

# KIC 012058931

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
012058931-01	OBS	0546.01	20.684223	149.506589	837.3	6.579	47.7	50.3	1.09	6246	3.42	66.98
012058931-02	OBS	0546.02	9.825751	141.252627	421.8	5.389	32.6	34.7	1.09	6246	2.66	180.70

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
012058931-01	OBS	PC	1.00	0	0	0	0	NO_COMMENT
012058931-02	OBS	PC	1.00	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.

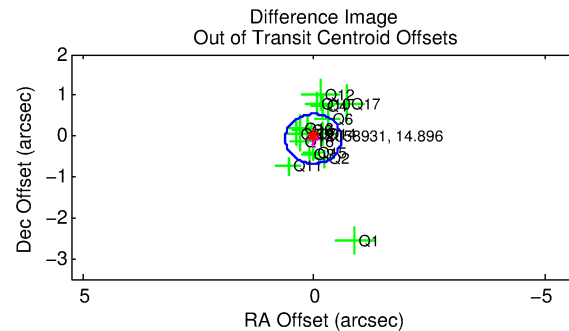
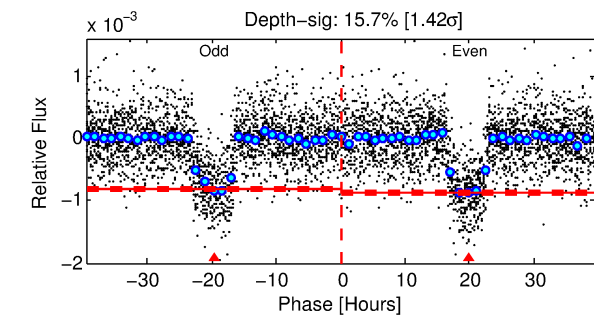
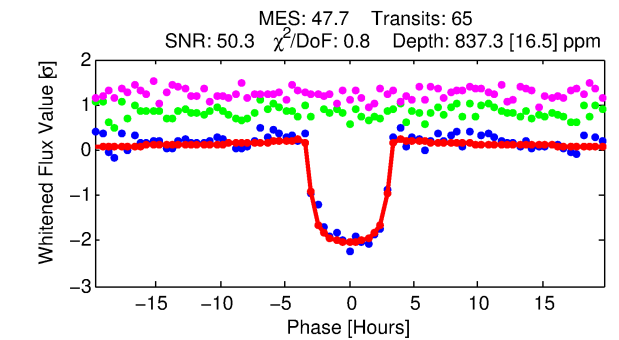
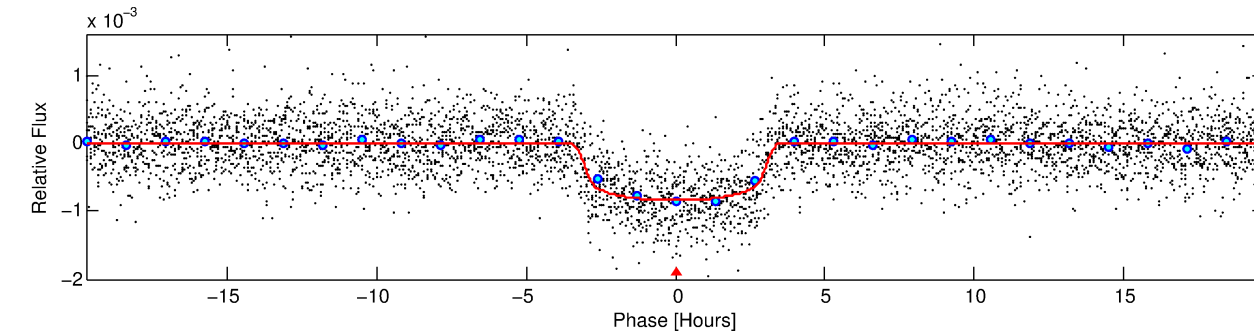
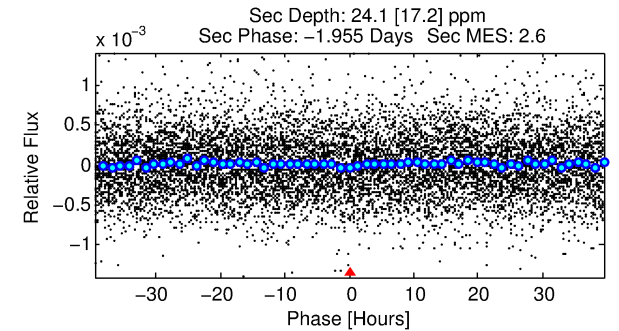
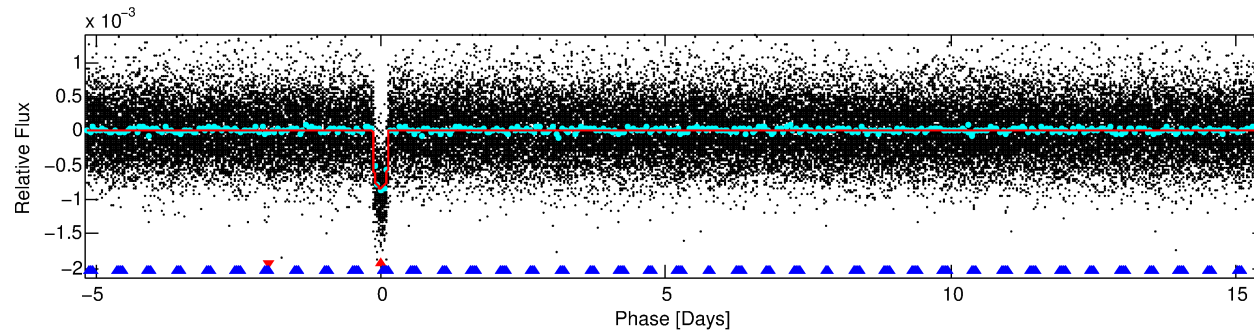
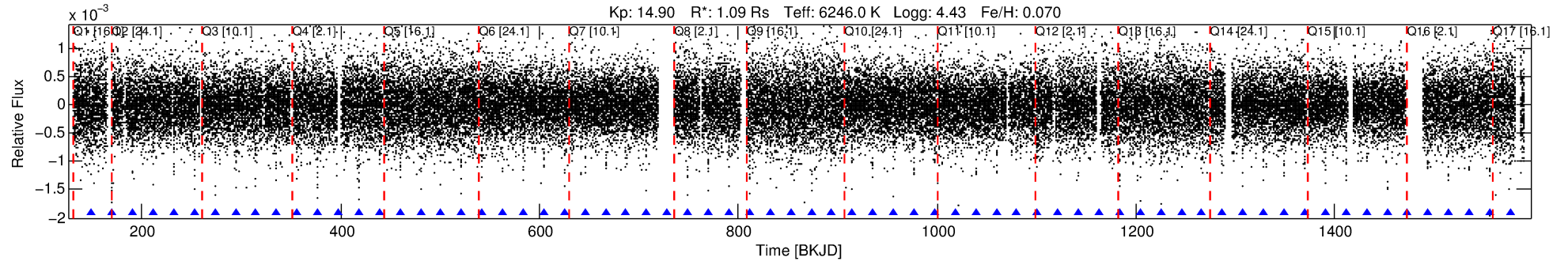
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 012058931-01

No Significant Match Found

# DV One-Page Summary

KIC: 12058931 Candidate: 1 of 2 Period: 20.684 d  
KOI: K00546.01 Name: Kepler-182c Corr: 0.991



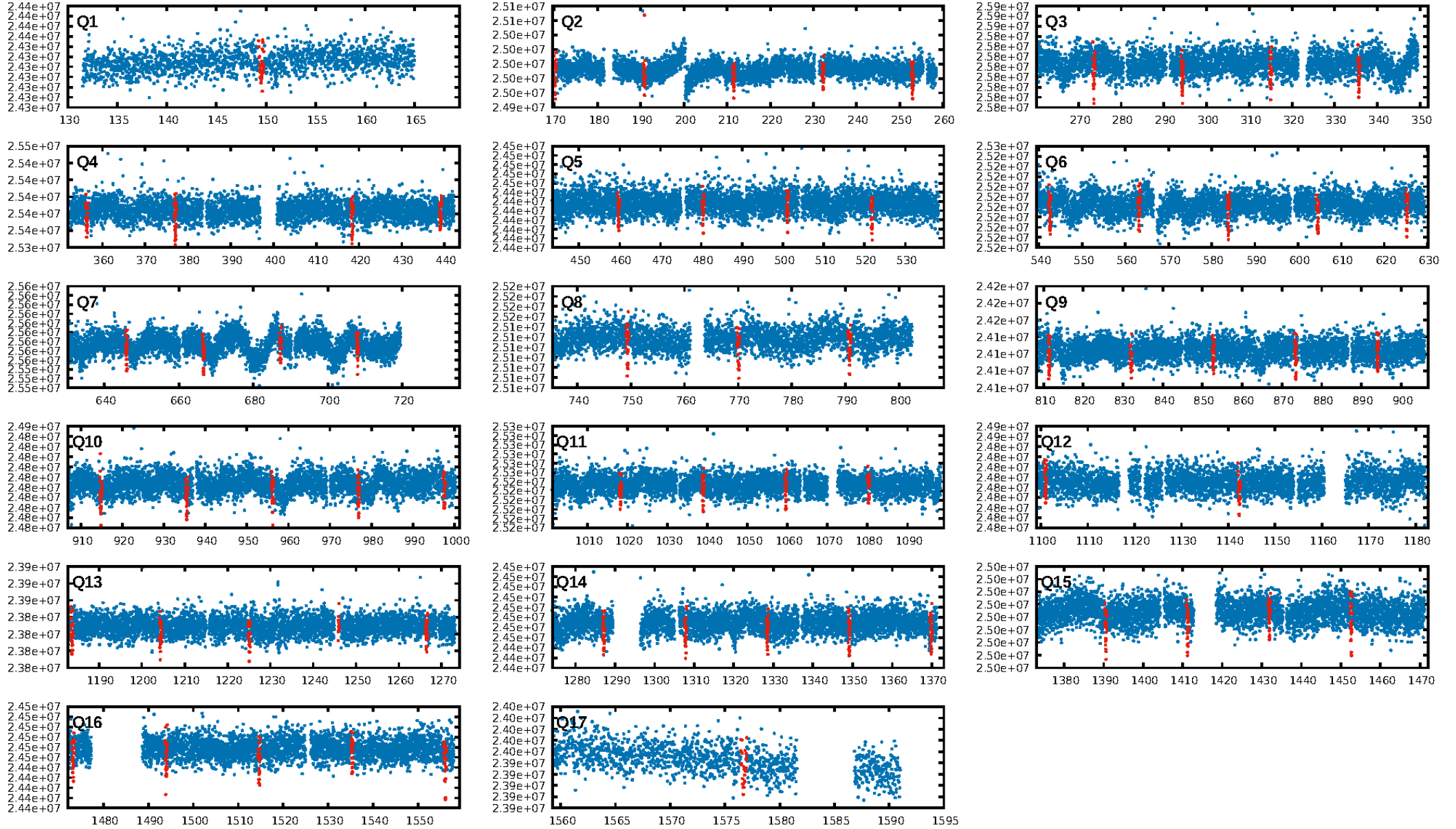
## DV Fit Results:

Period = 20.68422 [0.00006] d  
Epoch = 149.5066 [0.0023] BKJD  
Rp/R\* = 0.0287 [0.0021]  
a/R\* = 17.09 [6.13]  
b = 0.74 [0.22]  
Seff = 66.98 [29.06]  
Teff = 729 [79] K  
Rp = 3.42 [1.17] Re  
a = 0.1558 [0.0439] AU  
Ag = 27.53 [22.94] [1.16σ]  
Teffp = 2584 [478] K [3.83σ]

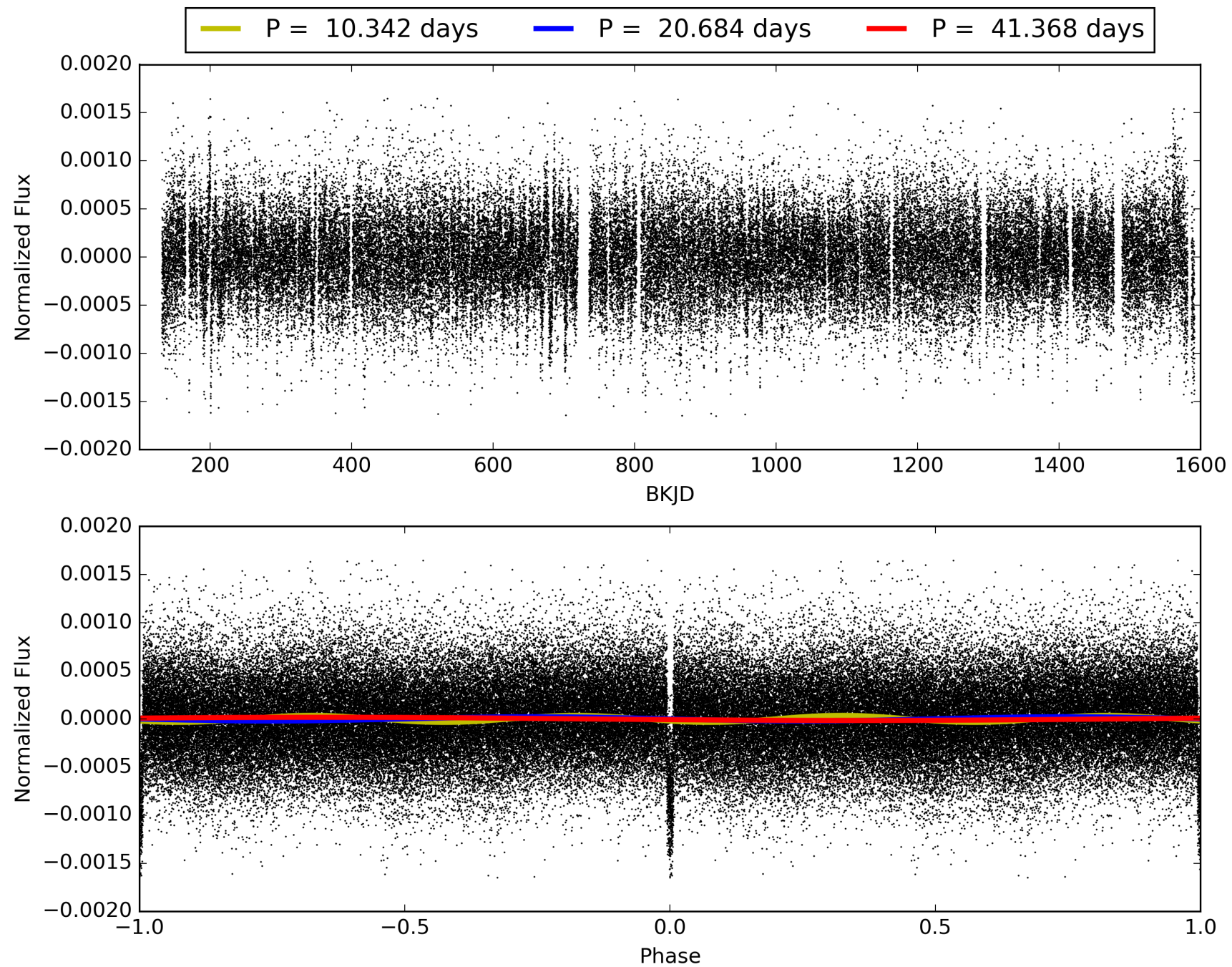
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [30.64σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 99.3%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 0.00e+00  
RollingBand-fgt: 1.00 [63/63]  
GhostDiagnostic-chr: 3.494  
Centroid-sig: 52.1%  
Centroid-so: 0.155 arcsec [0.59σ]  
OotOffset-rm: 0.068 arcsec [0.33σ]  
KicOffset-rm: 0.140 arcsec [0.73σ]  
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]

# TCE 012058931-01, PDC Light Curves



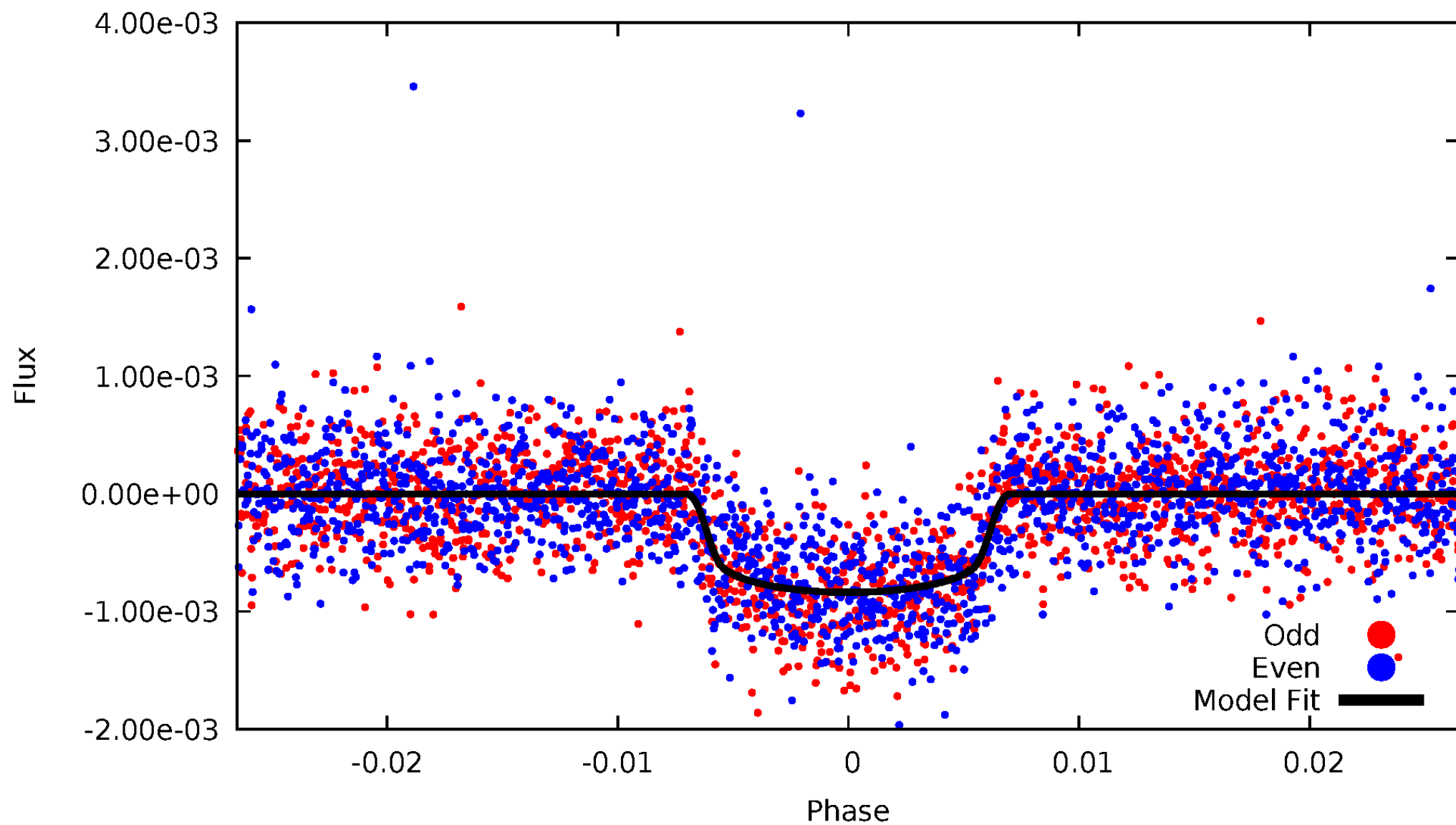
# TCE 012058931-01





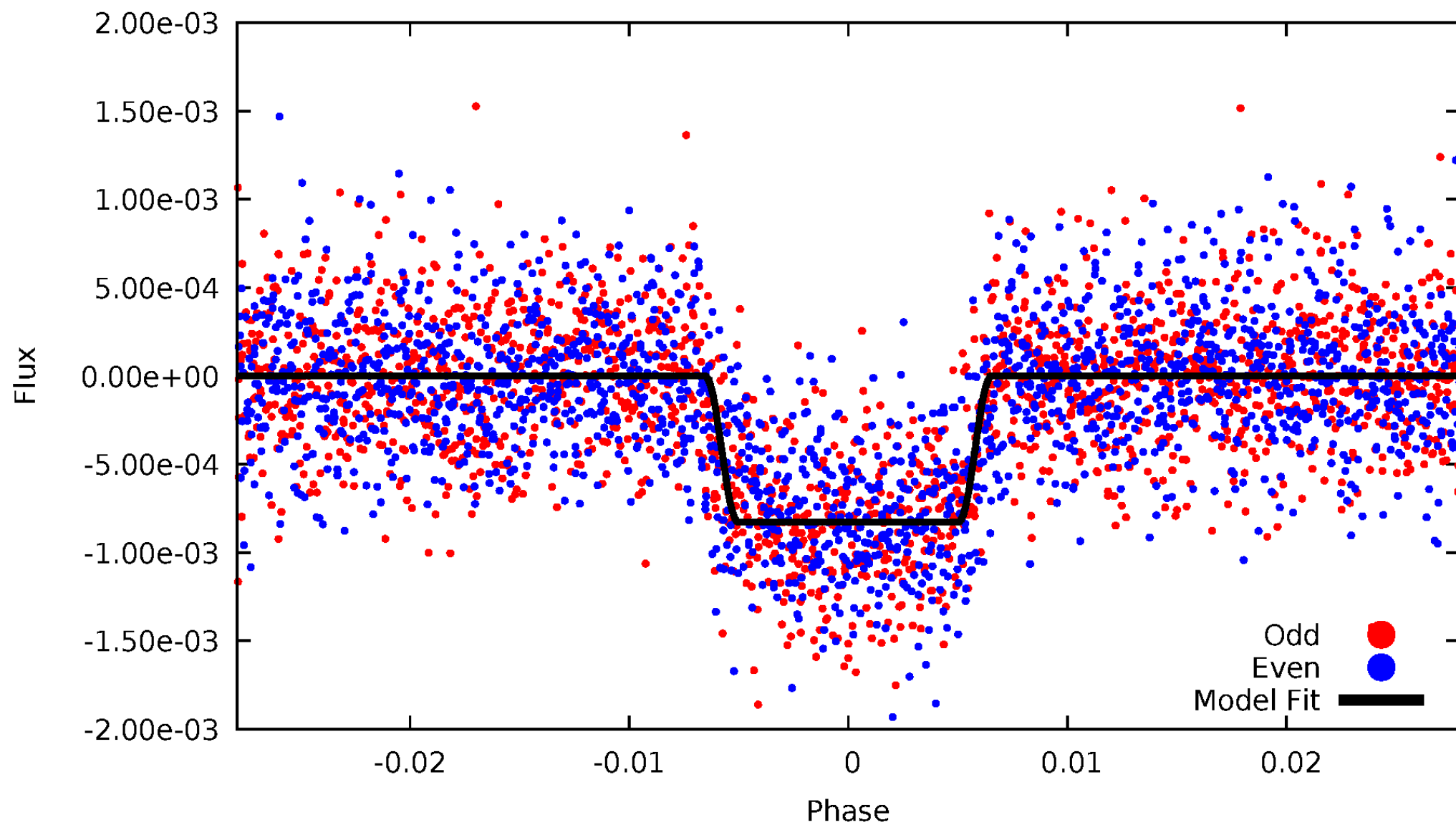
# DV Odd/Even

TCE 012058931-01



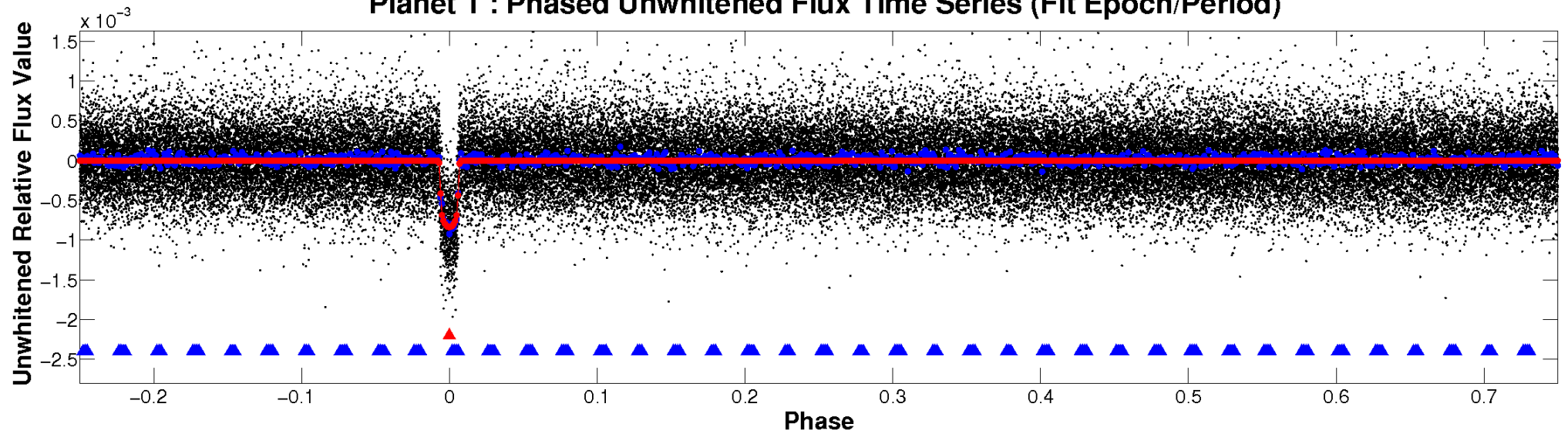
# ALT Odd/Even

TCE 012058931-01

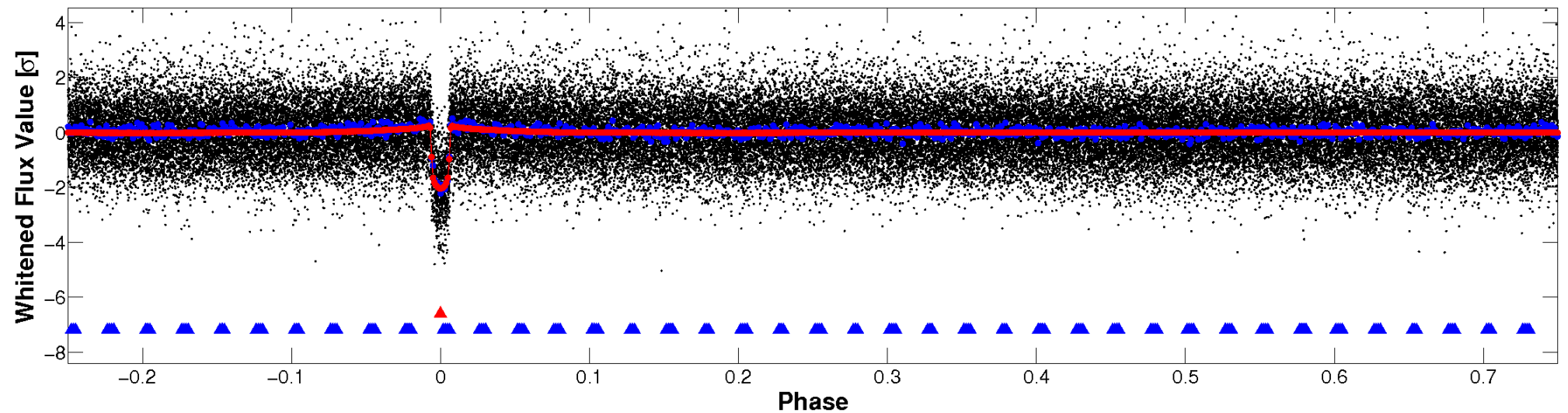


# Non-Whitened Vs. Whitened Light Curve

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

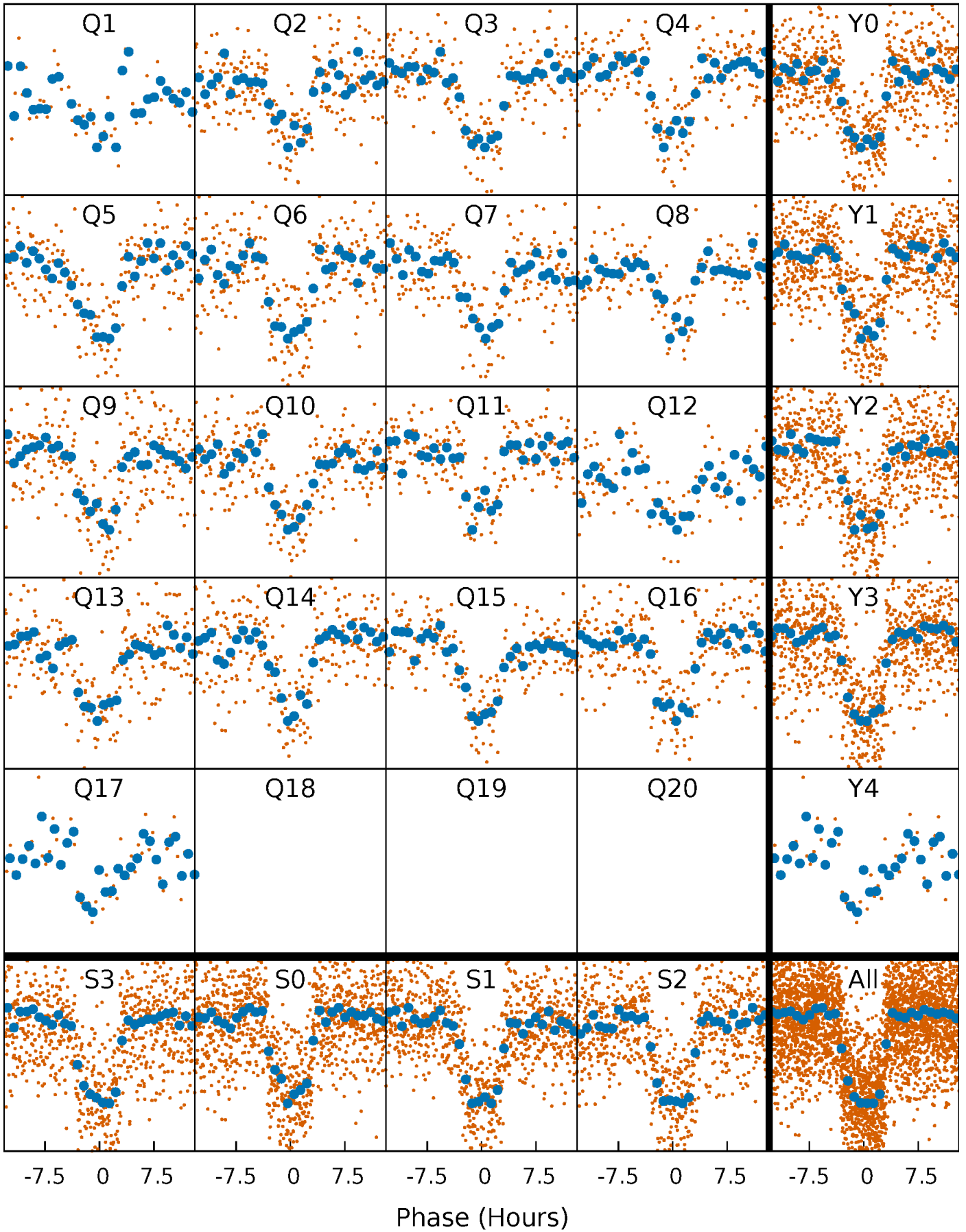


Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

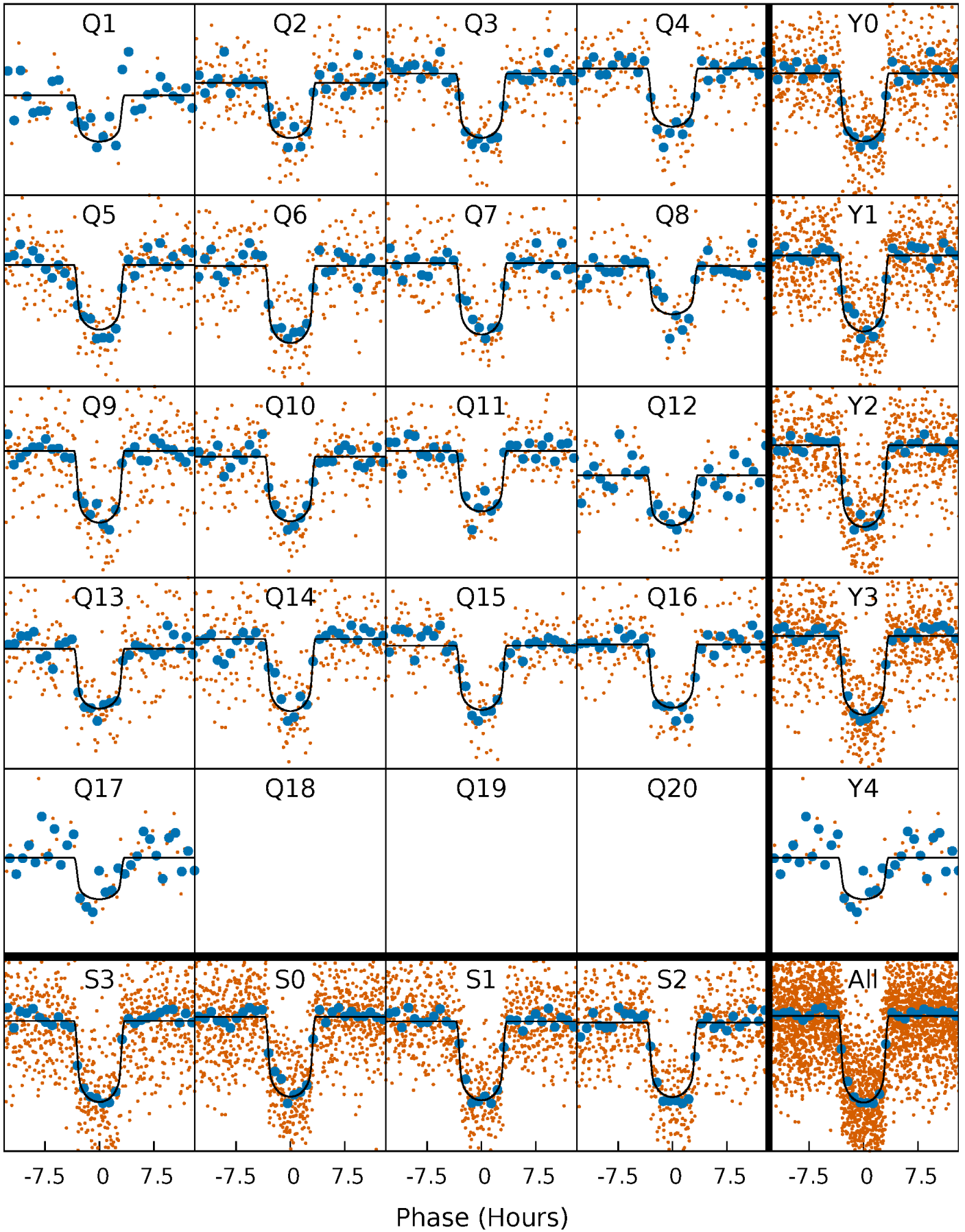
TCE 012058931-01 P= 20.684223 Days  $T_0=149.506589$  (BKJD)





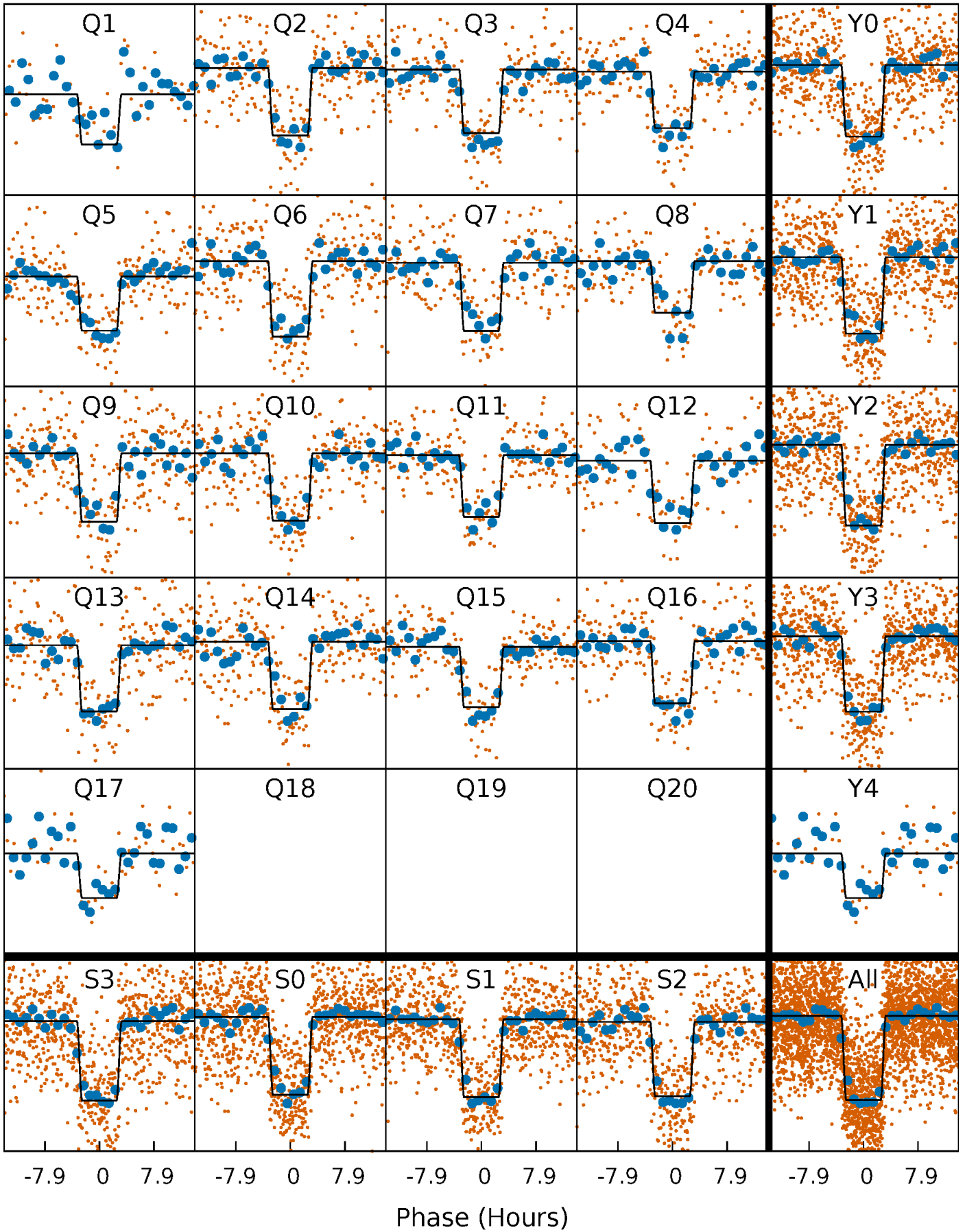
# DV Quarter-Phased Transit Curves

TCE 012058931-01 P= 20.684223 Days  $T_0=149.506589$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

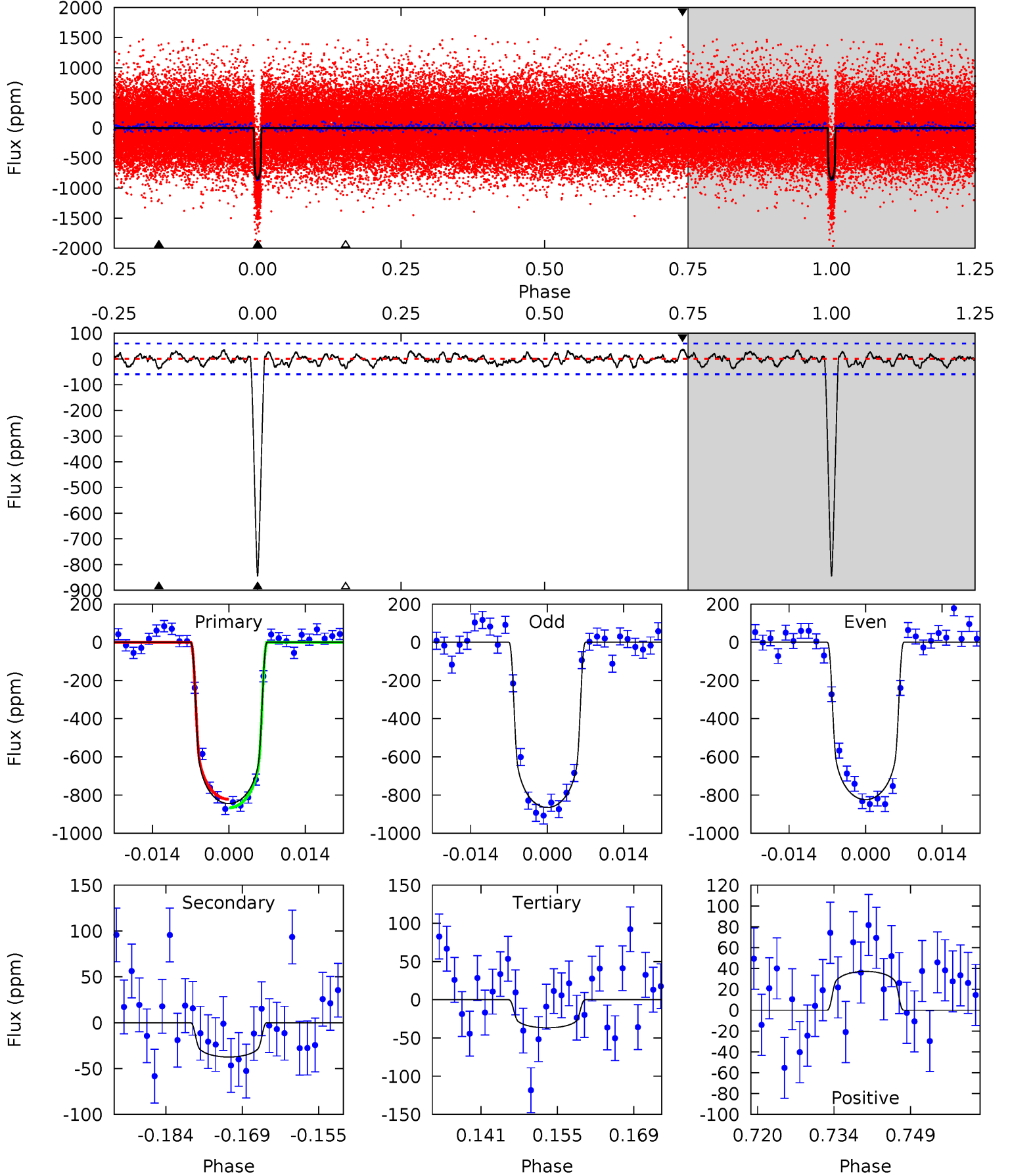
TCE 012058931-01 P= 20.684294 Days  $T_0=149.505808$  (BKJD)



# DV Model-Shift Uniqueness Test

012058931-01,  $P = 20.684223$  Days,  $E = 128.822366$  Days

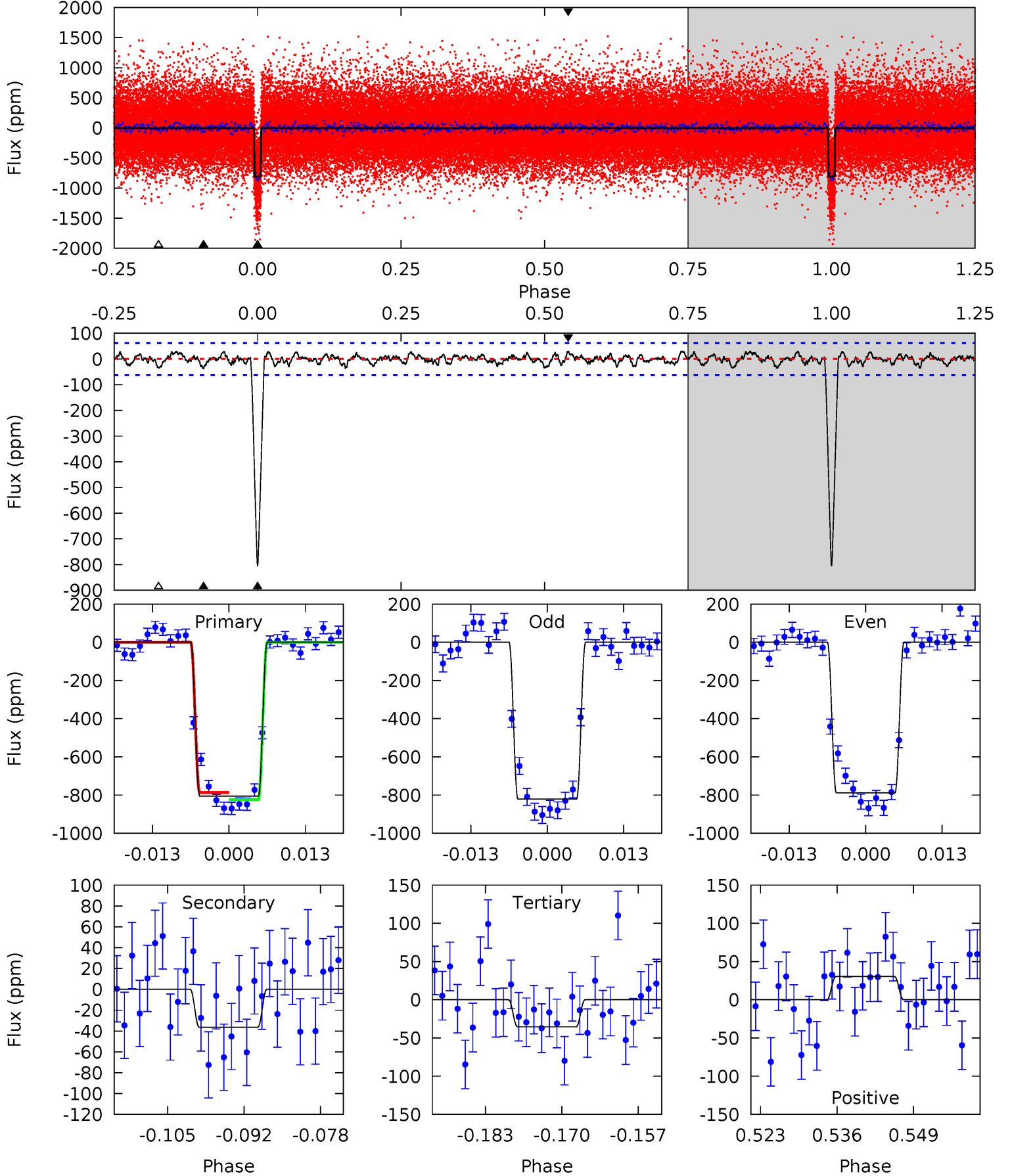
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
70.1	3.11	3.04	3.09	4.96	2.45	1.20	67.1	67.0	0.06	0.02	1.70	1.00	0.04	1.85



# Alt Model-Shift Uniqueness Test

012058931-01,  $P = 20.684294$  Days,  $E = 128.821514$  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
64.8	2.93	2.85	2.44	4.97	2.48	1.07	61.9	62.3	0.08	0.49	1.32	1.02	0.04	1.50



### Stellar Parameters For KIC 012058931

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6246^{+167}_{-223}$	$4.433^{+0.056}_{-0.224}$	$0.070^{+0.250}_{-0.300}$	$1.092^{+0.365}_{-0.122}$	$1.180^{+0.158}_{-0.158}$	$1.276^{+0.370}_{-0.706}$
	+3%/-4%	+1%/-5%	+357%/-429%	+33%/-11%	+13%/-13%	+29%/-55%
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 012058931-01 / KOI 0546.01

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-37 \pm 12$	$3.57^{+0.67}_{-0.42}$	$1040^{+79}_{-52}$	$3378^{+191}_{-209}$	$36^{+18}_{-14}$
Alt.	$-36 \pm 12$	$3.57^{+0.64}_{-0.44}$	$1042^{+78}_{-56}$	$3368^{+200}_{-228}$	$36^{+17}_{-15}$

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



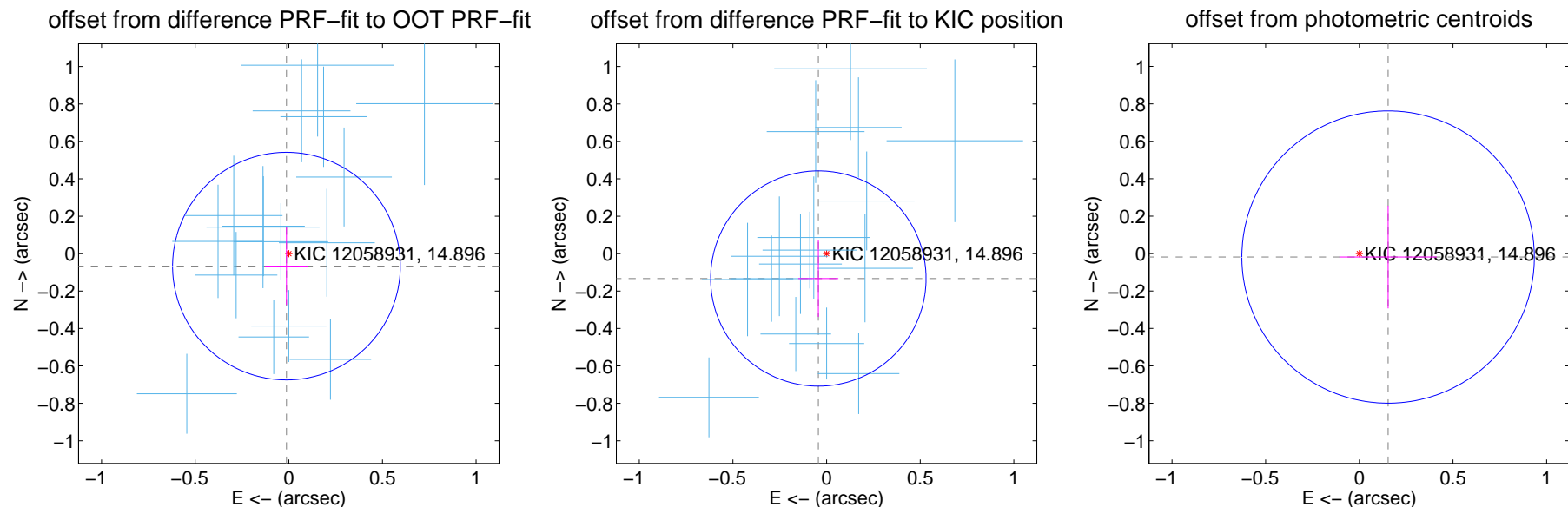
## DV Centroid Data

Supplemental centroid analysis for 012058931-01. Kepler magnitude: 14.90. Transit SNR 50.29

There are 17 quarters with good PRF difference image offsets

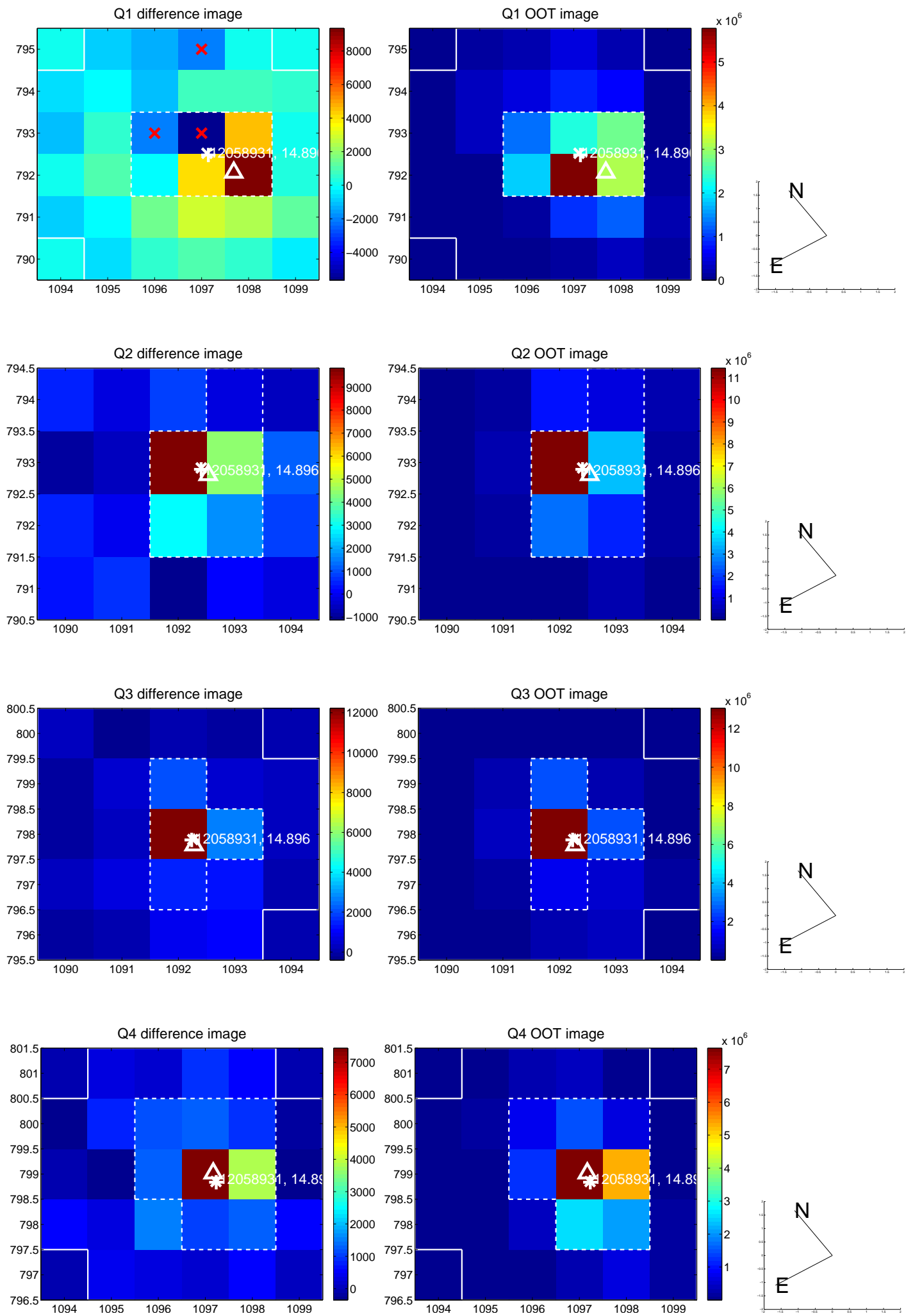
The direct PRF centroid is offset from the target star catalog position by about 0.20 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.068 \pm 0.203$	0.33	$0.013 \pm 0.114$	$-0.067 \pm 0.208$
PRF-fit source offset from KIC position	$0.140 \pm 0.192$	0.73	$0.044 \pm 0.107$	$-0.133 \pm 0.205$
photometric centroid source offset	$0.15 \pm 0.26$	0.59	$-0.15 \pm 0.26$	$-0.02 \pm 0.27$

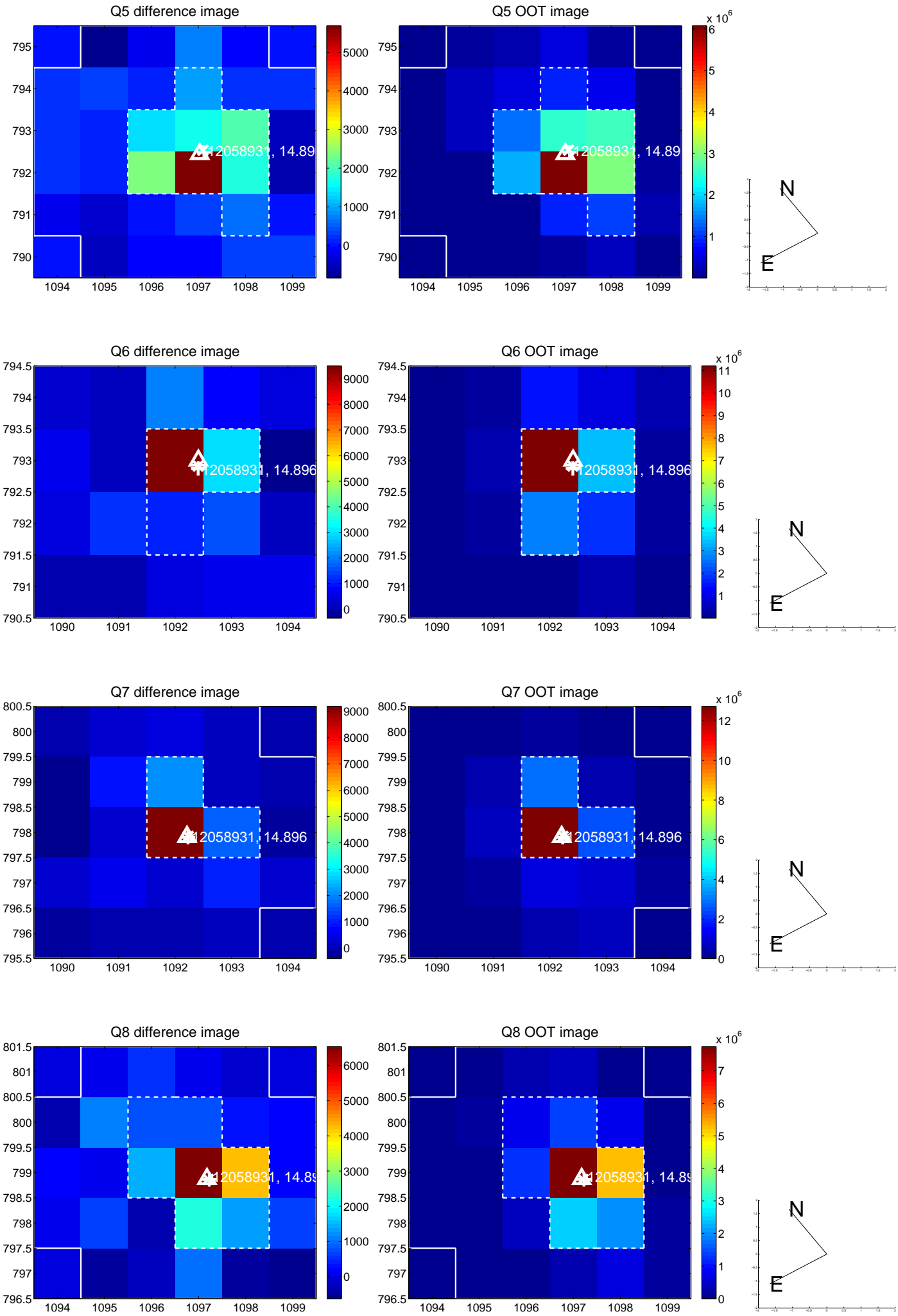


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets**; **Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

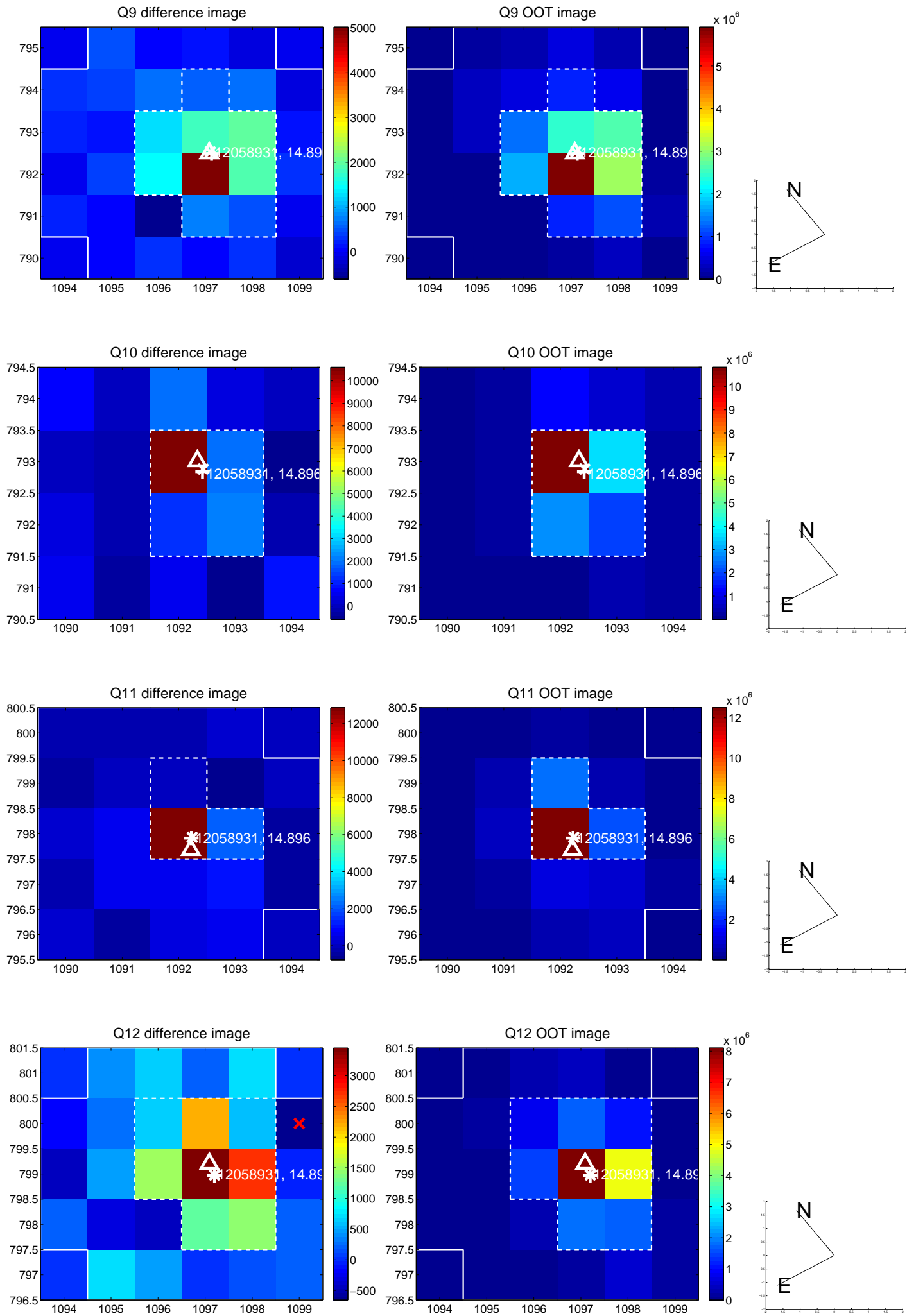
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



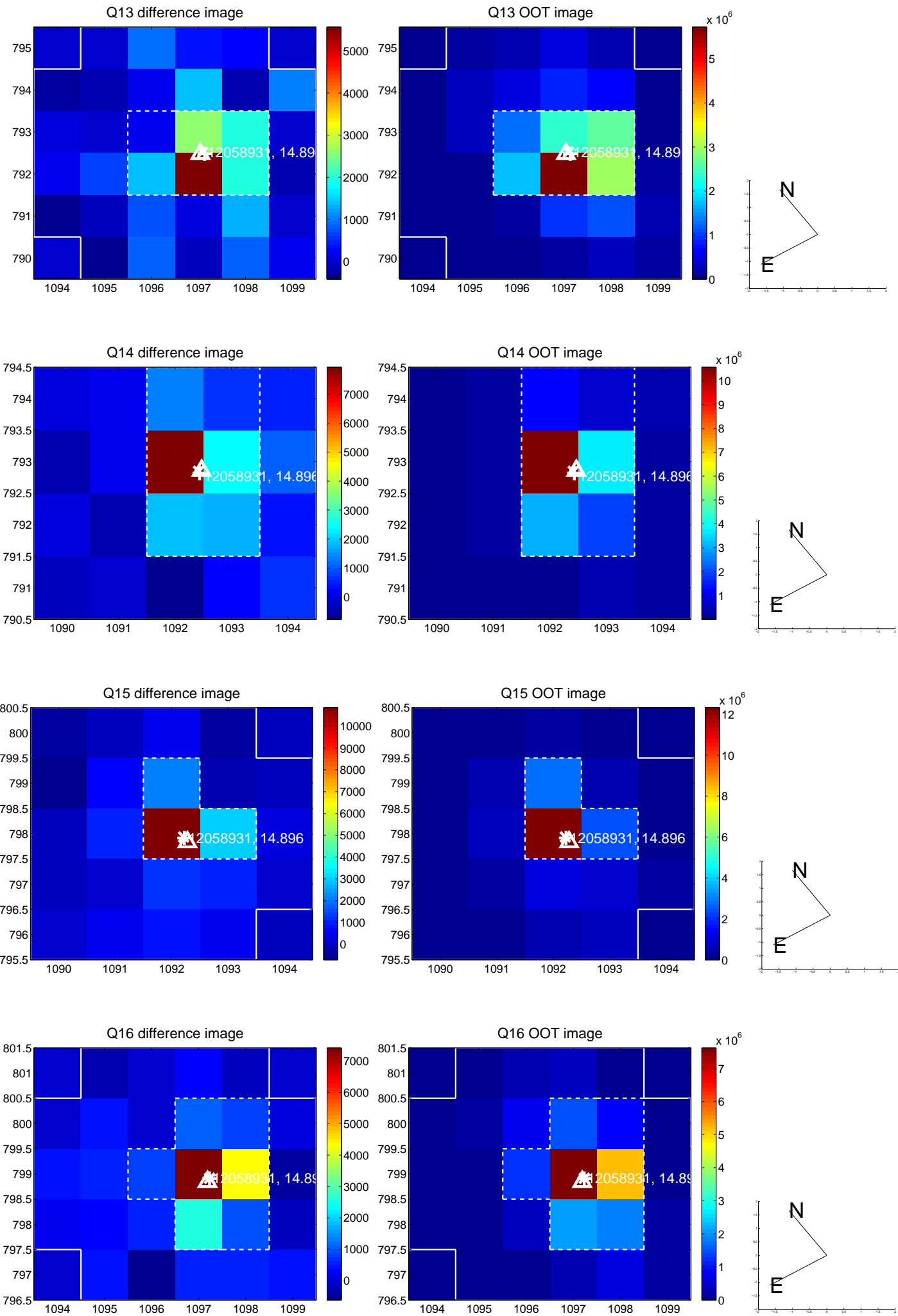
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

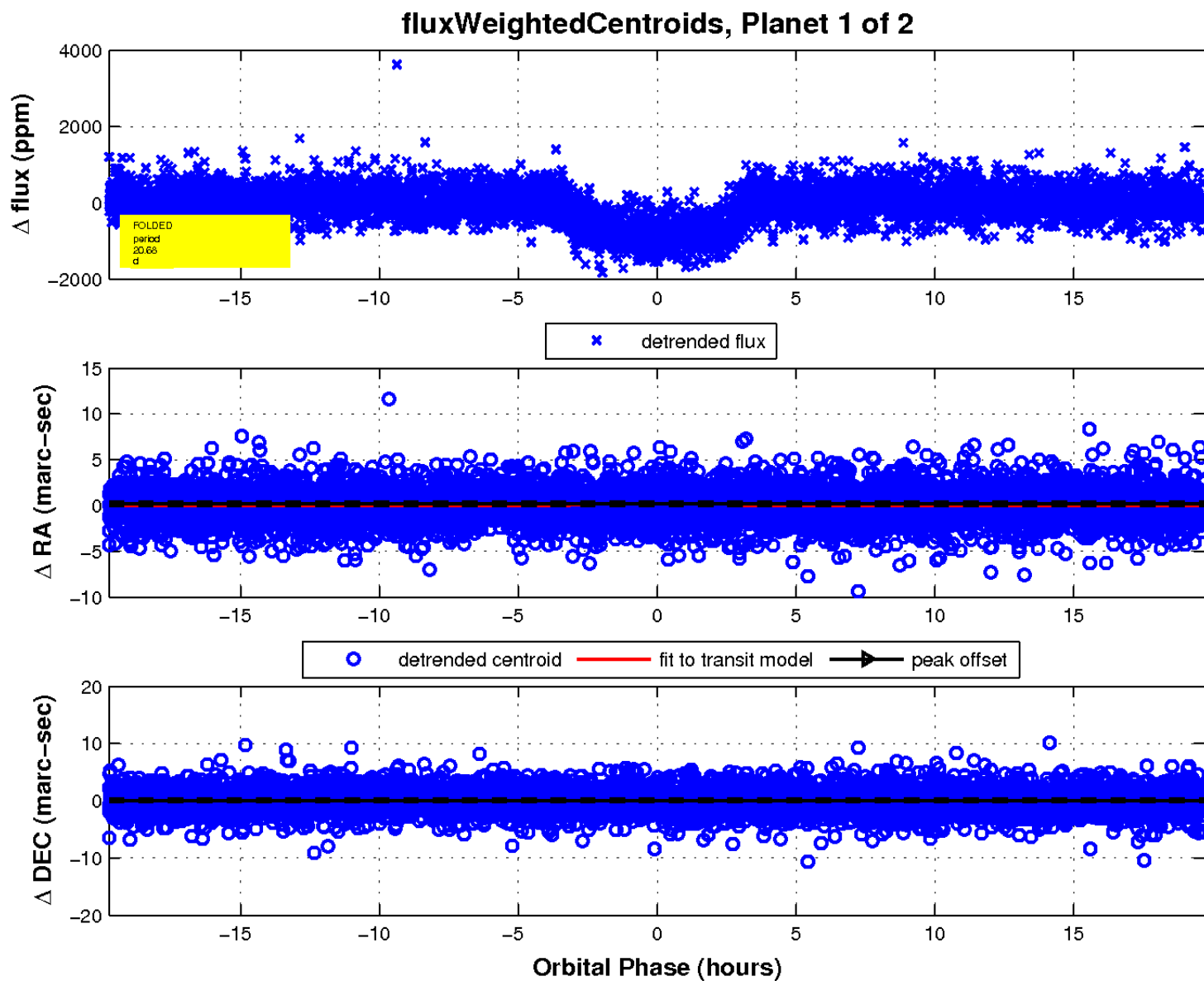
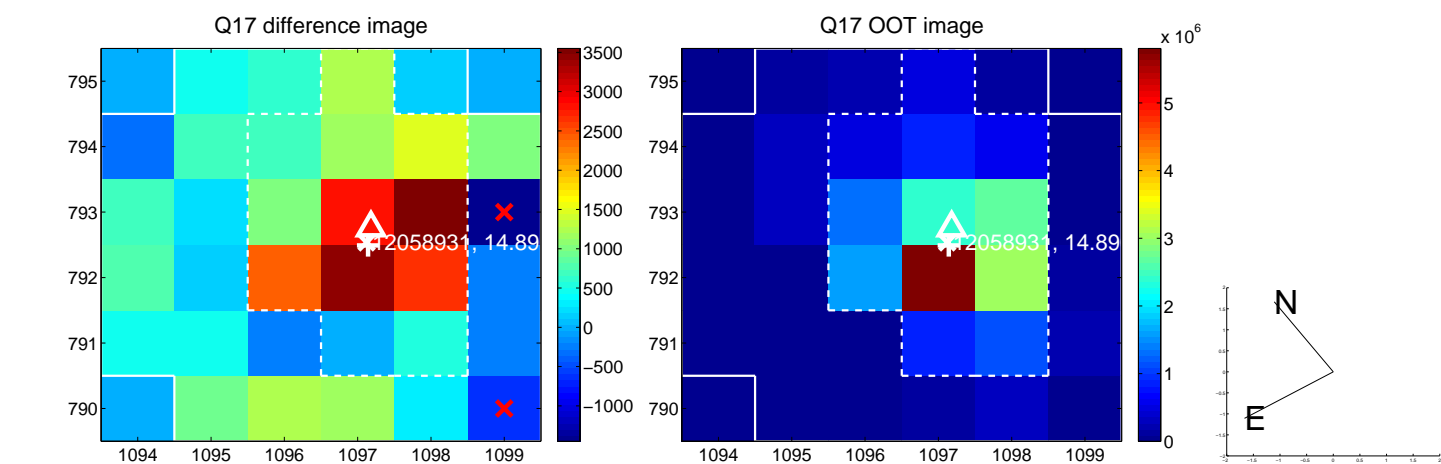


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



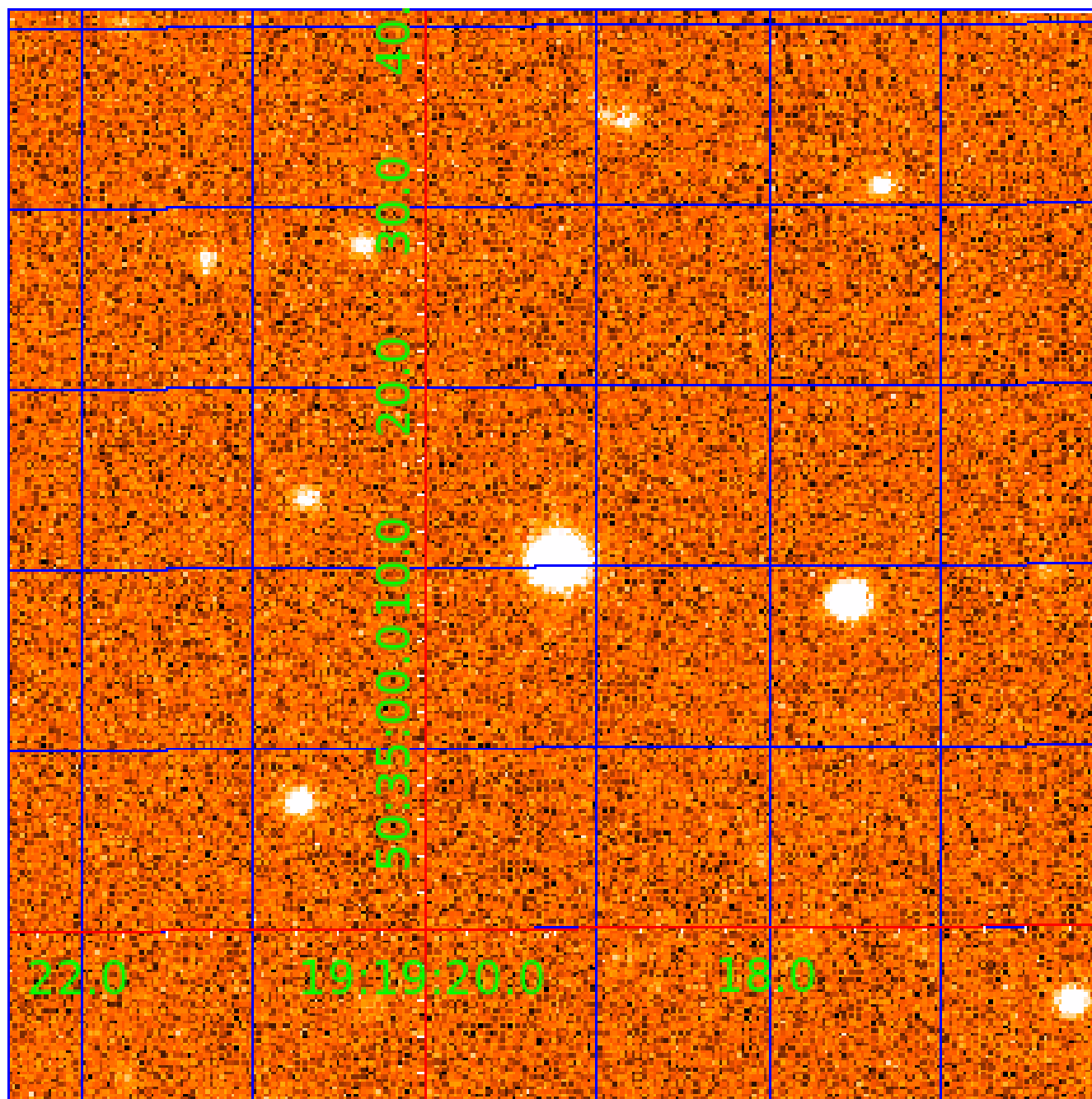


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



# UKIRT Image

Declination



# KIC 012058931

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
012058931-01	OBS	0546.01	20.684223	149.506589	837.3	6.579	47.7	50.3	1.09	6246	3.42	66.98
012058931-02	OBS	0546.02	9.825751	141.252627	421.8	5.389	32.6	34.7	1.09	6246	2.66	180.70

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
012058931-01	OBS	PC	1.00	0	0	0	0	NO_COMMENT
012058931-02	OBS	PC	1.00	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.

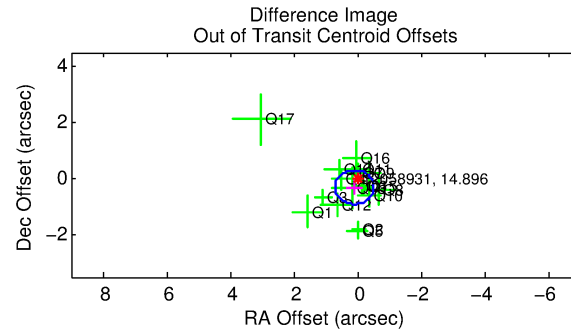
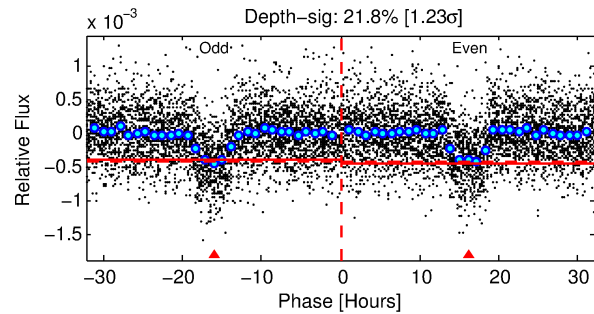
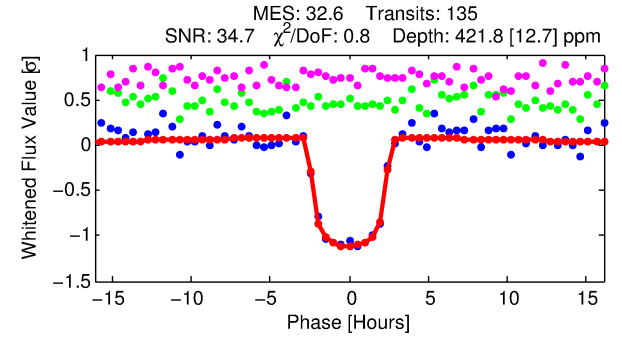
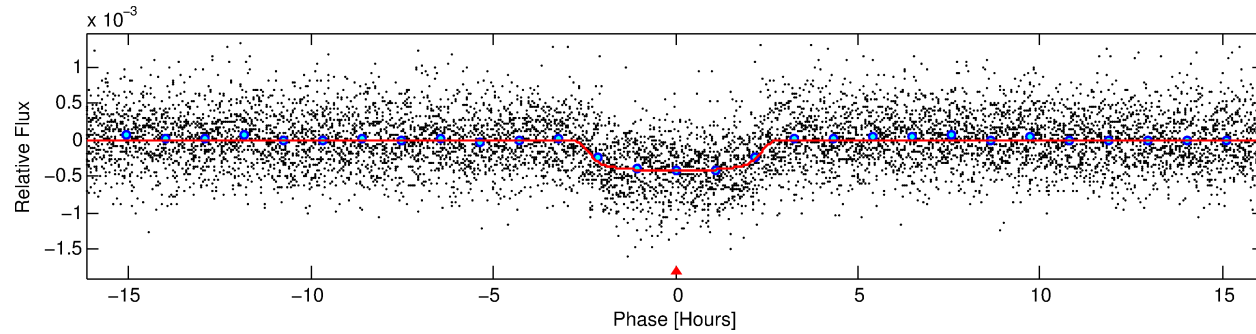
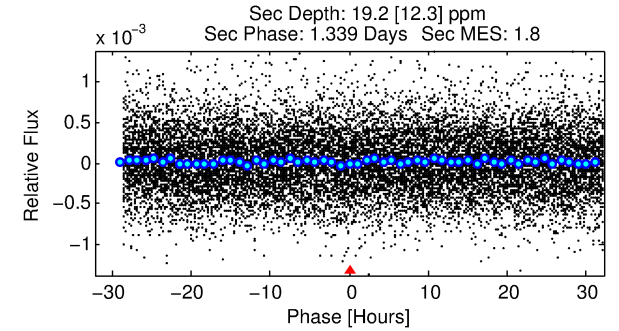
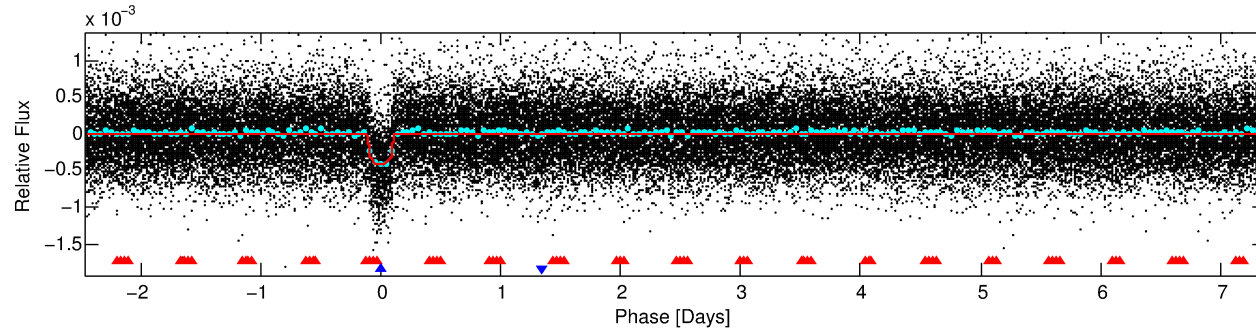
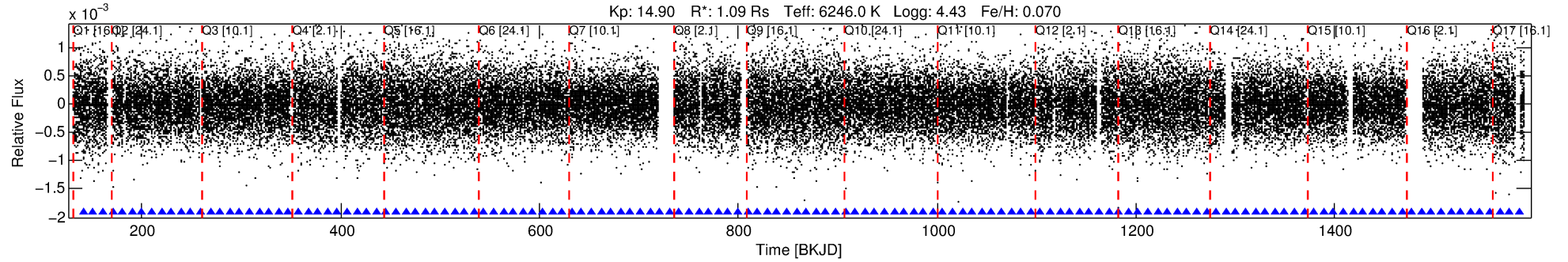
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 012058931-02

No Significant Match Found

# DV One-Page Summary

KIC: 12058931 Candidate: 2 of 2 Period: 9.826 d  
KOI: K00546.02 Name: Kepler-182b Corr: 0.974



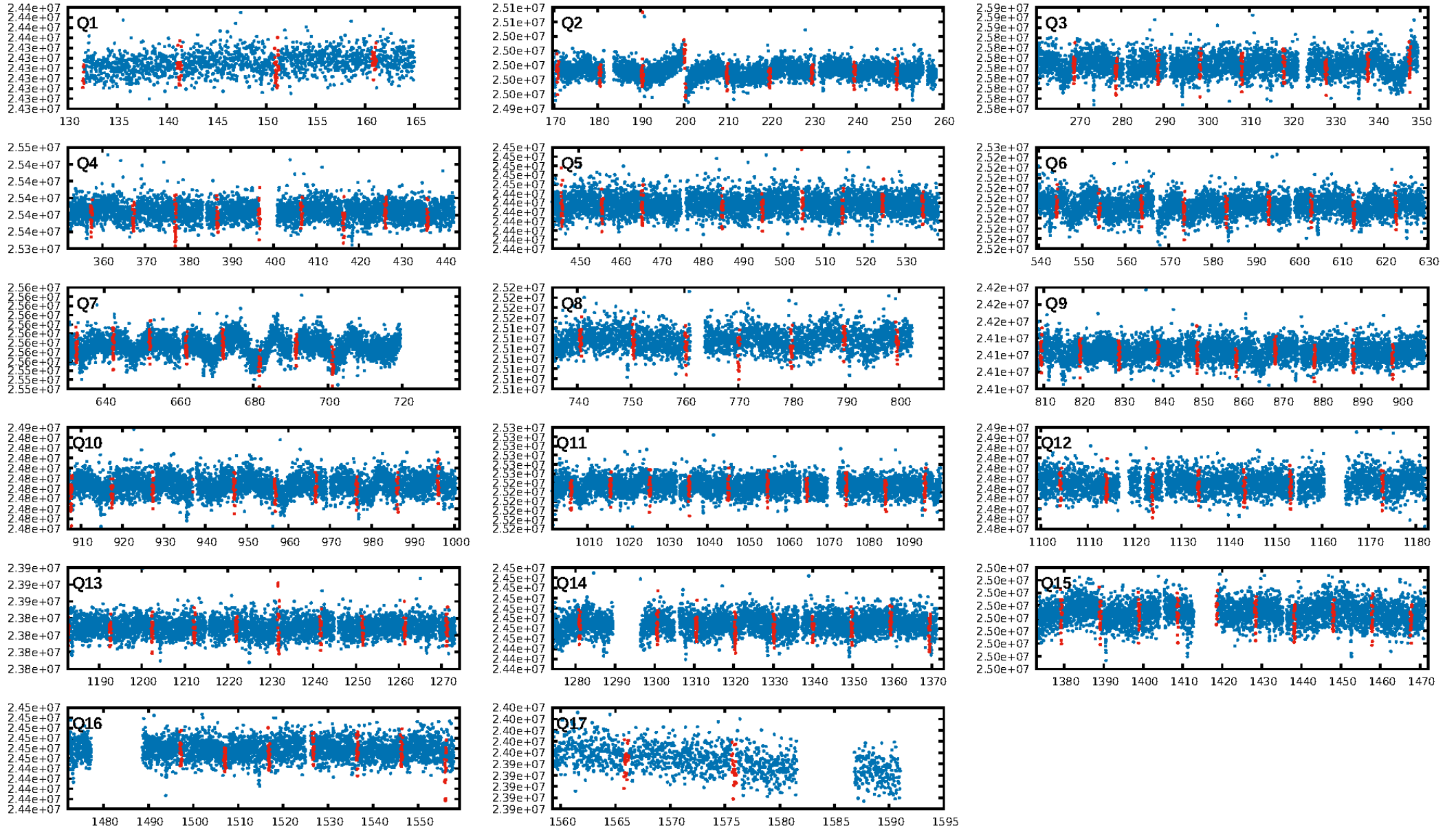
## DV Fit Results:

Period = 9.82575 [0.00004] d  
Epoch = 141.2526 [0.0031] BKJD  
Rp/R\* = 0.0223 [0.0011]  
a/R\* = 6.59 [1.55]  
b = 0.91 [0.05]  
Seff = 180.70 [78.41]  
Teff = 935 [101] K  
Rp = 2.66 [0.90] Re  
a = 0.0949 [0.0267] AU  
Ag = 13.46 [10.34] [1.21 $\sigma$ ]  
Teffp = 2769 [460] K [3.89 $\sigma$ ]

## DV Diagnostic Results:

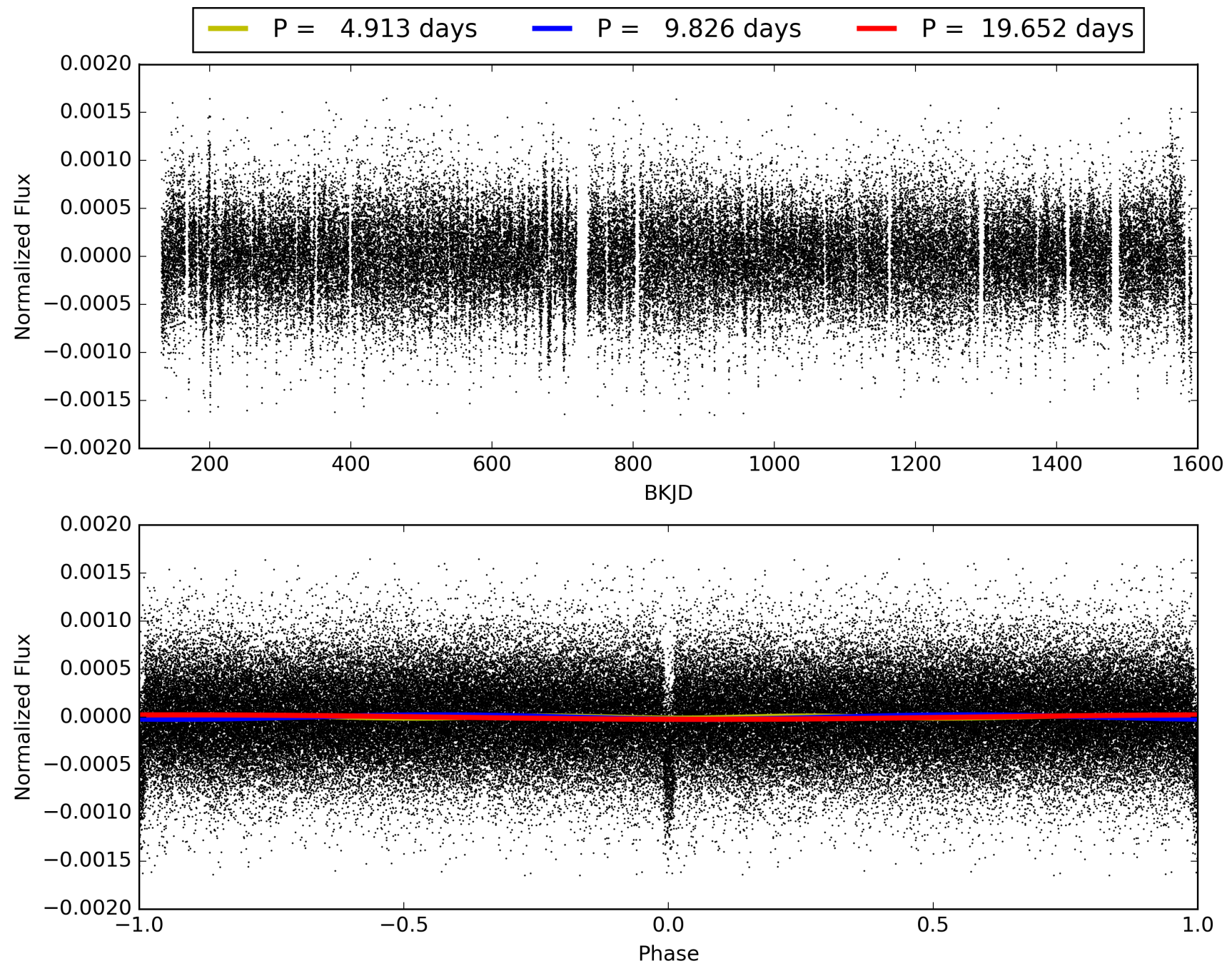
ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [30.64 $\sigma$ ]  
ModelChiSquare2-sig: 99.7%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 1.21e-227  
RollingBand-fgt: 1.00 [129/129]  
GhostDiagnostic-chr: 3.208  
Centroid-sig: 10.7%  
Centroid-so: 0.630 arcsec [1.53 $\sigma$ ]  
OotOffset-rm: 0.318 arcsec [1.58 $\sigma$ ]  
KicOffset-rm: 0.393 arcsec [1.95 $\sigma$ ]  
OotOffset-st: 4/4/4/5 [17]  
KicOffset-st: 4/4/4/5 [17]  
DiffImageQuality-fgm: 0.94 [16/17]  
DiffImageOverlap-fno: 1.00 [17/17]

# TCE 012058931-02, PDC Light Curves



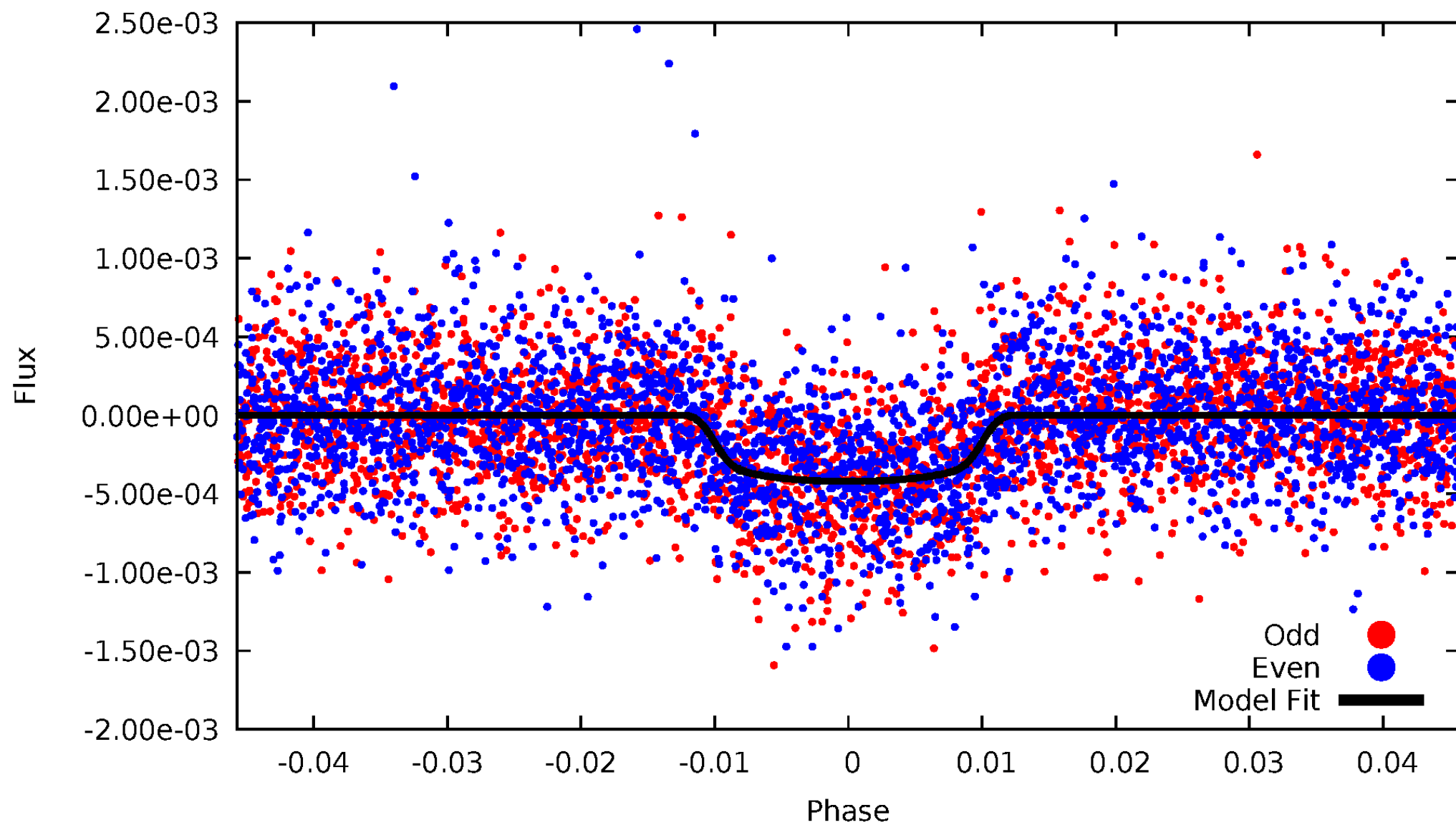


# TCE 012058931-02



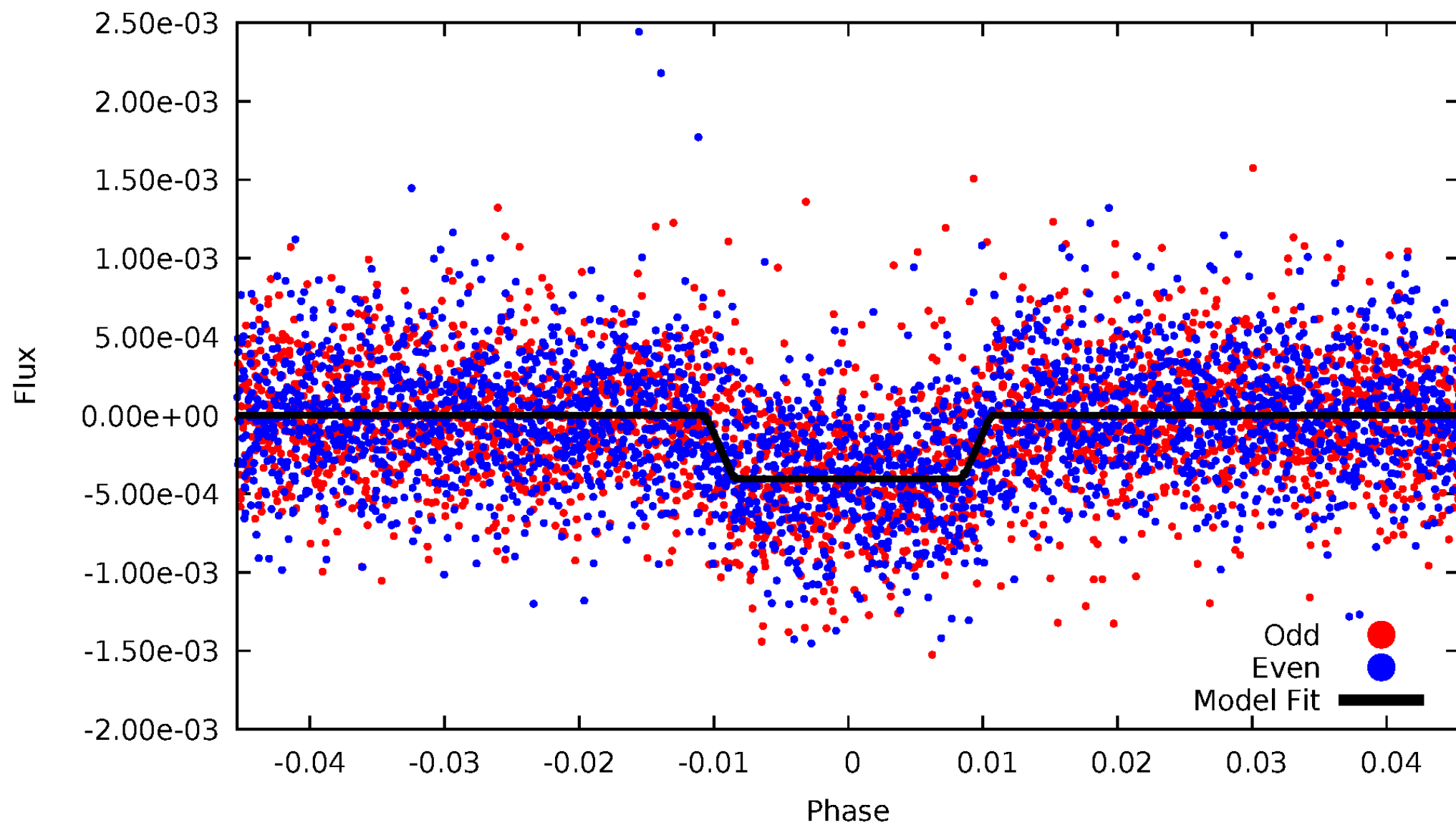
# DV Odd/Even

TCE 012058931-02



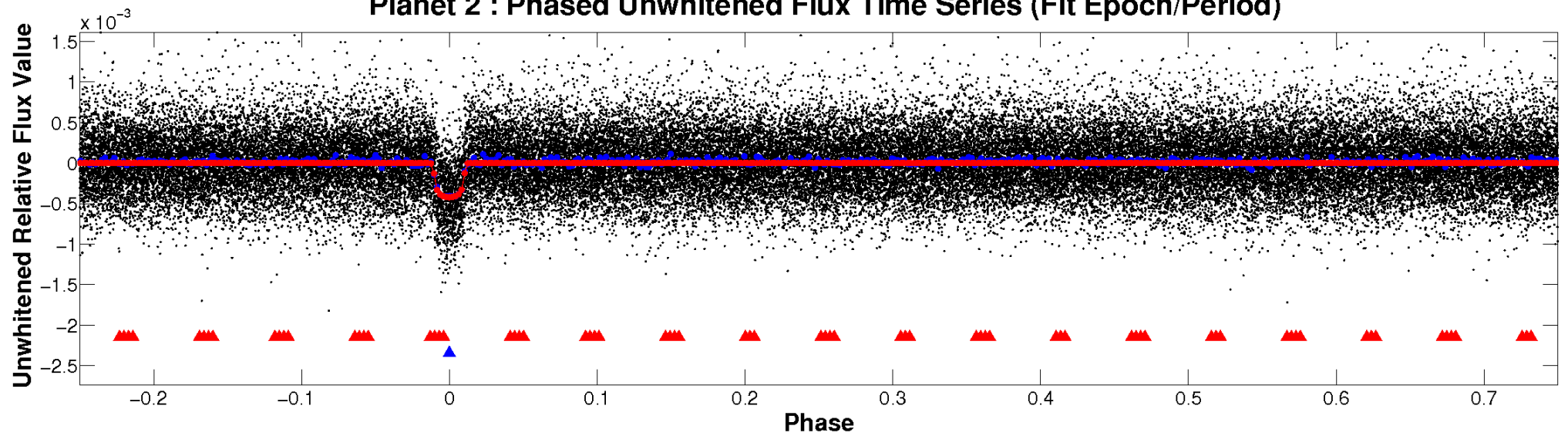
# ALT Odd/Even

TCE 012058931-02

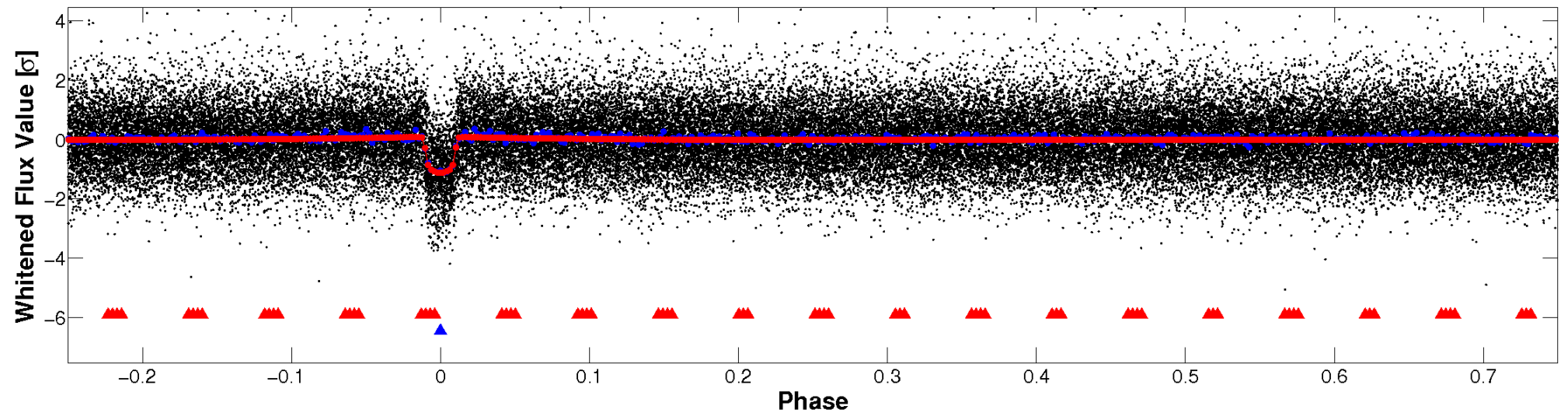


# Non-Whitened Vs. Whitened Light Curve

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



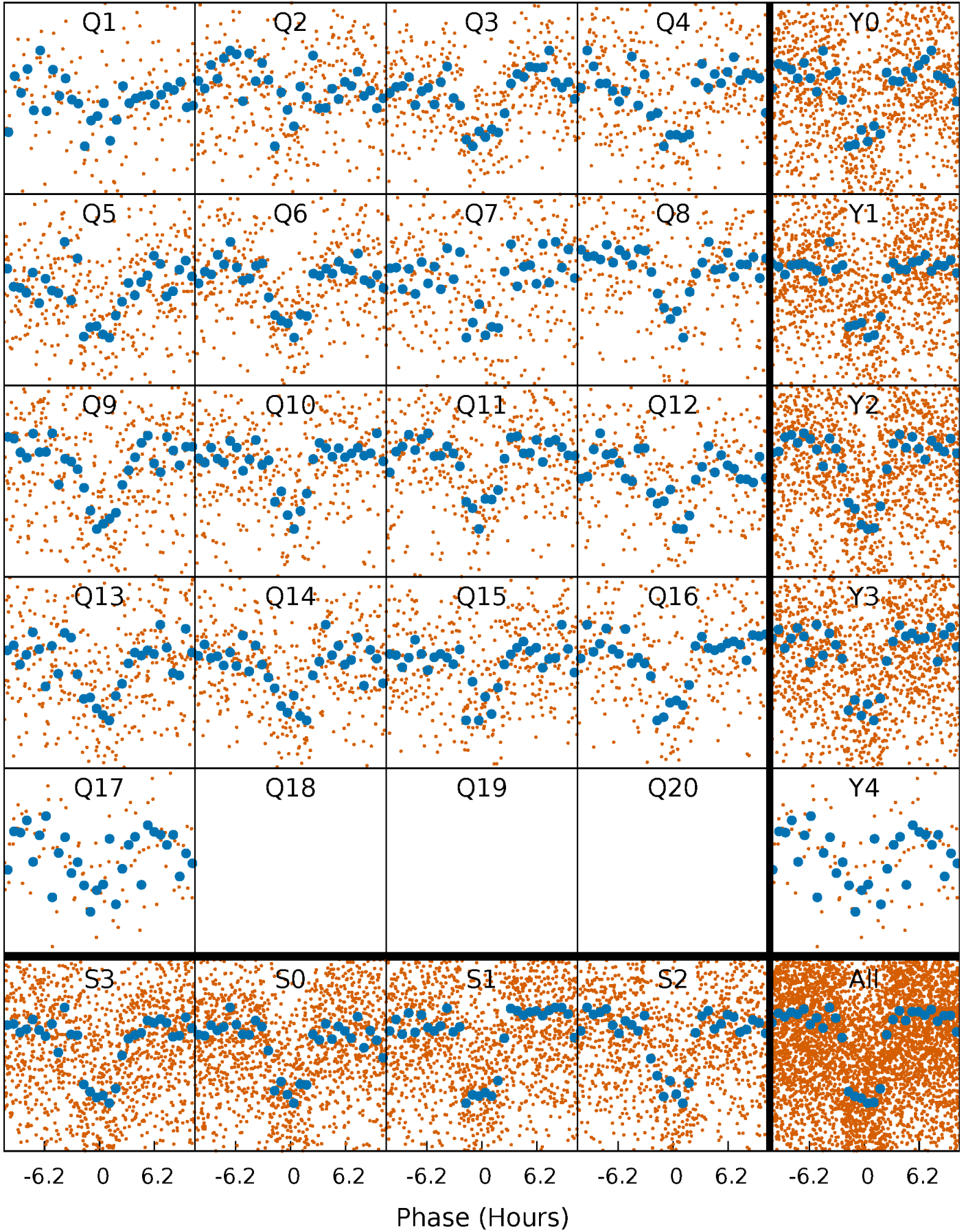
## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)





# PDC Quarter-Phased Transit Curves

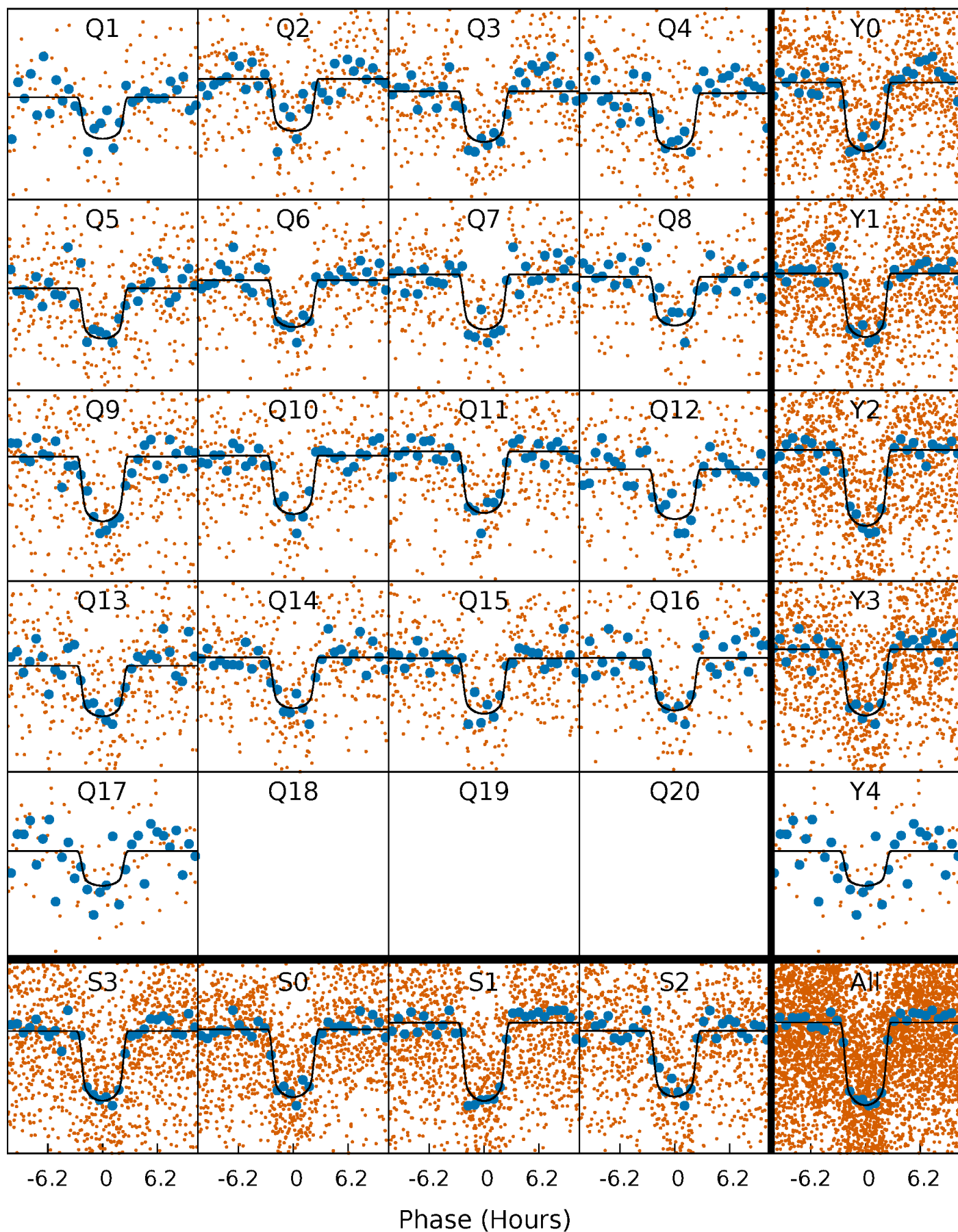
TCE 012058931-02   P= 9.825751 Days    $T_0=141.252627$  (BKJD)





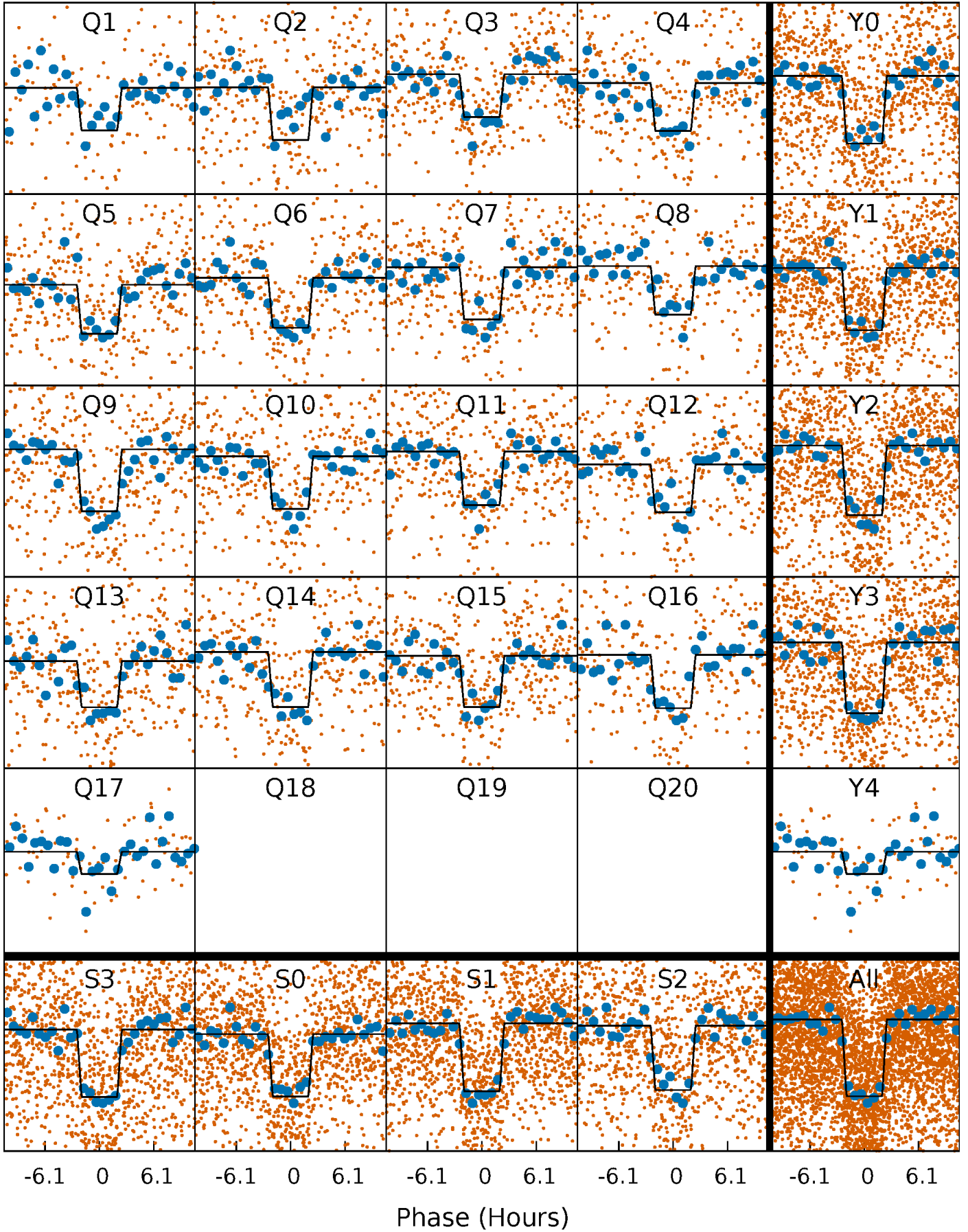
# DV Quarter-Phased Transit Curves

TCE 012058931-02   P= 9.825751 Days    $T_0=141.252627$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

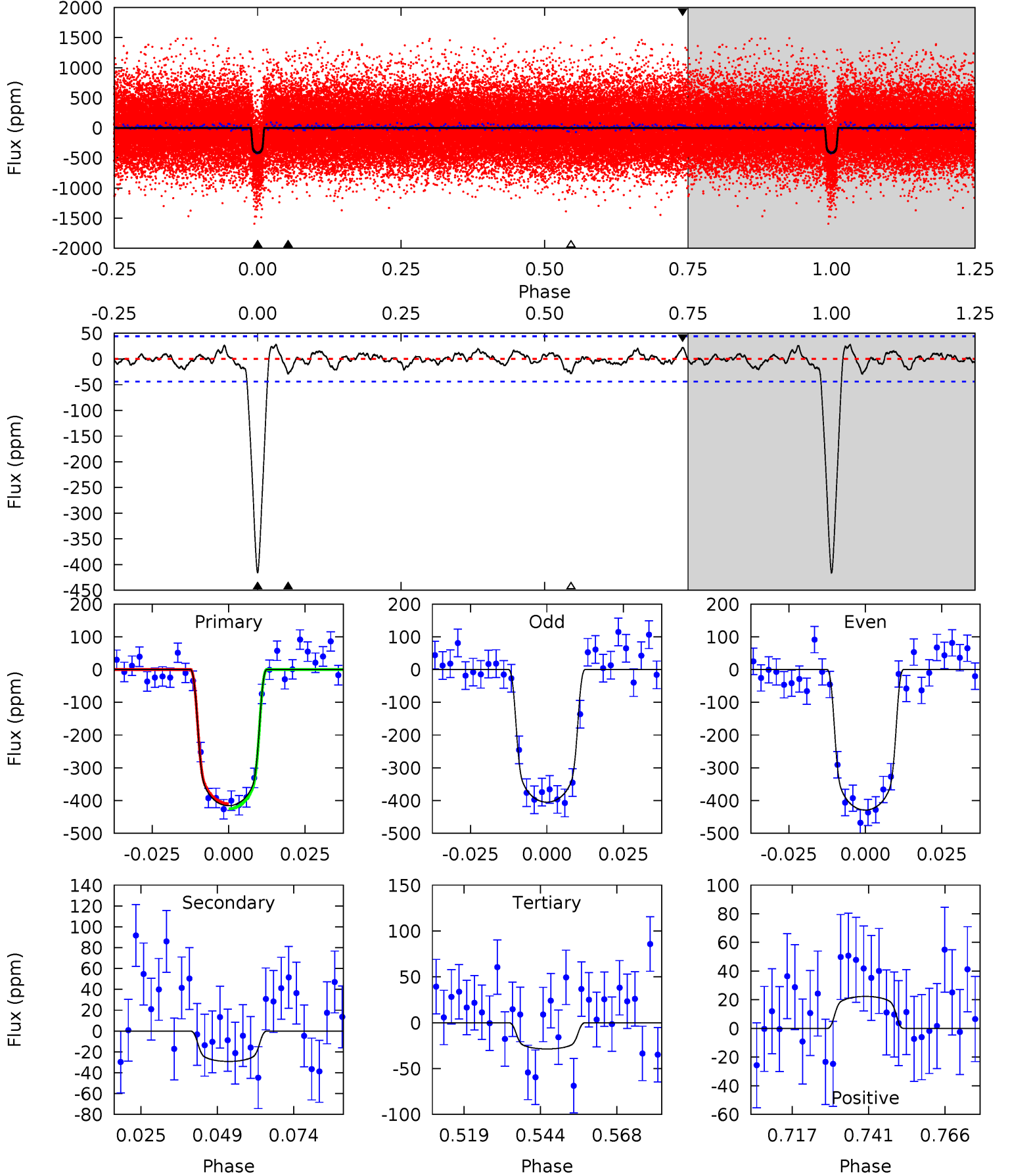
TCE 012058931-02   P= 9.825852 Days    $T_0=141.246414$  (BKJD)



# DV Model-Shift Uniqueness Test

012058931-02, P = 9.825751 Days, E = 131.426876 Days

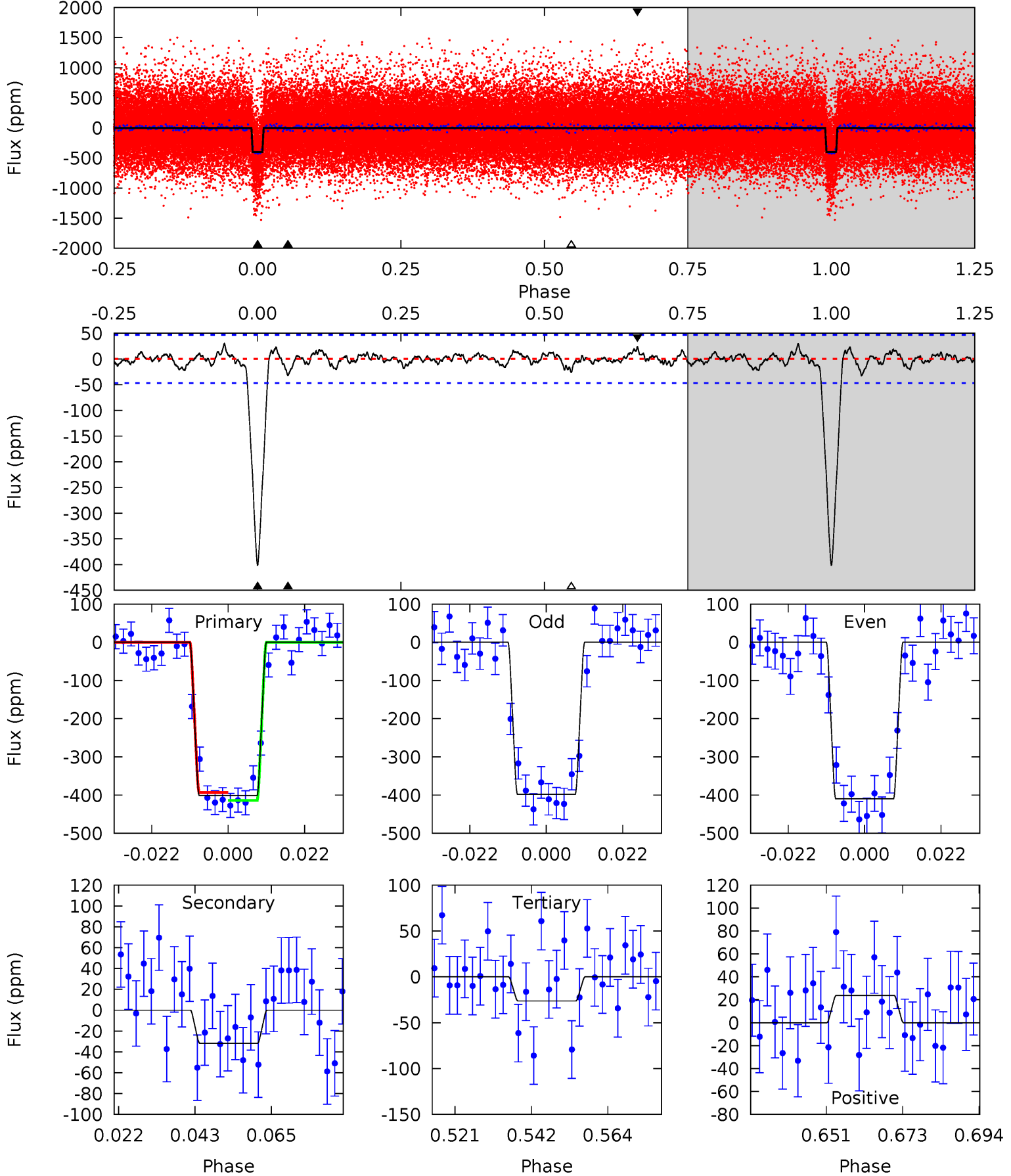
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
45.7	3.21	3.15	2.45	4.85	2.25	1.01	42.5	43.2	0.06	0.76	1.34	1.00	0.06	0.86



# Alt Model-Shift Uniqueness Test

012058931-02, P = 9.825852 Days, E = 131.420562 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
41.6	3.29	2.73	2.47	4.88	2.30	0.89	38.9	39.1	0.56	0.82	0.61	0.98	0.07	1.08



### Stellar Parameters For KIC 012058931

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6246^{+167}_{-223}$	$4.433^{+0.056}_{-0.224}$	$0.070^{+0.250}_{-0.300}$	$1.092^{+0.365}_{-0.122}$	$1.180^{+0.158}_{-0.158}$	$1.276^{+0.370}_{-0.706}$
	+3%/-4%	+1%/-5%	+357%/-429%	+33%/-11%	+13%/-13%	+29%/-55%
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 012058931-02 / KOI 0546.02

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-29 \pm 9$	$2.76^{+0.46}_{-0.30}$	$1329^{+105}_{-68}$	$3517^{+195}_{-201}$	$18^{+8}_{-6}$
Alt.	$-32 \pm 10$	$2.50^{+0.42}_{-0.27}$	$1338^{+96}_{-70}$	$3682^{+219}_{-242}$	$23^{+10}_{-9}$

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

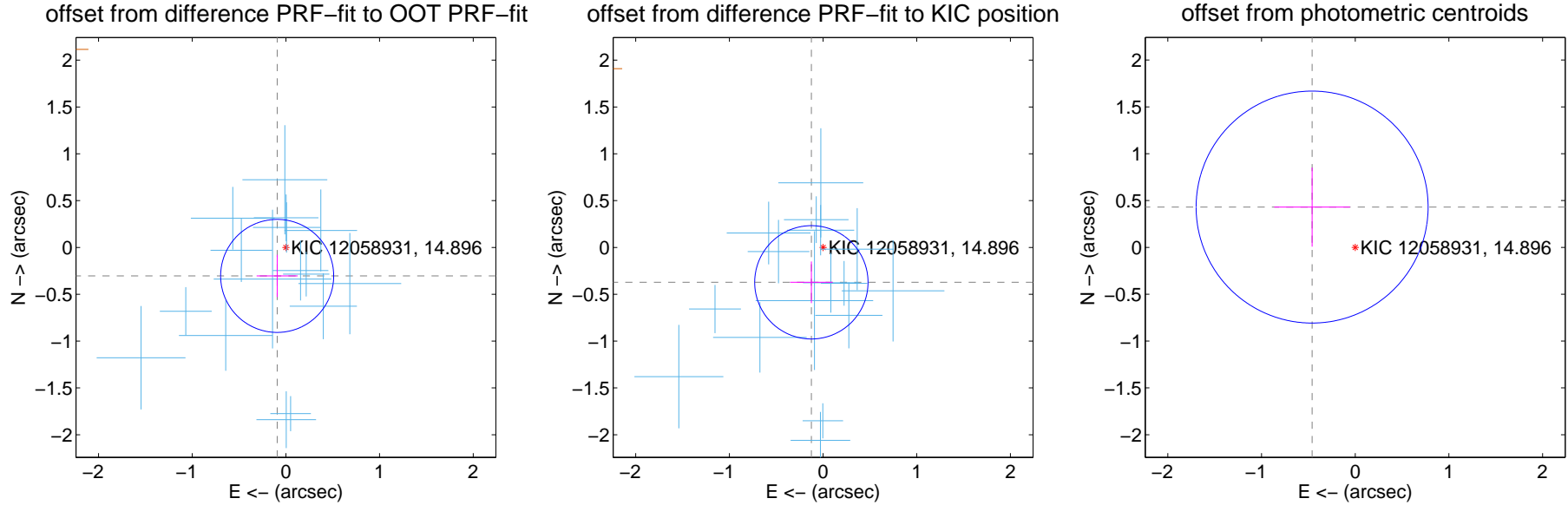
## DV Centroid Data

Supplemental centroid analysis for 012058931-02. Kepler magnitude: 14.90. Transit SNR 34.65

There are 16 quarters with good PRF difference image offsets

The direct PRF centroid is offset from the target star catalog position by about 0.21 arcsec

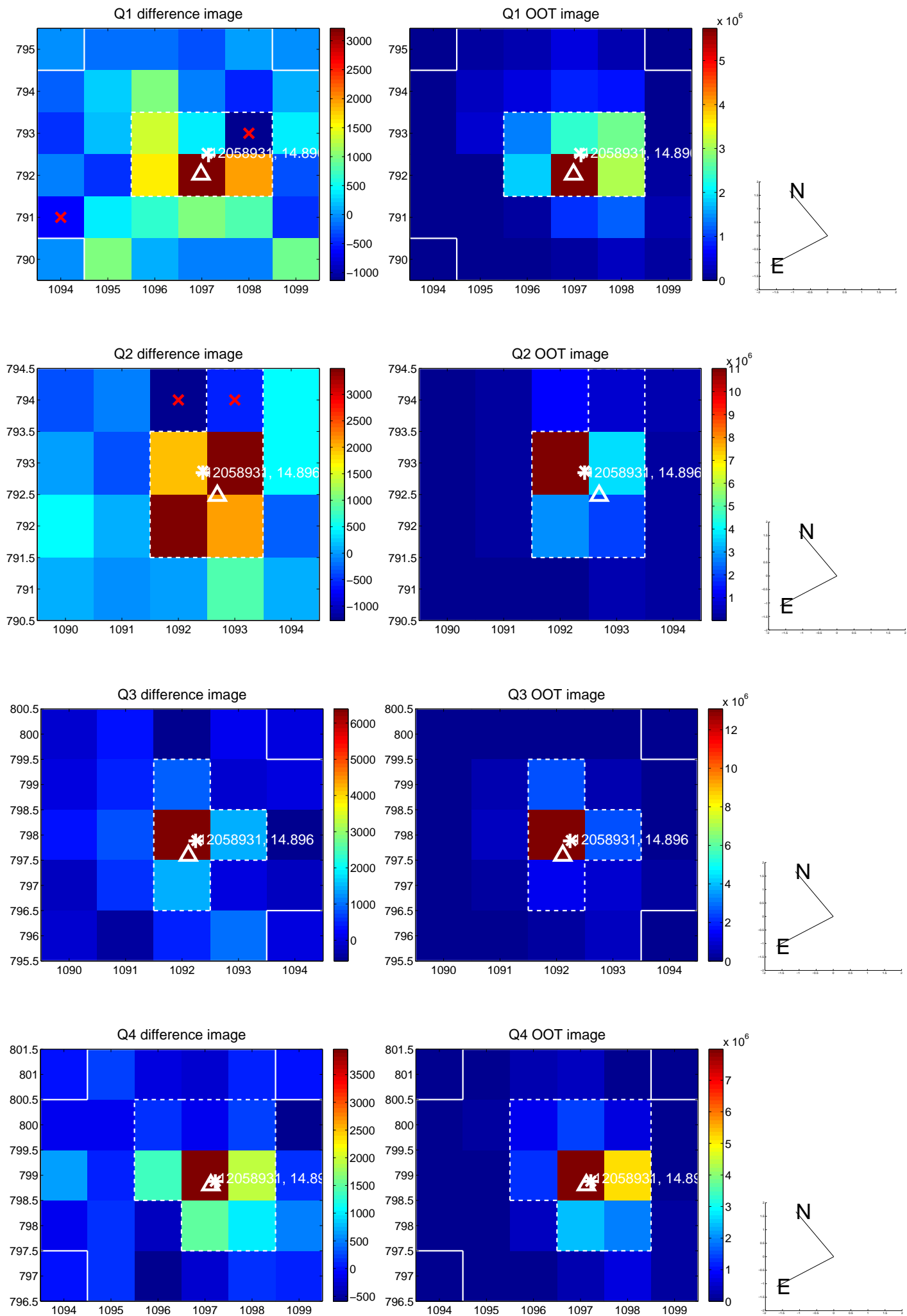
	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.318 \pm 0.201$	1.58	$0.093 \pm 0.219$	$-0.304 \pm 0.225$
PRF-fit source offset from KIC position	$0.393 \pm 0.202$	1.95	$0.125 \pm 0.227$	$-0.372 \pm 0.222$
photometric centroid source offset	$0.63 \pm 0.41$	1.53	$0.46 \pm 0.40$	$0.43 \pm 0.42$



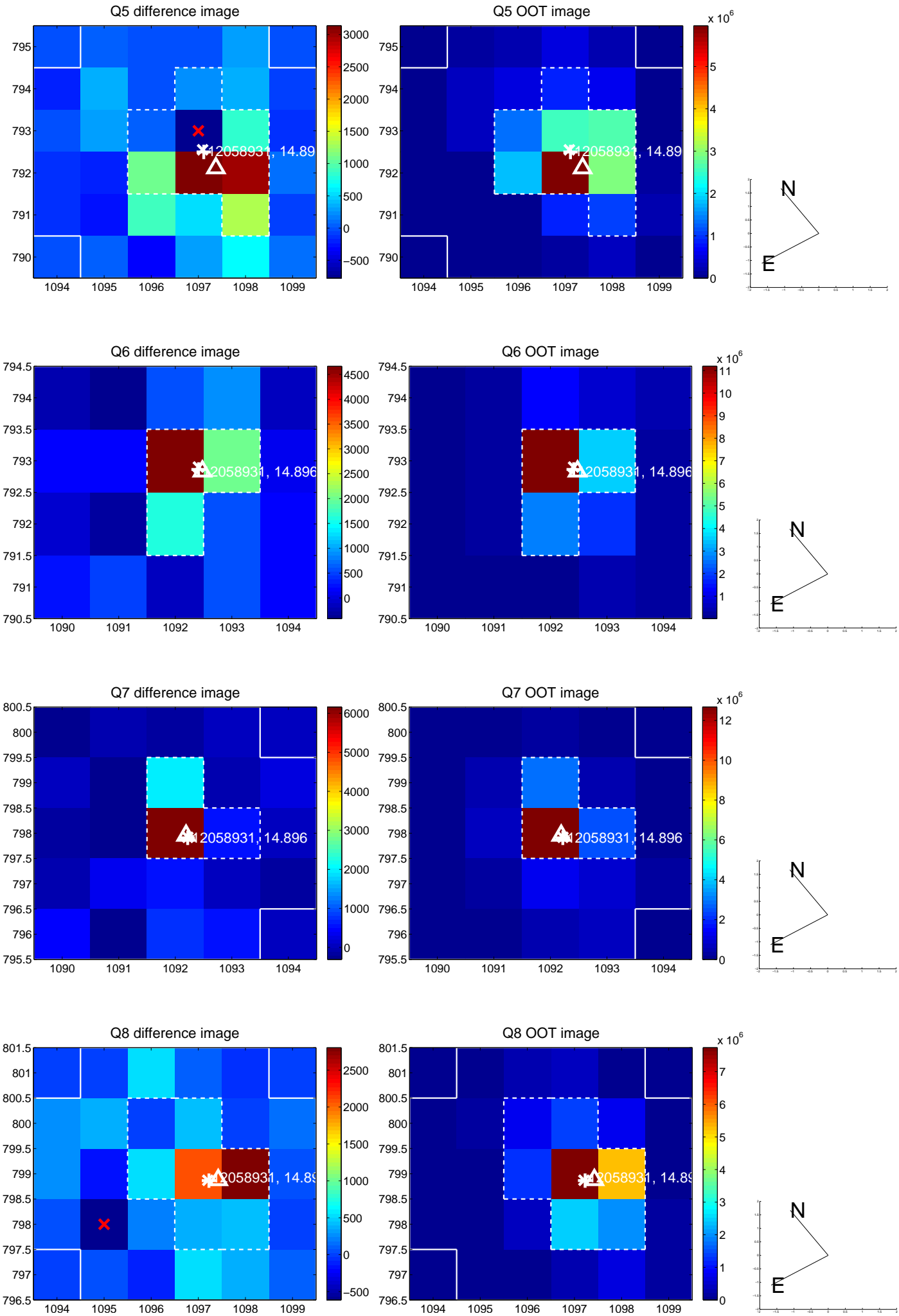
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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



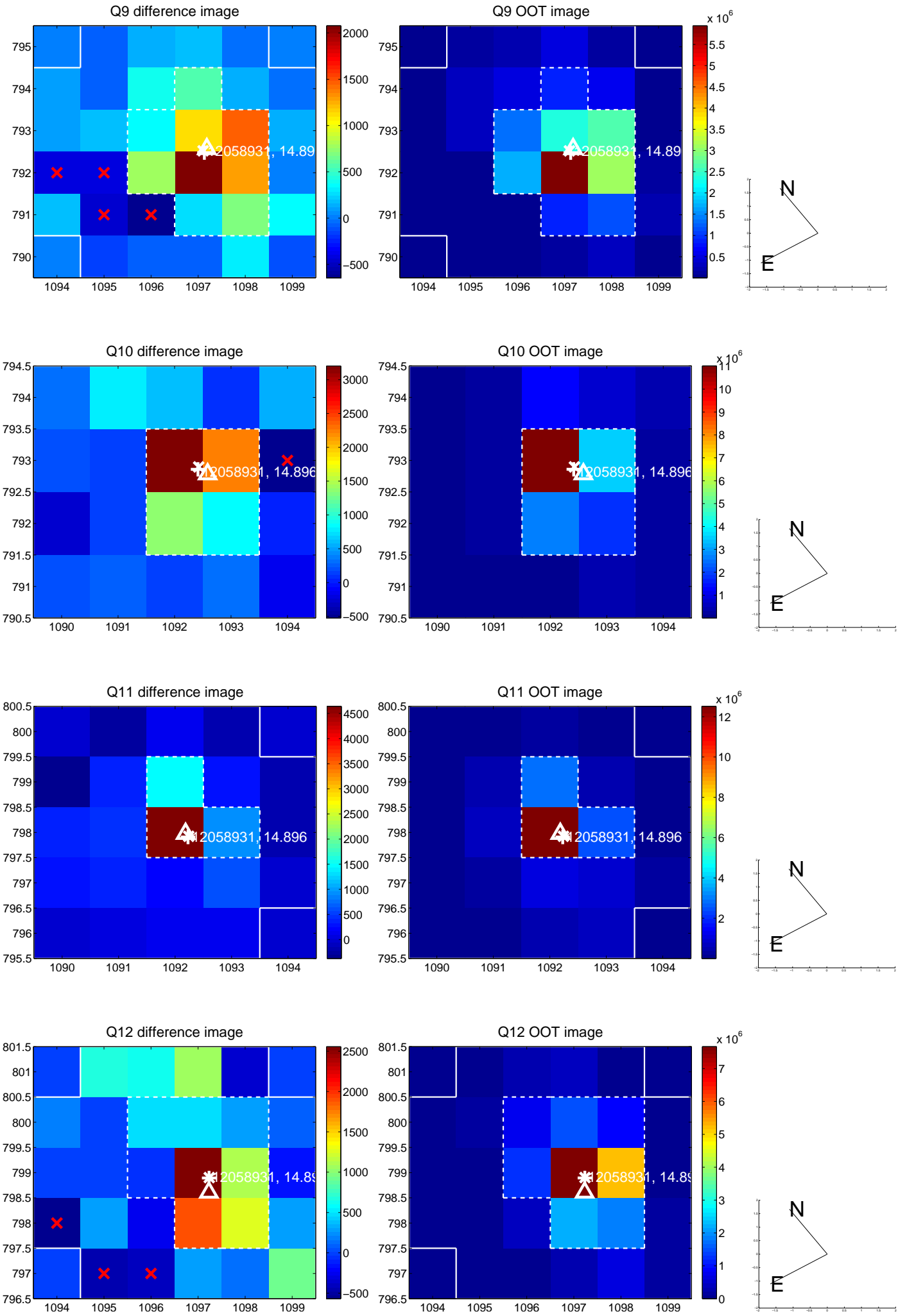
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



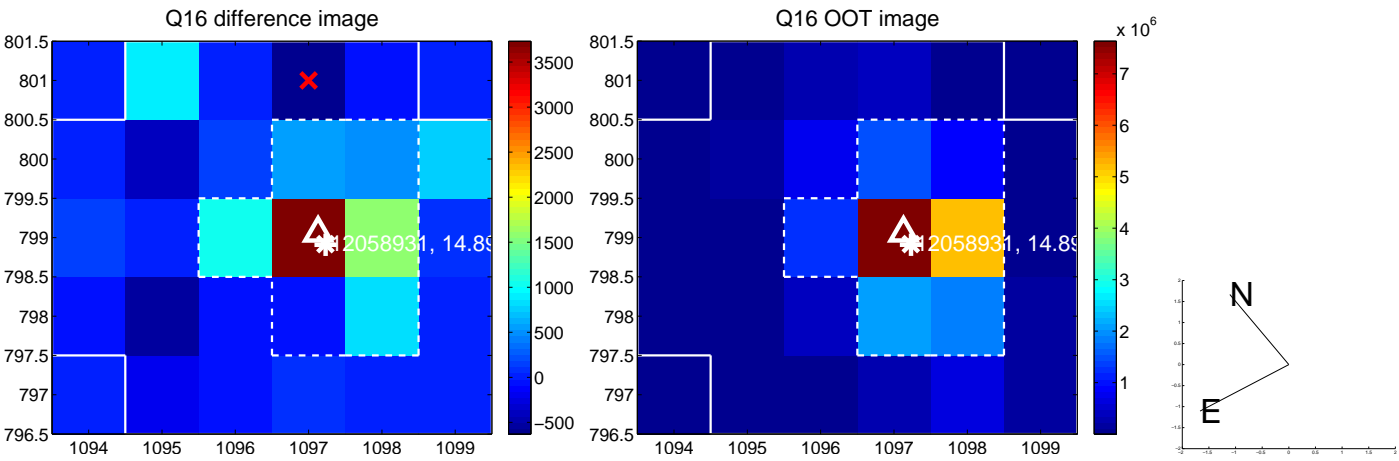
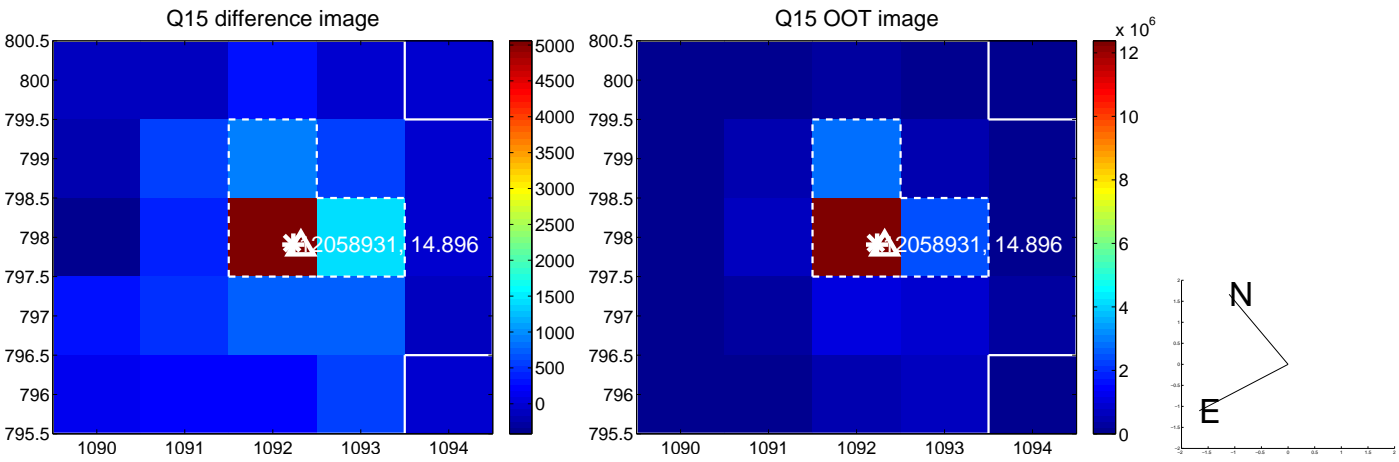
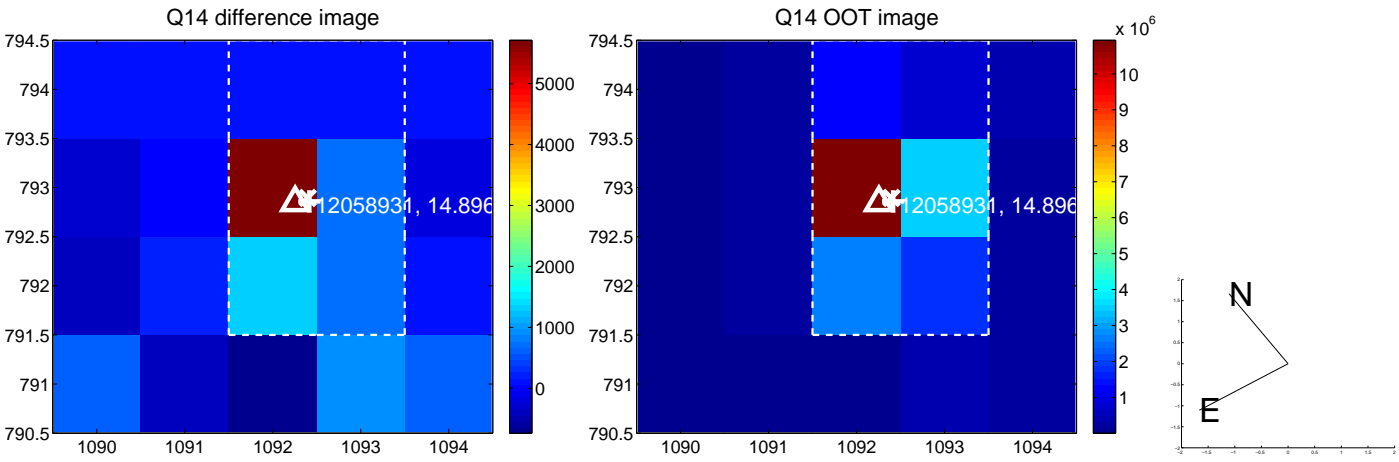
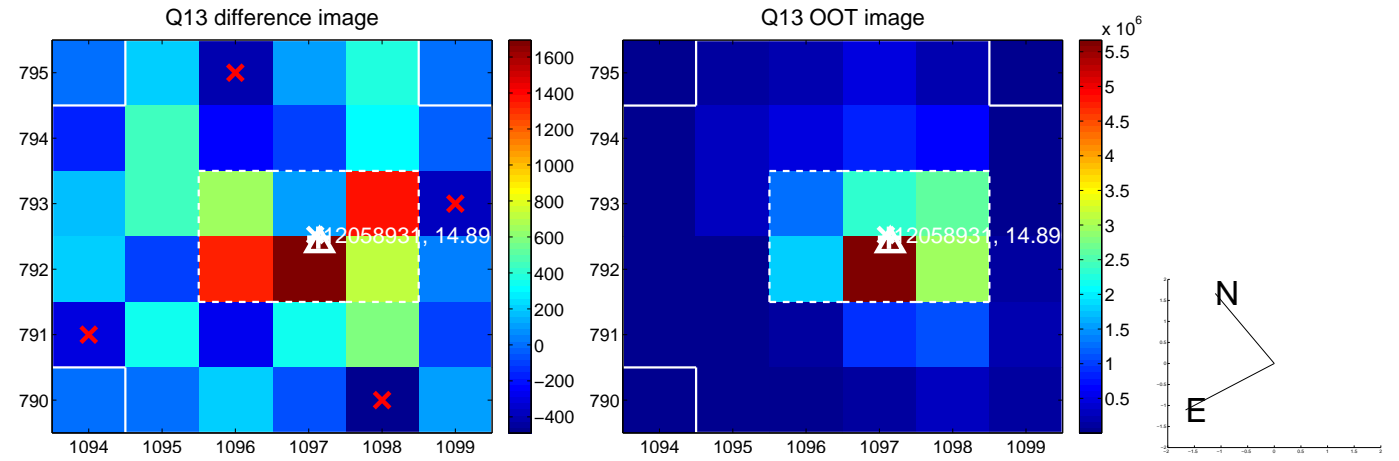
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



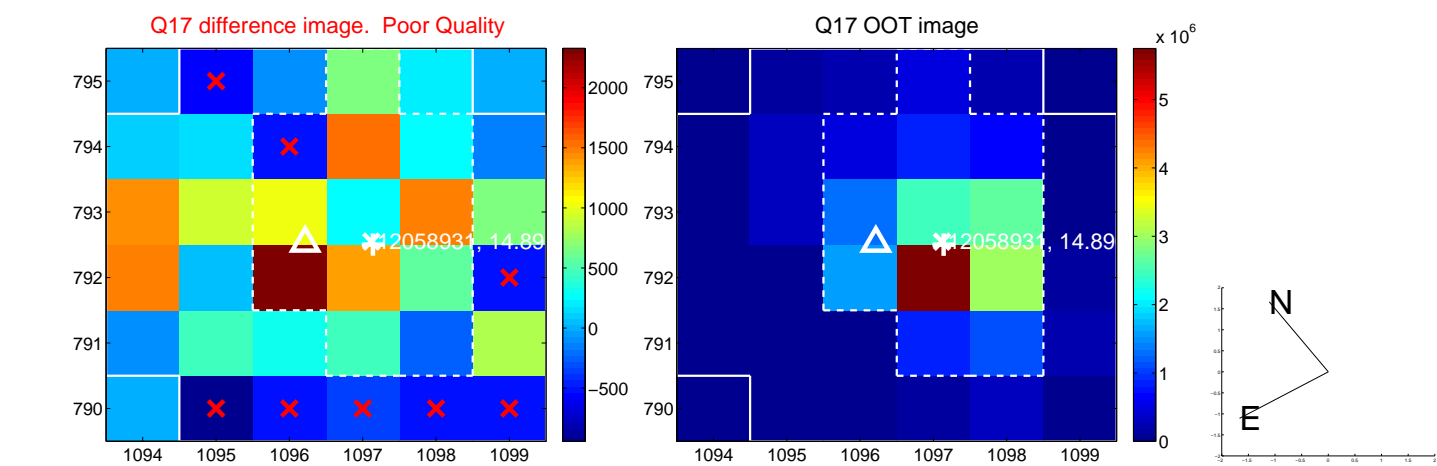
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



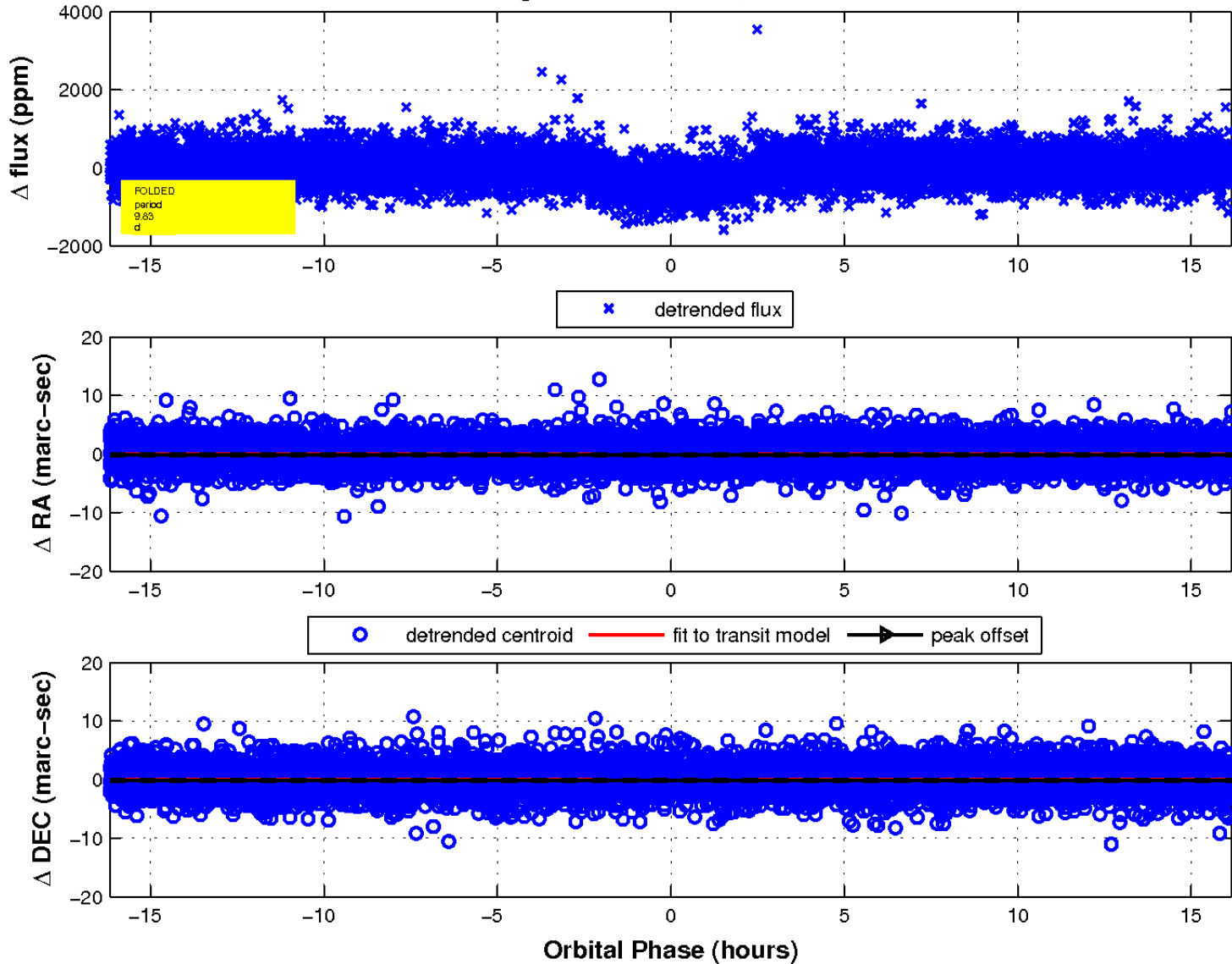
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



fluxWeightedCentroids, Planet 2 of 2



UKIRT Image

