

# KIC 009016344

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009016344-01	OBS	No	0.546865	131.739521	35.7	2.440	12.5	13.2	1.89	7207	1.31	38576.78
009016344-02	OBS	No	0.546863	131.917672	35.5	1.856	10.8	11.4	1.89	7207	1.31	38576.93
009016344-03	OBS	No	42.076666	169.999906	435.1	3.821	8.5	10.0	1.89	7207	4.60	117.88
009016344-04	OBS	No	128.810512	162.137543	871.7	3.510	8.7	8.5	1.89	7207	6.72	26.52
009016344-05	OBS	No	35.457679	137.022461	485.4	3.034	8.6	8.4	1.89	7207	7.72	148.10
009016344-06	OBS	No	44.605881	171.168409	313.3	3.373	7.9	6.9	1.89	7207	3.66	109.05

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009016344-01	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT
009016344-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE_ZUMA—LPP_DV—MOD_NONUNIQ_DV—SAME_NTL_PERIOD
009016344-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT
009016344-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT
009016344-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_ALT
009016344-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT

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

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

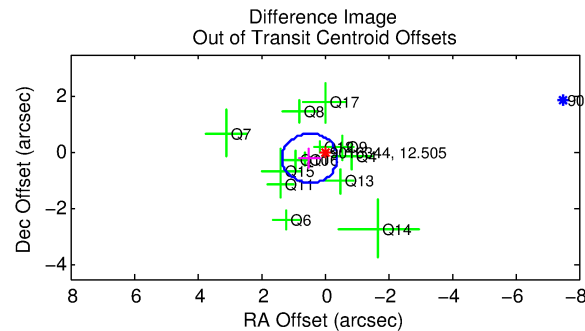
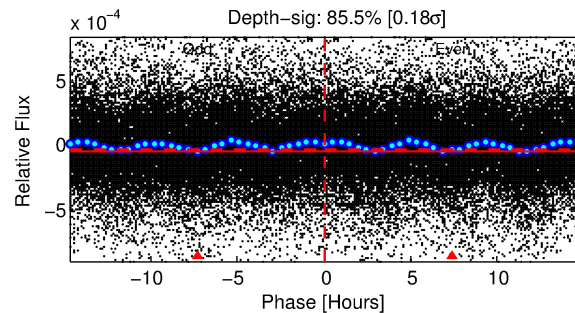
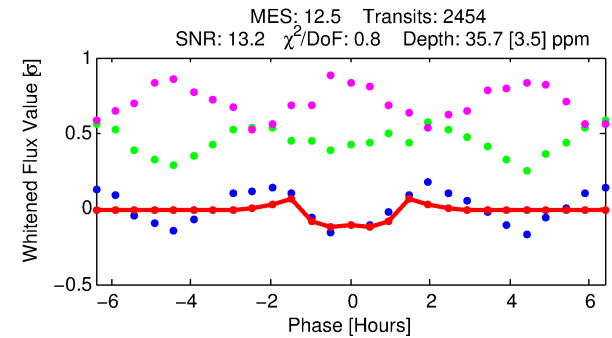
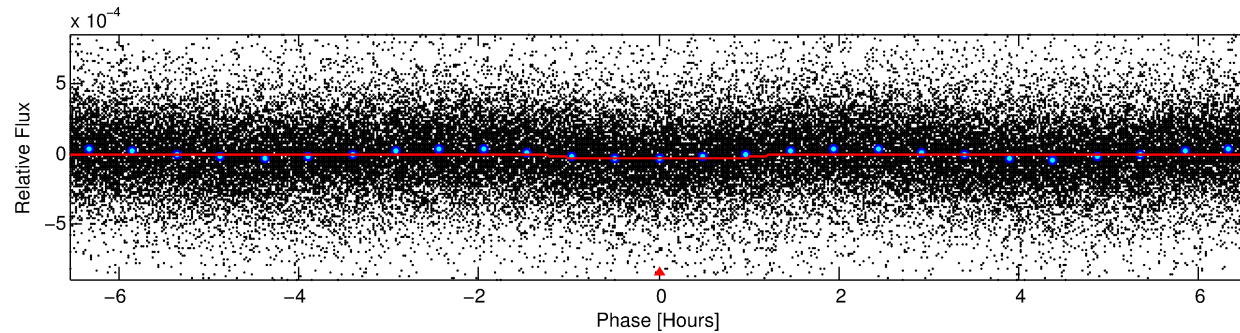
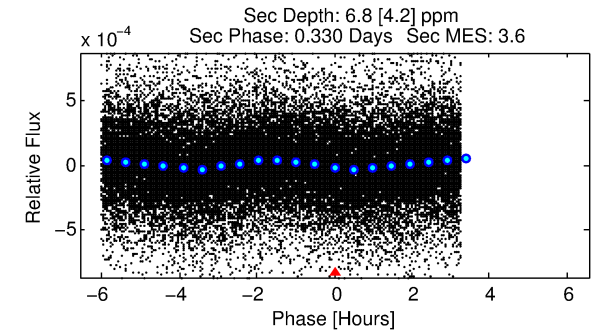
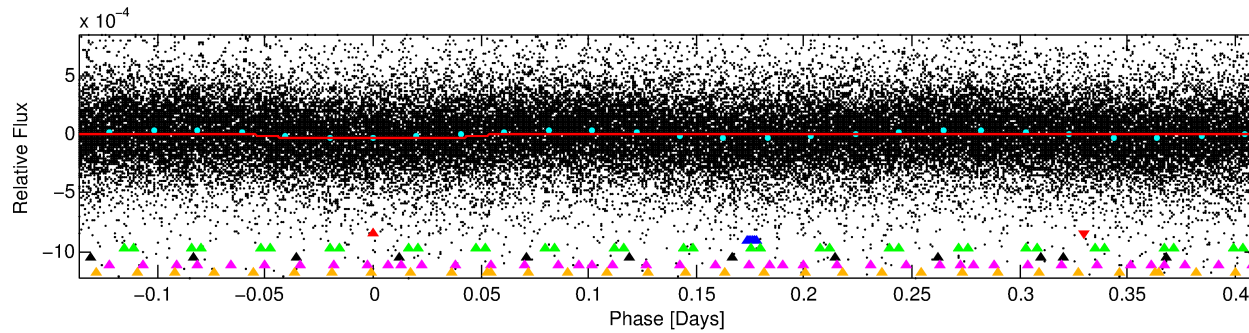
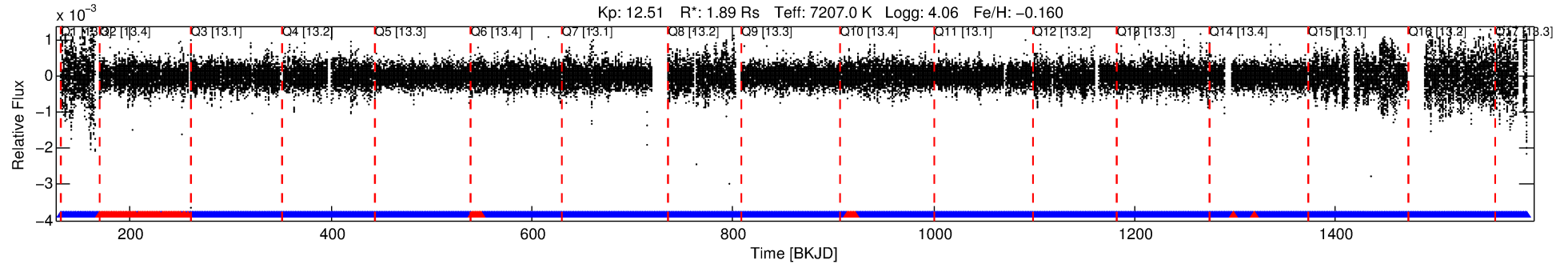
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 009016344-01

No Significant Match Found

# DV One-Page Summary

KIC: 9016344 Candidate: 1 of 6 Period: 0.547 d



## DV Fit Results:

Period = 0.54686 [0.00001] d  
Epoch = 131.7395 [0.0012] BKJD  
Rp/R\* = 0.0064 [0.0010]  
a/R\* = 1.22 [0.39]  
b = 0.90 [0.21]  
Seff = 38576.78 [14933.16]  
Teq = 3574 [346] K  
Rp = 1.31 [0.45] Re  
a = 0.0150 [0.0037] AU  
Ag = 0.49 [0.38] [-1.34σ]  
Teffp = 4619 [832] K [1.16σ]

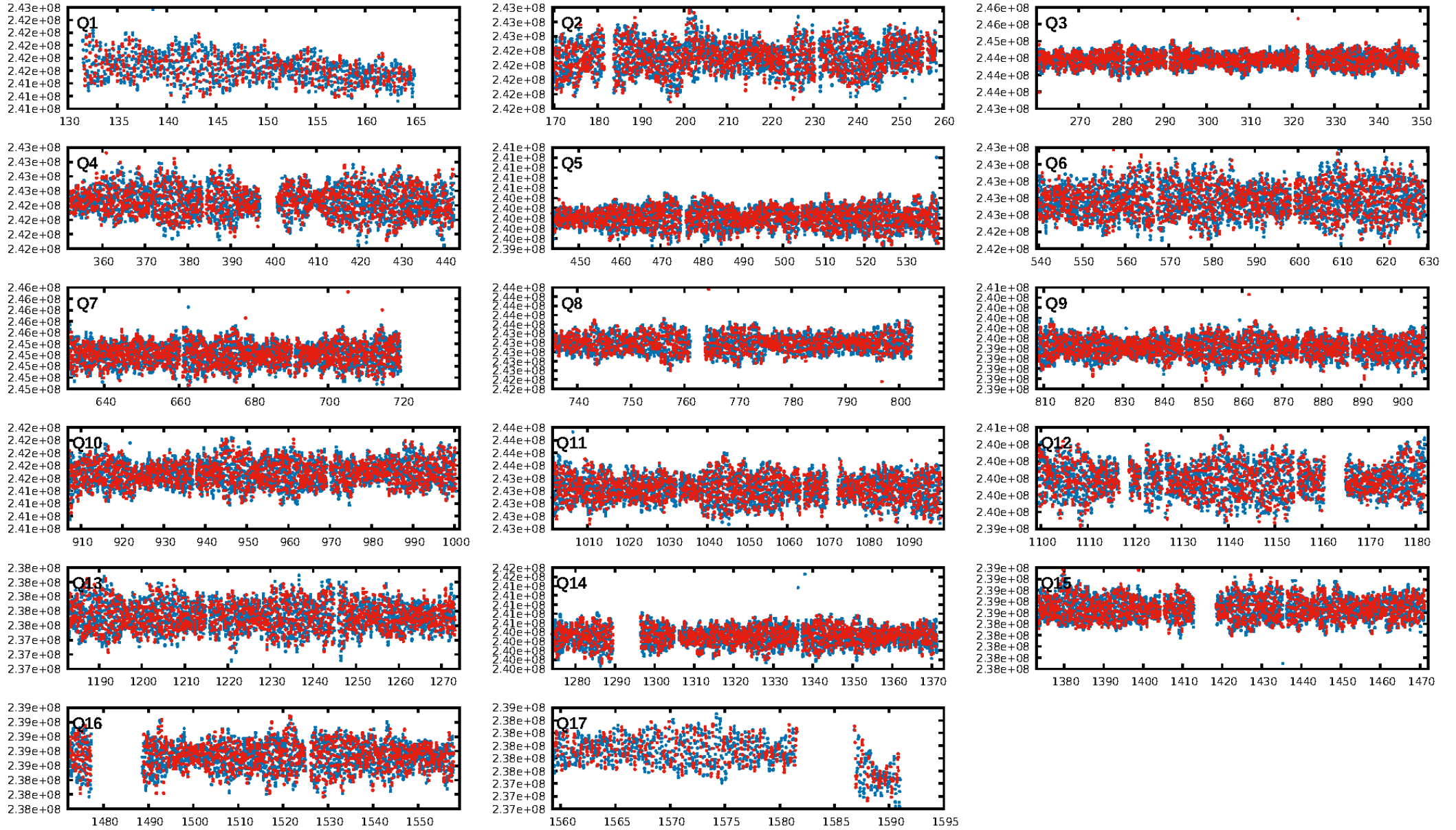
## DV Diagnostic Results:

ShortPeriod-sig: 0.0% [0.00σ]  
LongPeriod-sig: 100.0% [215.22σ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: N/A  
RollingBand-fgt: 0.94 [2207/2344]  
GhostDiagnostic-chr: 2.411  
Centroid-sig: 24.2%  
Centroid-so: 0.411 arcsec [1.09σ]  
OotOffset-rm: 0.515 arcsec [1.77σ]  
KicOffset-rm: 0.591 arcsec [1.97σ]  
OotOffset-st: 3/3/4/3 [13]  
KicOffset-st: 3/3/4/3 [13]  
DiffImageQuality-fgm: 0.77 [10/13]  
DiffImageOverlap-fno: 0.00 [0/17]

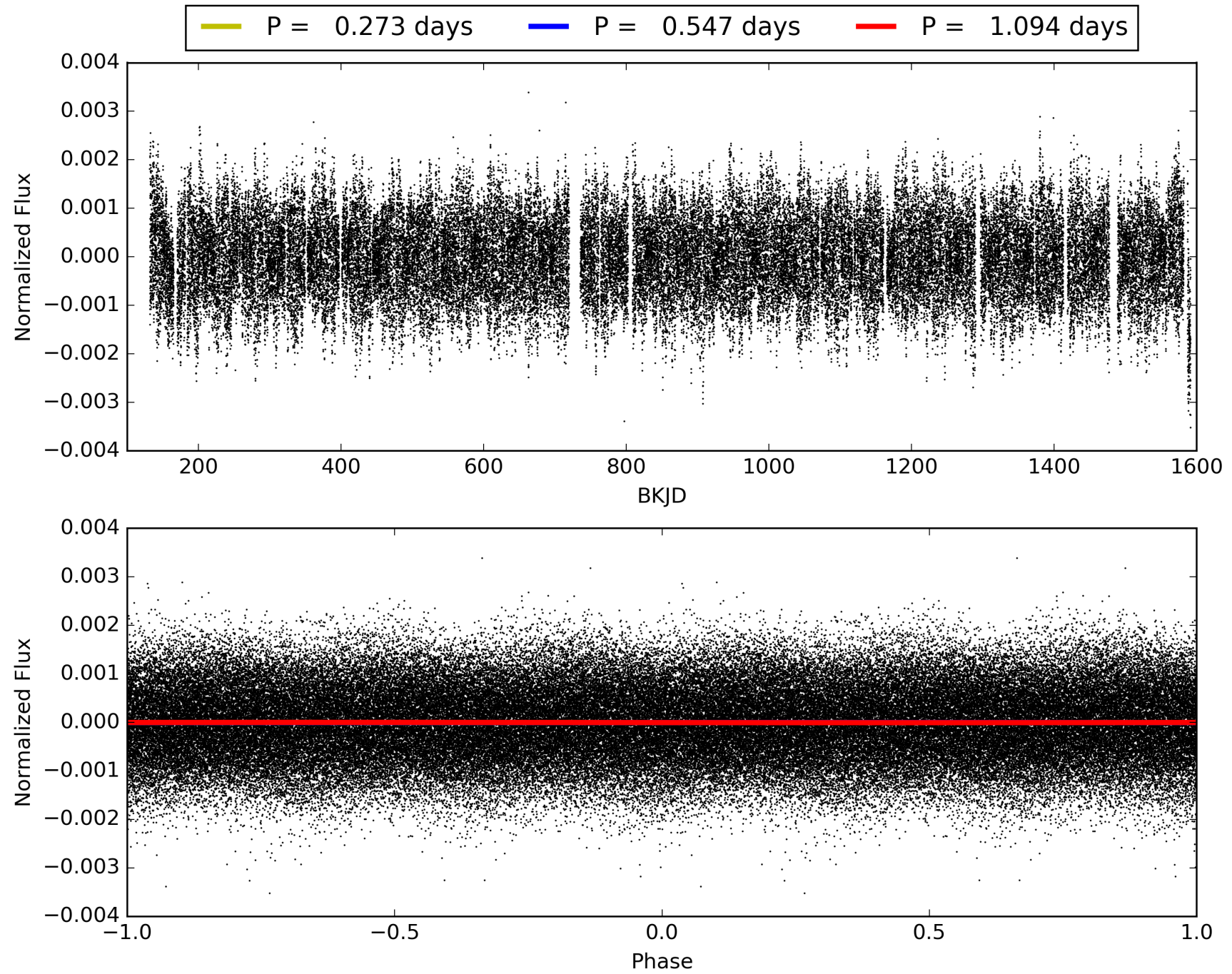
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 00:27:40 Z

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

# TCE 009016344-01, PDC Light Curves

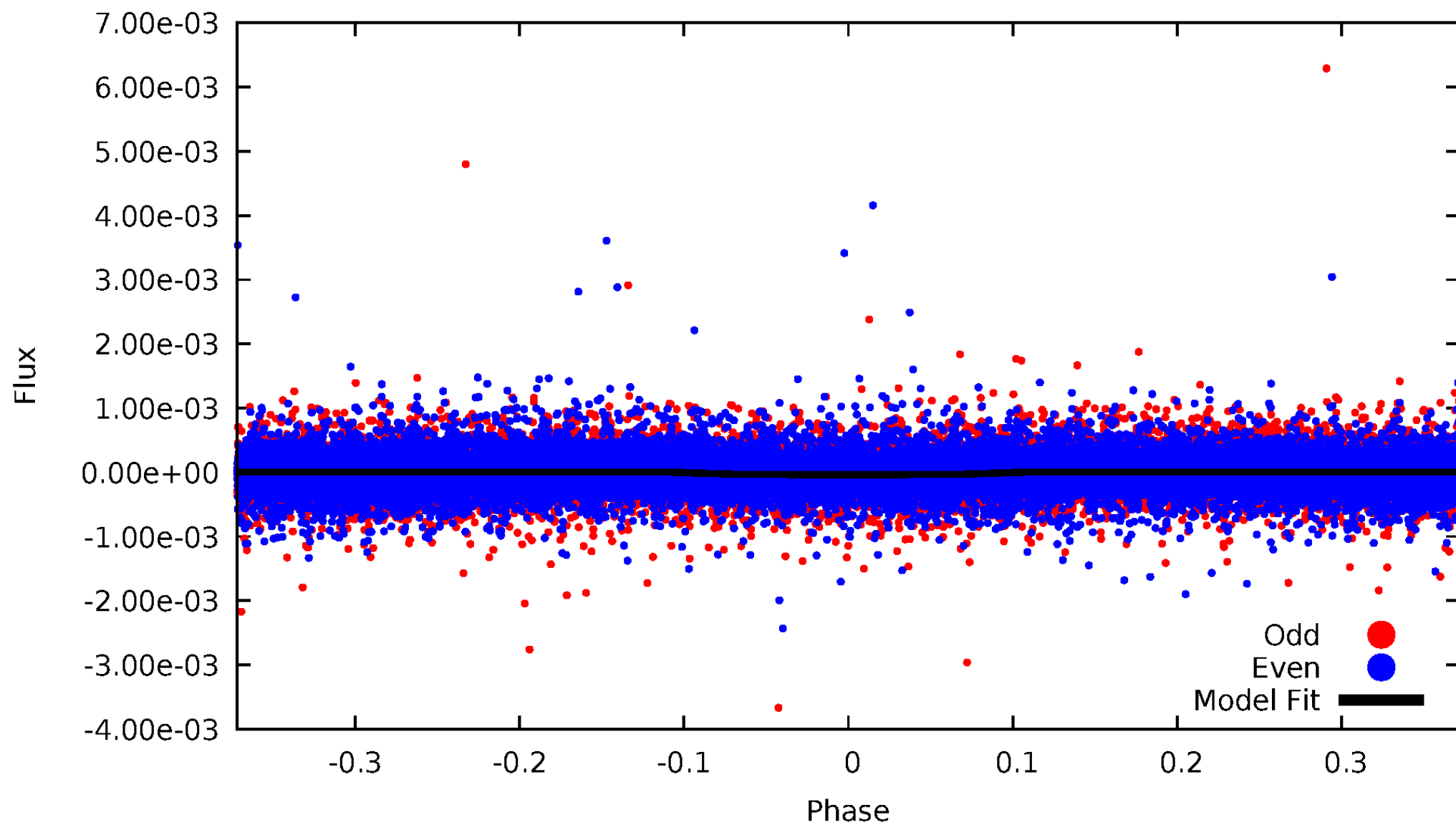


TCE 009016344-01



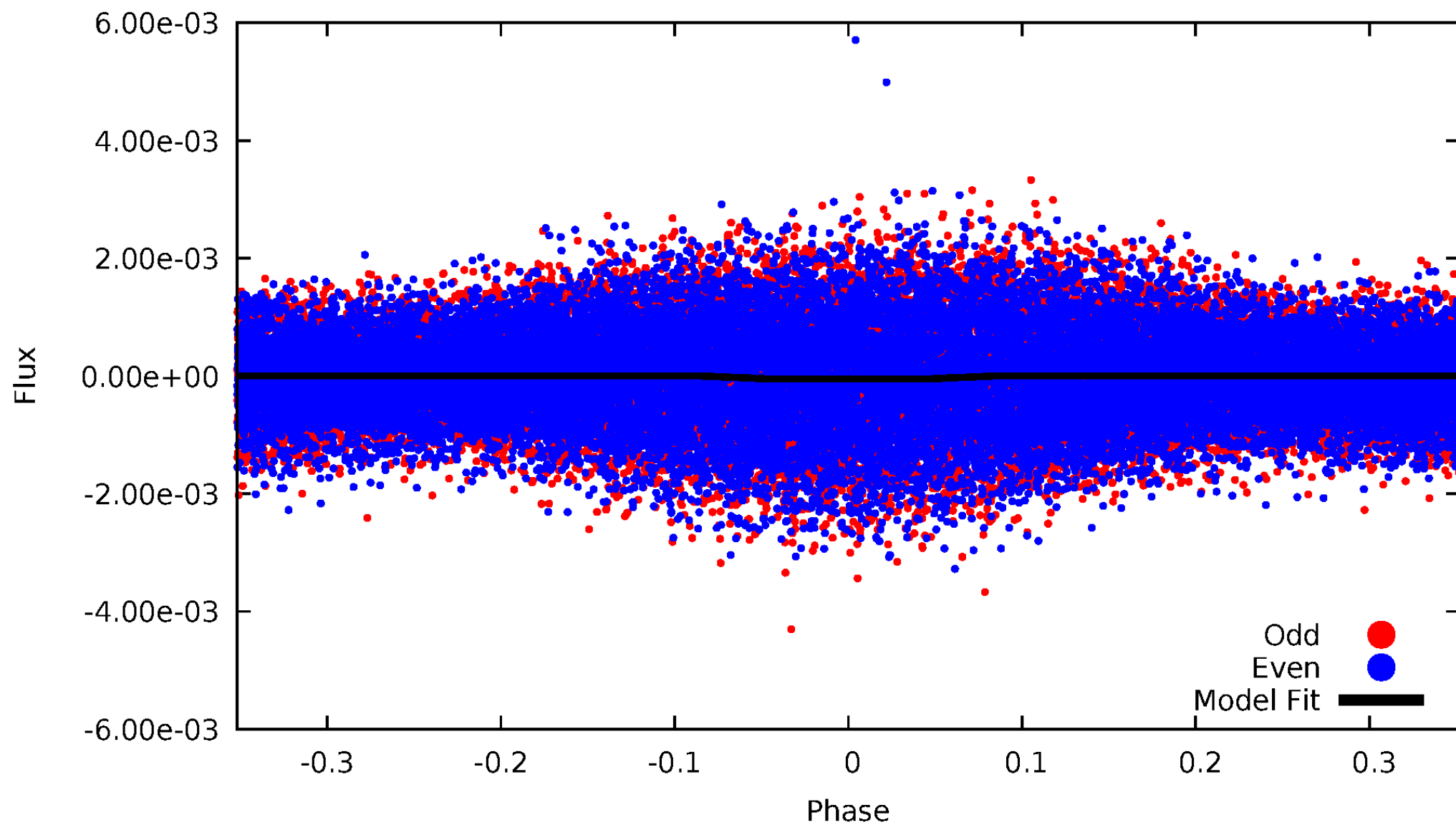
# DV Odd/Even

TCE 009016344-01



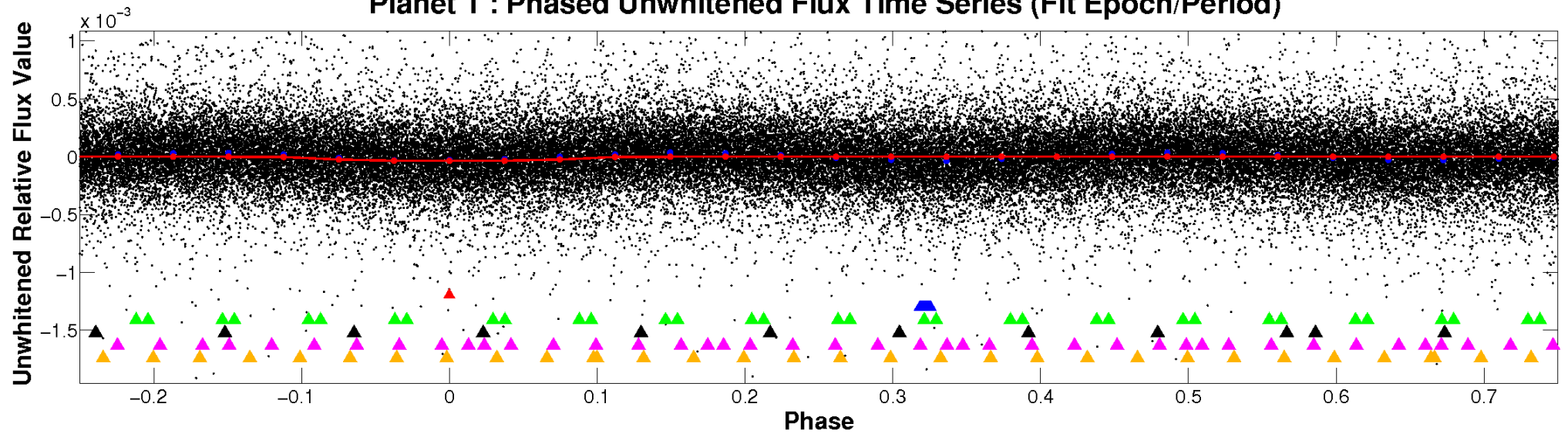
# ALT Odd/Even

TCE 009016344-01

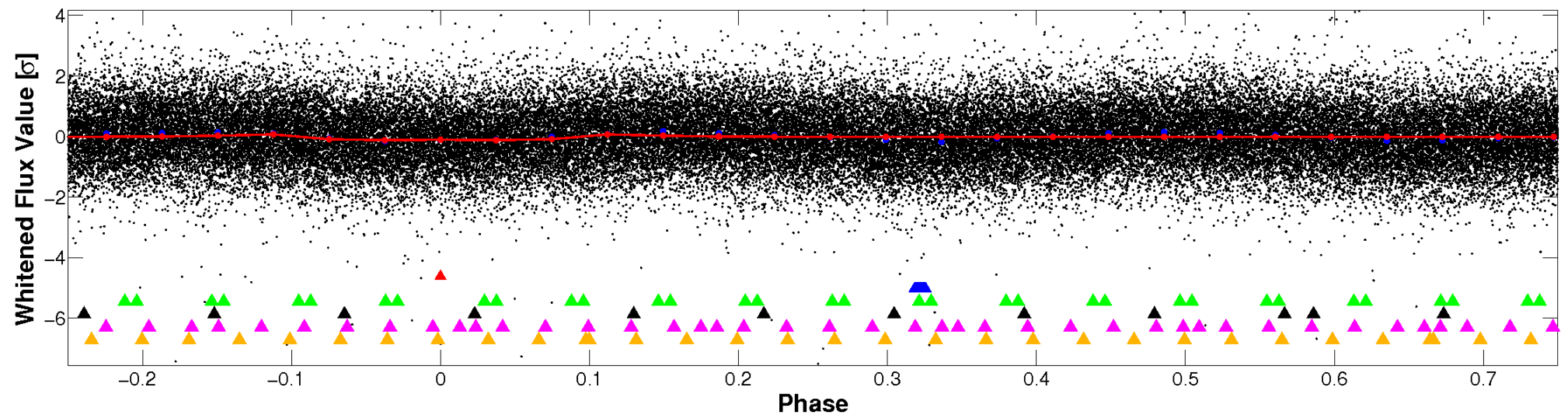


# Non-Whitened Vs. Whitened Light Curve

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

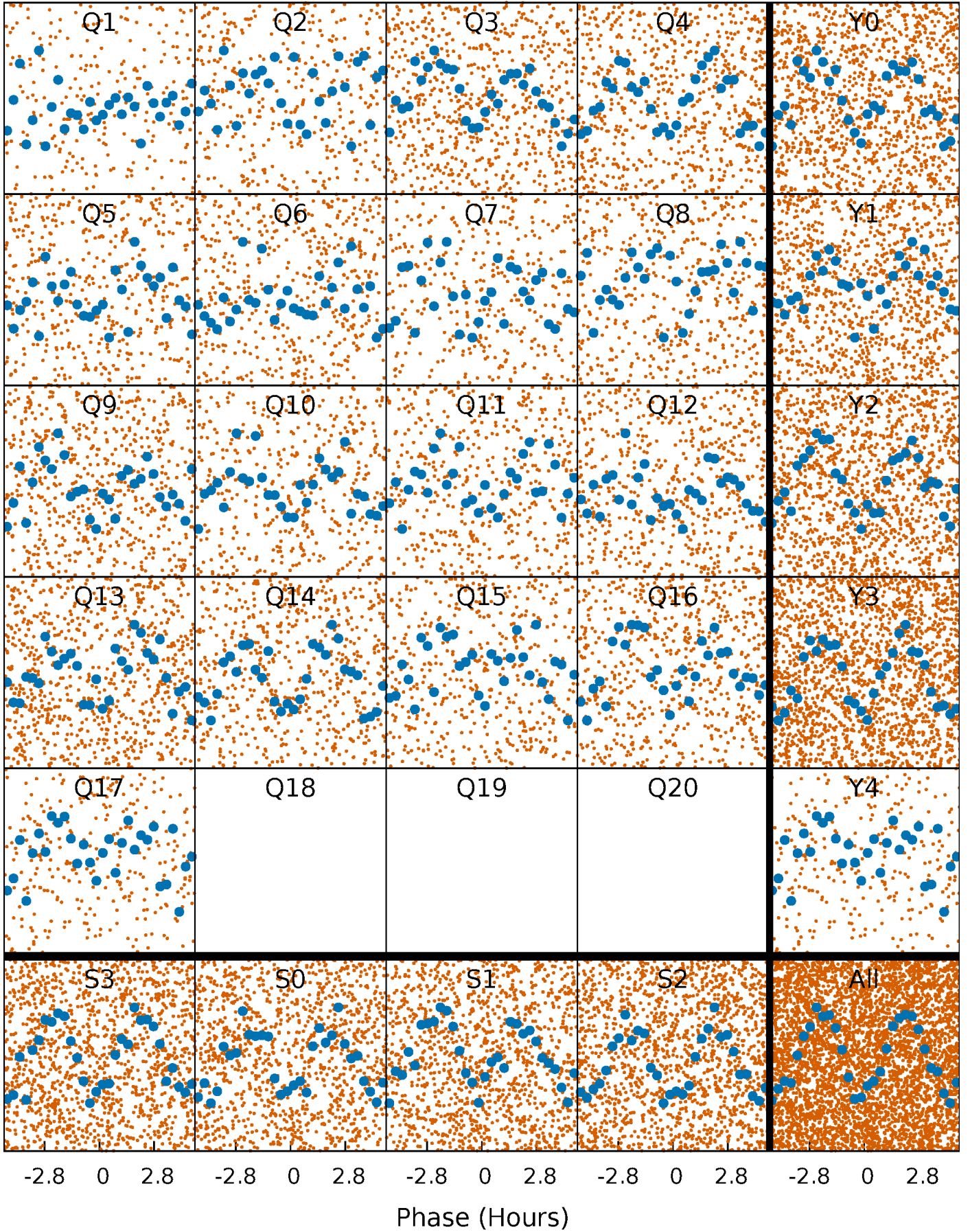


**Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



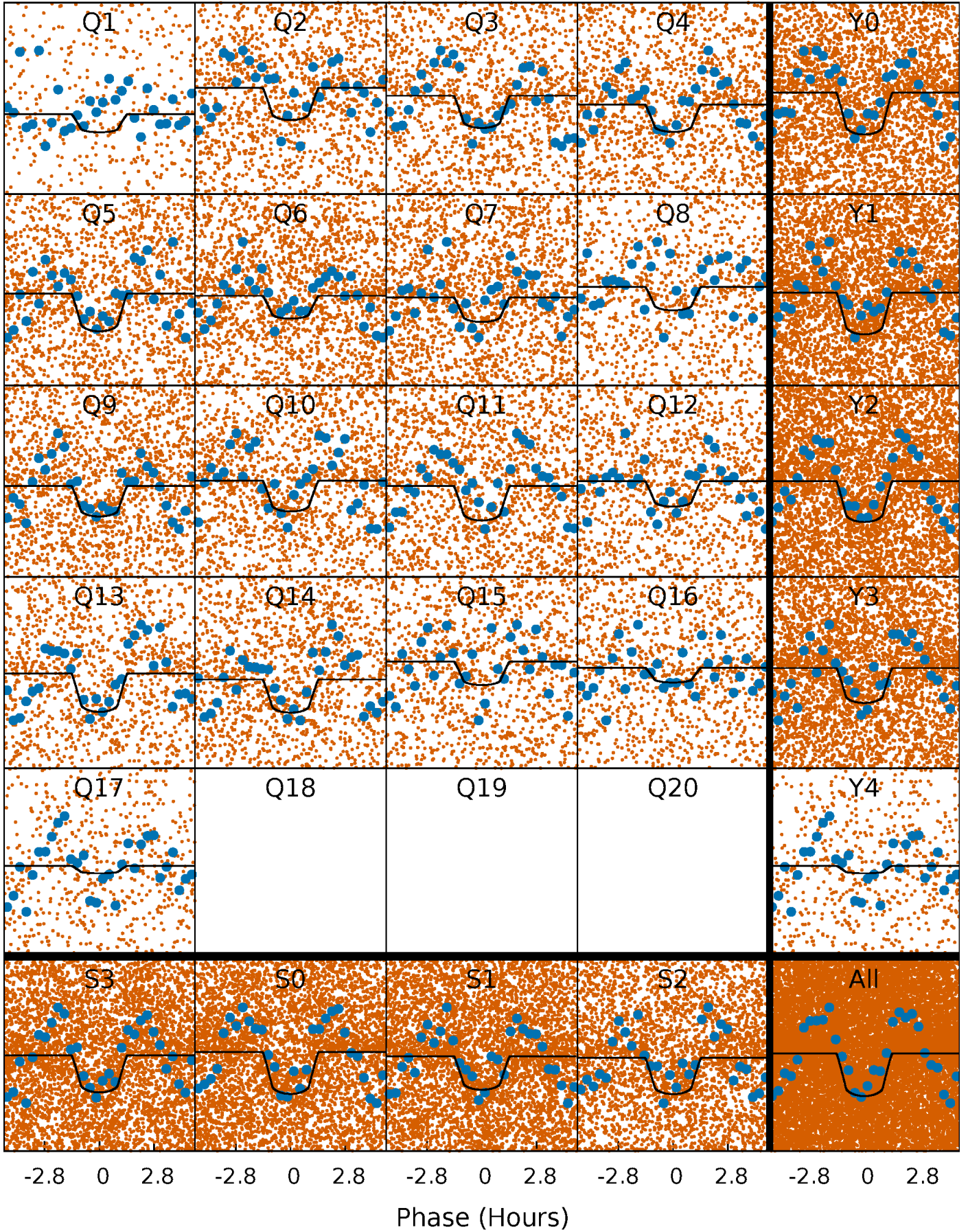
# PDC Quarter-Phased Transit Curves

TCE 009016344-01 P= 0.546865 Days  $T_0=131.739521$  (BKJD)



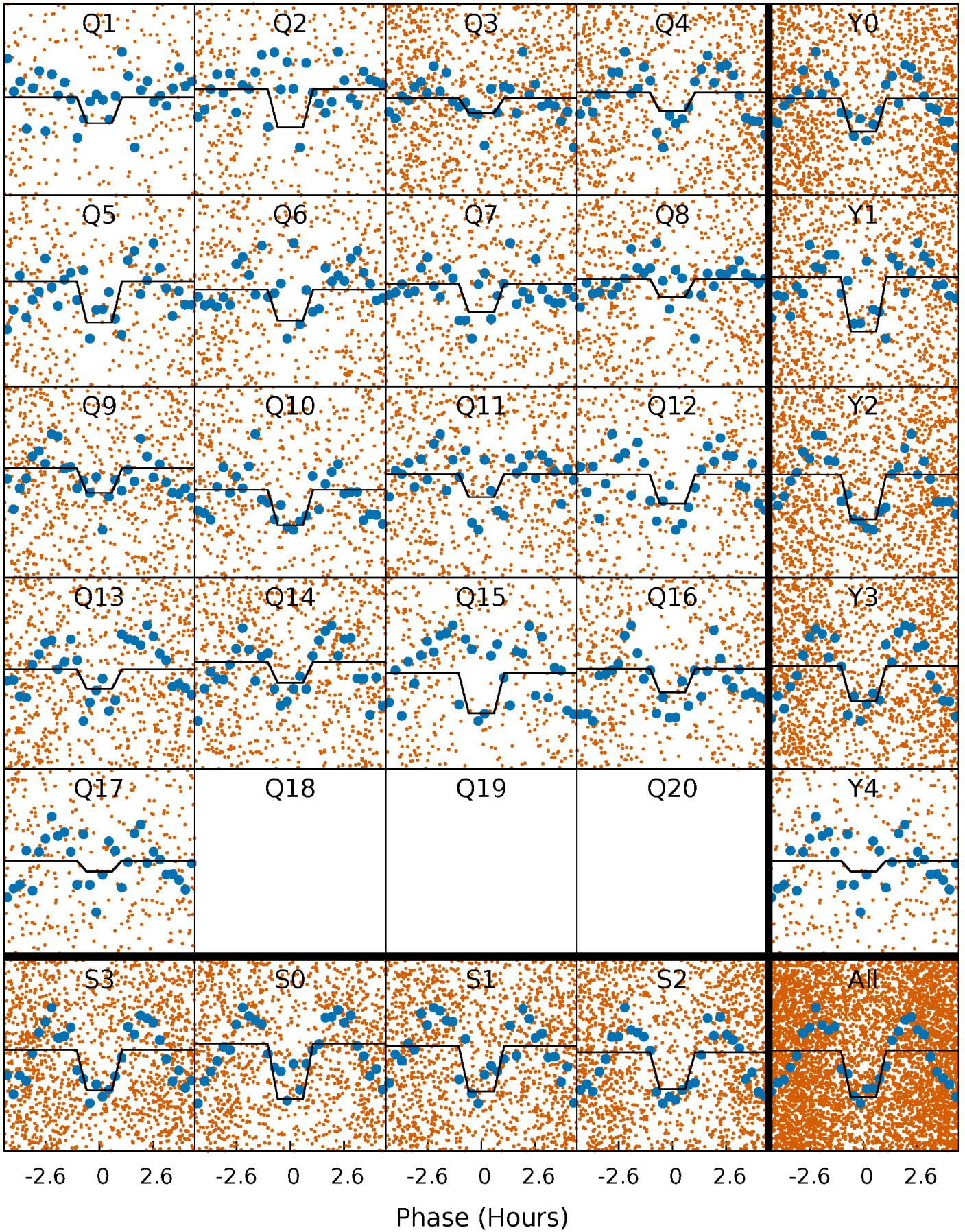
# DV Quarter-Phased Transit Curves

TCE 009016344-01 P= 0.546865 Days  $T_0=131.739521$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

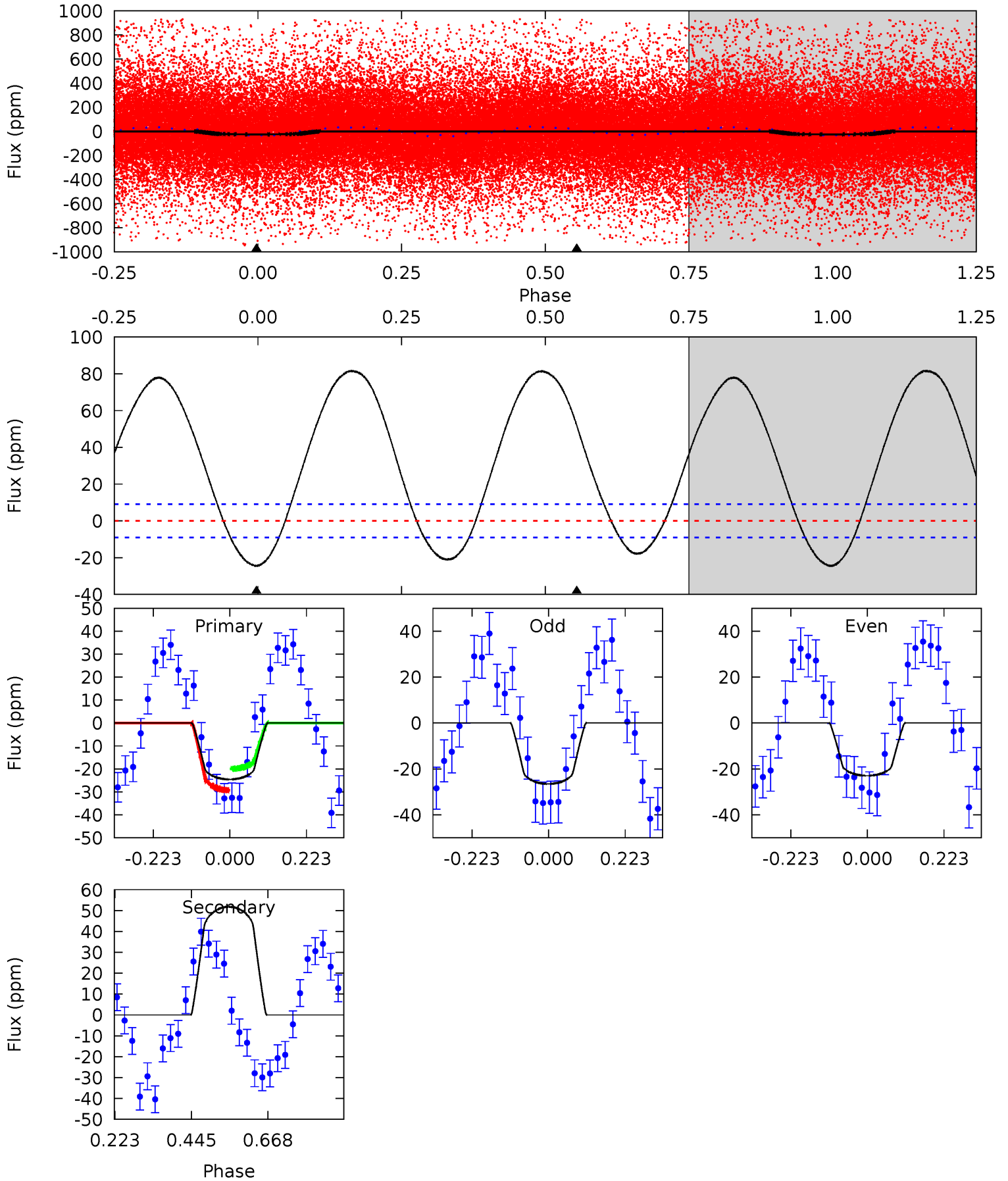
TCE 009016344-01 P= 0.546866 Days  $T_0=131.733915$  (BKJD)



# DV Model-Shift Uniqueness Test

009016344-01, P = 0.546865 Days, E = 131.192656 Days

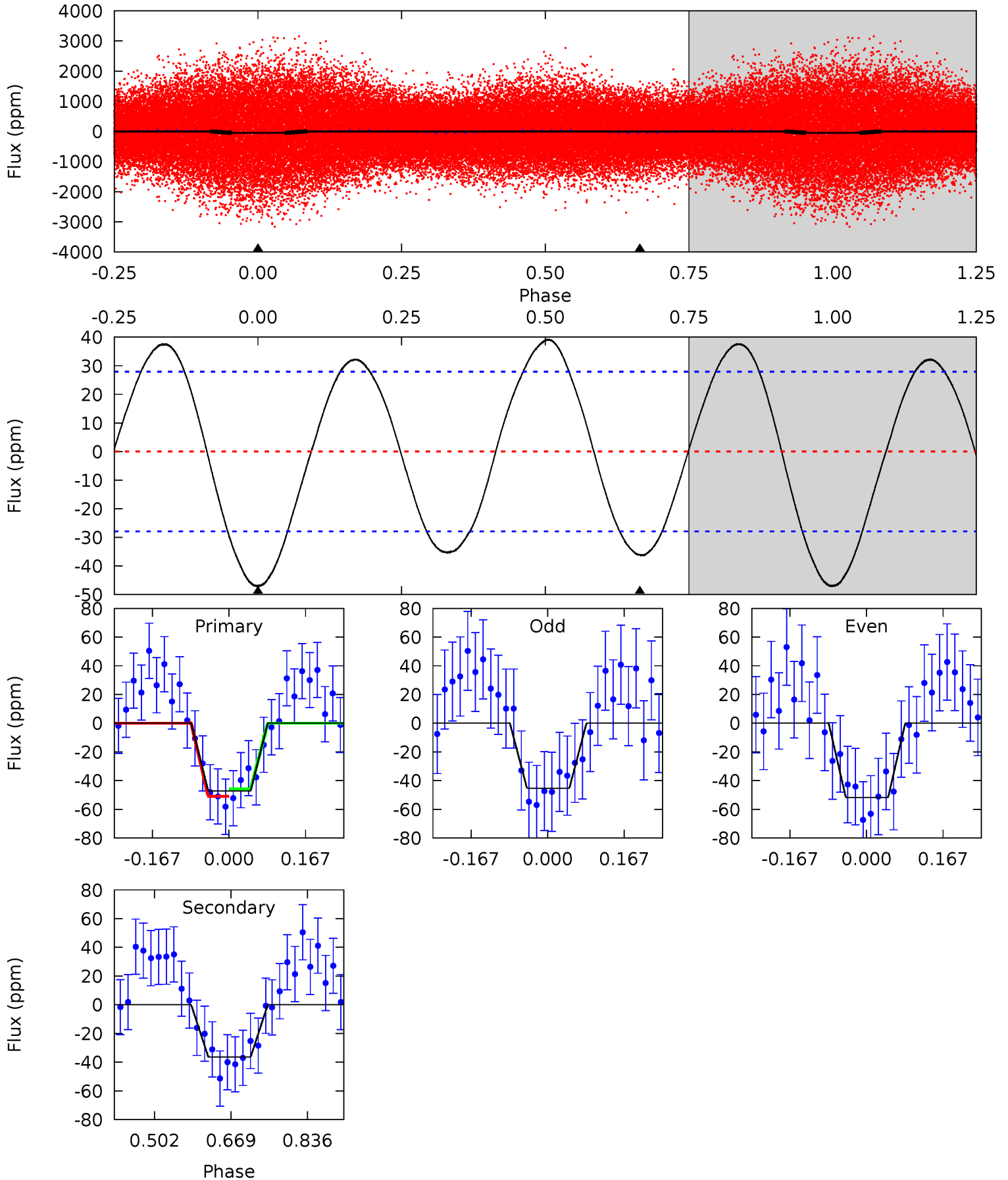
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
11.9	-25.0	0	0	4.39	1.22	11.5	11.9	11.9	-25.0	-25.0	0.87	1.04	0.77	2.30



# Alt Model-Shift Uniqueness Test

009016344-01, P = 0.546866 Days, E = 131.187049 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
7.55	5.81	0	0	4.46	1.38	4.02	7.55	7.55	5.81	5.81	0.51	2.67	0.45	0.43



### Stellar Parameters For KIC 009016344

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$\rho_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$7207^{+226}_{-302}$	$4.060^{+0.185}_{-0.167}$	$-0.160^{+0.250}_{-0.350}$	$1.894^{+0.576}_{-0.471}$	$1.499^{+0.225}_{-0.250}$	$0.311^{+0.356}_{-0.143}$
	+3%/-4%	+5%/-4%	+156%/-219%	+30%/-25%	+15%/-17%	+114%/-46%
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 009016344-01 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$52 \pm 2$	$1.30^{+0.30}_{-0.26}$	$4973^{+374}_{-370}$	$-7946^{+771}_{-898}$	$-3.797^{+1.249}_{-2.023}$
Alt.	$-36 \pm 6$	$1.44^{+0.33}_{-0.29}$	$4971^{+407}_{-349}$	$6302^{+856}_{-639}$	$2.082^{+1.296}_{-0.735}$

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

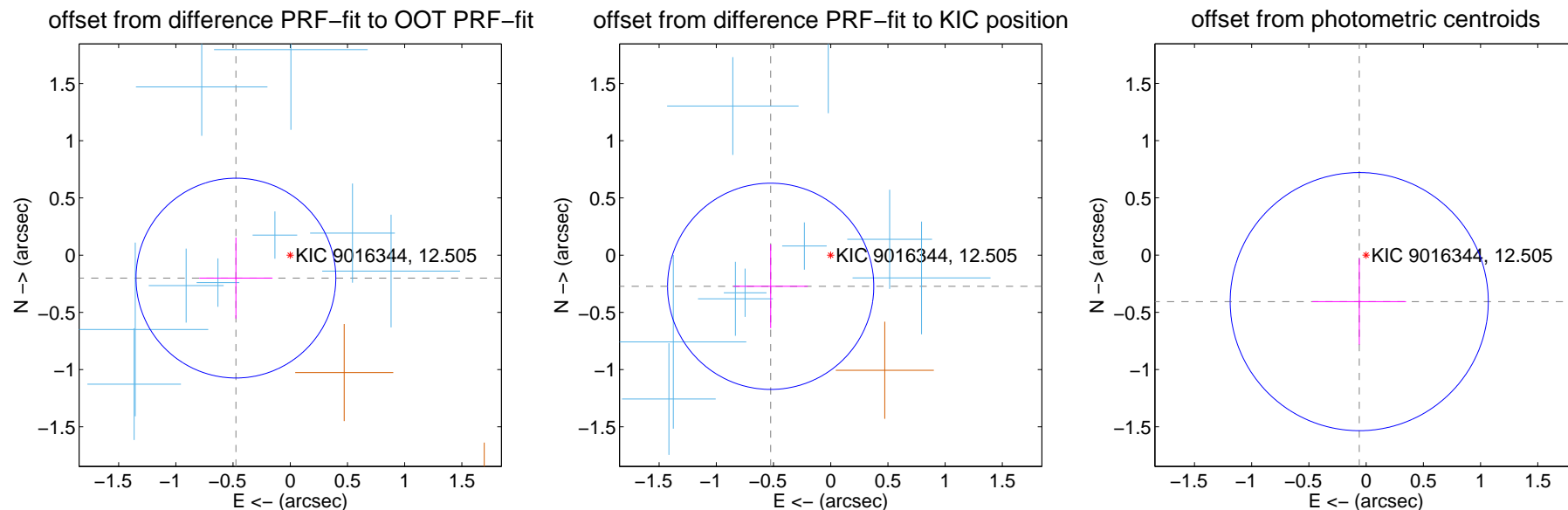
## DV Centroid Data

Supplemental centroid analysis for 009016344-01. Kepler magnitude: 12.51. Transit SNR 13.21

There are 10 quarters with good PRF difference image offsets

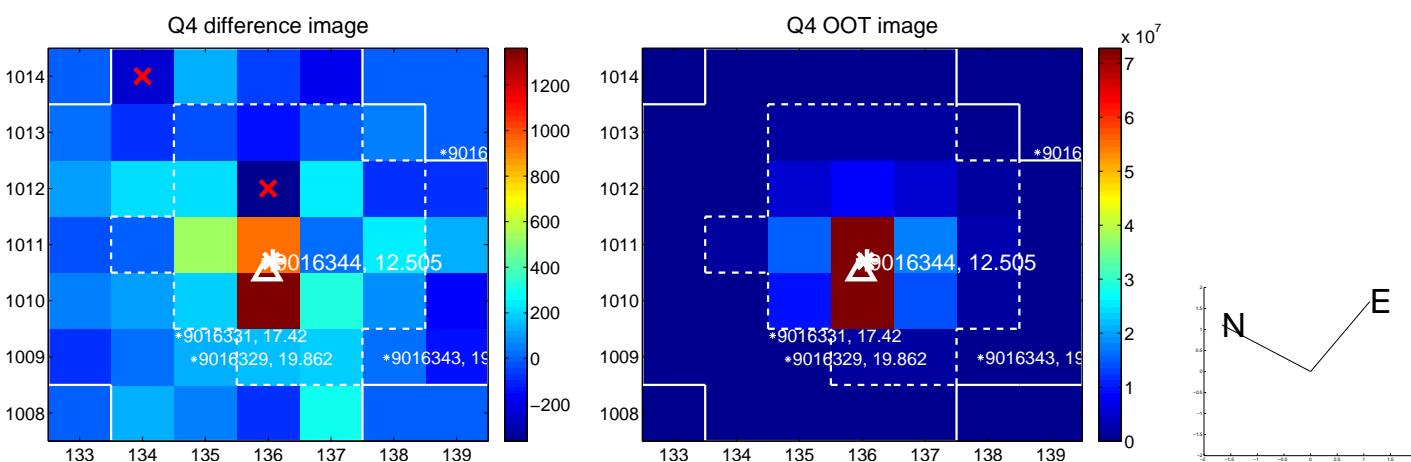
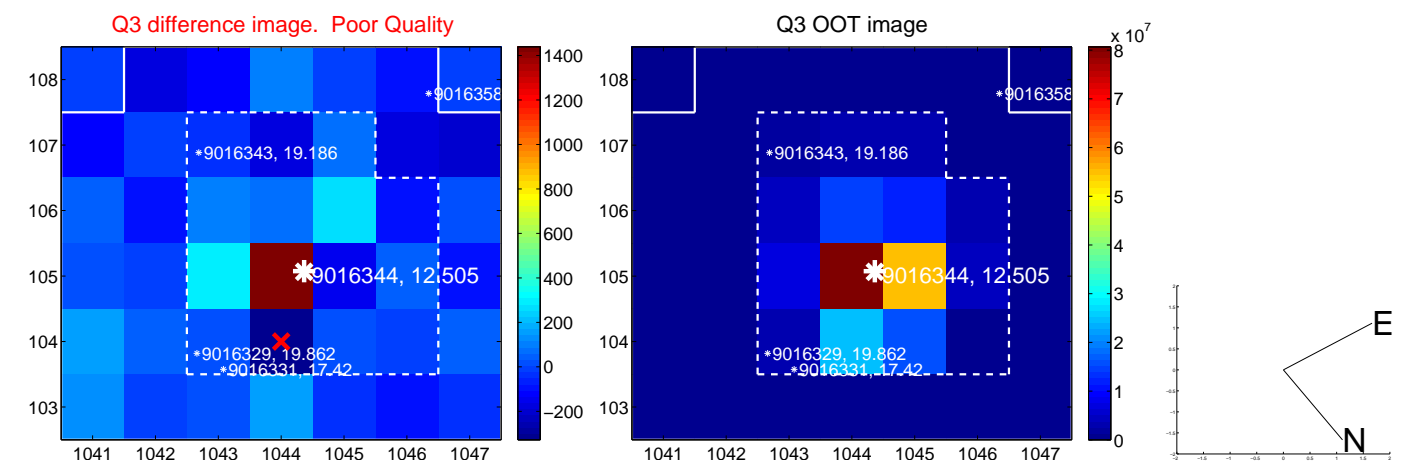
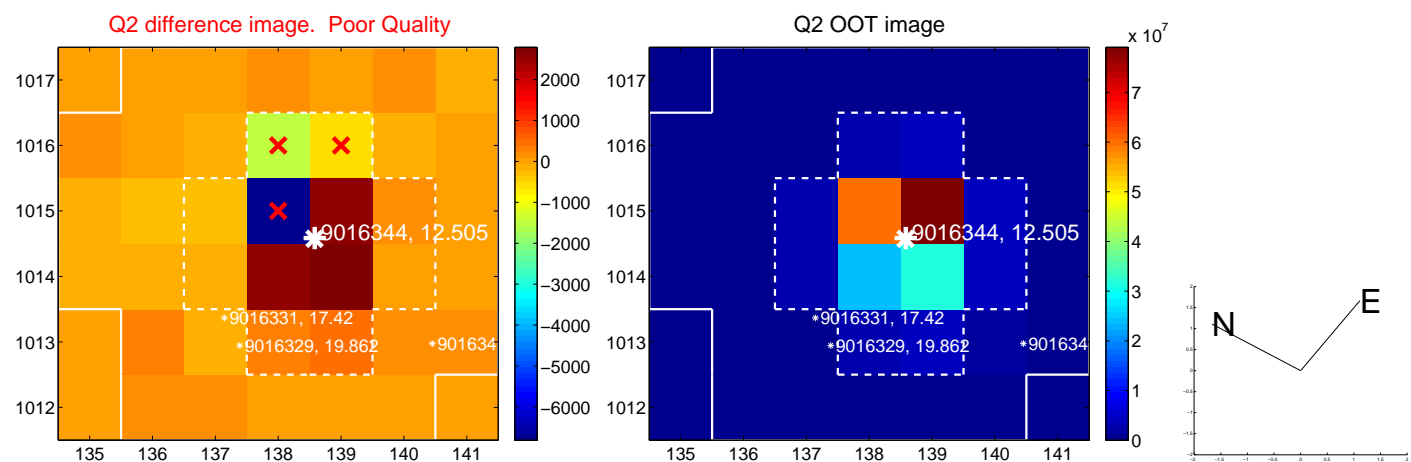
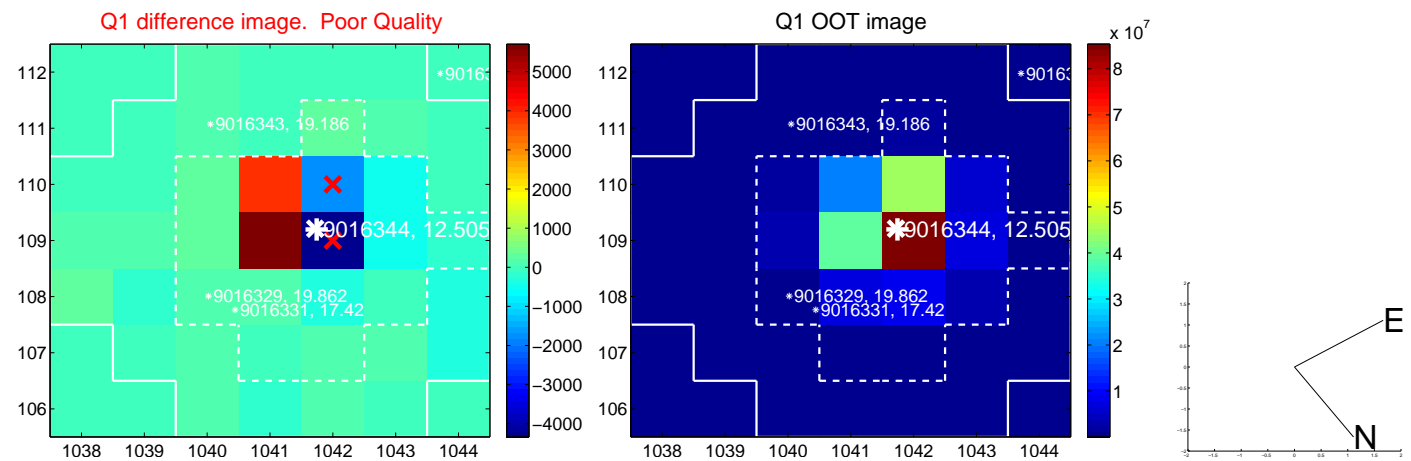
The direct PRF centroid is offset from the target star catalog position by about 0.15 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.515 \pm 0.291$	1.77	$0.475 \pm 0.320$	$-0.200 \pm 0.354$
PRF-fit source offset from KIC position	$0.591 \pm 0.300$	1.97	$0.525 \pm 0.324$	$-0.272 \pm 0.365$
photometric centroid source offset	$0.41 \pm 0.38$	1.09	$0.06 \pm 0.41$	$-0.41 \pm 0.38$

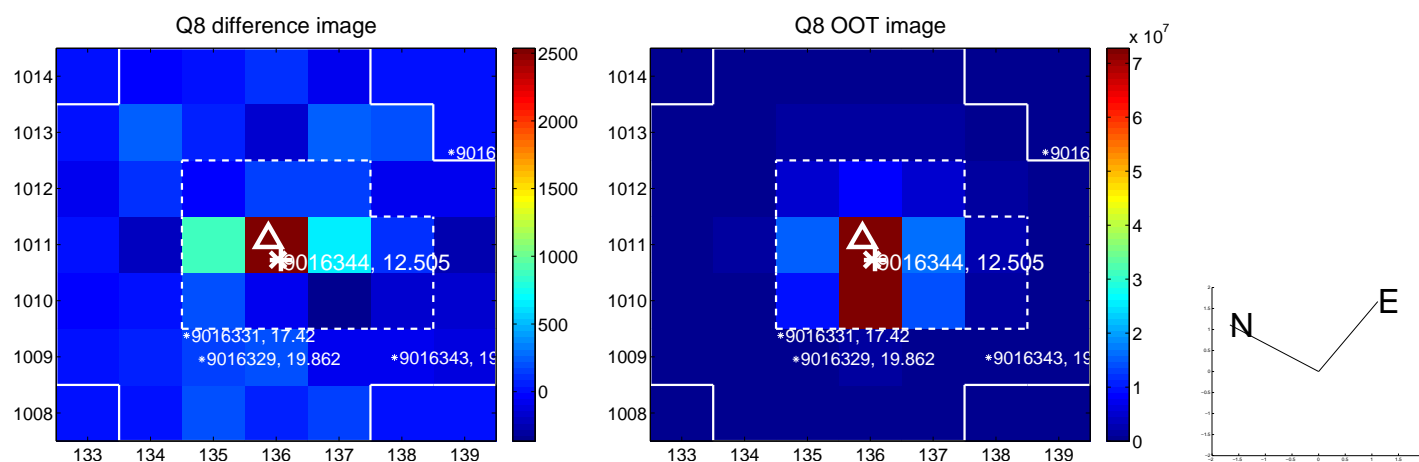
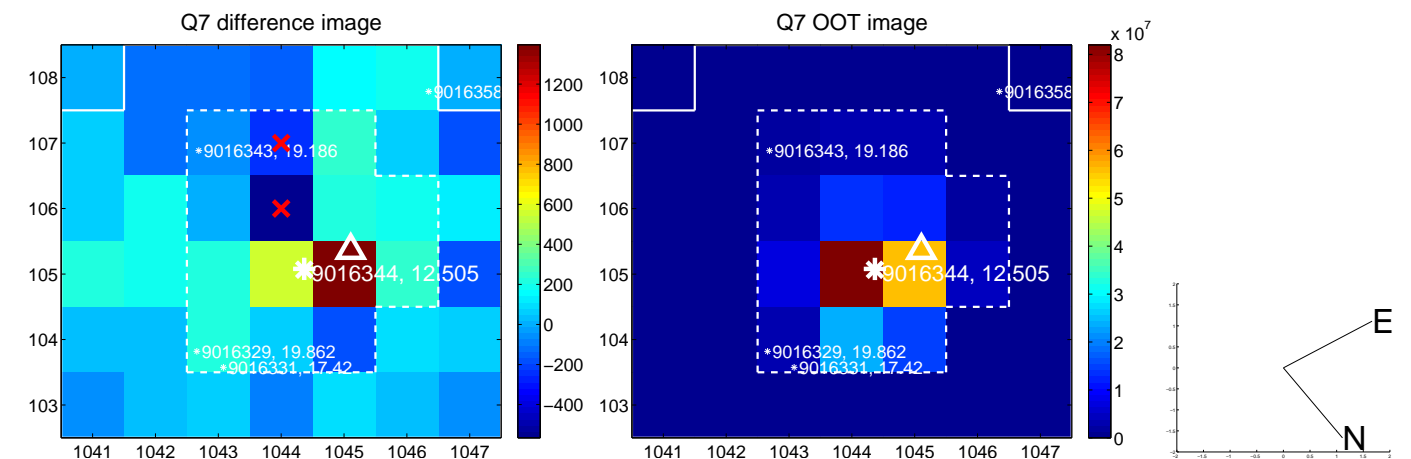
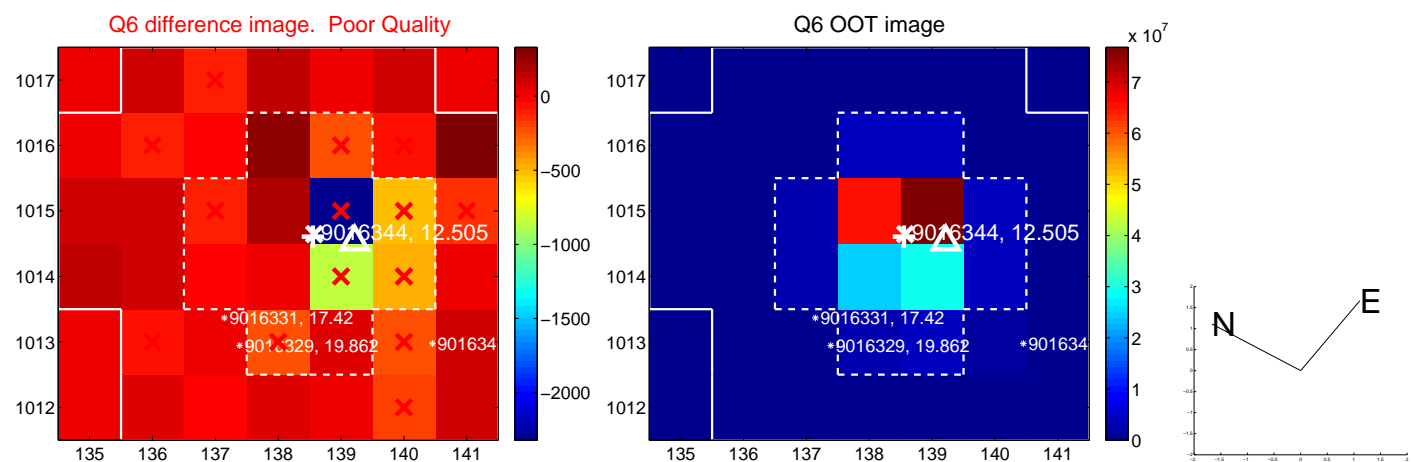
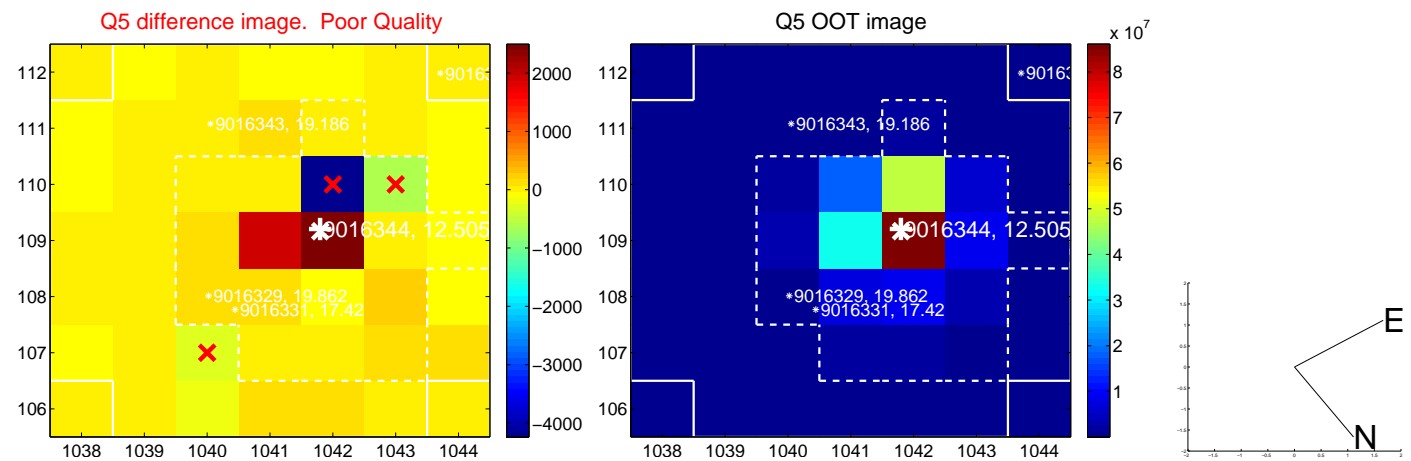


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

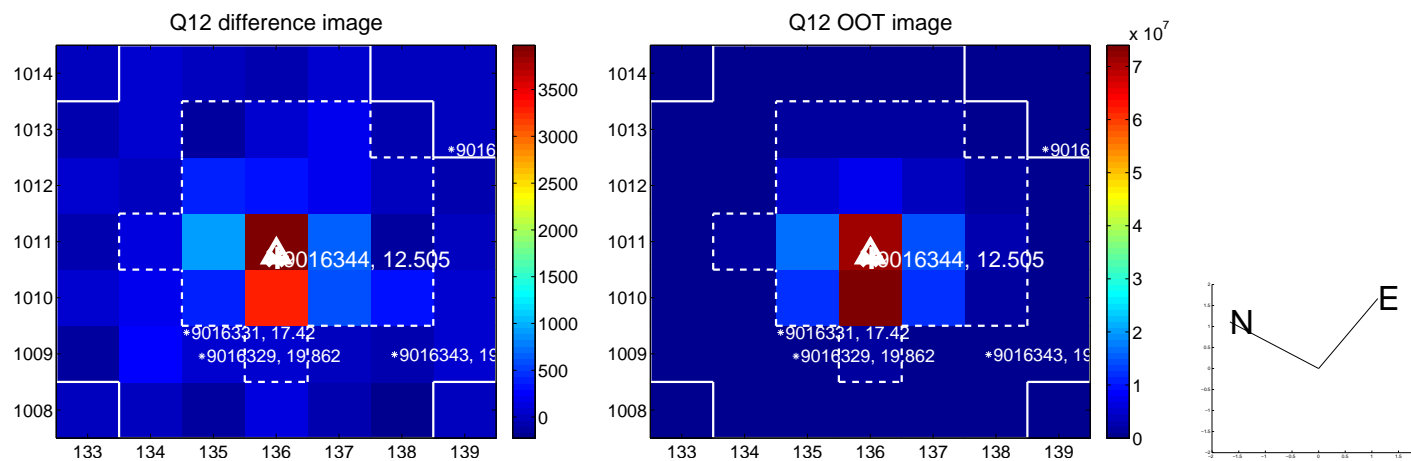
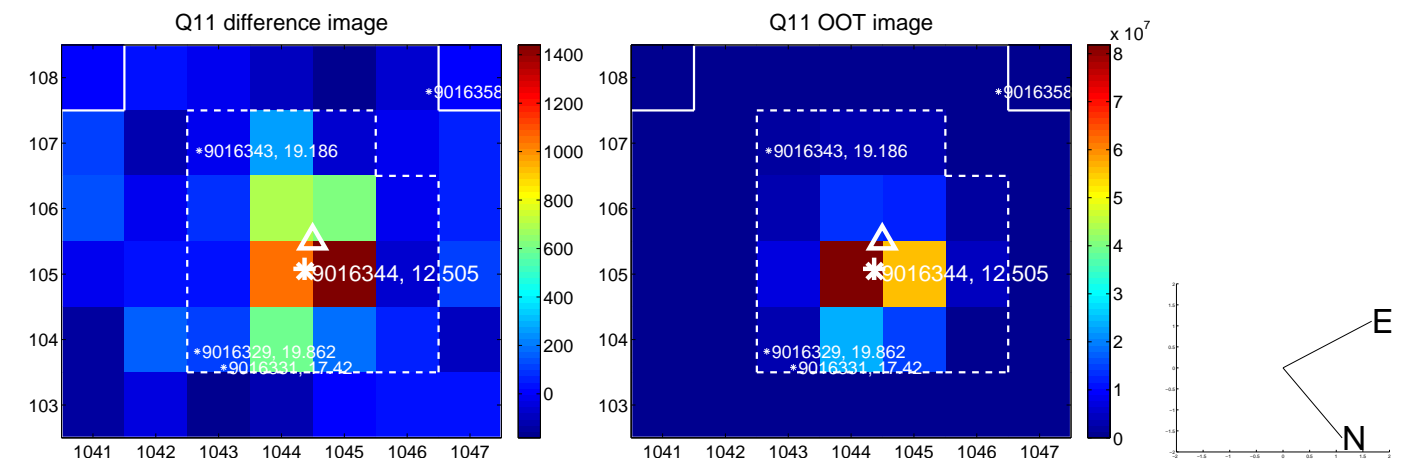
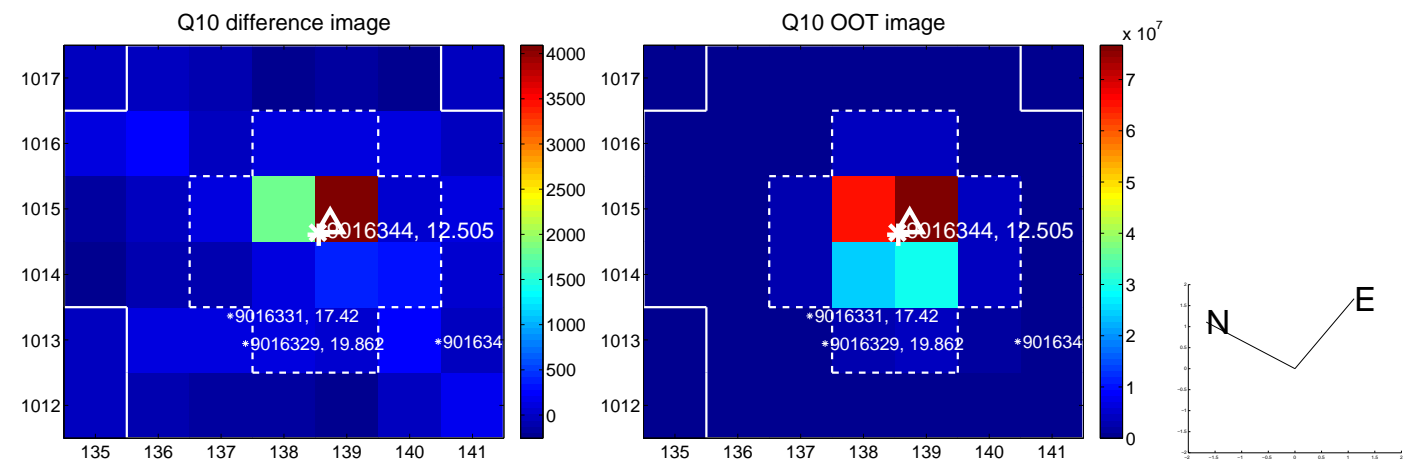
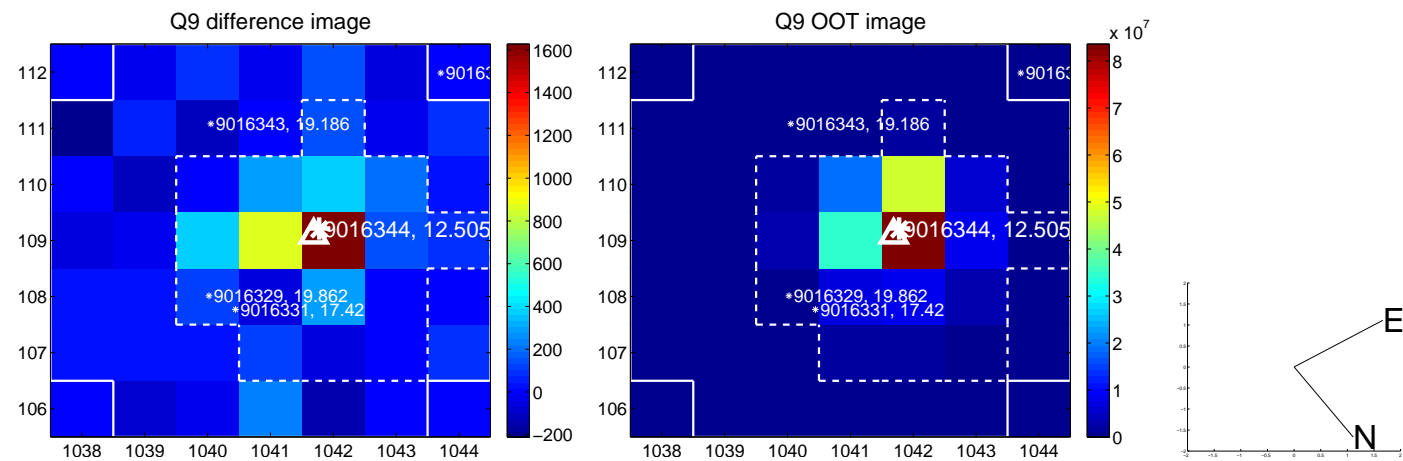
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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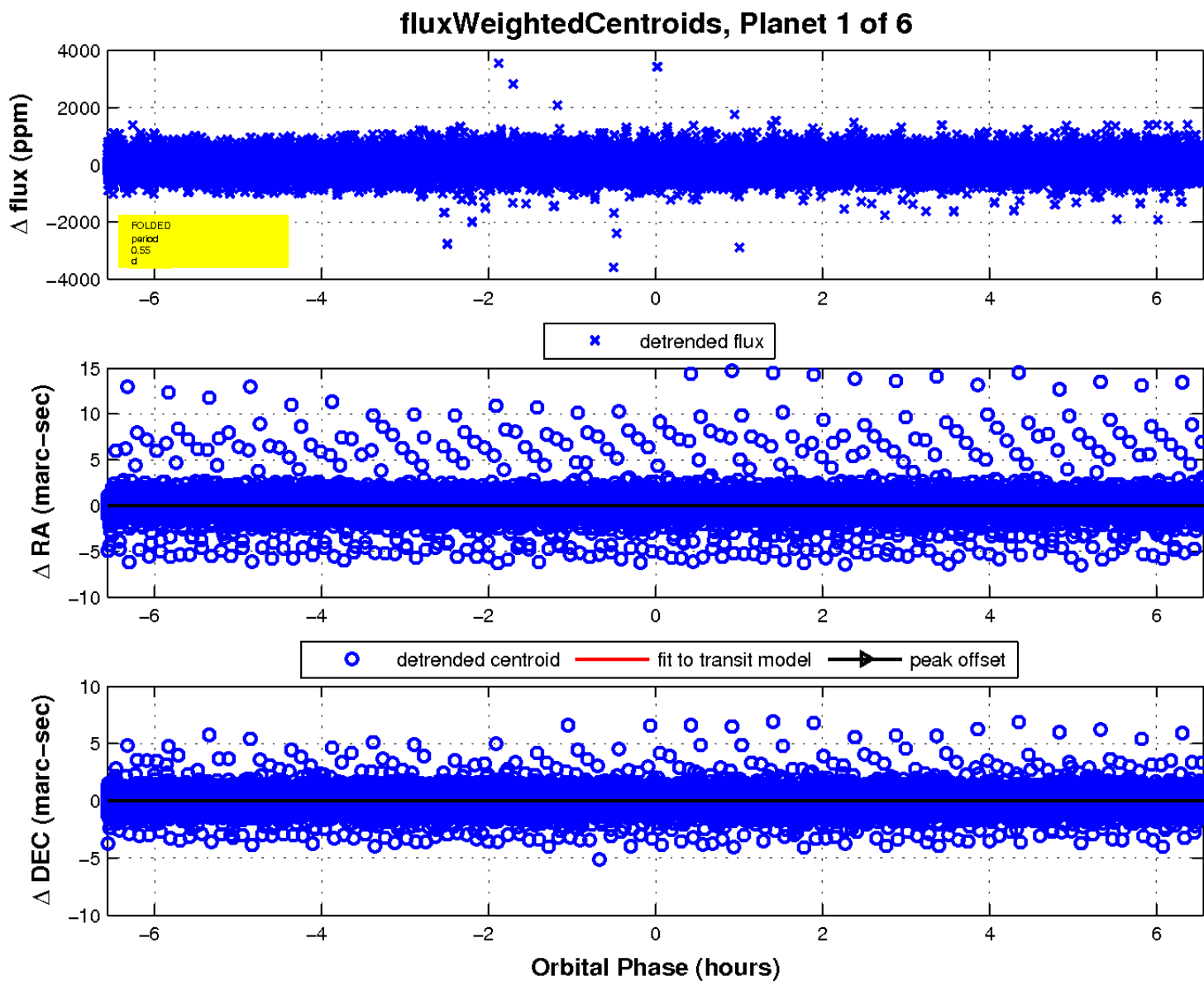
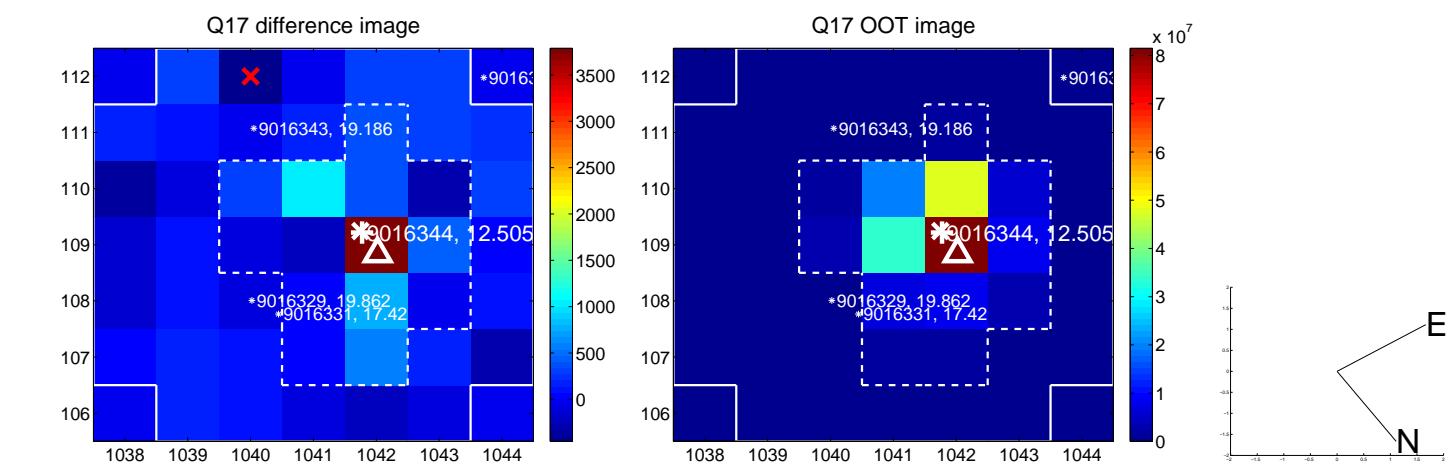


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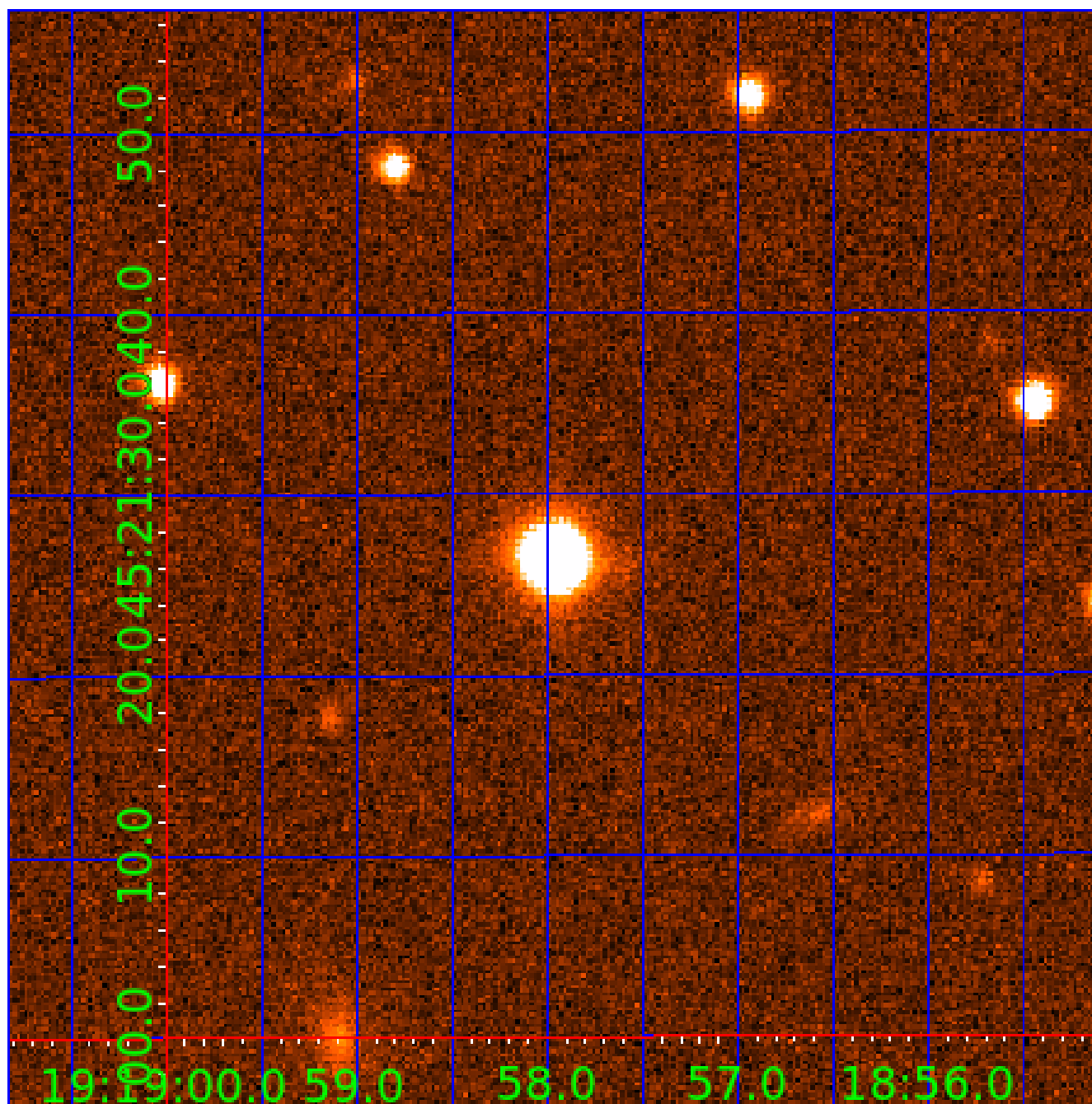


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UKIRT Image

Declination



# KIC 009016344

## Q1-17 DR25 TCE Parameters

TCE	Run Type	KOI?	Period (Days)	Epoch (BKJD)	Depth (ppm)	Duration (Hours)	MES	SNR	$R_{\star}$ ( $R_{\odot}$ )	$T_{\star}$ (K)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
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009016344-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE_ZUMA—LPP_DV—MOD_NONUNIQ_DV—SAME_NTL_PERIOD
009016344-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT
009016344-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT
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009016344-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT

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

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

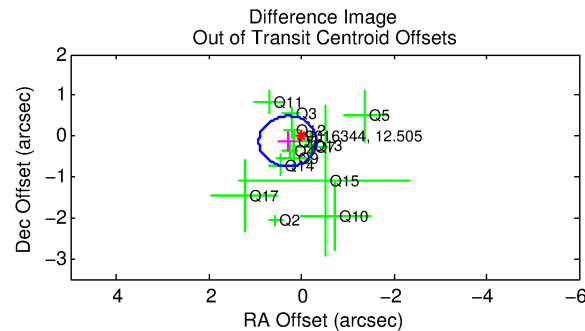
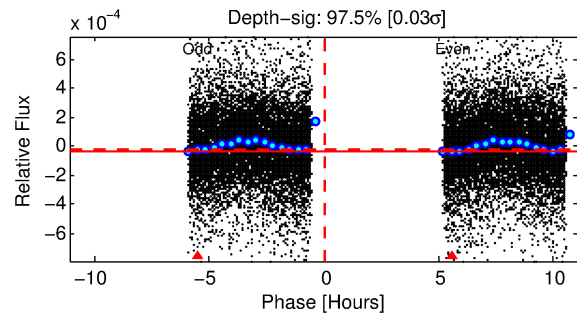
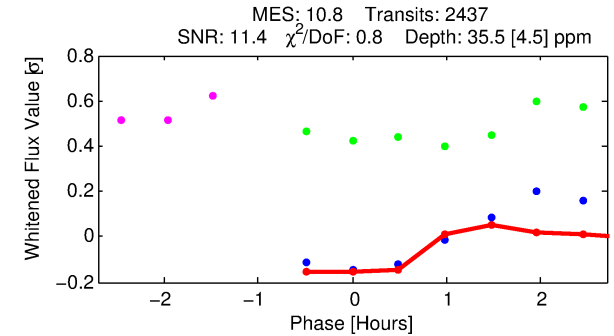
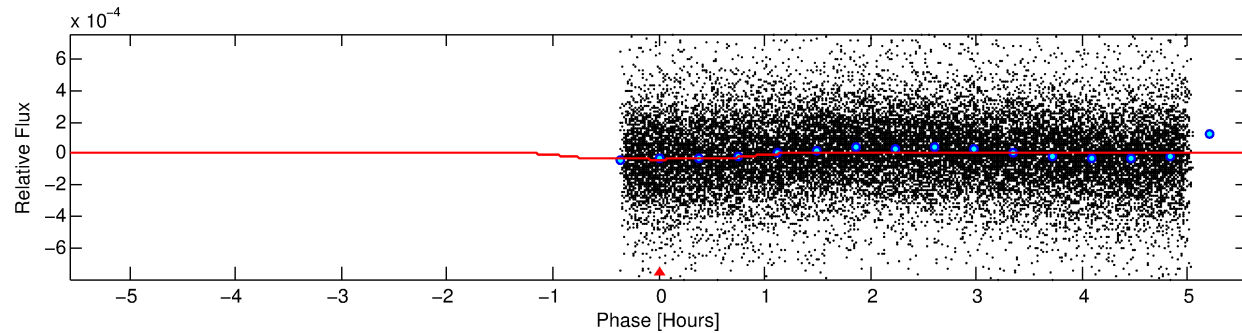
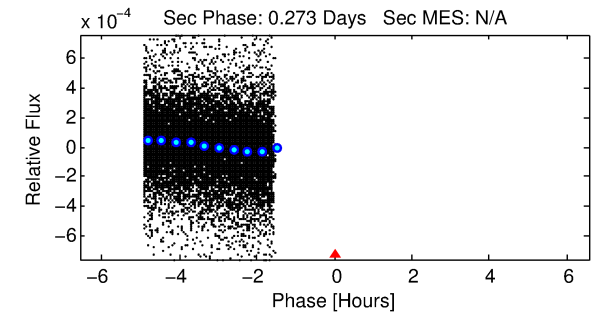
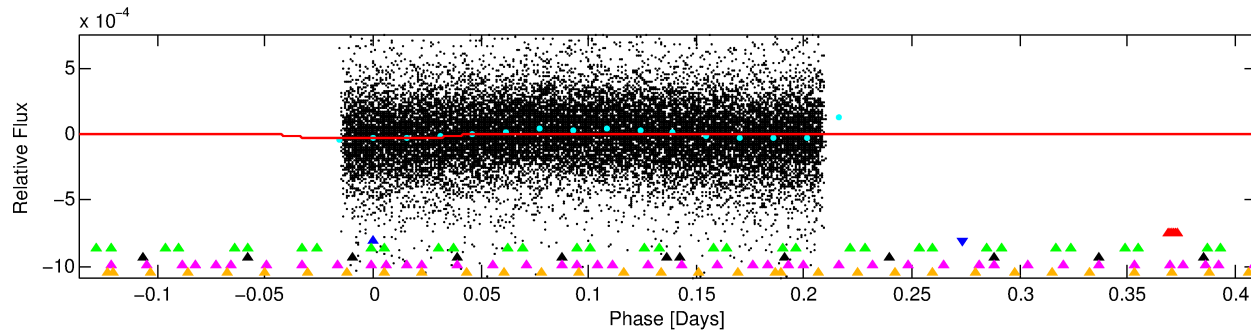
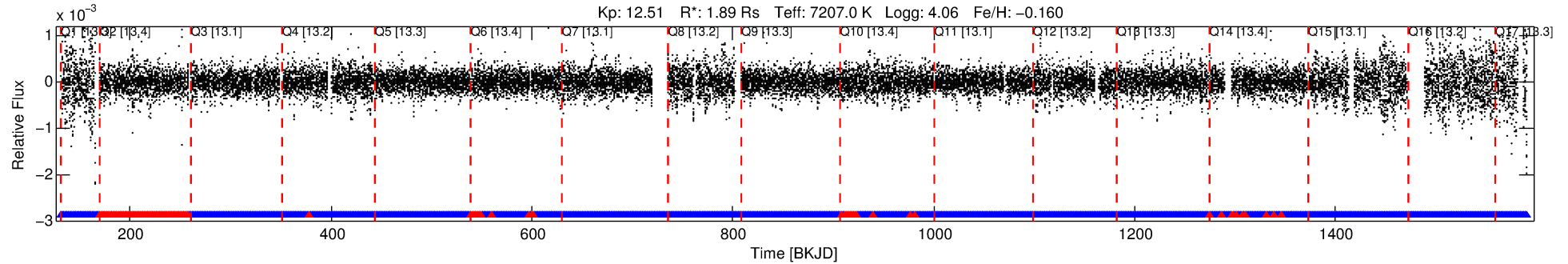
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 009016344-02

No Significant Match Found

# DV One-Page Summary

KIC: 9016344 Candidate: 2 of 6 Period: 0.547 d



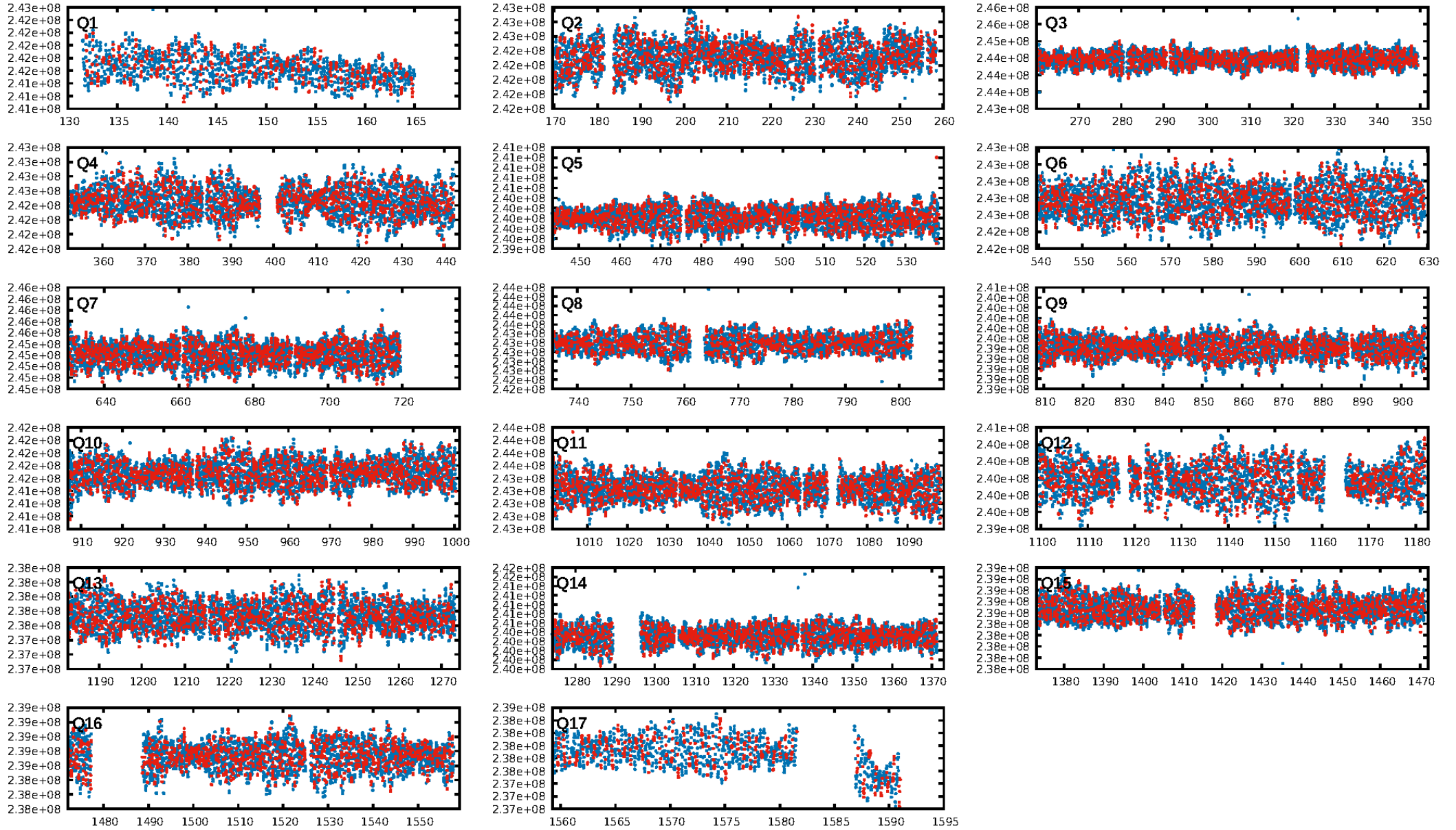
## DV Fit Results:

Period = 0.54686 [0.00001] d  
Epoch = 131.9177 [0.0045] BKJD  
Rp/R\* = 0.0063 [0.0022]  
a/R\* = 1.38 [1.45]  
b = 0.90 [0.47]  
Seff = 38576.93 [14933.22]  
Teq = 3574 [346] K  
Rp = 1.31 [0.61] Re  
a = 0.0150 [0.0037] AU

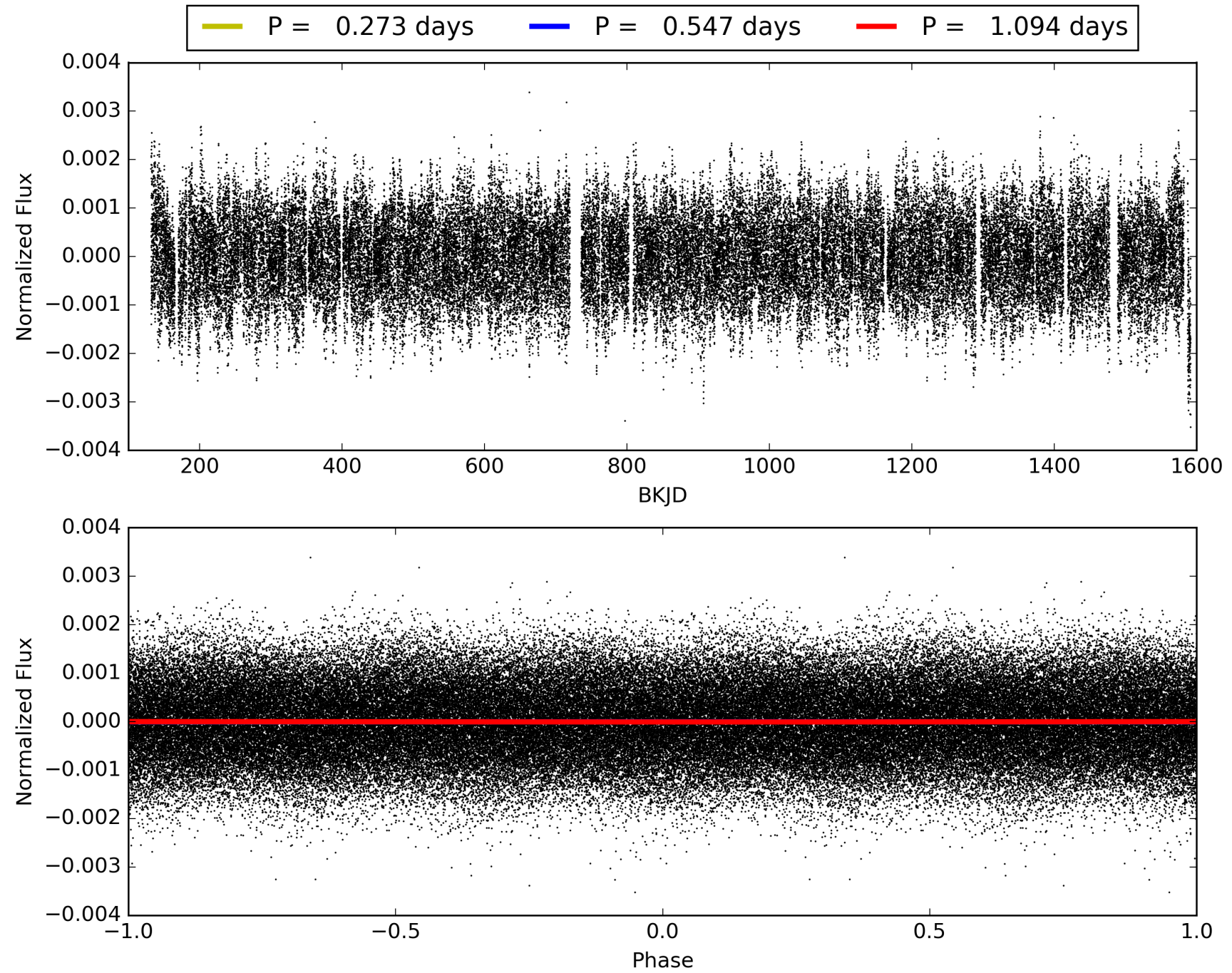
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 0.0% [0.00σ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: N/A  
RollingBand-fgt: 0.92 [2134/2328]  
GhostDiagnostic-chr: 1.037  
Centroid-sig: 18.5%  
Centroid-so: 0.576 arcsec [1.29σ]  
OotOffset-rm: 0.329 arcsec [1.60σ]  
KicOffset-rm: 0.337 arcsec [1.88σ]  
OotOffset-st: 4/4/2/4 [14]  
KicOffset-st: 4/4/2/4 [14]  
DiffImageQuality-fgm: 0.64 [9/14]  
DiffImageOverlap-fno: 0.00 [0/17]

# TCE 009016344-02, PDC Light Curves

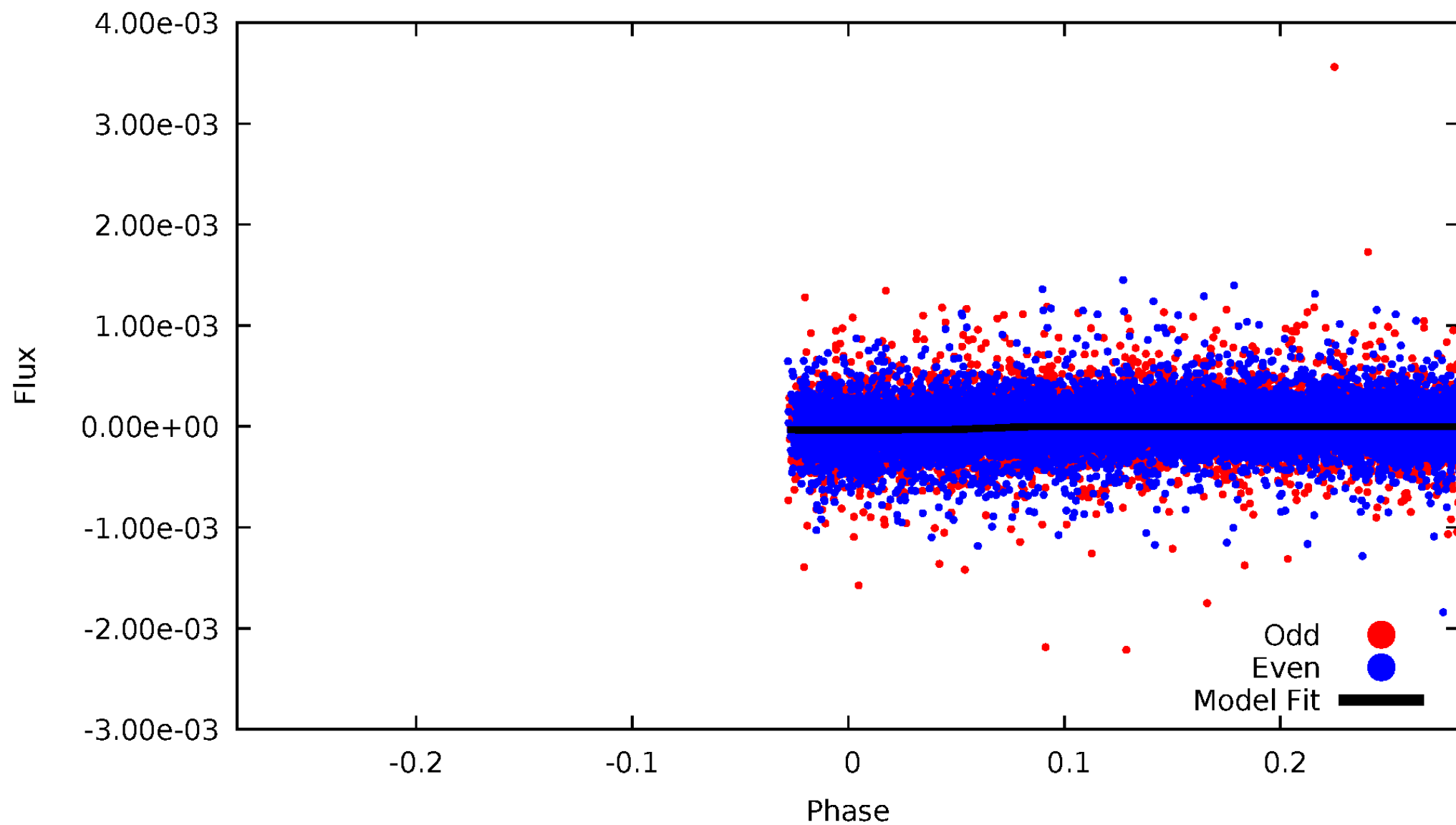


TCE 009016344-02



# DV Odd/Even

TCE 009016344-02



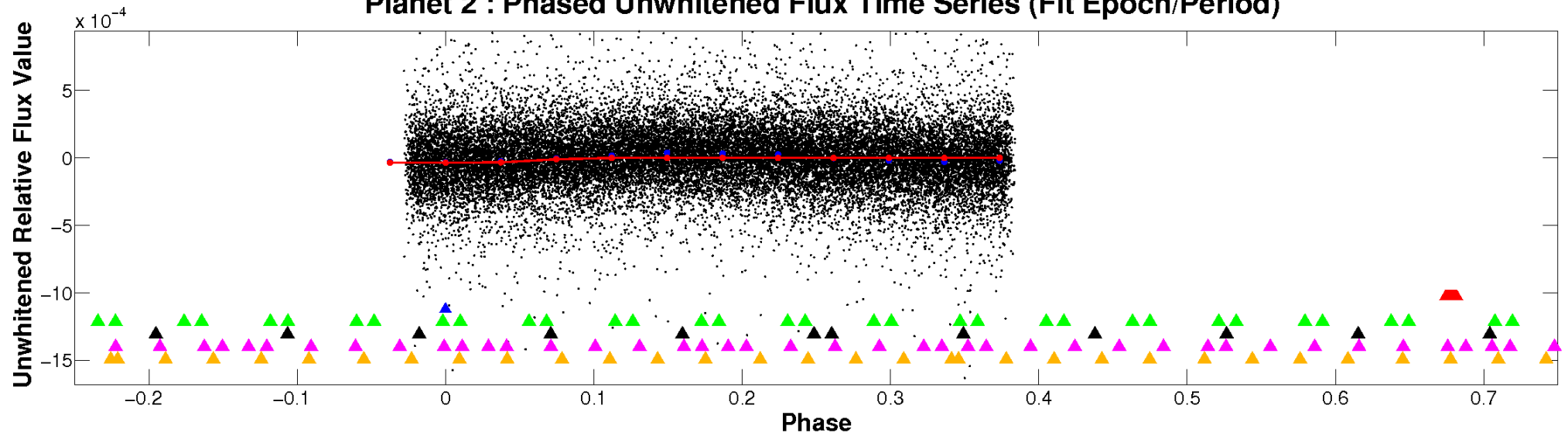


ALT Odd/Even

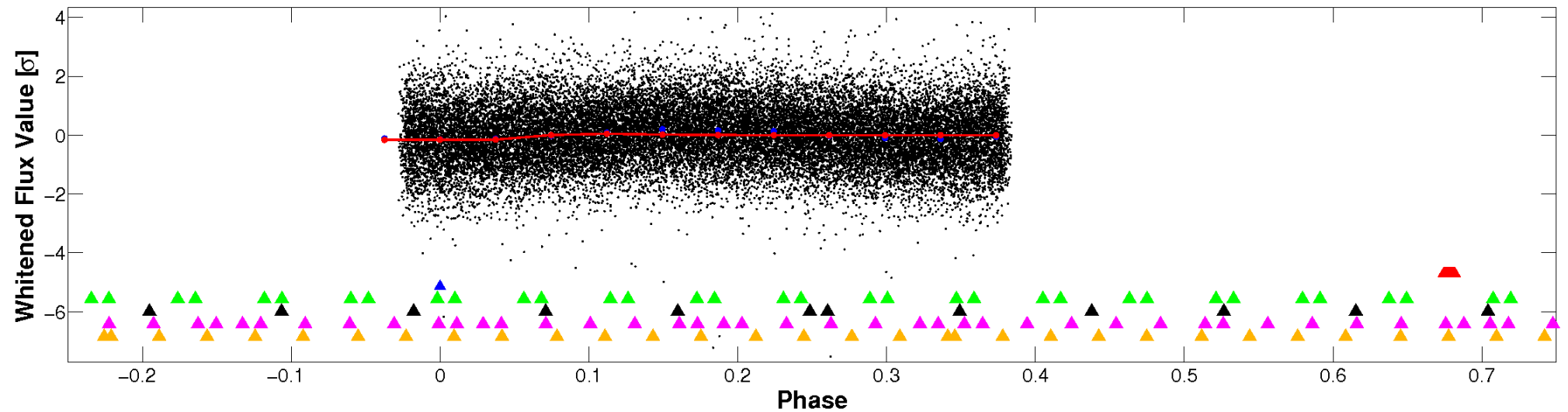
This plot does not exist for this TCE.

# Non-Whitened Vs. Whitened Light Curve

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

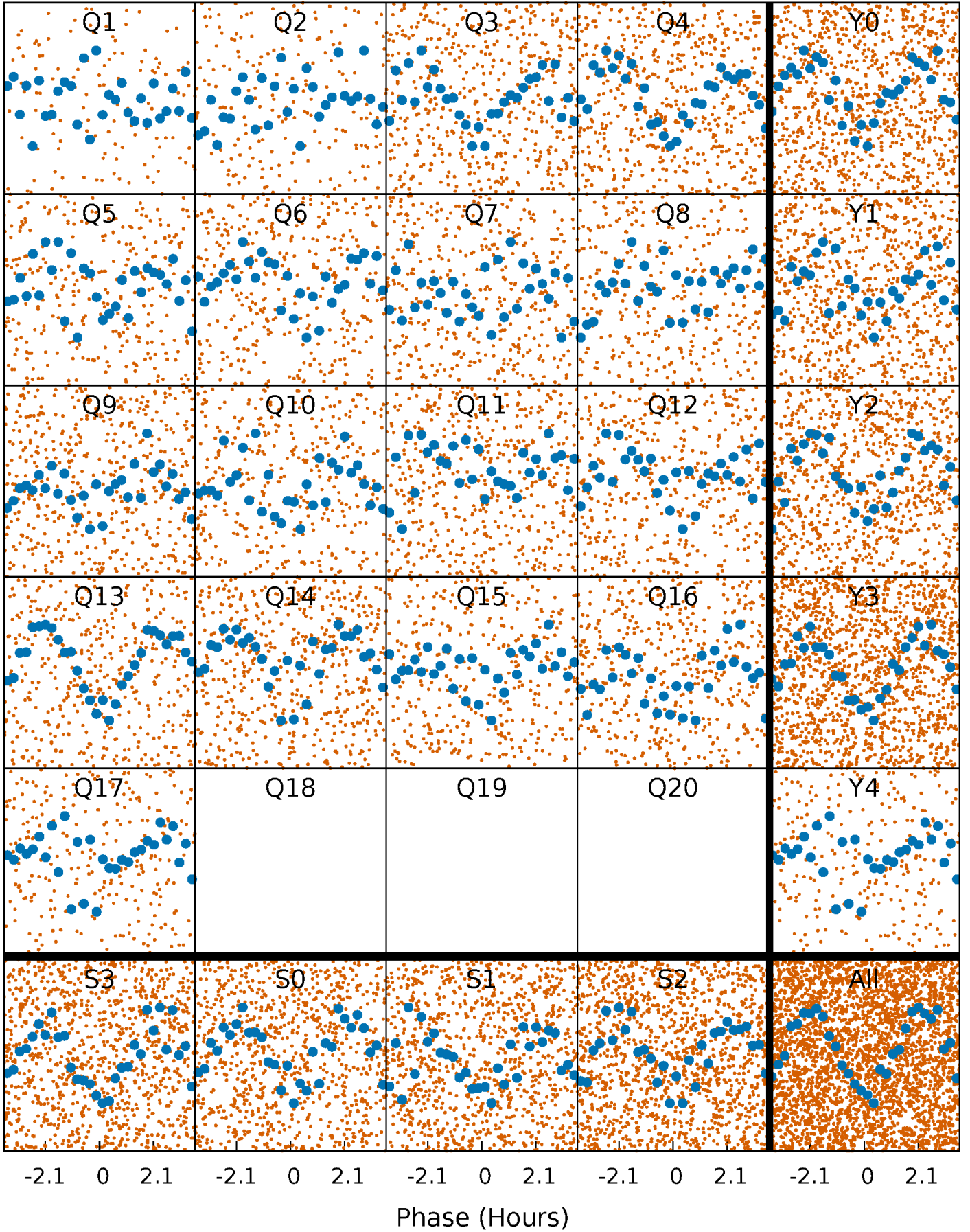


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



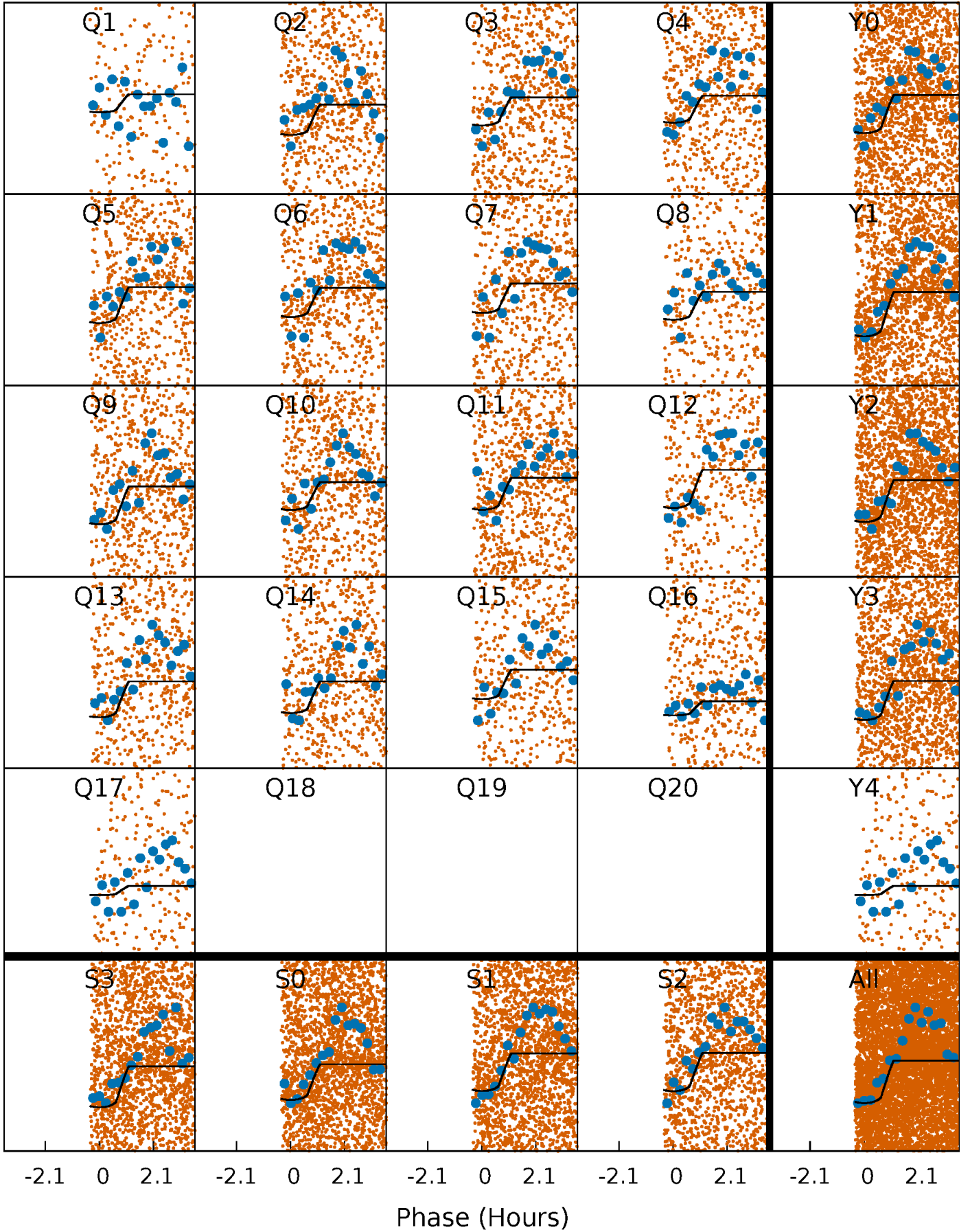
# PDC Quarter-Phased Transit Curves

TCE 009016344-02   P= 0.546863 Days    $T_0=131.917672$  (BKJD)



# DV Quarter-Phased Transit Curves

TCE 009016344-02   P= 0.546863 Days    $T_0=131.917672$  (BKJD)

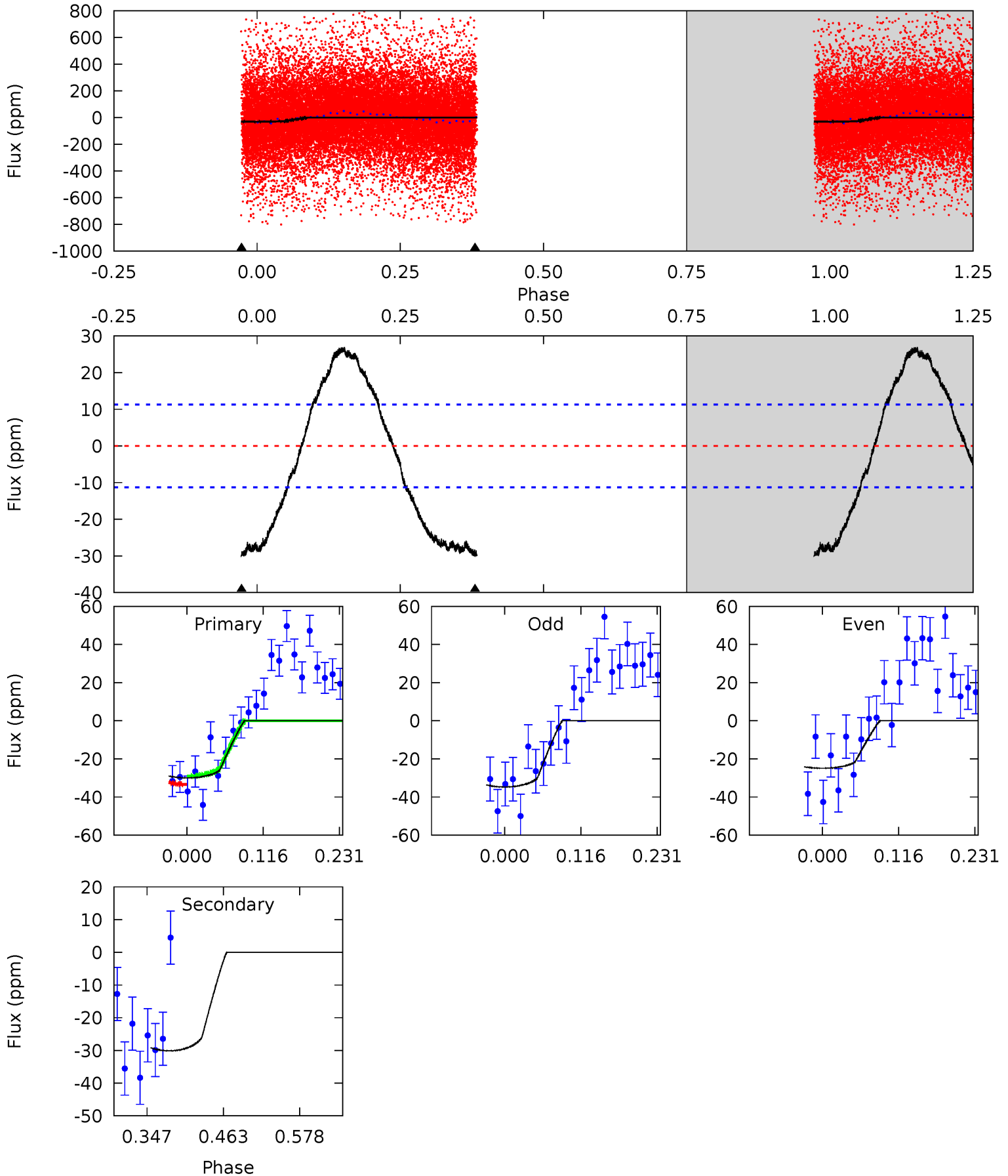


This plot does not exist for this TCE.

# DV Model-Shift Uniqueness Test

009016344-02, P = 0.546863 Days, E = 131.370809 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
12.0	12.1	0	0	4.53	1.57	7.36	12.0	12.0	12.1	12.1	1.99	0.89	0.47	0.73



## Alt Model-Shift Uniqueness Test

This plot does not exist for this TCE.

### Stellar Parameters For KIC 009016344

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$\rho_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$7207^{+226}_{-302}$	$4.060^{+0.185}_{-0.167}$	$-0.160^{+0.250}_{-0.350}$	$1.894^{+0.576}_{-0.471}$	$1.499^{+0.225}_{-0.250}$	$0.311^{+0.356}_{-0.143}$
	+3%/-4%	+5%/-4%	+156%/-219%	+30%/-25%	+15%/-17%	+114%/-46%
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 009016344-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-30 \pm 2$	$1.33^{+0.51}_{-0.48}$	$4988^{+412}_{-380}$	$6295^{+1830}_{-1025}$	$2.110^{+2.770}_{-1.009}$
Alt.	N/A	N/A	N/A	N/A	N/A

$T_{\text{max}}$  = 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

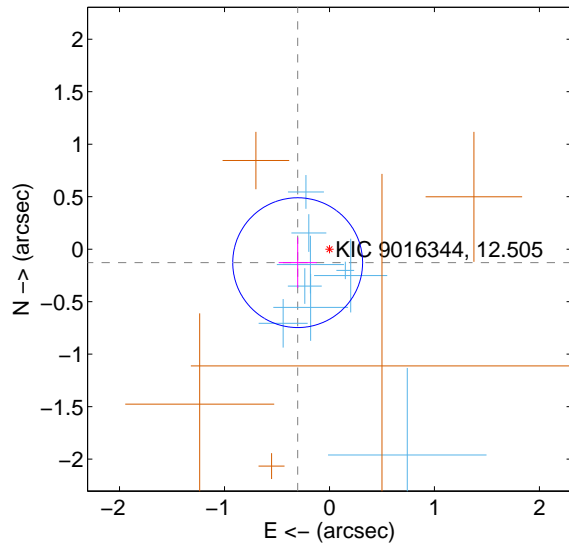
Supplemental centroid analysis for 009016344-02. Kepler magnitude: 12.51. Transit SNR 11.38

There are 9 quarters with good PRF difference image offsets

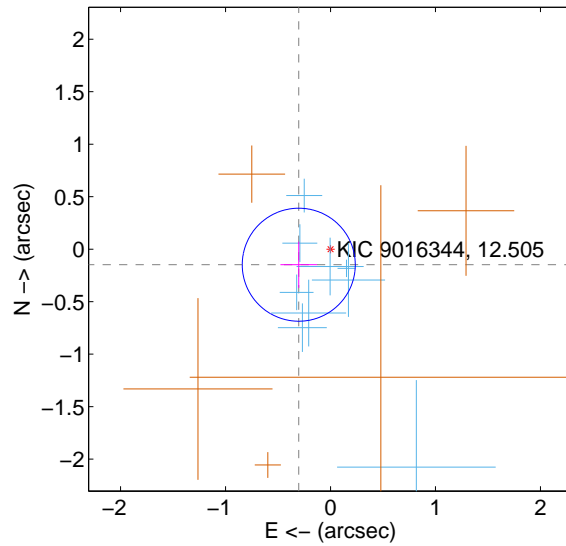
The direct PRF centroid is offset from the target star catalog position by about 0.15 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.329 \pm 0.206$	1.60	$0.303 \pm 0.181$	$-0.128 \pm 0.241$
PRF-fit source offset from KIC position	$0.337 \pm 0.179$	1.88	$0.302 \pm 0.175$	$-0.148 \pm 0.220$
photometric centroid source offset	$0.58 \pm 0.45$	1.29	$0.38 \pm 0.47$	$-0.43 \pm 0.43$

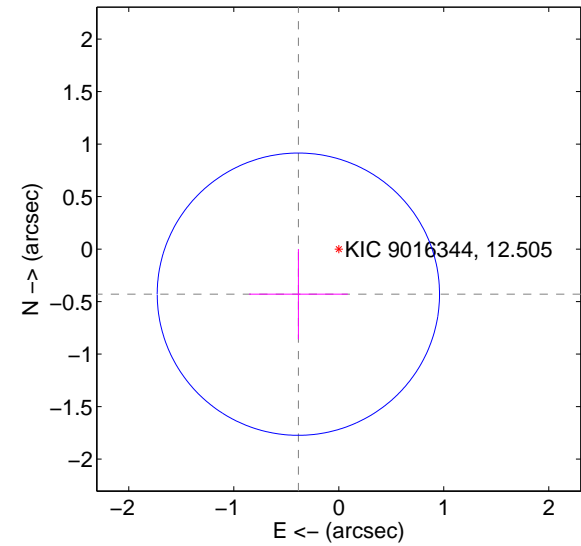
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position



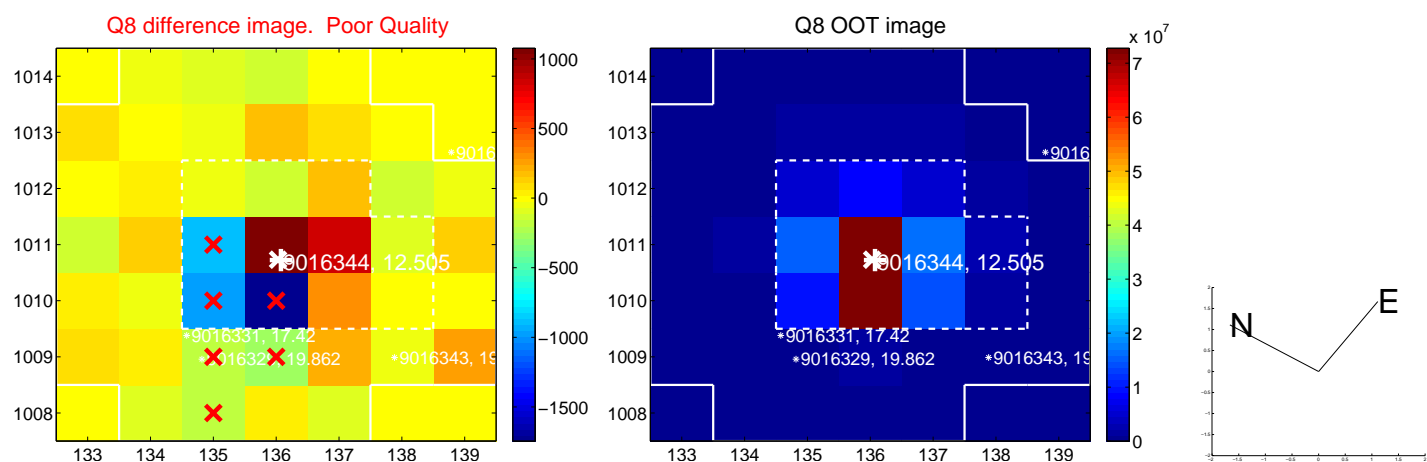
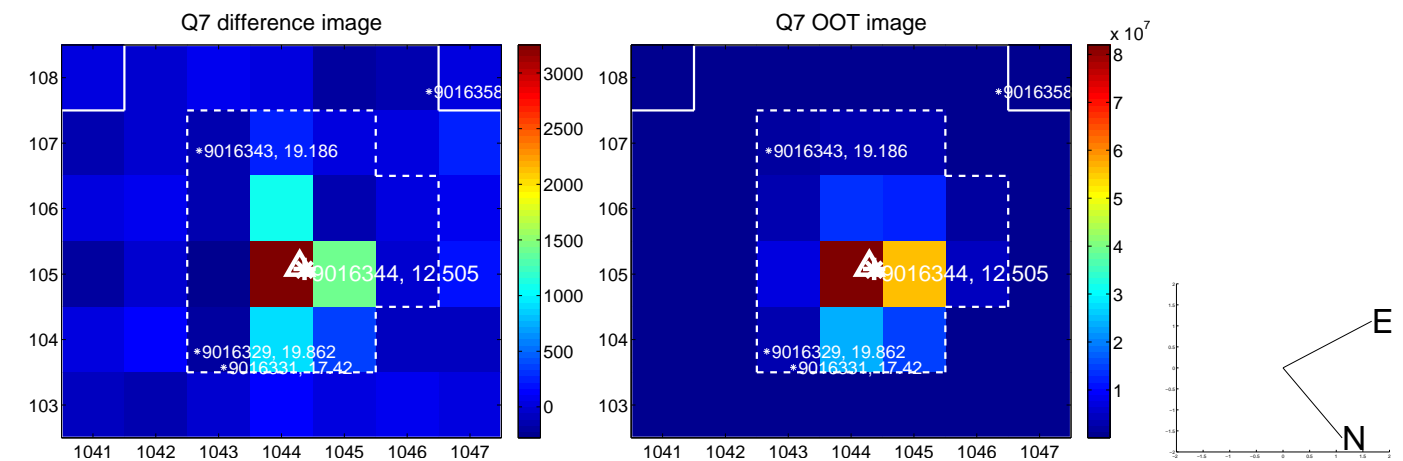
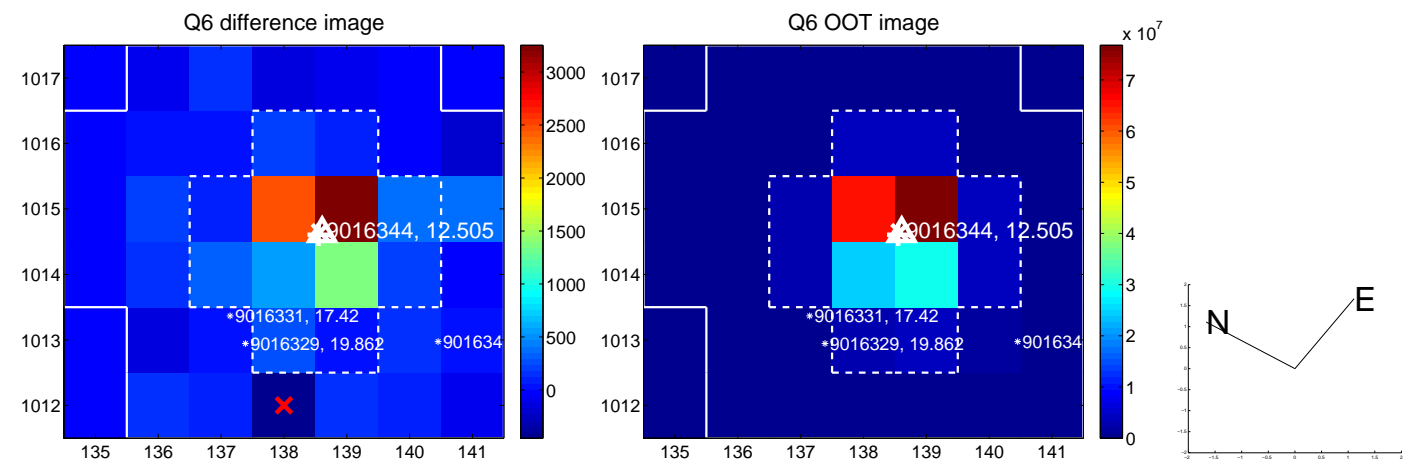
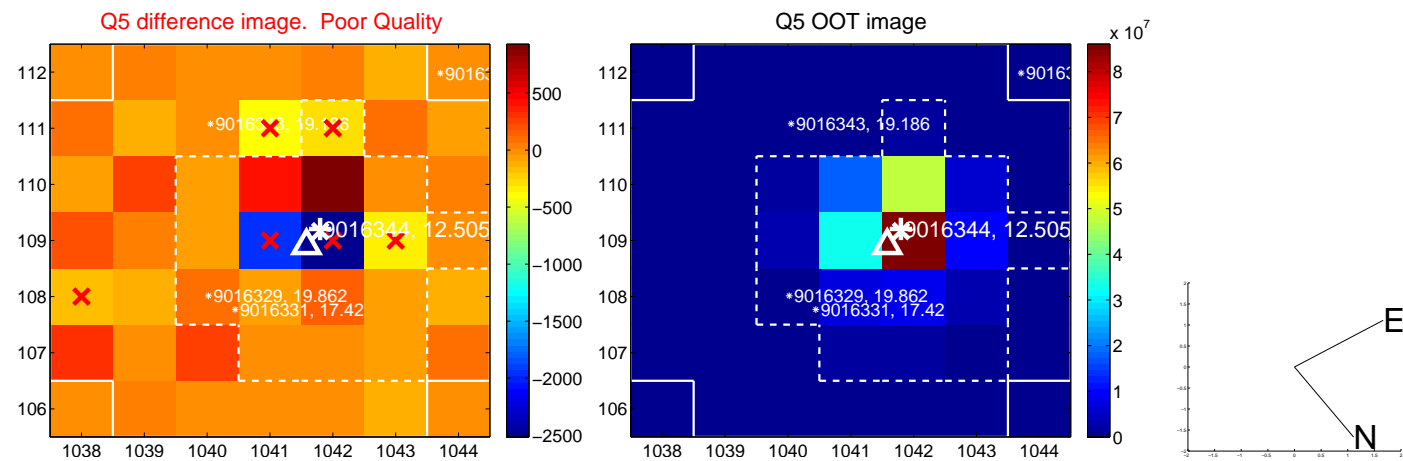
offset from photometric centroids



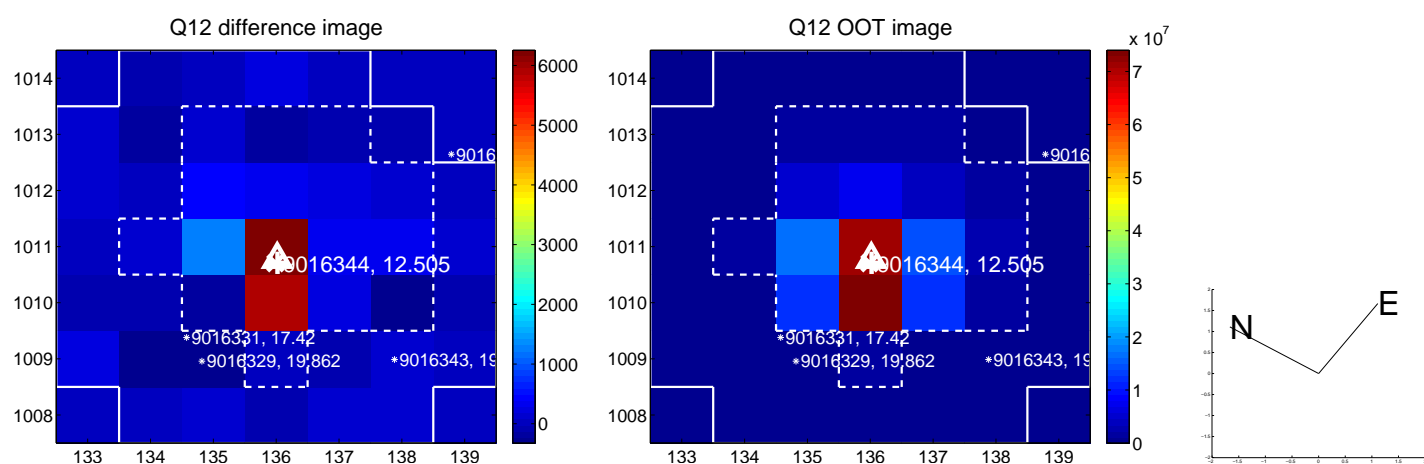
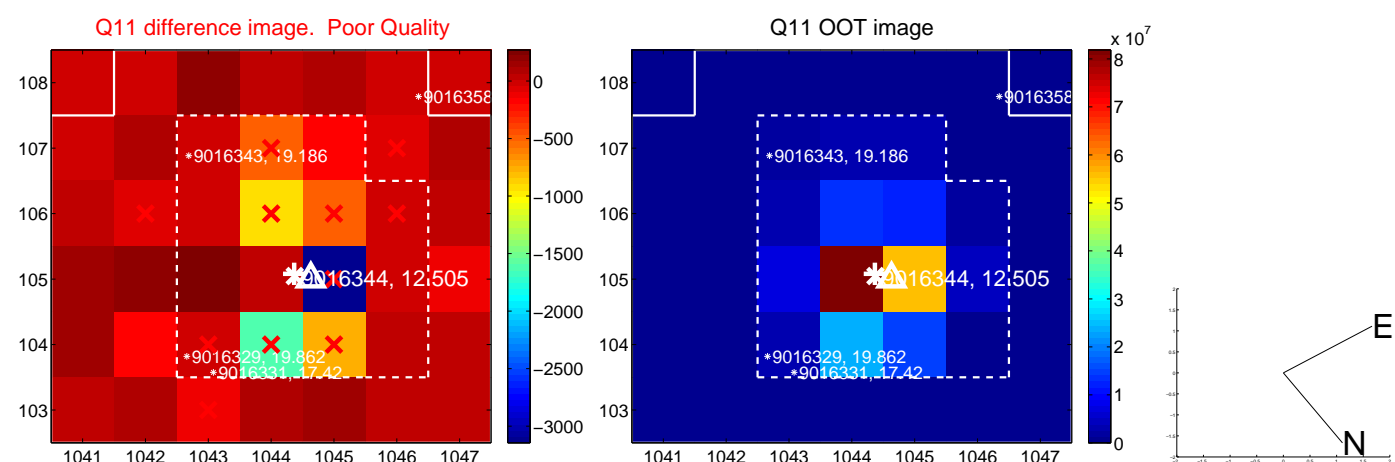
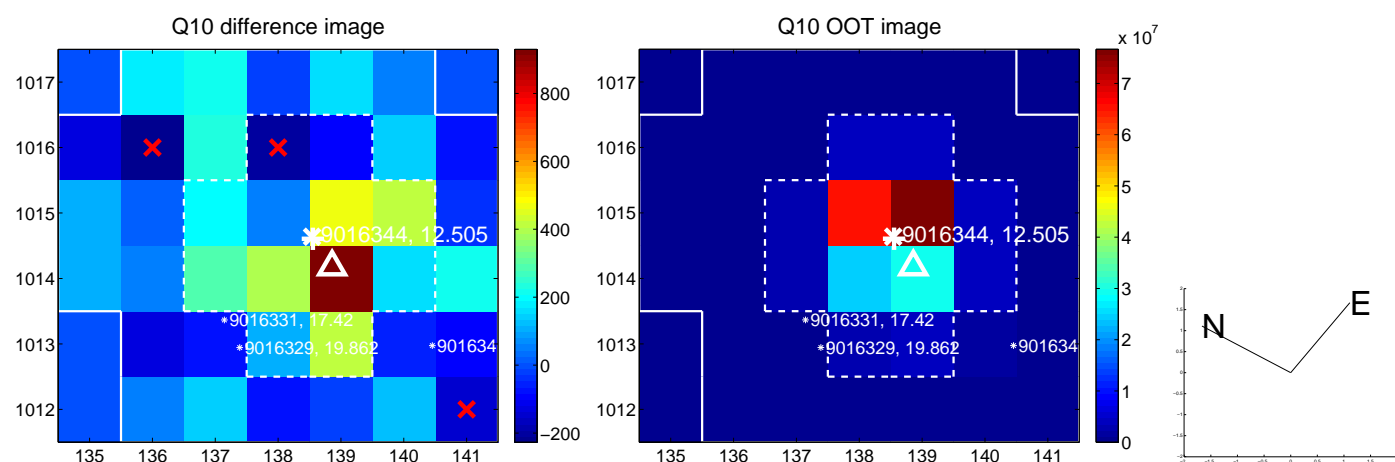
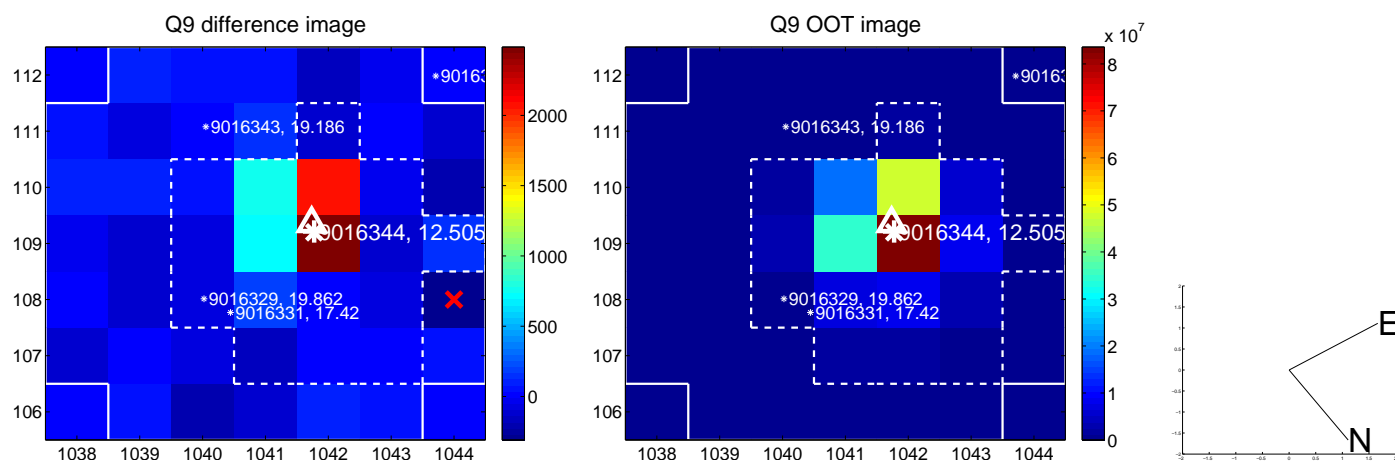
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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



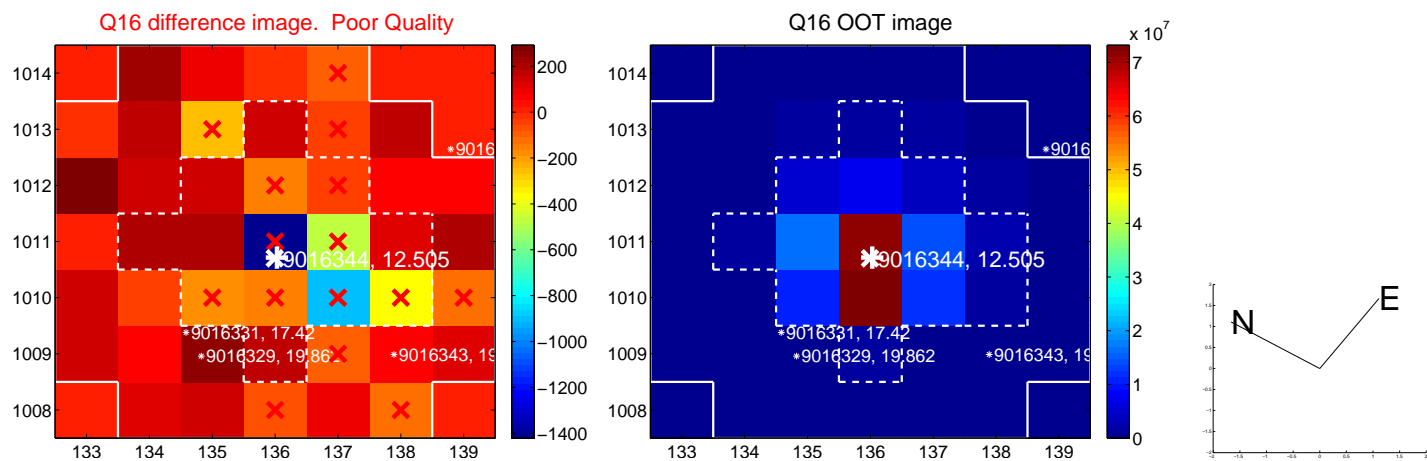
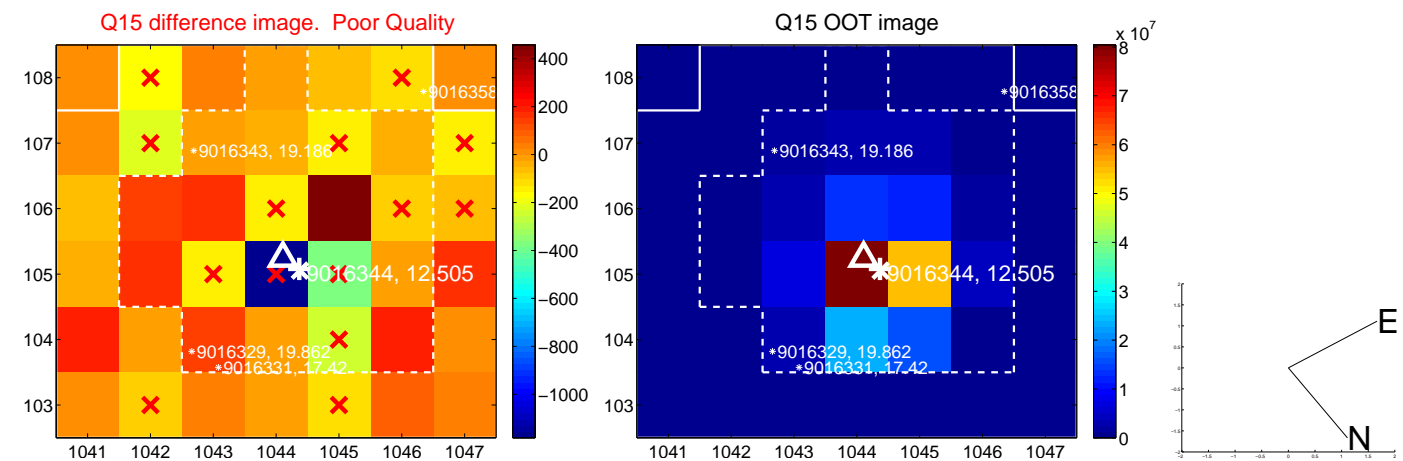
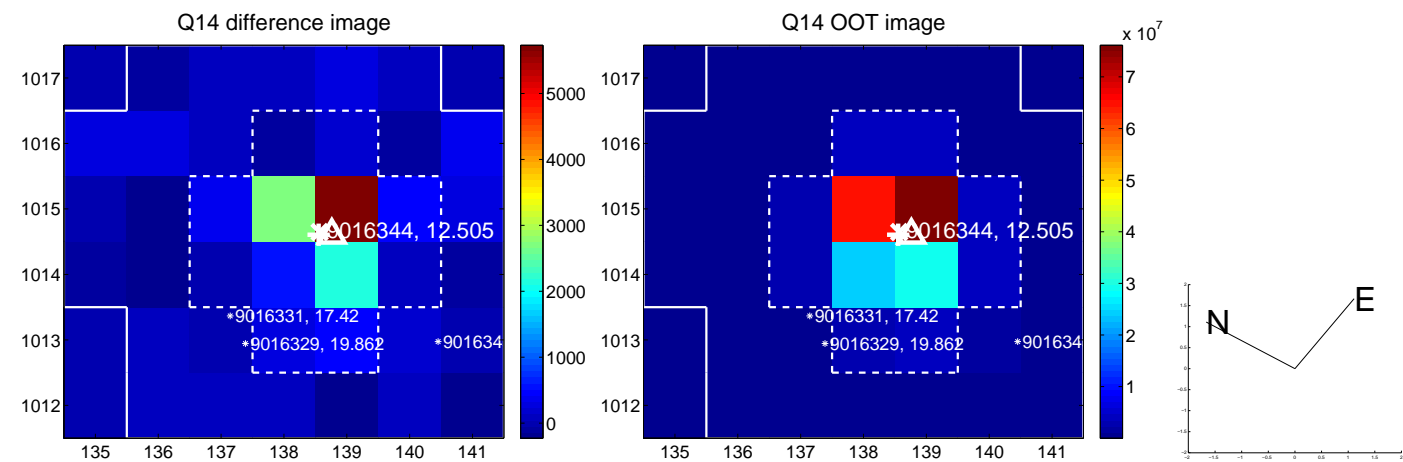
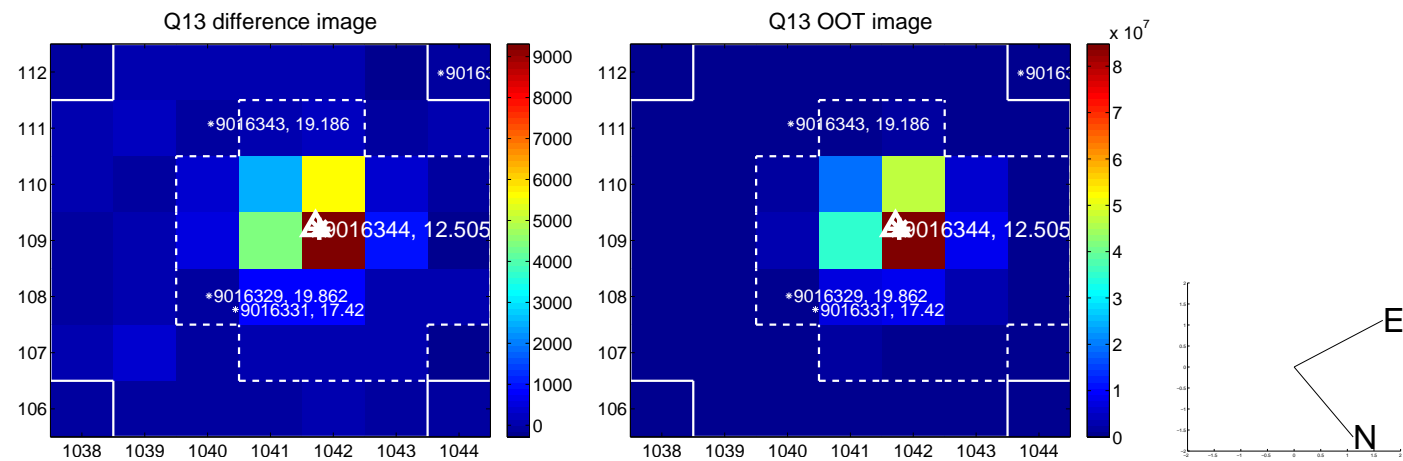
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



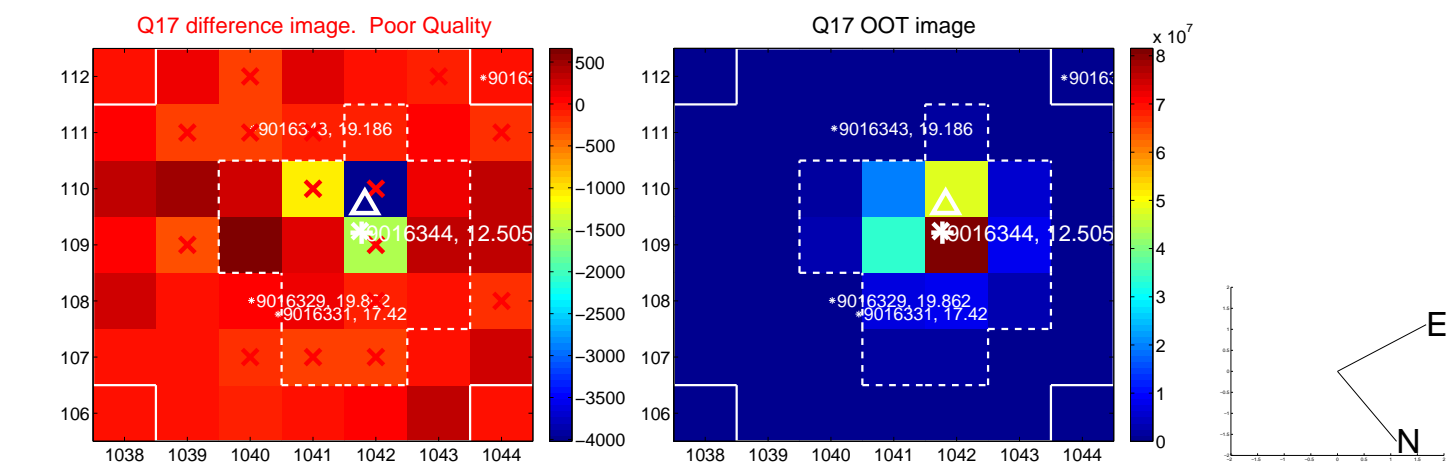
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



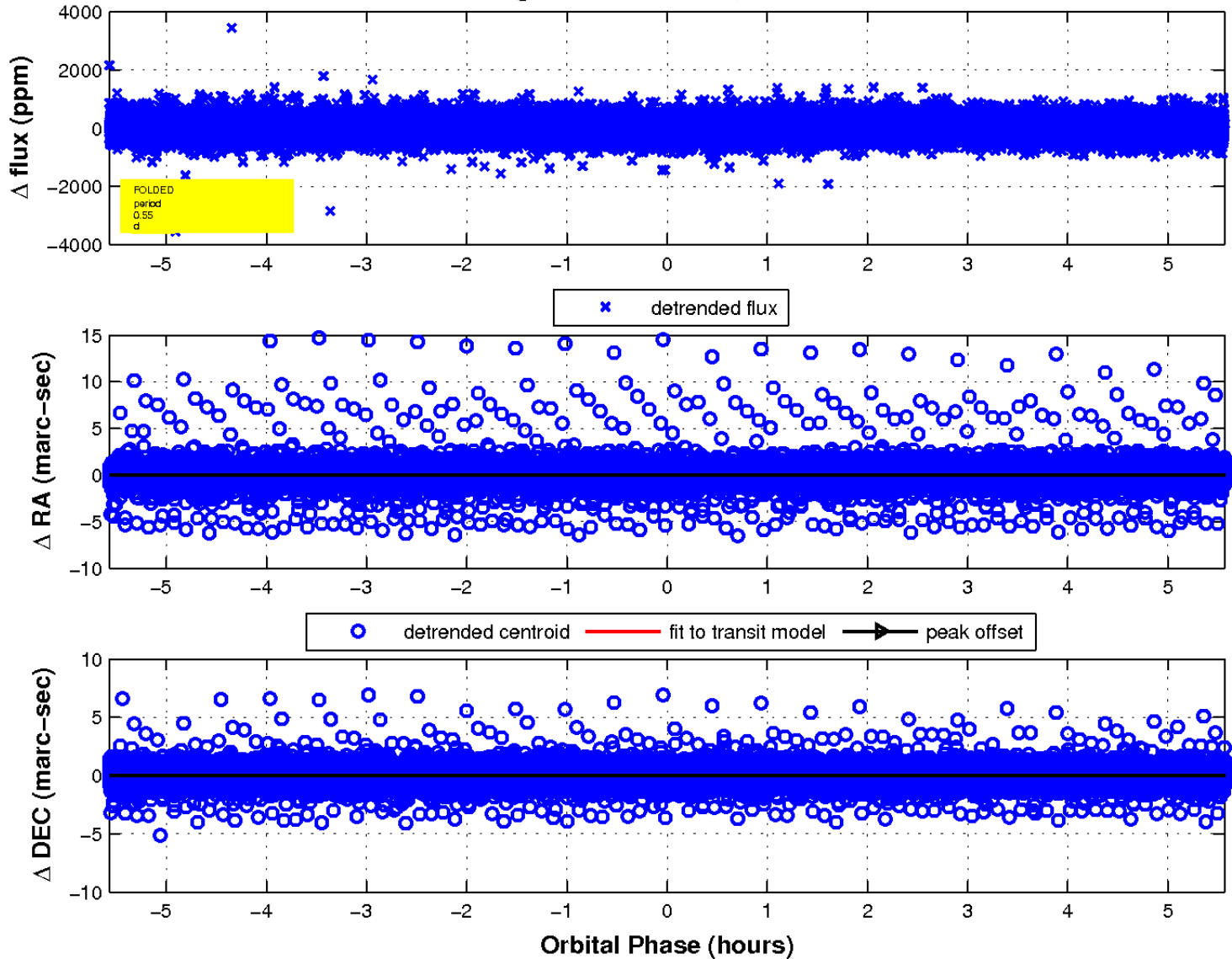
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



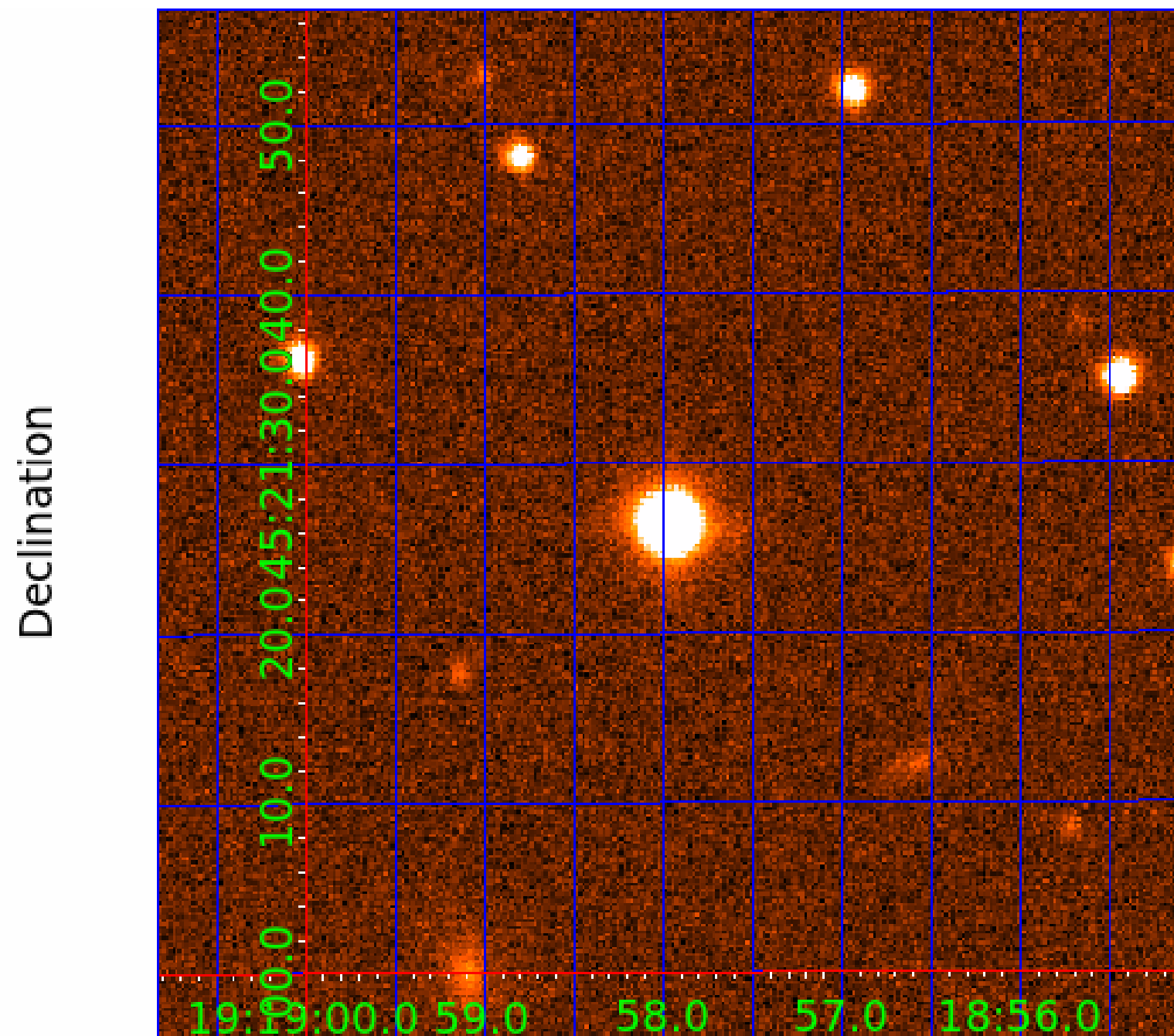
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



fluxWeightedCentroids, Planet 2 of 6



UKIRT Image



# KIC 009016344

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009016344-01	OBS	No	0.546865	131.739521	35.7	2.440	12.5	13.2	1.89	7207	1.31	38576.78
009016344-02	OBS	No	0.546863	131.917672	35.5	1.856	10.8	11.4	1.89	7207	1.31	38576.93
009016344-03	OBS	No	42.076666	169.999906	435.1	3.821	8.5	10.0	1.89	7207	4.60	117.88
009016344-04	OBS	No	128.810512	162.137543	871.7	3.510	8.7	8.5	1.89	7207	6.72	26.52
009016344-05	OBS	No	35.457679	137.022461	485.4	3.034	8.6	8.4	1.89	7207	7.72	148.10
009016344-06	OBS	No	44.605881	171.168409	313.3	3.373	7.9	6.9	1.89	7207	3.66	109.05

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009016344-01	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT
009016344-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE_ZUMA—LPP_DV—MOD_NONUNIQ_DV—SAME_NTL_PERIOD
009016344-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT
009016344-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT
009016344-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_ALT
009016344-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT

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

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

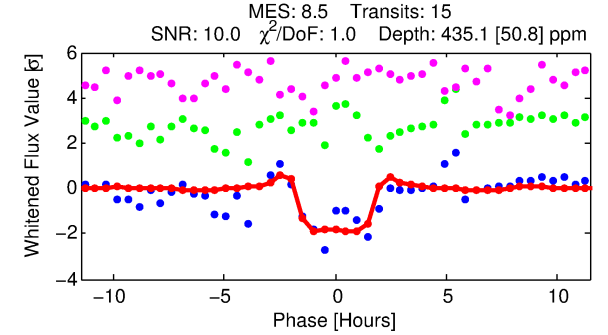
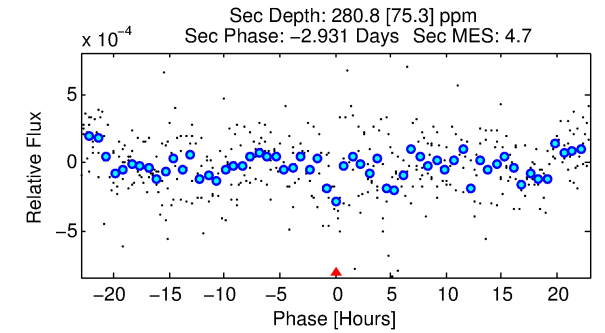
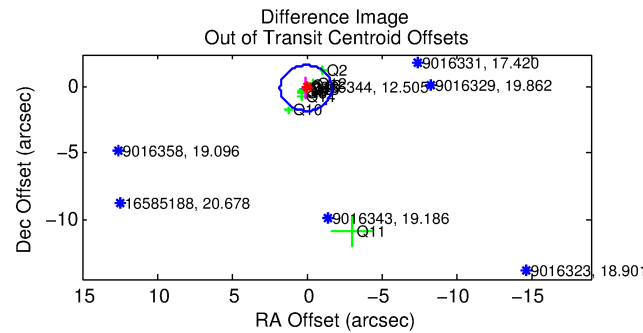
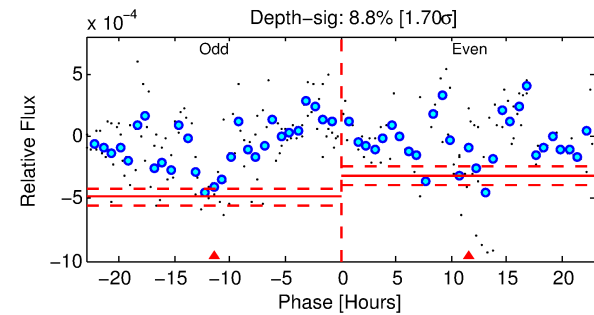
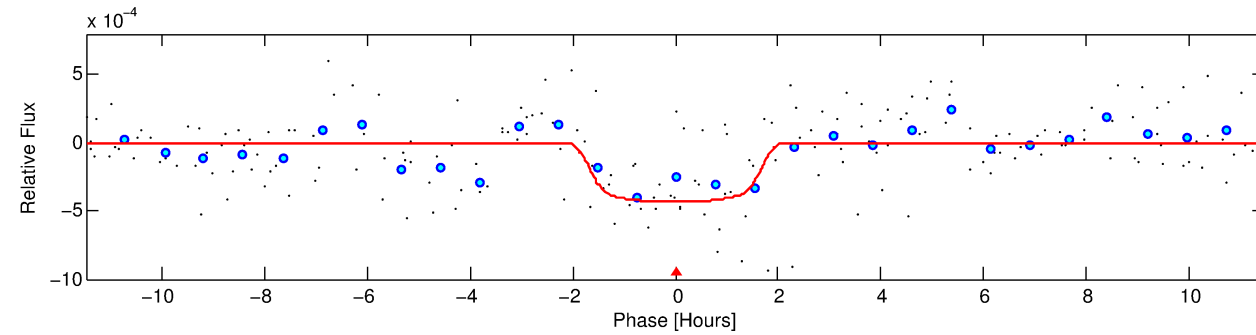
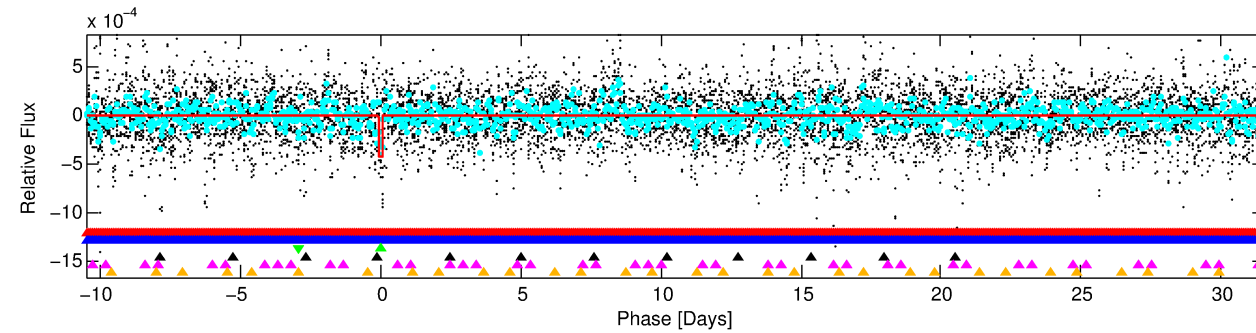
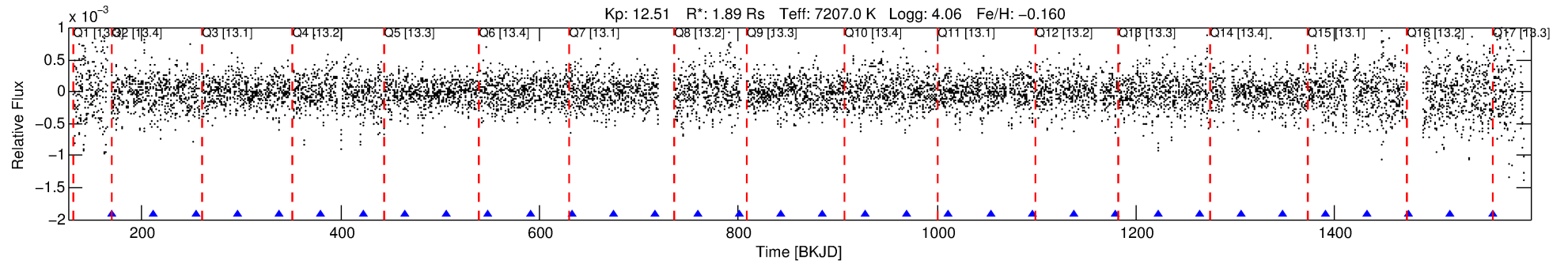
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 009016344-03

No Significant Match Found

# DV One-Page Summary

KIC: 9016344 Candidate: 3 of 6 Period: 42.077 d



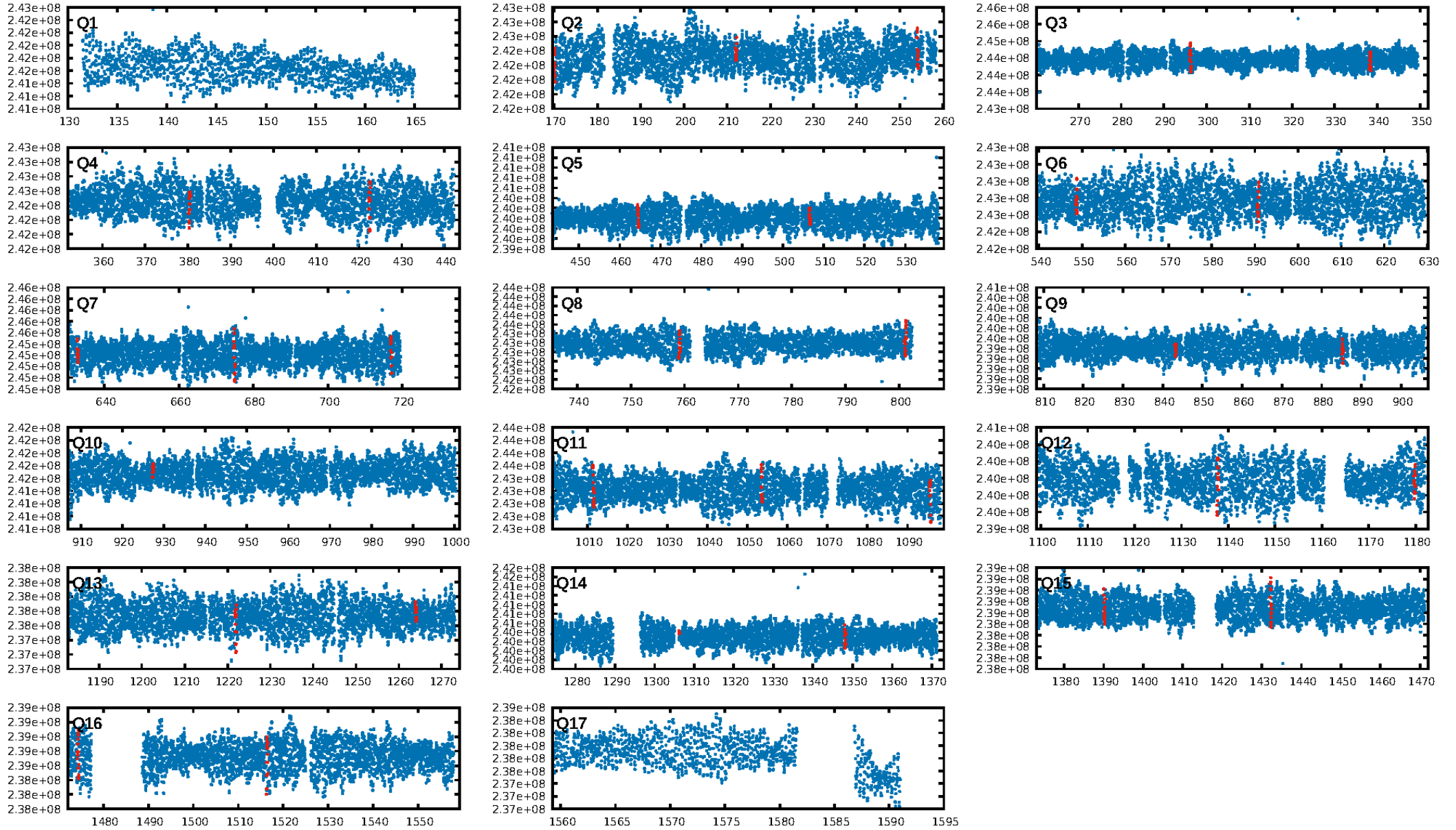
## DV Fit Results:

Period = 42.07667 [0.00042] d  
Epoch = 169.9999 [0.0073] BKJD  
Rp/R\* = 0.0223 [0.0038]  
a/R\* = 39.89 [36.08]  
b = 0.91 [0.18]  
Seff = 117.88 [45.63]  
Teff = 840 [81] K  
Rp = 4.60 [1.60] Re  
a = 0.2712 [0.0671] AU  
Ag = 536.15 [297.08] [1.80 $\sigma$ ]  
Teffp = 6251 [722] K [7.45 $\sigma$ ]

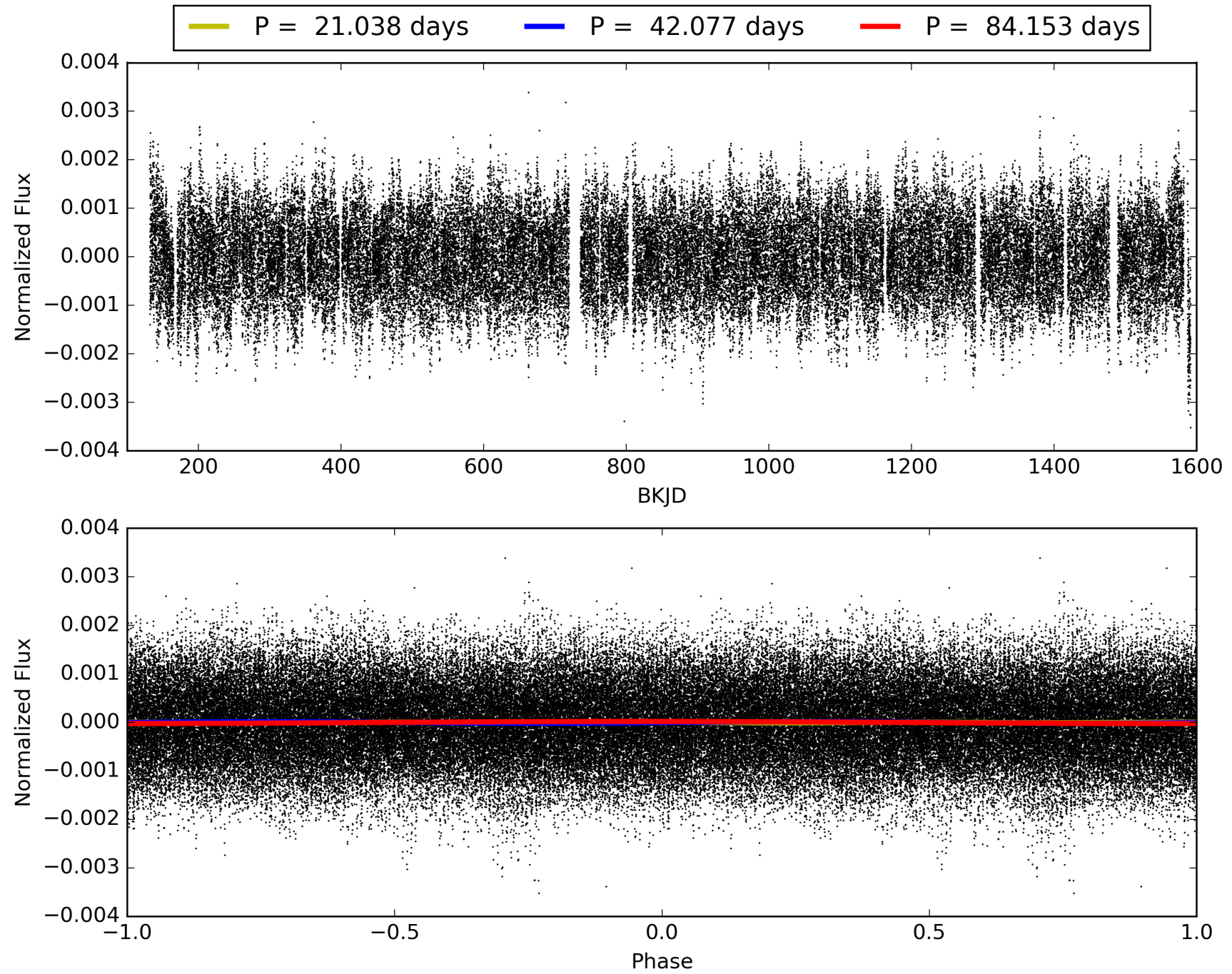
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [32.56 $\sigma$ ]  
LongPeriod-sig: 100.0% [11.91 $\sigma$ ]  
ModelChiSquare2-sig: 16.7%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [15/15]  
GhostDiagnostic-chr: 1.148  
Centroid-sig: 5.8%  
Centroid-so: 0.381 arcsec [1.56 $\sigma$ ]  
OotOffset-rm: 0.073 arcsec [0.13 $\sigma$ ]  
KicOffset-rm: 0.149 arcsec [0.26 $\sigma$ ]  
OotOffset-st: 3/4/4/2 [13]  
KicOffset-st: 3/4/4/2 [13]  
DiffImageQuality-fgm: 0.46 [6/13]  
DiffImageOverlap-fno: 0.00 [0/15]

# TCE 009016344-03, PDC Light Curves

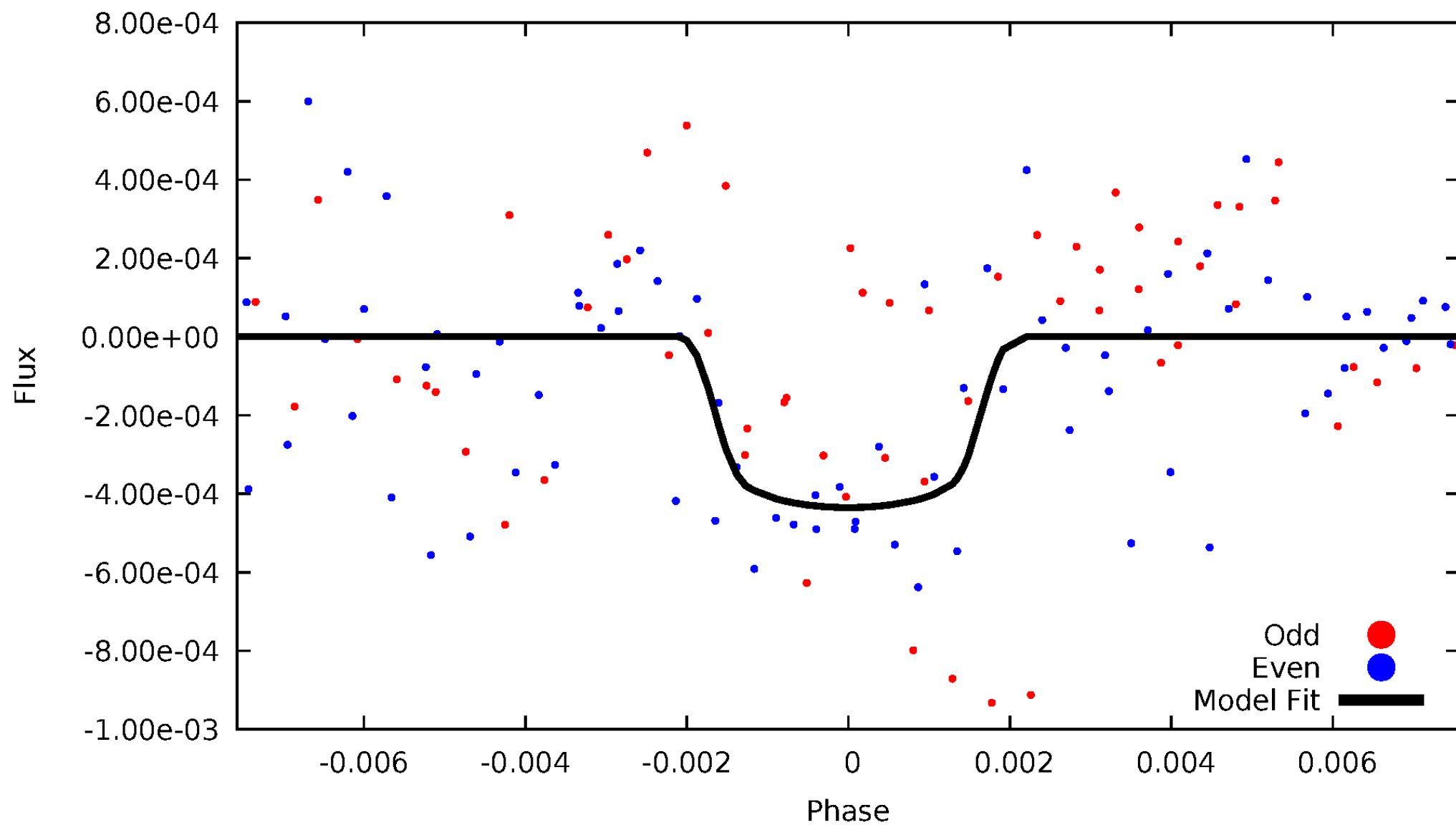


TCE 009016344-03



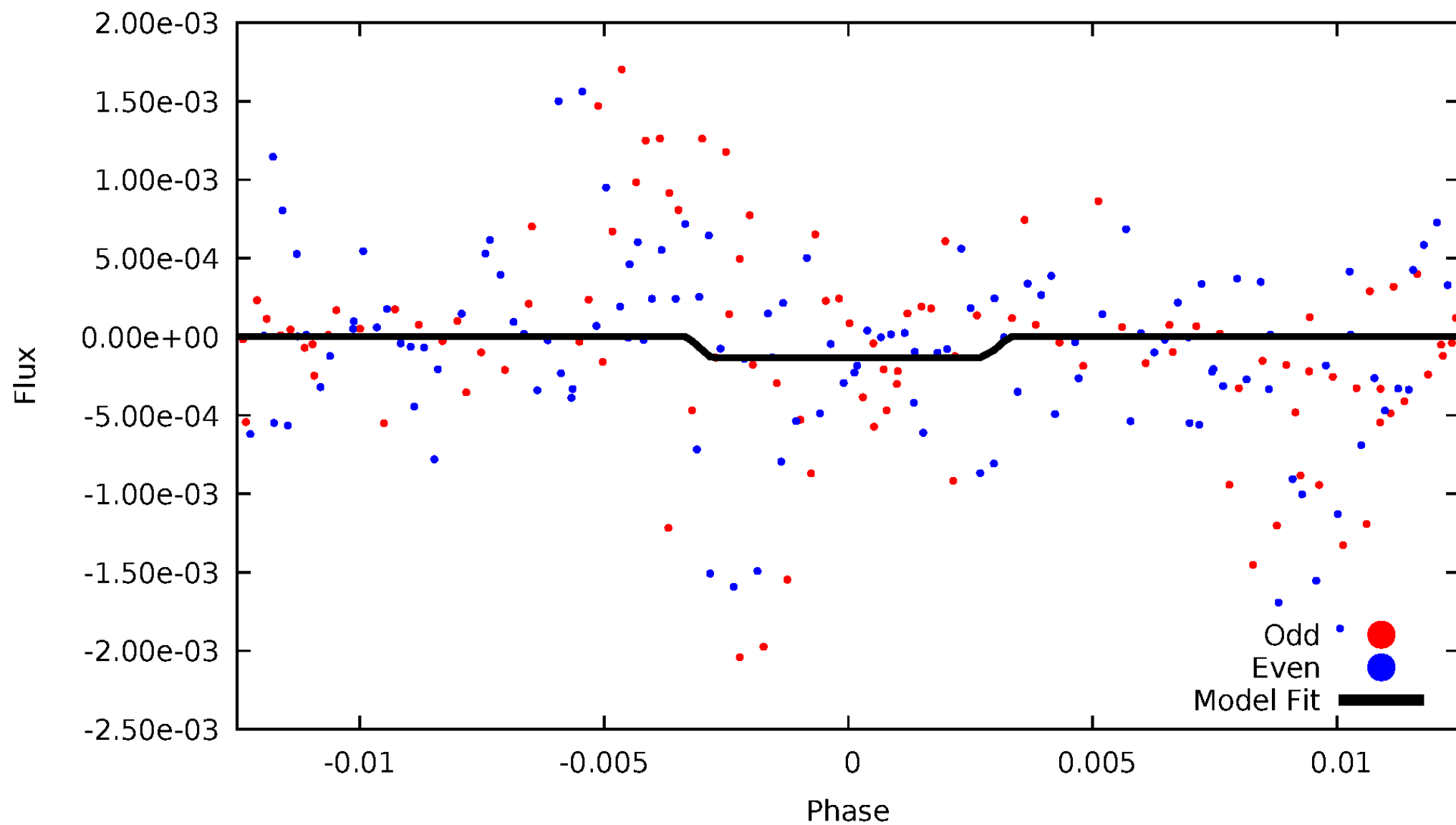
# DV Odd/Even

TCE 009016344-03



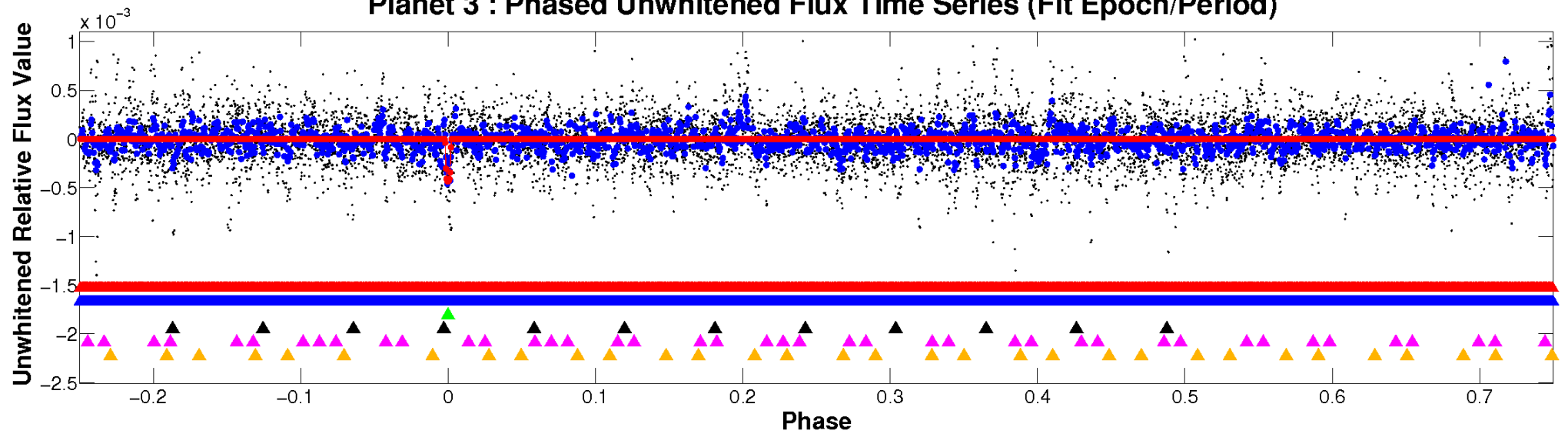
# ALT Odd/Even

TCE 009016344-03

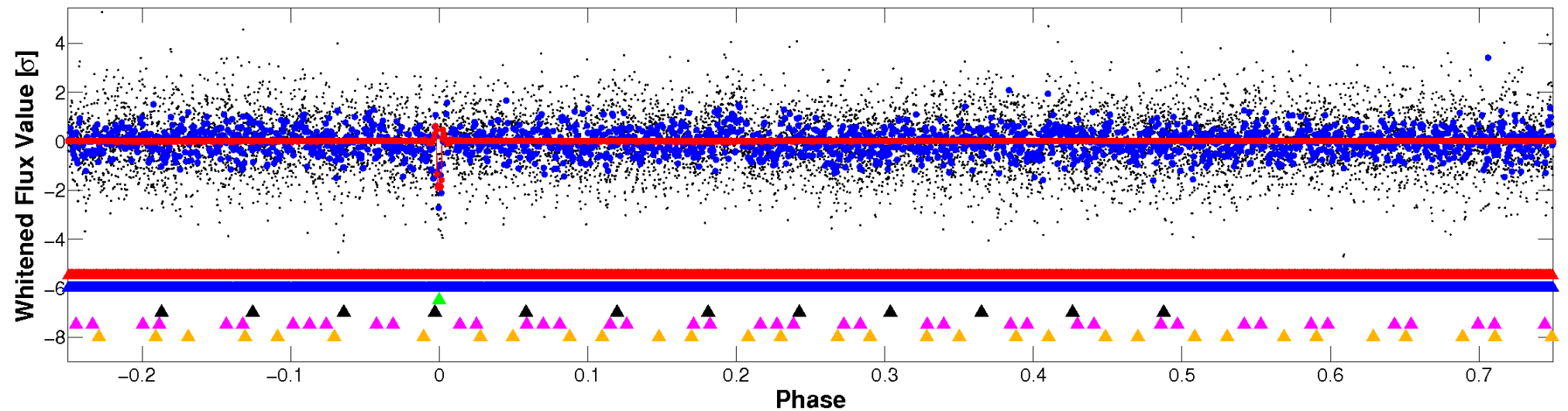


# Non-Whitened Vs. Whitened Light Curve

Planet 3 : Phased Unwhitened Flux Time Series (Fit Epoch/Period)

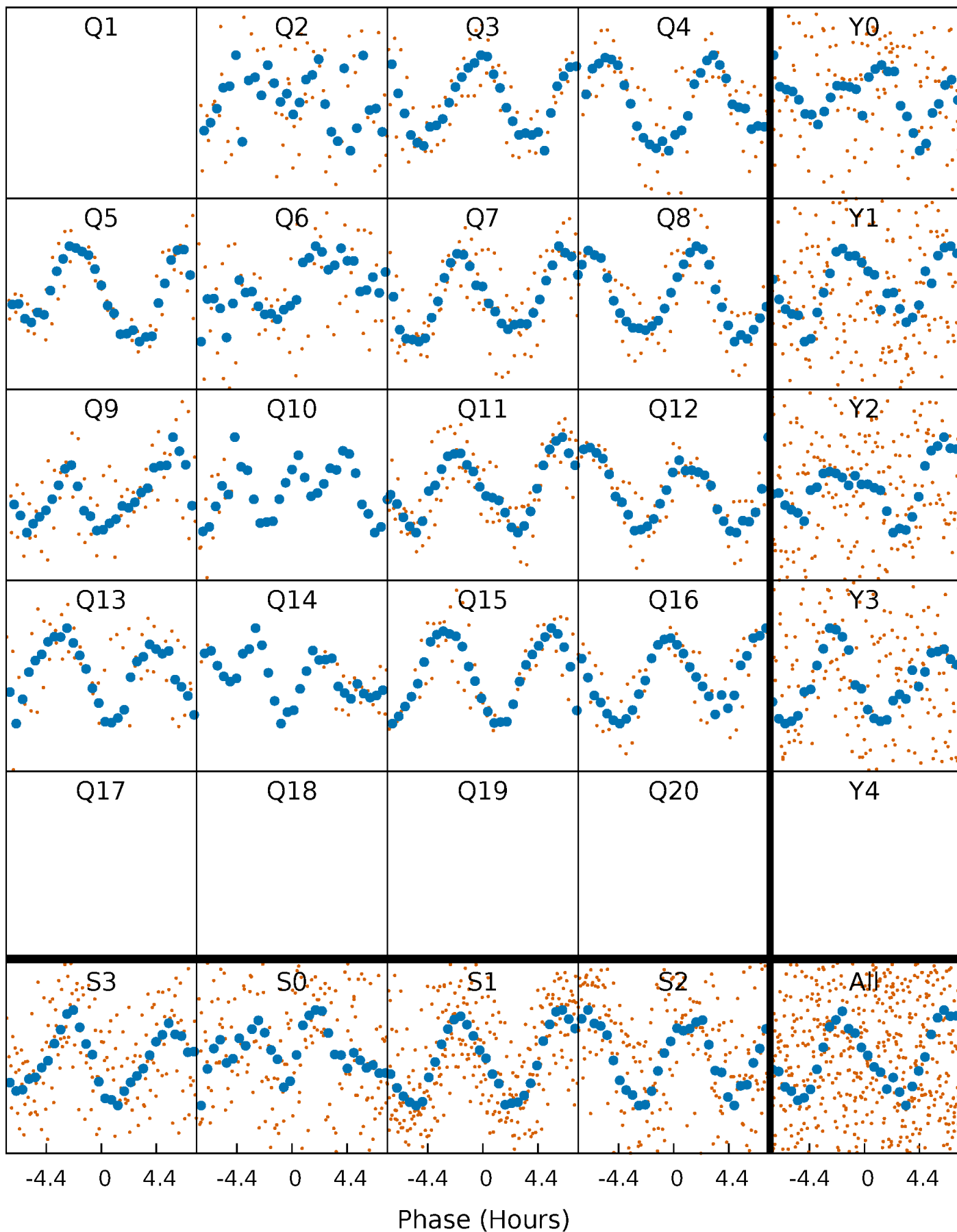


Planet 3 : Phased Whitened Flux Time Series (Fit Epoch/Period)



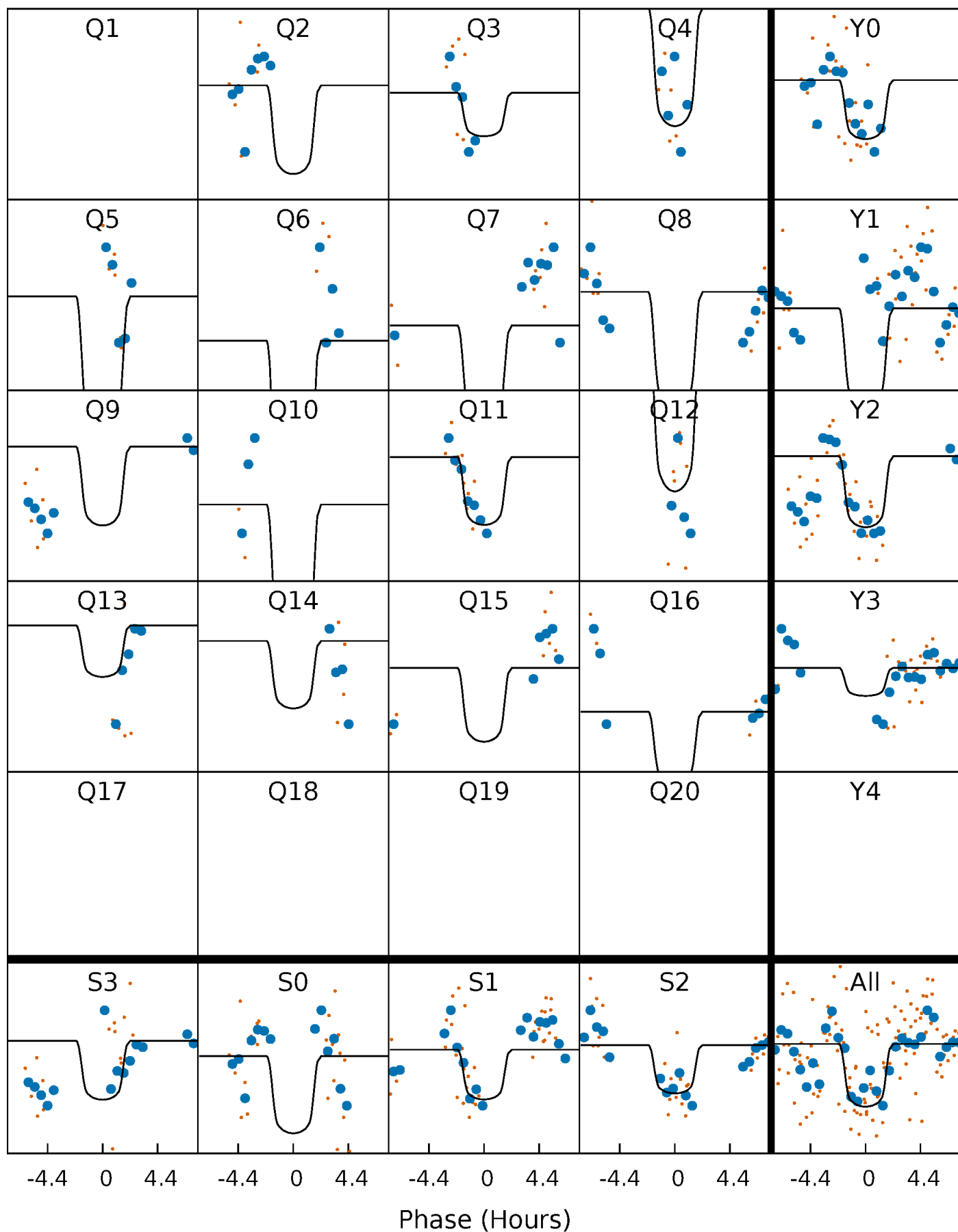
# PDC Quarter-Phased Transit Curves

TCE 009016344-03 P= 42.076666 Days  $T_0=169.999906$  (BKJD)



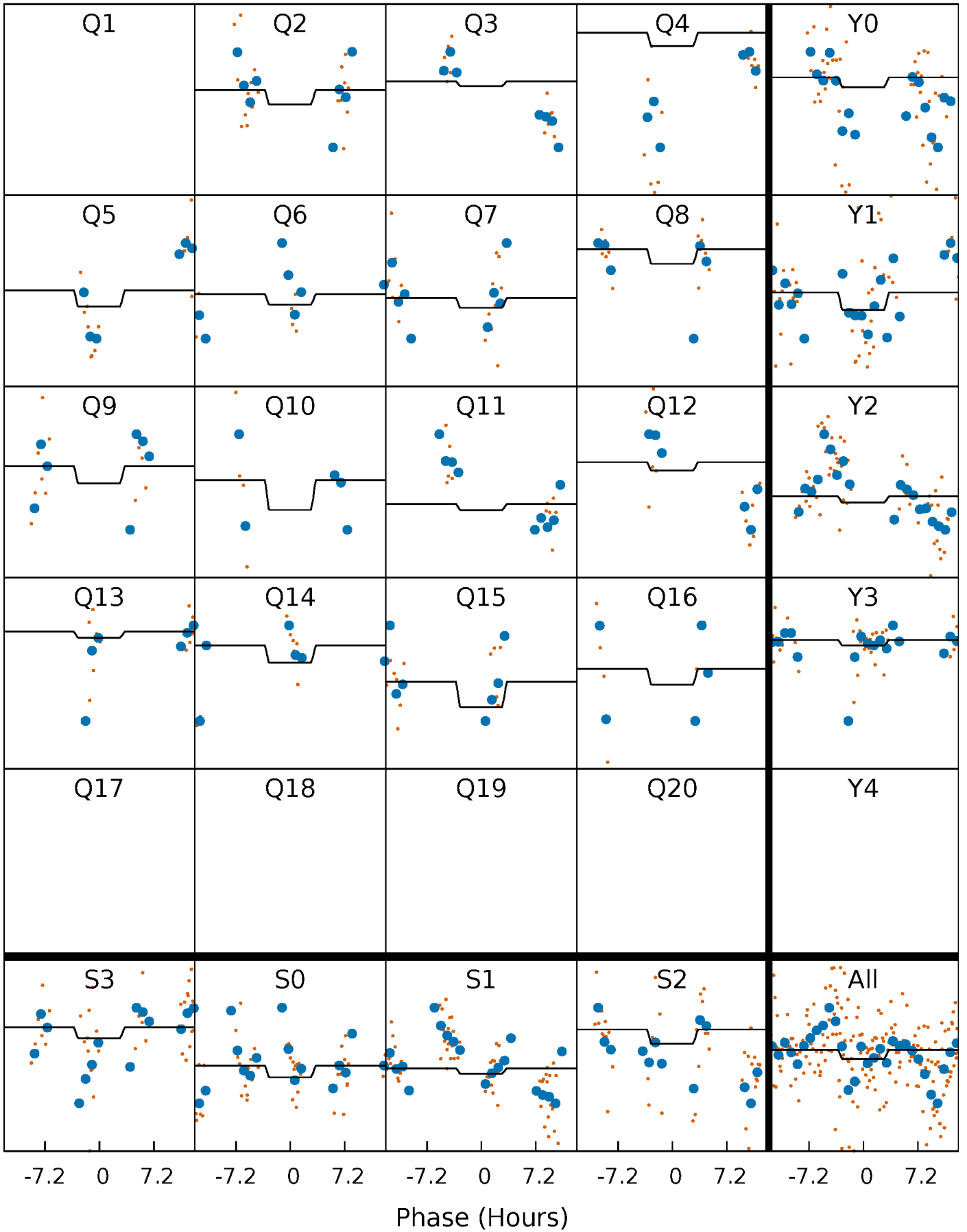
# DV Quarter-Phased Transit Curves

TCE 009016344-03 P= 42.076666 Days  $T_0=169.999906$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

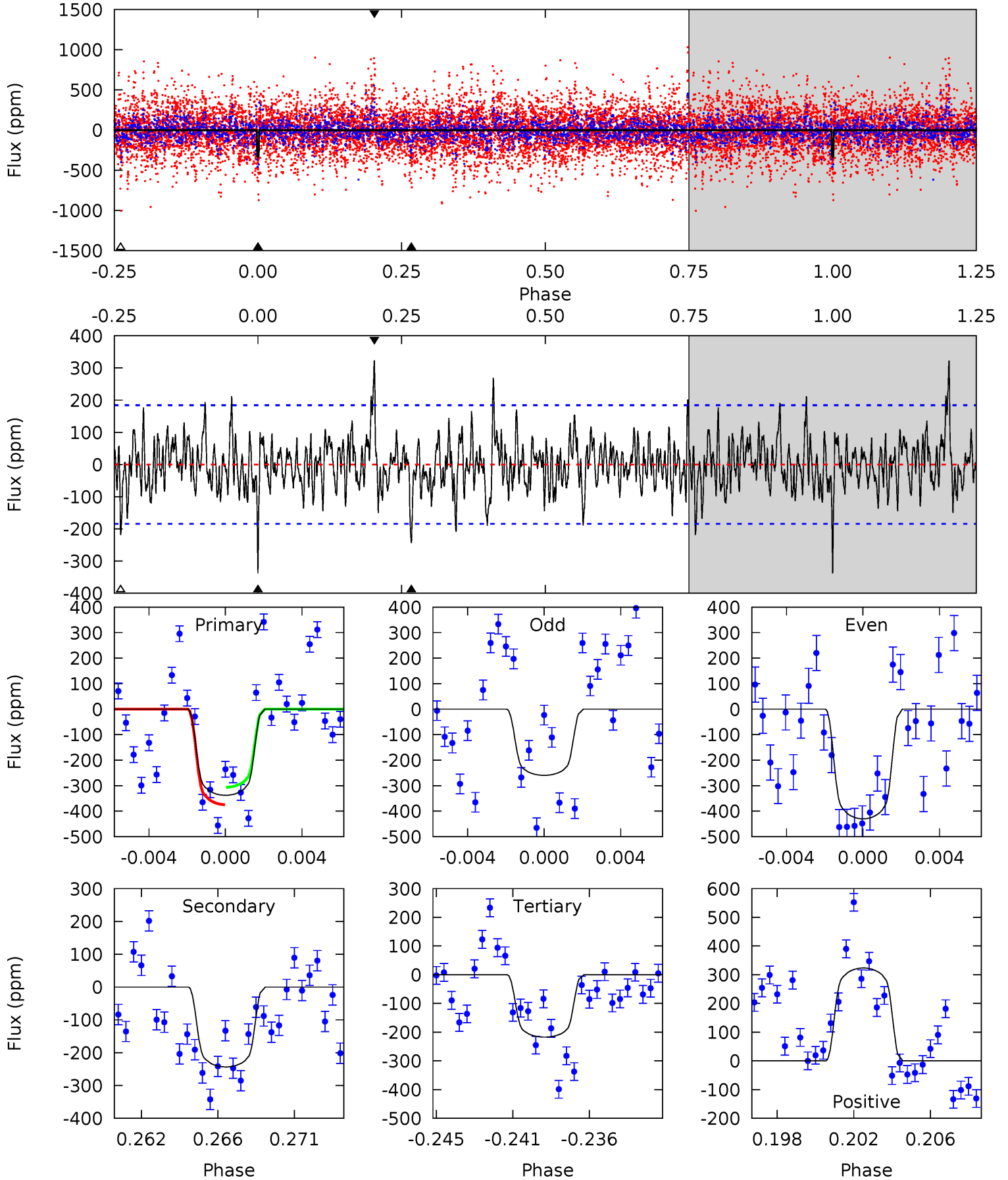
TCE 009016344-03 P= 42.077971 Days  $T_0=170.094477$  (BKJD)



# DV Model-Shift Uniqueness Test

009016344-03, P = 42.076666 Days, E = 127.923240 Days

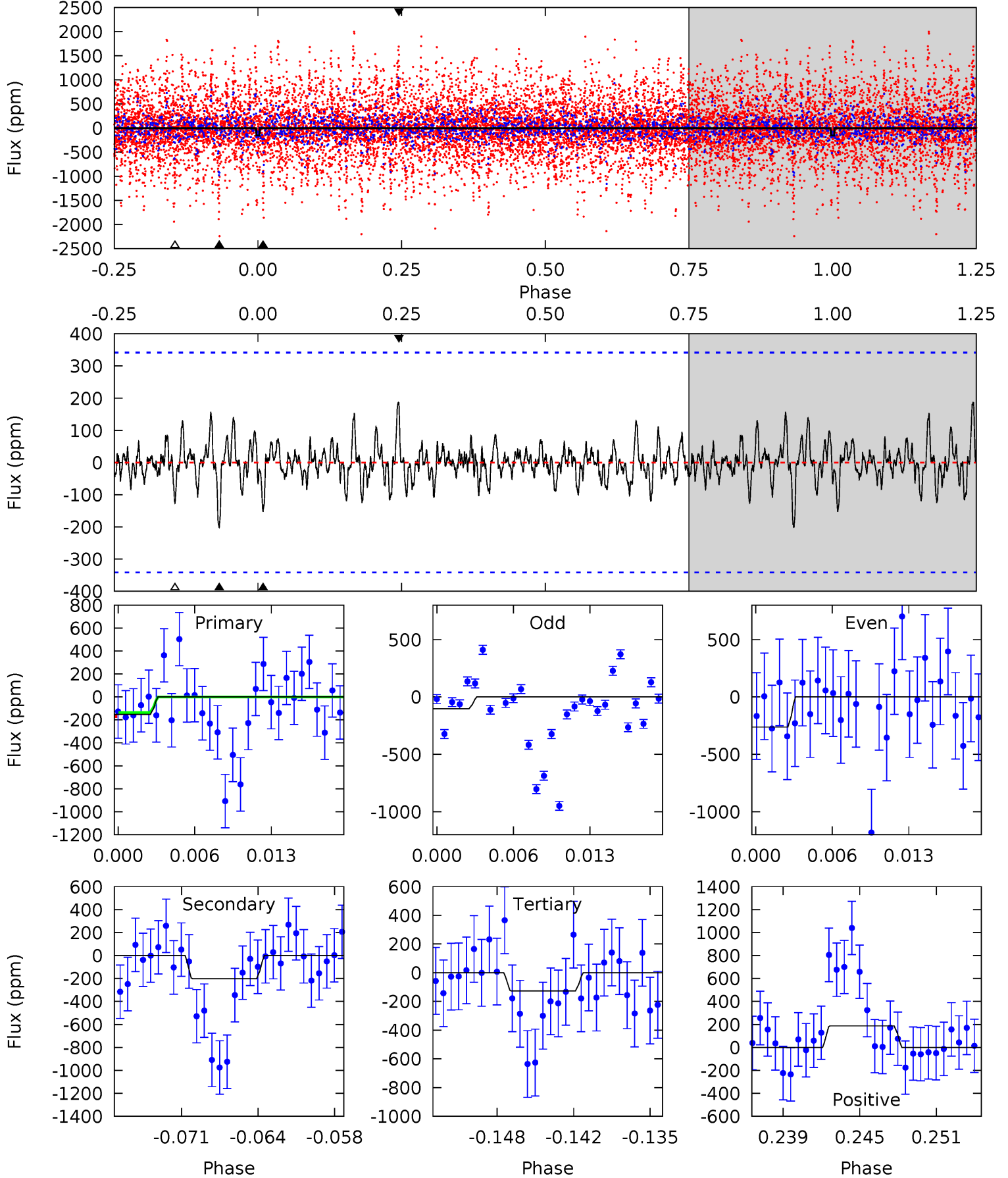
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
9.51	6.85	6.12	9.11	5.19	2.86	1.90	3.39	0.40	0.74	-2.25	2.43	0.76	0.49	0.96



# Alt Model-Shift Uniqueness Test

009016344-03, P = 42.077971 Days, E = 128.016506 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
2.28	3.02	1.90	2.80	5.11	2.72	0.71	0.39	-0.51	1.13	0.23	1.20	5.99	0.48	0.27



### Stellar Parameters For KIC 009016344

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$7207^{+226}_{-302}$	$4.060^{+0.185}_{-0.167}$	$-0.160^{+0.250}_{-0.350}$	$1.894^{+0.576}_{-0.471}$	$1.499^{+0.225}_{-0.250}$	$0.311^{+0.356}_{-0.143}$
	+3%/-4%	+5%/-4%	+156%/-219%	+30%/-25%	+15%/-17%	+114%/-46%
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 009016344-03 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-244 \pm 36$	$4.57^{+1.05}_{-0.91}$	$1160^{+94}_{-78}$	$5938^{+598}_{-495}$	$469^{+267}_{-158}$
Alt.	$-202 \pm 67$	$2.34^{+0.92}_{-0.80}$	$1172^{+89}_{-94}$	$8097^{+2984}_{-1538}$	$1430^{+2066}_{-769}$

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

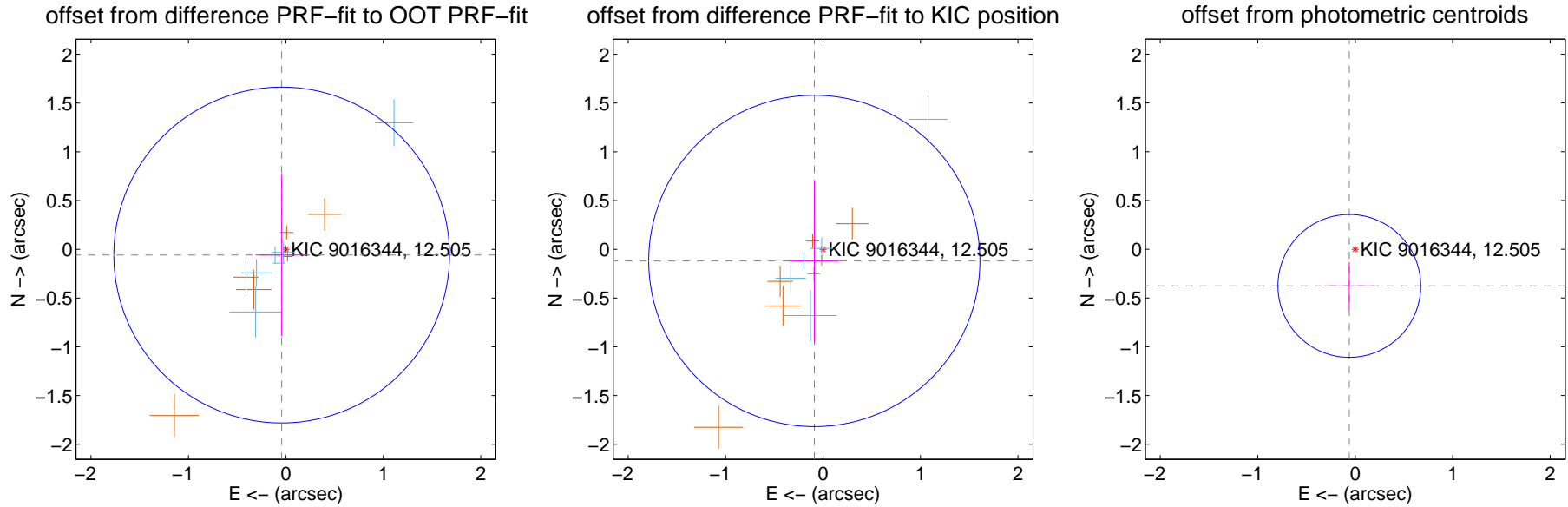
## DV Centroid Data

Supplemental centroid analysis for 009016344-03. Kepler magnitude: 12.51. Transit SNR 10.01

There are 6 quarters with good PRF difference image offsets

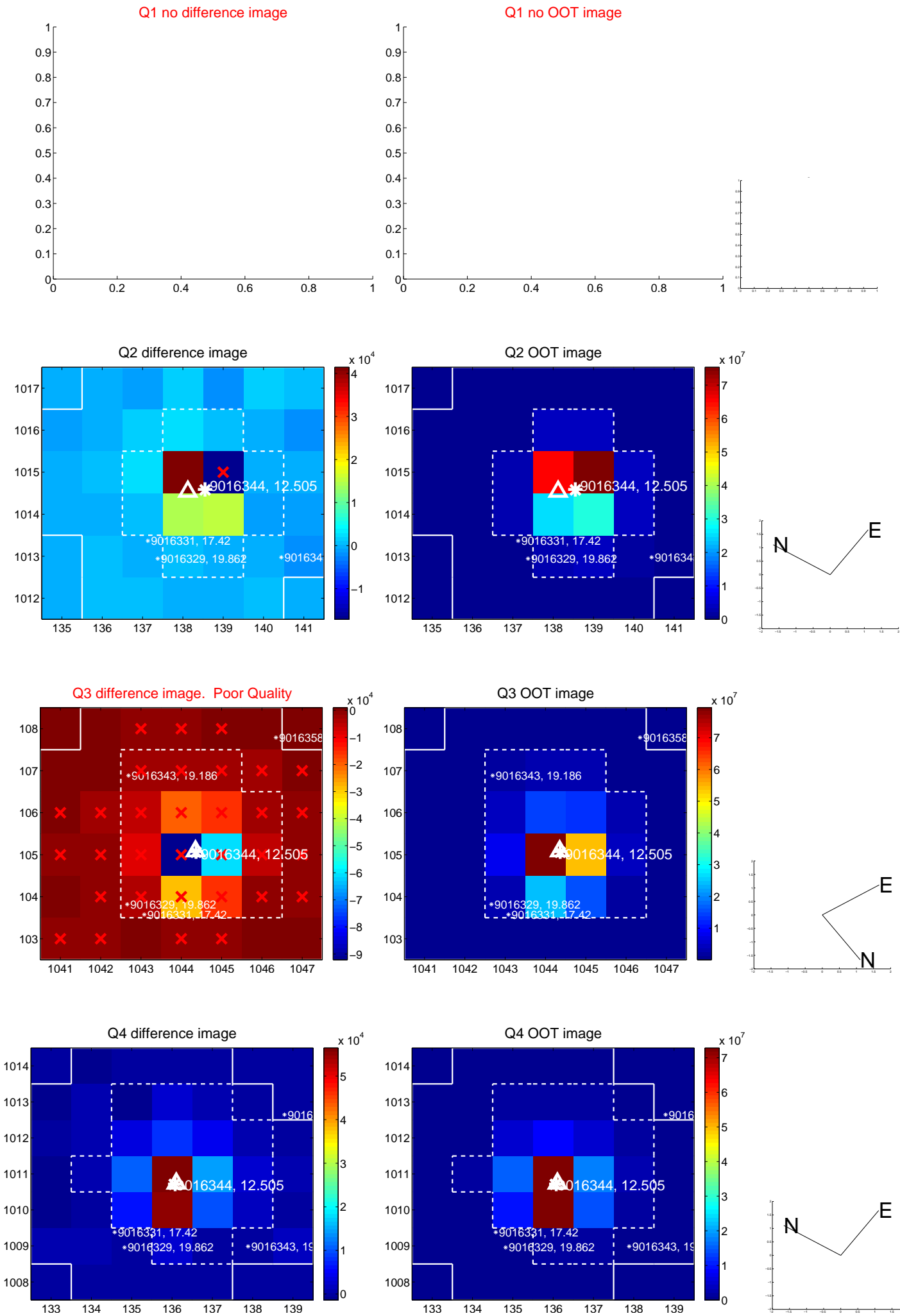
The direct PRF centroid is offset from the target star catalog position by about 0.14 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.073 \pm 0.574$	0.13	$0.043 \pm 0.267$	$-0.059 \pm 0.832$
PRF-fit source offset from KIC position	$0.149 \pm 0.566$	0.26	$0.090 \pm 0.258$	$-0.120 \pm 0.829$
photometric centroid source offset	$0.38 \pm 0.24$	1.56	$0.06 \pm 0.26$	$-0.38 \pm 0.24$

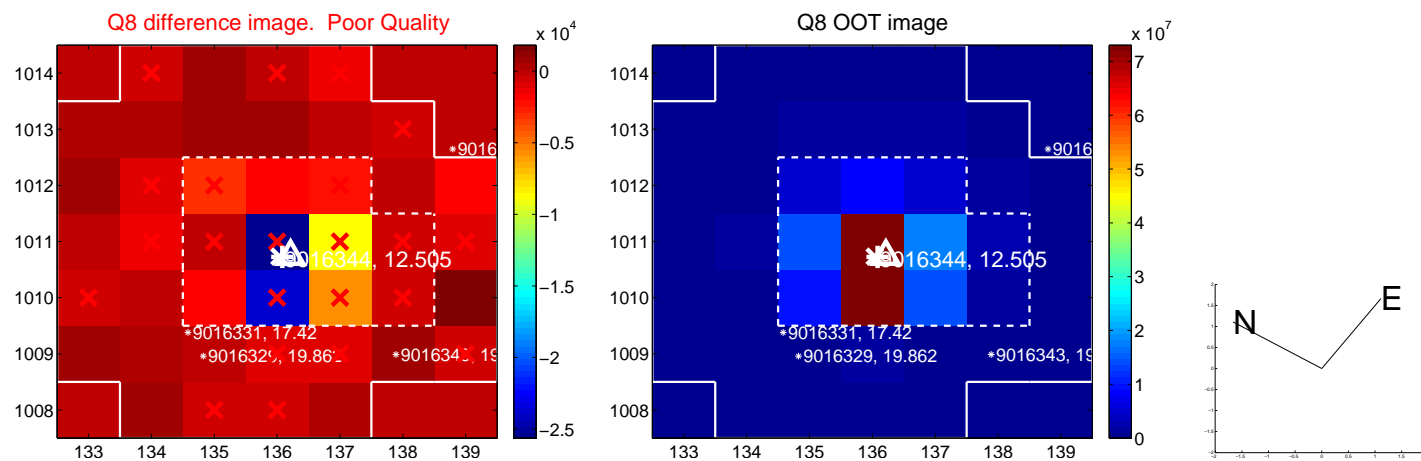
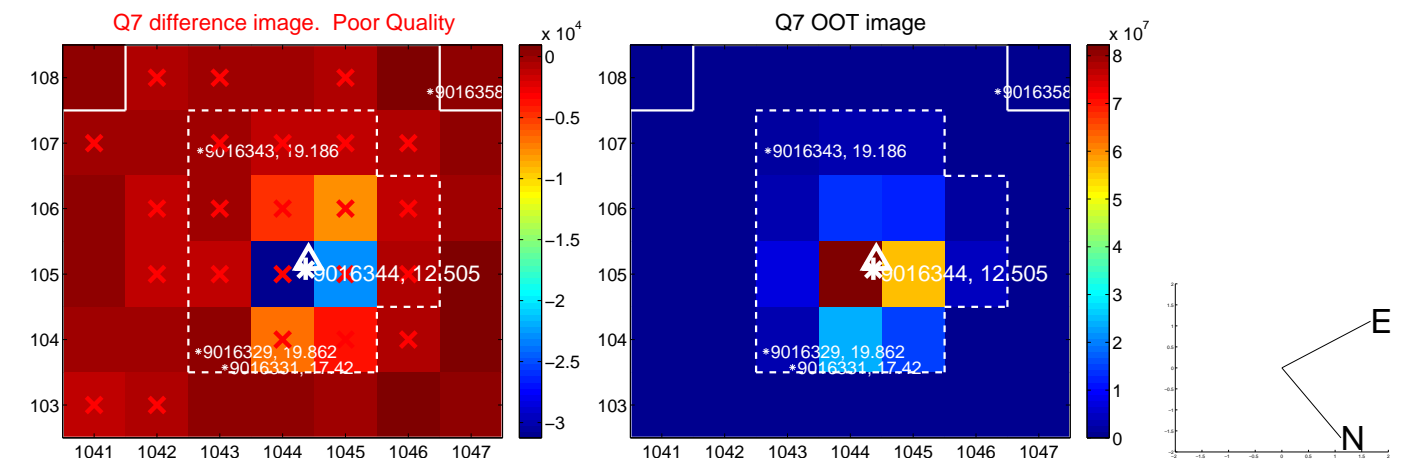
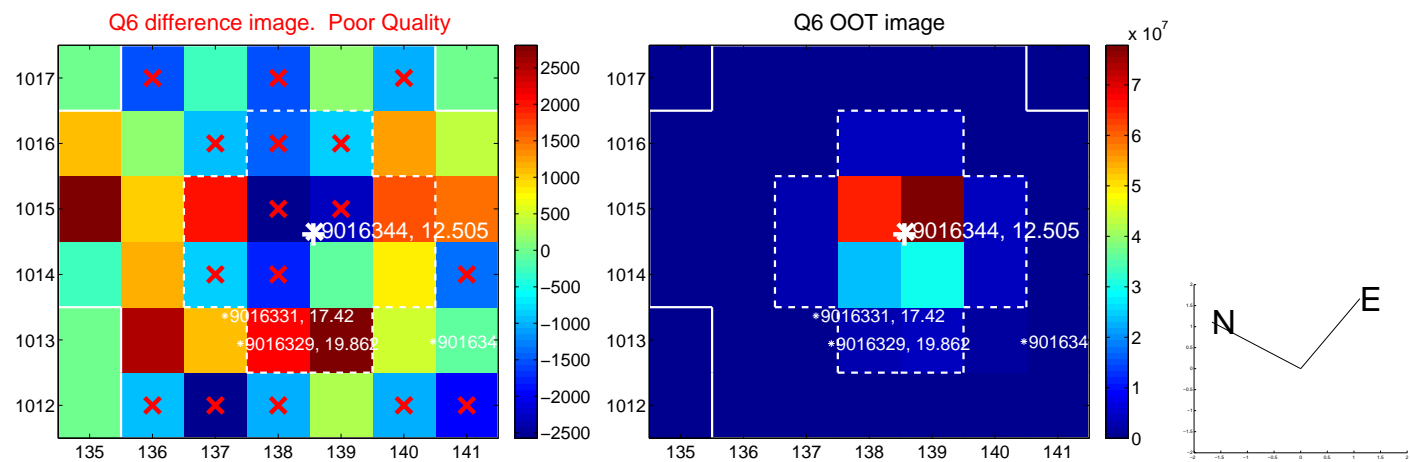
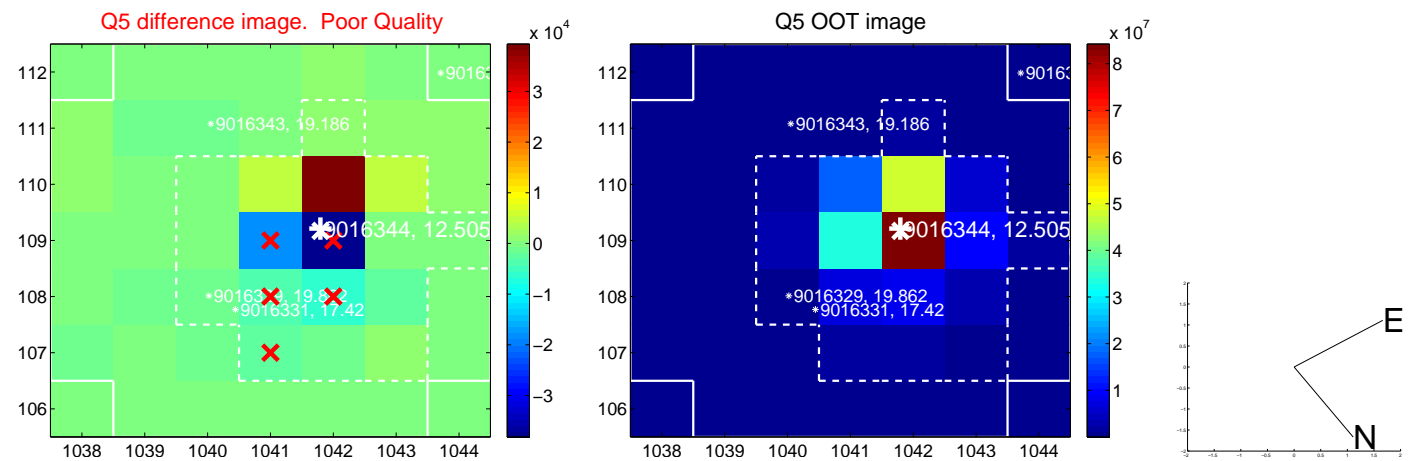


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

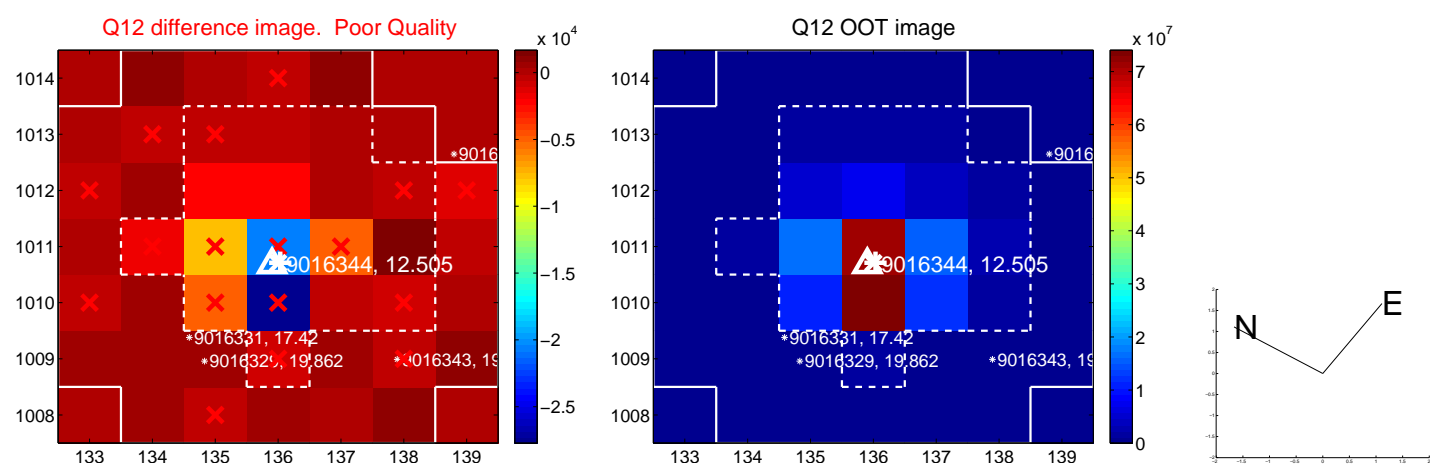
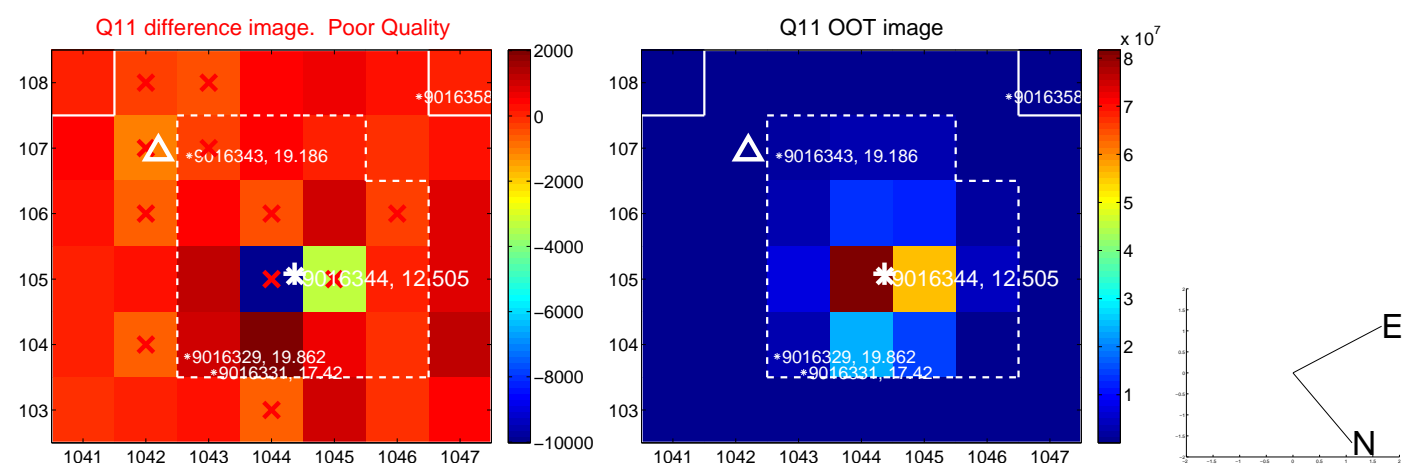
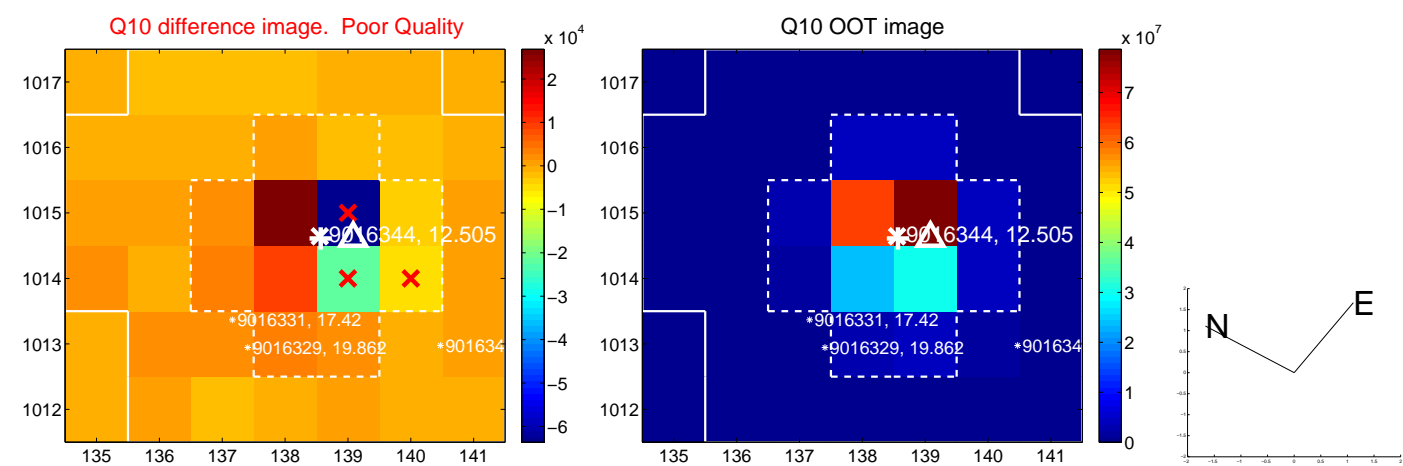
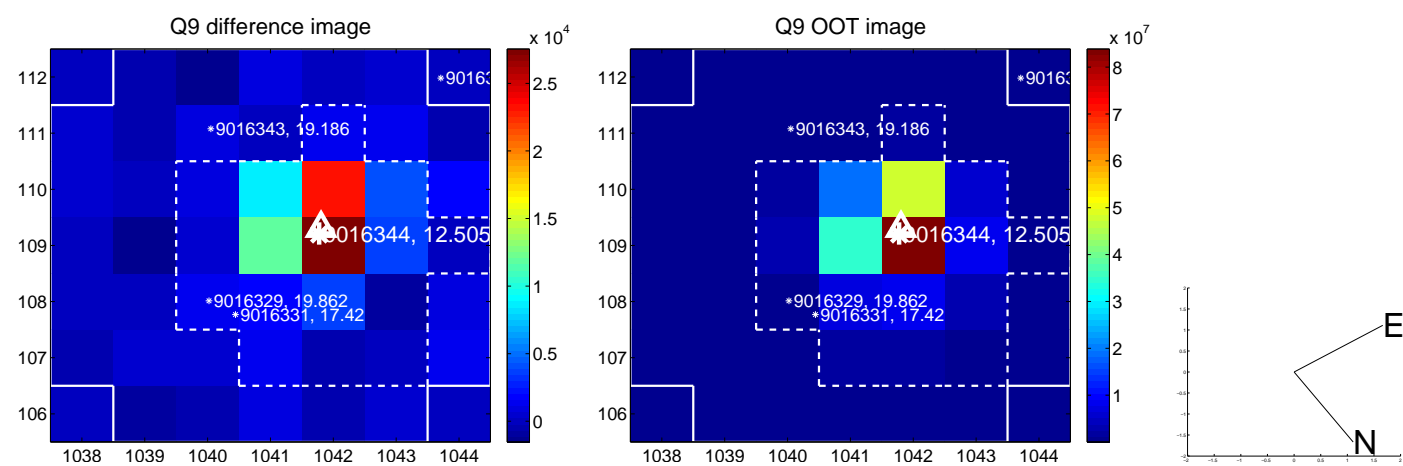
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



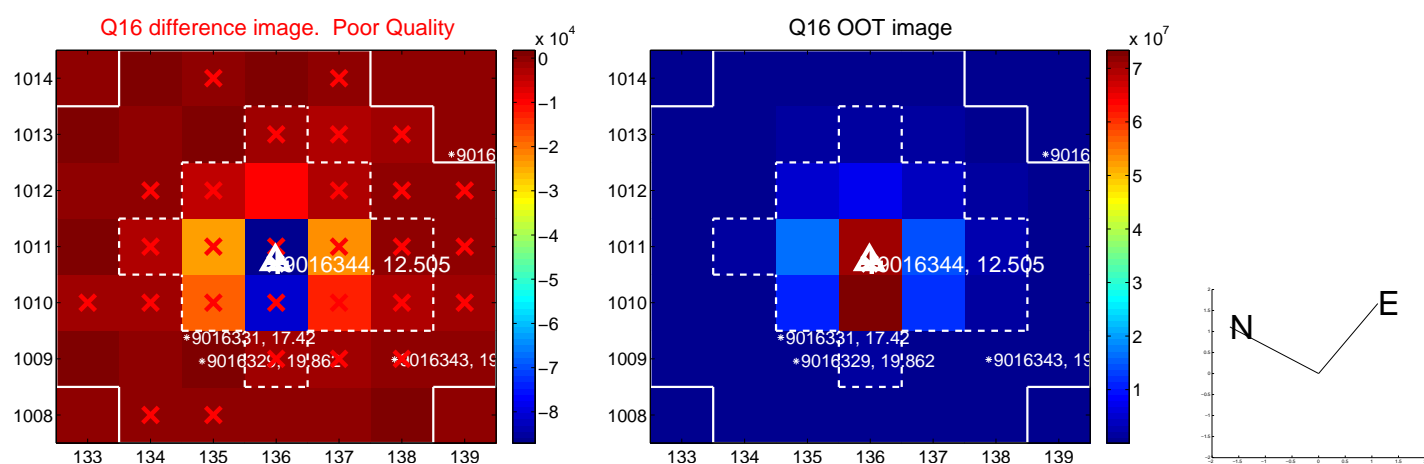
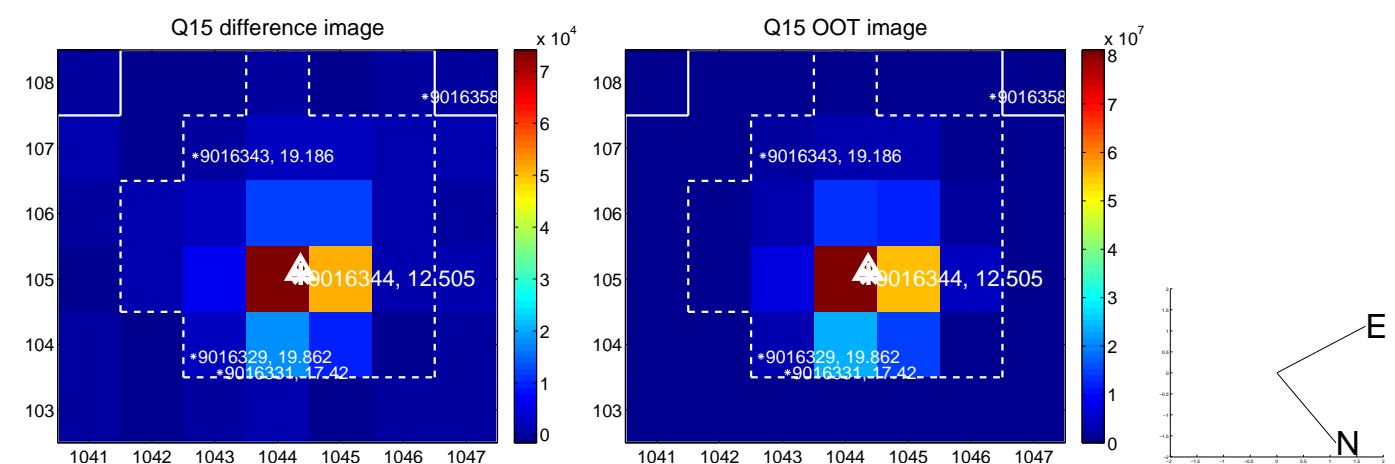
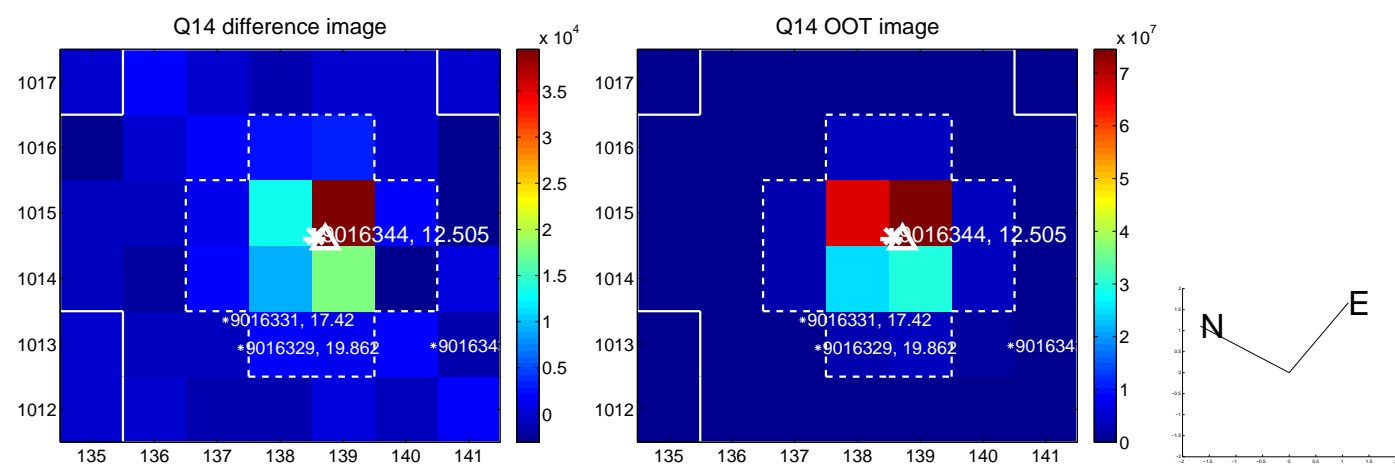
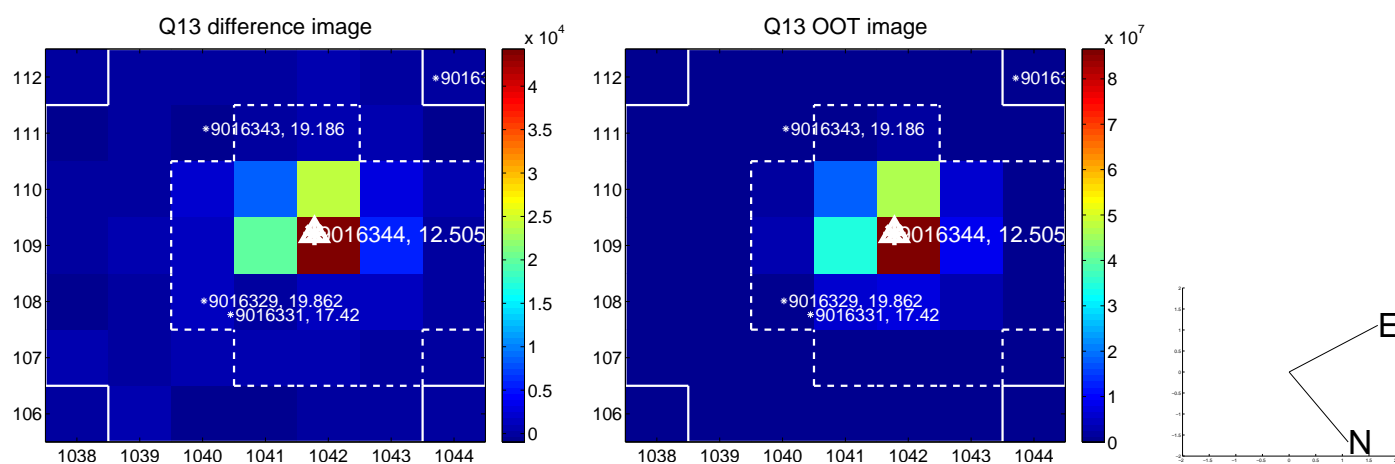
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



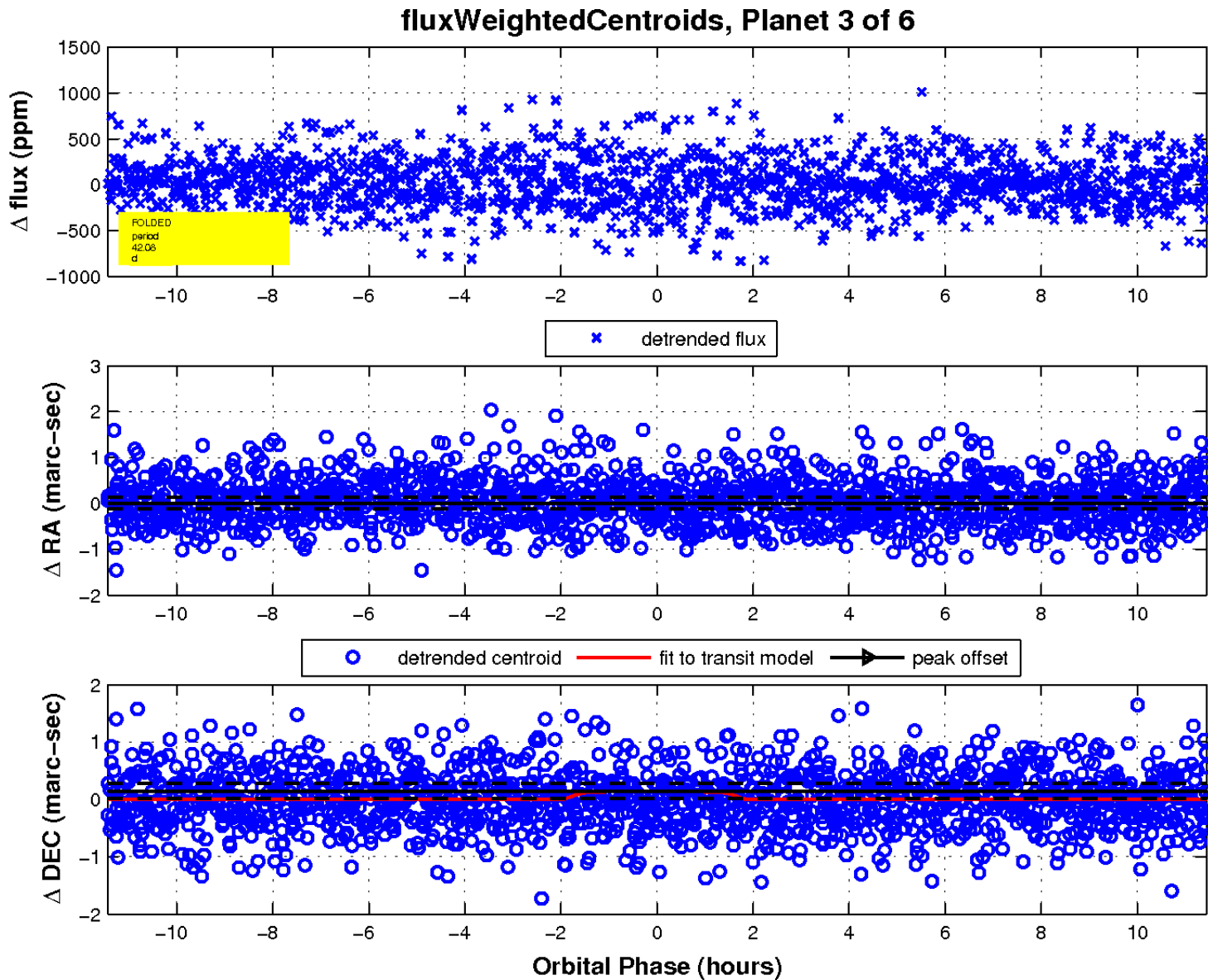
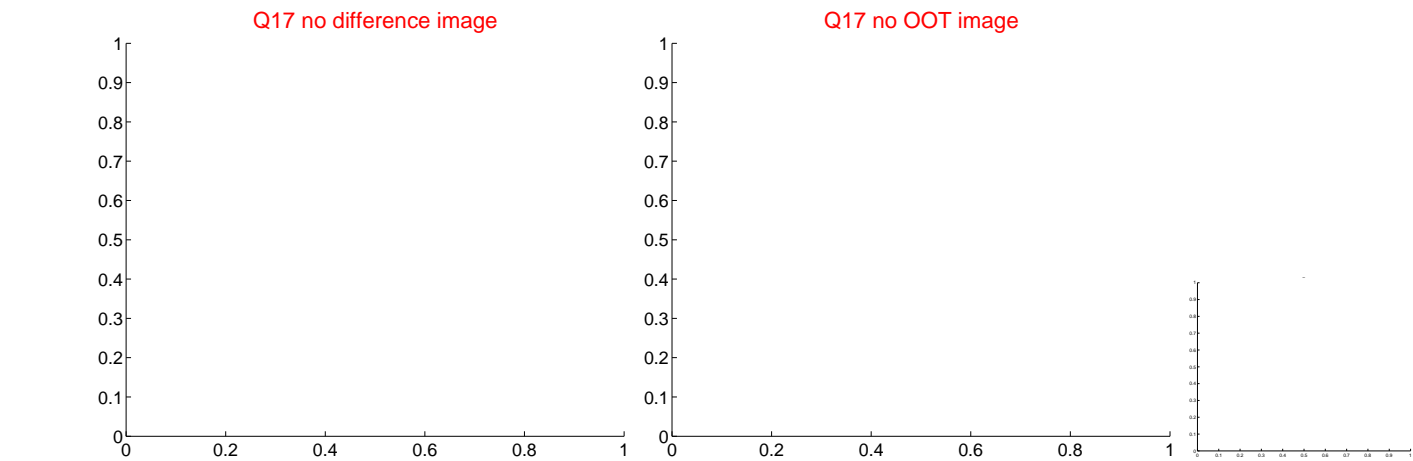
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

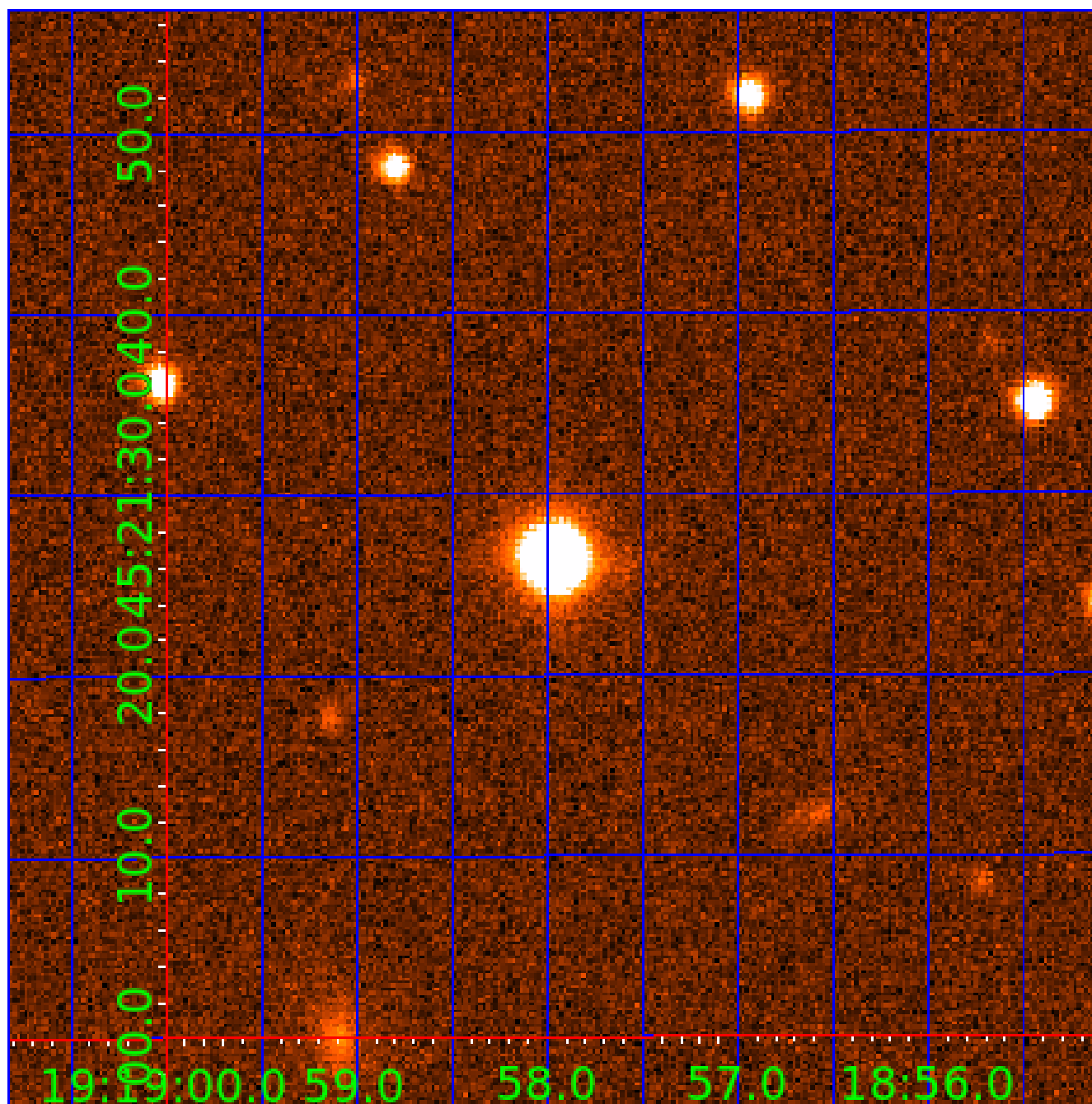


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 009016344

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009016344-01	OBS	No	0.546865	131.739521	35.7	2.440	12.5	13.2	1.89	7207	1.31	38576.78
009016344-02	OBS	No	0.546863	131.917672	35.5	1.856	10.8	11.4	1.89	7207	1.31	38576.93
009016344-03	OBS	No	42.076666	169.999906	435.1	3.821	8.5	10.0	1.89	7207	4.60	117.88
009016344-04	OBS	No	128.810512	162.137543	871.7	3.510	8.7	8.5	1.89	7207	6.72	26.52
009016344-05	OBS	No	35.457679	137.022461	485.4	3.034	8.6	8.4	1.89	7207	7.72	148.10
009016344-06	OBS	No	44.605881	171.168409	313.3	3.373	7.9	6.9	1.89	7207	3.66	109.05

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009016344-01	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT
009016344-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE_ZUMA—LPP_DV—MOD_NONUNIQ_DV—SAME_NTL_PERIOD
009016344-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT
009016344-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT
009016344-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_ALT
009016344-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT

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

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

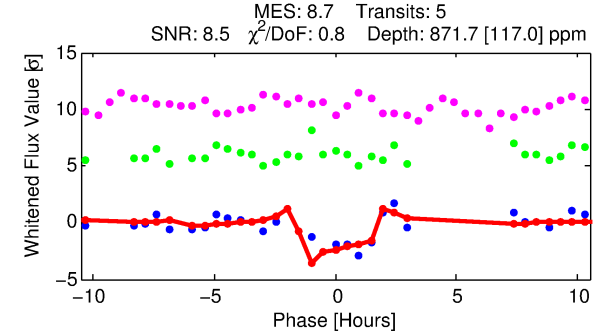
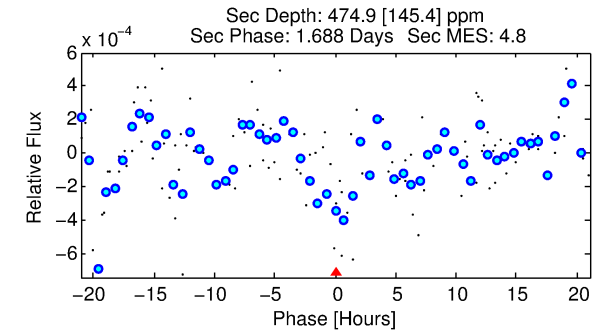
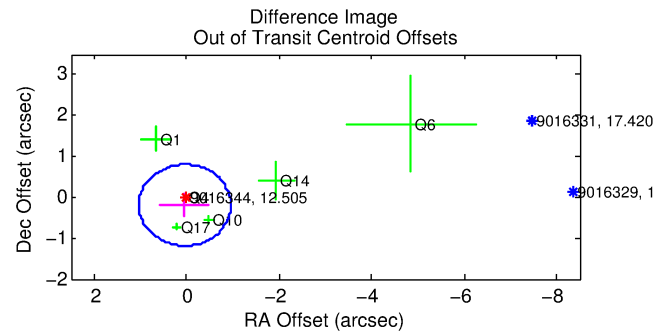
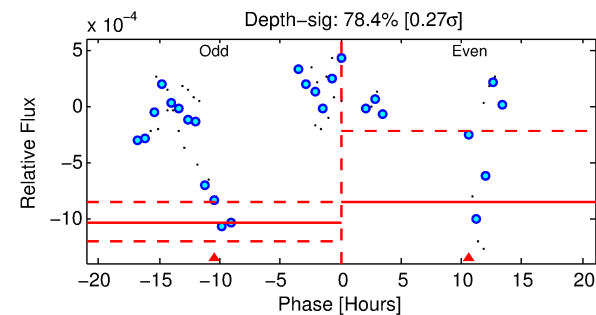
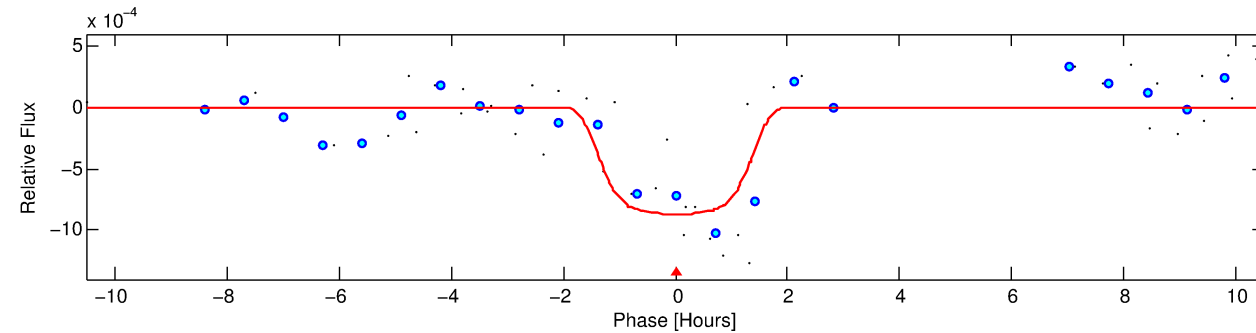
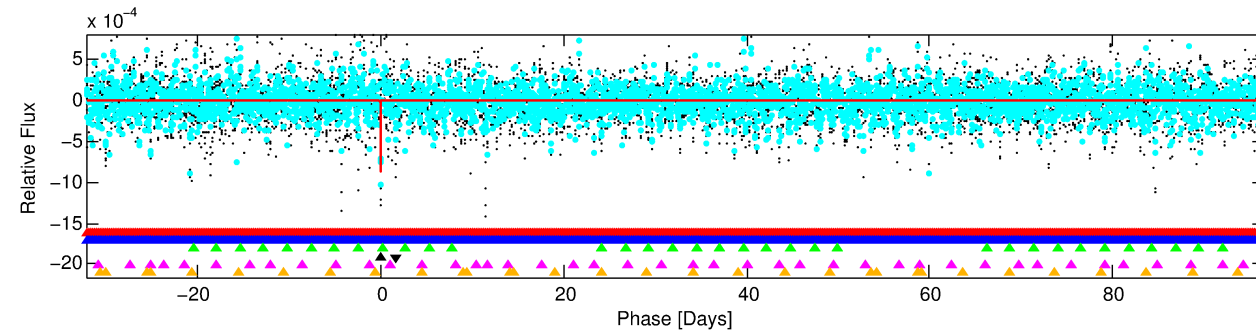
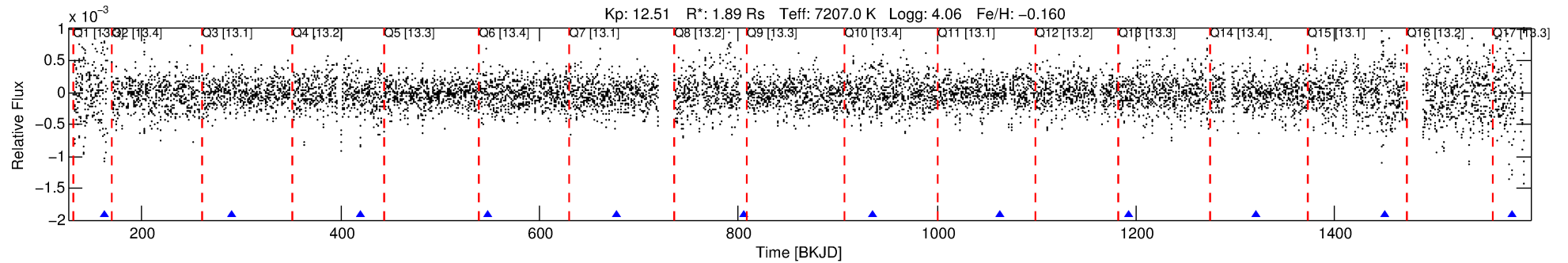
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 009016344-04

No Significant Match Found

# DV One-Page Summary

KIC: 9016344 Candidate: 4 of 6 Period: 128.811 d



## DV Fit Results:

Period = 128.81051 [0.00154] d  
Epoch = 162.1375 [0.0099] BKJD  
Rp/R\* = 0.0325 [0.0029]  
a/R\* = 122.21 [32.45]  
b = 0.94 [0.03]  
Teff = 26.52 [10.27]  
Teq = 579 [56] K  
Rp = 6.72 [2.13] Re  
a = 0.5718 [0.1415] AU  
Ag = 1892.59 [940.01] [2.01σ]  
Teffp = 5901 [577] K [9.18σ]

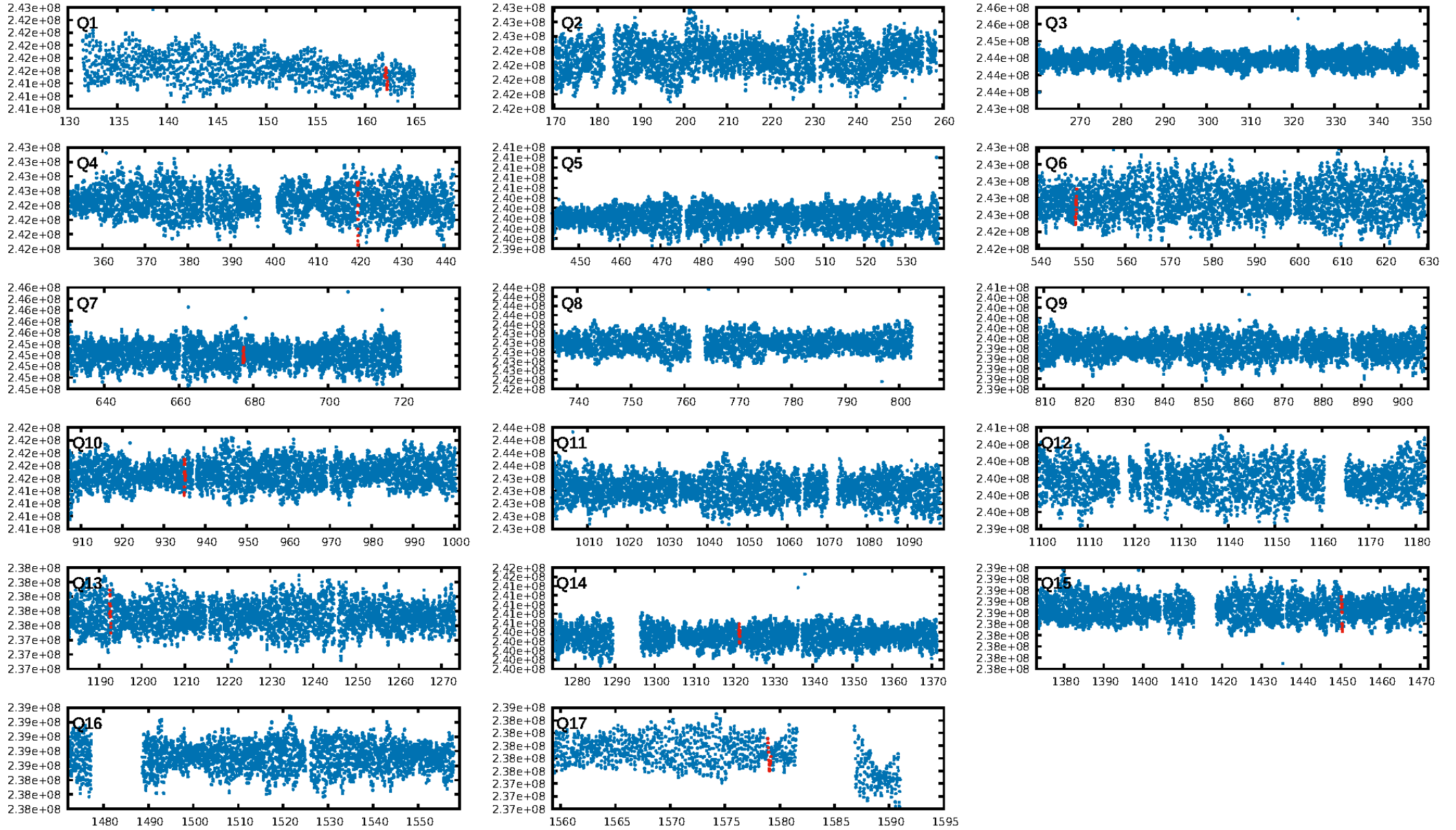
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [415.12σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 75.5%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: 3.132  
Centroid-sig: 20.1%  
Centroid-so: 0.387 arcsec [1.46σ]  
OotOffset-rm: 0.196 arcsec [0.59σ]  
KicOffset-rm: 0.248 arcsec [0.40σ]  
OotOffset-st: 3/0/1/2 [6]  
KicOffset-st: 3/0/1/2 [6]  
DiffImageQuality-fgm: 0.50 [3/6]  
DiffImageOverlap-fno: 0.00 [0/7]

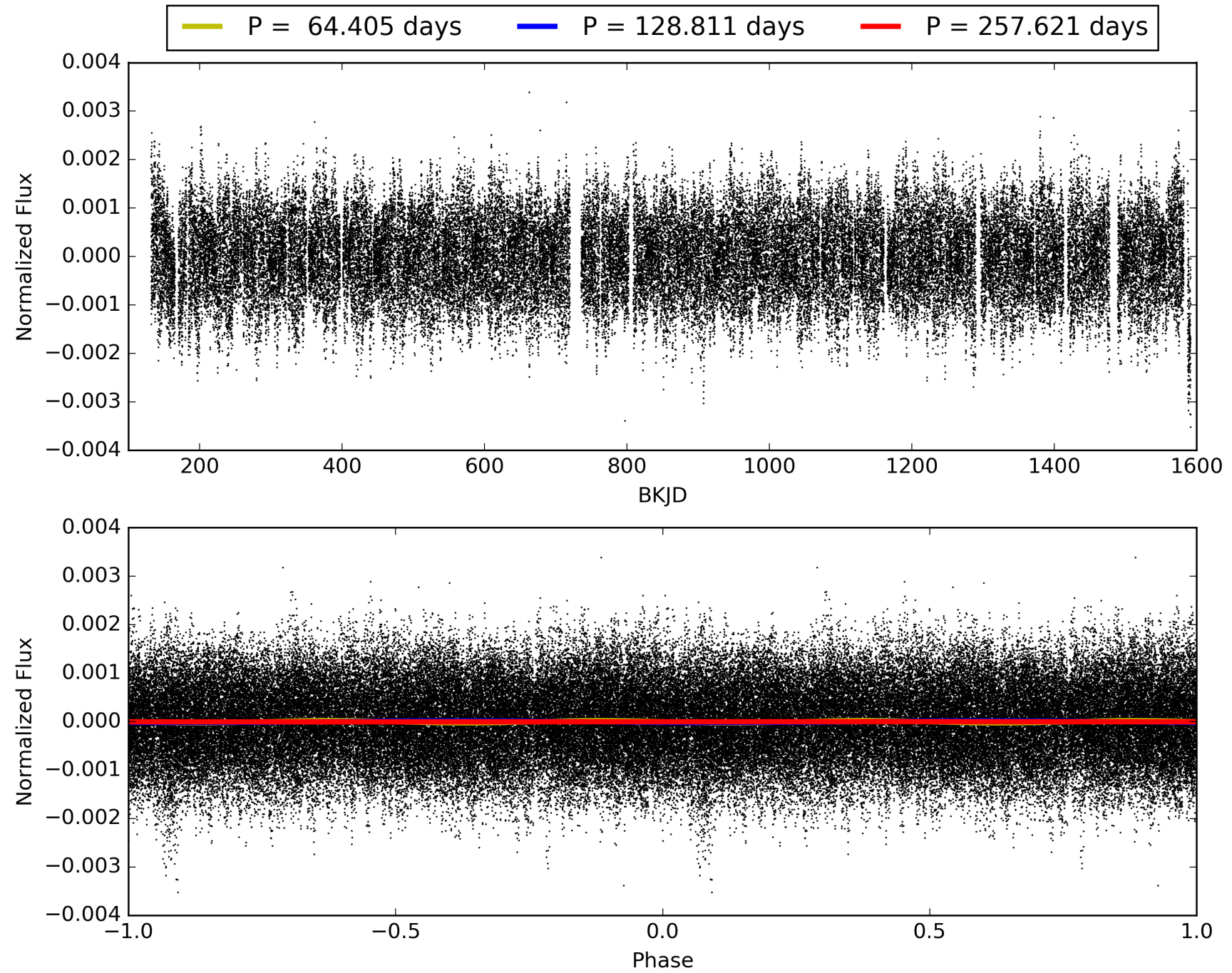
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 00:28:02 Z

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

# TCE 009016344-04, PDC Light Curves

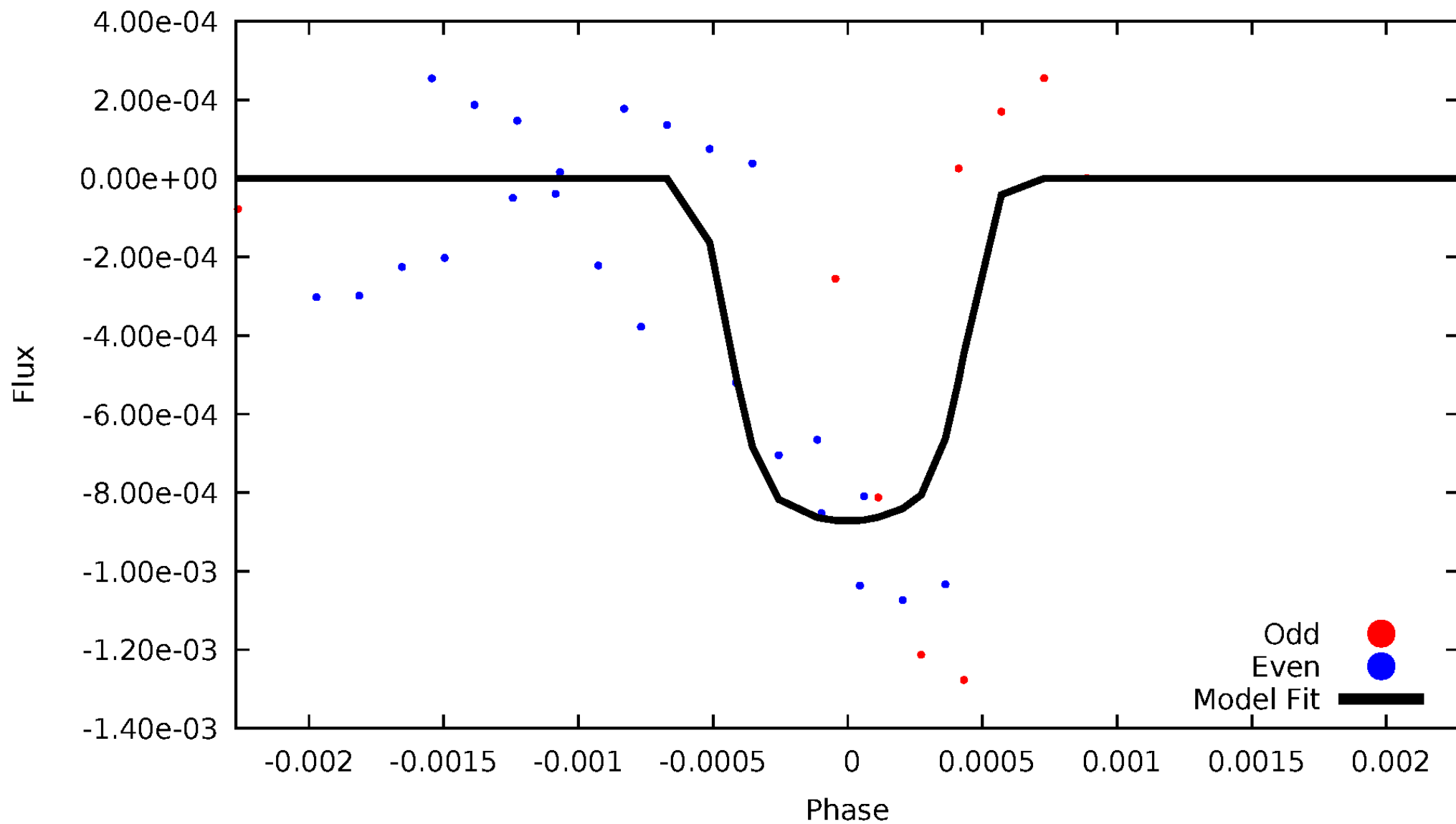


TCE 009016344-04



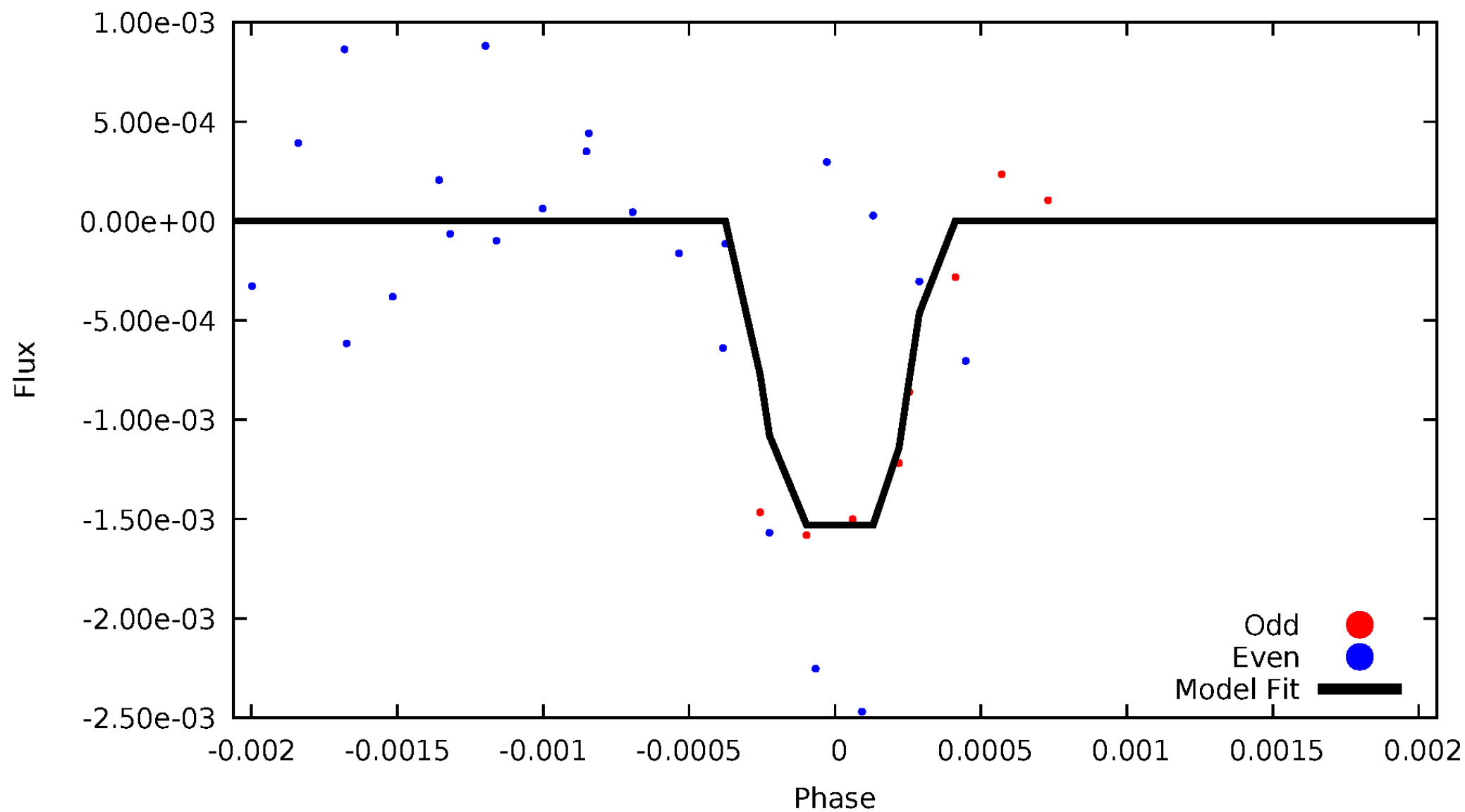
# DV Odd/Even

TCE 009016344-04



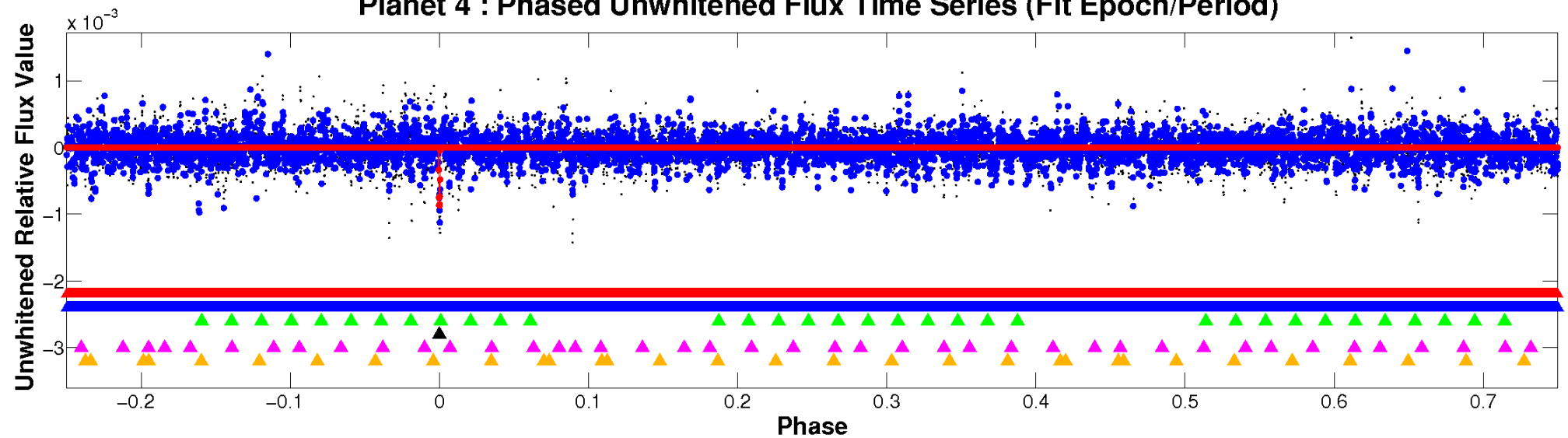
# ALT Odd/Even

TCE 009016344-04

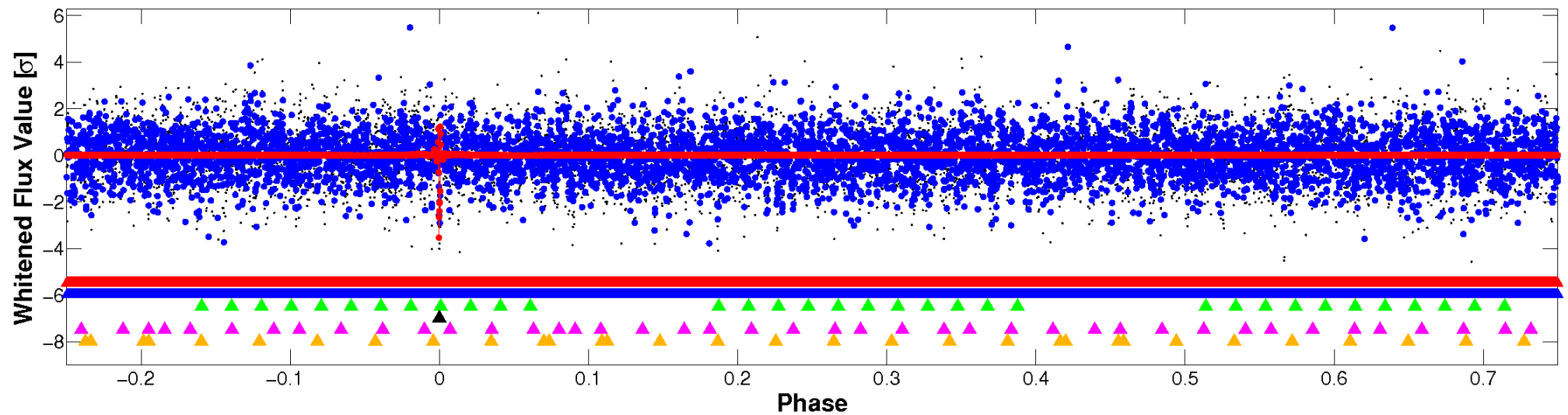


# Non-Whitened Vs. Whitened Light Curve

## Planet 4 : Phased Unwhitened Flux Time Series (Fit Epoch/Period)

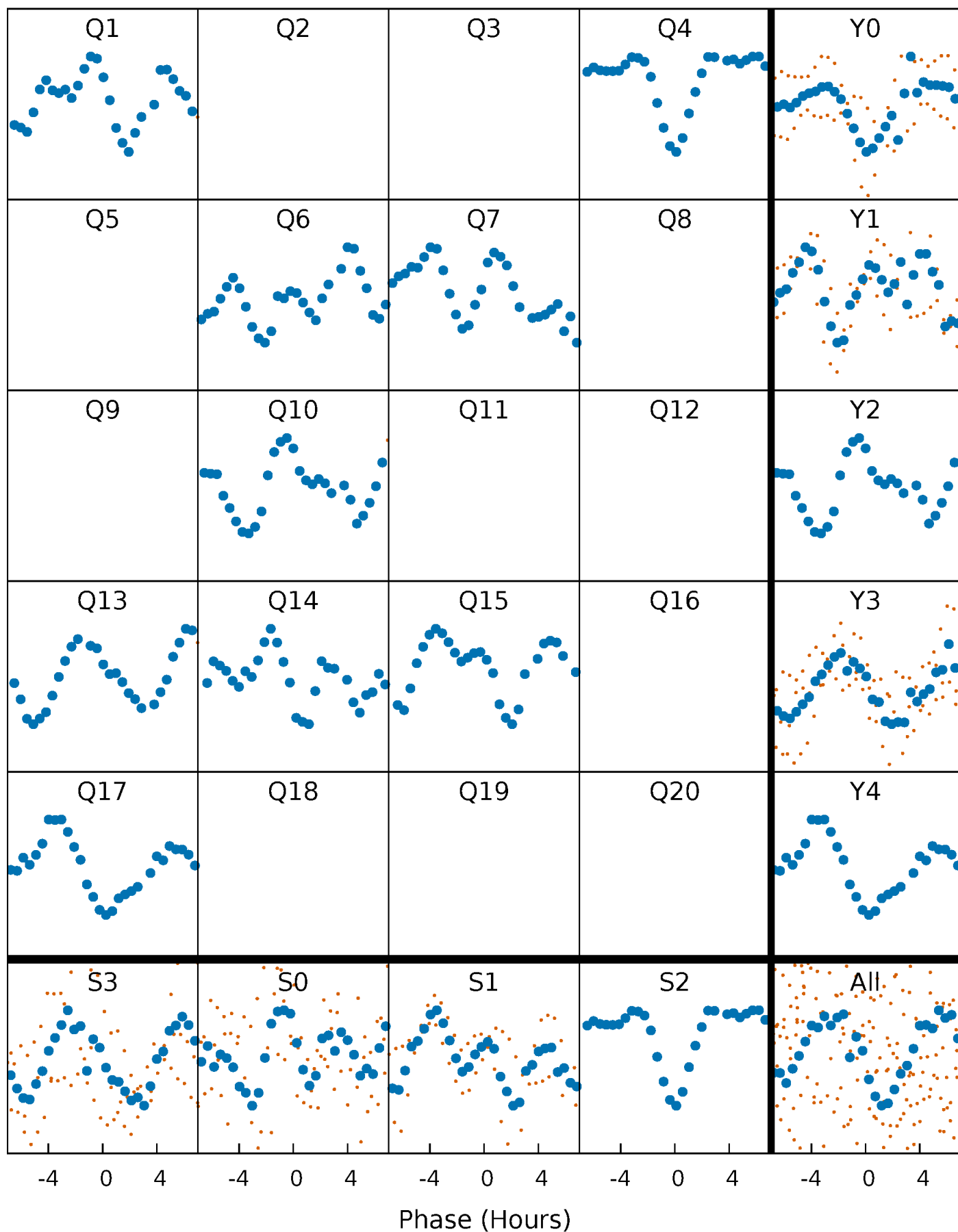


## Planet 4 : Phased Whitened Flux Time Series (Fit Epoch/Period)



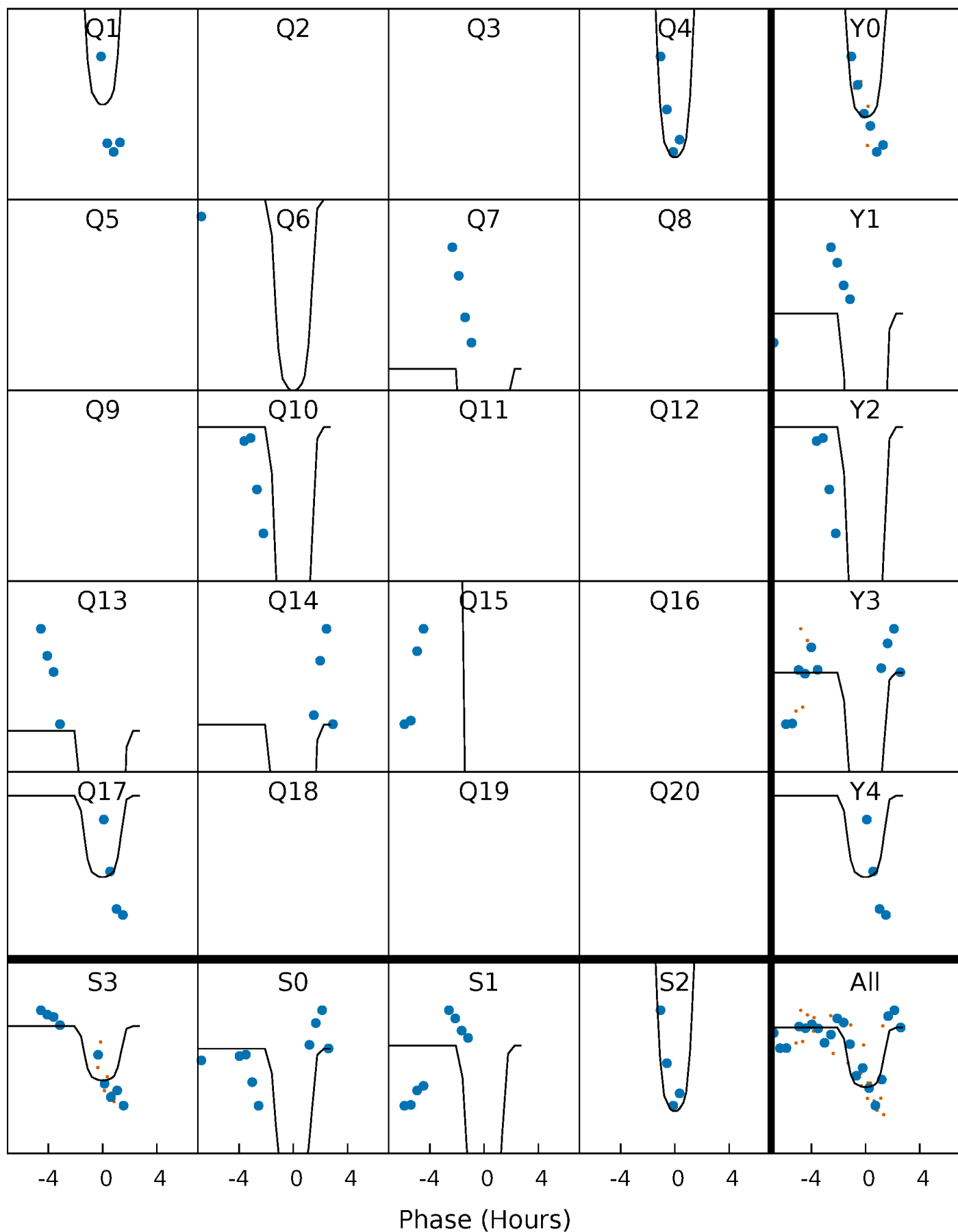
# PDC Quarter-Phased Transit Curves

TCE 009016344-04 P=128.810512 Days  $T_0=162.137543$  (BKJD)



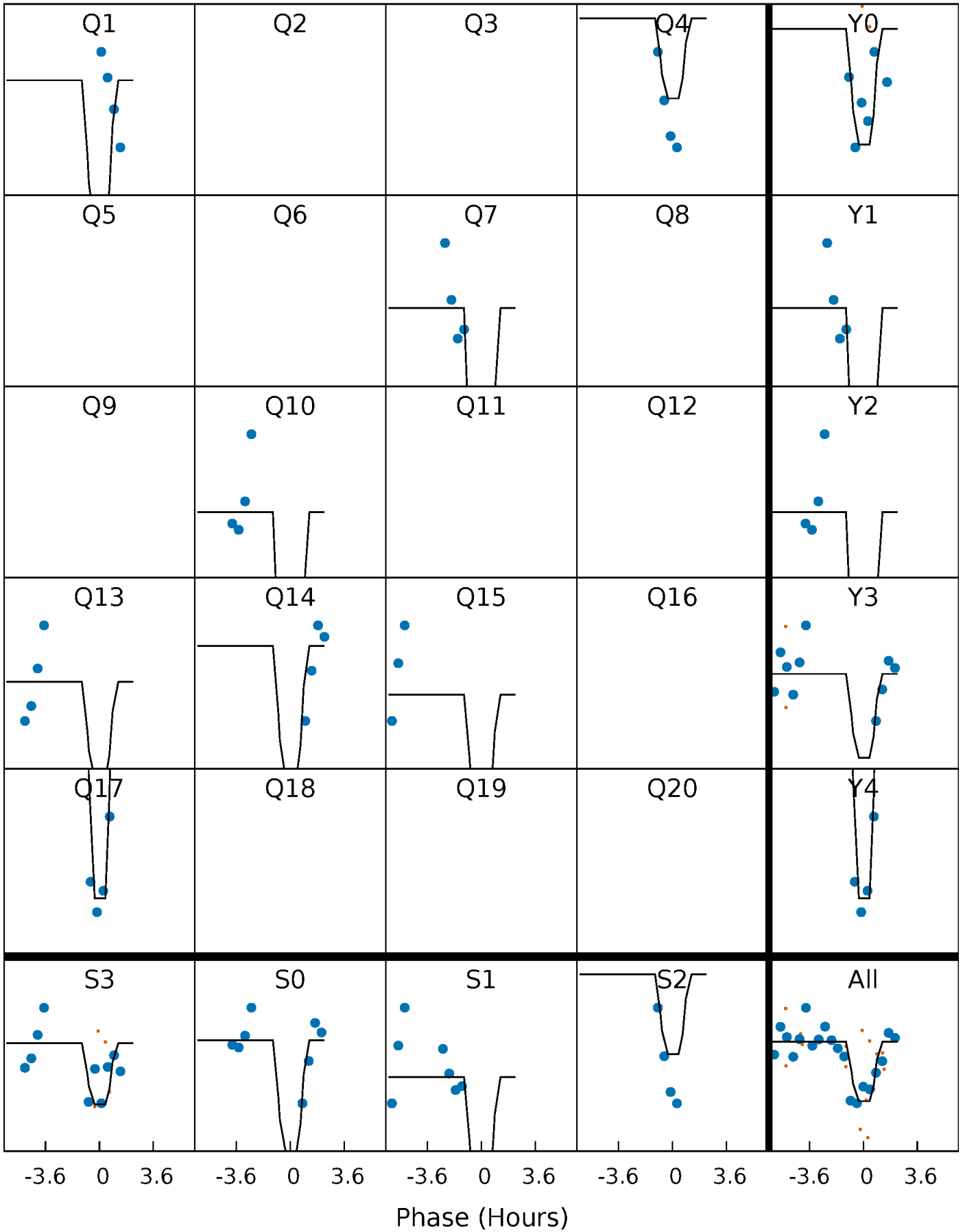
# DV Quarter-Phased Transit Curves

TCE 009016344-04 P=128.810512 Days  $T_0=162.137543$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

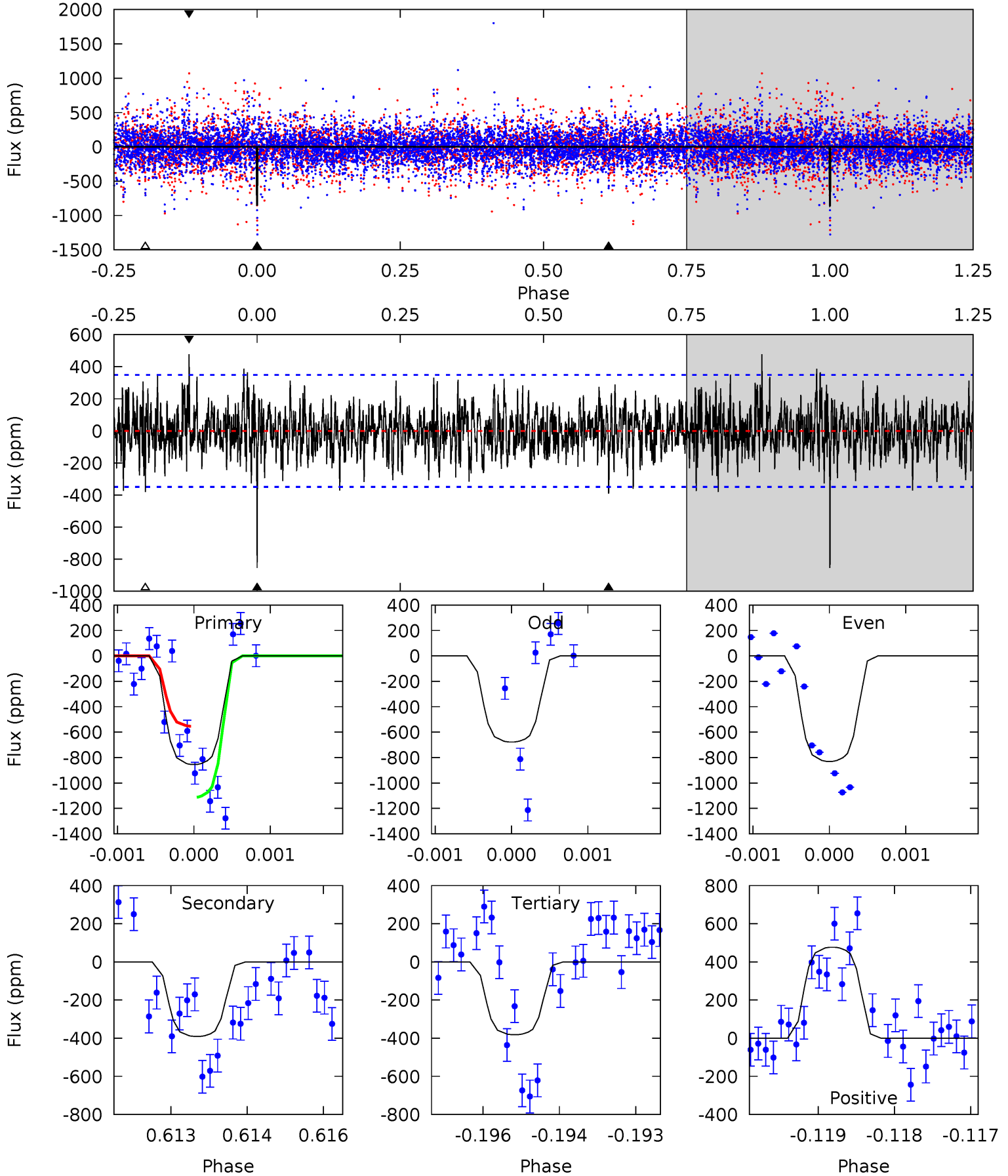
TCE 009016344-04 P=128.813992 Days  $T_0=162.126556$  (BKJD)



# DV Model-Shift Uniqueness Test

009016344-04,  $P = 128.810512$  Days,  $E = 33.327031$  Days

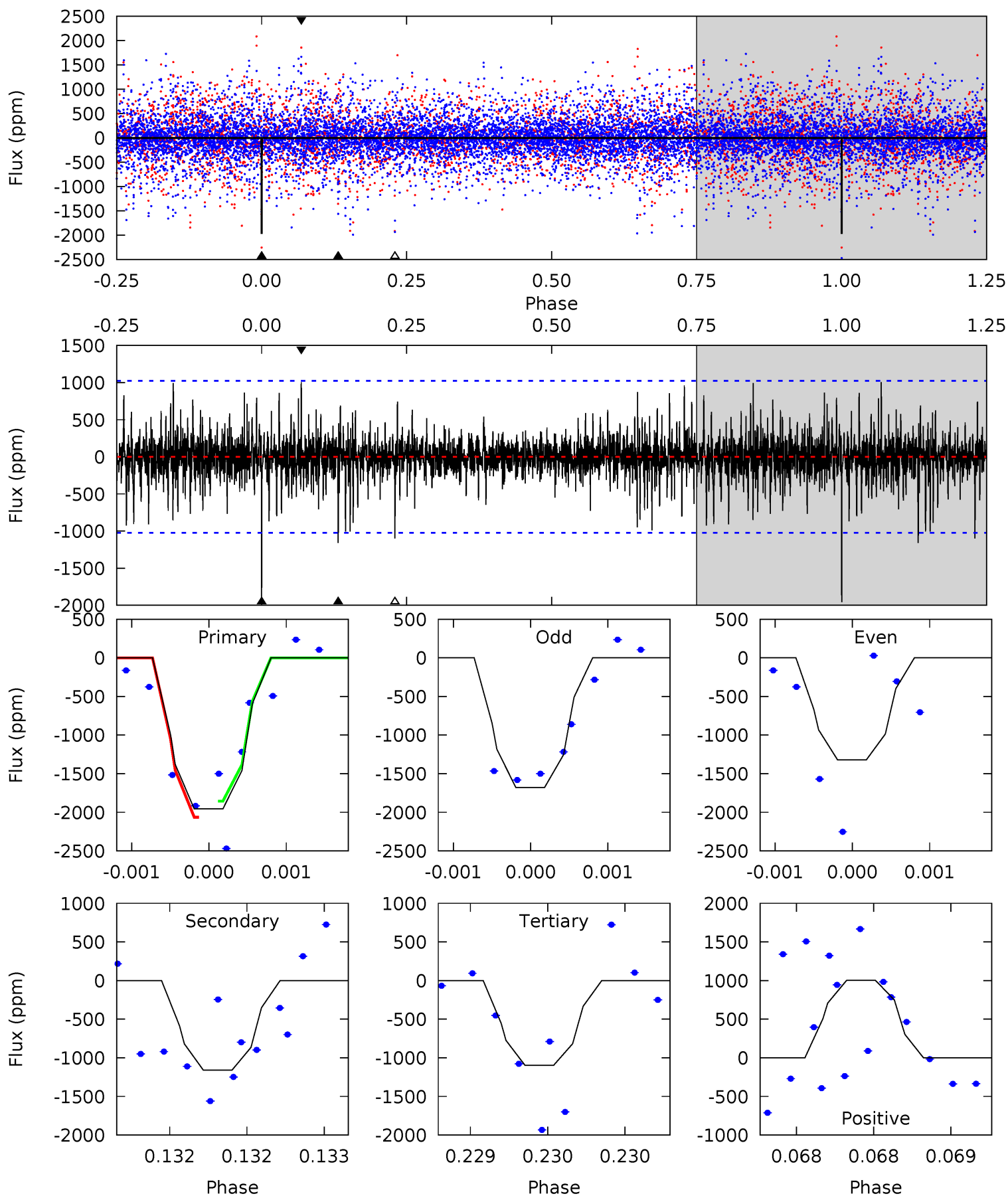
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
13.3	6.07	5.93	7.41	5.43	3.25	1.78	7.34	5.87	0.14	-1.33	1.19	0.64	0.36	4.21



# Alt Model-Shift Uniqueness Test

009016344-04, P = 128.813992 Days, E = 33.312564 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
10.6	6.31	5.97	5.46	5.57	3.47	1.20	4.68	5.18	0.34	0.85	1.11	0.77	0.34	0



### Stellar Parameters For KIC 009016344

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$\rho_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$7207^{+226}_{-302}$	$4.060^{+0.185}_{-0.167}$	$-0.160^{+0.250}_{-0.350}$	$1.894^{+0.576}_{-0.471}$	$1.499^{+0.225}_{-0.250}$	$0.311^{+0.356}_{-0.143}$
	+3%/-4%	+5%/-4%	+156%/-219%	+30%/-25%	+15%/-17%	+114%/-46%
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 009016344-04 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-391 \pm 64$	$6.66^{+1.24}_{-0.99}$	$806^{+60}_{-57}$	$5533^{+390}_{-355}$	$1553^{+599}_{-501}$
Alt.	$-1160 \pm 184$	$7.99^{+1.50}_{-1.25}$	$800^{+66}_{-62}$	$6660^{+467}_{-471}$	$3258^{+1274}_{-962}$

$T_{\text{max}}$  = 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

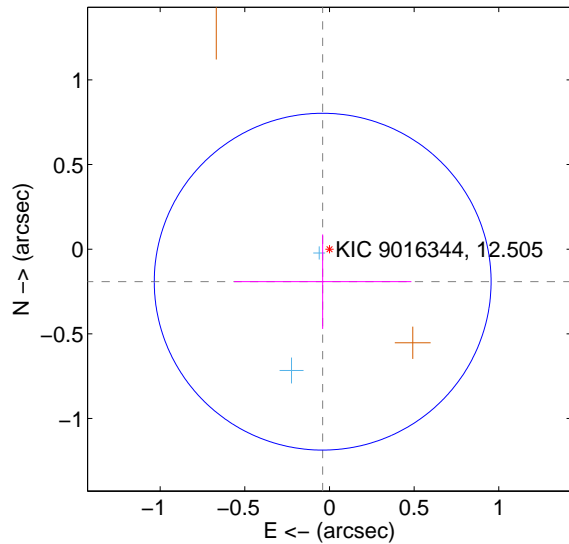
Supplemental centroid analysis for 009016344-04. Kepler magnitude: 12.51. Transit SNR 8.51

There are 3 quarters with good PRF difference image offsets

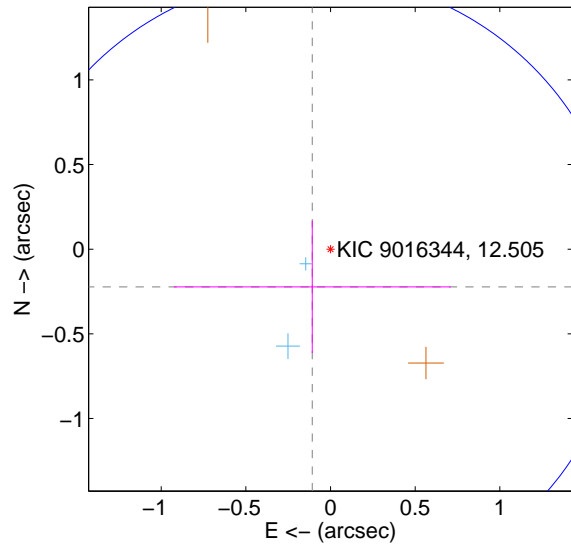
The direct PRF centroid is offset from the target star catalog position by about 0.15 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.196 \pm 0.332$	0.59	$0.040 \pm 0.524$	$-0.192 \pm 0.279$
PRF-fit source offset from KIC position	$0.248 \pm 0.614$	0.40	$0.108 \pm 0.818$	$-0.223 \pm 0.391$
photometric centroid source offset	$0.39 \pm 0.27$	1.46	$0.30 \pm 0.28$	$-0.25 \pm 0.24$

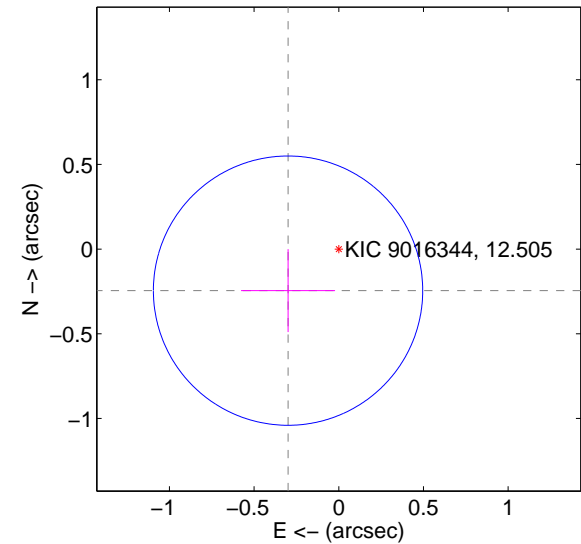
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

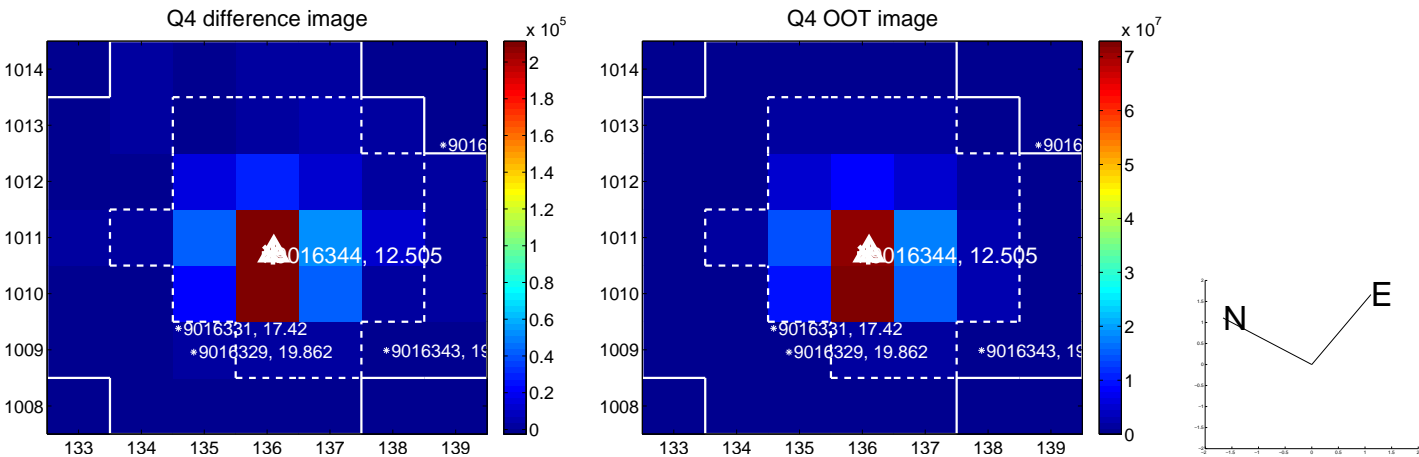
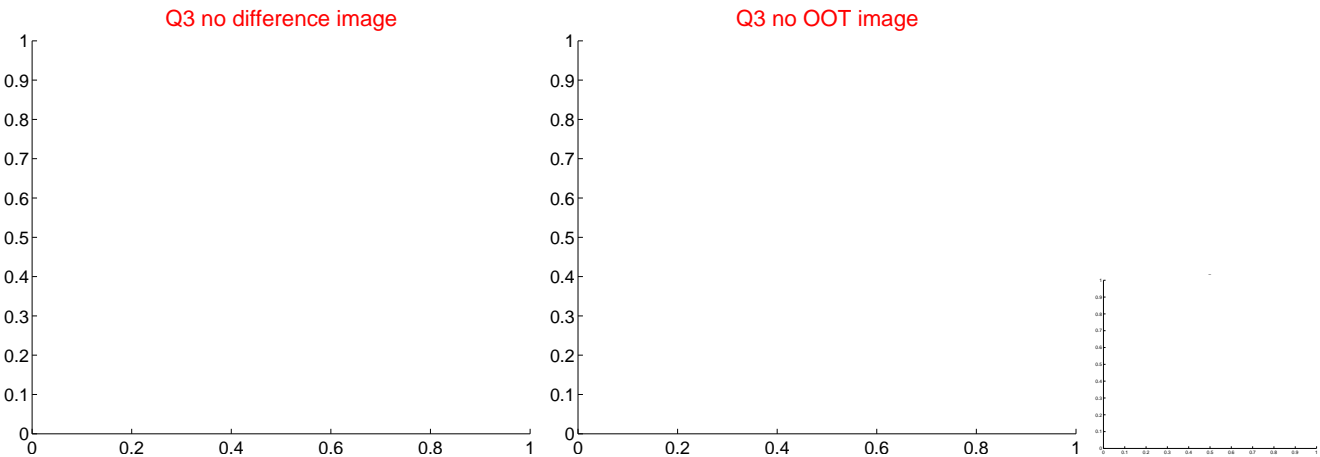
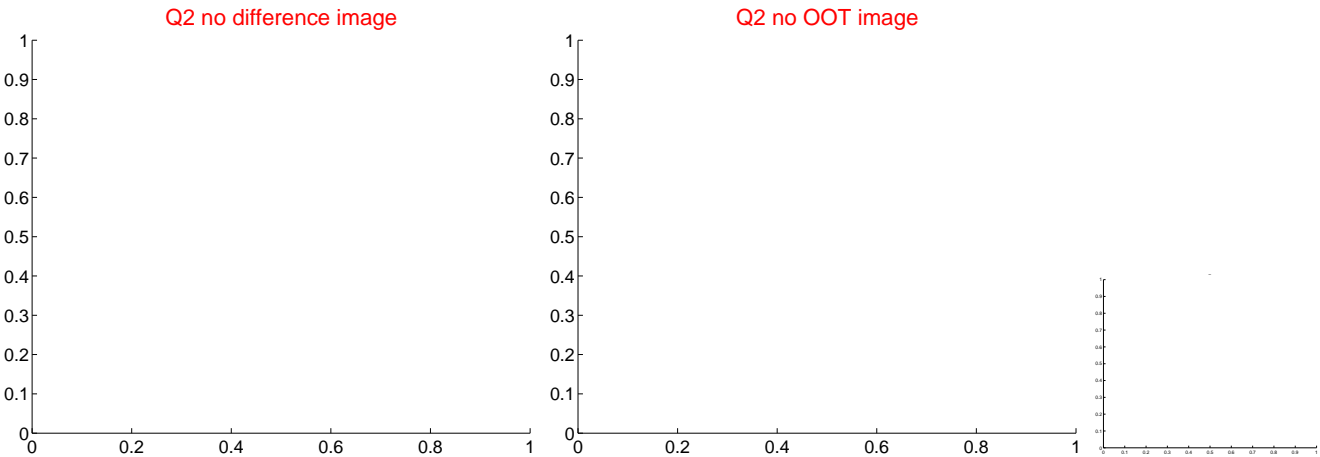
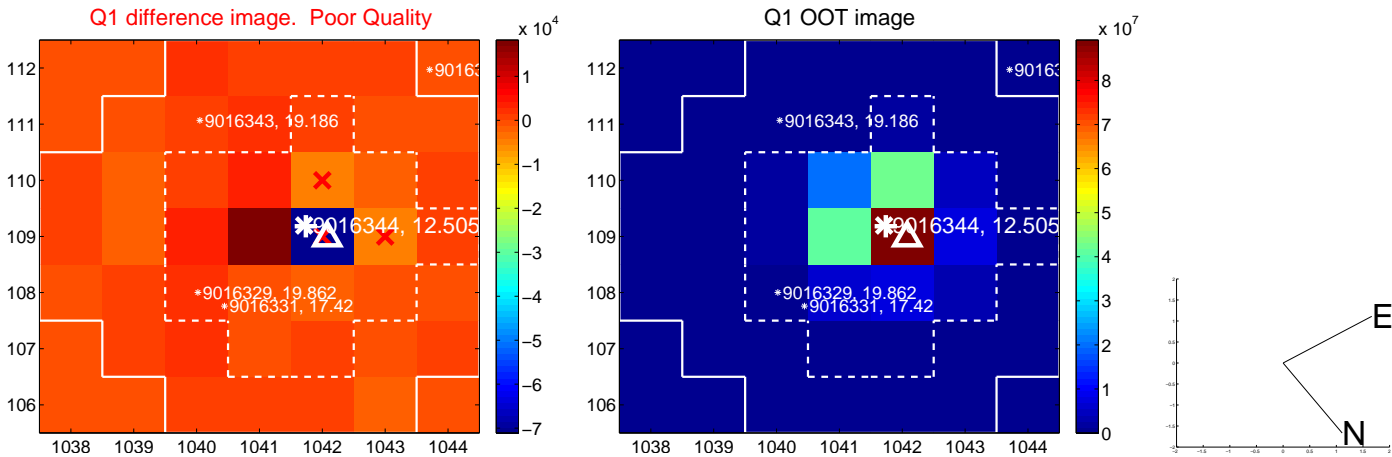


offset from photometric centroids



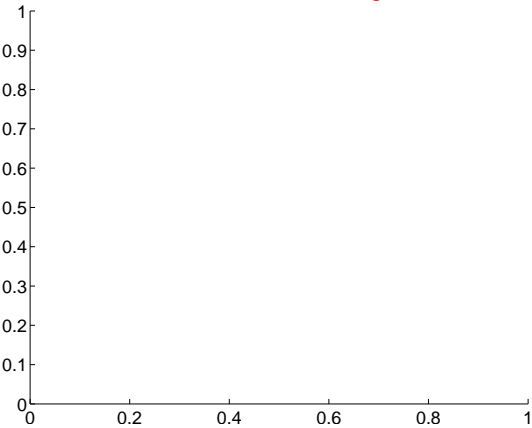
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

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

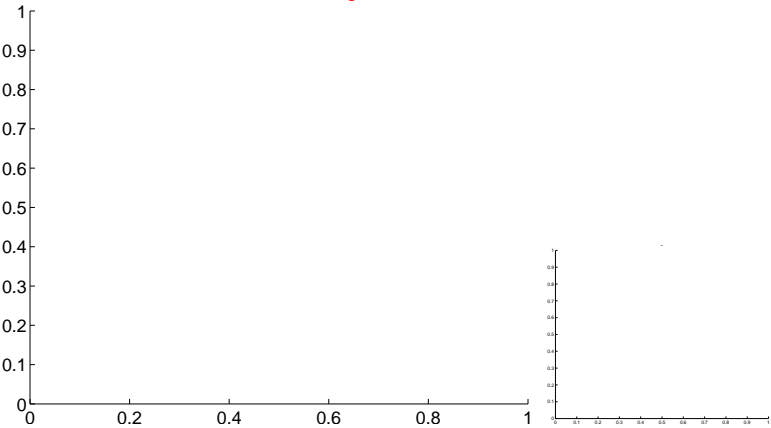


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

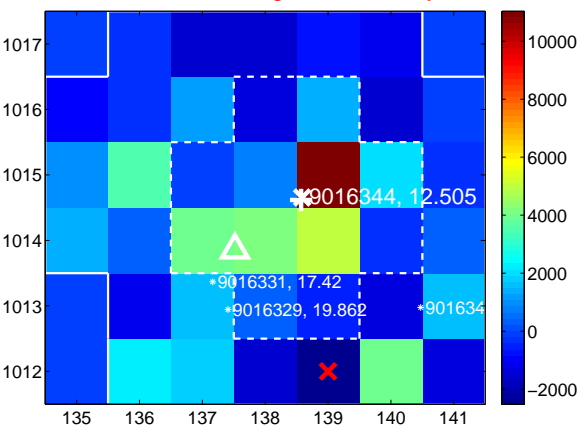
Q5 no difference image



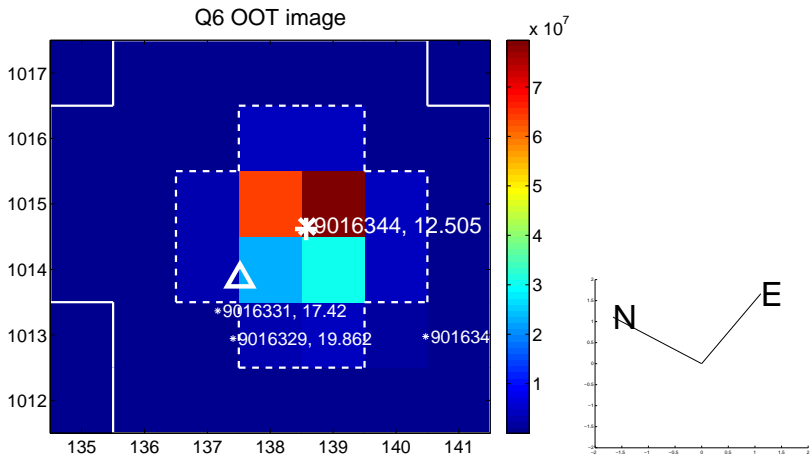
Q5 no OOT image



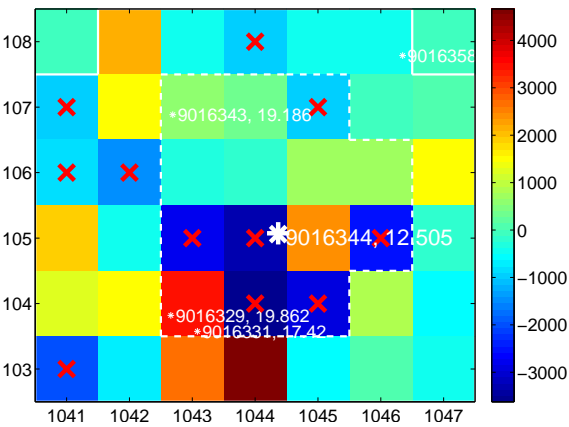
Q6 difference image. Poor Quality



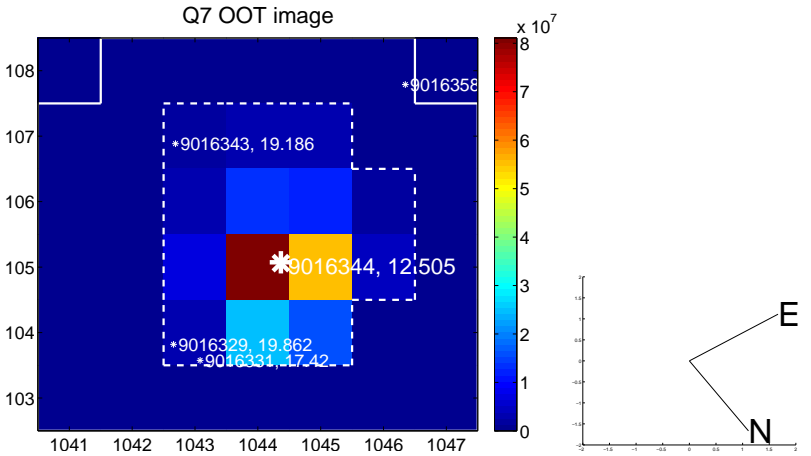
Q6 OOT image



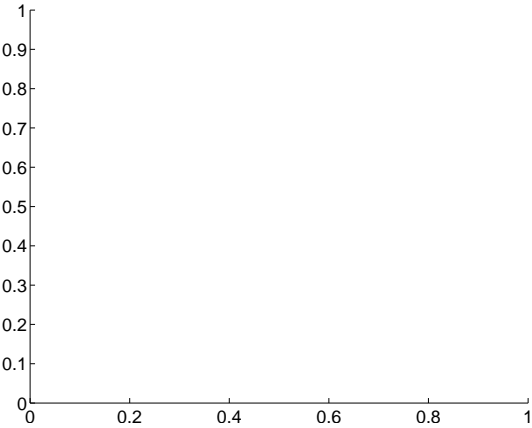
Q7 difference image. Poor Quality



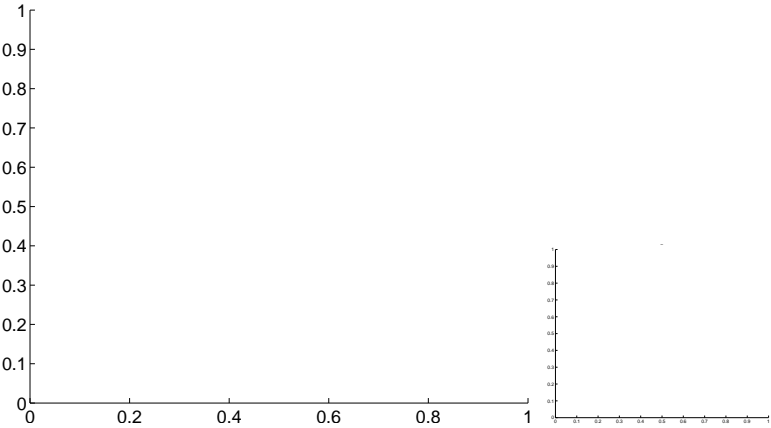
Q7 OOT image



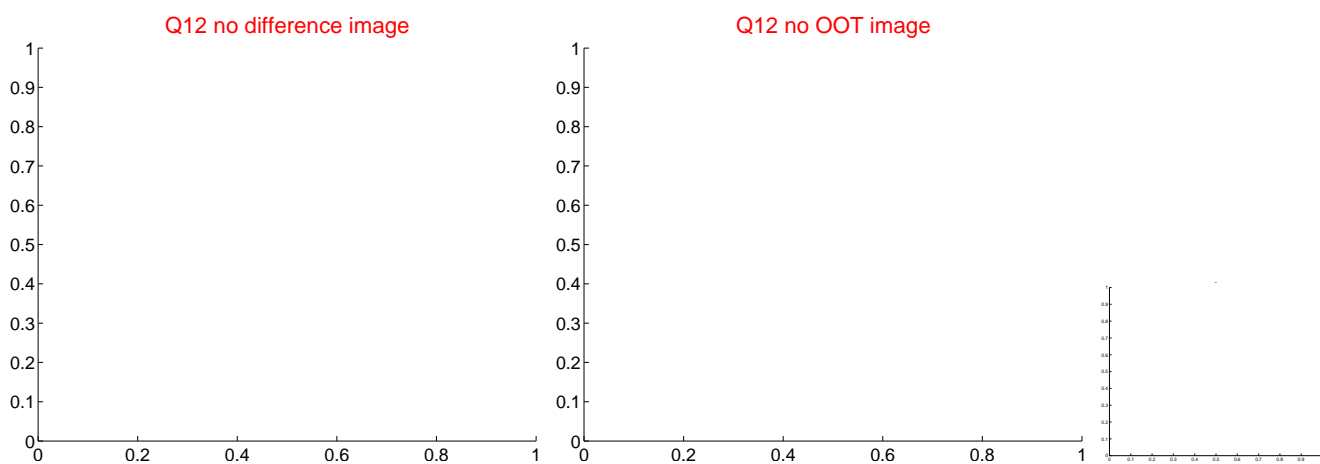
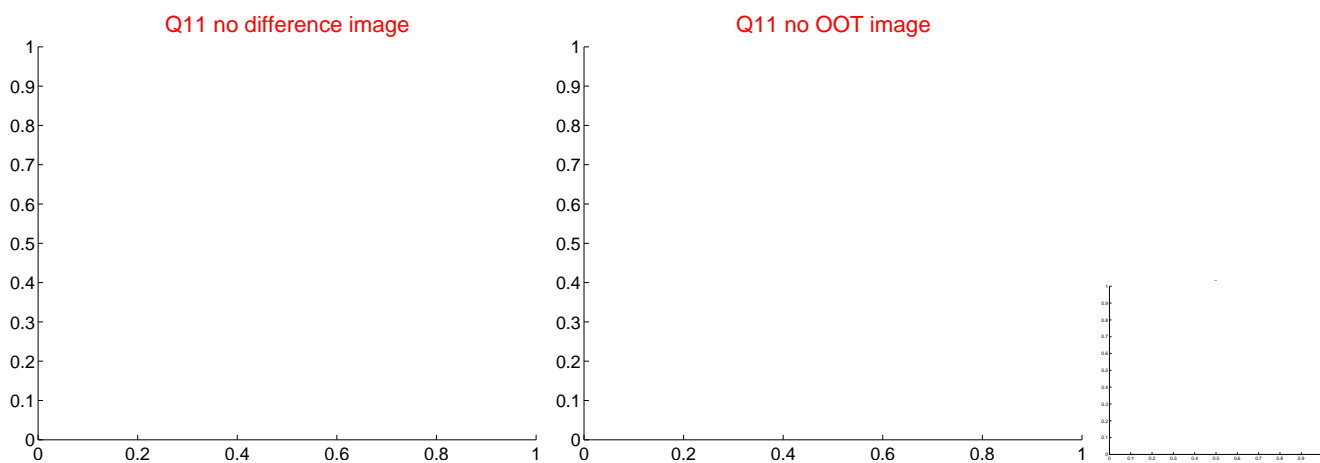
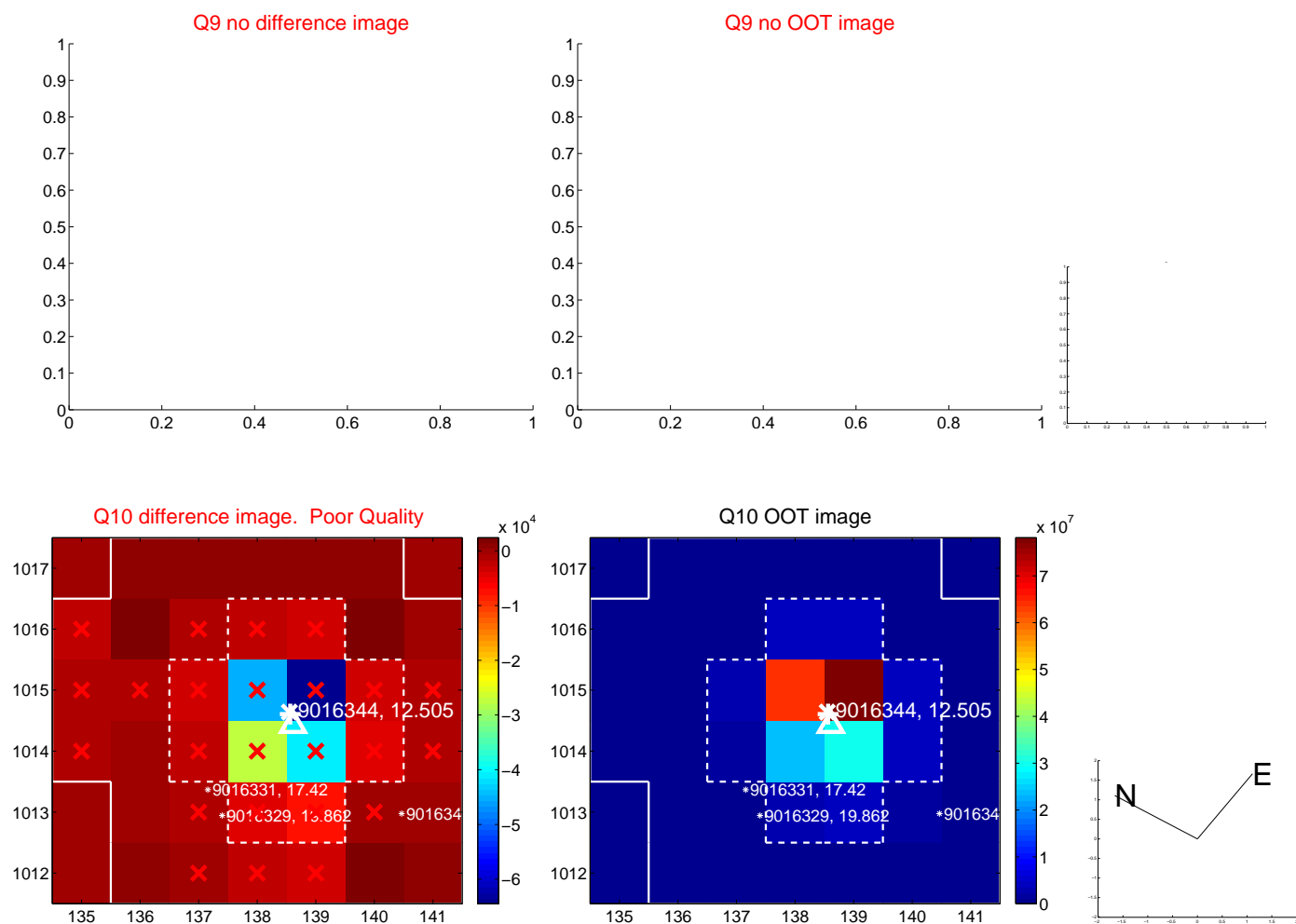
Q8 no difference image



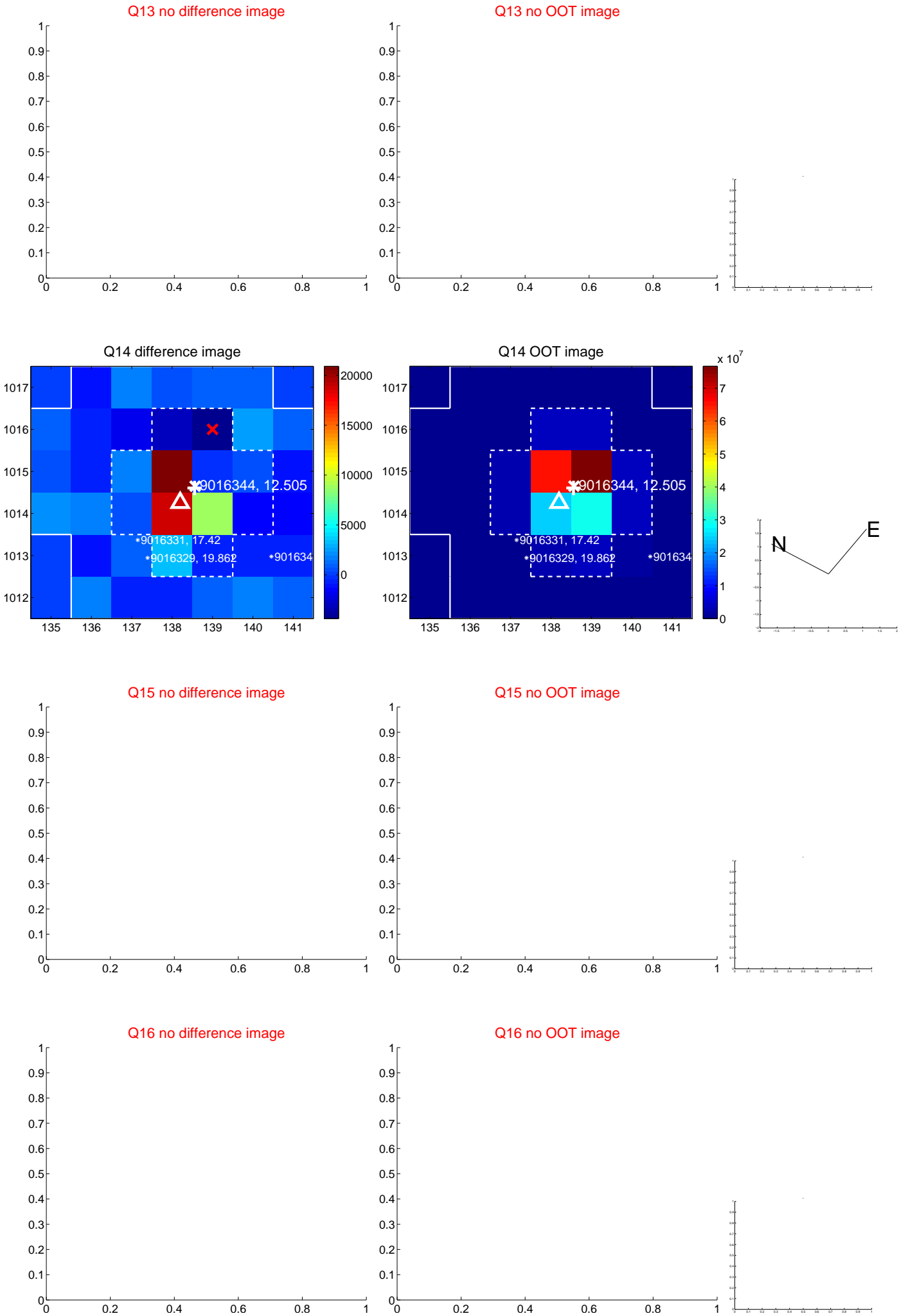
Q8 no OOT image



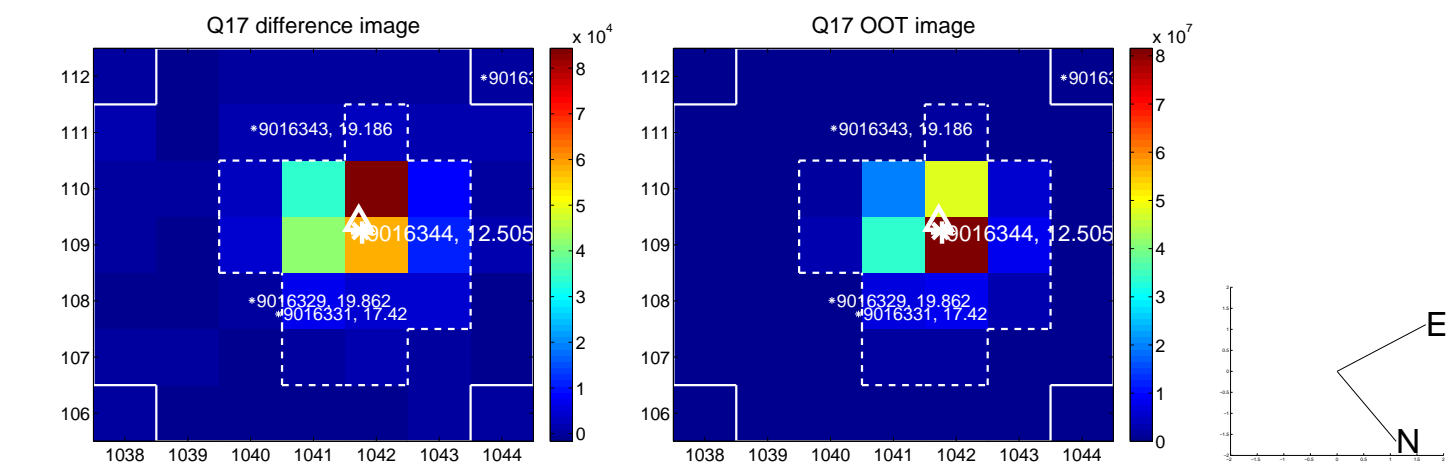
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value



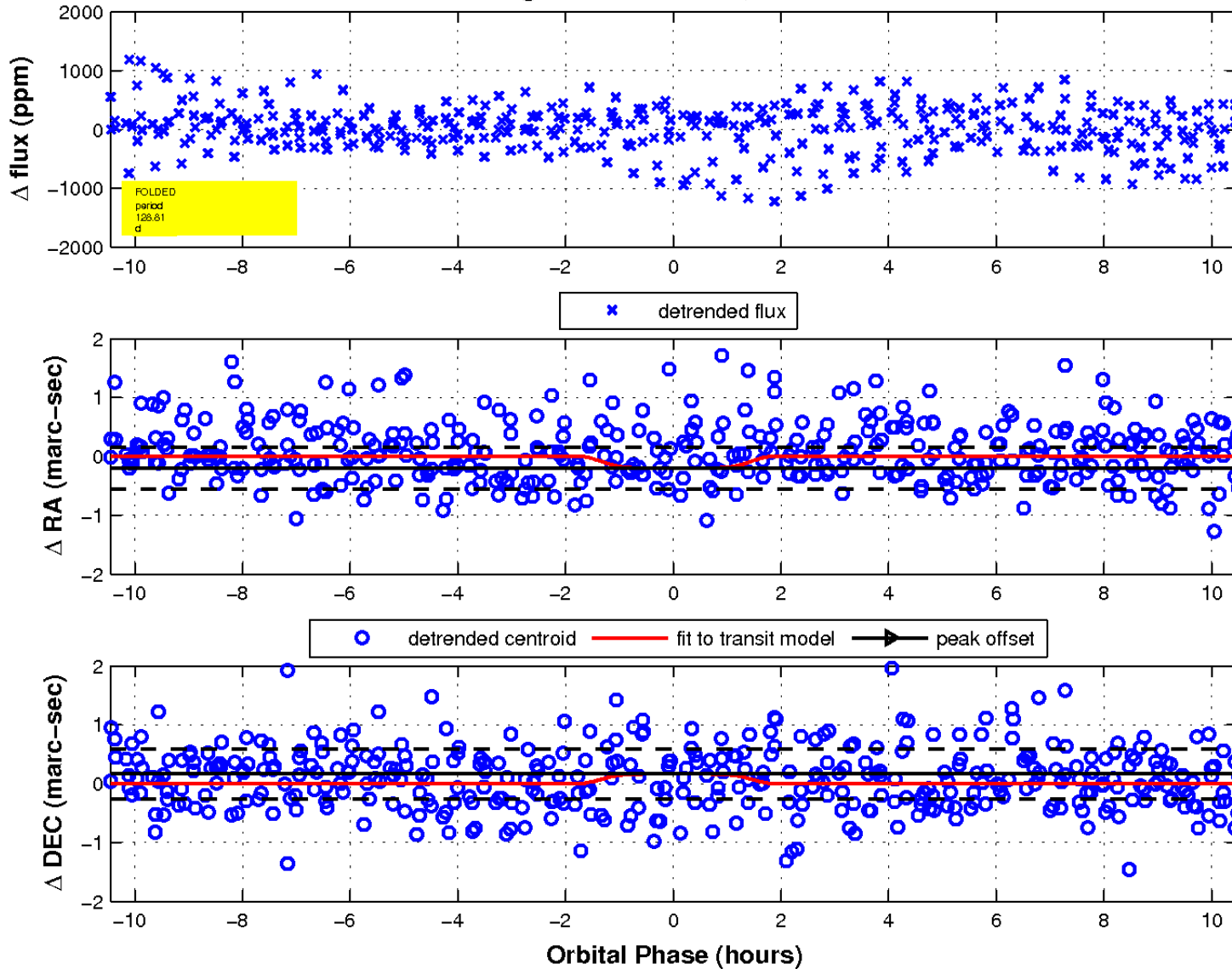
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

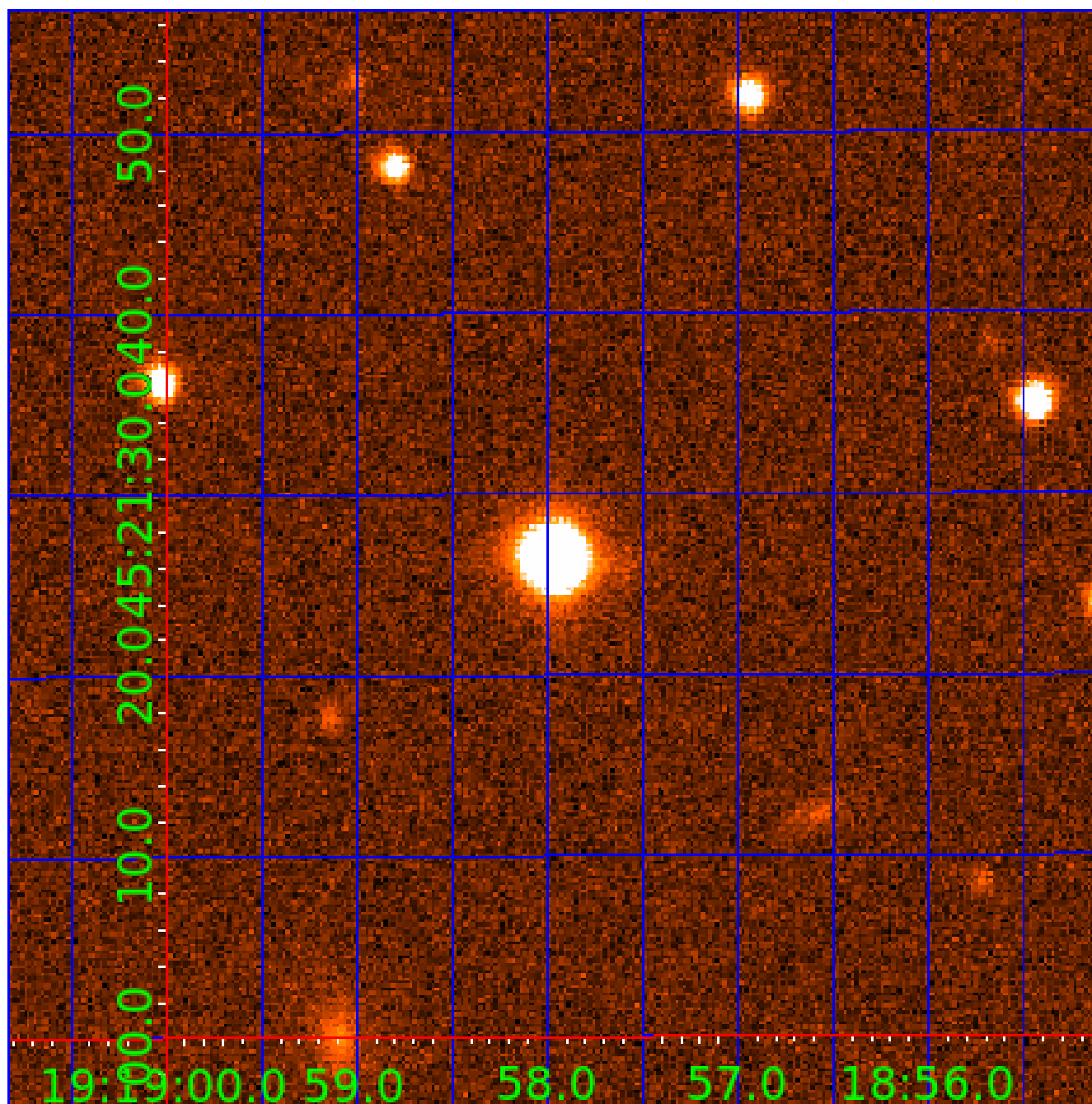


fluxWeightedCentroids, Planet 4 of 6



UKIRT Image

Declination



# KIC 009016344

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009016344-01	OBS	No	0.546865	131.739521	35.7	2.440	12.5	13.2	1.89	7207	1.31	38576.78
009016344-02	OBS	No	0.546863	131.917672	35.5	1.856	10.8	11.4	1.89	7207	1.31	38576.93
009016344-03	OBS	No	42.076666	169.999906	435.1	3.821	8.5	10.0	1.89	7207	4.60	117.88
009016344-04	OBS	No	128.810512	162.137543	871.7	3.510	8.7	8.5	1.89	7207	6.72	26.52
009016344-05	OBS	No	35.457679	137.022461	485.4	3.034	8.6	8.4	1.89	7207	7.72	148.10
009016344-06	OBS	No	44.605881	171.168409	313.3	3.373	7.9	6.9	1.89	7207	3.66	109.05

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009016344-01	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT
009016344-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE_ZUMA—LPP_DV—MOD_NONUNIQ_DV—SAME_NTL_PERIOD
009016344-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT
009016344-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT
009016344-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_ALT
009016344-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT

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

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

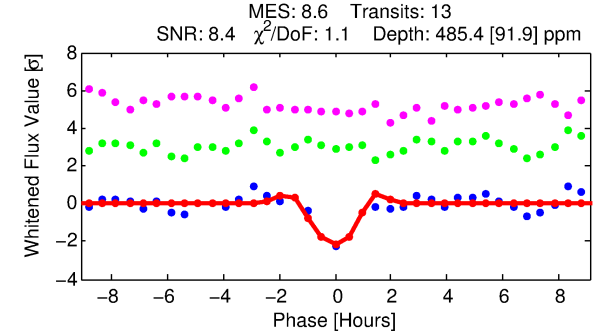
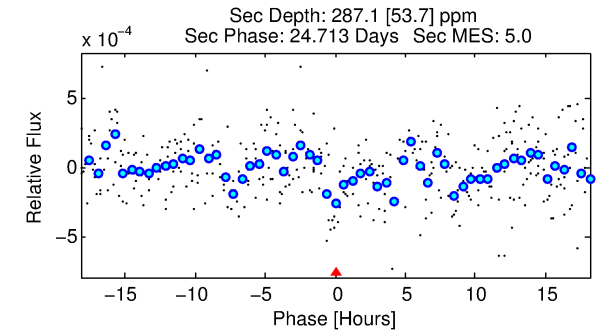
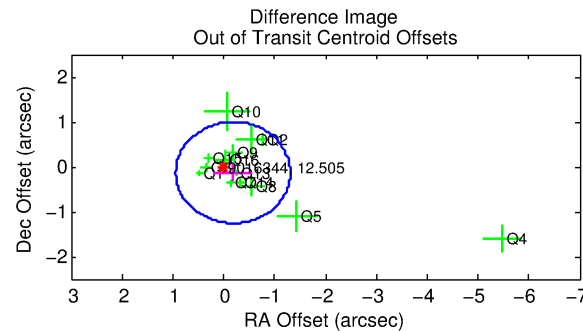
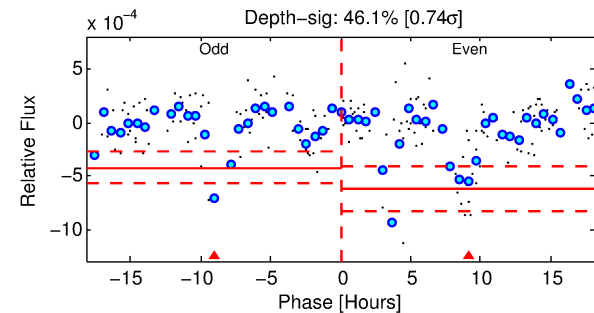
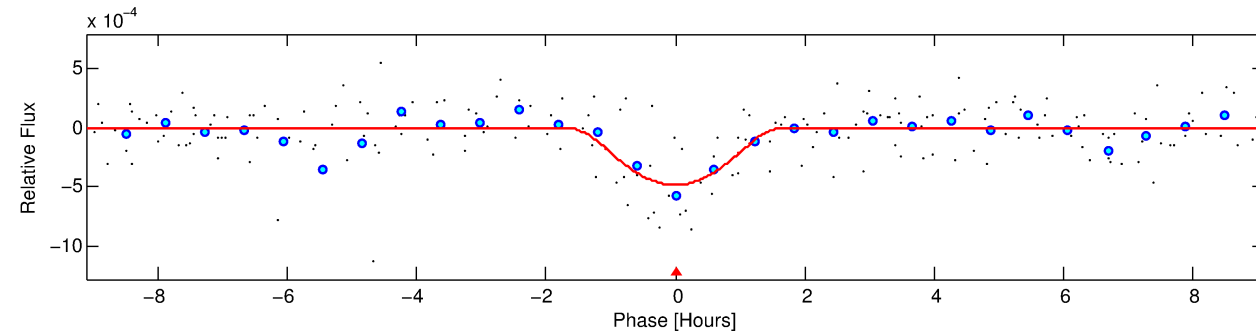
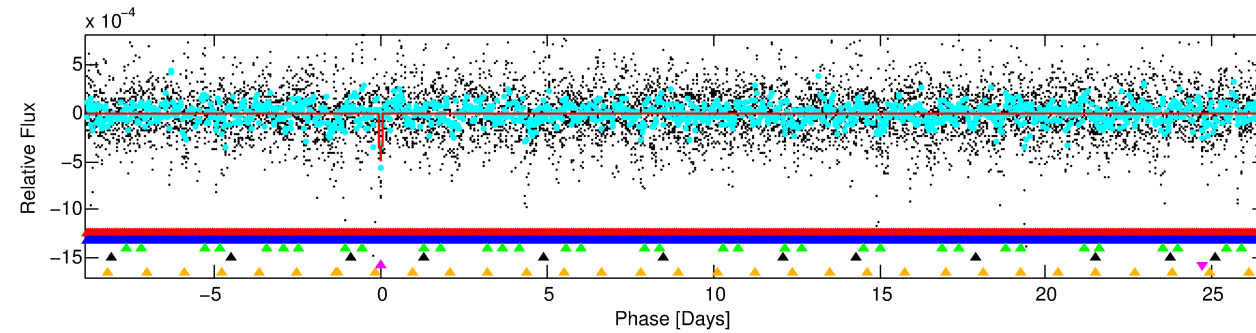
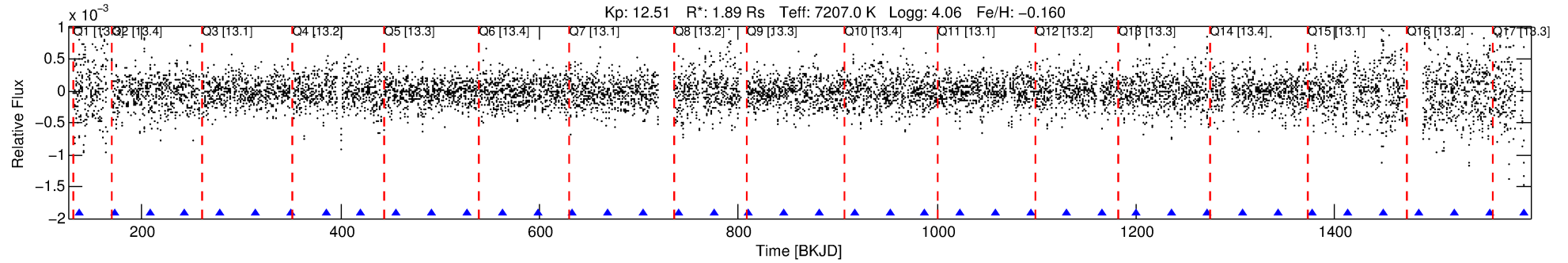
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 009016344-05

No Significant Match Found

# DV One-Page Summary

KIC: 9016344 Candidate: 5 of 6 Period: 35.458 d



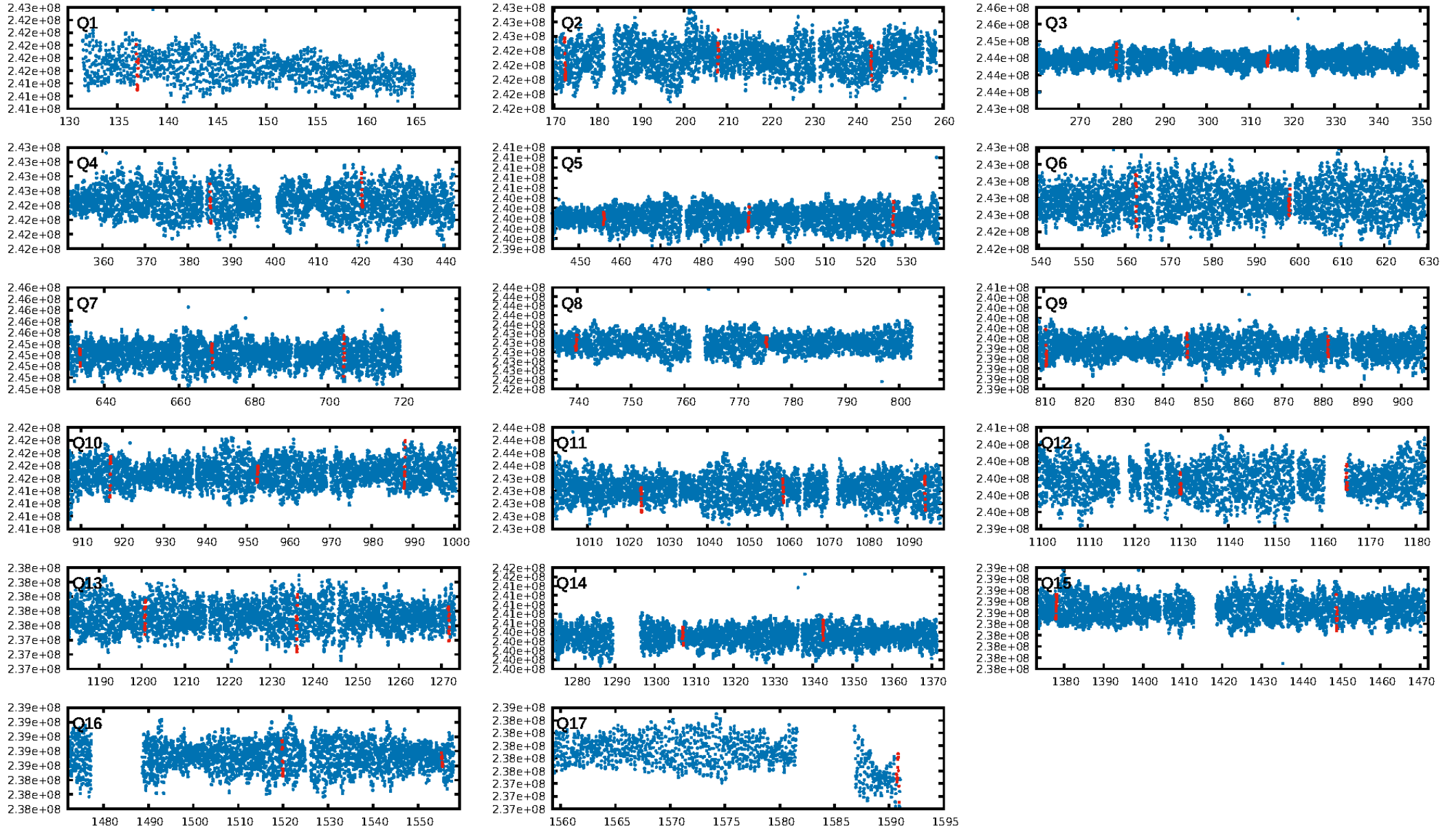
## DV Fit Results:

Period = 35.45768 [0.00041] d  
Epoch = 137.0225 [0.0086] BKJD  
Rp/R\* = 0.0374 [0.1210]  
a/R\* = 25.20 [22.73]  
b = 1.00 [0.19]  
Seff = 148.10 [57.33]  
Teq = 890 [86] K  
Rp = 7.72 [25.12] Re  
a = 0.2420 [0.0599] AU  
Ag = 155.08 [1006.32] [0.15σ]  
Teffp = 4853 [7865] K [0.50σ]

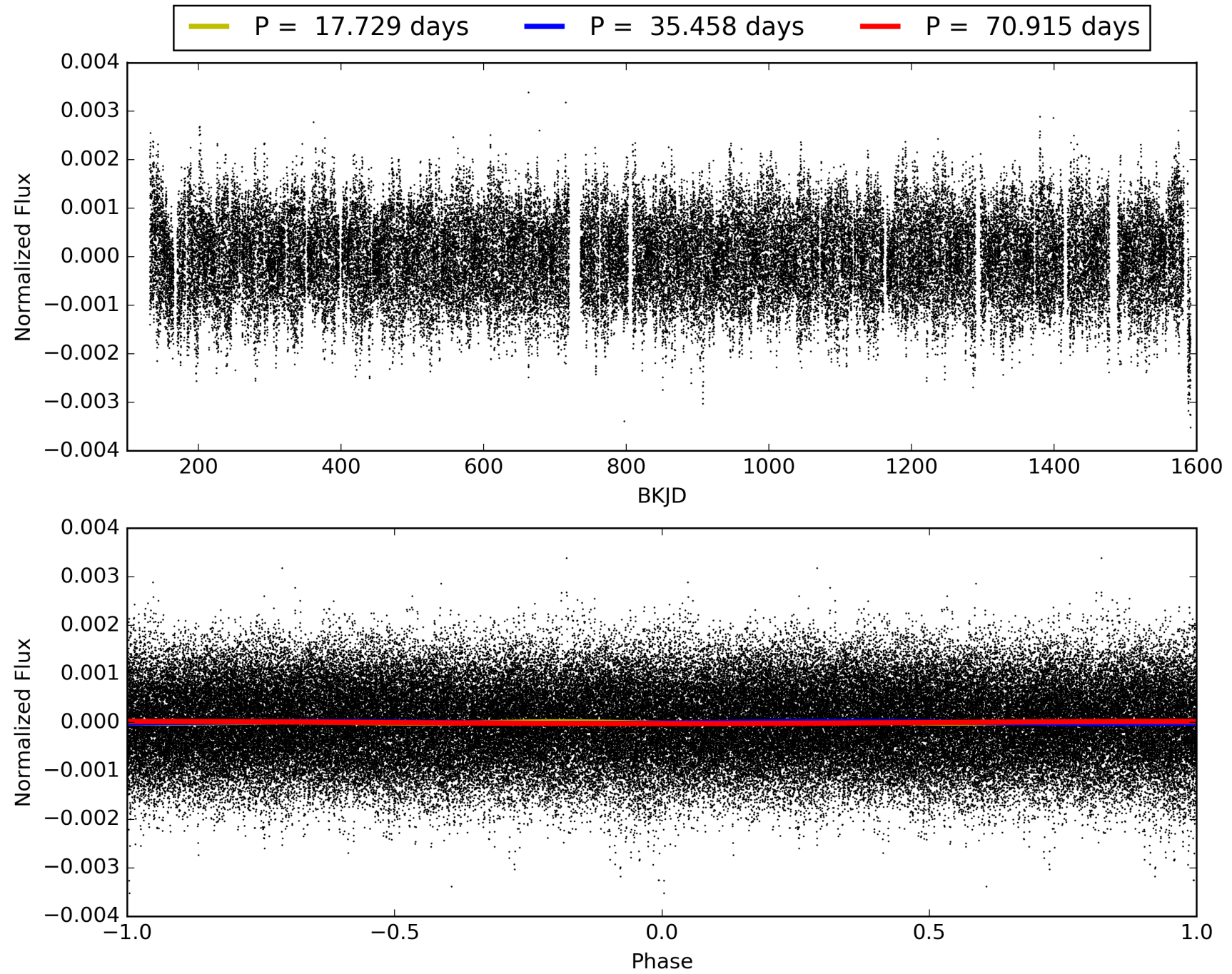
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [215.22σ]  
LongPeriod-sig: 100.0% [32.56σ]  
ModelChiSquare2-sig: 13.3%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [12/12]  
**GhostDiagnostic-chr: 2.53**  
Centroid-sig: 39.3%  
Centroid-so: 0.205 arcsec [0.74σ]  
OotOffset-rm: 0.225 arcsec [0.60σ]  
KicOffset-rm: 0.175 arcsec [0.44σ]  
OotOffset-st: 4/3/3/4 [14]  
KicOffset-st: 4/3/3/4 [14]  
DiffImageQuality-fgm: 0.57 [8/14]  
DiffImageOverlap-fno: 0.00 [0/15]

# TCE 009016344-05, PDC Light Curves

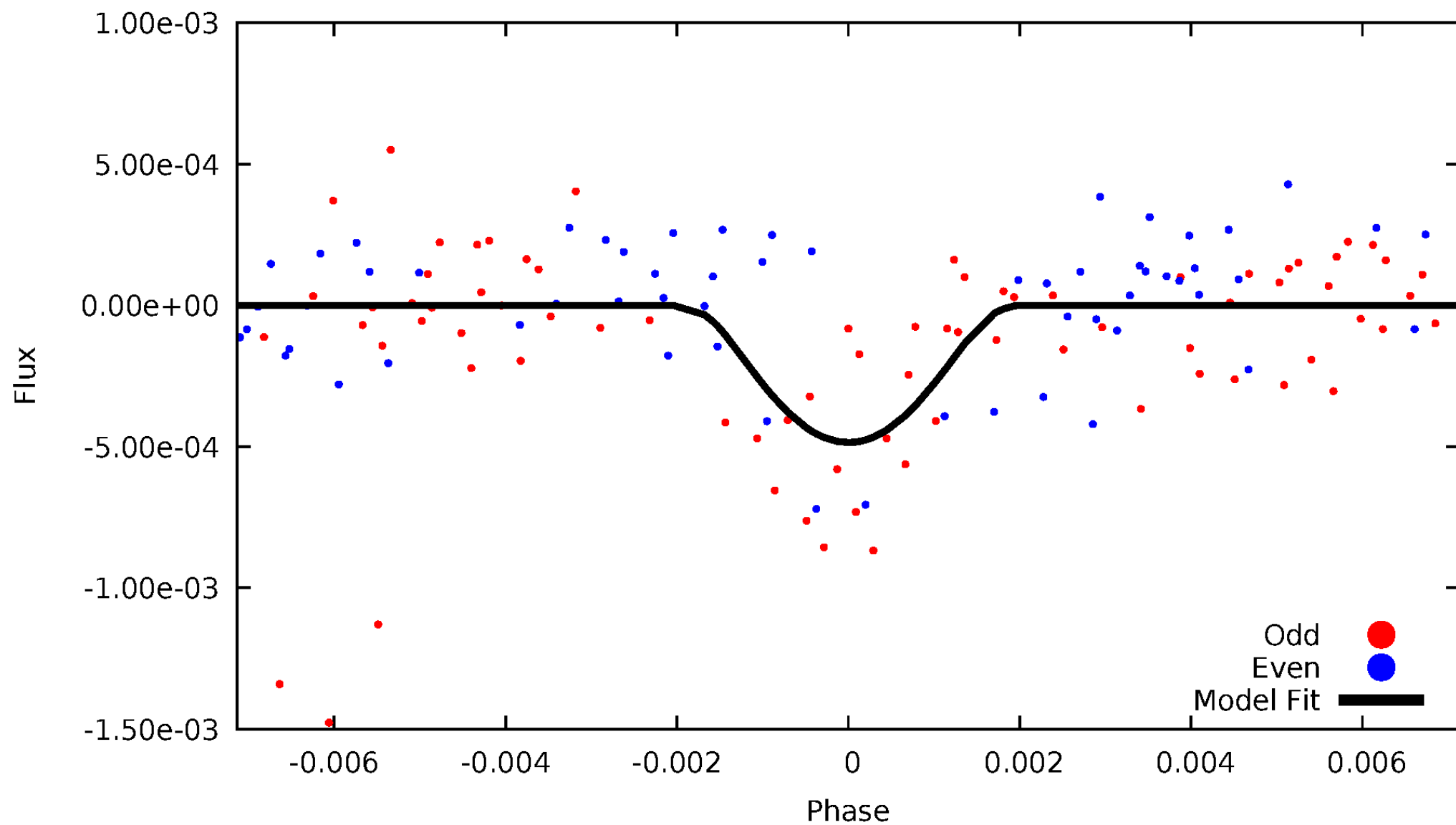


TCE 009016344-05



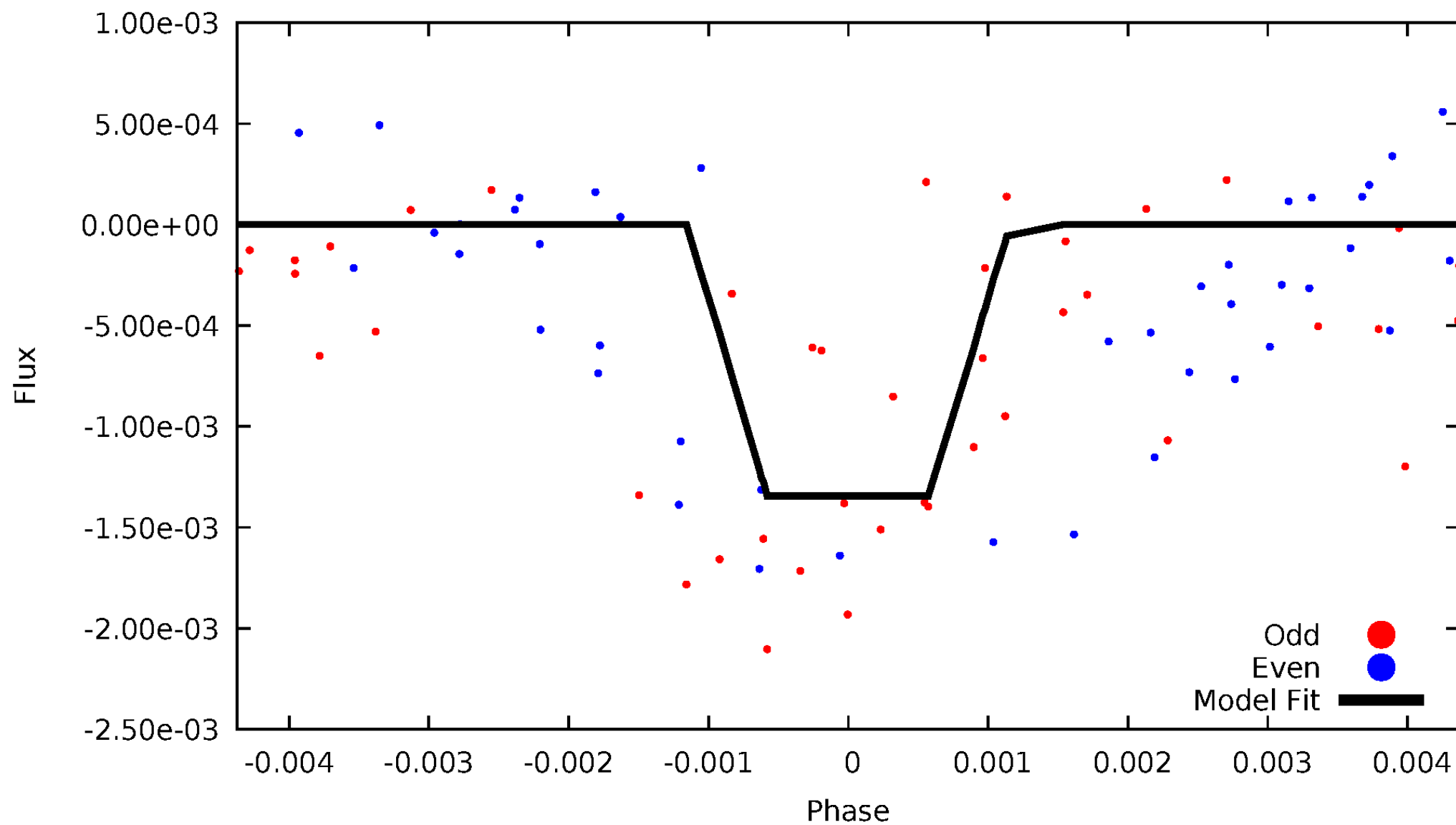
# DV Odd/Even

TCE 009016344-05



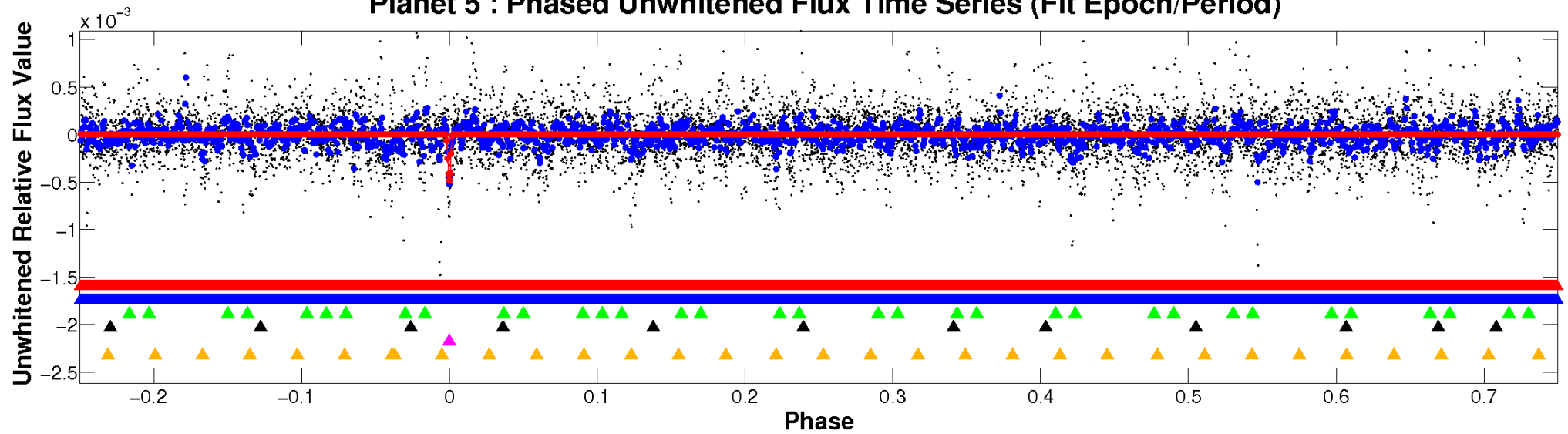
# ALT Odd/Even

TCE 009016344-05

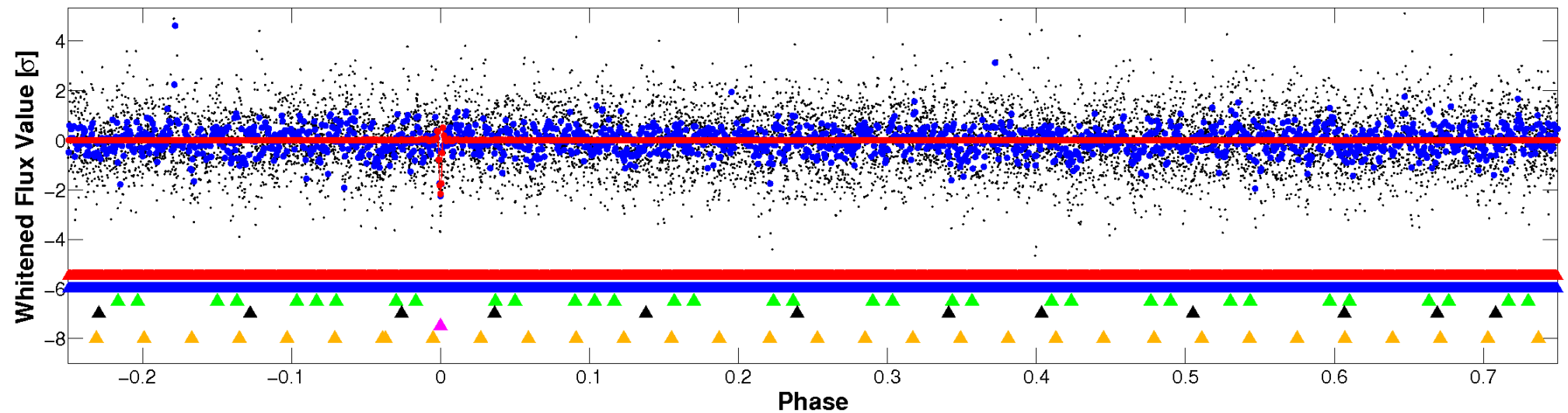


# Non-Whitened Vs. Whitened Light Curve

## Planet 5 : Phased Unwhitened Flux Time Series (Fit Epoch/Period)

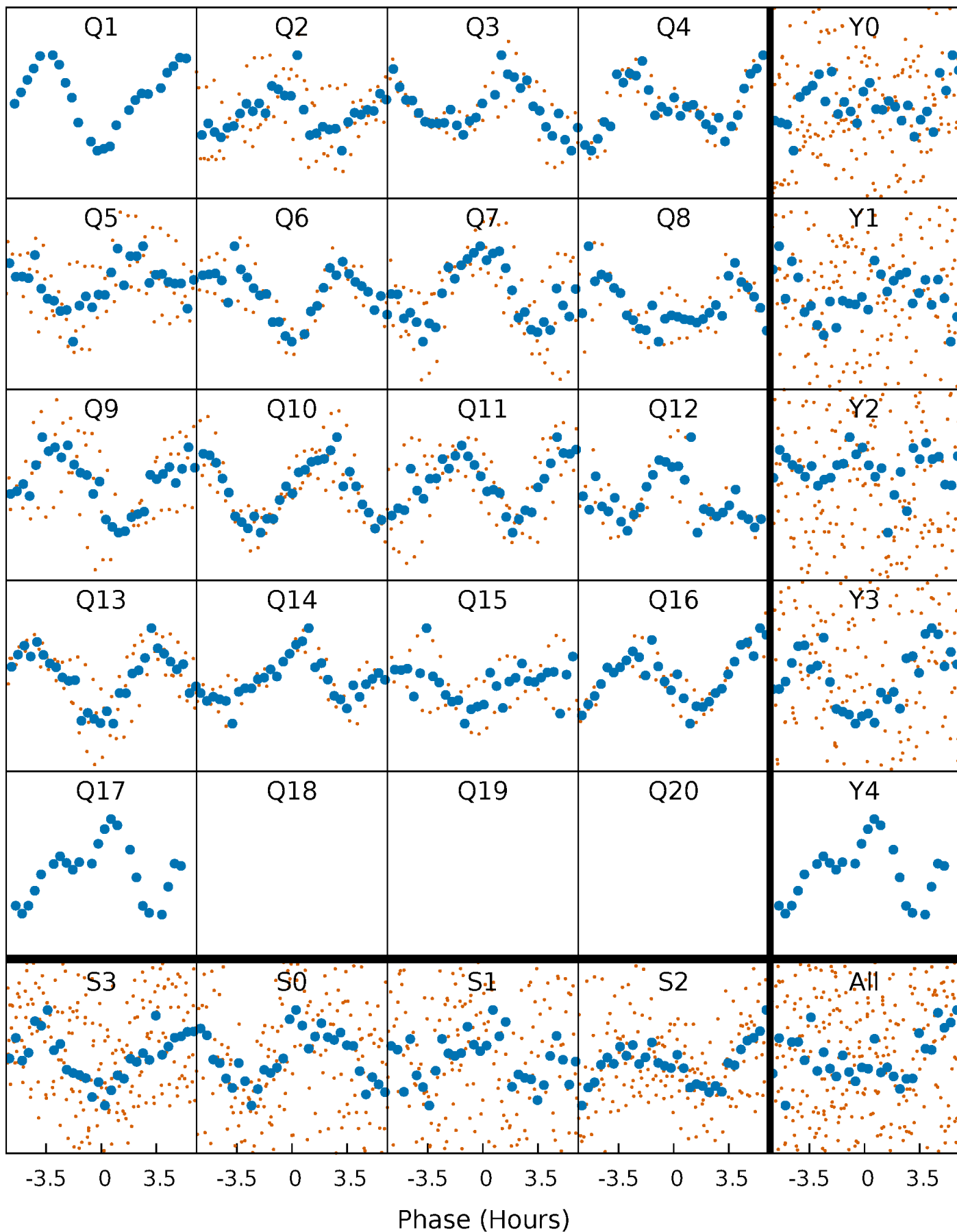


## Planet 5 : Phased Whitened Flux Time Series (Fit Epoch/Period)



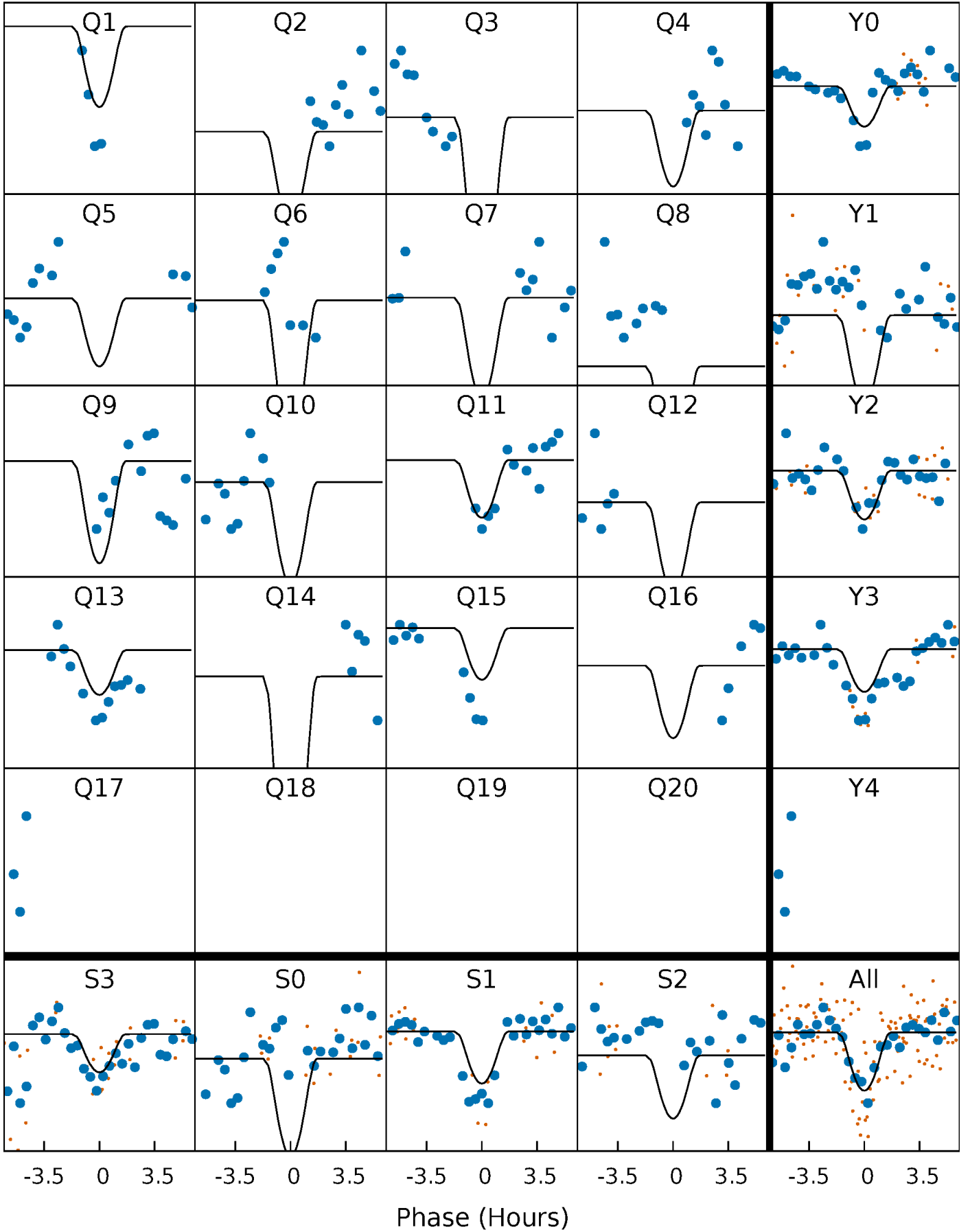
# PDC Quarter-Phased Transit Curves

TCE 009016344-05     $P = 35.457679$  Days     $T_0 = 137.022461$  (BKJD)



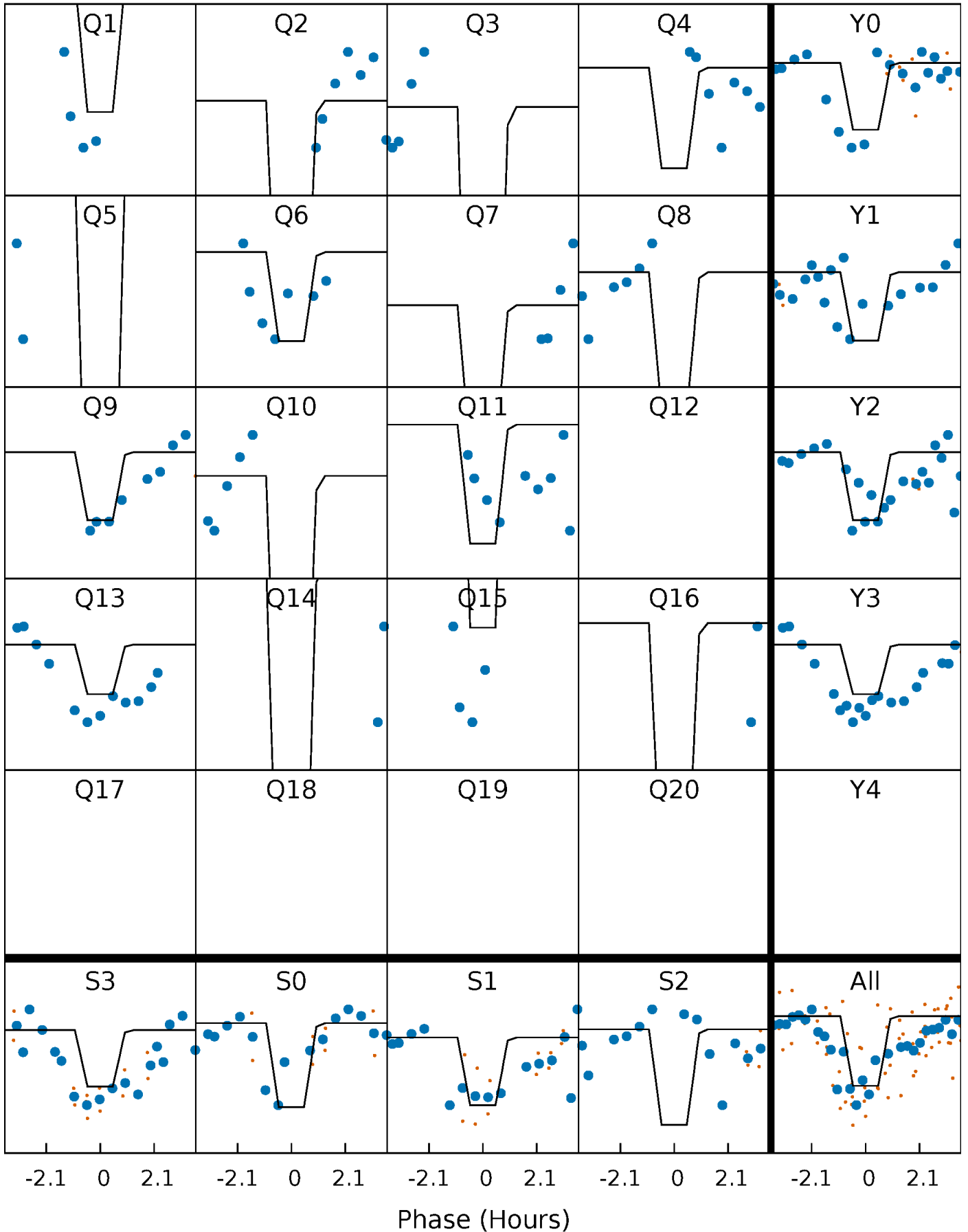
# DV Quarter-Phased Transit Curves

TCE 009016344-05   P= 35.457679 Days    $T_0=137.022461$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

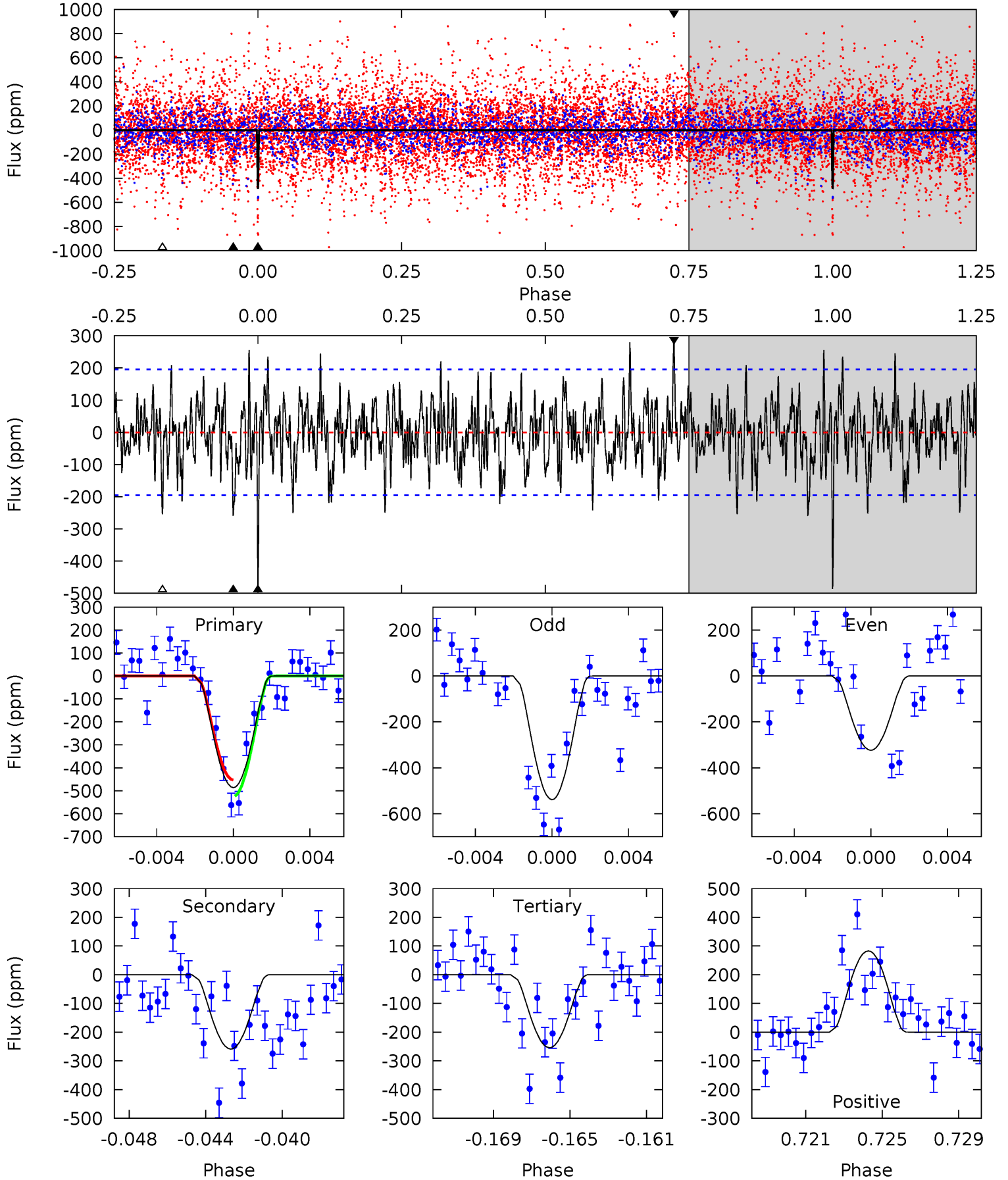
TCE 009016344-05   P= 35.457486 Days    $T_0=137.031744$  (BKJD)



# DV Model-Shift Uniqueness Test

009016344-05, P = 35.457679 Days, E = 101.564782 Days

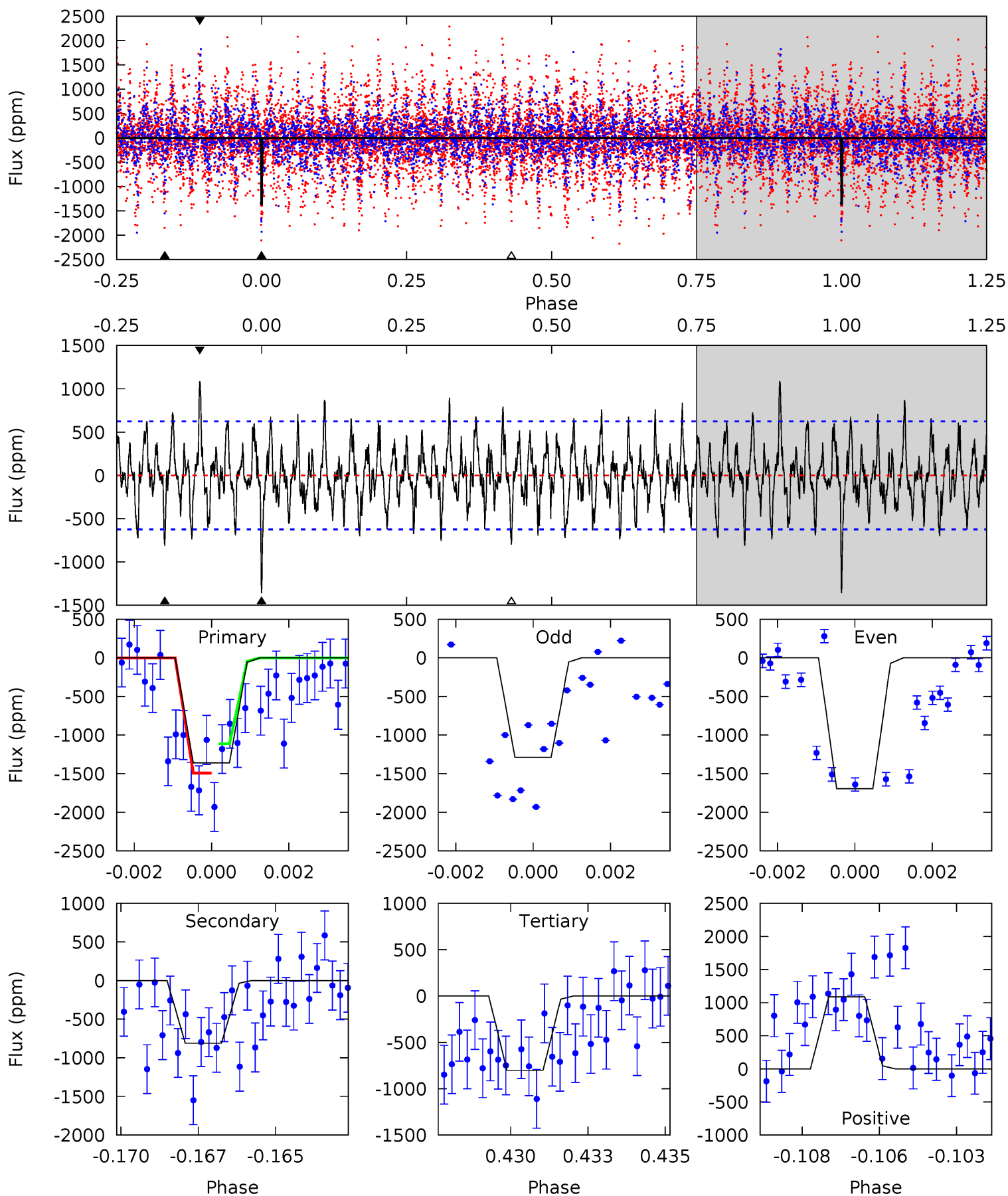
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
12.9	6.88	6.75	7.52	5.20	2.88	2.17	6.17	5.40	0.13	-0.64	2.74	1.08	0.37	0.93



# Alt Model-Shift Uniqueness Test

009016344-05,  $P = 35.457486$  Days,  $E = 101.574258$  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
11.5	6.88	6.79	9.21	5.29	3.03	2.43	4.74	2.32	0.09	-2.33	1.34	0.80	0.44	1.61



### Stellar Parameters For KIC 009016344

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$\rho_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$7207^{+226}_{-302}$	$4.060^{+0.185}_{-0.167}$	$-0.160^{+0.250}_{-0.350}$	$1.894^{+0.576}_{-0.471}$	$1.499^{+0.225}_{-0.250}$	$0.311^{+0.356}_{-0.143}$
	+3%/-4%	+5%/-4%	+156%/-219%	+30%/-25%	+15%/-17%	+114%/-46%
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 009016344-05 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-259 \pm 38$	$19.56^{+21.31}_{-13.16}$	$1237^{+96}_{-88}$	$3427^{+1748}_{-669}$	$21^{+178}_{-16}$
Alt.	$-811 \pm 118$	$21.37^{+21.50}_{-14.88}$	$1238^{+93}_{-90}$	$4046^{+2722}_{-812}$	$57^{+543}_{-43}$

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

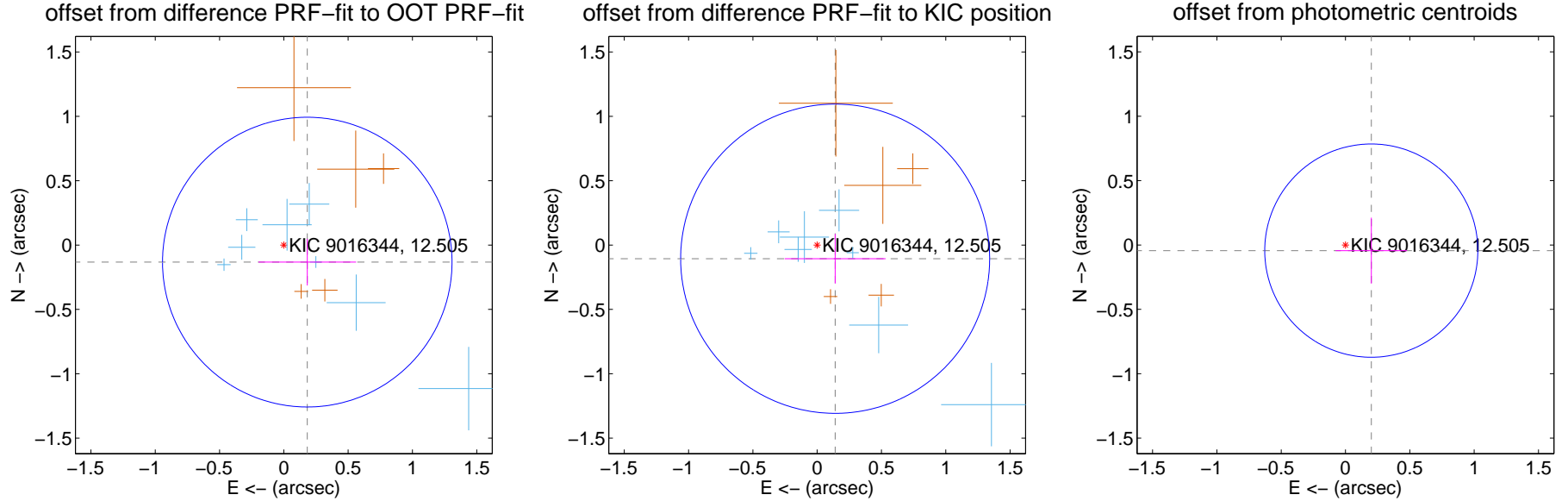
## DV Centroid Data

Supplemental centroid analysis for 009016344-05. Kepler magnitude: 12.51. Transit SNR 8.38

There are 8 quarters with good PRF difference image offsets

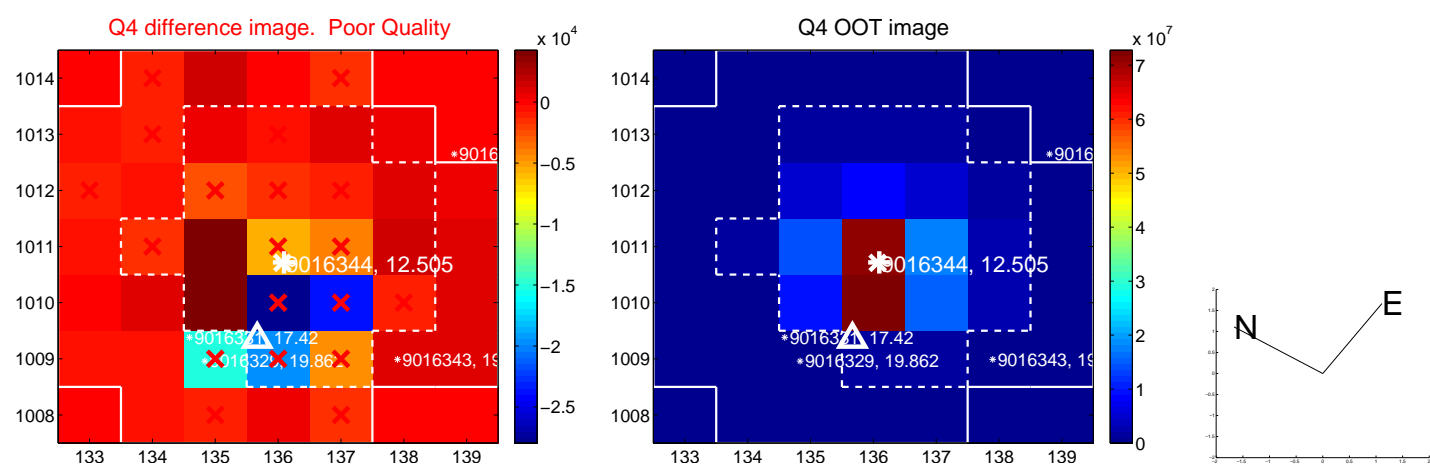
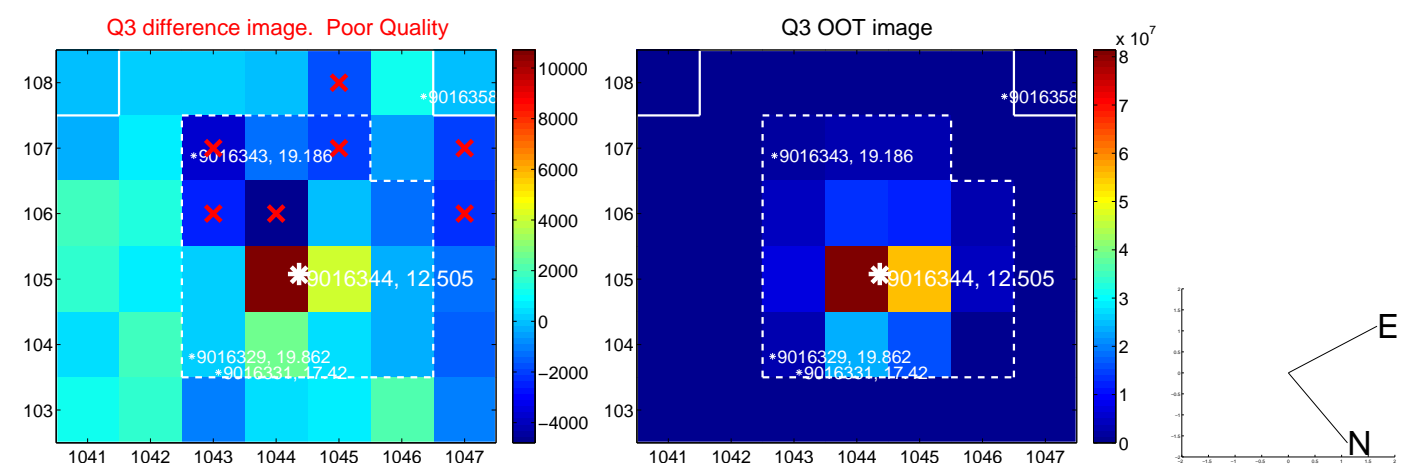
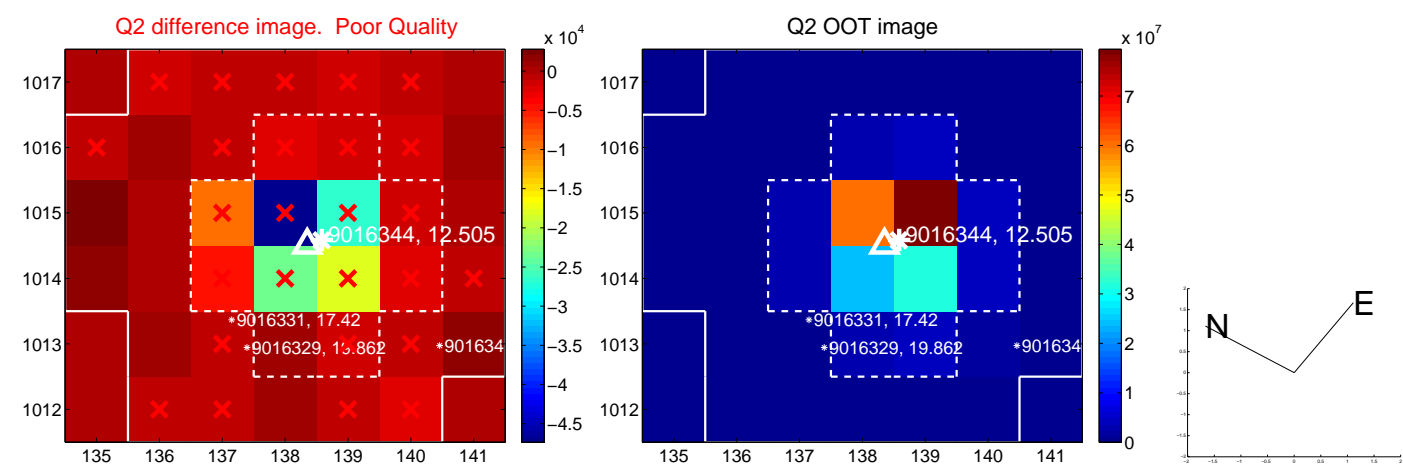
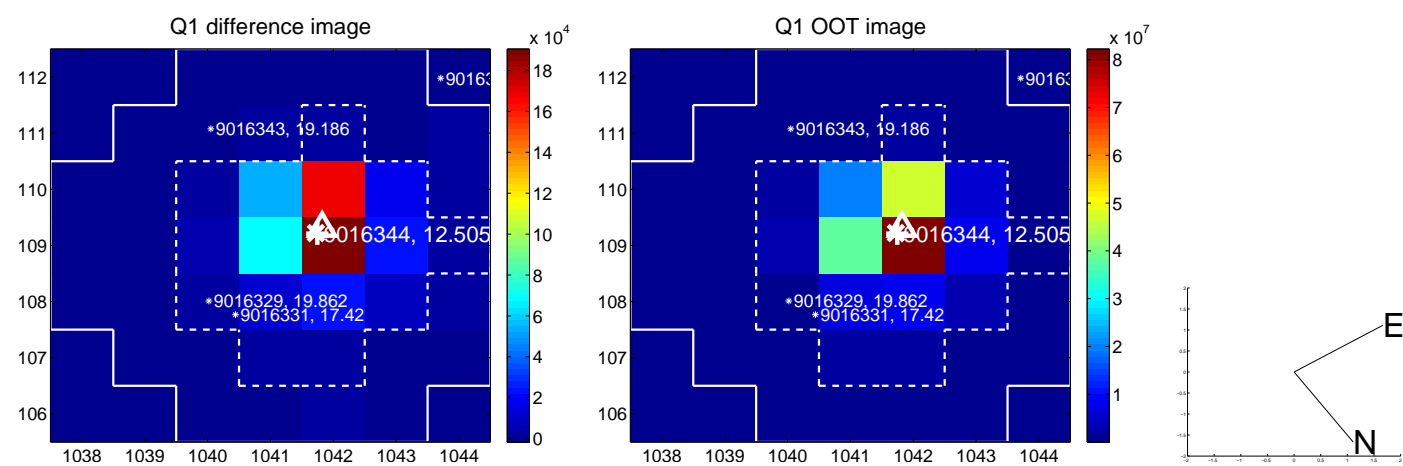
The direct PRF centroid is offset from the target star catalog position by about 0.16 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.225 \pm 0.375$	0.60	$-0.182 \pm 0.379$	$-0.133 \pm 0.182$
PRF-fit source offset from KIC position	$0.175 \pm 0.400$	0.44	$-0.140 \pm 0.392$	$-0.106 \pm 0.193$
photometric centroid source offset	$0.21 \pm 0.28$	0.74	$-0.20 \pm 0.28$	$-0.04 \pm 0.26$

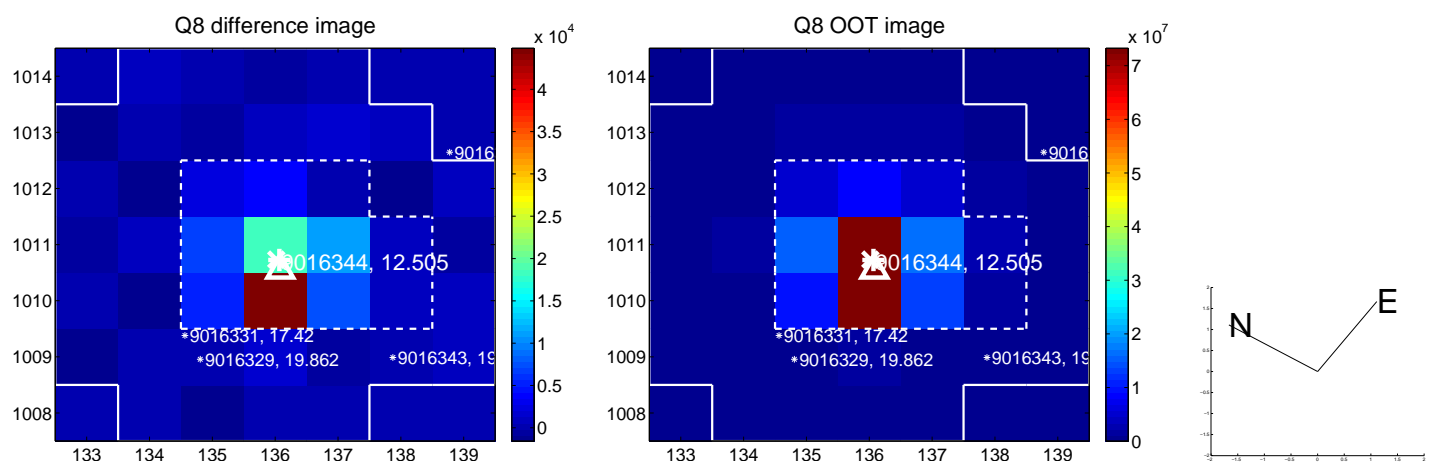
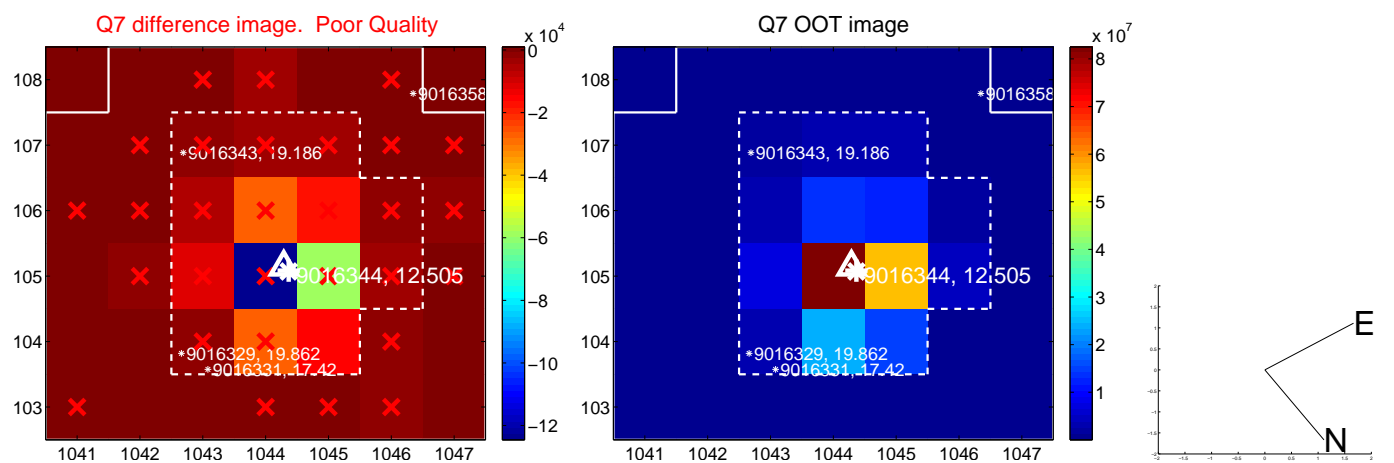
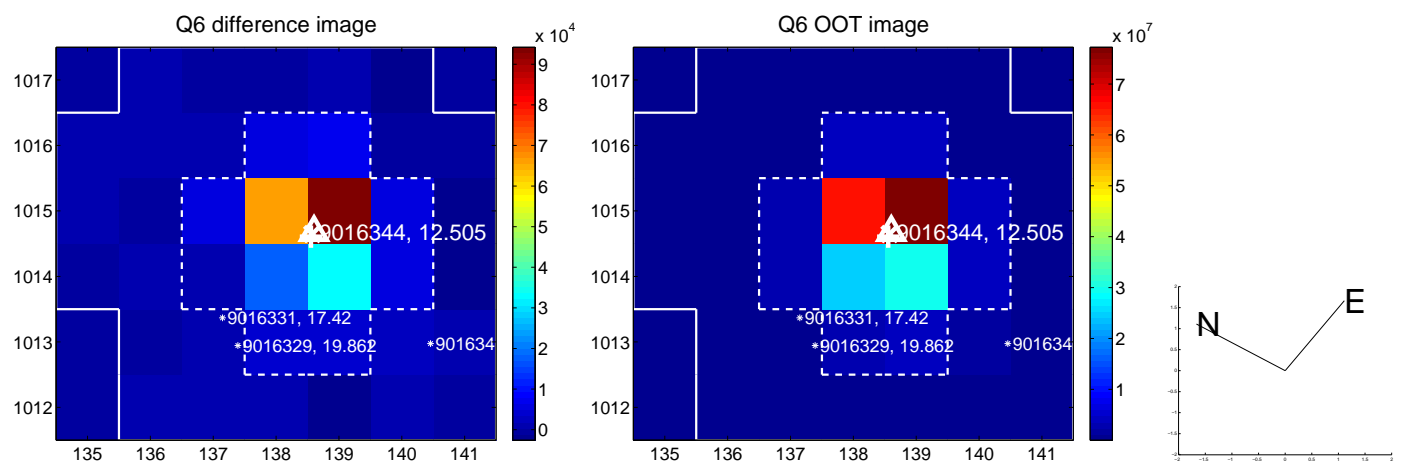
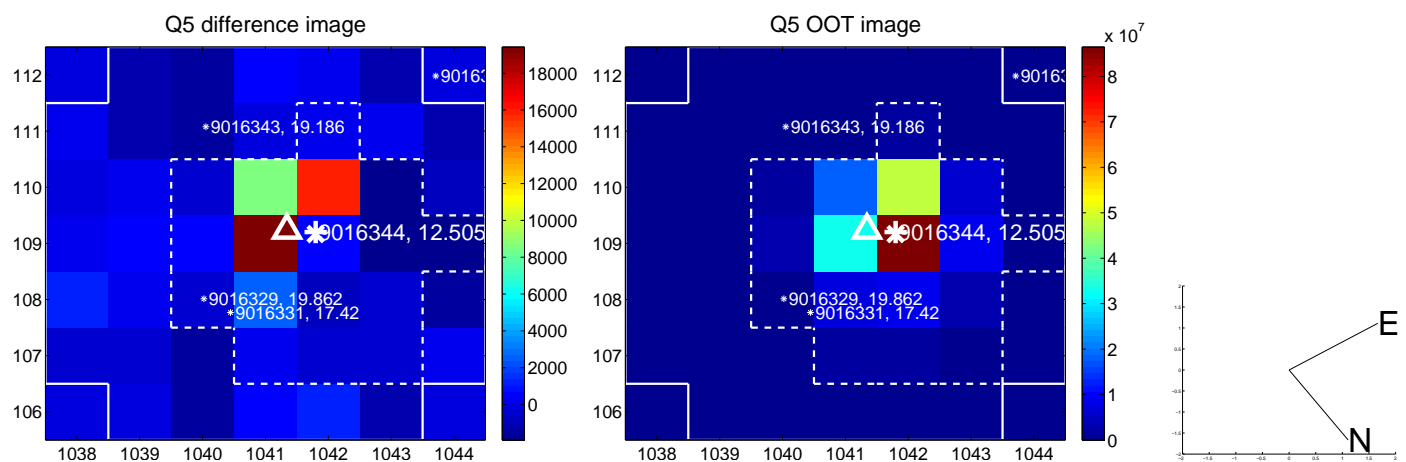


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

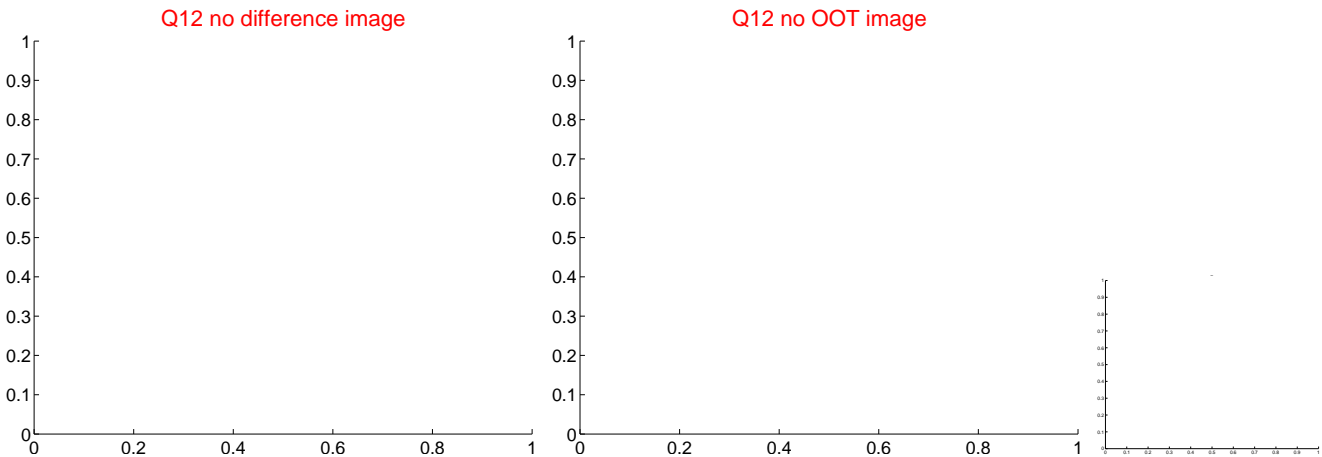
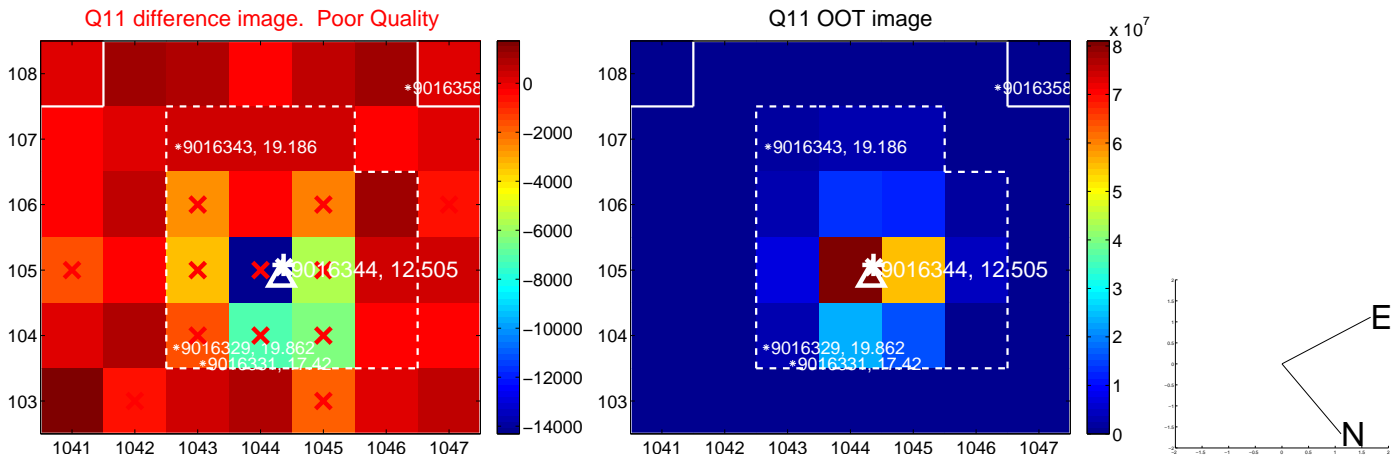
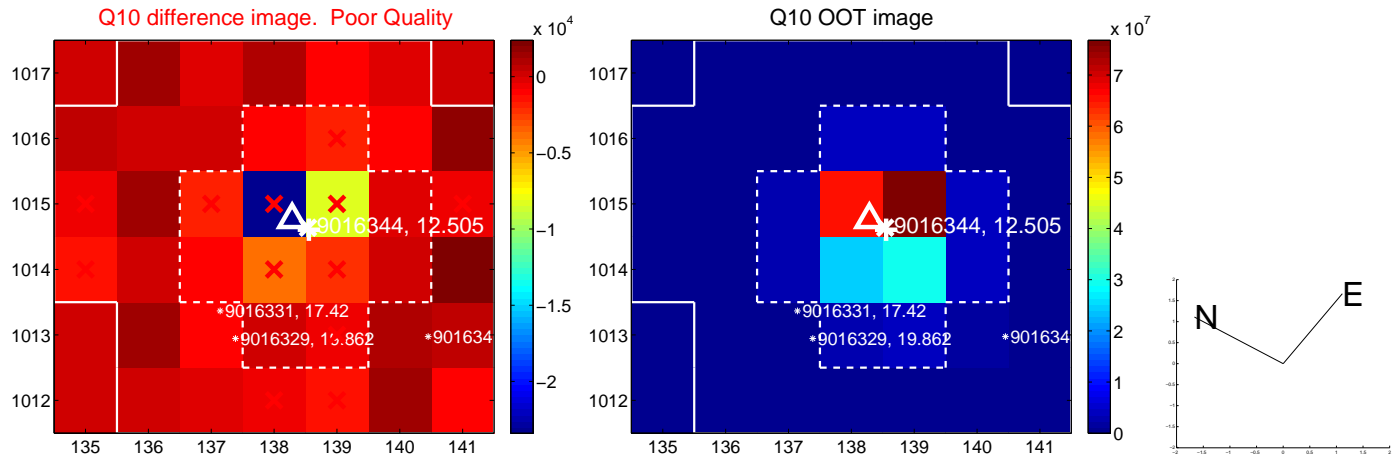
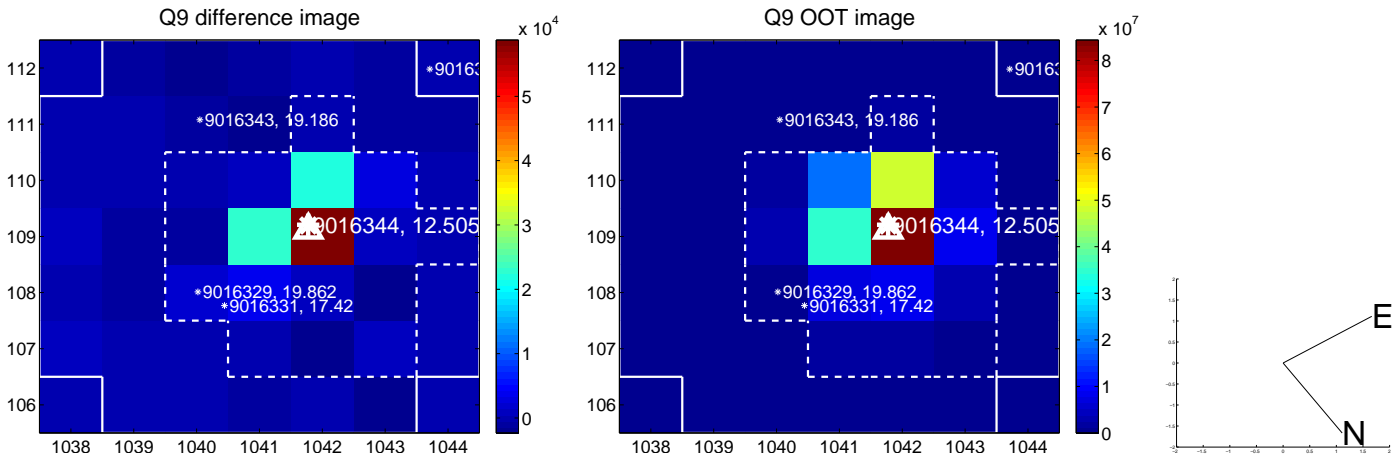
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



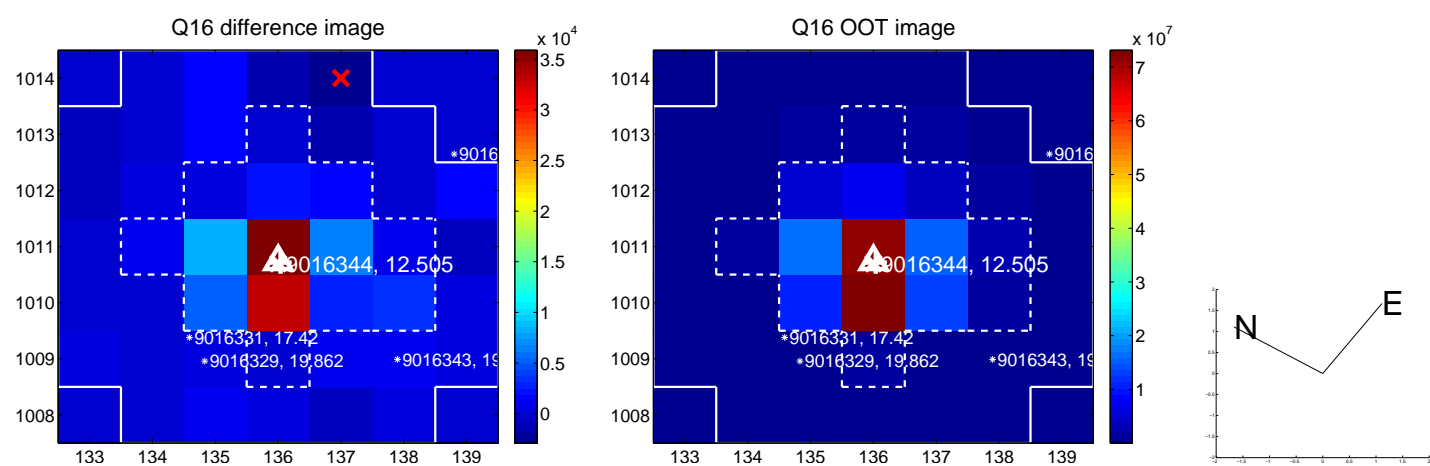
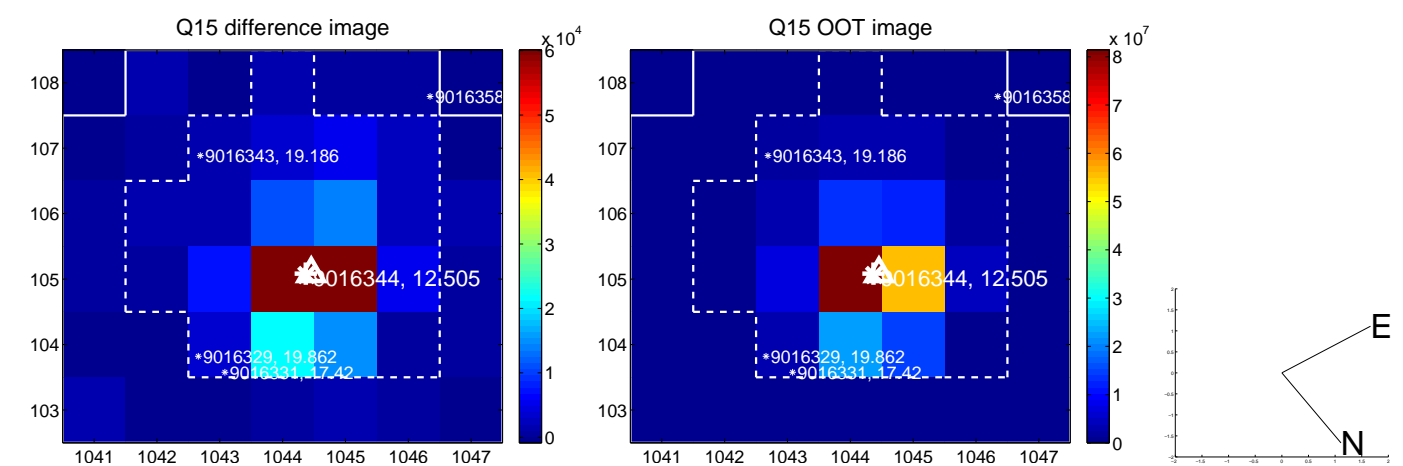
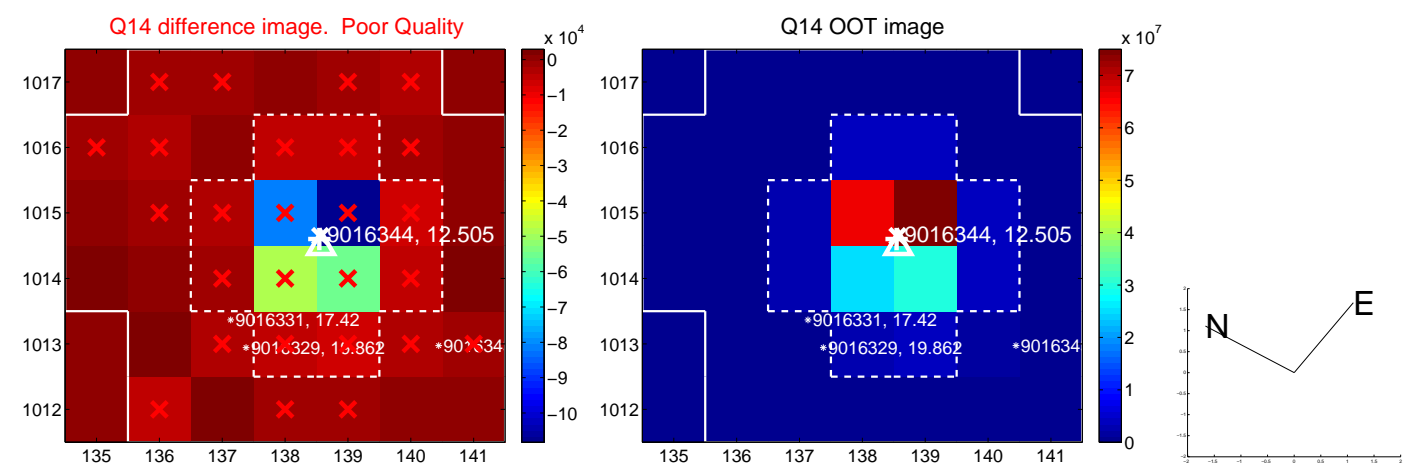
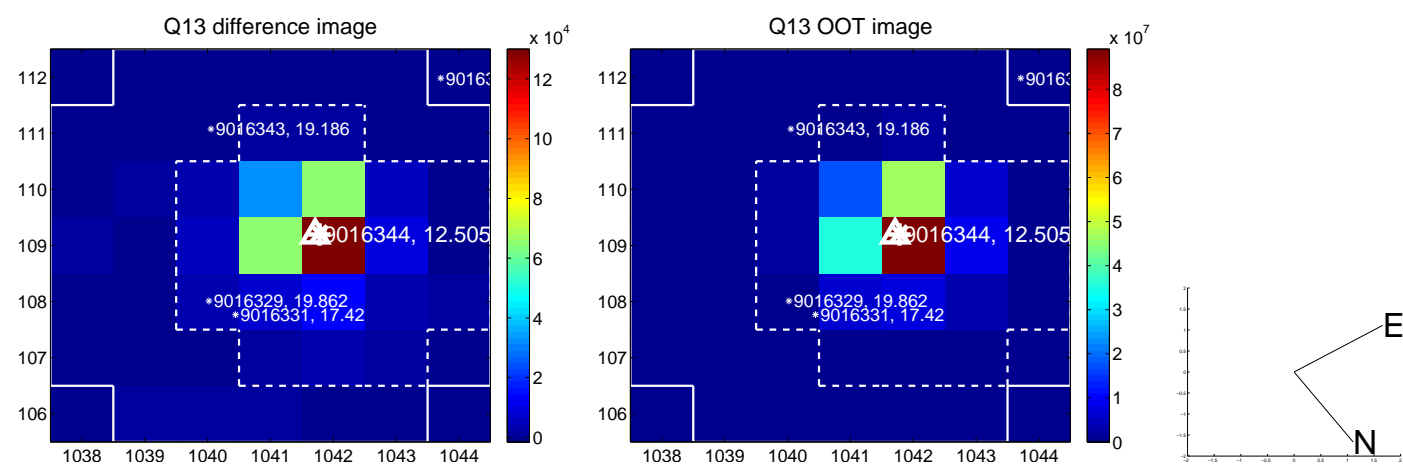
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



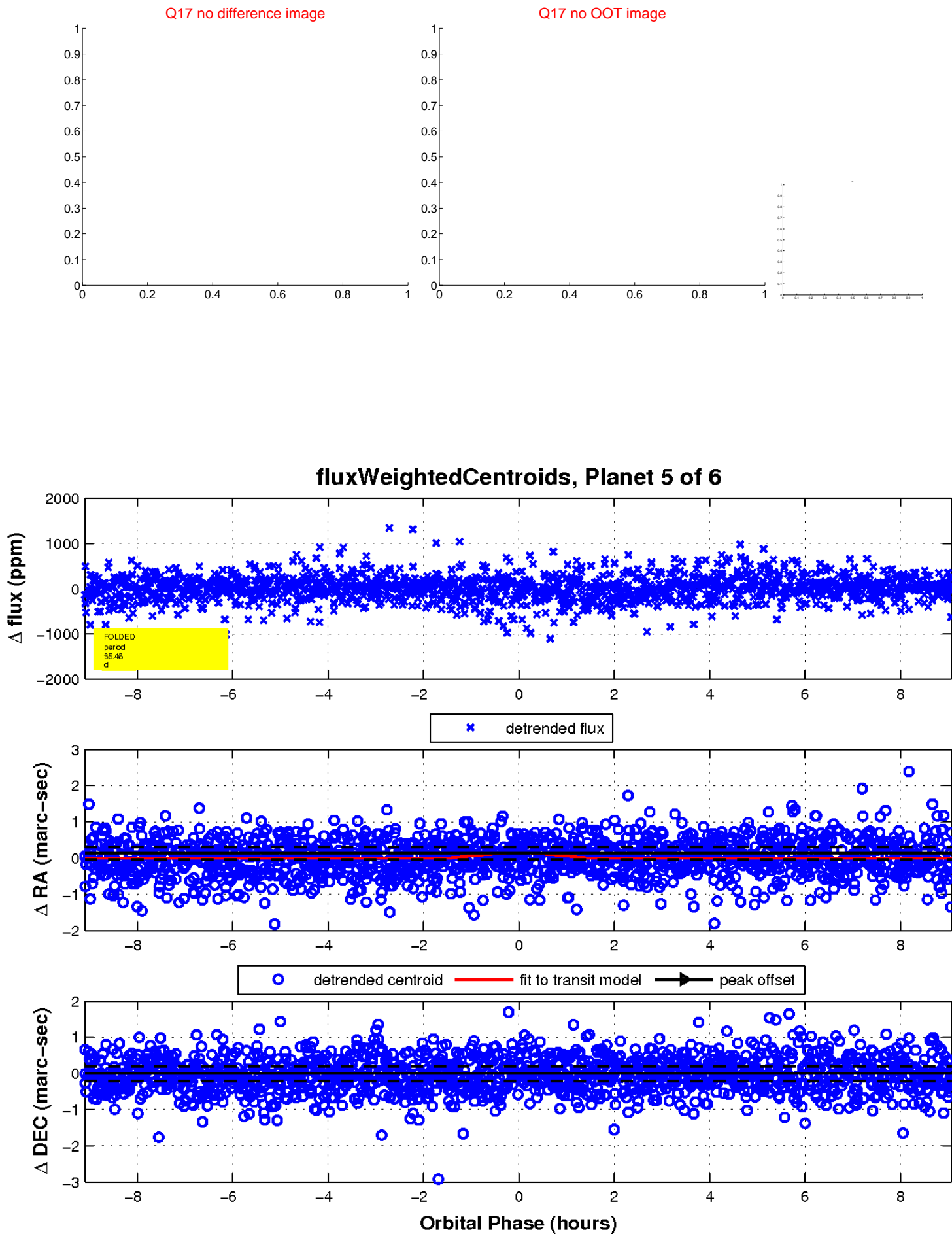
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

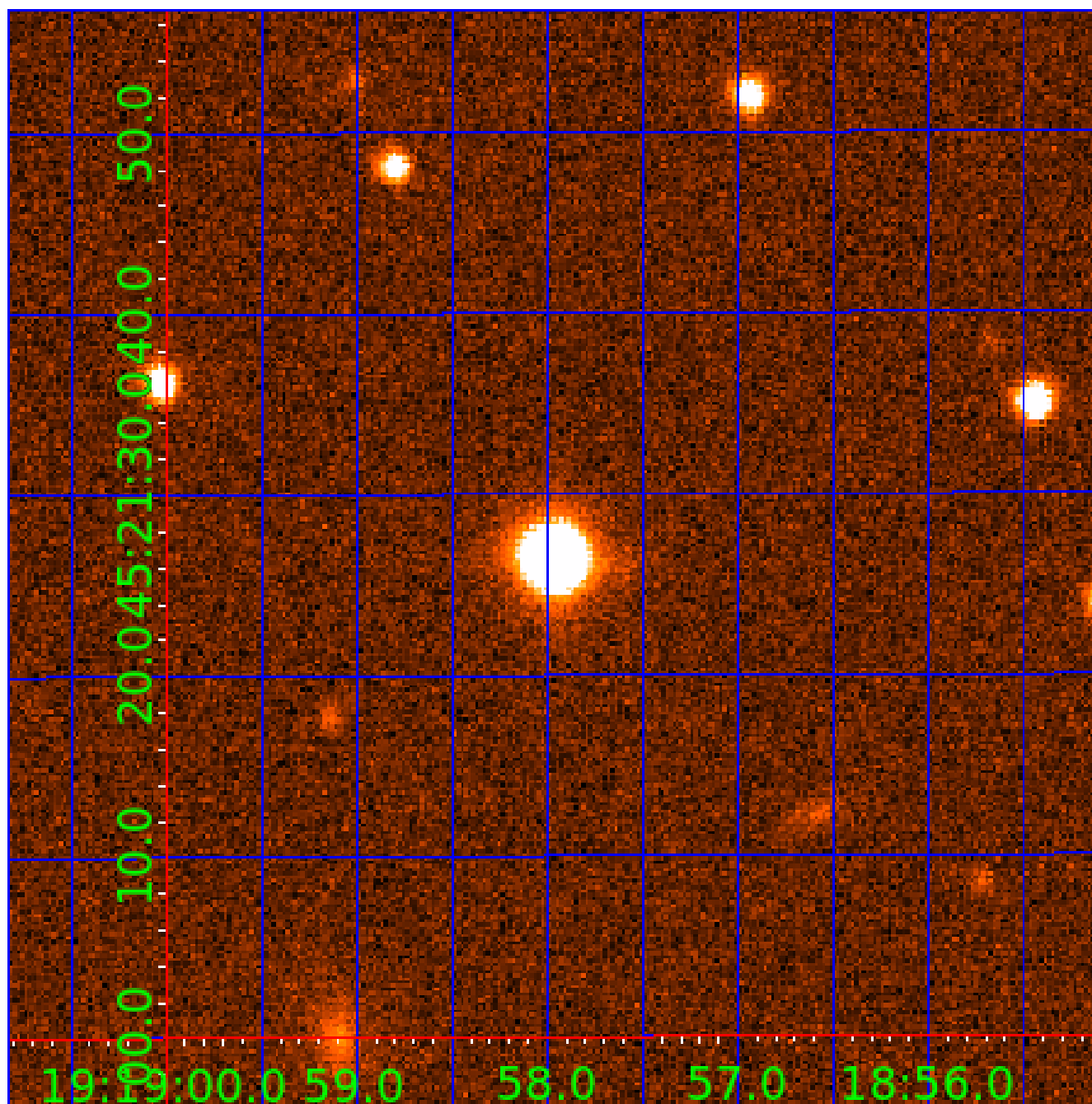


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 009016344

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009016344-01	OBS	No	0.546865	131.739521	35.7	2.440	12.5	13.2	1.89	7207	1.31	38576.78
009016344-02	OBS	No	0.546863	131.917672	35.5	1.856	10.8	11.4	1.89	7207	1.31	38576.93
009016344-03	OBS	No	42.076666	169.999906	435.1	3.821	8.5	10.0	1.89	7207	4.60	117.88
009016344-04	OBS	No	128.810512	162.137543	871.7	3.510	8.7	8.5	1.89	7207	6.72	26.52
009016344-05	OBS	No	35.457679	137.022461	485.4	3.034	8.6	8.4	1.89	7207	7.72	148.10
009016344-06	OBS	No	44.605881	171.168409	313.3	3.373	7.9	6.9	1.89	7207	3.66	109.05

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009016344-01	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT
009016344-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE_ZUMA—LPP_DV—MOD_NONUNIQ_DV—SAME_NTL_PERIOD
009016344-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT
009016344-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT
009016344-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_ALT
009016344-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT

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

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

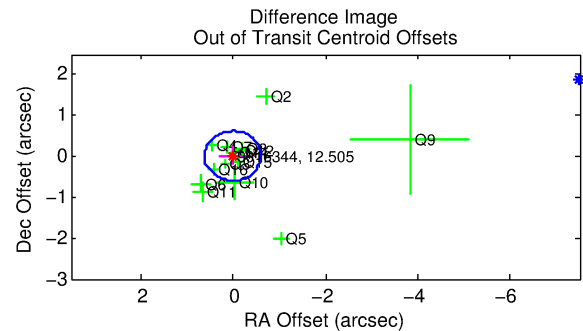
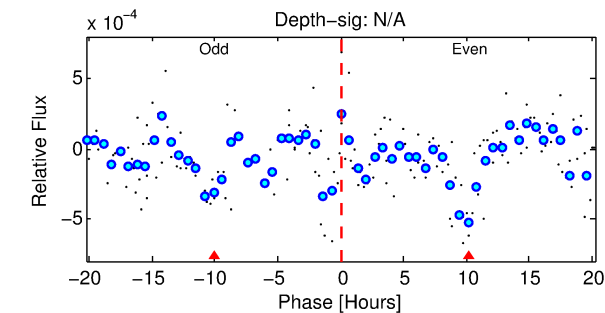
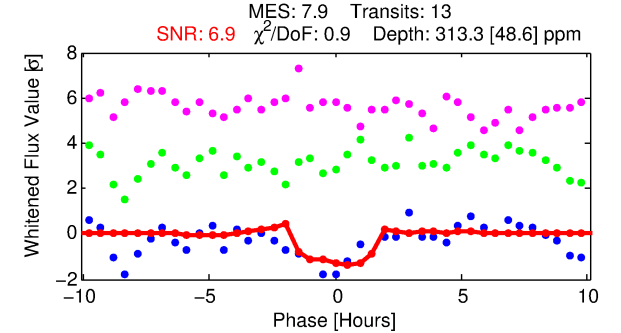
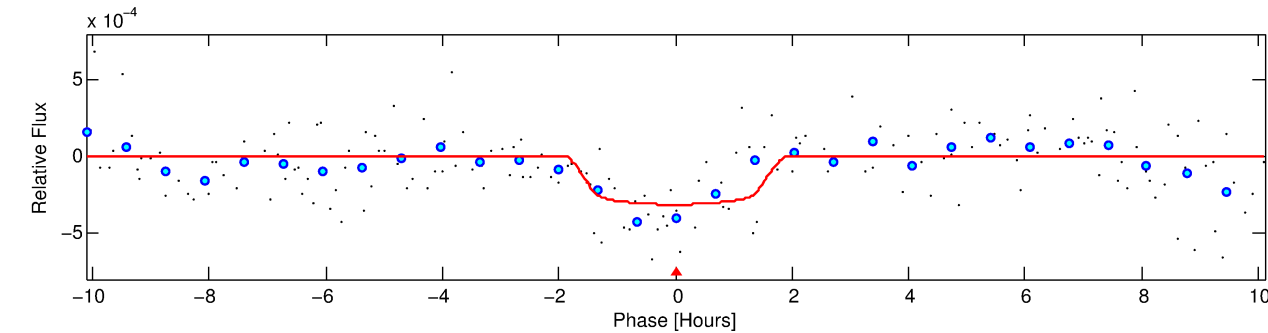
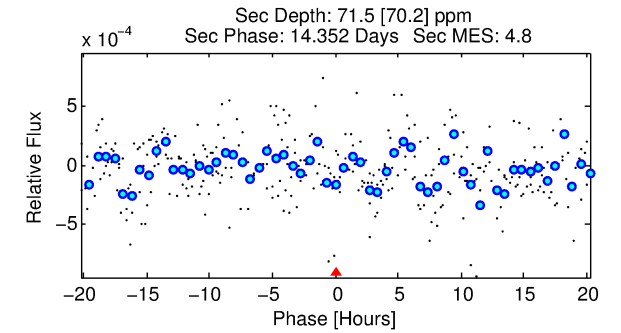
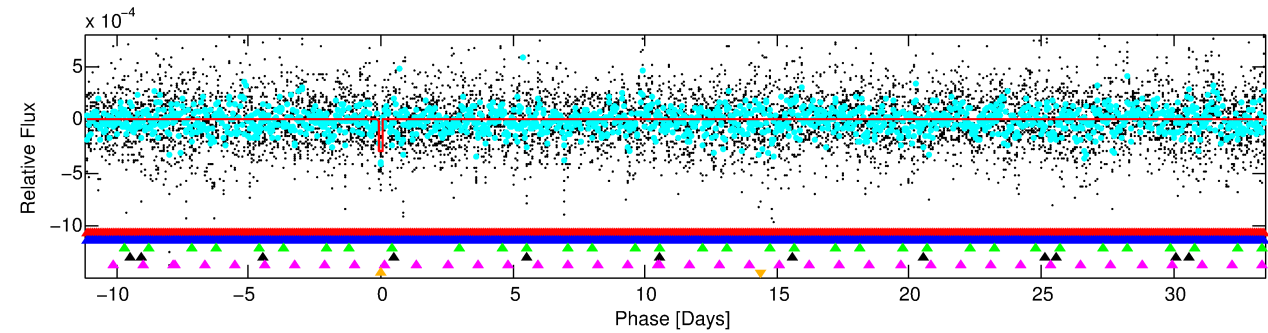
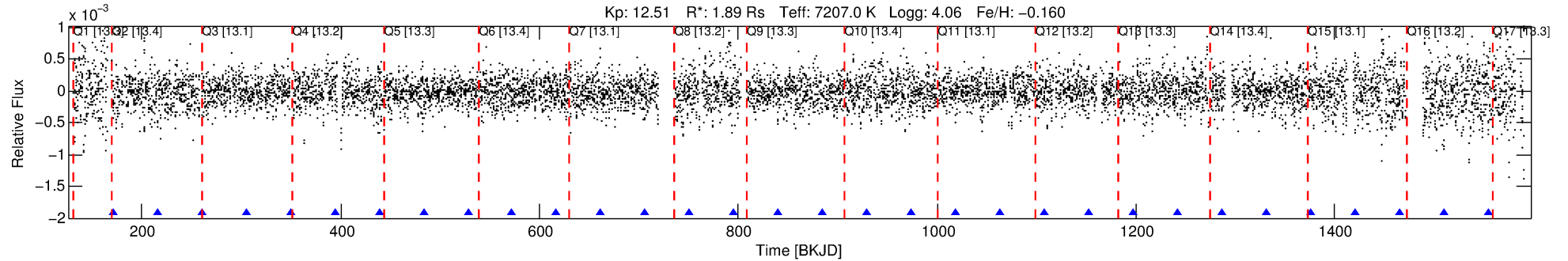
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 009016344-06

No Significant Match Found

# DV One-Page Summary

KIC: 9016344 Candidate: 6 of 6 Period: 44.606 d



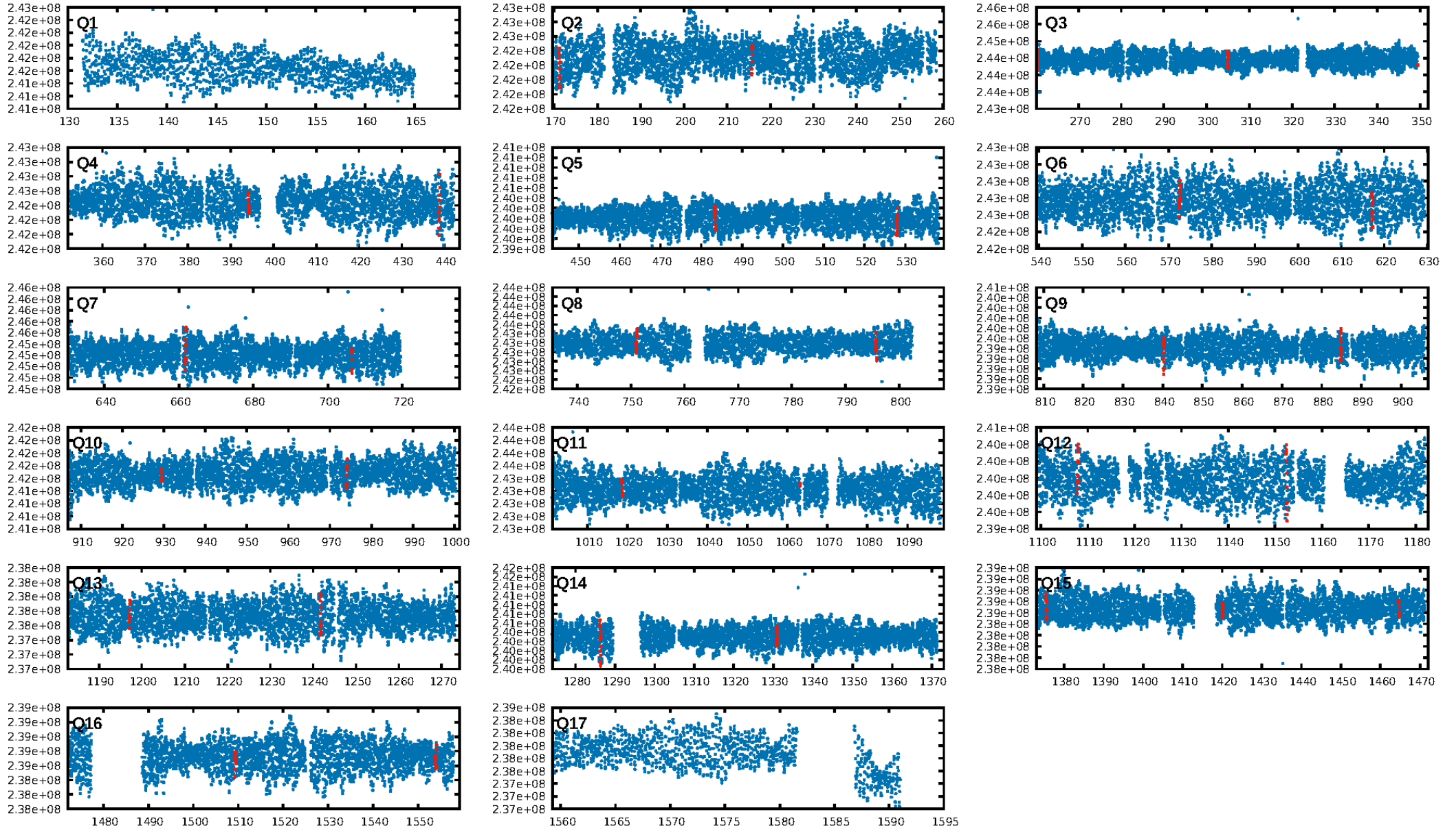
## DV Fit Results:

Period = 44.60588 [0.00052] d  
Epoch = 171.1684 [0.0099] BKJD  
Rp/R\* = 0.0177 [0.0121]  
a/R\* = 66.92 [274.64]  
b = 0.77 [2.15]  
Seff = 109.05 [42.22]  
Teff = 824 [80] K  
Rp = 3.66 [2.73] Re  
a = 0.2820 [0.0698] AU  
Ag = 233.09 [399.75] [0.58 $\sigma$ ]  
Teffp = 4978 [2100] K [1.98 $\sigma$ ]

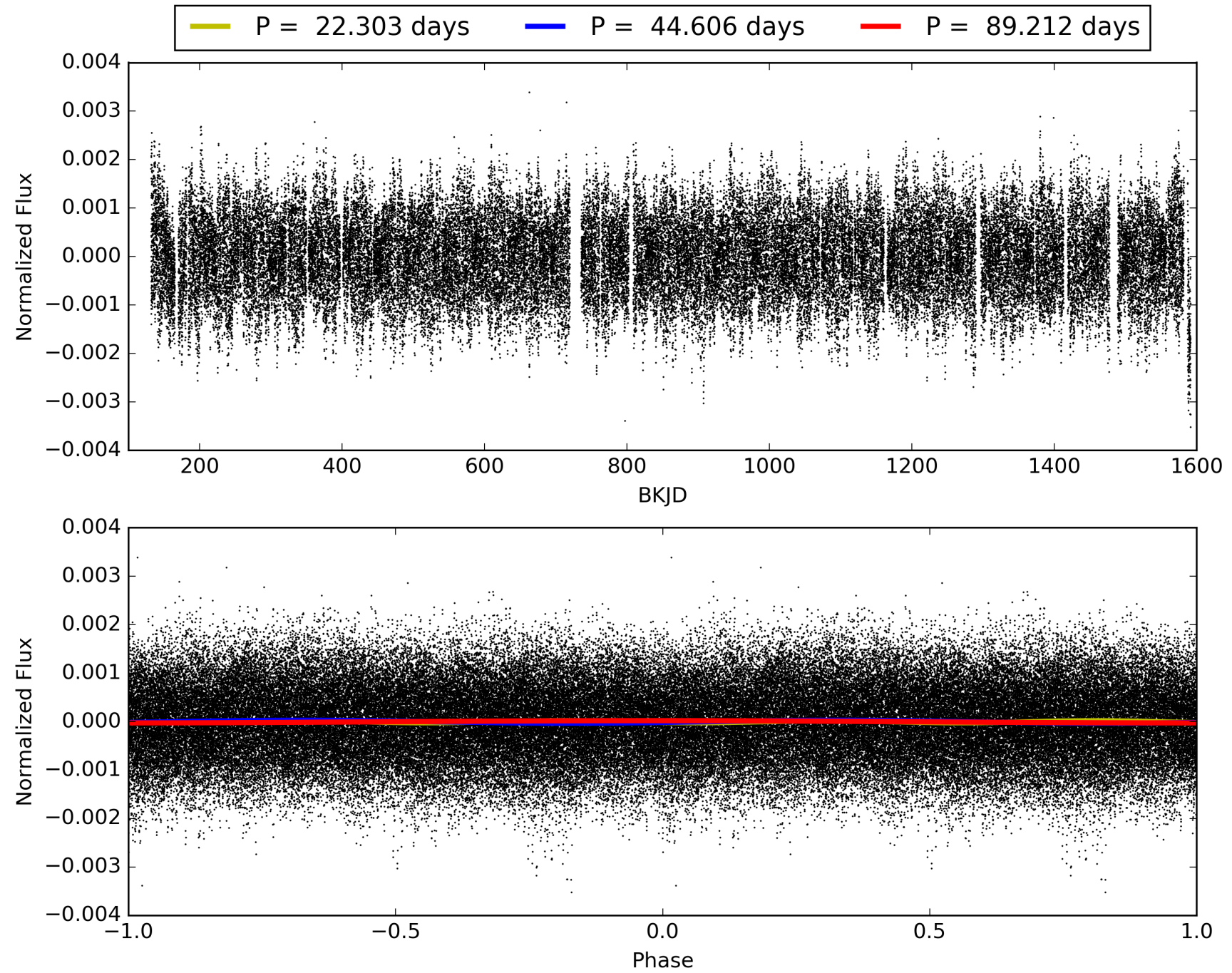
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [11.91 $\sigma$ ]  
LongPeriod-sig: 100.0% [415.12 $\sigma$ ]  
ModelChiSquare2-sig: 12.0%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [13/13]  
GhostDiagnostic-chr: -0.8847  
Centroid-sig: 0.2%  
Centroid-so: 0.744 arcsec [2.16 $\sigma$ ]  
OotOffset-rm: 0.017 arcsec [0.08 $\sigma$ ]  
KicOffset-rm: 0.066 arcsec [0.25 $\sigma$ ]  
OotOffset-st: 4/4/4/2 [14]  
KicOffset-st: 4/4/4/2 [14]  
DiffImageQuality-fgm: 0.57 [8/14]  
DiffImageOverlap-fno: 0.00 [0/14]

# TCE 009016344-06, PDC Light Curves

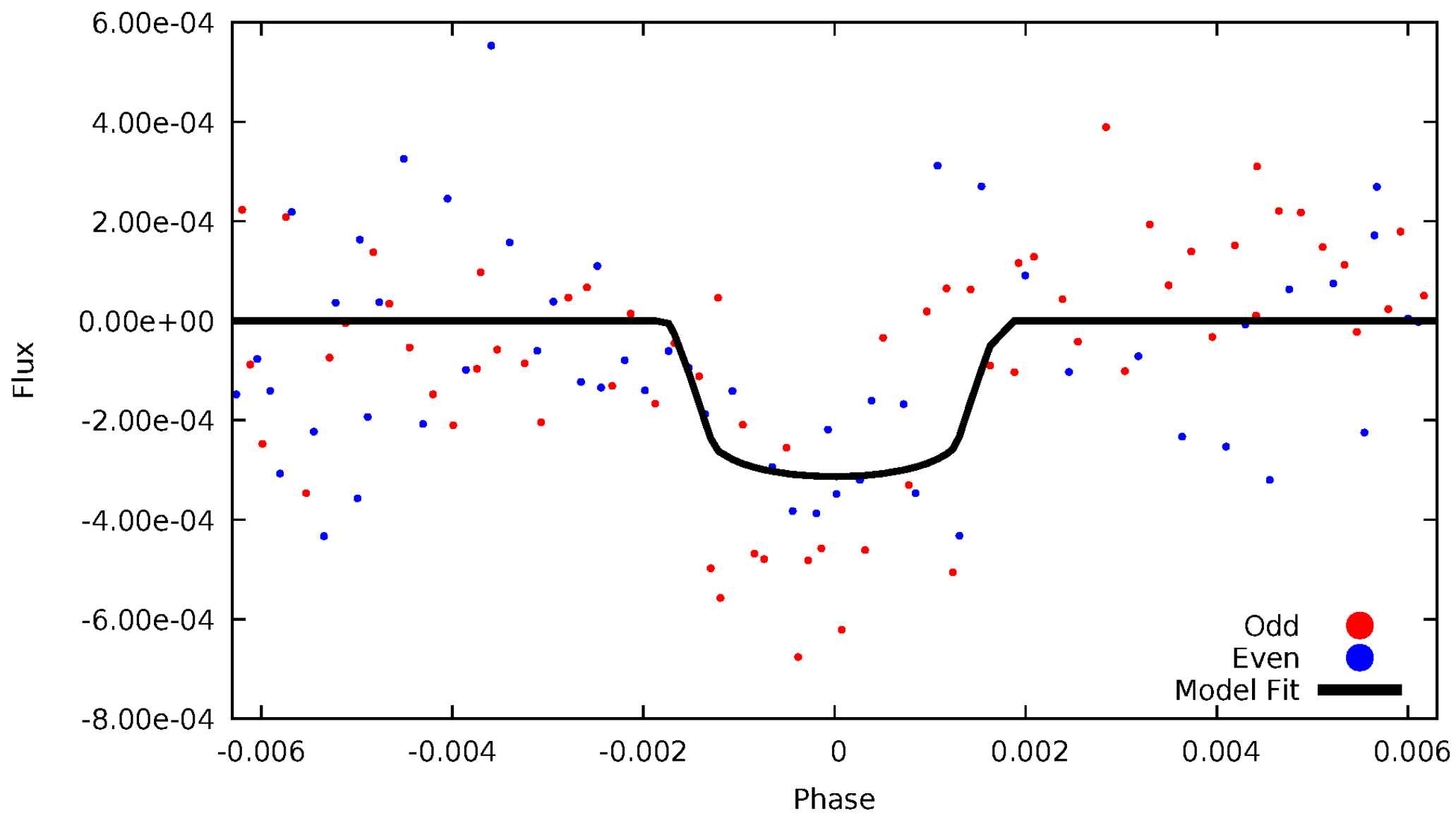


TCE 009016344-06



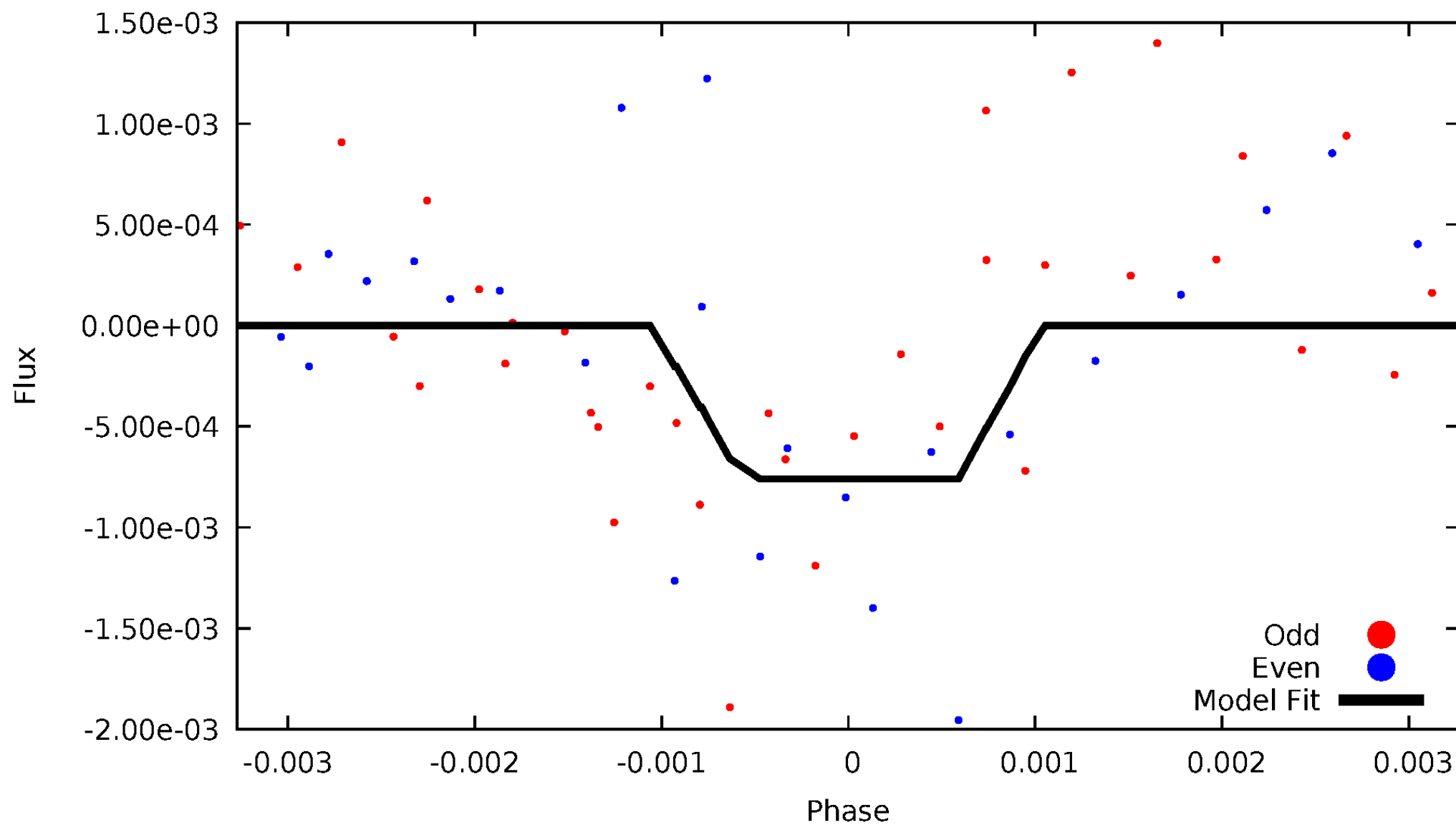
# DV Odd/Even

TCE 009016344-06



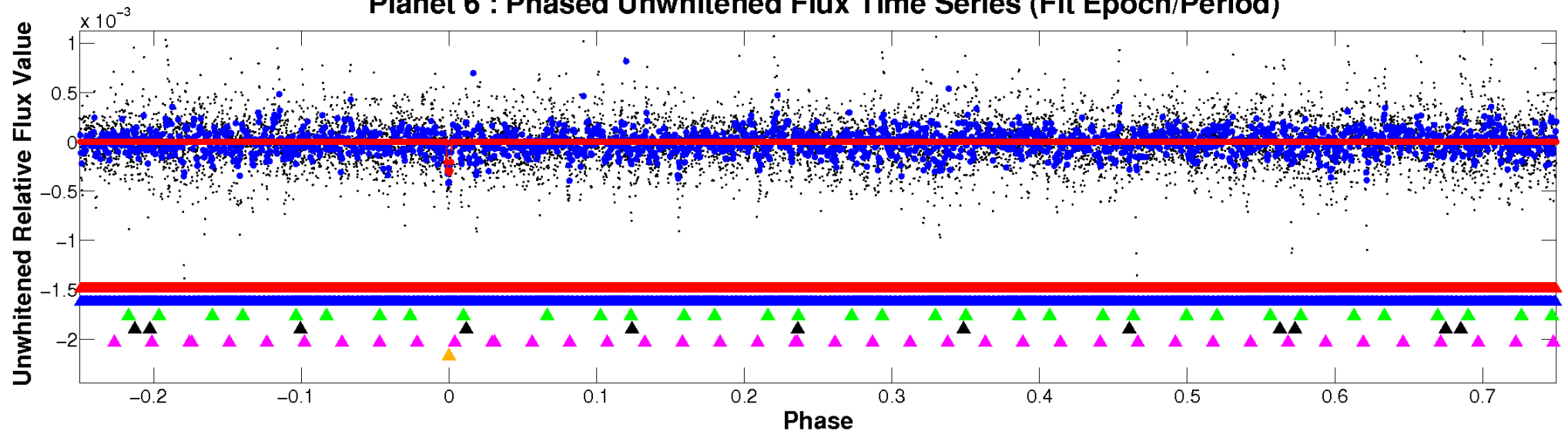
# ALT Odd/Even

TCE 009016344-06

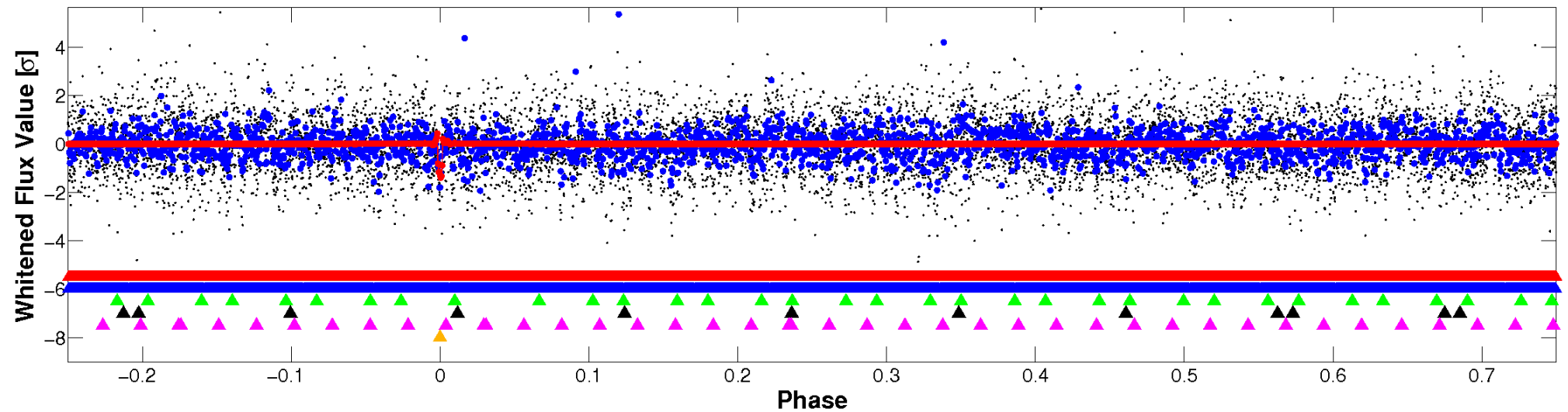


# Non-Whitened Vs. Whitened Light Curve

## Planet 6 : Phased Unwhitened Flux Time Series (Fit Epoch/Period)

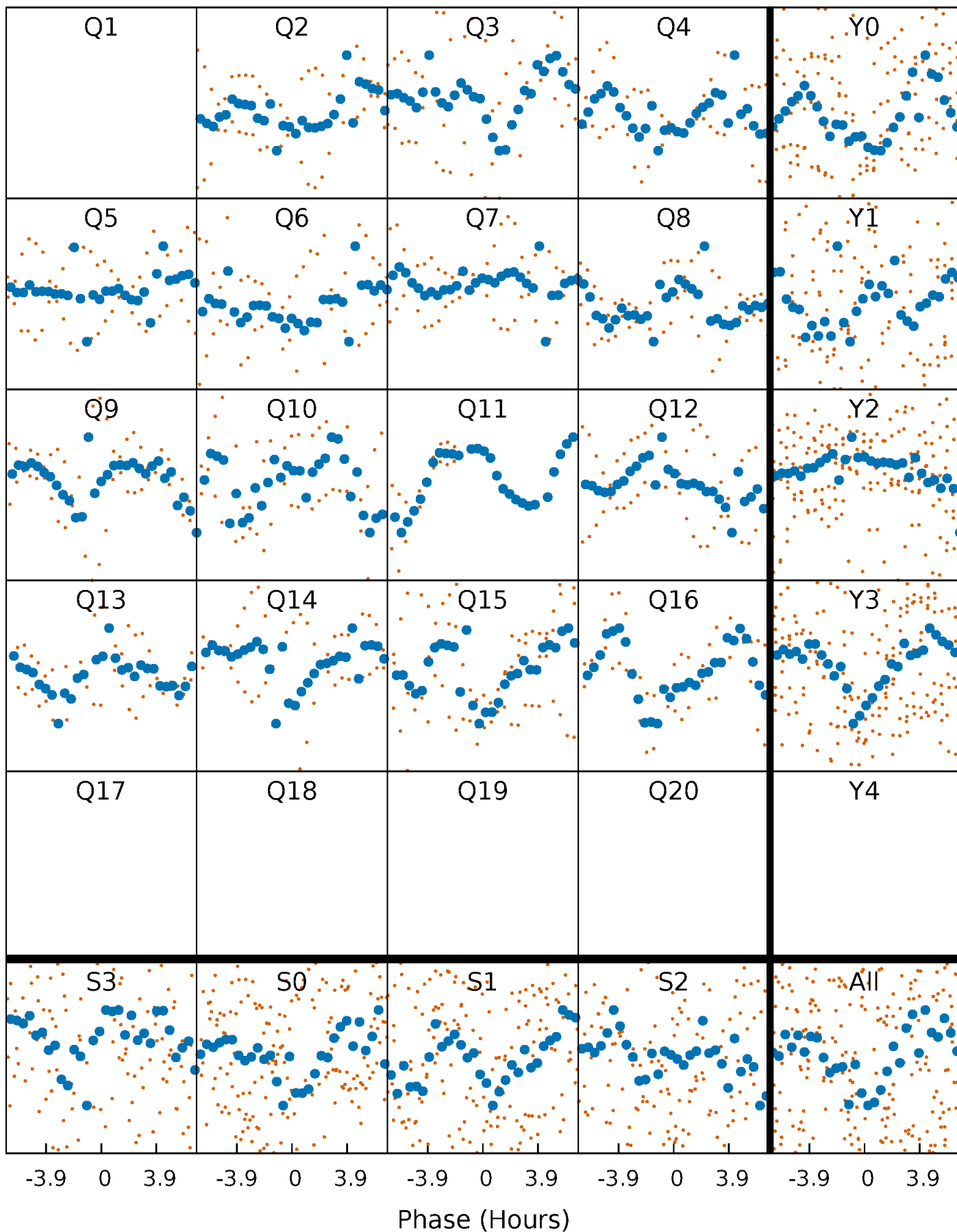


## Planet 6 : Phased Whitened Flux Time Series (Fit Epoch/Period)



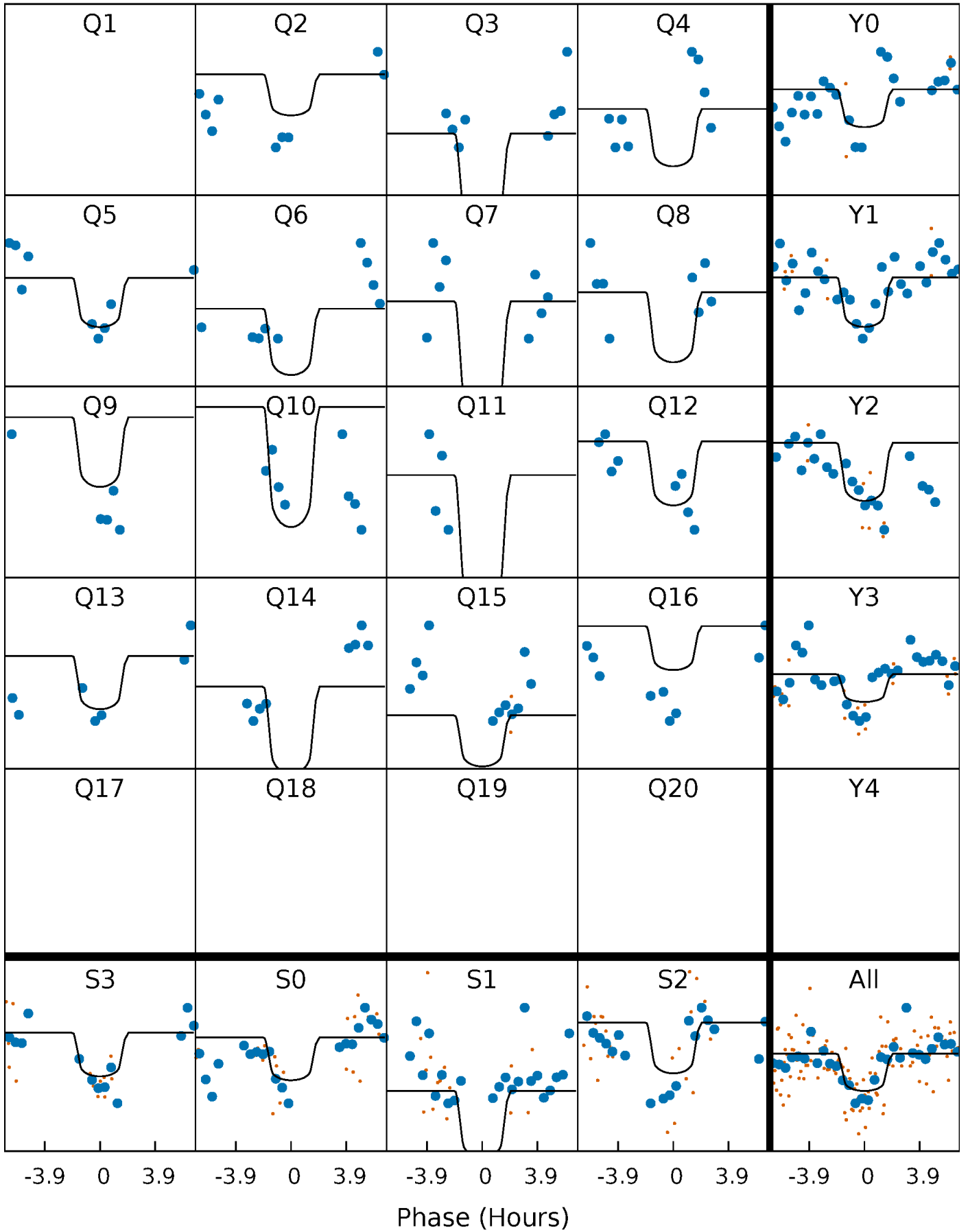
# PDC Quarter-Phased Transit Curves

TCE 009016344-06 P= 44.605881 Days  $T_0=171.168408$  (BKJD)



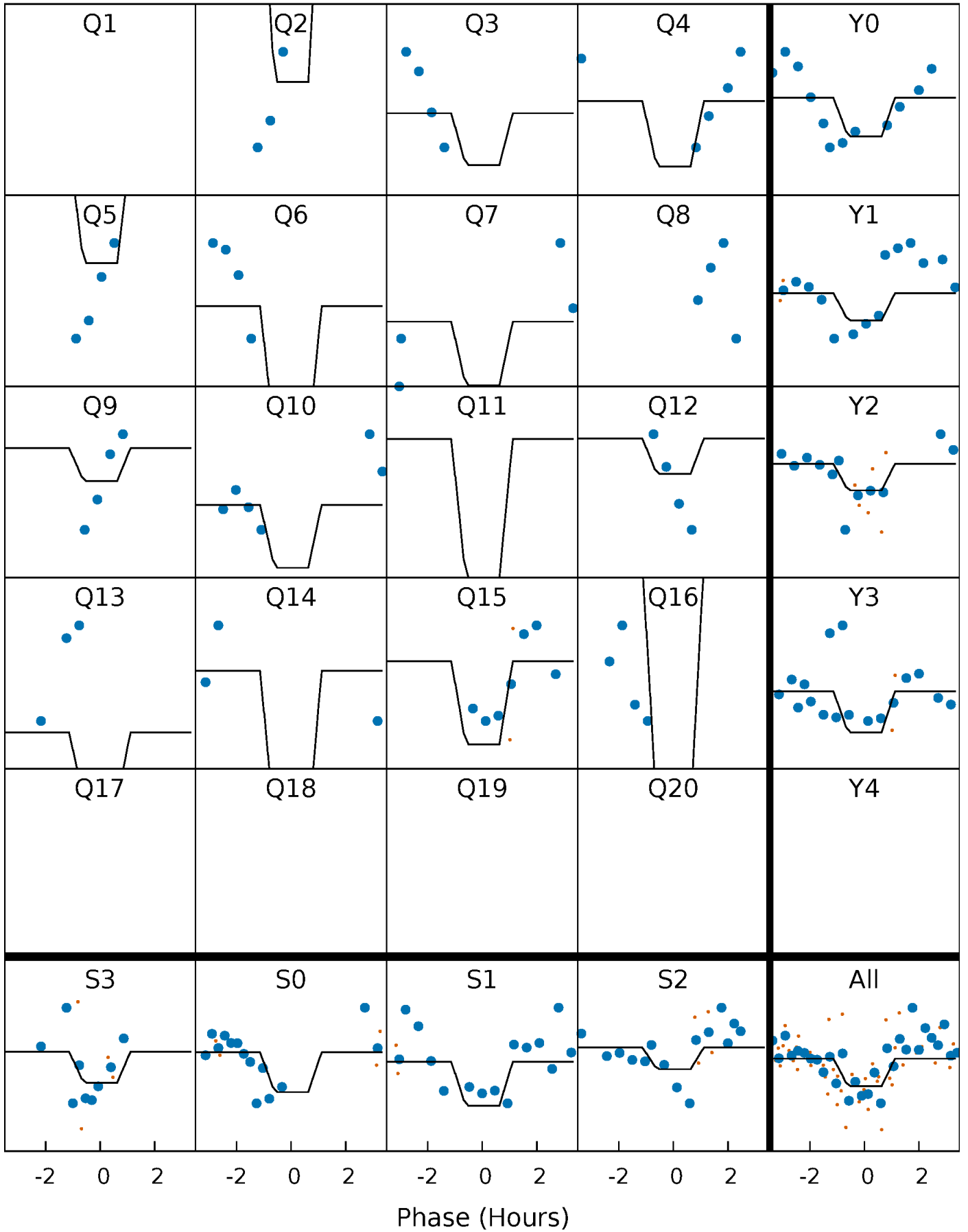
# DV Quarter-Phased Transit Curves

TCE 009016344-06 P= 44.605881 Days  $T_0=171.168408$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

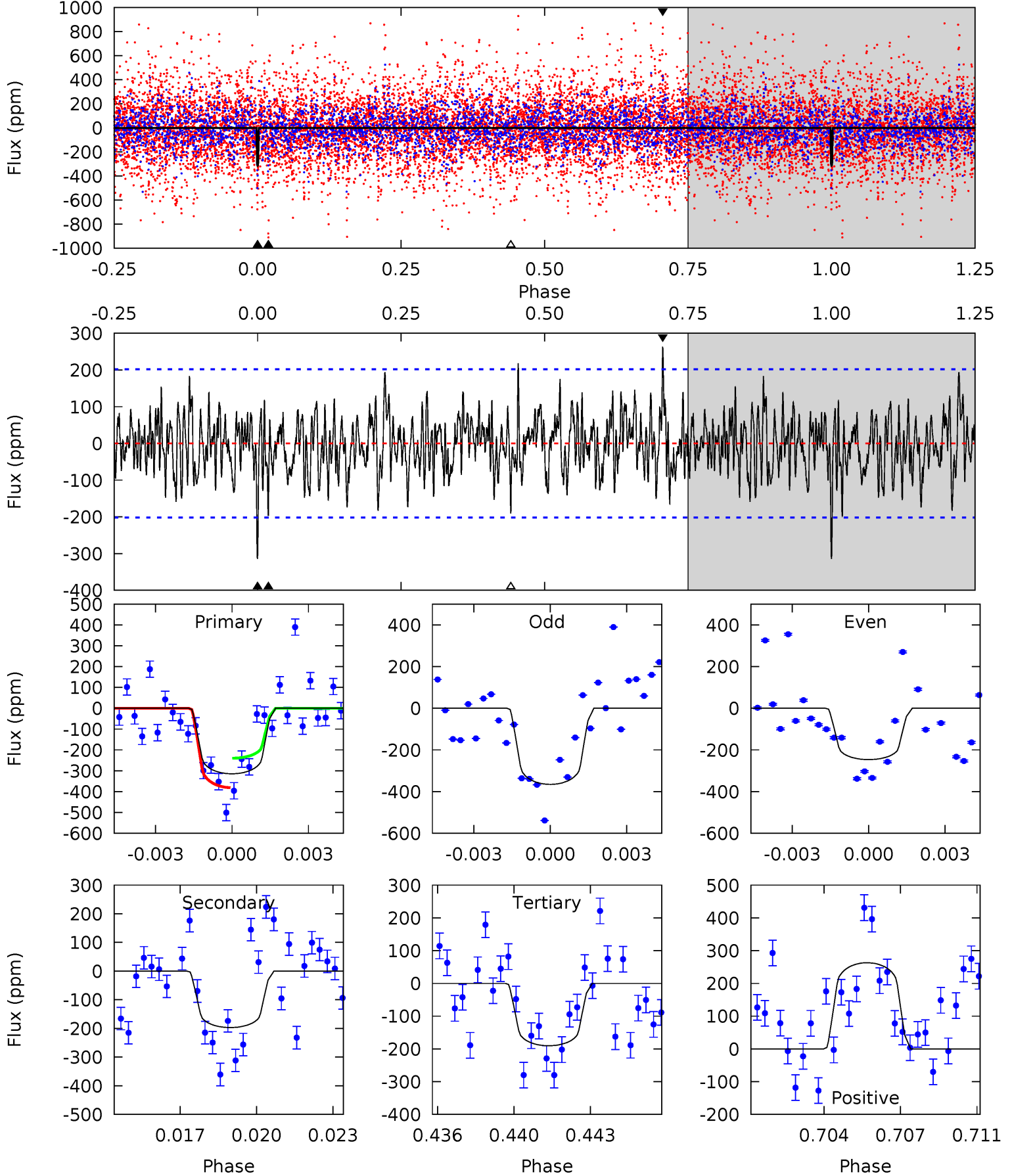
TCE 009016344-06 P= 44.607276 Days  $T_0=171.169612$  (BKJD)



# DV Model-Shift Uniqueness Test

009016344-06, P = 44.605881 Days, E = 126.562527 Days

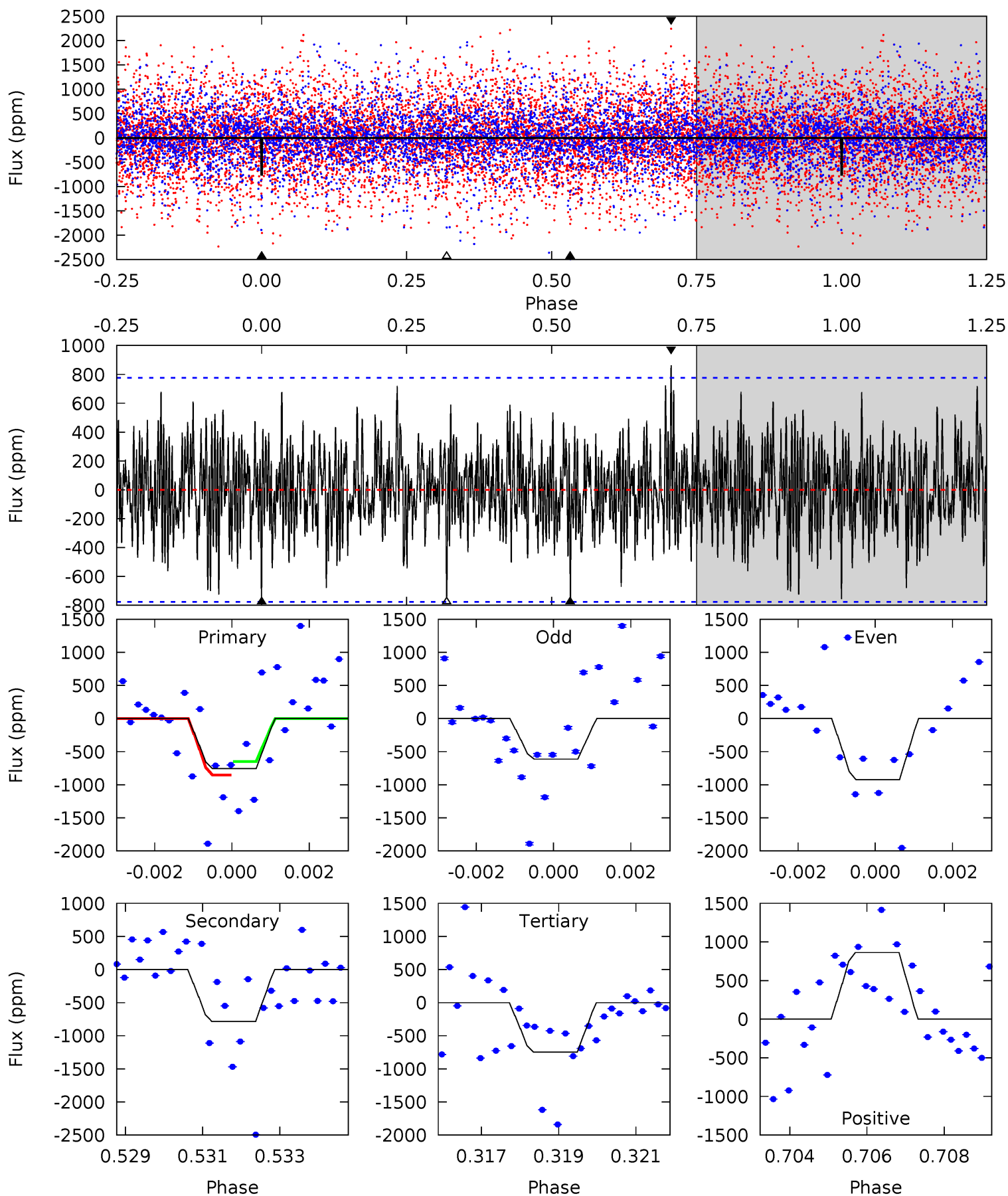
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
8.15	5.10	4.93	6.81	5.23	2.94	1.73	3.21	1.33	0.17	-1.71	1.53	0.76	0.46	1.84



# Alt Model-Shift Uniqueness Test

009016344-06, P = 44.607276 Days, E = 126.562336 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
5.20	5.39	5.14	5.93	5.34	3.11	1.62	0.07	-0.73	0.26	-0.54	1.06	1.00	0.52	0.70



### Stellar Parameters For KIC 009016344

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$7207^{+226}_{-302}$	$4.060^{+0.185}_{-0.167}$	$-0.160^{+0.250}_{-0.350}$	$1.894^{+0.576}_{-0.471}$	$1.499^{+0.225}_{-0.250}$	$0.311^{+0.356}_{-0.143}$
	+3%/-4%	+5%/-4%	+156%/-219%	+30%/-25%	+15%/-17%	+114%/-46%
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 009016344-06 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-197 \pm 39$	$3.77^{+2.58}_{-2.05}$	$1143^{+93}_{-83}$	$6172^{+3631}_{-1242}$	$590^{+2369}_{-381}$
Alt.	$-785 \pm 145$	$5.69^{+2.65}_{-2.49}$	$1144^{+88}_{-83}$	$7307^{+3064}_{-1433}$	$1084^{+2241}_{-614}$

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

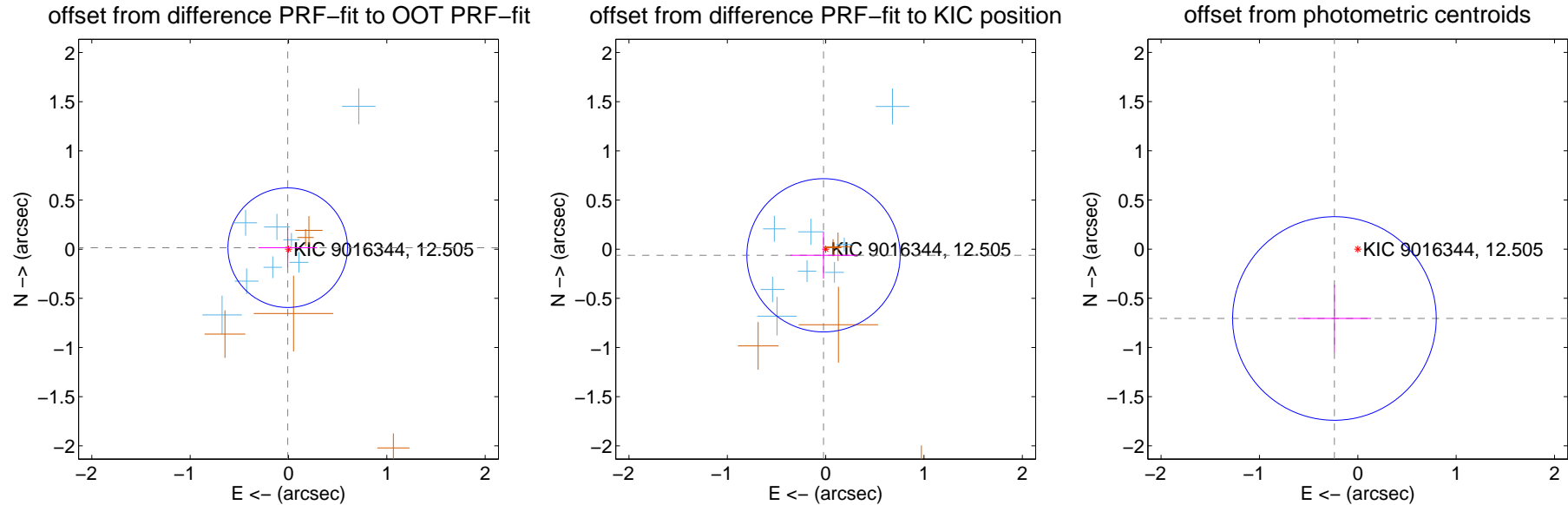
## DV Centroid Data

Supplemental centroid analysis for 009016344-06. Kepler magnitude: 12.51. Transit SNR 6.88

There are 8 quarters with good PRF difference image offsets

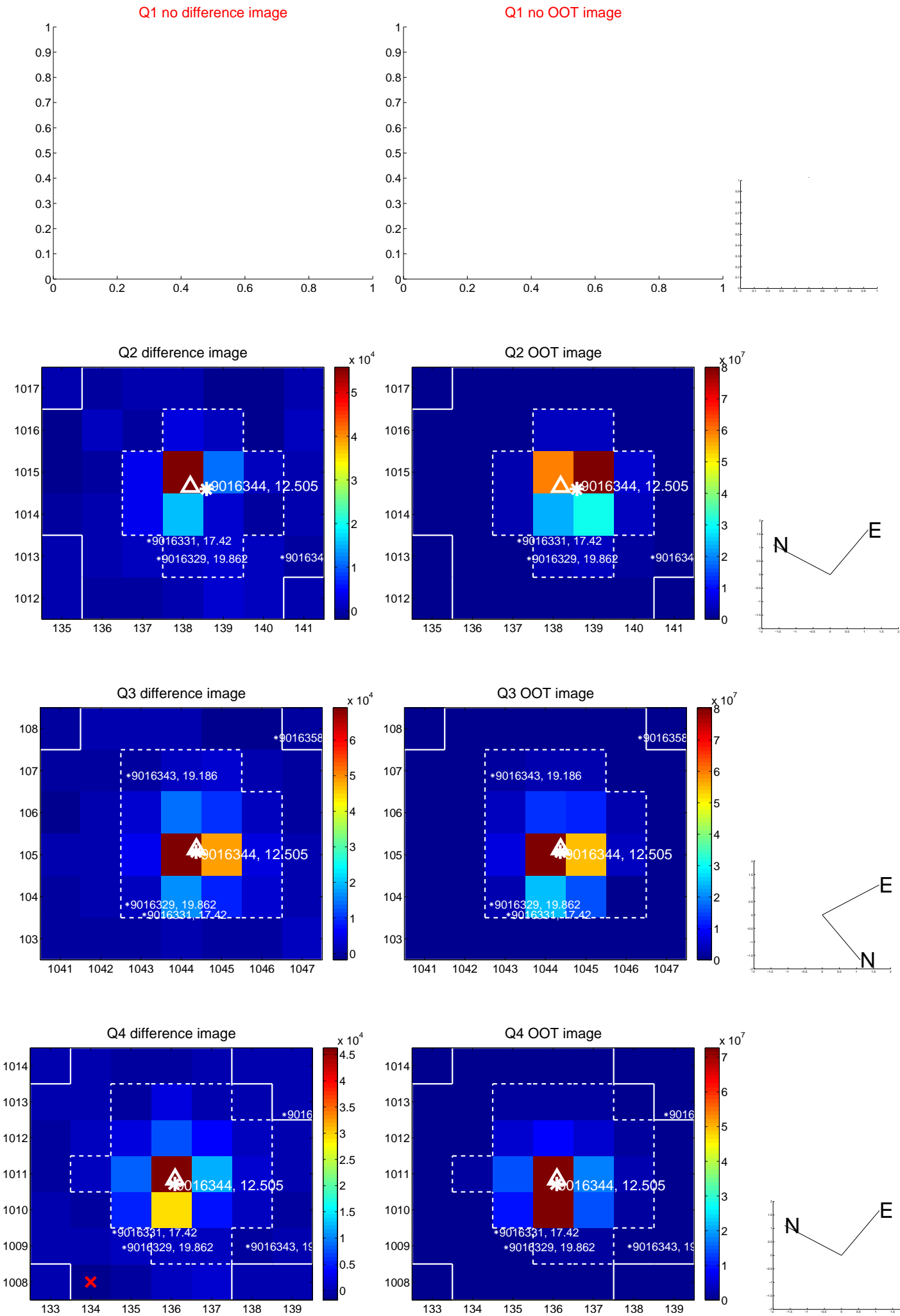
The direct PRF centroid is offset from the target star catalog position by about 0.14 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.017 \pm 0.203$	0.08	$0.008 \pm 0.297$	$0.015 \pm 0.200$
PRF-fit source offset from KIC position	$0.066 \pm 0.260$	0.25	$0.022 \pm 0.339$	$-0.062 \pm 0.237$
photometric centroid source offset	$0.74 \pm 0.34$	2.16	$0.24 \pm 0.37$	$-0.71 \pm 0.34$

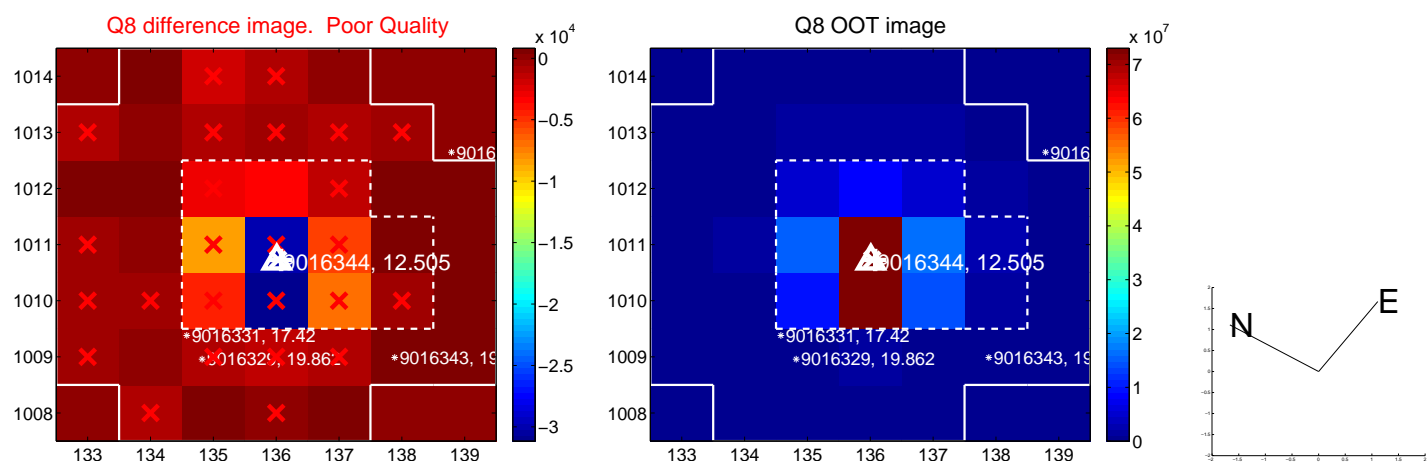
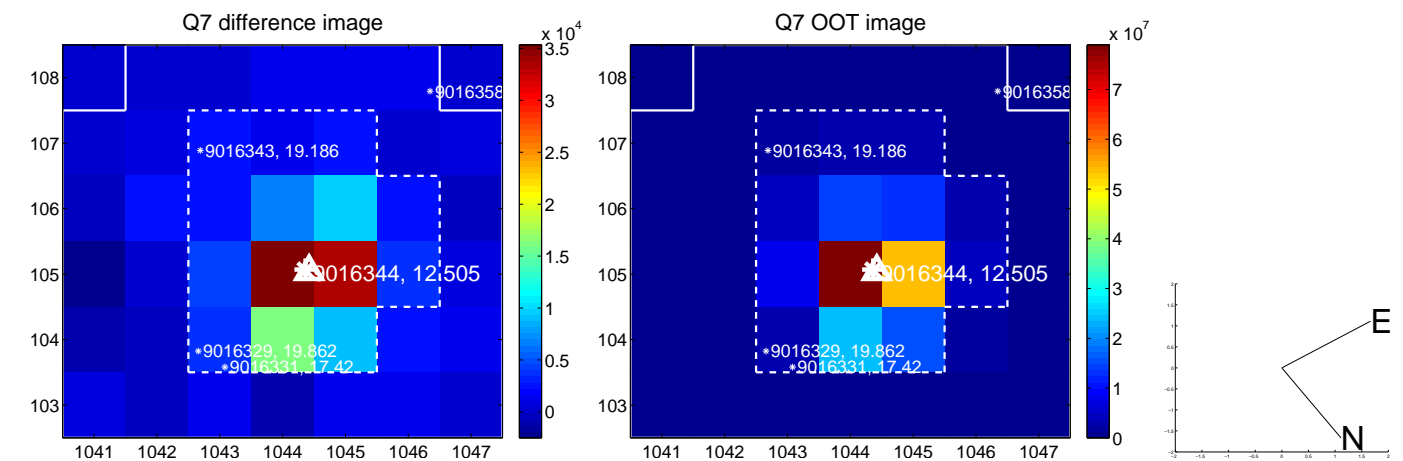
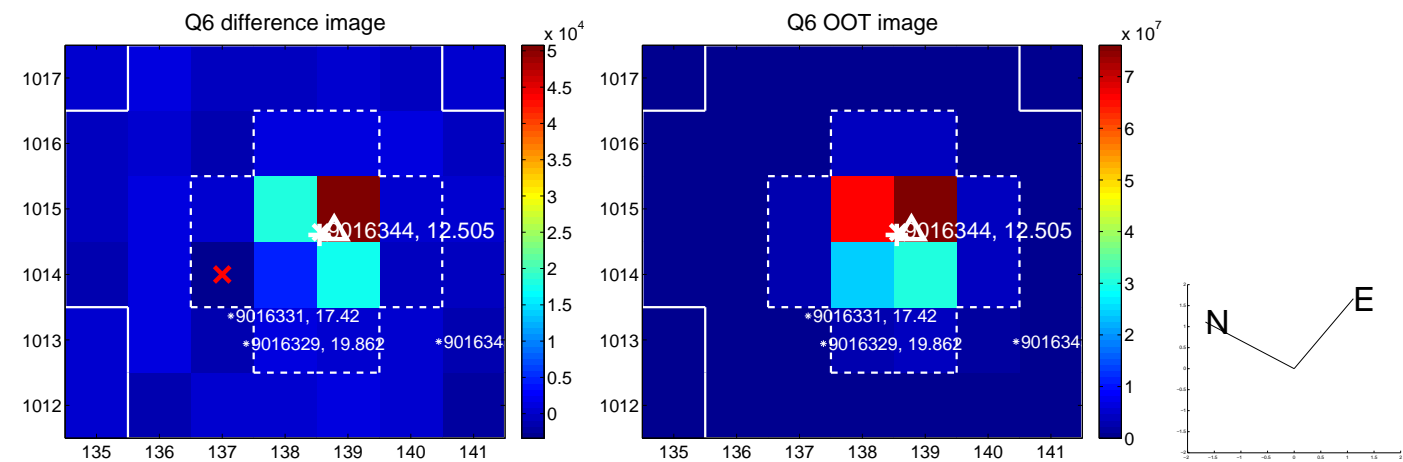
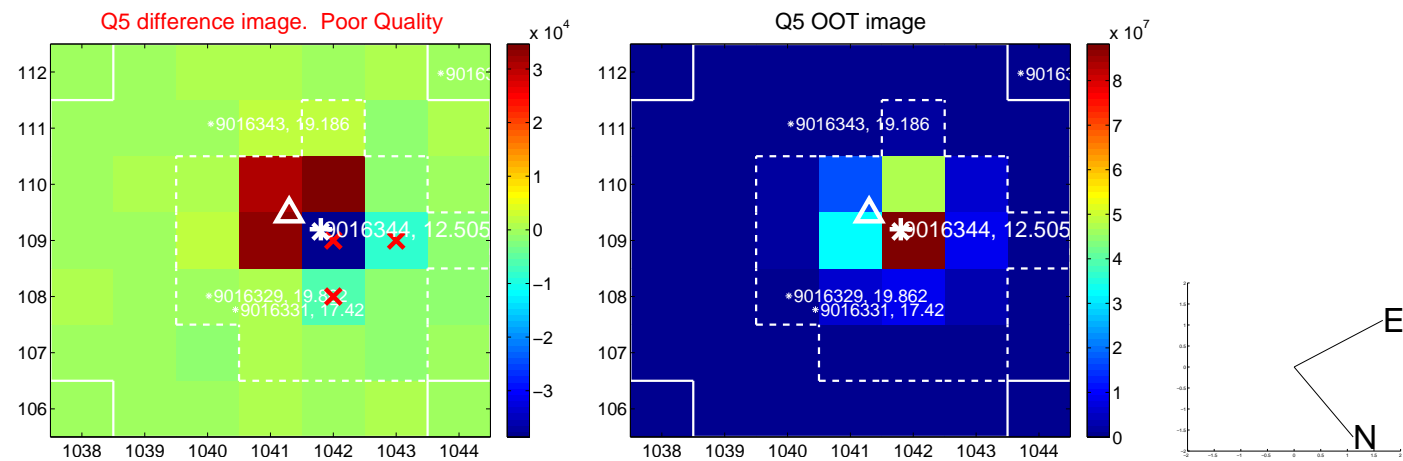


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets**; **Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

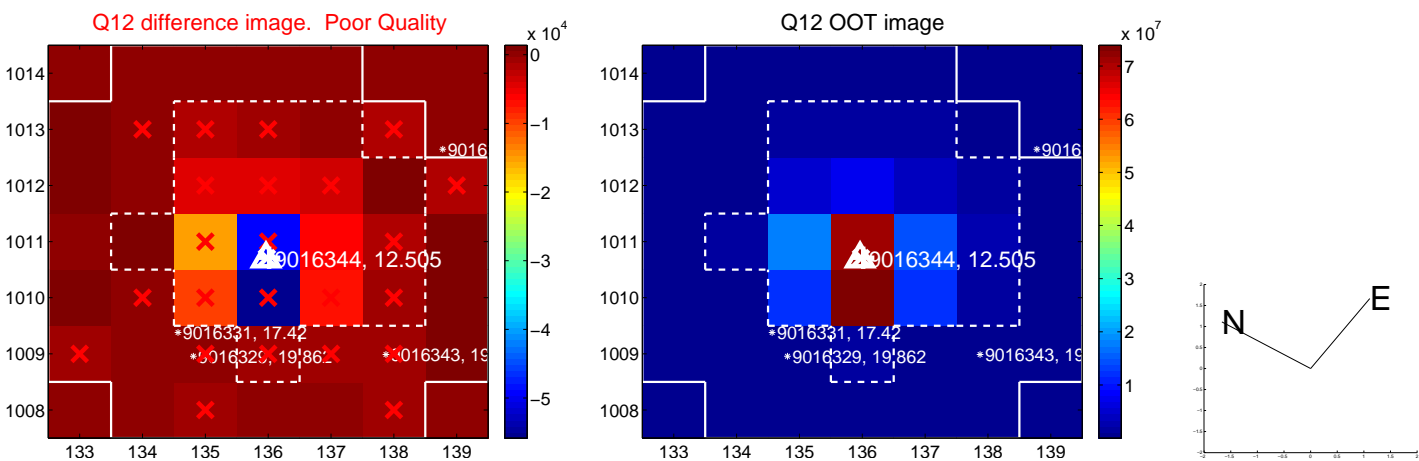
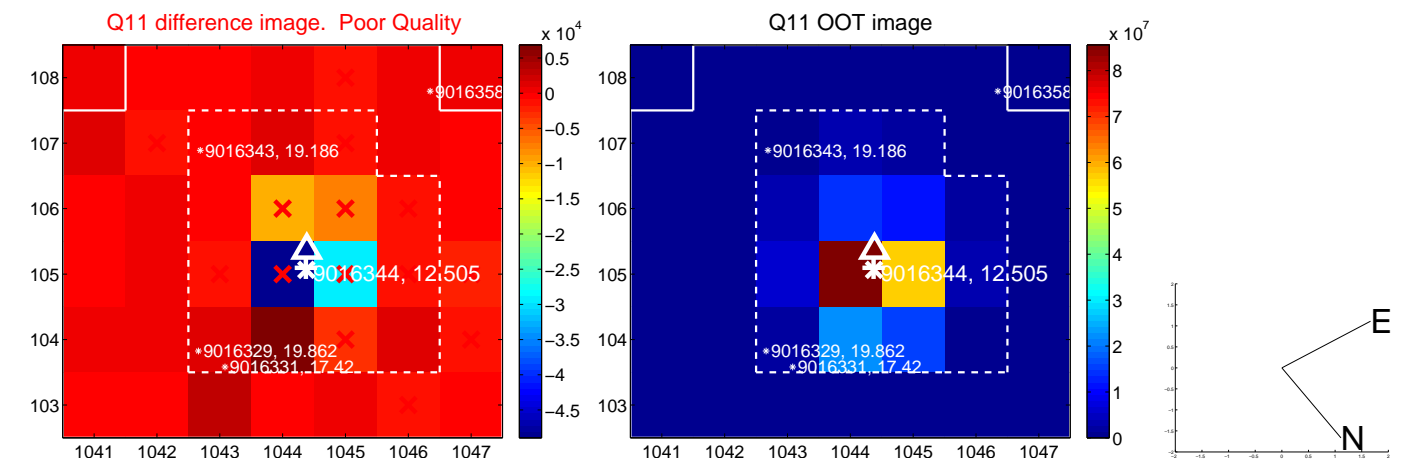
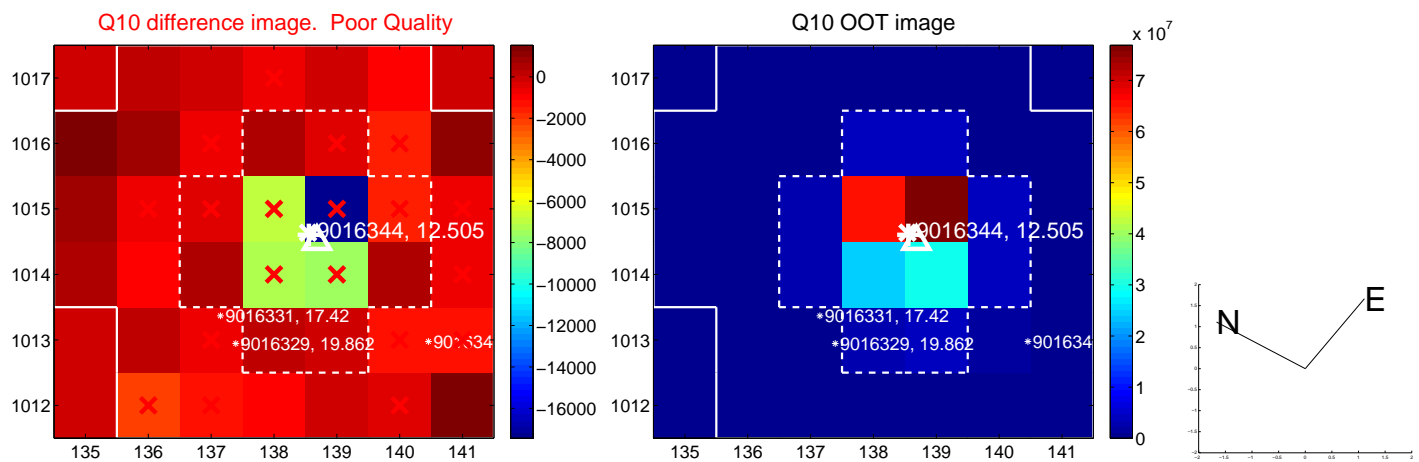
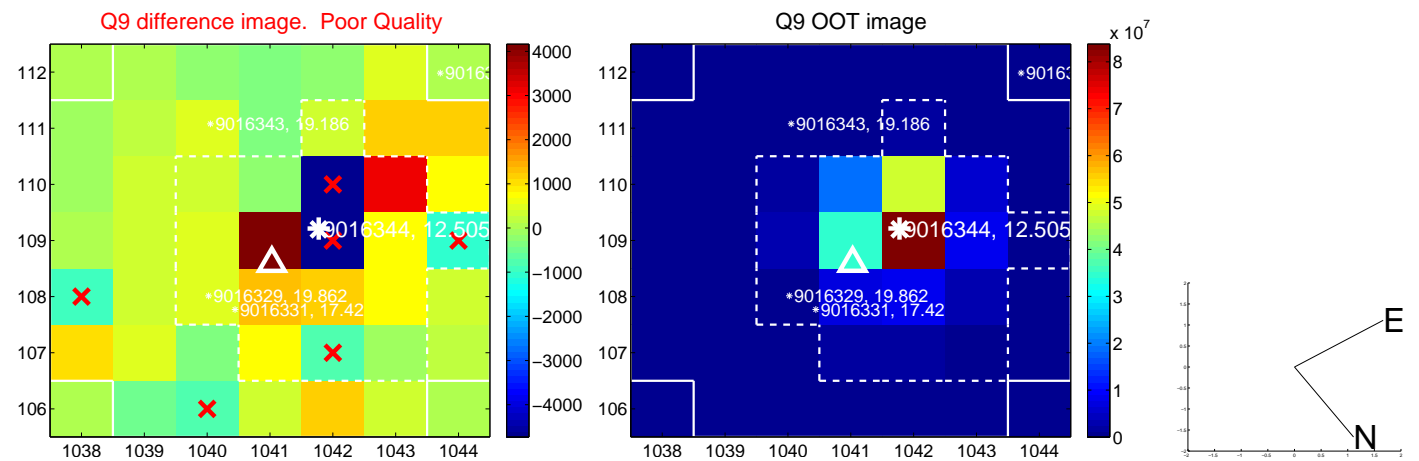
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



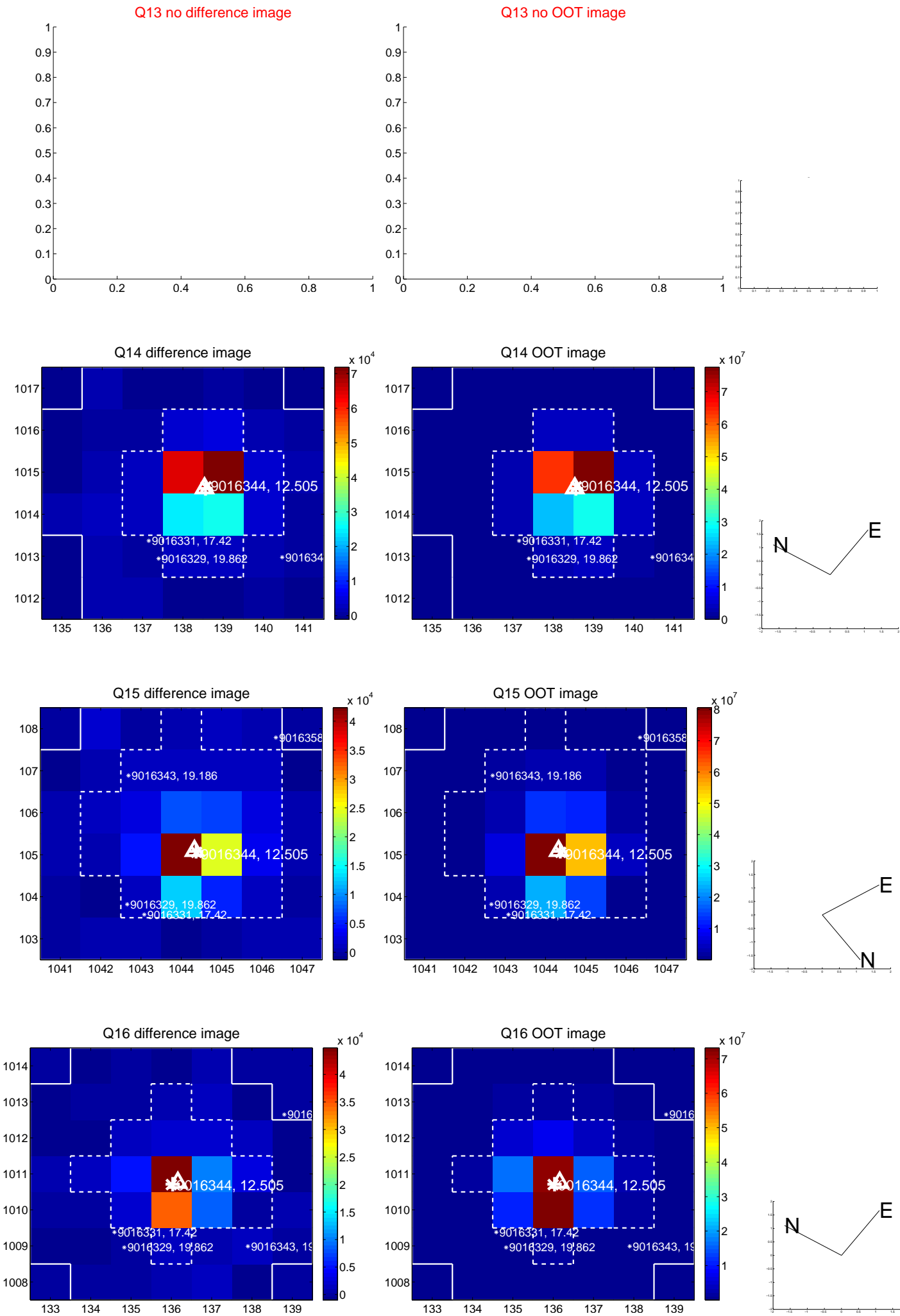
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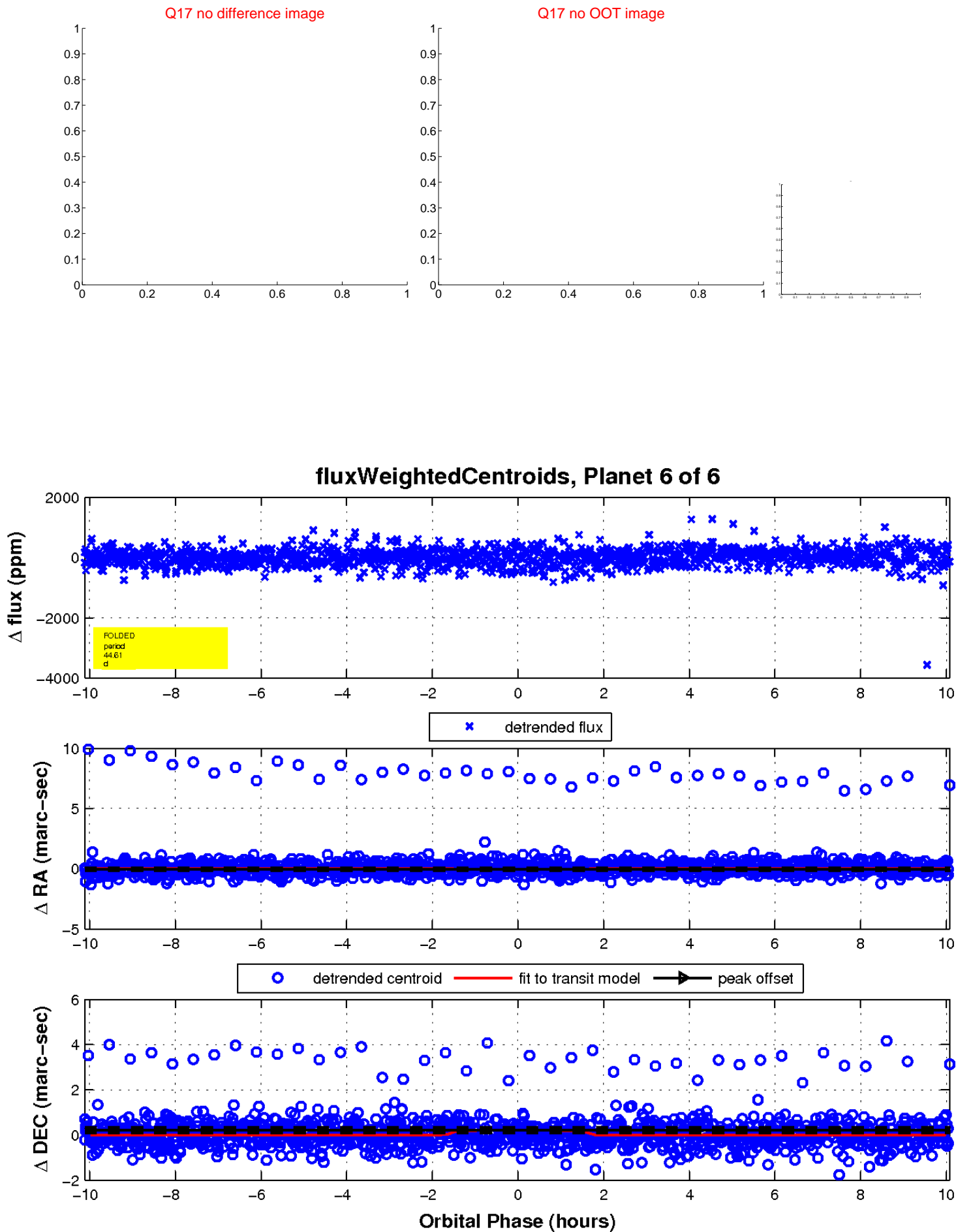
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UKIRT Image

Declination

