

# KIC 009839821

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009839821-01	OBS	2012.01	34.853710	164.046488	763.6	5.540	26.4	27.7	0.85	5818	2.52	17.64
009839821-02	OBS	2012.02	180.925548	234.316077	713.9	8.722	12.0	12.5	0.85	5818	2.37	1.96

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009839821-01	OBS	PC	1.00	0	0	0	0	NO_COMMENT
009839821-02	OBS	PC	0.88	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.

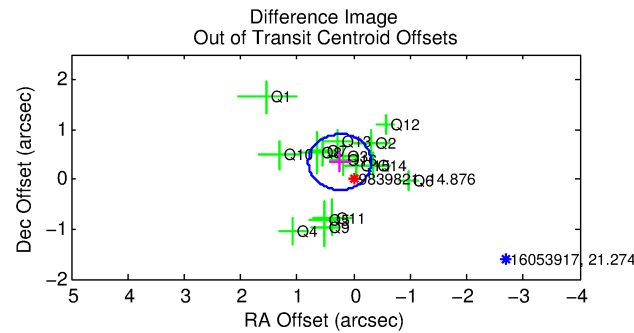
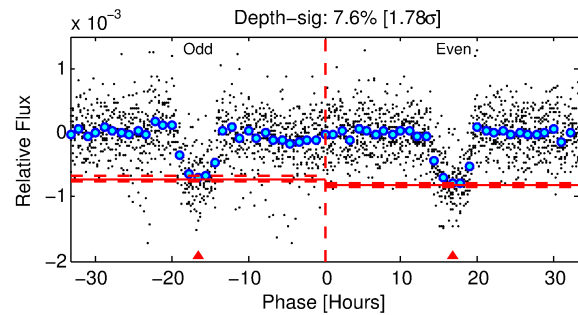
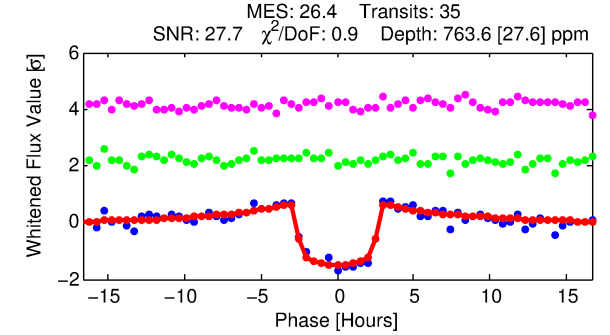
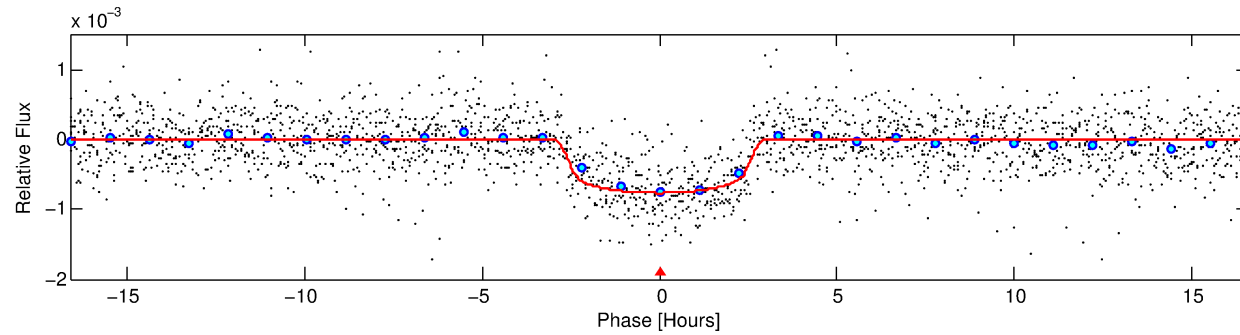
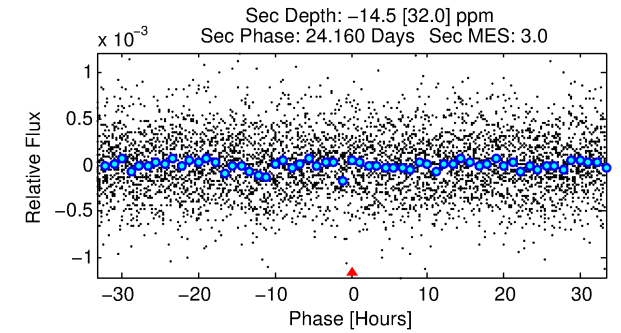
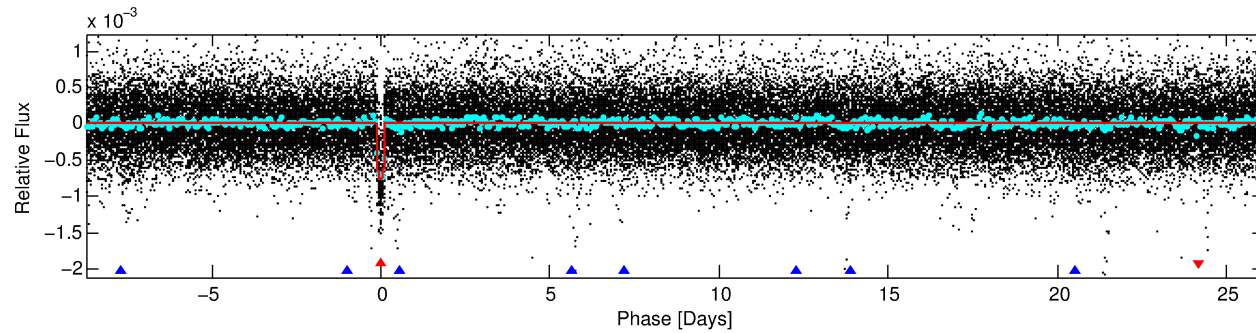
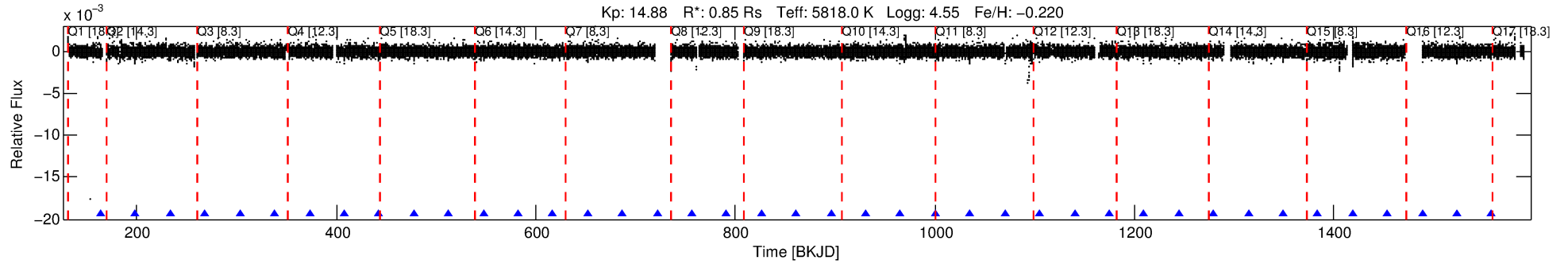
## Ephemeris Match Information For 009839821-01

No Significant Match Found

# DV One-Page Summary

KIC: 9839821 Candidate: 1 of 2 Period: 34.854 d

KOI: K02012.01 Corr: 0.983



## DV Fit Results:

Period = 34.85371 [0.00013] d  
Epoch = 164.0465 [0.0029] BKJD  
Rp/R\* = 0.0273 [0.0041]  
a/R\* = 34.86 [23.85]  
b = 0.73 [0.45]  
Seff = 17.64 [5.65]  
Teff = 523 [42] K  
Rp = 2.52 [0.71] Re  
a = 0.2045 [0.0415] AU  
Ag = N/A  
Teffp = N/A

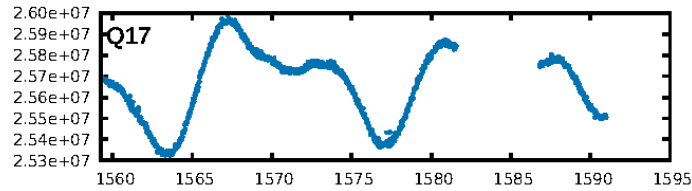
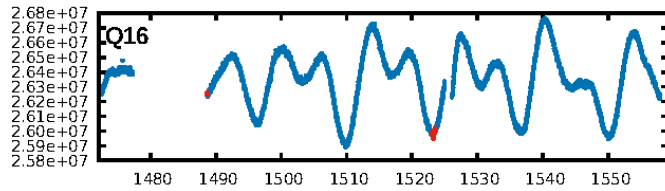
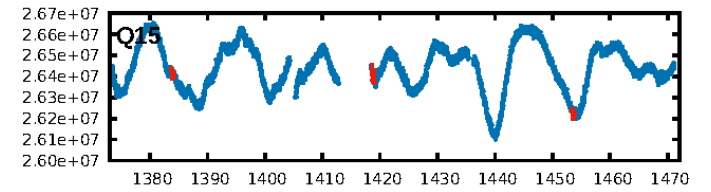
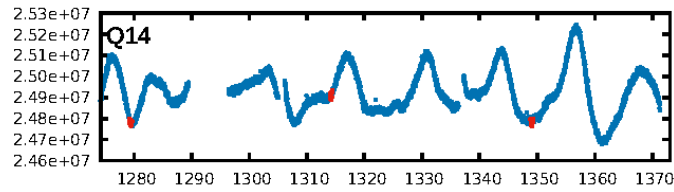
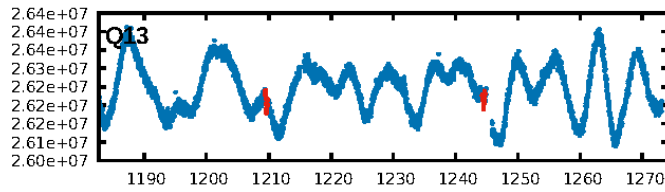
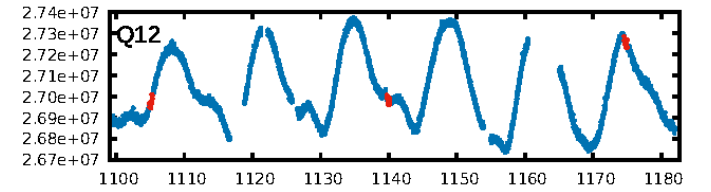
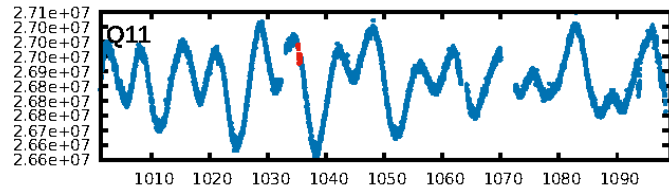
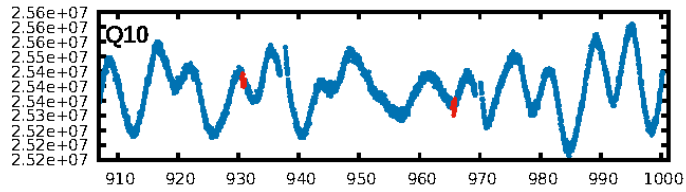
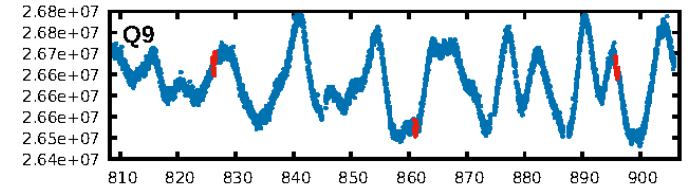
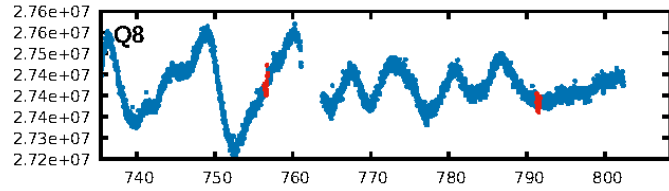
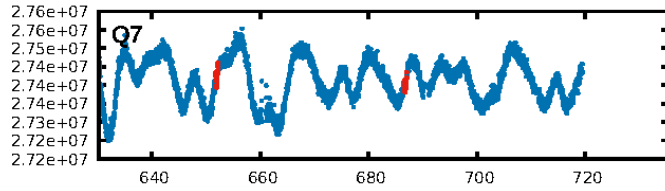
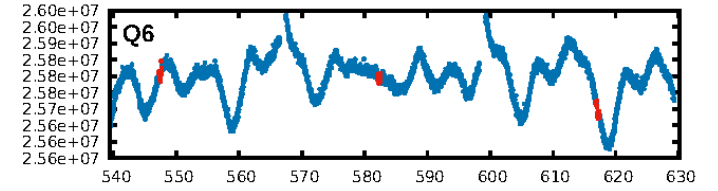
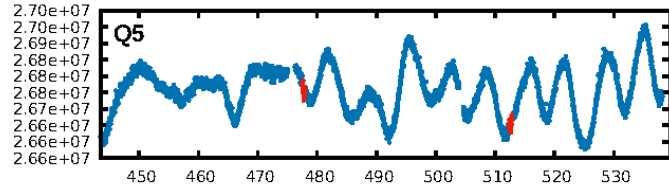
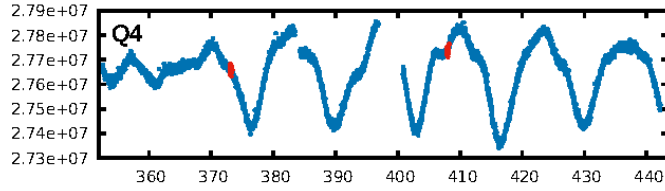
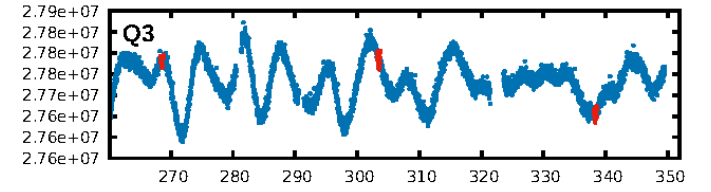
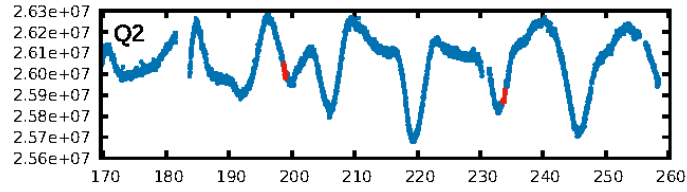
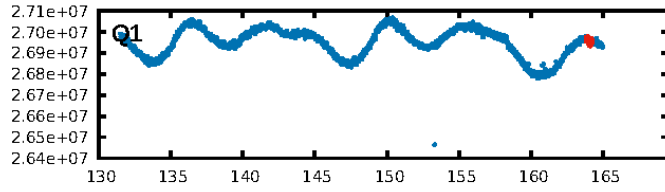
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [339.29σ]  
ModelChiSquare2-sig: 53.7%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 3.58e-134  
RollingBand-fgt: 1.00 [34/34]  
GhostDiagnostic-chr: 2.73  
Centroid-sig: 35.6%  
Centroid-so: 0.539 arcsec [1.62σ]  
OotOffset-rm: 0.423 arcsec [2.28σ]  
KicOffset-rm: 0.356 arcsec [2.03σ]  
OotOffset-st: 4/4/4/4 [16]  
KicOffset-st: 4/4/4/4 [16]  
DiffImageQuality-fgm: 1.00 [16/16]  
DiffImageOverlap-fno: 1.00 [16/16]

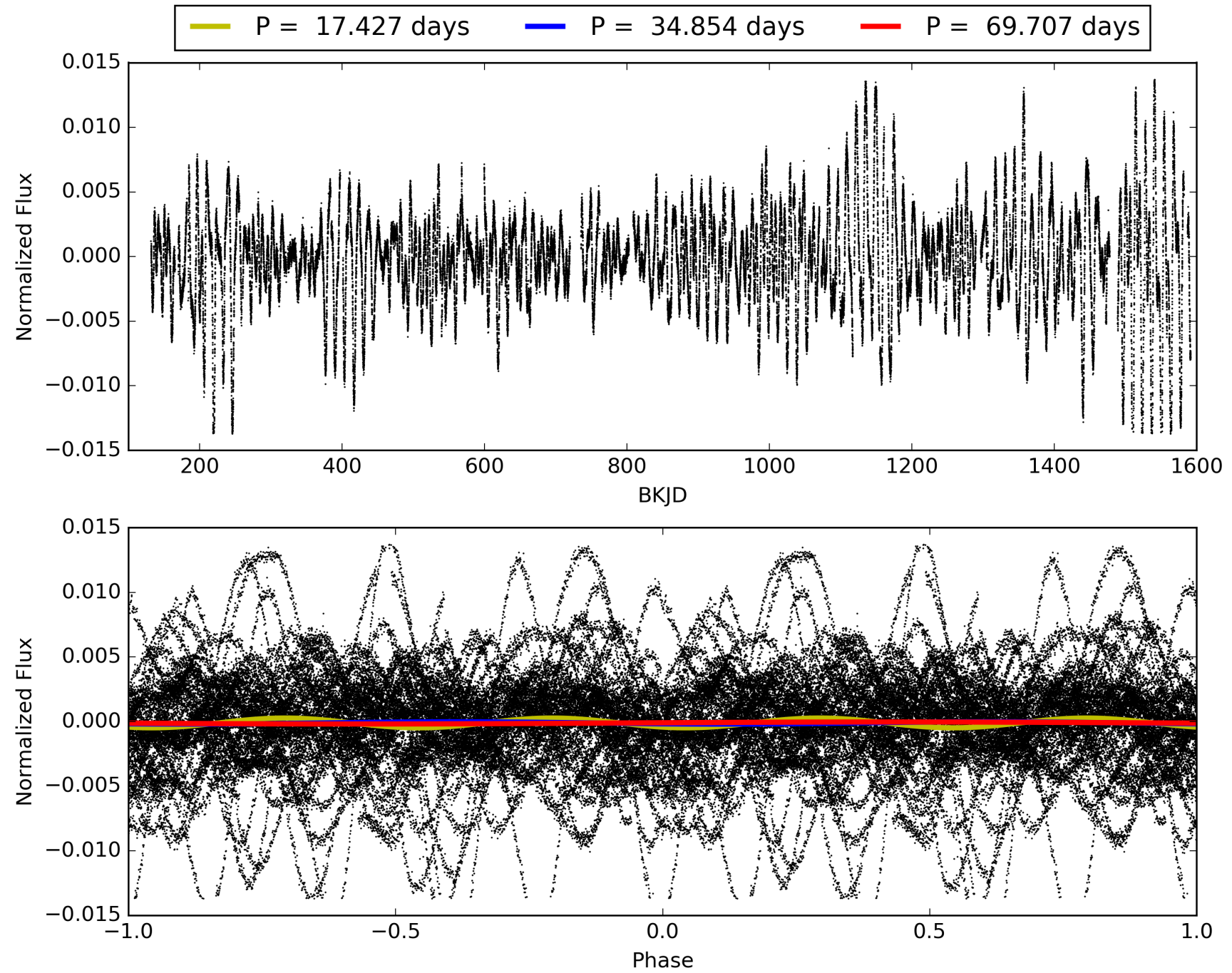
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 30-Jan-2016 00:16:03 Z

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

# TCE 009839821-01, PDC Light Curves

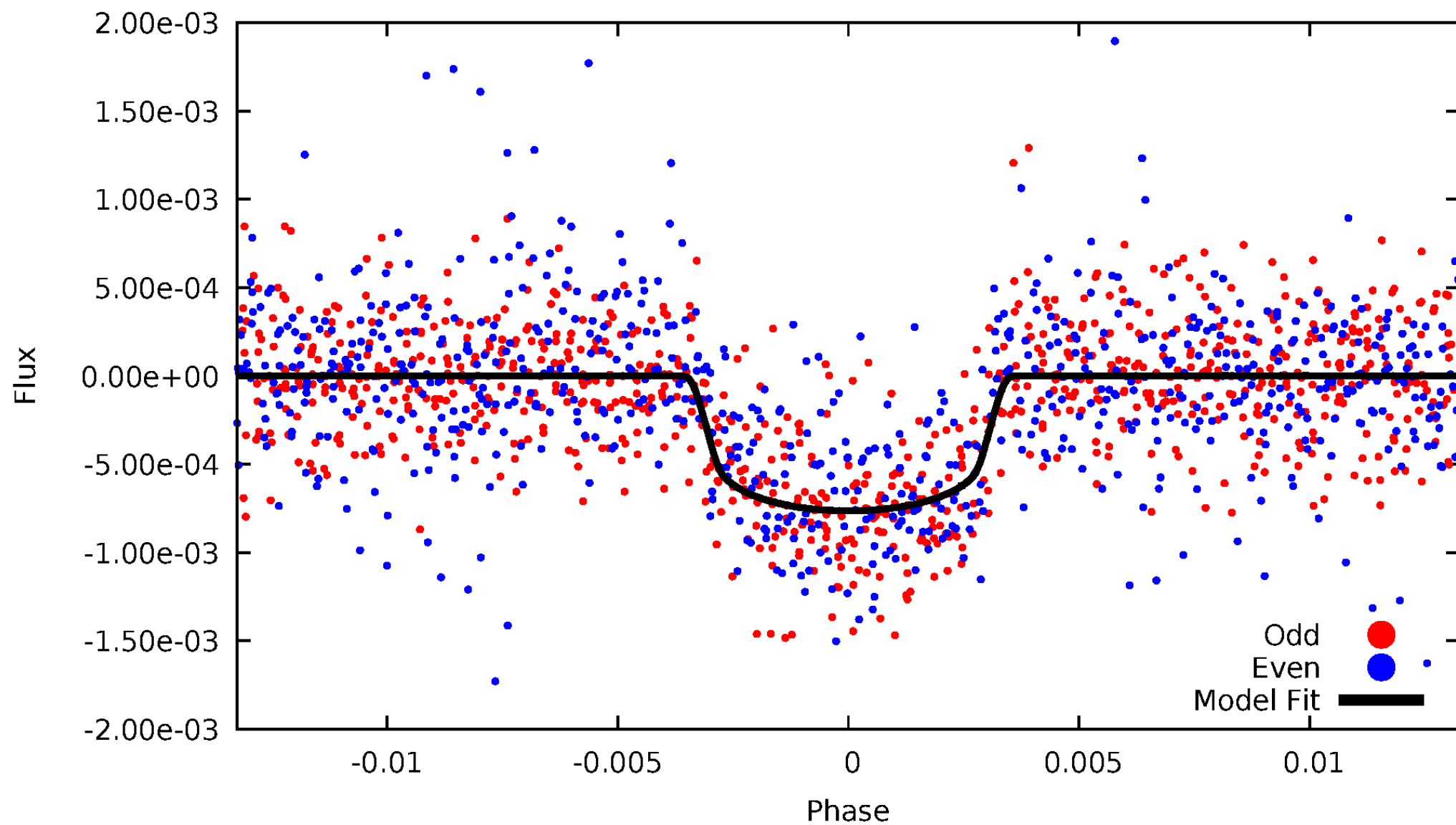


TCE 009839821-01



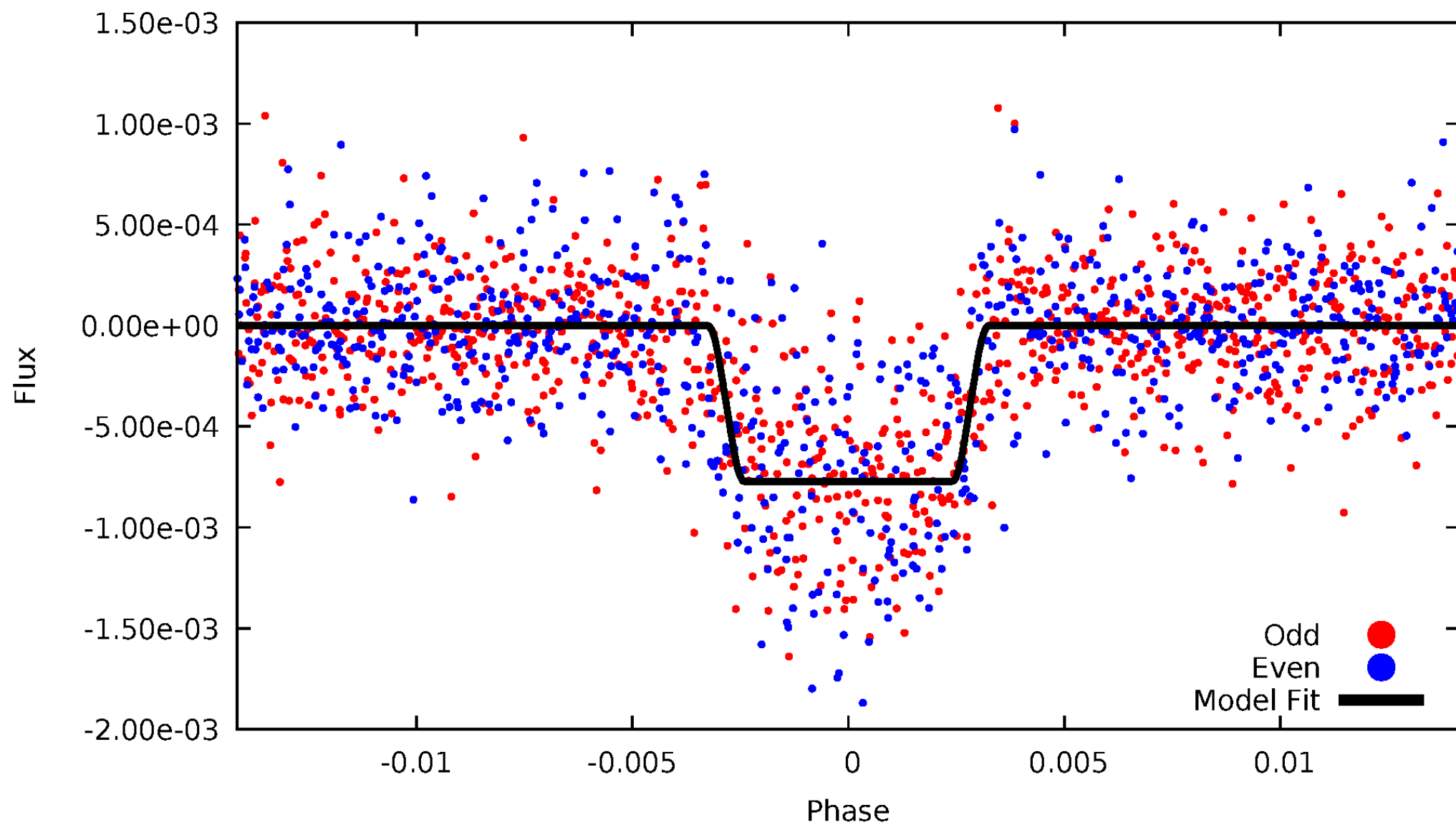
# DV Odd/Even

TCE 009839821-01



# ALT Odd/Even

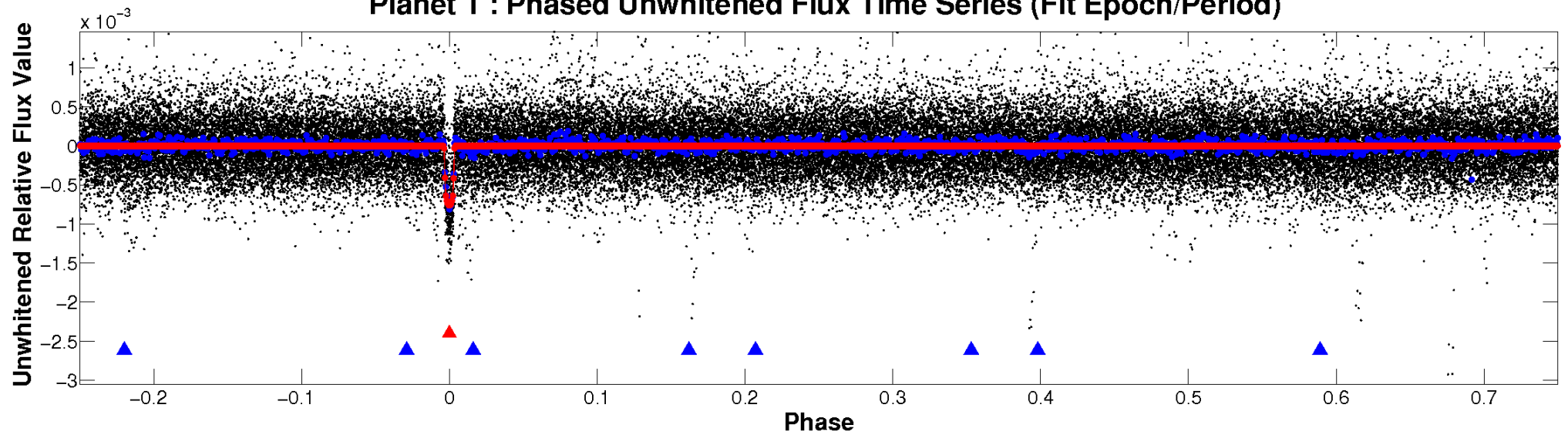
TCE 009839821-01



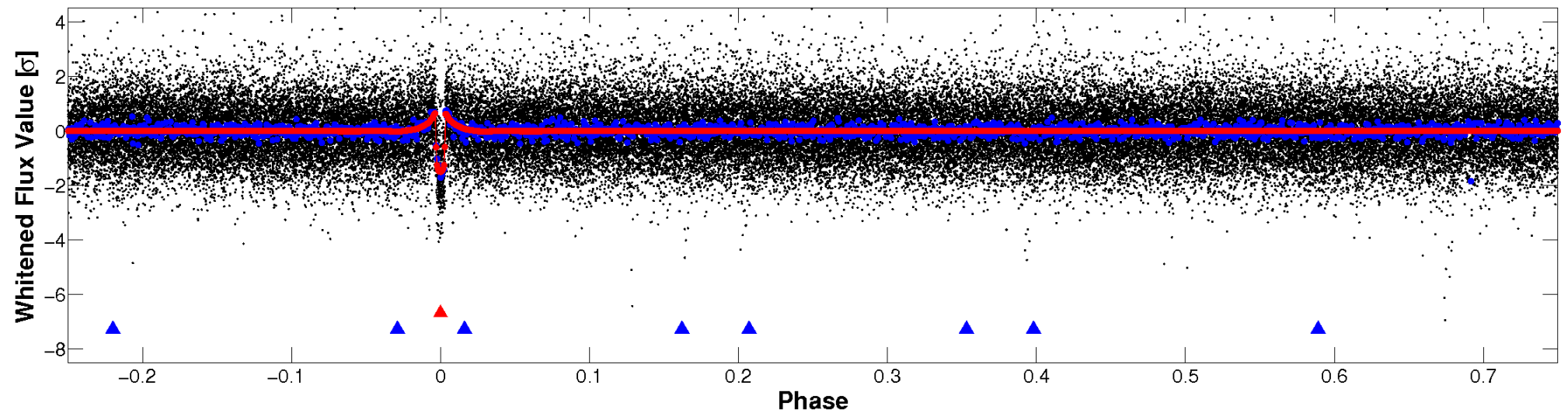


# Non-Whitened Vs. Whitened Light Curve

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

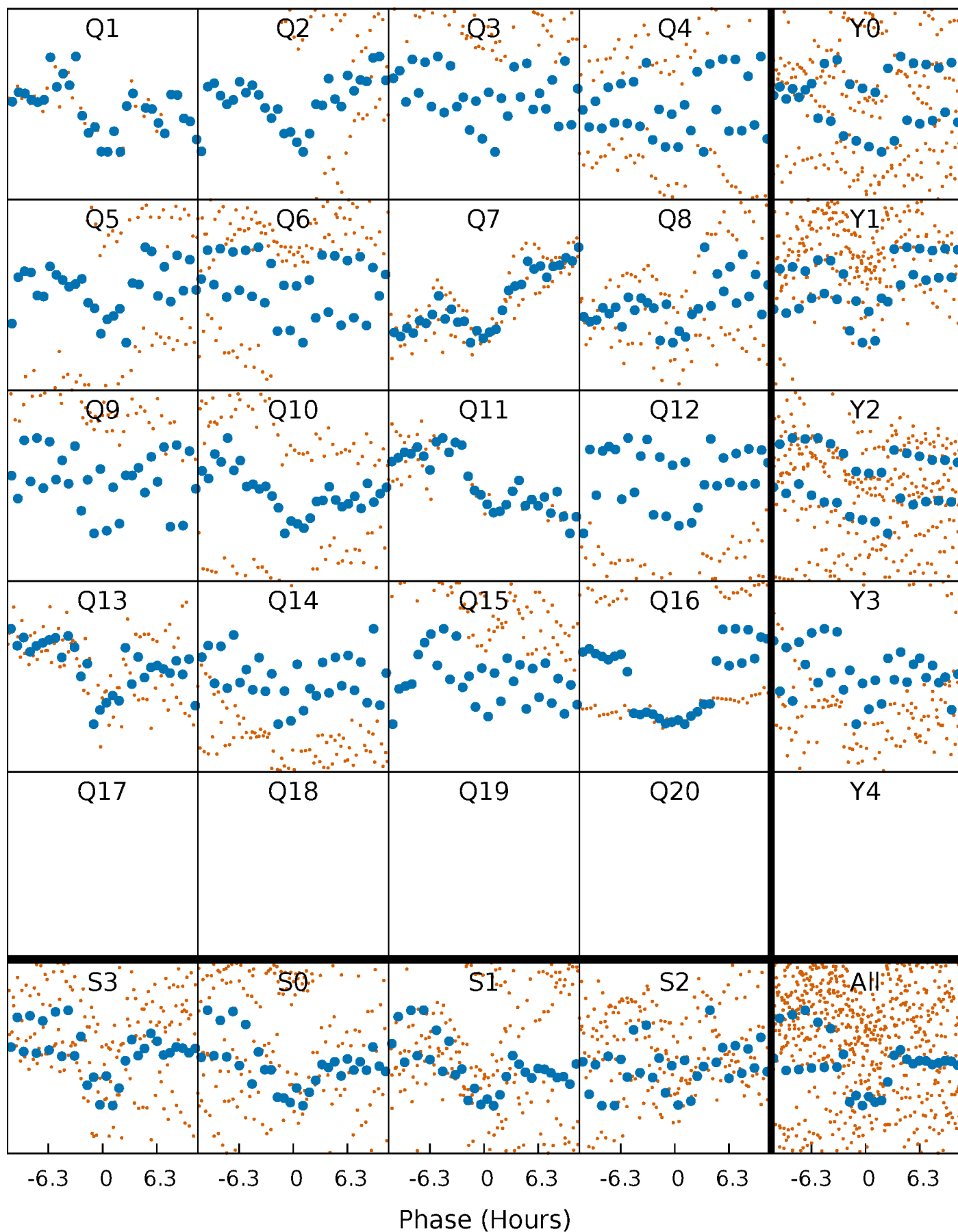


**Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



# PDC Quarter-Phased Transit Curves

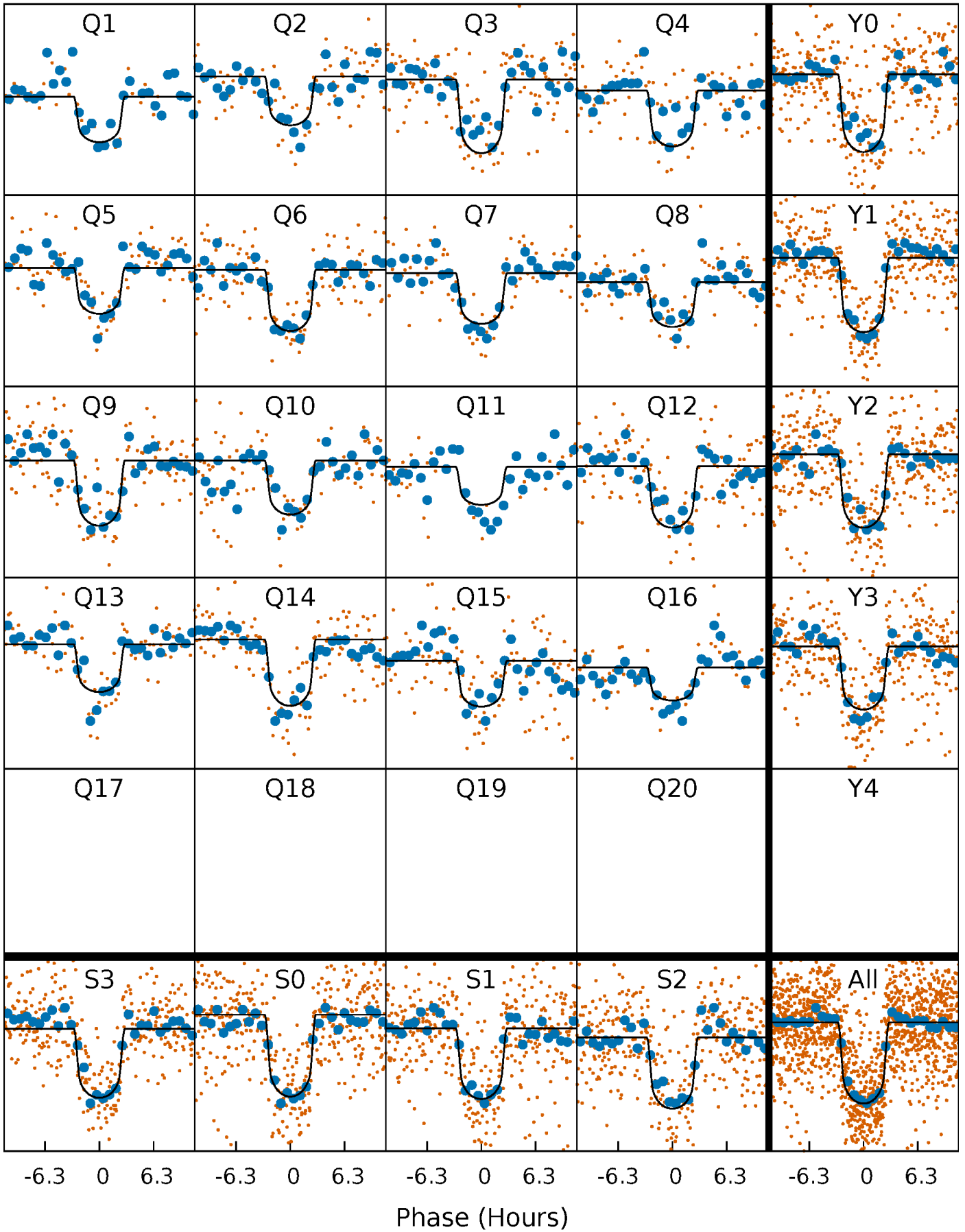
TCE 009839821-01 P= 34.853710 Days  $T_0=164.046488$  (BKJD)





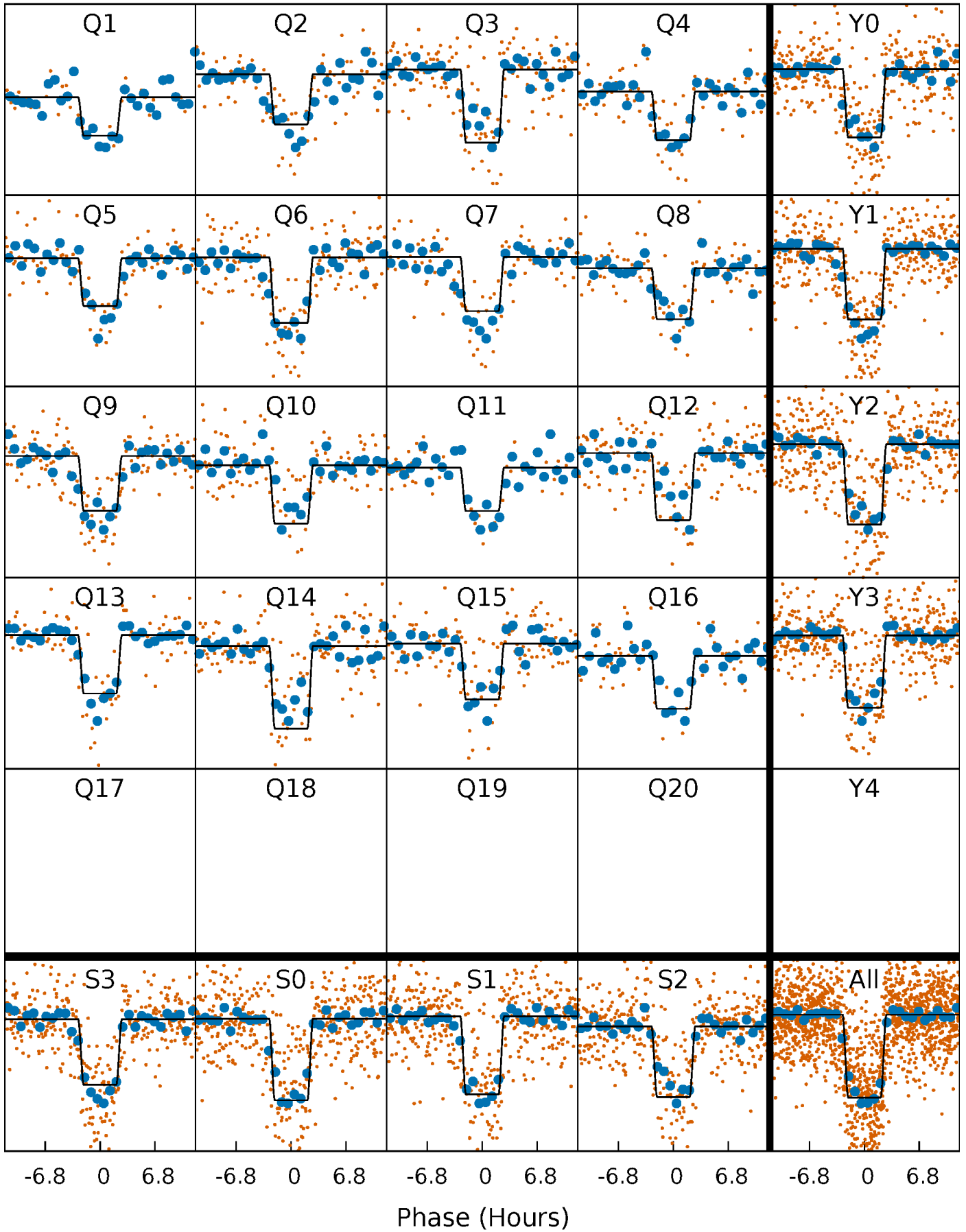
# DV Quarter-Phased Transit Curves

TCE 009839821-01 P= 34.853710 Days  $T_0=164.046488$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

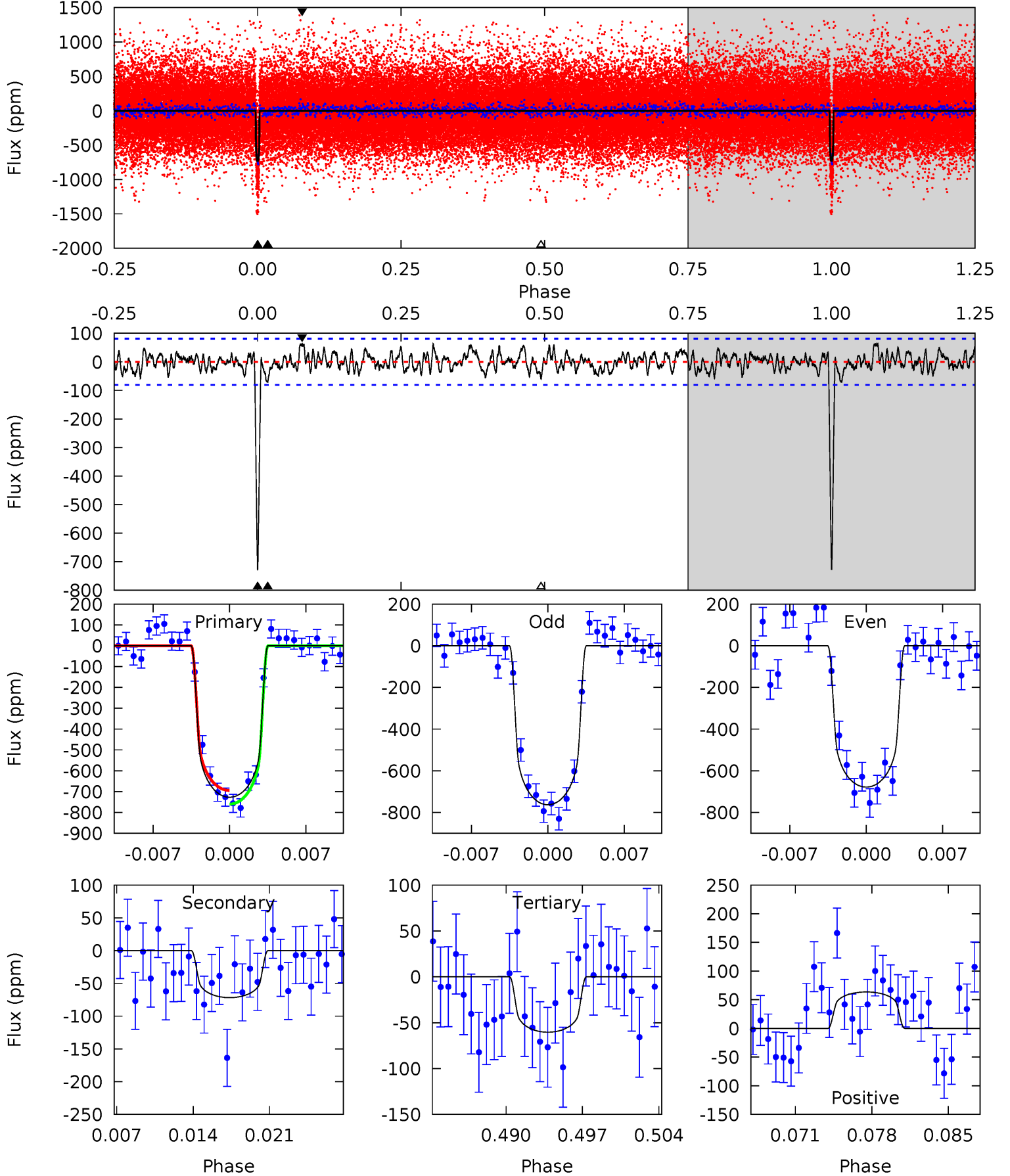
TCE 009839821-01 P= 34.853408 Days  $T_0=164.053726$  (BKJD)



# DV Model-Shift Uniqueness Test

009839821-01, P = 34.853710 Days, E = 129.192778 Days

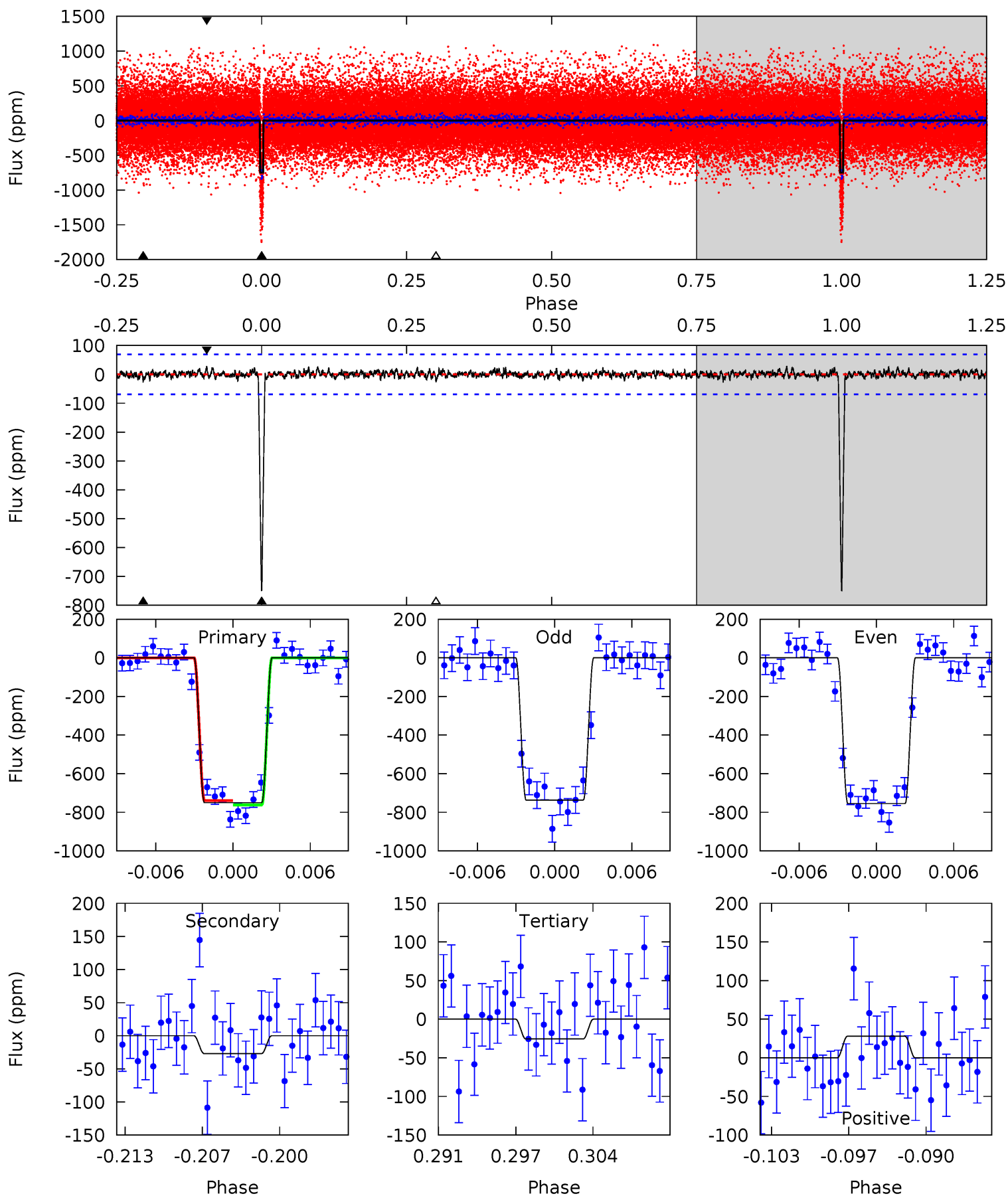
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
45.7	4.52	3.80	4.00	5.09	2.69	1.51	41.9	41.7	0.72	0.51	2.66	0.96	0.08	2.07



# Alt Model-Shift Uniqueness Test

009839821-01, P = 34.853408 Days, E = 129.200318 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
55.3	1.99	1.89	2.06	5.11	2.72	0.56	53.4	53.2	0.10	-0.07	0.69	0.98	0.04	0.85



### Stellar Parameters For KIC 009839821

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5818^{+139}_{-157}$	$4.554^{+0.042}_{-0.168}$	$-0.220^{+0.300}_{-0.300}$	$0.848^{+0.199}_{-0.071}$	$0.937^{+0.090}_{-0.121}$	$2.166^{+0.456}_{-0.993}$
	+2%/-3%	+1%/-4%	+136%/-136%	+23%/-8%	+10%/-13%	+21%/-46%
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 009839821-01 / KOI 2012.01

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-72 \pm 16$	$2.59^{+0.50}_{-0.41}$	$742^{+40}_{-29}$	$3668^{+237}_{-227}$	$236^{+113}_{-80}$
Alt.	$-27 \pm 14$	$2.66^{+0.50}_{-0.43}$	$742^{+41}_{-28}$	$3119^{+251}_{-305}$	$82^{+60}_{-42}$

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

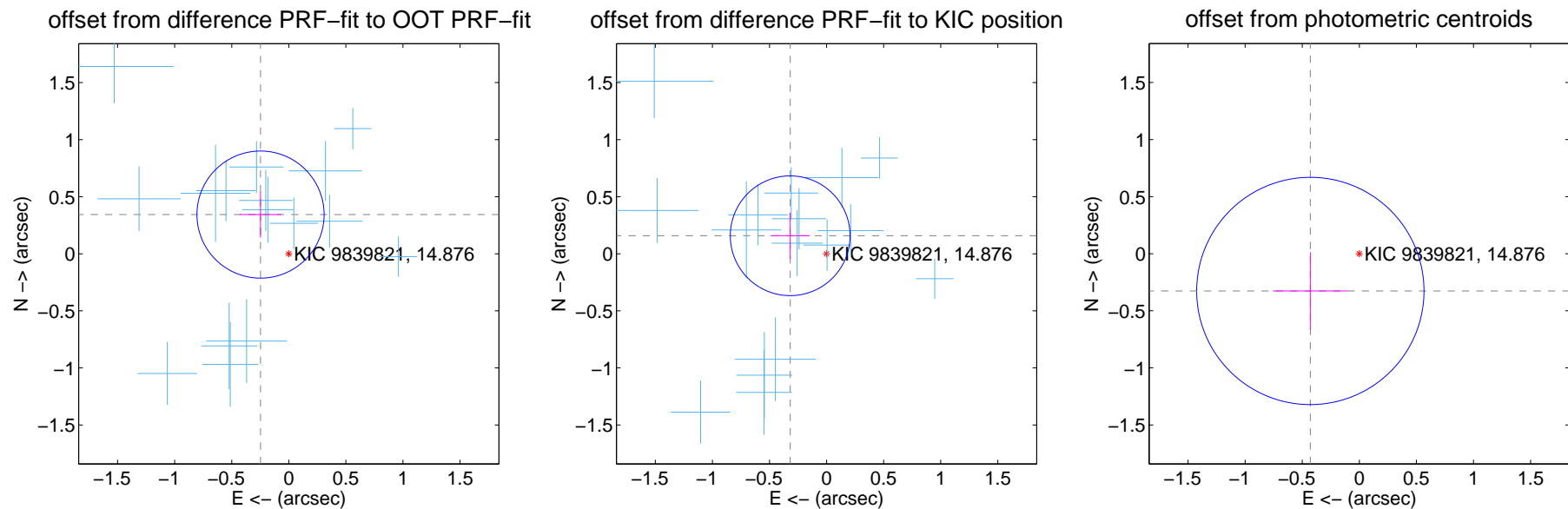
## DV Centroid Data

Supplemental centroid analysis for 009839821-01. Kepler magnitude: 14.88. Transit SNR 27.72

There are 16 quarters with good PRF difference image offsets

The direct PRF centroid is offset from the target star catalog position by about 0.30 arcsec

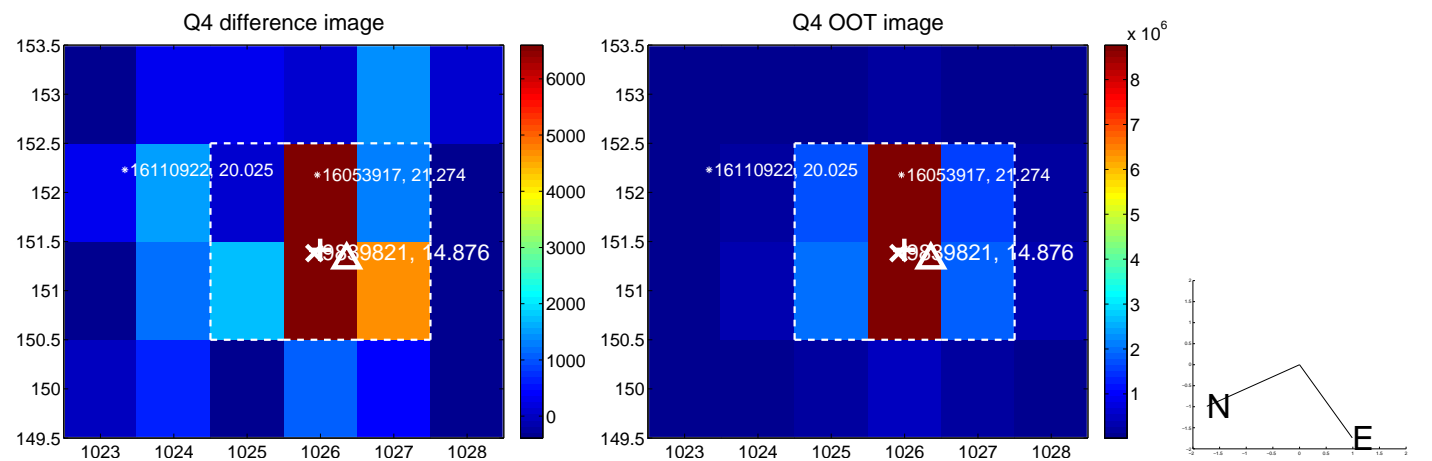
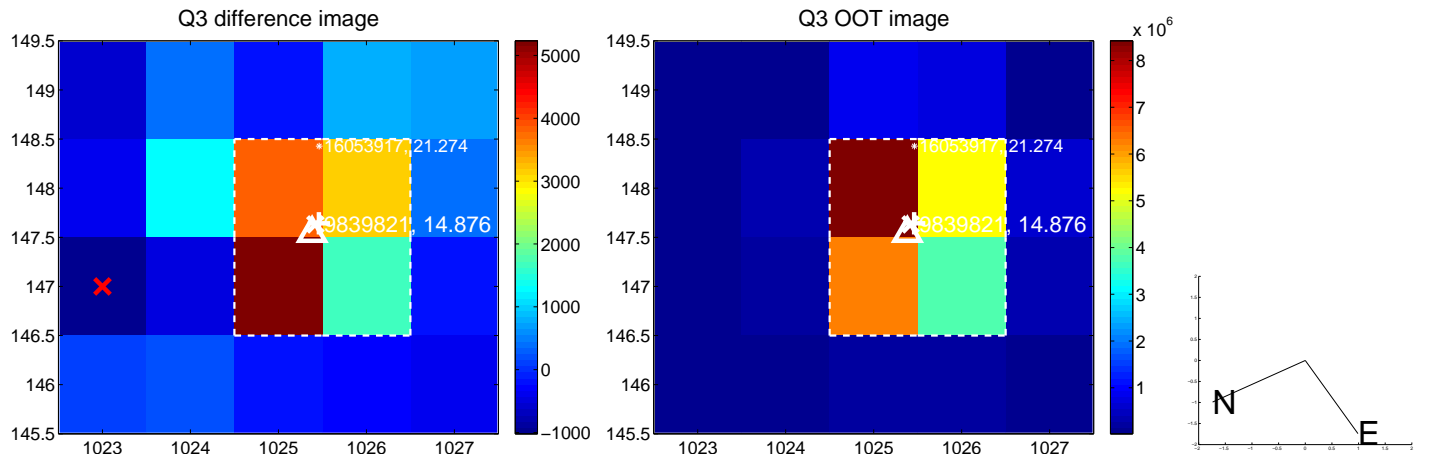
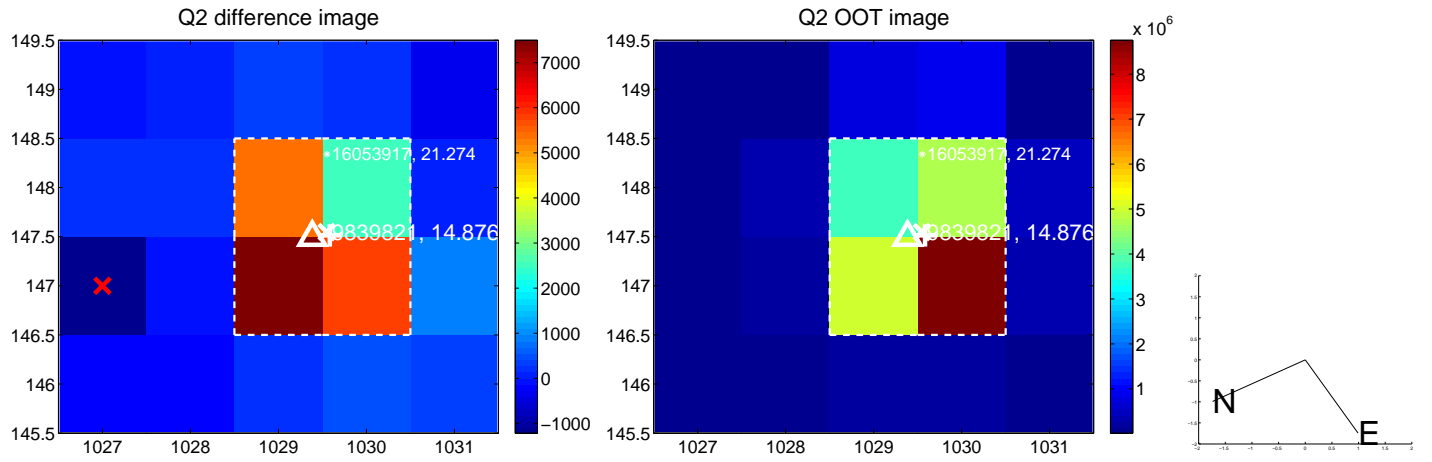
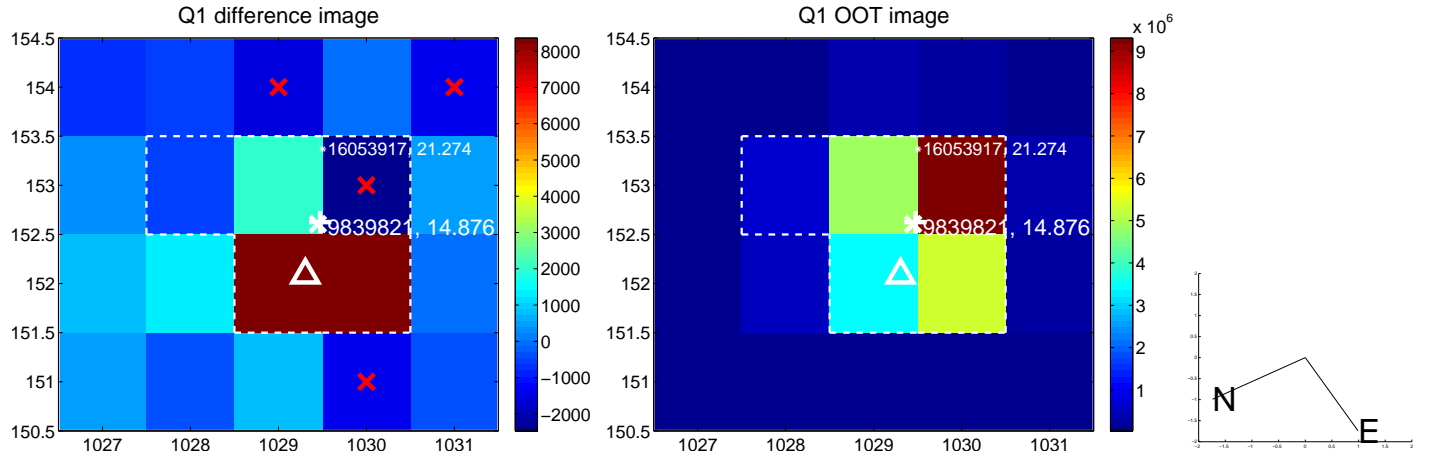
	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.423 \pm 0.186$	2.28	$0.248 \pm 0.182$	$0.343 \pm 0.202$
PRF-fit source offset from KIC position	$0.356 \pm 0.175$	2.03	$0.319 \pm 0.171$	$0.158 \pm 0.204$
photometric centroid source offset	$0.54 \pm 0.33$	1.62	$0.43 \pm 0.33$	$-0.33 \pm 0.34$



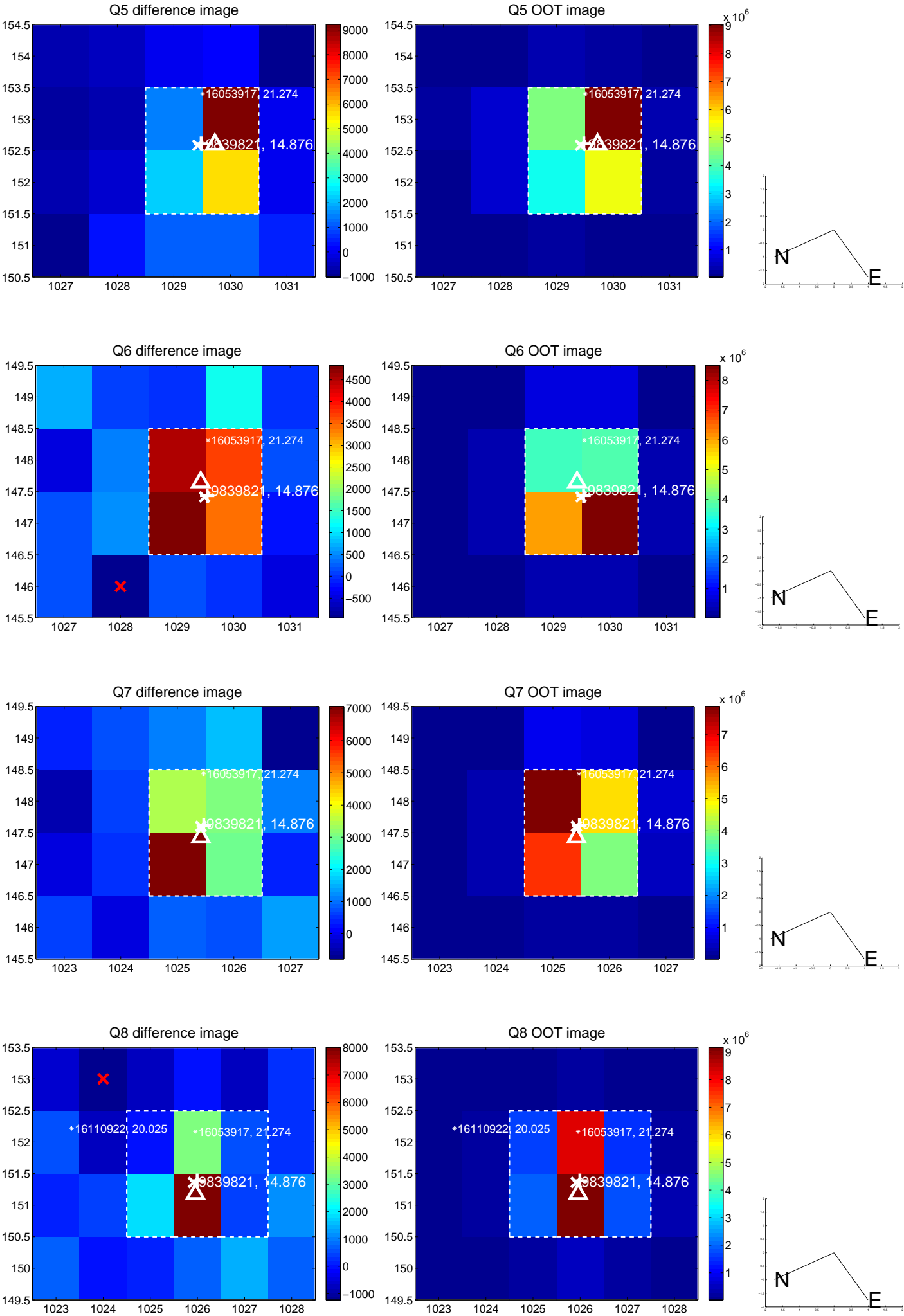
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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



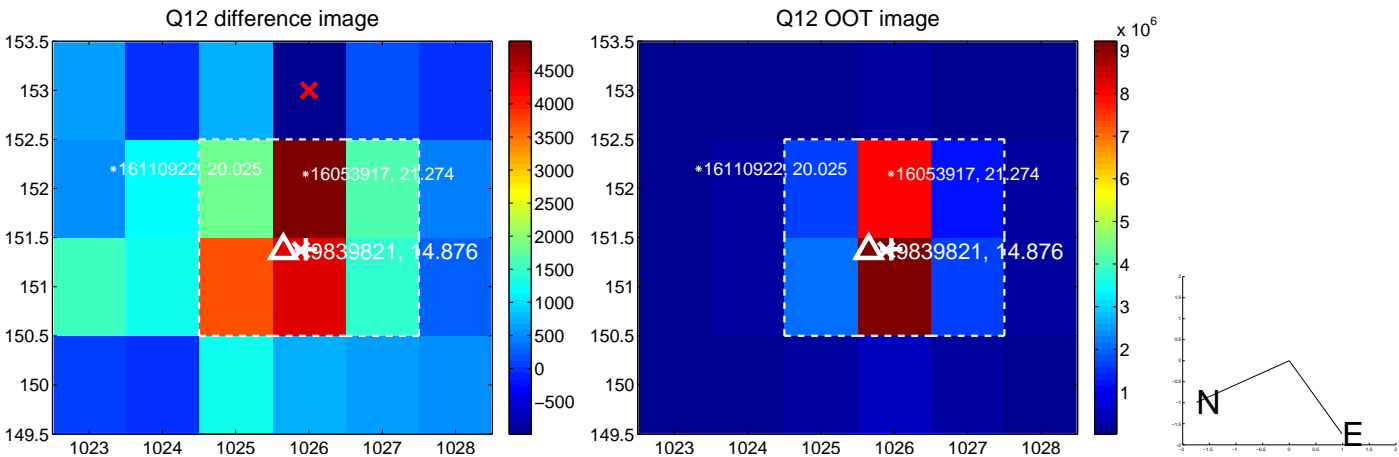
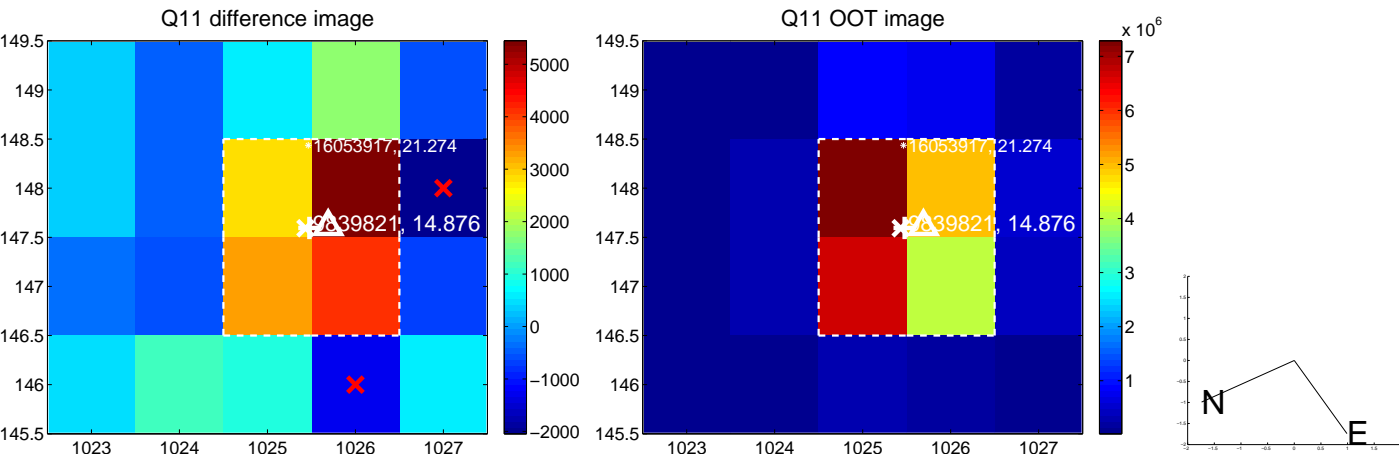
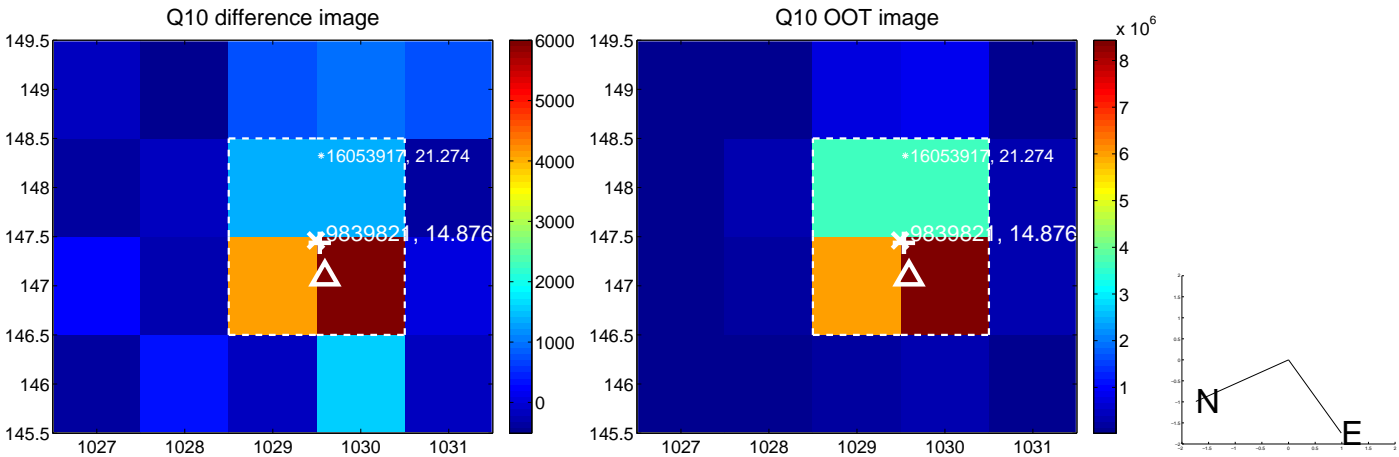
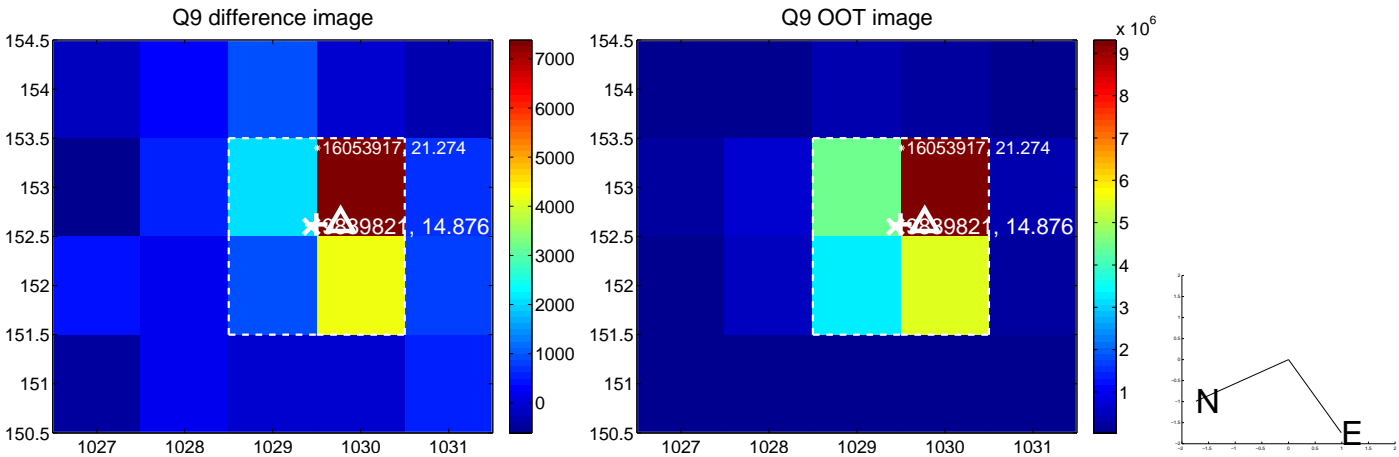
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



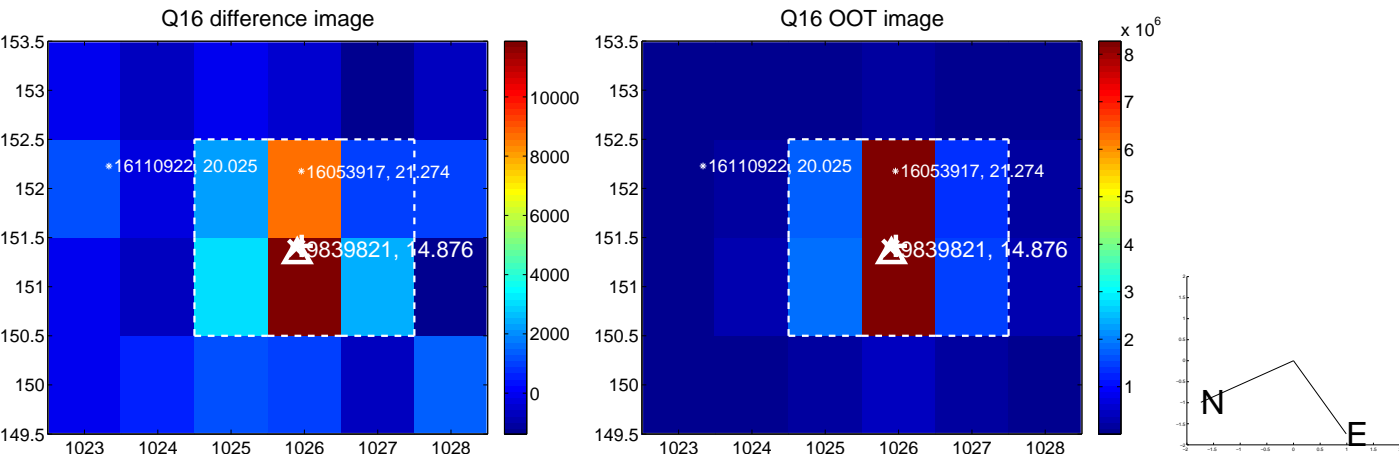
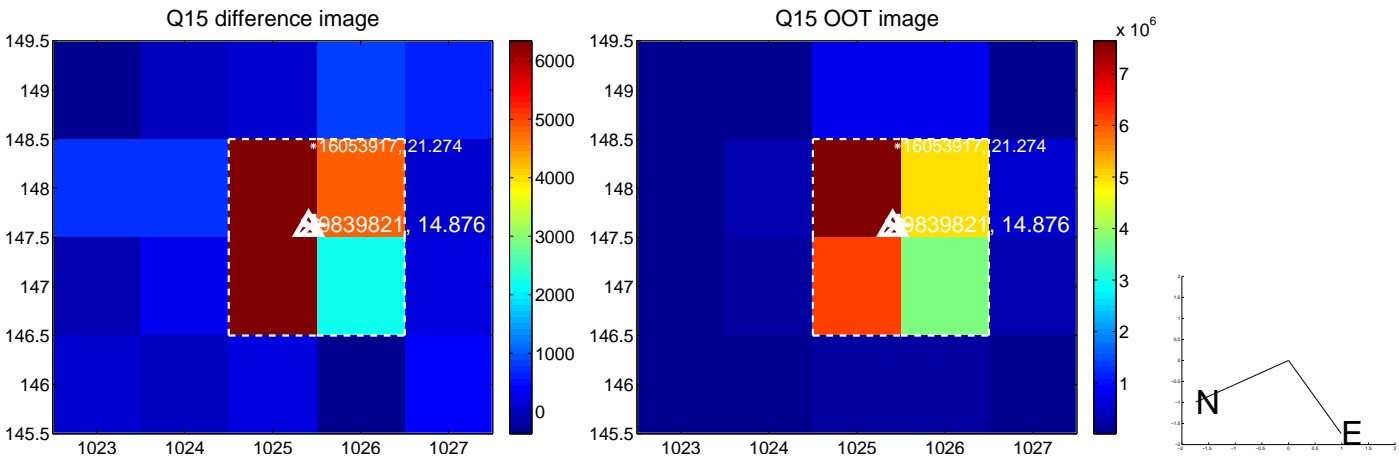
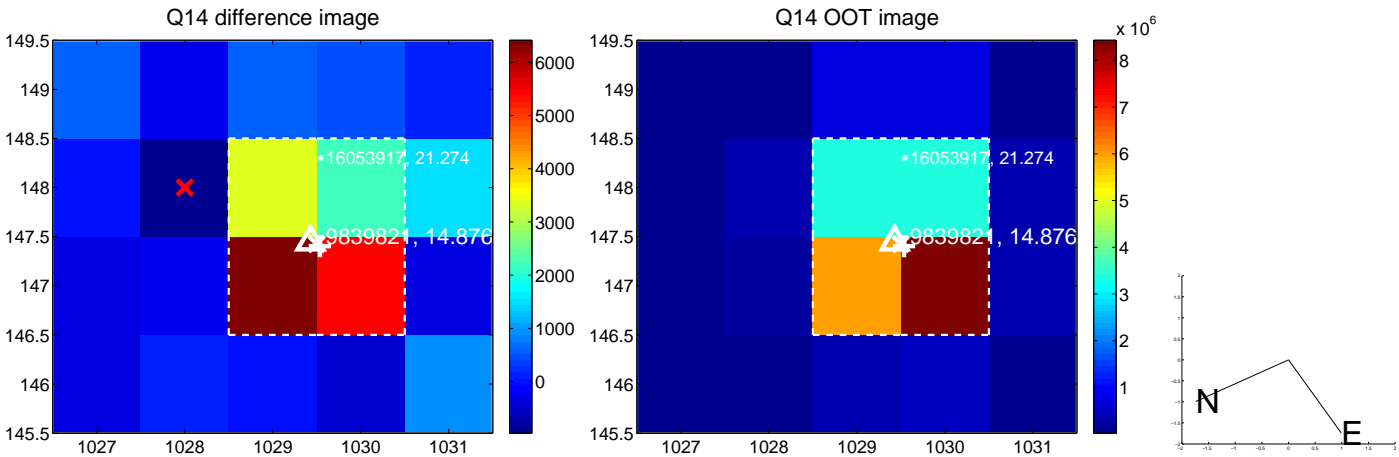
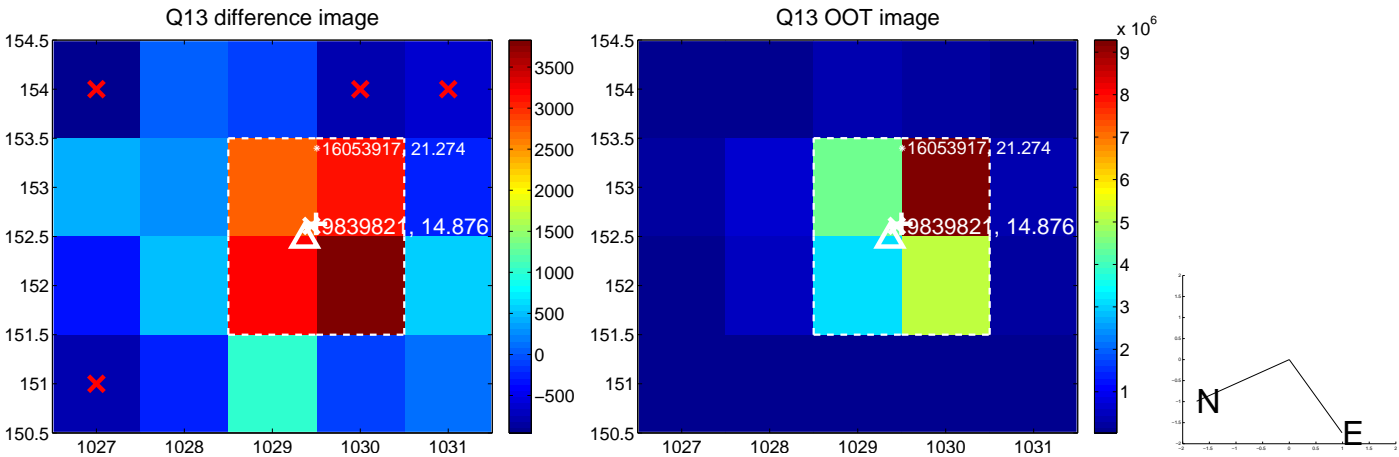
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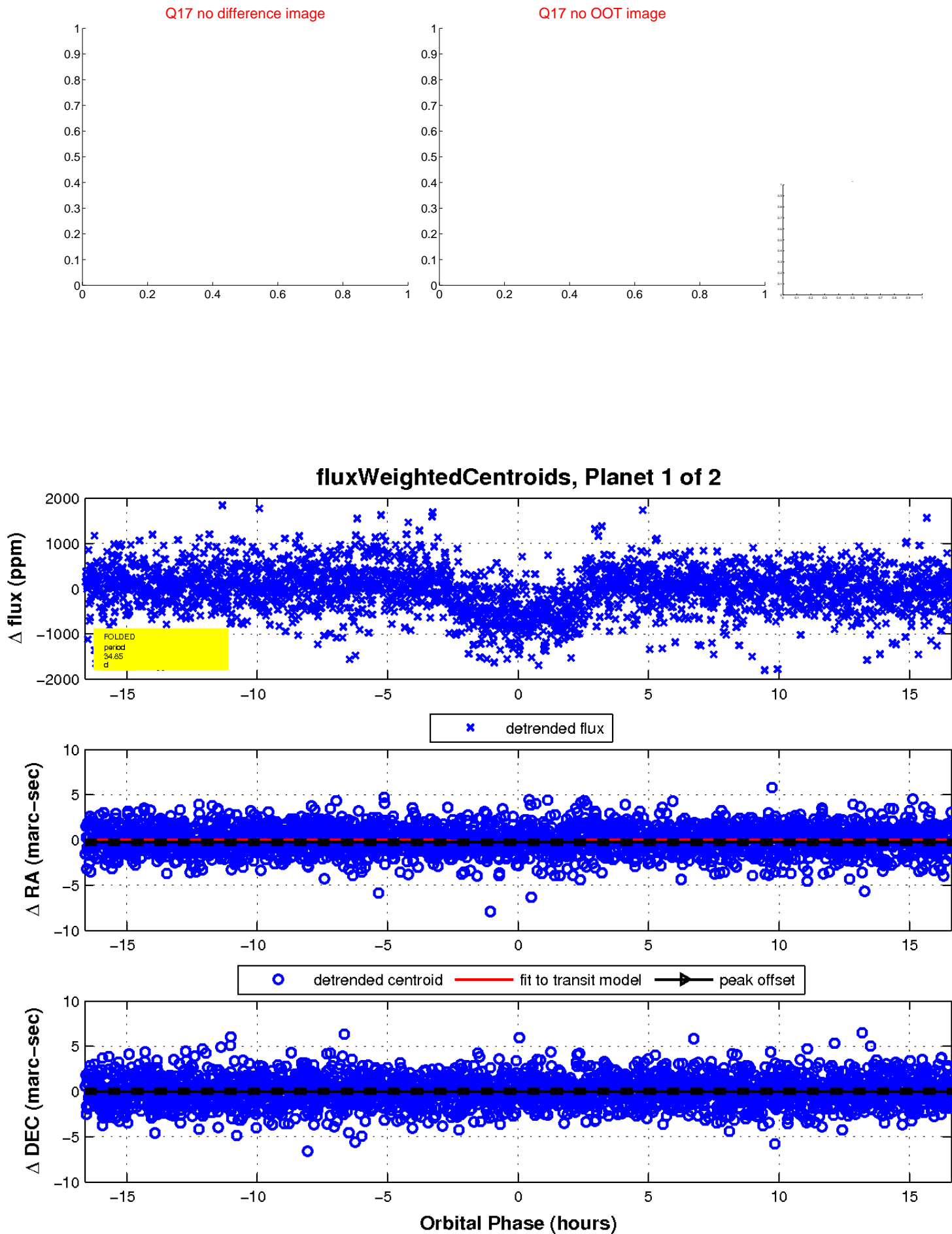
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

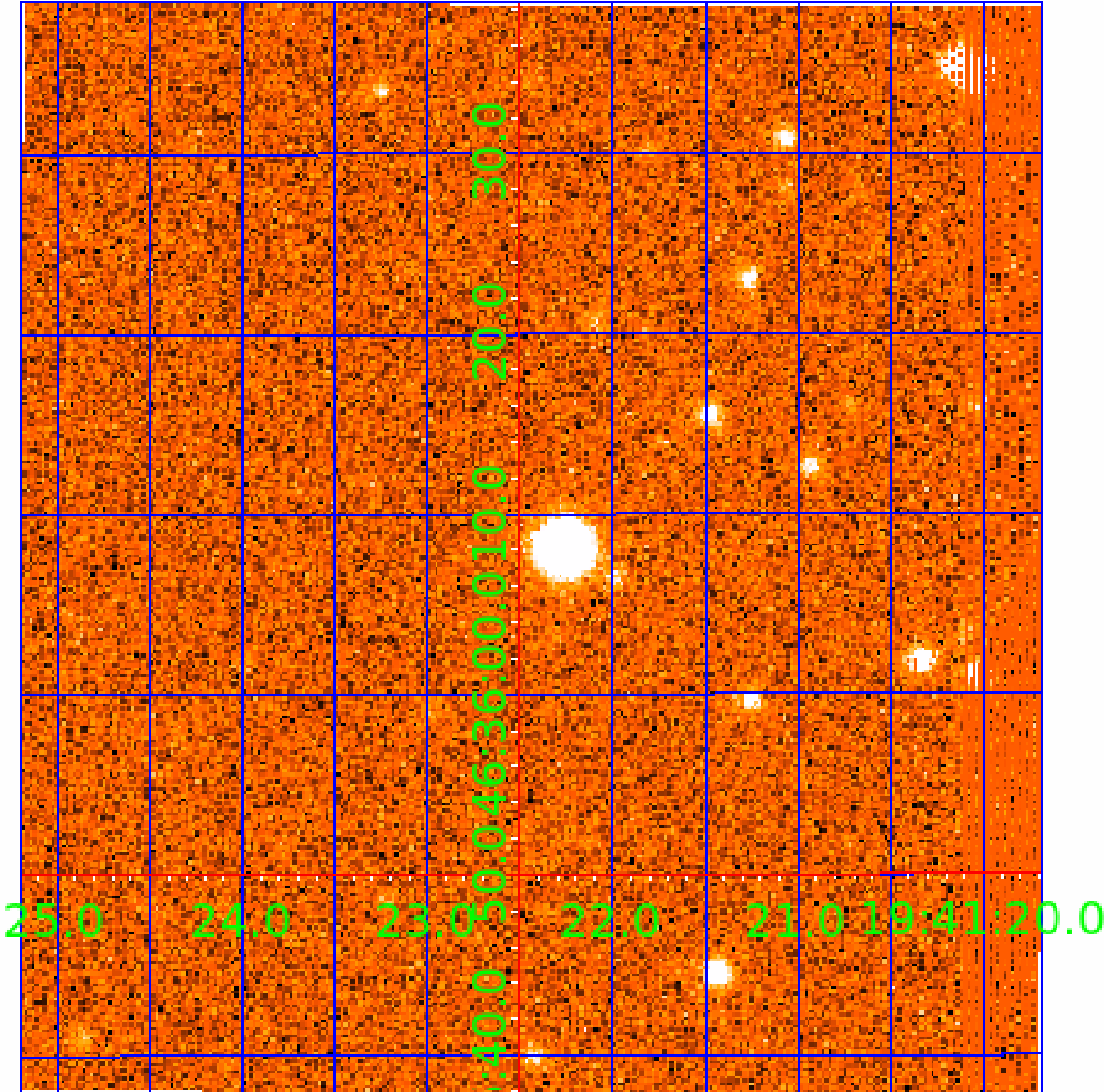


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination





# KIC 009839821

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009839821-01	OBS	2012.01	34.853710	164.046488	763.6	5.540	26.4	27.7	0.85	5818	2.52	17.64
009839821-02	OBS	2012.02	180.925548	234.316077	713.9	8.722	12.0	12.5	0.85	5818	2.37	1.96

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009839821-01	OBS	PC	1.00	0	0	0	0	NO_COMMENT
009839821-02	OBS	PC	0.88	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.

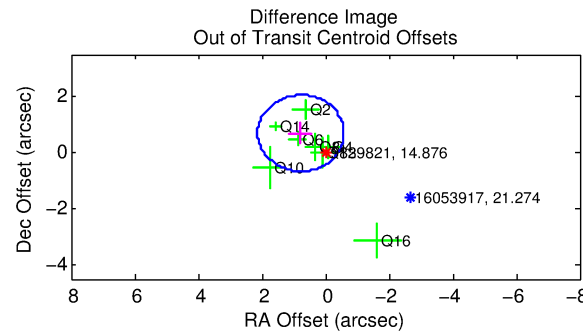
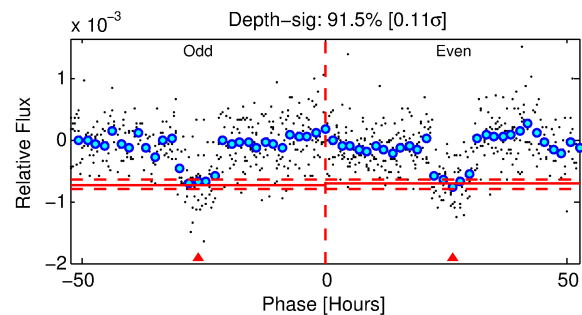
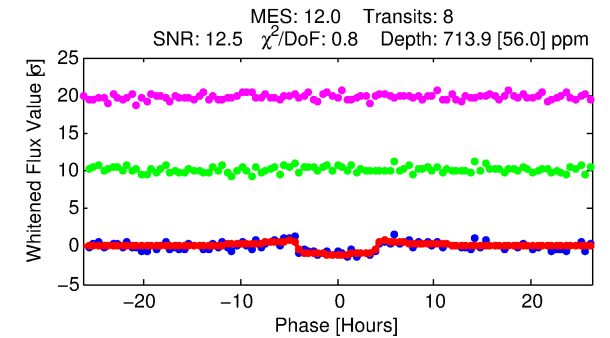
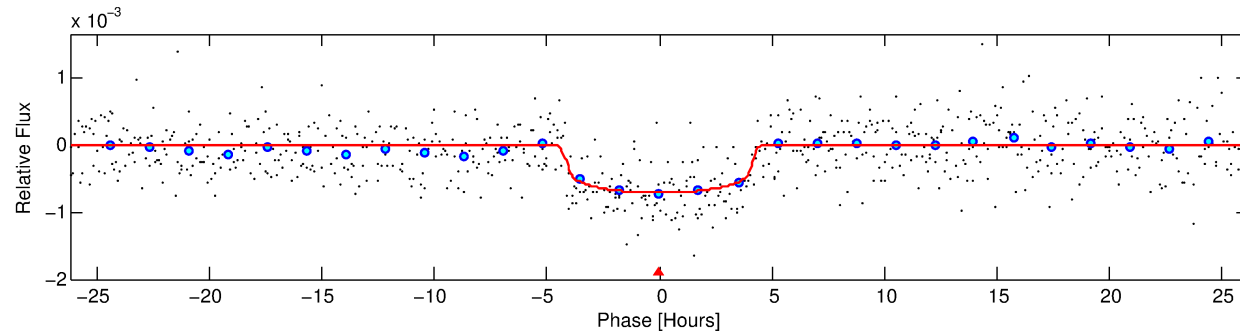
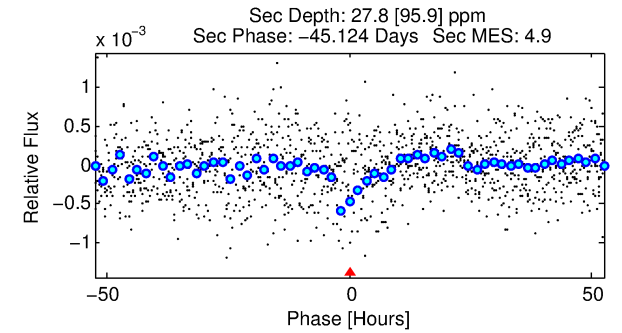
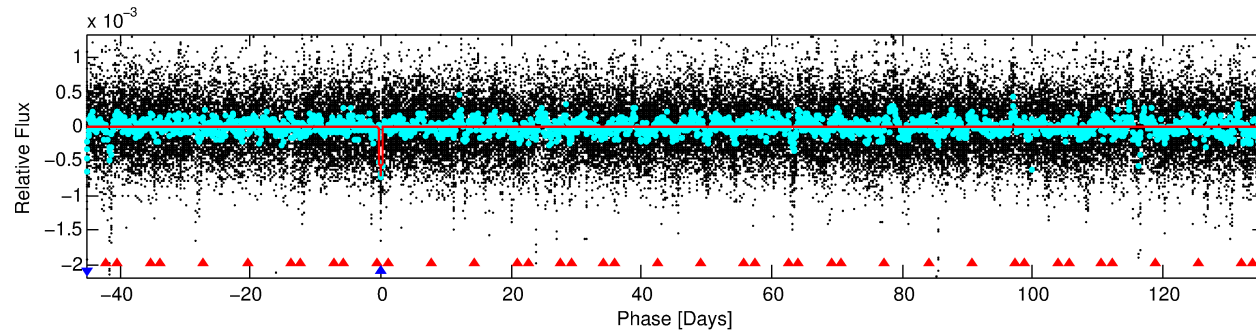
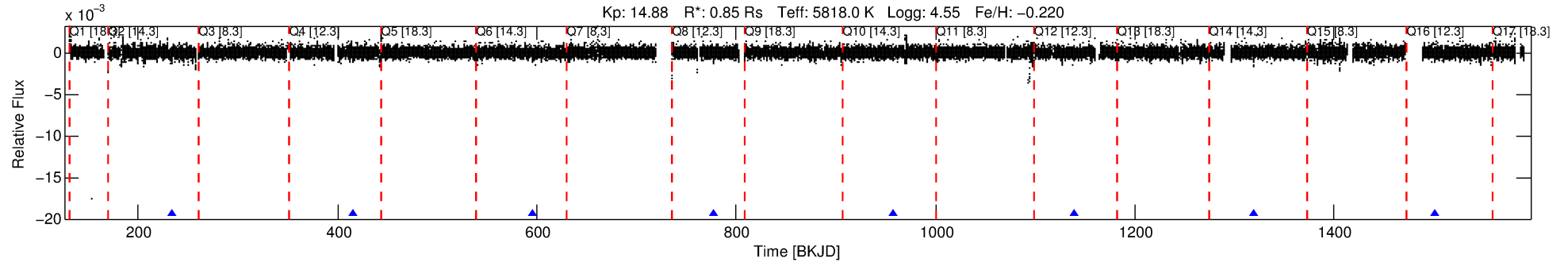
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 009839821-02

No Significant Match Found

# DV One-Page Summary

KIC: 9839821 Candidate: 2 of 2 Period: 180.926 d  
KOI: K02012.02 Corr: 0.990



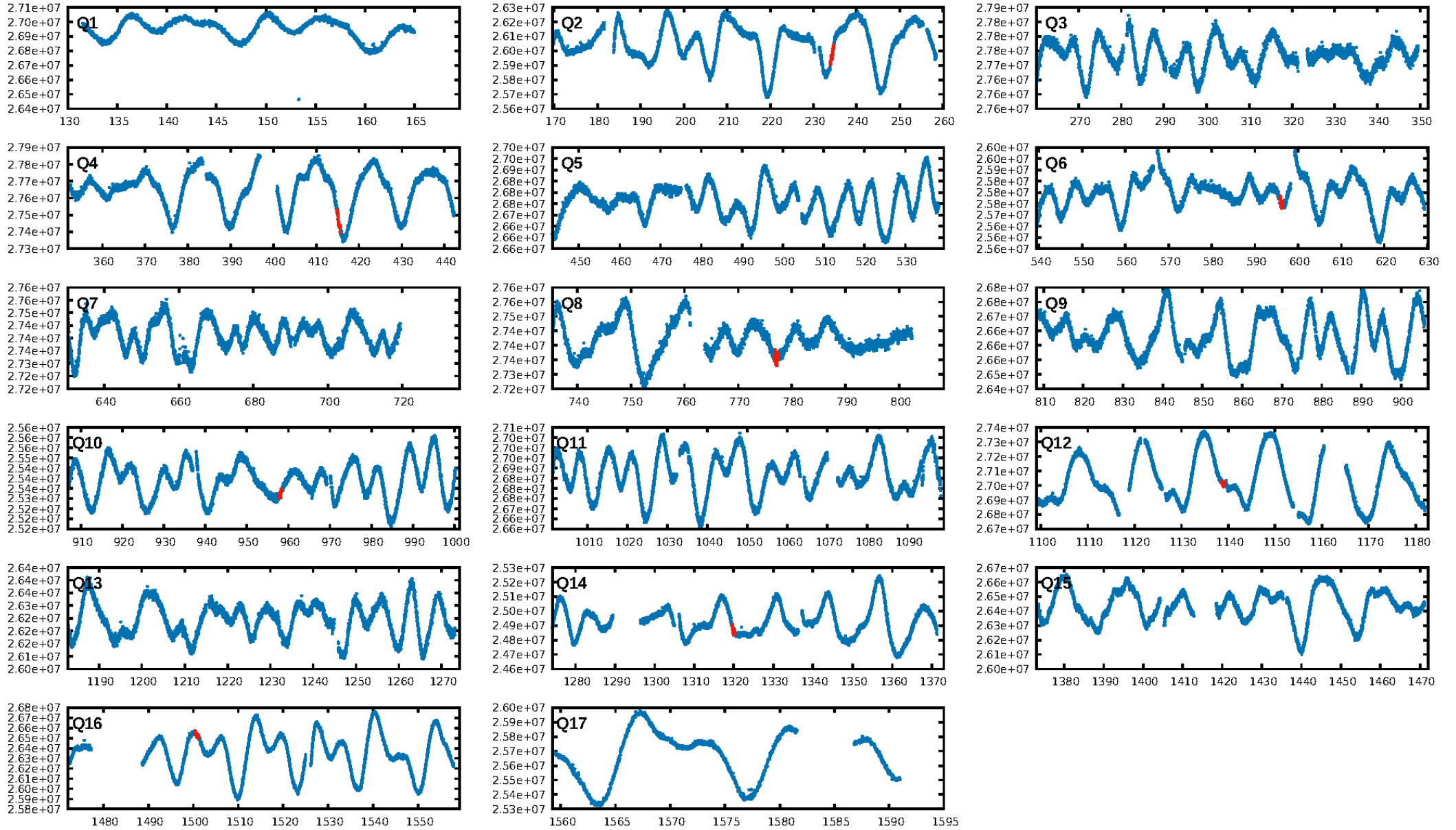
## DV Fit Results:

Period = 180.92555 [0.00181] d  
Epoch = 234.3161 [0.0079] BKJD  
Rp/R\* = 0.0256 [0.0084]  
a/R\* = 129.99 [190.75]  
b = 0.62 [1.49]  
Seff = 1.96 [0.63]  
Teq = 302 [24] K  
Rp = 2.37 [0.95] Re  
a = 0.6132 [0.1243] AU  
Ag = 1026.52 [3612.24] [0.28σ]  
Teffp = 2641 [2316] K [1.01σ]

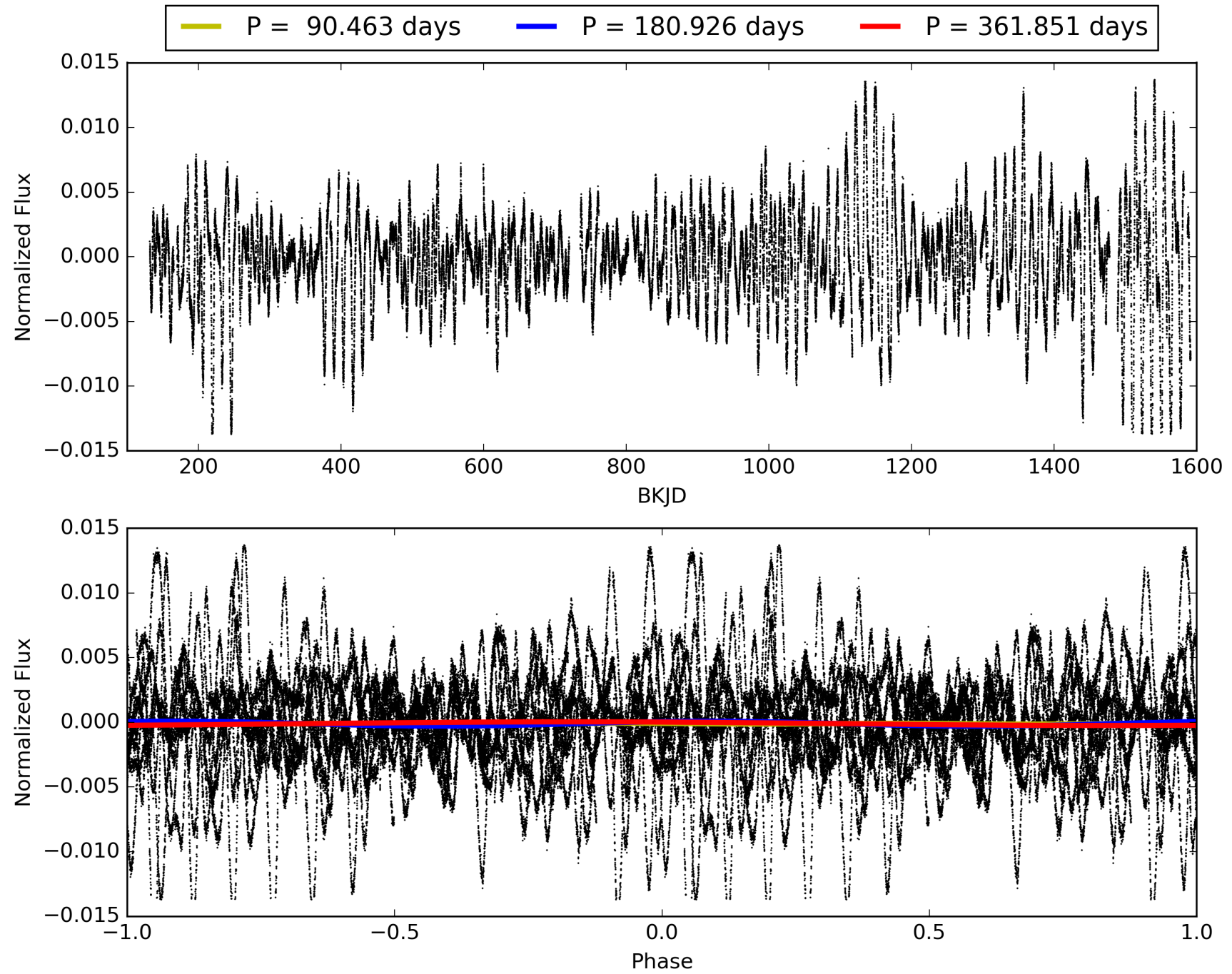
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [339.29σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 58.6%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 5.25e-22  
RollingBand-fgt: 1.00 [8/8]  
GhostDiagnostic-chr: 5.304  
Centroid-sig: 16.8%  
Centroid-so: 1.007 arcsec [1.49σ]  
OotOffset-rm: 1.040 arcsec [2.30σ]  
KicOffset-rm: 1.025 arcsec [1.83σ]  
OotOffset-st: 4/0/4/0 [8]  
KicOffset-st: 4/0/4/0 [8]  
DiffImageQuality-fgm: 0.88 [7/8]  
DiffImageOverlap-fno: 0.88 [7/8]

# TCE 009839821-02, PDC Light Curves

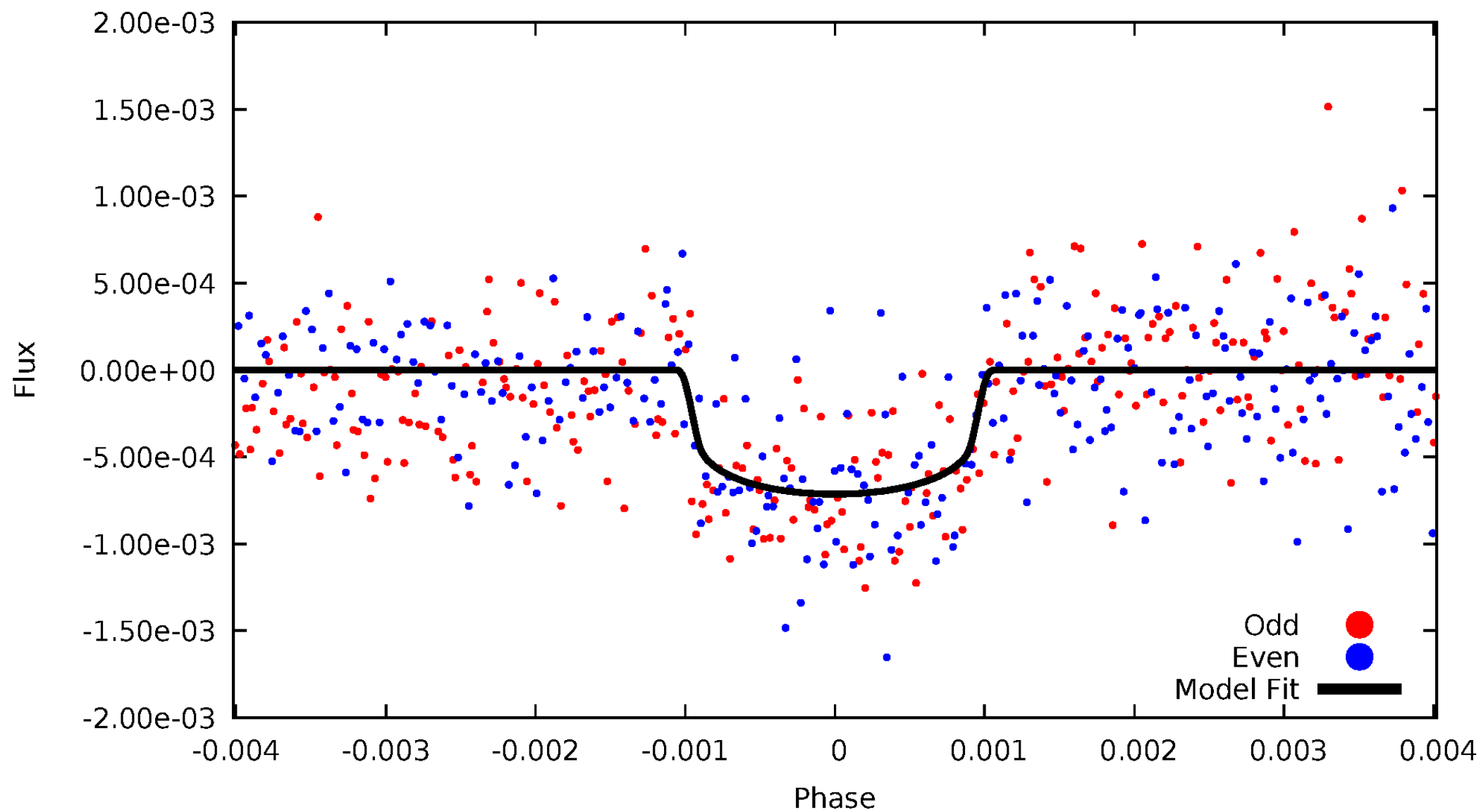


# TCE 009839821-02



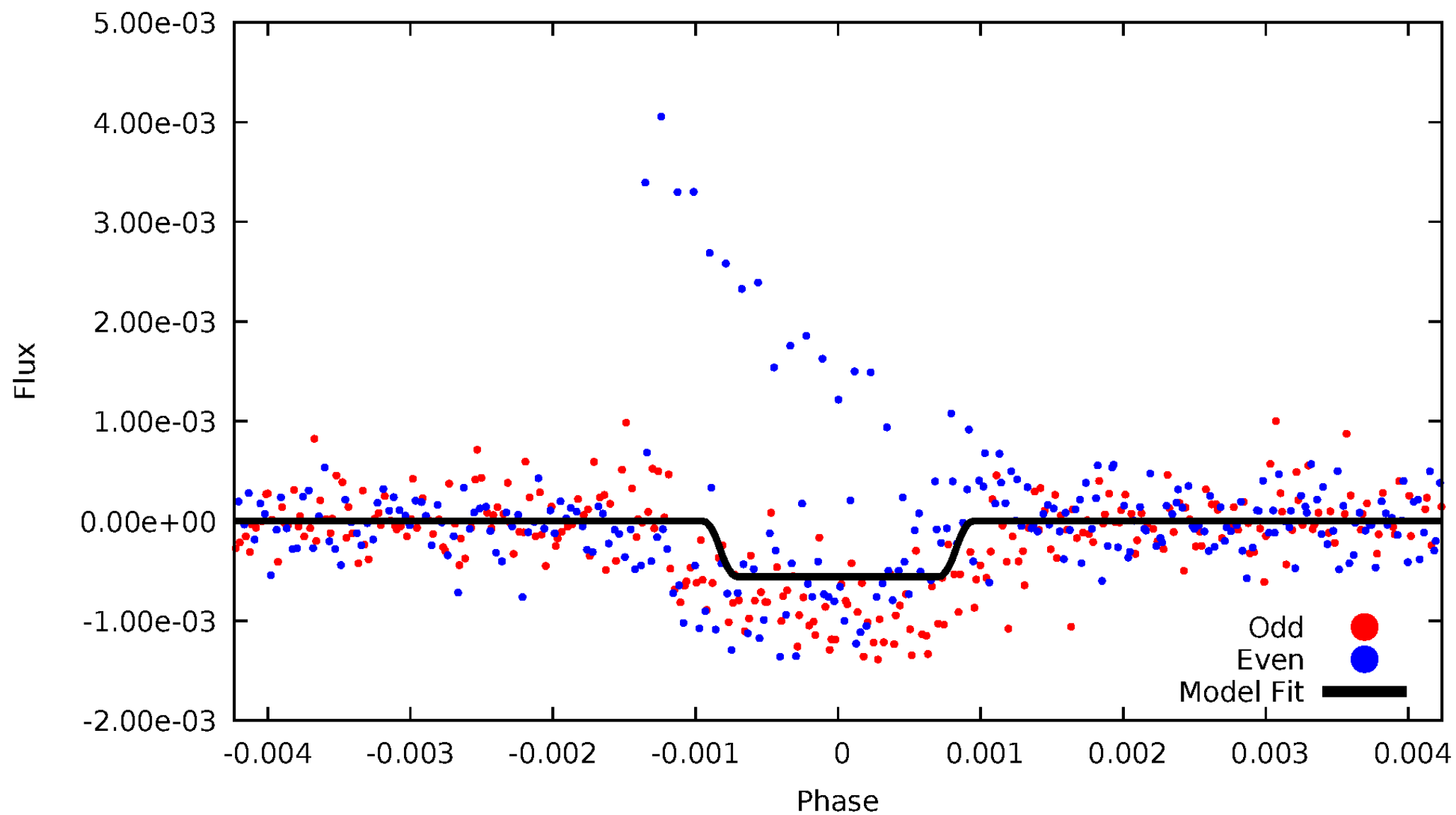
DV Odd/Even

TCE 009839821-02



# ALT Odd/Even

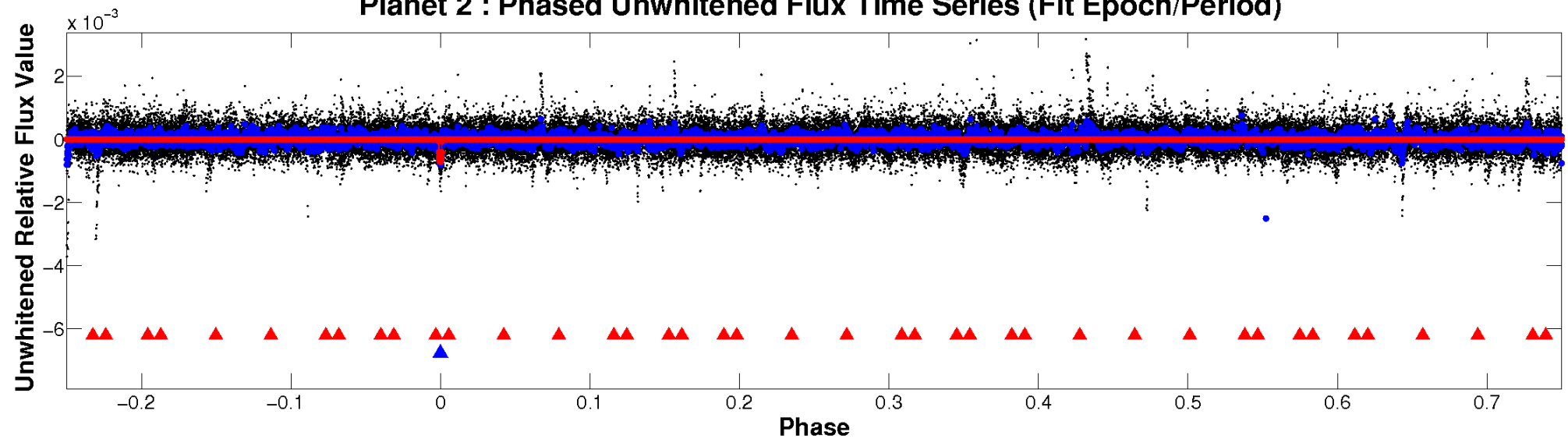
TCE 009839821-02



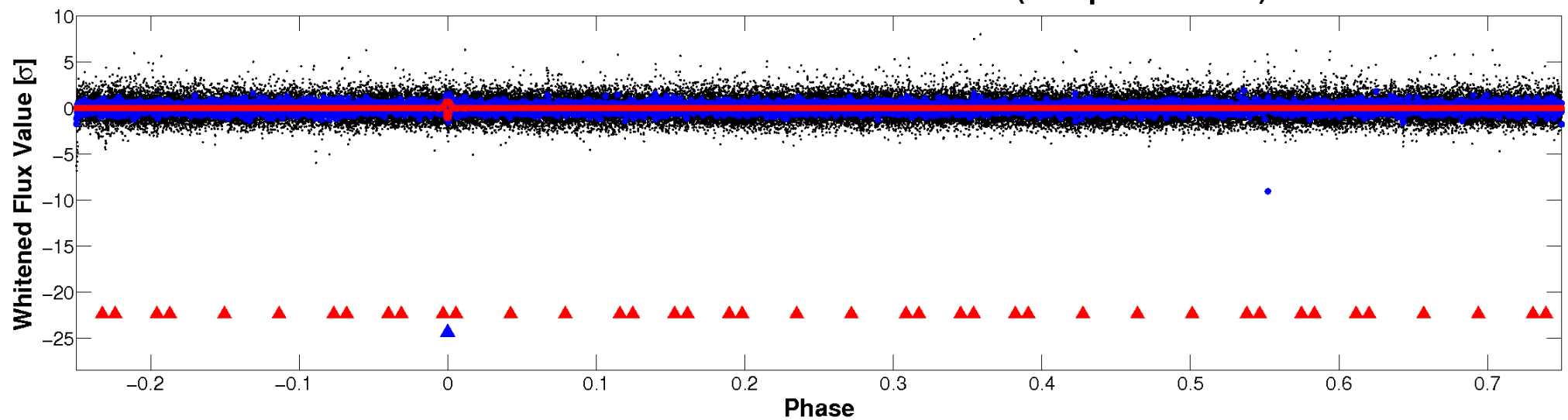


# Non-Whitened Vs. Whitened Light Curve

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

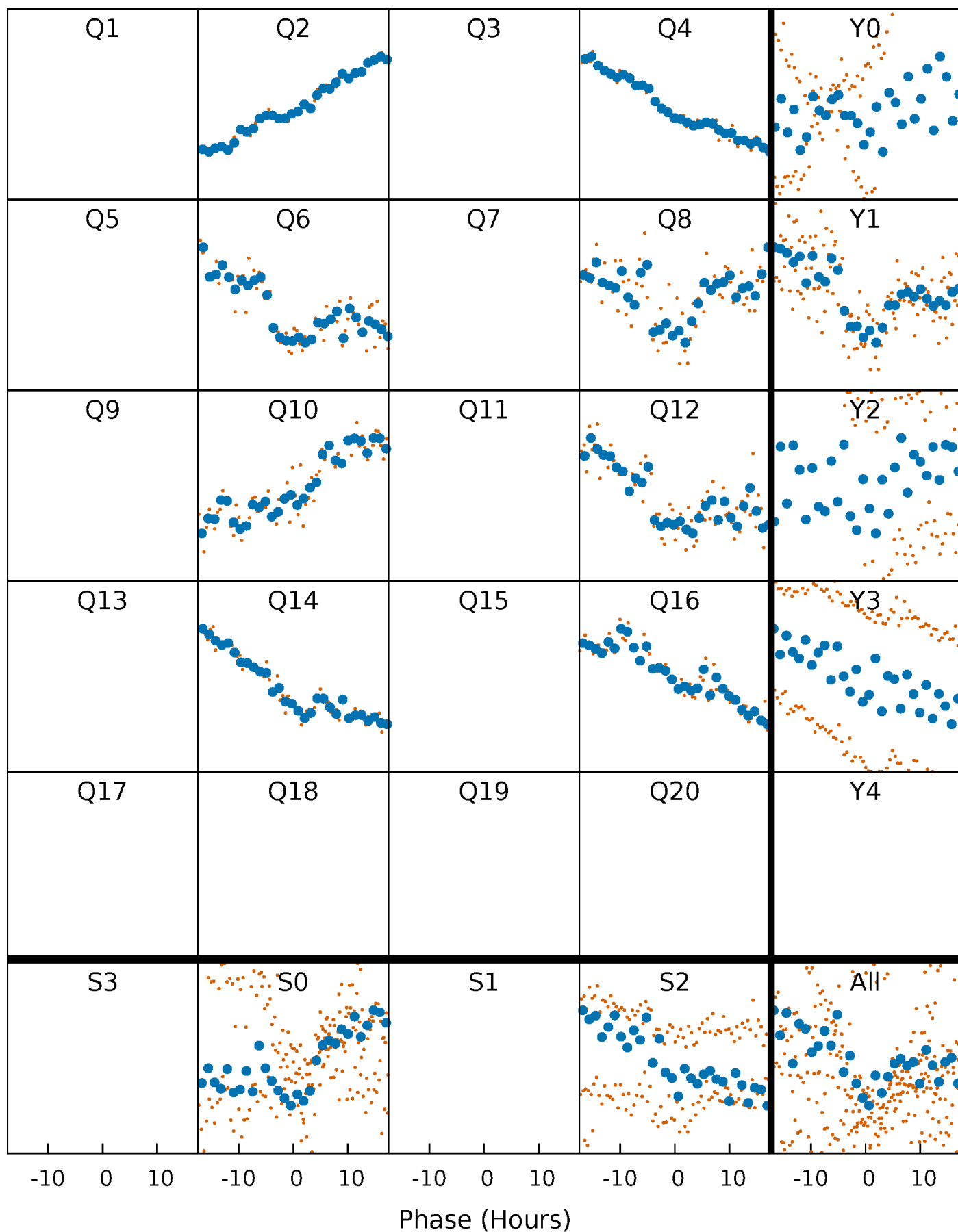


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



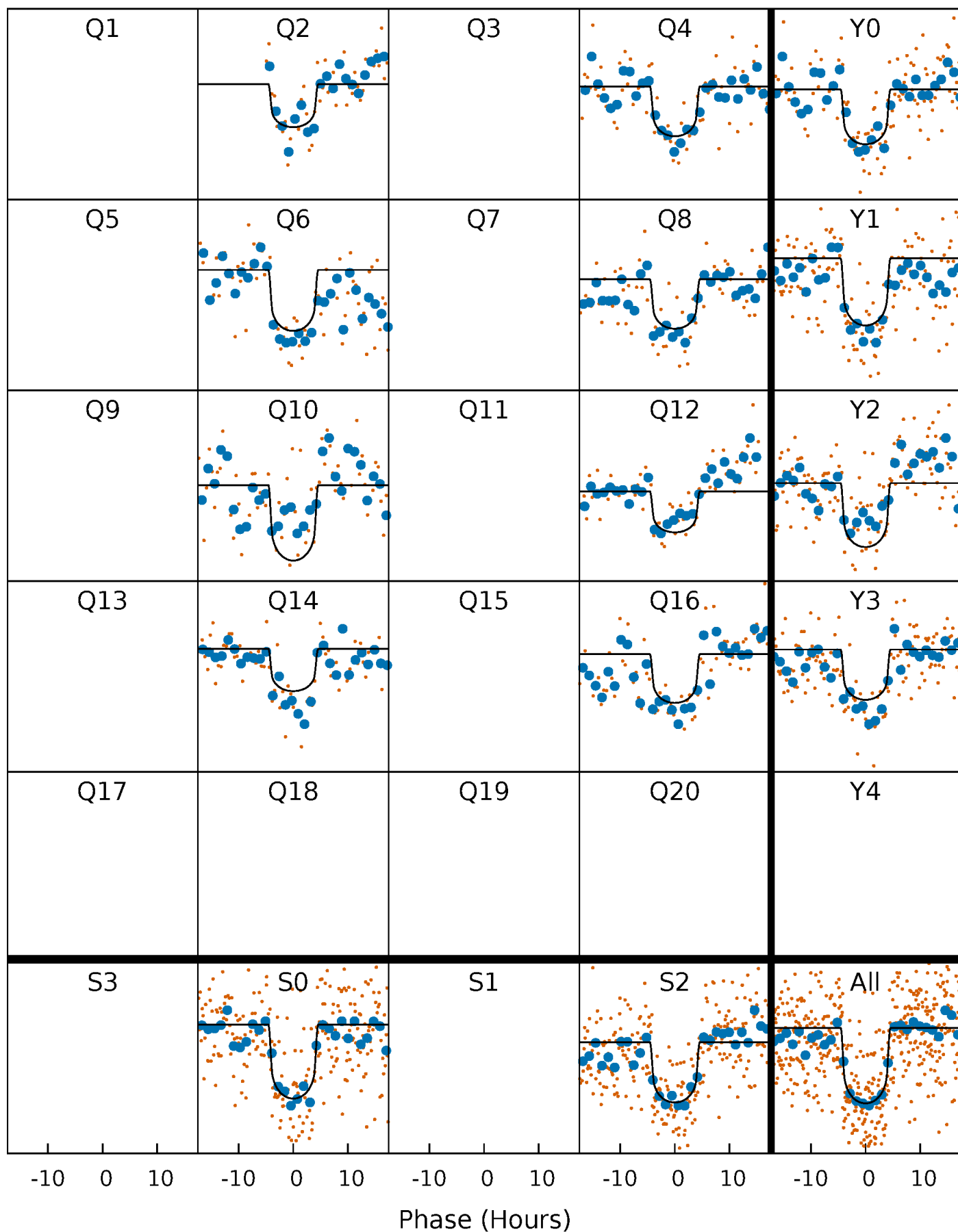
# PDC Quarter-Phased Transit Curves

TCE 009839821-02 P=180.925547 Days  $T_0=234.316077$  (BKJD)



# DV Quarter-Phased Transit Curves

TCE 009839821-02 P=180.925547 Days  $T_0=234.316077$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

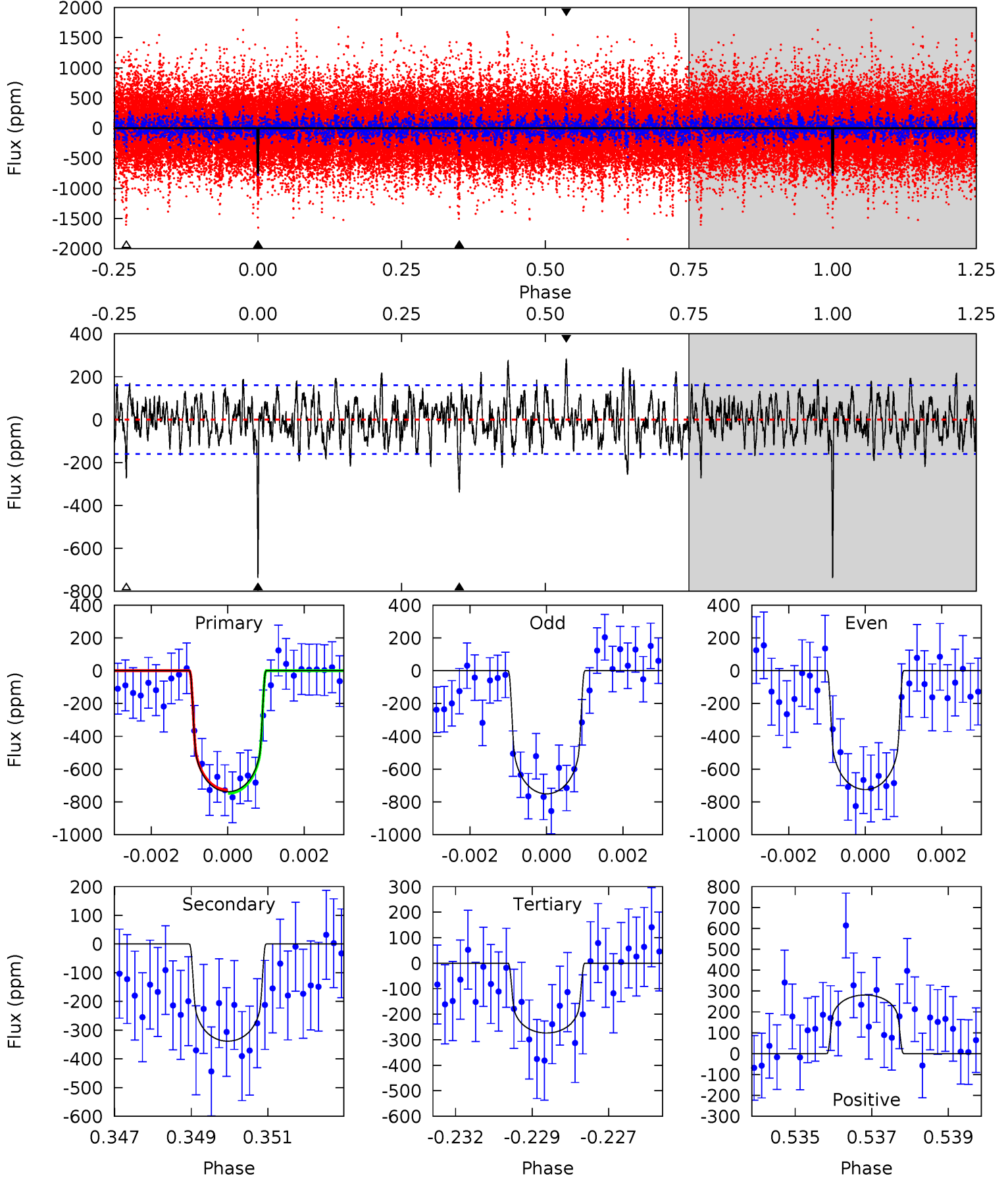
TCE 009839821-02 P=180.925551 Days  $T_0=234.355884$  (BKJD)



# DV Model-Shift Uniqueness Test

009839821-02, P = 180.925547 Days, E = 53.390530 Days

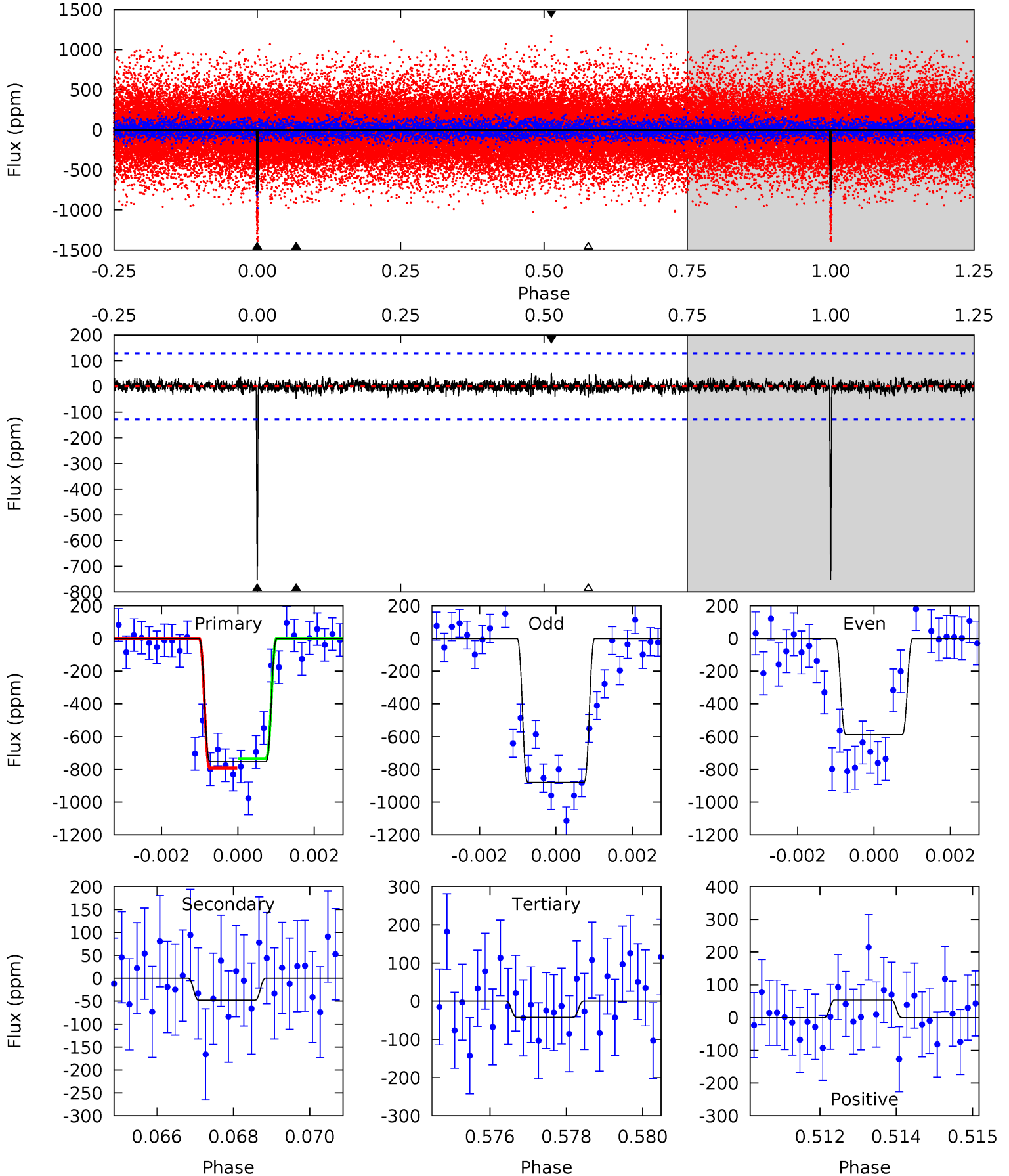
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
24.5	11.2	9.09	9.33	5.32	3.08	2.63	15.4	15.2	2.15	1.90	0.43	0.95	0.28	0.34



# Alt Model-Shift Uniqueness Test

009839821-02, P = 180.925551 Days, E = 53.430333 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
31.2	1.98	1.76	2.22	5.34	3.11	0.48	29.4	28.9	0.22	-0.24	6.03	0.67	0.07	1.20





### Stellar Parameters For KIC 009839821

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5818^{+139}_{-157}$	$4.554^{+0.042}_{-0.168}$	$-0.220^{+0.300}_{-0.300}$	$0.848^{+0.199}_{-0.071}$	$0.937^{+0.090}_{-0.121}$	$2.166^{+0.456}_{-0.993}$
	+2%/-3%	+1%/-4%	+136%/-136%	+23%/-8%	+10%/-13%	+21%/-46%
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 009839821-02 / KOI 2012.02

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-338 \pm 30$	$2.44^{+0.90}_{-0.89}$	$428^{+23}_{-16}$	$5006^{+1063}_{-562}$	$11630^{+16124}_{-5379}$
Alt.	$-48 \pm 24$	$2.24^{+0.90}_{-0.74}$	$429^{+25}_{-17}$	$3560^{+625}_{-481}$	$1812^{+2725}_{-1163}$

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

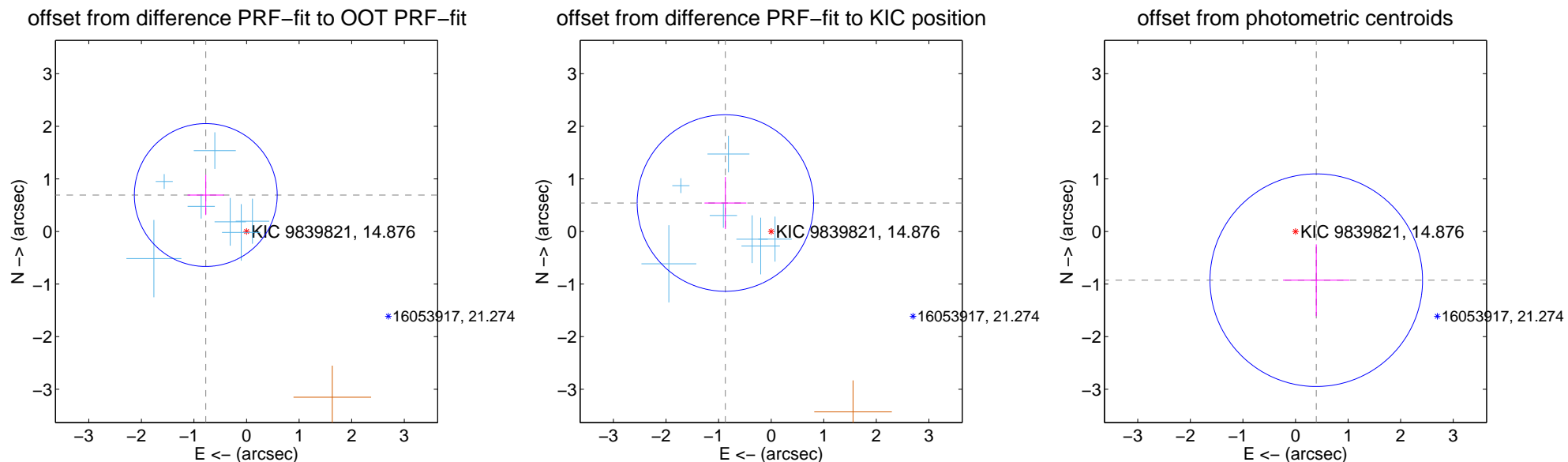
## DV Centroid Data

Supplemental centroid analysis for 009839821-02. Kepler magnitude: 14.88. Transit SNR 12.45

There are 7 quarters with good PRF difference image offsets

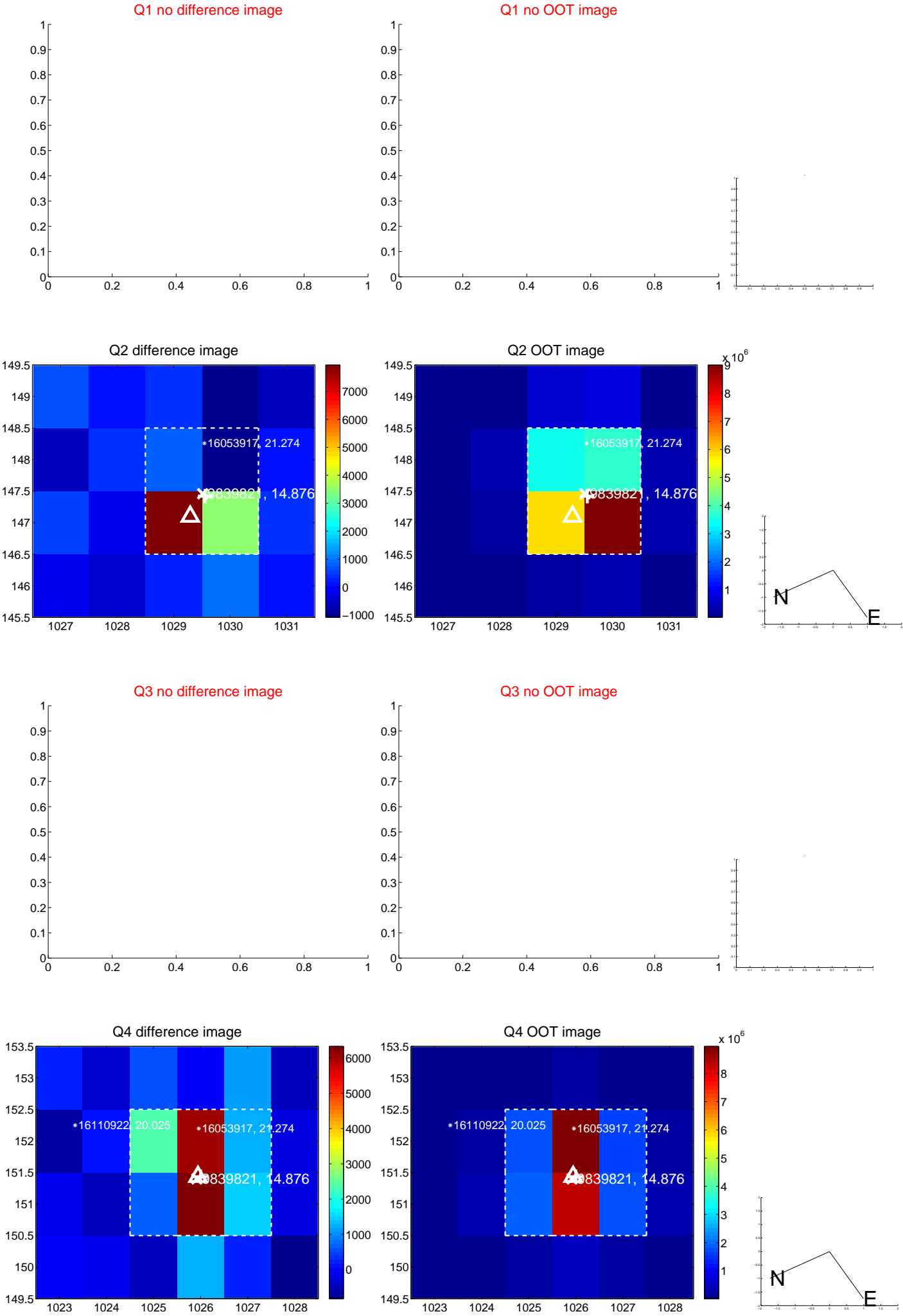
The direct PRF centroid is offset from the target star catalog position by about 0.29 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.040 \pm 0.453$	2.30	$0.775 \pm 0.347$	$0.693 \pm 0.381$
PRF-fit source offset from KIC position	$1.025 \pm 0.559$	1.83	$0.870 \pm 0.399$	$0.541 \pm 0.495$
photometric centroid source offset	$1.01 \pm 0.67$	1.49	$-0.39 \pm 0.63$	$-0.93 \pm 0.68$

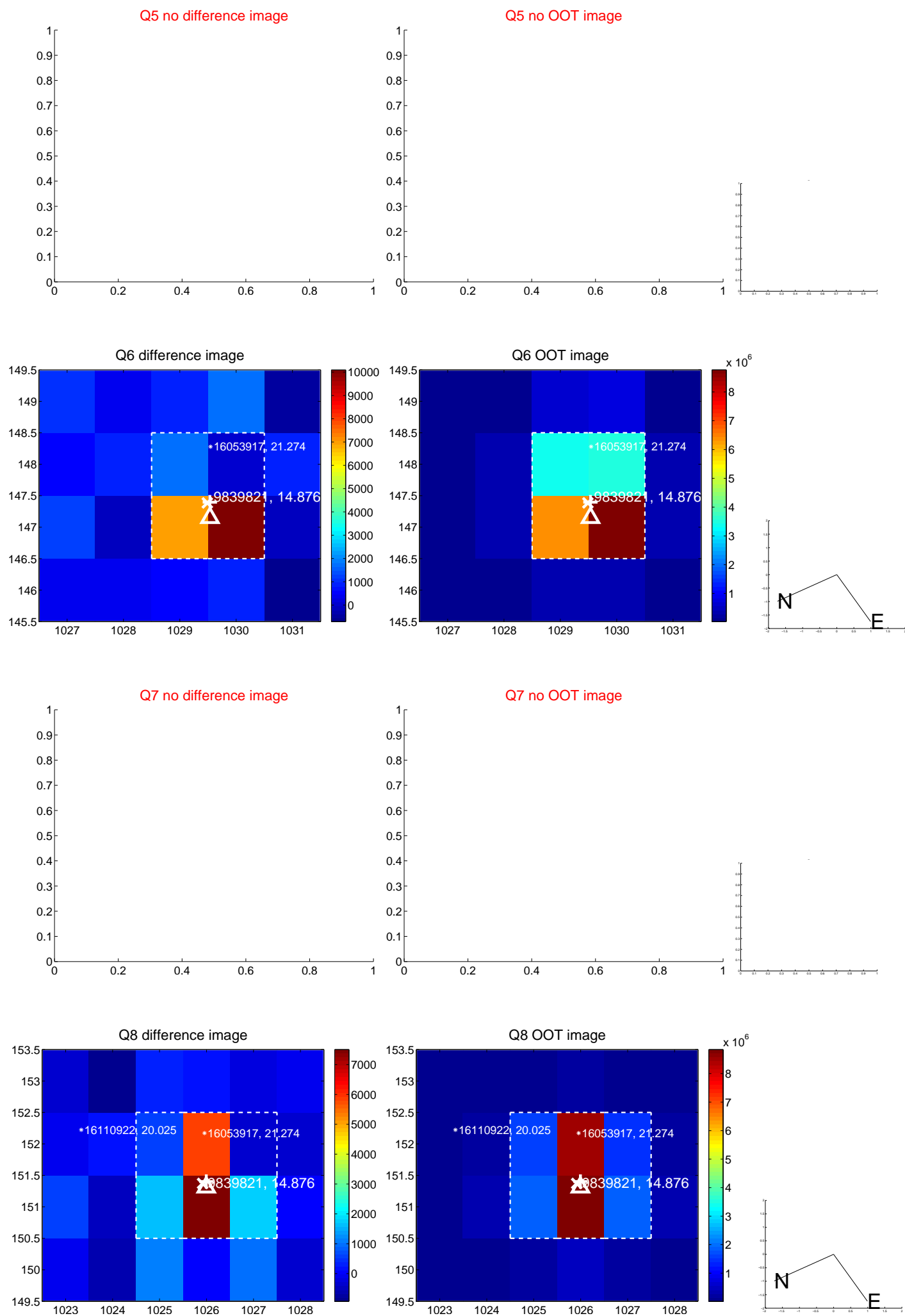


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

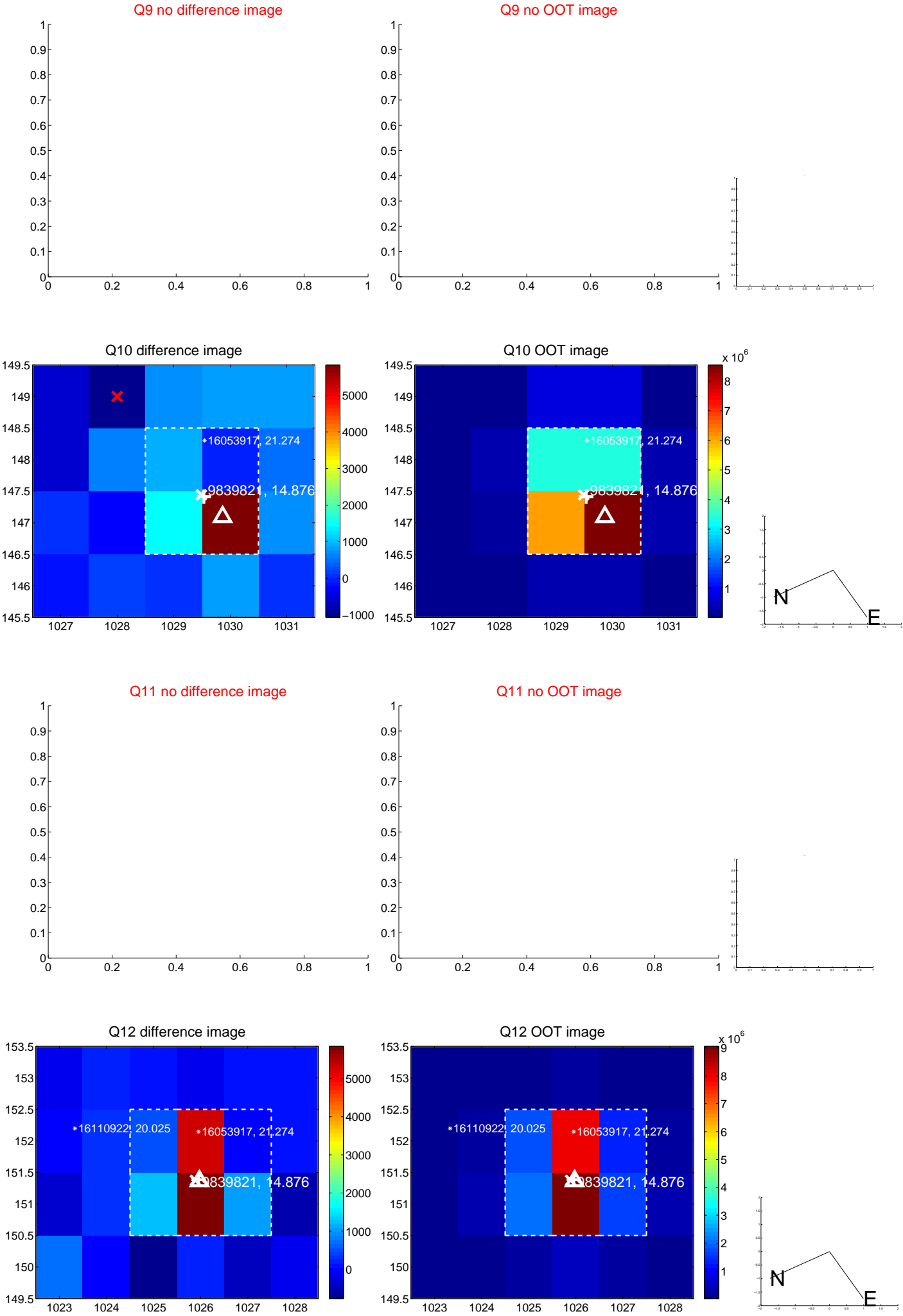
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



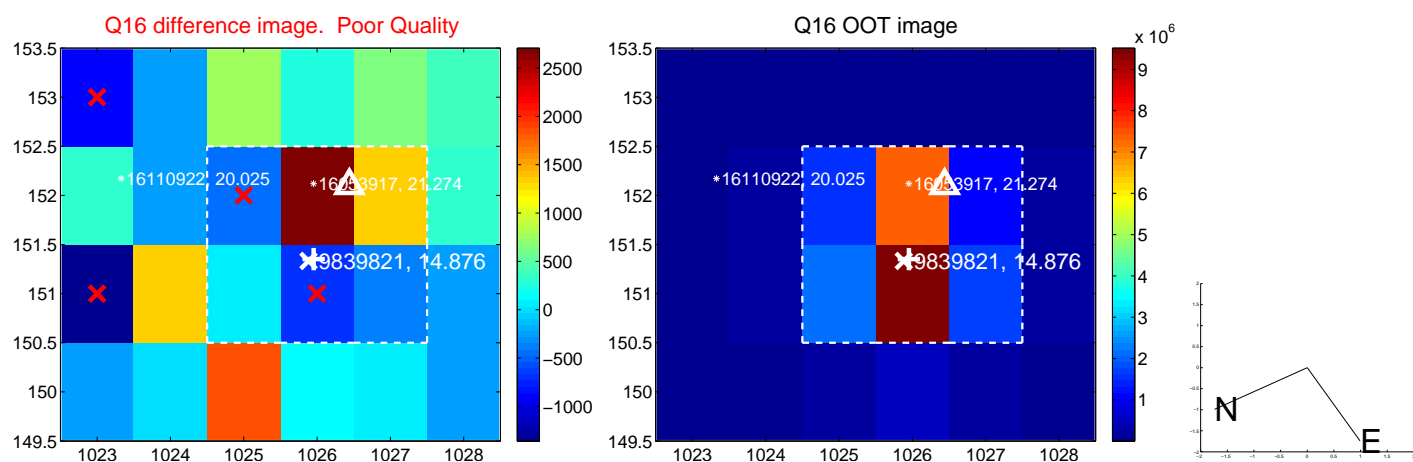
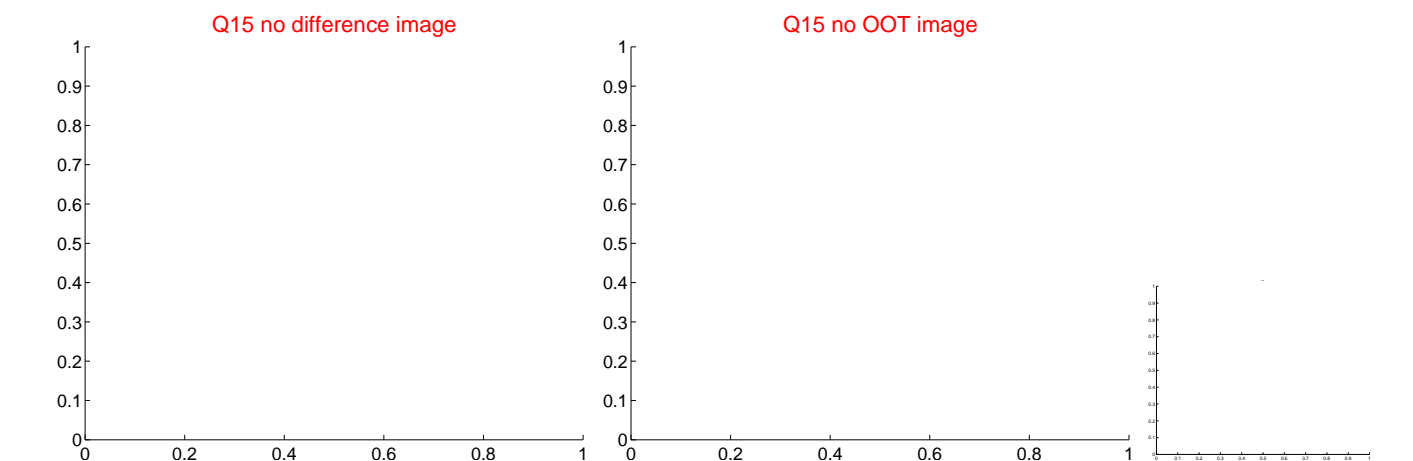
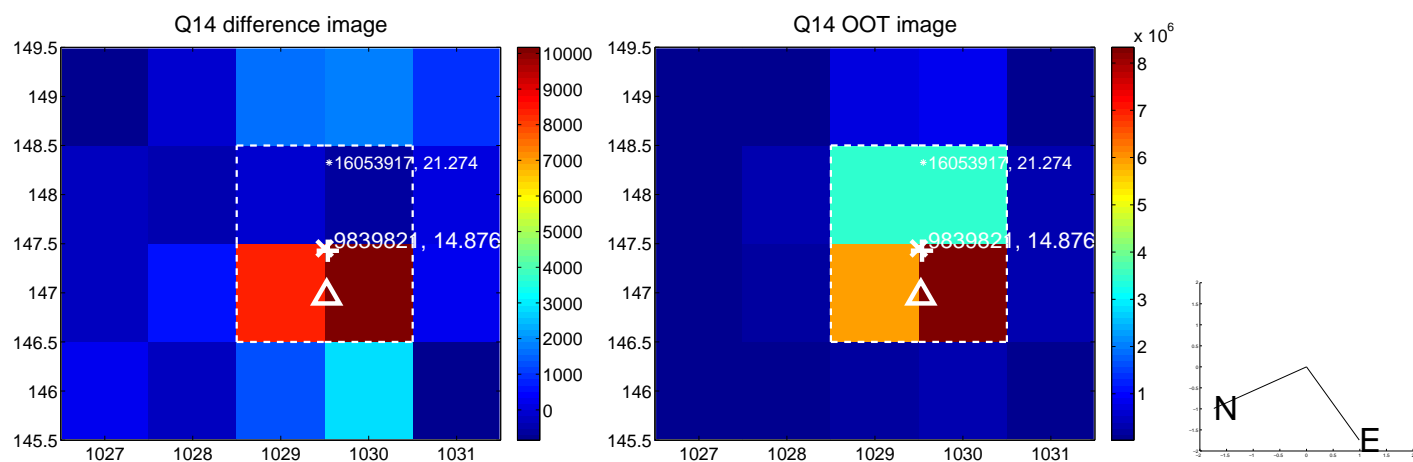
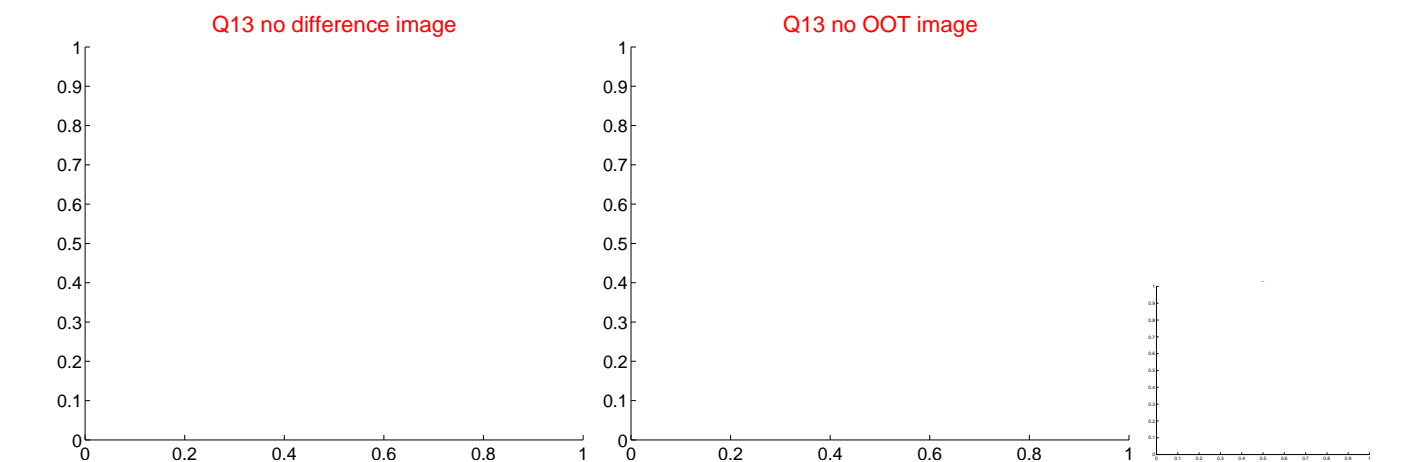
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value



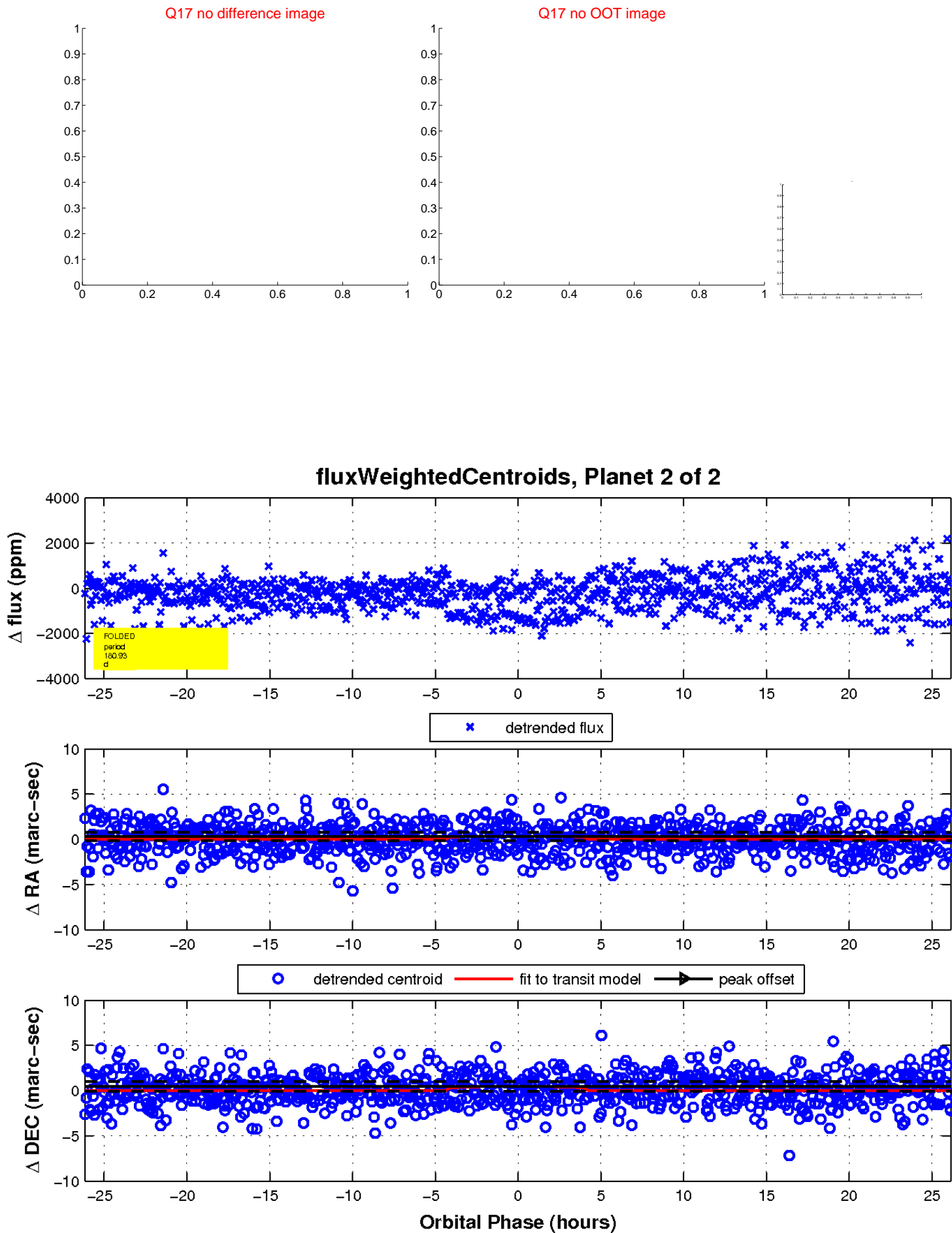
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

