

# KIC 010858785

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
010858785-01	OBS	4171.01	0.952344	132.350793	107.4	2.164	12.5	12.4	0.92	6086	1.13	2897.37
010858785-02	OBS	No	0.952323	131.904486	25.8	2.218	10.2	3.2	0.92	6086	0.48	2897.45

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
010858785-01	OBS	FP	0.00	0	1	1	1	MOD_SEC_ALT—HAS_SEC_TCE—CENT_RESOLVED_OFFSET—EPHEM_MATCH
010858785-02	OBS	FP	0.00	1	1	1	1	IS_SEC_TCE—CENT_RESOLVED_OFFSET—EPHEM_MATCH

**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 010858785-01

TCE (1)	KIC	Parent (2)	Parent KIC	P <sub>1</sub> :P <sub>2</sub>	Dist ( $''$ )	$\Delta$ Row	$\Delta$ Col	m <sub>2</sub>	m <sub>1</sub>	D <sub>2</sub> /D <sub>1</sub>	Mechanism	Flag	$\sigma_P$	$\sigma_T$
010858785-01	10858785	010858720-pri	10858720	1:1	74.4	4	18	10.97	15.87	4475.70	Direct-PRF	0	3.32	1.19

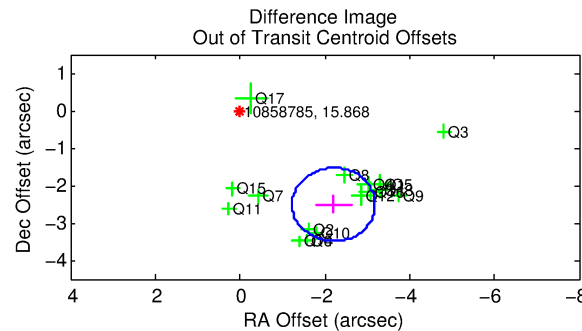
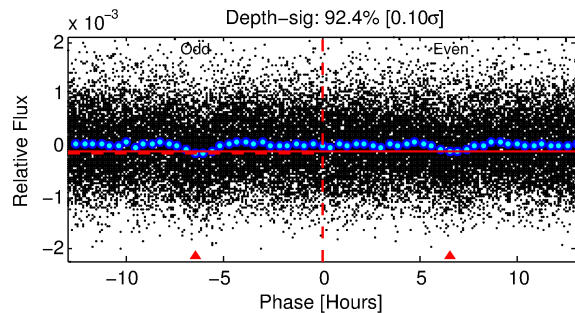
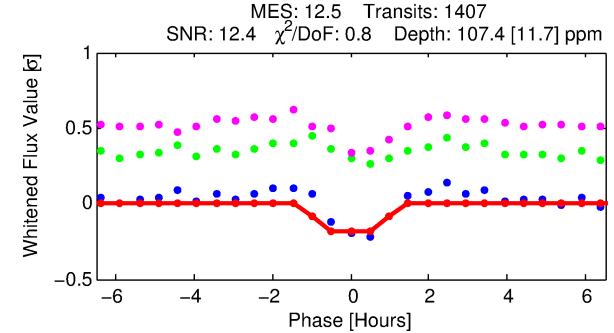
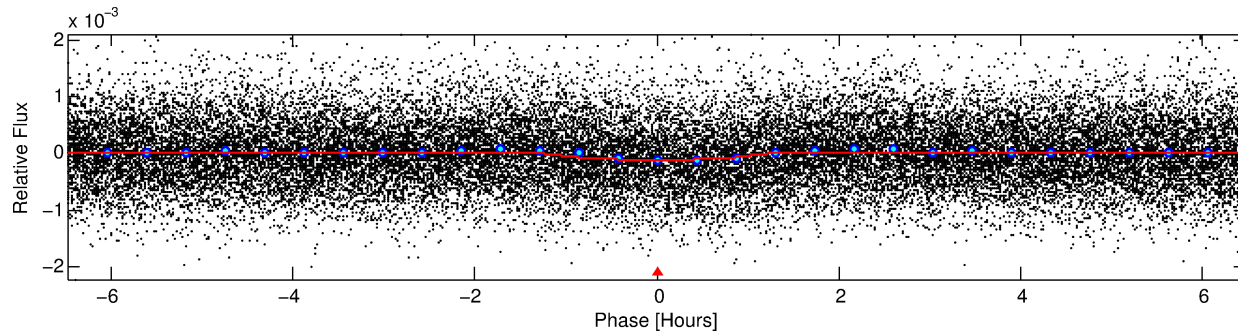
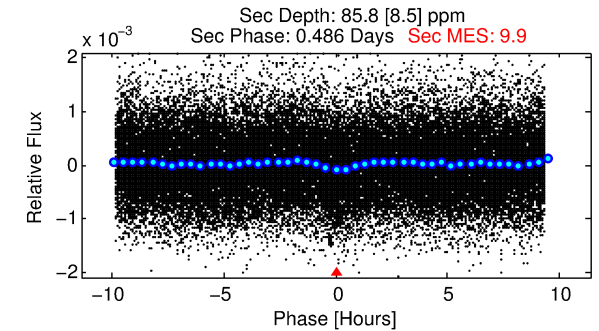
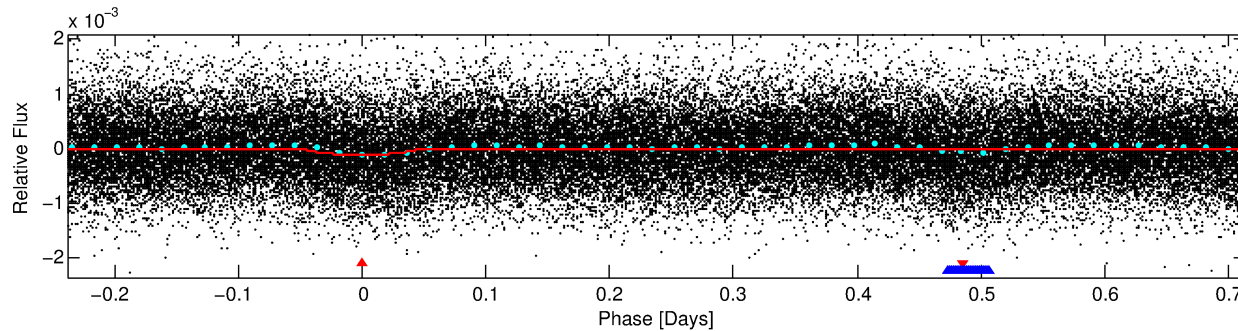
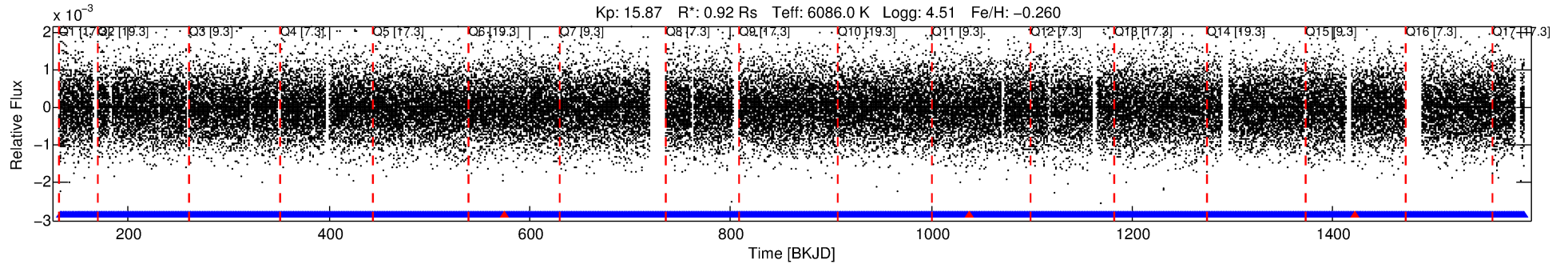
**Notes:** P<sub>1</sub>:P<sub>2</sub> is the period ratio. Dist is the distance in arcseconds.  $\Delta$ Row and  $\Delta$ Col are the number of pixels apart in row and column. m<sub>2</sub> and m<sub>1</sub> are the magnitudes of the parent and child. D<sub>2</sub>/D<sub>1</sub> is the parent's transit depth divided by the child's.  $\sigma_P$  and  $\sigma_T$  are the significance of the match in period and epoch. For a match to be considered significant  $\sigma_P < 5.0$  and  $\sigma_T < 5.0$ . Matches which have  $\sigma_P$  and  $\sigma_T$  very close to this cutoff should receive extra scrutiny, especially if the period ratio is very large.

# DV One-Page Summary

KIC: 10858785 Candidate: 1 of 2 Period: 0.952 d

KOI: K04171 Corr: No Ephemeris Match

Kp: 15.87 R\*: 0.92 Rs Teff: 6086.0 K Logg: 4.51 Fe/H: -0.260



## DV Fit Results:

Period = 0.95234 [0.00001] d  
Epoch = 132.3508 [0.0024] BKJD  
Rp/R\* = 0.0113 [0.0059]  
a/R\* = 1.76 [3.37]  
b = 0.91 [0.55]  
Seff = 2897.37 [1026.80]  
Teq = 1871 [166] K  
Rp = 1.13 [0.67] Re  
a = 0.0190 [0.0043] AU  
Ag = 13.21 [14.61] [0.84σ]  
Teff = 5515 [1466] K [2.47σ]

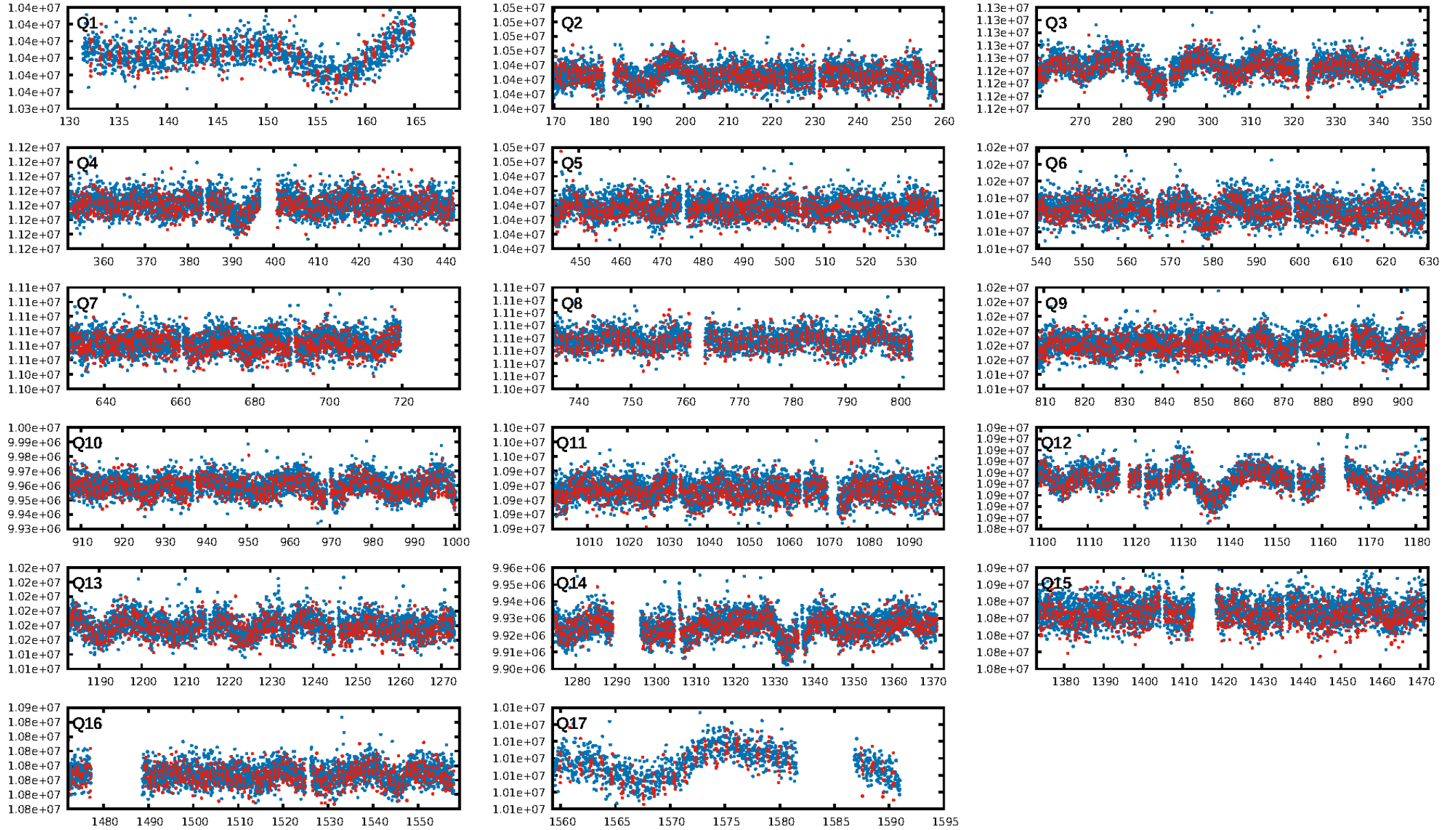
## DV Diagnostic Results:

ShortPeriod-sig: 0.0% [0.00σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: N/A  
ModelChiSquareGoF-sig: N/A  
Bootstrap-pfa: 1.39e-36  
RollingBand-fgt: 1.00 [1342/1345]  
GhostDiagnostic-chr: -0.3884  
Centroid-sig: 0.0%  
Centroid-so: 4.578 arcsec [4.13σ]  
OotOffset-rm: 3.343 arcsec [10.25σ]  
KicOffset-rm: 3.289 arcsec [10.12σ]  
OotOffset-st: 4/4/4/5 [17]  
KicOffset-st: 4/4/4/5 [17]  
DiffImageQuality-fgm: 0.06 [1/17]  
DiffImageOverlap-fno: 1.00 [17/17]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 29-Jan-2016 11:13:11 Z

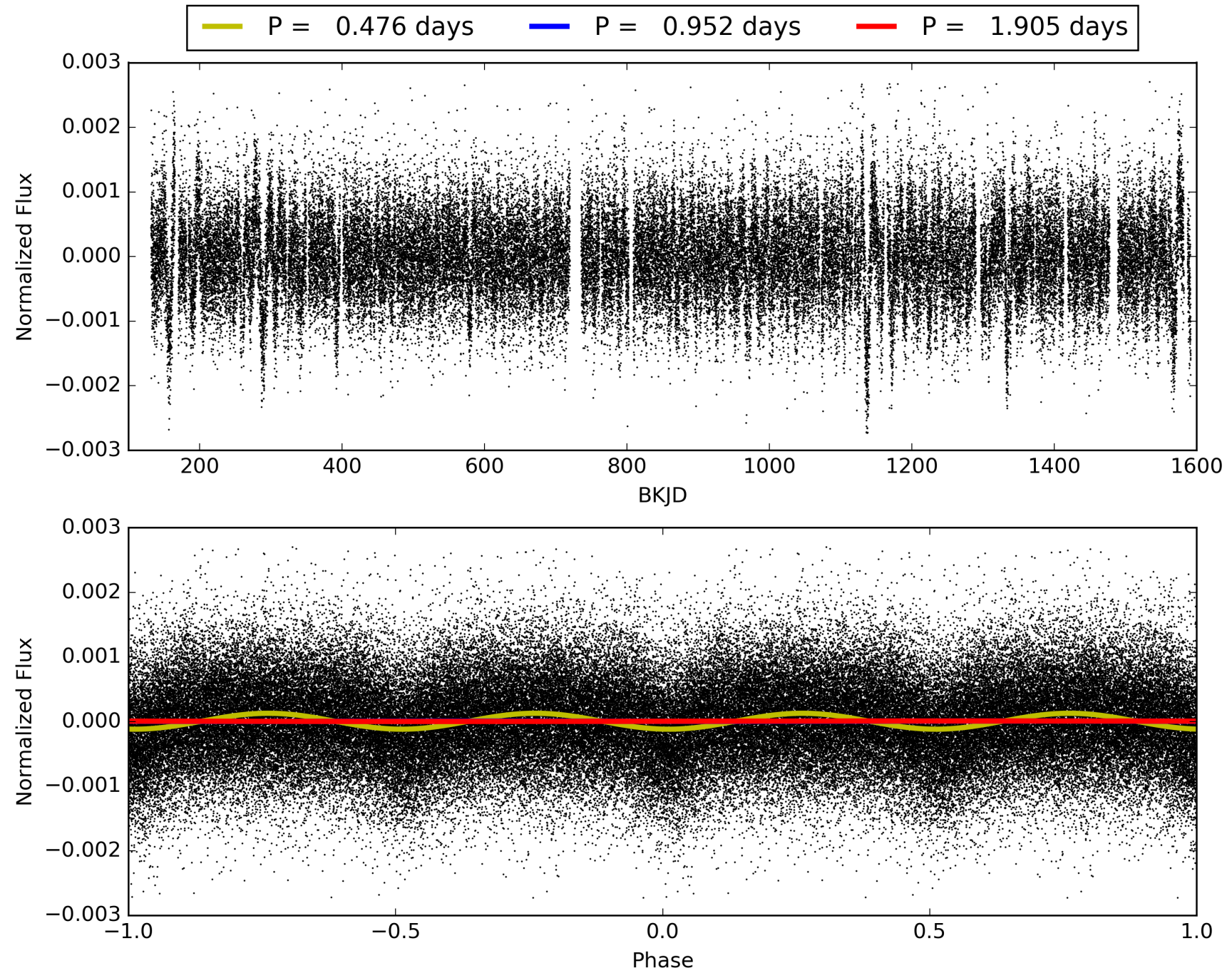
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 010858785-01, PDC Light Curves



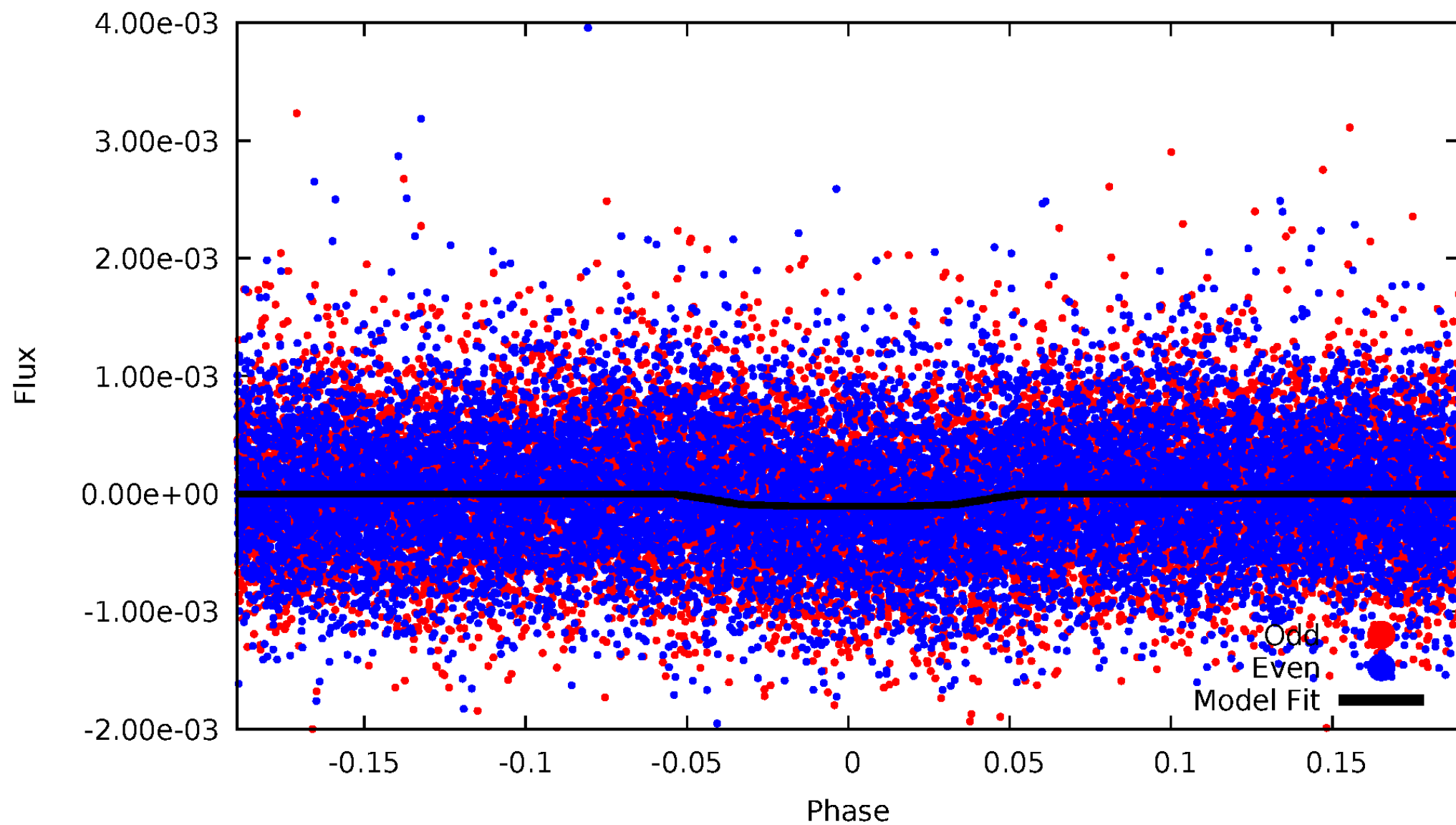


# TCE 010858785-01



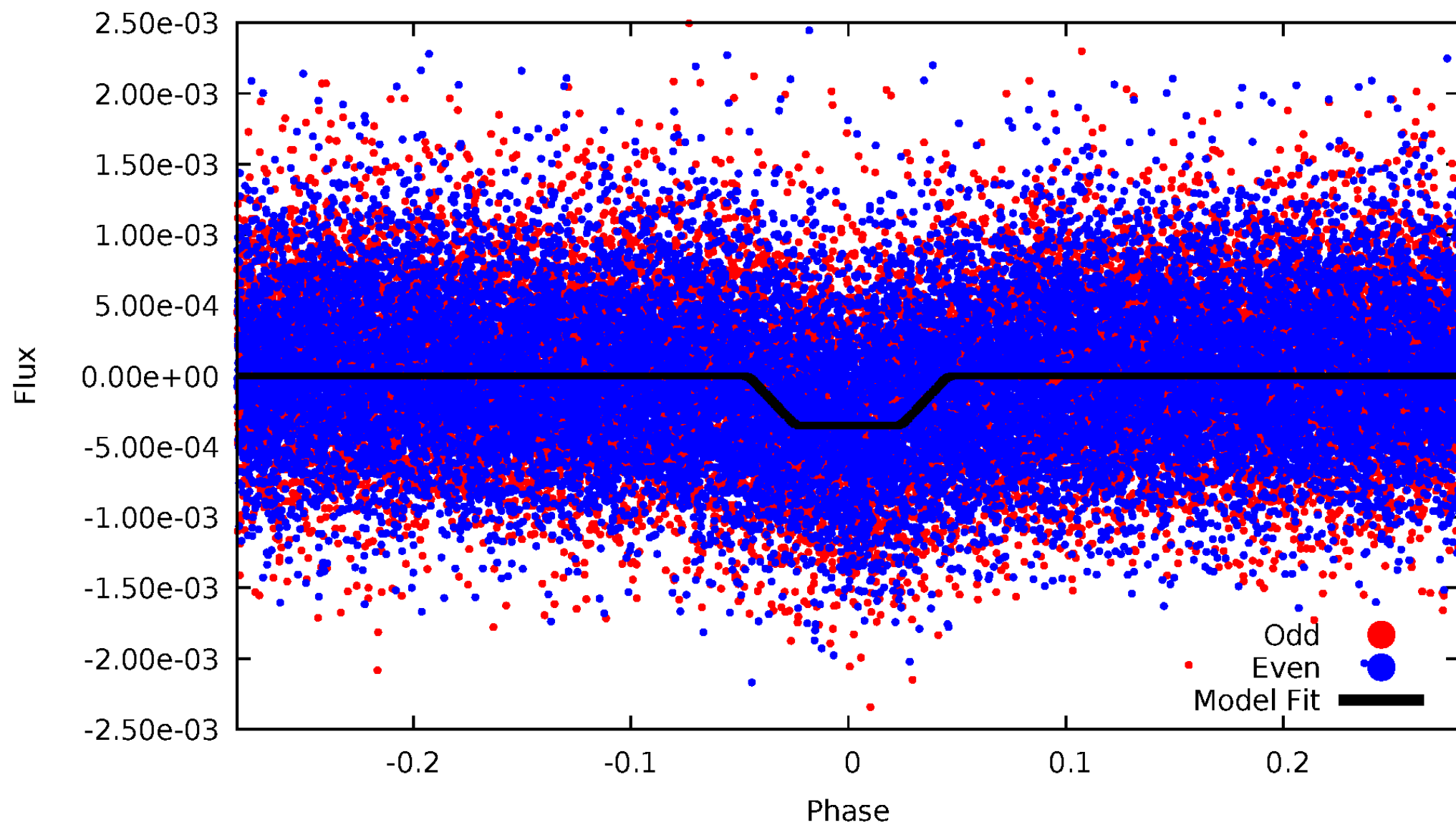
# DV Odd/Even

TCE 010858785-01

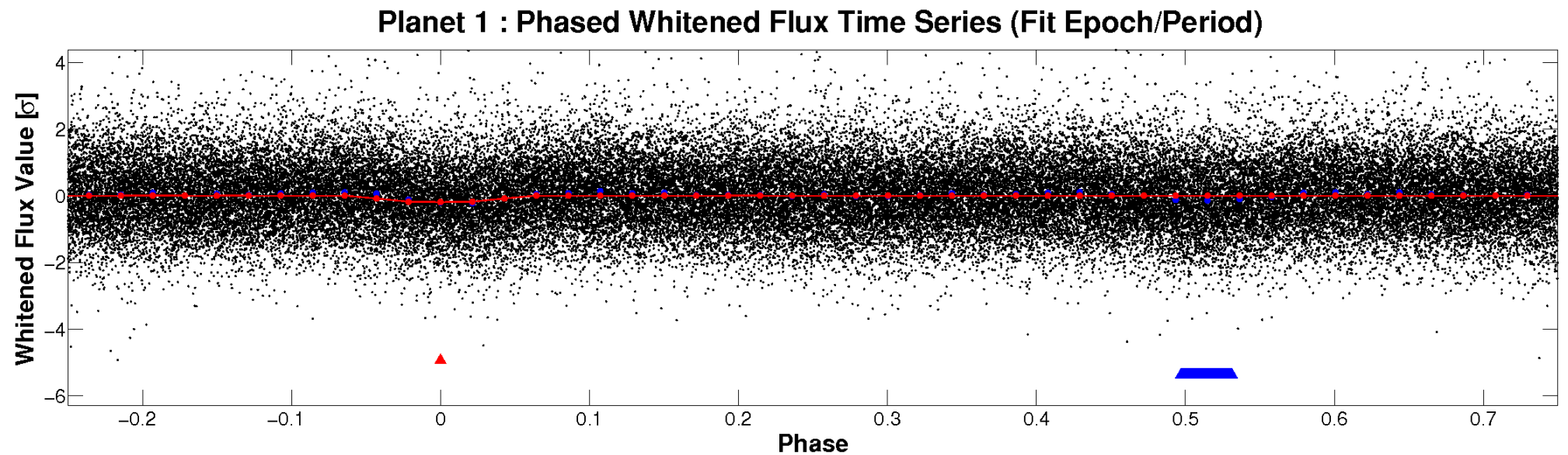
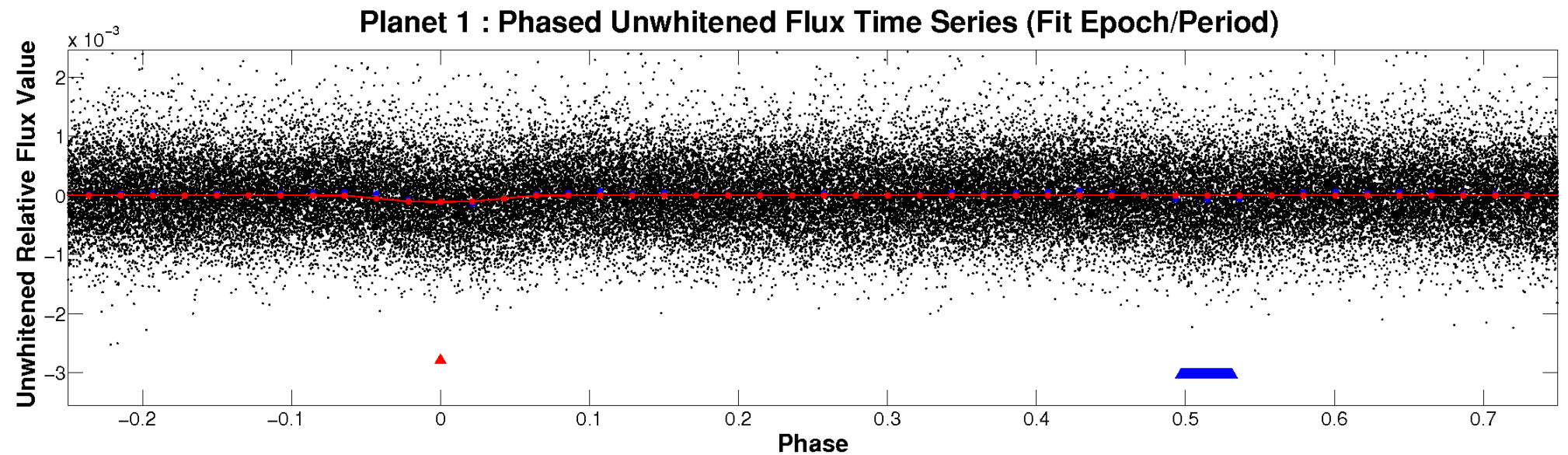


# ALT Odd/Even

TCE 010858785-01



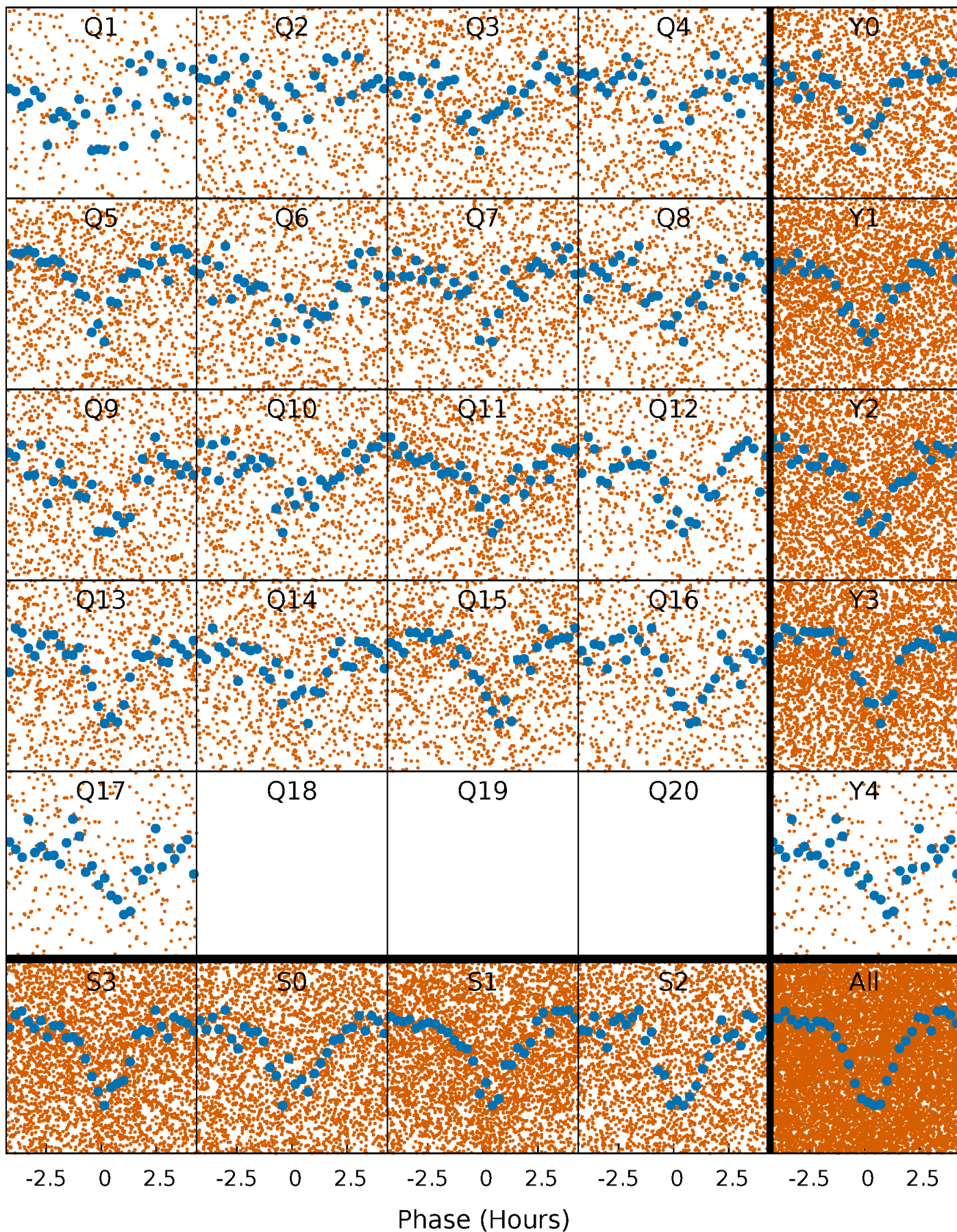
# Non-Whitened Vs. Whitened Light Curve





# PDC Quarter-Phased Transit Curves

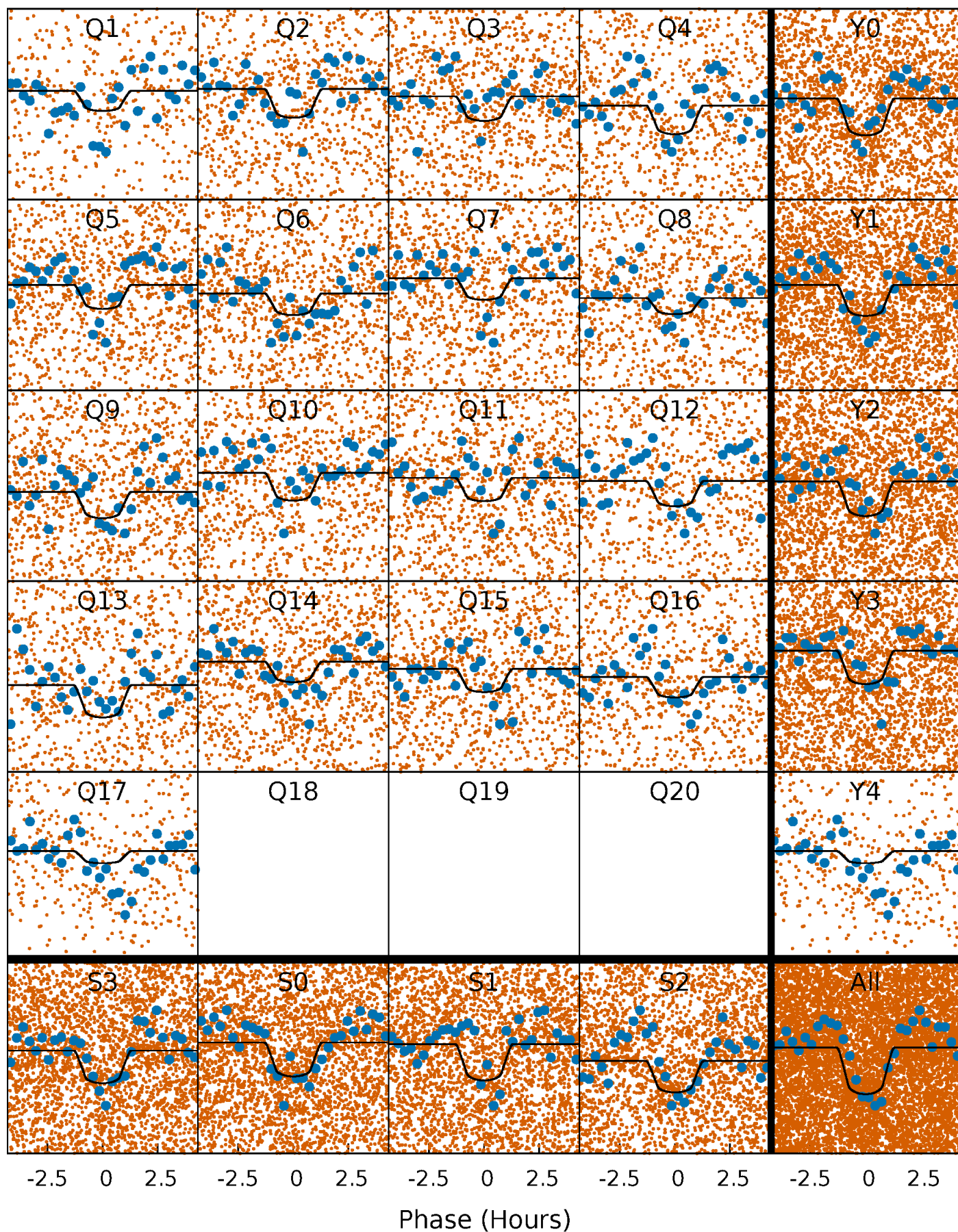
TCE 010858785-01 P= 0.952344 Days  $T_0=132.350793$  (BKJD)





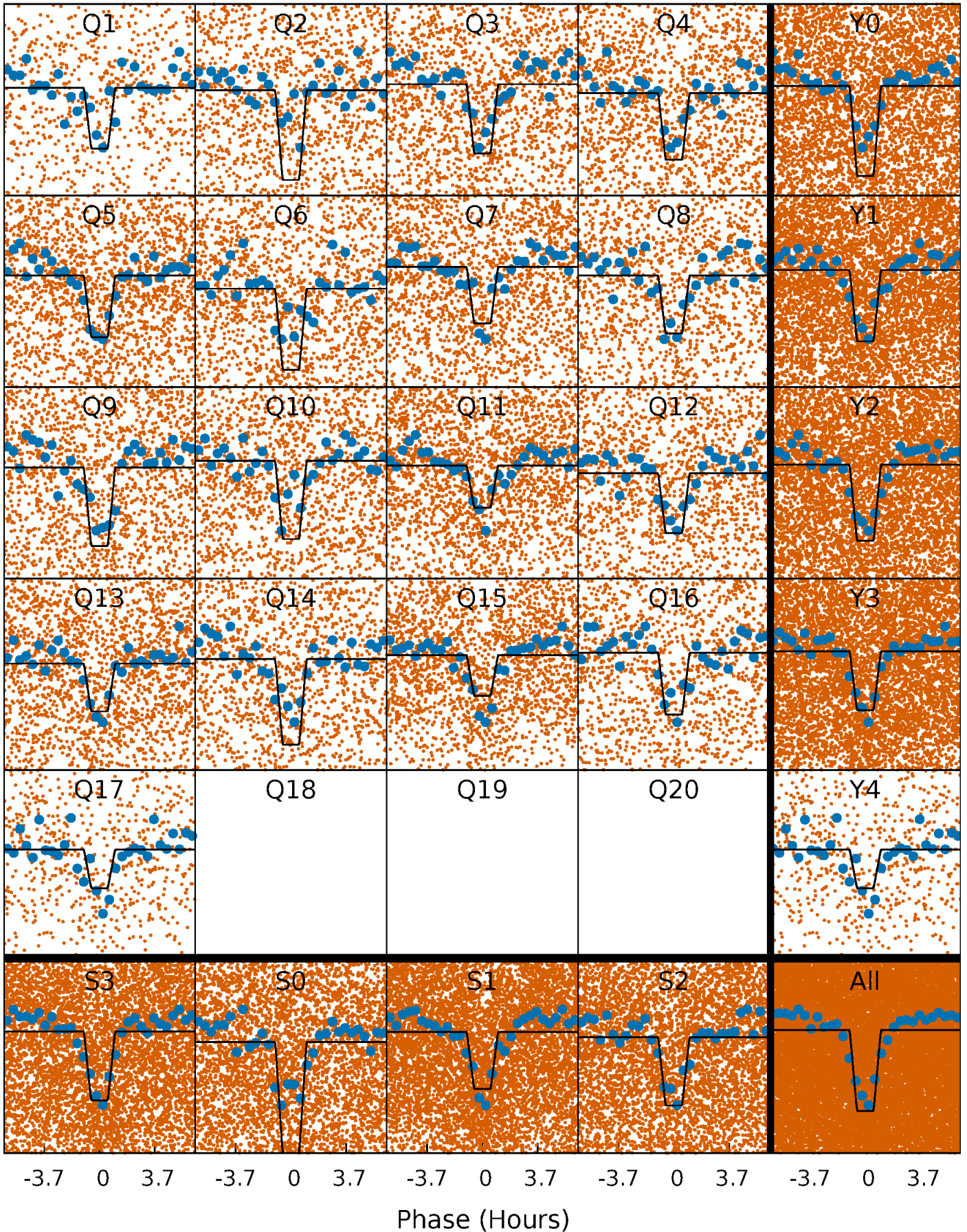
# DV Quarter-Phased Transit Curves

TCE 010858785-01 P= 0.952344 Days  $T_0=132.350793$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

TCE 010858785-01 P= 0.952369 Days  $T_0=132.342668$  (BKJD)

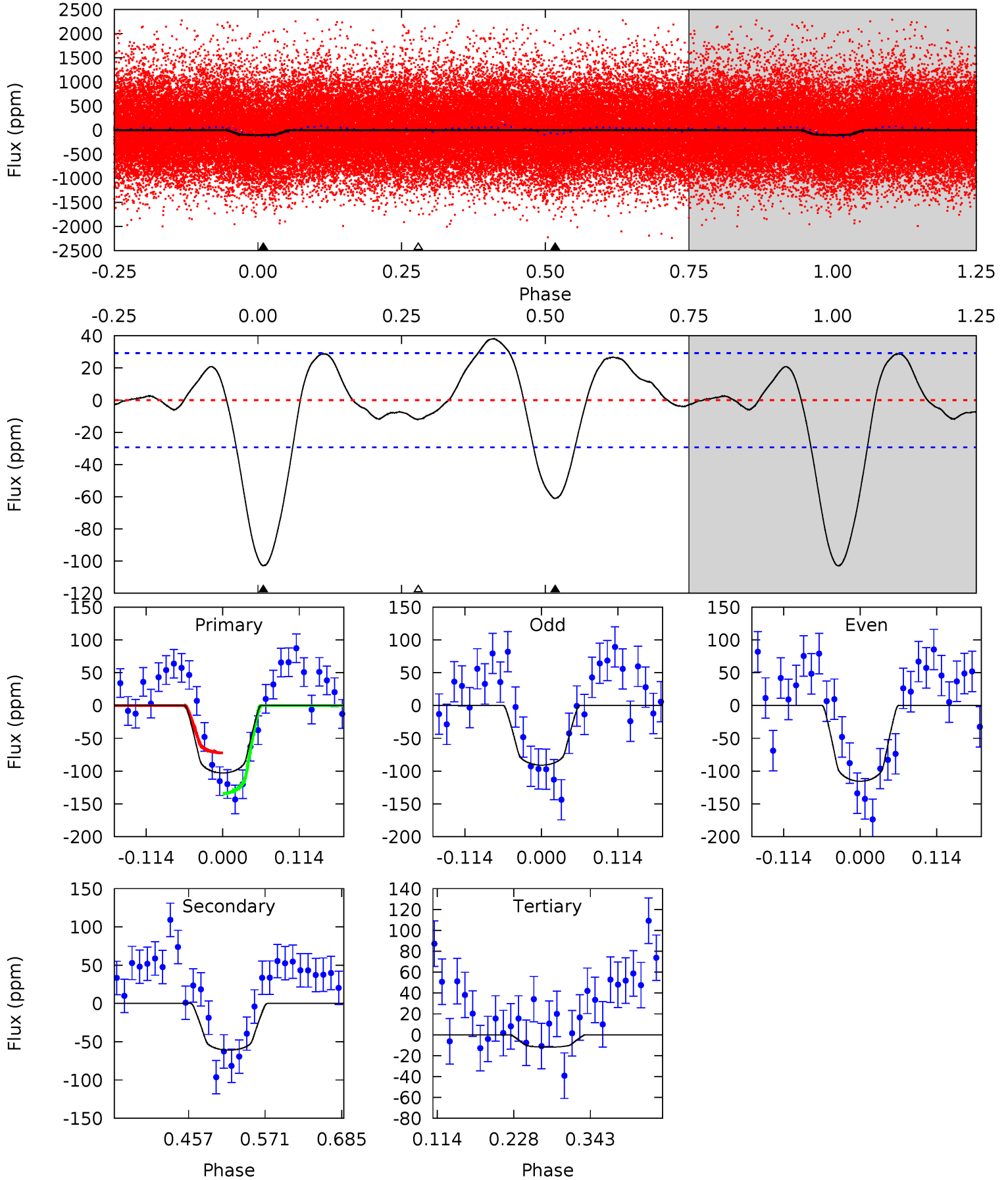




# DV Model-Shift Uniqueness Test

010858785-01, P = 0.952344 Days, E = 131.398449 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
16.0	9.46	1.84	0	4.54	1.58	1.84	14.1	16.0	7.62	9.46	1.91	0.86	0.27	4.81

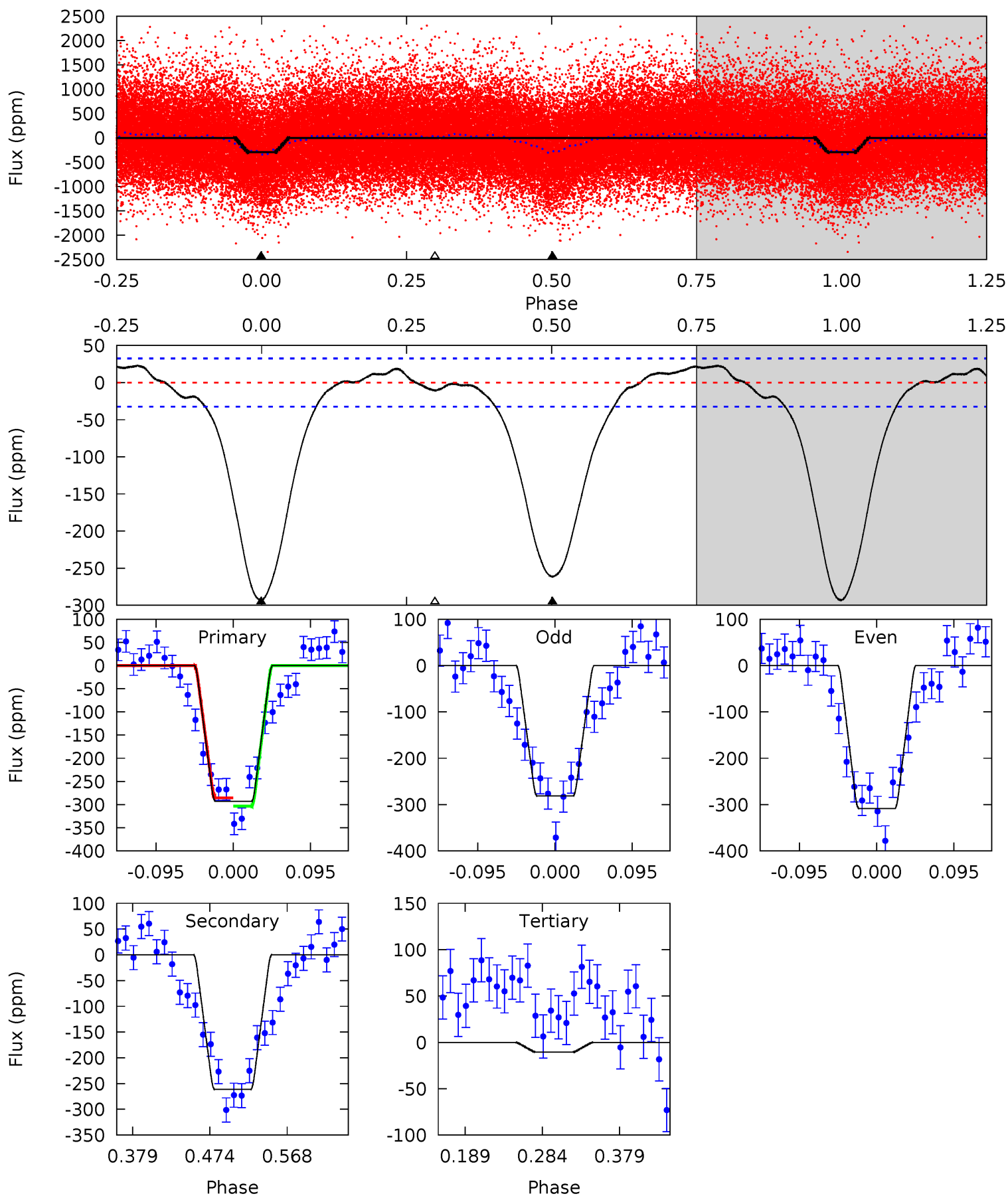




# Alt Model-Shift Uniqueness Test

010858785-01, P = 0.952369 Days, E = 131.390299 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
41.3	36.9	1.49	0	4.58	1.67	2.11	39.8	41.3	35.4	36.9	1.90	1.00	0.07	1.27



### Stellar Parameters For KIC 010858785

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M$ ( $M_{\odot}$ )	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6086^{+164}_{-200}$	$4.511^{+0.048}_{-0.180}$	$-0.260^{+0.250}_{-0.350}$	$0.921^{+0.247}_{-0.099}$	$1.003^{+0.116}_{-0.129}$	$1.808^{+0.448}_{-0.881}$
	+3%/-3%	+1%/-4%	+96%/-135%	+27%/-11%	+12%/-13%	+25%/-49%
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 010858785-01 / KOI 4171.01

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-61 \pm 6$	$1.18^{+0.67}_{-0.51}$	$2656^{+187}_{-120}$	$5062^{+1715}_{-860}$	$8.696^{+18.190}_{-5.263}$
Alt.	$-261 \pm 7$	$2.00^{+0.67}_{-0.66}$	$2668^{+165}_{-128}$	$5602^{+1170}_{-691}$	$13^{+16}_{-5}$

$T_{max}$  = 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

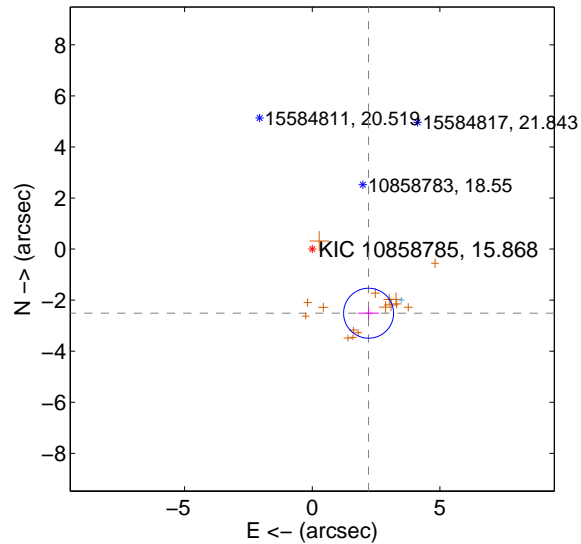
Supplemental centroid analysis for 010858785-01. Kepler magnitude: 15.87. Transit SNR 12.37

There are 1 quarters with good PRF difference image offsets

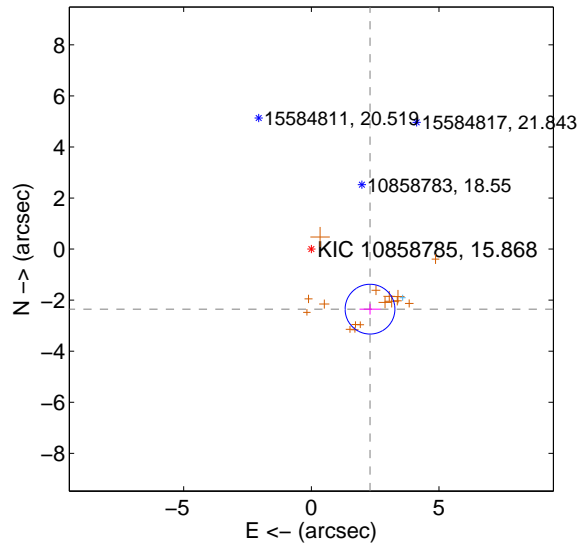
The direct PRF centroid is offset from the target star catalog position by about 0.17 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$3.343 \pm 0.326$	10.25	$-2.207 \pm 0.414$	$-2.511 \pm 0.237$
PRF-fit source offset from KIC position	$3.289 \pm 0.325$	10.12	$-2.298 \pm 0.412$	$-2.353 \pm 0.211$
photometric centroid source offset	$4.58 \pm 1.11$	4.13	$-2.32 \pm 1.20$	$-3.94 \pm 1.07$

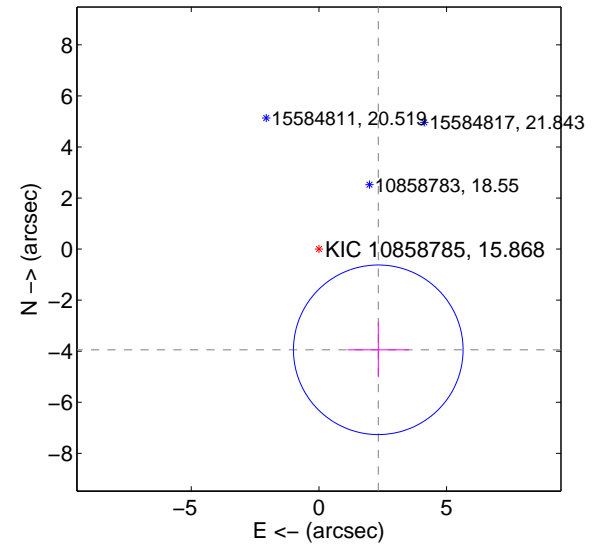
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position



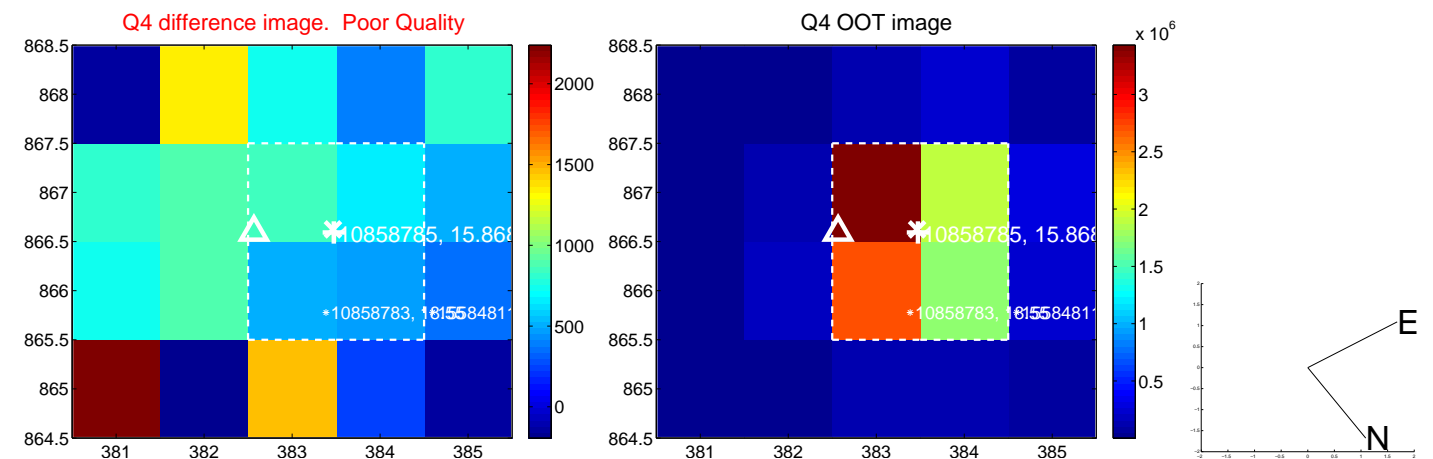
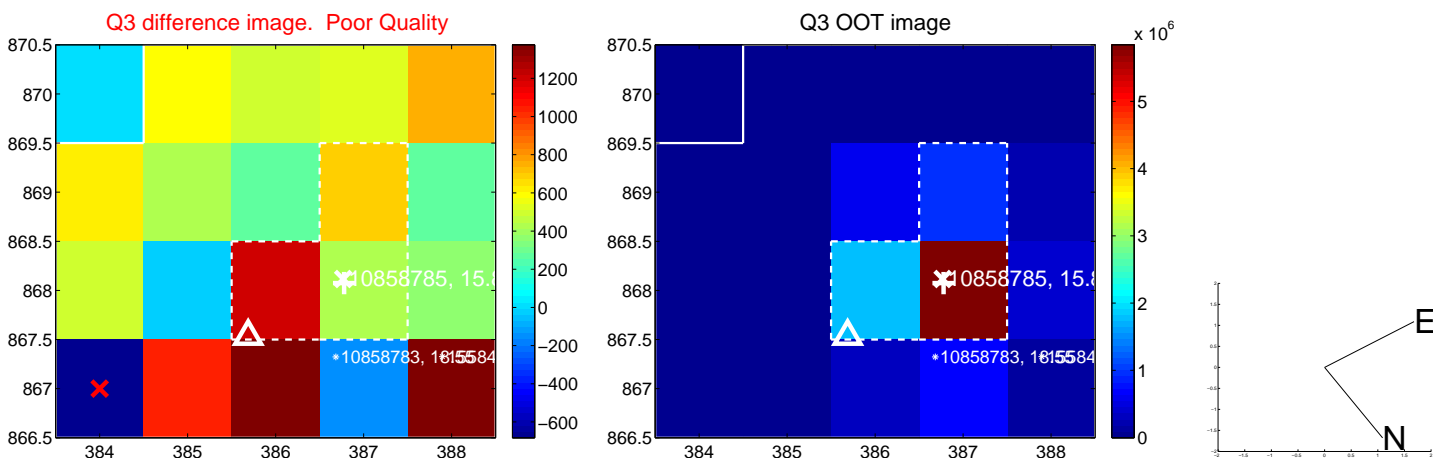
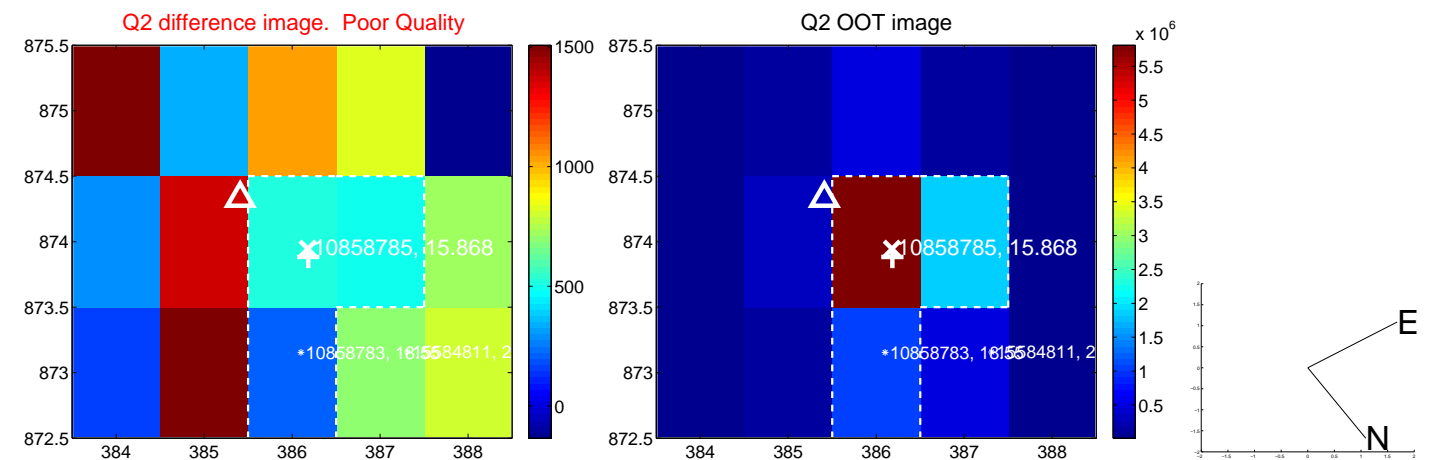
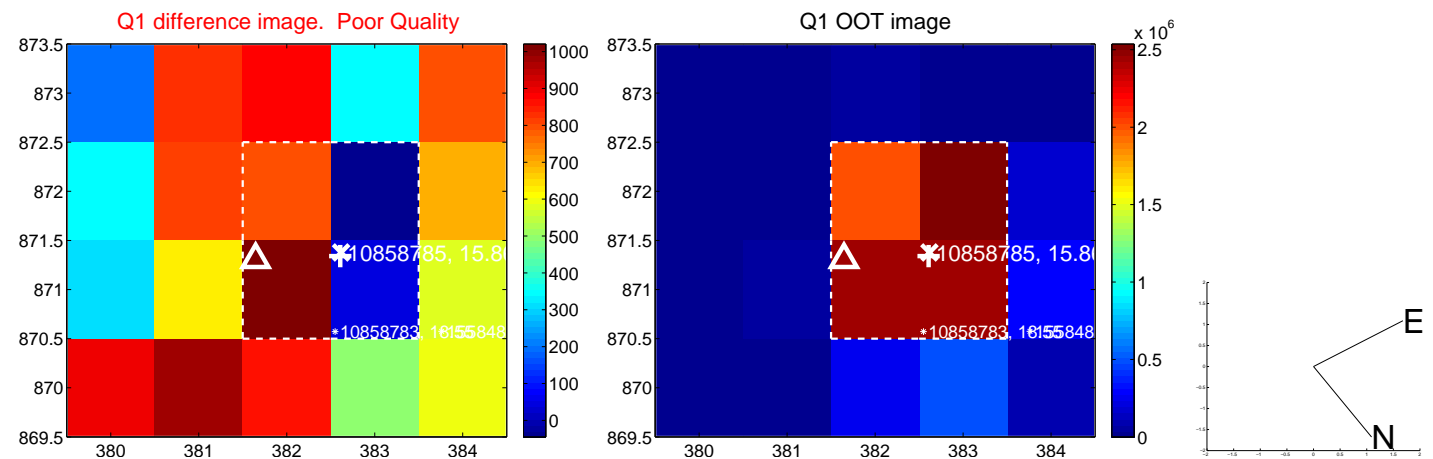
offset from photometric centroids



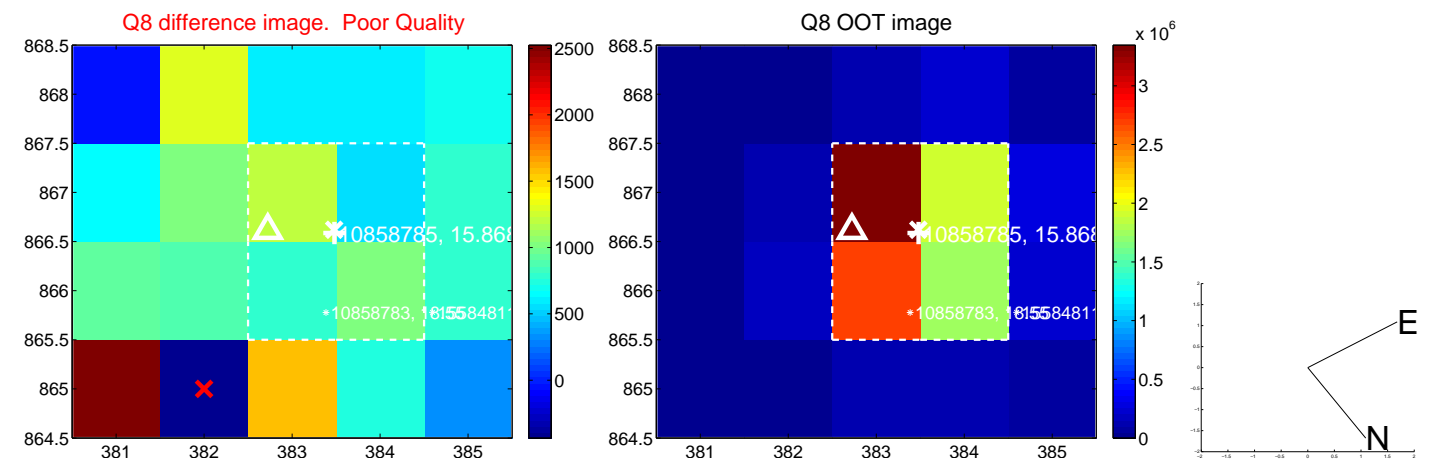
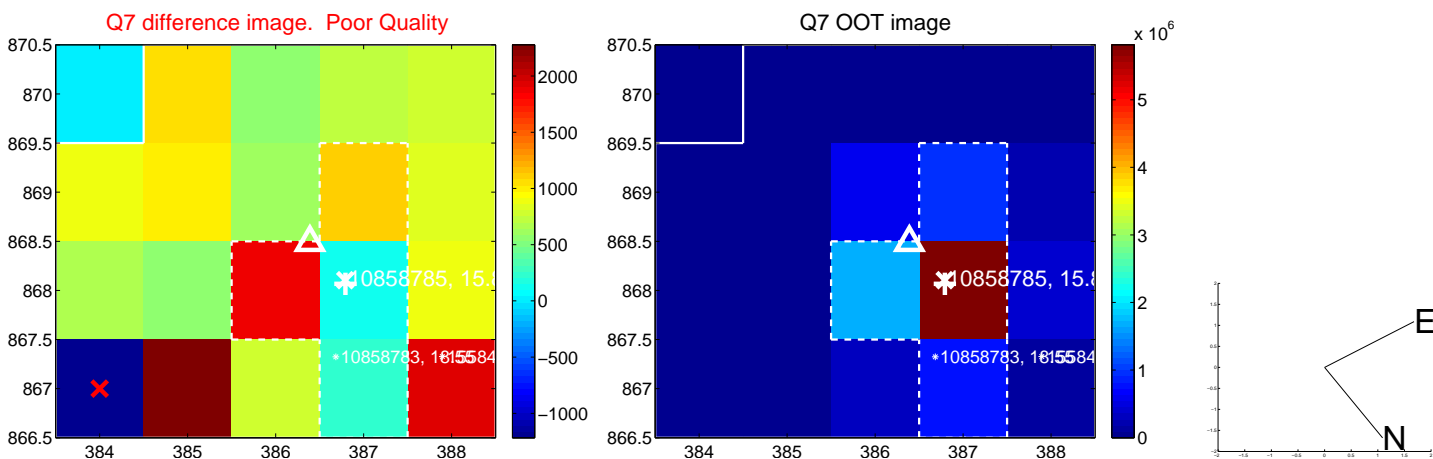
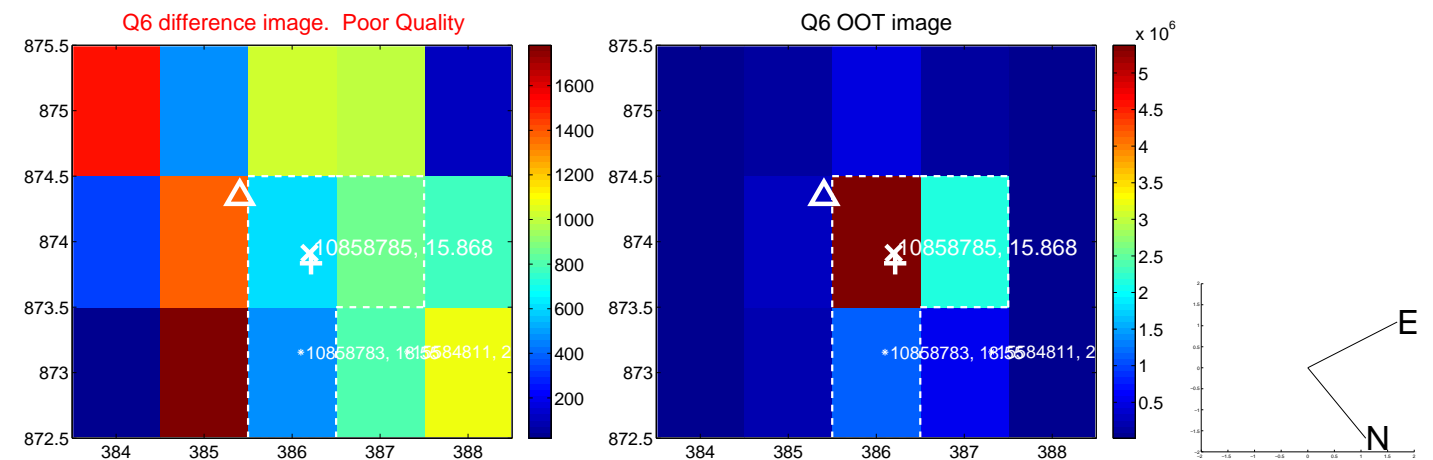
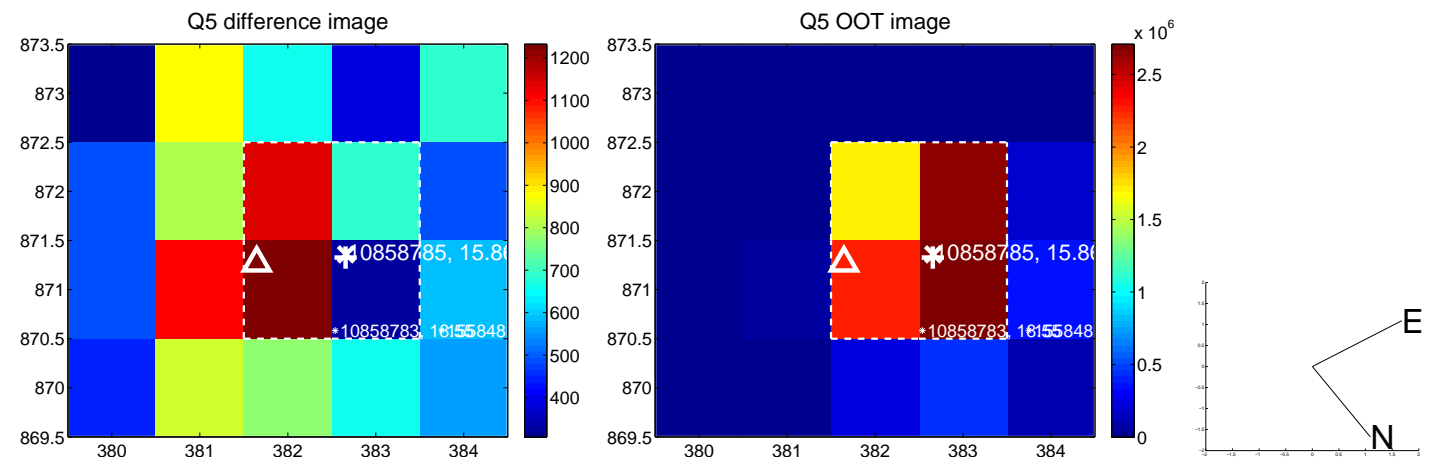
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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



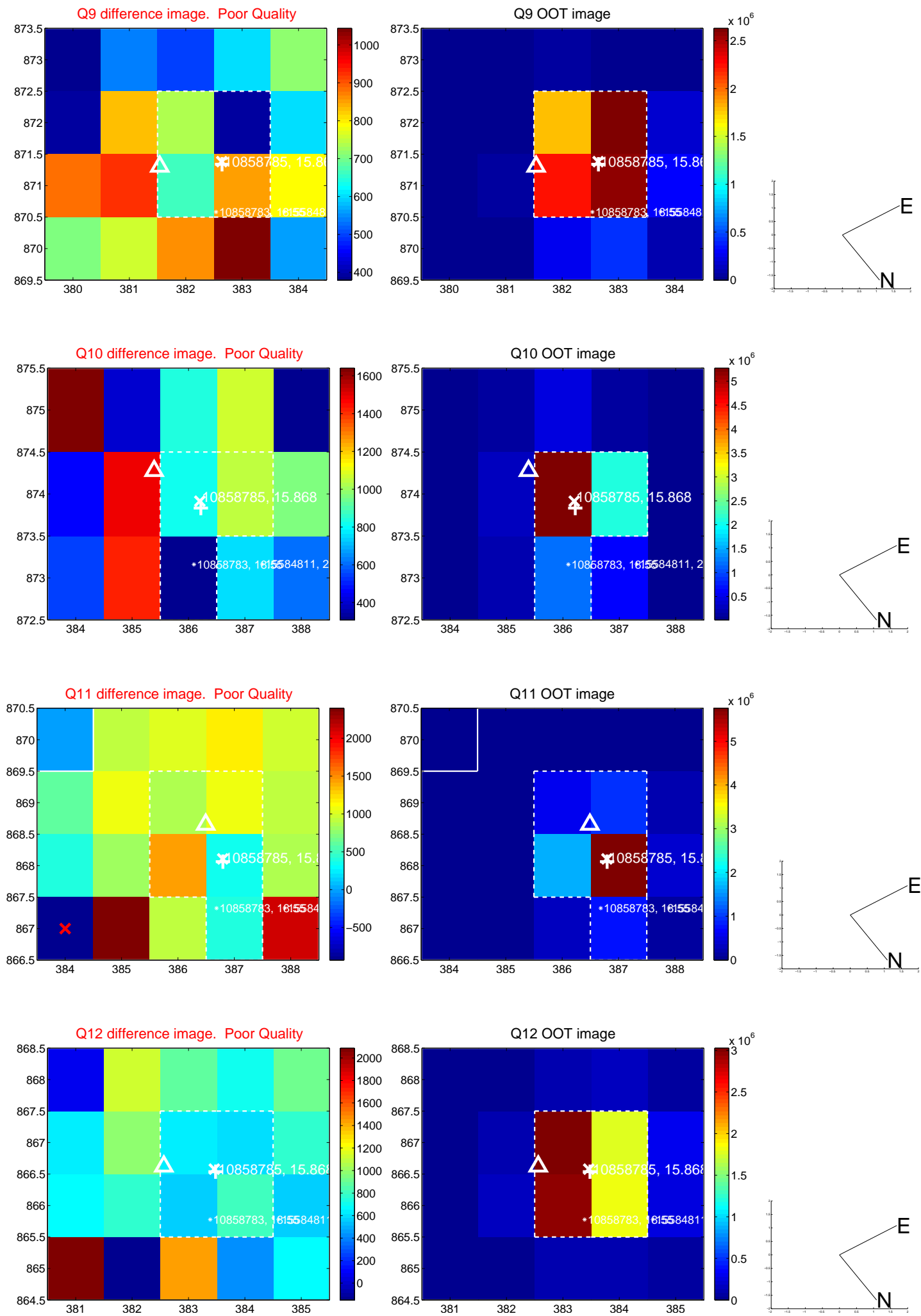
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

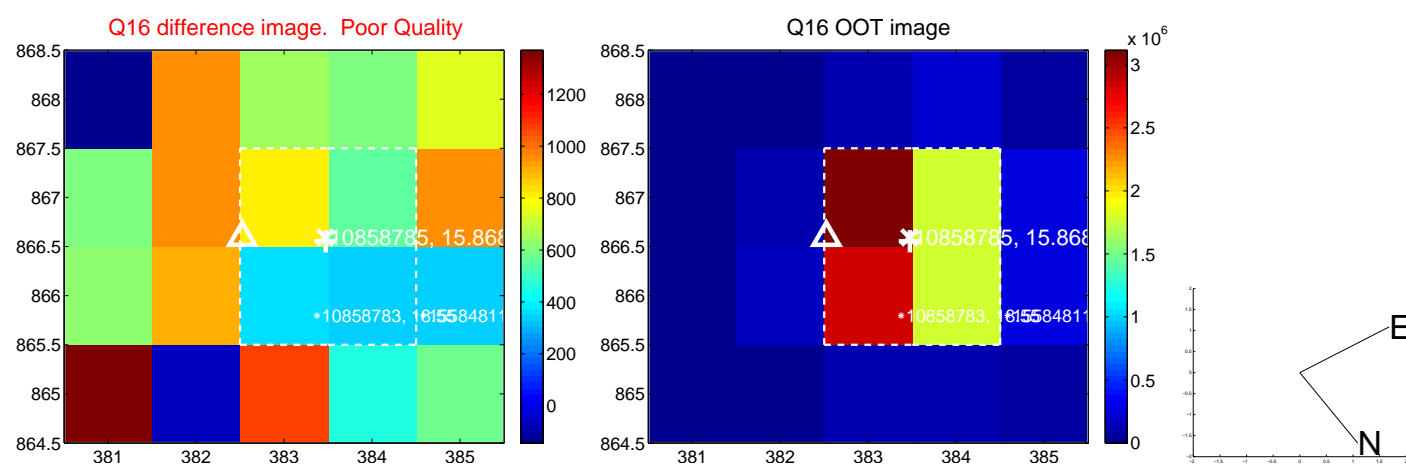
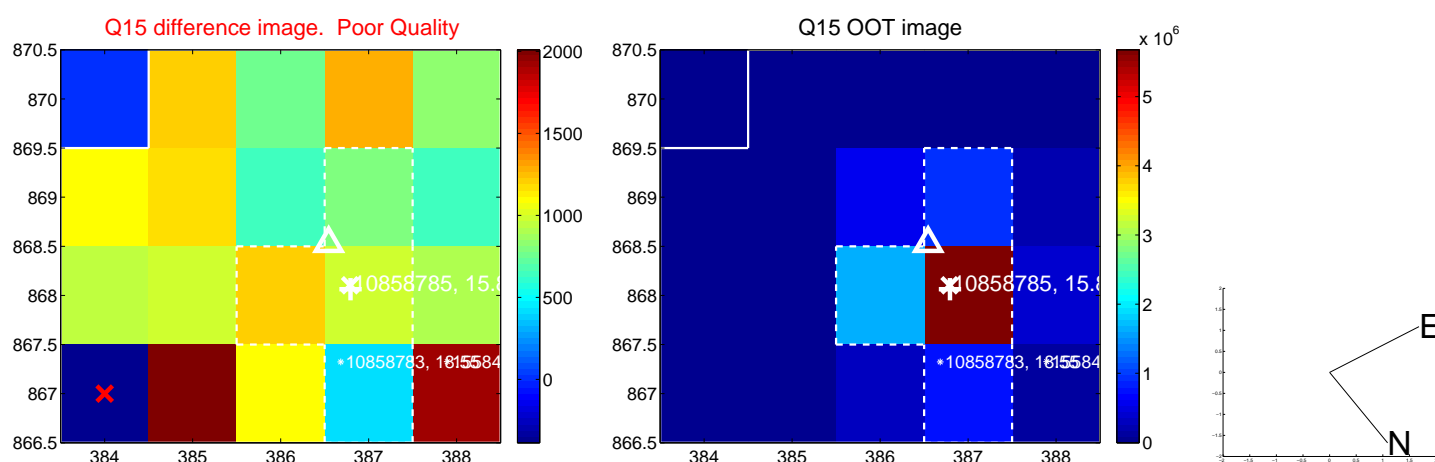
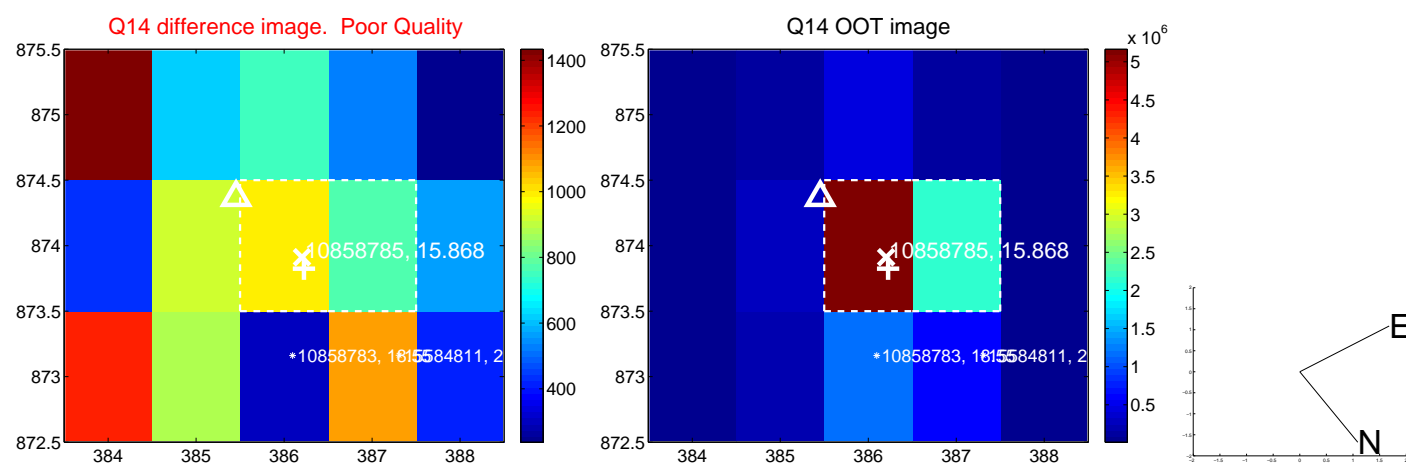
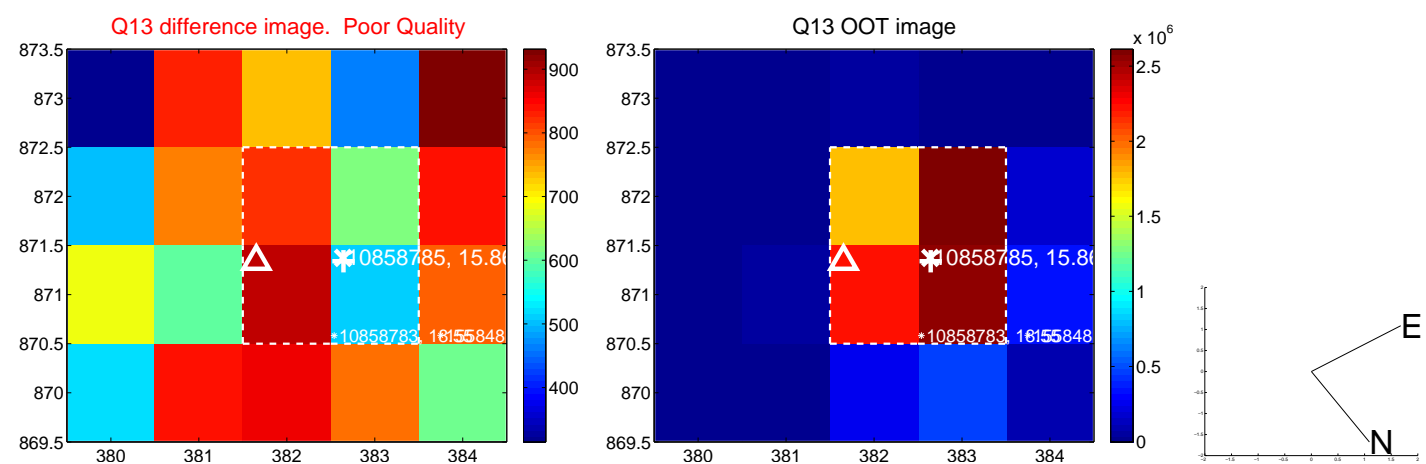


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

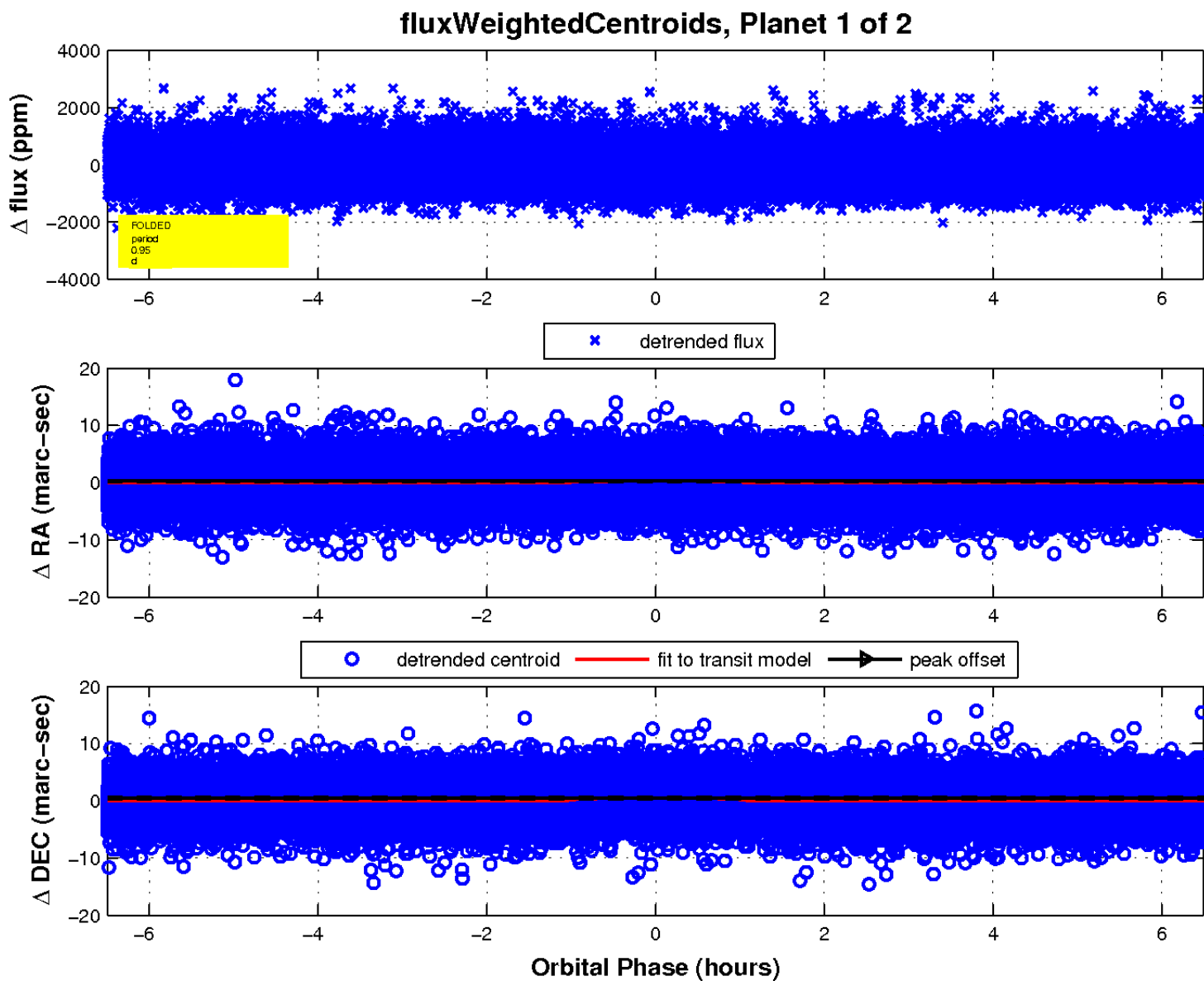
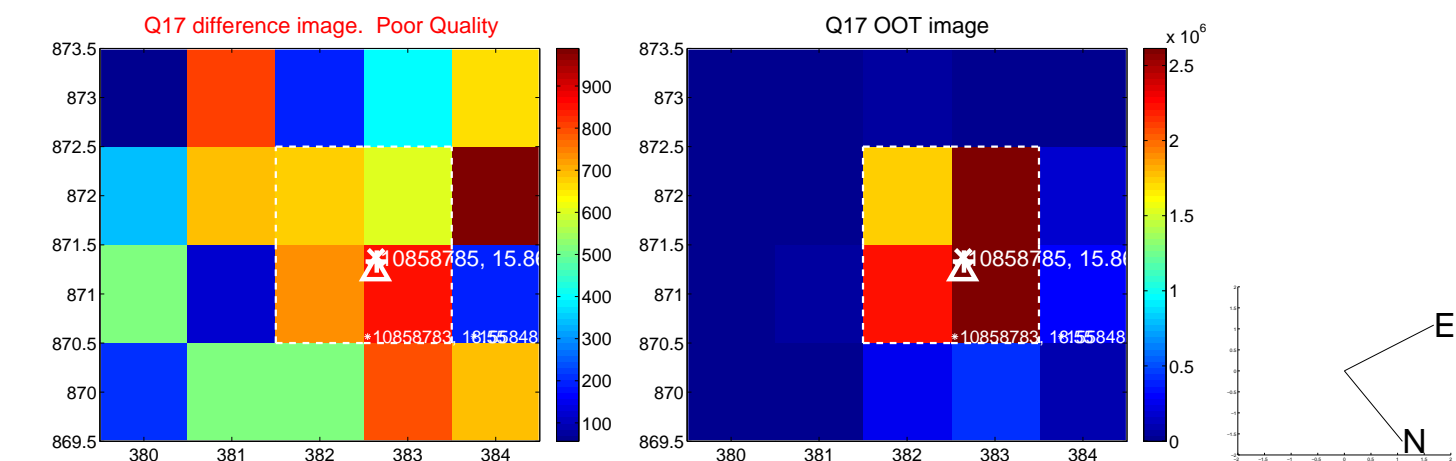




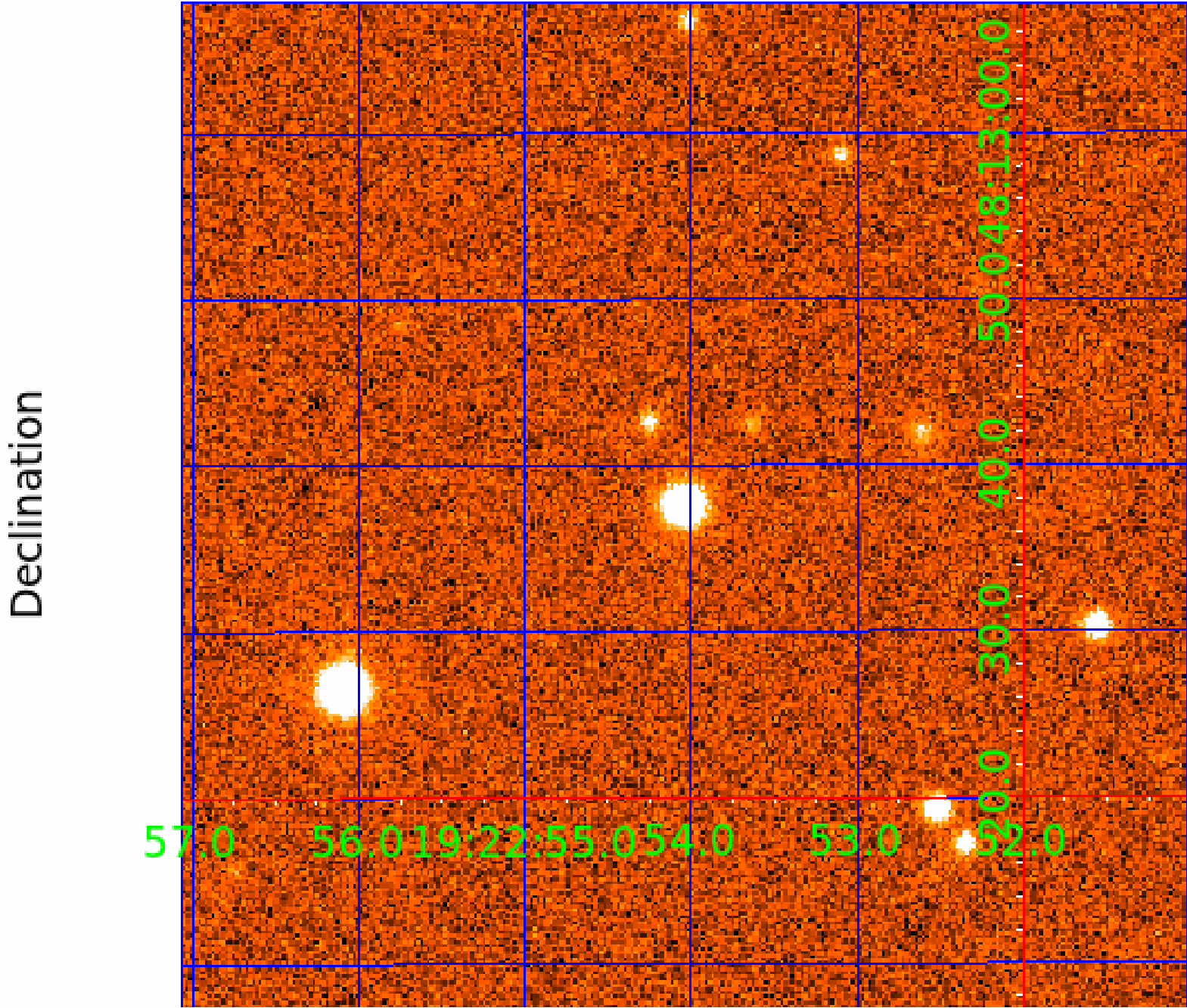
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



UKIRT Image





# KIC 010858785

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
010858785-01	OBS	4171.01	0.952344	132.350793	107.4	2.164	12.5	12.4	0.92	6086	1.13	2897.37
010858785-02	OBS	No	0.952323	131.904486	25.8	2.218	10.2	3.2	0.92	6086	0.48	2897.45

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
010858785-01	OBS	FP	0.00	0	1	1	1	MOD_SEC_ALT—HAS_SEC_TCE—CENT_RESOLVED_OFFSET—EPHEM_MATCH
010858785-02	OBS	FP	0.00	1	1	1	1	IS_SEC_TCE—CENT_RESOLVED_OFFSET—EPHEM_MATCH

**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 010858785-02

TCE (1)	KIC	Parent (2)	Parent KIC	$P_1:P_2$	Dist ( $\mu$ )	$\Delta$ Row	$\Delta$ Col	$m_2$	$m_1$	$D_2/D_1$	Mechanism	Flag	$\sigma_P$	$\sigma_T$
010858785-02	10858785	010858803-02	10858803	1:1	23.0	-5	-3	15.61	15.87	3.15	Direct-PRF	1	2.60	2.45

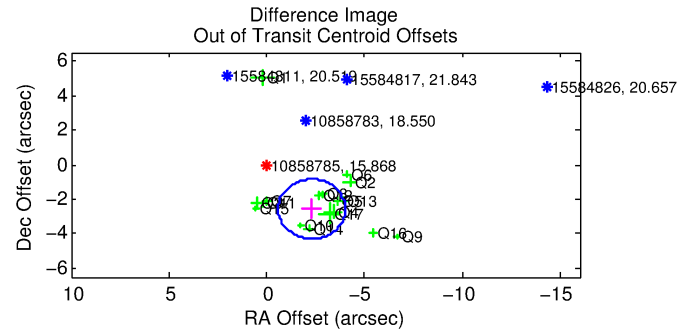
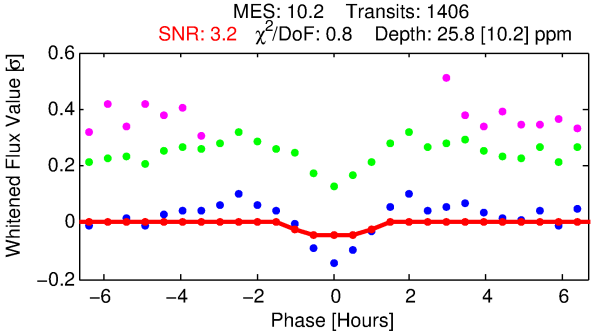
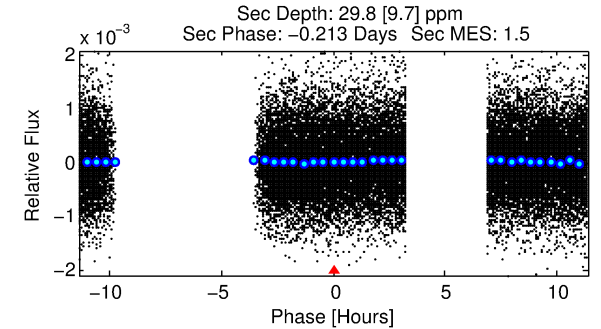
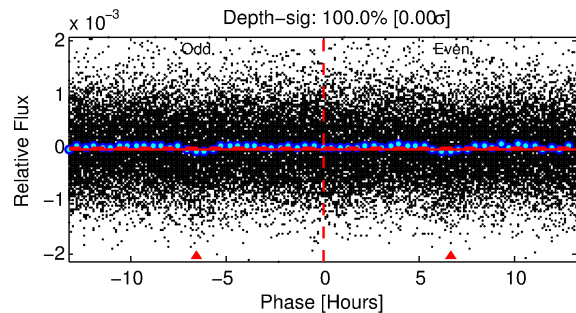
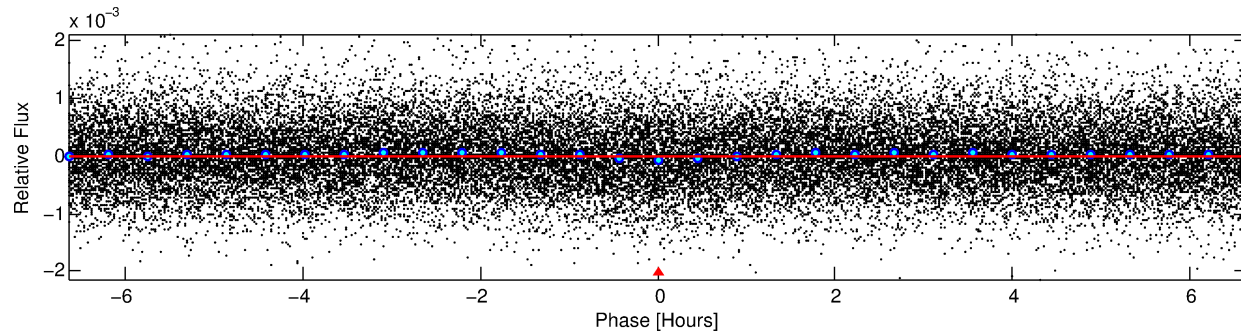
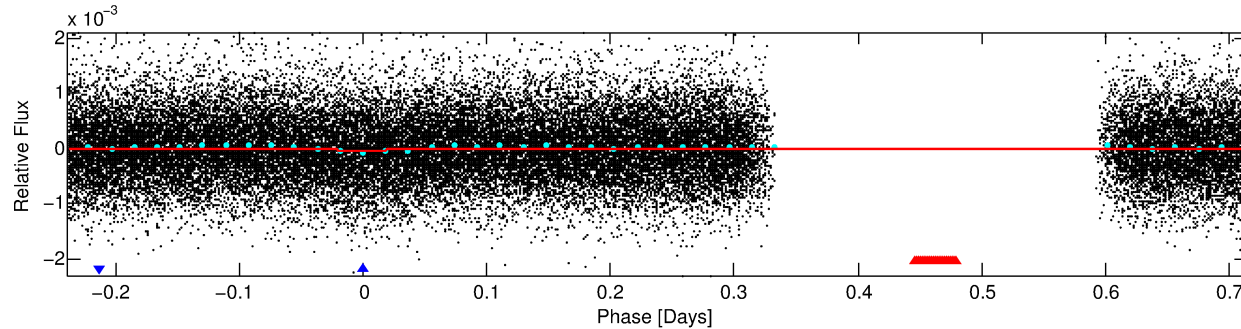
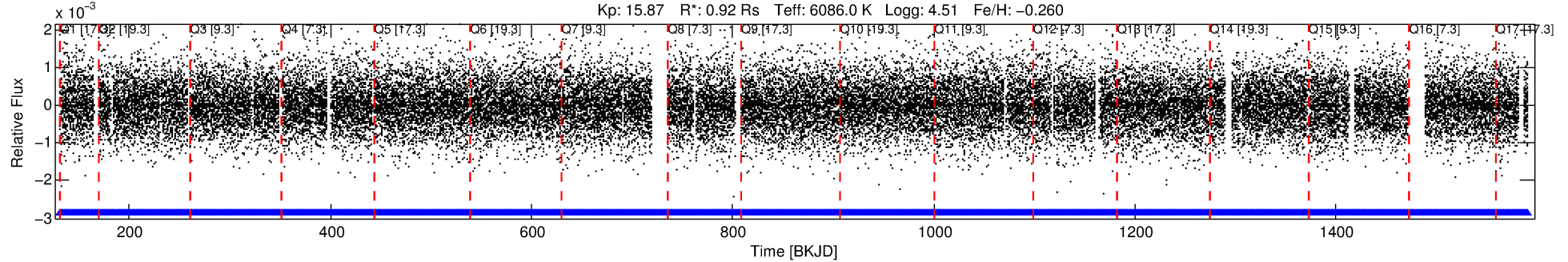
**Notes:**  $P_1:P_2$  is the period ratio. Dist is the distance in arcseconds.  $\Delta$ Row and  $\Delta$ Col are the number of pixels apart in row and column.  $m_2$  and  $m_1$  are the magnitudes of the parent and child.  $D_2/D_1$  is the parent's transit depth divided by the child's.  $\sigma_P$  and  $\sigma_T$  are the significance of the match in period and epoch. For a match to be considered significant  $\sigma_P < 5.0$  and  $\sigma_T < 5.0$ . Matches which have  $\sigma_P$  and  $\sigma_T$  very close to this cutoff should receive extra scrutiny, especially if the period ratio is very large.

# DV One-Page Summary

KIC: 10858785 Candidate: 2 of 2 Period: 0.952 d

KOI: K04171 Corr: No Ephemeris Match

Kp: 15.87 R\*: 0.92 Rs Teff: 6086.0 K Logg: 4.51 Fe/H: -0.260



## DV Fit Results:

Period = 0.95232 [0.00003] d  
Epoch = 131.9045 [0.0099] BKJD  
Rp/R\* = 0.0048 [0.0054]  
a/R\* = 2.95 [14.38]  
b = 0.50 [8.32]  
Seff = 2897.45 [1026.83]  
Teq = 1871 [166] K  
Rp = 0.48 [0.55] Re  
a = 0.0190 [0.0043] AU  
Ag = 25.47 [58.25] [0.42σ]  
Teffp = 6498 [3683] K [1.26σ]

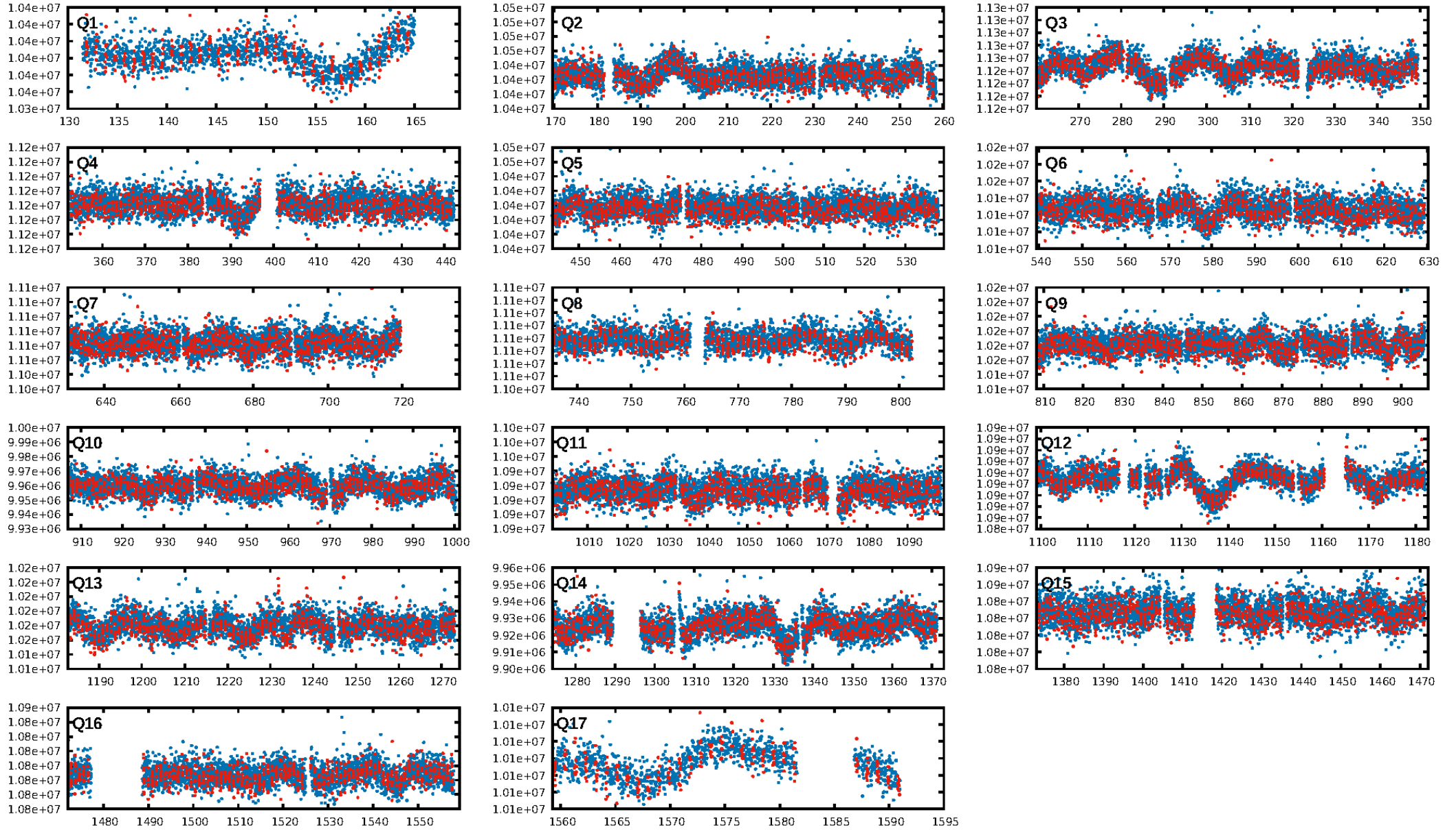
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 0.0% [0.00σ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: 1.54e-24  
RollingBand-fgt: 1.00 [1342/1342]  
GhostDiagnostic-chr: -1.918  
Centroid-sig: 0.0%  
Centroid-so: 18.023 arcsec [4.09σ]  
OotOffset-rm: 3.439 arcsec [5.99σ]  
KicOffset-rm: 3.374 arcsec [5.83σ]  
OotOffset-st: 4/4/4/5 [17]  
KicOffset-st: 4/4/4/5 [17]  
DiffImageQuality-fgm: 0.00 [0/17]  
DiffImageOverlap-fno: 1.00 [17/17]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 29-Jan-2016 11:13:22 Z

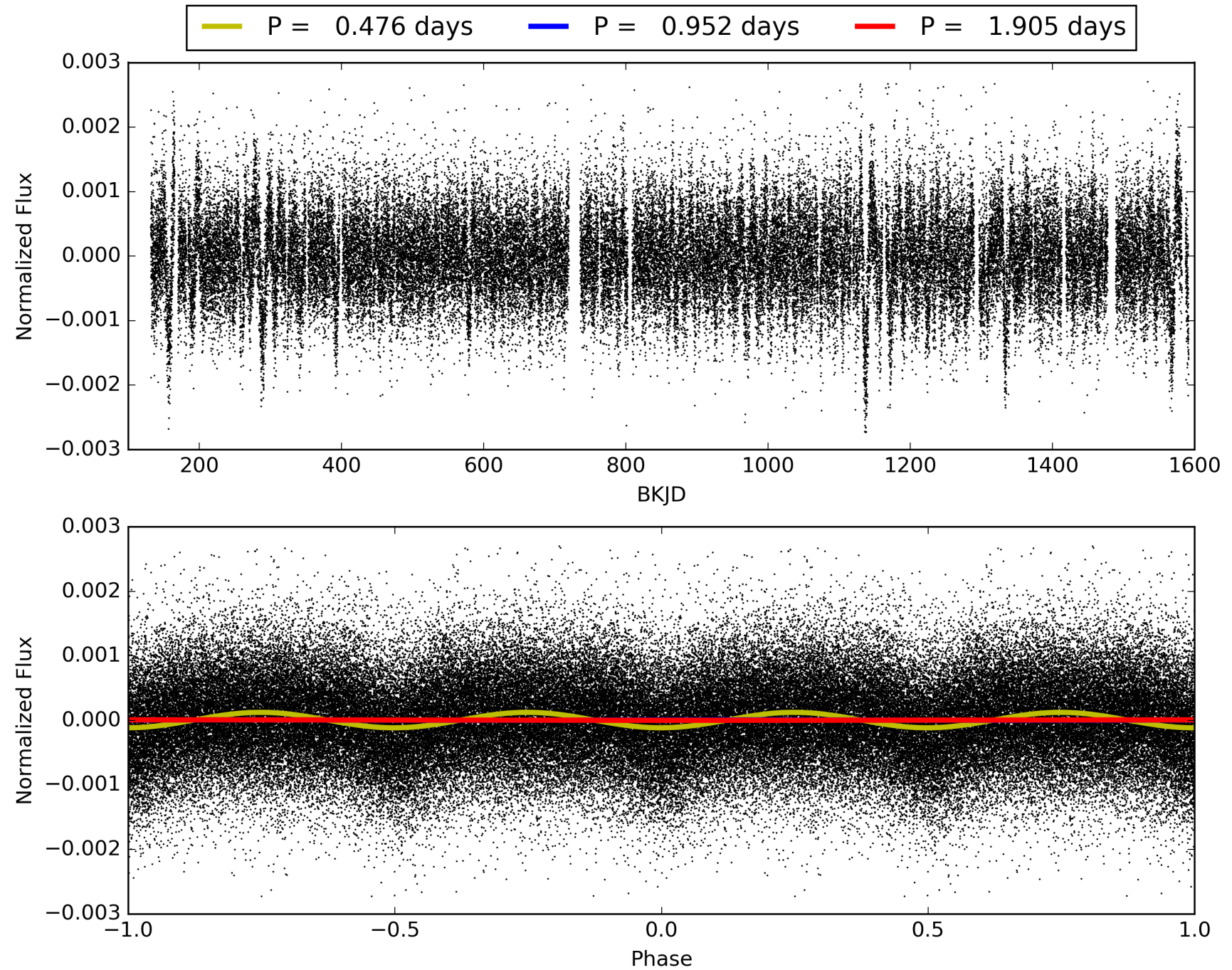
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 010858785-02, PDC Light Curves





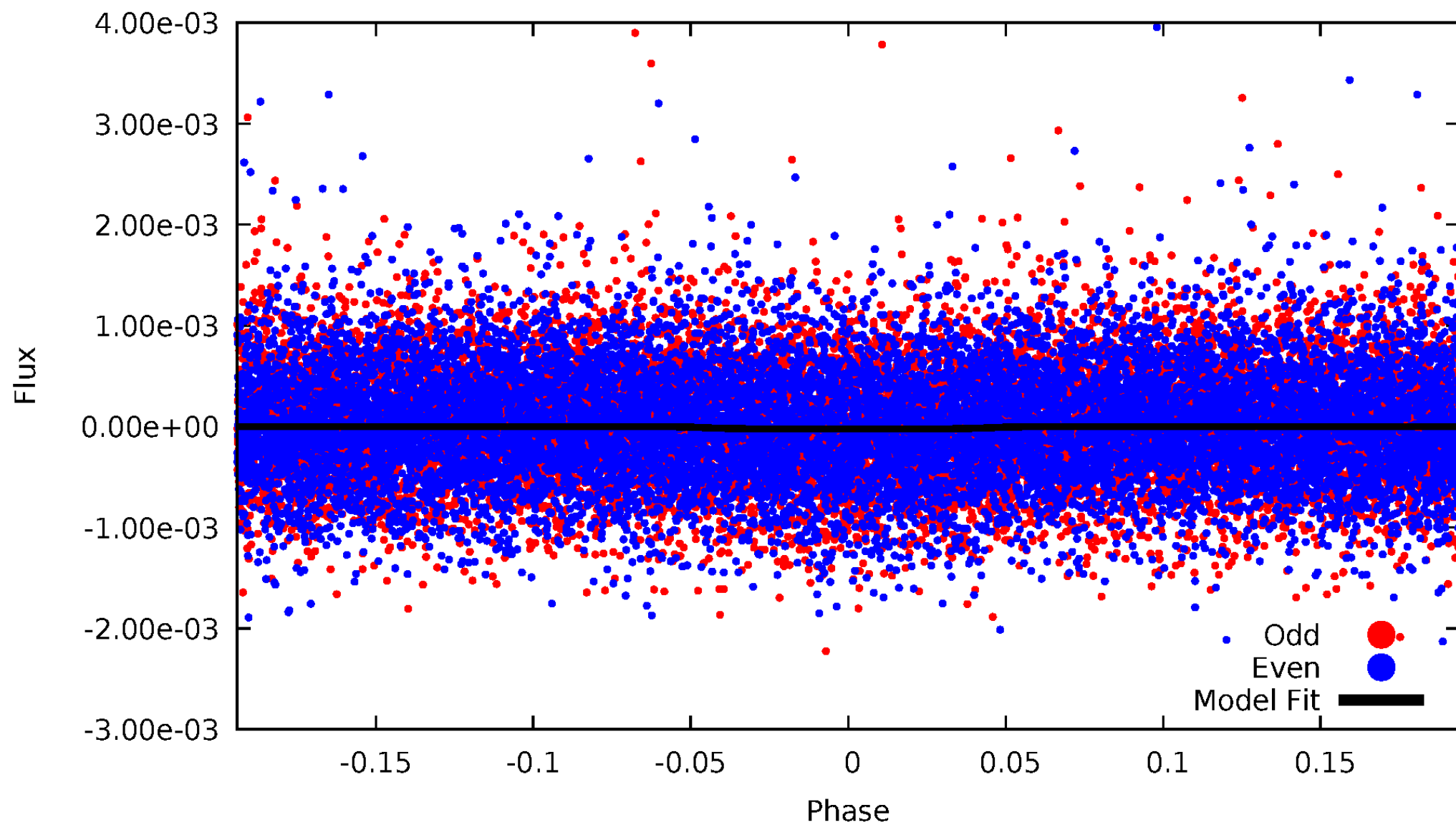
# TCE 010858785-02





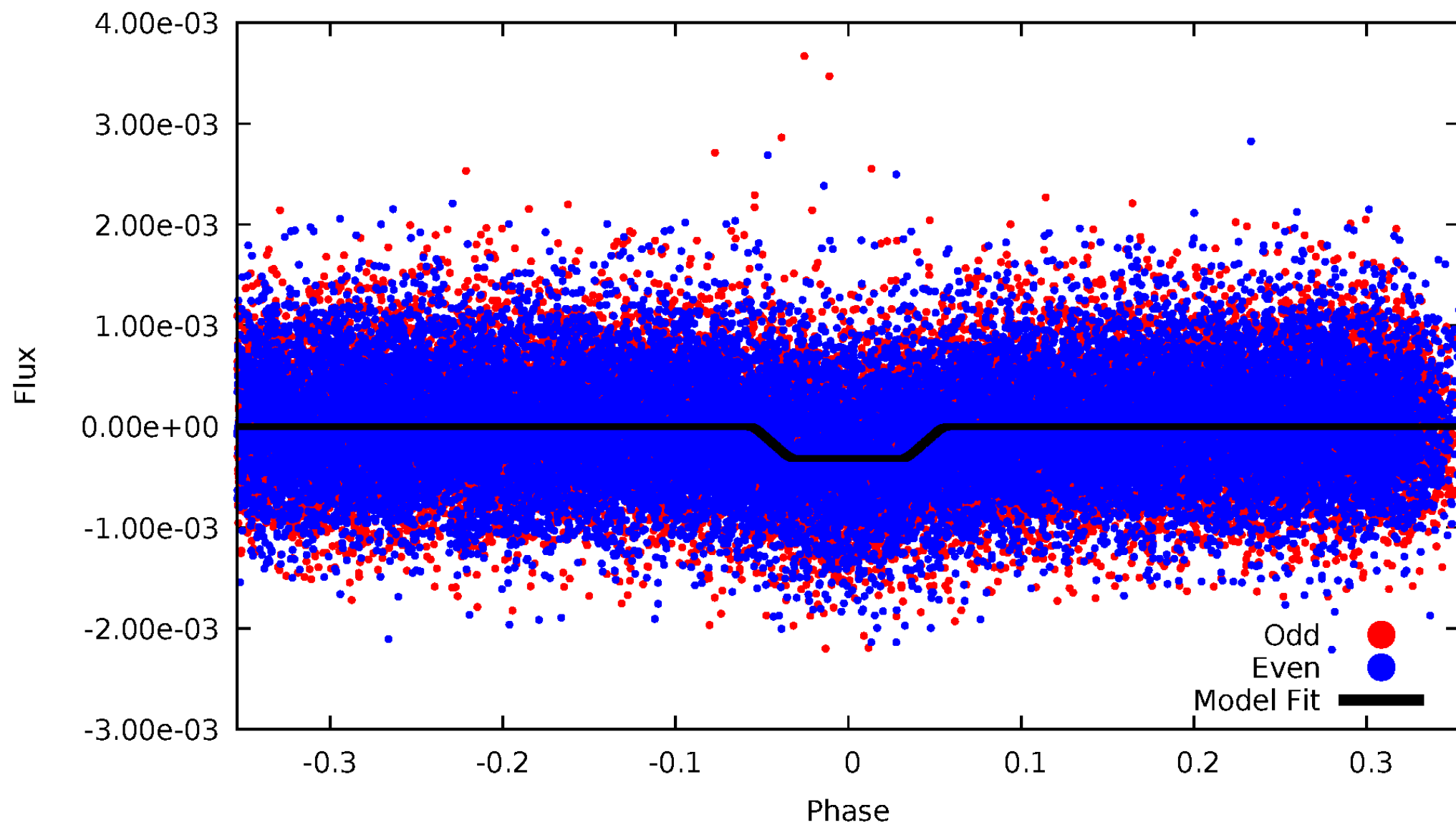
# DV Odd/Even

TCE 010858785-02



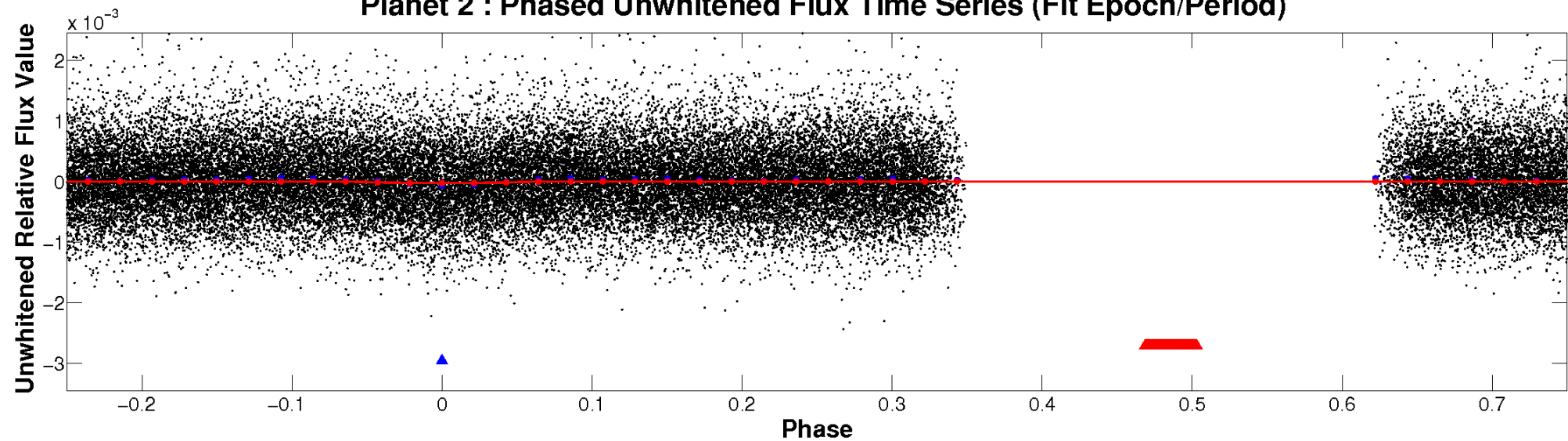
# ALT Odd/Even

TCE 010858785-02

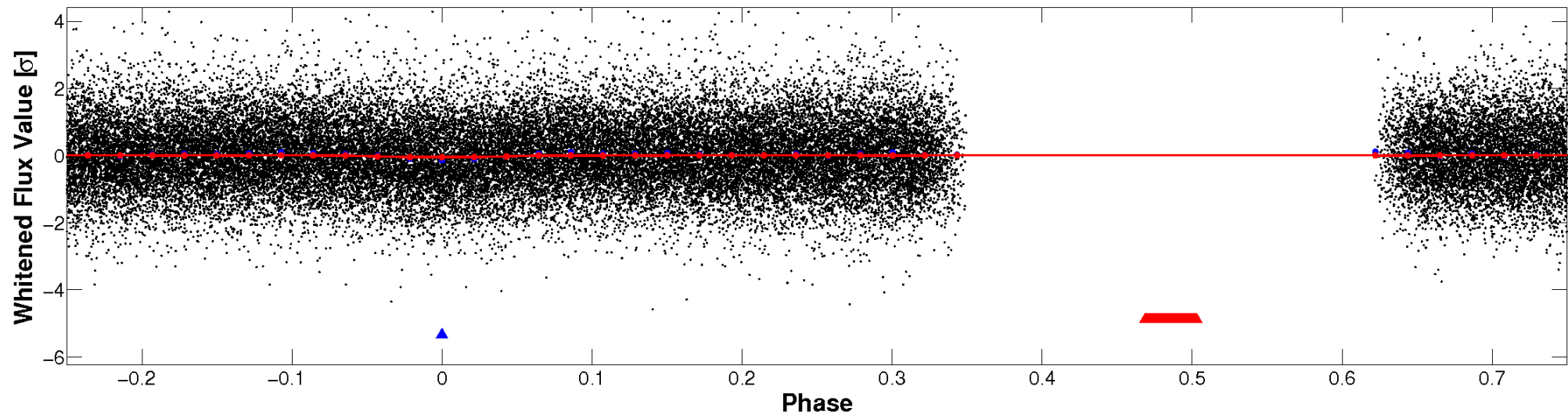


# Non-Whitened Vs. Whitened Light Curve

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

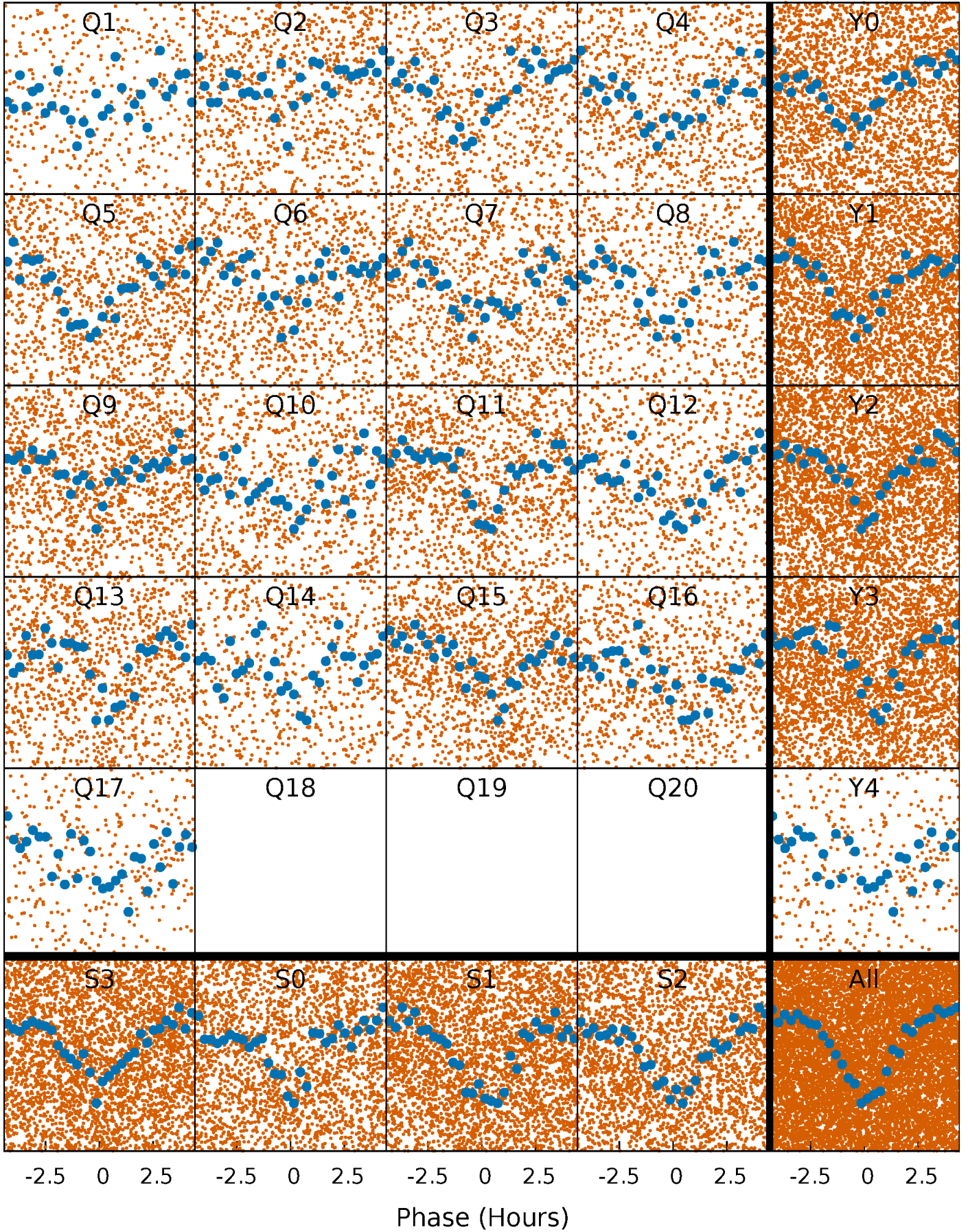


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

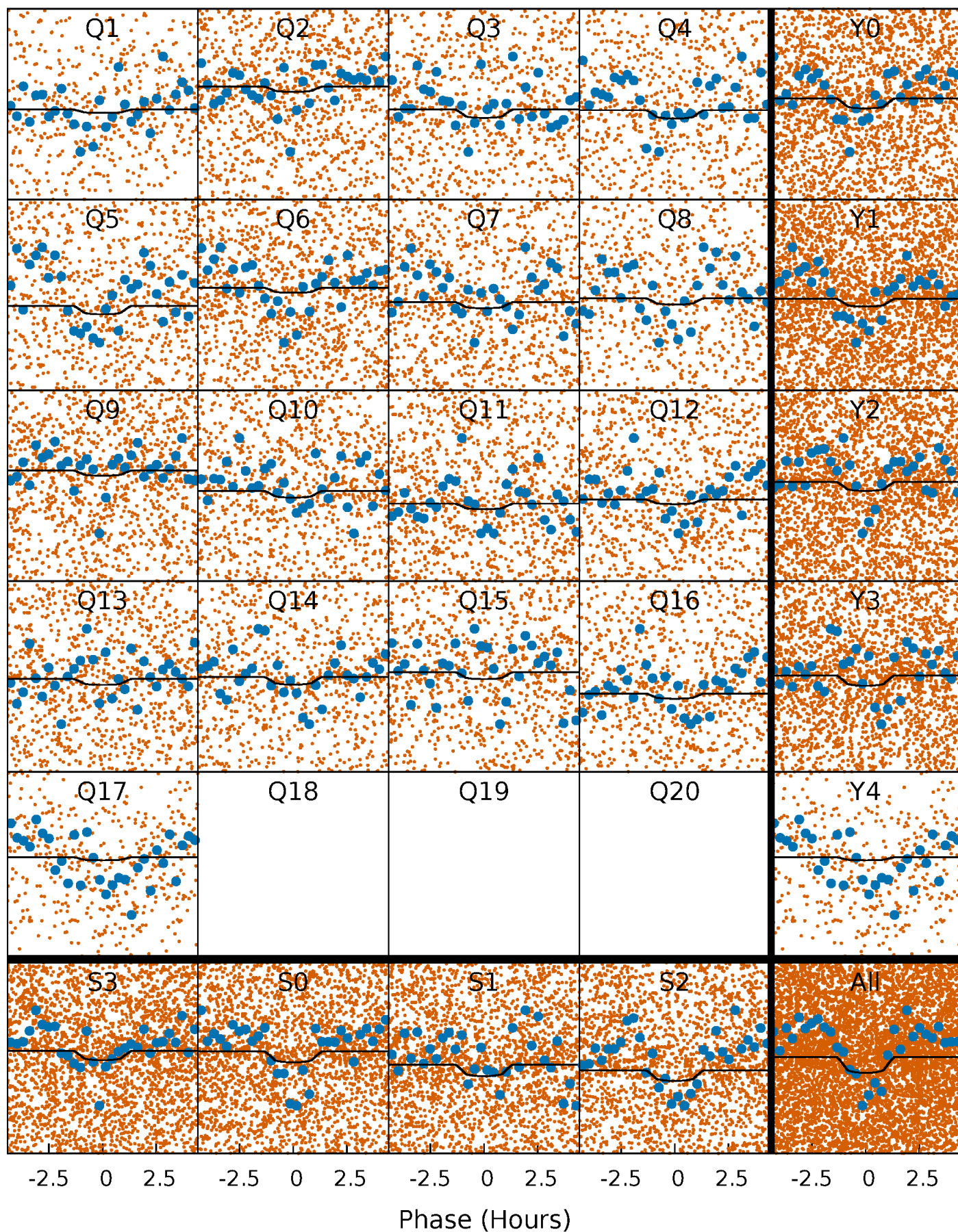
TCE 010858785-02   P= 0.952323 Days    $T_0=131.904486$  (BKJD)





# DV Quarter-Phased Transit Curves

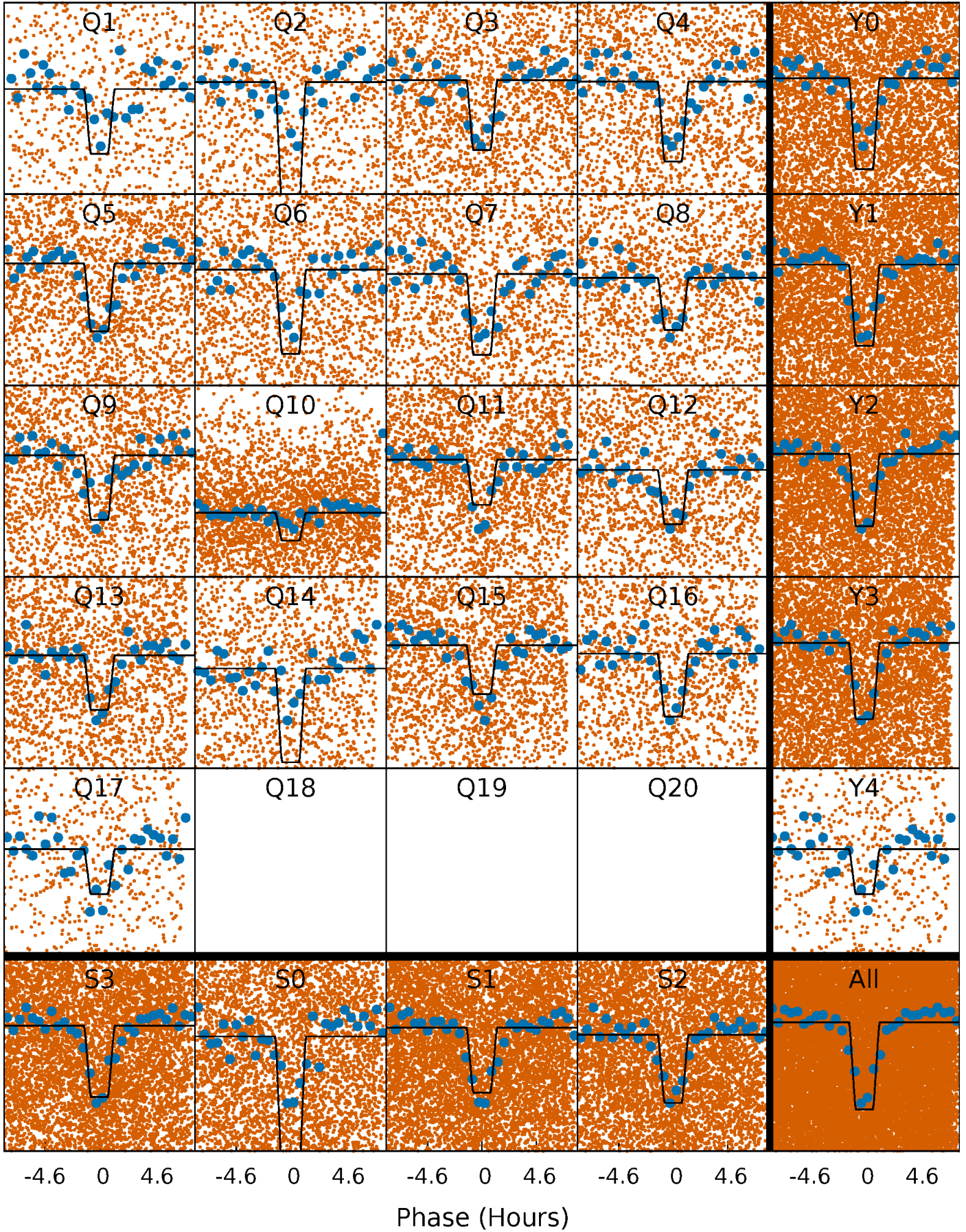
TCE 010858785-02   P= 0.952323 Days    $T_0=131.904486$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

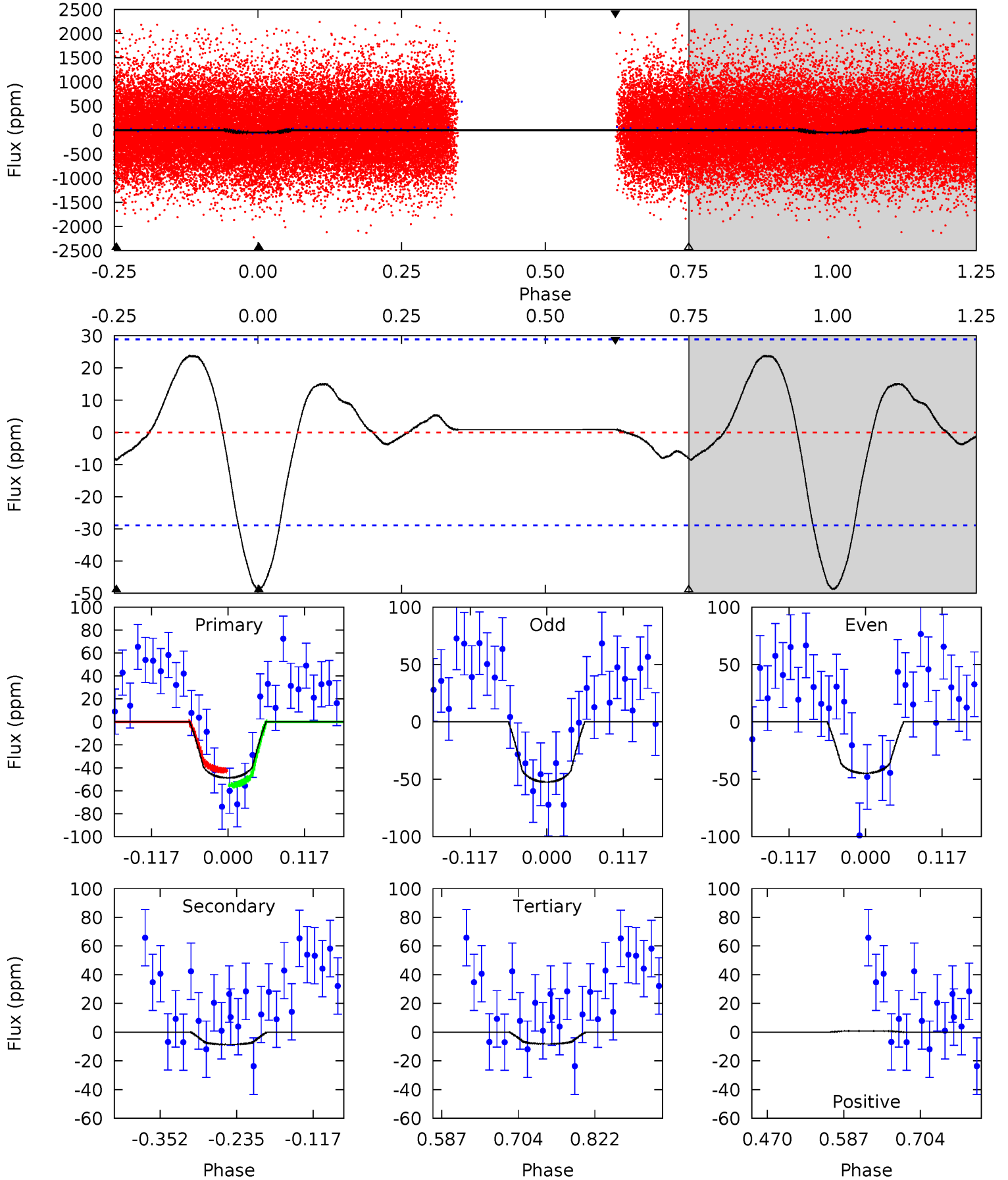
TCE 010858785-02   P= 0.952373 Days    $T_0=131.865683$  (BKJD)



# DV Model-Shift Uniqueness Test

010858785-02, P = 0.952323 Days, E = 130.952163 Days

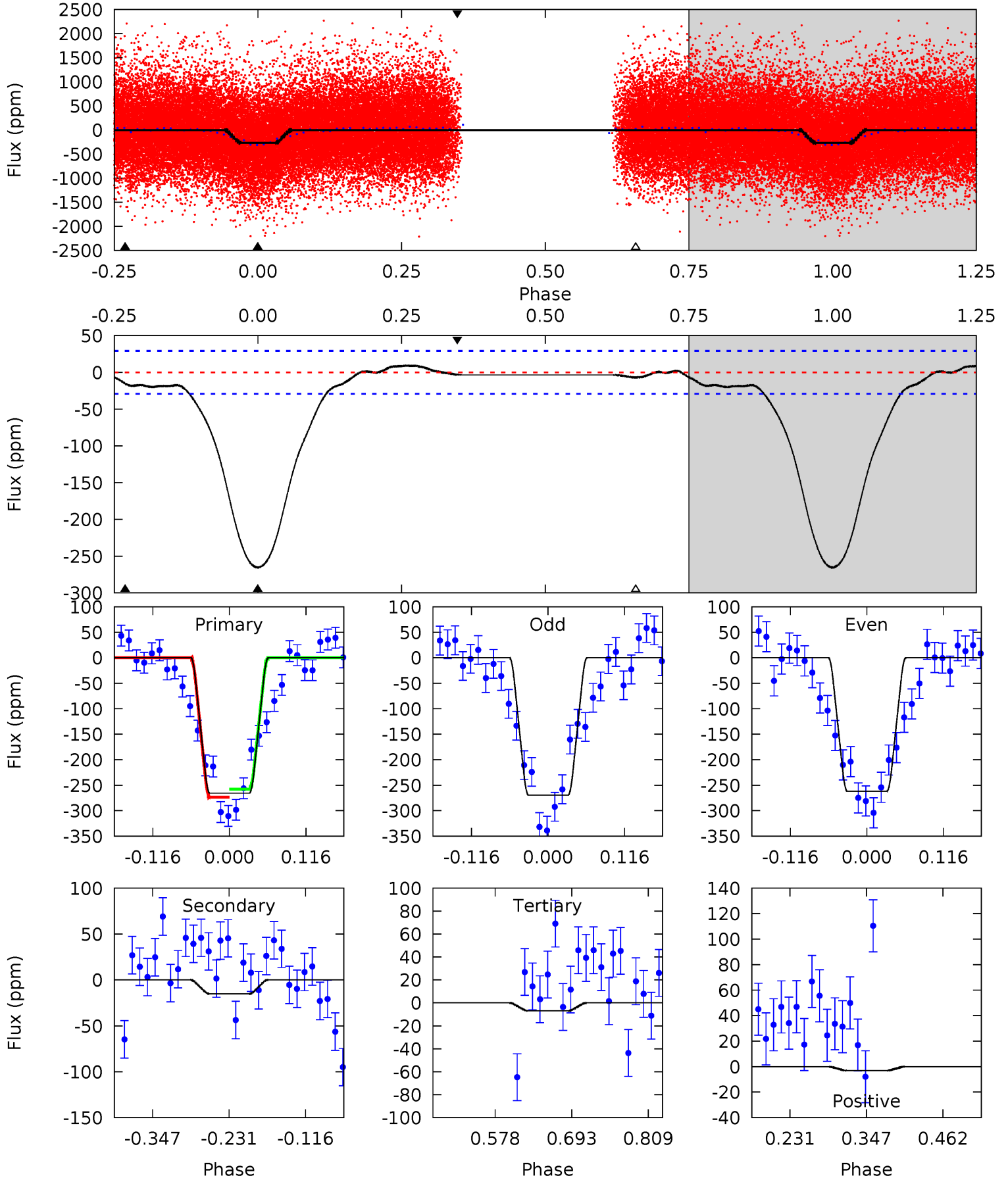
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
7.65	1.35	1.29	0.13	4.53	1.57	1.12	6.36	7.52	0.06	1.22	0.60	1.53	0.33	1.03



# Alt Model-Shift Uniqueness Test

010858785-02, P = 0.952373 Days, E = 130.913310 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
41.2	2.36	1.09	-0.47	4.53	1.57	1.33	40.1	41.6	1.27	2.83	0.60	0.98	0.03	1.24



### Stellar Parameters For KIC 010858785

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M$ ( $M_{\odot}$ )	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6086^{+164}_{-200}$	$4.511^{+0.048}_{-0.180}$	$-0.260^{+0.250}_{-0.350}$	$0.921^{+0.247}_{-0.099}$	$1.003^{+0.116}_{-0.129}$	$1.808^{+0.448}_{-0.881}$
	+3%/-3%	+1%/-4%	+96%/-135%	+27%/-11%	+12%/-13%	+25%/-49%
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 010858785-02 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-9 \pm 6$	$0.63^{+0.52}_{-0.39}$	$2659^{+157}_{-127}$	$4159^{+2750}_{-1588}$	$3.363^{+26.176}_{-2.928}$
Alt.	$-15 \pm 6$	$1.87^{+0.60}_{-0.53}$	$2673^{+171}_{-130}$	$3098^{+578}_{-701}$	$0.777^{+0.980}_{-0.418}$

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

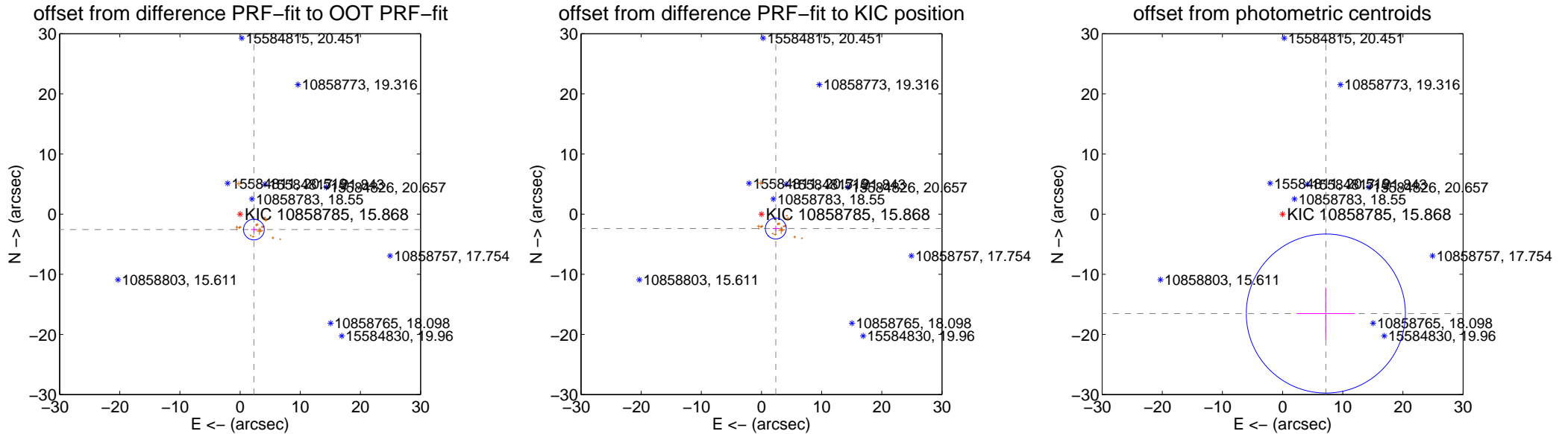
## DV Centroid Data

Supplemental centroid analysis for 010858785-02. Kepler magnitude: 15.87. Transit SNR 3.17

There are 0 quarters with good PRF difference image offsets

The direct PRF centroid is offset from the target star catalog position by about 0.17 arcsec

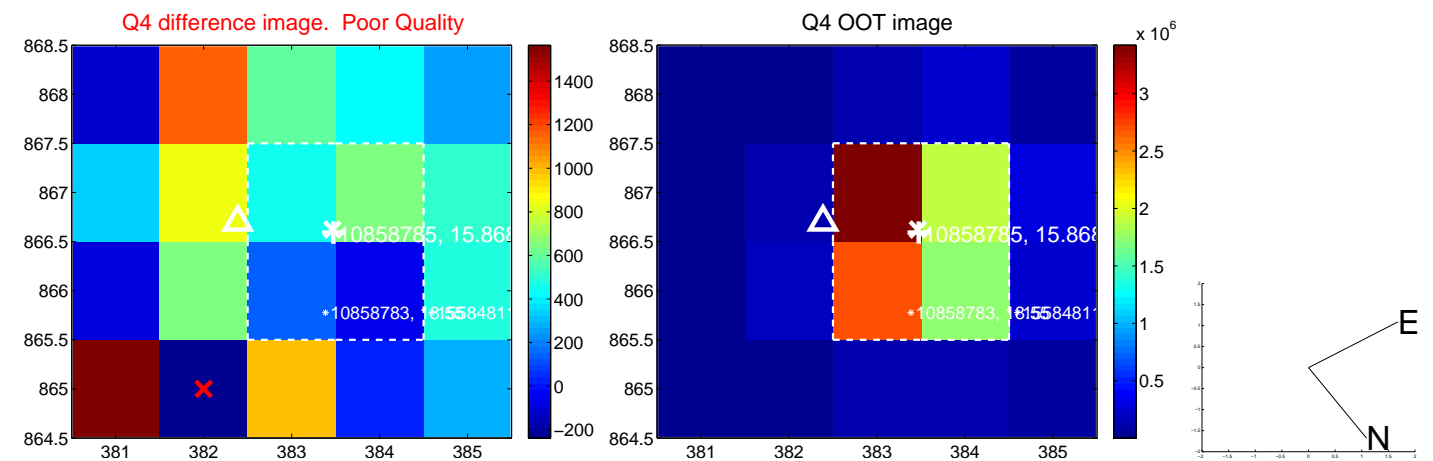
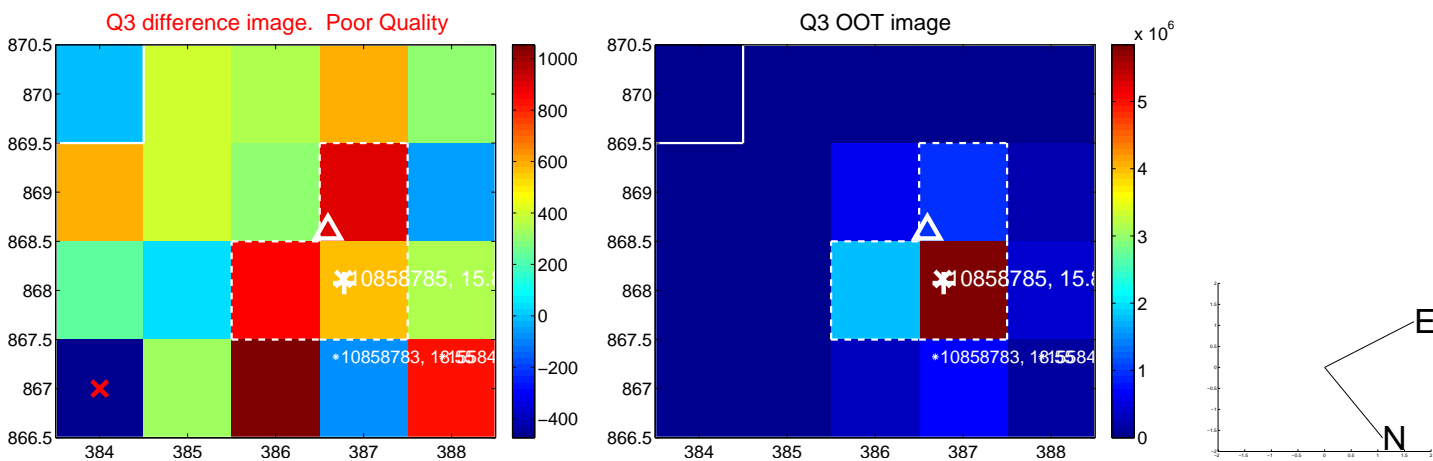
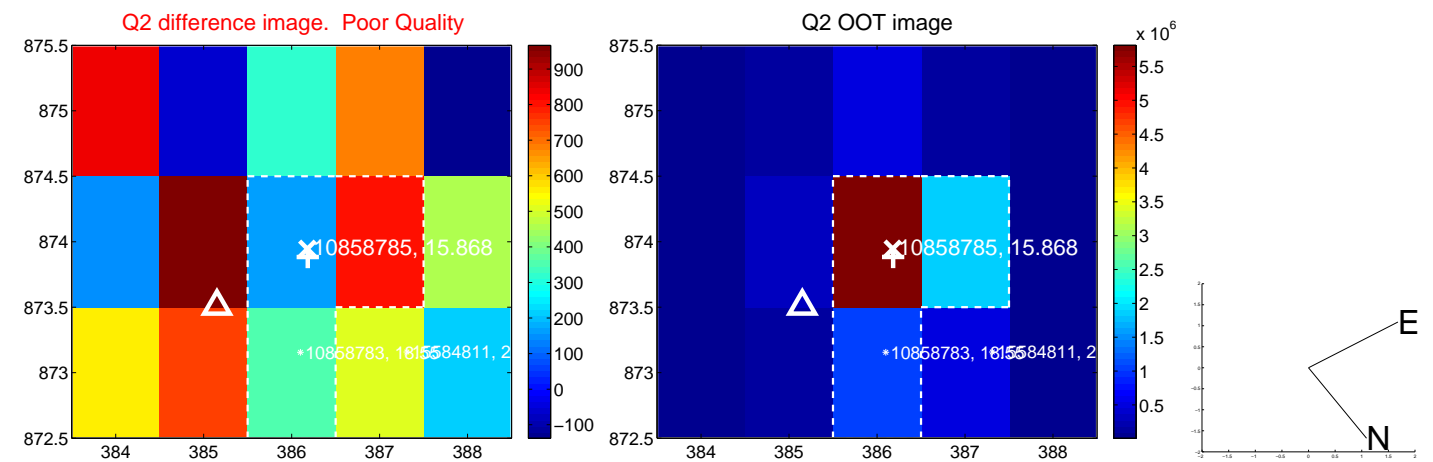
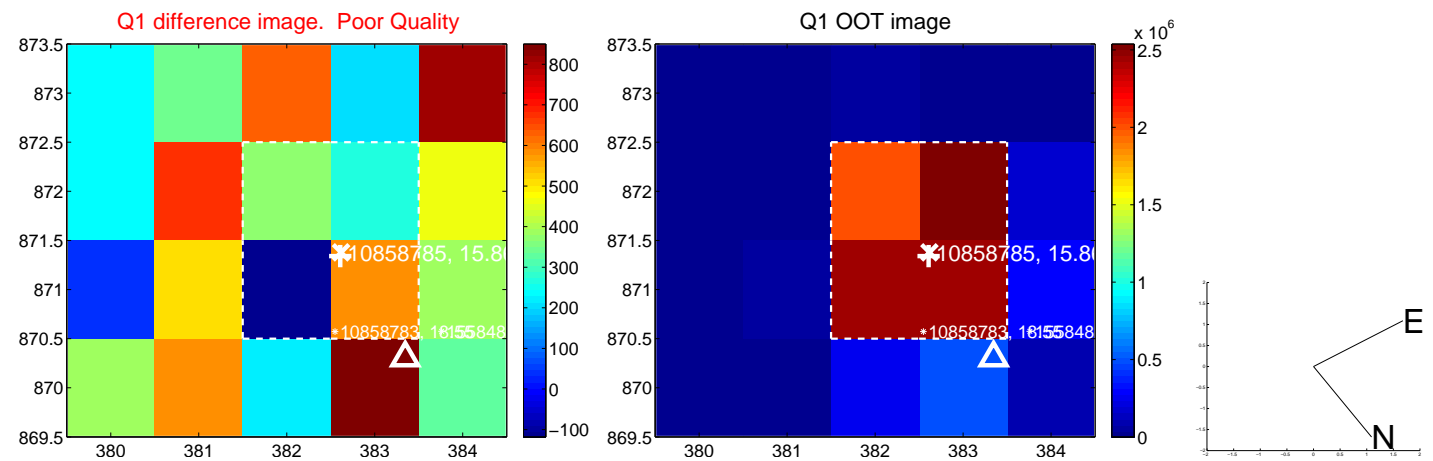
	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$3.439 \pm 0.574$	5.99	$-2.292 \pm 0.483$	$-2.564 \pm 0.532$
PRF-fit source offset from KIC position	$3.374 \pm 0.578$	5.83	$-2.378 \pm 0.529$	$-2.394 \pm 0.474$
photometric centroid source offset	$18.02 \pm 4.41$	4.09	$-7.19 \pm 4.85$	$-16.53 \pm 4.32$



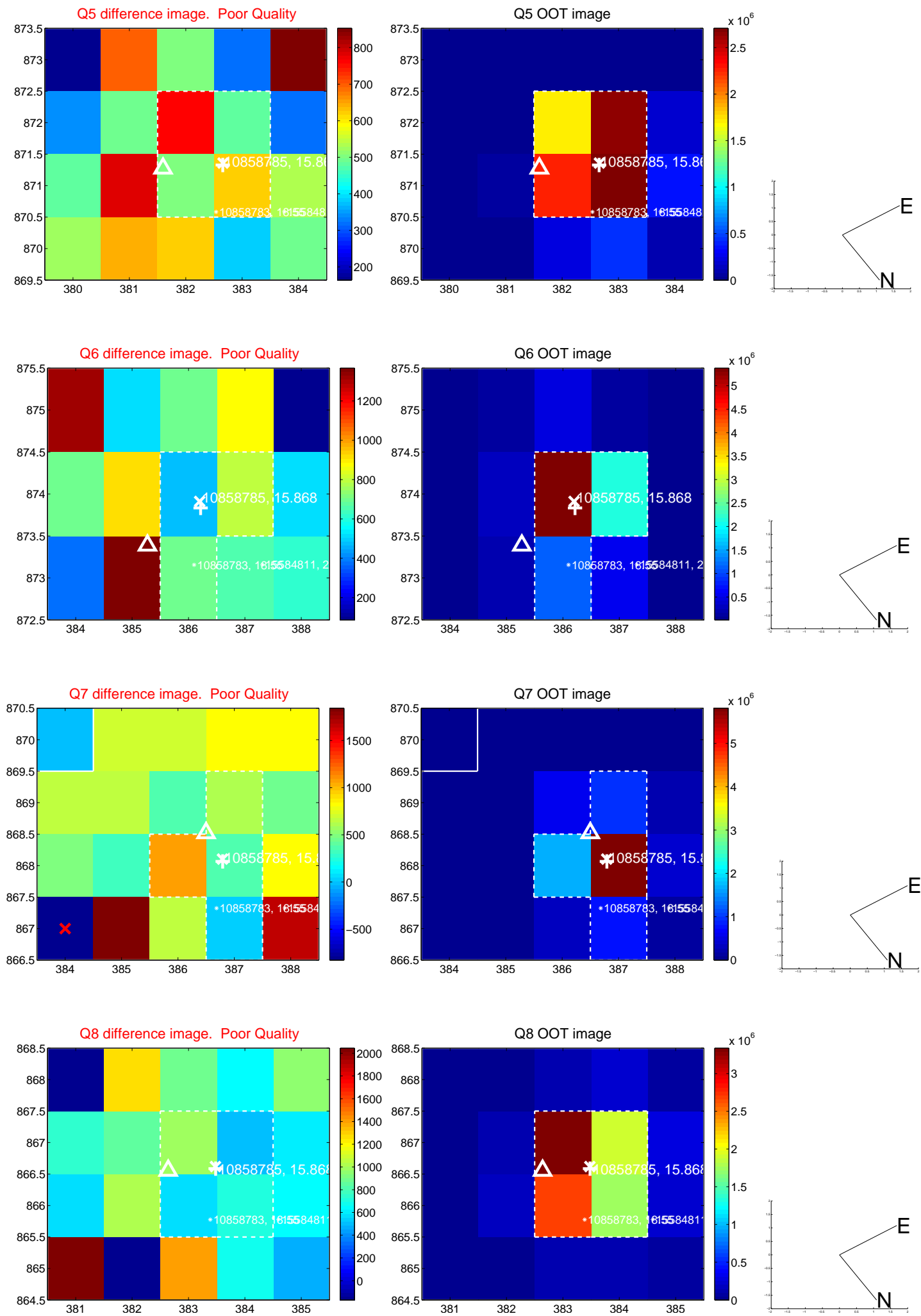
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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



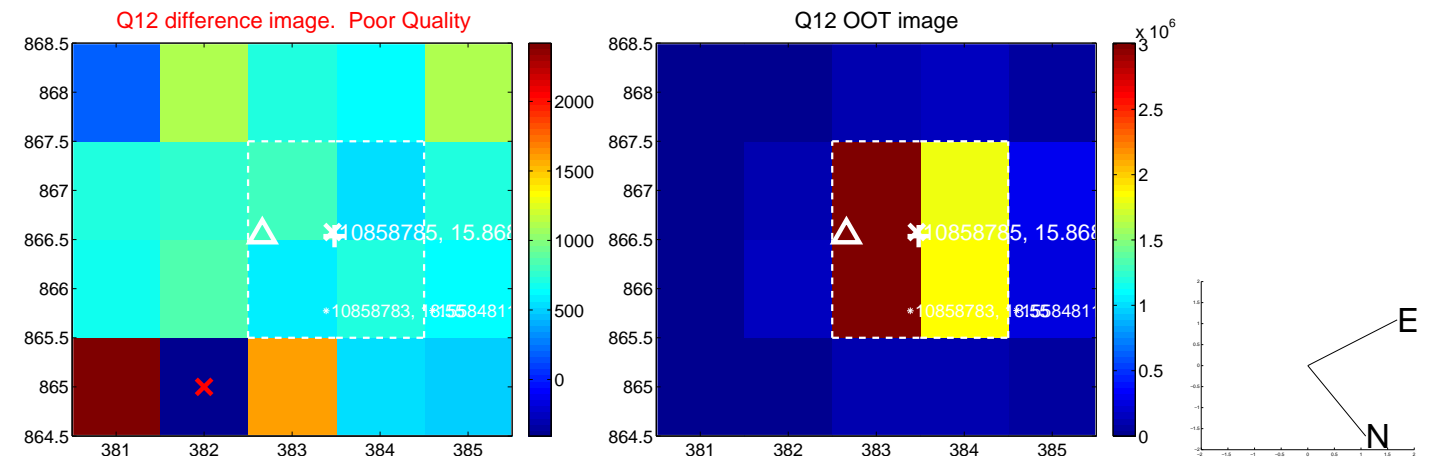
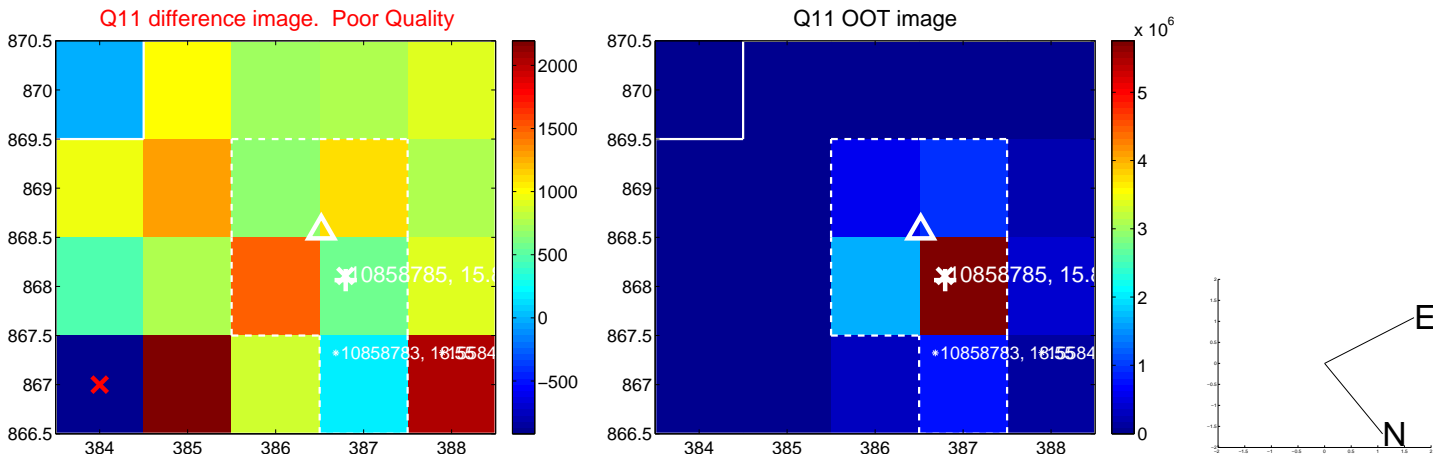
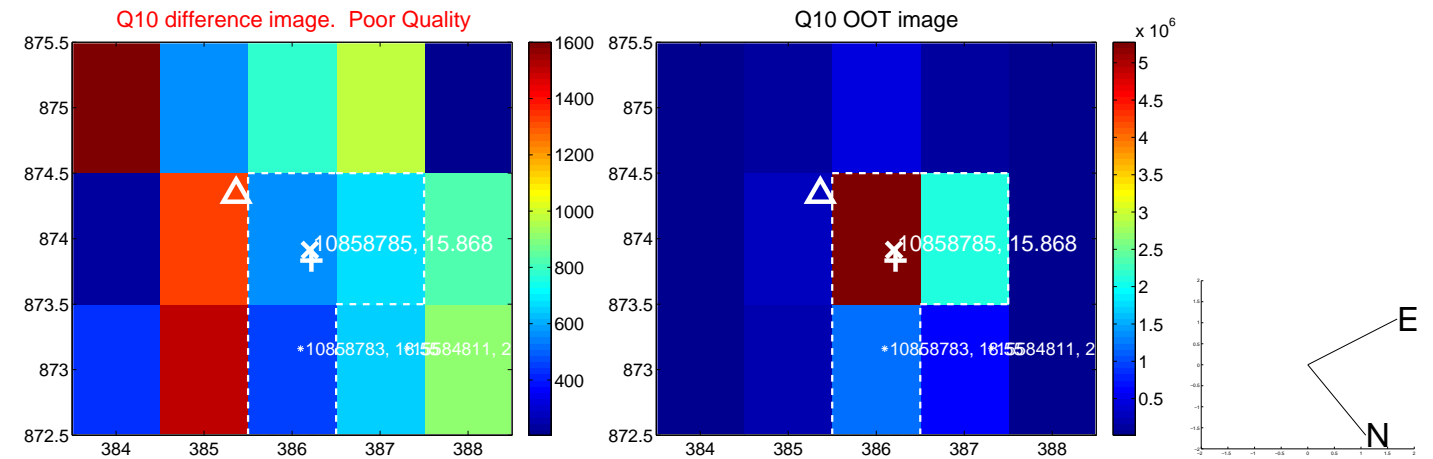
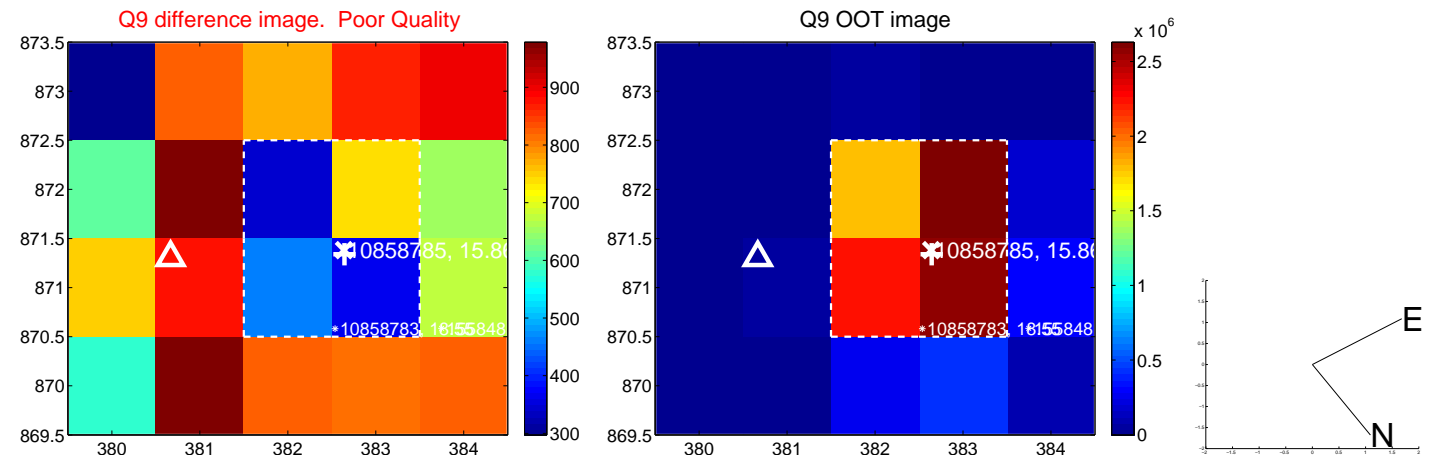
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



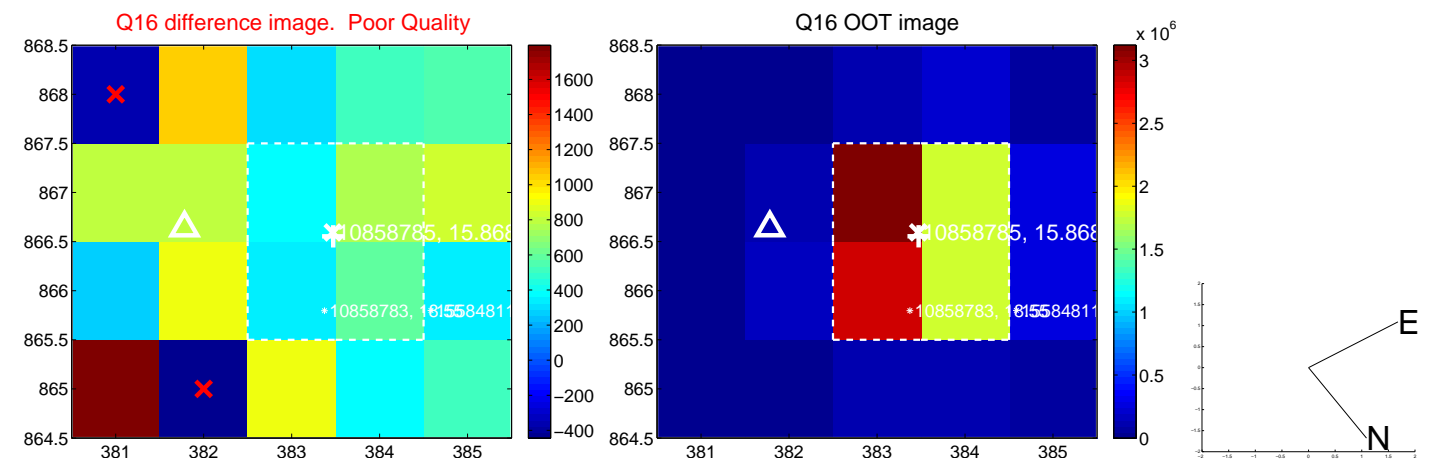
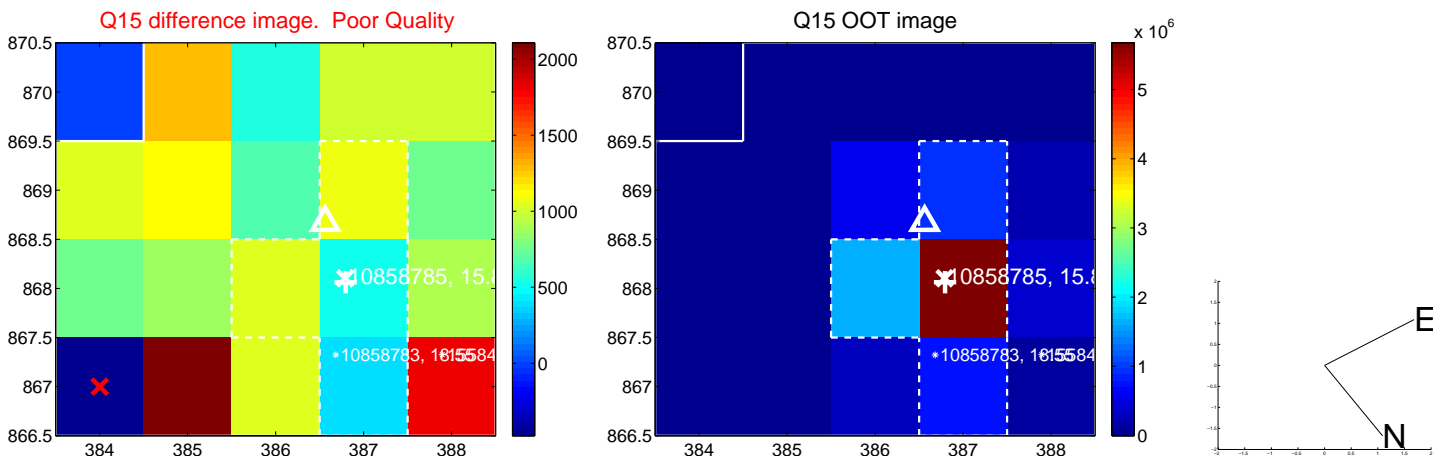
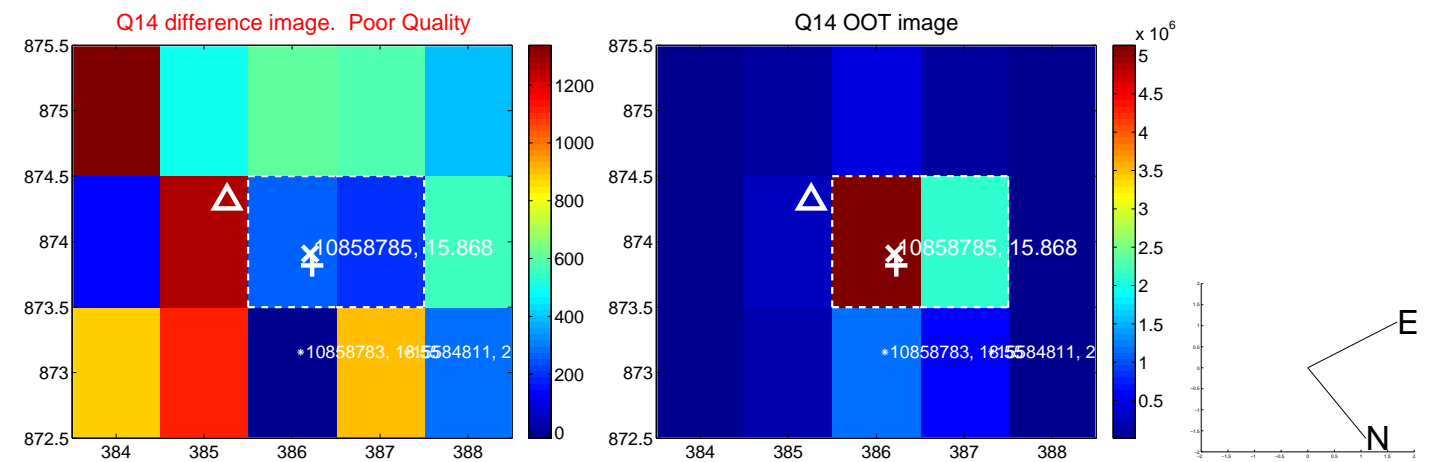
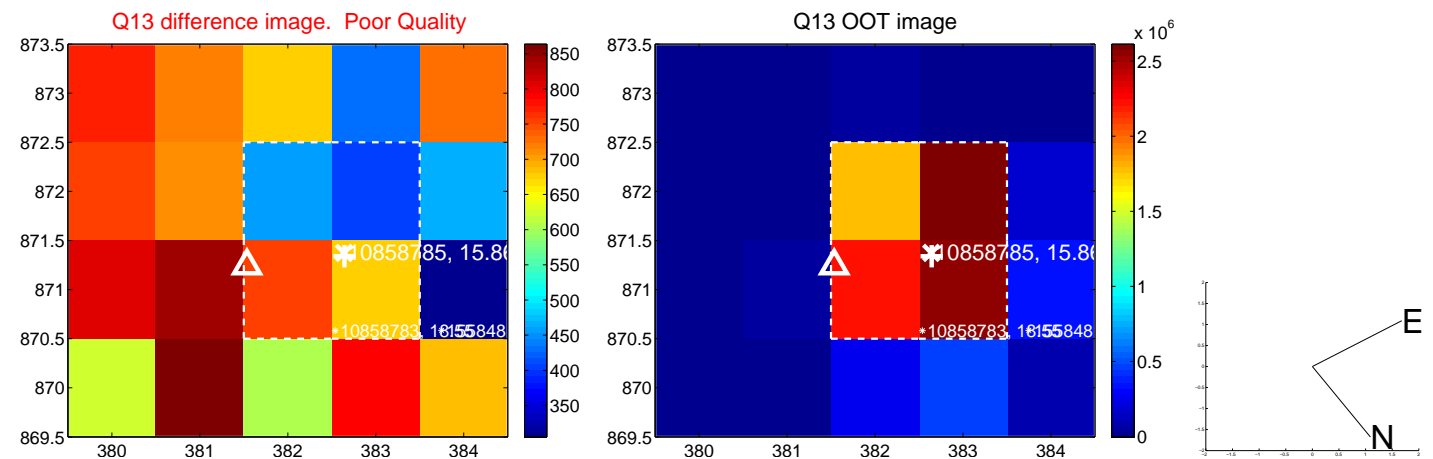
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



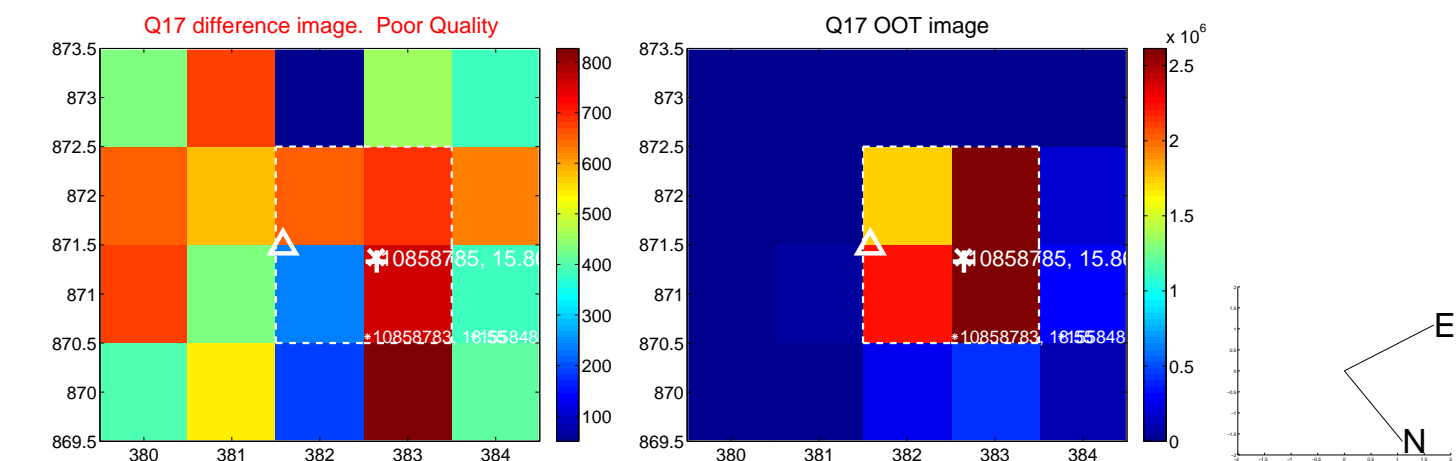
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



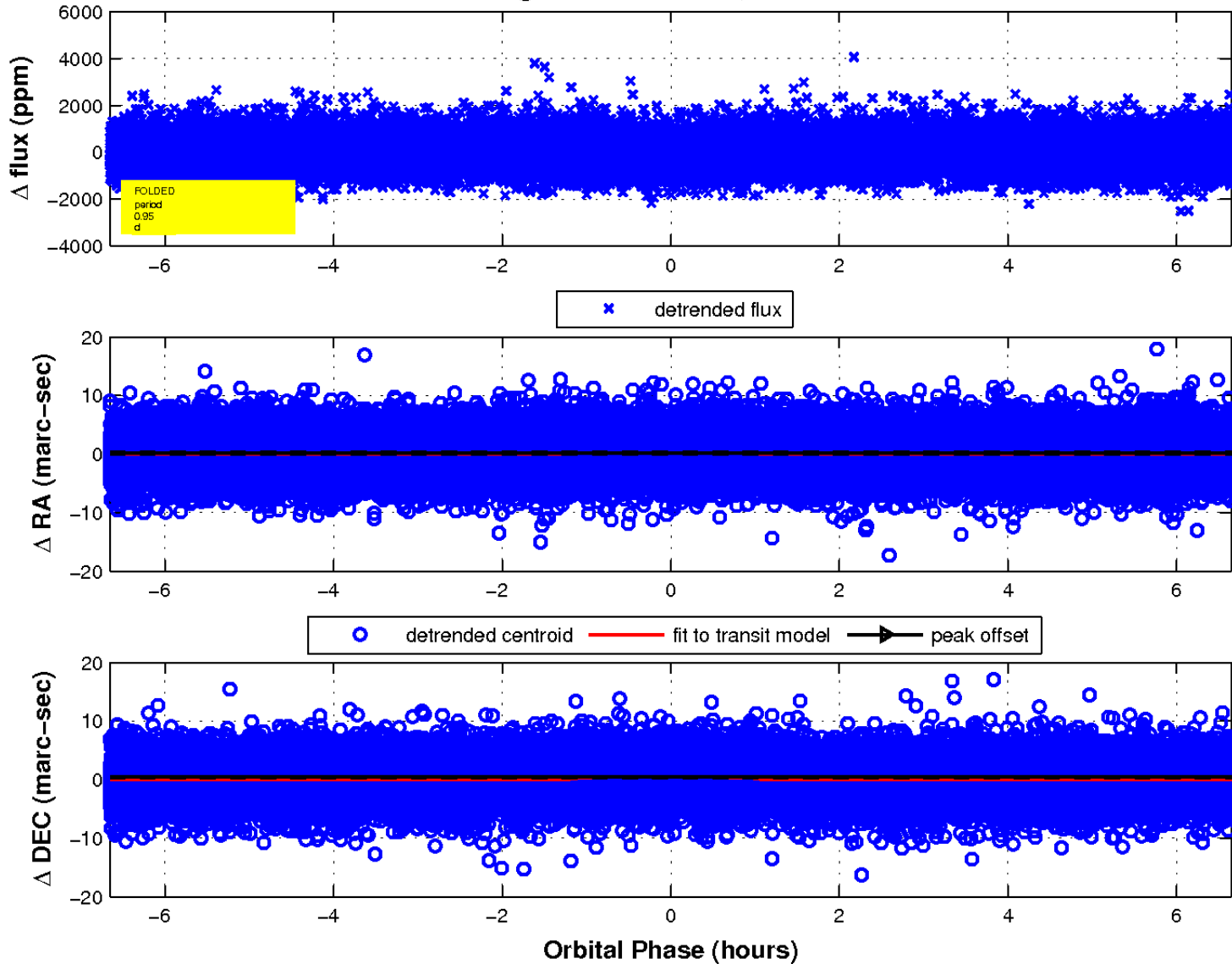
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



fluxWeightedCentroids, Planet 2 of 2





UKIRT Image

Declination

