

# KIC 010987439

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
010987439-01	OBS	7396.01	10.674599	138.884703	16575.4	3.805	3051.2	2595.5	1.49	6496	33.49	326.21
010987439-02	OBS	No	10.674598	133.762552	13710.3	3.253	2445.3	2375.0	1.49	6496	30.67	326.21

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
010987439-01	OBS	FP	0.00	0	1	0	0	MOD_SEC_DV—MOD_SEC_ALT—MOD_ODDEVEN_ALT—DEEP_V_SHAPED—HAS_SEC_TCE—CENT_SATURATED
010987439-02	OBS	FP	0.00	1	1	0	0	IS_SEC_TCE—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 010987439-01

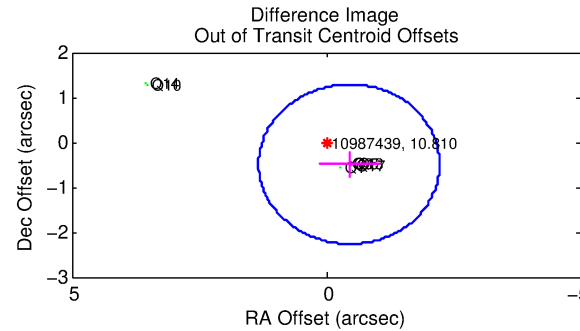
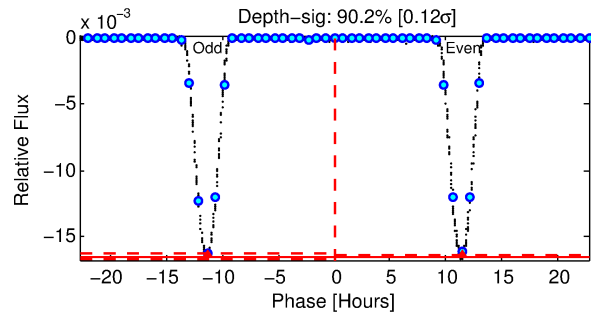
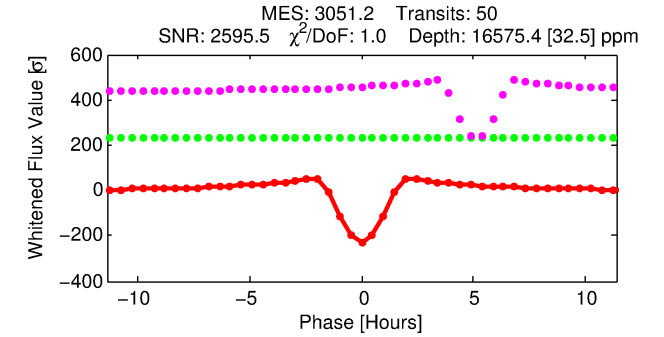
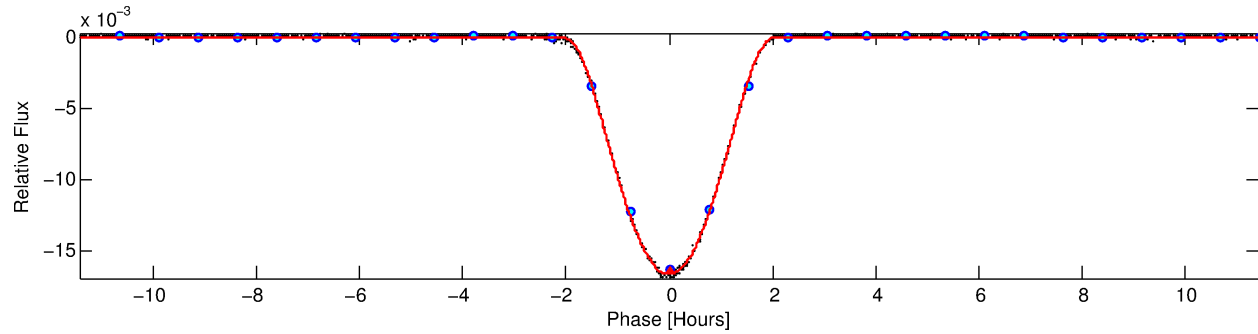
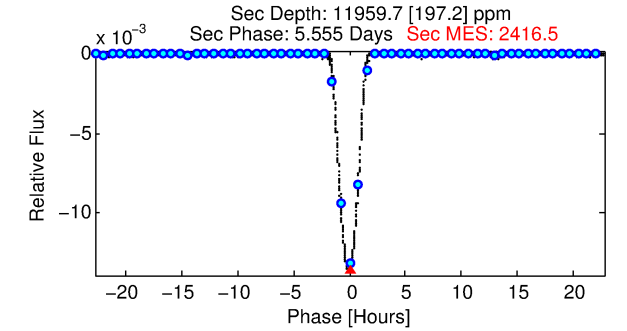
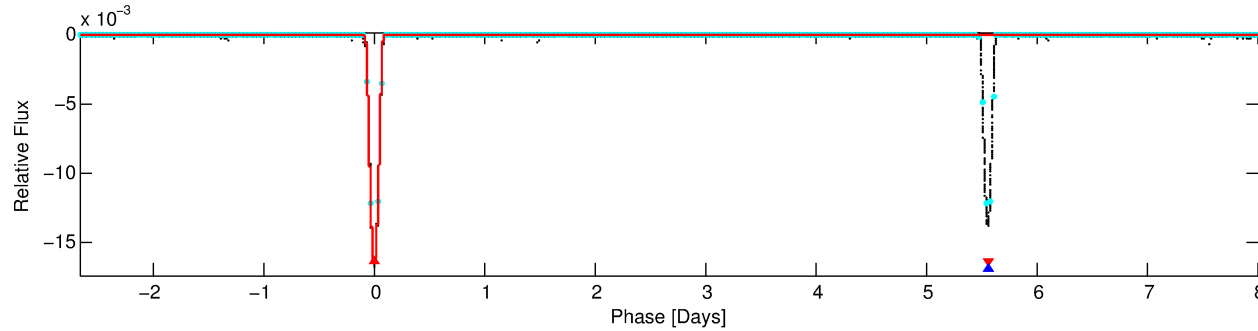
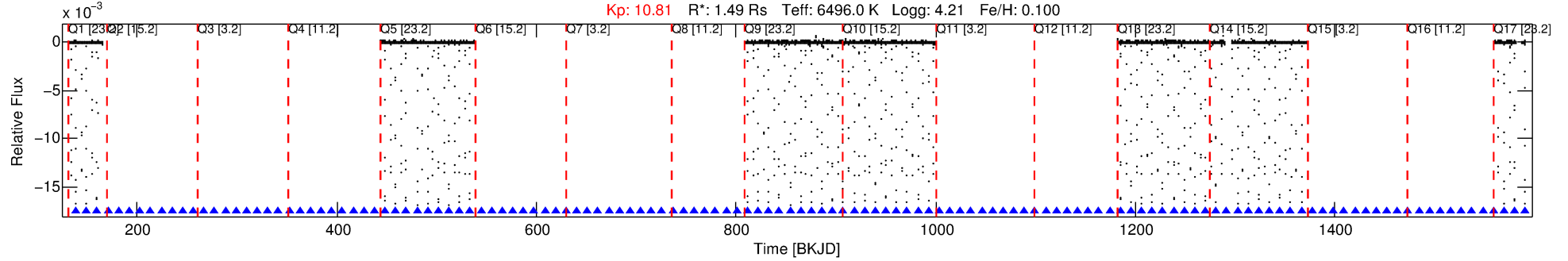
No Significant Match Found

# DV One-Page Summary

KIC: 10987439 Candidate: 1 of 2 Period: 10.675 d

KOI: K07396.01 Corr: 0.999

Kp: 10.81 R\*: 1.49 Rs Teff: 6496.0 K Logg: 4.21 Fe/H: 0.100



## DV Fit Results:

Period = 10.67460 [0.00000] d  
Epoch = 138.8847 [0.0000] BKJD  
Rp/R\* = 0.2067 [0.0042]  
a/R\* = 14.52 [0.03]  
b = 1.00 [0.01]  
Seff = 326.21 [72.70]  
Teq = 1084 [60] K  
Rp = 33.49 [6.26] Re  
a = 0.1039 [0.0158] AU  
Ag = 63.28 [14.00] [4.45σ]  
Teffp = 4726 [79] K [36.51σ]

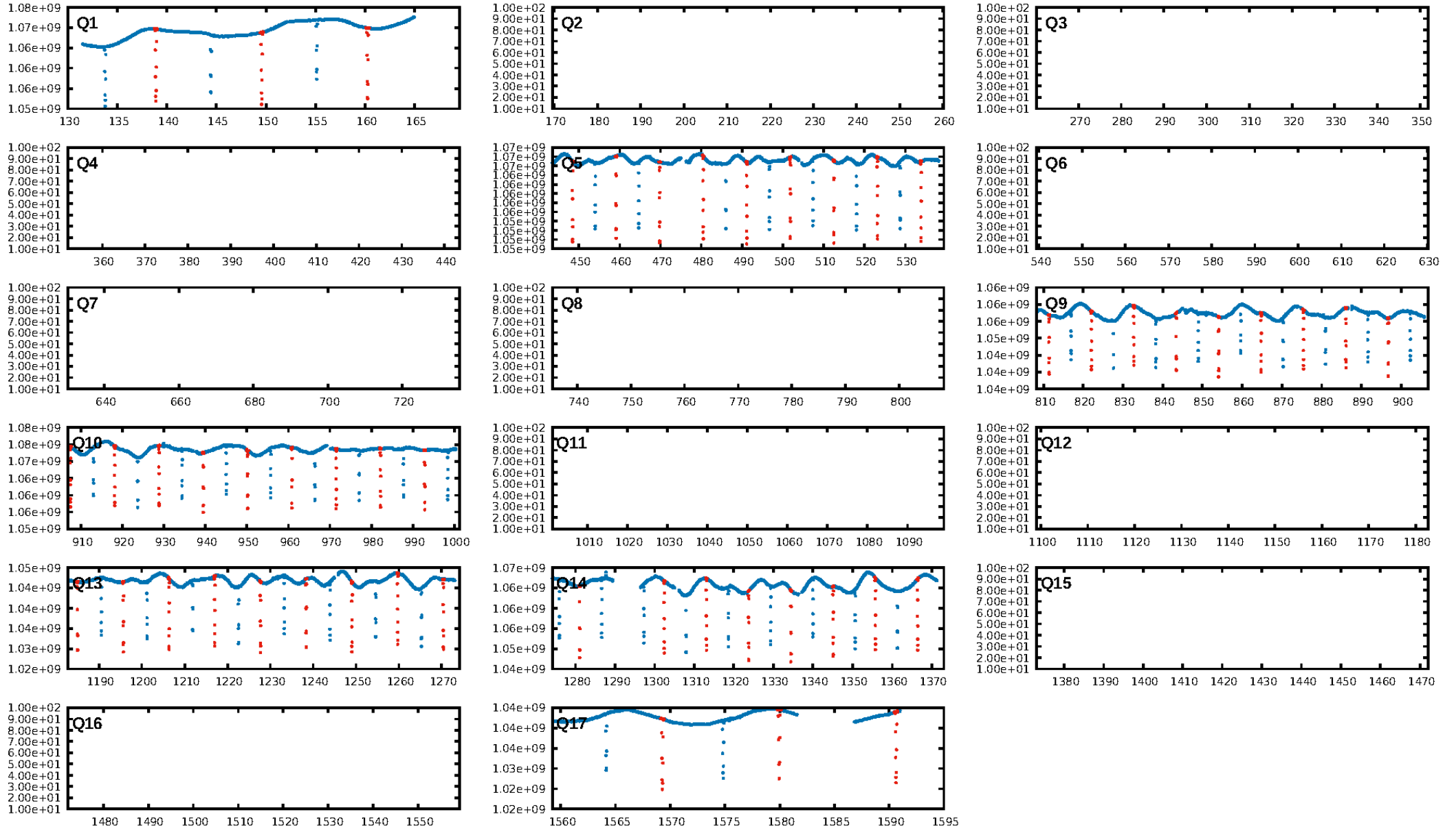
## DV Diagnostic Results:

ShortPeriod-sig: 0.0% [0.00σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 0.0%  
ModelChiSquareGof-sig: 94.3%  
Bootstrap-pfa: 0.00e+00  
RollingBand-fgt: 1.00 [44/44]  
GhostDiagnostic-chr: 7.548  
Centroid-sig: 0.0%  
Centroid-so: 1.110 arcsec [296.43σ]  
OotOffset-rm: 0.664 arcsec [1.12σ]  
KicOffset-rm: 0.701 arcsec [1.89σ]  
OotOffset-st: 2/0/0/5 [7]  
KicOffset-st: 2/0/0/5 [7]  
DiffImageQuality-fgm: 0.00 [0/7]  
DiffImageOverlap-fno: 1.00 [7/7]

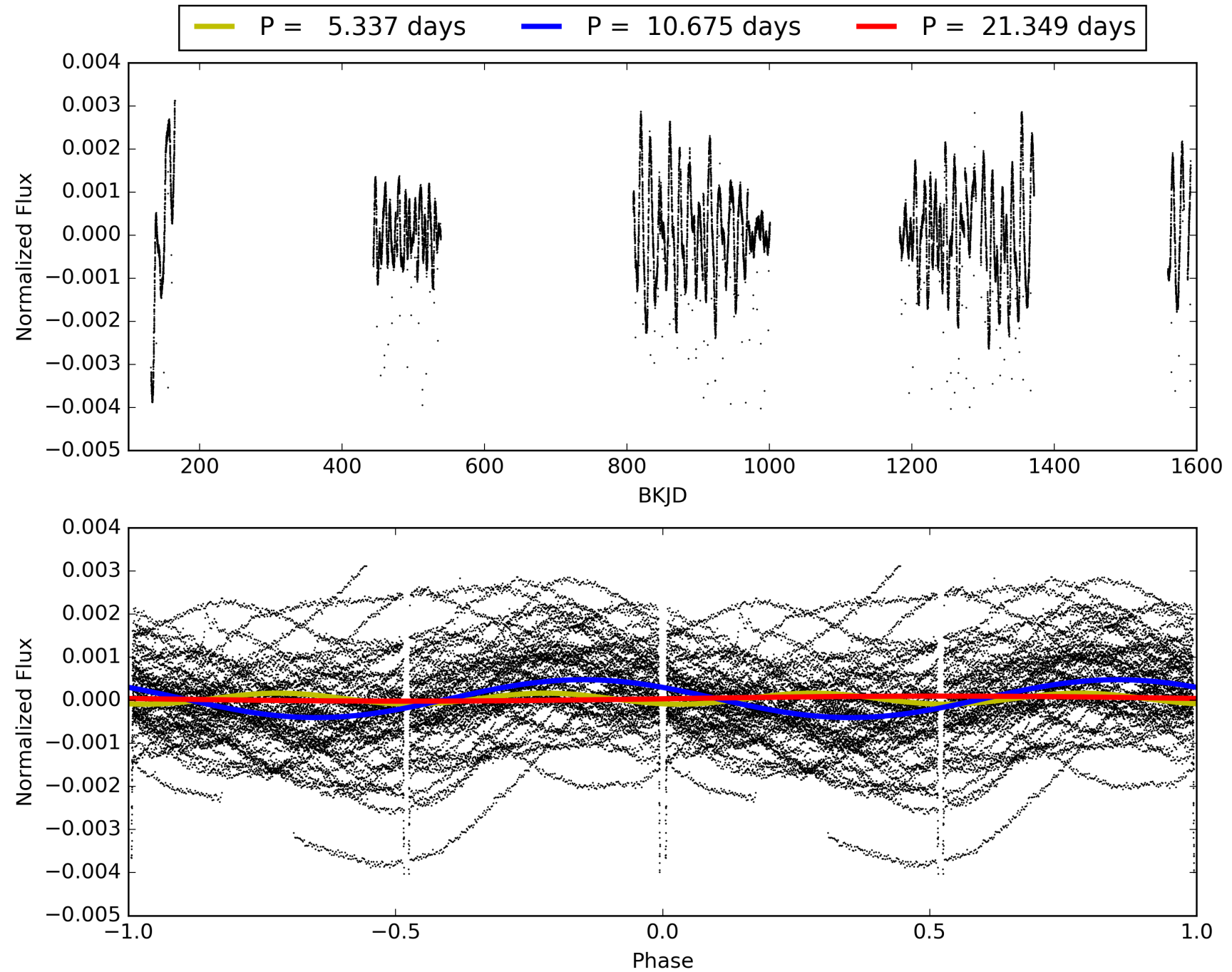
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 29-Jan-2016 13:01:44 Z

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

# TCE 010987439-01, PDC Light Curves

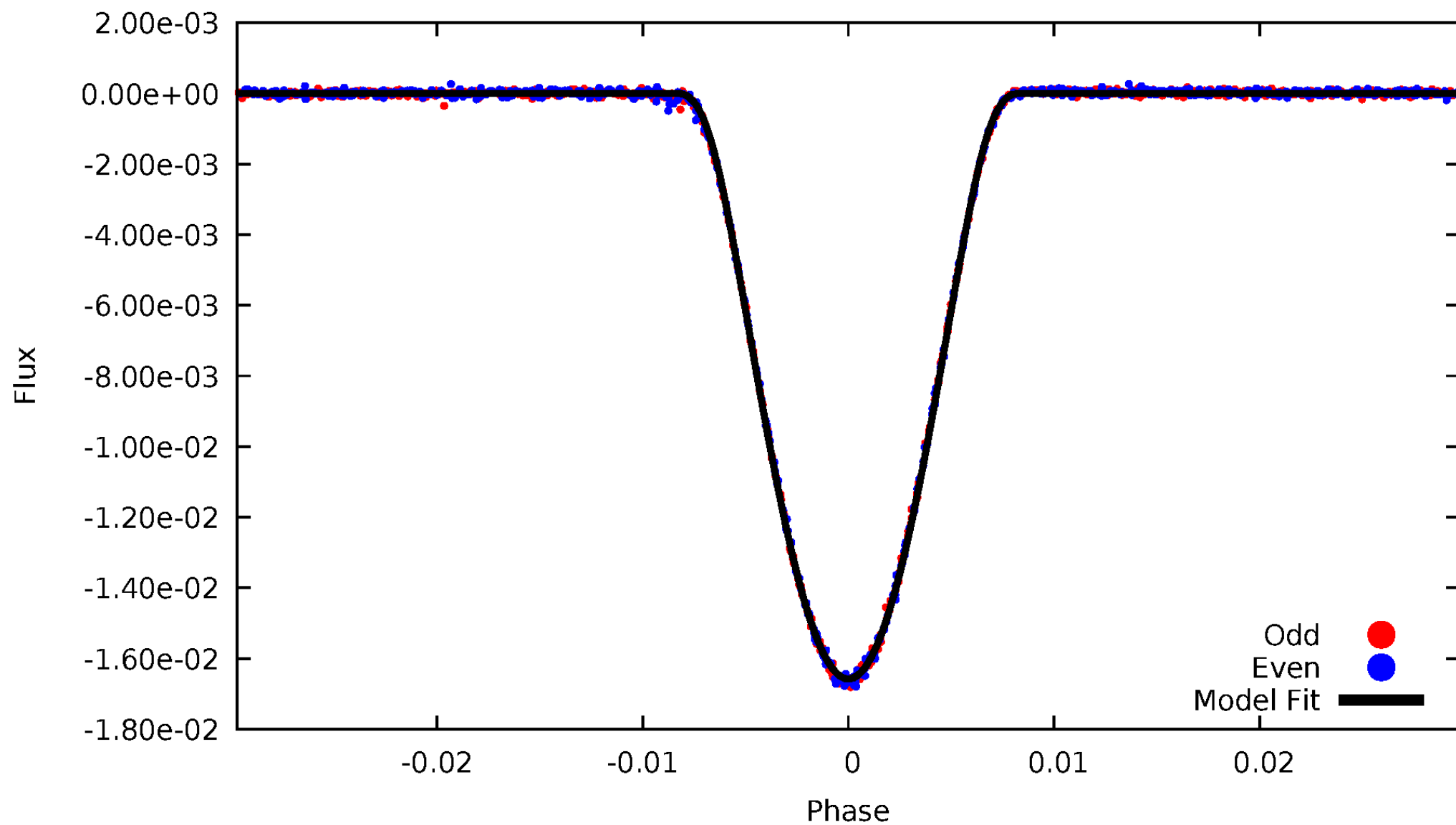


TCE 010987439-01



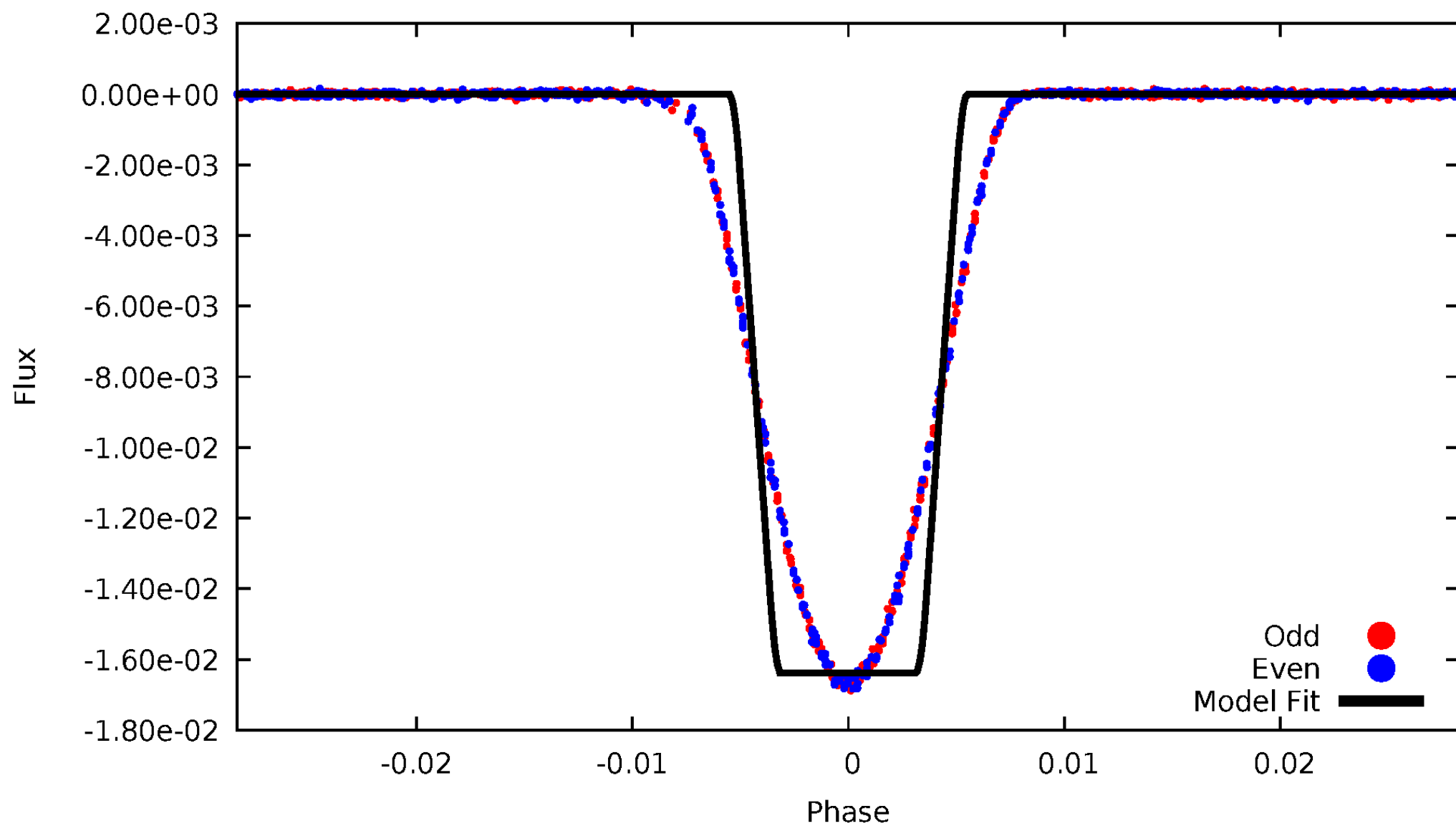
# DV Odd/Even

TCE 010987439-01



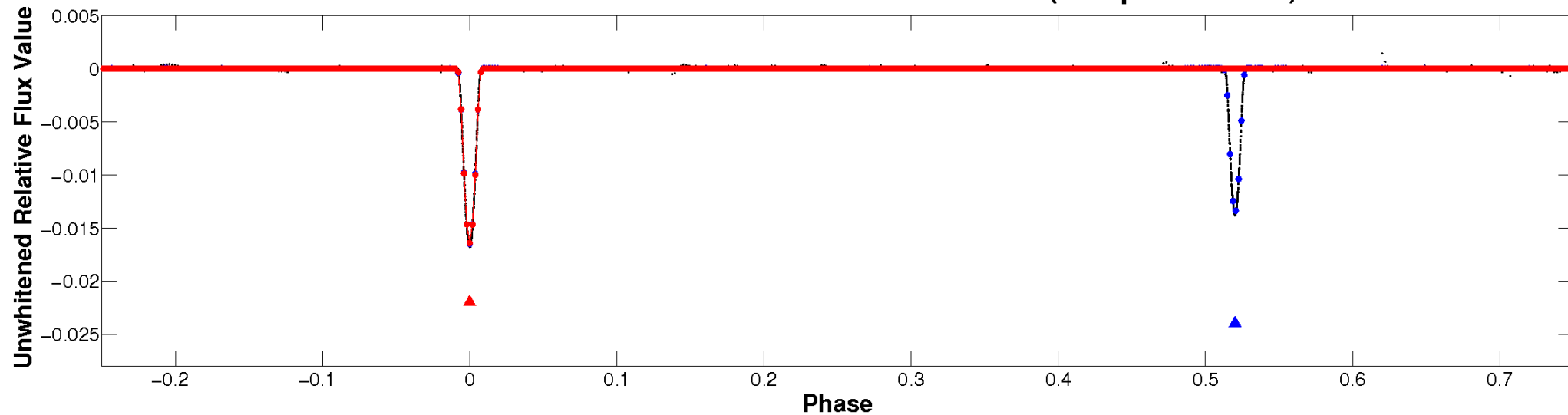
# ALT Odd/Even

TCE 010987439-01

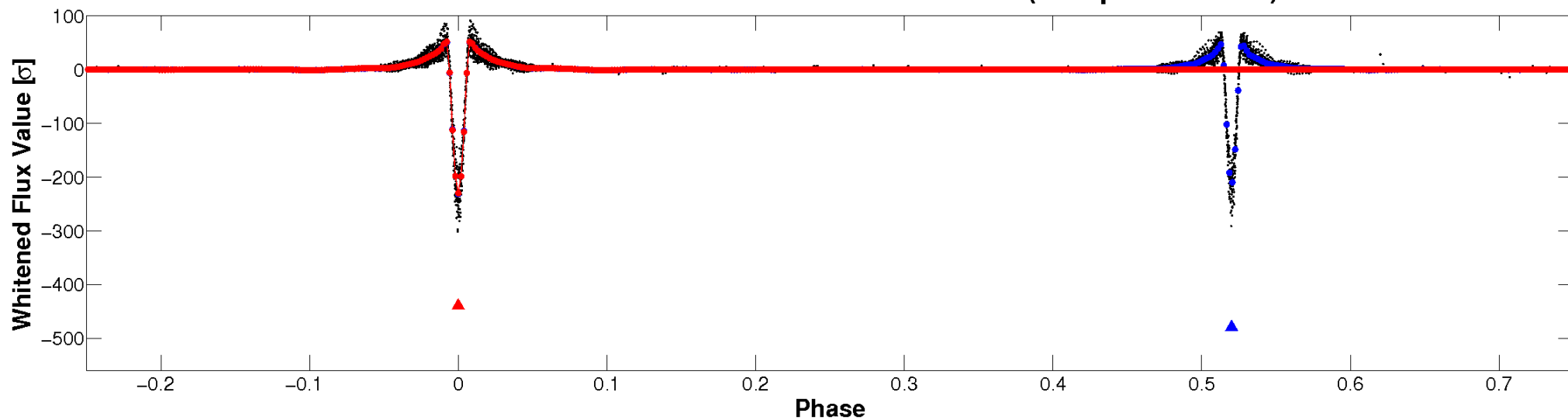


# Non-Whitened Vs. Whitened Light Curve

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

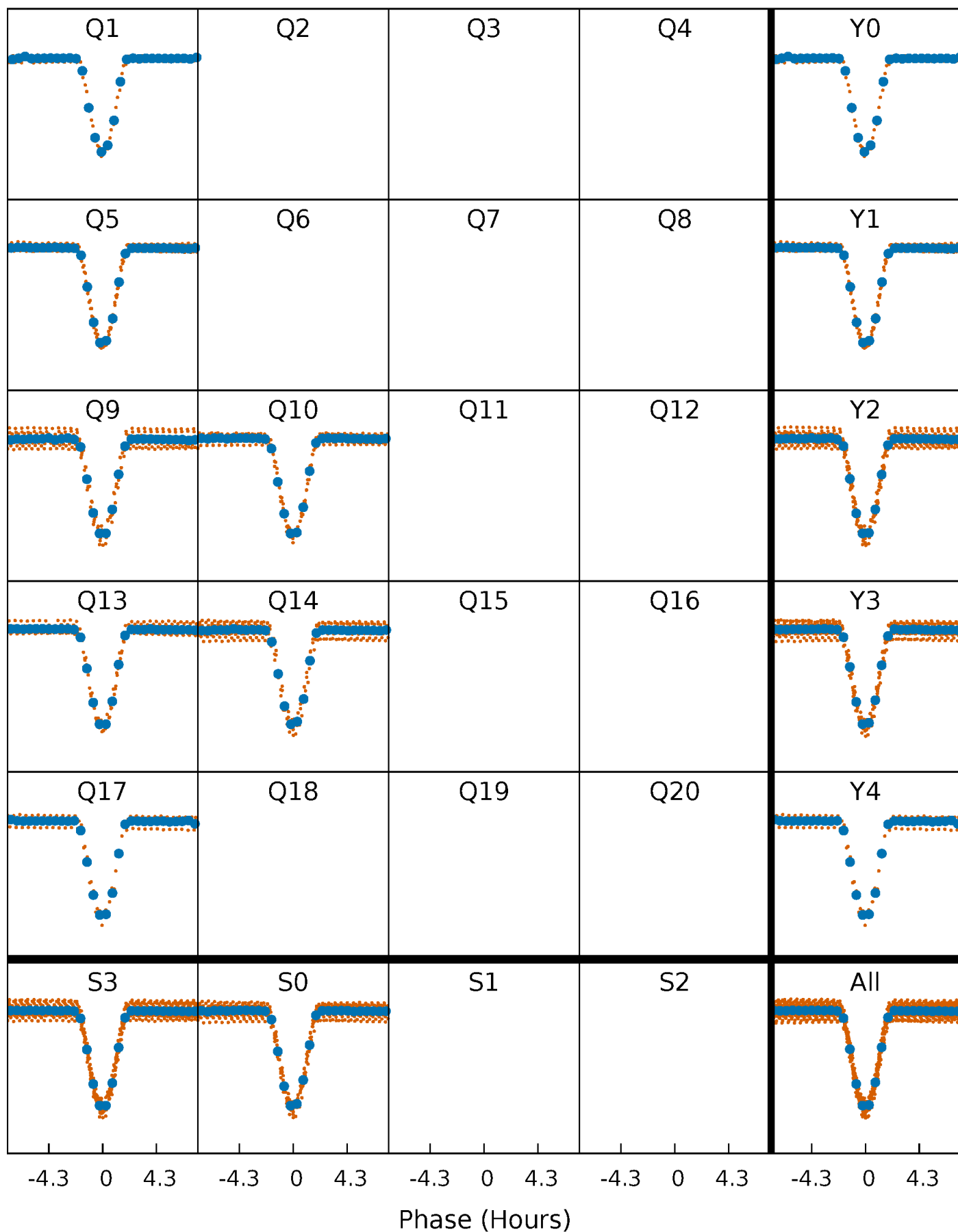


## Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

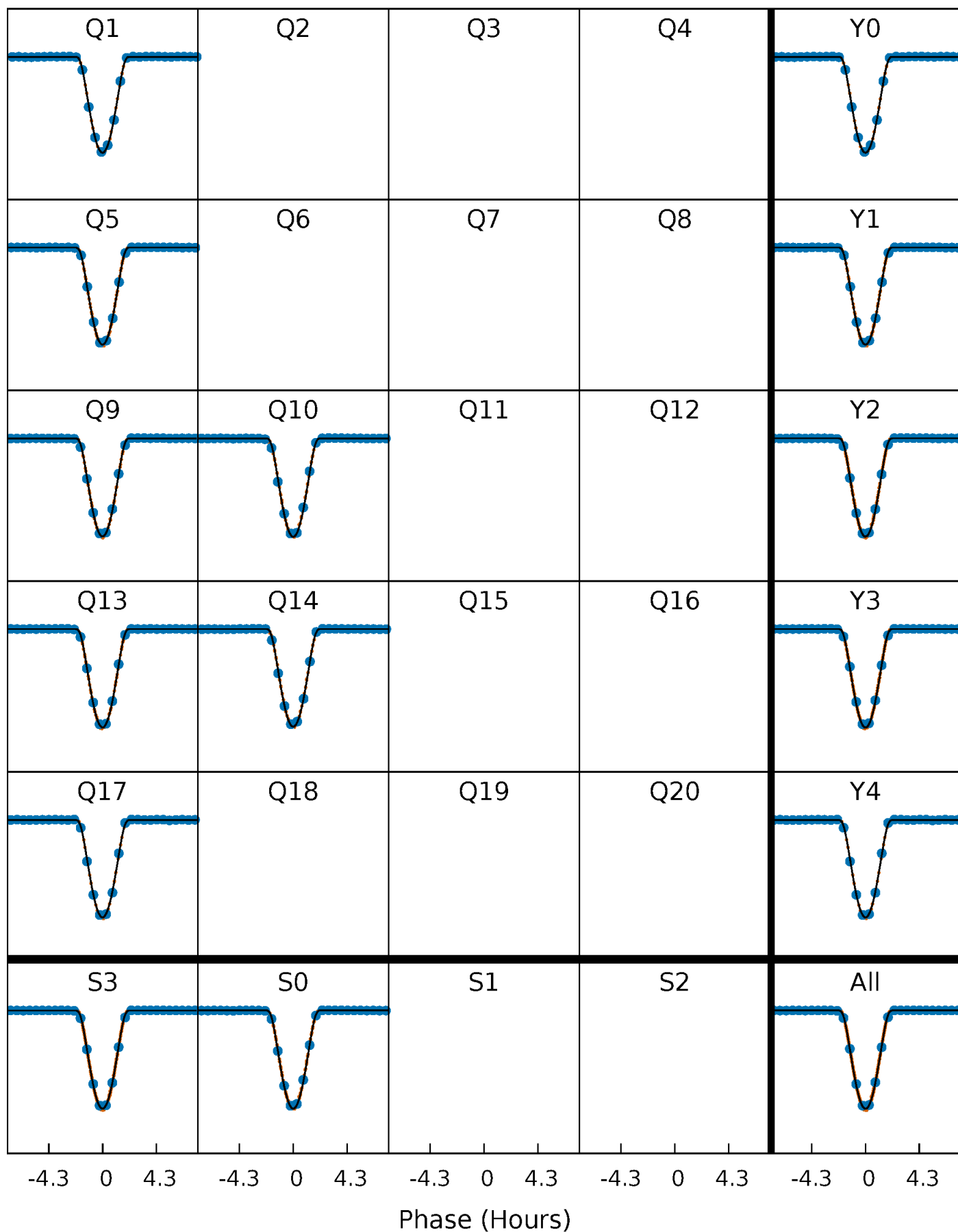
TCE 010987439-01   P= 10.674599 Days    $T_0=138.884703$  (BKJD)





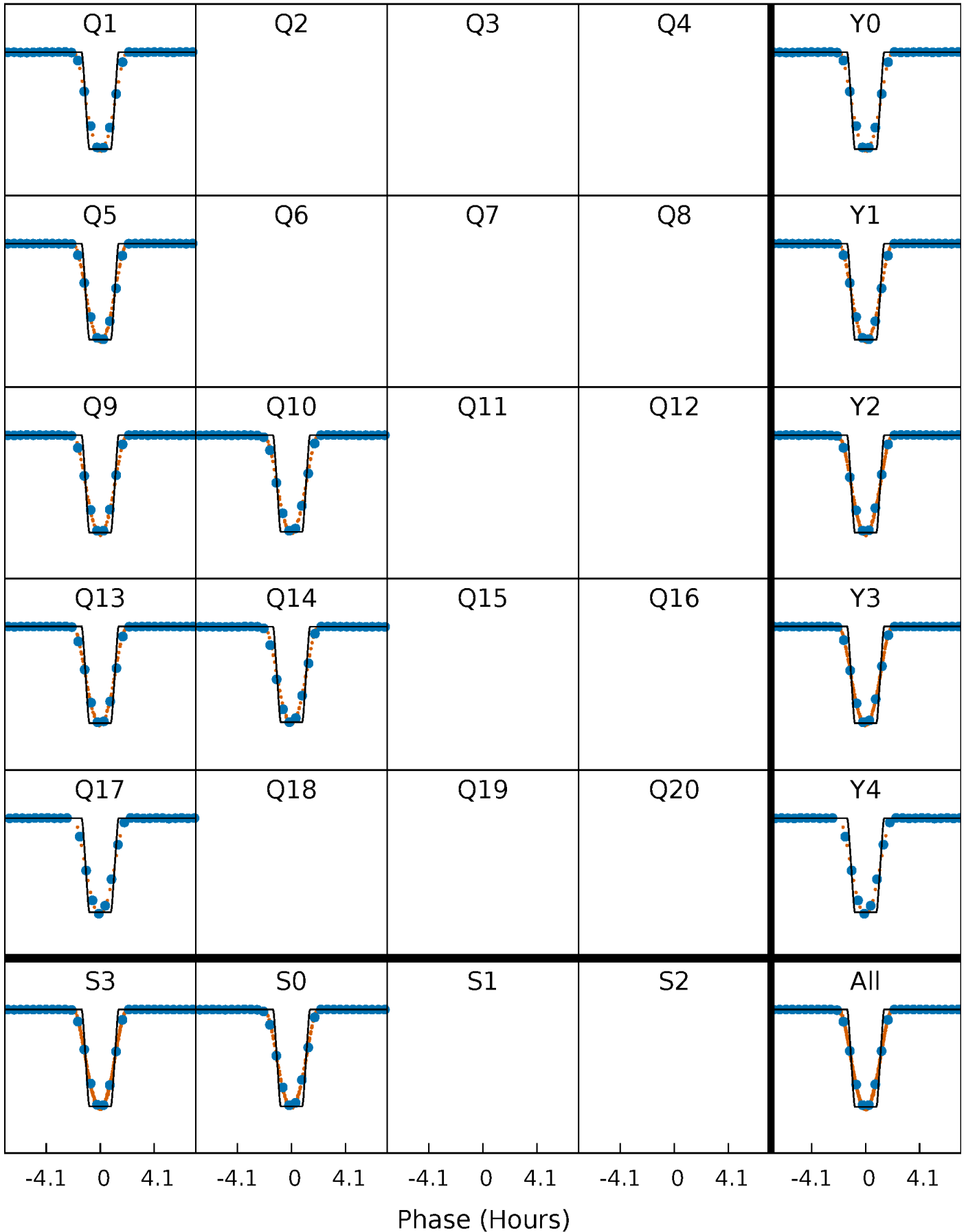
# DV Quarter-Phased Transit Curves

TCE 010987439-01 P= 10.674599 Days  $T_0=138.884703$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

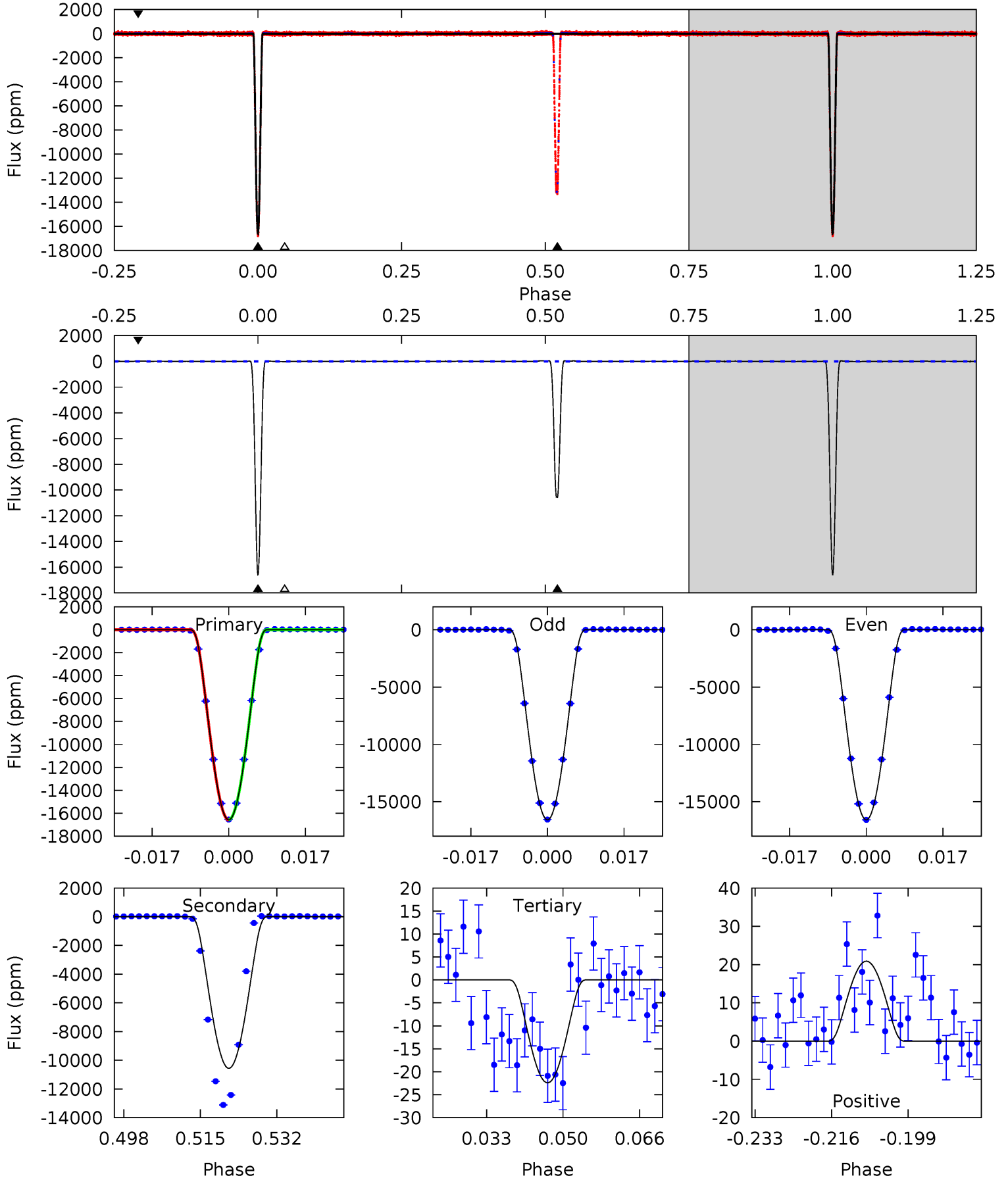
TCE 010987439-01 P= 10.674608 Days  $T_0=138.883984$  (BKJD)



# DV Model-Shift Uniqueness Test

010987439-01, P = 10.674599 Days, E = 128.210104 Days

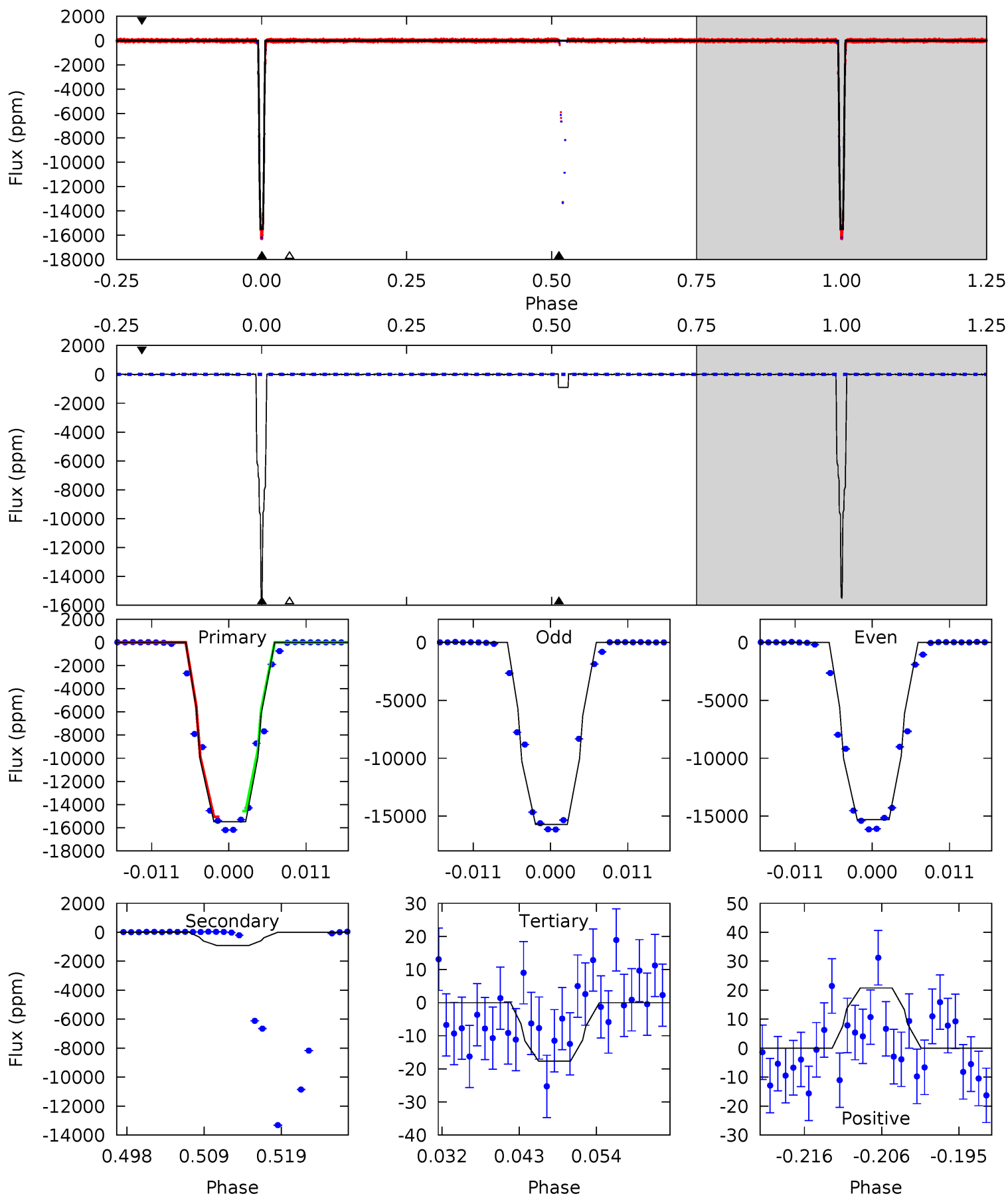
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
6596	4202	8.91	8.31	4.93	2.40	3.63	6587	6587	4193	4193	1.09	1.00	0.00	0.44



# Alt Model-Shift Uniqueness Test

010987439-01, P = 10.674608 Days, E = 128.209376 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
2020	119.4	2.31	2.71	5.01	2.55	4.47	2018	2018	117.1	116.7	20.2	1.00	0.00	0



### Stellar Parameters For KIC 010987439

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6496^{+77}_{-83}$	$4.212^{+0.095}_{-0.116}$	$0.100^{+0.150}_{-0.200}$	$1.485^{+0.276}_{-0.184}$	$1.312^{+0.105}_{-0.095}$	$0.565^{+0.239}_{-0.198}$
	+1%/-1%	+2%/-3%	+150%/-200%	+19%/-12%	+8%/-7%	+42%/-35%
Source	SPE68	SPE68	SPE68	DSEP		

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

### Secondary Eclipse Parameters for KIC 010987439-01 / KOI 7396.01

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-10562 \pm 3$	$33.60^{+2.99}_{-2.47}$	$1516^{+65}_{-55}$	$4723^{+59}_{-61}$	$56^{+9}_{-8}$
Alt.	$-916 \pm 8$	$20.78^{+2.22}_{-1.66}$	$1516^{+73}_{-56}$	$3592^{+49}_{-49}$	$13^{+2}_{-2}$

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

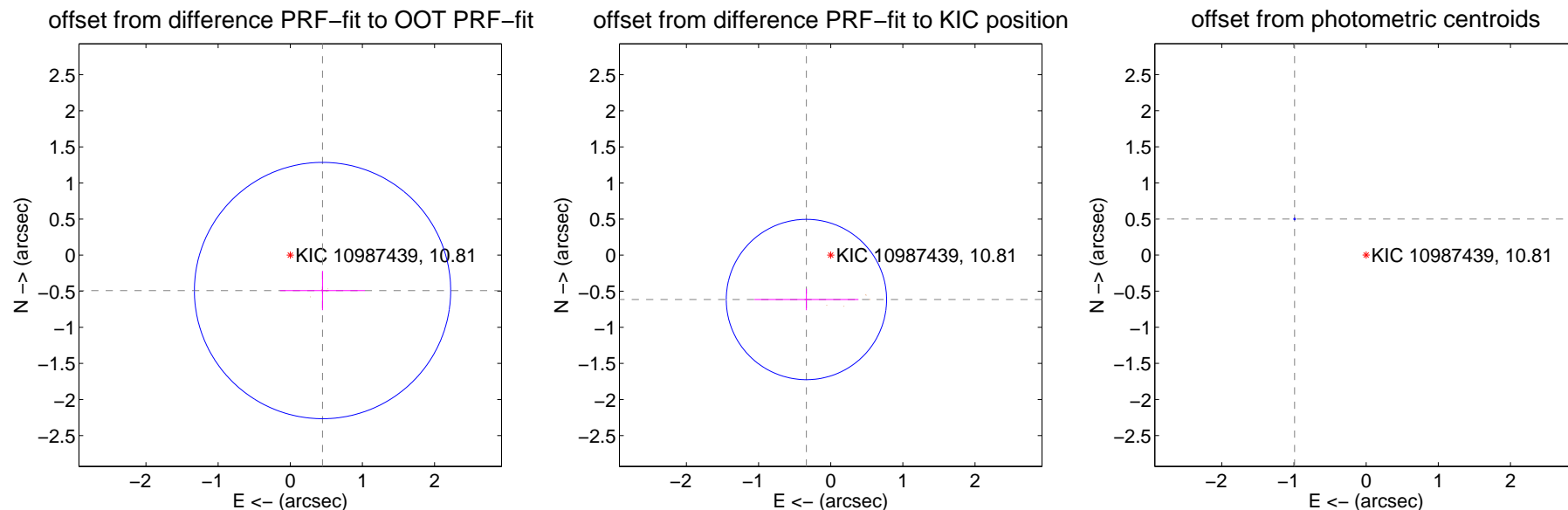
## DV Centroid Data

Supplemental centroid analysis for 010987439-01. **Kepler magnitude: 10.81.** Transit SNR 2595.52

**There are 0 quarters with good PRF difference image offsets**

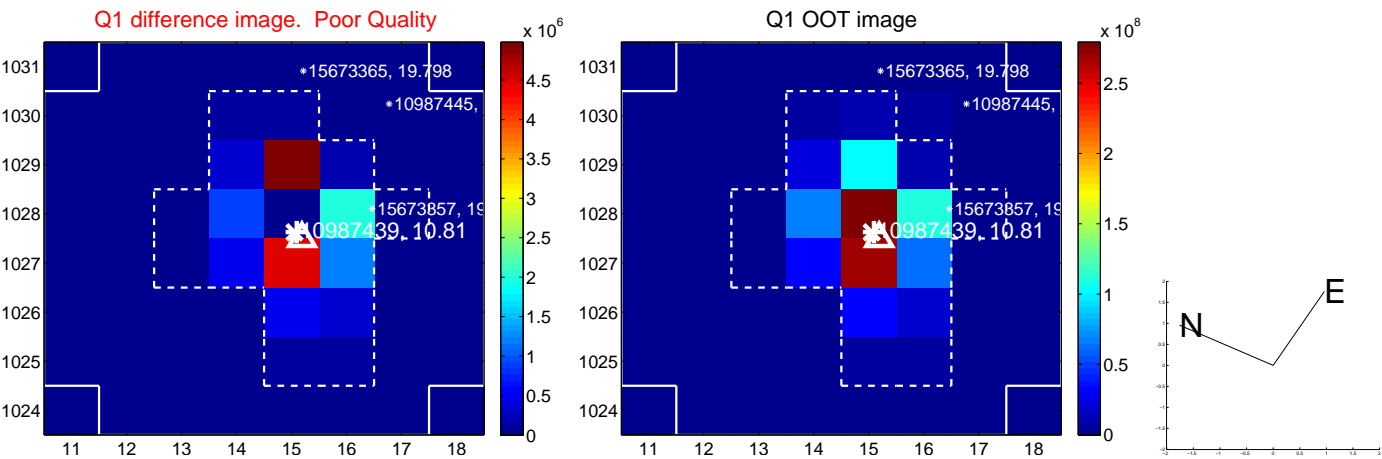
The direct PRF centroid is offset from the target star catalog position by about 0.12 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.664 \pm 0.592$	1.12	$-0.447 \pm 0.588$	$-0.491 \pm 0.273$
PRF-fit source offset from KIC position	$0.701 \pm 0.370$	1.89	$0.337 \pm 0.722$	$-0.615 \pm 0.148$
photometric centroid source offset	<b><math>1.11 \pm 0.00</math></b>	<b>296.43</b>	$0.99 \pm 0.00$	$0.50 \pm 0.00$

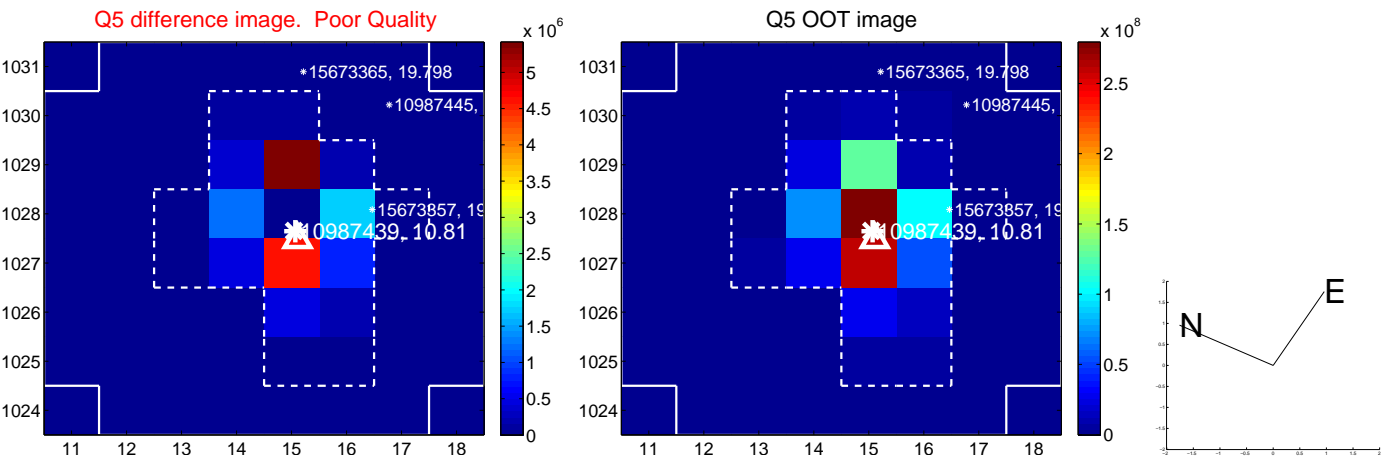


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

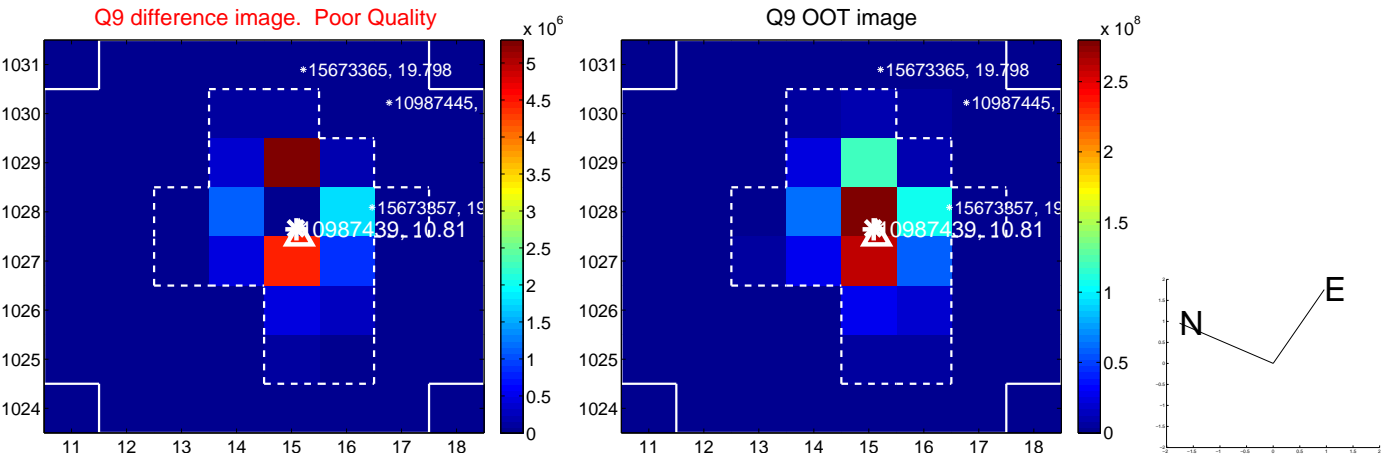


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

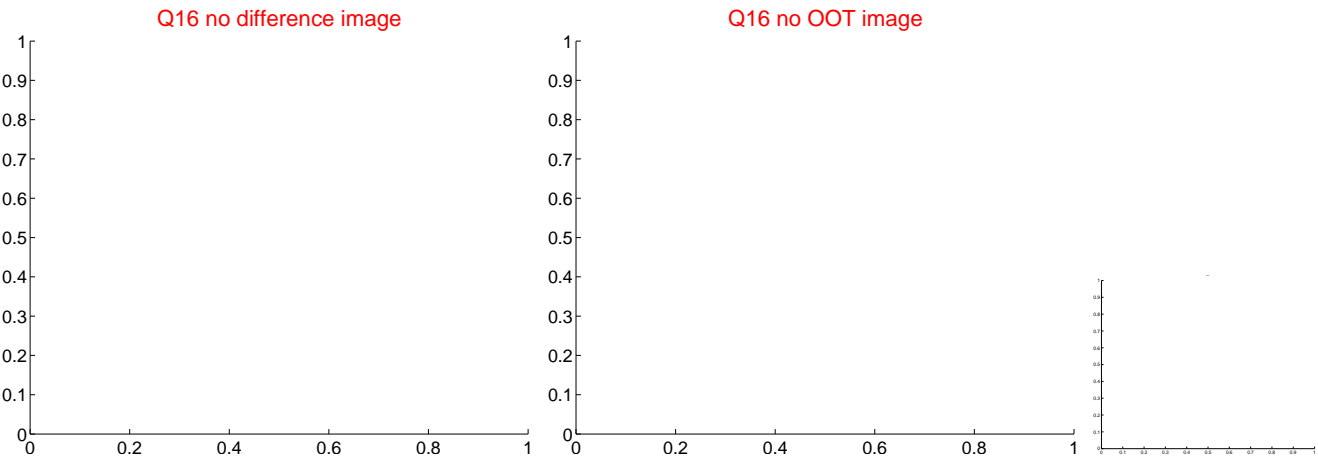
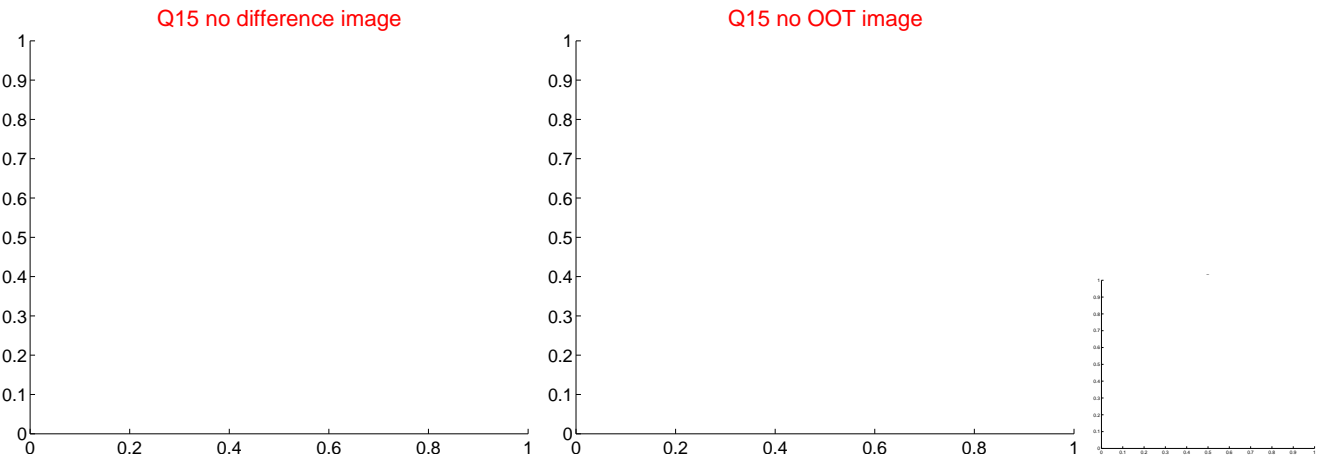
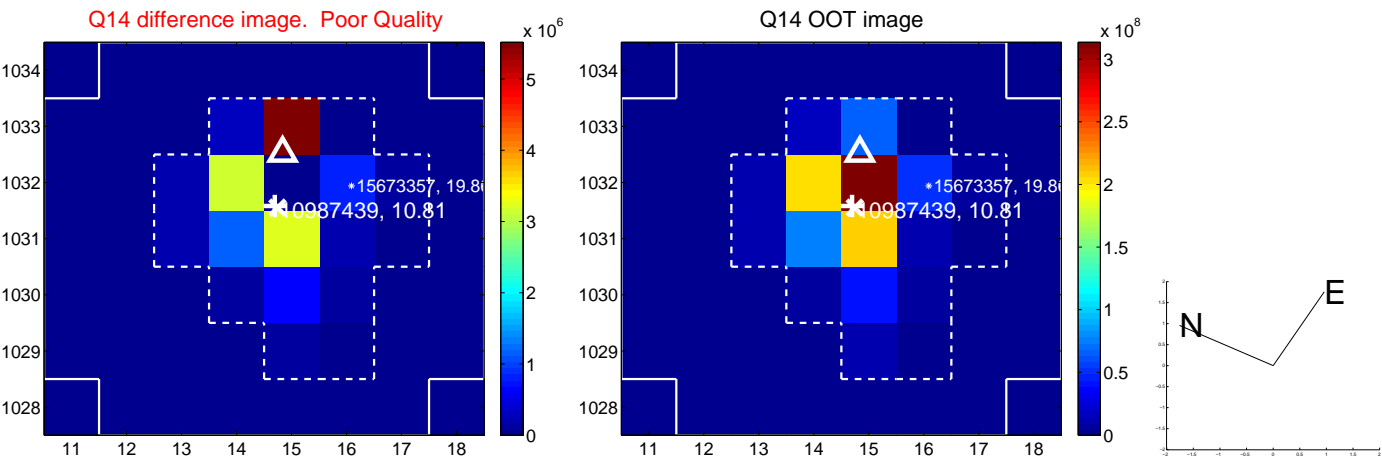
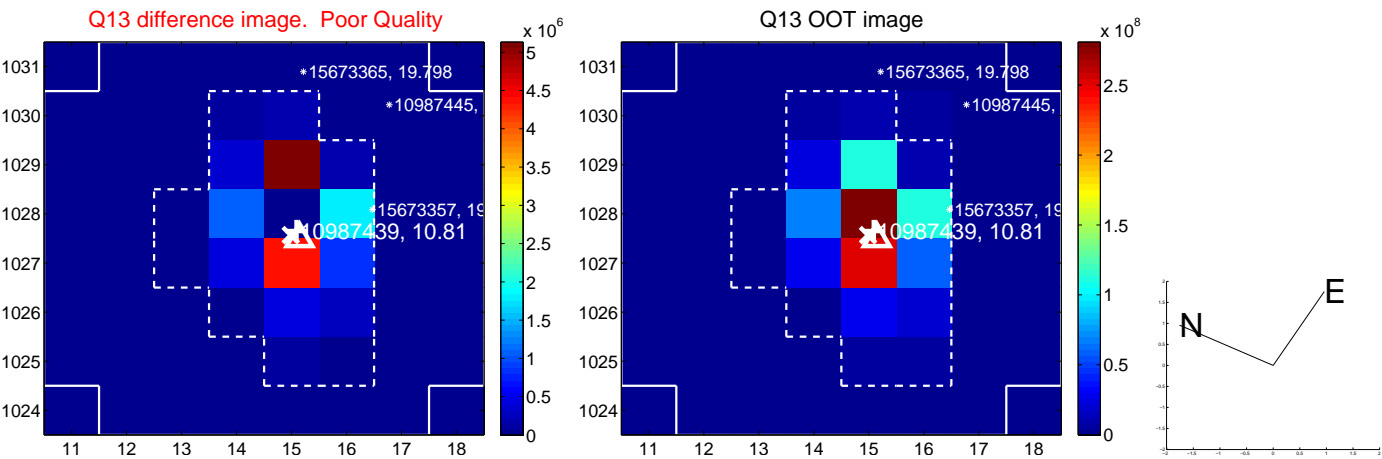




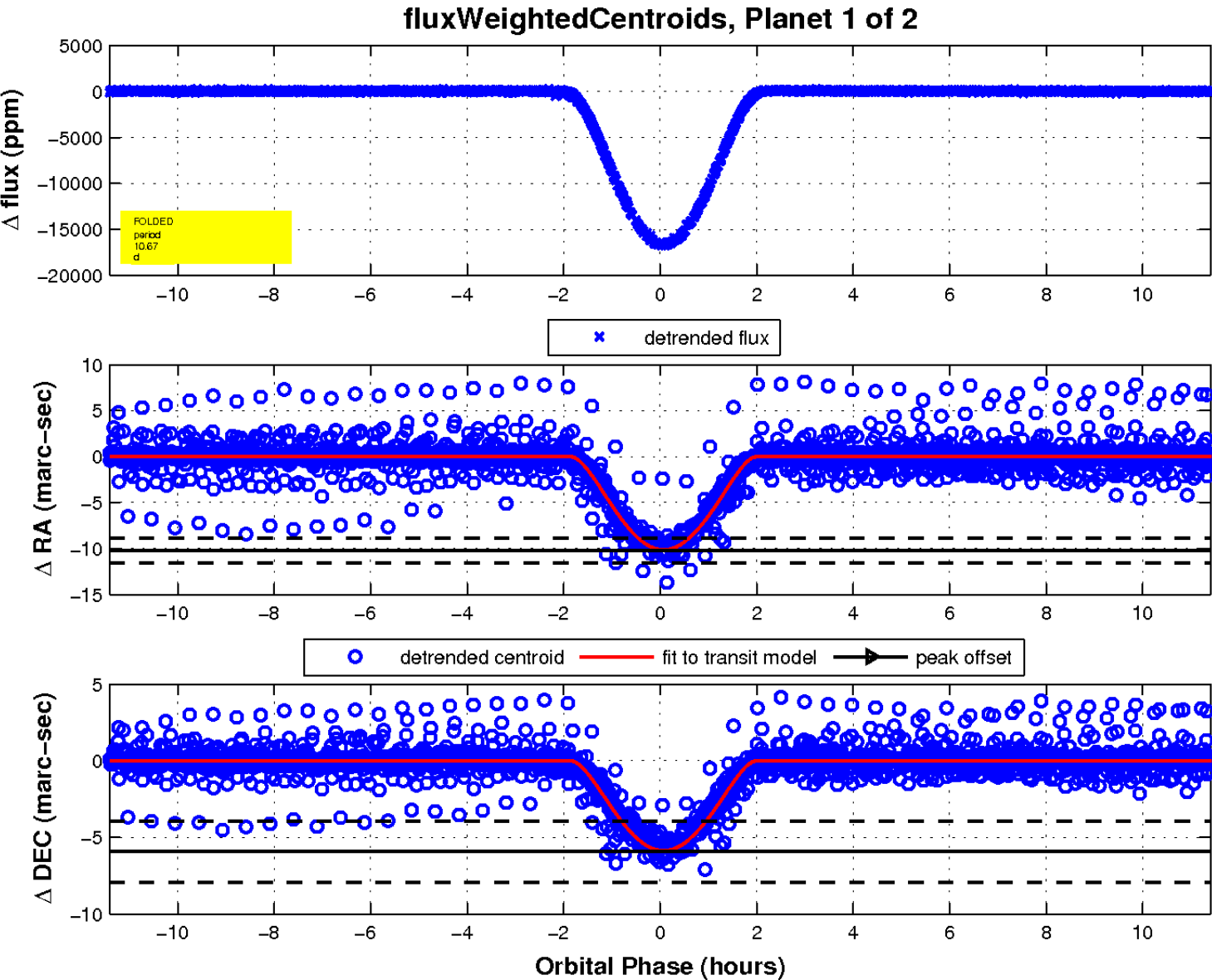
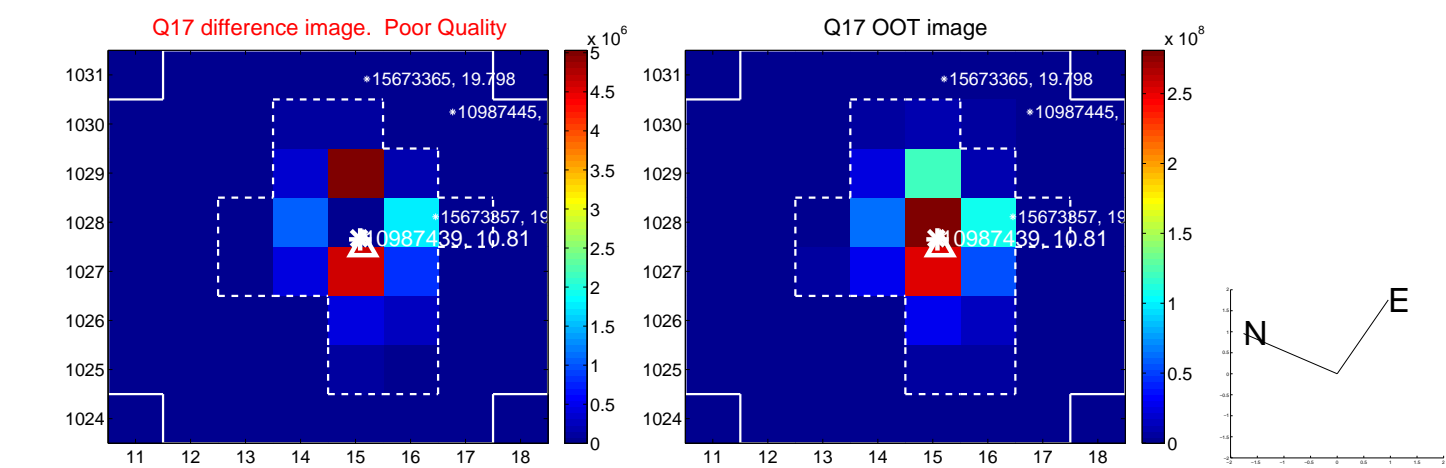
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

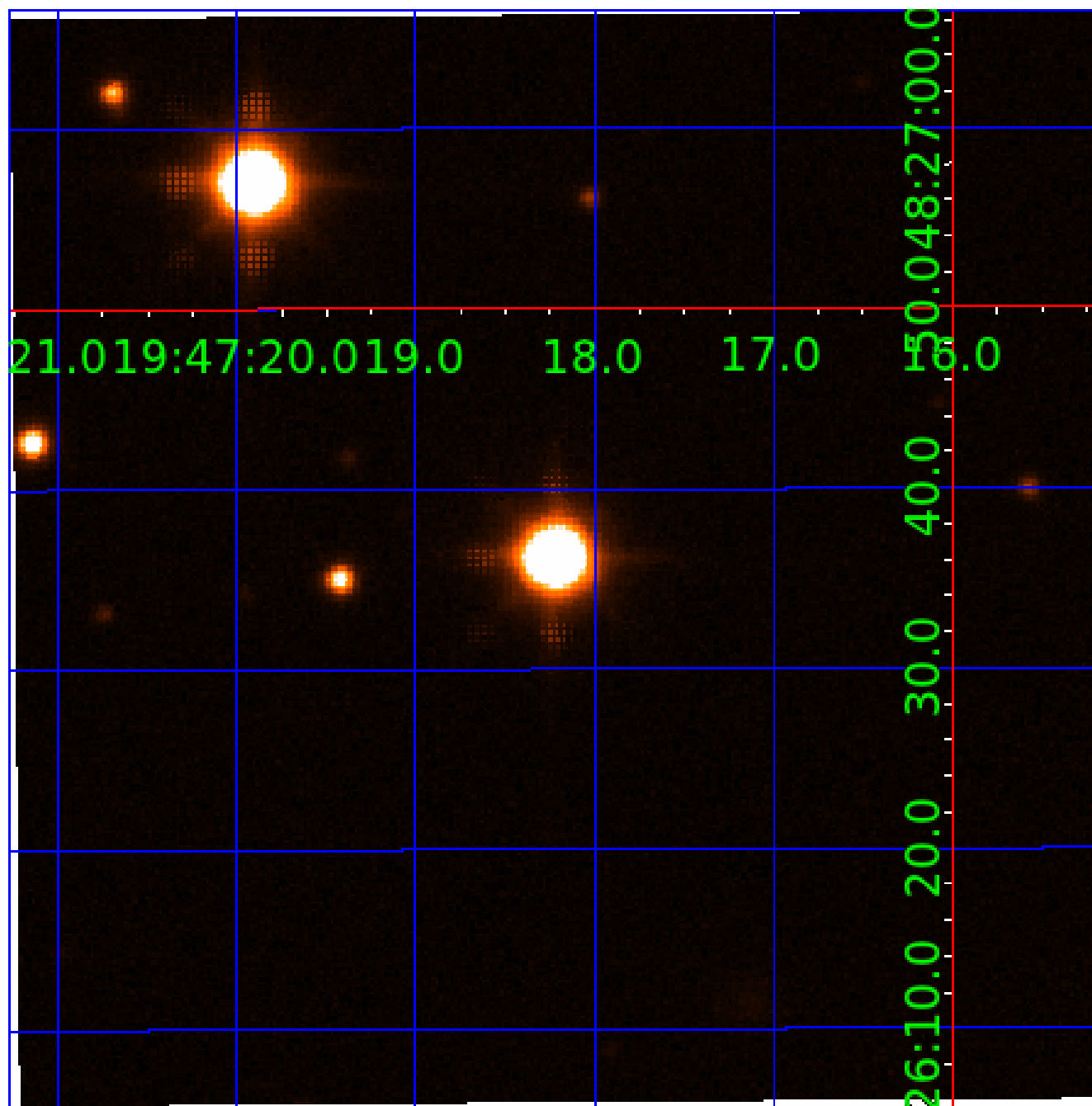


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 010987439

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
010987439-01	OBS	7396.01	10.674599	138.884703	16575.4	3.805	3051.2	2595.5	1.49	6496	33.49	326.21
010987439-02	OBS	No	10.674598	133.762552	13710.3	3.253	2445.3	2375.0	1.49	6496	30.67	326.21

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
010987439-01	OBS	FP	0.00	0	1	0	0	MOD_SEC_DV—MOD_SEC_ALT—MOD_ODDEVEN_ALT—DEEP_V_SHAPED—HAS_SEC_TCE—CENT SATURATED
010987439-02	OBS	FP	0.00	1	1	0	0	IS_SEC_TCE—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 010987439-02

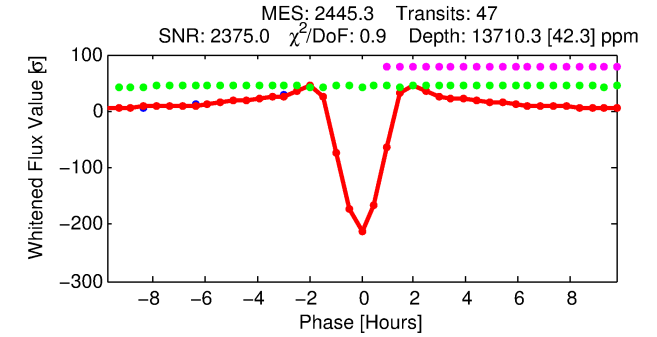
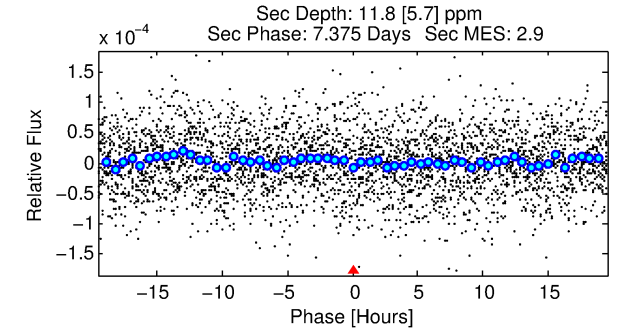
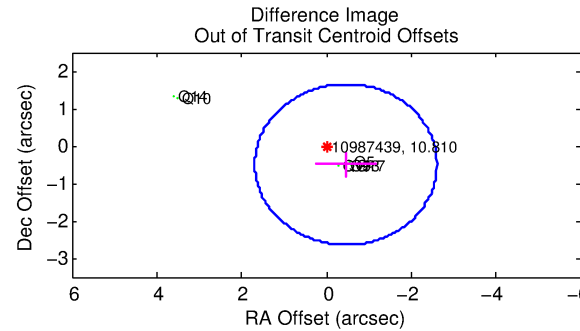
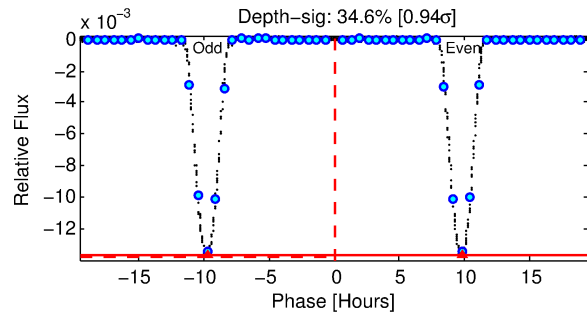
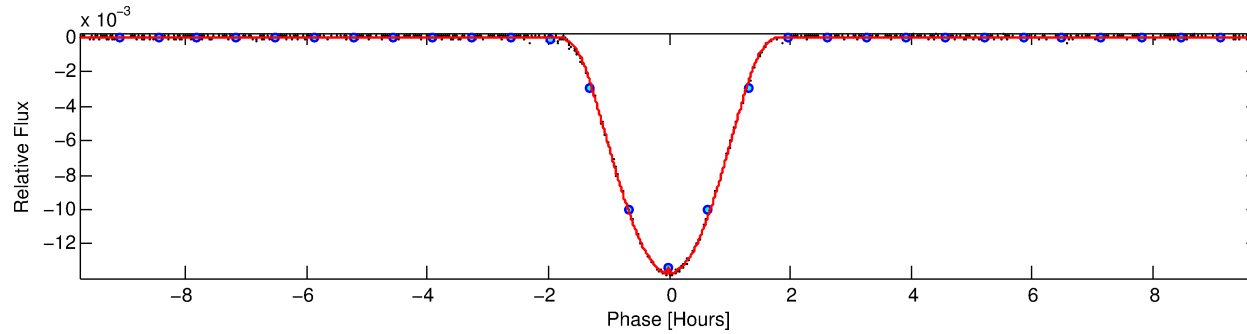
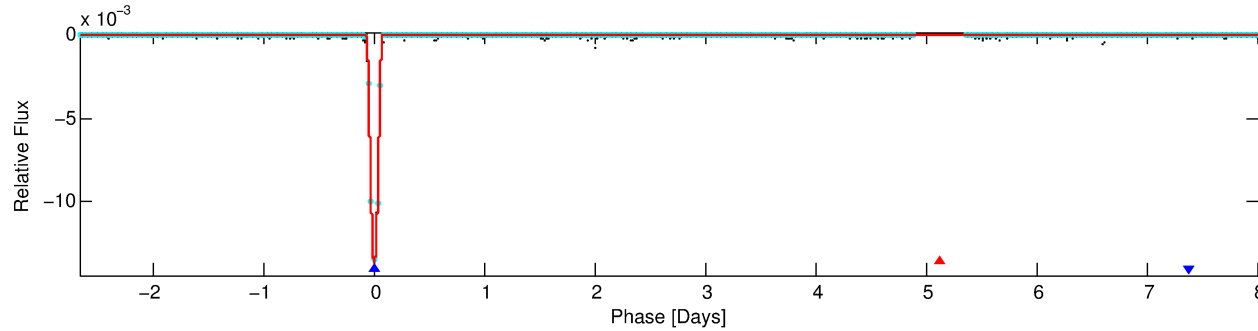
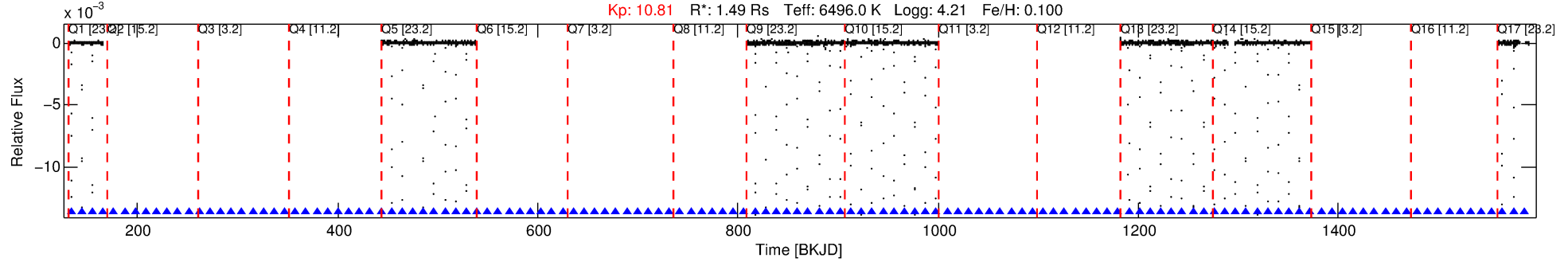
No Significant Match Found

# DV One-Page Summary

KIC: 10987439 Candidate: 2 of 2 Period: 10.675 d

KOI: K07396 Corr: No Ephemeris Match

Kp: 10.81 R\*: 1.49 Rs Teff: 6496.0 K Logg: 4.21 Fe/H: 0.100



## DV Fit Results:

Period = 10.67460 [0.00000] d  
Epoch = 133.7626 [0.0000] BKJD  
Rp/R\* = 0.1892 [0.0043]  
a/R\* = 16.17 [0.05]  
b = 1.00 [0.01]  
Seff = 326.21 [72.70]  
Teq = 1084 [60] K  
Rp = 30.67 [5.74] Re  
a = 0.1039 [0.0158] AU  
Ag = 0.07 [0.04] [-23.21σ]  
Teffp = 876 [107] K [-1.69σ]

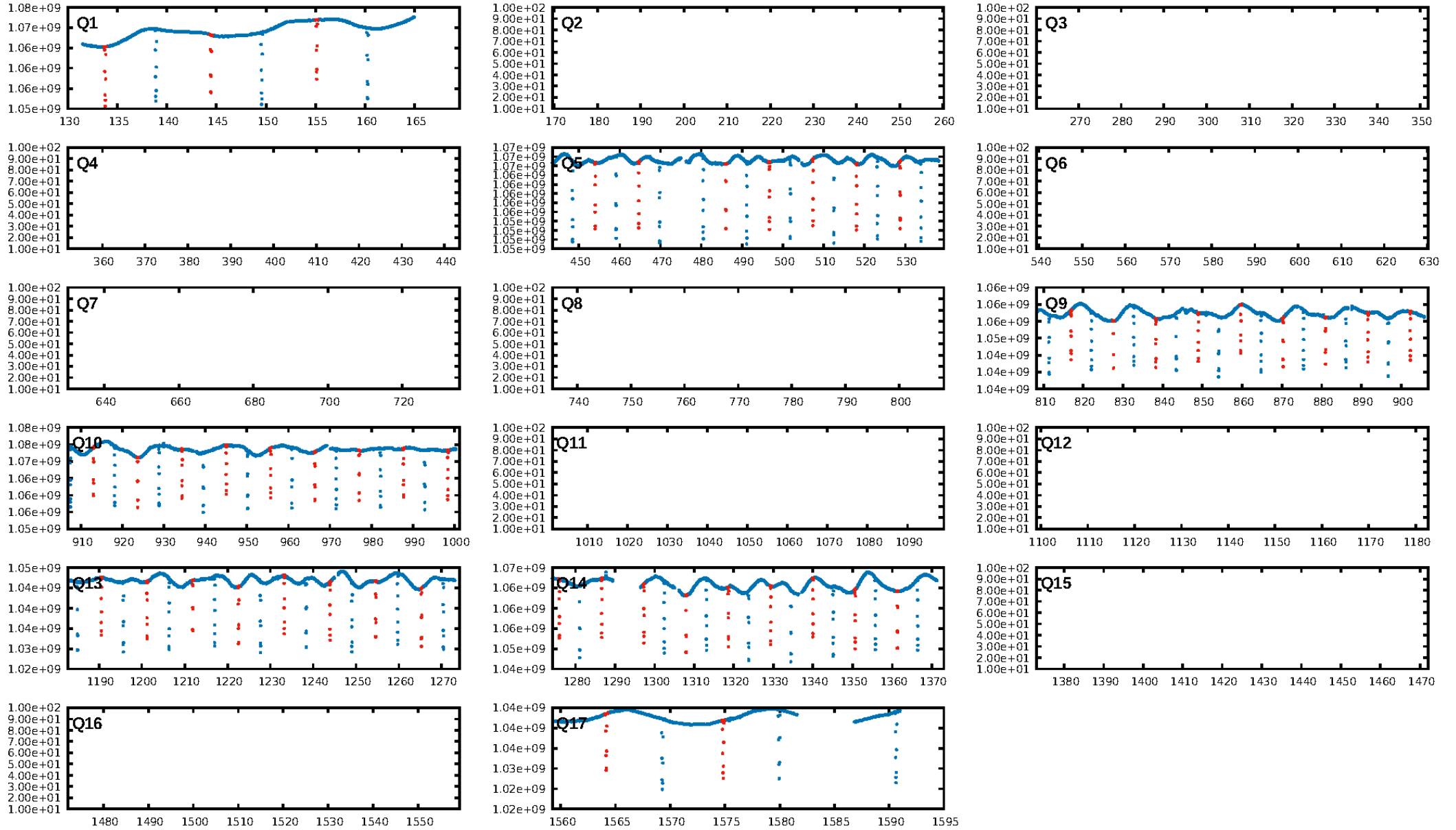
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 0.0% [0.00σ]  
ModelChiSquare2-sig: 93.3%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 0.00e+00  
RollingBand-fgt: 1.00 [42/42]  
GhostDiagnostic-chr: 7.232  
Centroid-sig: 0.0%  
Centroid-so: 1.078 arcsec [215.55σ]  
OotOffset-rm: 0.678 arcsec [0.95σ]  
KicOffset-rm: 0.810 arcsec [1.54σ]  
OotOffset-st: 2/0/0/5 [7]  
KicOffset-st: 2/0/0/5 [7]  
DiffImageQuality-fgm: 0.00 [0/7]  
DiffImageOverlap-fno: 1.00 [7/7]

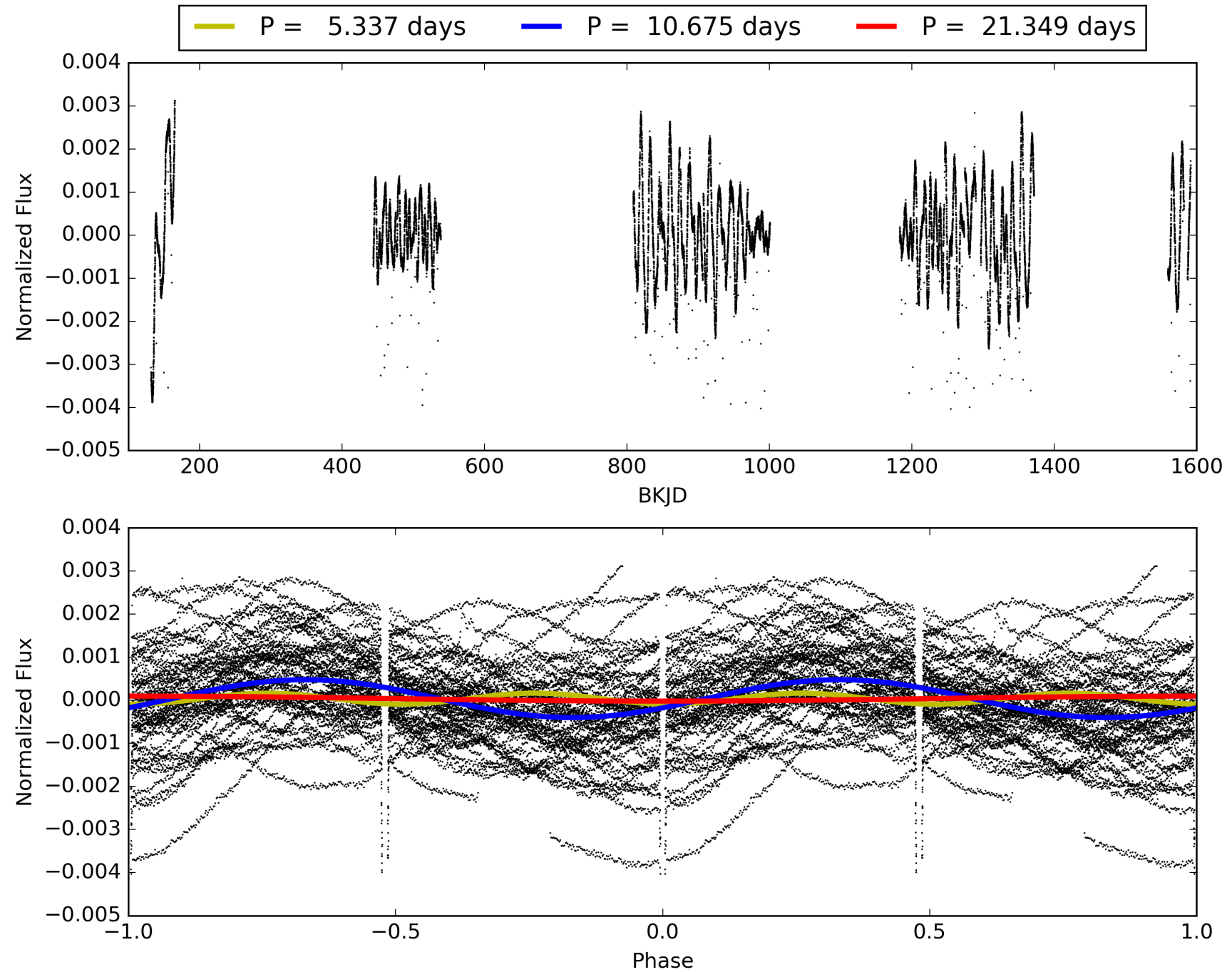
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 29-Jan-2016 13:01:47 Z

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

# TCE 010987439-02, PDC Light Curves



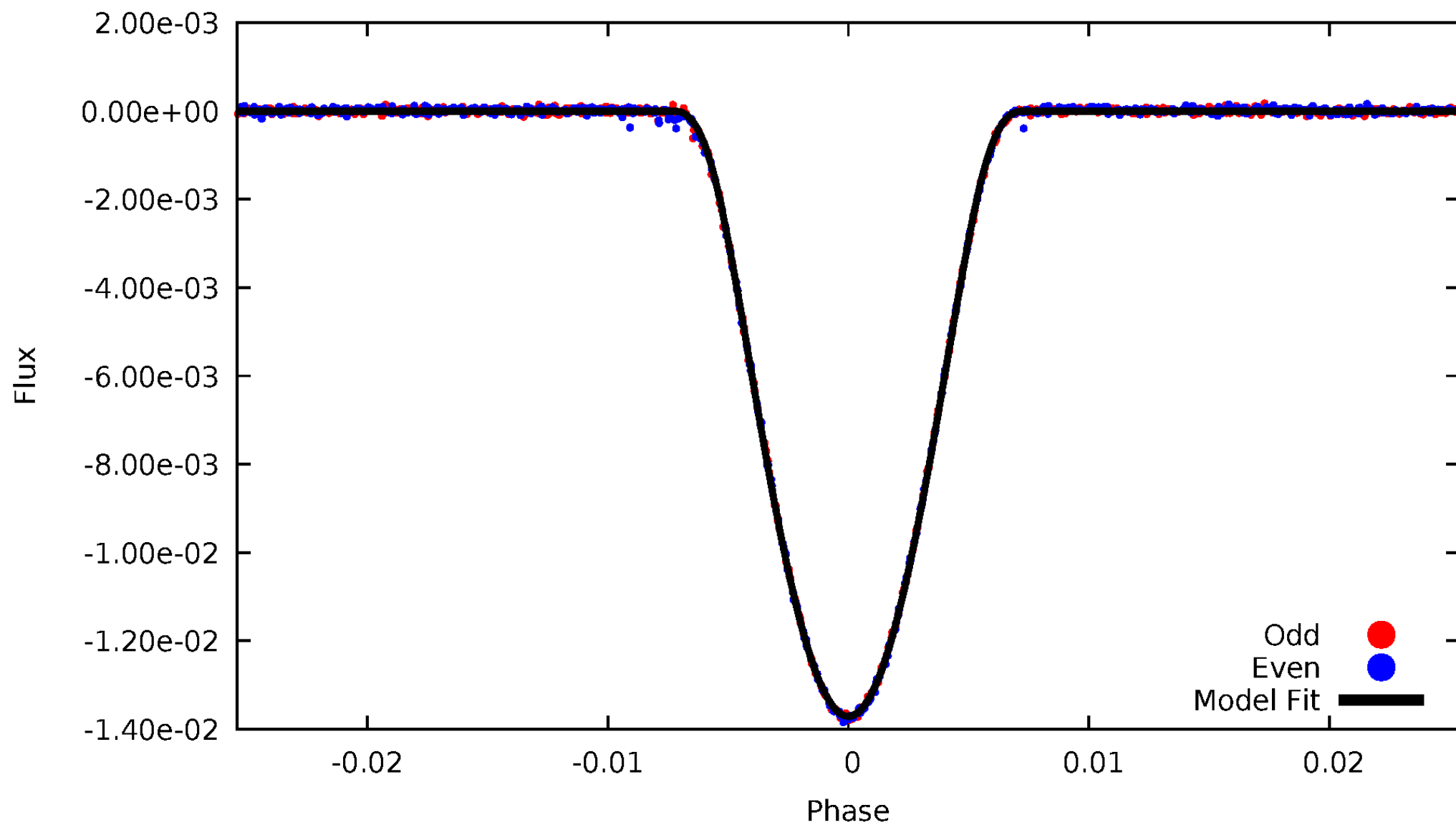
# TCE 010987439-02





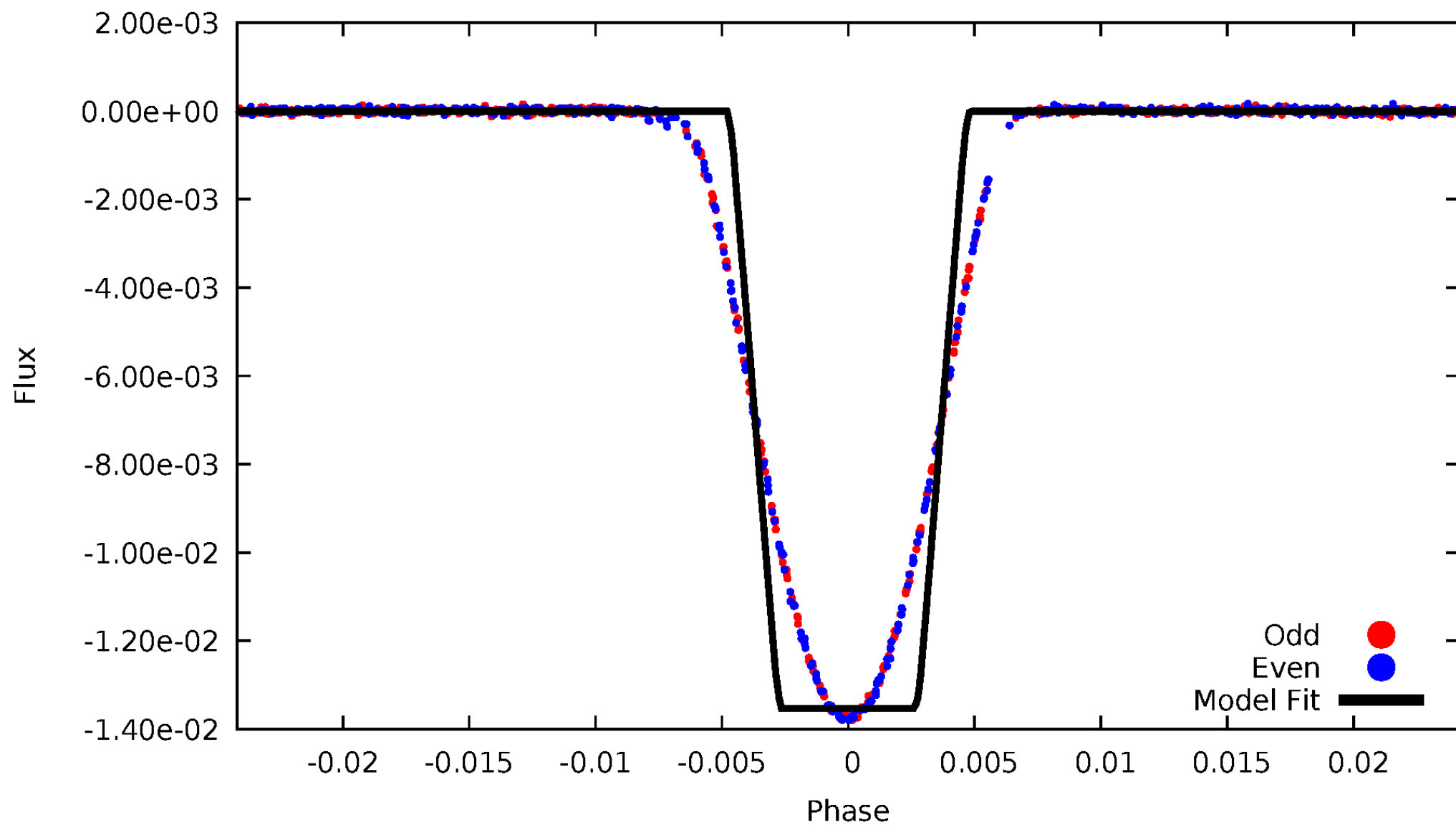
# DV Odd/Even

TCE 010987439-02



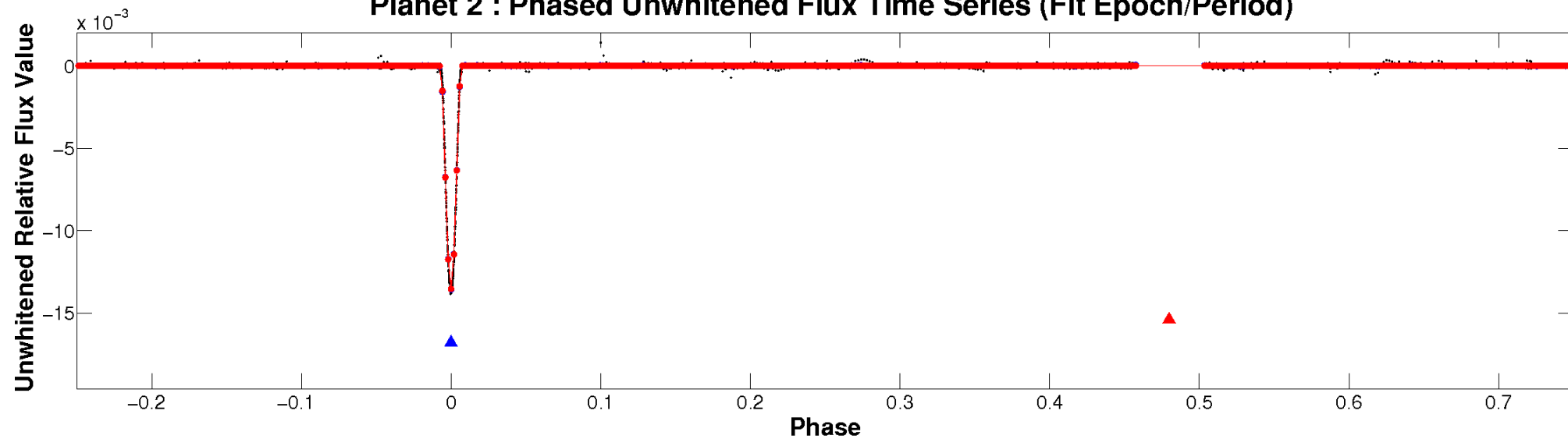
# ALT Odd/Even

TCE 010987439-02

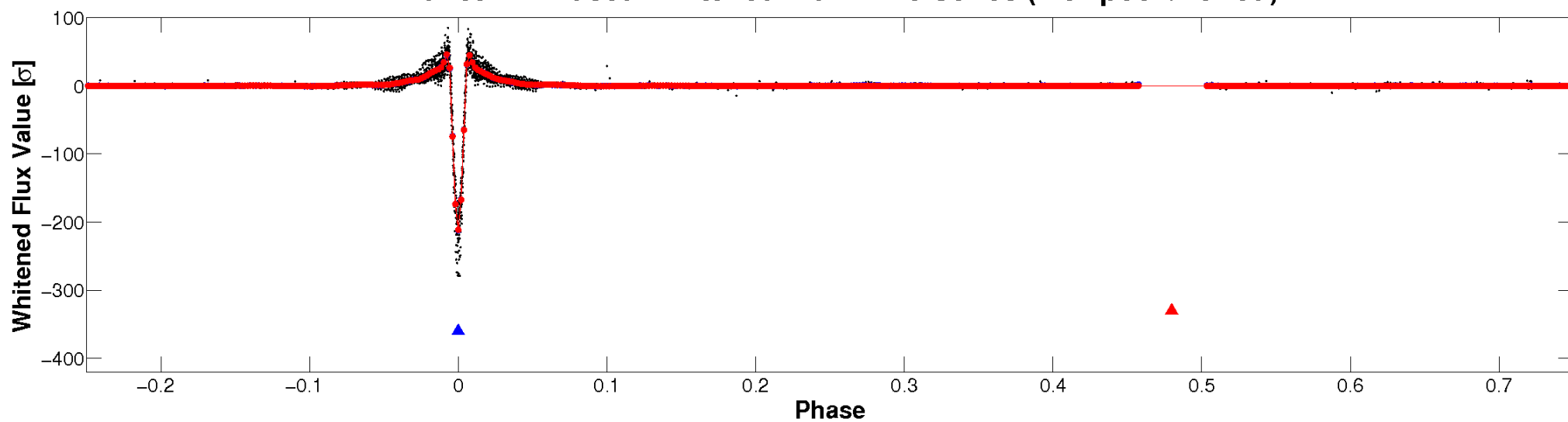


# Non-Whitened Vs. Whitened Light Curve

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

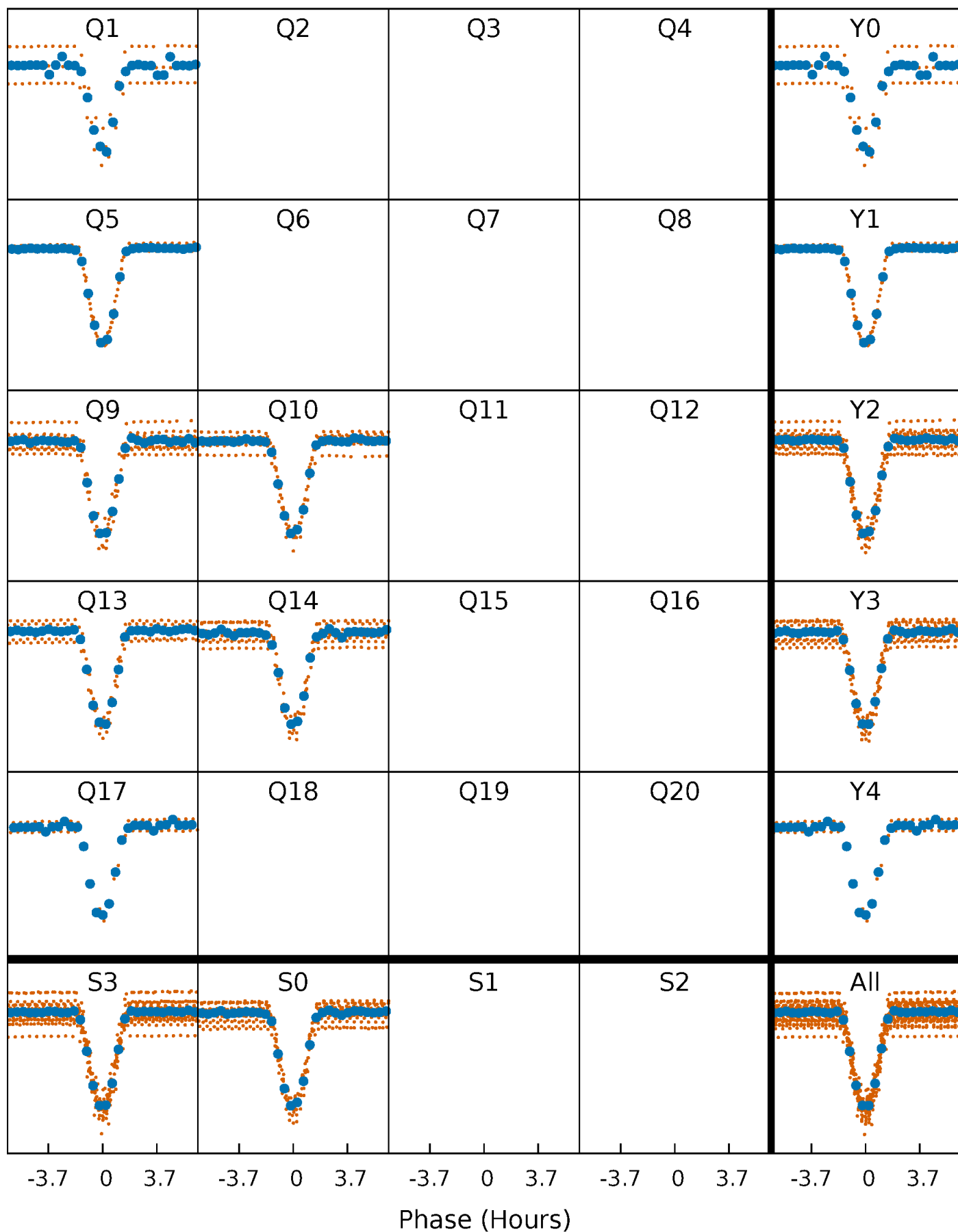


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



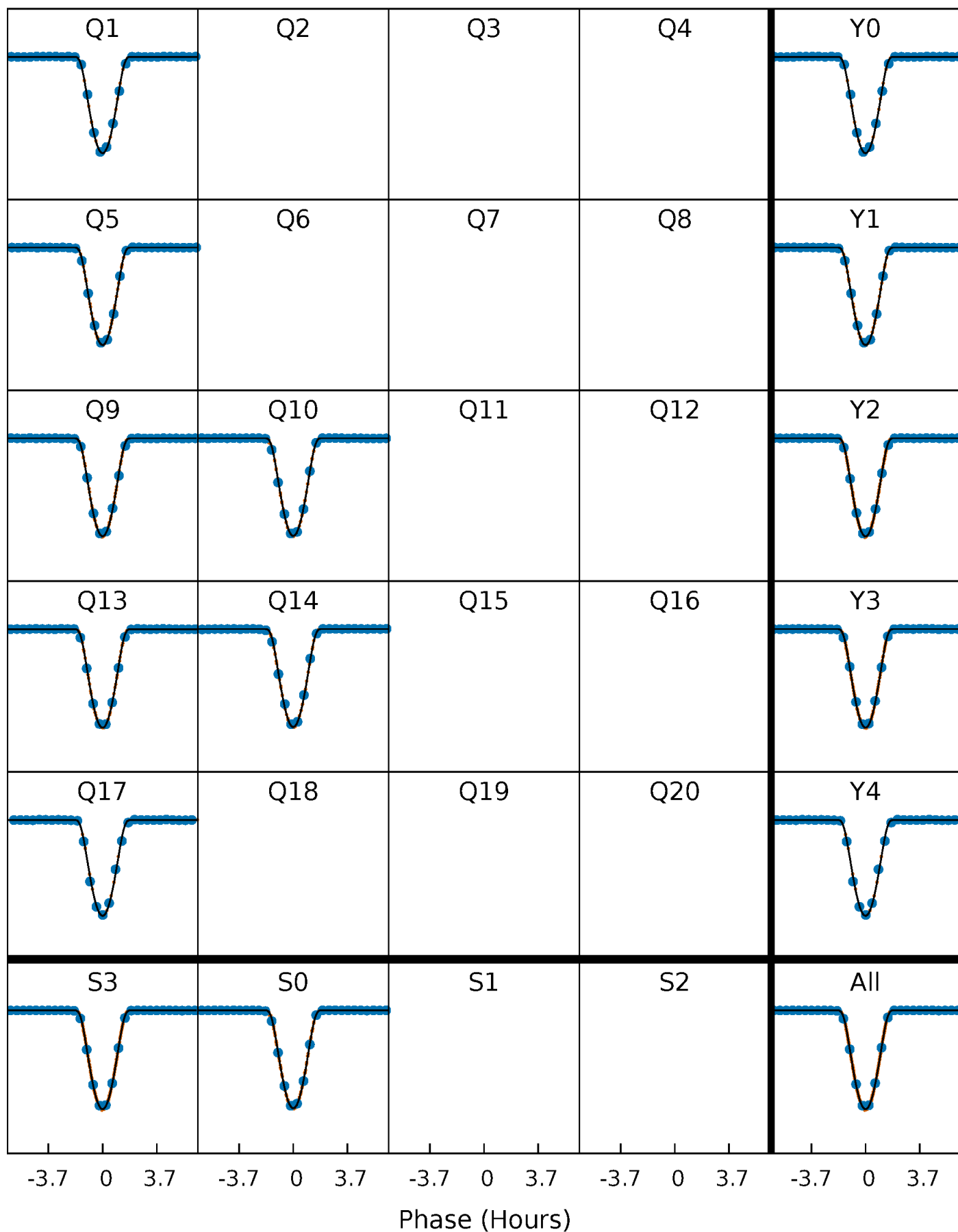
# PDC Quarter-Phased Transit Curves

TCE 010987439-02     $P = 10.674598$  Days     $T_0 = 133.762552$  (BKJD)



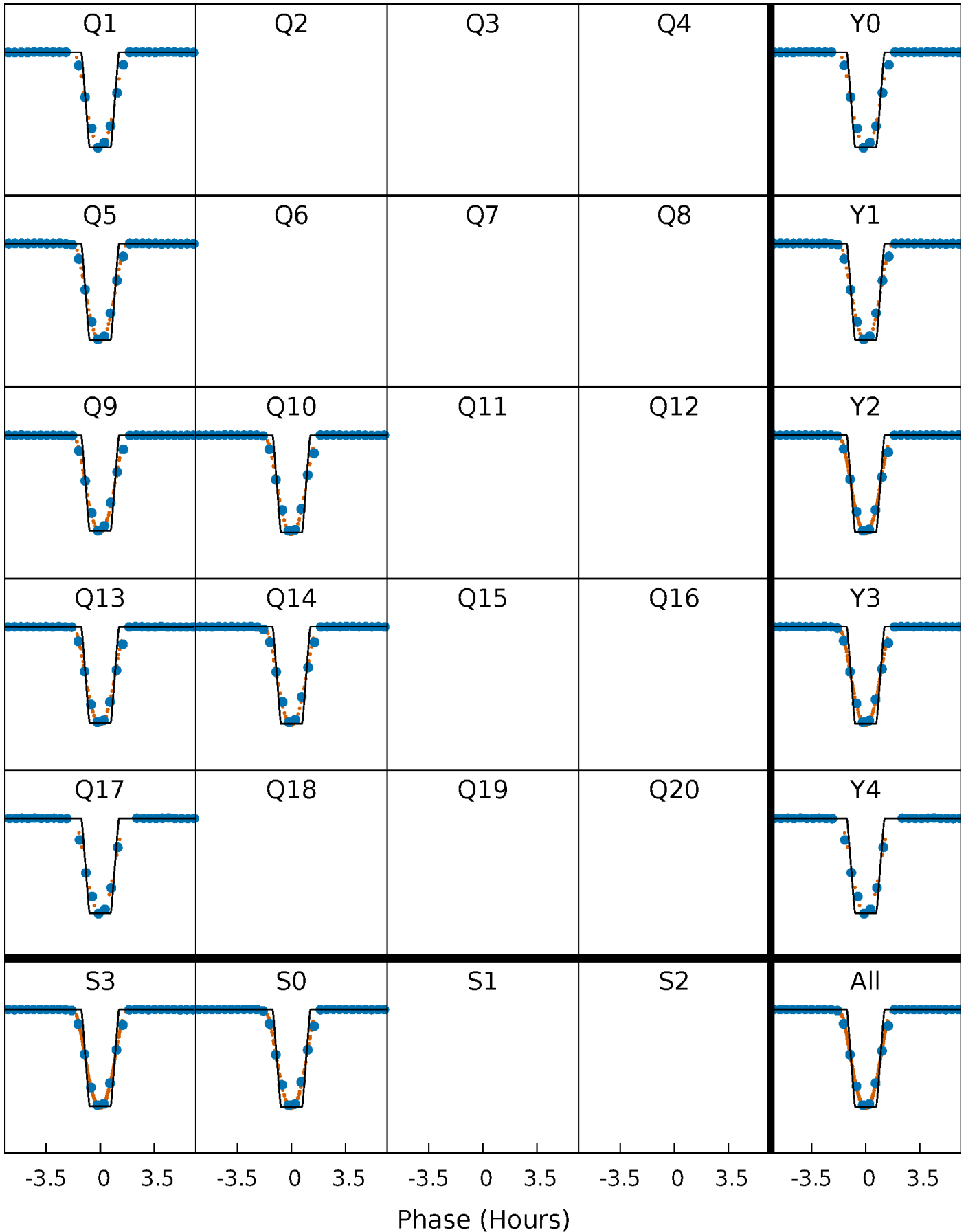
# DV Quarter-Phased Transit Curves

TCE 010987439-02 P= 10.674598 Days  $T_0=133.762552$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

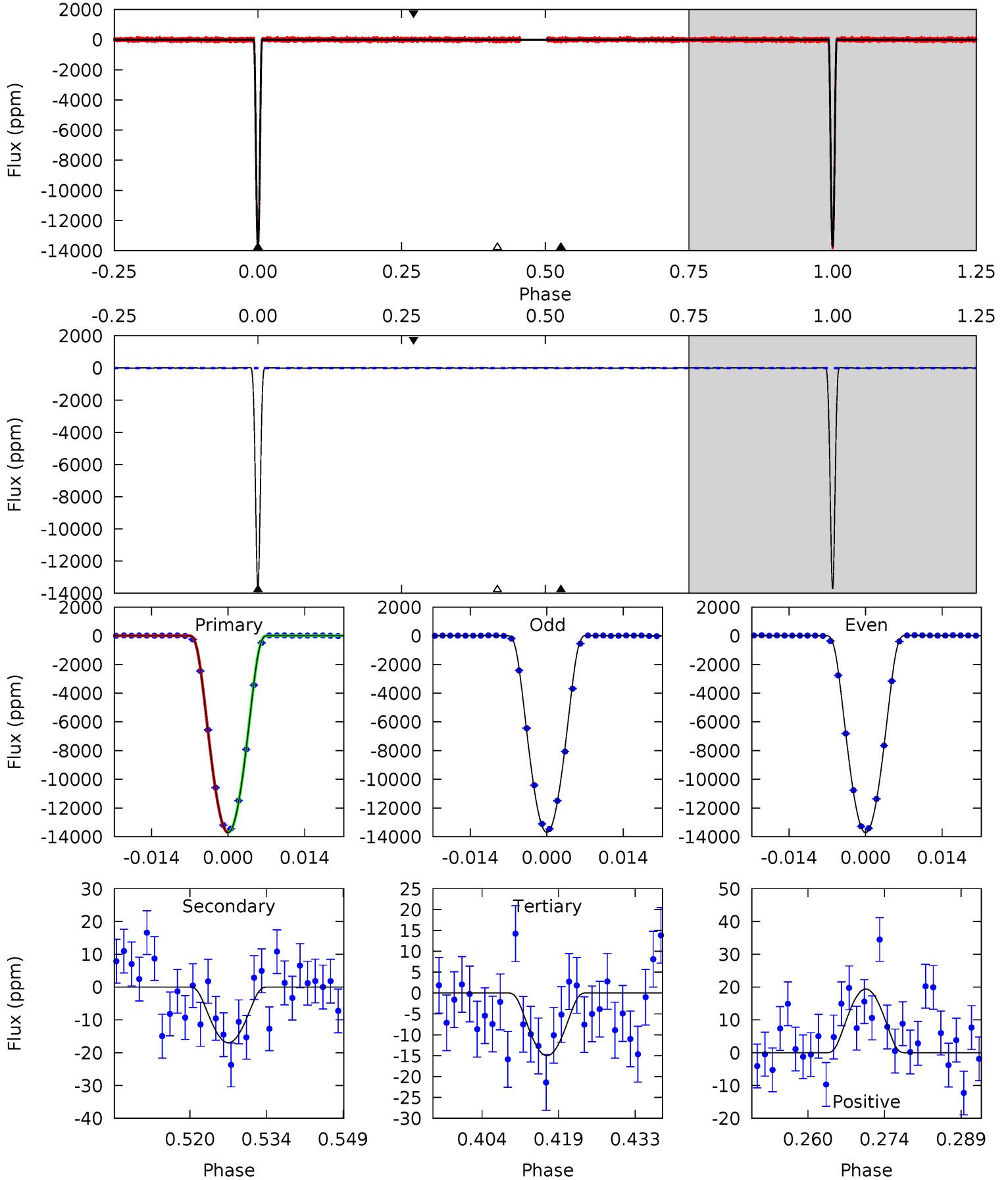
TCE 010987439-02   P= 10.674602 Days    $T_0=133.762231$  (BKJD)



# DV Model-Shift Uniqueness Test

010987439-02, P = 10.674598 Days, E = 123.087954 Days

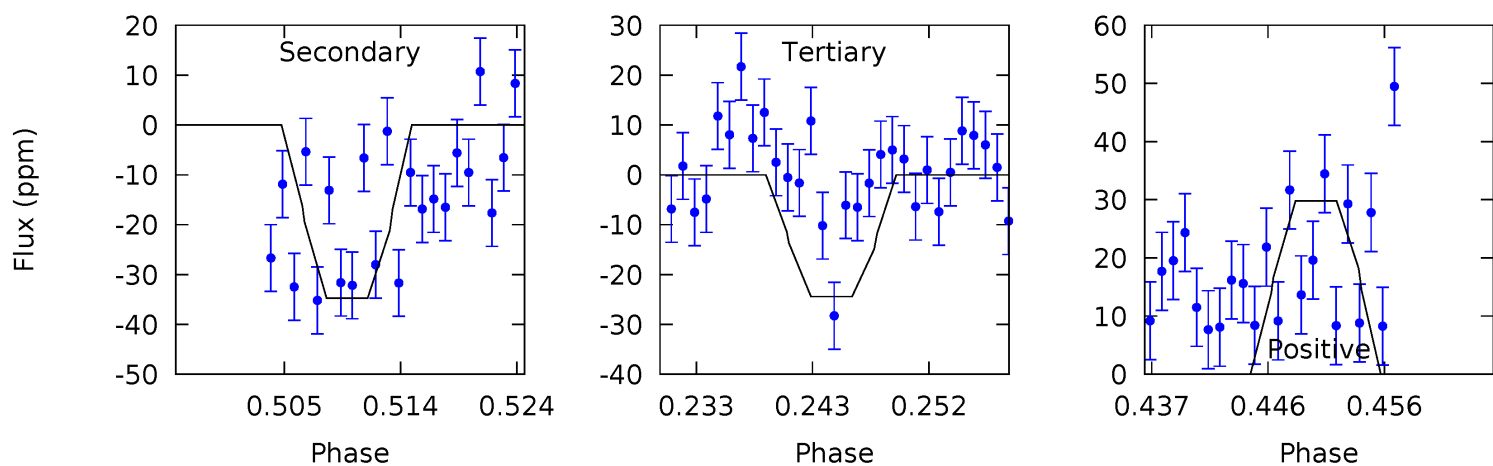
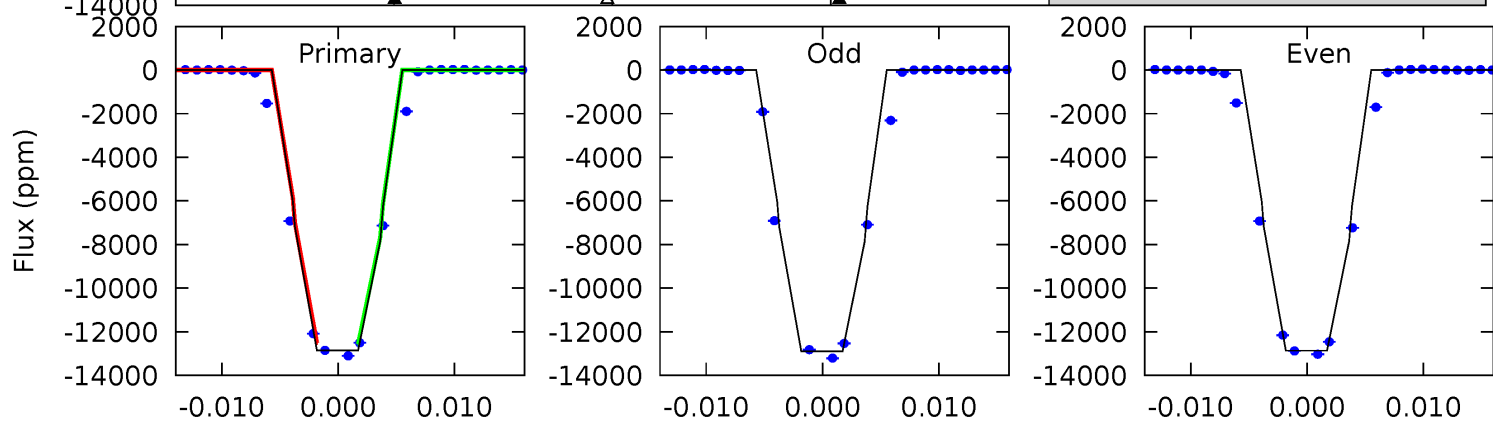
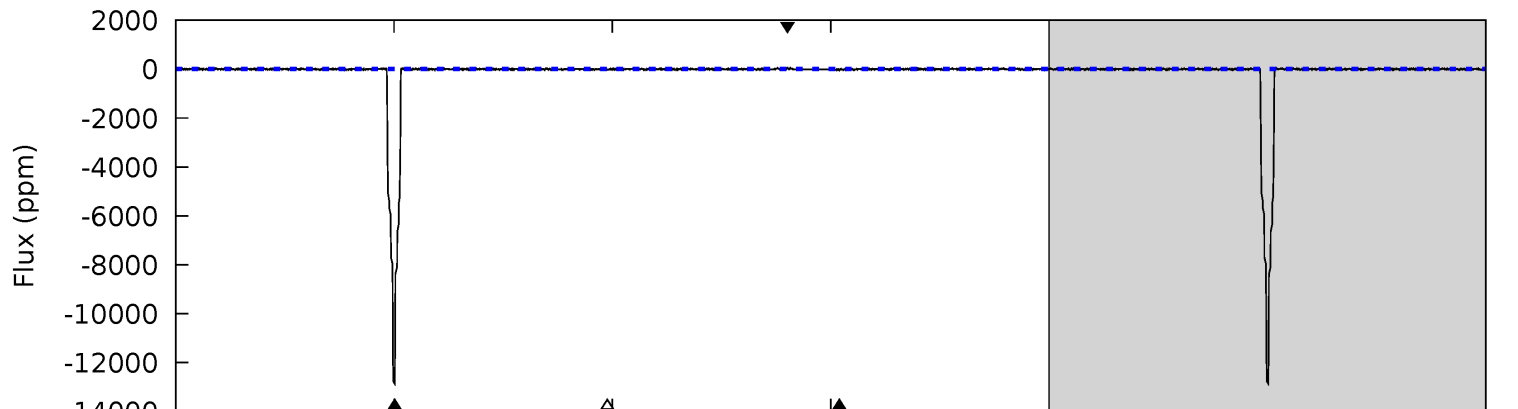
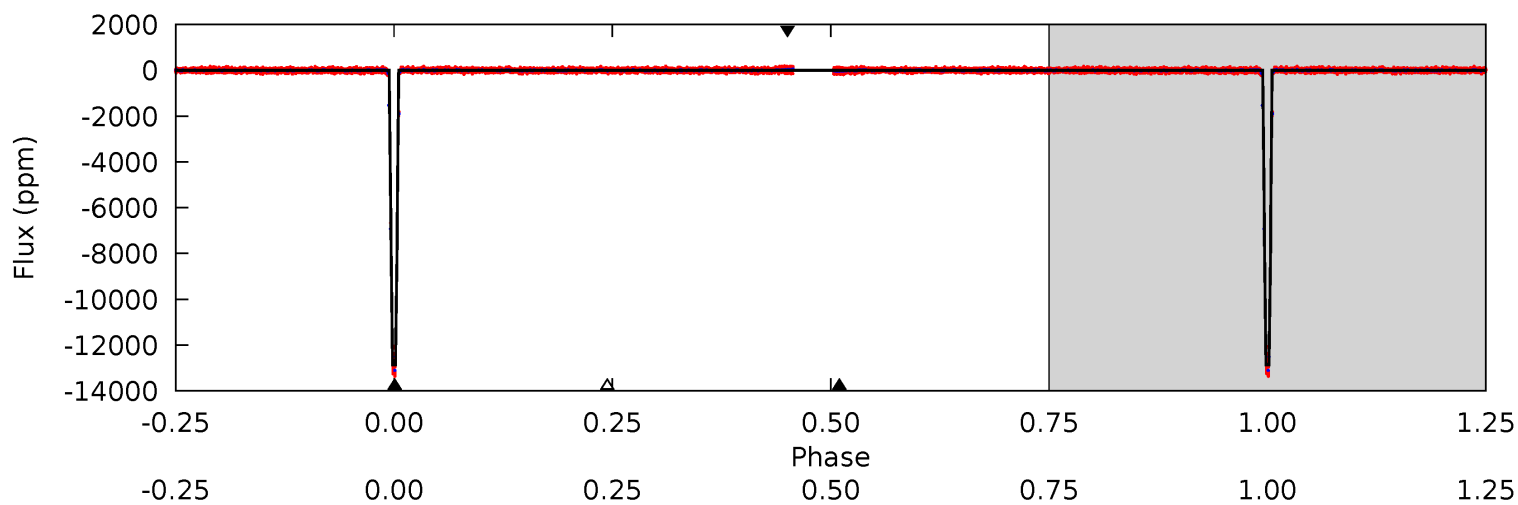
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
5251	6.50	5.74	7.43	4.96	2.45	2.19	5245	5243	0.76	-0.93	3.10	1.00	0.00	0.43



# Alt Model-Shift Uniqueness Test

010987439-02, P = 10.674602 Days, E = 123.087629 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
2137	5.77	4.06	4.95	5.03	2.59	1.21	2133	2132	1.71	0.82	3.47	1.00	0.00	0





### Stellar Parameters For KIC 010987439

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6496^{+77}_{-83}$	$4.212^{+0.095}_{-0.116}$	$0.100^{+0.150}_{-0.200}$	$1.485^{+0.276}_{-0.184}$	$1.312^{+0.105}_{-0.095}$	$0.565^{+0.239}_{-0.198}$
	+1%/-1%	+2%/-3%	+150%/-200%	+19%/-12%	+8%/-7%	+42%/-35%
Source	SPE68	SPE68	SPE68	DSEP		

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

### Secondary Eclipse Parameters for KIC 010987439-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-17 \pm 3$	$30.72^{+2.98}_{-2.32}$	$1517^{+66}_{-56}$	$-2094^{+57}_{-61}$	$0.105^{+0.026}_{-0.022}$
Alt.	$-35 \pm 6$	$18.99^{+1.98}_{-1.56}$	$1517^{+75}_{-54}$	$2166^{+90}_{-134}$	$0.564^{+0.151}_{-0.136}$

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

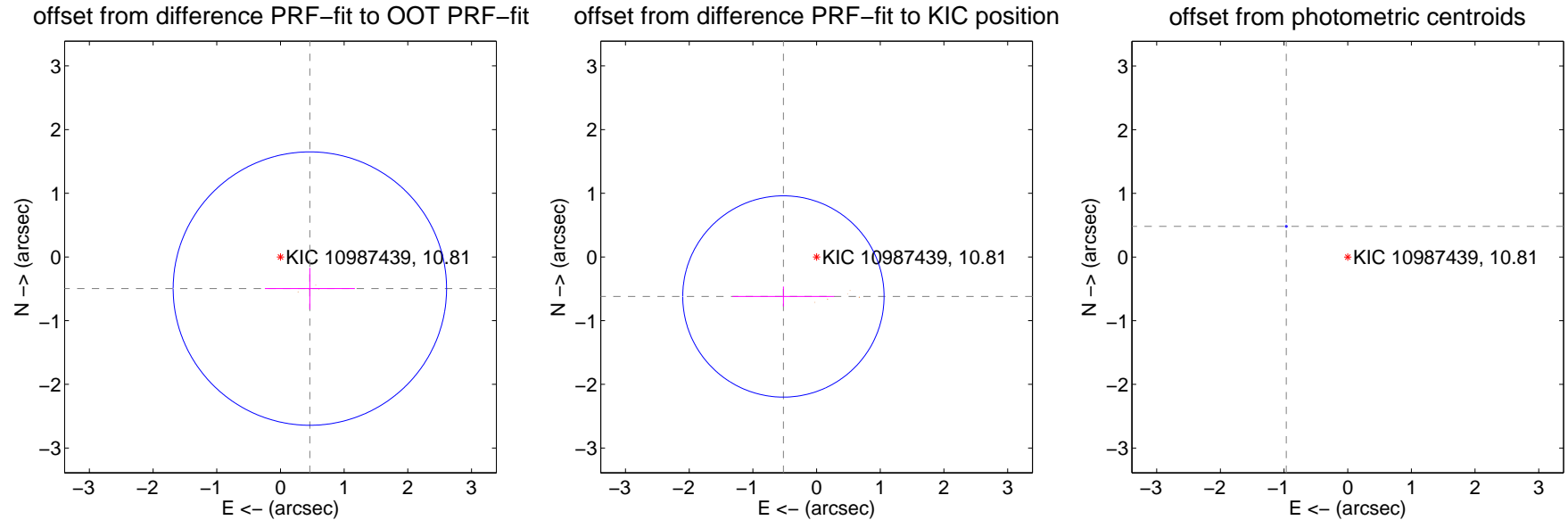
## DV Centroid Data

Supplemental centroid analysis for 010987439-02. **Kepler magnitude: 10.81.** Transit SNR 2375.02

**There are 0 quarters with good PRF difference image offsets**

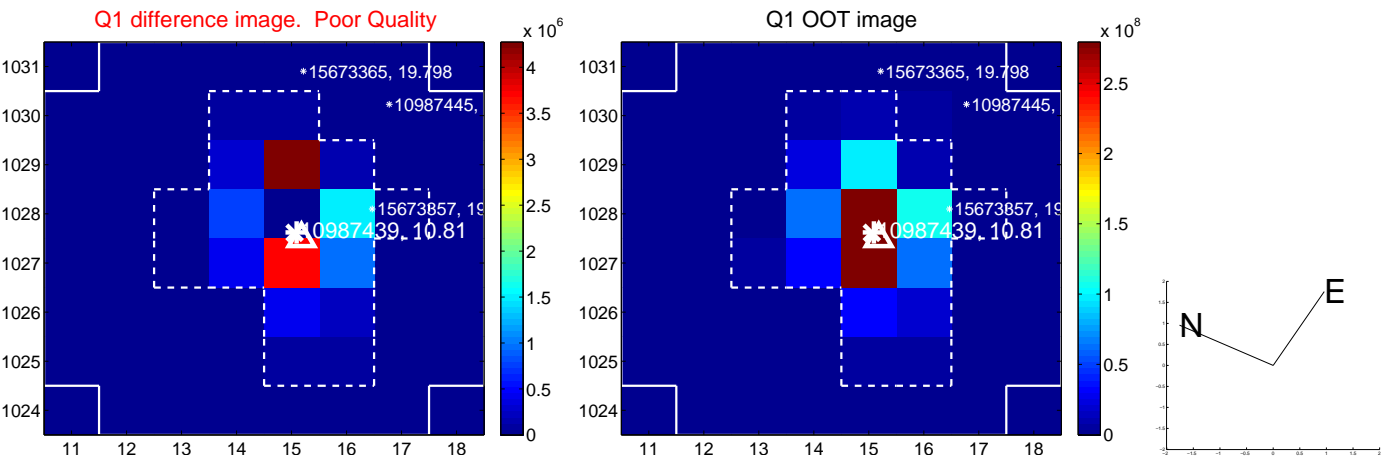
The direct PRF centroid is offset from the target star catalog position by about 0.15 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.678 \pm 0.715$	0.95	$-0.462 \pm 0.707$	$-0.496 \pm 0.325$
PRF-fit source offset from KIC position	$0.810 \pm 0.527$	1.54	$0.521 \pm 0.798$	$-0.620 \pm 0.156$
photometric centroid source offset	<b><math>1.08 \pm 0.01</math></b>	<b>215.55</b>	$0.96 \pm 0.01$	$0.48 \pm 0.00$

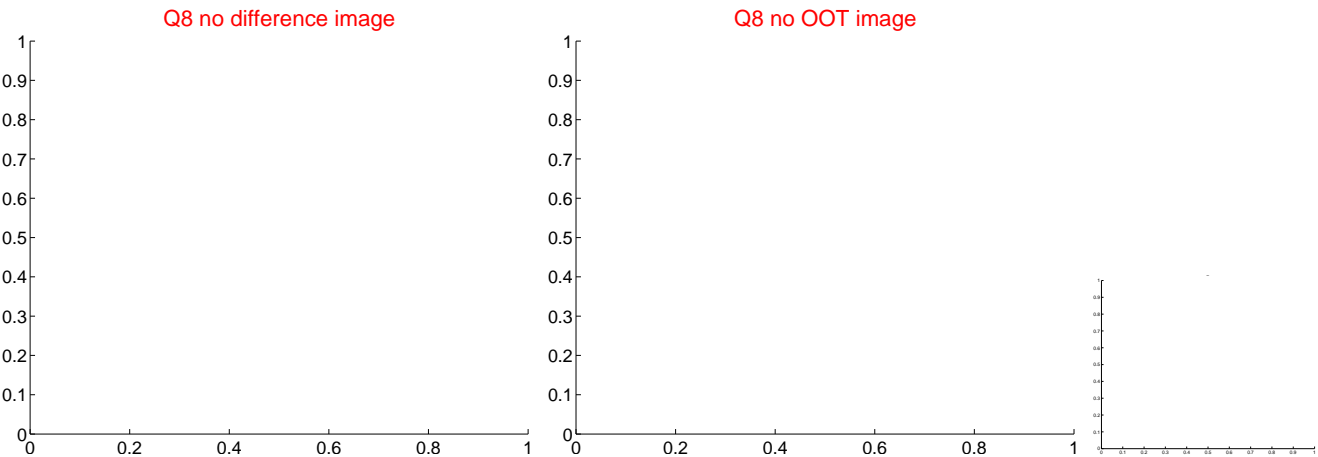
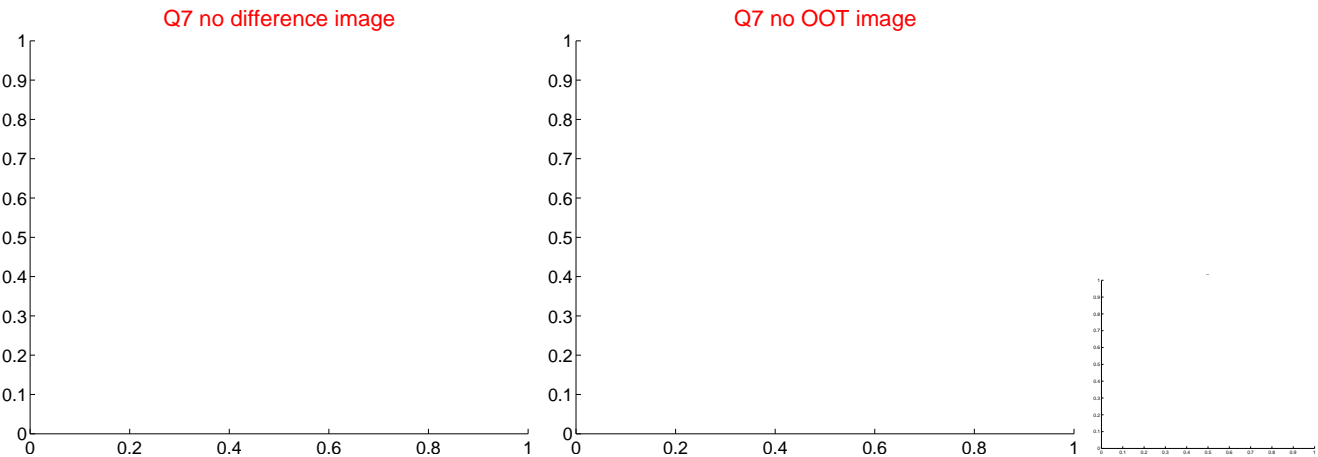
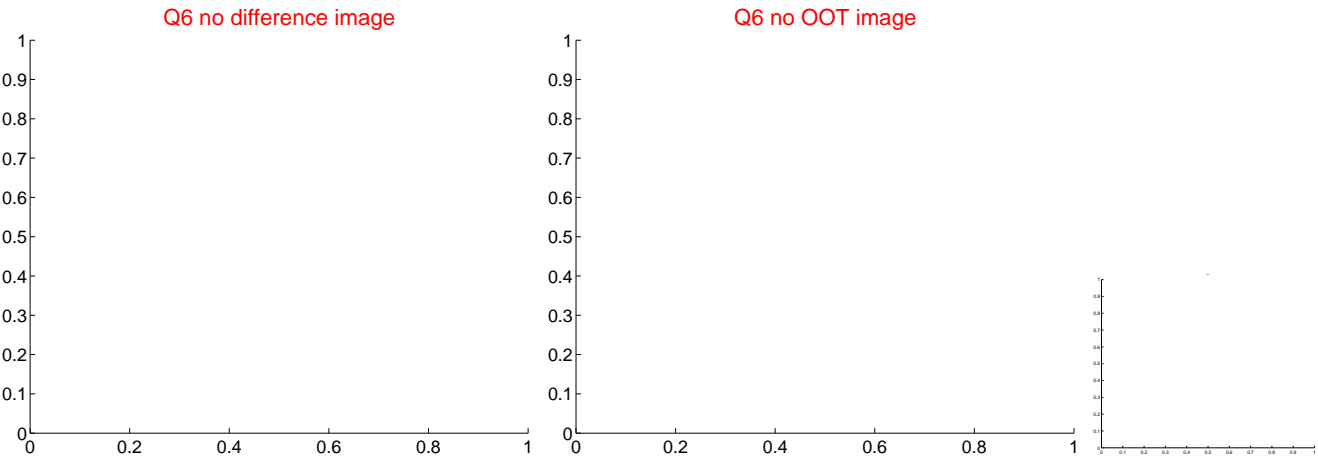
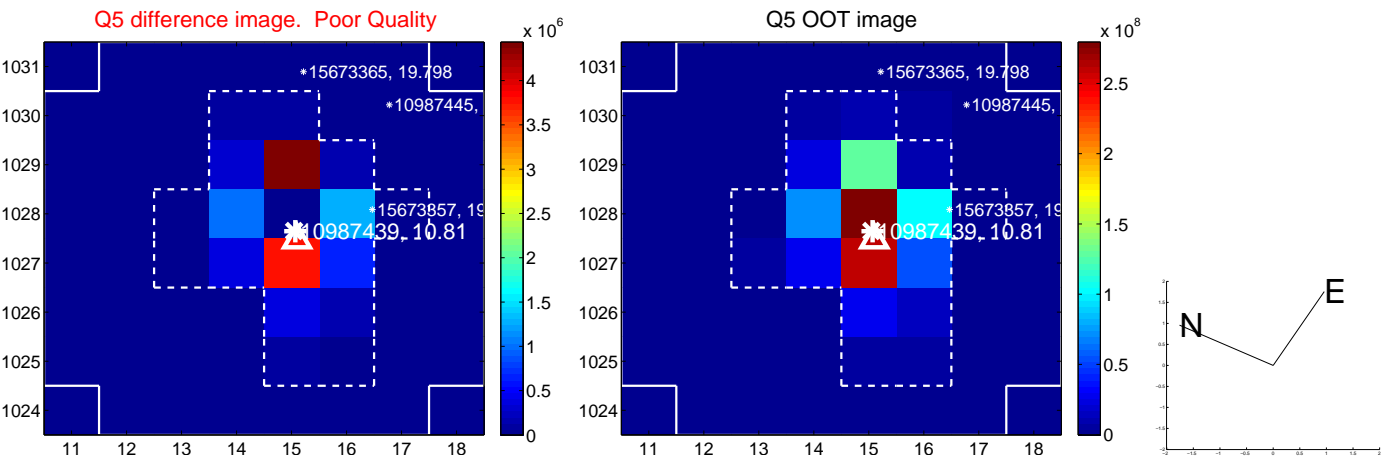


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

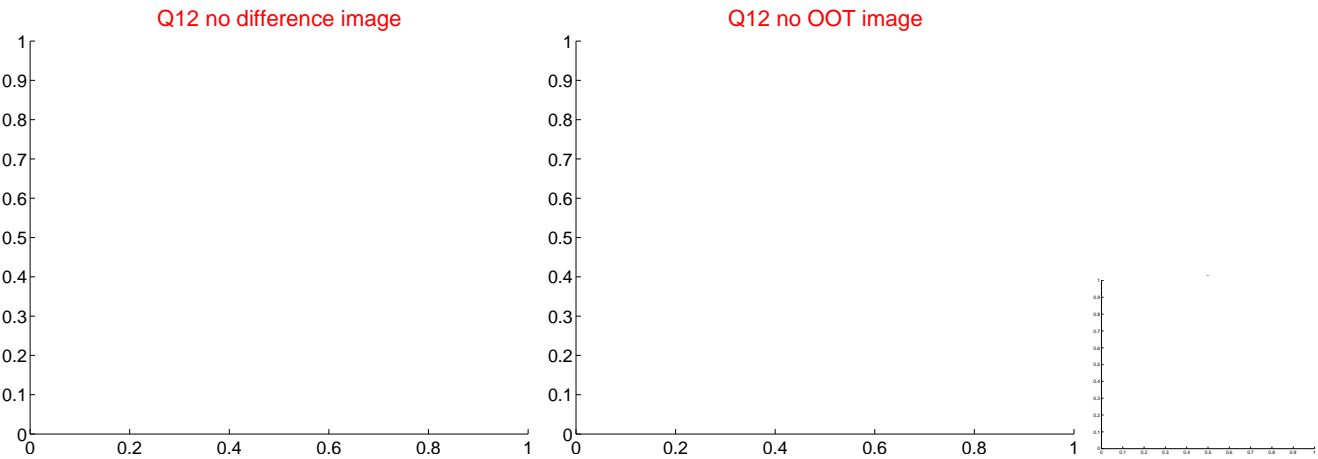
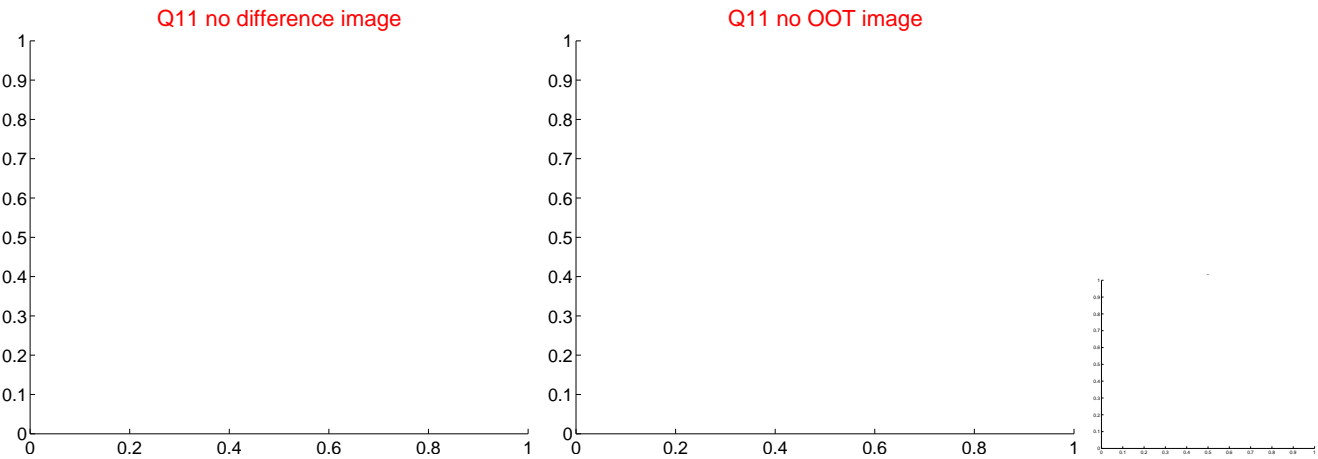
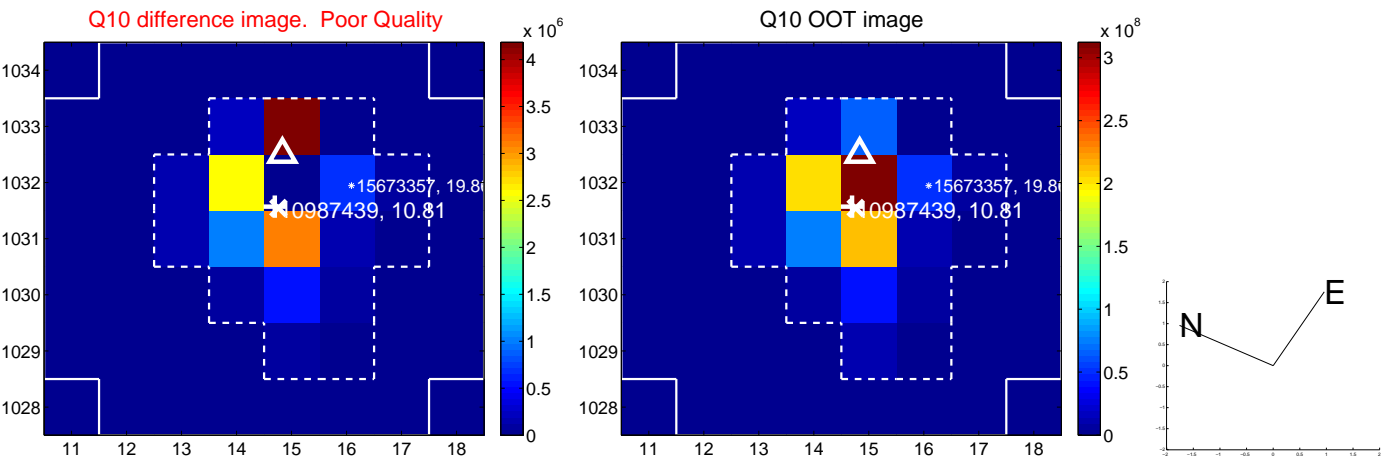
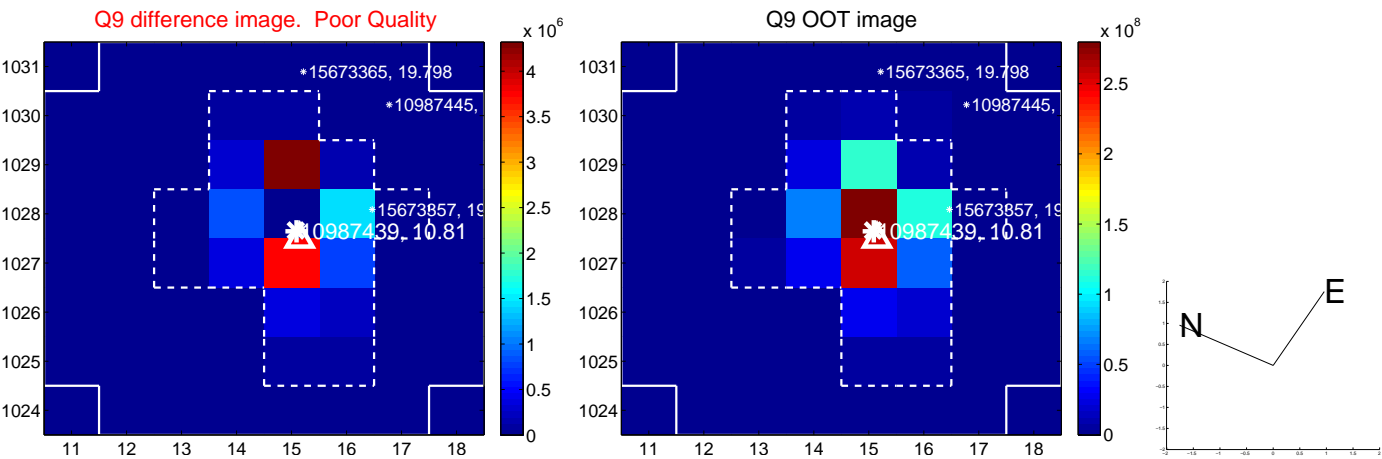
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



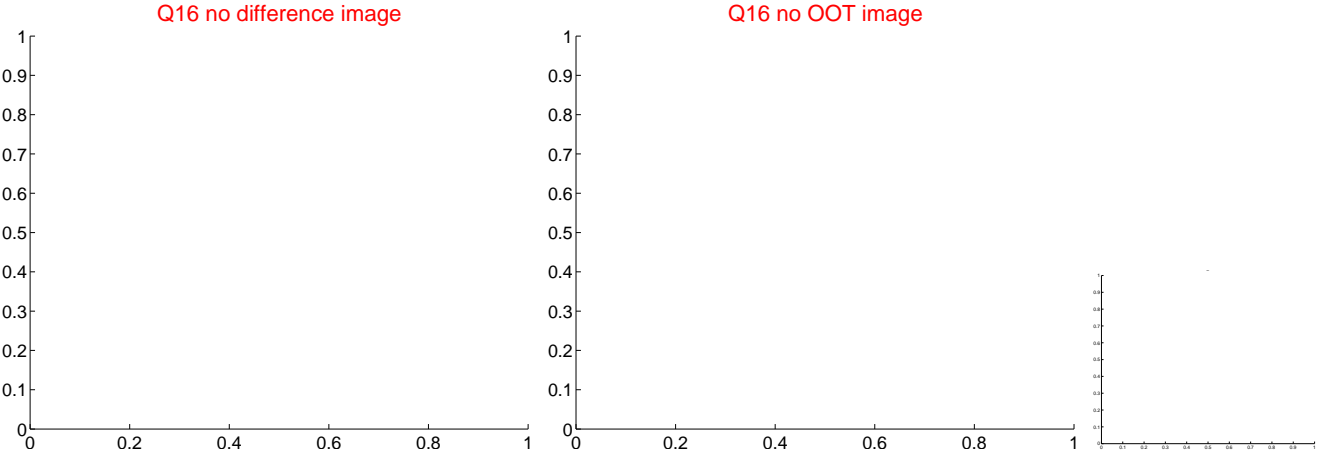
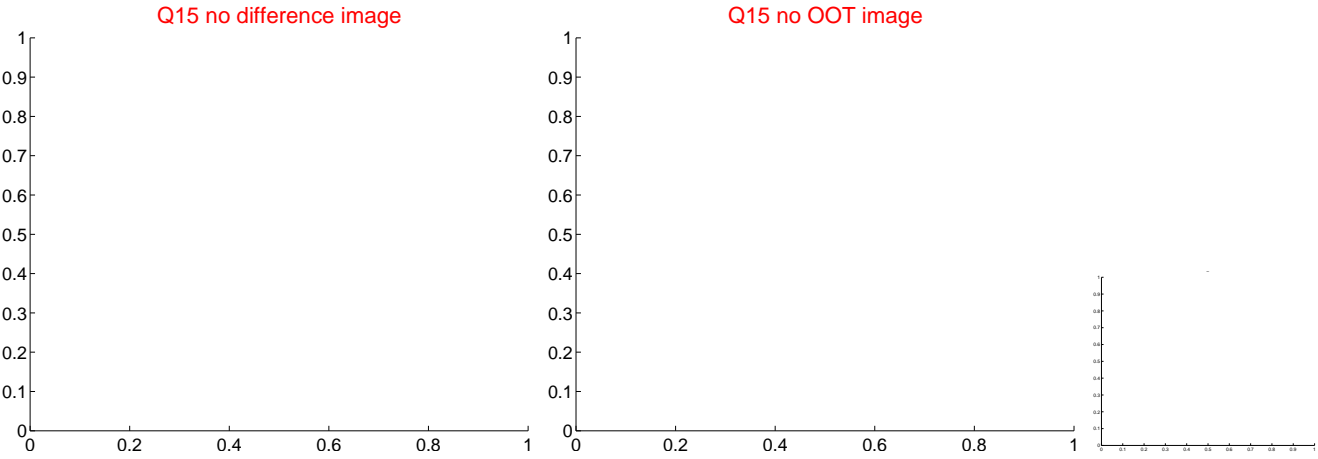
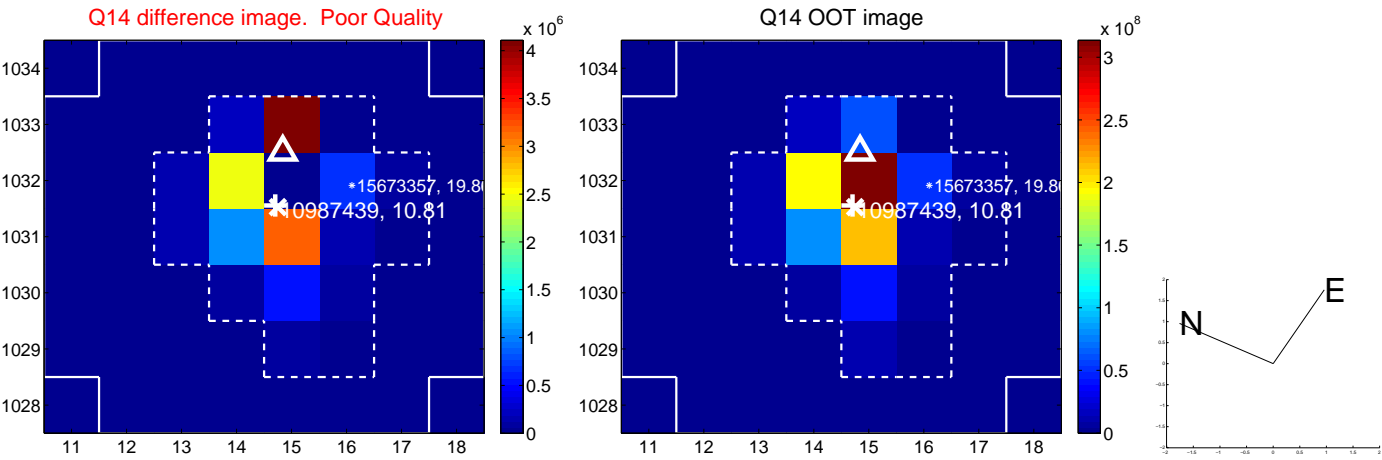
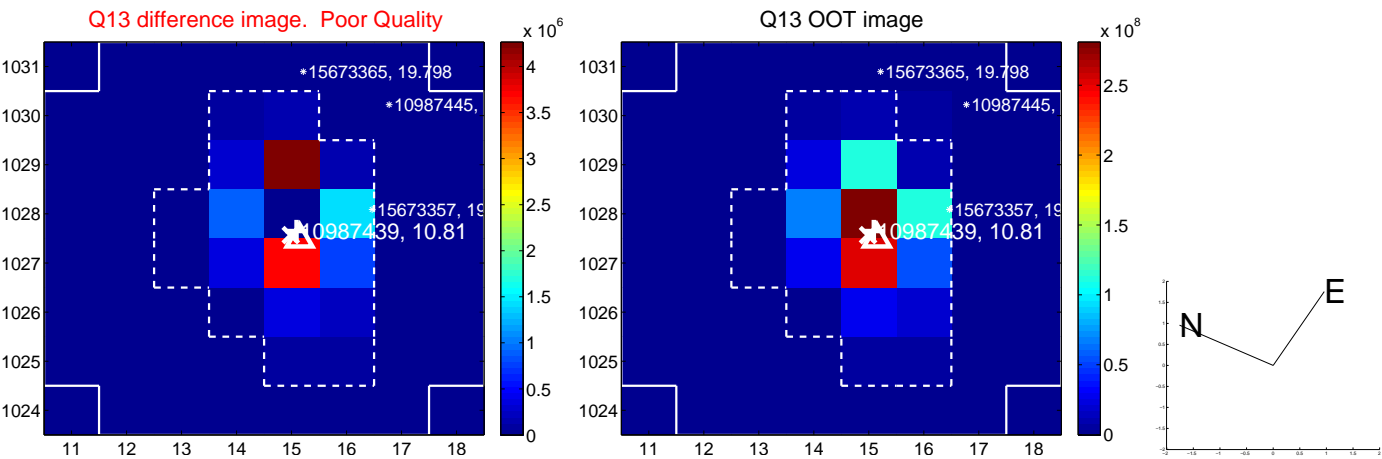
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



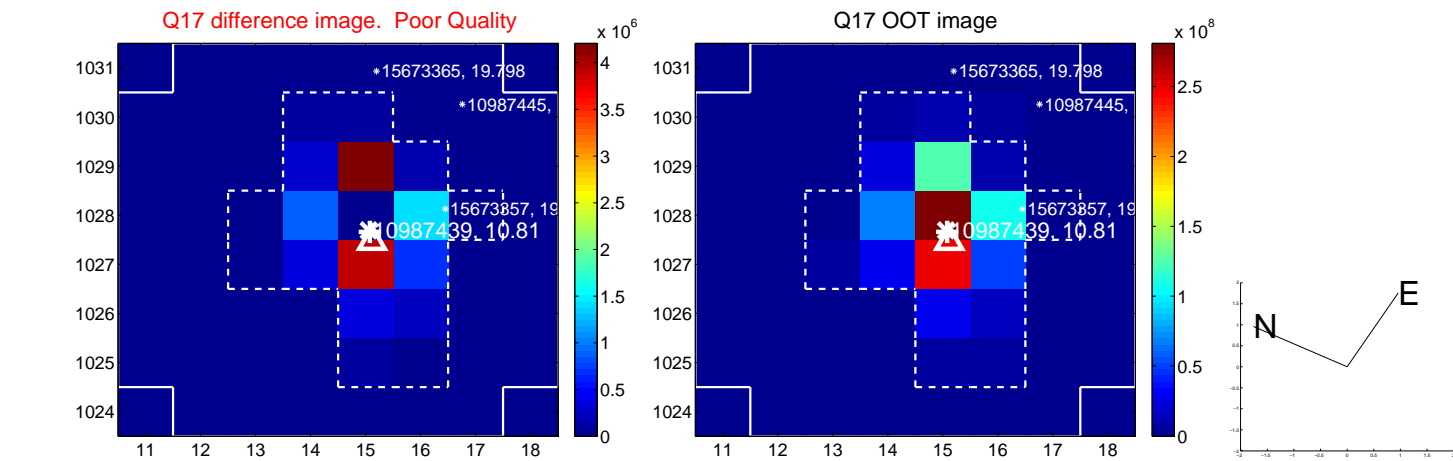
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



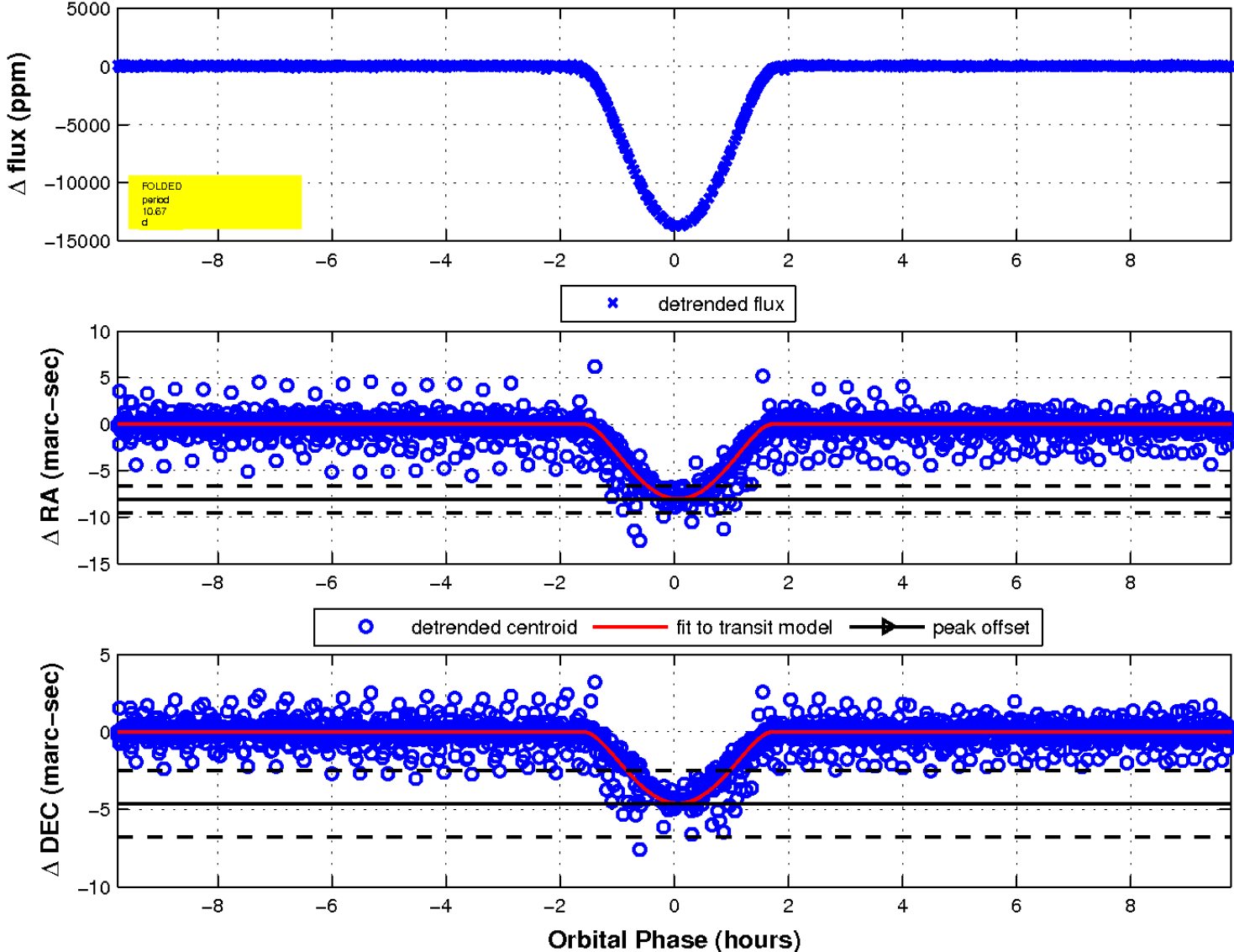
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



fluxWeightedCentroids, Planet 2 of 2



UKIRT Image

Declination

