

# KIC 007687231

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
007687231-01	OBS	No	448.250828	466.745644	8.3	3.295	14.0	1.6	29.64	4148	10.48	196.27
007687231-02	OBS	No	77.767158	178.091638	16.8	5.534	10.8	3.9	29.64	4148	14.01	2028.41

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
007687231-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_ZUMA—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_TER_DV—MOD_POS_DV—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
007687231-02	OBS	FP	0.00	1	0	0	0	LPP_DV—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_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.

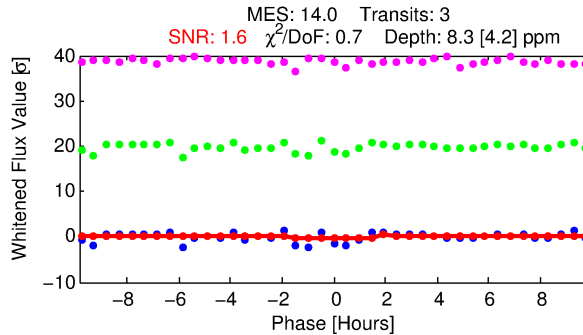
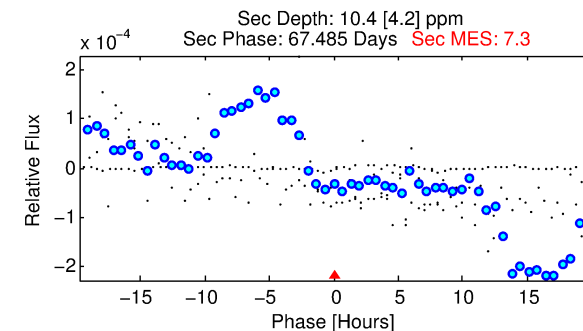
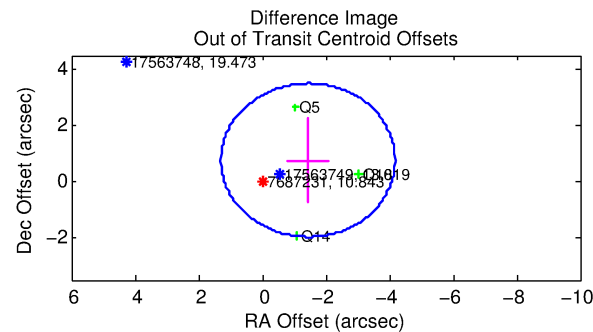
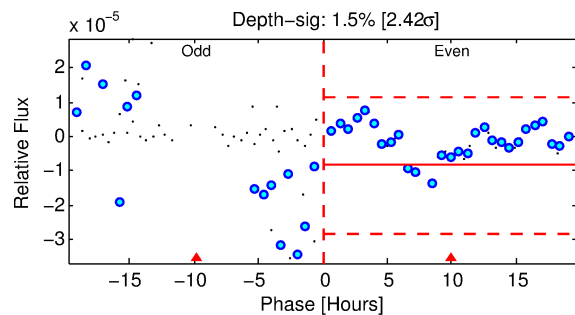
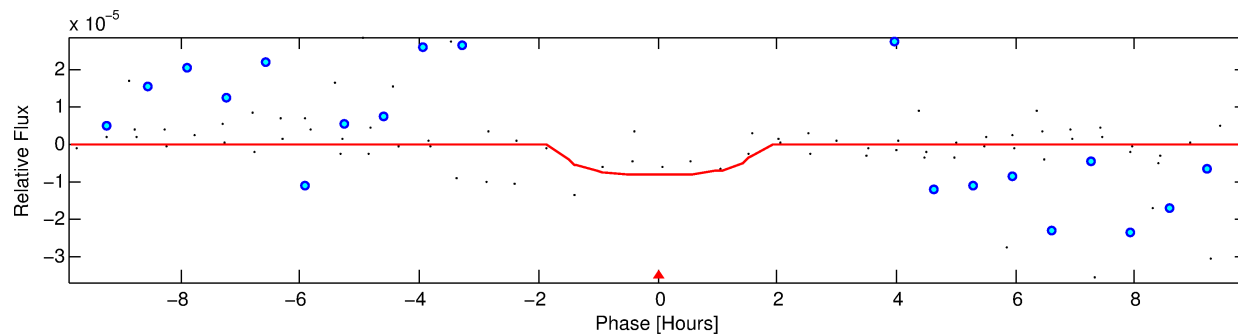
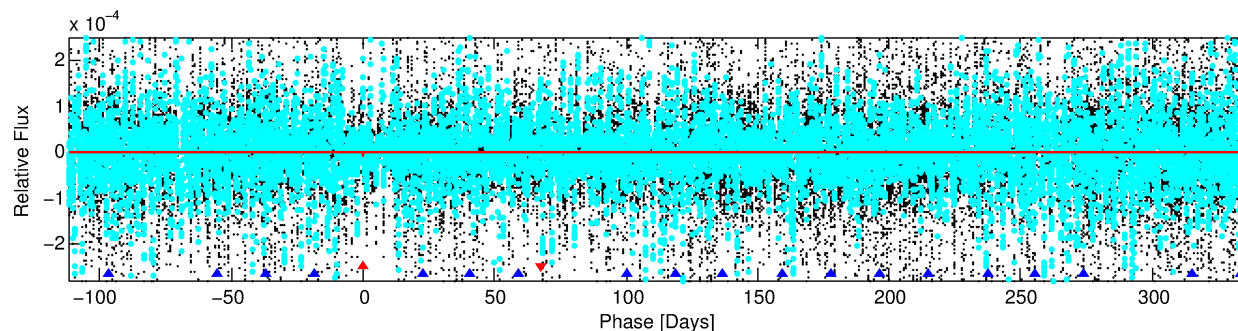
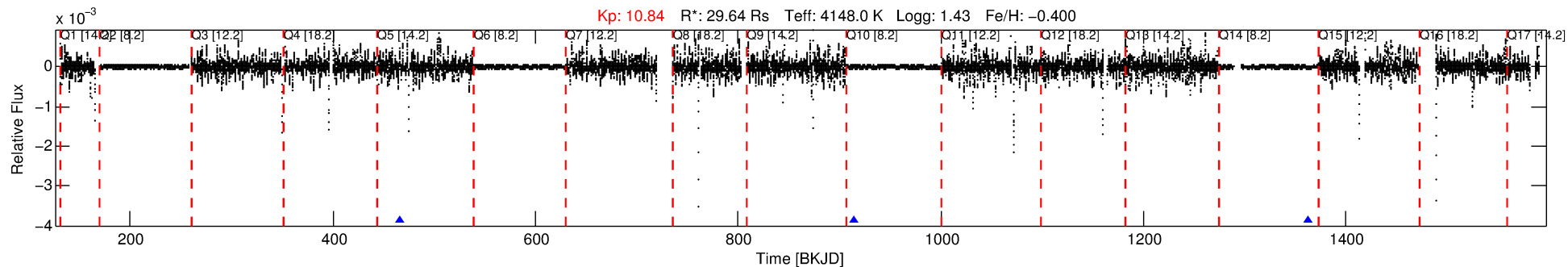
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 007687231-01

No Significant Match Found

# DV One-Page Summary

KIC: 7687231 Candidate: 1 of 2 Period: 448.251 d



## DV Fit Results:

Period = 448.25083 [0.02955] d  
Epoch = 466.7456 [0.0319] BKJD  
 $R_p/R^* = 0.0032$  [0.0060]  
 $a/R^* = 483.98$  [3029.47]  
 $b = 0.89$  [1.55]  
 $\text{Seff} = 196.27$  [60.95]  
 $T_{\text{eq}} = 954$  [74] K  
 $R_p = 10.48$  [19.90]  $R_e$   
 $a = 1.0898$  [0.2794] AU  
 $A_g = 61.83$  [232.55] [0.26 $\sigma$ ]  
 $T_{\text{eff}} = 4138$  [3879] K [0.82 $\sigma$ ]

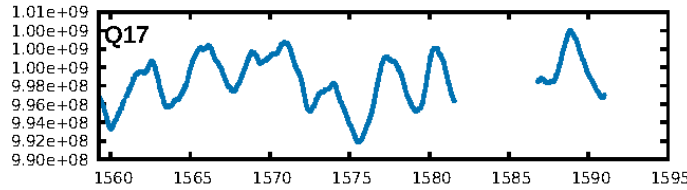
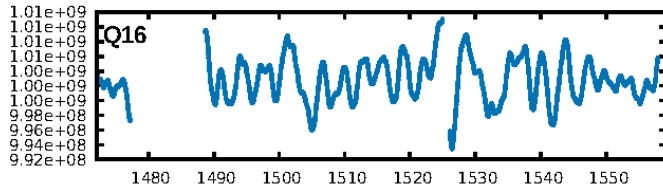
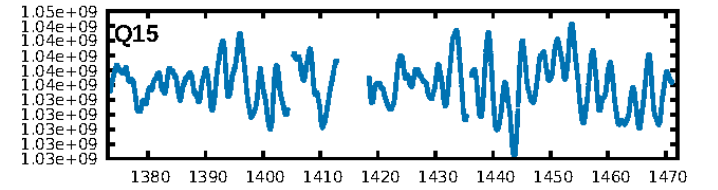
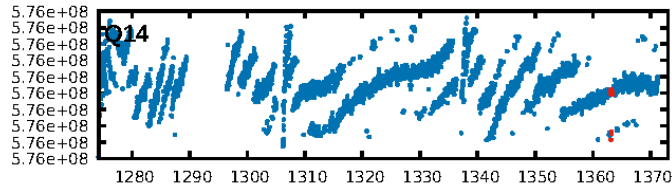
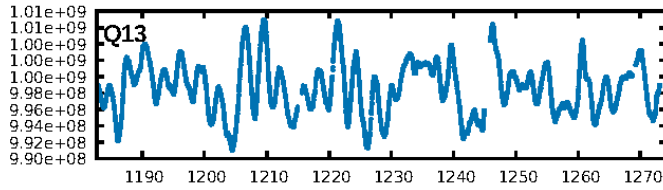
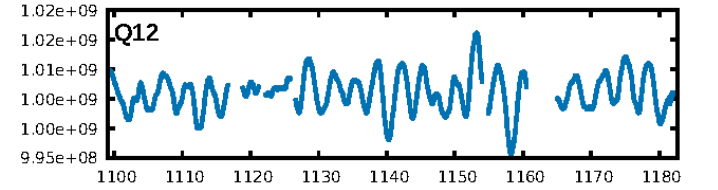
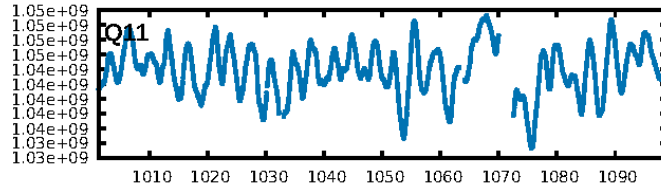
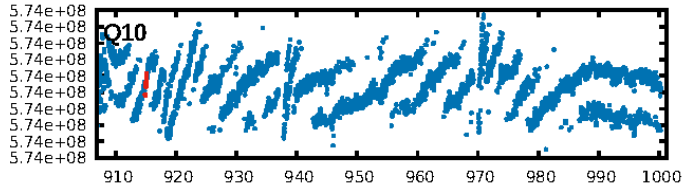
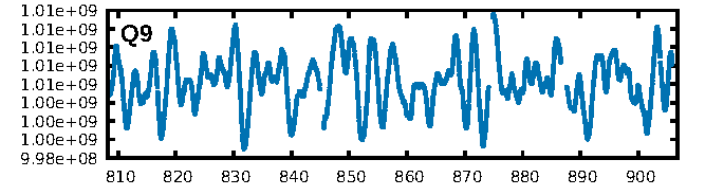
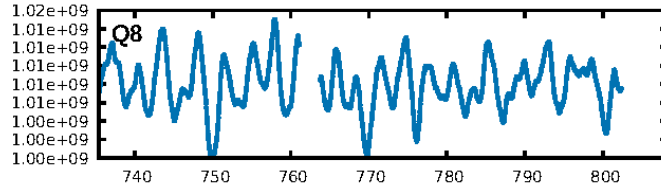
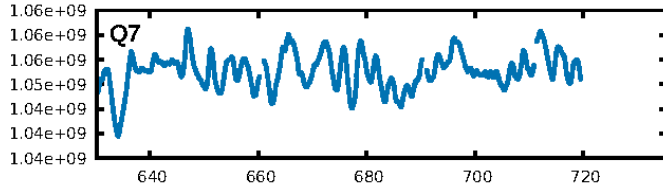
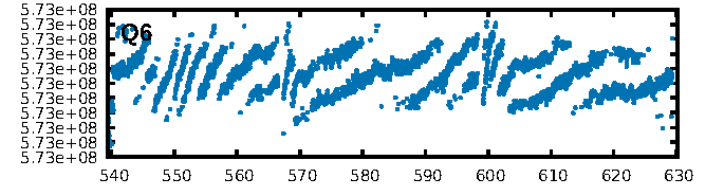
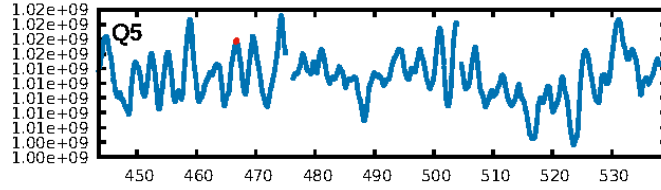
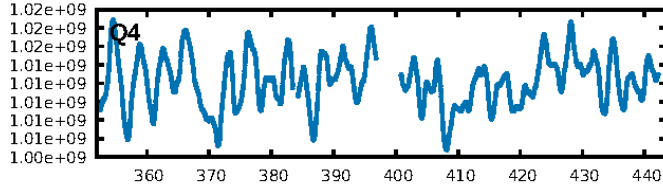
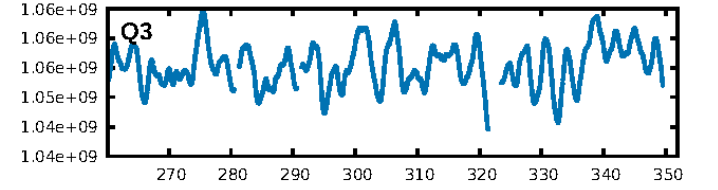
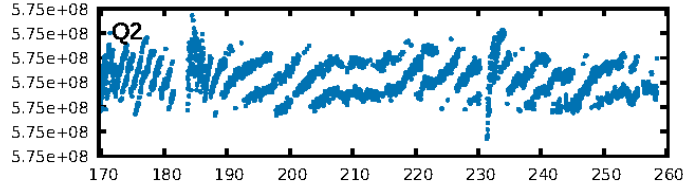
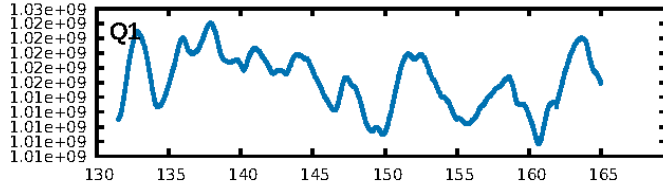
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [1380.65 $\sigma$ ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 78.4%  
ModelChiSquareGof-sig: 99.9%  
**Bootstrap-pfa: 1.47e-08**  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: -1.869  
Centroid-sig: 8.5%  
Centroid-so: 21.583 arcsec [1.30 $\sigma$ ]  
OotOffset-rm: 1.632 arcsec [1.79 $\sigma$ ]  
KicOffset-rm: 1.630 arcsec [1.32 $\sigma$ ]  
OotOffset-st: 2/0/0/1 [3]  
KicOffset-st: 2/0/0/1 [3]  
DiffImageQuality-fgm: 0.33 [1/3]  
DiffImageOverlap-fno: 1.00 [3/3]

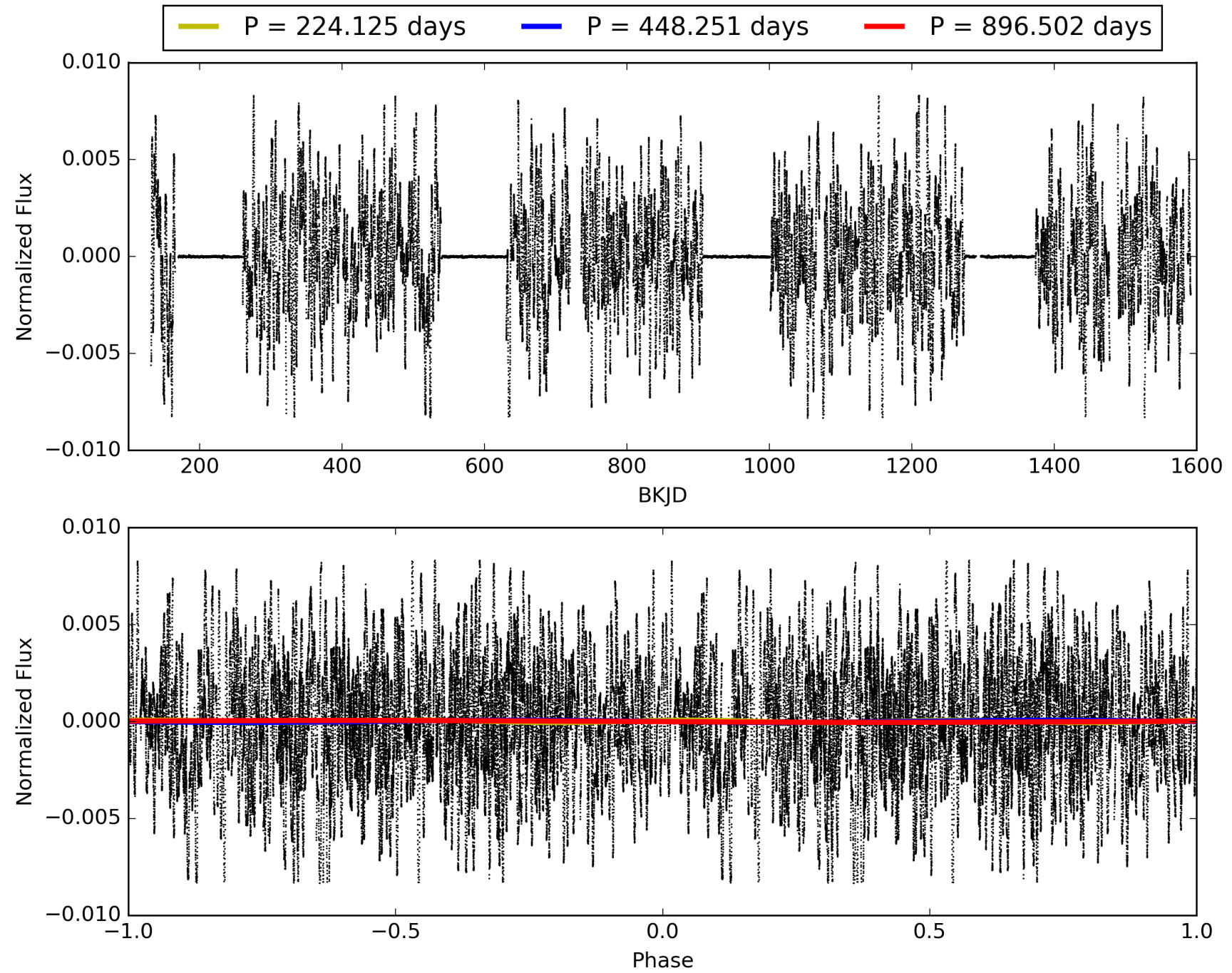
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This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 007687231-01, PDC Light Curves

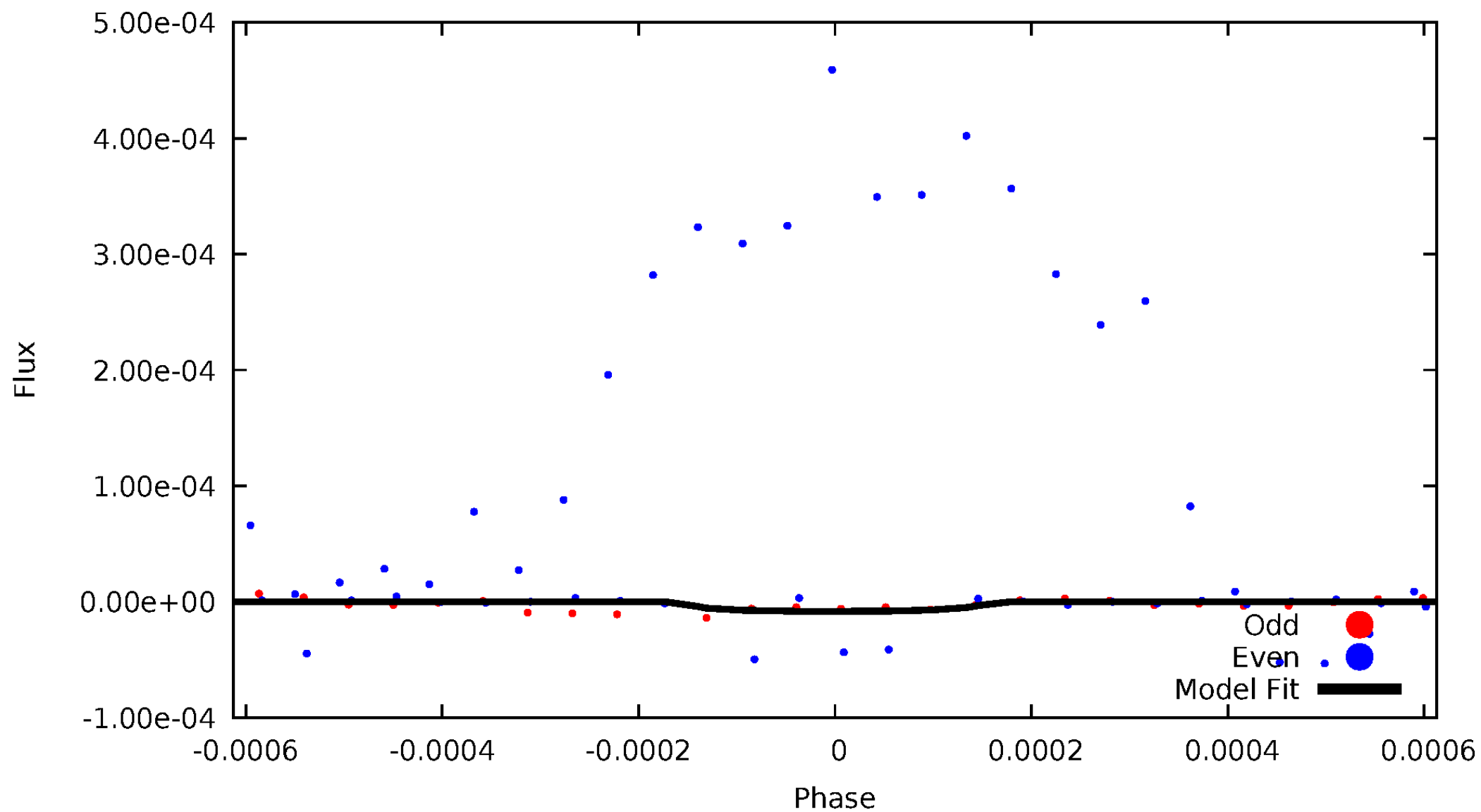


TCE 007687231-01



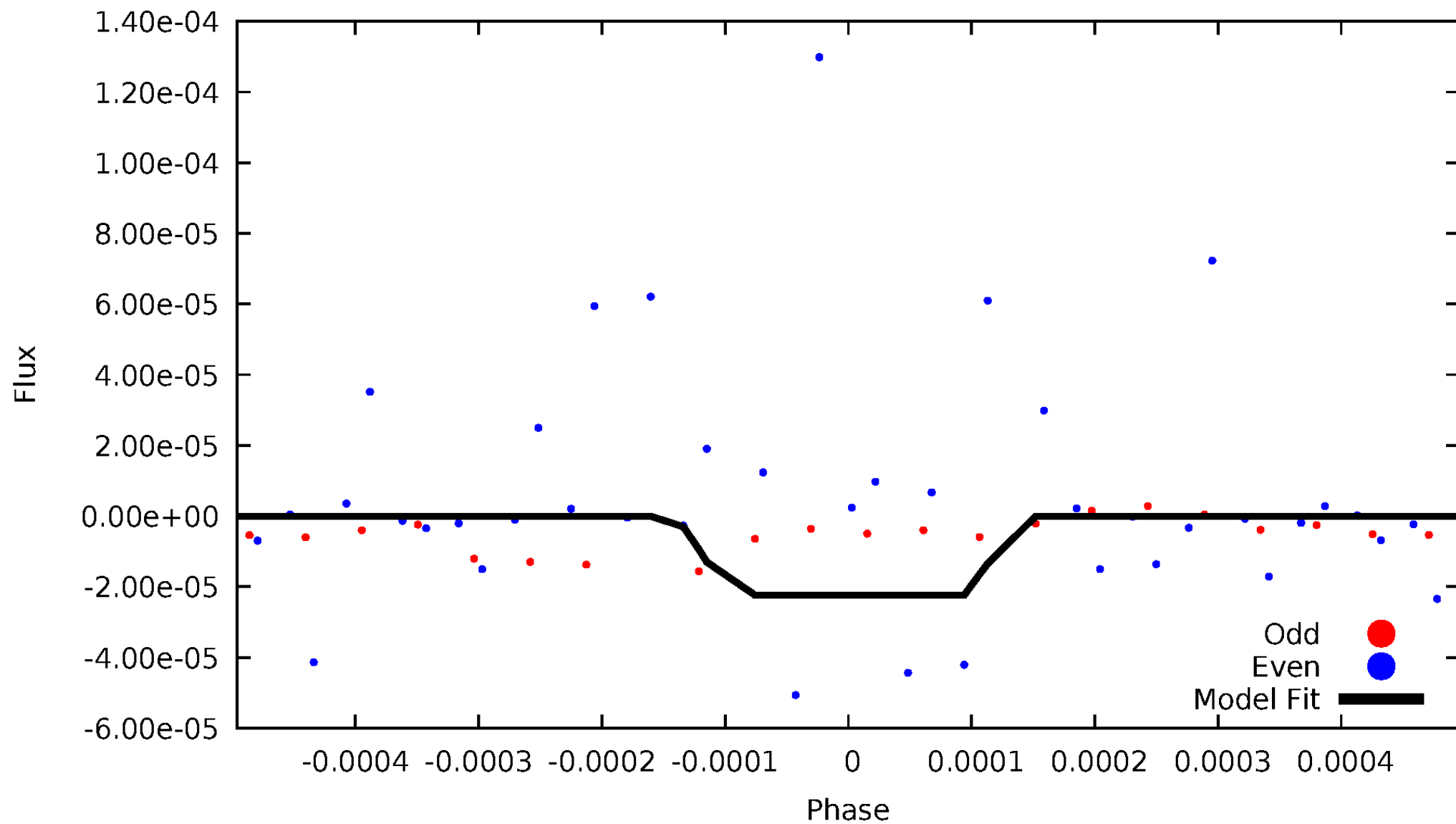
# DV Odd/Even

TCE 007687231-01



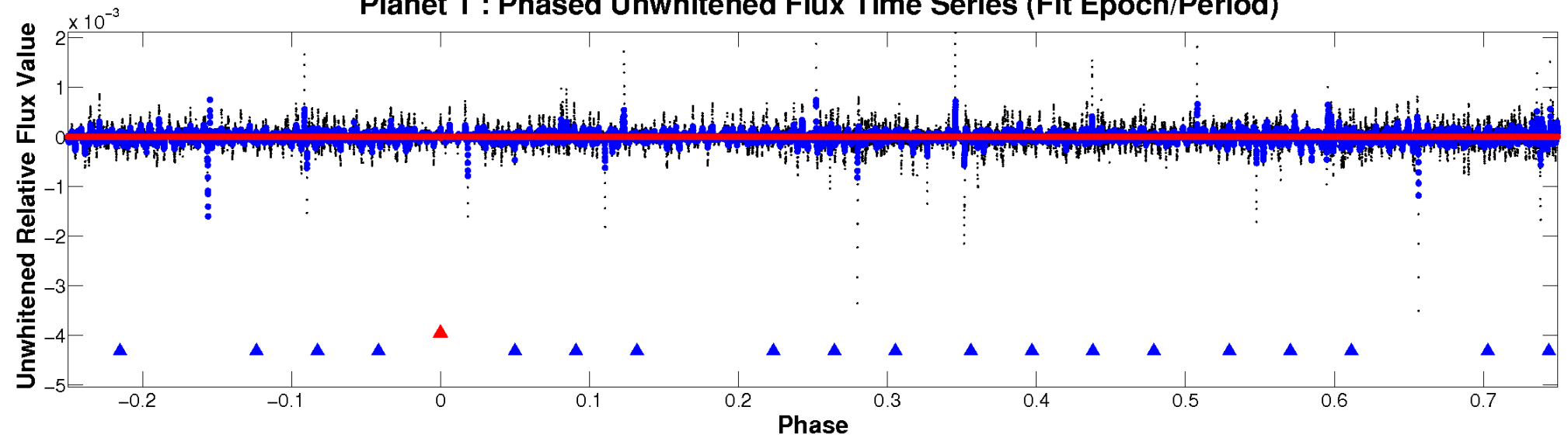
# ALT Odd/Even

TCE 007687231-01

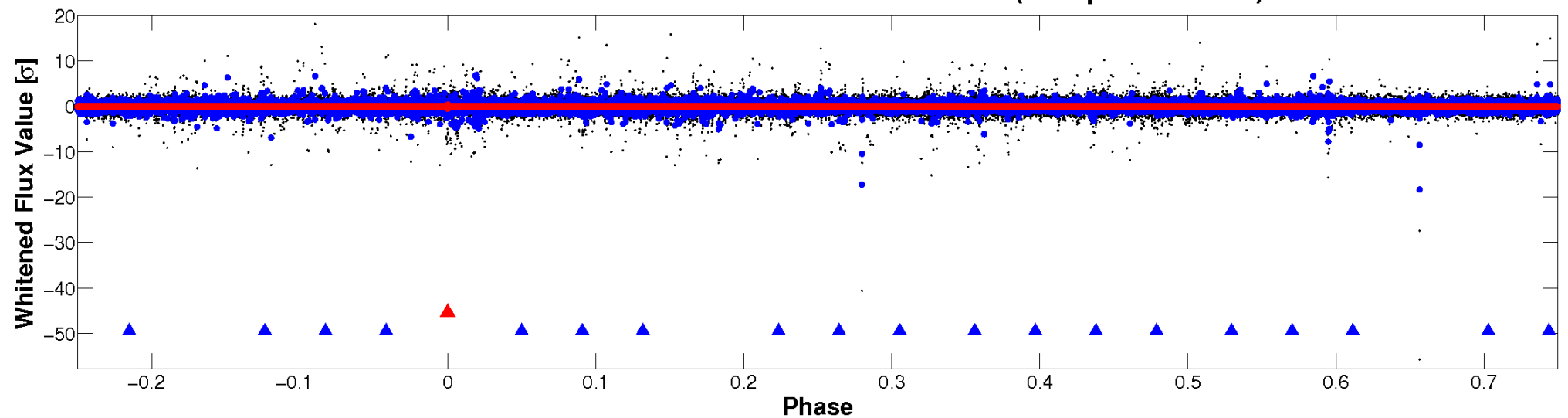


# Non-Whitened Vs. Whitened Light Curve

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

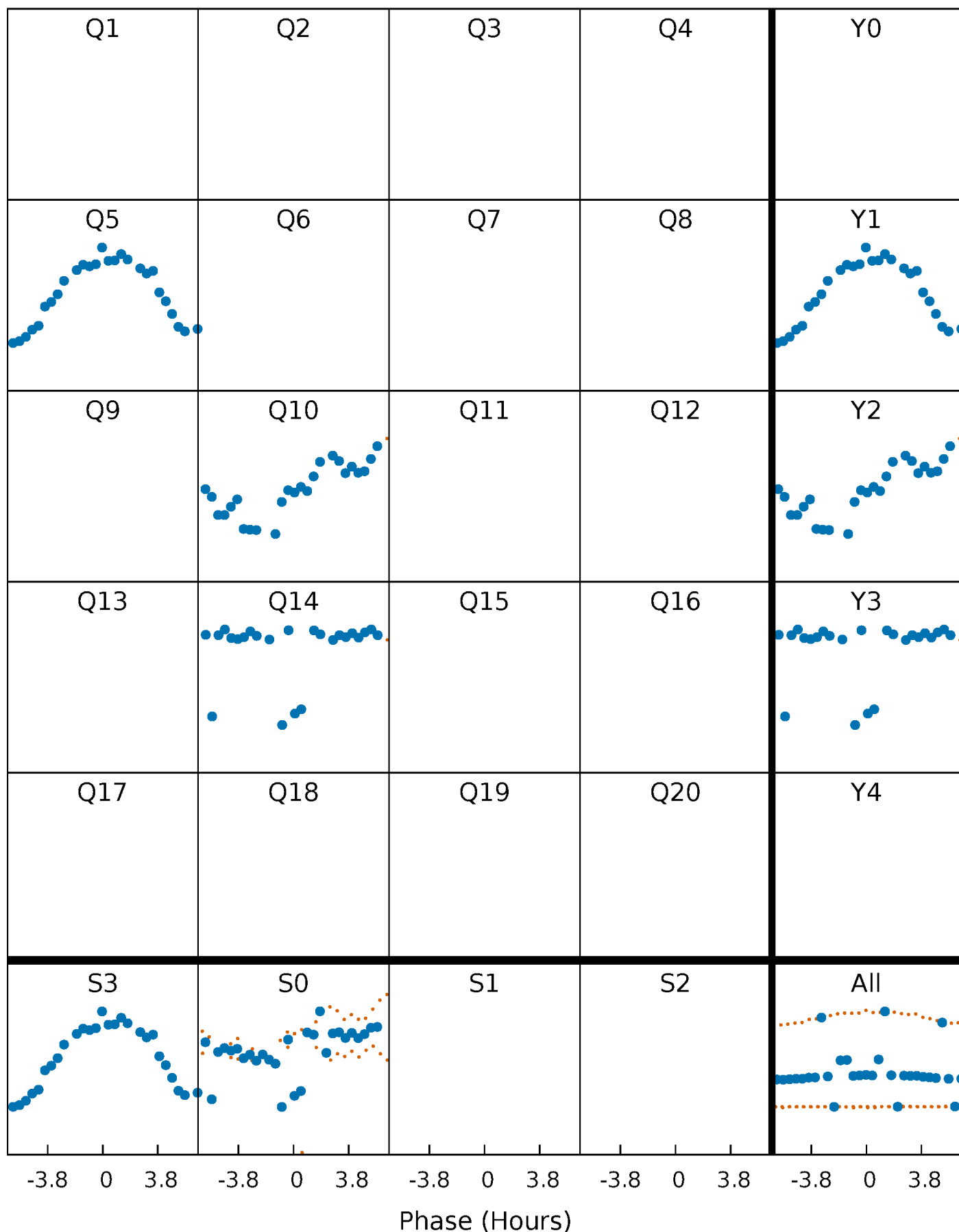


Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

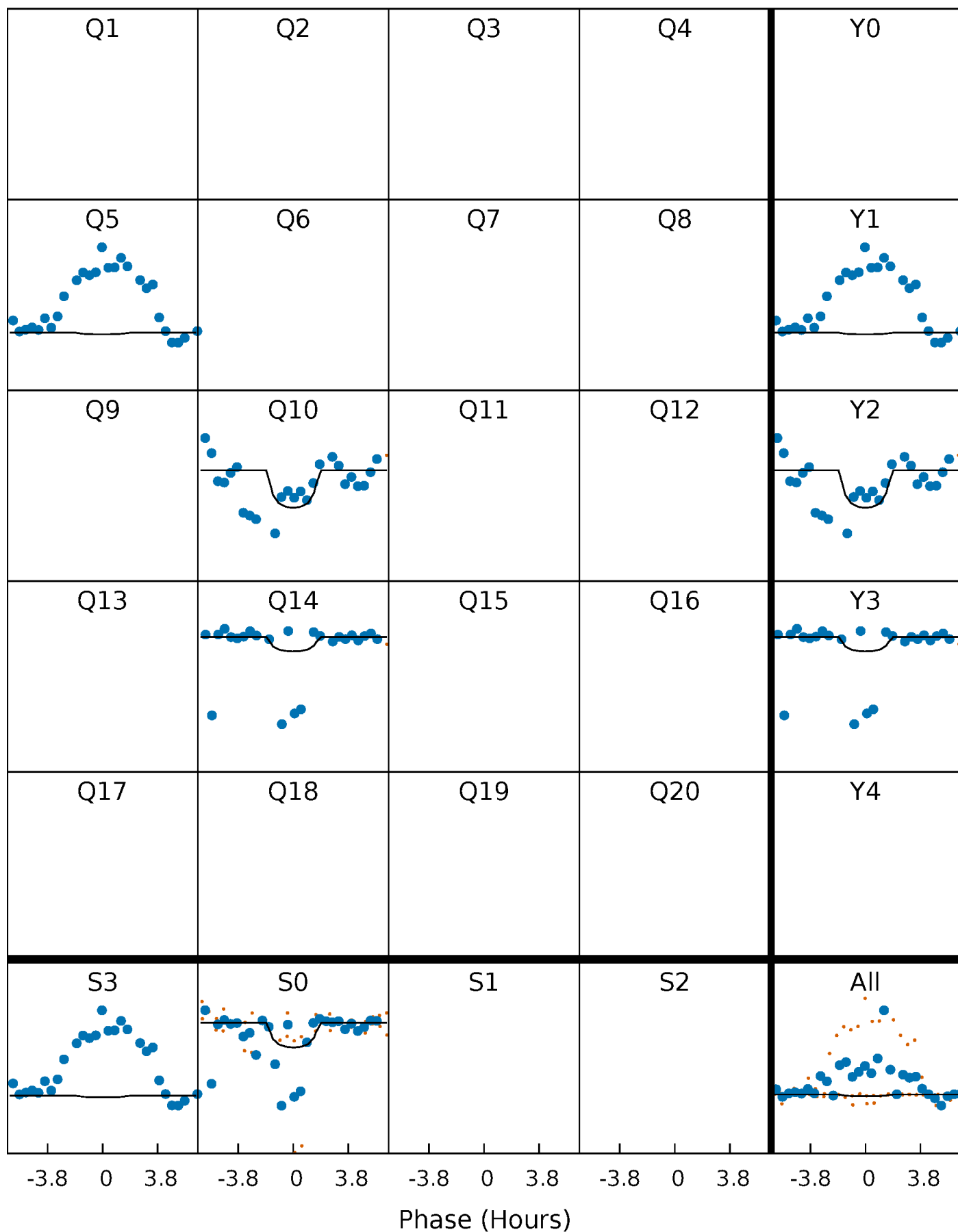
TCE 007687231-01 P=448.250828 Days  $T_0=466.745644$  (BKJD)





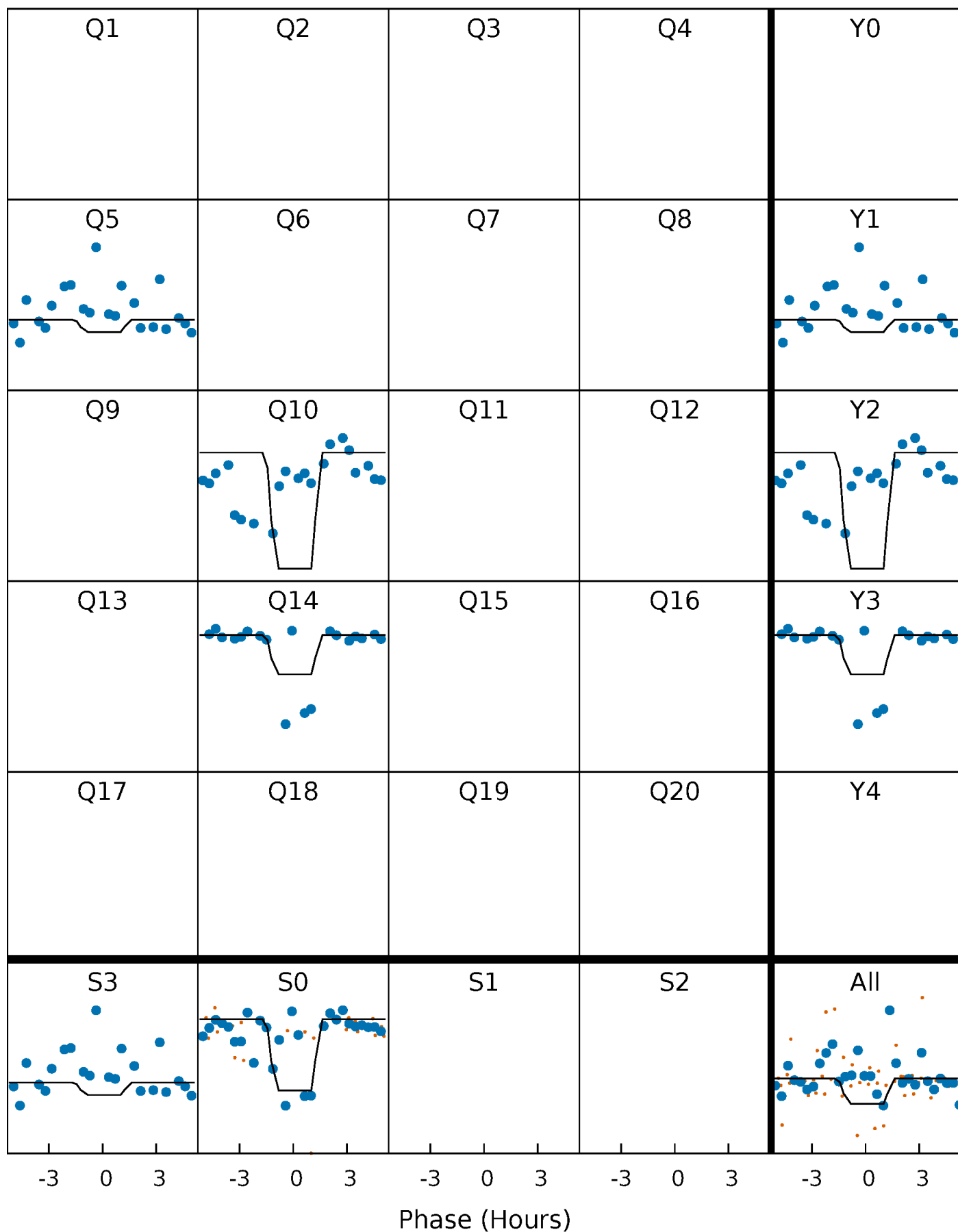
# DV Quarter-Phased Transit Curves

TCE 007687231-01 P=448.250828 Days  $T_0=466.745644$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

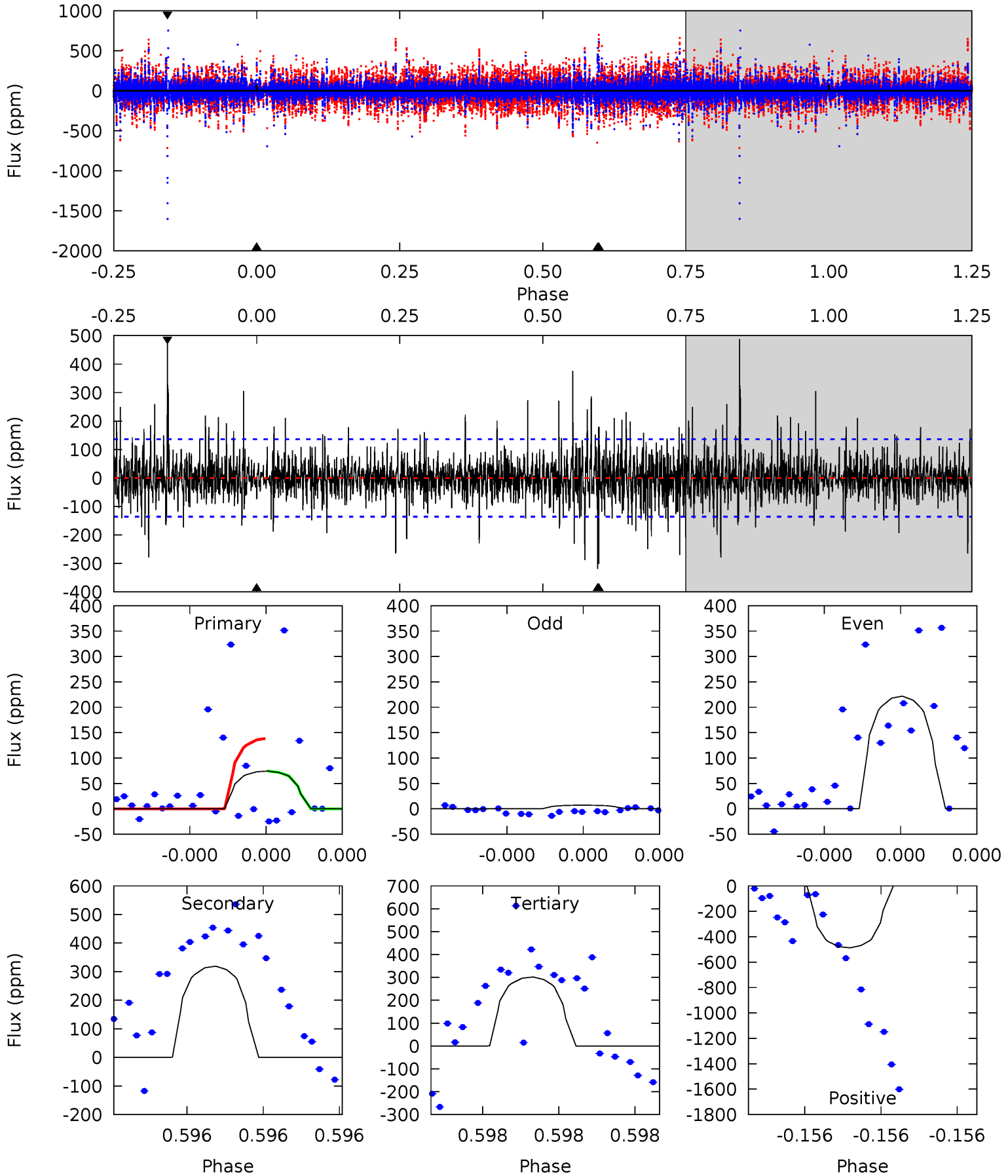
TCE 007687231-01 P=448.237383 Days  $T_0=466.754940$  (BKJD)



# DV Model-Shift Uniqueness Test

007687231-01, P = 448.250828 Days, E = 18.494816 Days

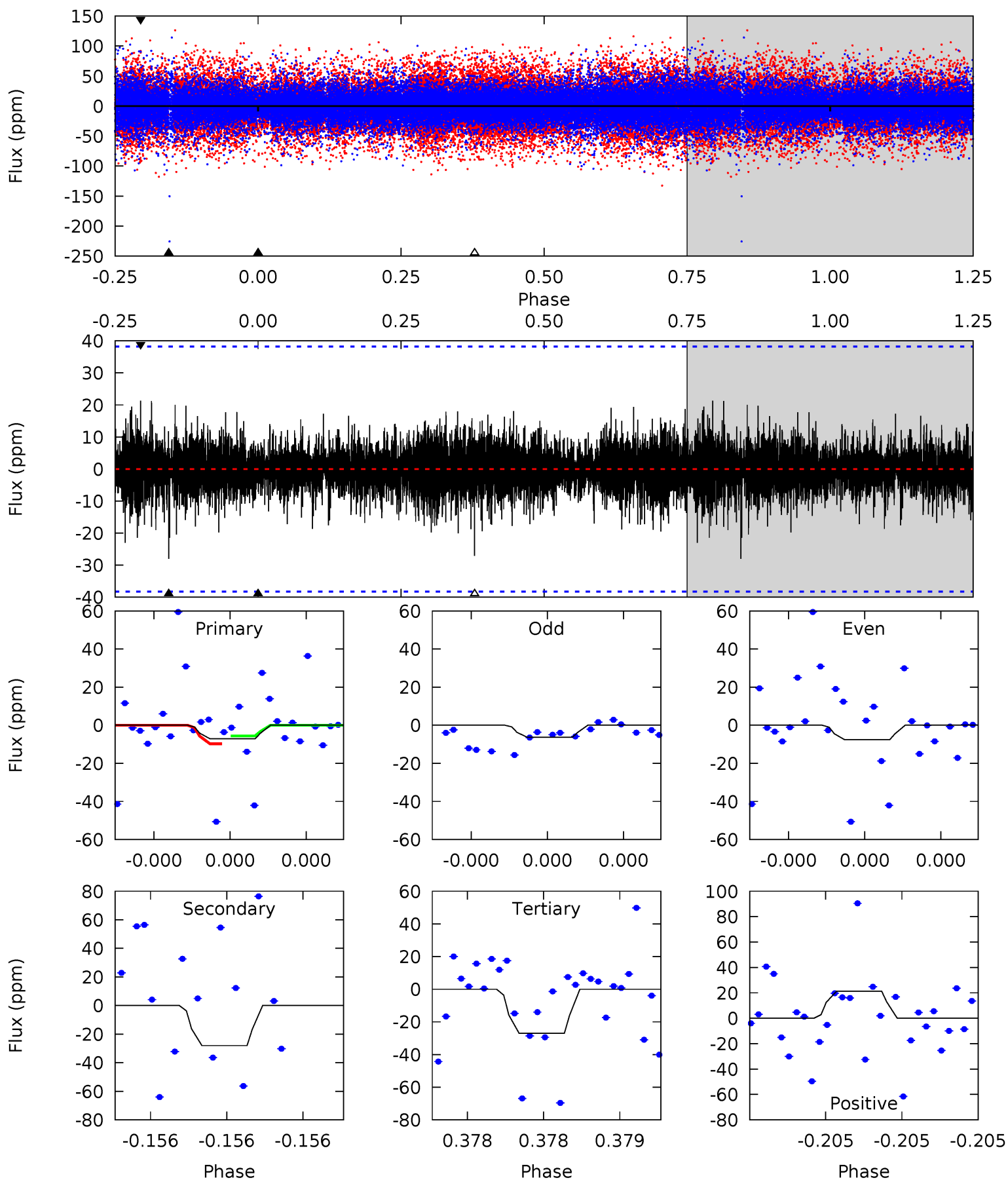
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
3.08	13.2	12.5	20.2	5.65	3.60	1.97	-9.43	-17.1	0.72	-6.96	3.54	-17.5	0.60	1.32



# Alt Model-Shift Uniqueness Test

007687231-01, P = 448.237383 Days, E = 18.517557 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
1.05	4.14	4.01	3.15	5.67	3.63	0.71	-2.95	-2.10	0.14	0.99	0.09	-0.21	0.43	0



### Stellar Parameters For KIC 007687231

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$4148^{+75}_{-56}$	$1.428^{+0.108}_{-0.120}$	$-0.400^{+0.150}_{-0.100}$	$29.645^{+10.641}_{-3.325}$	$0.859^{+0.528}_{-0.028}$	$0.000^{+0.000}_{-0.000}$
	+2%/-1%	+8%/-8%	+37%/-25%	+36%/-11%	+61%/-3%	+43%/-41%
Source	SPE74	SPE74	SPE74	DSEP		

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

### Secondary Eclipse Parameters for KIC 007687231-01 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-319 \pm 24$	$18.78^{+17.77}_{-12.53}$	$1334^{+81}_{-53}$	$7019^{+8435}_{-1953}$	$630^{+4864}_{-463}$
Alt.	$-28 \pm 7$	$20.84^{+18.61}_{-13.87}$	$1332^{+77}_{-54}$	$3933^{+2139}_{-751}$	$47^{+363}_{-34}$

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

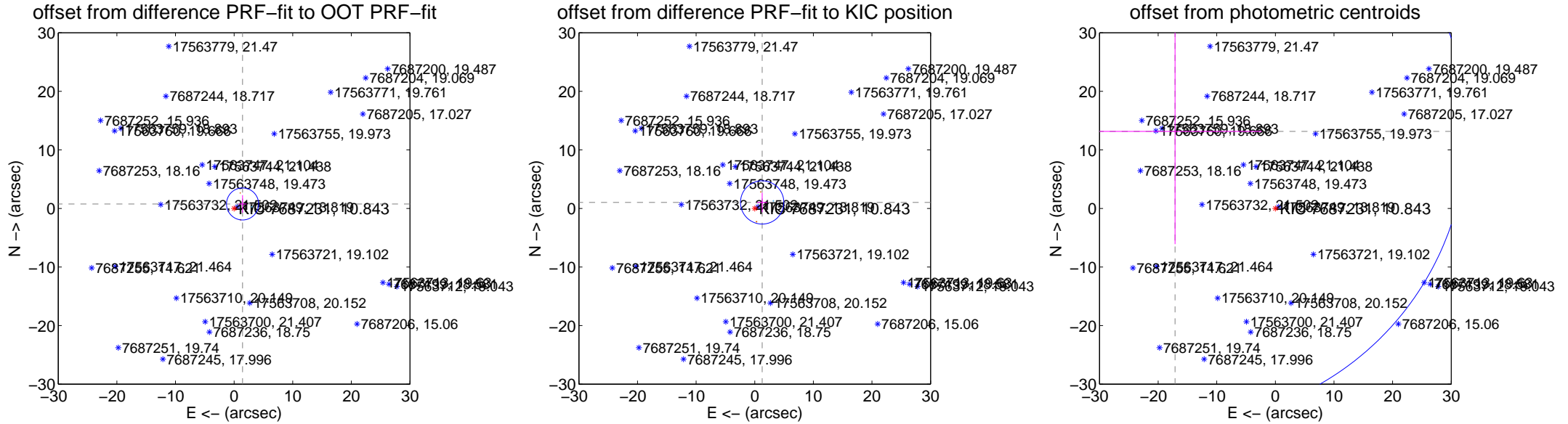
## DV Centroid Data

Supplemental centroid analysis for 007687231-01. **Kepler magnitude: 10.84.** Transit SNR 1.60

**There are 1 quarters with good PRF difference image offsets**

The direct PRF centroid is offset from the target star catalog position by about 0.87 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.632 \pm 0.912$	1.79	$-1.441 \pm 0.660$	$0.766 \pm 1.495$
PRF-fit source offset from KIC position	$1.630 \pm 1.232$	1.32	$-1.266 \pm 0.845$	$1.027 \pm 1.654$
photometric centroid source offset	$21.58 \pm 16.58$	1.30	$17.11 \pm 14.77$	$13.16 \pm 19.25$

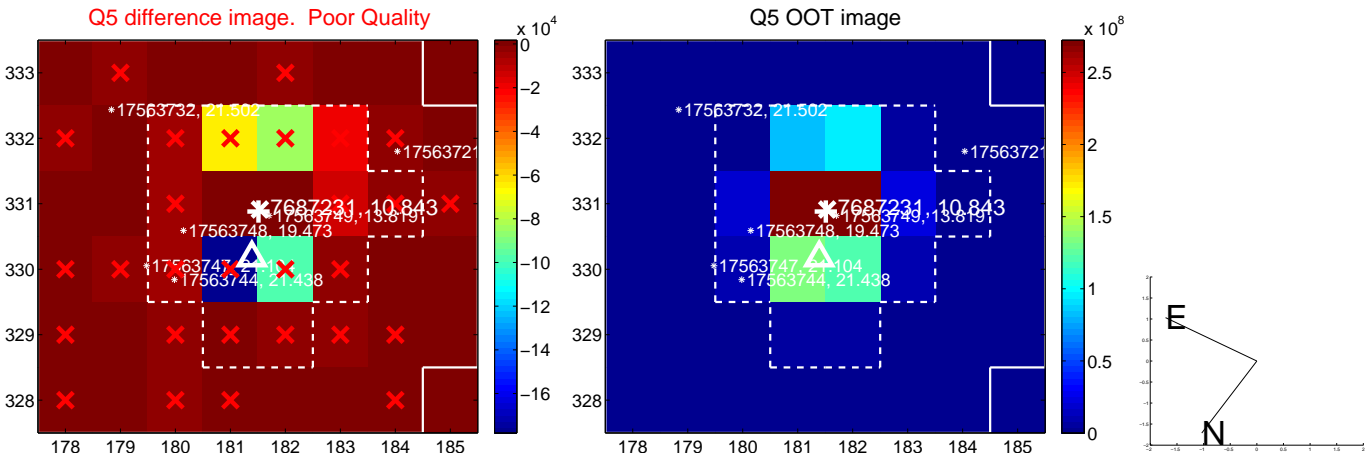


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

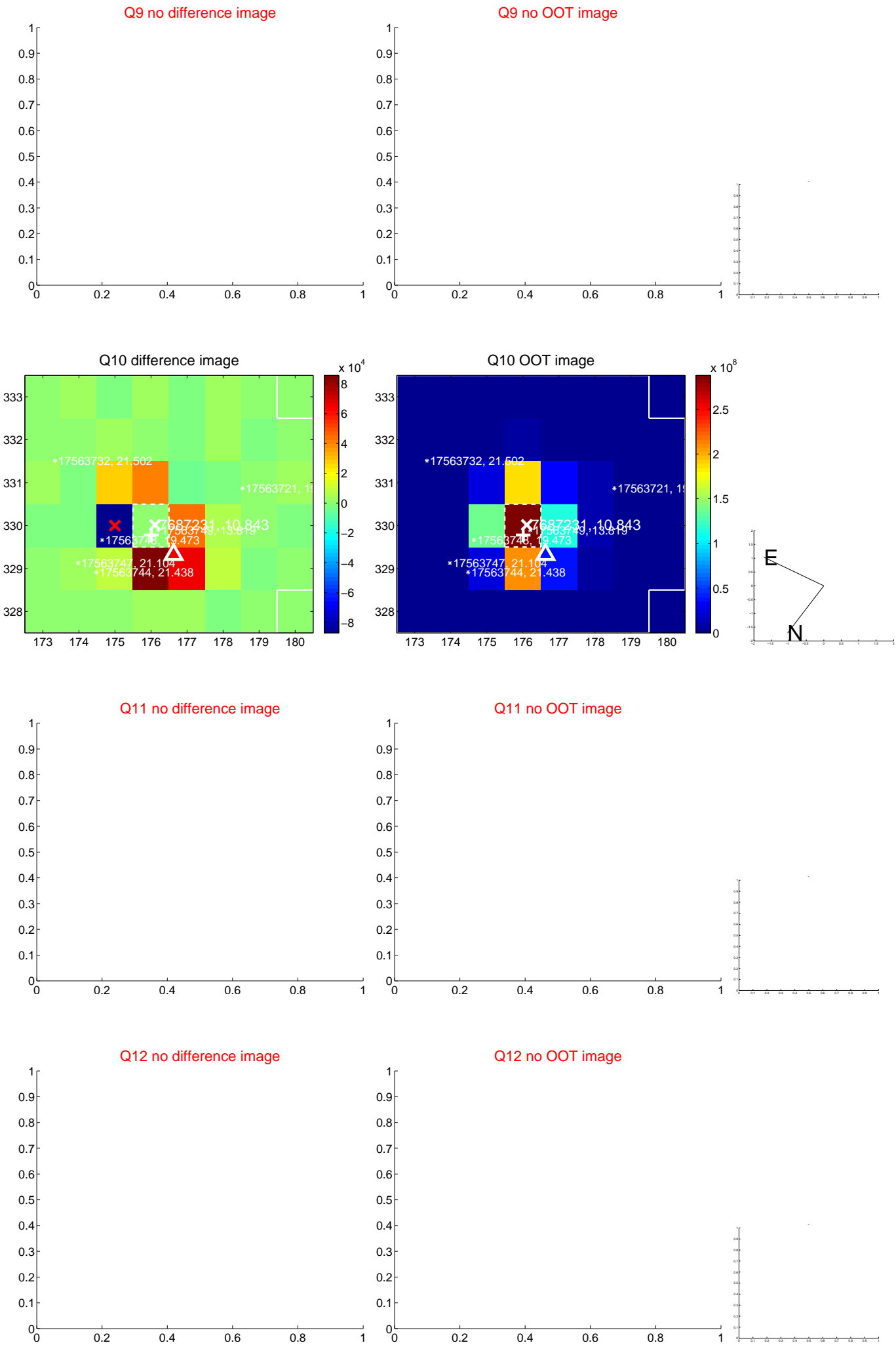


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

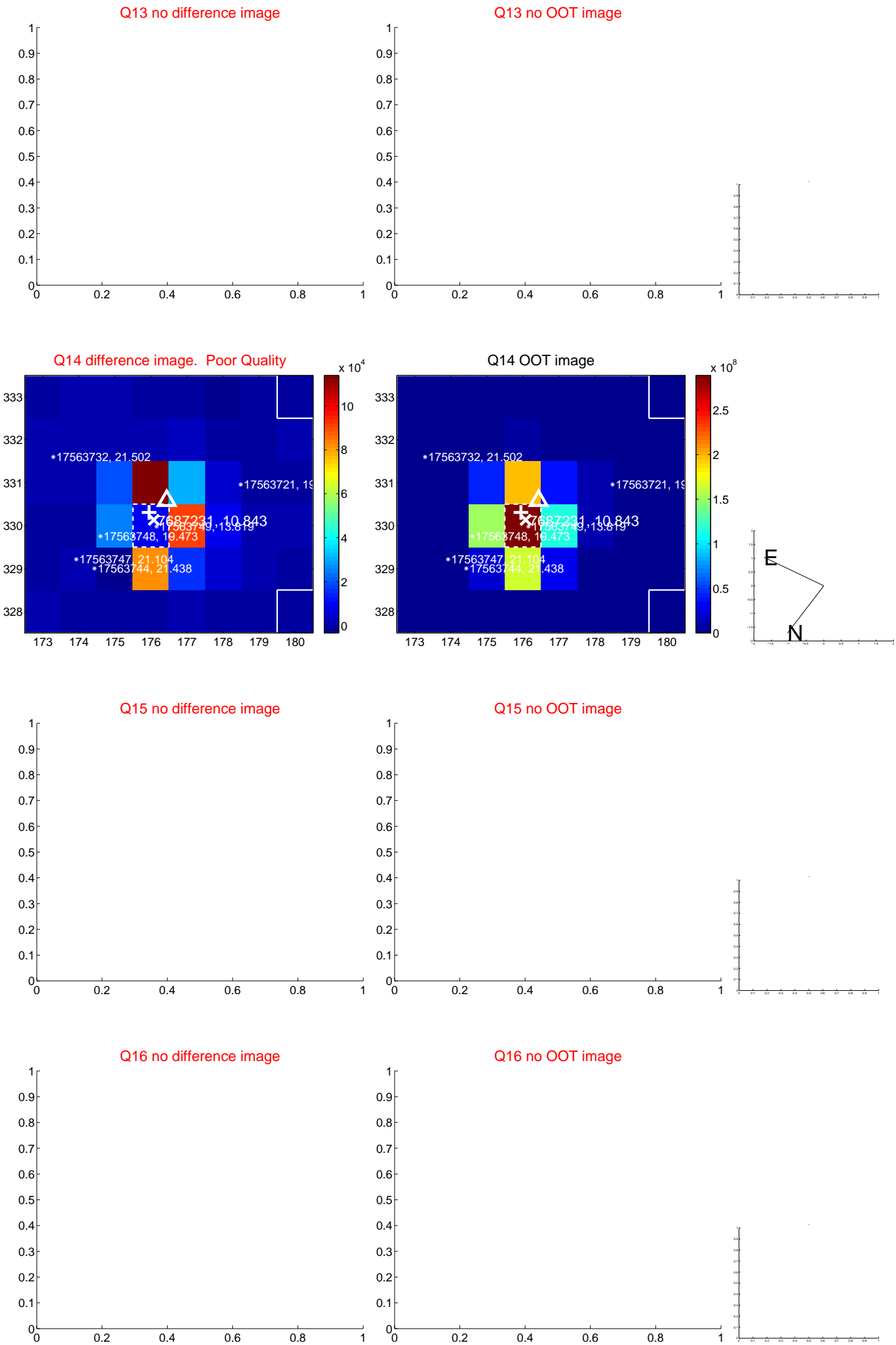




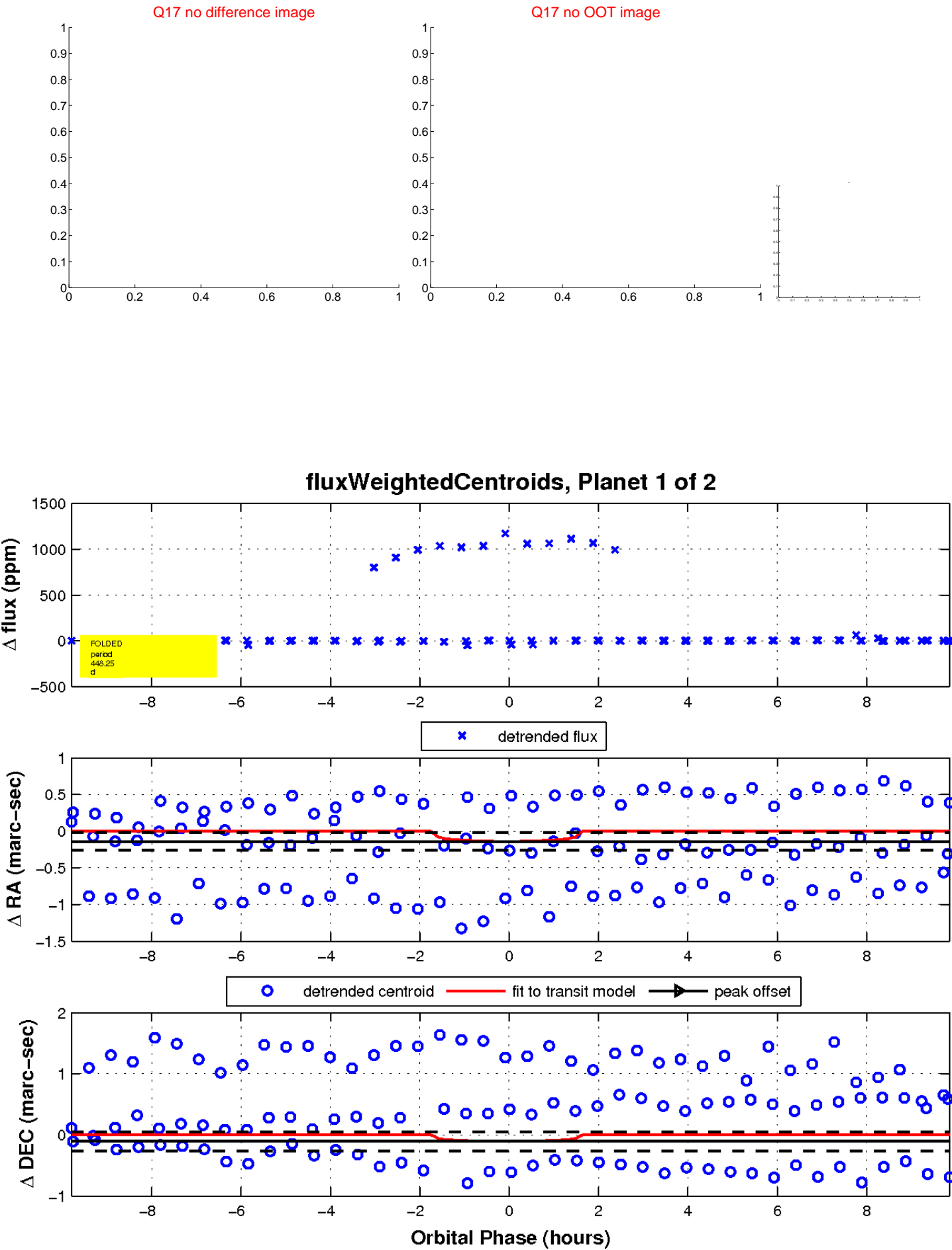
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



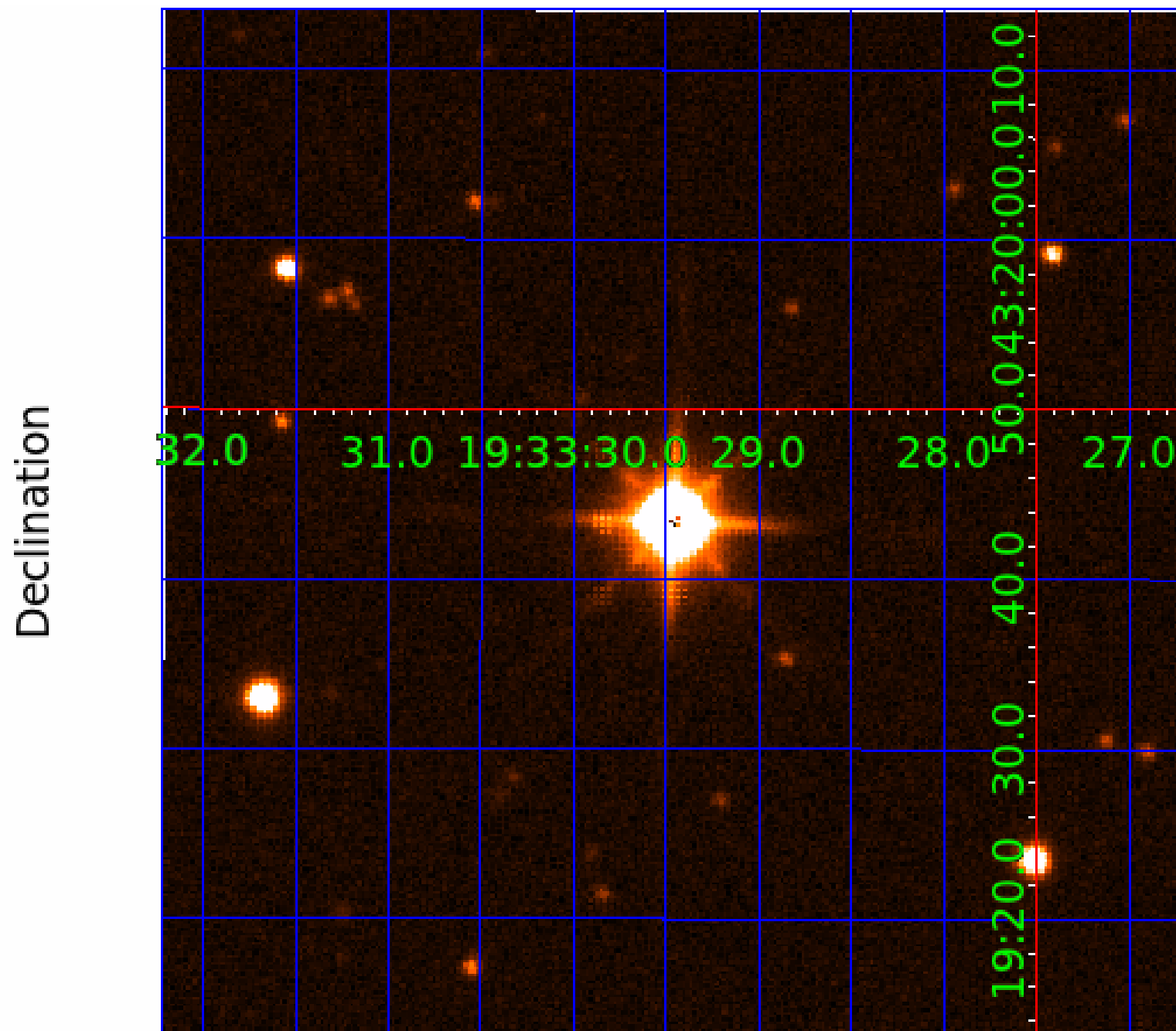
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



UKIRT Image



# KIC 007687231

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
007687231-01	OBS	No	448.250828	466.745644	8.3	3.295	14.0	1.6	29.64	4148	10.48	196.27
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## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
007687231-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_ZUMA—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_TER_DV—MOD_POS_DV—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
007687231-02	OBS	FP	0.00	1	0	0	0	LPP_DV—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_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.

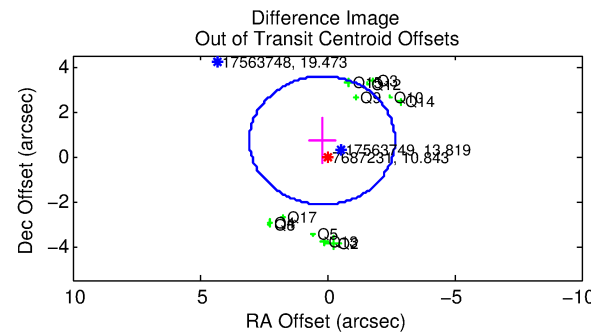
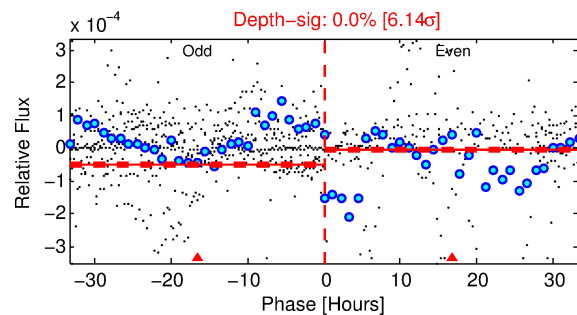
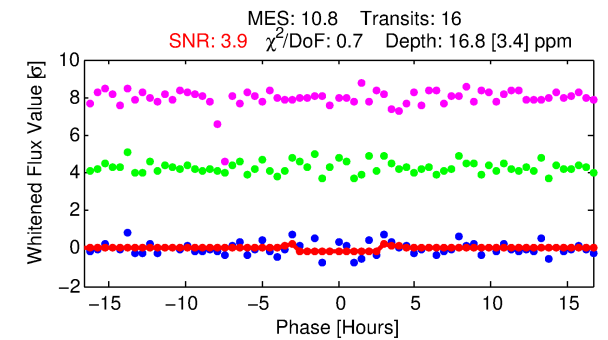
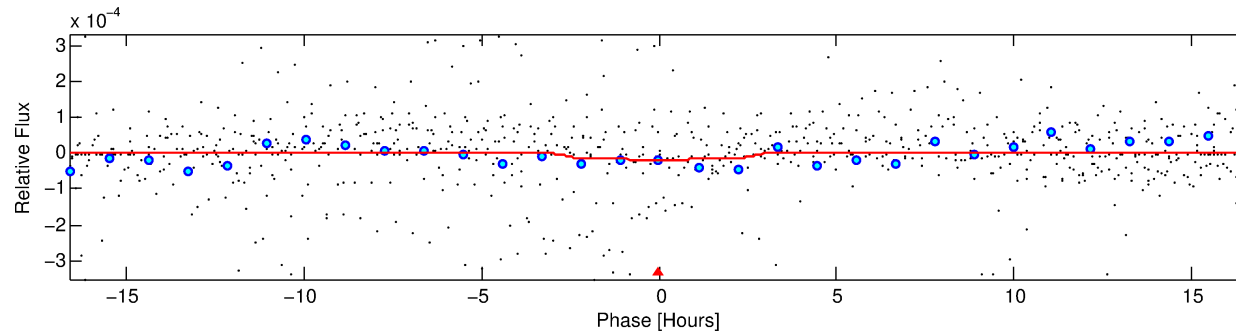
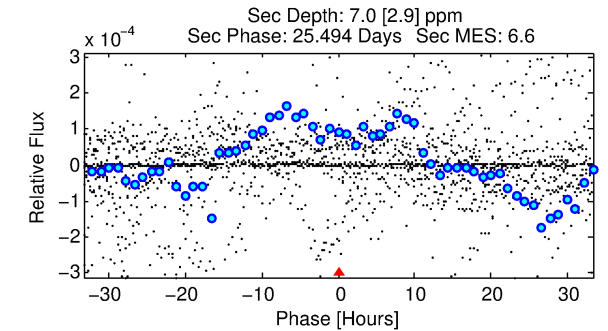
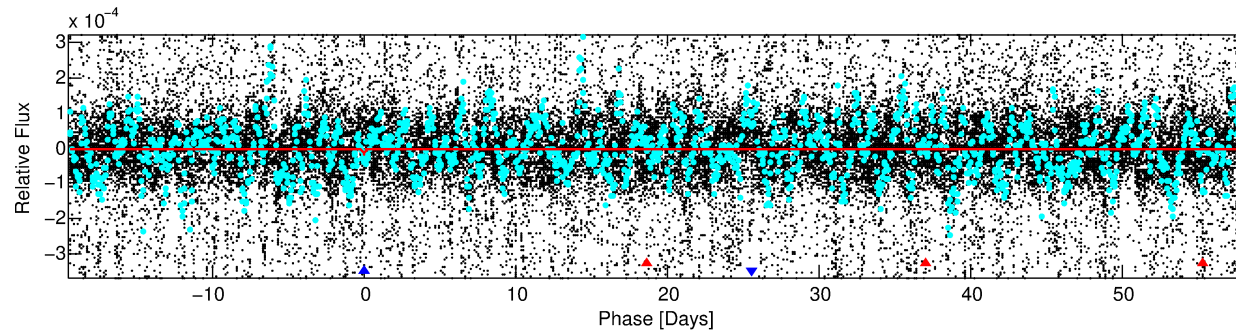
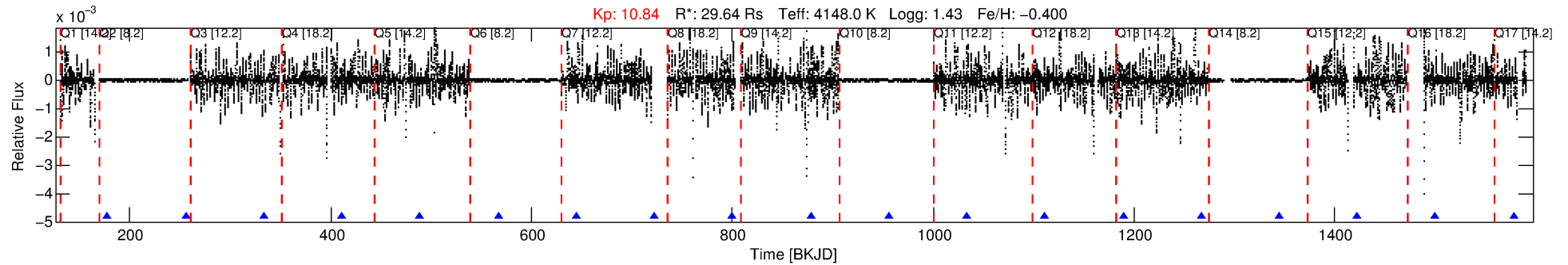
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 007687231-02

No Significant Match Found

# DV One-Page Summary

KIC: 7687231 Candidate: 2 of 2 Period: 77.767 d



## DV Fit Results:

Period = 77.76716 [0.00098] d  
Epoch = 178.0916 [0.0130] BKJD  
 $R_p/R^* = 0.0043$  [0.0017]  
 $a/R^* = 61.51$  [80.36]  
 $b = 0.82$  [0.51]  
 $\text{Seff} = 2028.41$  [629.87]  
 $T_{\text{eq}} = 1711$  [133] K  
 $R_p = 14.01$  [7.49]  $R_{\text{e}}$   
 $a = 0.3390$  [0.0869] AU  
 $\text{Ag} = 2.25$  [2.12] [0.59 $\sigma$ ]  
 $T_{\text{eff}} = 3240$  [726] K [2.07 $\sigma$ ]

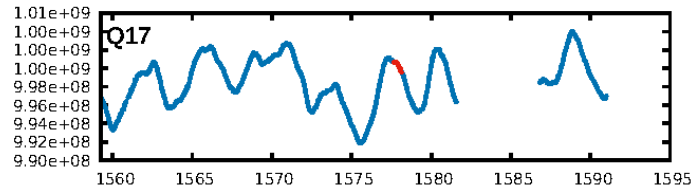
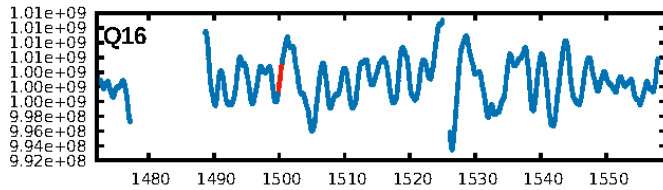
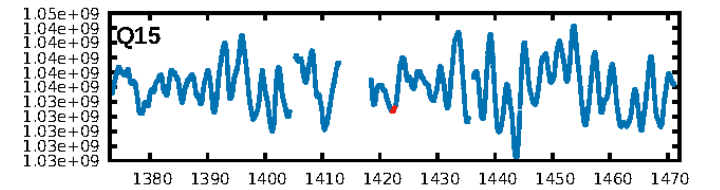
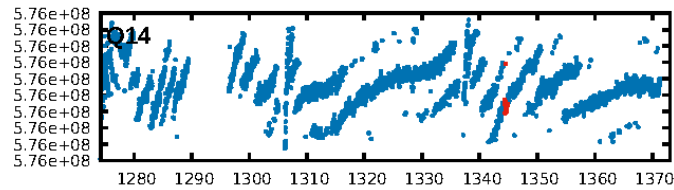
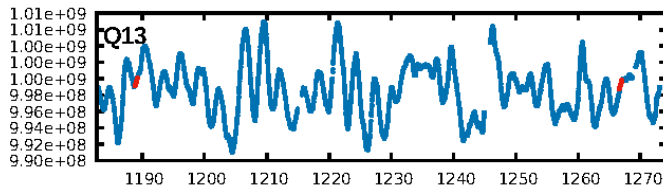
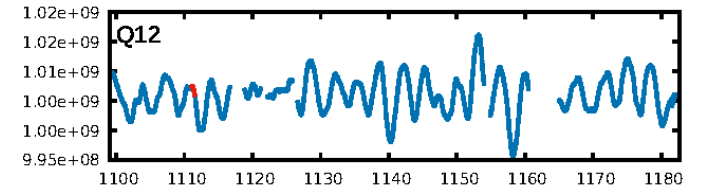
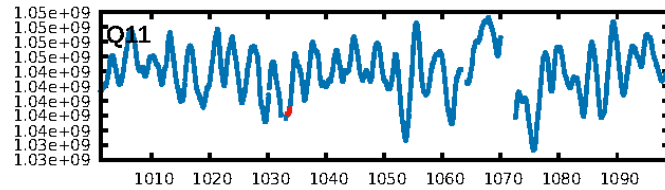
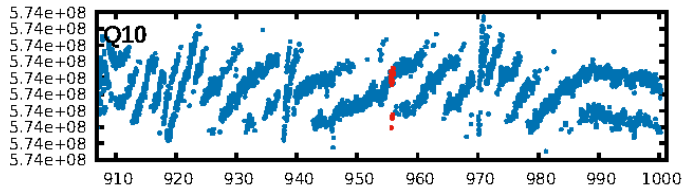
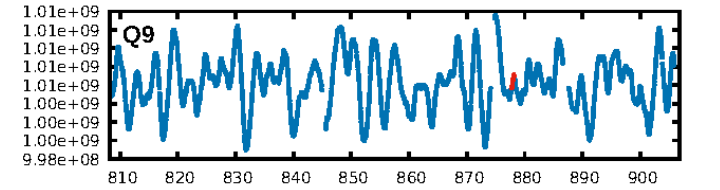
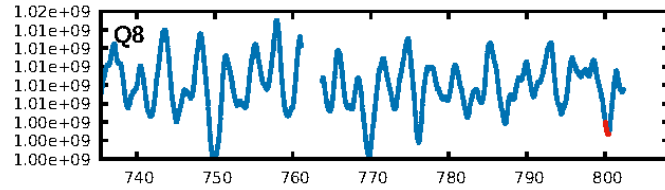
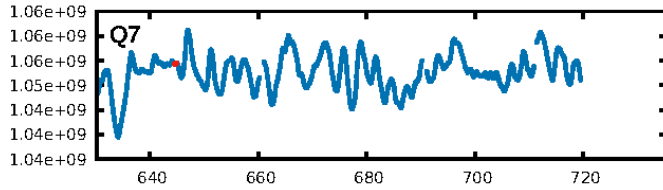
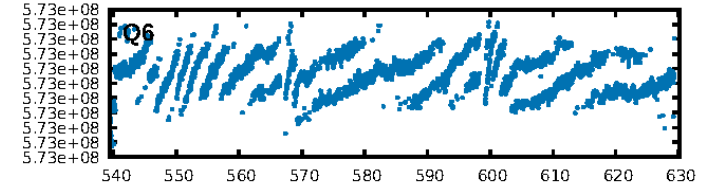
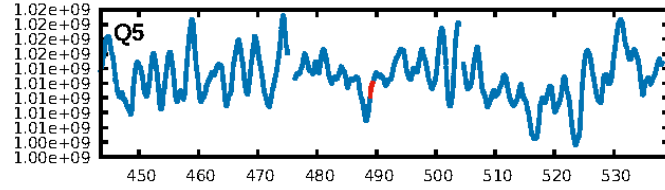
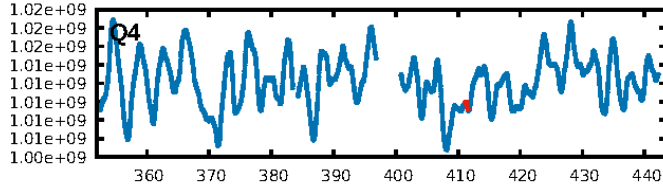
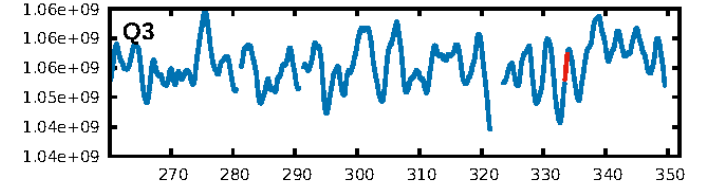
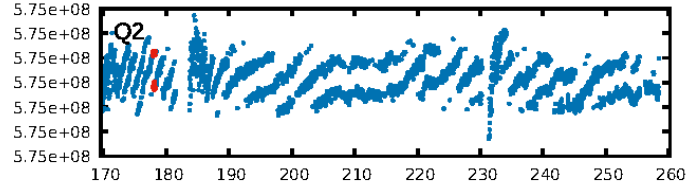
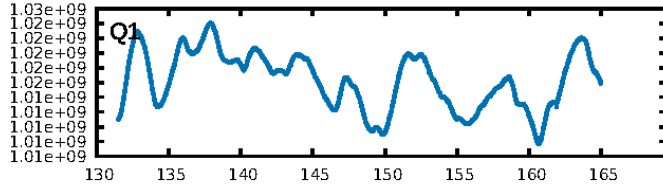
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [1380.65 $\sigma$ ]  
ModelChiSquare2-sig: 97.1%  
ModelChiSquareGof-sig: 100.0%  
**Bootstrap-pfa: 7.20e-08**  
RollingBand-fgt: 1.00 [15/15]  
GhostDiagnostic-chr: -1.732  
Centroid-sig: 80.4%  
Centroid-so: 1.823 arcsec [0.30 $\sigma$ ]  
OotOffset-rm: 0.736 arcsec [0.77 $\sigma$ ]  
KicOffset-rm: 0.897 arcsec [1.08 $\sigma$ ]  
OotOffset-st: 3/2/3/4 [12]  
KicOffset-st: 3/2/3/4 [12]  
DiffImageQuality-fgm: 0.25 [3/12]  
DiffImageOverlap-fno: 1.00 [13/13]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 15:47:05 Z

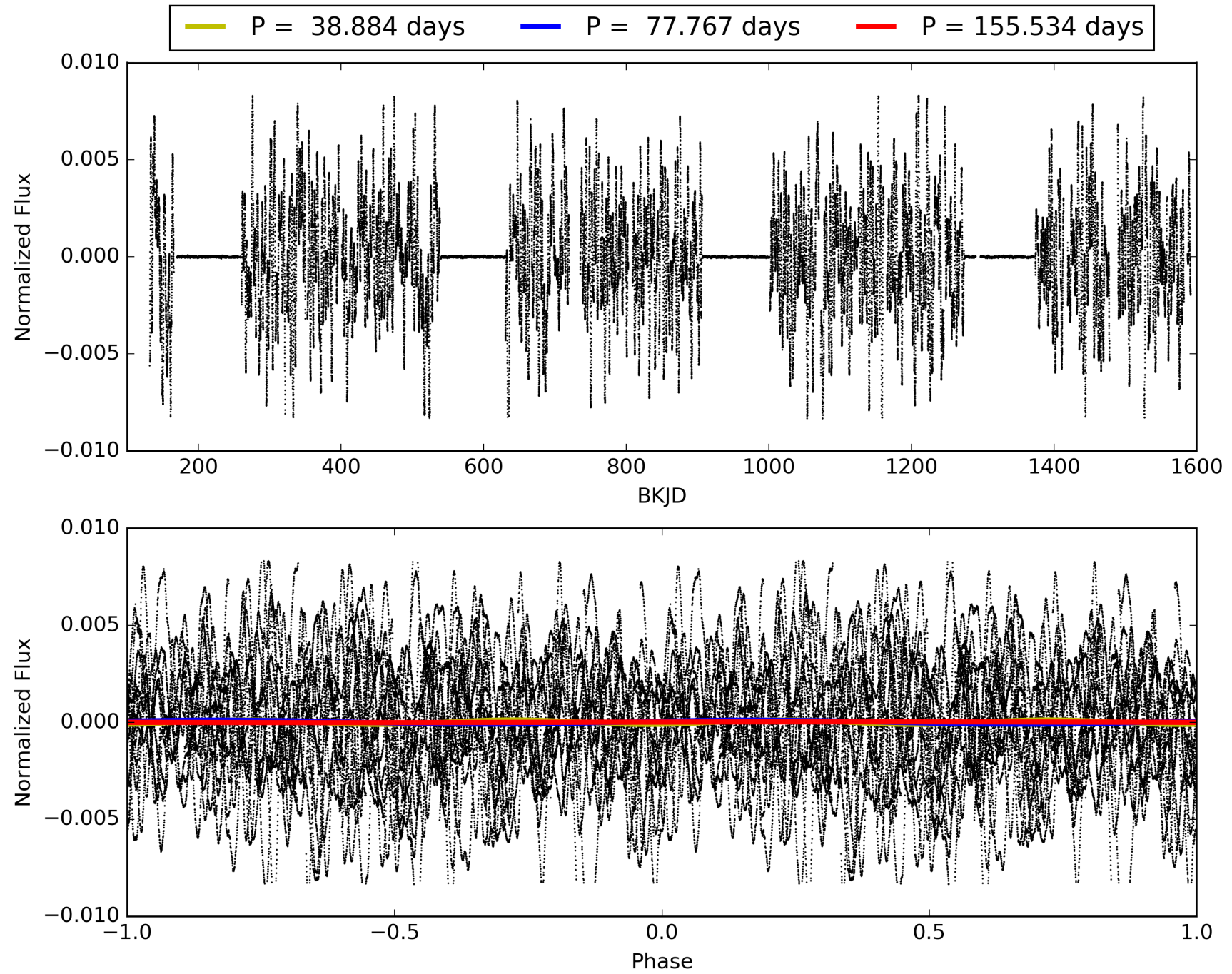
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 007687231-02, PDC Light Curves





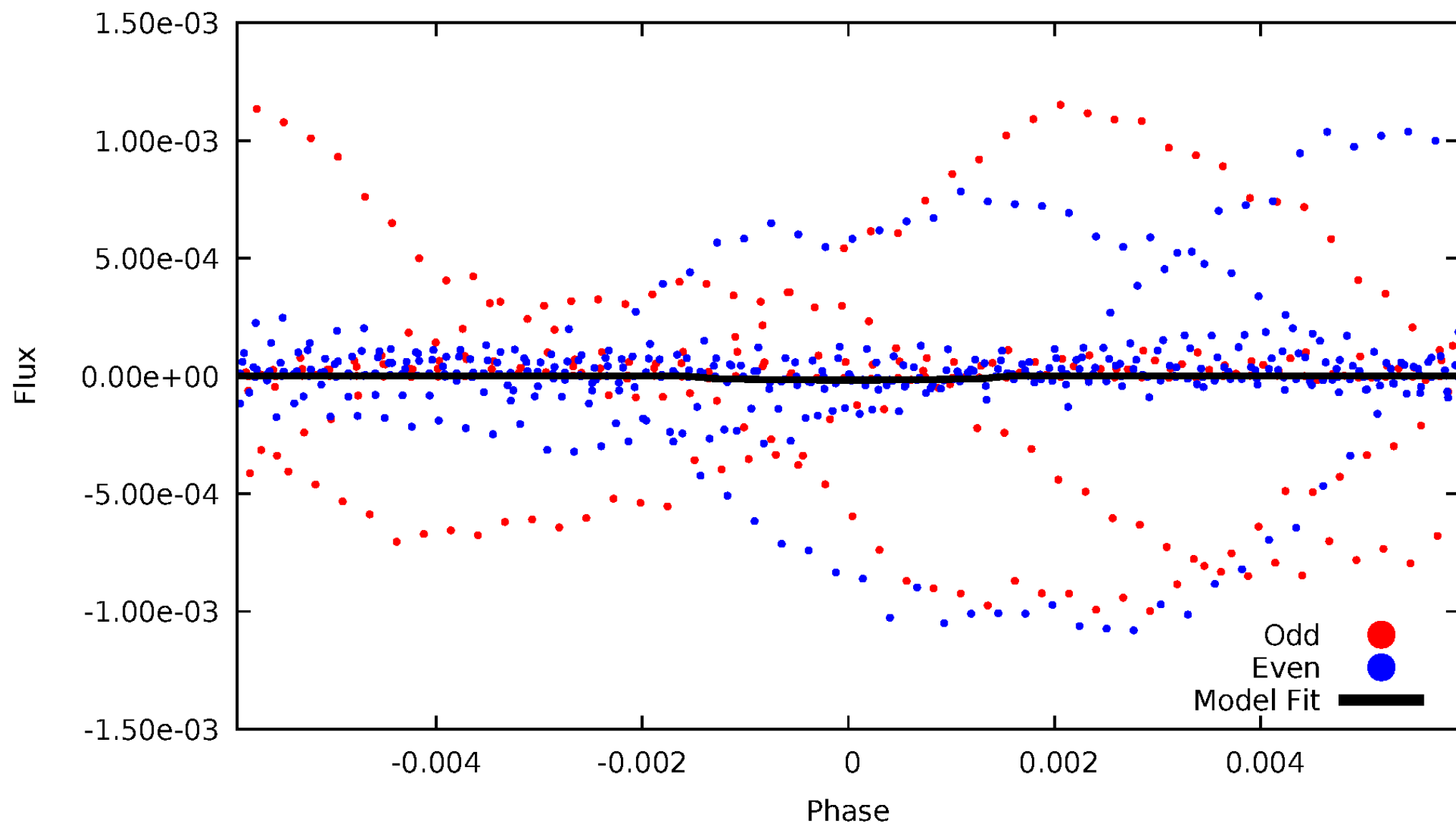
TCE 007687231-02





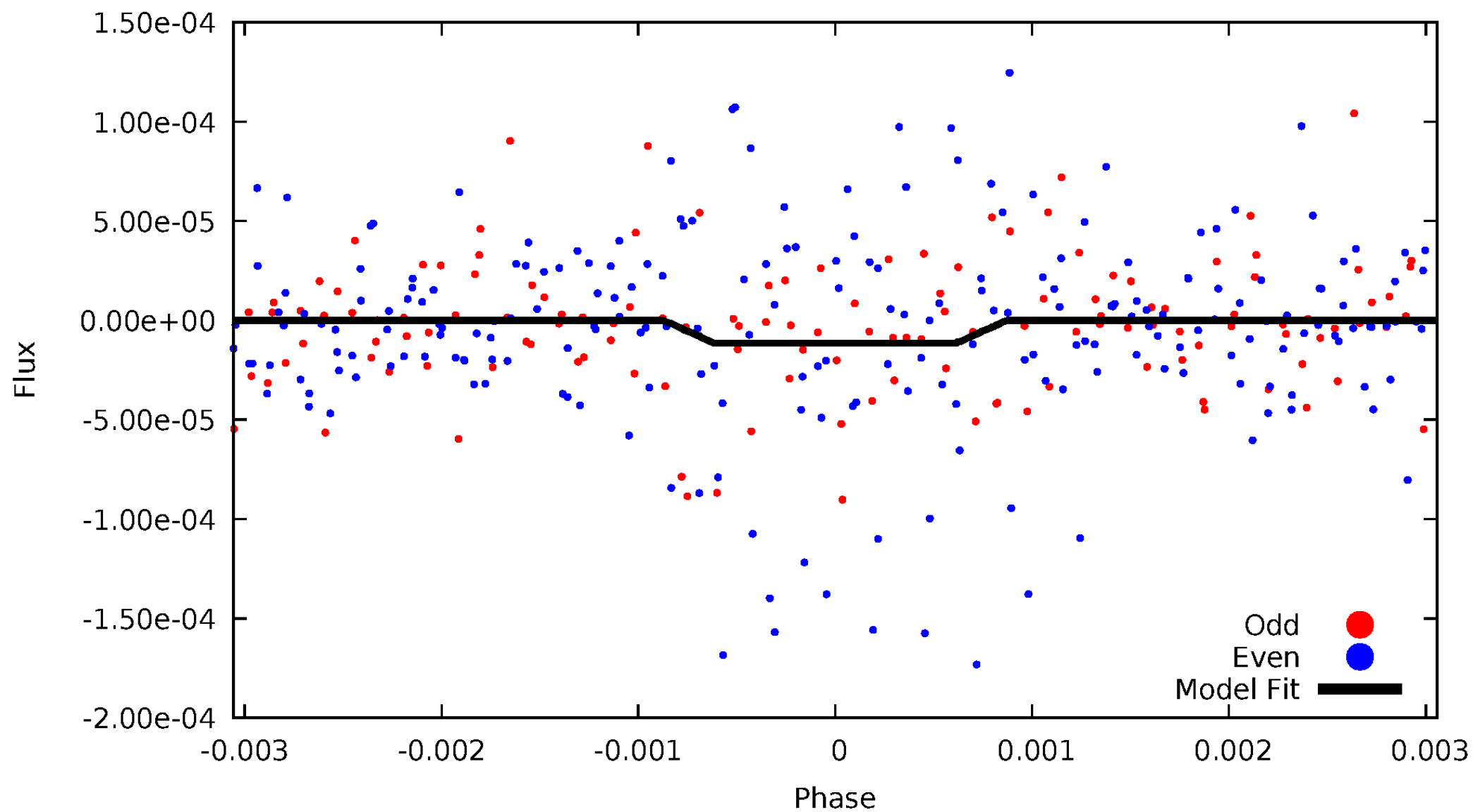
# DV Odd/Even

TCE 007687231-02



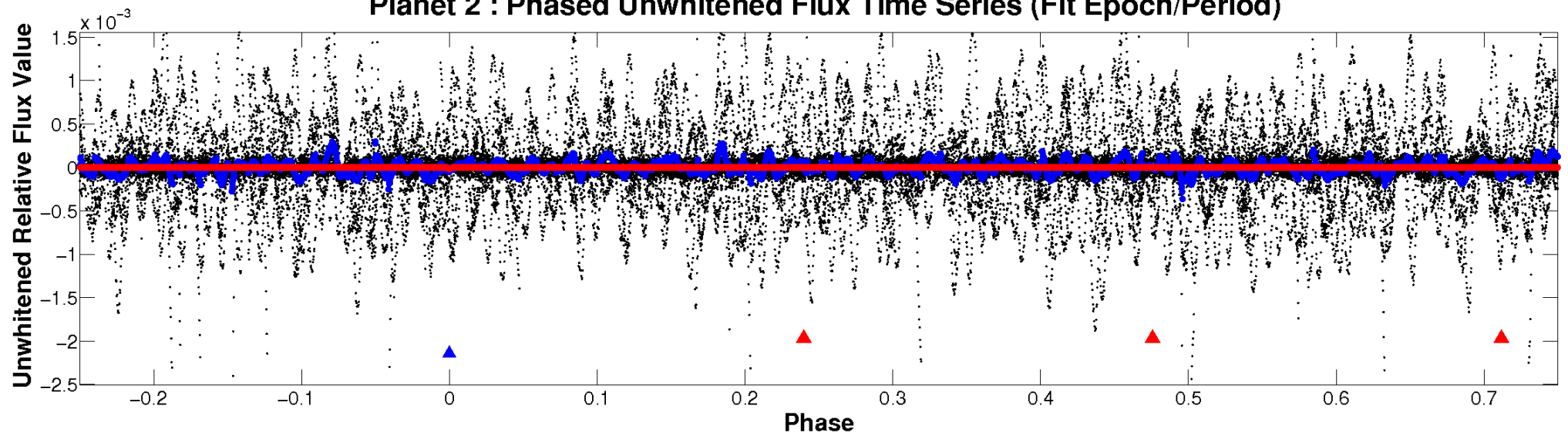
# ALT Odd/Even

TCE 007687231-02

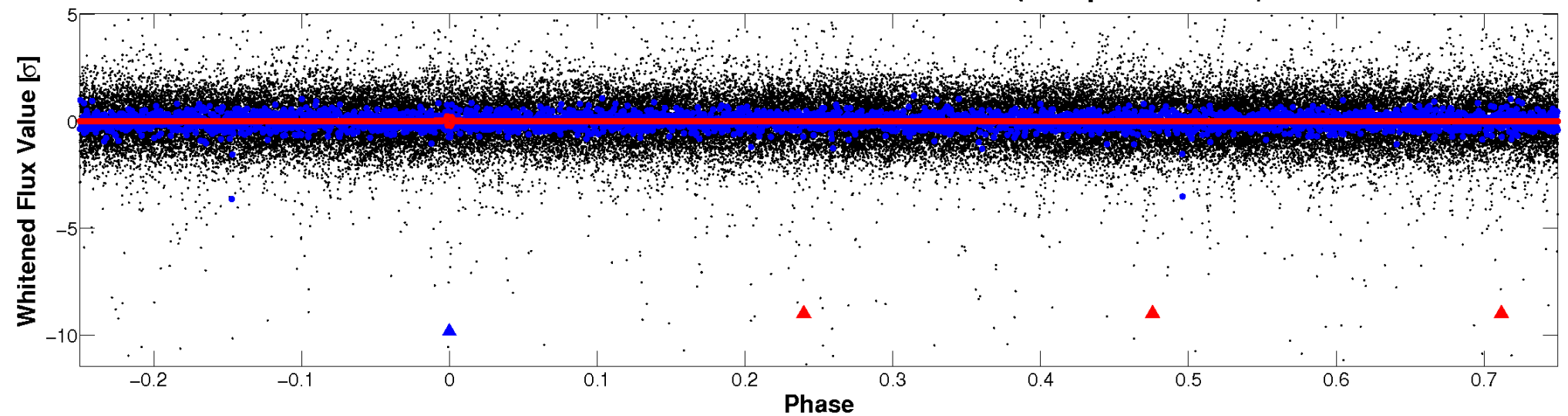


# Non-Whitened Vs. Whitened Light Curve

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

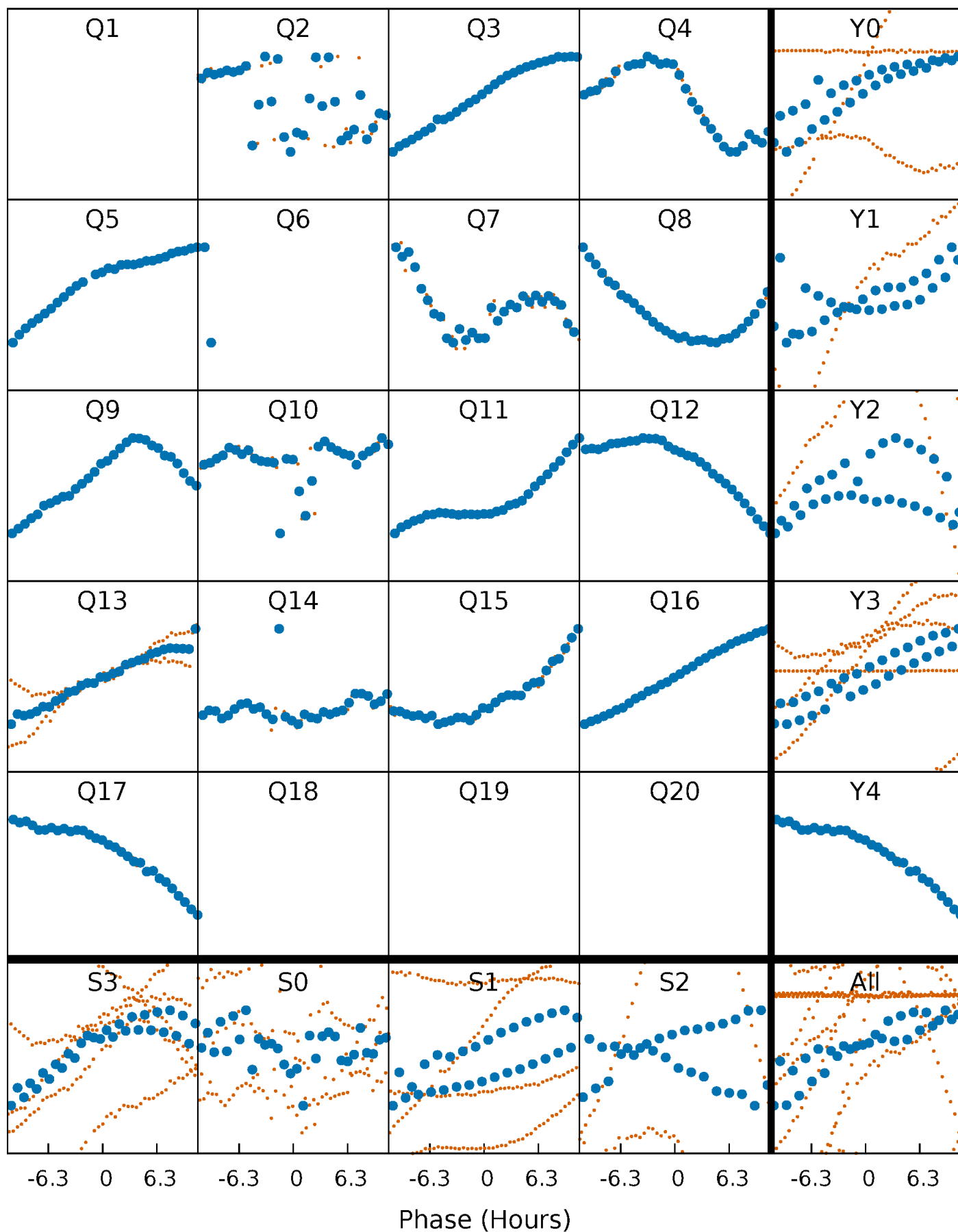


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



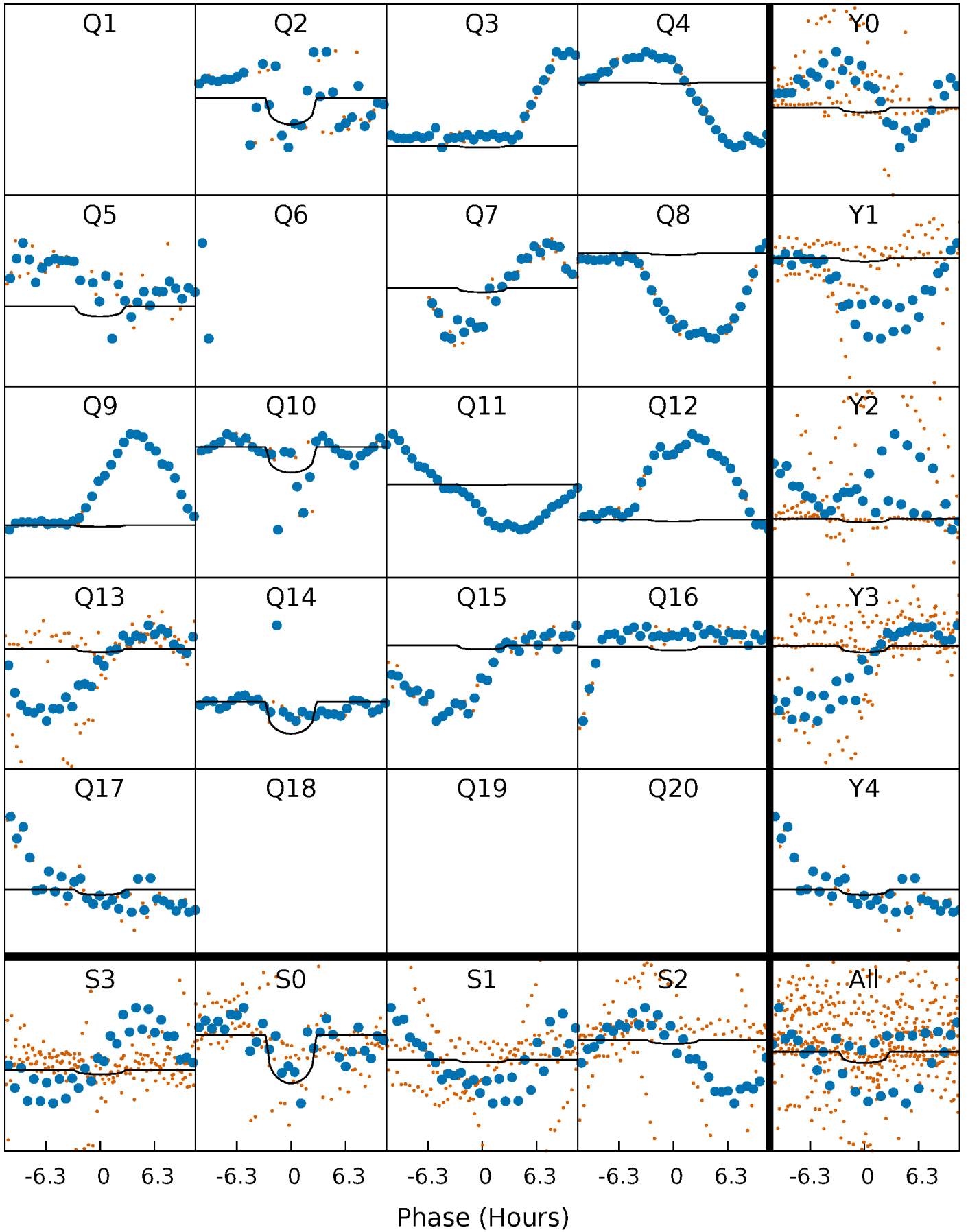
# PDC Quarter-Phased Transit Curves

TCE 007687231-02 P= 77.767158 Days  $T_0=178.091637$  (BKJD)



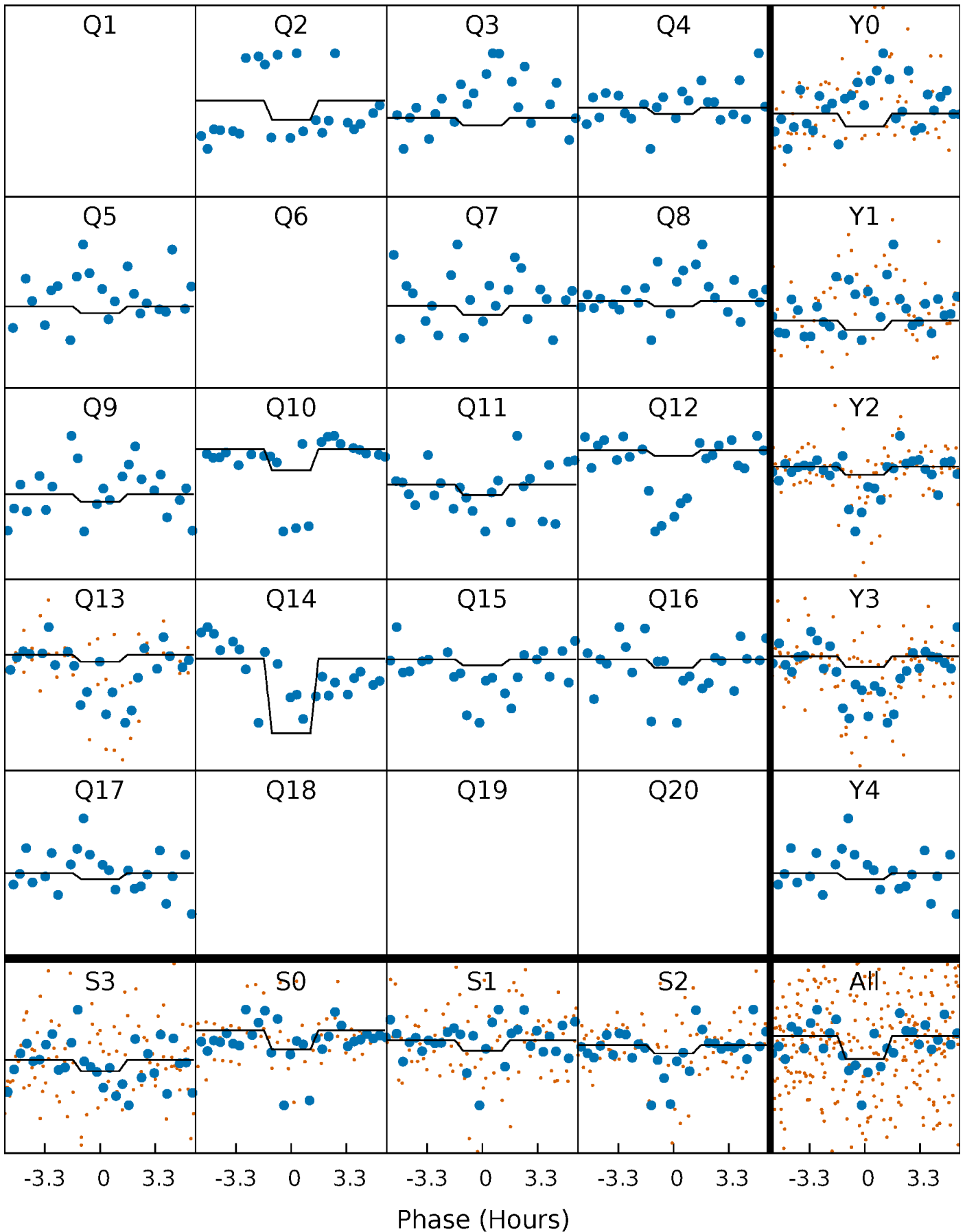
# DV Quarter-Phased Transit Curves

TCE 007687231-02   P= 77.767158 Days    $T_0=178.091637$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

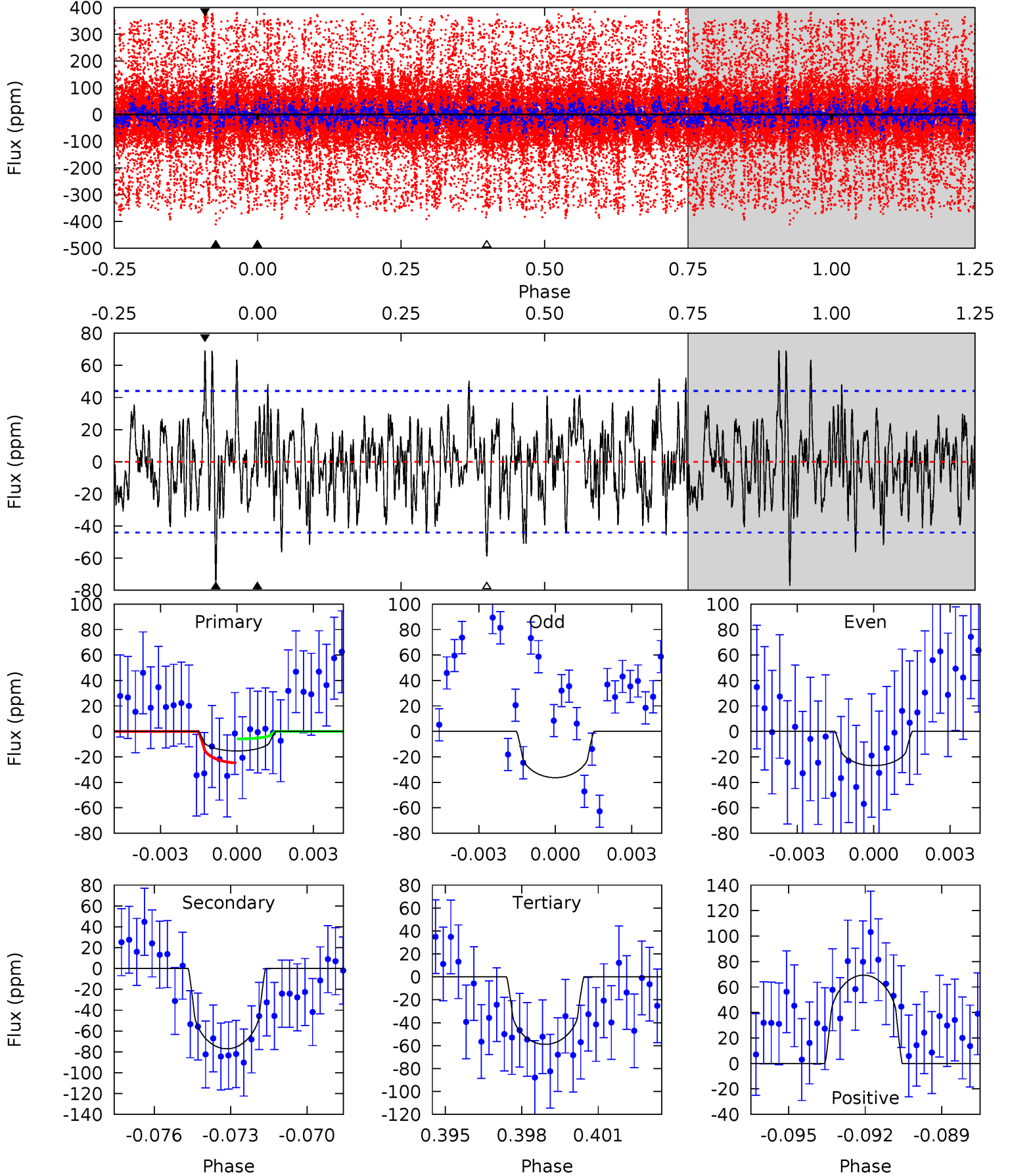
TCE 007687231-02 P= 77.752602 Days  $T_0=178.293282$  (BKJD)



# DV Model-Shift Uniqueness Test

007687231-02, P = 77.767158 Days, E = 100.324479 Days

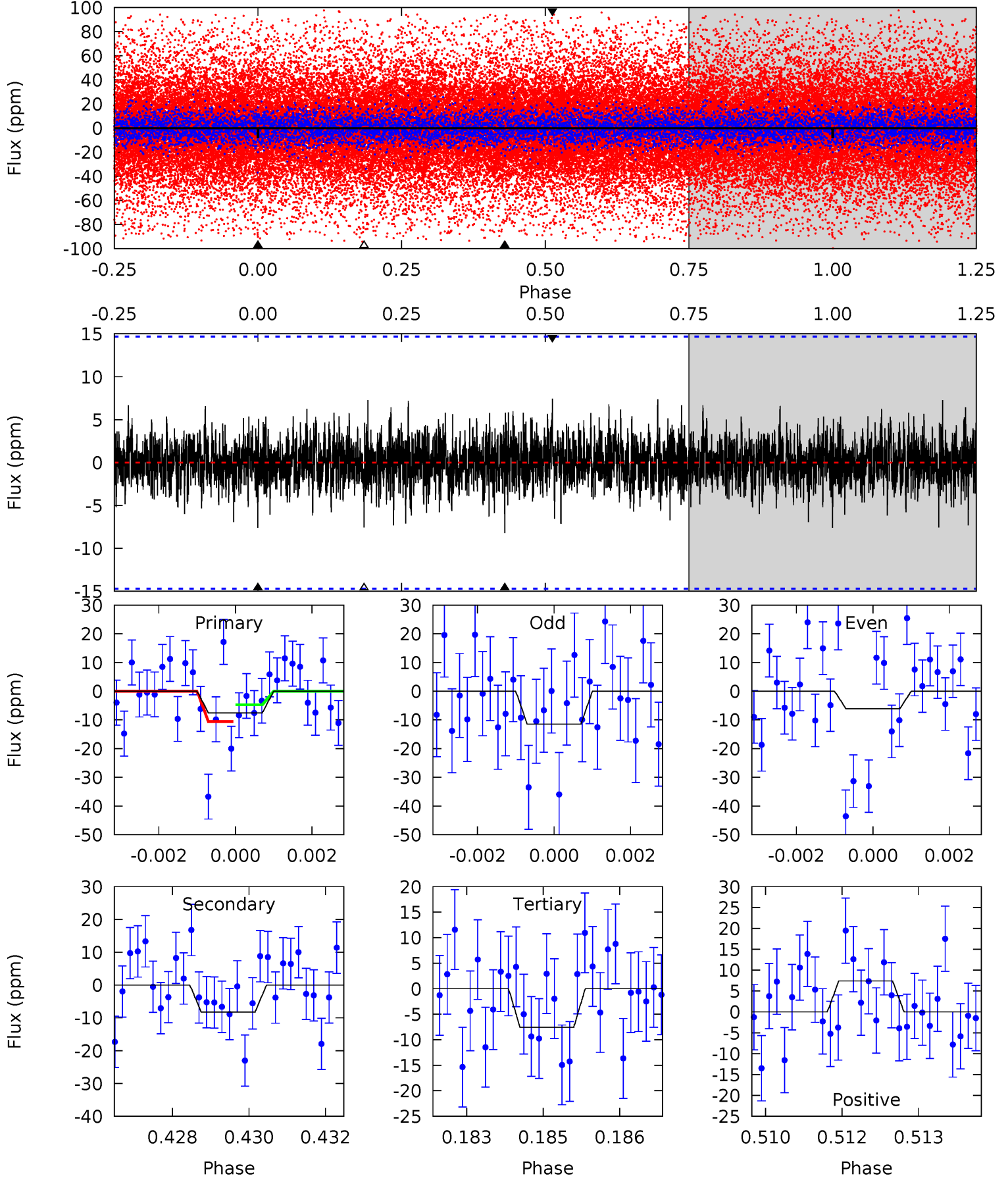
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
1.84	9.18	7.02	8.26	5.24	2.95	2.31	-5.18	-6.43	2.16	0.92	0.54	3.34	0.47	1.14



# Alt Model-Shift Uniqueness Test

007687231-02, P = 77.752602 Days, E = 100.540680 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
2.76	2.99	2.75	2.70	5.35	3.13	0.75	0.01	0.06	0.25	0.29	0.97	3.82	0.47	0





### Stellar Parameters For KIC 007687231

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$4148^{+75}_{-56}$	$1.428^{+0.108}_{-0.120}$	$-0.400^{+0.150}_{-0.100}$	$29.645^{+10.641}_{-3.325}$	$0.859^{+0.528}_{-0.028}$	$0.000^{+0.000}_{-0.000}$
	+2%/-1%	+8%/-8%	+37%/-25%	+36%/-11%	+61%/-3%	+43%/-41%
Source	SPE74	SPE74	SPE74	DSEP		

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

### Secondary Eclipse Parameters for KIC 007687231-02 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-77 \pm 8$	$14.14^{+6.53}_{-5.17}$	$2393^{+138}_{-99}$	$5578^{+1457}_{-806}$	$25^{+38}_{-13}$
Alt.	$-8 \pm 3$	$11.02^{+6.06}_{-5.00}$	$2385^{+136}_{-88}$	$3849^{+1055}_{-580}$	$4.086^{+11.003}_{-2.410}$

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

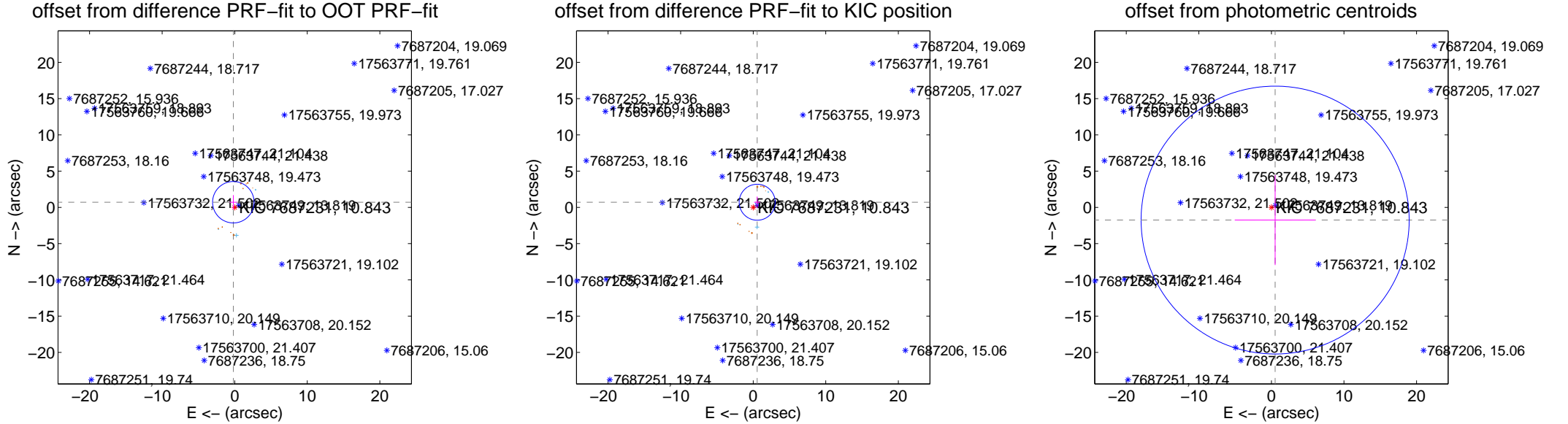
## DV Centroid Data

Supplemental centroid analysis for 007687231-02. **Kepler magnitude: 10.84.** Transit SNR 3.93

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

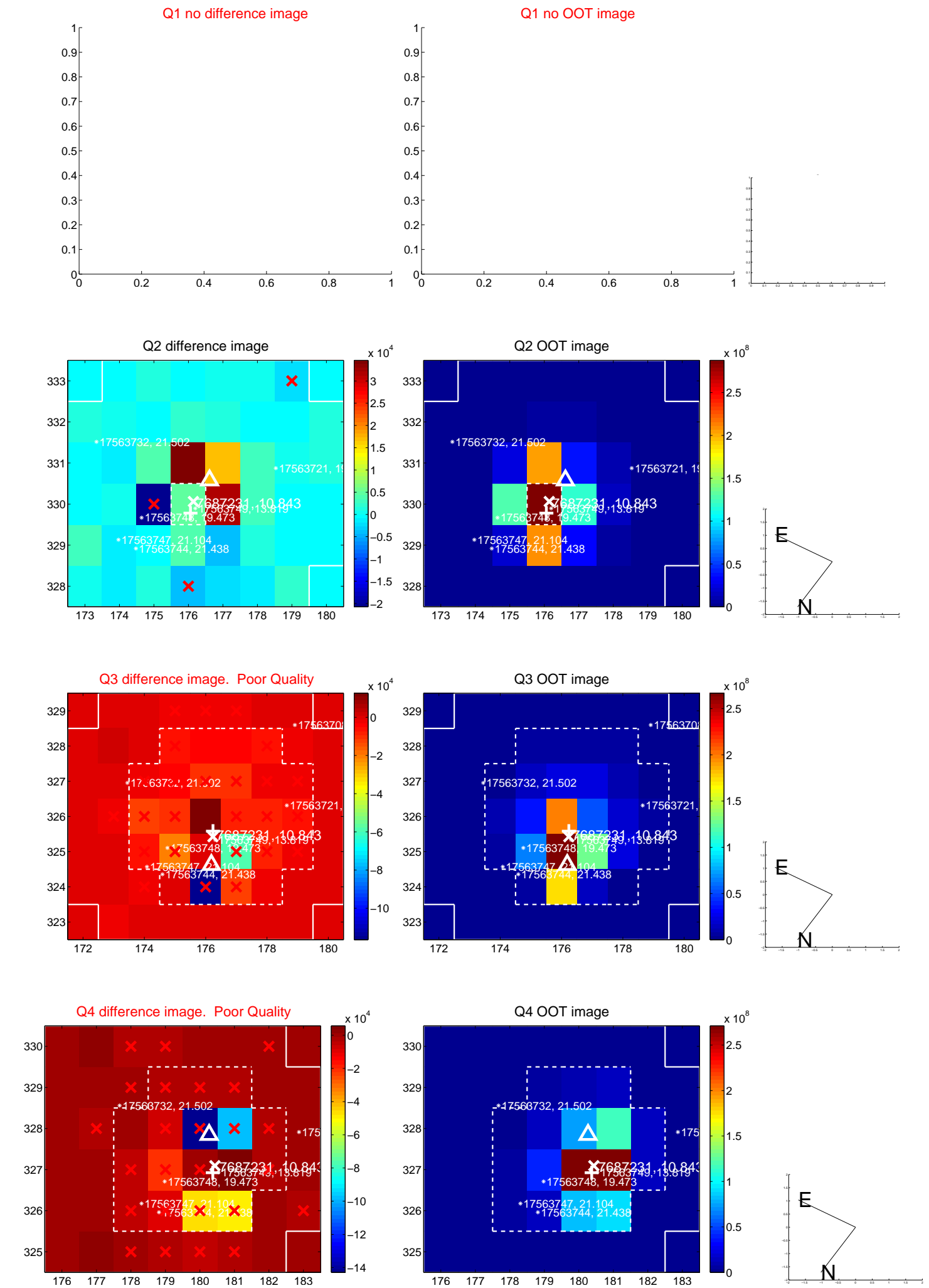
The direct PRF centroid is offset from the target star catalog position by about 0.35 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.736 \pm 0.953$	0.77	$0.191 \pm 0.504$	$0.711 \pm 0.977$
PRF-fit source offset from KIC position	$0.897 \pm 0.827$	1.08	$-0.551 \pm 0.415$	$0.708 \pm 0.785$
photometric centroid source offset	$1.82 \pm 6.16$	0.30	$-0.51 \pm 5.57$	$-1.75 \pm 6.21$

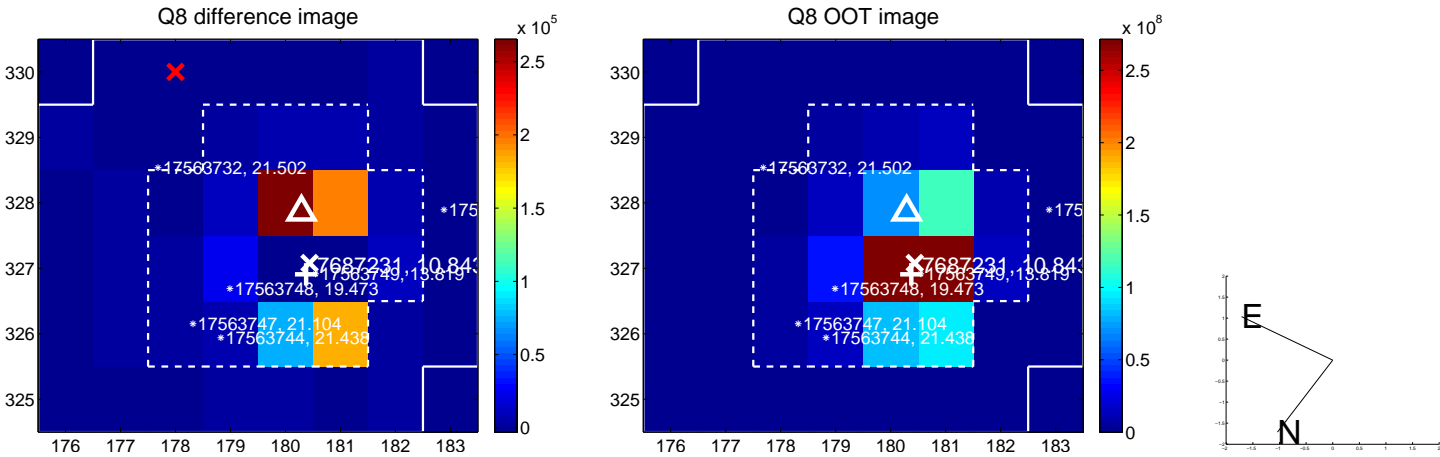
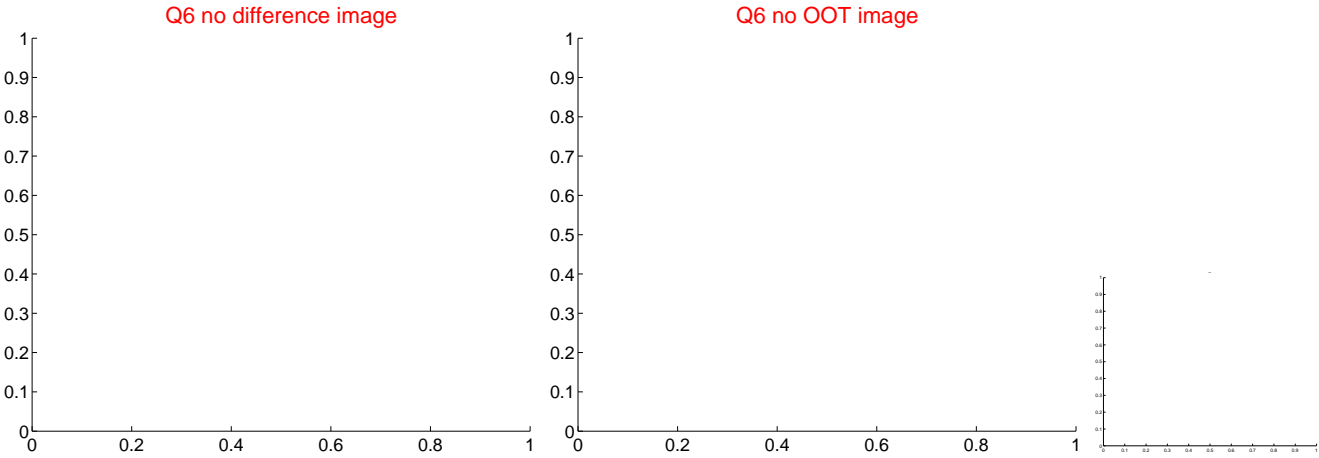
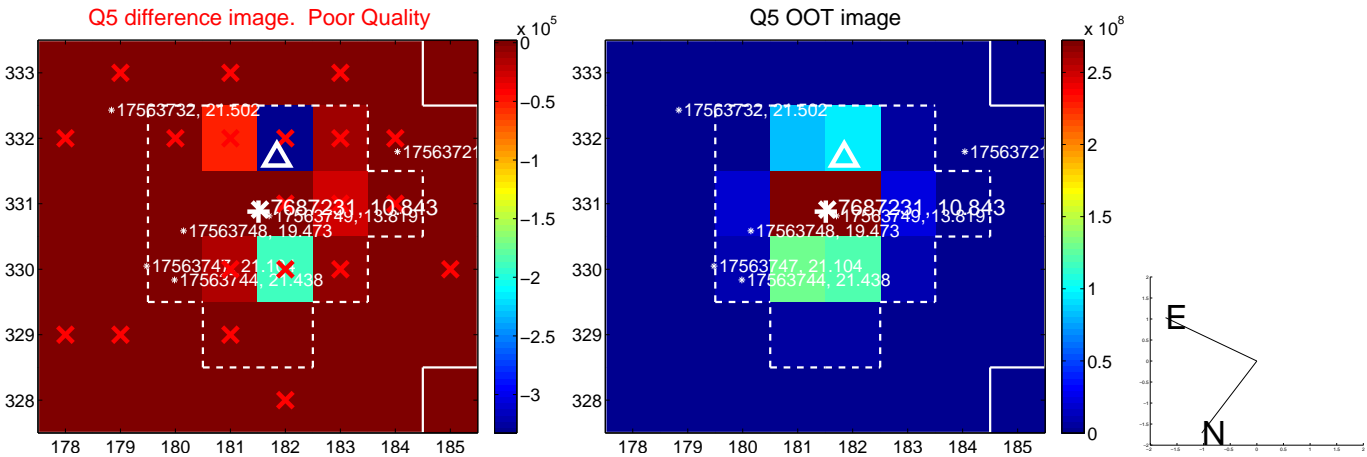


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

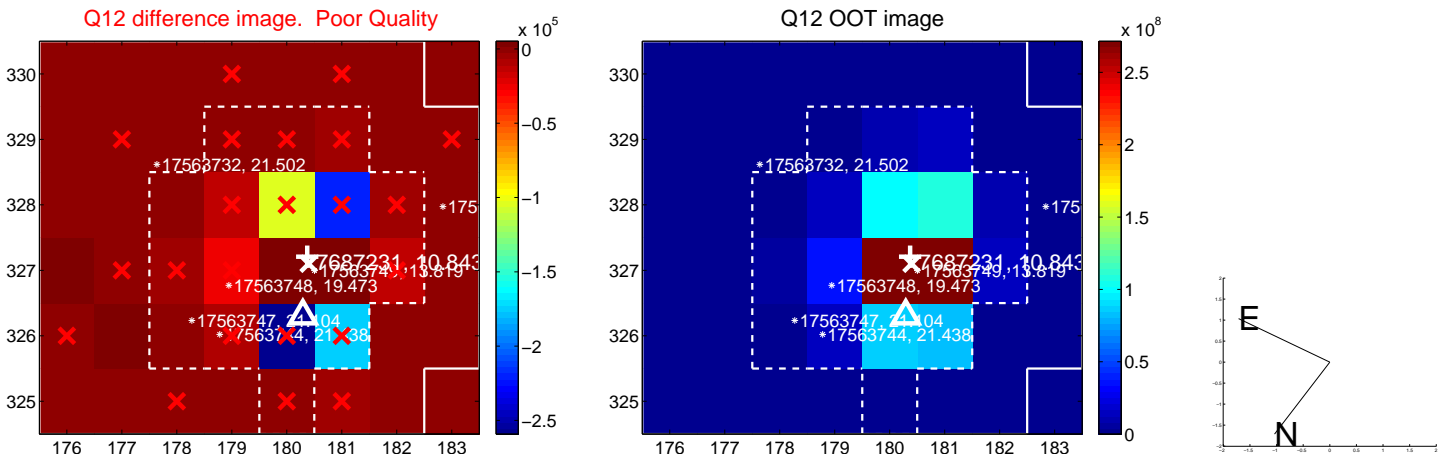
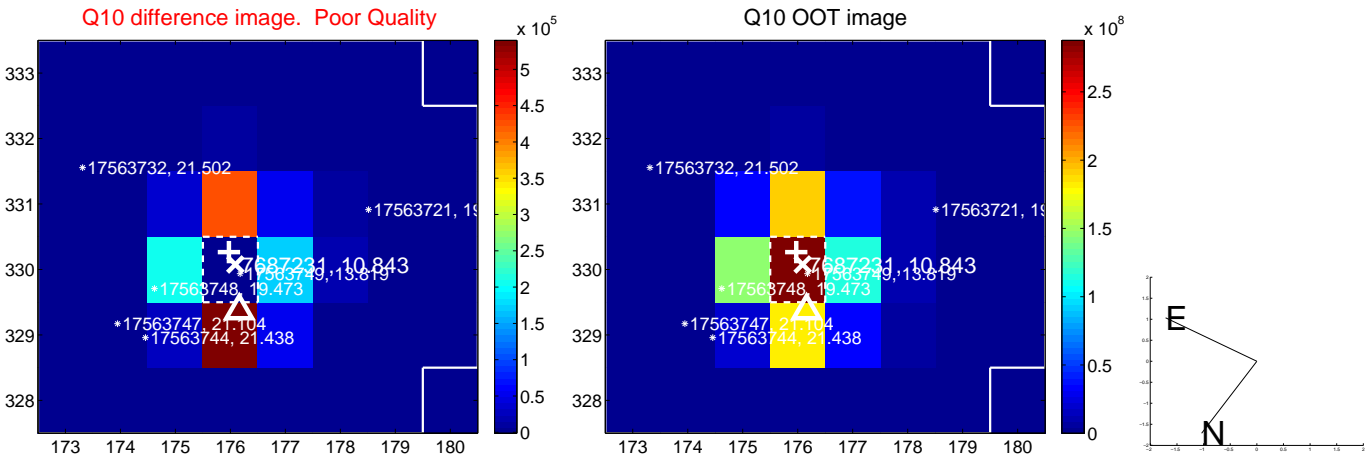
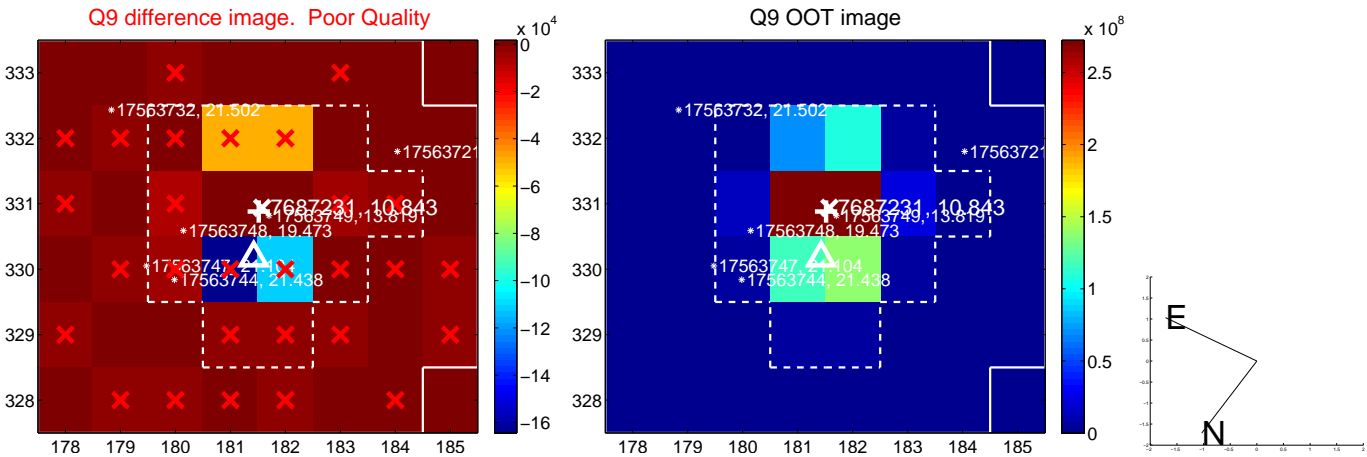
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



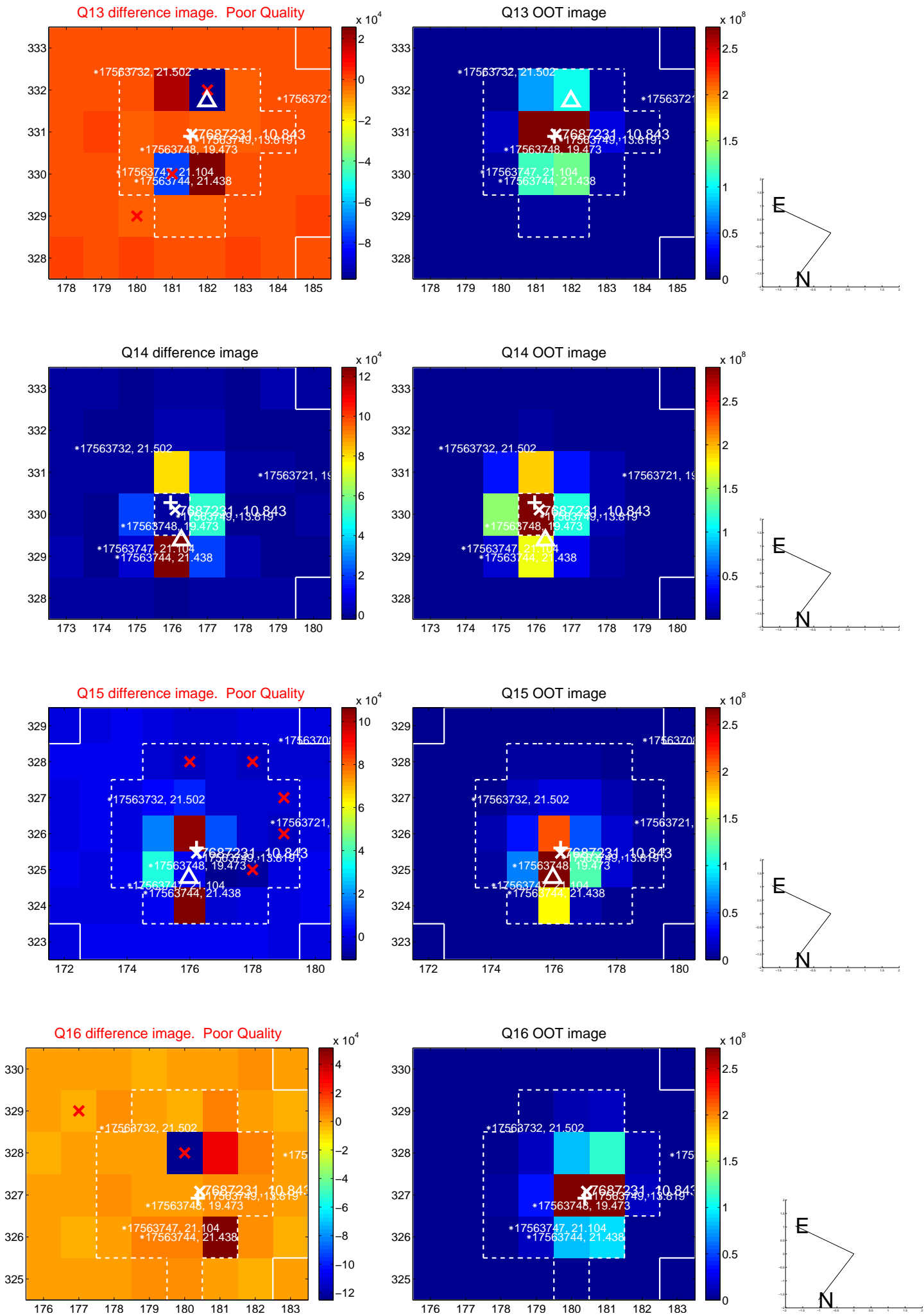
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



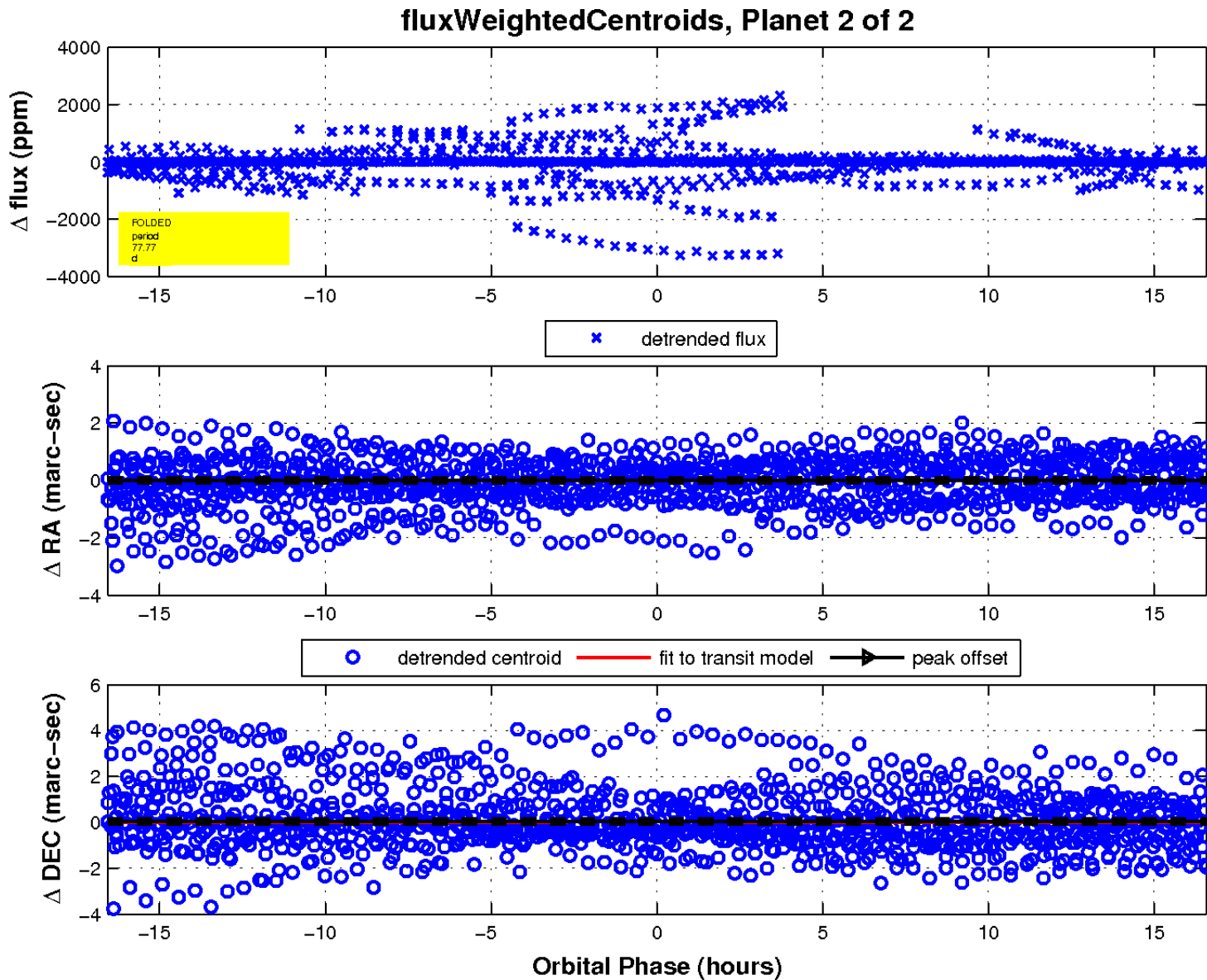
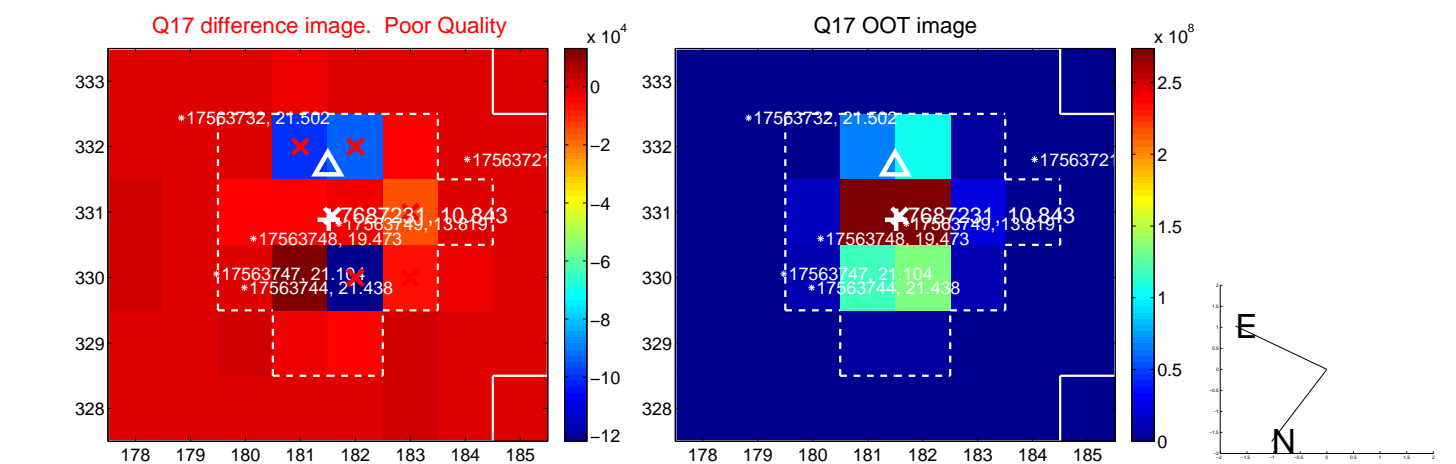
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

