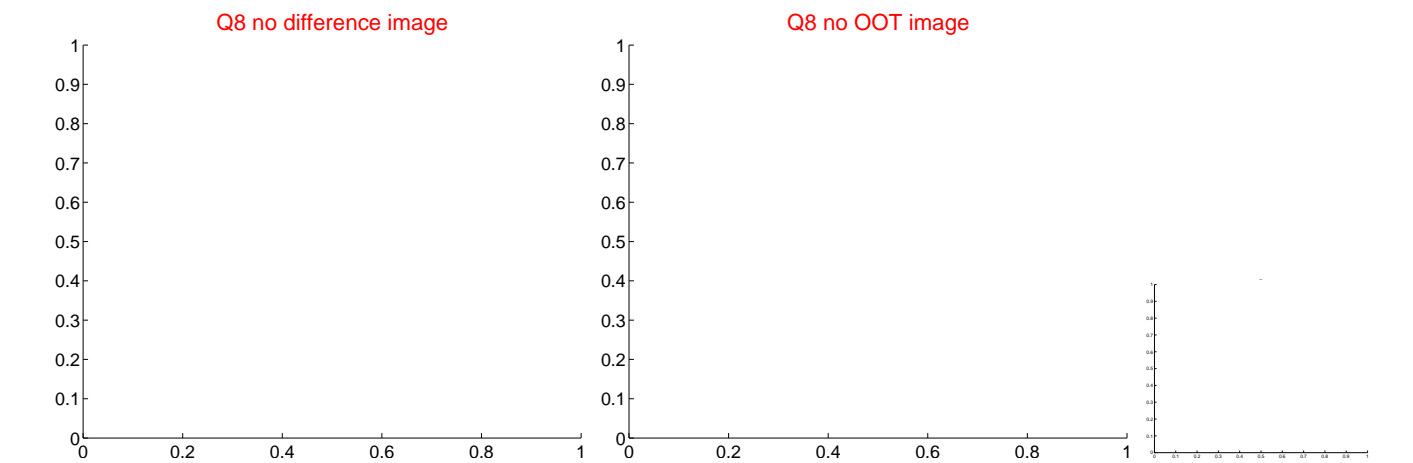
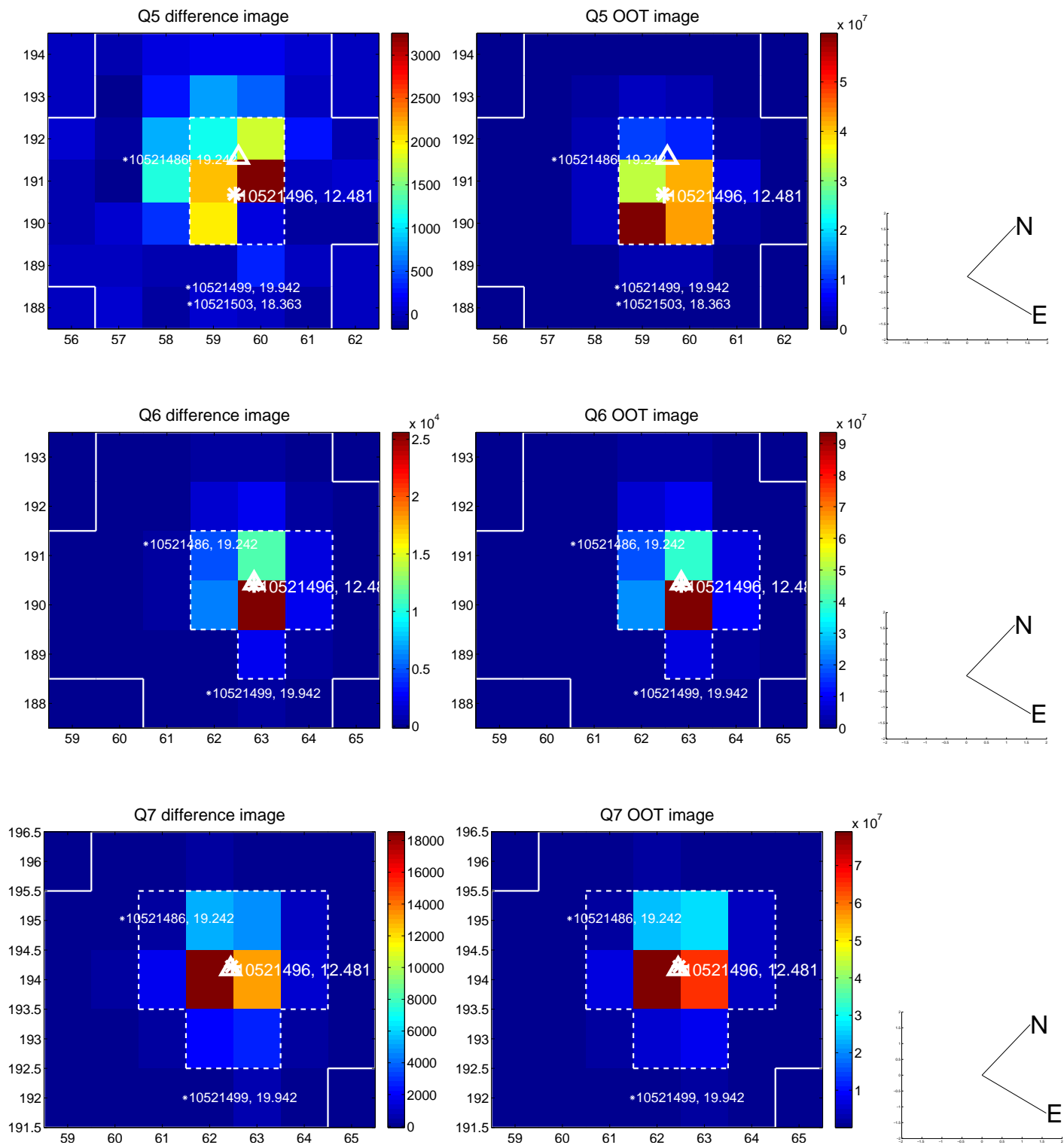


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

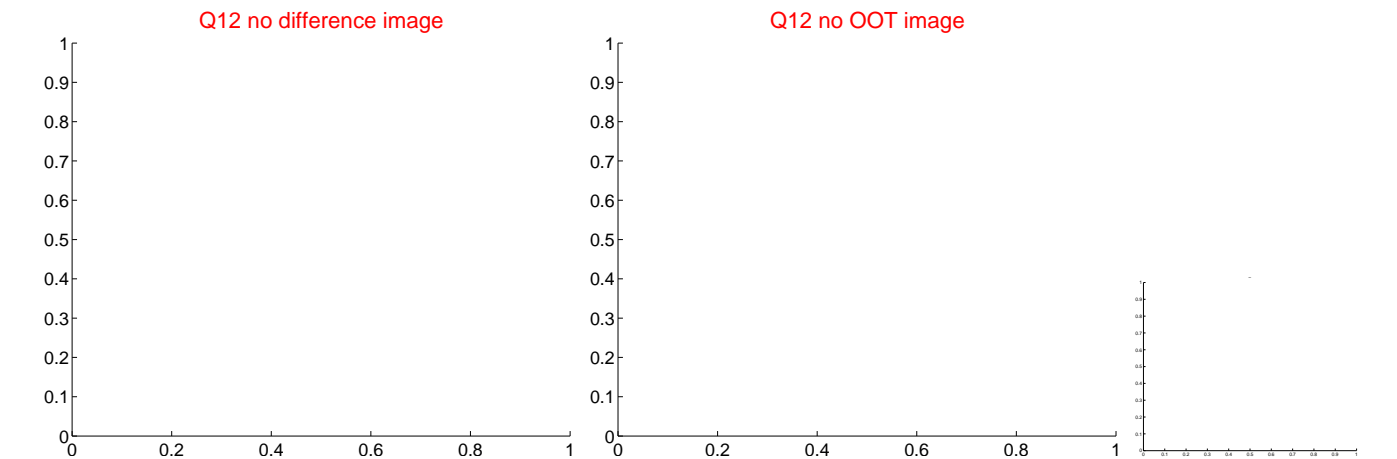
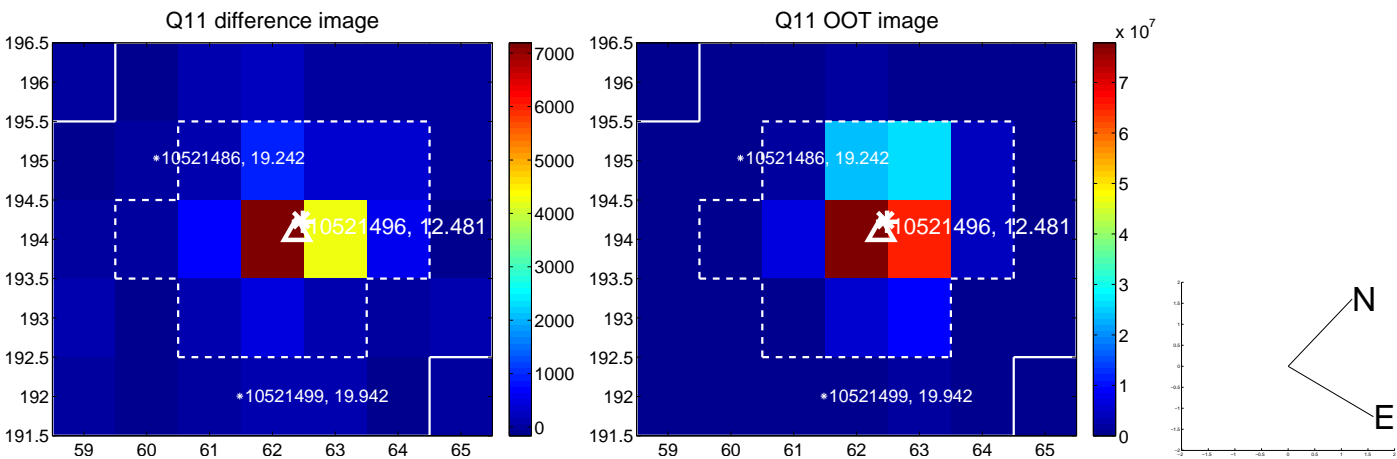
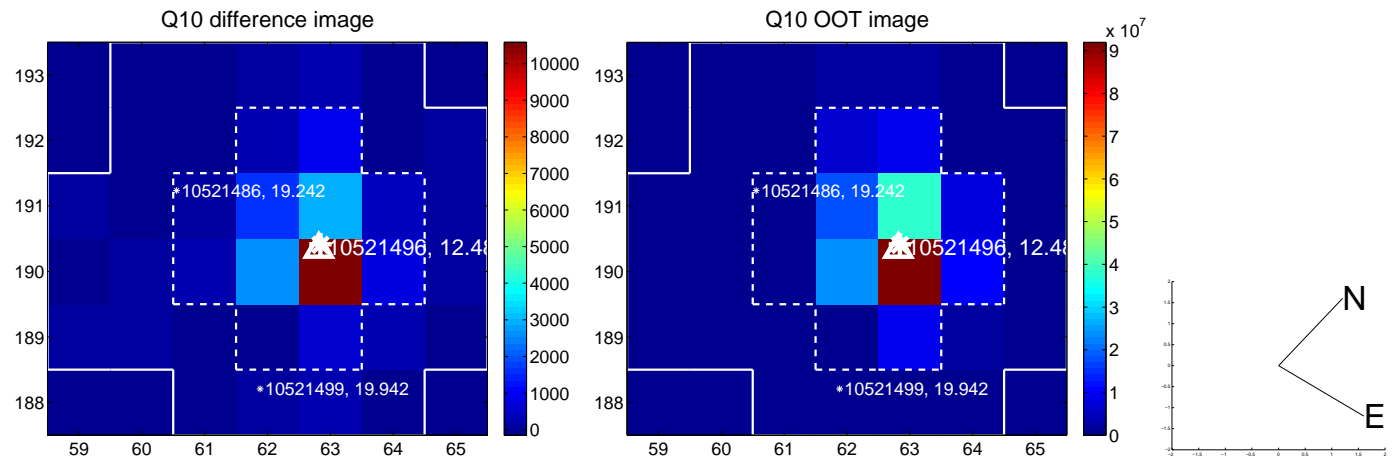
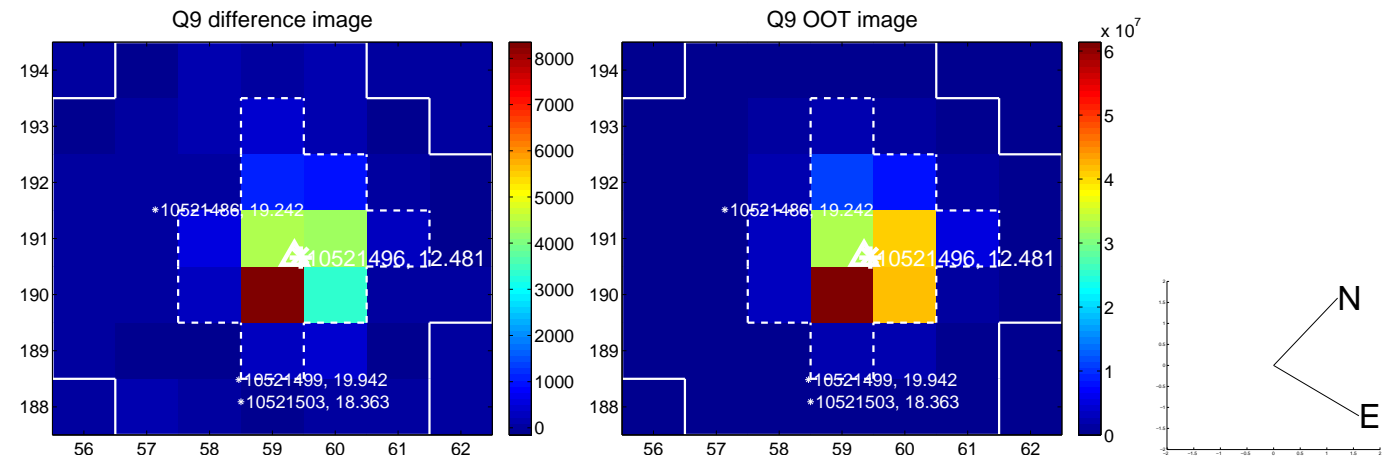


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

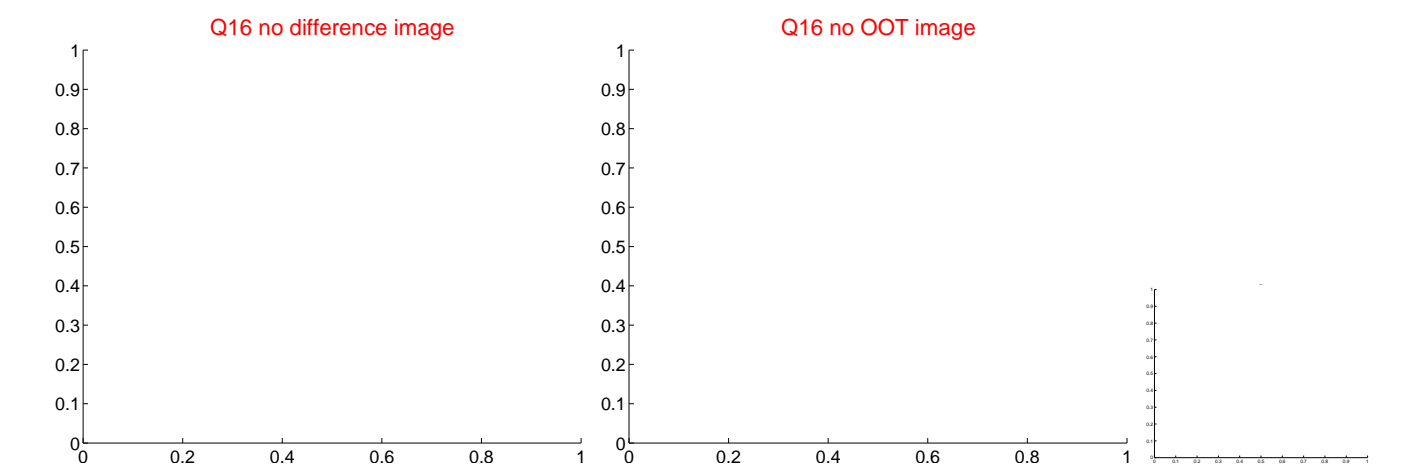
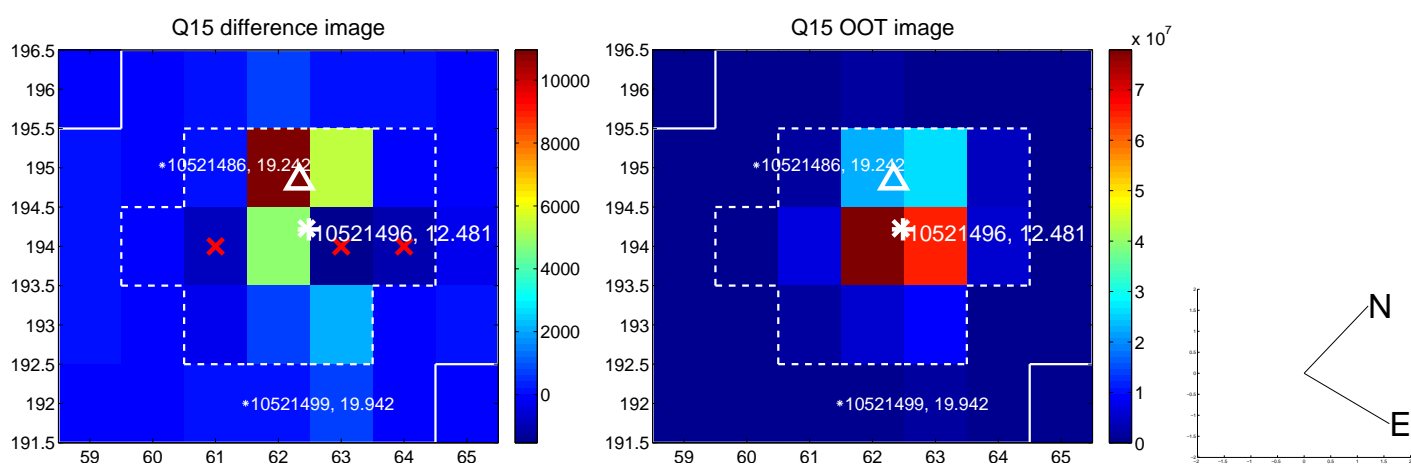
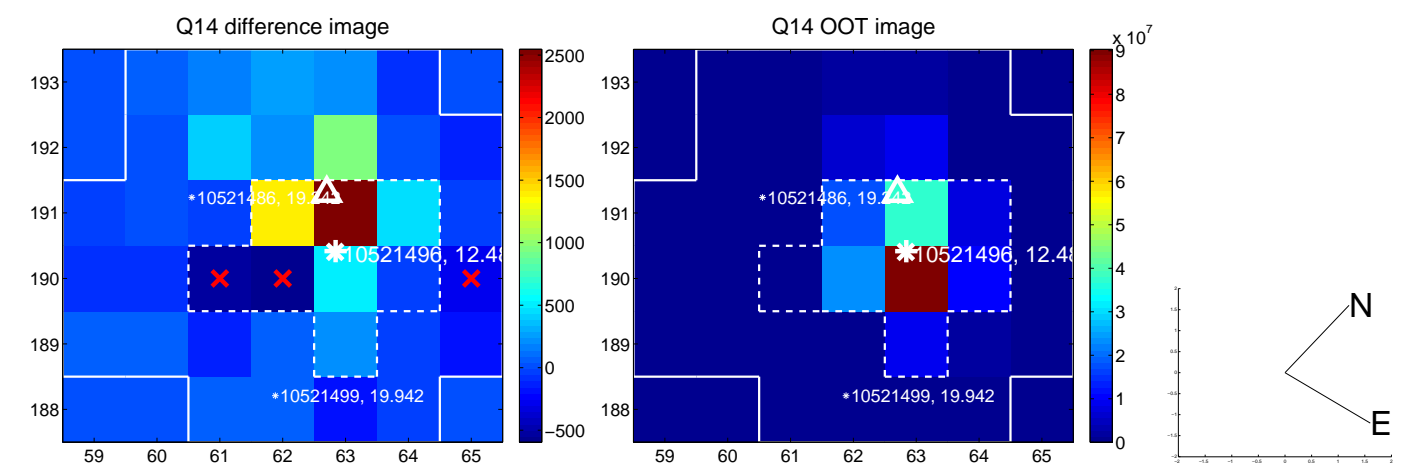
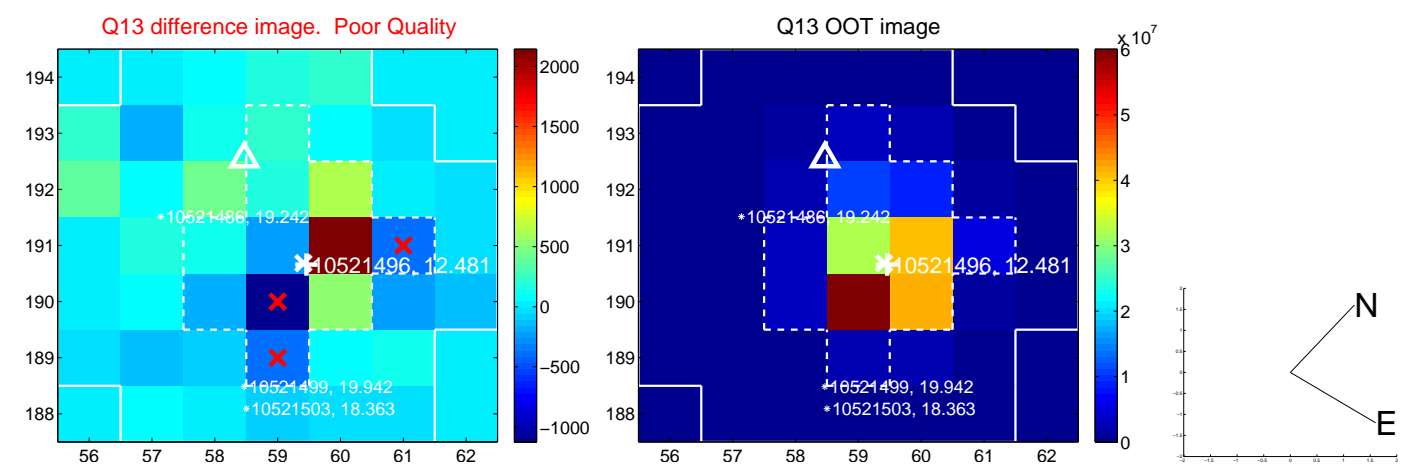




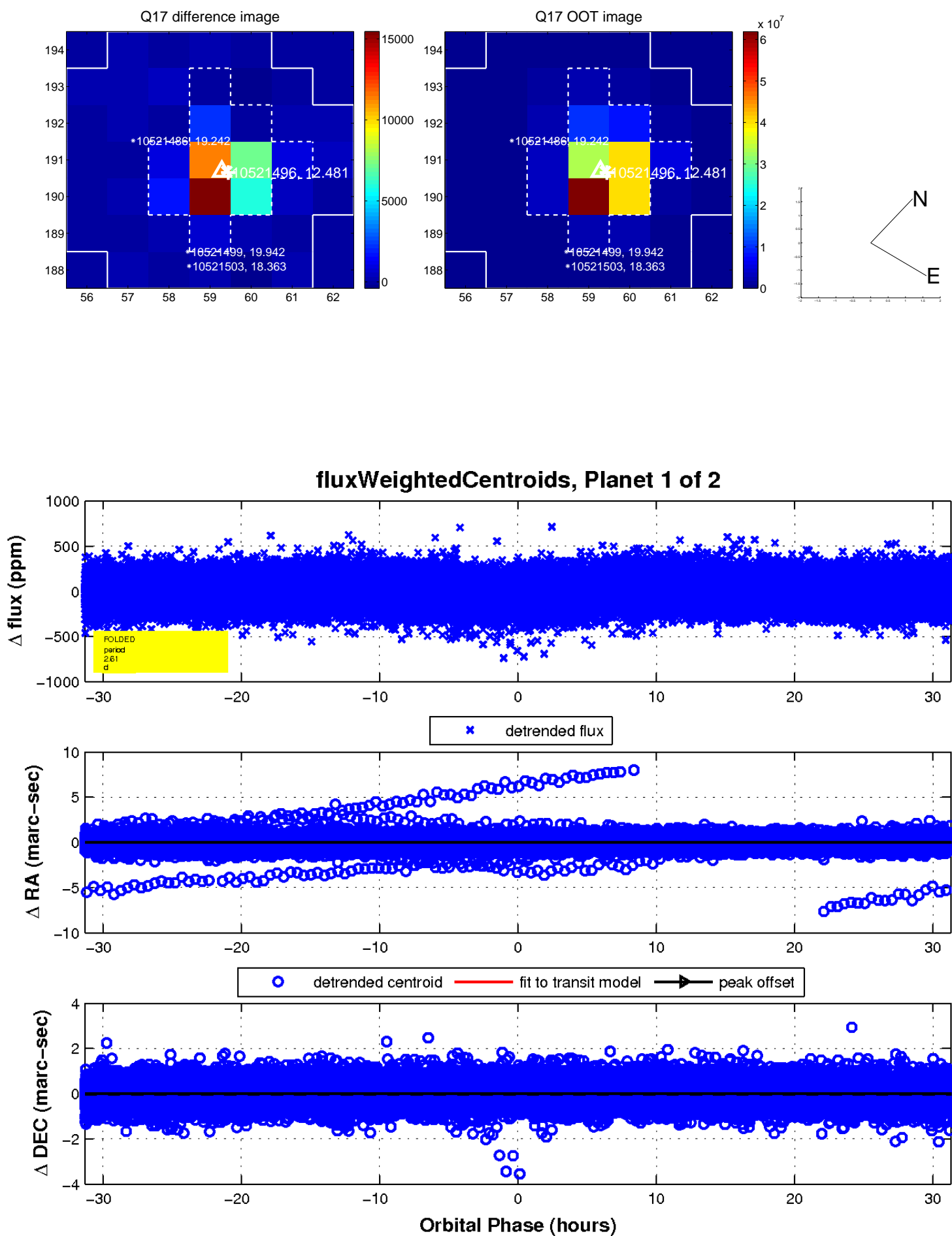
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

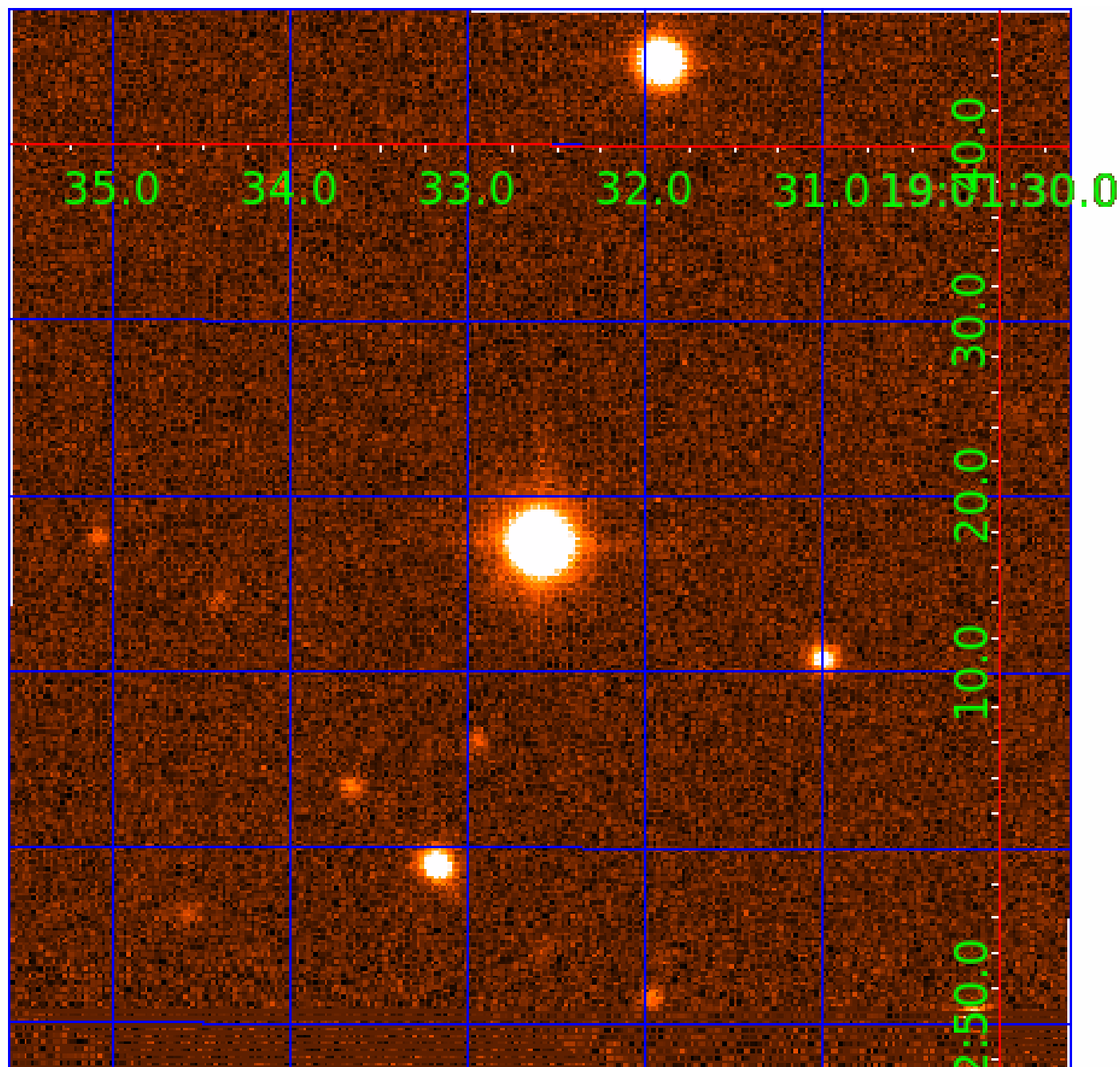


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination





# KIC 010521496

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
010521496-01	OBS	No	2.607428	133.840582	15.5	11.078	7.9	5.4	2.40	7209	1.01	7234.37
010521496-02	OBS	No	301.684510	255.305314	212.3	20.441	22.9	6.5	2.40	7209	3.63	12.83

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
010521496-01	OBS	FP	0.00	1	0	0	0	LPP_DV
010521496-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_ZUMA—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—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.

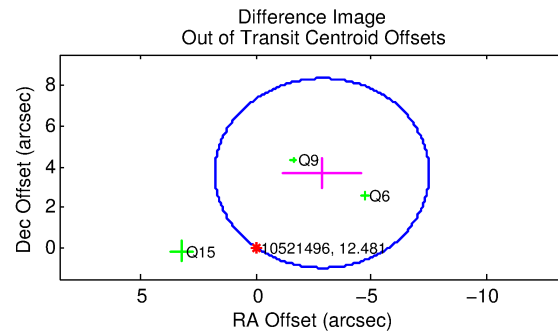
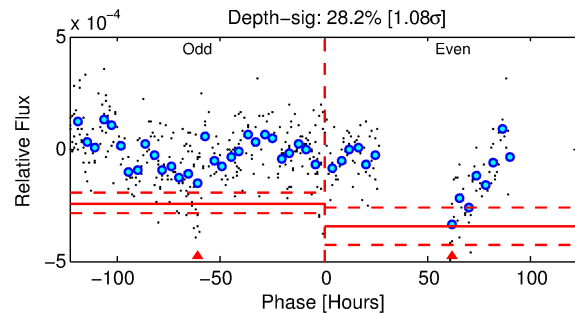
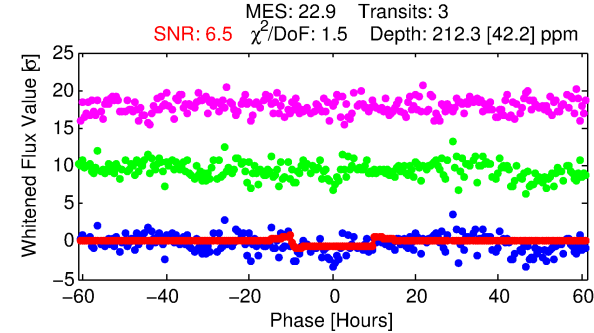
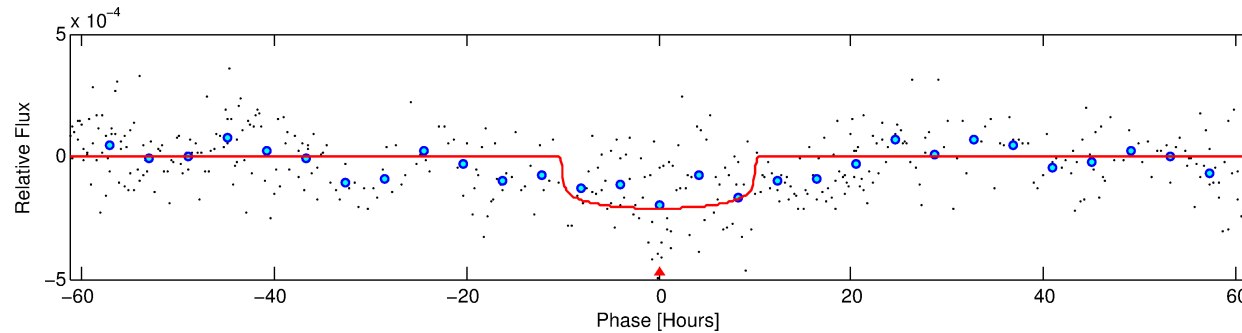
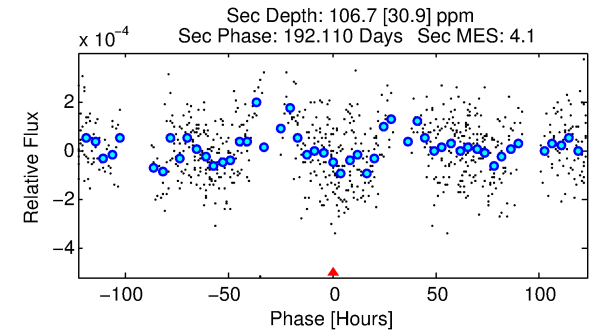
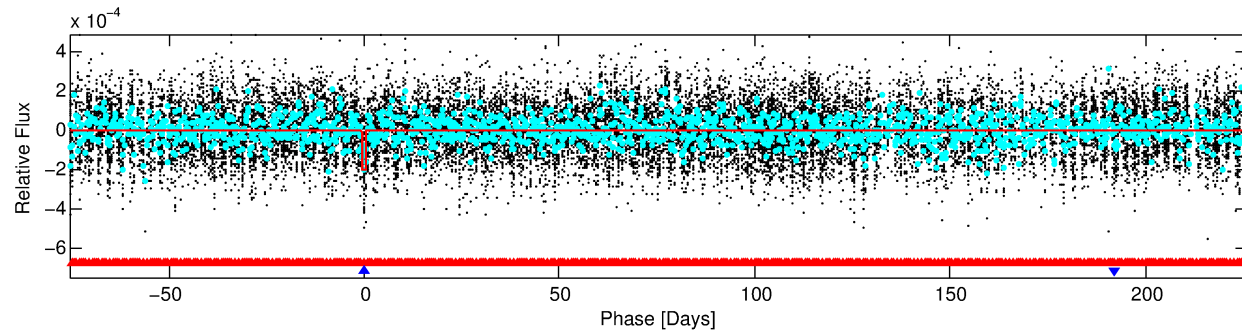
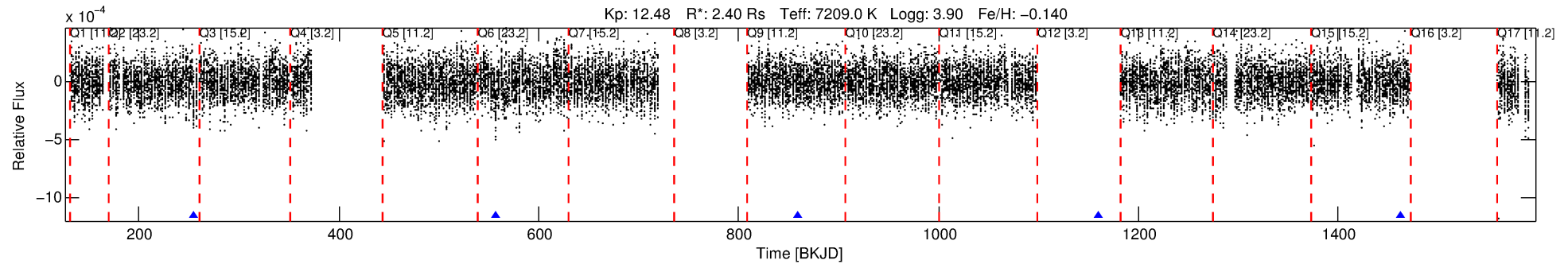
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 010521496-02

No Significant Match Found

# DV One-Page Summary

KIC: 10521496 Candidate: 2 of 2 Period: 301.685 d



## DV Fit Results:

Period = 301.68451 [0.01129] d  
Epoch = 255.3053 [0.0193] BKJD  
Rp/R\* = 0.0138 [0.0078]  
a/R\* = 98.90 [310.31]  
b = 0.51 [4.59]  
Seff = 12.83 [7.16]  
Teff = 483 [67] K  
Rp = 3.63 [2.47] Re  
a = 1.0440 [0.3620] AU  
Ag = 4858.93 [6222.80] [0.78σ]  
Teffp = 6230 [1827] K [3.14σ]

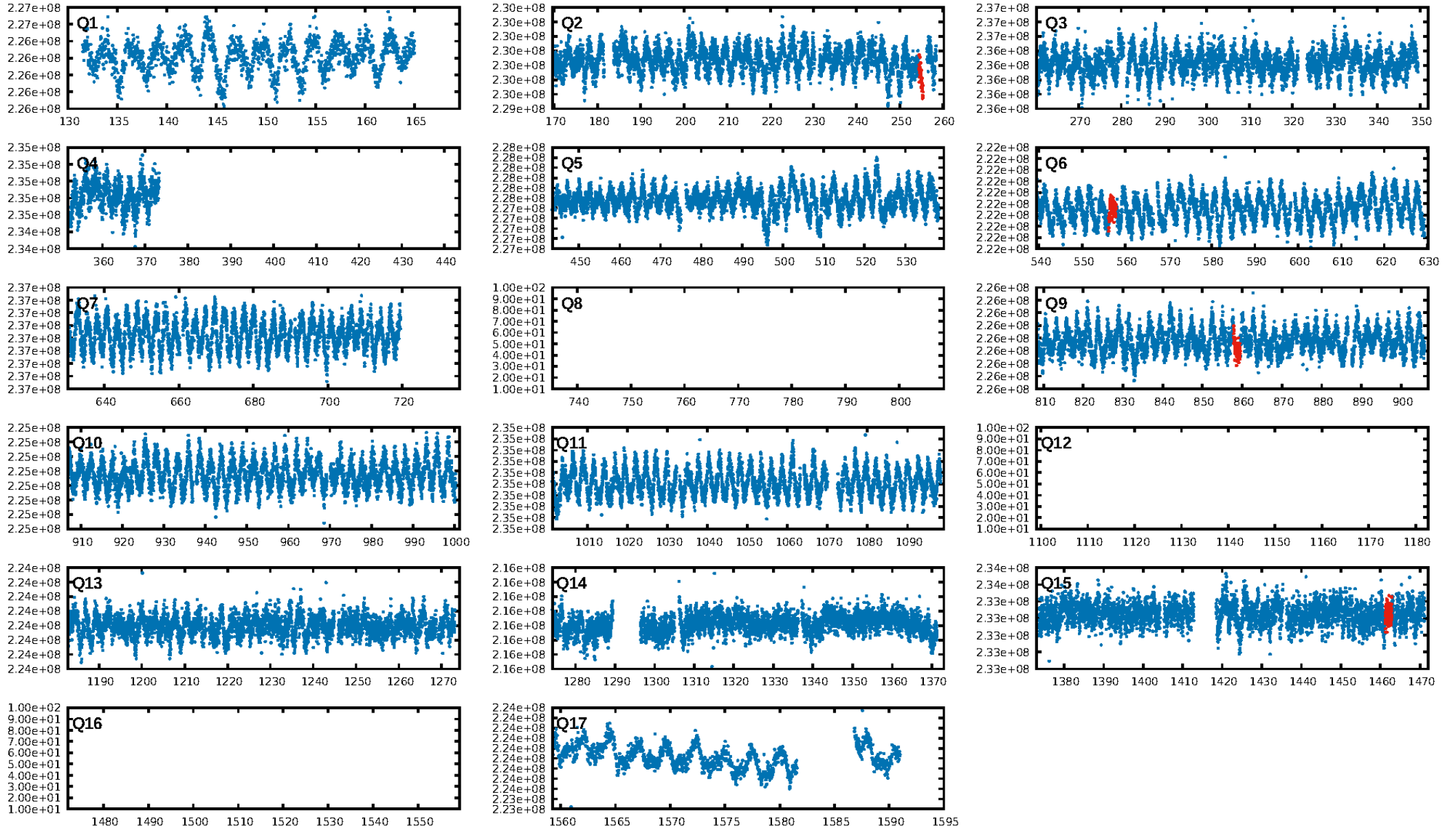
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [308.72σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 0.0%  
ModelChiSquareGof-sig: 95.3%  
Bootstrap-pfa: 1.92e-51  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: -2.44  
Centroid-sig: 3.2%  
Centroid-so: 0.958 arcsec [1.38σ]  
OotOffset-rm: 4.665 arcsec [3.02σ]  
OotOffset-st: 1/1/0/1 [3]  
KicOffset-rm: 4.614 arcsec [2.56σ]  
KicOffset-st: 1/1/0/1 [3]  
DiffImageQuality-fgm: 0.33 [1/3]  
DiffImageOverlap-fno: 0.00 [0/3]

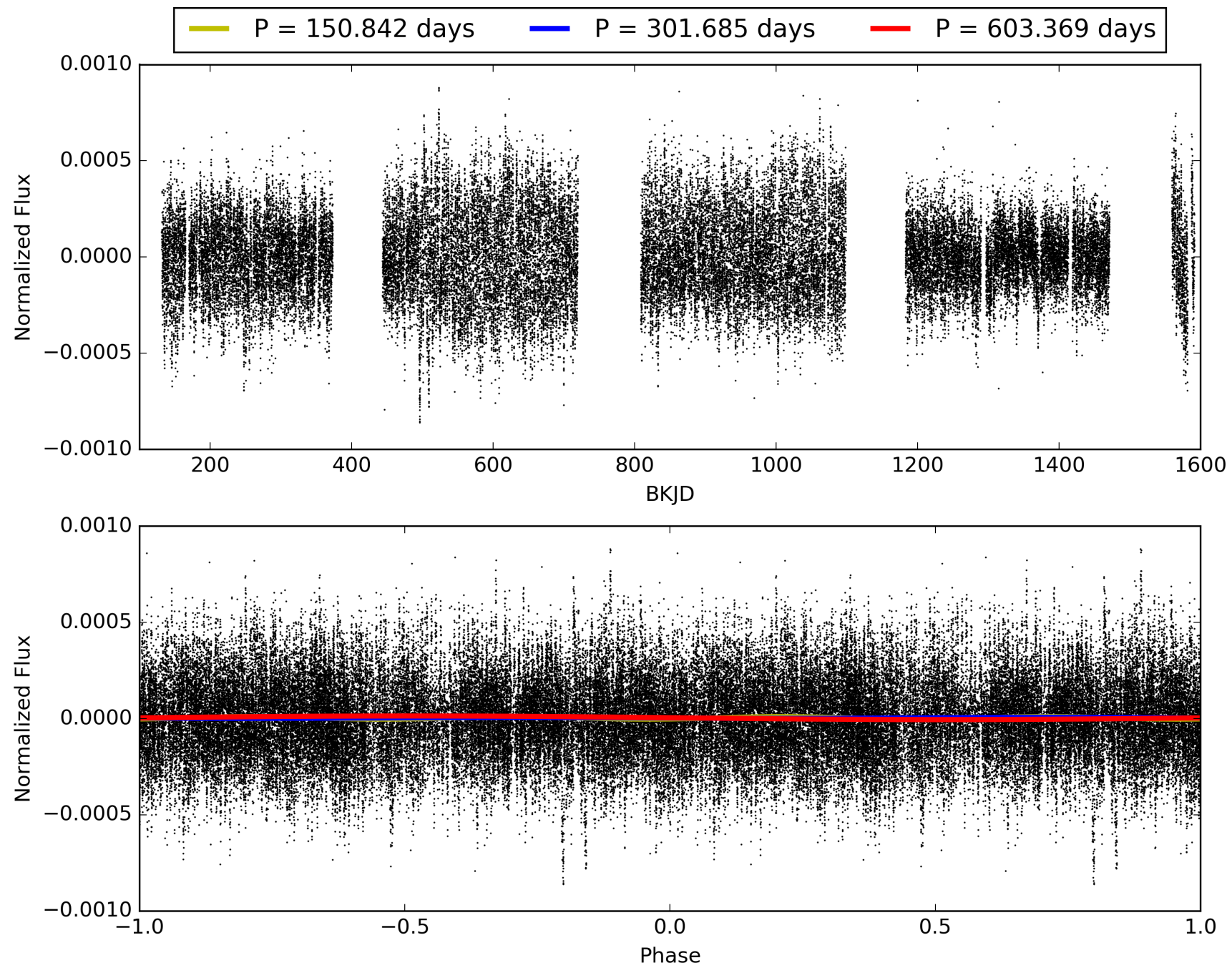
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 28-Jan-2016 23:36:05 Z

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

# TCE 010521496-02, PDC Light Curves



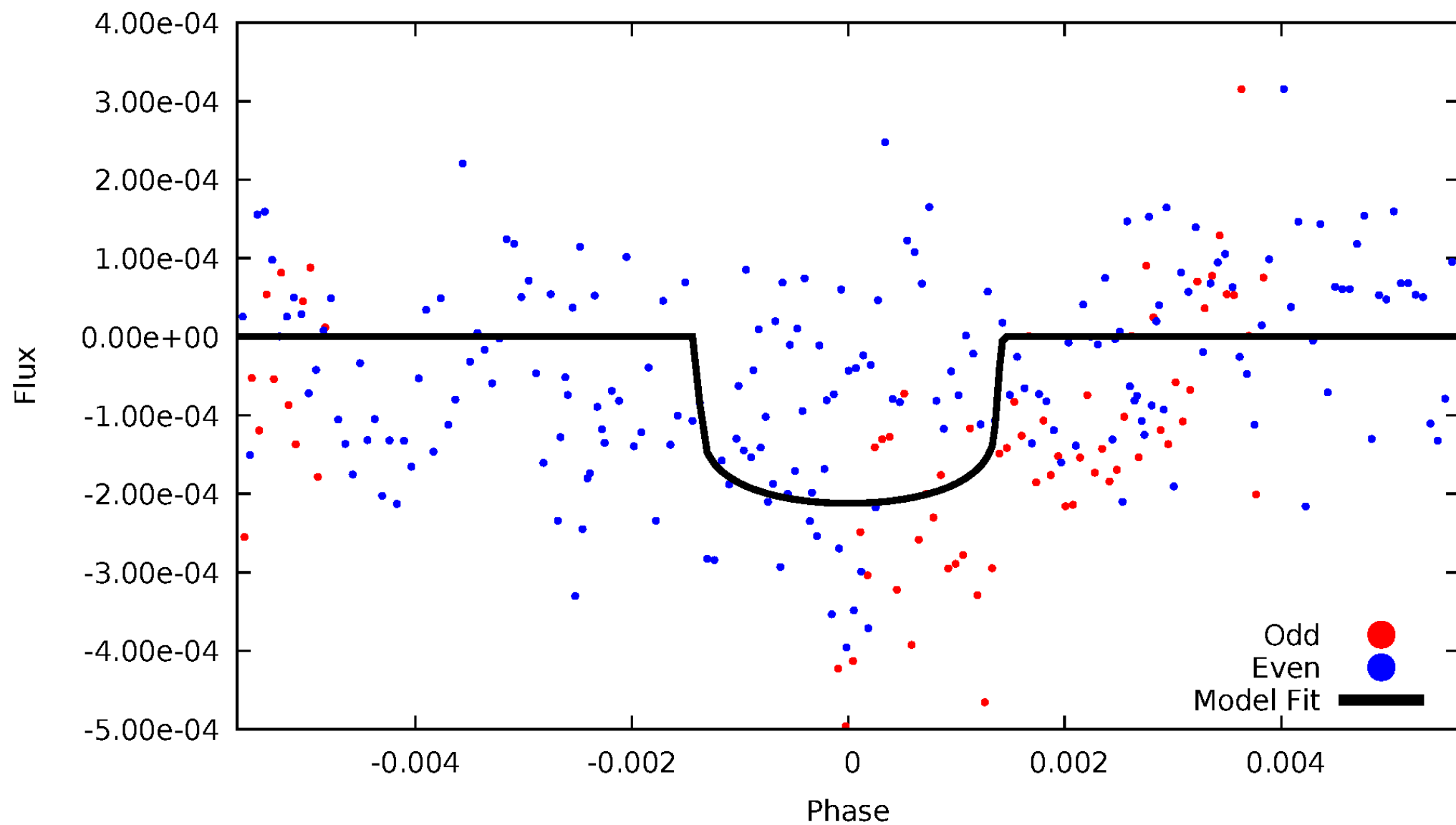
# TCE 010521496-02





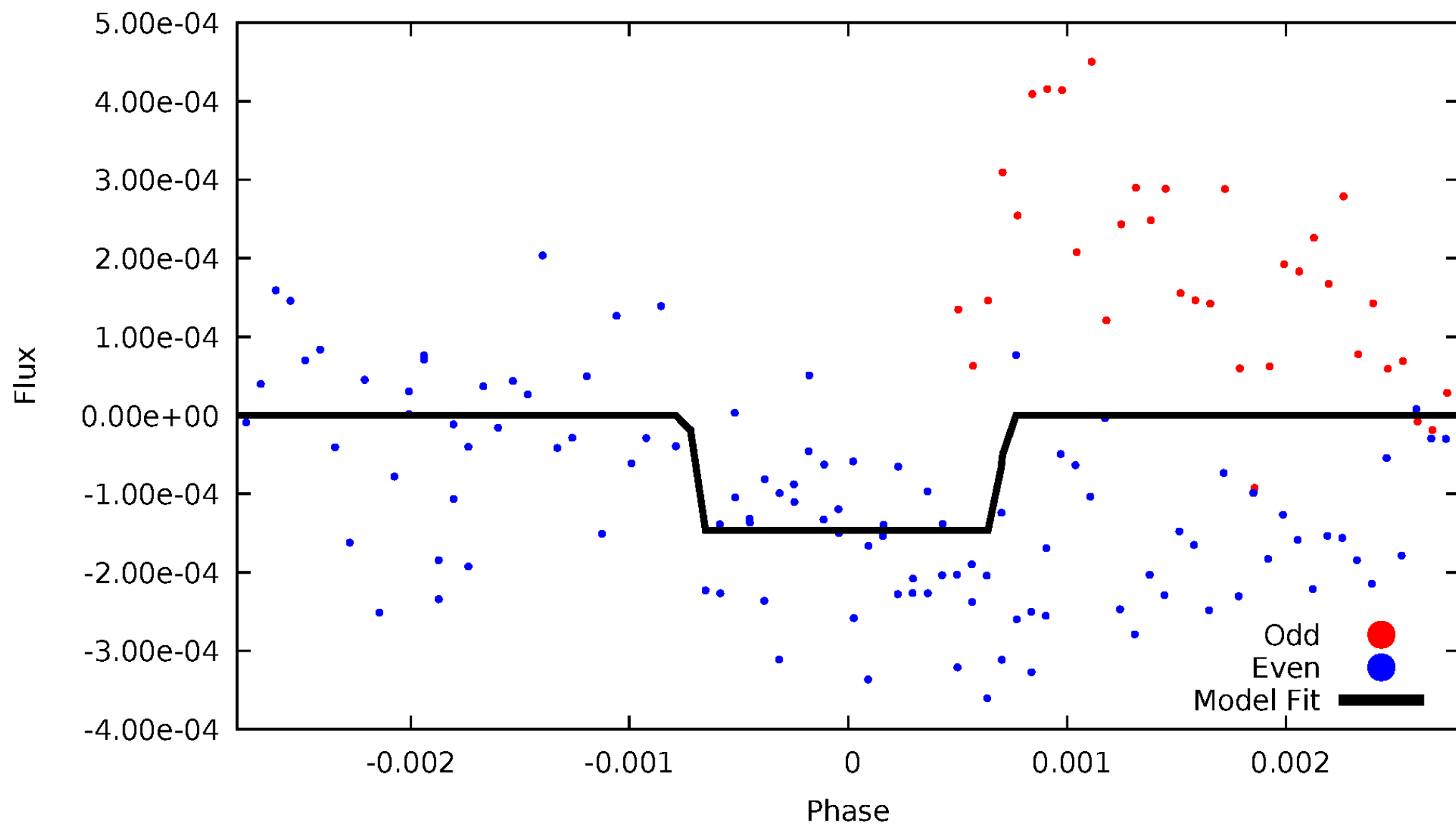
# DV Odd/Even

TCE 010521496-02



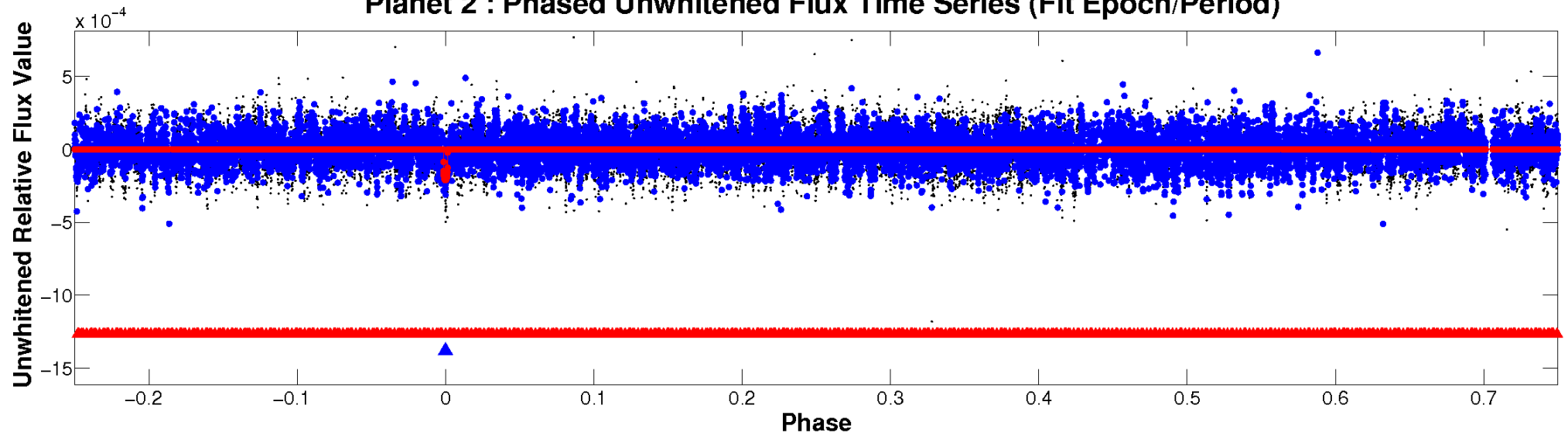
# ALT Odd/Even

TCE 010521496-02

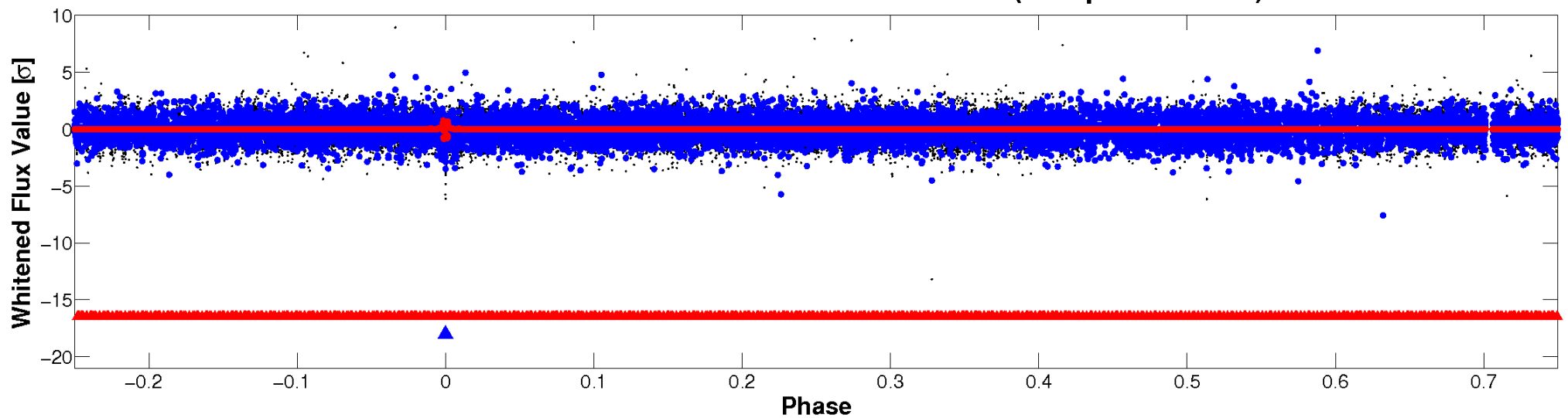


# Non-Whitened Vs. Whitened Light Curve

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

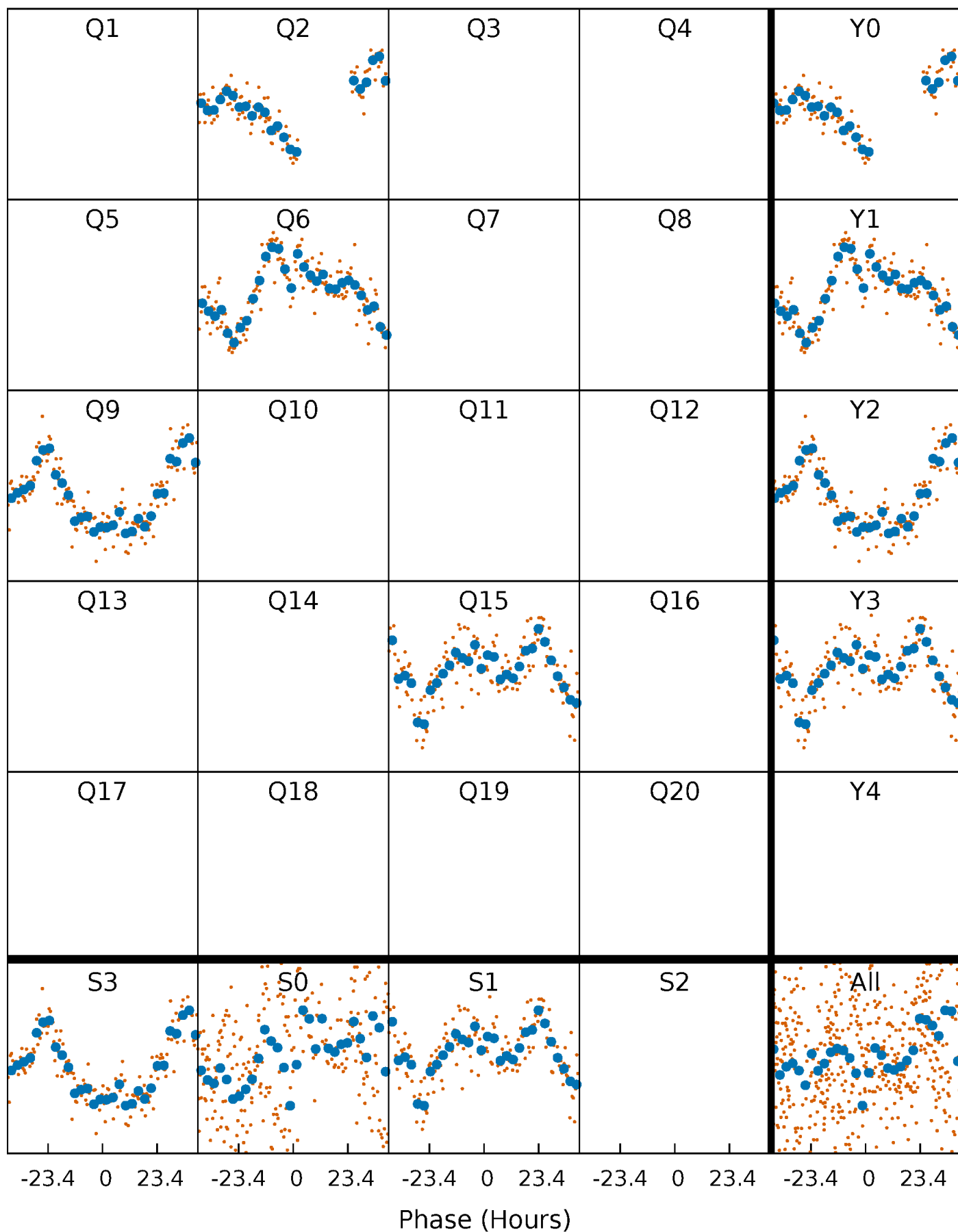


**Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



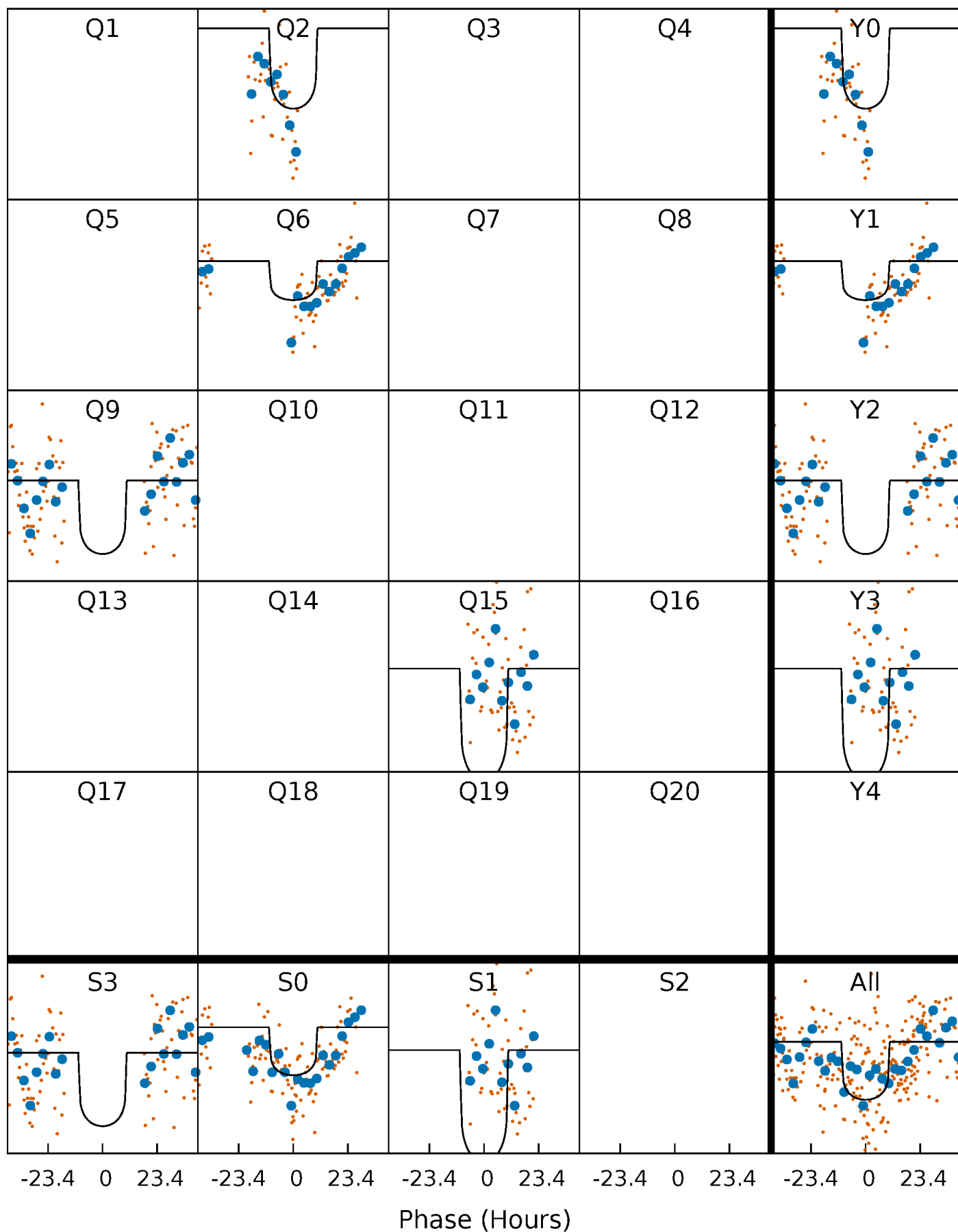
# PDC Quarter-Phased Transit Curves

TCE 010521496-02     $P=301.684510$  Days     $T_0=255.305314$  (BKJD)



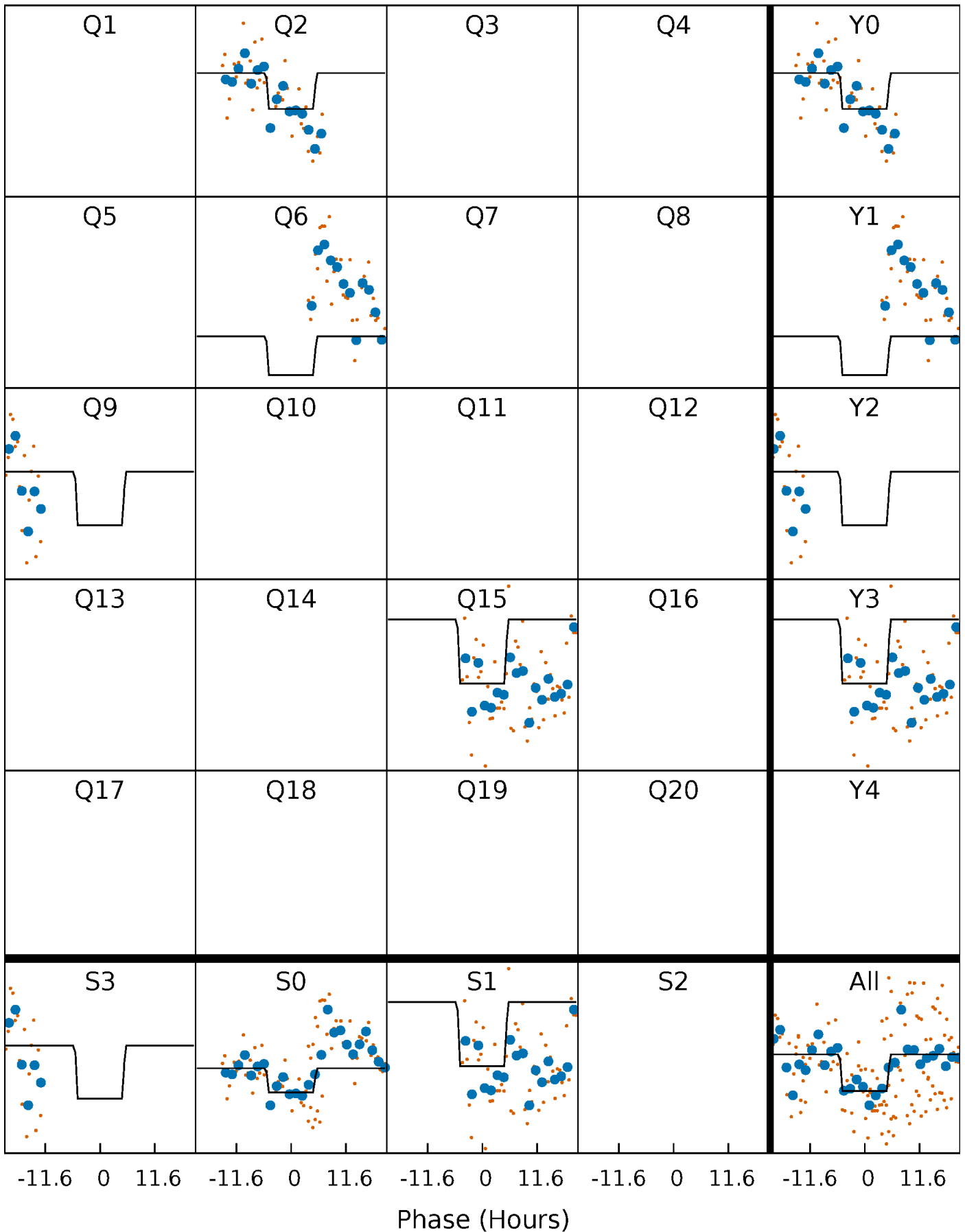
# DV Quarter-Phased Transit Curves

TCE 010521496-02     $P=301.684510$  Days     $T_0=255.305314$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

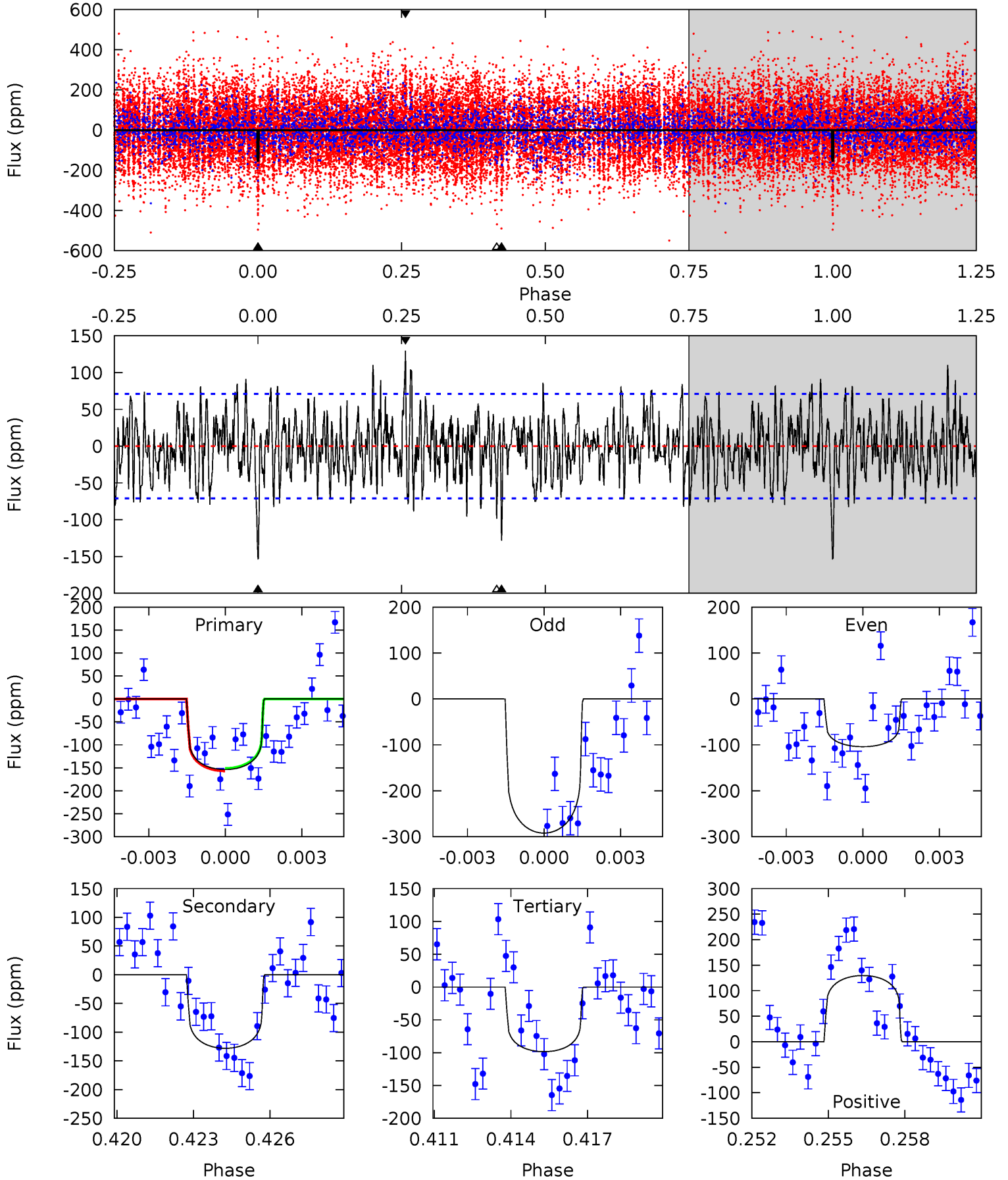
TCE 010521496-02     $P=301.701513$  Days     $T_0=255.108631$  (BKJD)



# DV Model-Shift Uniqueness Test

010521496-02, P = 301.684510 Days, E = 255.305314 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
11.4	9.51	7.31	9.62	5.26	2.98	2.53	4.10	1.79	2.20	-0.11	6.14	0.77	0.46	0.20

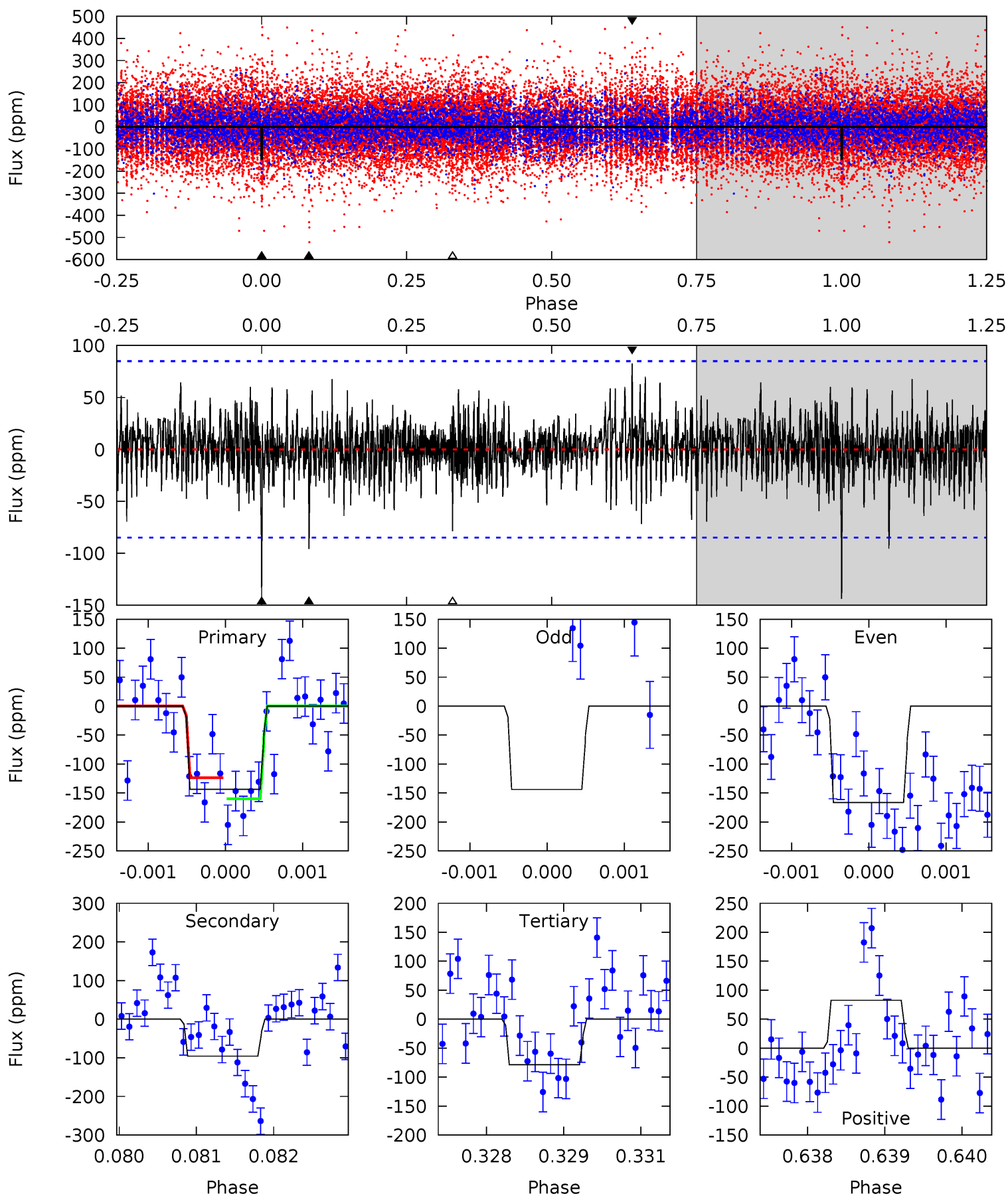




# Alt Model-Shift Uniqueness Test

010521496-02, P = 301.701513 Days, E = 255.108631 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
9.12	6.07	5.00	5.24	5.39	3.19	1.26	4.12	3.89	1.07	0.83	0.41	0.38	0.36	1.14



### Stellar Parameters For KIC 010521496

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$7209^{+201}_{-277}$	$3.898^{+0.308}_{-0.132}$	$-0.140^{+0.250}_{-0.350}$	$2.404^{+0.563}_{-0.915}$	$1.667^{+0.186}_{-0.371}$	$0.169^{+0.365}_{-0.064}$
	+3%/-4%	+8%/-3%	+179%/-250%	+23%/-38%	+11%/-22%	+216%/-38%
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 010521496-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-128 \pm 13$	$3.53^{+2.06}_{-1.86}$	$662^{+50}_{-67}$	$6302^{+3092}_{-1088}$	$6198^{+20693}_{-3812}$
Alt.	$-96 \pm 16$	$3.16^{+1.93}_{-1.75}$	$664^{+47}_{-60}$	$6267^{+3452}_{-1198}$	$5736^{+21899}_{-3519}$

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

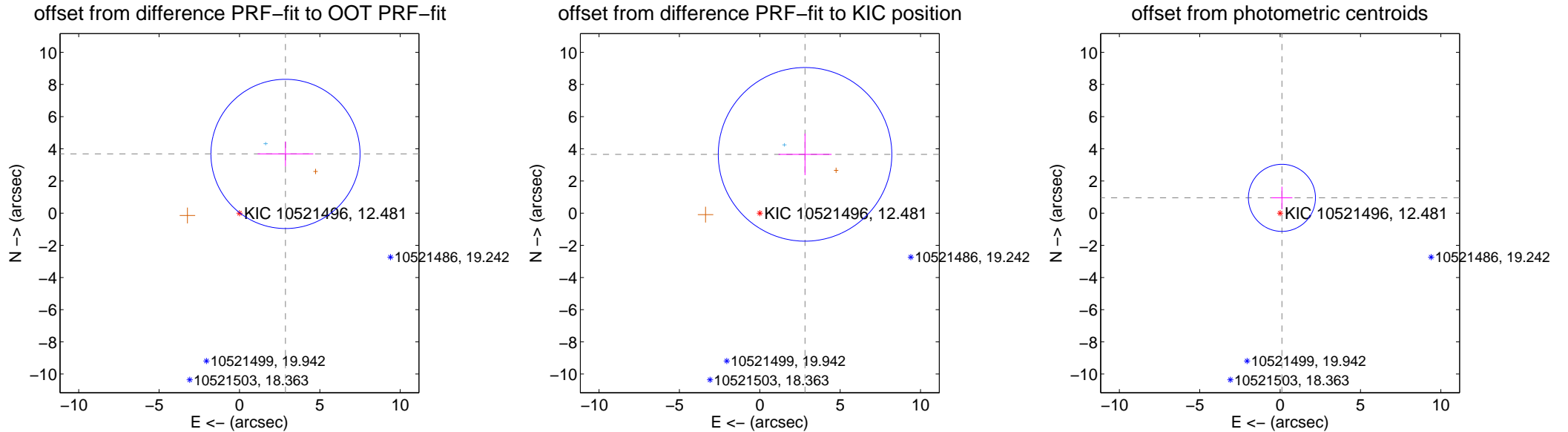
## DV Centroid Data

Supplemental centroid analysis for 010521496-02. Kepler magnitude: 12.48. Transit SNR 6.50

There are 1 quarters with good PRF difference image offsets

The direct PRF centroid is offset from the target star catalog position by about 0.15 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$4.665 \pm 1.546$	$3.02$	$-2.863 \pm 1.731$	$3.683 \pm 0.772$
PRF-fit source offset from KIC position	$4.614 \pm 1.799$	$2.56$	$-2.815 \pm 1.650$	$3.655 \pm 1.291$
photometric centroid source offset	$0.96 \pm 0.70$	$1.38$	$-0.11 \pm 0.65$	$0.95 \pm 0.70$

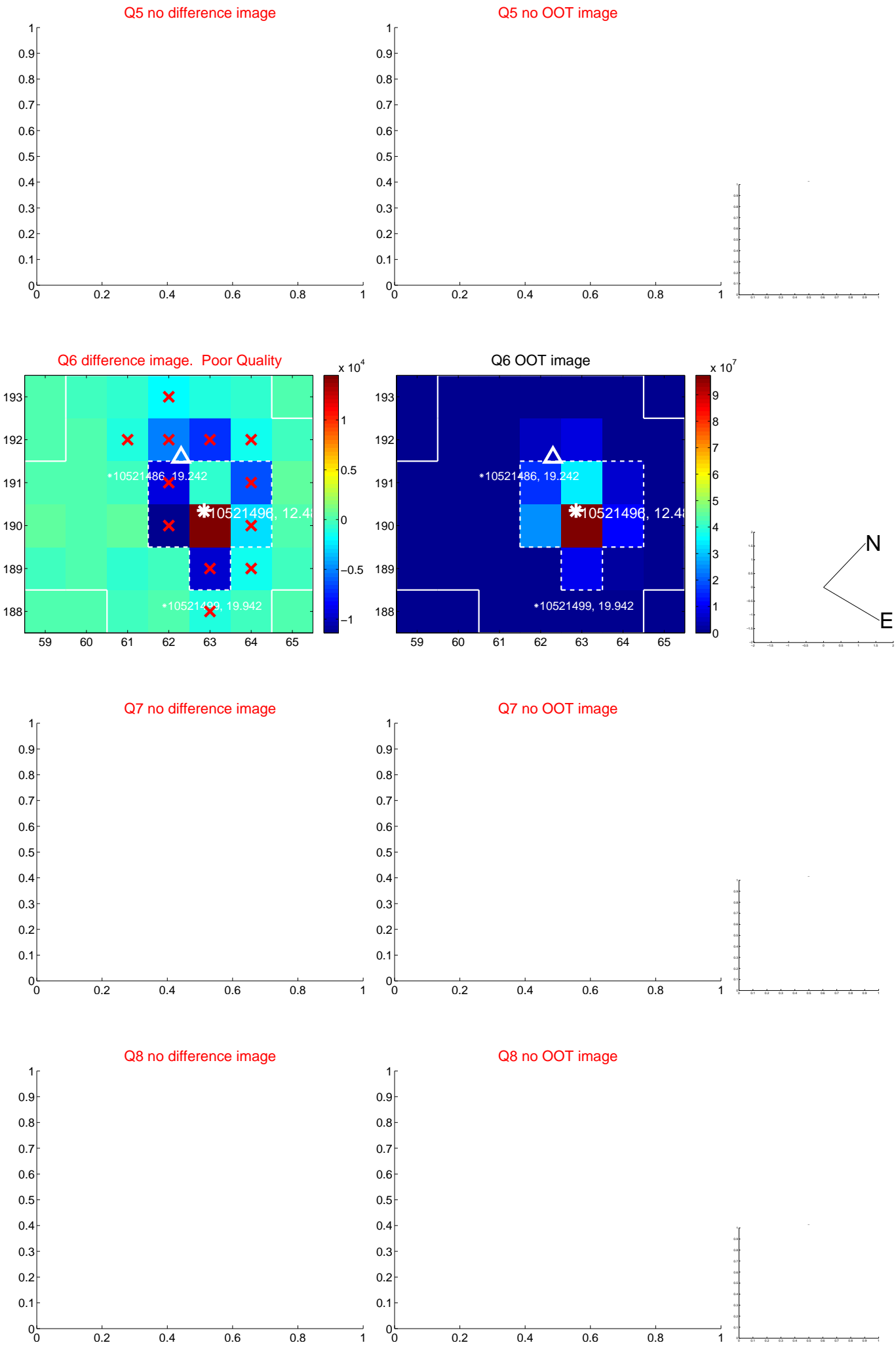


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

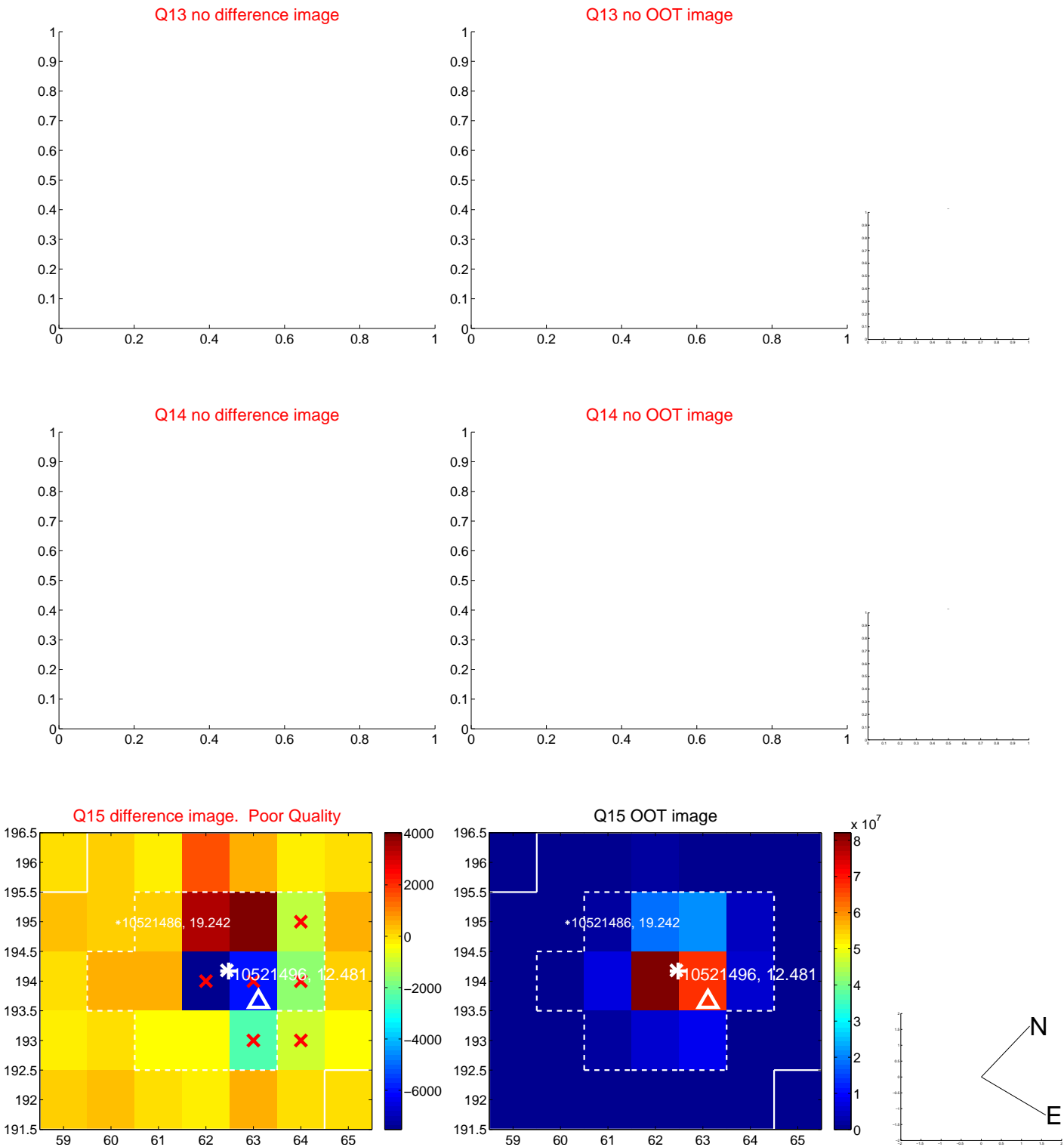


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



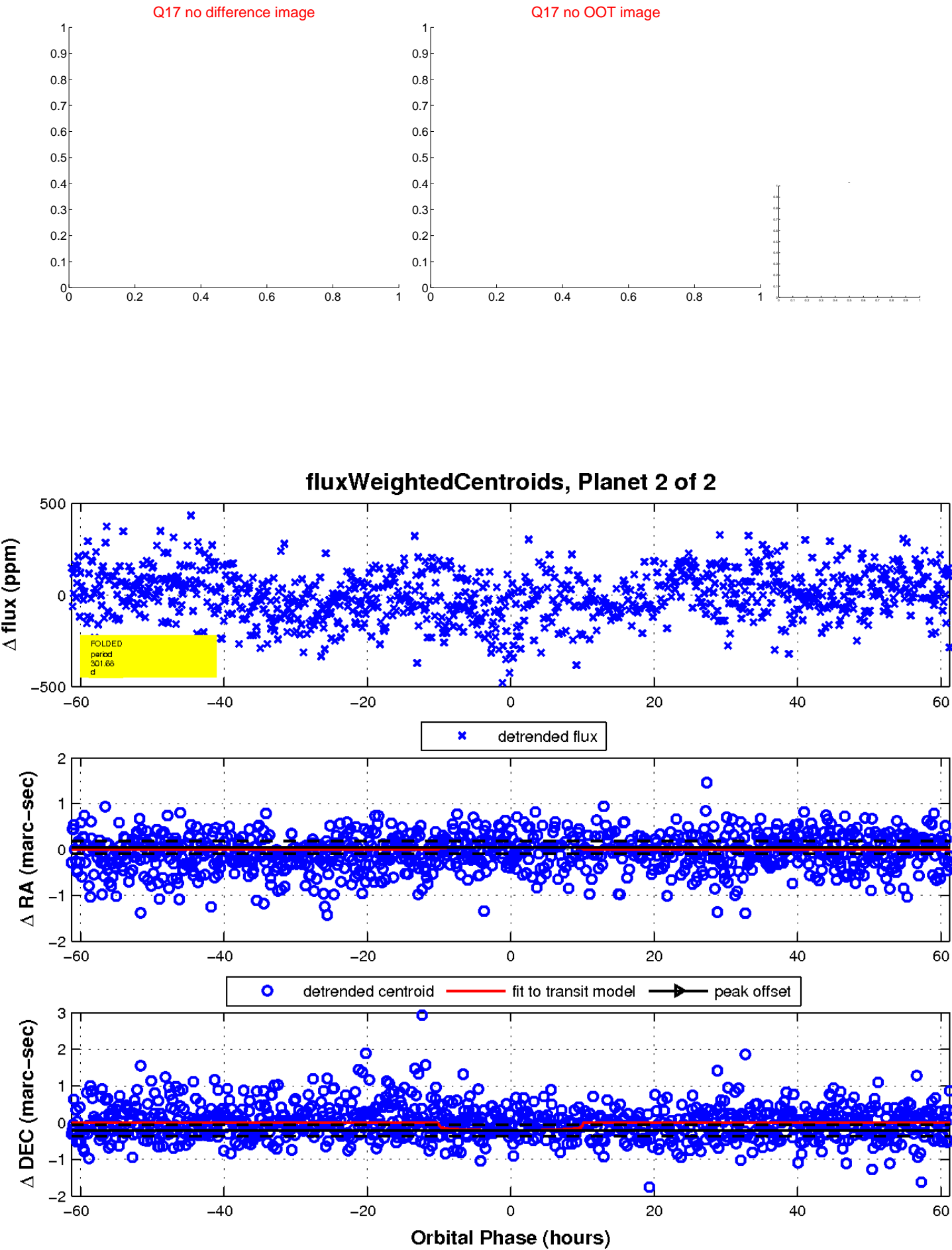


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





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



UKIRT Image

Declination

