

# KIC 009967009

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009967009-01	OBS	3462.01	12.432663	142.104730	212.3	8.095	9.4	9.5	1.23	5480	2.01	117.39
009967009-02	OBS	3462.02	30.989654	141.446515	312.3	10.111	9.2	9.9	1.23	5480	2.28	34.73

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009967009-01	OBS	PC	0.84	0	0	0	0	NO_COMMENT
009967009-02	OBS	PC	0.90	0	0	0	0	NO_COMMENT

**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 009967009-01

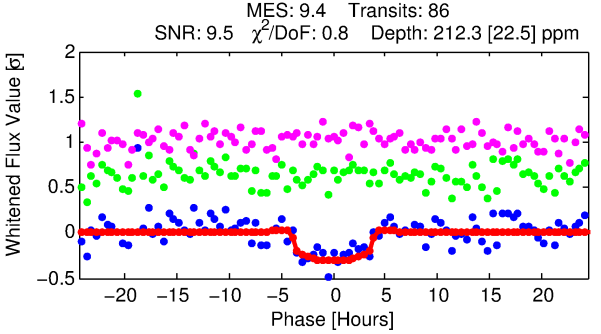
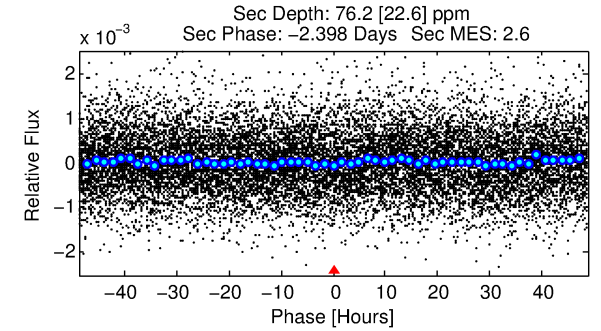
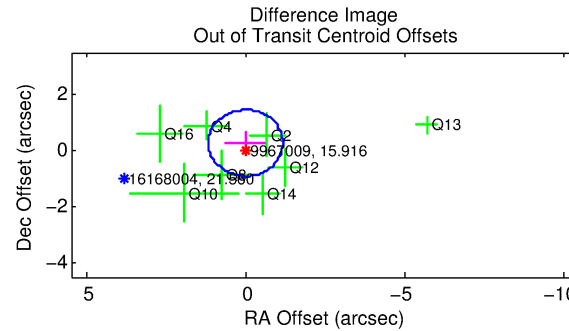
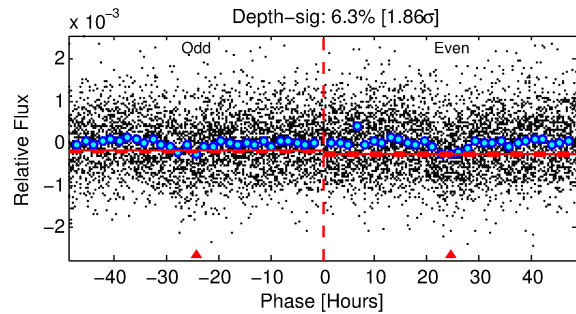
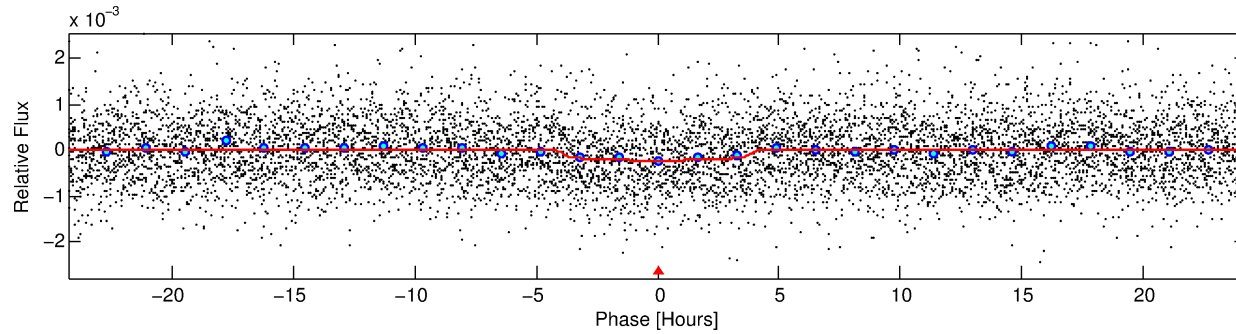
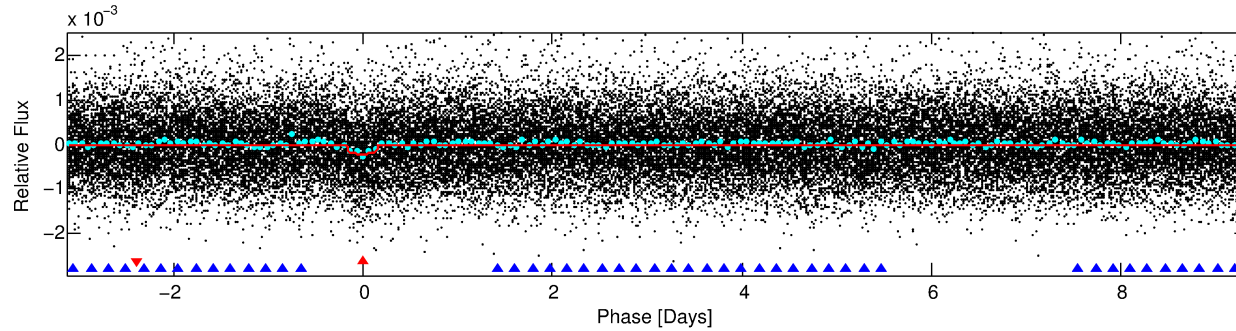
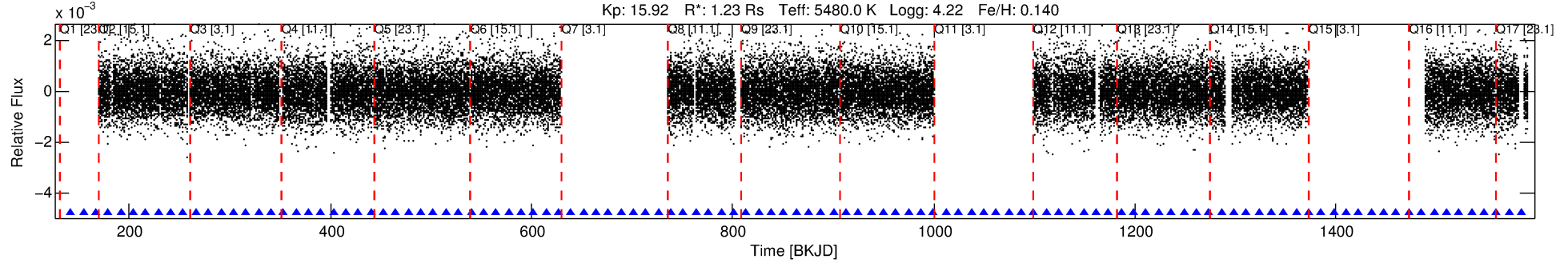
No Significant Match Found

# DV One-Page Summary

KIC: 9967009 Candidate: 1 of 2 Period: 12.433 d

KOI: K03462.01 Corr: 0.983

Kp: 15.92 R\*: 1.23 Rs Teff: 5480.0 K Logg: 4.22 Fe/H: 0.140



## DV Fit Results:

Period = 12.43266 [0.00024] d  
Epoch = 142.1047 [0.0150] BKJD  
Rp/R\* = 0.0150 [0.0084]  
a/R\* = 7.17 [16.32]  
b = 0.81 [0.98]  
Seff = 117.39 [38.91]  
Teq = 839 [70] K  
Rp = 2.01 [1.20] Re  
a = 0.1020 [0.0207] AU  
Ag = 107.86 [129.62] [0.82σ]  
Teff = 4182 [1211] K [2.76σ]

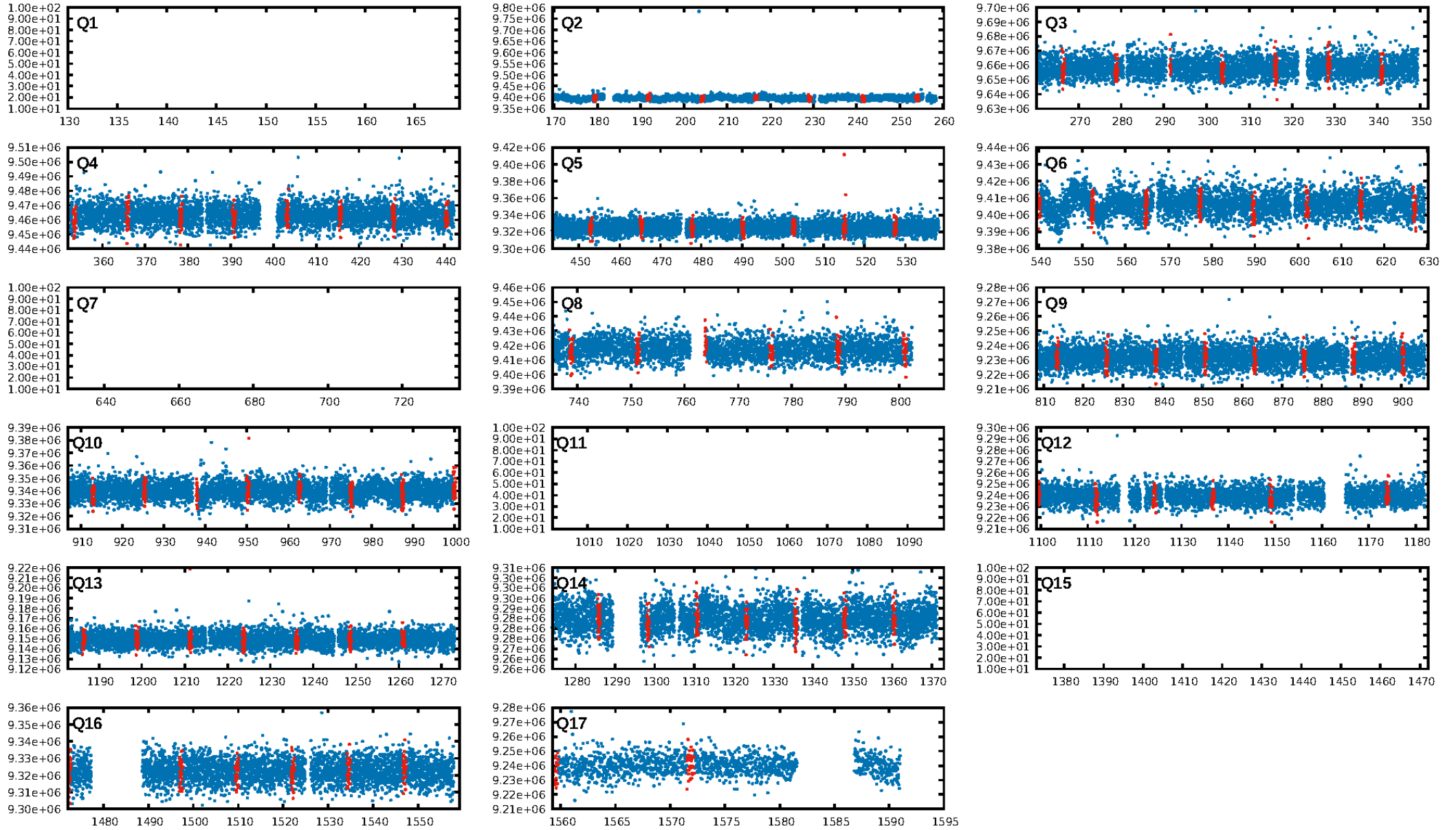
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [34.38σ]  
ModelChiSquare2-sig: 98.1%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 1.40e-19  
RollingBand-fgt: 1.00 [84/84]  
GhostDiagnostic-chr: 1.825  
Centroid-sig: 2.6%  
Centroid-so: 3.236 arcsec [2.31σ]  
OotOffset-rm: 0.271 arcsec [0.69σ]  
KicOffset-rm: 0.501 arcsec [1.40σ]  
OotOffset-st: 3/0/4/1 [8]  
KicOffset-st: 3/0/4/1 [8]  
DiffImageQuality-fgm: 0.25 [2/8]  
DiffImageOverlap-fno: 1.00 [13/13]

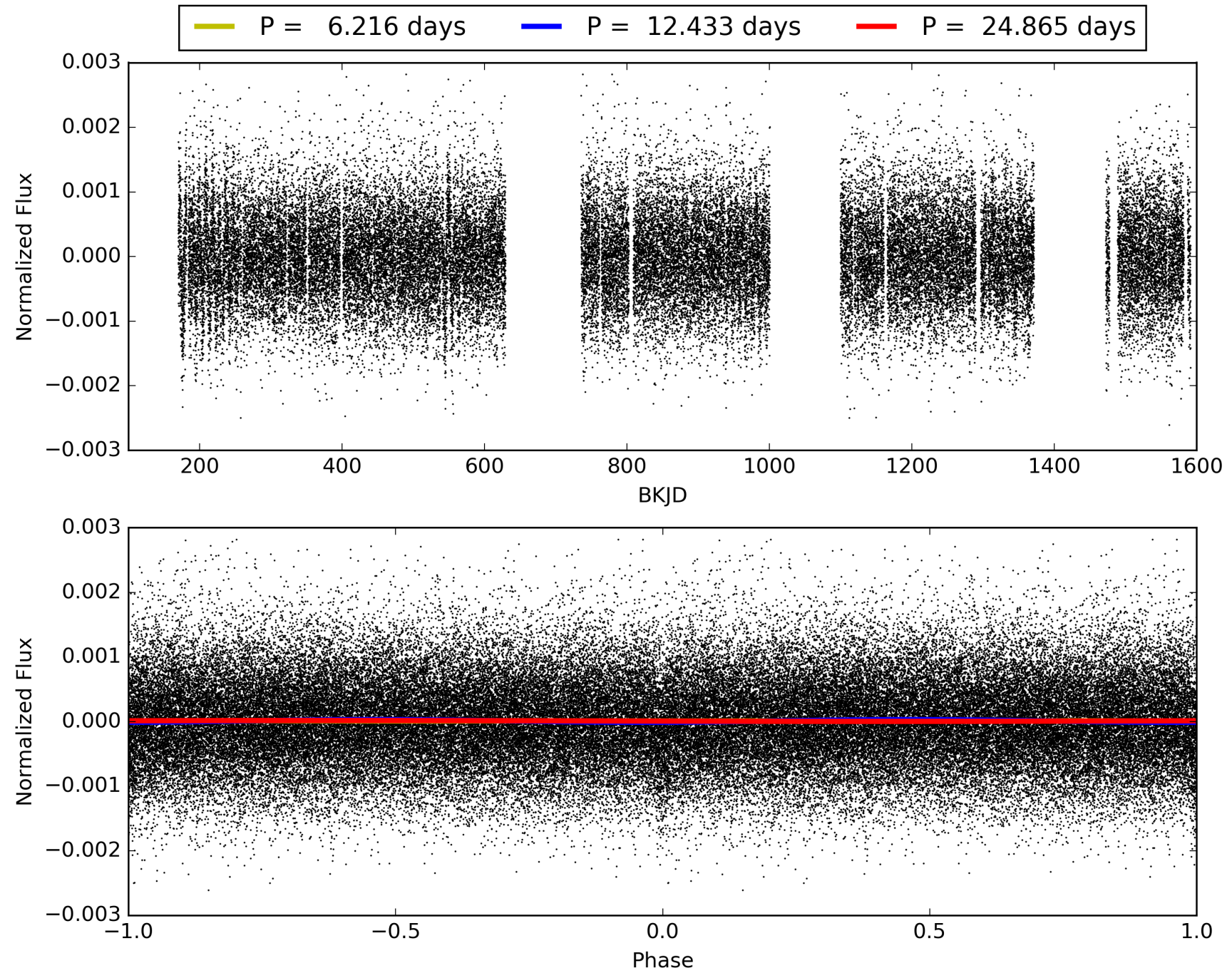
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 12:56:01 Z

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

# TCE 009967009-01, PDC Light Curves

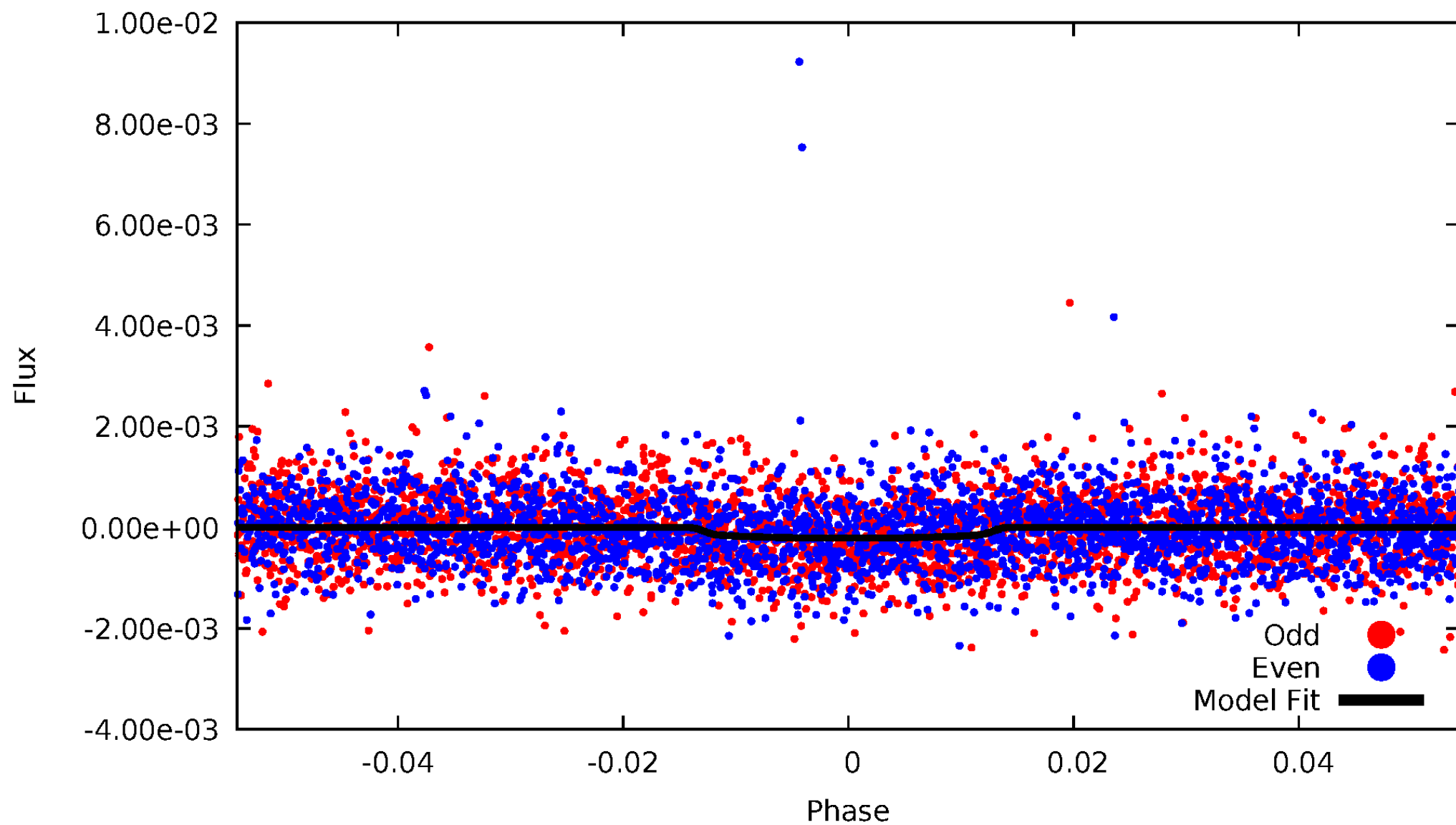


TCE 009967009-01



# DV Odd/Even

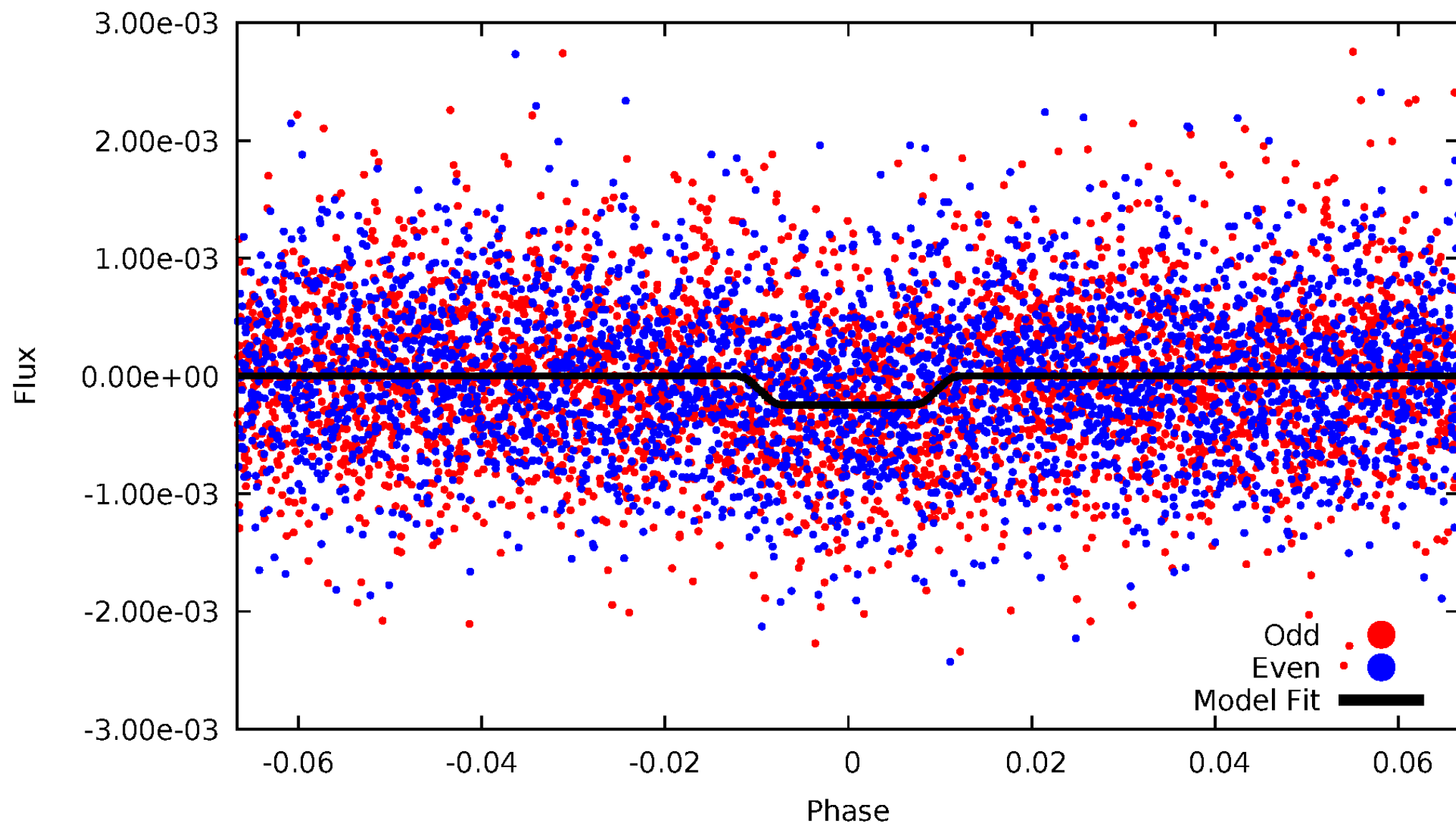
TCE 009967009-01



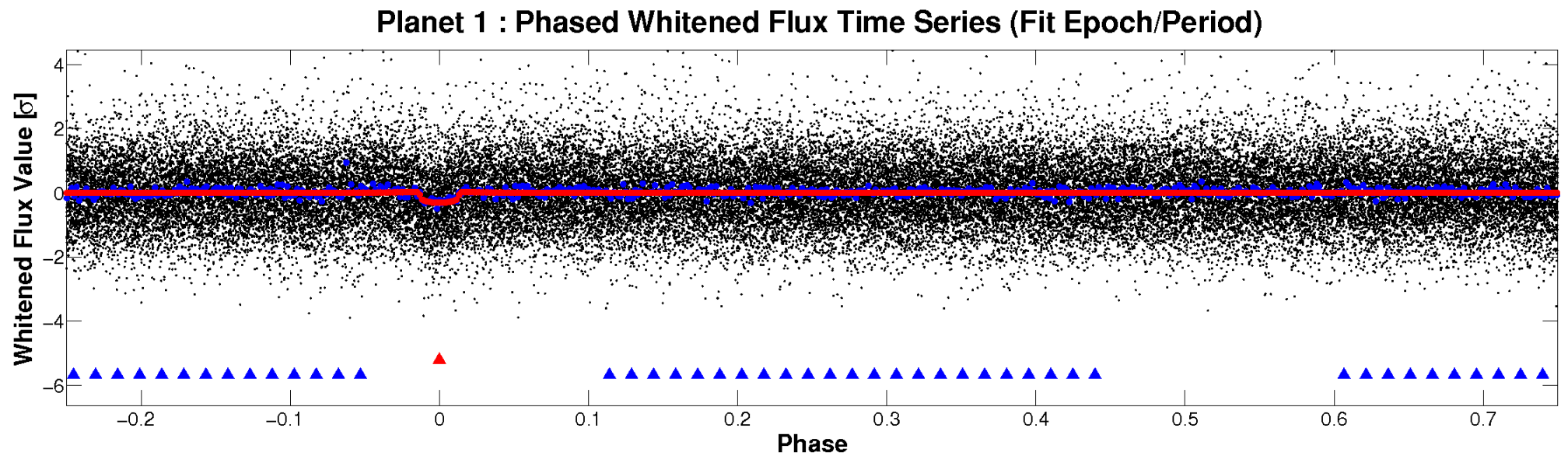
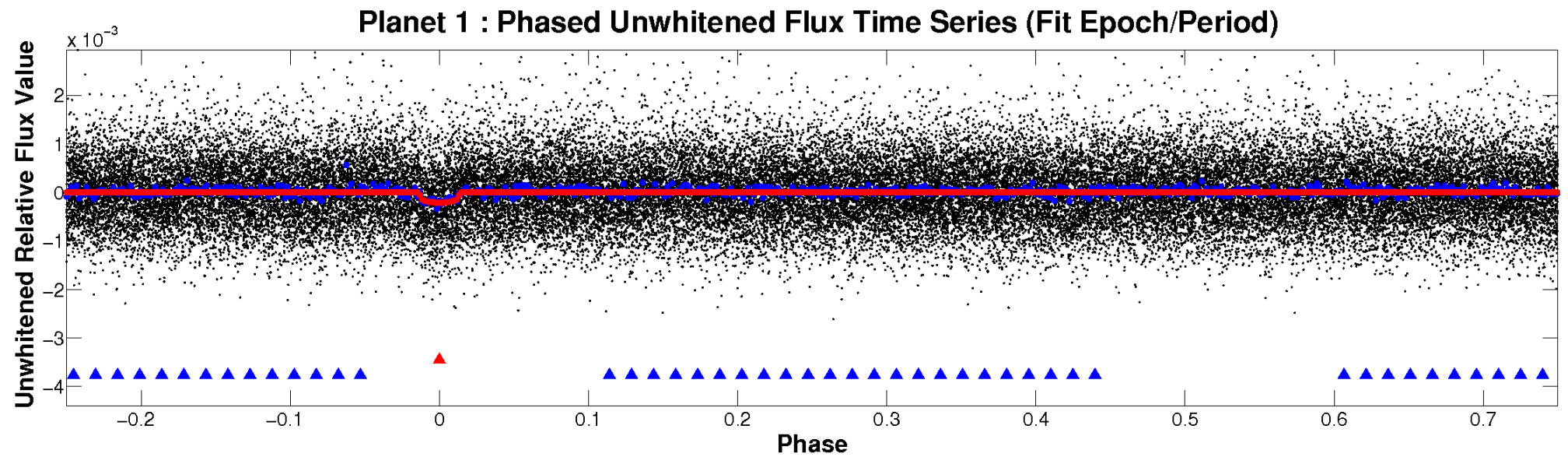


# ALT Odd/Even

TCE 009967009-01

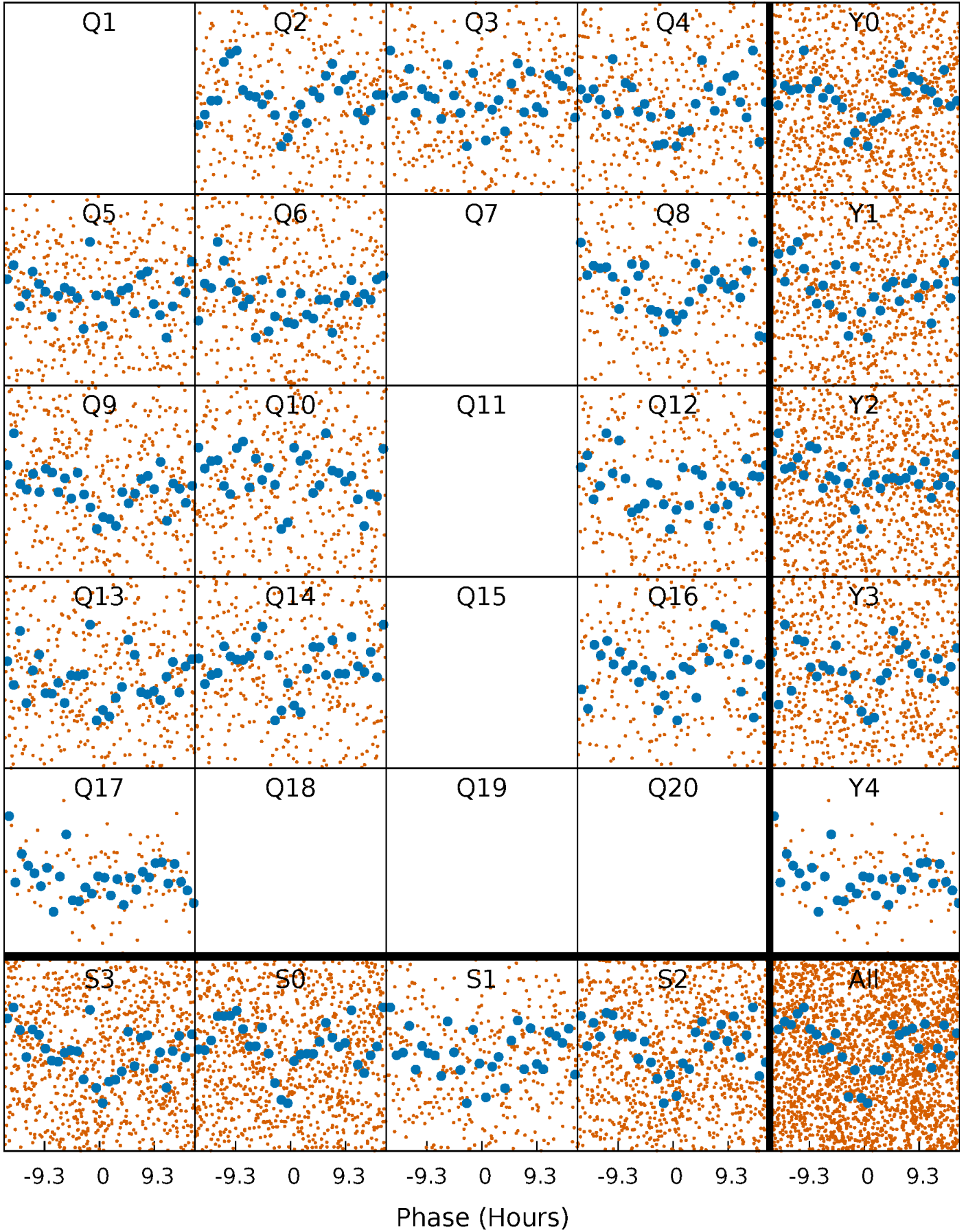


# Non-Whitened Vs. Whitened Light Curve



# PDC Quarter-Phased Transit Curves

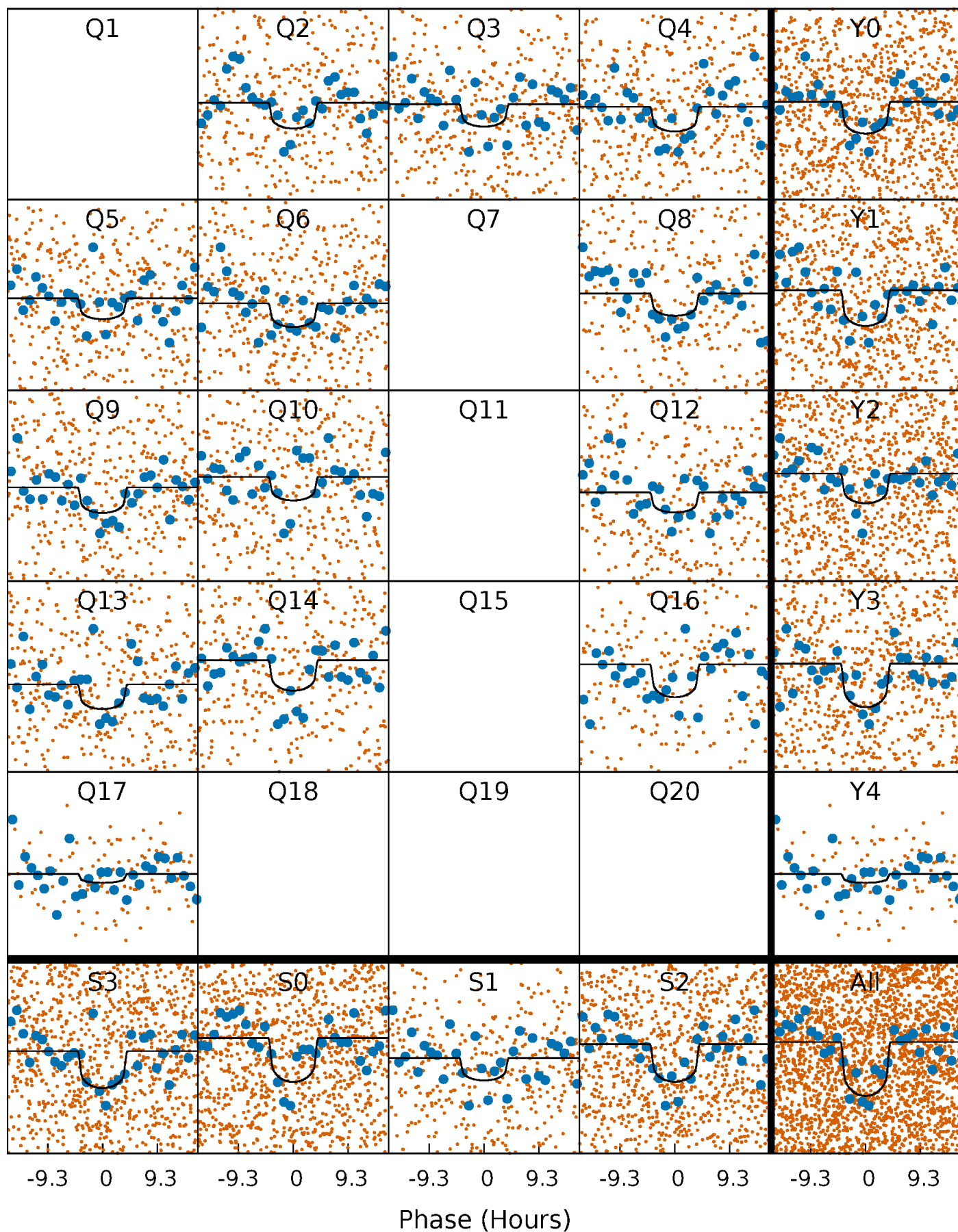
TCE 009967009-01 P= 12.432663 Days  $T_0=142.104730$  (BKJD)





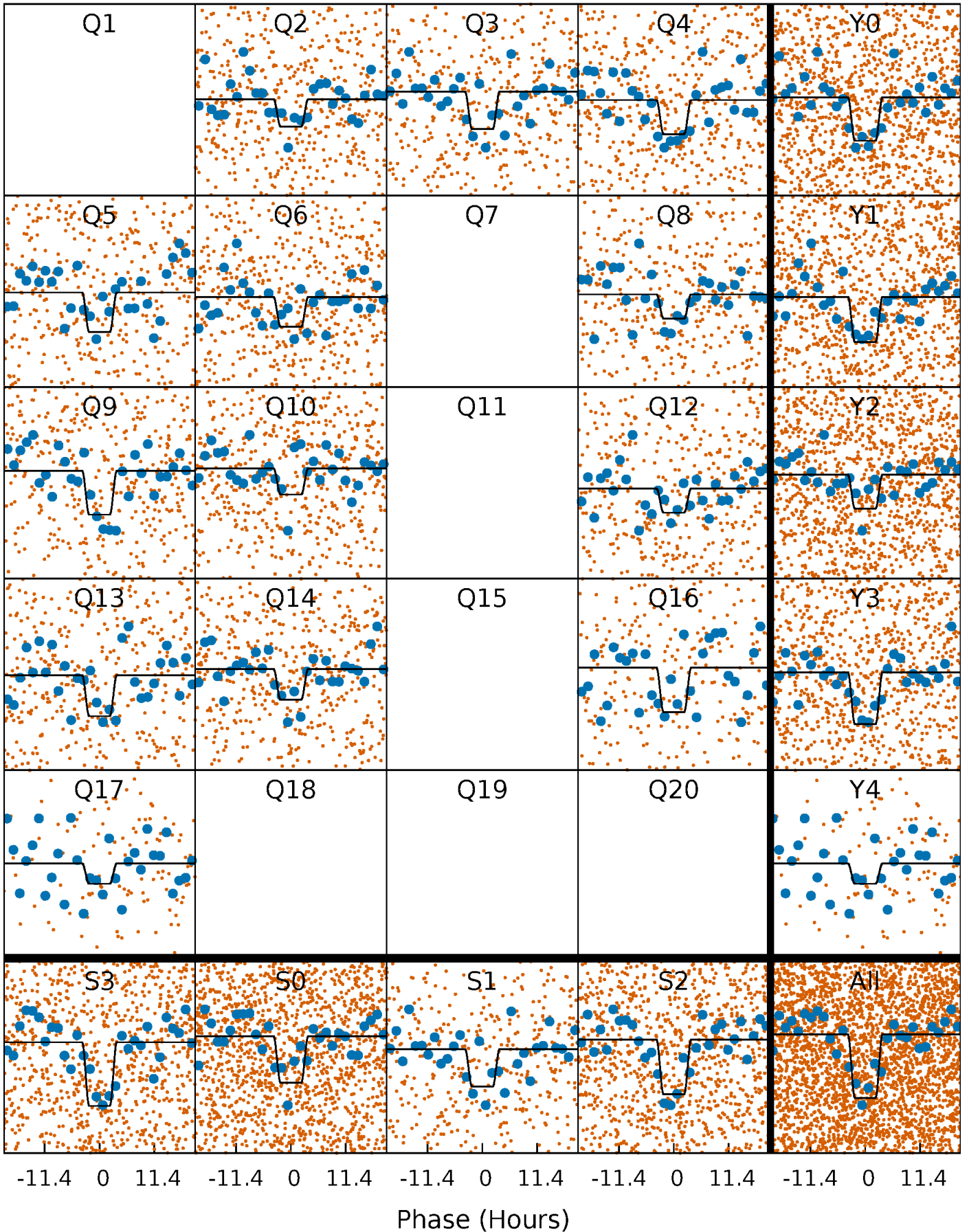
# DV Quarter-Phased Transit Curves

TCE 009967009-01 P= 12.432663 Days  $T_0=142.104730$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

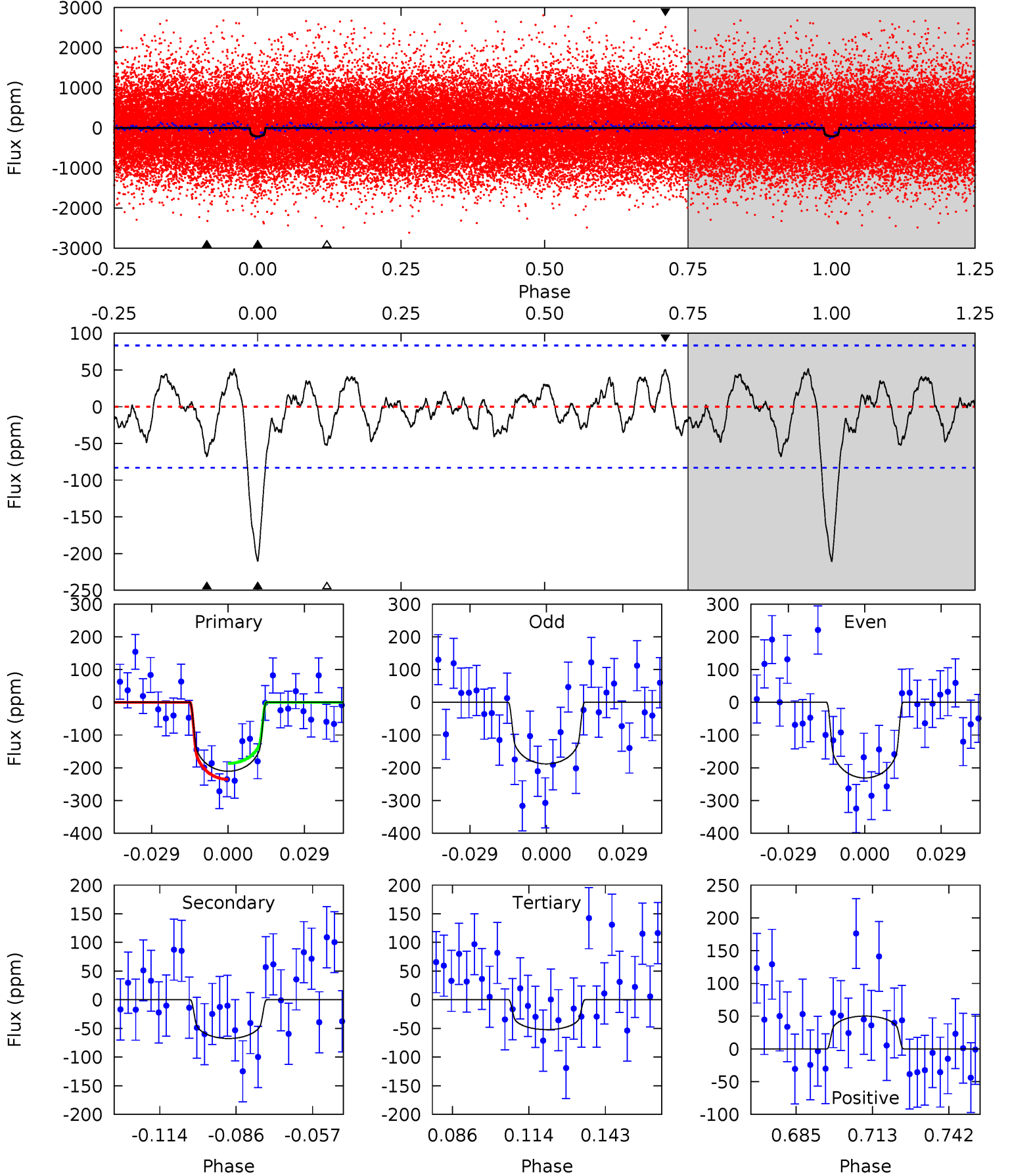
TCE 009967009-01 P= 12.432646 Days  $T_0=142.090443$  (BKJD)



# DV Model-Shift Uniqueness Test

009967009-01, P = 12.432663 Days, E = 142.104730 Days

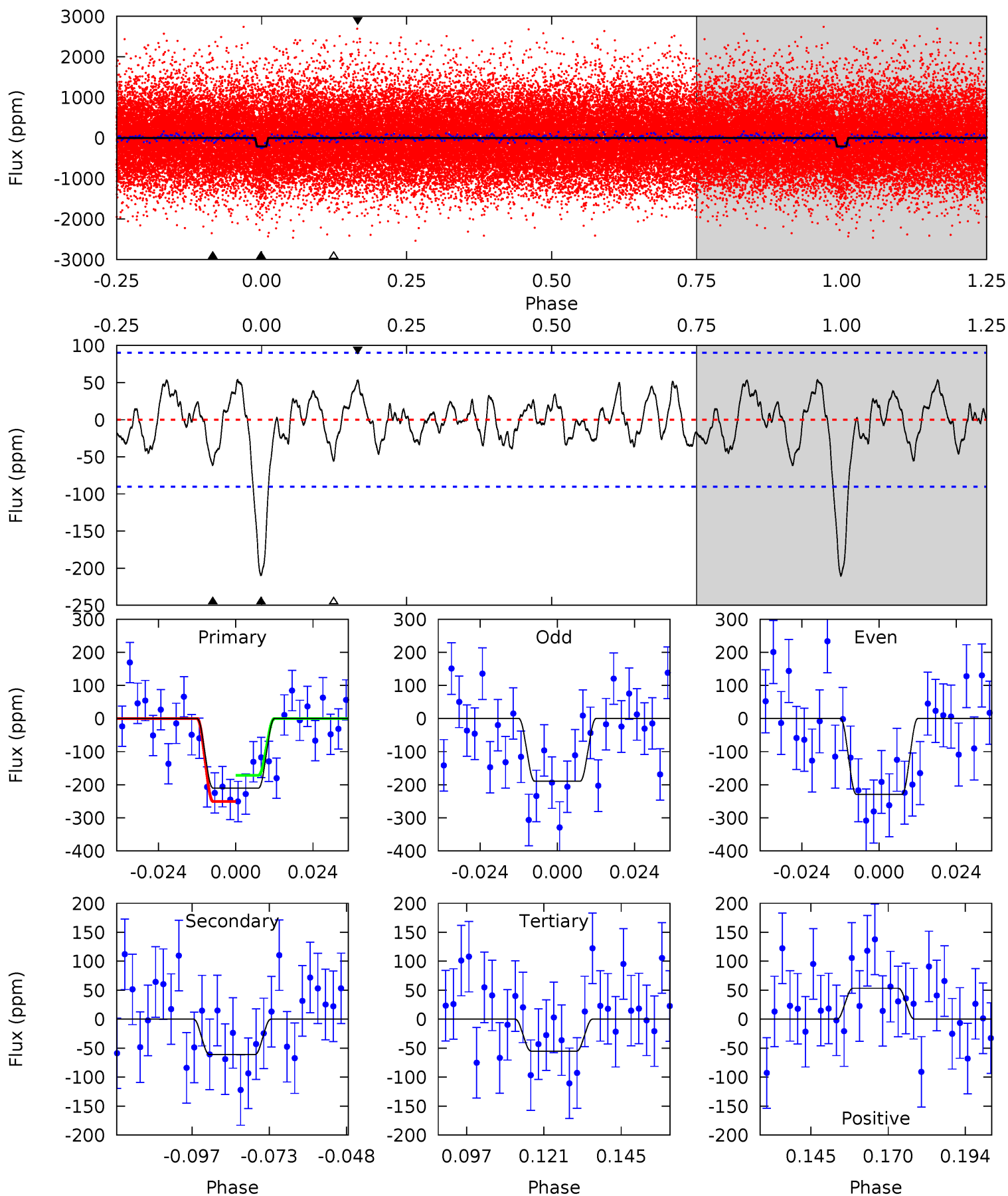
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
12.2	3.91	3.02	2.91	4.82	2.19	1.32	9.17	9.28	0.90	1.01	1.24	0.87	0.20	1.41



# Alt Model-Shift Uniqueness Test

009967009-01, P = 12.432646 Days, E = 142.090443 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
11.3	3.28	2.97	2.87	4.85	2.25	1.26	8.34	8.44	0.31	0.42	1.08	0.95	0.20	2.13





### Stellar Parameters For KIC 009967009

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M$ ( $M_{\odot}$ )	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$5480^{+82}_{-65}$	$4.220^{+0.192}_{-0.112}$	$0.140^{+0.150}_{-0.100}$	$1.229^{+0.210}_{-0.257}$	$0.914^{+0.065}_{-0.038}$	$0.694^{+0.667}_{-0.253}$
	+1%/-1%	+5%/-3%	+107%/-71%	+17%/-21%	+7%/-4%	+96%/-37%
Source	SPE90	SPE90	SPE90	DSEP		

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

### Secondary Eclipse Parameters for KIC 009967009-01 / KOI 3462.01

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	$-68 \pm 17$	$2.03^{+1.13}_{-1.02}$	$1169^{+58}_{-70}$	$4202^{+1351}_{-612}$	$92^{+256}_{-57}$
Alt.	$-61 \pm 19$	$1.99^{+1.18}_{-1.00}$	$1169^{+57}_{-71}$	$4147^{+1390}_{-624}$	$86^{+260}_{-53}$

$T_{\text{max}}$  = 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

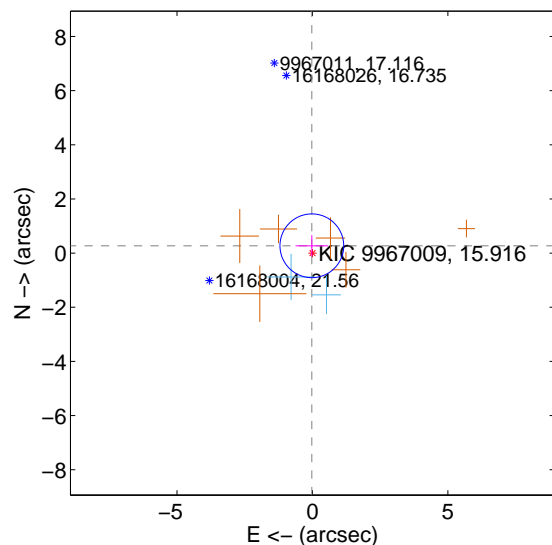
Supplemental centroid analysis for 009967009-01. Kepler magnitude: 15.92. Transit SNR 9.46

There are 2 quarters with good PRF difference image offsets

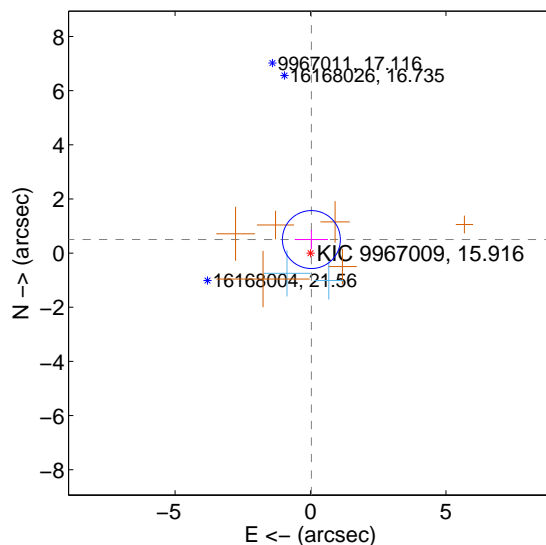
The direct PRF centroid is offset from the target star catalog position by about 0.12 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.271 \pm 0.392$	0.69	$0.022 \pm 0.603$	$0.270 \pm 0.391$
PRF-fit source offset from KIC position	$0.501 \pm 0.357$	1.40	$-0.032 \pm 0.612$	$0.500 \pm 0.355$
photometric centroid source offset	$3.24 \pm 1.40$	2.31	$2.55 \pm 1.19$	$2.00 \pm 1.69$

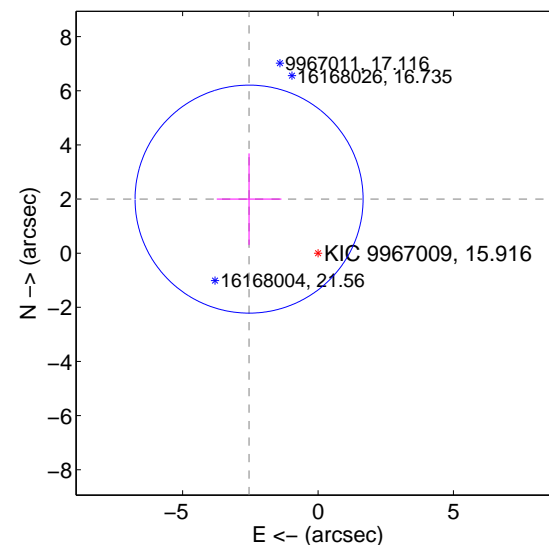
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

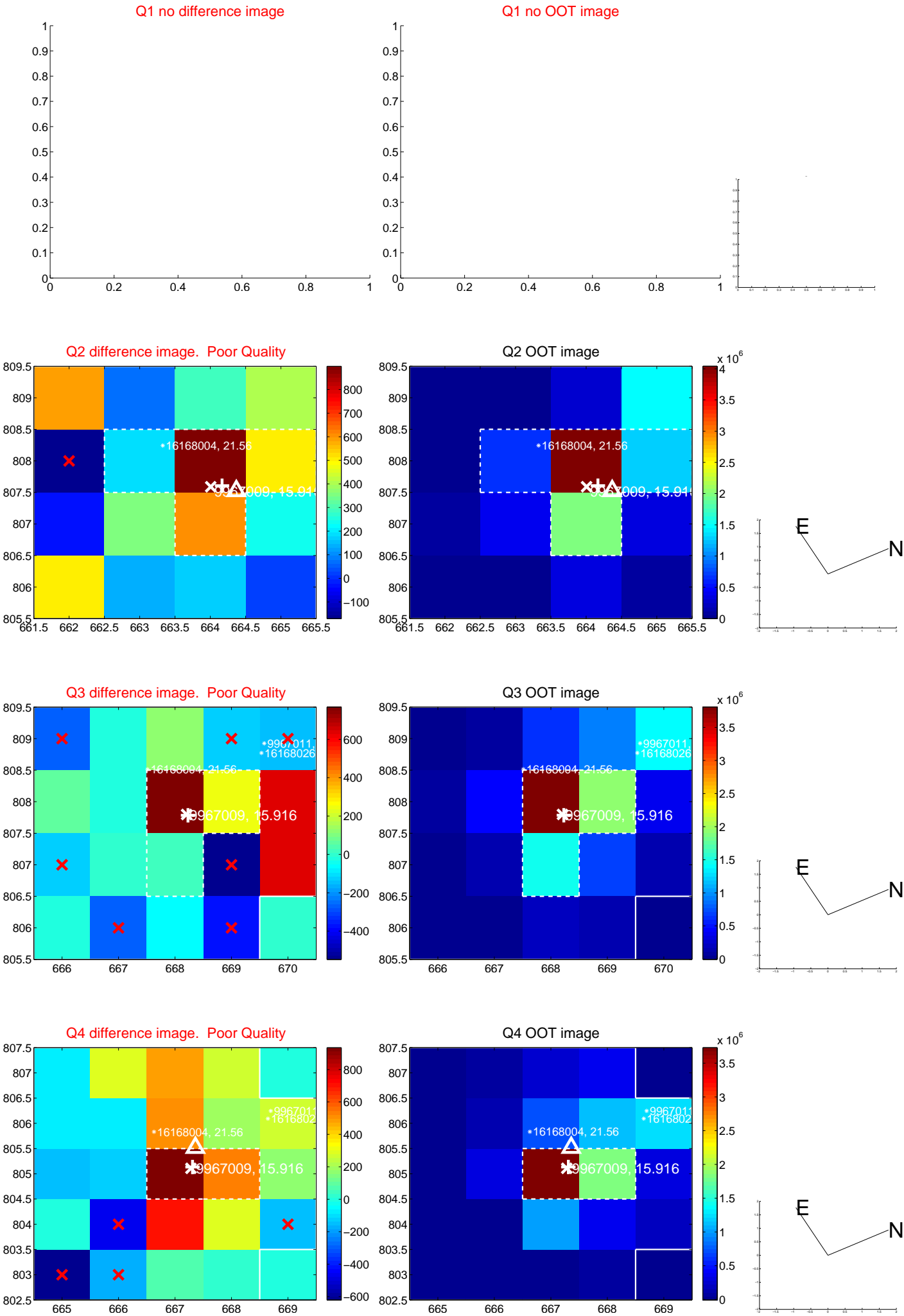


offset from photometric centroids

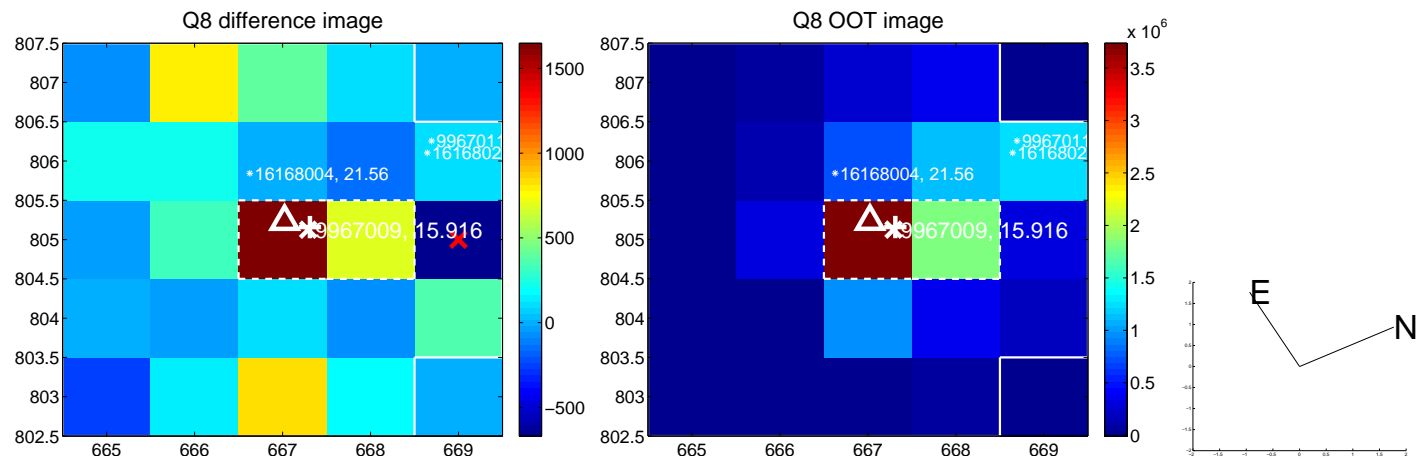
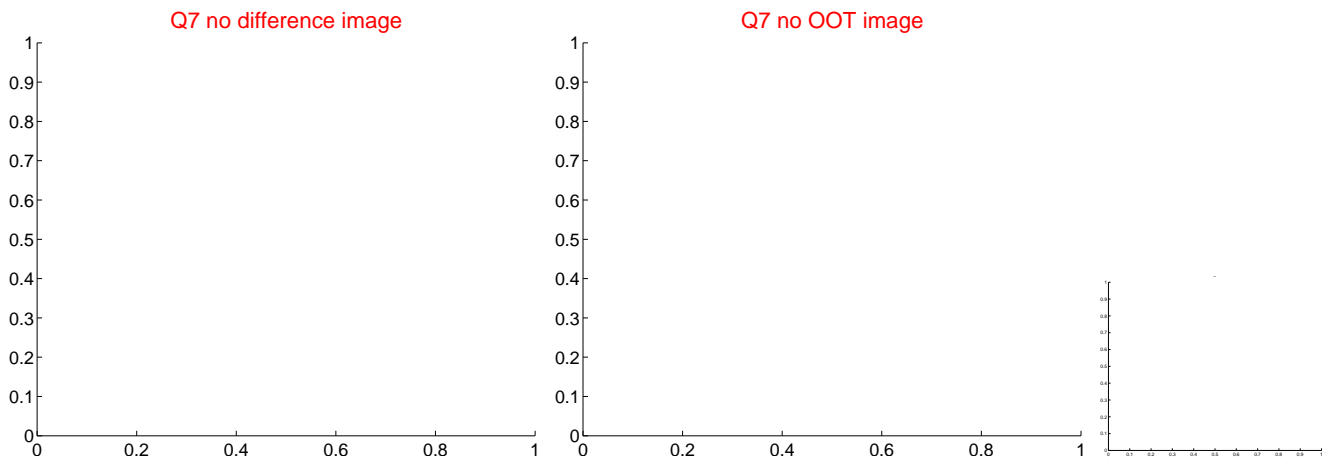
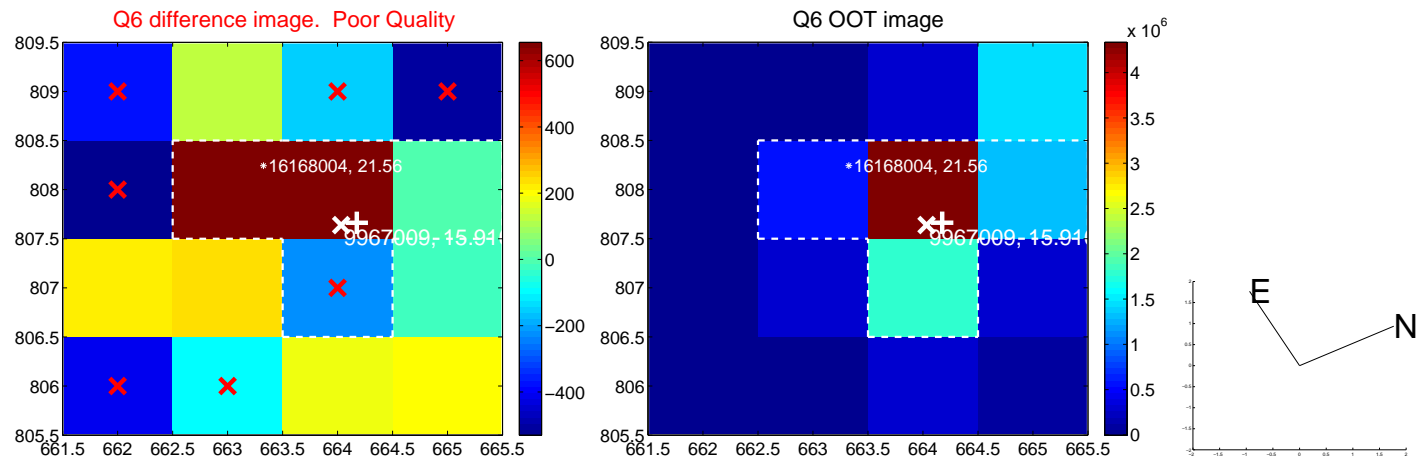
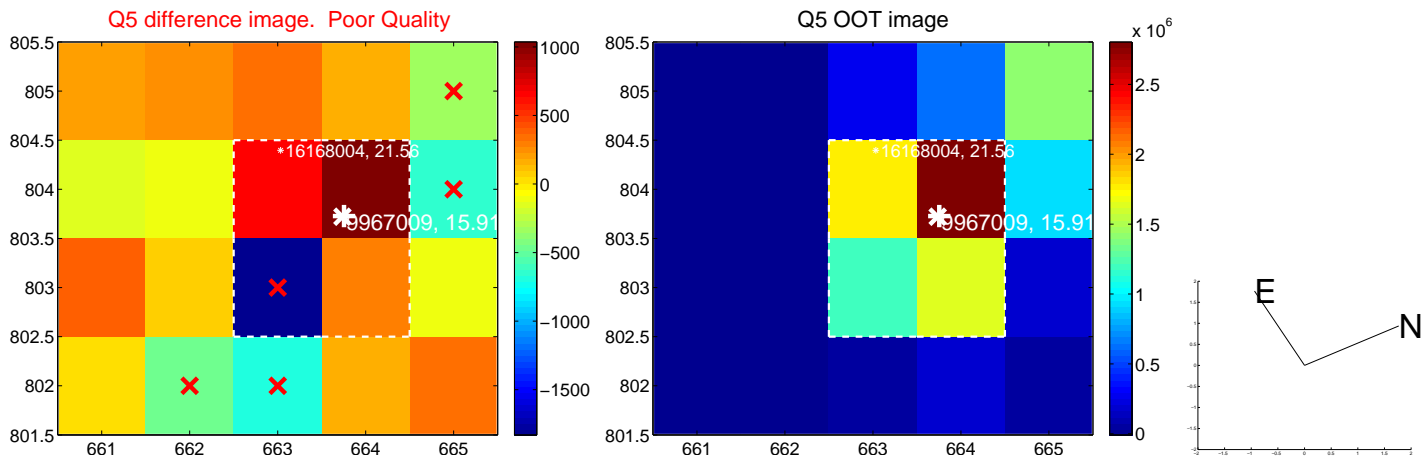


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

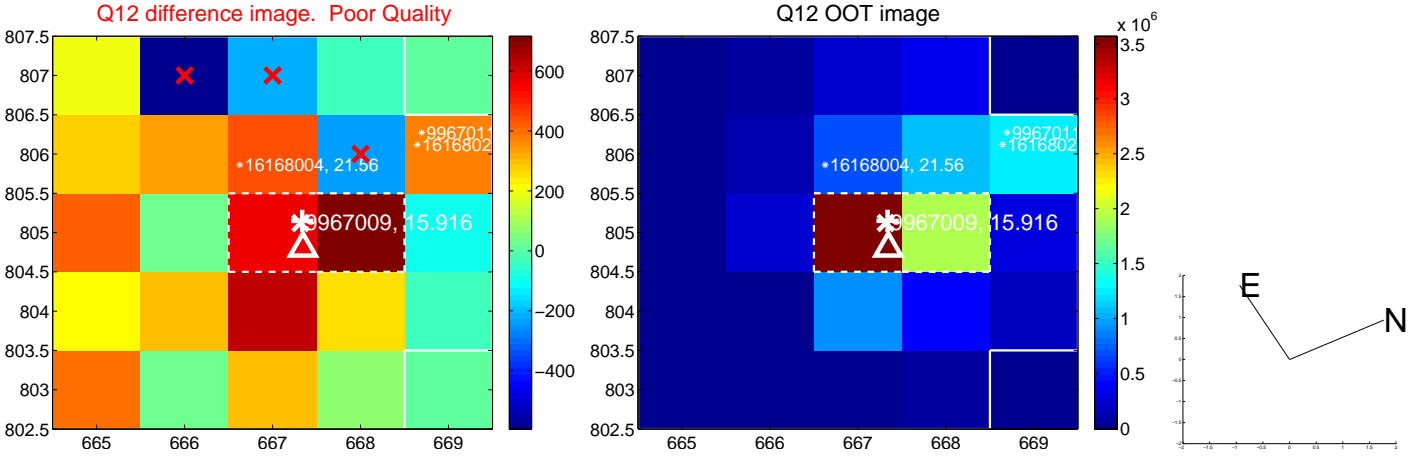
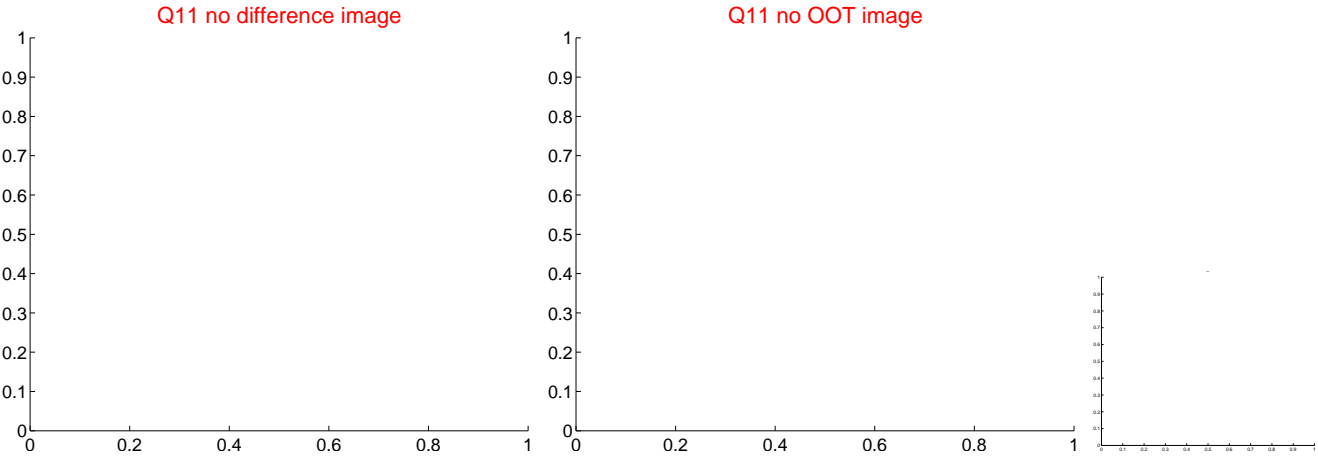
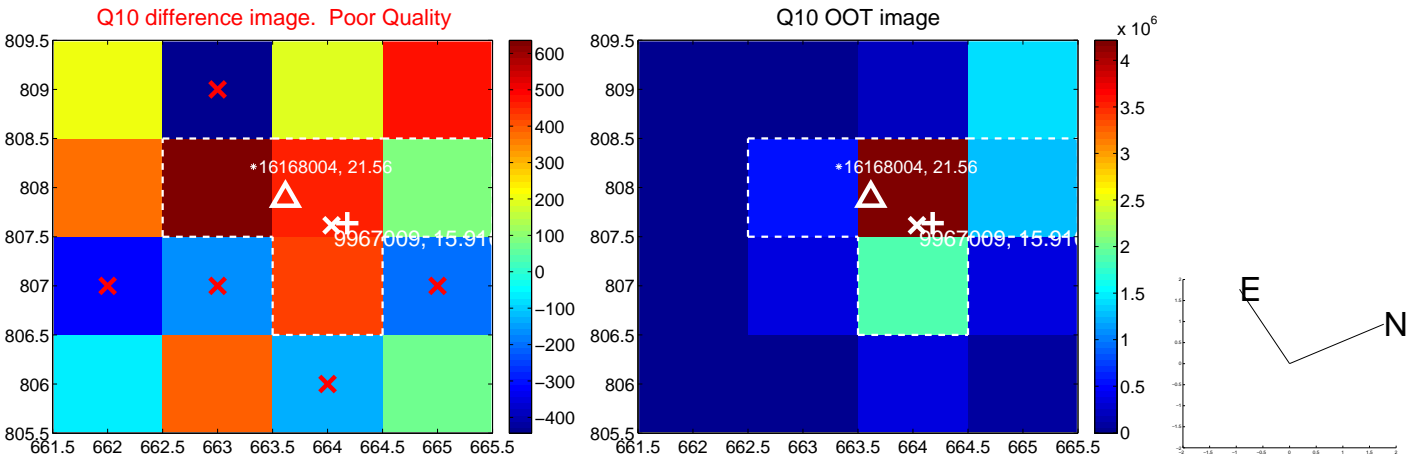
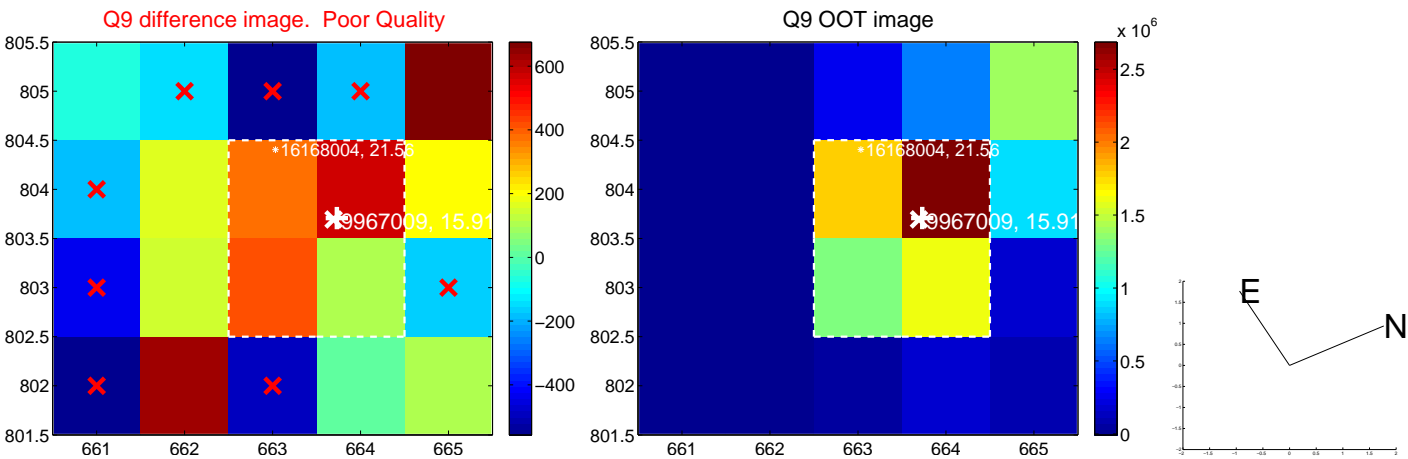


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

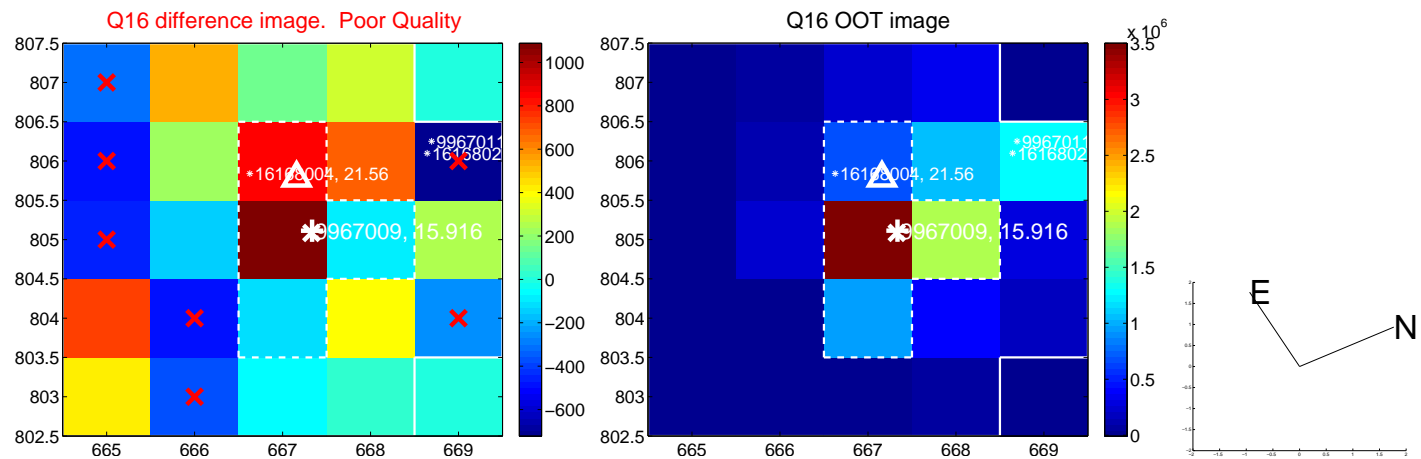
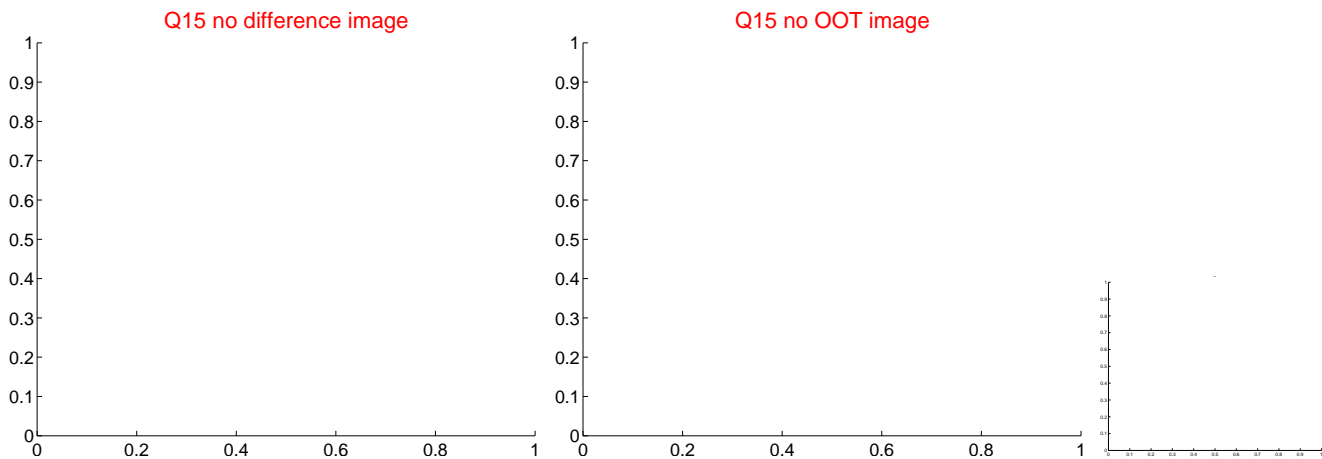
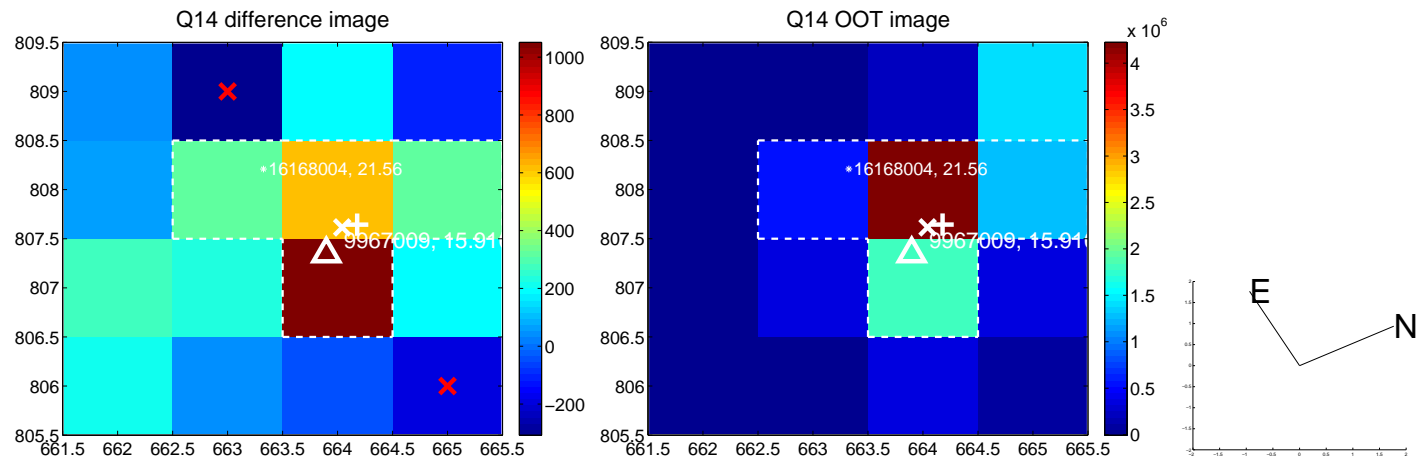
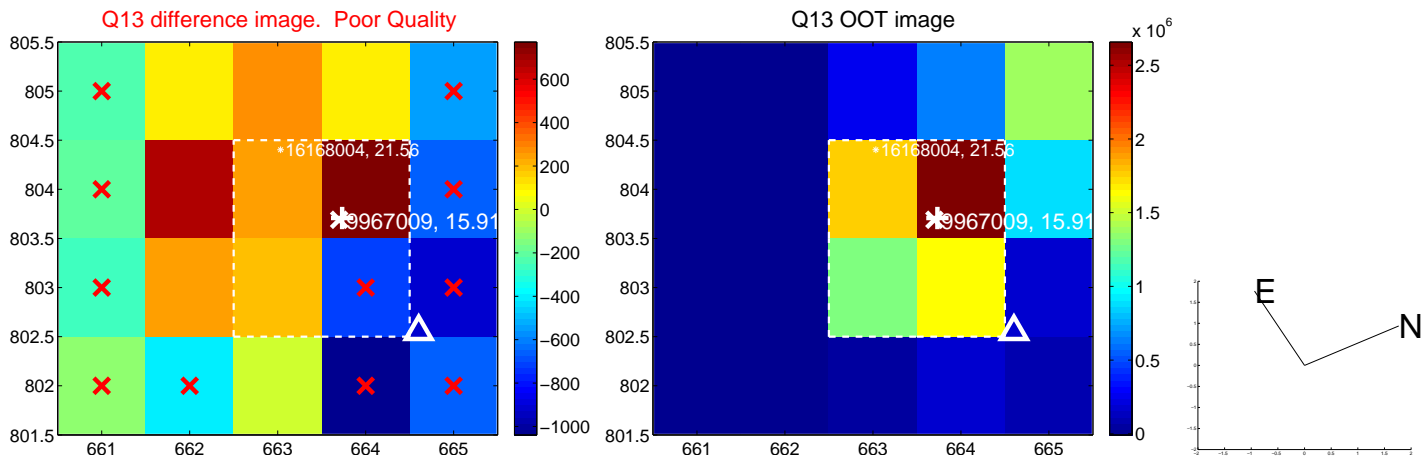




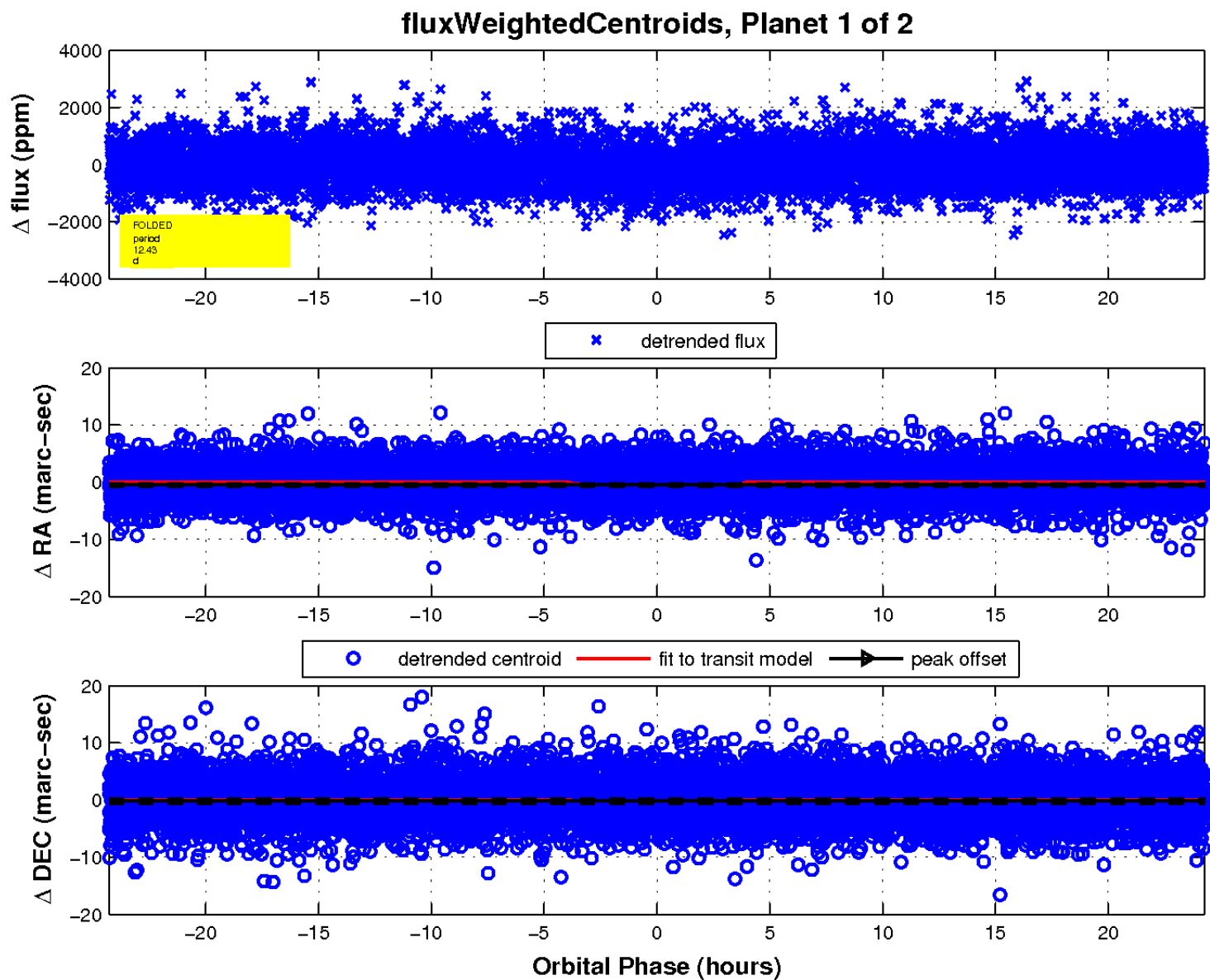
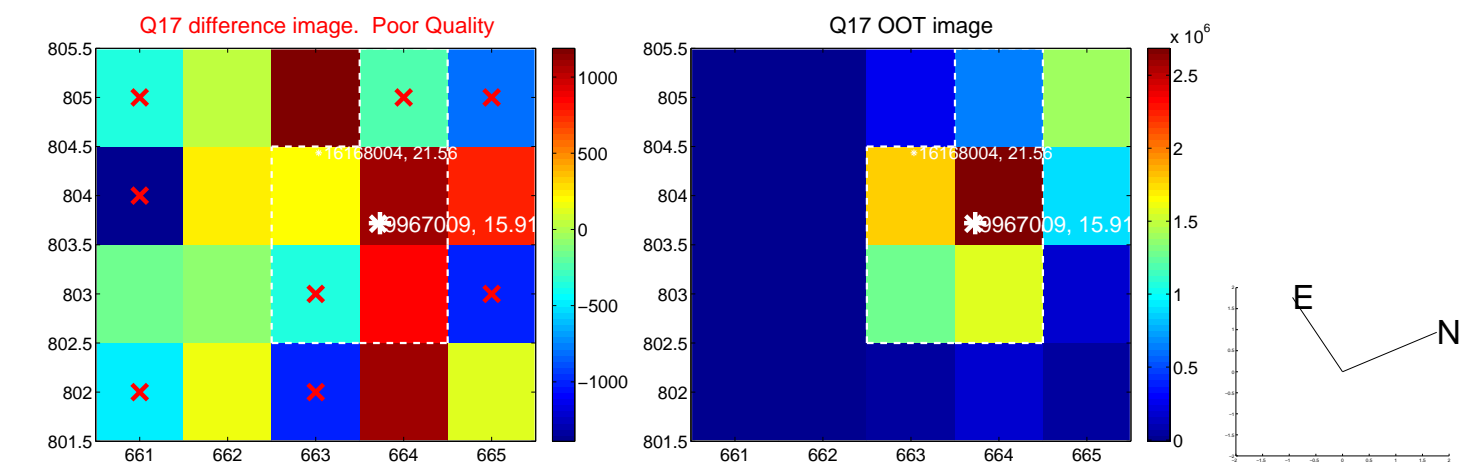
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

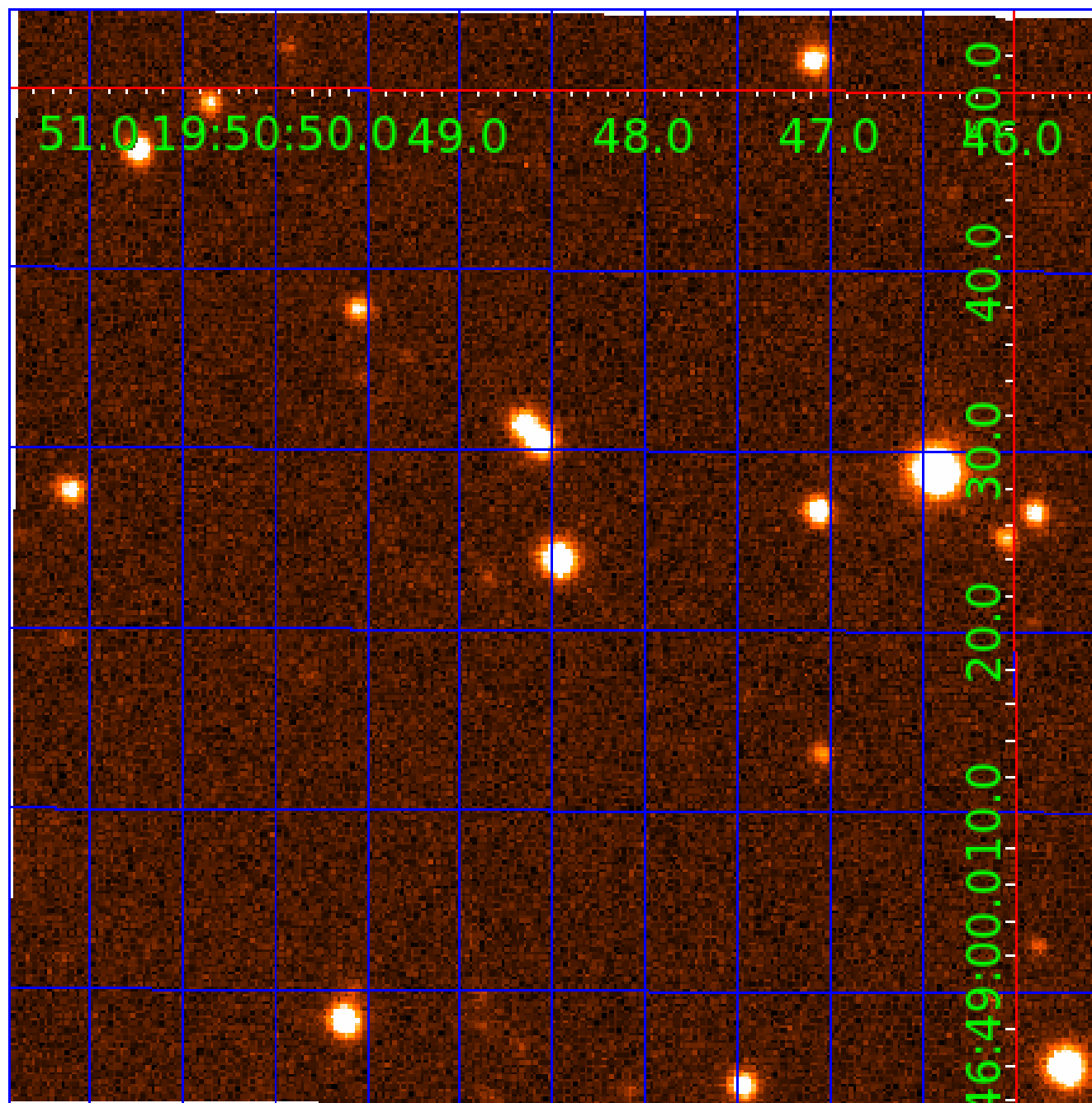


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination





# KIC 009967009

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009967009-01	OBS	3462.01	12.432663	142.104730	212.3	8.095	9.4	9.5	1.23	5480	2.01	117.39
009967009-02	OBS	3462.02	30.989654	141.446515	312.3	10.111	9.2	9.9	1.23	5480	2.28	34.73

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009967009-01	OBS	PC	0.84	0	0	0	0	NO_COMMENT
009967009-02	OBS	PC	0.90	0	0	0	0	NO_COMMENT

**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.

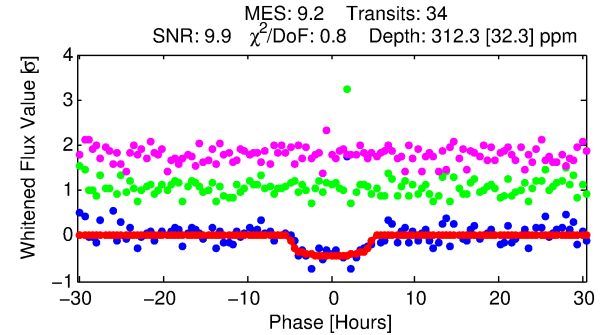
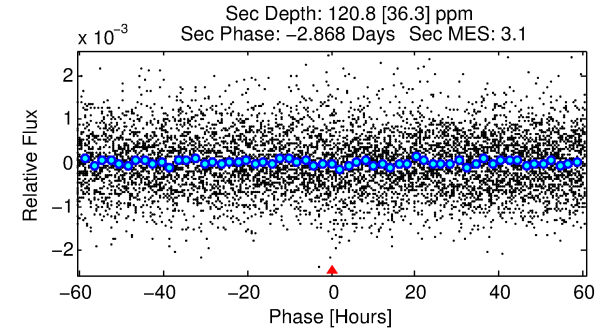
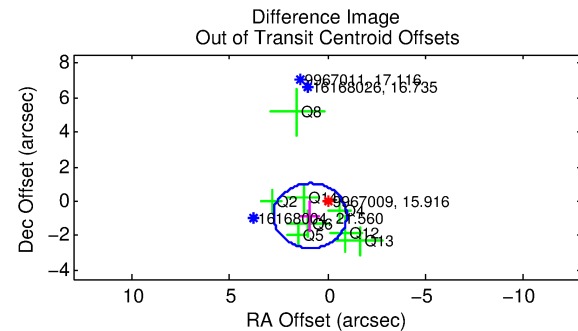
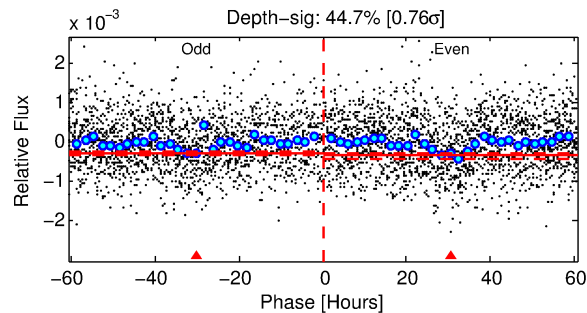
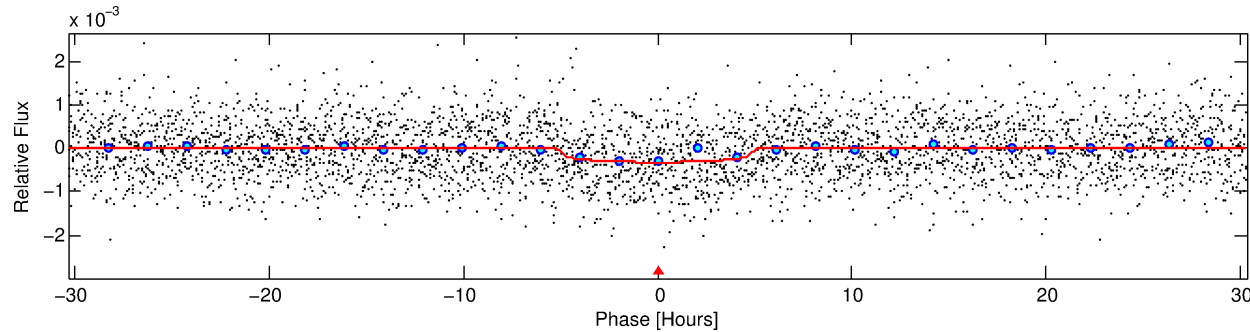
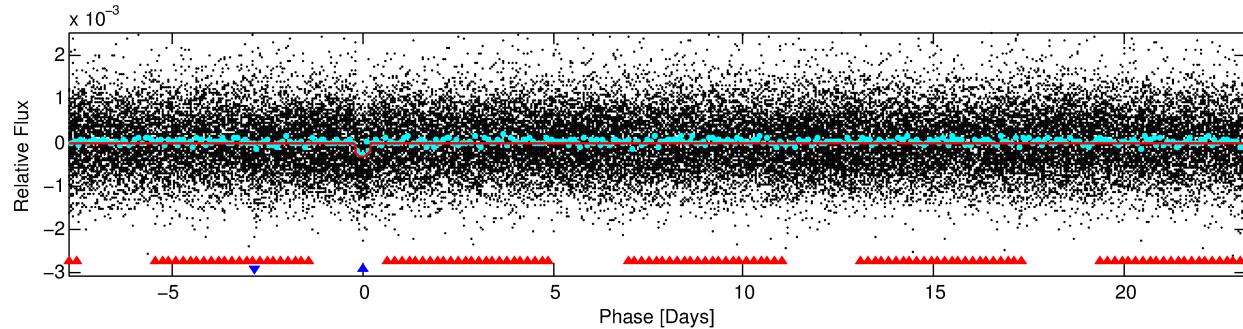
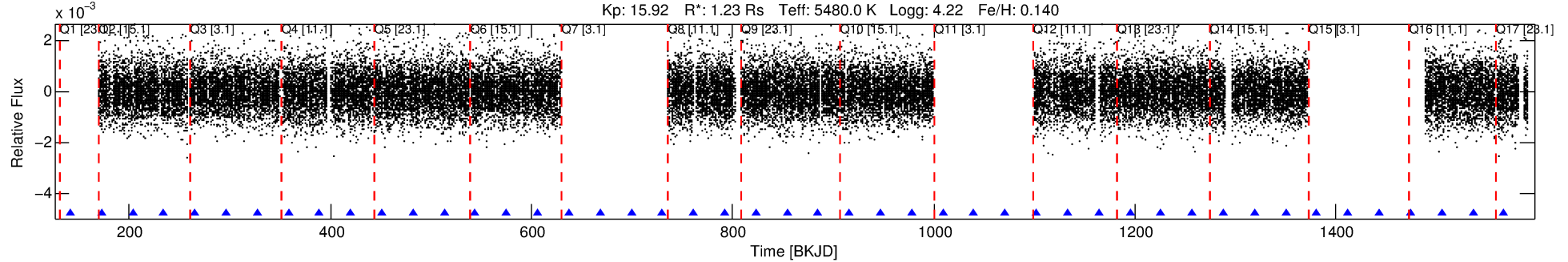
## Ephemeris Match Information For 009967009-02

No Significant Match Found

# DV One-Page Summary

KIC: 9967009 Candidate: 2 of 2 Period: 30.990 d  
KOI: K03462.02 Corr: 0.916

Kp: 15.92 R\*: 1.23 Rs Teff: 5480.0 K Logg: 4.22 Fe/H: 0.140



## DV Fit Results:

Period = 30.98965 [0.00066] d  
Epoch = 141.4465 [0.0165] BKJD  
Rp/R\* = 0.0170 [0.0144]  
a/R\* = 18.25 [61.06]  
b = 0.65 [2.97]  
Seff = 34.73 [11.51]  
Teq = 619 [51] K  
Rp = 2.28 [1.99] Re  
a = 0.1874 [0.0380] AU  
Ag = 447.93 [783.04] [0.57σ]  
Teff = 4403 [1892] K [2.00σ]

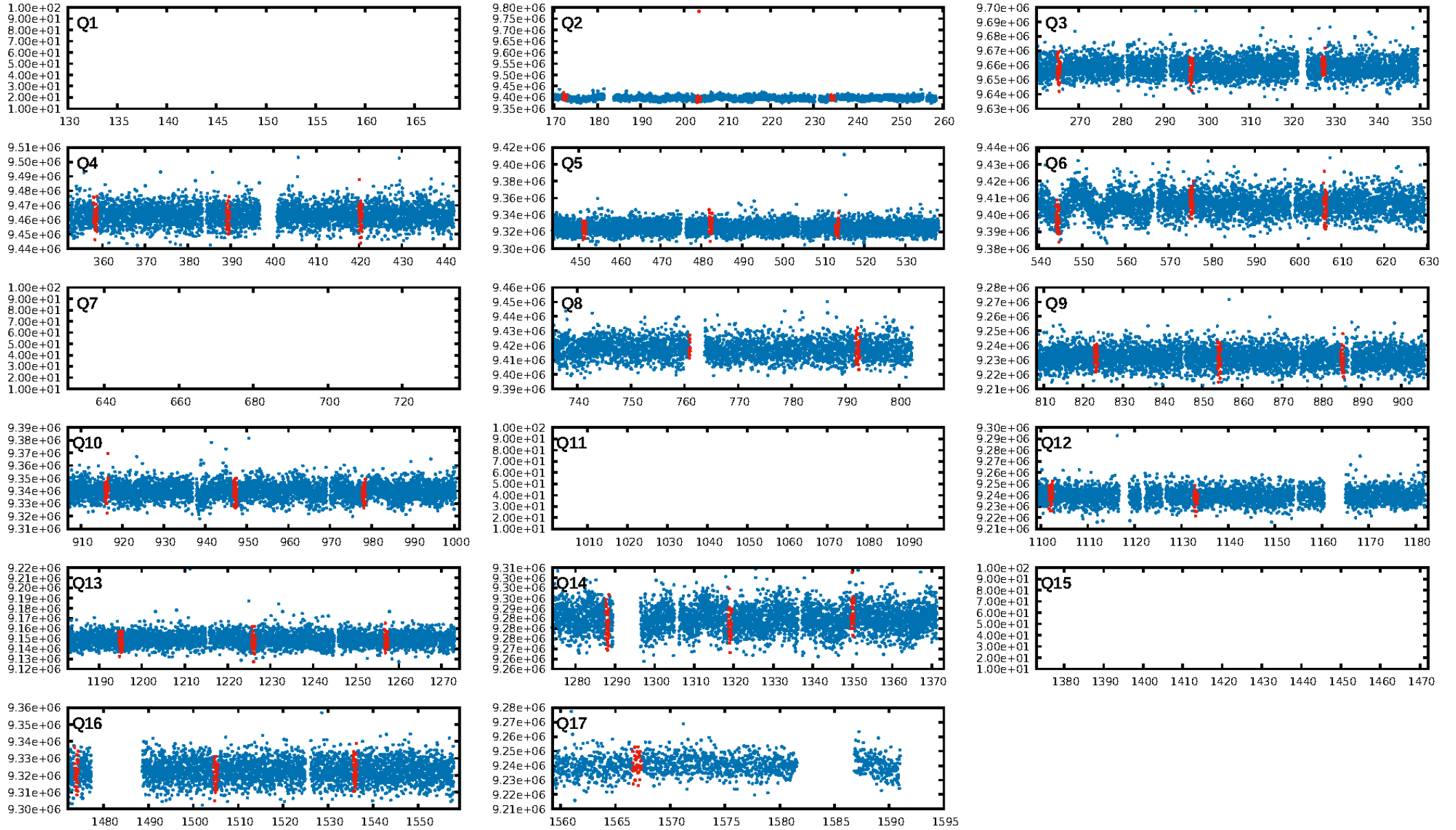
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [34.38σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 74.3%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 4.77e-20  
RollingBand-fgt: 1.00 [33/33]  
GhostDiagnostic-chr: -1.44  
Centroid-sig: 4.0%  
Centroid-so: 2.194 arcsec [1.84σ]  
OotOffset-rm: 1.233 arcsec [1.97σ]  
KicOffset-rm: 1.000 arcsec [1.83σ]  
OotOffset-st: 3/0/3/2 [8]  
KicOffset-st: 3/0/3/2 [8]  
DiffImageQuality-fgm: 0.75 [6/8]  
DiffImageOverlap-fno: 1.00 [13/13]

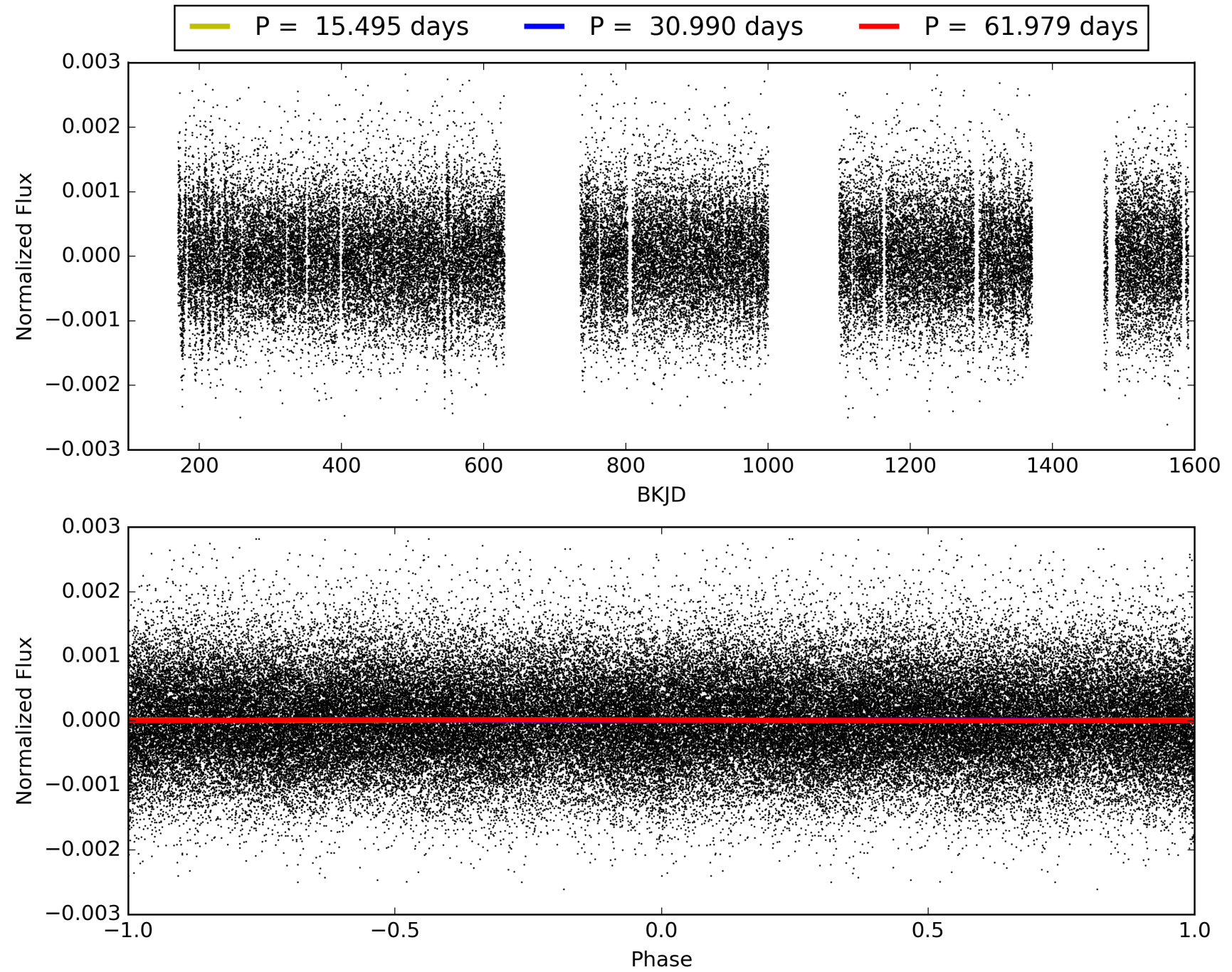
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 12:56:08 Z

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

# TCE 009967009-02, PDC Light Curves



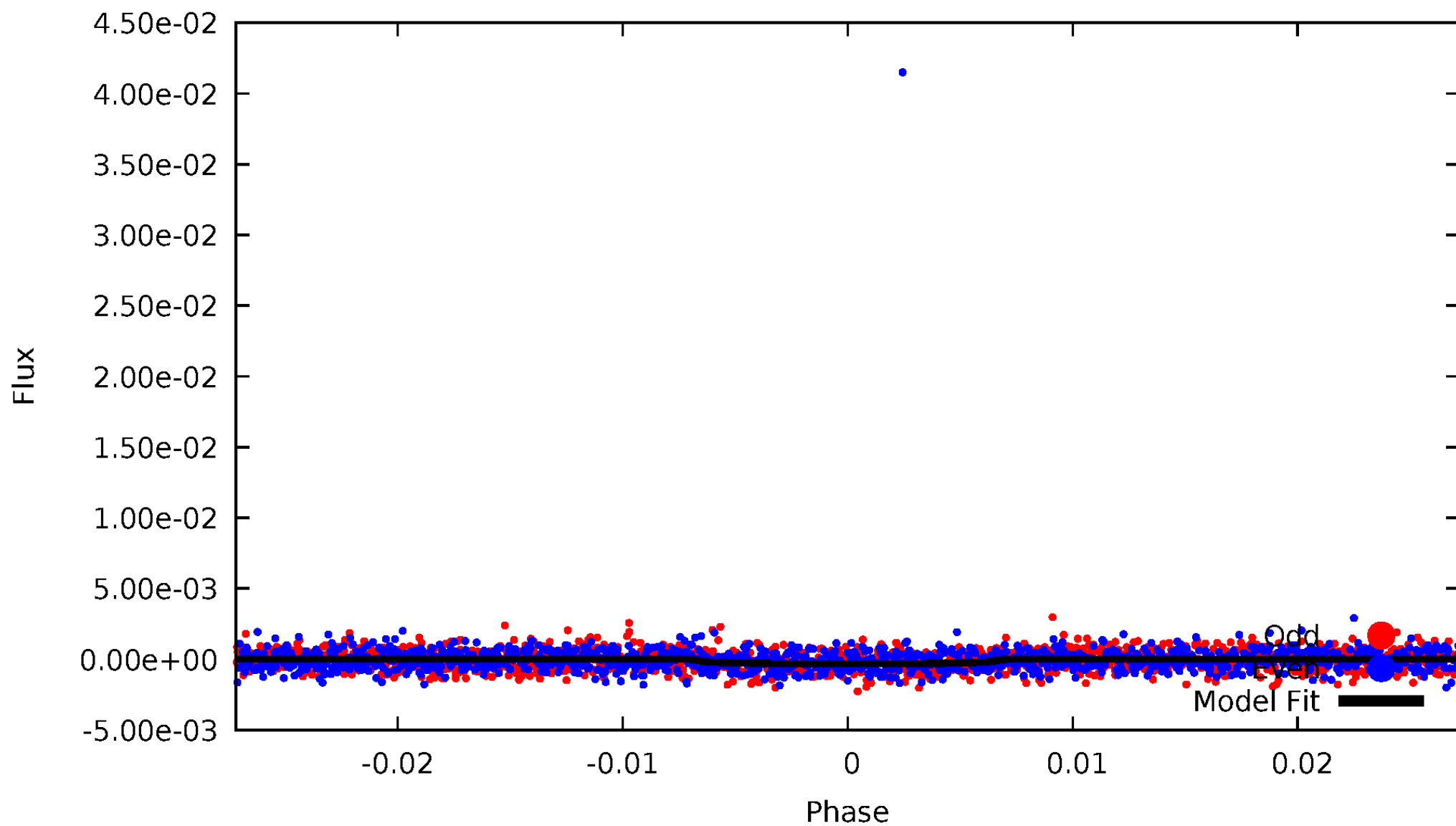
# TCE 009967009-02





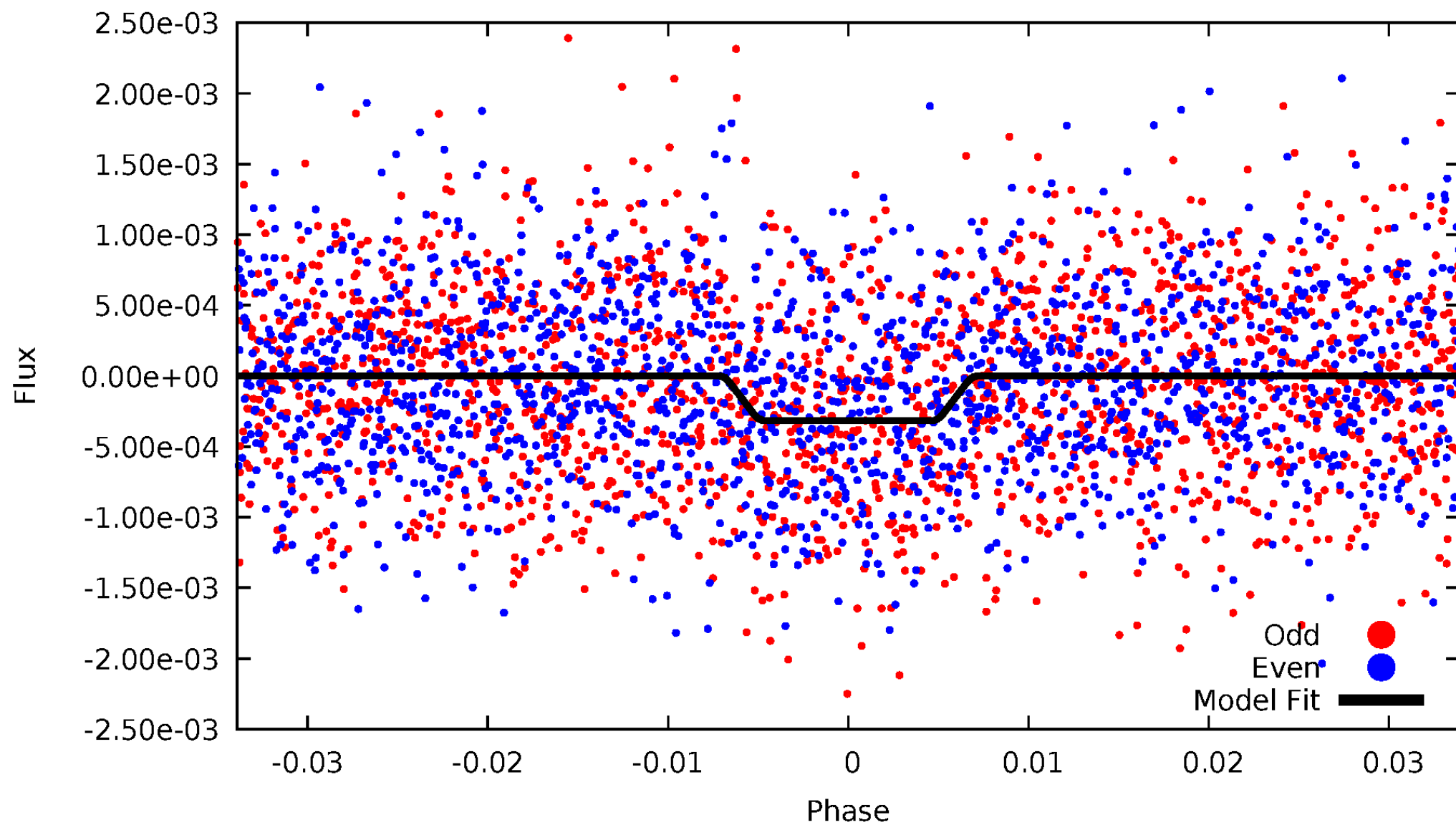
# DV Odd/Even

TCE 009967009-02



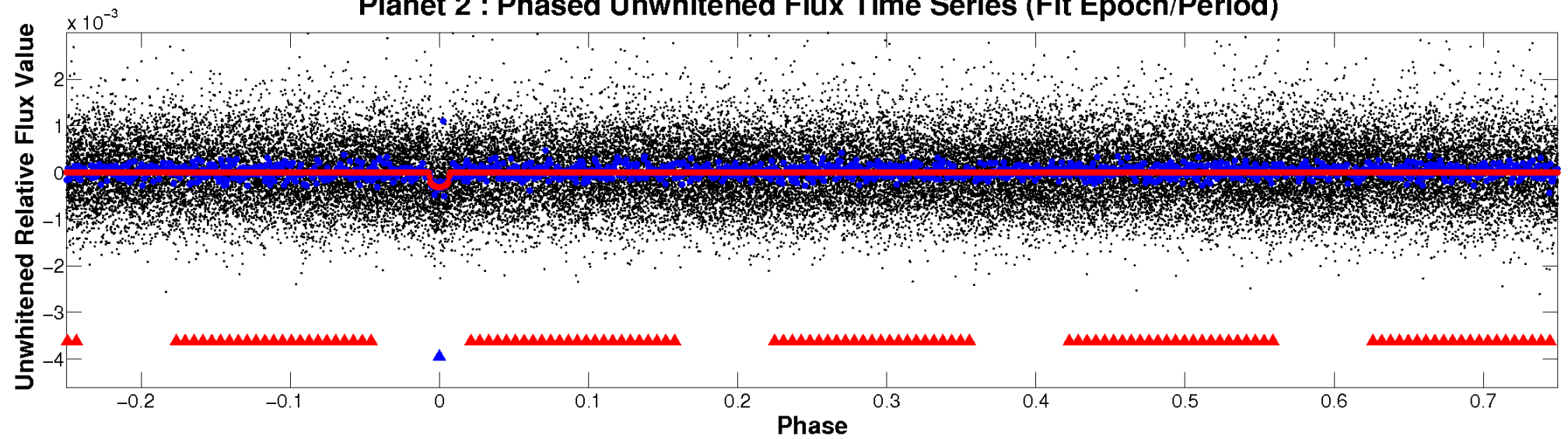
# ALT Odd/Even

TCE 009967009-02

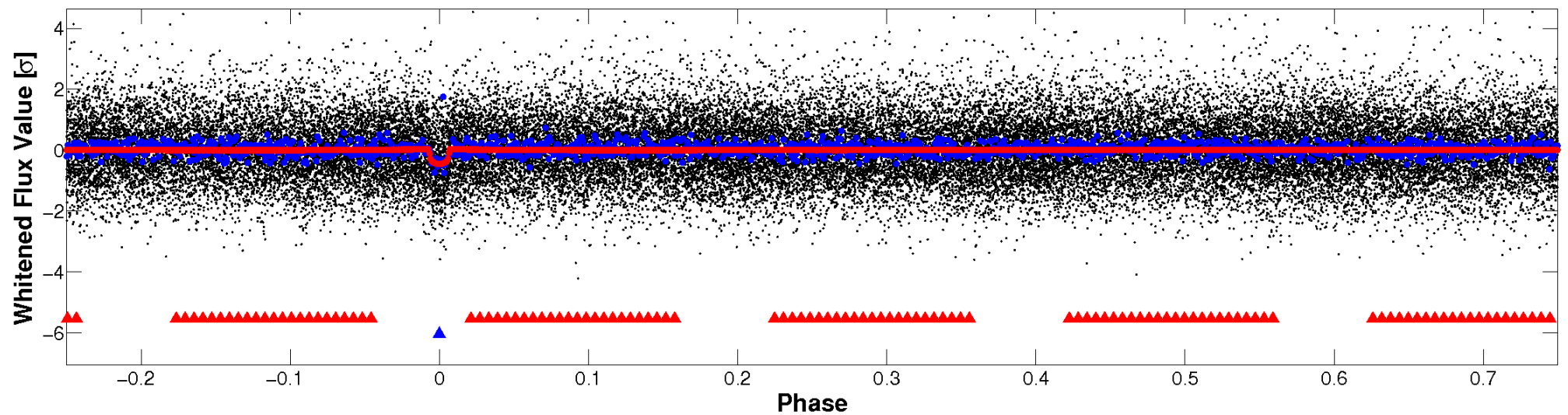


# Non-Whitened Vs. Whitened Light Curve

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

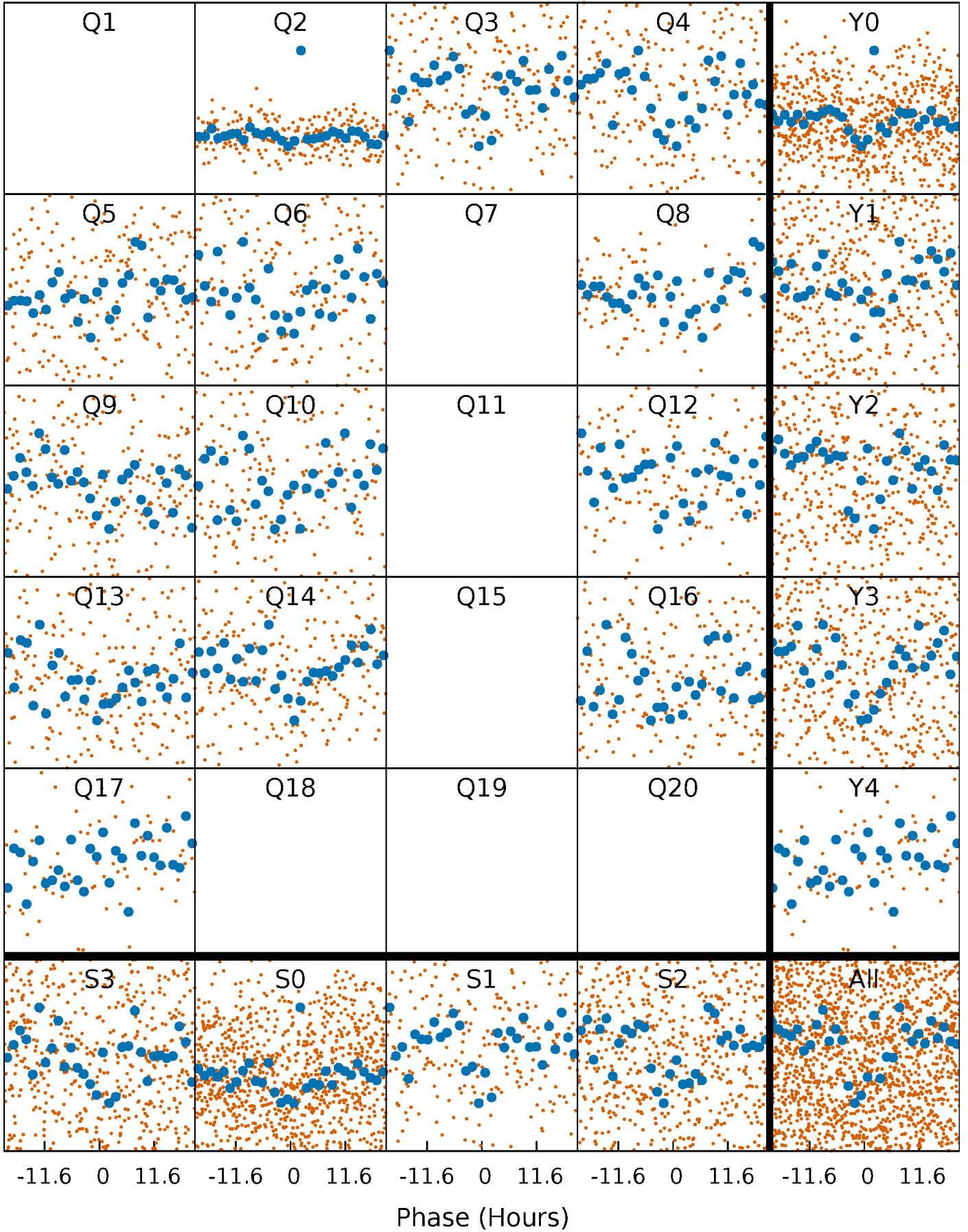


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



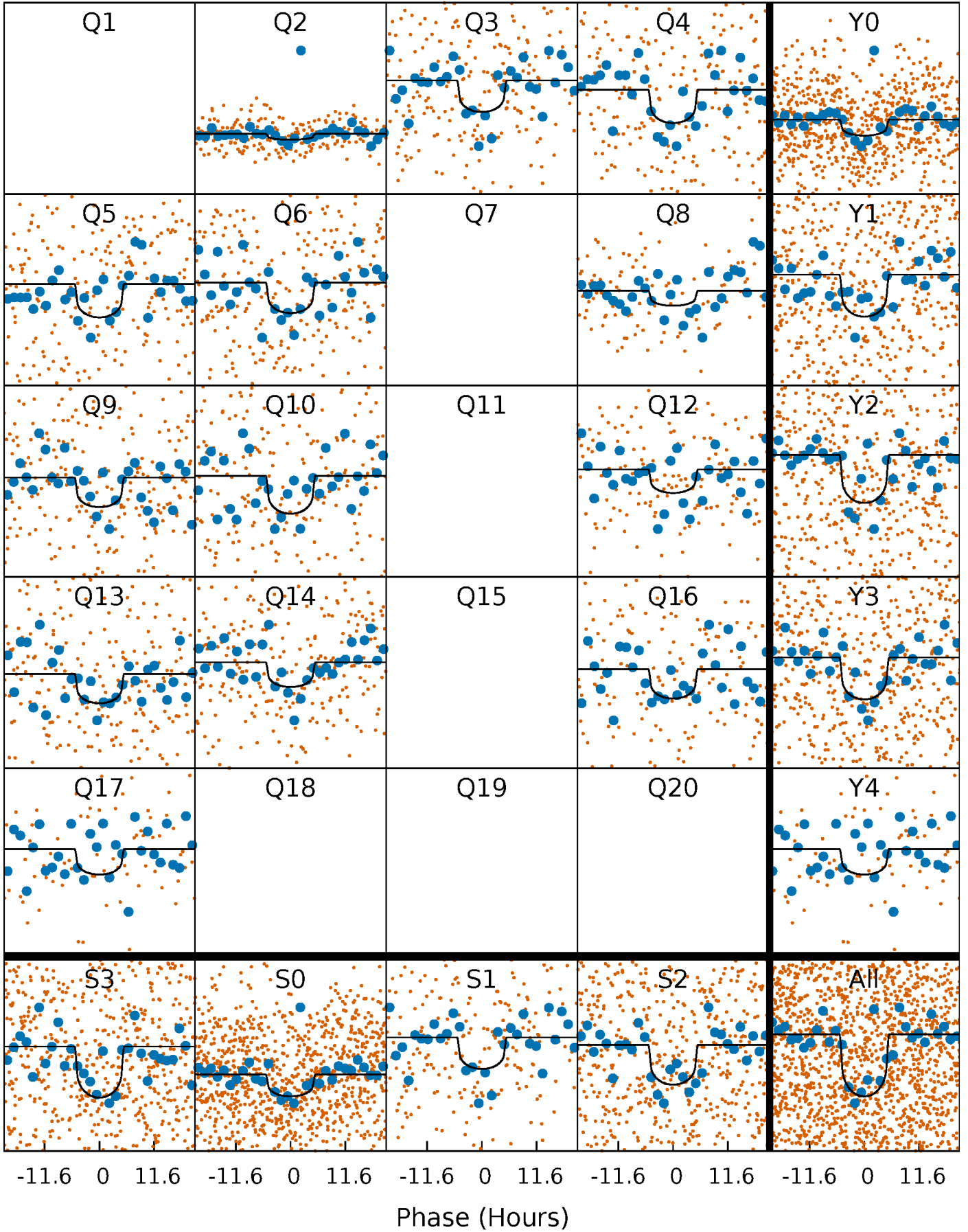
# PDC Quarter-Phased Transit Curves

TCE 009967009-02 P= 30.989654 Days  $T_0=141.446515$  (BKJD)



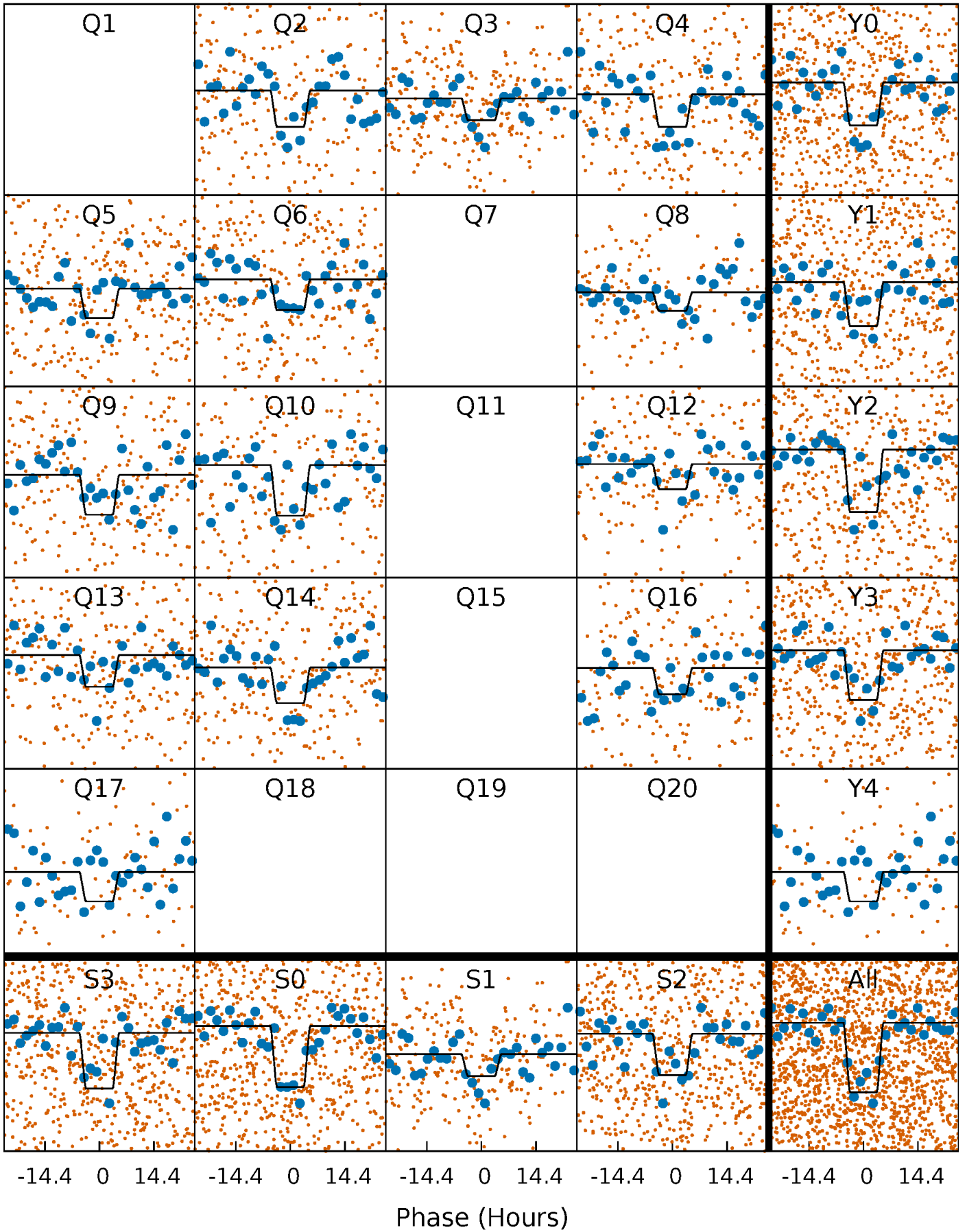
# DV Quarter-Phased Transit Curves

TCE 009967009-02     $P = 30.989654$  Days     $T_0 = 141.446515$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

TCE 009967009-02 P= 30.990150 Days  $T_0=141.444666$  (BKJD)

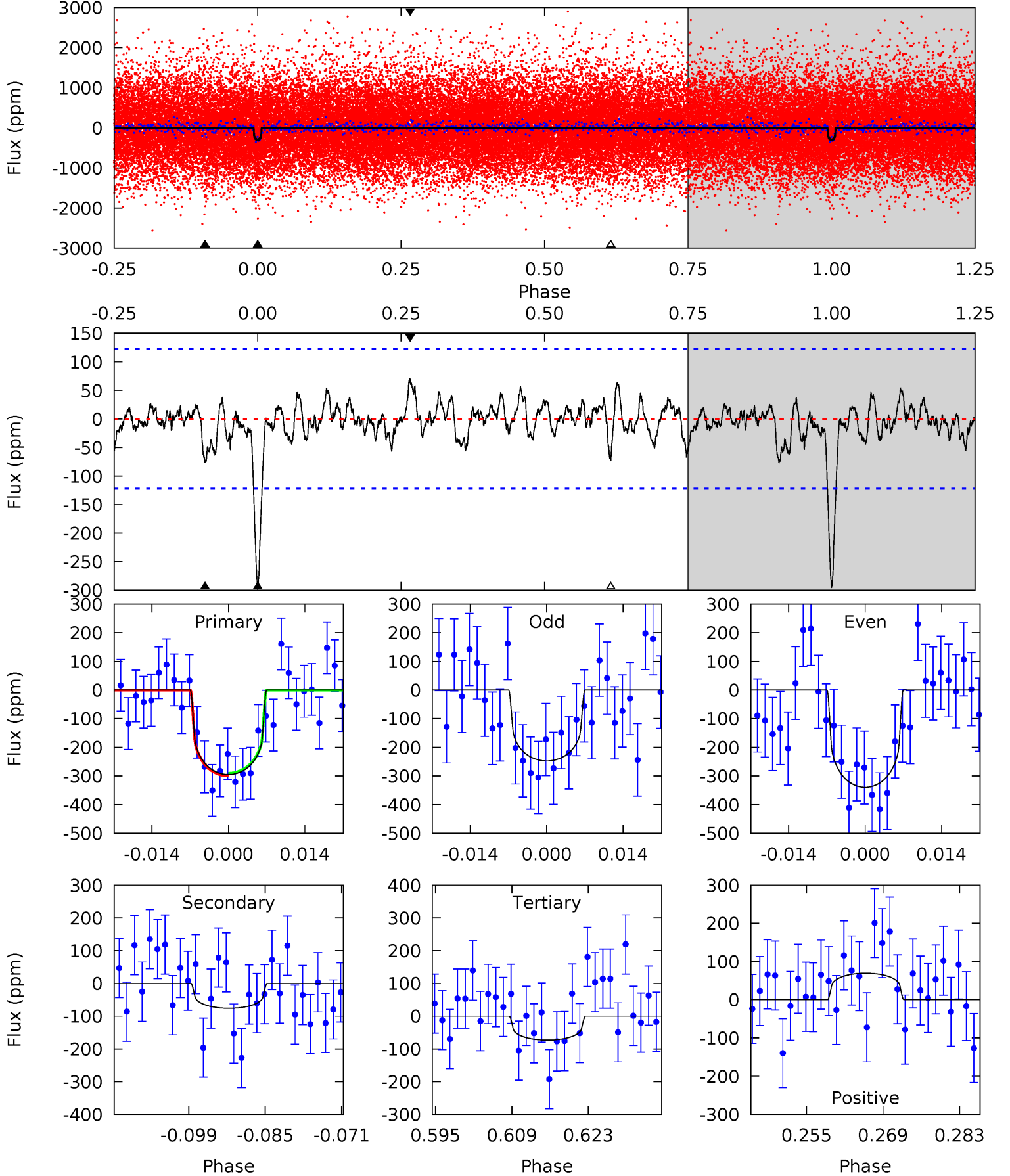




# DV Model-Shift Uniqueness Test

009967009-02, P = 30.989654 Days, E = 141.446515 Days

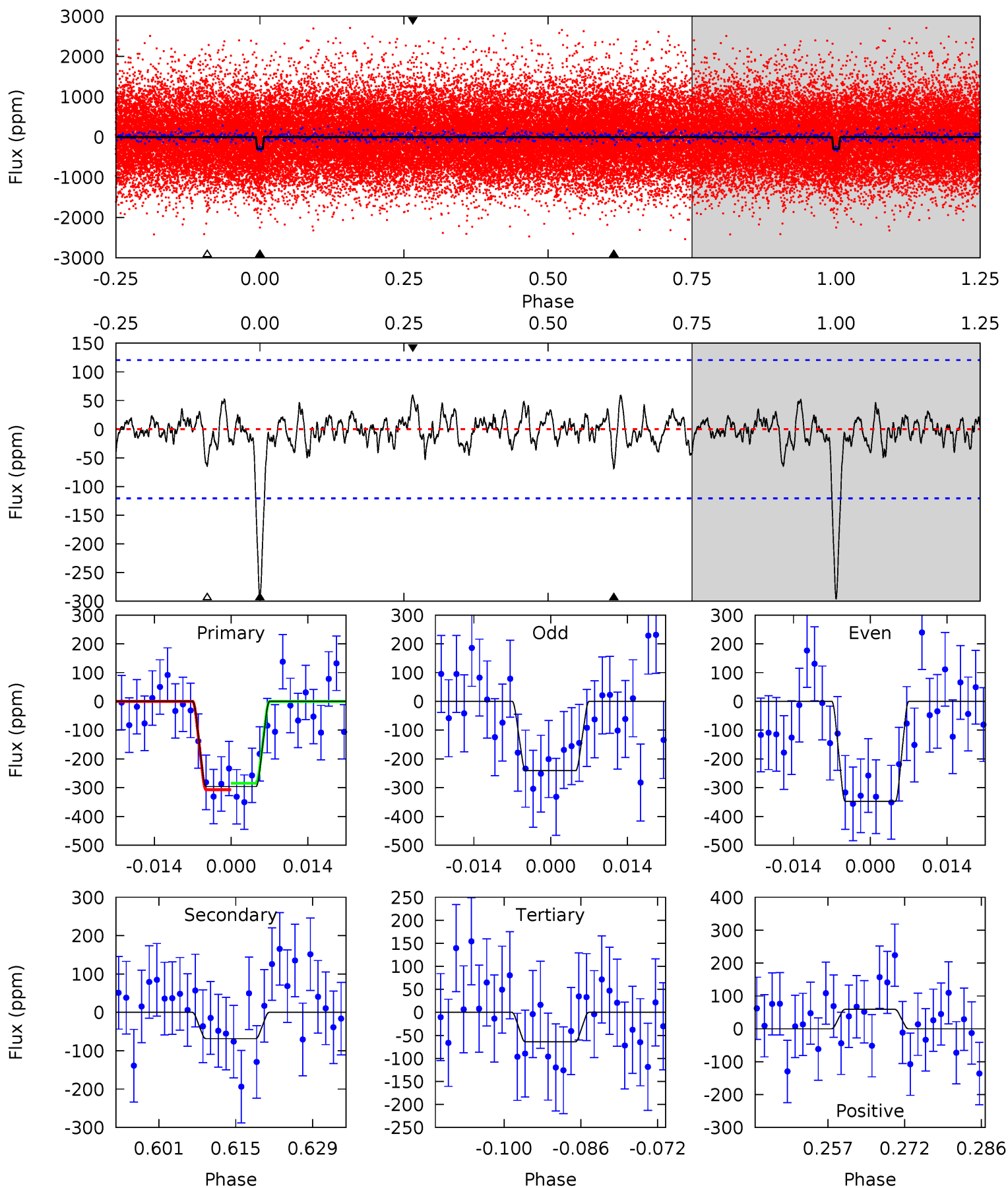
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
12.0	3.08	2.97	2.82	4.96	2.45	0.96	8.99	9.14	0.11	0.26	1.87	0.77	0.19	0.18



# Alt Model-Shift Uniqueness Test

009967009-02, P = 30.990150 Days, E = 141.444666 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	2.81	2.64	2.43	4.96	2.45	0.81	9.53	9.74	0.18	0.38	2.20	1.03	0.17	0.46



### Stellar Parameters For KIC 009967009

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$5480^{+82}_{-65}$	$4.220^{+0.192}_{-0.112}$	$0.140^{+0.150}_{-0.100}$	$1.229^{+0.210}_{-0.257}$	$0.914^{+0.065}_{-0.038}$	$0.694^{+0.667}_{-0.253}$
	+1%/-1%	+5%/-3%	+107%/-71%	+17%/-21%	+7%/-4%	+96%/-37%
Source	SPE90	SPE90	SPE90	DSEP		

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

### Secondary Eclipse Parameters for KIC 009967009-02 / KOI 3462.02

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-76 \pm 25$	$2.43^{+1.74}_{-1.49}$	$860^{+41}_{-50}$	$4040^{+1850}_{-687}$	$244^{+1346}_{-166}$
Alt.	$-68 \pm 24$	$2.65^{+1.78}_{-1.60}$	$858^{+41}_{-46}$	$3844^{+1736}_{-639}$	$188^{+1036}_{-130}$

$T_{max}$  = Theoretical Maximum Planetary Temperature

$T_{obs}$  = Observed Planetary Temperature (Assuming  $A=0.3$ )

$A_{obs}$  = Observed Albedo (Assuming  $T=0$ )

If a secondary eclipse is present, the system is likely an EB if  $T_{obs} \gg T_{max}$  AND  $A_{obs} \gg 1.0$

## DV Centroid Data

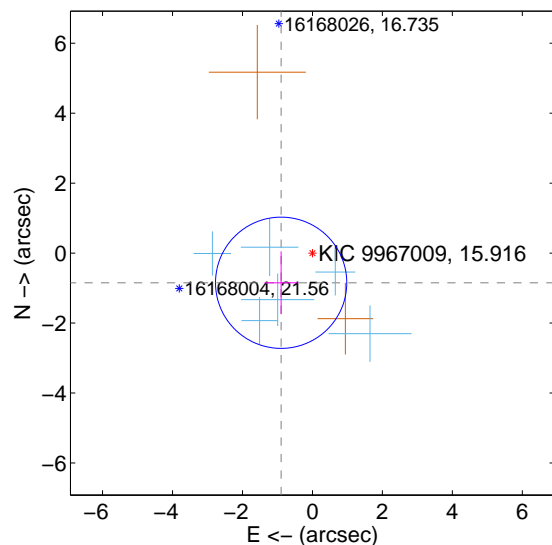
Supplemental centroid analysis for 009967009-02. Kepler magnitude: 15.92. Transit SNR 9.87

There are 6 quarters with good PRF difference image offsets

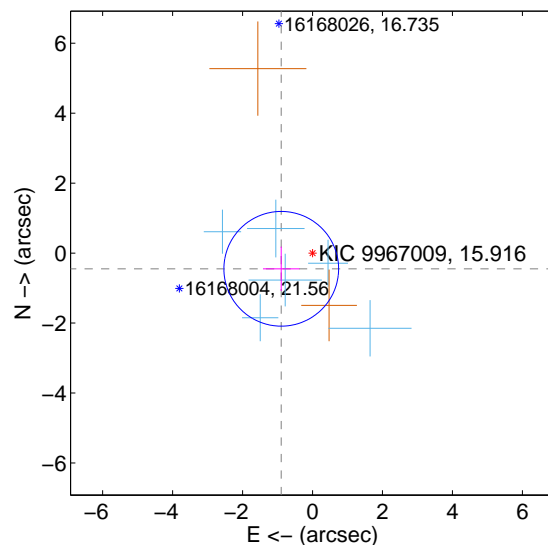
The direct PRF centroid is offset from the target star catalog position by about 0.56 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.233 \pm 0.625$	1.97	$0.895 \pm 0.471$	$-0.848 \pm 0.898$
PRF-fit source offset from KIC position	$1.000 \pm 0.547$	1.83	$0.894 \pm 0.522$	$-0.449 \pm 0.634$
photometric centroid source offset	$2.19 \pm 1.19$	1.84	$2.19 \pm 1.19$	$-0.19 \pm 1.73$

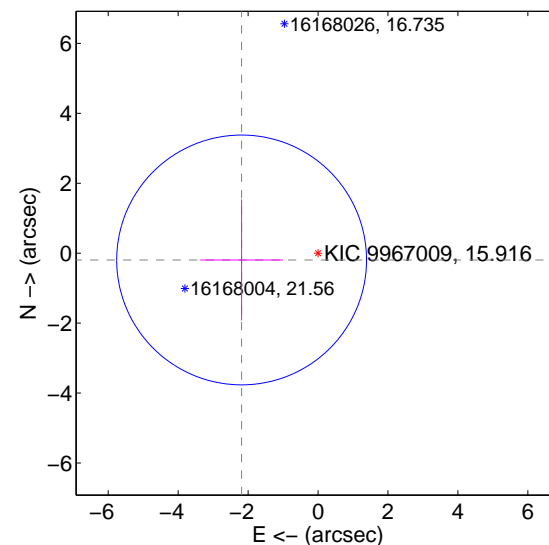
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

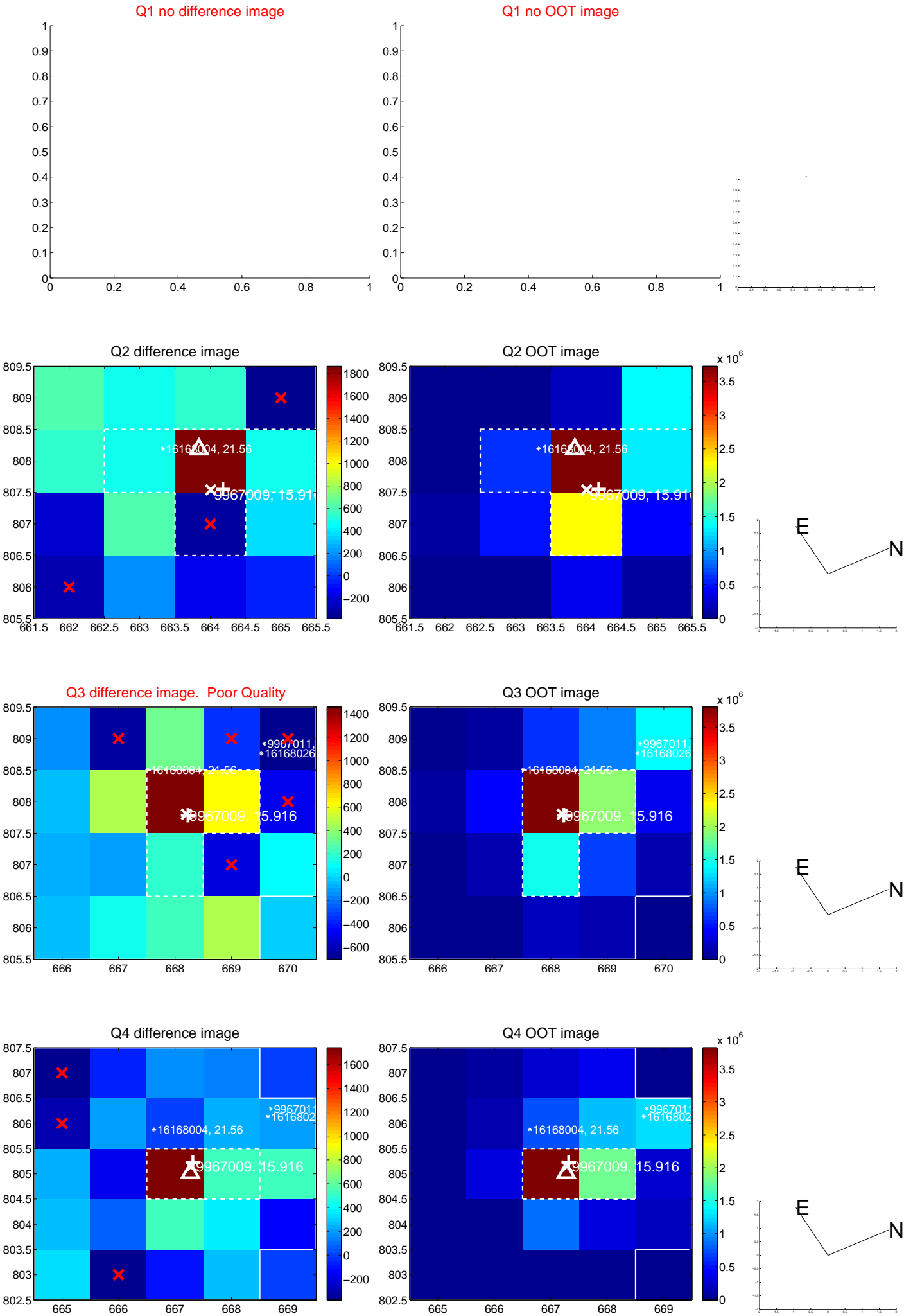


offset from photometric centroids

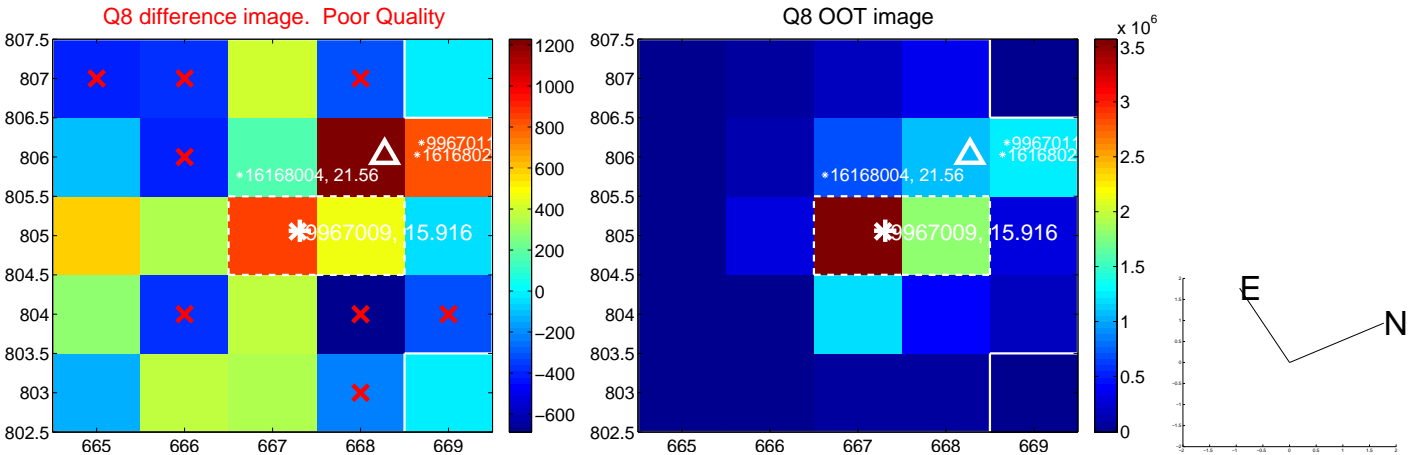
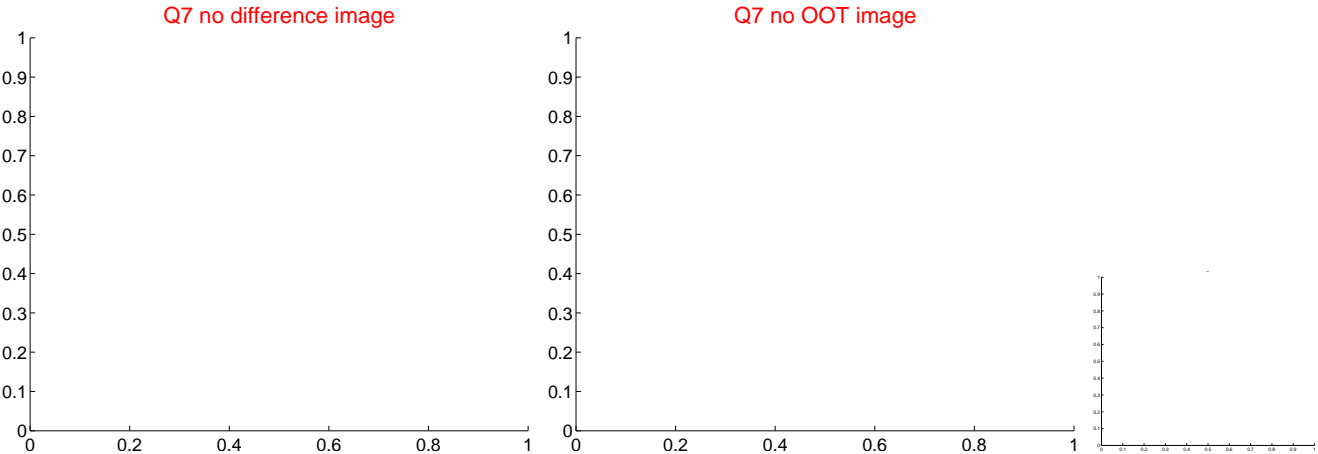
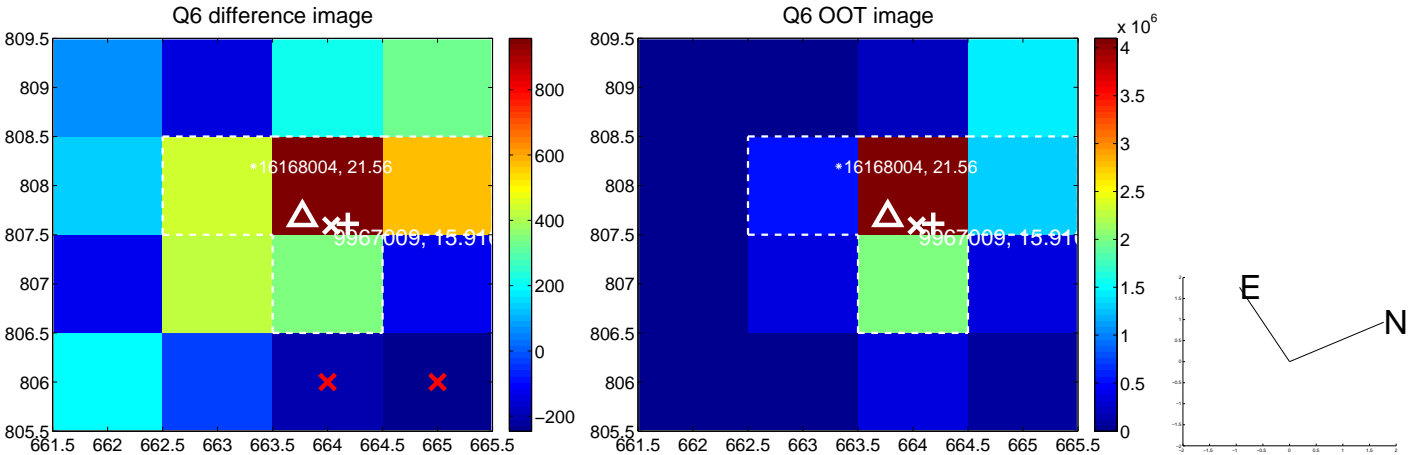
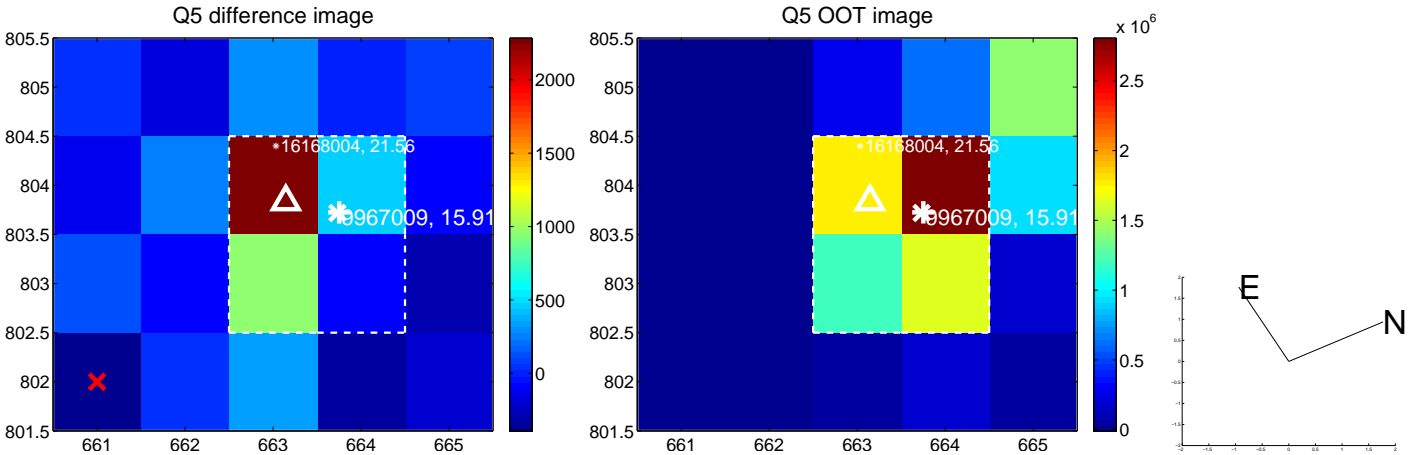


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

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

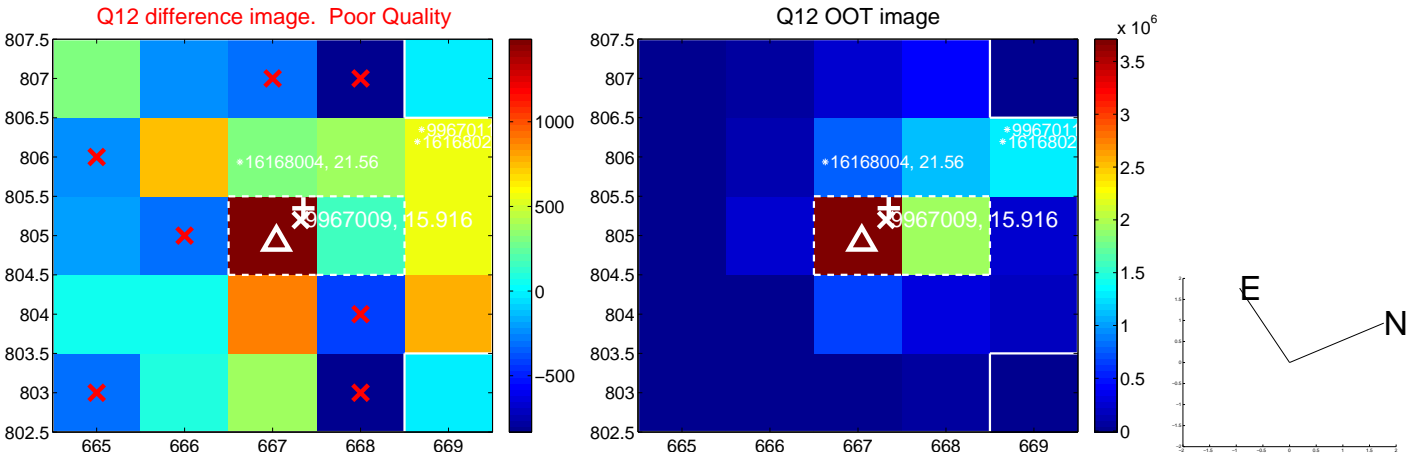
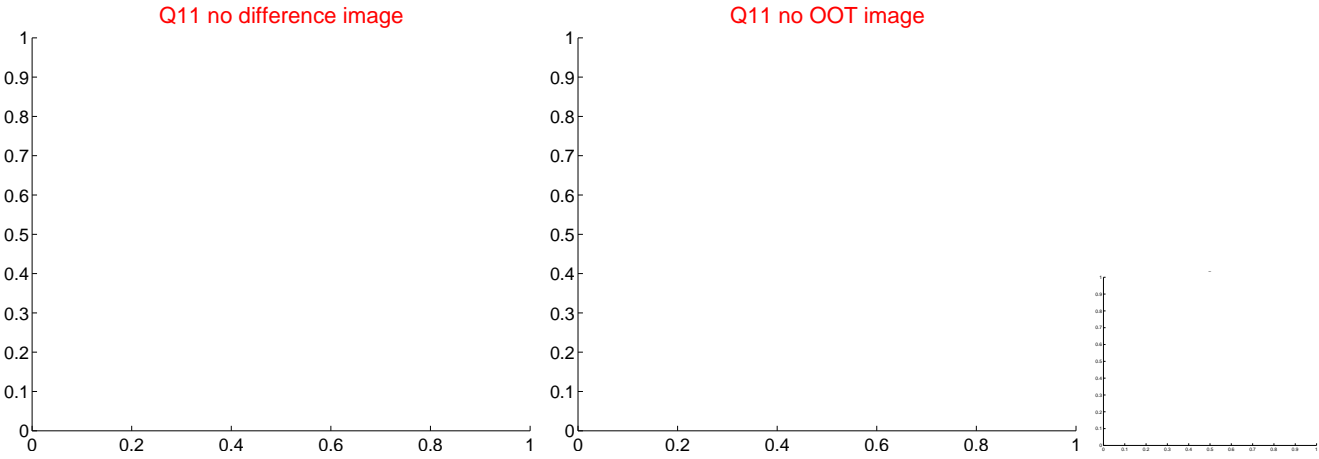
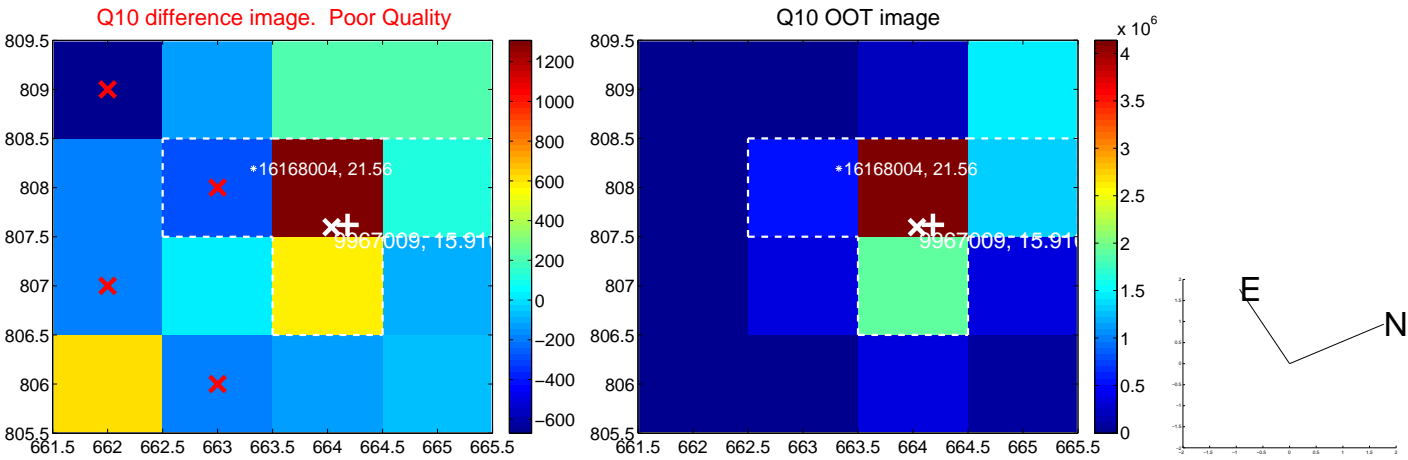
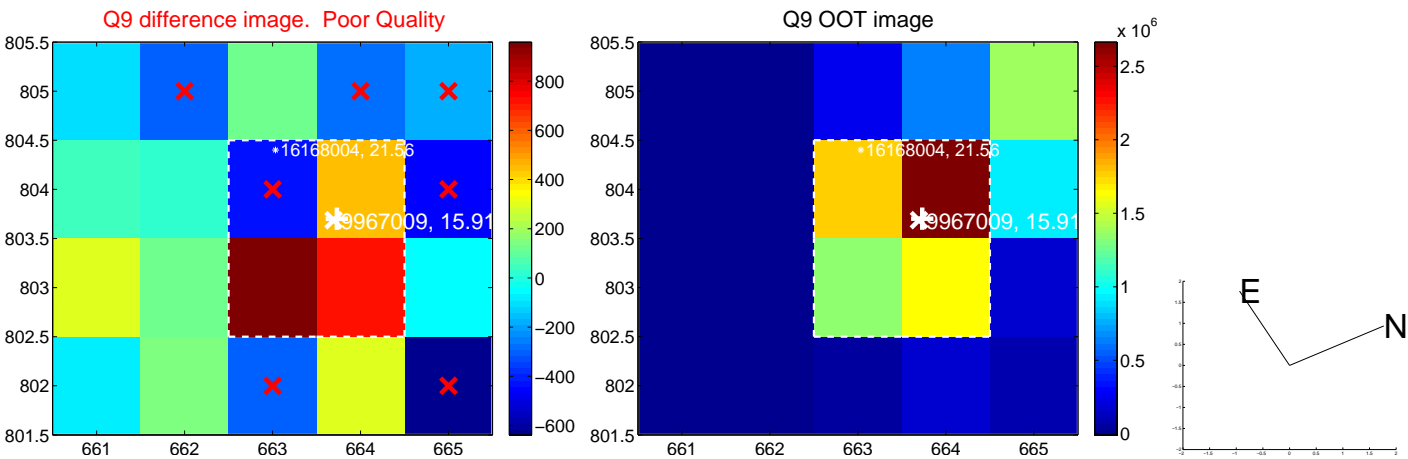


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

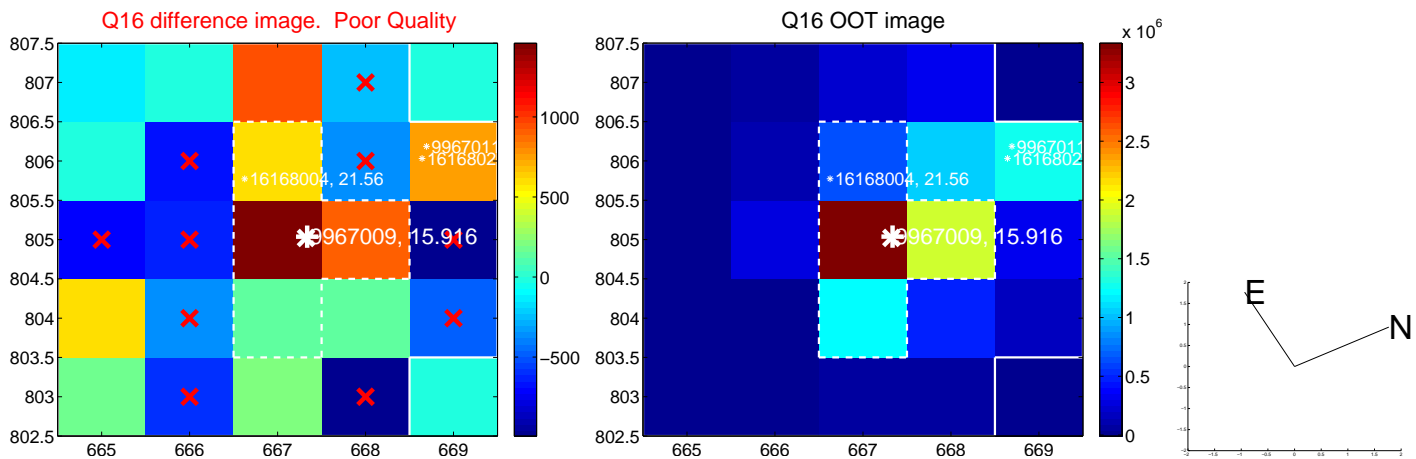
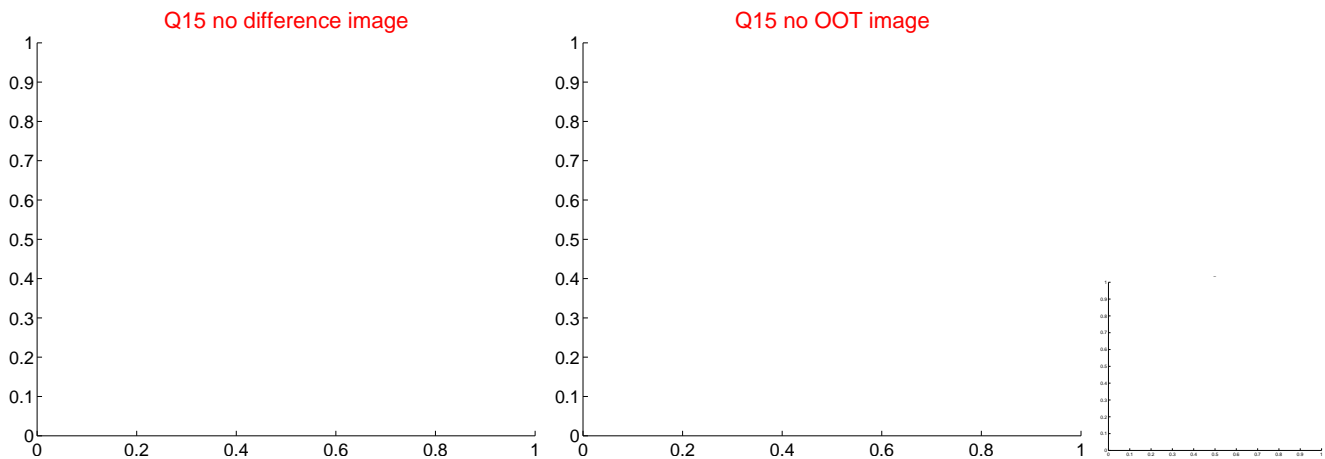
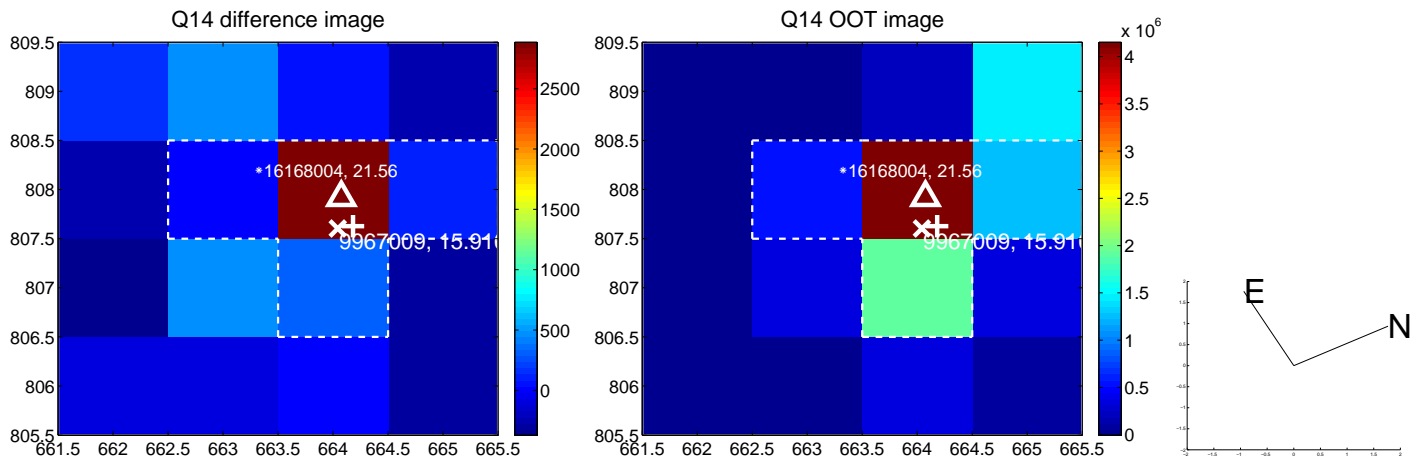
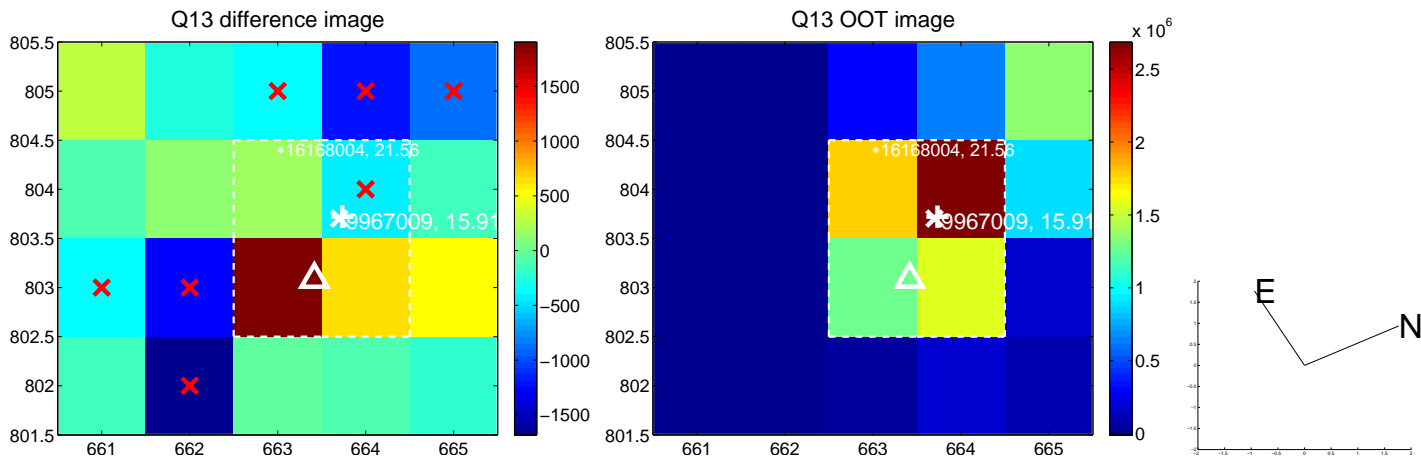




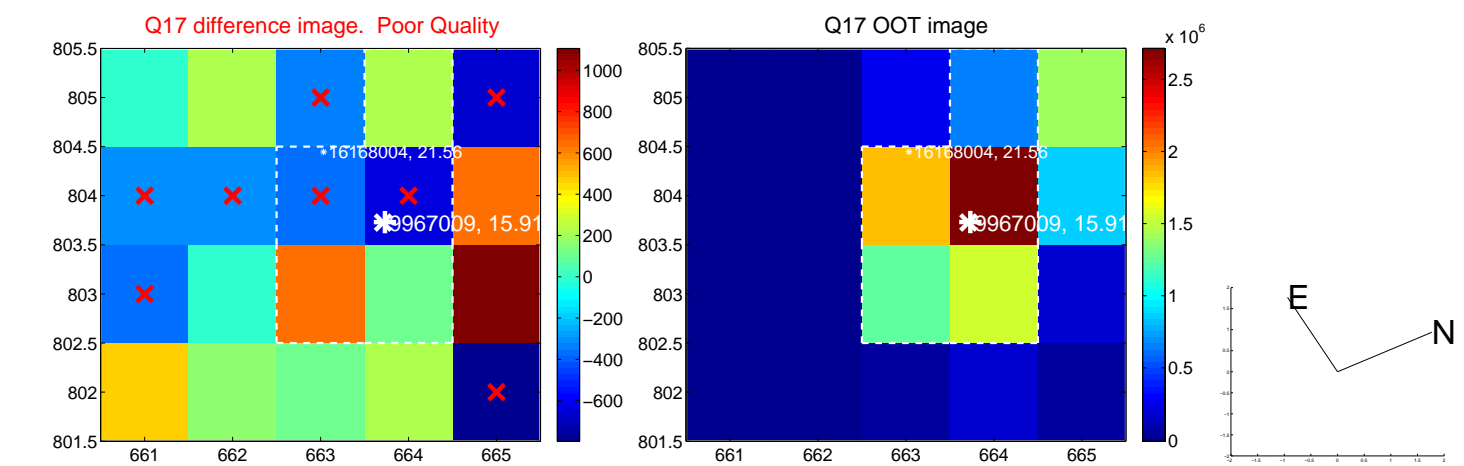
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



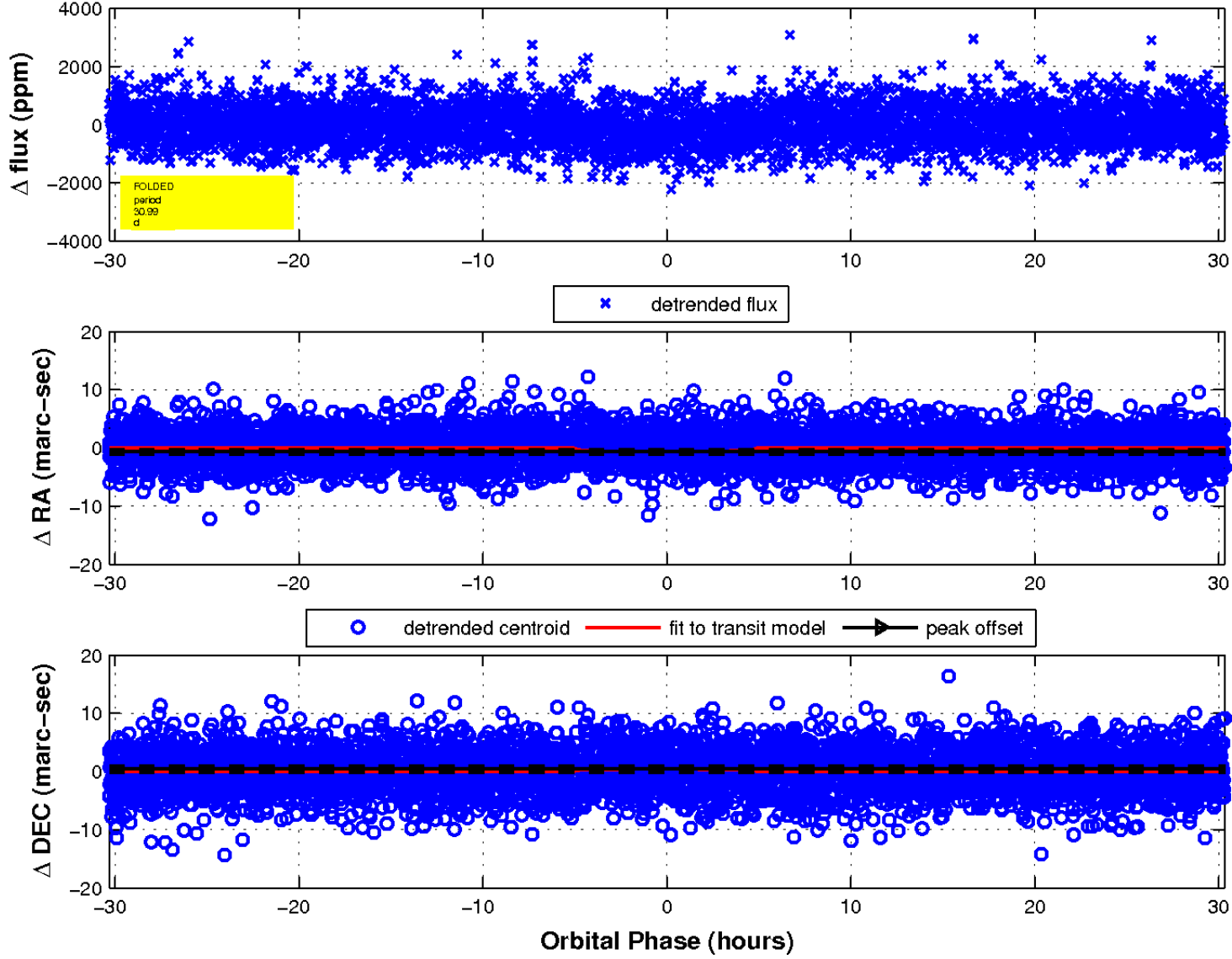
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



fluxWeightedCentroids, Planet 2 of 2



UKIRT Image

Declination

