

# KIC 004851530

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
004851530-01	OBS	1884.01	23.081775	150.585411	567.9	9.430	17.6	12.6	0.80	5275	2.07	21.35
004851530-02	OBS	1884.02	4.775012	135.806476	512.6	1.788	14.3	16.7	0.80	5275	1.89	174.49

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
004851530-01	OBS	FP	0.01	1	0	0	0	LPP_DV
004851530-02	OBS	PC	0.99	0	0	0	0	CENT_KIC_POS

**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.

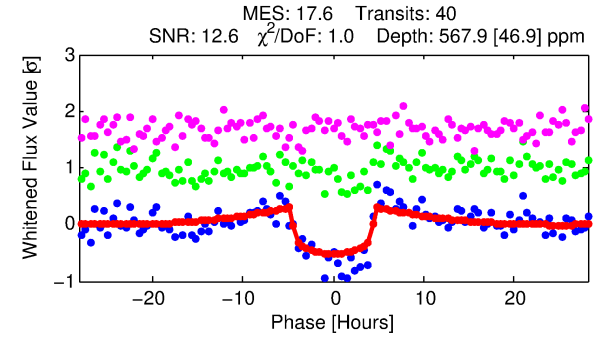
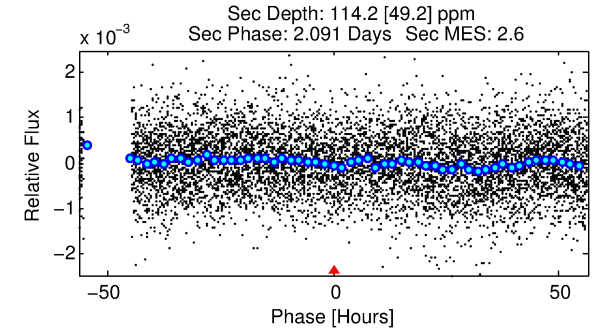
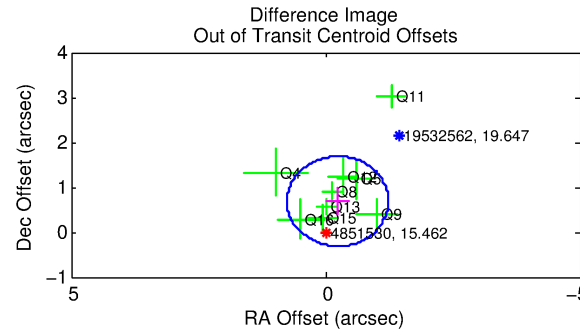
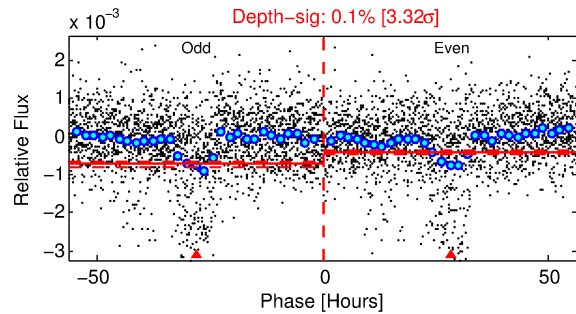
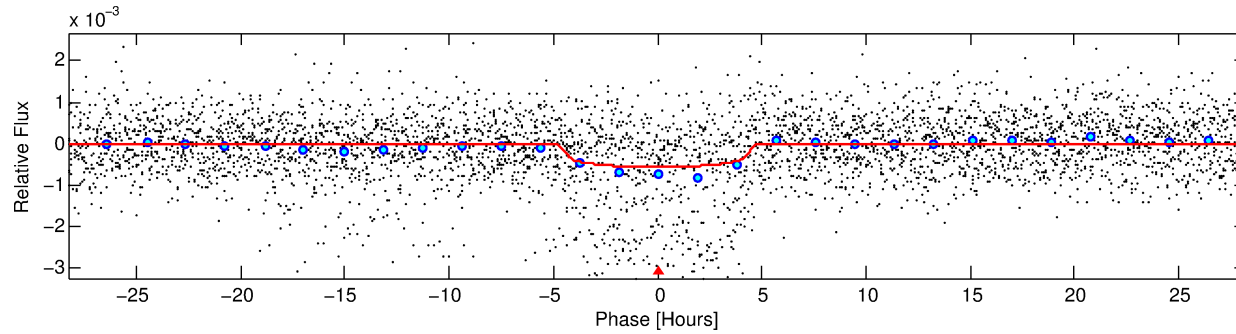
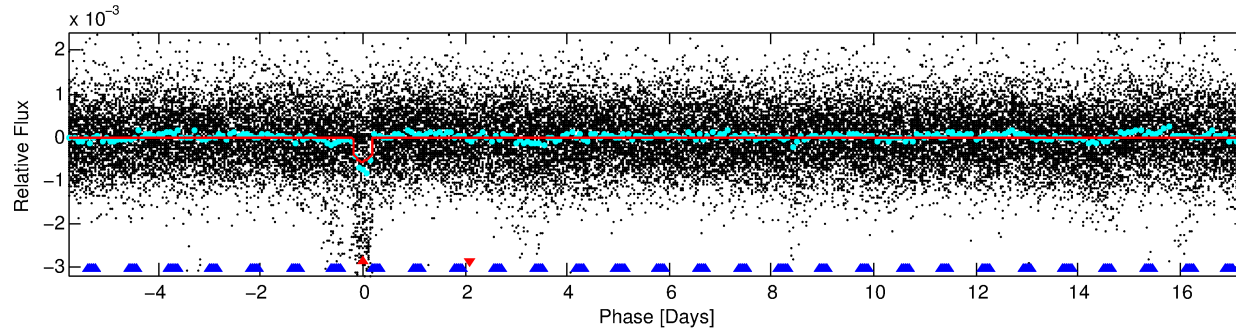
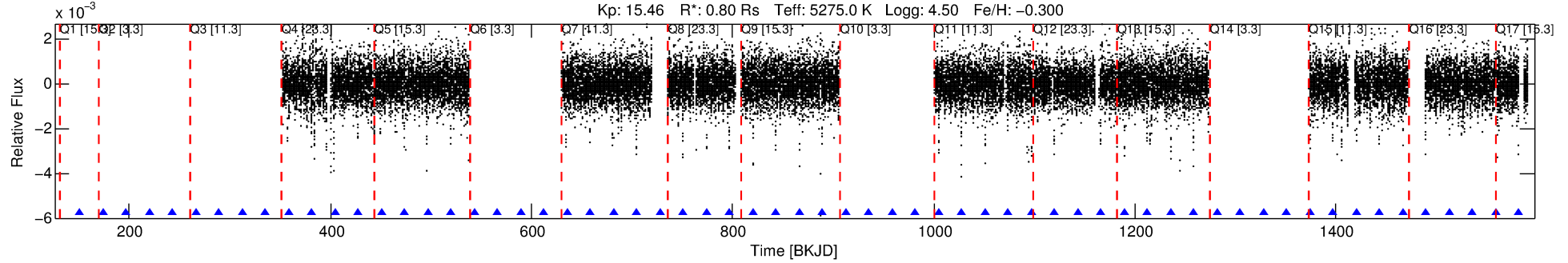
## Ephemeris Match Information For 004851530-01

No Significant Match Found

# DV One-Page Summary

KIC: 4851530 Candidate: 1 of 2 Period: 23.082 d  
KOI: K01884 Corr: No Ephemeris Match

Kp: 15.46 R\*: 0.80 Rs Teff: 5275.0 K Logg: 4.50 Fe/H: -0.300



## DV Fit Results:

Period = 23.08177 [0.00031] d  
Epoch = 150.5854 [0.0118] BKJD  
Rp/R\* = 0.0238 [0.0058]  
a/R\* = 12.96 [12.14]  
b = 0.75 [0.54]  
Seff = 21.35 [4.95]  
Teq = 548 [32] K  
Rp = 2.07 [0.58] Re  
a = 0.1435 [0.0177] AU  
Ag = 302.91 [204.66] [1.48σ]  
Teff = 3535 [587] K [5.08σ]

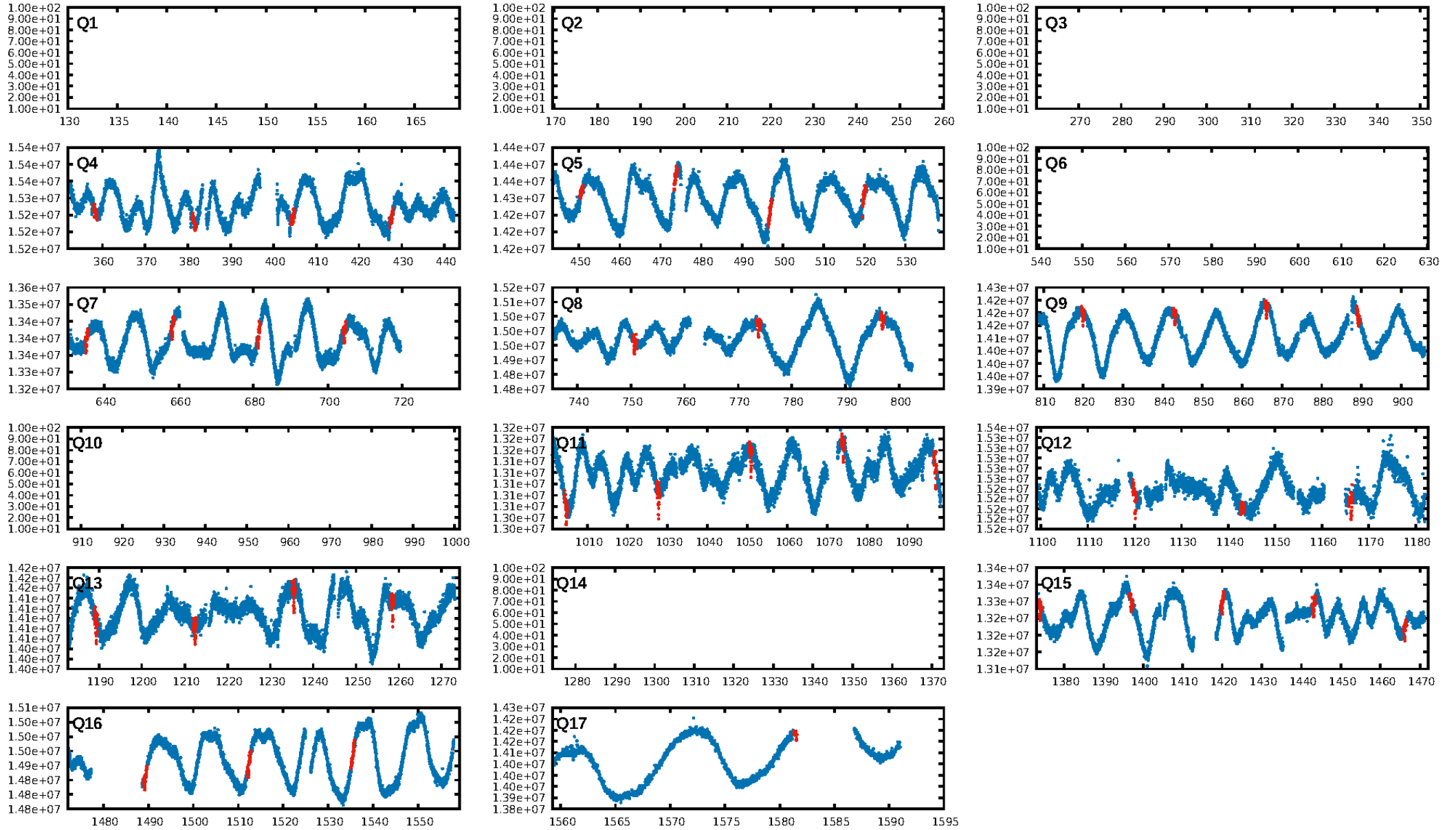
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [45.77σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 0.3%  
ModelChiSquareGof-sig: 98.1%  
Bootstrap-pfa: 1.68e-58  
RollingBand-fgt: 1.00 [39/39]  
GhostDiagnostic-chr: 254.2  
Centroid-sig: N/A  
Centroid-so: 0.214 arcsec [0.29σ]  
OotOffset-rm: 0.723 arcsec [2.17σ]  
KicOffset-rm: 0.114 arcsec [0.71σ]  
OotOffset-st: 0/2/4/3 [9]  
KicOffset-st: 0/2/4/3 [9]  
DiffImageQuality-fgm: 0.89 [8/9]  
DiffImageOverlap-fno: 0.90 [9/10]

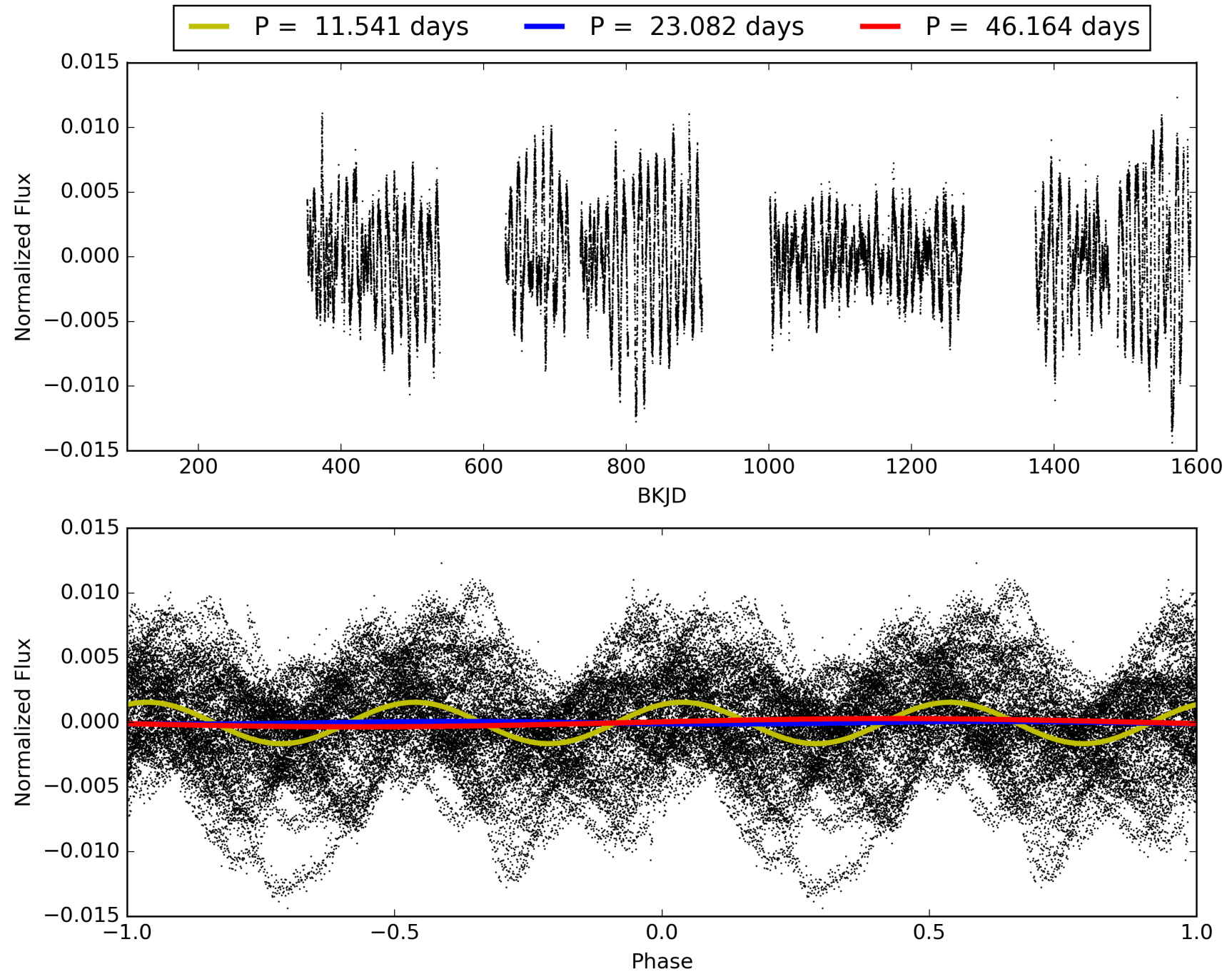
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 30-Jan-2016 05:20:52 Z

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

# TCE 004851530-01, PDC Light Curves

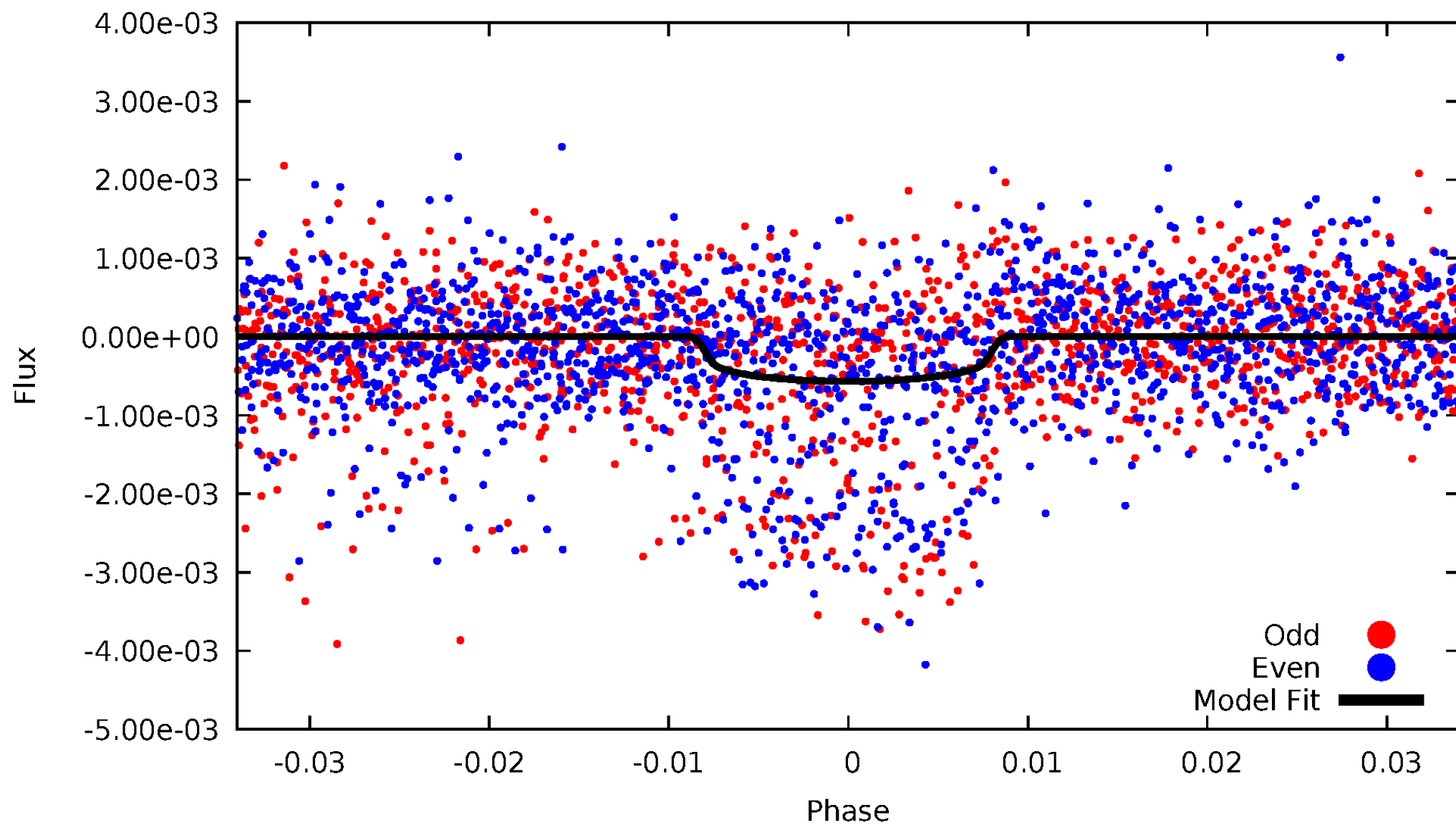


TCE 004851530-01



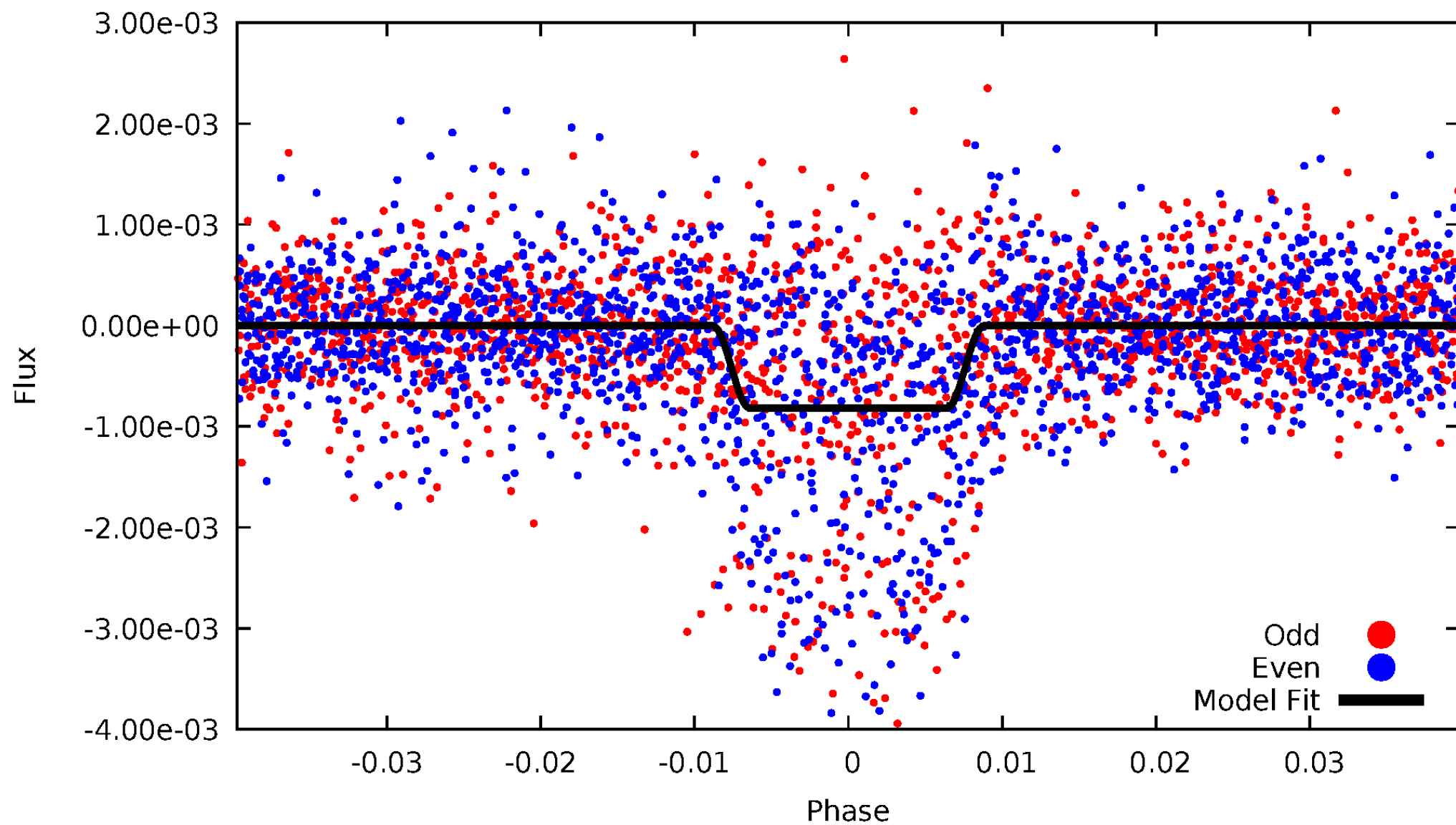
# DV Odd/Even

TCE 004851530-01



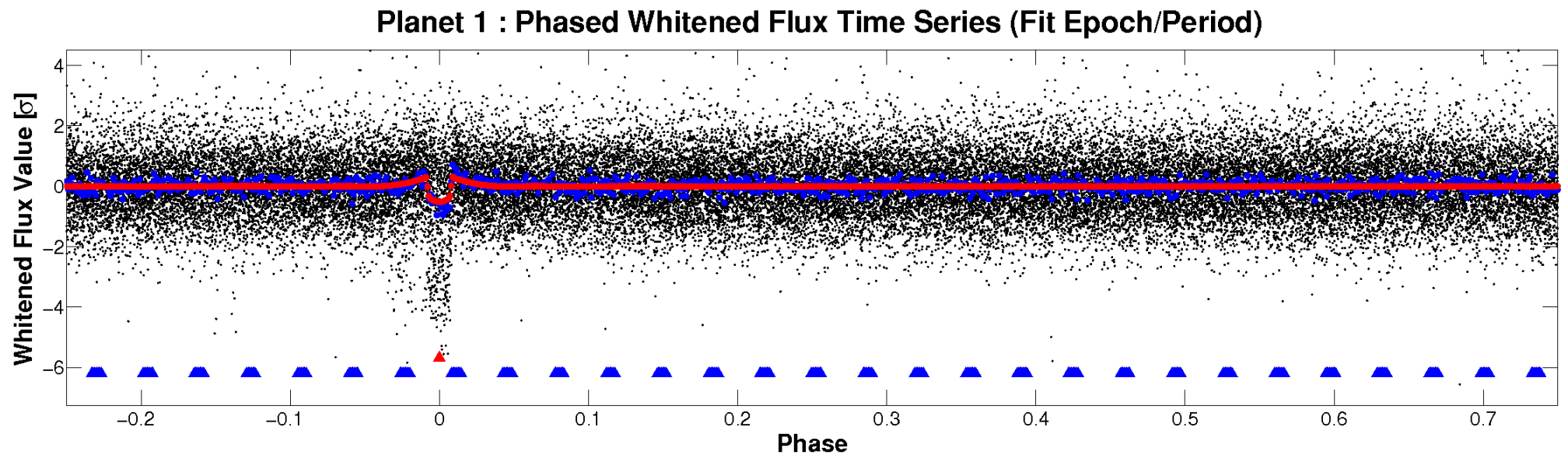
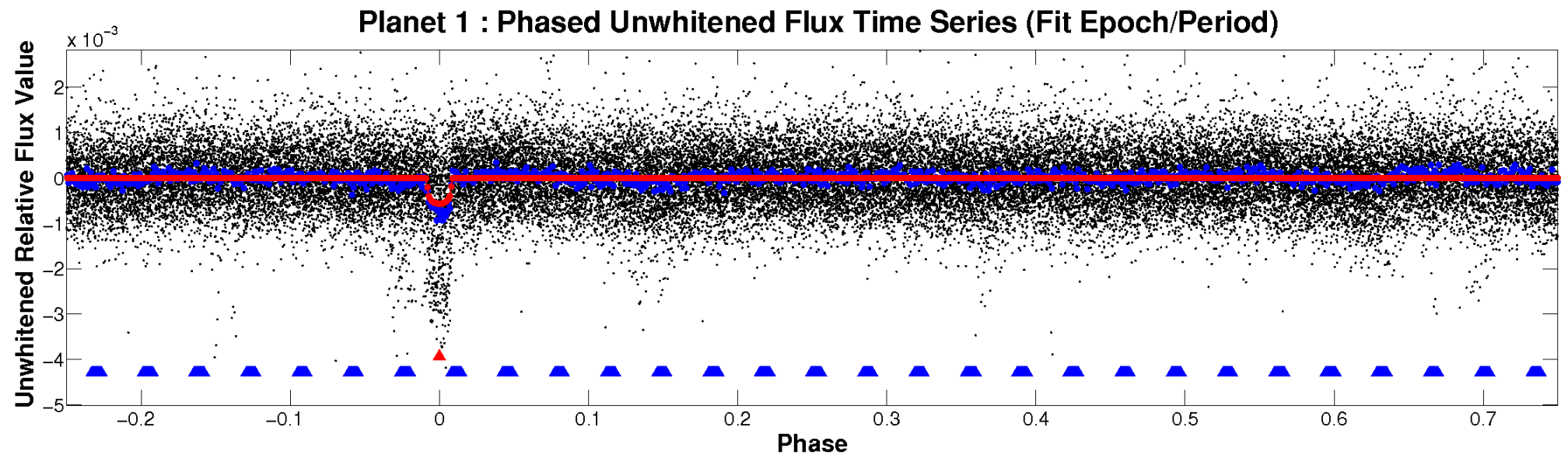
# ALT Odd/Even

TCE 004851530-01



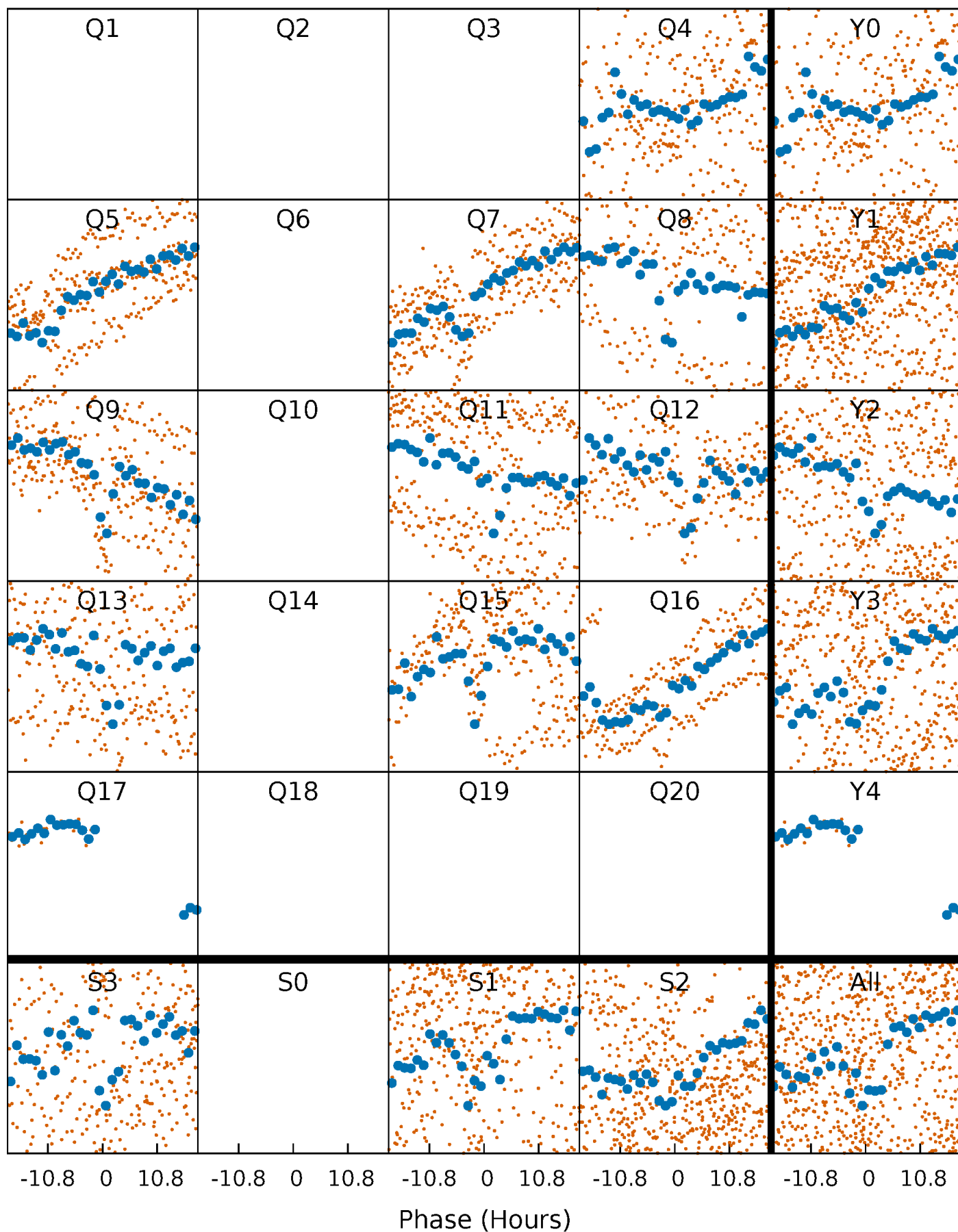


# Non-Whitened Vs. Whitened Light Curve



# PDC Quarter-Phased Transit Curves

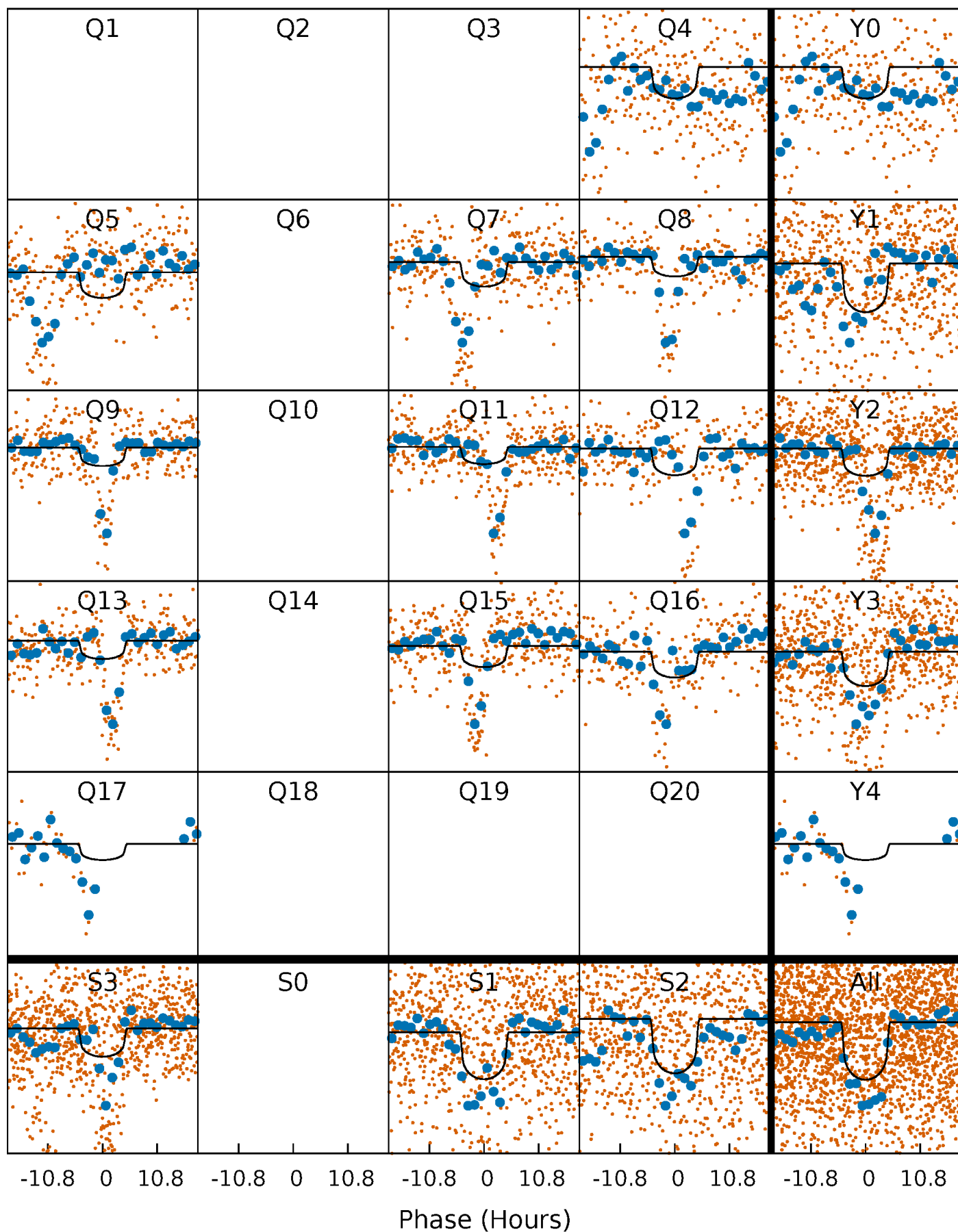
TCE 004851530-01 P= 23.081775 Days  $T_0=150.585411$  (BKJD)





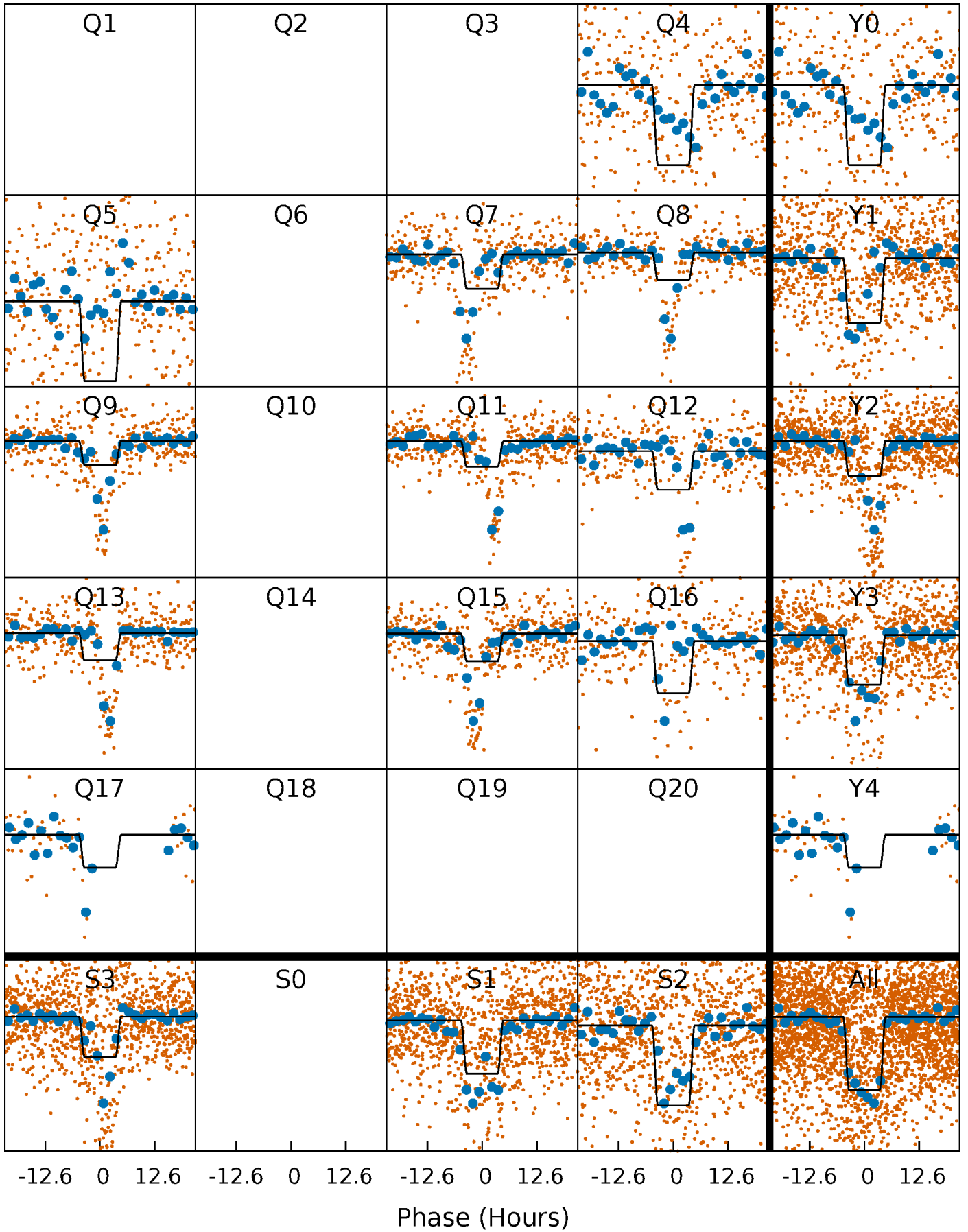
# DV Quarter-Phased Transit Curves

TCE 004851530-01     $P = 23.081775$  Days     $T_0 = 150.585411$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

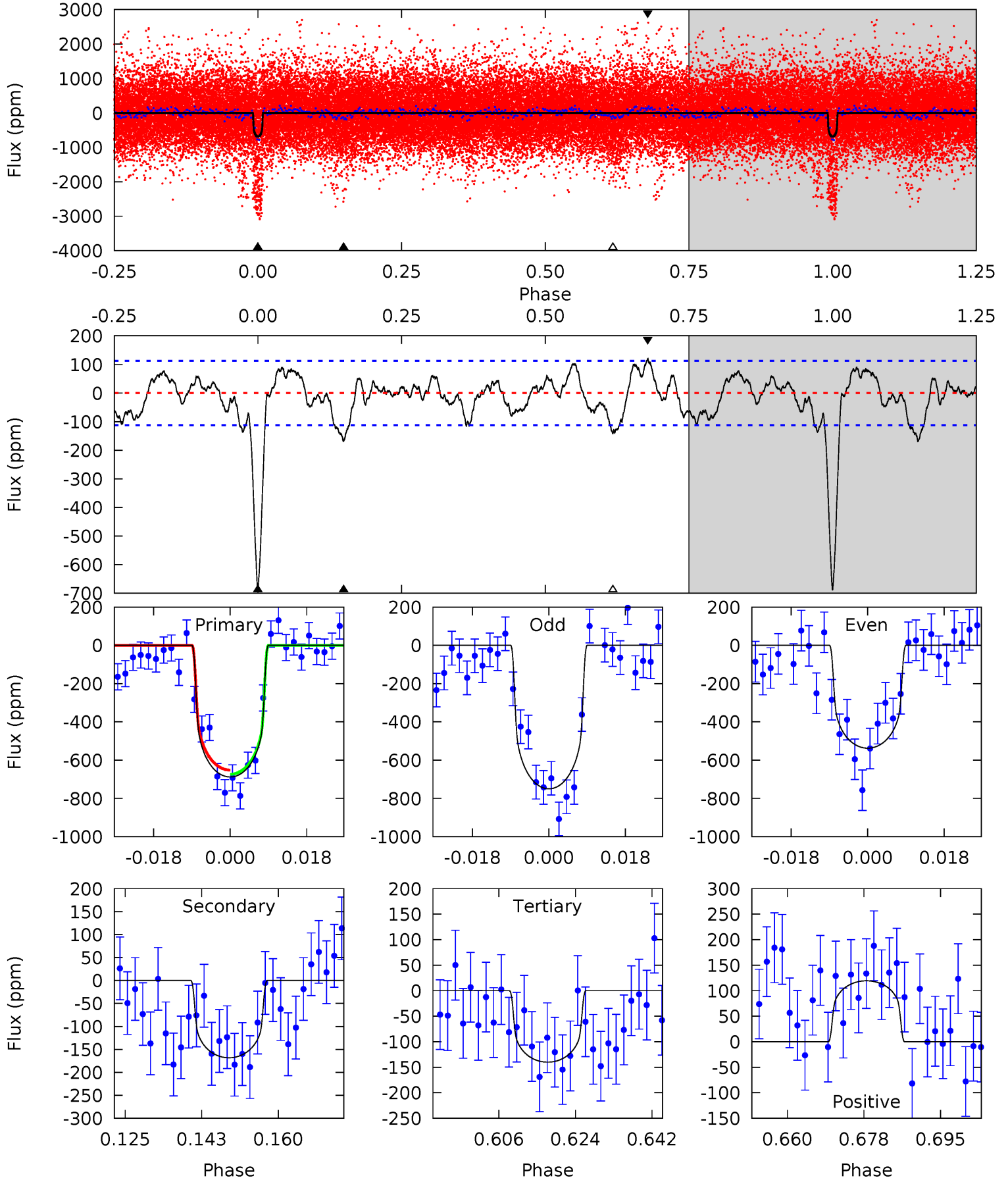
TCE 004851530-01 P= 23.082557 Days  $T_0=150.546544$  (BKJD)



# DV Model-Shift Uniqueness Test

004851530-01,  $P = 23.081775$  Days,  $E = 150.585411$  Days

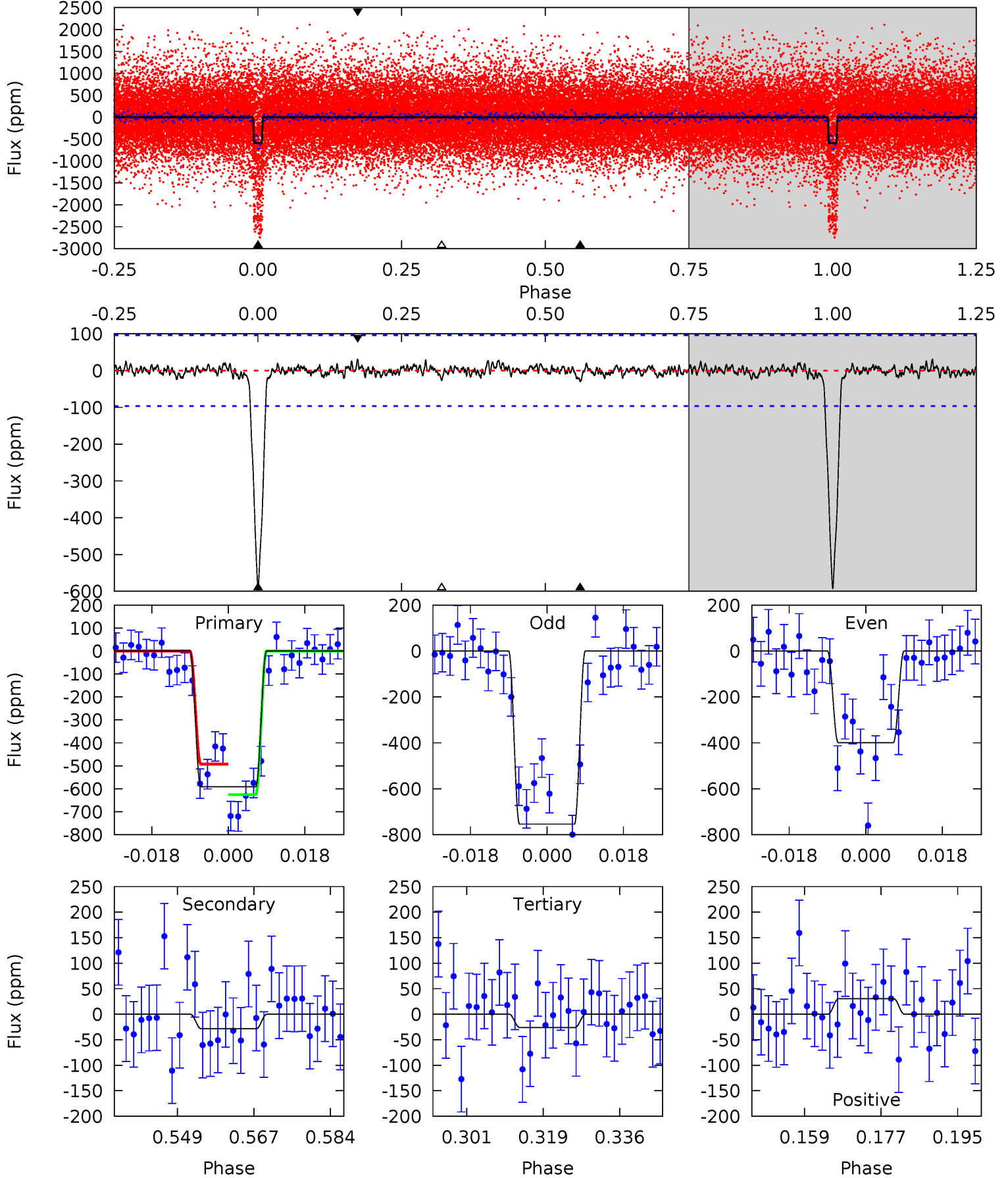
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
30.0	7.34	6.11	5.21	4.91	2.37	2.34	23.9	24.8	1.23	2.13	4.61	0.93	0.15	0.48



# Alt Model-Shift Uniqueness Test

004851530-01,  $P = 23.082557$  Days,  $E = 150.546544$  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
30.2	1.45	1.33	1.55	4.92	2.37	0.47	28.8	28.6	0.12	-0.09	9.01	0.91	0.05	3.39



### Stellar Parameters For KIC 004851530

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5275^{+184}_{-184}$	$4.505^{+0.104}_{-0.095}$	$-0.300^{+0.300}_{-0.300}$	$0.796^{+0.112}_{-0.102}$	$0.739^{+0.112}_{-0.052}$	$2.065^{+0.912}_{-0.583}$
	+3%/-3%	+2%/-2%	+100%/-100%	+14%/-13%	+15%/-7%	+44%/-28%
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 004851530-01 / KOI 1884.01

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-168 \pm 23$	$2.13^{+0.49}_{-0.56}$	$765^{+43}_{-34}$	$4119^{+487}_{-338}$	$426^{+368}_{-154}$
Alt.	$-28 \pm 20$	$2.54^{+0.61}_{-0.55}$	$766^{+39}_{-38}$	$2939^{+314}_{-452}$	$51^{+52}_{-37}$

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

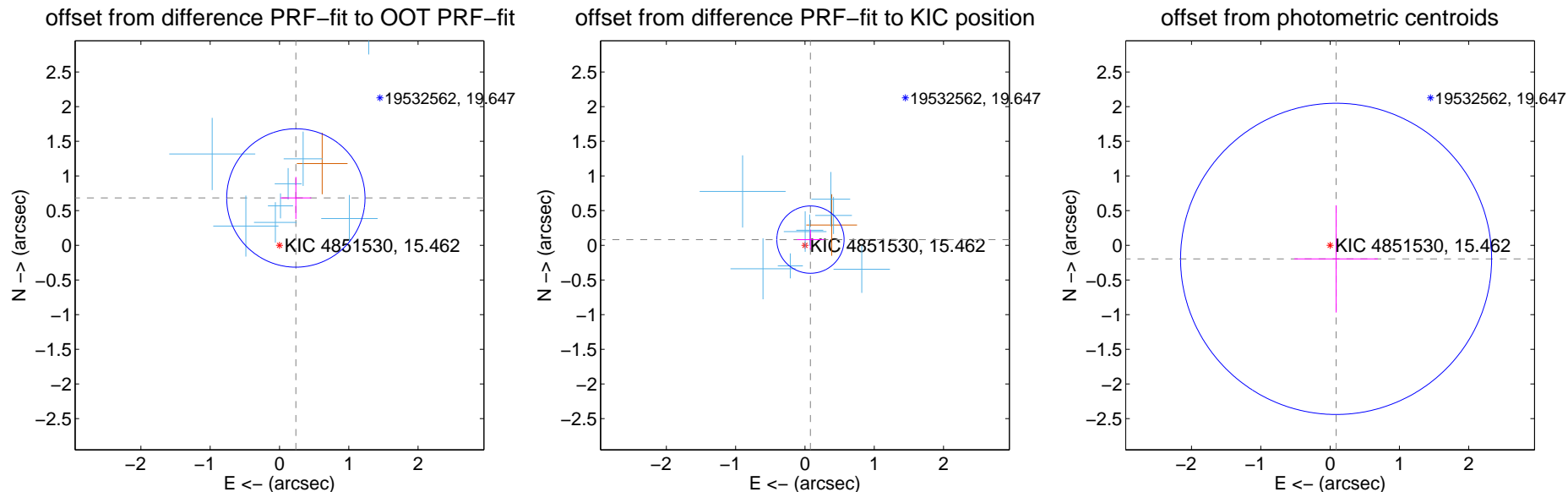
## DV Centroid Data

Supplemental centroid analysis for 004851530-01. Kepler magnitude: 15.46. Transit SNR 12.63

There are 8 quarters with good PRF difference image offsets

The direct PRF centroid is offset from the target star catalog position by about 0.63 arcsec

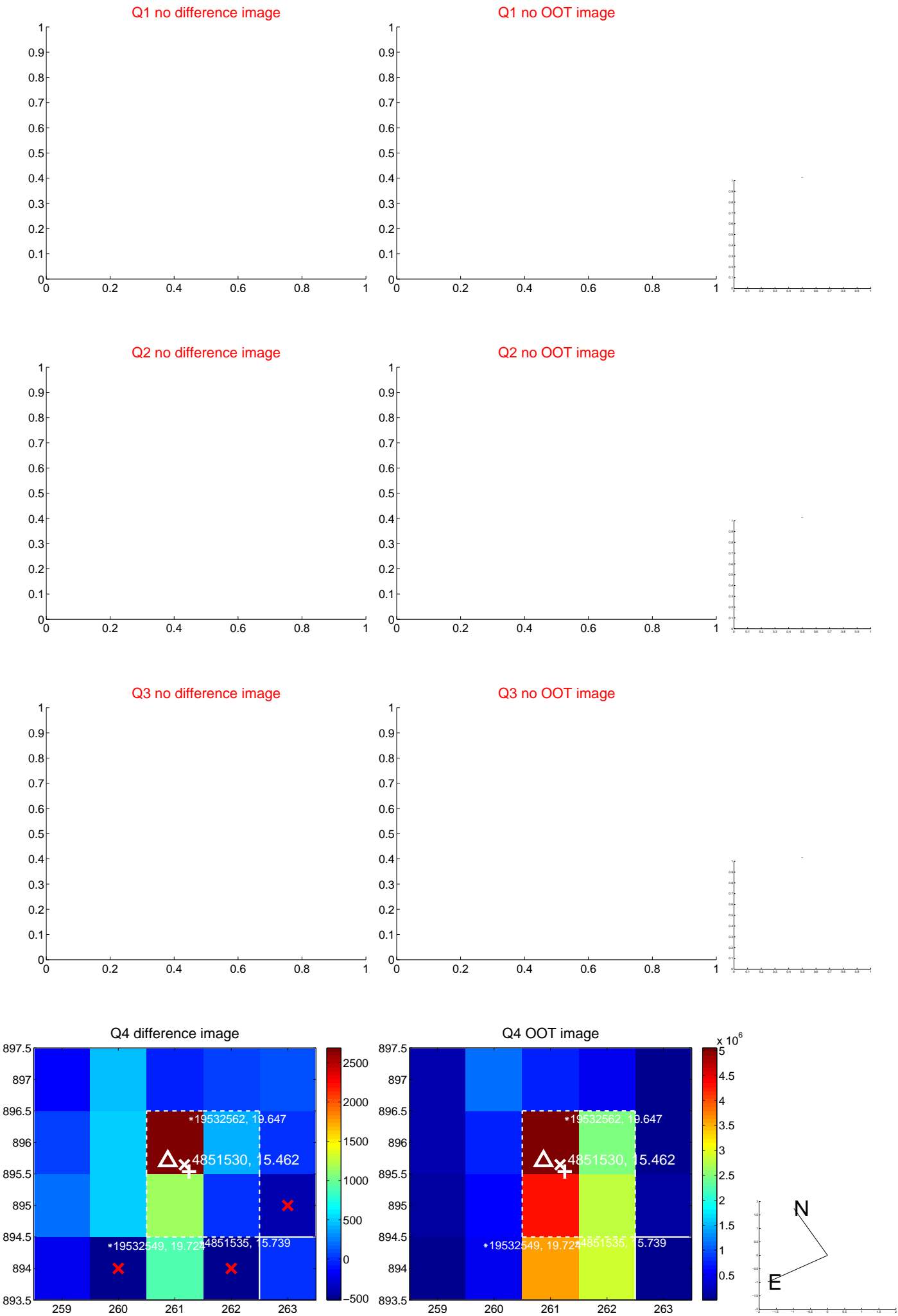
	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.723 \pm 0.333$	2.17	$-0.236 \pm 0.223$	$0.683 \pm 0.304$
PRF-fit source offset from KIC position	$0.114 \pm 0.162$	0.71	$-0.079 \pm 0.195$	$0.082 \pm 0.144$
photometric centroid source offset	$0.21 \pm 0.75$	0.29	$-0.09 \pm 0.60$	$-0.20 \pm 0.77$



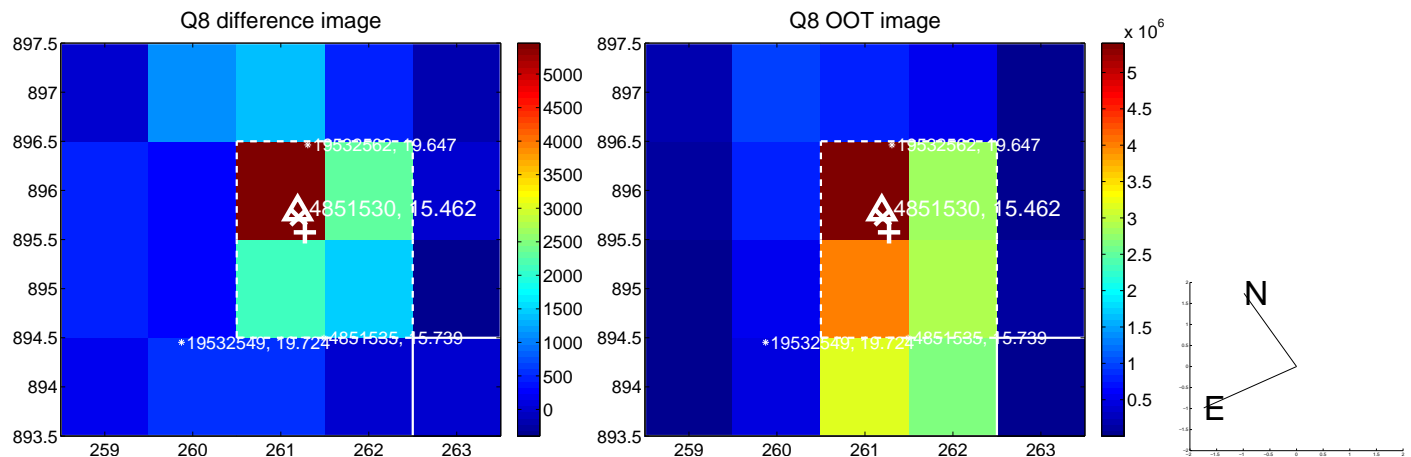
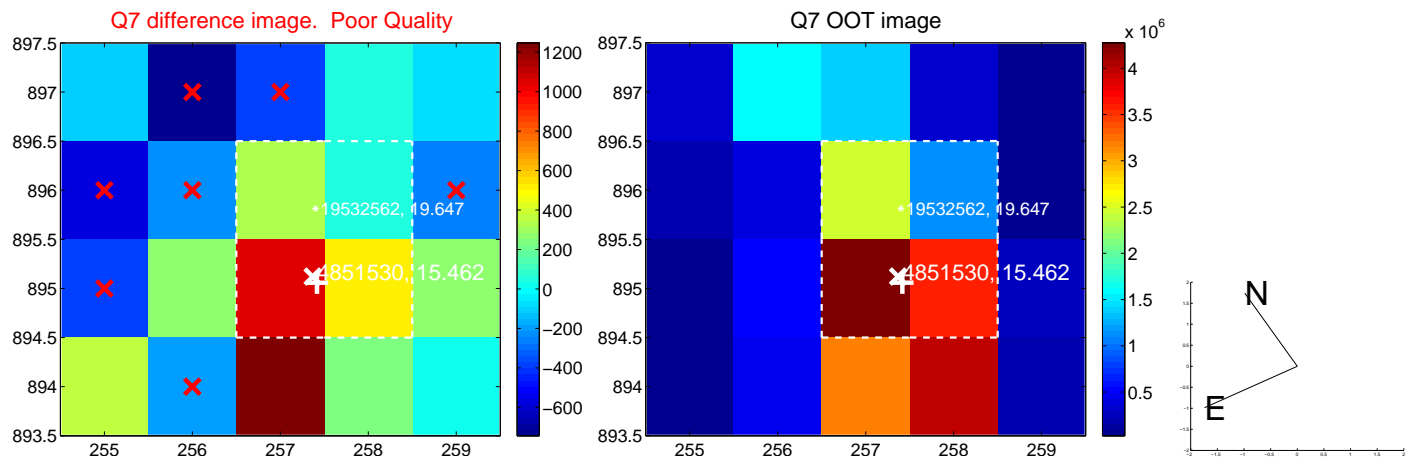
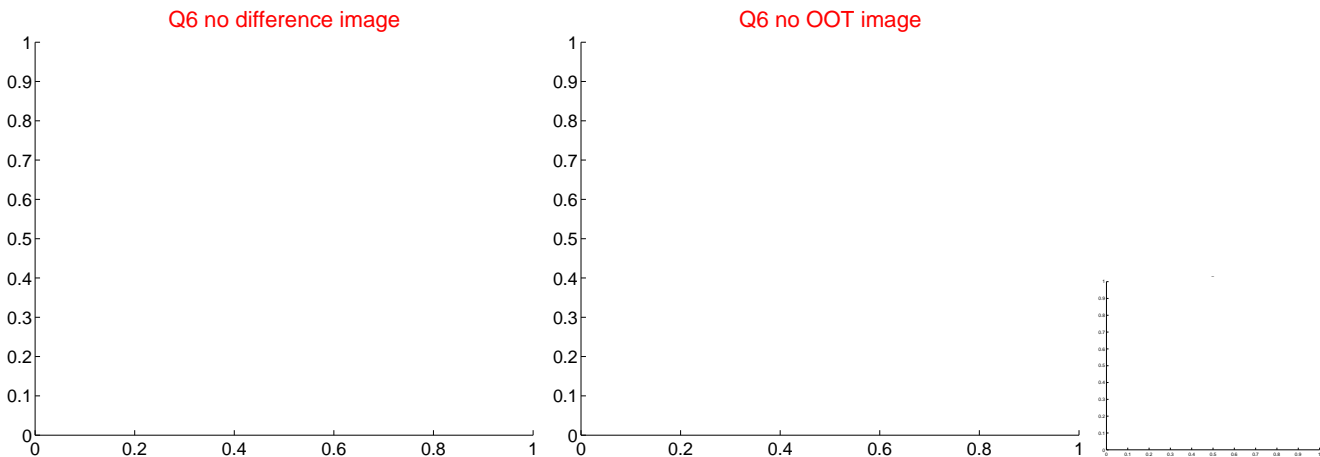
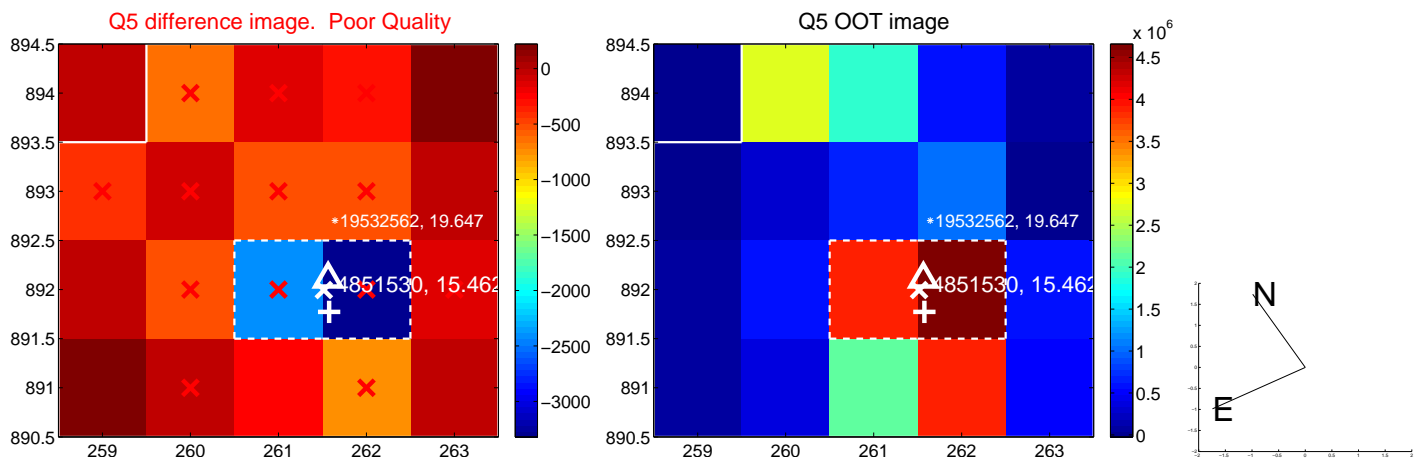
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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



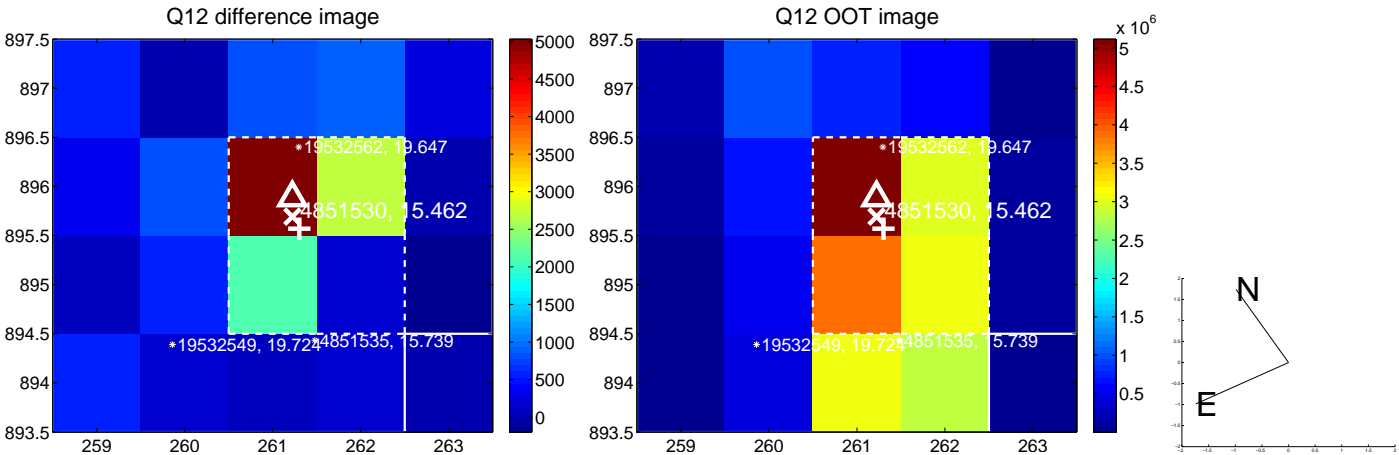
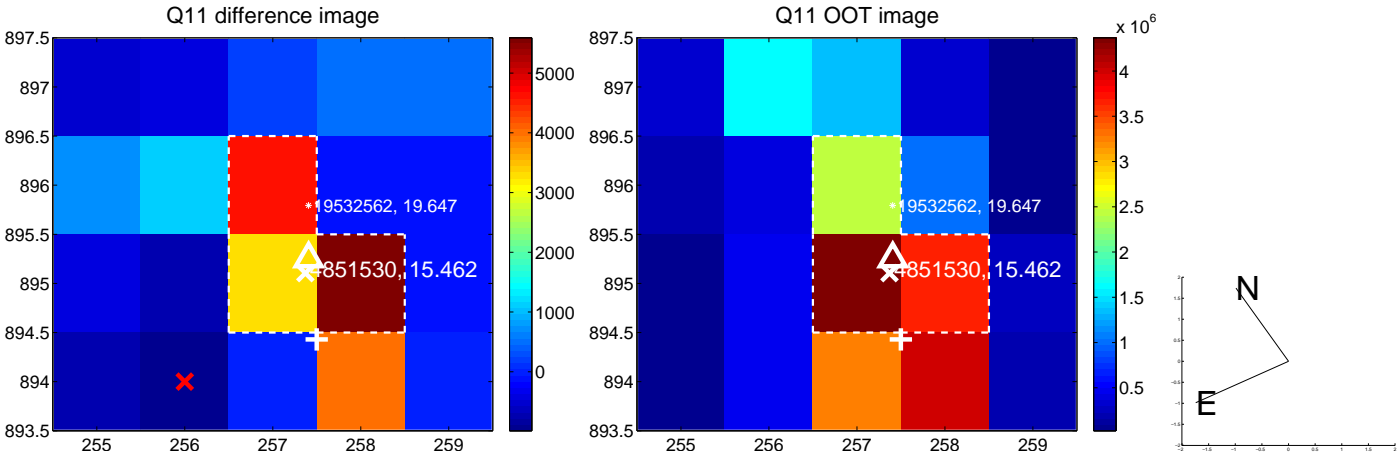
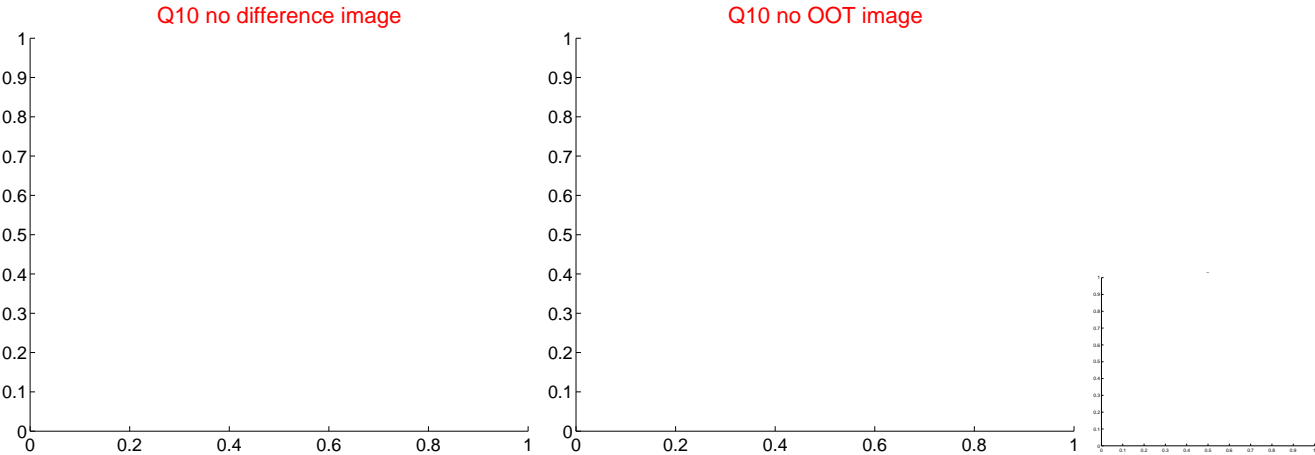
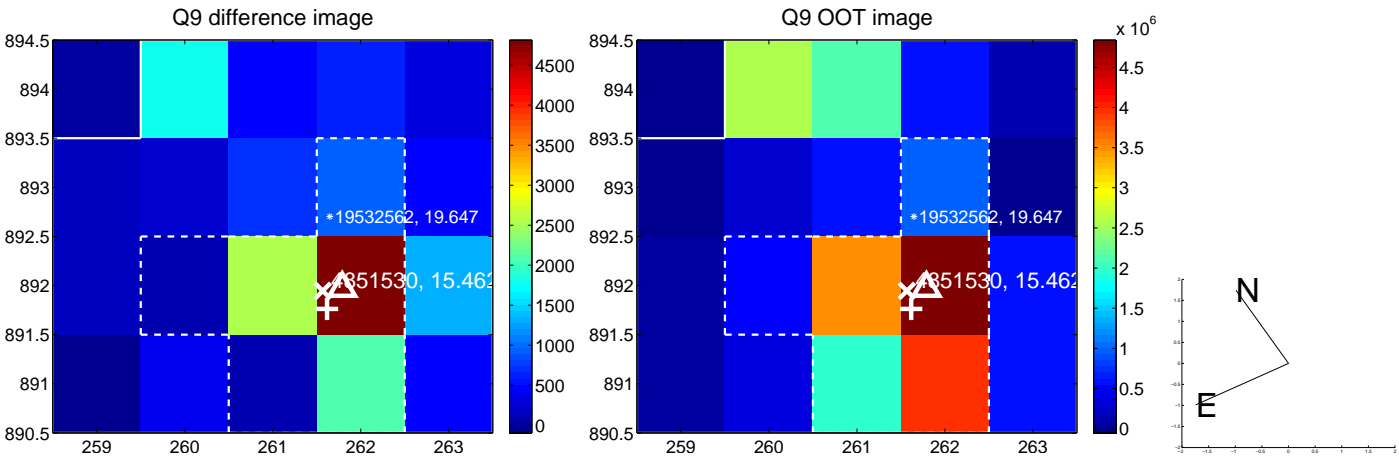
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\Delta$ : difference centroid. red  $\times$ : large negative pixel value.



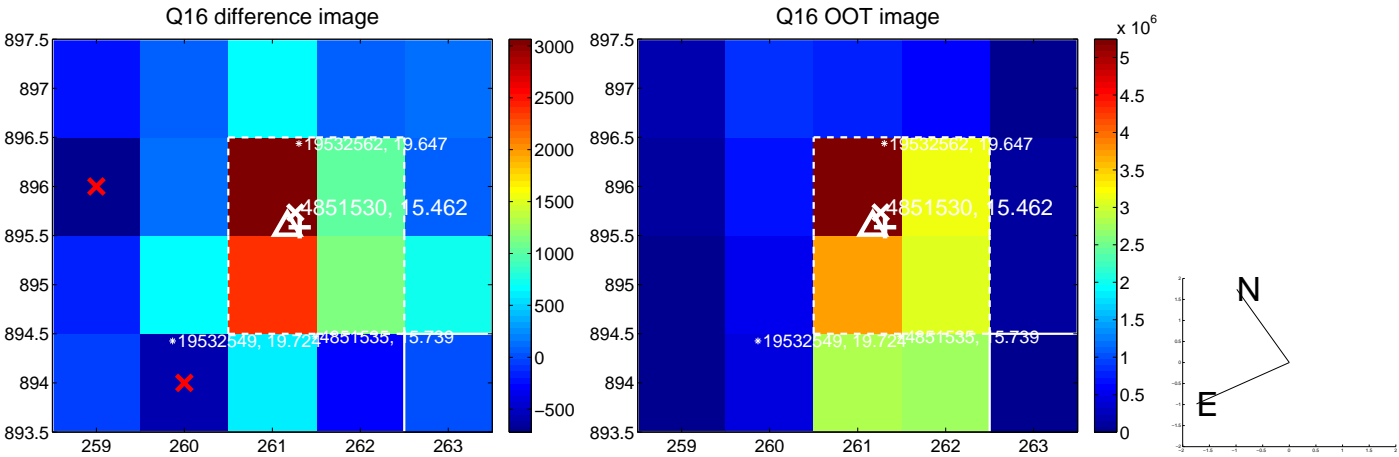
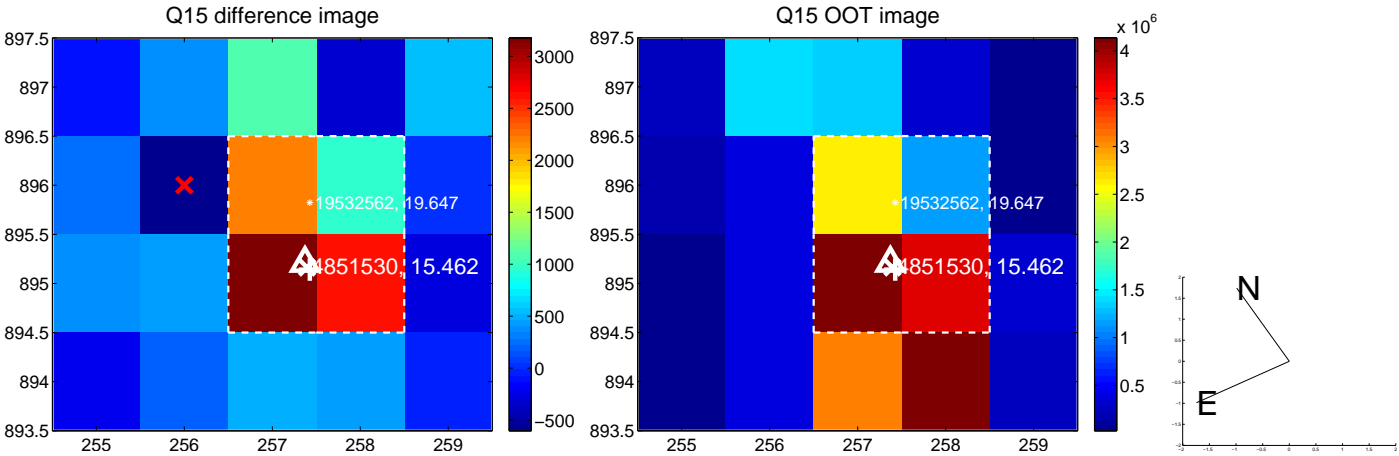
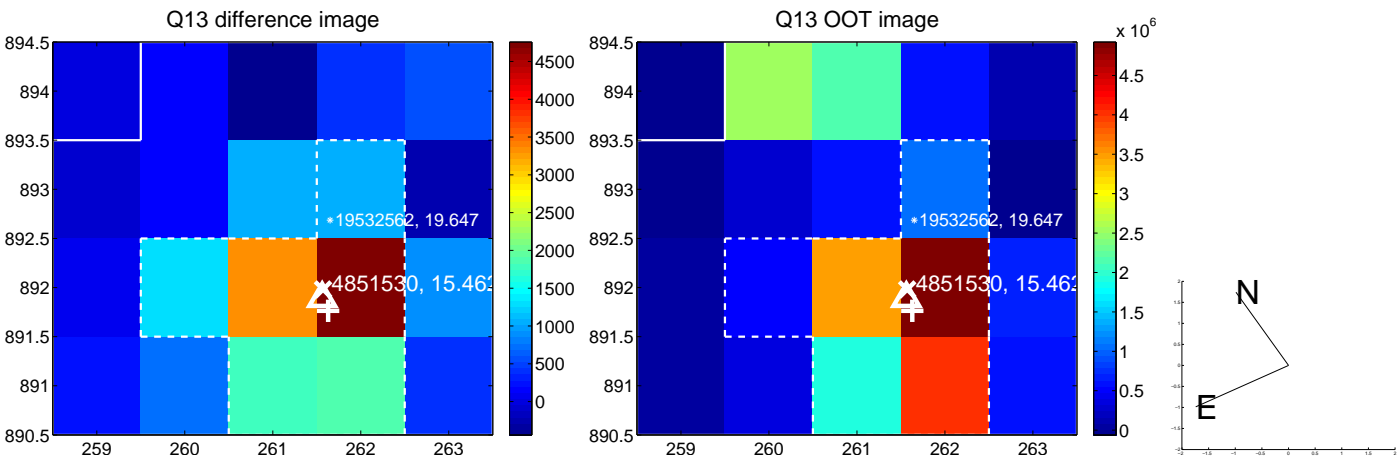
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



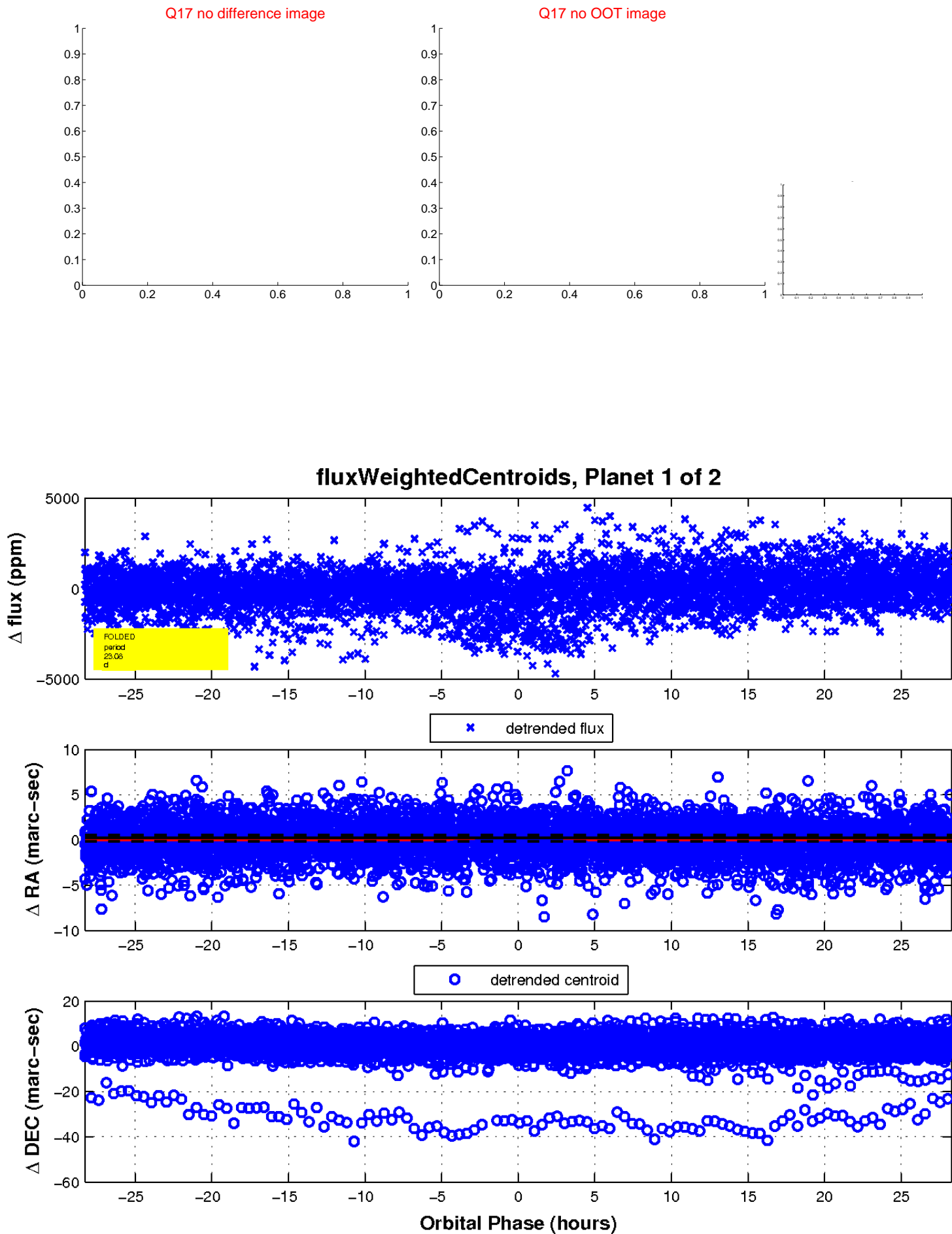
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

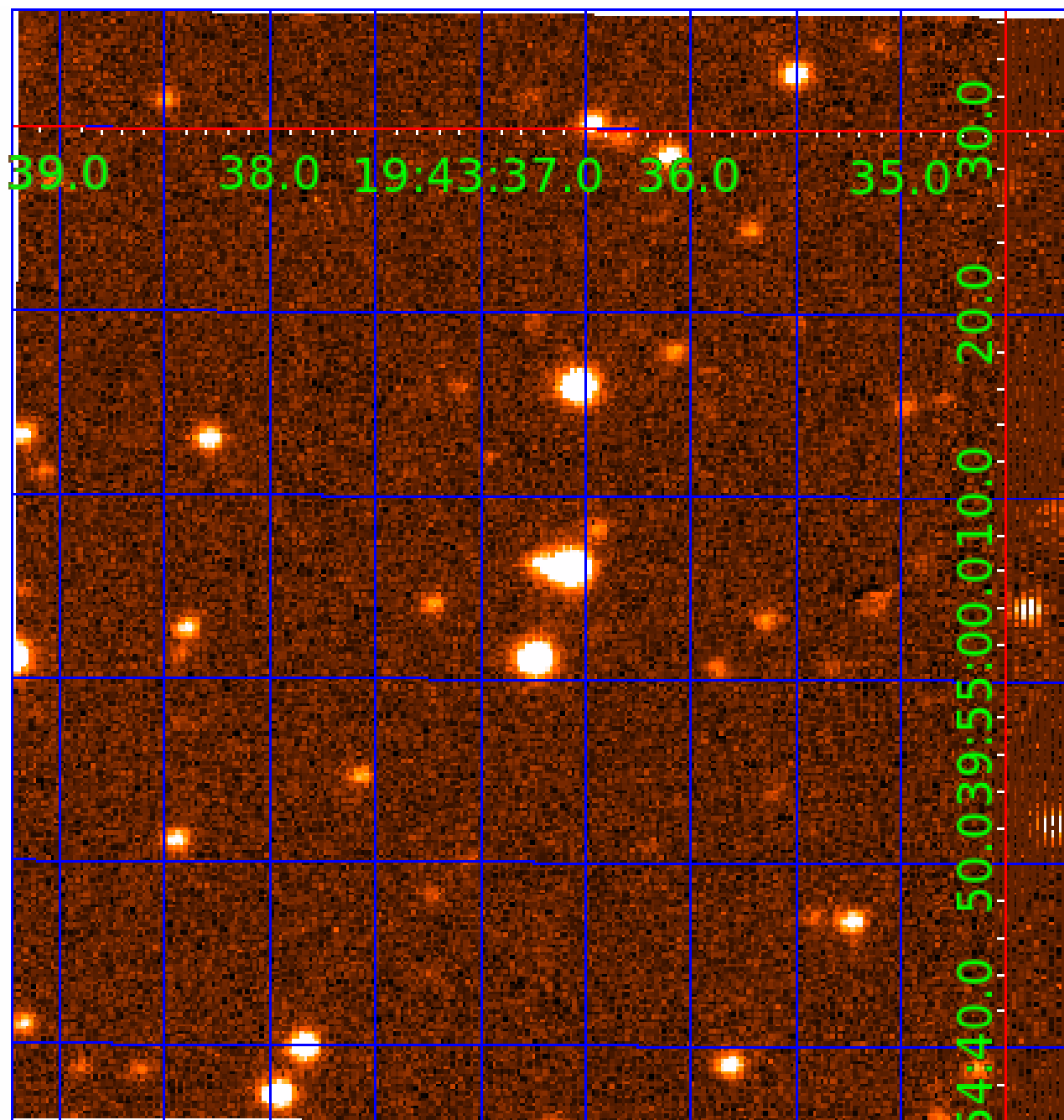


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination





# KIC 004851530

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
004851530-01	OBS	1884.01	23.081775	150.585411	567.9	9.430	17.6	12.6	0.80	5275	2.07	21.35
004851530-02	OBS	1884.02	4.775012	135.806476	512.6	1.788	14.3	16.7	0.80	5275	1.89	174.49

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
004851530-01	OBS	FP	0.01	1	0	0	0	LPP_DV
004851530-02	OBS	PC	0.99	0	0	0	0	CENT_KIC_POS

**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.

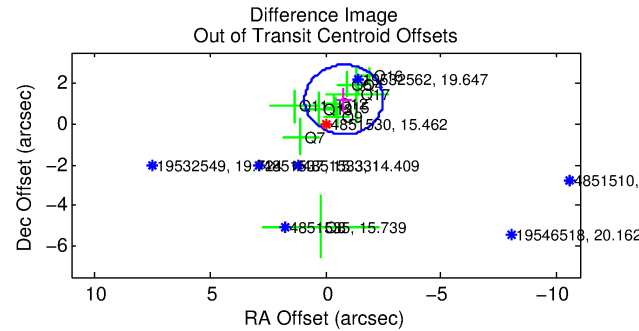
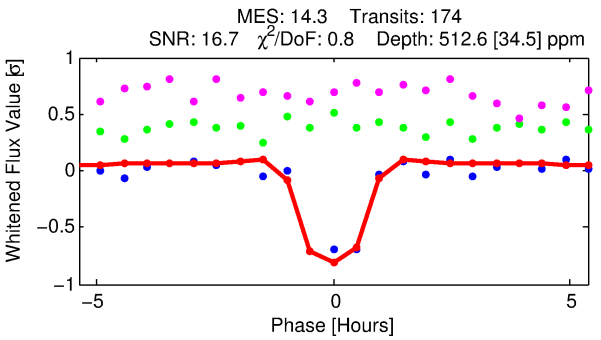
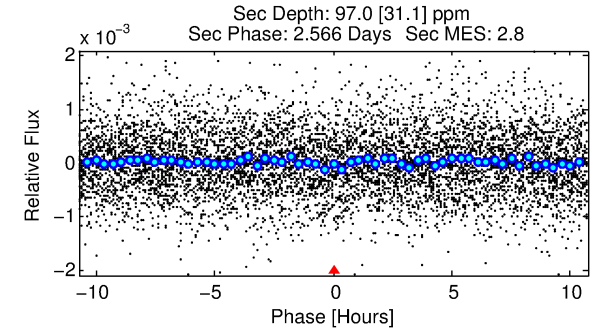
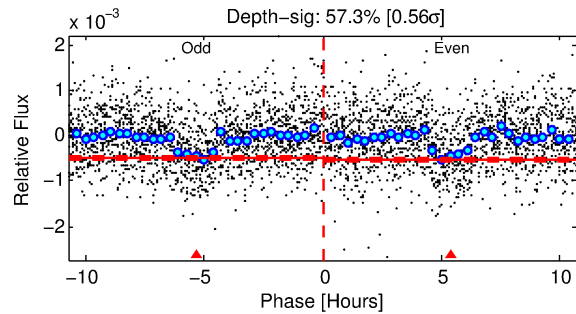
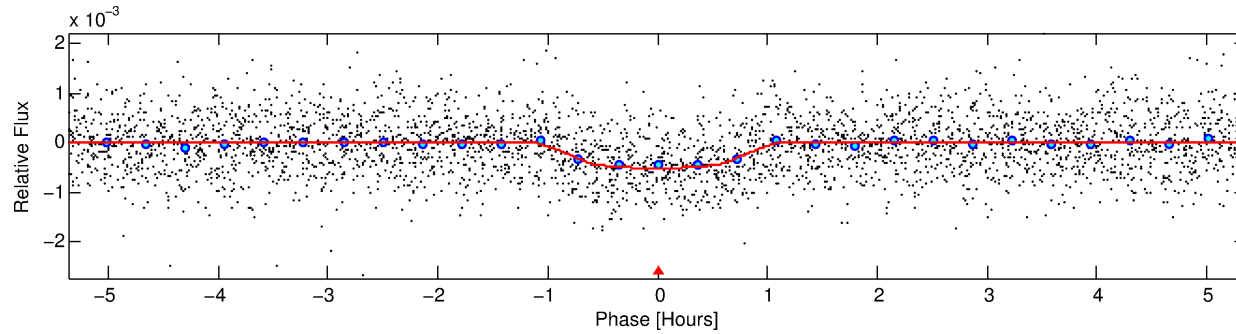
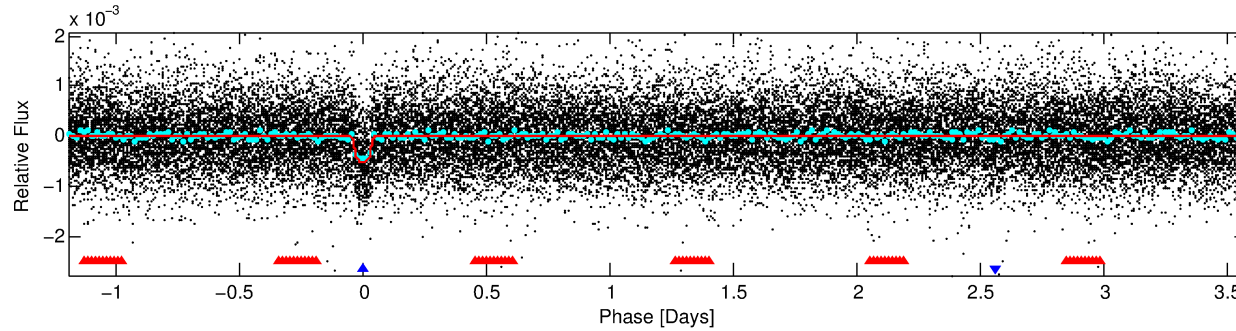
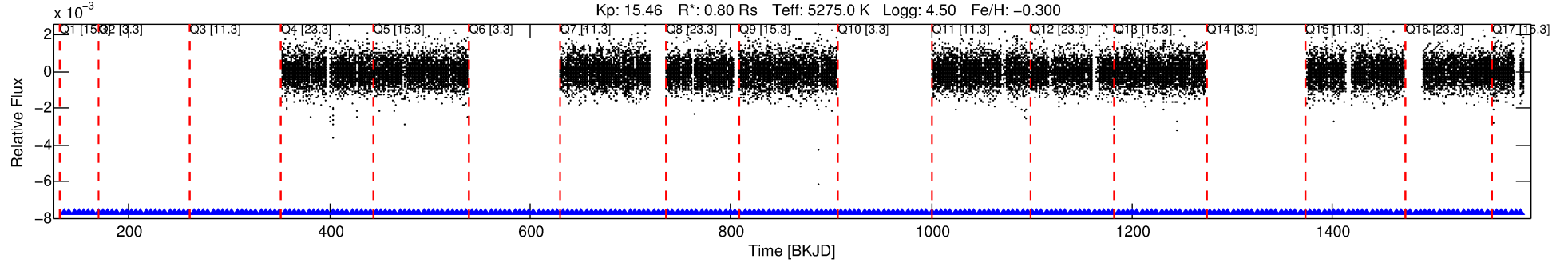
## Ephemeris Match Information For 004851530-02

No Significant Match Found

# DV One-Page Summary

KIC: 4851530 Candidate: 2 of 2 Period: 4.775 d  
KOI: K01884.02 Corr: 0.981

Kp: 15.46 R\*: 0.80 Rs Teff: 5275.0 K Logg: 4.50 Fe/H: -0.300



## DV Fit Results:

Period = 4.77501 [0.00001] d  
Epoch = 135.8065 [0.0021] BKJD  
Rp/R\* = 0.0218 [0.0210]  
a/R\* = 16.25 [60.33]  
b = 0.64 [3.49]  
Seff = 174.49 [40.45]  
Teq = 927 [54] K  
Rp = 1.89 [1.84] Re  
a = 0.0502 [0.0062] AU  
Ag = 37.49 [73.40] [0.50σ]  
Teffp = 3546 [1732] K [1.51σ]

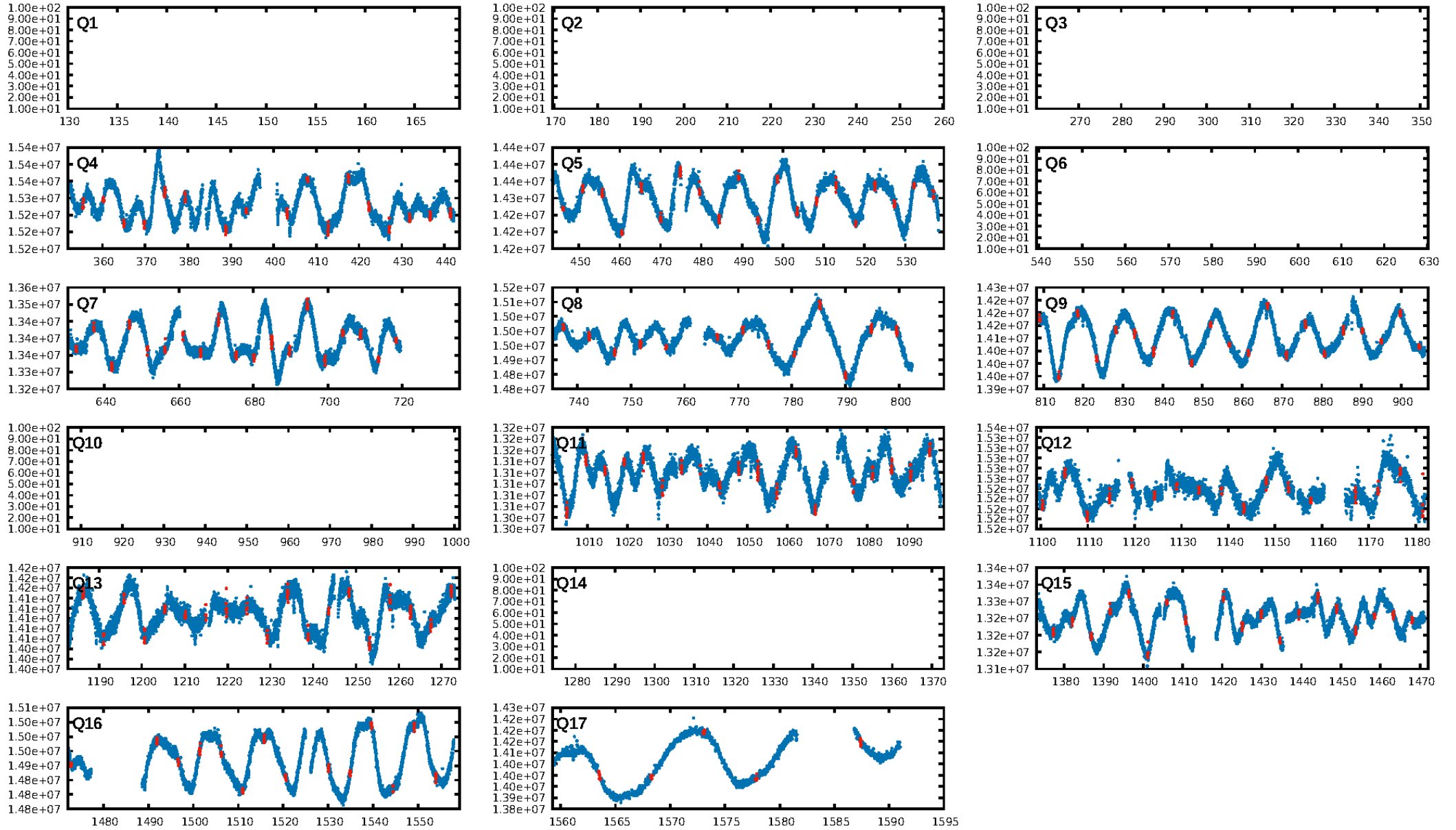
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [45.77σ]  
ModelChiSquare2-sig: 100.0%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 3.00e-43  
RollingBand-fgt: 1.00 [169/169]  
GhostDiagnostic-chr: 5.885  
Centroid-sig: N/A  
Centroid-so: 0.117 arcsec [0.20σ]  
OotOffset-rm: 1.426 arcsec [2.51σ]  
KicOffset-rm: 0.695 arcsec [1.17σ]  
OotOffset-st: 0/3/4/4 [11]  
KicOffset-st: 0/3/4/4 [11]  
DiffImageQuality-fgm: 0.82 [9/11]  
DiffImageOverlap-fno: 1.00 [11/11]

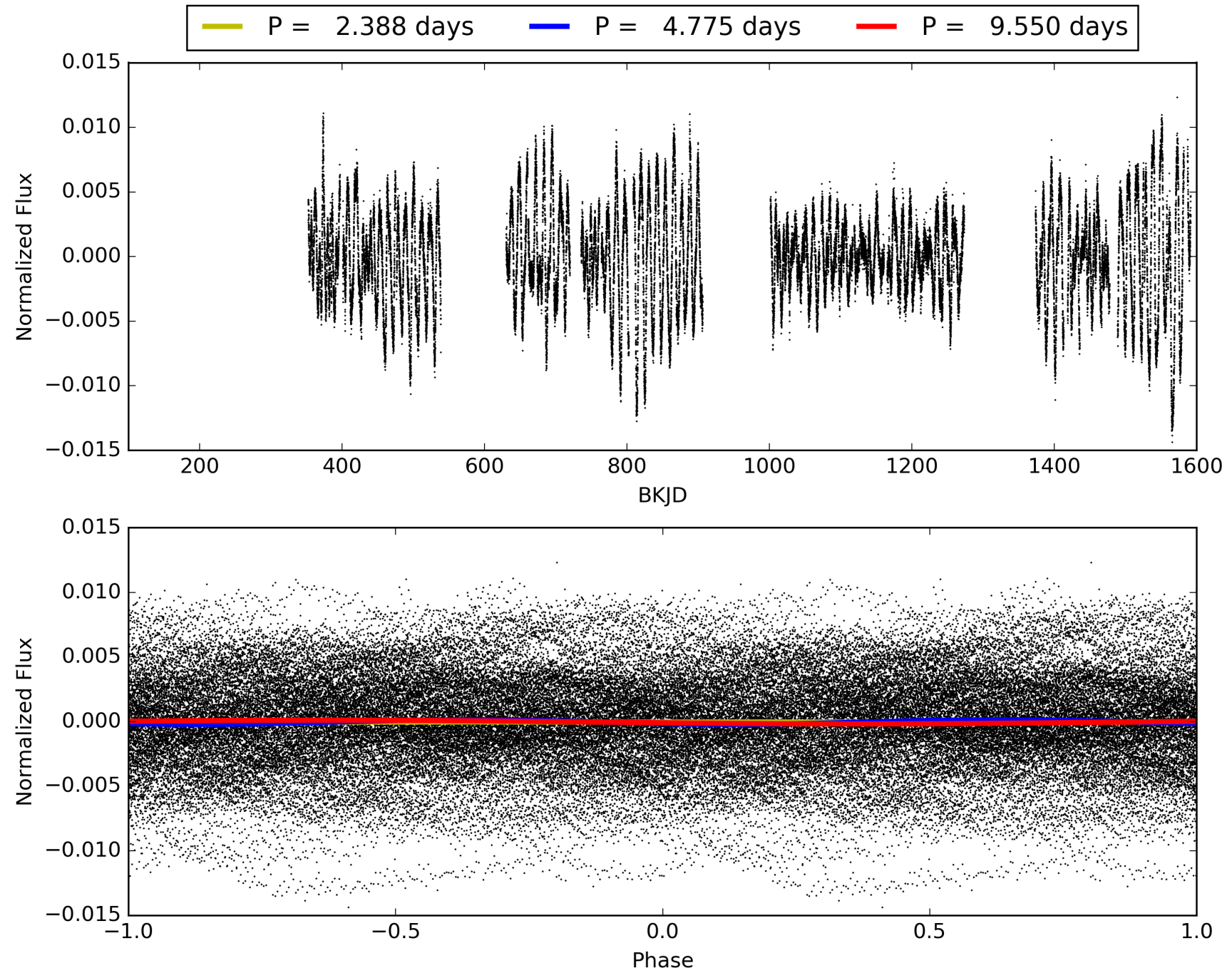
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 30-Jan-2016 05:20:57 Z

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

# TCE 004851530-02, PDC Light Curves

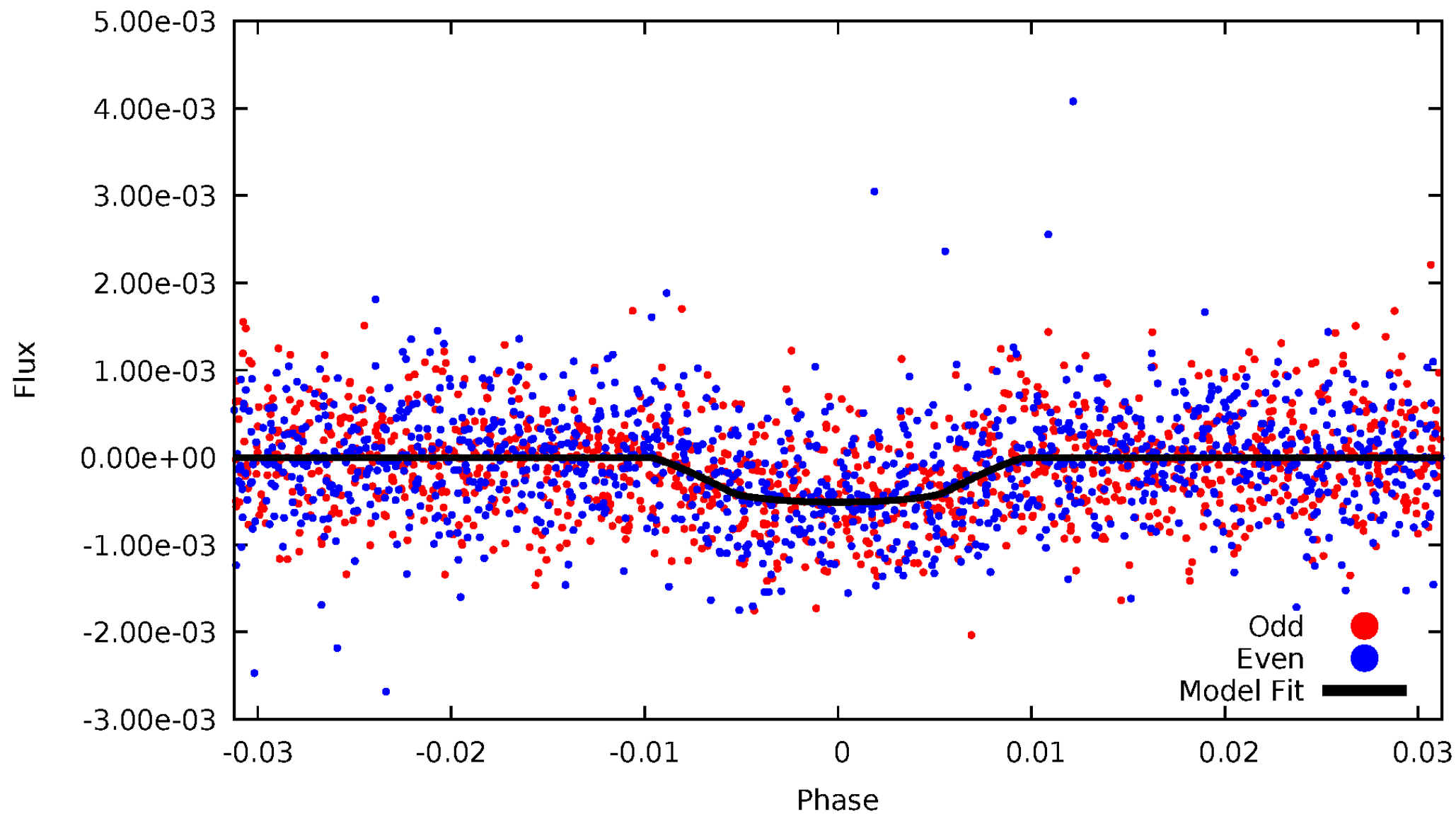


TCE 004851530-02



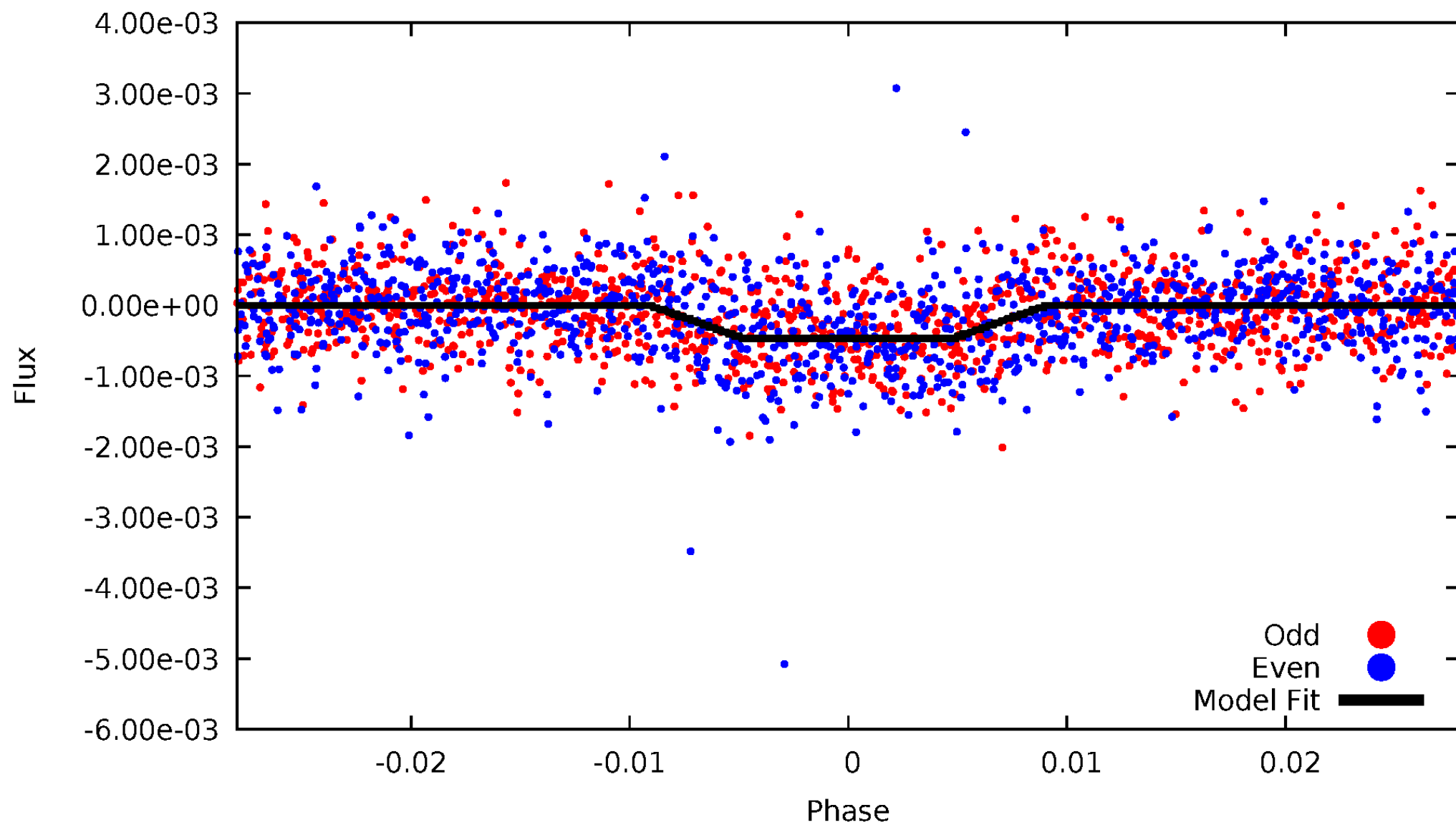
# DV Odd/Even

TCE 004851530-02



# ALT Odd/Even

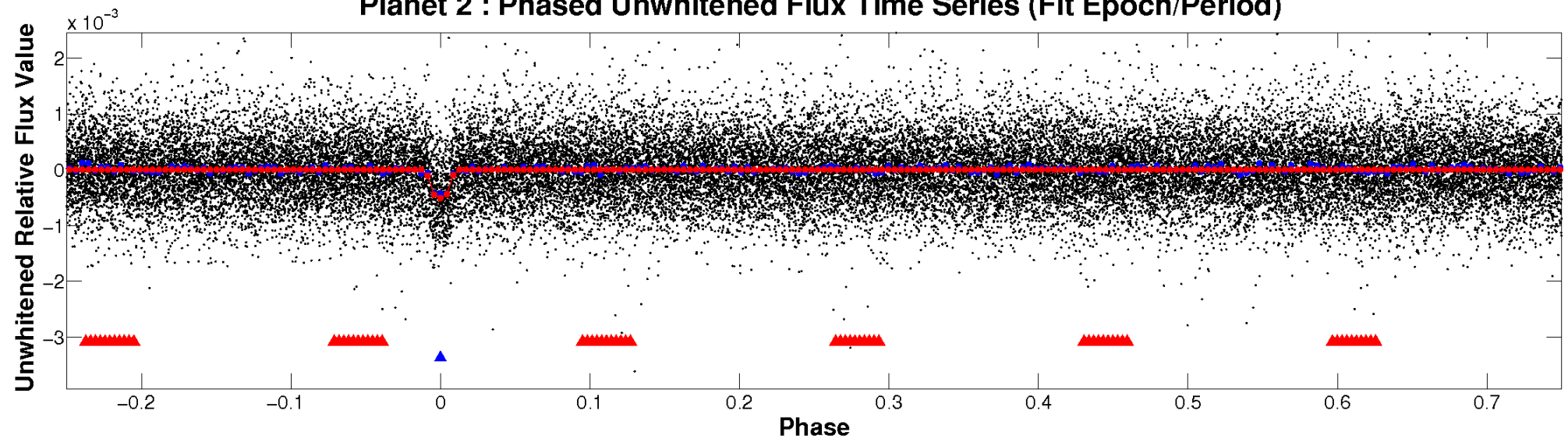
TCE 004851530-02



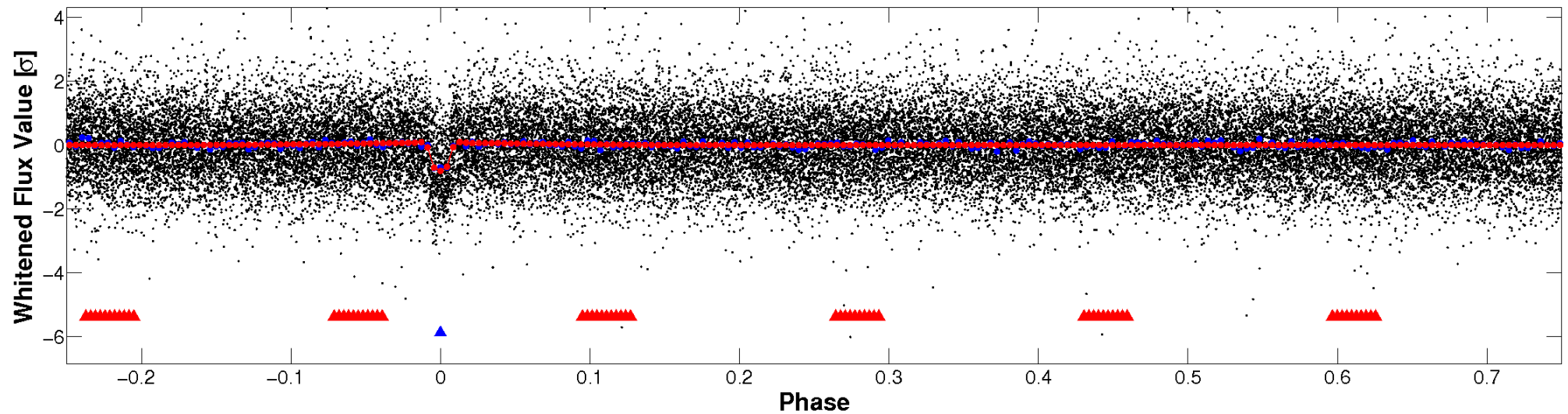


# Non-Whitened Vs. Whitened Light Curve

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

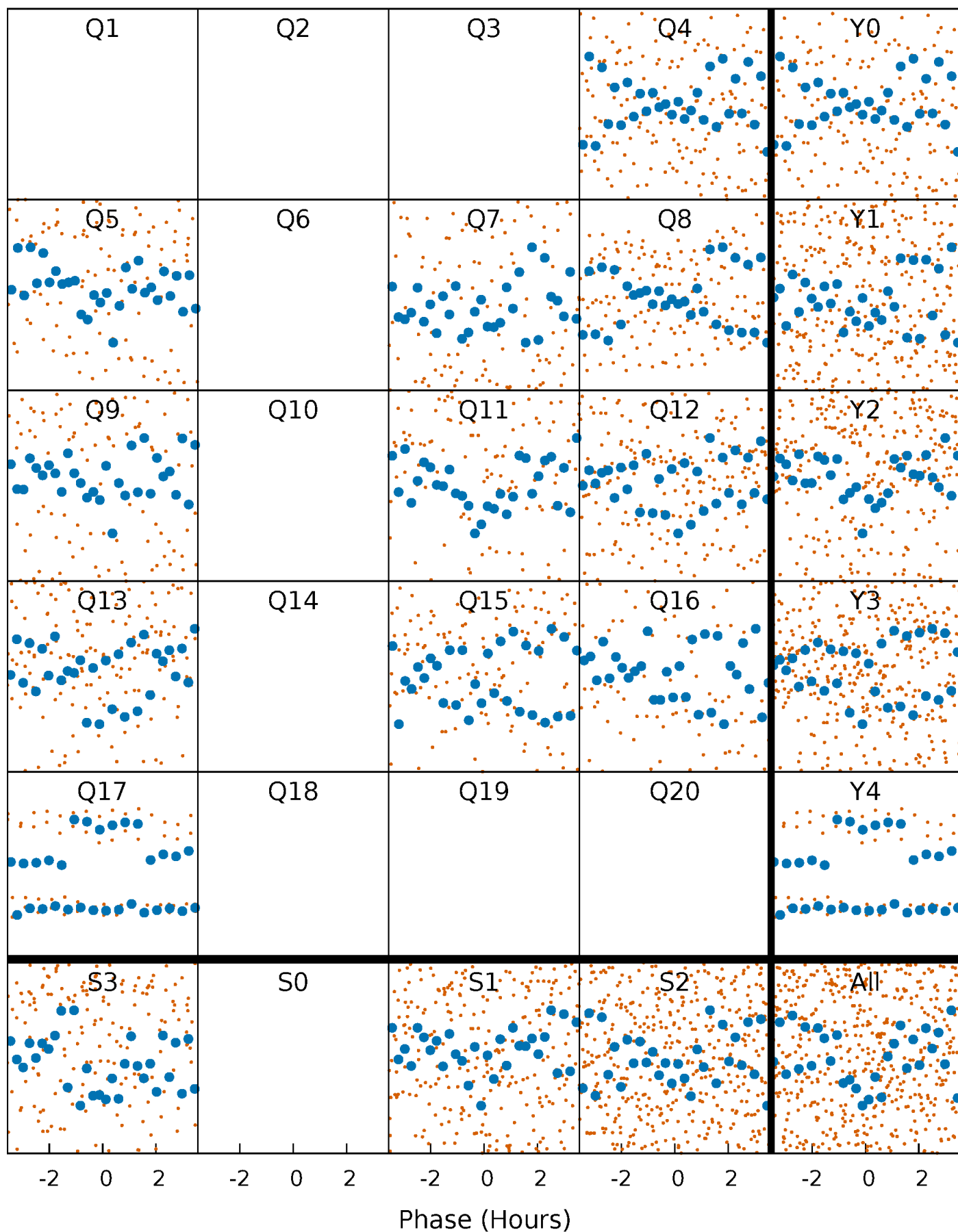


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



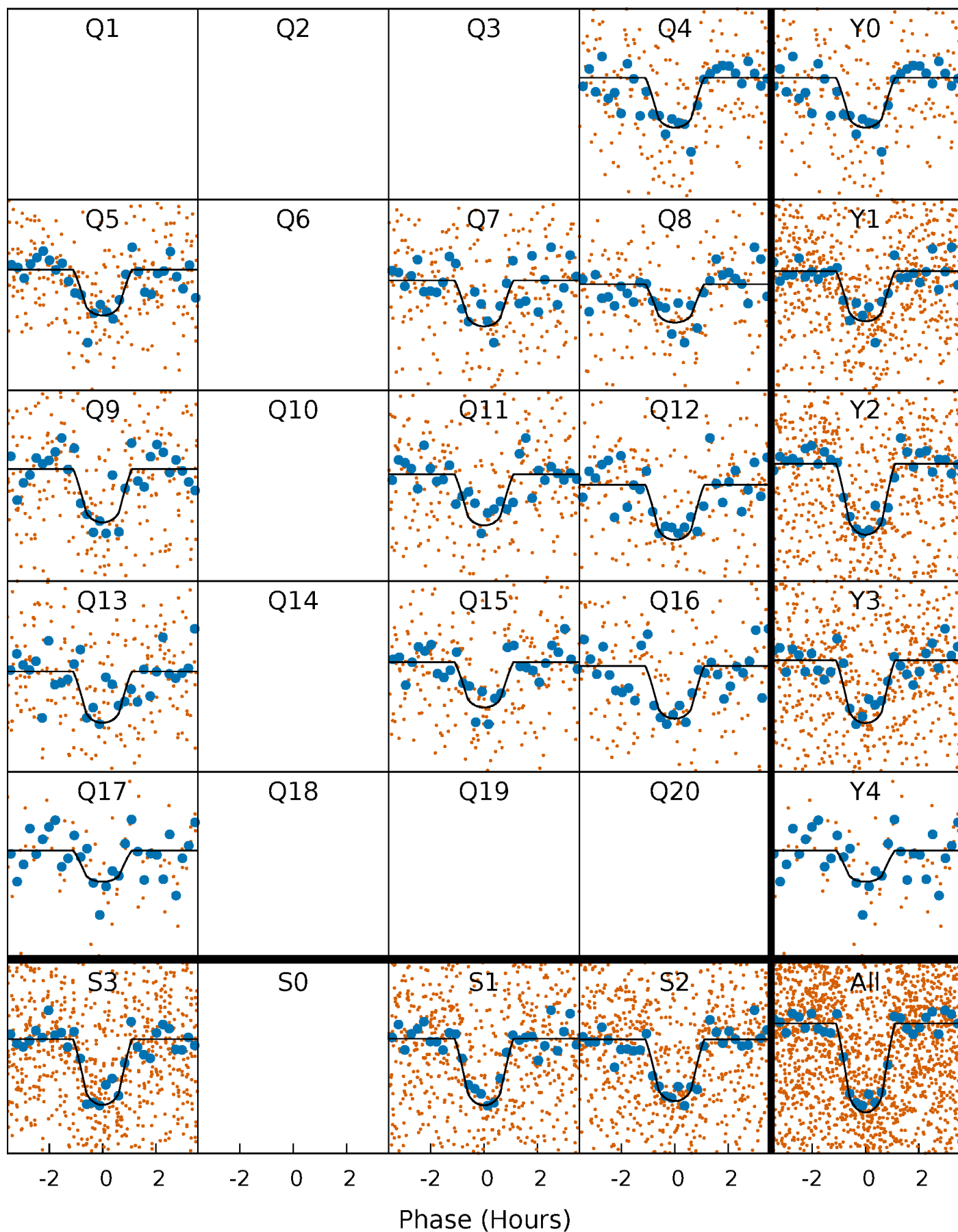
# PDC Quarter-Phased Transit Curves

TCE 004851530-02   P= 4.775012 Days    $T_0=135.806476$  (BKJD)



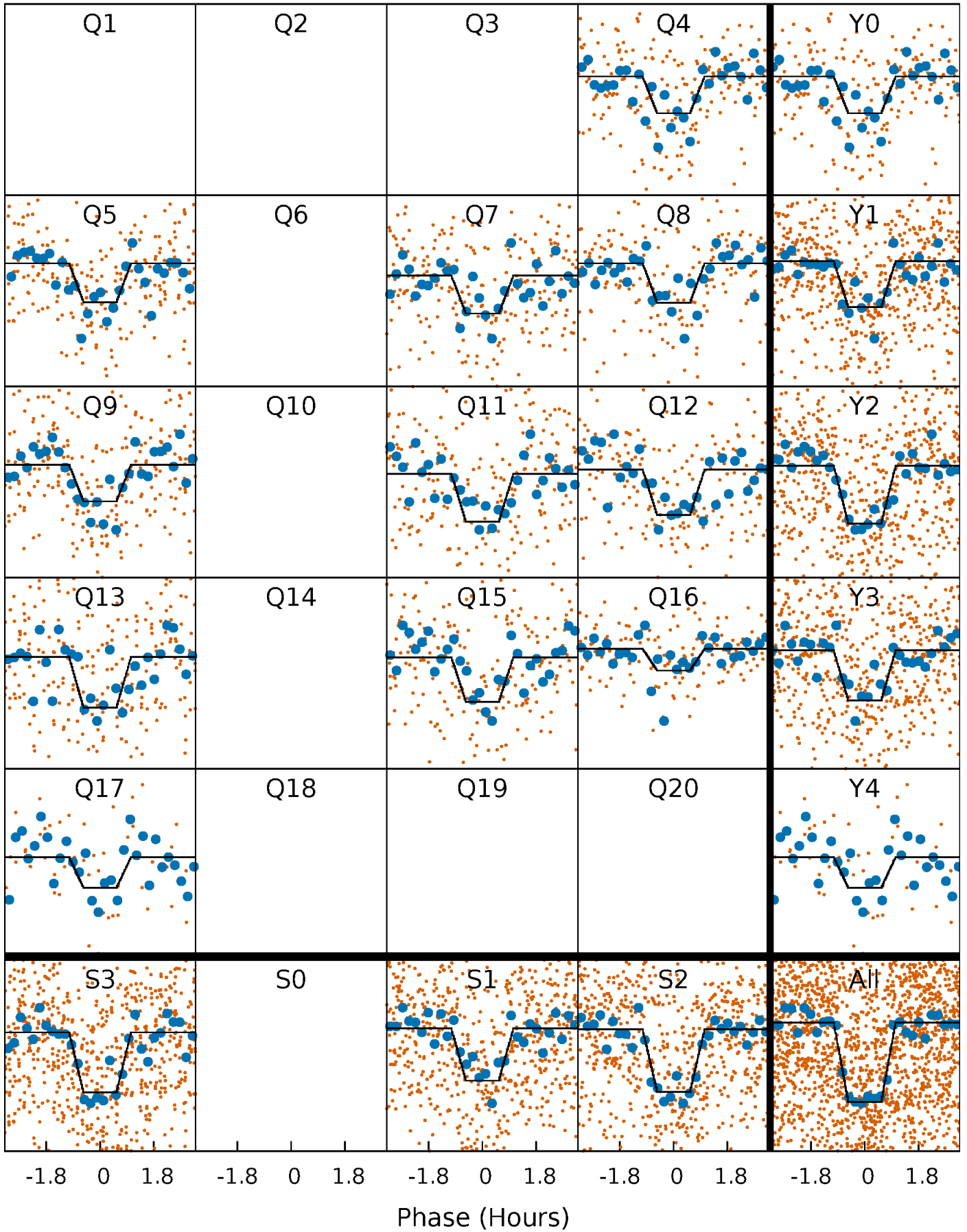
# DV Quarter-Phased Transit Curves

TCE 004851530-02     $P = 4.775012$  Days     $T_0 = 135.806476$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

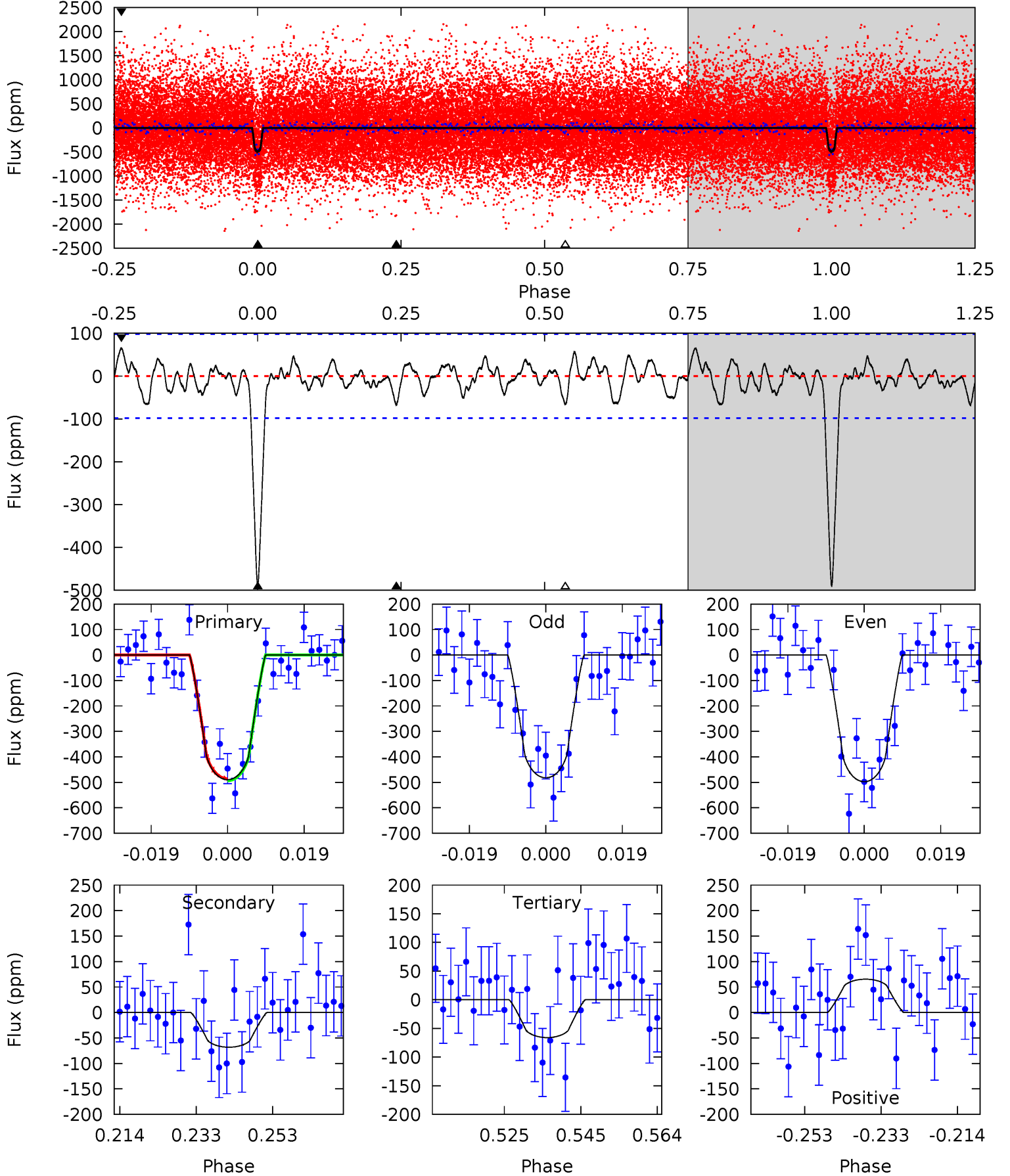
TCE 004851530-02     $P = 4.774992$  Days     $T_0 = 135.809462$  (BKJD)



# DV Model-Shift Uniqueness Test

004851530-02, P = 4.775012 Days, E = 135.806476 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
24.5	3.41	3.30	3.27	4.90	2.34	1.29	21.2	21.2	0.11	0.14	0.38	0.96	0.12	0.19

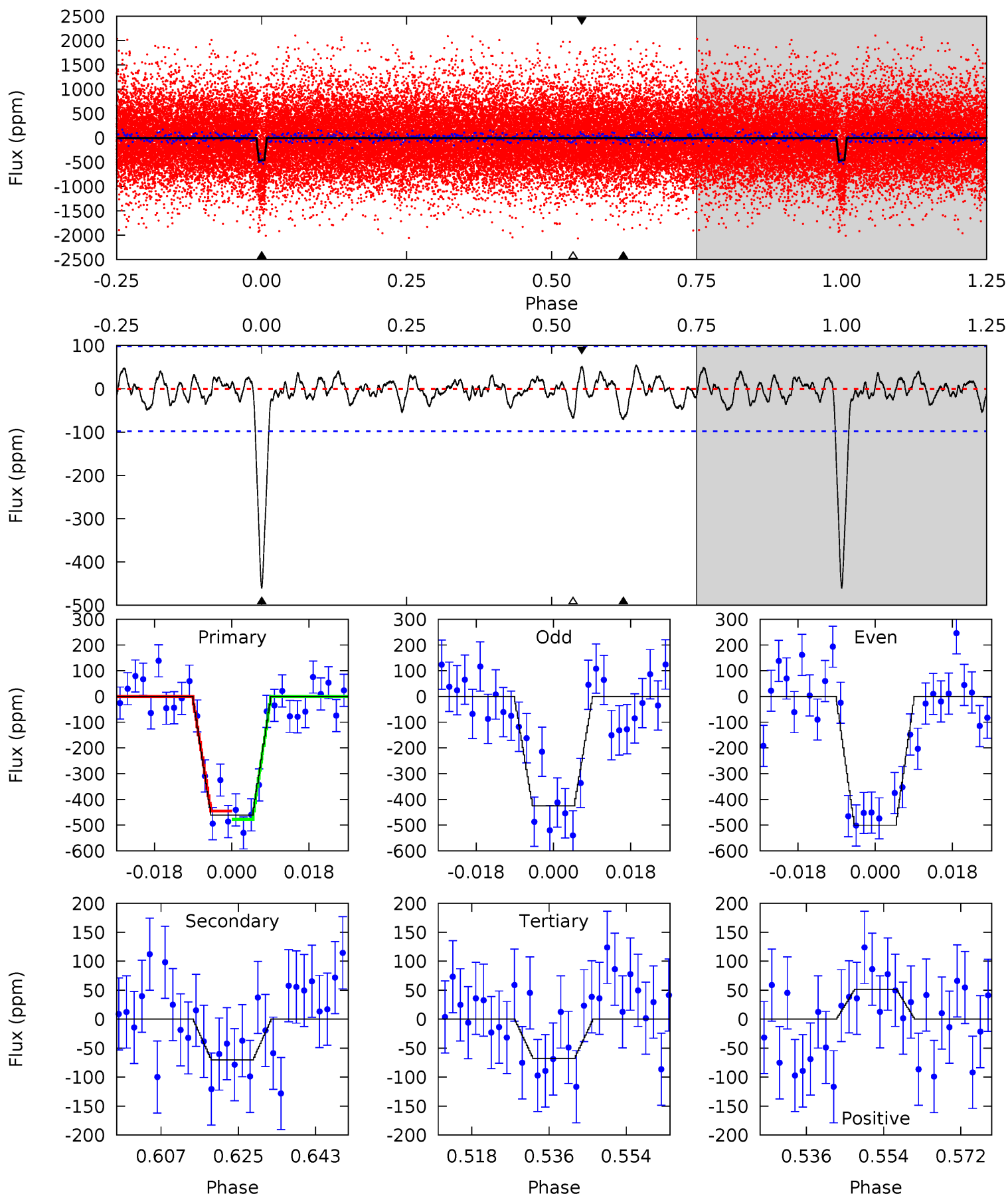




# Alt Model-Shift Uniqueness Test

004851530-02, P = 4.774992 Days, E = 135.809462 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
23.0	3.51	3.38	2.58	4.91	2.37	1.06	19.7	20.5	0.13	0.93	1.87	1.08	0.11	0.81





### Stellar Parameters For KIC 004851530

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5275^{+184}_{-184}$	$4.505^{+0.104}_{-0.095}$	$-0.300^{+0.300}_{-0.300}$	$0.796^{+0.112}_{-0.102}$	$0.739^{+0.112}_{-0.052}$	$2.065^{+0.912}_{-0.583}$
	+3%/-3%	+2%/-2%	+100%/-100%	+14%/-13%	+15%/-7%	+44%/-28%
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 004851530-02 / KOI 1884.02

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-68 \pm 20$	$2.22^{+1.67}_{-1.36}$	$1295^{+64}_{-69}$	$3427^{+1352}_{-550}$	$19^{+101}_{-13}$
Alt.	$-70 \pm 20$	$2.18^{+1.70}_{-1.29}$	$1297^{+67}_{-69}$	$3461^{+1356}_{-564}$	$20^{+101}_{-14}$

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

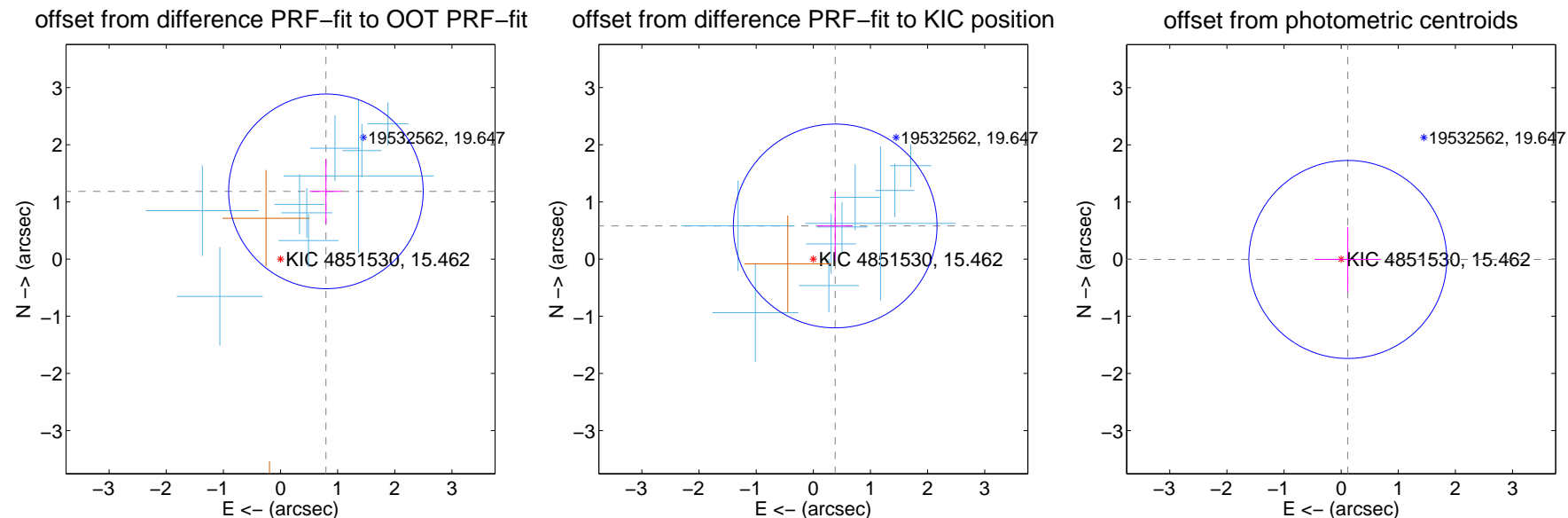
## DV Centroid Data

Supplemental centroid analysis for 004851530-02. Kepler magnitude: 15.46. Transit SNR 16.73

There are 9 quarters with good PRF difference image offsets

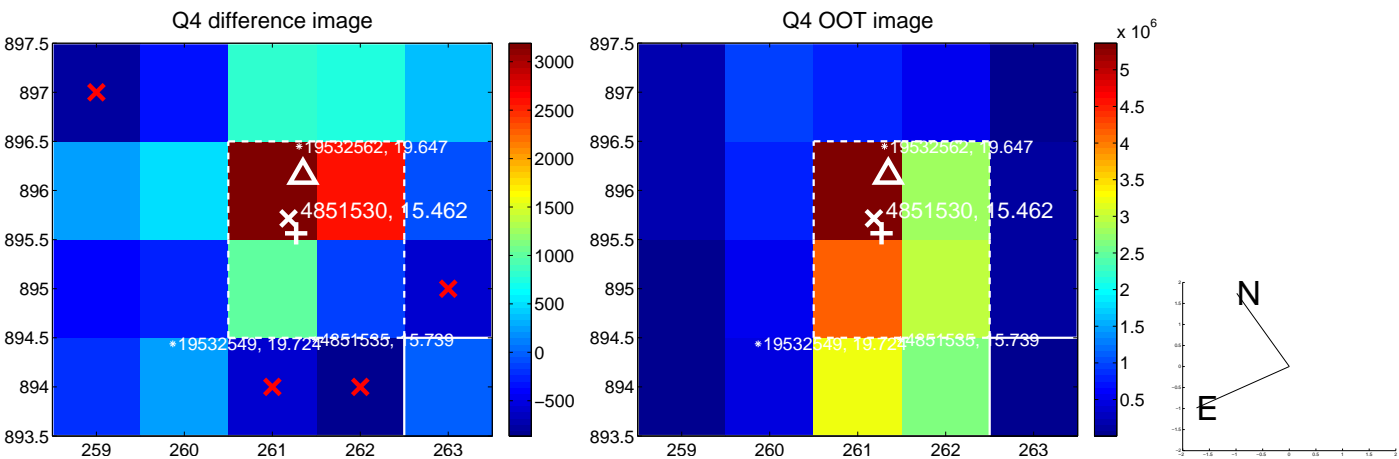
The direct PRF centroid is offset from the target star catalog position by about 0.85 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.426 \pm 0.567$	2.51	$-0.794 \pm 0.283$	$1.184 \pm 0.569$
PRF-fit source offset from KIC position	$0.695 \pm 0.594$	1.17	$-0.383 \pm 0.304$	$0.579 \pm 0.600$
photometric centroid source offset	$0.12 \pm 0.58$	0.20	$-0.12 \pm 0.58$	$-0.01 \pm 0.57$

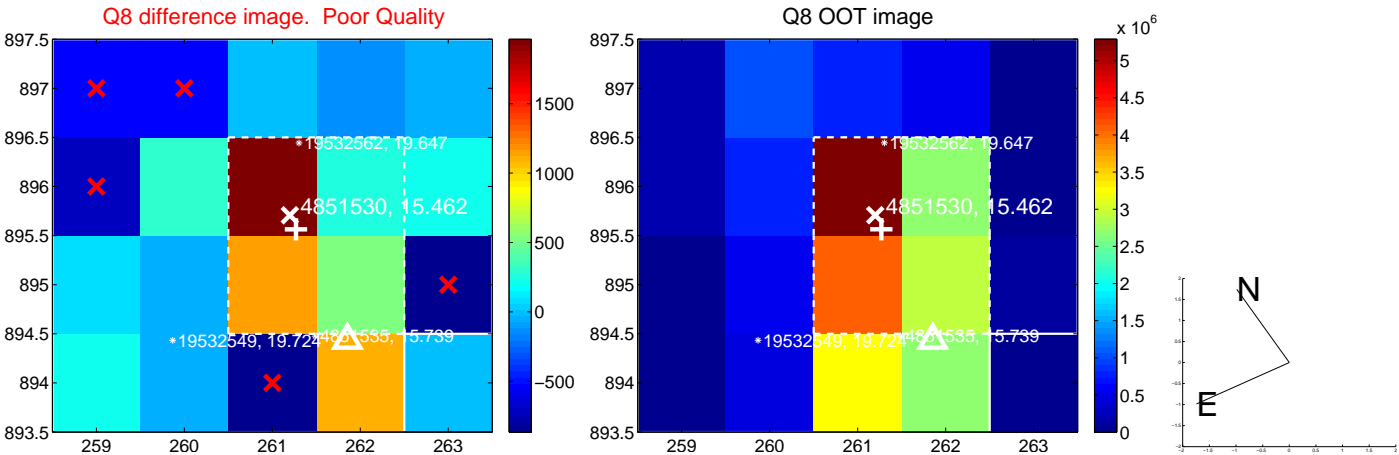
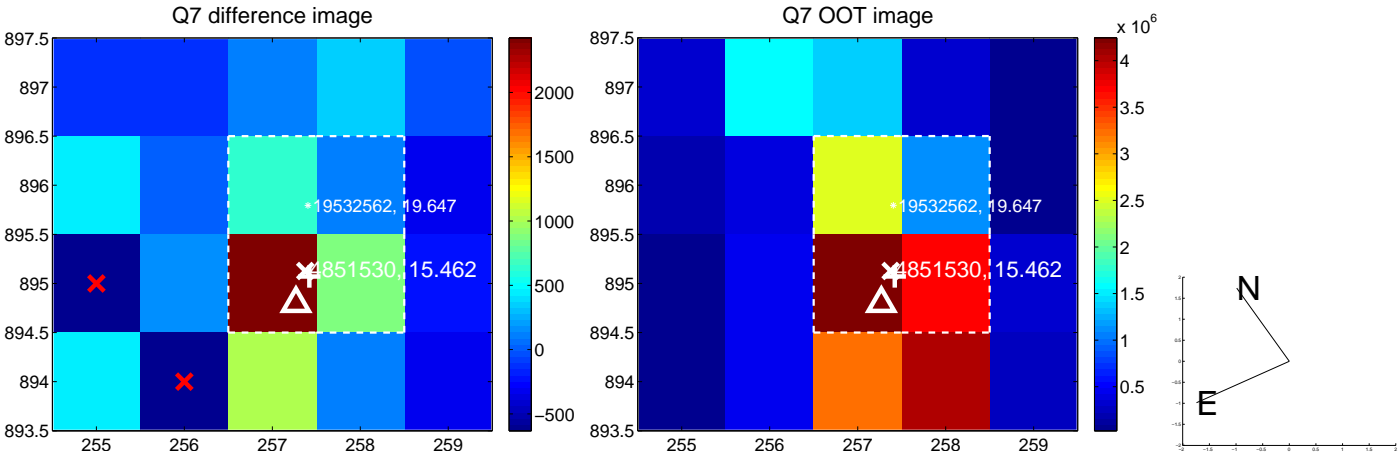
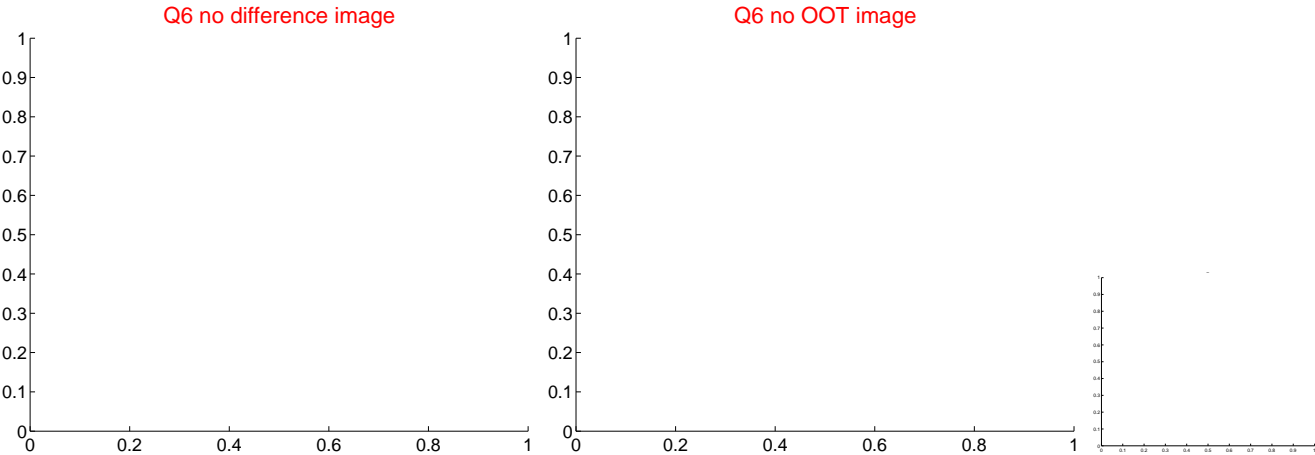
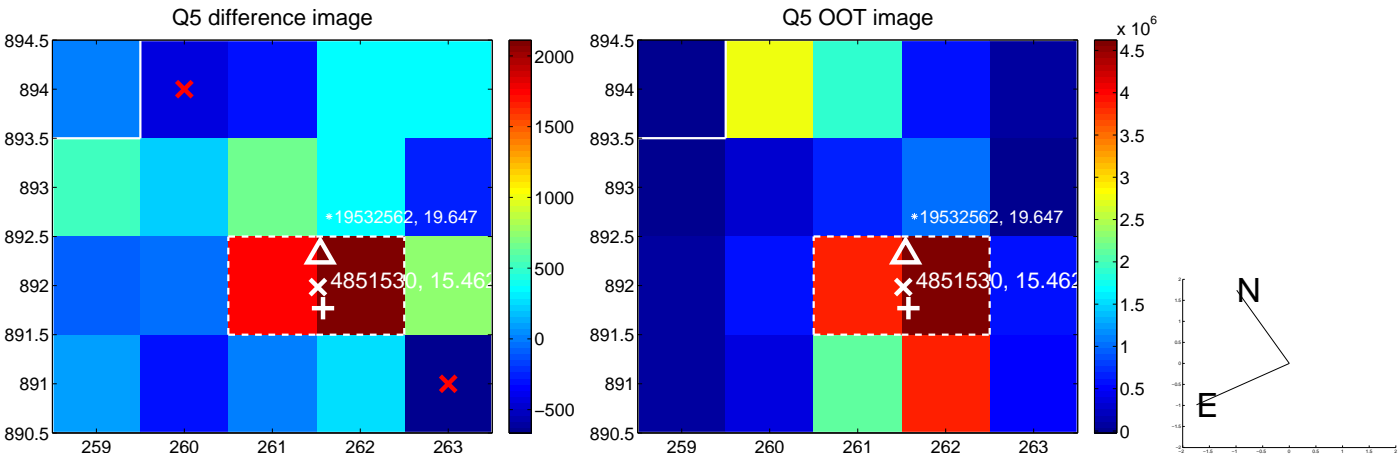


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

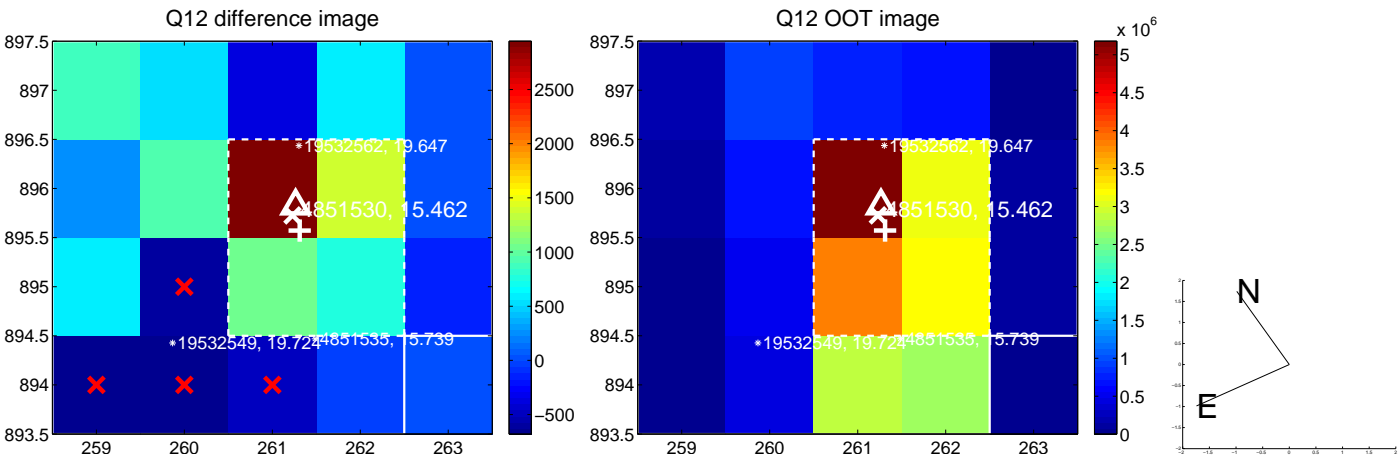
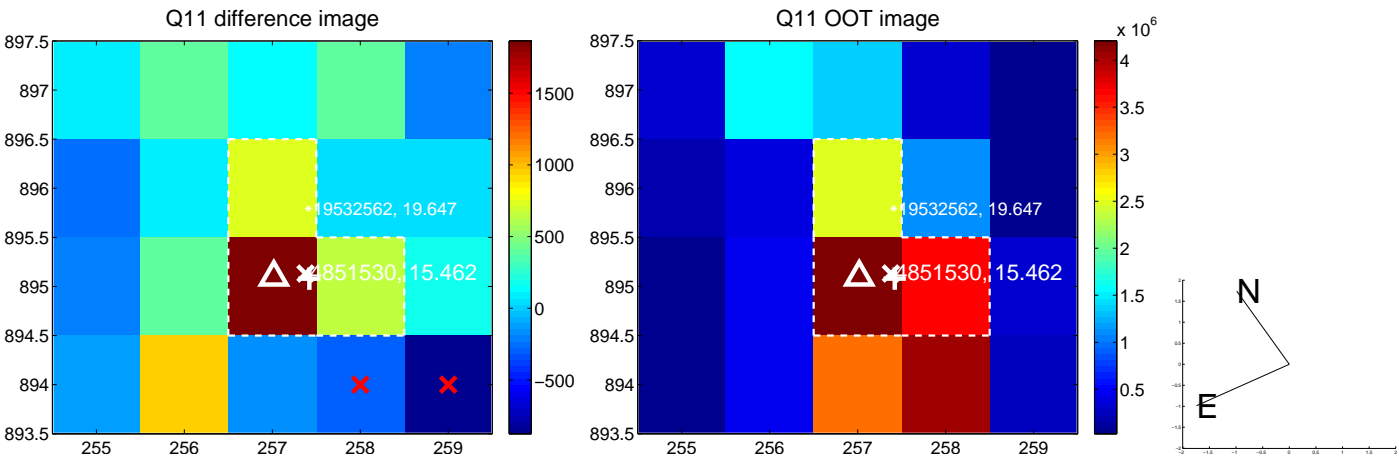
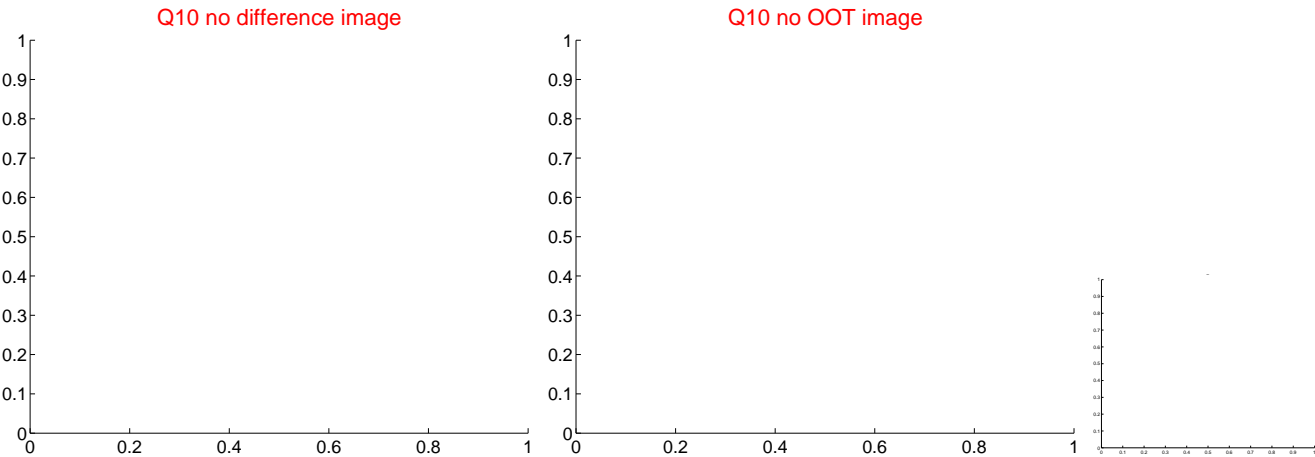
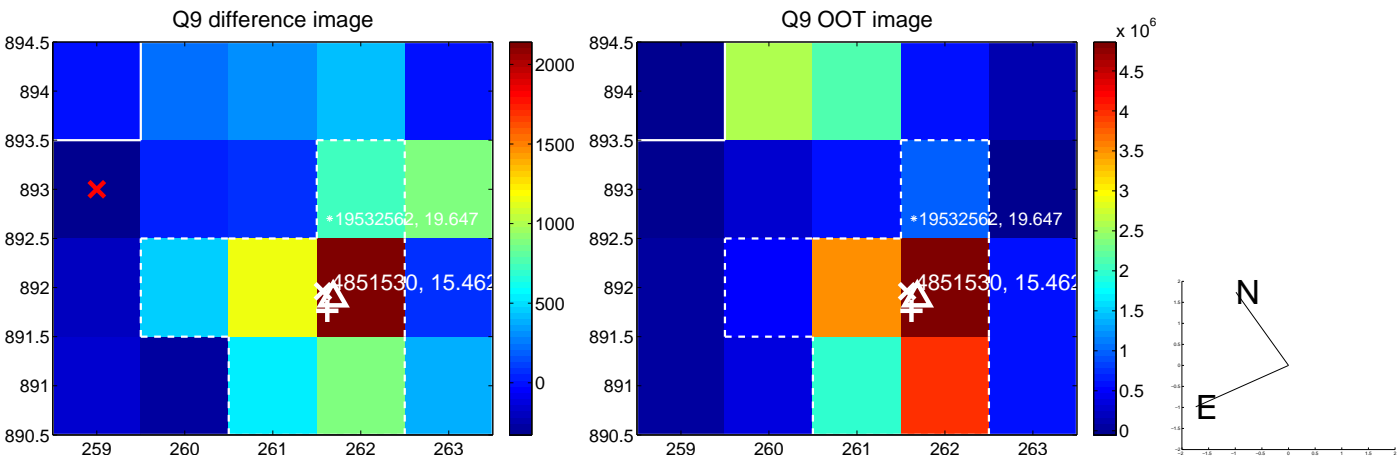
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



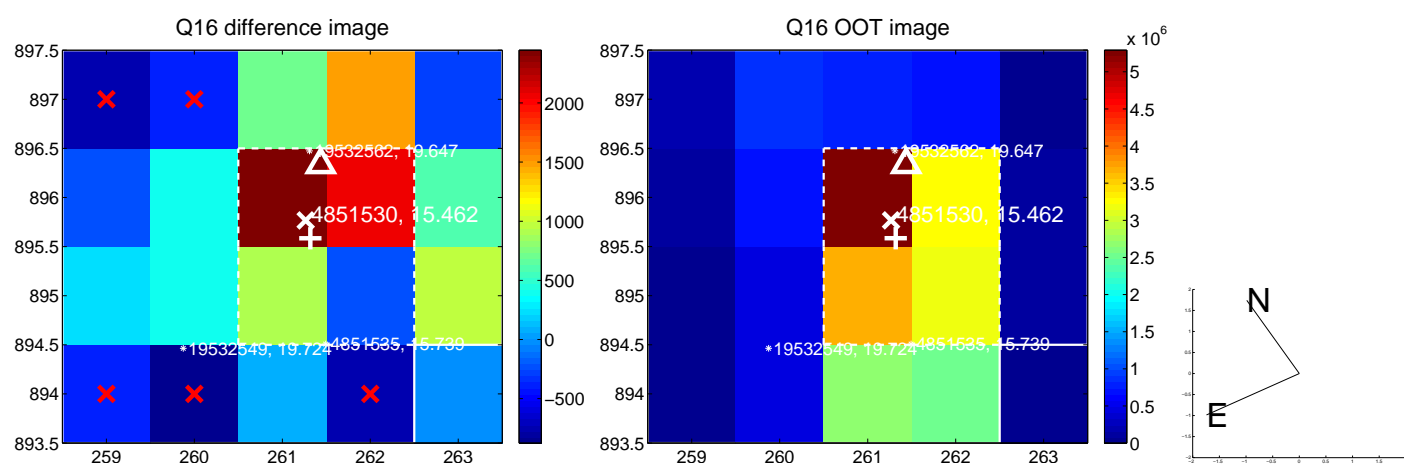
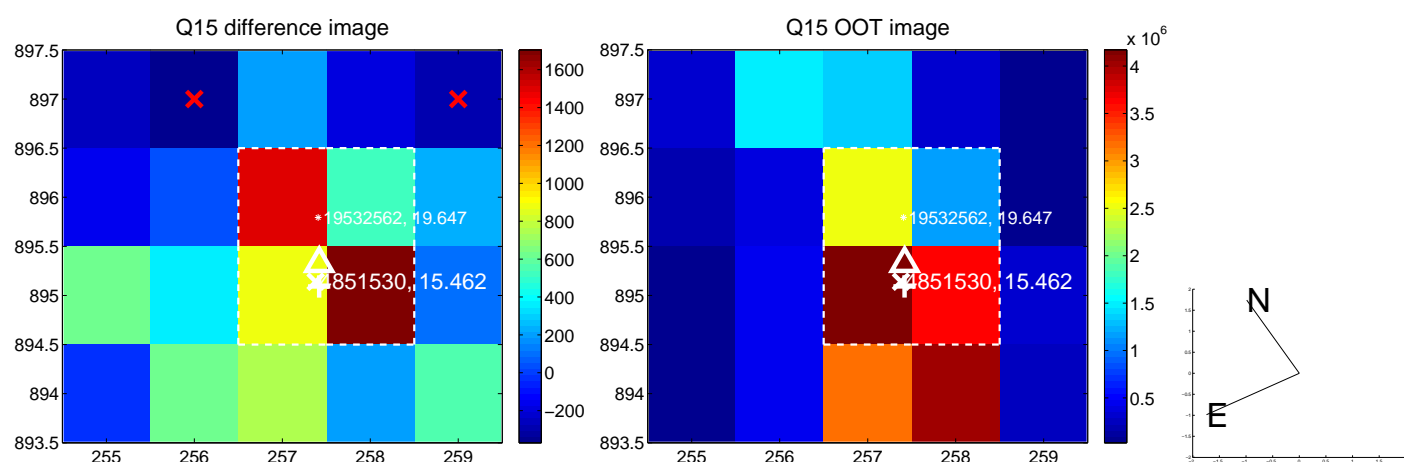
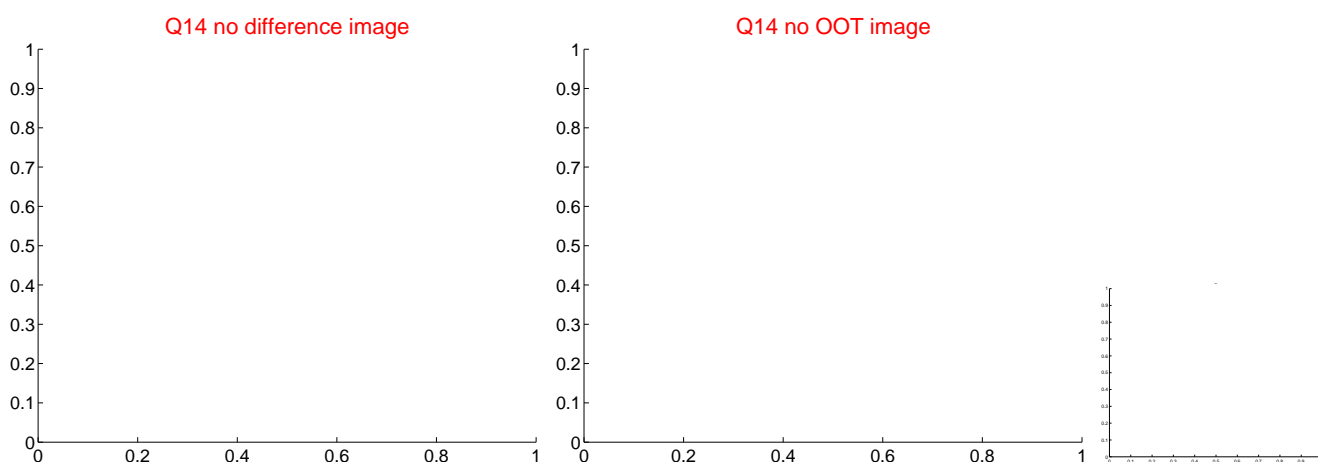
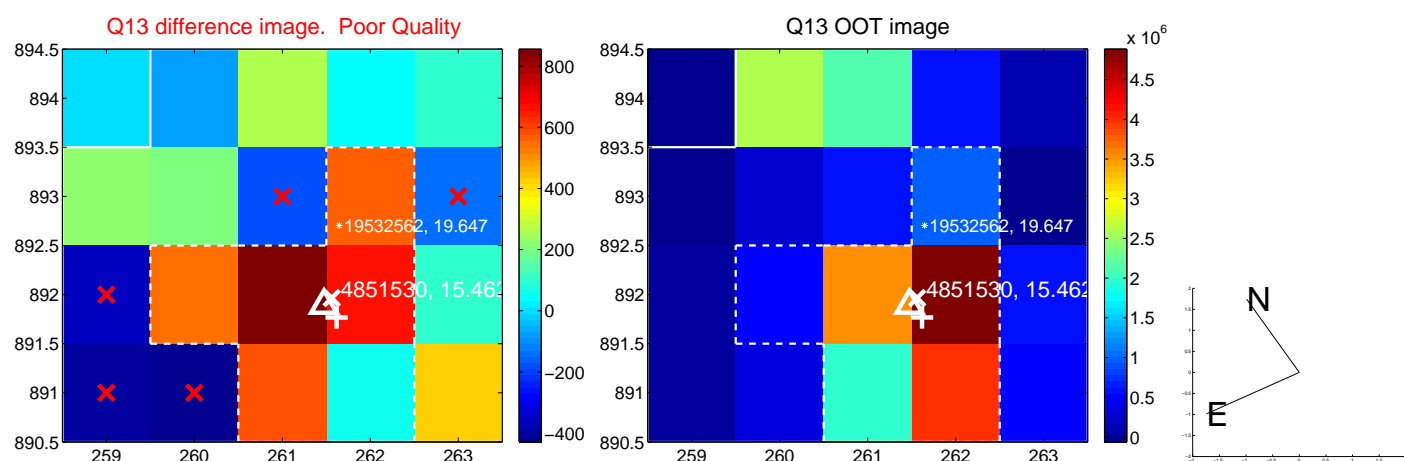
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



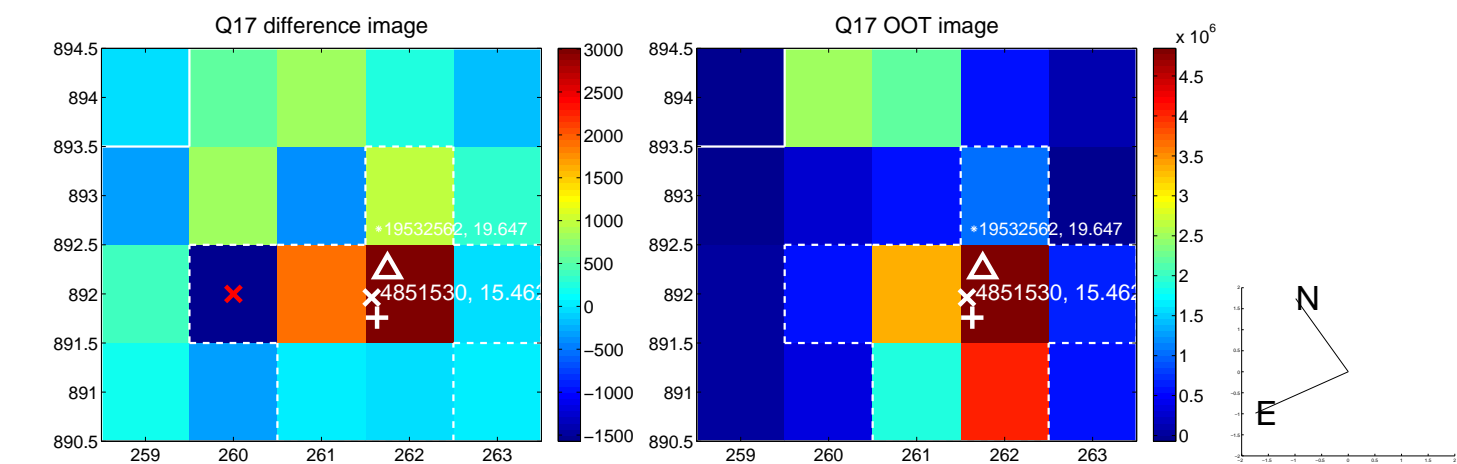
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



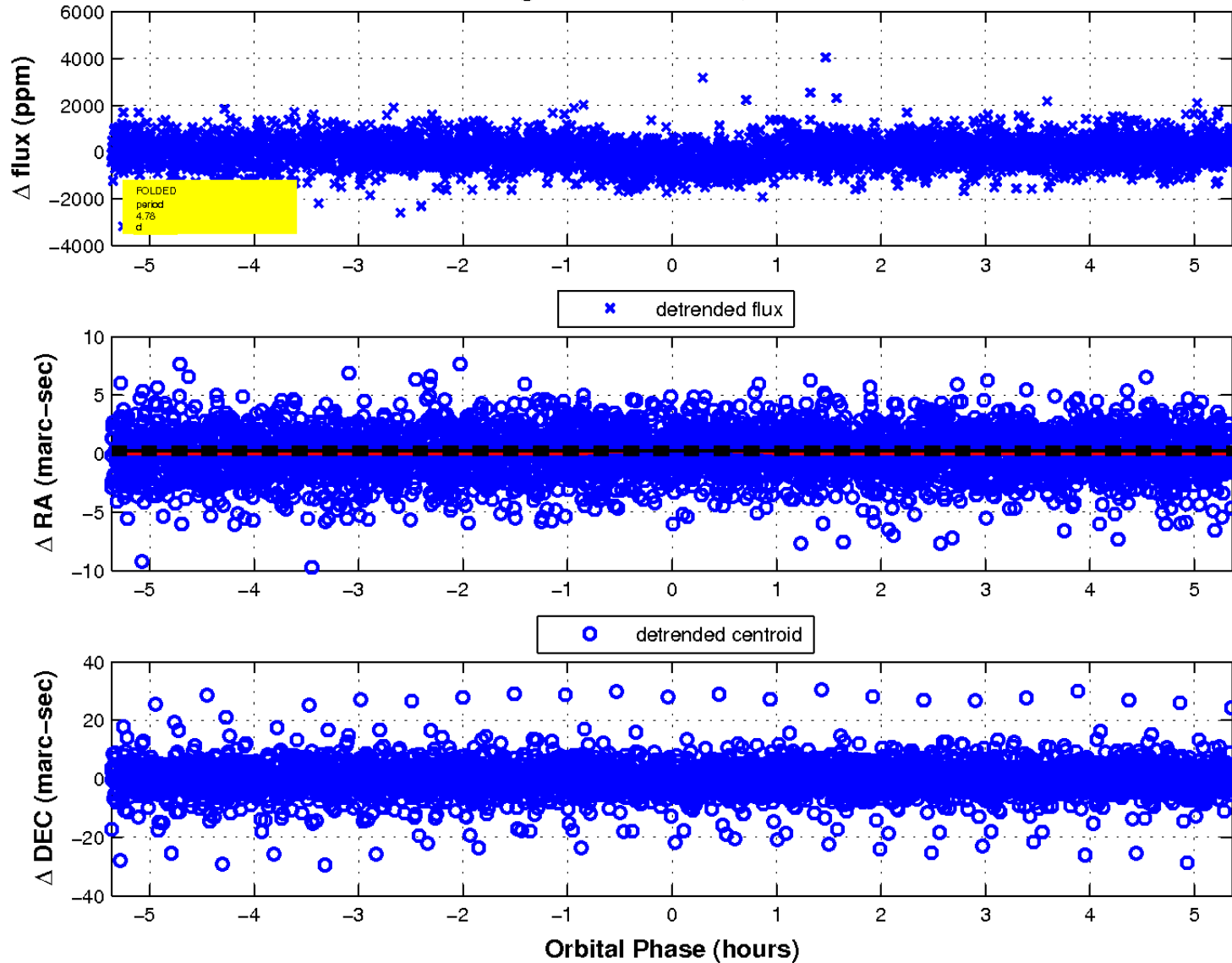
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



fluxWeightedCentroids, Planet 2 of 2





UKIRT Image

