

# KIC 004936180

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
004936180-01	OBS	0820.01	4.640932	131.951714	3511.4	1.572	135.0	140.1	0.83	6463	7.21	421.84
004936180-02	OBS	No	2.784687	132.073525	73.9	8.443	8.2	7.6	0.83	6463	0.81	833.52

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
004936180-01	OBS	FP	0.00	0	1	0	0	DEEP_V_SHAPED
004936180-02	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_ALT—CENT_FEW_DIFFS

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

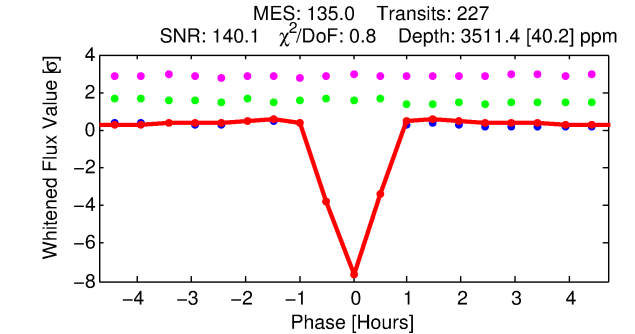
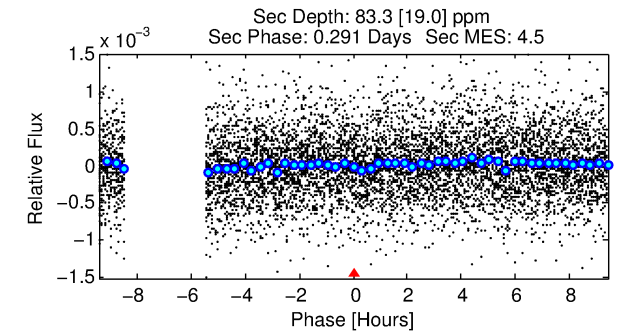
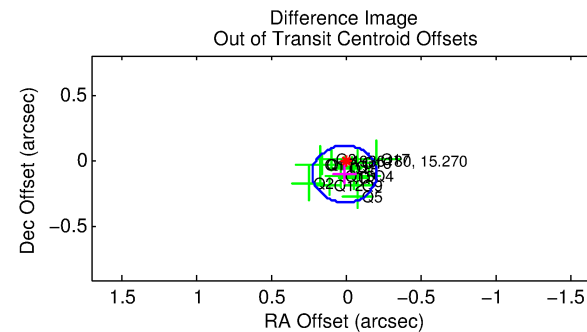
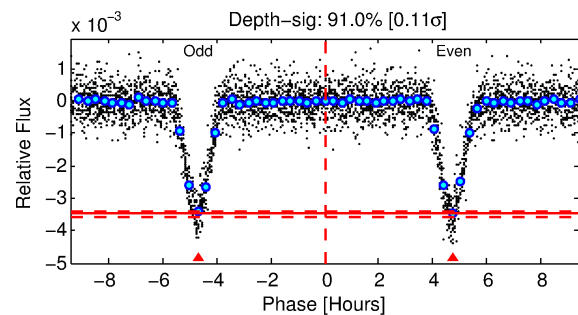
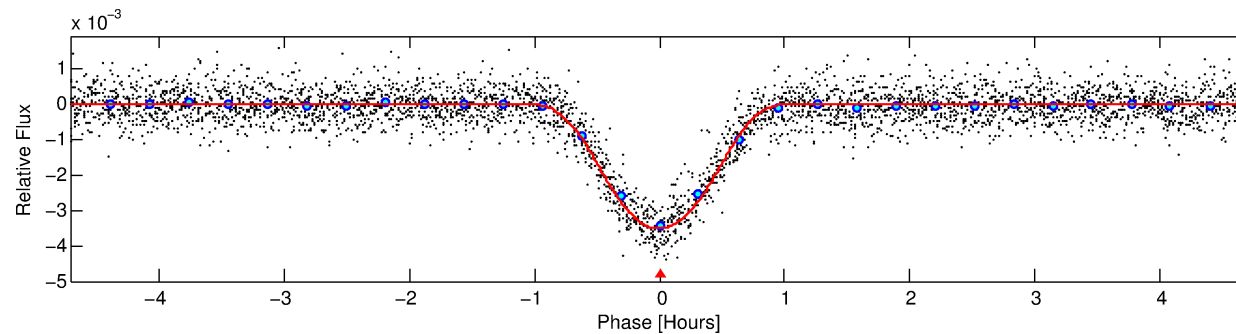
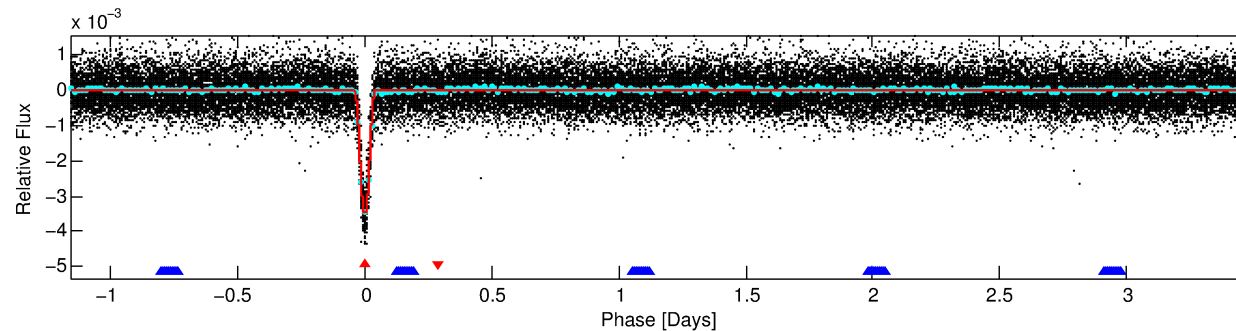
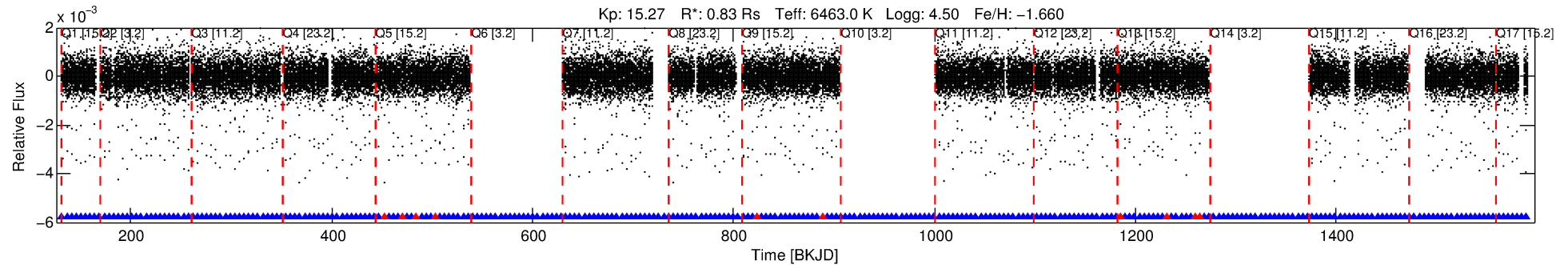
N = Not Transit-Like. S = Stellar Eclipse. C = Centroid Offset. E = Ephemeris Match.

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 004936180-01

No Significant Match Found

KOI: K00820.01    Corr: 0.965



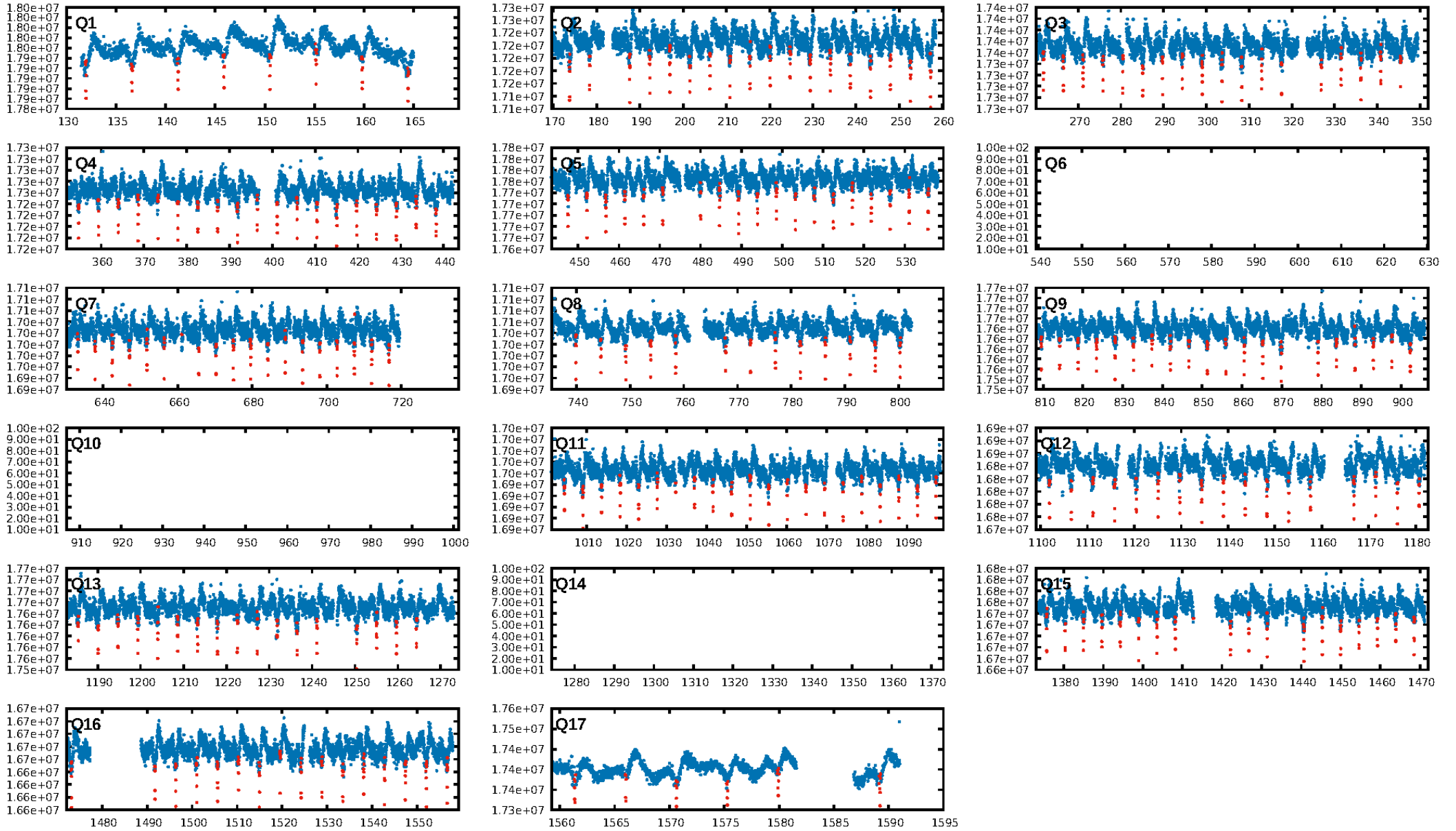
DV Diagnostic Results:

ShortPeriod-sig: 100.0% [5.19σ]  
 LongPeriod-sig: N/A  
 ModelChiSquare2-sig: N/A  
 ModelChiSquareGof-sig: N/A  
 Bootstrap-pfa: 0.00e+00  
 RollingBand-fgt: 0.95 [203/213]  
 GhostDiagnostic-chr: 4.88

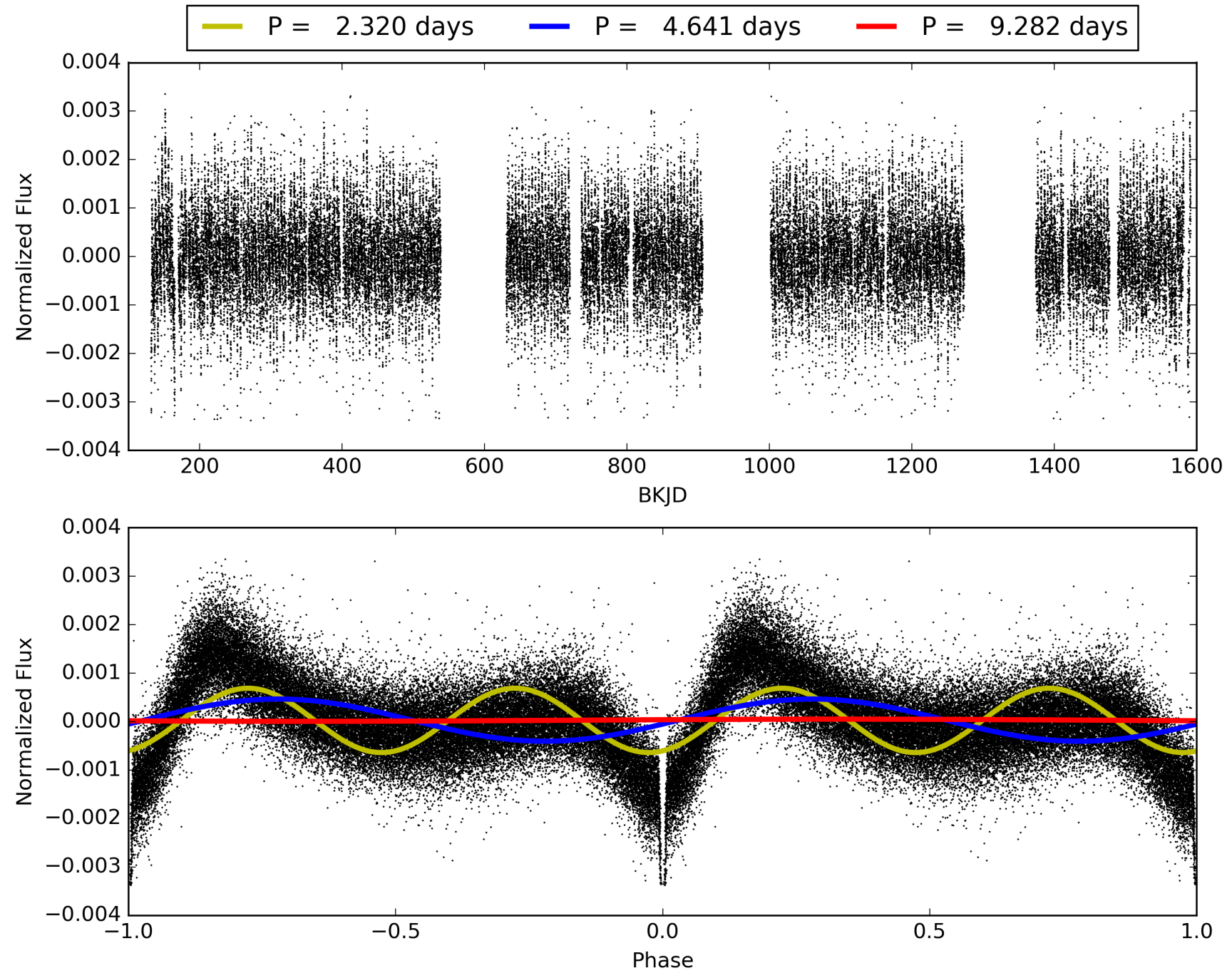
Centroid-sig: 2.9%  
Centroid-so: 0.082 arcsec [0.75 $\sigma$ ]  
OotOffset-rm: 0.098 arcsec [1.37 $\sigma$ ]  
KicOffset-rm: 0.126 arcsec [1.72 $\sigma$ ]  
OotOffset-st: 1/4/4/5 [14]  
KicOffset-st: 1/4/4/5 [14]  
DiffImageQuality-fgm: 1.00 [14/14]  
DiffImageOverlap-fno: 1.00 [14/14]

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

# TCE 004936180-01, PDC Light Curves

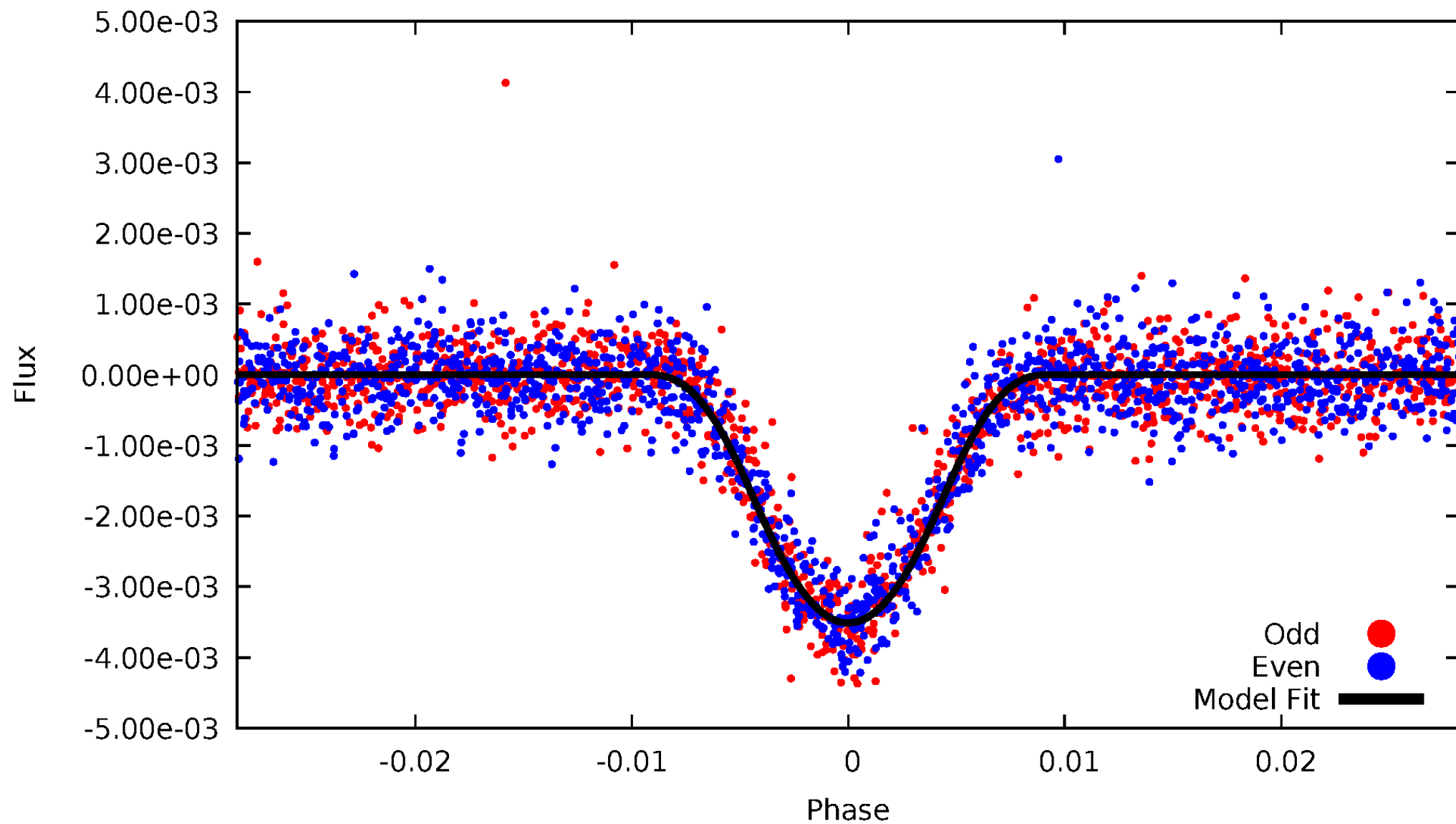


TCE 004936180-01



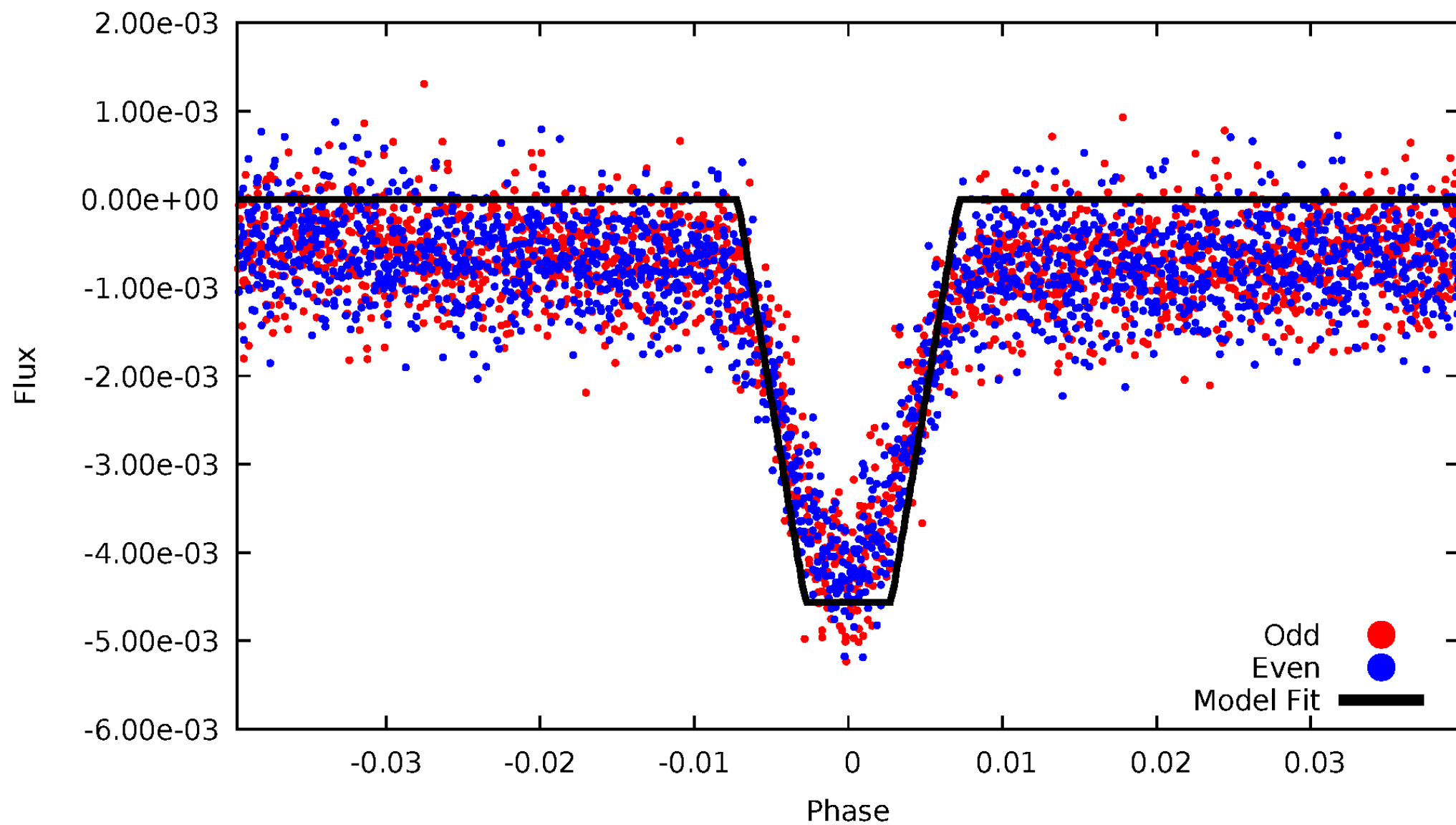
# DV Odd/Even

TCE 004936180-01



# ALT Odd/Even

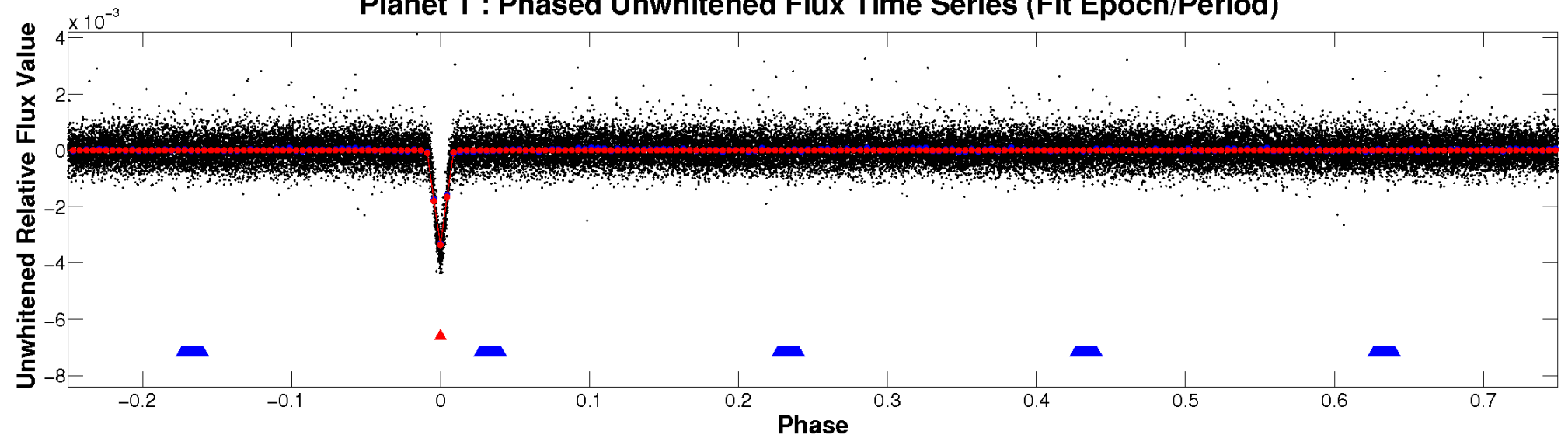
TCE 004936180-01



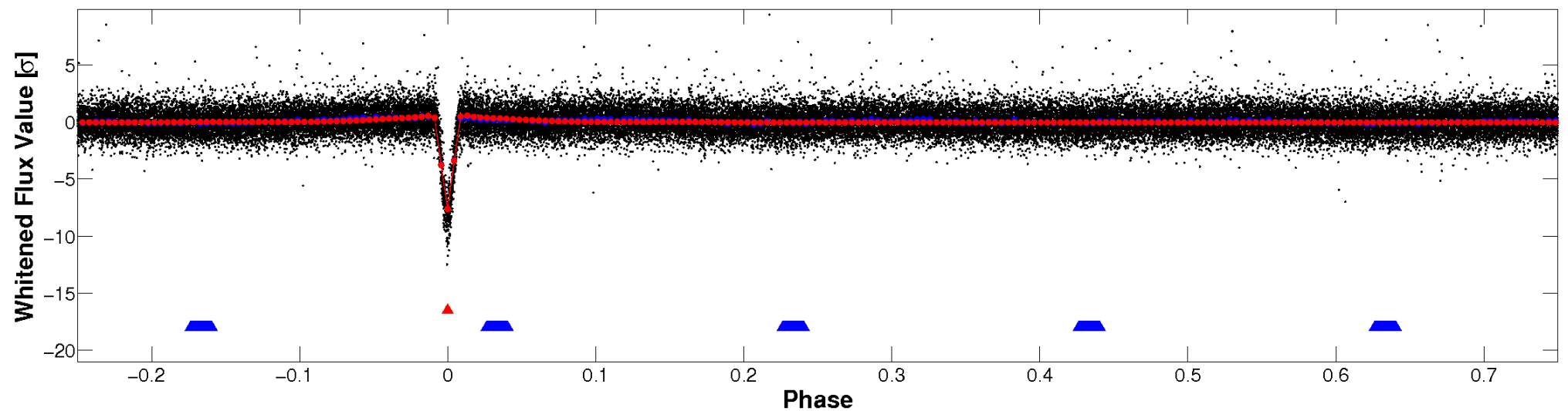


# Non-Whitened Vs. Whitened Light Curve

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

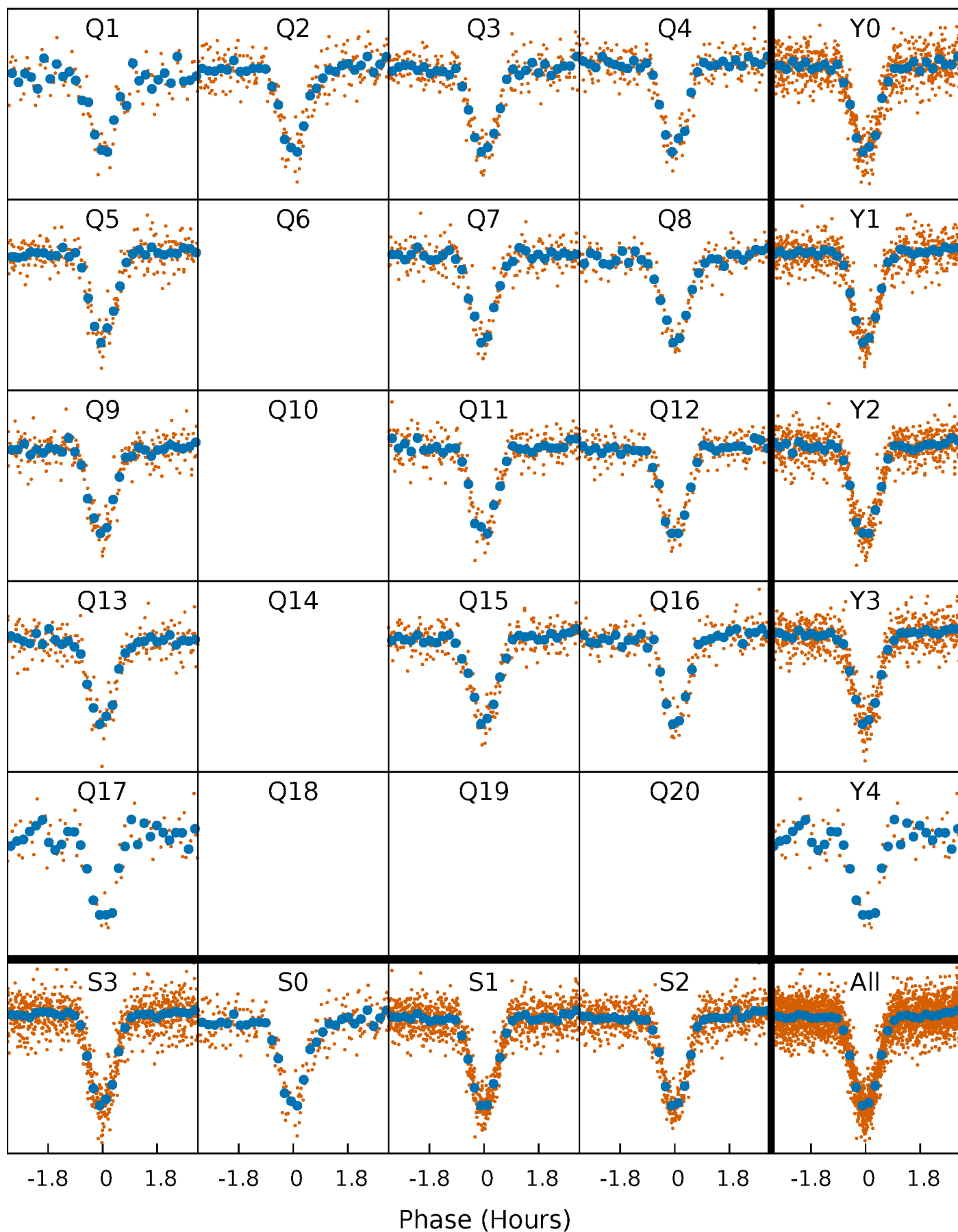


Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

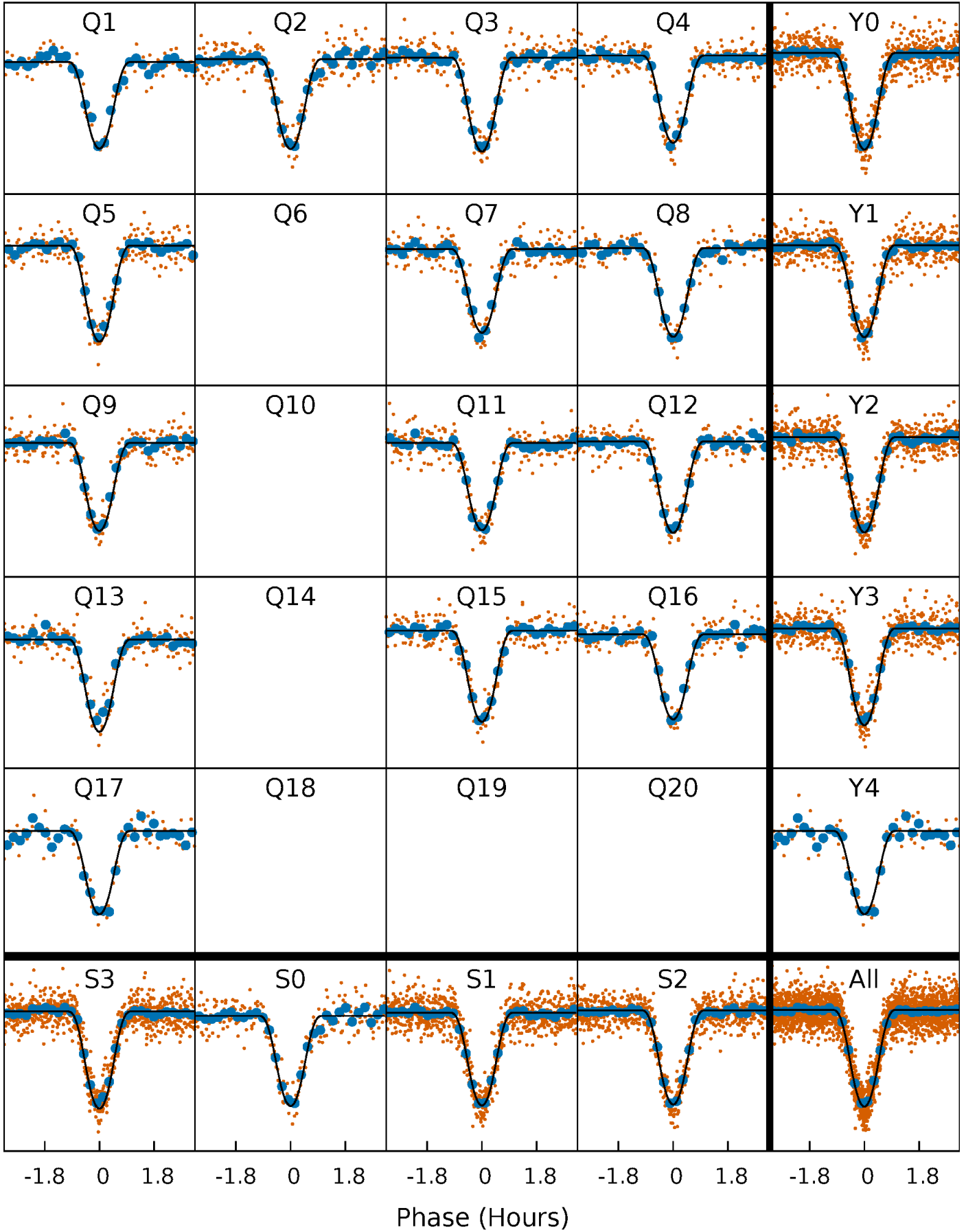
TCE 004936180-01   P= 4.640932 Days    $T_0=131.951714$  (BKJD)





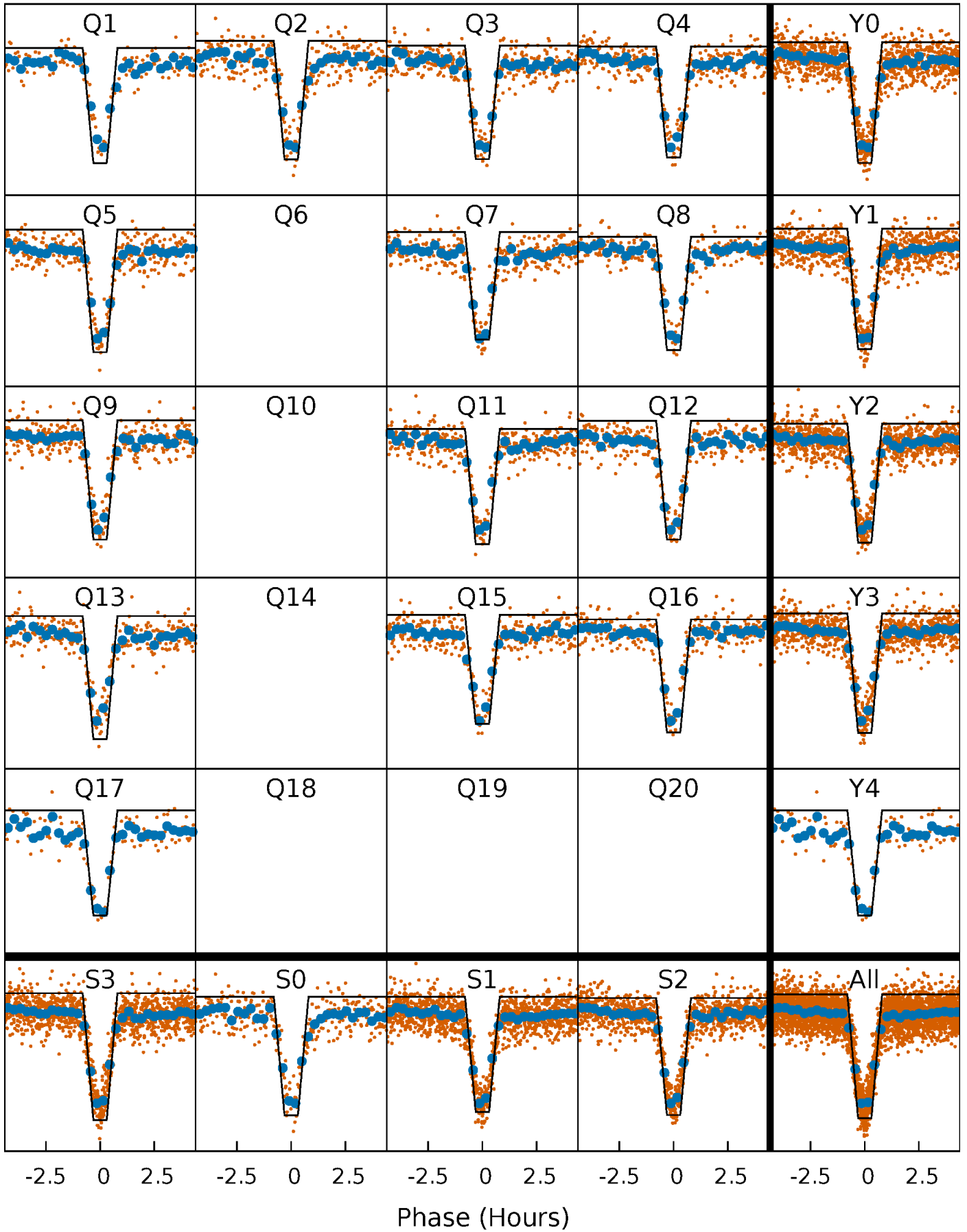
# DV Quarter-Phased Transit Curves

TCE 004936180-01 P= 4.640932 Days  $T_0=131.951714$  (BKJD)



## Alt. Detrend Quarter-Phased Transit Curves

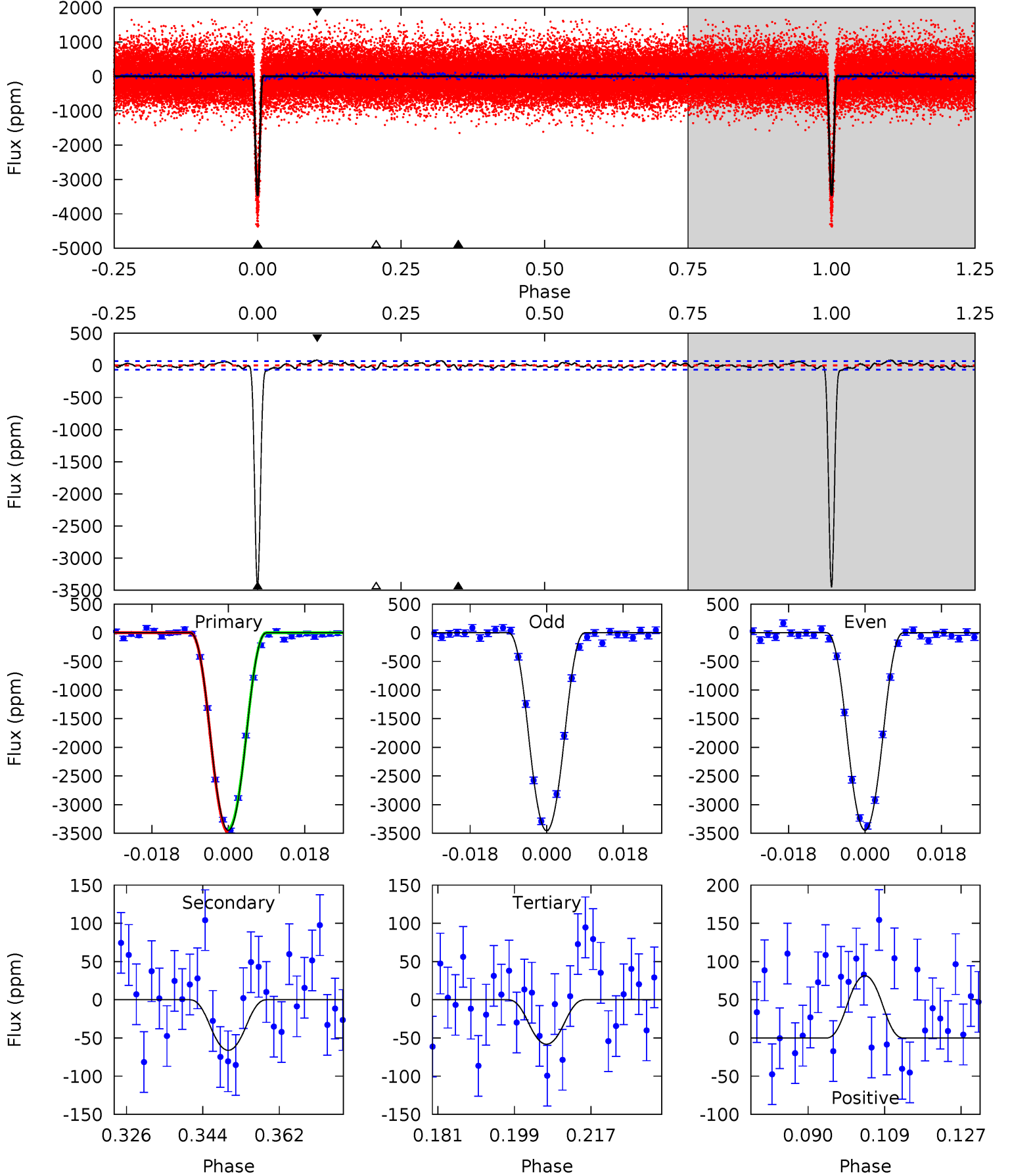
TCE 004936180-01 P= 4.640947 Days  $T_0=131.949722$  (BKJD)



# DV Model-Shift Uniqueness Test

004936180-01, P = 4.640932 Days, E = 127.310782 Days

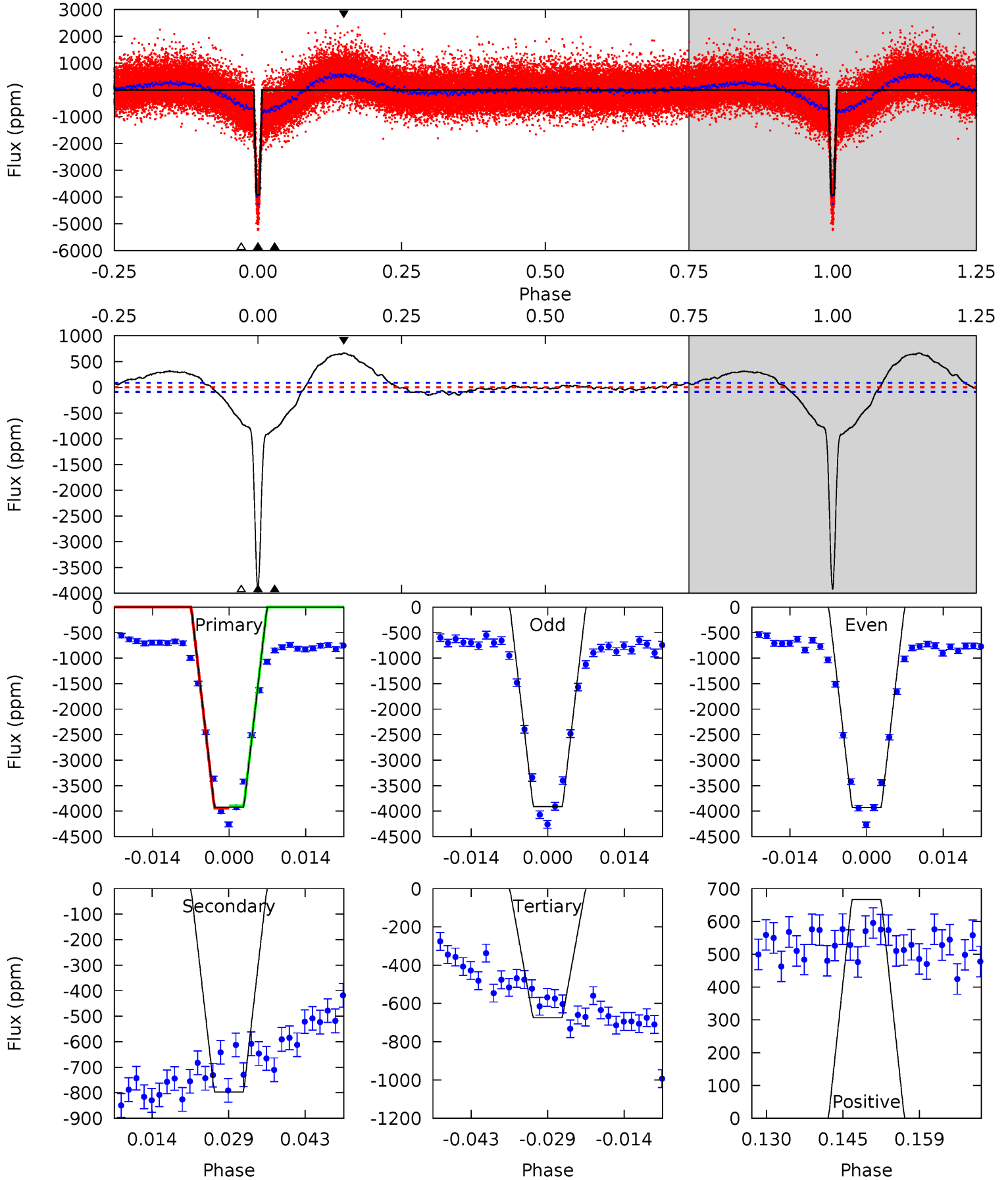
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
251.1	4.82	4.23	5.93	4.91	2.36	1.89	246.9	245.2	0.58	-1.11	0.28	0.99	0.02	2.06



# Alt Model-Shift Uniqueness Test

004936180-01, P = 4.640947 Days, E = 127.308775 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
219.5	44.6	37.8	37.3	4.95	2.44	14.2	181.7	182.1	6.86	7.32	0.58	1.00	0.15	1.30



### Stellar Parameters For KIC 004936180

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6463^{+205}_{-205}$	$4.500^{+0.087}_{-0.163}$	$-1.660^{+0.300}_{-0.200}$	$0.826^{+0.159}_{-0.086}$	$0.786^{+0.062}_{-0.045}$	$1.962^{+0.680}_{-0.833}$
	+3%/-3%	+2%/-4%	+18%/-12%	+19%/-10%	+8%/-6%	+35%/-42%
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 004936180-01 / KOI 0820.01

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-66 \pm 14$	$7.30^{+2.07}_{-1.92}$	$1630^{+98}_{-84}$	$2714^{+294}_{-215}$	$1.638^{+1.463}_{-0.668}$
Alt.	$-797 \pm 18$	$6.22^{+1.63}_{-1.86}$	$1627^{+96}_{-79}$	$4401^{+666}_{-391}$	$29^{+29}_{-11}$

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

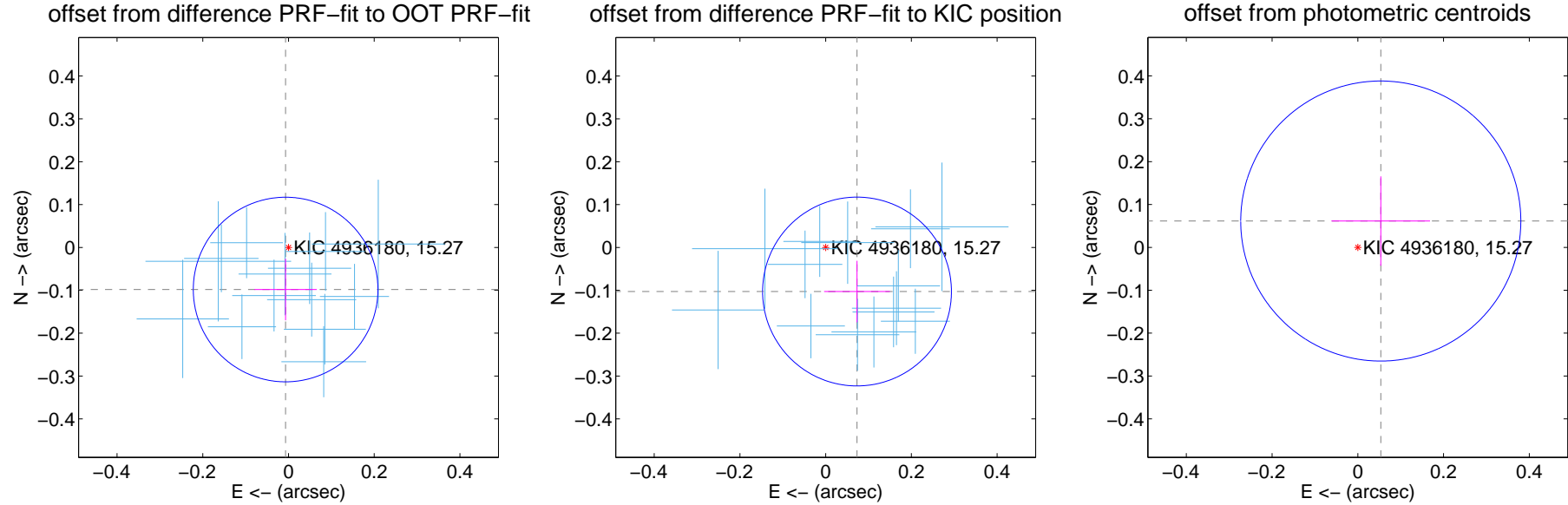
## DV Centroid Data

Supplemental centroid analysis for 004936180-01. Kepler magnitude: 15.27. Transit SNR 140.11

There are 14 quarters with good PRF difference image offsets

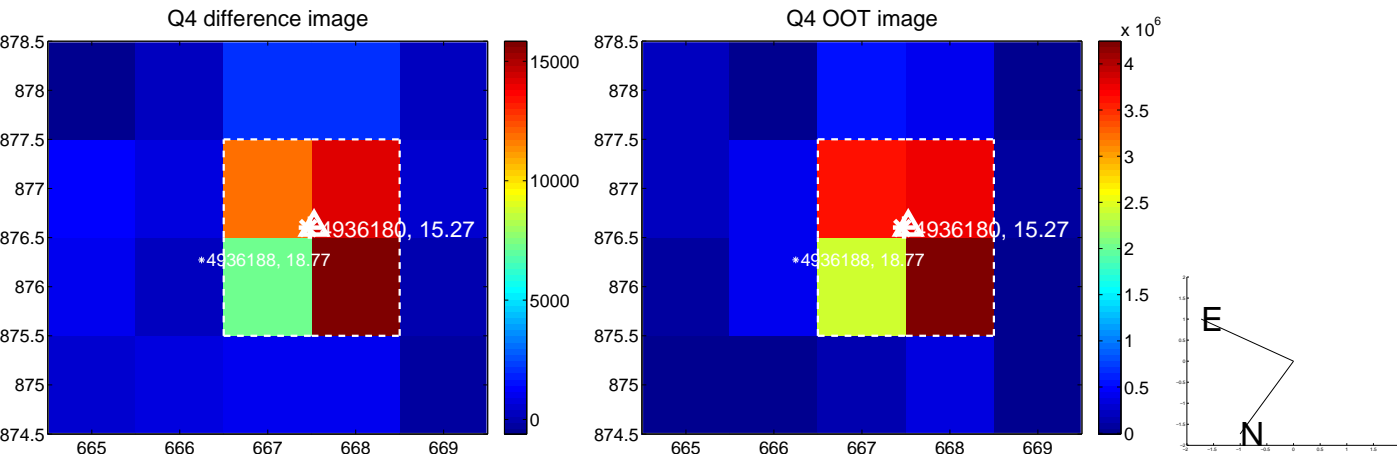
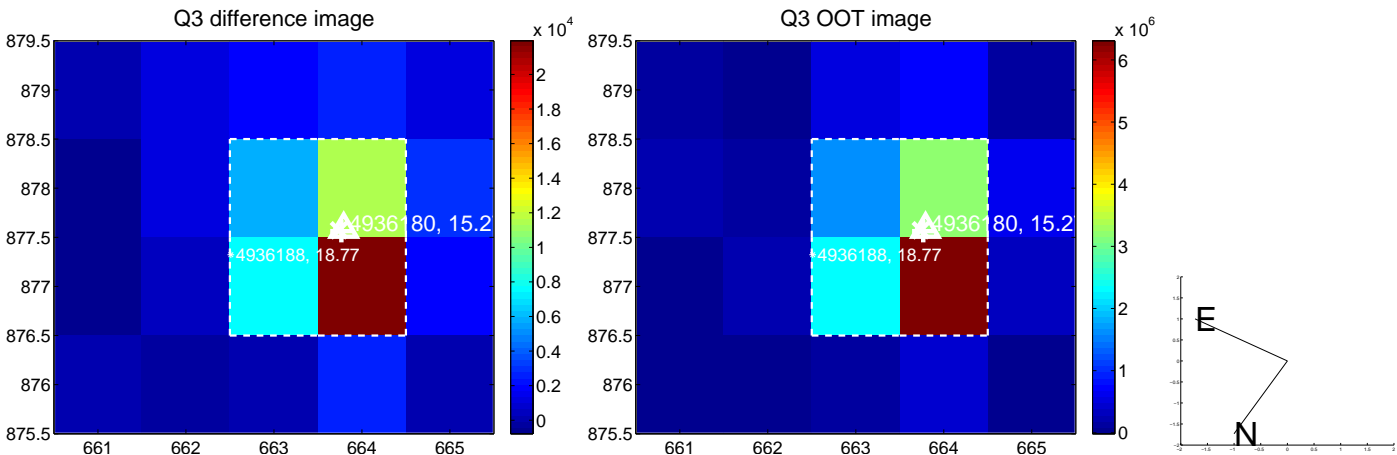
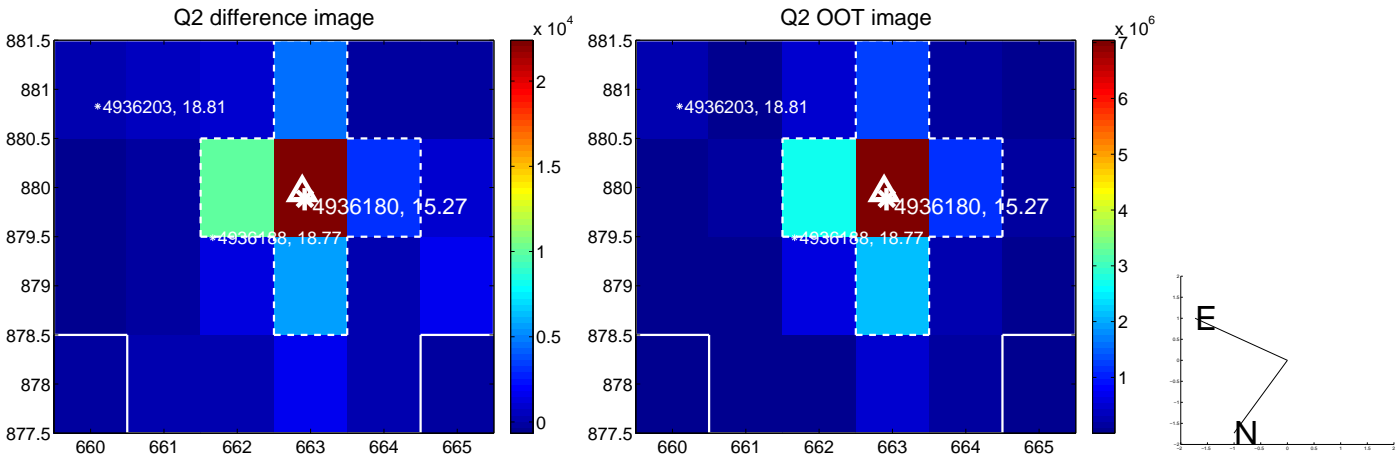
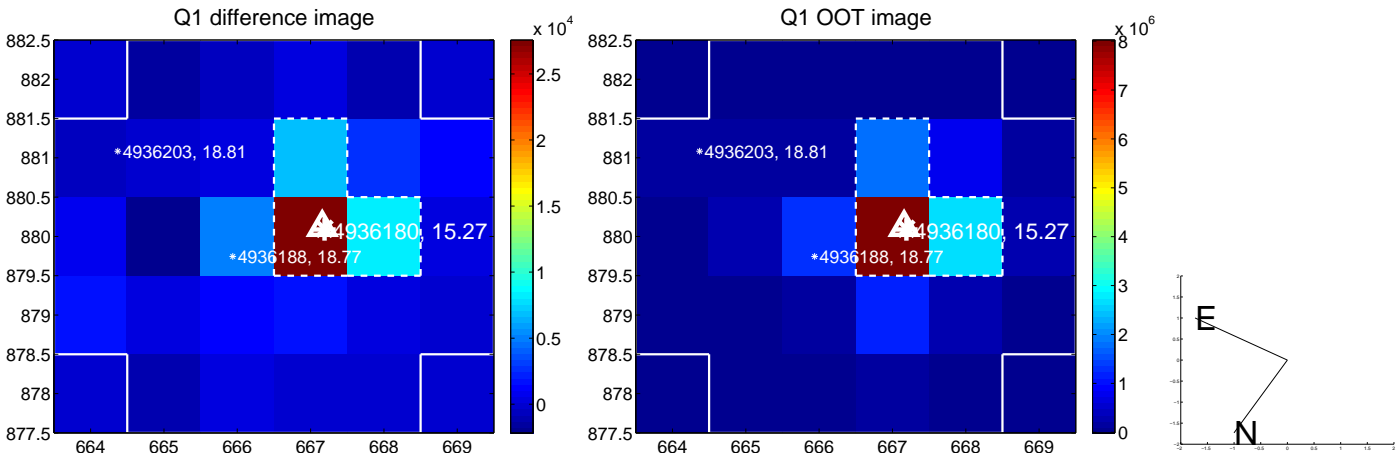
The direct PRF centroid is offset from the target star catalog position by about 0.07 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.098 \pm 0.072$	1.37	$0.007 \pm 0.073$	$-0.098 \pm 0.072$
PRF-fit source offset from KIC position	$0.126 \pm 0.073$	1.72	$-0.073 \pm 0.077$	$-0.103 \pm 0.072$
photometric centroid source offset	$0.08 \pm 0.11$	0.75	$-0.05 \pm 0.11$	$0.06 \pm 0.10$



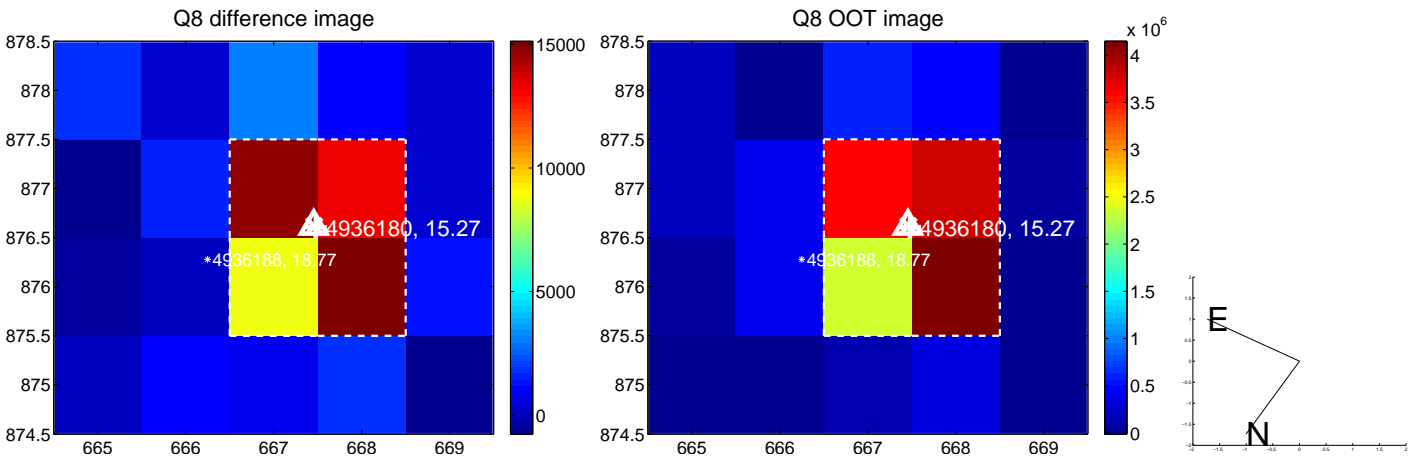
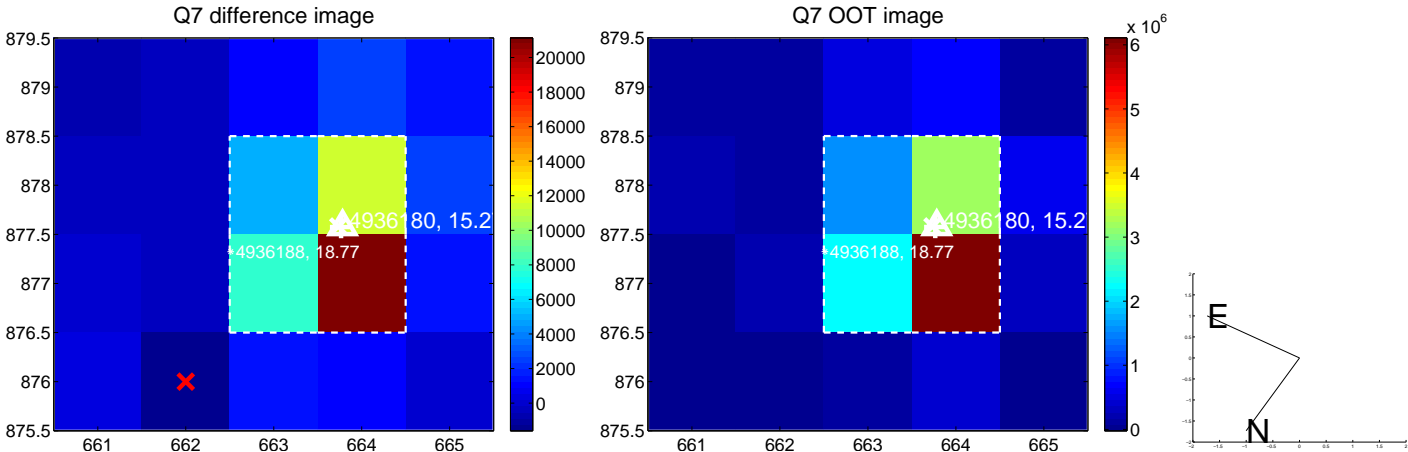
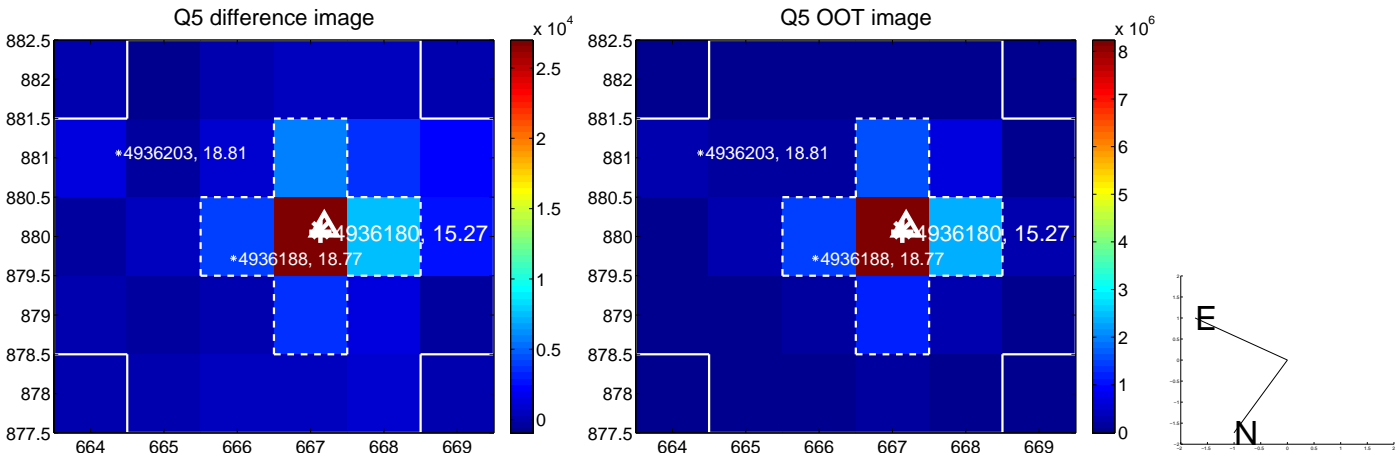
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

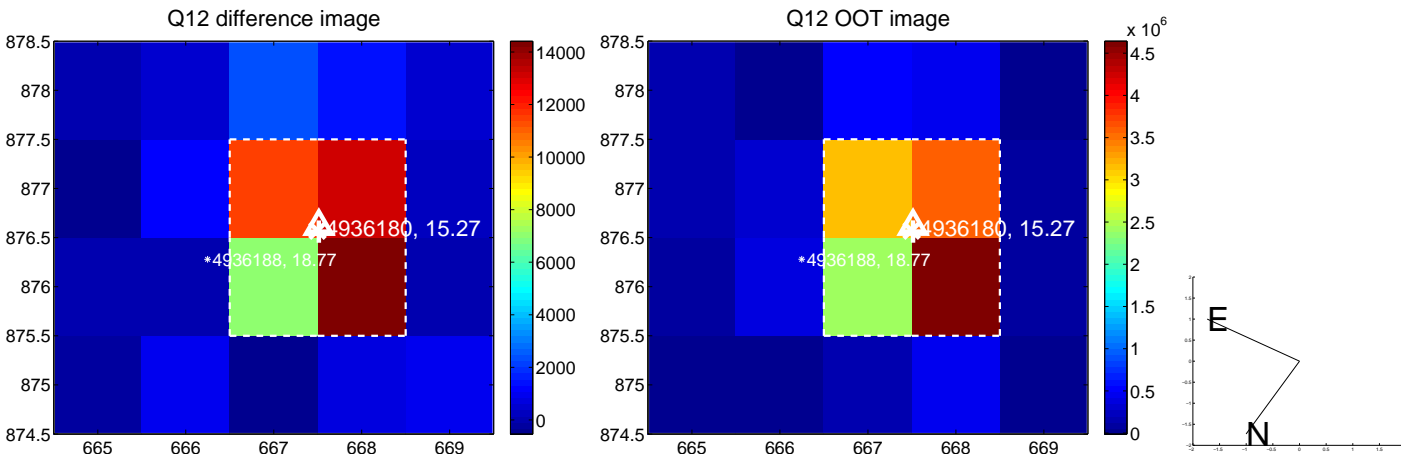
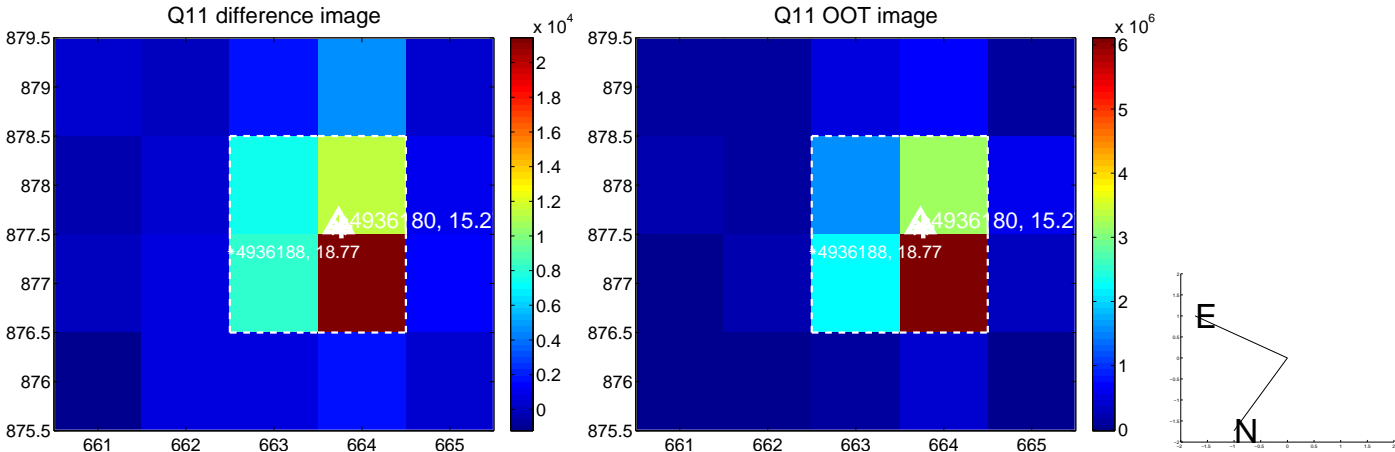
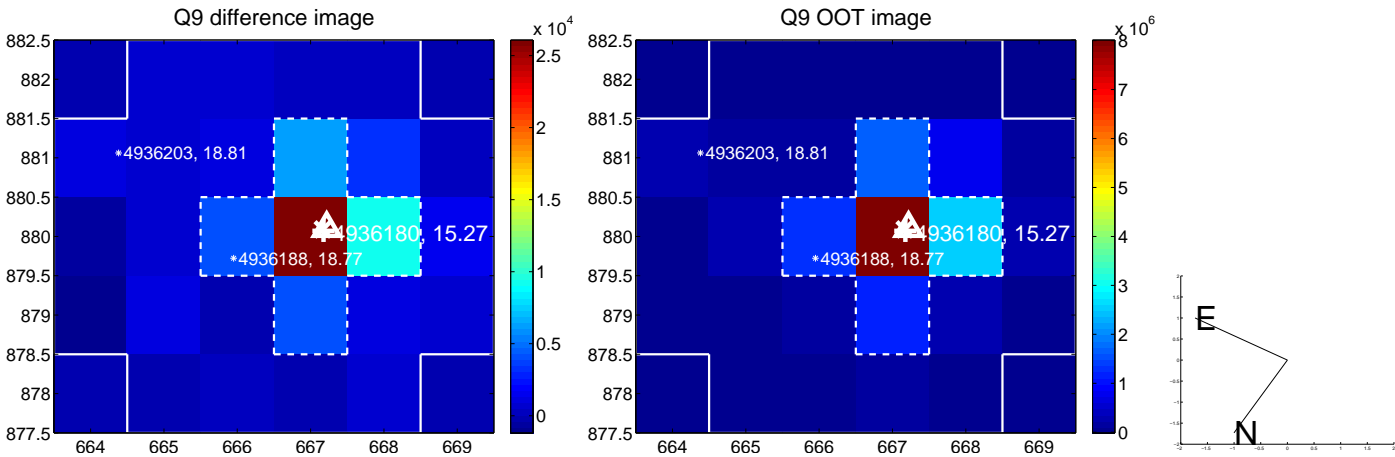




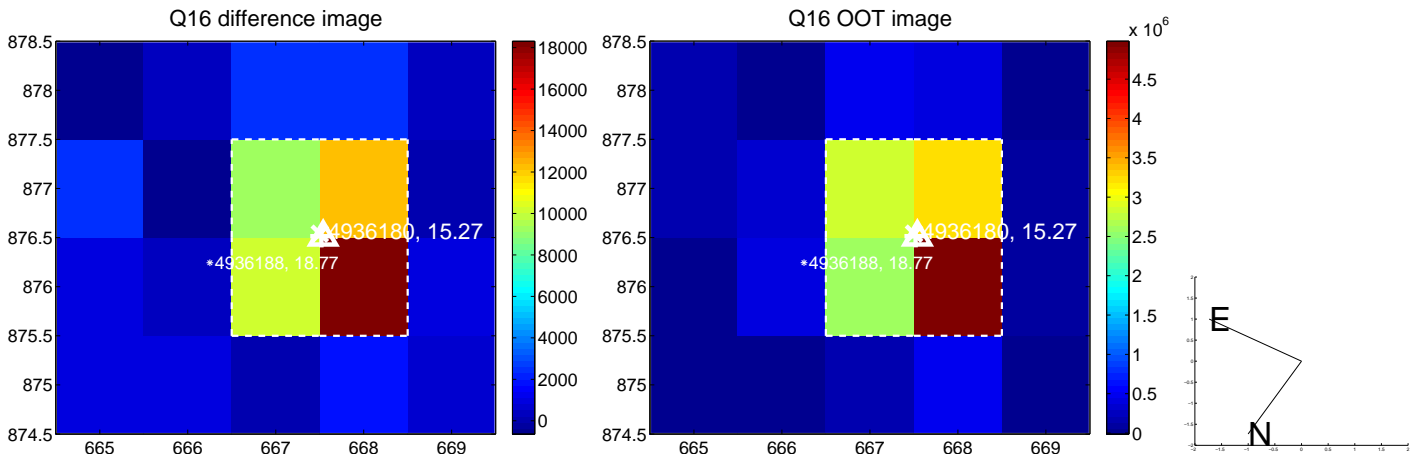
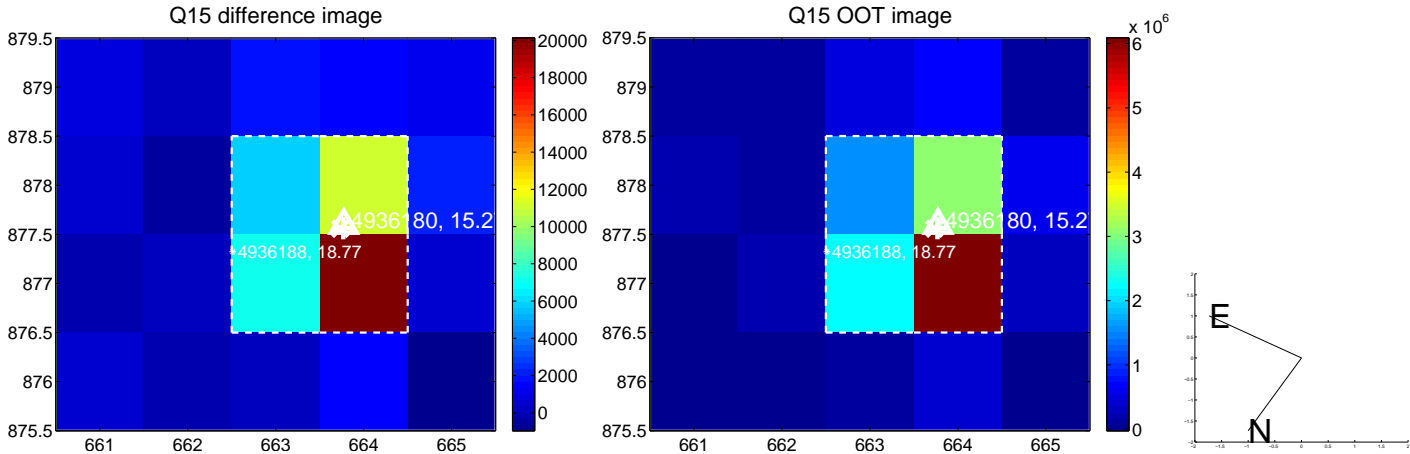
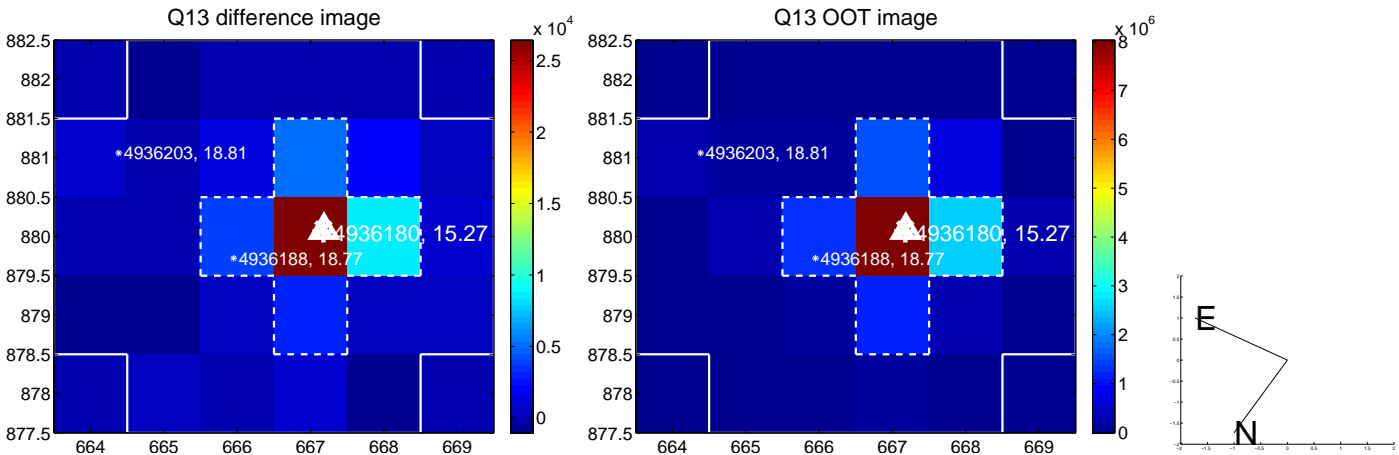
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



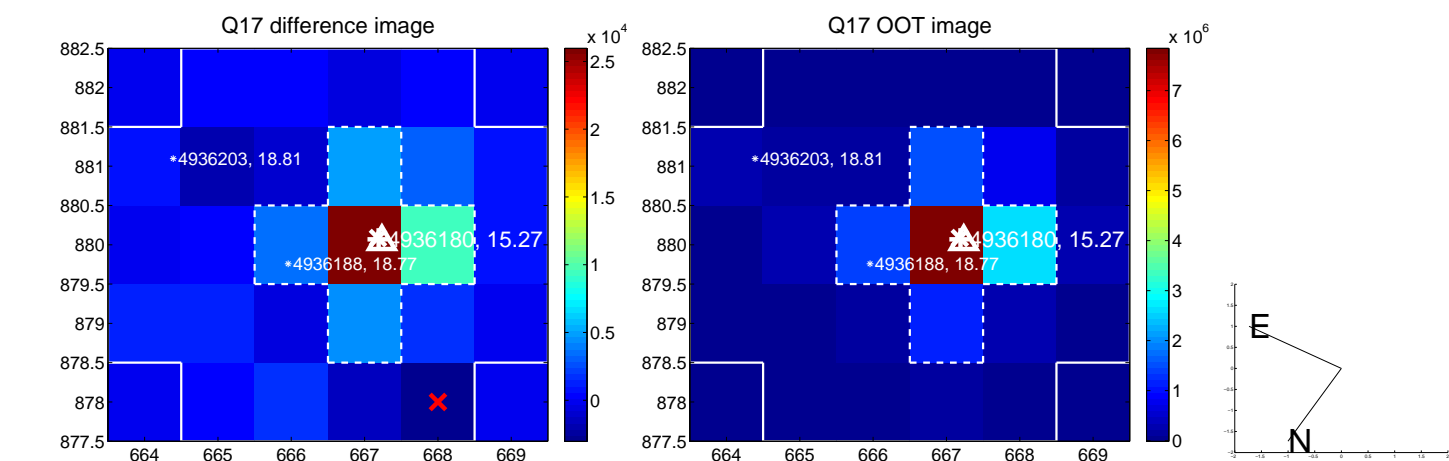
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



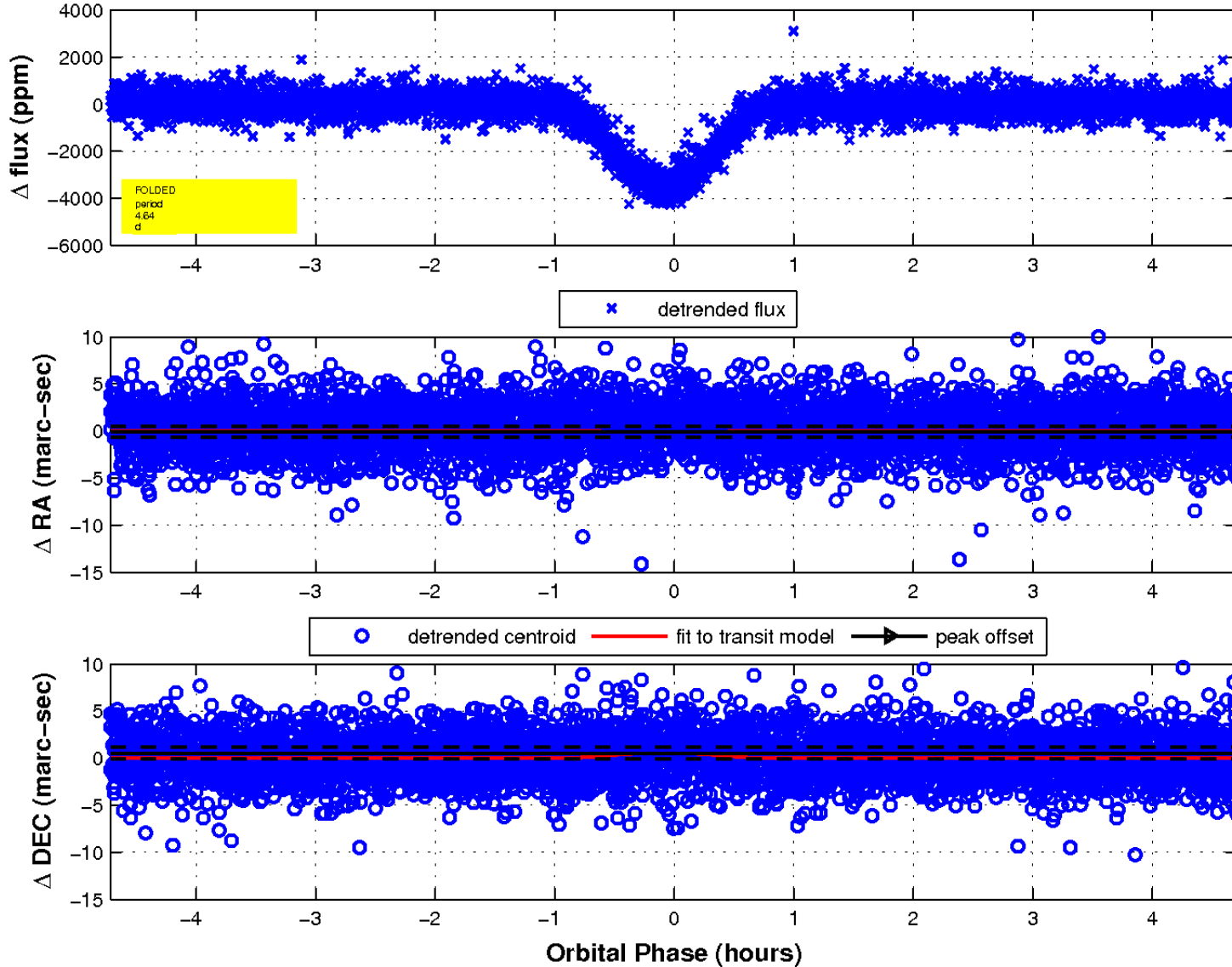
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

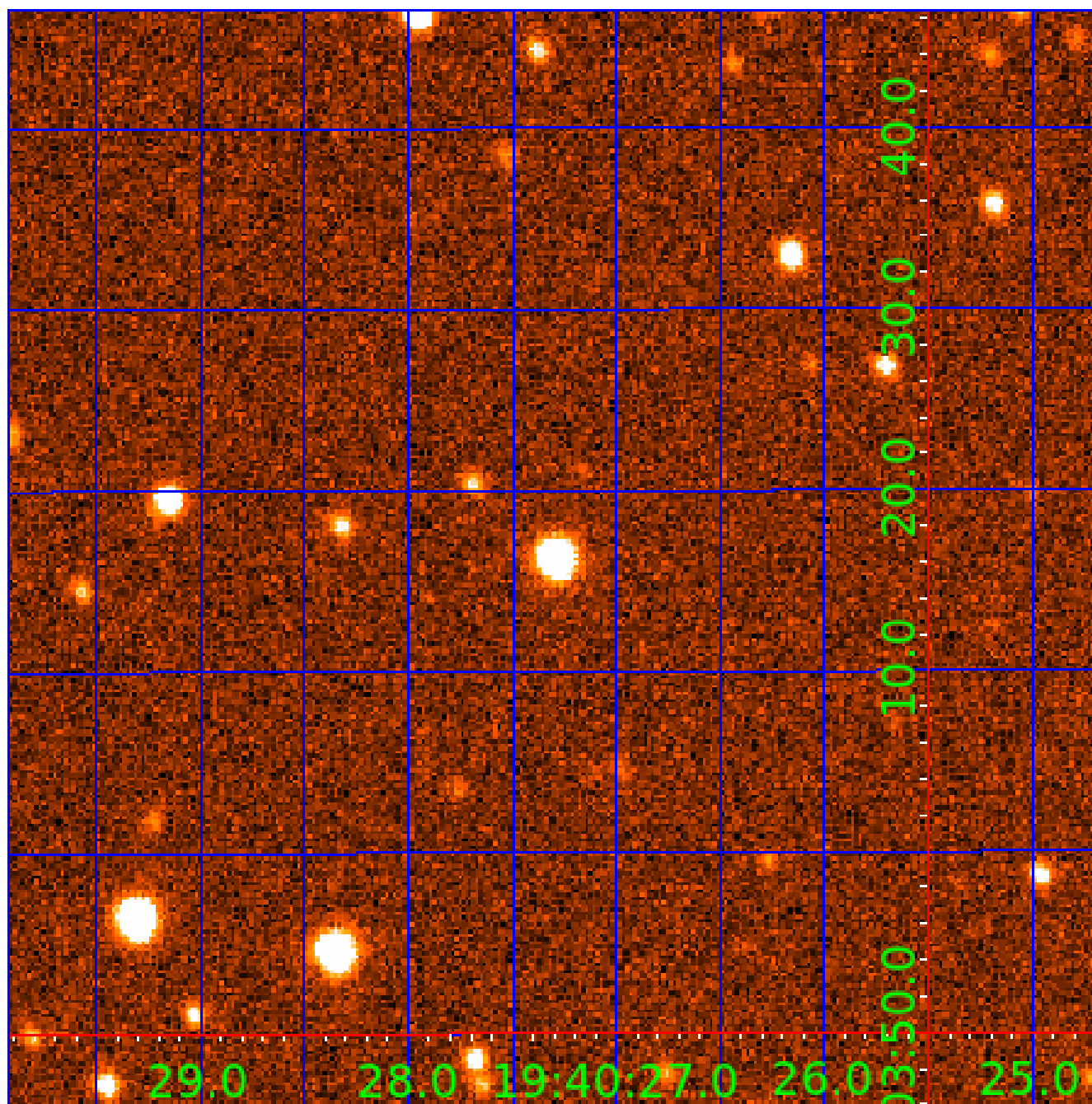


fluxWeightedCentroids, Planet 1 of 2



UKIRT Image

Declination



# KIC 004936180

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
004936180-01	OBS	0820.01	4.640932	131.951714	3511.4	1.572	135.0	140.1	0.83	6463	7.21	421.84
004936180-02	OBS	No	2.784687	132.073525	73.9	8.443	8.2	7.6	0.83	6463	0.81	833.52

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
004936180-01	OBS	FP	0.00	0	1	0	0	DEEP_V_SHAPED
004936180-02	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_ALT—CENT_FEW_DIFS

**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 004936180-02

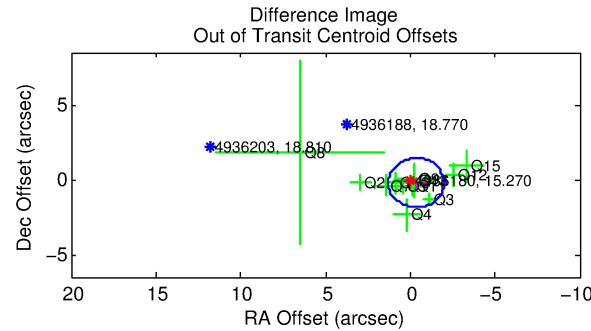
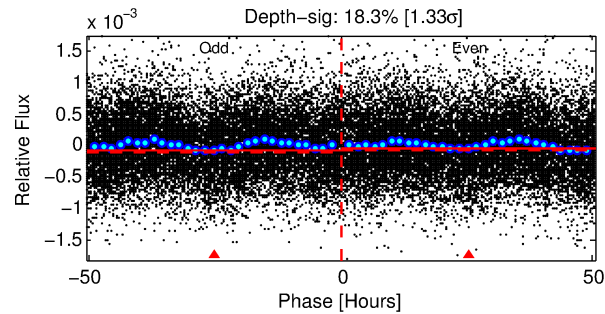
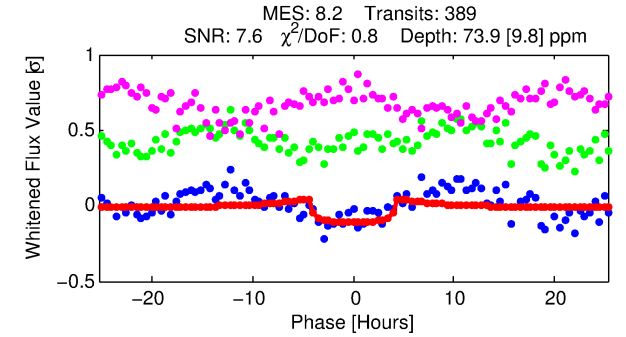
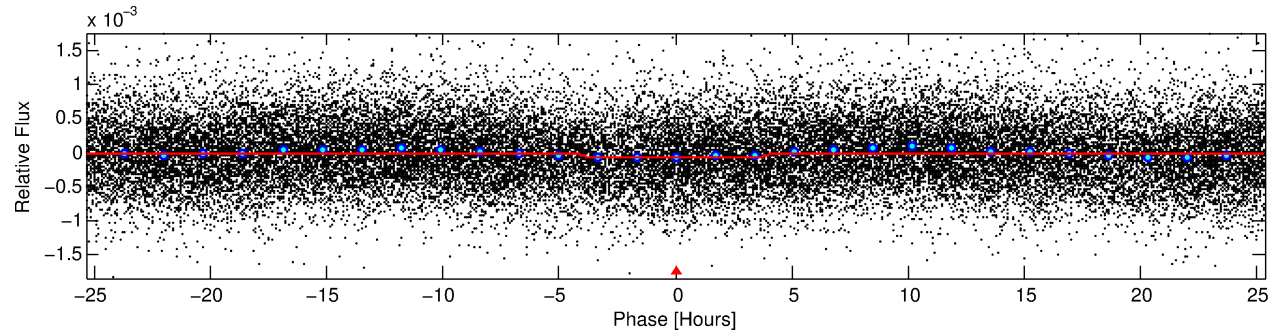
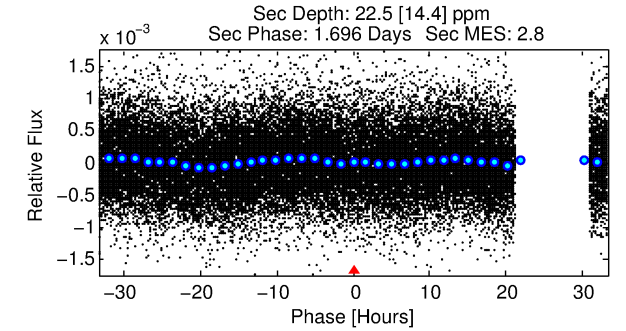
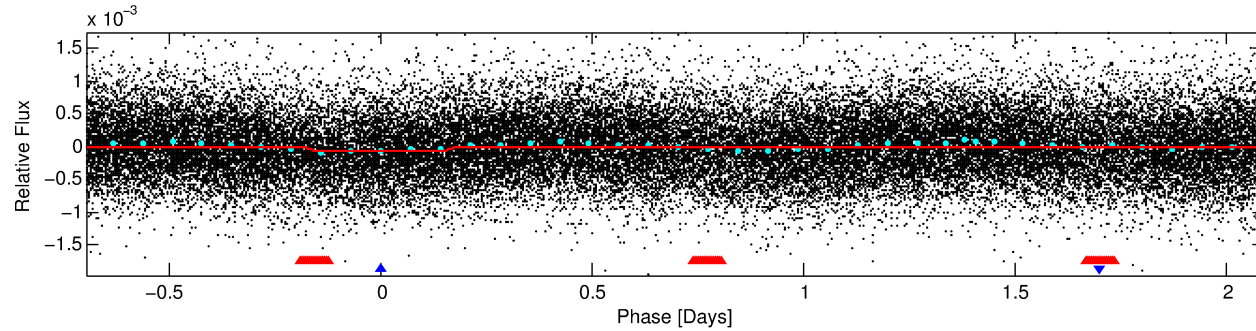
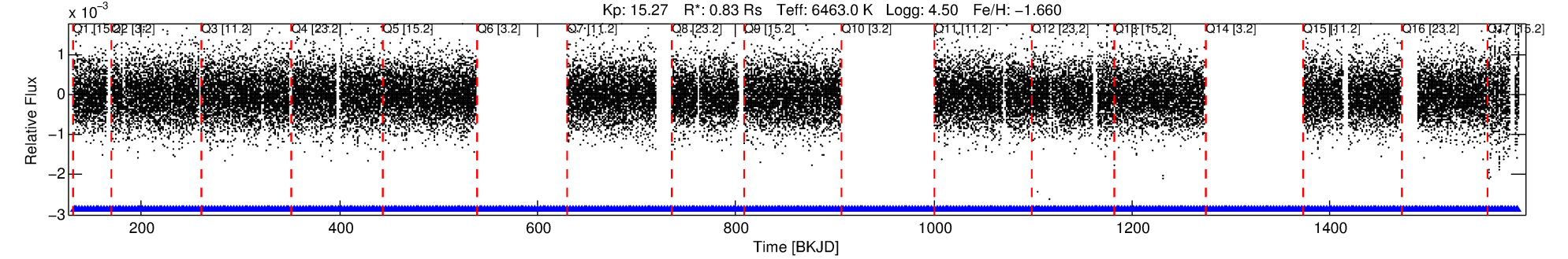
No Significant Match Found

# DV One-Page Summary

KIC: 4936180 Candidate: 2 of 2 Period: 2.785 d

KOI: K00820 Corr: No Ephemeris Match

Kp: 15.27 R\*: 0.83 Rs Teff: 6463.0 K Logg: 4.50 Fe/H: -1.660



## DV Fit Results:

Period = 2.78469 [0.00004] d  
Epoch = 132.0735 [0.0085] BKJD  
Rp/R\* = 0.0089 [0.0031]  
a/R\* = 1.62 [1.97]  
b = 0.86 [0.61]  
Seff = 833.52 [257.14]  
Teq = 1370 [106] K  
Rp = 0.81 [0.32] Re  
a = 0.0358 [0.0064] AU  
Ag = 24.39 [24.02] [0.97σ]  
Teffp = 4707 [1121] K [2.96σ]

## DV Diagnostic Results:

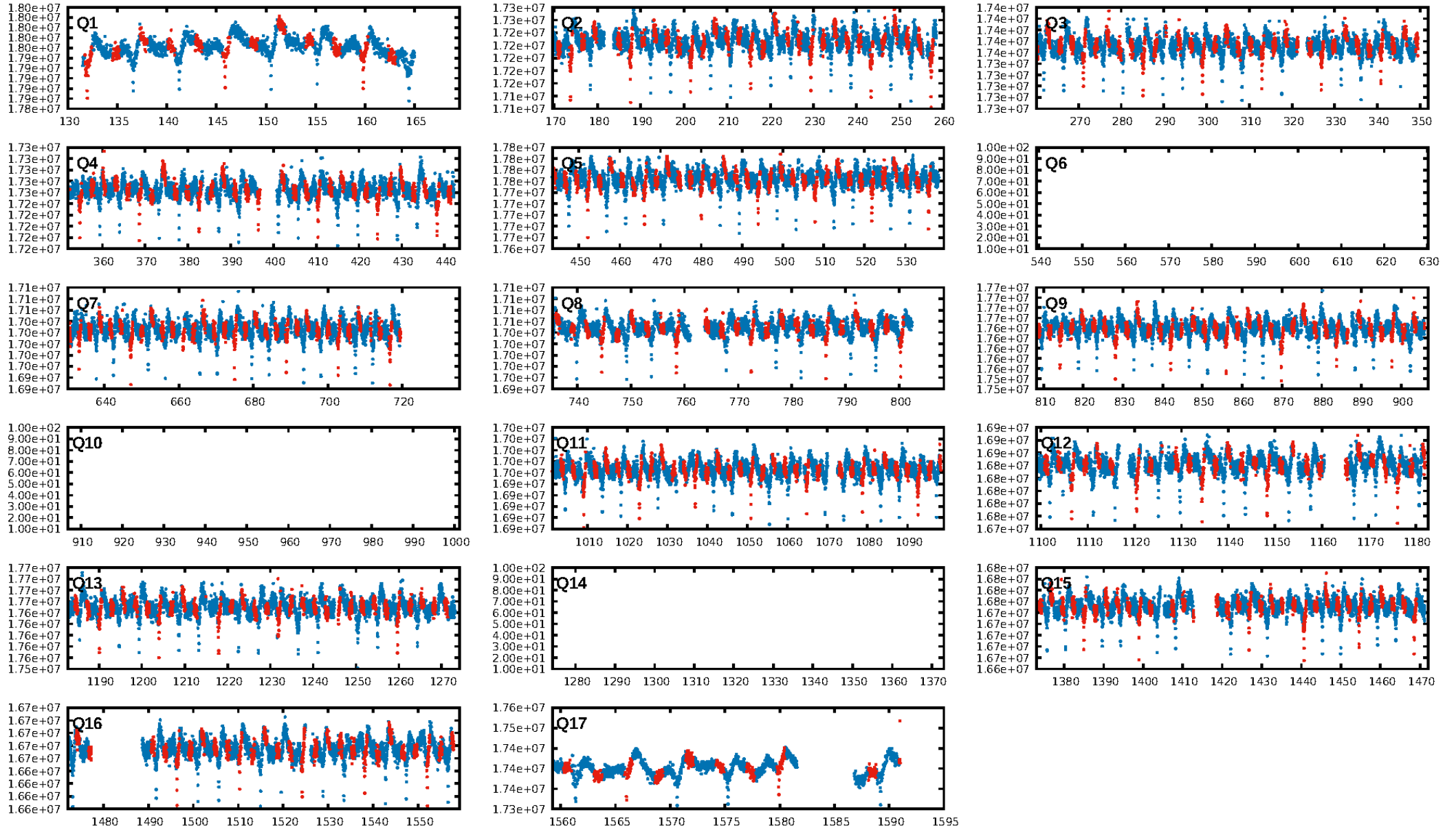
ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [5.19σ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: 2.90e-14  
RollingBand-fgt: 1.00 [368/368]  
GhostDiagnostic-chr: 11.92  
Centroid-sig: 0.2%  
Centroid-so: 3.202 arcsec [2.29σ]  
OotOffset-rm: 0.396 arcsec [0.72σ]  
KicOffset-rm: 0.462 arcsec [0.67σ]  
OotOffset-st: 1/4/4/3 [12]  
KicOffset-st: 1/4/4/3 [12]  
DiffImageQuality-fgm: 0.00 [0/12]  
DiffImageOverlap-fno: 1.00 [14/14]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 30-Jan-2016 05:54:01 Z

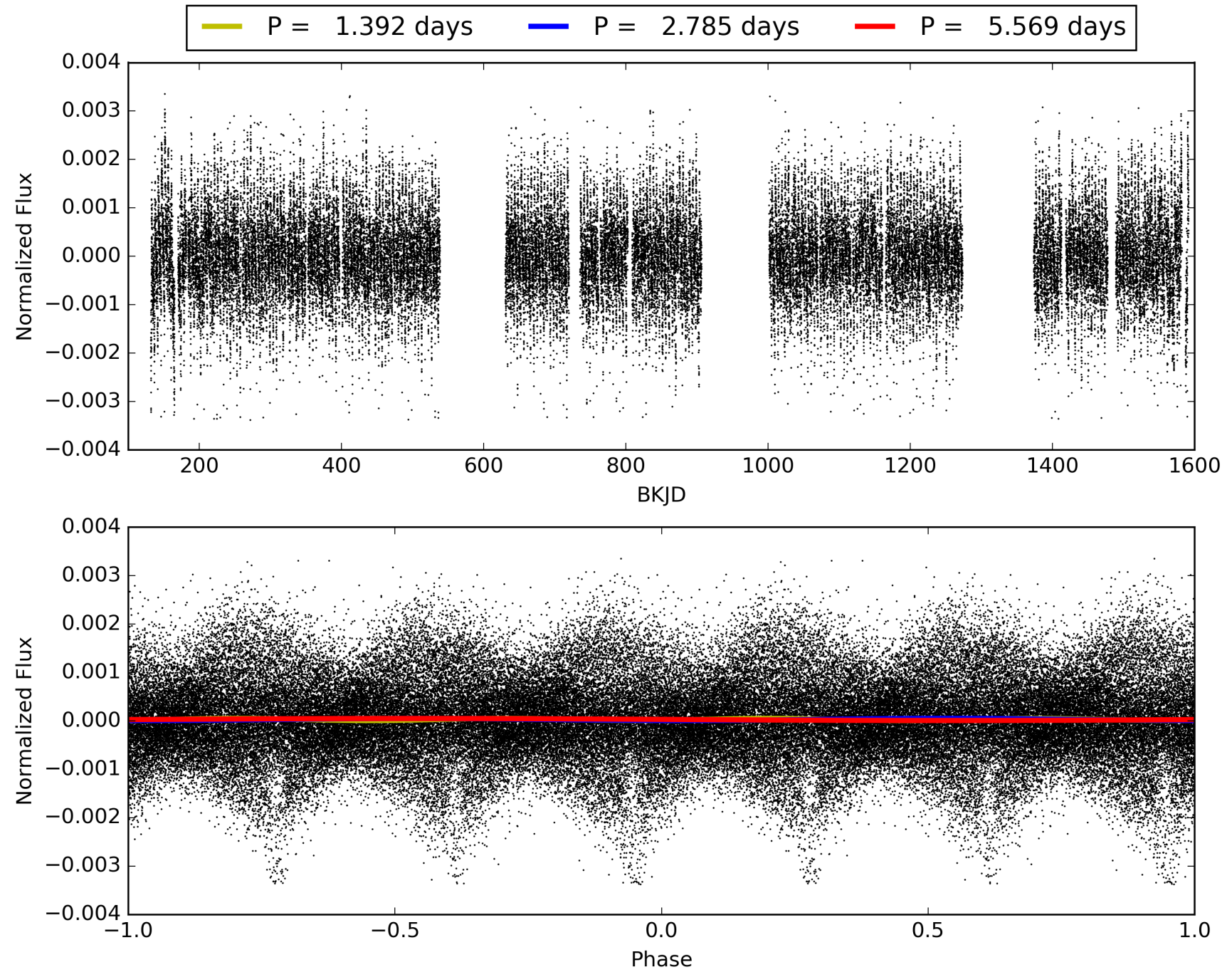
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center



# TCE 004936180-02, PDC Light Curves

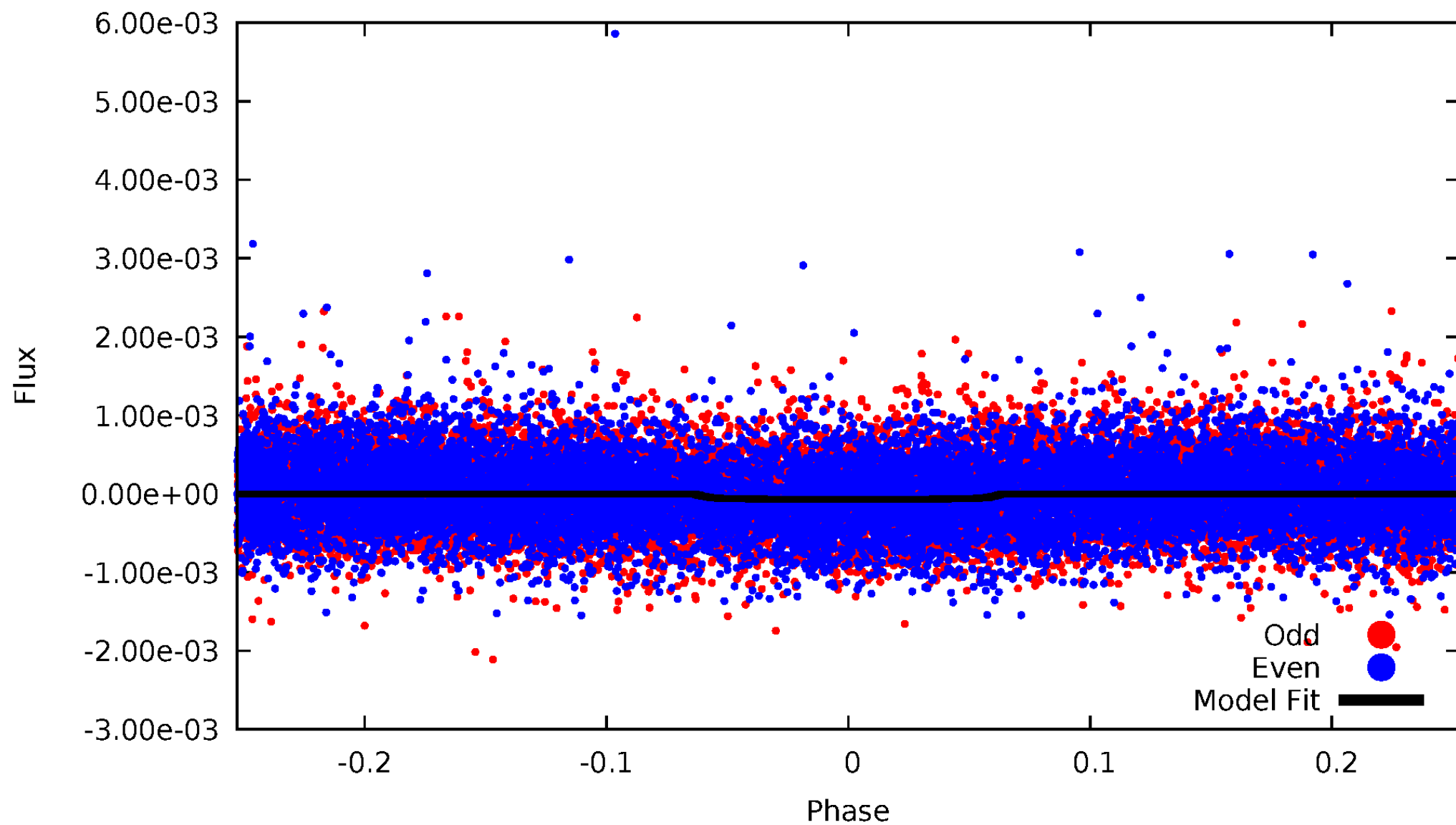


# TCE 004936180-02



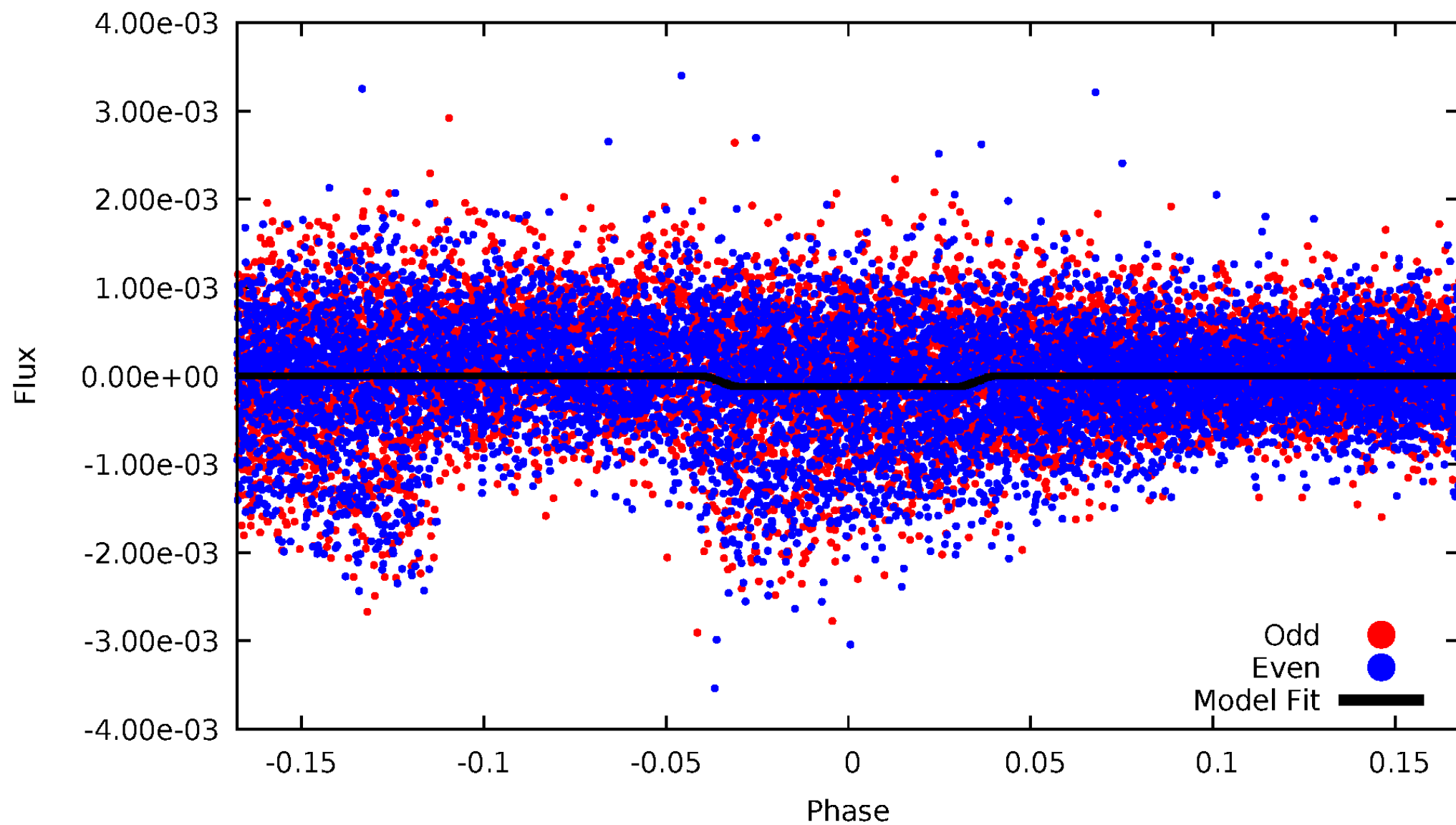
# DV Odd/Even

TCE 004936180-02



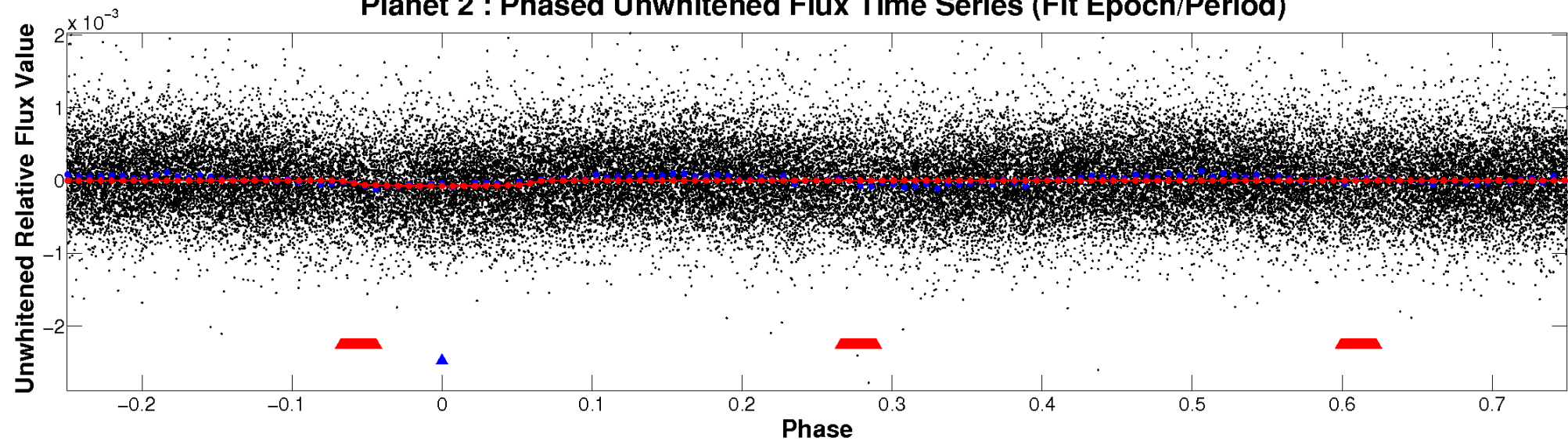
# ALT Odd/Even

TCE 004936180-02

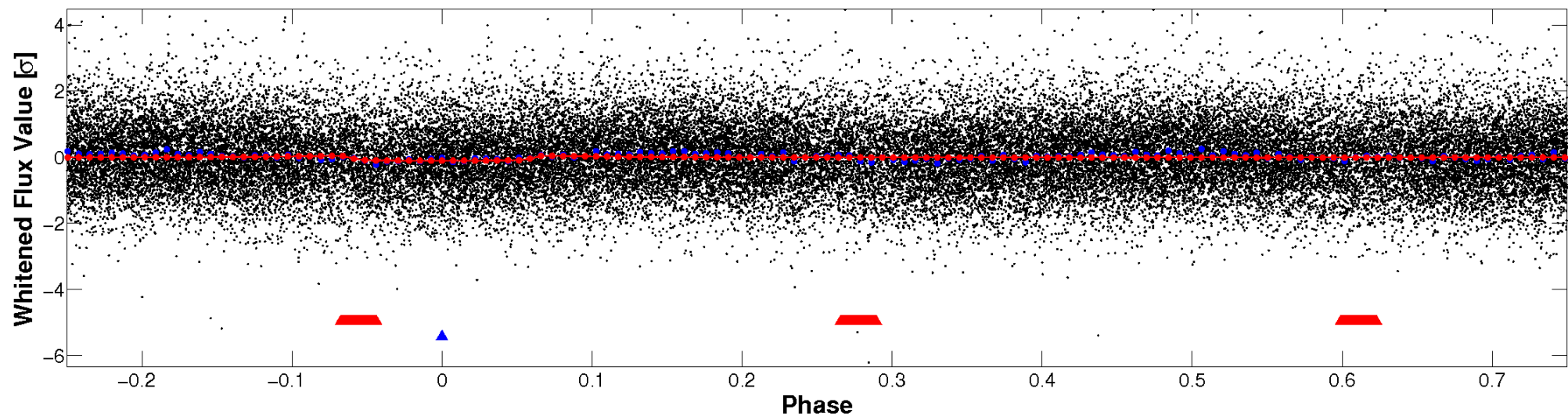


# Non-Whitened Vs. Whitened Light Curve

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



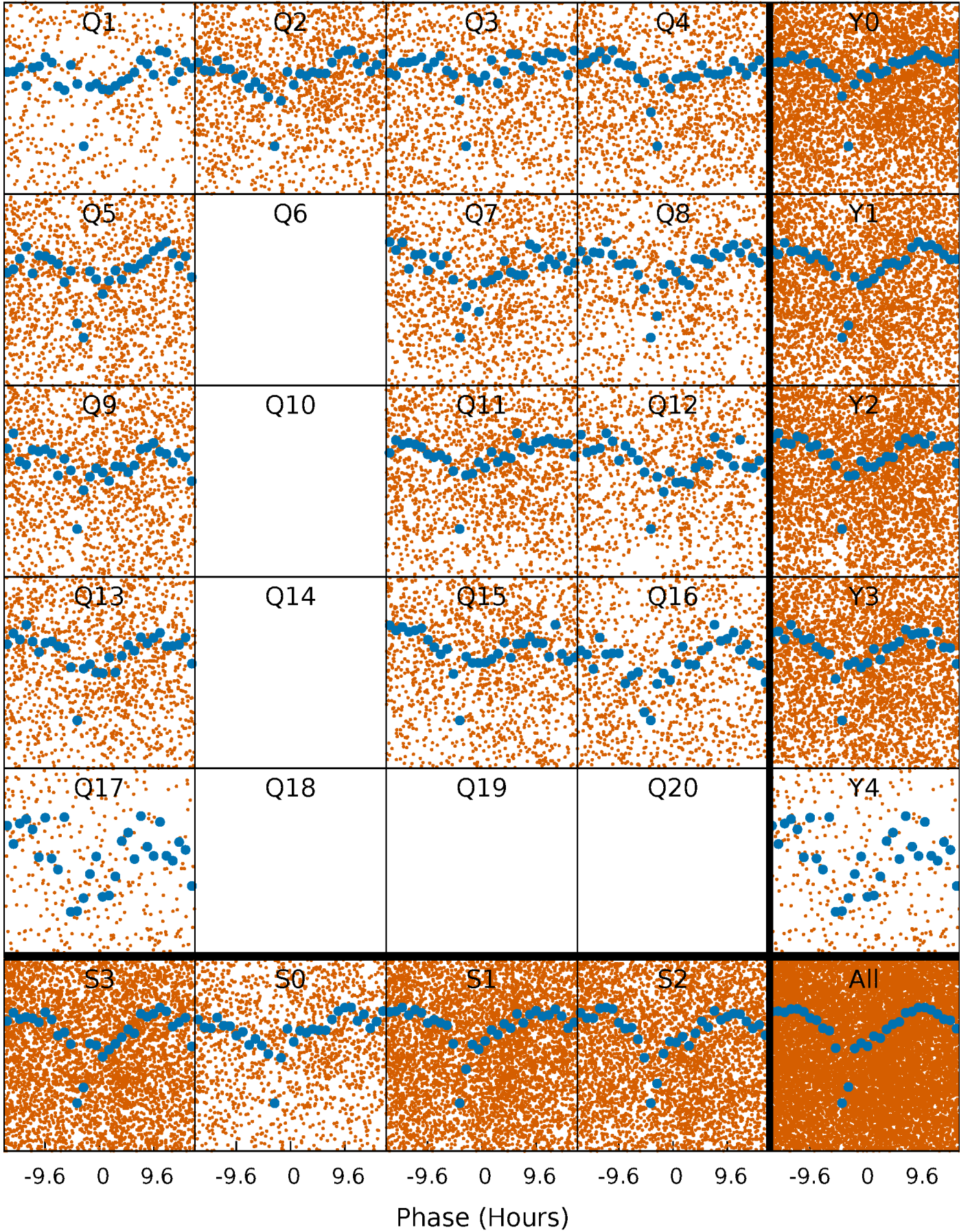
## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)





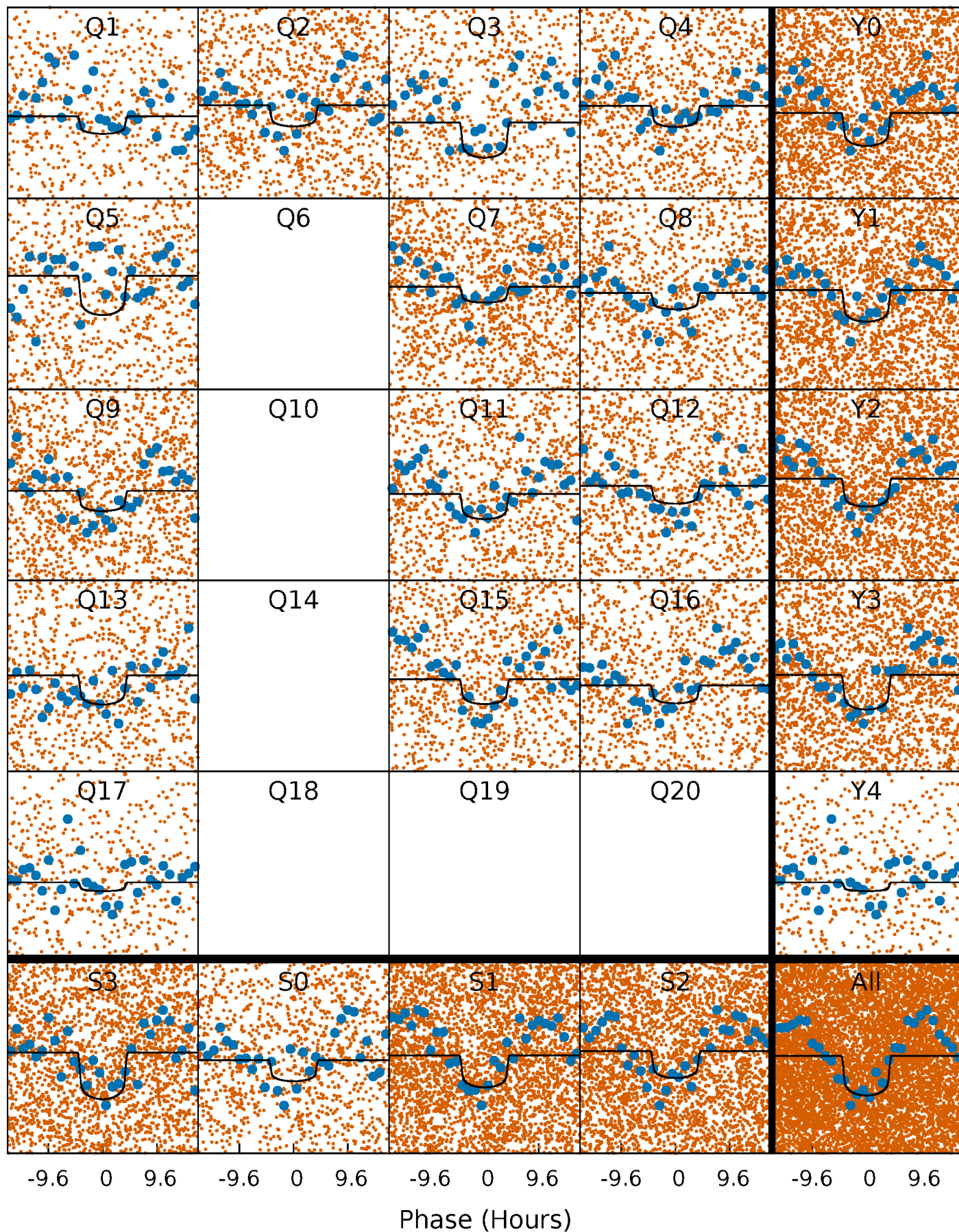
# PDC Quarter-Phased Transit Curves

TCE 004936180-02   P= 2.784687 Days    $T_0=132.073525$  (BKJD)



# DV Quarter-Phased Transit Curves

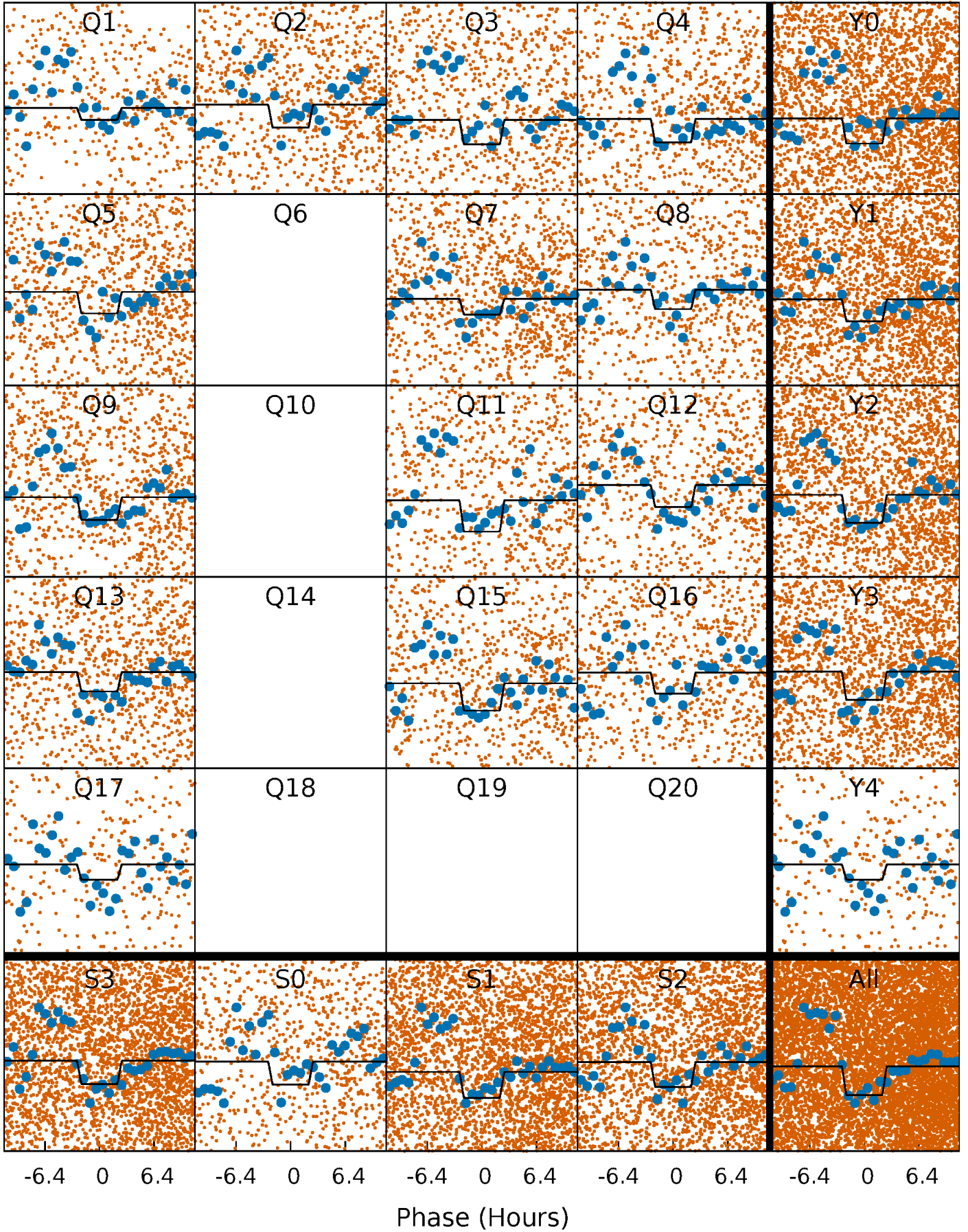
TCE 004936180-02 P= 2.784687 Days  $T_0=132.073525$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

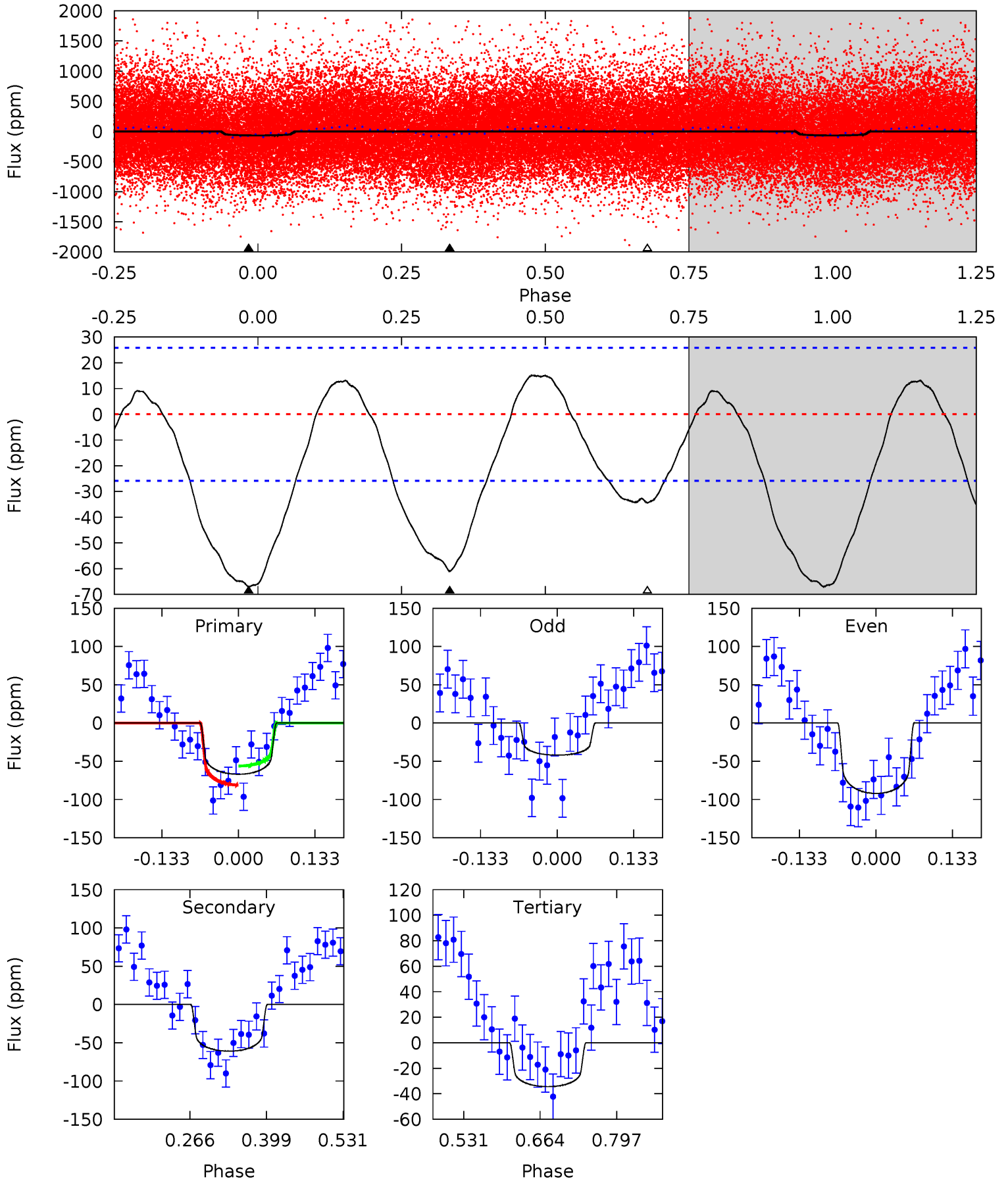
TCE 004936180-02   P= 2.784617 Days    $T_0=132.154577$  (BKJD)



# DV Model-Shift Uniqueness Test

004936180-02, P = 2.784687 Days, E = 129.288838 Days

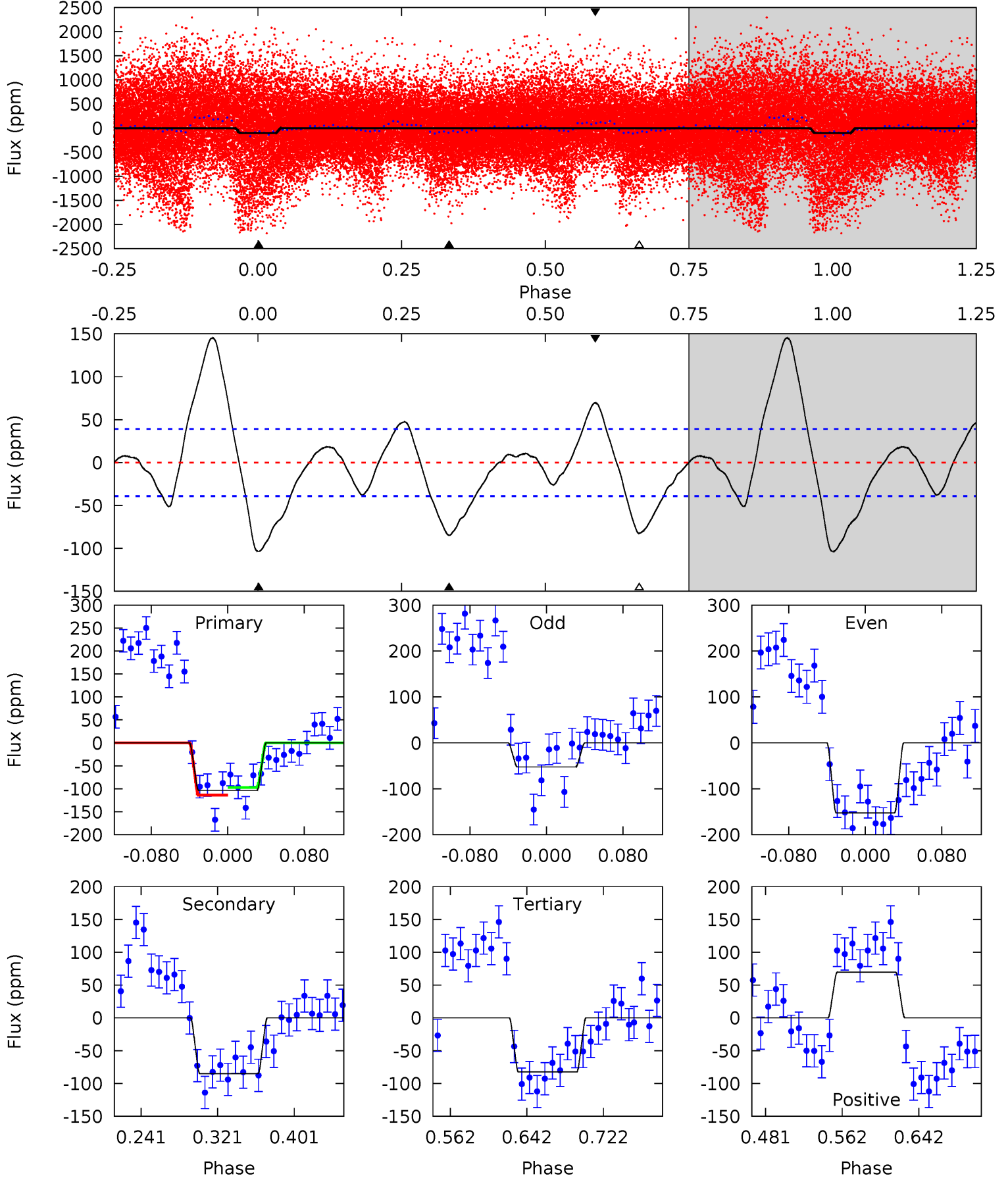
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
11.7	10.6	6.00	0	4.50	1.50	2.94	5.69	11.7	4.63	10.6	4.36	0.85	0.18	2.17



# Alt Model-Shift Uniqueness Test

004936180-02, P = 2.784617 Days, E = 129.369960 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
12.2	10.0	9.72	8.22	4.61	1.75	4.64	2.49	3.99	0.28	1.78	5.91	9.42	0.58	1.00



### Stellar Parameters For KIC 004936180

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6463^{+205}_{-205}$	$4.500^{+0.087}_{-0.163}$	$-1.660^{+0.300}_{-0.200}$	$0.826^{+0.159}_{-0.086}$	$0.786^{+0.062}_{-0.045}$	$1.962^{+0.680}_{-0.833}$
	+3%/-3%	+2%/-4%	+18%/-12%	+19%/-10%	+8%/-6%	+35%/-42%
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 004936180-02 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-61 \pm 6$	$0.81^{+0.32}_{-0.29}$	$1935^{+108}_{-92}$	$6107^{+1640}_{-880}$	$65^{+86}_{-31}$
Alt.	$-85 \pm 8$	$1.00^{+0.33}_{-0.31}$	$1930^{+115}_{-98}$	$5910^{+1314}_{-677}$	$59^{+64}_{-26}$

$T_{max}$  = 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

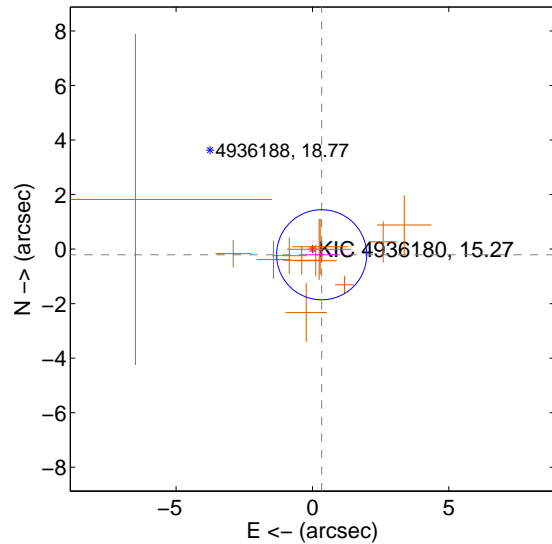
Supplemental centroid analysis for 004936180-02. Kepler magnitude: 15.27. Transit SNR 7.55

There are 0 quarters with good PRF difference image offsets

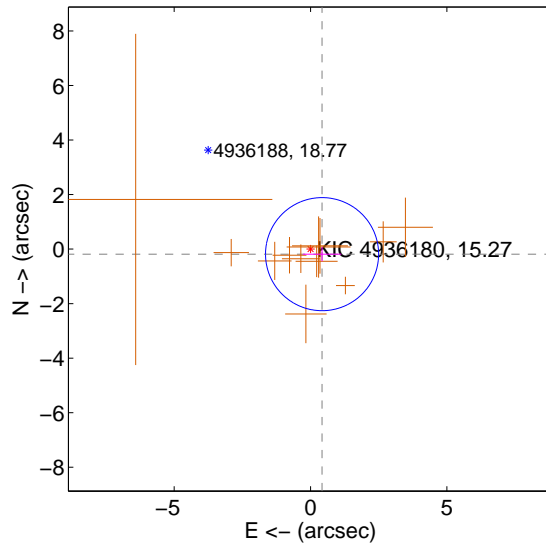
The direct PRF centroid is offset from the target star catalog position by about 0.08 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.396 \pm 0.550$	0.72	$-0.337 \pm 0.592$	$-0.207 \pm 0.295$
PRF-fit source offset from KIC position	$0.462 \pm 0.691$	0.67	$-0.423 \pm 0.705$	$-0.185 \pm 0.264$
photometric centroid source offset	$3.20 \pm 1.40$	2.29	$3.20 \pm 1.40$	$0.20 \pm 1.25$

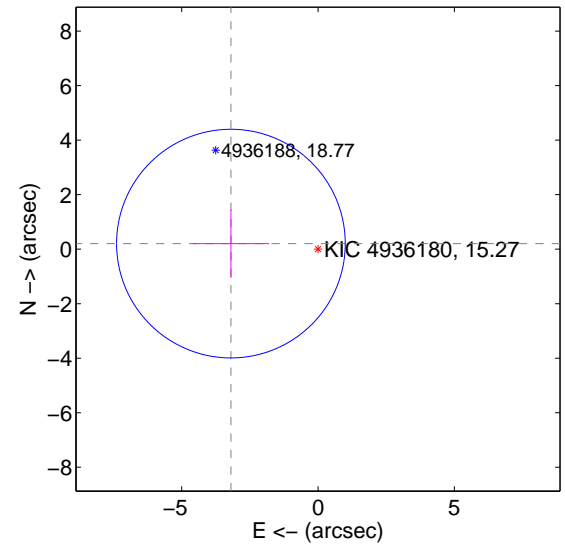
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

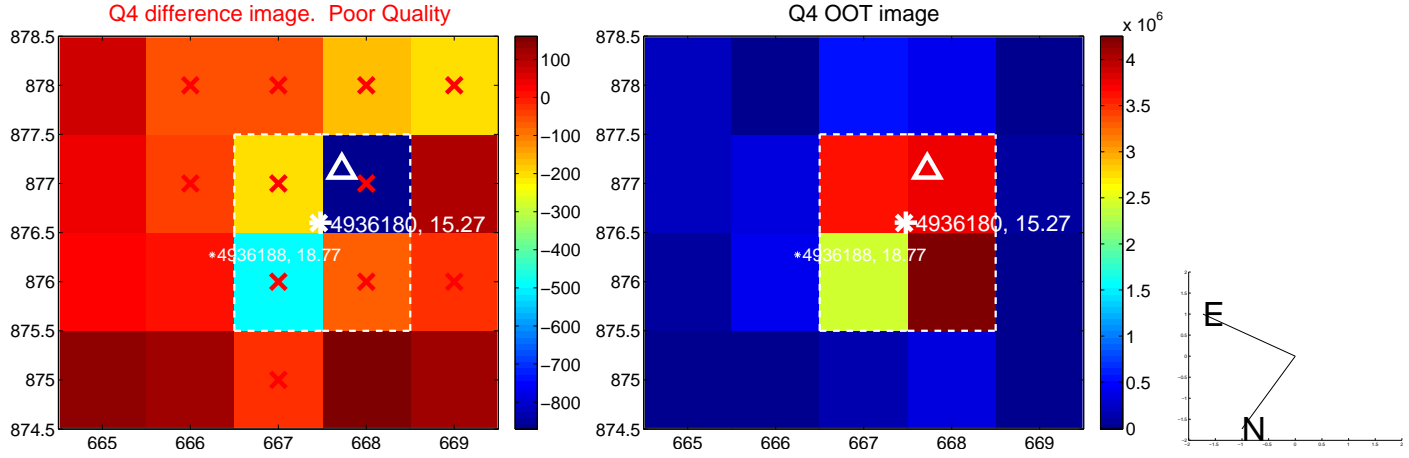
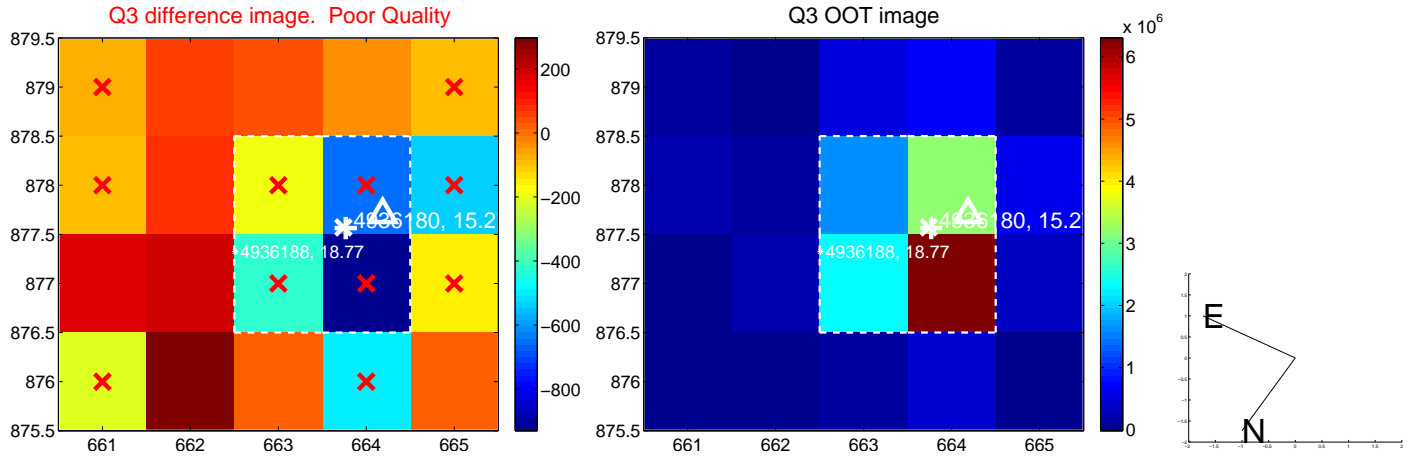
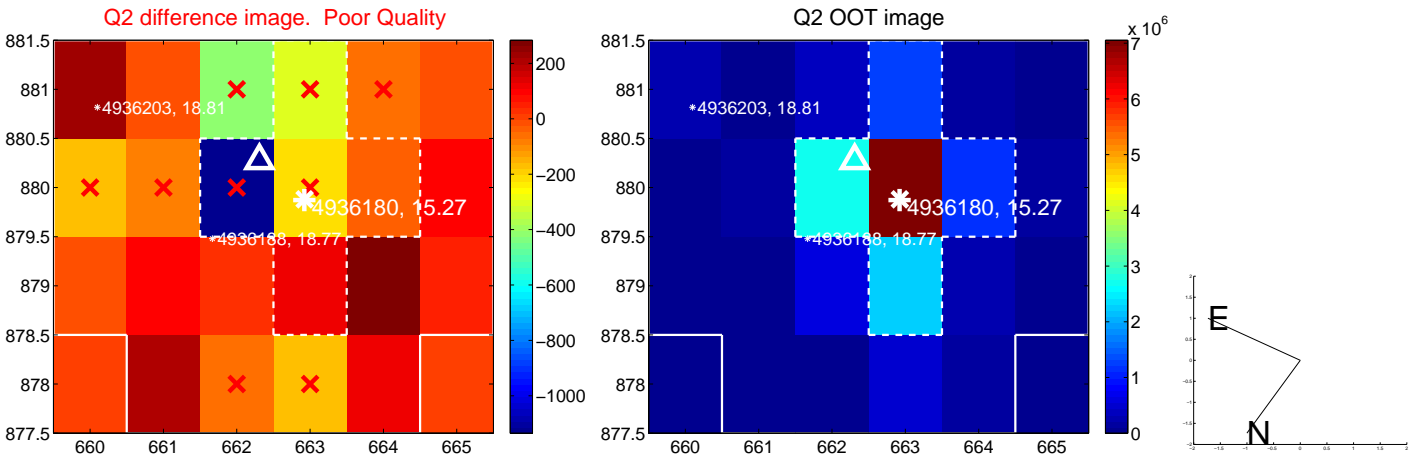
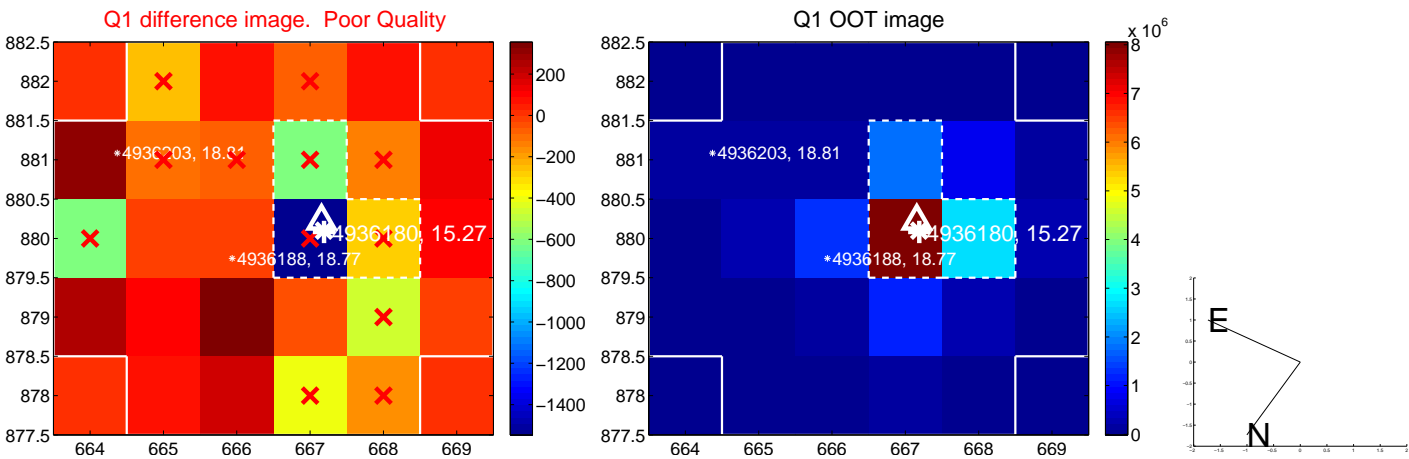


offset from photometric centroids

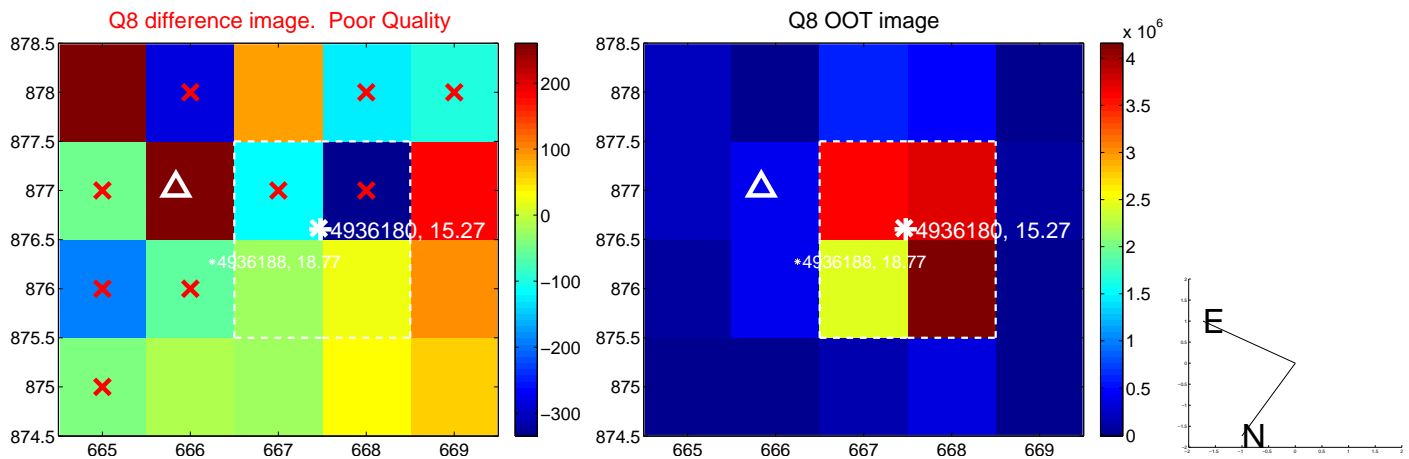
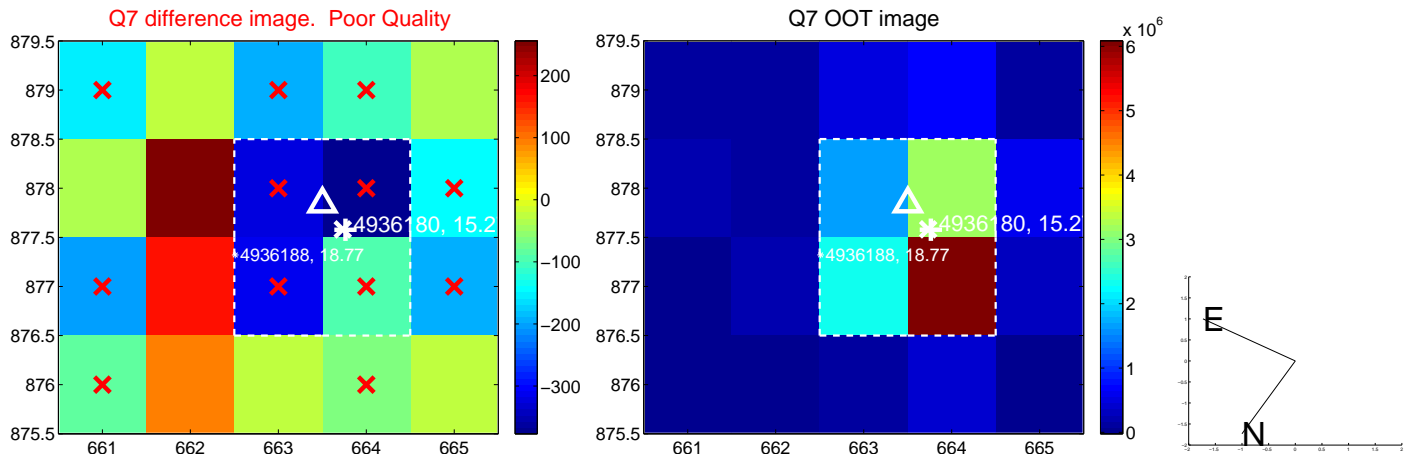
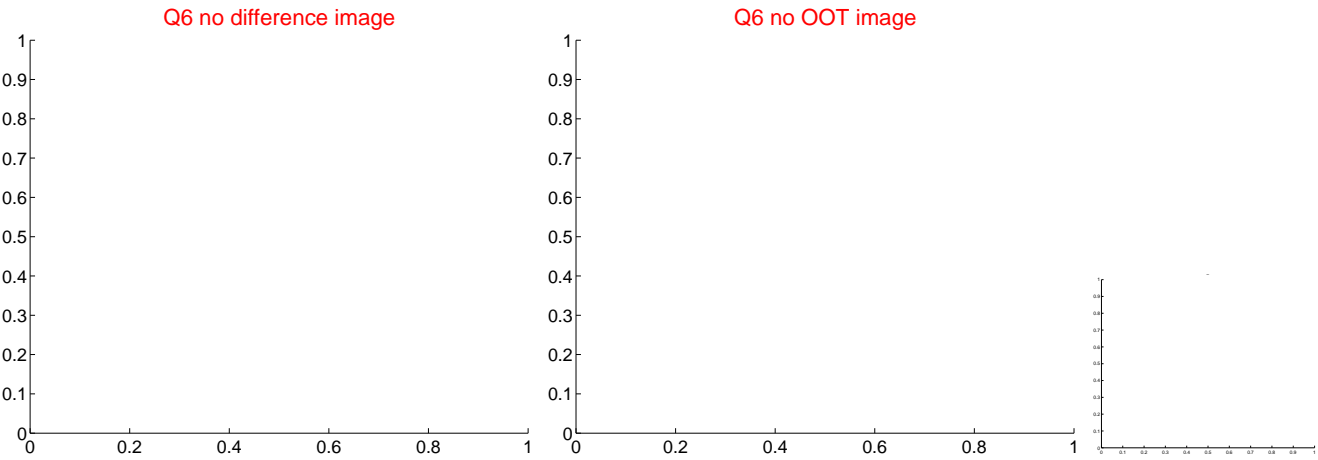
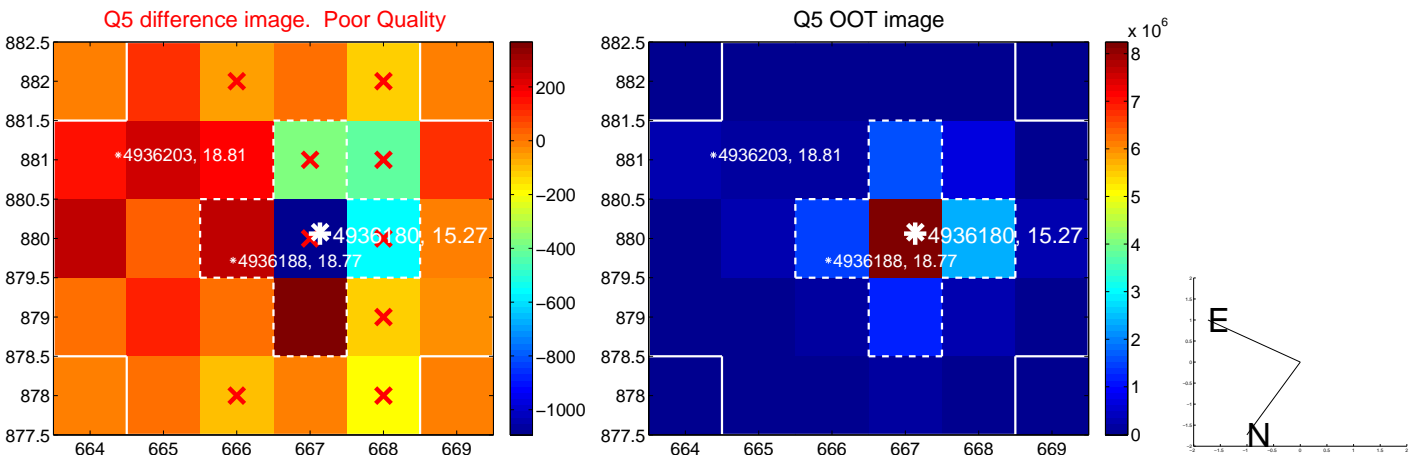


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

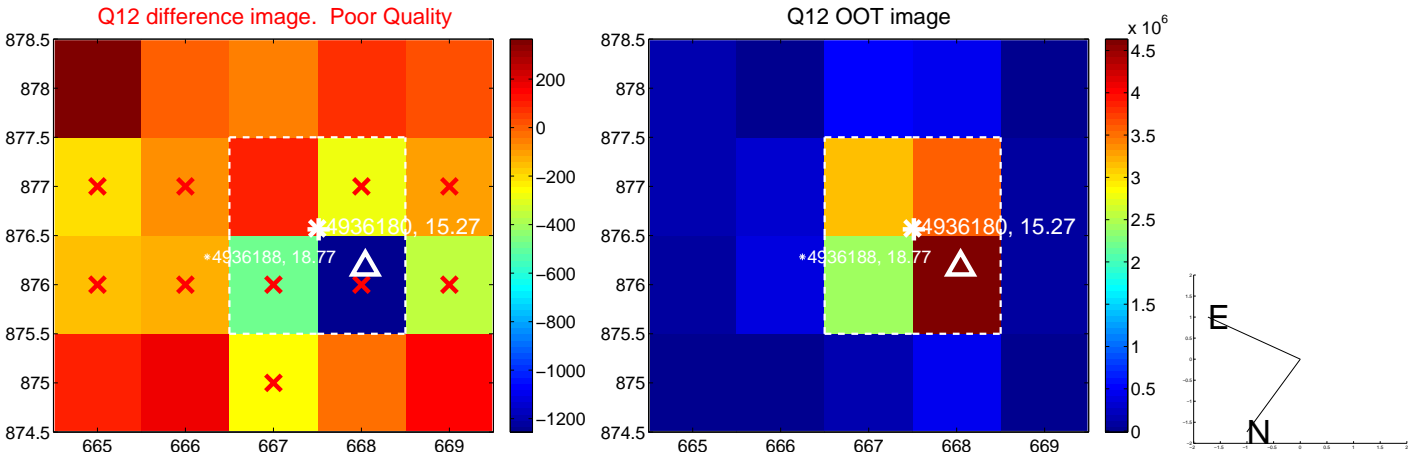
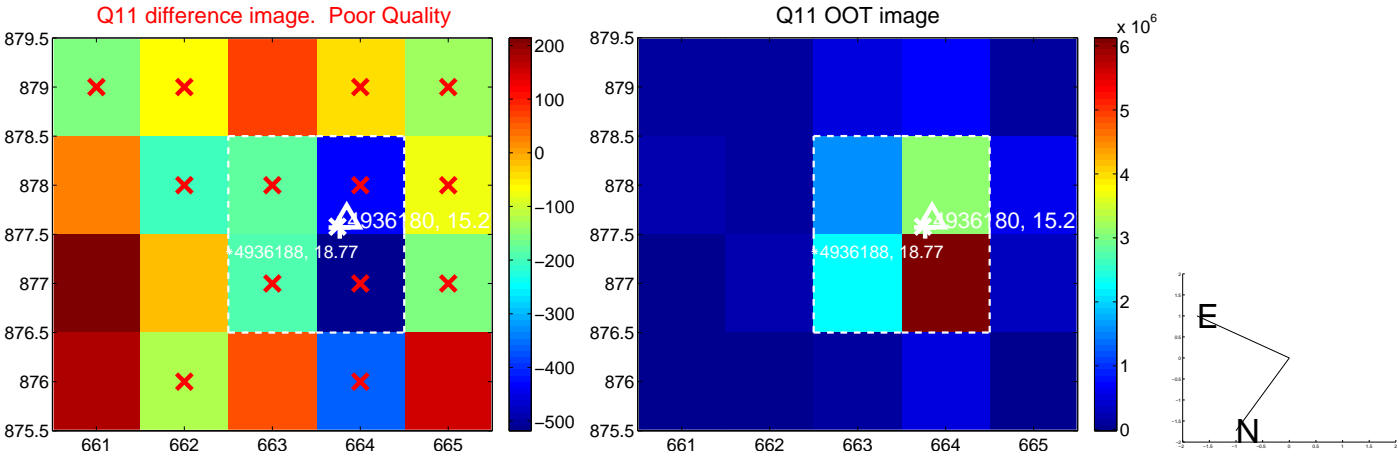
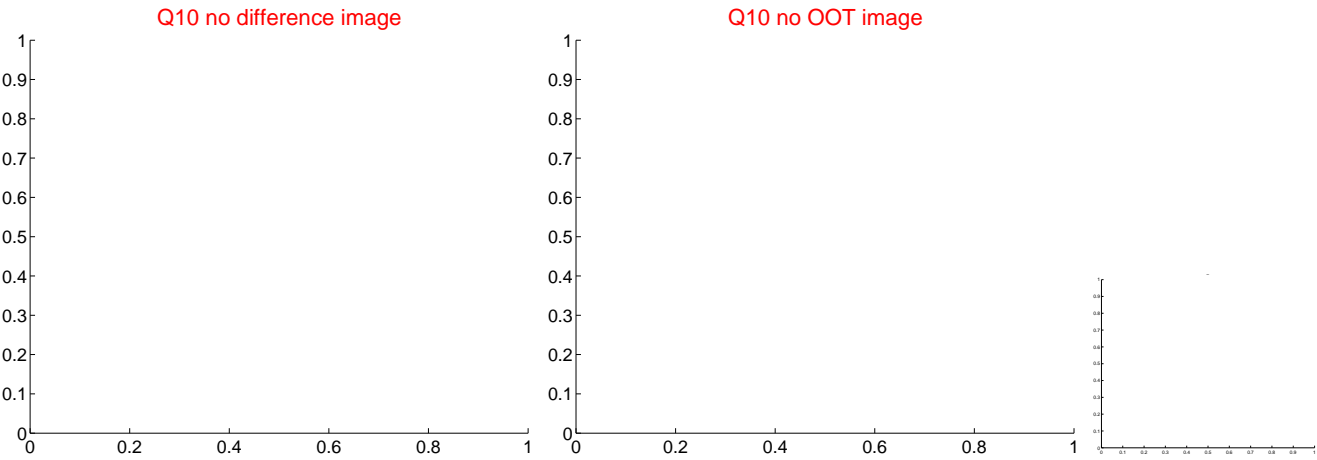
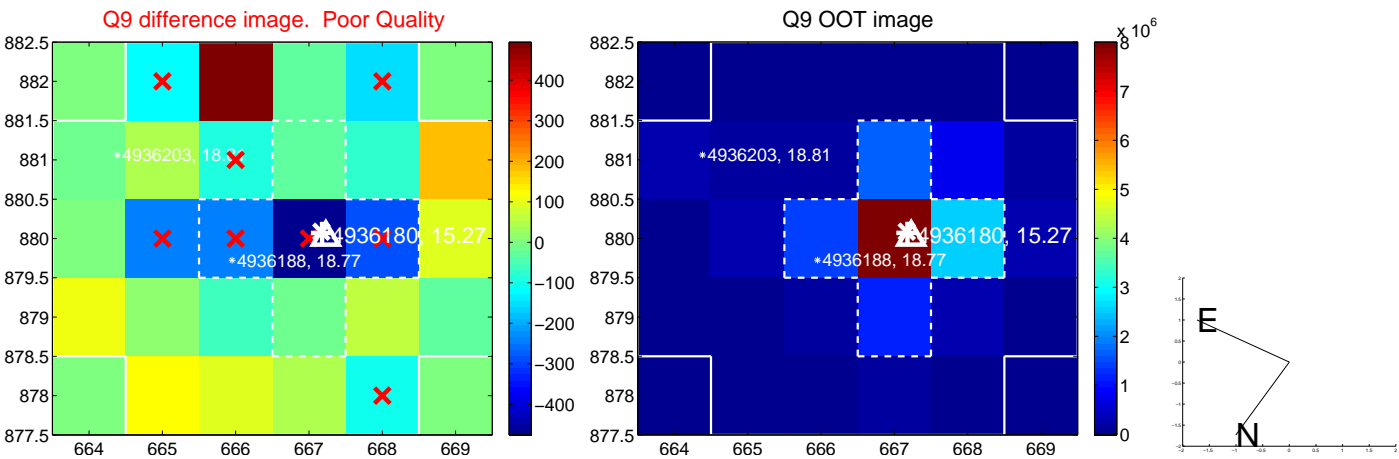


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

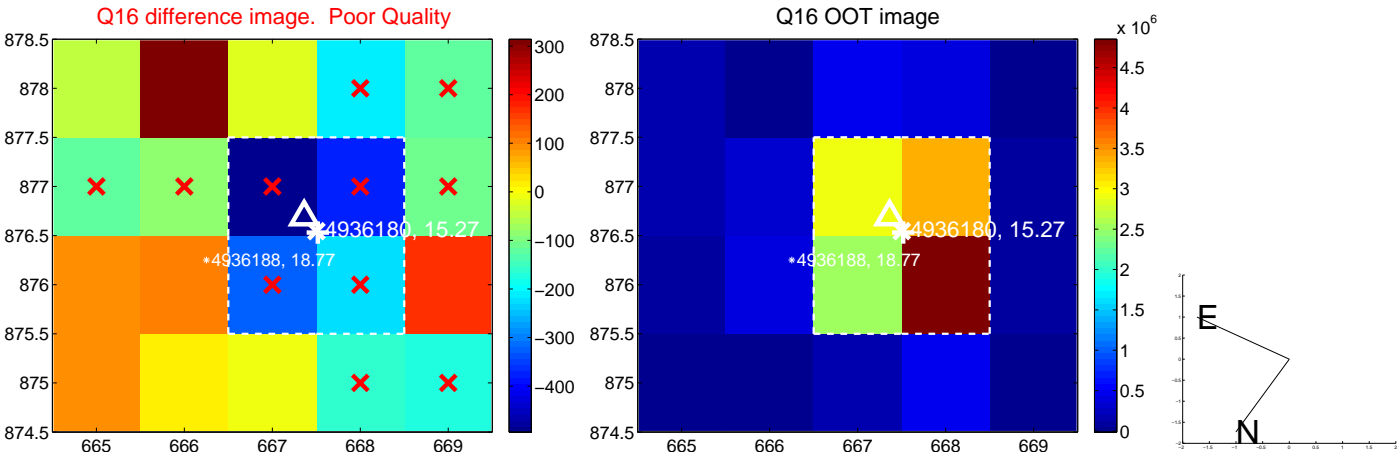
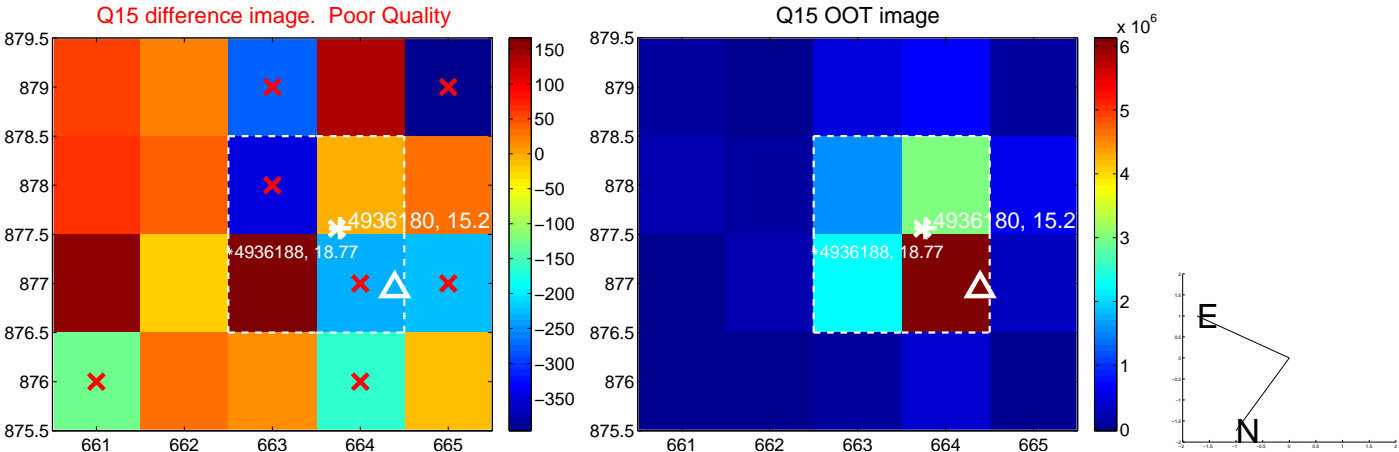
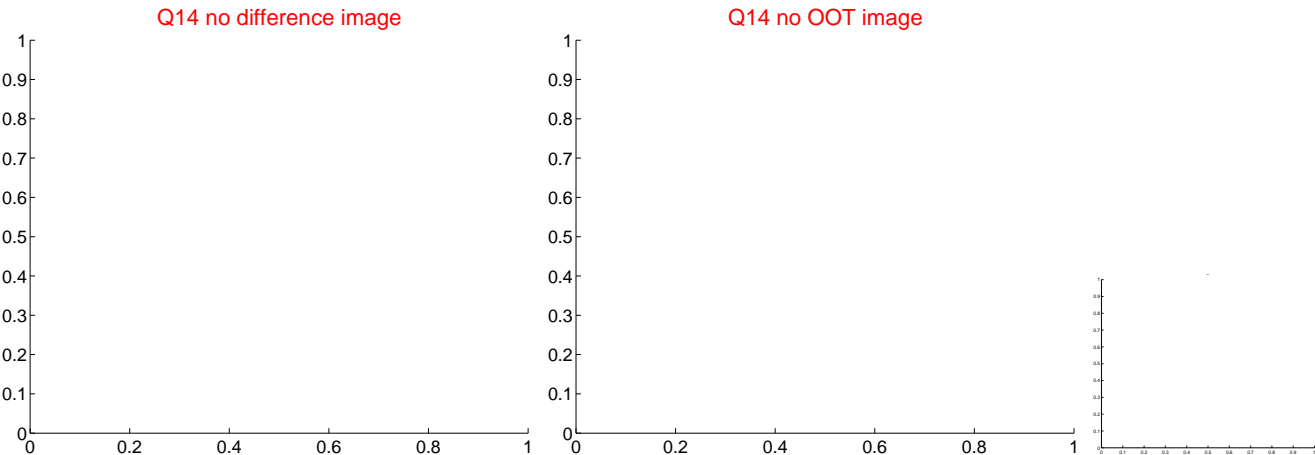
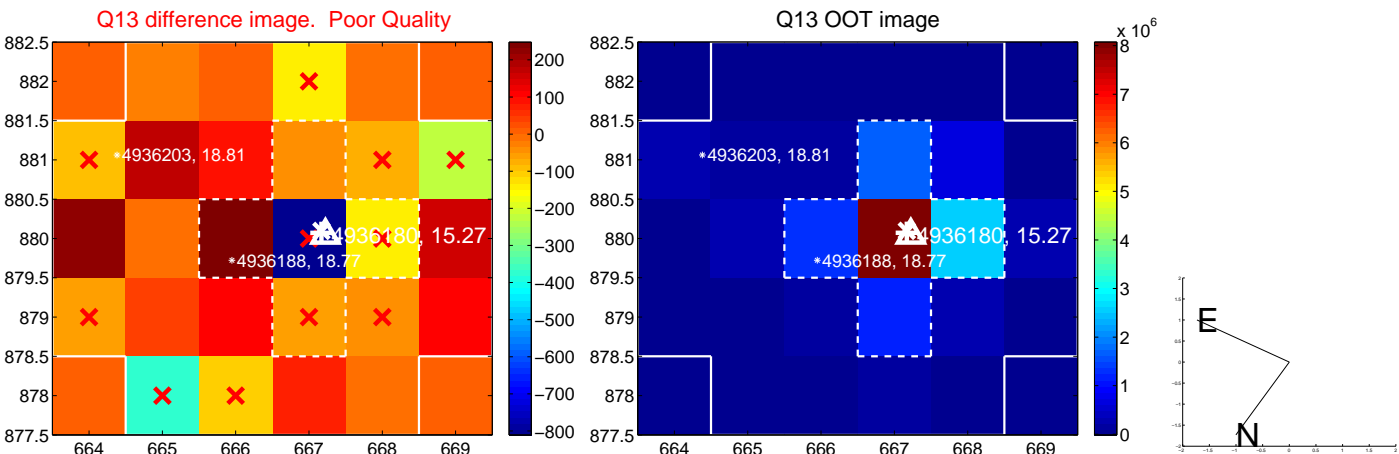




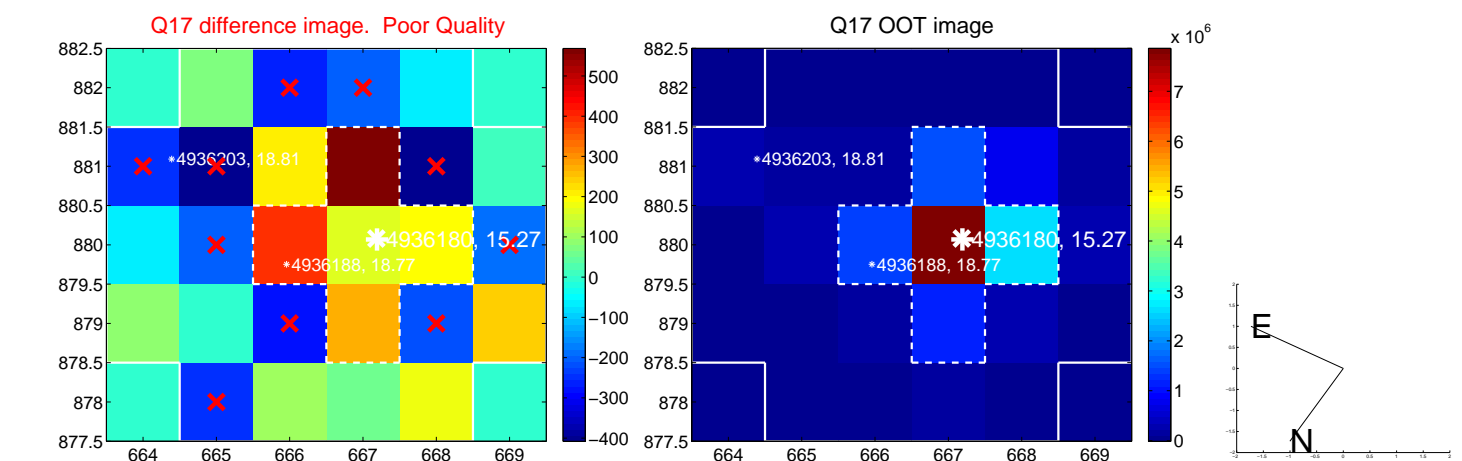
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



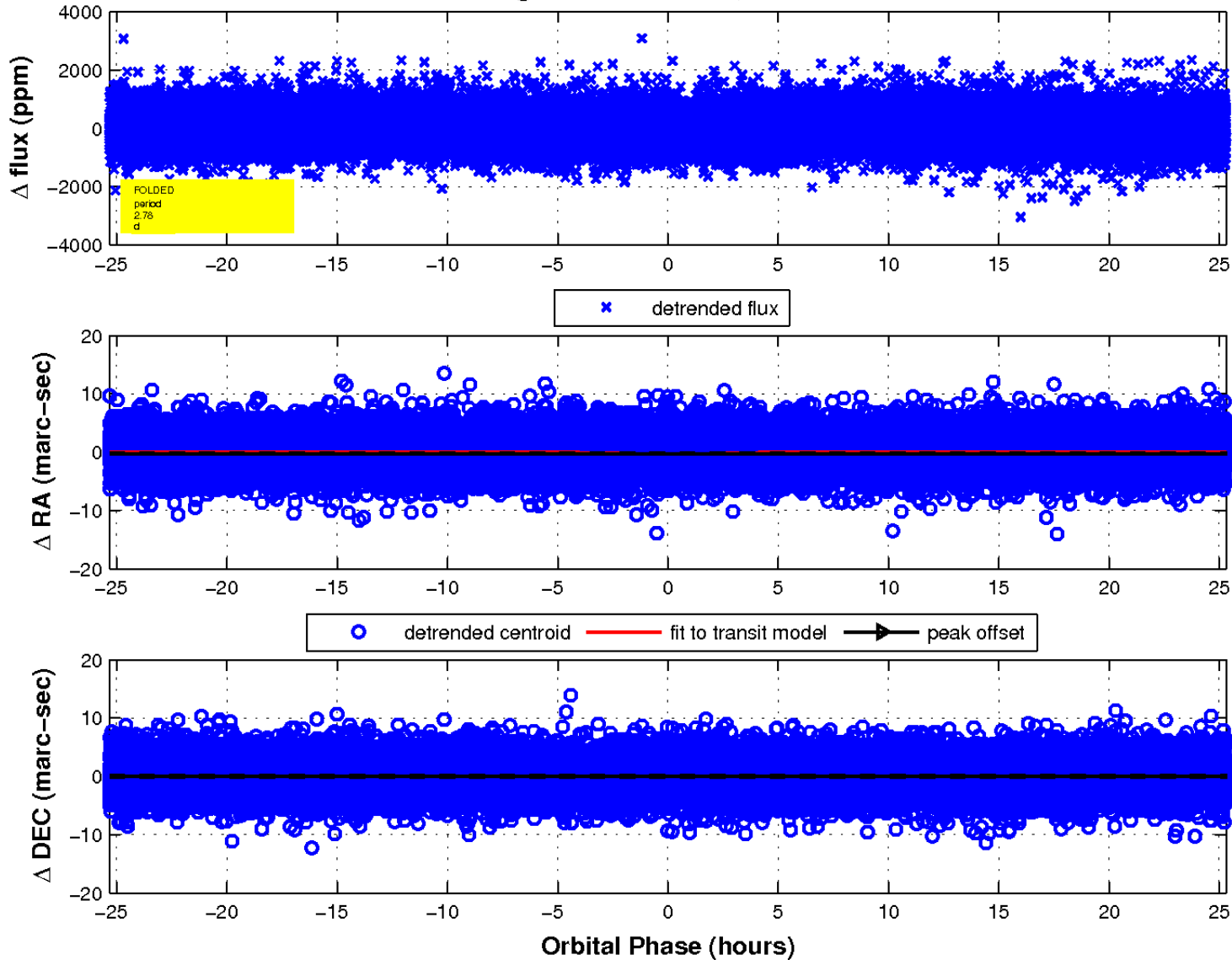
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



fluxWeightedCentroids, Planet 2 of 2



UKIRT Image

Declination

