

# KIC 011086270

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
011086270-01	OBS	0124.01	12.691047	137.125957	250.5	3.999	47.6	54.1	1.63	5869	3.02	244.66
011086270-02	OBS	0124.02	31.719852	142.819233	352.0	4.945	50.2	53.5	1.63	5869	3.42	72.13

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
011086270-01	OBS	FP	0.41	0	1	0	0	MOD_SEC_ALT
011086270-02	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.

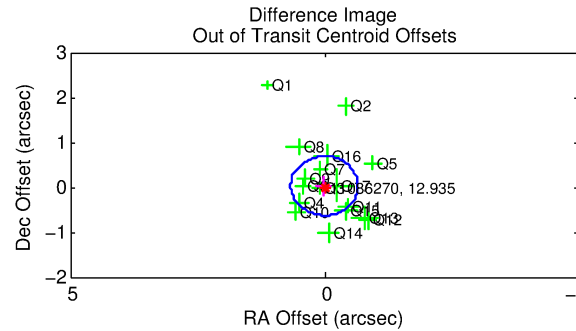
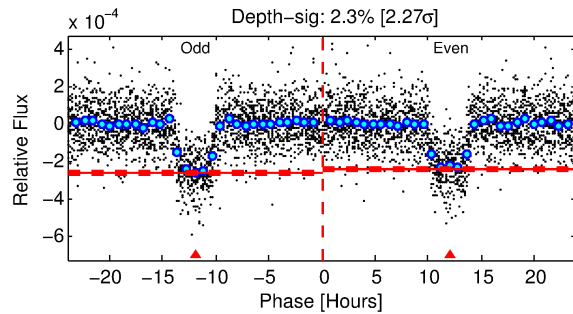
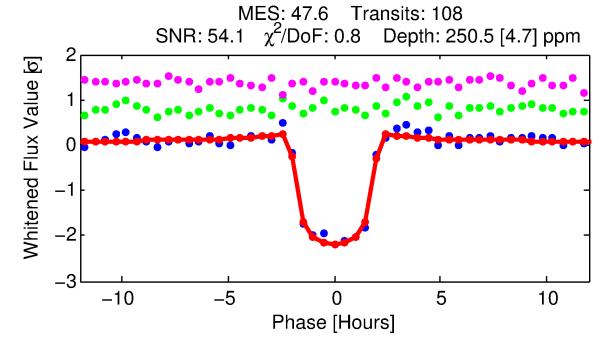
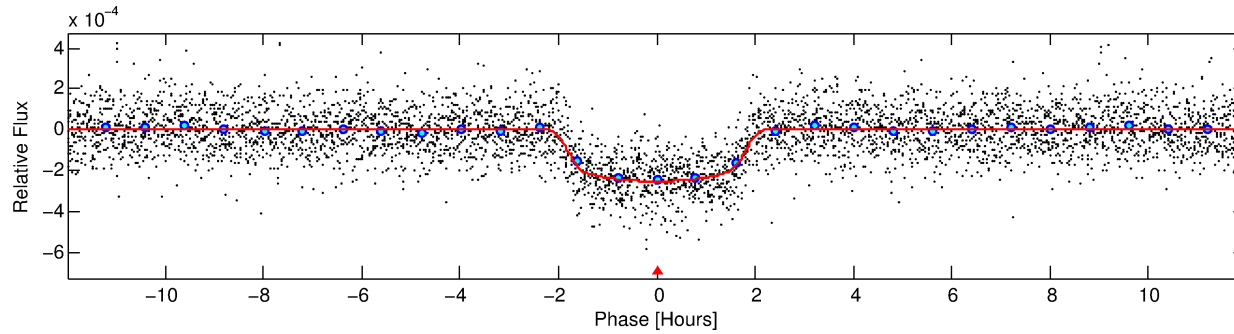
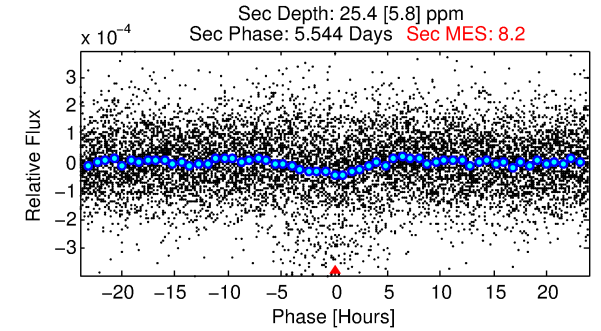
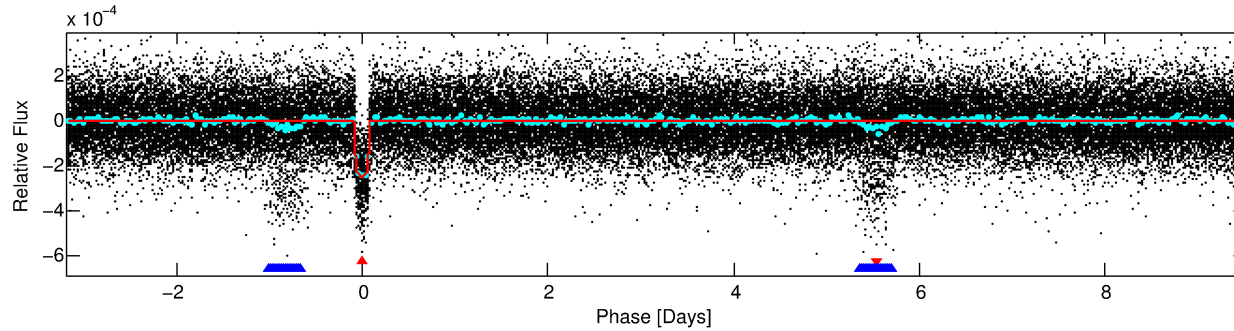
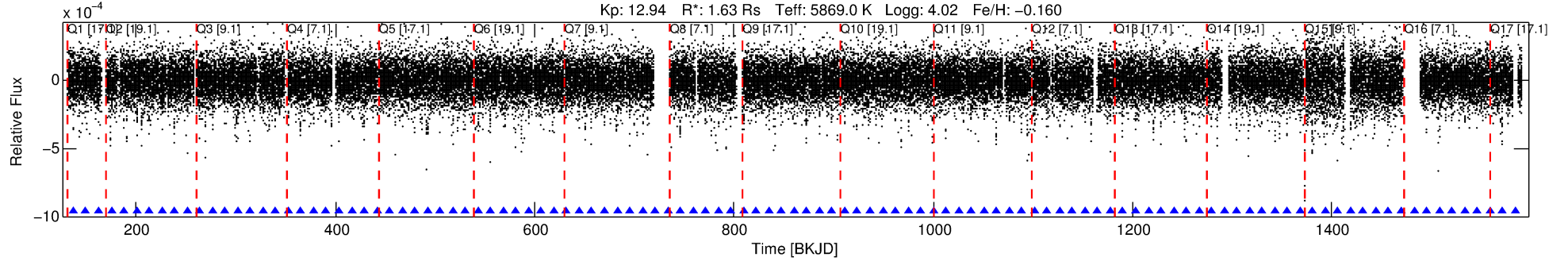
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 011086270-01

No Significant Match Found

# DV One-Page Summary

KIC: 11086270 Candidate: 1 of 2 Period: 12.691 d  
KOI: K00124.01 Name: Kepler-110b Corr: 0.974



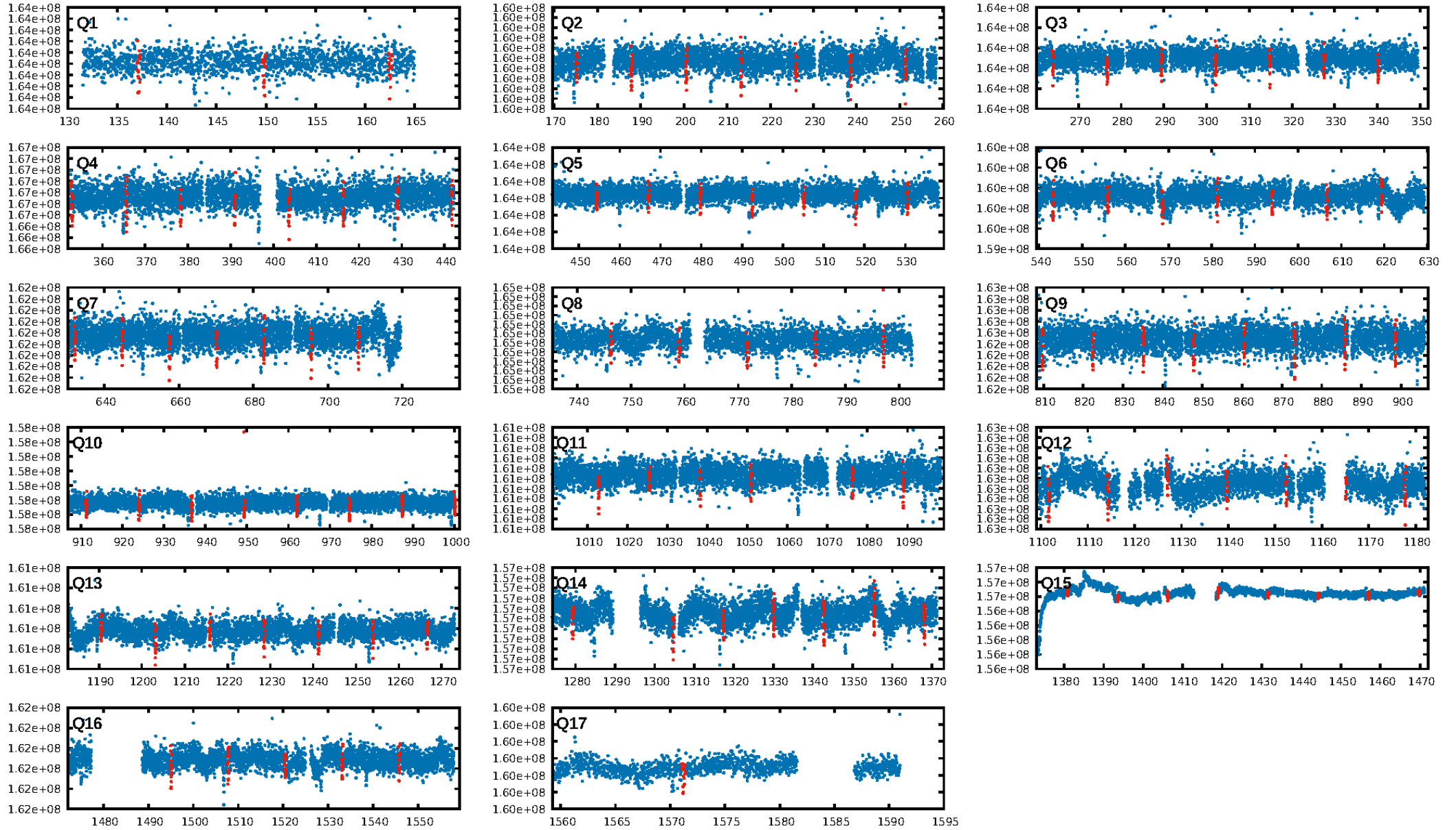
## DV Fit Results:

Period = 12.69105 [0.00002] d  
Epoch = 137.1260 [0.0015] BKJD  
Rp/R\* = 0.0170 [0.0012]  
a/R\* = 11.85 [3.99]  
b = 0.89 [0.08]  
Seff = 244.66 [91.20]  
Teff = 1008 [94] K  
Rp = 3.02 [0.80] Re  
a = 0.1072 [0.0251] AU  
Ag = 17.54 [7.92] [2.09σ]  
Teffp = 3191 [223] K [9.03σ]

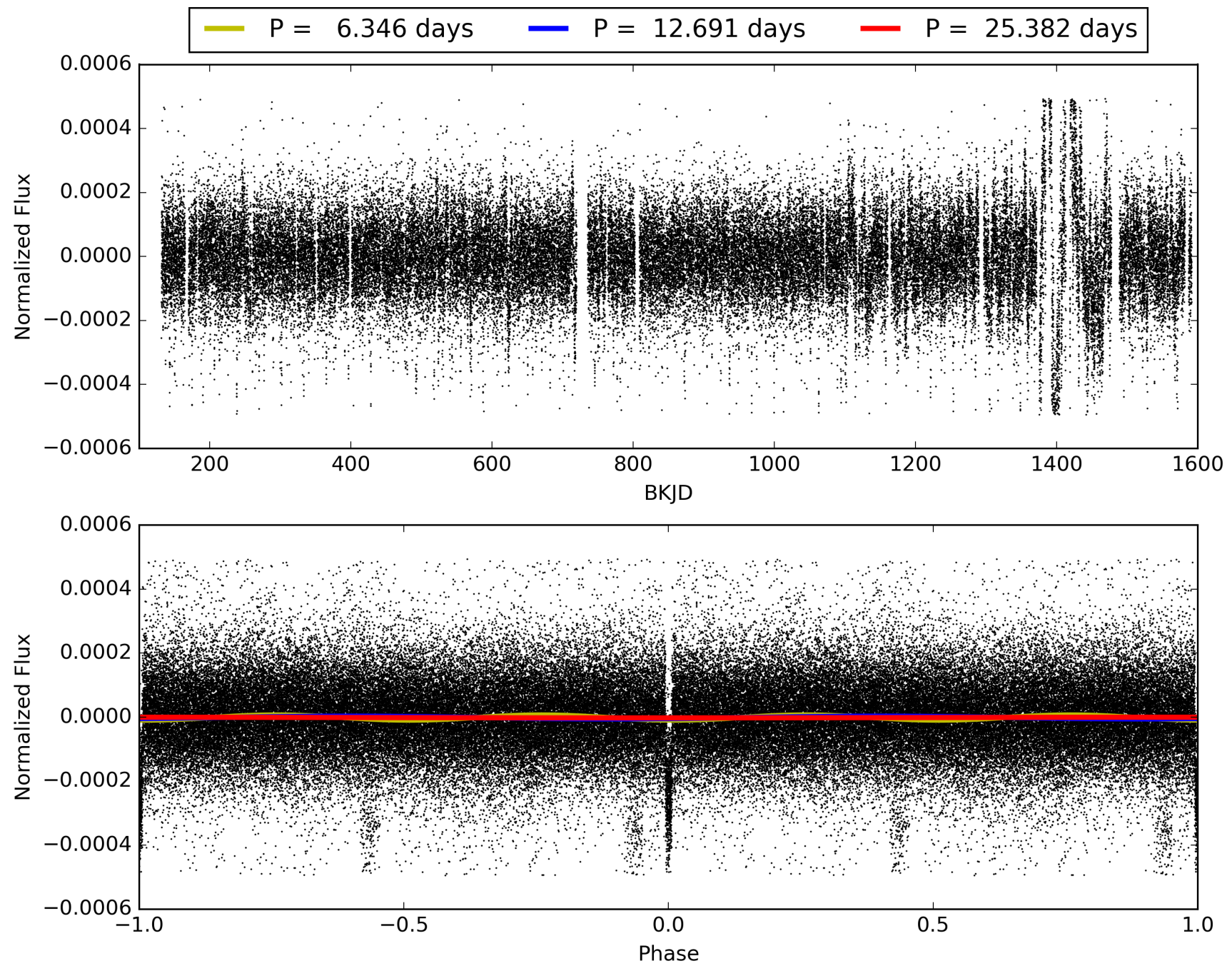
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [71.81σ]  
ModelChiSquare2-sig: 99.8%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 0.00e+00  
RollingBand-fgt: 1.00 [104/104]  
GhostDiagnostic-chr: 46.98  
Centroid-sig: 11.5%  
Centroid-so: 0.310 arcsec [1.46σ]  
OotOffset-rm: 0.029 arcsec [0.13σ]  
KicOffset-rm: 0.129 arcsec [0.60σ]  
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 011086270-01, PDC Light Curves

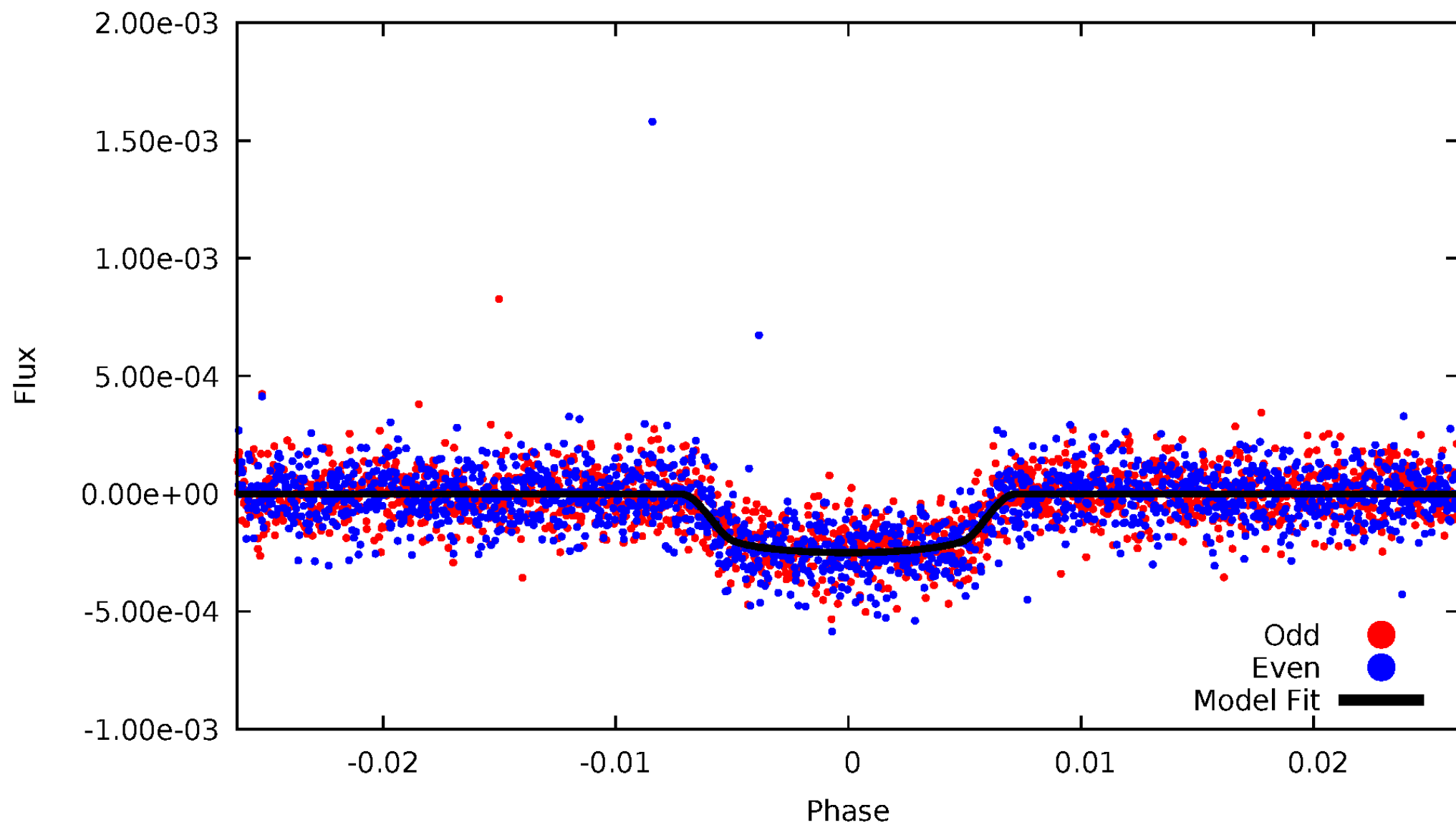


# TCE 011086270-01



# DV Odd/Even

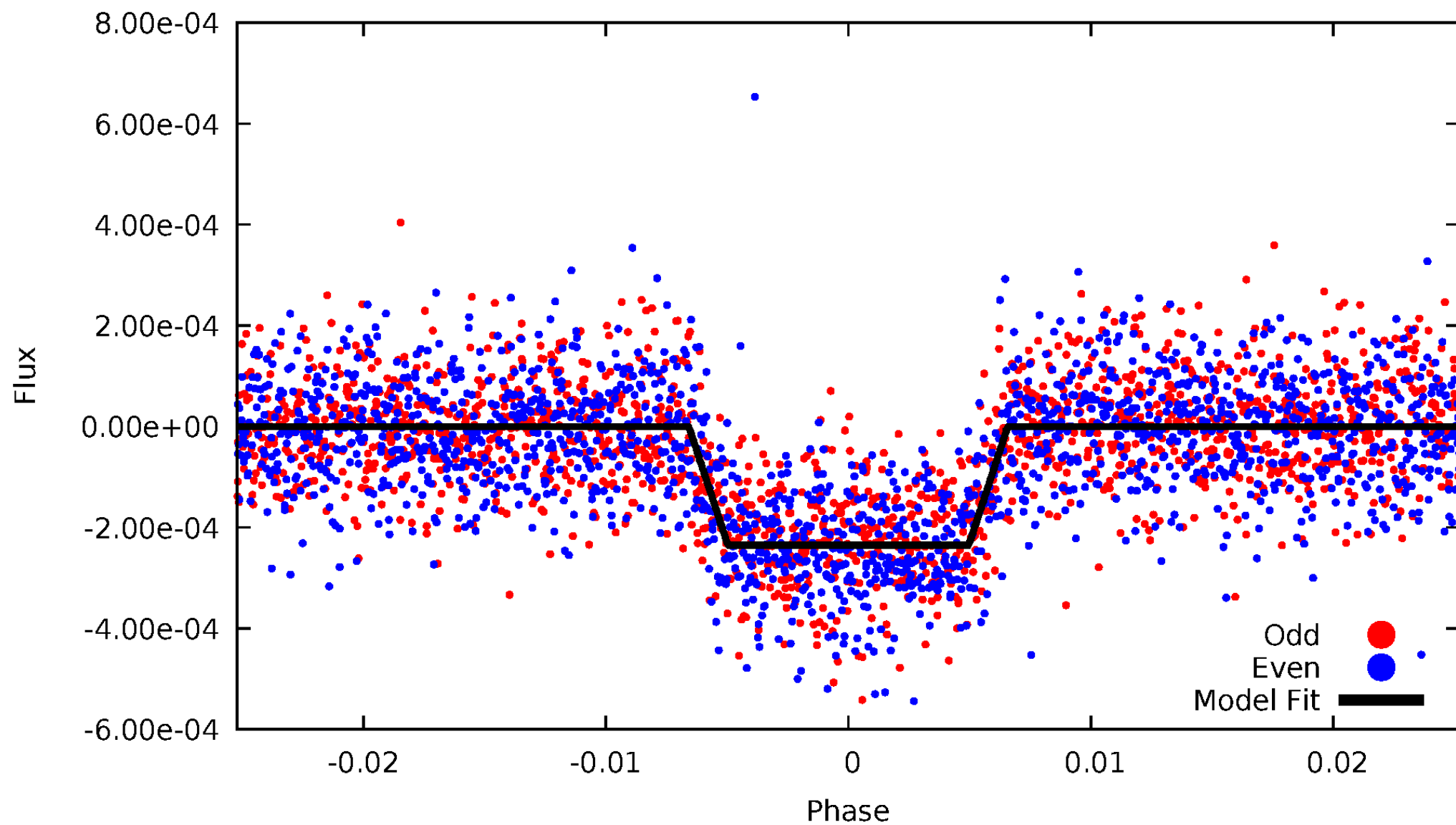
TCE 011086270-01



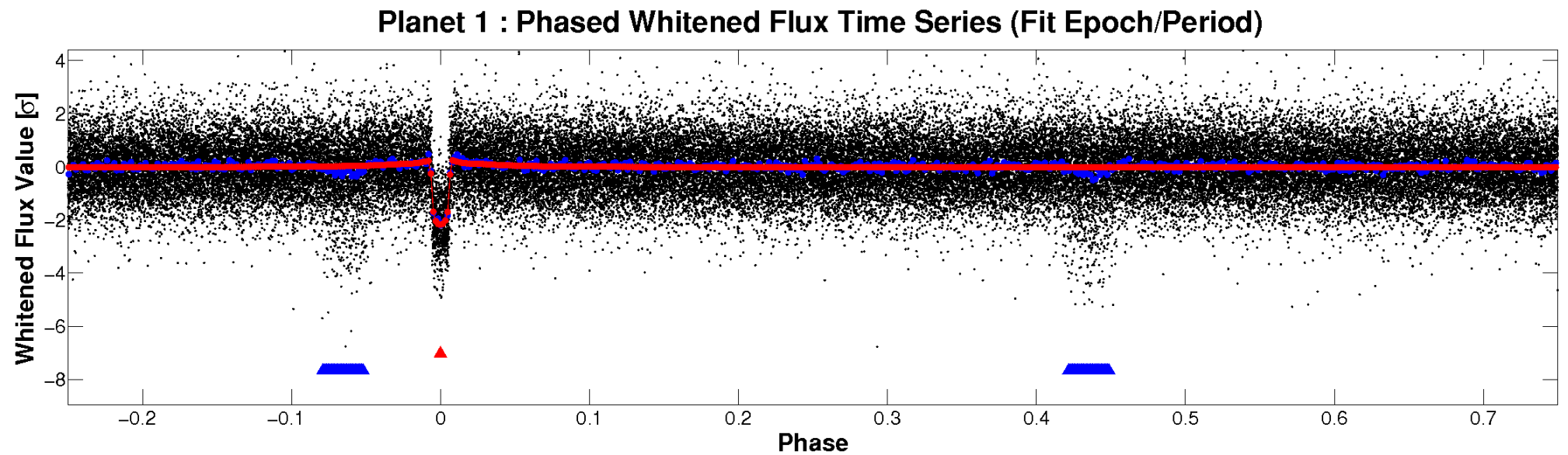
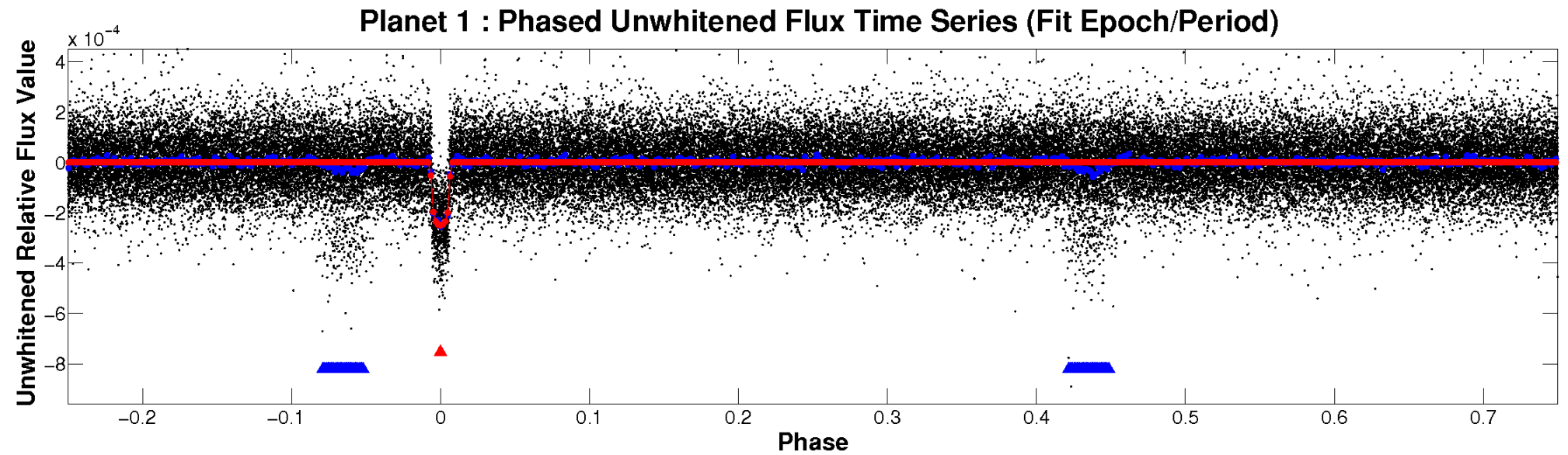


# ALT Odd/Even

TCE 011086270-01

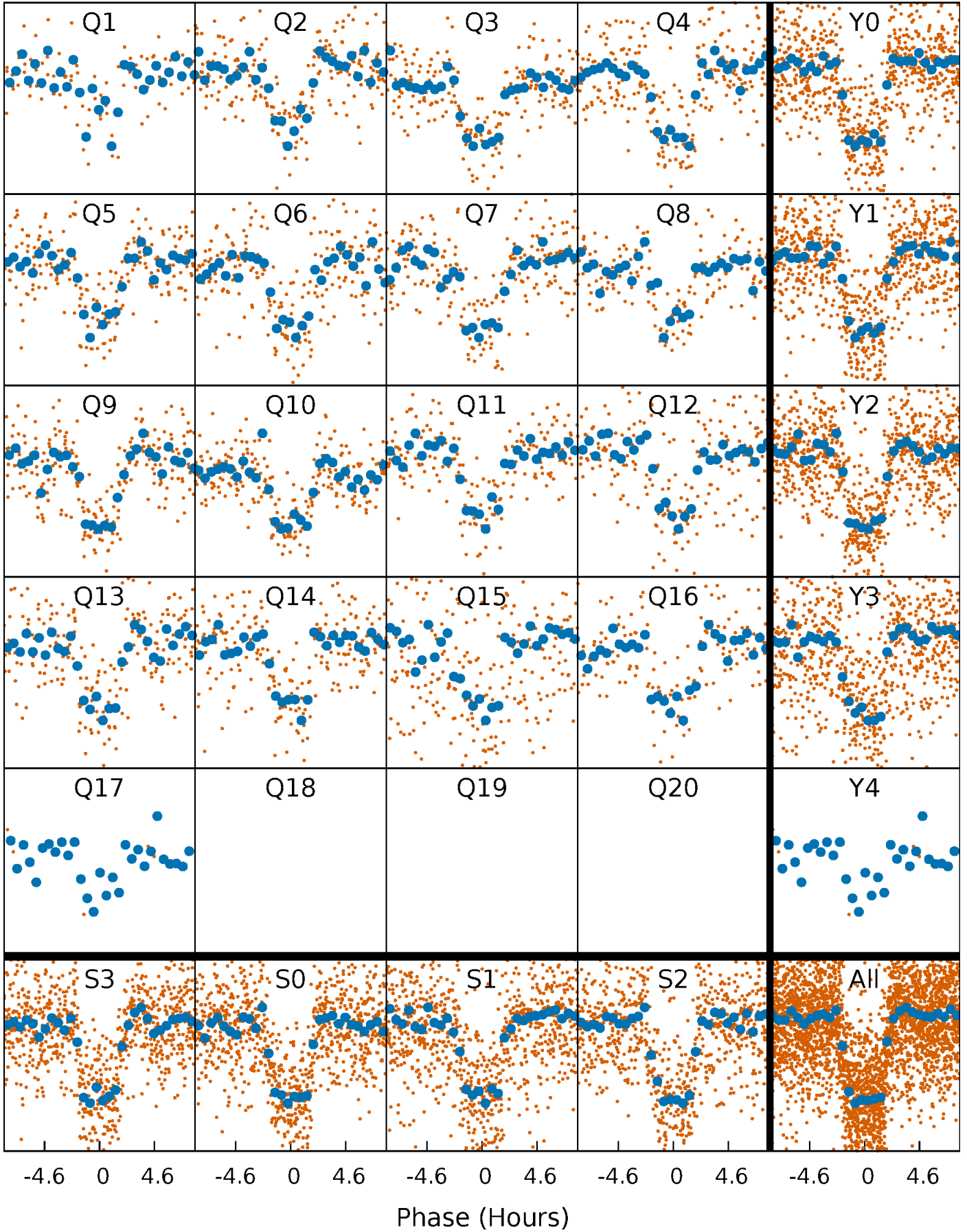


# Non-Whitened Vs. Whitened Light Curve



# PDC Quarter-Phased Transit Curves

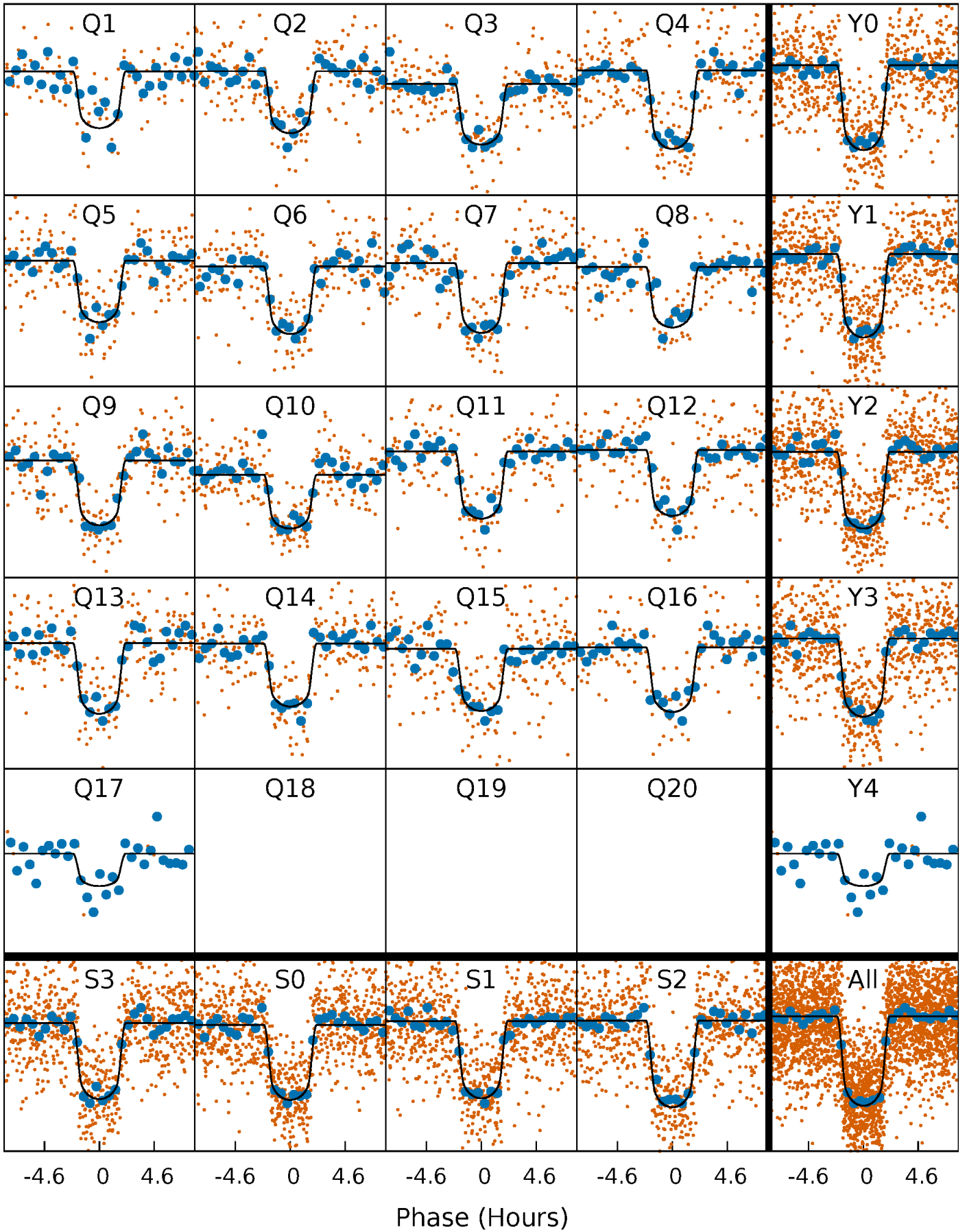
TCE 011086270-01 P= 12.691047 Days  $T_0=137.125957$  (BKJD)





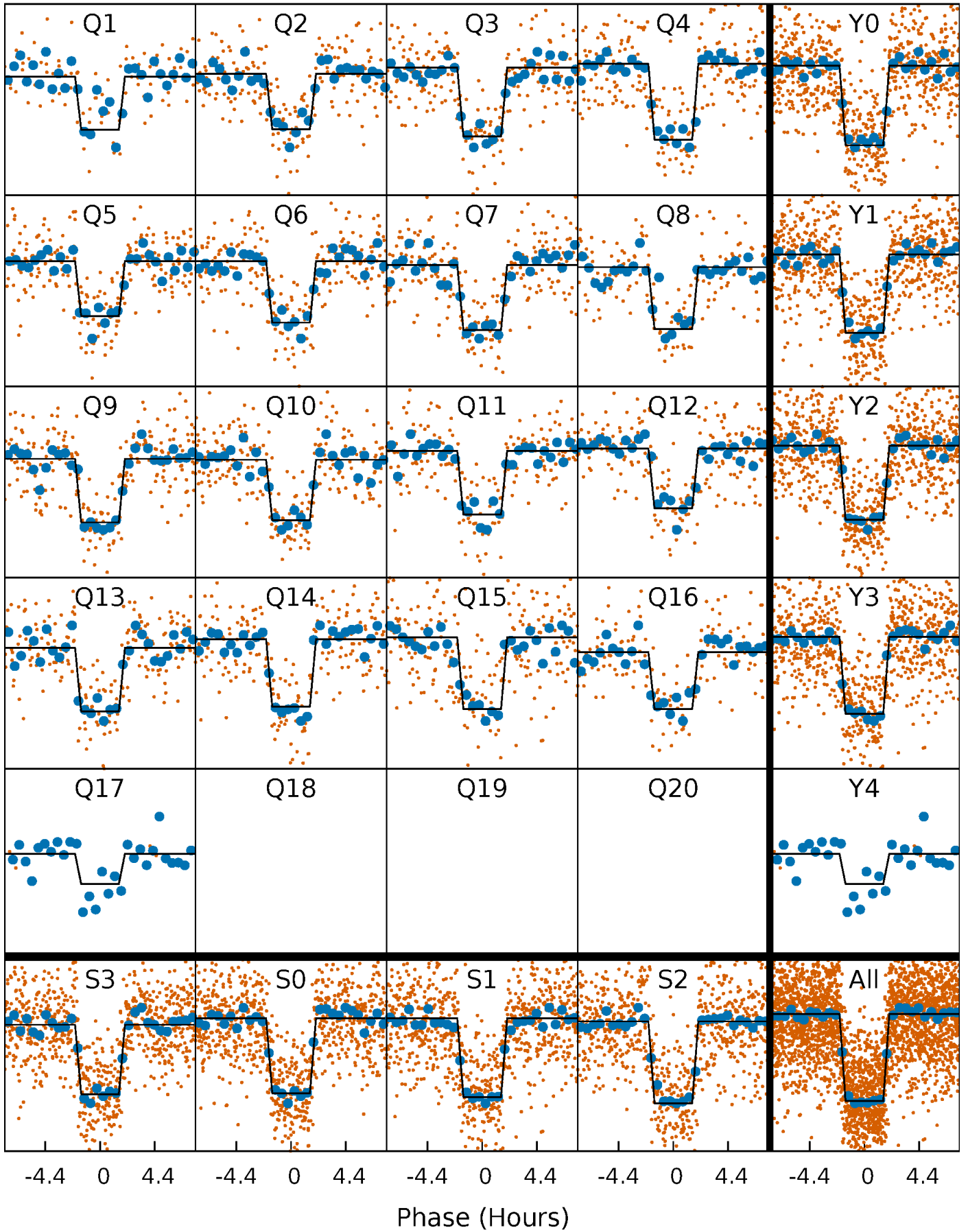
# DV Quarter-Phased Transit Curves

TCE 011086270-01 P= 12.691047 Days  $T_0=137.125957$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

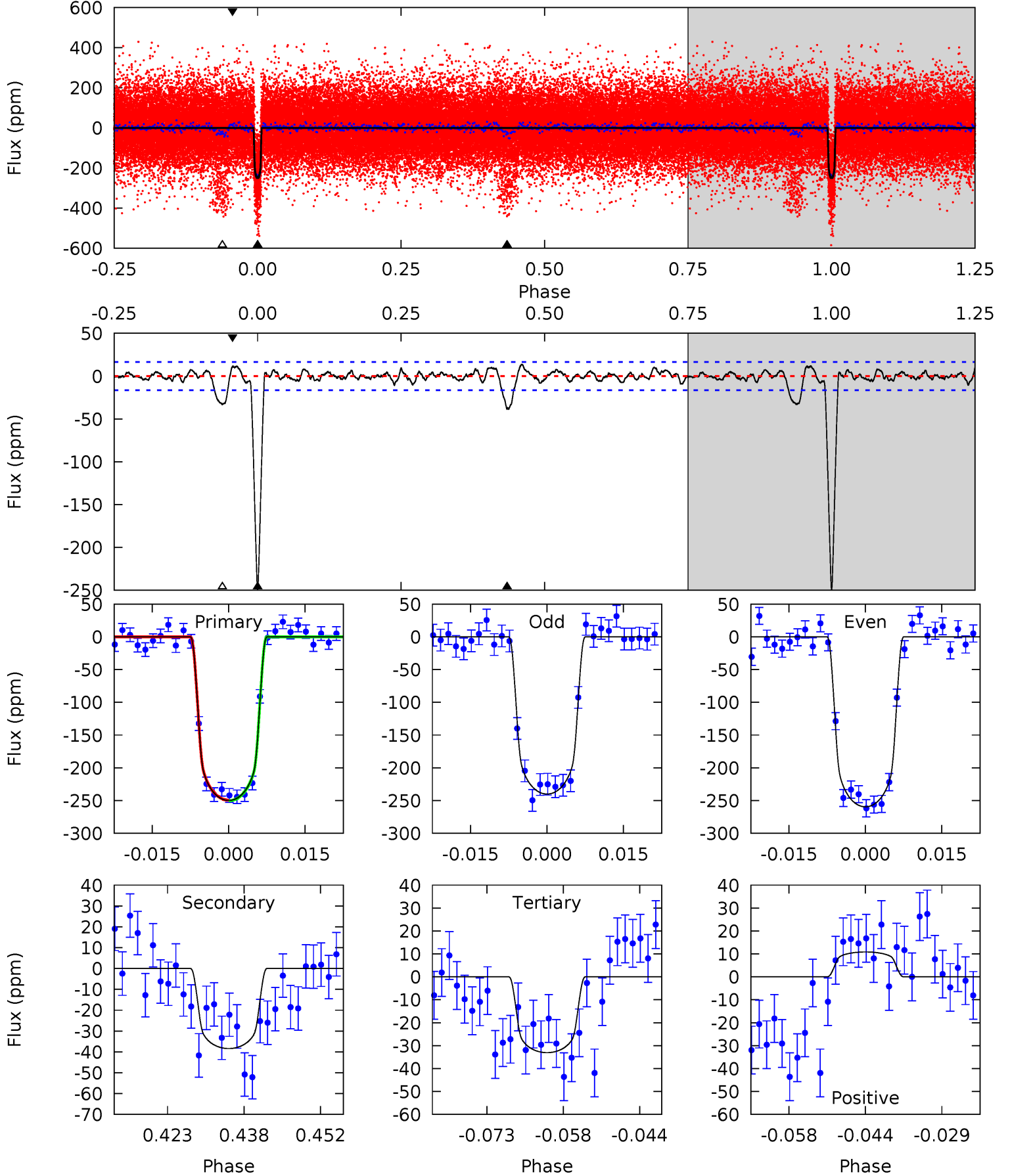
TCE 011086270-01 P= 12.691085 Days  $T_0=137.124144$  (BKJD)



# DV Model-Shift Uniqueness Test

011086270-01,  $P = 12.691047$  Days,  $E = 124.434910$  Days

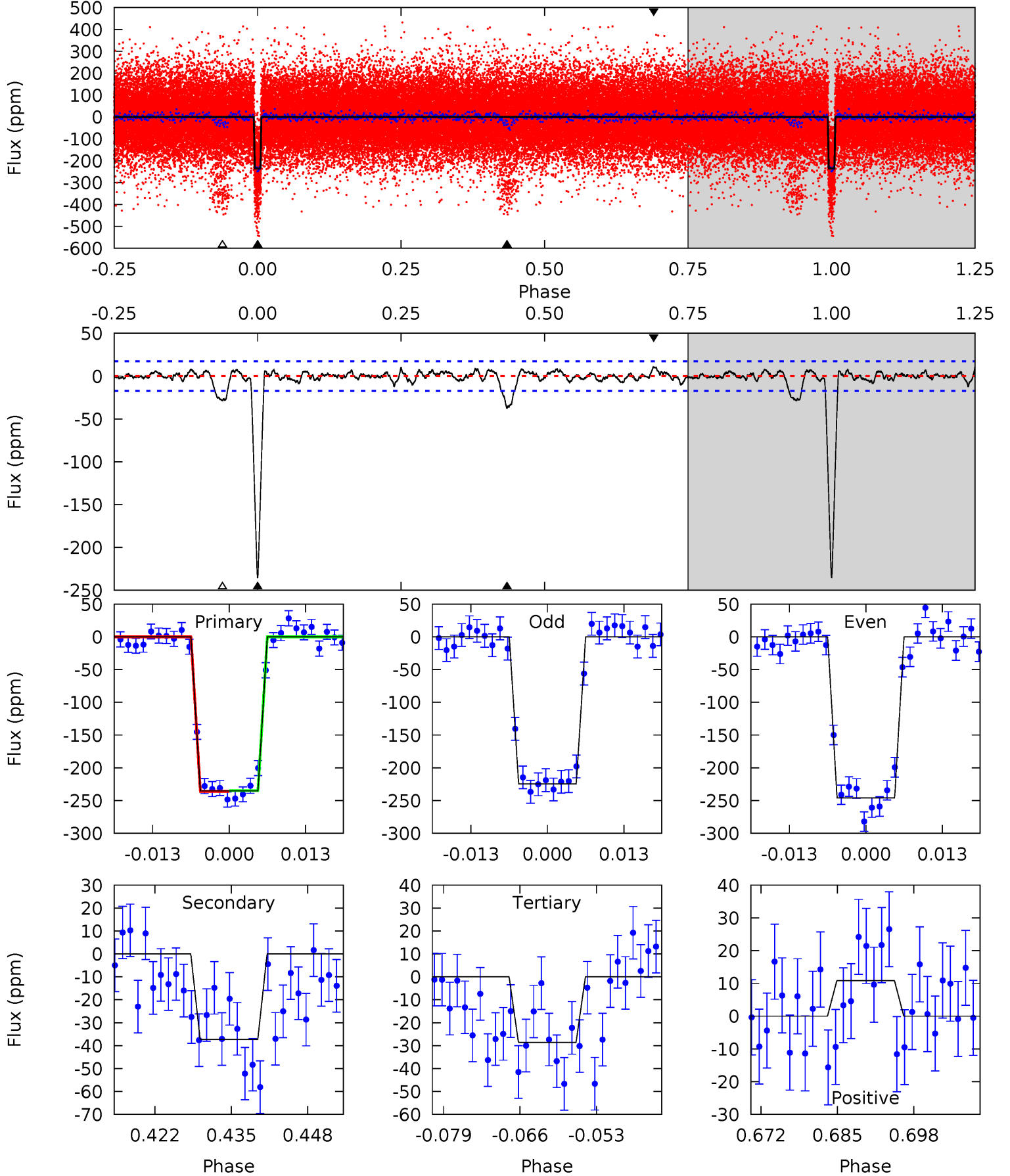
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
75.0	11.5	9.93	3.25	4.95	2.44	1.86	65.1	71.7	1.60	8.27	2.93	1.03	0.05	0.14



# Alt Model-Shift Uniqueness Test

011086270-01,  $P = 12.691085$  Days,  $E = 124.433059$  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
67.9	10.8	8.24	3.12	4.97	2.48	1.61	59.6	64.7	2.53	7.65	3.06	0.98	0.04	0.17



### Stellar Parameters For KIC 011086270

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$5869^{+117}_{-117}$	$4.024^{+0.210}_{-0.105}$	$-0.160^{+0.150}_{-0.150}$	$1.626^{+0.254}_{-0.413}$	$1.019^{+0.098}_{-0.098}$	$0.334^{+0.393}_{-0.094}$
	+2%/-2%	+5%/-3%	+94%/-94%	+16%/-25%	+10%/-10%	+118%/-28%
Source	SPE59	SPE59	SPE59	DSEP		

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

### Secondary Eclipse Parameters for KIC 011086270-01 / KOI 0124.01

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	$-38 \pm 3$	$3.01^{+0.36}_{-0.43}$	$1403^{+70}_{-95}$	$3870^{+138}_{-114}$	$27^{+9}_{-6}$
Alt.	$-37 \pm 3$	$2.69^{+0.38}_{-0.38}$	$1401^{+75}_{-93}$	$4009^{+162}_{-142}$	$33^{+12}_{-8}$

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



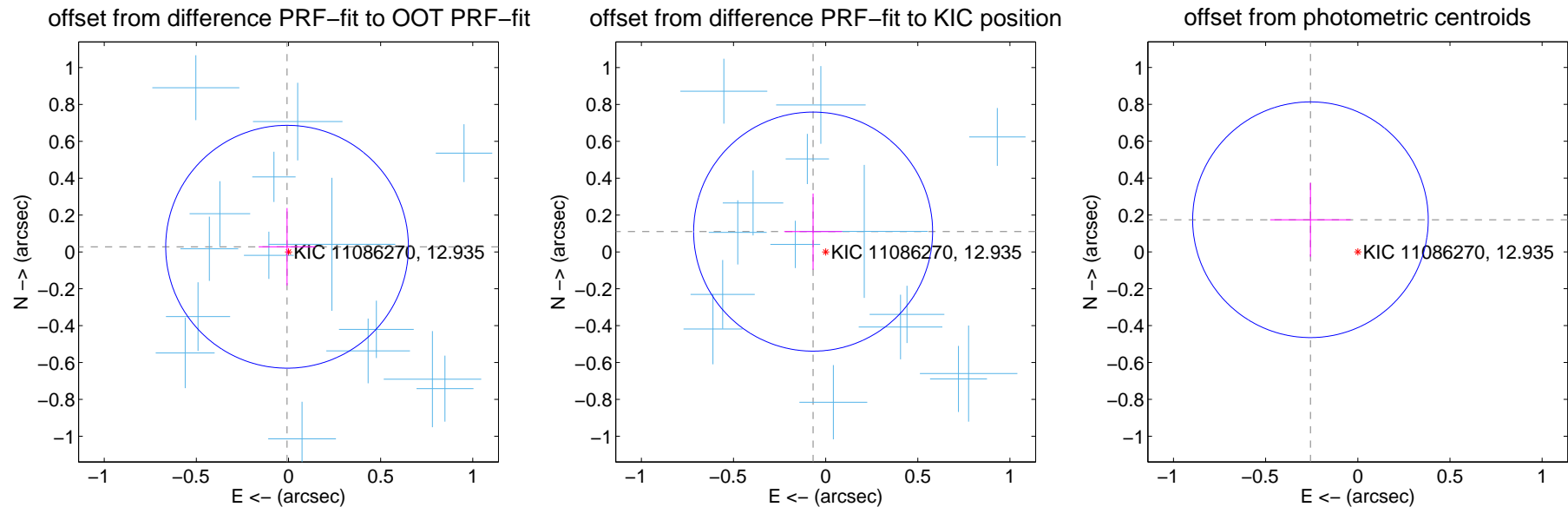
## DV Centroid Data

Supplemental centroid analysis for 011086270-01. Kepler magnitude: 12.94. Transit SNR 54.13

There are 16 quarters with good PRF difference image offsets

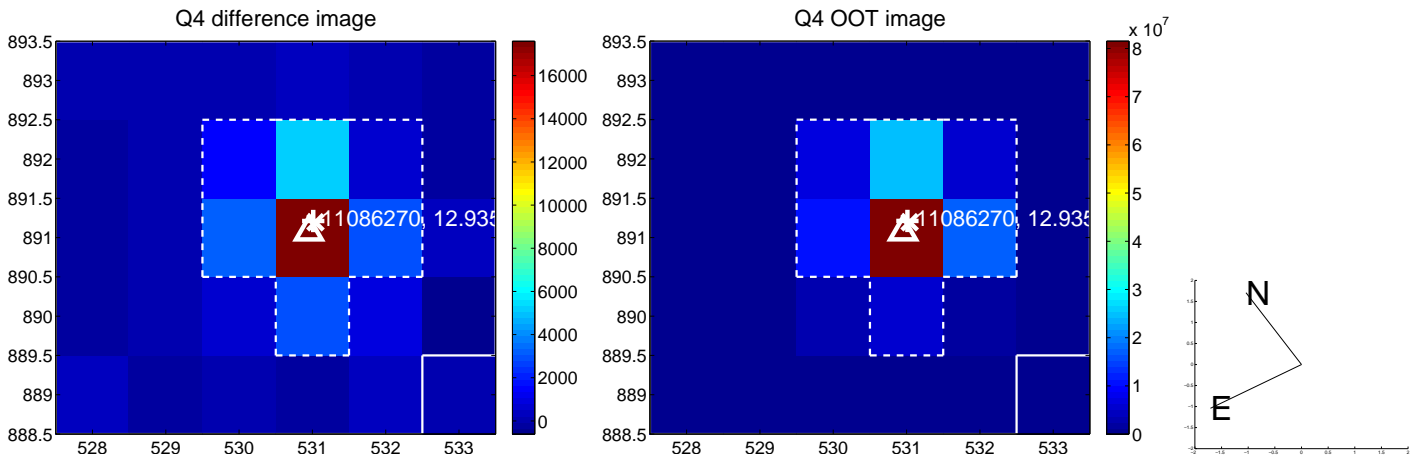
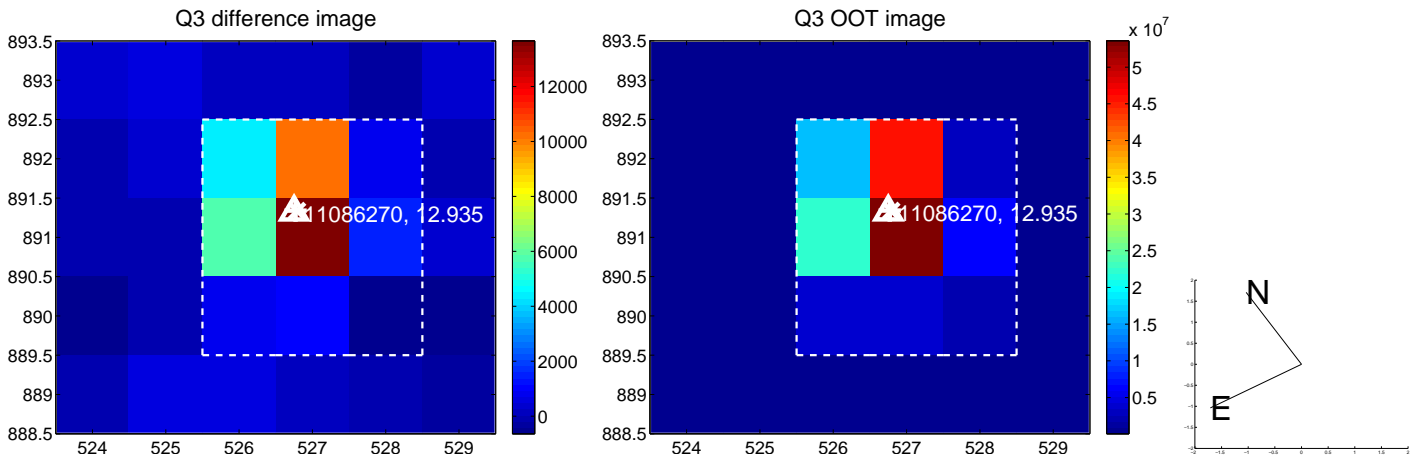
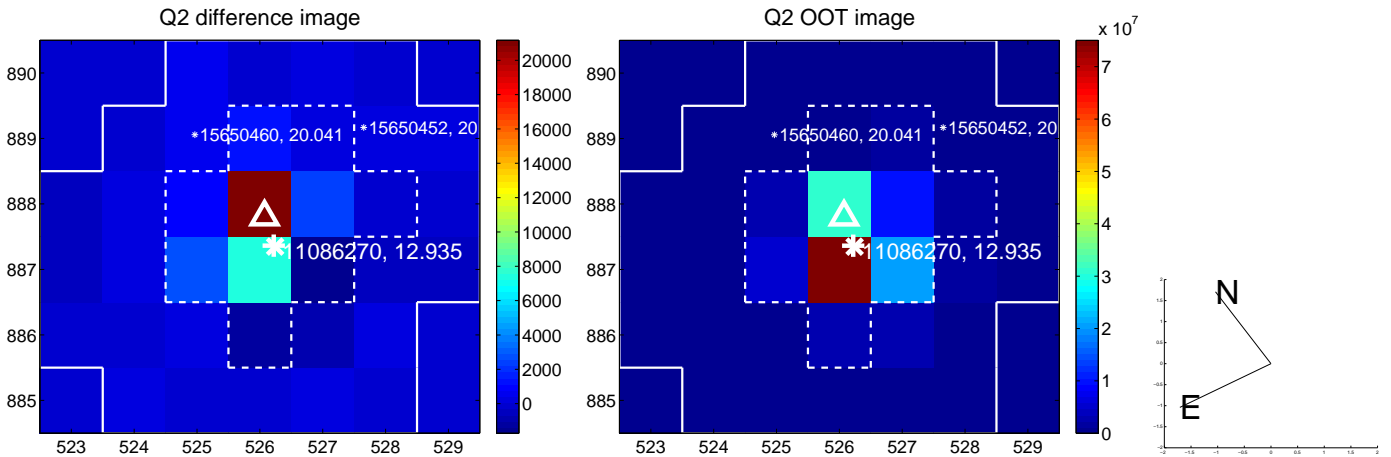
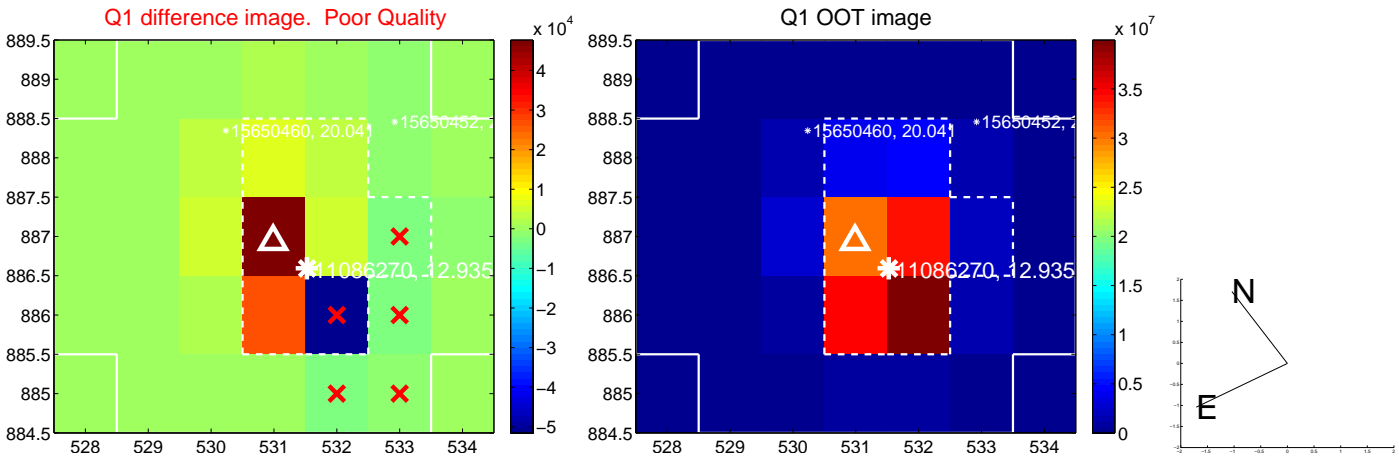
The direct PRF centroid is offset from the target star catalog position by about 0.07 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.029 \pm 0.220$	0.13	$0.008 \pm 0.154$	$0.028 \pm 0.210$
PRF-fit source offset from KIC position	$0.129 \pm 0.216$	0.60	$0.068 \pm 0.157$	$0.110 \pm 0.207$
photometric centroid source offset	$0.31 \pm 0.21$	1.46	$0.26 \pm 0.22$	$0.17 \pm 0.20$

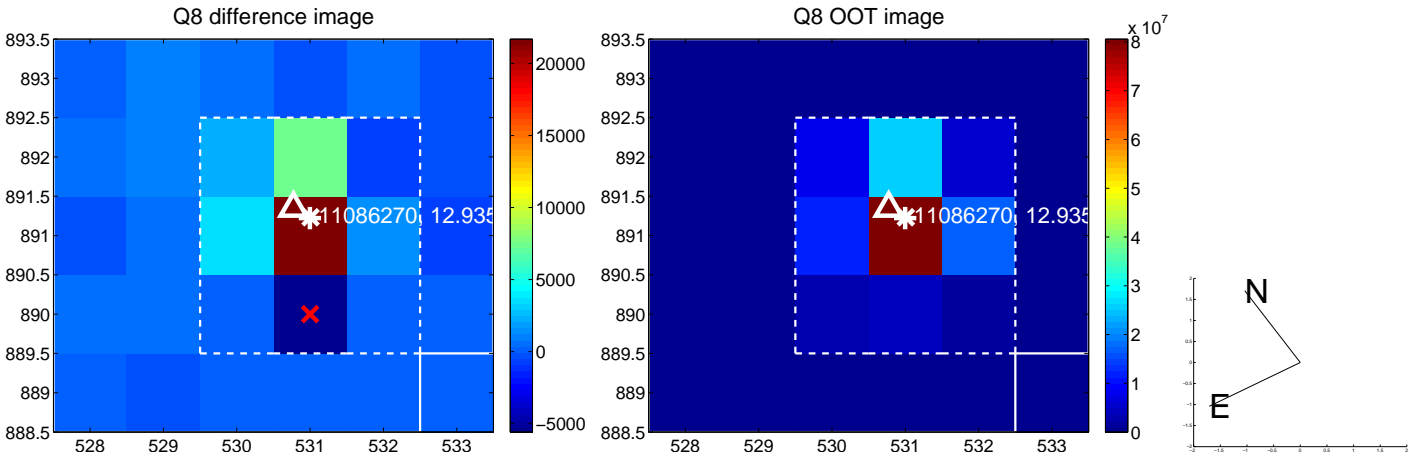
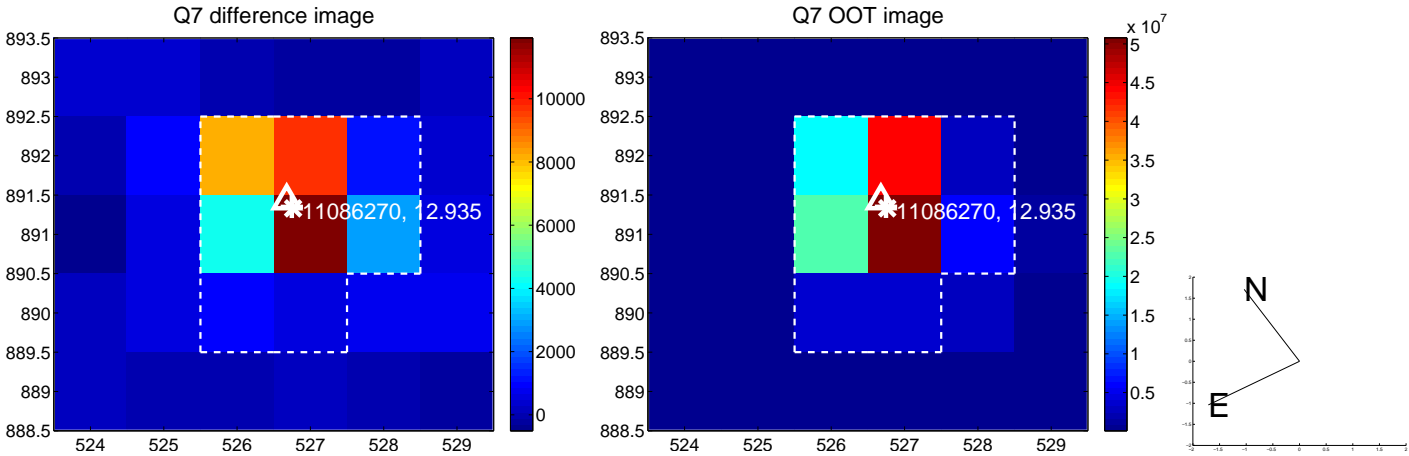
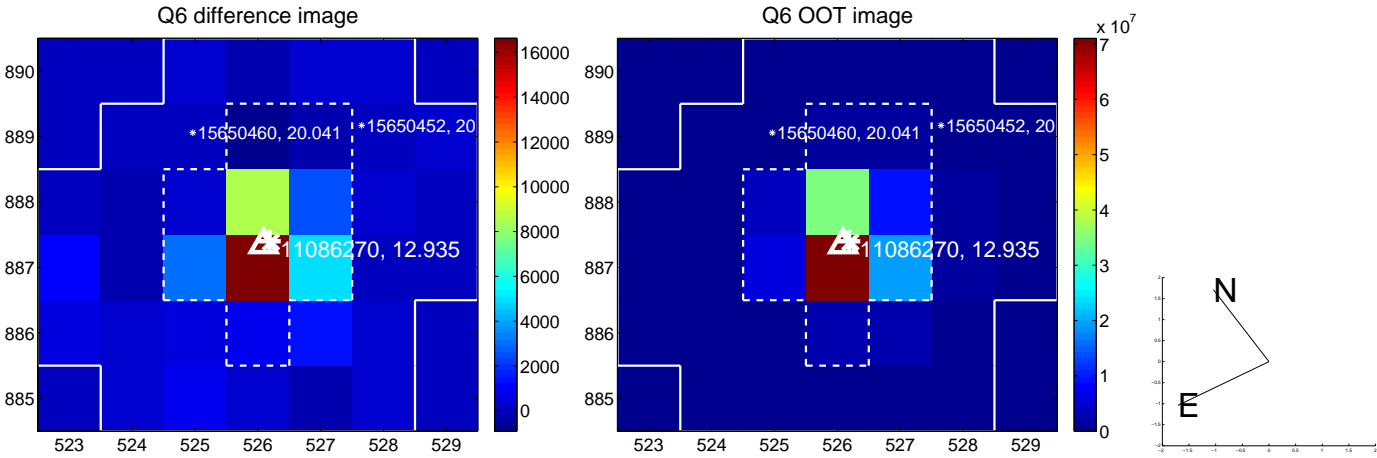
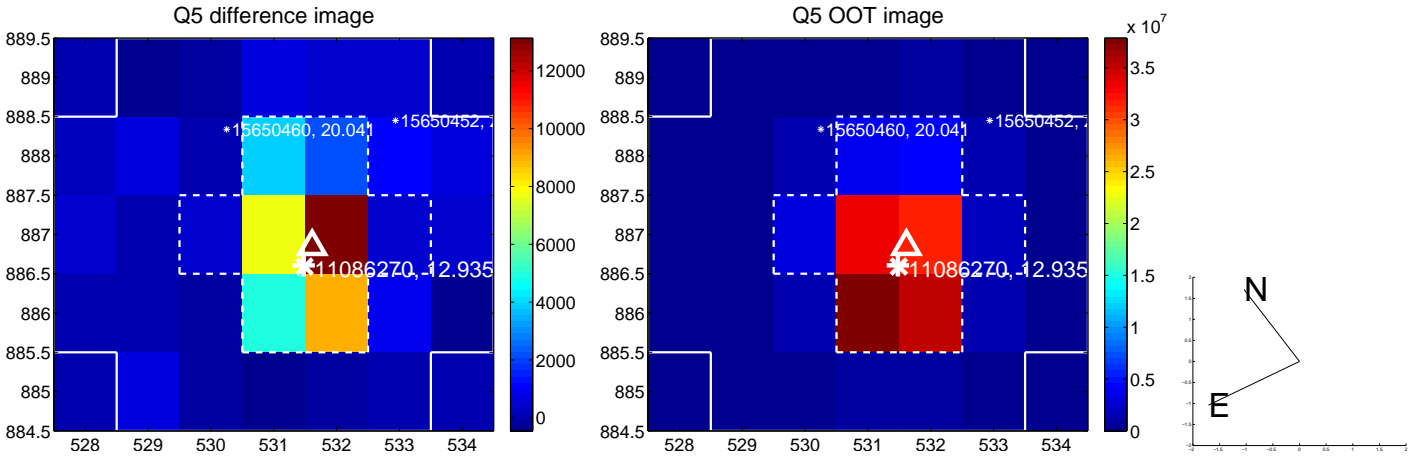


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets**; **Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

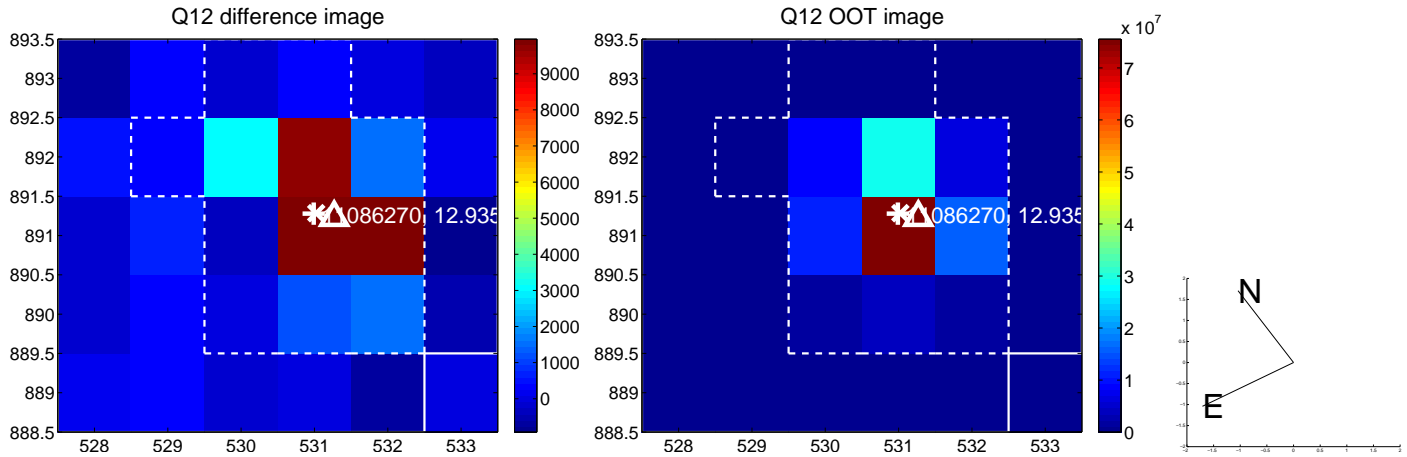
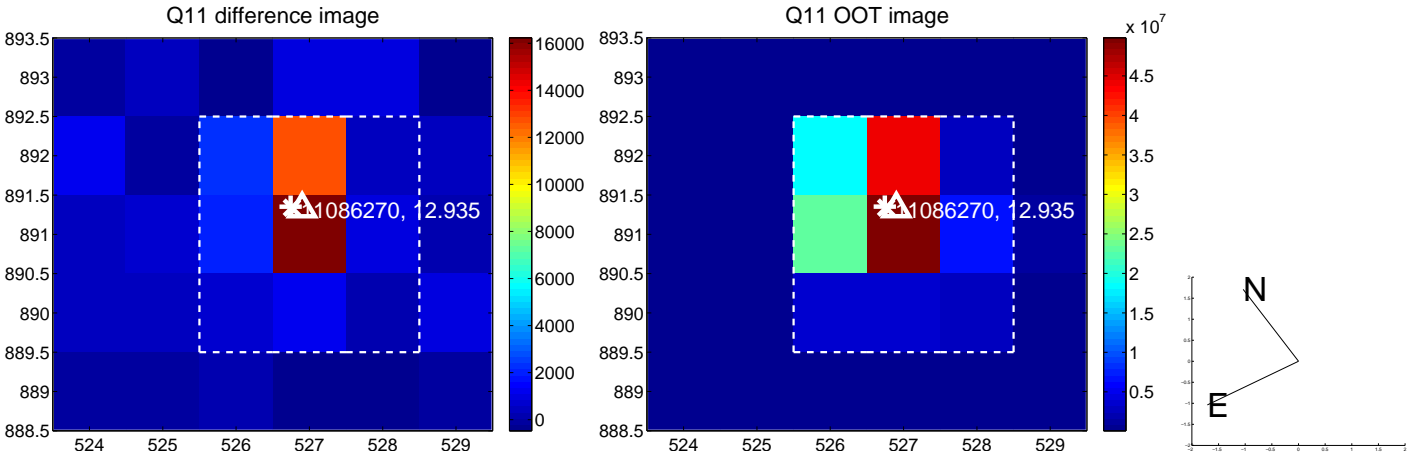
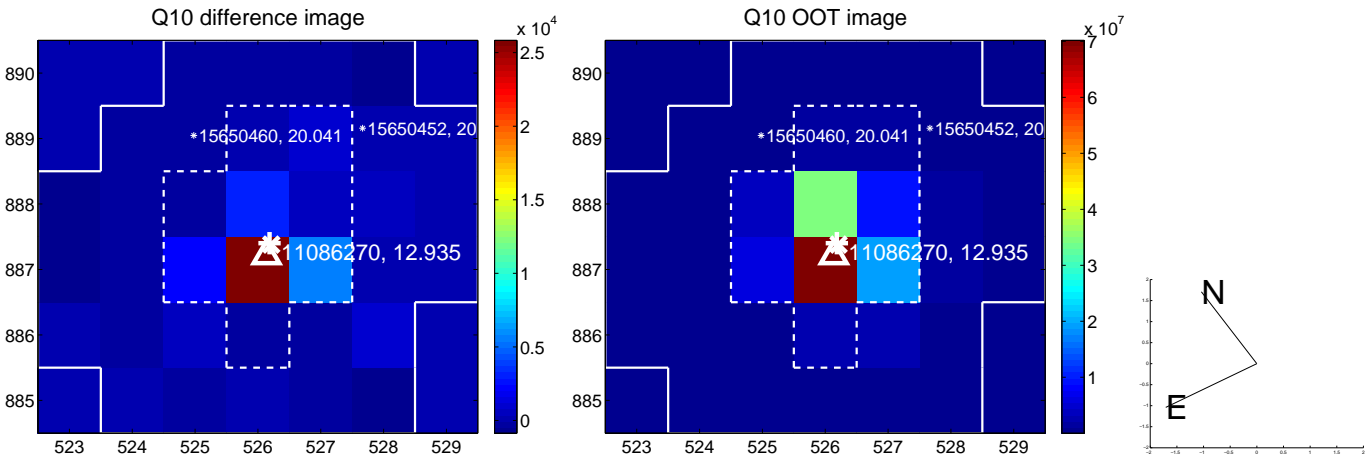
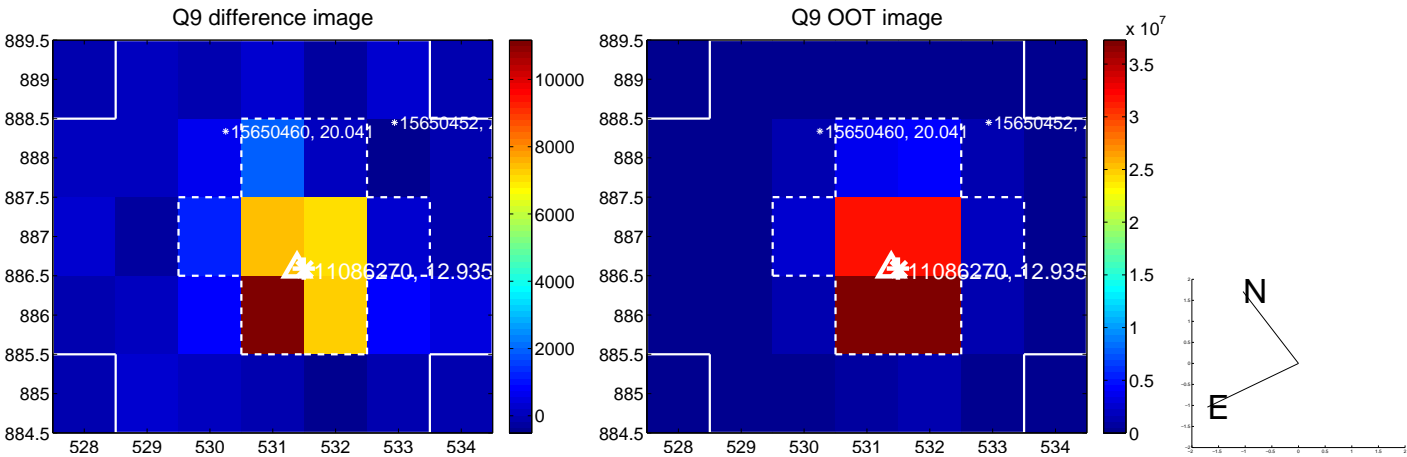
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



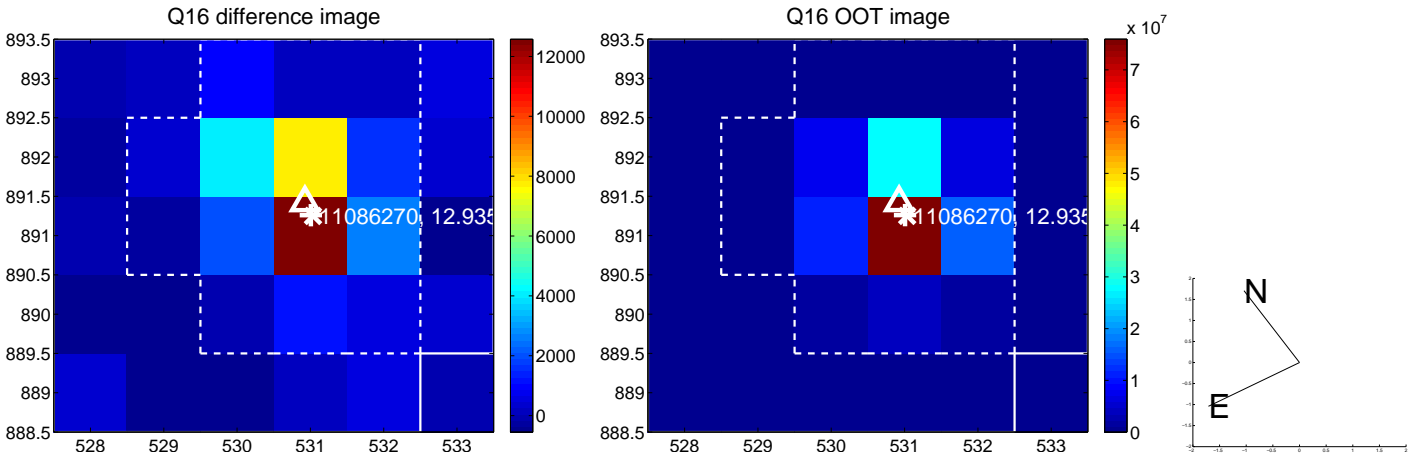
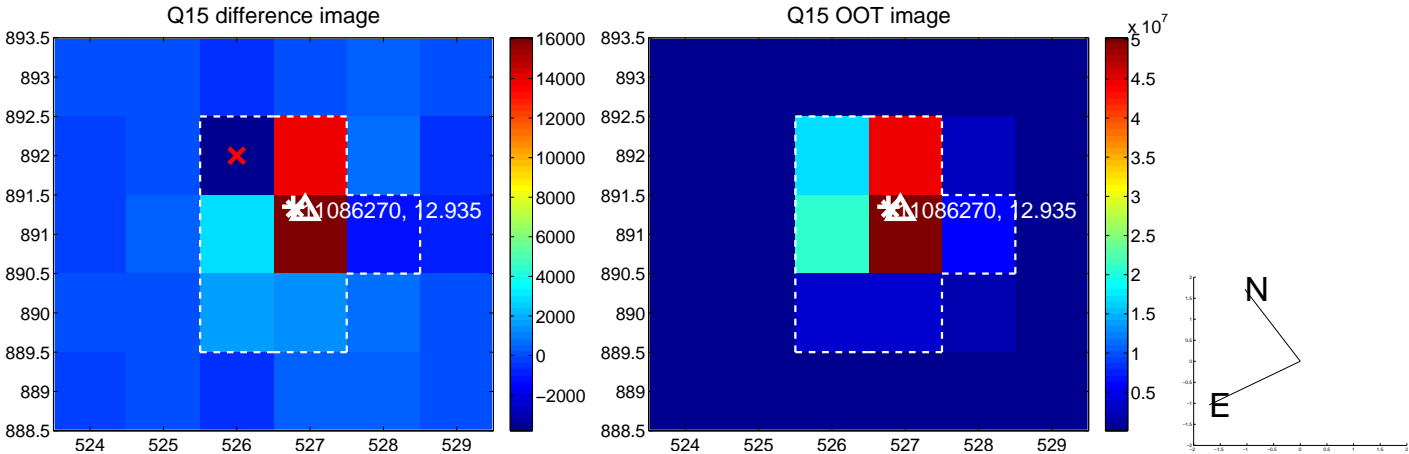
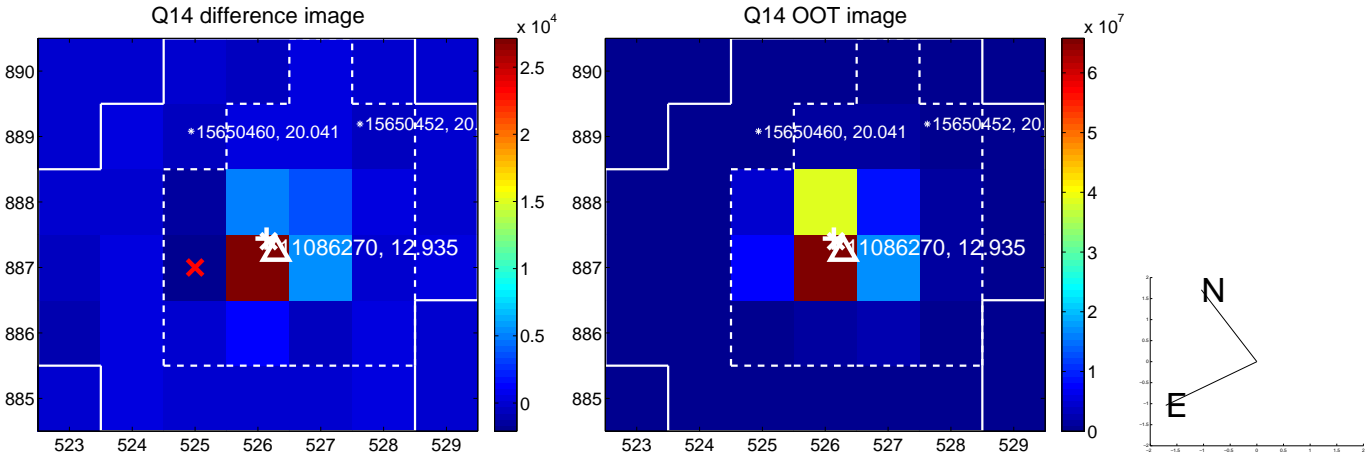
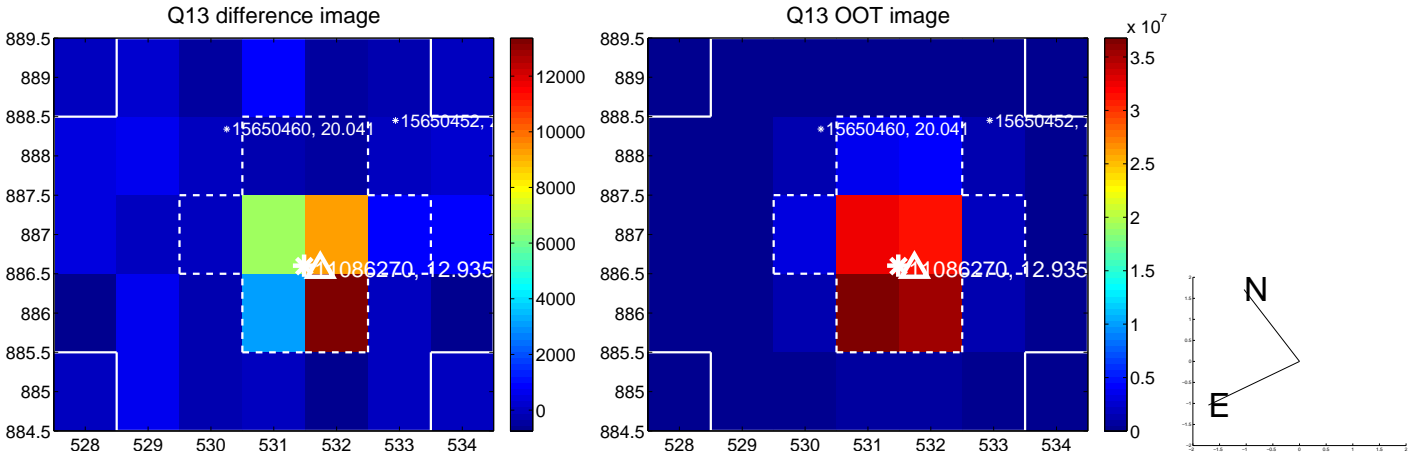
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

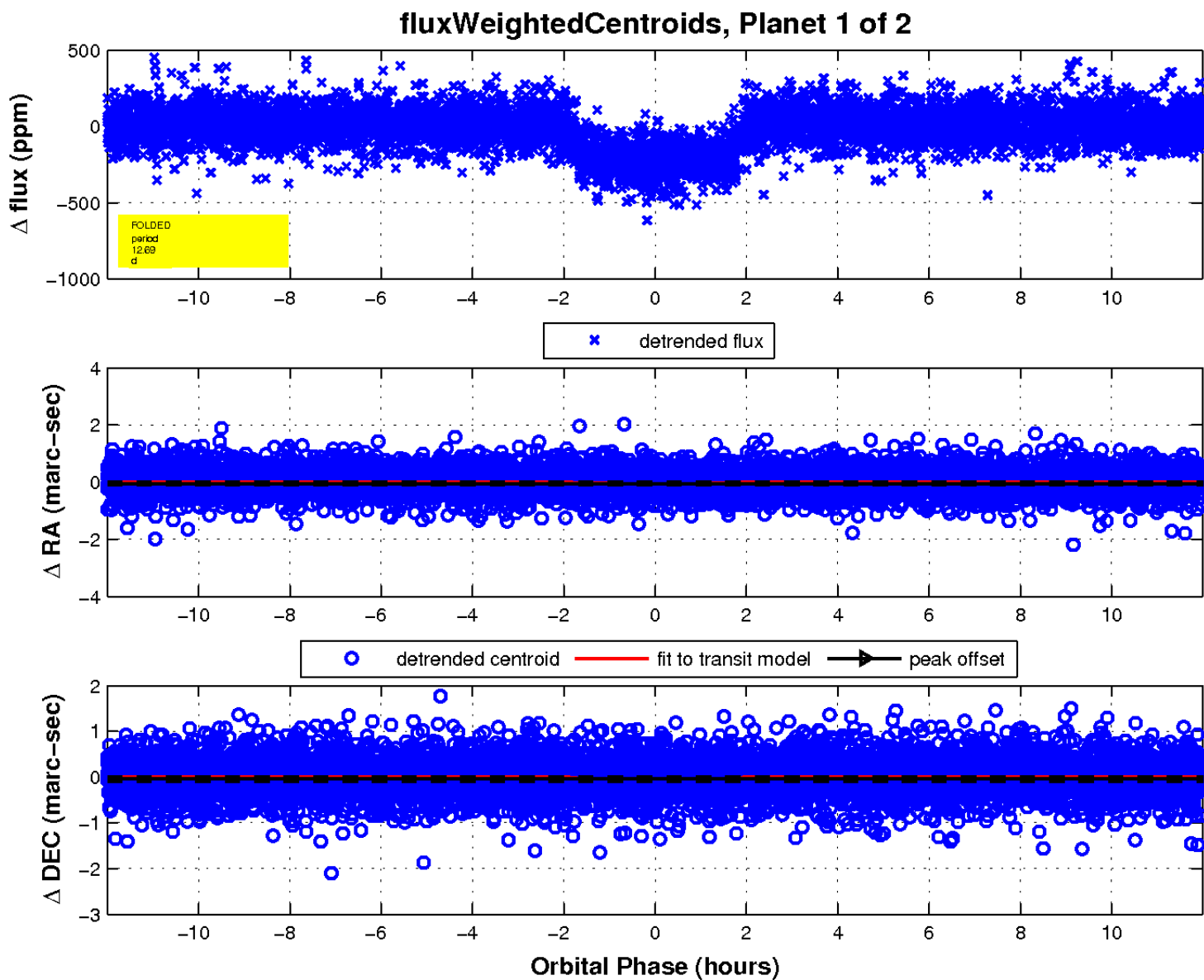
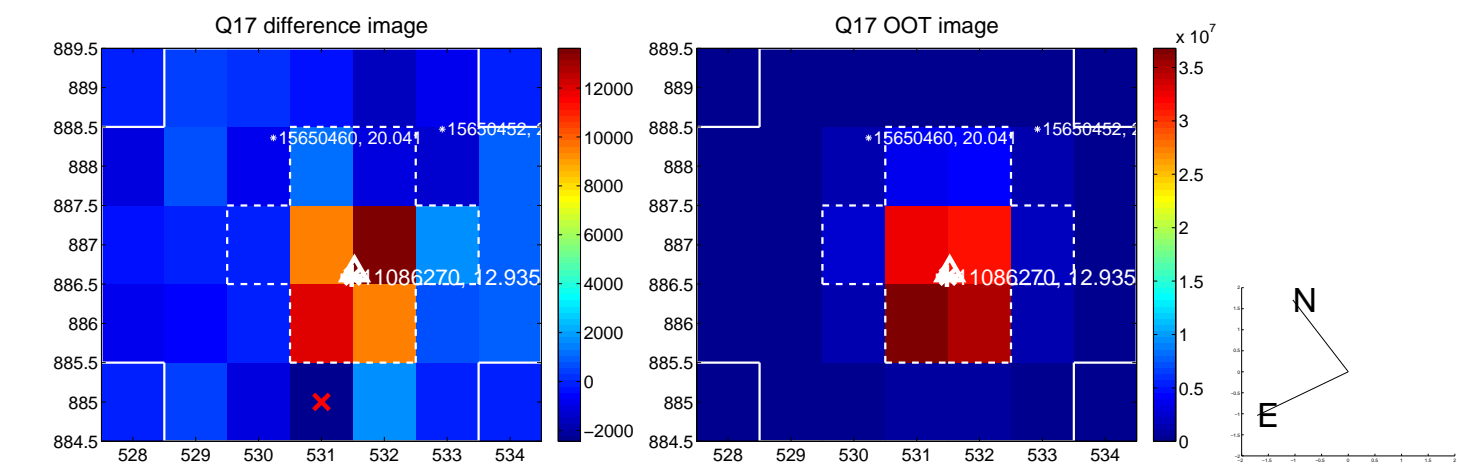


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

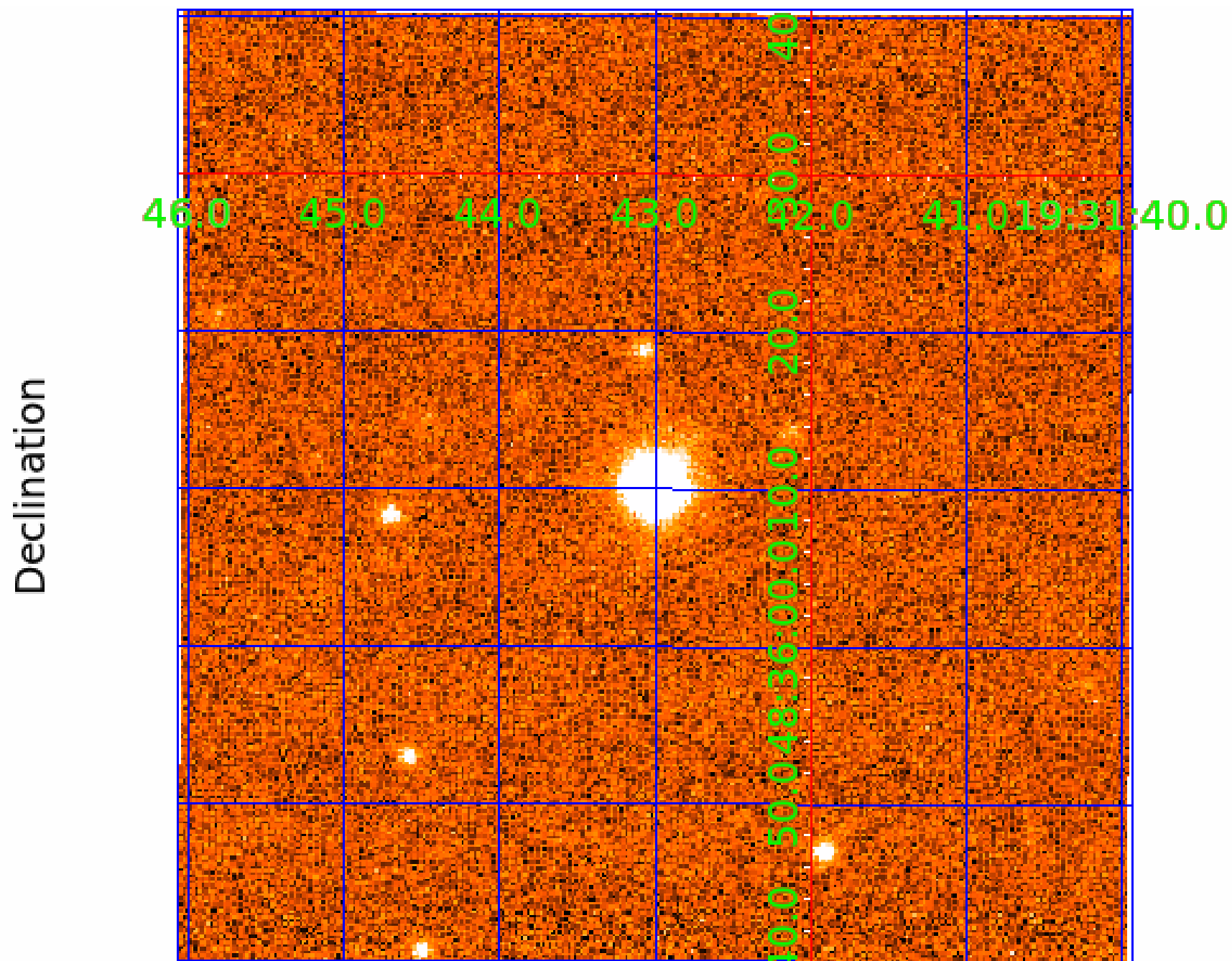




white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image



# KIC 011086270

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
011086270-01	OBS	0124.01	12.691047	137.125957	250.5	3.999	47.6	54.1	1.63	5869	3.02	244.66
011086270-02	OBS	0124.02	31.719852	142.819233	352.0	4.945	50.2	53.5	1.63	5869	3.42	72.13

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
011086270-01	OBS	FP	0.41	0	1	0	0	MOD_SEC_ALT
011086270-02	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.

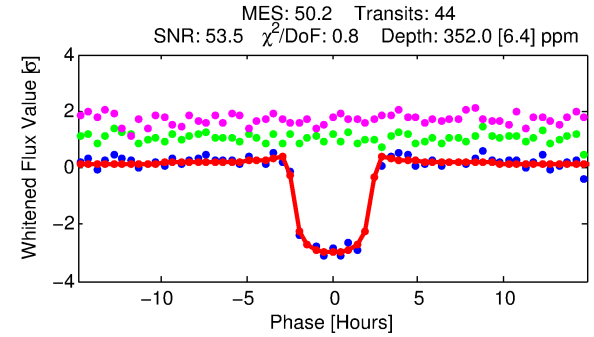
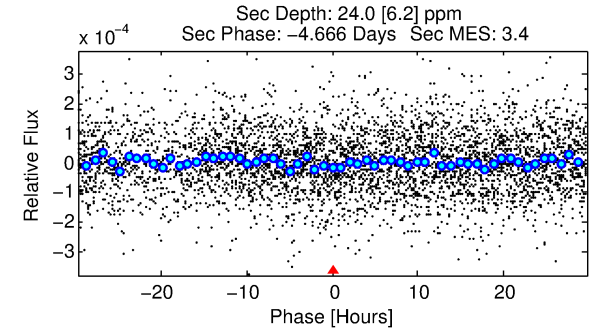
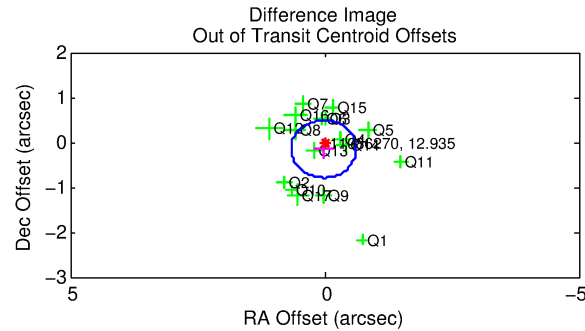
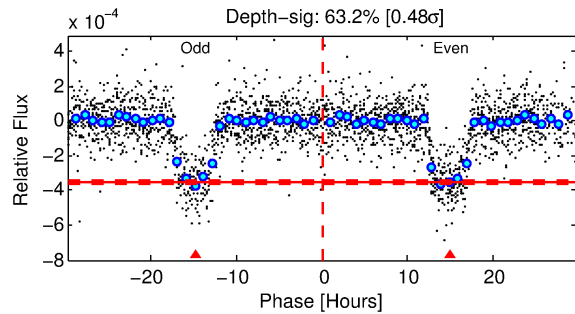
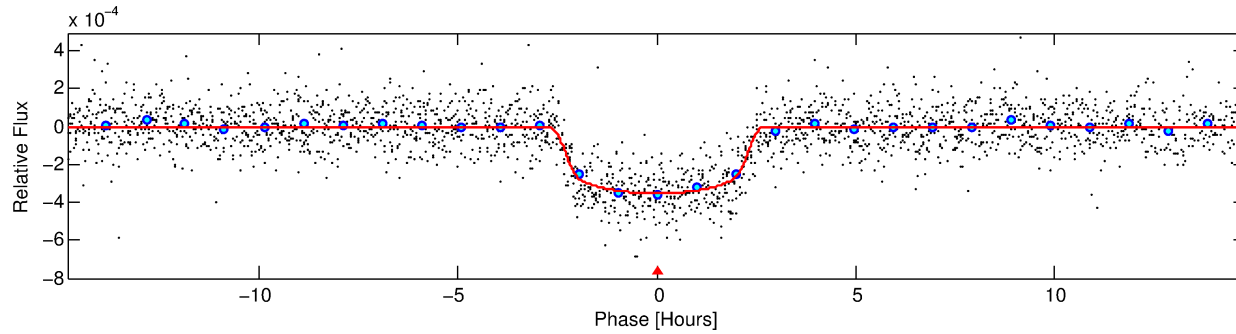
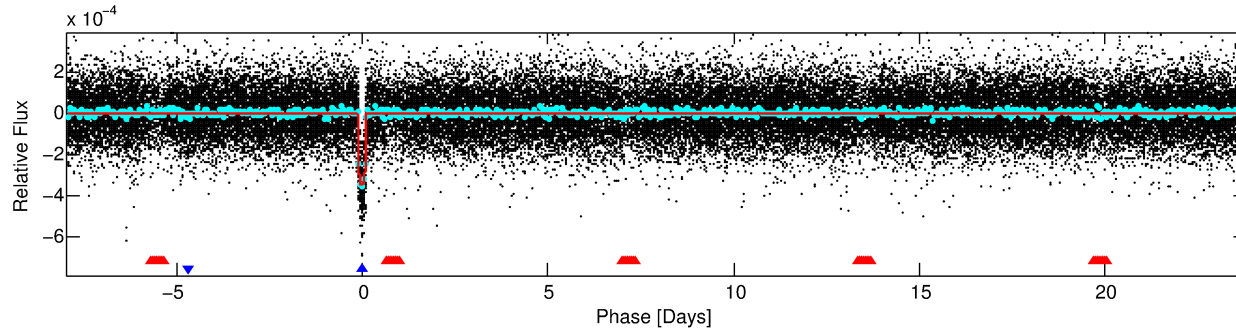
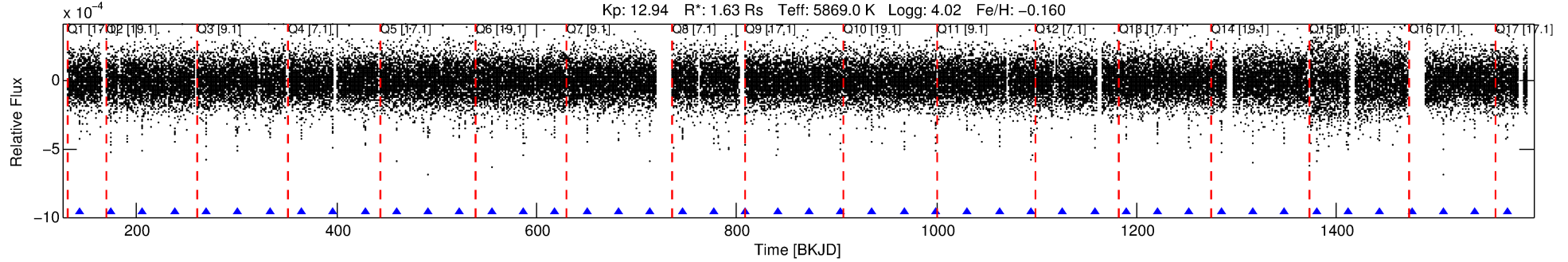
## Ephemeris Match Information For 011086270-02

No Significant Match Found

# DV One-Page Summary

KIC: 11086270 Candidate: 2 of 2 Period: 31.720 d  
KOI: K00124.02 Name: Kepler-110c Corr: 0.987

Kp: 12.94 R\*: 1.63 Rs Teff: 5869.0 K Logg: 4.02 Fe/H: -0.160



## DV Fit Results:

Period = 31.71985 [0.00007] d  
Epoch = 142.8192 [0.0017] BKJD  
Rp/R\* = 0.0193 [0.0018]  
a/R\* = 29.43 [13.06]  
b = 0.82 [0.18]  
Seff = 72.13 [26.89]  
Teq = 743 [69] K  
Rp = 3.42 [0.93] Re  
a = 0.1974 [0.0461] AU  
Ag = 43.87 [21.26] [2.02σ]  
Teffp = 2957 [243] K [8.75σ]

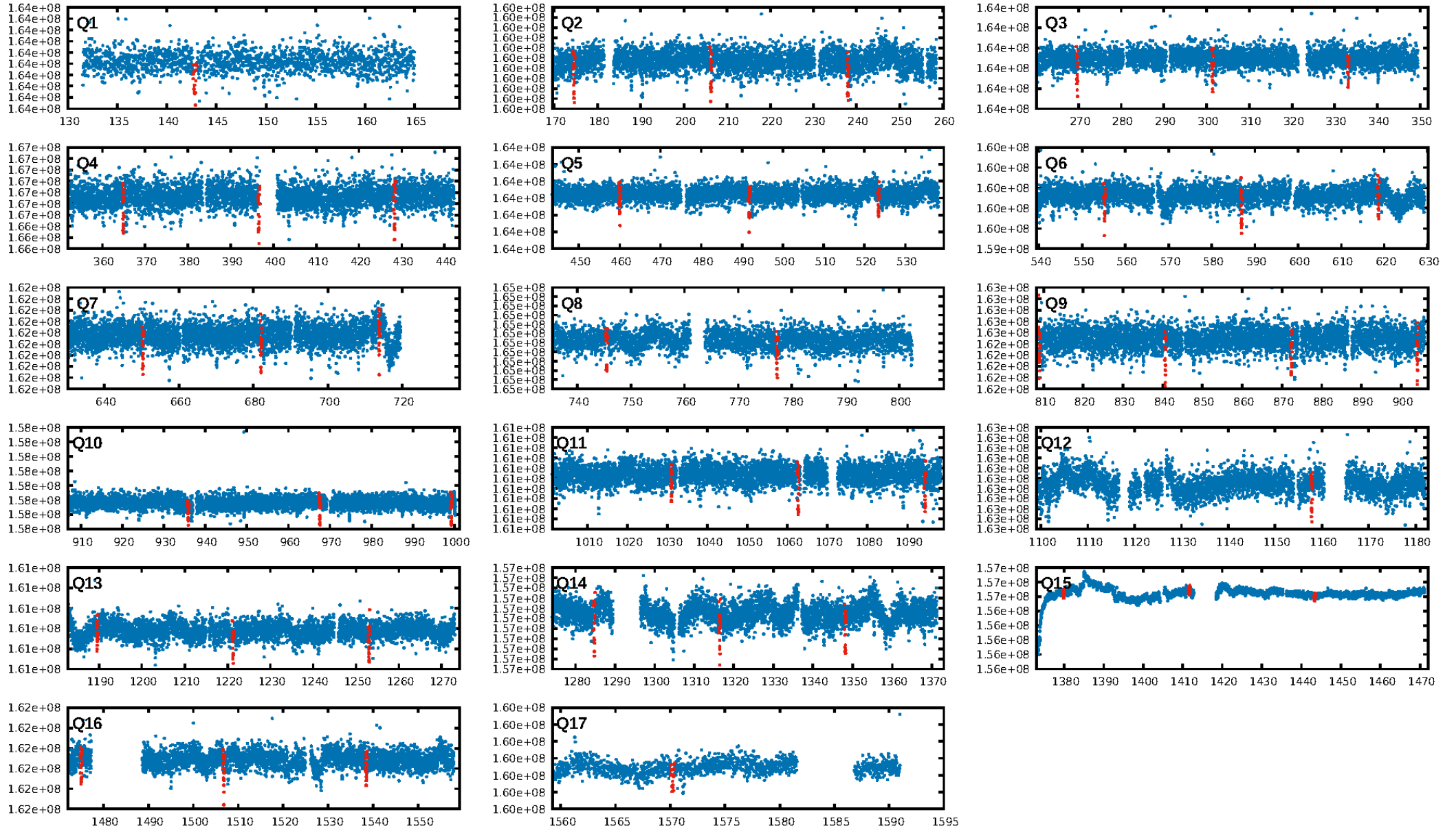
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [71.81σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 80.9%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 0.00e+00  
RollingBand-fgt: 1.00 [42/42]  
GhostDiagnostic-chr: 12.72  
Centroid-sig: 14.0%  
Centroid-so: 0.223 arcsec [1.08σ]  
OotOffset-rm: 0.156 arcsec [0.73σ]  
KicOffset-rm: 0.087 arcsec [0.43σ]  
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: 28-Jan-2016 23:45:37 Z

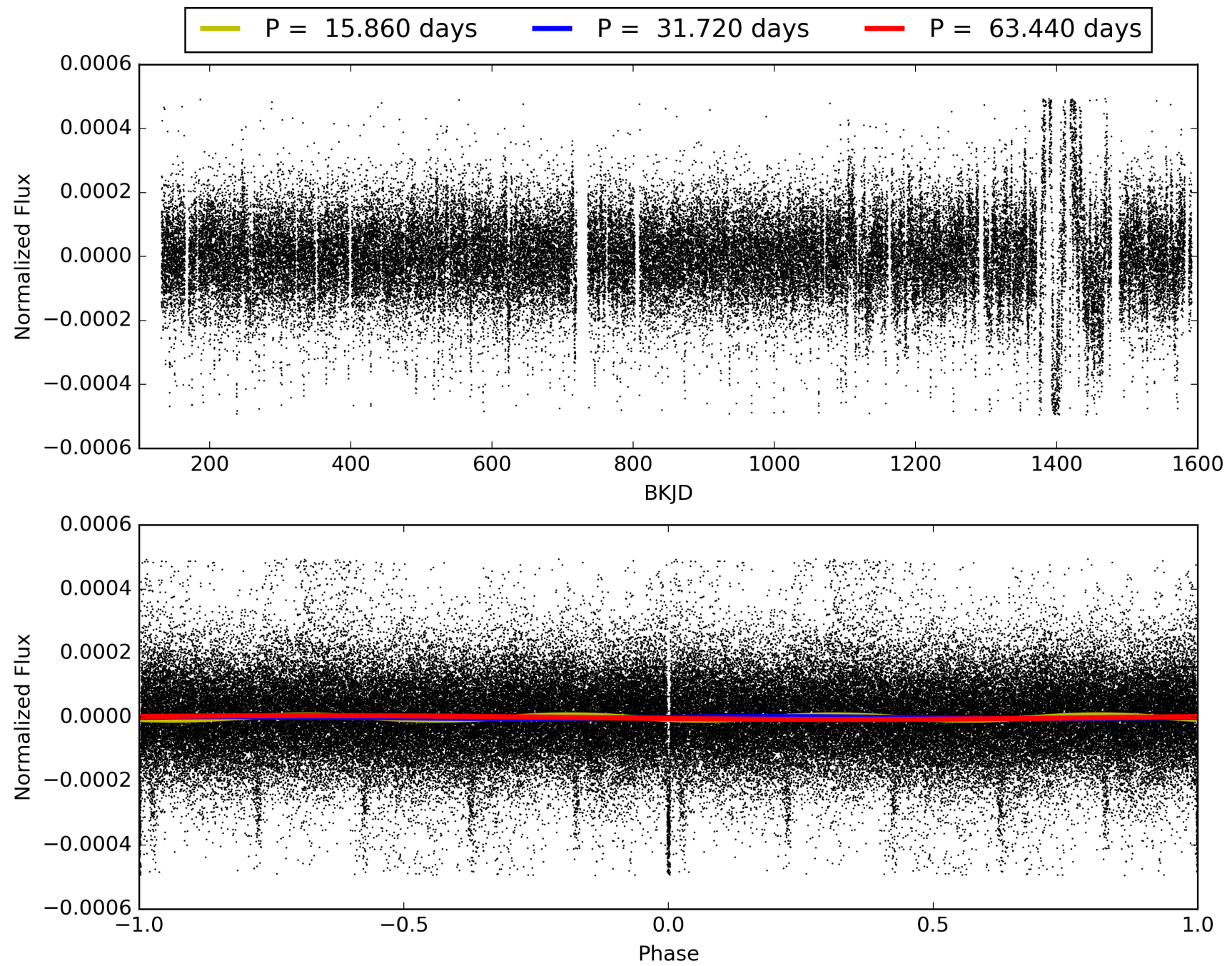
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 011086270-02, PDC Light Curves



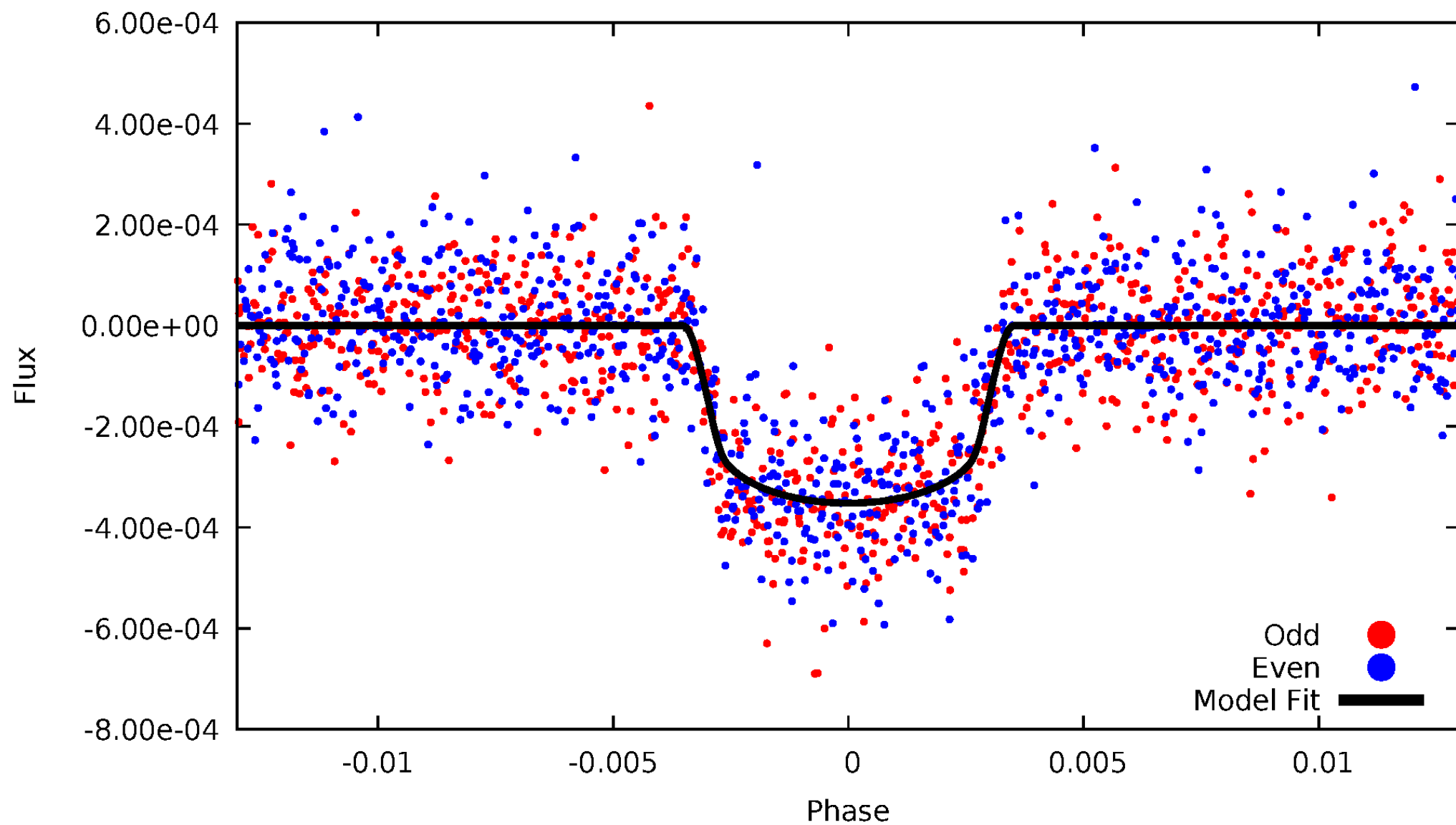


TCE 011086270-02



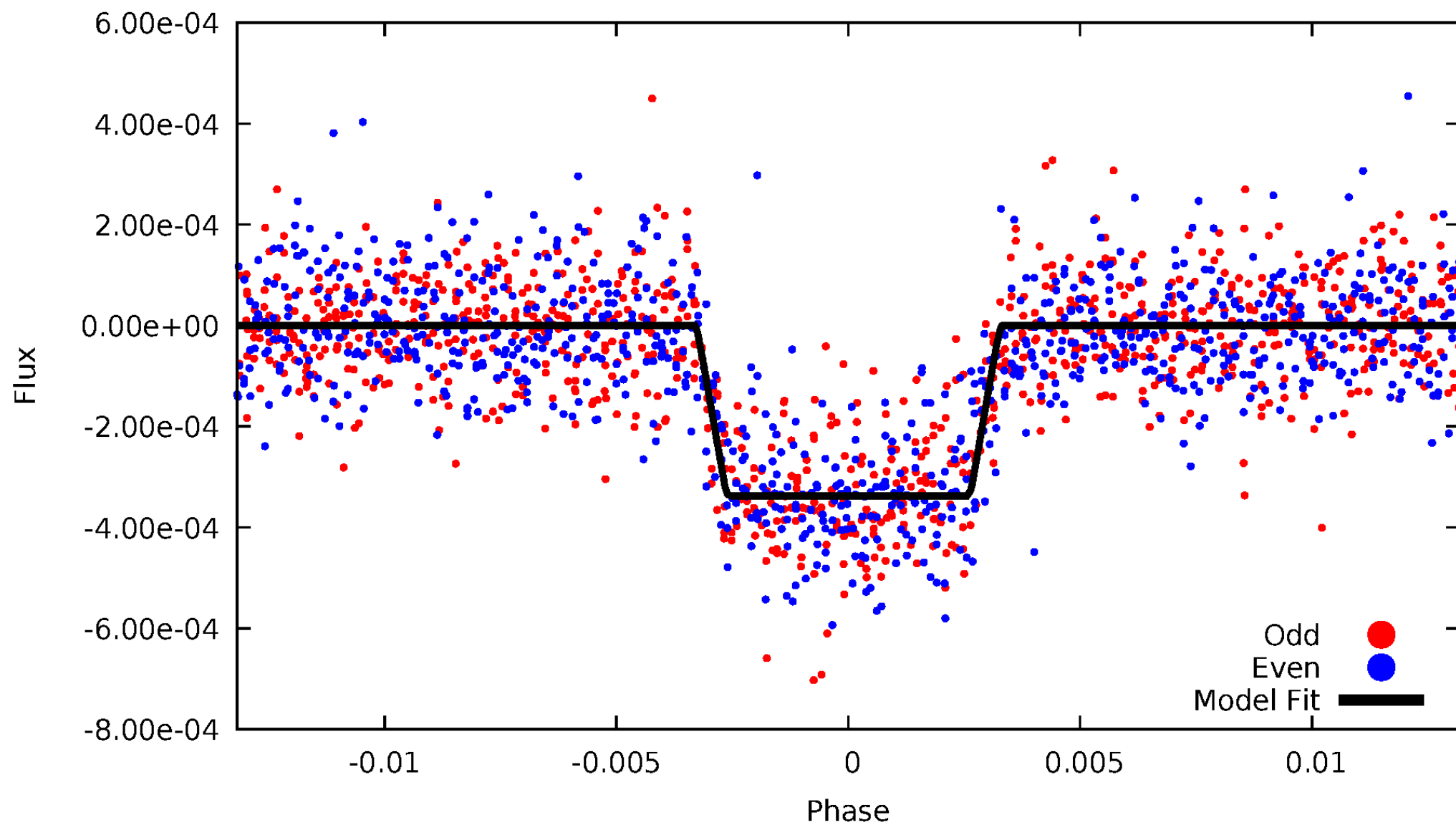
# DV Odd/Even

TCE 011086270-02



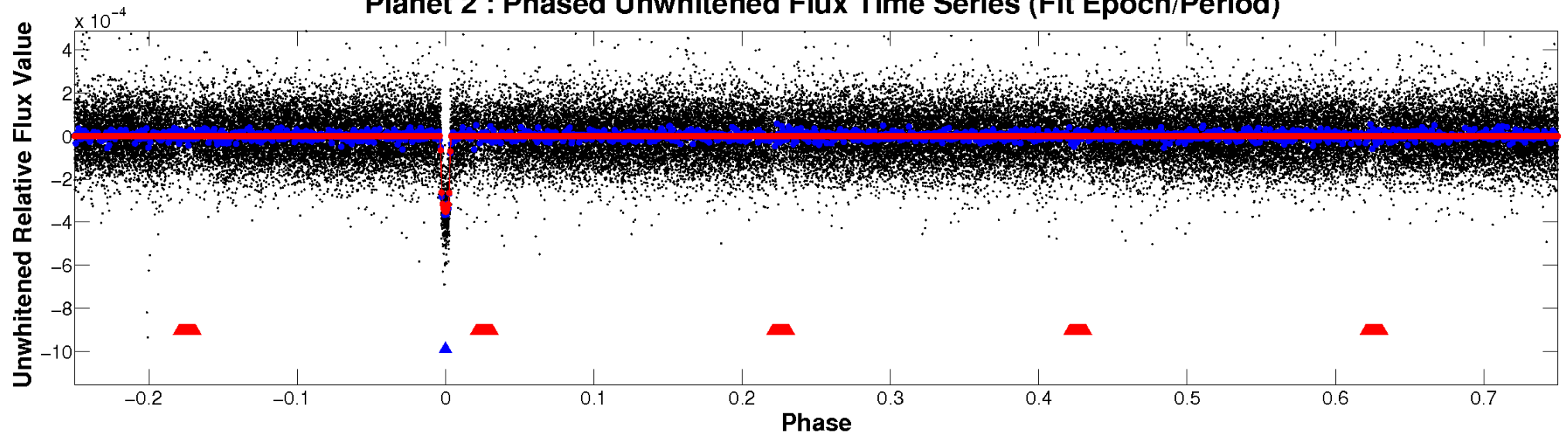
# ALT Odd/Even

TCE 011086270-02

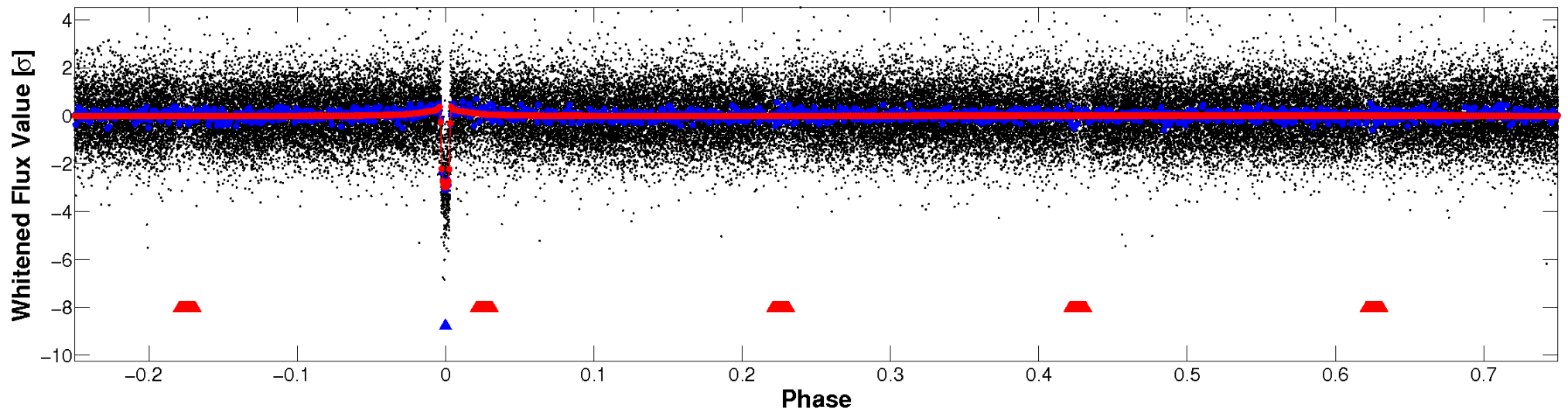


# Non-Whitened Vs. Whitened Light Curve

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

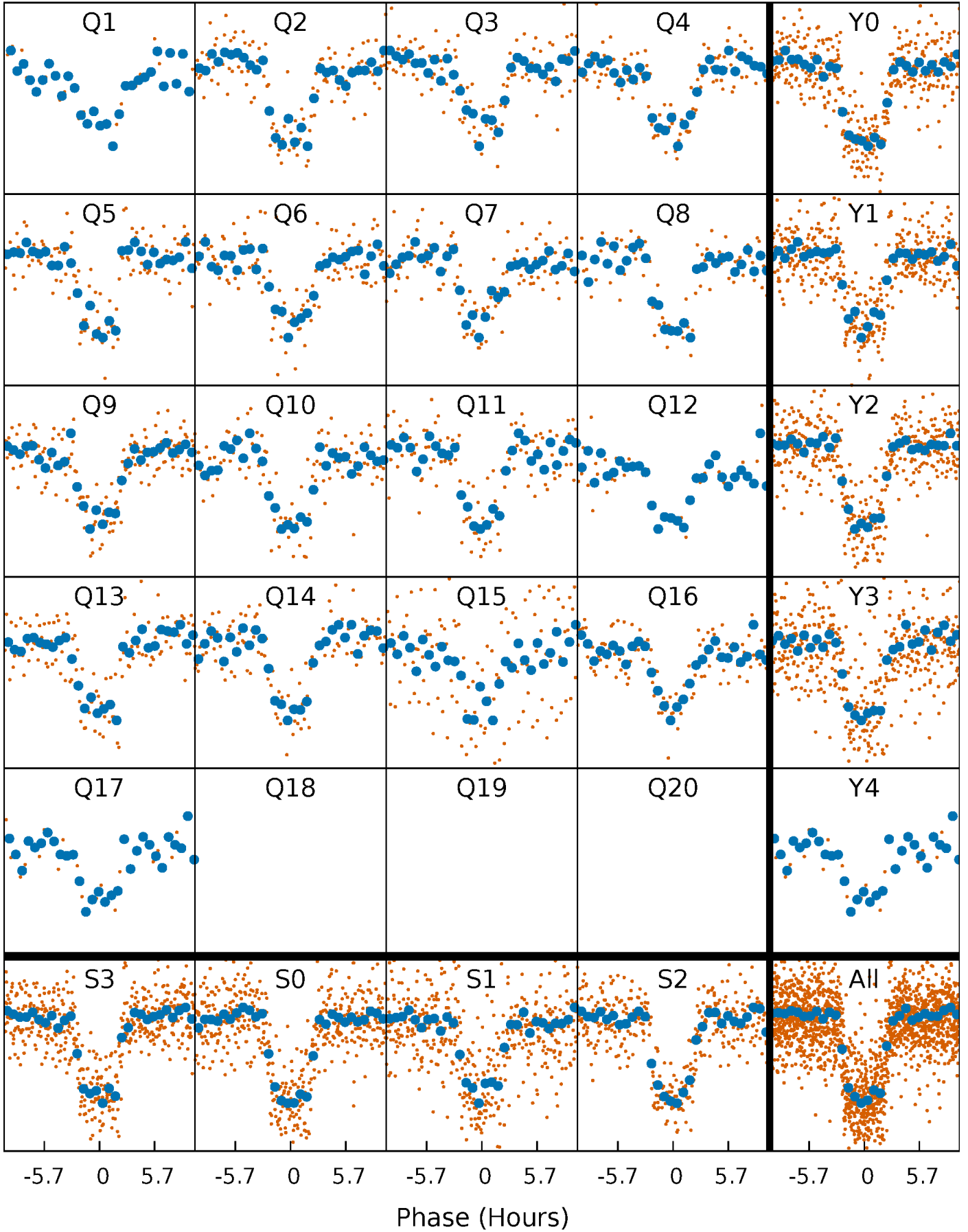


**Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



# PDC Quarter-Phased Transit Curves

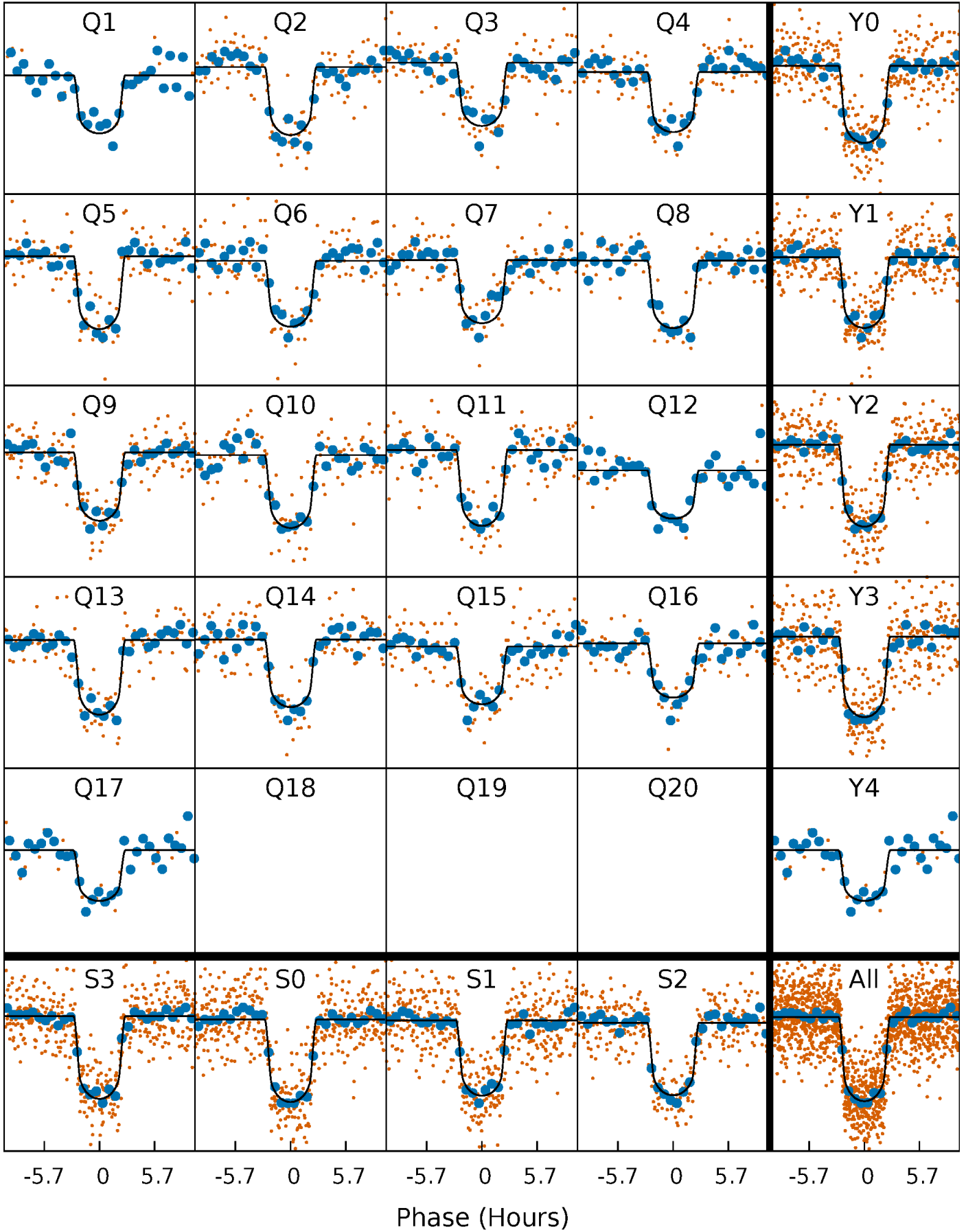
TCE 011086270-02 P= 31.719852 Days  $T_0=142.819233$  (BKJD)





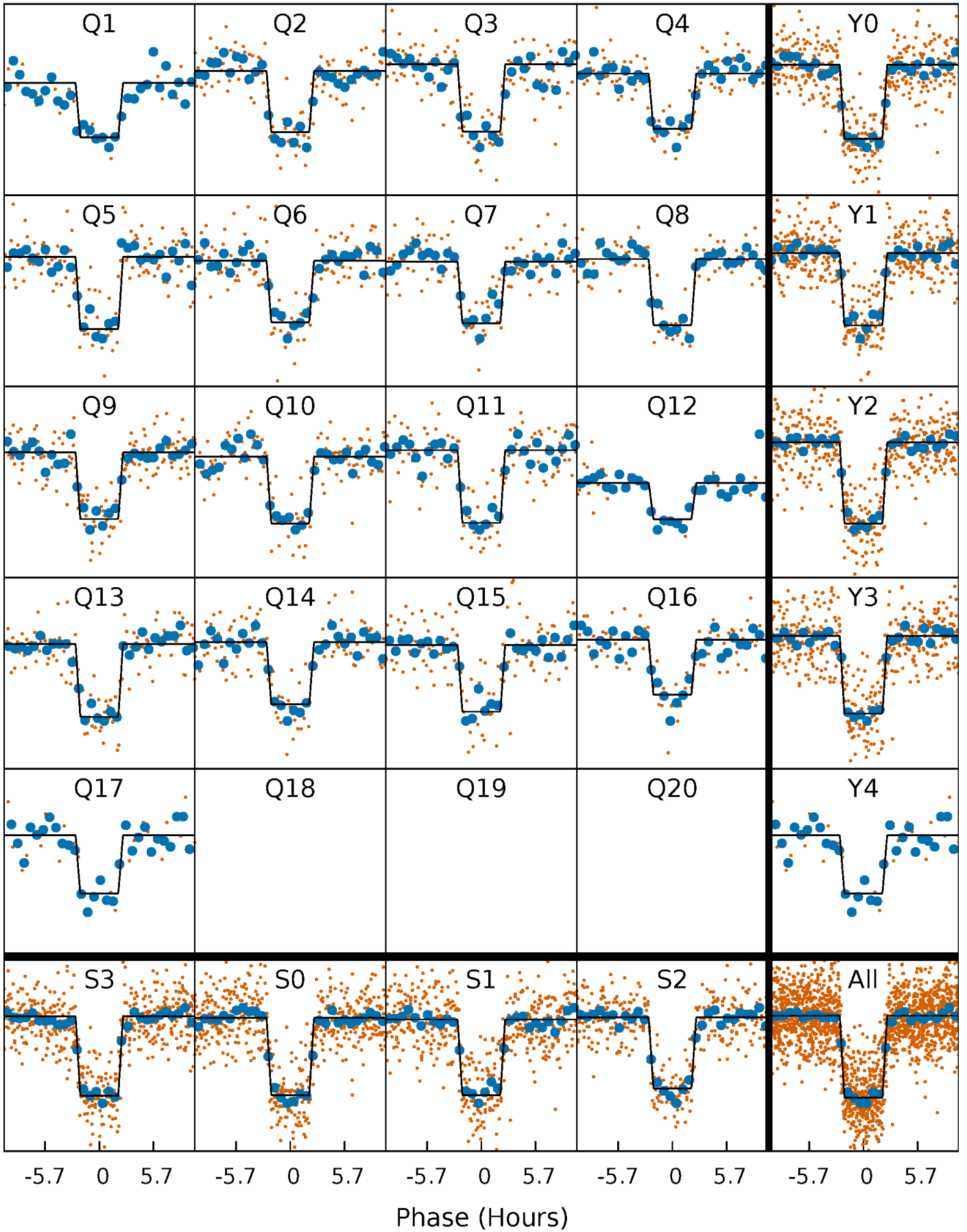
# DV Quarter-Phased Transit Curves

TCE 011086270-02 P= 31.719852 Days  $T_0=142.819233$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

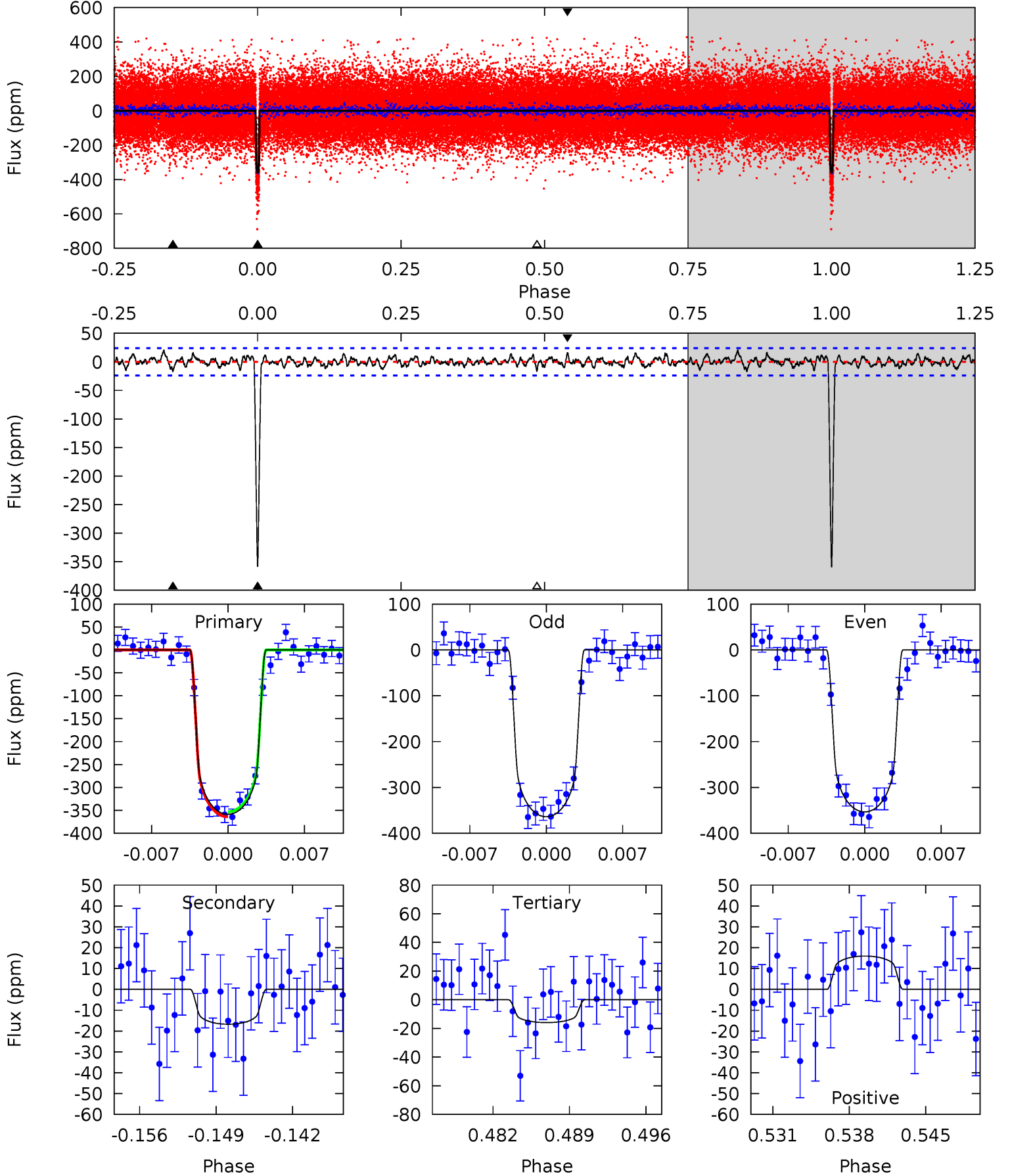
TCE 011086270-02 P= 31.719742 Days  $T_0=142.821714$  (BKJD)



# DV Model-Shift Uniqueness Test

011086270-02,  $P = 31.719852$  Days,  $E = 111.099381$  Days

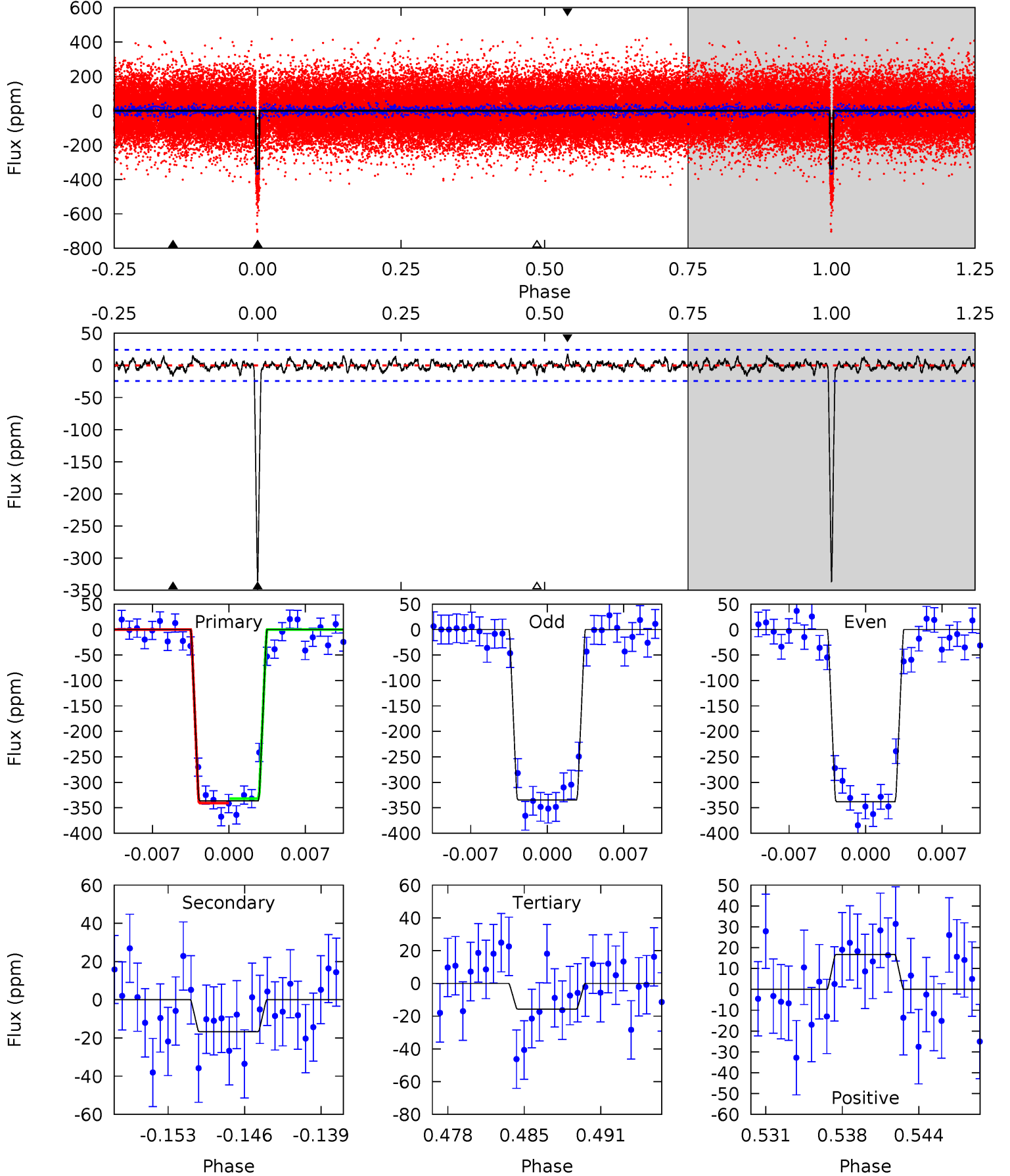
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
76.4	3.57	3.39	3.40	5.09	2.69	1.19	73.0	73.0	0.18	0.17	1.12	1.01	0.06	1.18



# Alt Model-Shift Uniqueness Test

011086270-02,  $P = 31.719742$  Days,  $E = 111.101972$  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
70.5	3.50	3.29	3.50	5.10	2.71	1.04	67.2	67.0	0.22	0.00	0.38	0.99	0.05	0.93



### Stellar Parameters For KIC 011086270

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$5869^{+117}_{-117}$	$4.024^{+0.210}_{-0.105}$	$-0.160^{+0.150}_{-0.150}$	$1.626^{+0.254}_{-0.413}$	$1.019^{+0.098}_{-0.098}$	$0.334^{+0.393}_{-0.094}$
	+2%/-2%	+5%/-3%	+94%/-94%	+16%/-25%	+10%/-10%	+118%/-28%
Source	SPE59	SPE59	SPE59	DSEP		

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

### Secondary Eclipse Parameters for KIC 011086270-02 / KOI 0124.02

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	$-17 \pm 5$	$3.36^{+0.54}_{-0.52}$	$1030^{+56}_{-69}$	$3262^{+175}_{-190}$	$31^{+17}_{-11}$
Alt.	$-17 \pm 5$	$3.21^{+0.49}_{-0.50}$	$1035^{+53}_{-72}$	$3315^{+188}_{-194}$	$35^{+18}_{-13}$

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

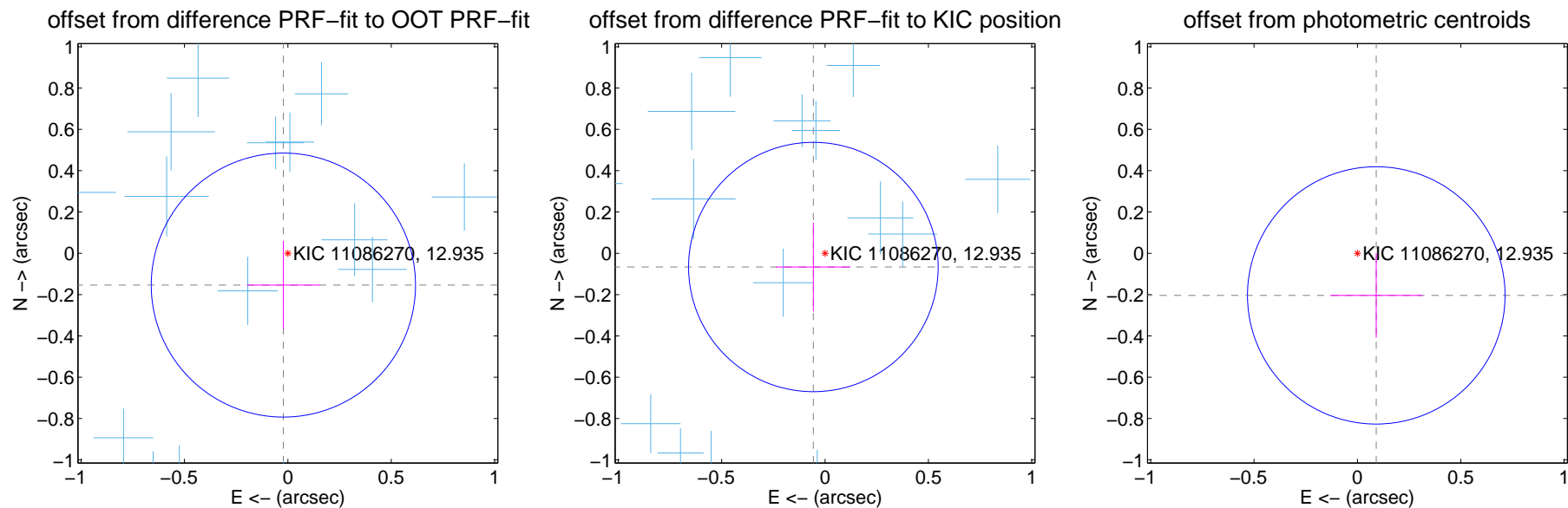
## DV Centroid Data

Supplemental centroid analysis for 011086270-02. Kepler magnitude: 12.94. Transit SNR 53.46

There are 17 quarters with good PRF difference image offsets

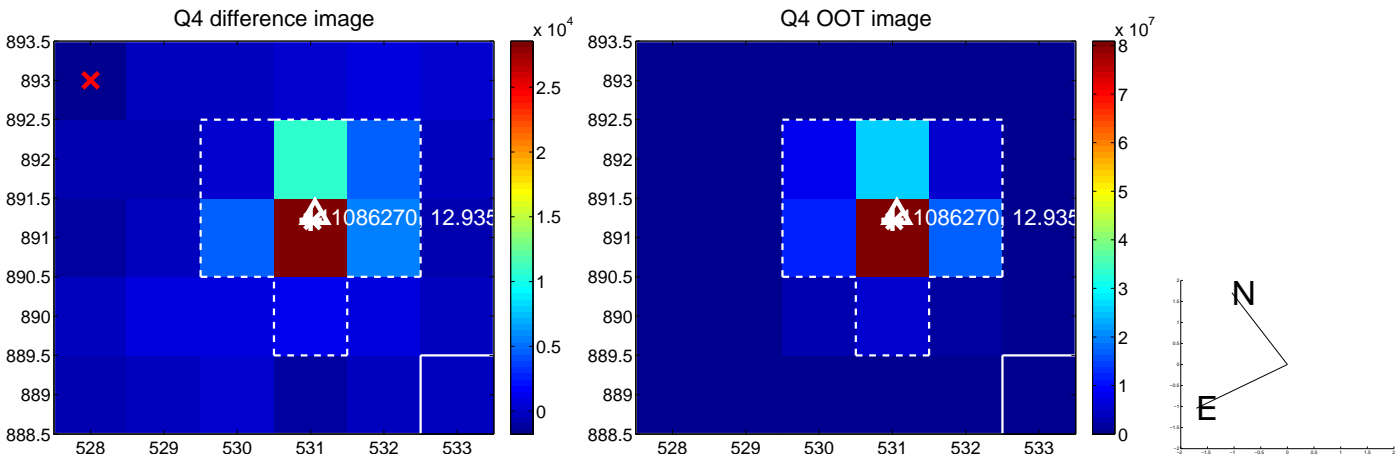
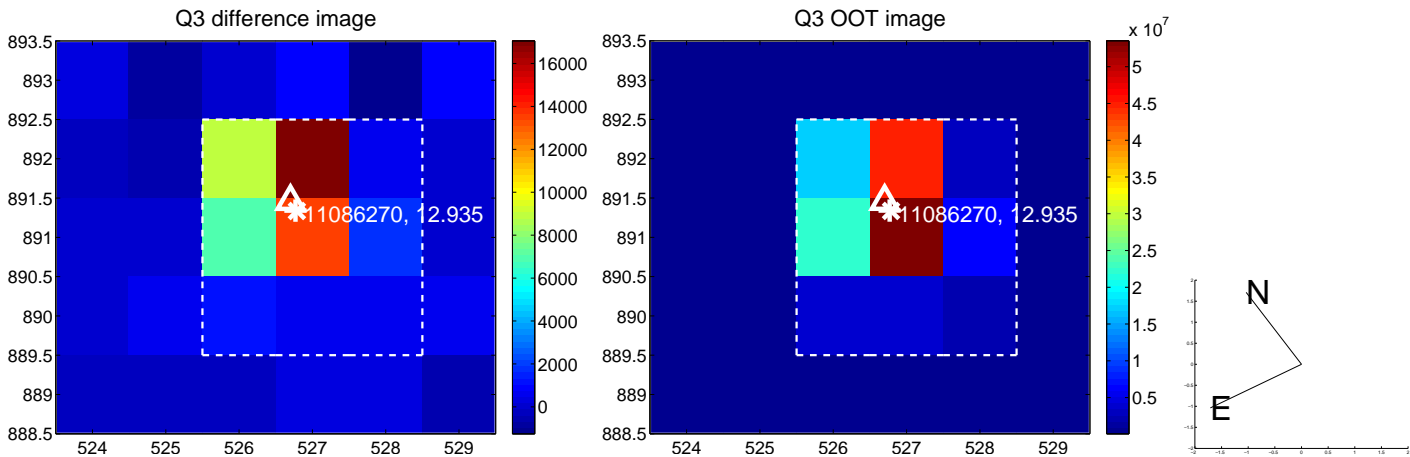
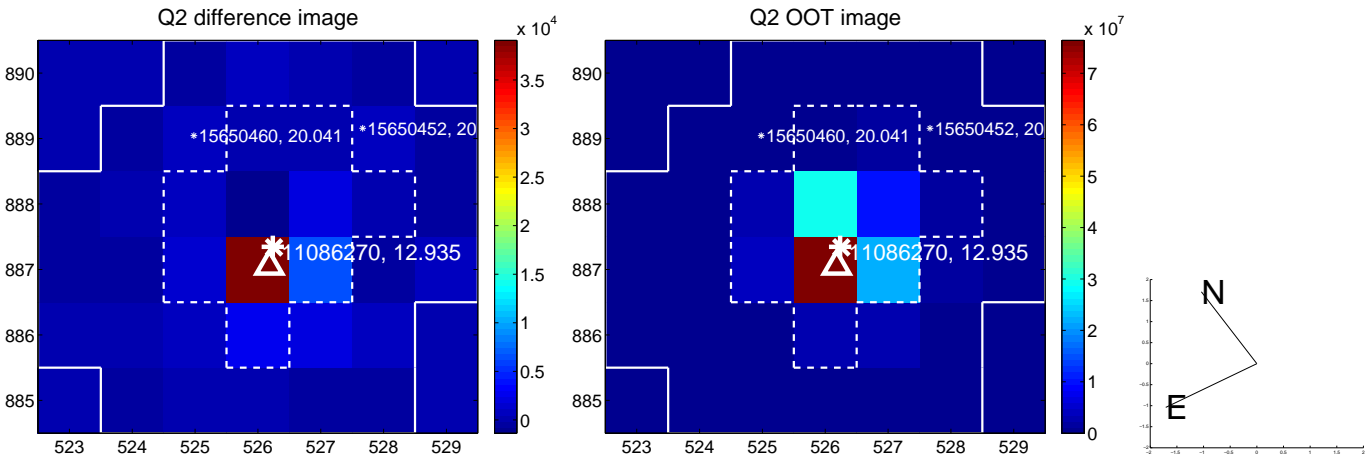
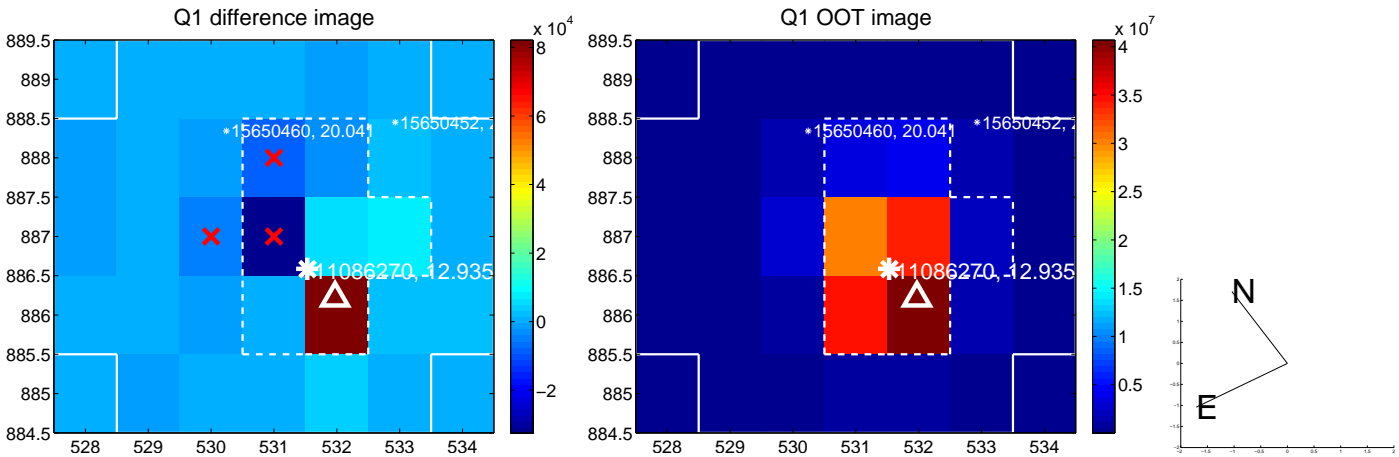
The direct PRF centroid is offset from the target star catalog position by about 0.07 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.156 \pm 0.213$	0.73	$0.022 \pm 0.177$	$-0.154 \pm 0.214$
PRF-fit source offset from KIC position	$0.087 \pm 0.201$	0.43	$0.056 \pm 0.180$	$-0.067 \pm 0.215$
photometric centroid source offset	$0.22 \pm 0.21$	1.08	$-0.09 \pm 0.22$	$-0.20 \pm 0.20$



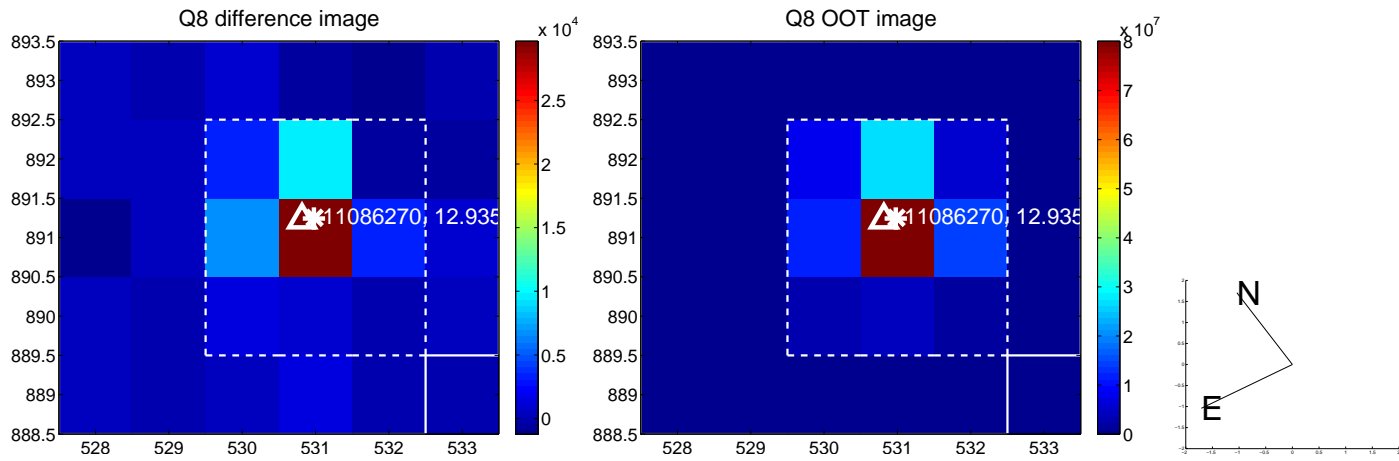
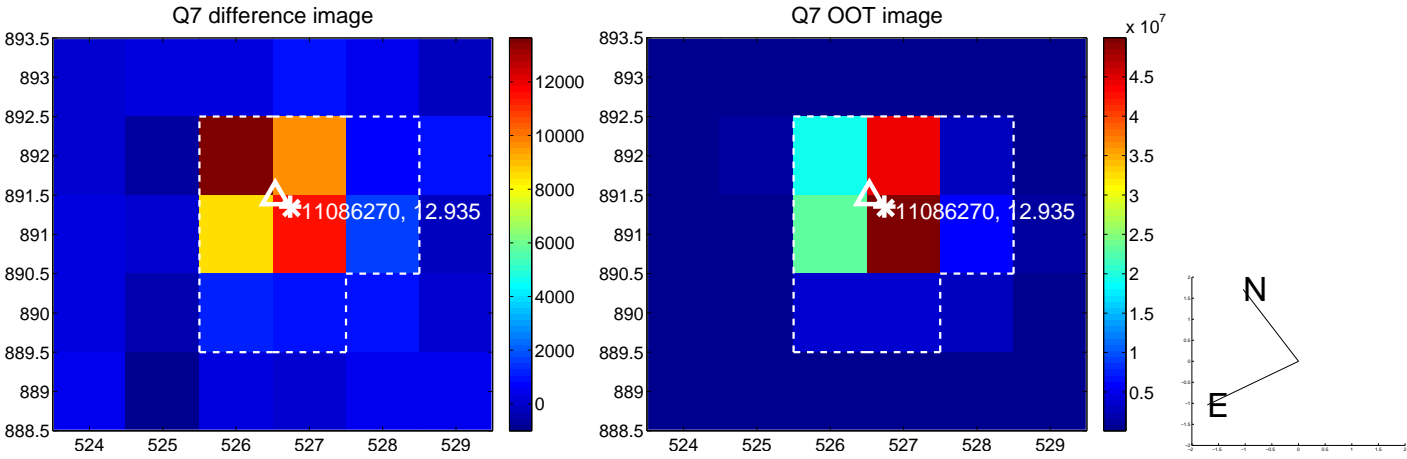
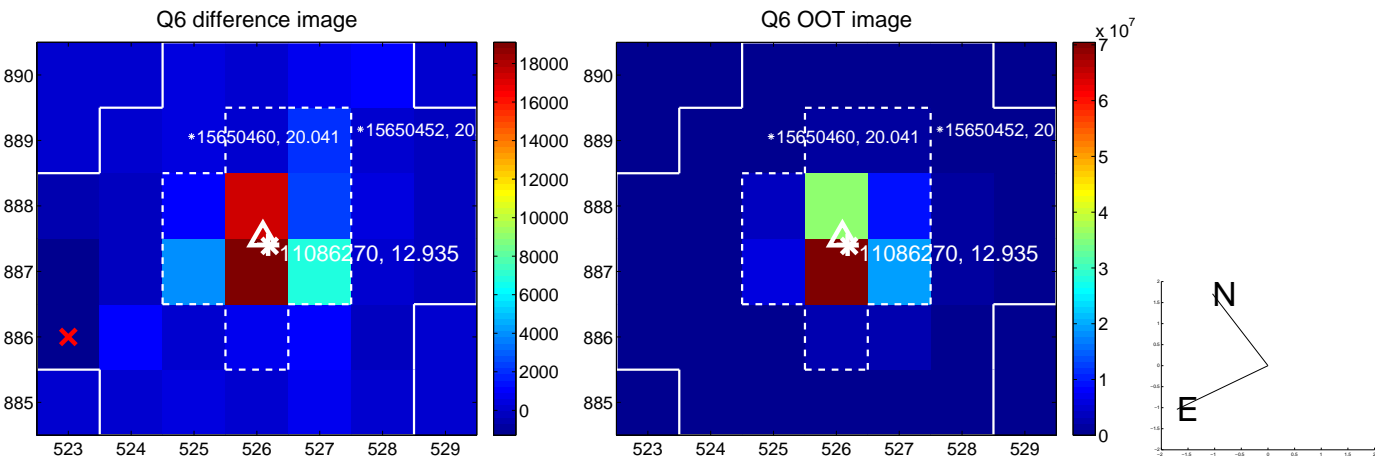
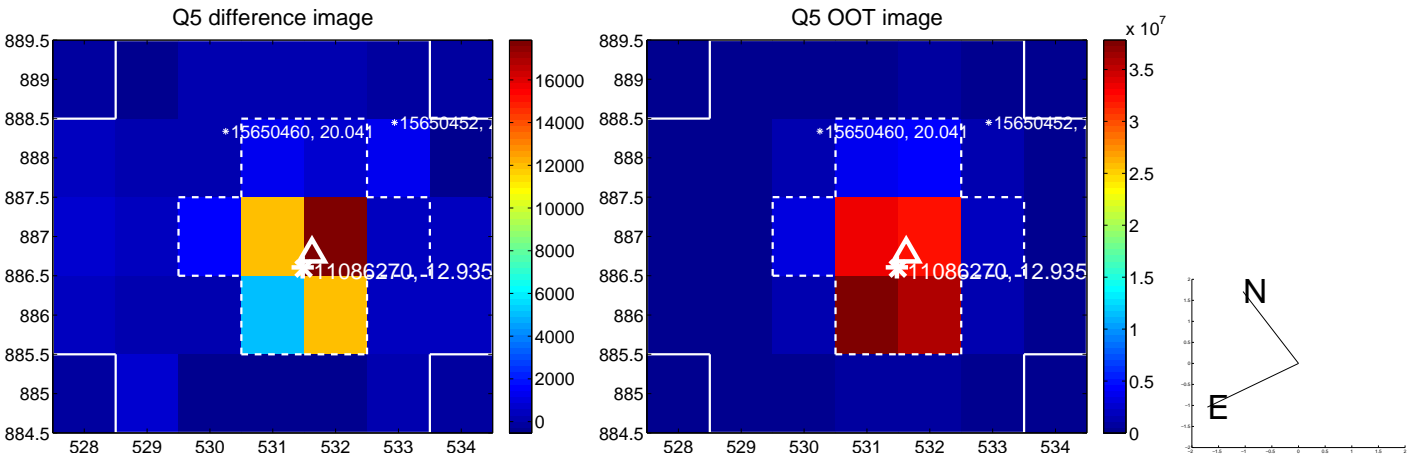
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

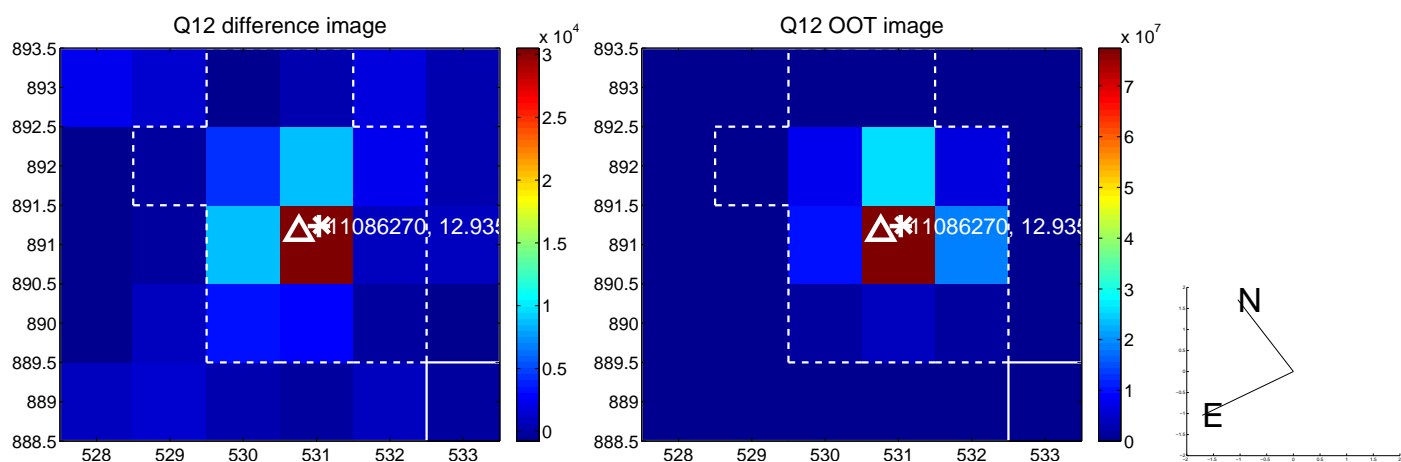
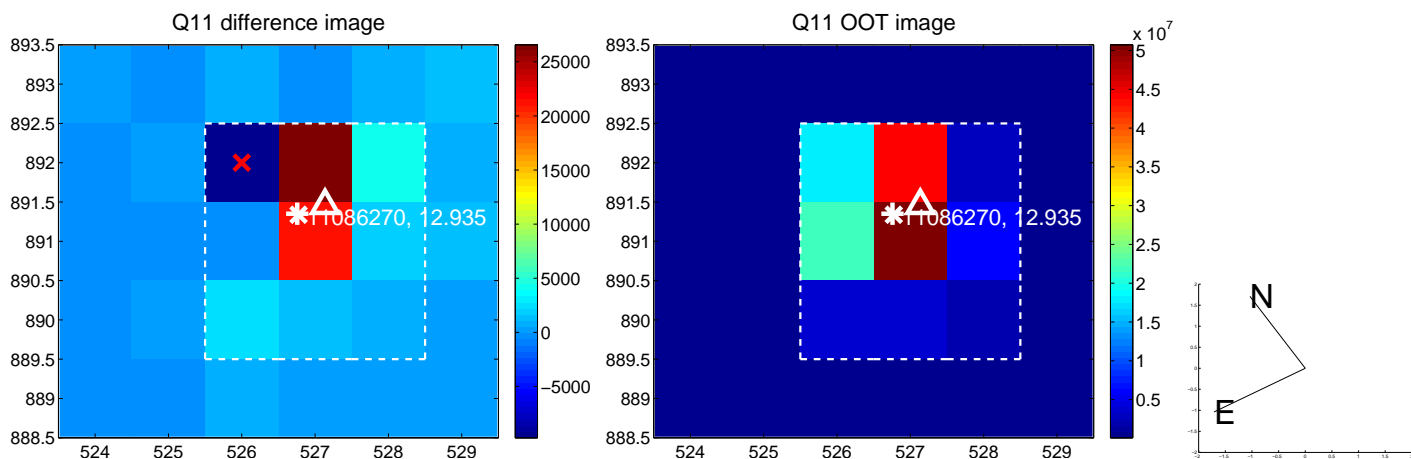
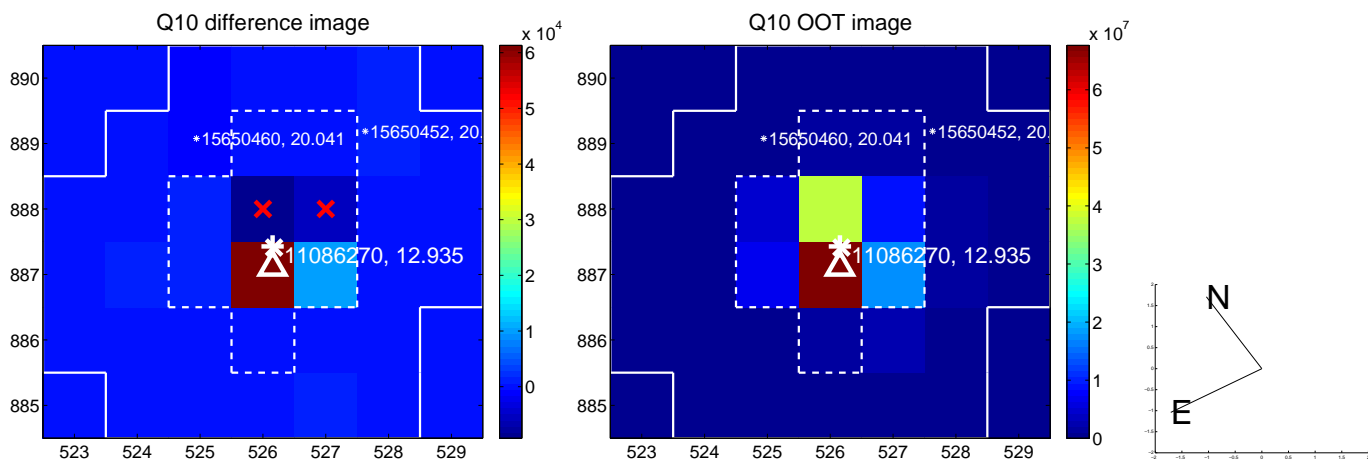
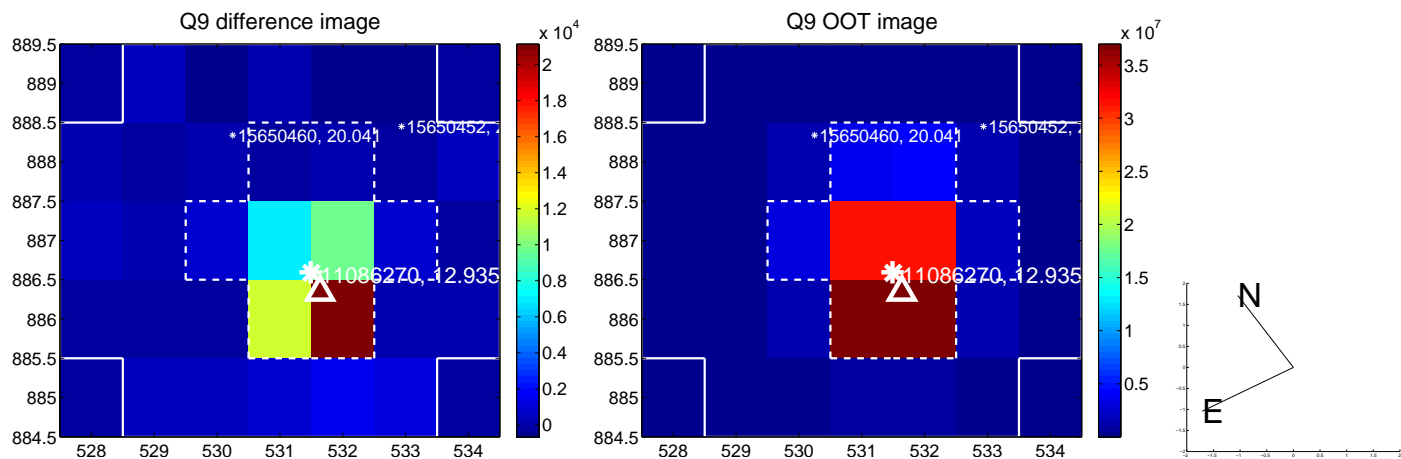




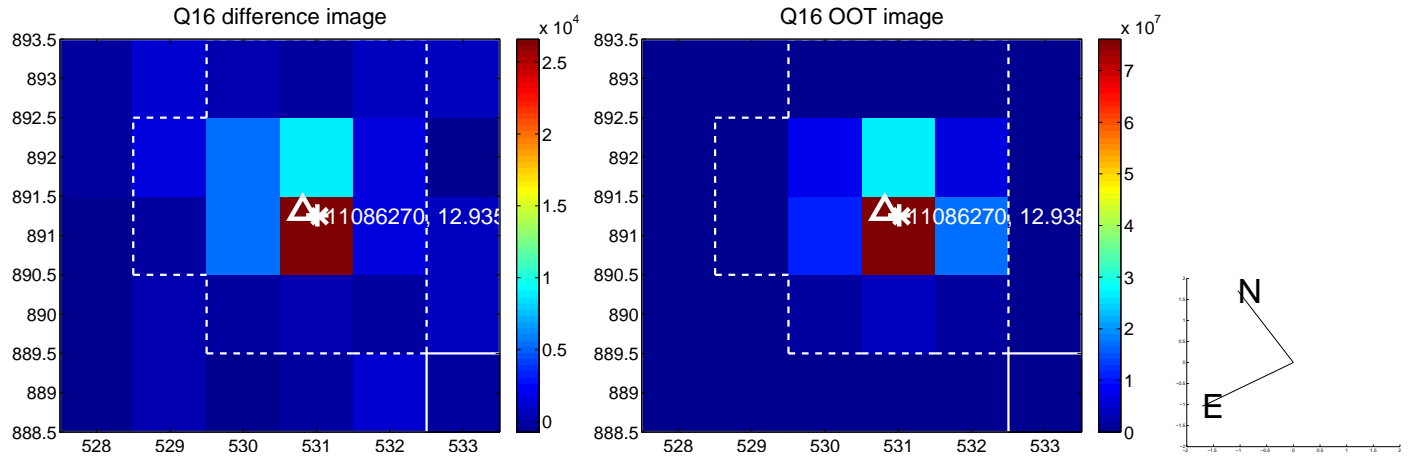
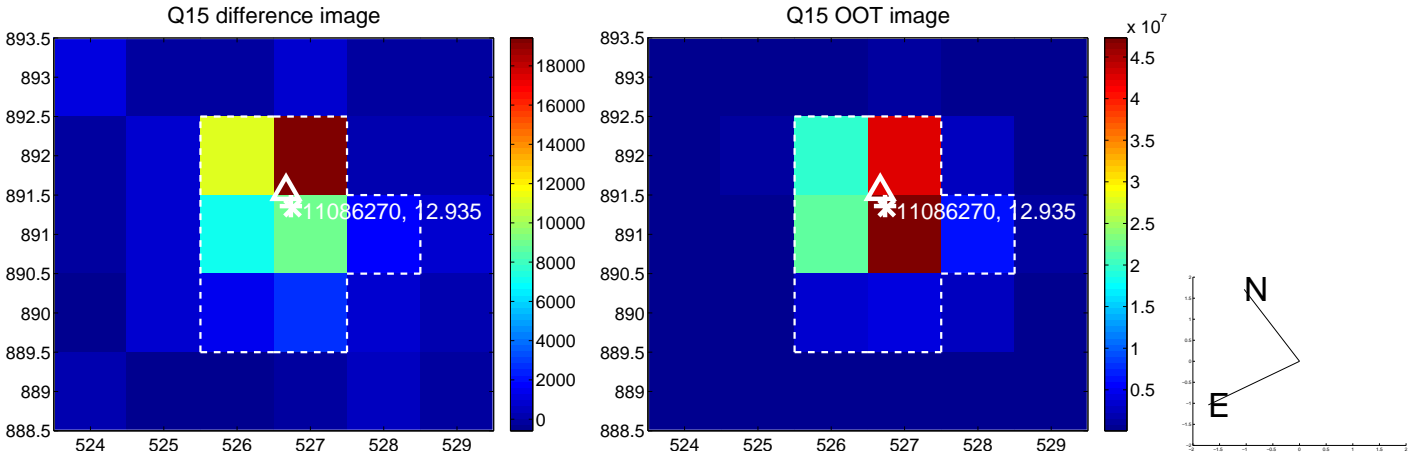
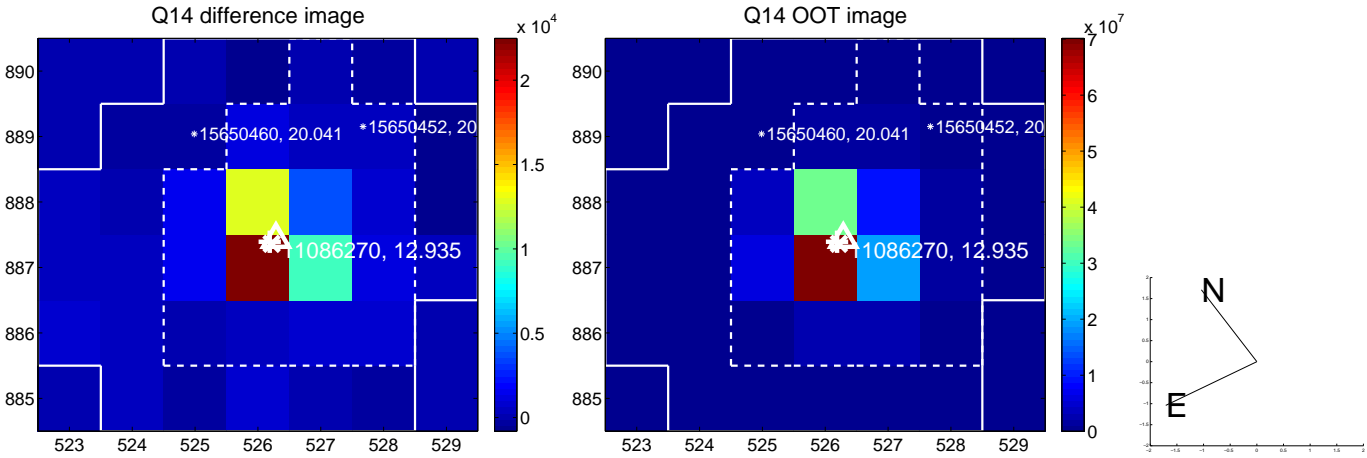
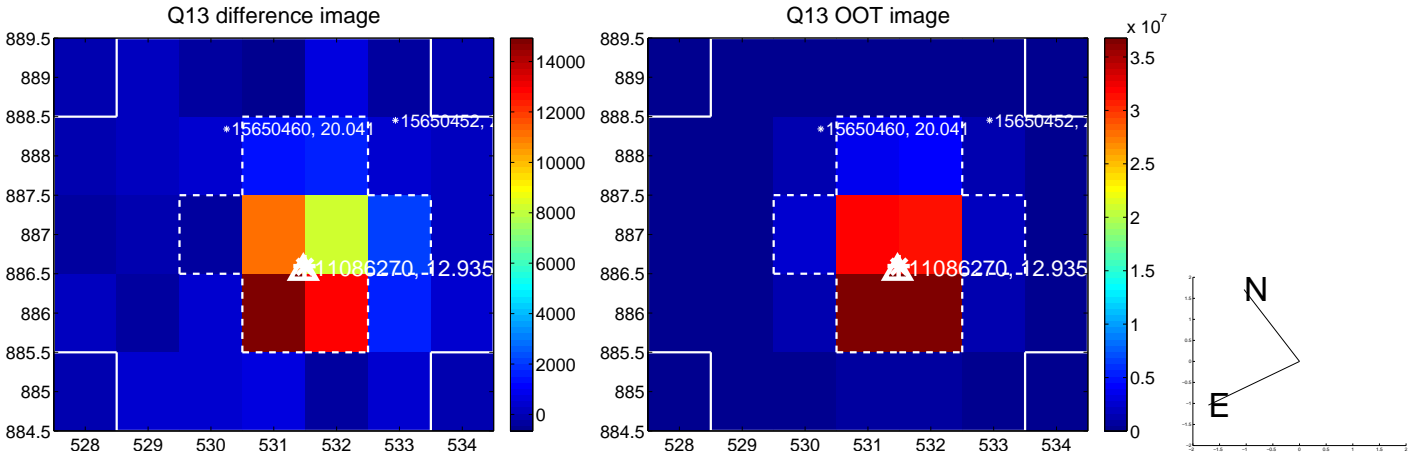
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



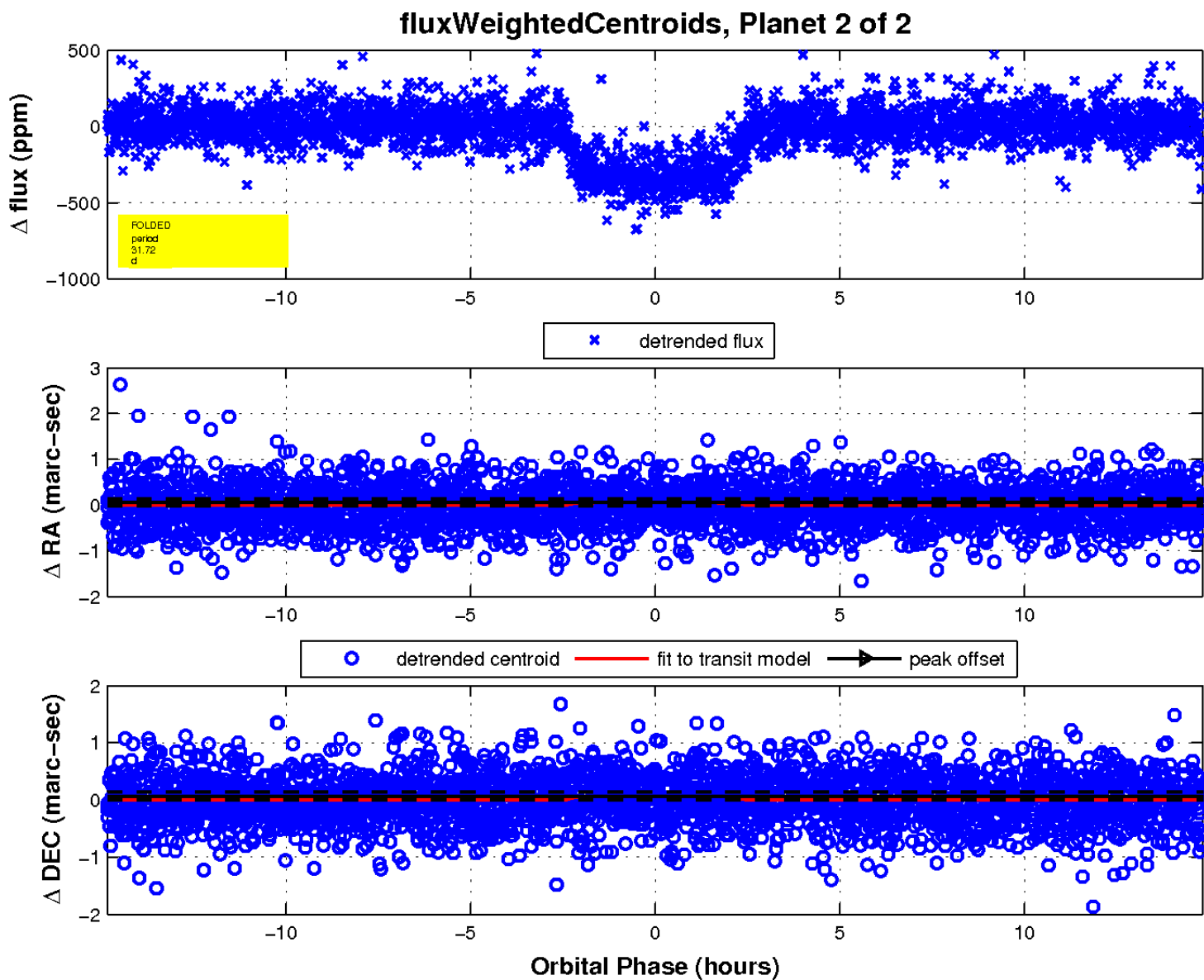
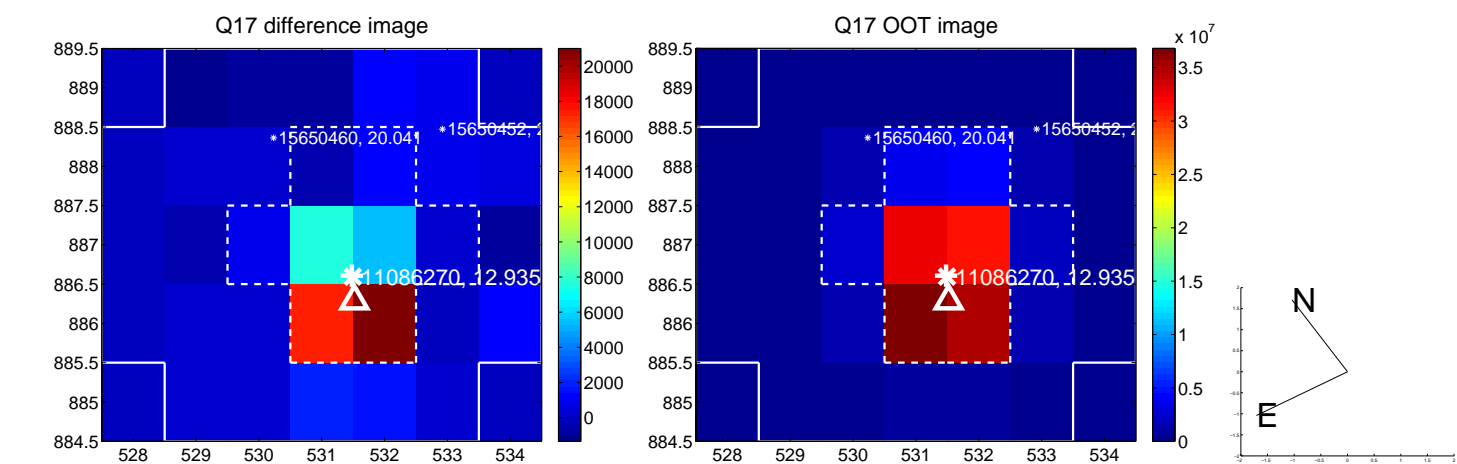
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

