

# KIC 009885213

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009885213-01	OBS	No	403.715864	512.873942	139.4	13.966	7.3	7.8	1.54	6031	1.96	2.40
009885213-02	OBS	No	511.360787	185.743414	161.5	7.468	7.4	7.1	1.54	6031	2.26	1.75

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009885213-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—ALL_TRANS_CHASES—CENT_FEW_DIFFS
009885213-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—ALL_TRANS_CHASES—CENT_FEW_DIFFS

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

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

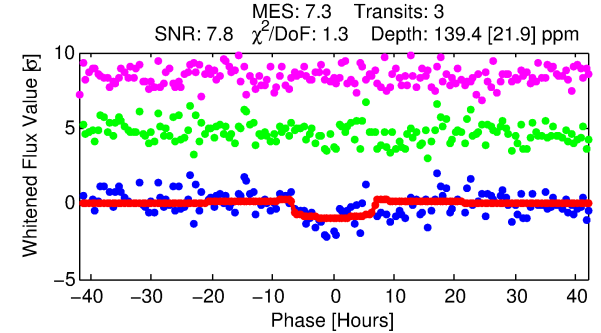
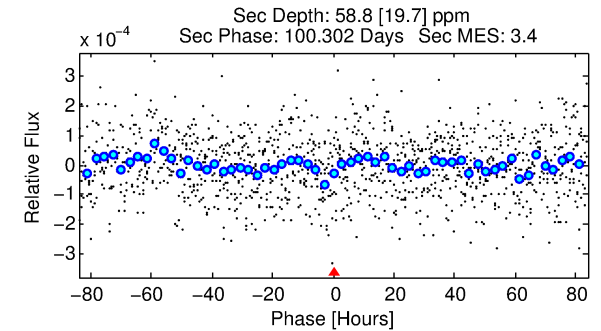
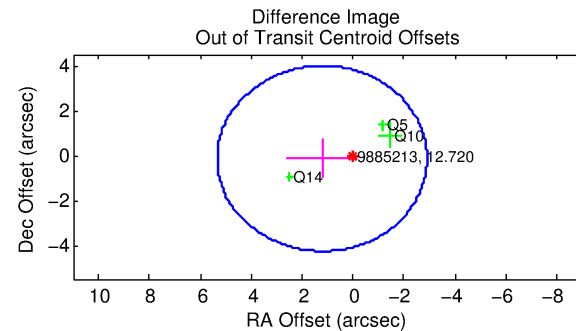
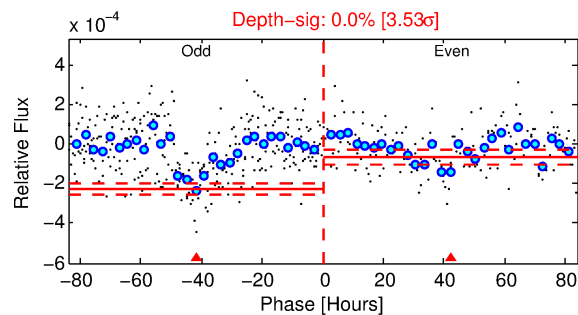
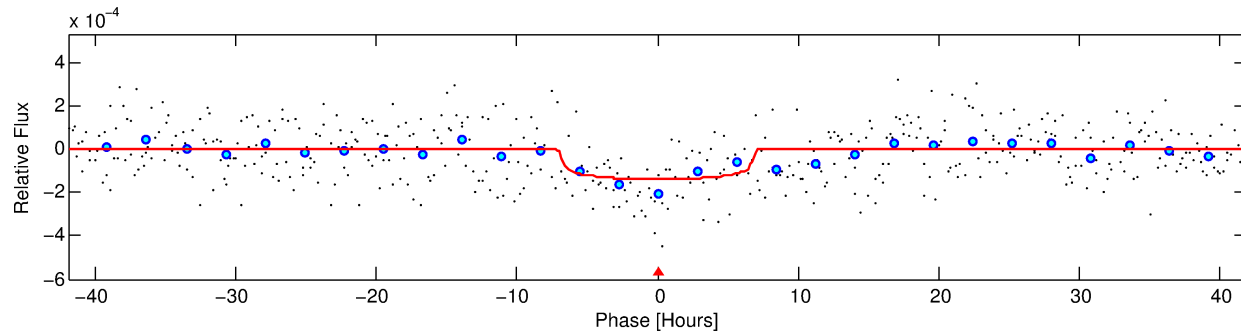
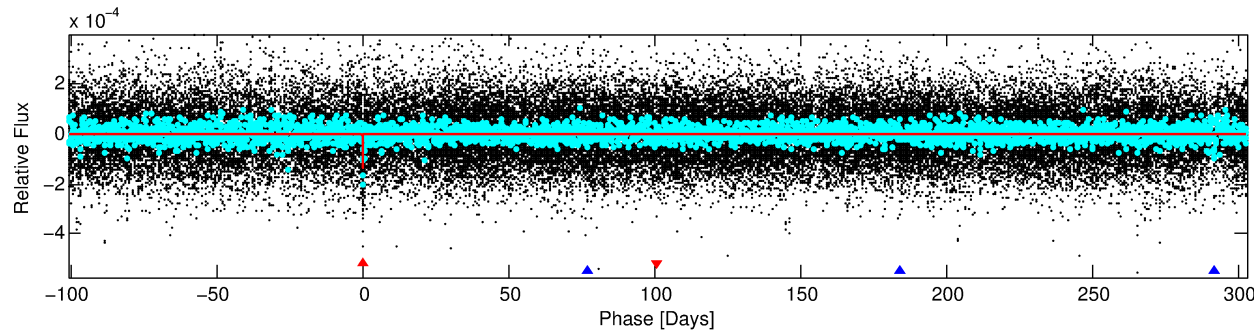
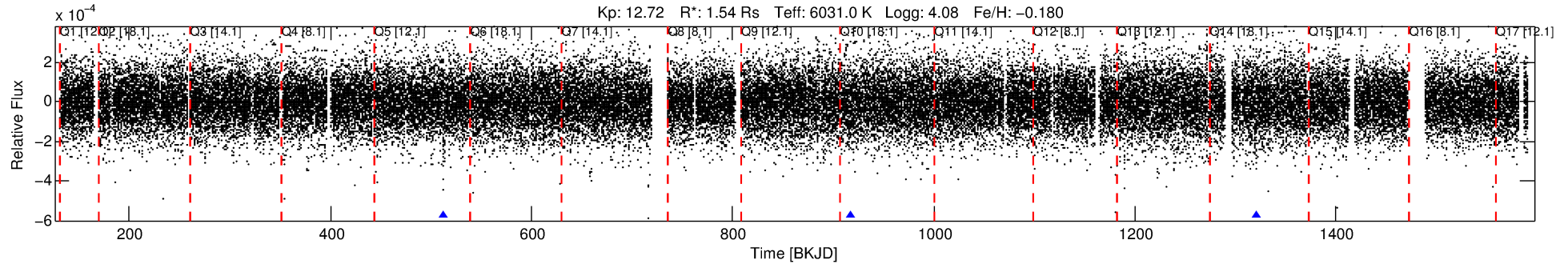
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 009885213-01

No Significant Match Found

# DV One-Page Summary

KIC: 9885213 Candidate: 1 of 2 Period: 403.716 d



## DV Fit Results:

Period = 403.71586 [0.01653] d  
Epoch = 512.8739 [0.0216] BKJD  
Rp/R\* = 0.0116 [0.0050]  
a/R\* = 156.00 [329.19]  
b = 0.72 [1.39]  
Seff = 2.40 [1.02]  
Teq = 318 [34] K  
Rp = 1.96 [1.00] Re  
a = 1.0821 [0.2816] AU  
Ag = 9886.99 [10031.64] [0.99 $\sigma$ ]  
Teffp = 4895 [1143] K [4.00 $\sigma$ ]

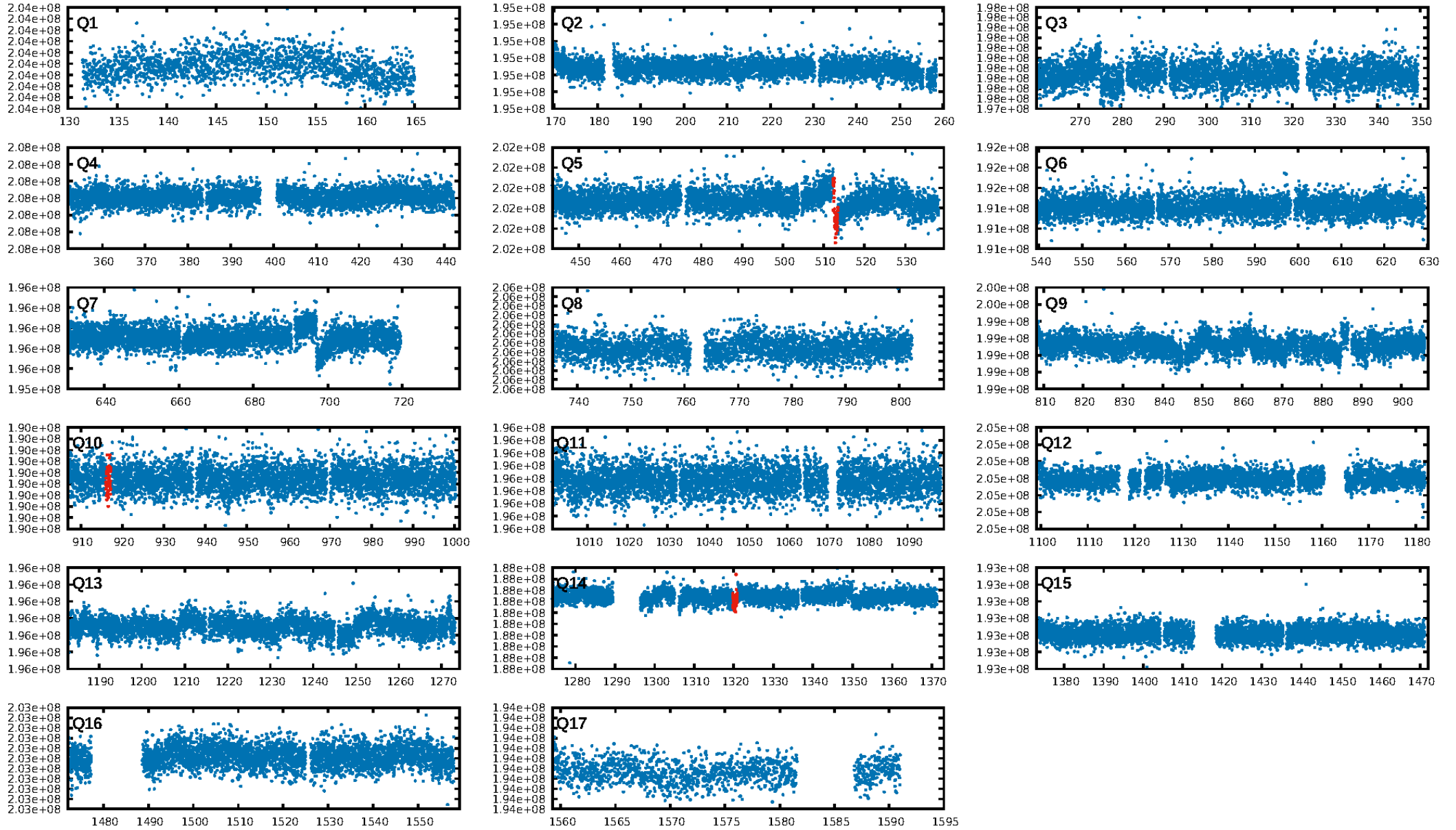
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [163.13 $\sigma$ ]  
ModelChiSquare2-sig: 0.0%  
ModelChiSquareGof-sig: 75.9%  
Bootstrap-pfa: 1.07e-09  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: 1.882  
Centroid-sig: 5.9%  
Centroid-so: 2.127 arcsec [1.30 $\sigma$ ]  
OotOffset-rm: 1.222 arcsec [0.89 $\sigma$ ]  
KicOffset-rm: 1.325 arcsec [0.93 $\sigma$ ]  
OotOffset-st: 2/0/0/1 [3]  
KicOffset-st: 2/0/0/1 [3]  
DiffImageQuality-fgm: 1.00 [3/3]  
DiffImageOverlap-fno: 1.00 [3/3]

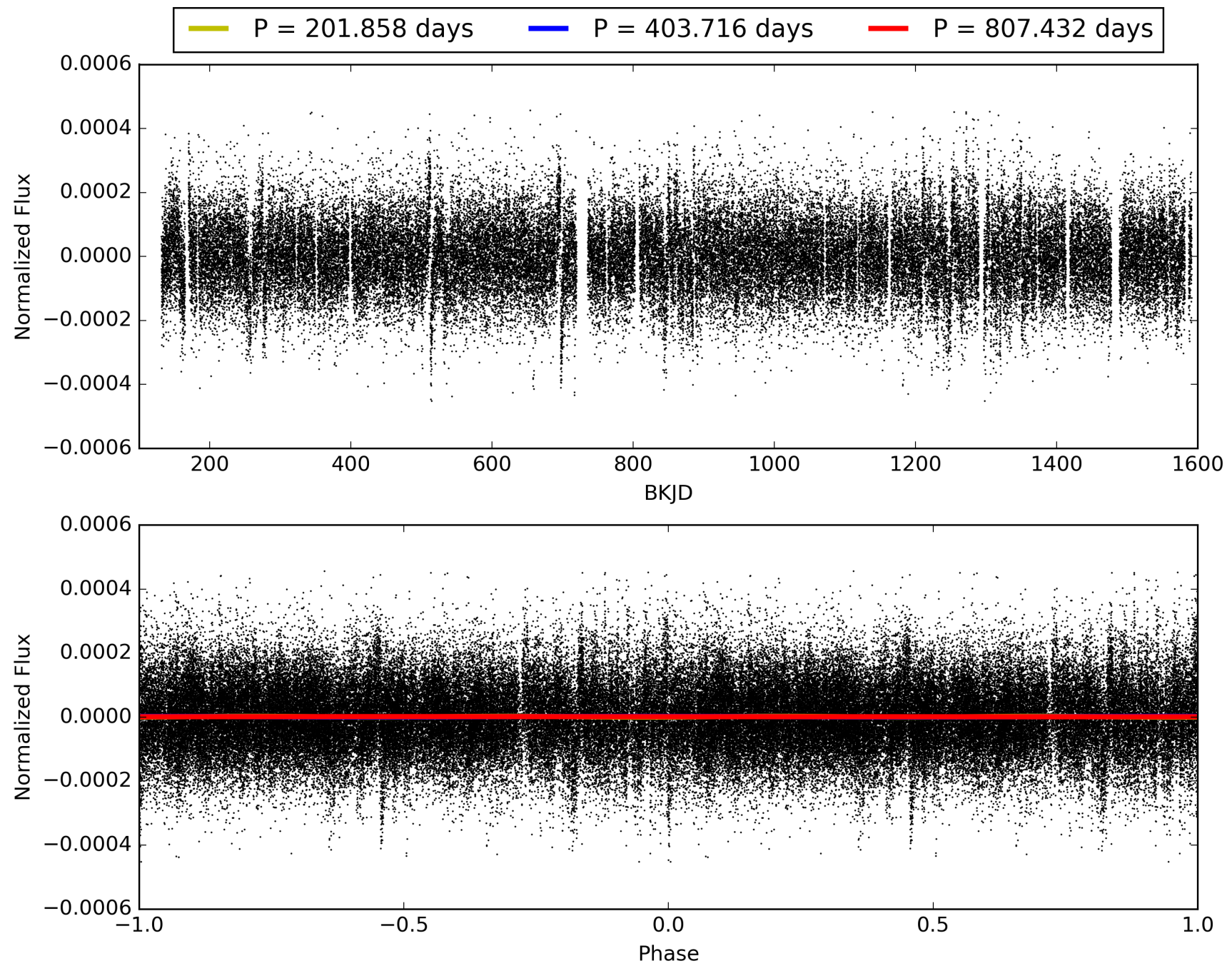
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 29-Jan-2016 00:59:12 Z

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

# TCE 009885213-01, PDC Light Curves

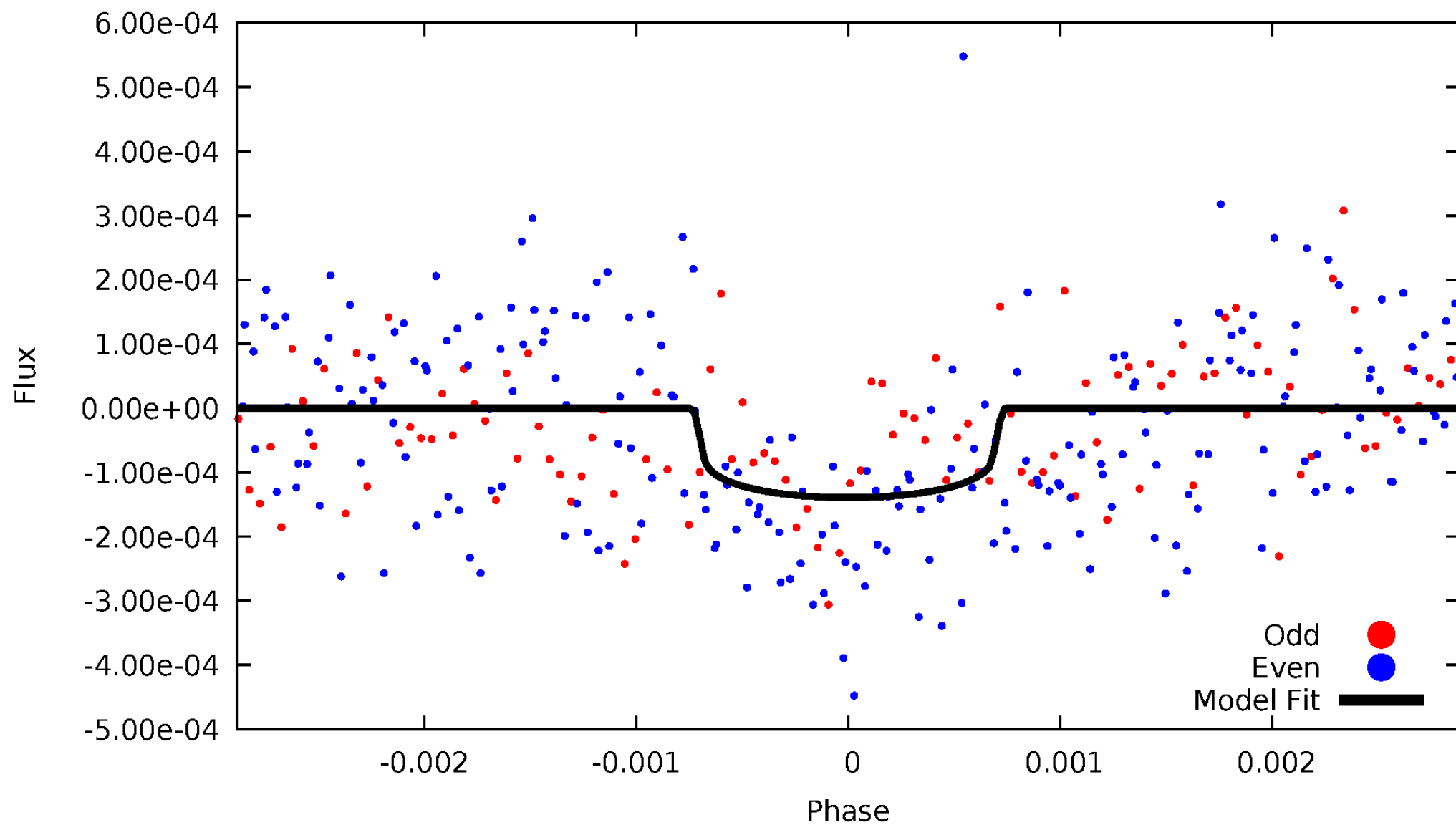


TCE 009885213-01



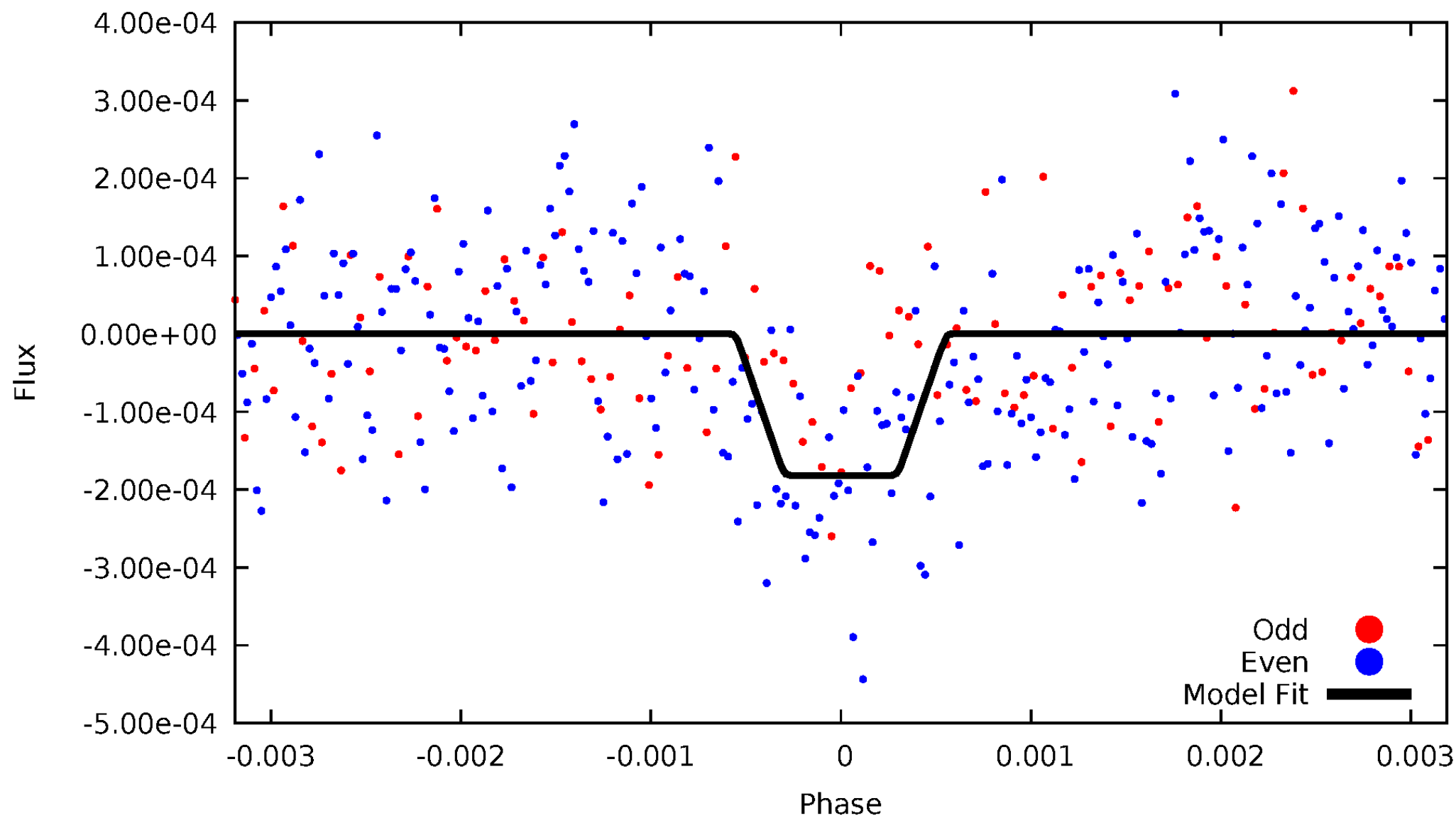
# DV Odd/Even

TCE 009885213-01



# ALT Odd/Even

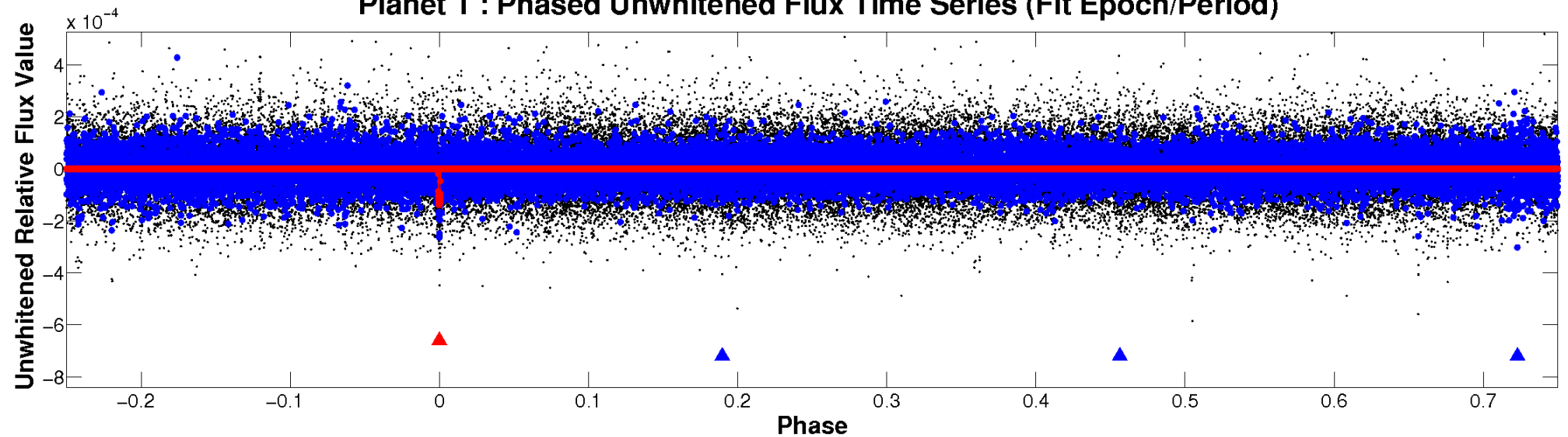
TCE 009885213-01



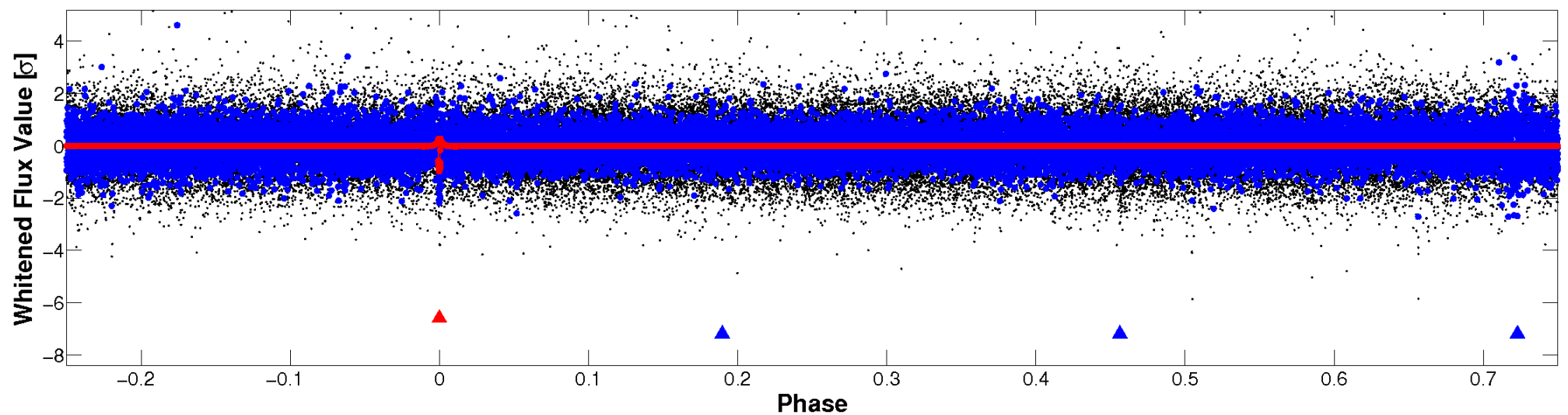


# Non-Whitened Vs. Whitened Light Curve

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

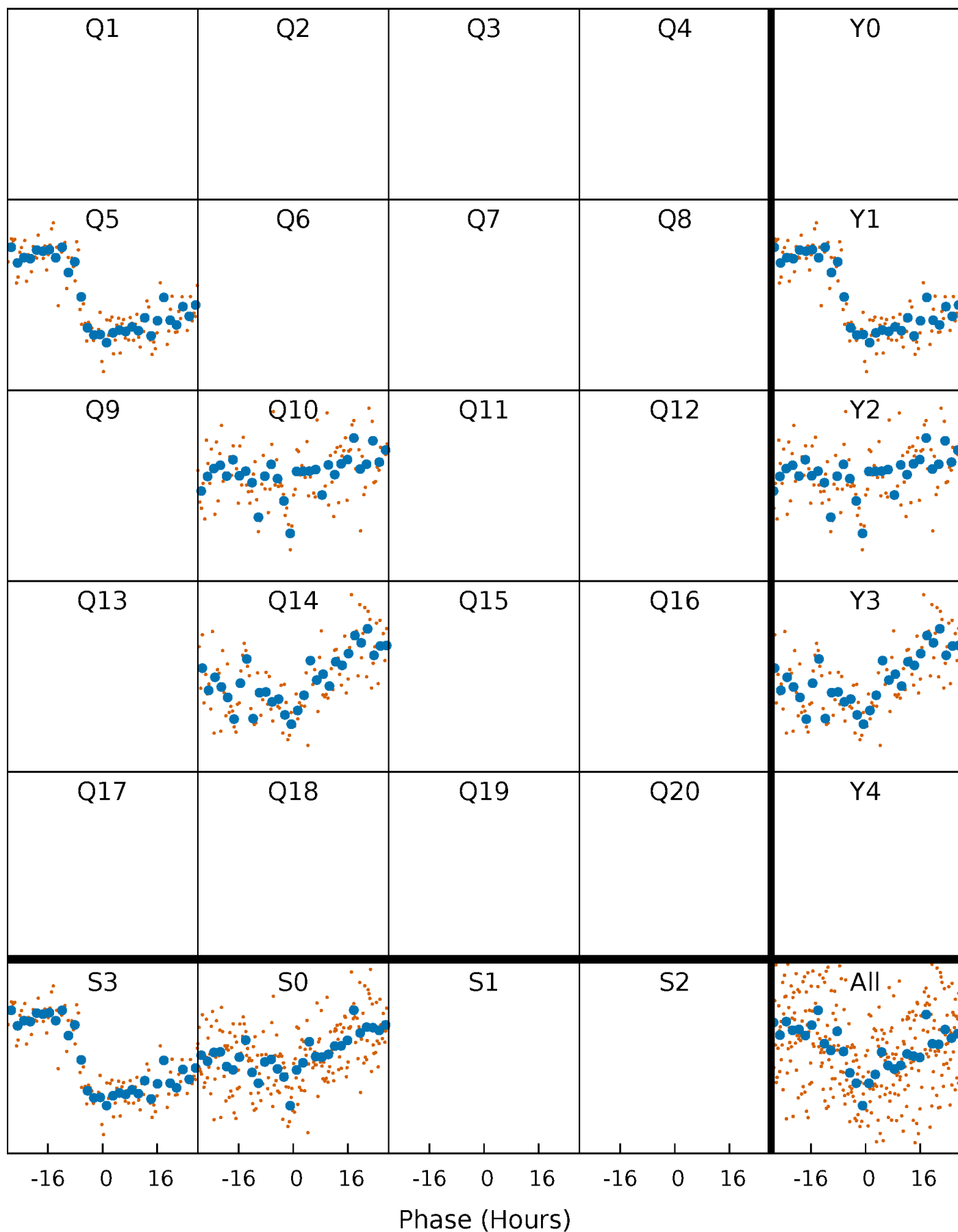


Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

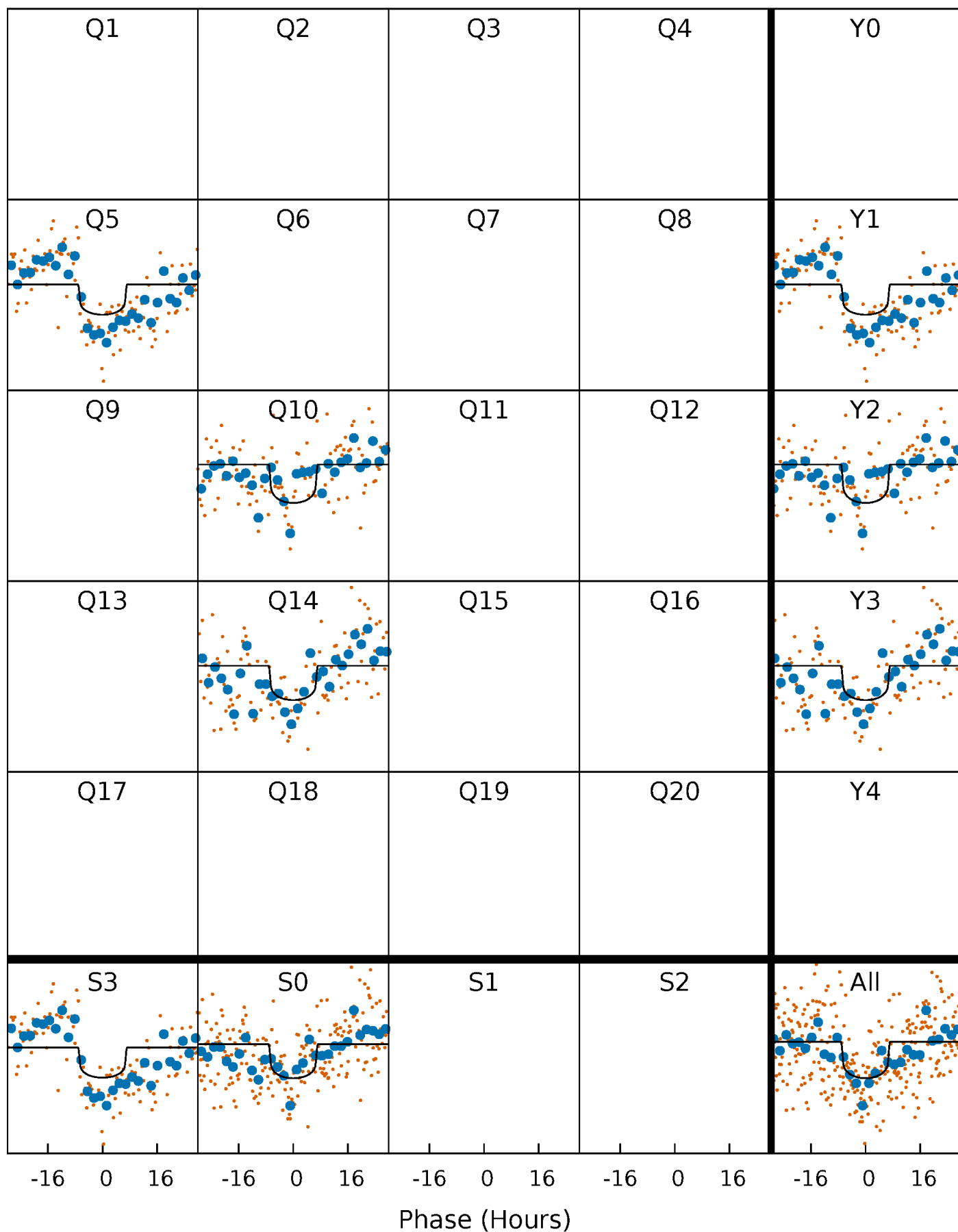
TCE 009885213-01 P=403.715864 Days  $T_0=512.873942$  (BKJD)





# DV Quarter-Phased Transit Curves

TCE 009885213-01 P=403.715864 Days  $T_0=512.873942$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

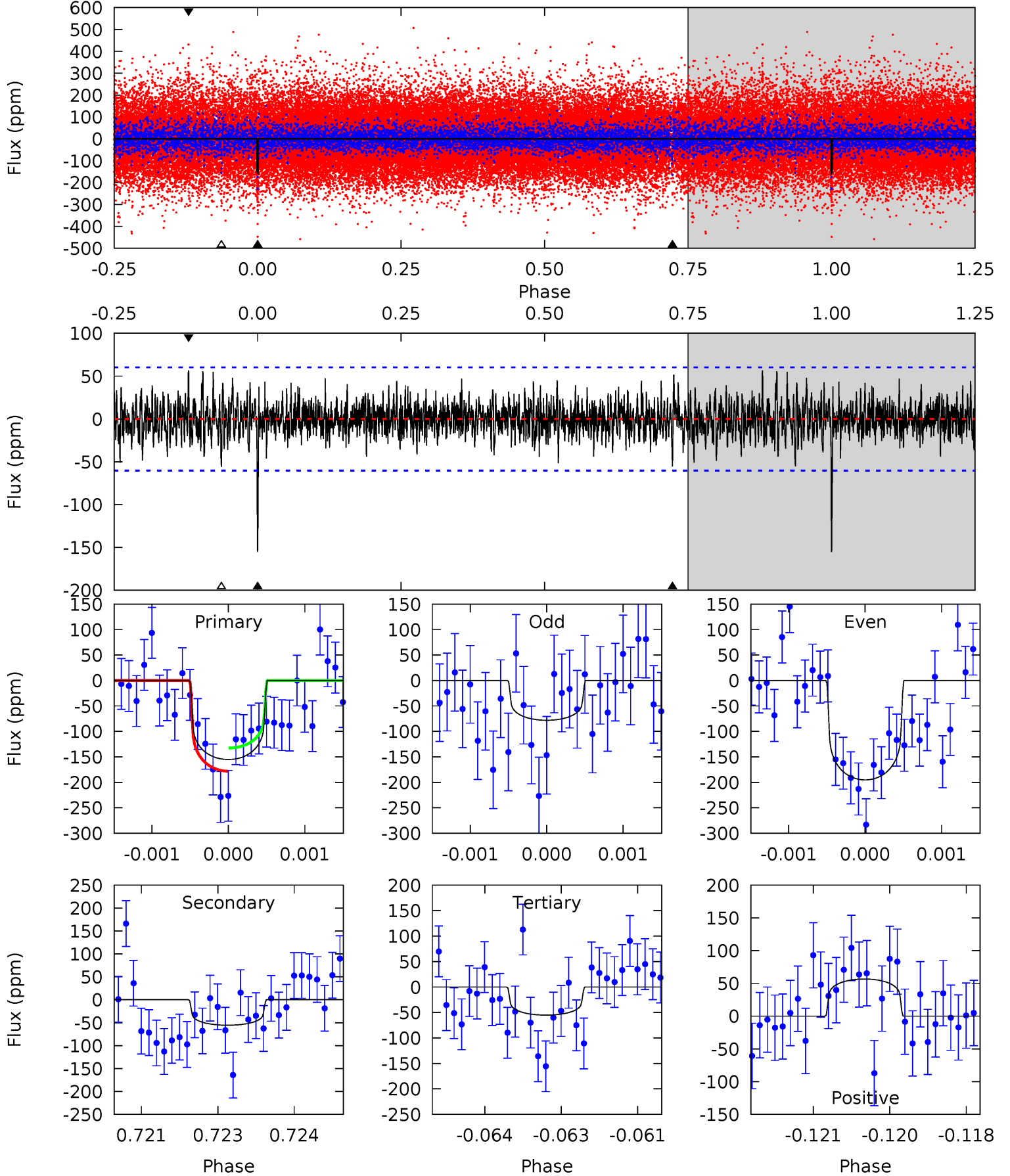
TCE 009885213-01 P=403.733090 Days  $T_0=512.838622$  (BKJD)



# DV Model-Shift Uniqueness Test

009885213-01,  $P = 403.715864$  Days,  $E = 109.158078$  Days

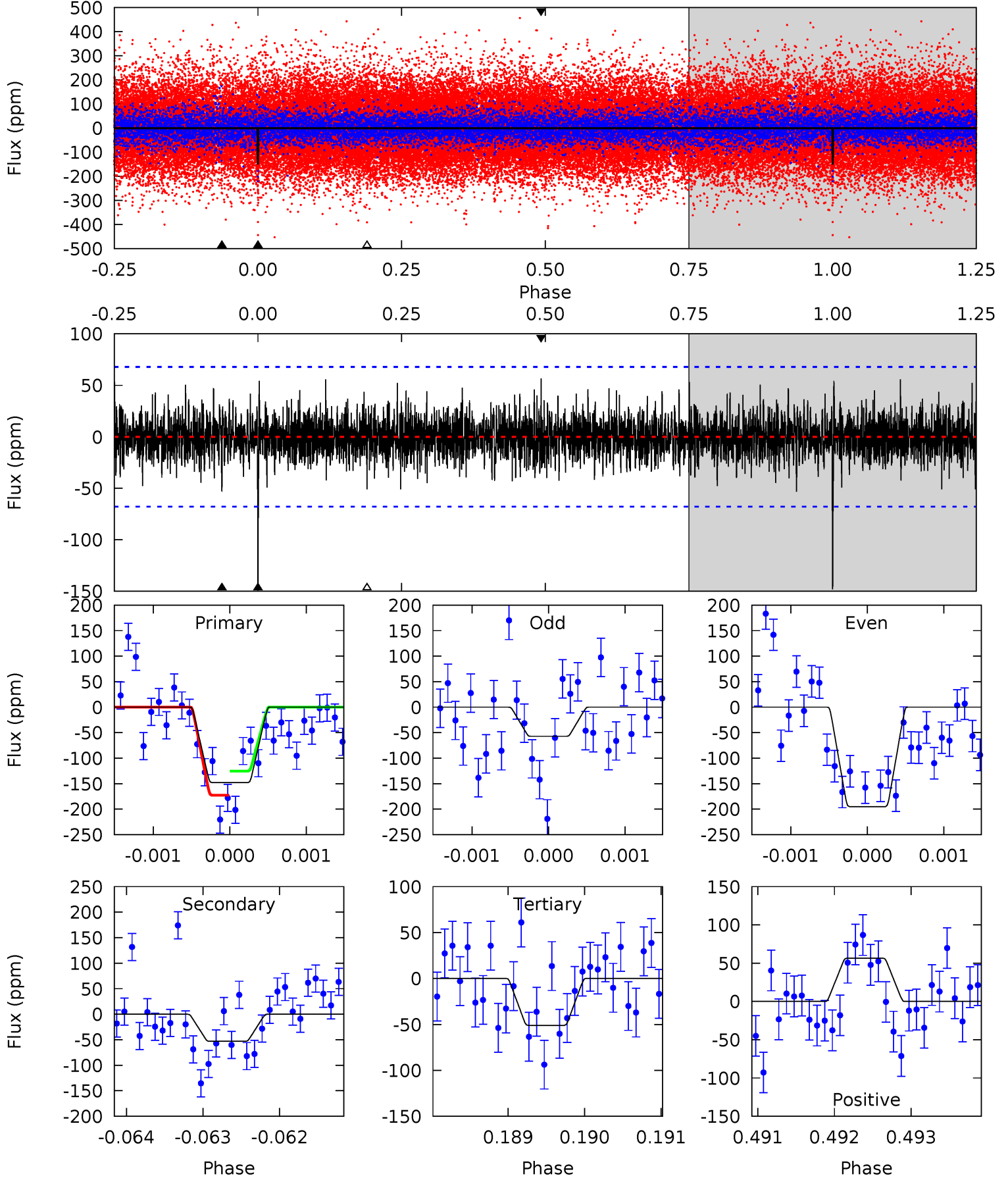
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
13.8	4.95	4.92	5.06	5.38	3.18	1.36	8.93	8.79	0.04	-0.10	5.03	1.07	0.27	2.03



# Alt Model-Shift Uniqueness Test

009885213-01, P = 403.733090 Days, E = 109.105532 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
11.8	4.25	4.08	4.52	5.43	3.26	1.21	7.76	7.32	0.17	-0.27	5.25	1.09	0.28	1.89



### Stellar Parameters For KIC 009885213

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6031^{+164}_{-164}$	$4.078^{+0.240}_{-0.129}$	$-0.180^{+0.300}_{-0.250}$	$1.541^{+0.348}_{-0.425}$	$1.038^{+0.174}_{-0.143}$	$0.400^{+0.568}_{-0.151}$
	+3%/-3%	+6%/-3%	+167%/-139%	+23%/-28%	+17%/-14%	+142%/-38%
Source	PHO1	FLK73	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 009885213-01 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-56 \pm 11$	$1.86^{+0.90}_{-0.76}$	$439^{+29}_{-32}$	$4919^{+1321}_{-656}$	$10230^{+19773}_{-5590}$
Alt.	$-53 \pm 12$	$2.23^{+0.92}_{-0.89}$	$440^{+28}_{-35}$	$4574^{+1102}_{-570}$	$6929^{+11748}_{-3733}$

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

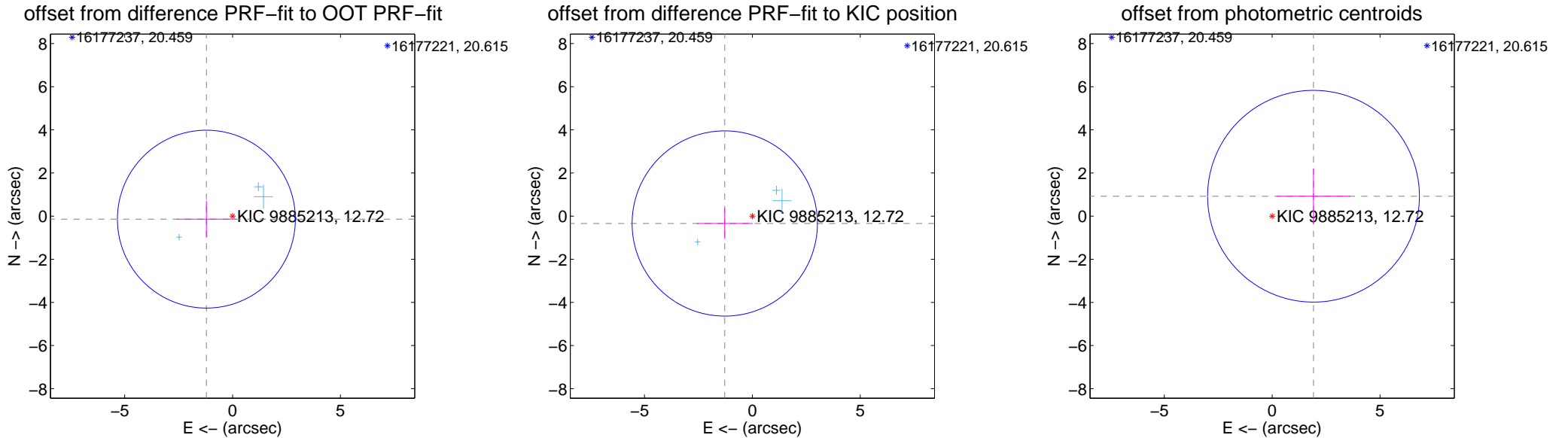
## DV Centroid Data

Supplemental centroid analysis for 009885213-01. Kepler magnitude: 12.72. Transit SNR 7.79

There are 3 quarters with good PRF difference image offsets

The direct PRF centroid is offset from the target star catalog position by about 0.23 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.222 \pm 1.375$	0.89	$1.214 \pm 1.380$	$-0.140 \pm 0.851$
PRF-fit source offset from KIC position	$1.325 \pm 1.431$	0.93	$1.280 \pm 1.293$	$-0.341 \pm 0.717$
photometric centroid source offset	$2.13 \pm 1.64$	1.30	$-1.92 \pm 1.71$	$0.92 \pm 1.29$



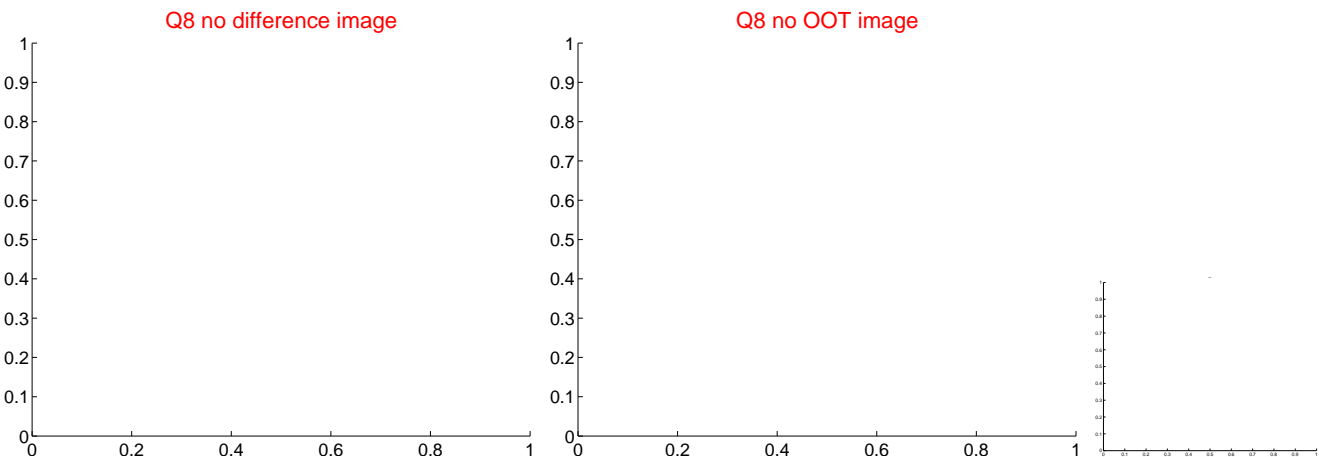
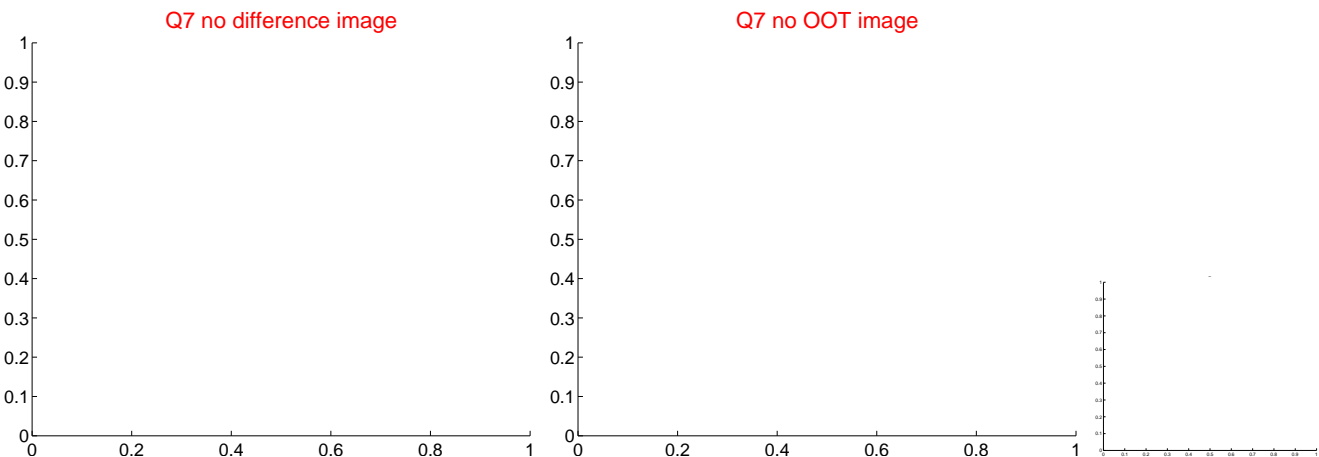
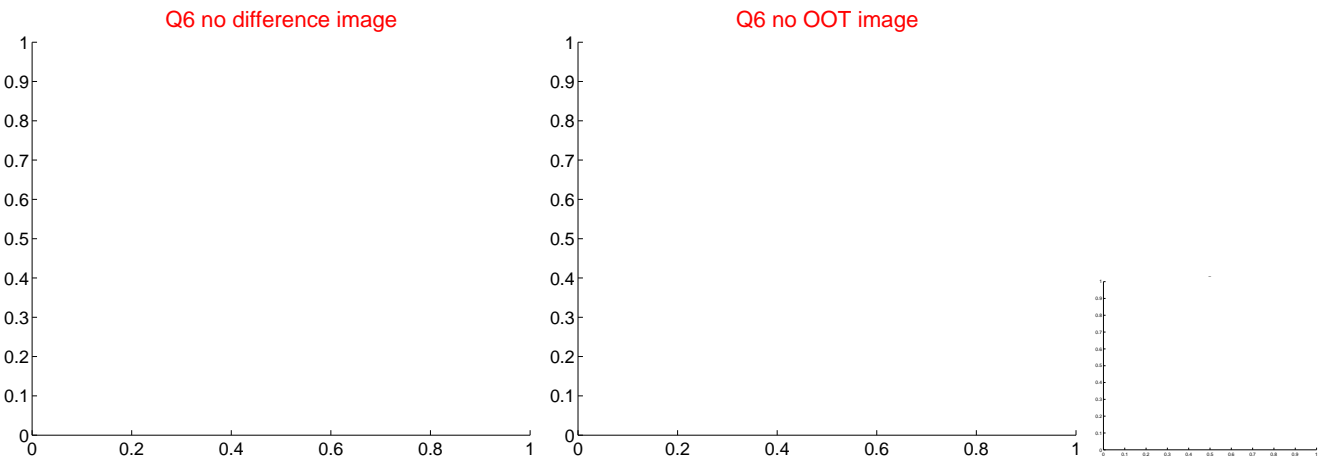
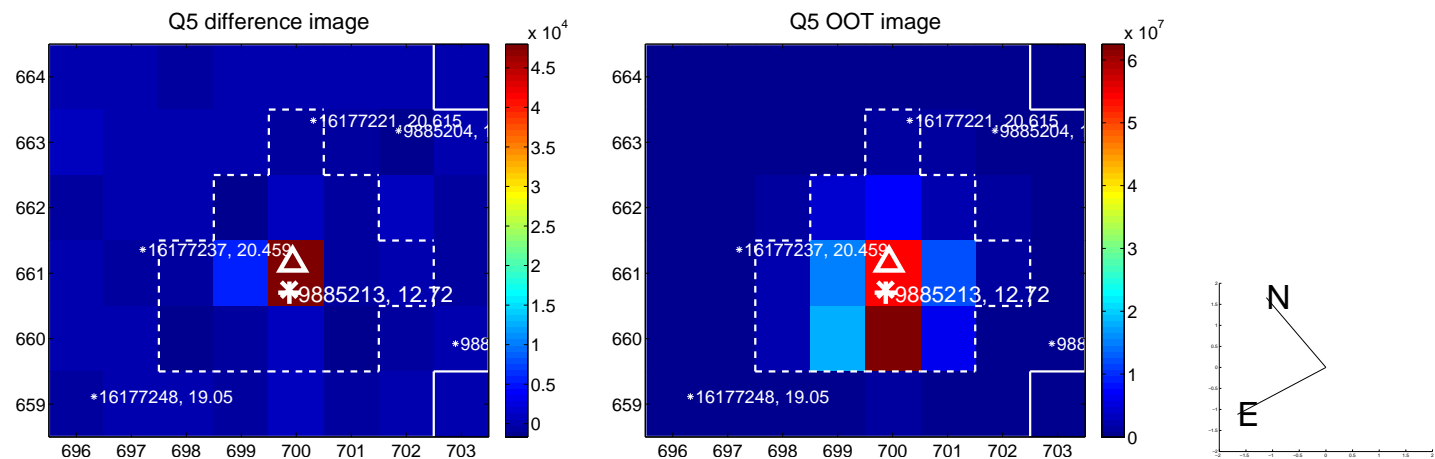
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

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

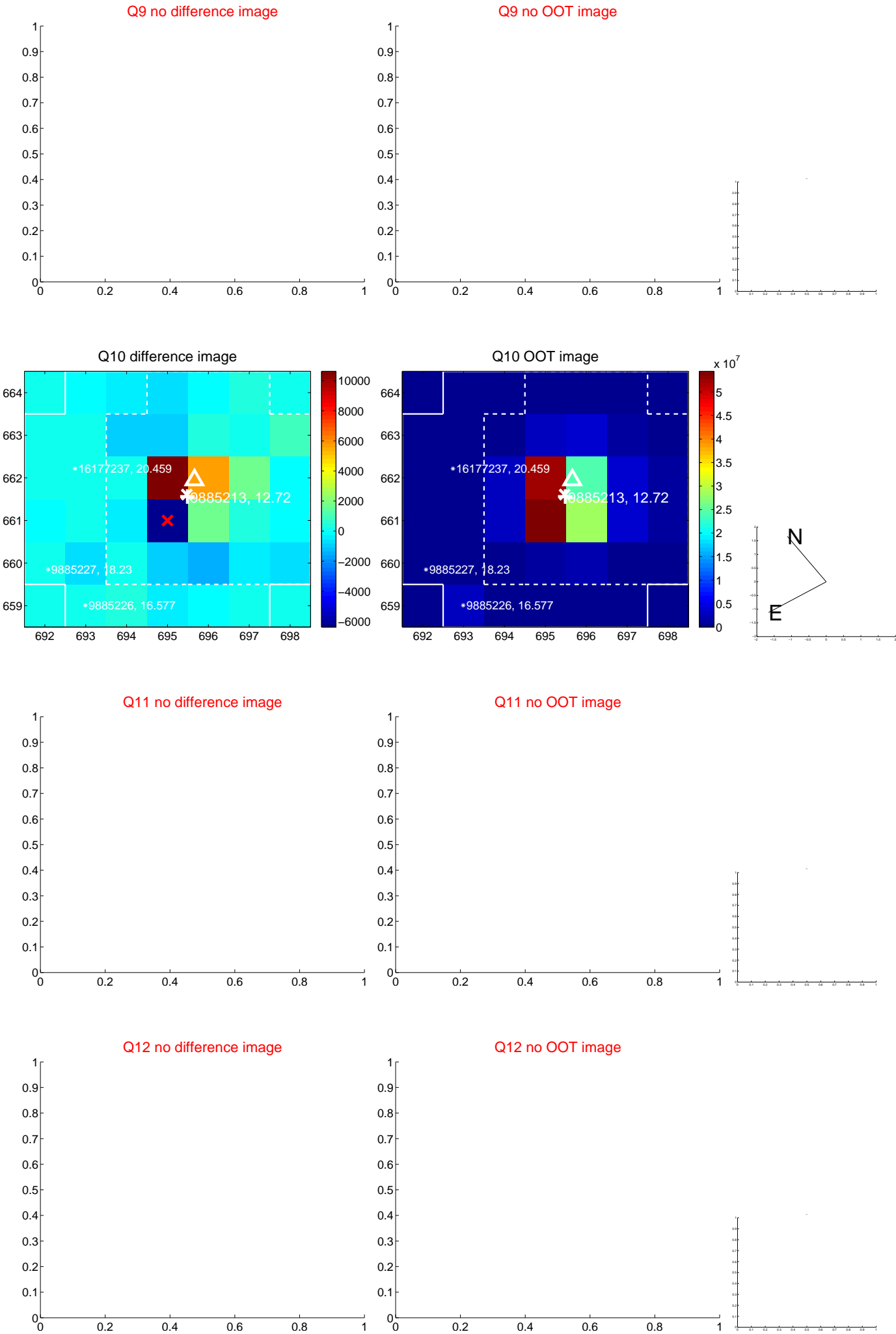




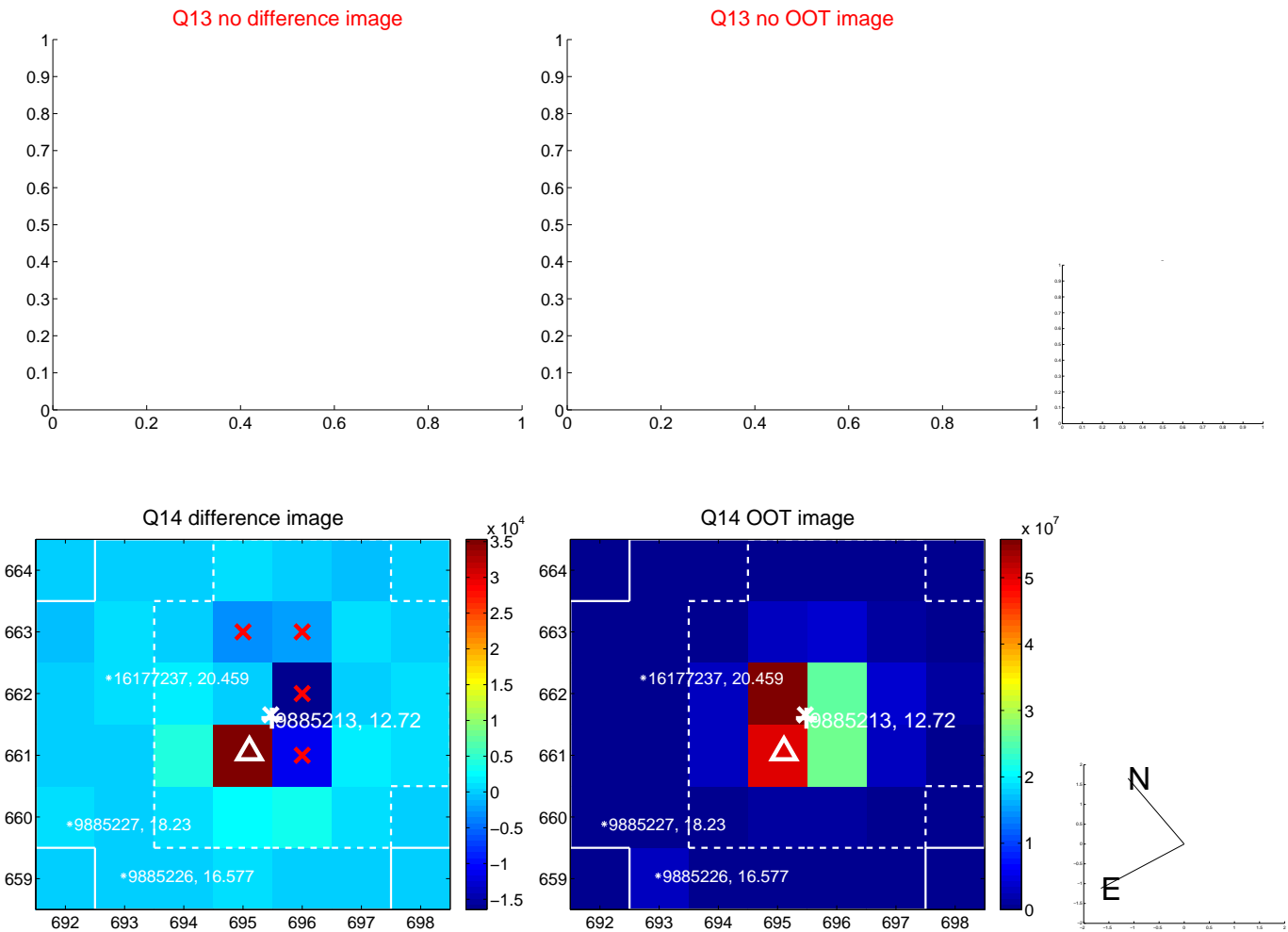
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



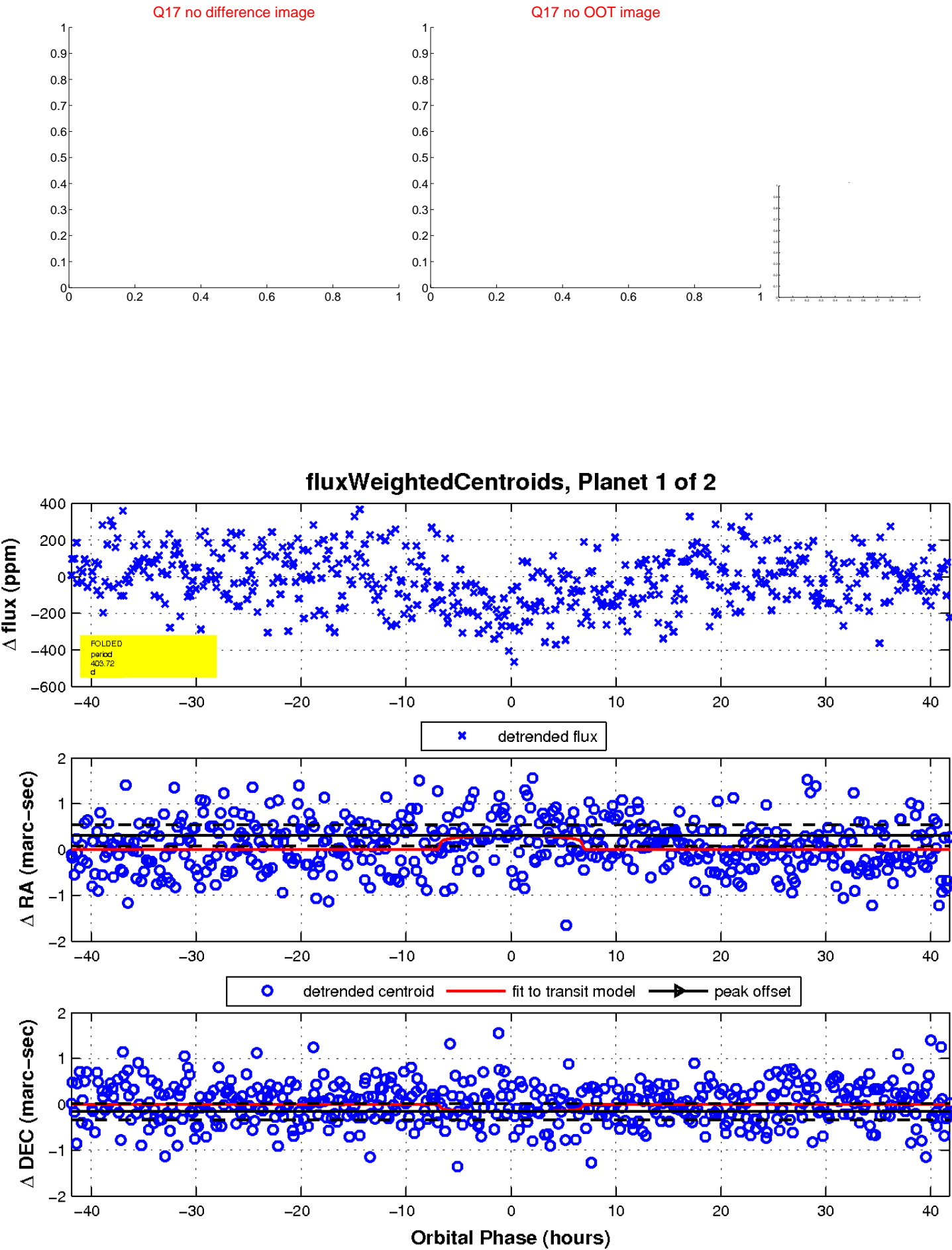
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

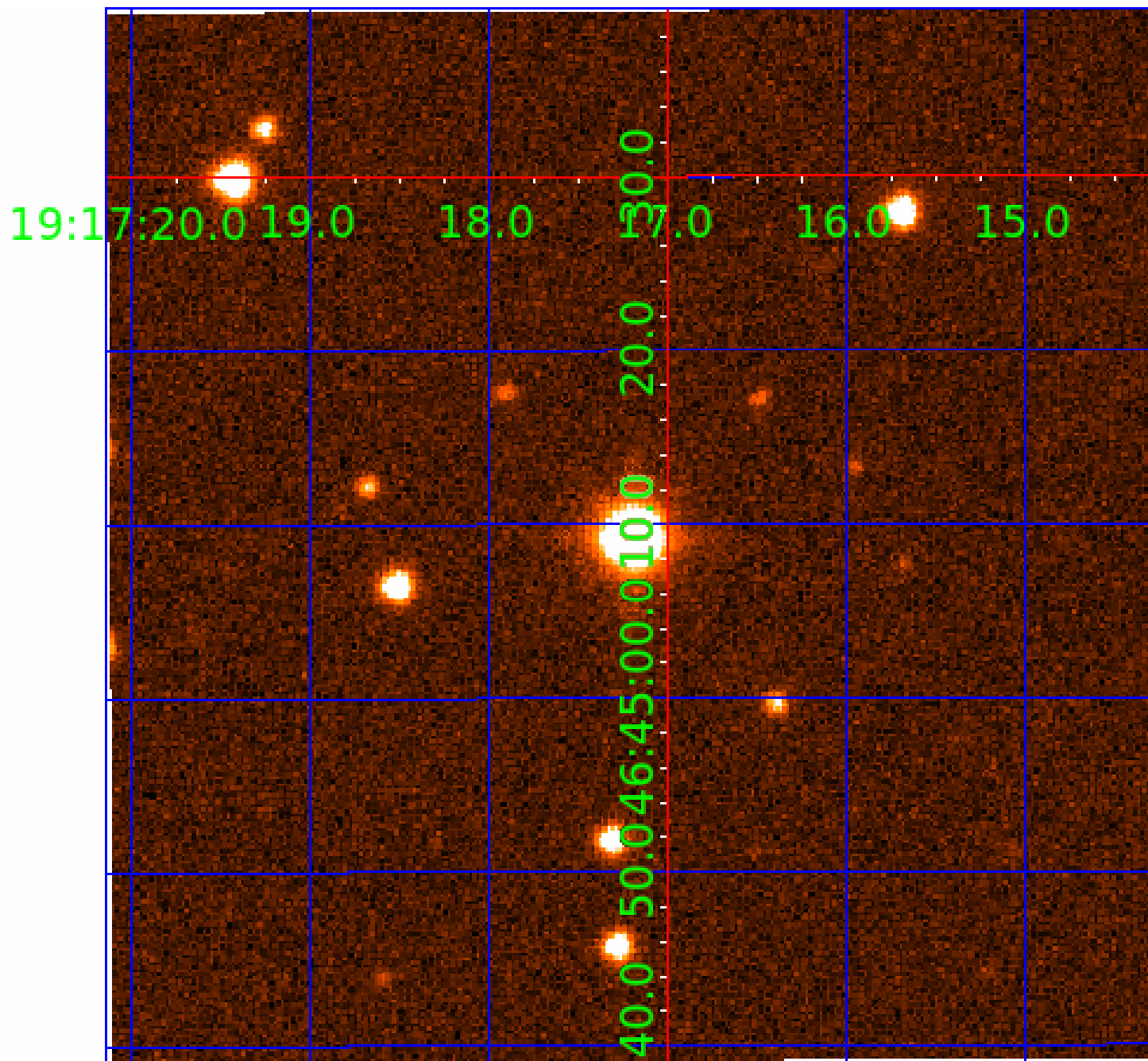


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 009885213

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009885213-01	OBS	No	403.715864	512.873942	139.4	13.966	7.3	7.8	1.54	6031	1.96	2.40
009885213-02	OBS	No	511.360787	185.743414	161.5	7.468	7.4	7.1	1.54	6031	2.26	1.75

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009885213-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—ALL_TRANS_CHASES—CENT_FEW_DIFFS
009885213-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—ALL_TRANS_CHASES—CENT_FEW_DIFFS

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

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

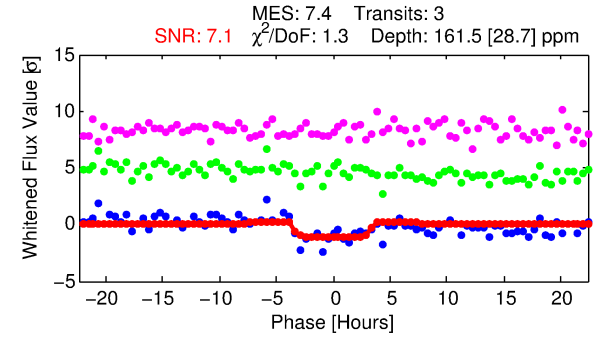
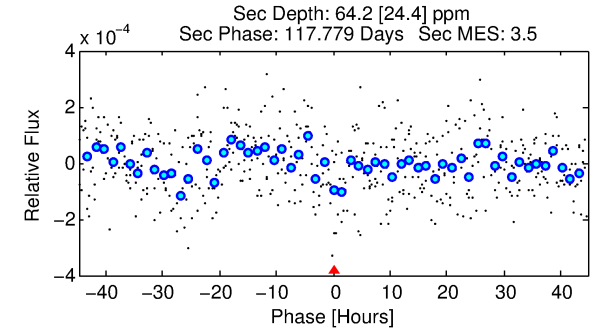
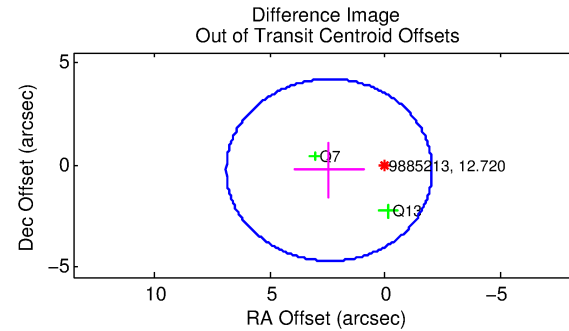
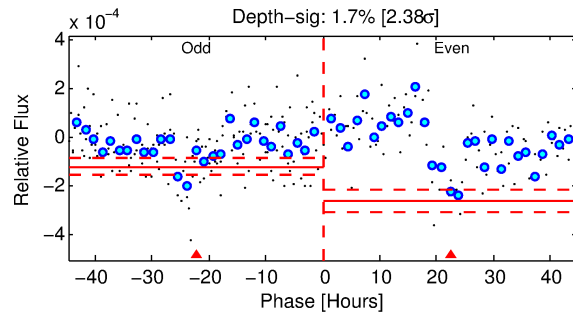
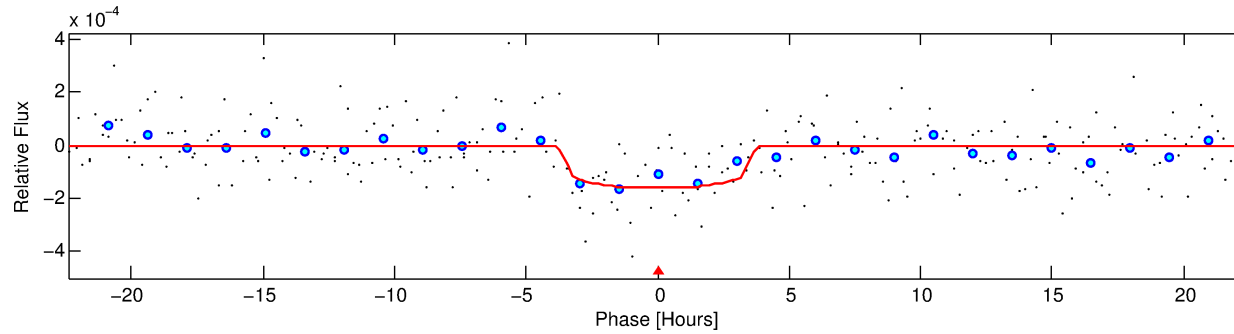
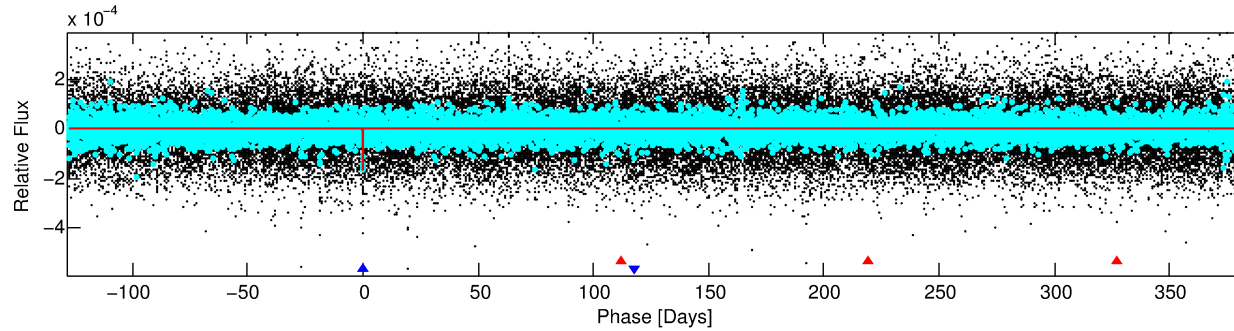
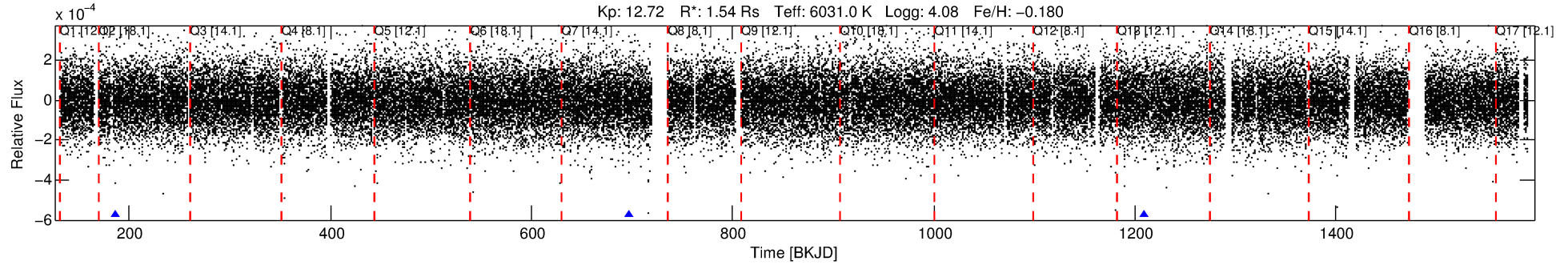
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 009885213-02

No Significant Match Found

# DV One-Page Summary

KIC: 9885213 Candidate: 2 of 2 Period: 511.361 d



## DV Fit Results:

Period = 511.36079 [0.01121] d  
Epoch = 185.7434 [0.0162] BKJD  
Rp/R\* = 0.0135 [0.0079]  
a/R\* = 266.53 [799.29]  
b = 0.88 [0.80]  
Seff = 1.75 [0.75]  
Teq = 293 [31] K  
Rp = 2.26 [1.46] Re  
a = 1.2668 [0.3297] AU  
Ag = 11079.97 [14379.14] [0.77 $\sigma$ ]  
Teffp = 4655 [1438] K [3.03 $\sigma$ ]

## DV Diagnostic Results:

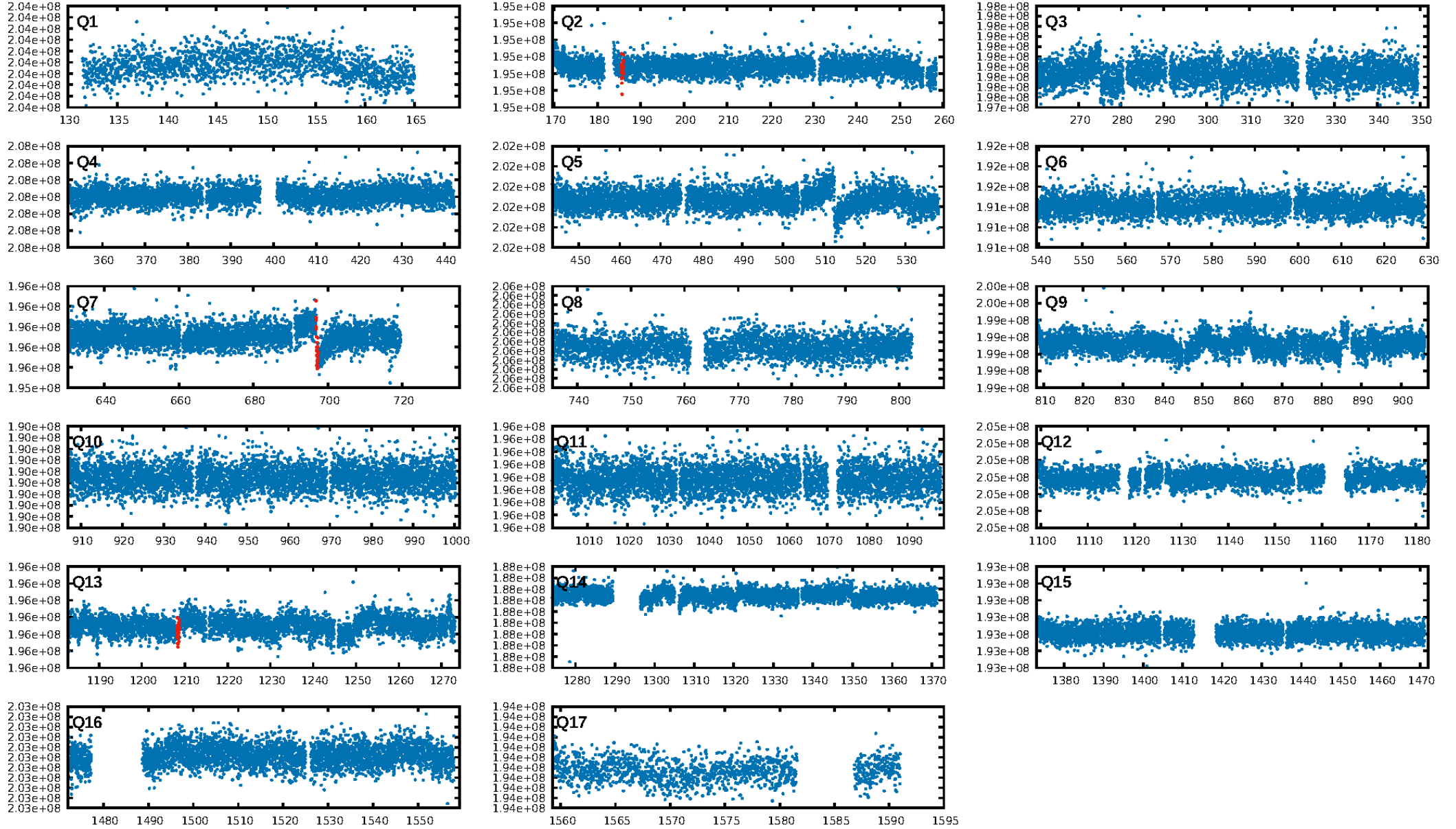
ShortPeriod-sig: 100.0% [163.13 $\sigma$ ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 1.9%  
ModelChiSquareGof-sig: 88.1%  
**Bootstrap-pfa: 3.53e-11**  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: 3.251  
Centroid-sig: 32.9%  
Centroid-so: 1.900 arcsec [1.12 $\sigma$ ]  
OotOffset-rm: 2.440 arcsec [1.64 $\sigma$ ]  
KicOffset-rm: 2.541 arcsec [1.74 $\sigma$ ]  
OotOffset-st: 0/1/0/1 [2]  
KicOffset-st: 0/1/0/1 [2]  
DiffImageQuality-fgm: 1.00 [2/2]  
DiffImageOverlap-fno: 1.00 [3/3]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 29-Jan-2016 00:59:25 Z

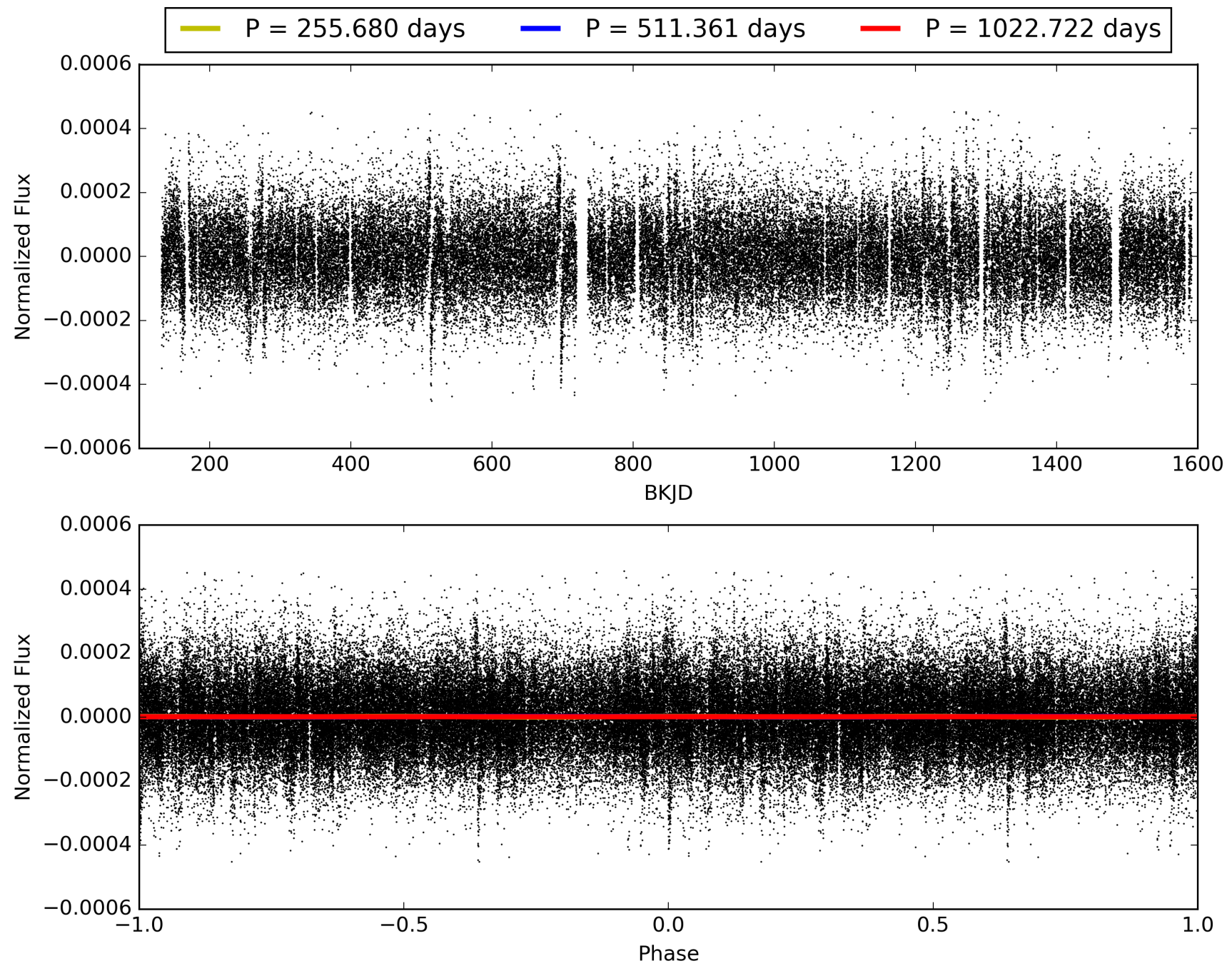
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center



# TCE 009885213-02, PDC Light Curves

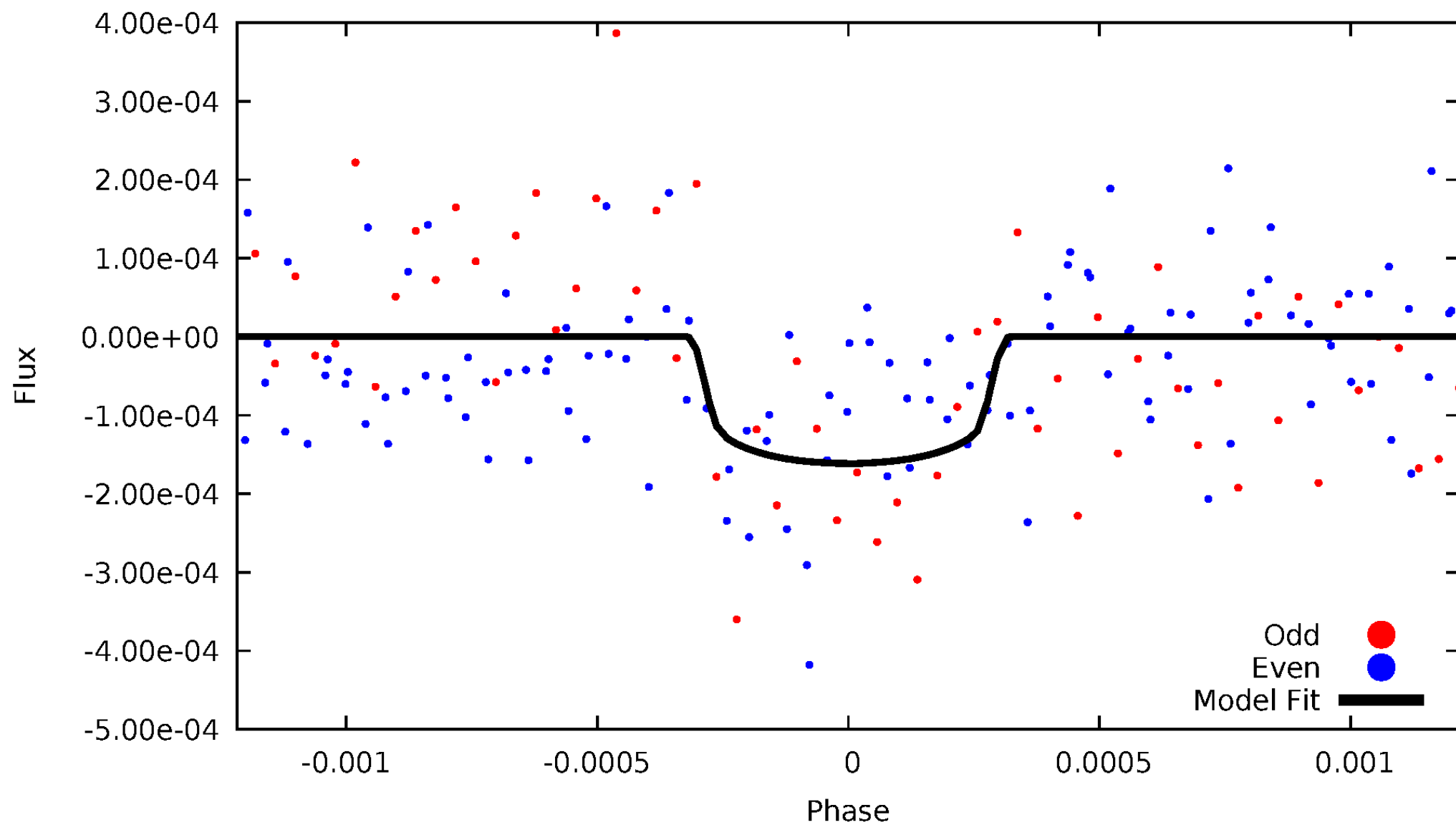


TCE 009885213-02



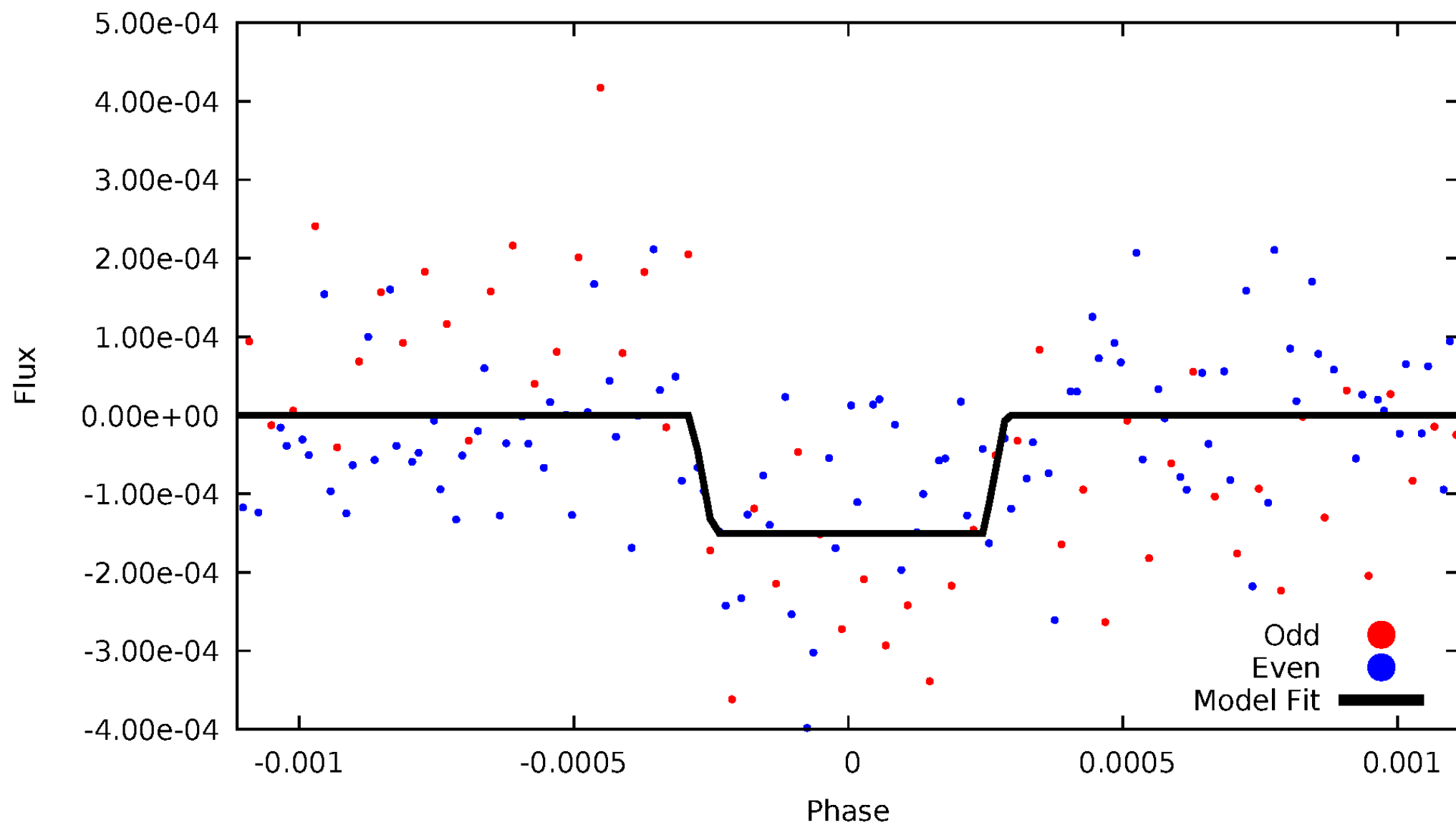
# DV Odd/Even

TCE 009885213-02



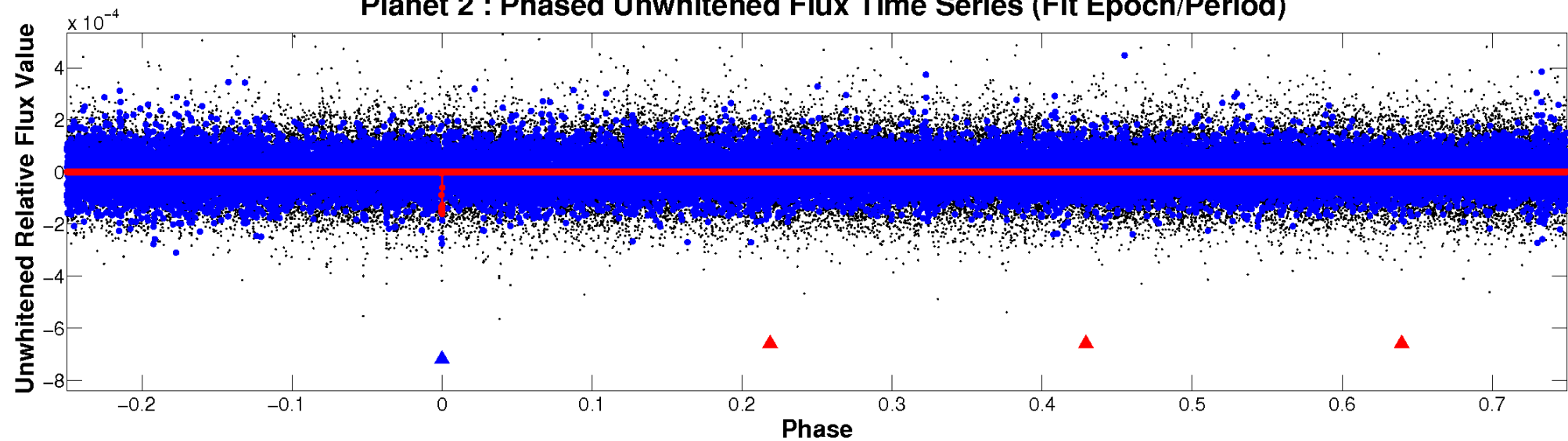
# ALT Odd/Even

TCE 009885213-02

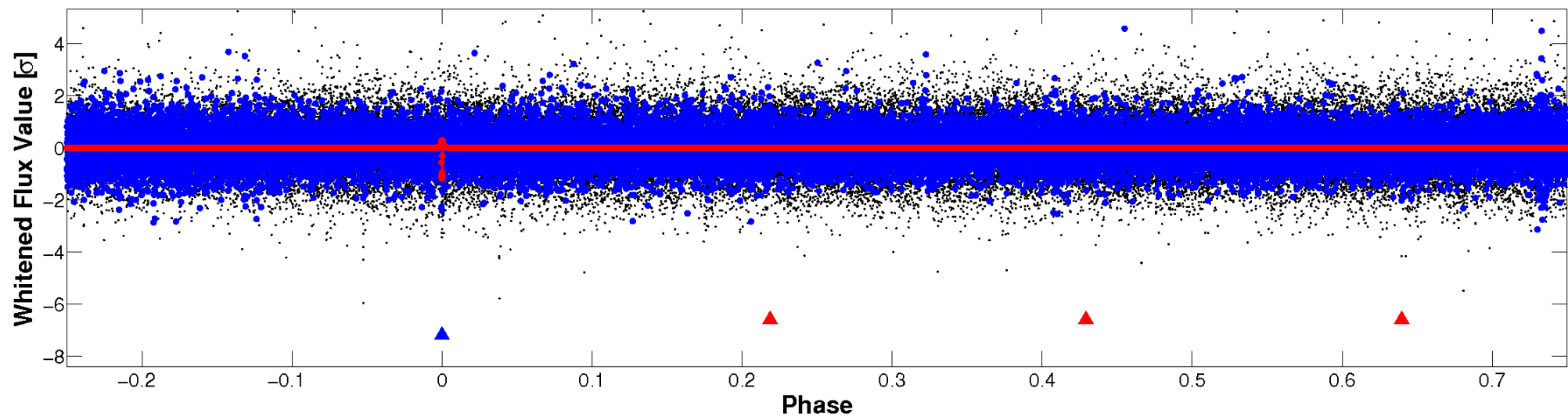


# Non-Whitened Vs. Whitened Light Curve

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

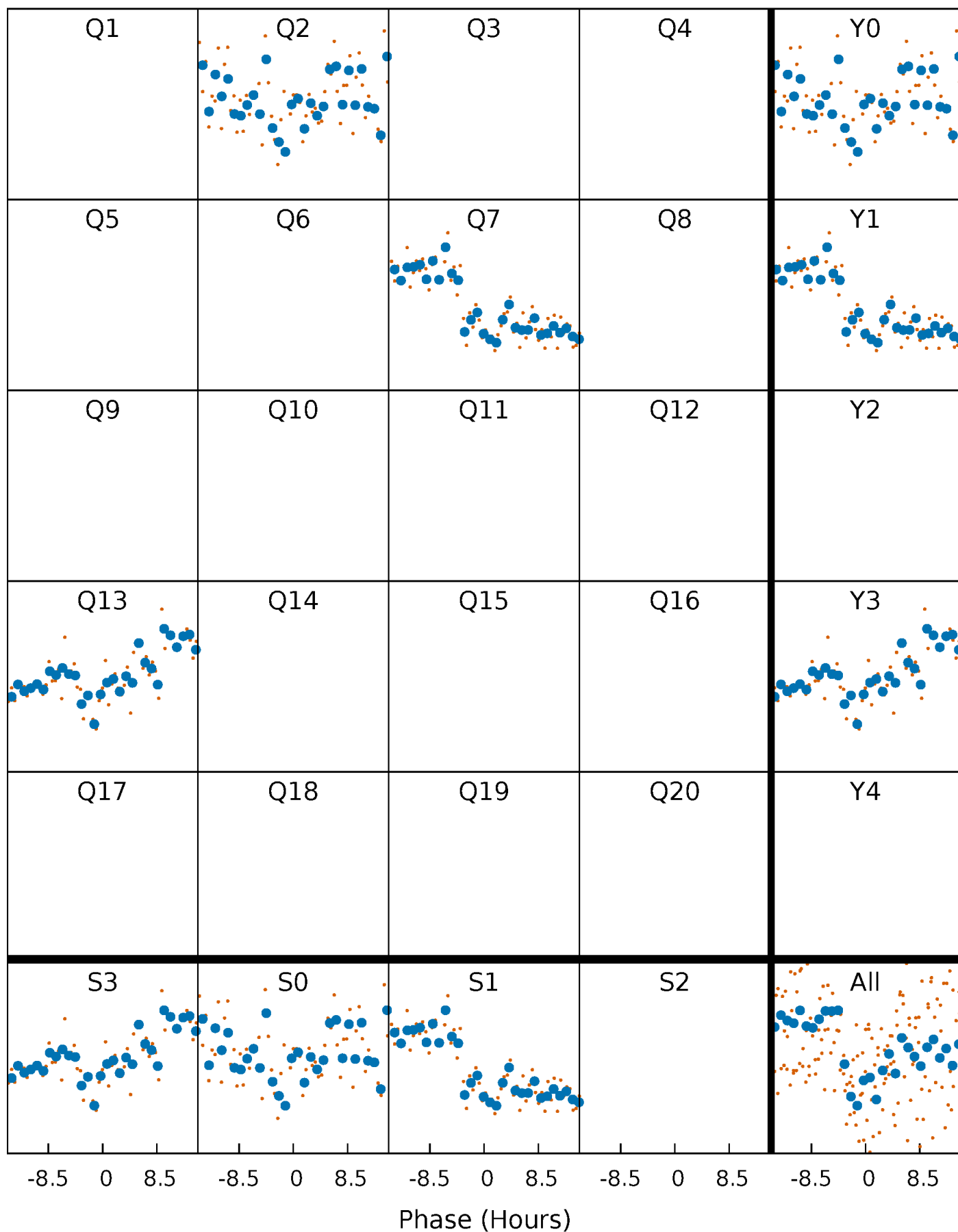


Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



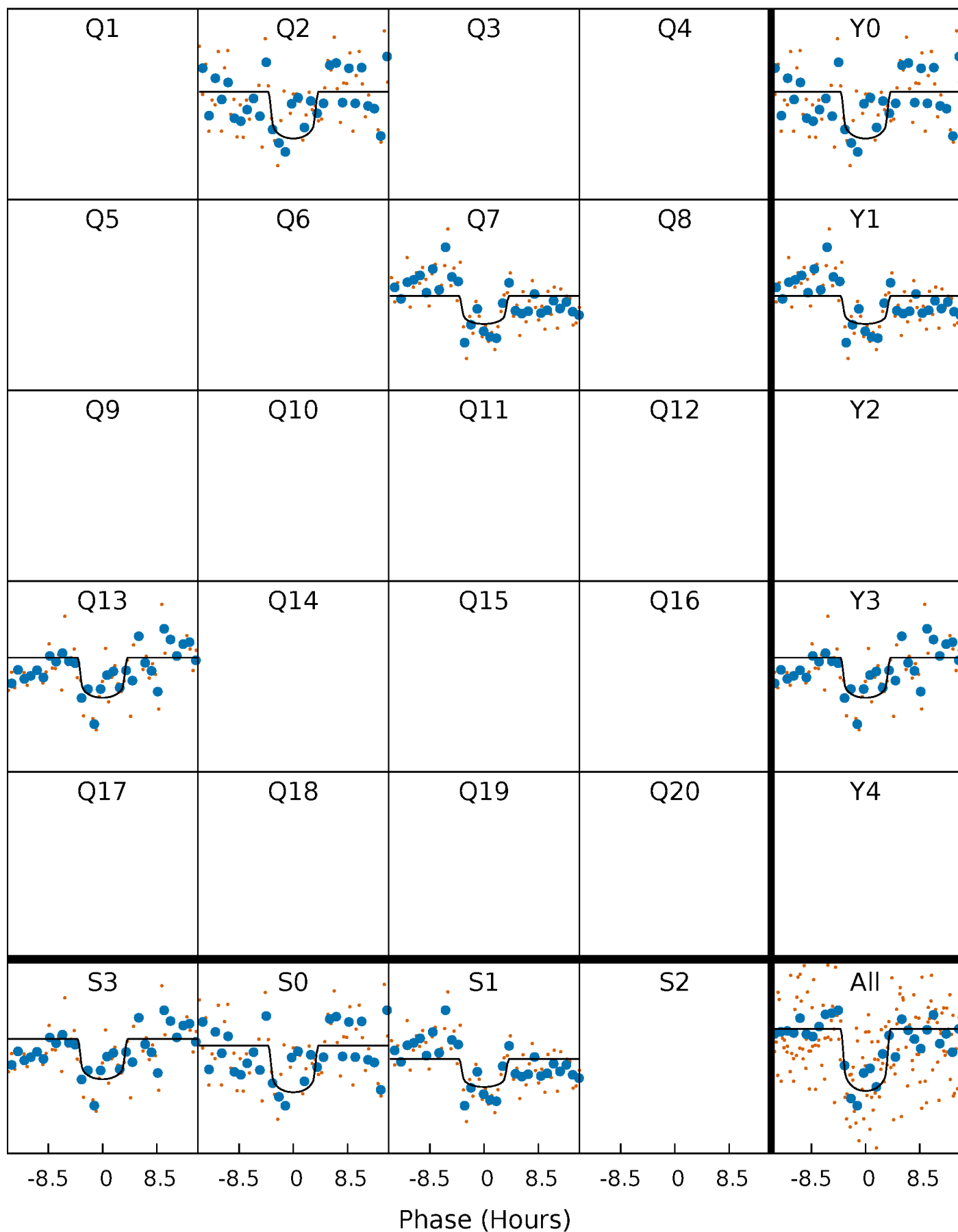
# PDC Quarter-Phased Transit Curves

TCE 009885213-02 P=511.360787 Days  $T_0=185.743414$  (BKJD)



# DV Quarter-Phased Transit Curves

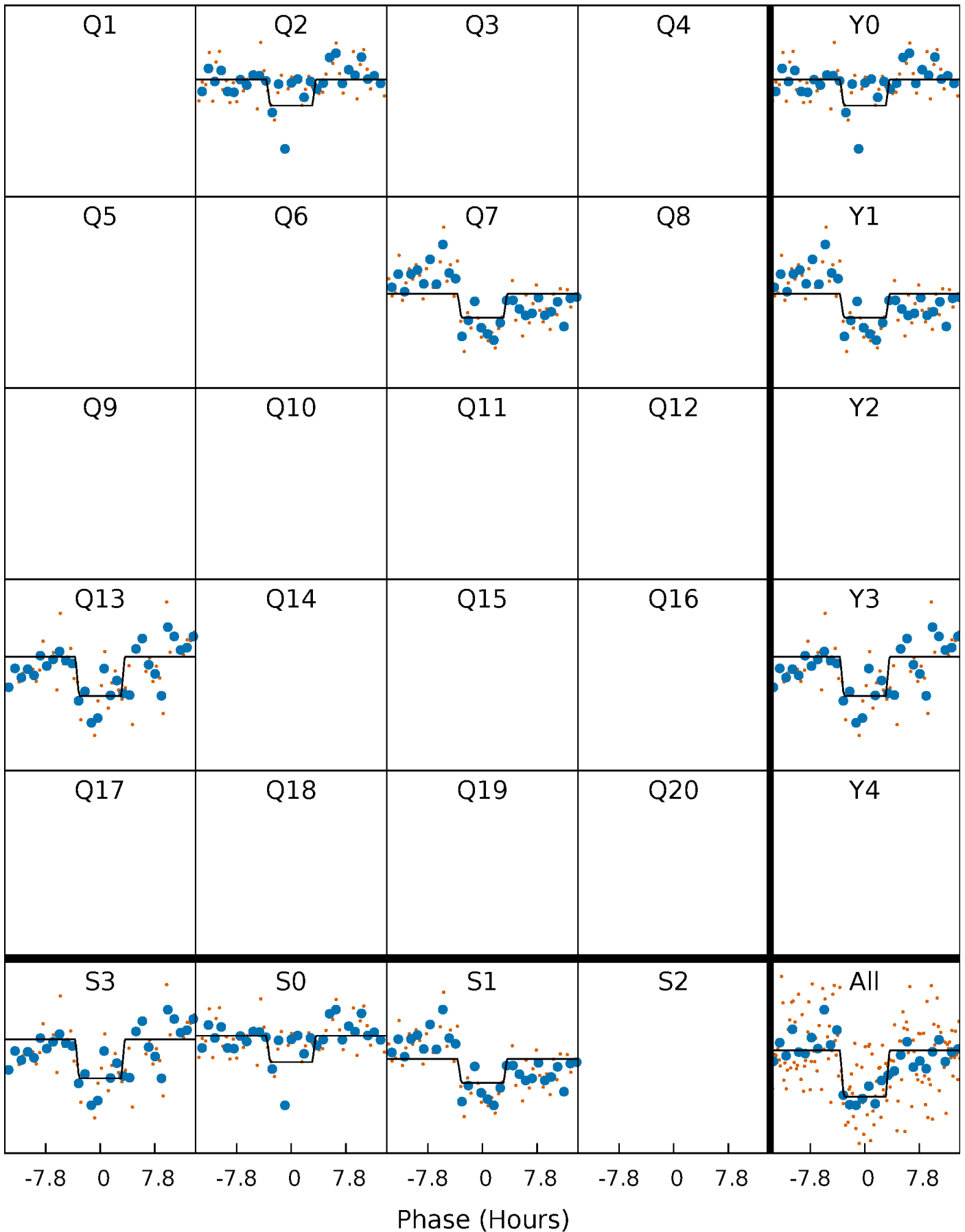
TCE 009885213-02 P=511.360787 Days  $T_0=185.743414$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

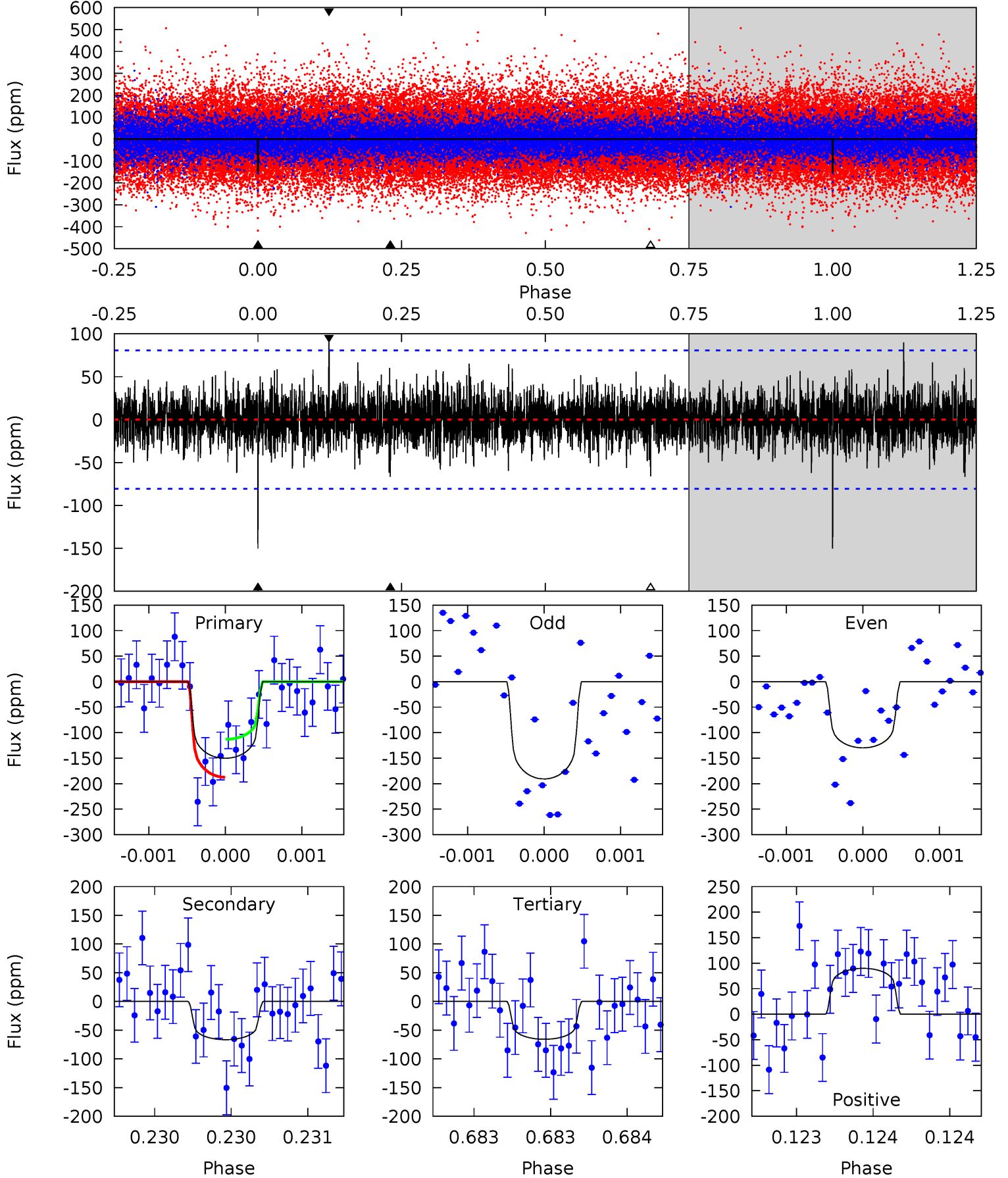
TCE 009885213-02 P=511.356650 Days  $T_0=185.741985$  (BKJD)



# DV Model-Shift Uniqueness Test

009885213-02, P = 511.360787 Days, E = 185.743414 Days

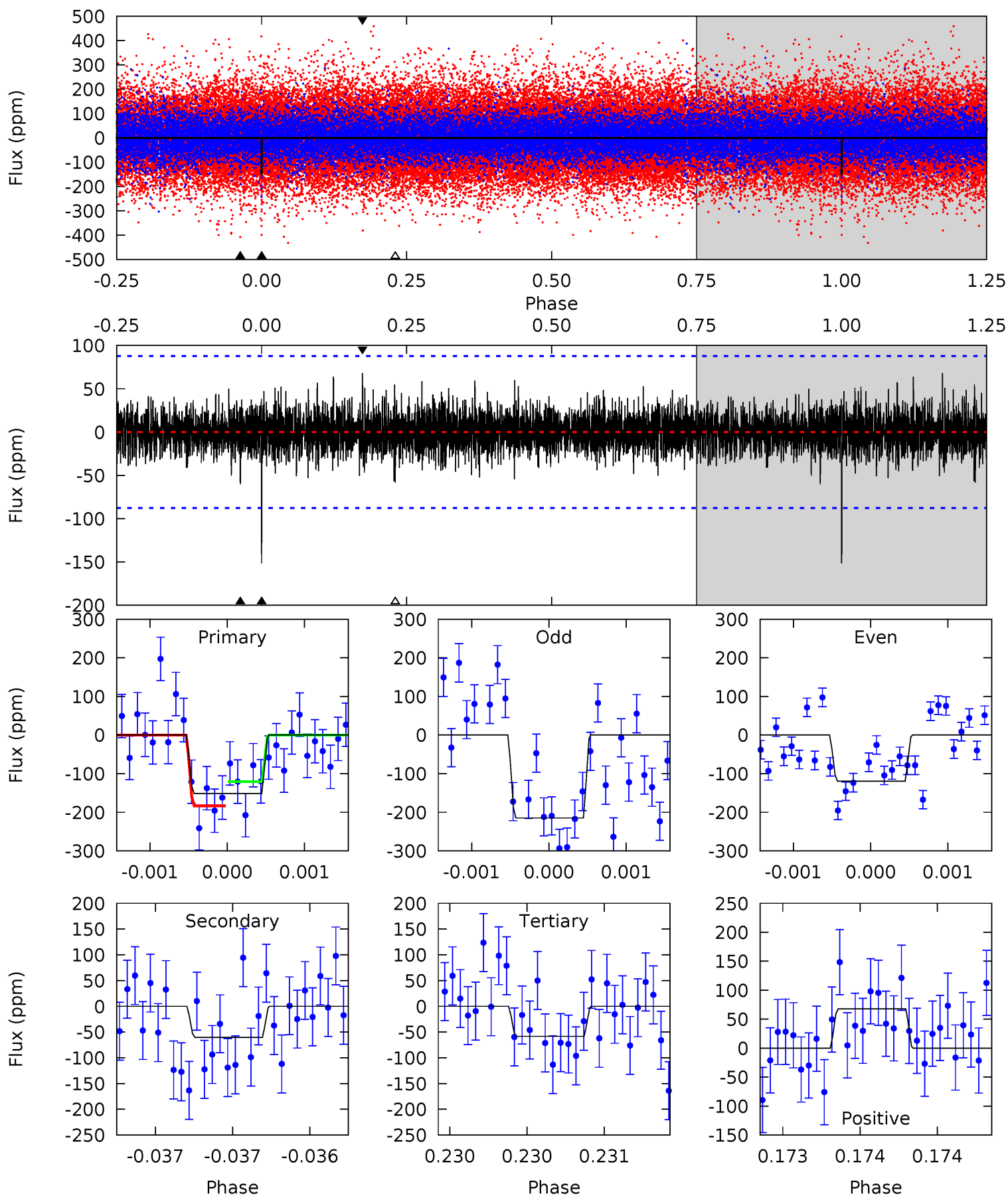
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
10.3	4.56	4.51	6.16	5.53	3.41	1.25	5.78	4.13	0.05	-1.60	1.97	1.03	0.37	2.55



# Alt Model-Shift Uniqueness Test

009885213-02, P = 511.356650 Days, E = 185.741985 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
9.58	3.81	3.69	4.30	5.56	3.46	1.00	5.88	5.28	0.12	-0.49	2.89	0.99	0.31	1.99



### Stellar Parameters For KIC 009885213

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M$ ( $M_{\odot}$ )	$\rho_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6031^{+164}_{-164}$	$4.078^{+0.240}_{-0.129}$	$-0.180^{+0.300}_{-0.250}$	$1.541^{+0.348}_{-0.425}$	$1.038^{+0.174}_{-0.143}$	$0.400^{+0.568}_{-0.151}$
	+3%/-3%	+6%/-3%	+167%/-139%	+23%/-28%	+17%/-14%	+142%/-38%
Source	PHO1	FLK73	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 009885213-02 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	$-67 \pm 15$	$2.22^{+1.33}_{-1.18}$	$407^{+24}_{-31}$	$4753^{+1992}_{-759}$	$11838^{+42584}_{-7246}$
Alt.	$-60 \pm 16$	$2.07^{+1.33}_{-1.16}$	$405^{+26}_{-28}$	$4800^{+2254}_{-820}$	$12279^{+52531}_{-8027}$

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

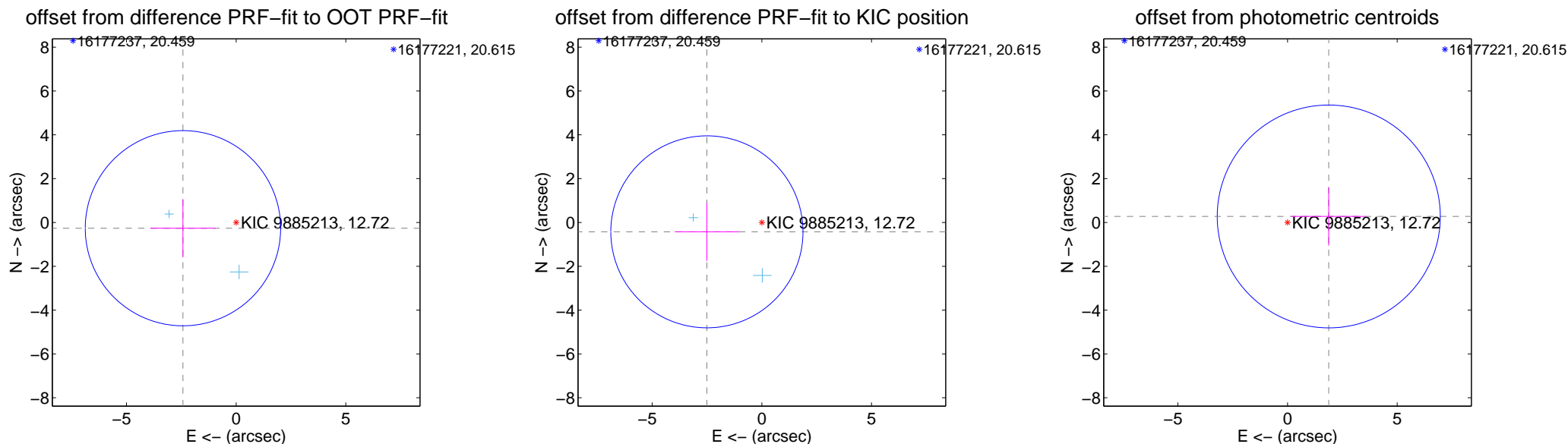
## DV Centroid Data

Supplemental centroid analysis for 009885213-02. Kepler magnitude: 12.72. Transit SNR 7.09

There are 2 quarters with good PRF difference image offsets

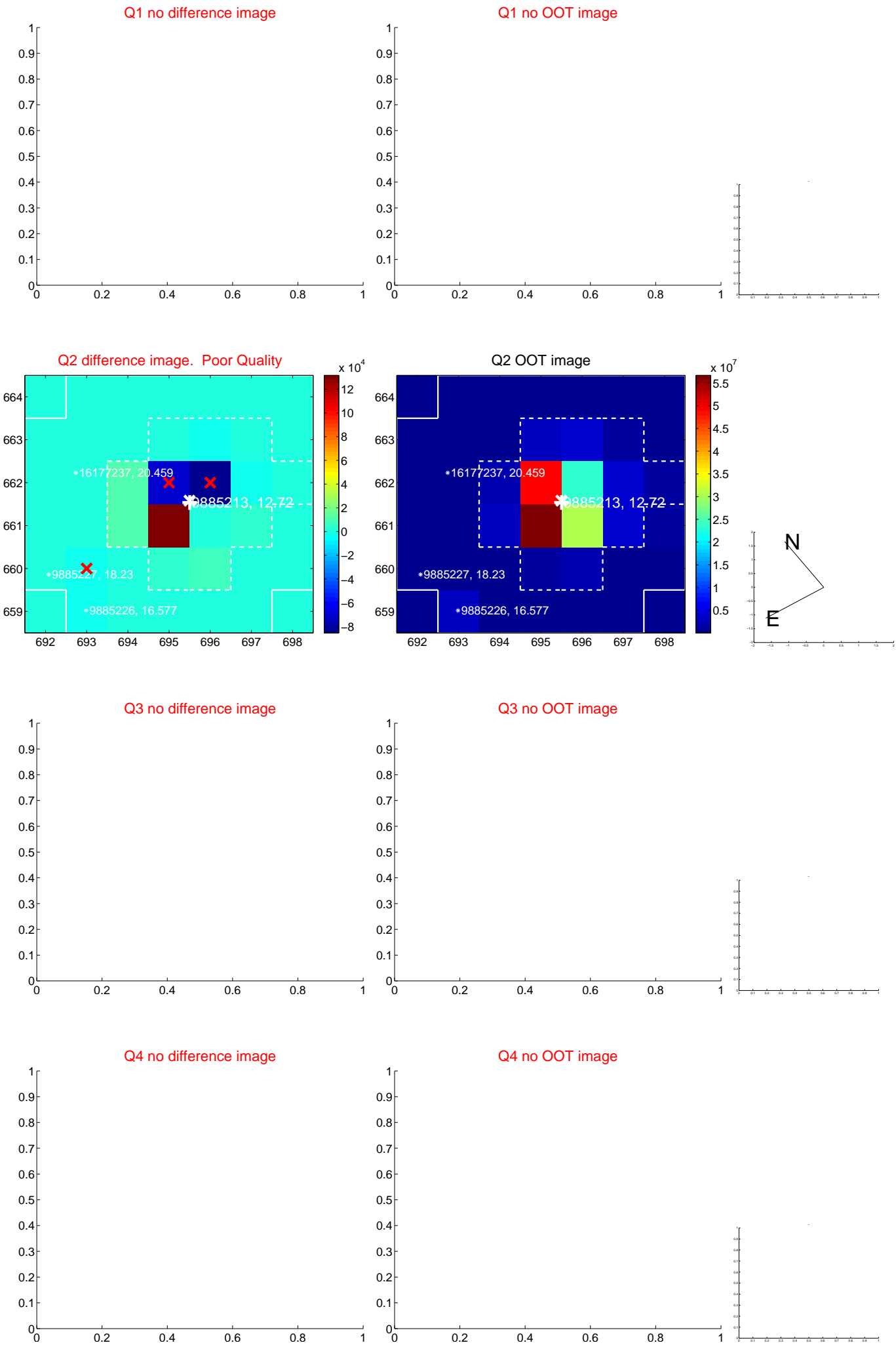
The direct PRF centroid is offset from the target star catalog position by about 0.20 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$2.440 \pm 1.485$	1.64	$2.425 \pm 1.486$	$-0.263 \pm 1.329$
PRF-fit source offset from KIC position	$2.541 \pm 1.460$	1.74	$2.504 \pm 1.464$	$-0.428 \pm 1.325$
photometric centroid source offset	$1.90 \pm 1.70$	1.12	$-1.88 \pm 1.70$	$0.27 \pm 1.33$



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.

Q5 no difference image



Q5 no OOT image



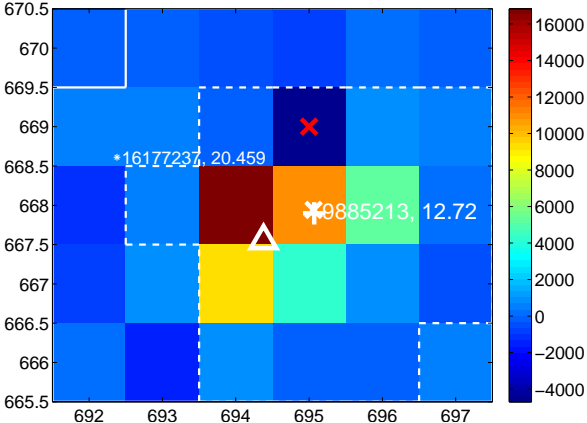
Q6 no difference image



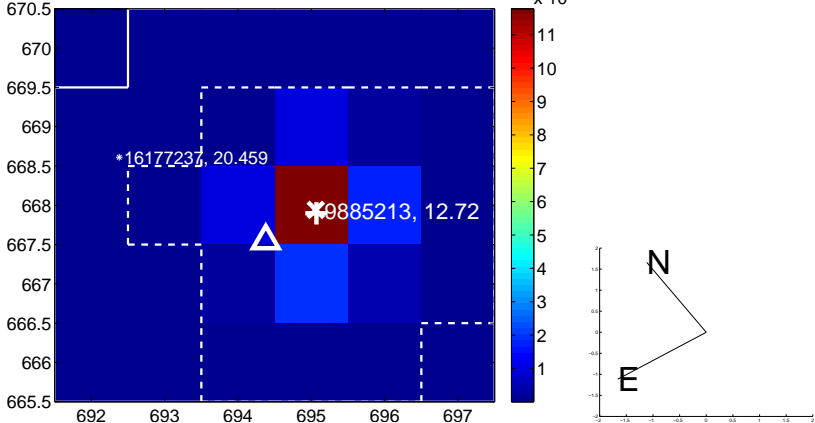
Q6 no OOT image



Q7 difference image



Q7 OOT image



Q8 no difference image



Q8 no OOT image

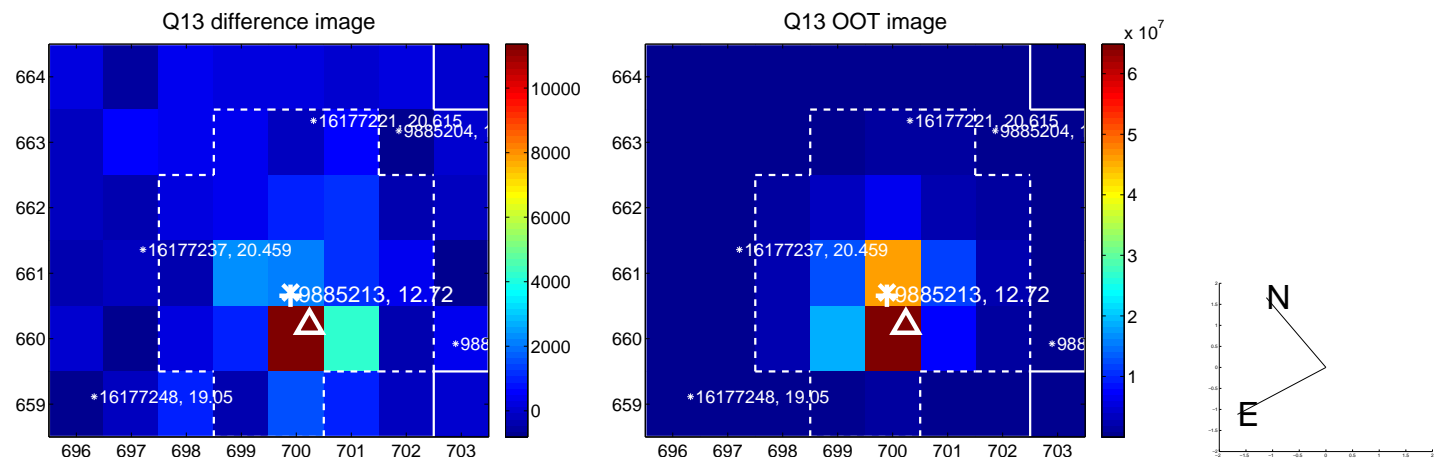




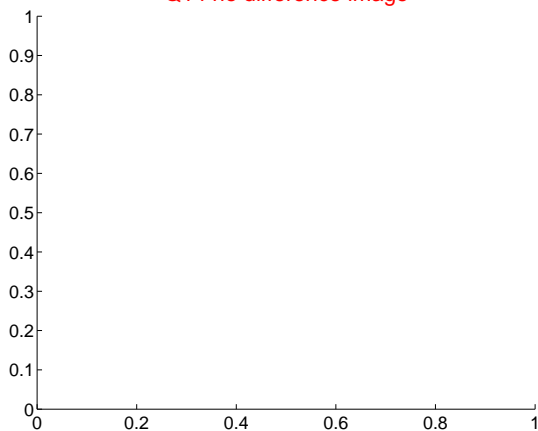
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



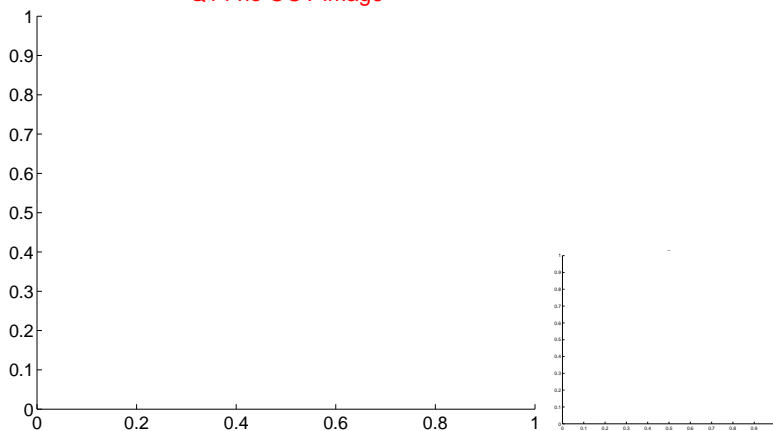
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



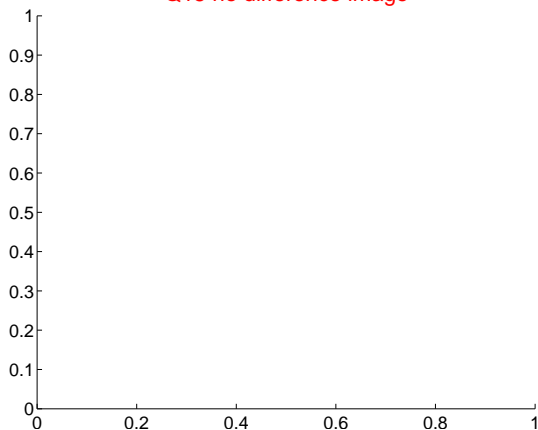
Q14 no difference image



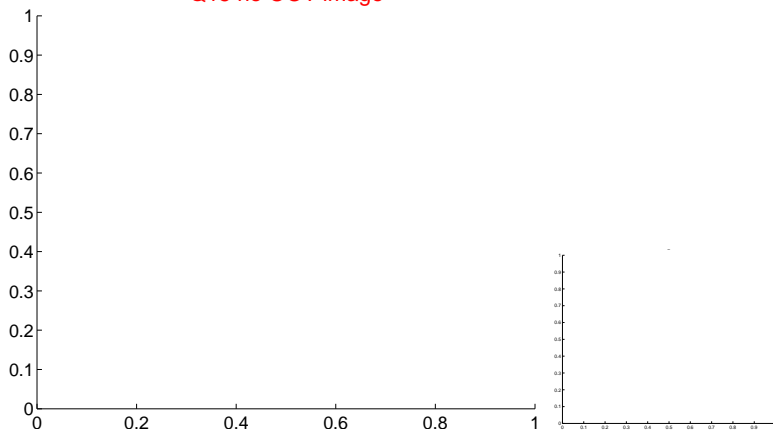
Q14 no OOT image



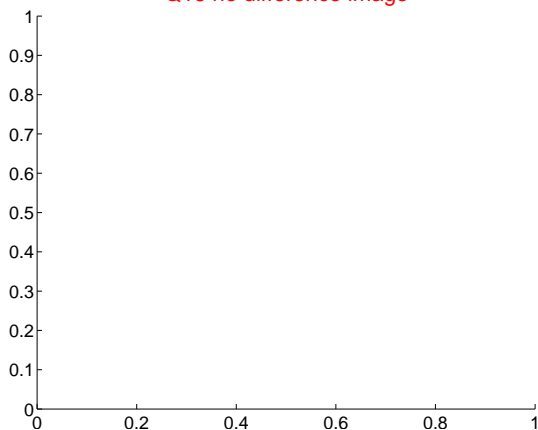
Q15 no difference image



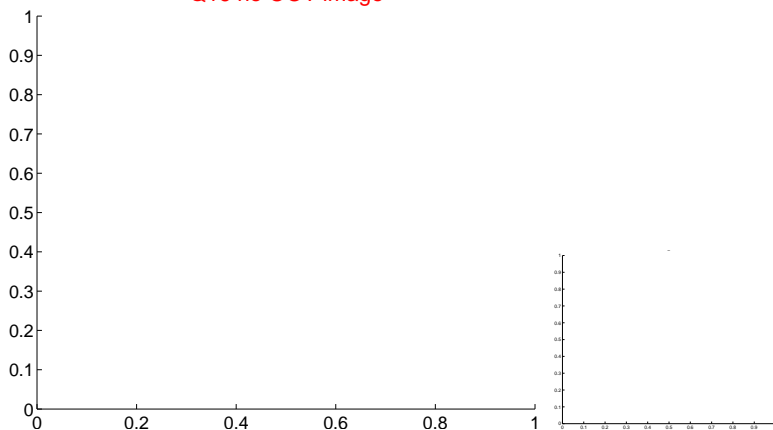
Q15 no OOT image



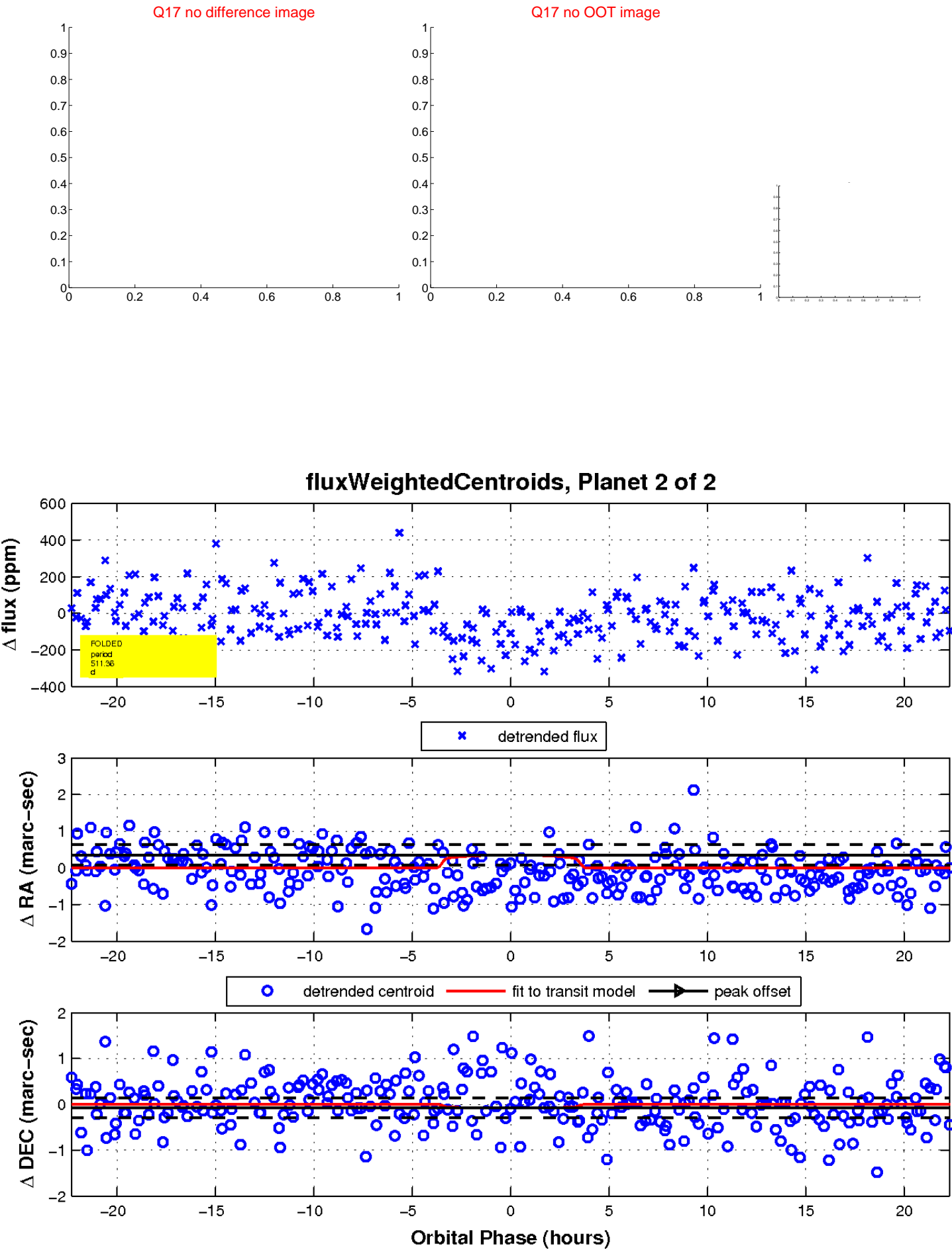
Q16 no difference image



Q16 no OOT image



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



UKIRT Image

Declination

