

# KIC 009347899

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009347899-01	OBS	0935.01	20.860226	138.295962	1889.7	5.882	94.9	98.2	1.26	6035	6.31	87.92
009347899-02	OBS	0935.02	42.634213	141.173759	1700.0	6.691	62.3	64.1	1.26	6035	5.79	33.90
009347899-03	OBS	0935.03	87.647786	134.939625	1005.9	9.048	28.8	30.4	1.26	6035	4.32	12.97
009347899-04	OBS	0935.04	9.617237	132.864070	124.8	4.116	7.8	8.8	1.26	6035	1.65	246.85

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009347899-01	OBS	PC	1.00	0	0	0	0	NO_COMMENT
009347899-02	OBS	PC	1.00	0	0	0	0	NO_COMMENT
009347899-03	OBS	PC	0.97	0	0	0	0	NO_COMMENT
009347899-04	OBS	PC	0.97	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.

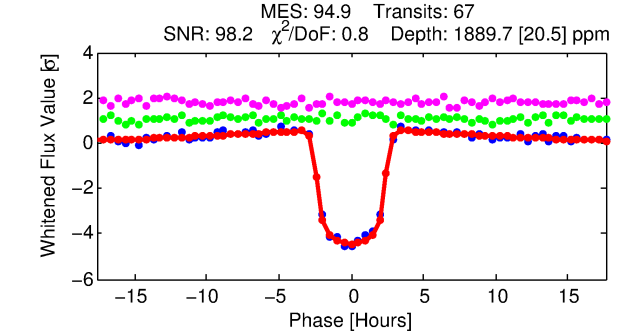
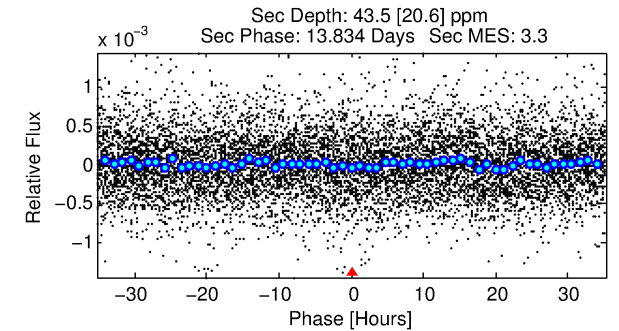
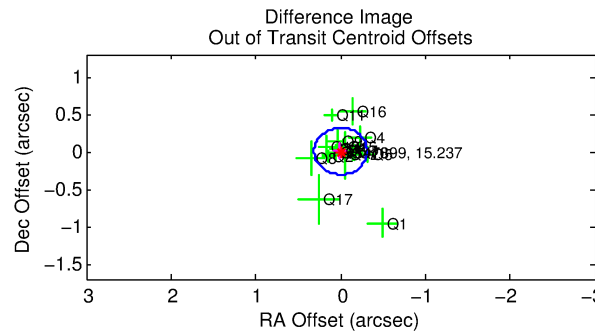
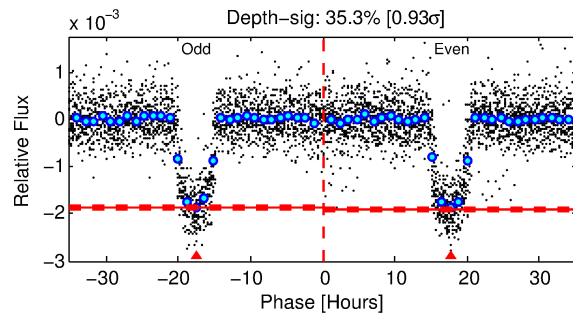
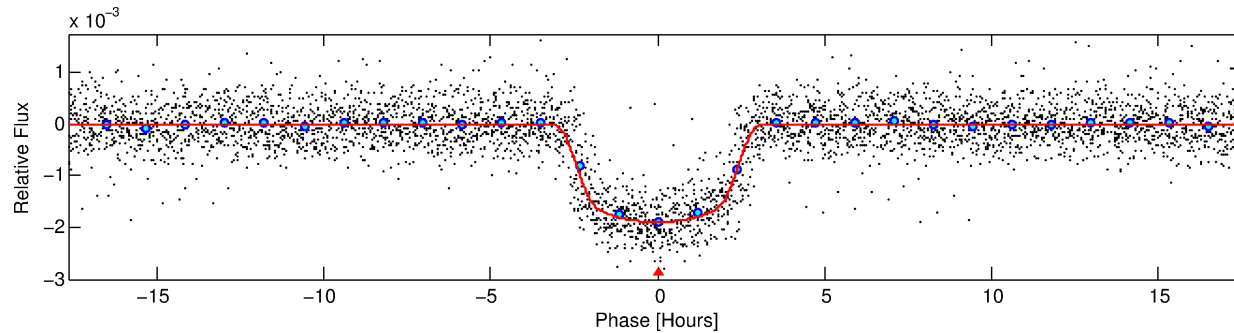
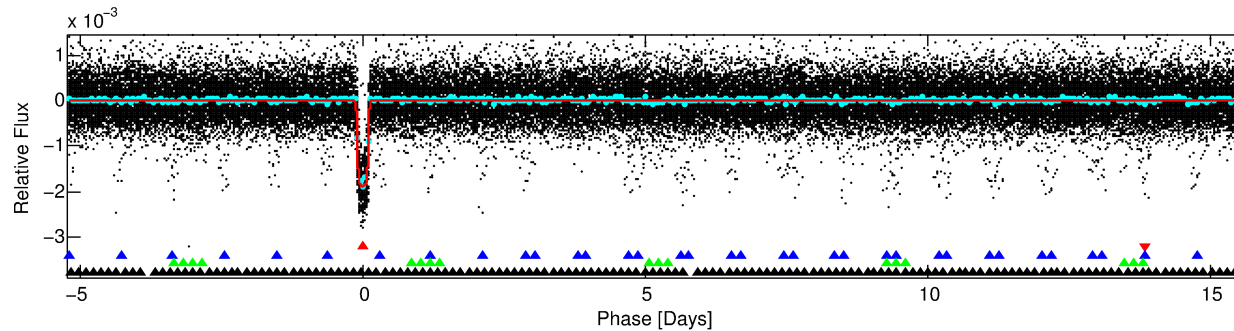
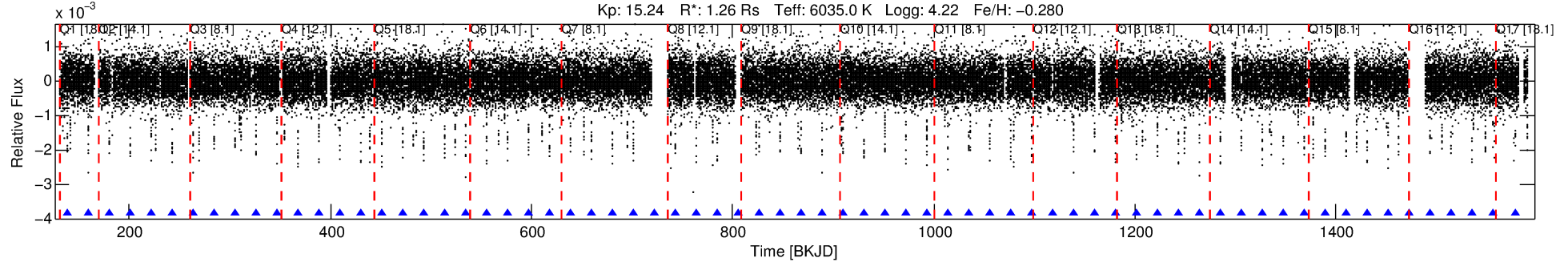
Ephemeris Match Information For 009347899-01

No Significant Match Found

# DV One-Page Summary

KIC: 9347899 Candidate: 1 of 4 Period: 20.860 d  
KOI: K00935.01 Name: Kepler-31b Corr: 0.936

Kp: 15.24 R\*: 1.26 Rs Teff: 6035.0 K Logg: 4.22 Fe/H: -0.280



## DV Fit Results:

Period = 20.86023 [0.00003] d  
Epoch = 138.2960 [0.0012] BKJD  
Rp/R\* = 0.0460 [0.0005]  
a/R\* = 15.54 [0.72]  
b = 0.88 [0.01]  
Seff = 87.92 [26.44]  
Teff = 781 [59] K  
Rp = 6.31 [1.26] Re  
a = 0.1462 [0.0270] AU  
Ag = 12.83 [7.14] [1.66σ]  
Teffp = 2285 [275] K [5.34σ]

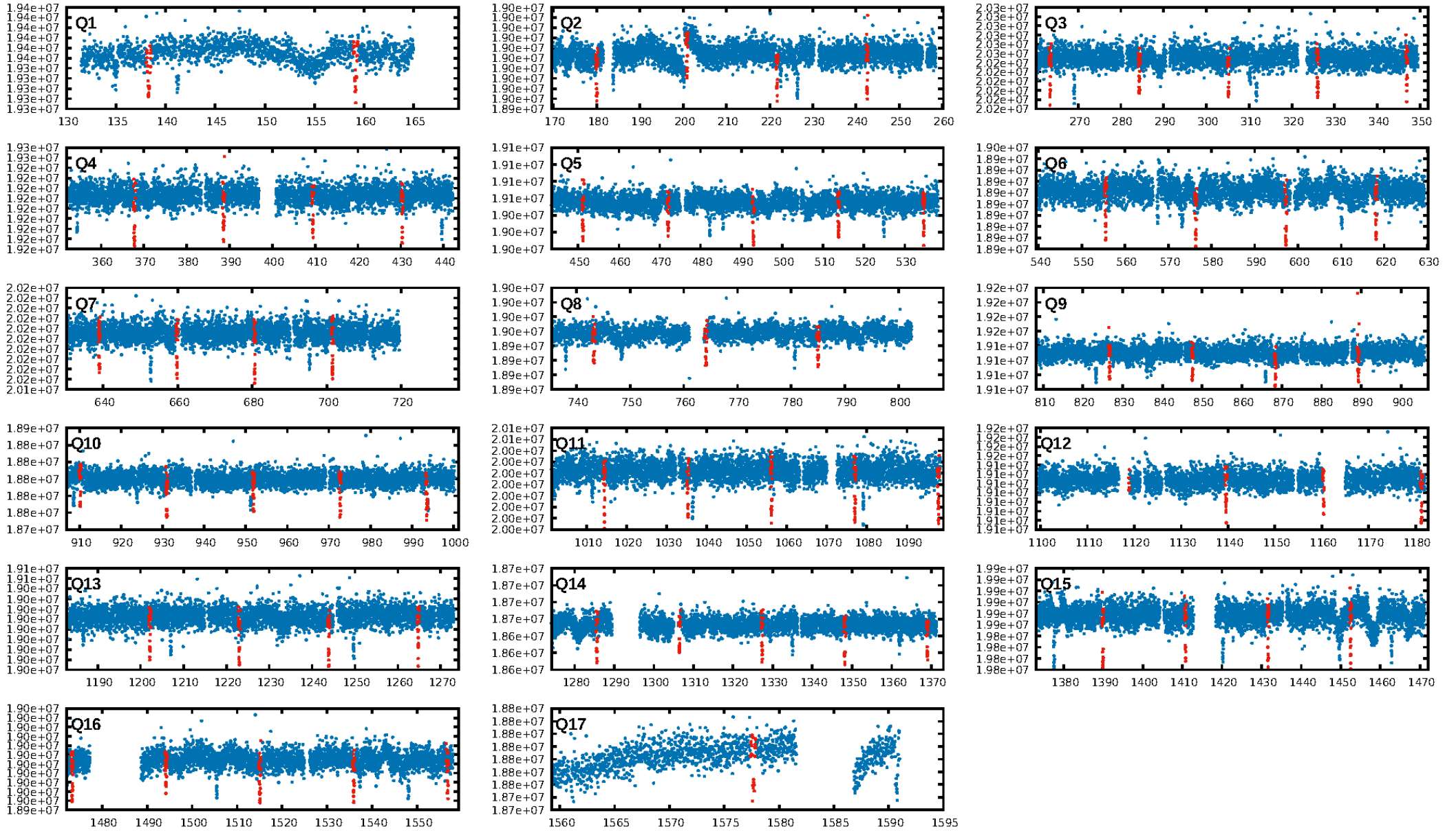
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [37.59σ]  
LongPeriod-sig: 100.0% [58.66σ]  
ModelChiSquare2-sig: 99.2%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 0.00e+00  
RollingBand-fgt: 1.00 [64/64]  
GhostDiagnostic-chr: 4.604  
Centroid-sig: 5.7%  
Centroid-so: 0.156 arcsec [1.23σ]  
OotOffset-rm: 0.007 arcsec [0.06σ]  
KicOffset-rm: 0.036 arcsec [0.40σ]  
OotOffset-st: 4/4/4/5 [17]  
KicOffset-st: 4/4/4/5 [17]  
DiffImageQuality-fgm: 1.00 [17/17]  
DiffImageOverlap-fno: 1.00 [17/17]

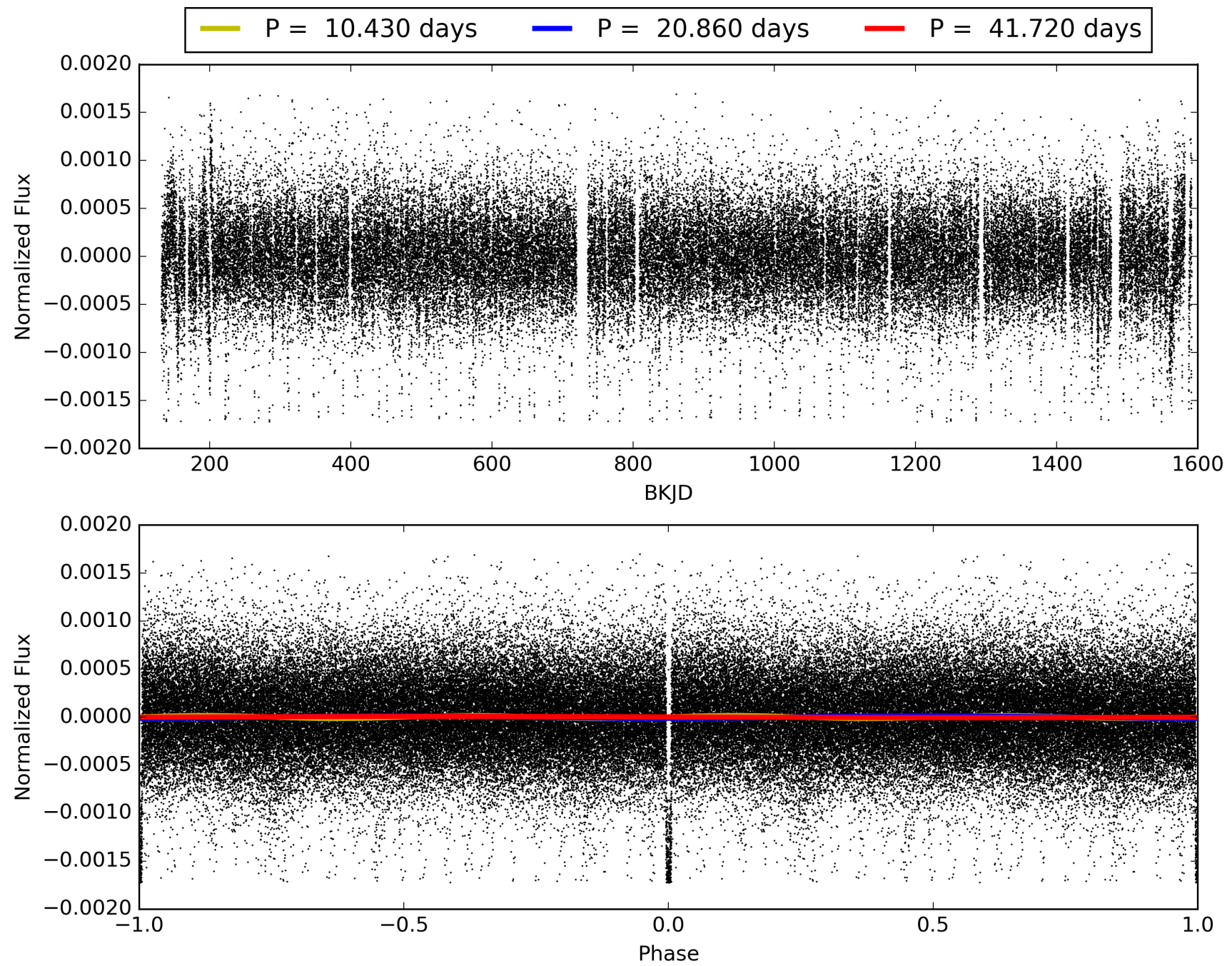
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 03:27:50 Z

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

# TCE 009347899-01, PDC Light Curves



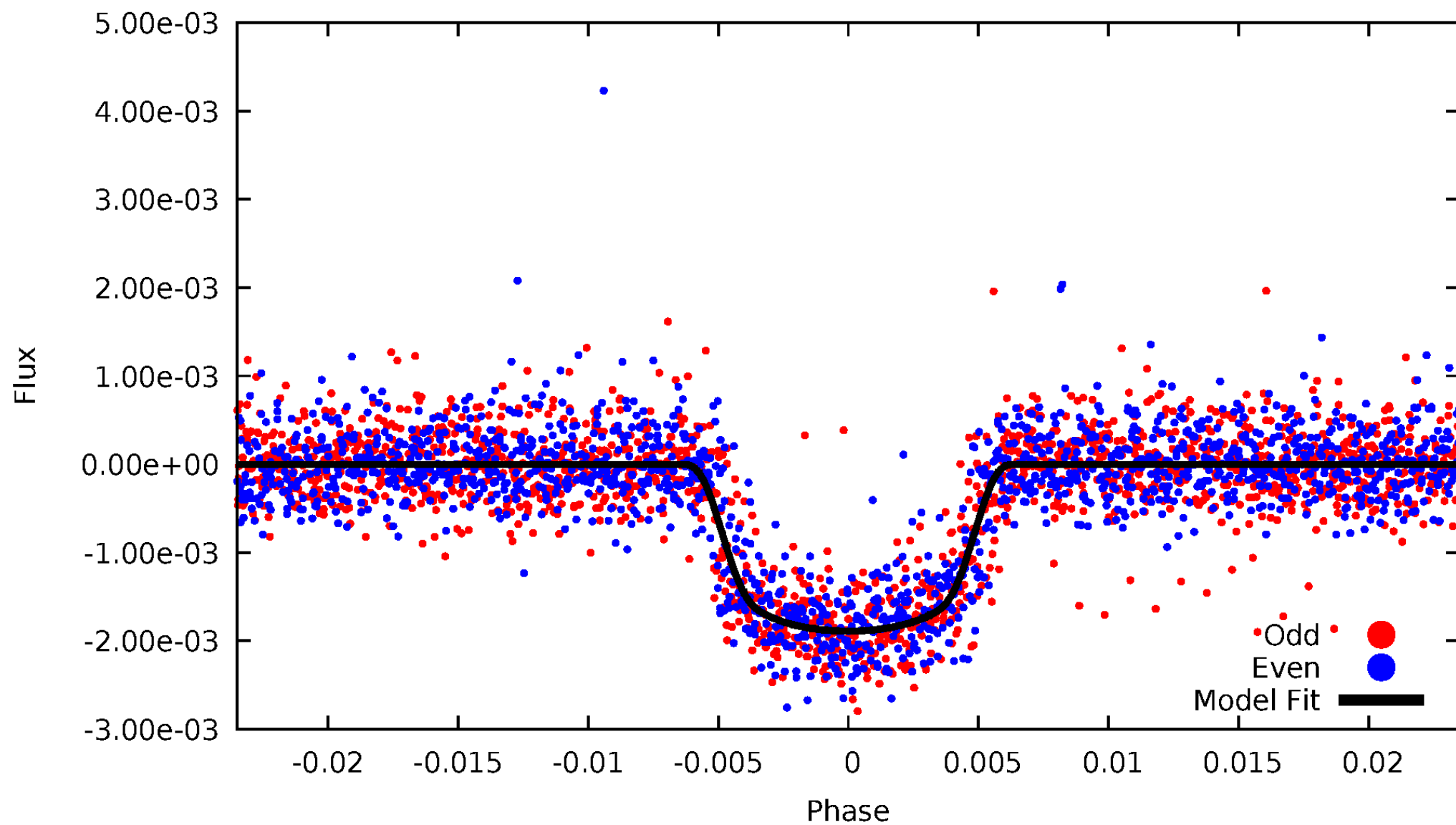
TCE 009347899-01





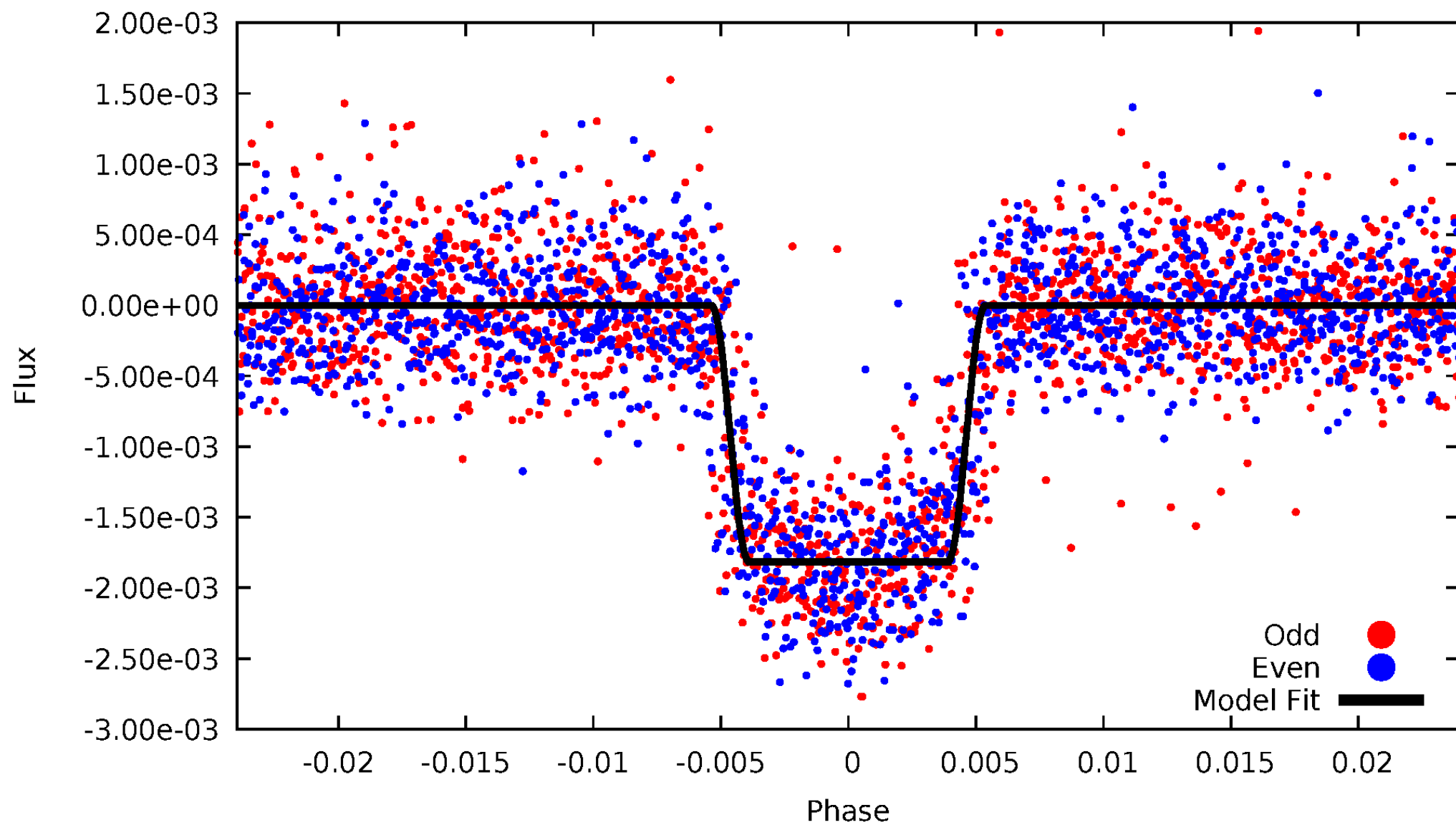
# DV Odd/Even

TCE 009347899-01



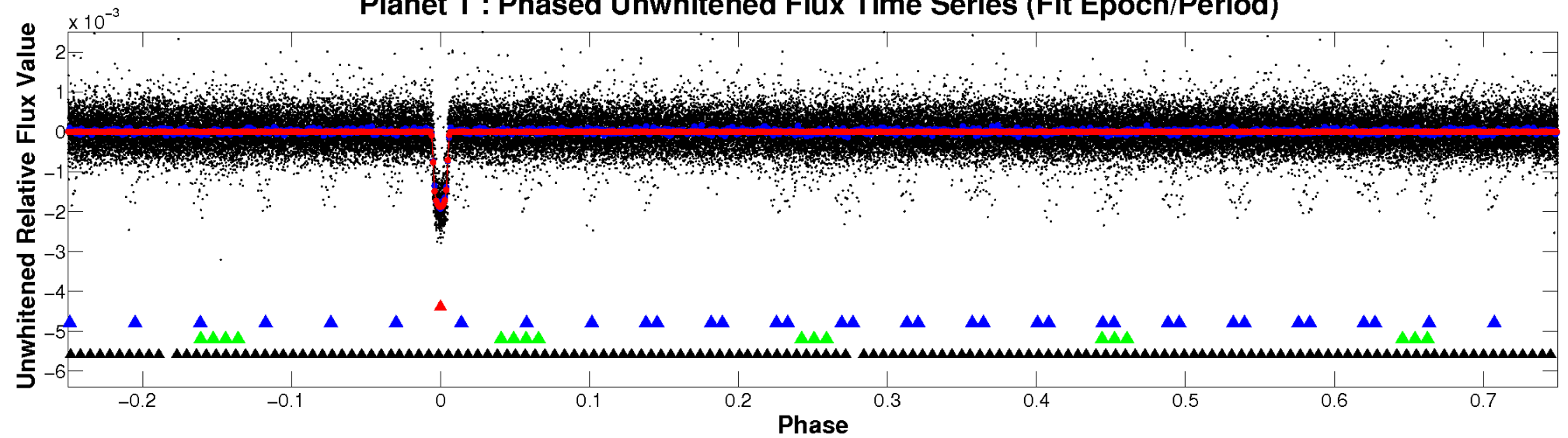
# ALT Odd/Even

TCE 009347899-01

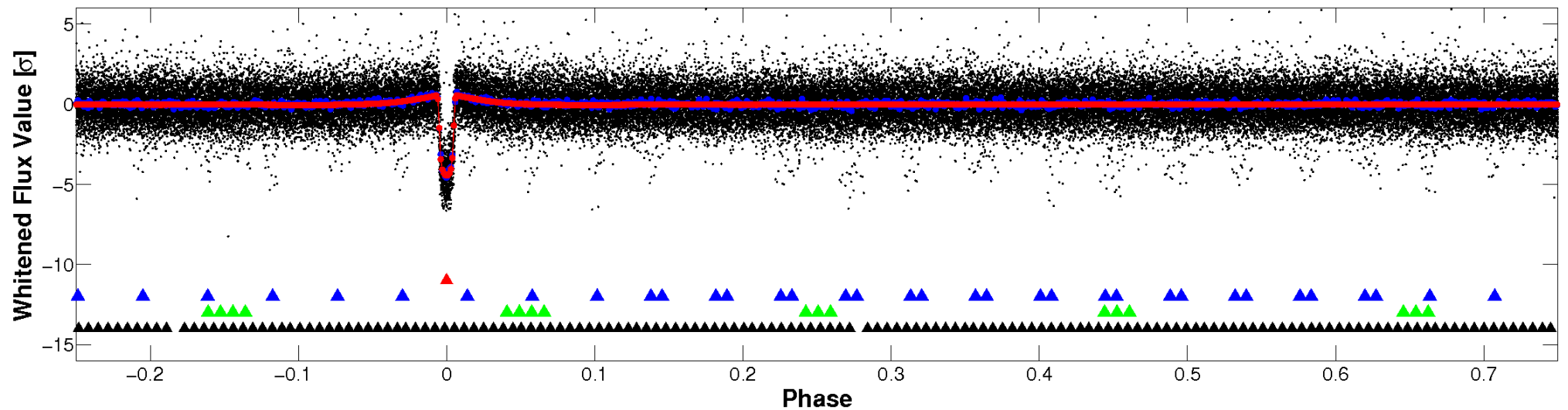


# Non-Whitened Vs. Whitened Light Curve

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

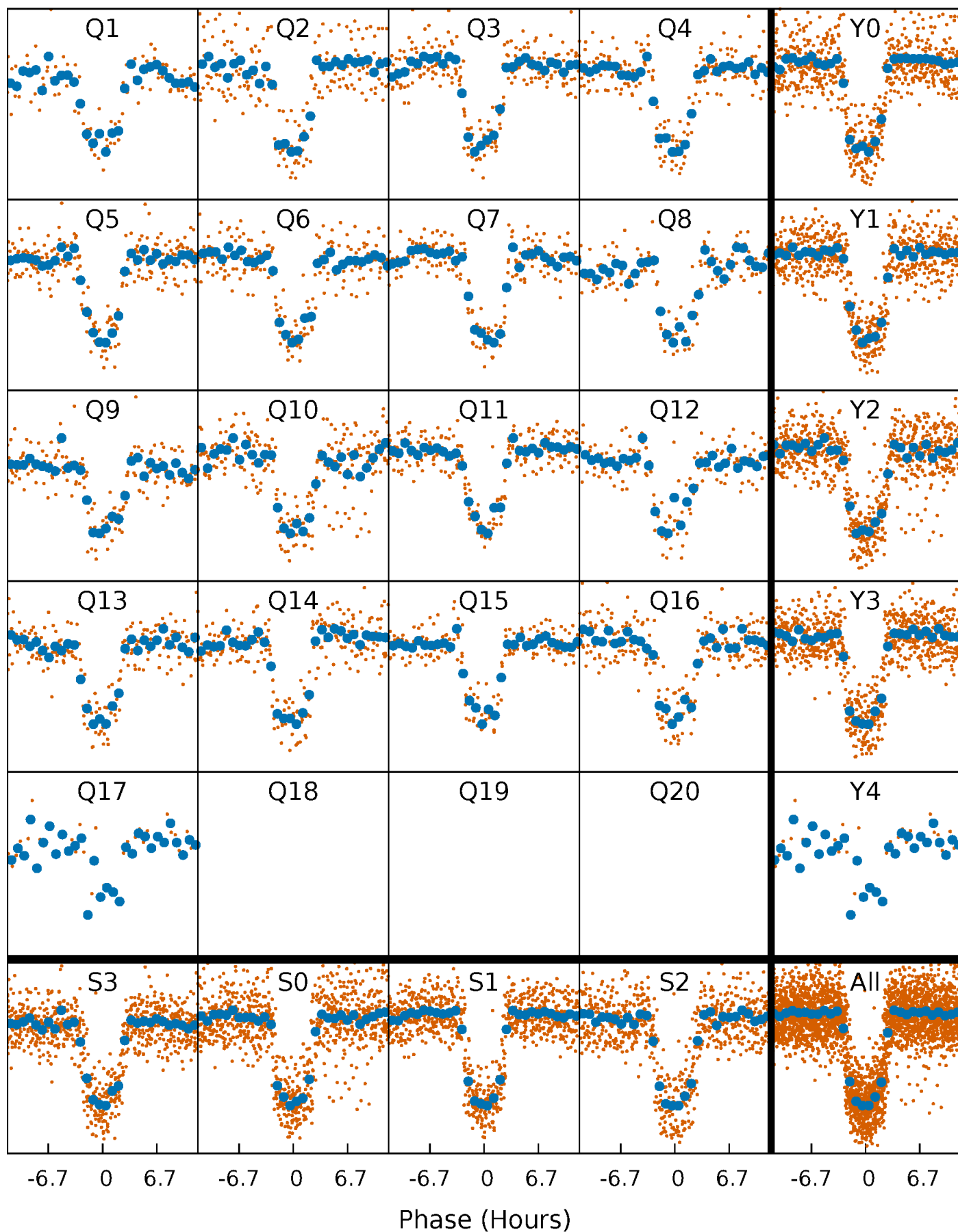


Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

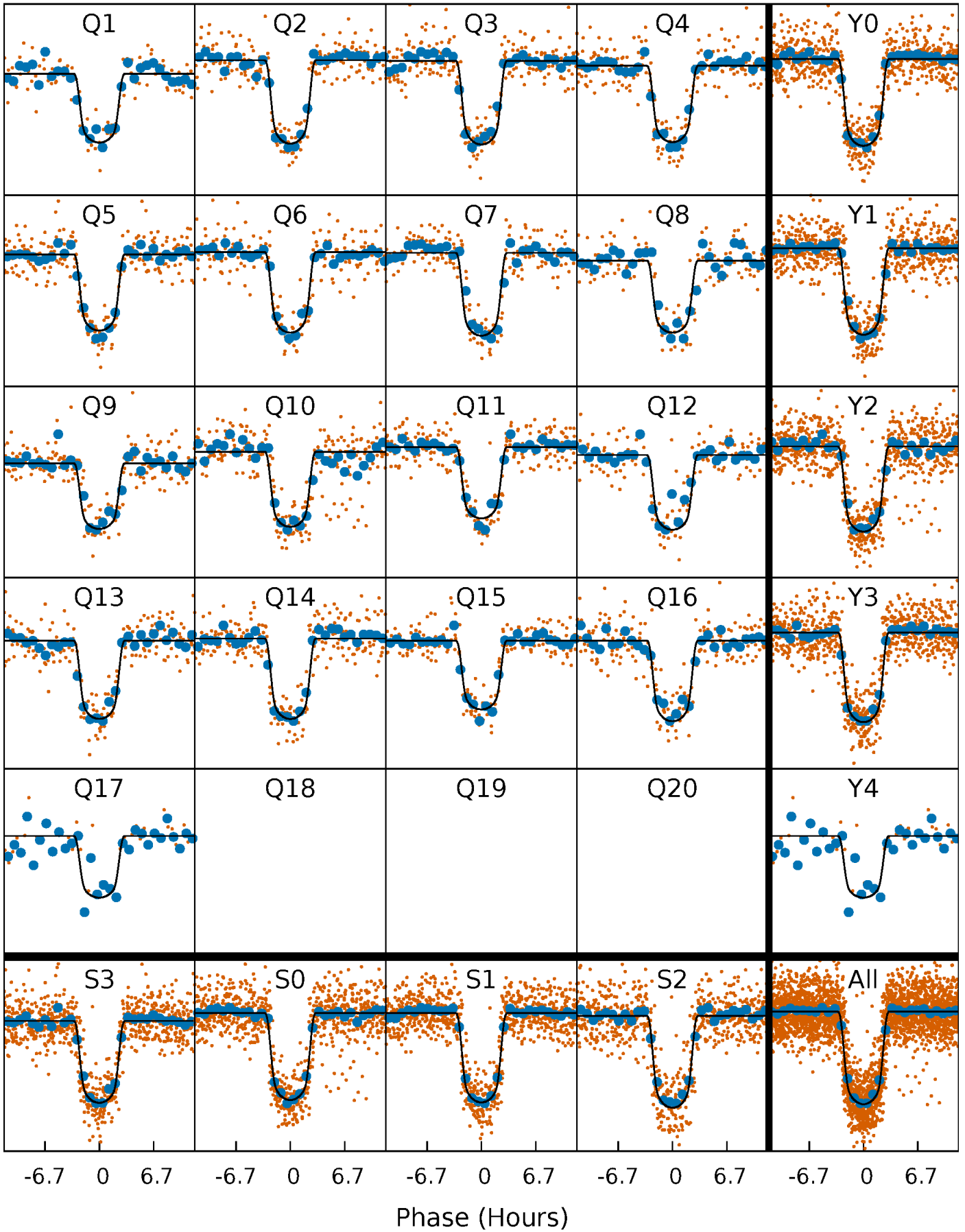
TCE 009347899-01   P= 20.860226 Days    $T_0=138.295962$  (BKJD)





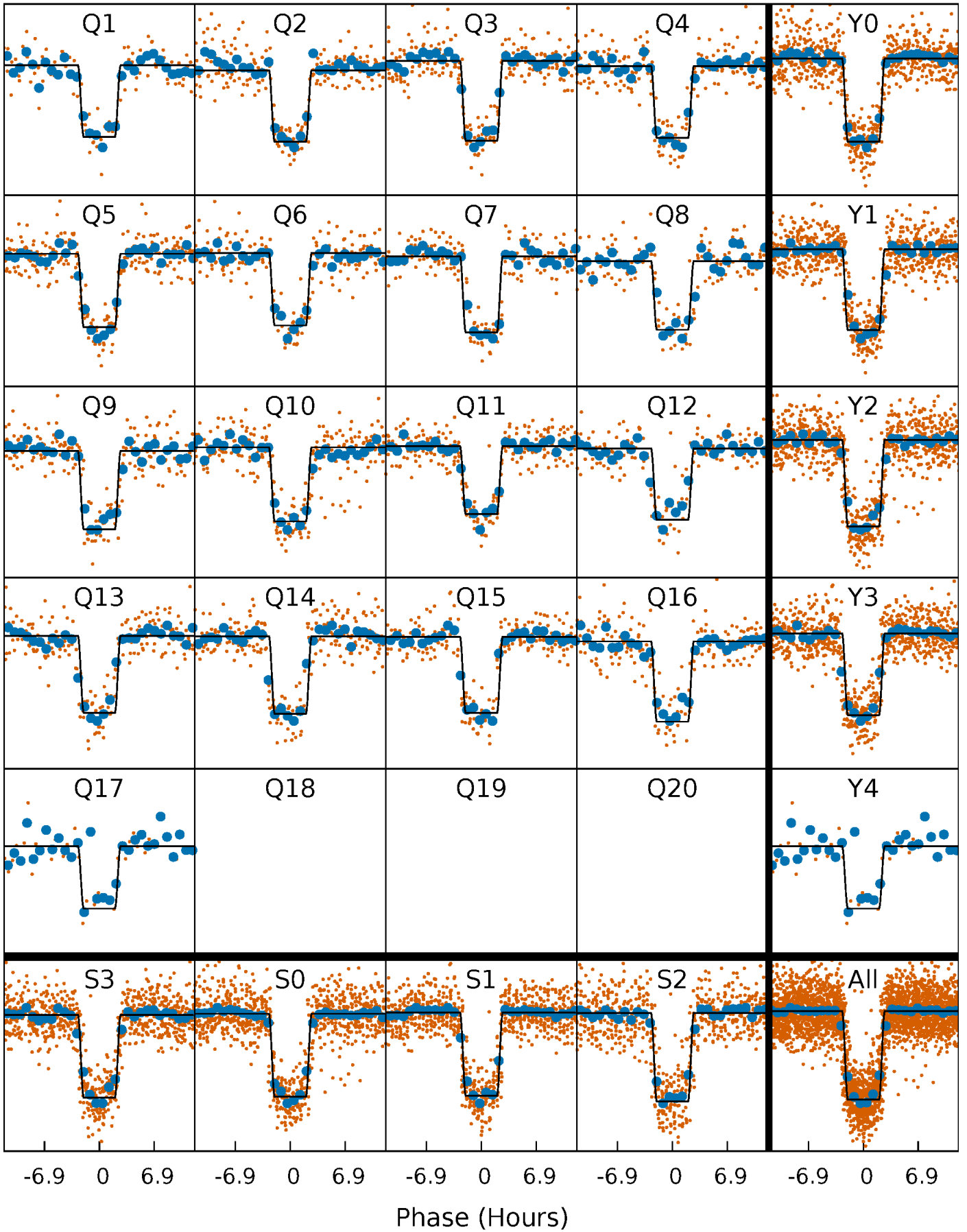
# DV Quarter-Phased Transit Curves

TCE 009347899-01   P= 20.860226 Days    $T_0=138.295962$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

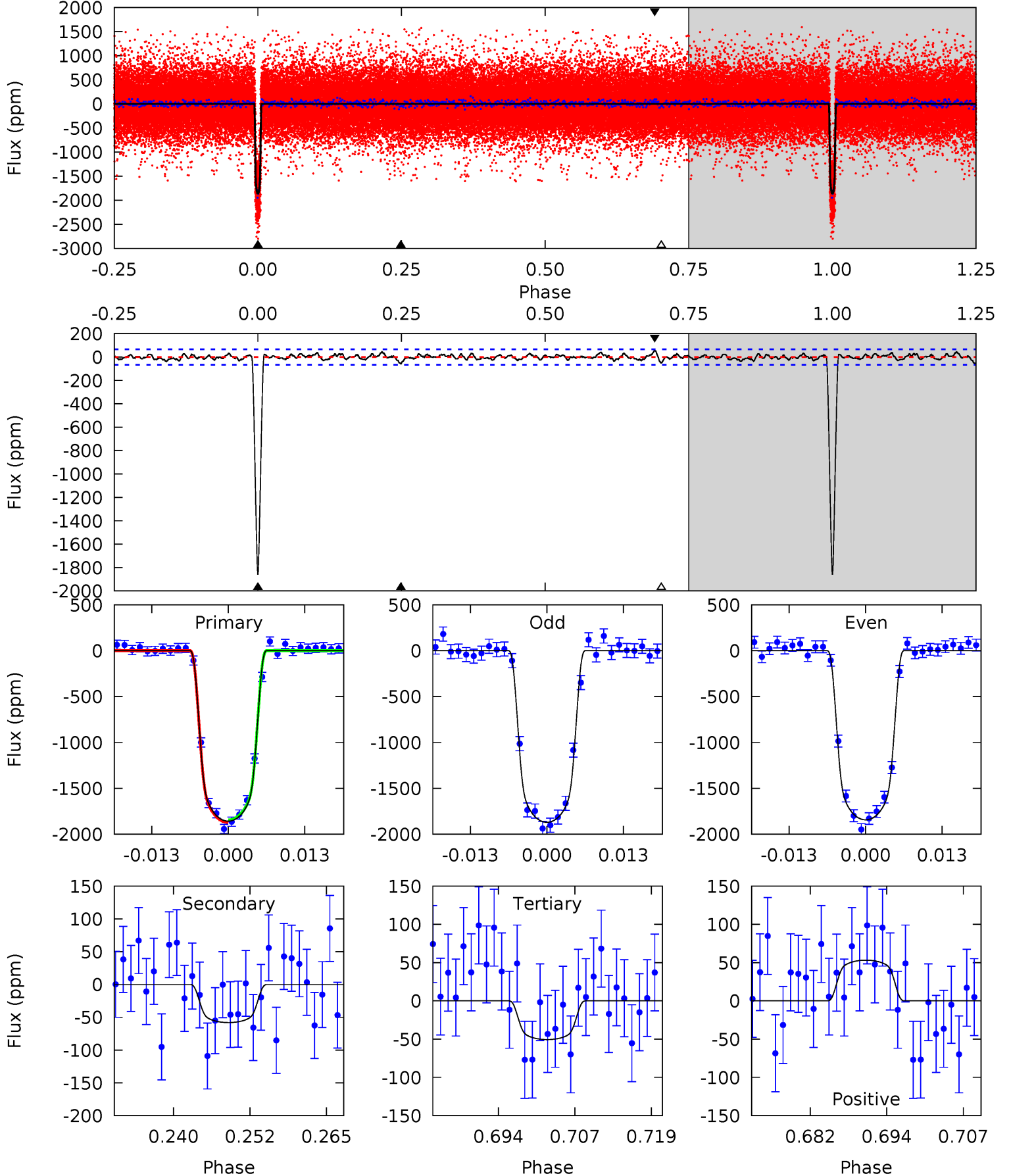
TCE 009347899-01 P= 20.860502 Days  $T_0=138.287721$  (BKJD)



# DV Model-Shift Uniqueness Test

009347899-01, P = 20.860226 Days, E = 117.435736 Days

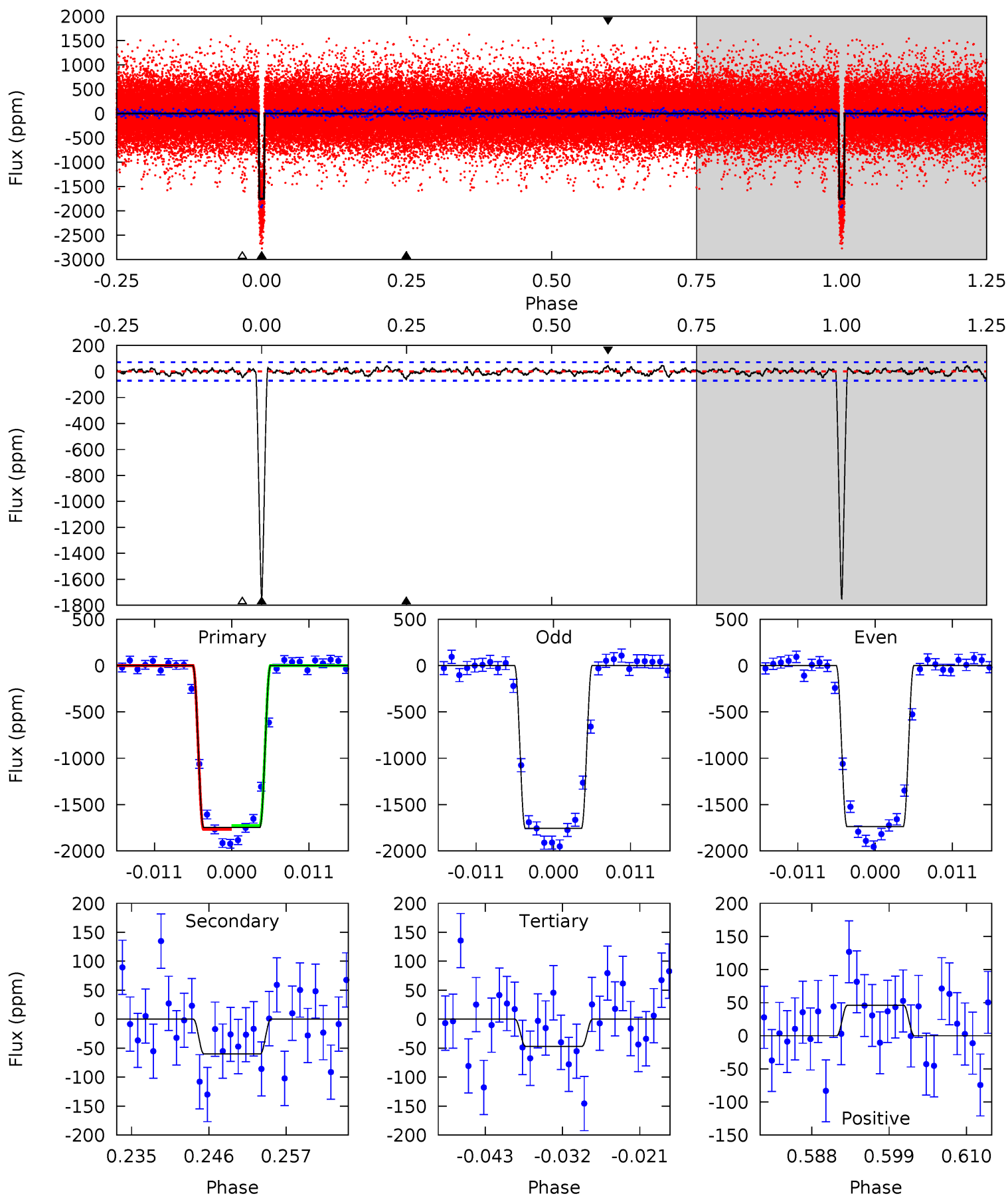
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
141.4	4.42	3.85	4.05	4.98	2.49	1.21	137.6	137.4	0.57	0.37	1.03	0.99	0.03	1.00



# Alt Model-Shift Uniqueness Test

009347899-01,  $P = 20.860502$  Days,  $E = 117.427219$  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
122.8	4.22	3.29	3.24	5.01	2.55	1.09	119.5	119.6	0.93	0.99	0.65	1.00	0.03	1.43





### Stellar Parameters For KIC 009347899

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6035^{+120}_{-120}$	$4.220^{+0.168}_{-0.112}$	$-0.280^{+0.150}_{-0.150}$	$1.257^{+0.187}_{-0.250}$	$0.958^{+0.076}_{-0.068}$	$0.678^{+0.545}_{-0.220}$
	+2%/-2%	+4%/-3%	+54%/-54%	+15%/-20%	+8%/-7%	+80%/-32%
Source	SPE58	SPE58	SPE58	DSEP		

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

### Secondary Eclipse Parameters for KIC 009347899-01 / KOI 0935.01

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	$-58 \pm 13$	$6.33^{+0.56}_{-0.72}$	$1092^{+51}_{-63}$	$3088^{+106}_{-116}$	$17^{+6}_{-5}$
Alt.	$-60 \pm 14$	$5.84^{+0.57}_{-0.59}$	$1089^{+51}_{-58}$	$3168^{+113}_{-135}$	$21^{+7}_{-6}$

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

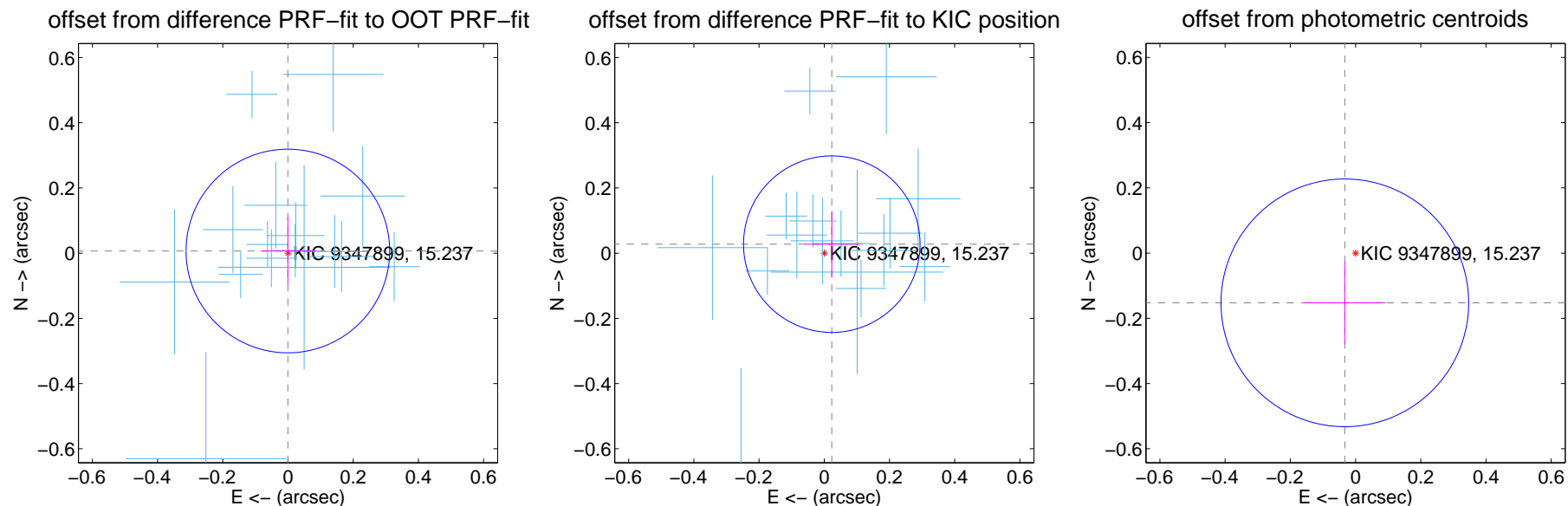
## DV Centroid Data

Supplemental centroid analysis for 009347899-01. Kepler magnitude: 15.24. Transit SNR 98.17

There are 17 quarters with good PRF difference image offsets

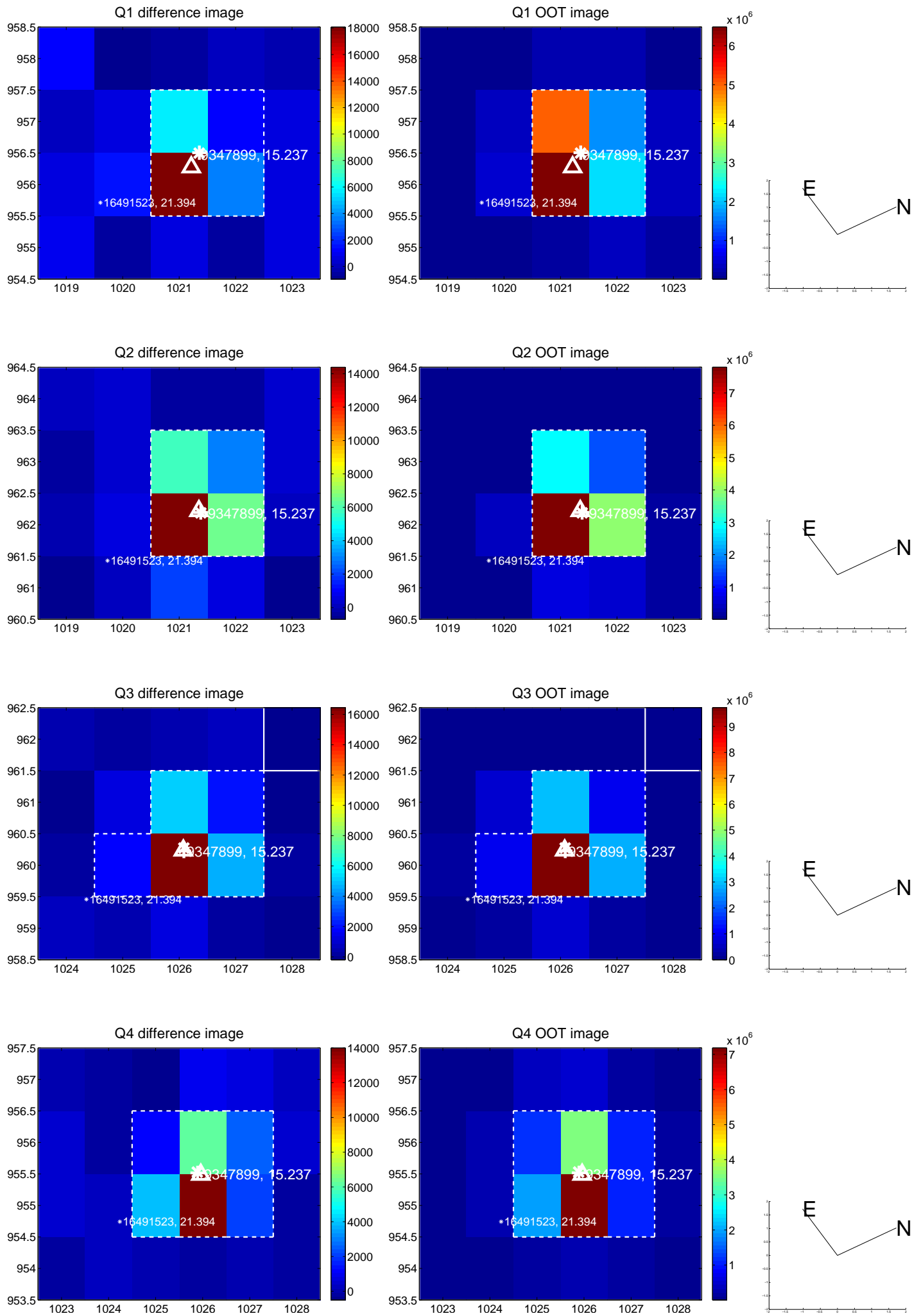
The direct PRF centroid is offset from the target star catalog position by about 0.05 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.007 \pm 0.104$	0.06	$0.000 \pm 0.083$	$0.007 \pm 0.104$
PRF-fit source offset from KIC position	$0.036 \pm 0.090$	0.40	$-0.023 \pm 0.083$	$0.028 \pm 0.102$
photometric centroid source offset	$0.16 \pm 0.13$	1.23	$0.03 \pm 0.12$	$-0.15 \pm 0.13$

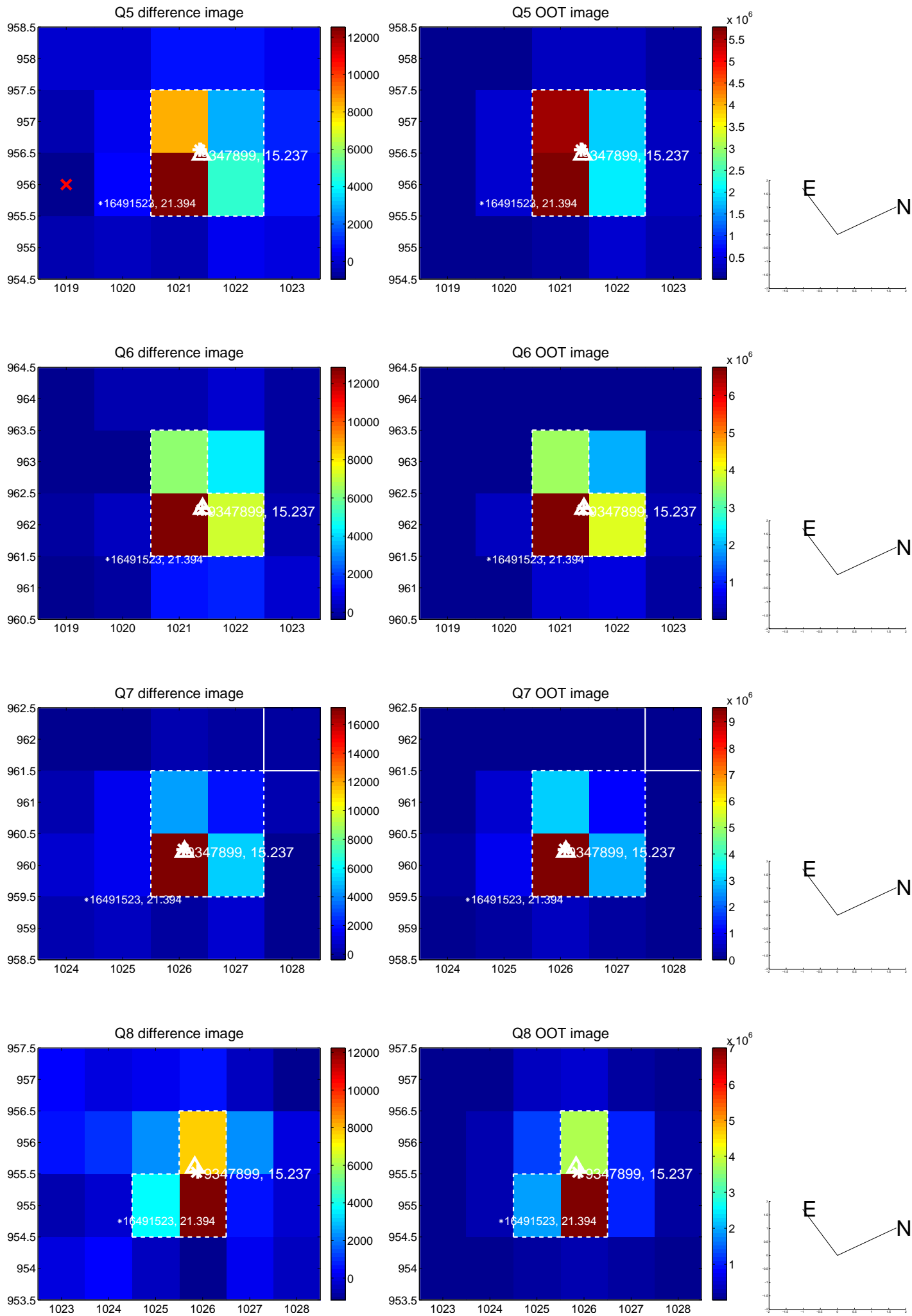


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

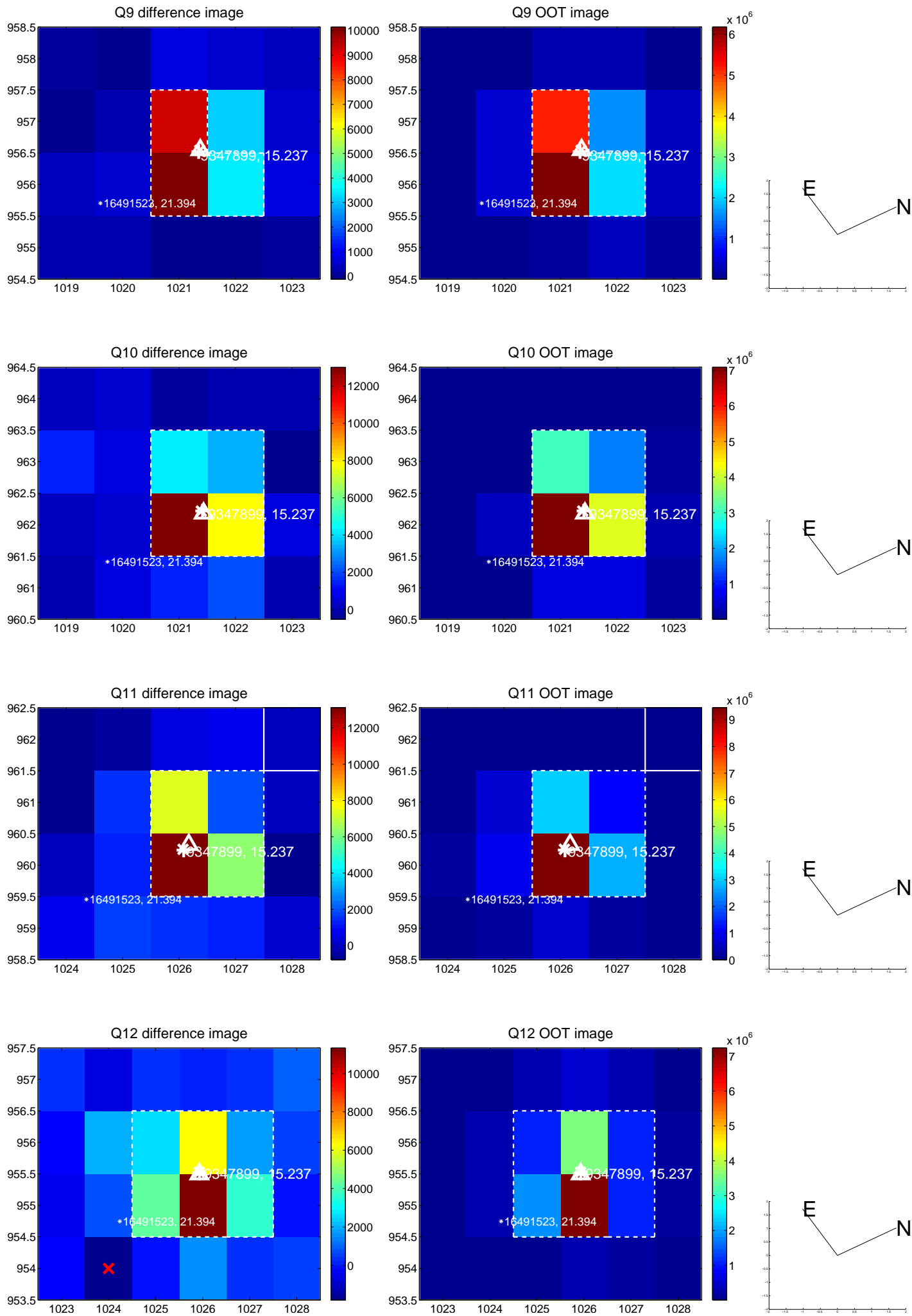


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

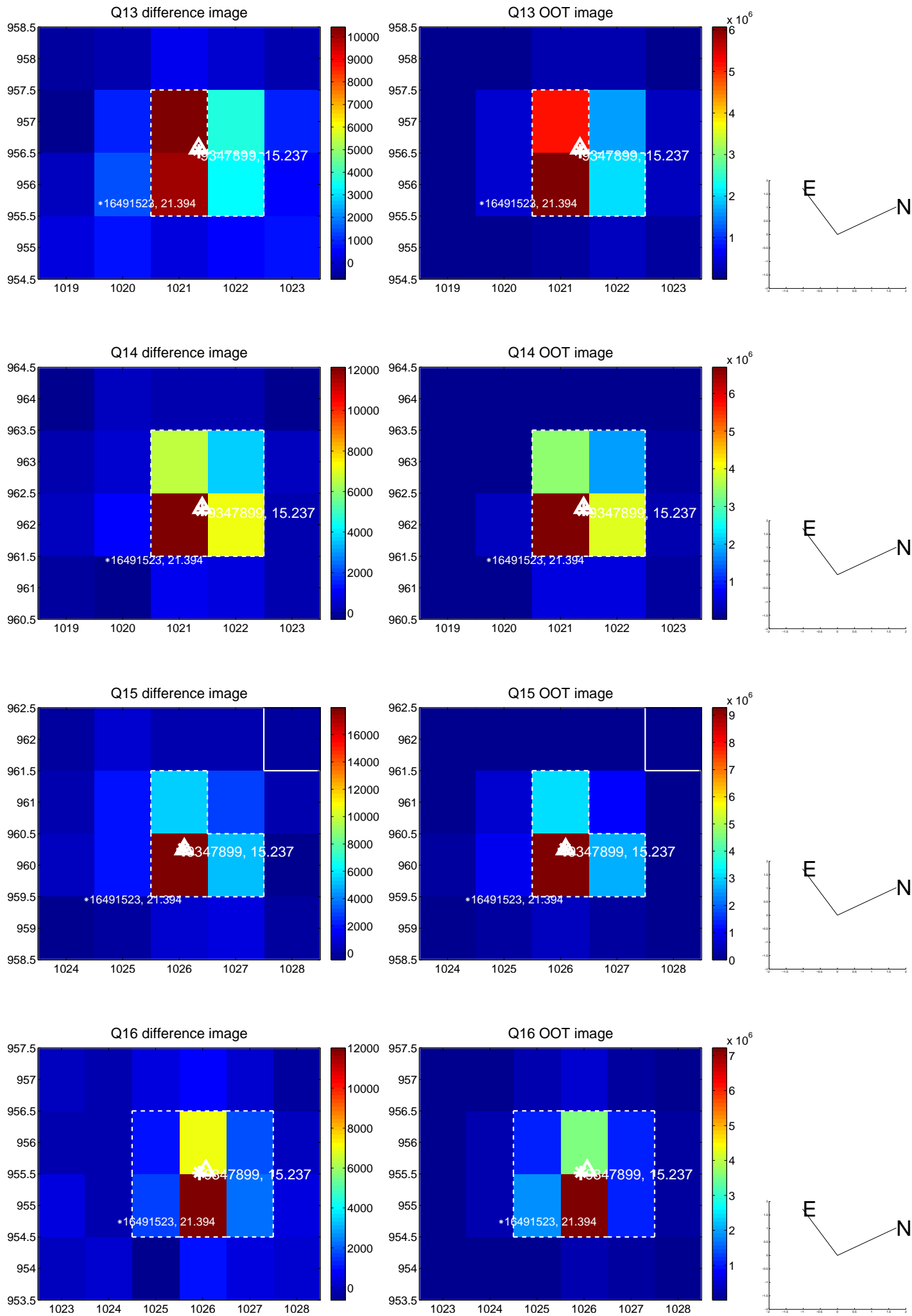




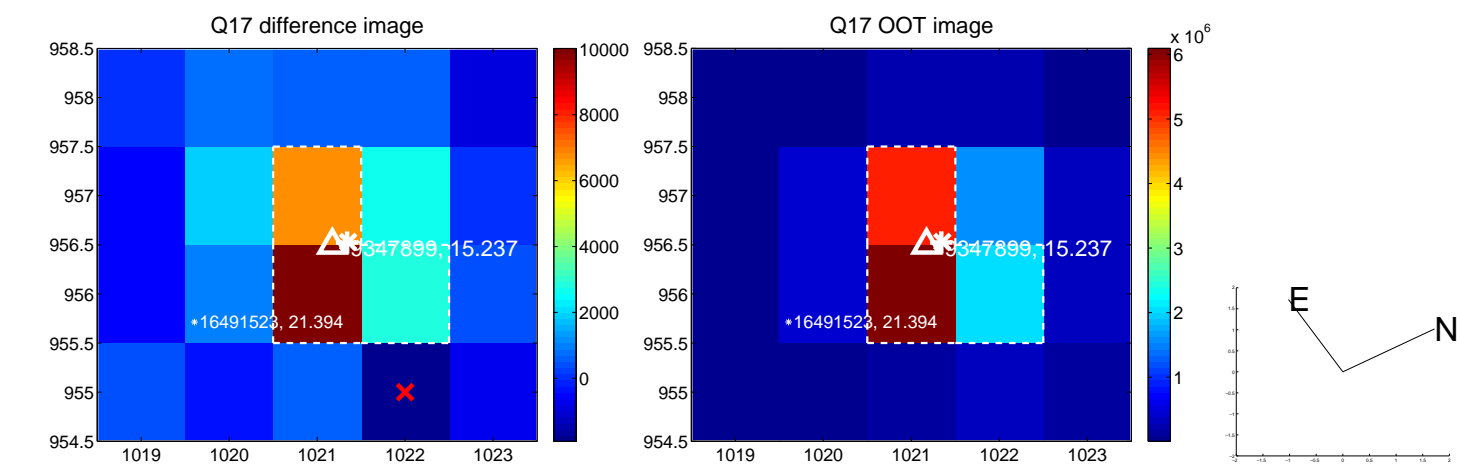
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



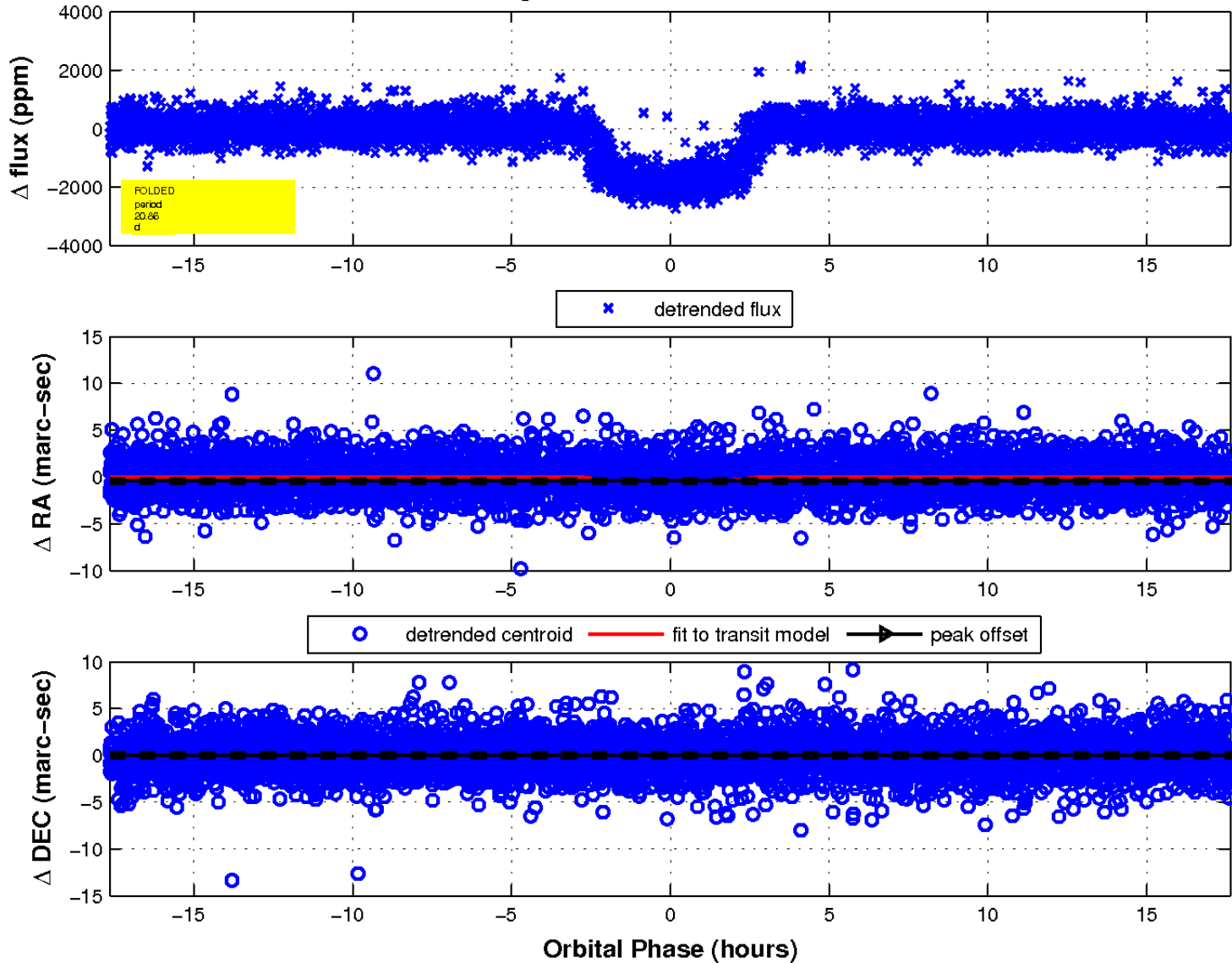
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

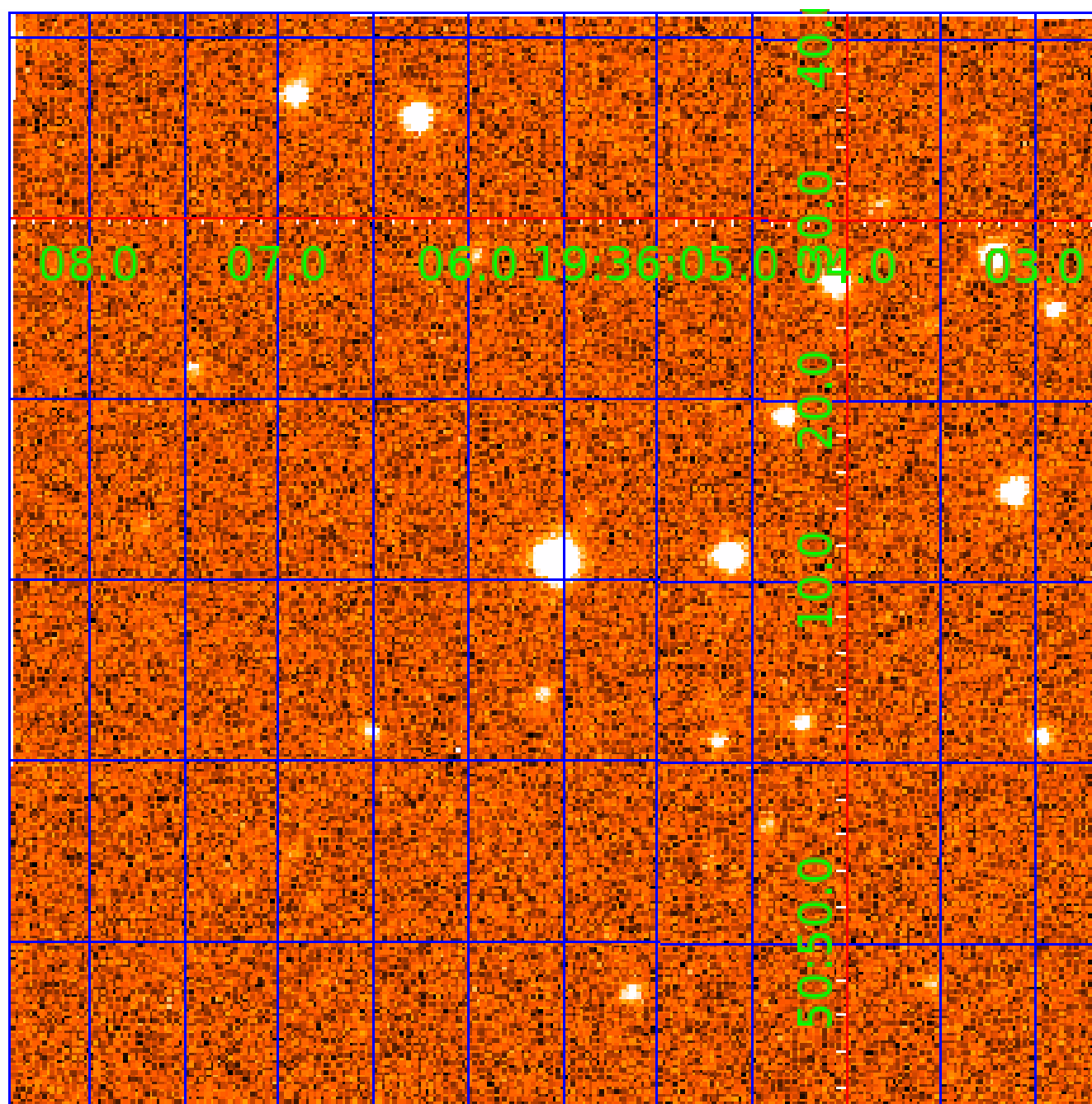


fluxWeightedCentroids, Planet 1 of 4



# UKIRT Image

Declination





# KIC 009347899

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009347899-01	OBS	0935.01	20.860226	138.295962	1889.7	5.882	94.9	98.2	1.26	6035	6.31	87.92
009347899-02	OBS	0935.02	42.634213	141.173759	1700.0	6.691	62.3	64.1	1.26	6035	5.79	33.90
009347899-03	OBS	0935.03	87.647786	134.939625	1005.9	9.048	28.8	30.4	1.26	6035	4.32	12.97
009347899-04	OBS	0935.04	9.617237	132.864070	124.8	4.116	7.8	8.8	1.26	6035	1.65	246.85

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009347899-01	OBS	PC	1.00	0	0	0	0	NO_COMMENT
009347899-02	OBS	PC	1.00	0	0	0	0	NO_COMMENT
009347899-03	OBS	PC	0.97	0	0	0	0	NO_COMMENT
009347899-04	OBS	PC	0.97	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.

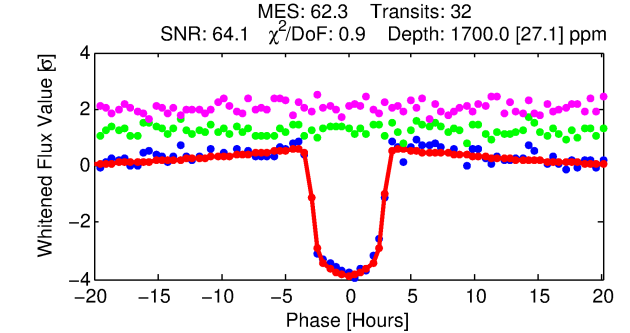
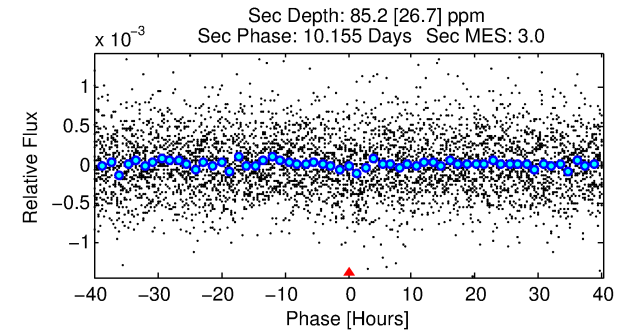
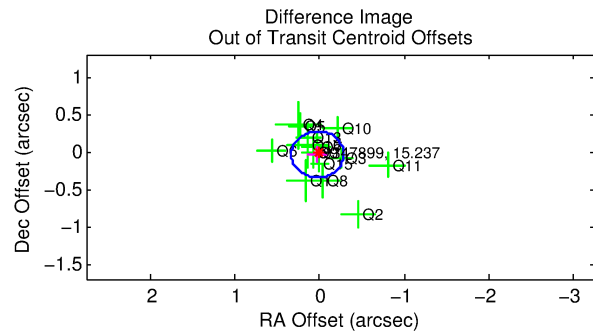
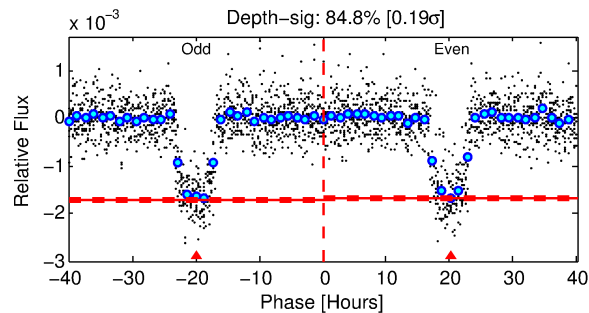
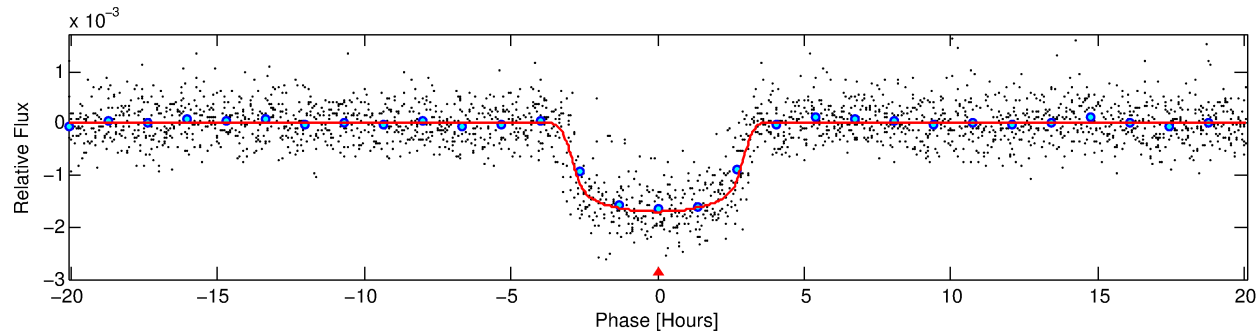
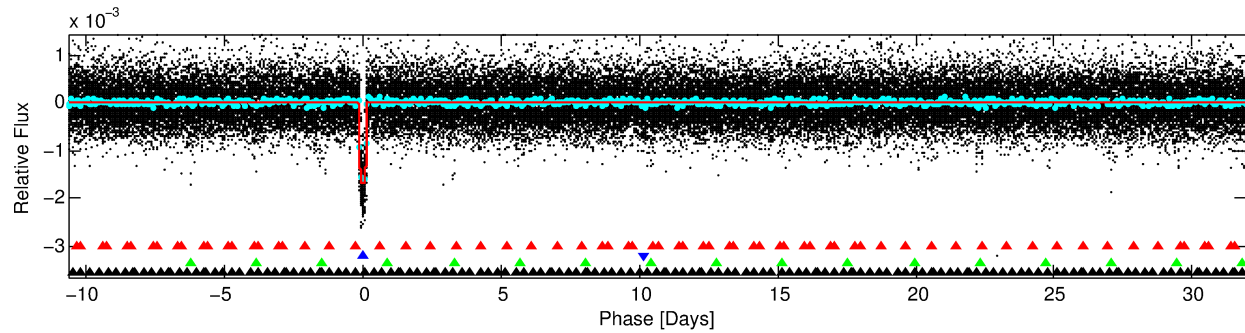
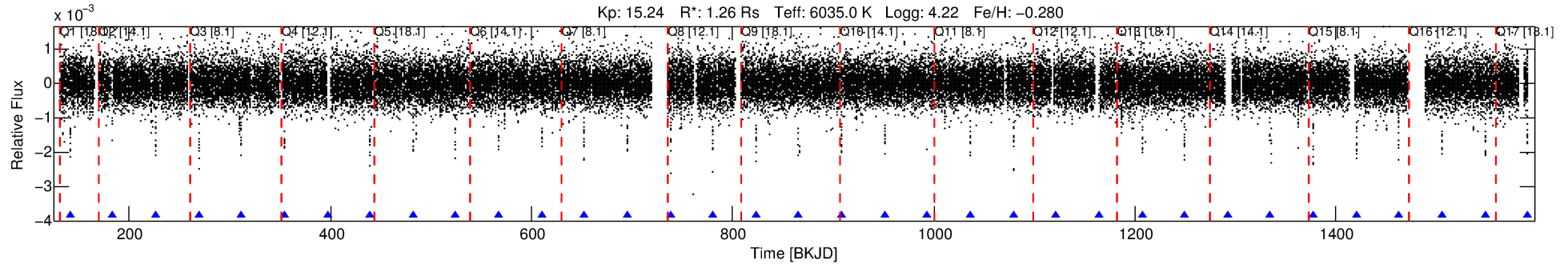
## Ephemeris Match Information For 009347899-02

No Significant Match Found

# DV One-Page Summary

KIC: 9347899 Candidate: 2 of 4 Period: 42.634 d  
KOI: K00935.02 Name: Kepler-31c Corr: 0.961

Kp: 15.24 R\*: 1.26 Rs Teff: 6035.0 K Logg: 4.22 Fe/H: -0.280



## DV Fit Results:

Period = 42.63421 [0.00010] d  
Epoch = 141.1738 [0.0020] BKJD  
Rp/R\* = 0.0422 [0.0010]  
a/R\* = 31.35 [3.42]  
b = 0.82 [0.04]  
Seff = 33.90 [10.19]  
Teq = 615 [46] K  
Rp = 5.79 [1.16] Re  
a = 0.2354 [0.0435] AU  
Ag = 77.50 [33.29] [2.30σ]  
Teffp = 2822 [230] K [9.39σ]

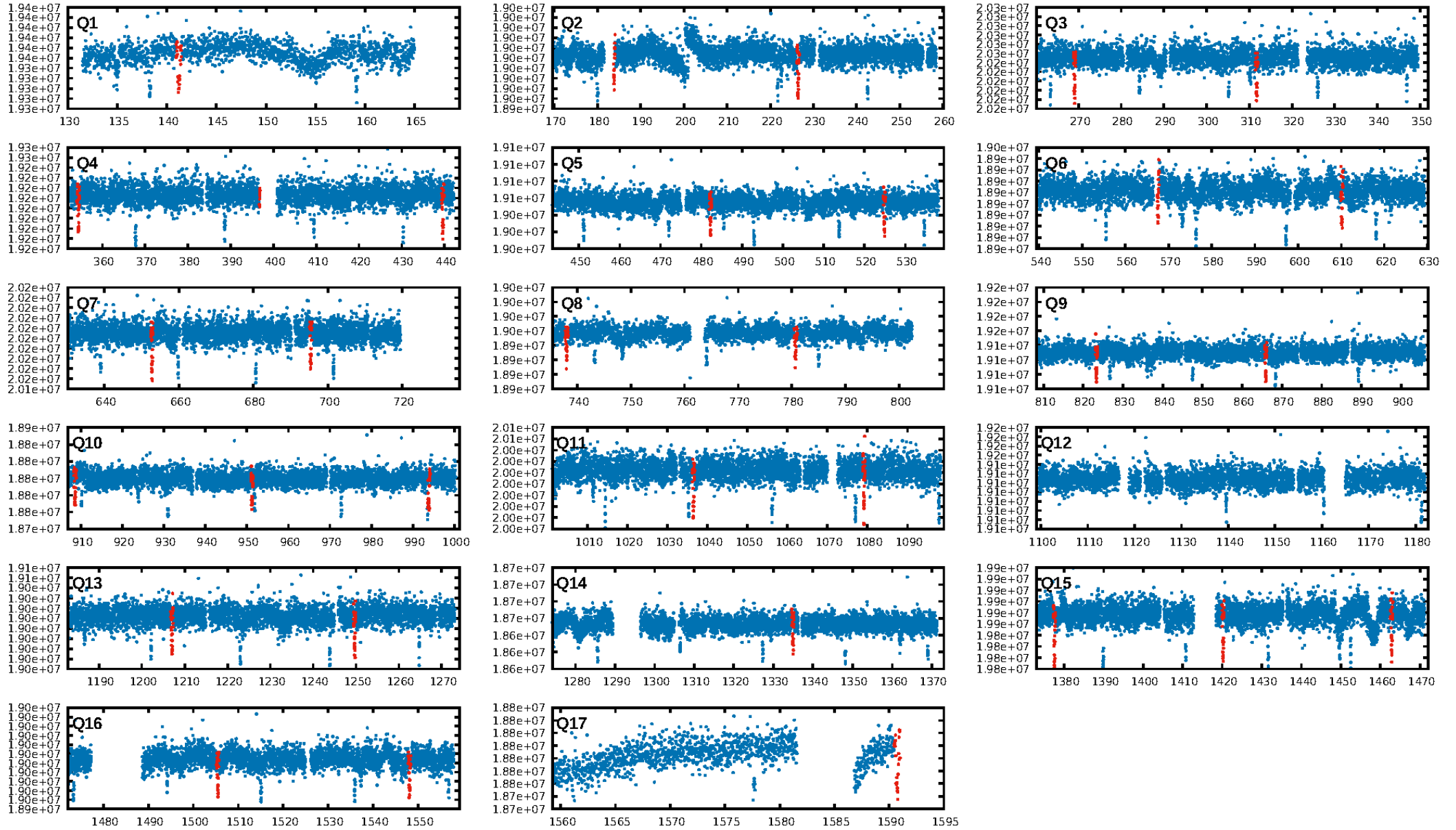
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [58.66σ]  
LongPeriod-sig: 100.0% [96.00σ]  
ModelChiSquare2-sig: 27.5%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 0.00e+00  
RollingBand-fgt: 1.00 [30/30]  
GhostDiagnostic-chr: 7.146  
Centroid-sig: 2.9%  
Centroid-so: 0.386 arcsec [2.13σ]  
OotOffset-rm: 0.044 arcsec [0.42σ]  
KicOffset-rm: 0.056 arcsec [0.49σ]  
OotOffset-st: 3/4/3/4 [14]  
KicOffset-st: 3/4/3/4 [14]  
DiffImageQuality-fgm: 1.00 [14/14]  
DiffImageOverlap-fno: 1.00 [14/14]

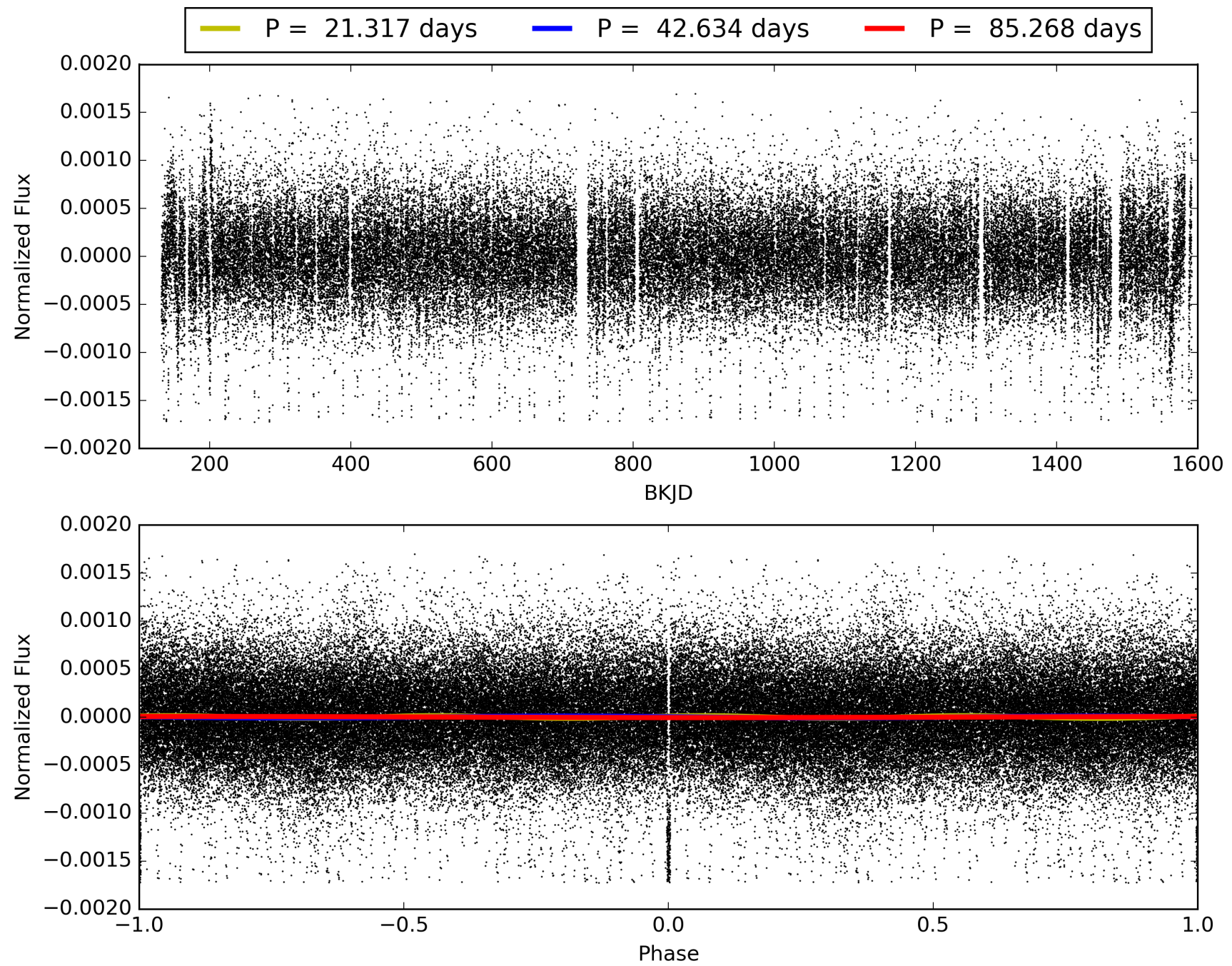
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 03:27:56 Z

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

# TCE 009347899-02, PDC Light Curves

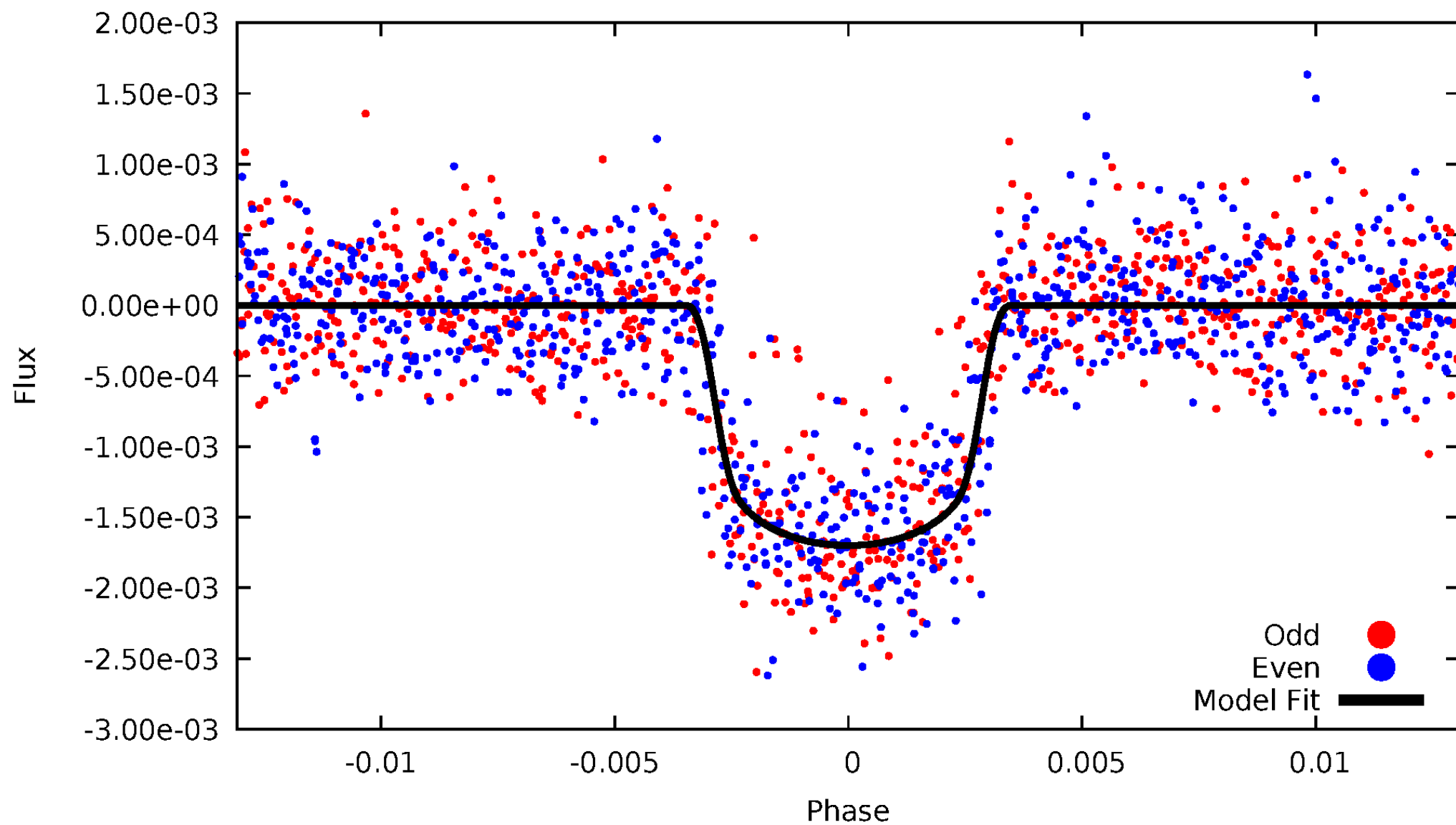


TCE 009347899-02



# DV Odd/Even

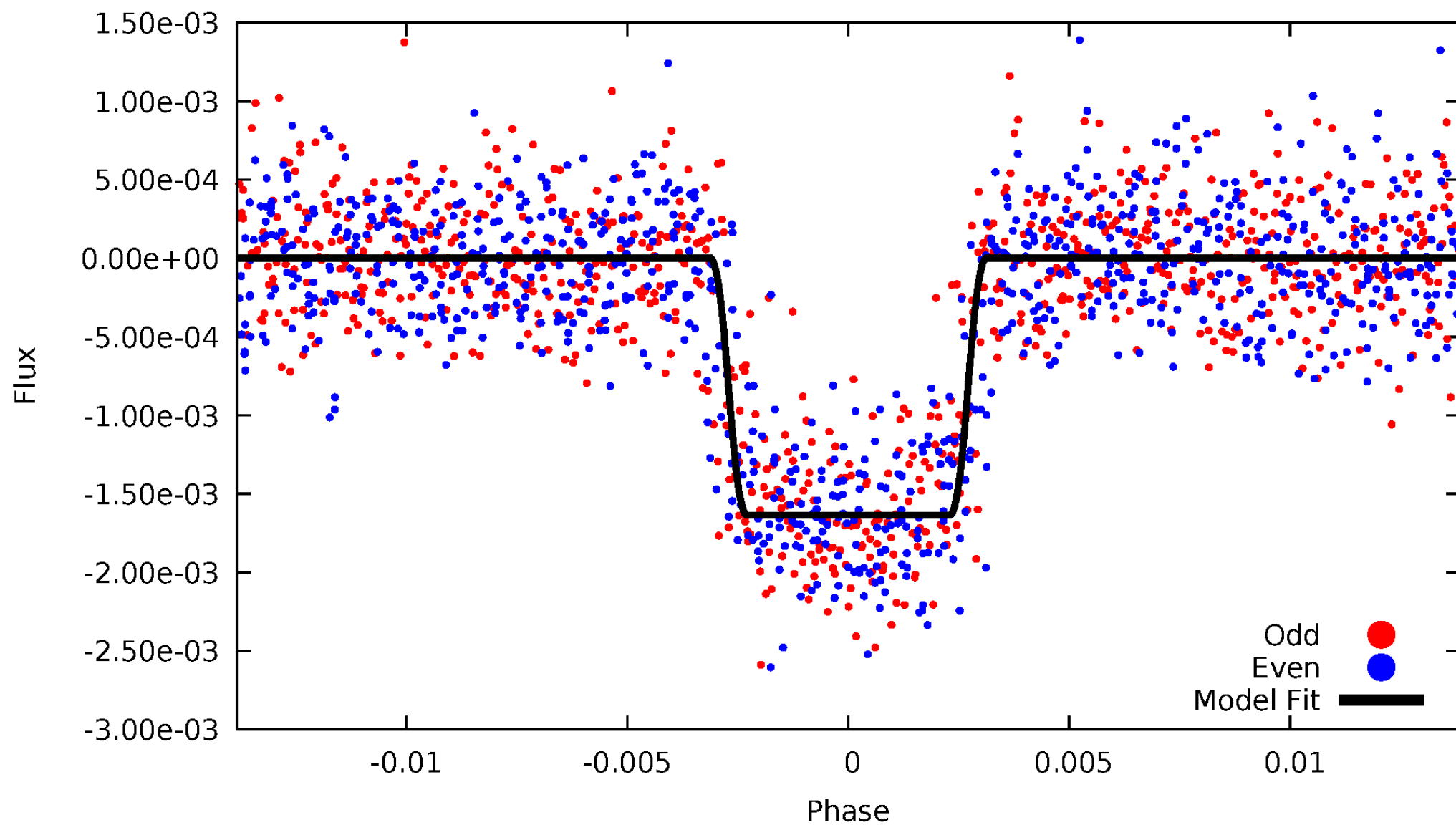
TCE 009347899-02





# ALT Odd/Even

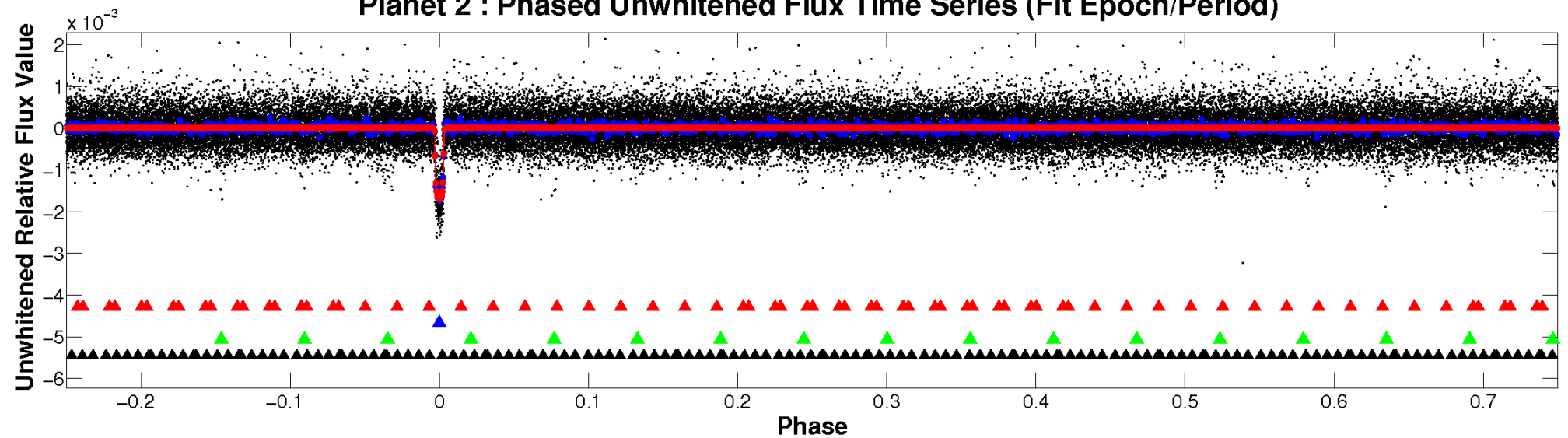
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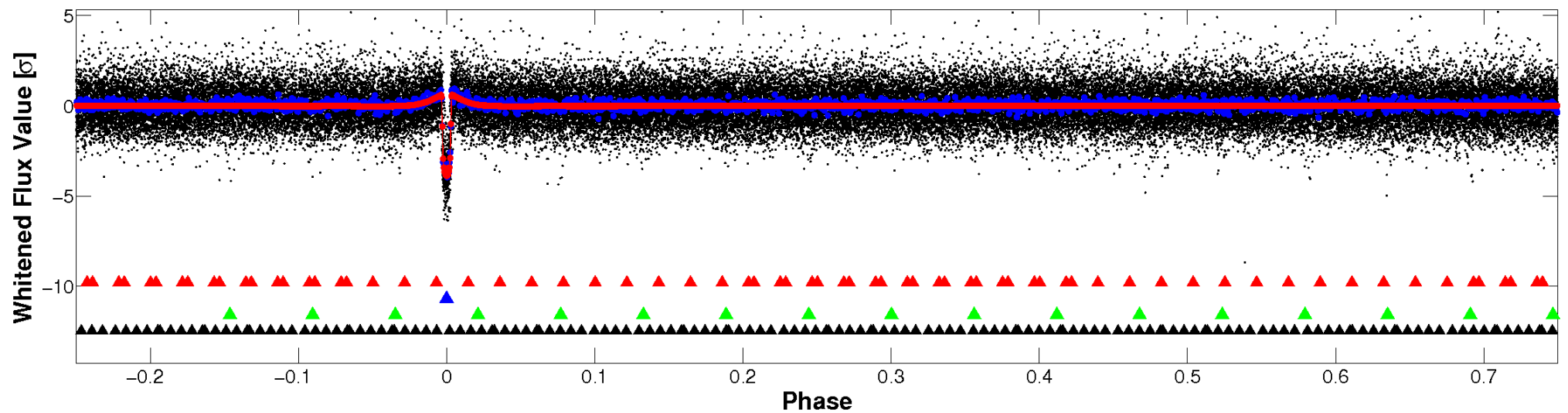


# Non-Whitened Vs. Whitened Light Curve

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

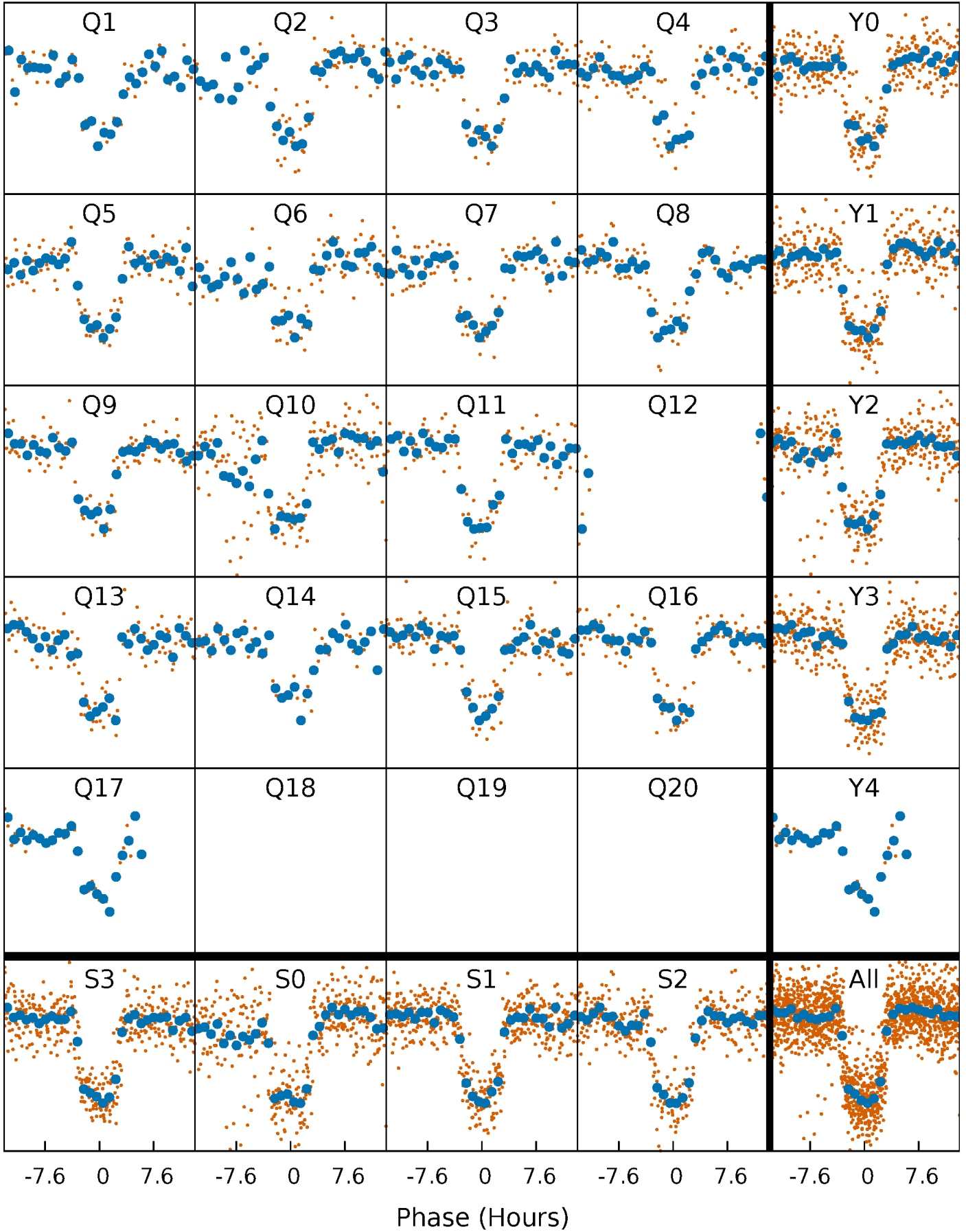


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



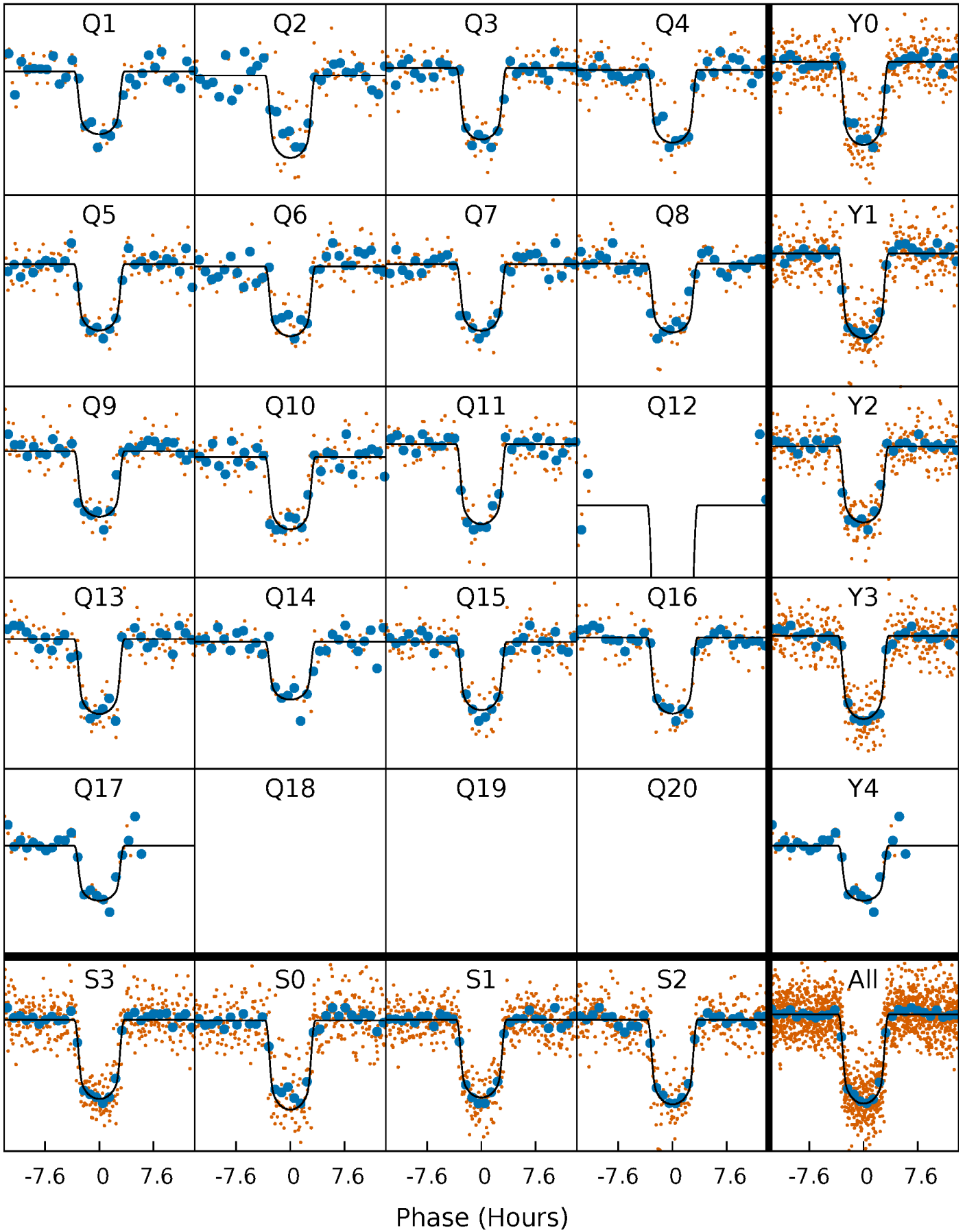
# PDC Quarter-Phased Transit Curves

TCE 009347899-02     $P = 42.634213$  Days     $T_0 = 141.173759$  (BKJD)



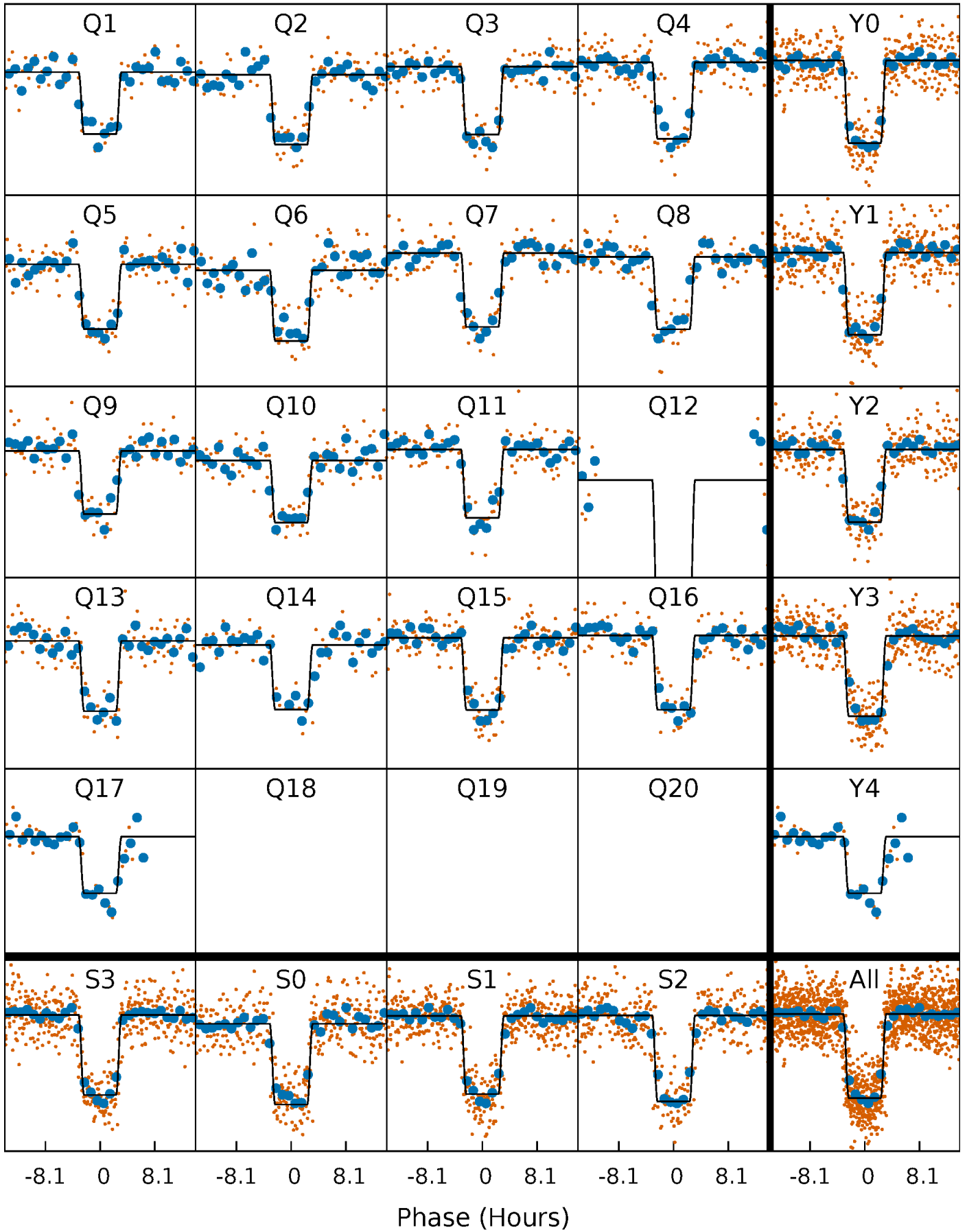
# DV Quarter-Phased Transit Curves

TCE 009347899-02     $P = 42.634213$  Days     $T_0 = 141.173759$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

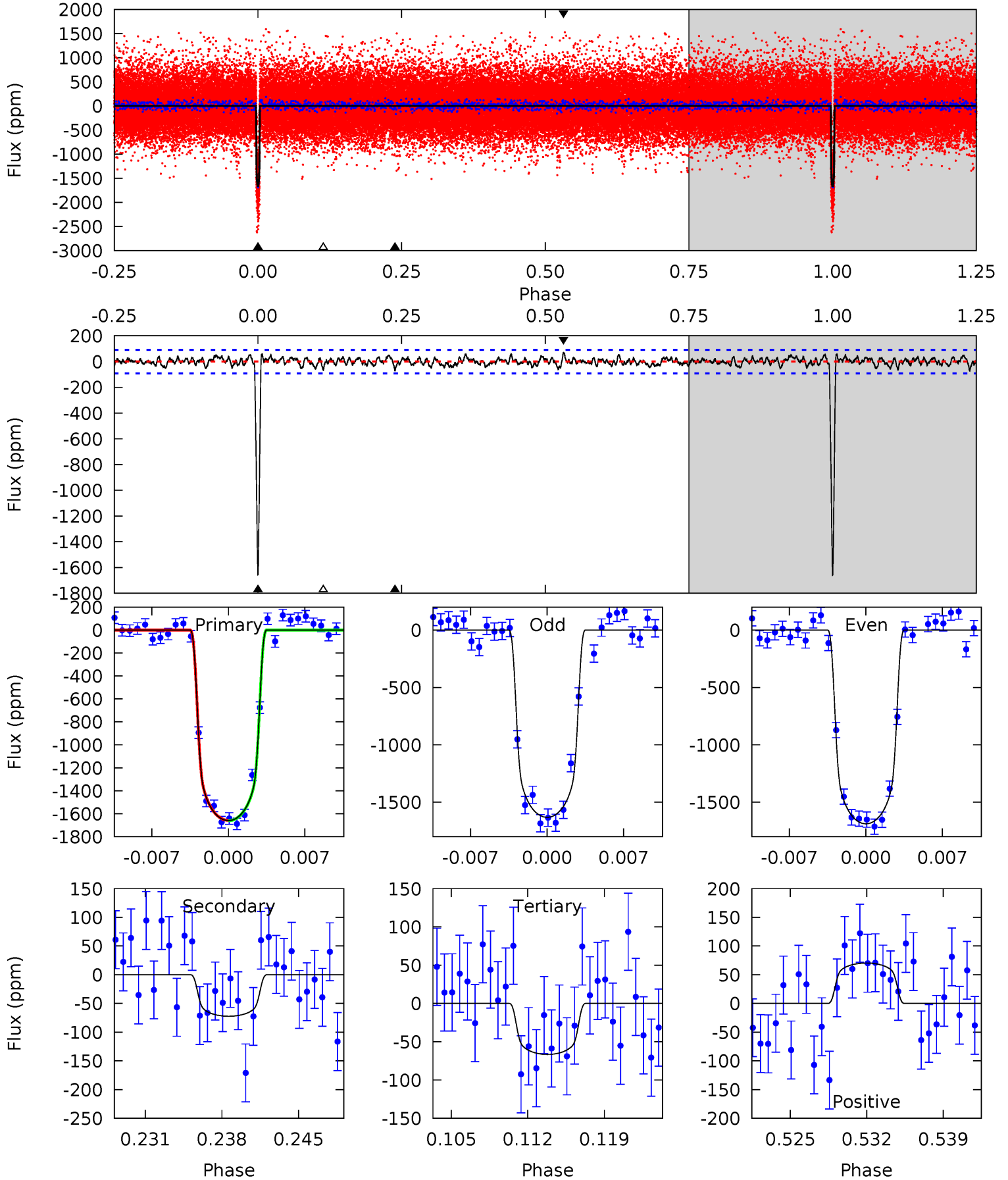
TCE 009347899-02 P= 42.633324 Days  $T_0=141.187335$  (BKJD)



# DV Model-Shift Uniqueness Test

009347899-02, P = 42.634213 Days, E = 98.539546 Days

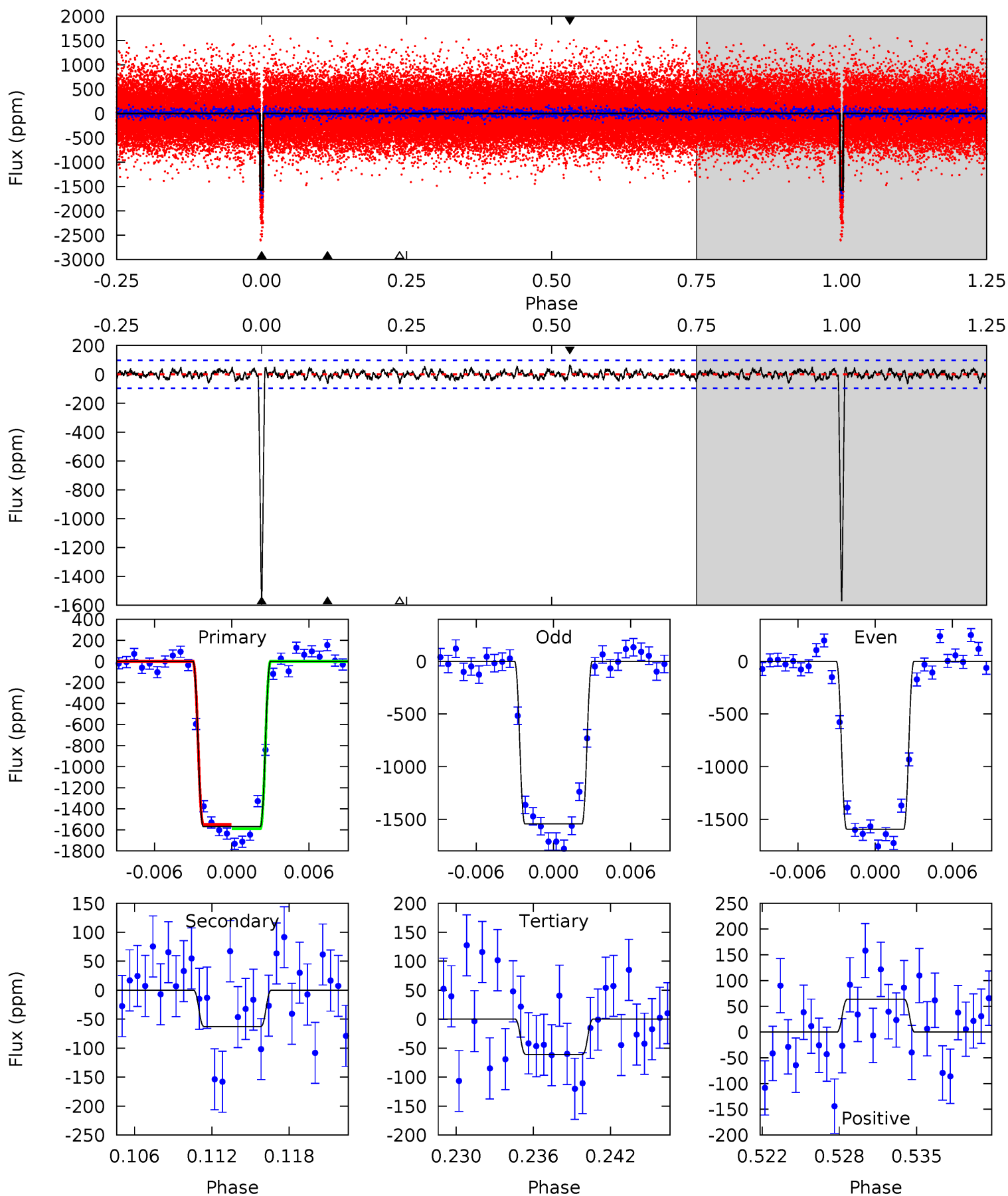
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
92.2	4.01	3.70	3.91	5.09	2.70	1.22	88.5	88.3	0.32	0.11	1.57	0.97	0.04	0.10



# Alt Model-Shift Uniqueness Test

009347899-02, P = 42.633324 Days, E = 98.554011 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
82.8	3.30	3.21	3.36	5.12	2.74	1.04	79.6	79.4	0.10	-0.06	1.30	1.01	0.04	1.09



### Stellar Parameters For KIC 009347899

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6035^{+120}_{-120}$	$4.220^{+0.168}_{-0.112}$	$-0.280^{+0.150}_{-0.150}$	$1.257^{+0.187}_{-0.250}$	$0.958^{+0.076}_{-0.068}$	$0.678^{+0.545}_{-0.220}$
	+2%/-2%	+4%/-3%	+54%/-54%	+15%/-20%	+8%/-7%	+80%/-32%
Source	SPE58	SPE58	SPE58	DSEP		

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

### Secondary Eclipse Parameters for KIC 009347899-02 / KOI 0935.02

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-72 \pm 18$	$5.78^{+0.52}_{-0.65}$	$859^{+41}_{-48}$	$3273^{+125}_{-140}$	$66^{+26}_{-18}$
Alt.	$-63 \pm 19$	$5.57^{+0.52}_{-0.58}$	$859^{+38}_{-48}$	$3246^{+132}_{-168}$	$62^{+25}_{-20}$

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



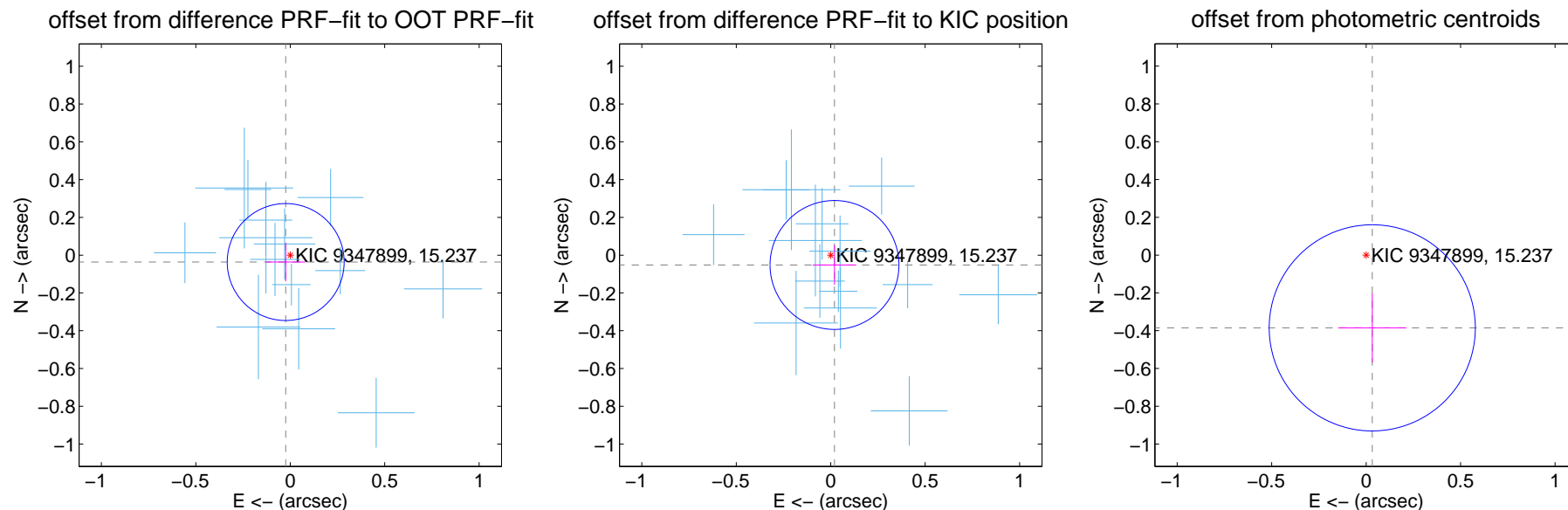
## DV Centroid Data

Supplemental centroid analysis for 009347899-02. Kepler magnitude: 15.24. Transit SNR 64.06

There are 14 quarters with good PRF difference image offsets

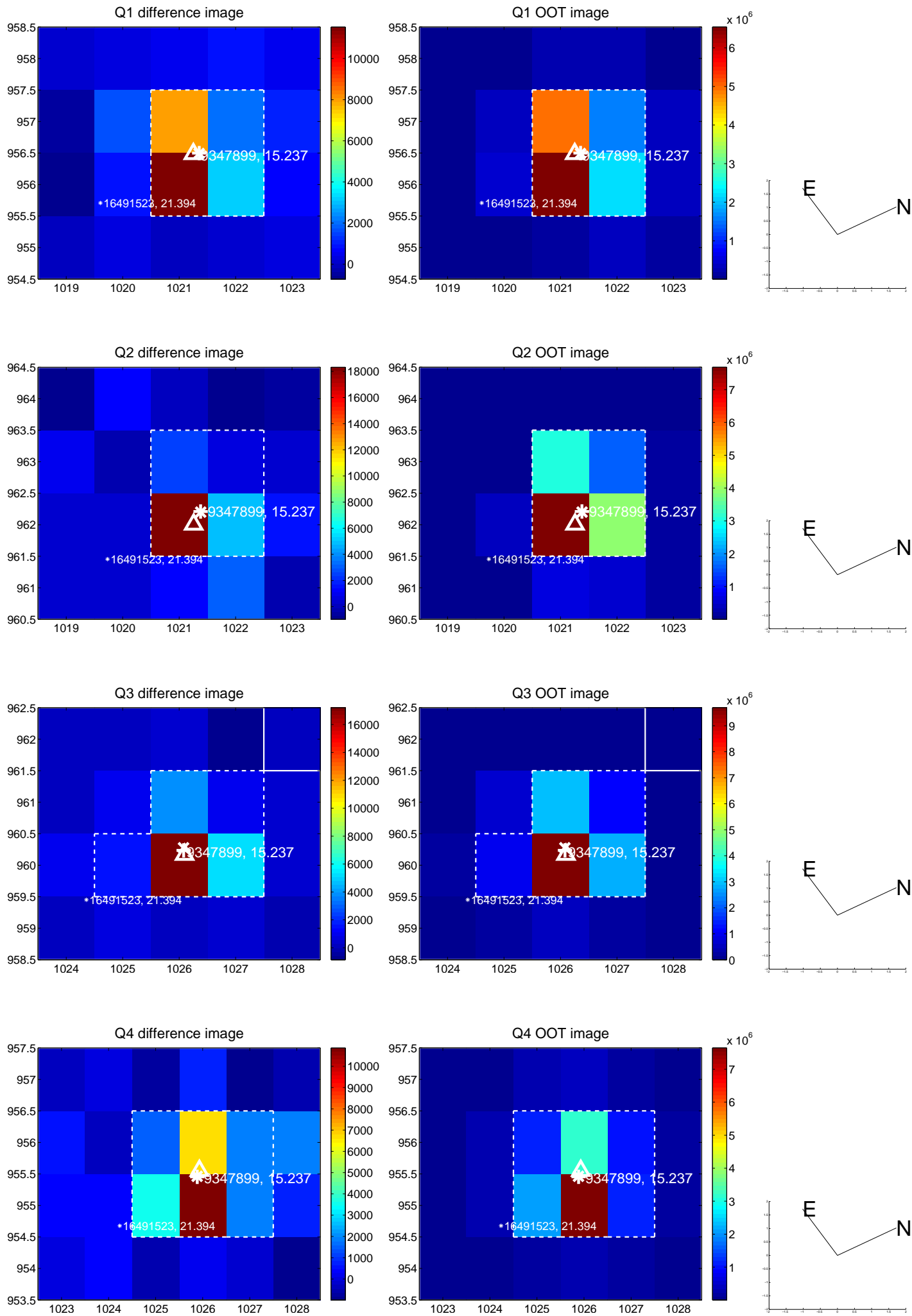
The direct PRF centroid is offset from the target star catalog position by about 0.05 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.044 \pm 0.103$	0.42	$0.024 \pm 0.105$	$-0.036 \pm 0.102$
PRF-fit source offset from KIC position	$0.056 \pm 0.114$	0.49	$-0.020 \pm 0.115$	$-0.052 \pm 0.104$
photometric centroid source offset	$0.39 \pm 0.18$	2.13	$-0.03 \pm 0.18$	$-0.38 \pm 0.18$

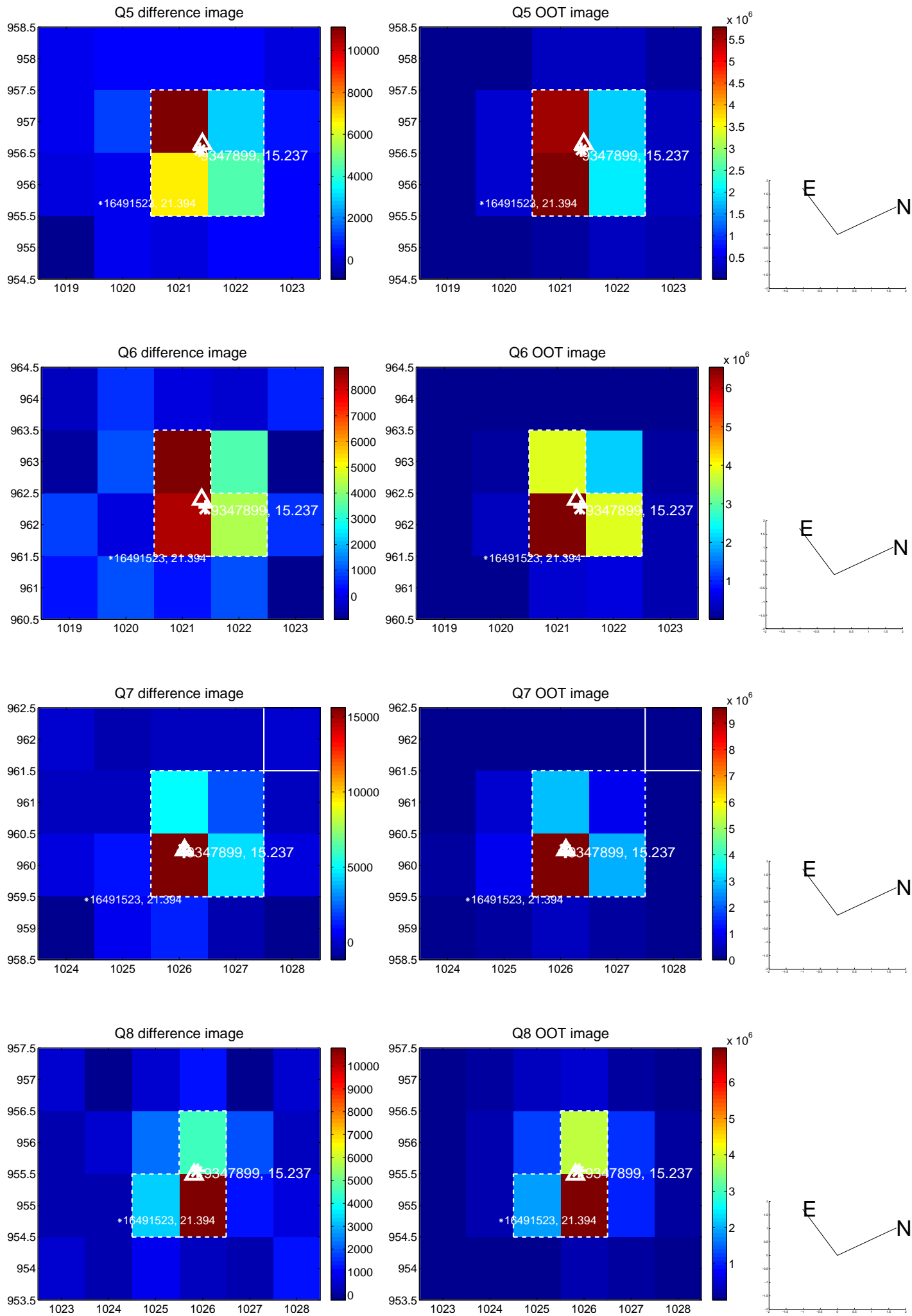


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

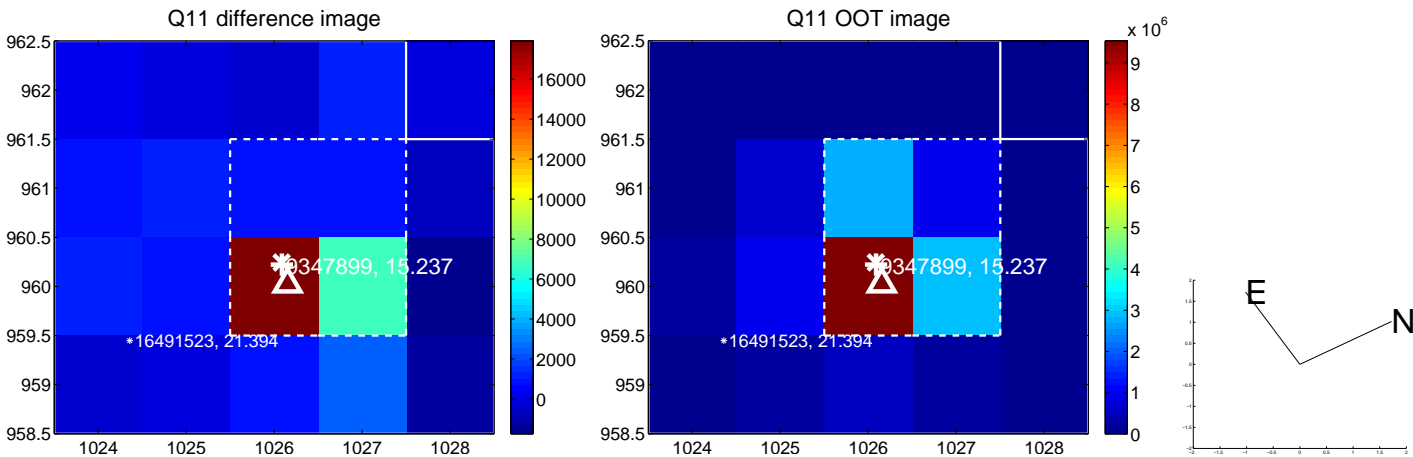
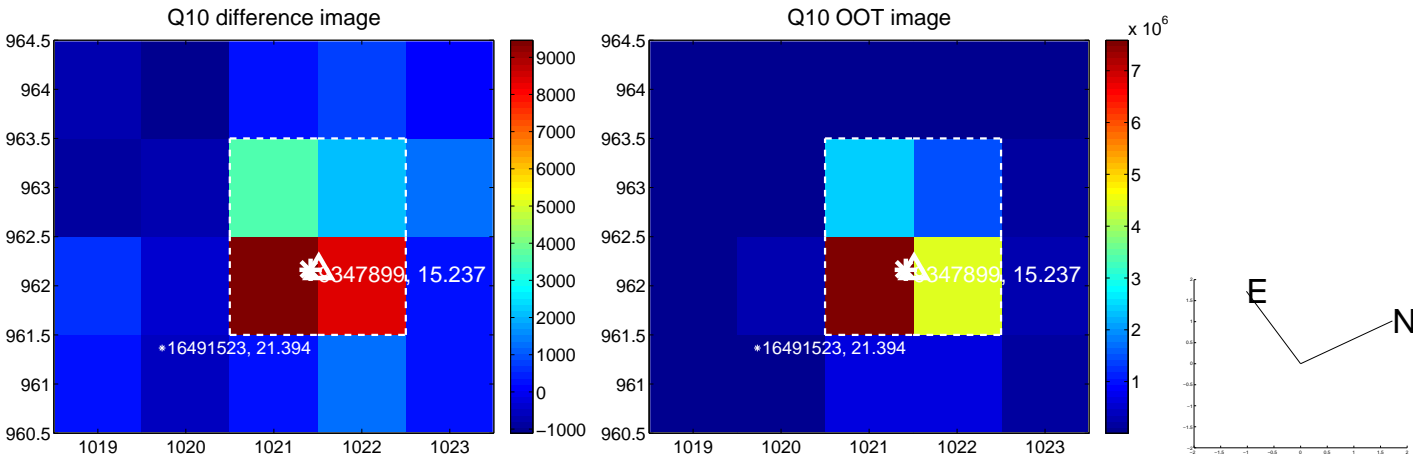
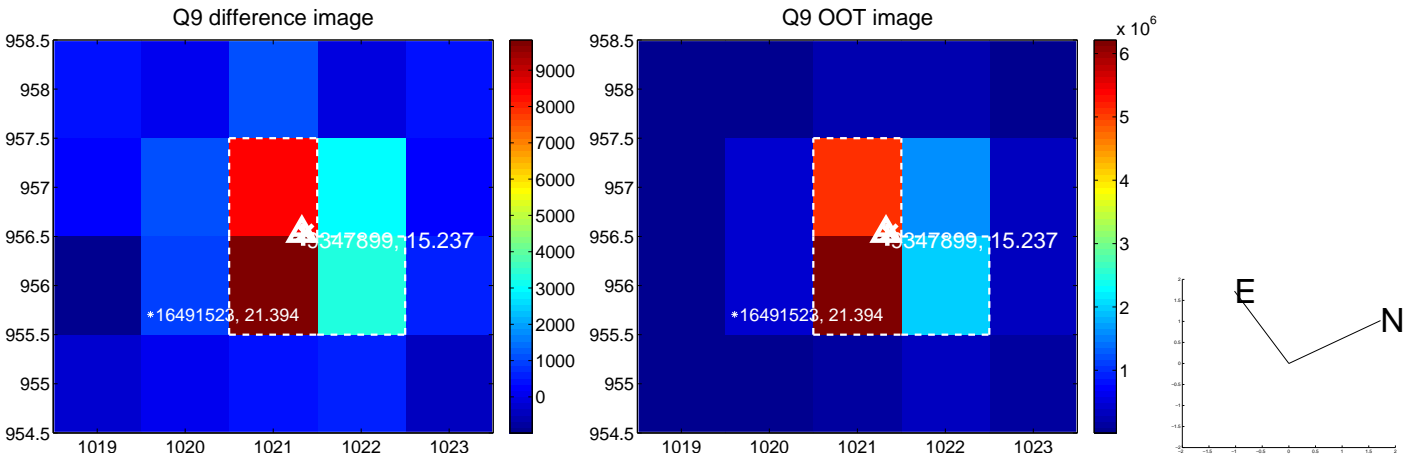
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



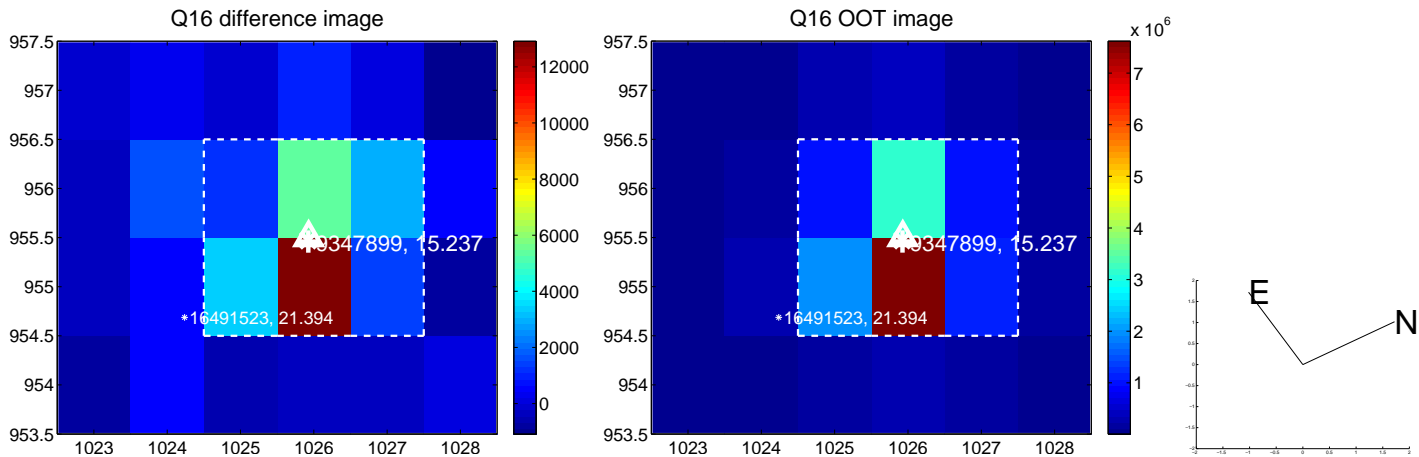
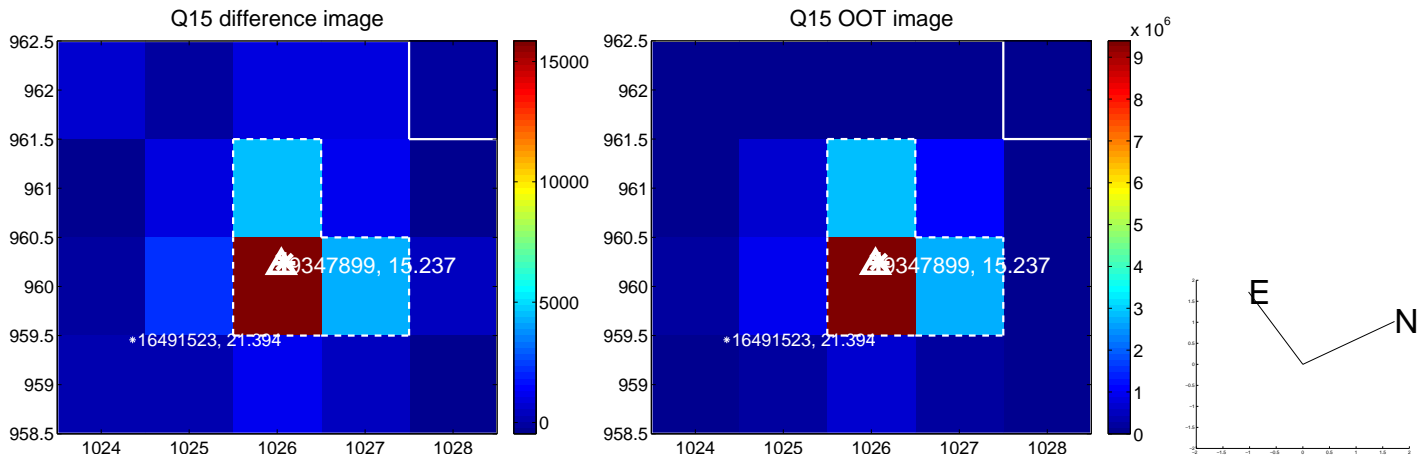
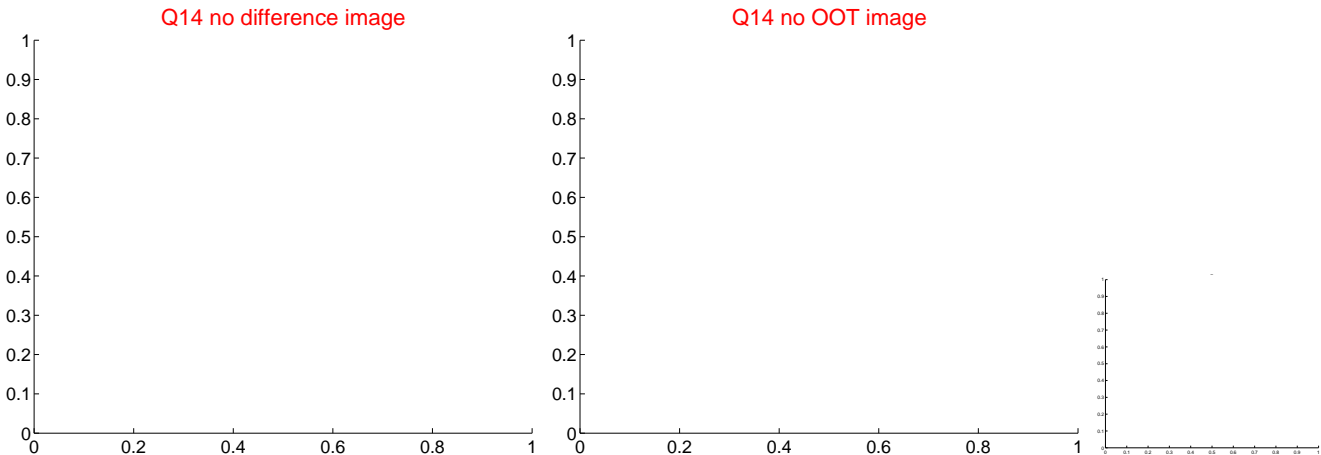
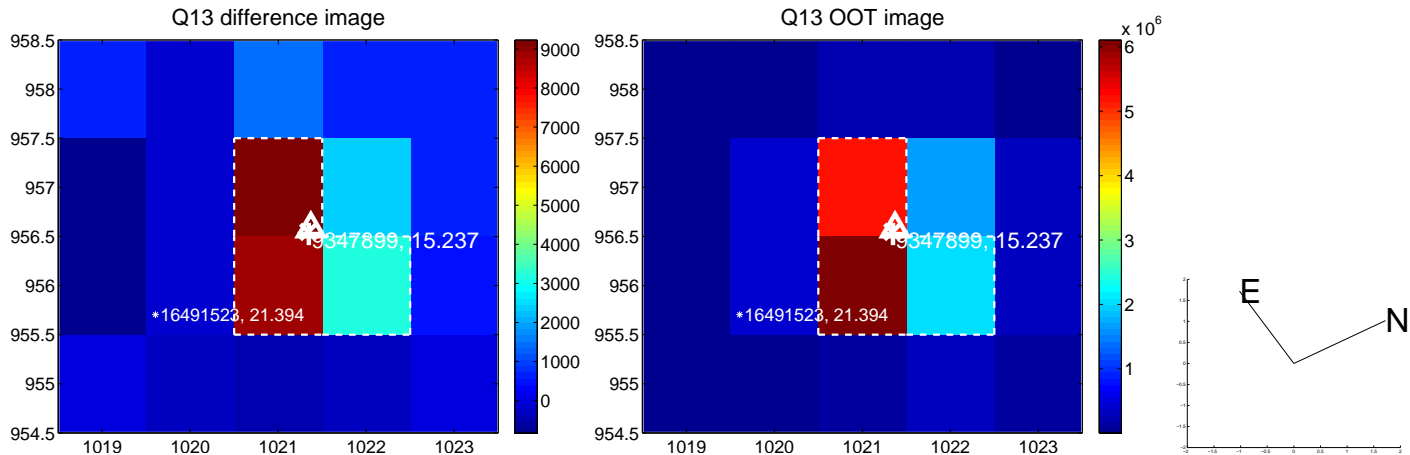
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



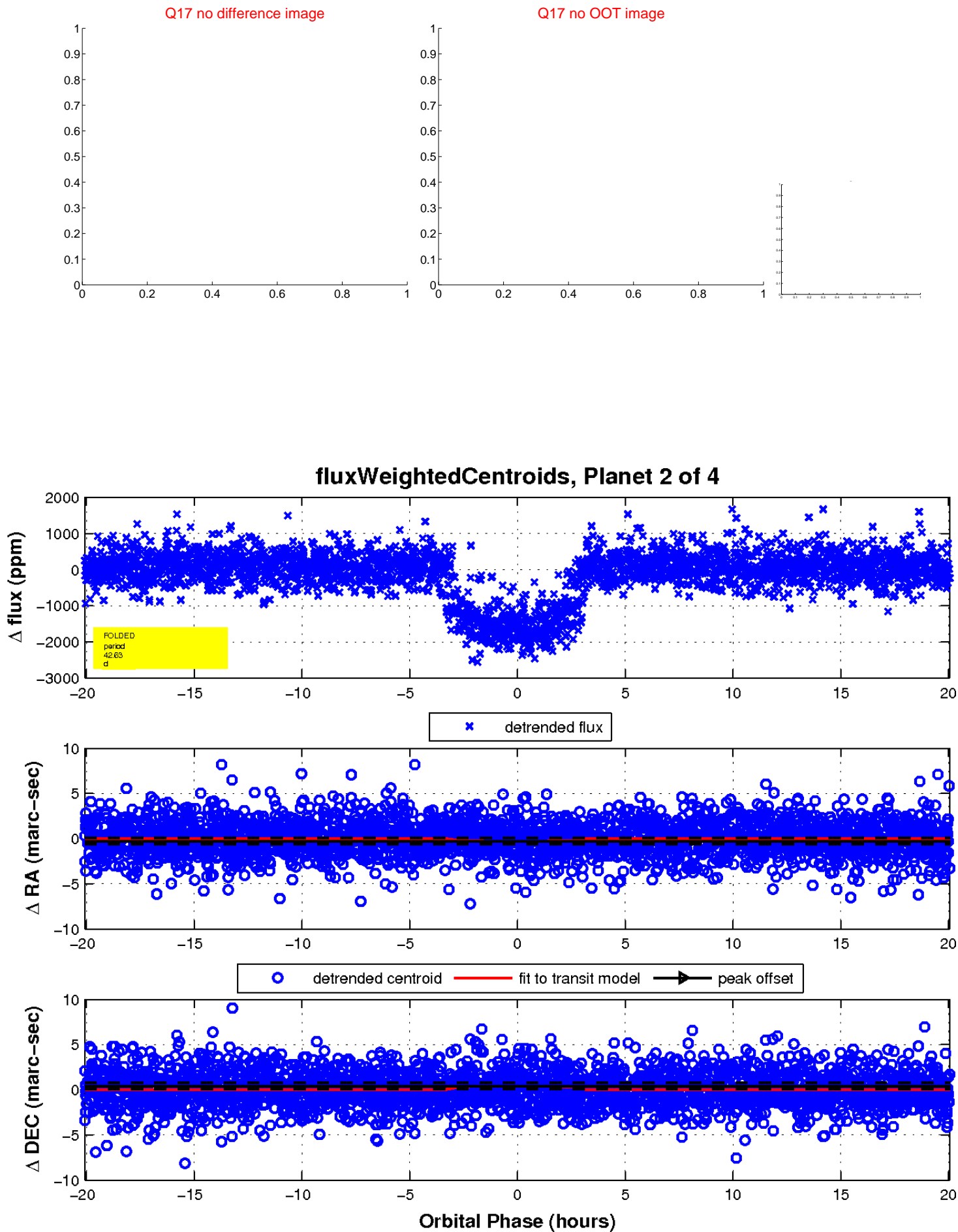
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

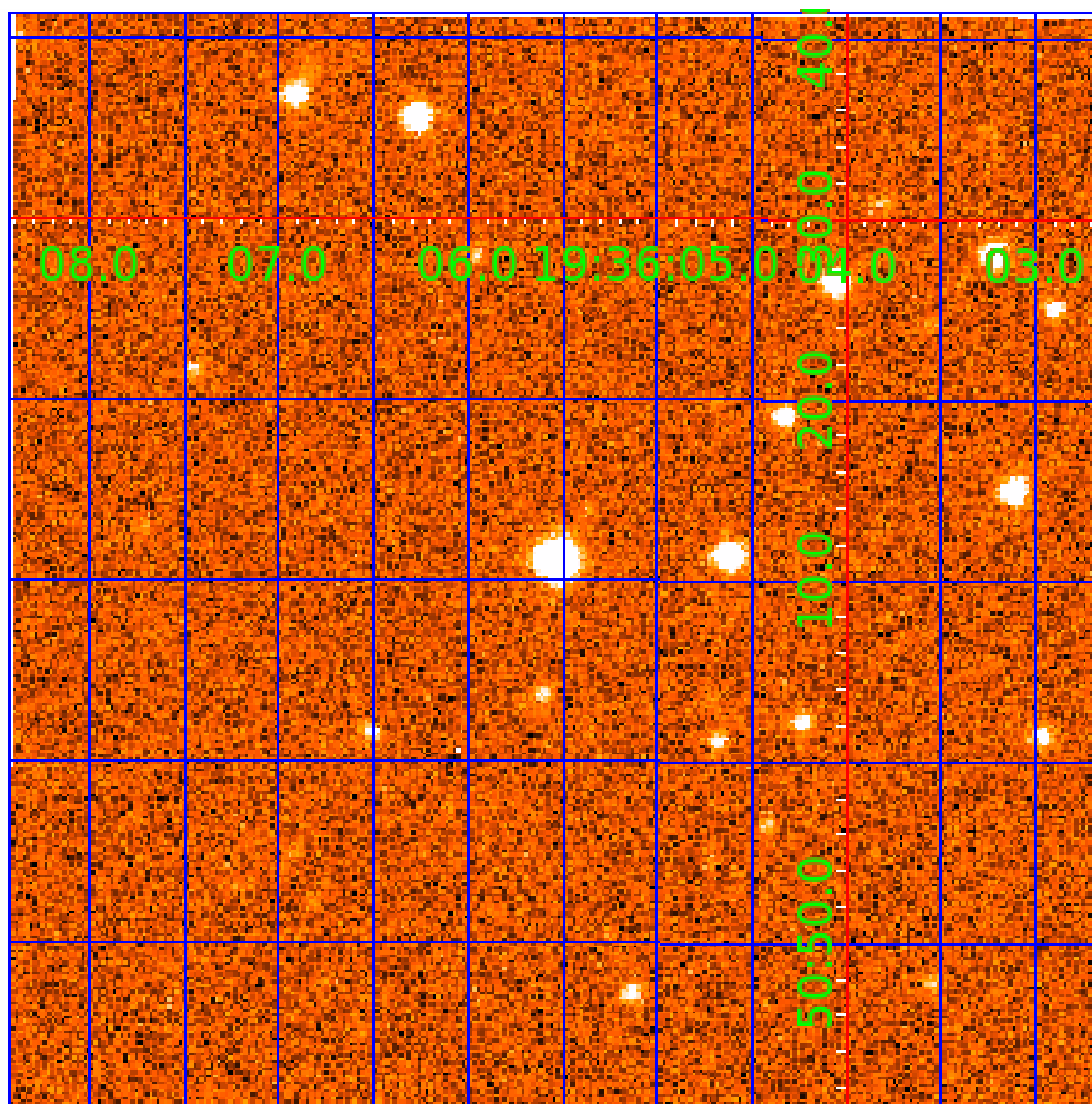


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



# UKIRT Image

Declination





# KIC 009347899

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009347899-01	OBS	0935.01	20.860226	138.295962	1889.7	5.882	94.9	98.2	1.26	6035	6.31	87.92
009347899-02	OBS	0935.02	42.634213	141.173759	1700.0	6.691	62.3	64.1	1.26	6035	5.79	33.90
009347899-03	OBS	0935.03	87.647786	134.939625	1005.9	9.048	28.8	30.4	1.26	6035	4.32	12.97
009347899-04	OBS	0935.04	9.617237	132.864070	124.8	4.116	7.8	8.8	1.26	6035	1.65	246.85

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009347899-01	OBS	PC	1.00	0	0	0	0	NO_COMMENT
009347899-02	OBS	PC	1.00	0	0	0	0	NO_COMMENT
009347899-03	OBS	PC	0.97	0	0	0	0	NO_COMMENT
009347899-04	OBS	PC	0.97	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.

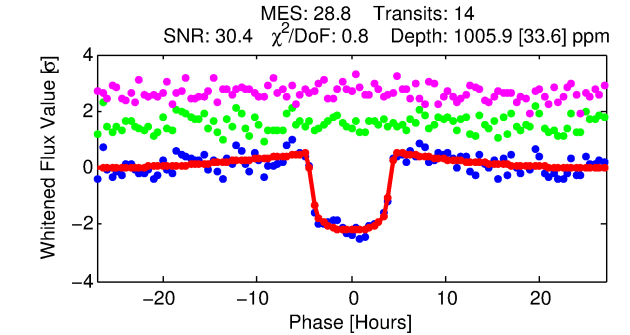
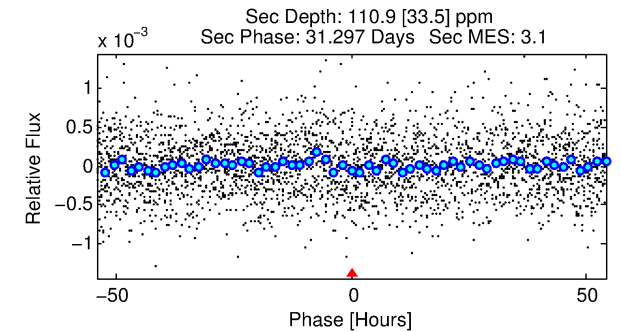
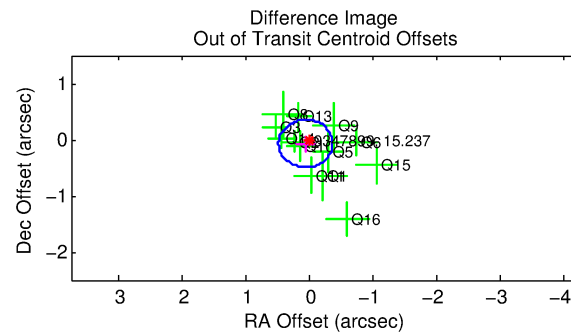
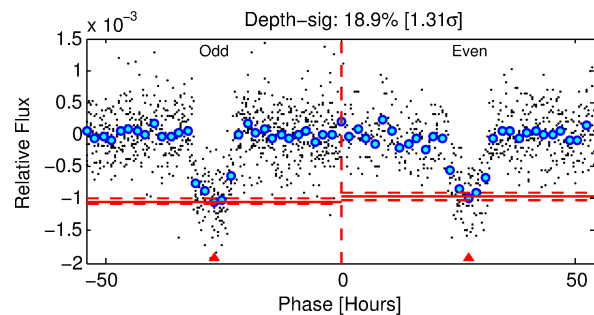
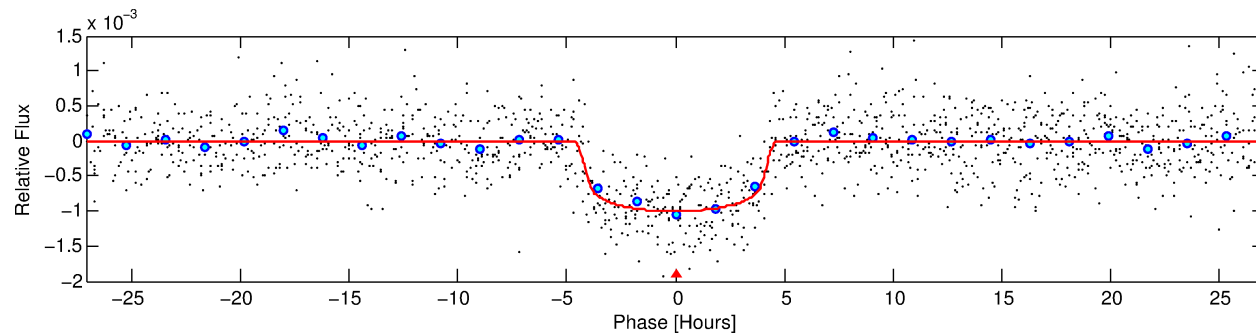
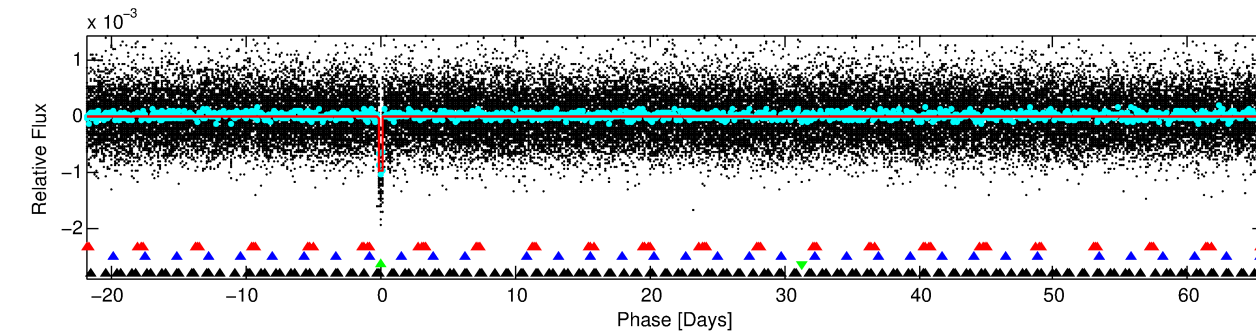
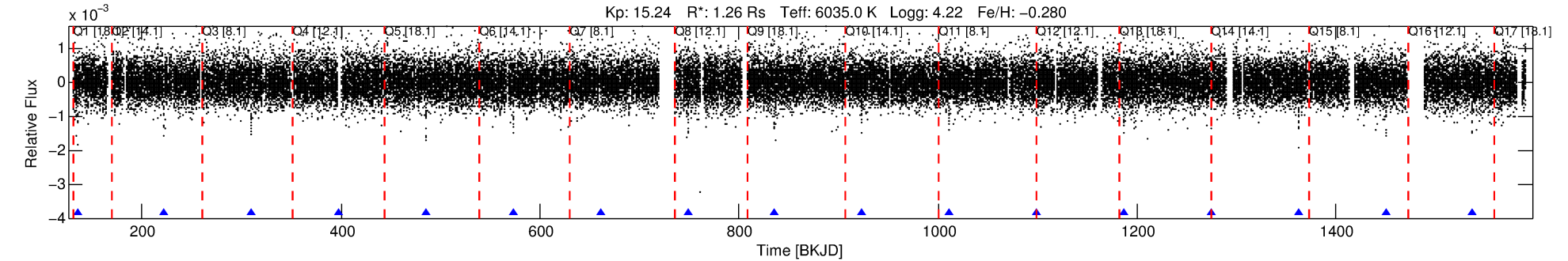
Ephemeris Match Information For 009347899-03

No Significant Match Found

# DV One-Page Summary

KIC: 9347899 Candidate: 3 of 4 Period: 87.648 d  
KOI: K00935.03 Name: Kepler-31d Corr: 0.994

Kp: 15.24 R\*: 1.26 Rs Teff: 6035.0 K Logg: 4.22 Fe/H: -0.280



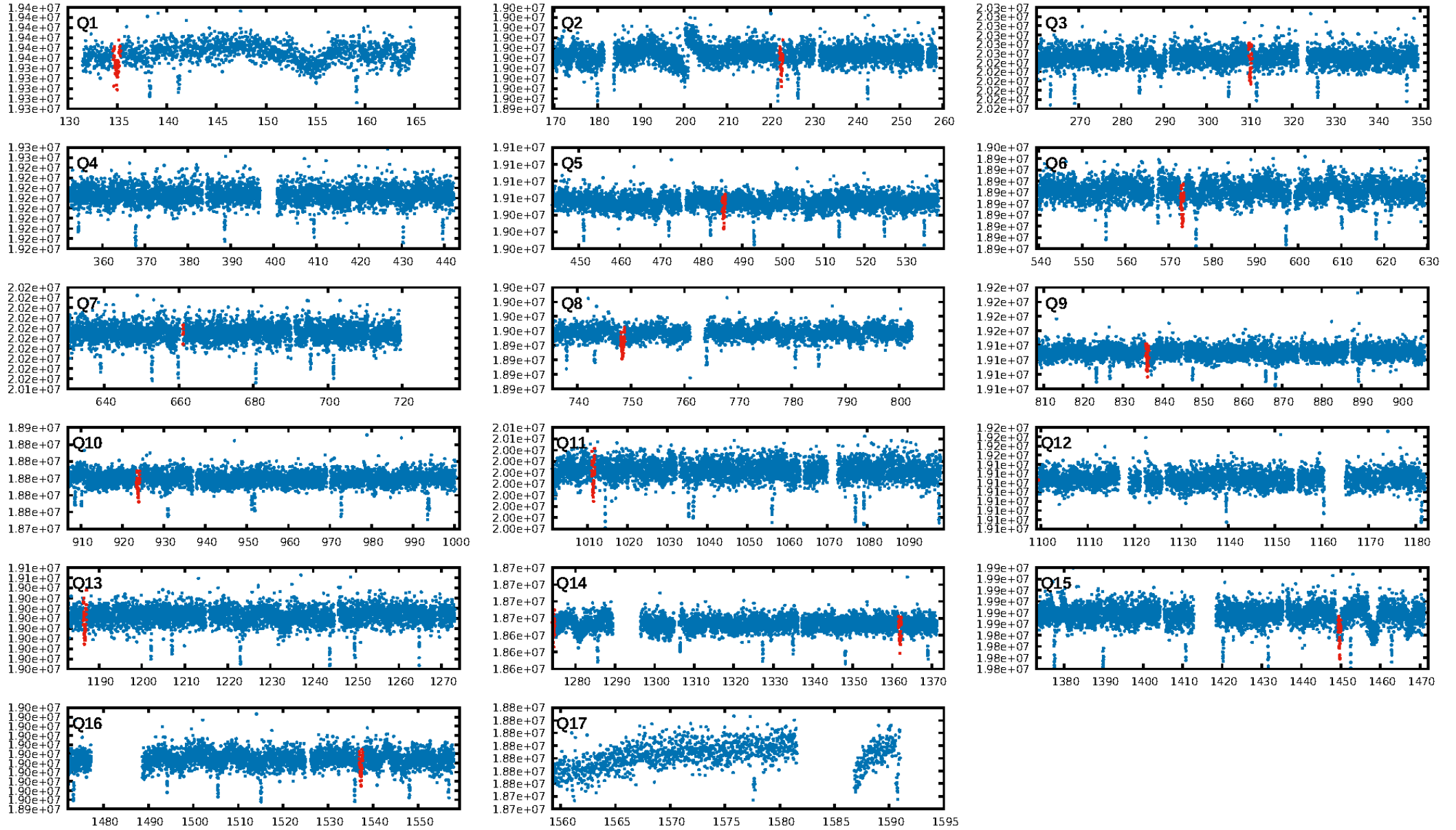
## DV Fit Results:

Period = 87.64779 [0.00047] d  
Epoch = 134.9396 [0.0046] BKJD  
Rp/R\* = 0.0315 [0.0025]  
a/R\* = 52.91 [19.90]  
b = 0.74 [0.23]  
Seff = 12.97 [3.90]  
Teff = 484 [36] K  
Rp = 4.32 [0.92] Re  
a = 0.3806 [0.0704] AU  
Ag = 473.93 [211.86] [2.23σ]  
Teffp = 3491 [305] K [9.79σ]

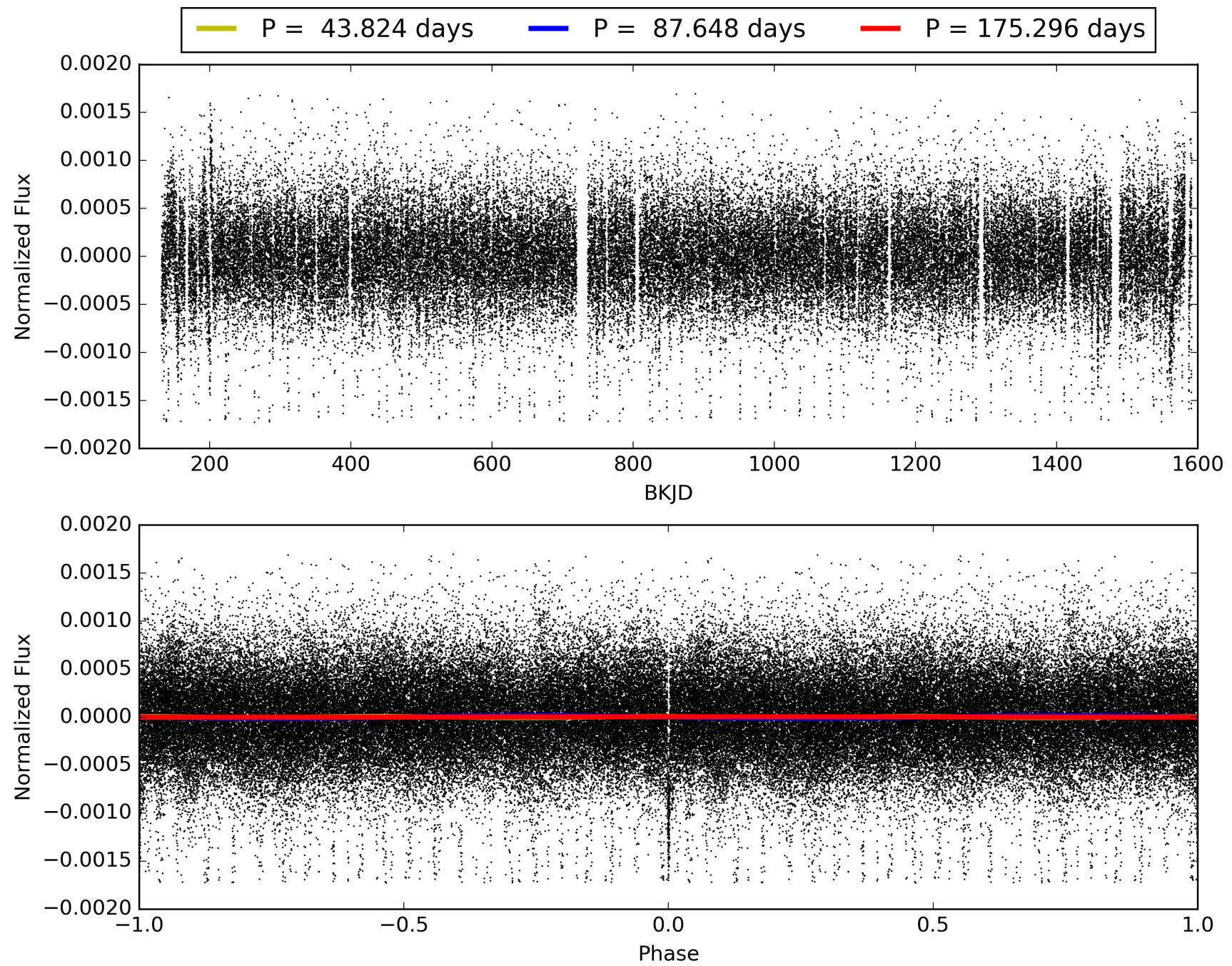
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [96.00σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 27.3%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 5.64e-179  
RollingBand-fgt: 1.00 [13/13]  
GhostDiagnostic-chr: 8.822  
Centroid-sig: 1.7%  
Centroid-so: 1.035 arcsec [2.75σ]  
OotOffset-rm: 0.095 arcsec [0.67σ]  
KicOffset-rm: 0.033 arcsec [0.22σ]  
OotOffset-st: 4/3/2/4 [13]  
KicOffset-st: 4/3/2/4 [13]  
DiffImageQuality-fgm: 1.00 [13/13]  
DiffImageOverlap-fno: 0.77 [10/13]

# TCE 009347899-03, PDC Light Curves

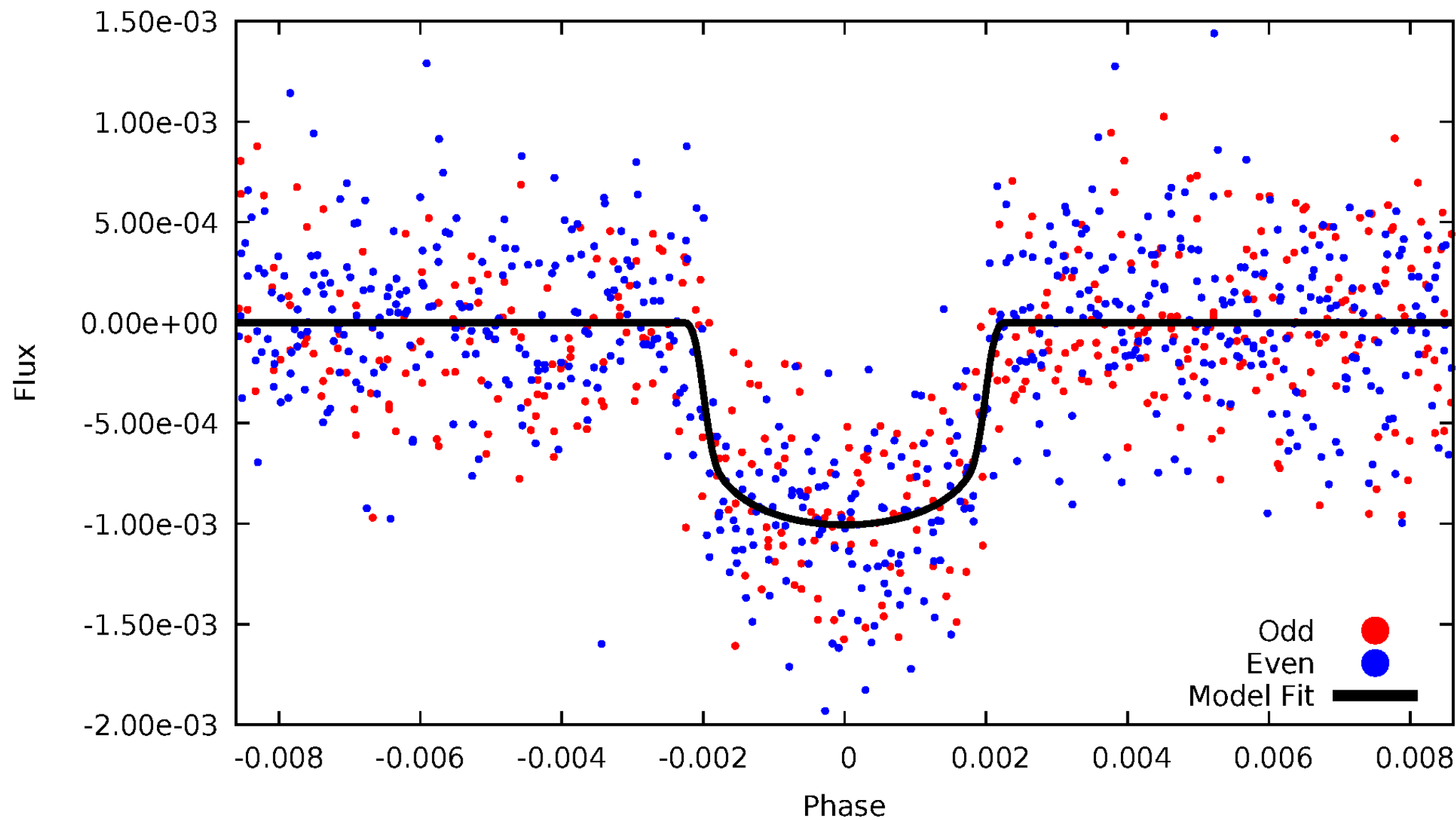


TCE 009347899-03



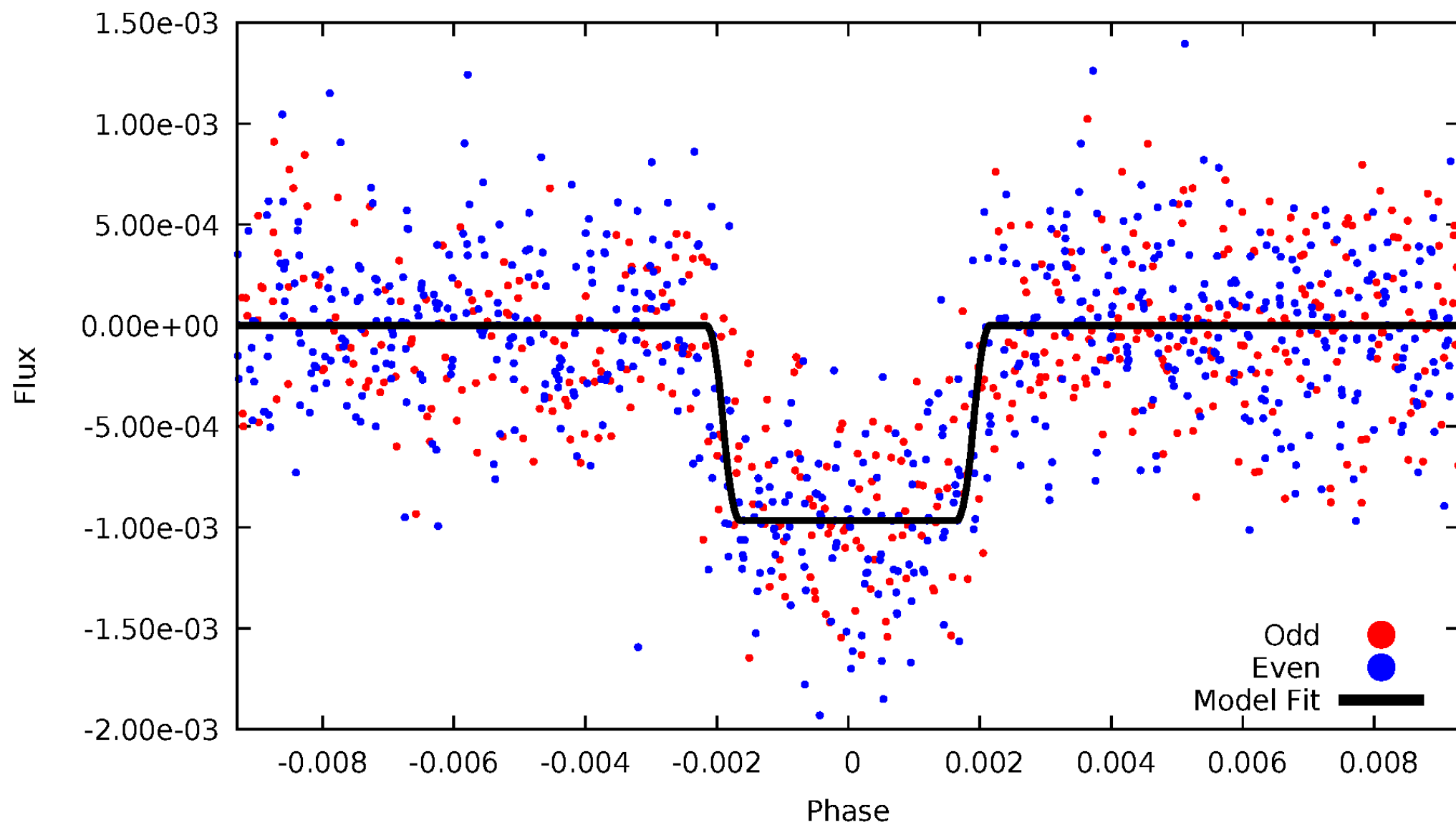
# DV Odd/Even

TCE 009347899-03



# ALT Odd/Even

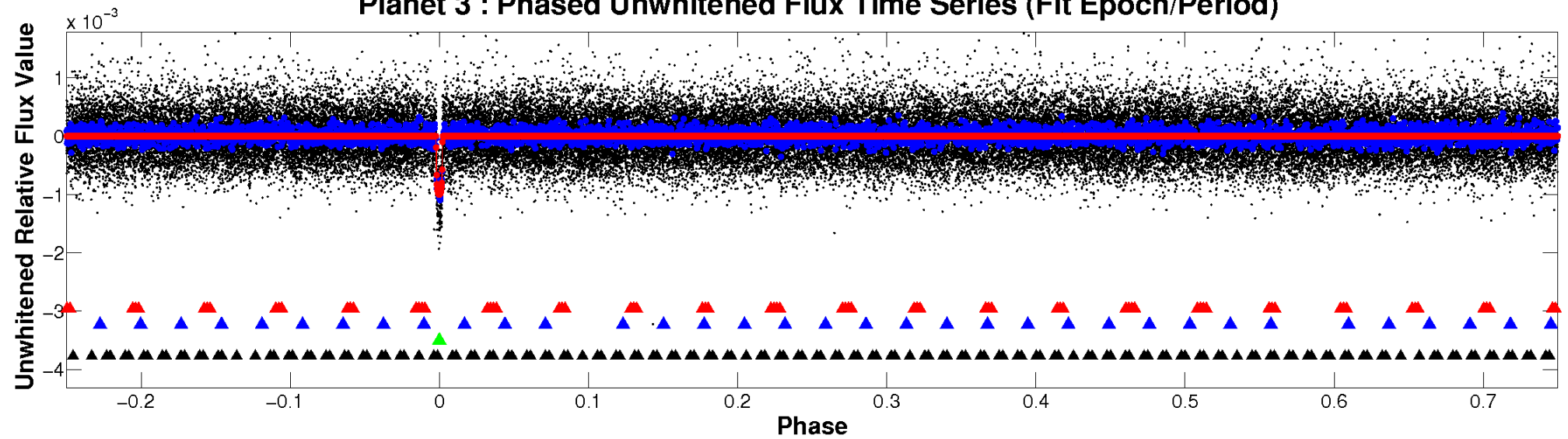
TCE 009347899-03



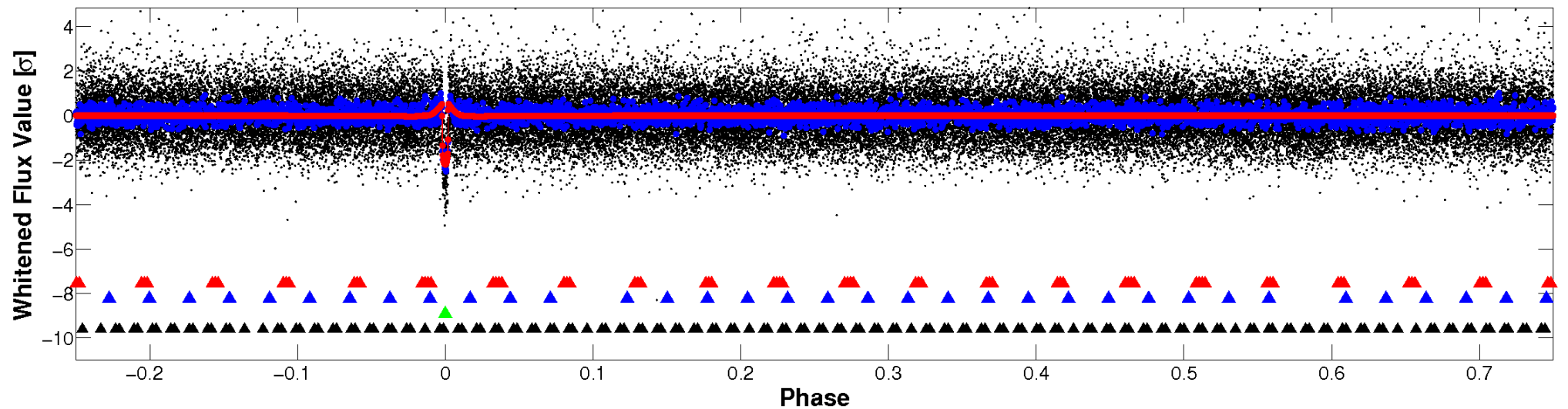


# Non-Whitened Vs. Whitened Light Curve

Planet 3 : Phased Unwhitened Flux Time Series (Fit Epoch/Period)



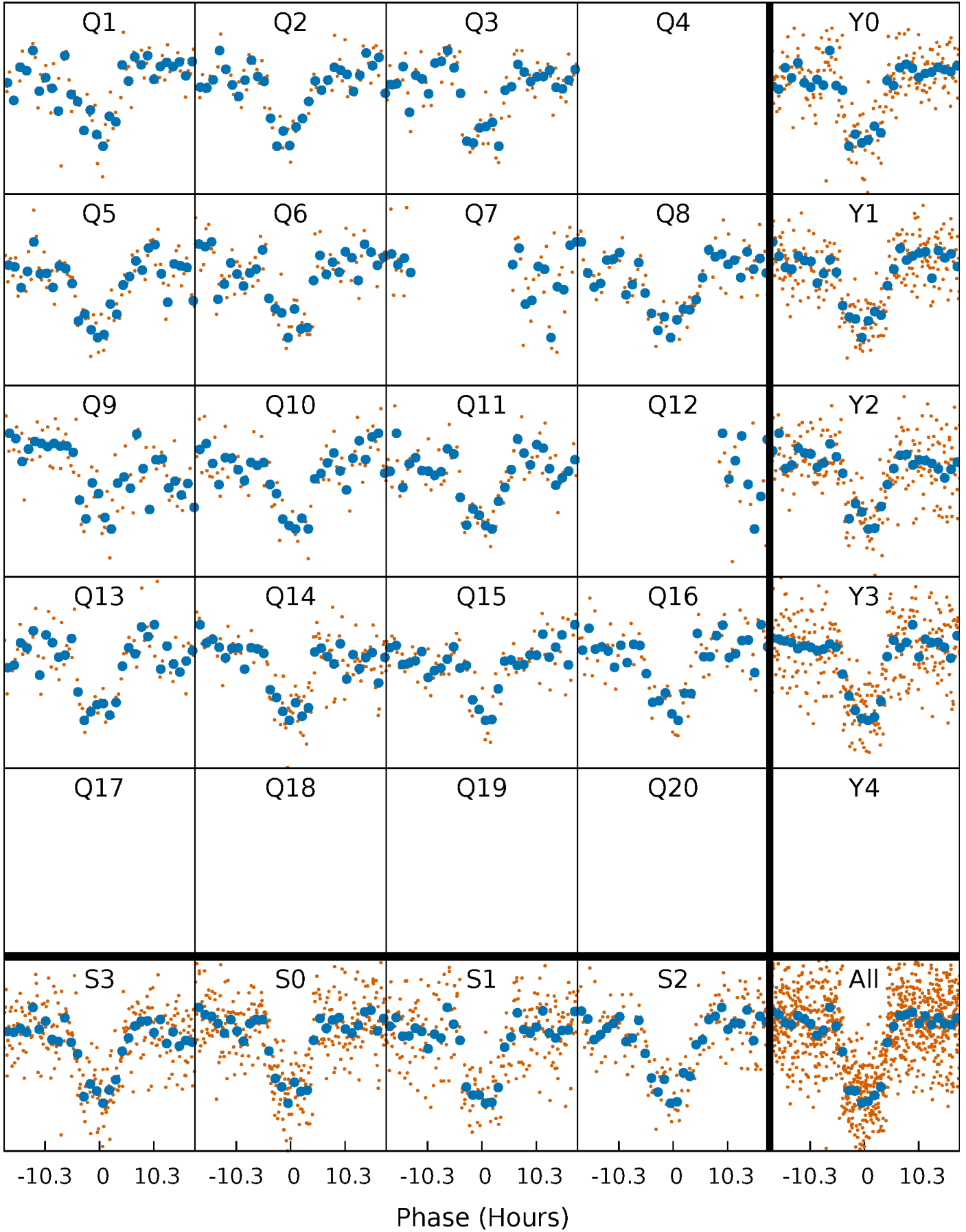
Planet 3 : Phased Whitened Flux Time Series (Fit Epoch/Period)





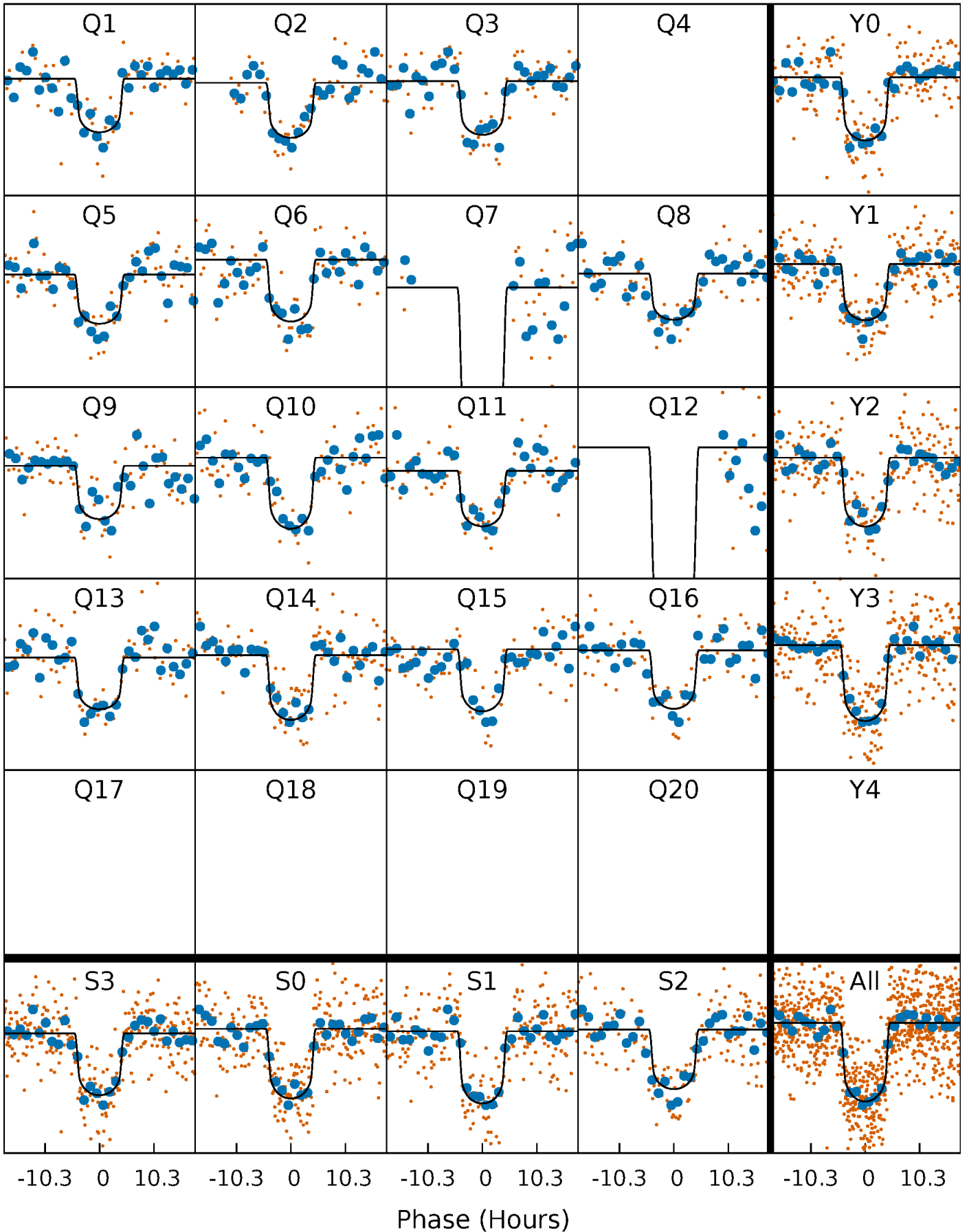
# PDC Quarter-Phased Transit Curves

TCE 009347899-03     $P = 87.647786$  Days     $T_0 = 134.939625$  (BKJD)



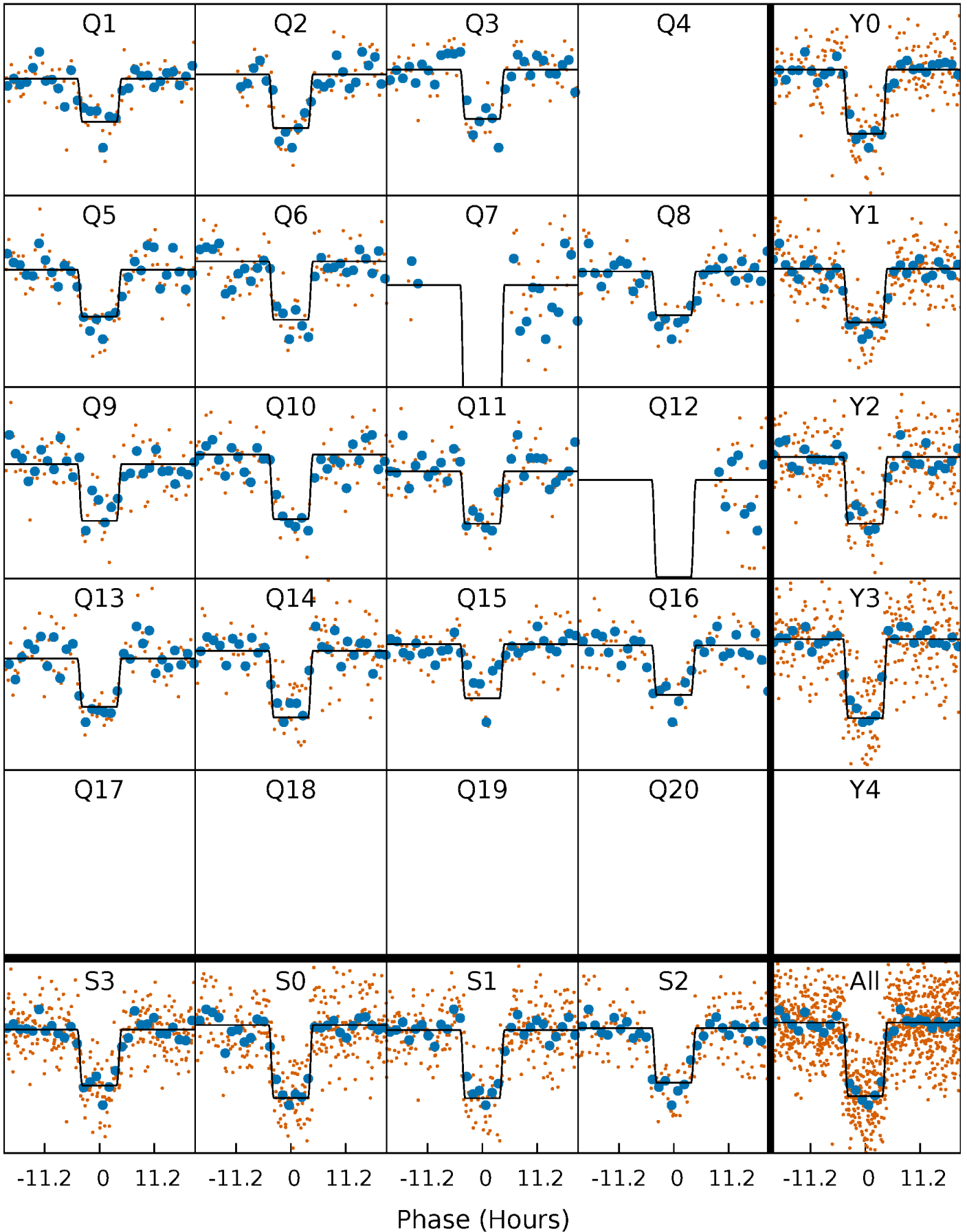
# DV Quarter-Phased Transit Curves

TCE 009347899-03   P= 87.647786 Days    $T_0=134.939625$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

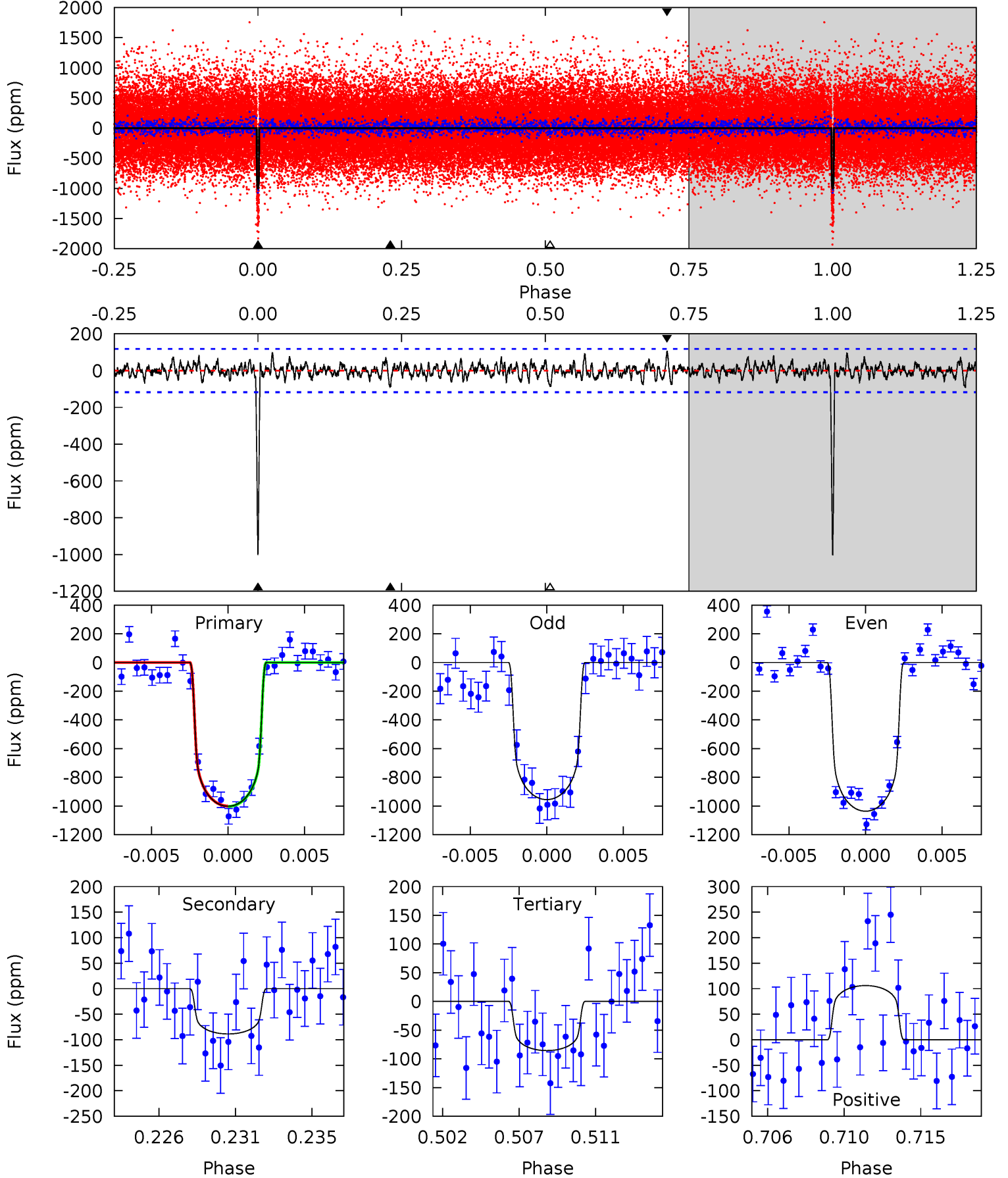
TCE 009347899-03 P= 87.650281 Days  $T_0=134.918756$  (BKJD)



# DV Model-Shift Uniqueness Test

009347899-03, P = 87.647786 Days, E = 47.291839 Days

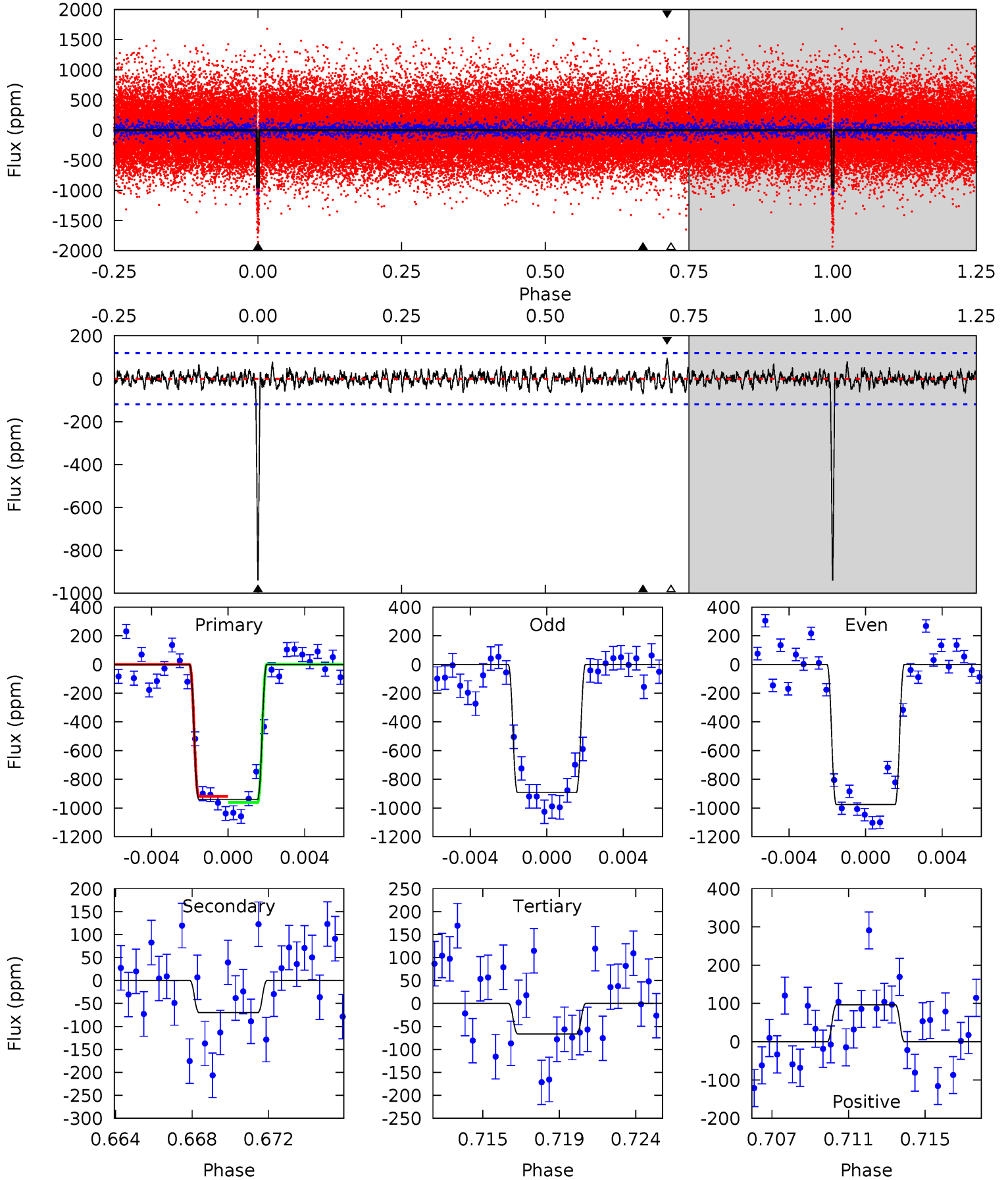
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
44.0	3.89	3.76	4.66	5.18	2.84	1.22	40.2	39.3	0.13	-0.77	1.75	0.99	0.10	0.06



# Alt Model-Shift Uniqueness Test

009347899-03, P = 87.650281 Days, E = 47.268475 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
40.8	3.04	2.87	4.19	5.19	2.86	0.98	37.9	36.6	0.16	-1.15	1.79	0.98	0.09	0.90



### Stellar Parameters For KIC 009347899

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6035^{+120}_{-120}$	$4.220^{+0.168}_{-0.112}$	$-0.280^{+0.150}_{-0.150}$	$1.257^{+0.187}_{-0.250}$	$0.958^{+0.076}_{-0.068}$	$0.678^{+0.545}_{-0.220}$
	+2%/-2%	+4%/-3%	+54%/-54%	+15%/-20%	+8%/-7%	+80%/-32%
Source	SPE58	SPE58	SPE58	DSEP		

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

### Secondary Eclipse Parameters for KIC 009347899-03 / KOI 0935.03

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-89 \pm 23$	$4.28^{+0.61}_{-0.55}$	$675^{+32}_{-37}$	$3711^{+183}_{-198}$	$382^{+169}_{-120}$
Alt.	$-70 \pm 23$	$4.23^{+0.57}_{-0.59}$	$675^{+32}_{-42}$	$3581^{+212}_{-248}$	$303^{+156}_{-110}$

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

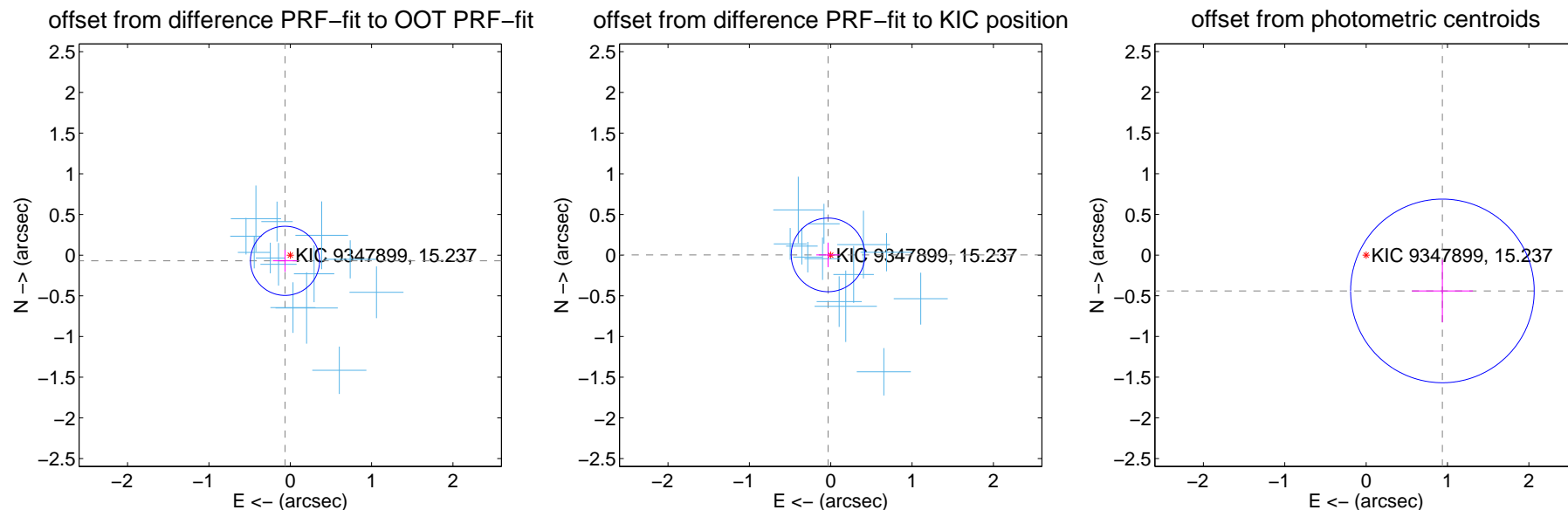
## DV Centroid Data

Supplemental centroid analysis for 009347899-03. Kepler magnitude: 15.24. Transit SNR 30.43

There are 13 quarters with good PRF difference image offsets

The direct PRF centroid is offset from the target star catalog position by about 0.05 arcsec

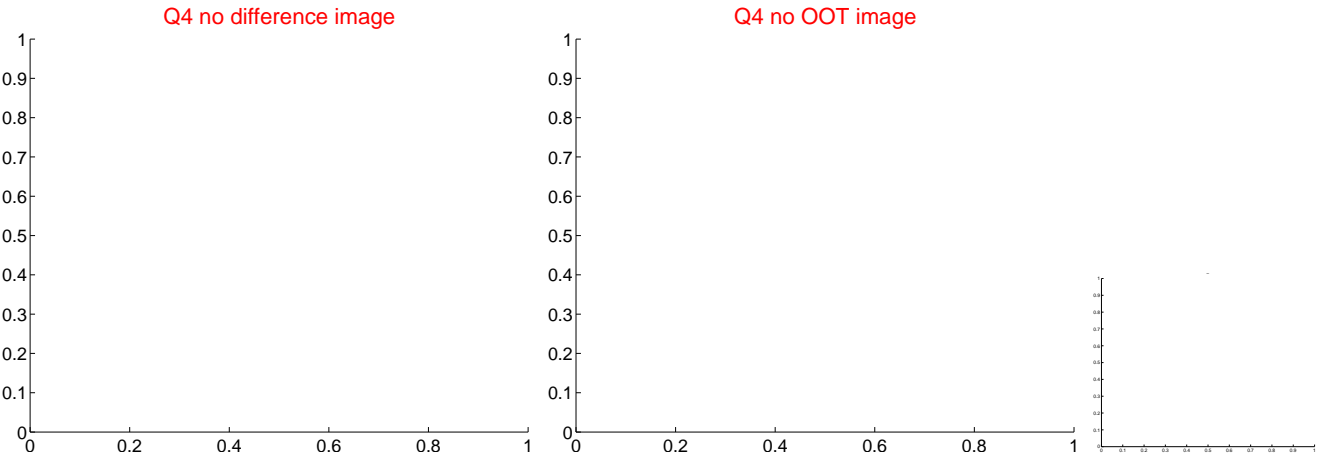
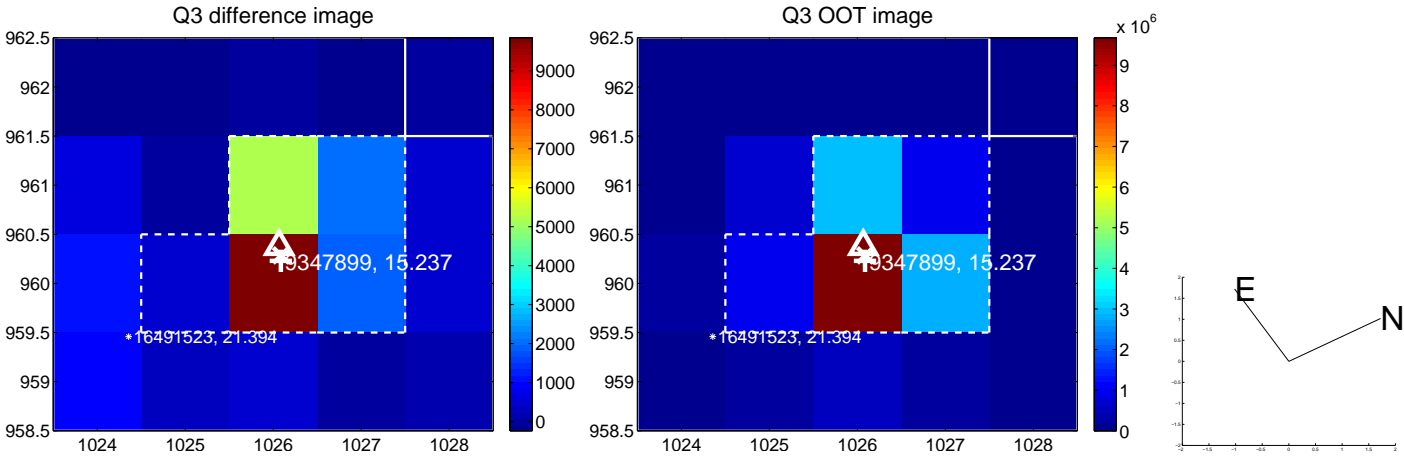
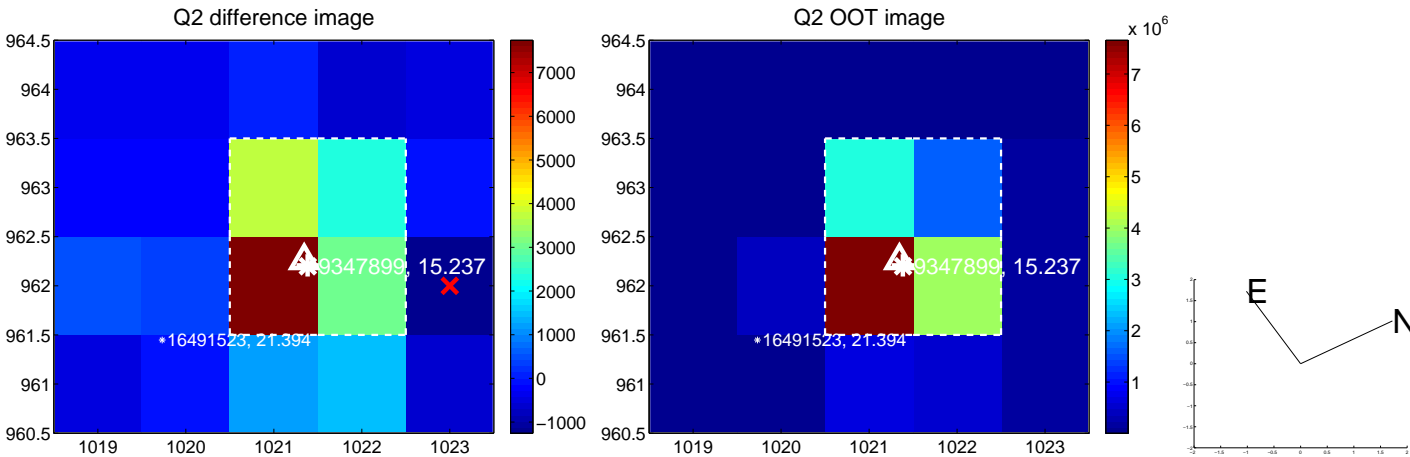
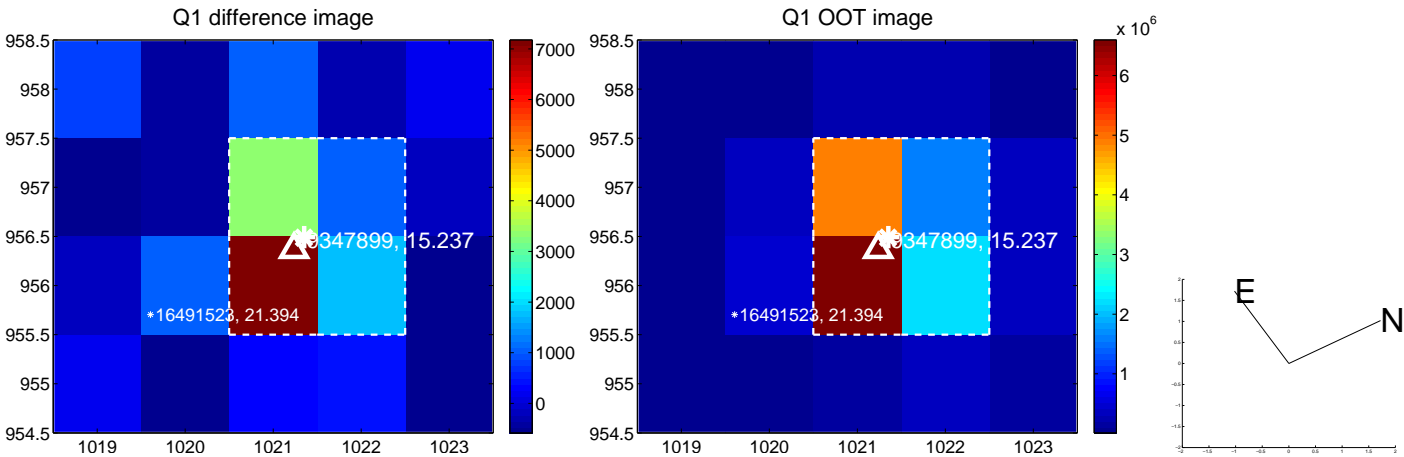
	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.095 \pm 0.142$	0.67	$0.064 \pm 0.149$	$-0.070 \pm 0.135$
PRF-fit source offset from KIC position	$0.033 \pm 0.151$	0.22	$0.033 \pm 0.144$	$0.003 \pm 0.151$
photometric centroid source offset	$1.04 \pm 0.38$	2.75	$-0.94 \pm 0.37$	$-0.44 \pm 0.38$



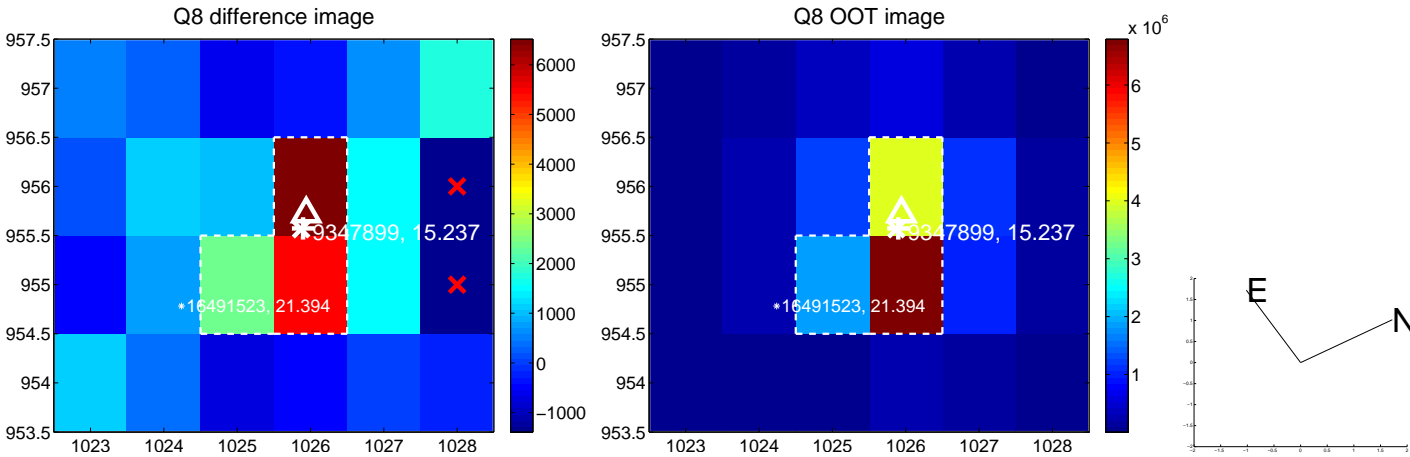
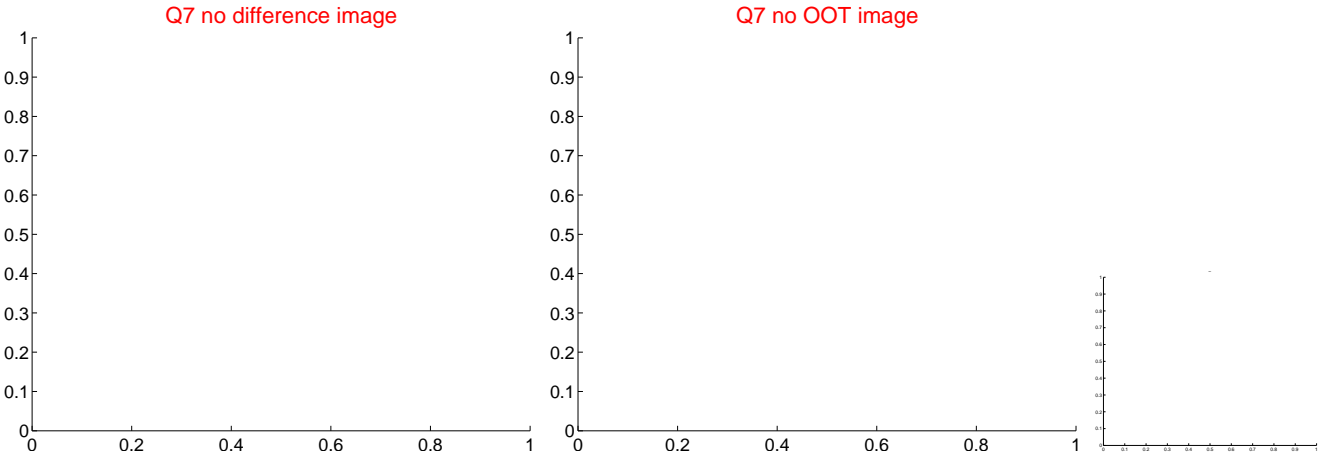
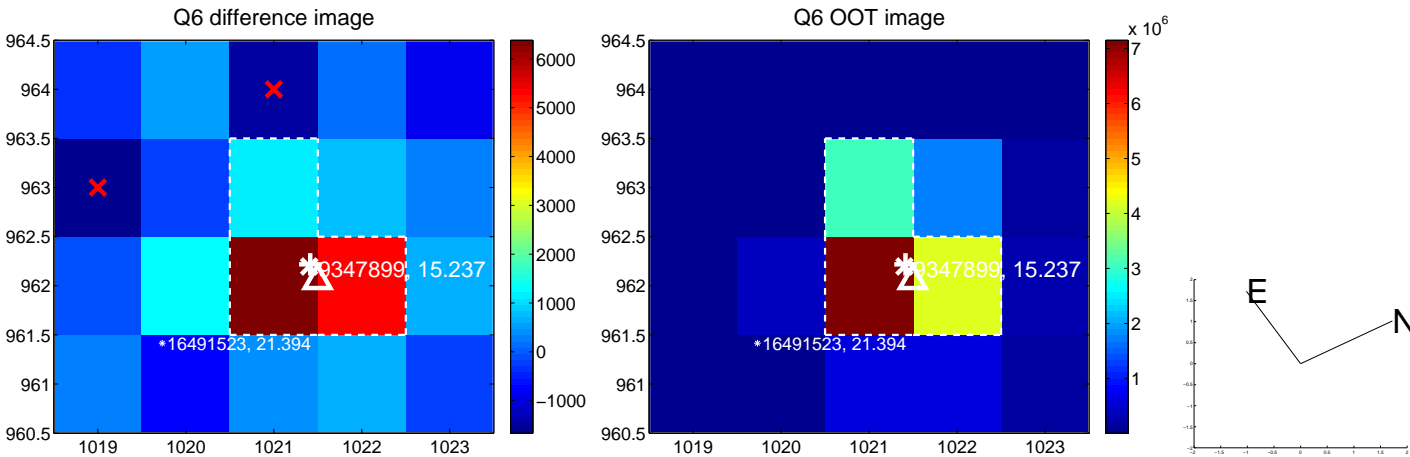
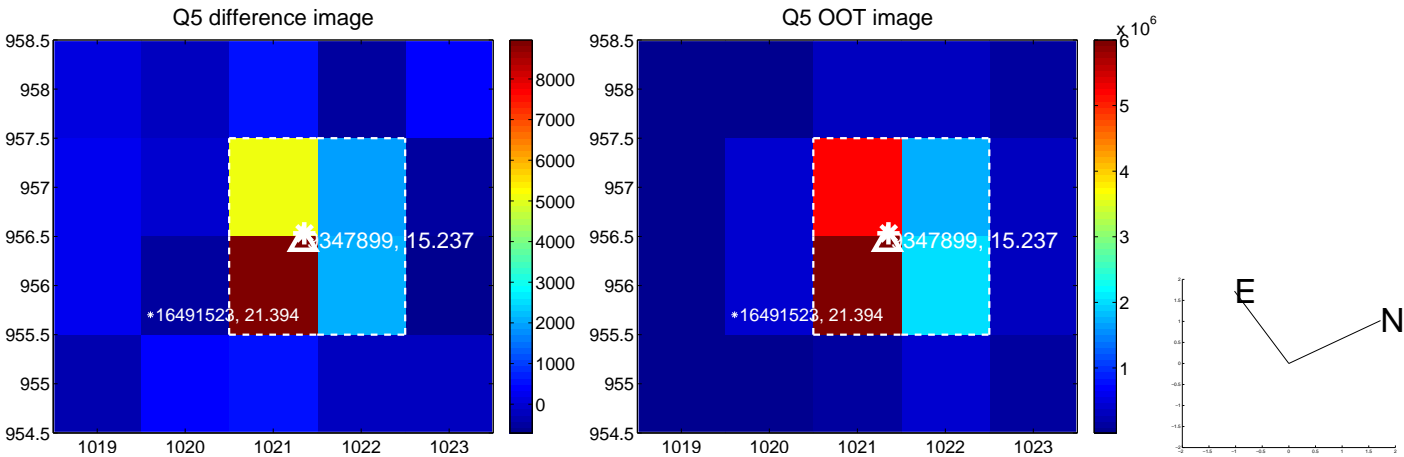
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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



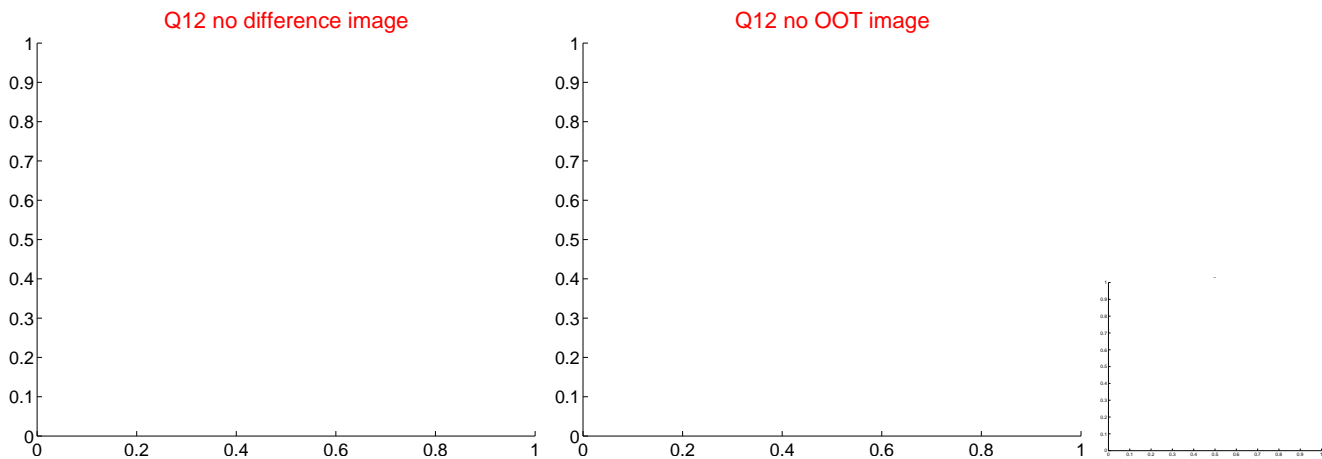
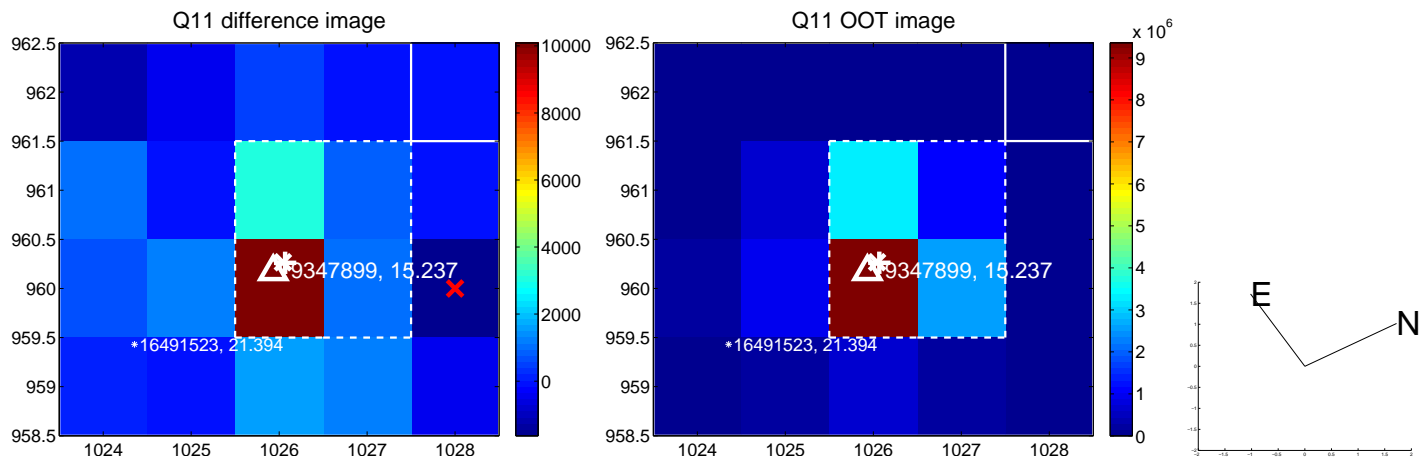
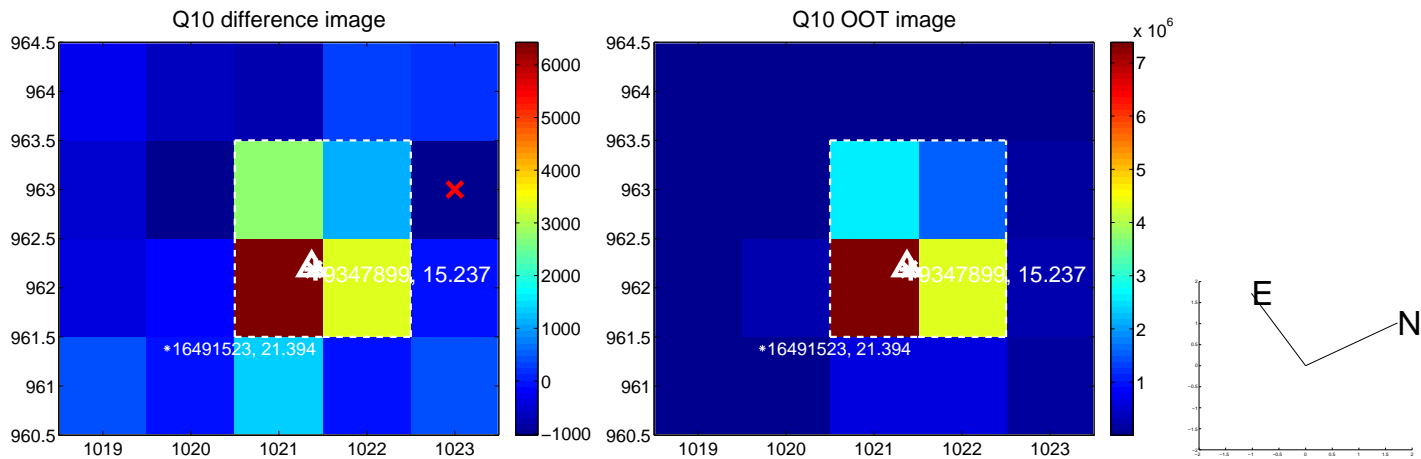
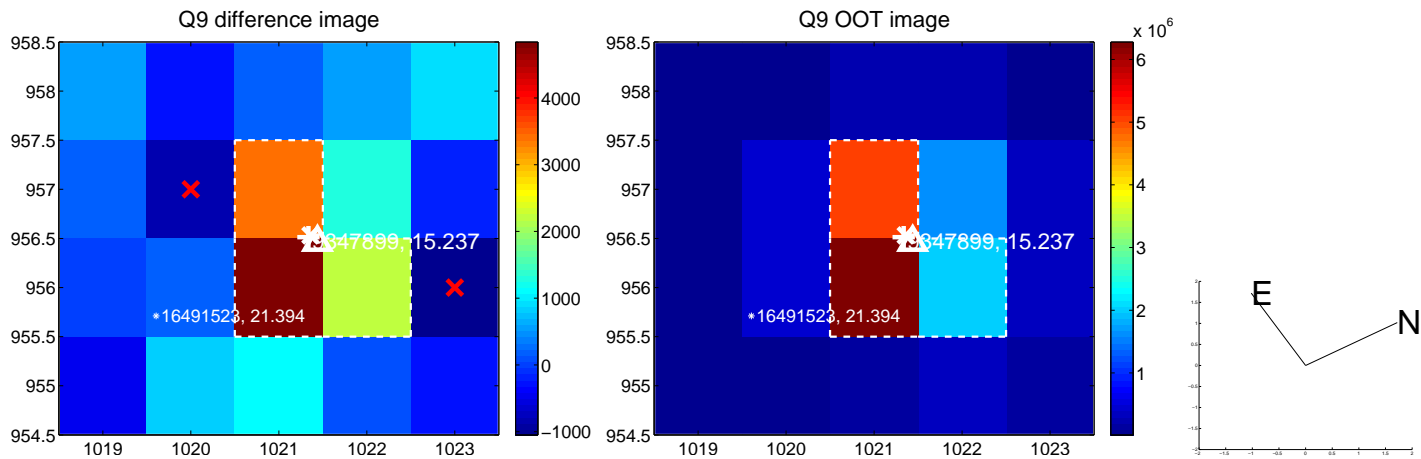
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



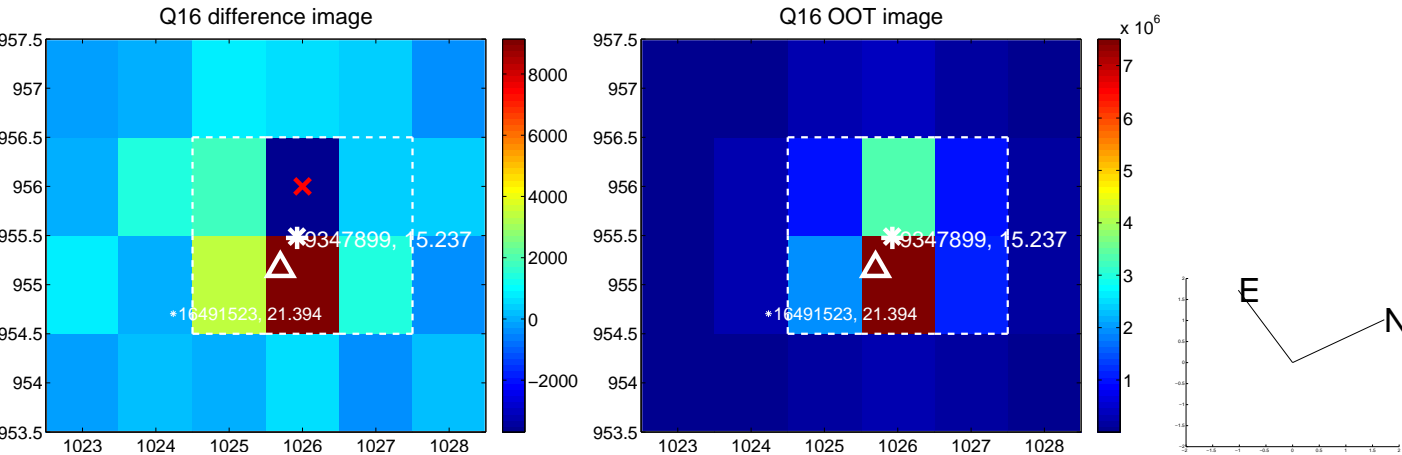
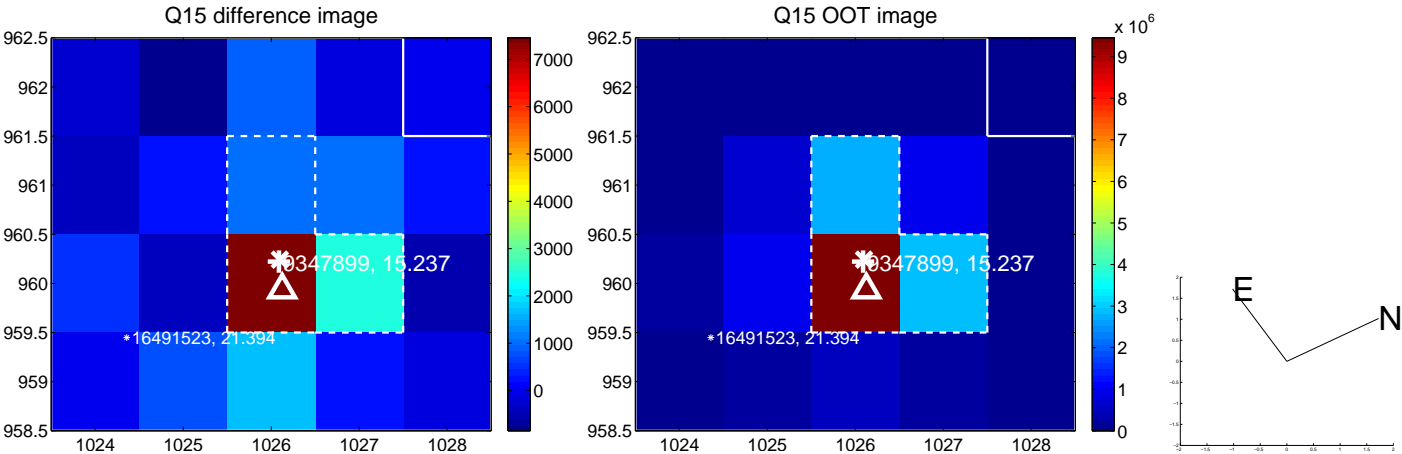
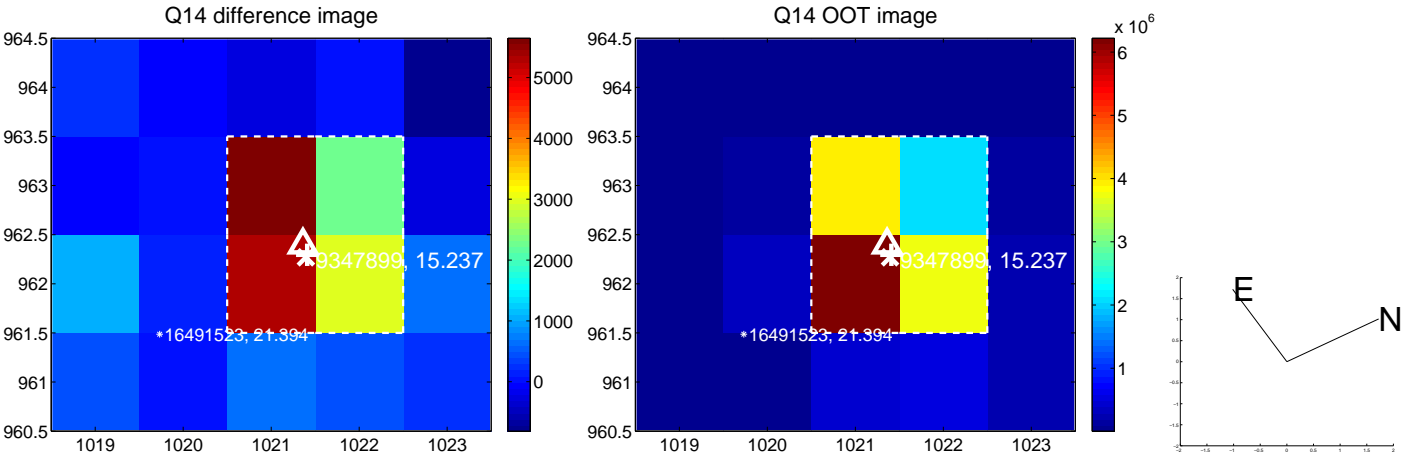
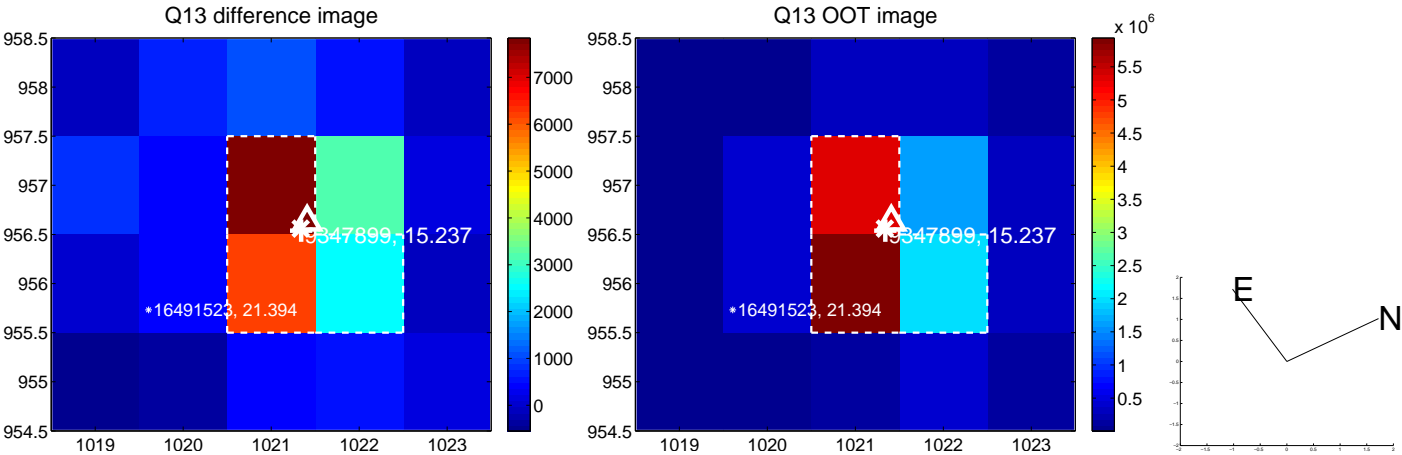
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



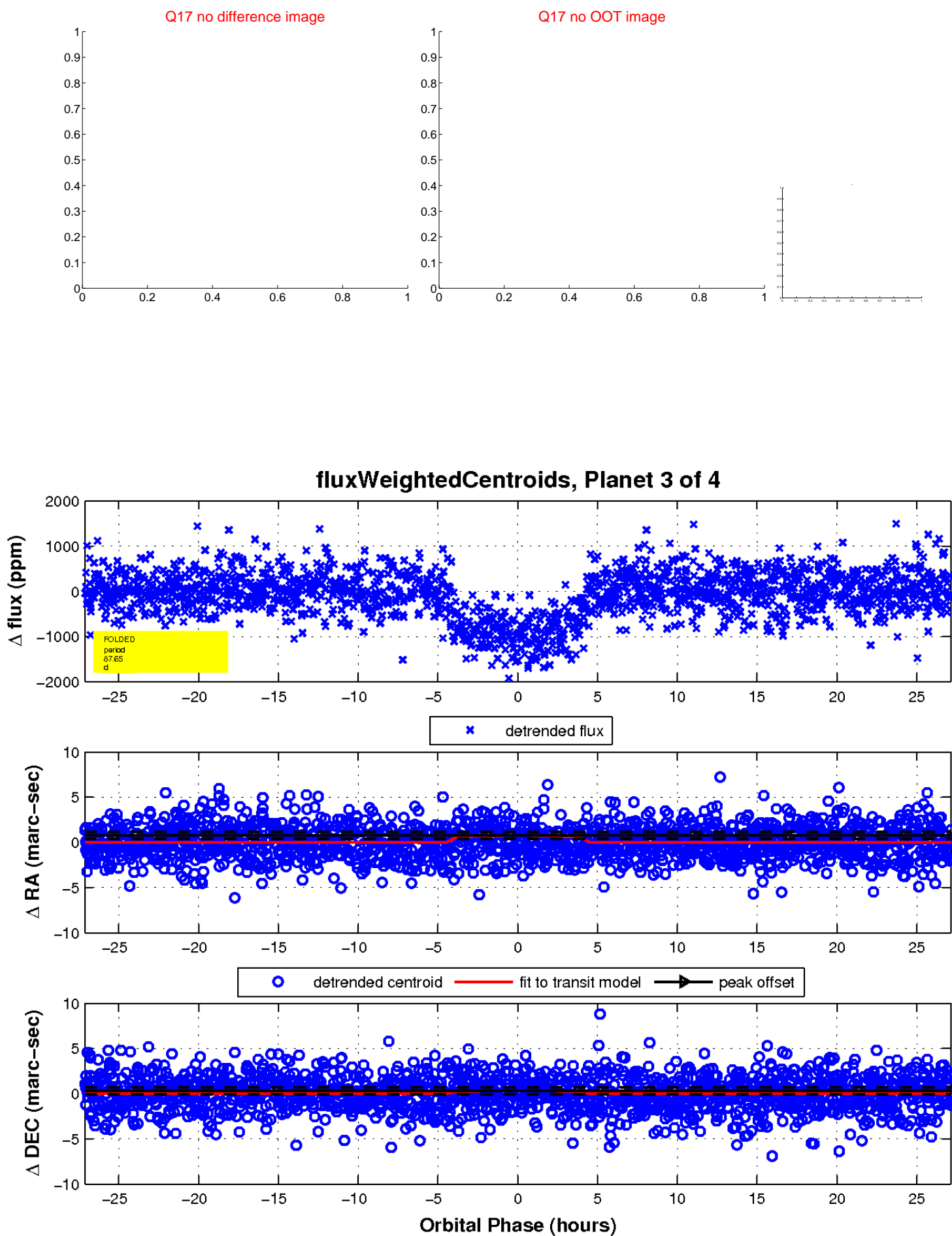
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

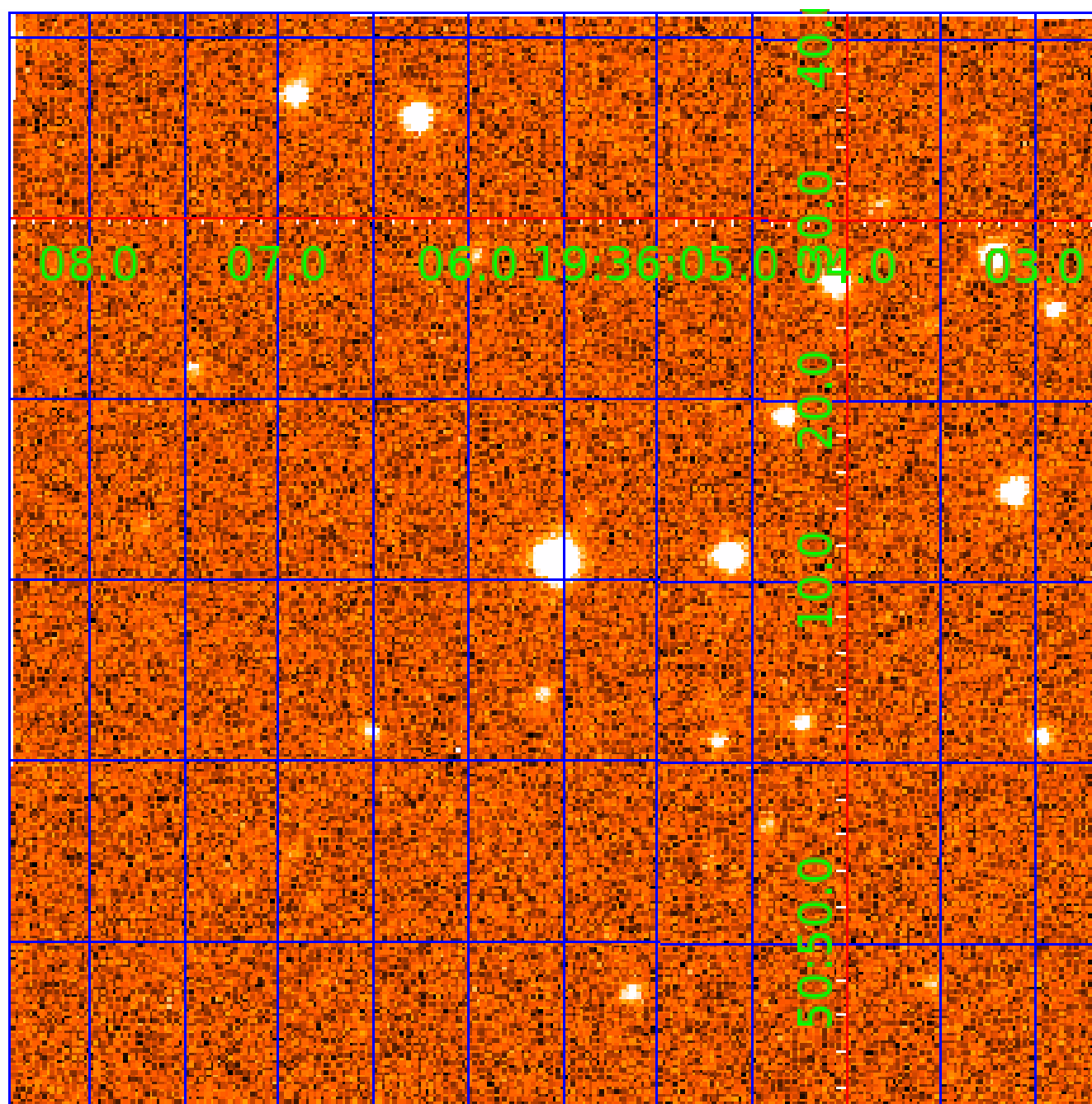


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



# UKIRT Image

Declination



# KIC 009347899

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009347899-01	OBS	0935.01	20.860226	138.295962	1889.7	5.882	94.9	98.2	1.26	6035	6.31	87.92
009347899-02	OBS	0935.02	42.634213	141.173759	1700.0	6.691	62.3	64.1	1.26	6035	5.79	33.90
009347899-03	OBS	0935.03	87.647786	134.939625	1005.9	9.048	28.8	30.4	1.26	6035	4.32	12.97
009347899-04	OBS	0935.04	9.617237	132.864070	124.8	4.116	7.8	8.8	1.26	6035	1.65	246.85

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009347899-01	OBS	PC	1.00	0	0	0	0	NO_COMMENT
009347899-02	OBS	PC	1.00	0	0	0	0	NO_COMMENT
009347899-03	OBS	PC	0.97	0	0	0	0	NO_COMMENT
009347899-04	OBS	PC	0.97	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 009347899-04

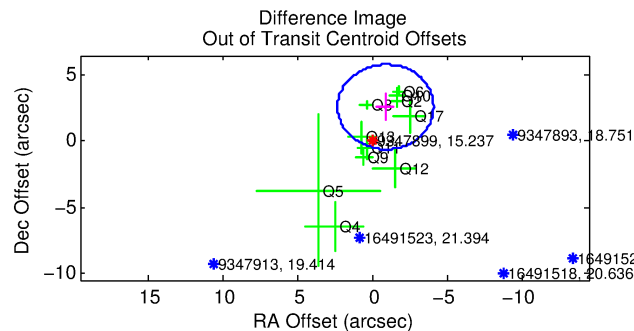
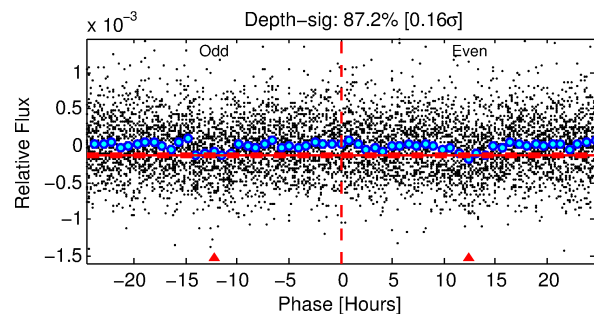
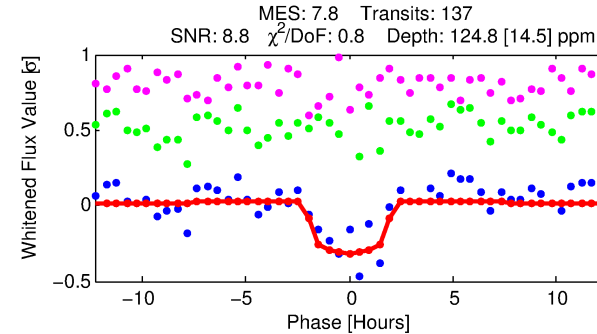
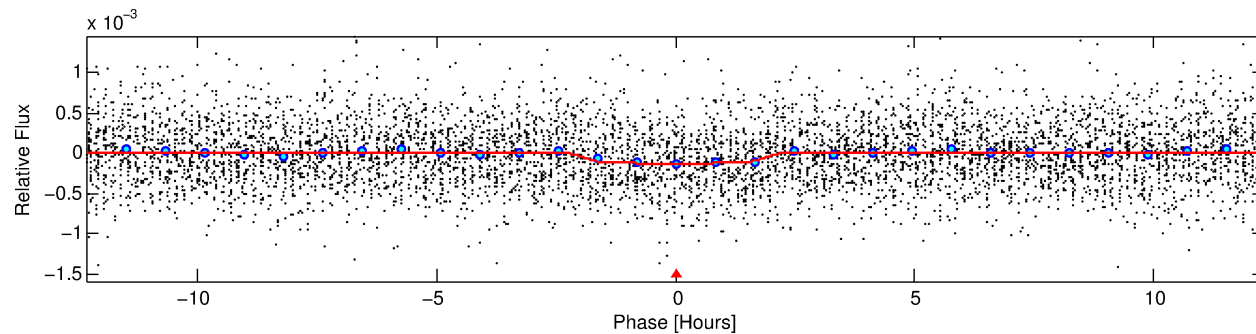
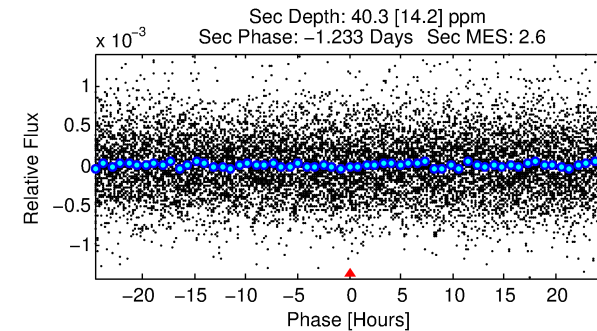
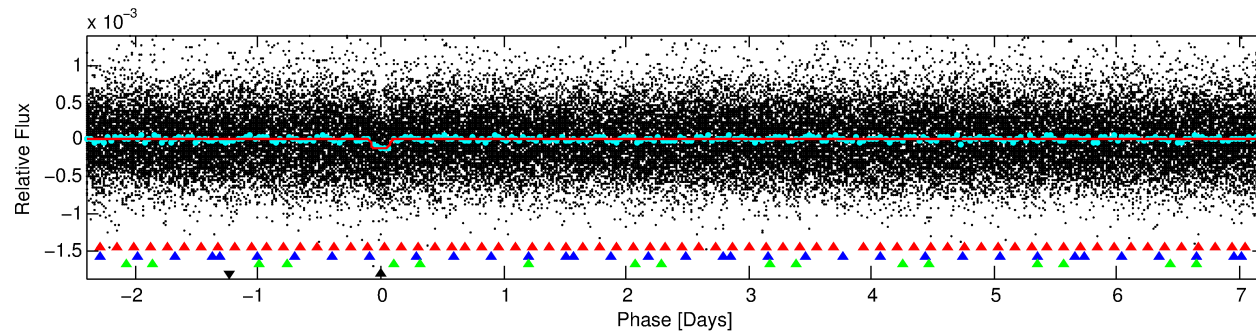
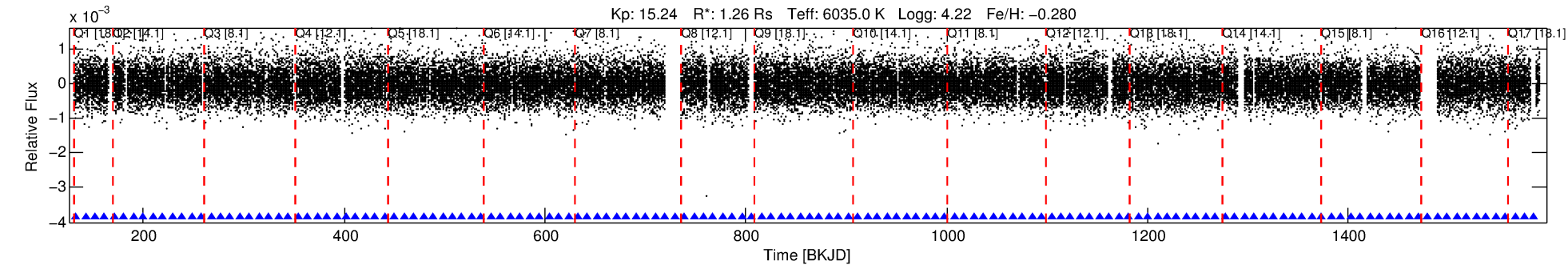
No Significant Match Found



# DV One-Page Summary

KIC: 9347899 Candidate: 4 of 4 Period: 9.617 d

KOI: K00935.04 Corr: 0.977



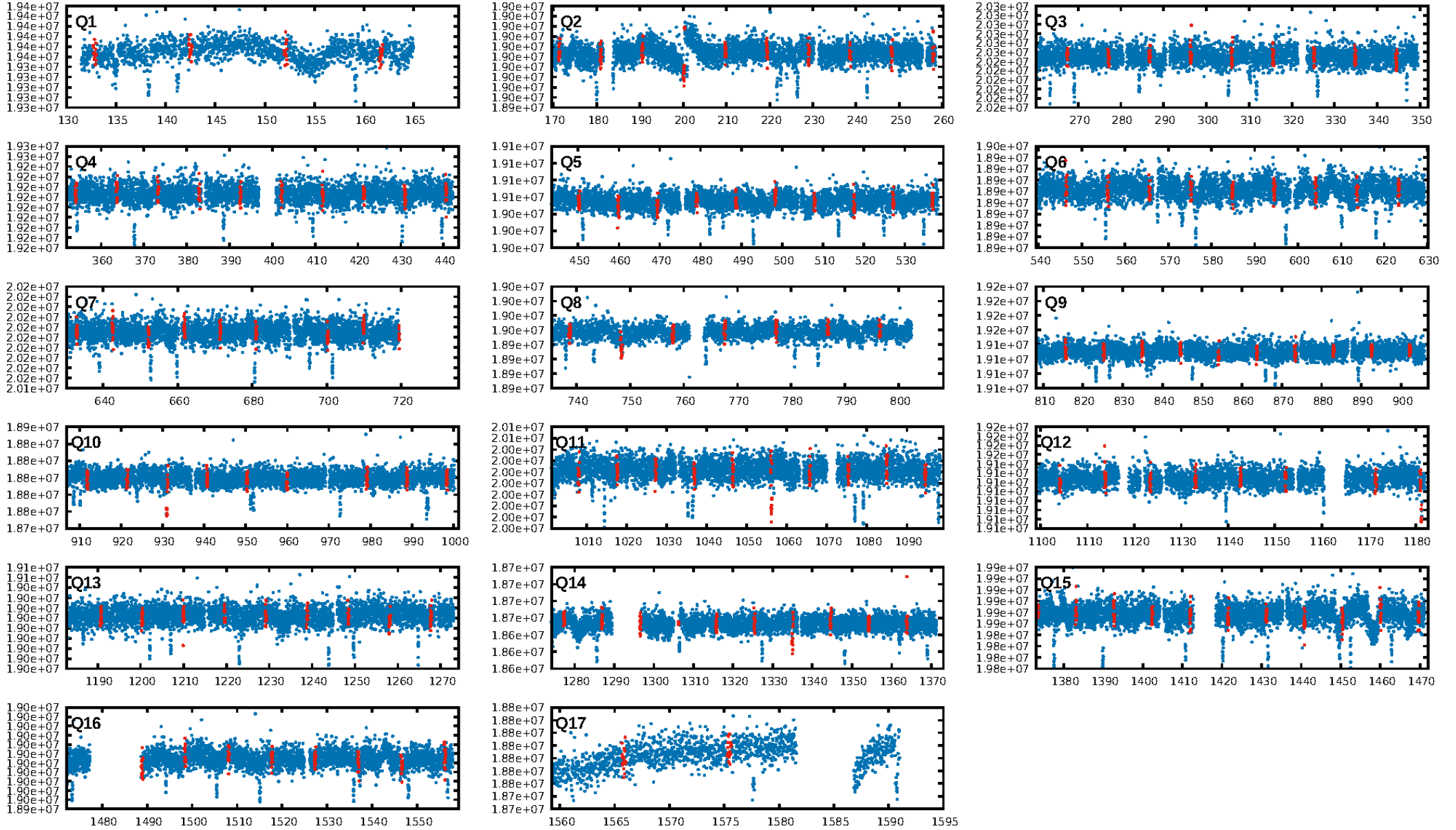
## DV Fit Results:

Period = 9.61724 [0.00011] d  
Epoch = 132.8641 [0.0089] BKJD  
Rp/R\* = 0.0120 [0.0066]  
a/R\* = 8.35 [23.71]  
b = 0.90 [0.62]  
Seff = 246.85 [74.22]  
Teff = 1011 [76] K  
Rp = 1.65 [0.96] Re  
a = 0.0872 [0.0161] AU  
Ag = 61.94 [73.18] [0.83σ]  
Teffp = 4384 [1258] K [2.68σ]

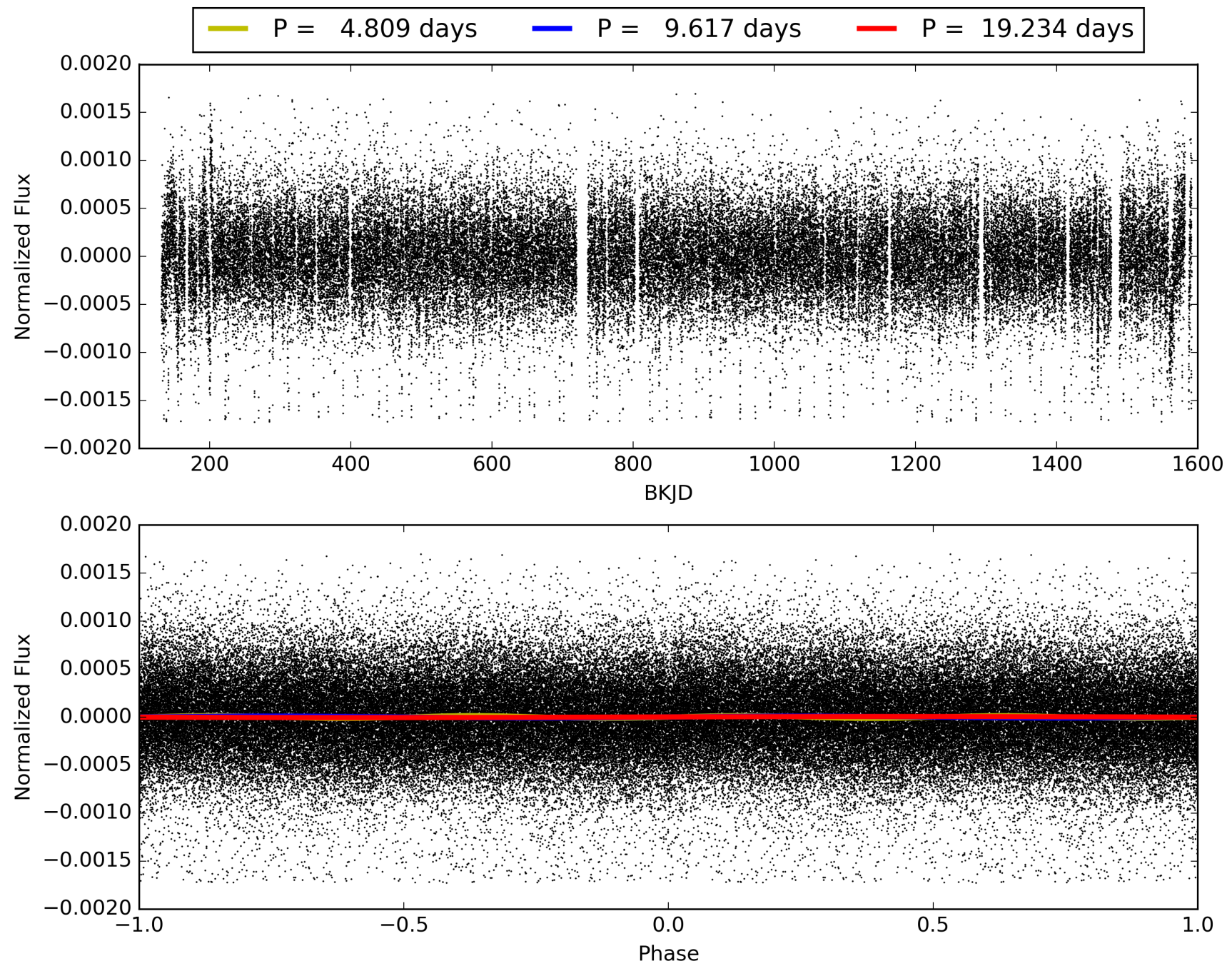
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [37.59σ]  
ModelChiSquare2-sig: 100.0%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 2.06e-15  
RollingBand-fgt: 1.00 [131/131]  
GhostDiagnostic-chr: 2.422  
Centroid-sig: 33.0%  
Centroid-so: 1.233 arcsec [0.86σ]  
OotOffset-rm: 2.756 arcsec [2.57σ]  
KicOffset-rm: 2.808 arcsec [2.64σ]  
OotOffset-st: 3/1/3/4 [11]  
KicOffset-st: 3/1/3/4 [11]  
DiffImageQuality-fgm: 0.64 [7/11]  
DiffImageOverlap-fno: 1.00 [17/17]

# TCE 009347899-04, PDC Light Curves

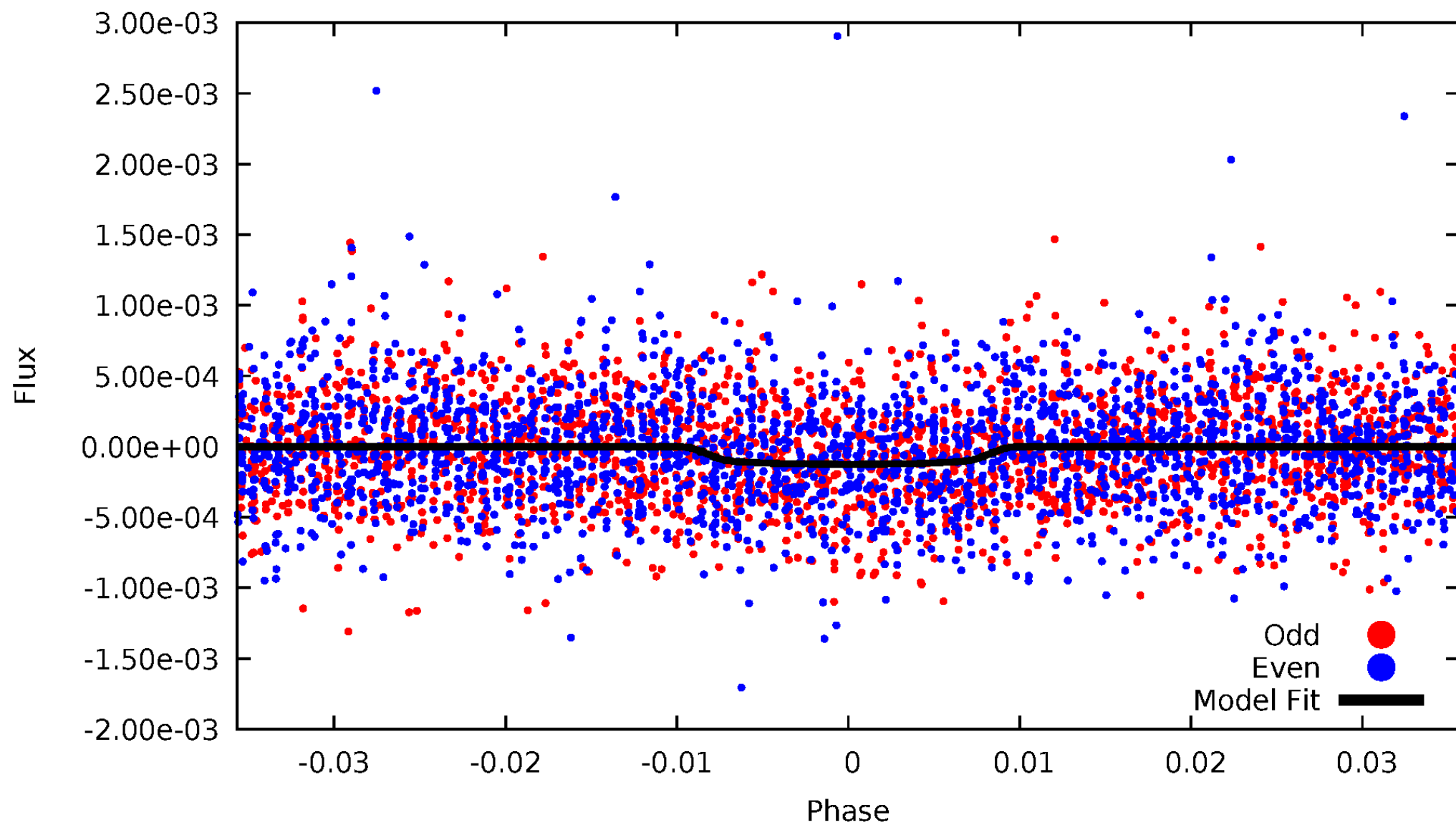


TCE 009347899-04



# DV Odd/Even

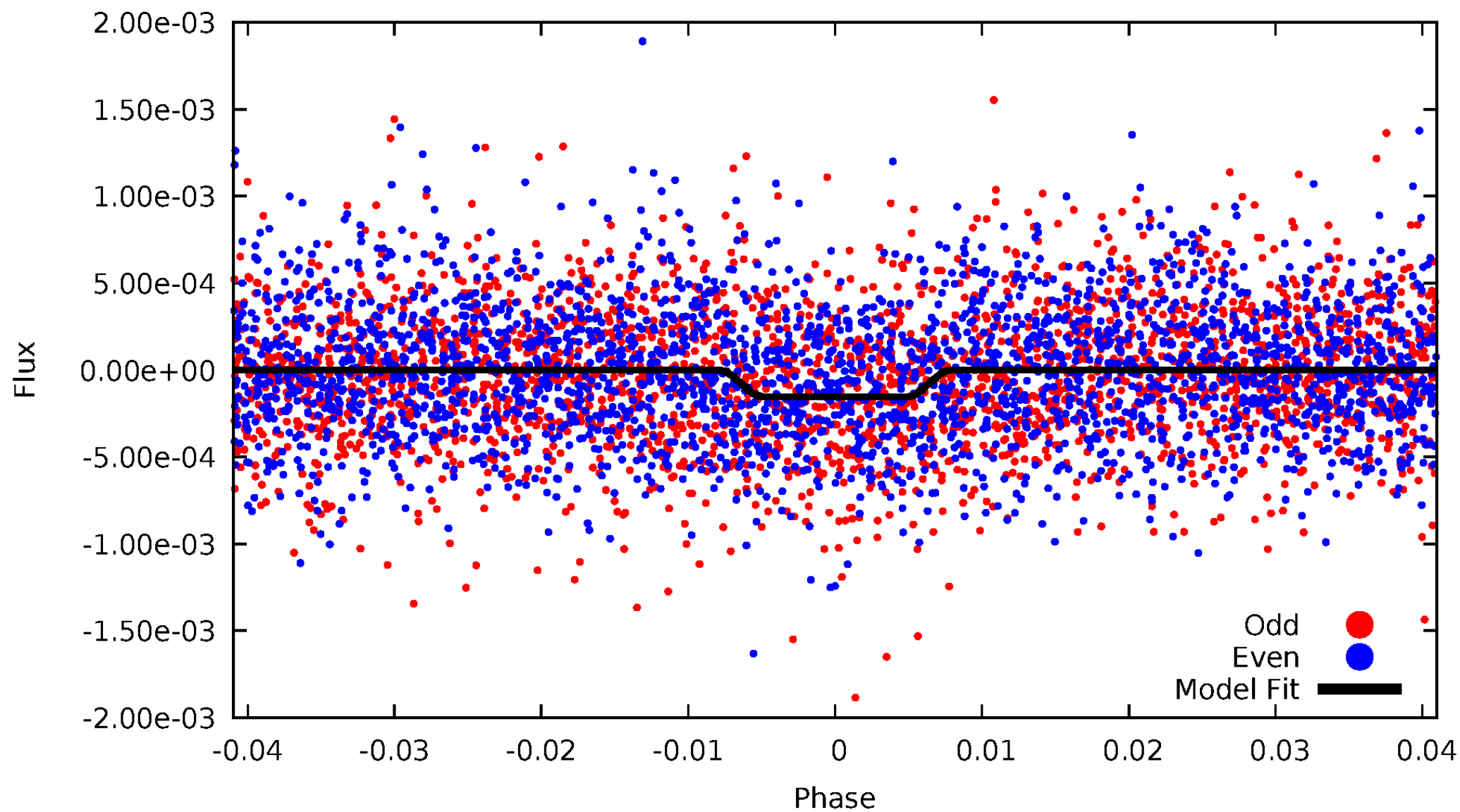
TCE 009347899-04





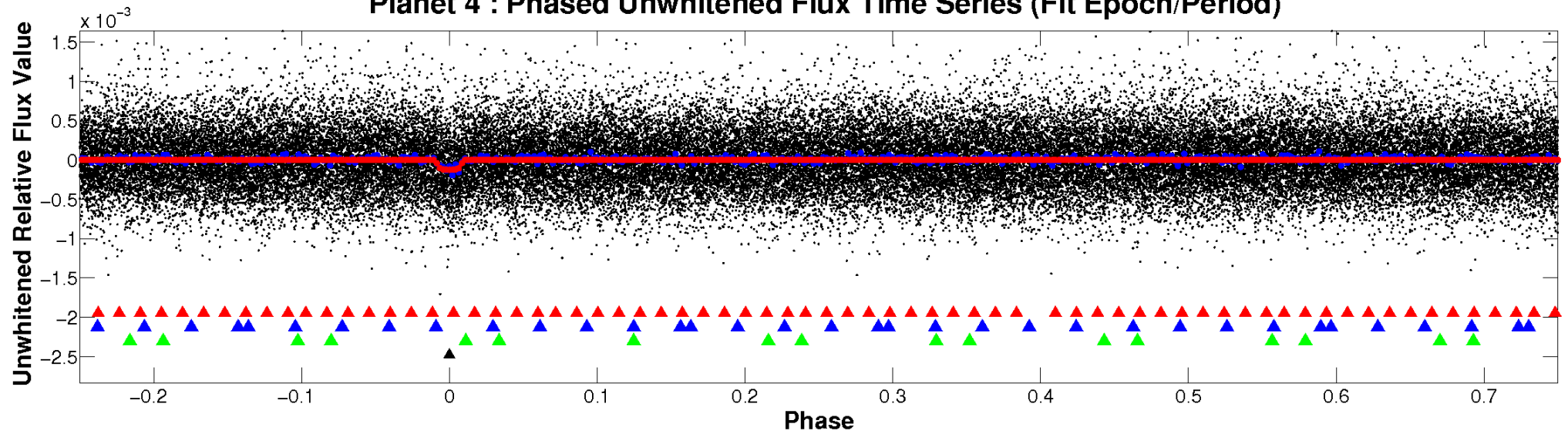
# ALT Odd/Even

TCE 009347899-04

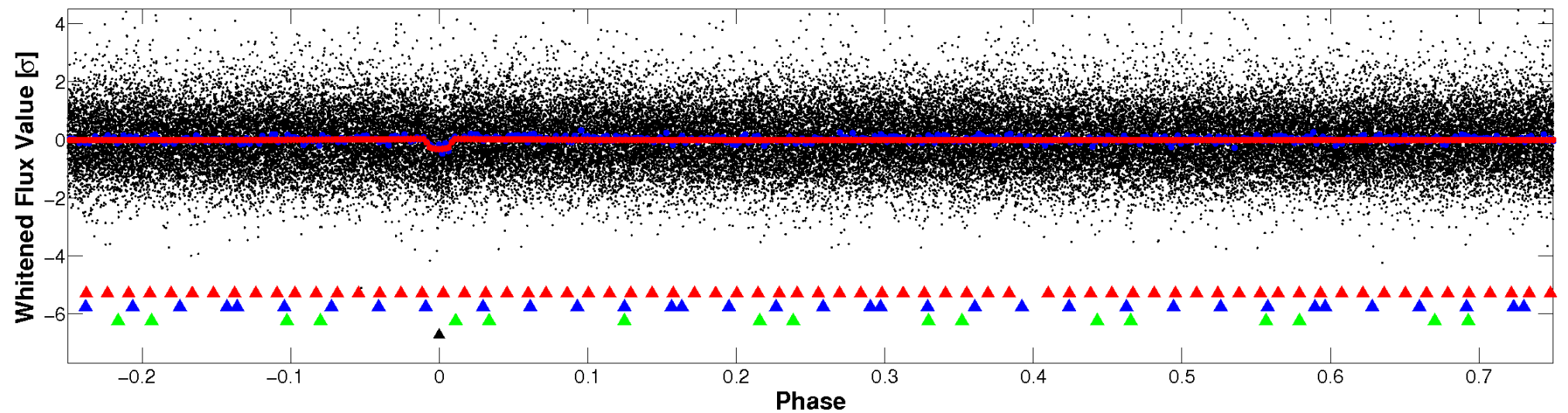


# Non-Whitened Vs. Whitened Light Curve

## Planet 4 : Phased Unwhitened Flux Time Series (Fit Epoch/Period)

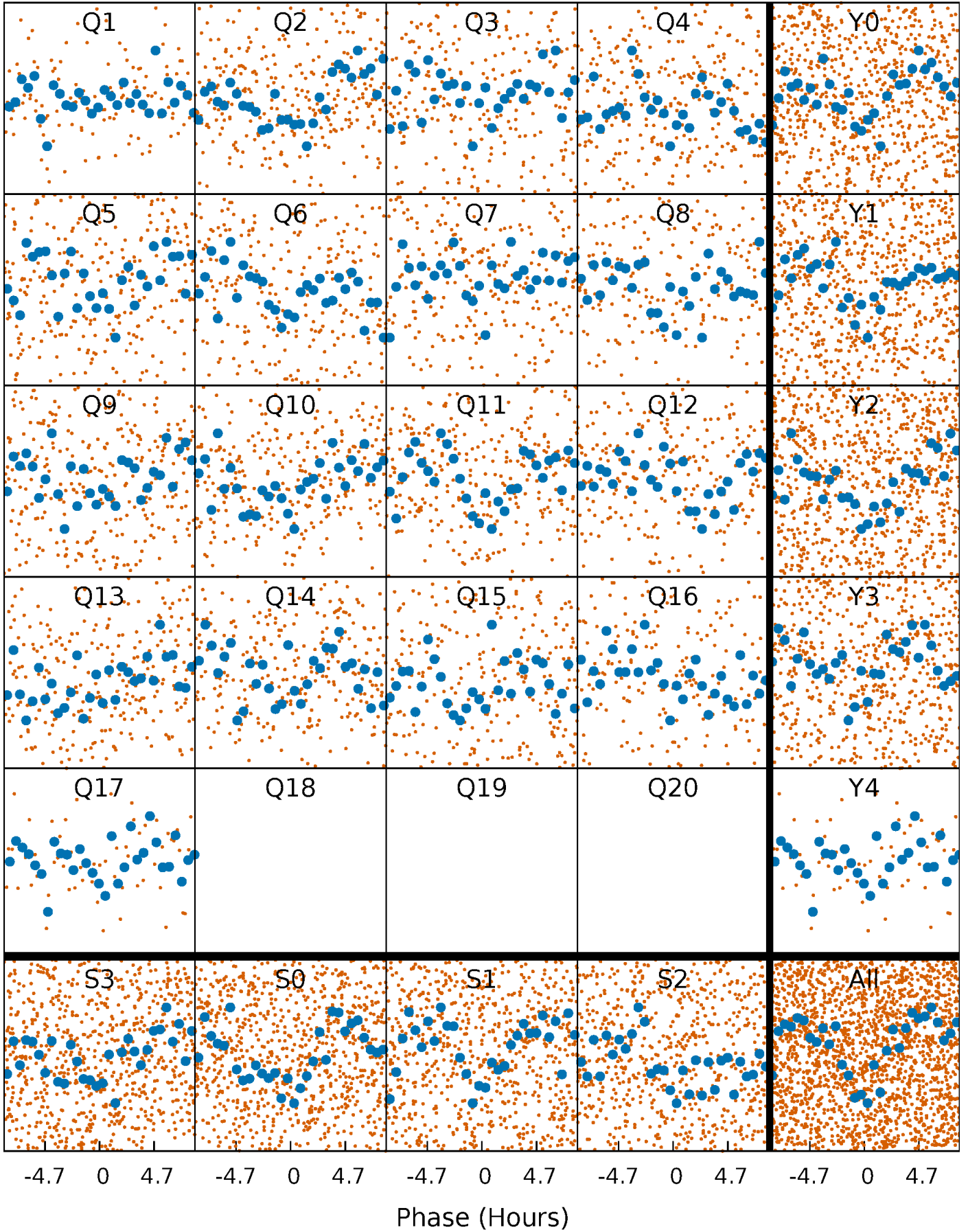


## Planet 4 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

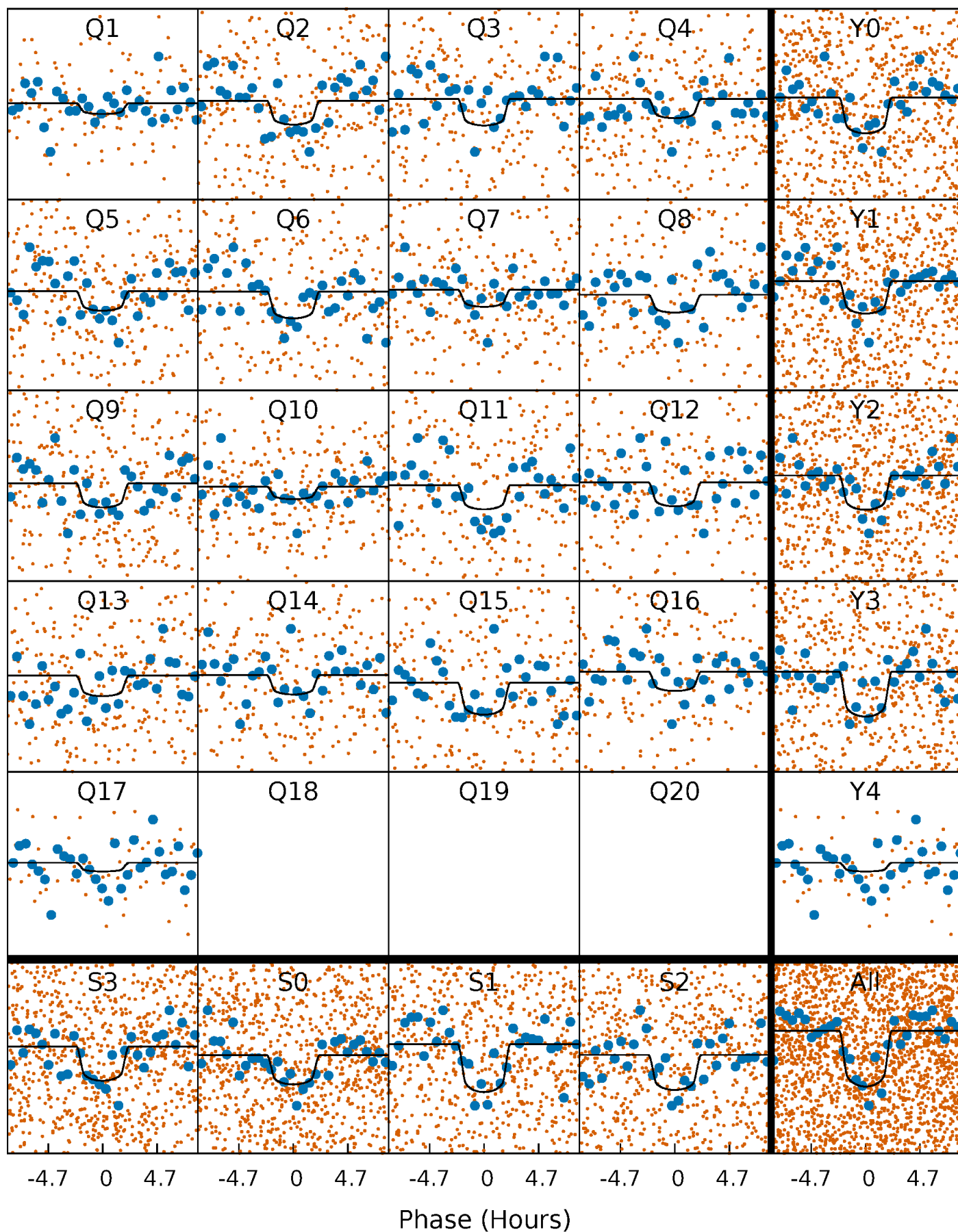
TCE 009347899-04    P= 9.617237 Days     $T_0=132.864070$  (BKJD)





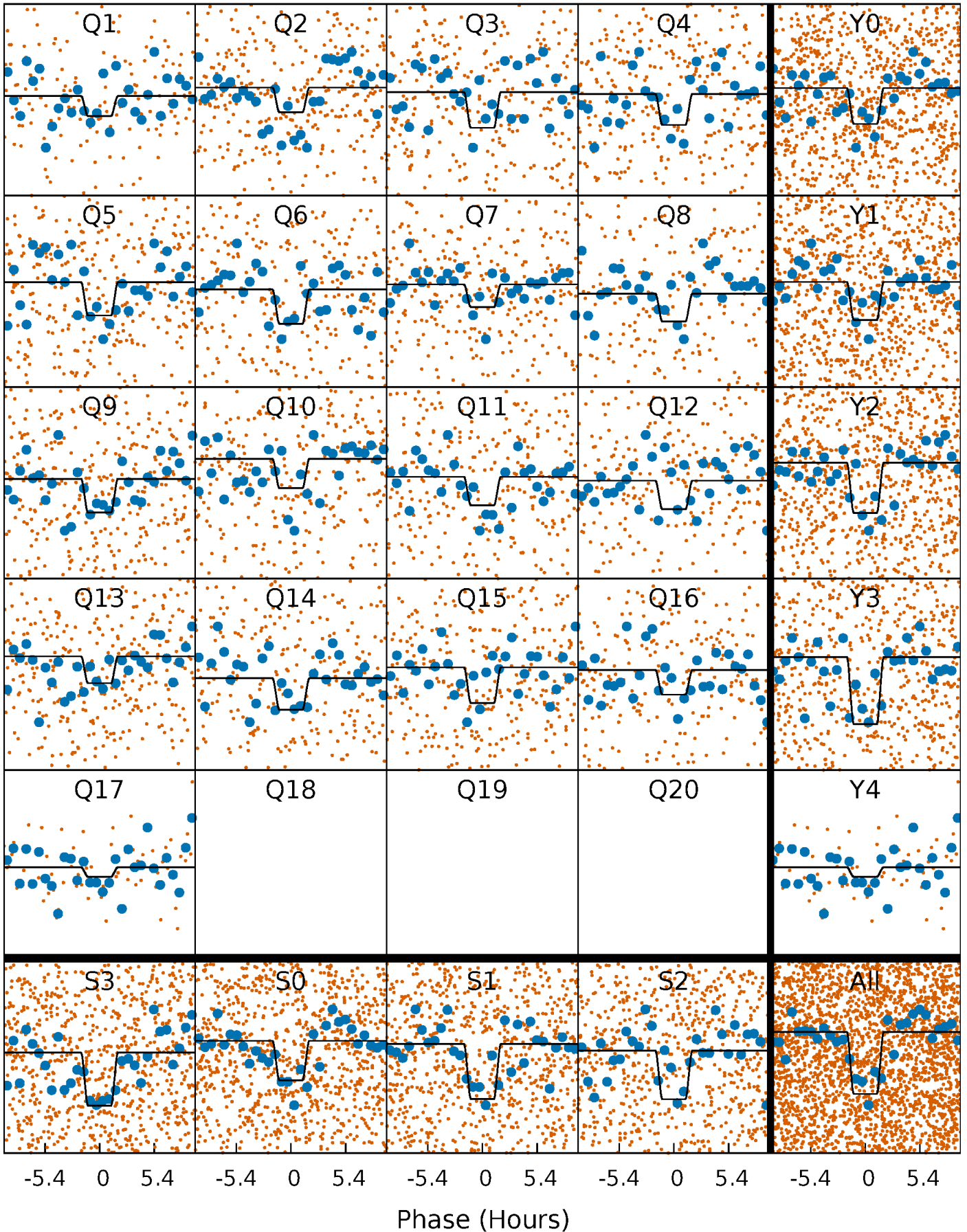
# DV Quarter-Phased Transit Curves

TCE 009347899-04 P= 9.617237 Days  $T_0=132.864070$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

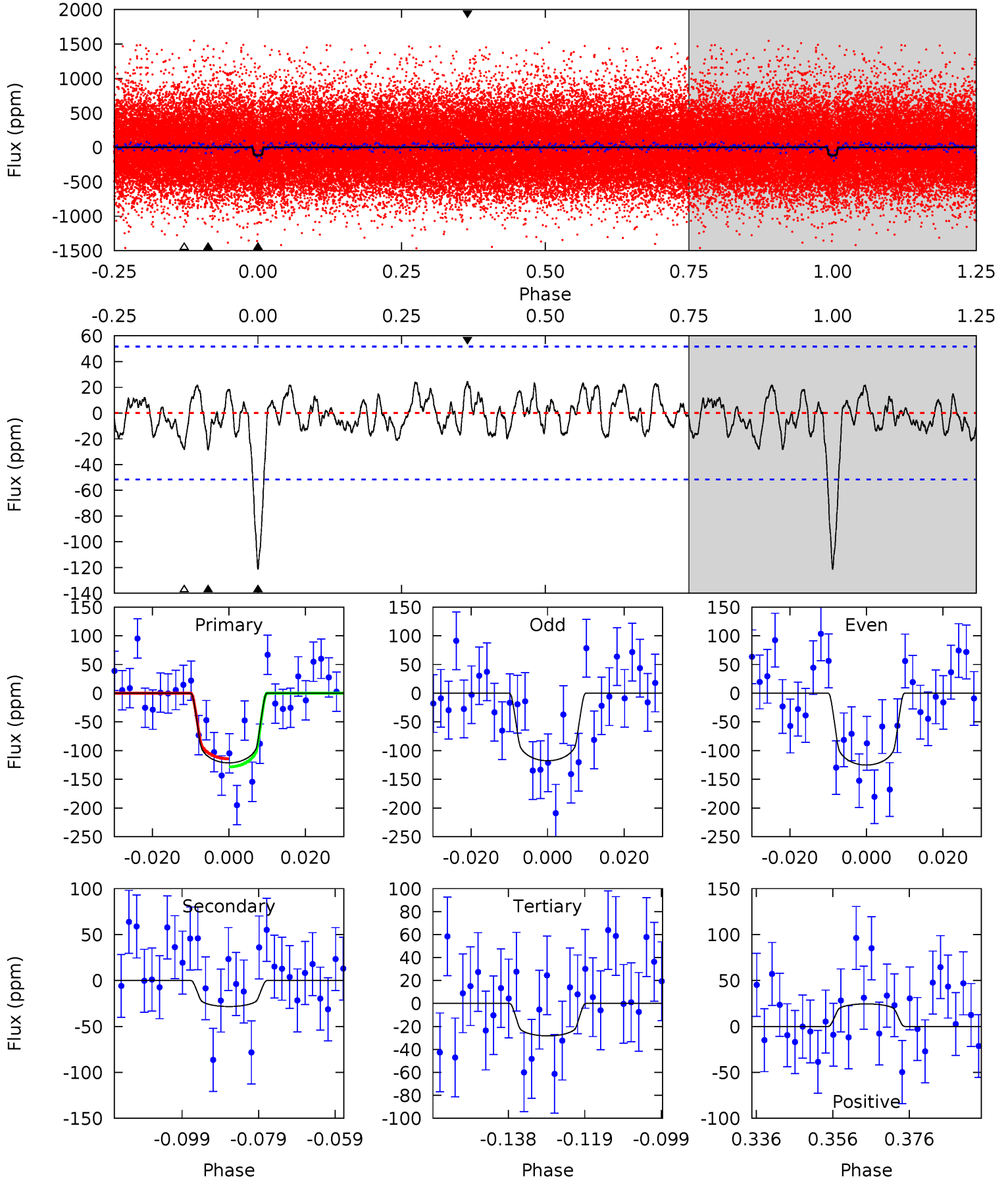
TCE 009347899-04     $P = 9.617044$  Days     $T_0 = 132.879176$  (BKJD)



# DV Model-Shift Uniqueness Test

009347899-04, P = 9.617237 Days, E = 123.246833 Days

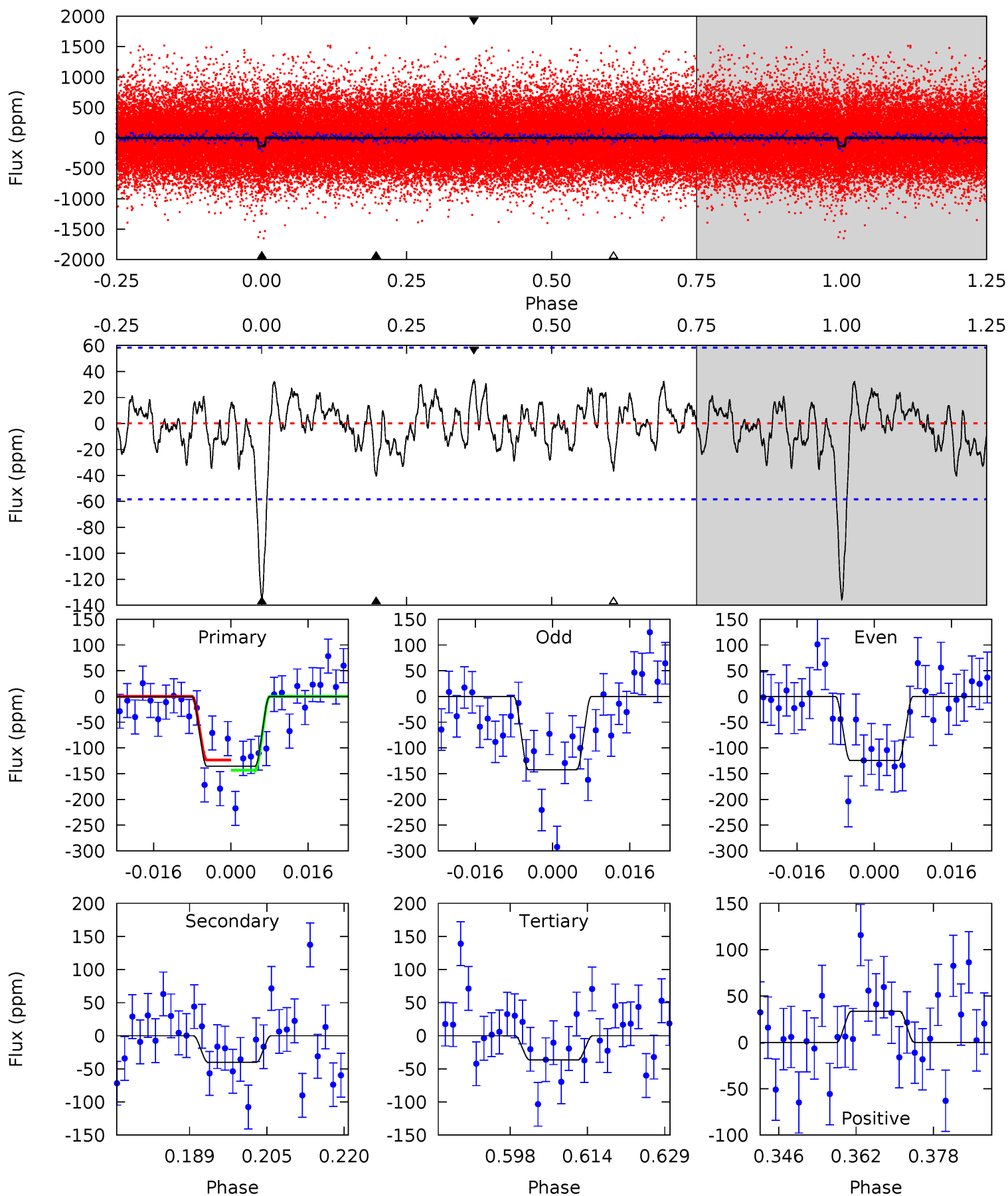
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
11.5	2.69	2.67	2.33	4.89	2.33	1.06	8.84	9.18	0.01	0.36	0.36	1.09	0.17	0.67



# Alt Model-Shift Uniqueness Test

009347899-04, P = 9.617044 Days, E = 123.262132 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
11.5	3.40	3.09	2.84	4.94	2.42	1.20	8.37	8.63	0.30	0.56	0.76	1.12	0.20	0.84



### Stellar Parameters For KIC 009347899

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6035^{+120}_{-120}$	$4.220^{+0.168}_{-0.112}$	$-0.280^{+0.150}_{-0.150}$	$1.257^{+0.187}_{-0.250}$	$0.958^{+0.076}_{-0.068}$	$0.678^{+0.545}_{-0.220}$
	+2%/-2%	+4%/-3%	+54%/-54%	+15%/-20%	+8%/-7%	+80%/-32%
Source	SPE58	SPE58	SPE58	DSEP		

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

### Secondary Eclipse Parameters for KIC 009347899-04 / KOI 0935.04

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	$-28 \pm 11$	$1.70^{+0.88}_{-0.85}$	$1409^{+73}_{-79}$	$4151^{+1423}_{-621}$	$40^{+126}_{-25}$
Alt.	$-40 \pm 12$	$1.74^{+0.85}_{-0.90}$	$1408^{+68}_{-78}$	$4420^{+1692}_{-596}$	$55^{+183}_{-31}$

$T_{\text{max}}$  = 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

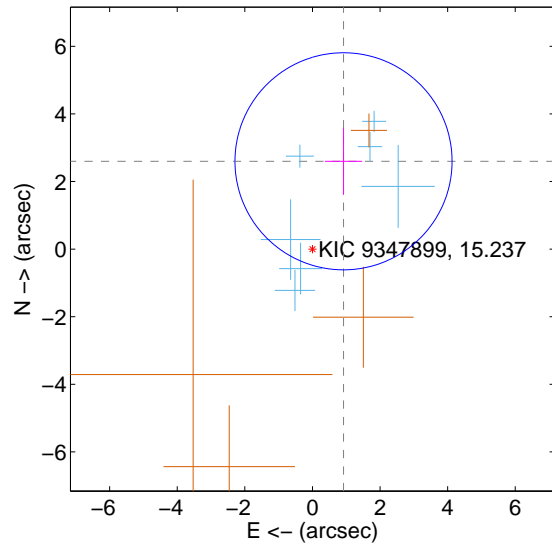
Supplemental centroid analysis for 009347899-04. Kepler magnitude: 15.24. Transit SNR 8.80

There are 7 quarters with good PRF difference image offsets

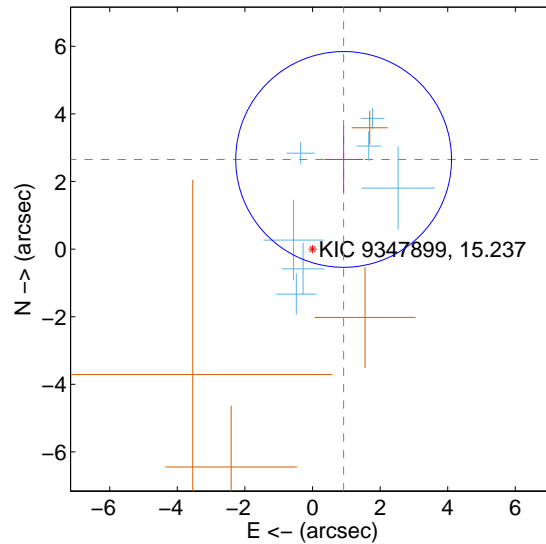
The direct PRF centroid is offset from the target star catalog position by about 0.05 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$2.756 \pm 1.071$	2.57	$-0.920 \pm 0.550$	$2.598 \pm 0.990$
PRF-fit source offset from KIC position	$2.808 \pm 1.064$	2.64	$-0.920 \pm 0.572$	$2.653 \pm 0.971$
photometric centroid source offset	$1.23 \pm 1.44$	0.86	$1.09 \pm 1.44$	$0.58 \pm 1.46$

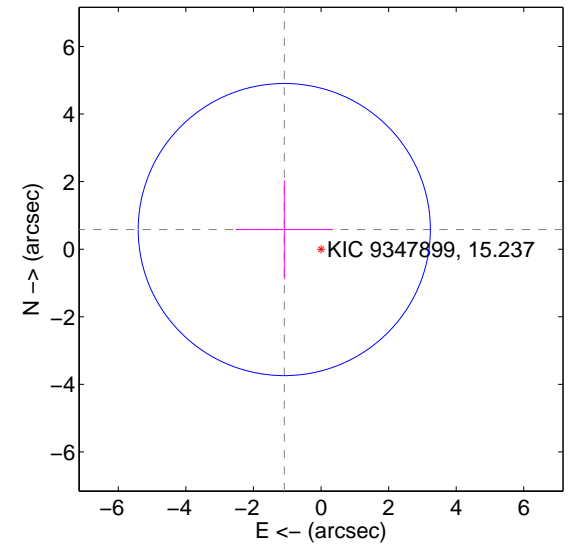
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position



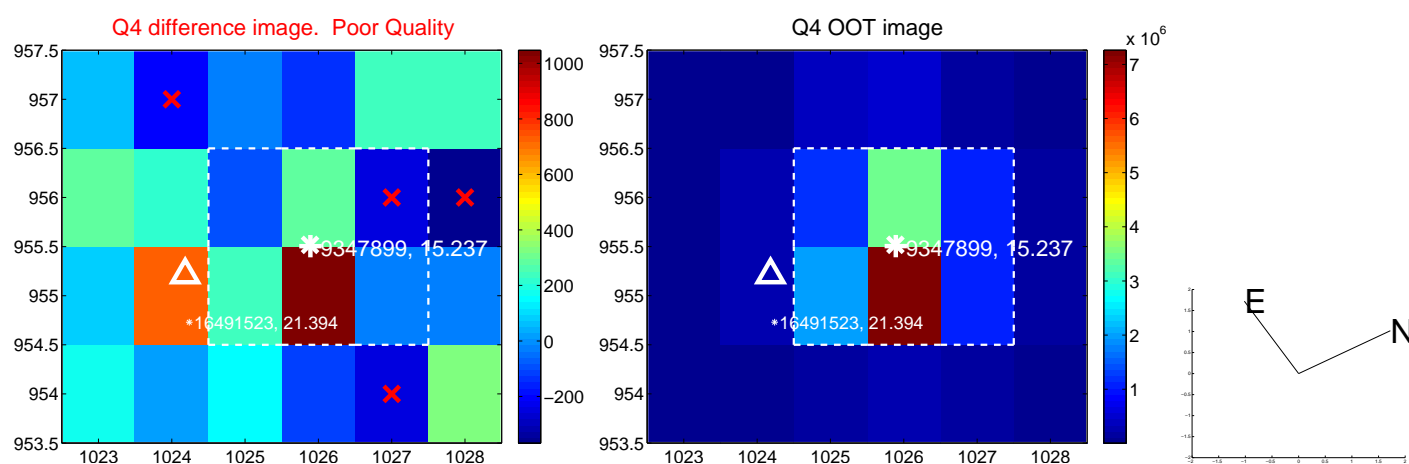
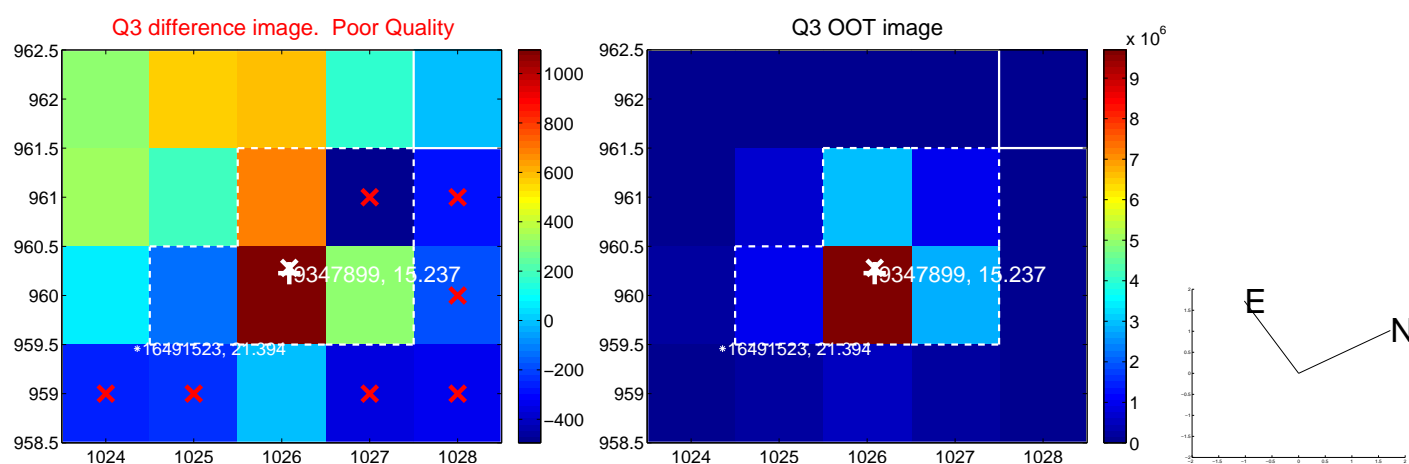
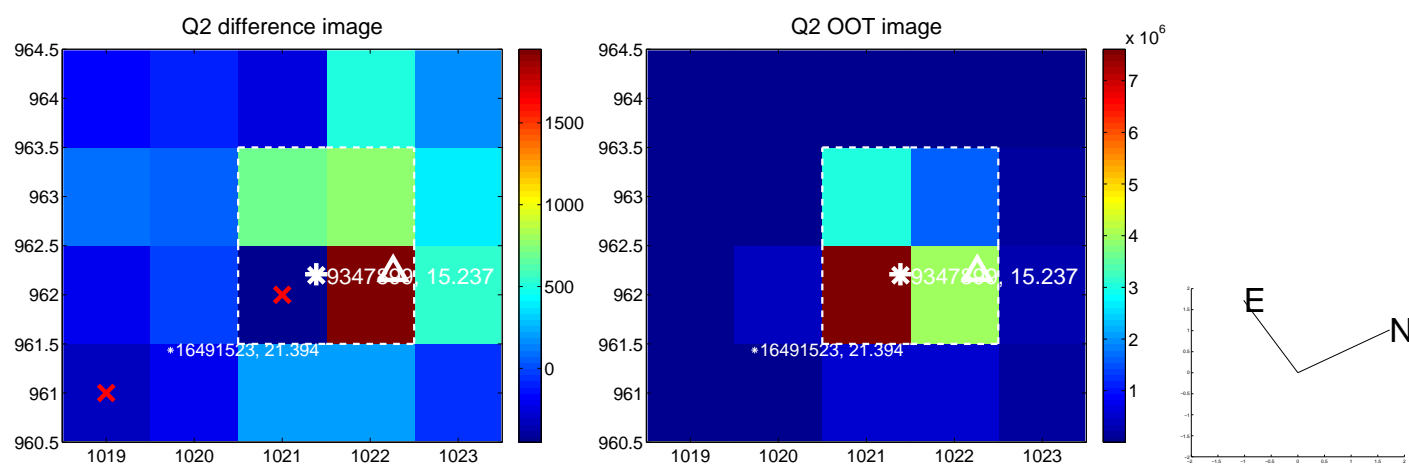
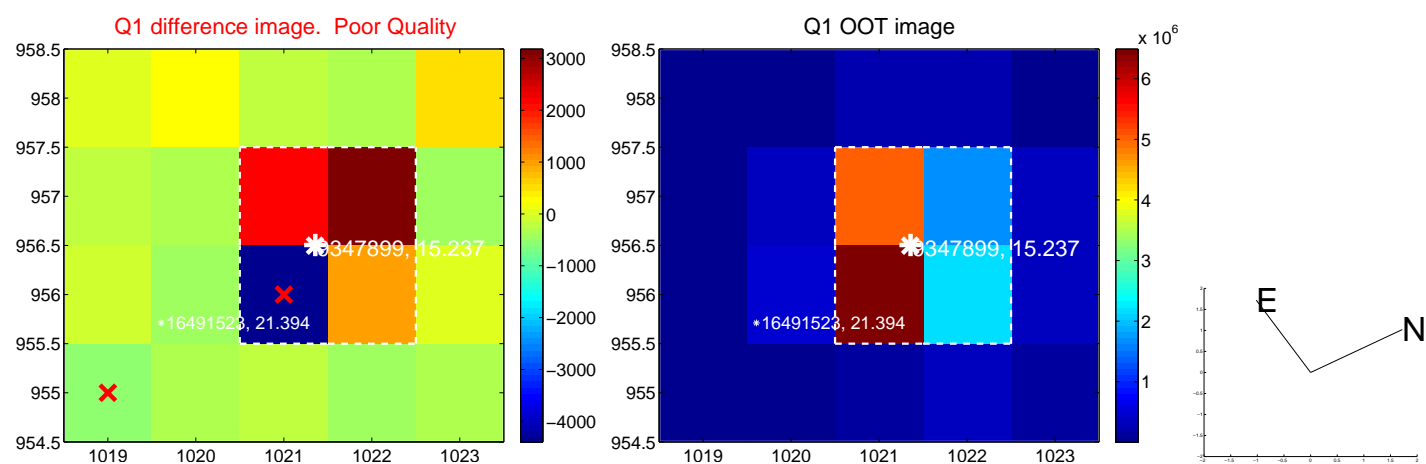
offset from photometric centroids



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.

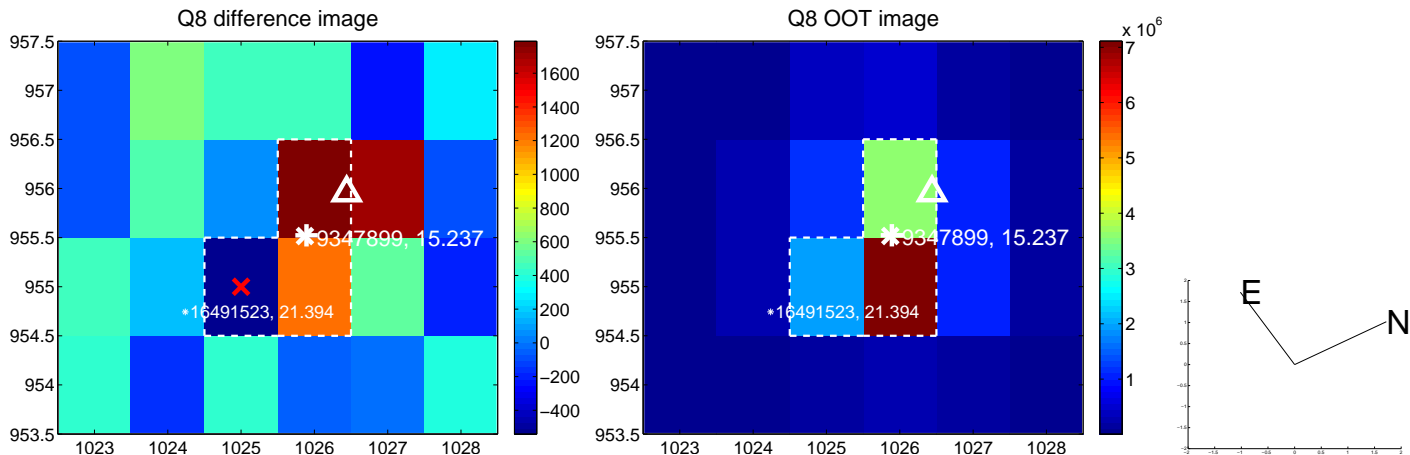
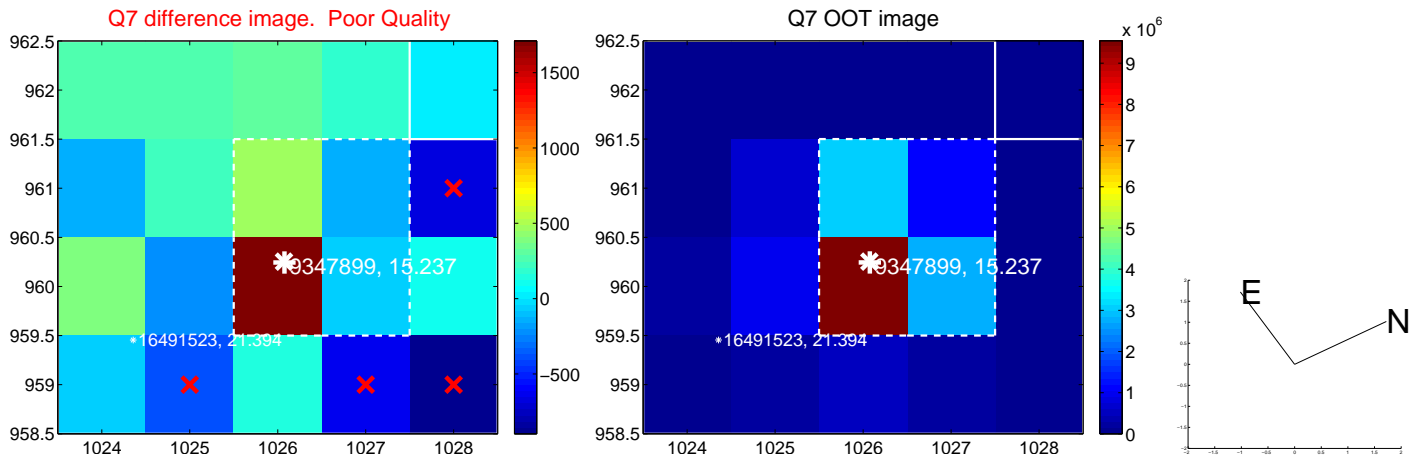
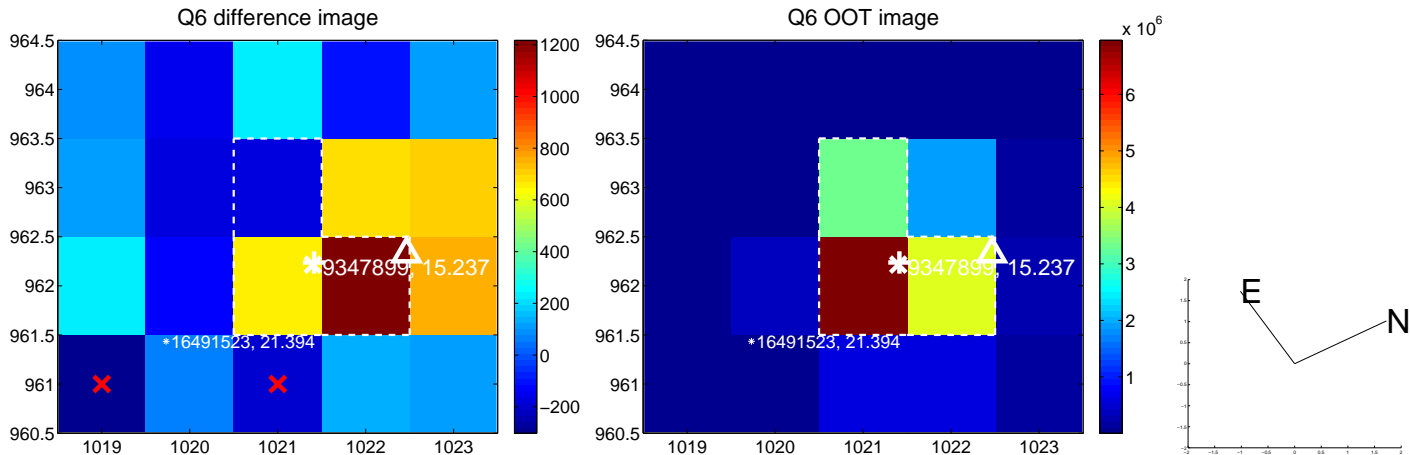
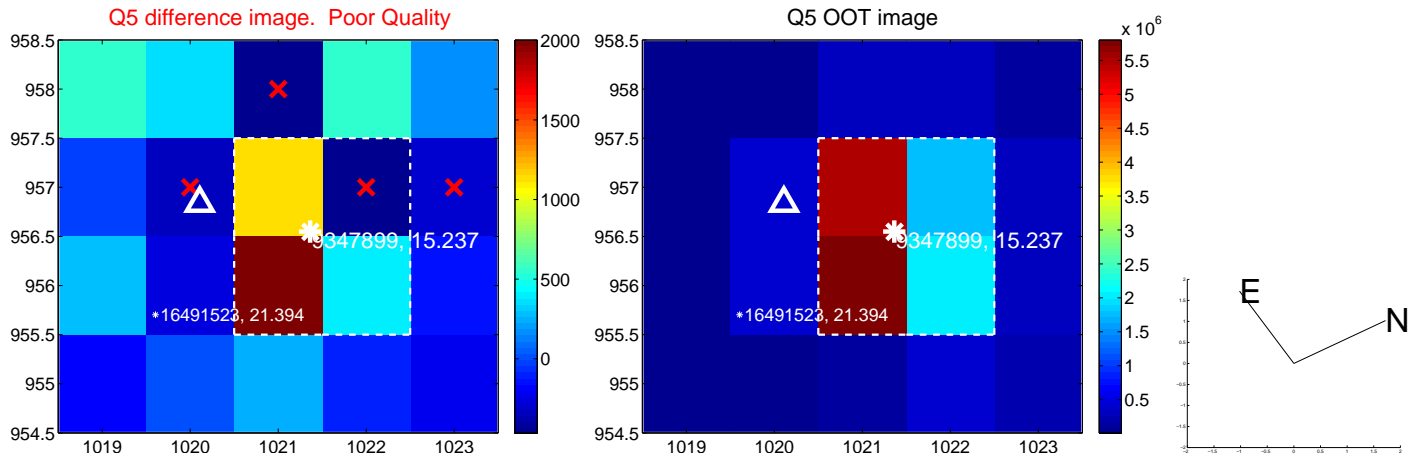


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

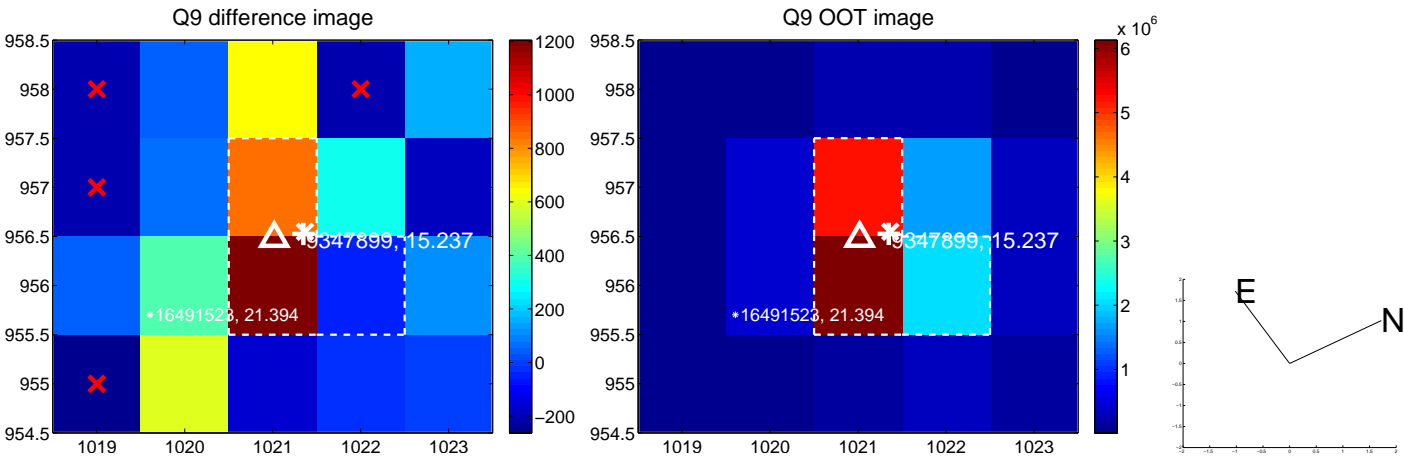




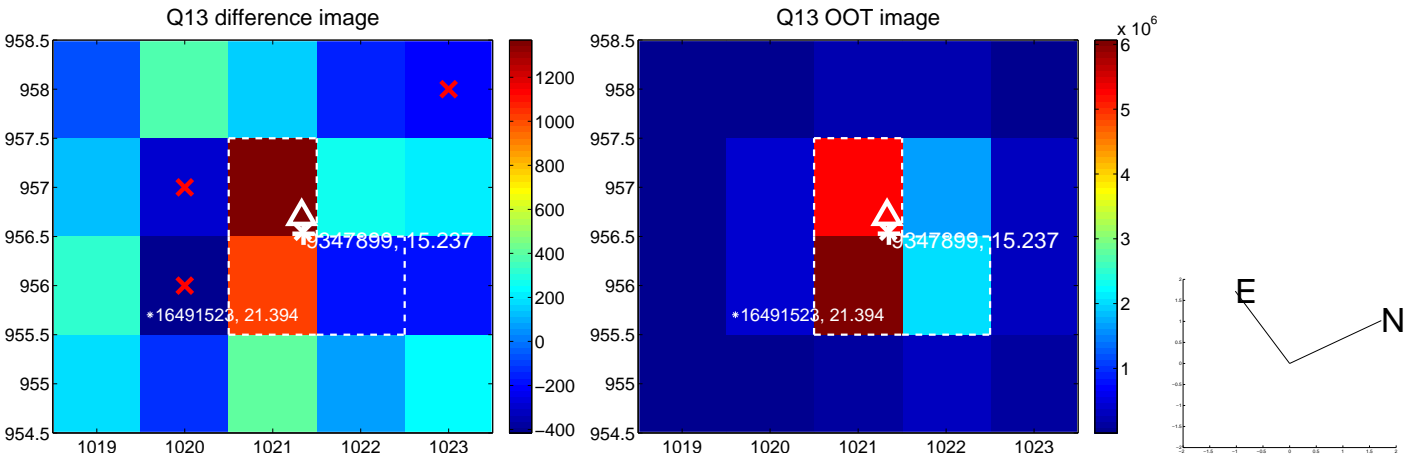
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



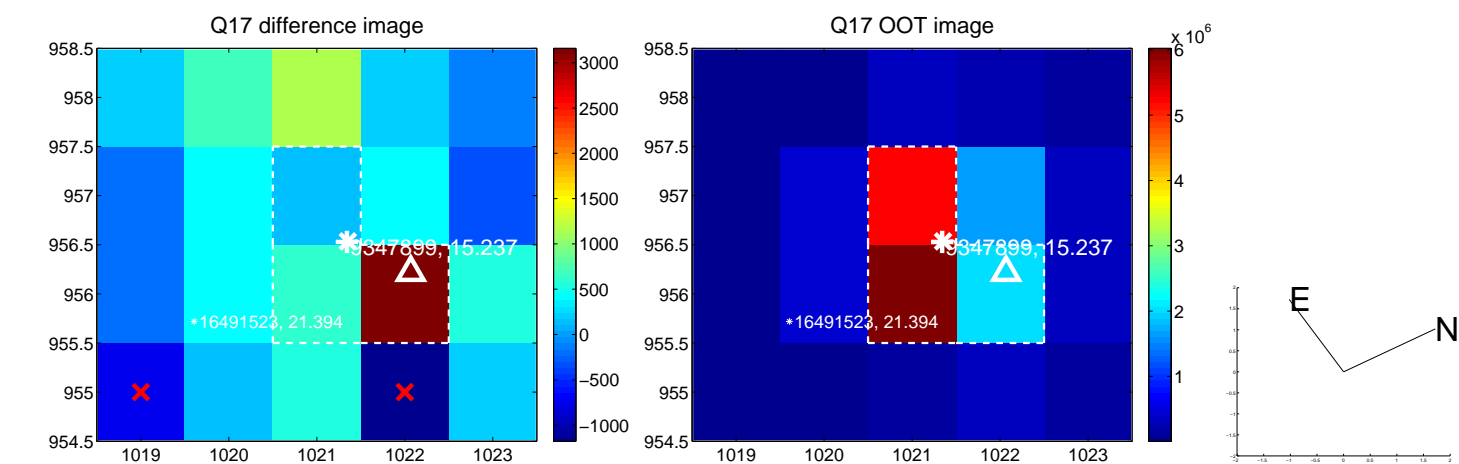
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



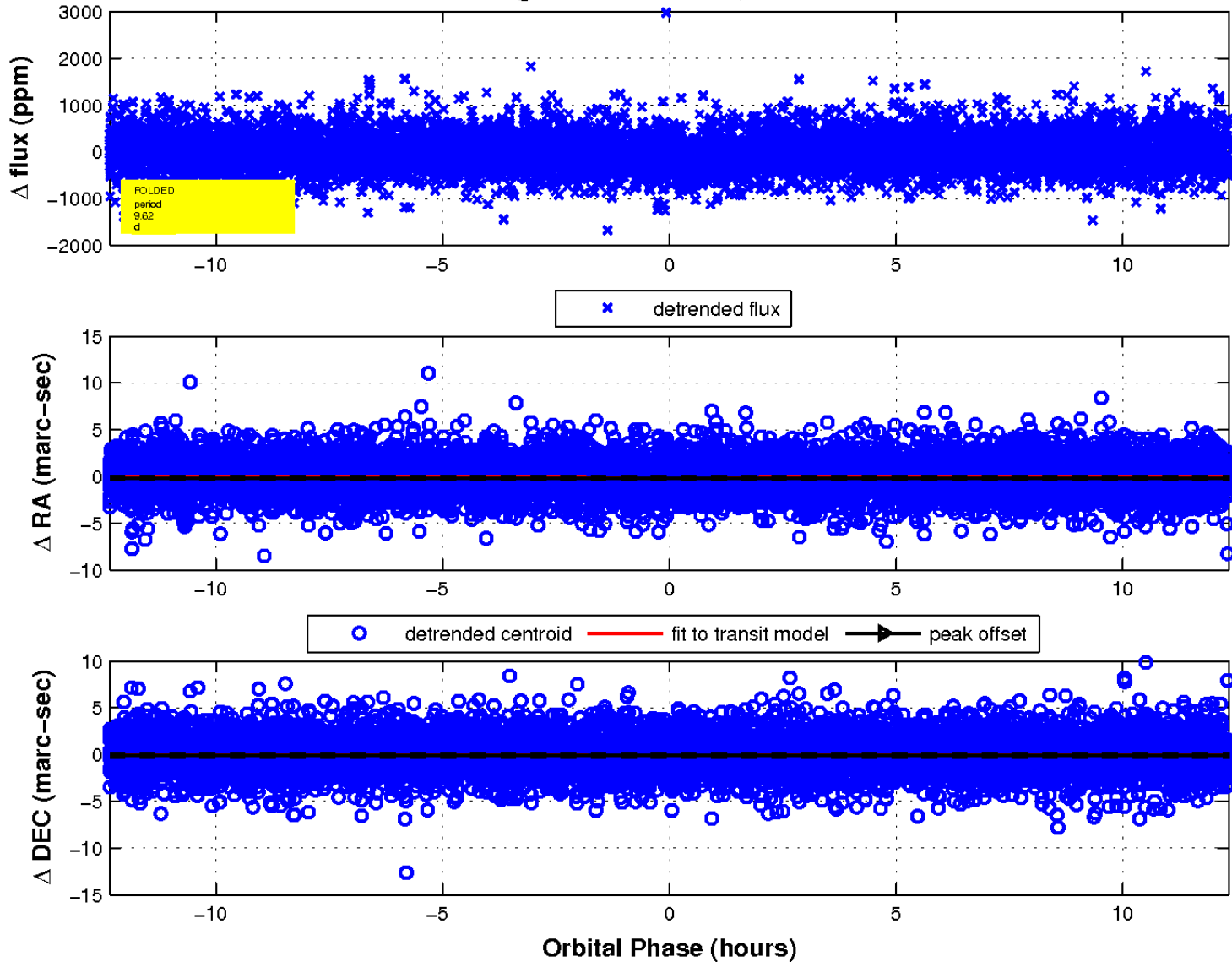
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



fluxWeightedCentroids, Planet 4 of 4



# UKIRT Image

Declination

