

# KIC 008978528

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
008978528-01	OBS	1874.01	18.684850	136.145662	1244.3	3.989	35.2	37.9	0.55	4156	2.17	6.16
008978528-02	OBS	1874.02	7.416313	135.856912	516.7	2.226	18.0	20.6	0.55	4156	1.42	21.13

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
008978528-01	OBS	PC	1.00	0	0	0	0	CENT_KIC_POS
008978528-02	OBS	PC	1.00	0	0	0	0	CENT_KIC_POS

**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.

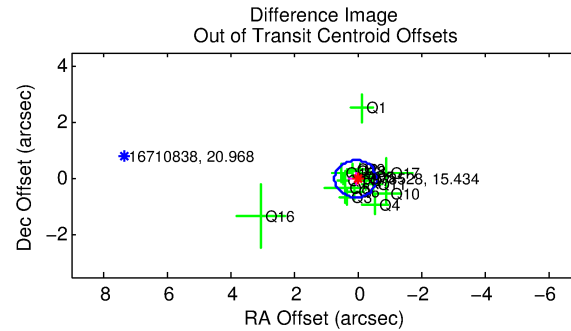
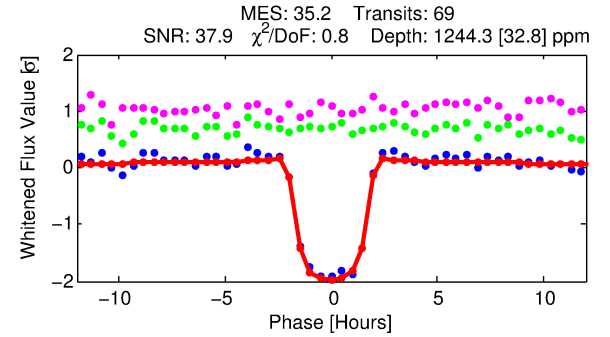
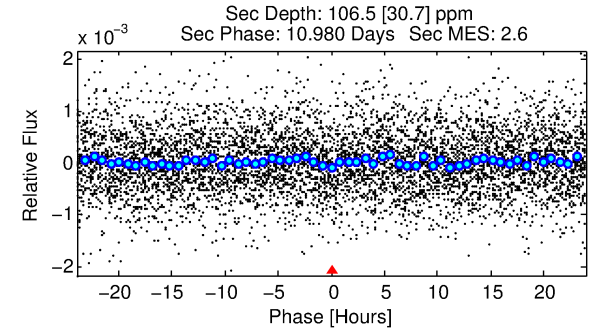
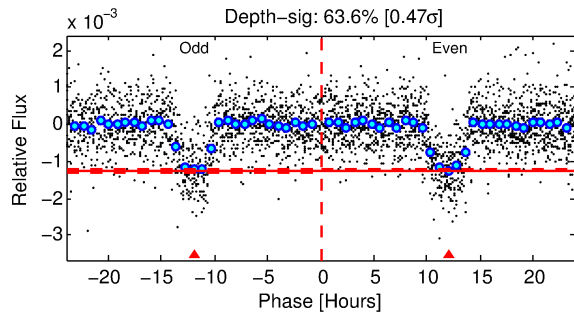
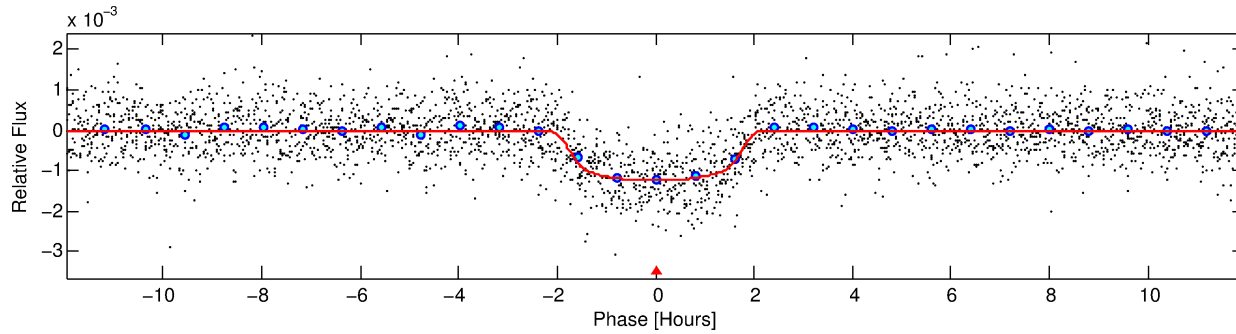
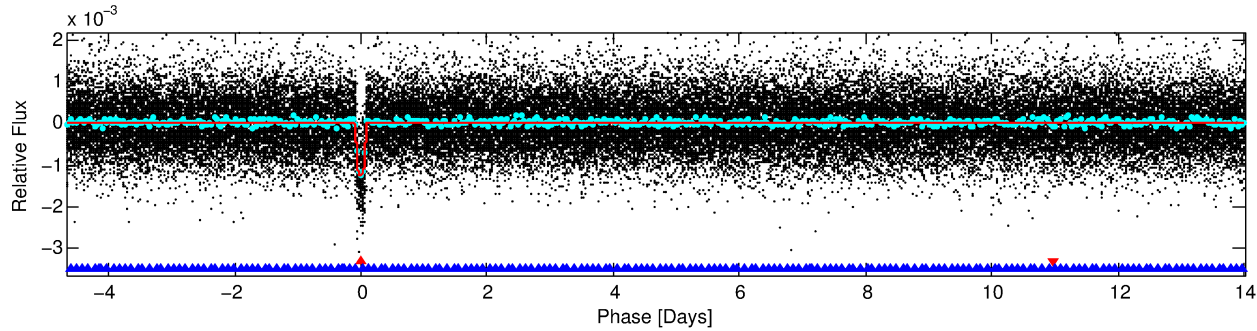
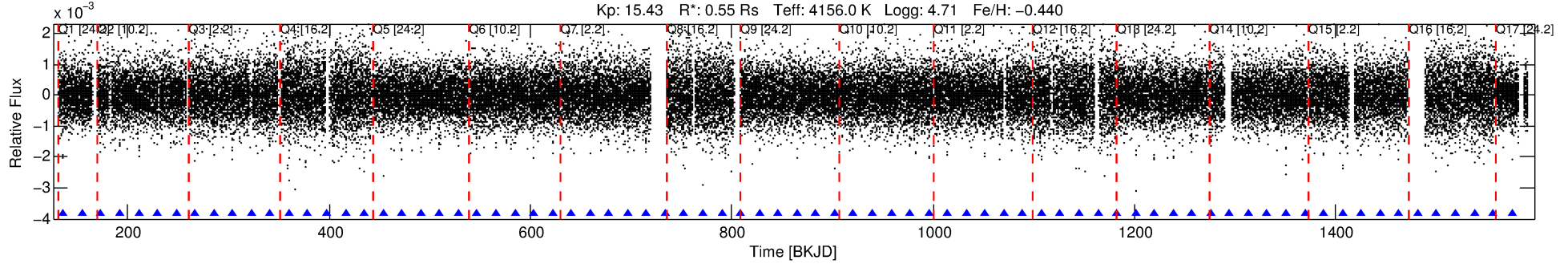
## Ephemeris Match Information For 008978528-01

No Significant Match Found

# DV One-Page Summary

KIC: 8978528 Candidate: 1 of 2 Period: 18.685 d  
KOI: K01874.01 Name: Kepler-329c Corr: 0.991

Kp: 15.43 R\*: 0.55 Rs Teff: 4156.0 K Logg: 4.71 Fe/H: -0.440



## DV Fit Results:

Period = 18.68485 [0.00005] d  
Epoch = 136.1457 [0.0021] BKJD  
Rp/R\* = 0.0365 [0.0030]  
a/R\* = 22.55 [7.61]  
b = 0.82 [0.13]  
Seff = 6.16 [0.65]  
Teq = 402 [11] K  
Rp = 2.17 [0.21] Re  
a = 0.1135 [0.0049] AU  
Ag = 160.36 [54.00] [2.95σ]  
Teffp = 2211 [190] K [9.53σ]

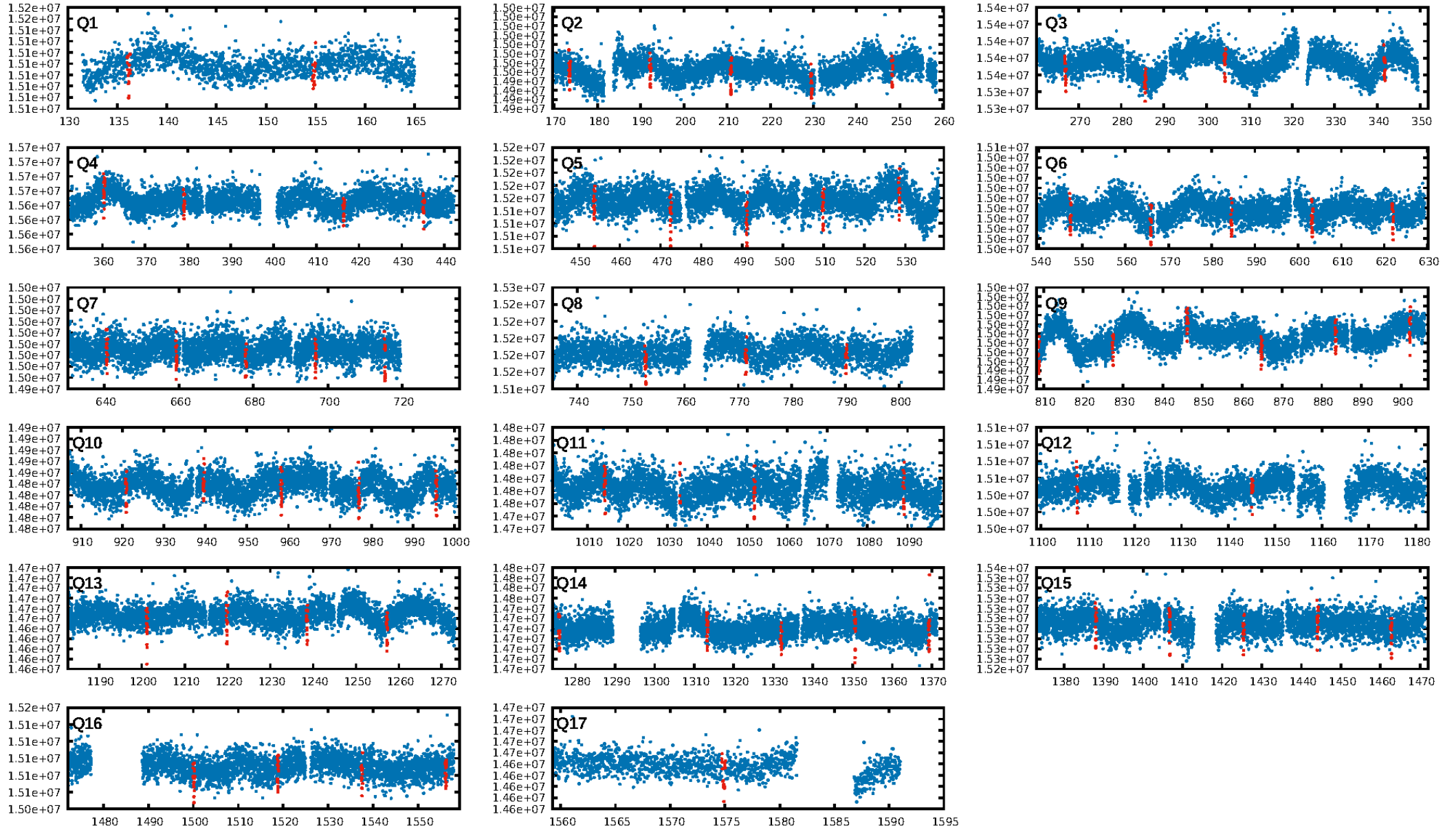
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [59.20σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 61.9%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 7.22e-262  
RollingBand-fgt: 1.00 [66/66]  
GhostDiagnostic-chr: 3.933  
Centroid-sig: 0.2%  
Centroid-so: 1.311 arcsec [3.97σ]  
OotOffset-rm: 0.056 arcsec [0.25σ]  
KicOffset-rm: 0.493 arcsec [2.05σ]  
OotOffset-st: 4/4/3/5 [16]  
KicOffset-st: 4/4/3/5 [16]  
DiffImageQuality-fgm: 0.94 [15/16]  
DiffImageOverlap-fno: 0.94 [16/17]

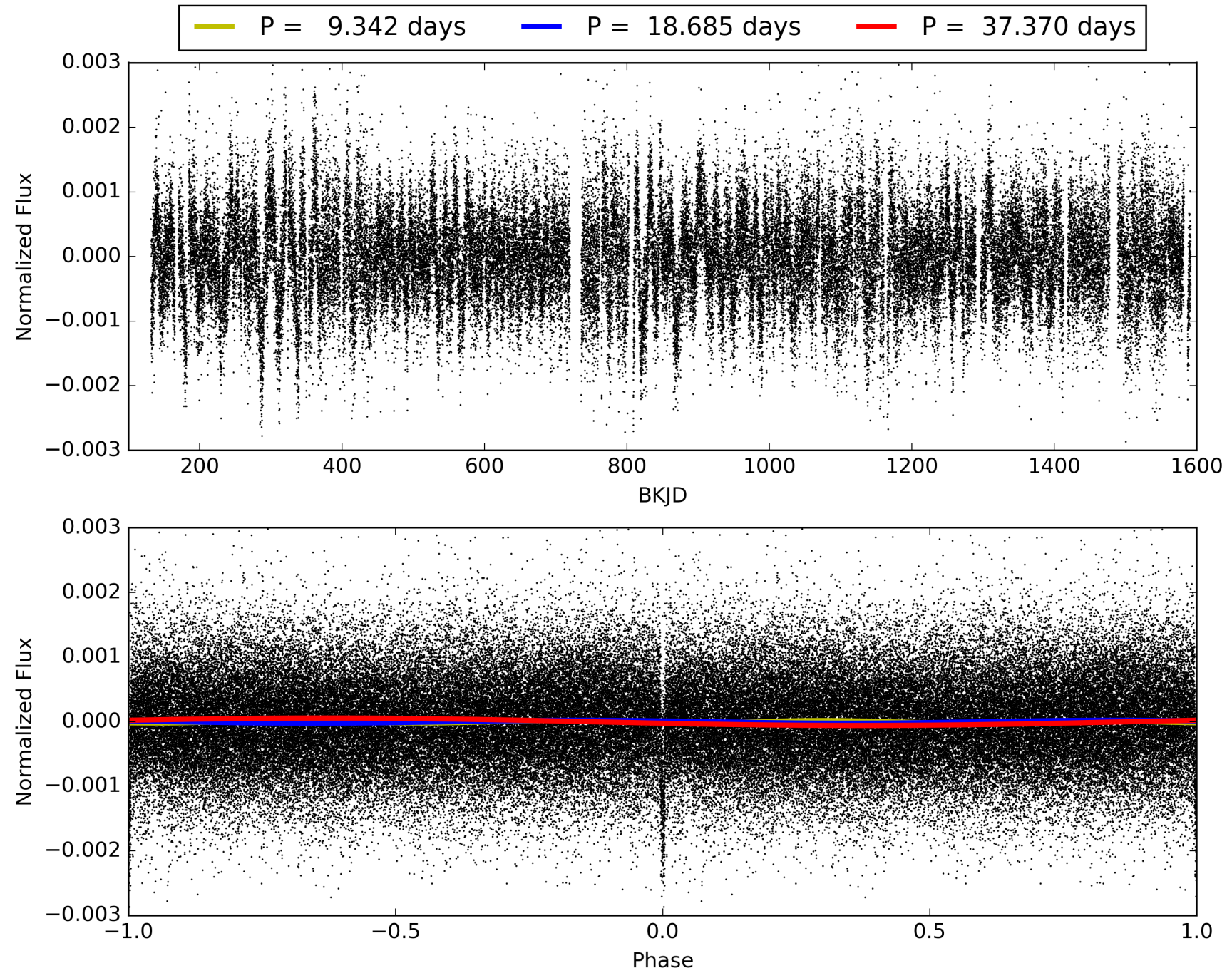
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 18:35:05 Z

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

# TCE 008978528-01, PDC Light Curves



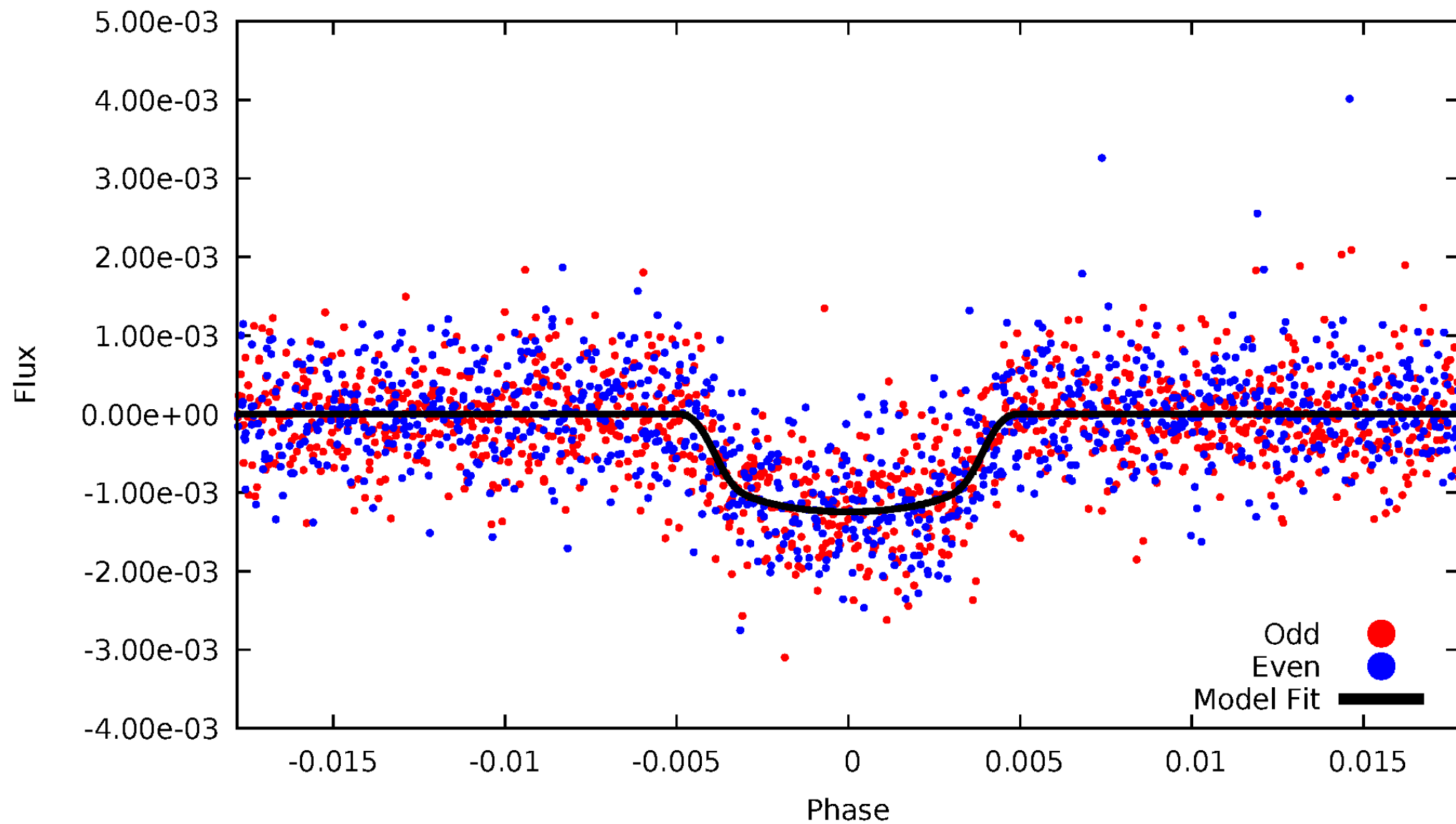
TCE 008978528-01





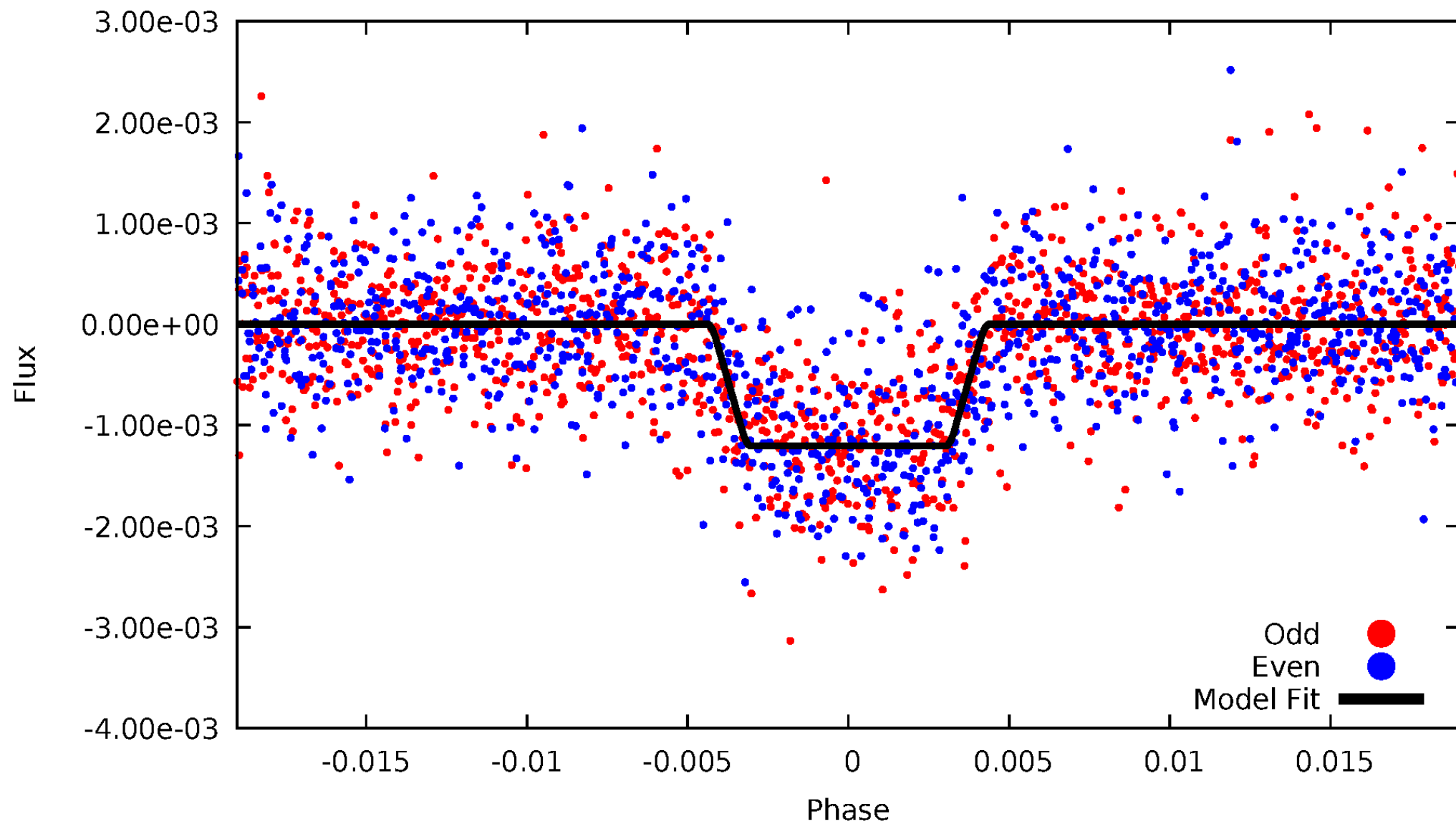
# DV Odd/Even

TCE 008978528-01



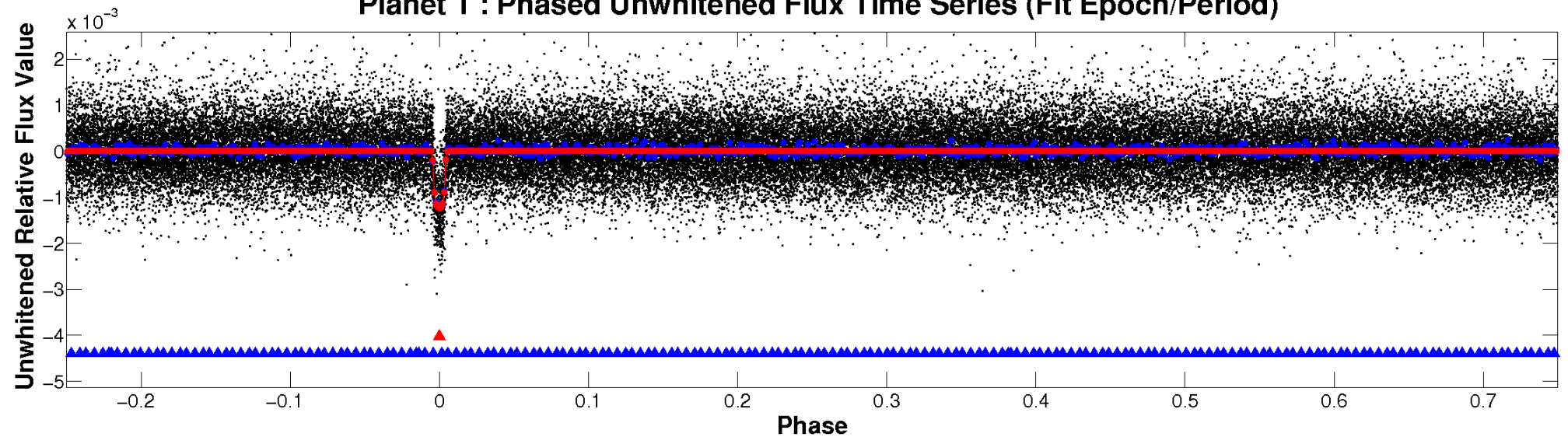
# ALT Odd/Even

TCE 008978528-01

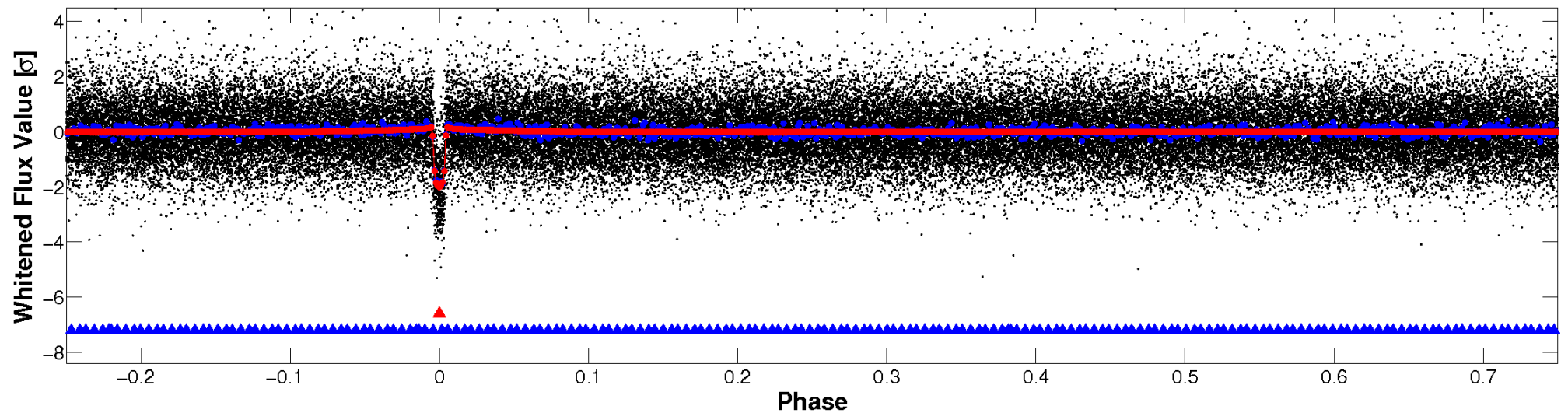


# Non-Whitened Vs. Whitened Light Curve

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

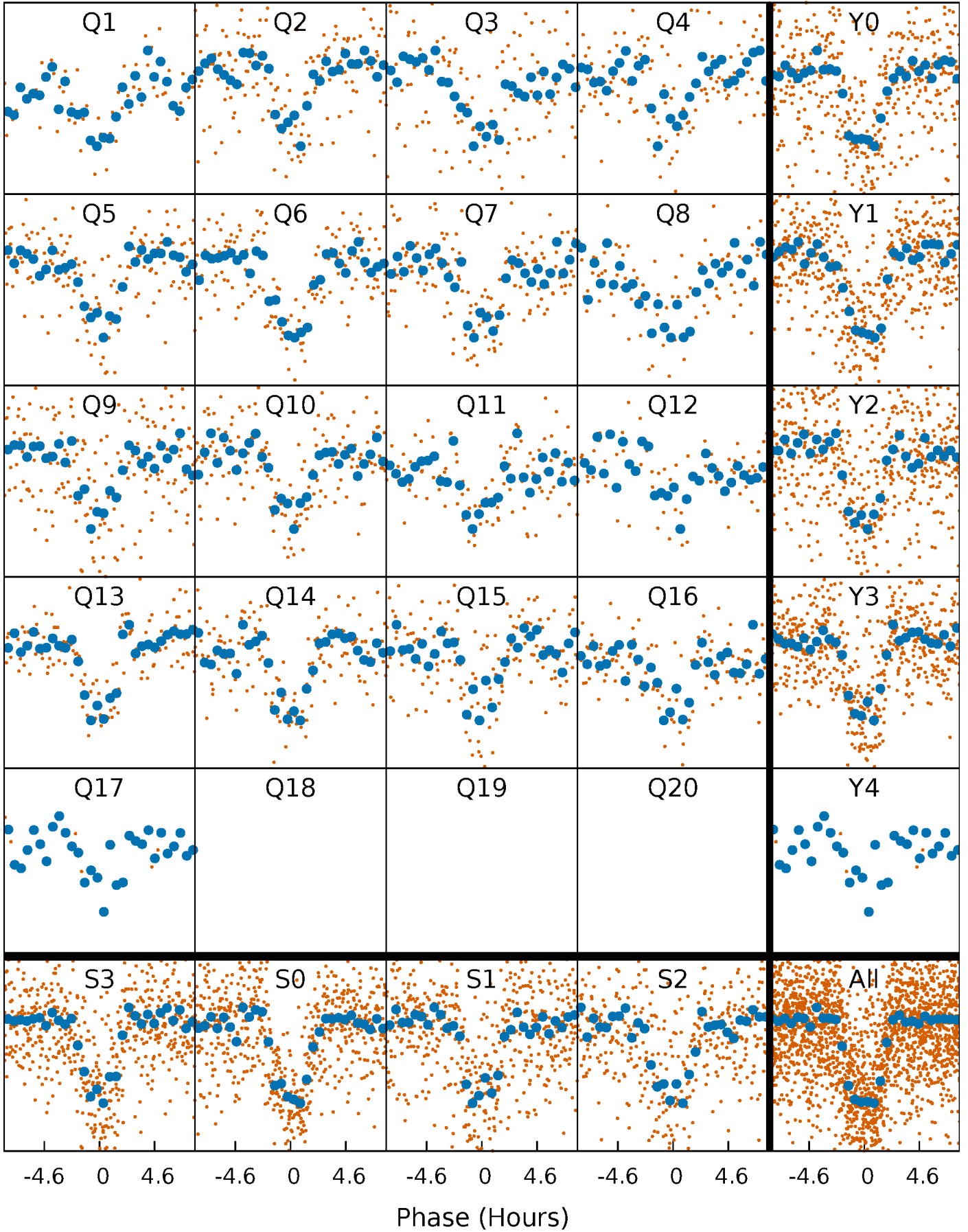


**Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



# PDC Quarter-Phased Transit Curves

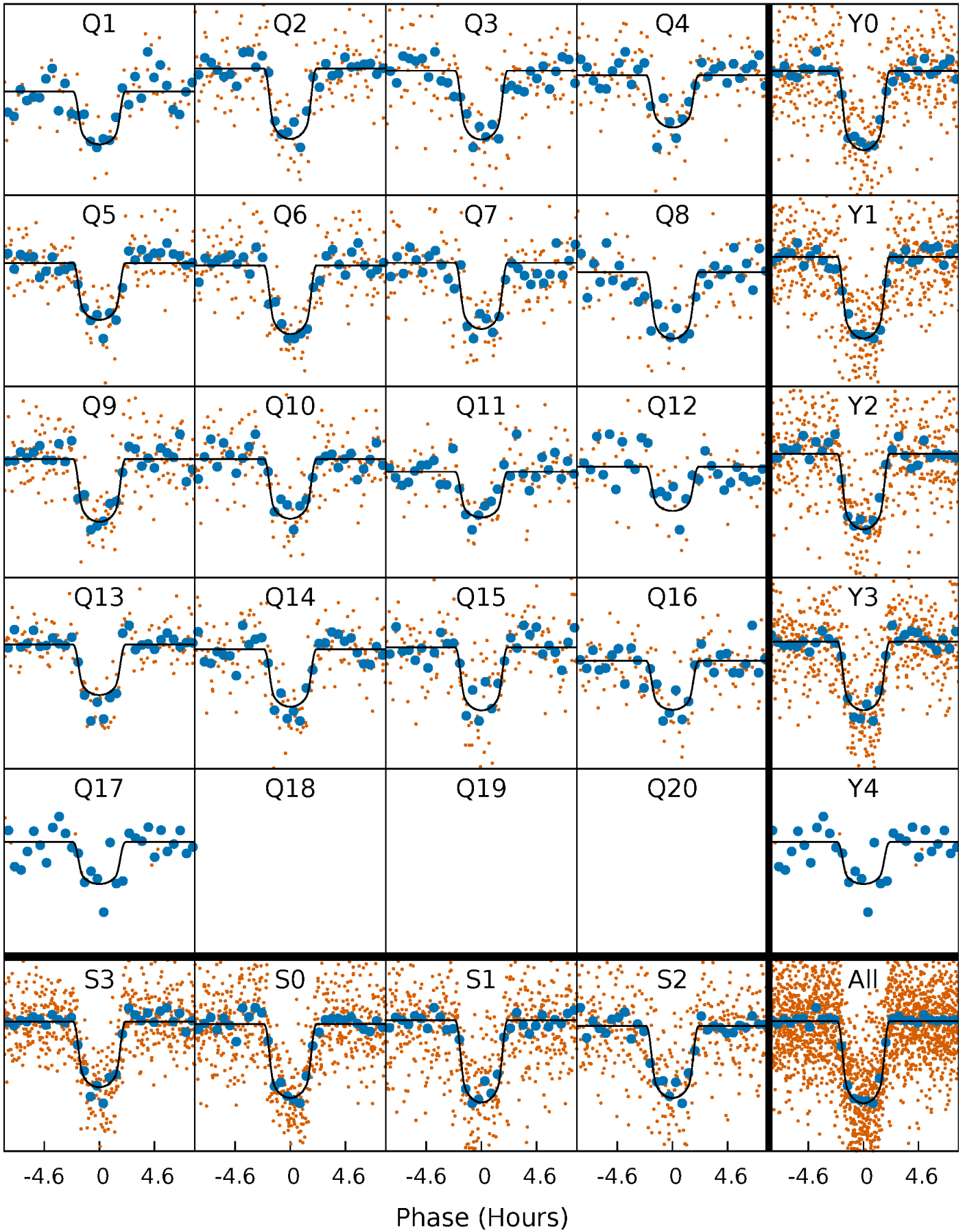
TCE 008978528-01 P= 18.684850 Days  $T_0=136.145662$  (BKJD)





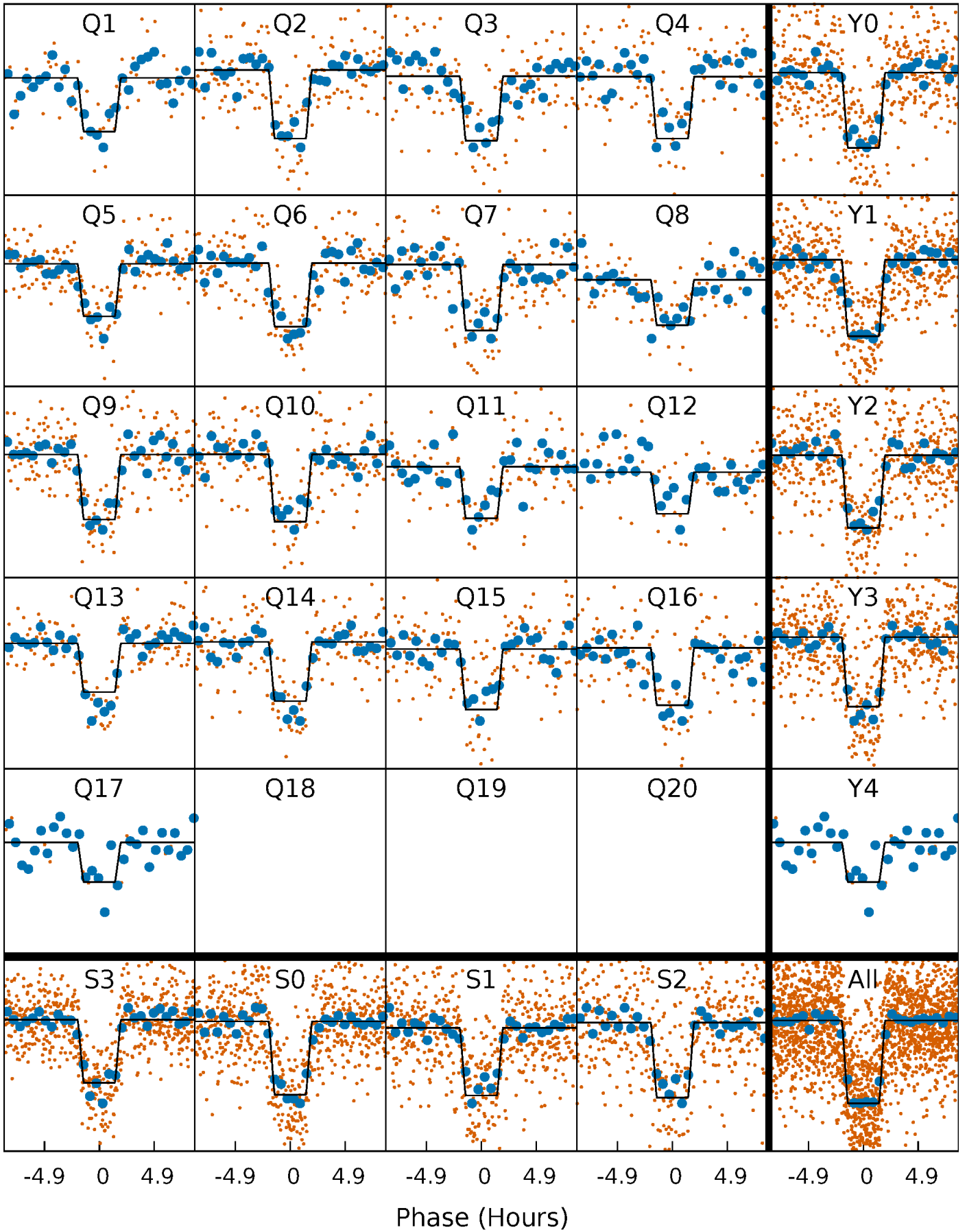
# DV Quarter-Phased Transit Curves

TCE 008978528-01 P= 18.684850 Days  $T_0=136.145662$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

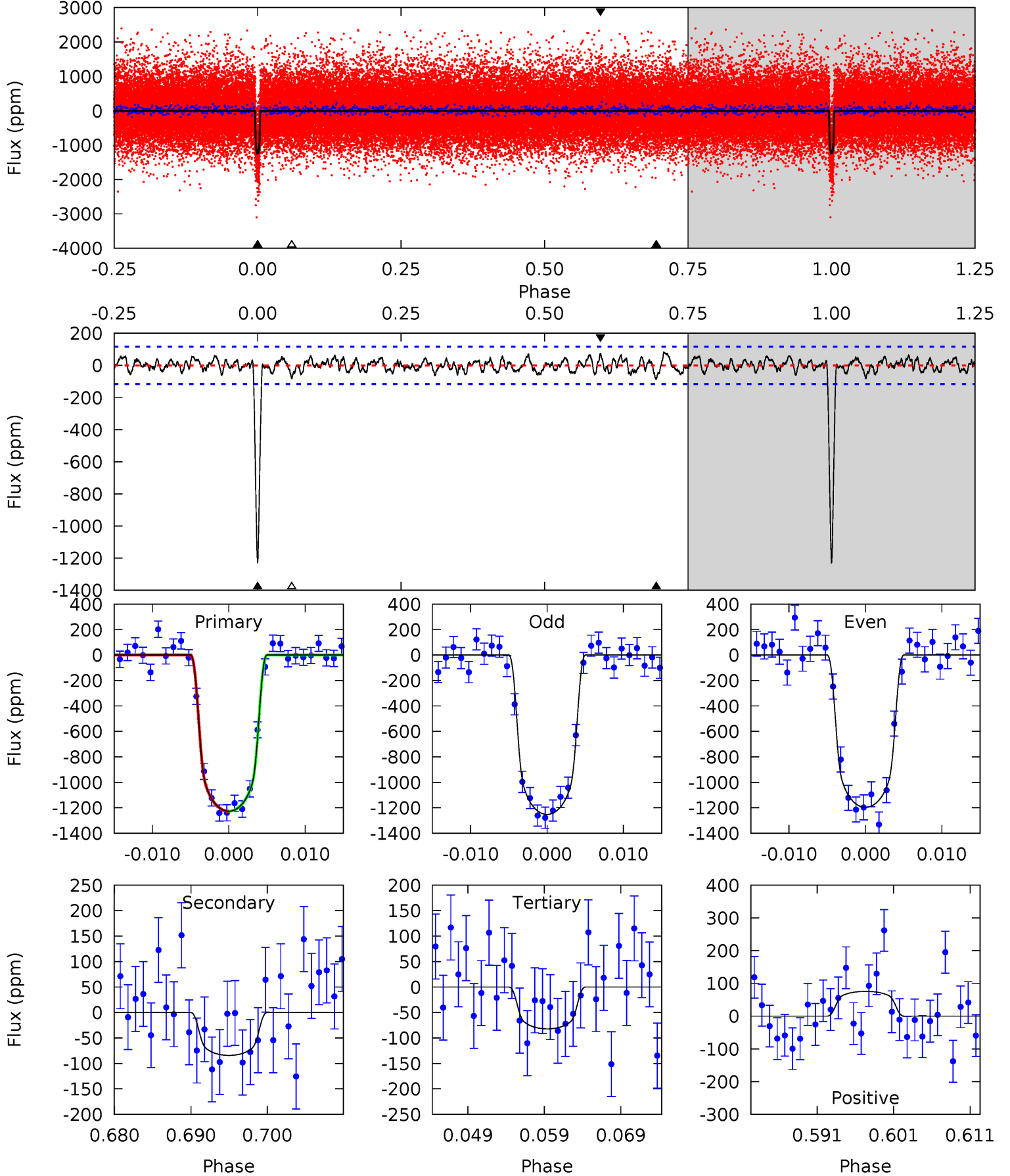
TCE 008978528-01 P= 18.684803 Days  $T_0=136.147489$  (BKJD)



# DV Model-Shift Uniqueness Test

008978528-01,  $P = 18.684850$  Days,  $E = 117.460812$  Days

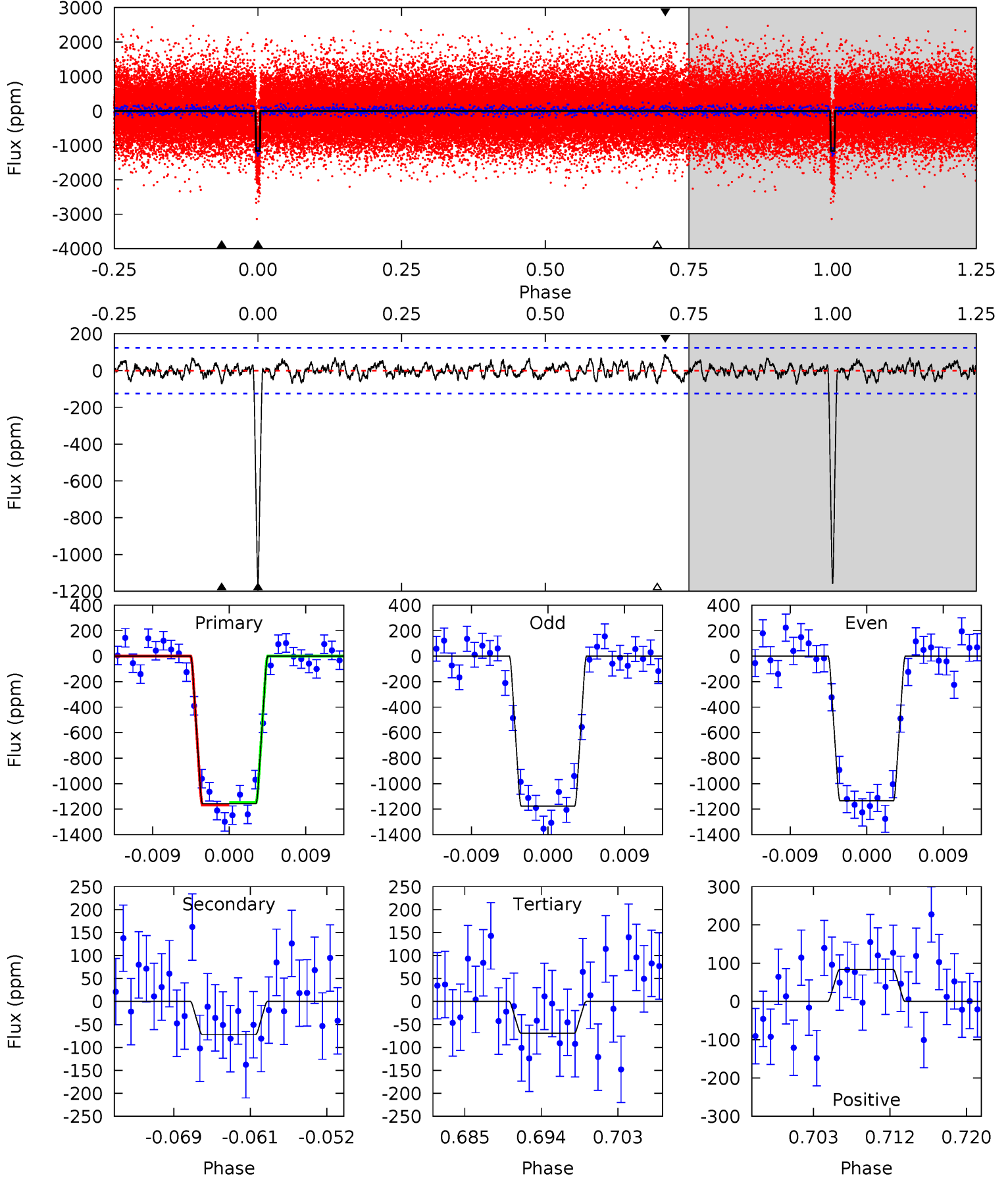
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
52.8	3.63	3.54	3.25	5.03	2.58	1.29	49.3	49.6	0.09	0.37	1.19	0.96	0.06	0.02



# Alt Model-Shift Uniqueness Test

008978528-01,  $P = 18.684803$  Days,  $E = 117.462686$  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
46.9	2.92	2.80	3.39	5.05	2.62	1.14	44.1	43.5	0.12	-0.47	0.85	0.99	0.07	0.37



### Stellar Parameters For KIC 008978528

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$4156^{+83}_{-91}$	$4.712^{+0.027}_{-0.030}$	$-0.440^{+0.150}_{-0.150}$	$0.545^{+0.030}_{-0.030}$	$0.559^{+0.027}_{-0.034}$	$4.858^{+0.590}_{-0.526}$
	+2%/-2%	+1%/-1%	+34%/-34%	+6%/-6%	+5%/-6%	+12%/-11%
Source	SPE60	SPE60	SPE60	DSEP		

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

### Secondary Eclipse Parameters for KIC 008978528-01 / KOI 1874.01

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	$-84 \pm 23$	$2.18^{+0.19}_{-0.19}$	$563^{+12}_{-15}$	$2719^{+121}_{-123}$	$126^{+43}_{-40}$
Alt.	$-72 \pm 25$	$2.07^{+0.20}_{-0.19}$	$562^{+13}_{-14}$	$2681^{+151}_{-141}$	$116^{+49}_{-42}$

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



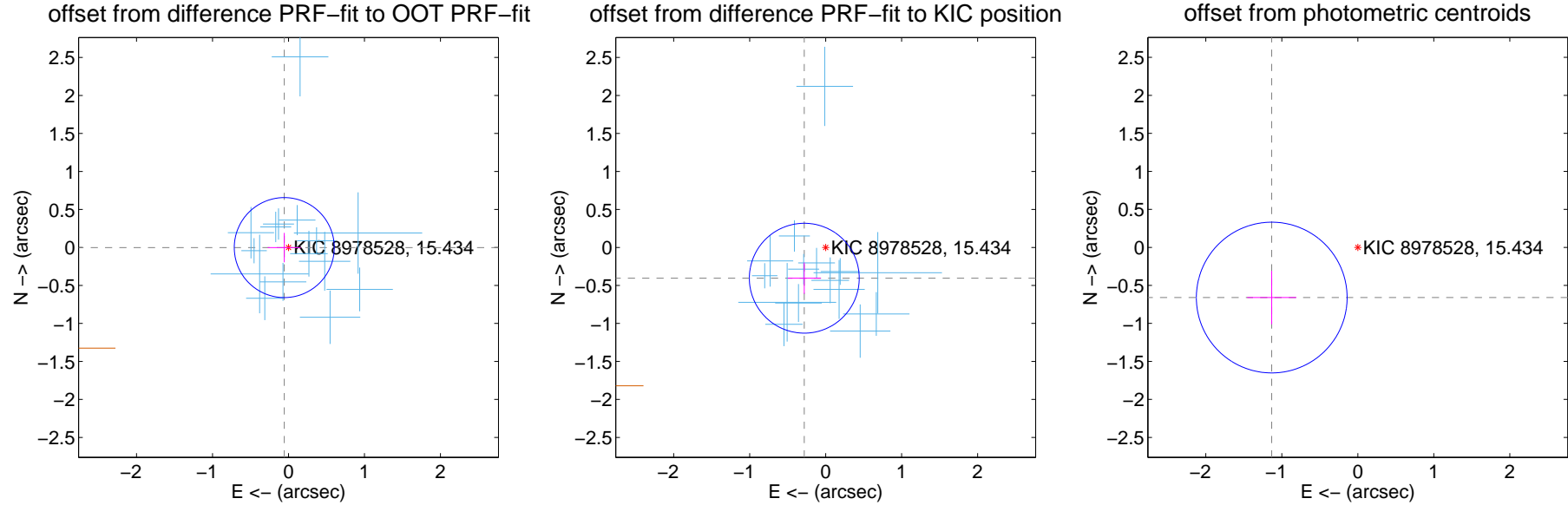
## DV Centroid Data

Supplemental centroid analysis for 008978528-01. Kepler magnitude: 15.43. Transit SNR 37.89

There are 15 quarters with good PRF difference image offsets

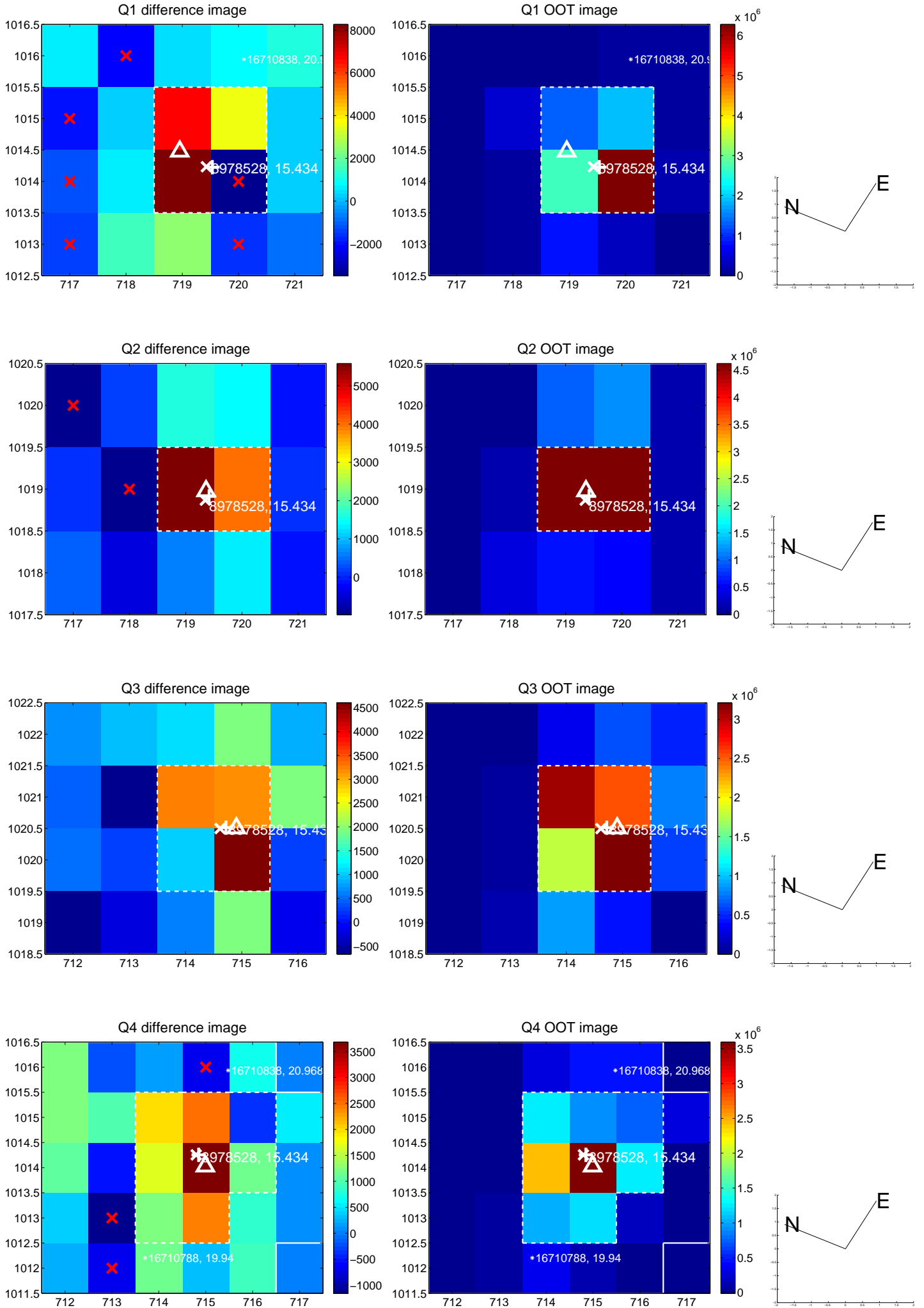
The direct PRF centroid is offset from the target star catalog position by about 0.57 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.056 \pm 0.219$	0.25	$0.056 \pm 0.218$	$-0.002 \pm 0.194$
PRF-fit source offset from KIC position	$0.493 \pm 0.241$	2.05	$0.281 \pm 0.216$	$-0.405 \pm 0.205$
photometric centroid source offset	$1.31 \pm 0.33$	3.97	$1.13 \pm 0.32$	$-0.66 \pm 0.35$

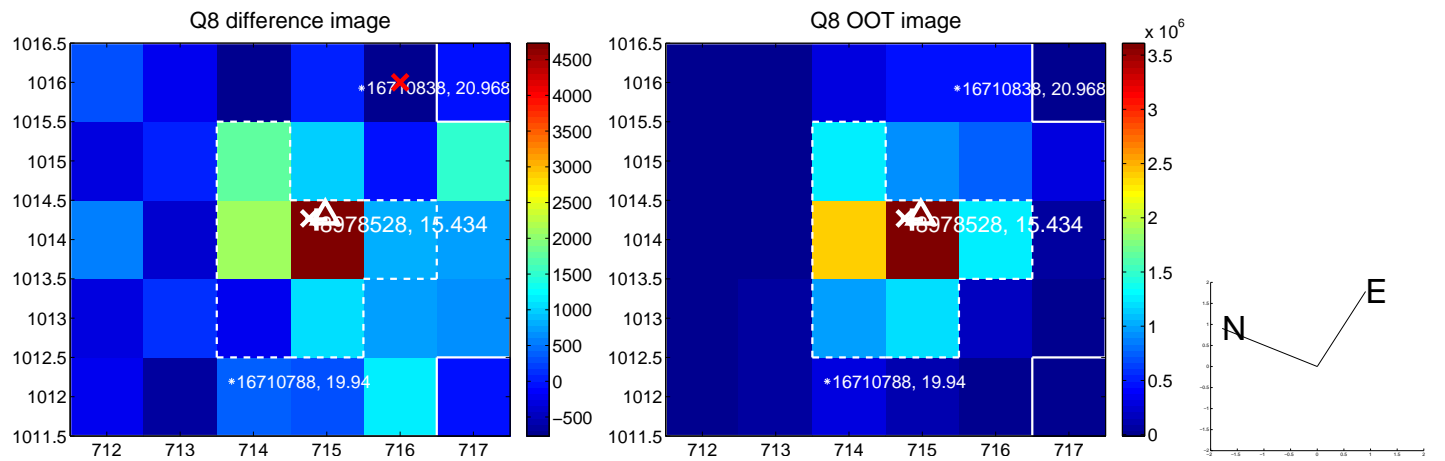
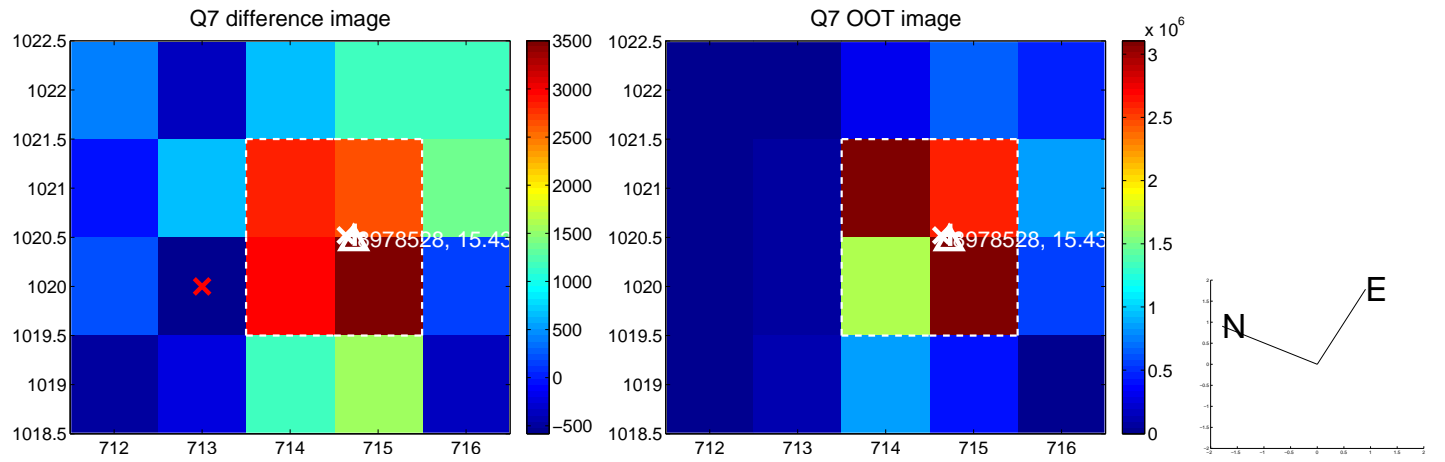
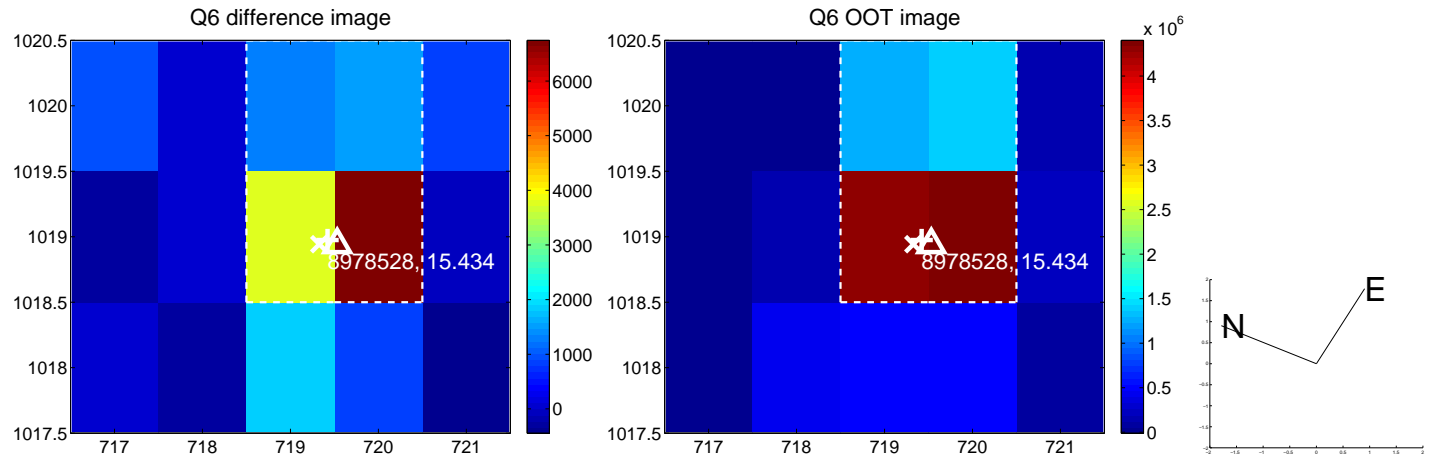
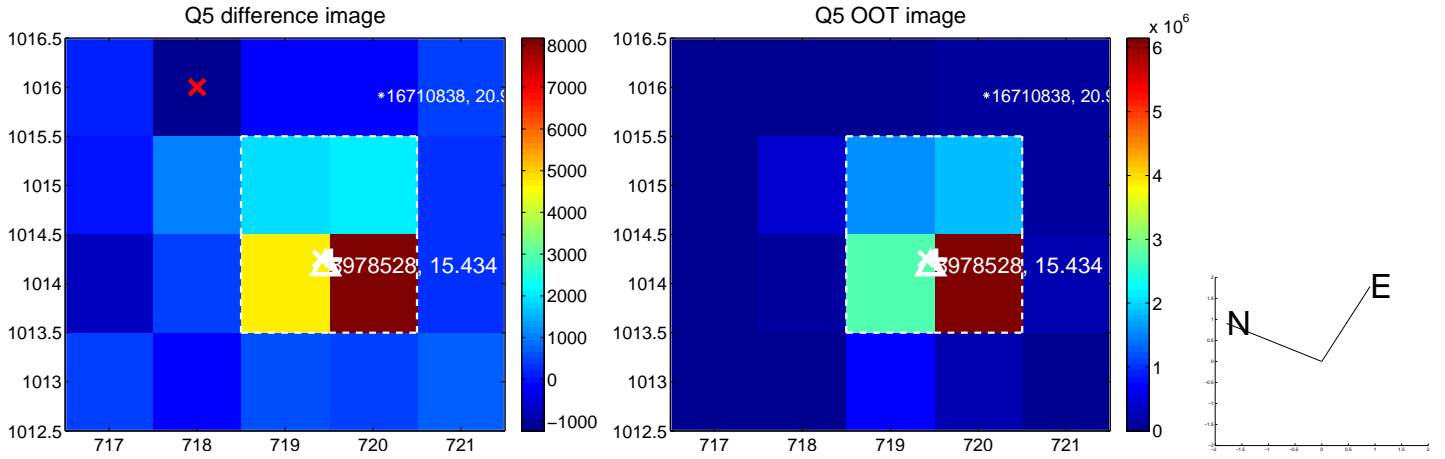


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

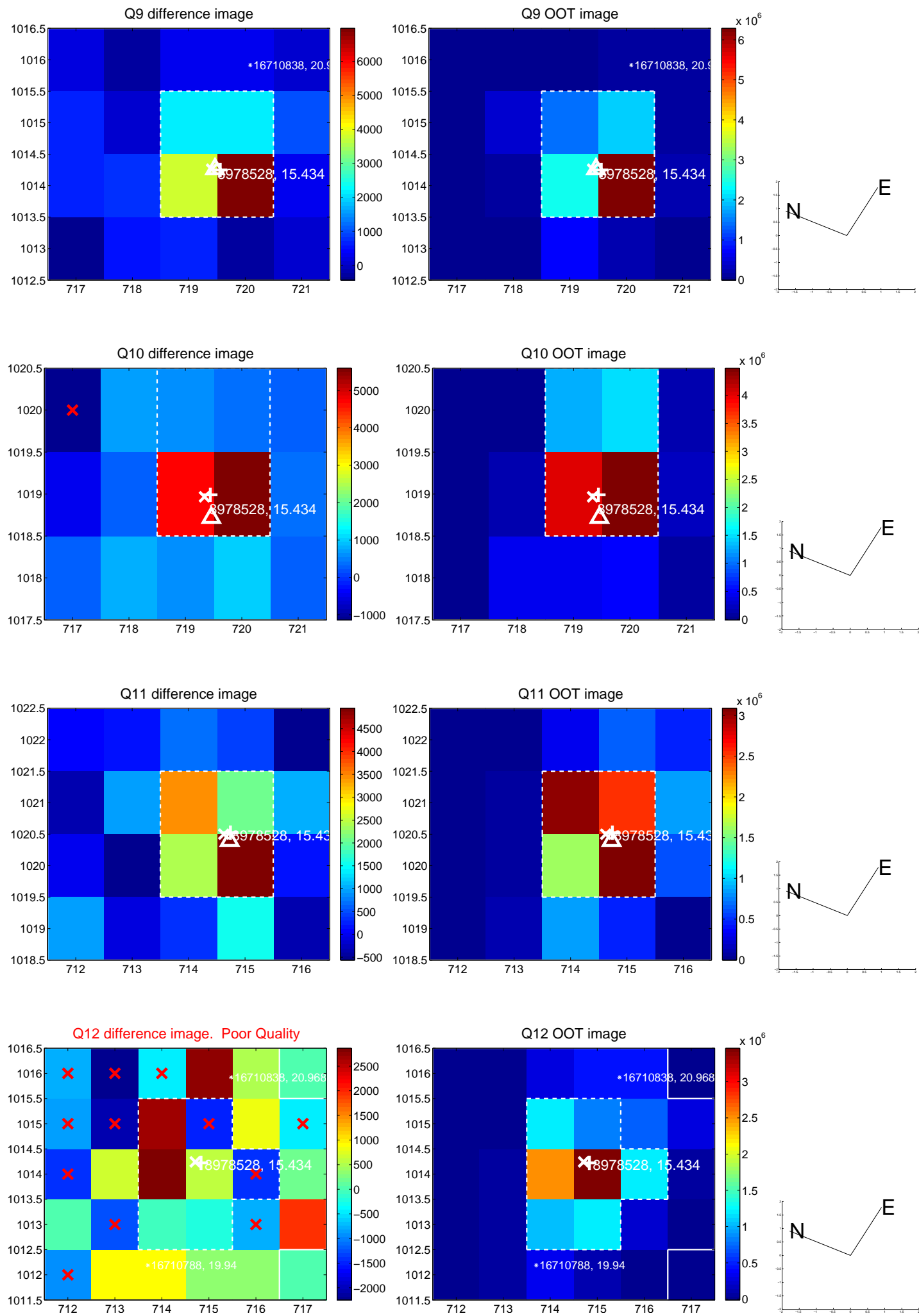
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



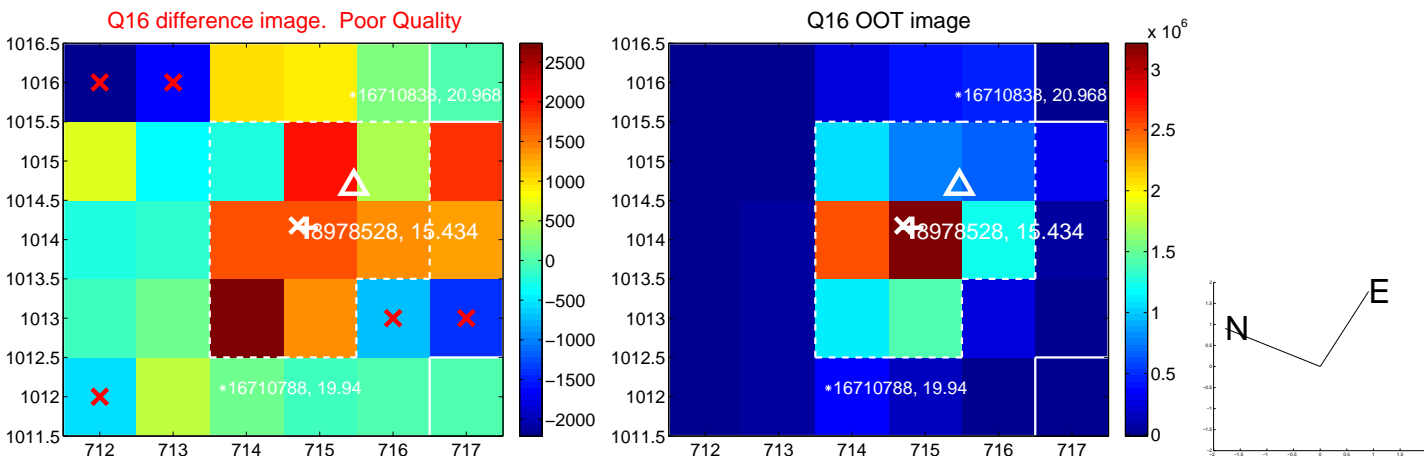
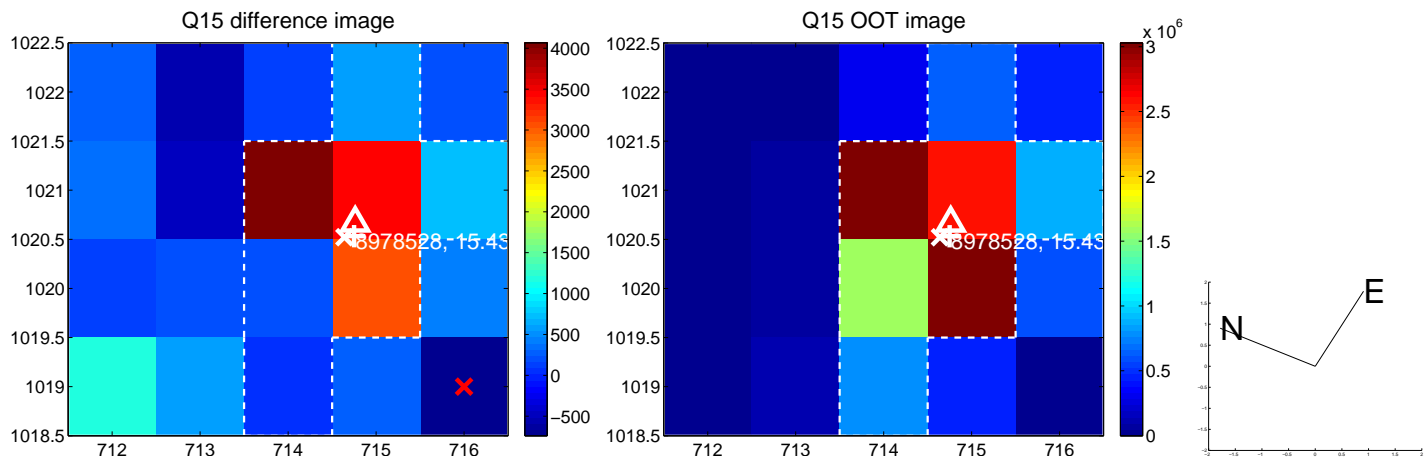
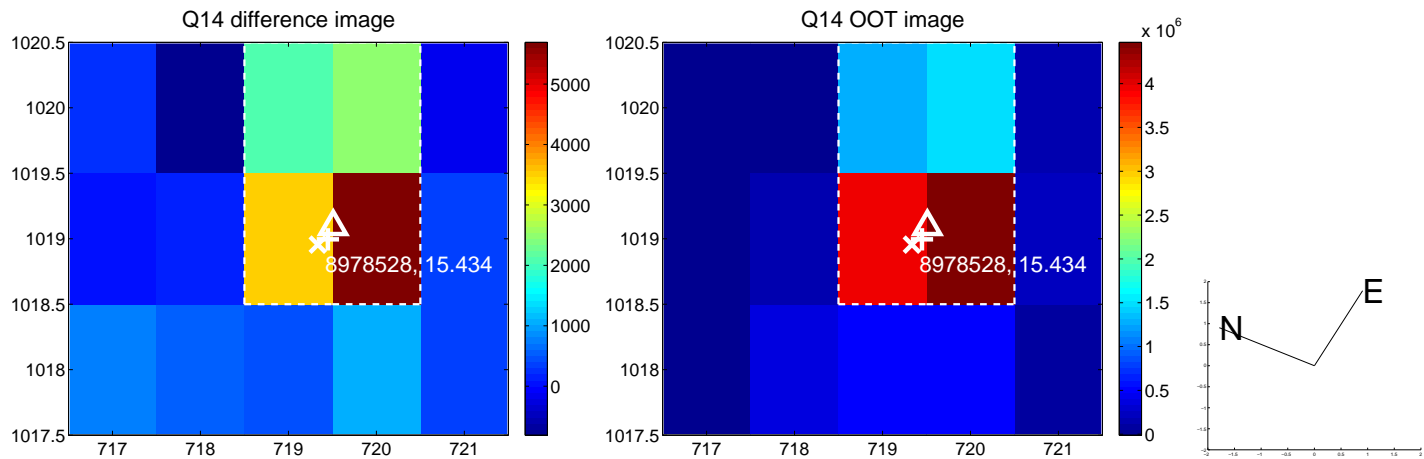
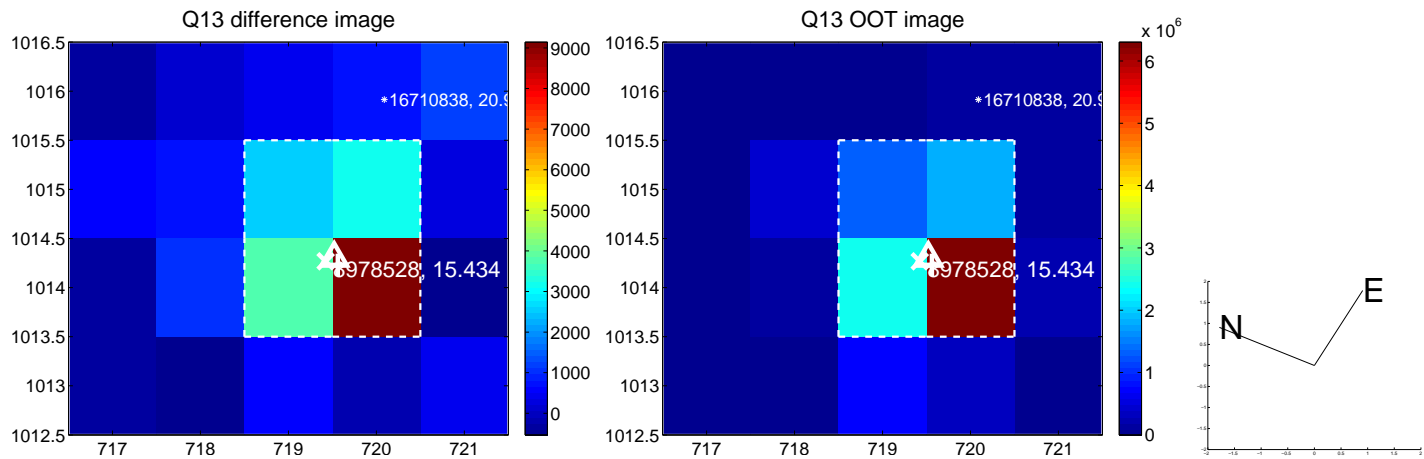
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

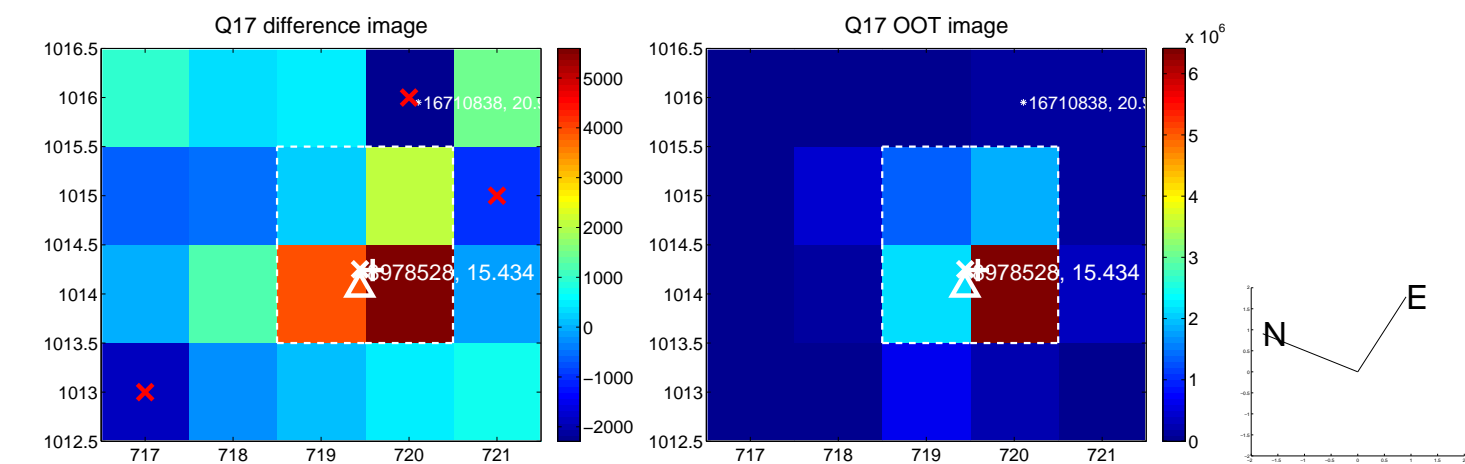


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

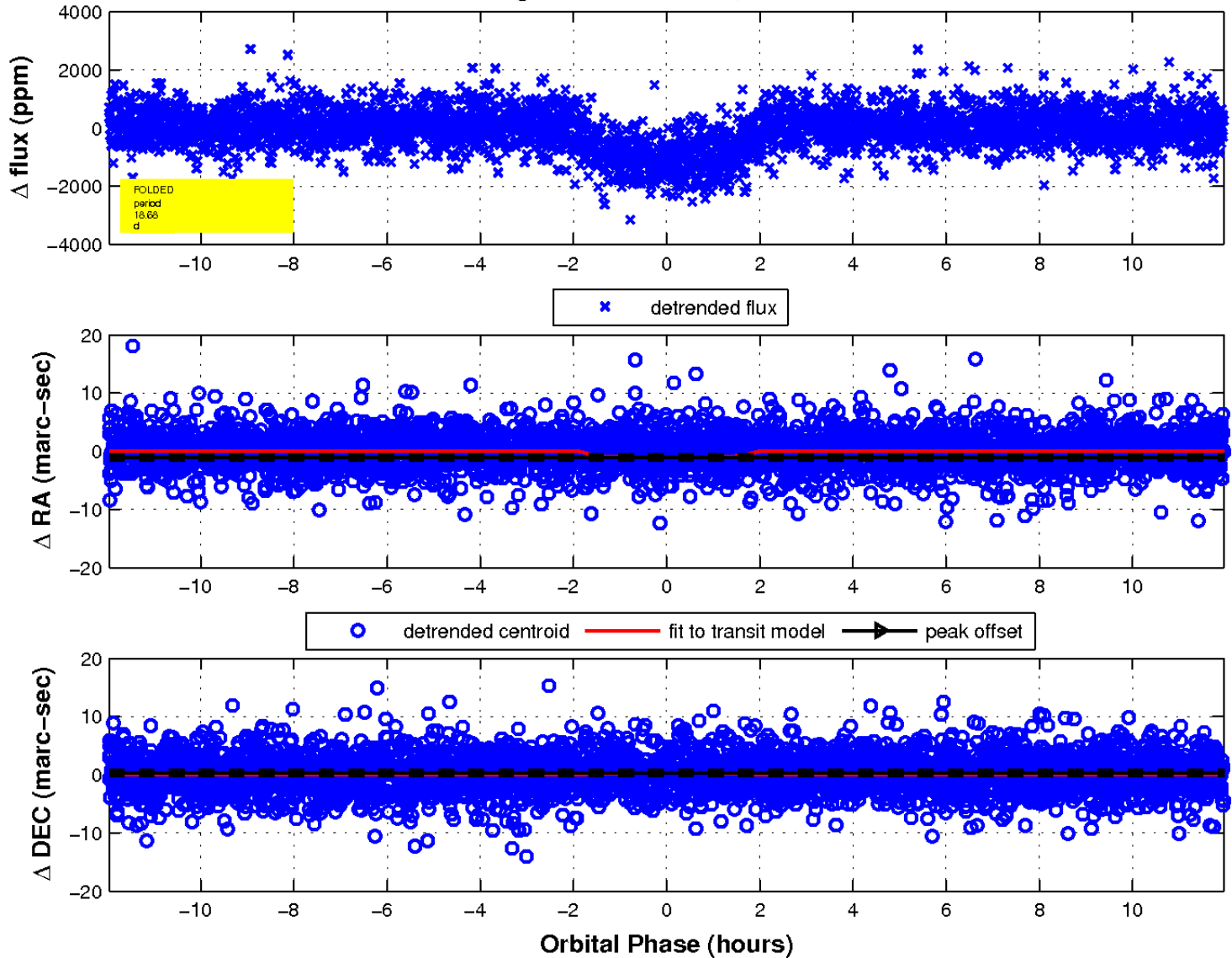




white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

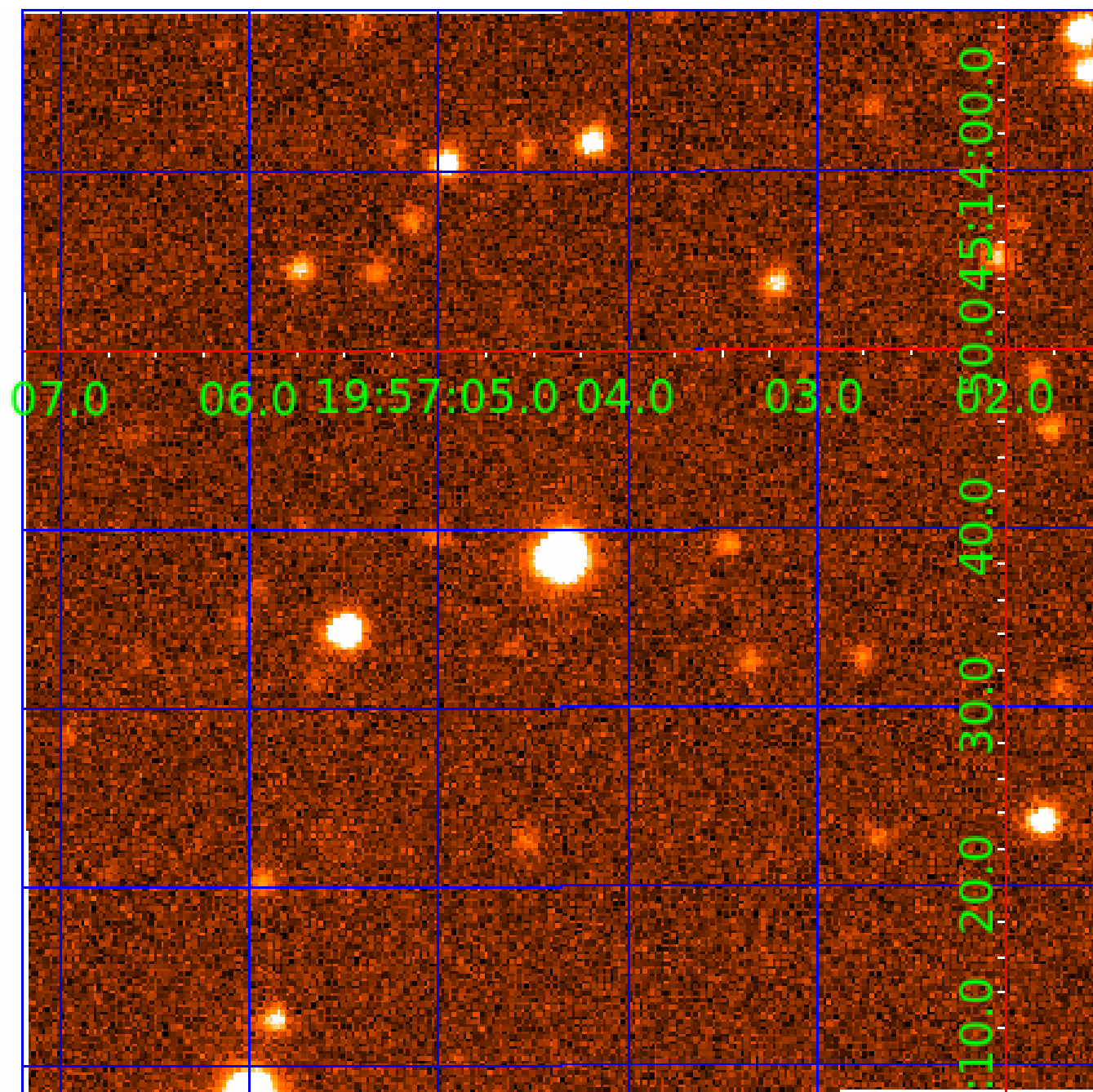


fluxWeightedCentroids, Planet 1 of 2



UKIRT Image

Declination



# KIC 008978528

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
008978528-01	OBS	1874.01	18.684850	136.145662	1244.3	3.989	35.2	37.9	0.55	4156	2.17	6.16
008978528-02	OBS	1874.02	7.416313	135.856912	516.7	2.226	18.0	20.6	0.55	4156	1.42	21.13

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
008978528-01	OBS	PC	1.00	0	0	0	0	CENT_KIC_POS
008978528-02	OBS	PC	1.00	0	0	0	0	CENT_KIC_POS

**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.

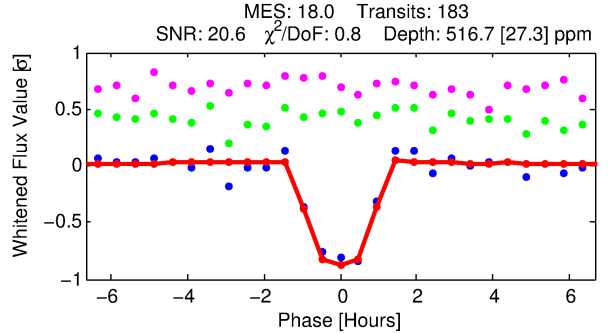
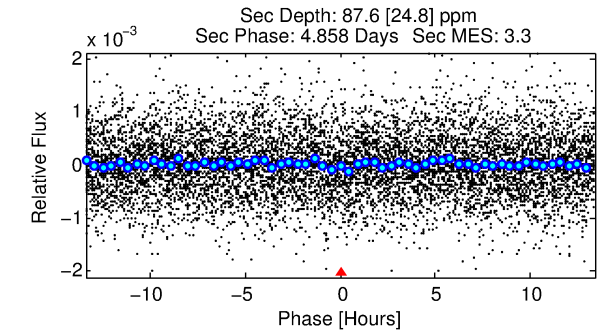
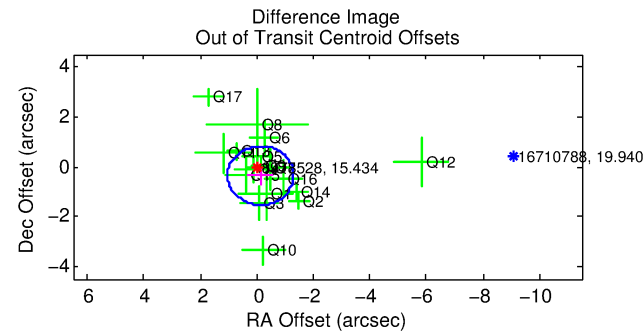
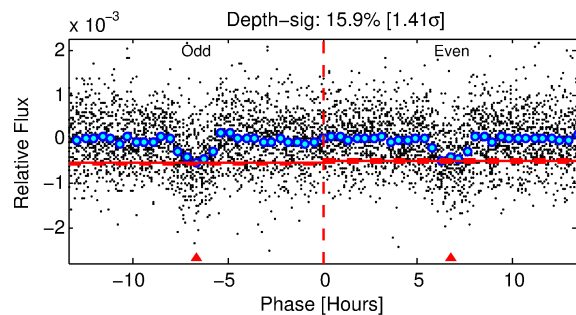
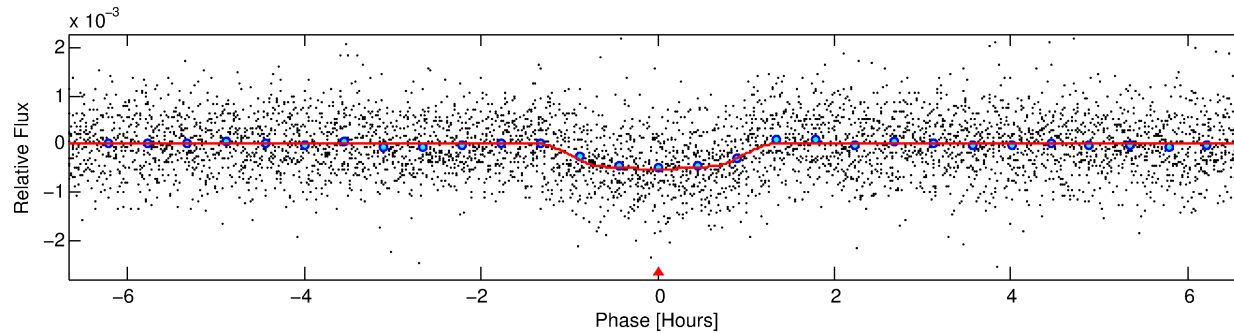
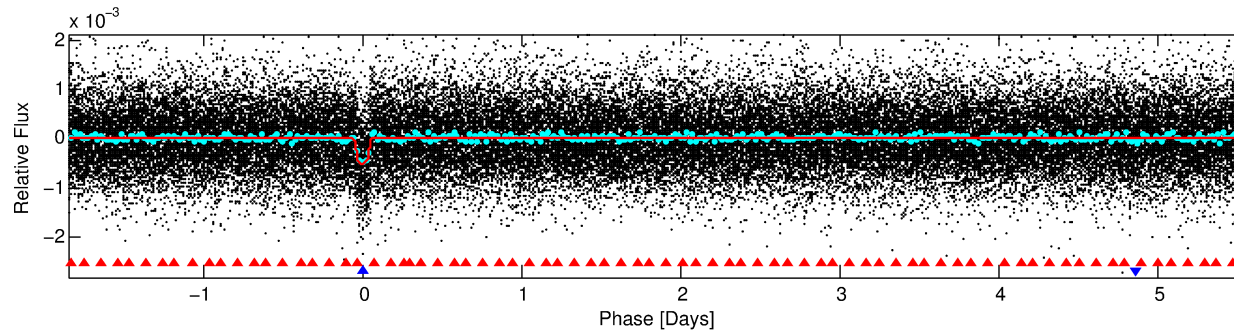
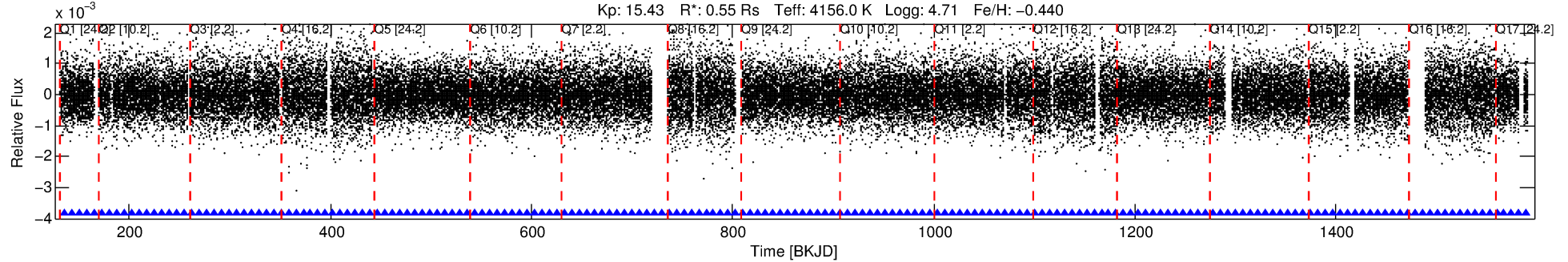
## Ephemeris Match Information For 008978528-02

No Significant Match Found

# DV One-Page Summary

KIC: 8978528 Candidate: 2 of 2 Period: 7.416 d  
KOI: K01874.02 Name: Kepler-329b Corr: 0.982

Kp: 15.43 R\*: 0.55 Rs Teff: 4156.0 K Logg: 4.71 Fe/H: -0.440



## DV Fit Results:

Period = 7.41631 [0.00002] d  
Epoch = 135.8569 [0.0024] BKJD  
Rp/R\* = 0.0239 [0.0094]  
a/R\* = 14.75 [25.25]  
b = 0.84 [0.59]  
Seff = 21.13 [2.23]  
Teq = 547 [14] K  
Rp = 1.42 [0.57] Re  
a = 0.0613 [0.0027] AU  
Ag = 89.99 [75.68] [1.18σ]  
Teffp = 2603 [549] K [3.75σ]

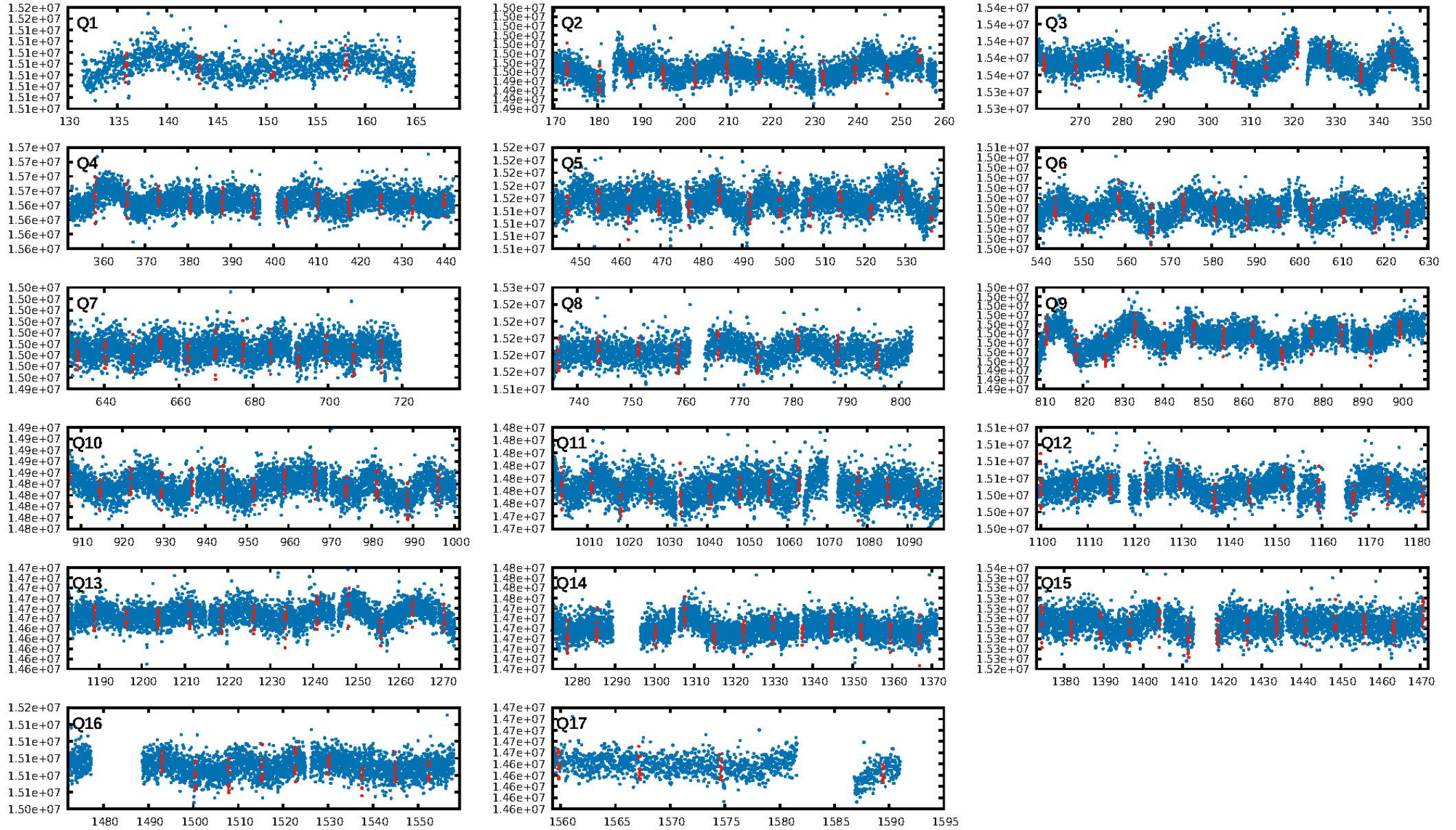
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [59.20σ]  
ModelChiSquare2-sig: 100.0%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 1.82e-71  
RollingBand-fgt: 1.00 [175/175]  
GhostDiagnostic-chr: 3.862  
Centroid-sig: 0.5%  
Centroid-so: 1.351 arcsec [2.15σ]  
OotOffset-rm: 0.381 arcsec [0.97σ]  
KicOffset-rm: 0.746 arcsec [2.40σ]  
OotOffset-st: 4/4/4/5 [17]  
KicOffset-st: 4/4/4/5 [17]  
DiffImageQuality-fgm: 0.71 [12/17]  
DiffImageOverlap-fno: 1.00 [17/17]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 18:35:11 Z

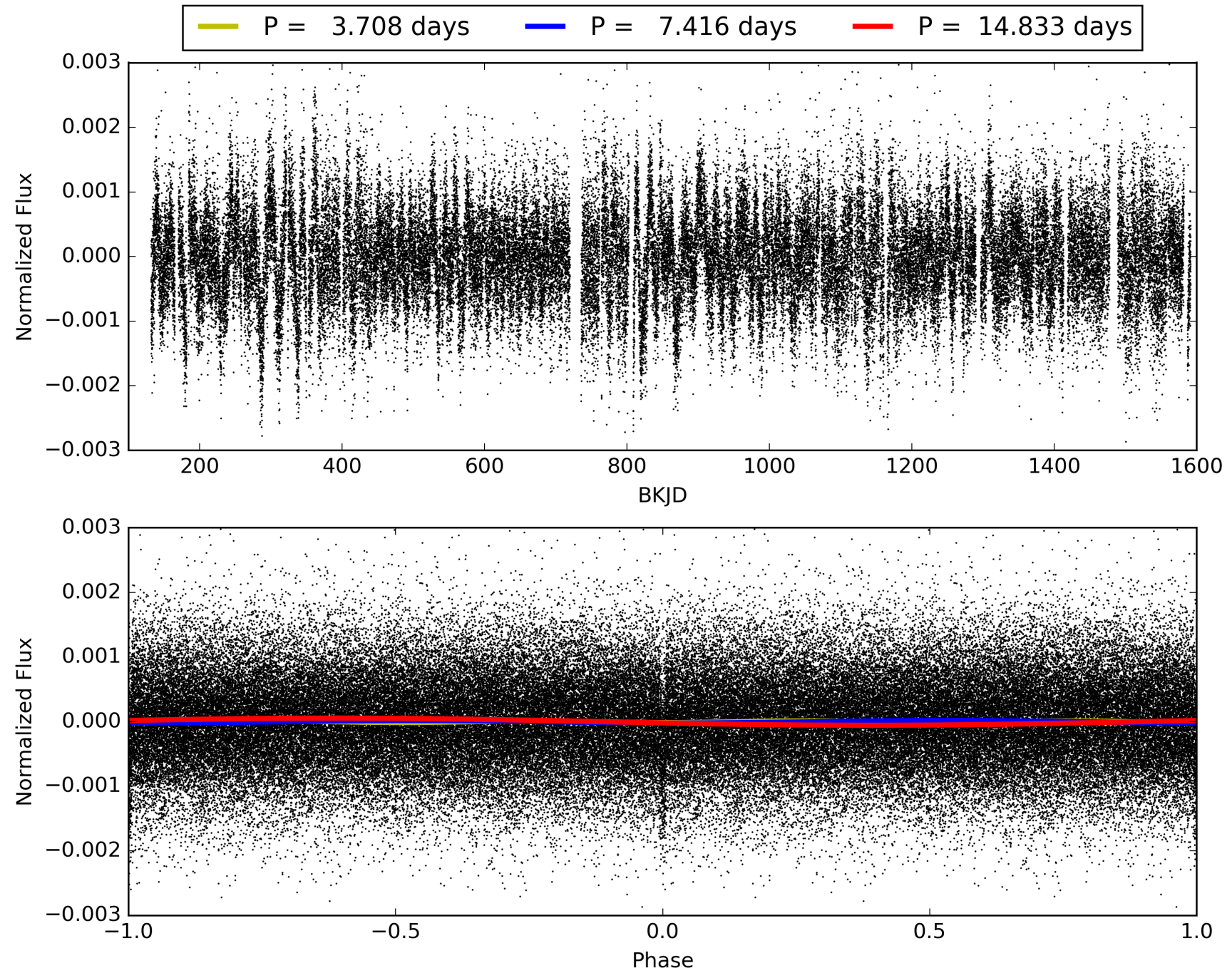
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 008978528-02, PDC Light Curves



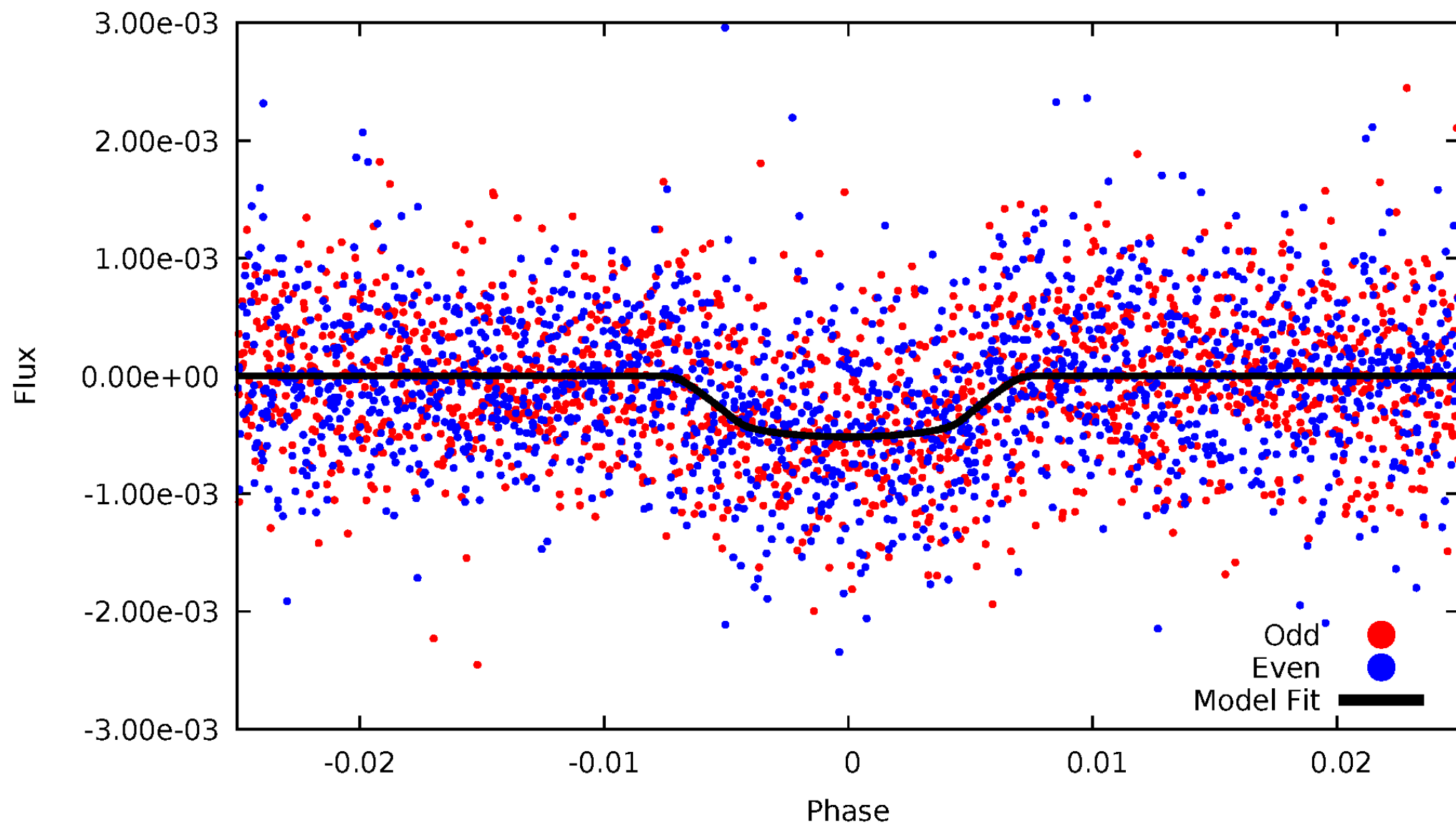


TCE 008978528-02



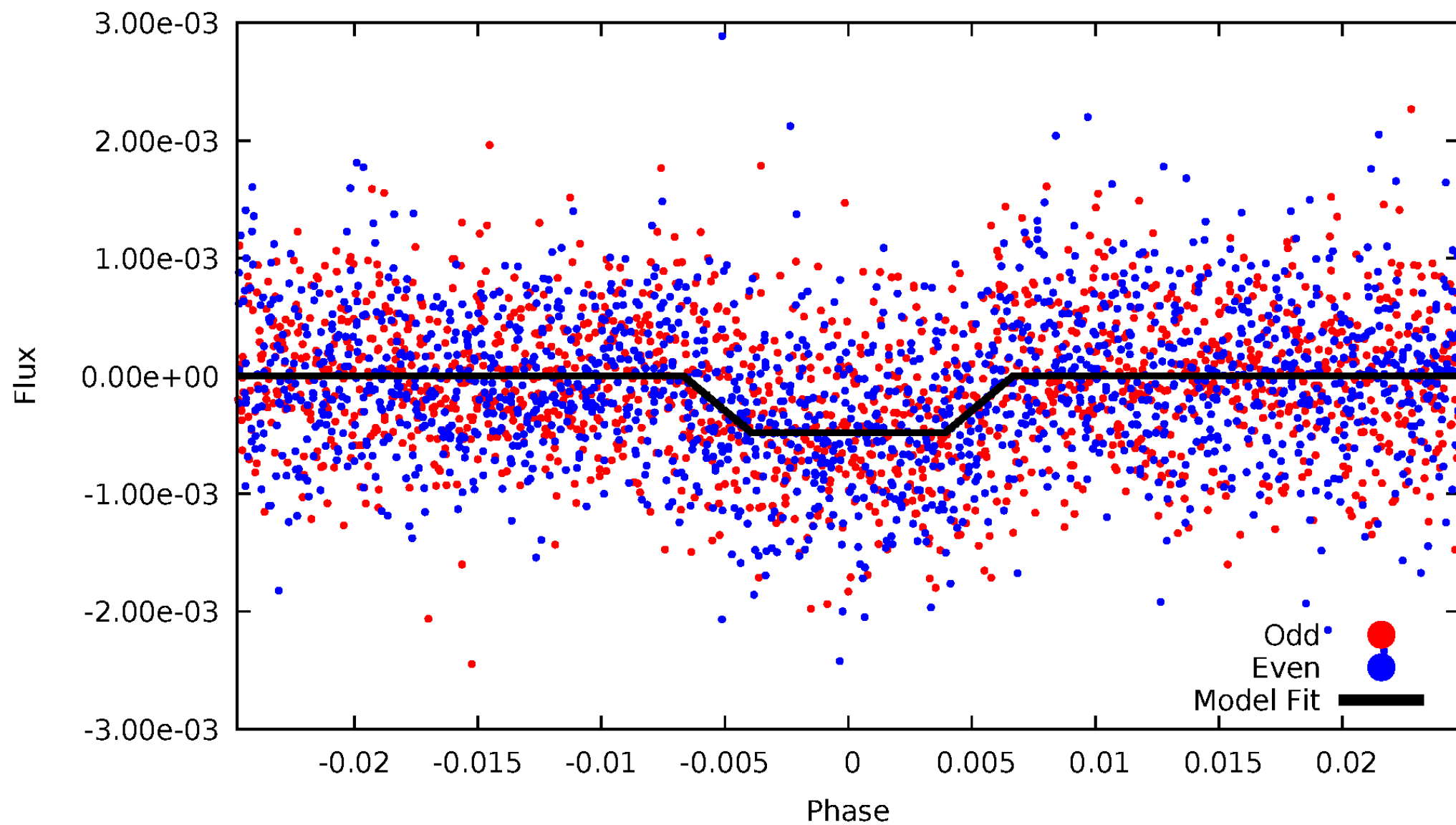
# DV Odd/Even

TCE 008978528-02



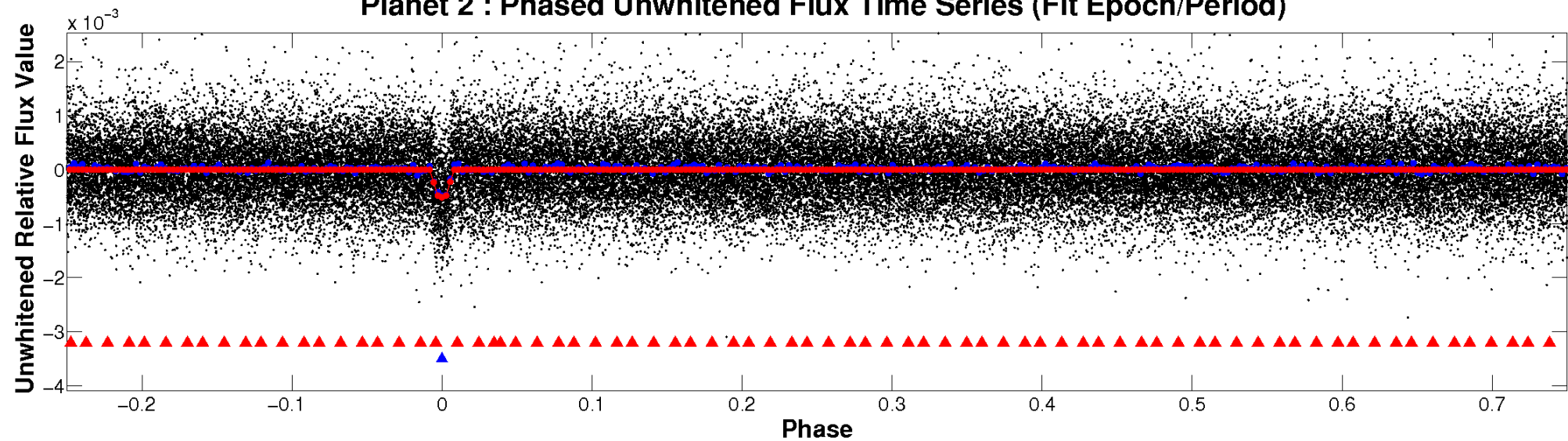
# ALT Odd/Even

TCE 008978528-02

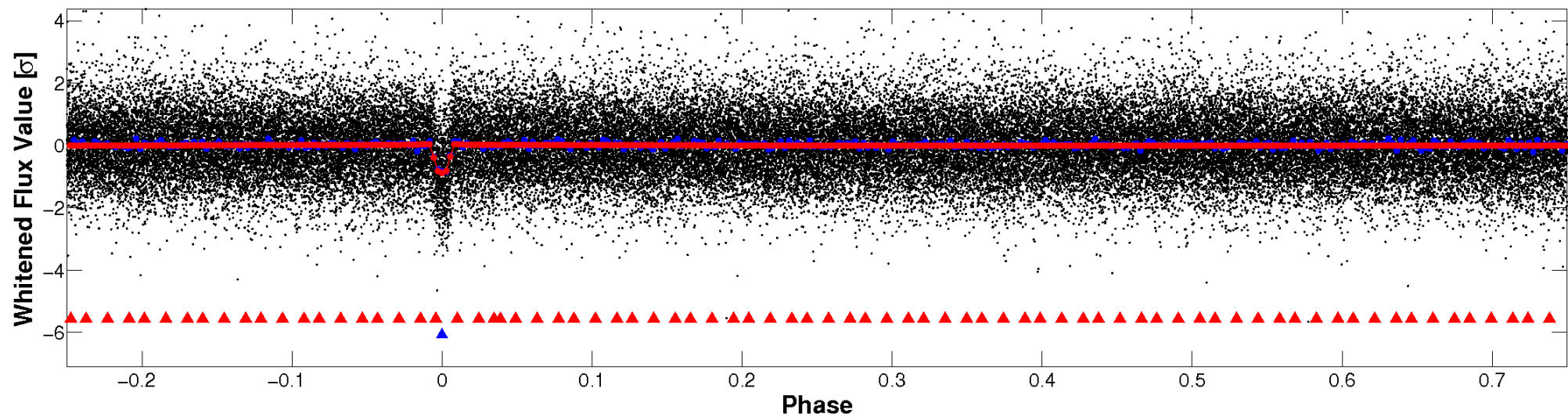


# Non-Whitened Vs. Whitened Light Curve

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



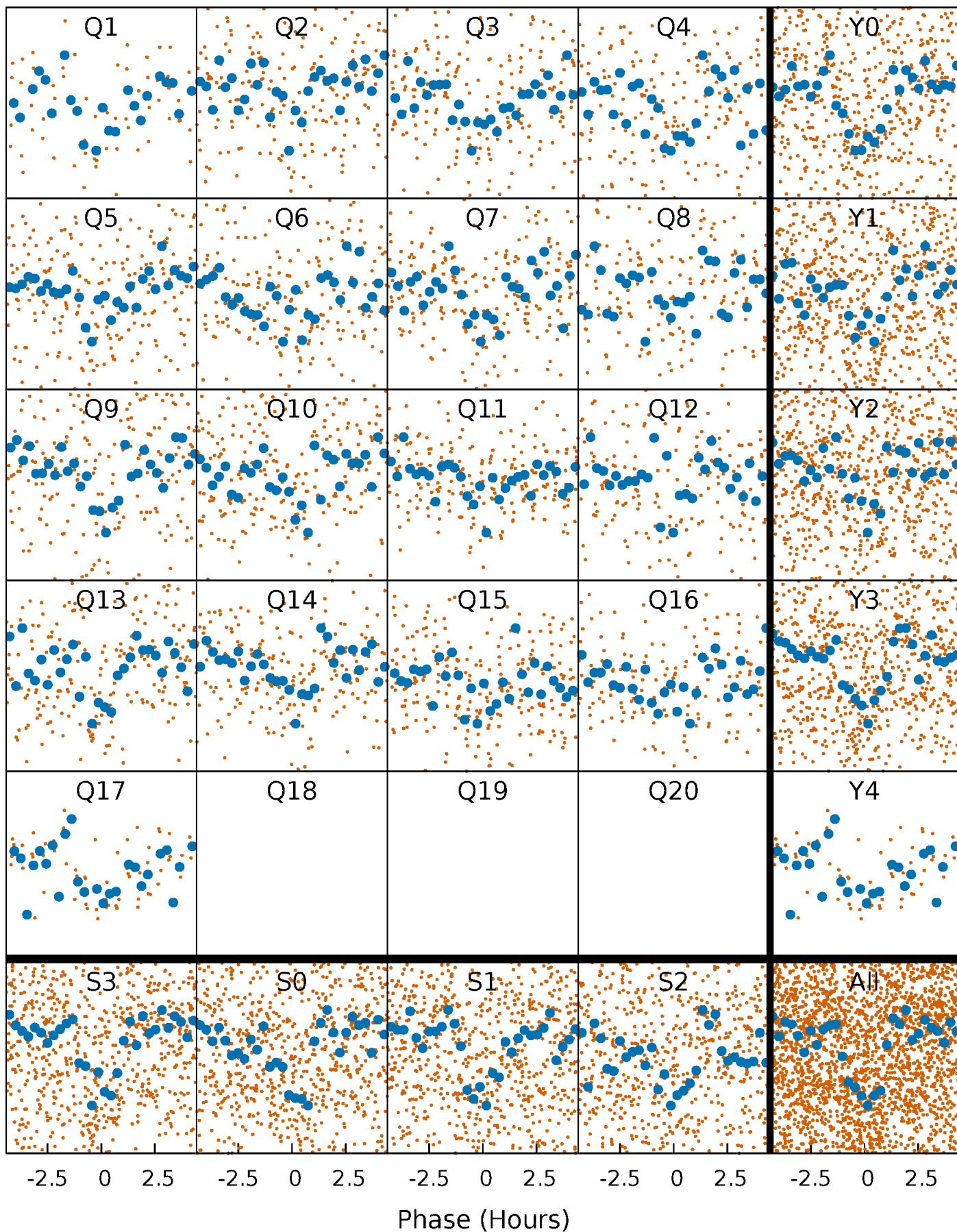
## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)





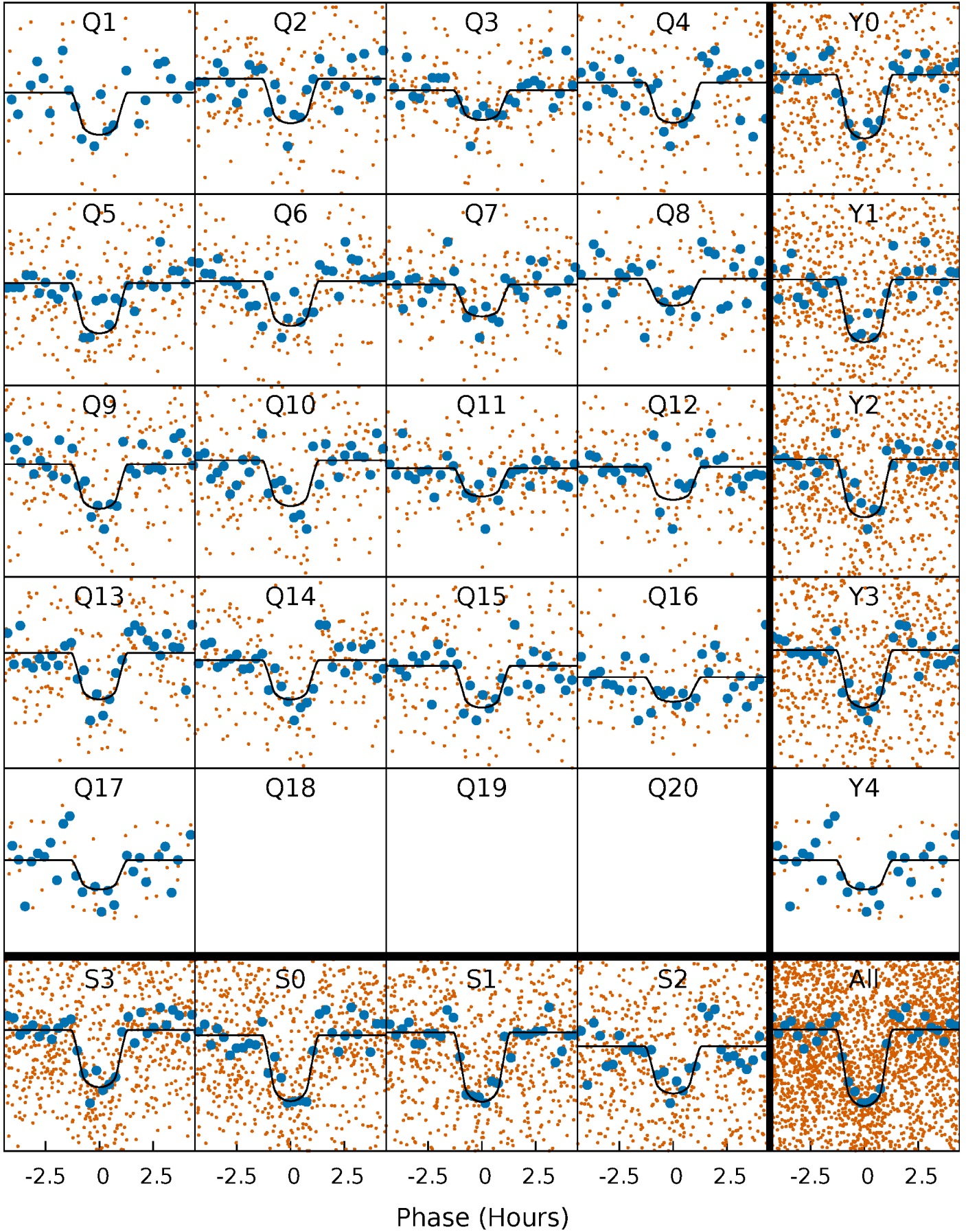
# PDC Quarter-Phased Transit Curves

TCE 008978528-02   P= 7.416313 Days    $T_0=135.856912$  (BKJD)



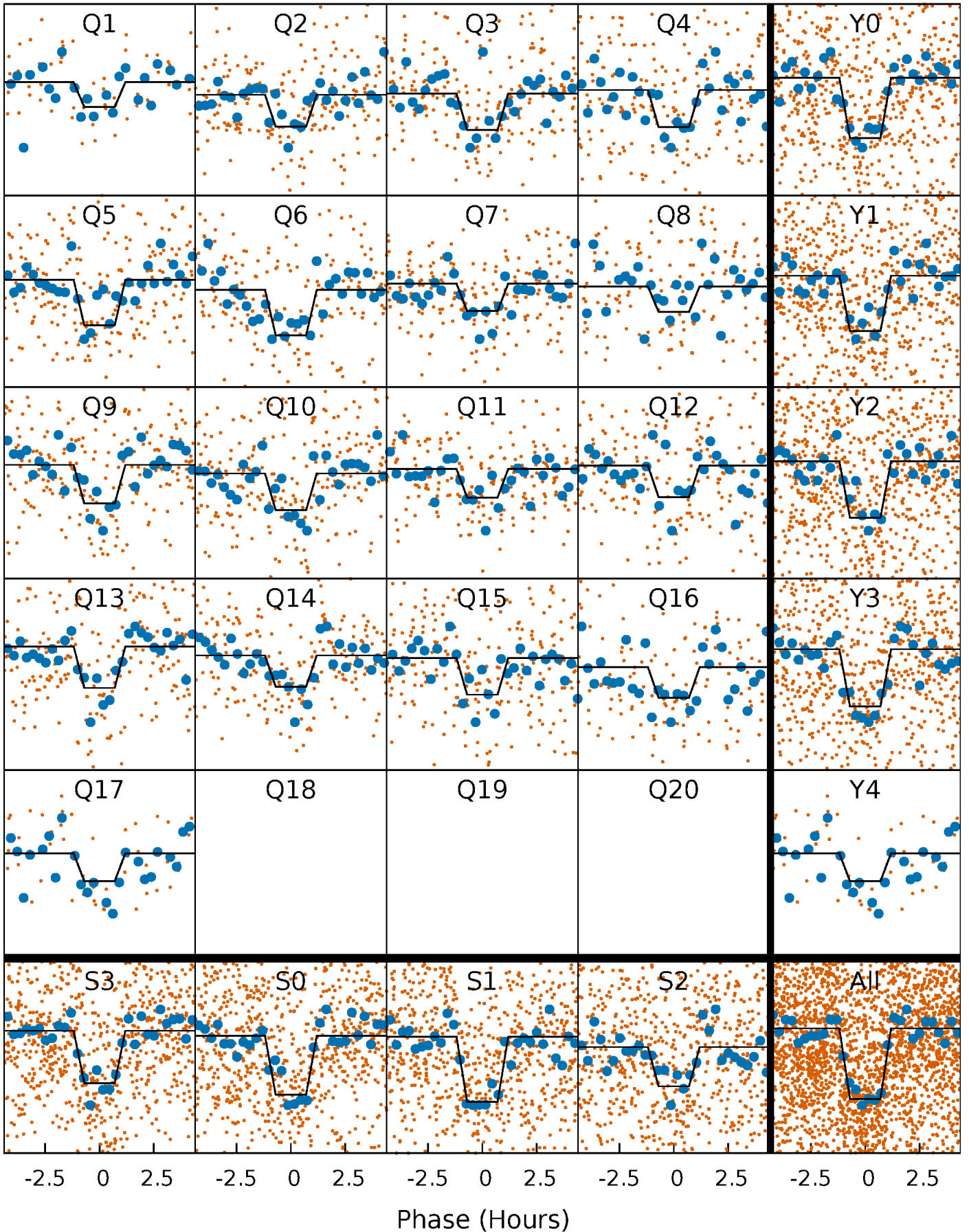
# DV Quarter-Phased Transit Curves

TCE 008978528-02   P= 7.416313 Days    $T_0=135.856912$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

TCE 008978528-02   P= 7.416320 Days    $T_0=135.856507$  (BKJD)

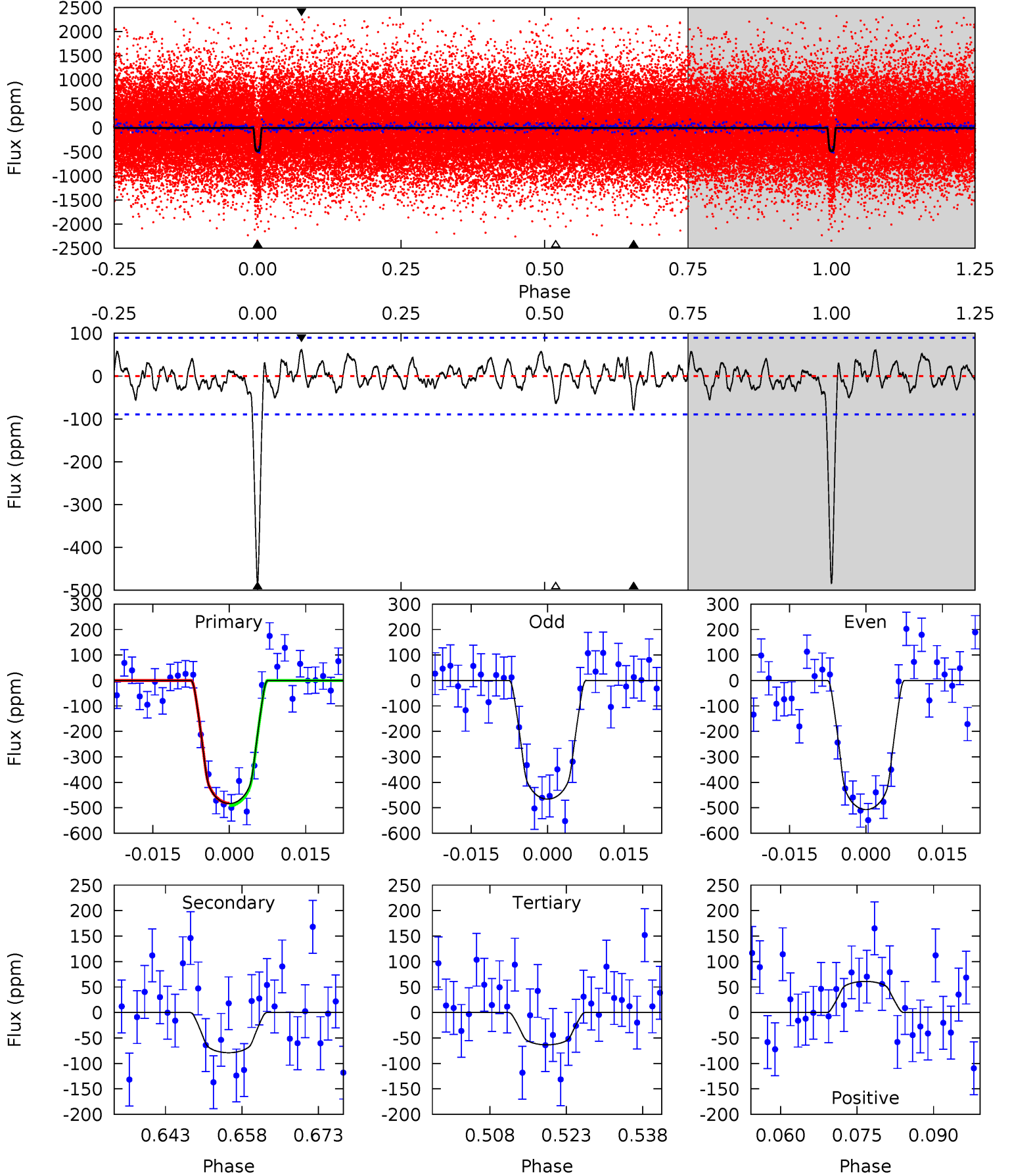




# DV Model-Shift Uniqueness Test

008978528-02, P = 7.416313 Days, E = 128.440599 Days

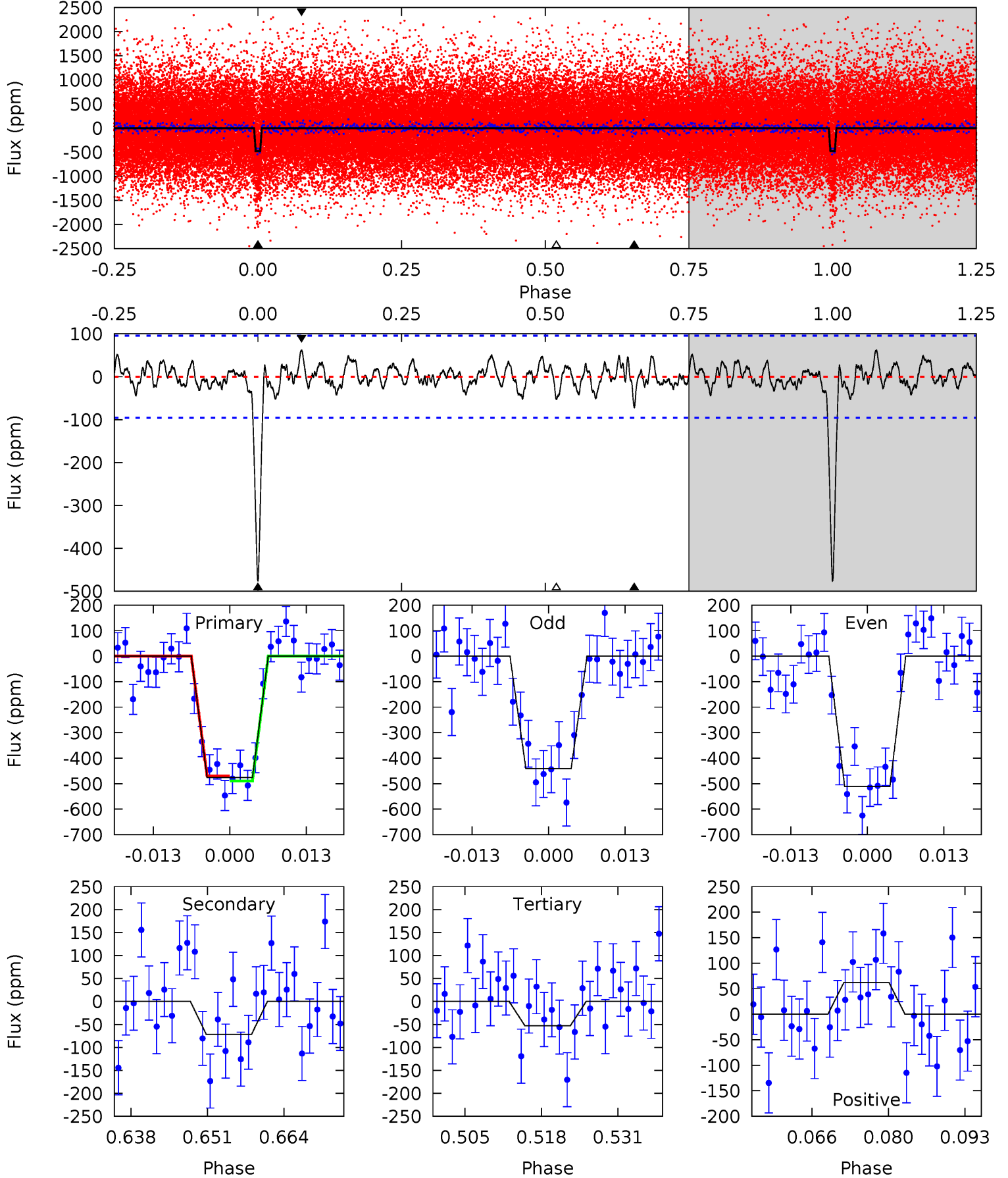
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
26.7	4.37	3.51	3.37	4.95	2.43	1.25	23.2	23.4	0.86	0.99	1.14	1.03	0.11	0.27



# Alt Model-Shift Uniqueness Test

008978528-02, P = 7.416320 Days, E = 128.440187 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
24.7	3.72	2.76	3.21	4.97	2.48	1.13	22.0	21.5	0.96	0.51	1.81	0.97	0.11	0.49



### Stellar Parameters For KIC 008978528

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$4156^{+83}_{-91}$	$4.712^{+0.027}_{-0.030}$	$-0.440^{+0.150}_{-0.150}$	$0.545^{+0.030}_{-0.030}$	$0.559^{+0.027}_{-0.034}$	$4.858^{+0.590}_{-0.526}$
	+2%/-2%	+1%/-1%	+34%/-34%	+6%/-6%	+5%/-6%	+12%/-11%
Source	SPE60	SPE60	SPE60	DSEP		

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

### Secondary Eclipse Parameters for KIC 008978528-02 / KOI 1874.02

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-79 \pm 18$	$1.42^{+0.52}_{-0.56}$	$764^{+19}_{-18}$	$3009^{+500}_{-261}$	$79^{+138}_{-38}$
Alt.	$-72 \pm 19$	$1.31^{+0.55}_{-0.51}$	$765^{+17}_{-20}$	$3059^{+533}_{-308}$	$88^{+161}_{-48}$

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

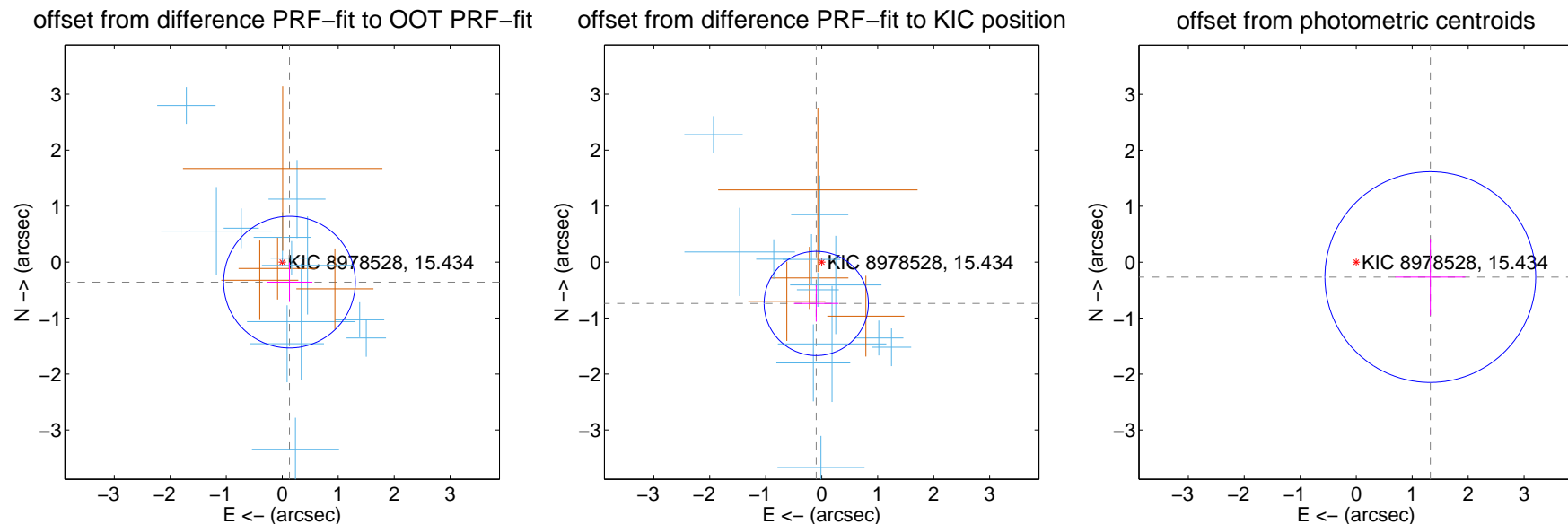
## DV Centroid Data

Supplemental centroid analysis for 008978528-02. Kepler magnitude: 15.43. Transit SNR 20.60

There are 12 quarters with good PRF difference image offsets

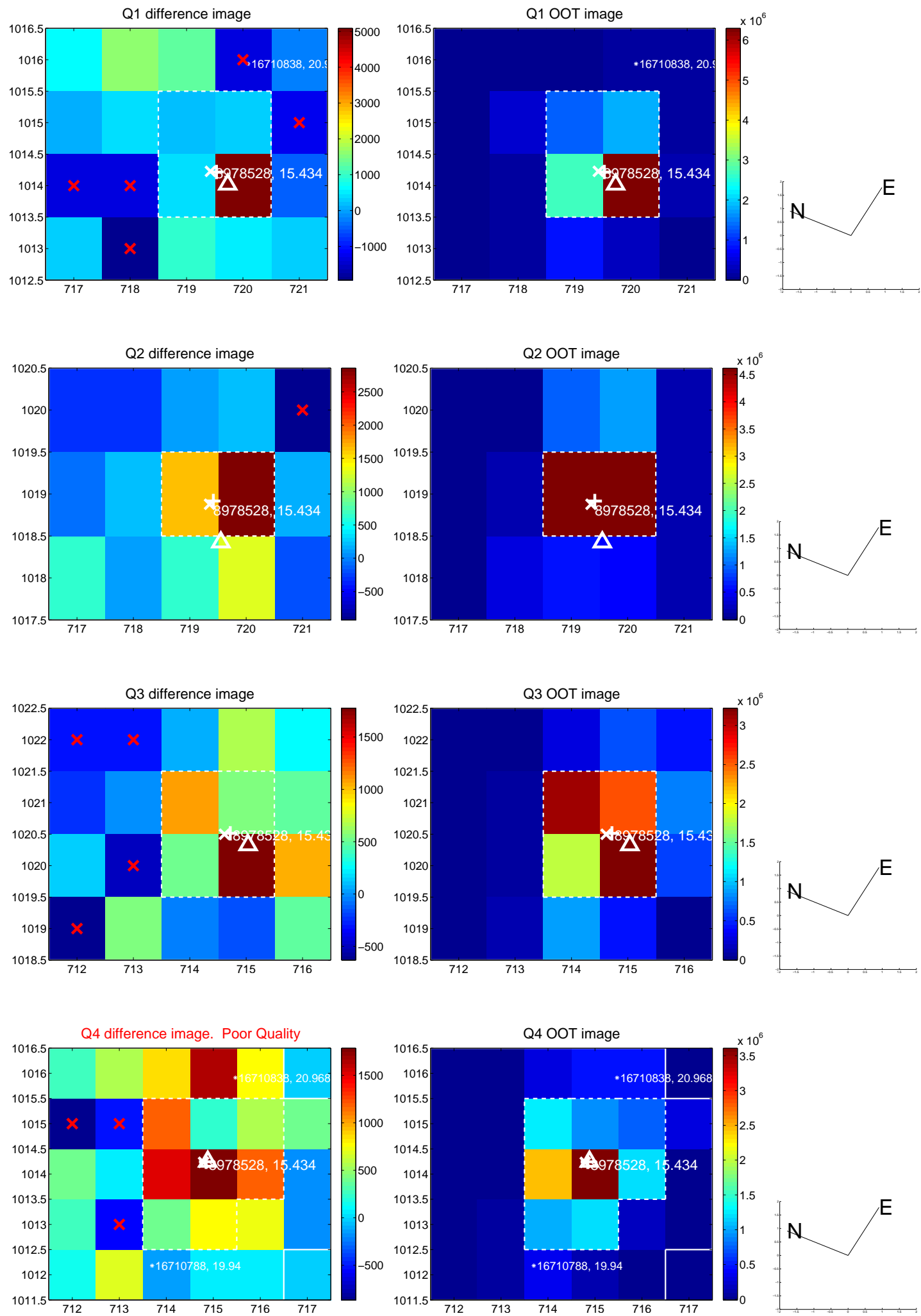
The direct PRF centroid is offset from the target star catalog position by about 0.56 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.381 \pm 0.392$	0.97	$-0.130 \pm 0.410$	$-0.358 \pm 0.352$
PRF-fit source offset from KIC position	$0.746 \pm 0.310$	2.40	$0.098 \pm 0.399$	$-0.739 \pm 0.325$
photometric centroid source offset	$1.35 \pm 0.63$	2.15	$-1.32 \pm 0.63$	$-0.27 \pm 0.68$

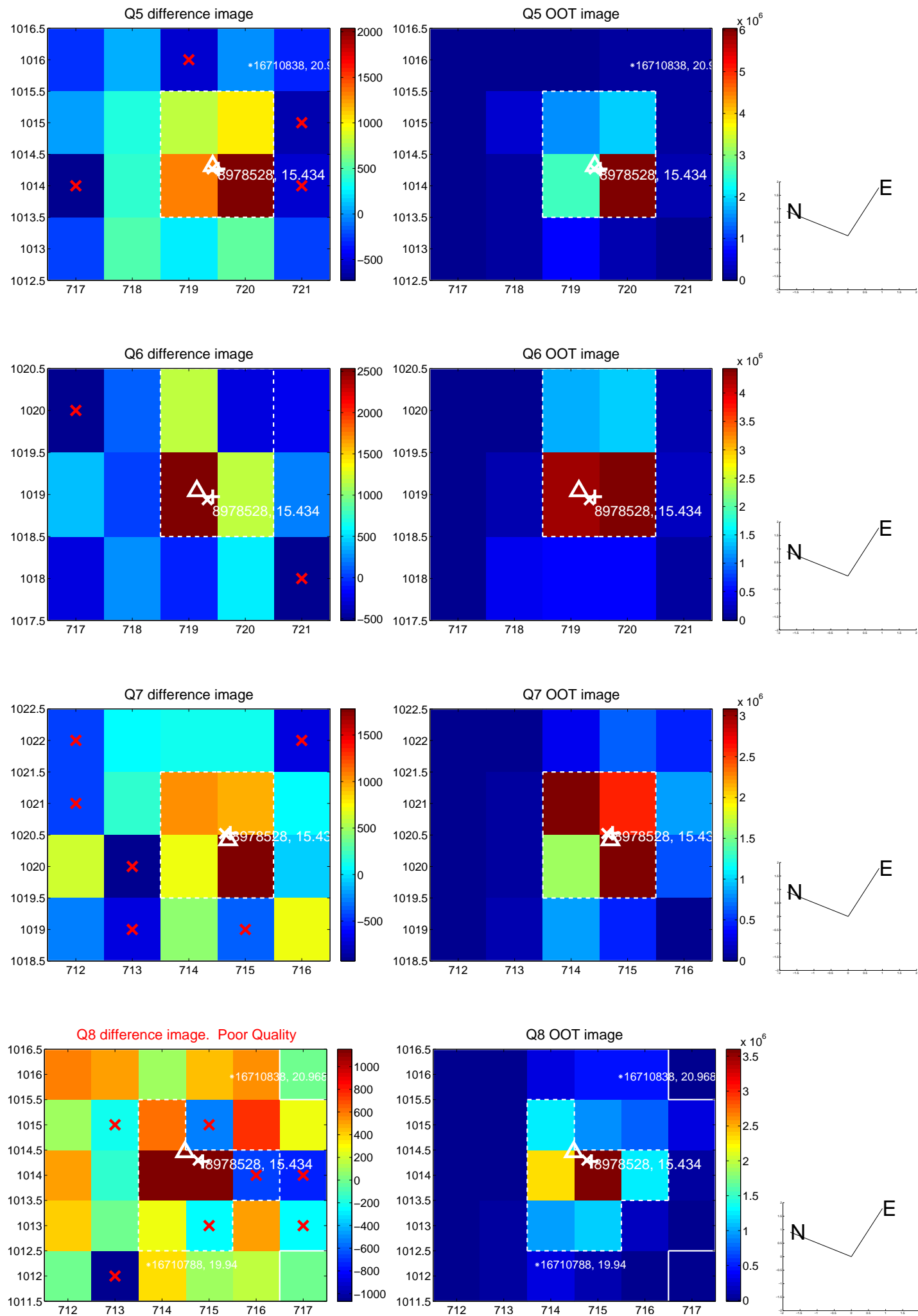


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

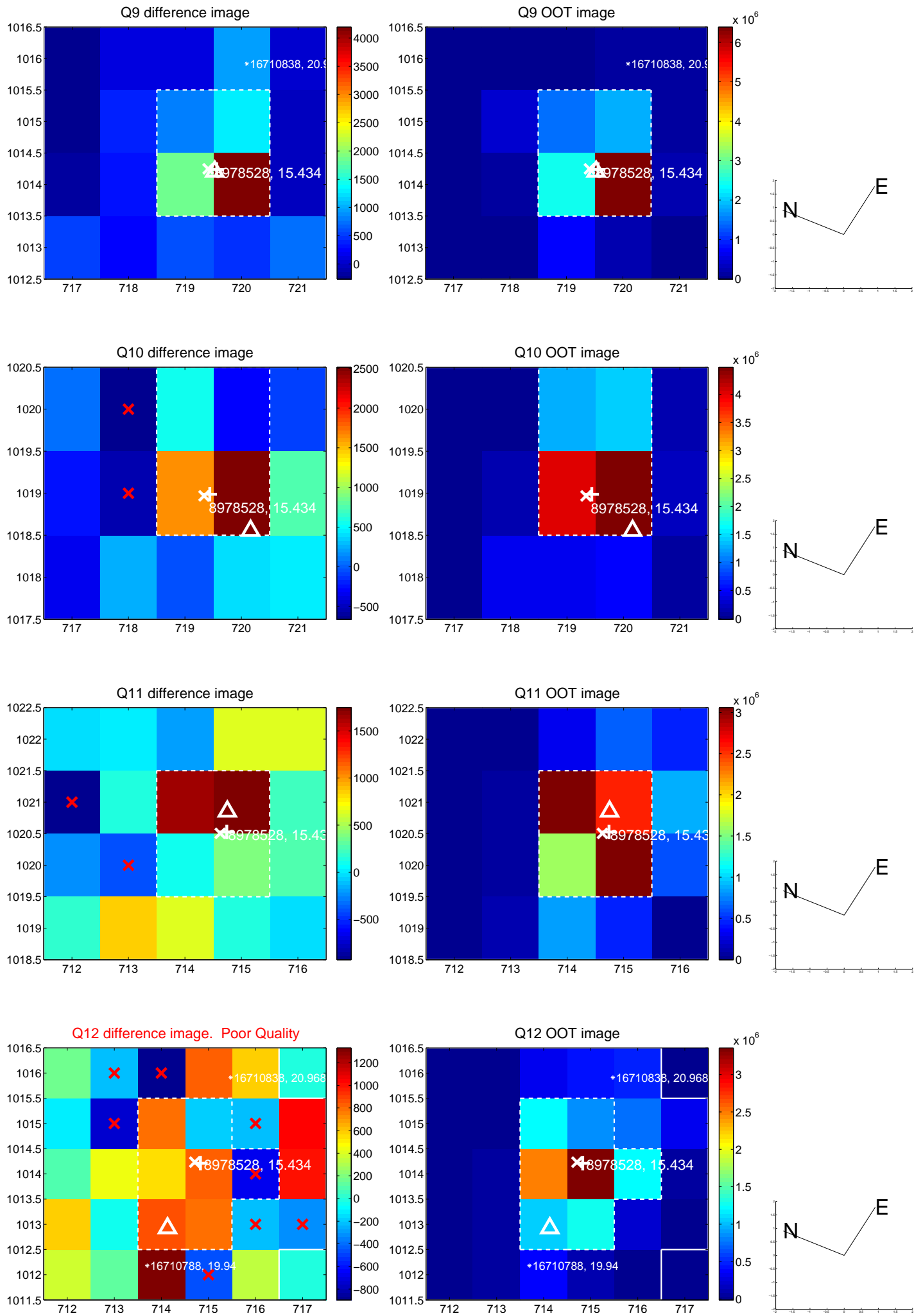
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

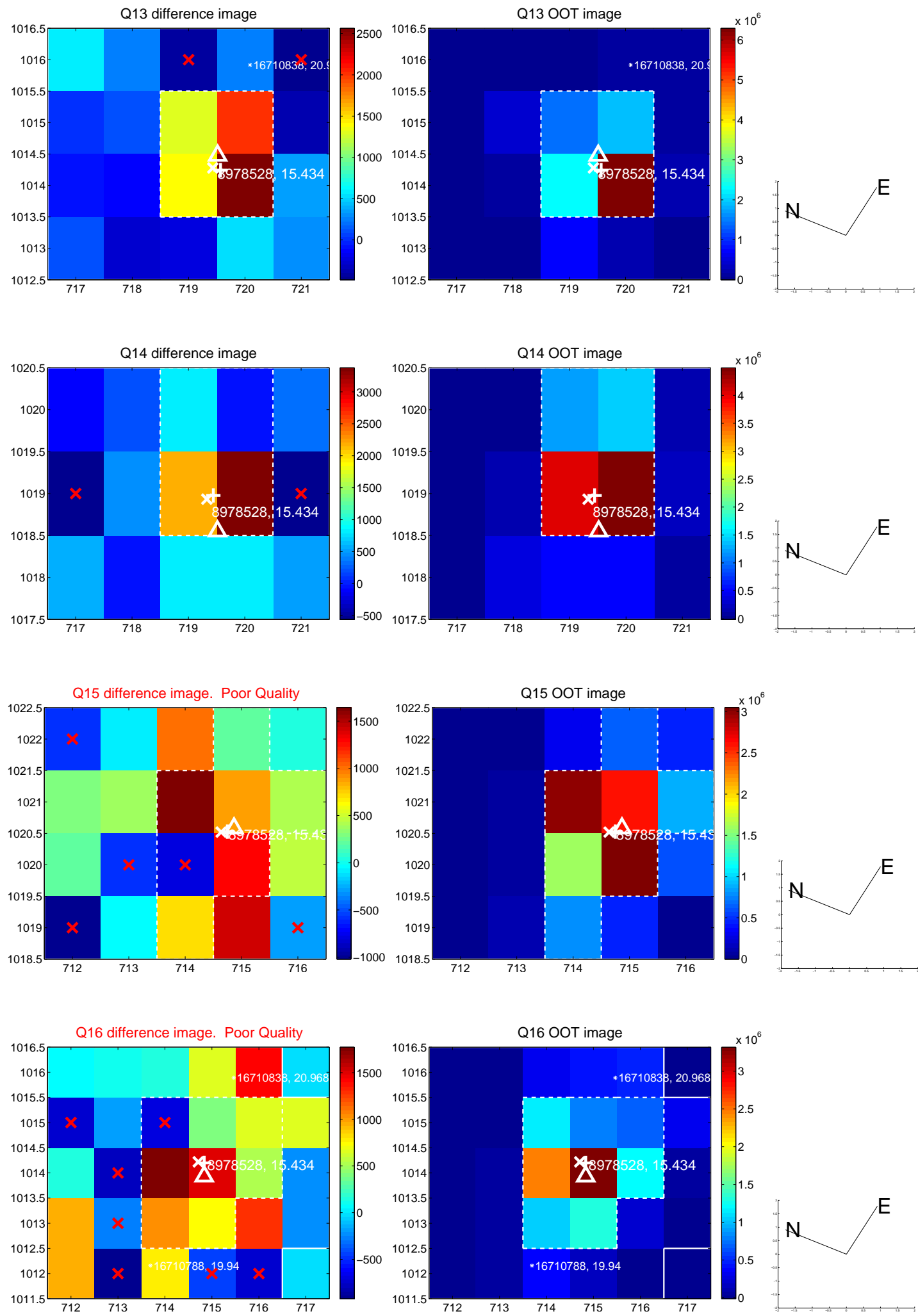


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

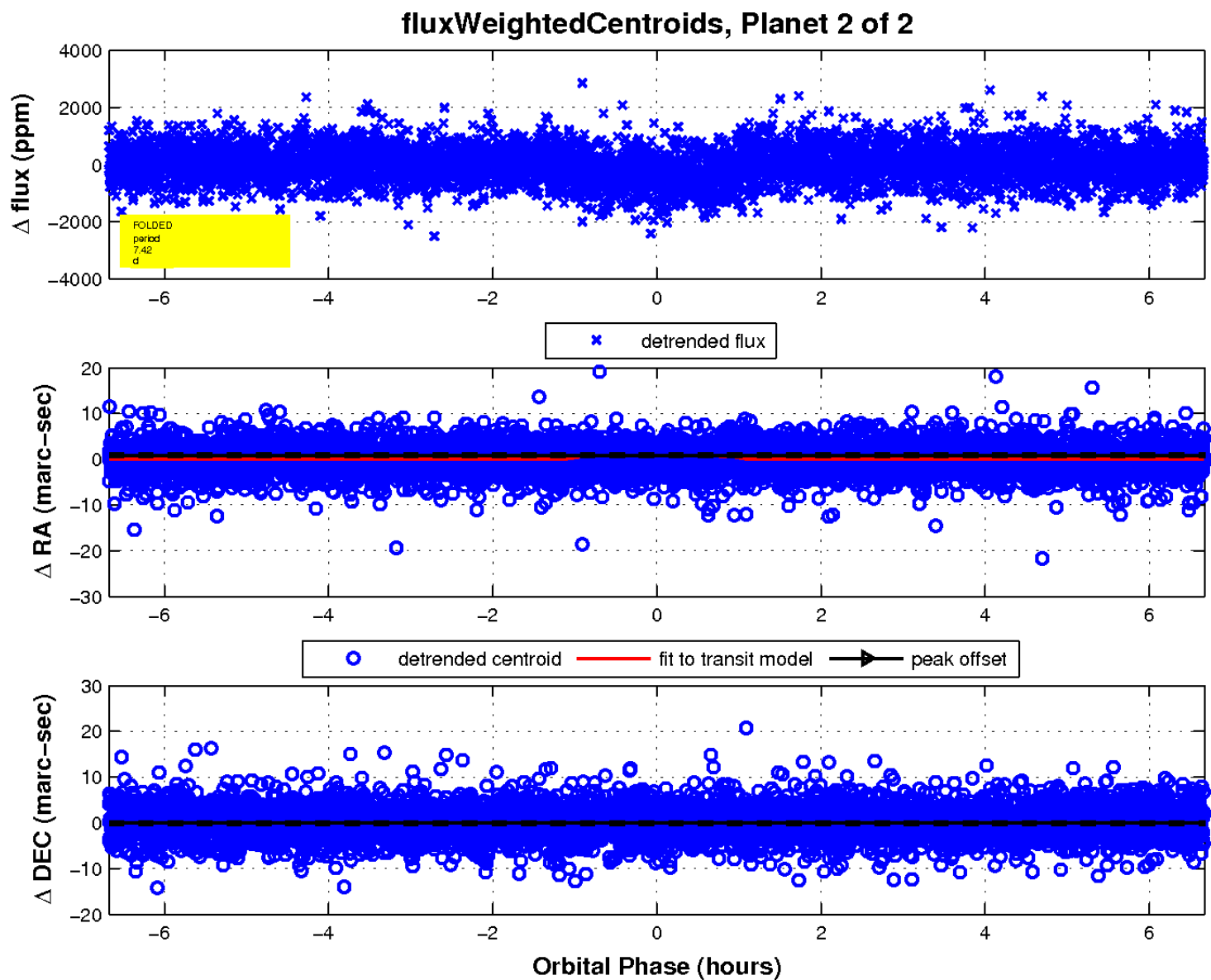
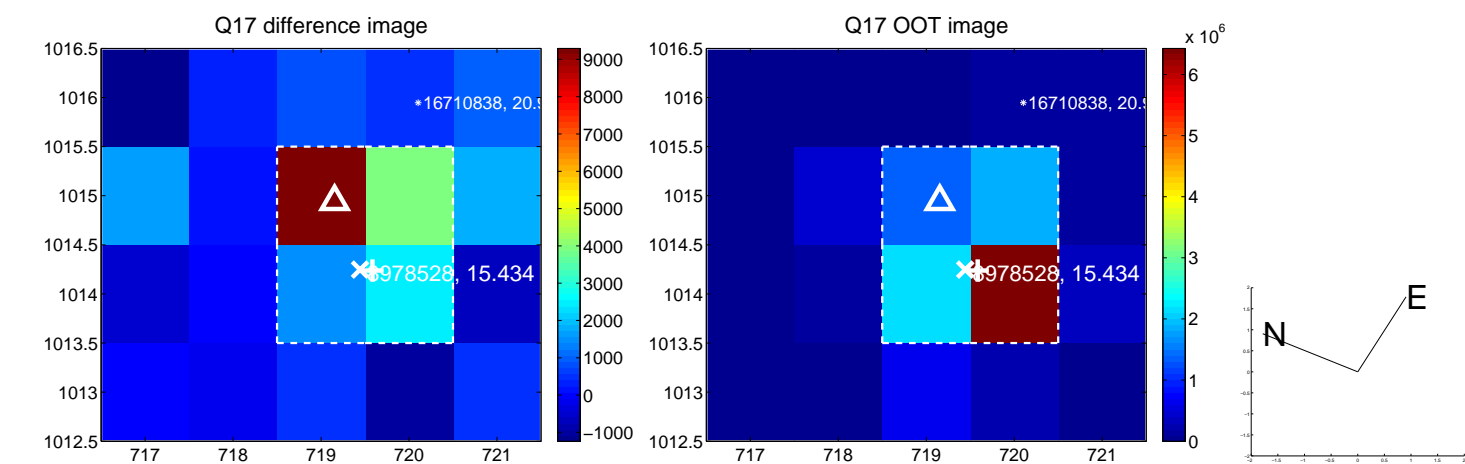




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white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination

