

# KIC 010684587

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
010684587-01	OBS	No	0.528245	131.979077	356.5	1.652	9.7	10.9	3.02	7530	6.64	101974.25
010684587-02	OBS	No	0.575138	131.612365	657.3	0.801	7.6	9.6	3.02	7530	9.14	91041.96

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
010684587-01	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—CENT_SATURATED
010684587-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE_ZUMA_TRACKER—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—CENT_SATURATED

**Notes:** OBS = Observed. INJ = Injected. INV = Inverted. SCR = Scrambled.

N = Not Transit-Like. S = Stellar Eclipse. C = Centroid Offset. E = Ephemeris Match.

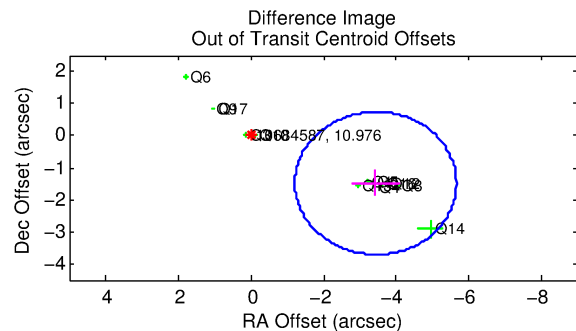
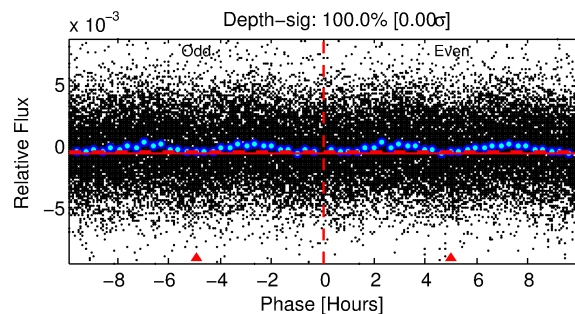
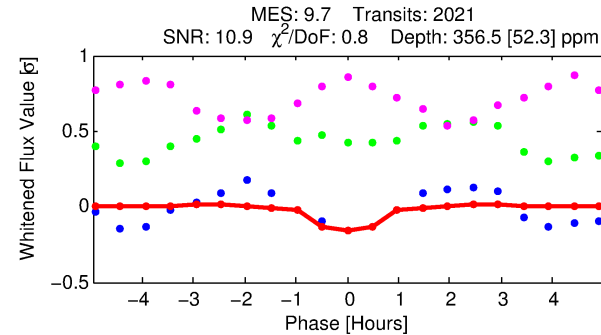
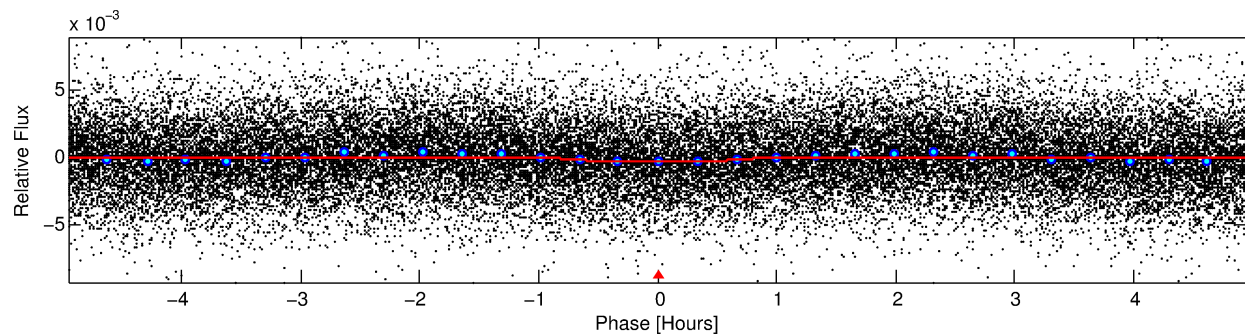
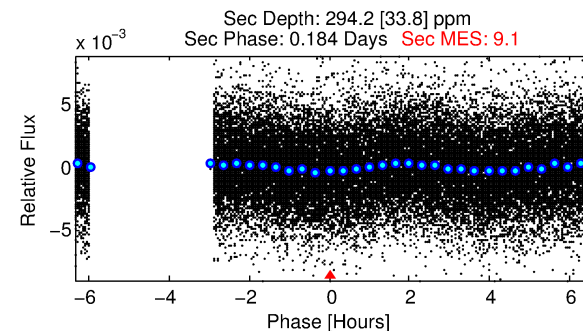
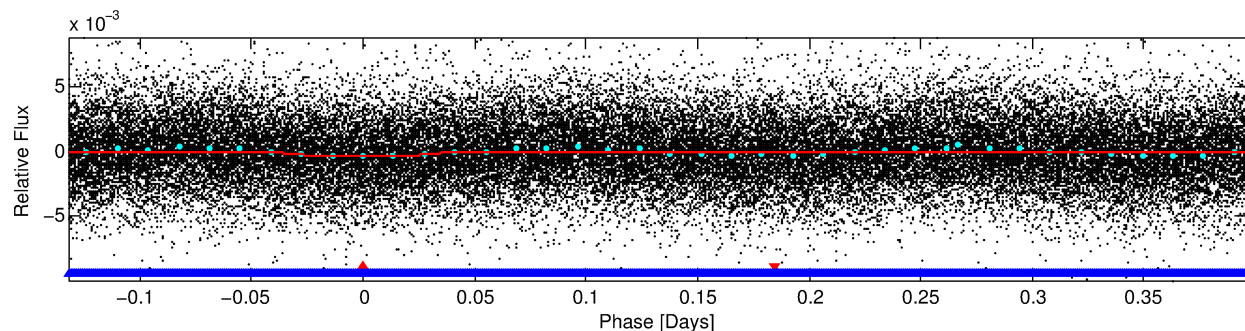
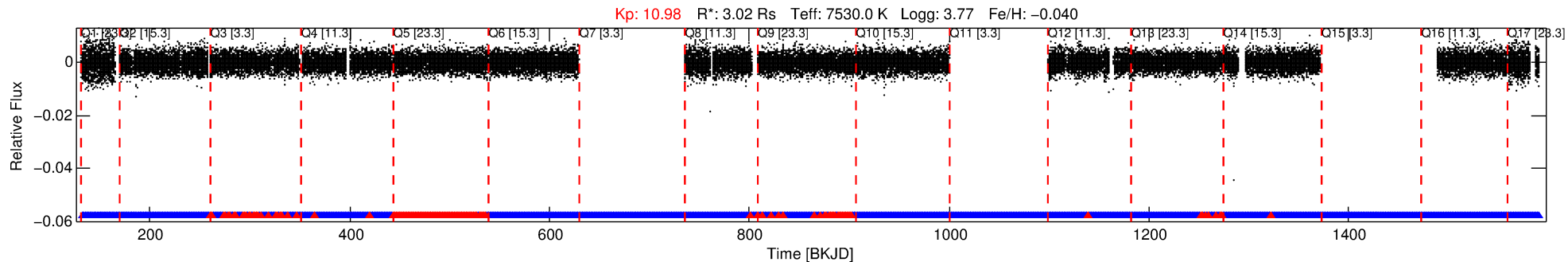
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 010684587-01

No Significant Match Found

# DV One-Page Summary

KIC: 10684587 Candidate: 1 of 2 Period: 0.528 d



## DV Fit Results:

Period = 0.52824 [0.00001] d  
Epoch = 131.9791 [0.0024] BKJD  
Rp/R\* = 0.0201 [0.0093]  
a/R\* = 1.51 [2.41]  
b = 0.90 [0.61]  
Seff = 101974.25 [69115.78]  
Teff = 4557 [772] K  
Rp = 6.64 [4.33] Re  
a = 0.0161 [0.0068] AU  
Ag = 0.95 [1.08] [-0.05 $\sigma$ ]  
Teffp = 6952 [1652] K [1.31 $\sigma$ ]

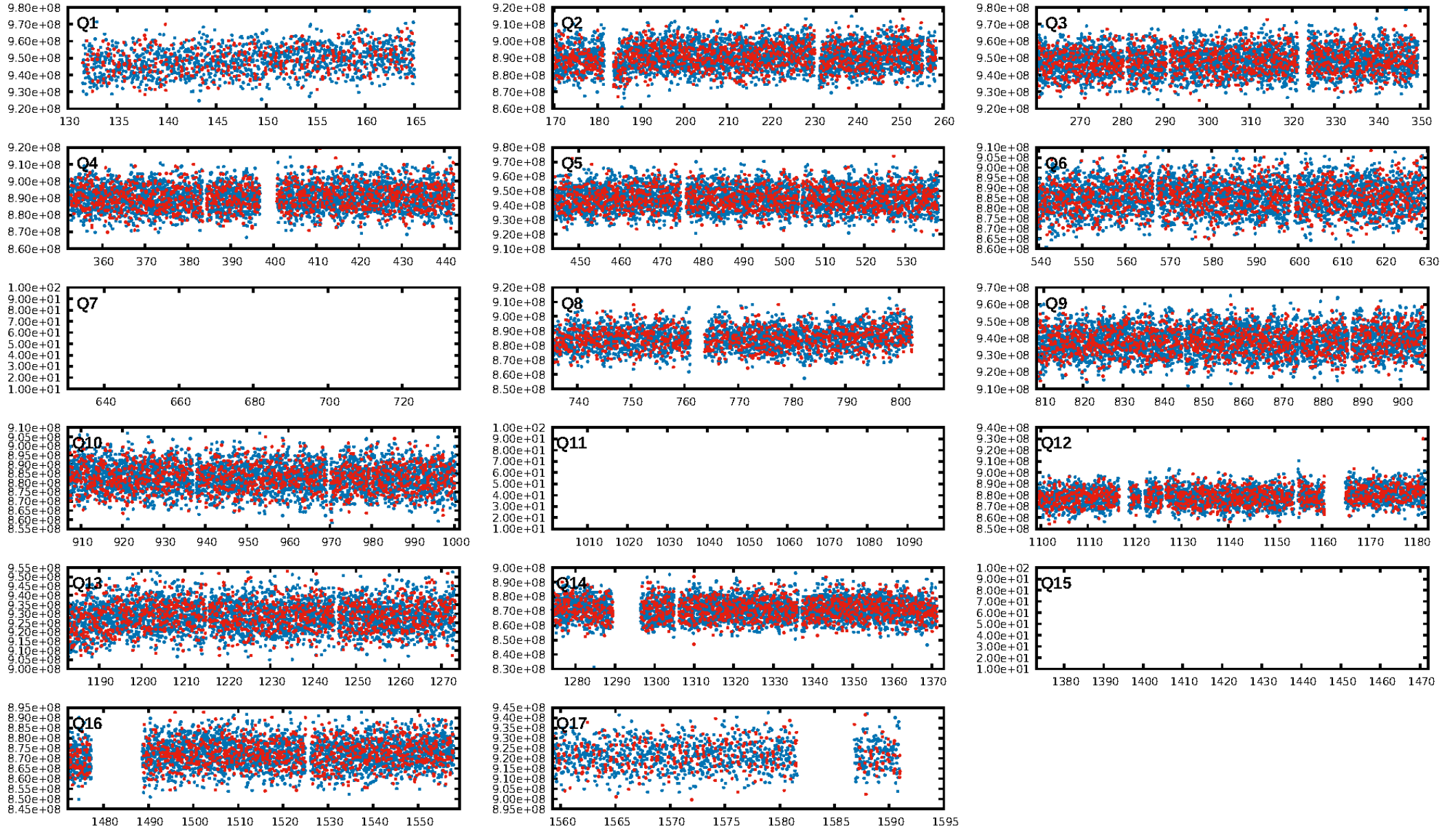
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 46.0% [0.61 $\sigma$ ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: 1.35e-19  
RollingBand-fgt: 0.87 [1665/1907]  
GhostDiagnostic-chr: 2.443  
Centroid-sig: 0.0%  
Centroid-so: 0.316 arcsec [5.35 $\sigma$ ]  
OotOffset-rm: 3.744 arcsec [5.05 $\sigma$ ]  
KicOffset-rm: 3.197 arcsec [4.16 $\sigma$ ]  
OotOffset-st: 3/1/4/5 [13]  
KicOffset-st: 3/1/4/5 [13]  
DiffImageQuality-fgm: 0.23 [3/13]  
DiffImageOverlap-fno: 1.00 [14/14]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 23:42:01 Z

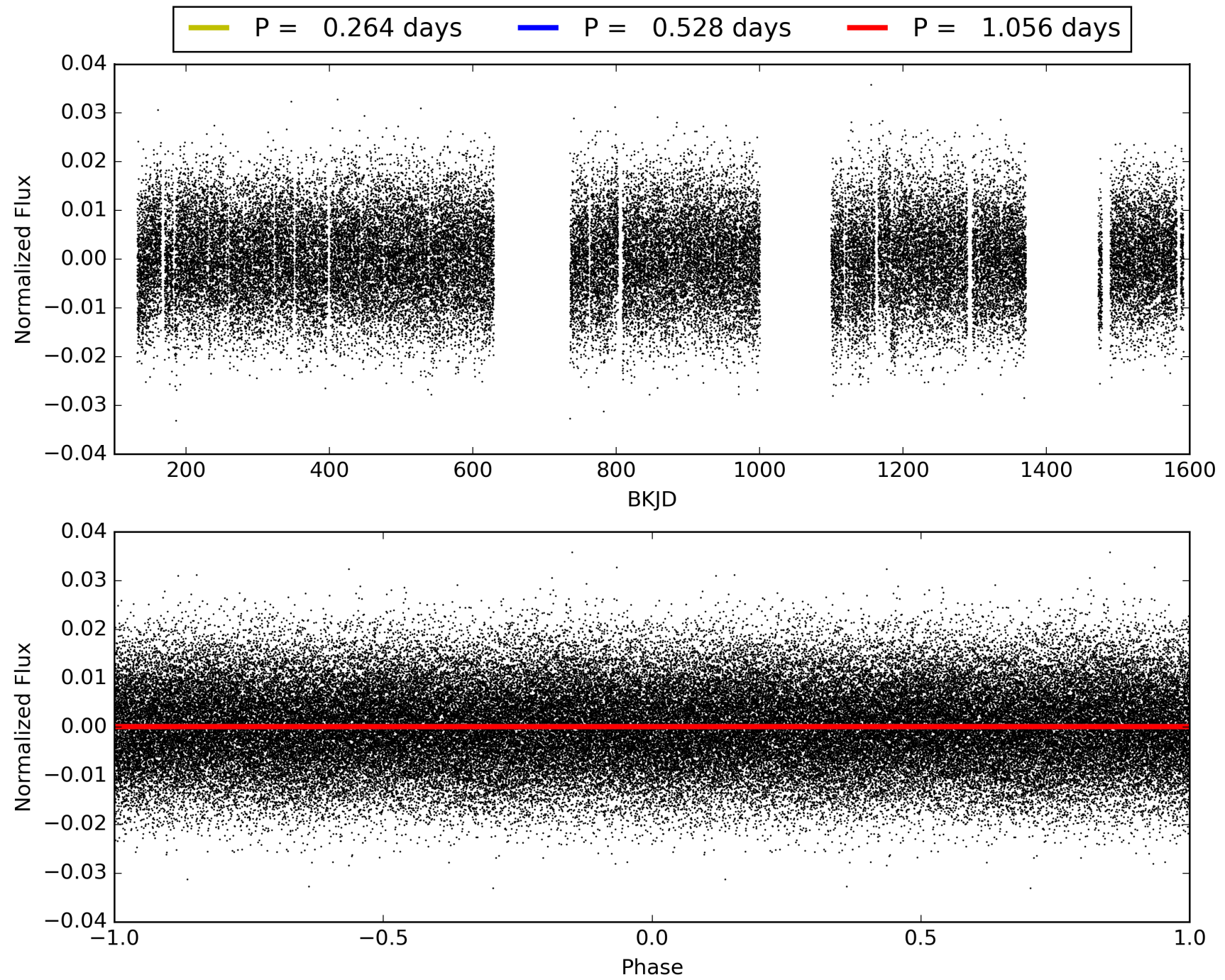
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 010684587-01, PDC Light Curves



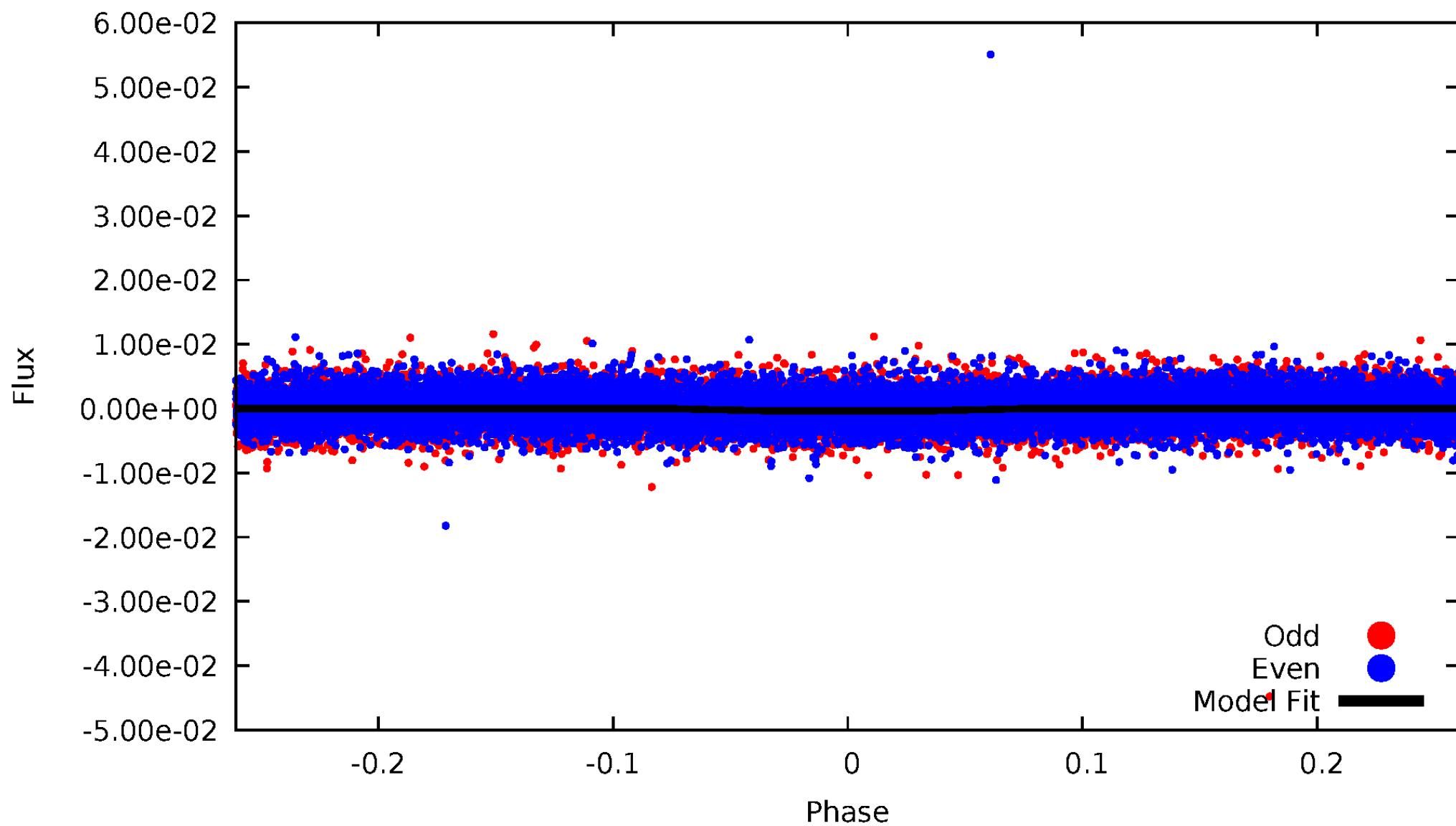


TCE 010684587-01



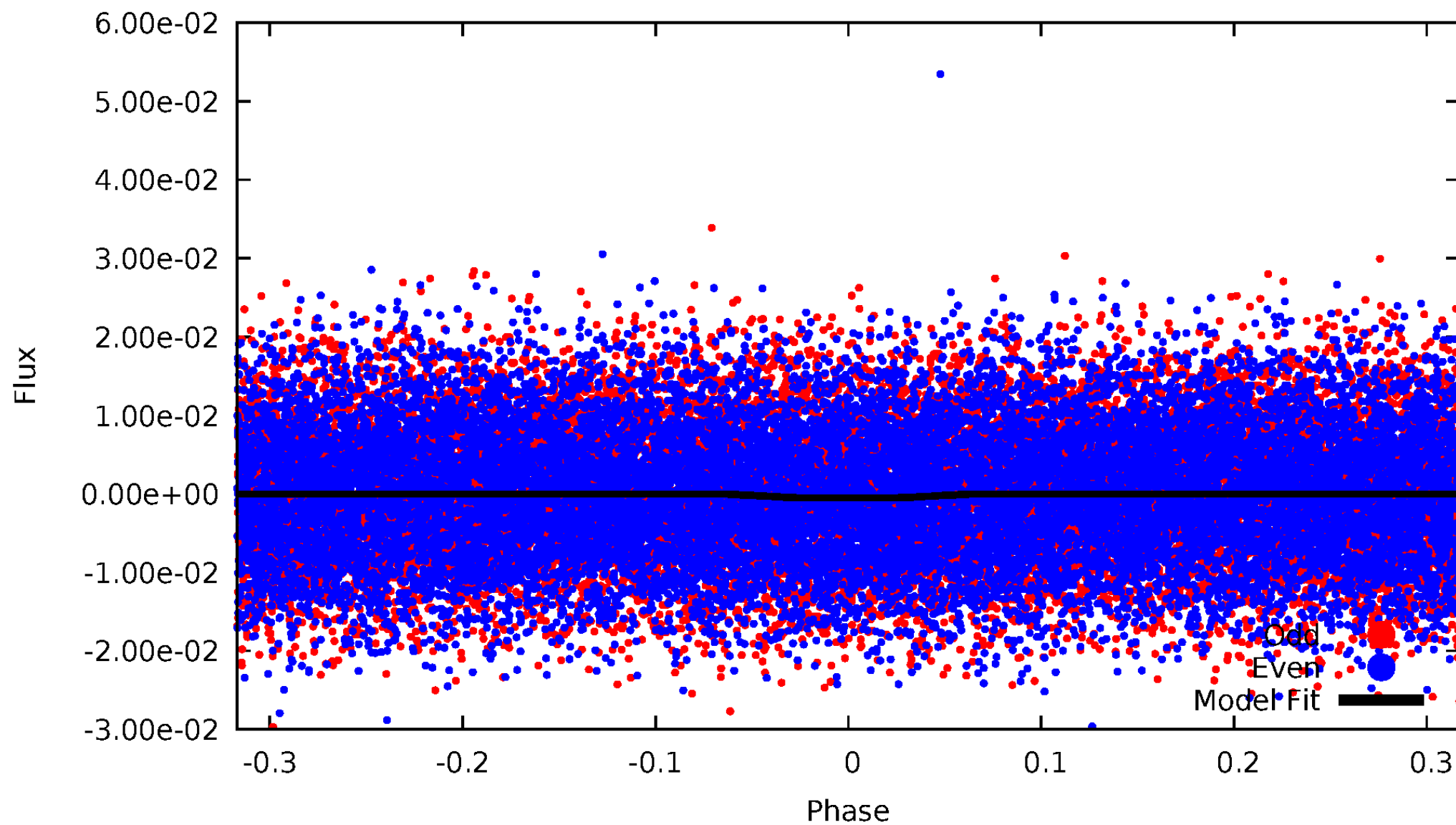
# DV Odd/Even

TCE 010684587-01



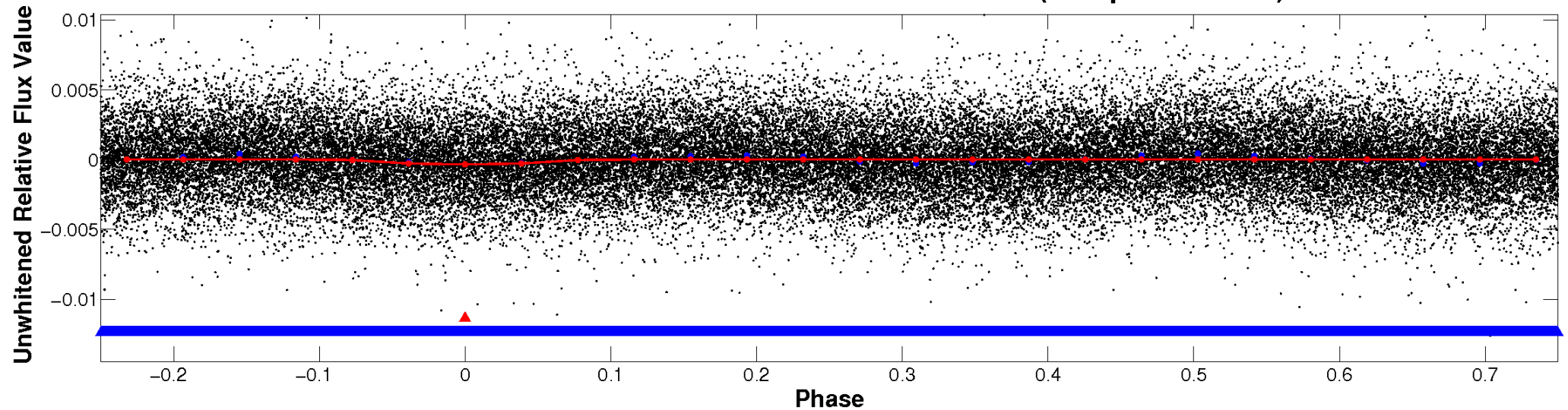
# ALT Odd/Even

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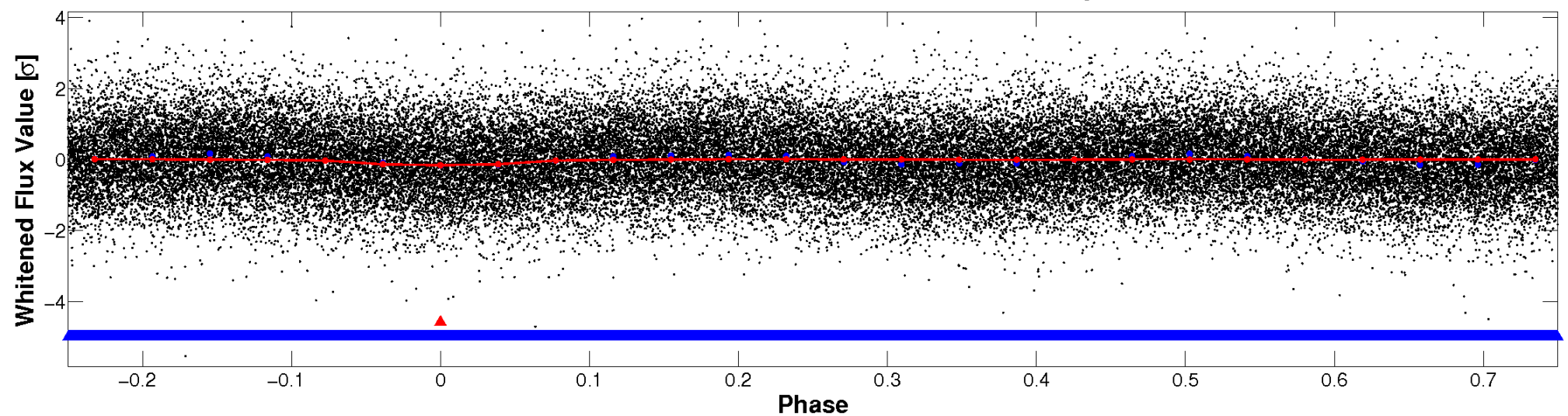


# Non-Whitened Vs. Whitened Light Curve

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



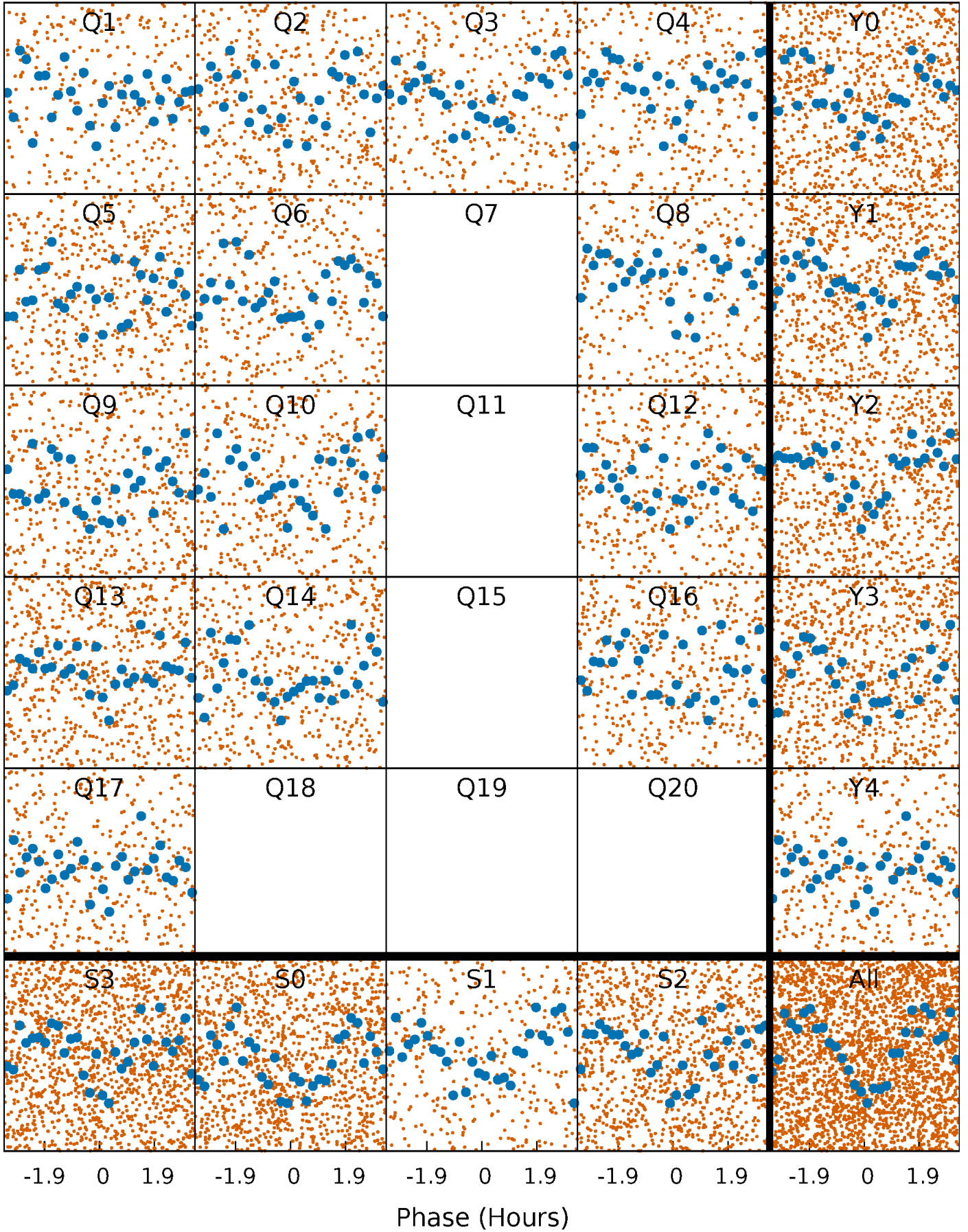
## Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)





# PDC Quarter-Phased Transit Curves

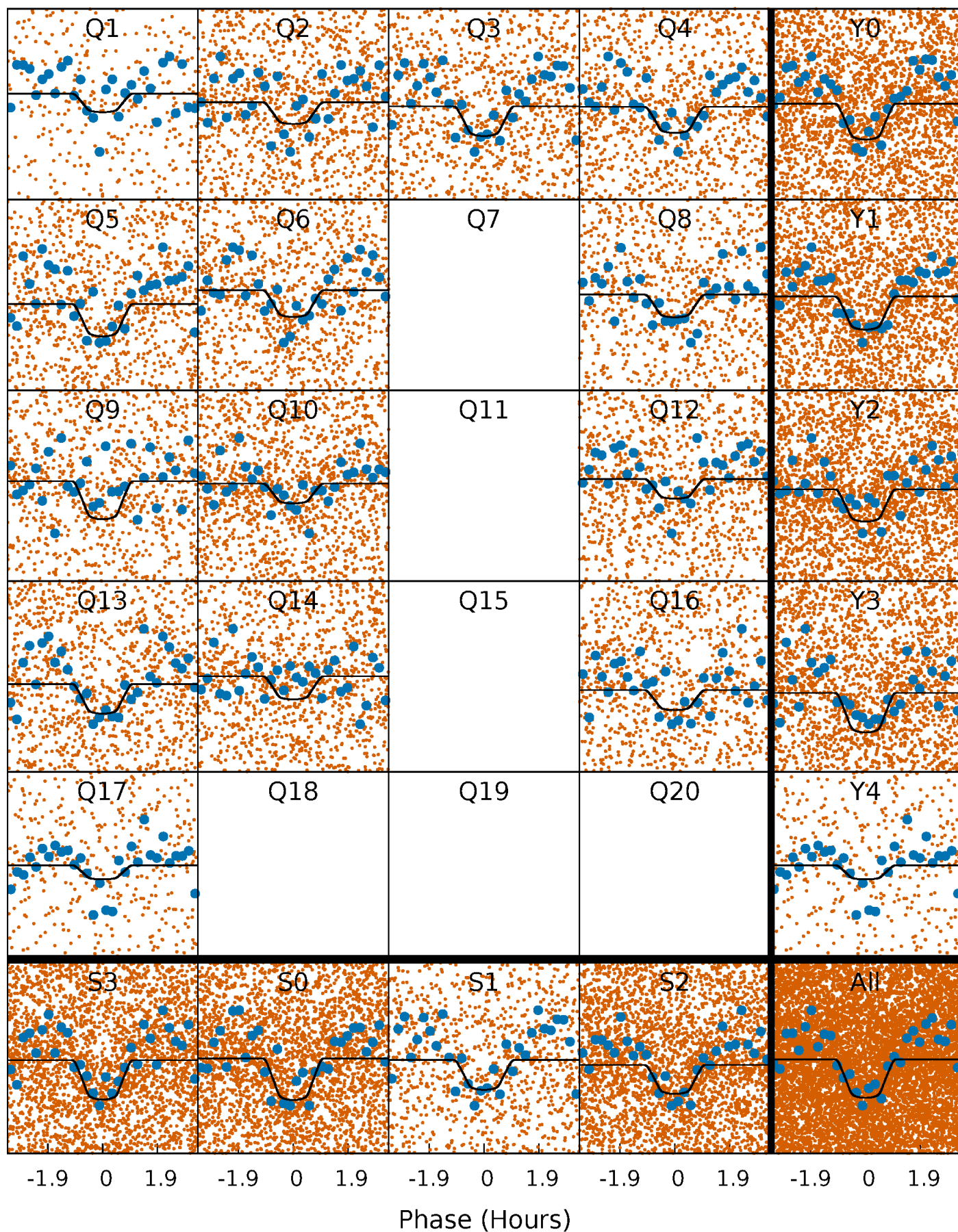
TCE 010684587-01   P= 0.528245 Days    $T_0=131.979077$  (BKJD)





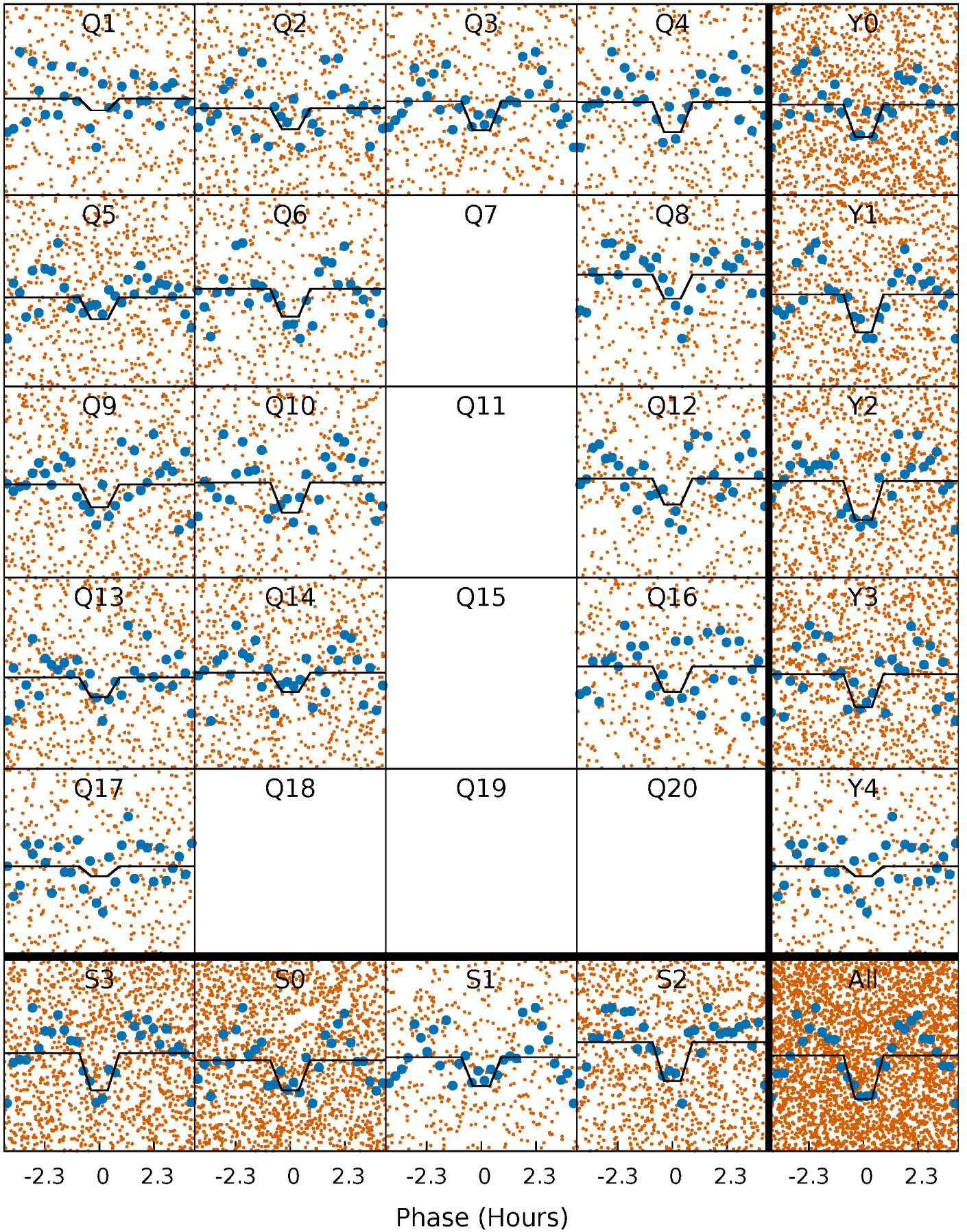
# DV Quarter-Phased Transit Curves

TCE 010684587-01 P= 0.528245 Days  $T_0=131.979077$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

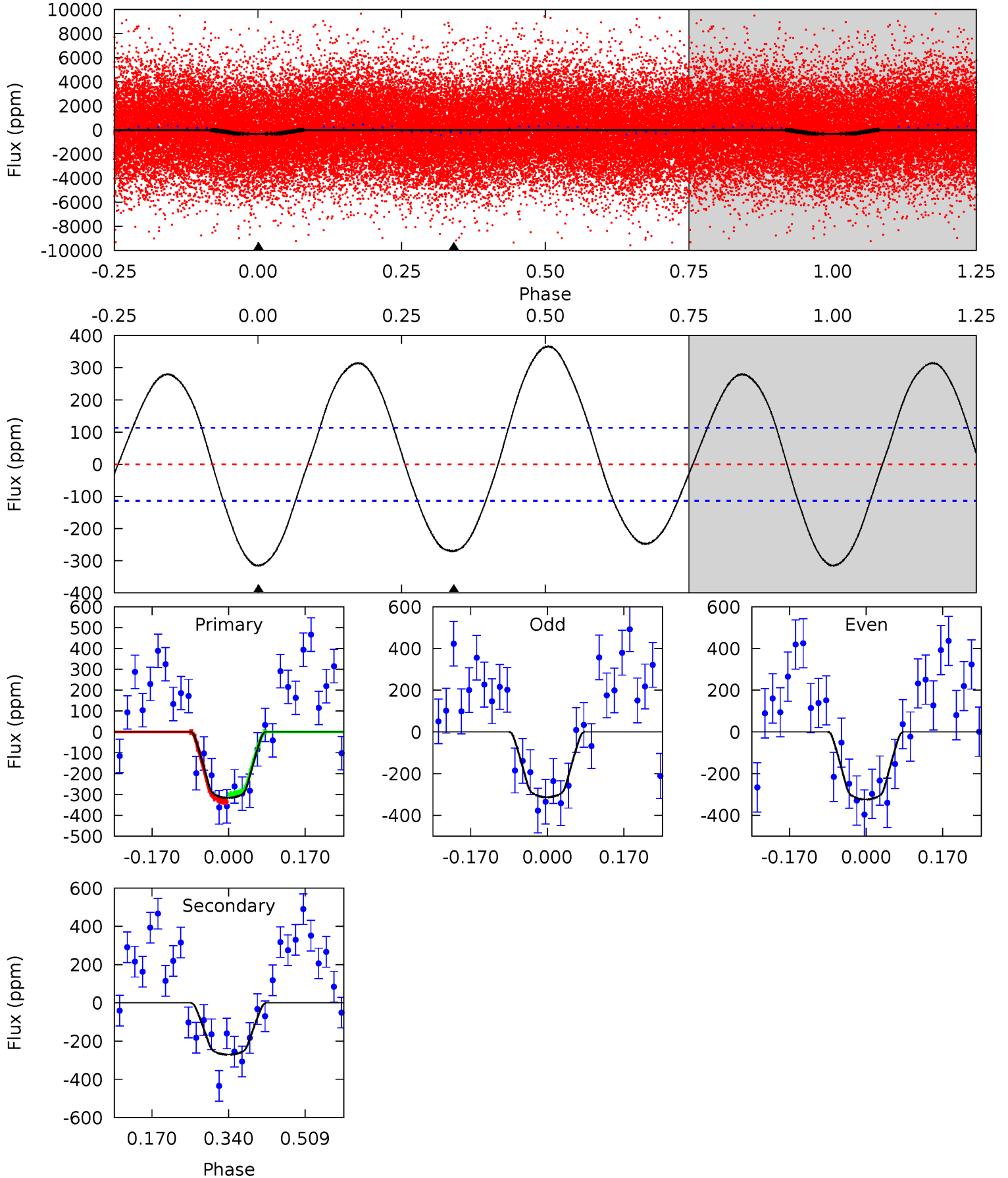
TCE 010684587-01 P= 0.528248 Days  $T_0=131.979758$  (BKJD)



# DV Model-Shift Uniqueness Test

010684587-01, P = 0.528245 Days, E = 131.450832 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
12.4	10.6	0	0	4.45	1.37	7.66	12.4	12.4	10.6	10.6	0.21	0.87	0.54	0.69

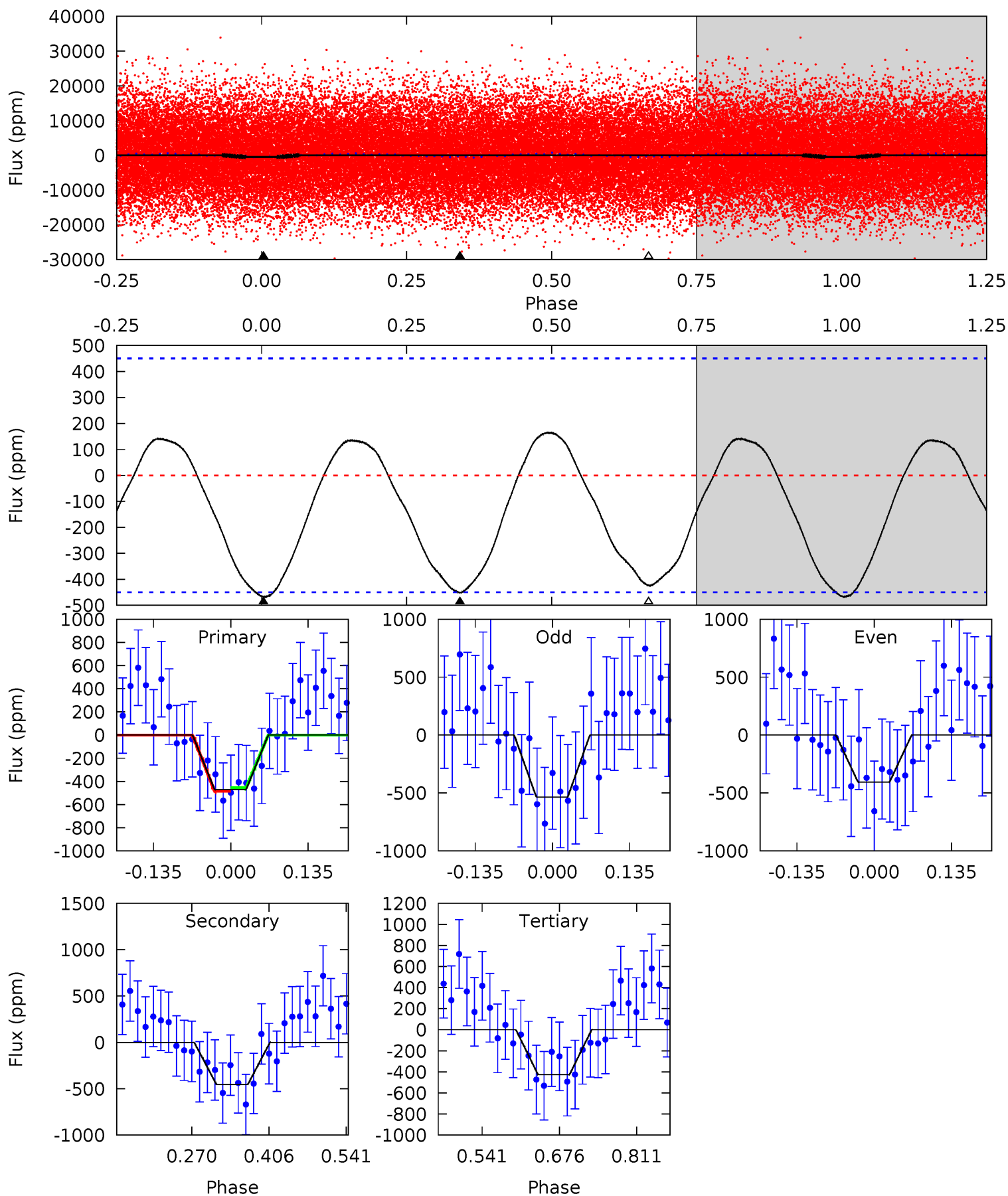




# Alt Model-Shift Uniqueness Test

010684587-01, P = 0.528248 Days, E = 131.451510 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
4.71	4.54	4.27	0	4.50	1.49	2.08	0.44	4.71	0.27	4.54	0.64	0.96	0.26	0.16





### Stellar Parameters For KIC 010684587

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$7530^{+209}_{-340}$	$3.774^{+0.376}_{-0.094}$	$-0.040^{+0.200}_{-0.350}$	$3.022^{+0.433}_{-1.387}$	$1.982^{+0.088}_{-0.500}$	$0.101^{+0.341}_{-0.029}$
	+3%/-5%	+10%/-2%	+500%/-875%	+14%/-46%	+4%/-25%	+337%/-29%
Source	KIC0	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 010684587-01 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	$-271 \pm 26$	$6.25^{+3.04}_{-3.07}$	$6194^{+410}_{-665}$	$5946^{+3266}_{-1610}$	$0.976^{+2.572}_{-0.541}$
Alt.	$-454 \pm 100$	$6.76^{+3.22}_{-2.96}$	$6189^{+432}_{-728}$	$6652^{+3306}_{-1530}$	$1.328^{+3.041}_{-0.726}$

$T_{\text{max}}$  = 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

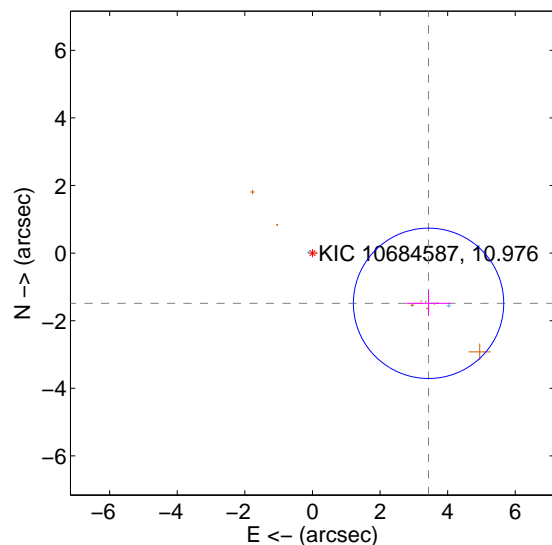
Supplemental centroid analysis for 010684587-01. **Kepler magnitude: 10.98.** Transit SNR 10.85

**There are 3 quarters with good PRF difference image offsets**

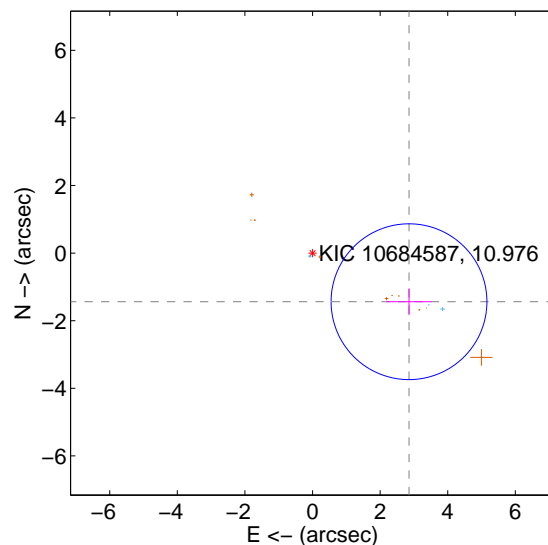
The direct PRF centroid is offset from the target star catalog position by about 0.69 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	<b><math>3.744 \pm 0.741</math></b>	<b>5.05</b>	$-3.436 \pm 0.650$	$-1.487 \pm 0.377$
PRF-fit source offset from KIC position	<b><math>3.197 \pm 0.769</math></b>	<b>4.16</b>	$-2.855 \pm 0.668$	$-1.439 \pm 0.393$
photometric centroid source offset	<b><math>0.32 \pm 0.06</math></b>	<b>5.35</b>	$-0.11 \pm 0.08$	$-0.29 \pm 0.06$

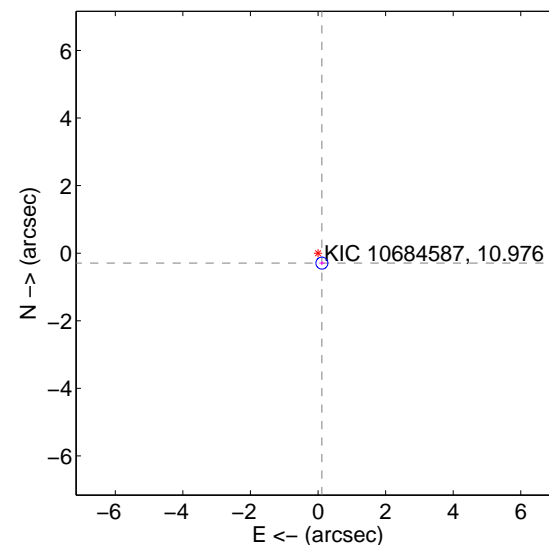
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

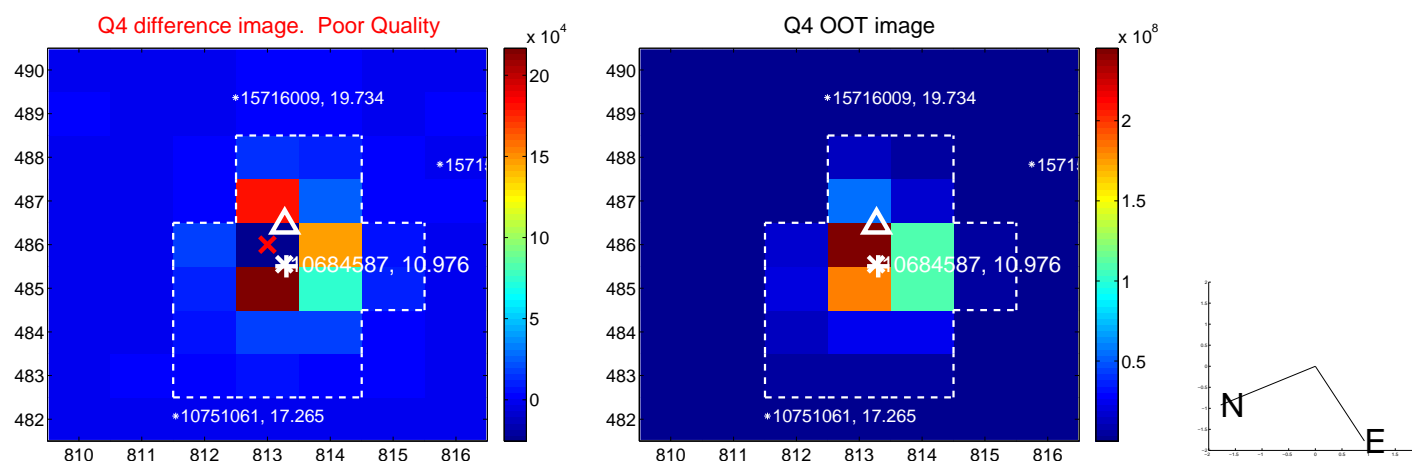
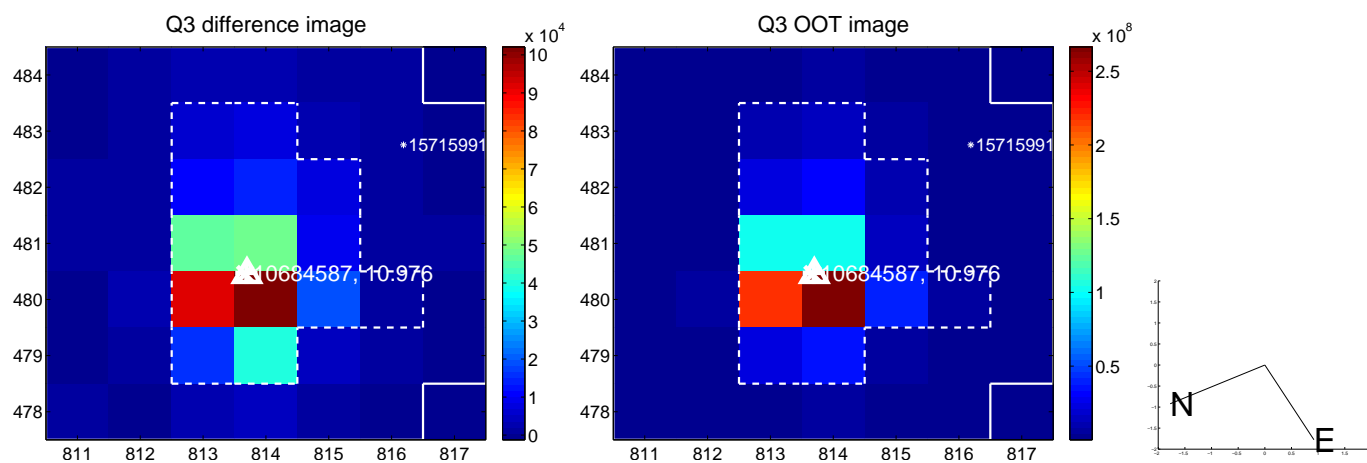
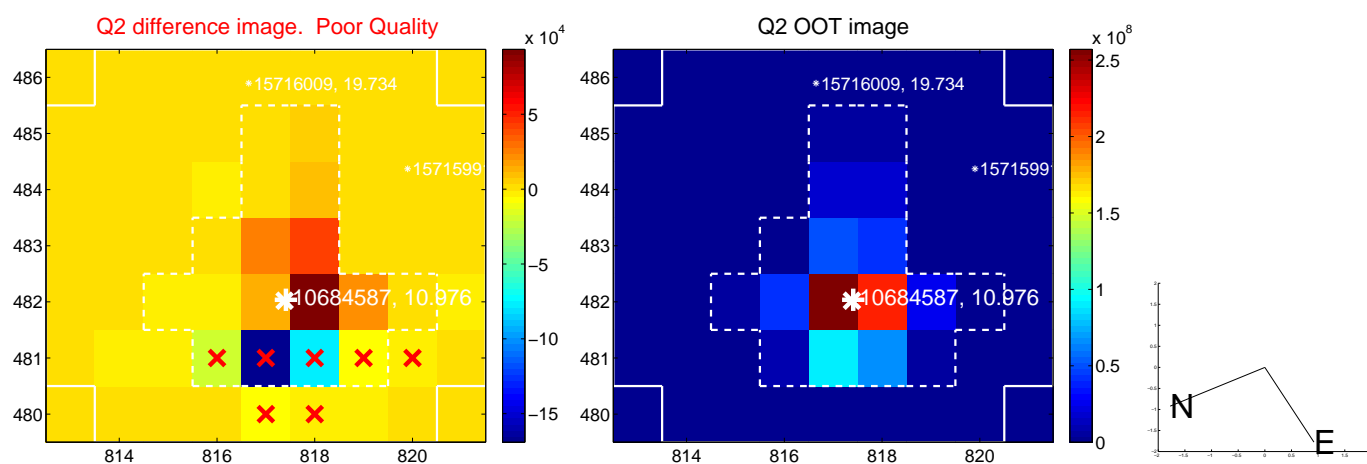
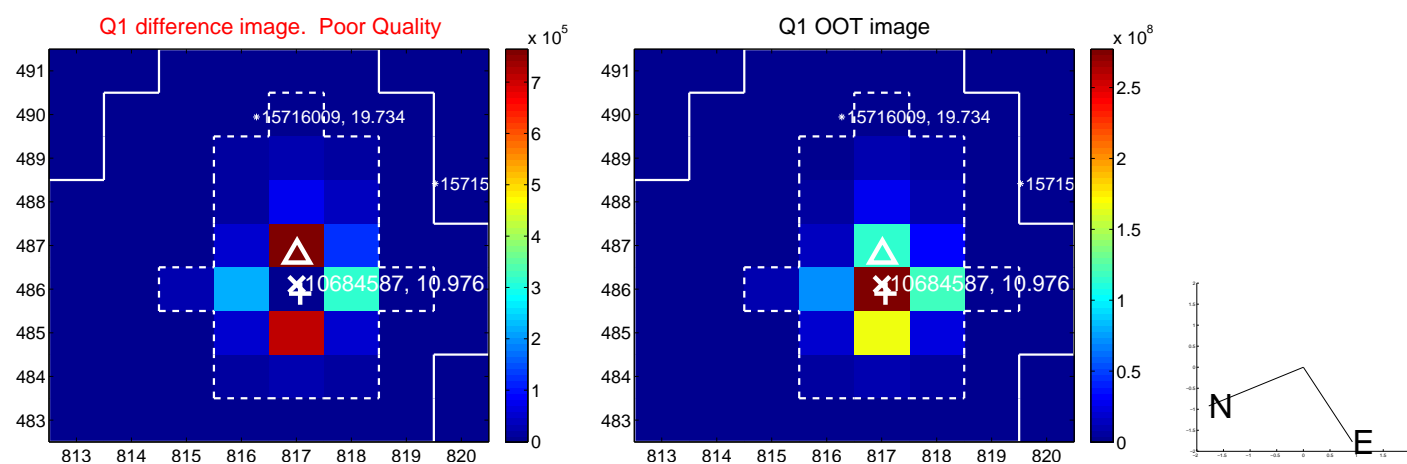


offset from photometric centroids

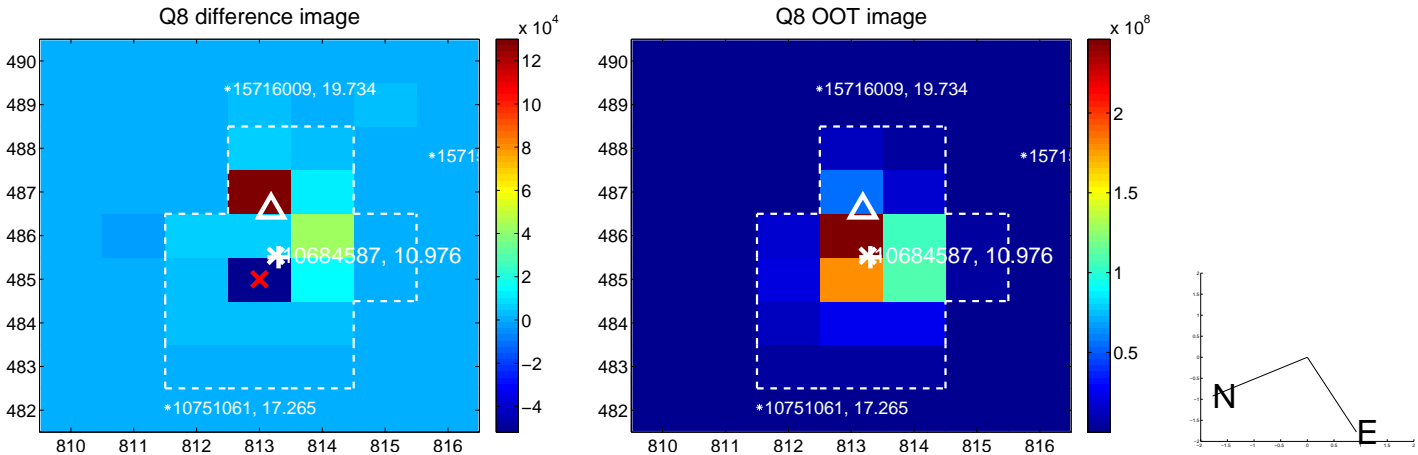
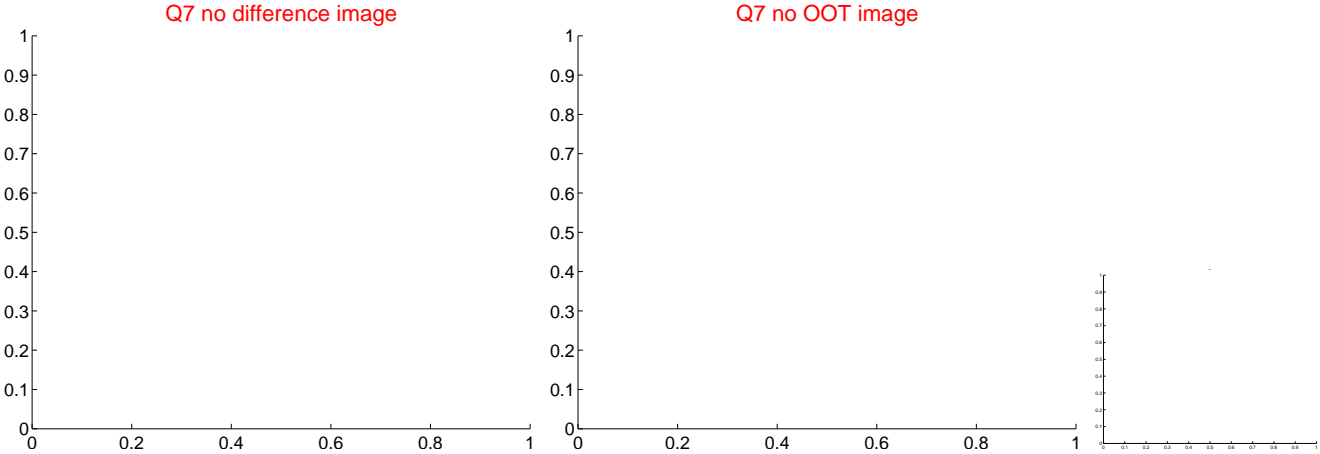
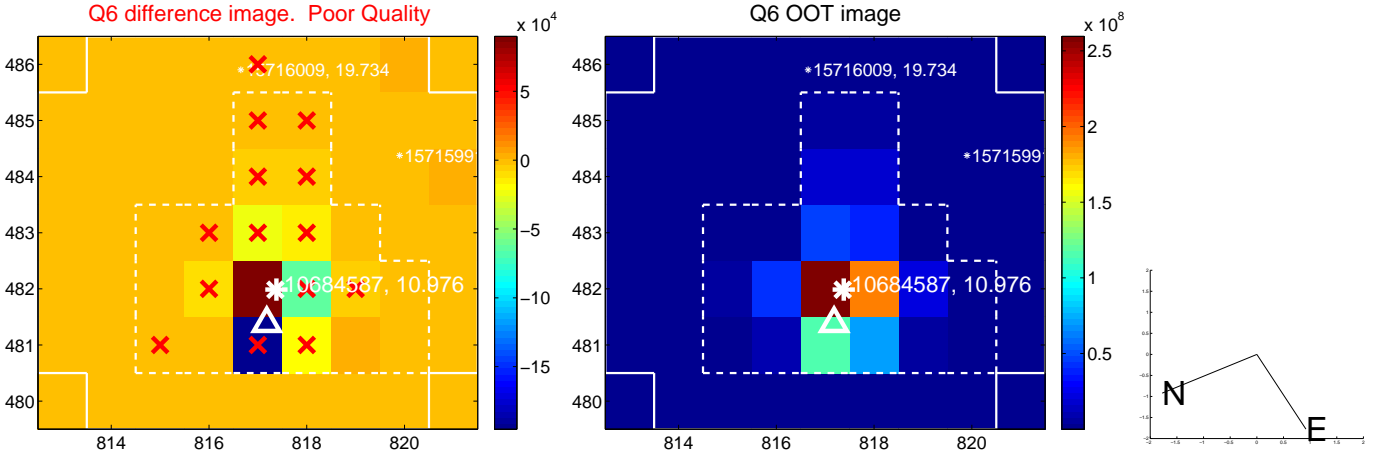
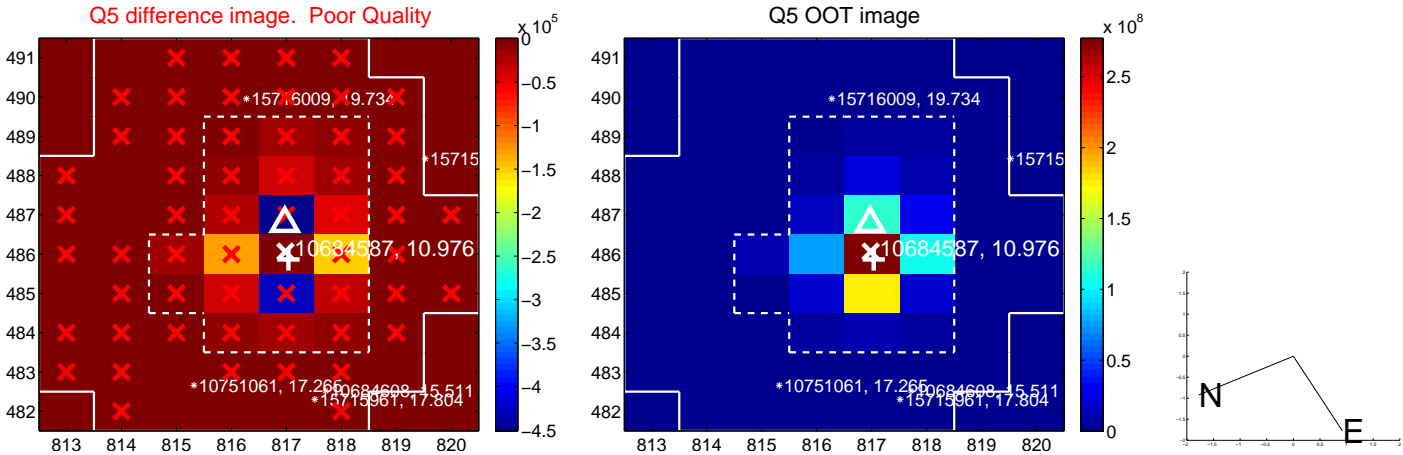


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

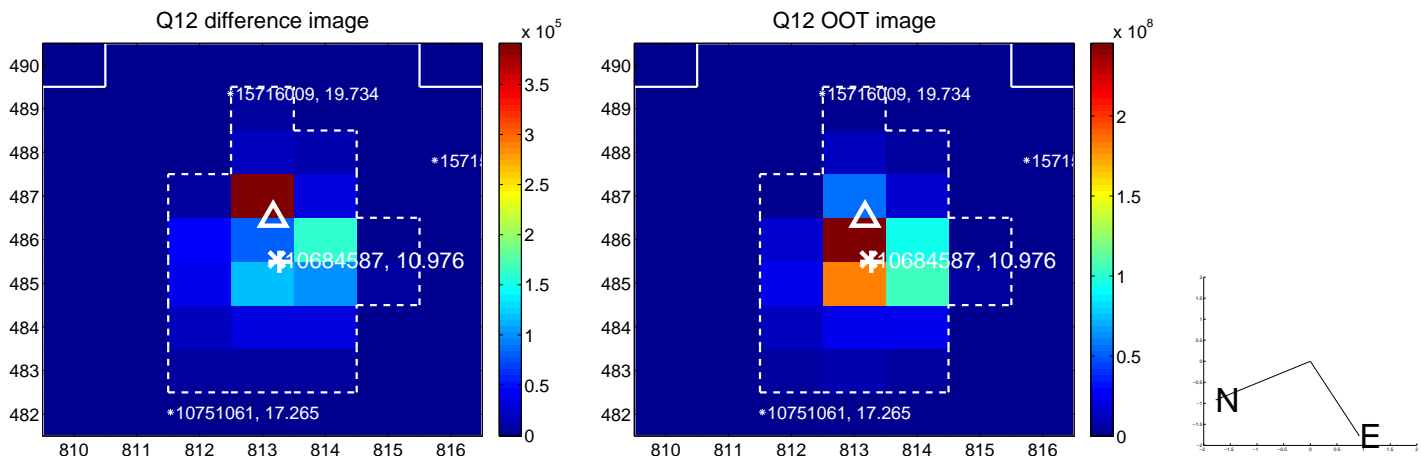
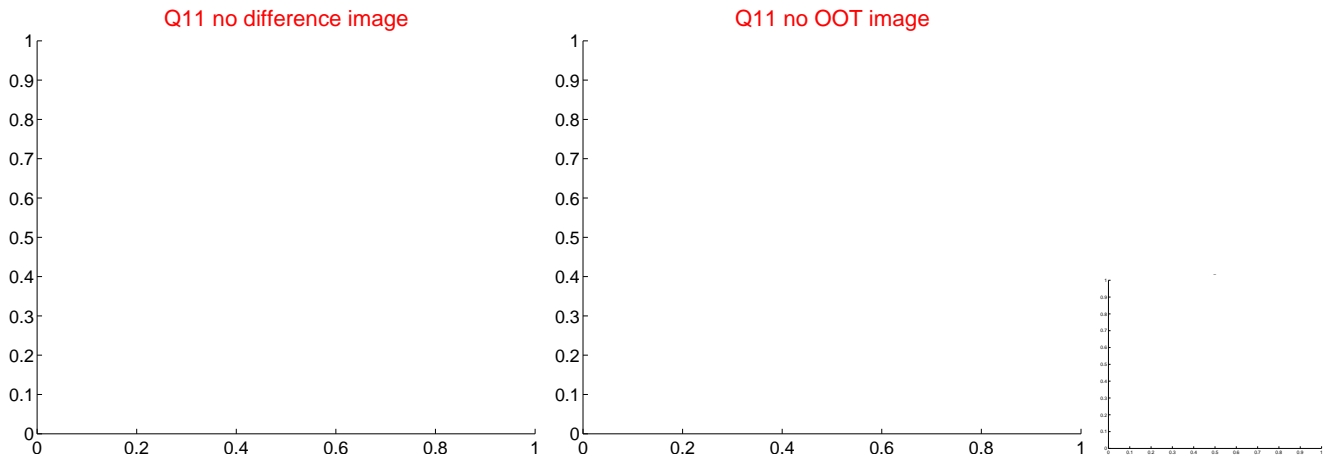
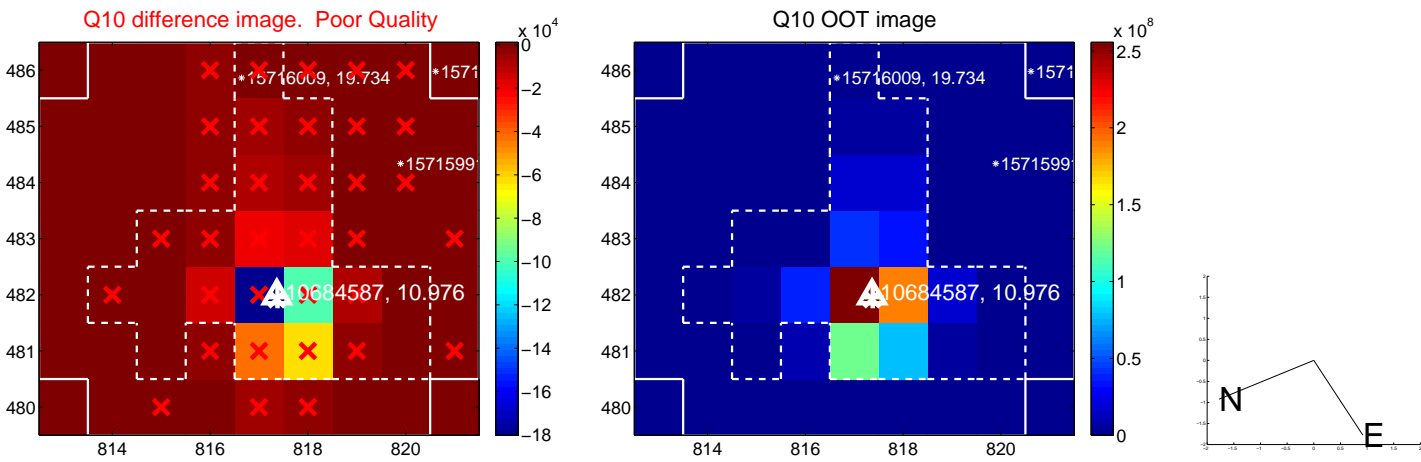
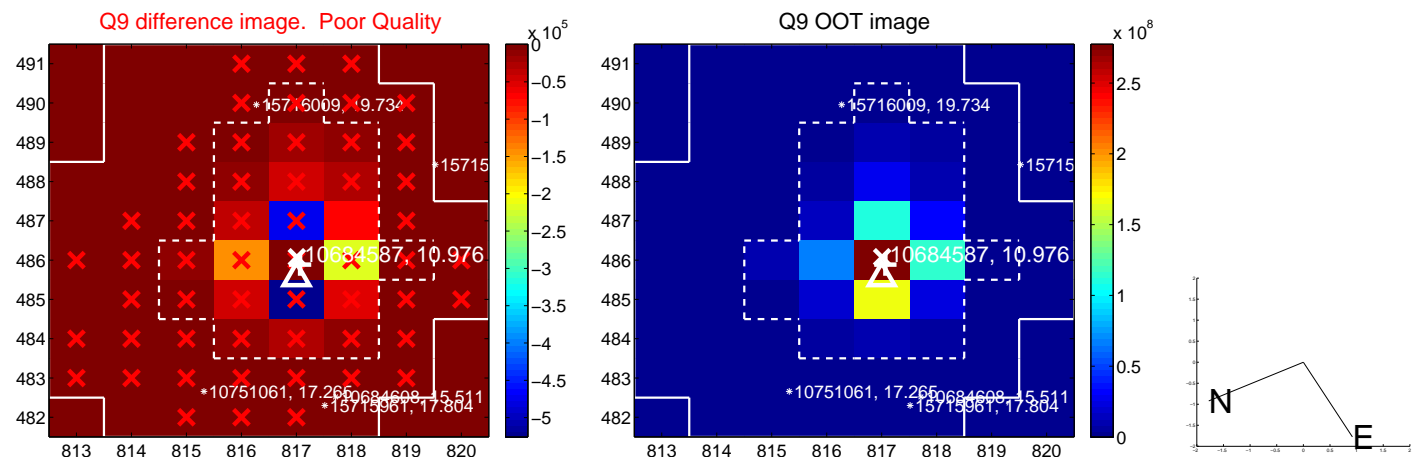


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

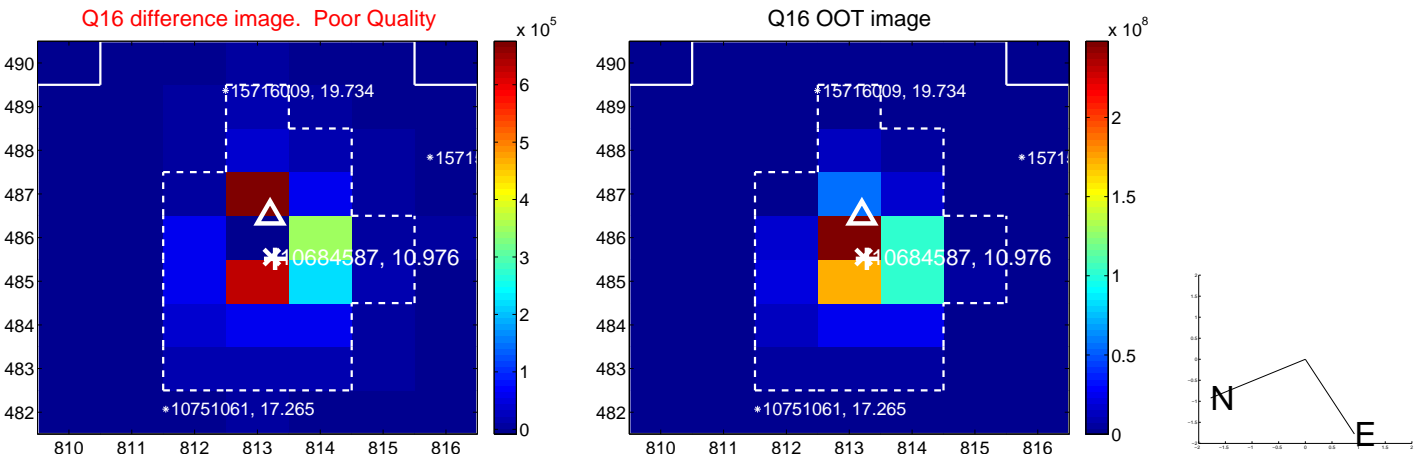
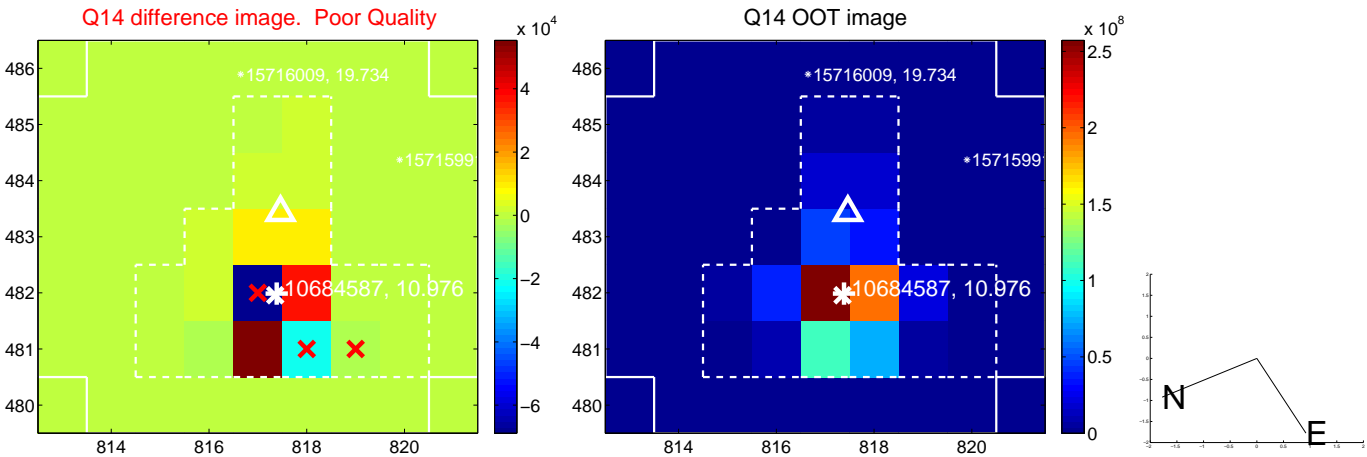
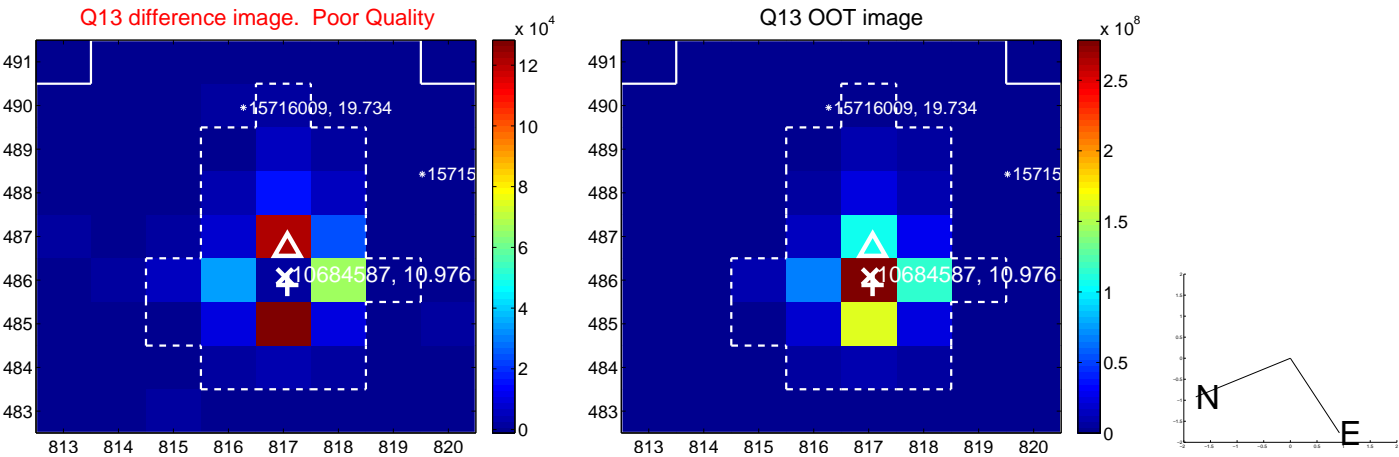




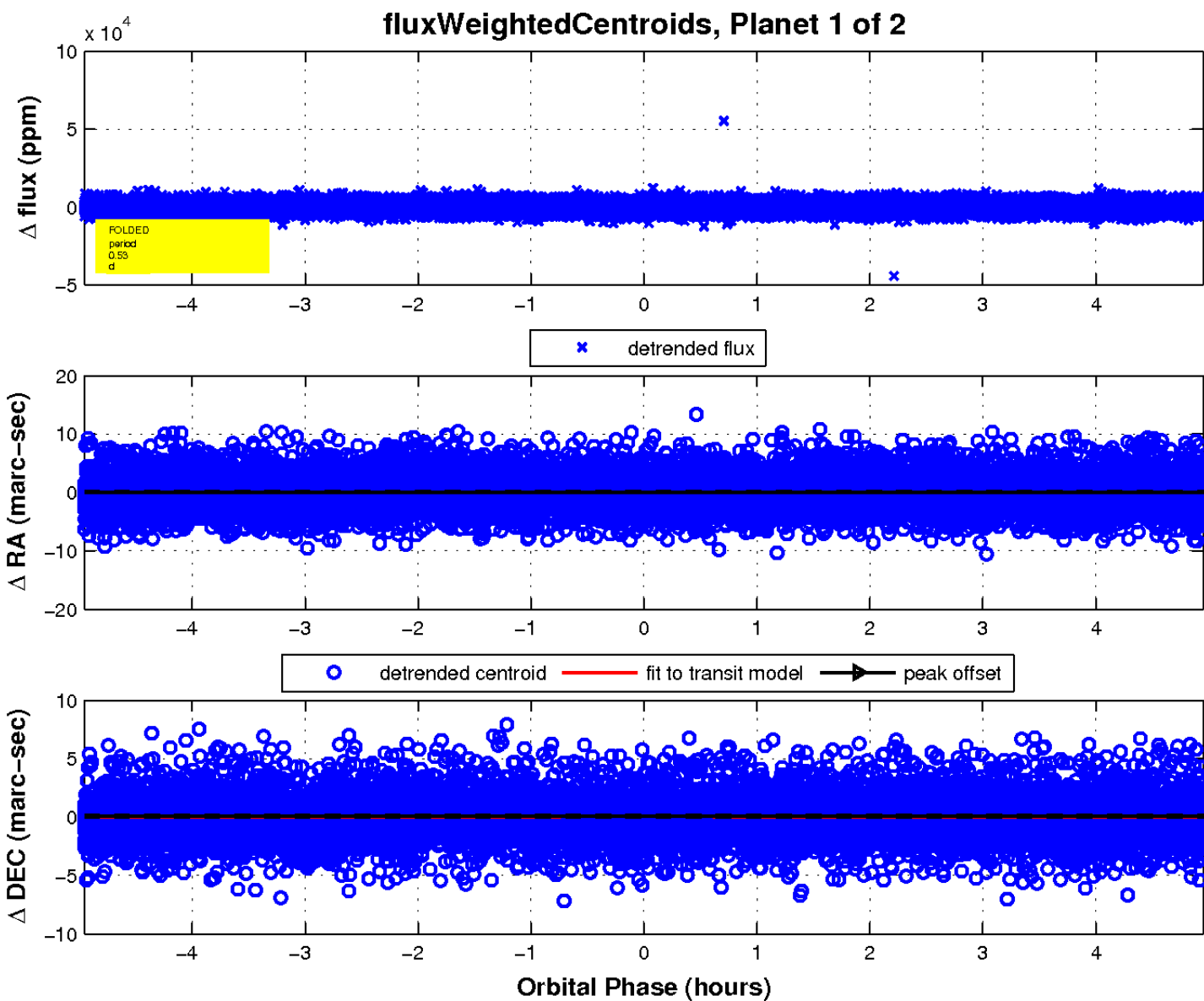
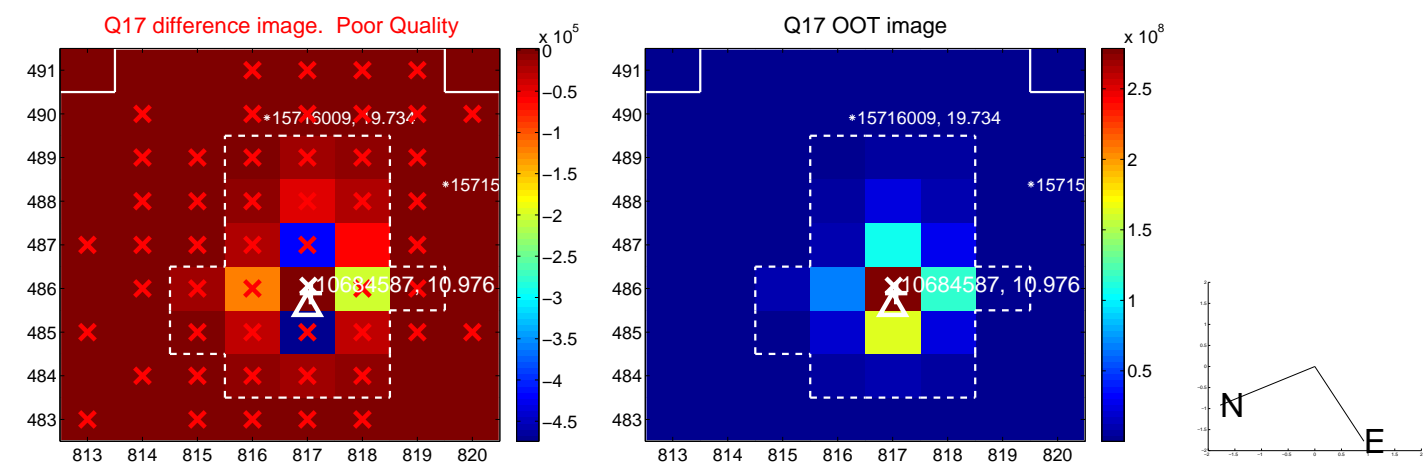
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



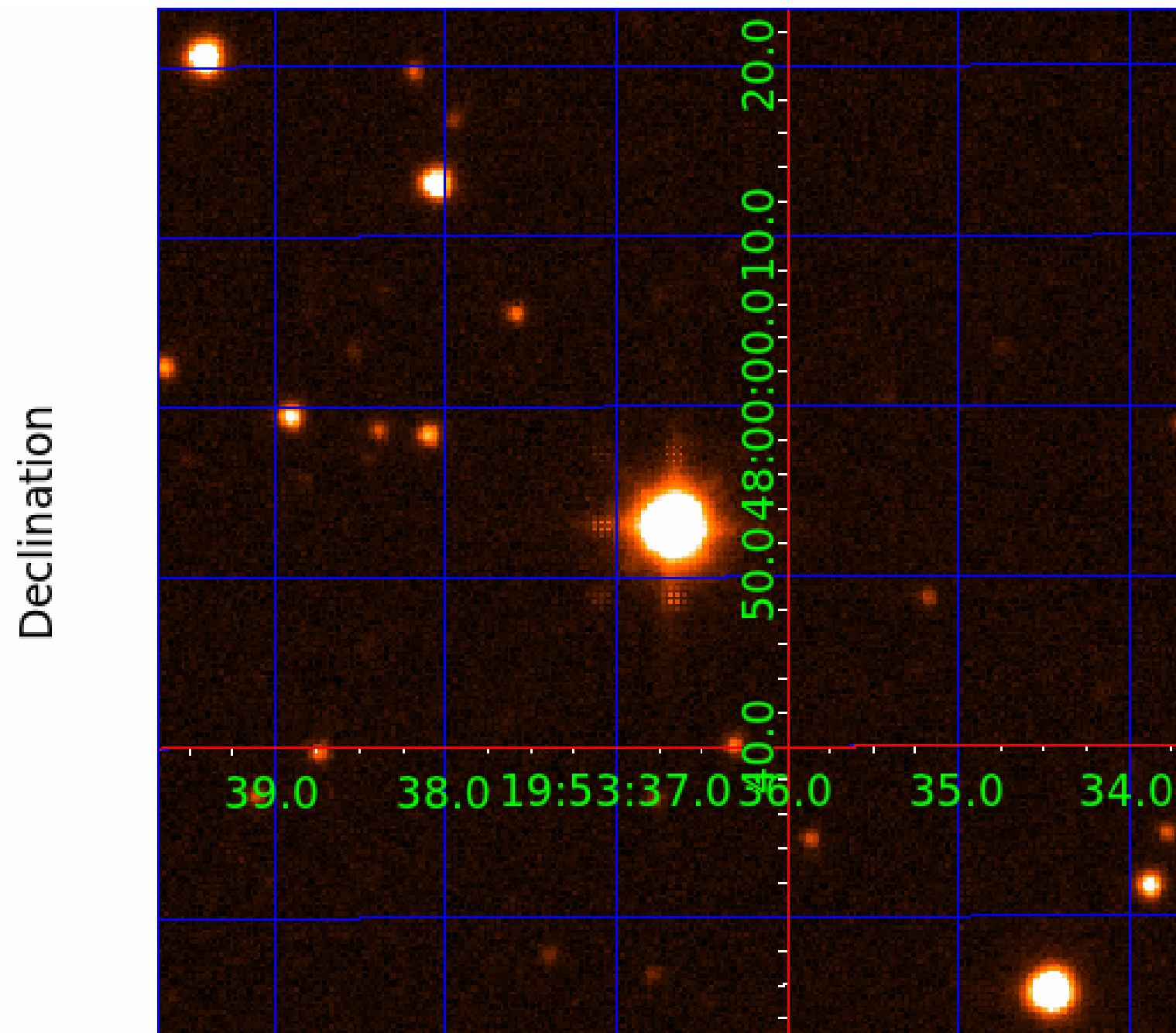
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



UKIRT Image





# KIC 010684587

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
010684587-01	OBS	No	0.528245	131.979077	356.5	1.652	9.7	10.9	3.02	7530	6.64	101974.25
010684587-02	OBS	No	0.575138	131.612365	657.3	0.801	7.6	9.6	3.02	7530	9.14	91041.96

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
010684587-01	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—CENT_SATURATED
010684587-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE_ZUMA_TRACKER—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—CENT_SATURATED

**Notes:** OBS = Observed. INJ = Injected. INV = Inverted. SCR = Scrambled.

N = Not Transit-Like. S = Stellar Eclipse. C = Centroid Offset. E = Ephemeris Match.

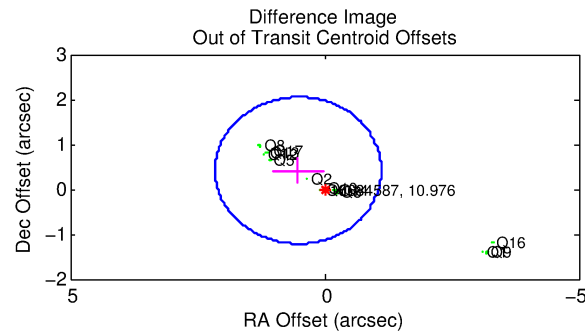
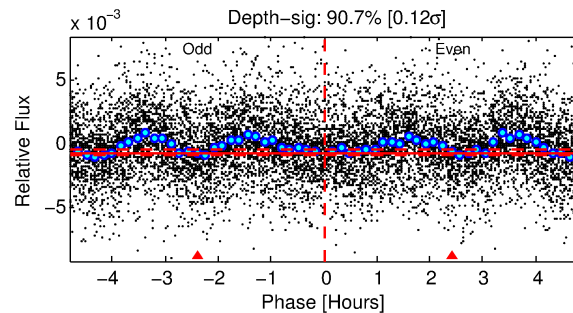
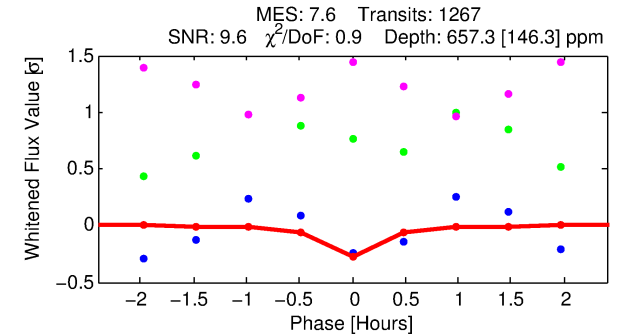
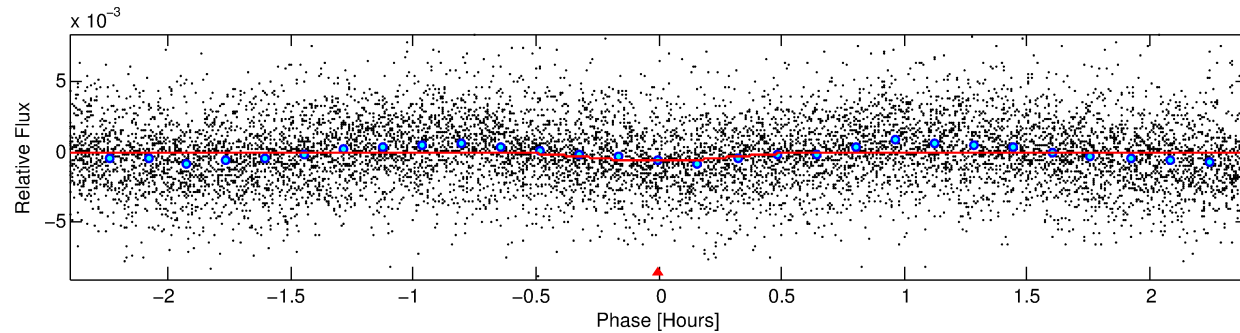
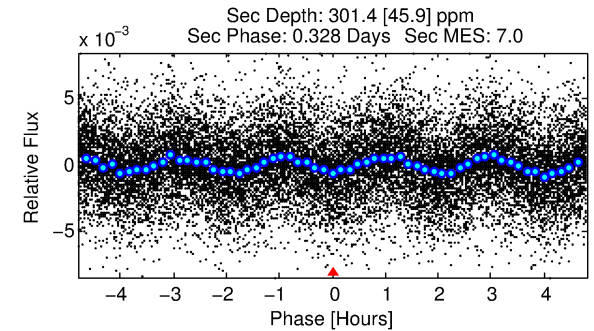
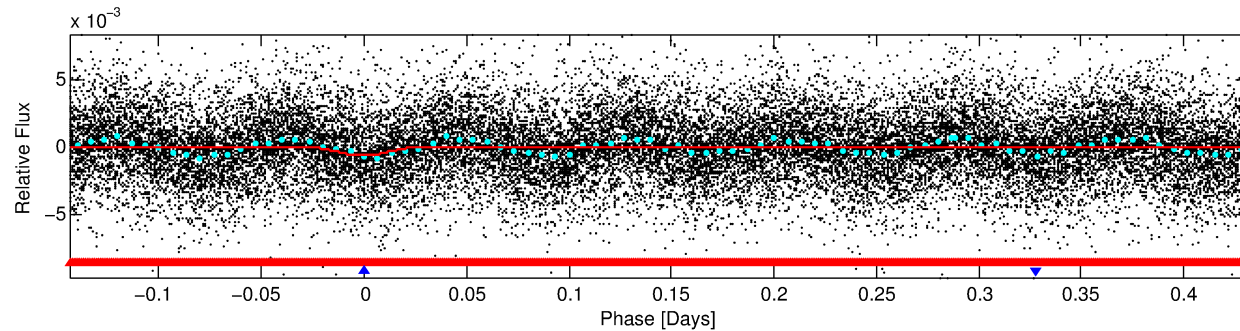
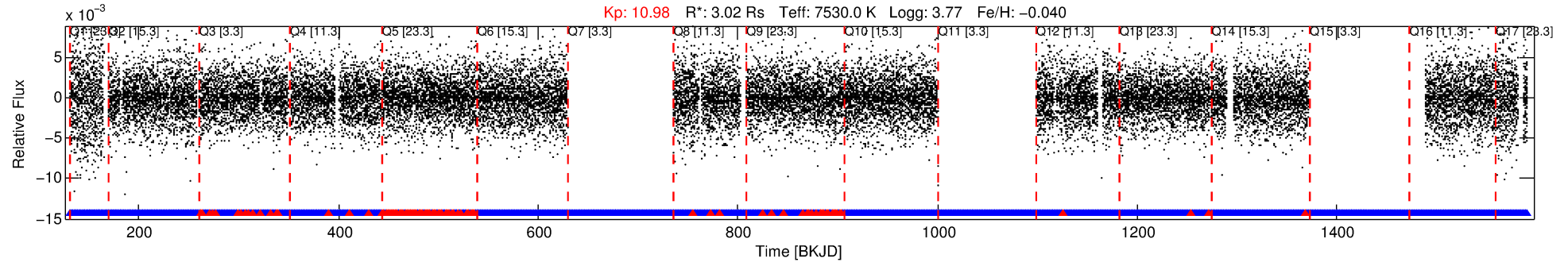
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 010684587-02

No Significant Match Found

# DV One-Page Summary

KIC: 10684587 Candidate: 2 of 2 Period: 0.575 d



## DV Fit Results:

Period = 0.57514 [0.00001] d  
Epoch = 131.6124 [0.0016] BKJD  
 $R_p/R^*$  = 0.0277 [0.0161]  
 $a/R^*$  = 2.86 [8.46]  
 $b$  = 0.90 [0.71]  
 $S_{\text{eff}}$  = 91041.96 [61706.13]  
 $T_{\text{eq}}$  = 4429 [751] K  
 $R_p$  = 9.14 [6.76]  $R_e$   
 $a$  = 0.0170 [0.0071] AU  
 $A_g$  = 0.57 [0.77] [-0.55σ]  
 $T_{\text{eff}}$  = 5961 [1764] K [0.80σ]

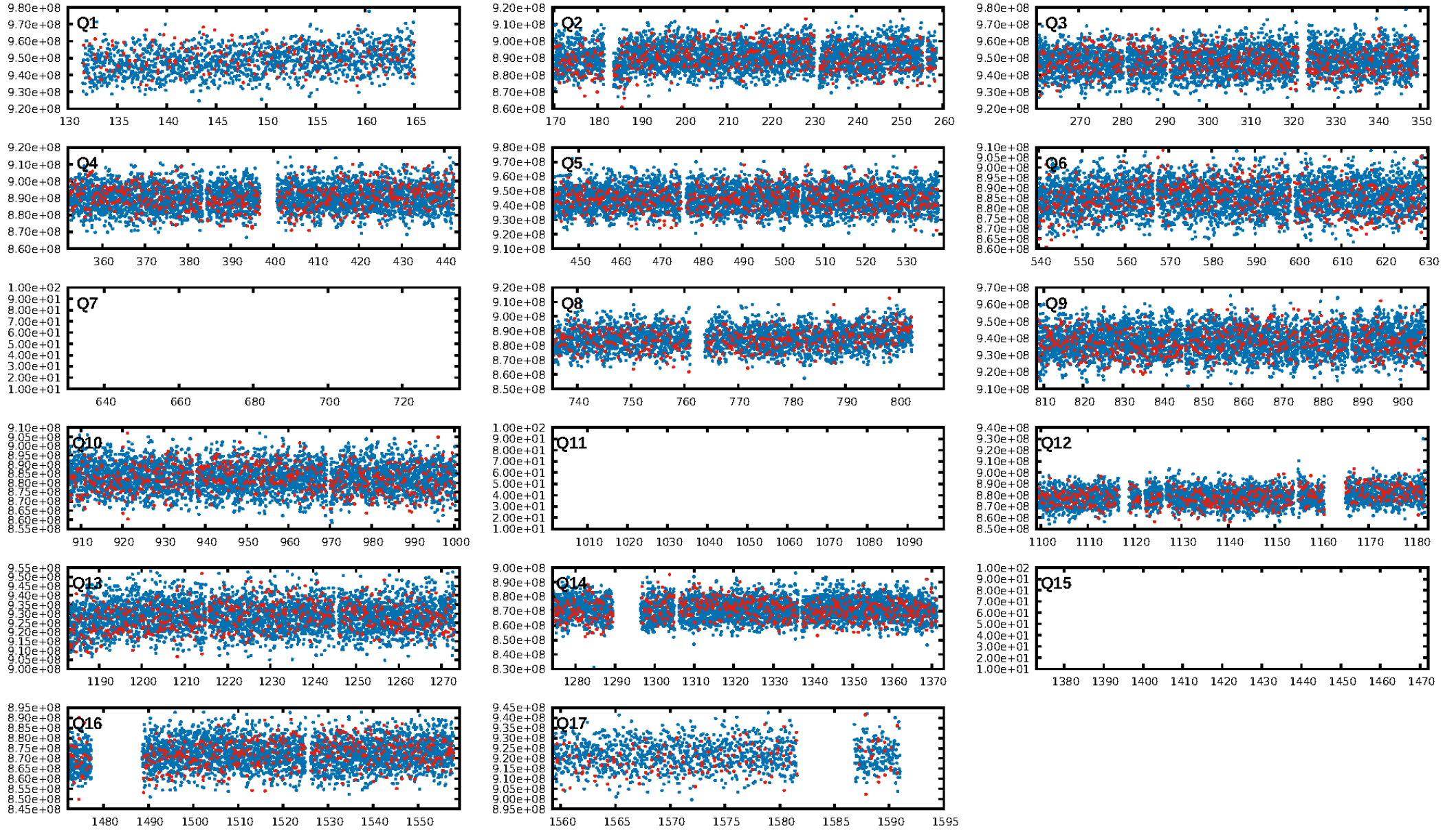
## DV Diagnostic Results:

ShortPeriod-sig: 46.0% [0.61σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
**Bootstrap-pfa: 1.97e-12**  
RollingBand-fgt: 0.88 [1053/1196]  
GhostDiagnostic-chr: 6.008  
Centroid-sig: 42.6%  
**Centroid-so: 0.160 arcsec [3.26σ]**  
OotOffset-rm: 0.665 arcsec [1.22σ]  
OotOffset-st: 4/1/3/5 [13]  
KicOffset-rm: 0.489 arcsec [0.92σ]  
KicOffset-st: 4/1/3/5 [13]  
DiffImageQuality-fgm: 0.38 [5/13]  
DiffImageOverlap-fno: 0.92 [12/13]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 23:42:11 Z

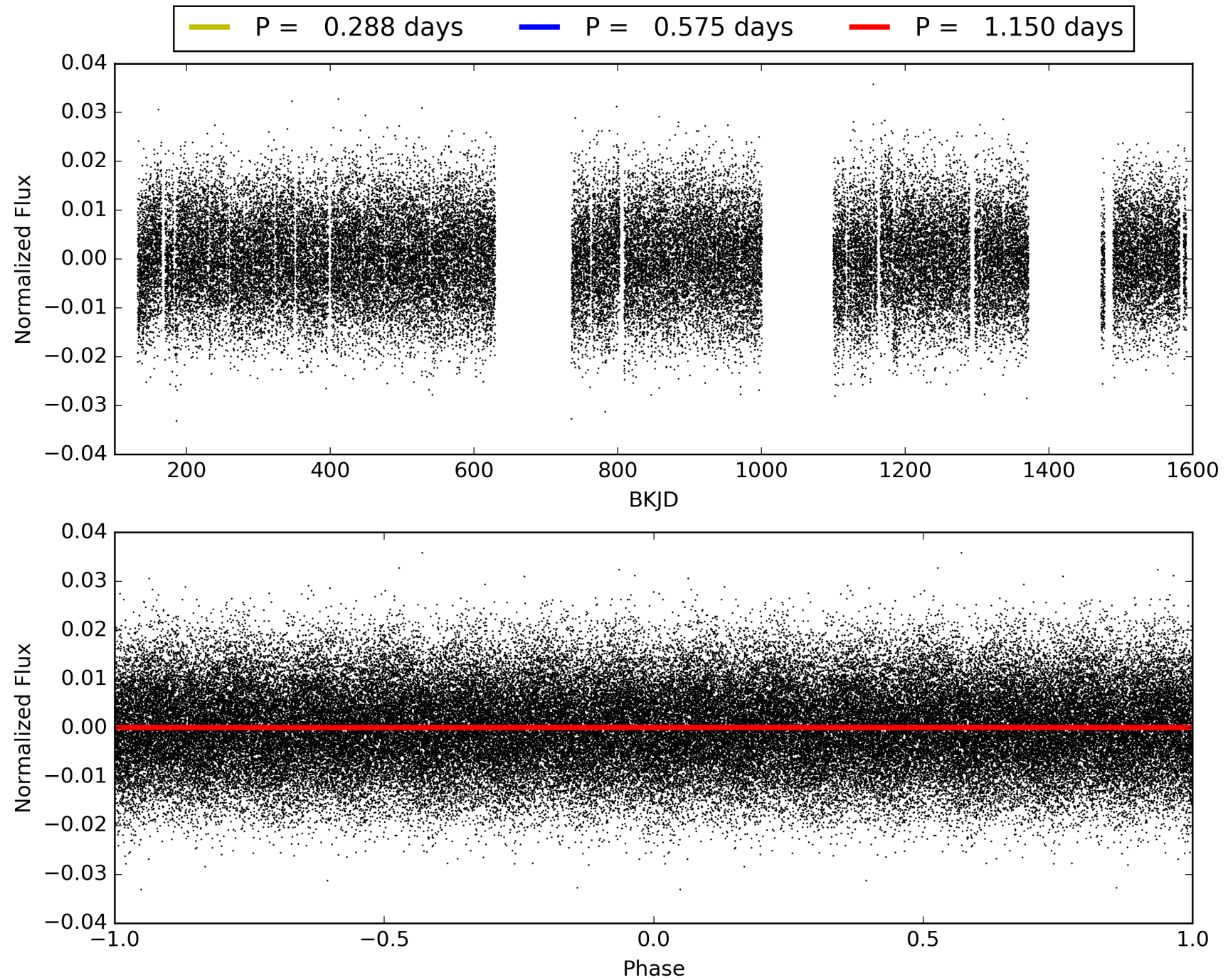
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 010684587-02, PDC Light Curves



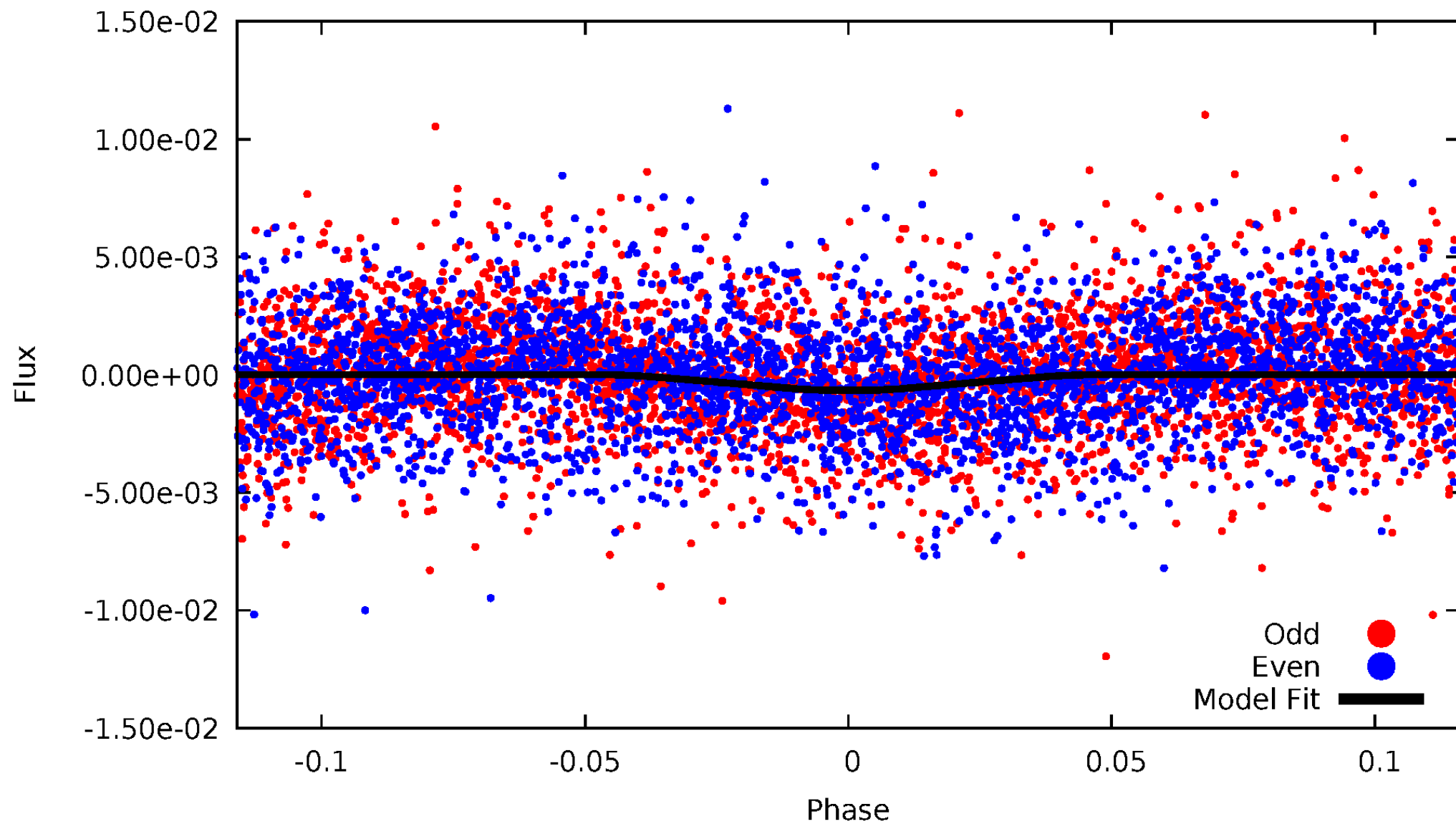


TCE 010684587-02



# DV Odd/Even

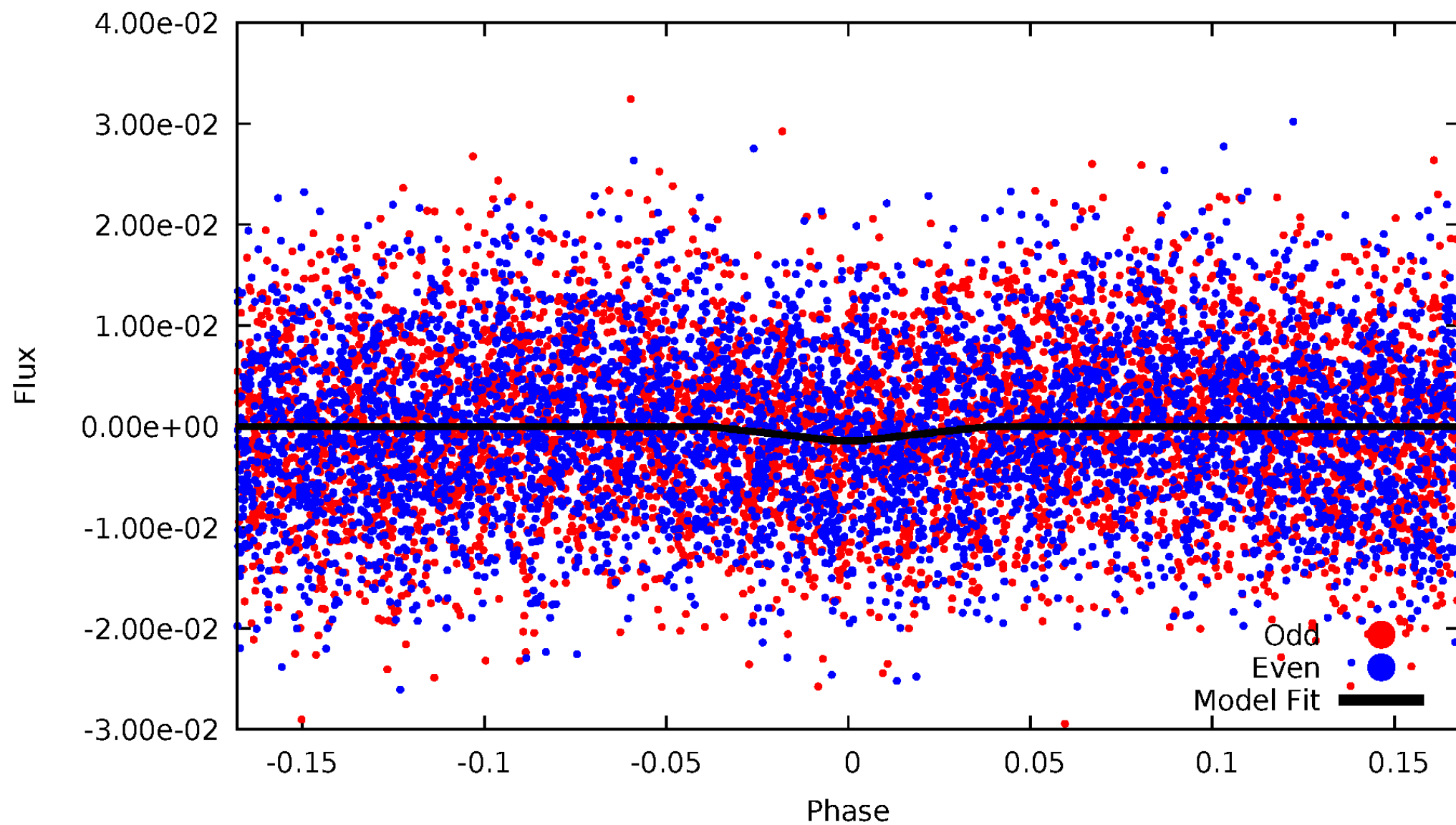
TCE 010684587-02





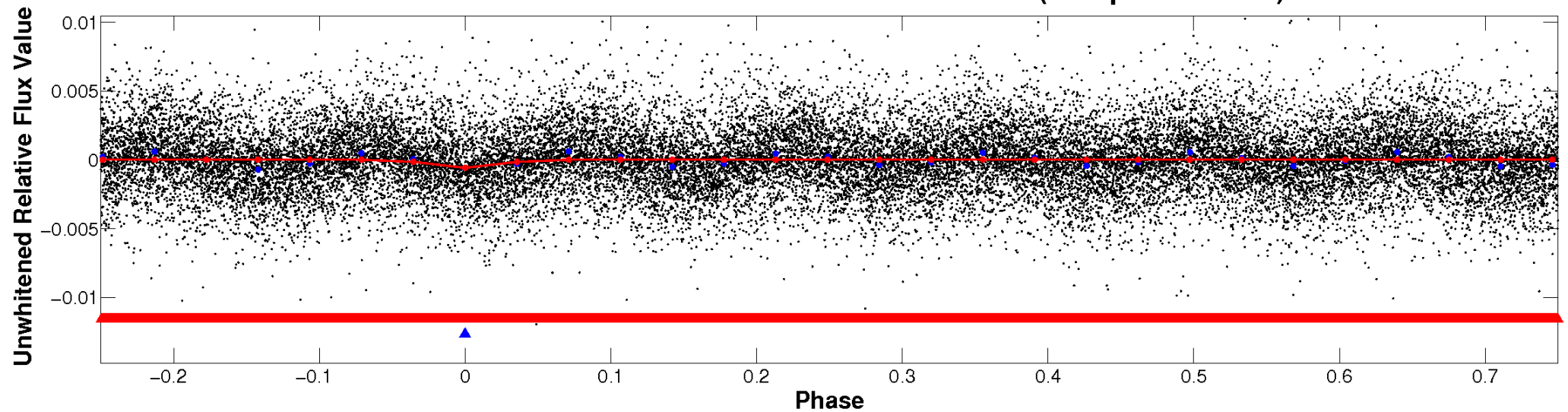
# ALT Odd/Even

TCE 010684587-02

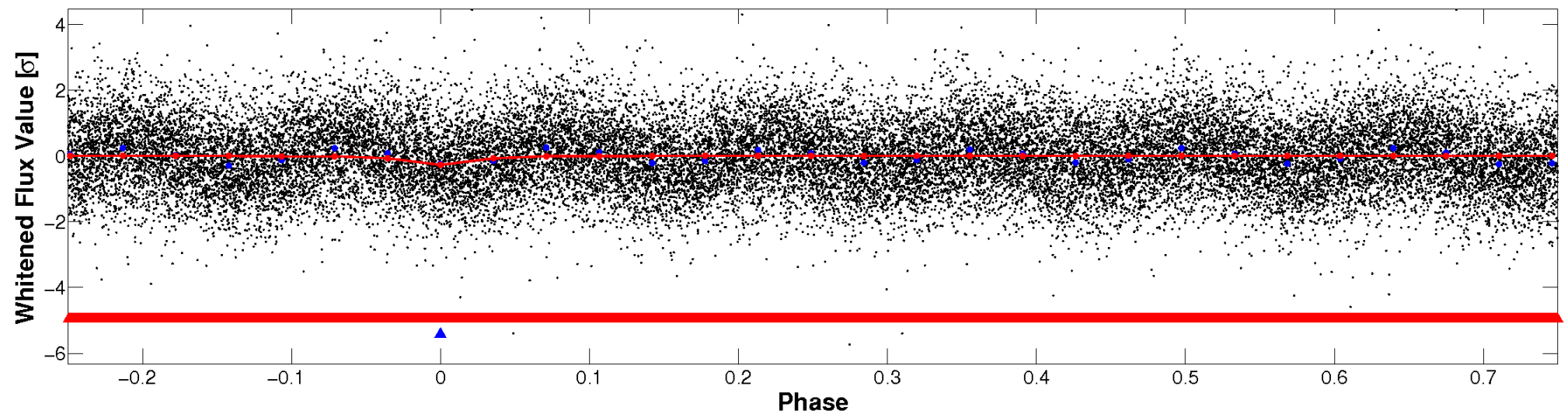


# Non-Whitened Vs. Whitened Light Curve

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

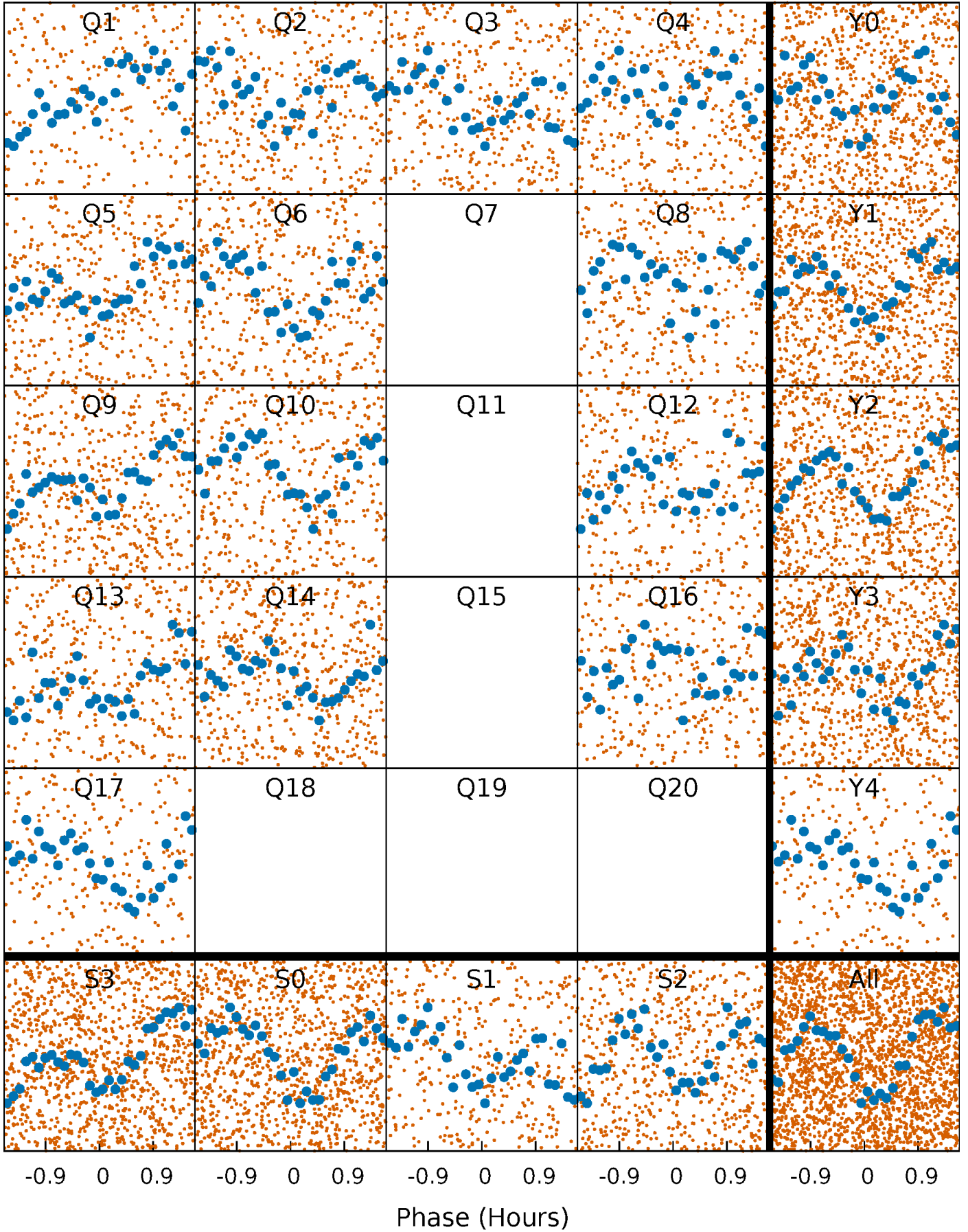


**Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



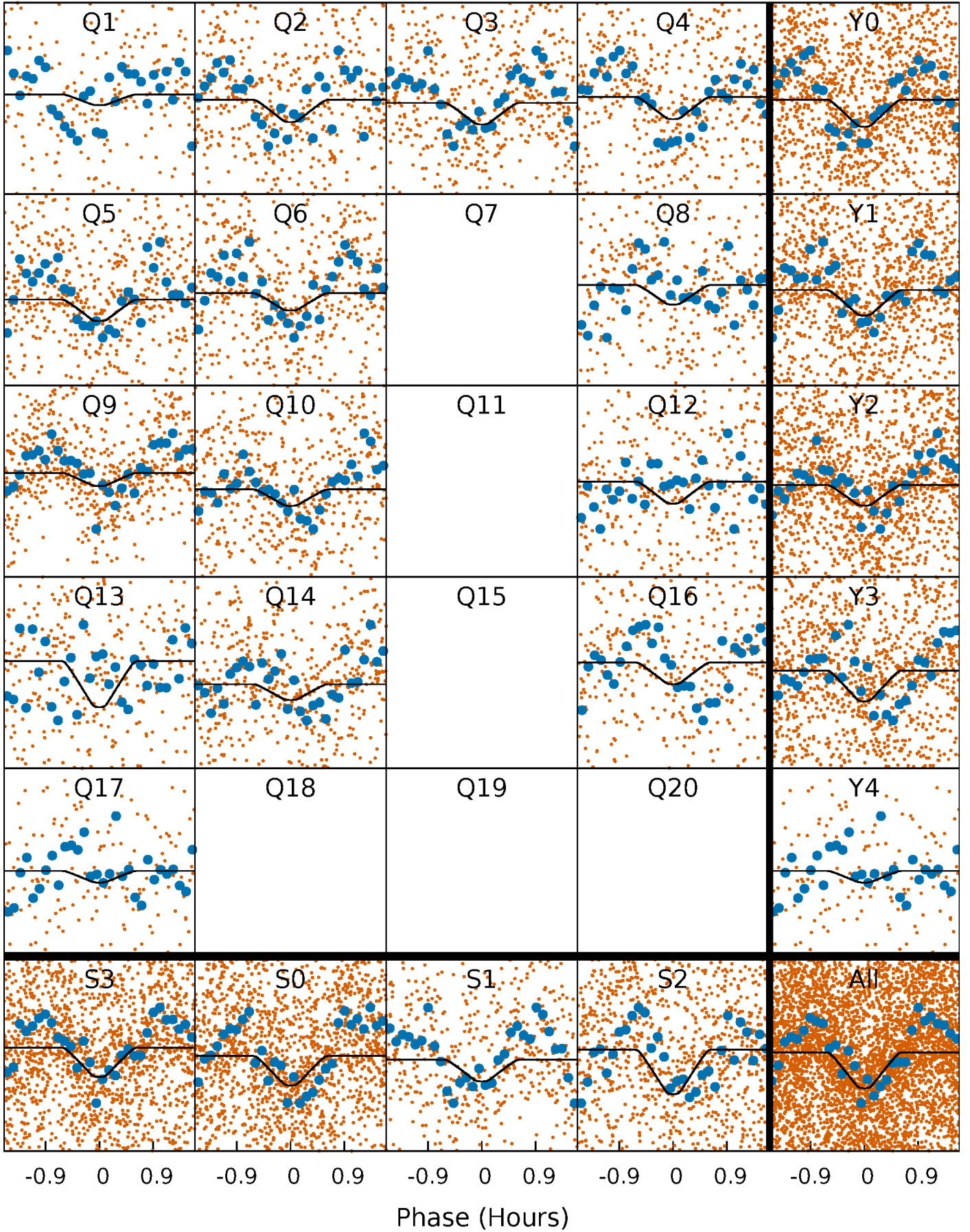
# PDC Quarter-Phased Transit Curves

TCE 010684587-02   P= 0.575138 Days    $T_0=131.612365$  (BKJD)



# DV Quarter-Phased Transit Curves

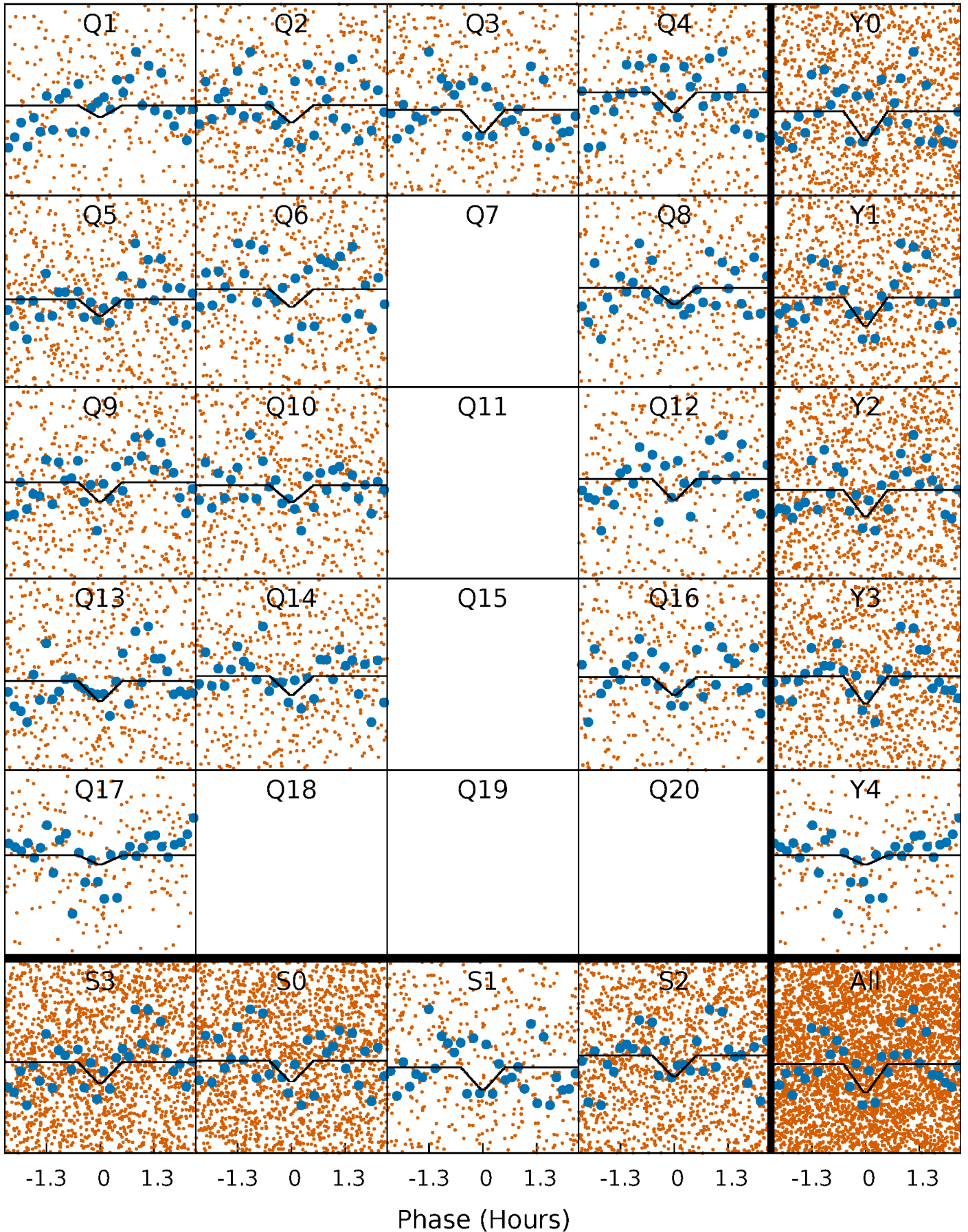
TCE 010684587-02   P= 0.575138 Days    $T_0=131.612365$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

TCE 010684587-02 P= 0.575149 Days  $T_0=131.605189$  (BKJD)

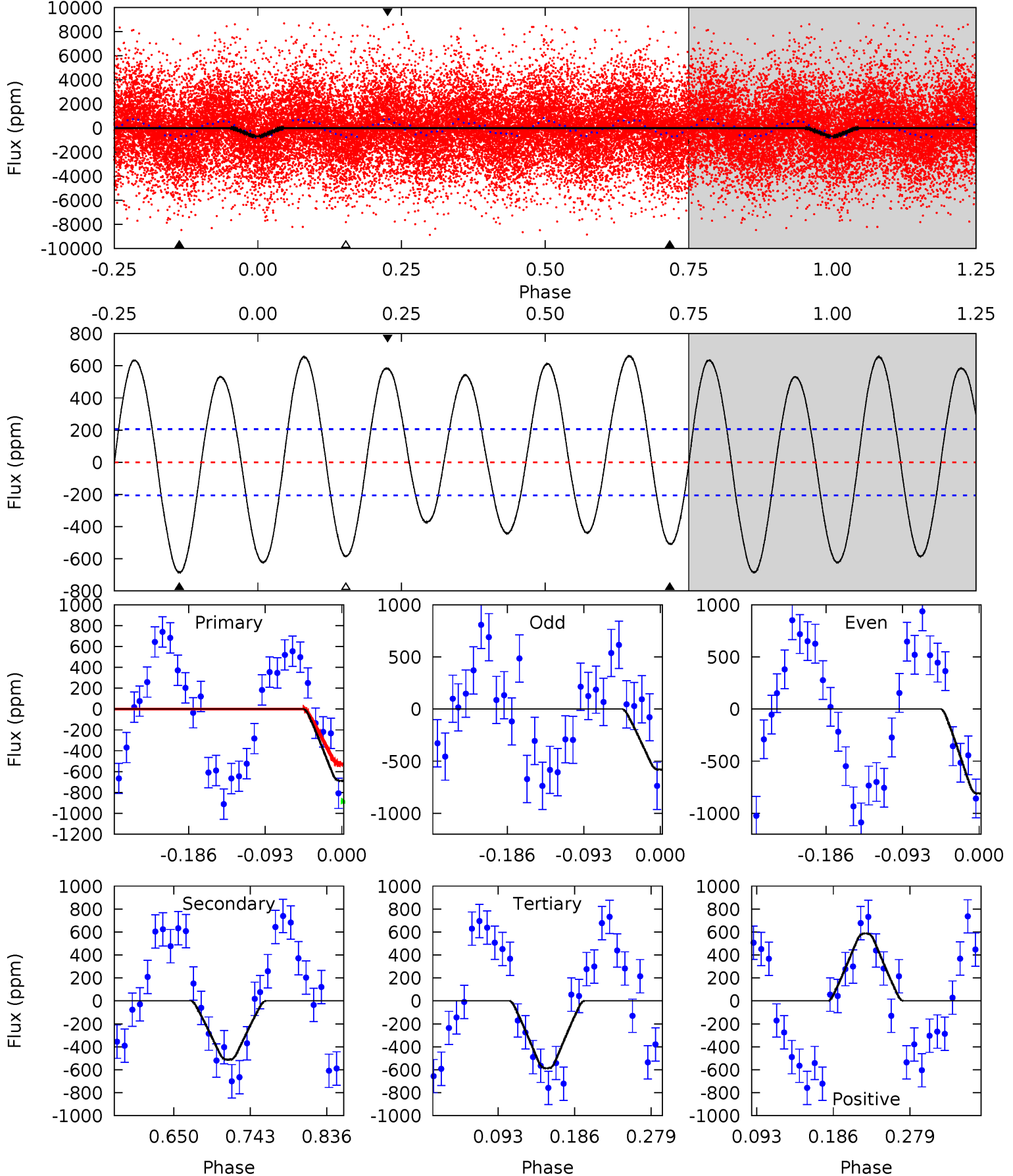




# DV Model-Shift Uniqueness Test

010684587-02, P = 0.575138 Days, E = 131.037227 Days

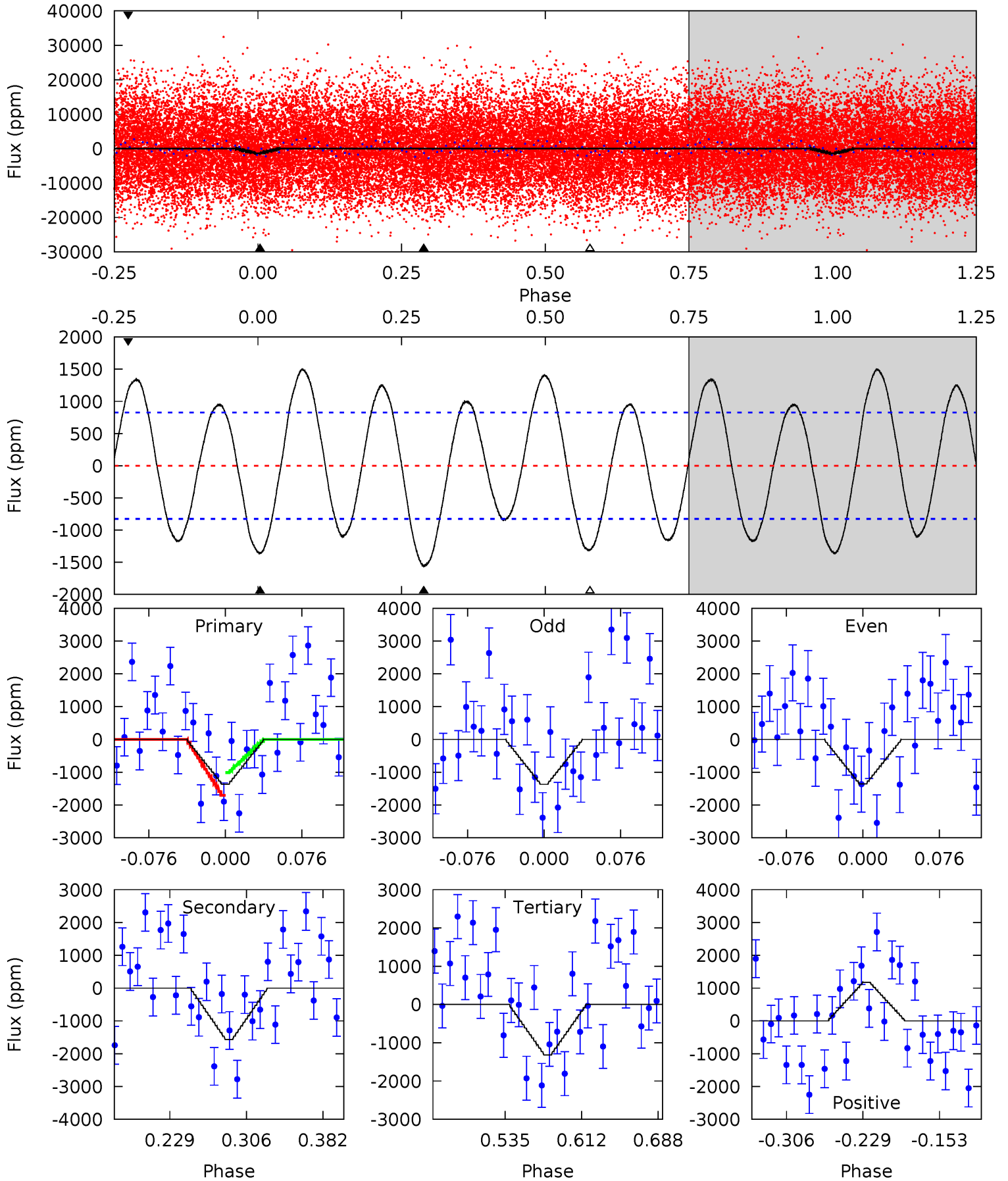
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
15.3	11.4	13.1	13.1	4.58	1.68	8.55	2.25	2.25	-1.69	-1.69	2.55	0.89	0.49	4.00



# Alt Model-Shift Uniqueness Test

010684587-02, P = 0.575149 Days, E = 131.030040 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
7.62	8.75	7.36	6.57	4.62	1.77	4.66	0.26	1.05	1.39	2.18	0.03	0.98	0.49	1.96



### Stellar Parameters For KIC 010684587

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$7530^{+209}_{-340}$	$3.774^{+0.376}_{-0.094}$	$-0.040^{+0.200}_{-0.350}$	$3.022^{+0.433}_{-1.387}$	$1.982^{+0.088}_{-0.500}$	$0.101^{+0.341}_{-0.029}$
	+3%/-5%	+10%/-2%	+500%/-875%	+14%/-46%	+4%/-25%	+337%/-29%
Source	KIC0	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 010684587-02 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	-512 $\pm$ 45	$8.25^{+5.57}_{-4.08}$	$6040^{+419}_{-687}$	$6146^{+3855}_{-1980}$	$1.124^{+3.259}_{-0.698}$
Alt.	-1566 $\pm$ 179	$11.16^{+5.30}_{-5.08}$	$6006^{+408}_{-674}$	$7286^{+3874}_{-1562}$	$1.965^{+4.704}_{-1.096}$

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

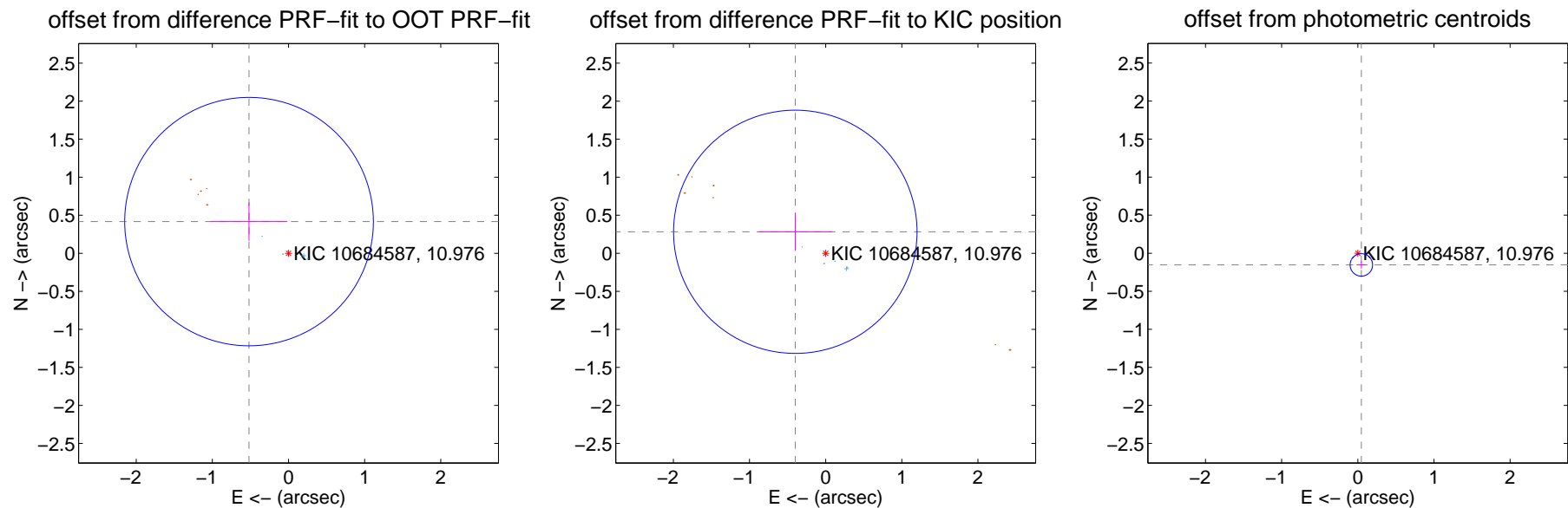
## DV Centroid Data

Supplemental centroid analysis for 010684587-02. **Kepler magnitude: 10.98.** Transit SNR 9.58

There are 5 quarters with good PRF difference image offsets

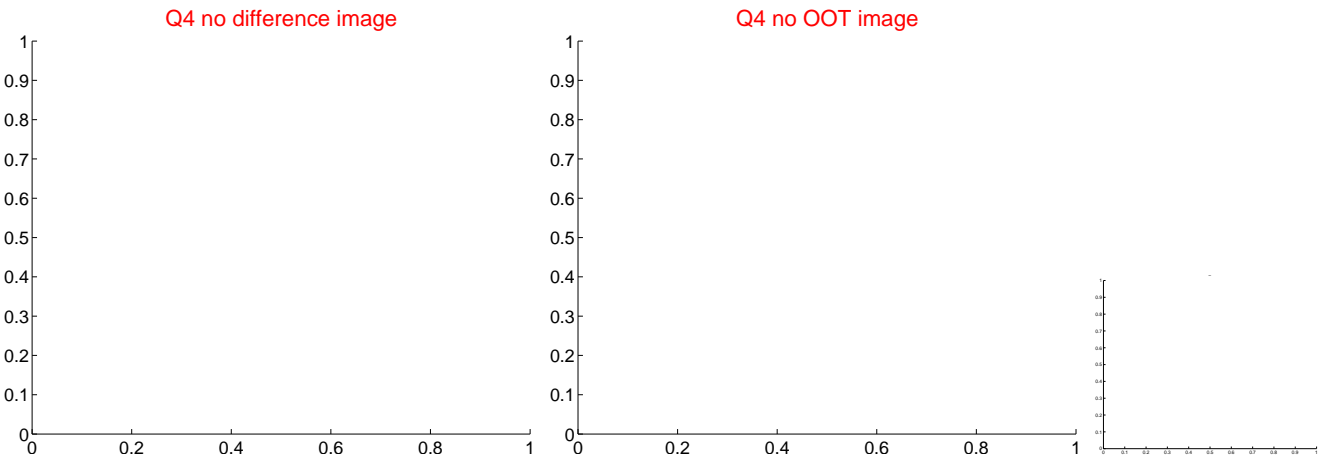
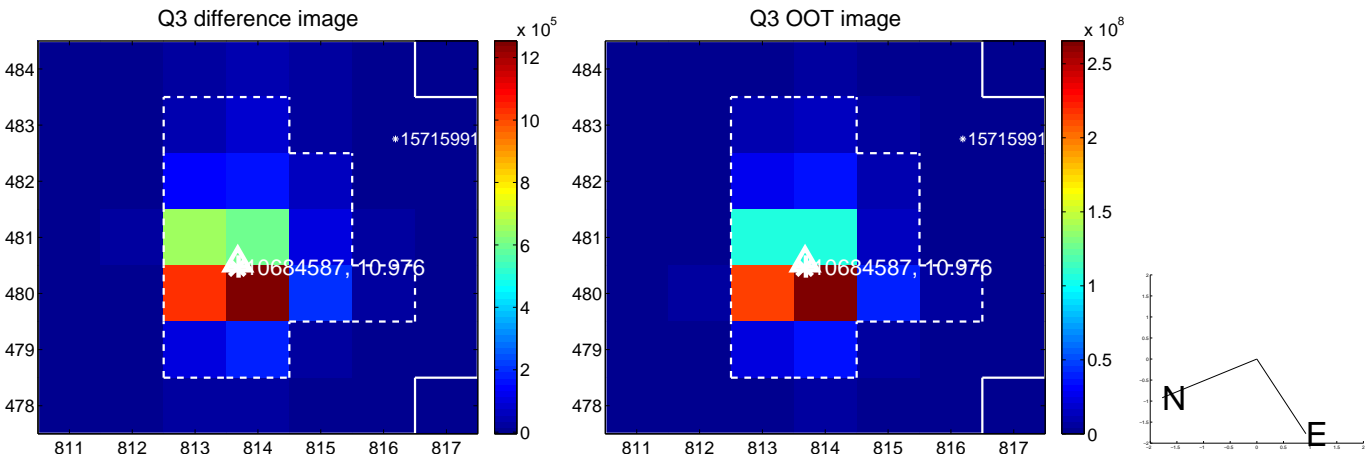
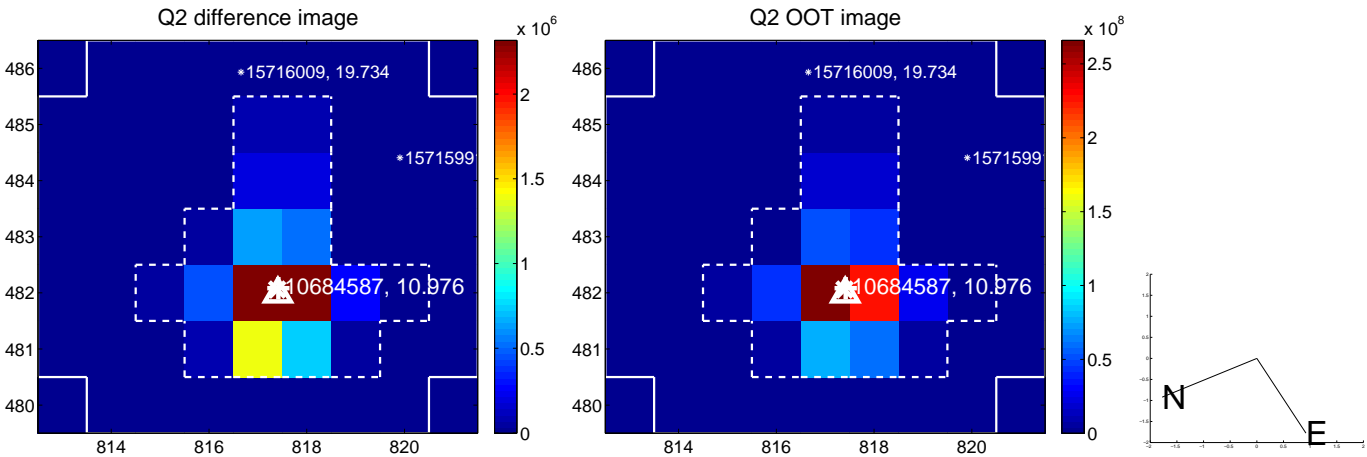
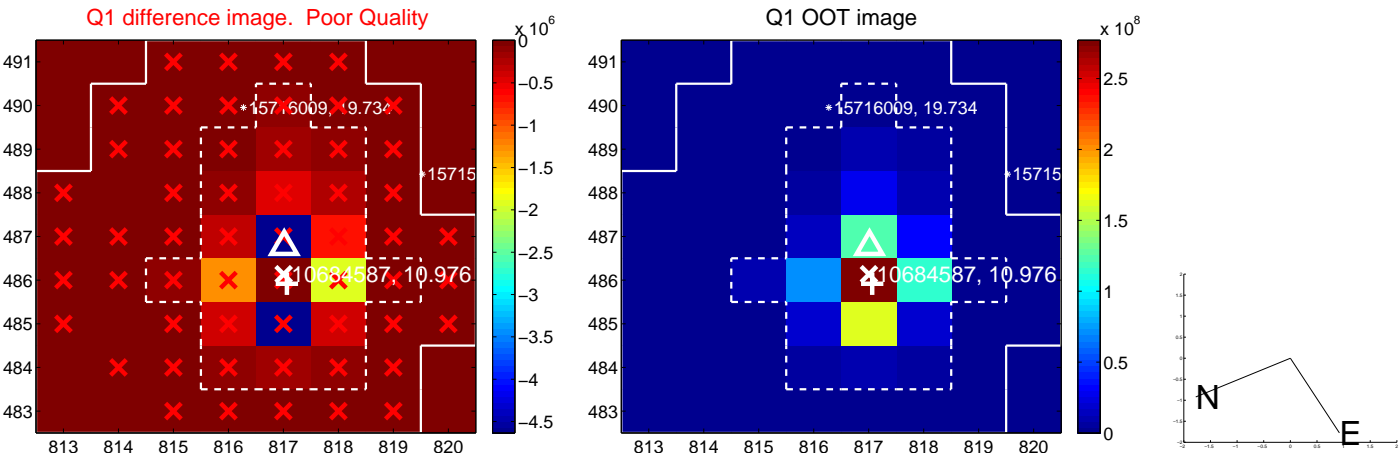
The direct PRF centroid is offset from the target star catalog position by about 0.70 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.665 \pm 0.544$	1.22	$0.518 \pm 0.503$	$0.417 \pm 0.253$
PRF-fit source offset from KIC position	$0.489 \pm 0.533$	0.92	$0.399 \pm 0.482$	$0.282 \pm 0.251$
photometric centroid source offset	$0.16 \pm 0.05$	<b>3.26</b>	$-0.05 \pm 0.06$	$-0.15 \pm 0.05$



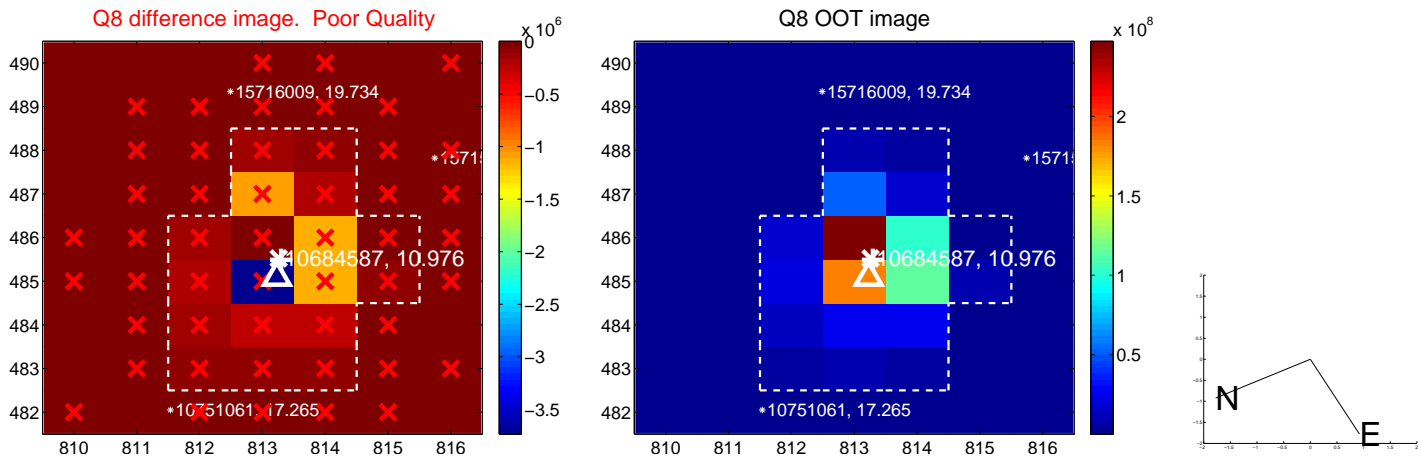
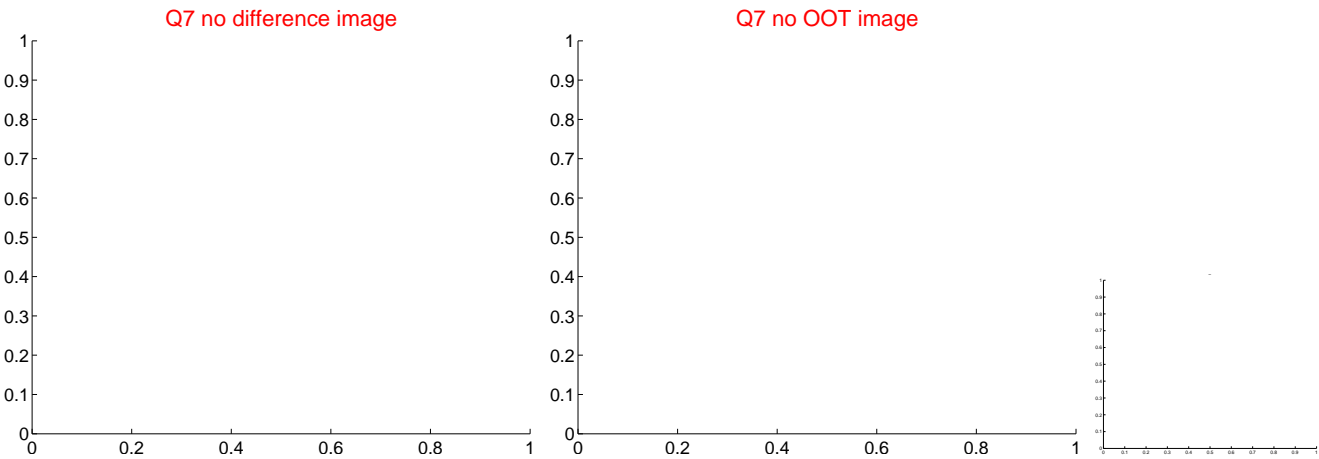
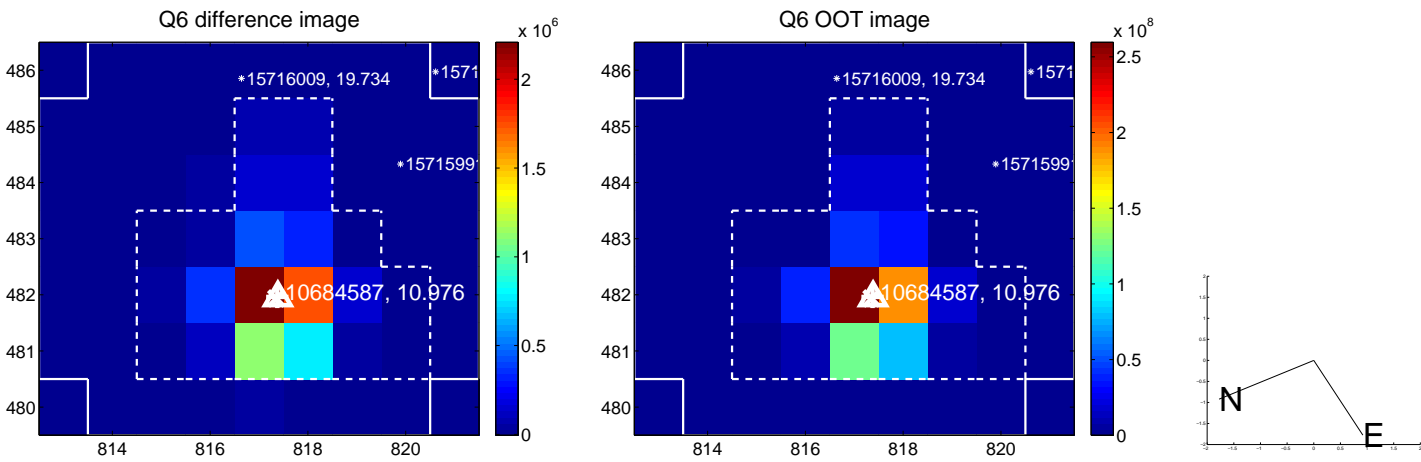
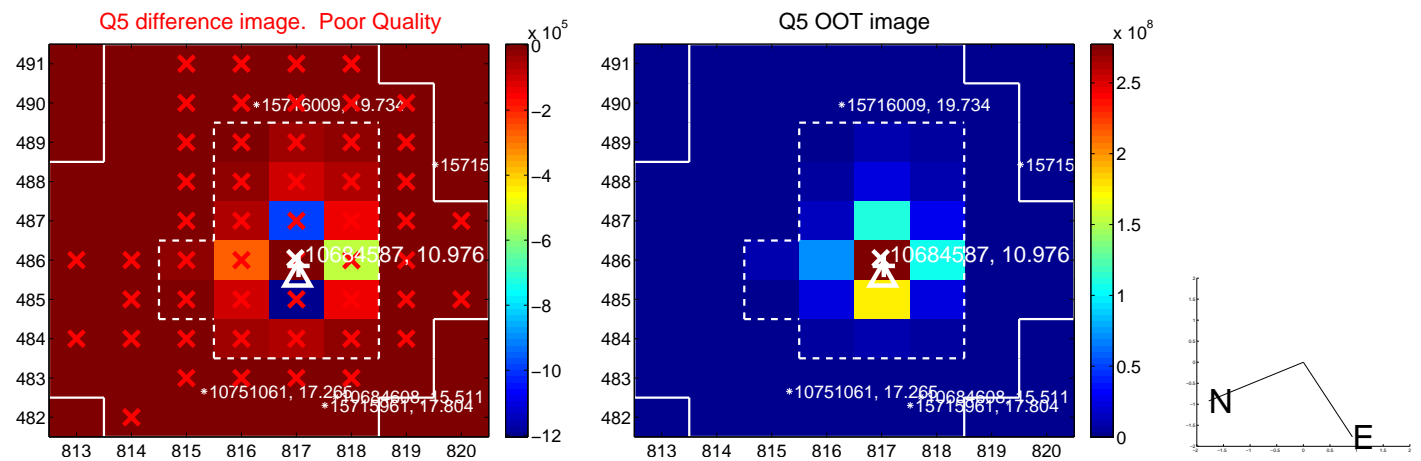
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

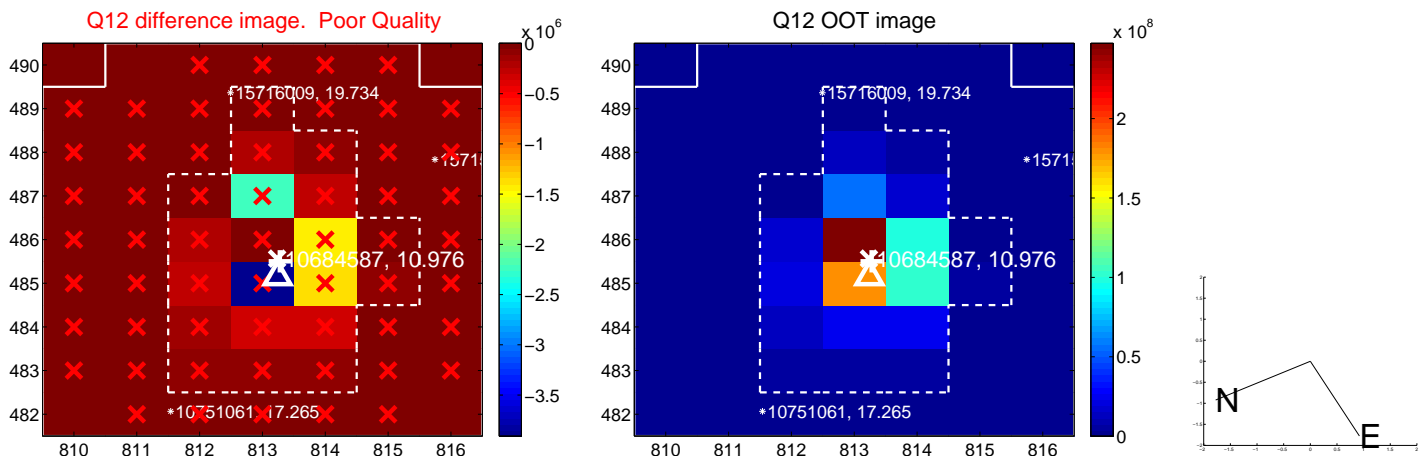
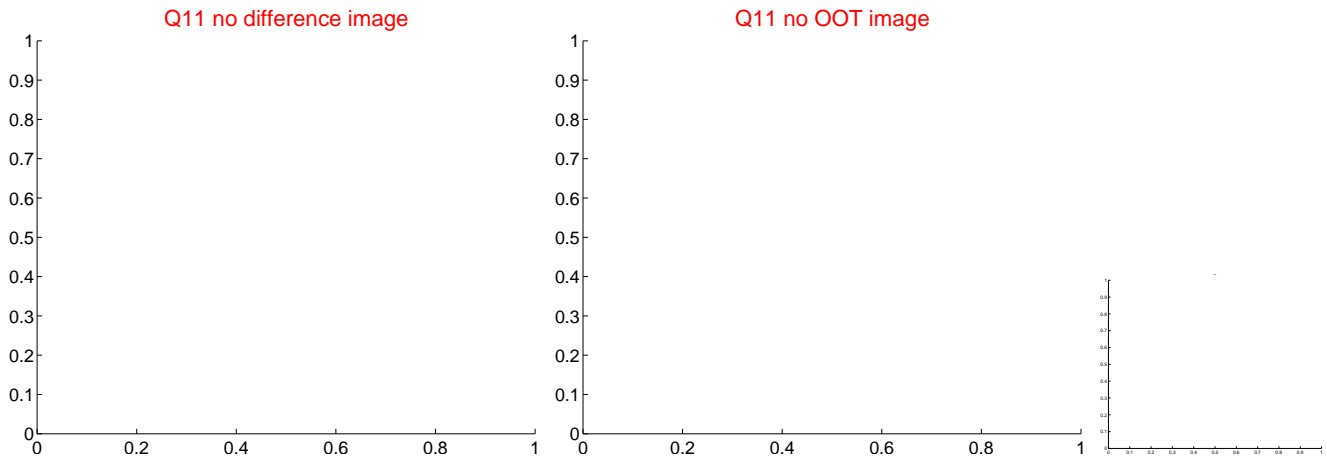
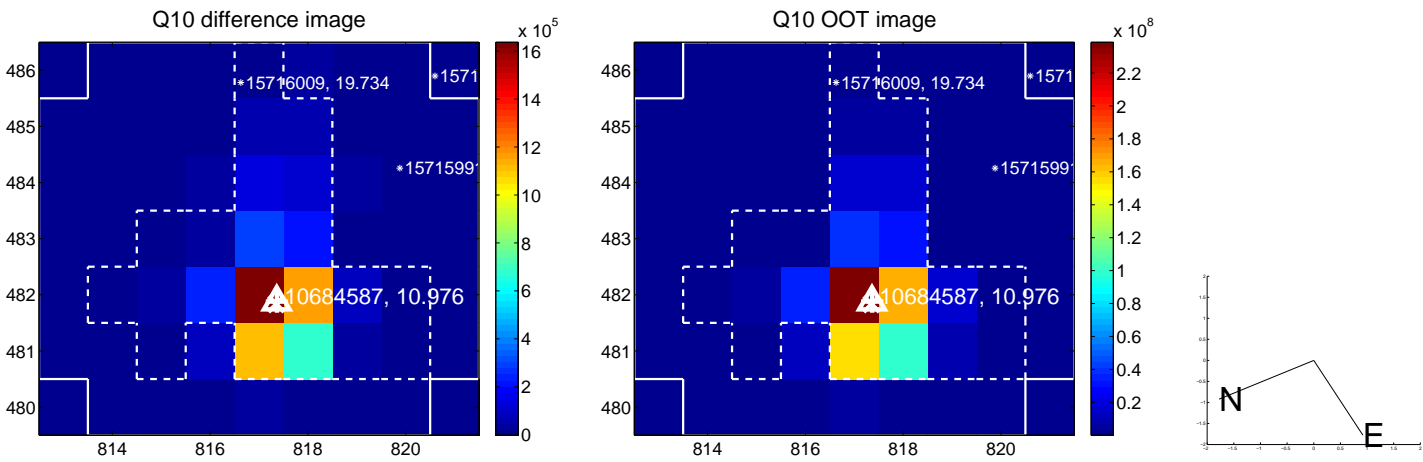
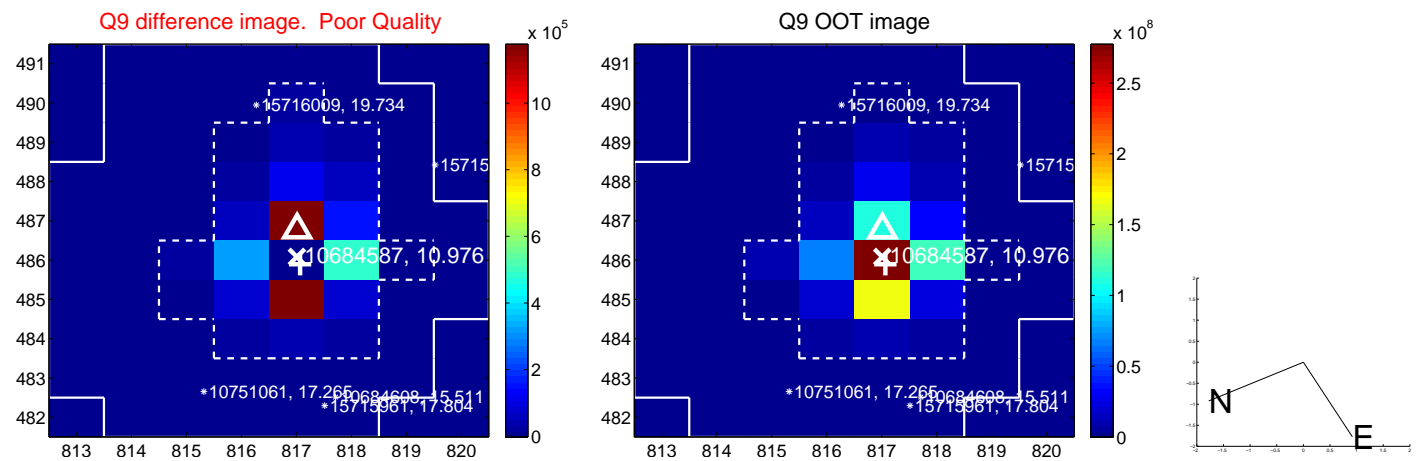




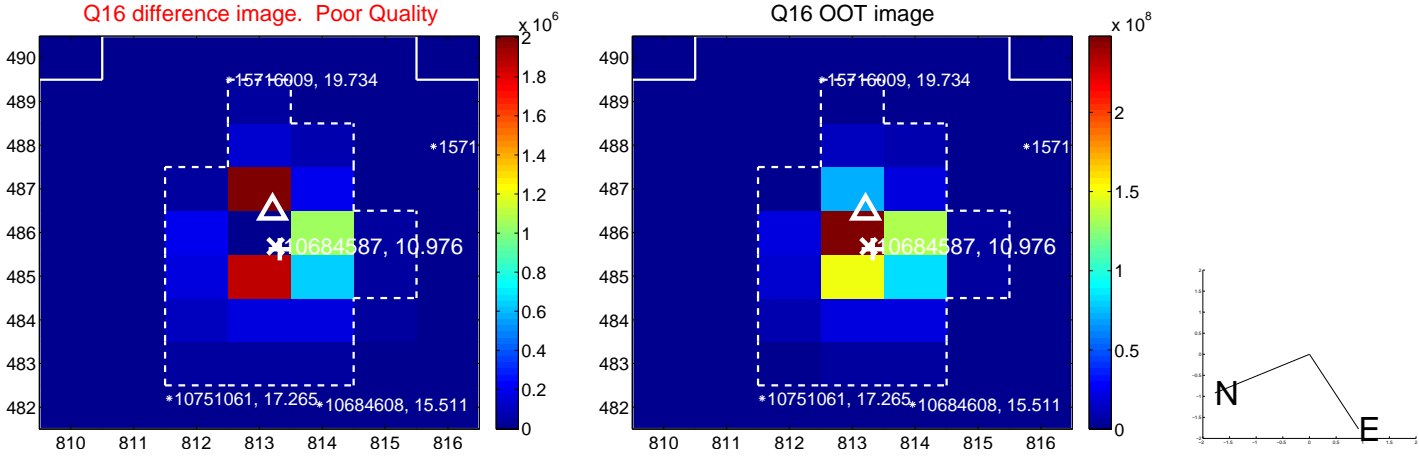
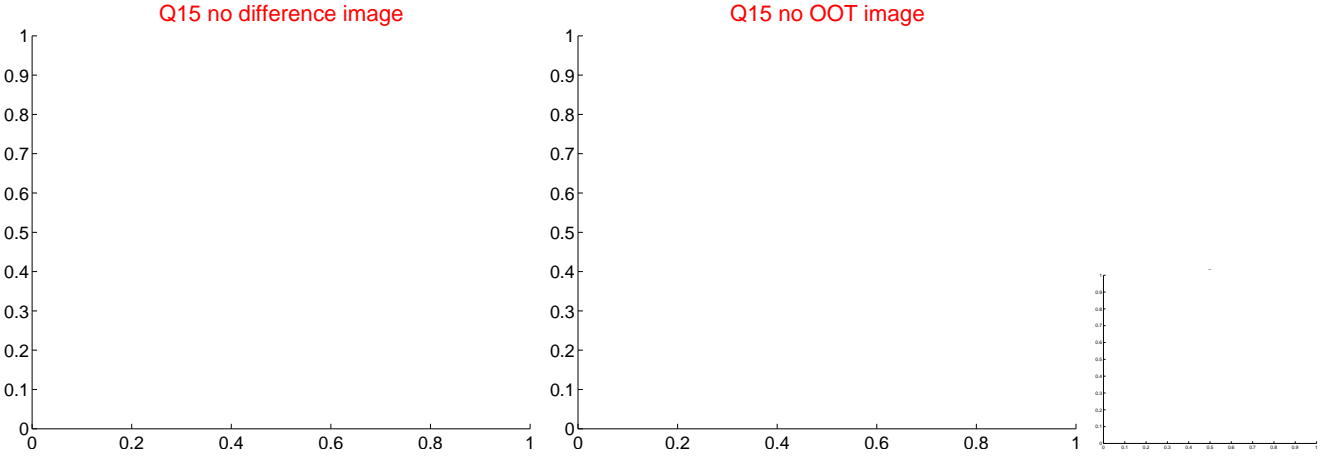
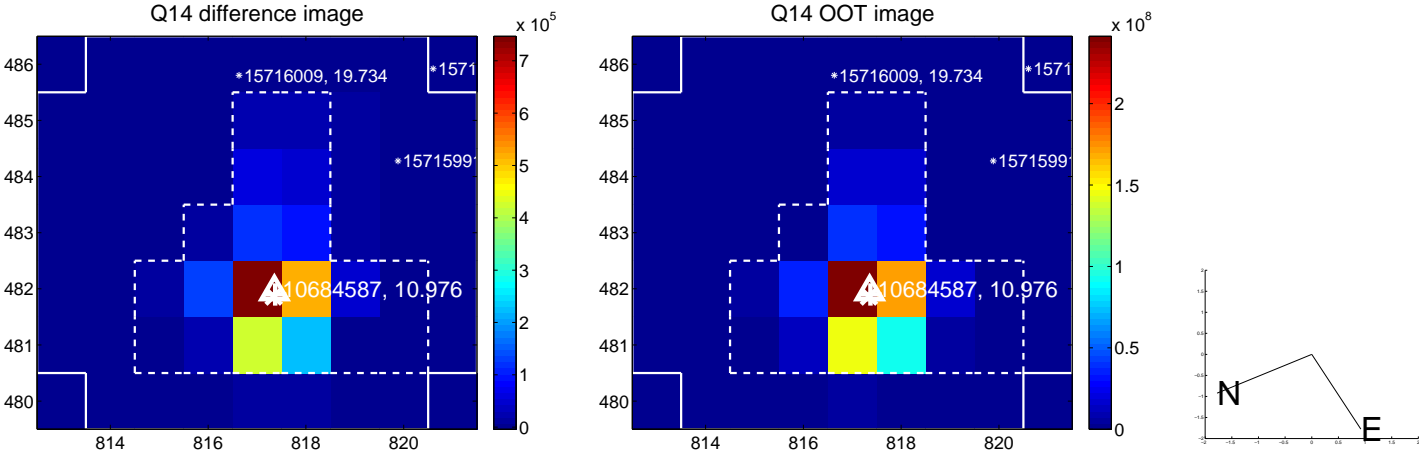
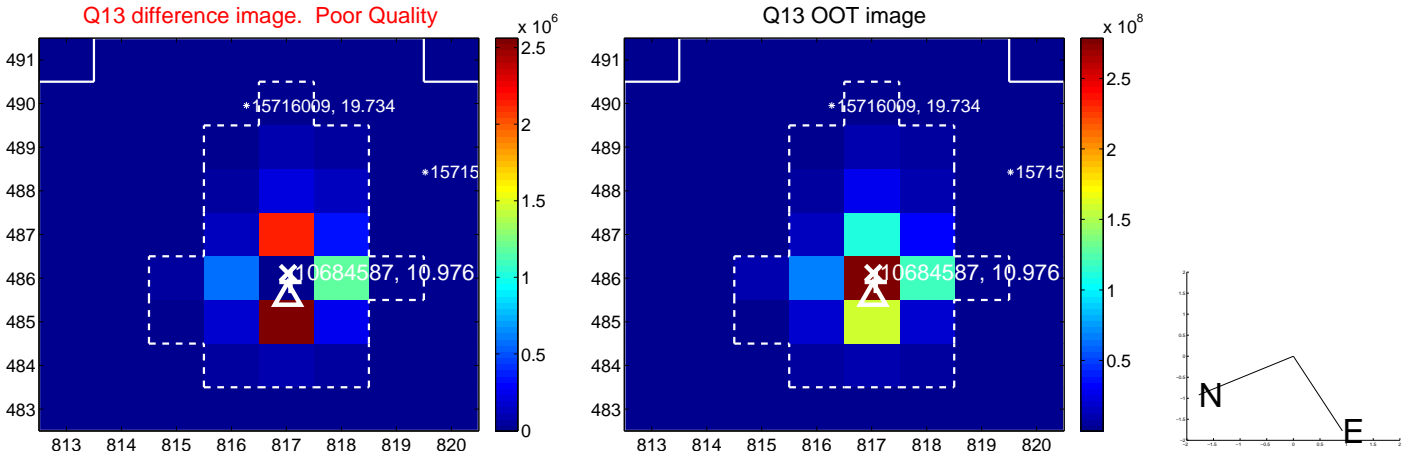
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



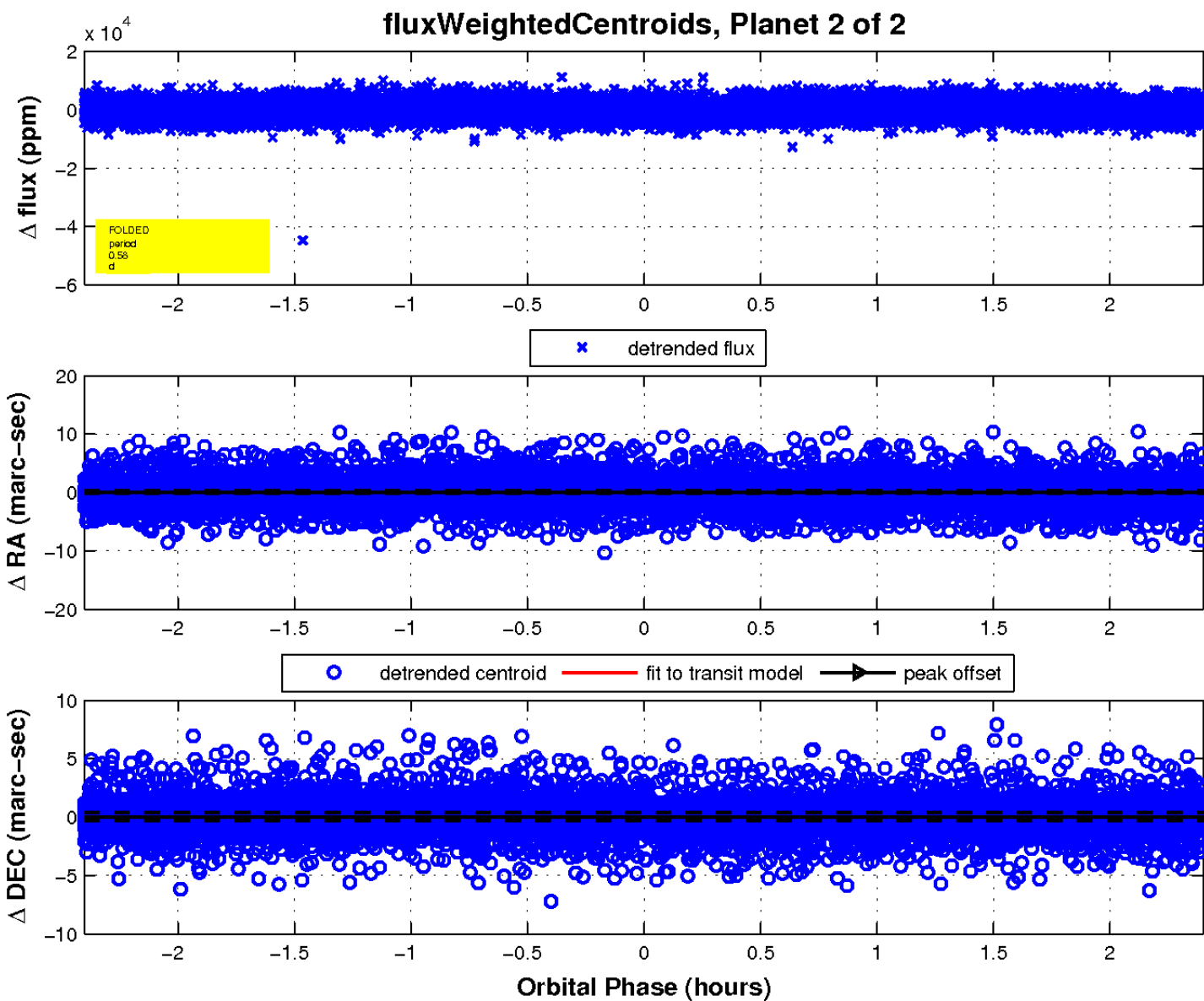
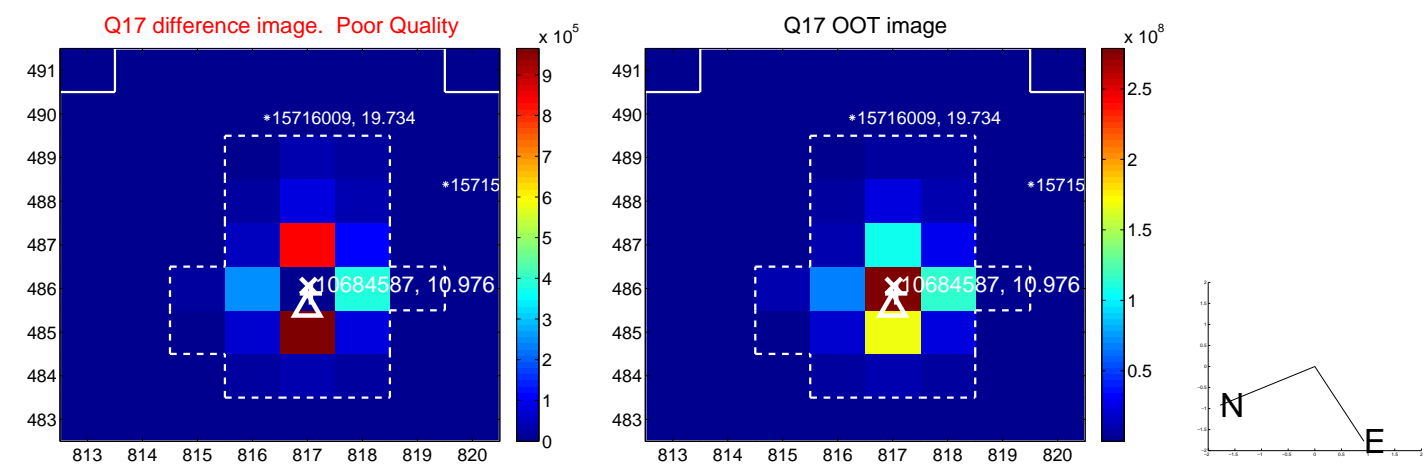
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

