

# KIC 009414857

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009414857-01	OBS	No	2.436818	131.840110	16.6	6.582	10.1	7.7	1.53	6751	0.72	2807.41
009414857-02	OBS	No	2.437396	132.804338	11.8	29.249	9.0	7.0	1.53	6751	0.61	2806.52

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009414857-01	OBS	FP	0.00	1	0	0	0	SWEET_NTL—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT
009414857-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE_ZUMA—LPP_DV—LPP_ALT—SAME_NTL_PERIOD—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.

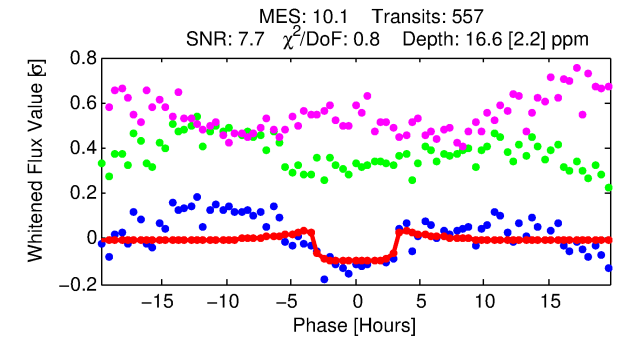
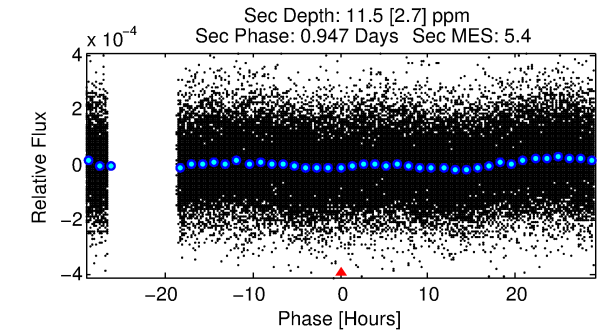
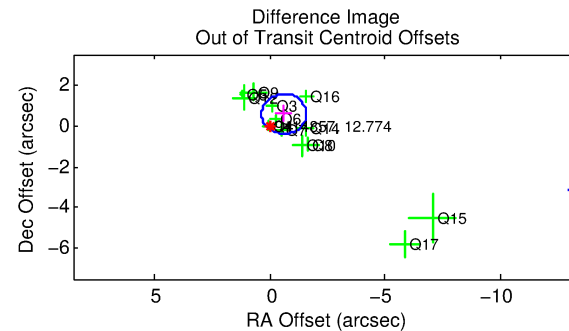
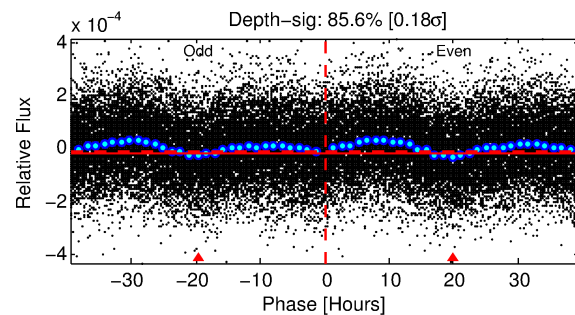
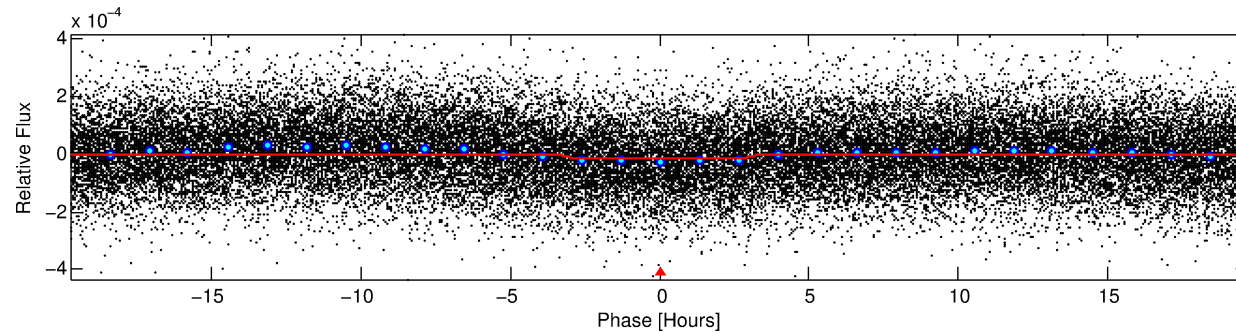
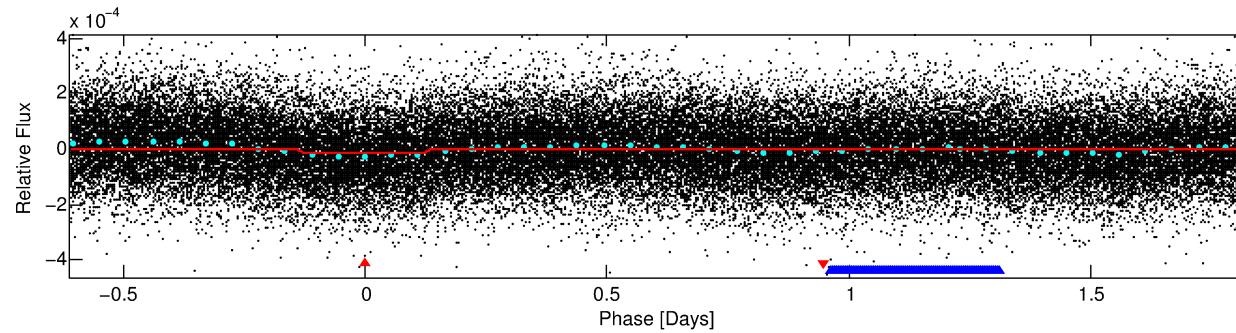
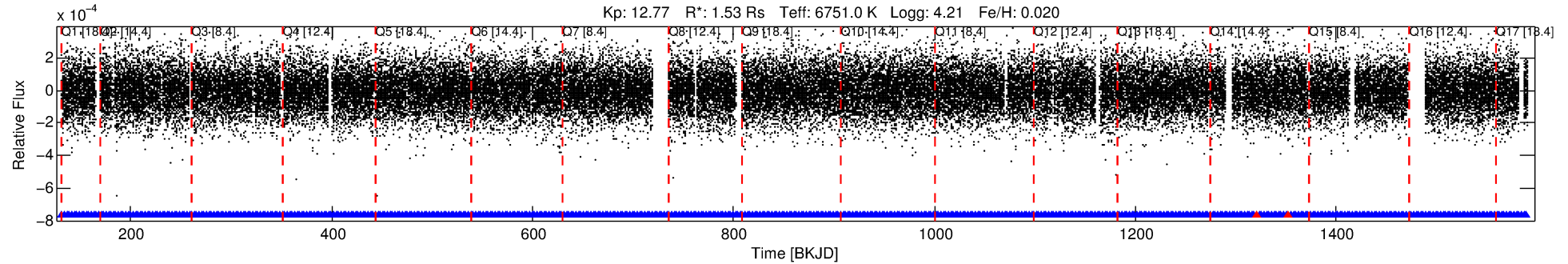
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 009414857-01

No Significant Match Found

# DV One-Page Summary

KIC: 9414857 Candidate: 1 of 2 Period: 2.437 d



## DV Fit Results:

Period = 2.43682 [0.00003] d  
Epoch = 131.8401 [0.0062] BKJD  
Rp/R\* = 0.0043 [0.0011]  
a/R\* = 1.57 [1.42]  
b = 0.90 [0.32]  
Seff = 2807.41 [835.58]  
Teq = 1856 [138] K  
Rp = 0.72 [0.25] Re  
a = 0.0393 [0.0073] AU  
Ag = 18.61 [11.74] [1.50 $\sigma$ ]  
Teffp = 5961 [883] K [4.59 $\sigma$ ]

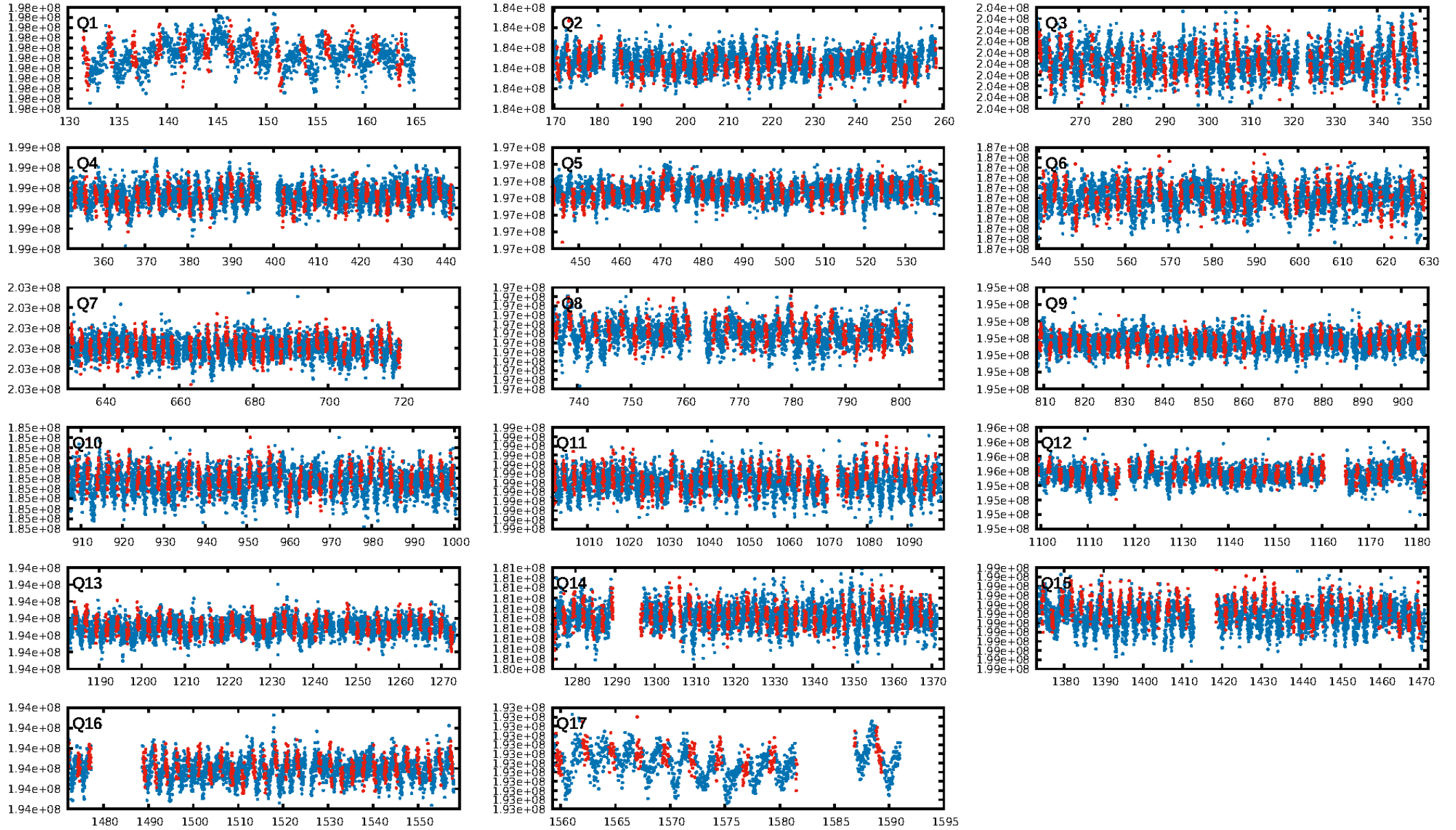
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 0.0% [0.00 $\sigma$ ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [531/533]  
GhostDiagnostic-chr: 1.501  
Centroid-sig: 9.6%  
Centroid-so: 1.346 arcsec [1.45 $\sigma$ ]  
OotOffset-rm: 0.850 arcsec [2.63 $\sigma$ ]  
KicOffset-rm: 0.875 arcsec [2.74 $\sigma$ ]  
OotOffset-st: 3/3/4/3 [13]  
KicOffset-st: 3/3/4/3 [13]  
DiffImageQuality-fgm: 0.77 [10/13]  
DiffImageOverlap-fno: 0.41 [7/17]

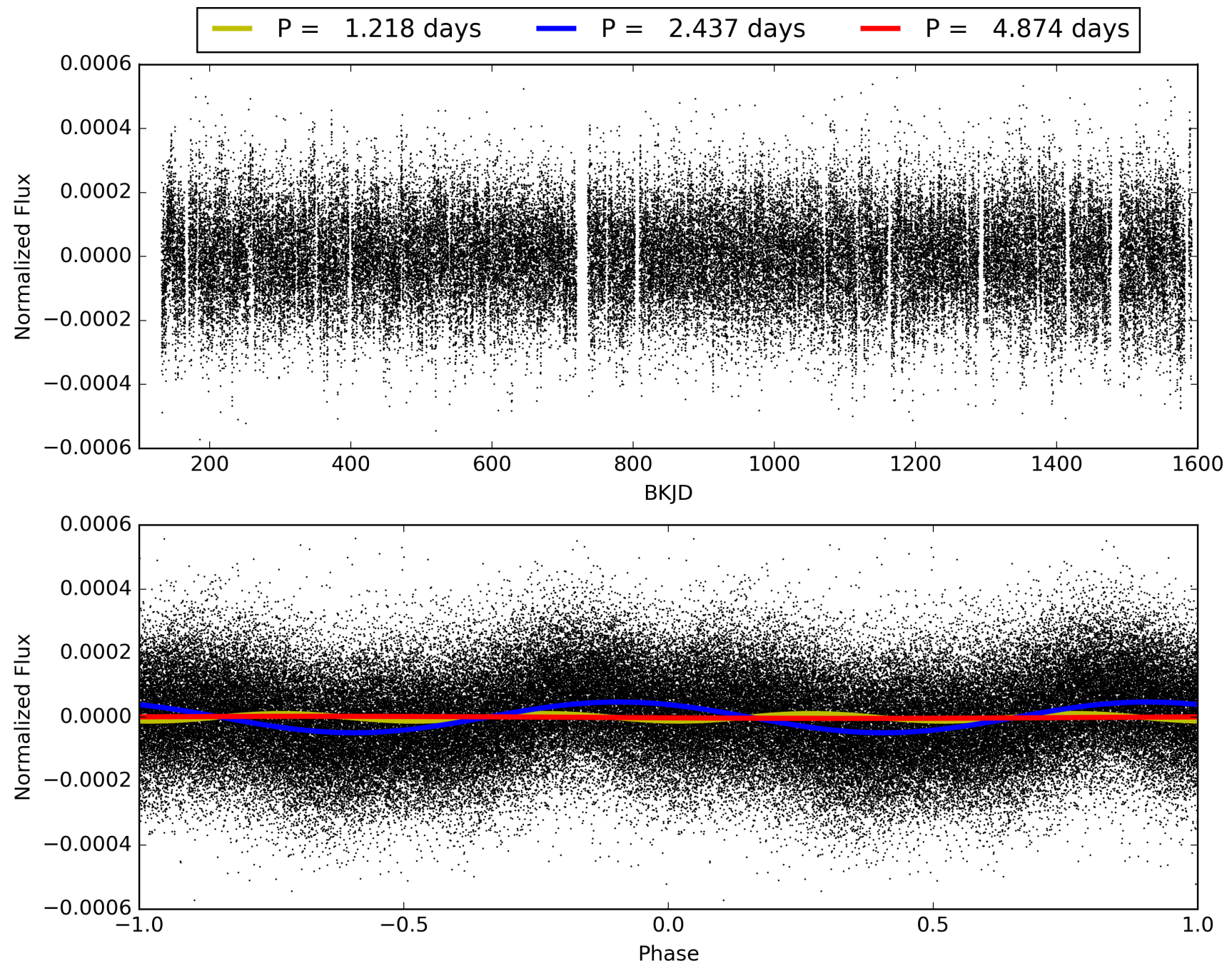
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 07:35:15 Z

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

# TCE 009414857-01, PDC Light Curves

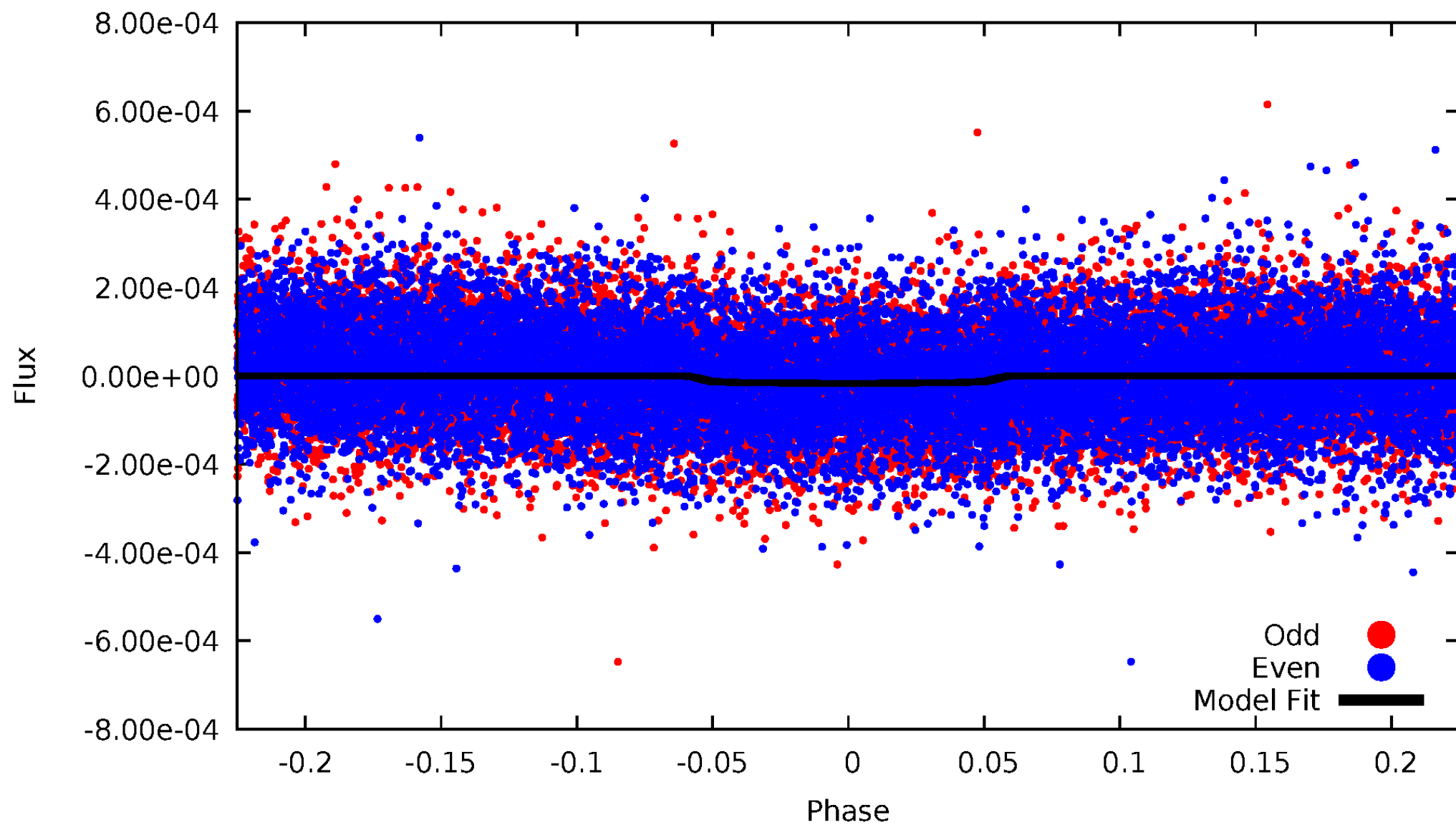


TCE 009414857-01



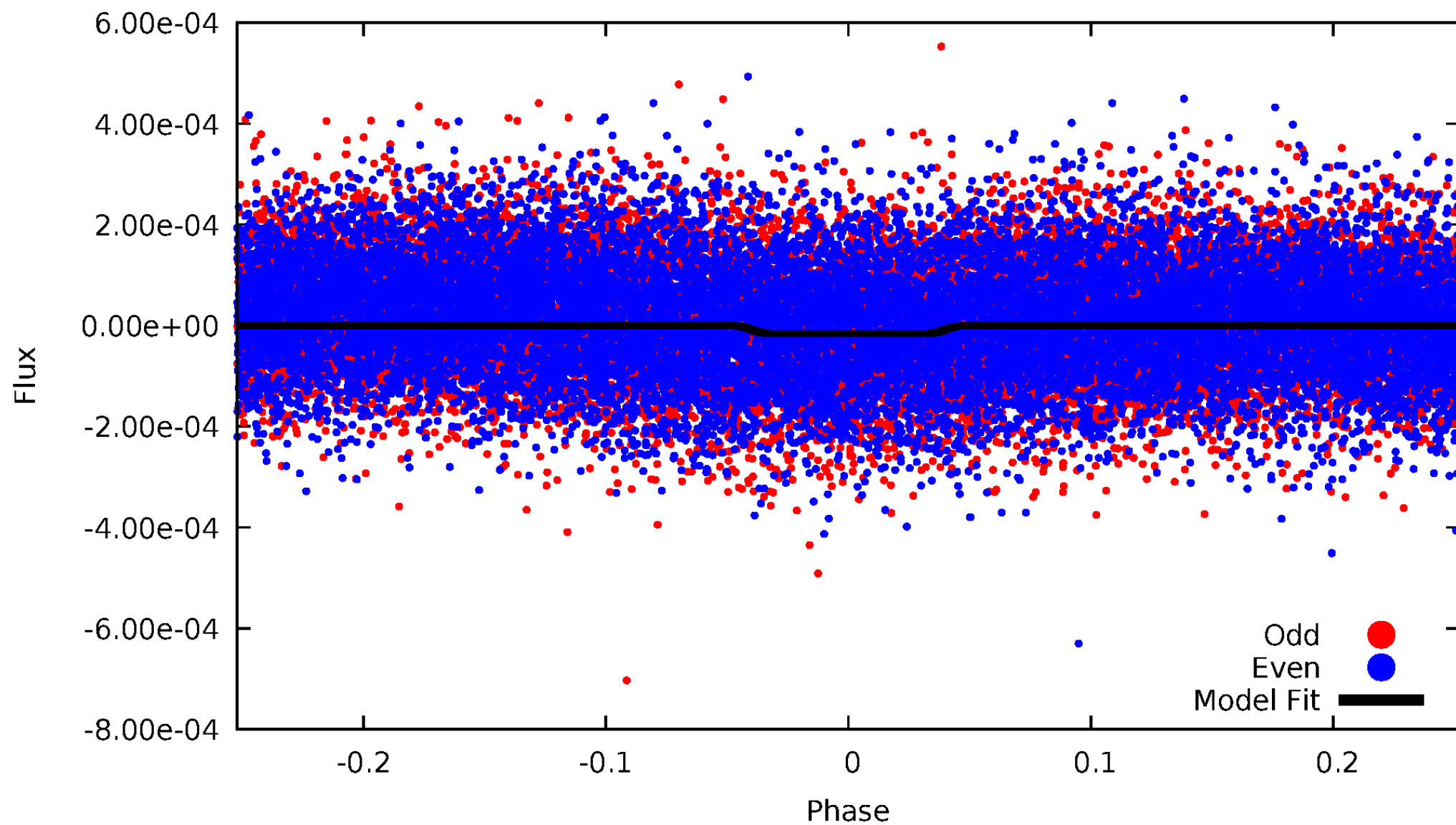
# DV Odd/Even

TCE 009414857-01

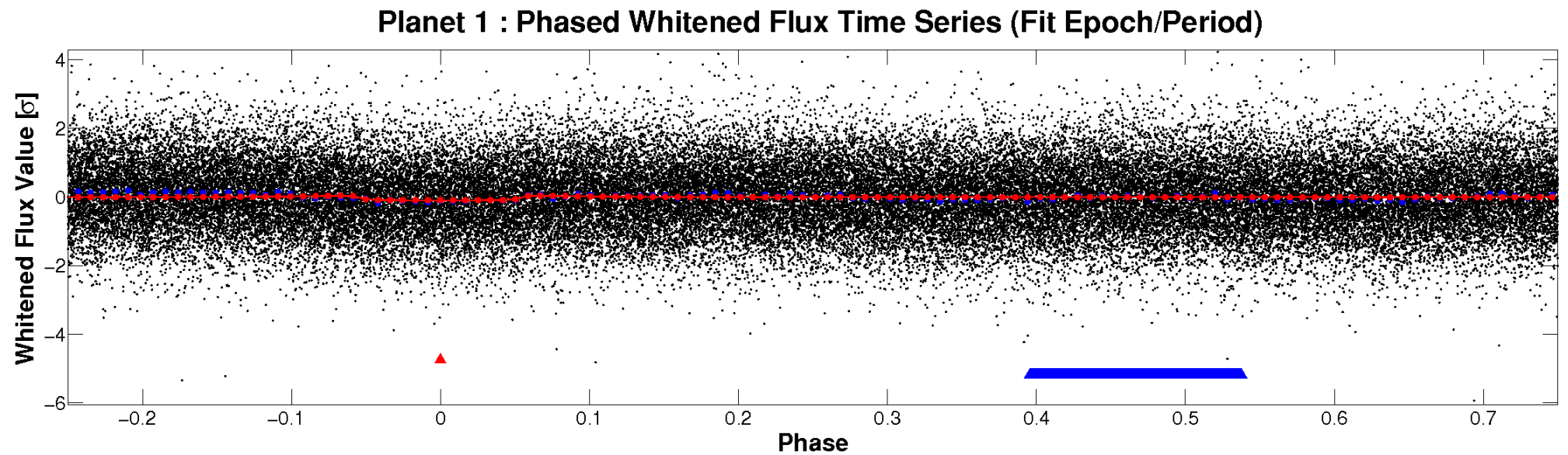
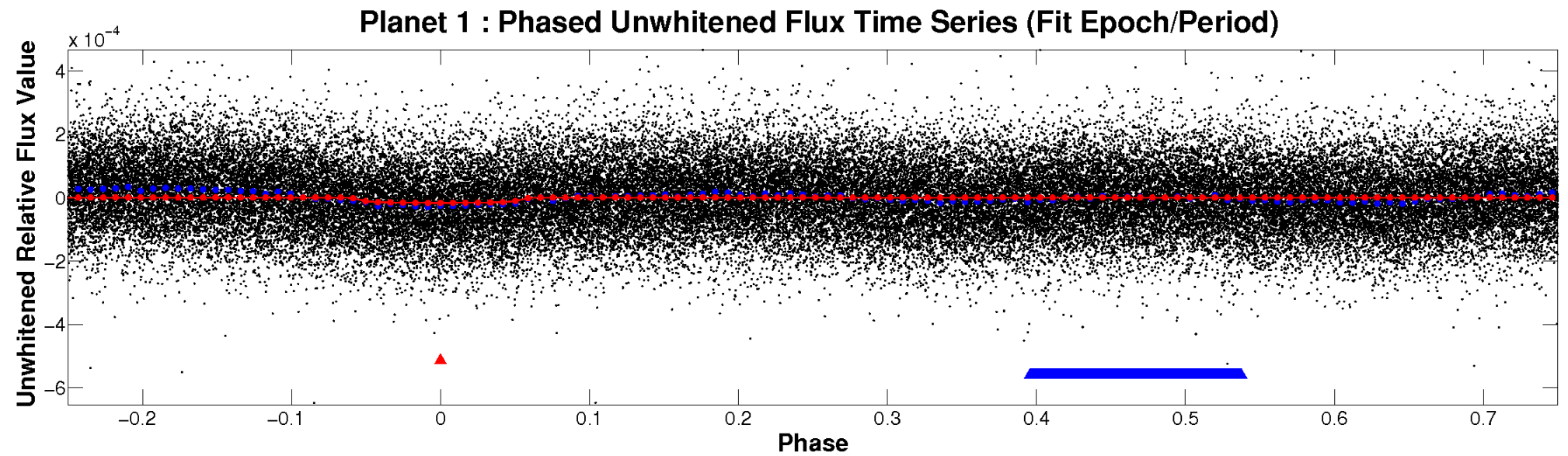


# ALT Odd/Even

TCE 009414857-01

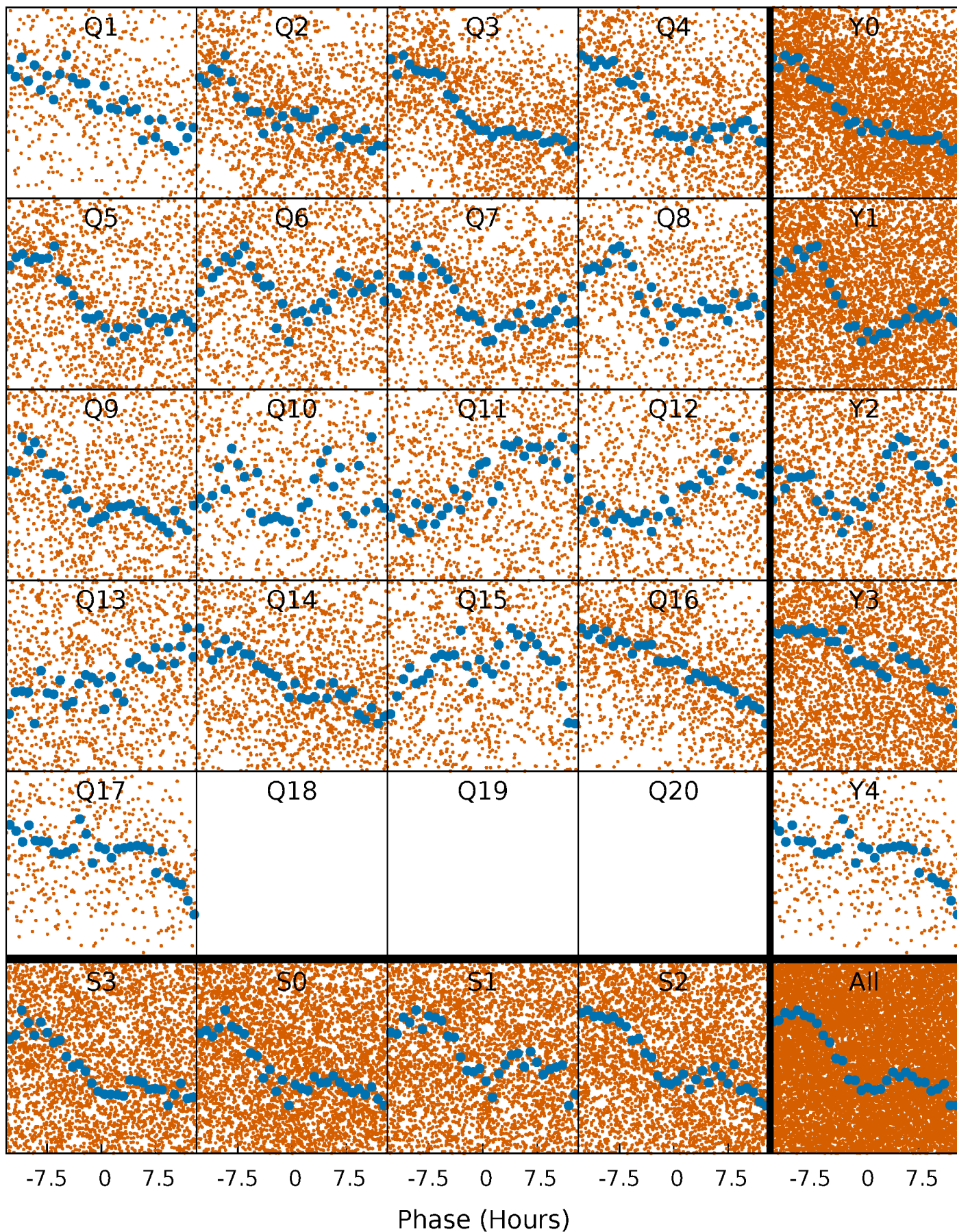


# Non-Whitened Vs. Whitened Light Curve



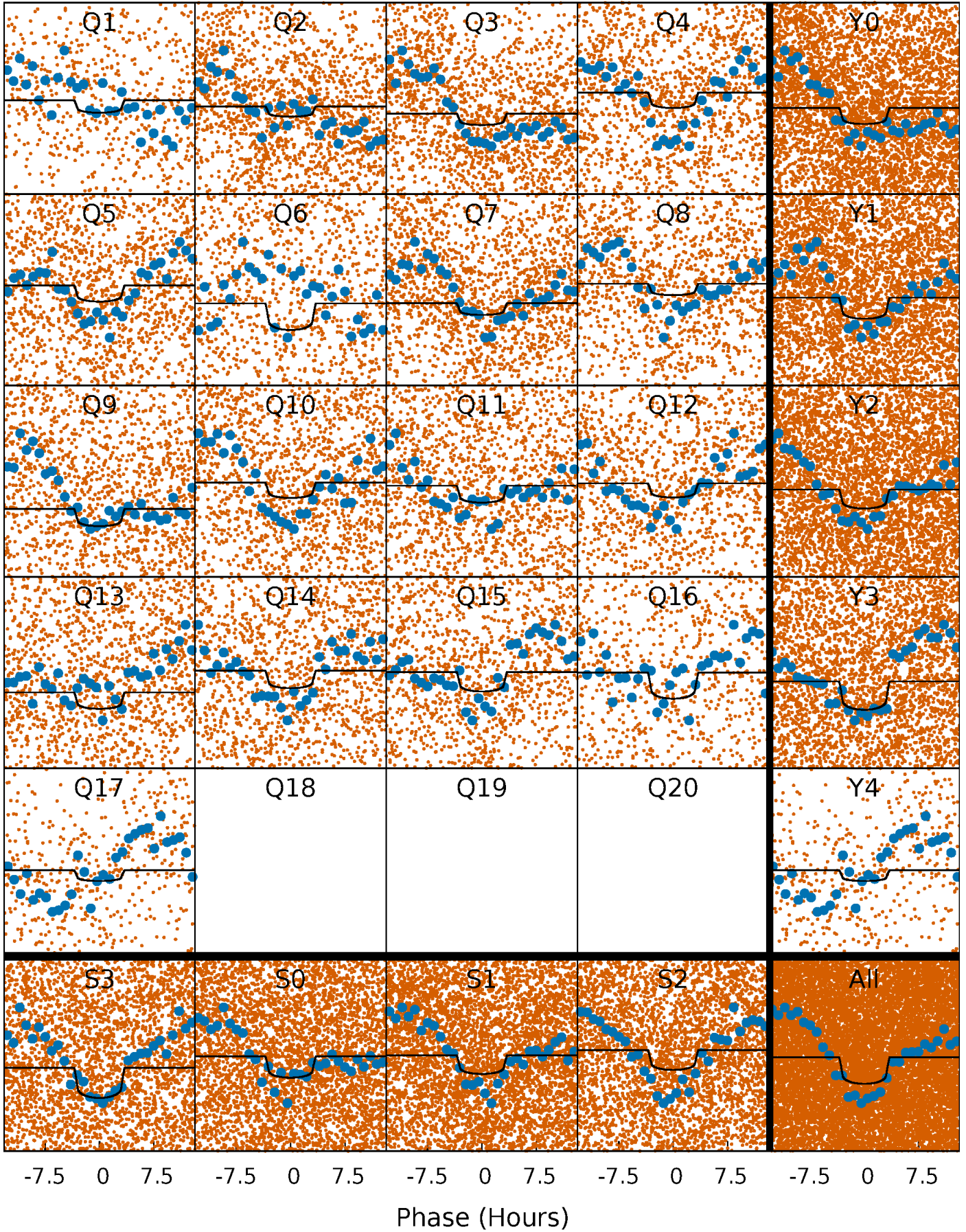
# PDC Quarter-Phased Transit Curves

TCE 009414857-01 P= 2.436818 Days  $T_0=131.840110$  (BKJD)



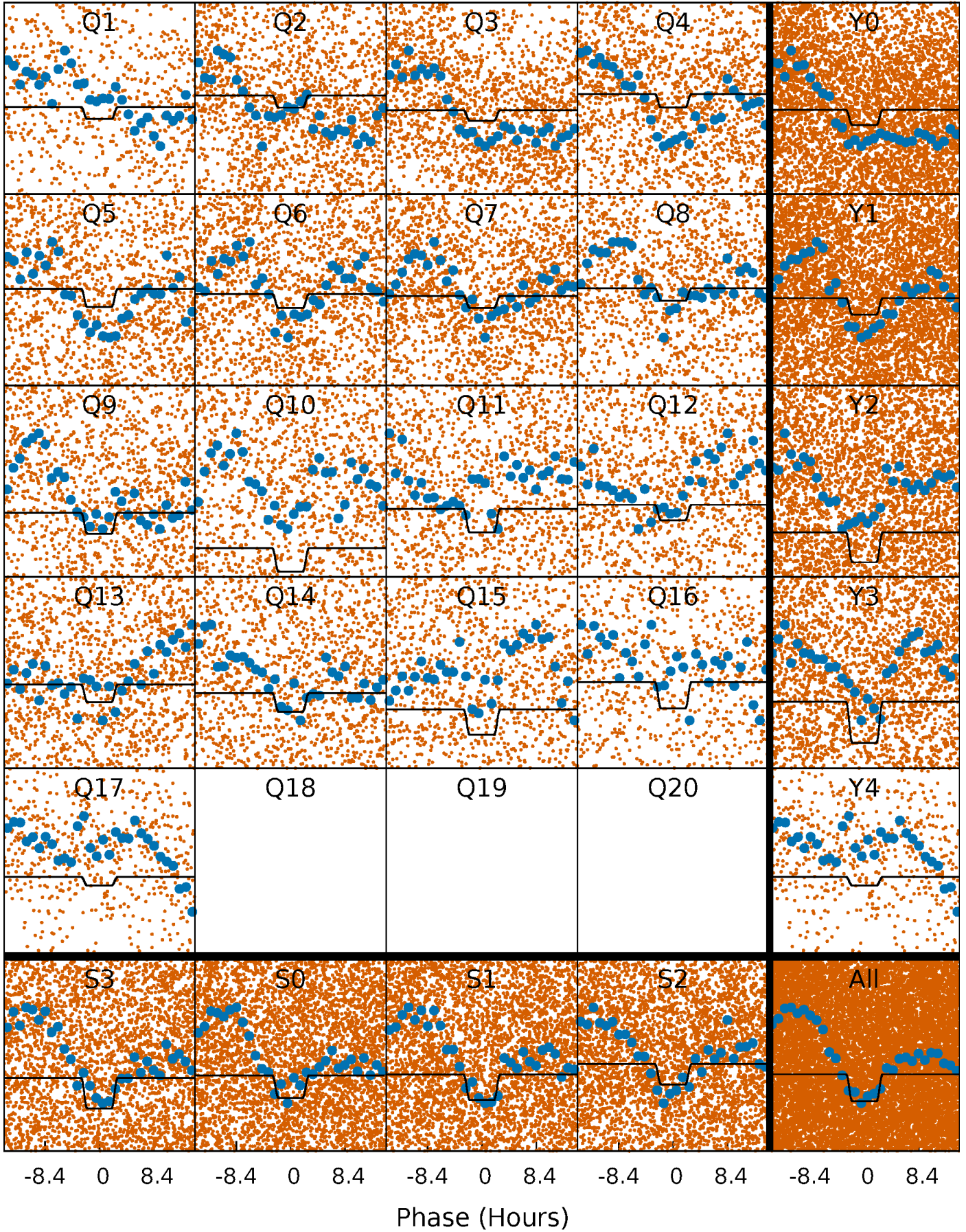
# DV Quarter-Phased Transit Curves

TCE 009414857-01 P= 2.436818 Days  $T_0=131.840110$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

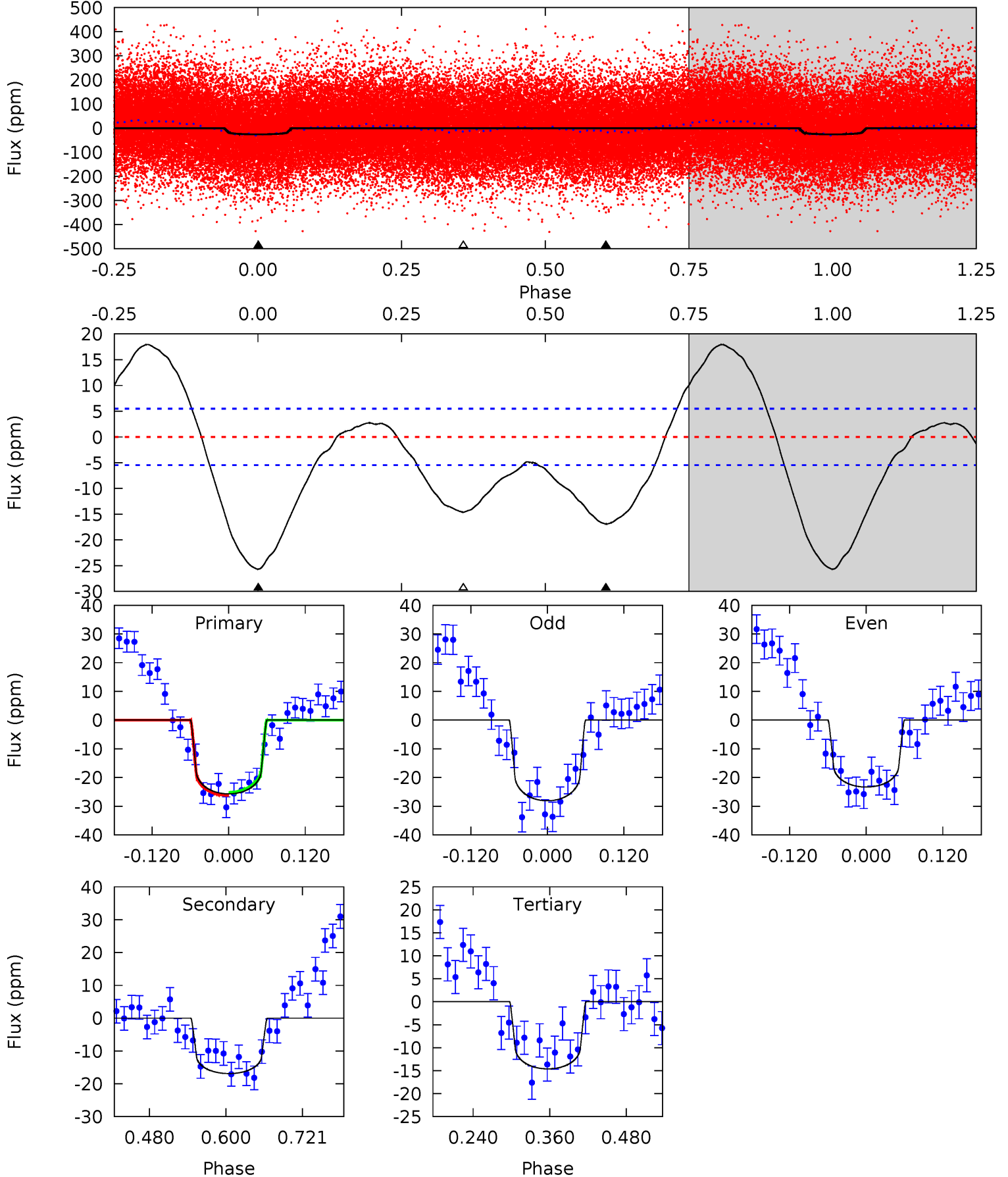
TCE 009414857-01 P= 2.436763 Days  $T_0=131.863440$  (BKJD)



# DV Model-Shift Uniqueness Test

009414857-01, P = 2.436818 Days, E = 129.403292 Days

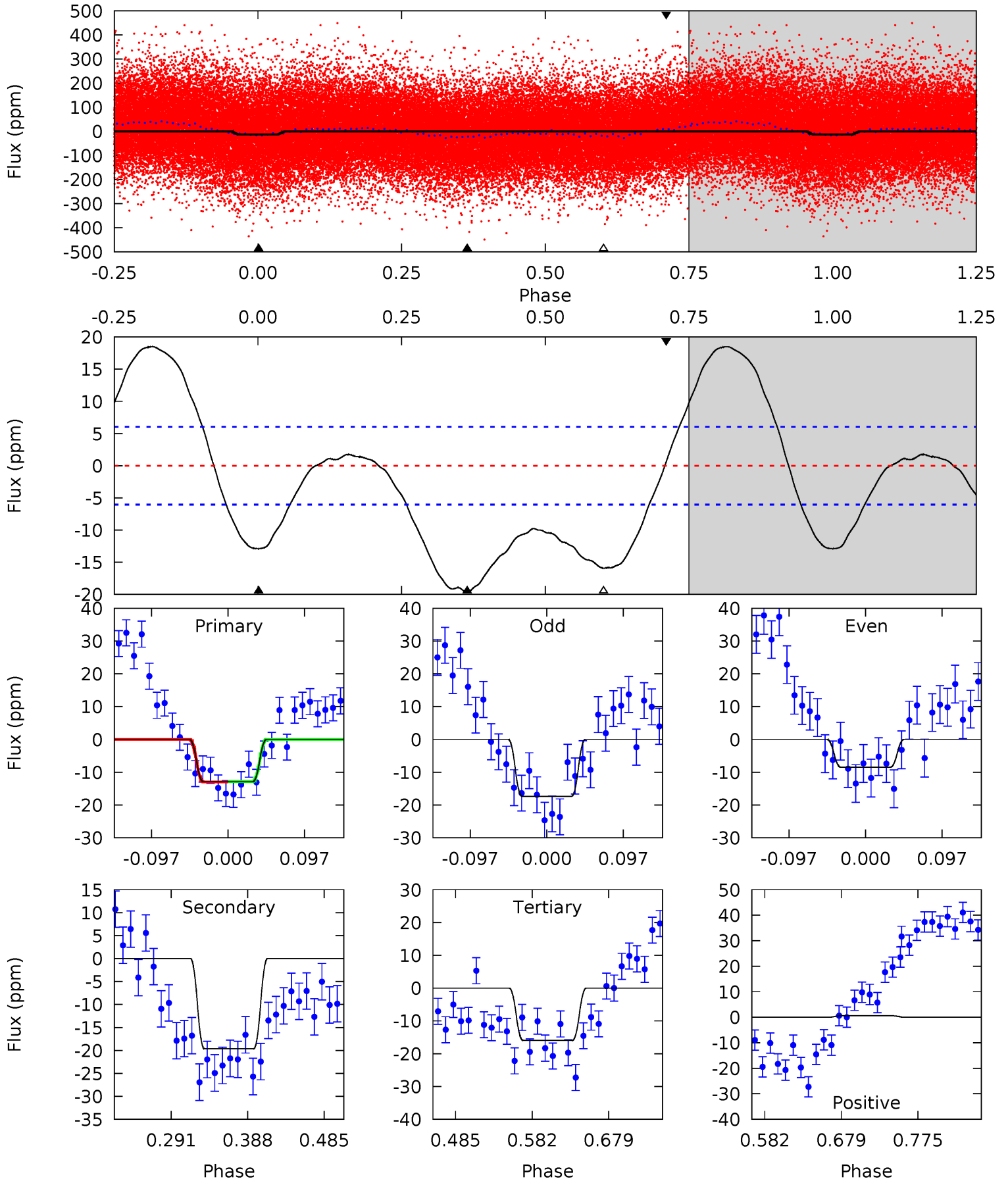
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
21.3	14.0	12.1	0	4.53	1.55	8.39	9.18	21.3	1.88	14.0	1.98	0.94	0.41	0.42



# Alt Model-Shift Uniqueness Test

009414857-01, P = 2.436763 Days, E = 129.426677 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
9.74	14.8	12.0	0.46	4.57	1.66	8.29	-2.29	9.28	2.80	14.4	3.35	1.08	0.49	0.05



### Stellar Parameters For KIC 009414857

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6751^{+162}_{-243}$	$4.205^{+0.112}_{-0.138}$	$0.020^{+0.250}_{-0.350}$	$1.526^{+0.347}_{-0.260}$	$1.361^{+0.159}_{-0.194}$	$0.540^{+0.286}_{-0.219}$
	+2%/-4%	+3%/-3%	+1250%/-1750%	+23%/-17%	+12%/-14%	+53%/-41%
Source	PHO1	FLK73	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 009414857-01 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-17 \pm 1$	$0.72^{+0.21}_{-0.20}$	$2589^{+148}_{-123}$	$6508^{+1175}_{-756}$	$27^{+23}_{-11}$
Alt.	$-20 \pm 1$	$0.66^{+0.21}_{-0.18}$	$2597^{+146}_{-138}$	$7089^{+1614}_{-883}$	$37^{+35}_{-16}$

$T_{max}$  = 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

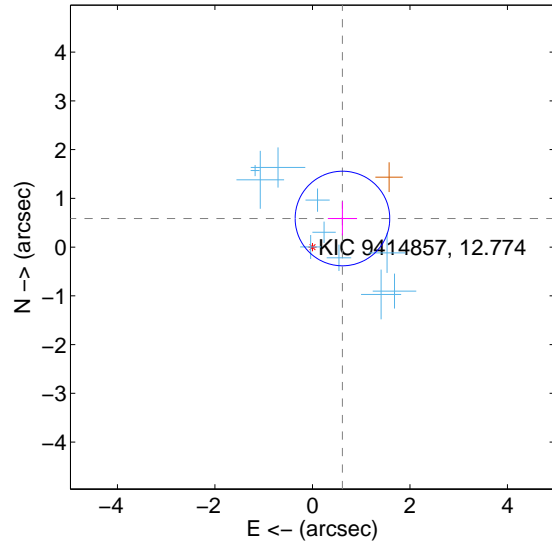
Supplemental centroid analysis for 009414857-01. Kepler magnitude: 12.77. Transit SNR 7.67

There are 10 quarters with good PRF difference image offsets

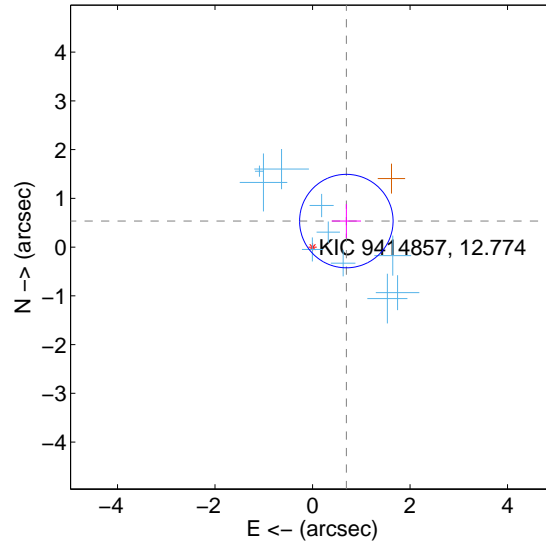
The direct PRF centroid is offset from the target star catalog position by about 0.08 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.850 \pm 0.323$	2.63	$-0.616 \pm 0.300$	$0.587 \pm 0.347$
PRF-fit source offset from KIC position	$0.875 \pm 0.320$	2.74	$-0.694 \pm 0.301$	$0.534 \pm 0.349$
photometric centroid source offset	$1.35 \pm 0.93$	1.45	$1.21 \pm 0.92$	$0.60 \pm 0.98$

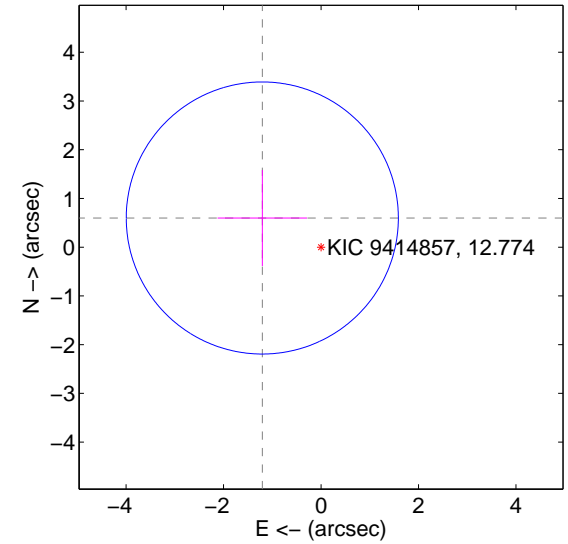
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

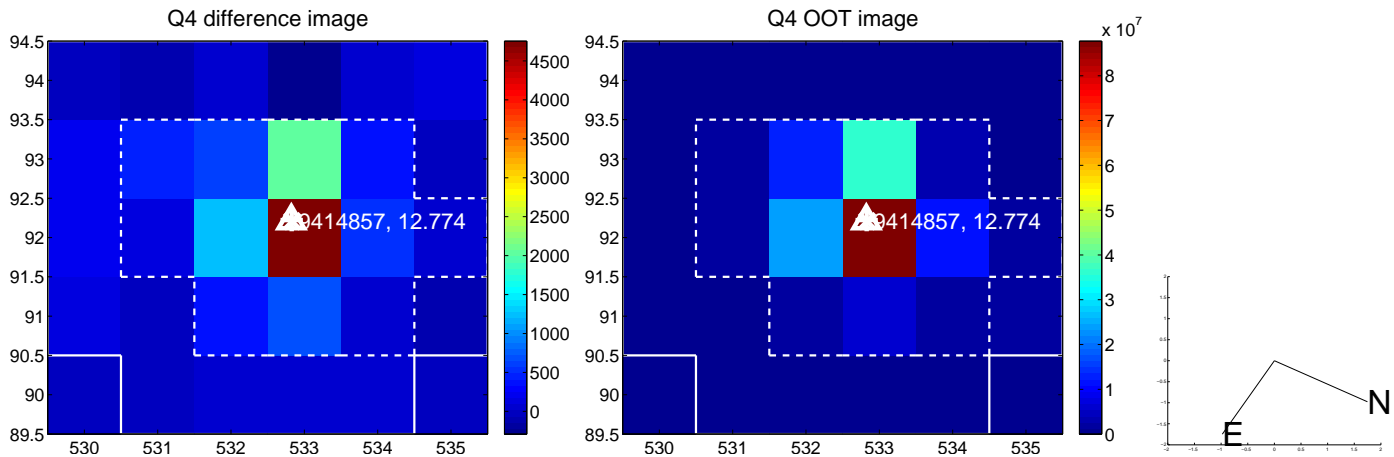
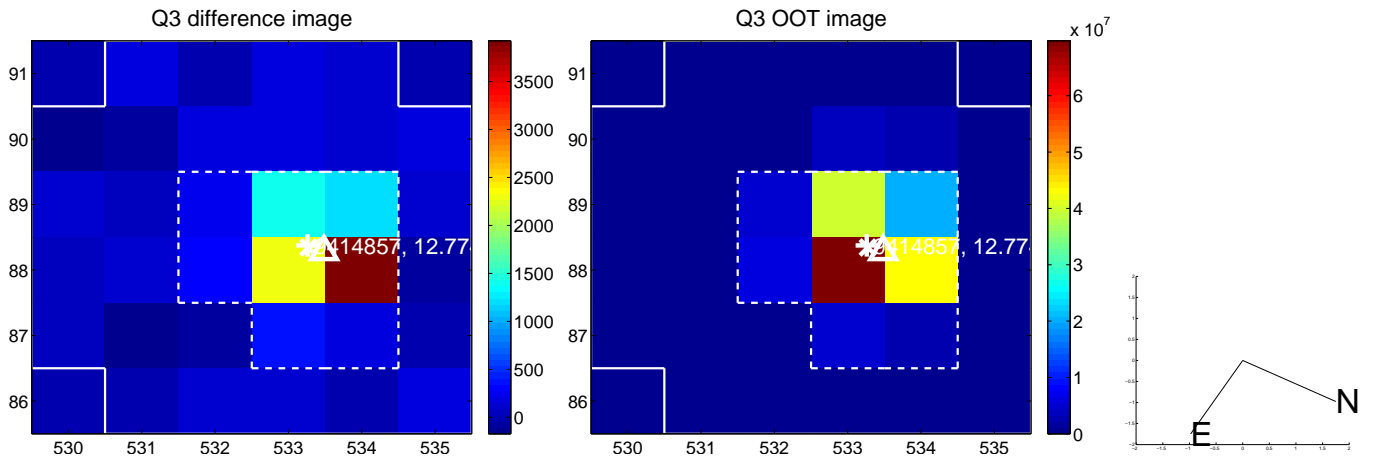
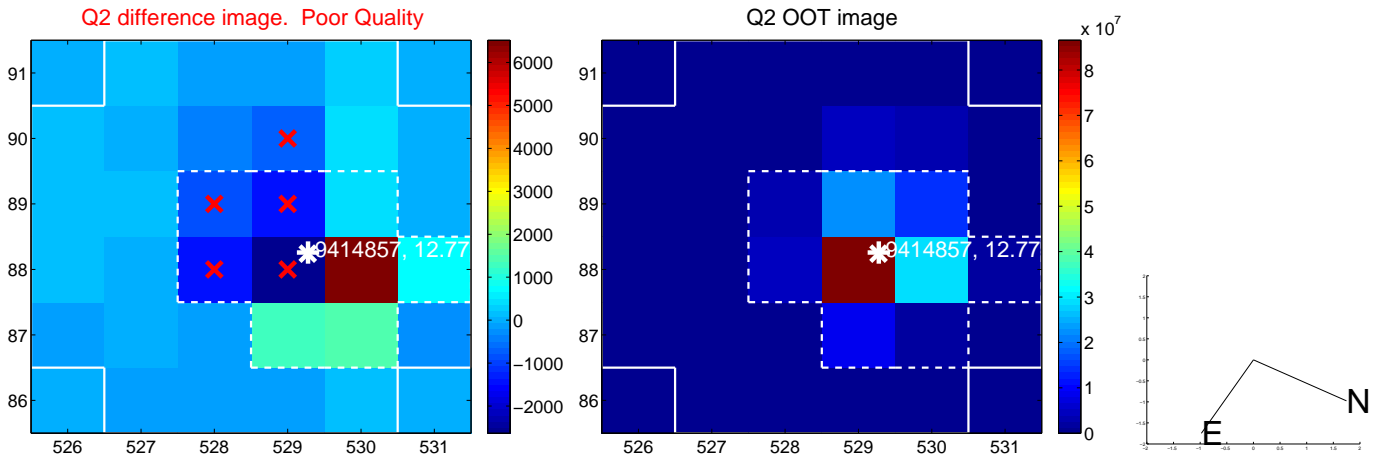
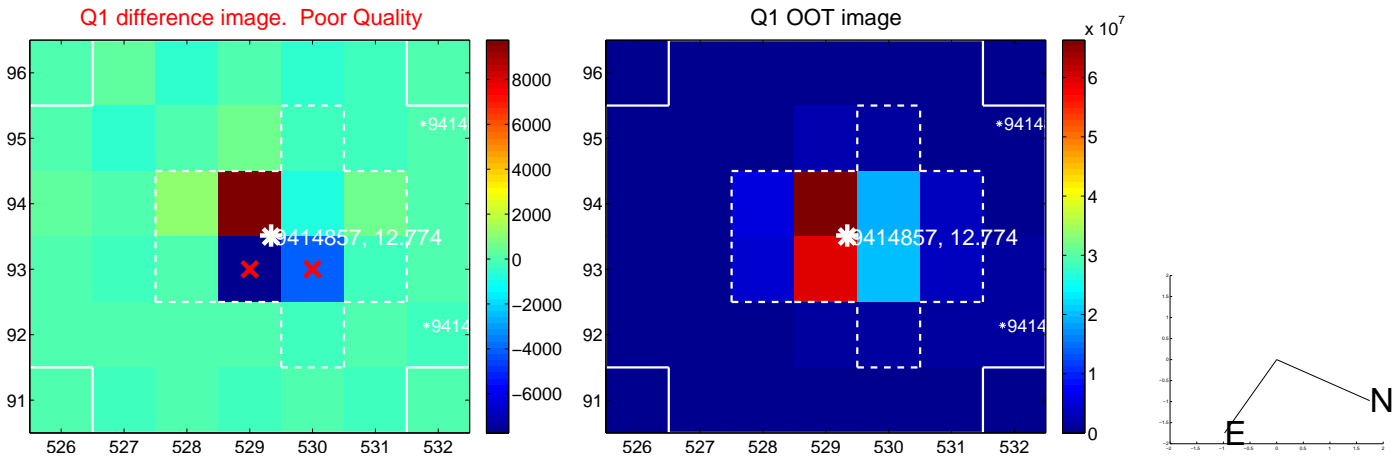


offset from photometric centroids

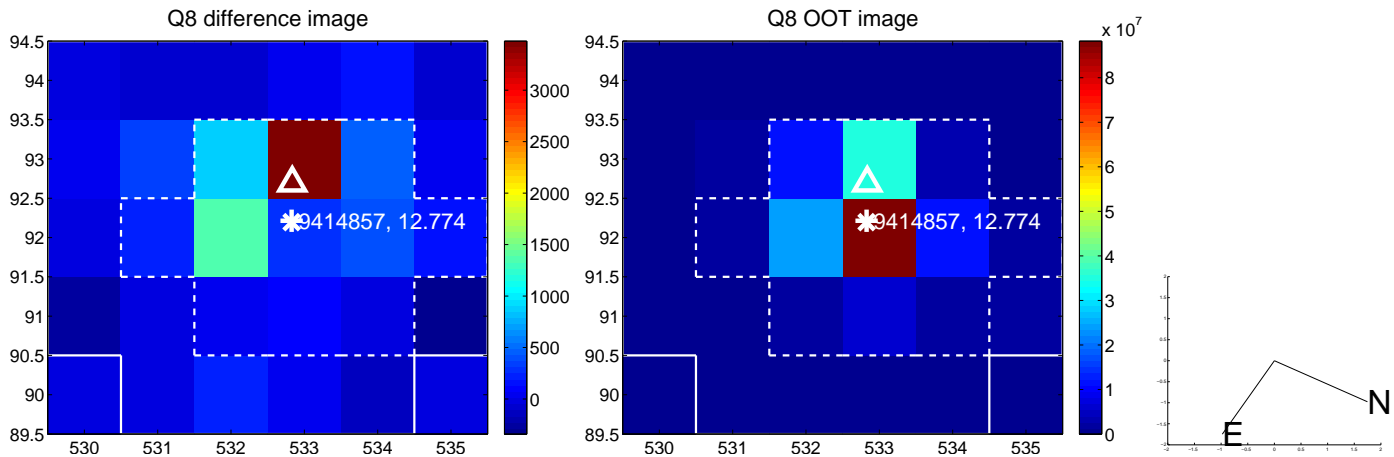
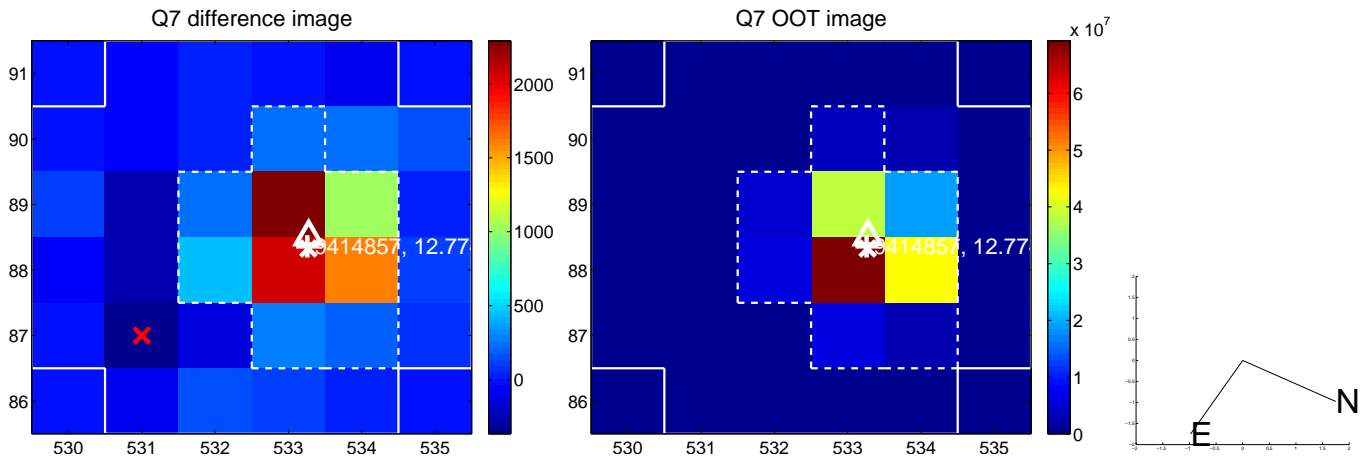
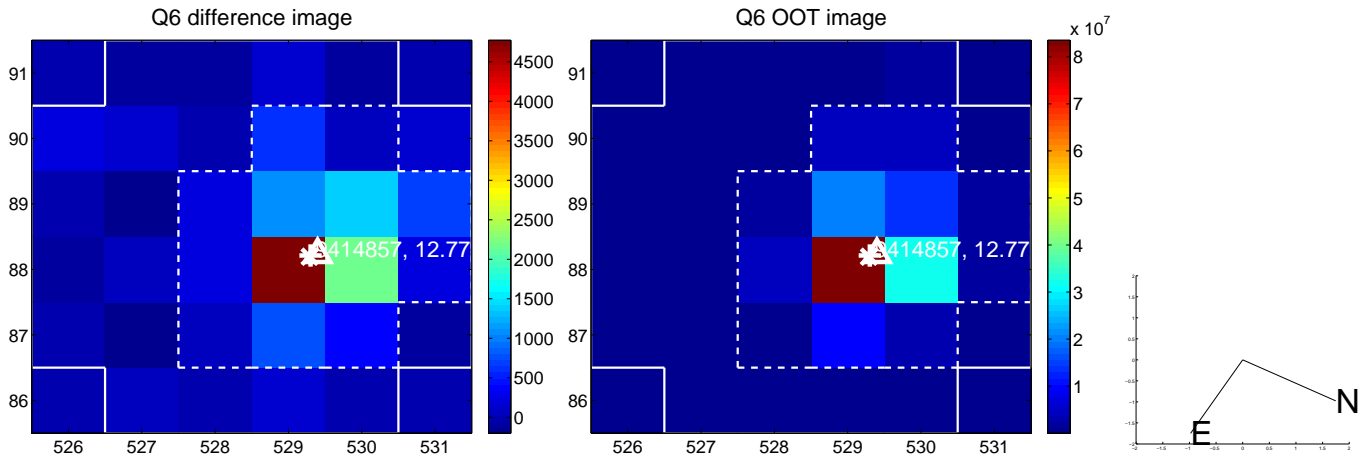
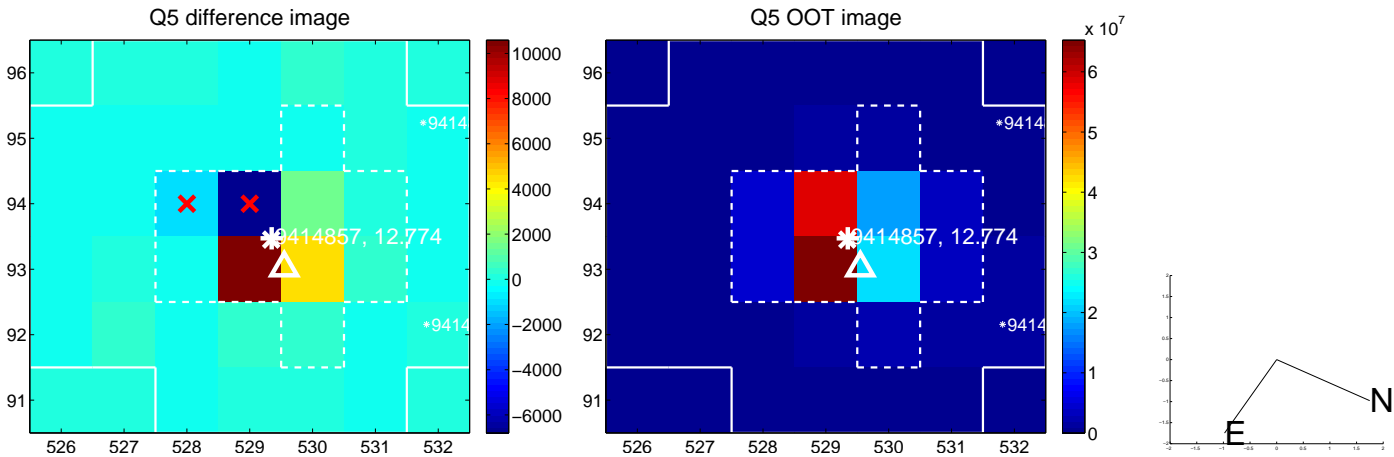


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

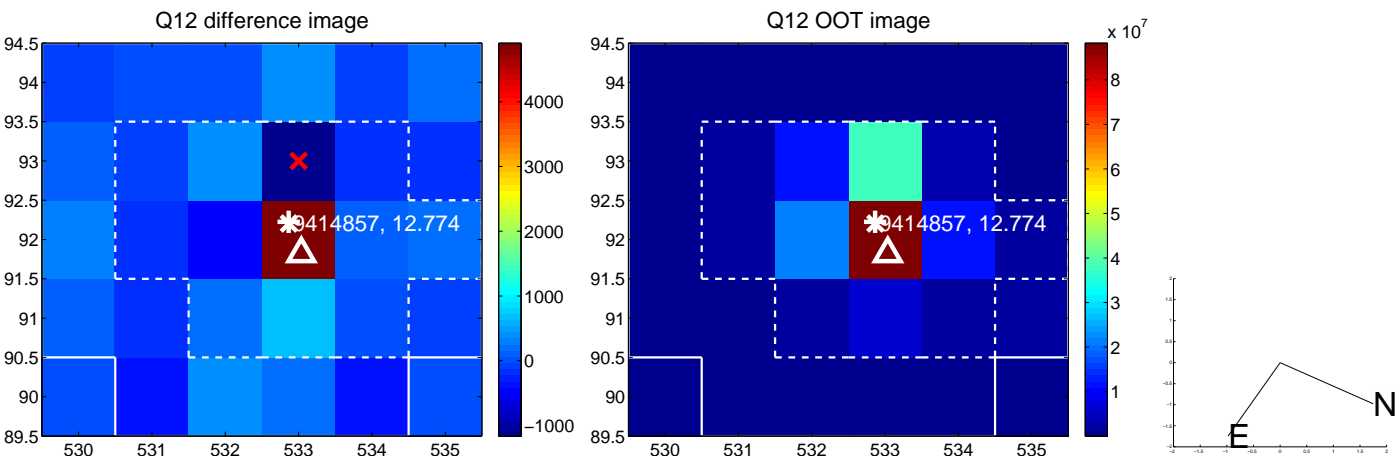
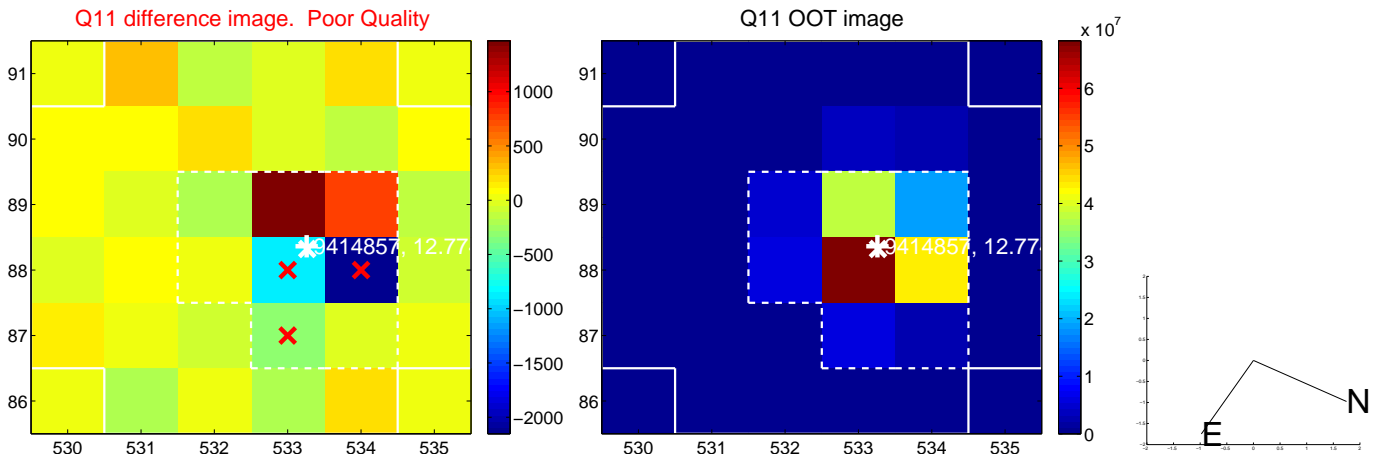
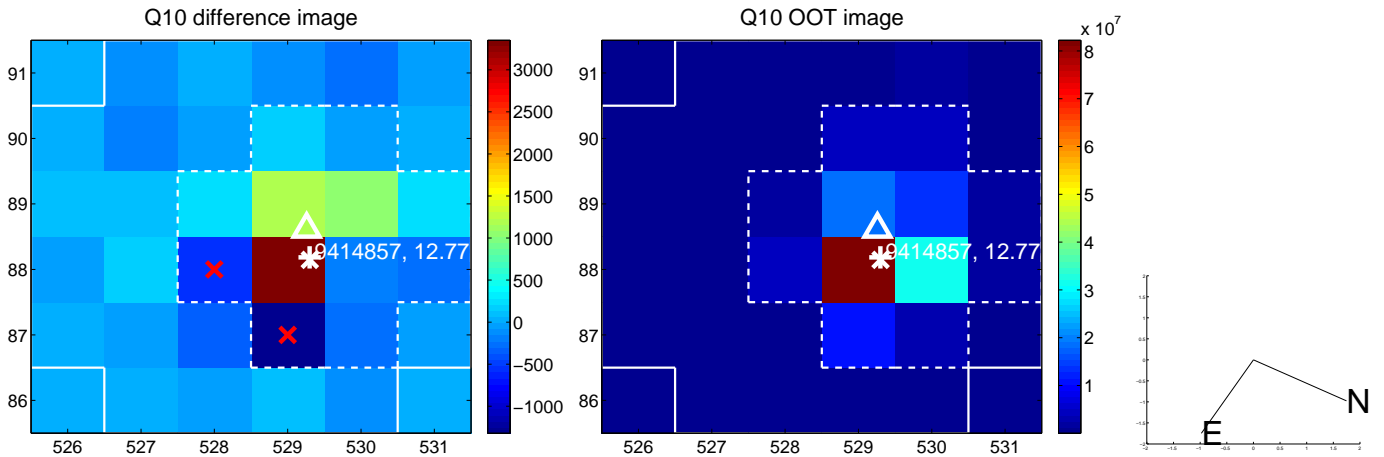
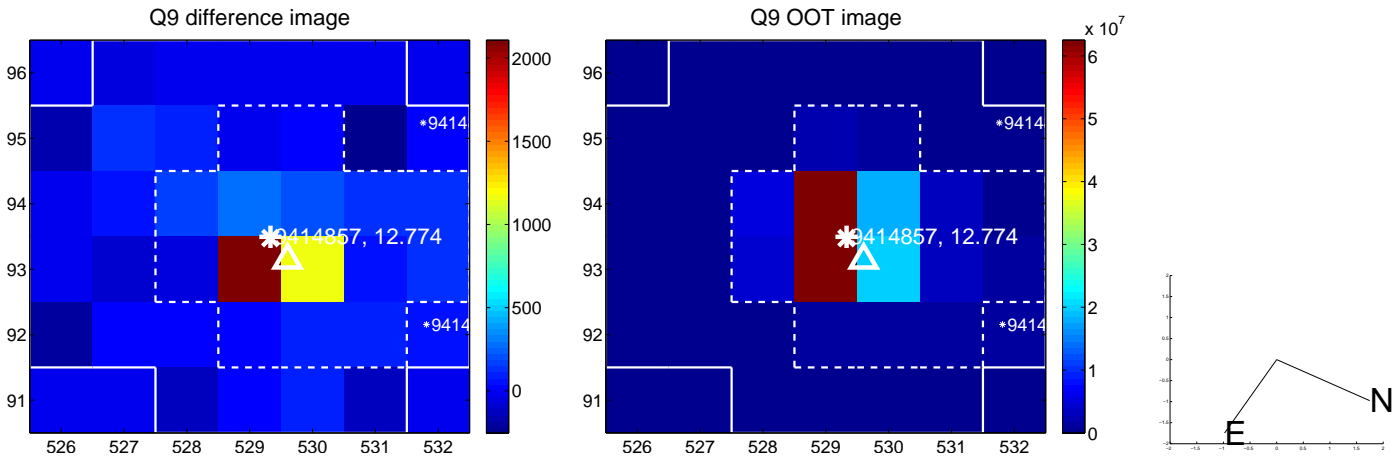
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



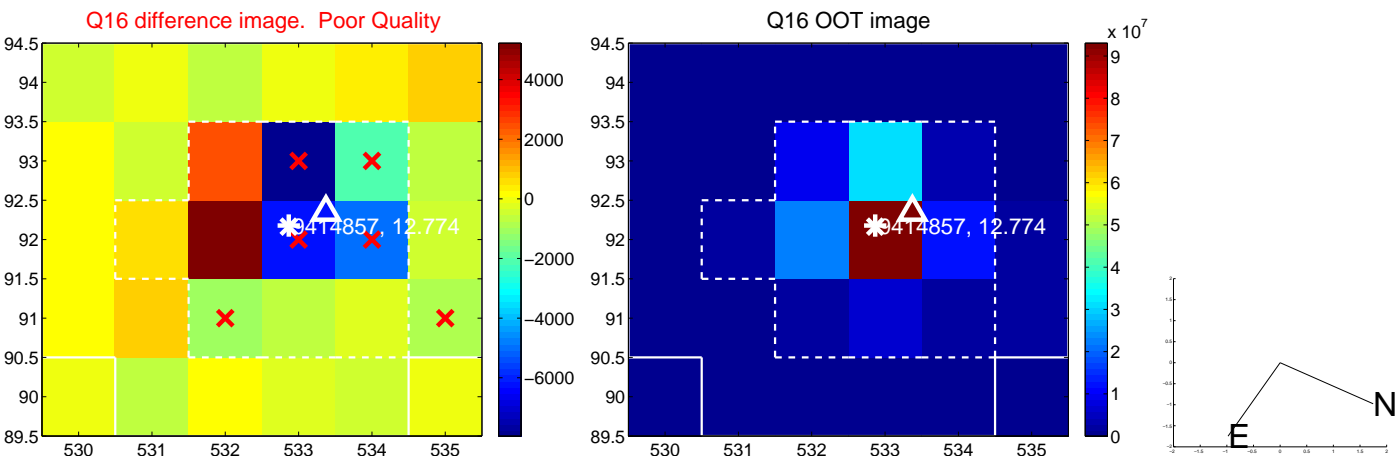
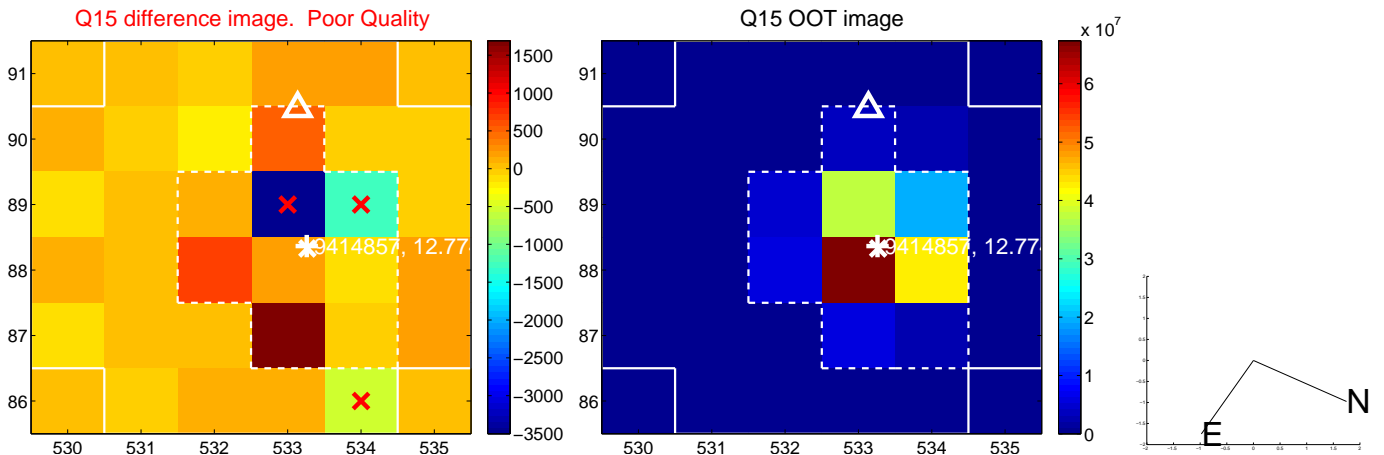
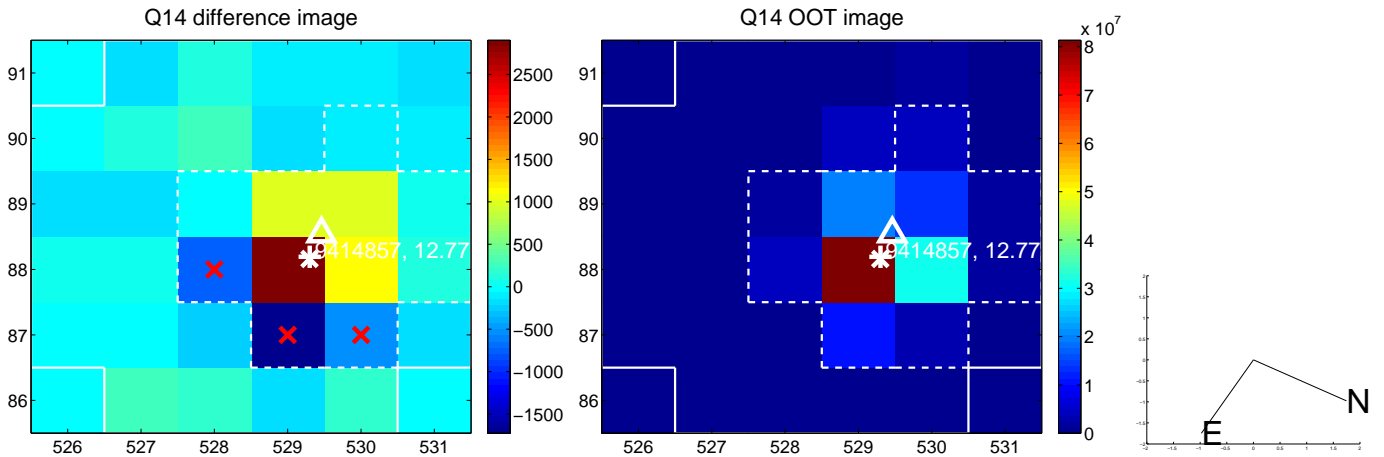
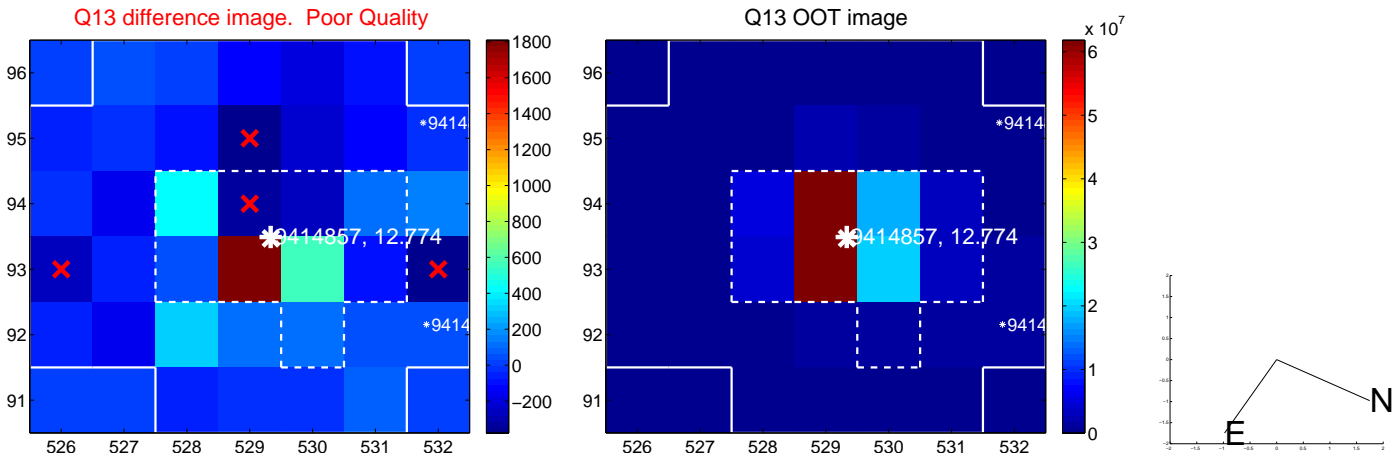
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



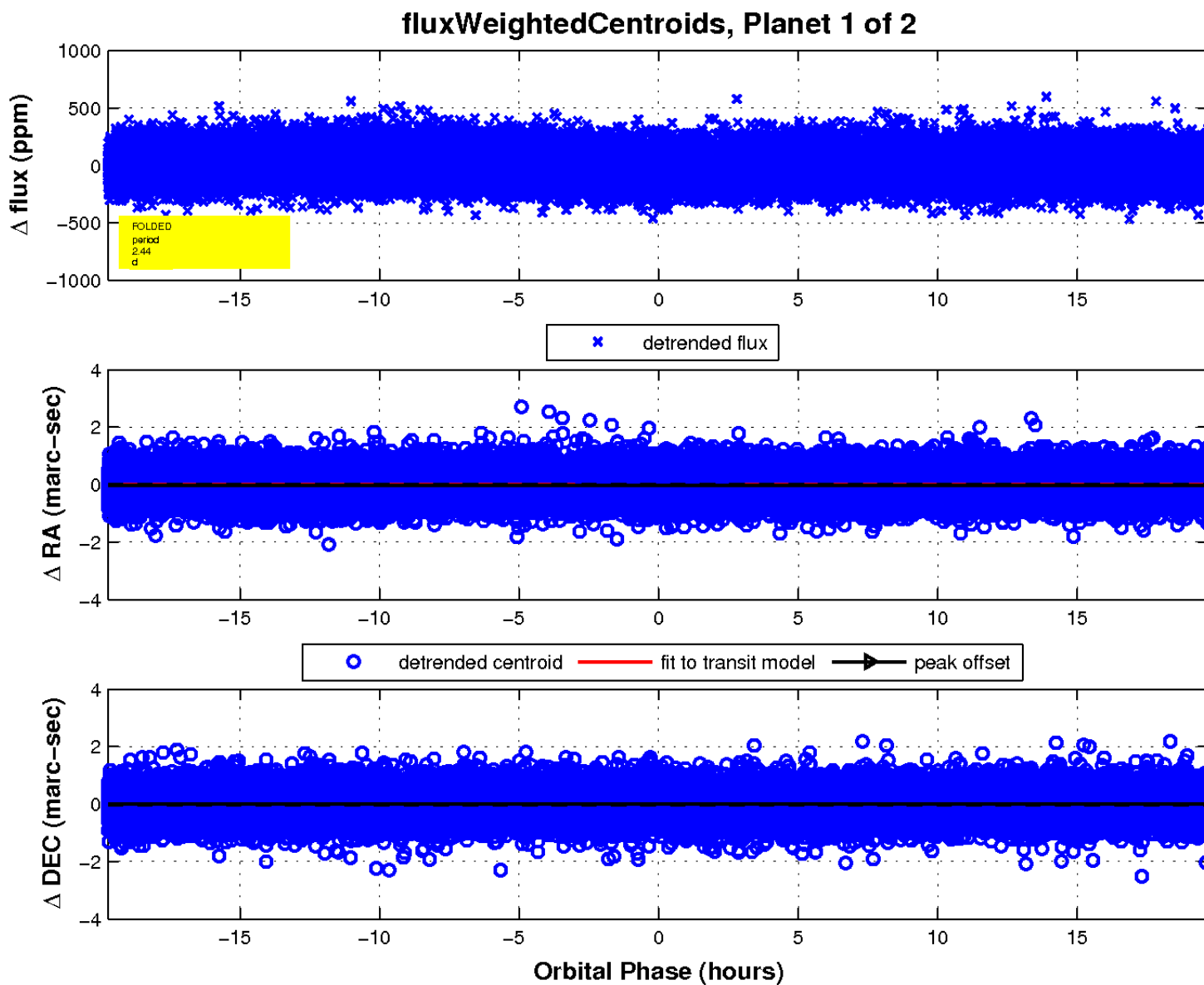
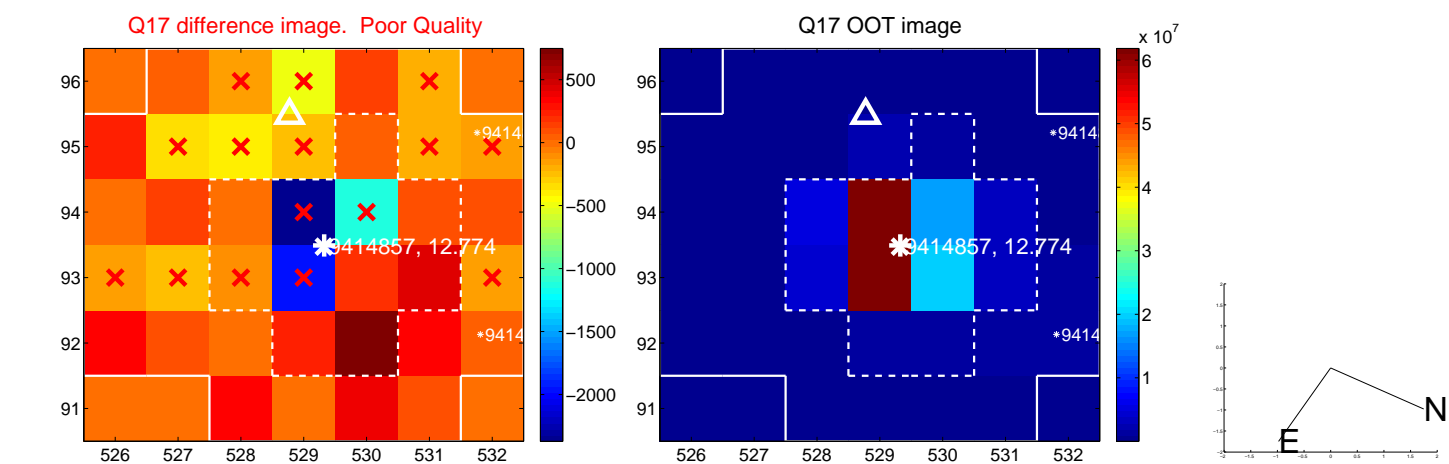
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



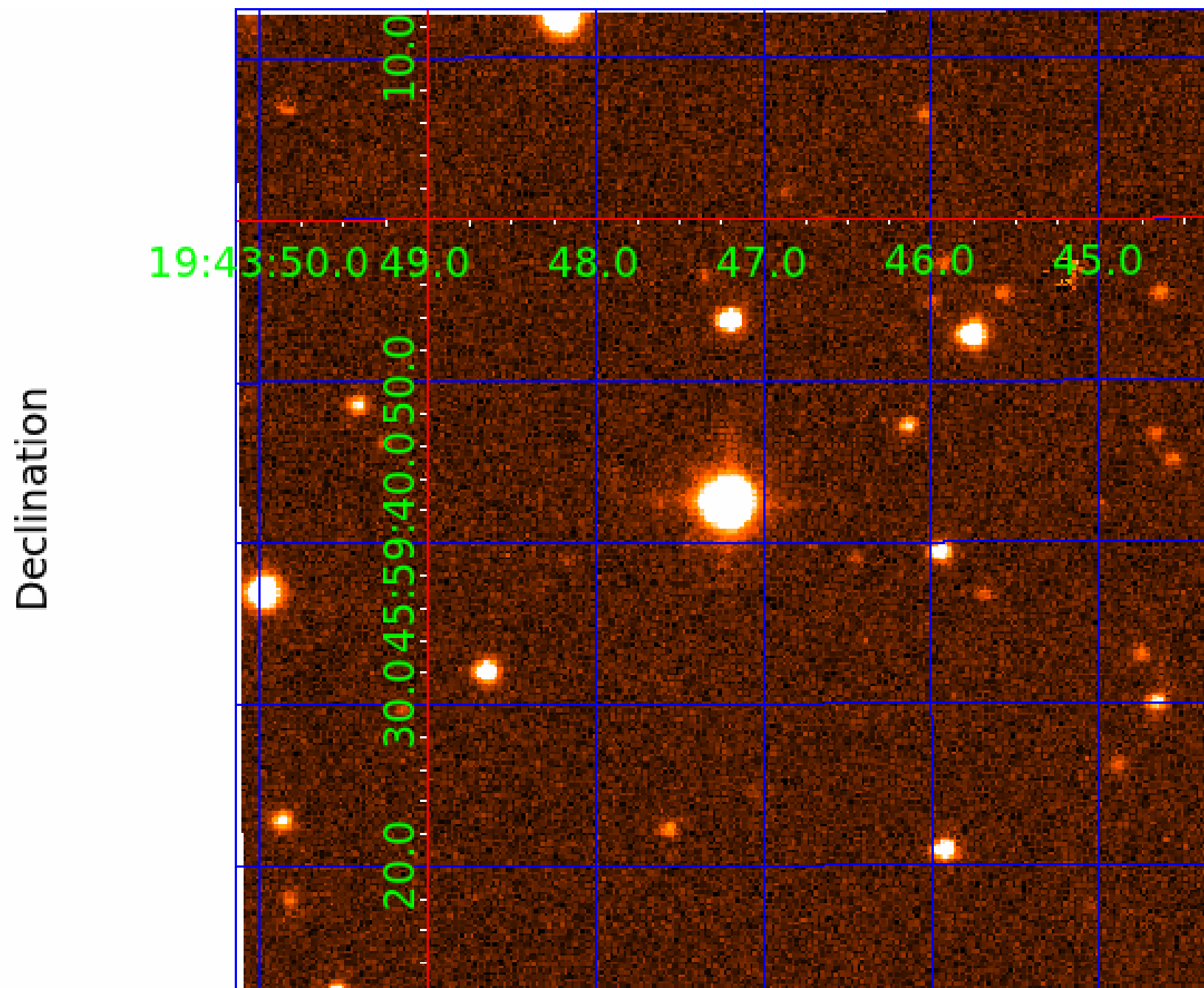
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



UKIRT Image



# KIC 009414857

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009414857-01	OBS	No	2.436818	131.840110	16.6	6.582	10.1	7.7	1.53	6751	0.72	2807.41
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## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009414857-01	OBS	FP	0.00	1	0	0	0	SWEET_NTL—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT
009414857-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE_ZUMA—LPP_DV—LPP_ALT—SAME_NTL_PERIOD—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.

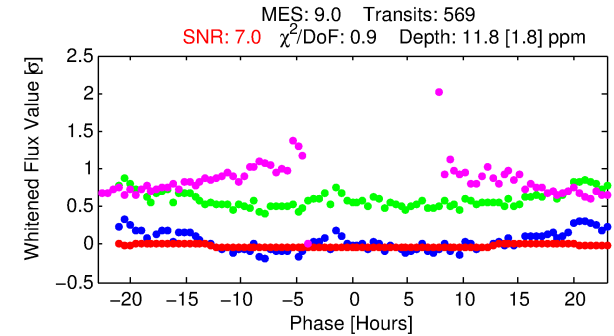
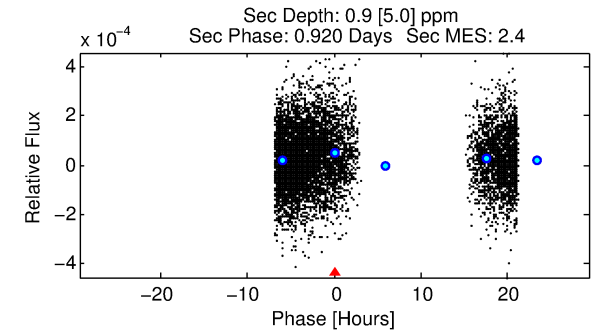
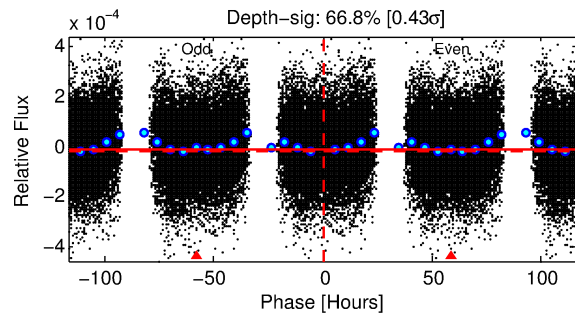
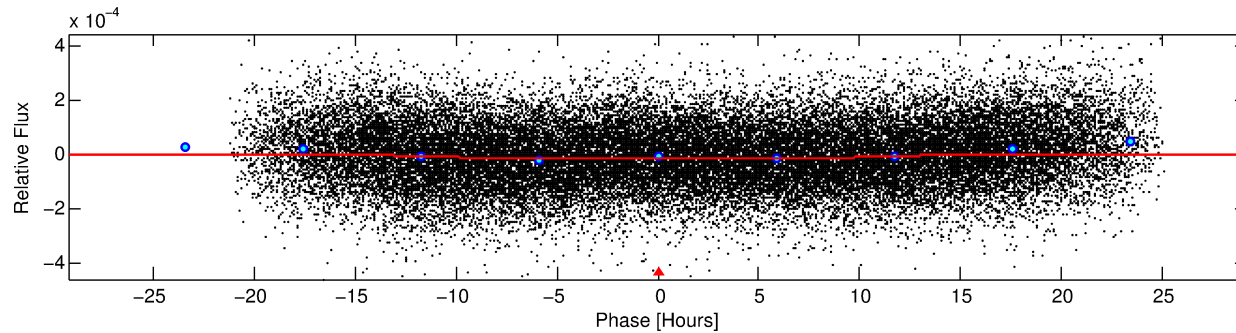
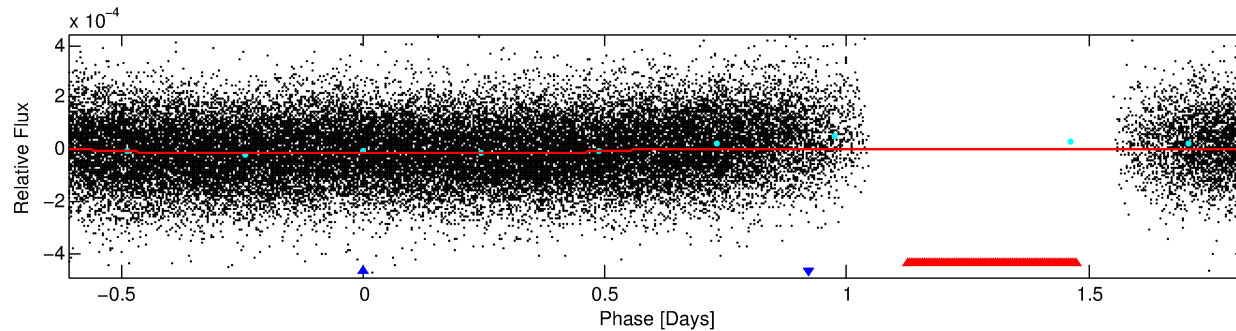
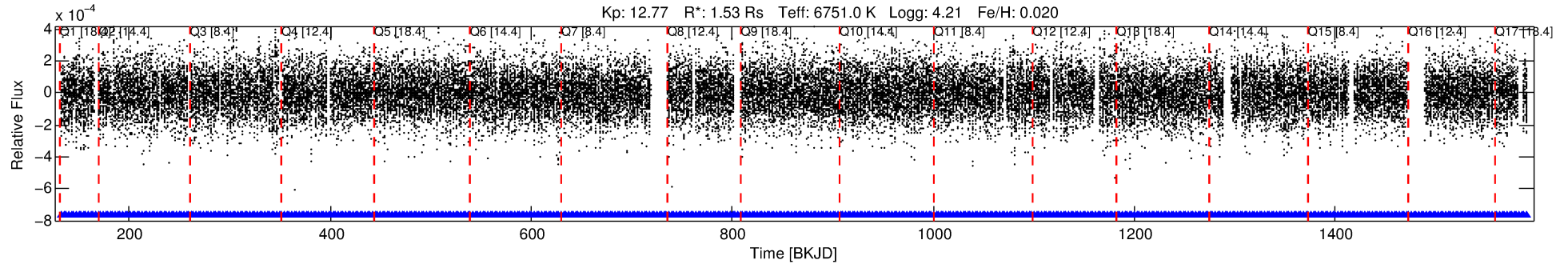
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 009414857-02

No Significant Match Found

# DV One-Page Summary

KIC: 9414857 Candidate: 2 of 2 Period: 2.437 d



## DV Fit Results:

Period = 2.43740 [0.00010] d  
Epoch = 132.8043 [0.0296] BKJD  
Rp/R\* = 0.0037 [0.0004]  
a/R\* = 1.00 [0.00]  
b = 0.90 [0.12]  
Seff = 2806.52 [835.32]  
Teff = 1856 [138] K  
Rp = 0.61 [0.16] Re  
a = 0.0393 [0.0073] AU  
Ag = 2.06 [11.36] [0.09 $\sigma$ ]  
Teffp = 3436 [4744] K [0.33 $\sigma$ ]

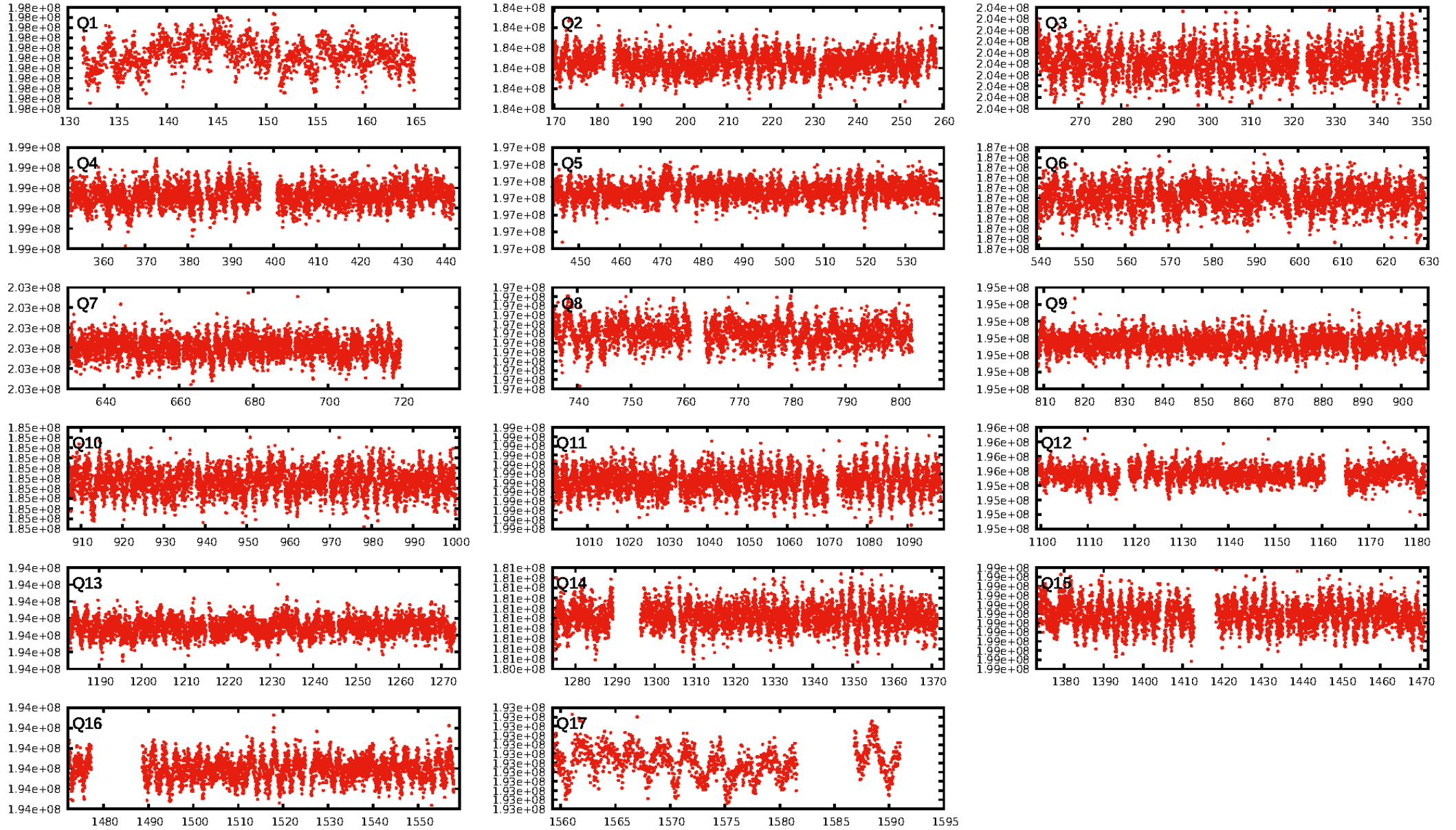
## DV Diagnostic Results:

ShortPeriod-sig: 0.0% [0.00 $\sigma$ ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [543/543]  
GhostDiagnostic-chr: 11.47  
Centroid-sig: 0.0%  
Centroid-so: 2.715 arcsec [3.64 $\sigma$ ]  
OotOffset-rm: N/A  
KicOffset-rm: N/A  
OotOffset-st: 0/0/0/0 [0]  
KicOffset-st: 0/0/0/0 [0]  
DiffImageQuality-fgm: N/A  
DiffImageOverlap-fno: 0.00 [0/17]

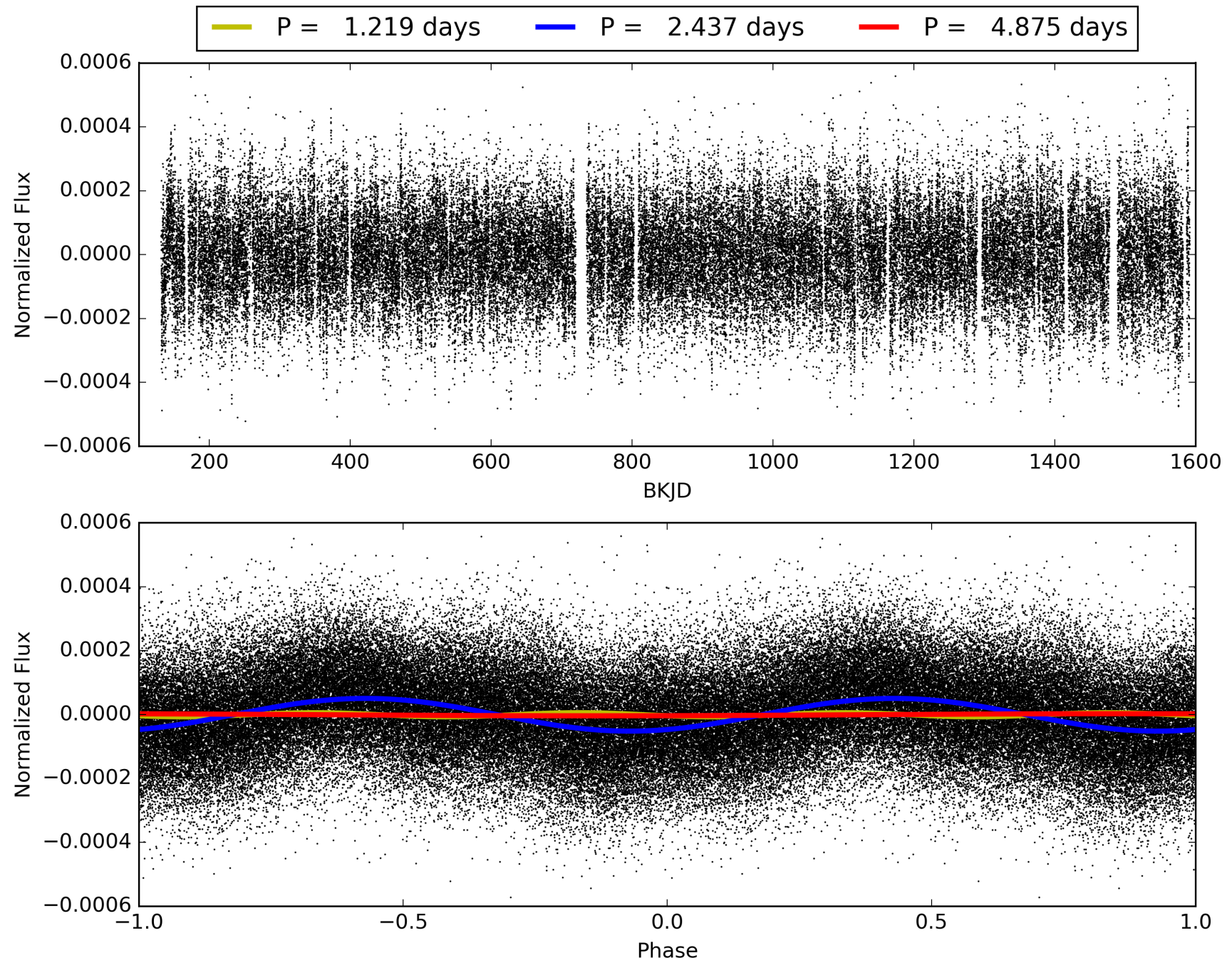
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 07:35:30 Z

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

# TCE 009414857-02, PDC Light Curves

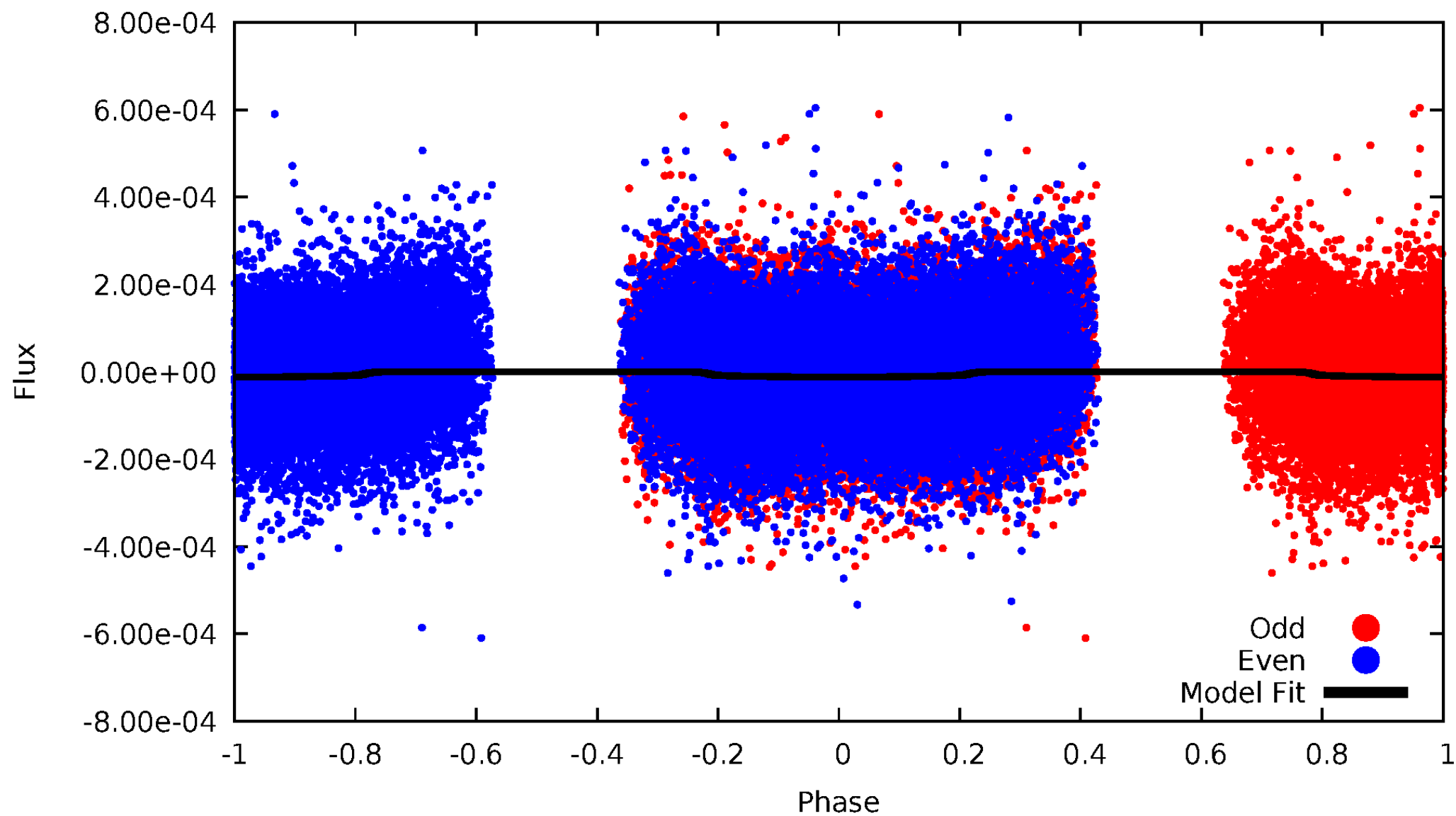


TCE 009414857-02



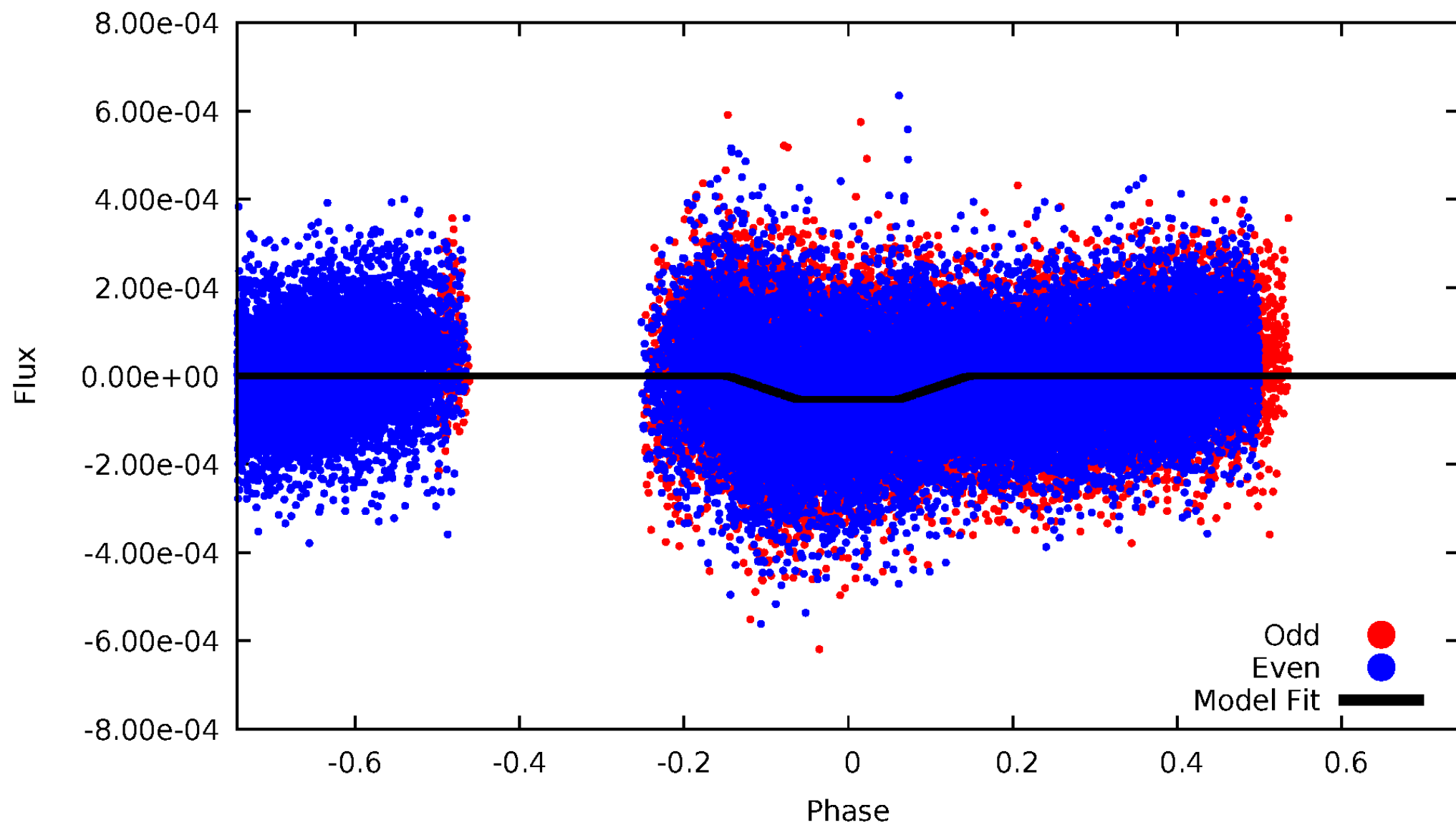
DV Odd/Even

TCE 009414857-02



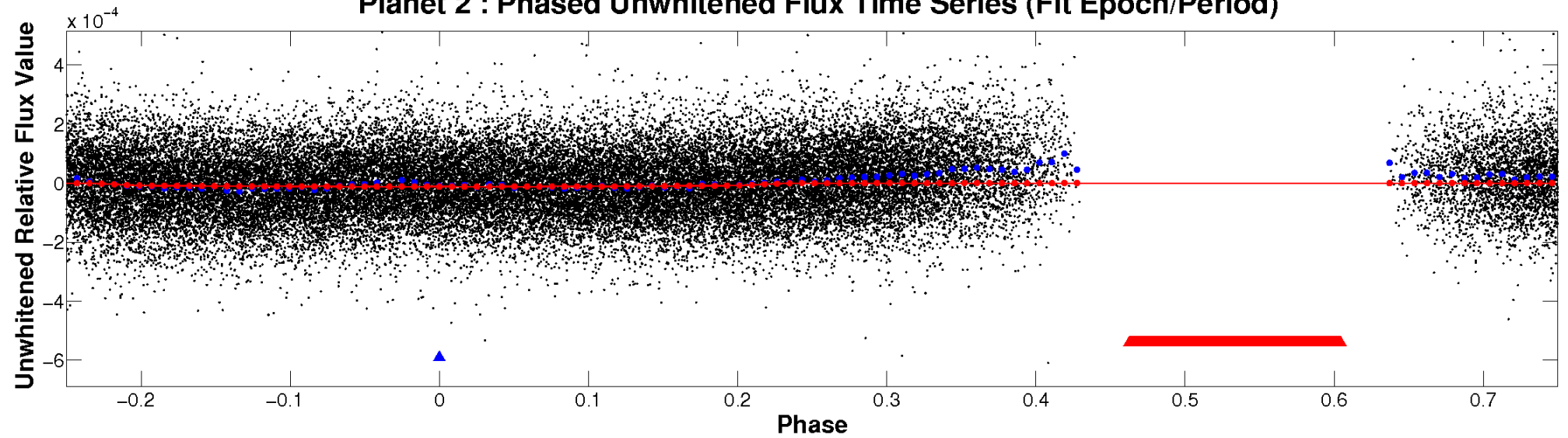
# ALT Odd/Even

TCE 009414857-02

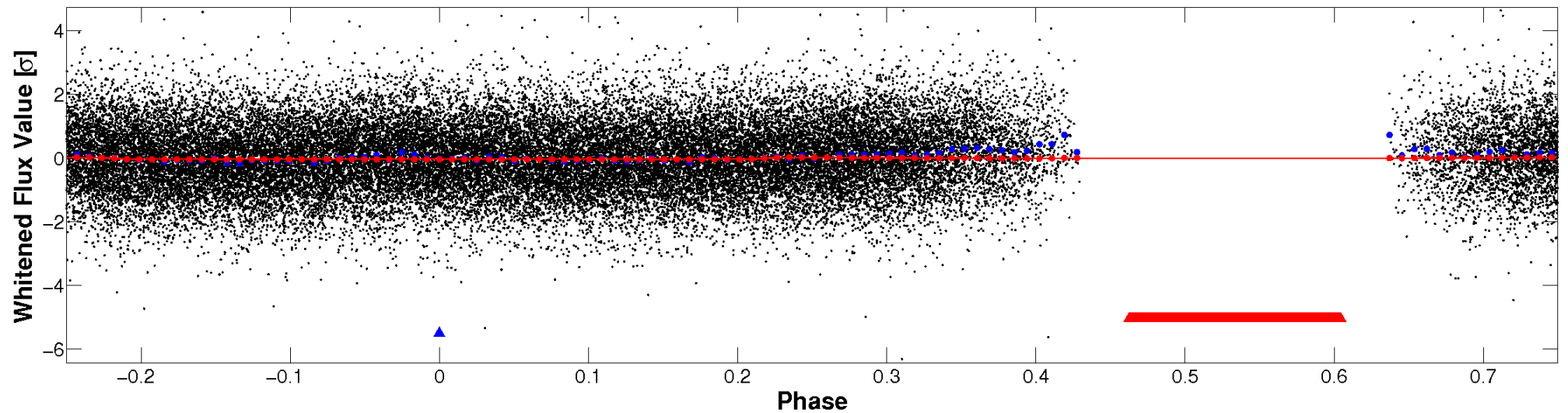


# Non-Whitened Vs. Whitened Light Curve

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

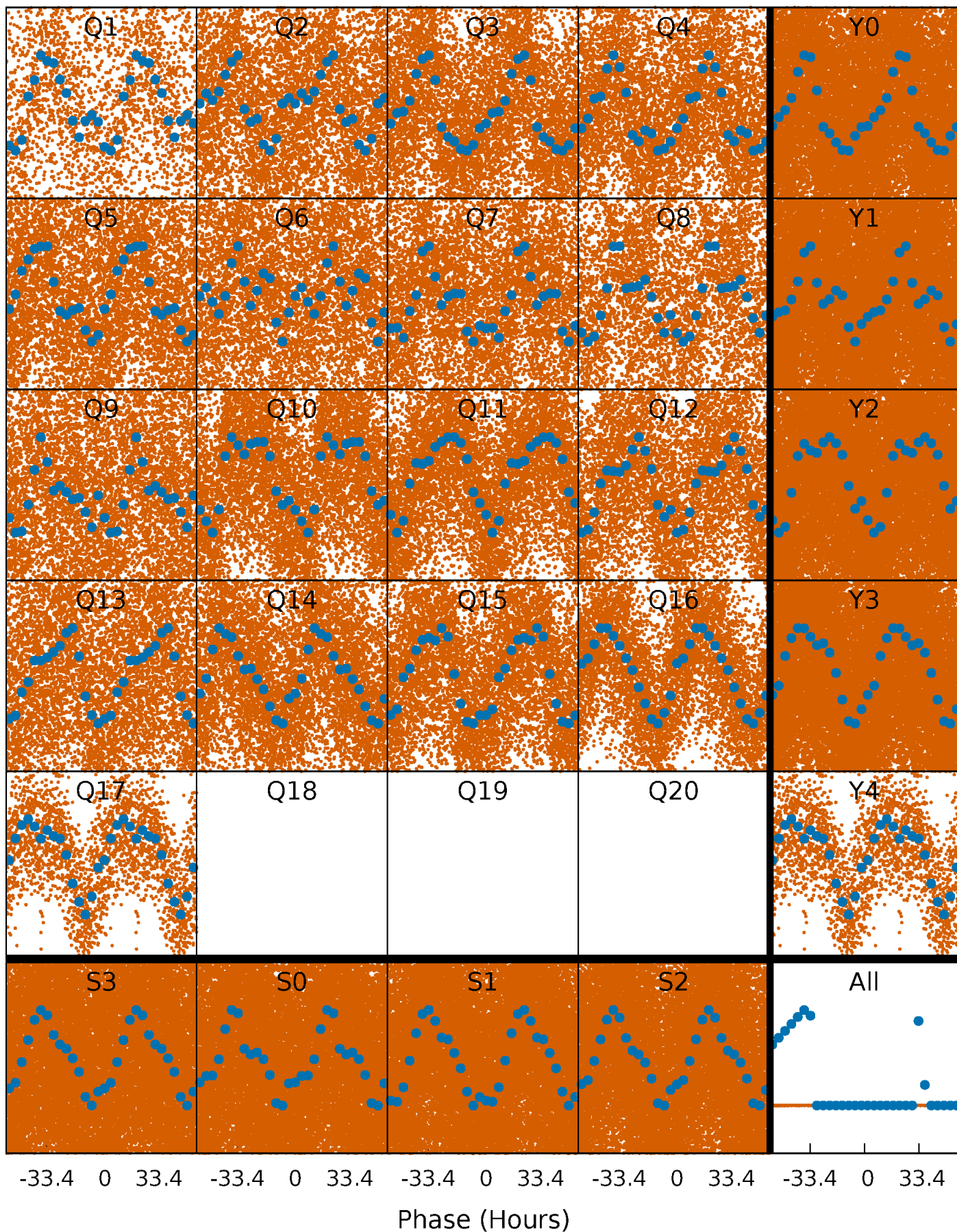


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



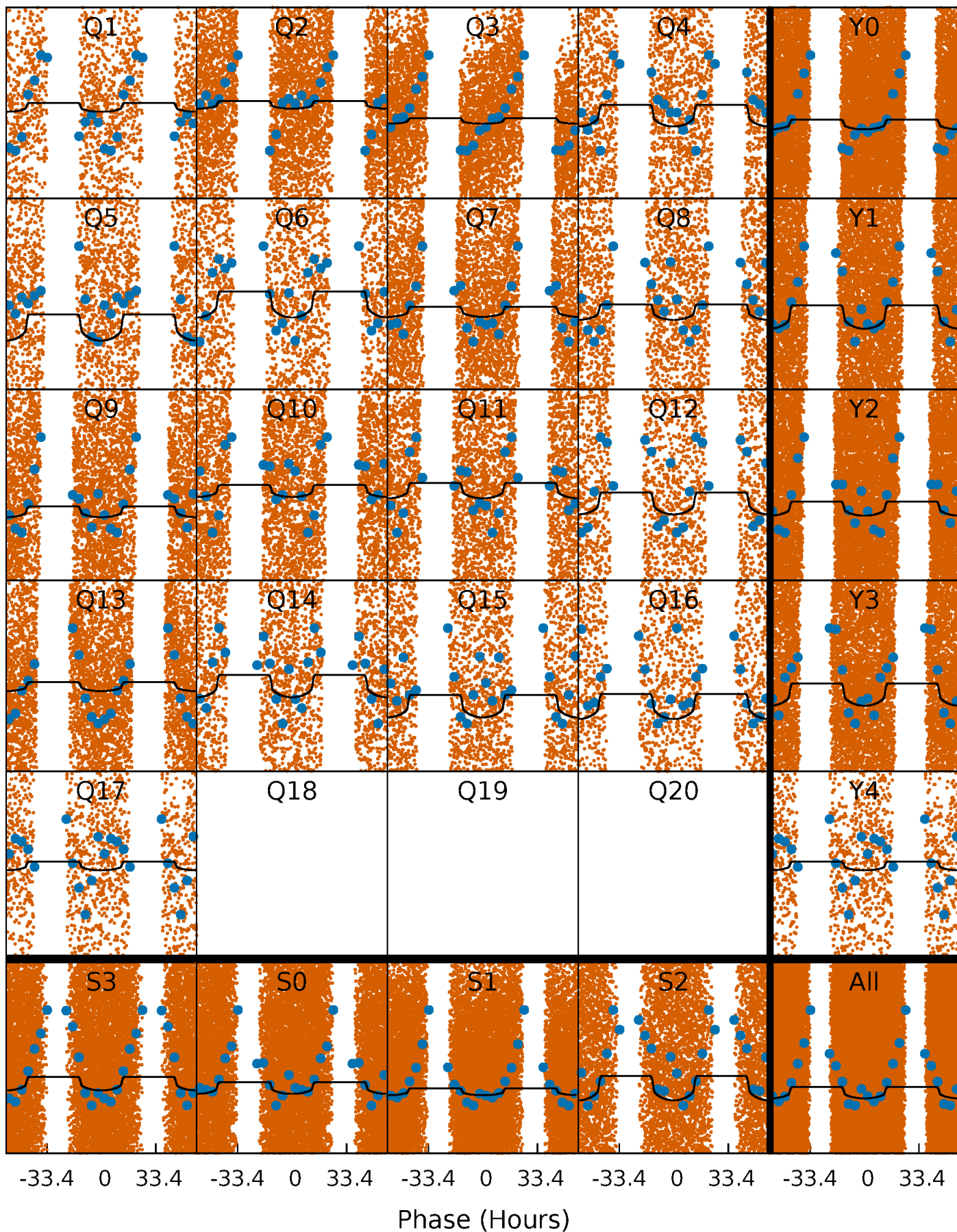
# PDC Quarter-Phased Transit Curves

TCE 009414857-02   P= 2.437396 Days    $T_0=132.804338$  (BKJD)



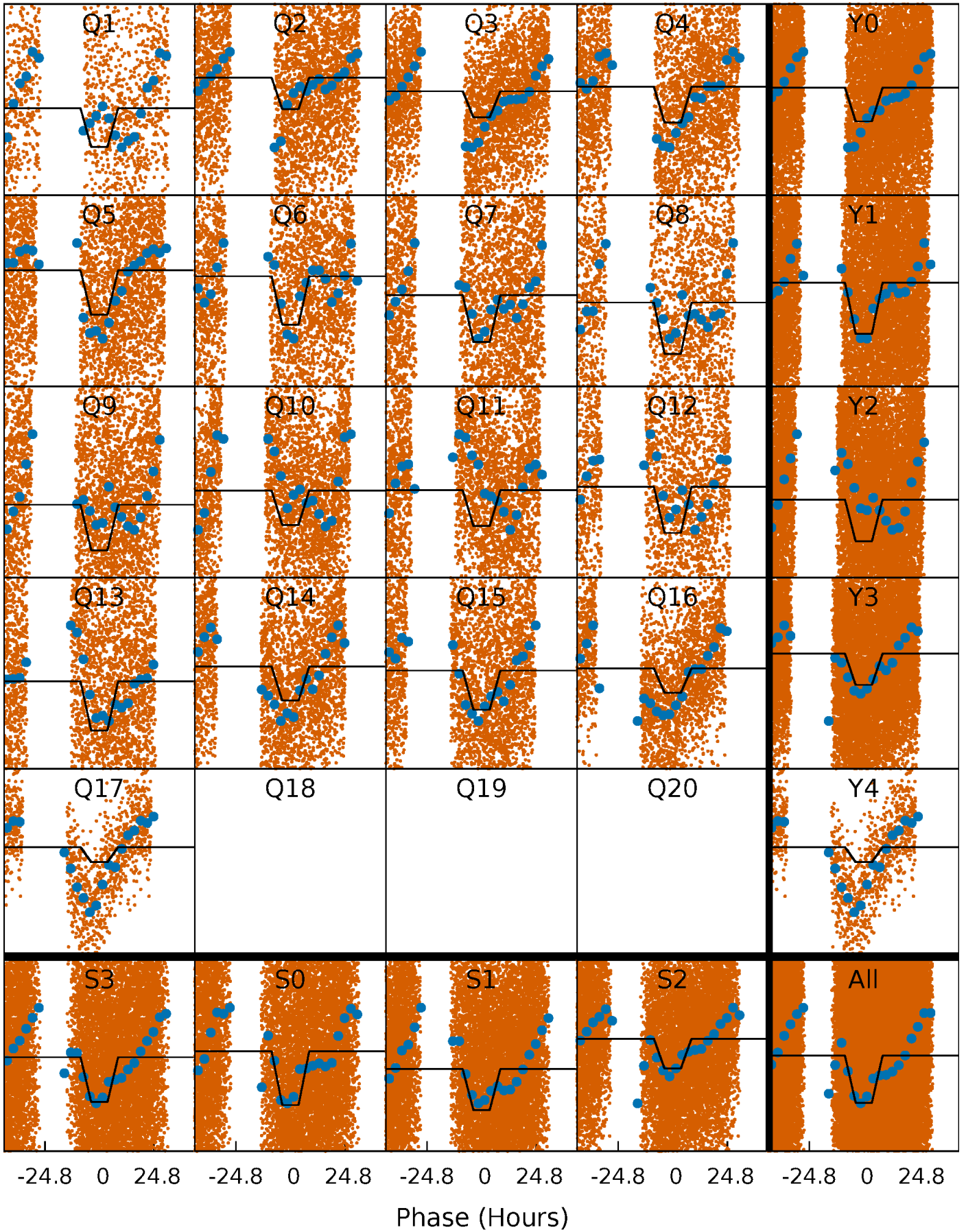
# DV Quarter-Phased Transit Curves

TCE 009414857-02   P= 2.437396 Days    $T_0=132.804338$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

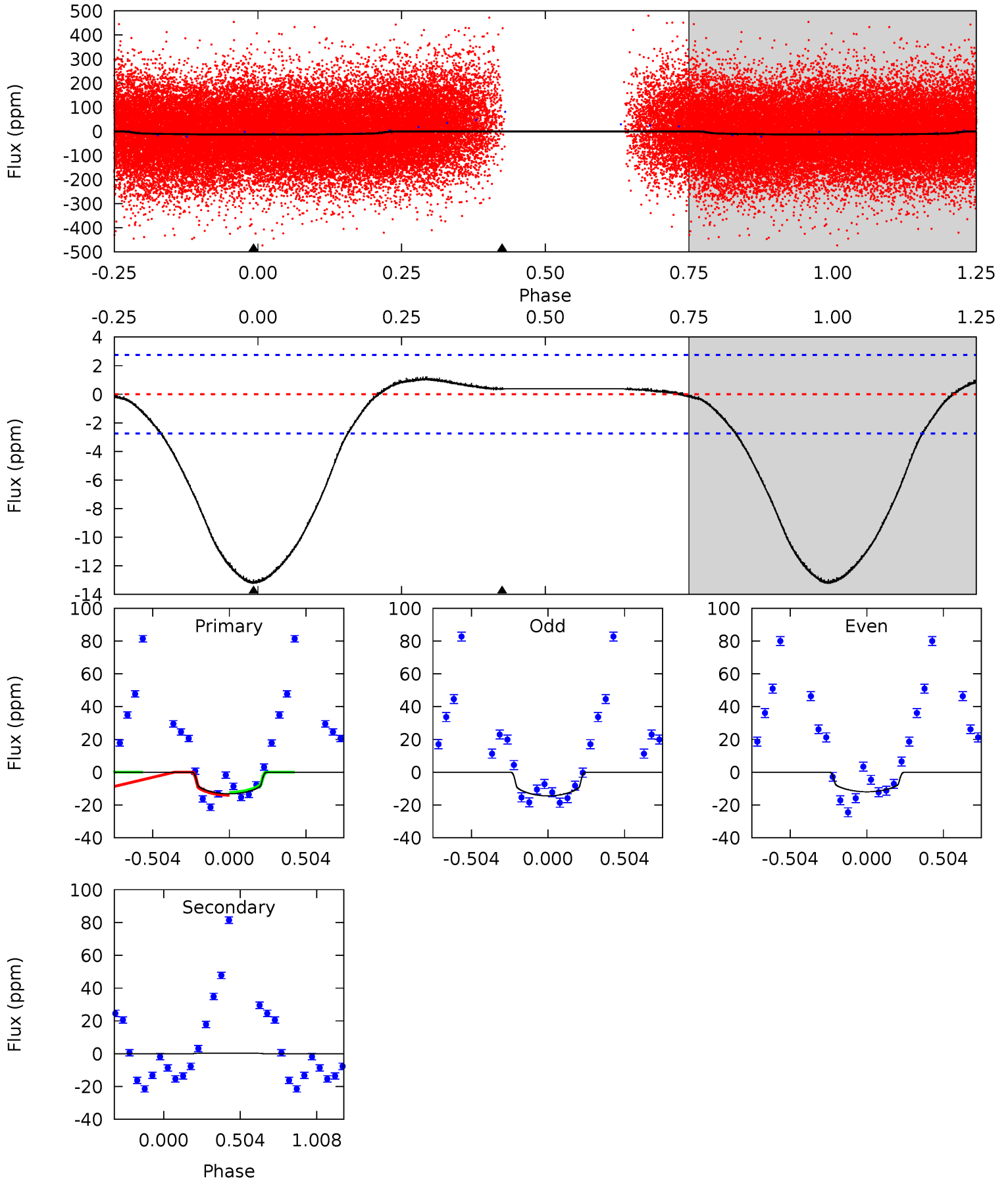
TCE 009414857-02   P= 2.437389 Days    $T_0=132.537297$  (BKJD)



# DV Model-Shift Uniqueness Test

009414857-02, P = 2.437396 Days, E = 130.366942 Days

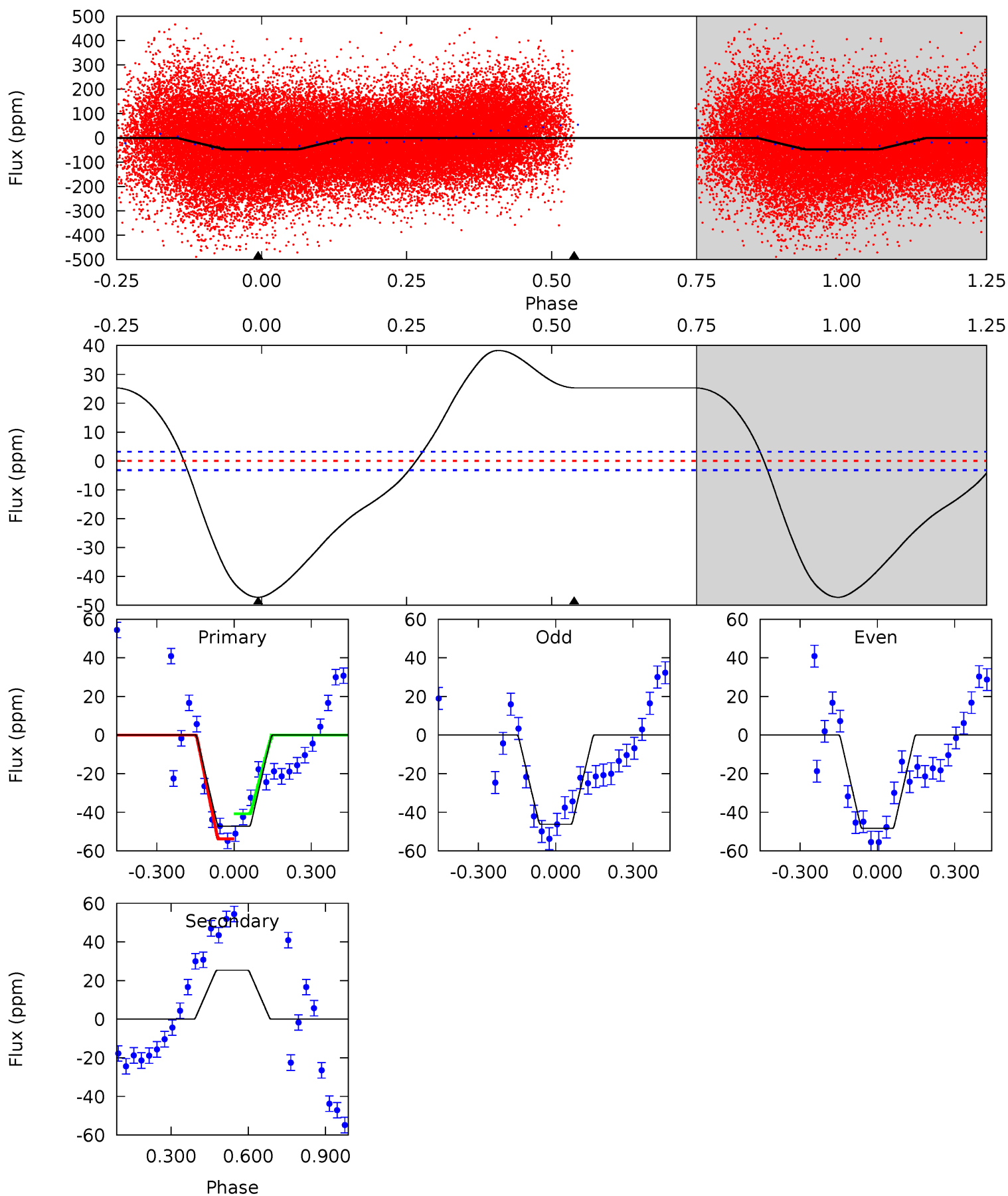
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
20.2	-0.54	0	0	4.21	0.67	0.35	20.2	20.2	-0.54	-0.54	1.93	-41.8	0.09	1.34



# Alt Model-Shift Uniqueness Test

009414857-02, P = 2.437389 Days, E = 130.099908 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
63.7	-34.2	0	0	4.33	1.04	7.12	63.7	63.7	-34.2	-34.2	1.40	1.29	0.45	7.65



### Stellar Parameters For KIC 009414857

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6751^{+162}_{-243}$	$4.205^{+0.112}_{-0.138}$	$0.020^{+0.250}_{-0.350}$	$1.526^{+0.347}_{-0.260}$	$1.361^{+0.159}_{-0.194}$	$0.540^{+0.286}_{-0.219}$
	+2%/-4%	+3%/-3%	+1250%/-1750%	+23%/-17%	+12%/-14%	+53%/-41%
Source	PHO1	FLK73	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 009414857-02 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	$0\pm1$	$0.61^{+0.10}_{-0.09}$	$2603^{+141}_{-147}$	$-3425^{+6209}_{-543}$	$-0.693^{+1.241}_{-1.581}$
Alt.	$25\pm1$	$1.20^{+0.17}_{-0.14}$	$2593^{+171}_{-151}$	$-5640^{+204}_{-237}$	$-14.706^{+3.284}_{-3.891}$

$T_{\text{max}}$  = 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

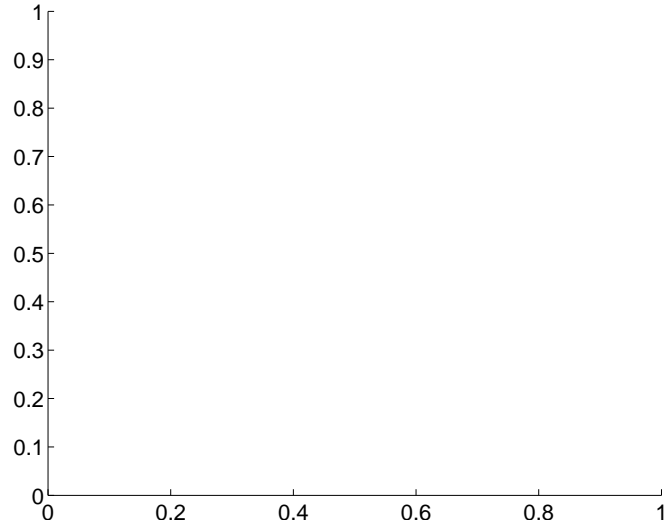
Supplemental centroid analysis for 009414857-02. Kepler magnitude: 12.77. Transit SNR 7.05

There are 0 quarters with good PRF difference image offsets

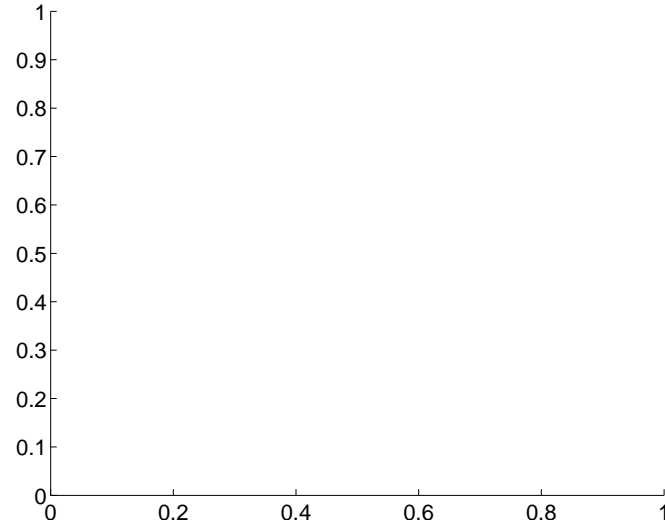
The direct PRF centroid is offset from the target star catalog position by about NaN arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	—	—	—	—
PRF-fit source offset from KIC position	—	—	—	—
photometric centroid source offset	$2.71 \pm 0.75$	$3.64$	$-1.92 \pm 0.70$	$-1.92 \pm 0.79$

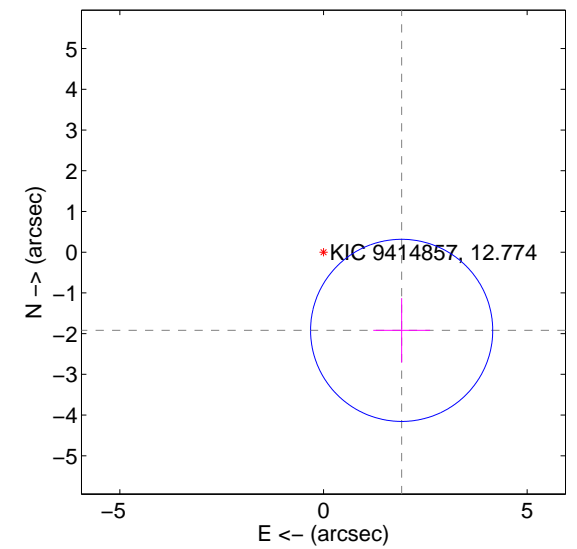
There is no PRF-fit offset from OOT-fit



There is no PRF-fit offset from KIC

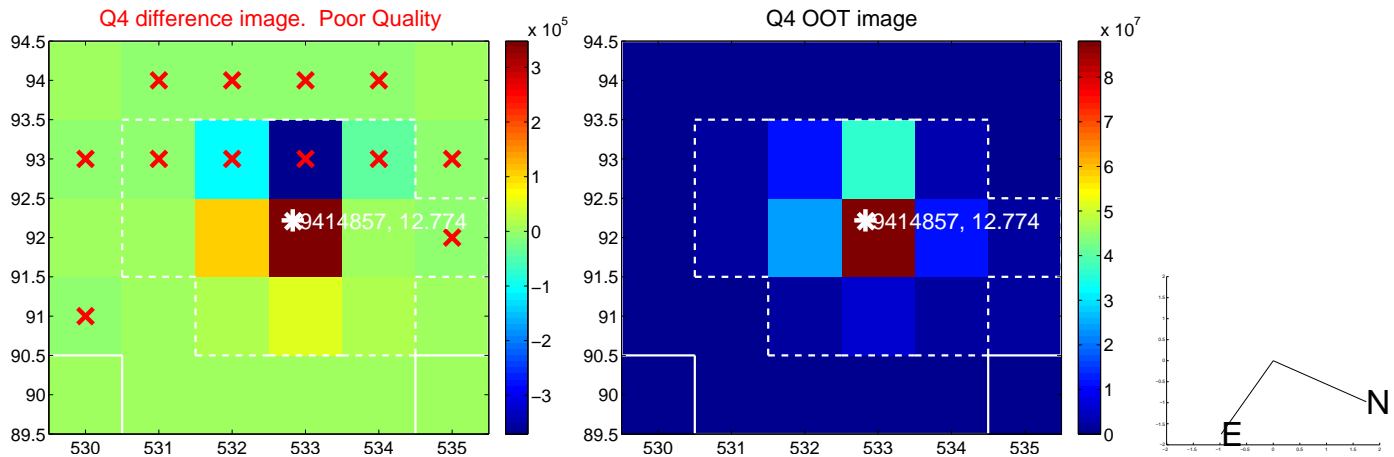
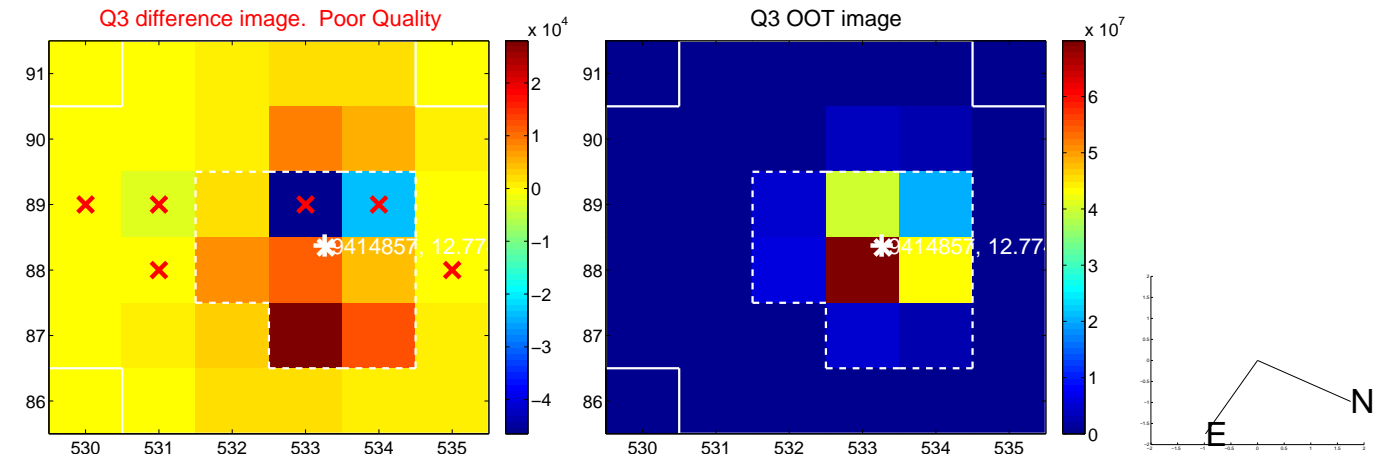
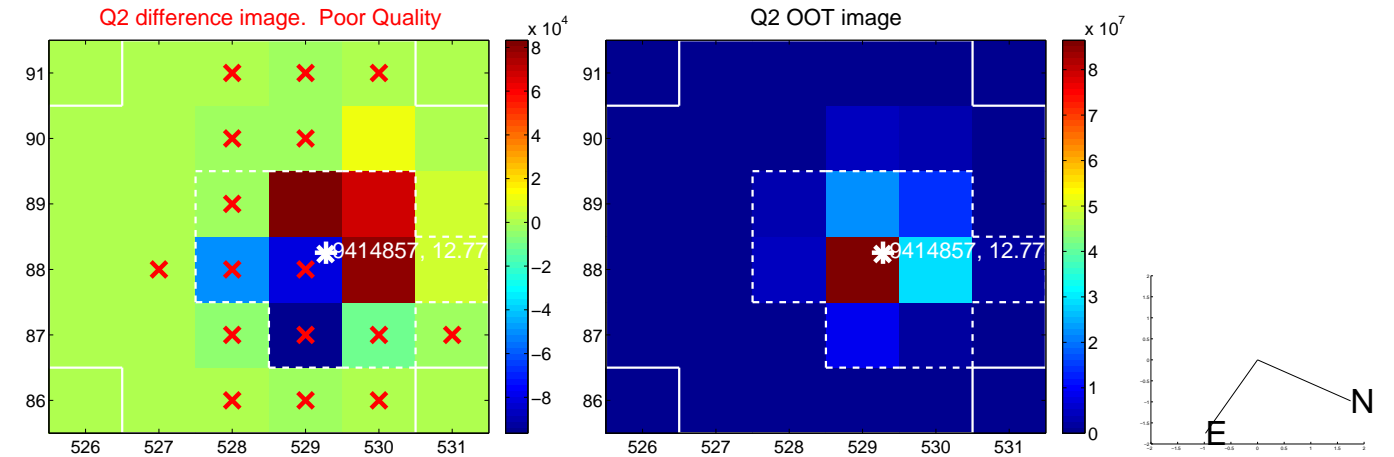
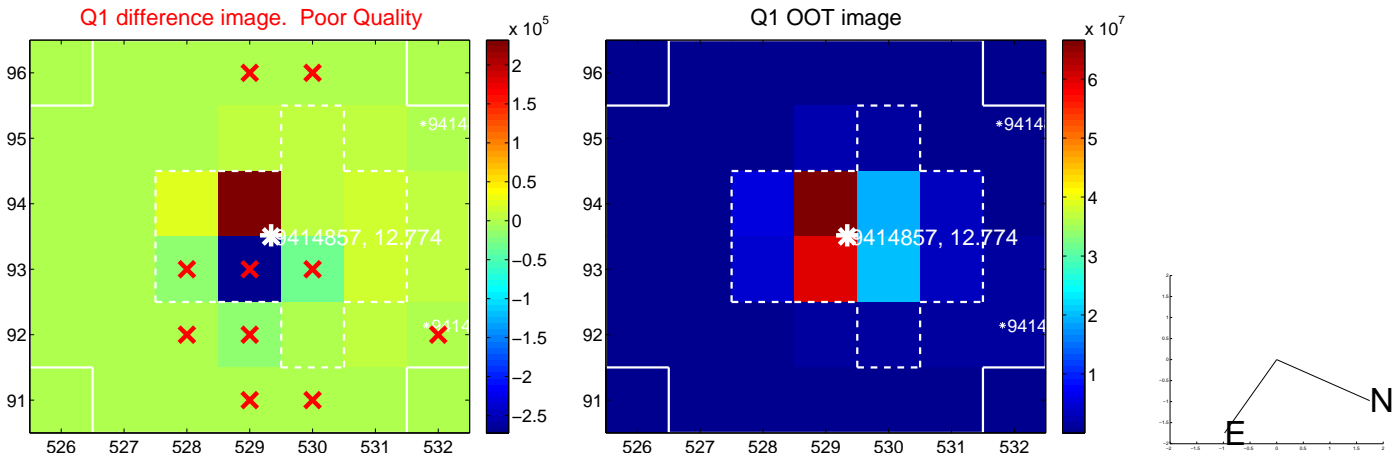


offset from photometric centroids

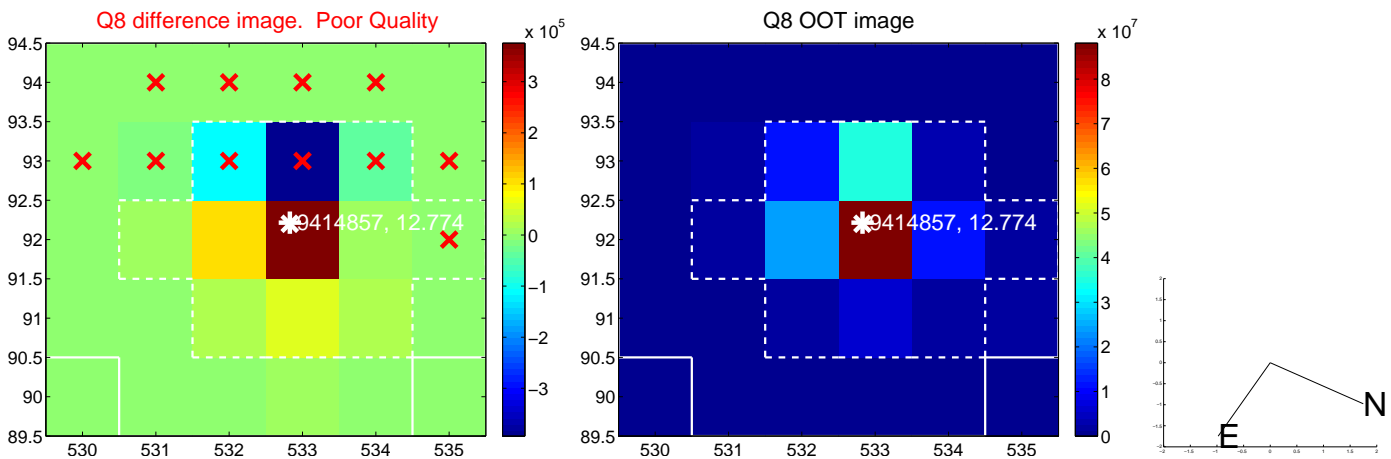
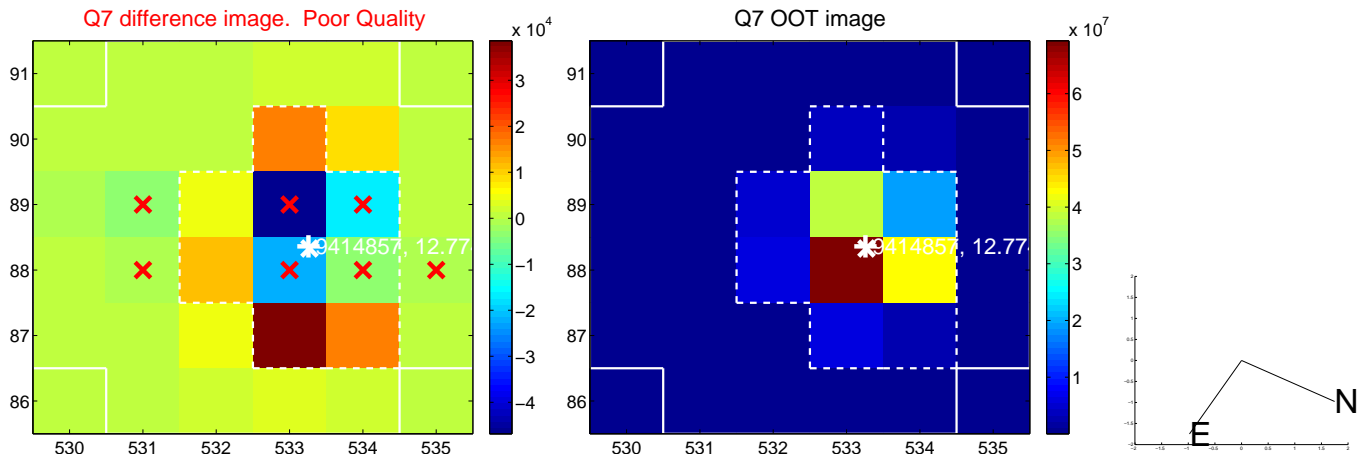
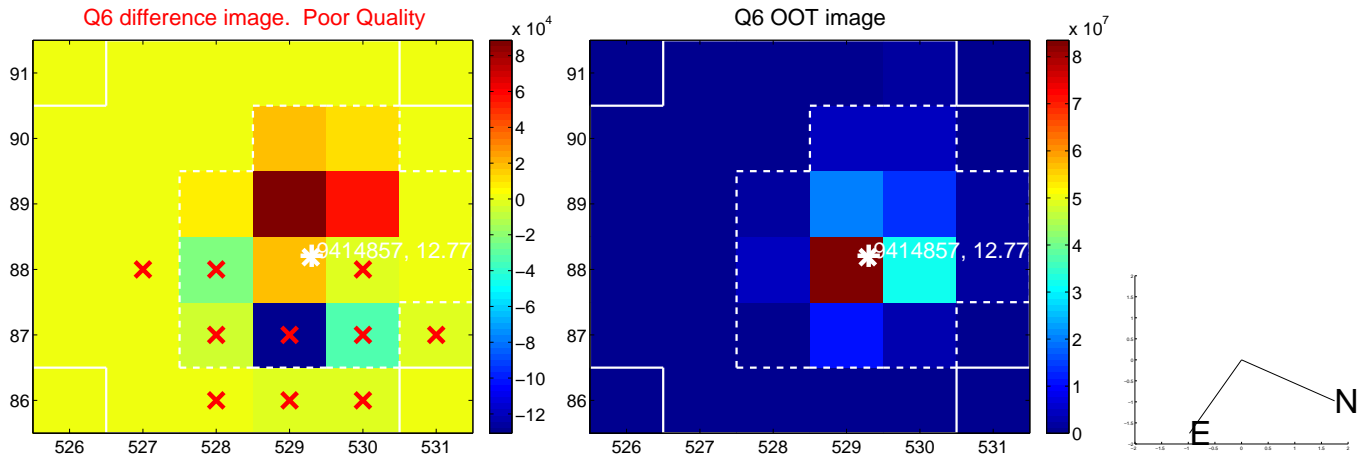
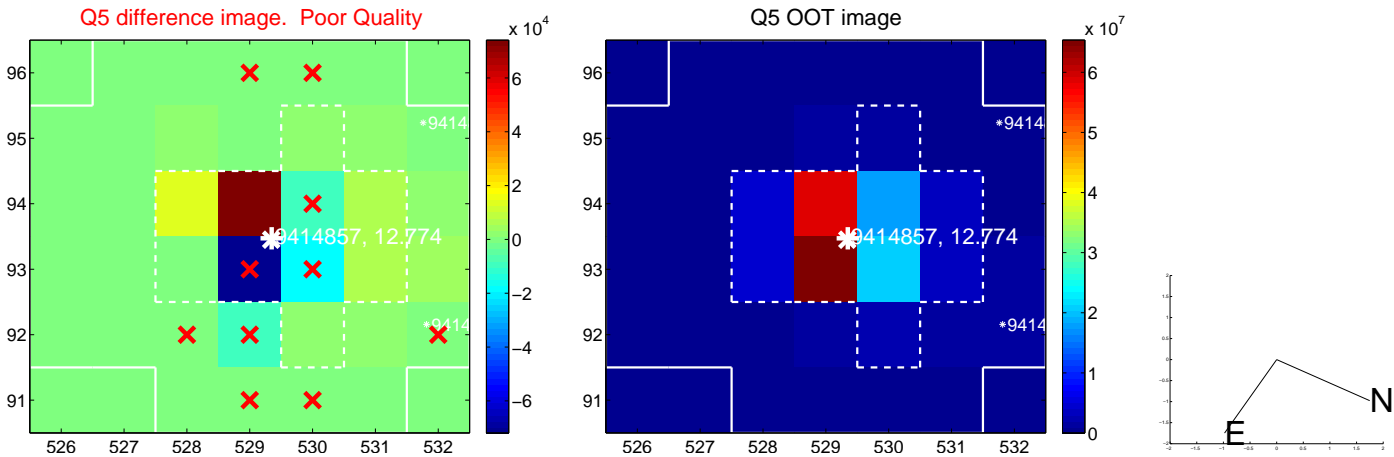


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

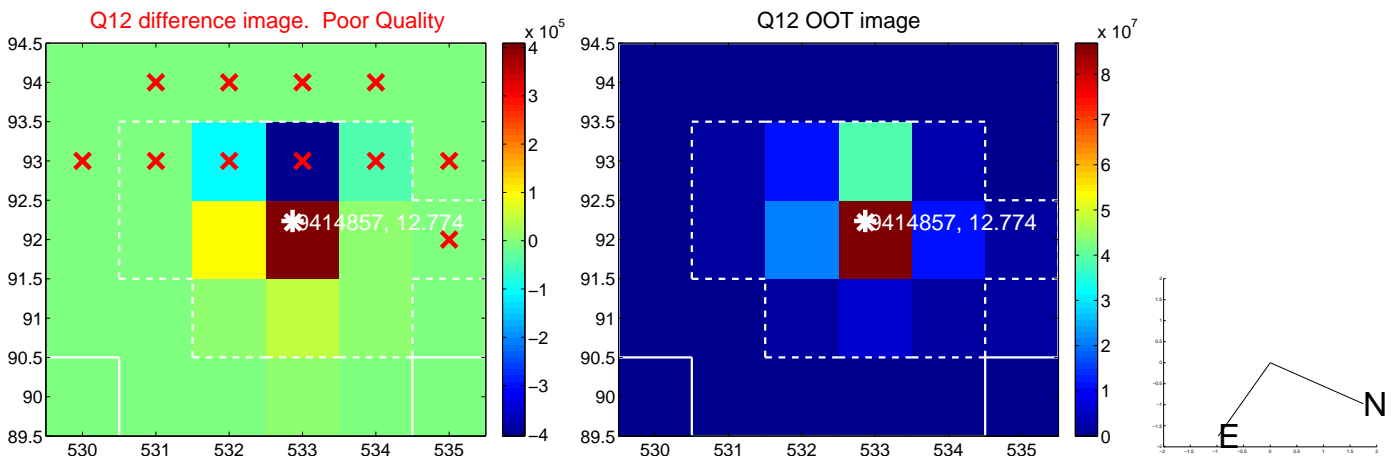
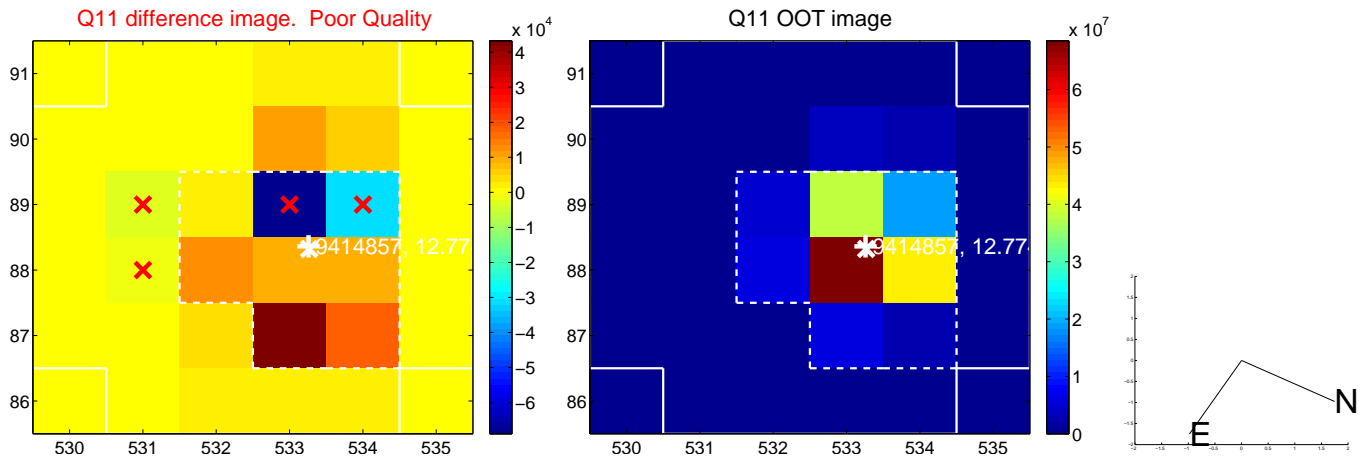
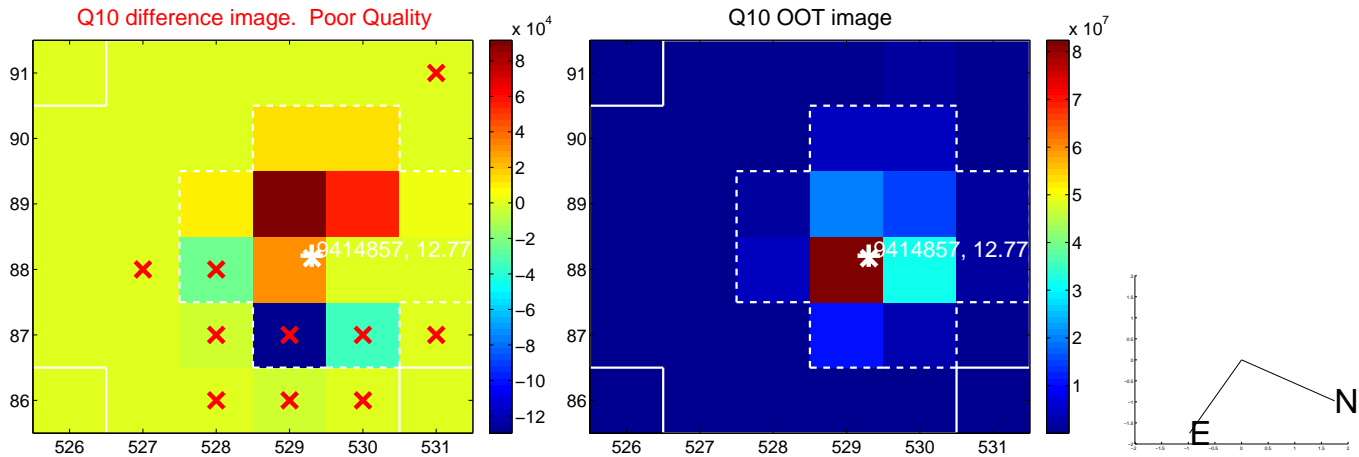
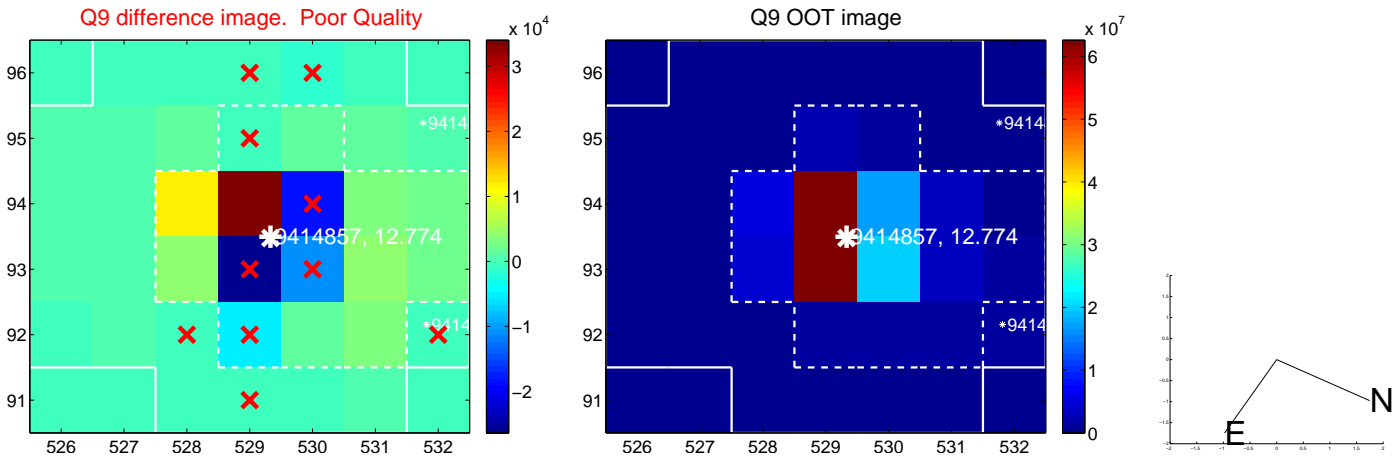
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



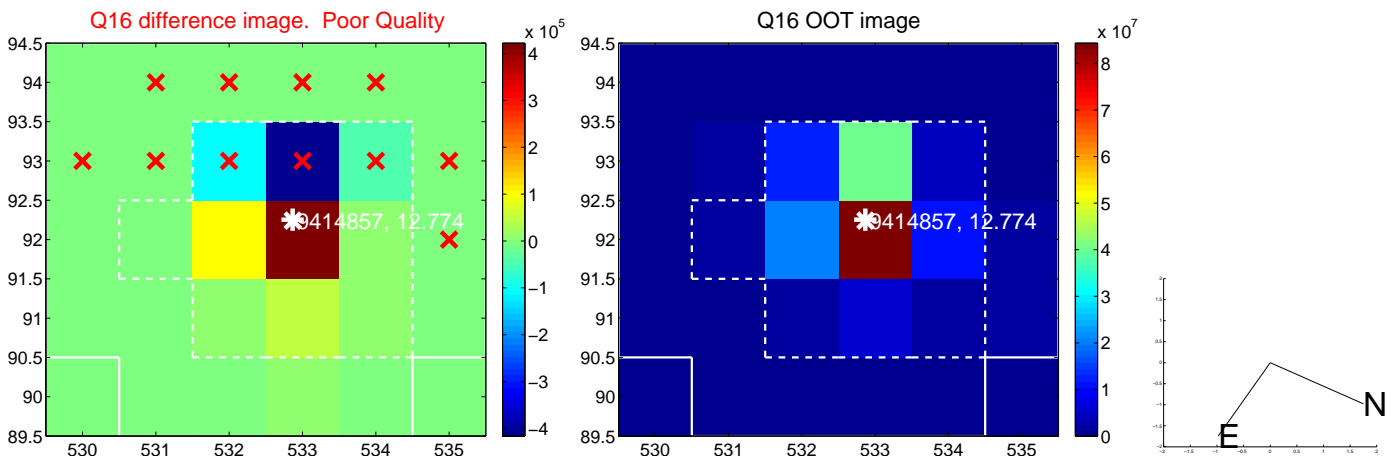
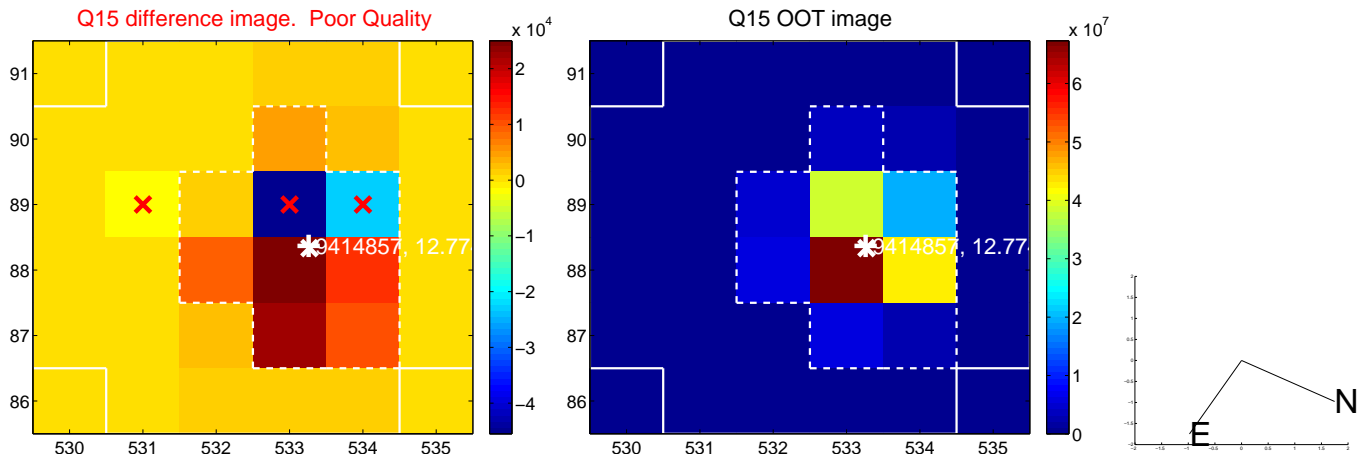
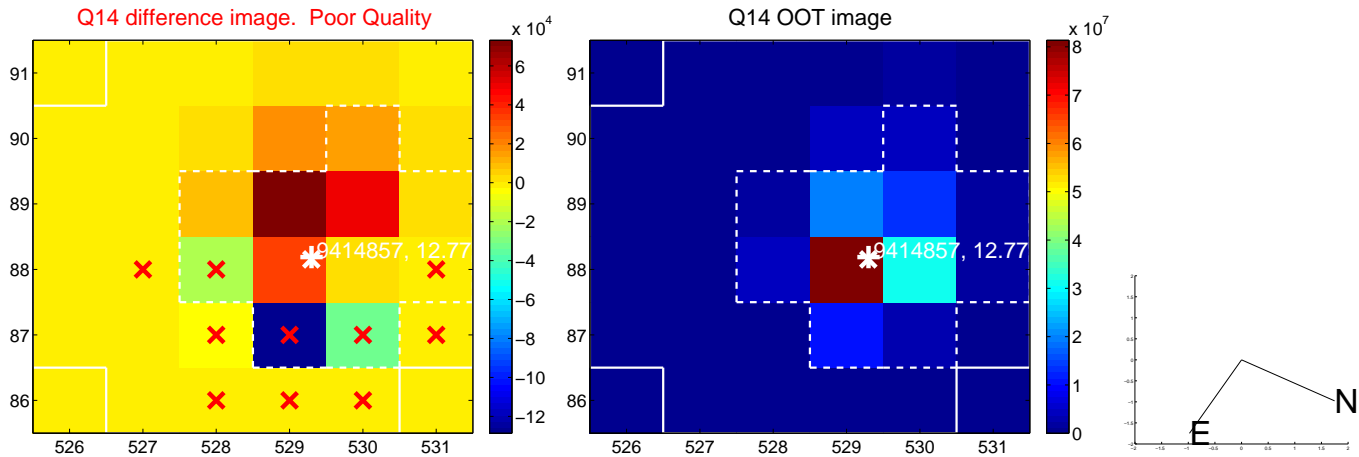
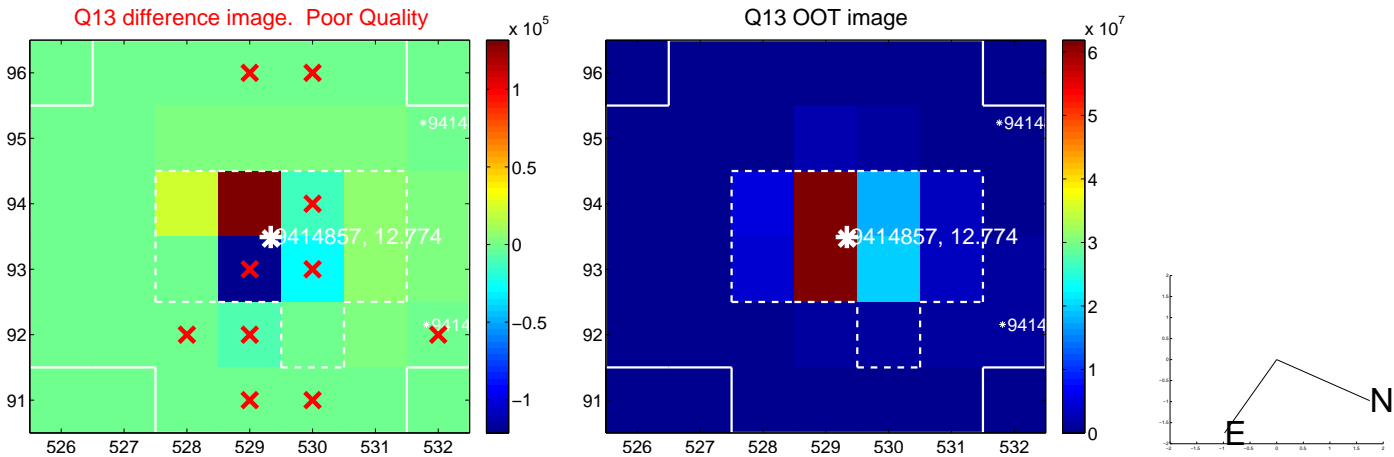
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



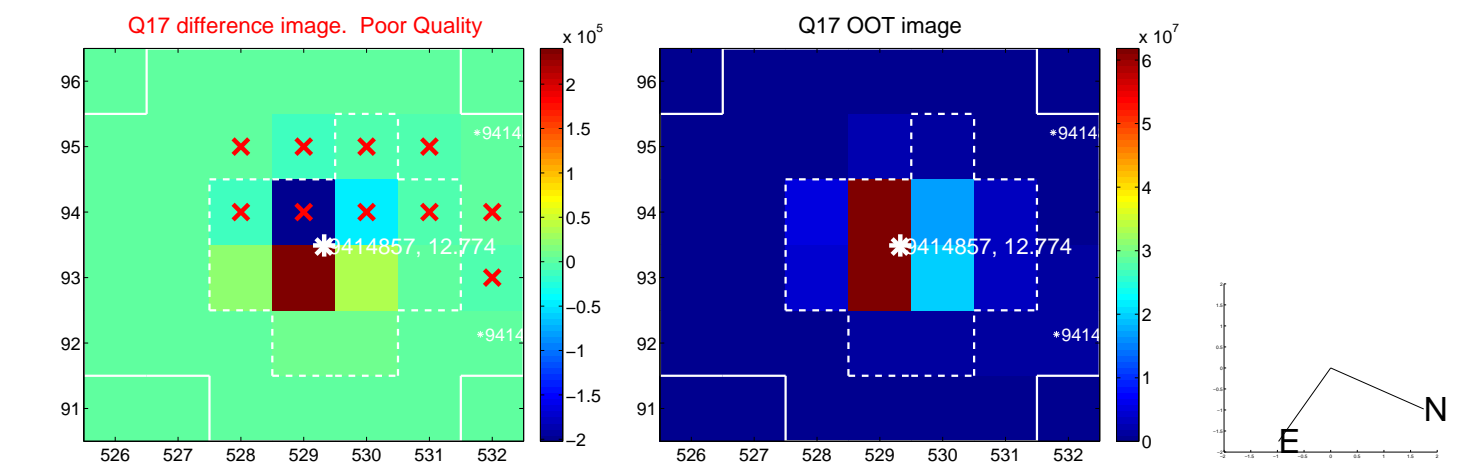
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



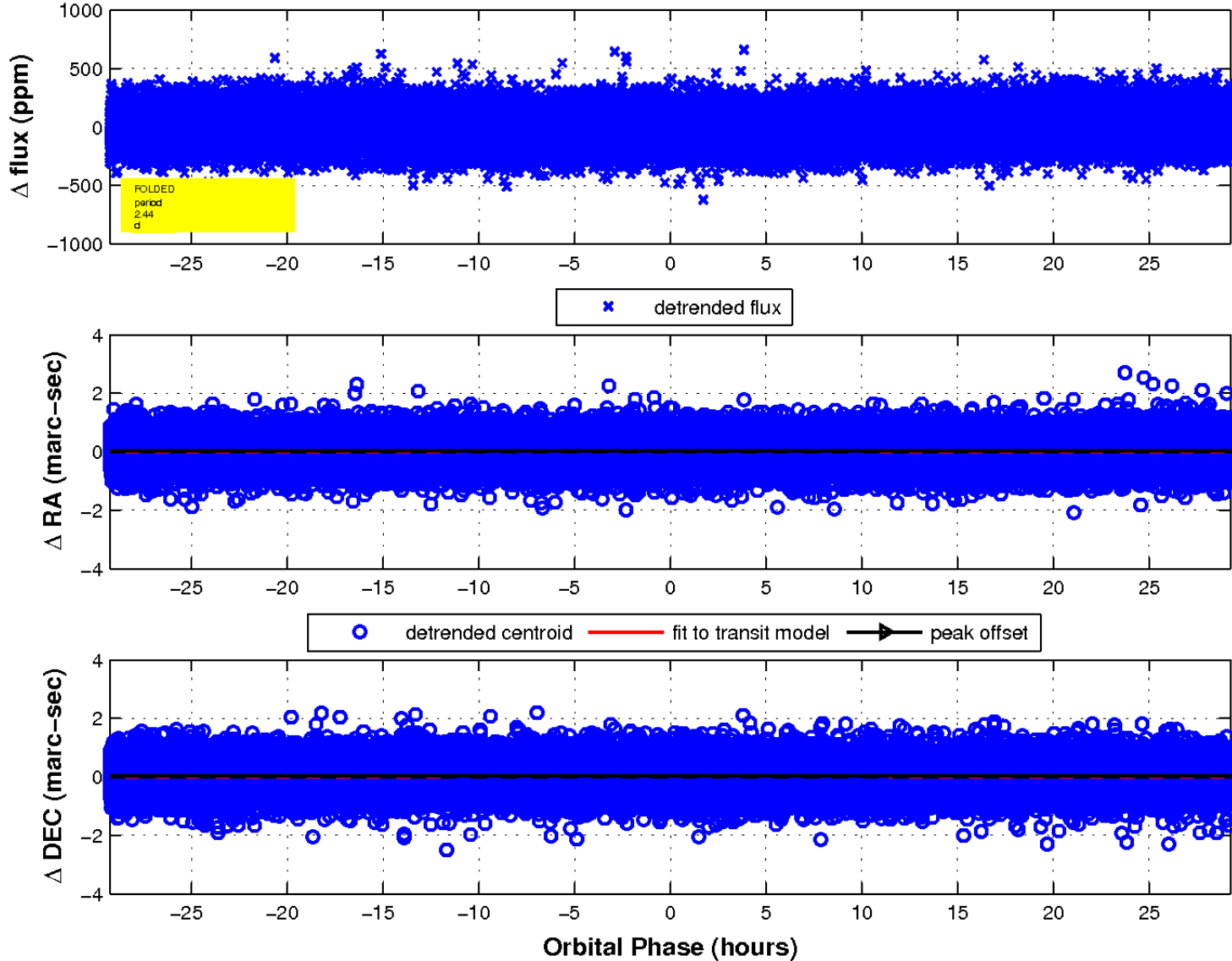
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



fluxWeightedCentroids, Planet 2 of 2



UKIRT Image

