

# KIC 009016467

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009016467-01	OBS	No	0.595308	132.069742	6.3	2.196	7.5	3.8	1.94	7237	0.56	35621.21
009016467-02	OBS	No	204.731068	237.363621	190.6	4.885	7.6	7.2	1.94	7237	3.10	14.78

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009016467-01	OBS	FP	0.00	1	0	0	0	LPP_DV—MOD_NONUNIQ_ALT—CENT_SATURATED
009016467-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT—CENT_SATURATED

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

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

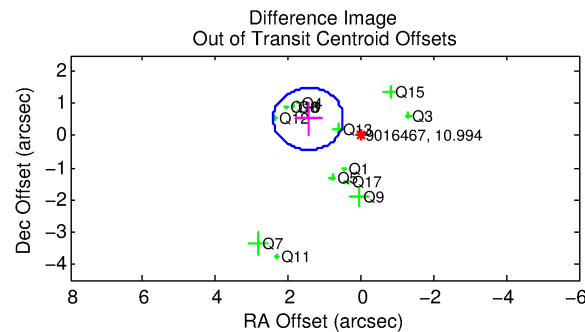
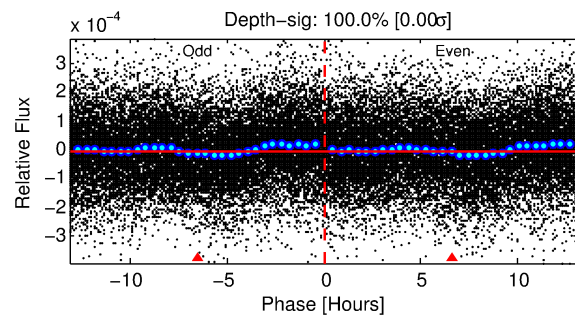
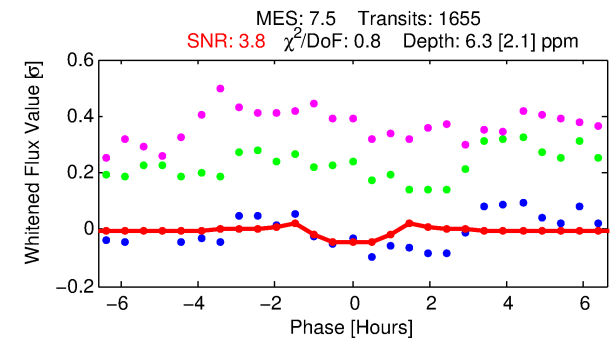
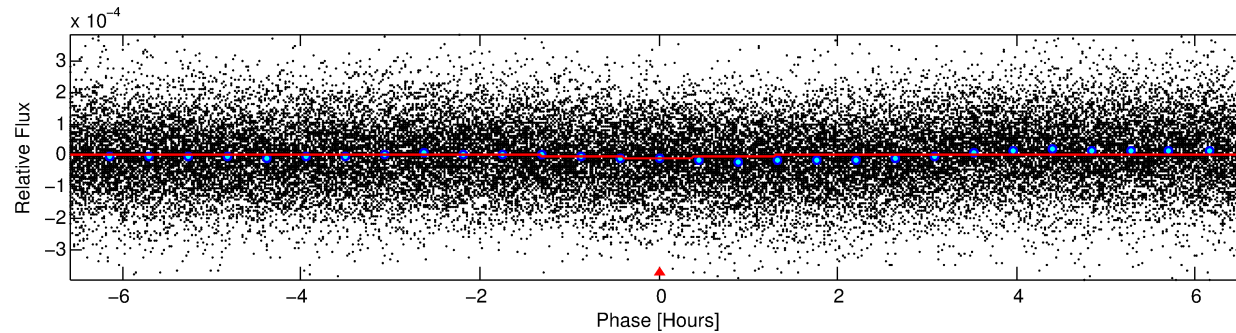
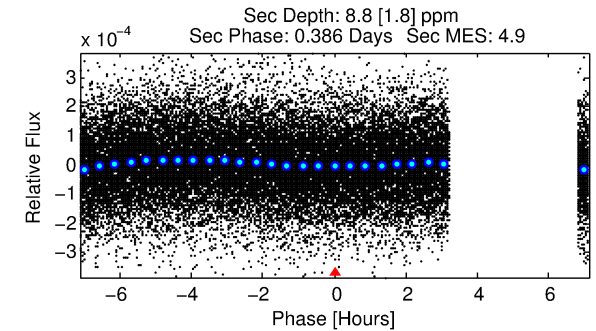
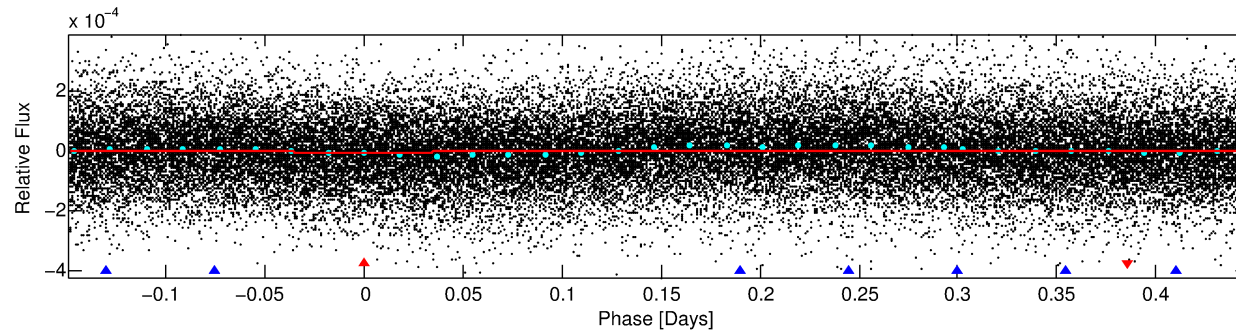
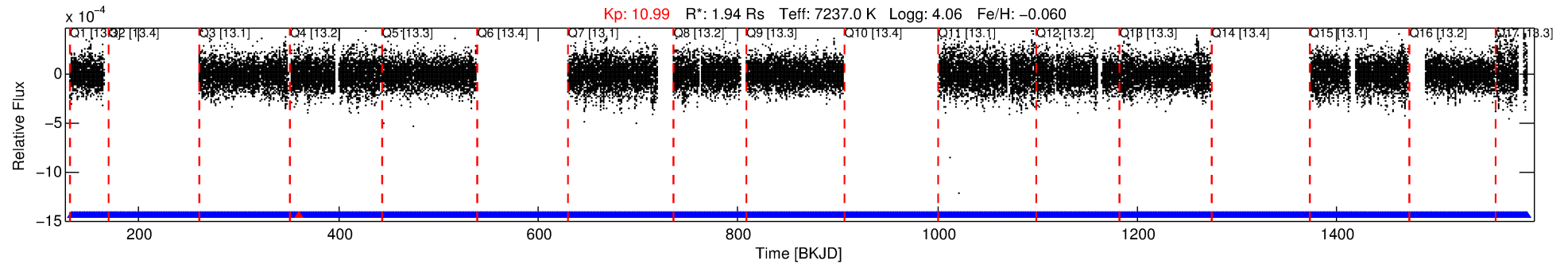
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 009016467-01

No Significant Match Found

# DV One-Page Summary

KIC: 9016467 Candidate: 1 of 2 Period: 0.595 d



## DV Fit Results:

Period = 0.59531 [0.00003] d  
Epoch = 132.0697 [0.0048] BKJD  
Rp/R\* = 0.0027 [0.0007]  
a/R\* = 1.31 [0.70]  
b = 0.90 [0.27]  
Seff = 35621.21 [13081.54]  
Teq = 3503 [322] K  
Rp = 0.56 [0.22] Re  
a = 0.0161 [0.0039] AU  
Ag = 3.94 [2.57] [1.15σ]  
Teffp = 7630 [1107] K [3.58σ]

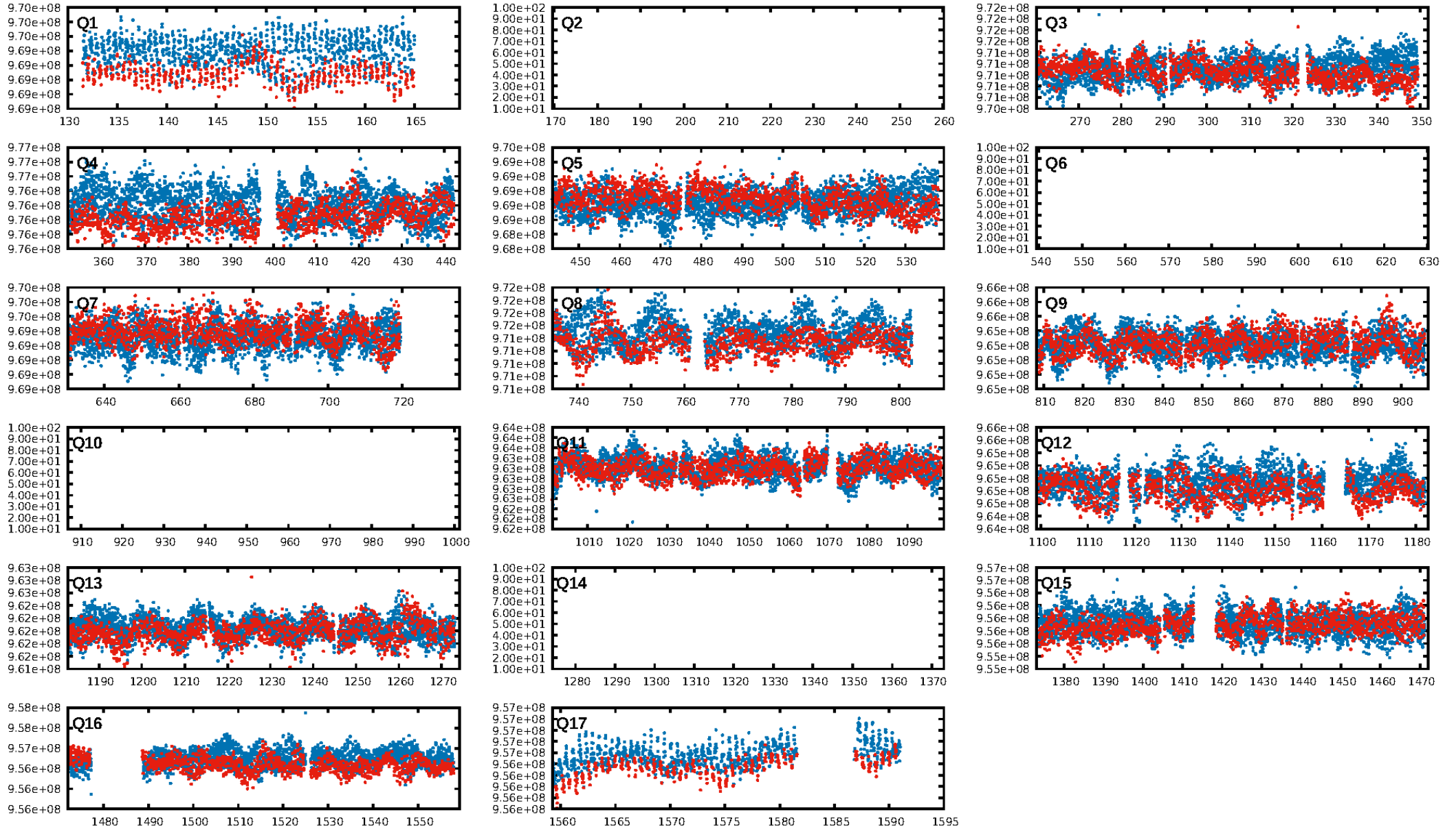
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [914.70σ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: 1.89e-12  
RollingBand-fgt: 1.00 [1553/1554]  
GhostDiagnostic-chr: 0.7472  
Centroid-sig: 3.1%  
Centroid-so: 2.498 arcsec [1.43σ]  
OotOffset-rm: 1.543 arcsec [4.79σ]  
KicOffset-rm: 2.112 arcsec [5.69σ]  
OotOffset-st: 0/4/4/5 [13]  
KicOffset-st: 0/4/4/5 [13]  
DiffImageQuality-fgm: 0.62 [8/13]  
DiffImageOverlap-fno: 1.00 [13/13]

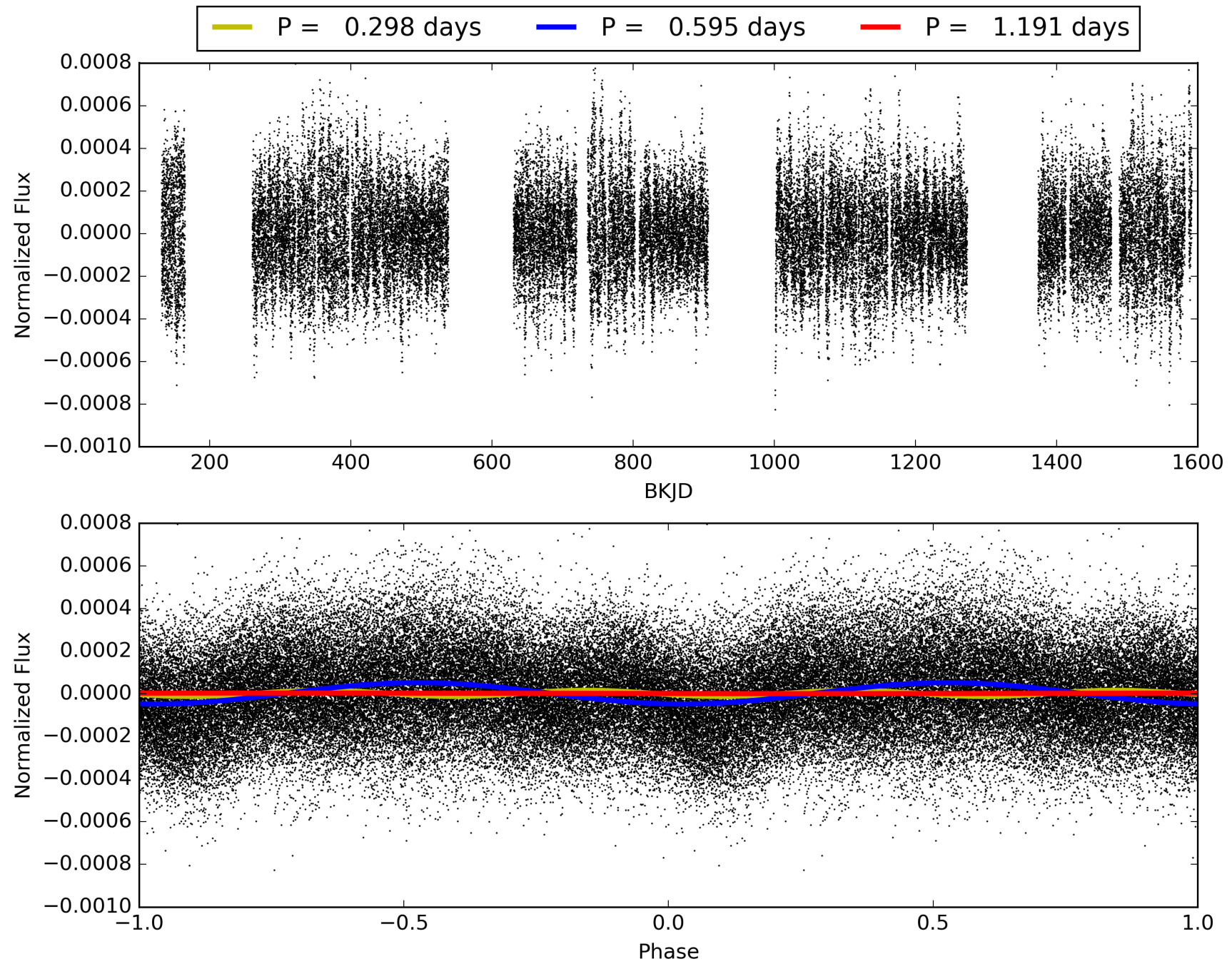
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 30-Jan-2016 23:19:13 Z

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

# TCE 009016467-01, PDC Light Curves

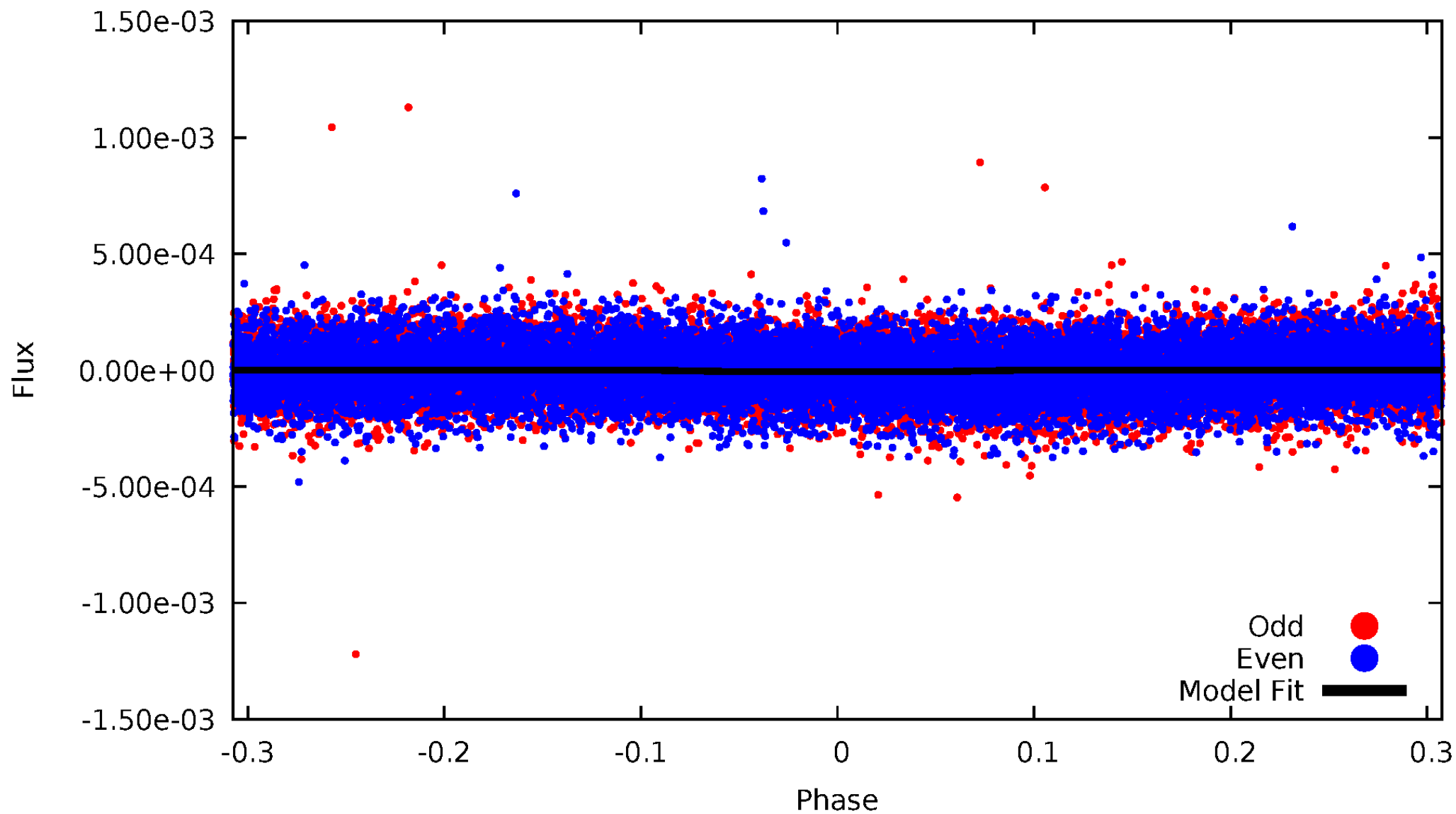


TCE 009016467-01



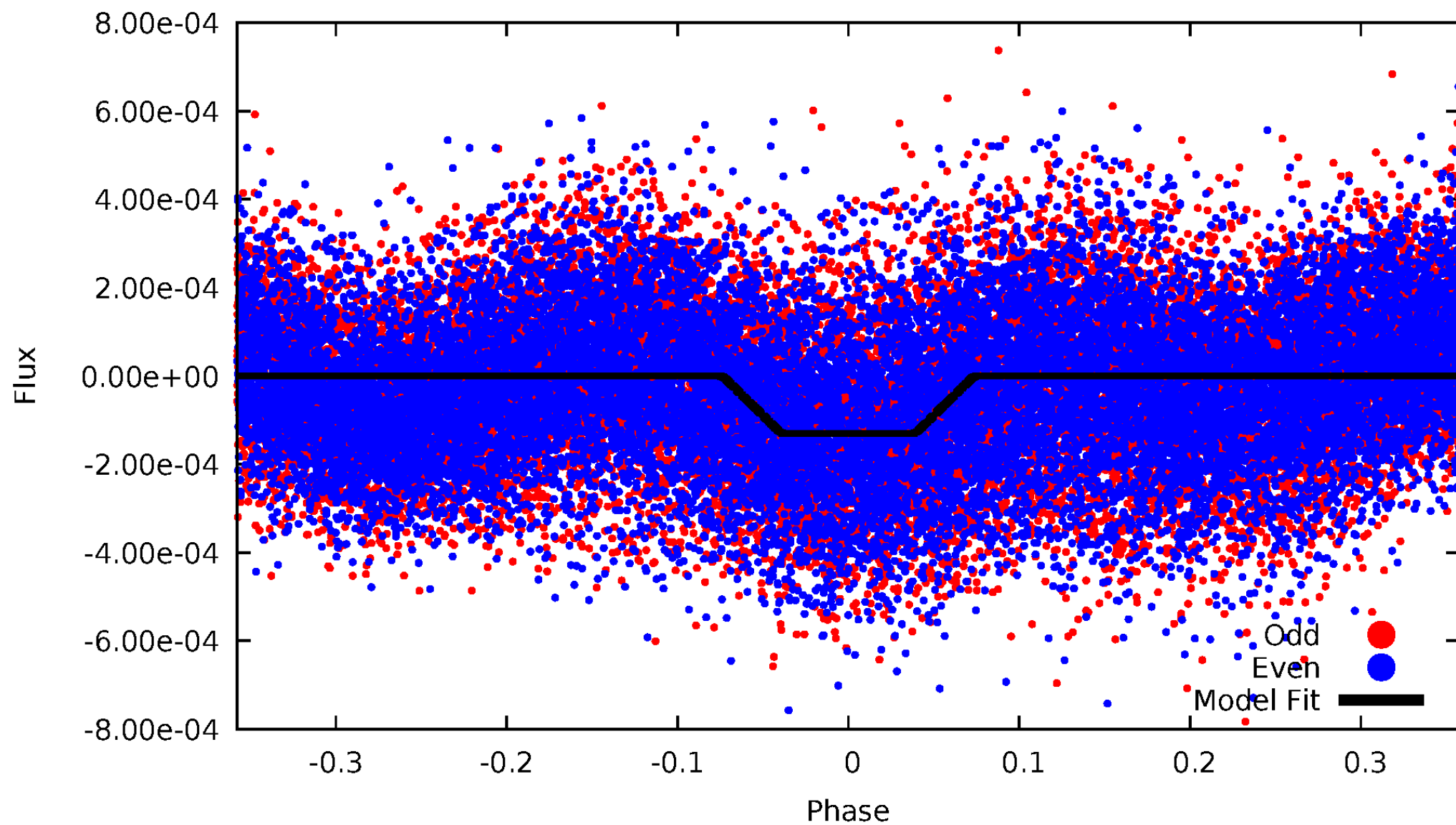
# DV Odd/Even

TCE 009016467-01



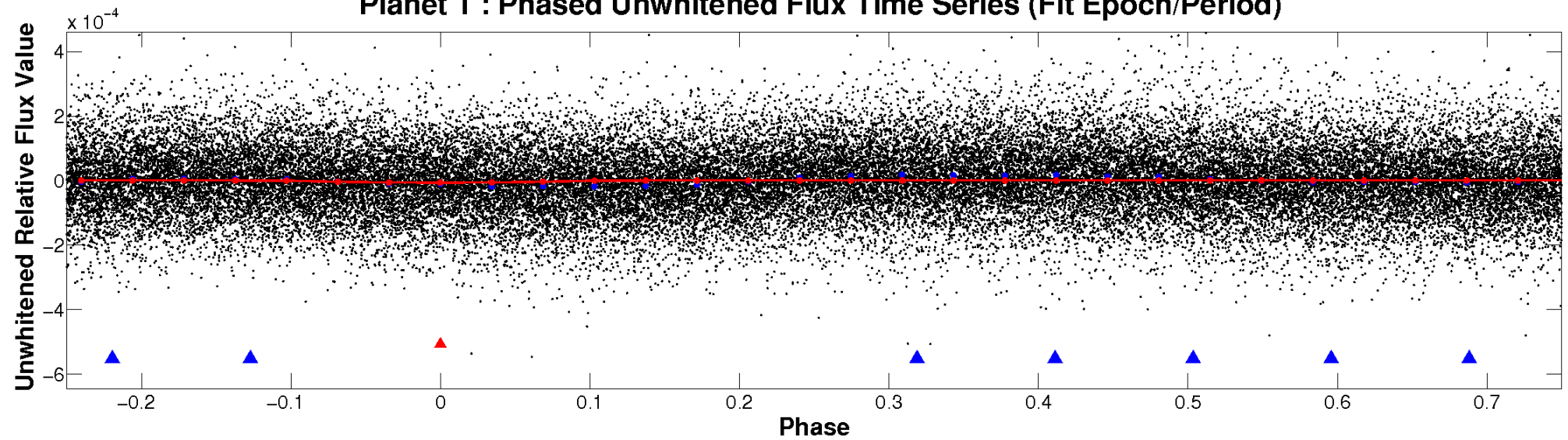
# ALT Odd/Even

TCE 009016467-01

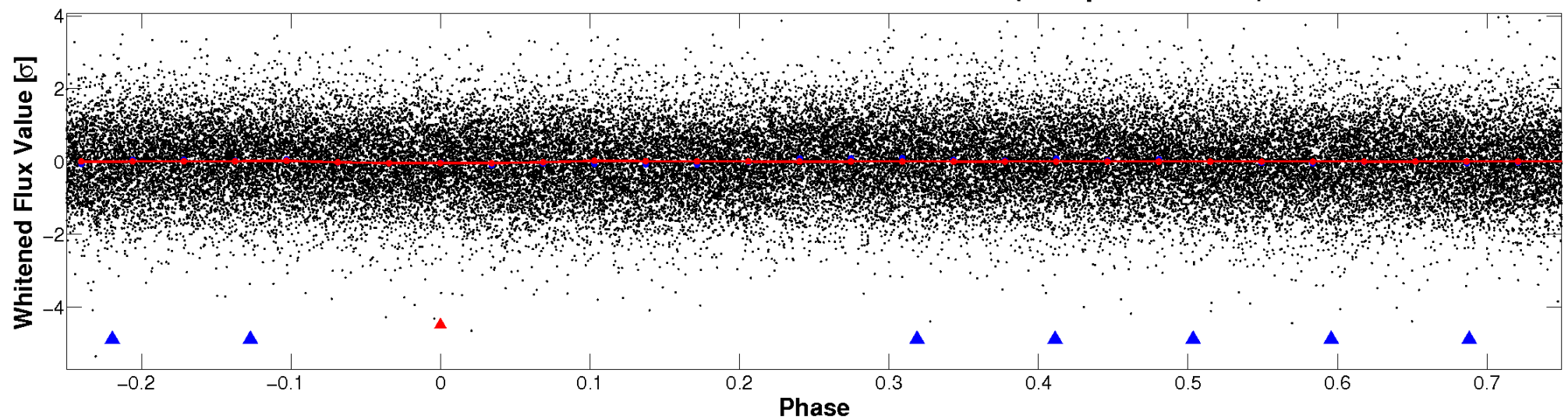


# Non-Whitened Vs. Whitened Light Curve

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

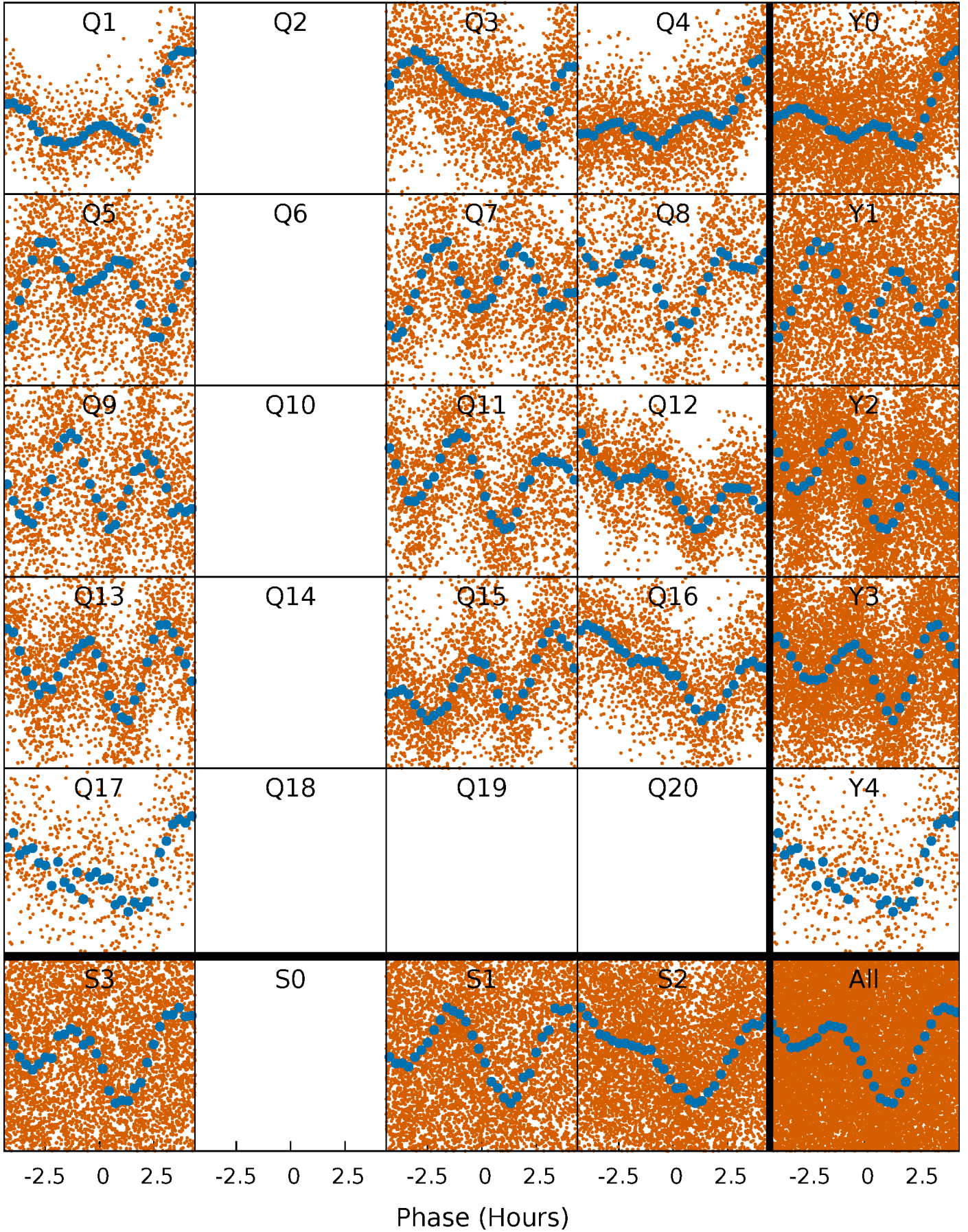


**Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



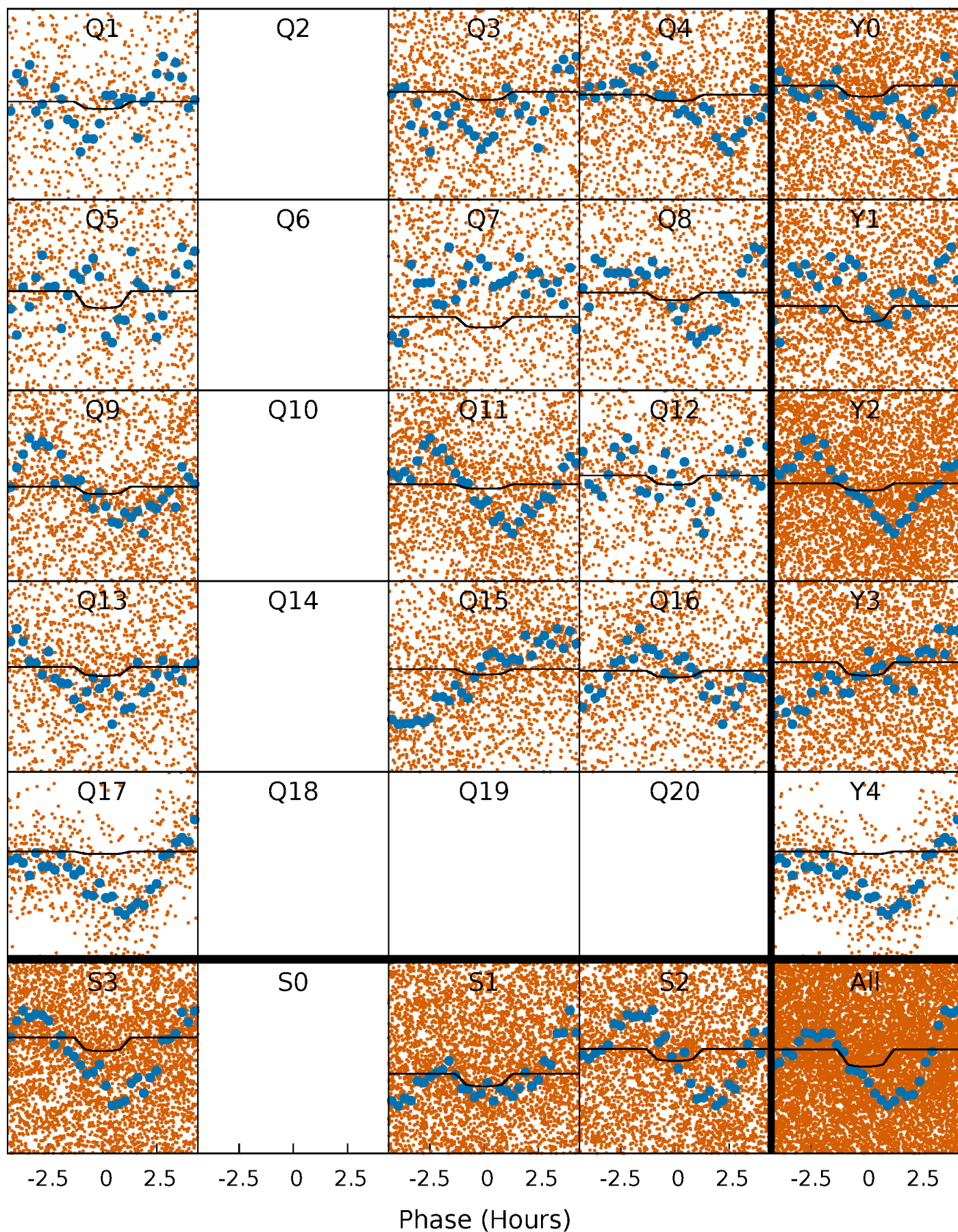
# PDC Quarter-Phased Transit Curves

TCE 009016467-01   P= 0.595308 Days    $T_0=132.069742$  (BKJD)



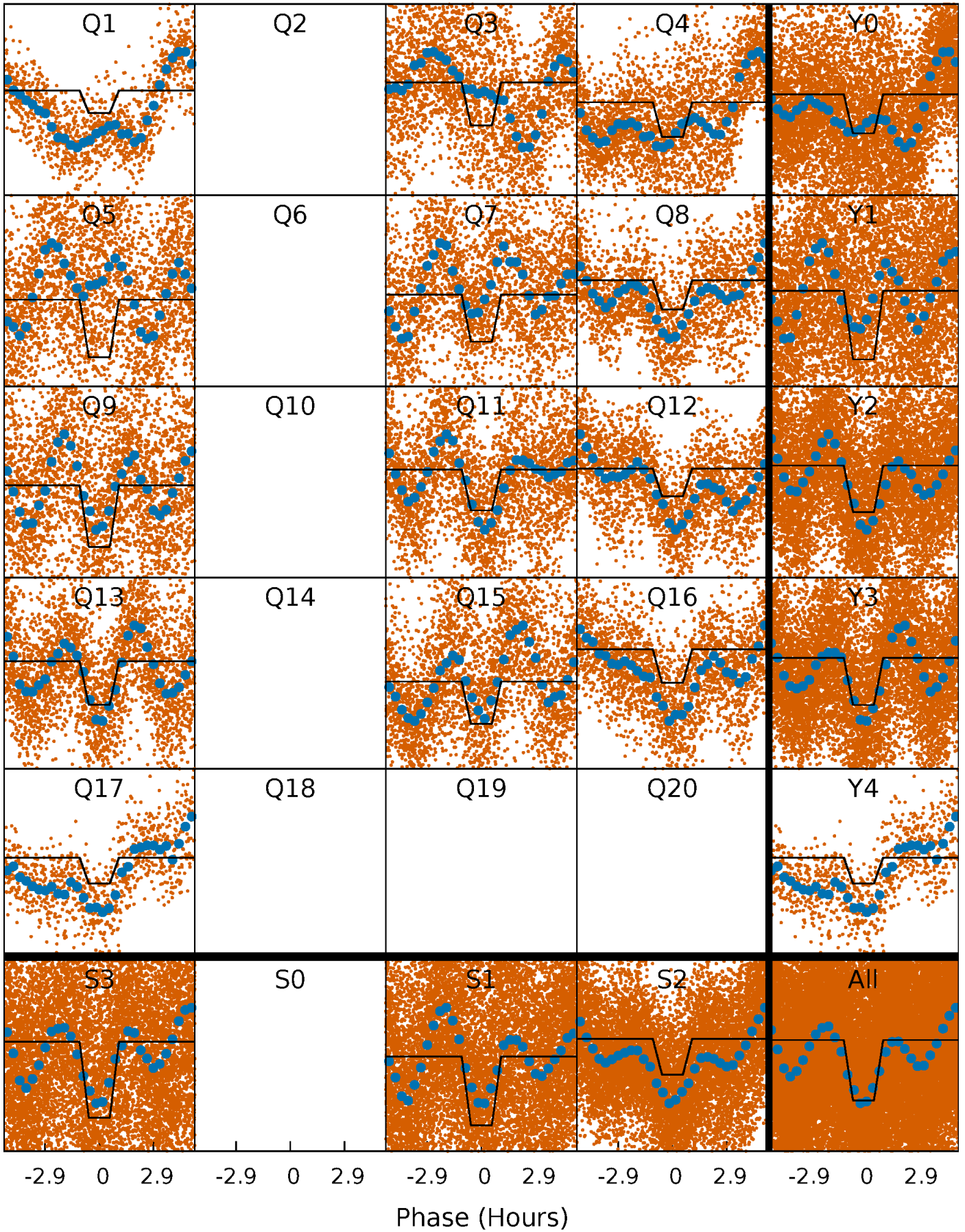
# DV Quarter-Phased Transit Curves

TCE 009016467-01   P= 0.595308 Days    $T_0=132.069742$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

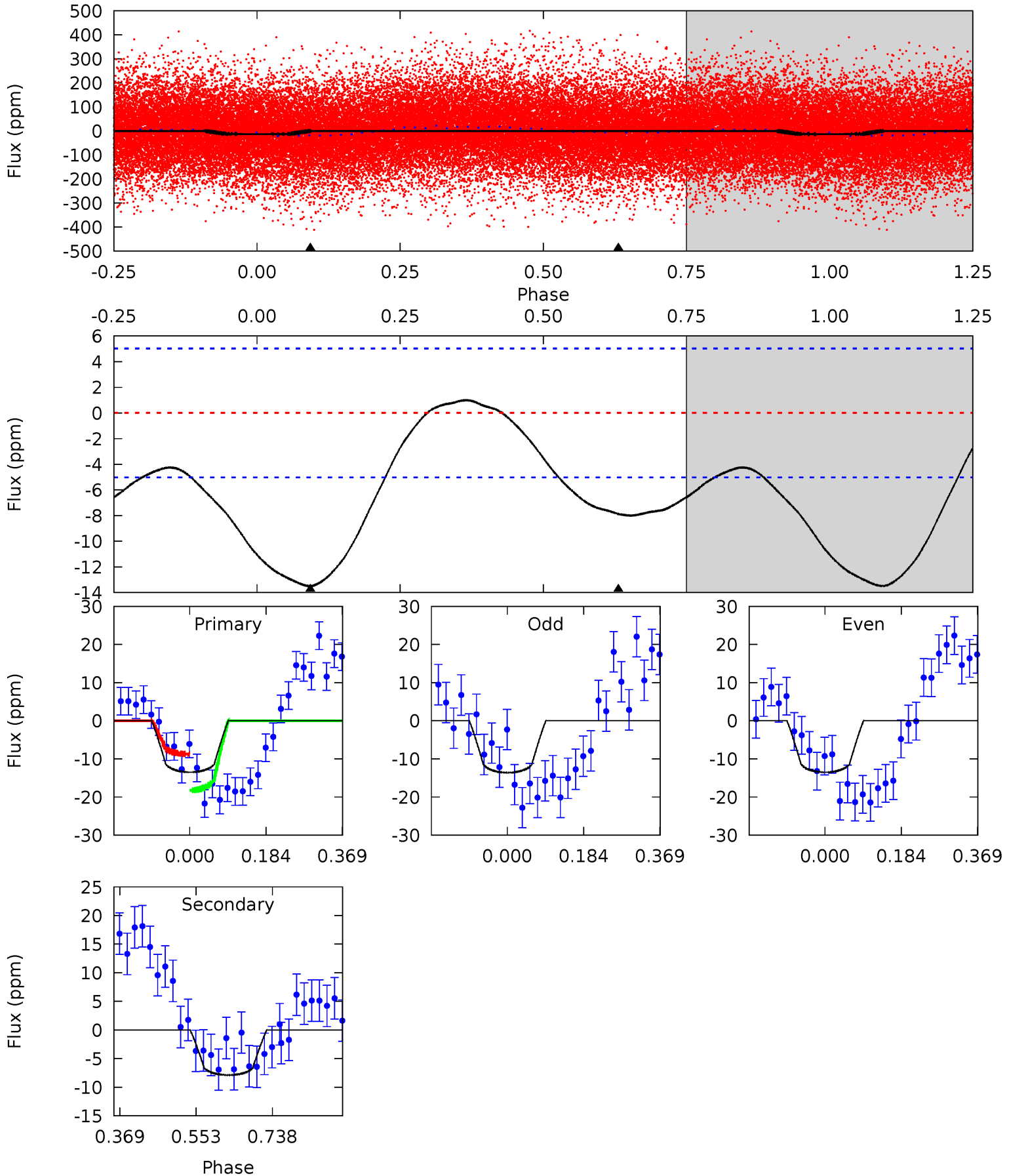
TCE 009016467-01   P= 0.595343 Days    $T_0=132.049684$  (BKJD)



# DV Model-Shift Uniqueness Test

009016467-01, P = 0.595308 Days, E = 131.474434 Days

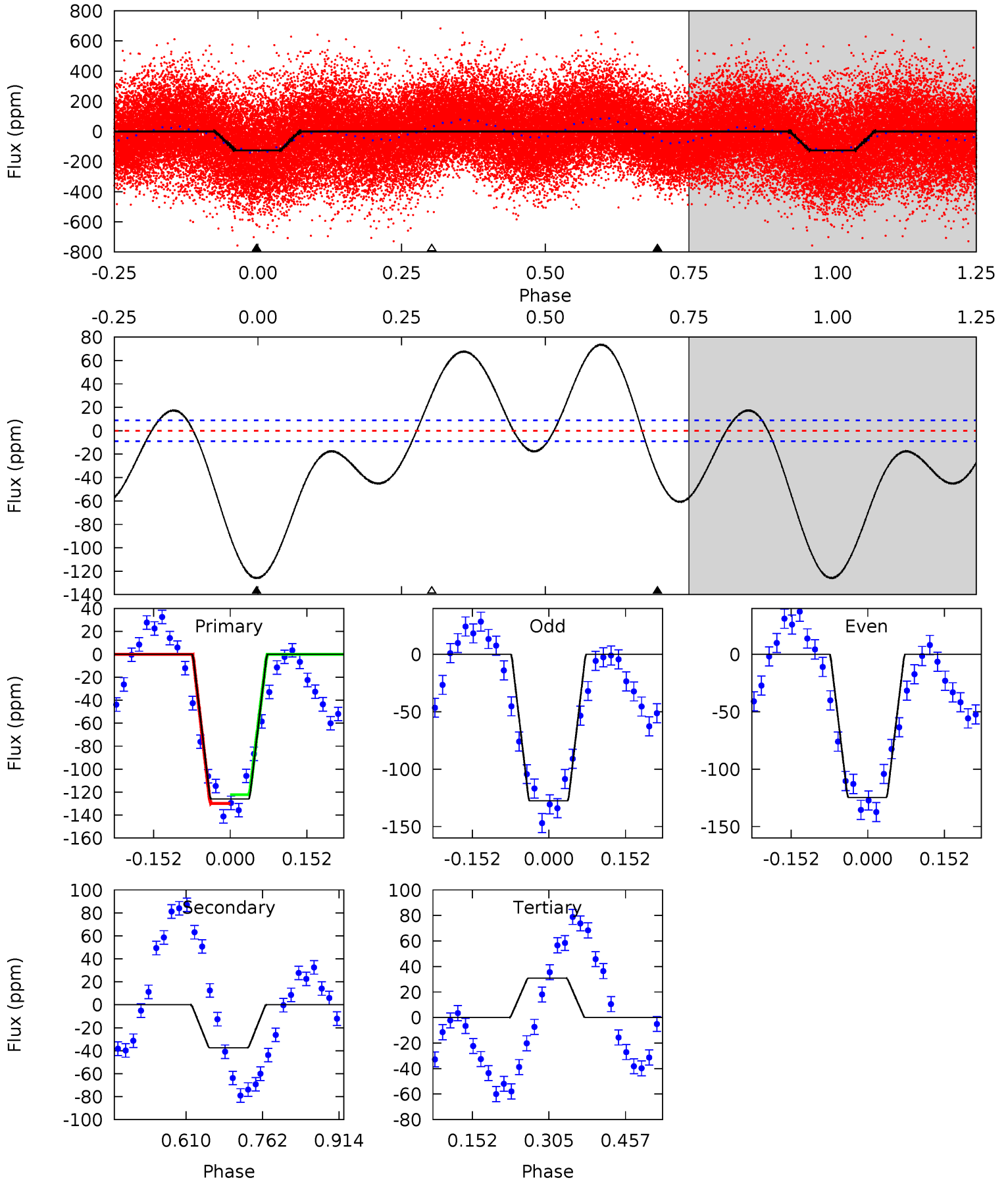
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
11.9	6.95	0	0	4.43	1.33	2.21	11.9	11.9	6.95	6.95	0.05	1.25	0.07	4.25



# Alt Model-Shift Uniqueness Test

009016467-01, P = 0.595343 Days, E = 131.454341 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
63.2	18.8	-15.5	0	4.48	1.43	18.3	78.7	63.2	34.3	18.8	0.76	0.98	0.37	1.95



### Stellar Parameters For KIC 009016467

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M$ ( $M_{\odot}$ )	$\rho_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$7237^{+201}_{-277}$	$4.059^{+0.175}_{-0.175}$	$-0.060^{+0.250}_{-0.350}$	$1.938^{+0.576}_{-0.471}$	$1.567^{+0.212}_{-0.259}$	$0.303^{+0.326}_{-0.134}$
	+3%/-4%	+4%/-4%	+417%/-583%	+30%/-24%	+14%/-17%	+108%/-44%
Source	PHO1	KIC0	KIC0	DSEP		

KIC = Kepler Input Catalog; PHO = Photometry; SPE = Spectroscopy; AST = Asteroseismology  
 TRA = Transits; DESP = Dartmouth Models; MULT = Multiple Models

### Secondary Eclipse Parameters for KIC 009016467-01 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	$-8 \pm 1$	$0.57^{+0.17}_{-0.17}$	$4893^{+370}_{-330}$	$7224^{+1694}_{-1035}$	$3.385^{+3.789}_{-1.324}$
Alt.	$-38 \pm 2$	$2.40^{+0.39}_{-0.35}$	$4900^{+373}_{-374}$	$4849^{+273}_{-294}$	$0.921^{+0.291}_{-0.240}$

$T_{\text{max}}$  = 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

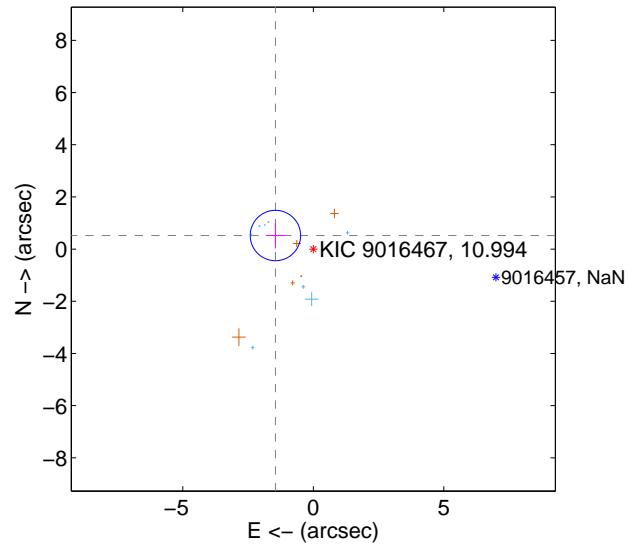
Supplemental centroid analysis for 009016467-01. **Kepler magnitude: 10.99.** Transit SNR 3.75

There are 8 quarters with good PRF difference image offsets

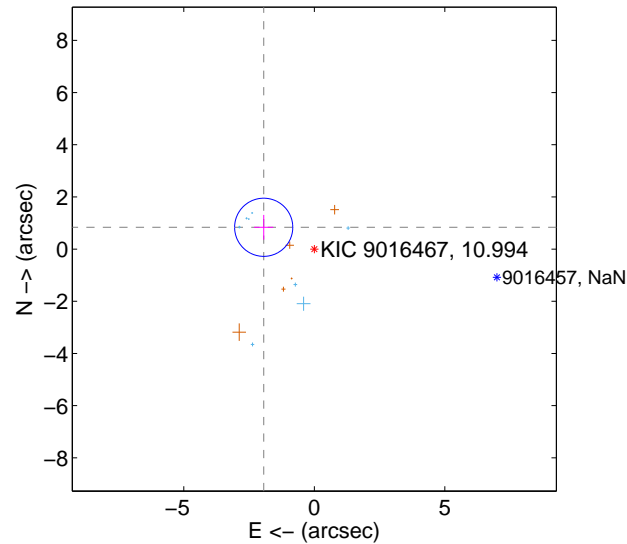
The direct PRF centroid is offset from the target star catalog position by about 0.35 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	<b><math>1.543 \pm 0.322</math></b>	<b>4.79</b>	$1.452 \pm 0.367$	$0.521 \pm 0.491$
PRF-fit source offset from KIC position	<b><math>2.112 \pm 0.371</math></b>	<b>5.69</b>	$1.940 \pm 0.366$	$0.836 \pm 0.474$
photometric centroid source offset	$2.50 \pm 1.74$	1.43	$1.41 \pm 1.68$	$2.06 \pm 1.77$

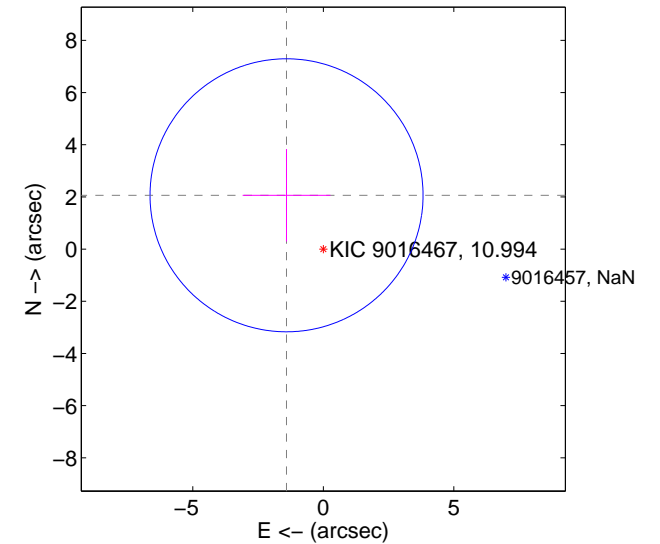
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

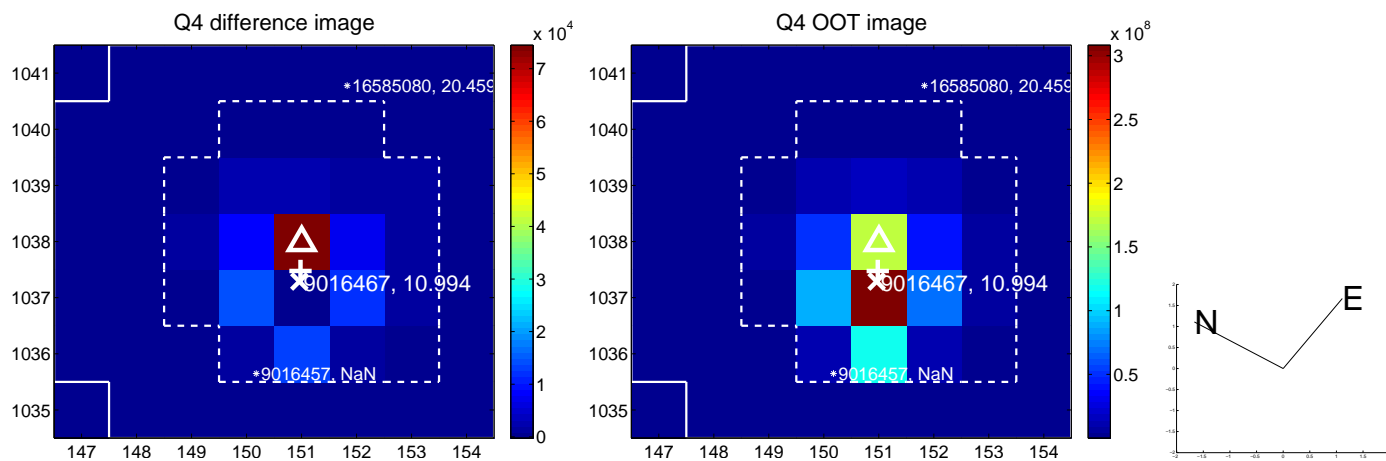
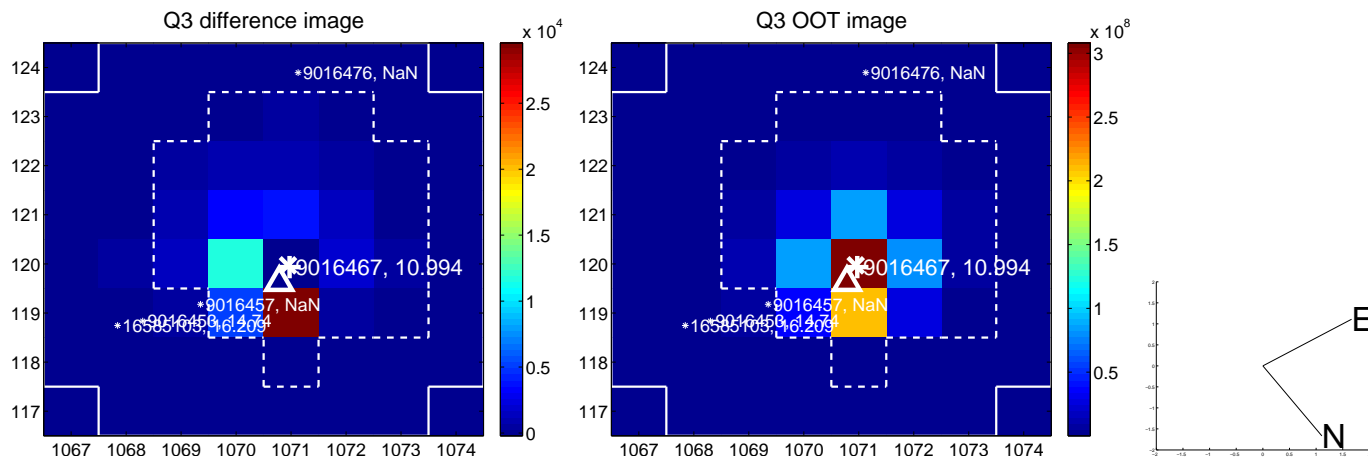
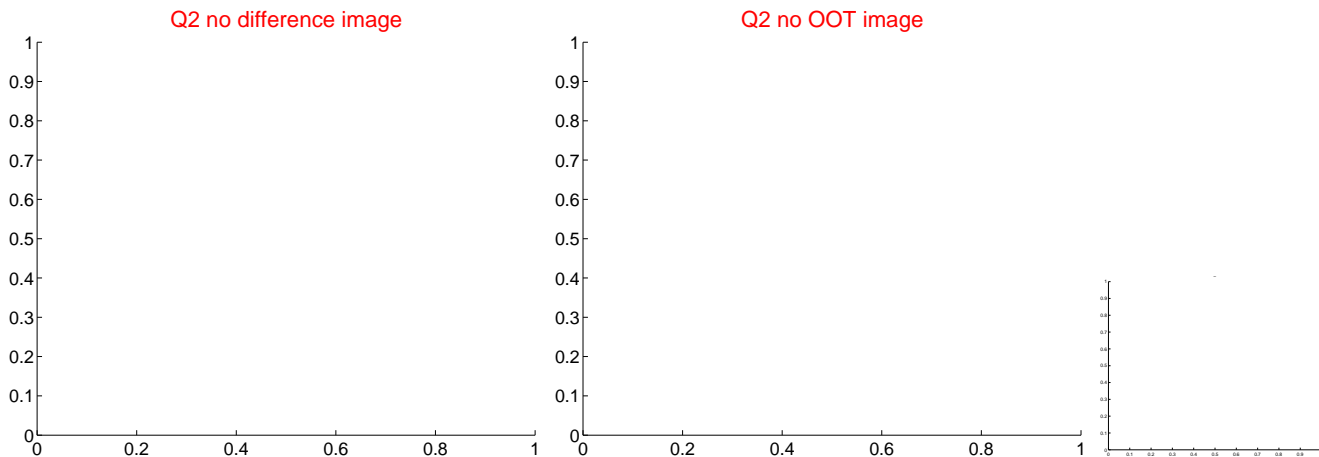
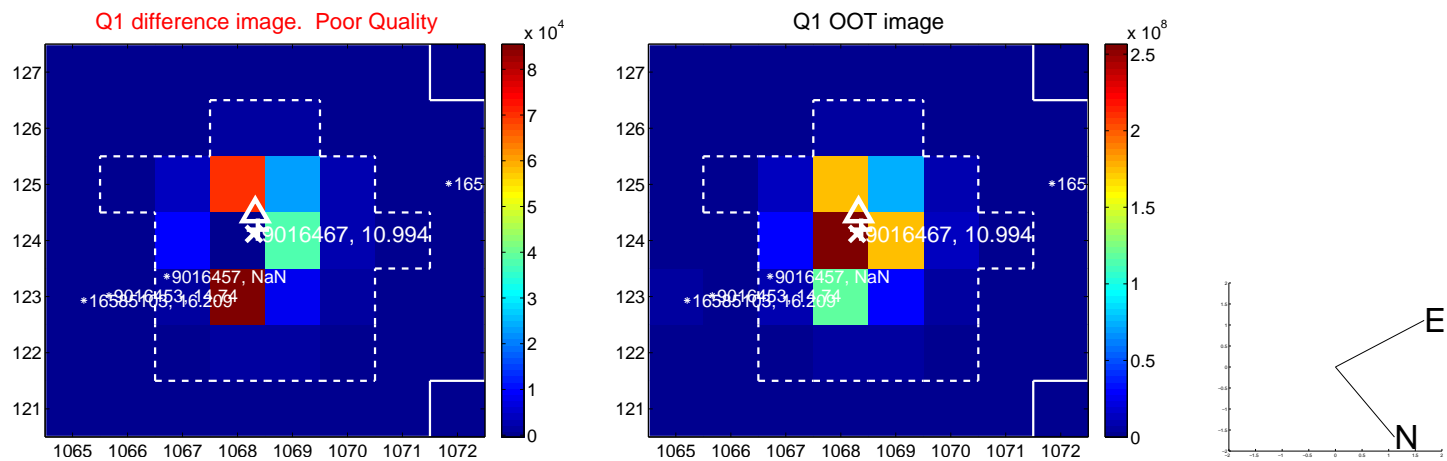


offset from photometric centroids

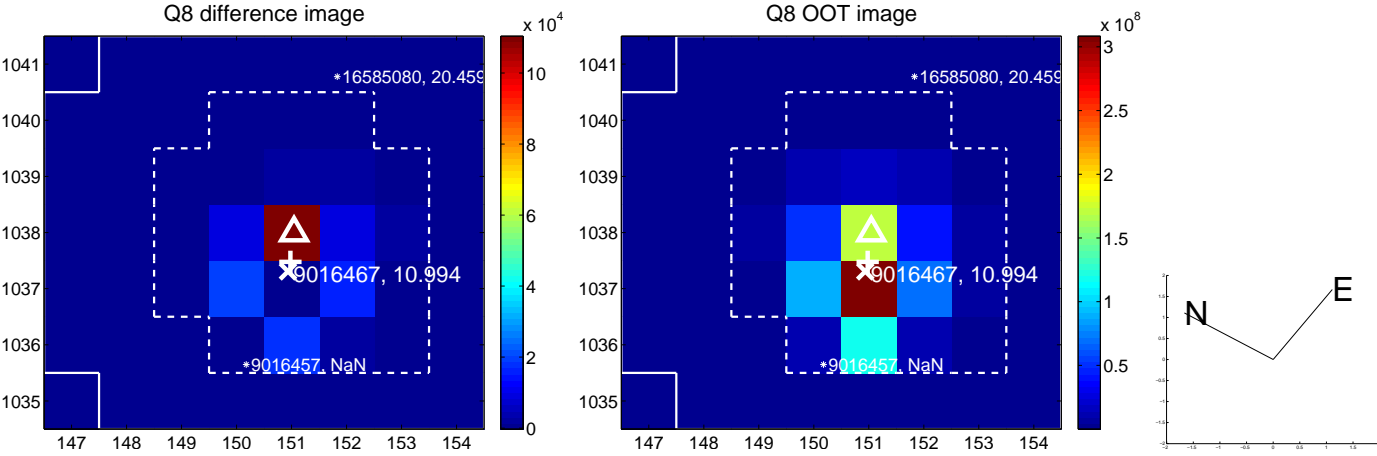
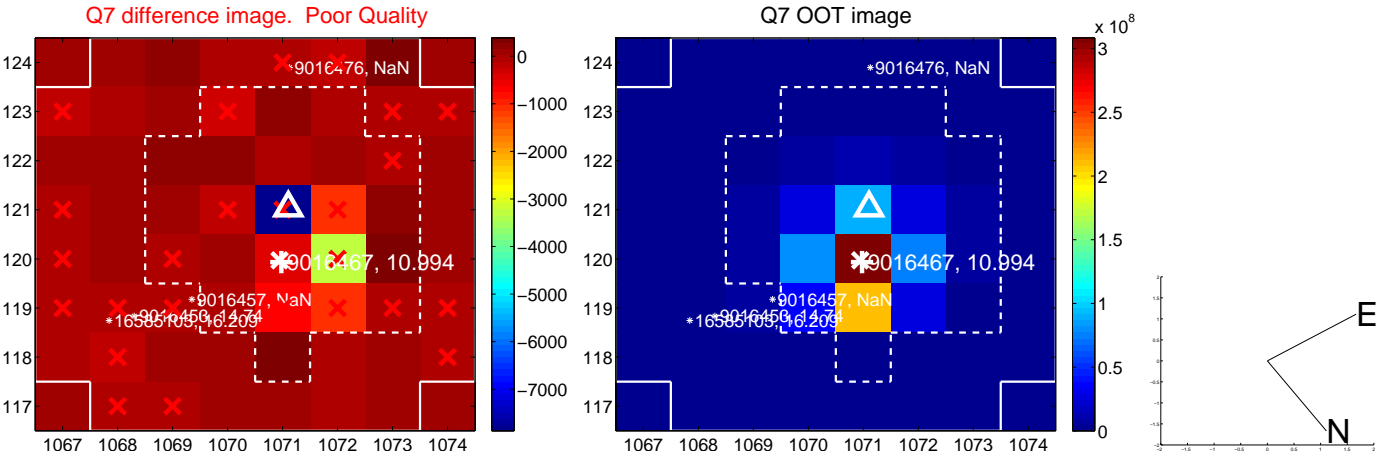
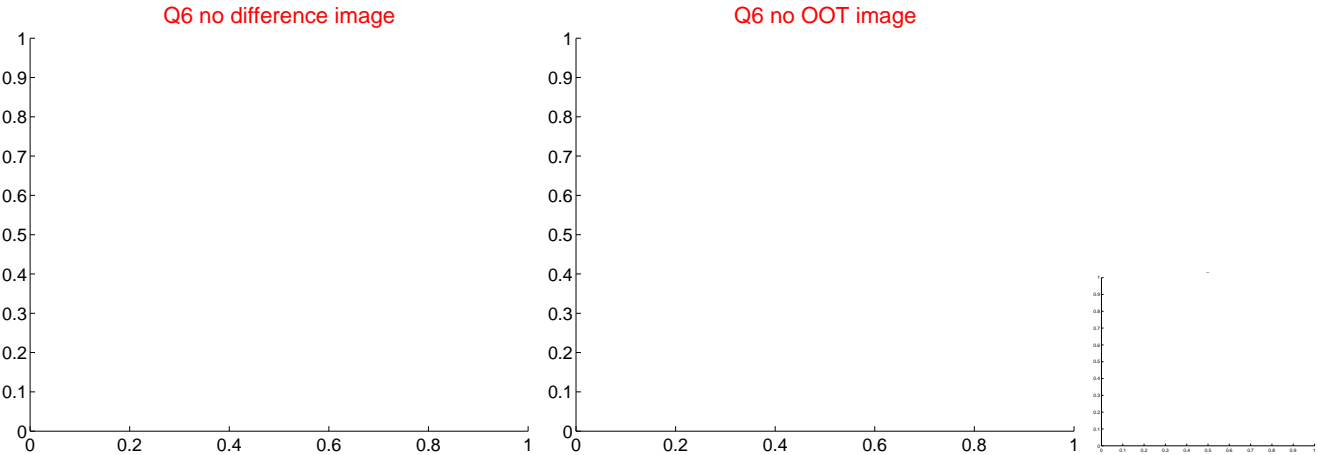
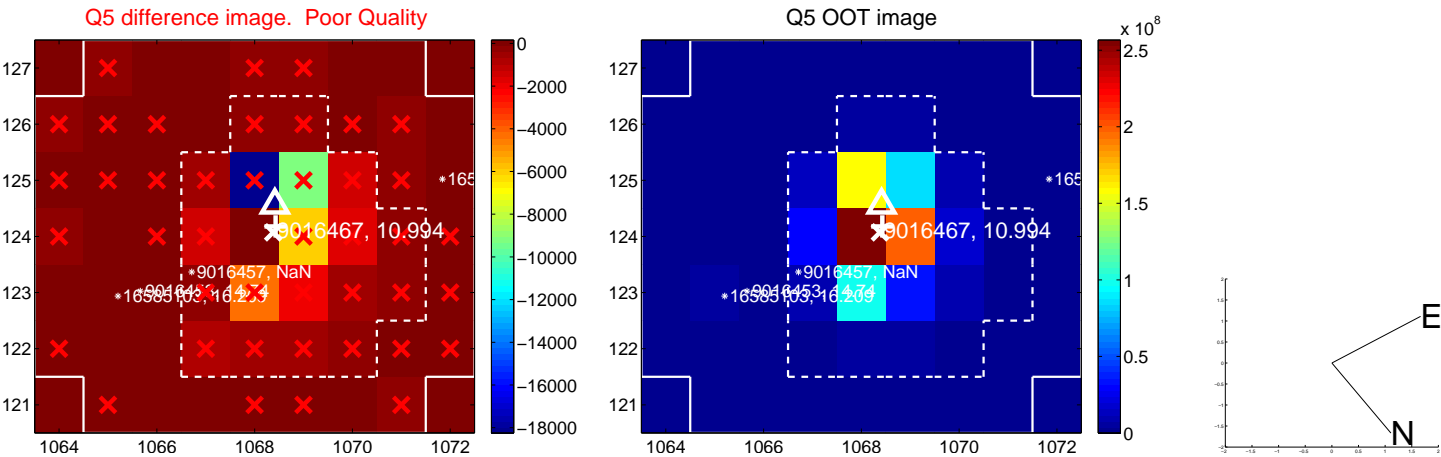


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

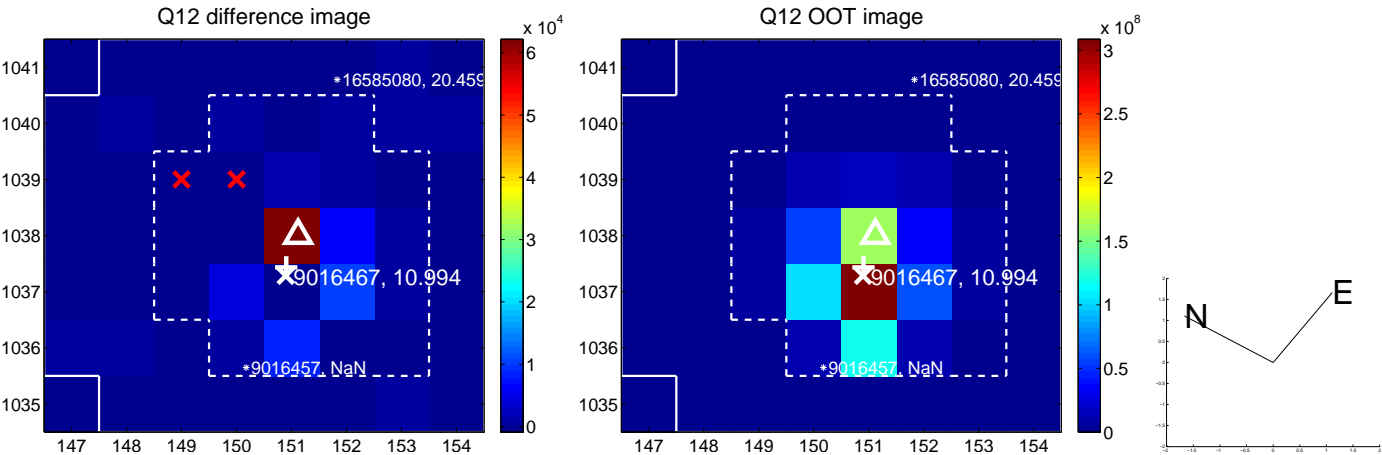
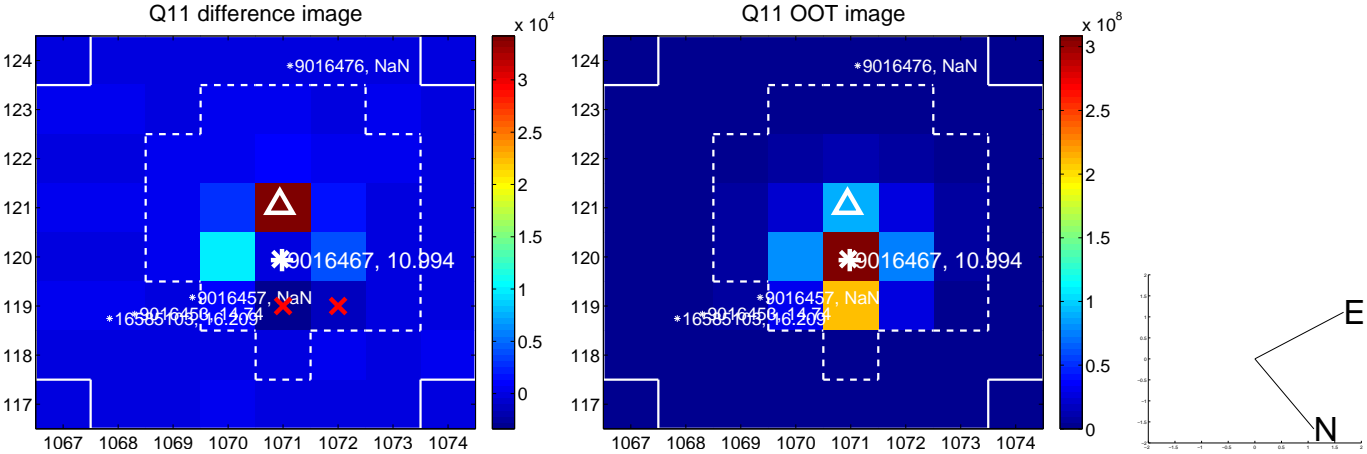
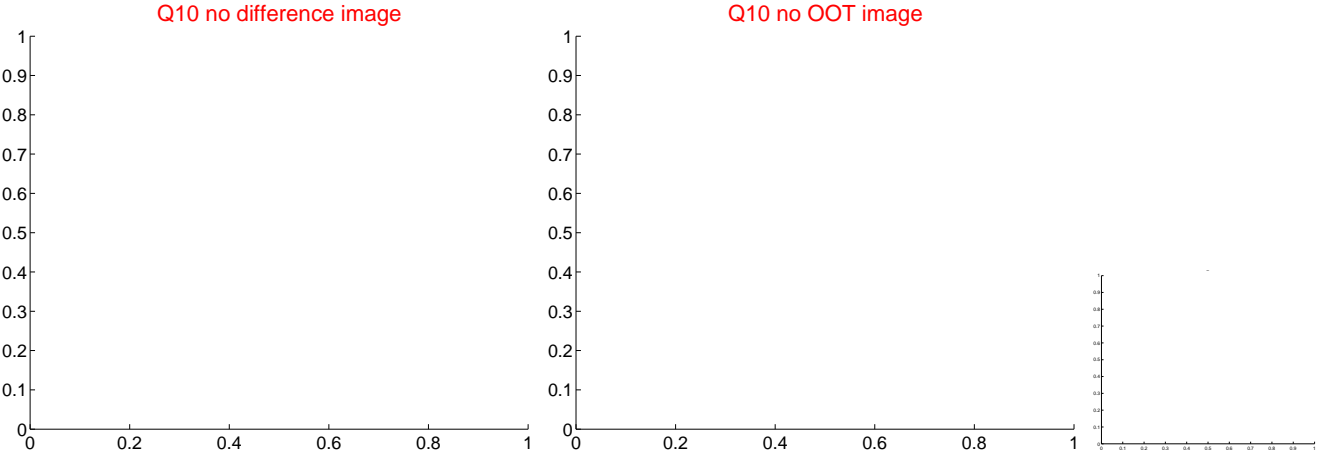
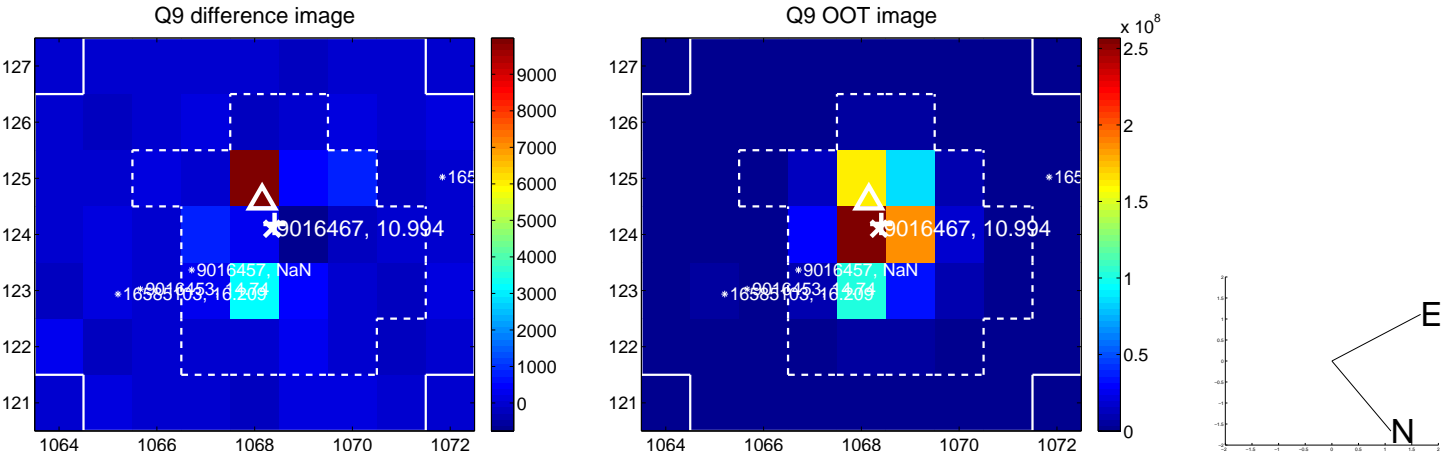
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



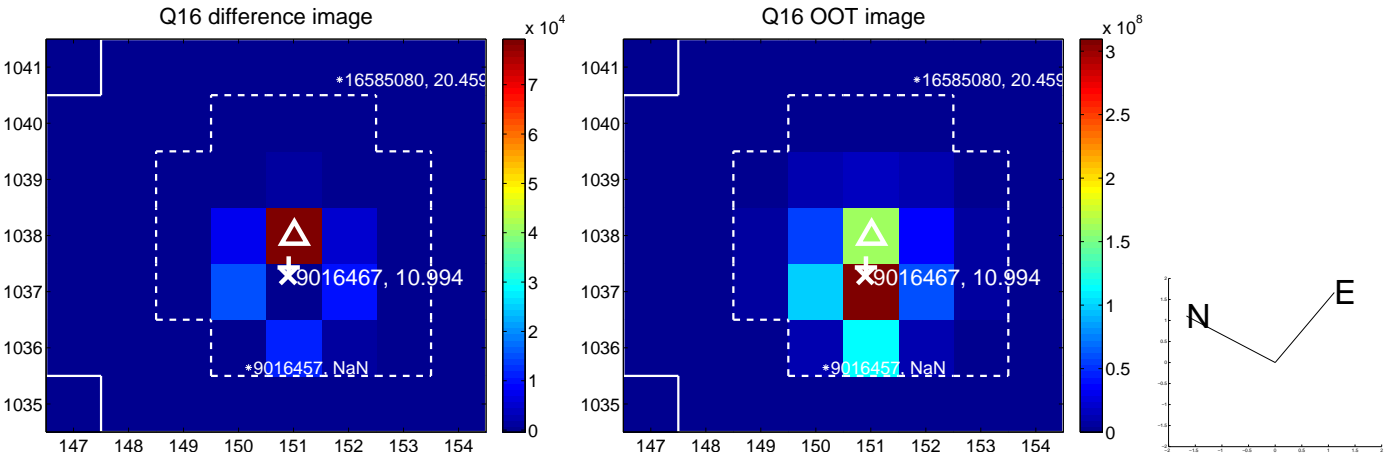
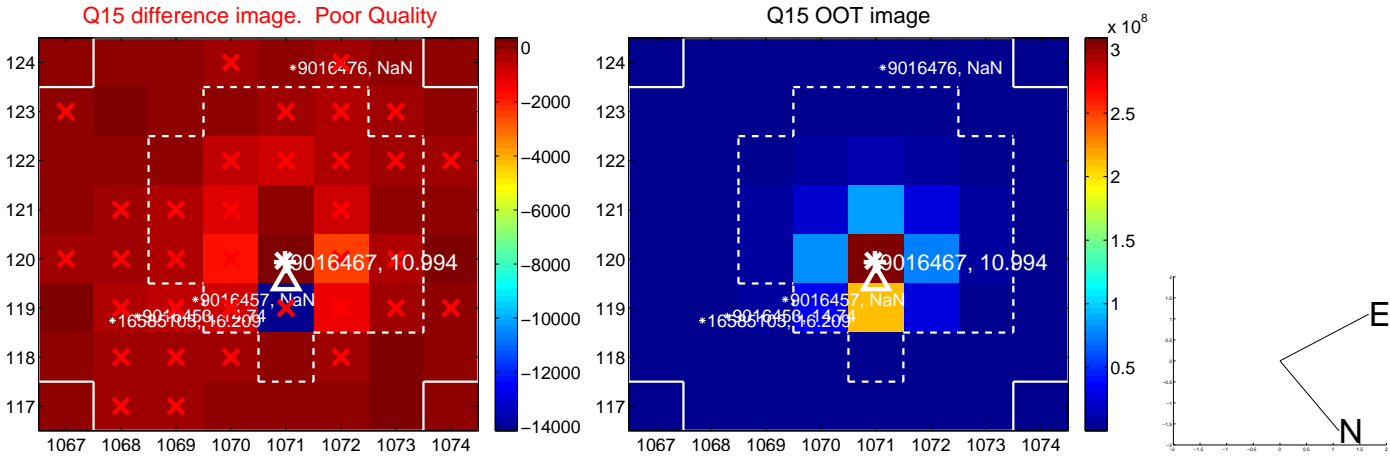
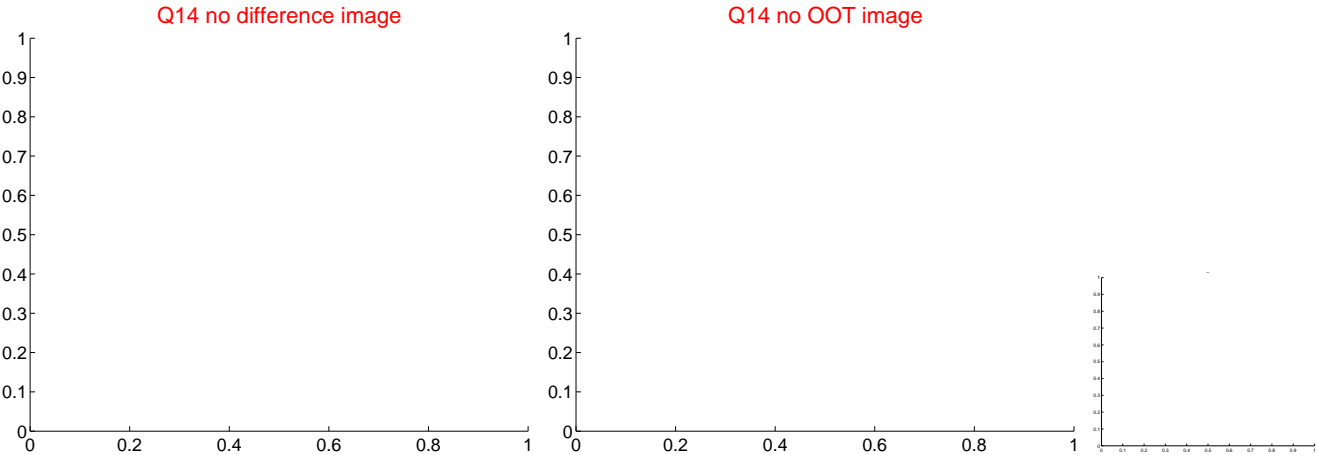
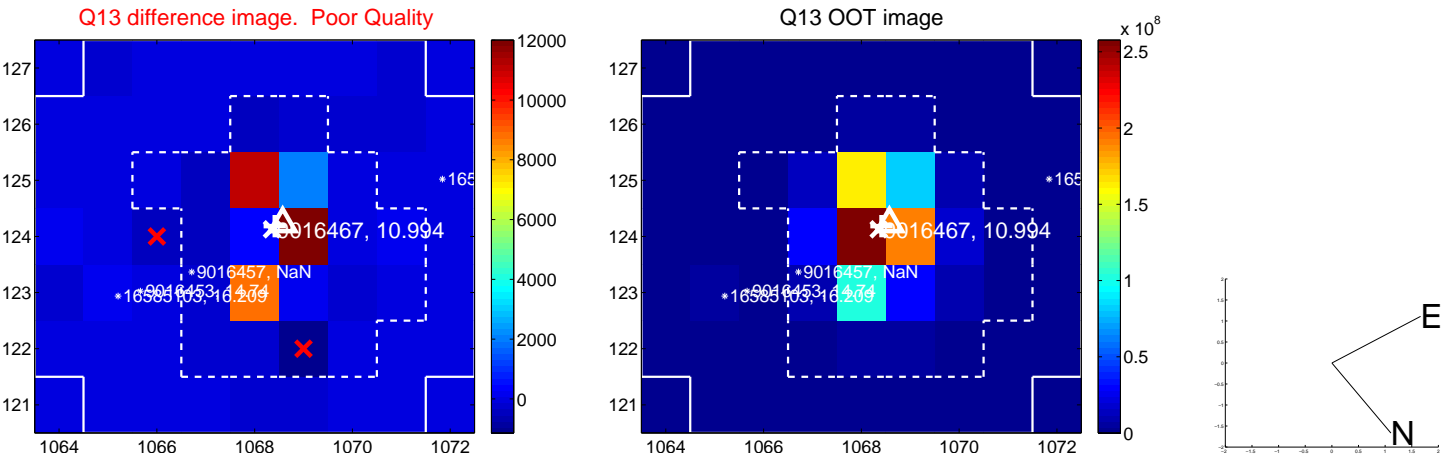
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



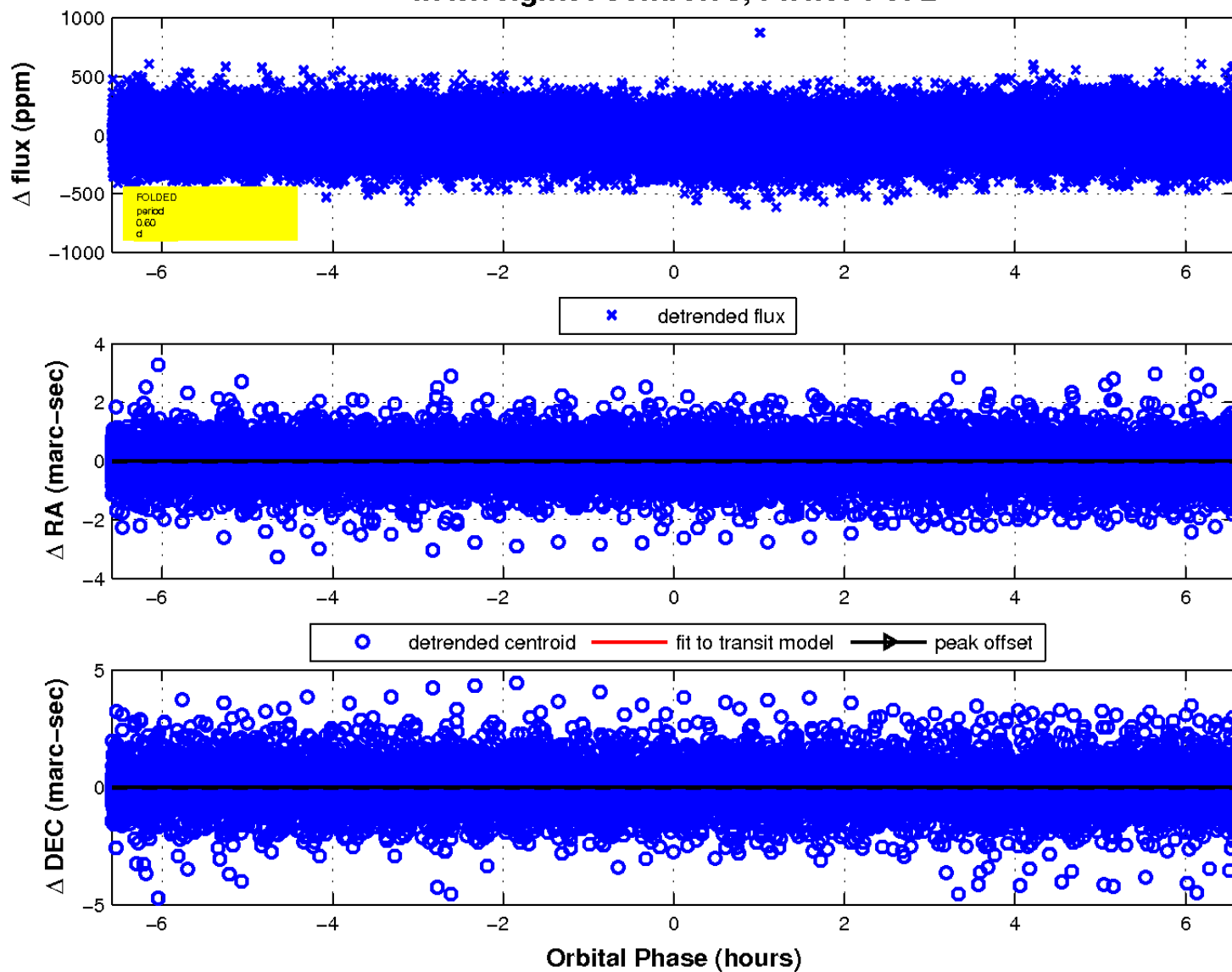
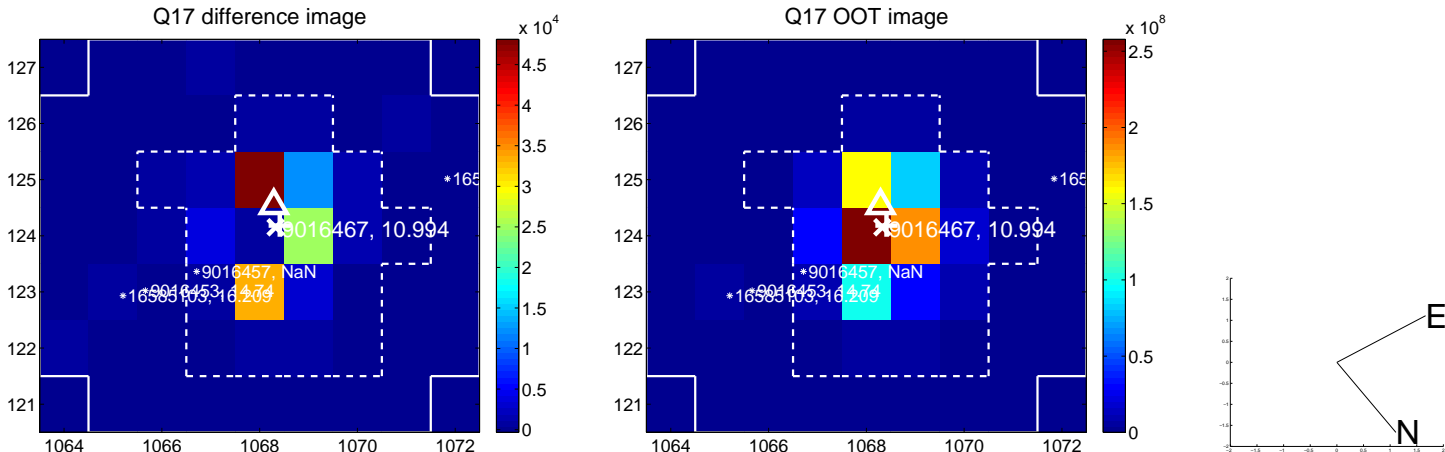
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

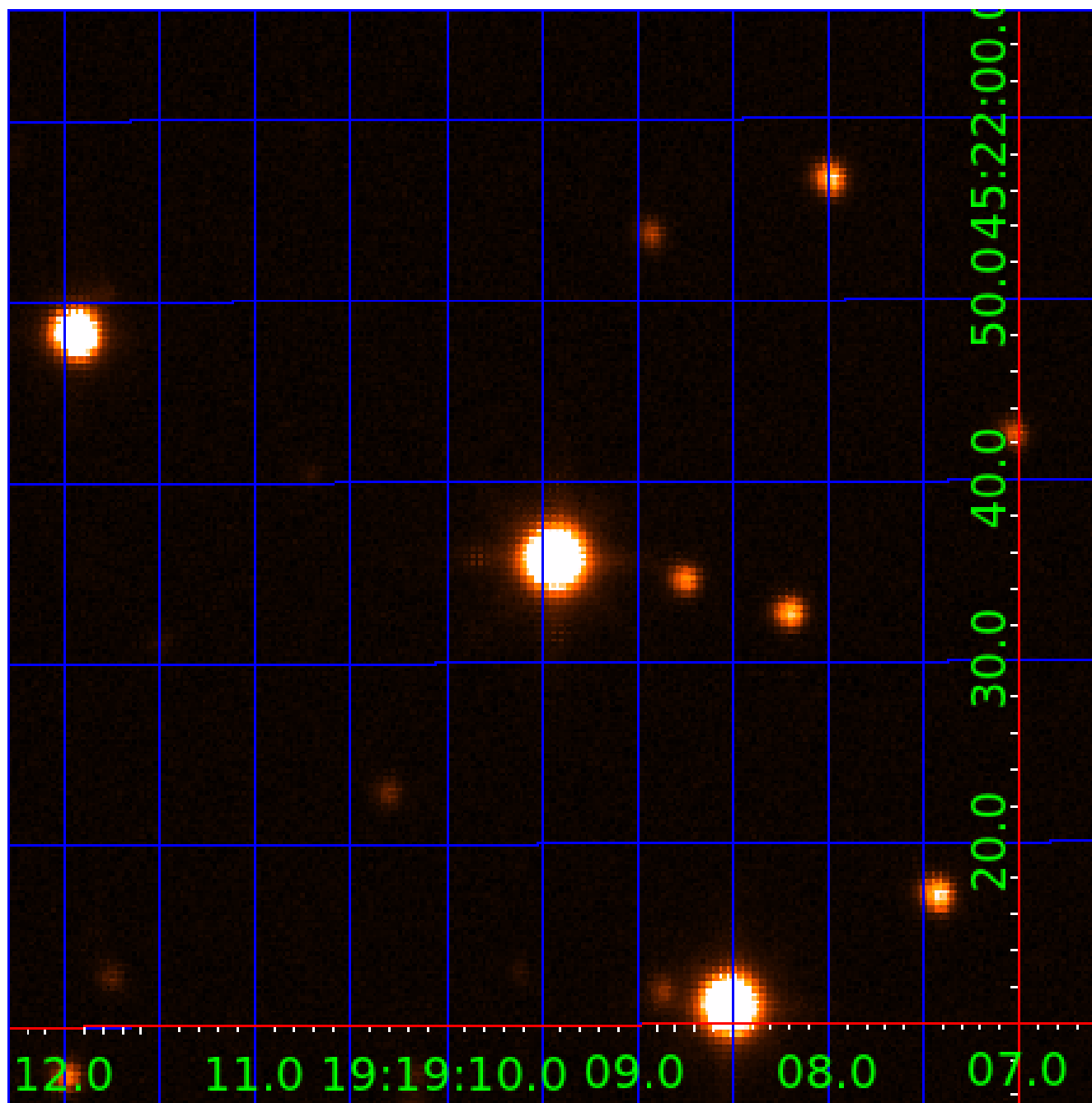


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 009016467

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009016467-01	OBS	No	0.595308	132.069742	6.3	2.196	7.5	3.8	1.94	7237	0.56	35621.21
009016467-02	OBS	No	204.731068	237.363621	190.6	4.885	7.6	7.2	1.94	7237	3.10	14.78

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009016467-01	OBS	FP	0.00	1	0	0	0	LPP_DV—MOD_NONUNIQ_ALT—CENT_SATURATED
009016467-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT—CENT_SATURATED

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

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

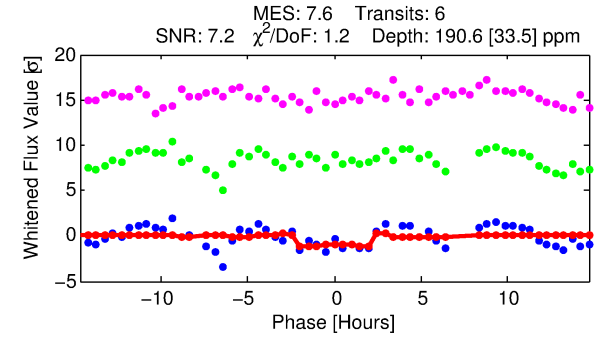
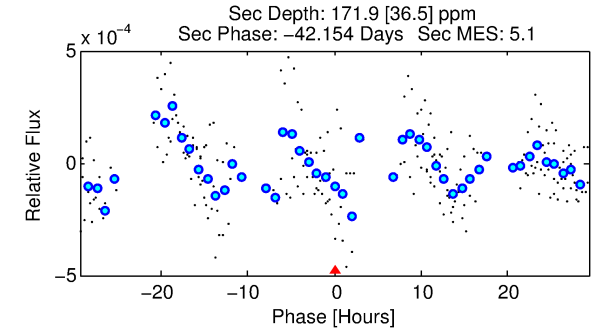
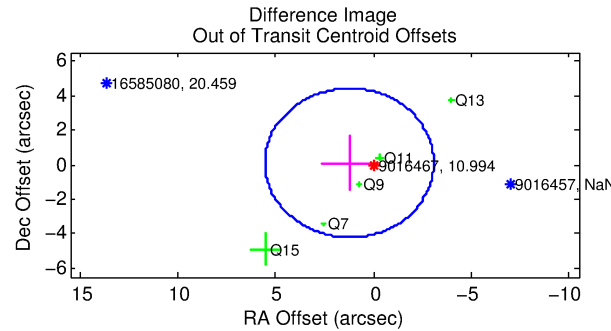
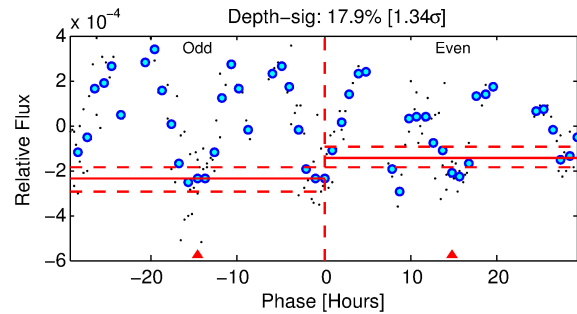
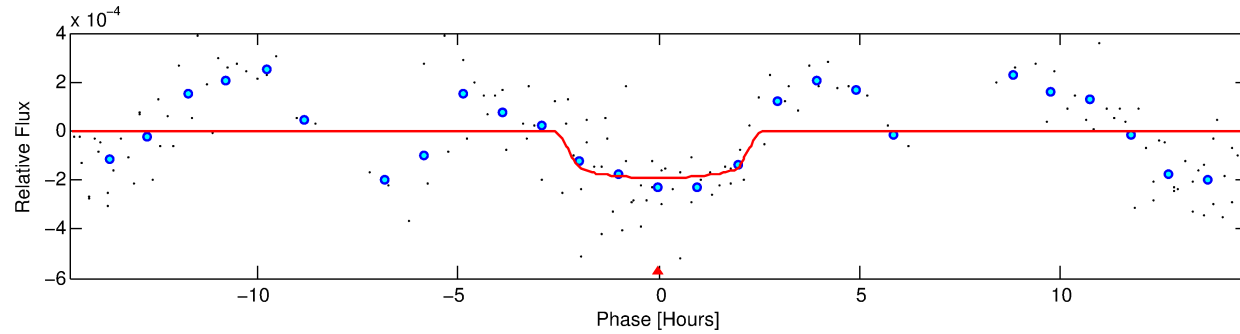
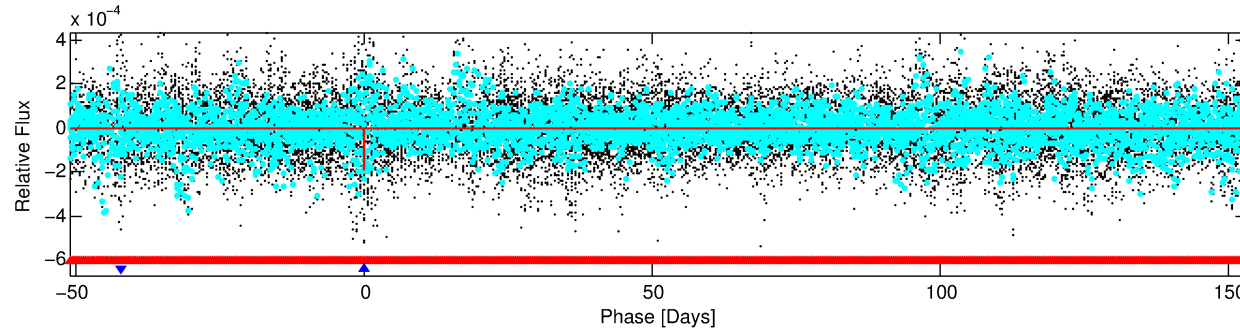
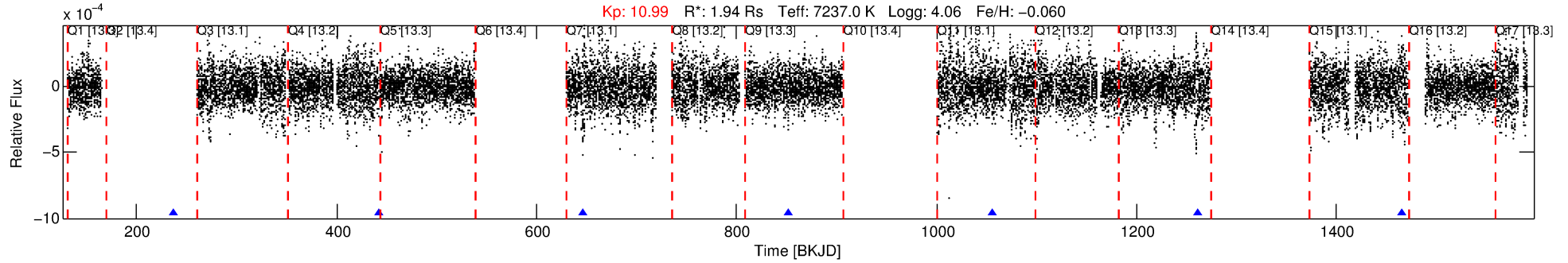
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 009016467-02

No Significant Match Found

# DV One-Page Summary

KIC: 9016467 Candidate: 2 of 2 Period: 204.731 d



## DV Fit Results:

Period = 204.73107 [0.00601] d  
Epoch = 237.3636 [0.0241] BKJD  
Rp/R\* = 0.0147 [0.0038]  
a/R\* = 149.83 [225.34]  
b = 0.90 [0.32]  
Seff = 14.78 [5.43]  
Teq = 500 [46] K  
Rp = 3.10 [1.23] Re  
a = 0.7902 [0.1891] AU  
Ag = 6133.82 [4024.29] [1.52 $\sigma$ ]  
Teffp = 6841 [1001] K [6.33 $\sigma$ ]

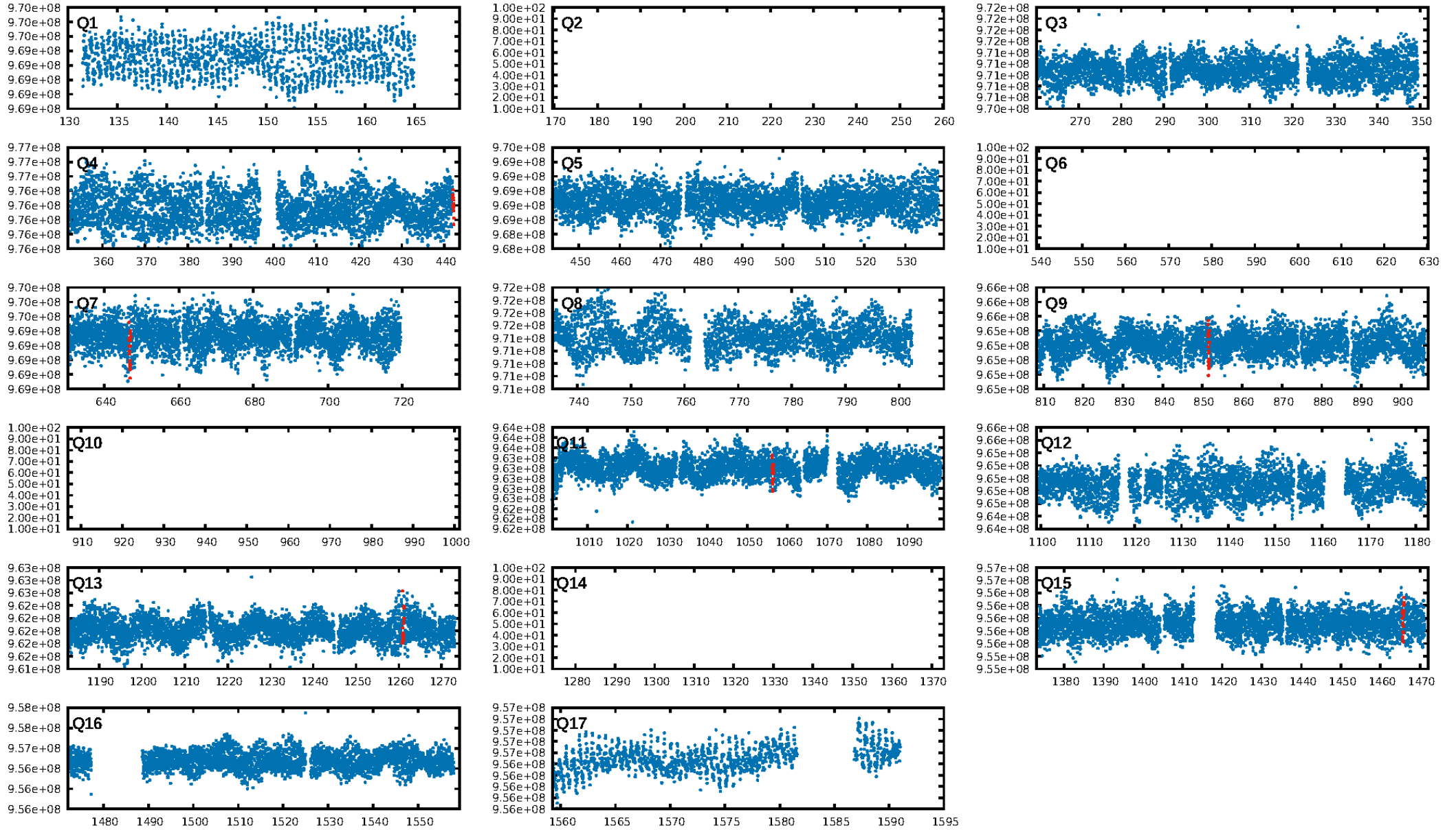
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [914.70 $\sigma$ ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 4.6%  
ModelChiSquareGof-sig: 99.9%  
**Bootstrap-pfa: 1.09e-11**  
RollingBand-fgt: 1.00 [6/6]  
GhostDiagnostic-chr: 4.904  
Centroid-sig: 7.2%  
Centroid-so: 1.180 arcsec [1.48 $\sigma$ ]  
OotOffset-rm: 1.245 arcsec [0.87 $\sigma$ ]  
OotOffset-st: 0.3/0/2 [5]  
KicOffset-rm: 1.897 arcsec [1.01 $\sigma$ ]  
KicOffset-st: 0.3/0/2 [5]  
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DiffImageOverlap-fno: 0.00 [0/5]

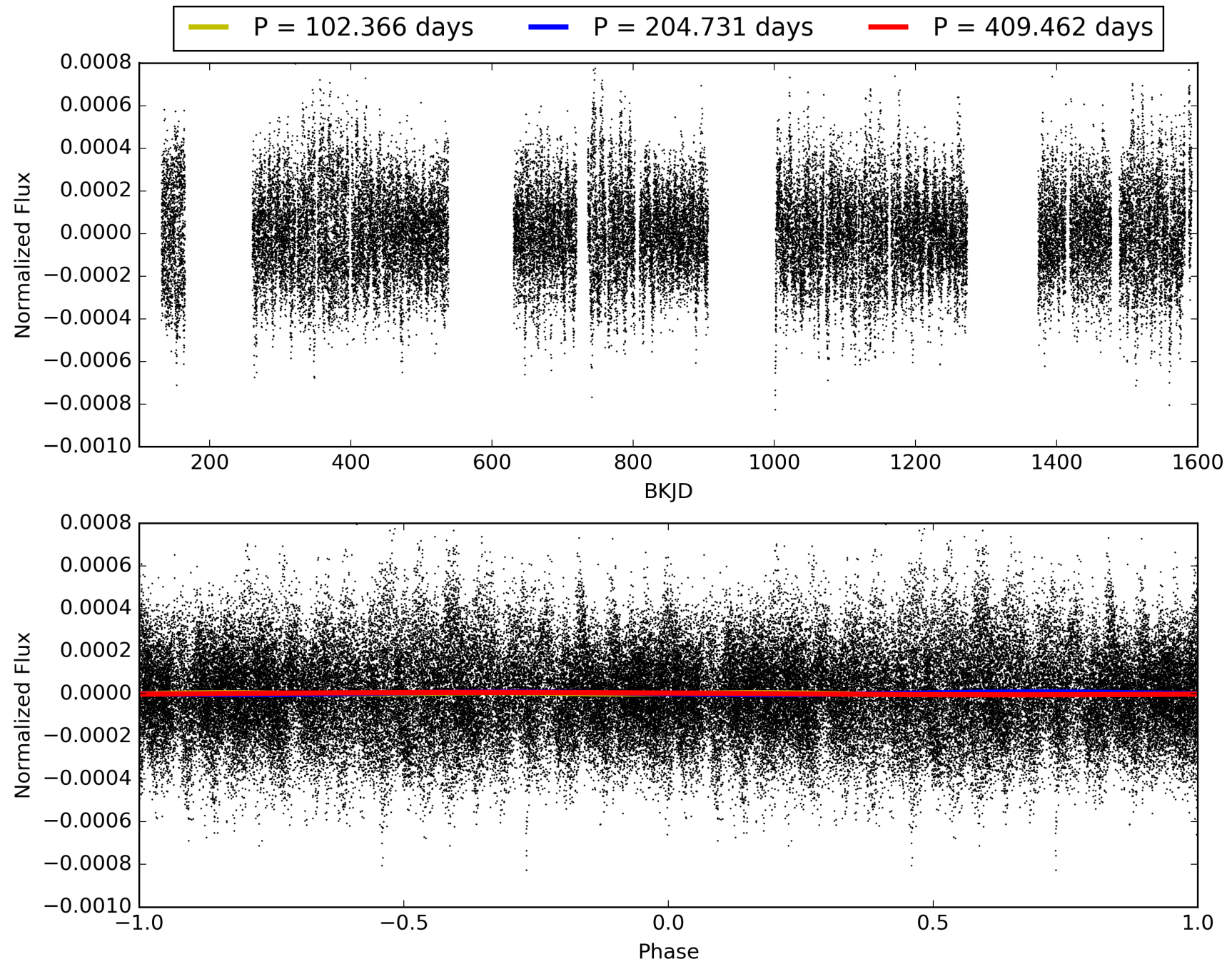
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This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 009016467-02, PDC Light Curves

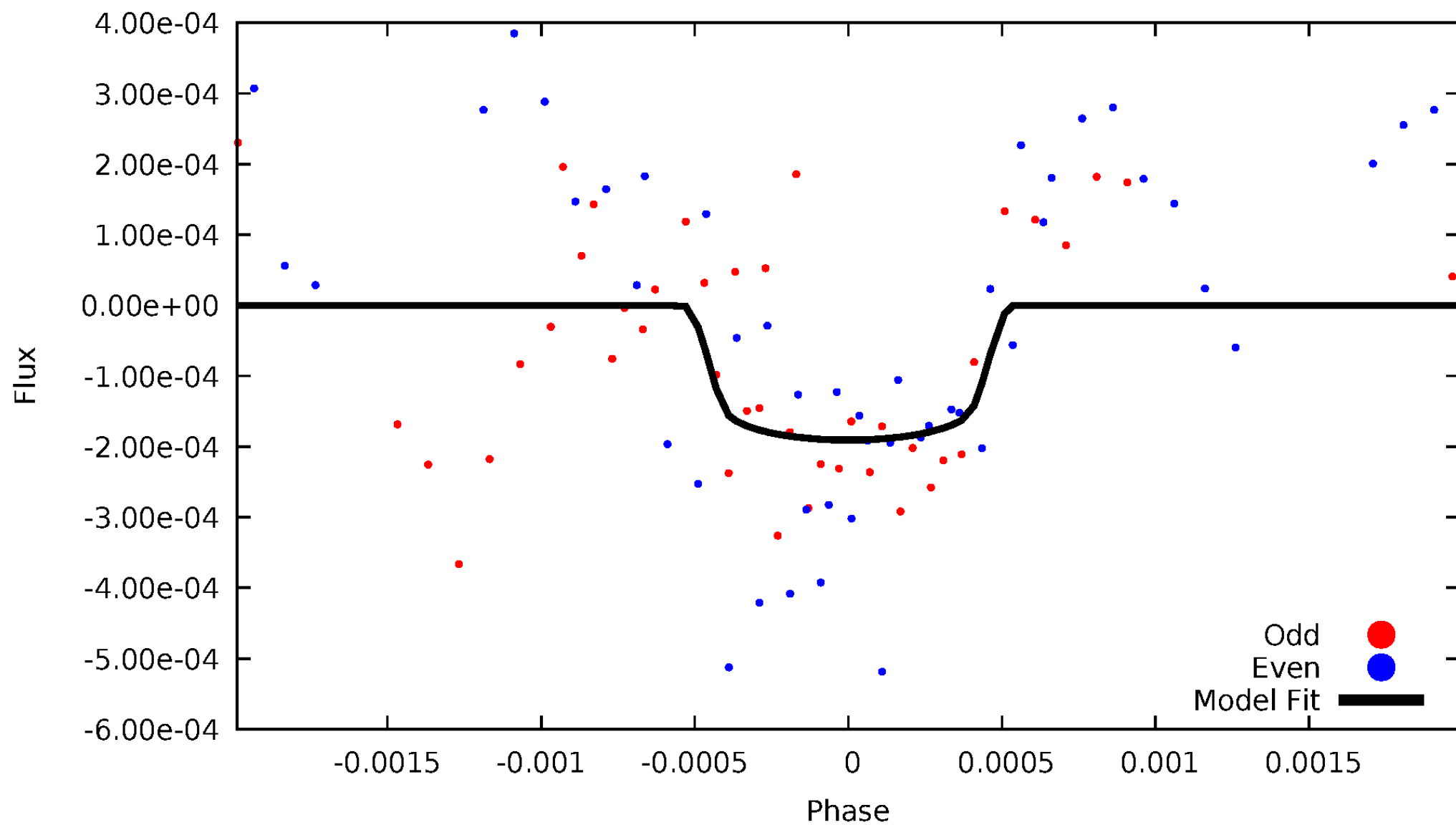


TCE 009016467-02



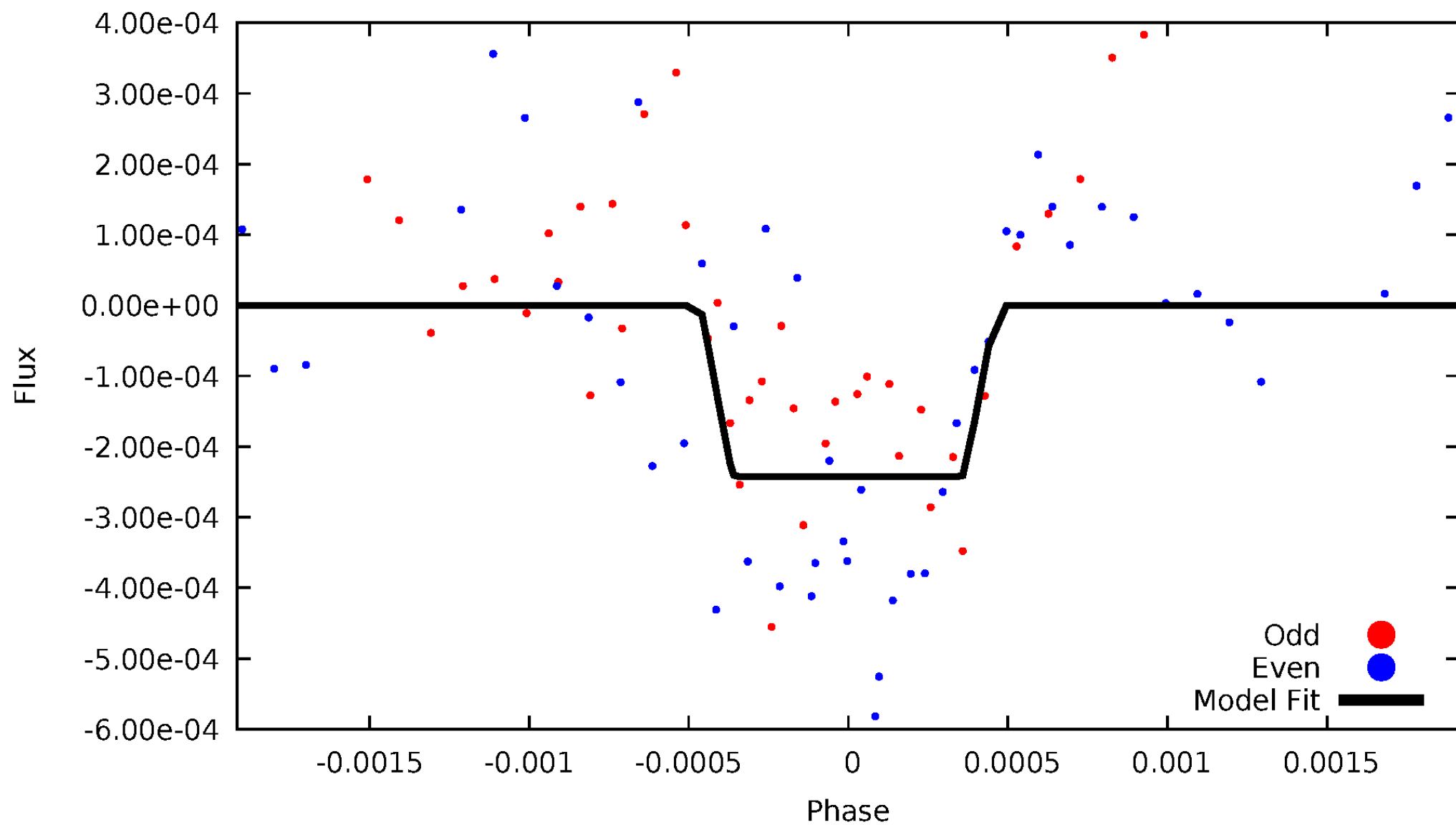
# DV Odd/Even

TCE 009016467-02



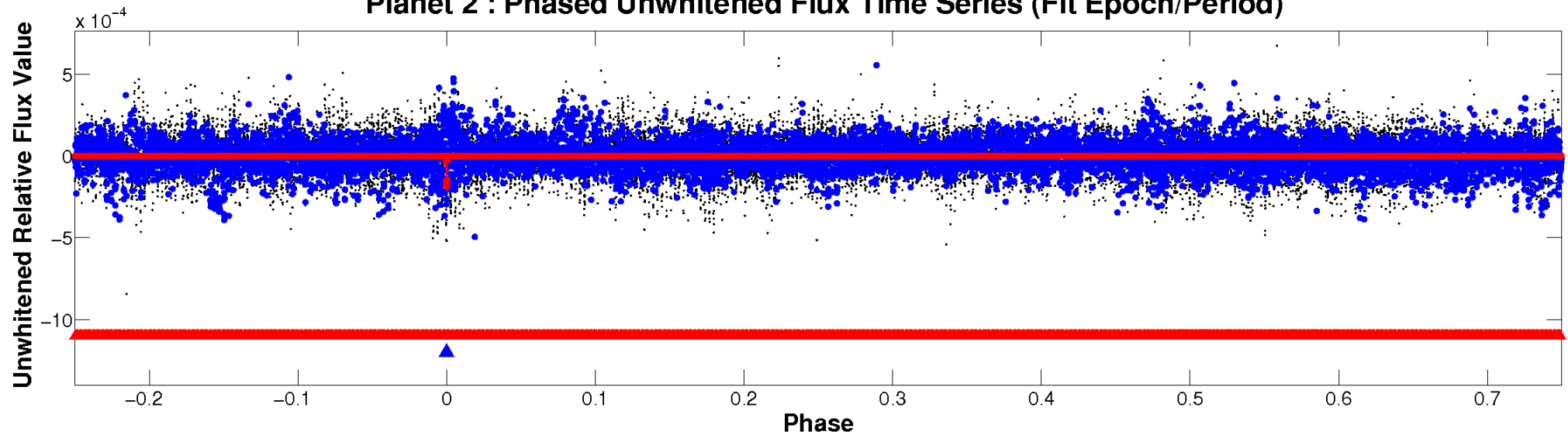
# ALT Odd/Even

TCE 009016467-02

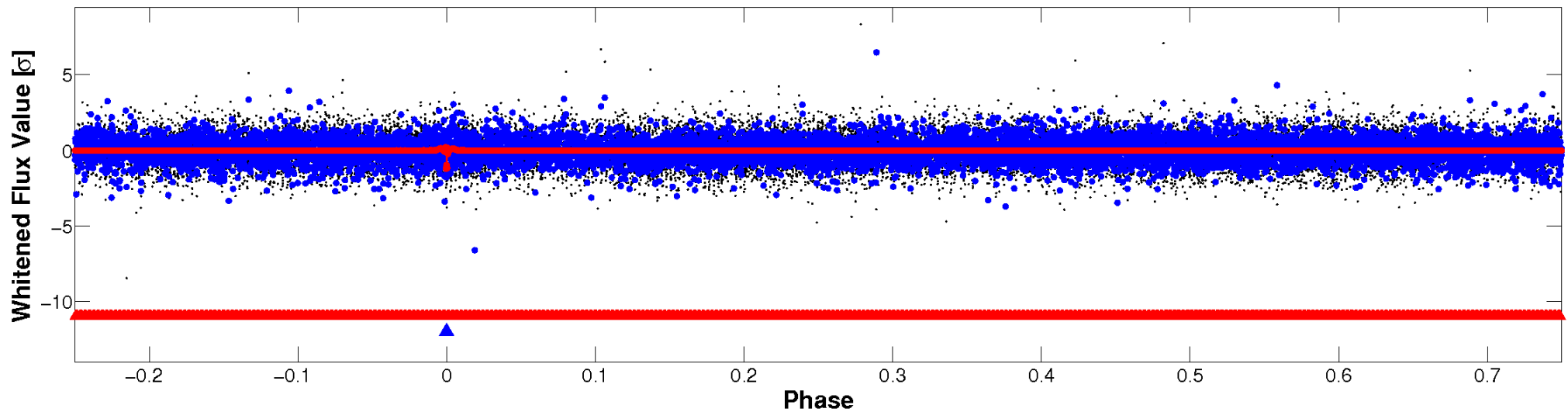


# Non-Whitened Vs. Whitened Light Curve

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

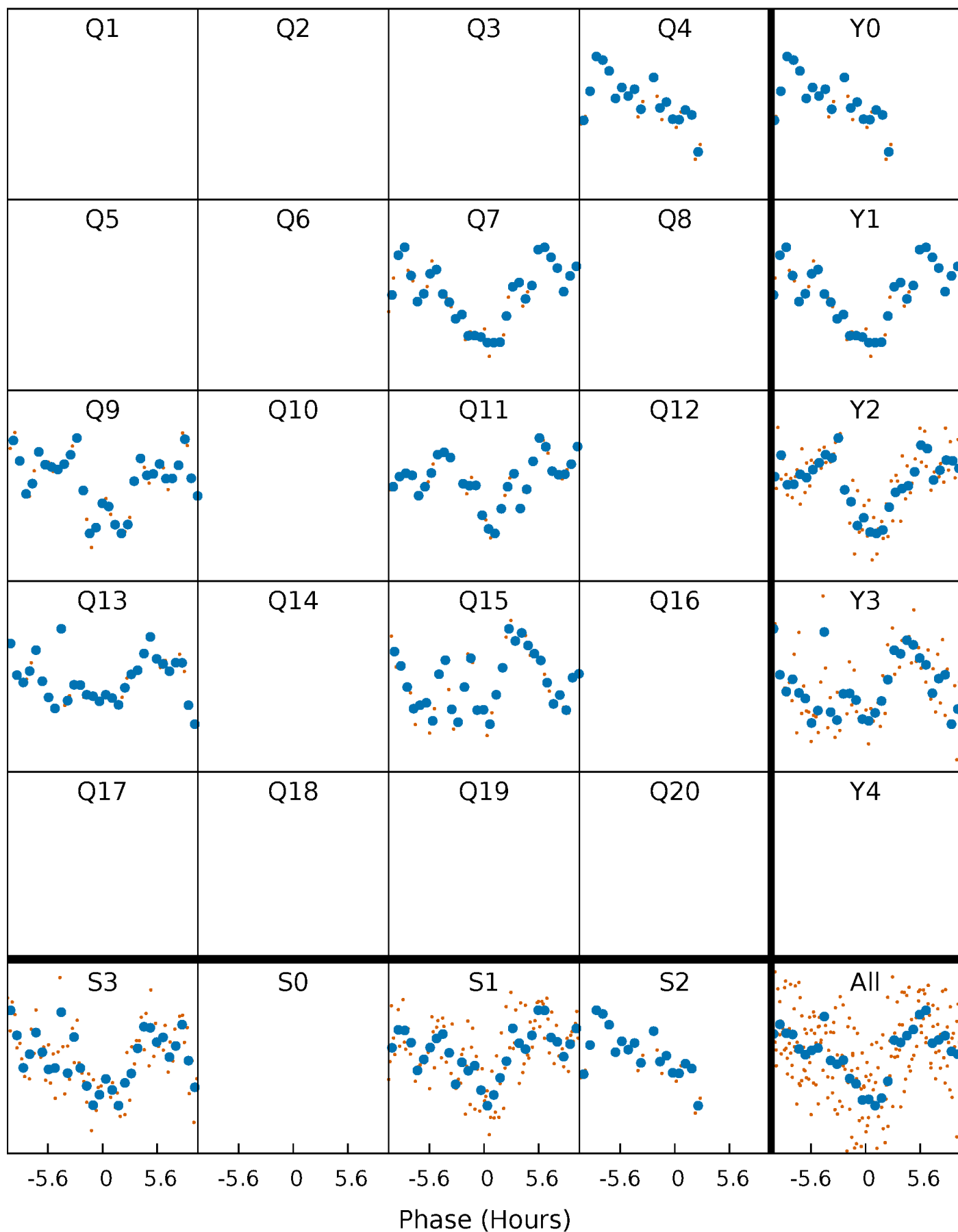


Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



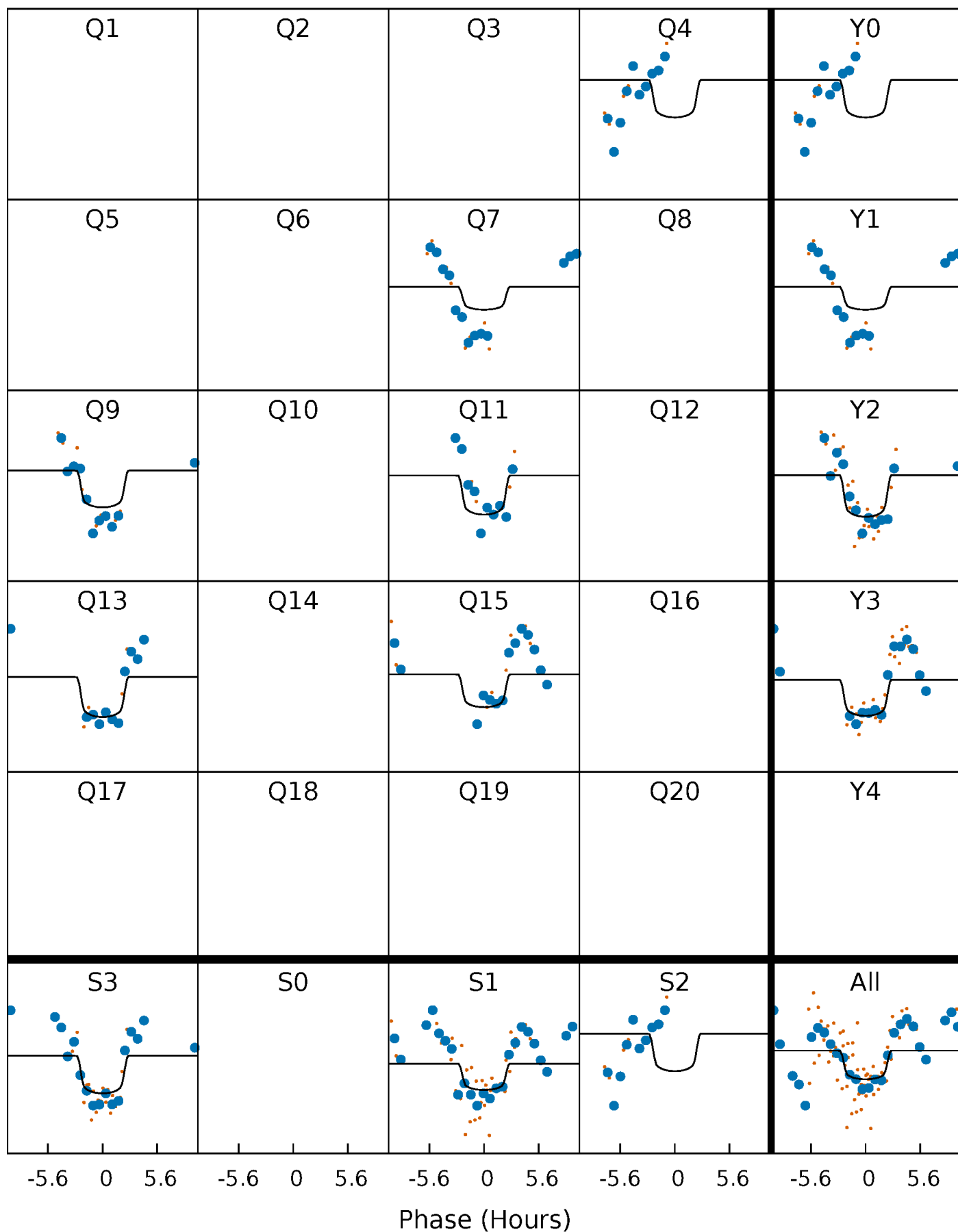
# PDC Quarter-Phased Transit Curves

TCE 009016467-02 P=204.731068 Days  $T_0=237.363621$  (BKJD)



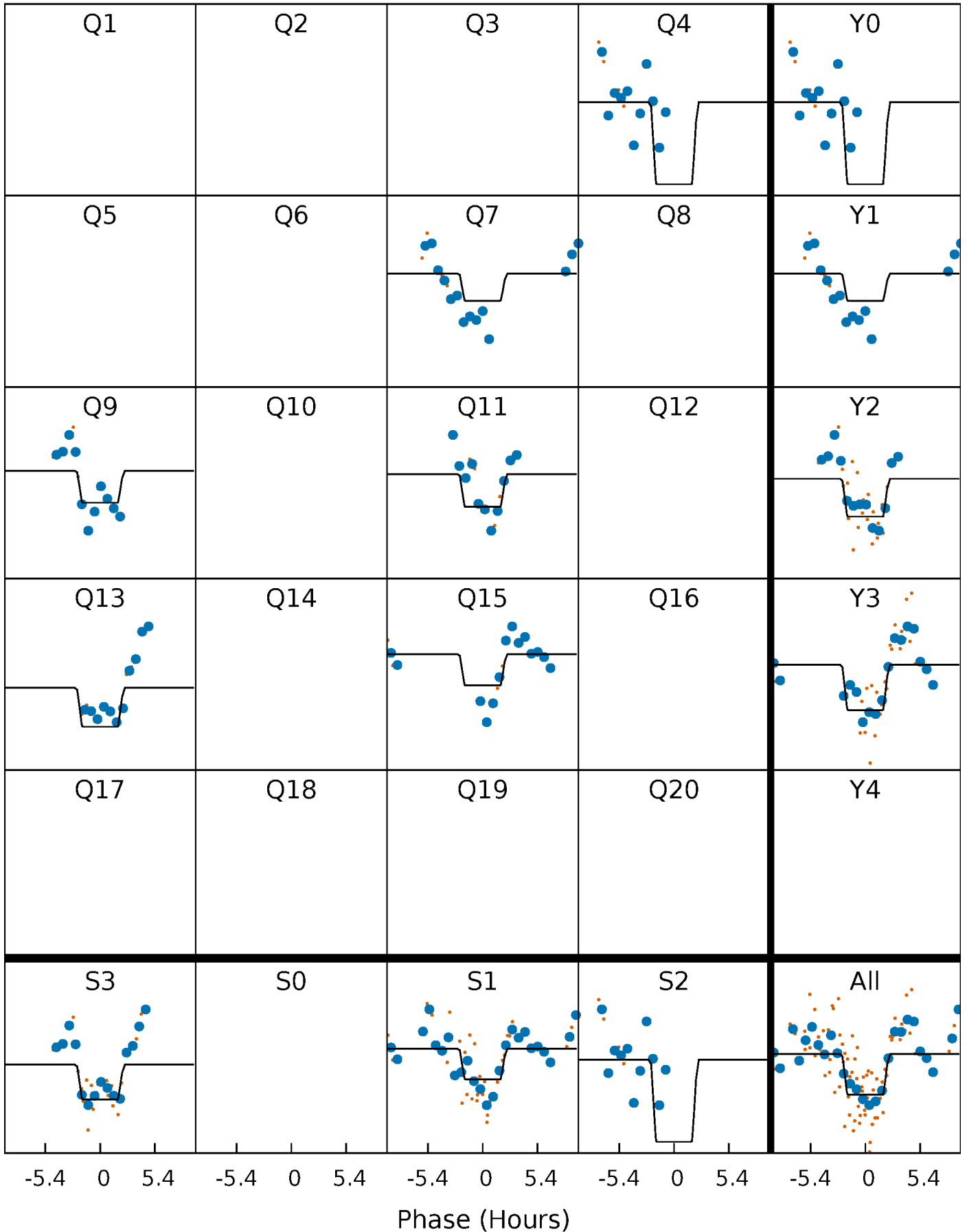
# DV Quarter-Phased Transit Curves

TCE 009016467-02     $P=204.731068$  Days     $T_0=237.363621$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

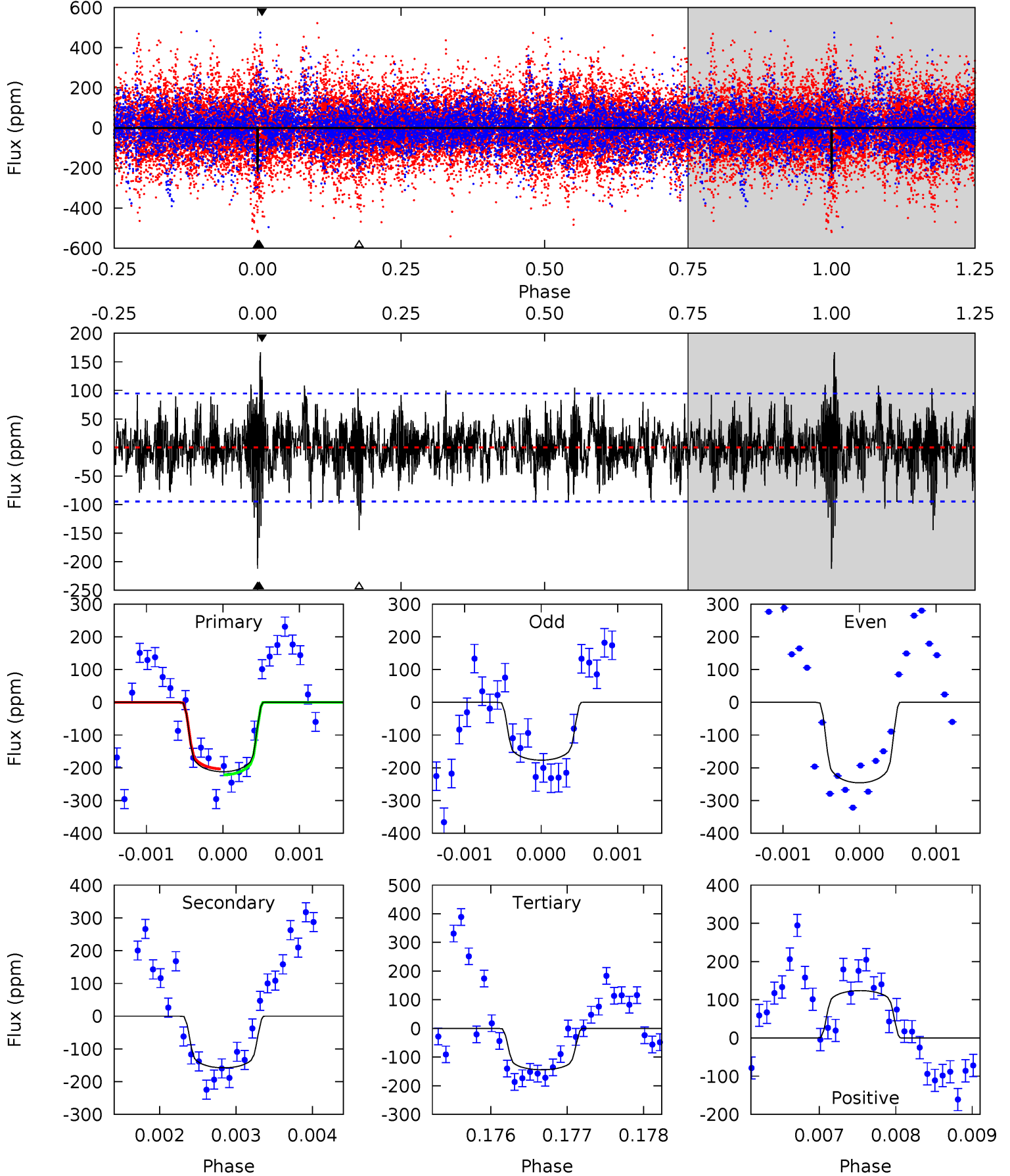
TCE 009016467-02 P=204.728029 Days  $T_0=237.374952$  (BKJD)



# DV Model-Shift Uniqueness Test

009016467-02, P = 204.731068 Days, E = 32.632553 Days

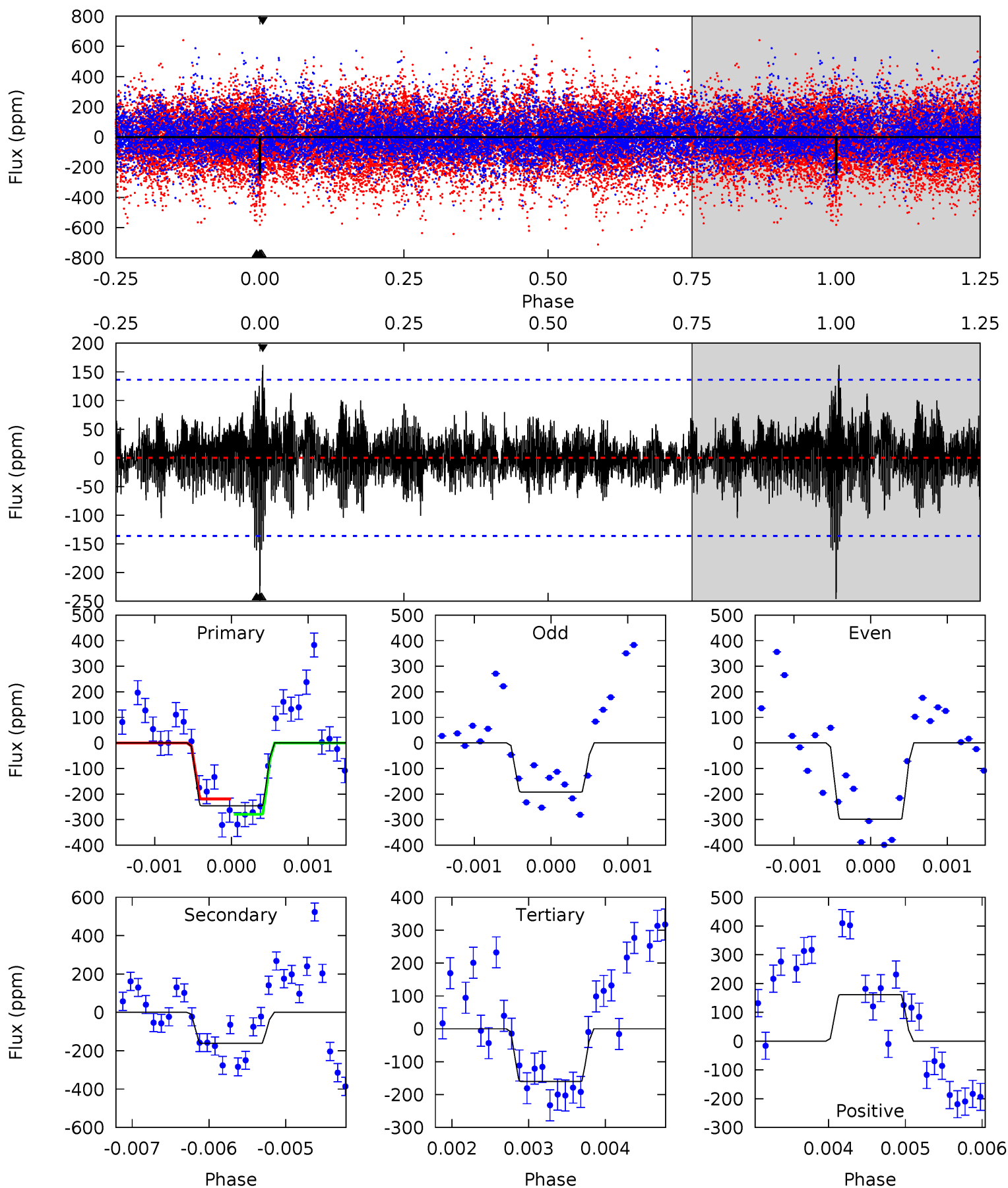
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
12.2	9.08	8.30	7.13	5.45	3.28	1.93	3.91	5.08	0.78	1.95	2.02	1.02	0.44	0.52



# Alt Model-Shift Uniqueness Test

009016467-02, P = 204.728029 Days, E = 32.646923 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
9.89	6.49	6.44	6.50	5.47	3.33	1.36	3.45	3.39	0.05	-0.01	2.13	1.13	0.40	1.20



### Stellar Parameters For KIC 009016467

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$\rho_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$7237^{+201}_{-277}$	$4.059^{+0.175}_{-0.175}$	$-0.060^{+0.250}_{-0.350}$	$1.938^{+0.576}_{-0.471}$	$1.567^{+0.212}_{-0.259}$	$0.303^{+0.326}_{-0.134}$
	+3%/-4%	+4%/-4%	+417%/-583%	+30%/-24%	+14%/-17%	+108%/-44%
Source	PHO1	KIC0	KIC0	DSEP		

KIC = Kepler Input Catalog; PHO = Photometry; SPE = Spectroscopy; AST = Asteroseismology  
 TRA = Transits; DESP = Dartmouth Models; MULT = Multiple Models

### Secondary Eclipse Parameters for KIC 009016467-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-158 \pm 17$	$3.03^{+0.97}_{-0.76}$	$695^{+53}_{-49}$	$6636^{+1157}_{-771}$	$5764^{+4820}_{-2430}$
Alt.	$-161 \pm 25$	$3.22^{+1.05}_{-0.88}$	$695^{+52}_{-48}$	$6538^{+1153}_{-807}$	$5366^{+4629}_{-2351}$

$T_{\text{max}}$  = 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

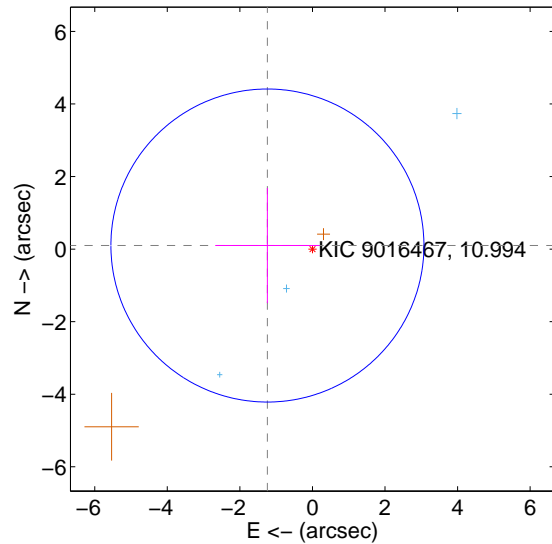
Supplemental centroid analysis for 009016467-02. **Kepler magnitude: 10.99.** Transit SNR 7.17

**There are 3 quarters with good PRF difference image offsets**

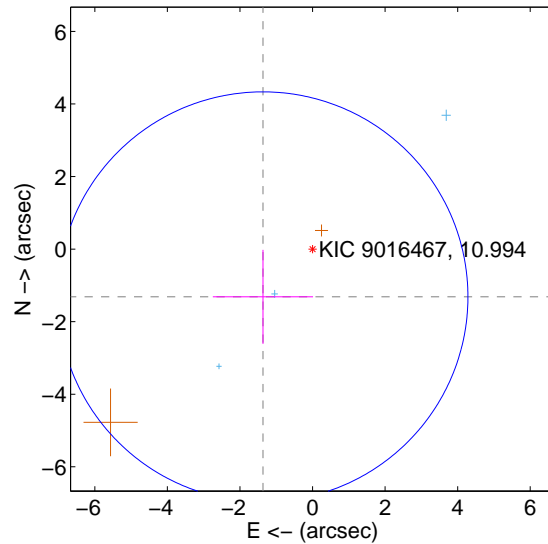
The direct PRF centroid is offset from the target star catalog position by about 0.12 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.245 \pm 1.438$	0.87	$1.241 \pm 1.437$	$0.098 \pm 1.587$
PRF-fit source offset from KIC position	$1.897 \pm 1.883$	1.01	$1.367 \pm 1.381$	$-1.316 \pm 1.297$
photometric centroid source offset	$1.18 \pm 0.80$	1.48	$0.85 \pm 0.74$	$-0.81 \pm 0.86$

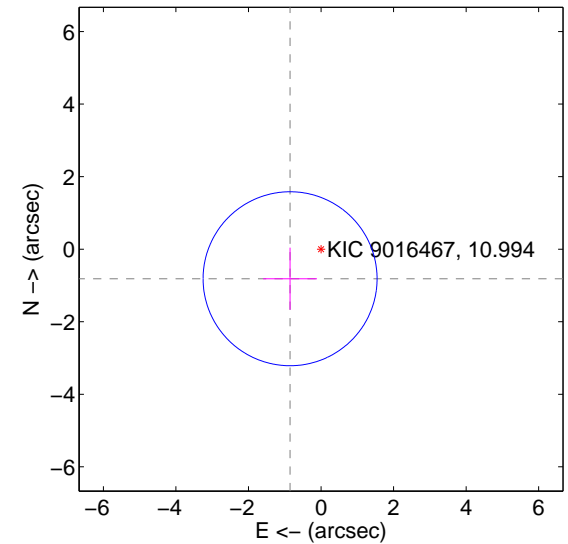
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

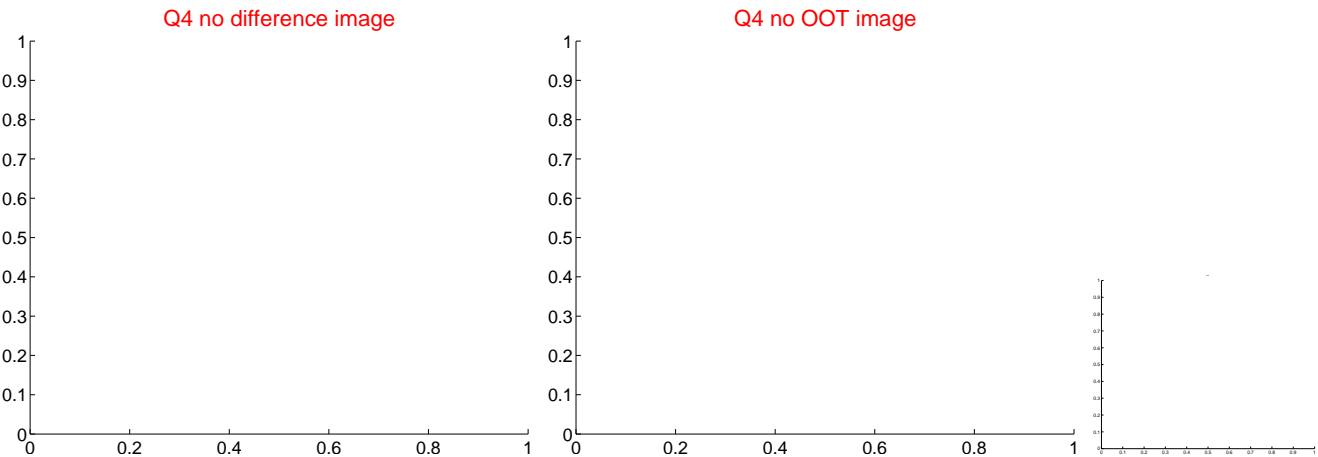
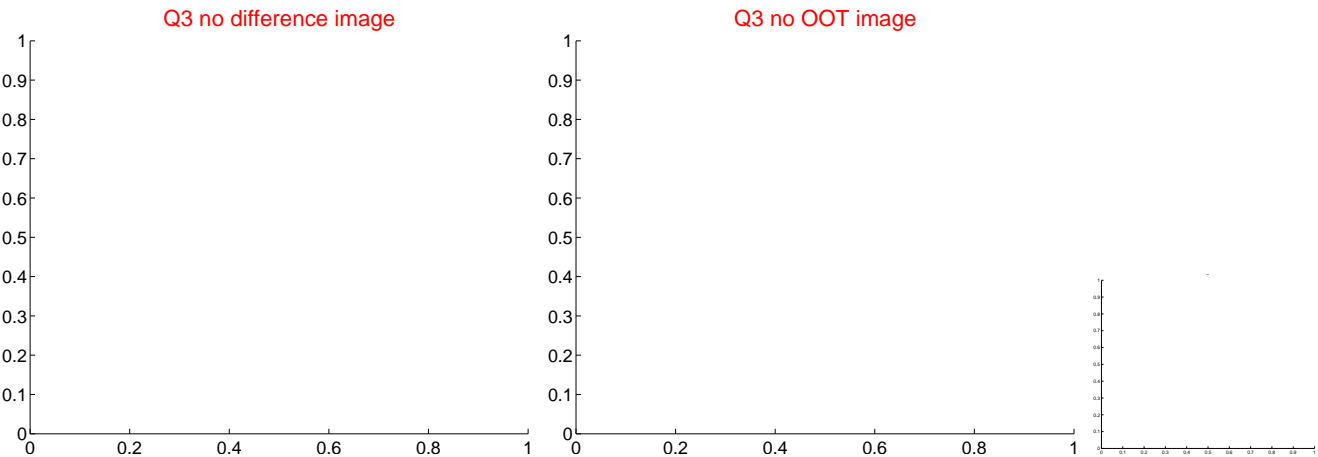
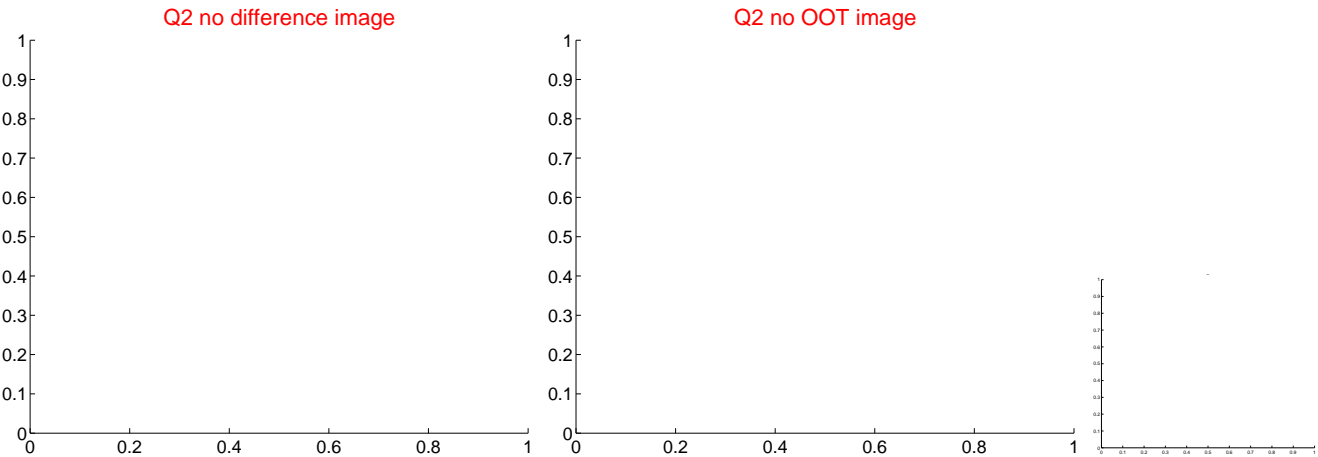
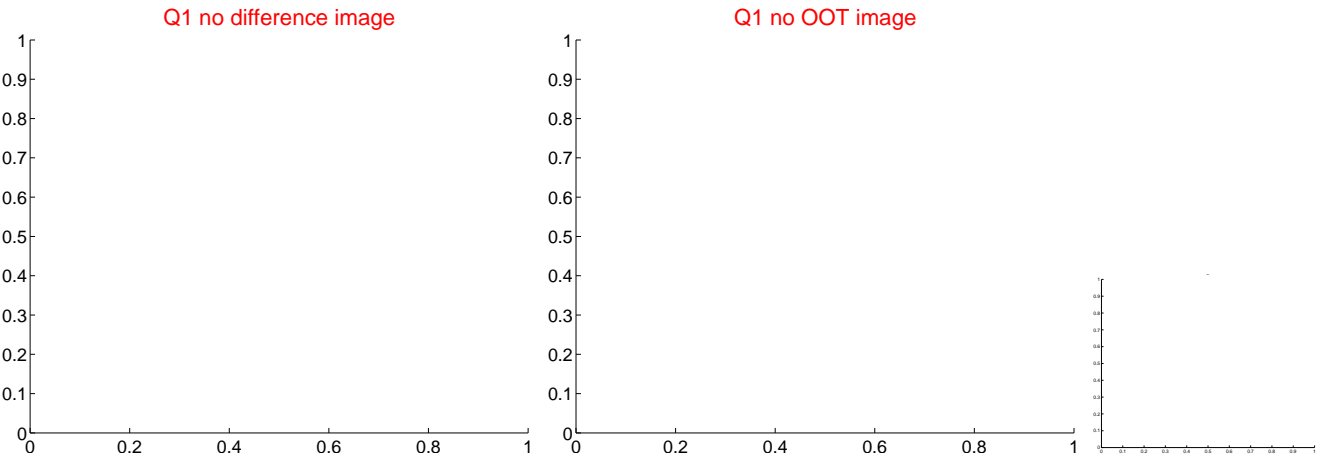


offset from photometric centroids



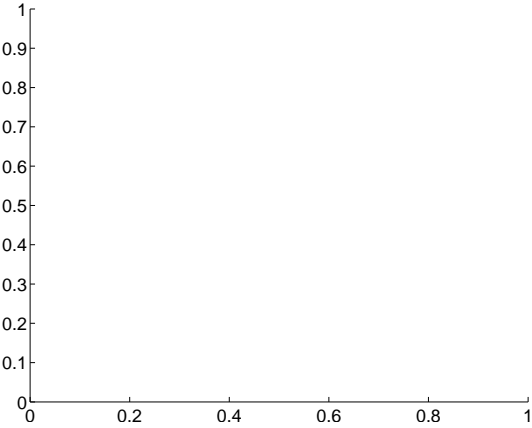
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

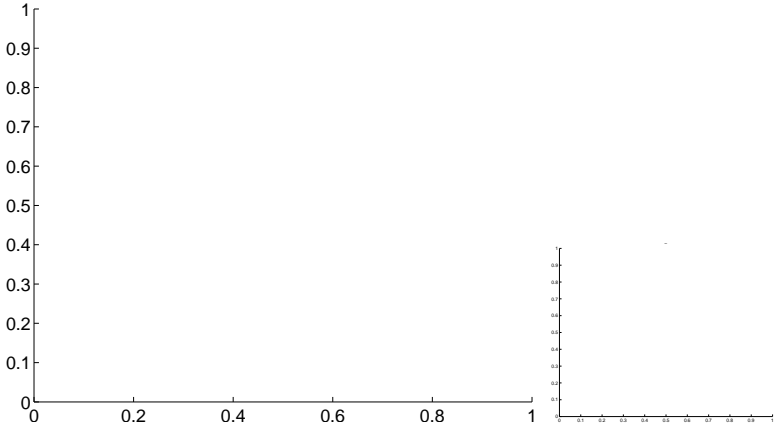


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

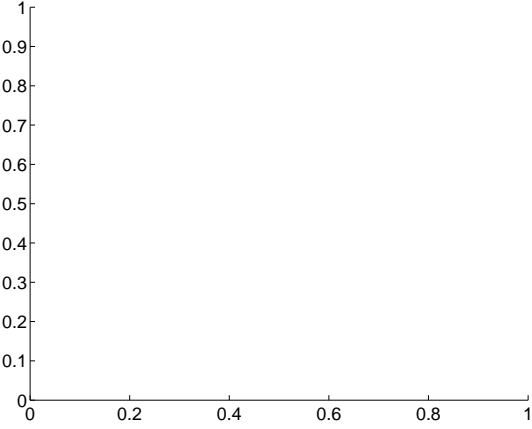
Q5 no difference image



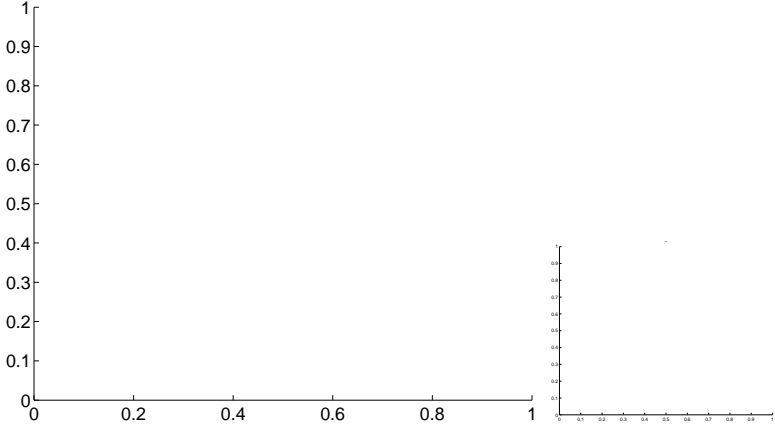
Q5 no OOT image



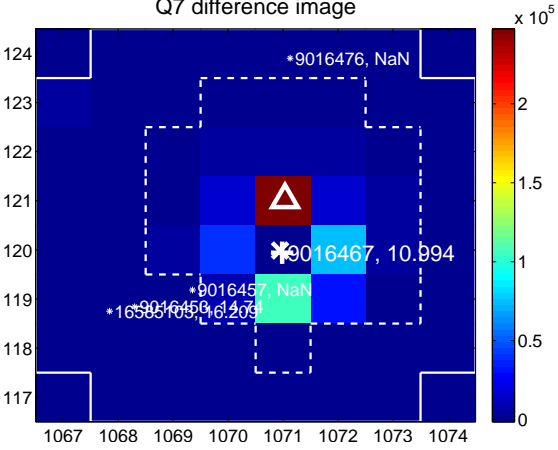
Q6 no difference image



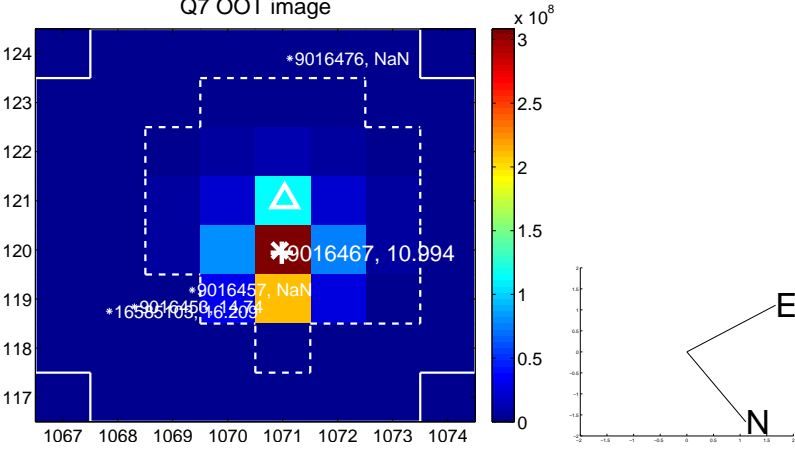
Q6 no OOT image



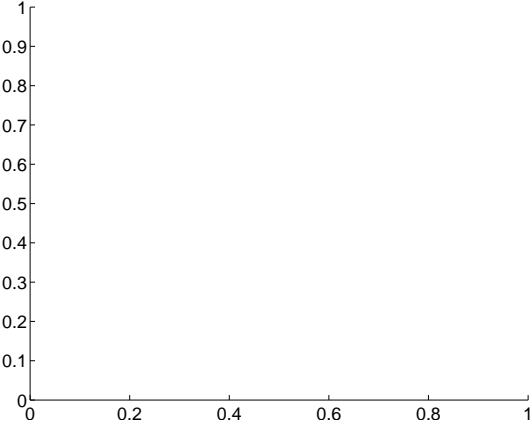
Q7 difference image



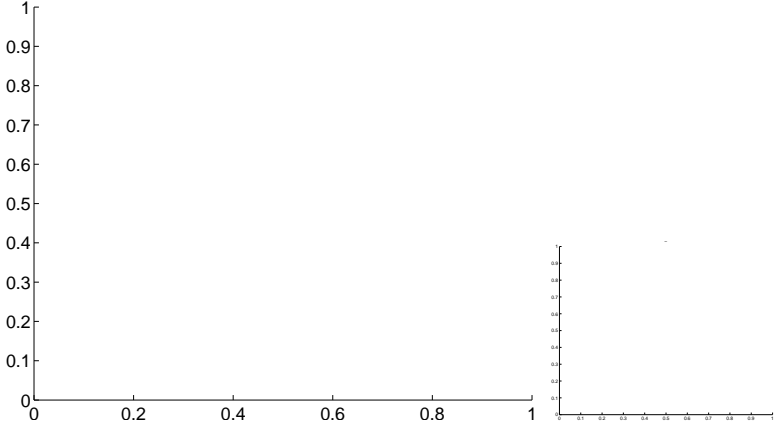
Q7 OOT image



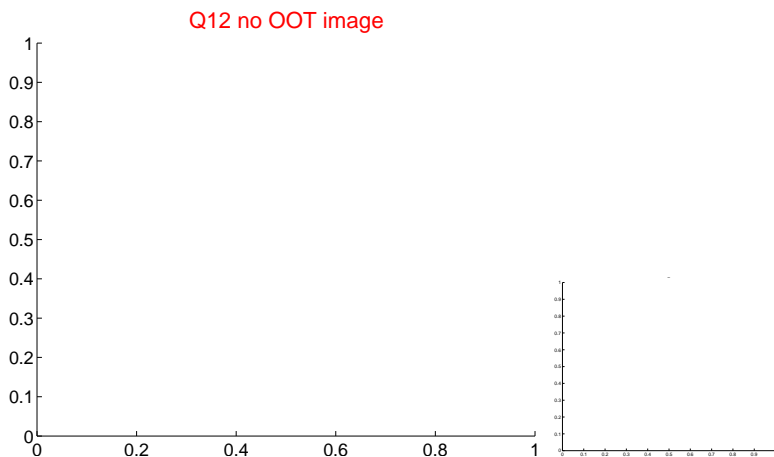
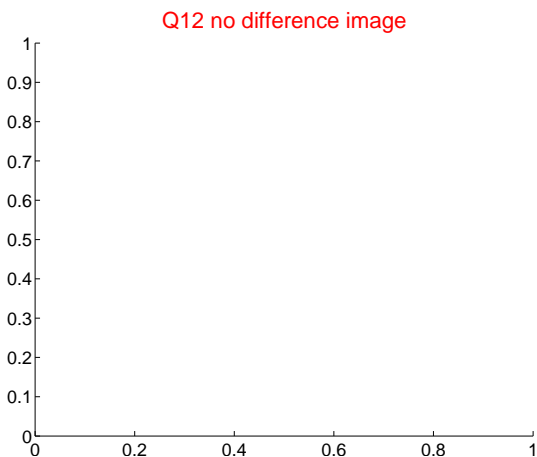
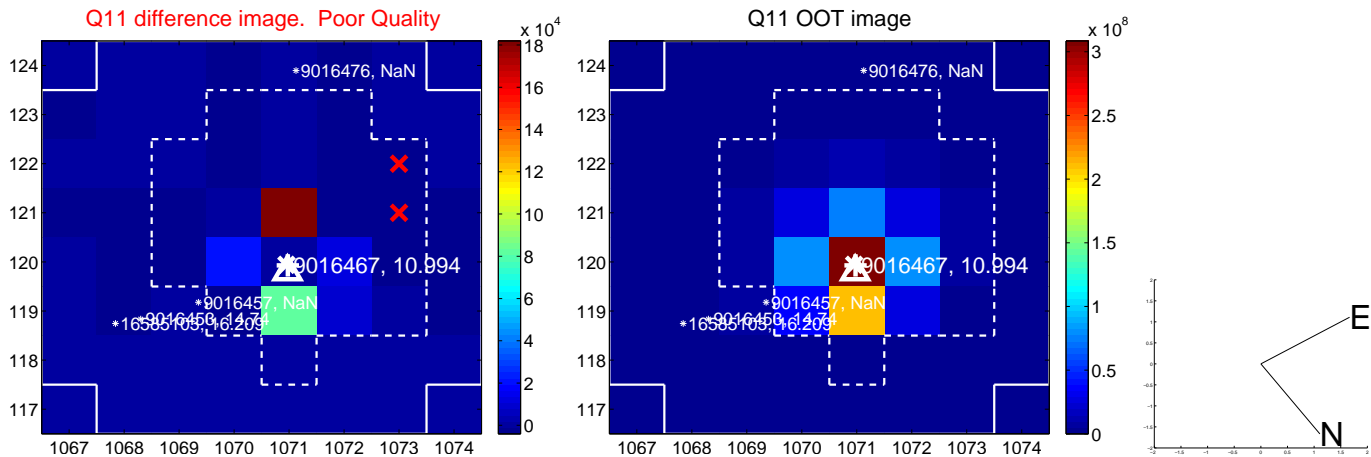
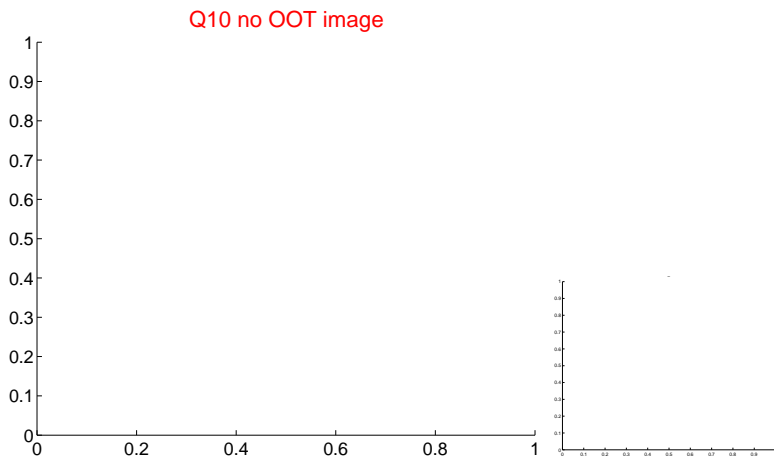
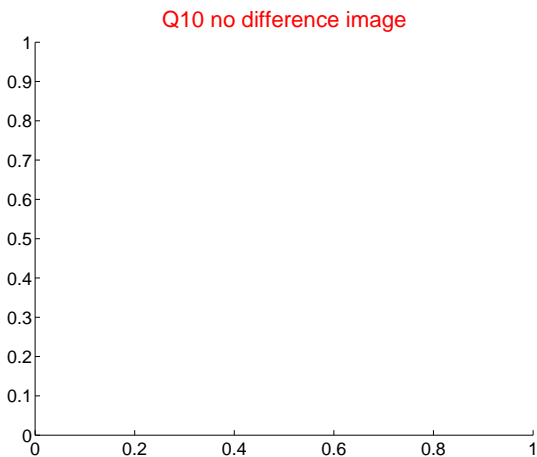
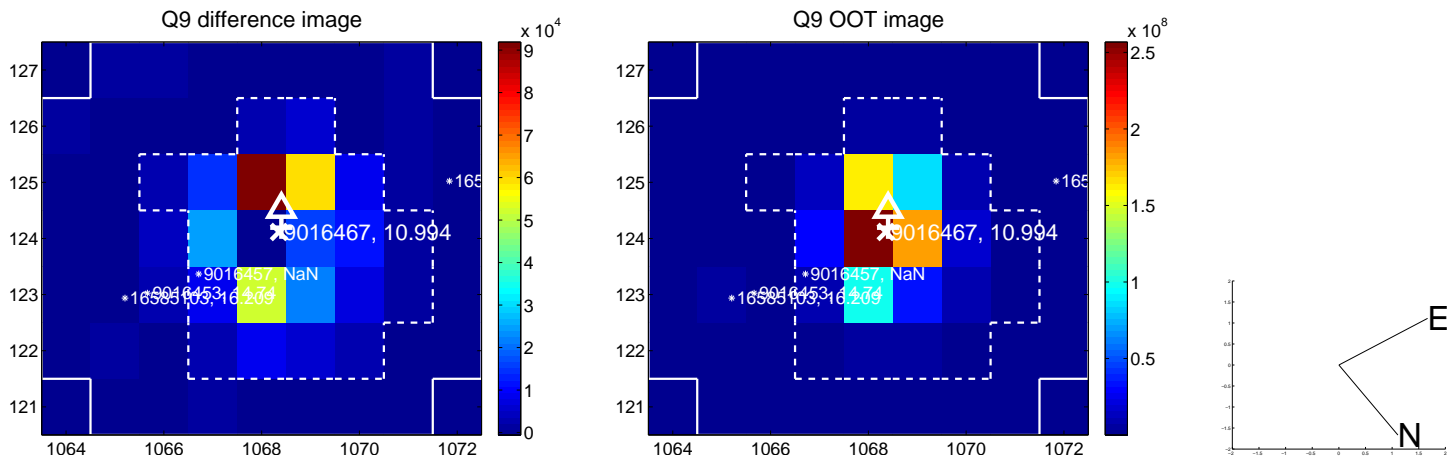
Q8 no difference image



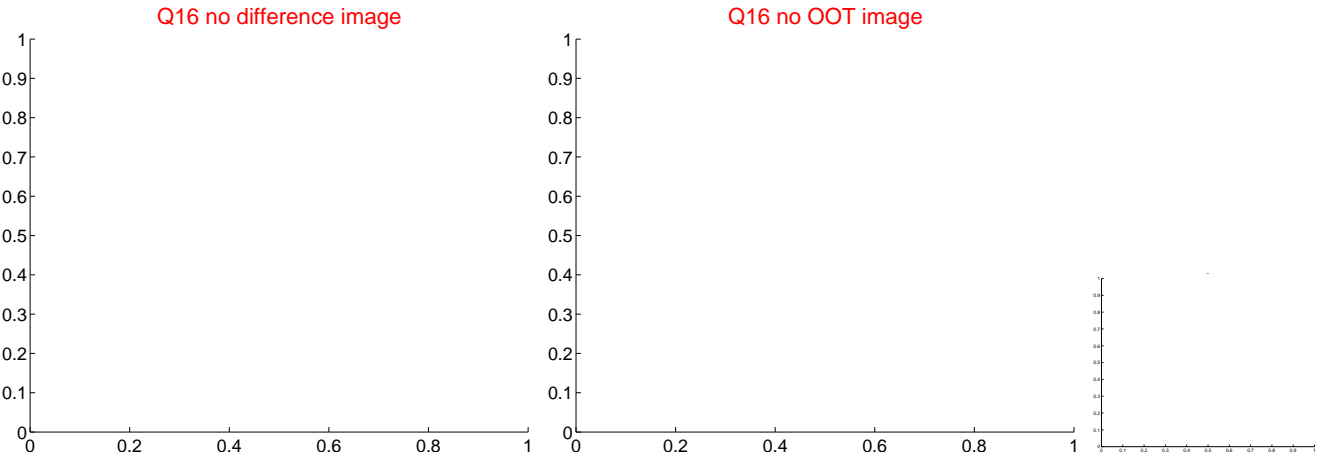
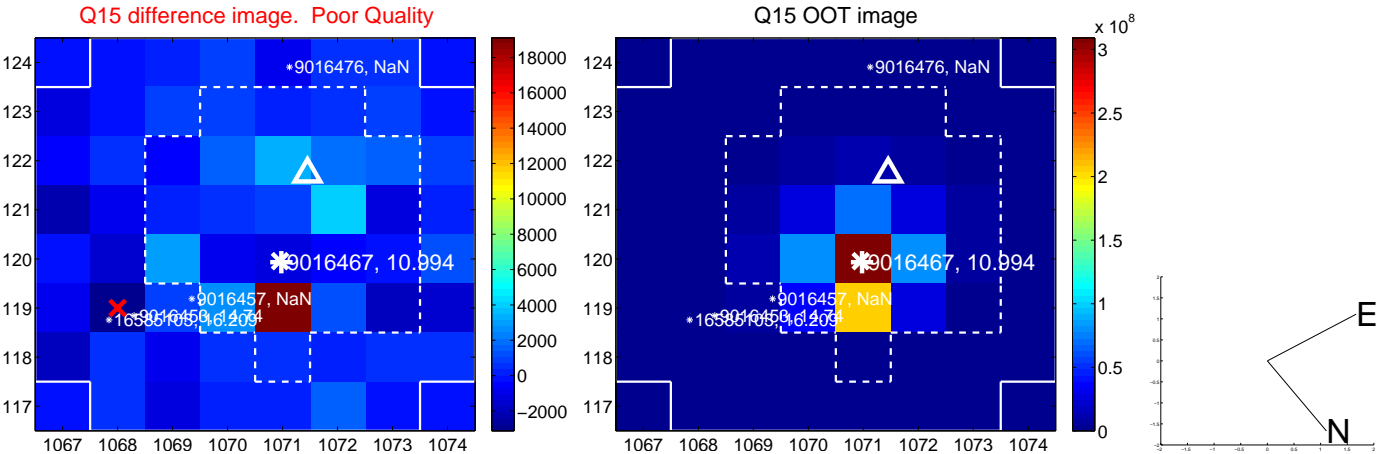
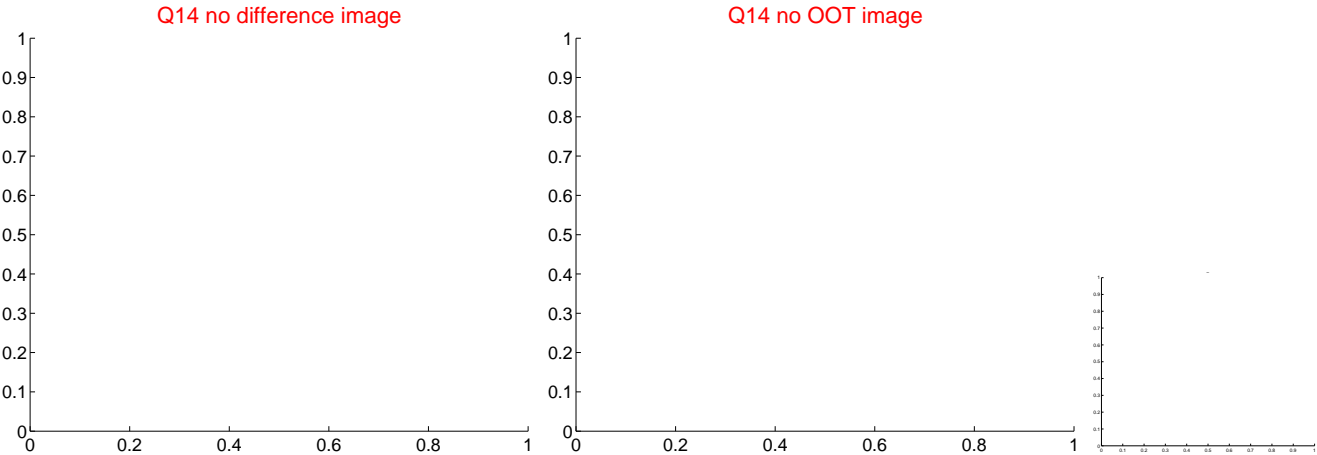
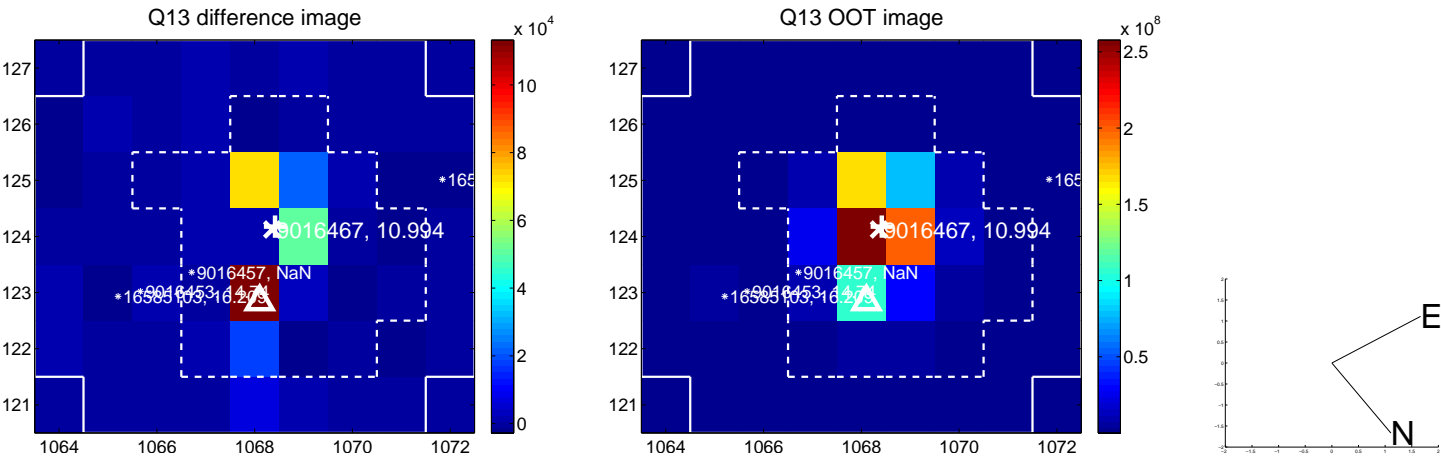
Q8 no OOT image



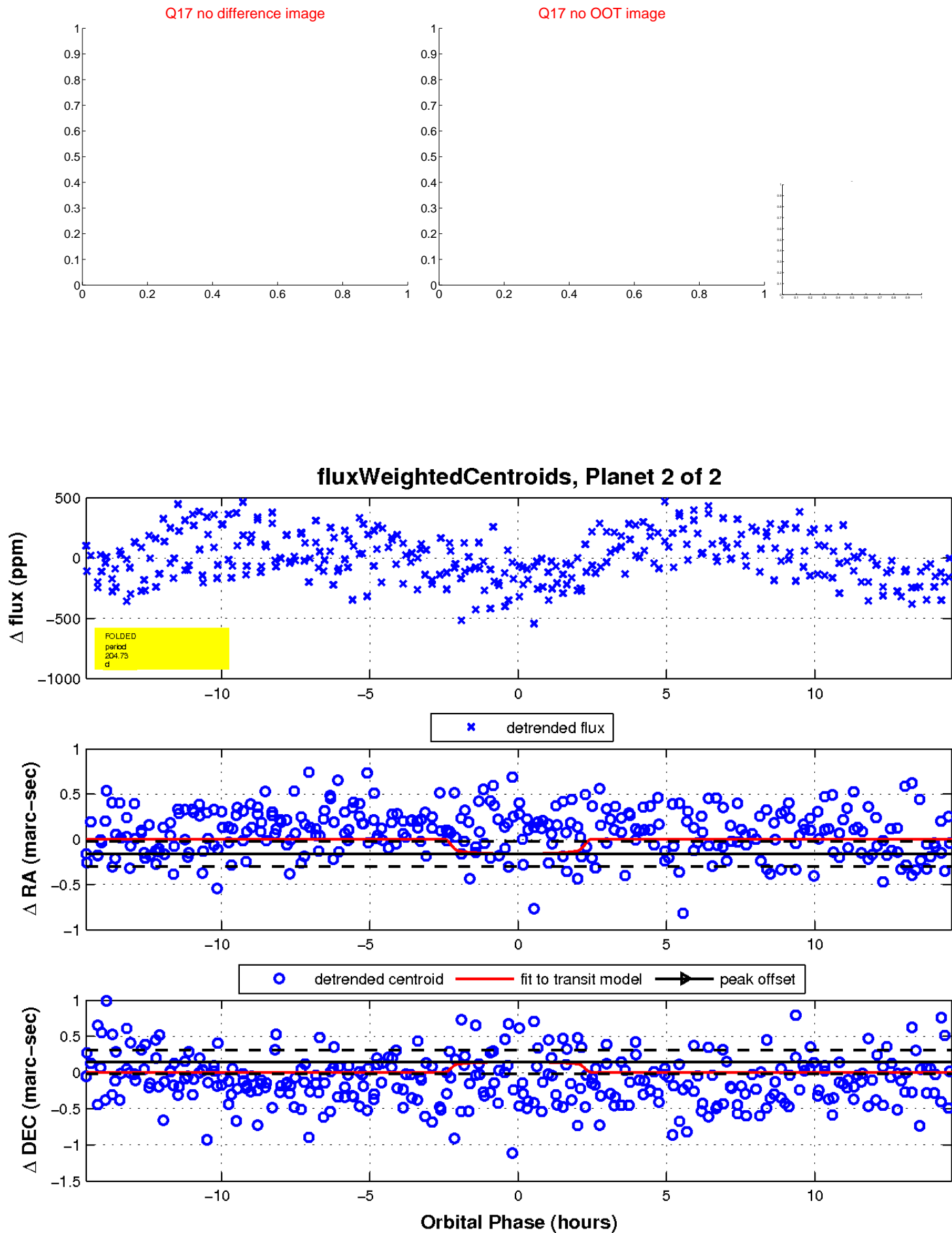
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



white ×: KIC target position; +: OOT centroid; △: difference centroid. red ×: large negative pixel value.



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



UKIRT Image

Declination

