

# KIC 009591593

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009591593-01	OBS	No	2.285510	131.788484	25.5	8.961	7.5	6.2	0.83	4764	0.51	319.01
009591593-02	OBS	No	342.253514	178.626619	148.4	9.555	9.4	2.6	0.83	4764	1.15	0.40

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009591593-01	OBS	FP	0.00	1	0	0	0	LPP_DV—MOD_NONUNIQ_DV—CENT_KIC_POS
009591593-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_TRACKER—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV— MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—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.

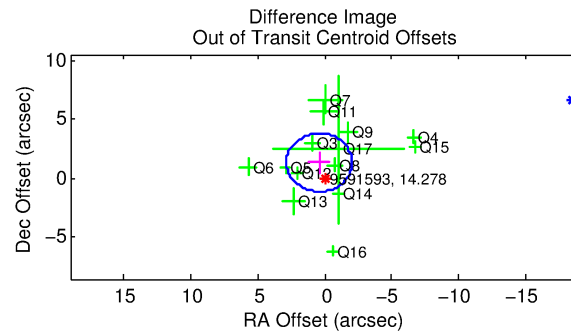
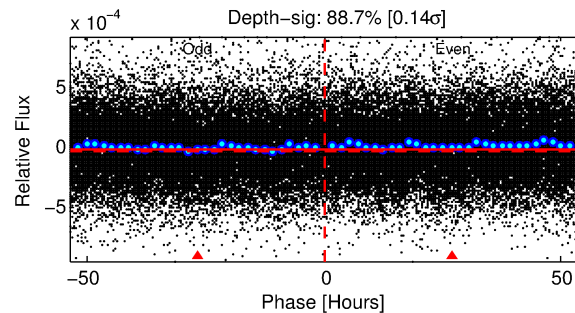
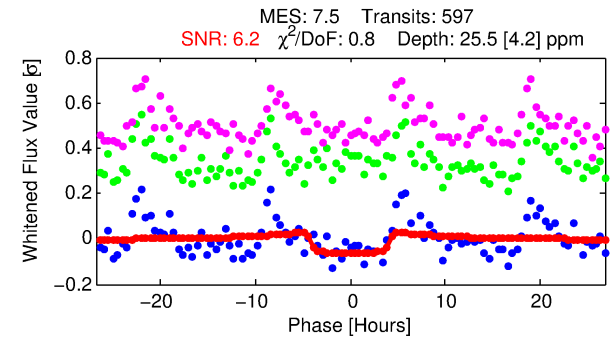
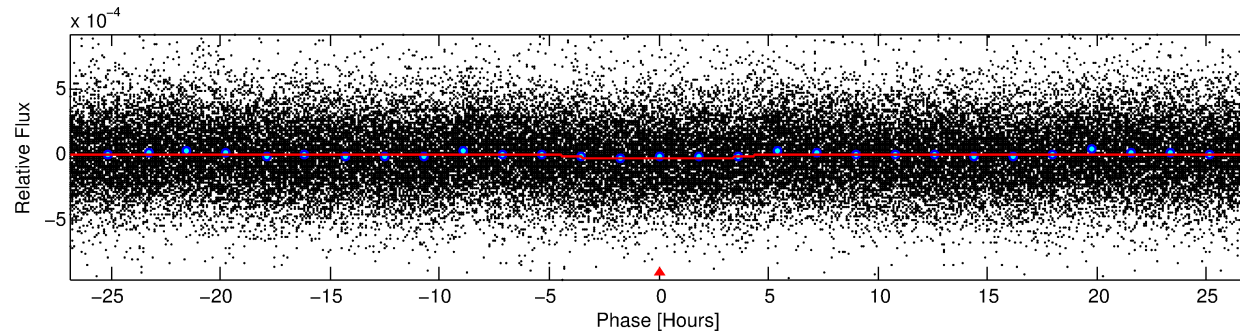
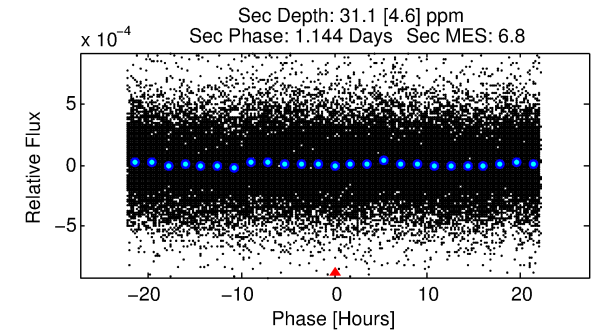
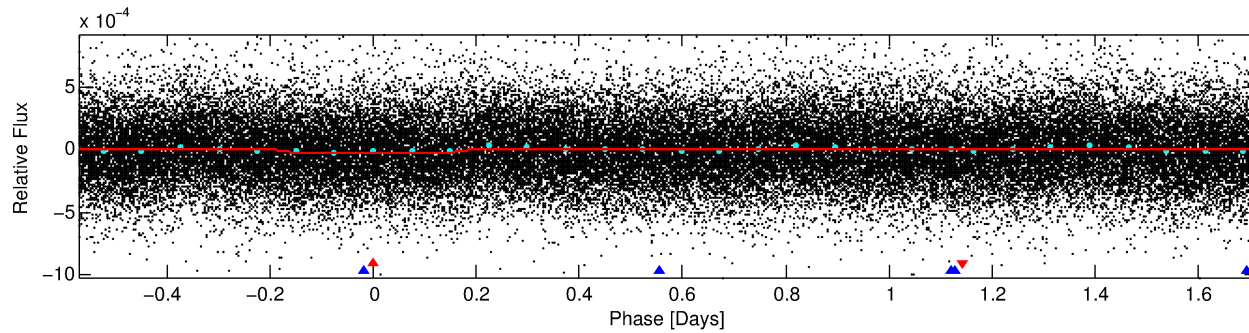
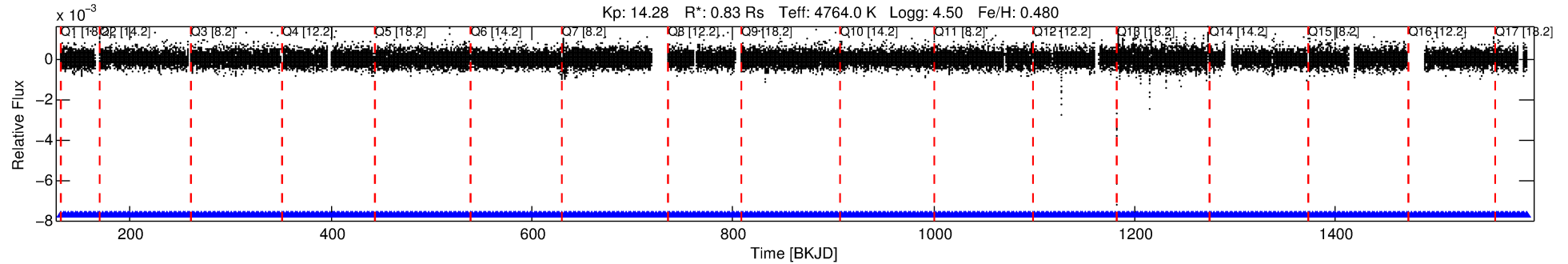
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 009591593-01

No Significant Match Found

# DV One-Page Summary

KIC: 9591593 Candidate: 1 of 2 Period: 2.286 d



## DV Fit Results:

Period = 2.28551 [0.00004] d  
Epoch = 131.7885 [0.0110] BKJD  
Rp/R\* = 0.0057 [0.0029]  
a/R\* = 1.28 [1.00]  
b = 0.90 [0.43]  
Seff = 319.01 [360.23]  
Teq = 1078 [304] K  
Rp = 0.51 [0.26] Re  
a = 0.0315 [0.0177] AU  
Ag = 64.13 [97.88] [0.64σ]  
Teffp = 4715 [1227] K [2.88σ]

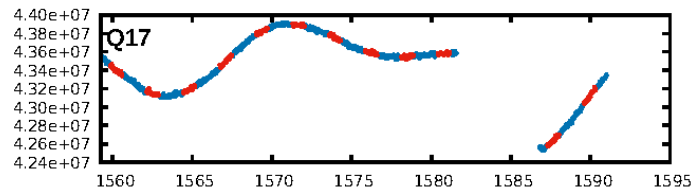
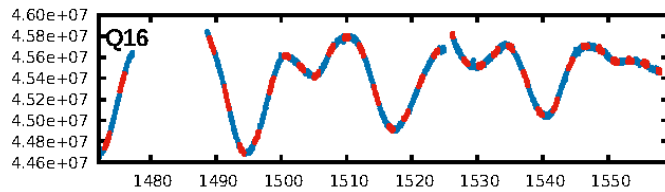
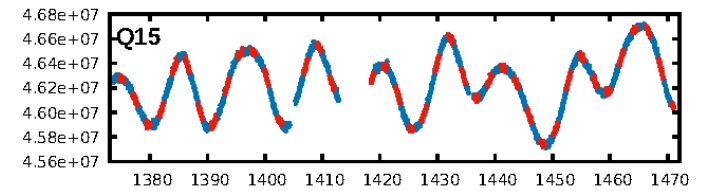
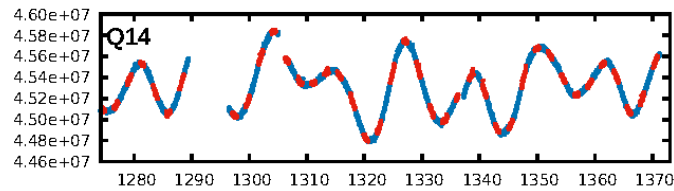
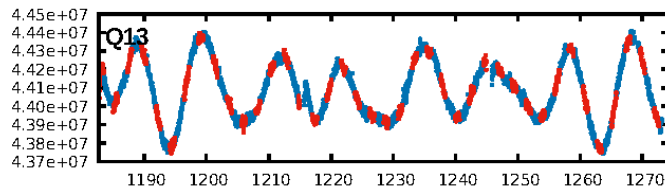
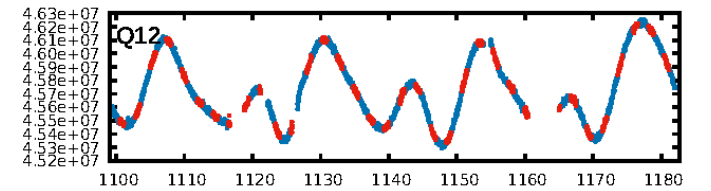
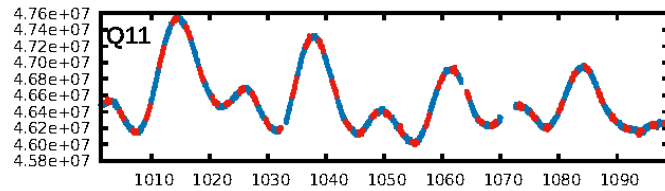
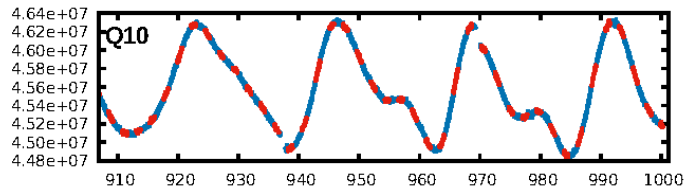
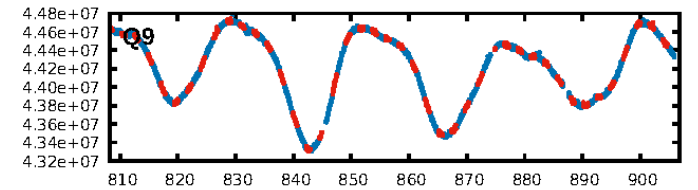
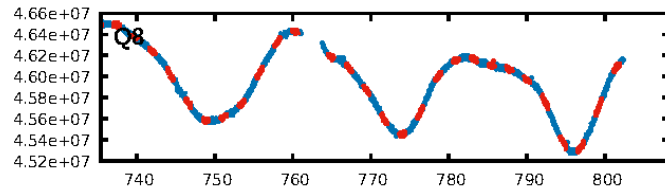
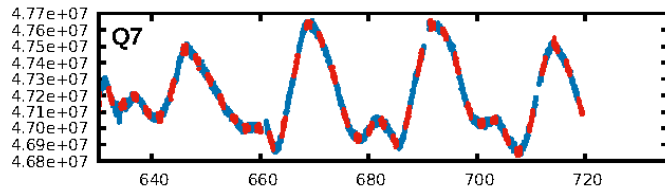
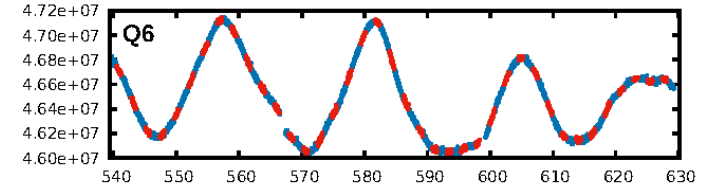
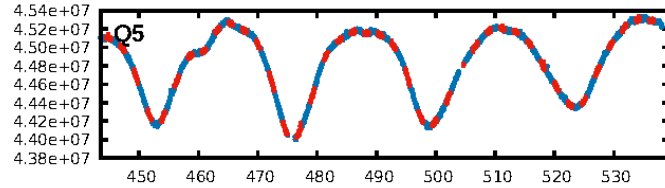
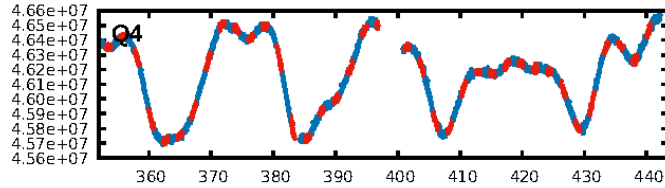
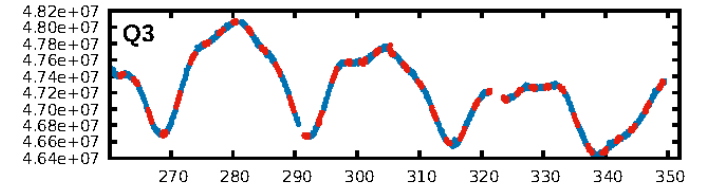
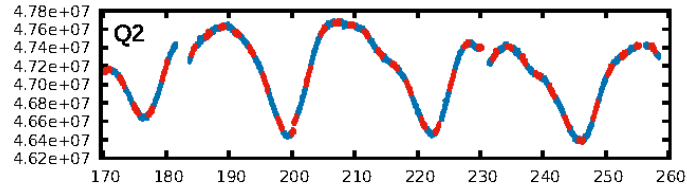
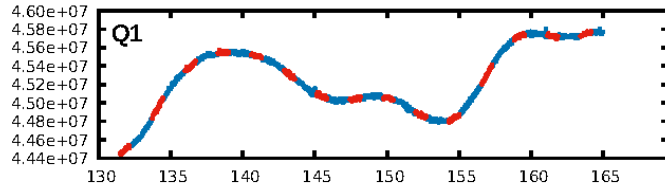
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [622.86σ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: 3.43e-11  
RollingBand-fgt: 1.00 [570/570]  
GhostDiagnostic-chr: -0.5977  
Centroid-sig: 6.3%  
Centroid-so: 2.067 arcsec [1.44σ]  
OotOffset-rm: 1.410 arcsec [1.72σ]  
KicOffset-rm: 0.949 arcsec [1.25σ]  
OotOffset-st: 2/4/4/4 [14]  
KicOffset-st: 2/4/4/4 [14]  
DiffImageQuality-fgm: 0.29 [4/14]  
DiffImageOverlap-fno: 1.00 [17/17]

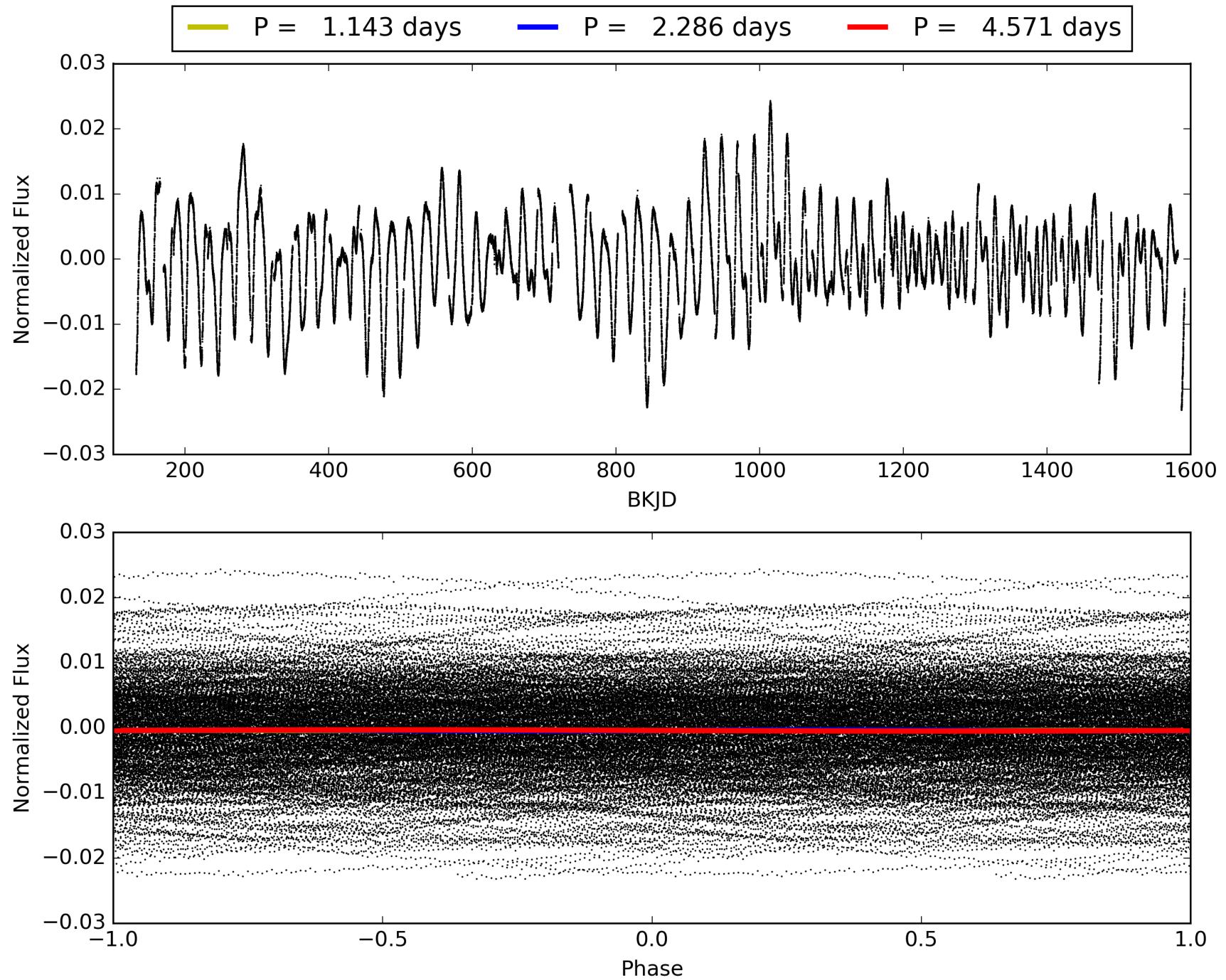
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 30-Jan-2016 18:16:02 Z

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

# TCE 009591593-01, PDC Light Curves

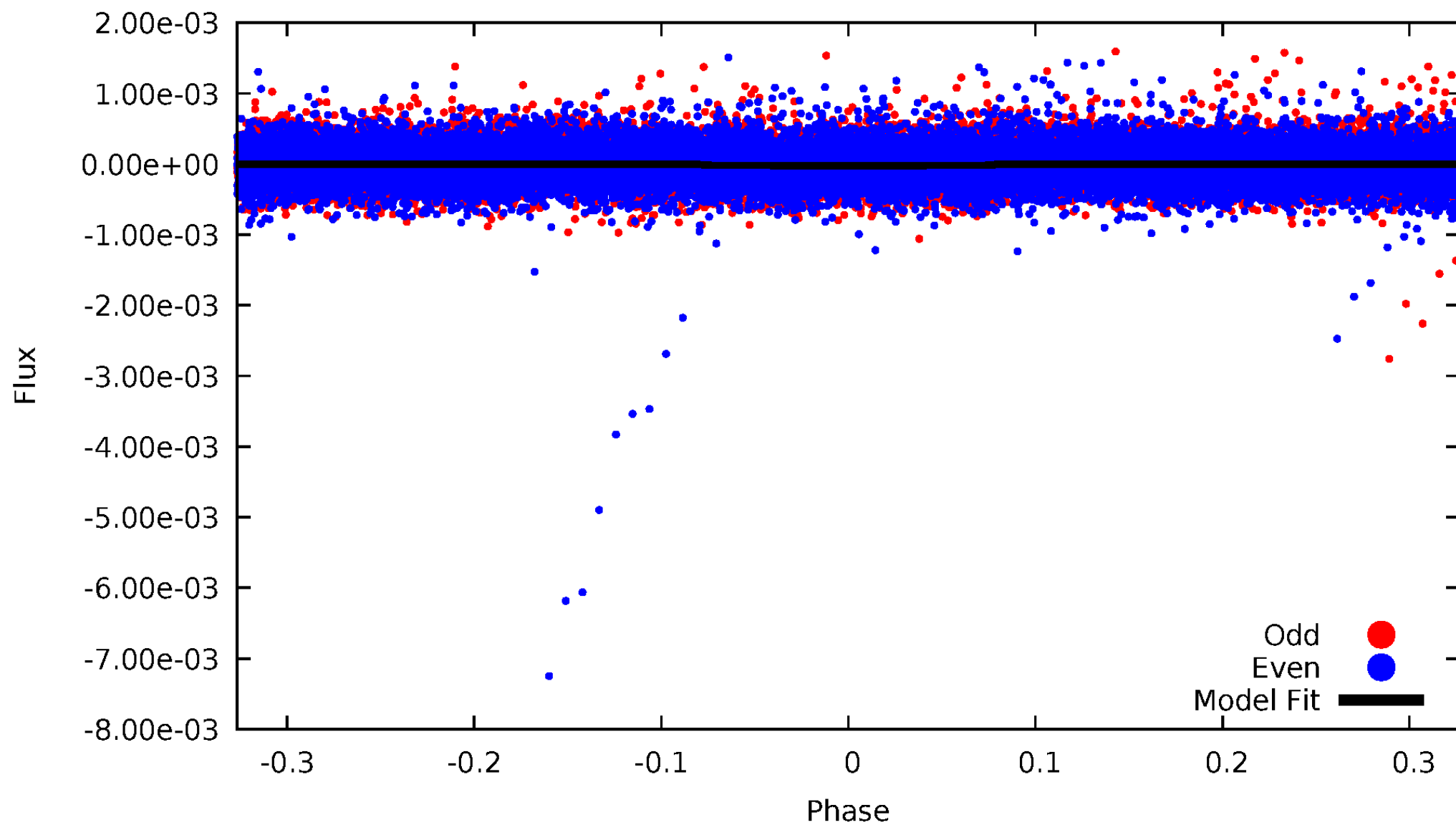


TCE 009591593-01



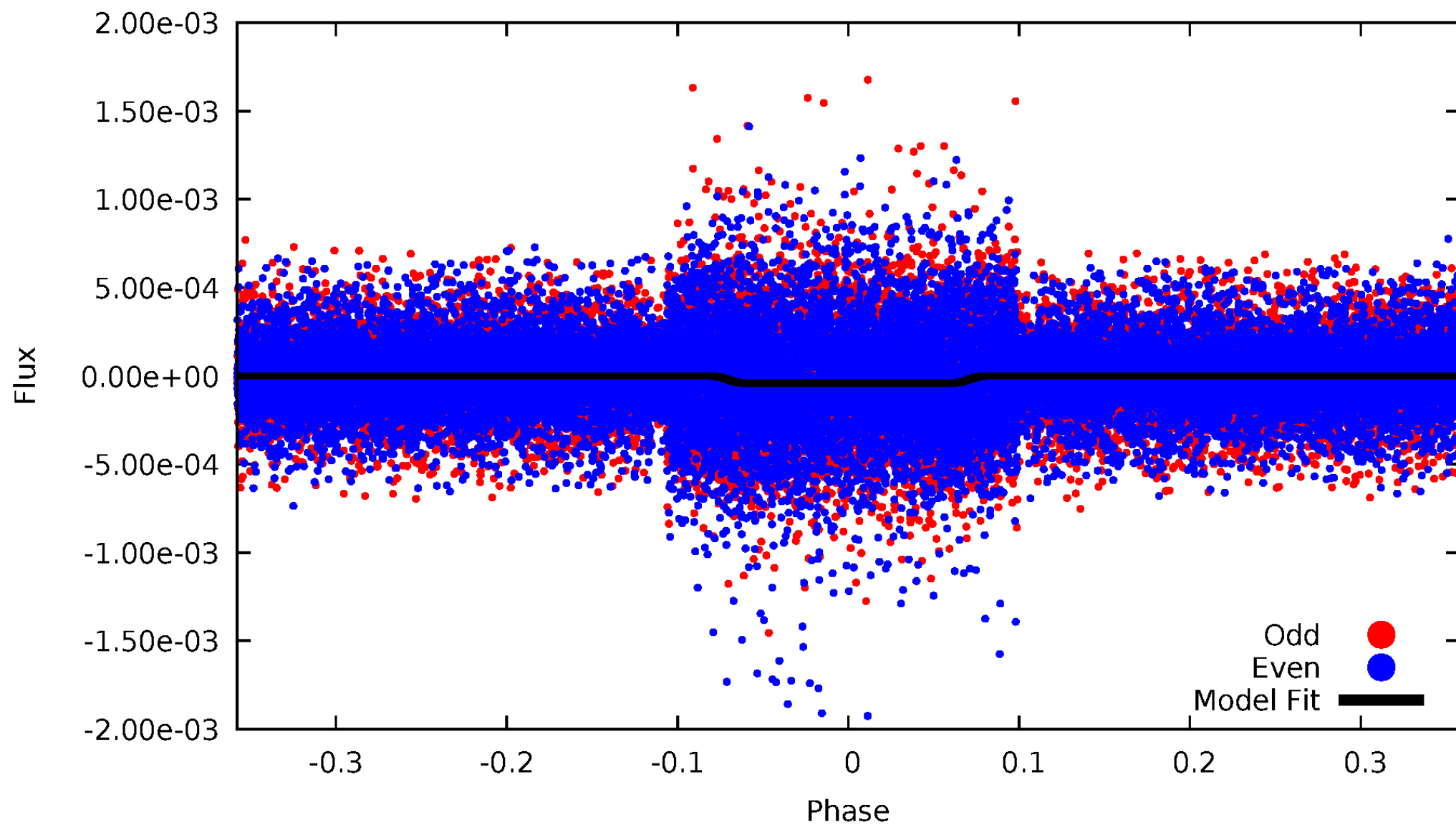
# DV Odd/Even

TCE 009591593-01



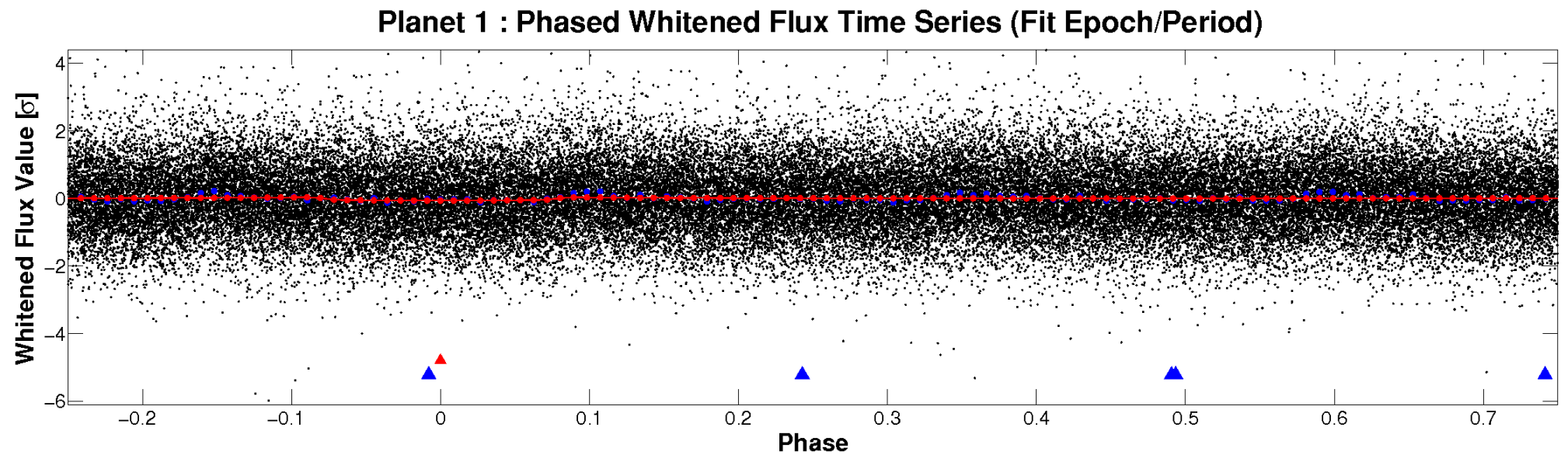
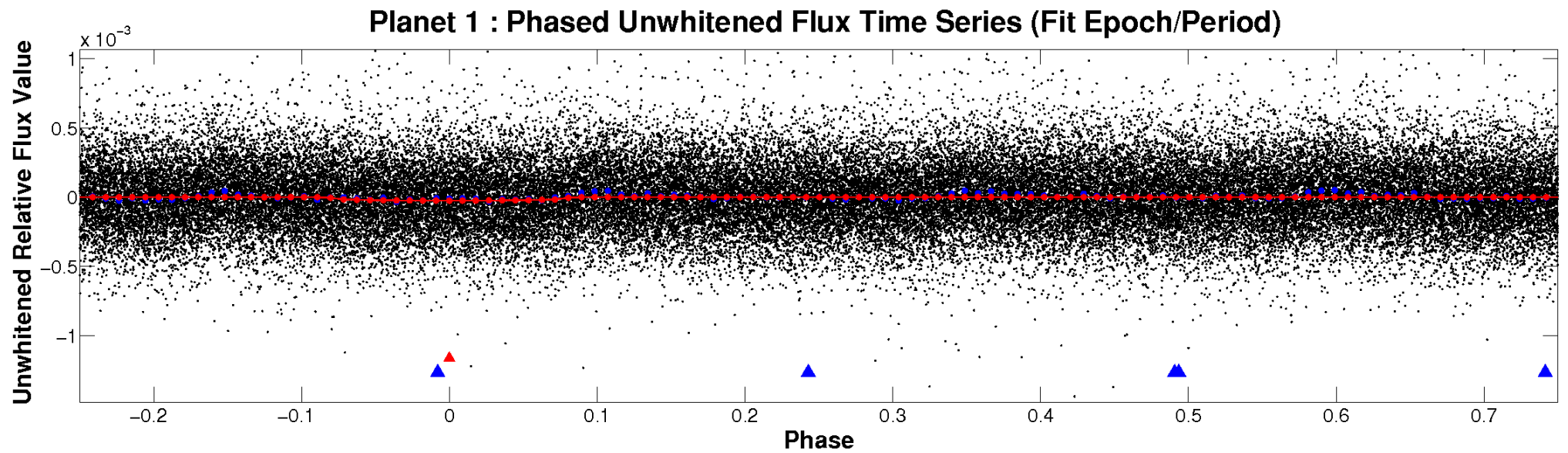
# ALT Odd/Even

TCE 009591593-01



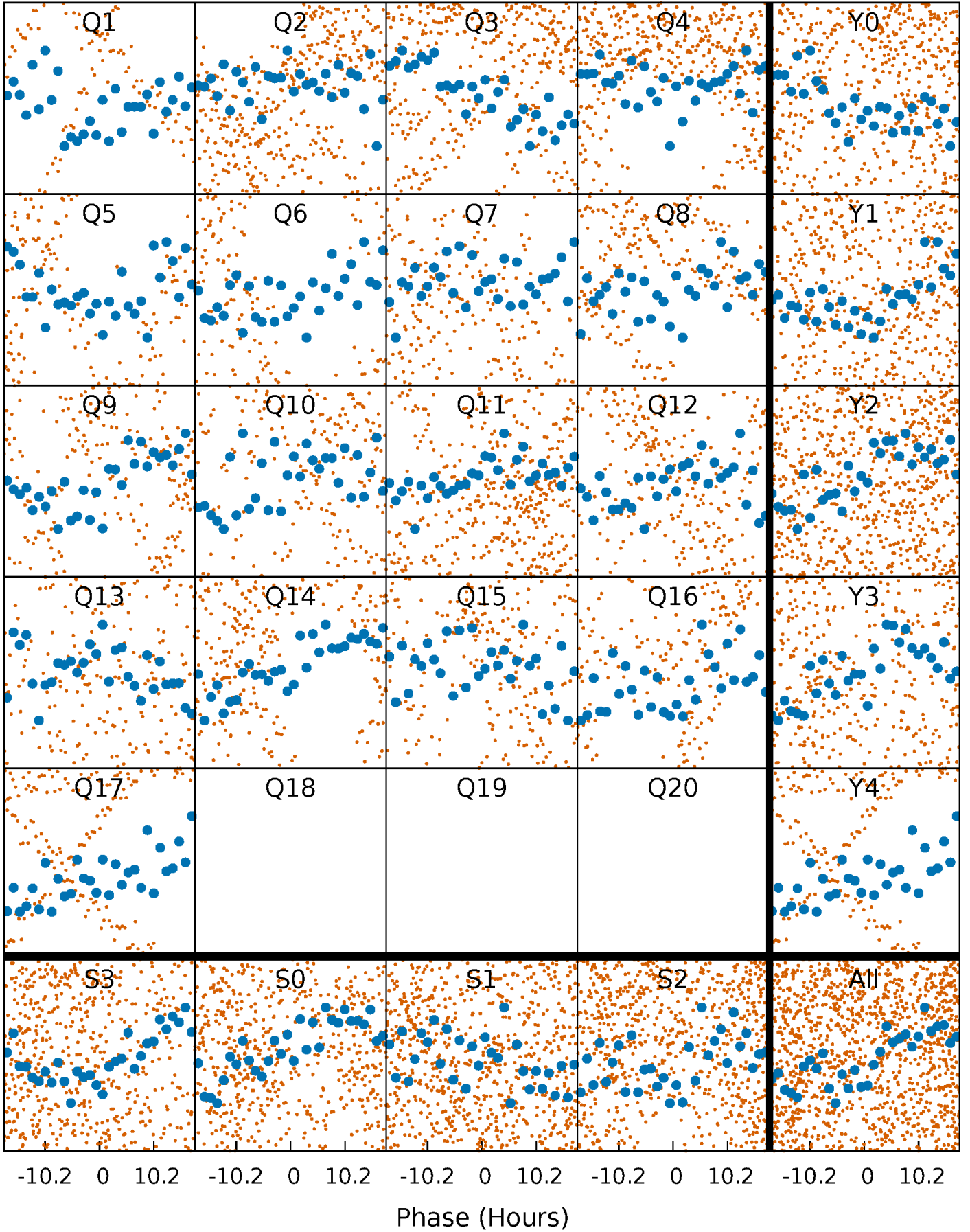


# Non-Whitened Vs. Whitened Light Curve



# PDC Quarter-Phased Transit Curves

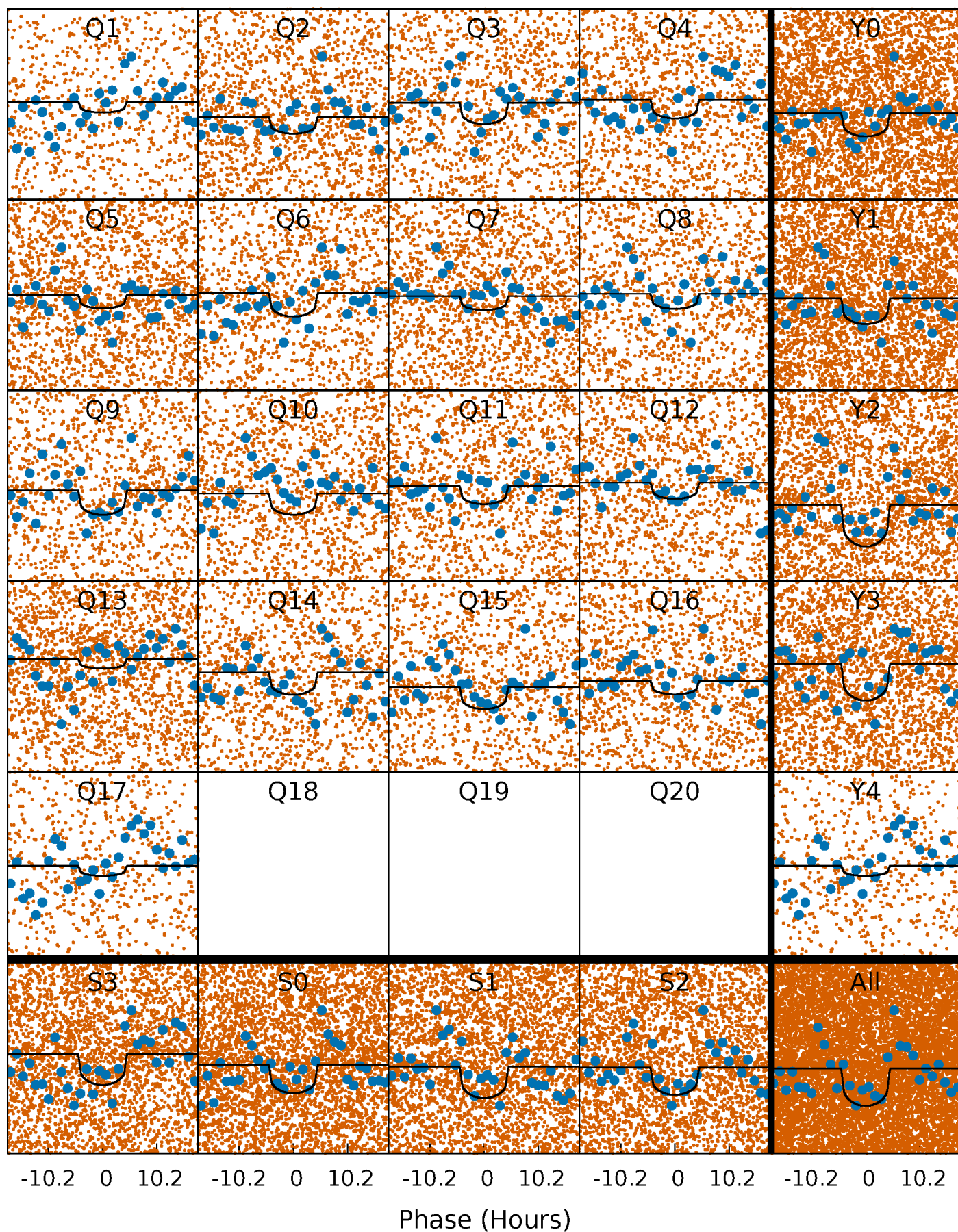
TCE 009591593-01   P= 2.285510 Days    $T_0=131.788484$  (BKJD)





# DV Quarter-Phased Transit Curves

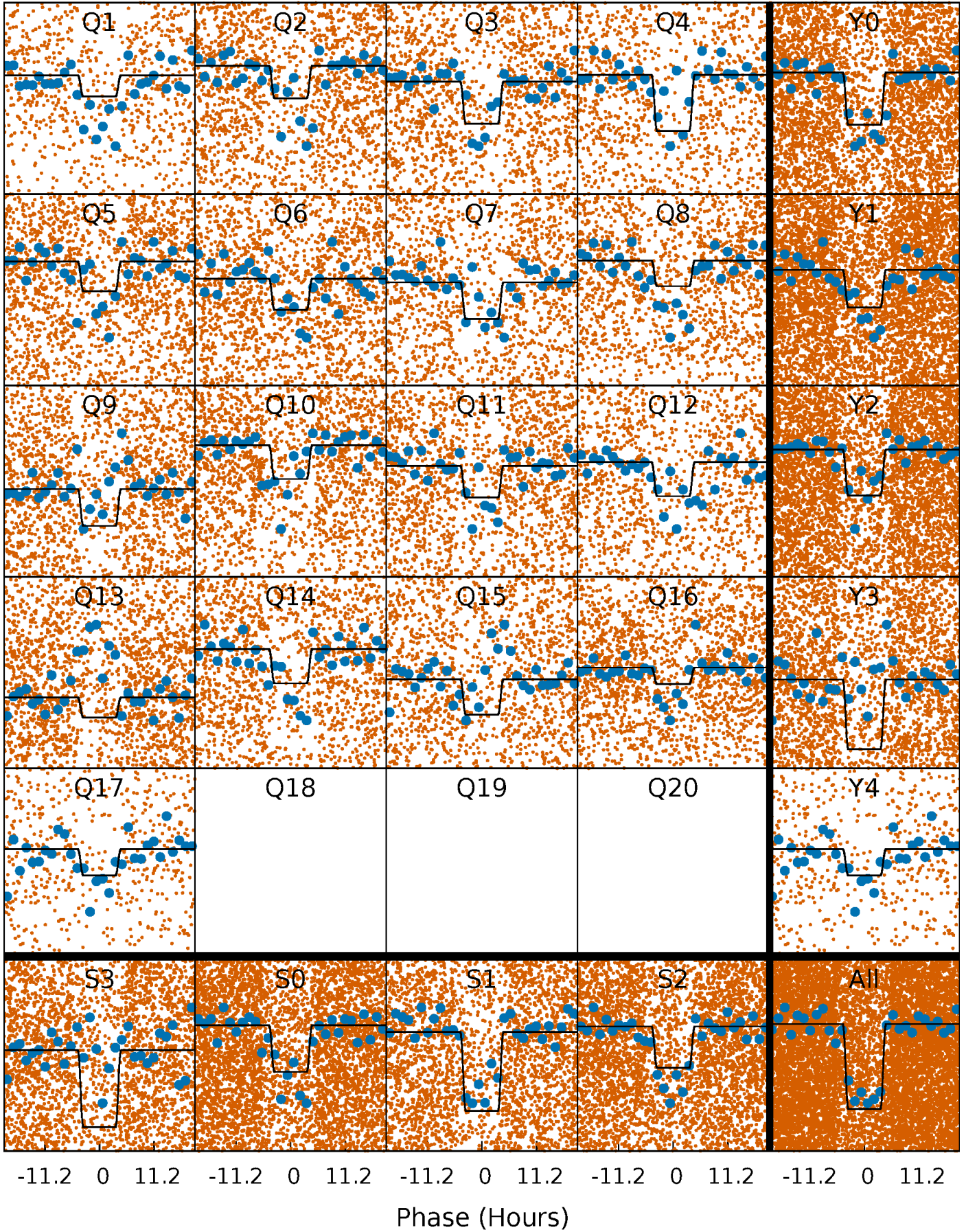
TCE 009591593-01 P= 2.285510 Days  $T_0=131.788484$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

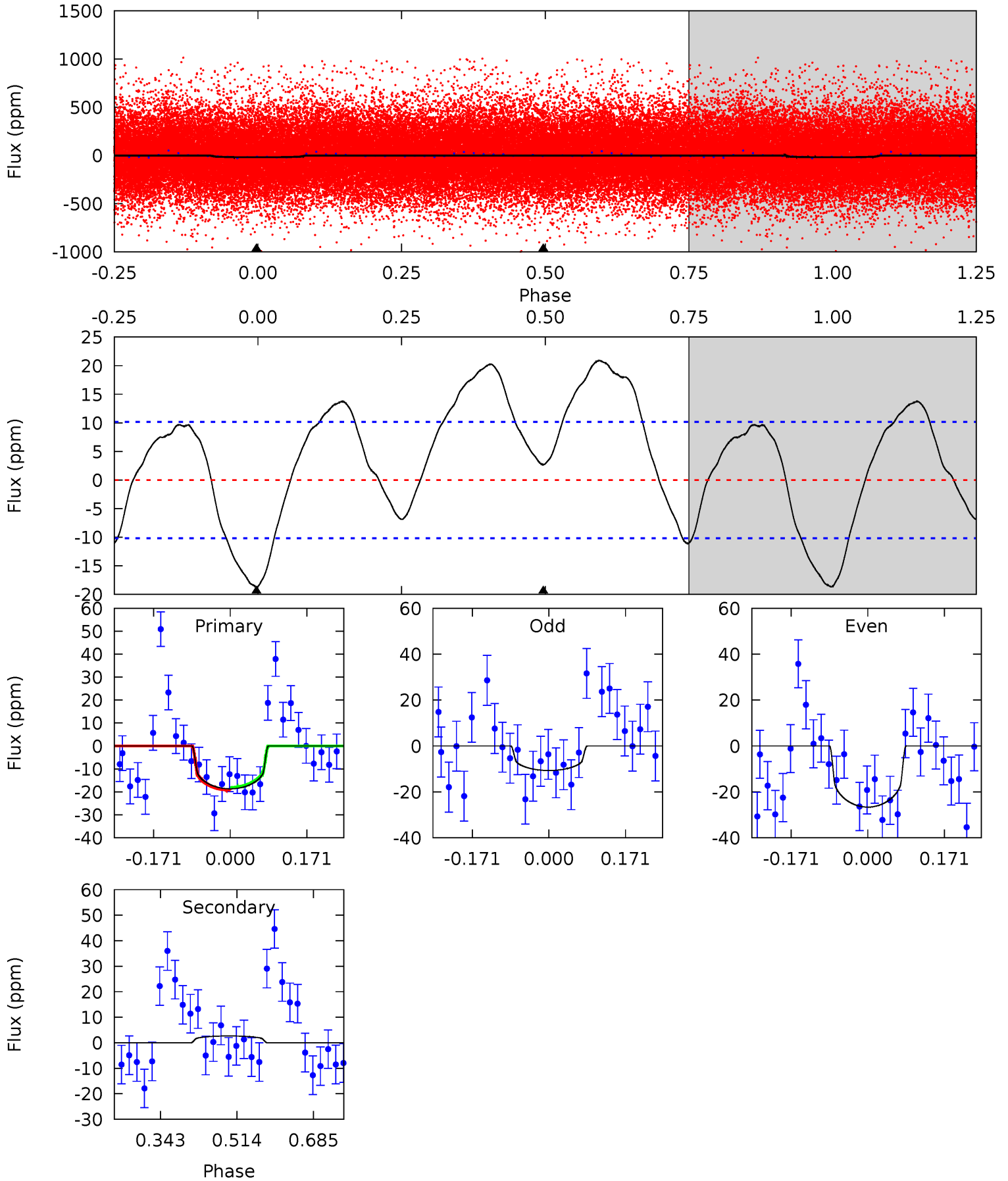
TCE 009591593-01 P= 2.285635 Days  $T_0=131.765317$  (BKJD)



# DV Model-Shift Uniqueness Test

009591593-01, P = 2.285510 Days, E = 129.502974 Days

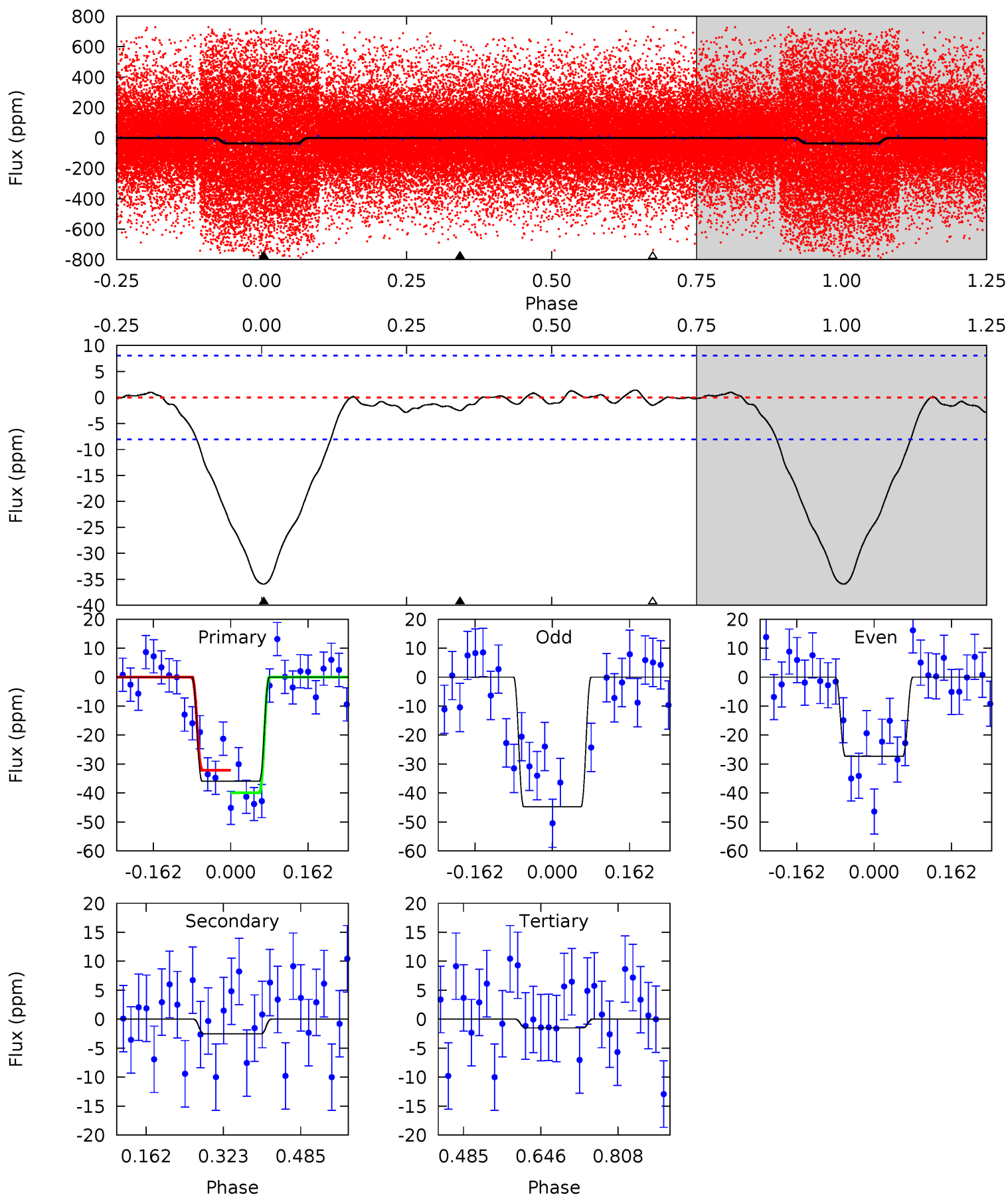
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
8.17	-1.17	0	0	4.45	1.37	2.55	8.17	8.17	-1.17	-1.17	3.47	0.63	0.53	0.25



# Alt Model-Shift Uniqueness Test

009591593-01, P = 2.285635 Days, E = 129.479682 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
19.9	1.40	0.83	0	4.46	1.40	0.40	19.0	19.9	0.57	1.40	4.82	1.20	0.04	2.16



### Stellar Parameters For KIC 009591593

	$T_{\text{eff}}(K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$4764^{+143}_{-129}$	$4.503^{+0.086}_{-0.731}$	$0.480^{+0.050}_{-0.250}$	$0.827^{+0.048}_{-0.048}$	$0.794^{+0.051}_{-0.038}$	$1.977^{+0.686}_{-1.865}$
	+3%/-3%	+2%/-16%	+10%/-52%	+6%/-6%	+6%/-5%	+35%/-94%
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 009591593-01 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$3\pm 2$	$0.52^{+0.28}_{-0.25}$	$1519^{+58}_{-55}$	$-3066^{+696}_{-789}$	$-4.467^{+4.118}_{-14.883}$
Alt.	$-3\pm 2$	$0.59^{+0.28}_{-0.26}$	$1516^{+67}_{-54}$	$2895^{+696}_{-565}$	$3.415^{+10.381}_{-2.508}$

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



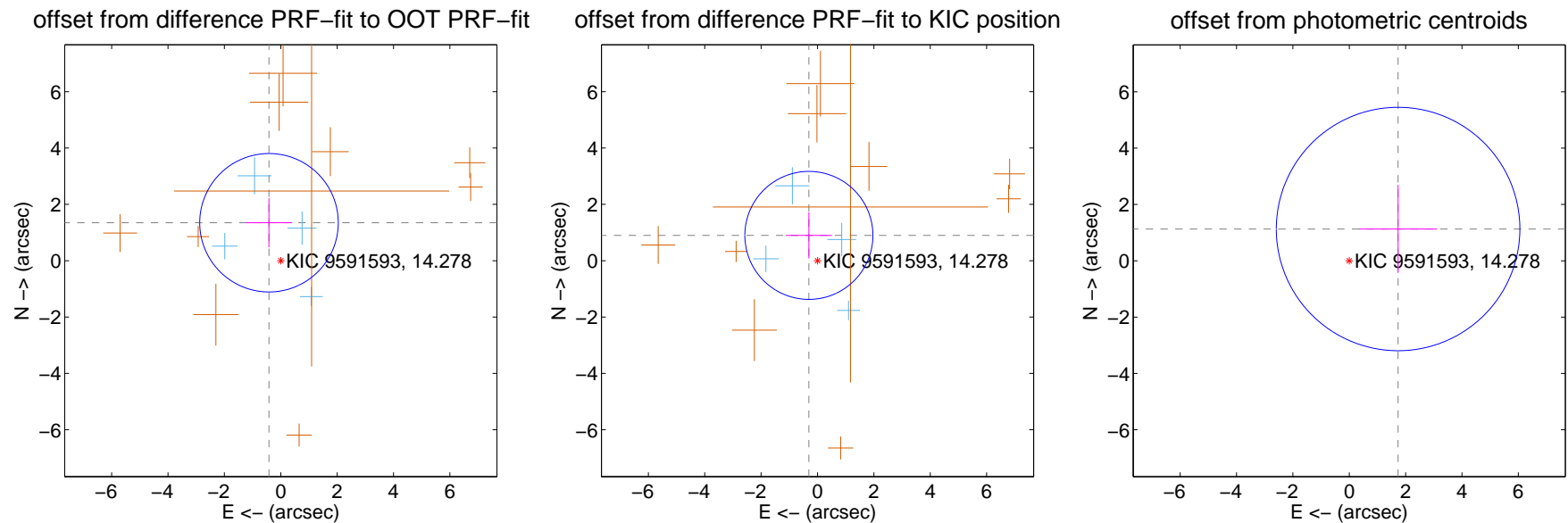
## DV Centroid Data

Supplemental centroid analysis for 009591593-01. Kepler magnitude: 14.28. Transit SNR 6.22

There are 4 quarters with good PRF difference image offsets

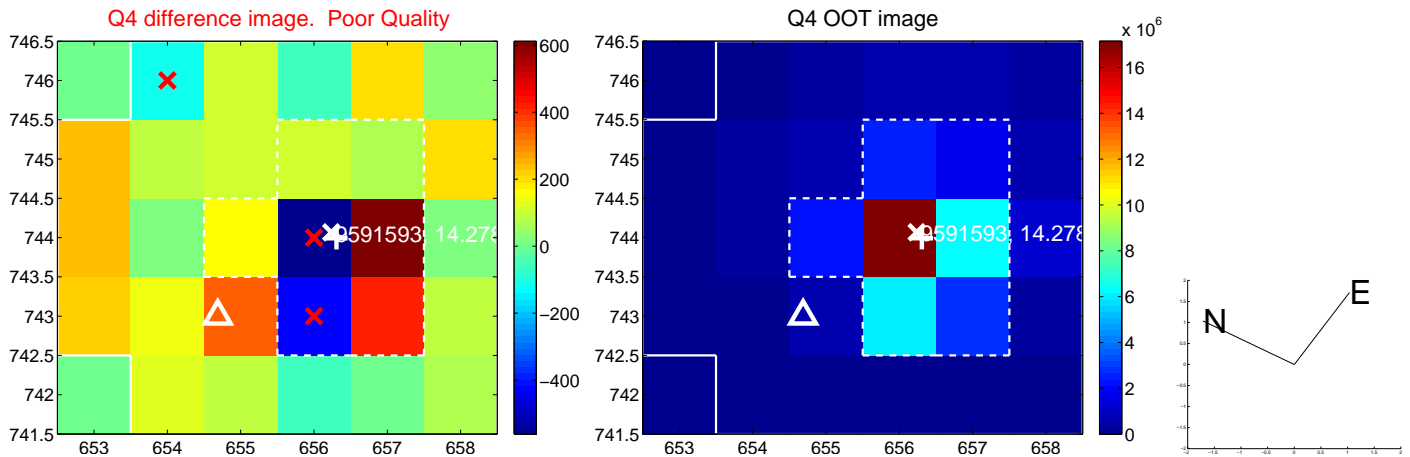
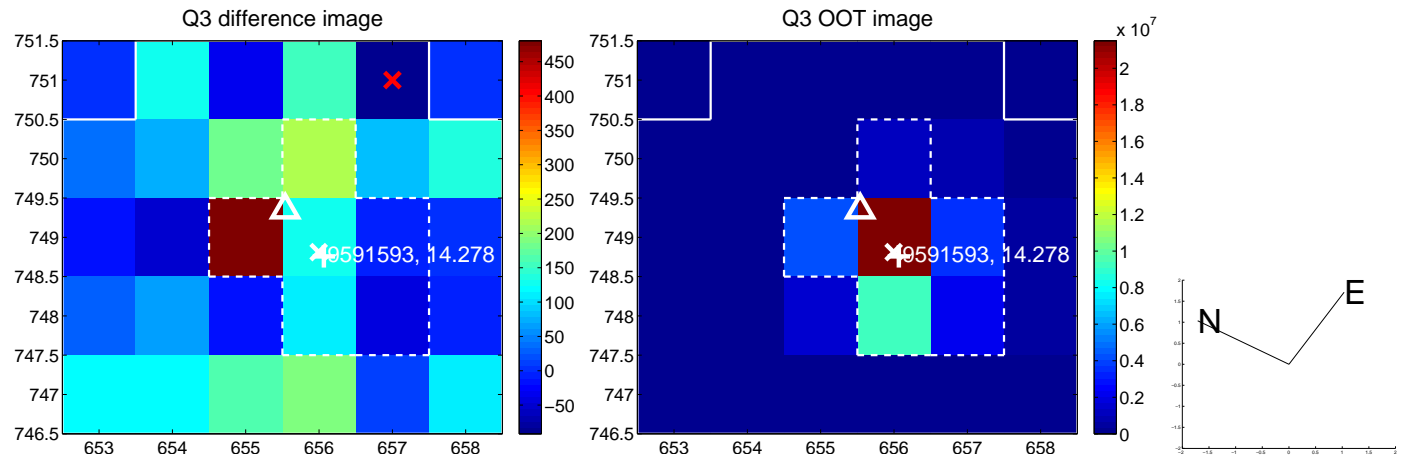
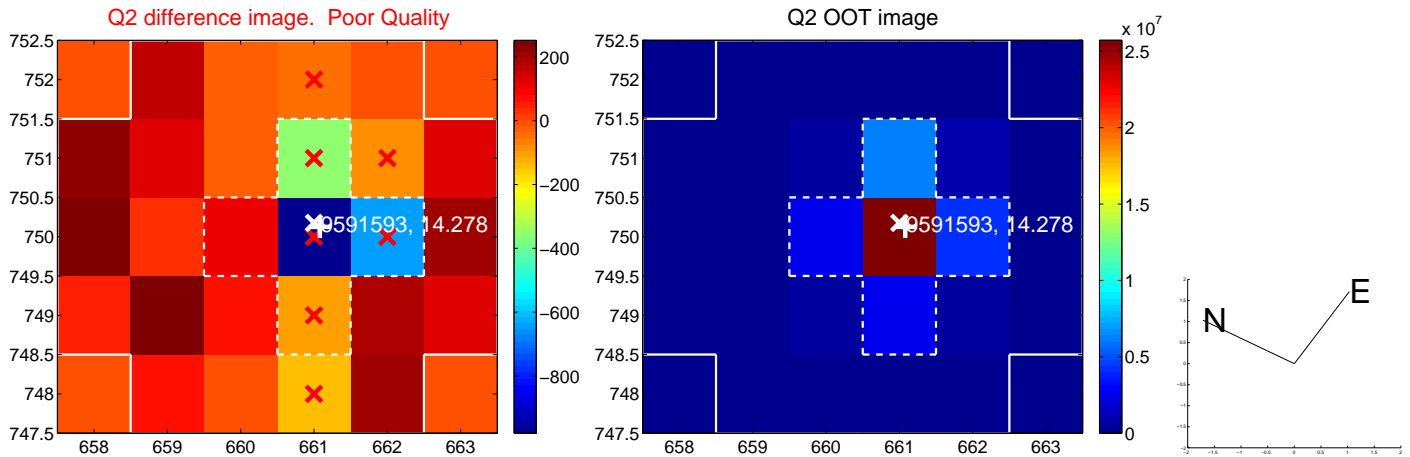
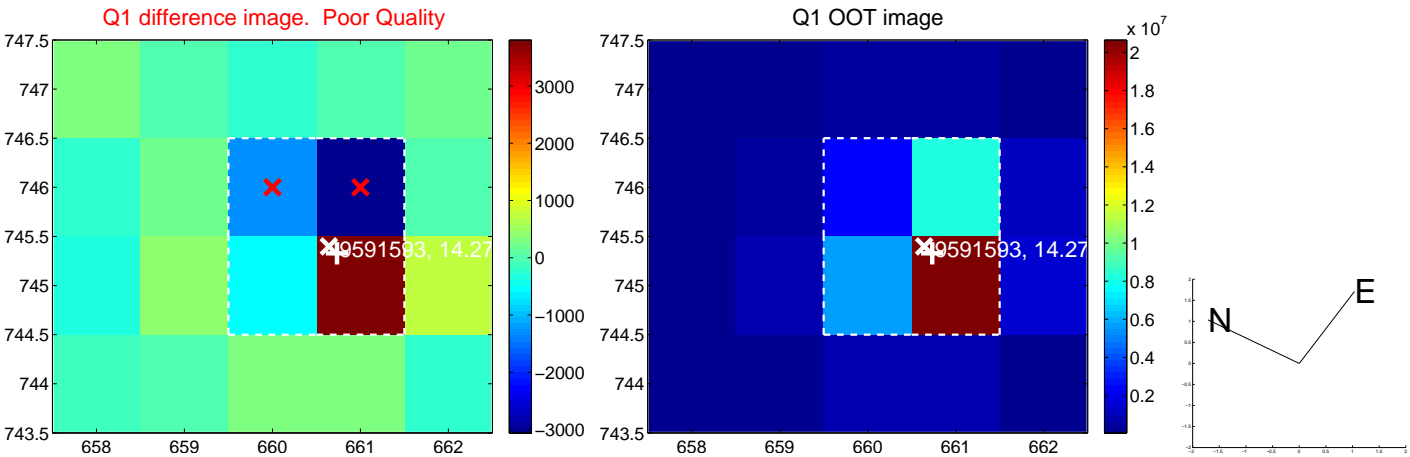
The direct PRF centroid is offset from the target star catalog position by about 0.57 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.410 \pm 0.819$	1.72	$0.418 \pm 0.821$	$1.347 \pm 0.871$
PRF-fit source offset from KIC position	$0.949 \pm 0.757$	1.25	$0.306 \pm 0.817$	$0.898 \pm 0.815$
photometric centroid source offset	$2.07 \pm 1.44$	1.44	$-1.73 \pm 1.39$	$1.13 \pm 1.56$

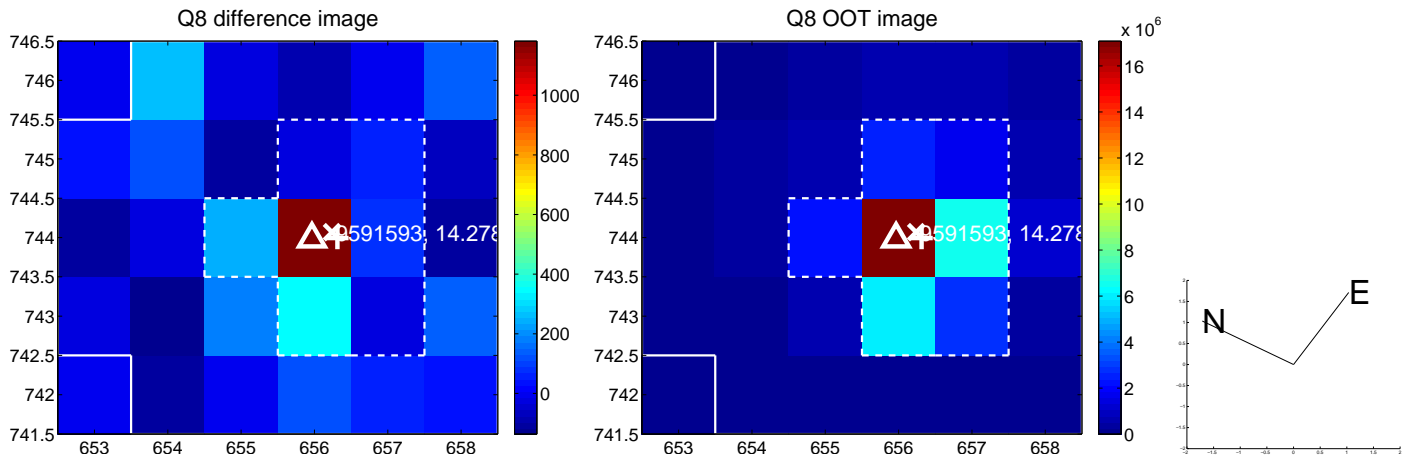
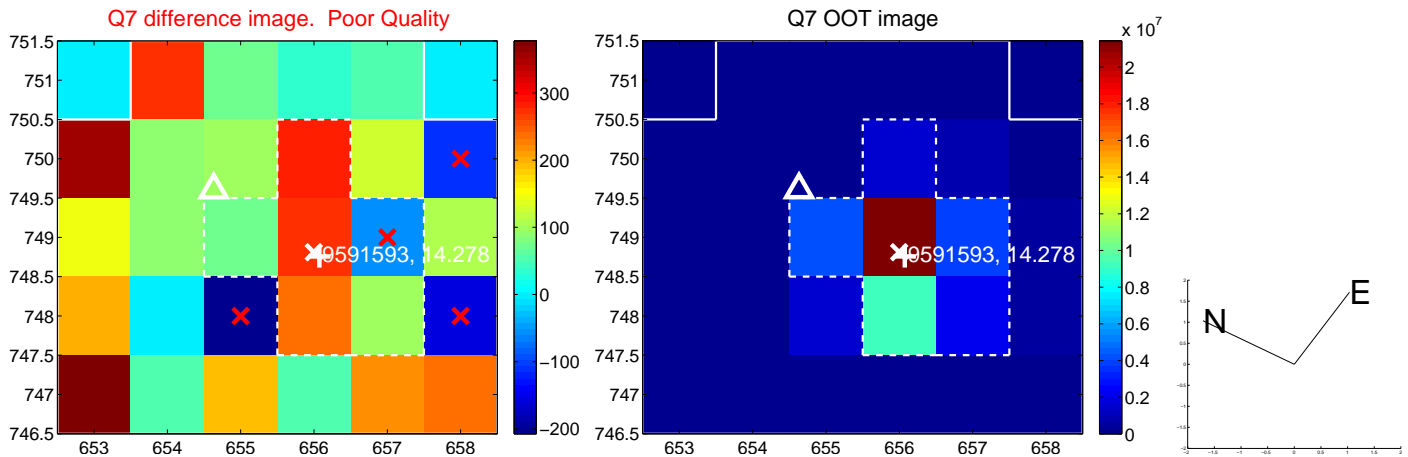
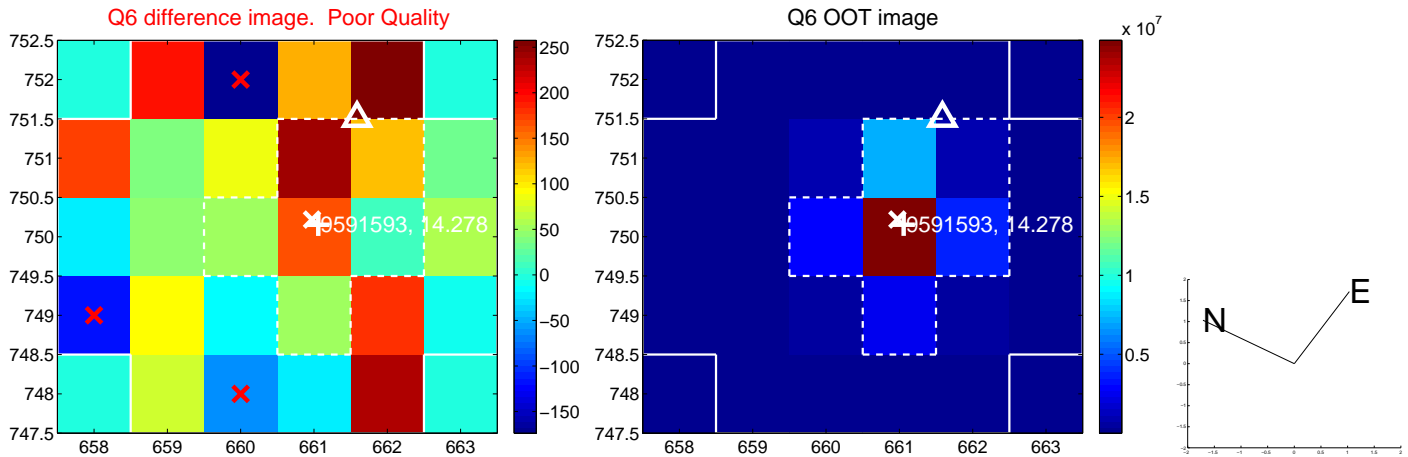
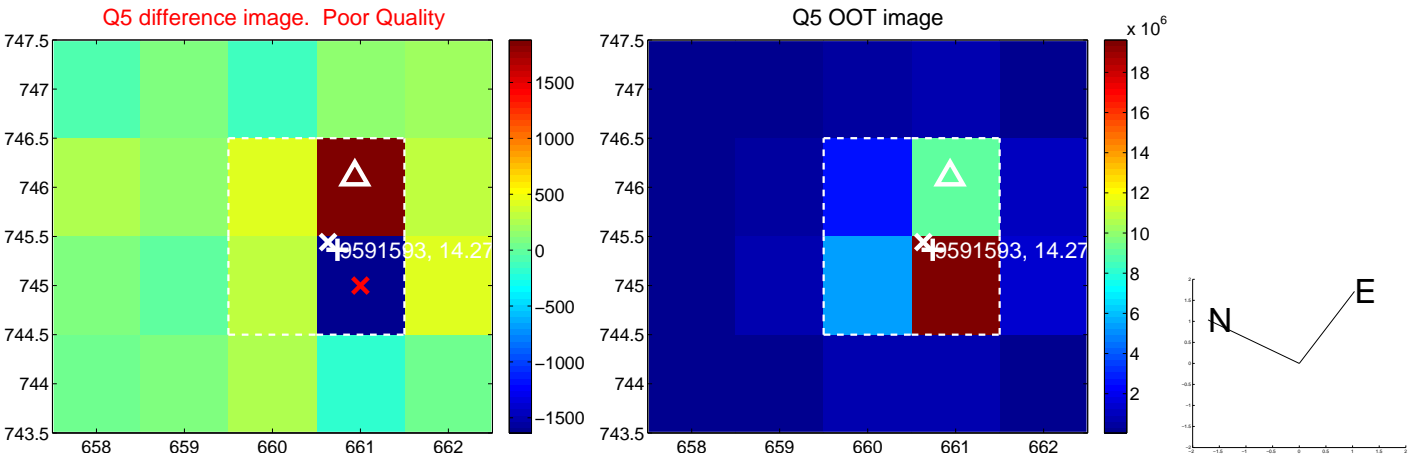


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

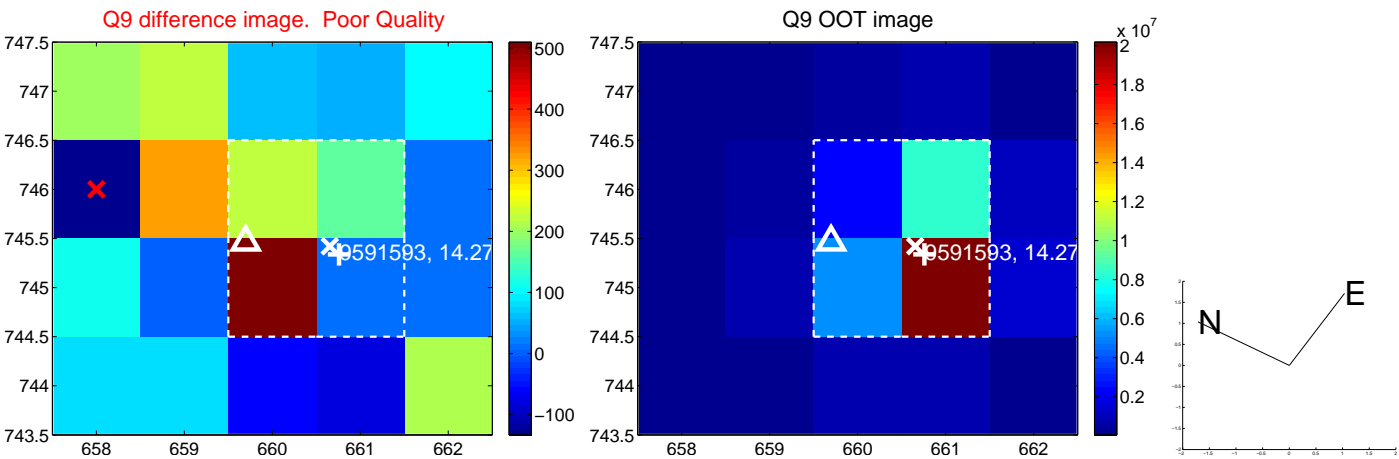
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



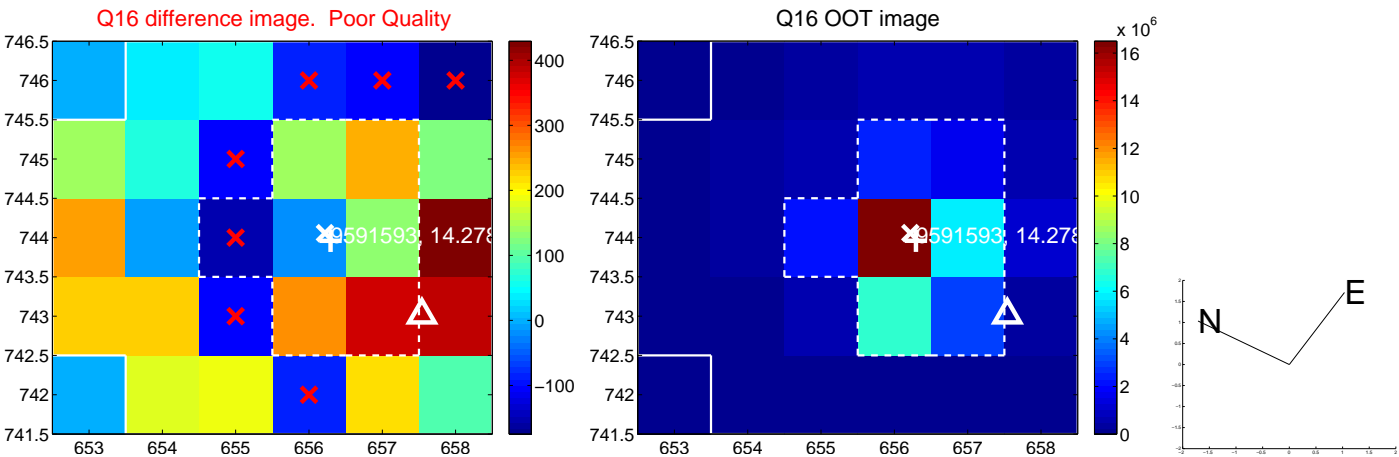
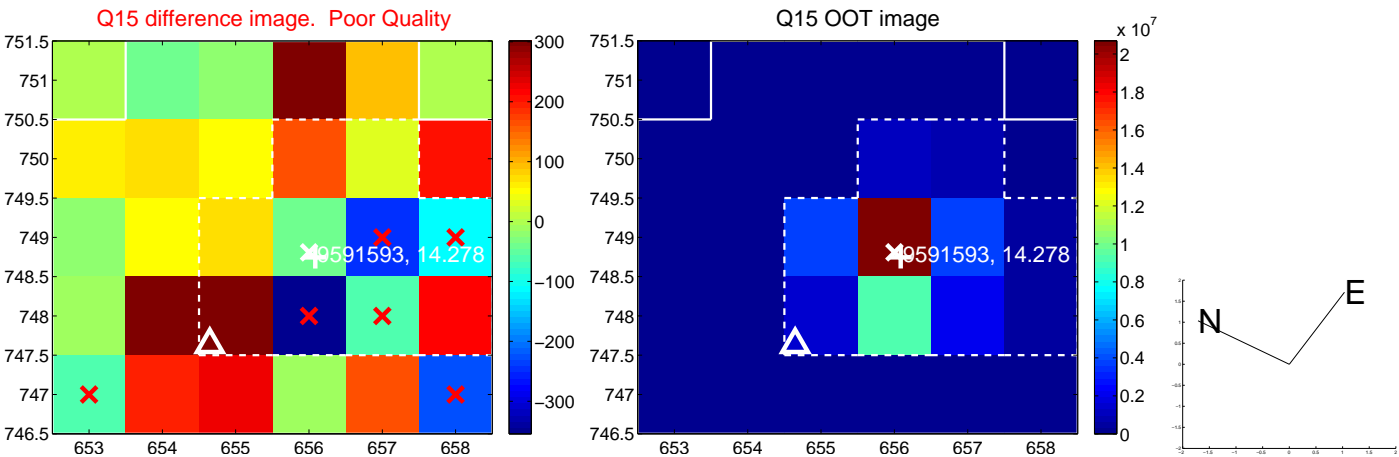
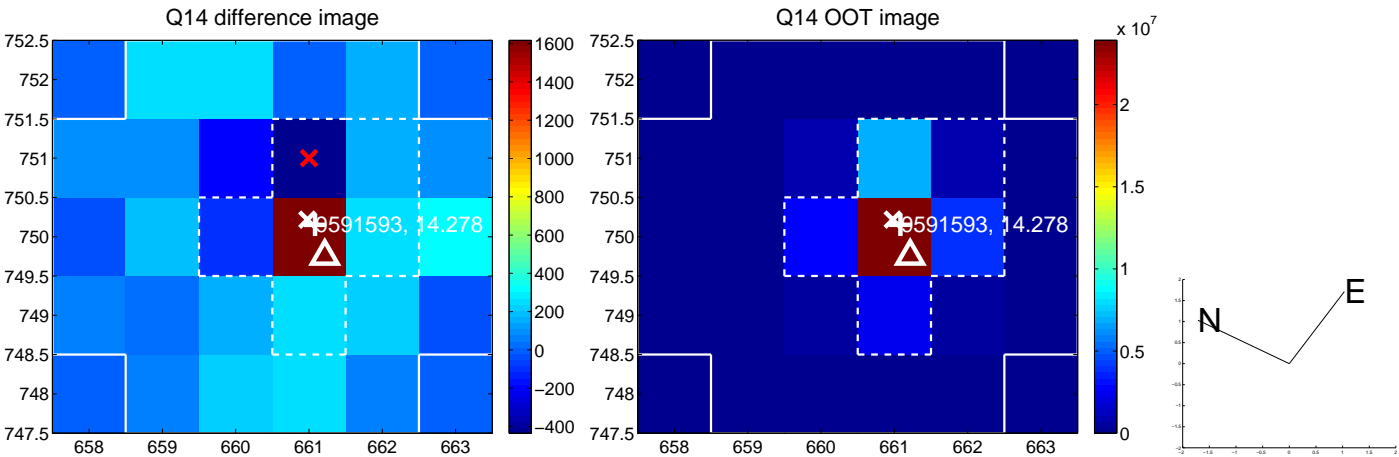
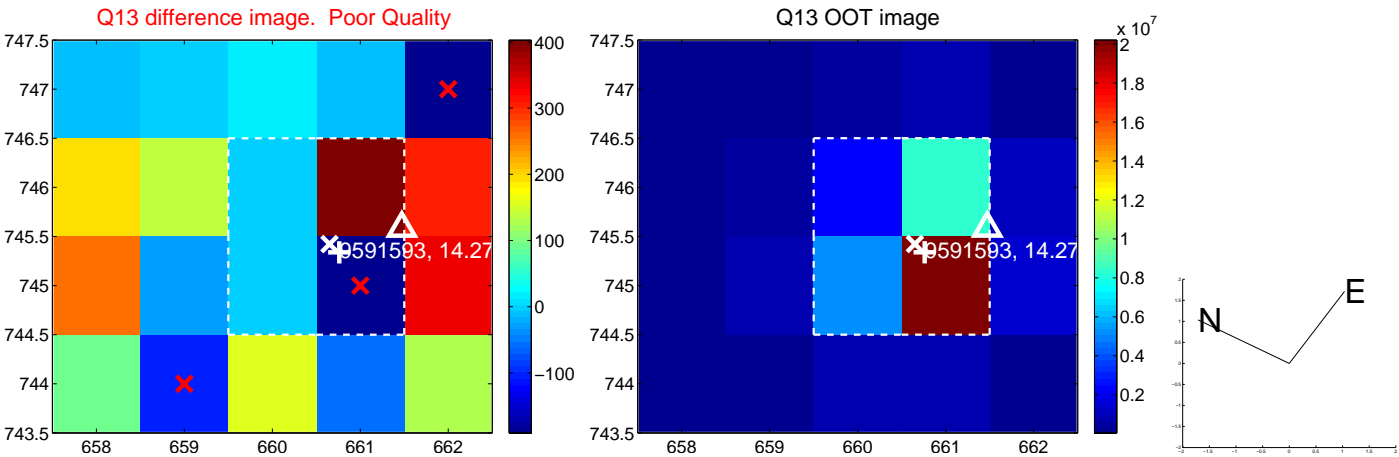
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

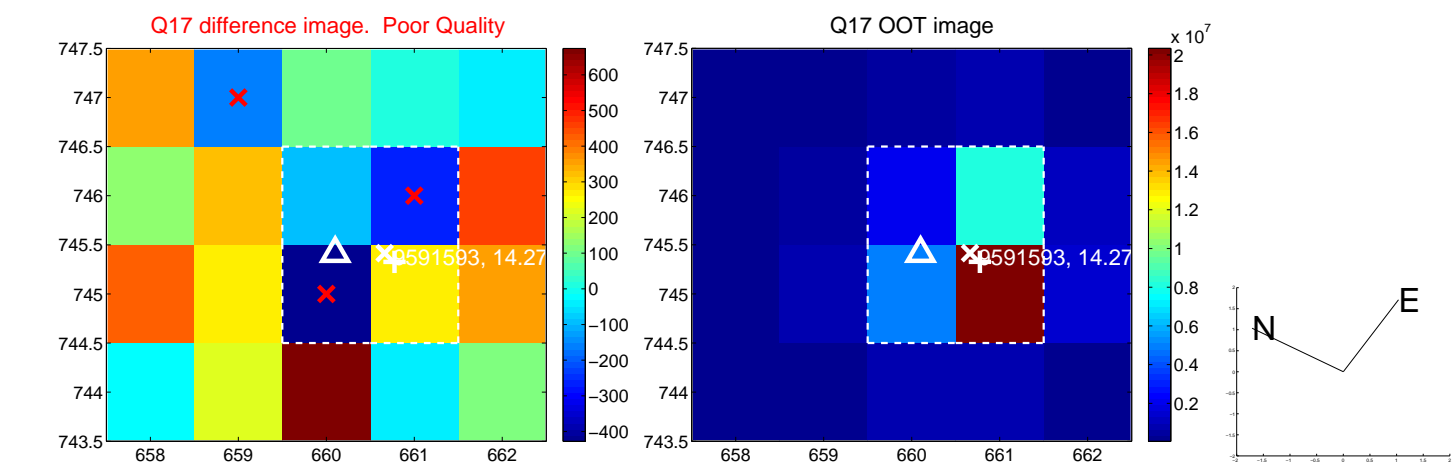


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

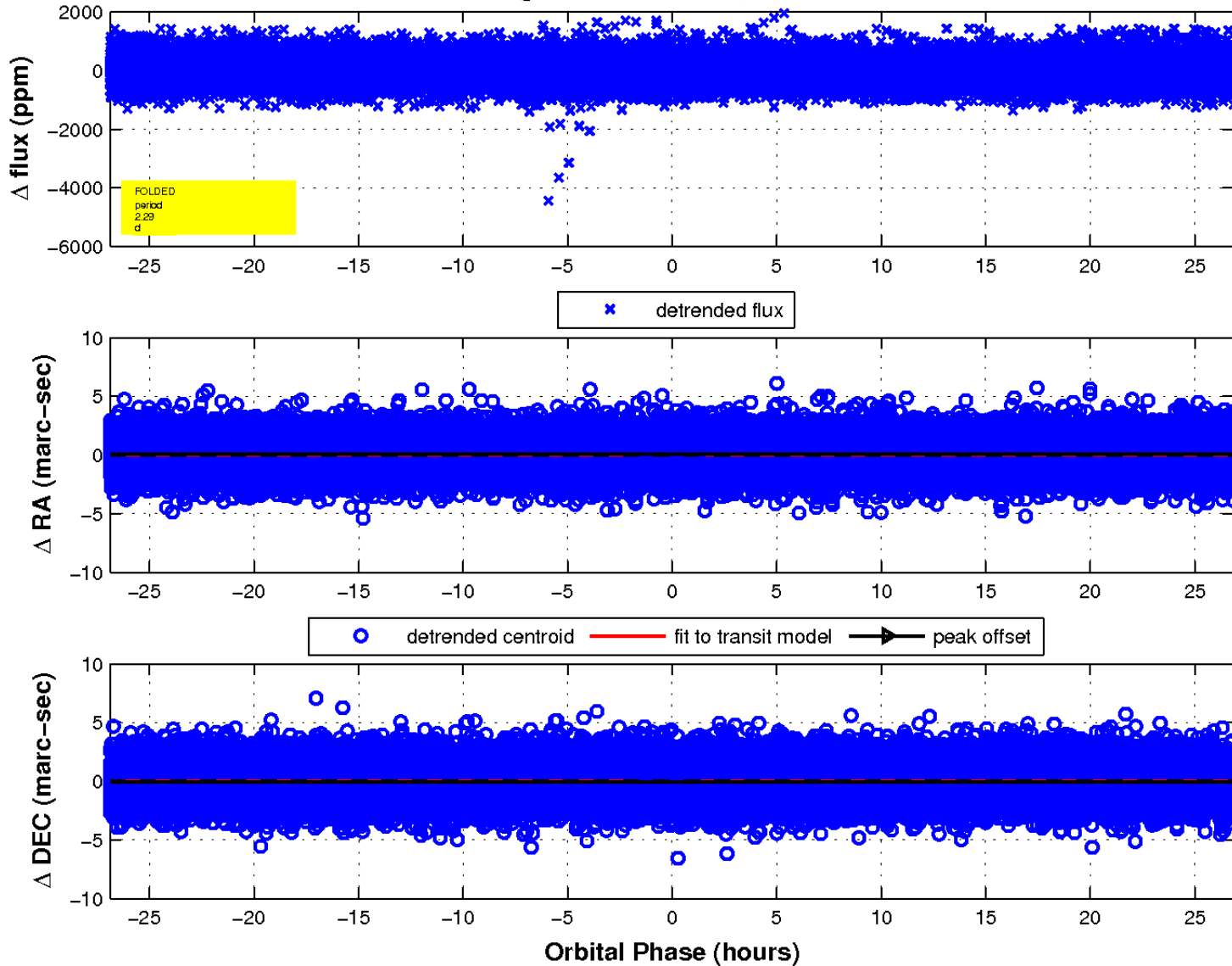




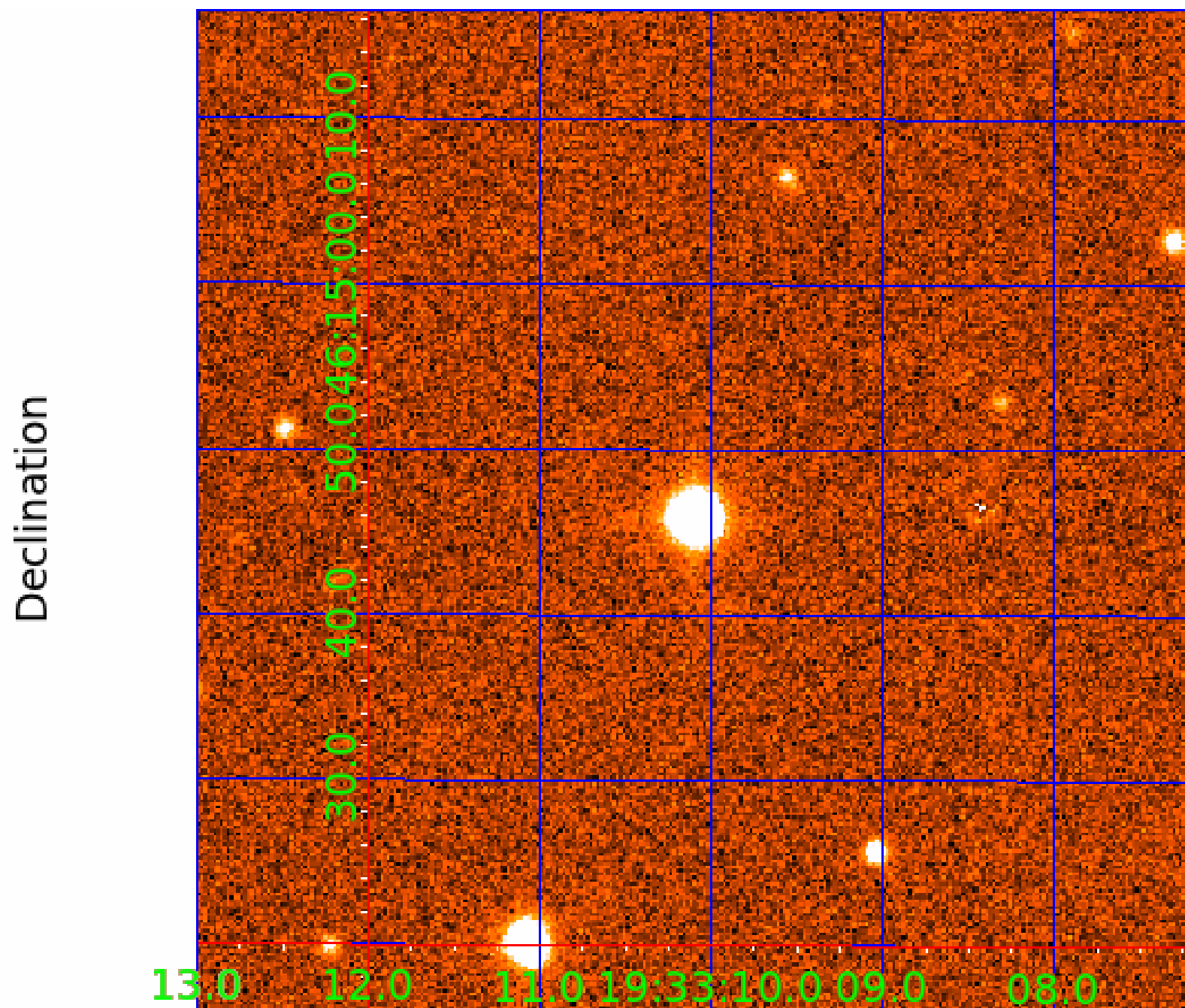
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



fluxWeightedCentroids, Planet 1 of 2



UKIRT Image



# KIC 009591593

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009591593-01	OBS	No	2.285510	131.788484	25.5	8.961	7.5	6.2	0.83	4764	0.51	319.01
009591593-02	OBS	No	342.253514	178.626619	148.4	9.555	9.4	2.6	0.83	4764	1.15	0.40

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009591593-01	OBS	FP	0.00	1	0	0	0	LPP_DV—MOD_NONUNIQ_DV—CENT_KIC_POS
009591593-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_TRACKER—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV— MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—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.

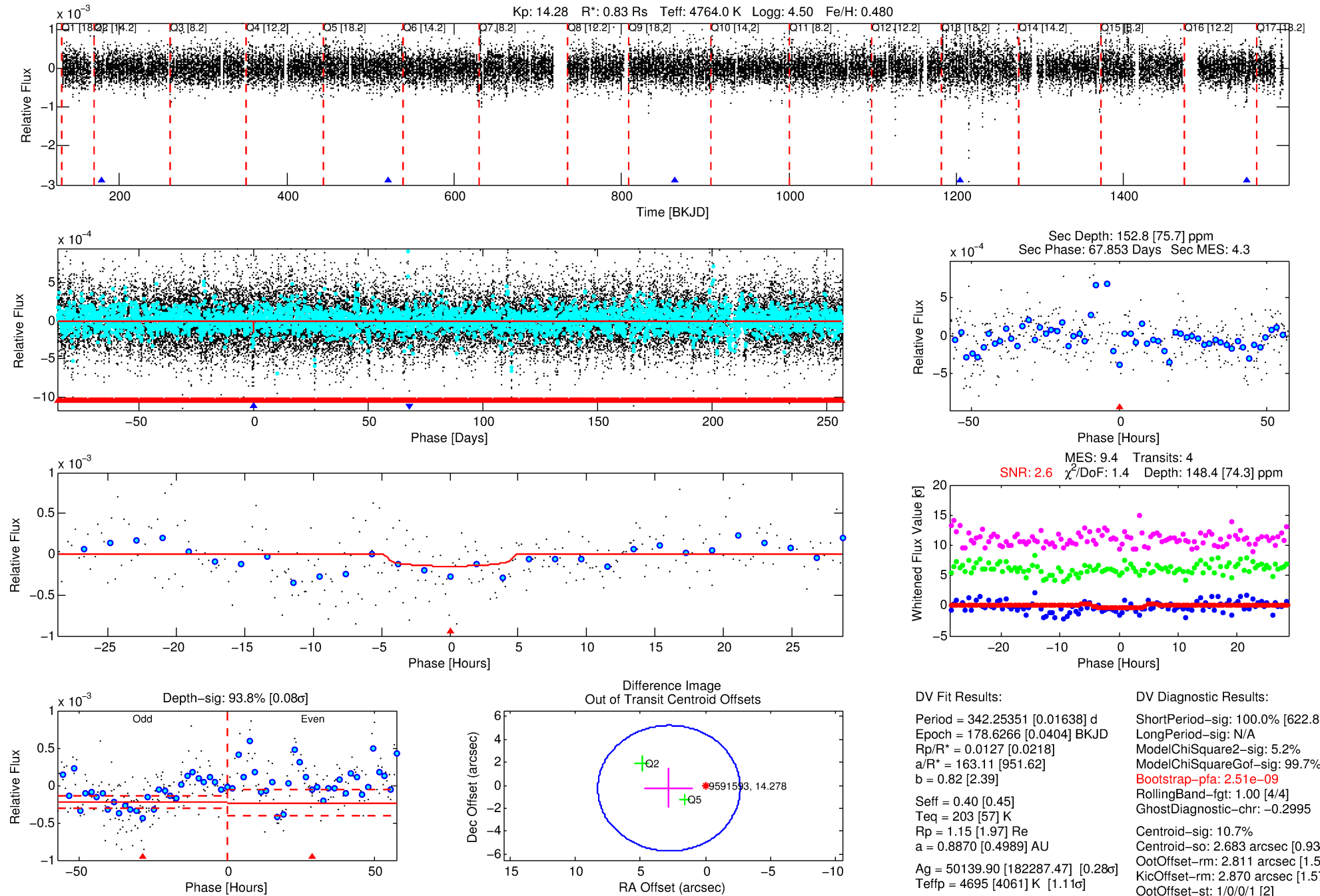
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 009591593-02

No Significant Match Found

# DV One-Page Summary

KIC: 9591593 Candidate: 2 of 2 Period: 342.254 d



## DV Fit Results:

Period = 342.25351 [0.01638] d  
Epoch = 178.6266 [0.0404] BKJD  
Rp/R\* = 0.0127 [0.0218]  
a/R\* = 163.11 [951.62]  
b = 0.82 [2.39]  
Seff = 0.40 [0.45]  
Teq = 203 [57] K  
Rp = 1.15 [1.97] Re  
a = 0.8870 [0.4989] AU  
Ag = 50139.90 [182287.47] [0.28 $\sigma$ ]  
Teff = 4695 [4061] K [1.11 $\sigma$ ]

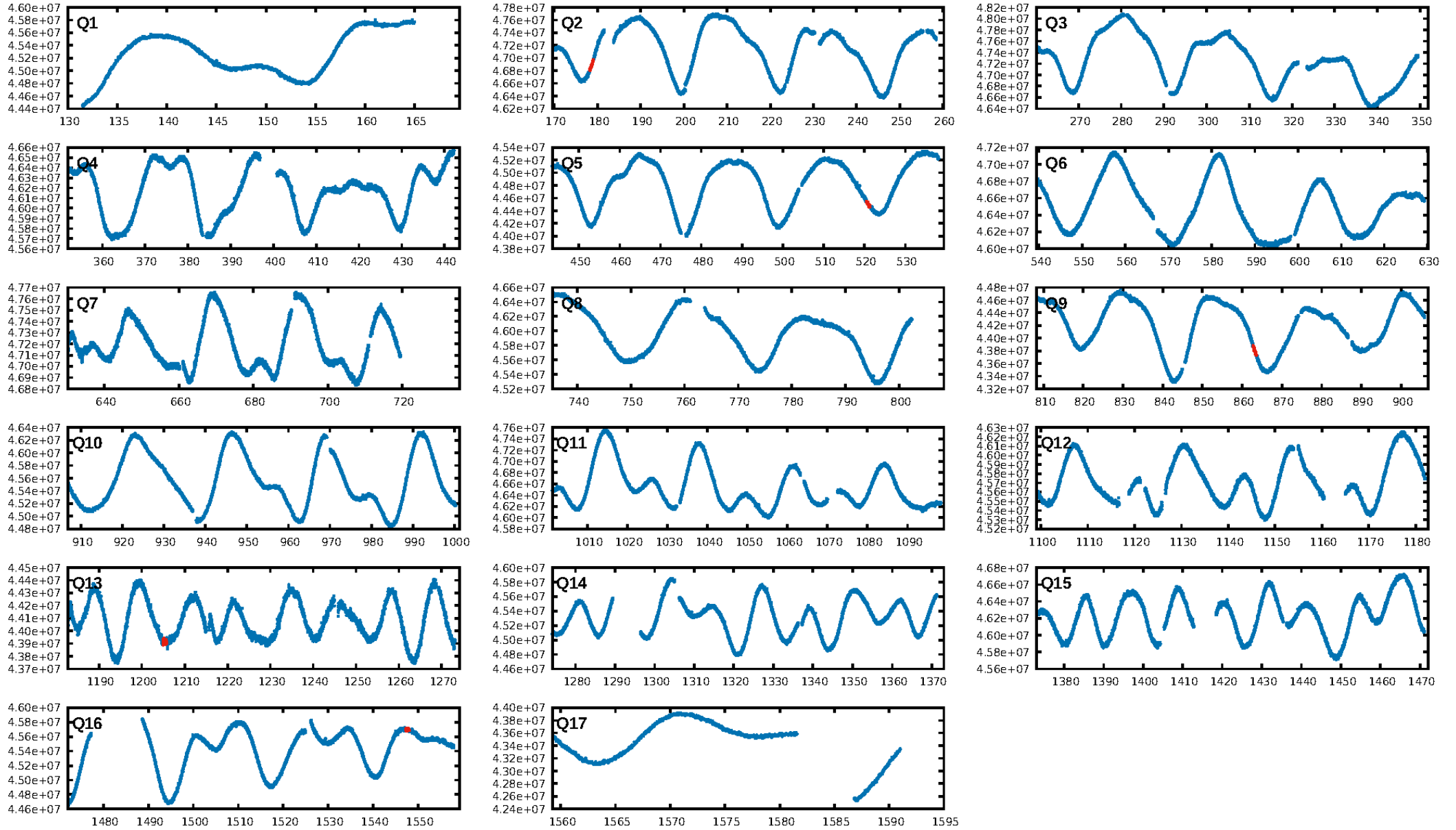
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [622.86 $\sigma$ ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 5.2%  
ModelChiSquareGof-sig: 99.7%  
**Bootstrap-pfa: 2.51e-09**  
RollingBand-fgt: 1.00 [4/4]  
GhostDiagnostic-chr: -0.2995  
Centroid-sig: 10.7%  
Centroid-so: 2.683 arcsec [0.93 $\sigma$ ]  
OotOffset-rm: 2.811 arcsec [1.54 $\sigma$ ]  
OotOffset-st: 1/0/0/1 [2]  
KicOffset-rm: 2.870 arcsec [1.57 $\sigma$ ]  
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DiffImageOverlap-fno: 0.50 [2/4]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 30-Jan-2016 18:16:14 Z

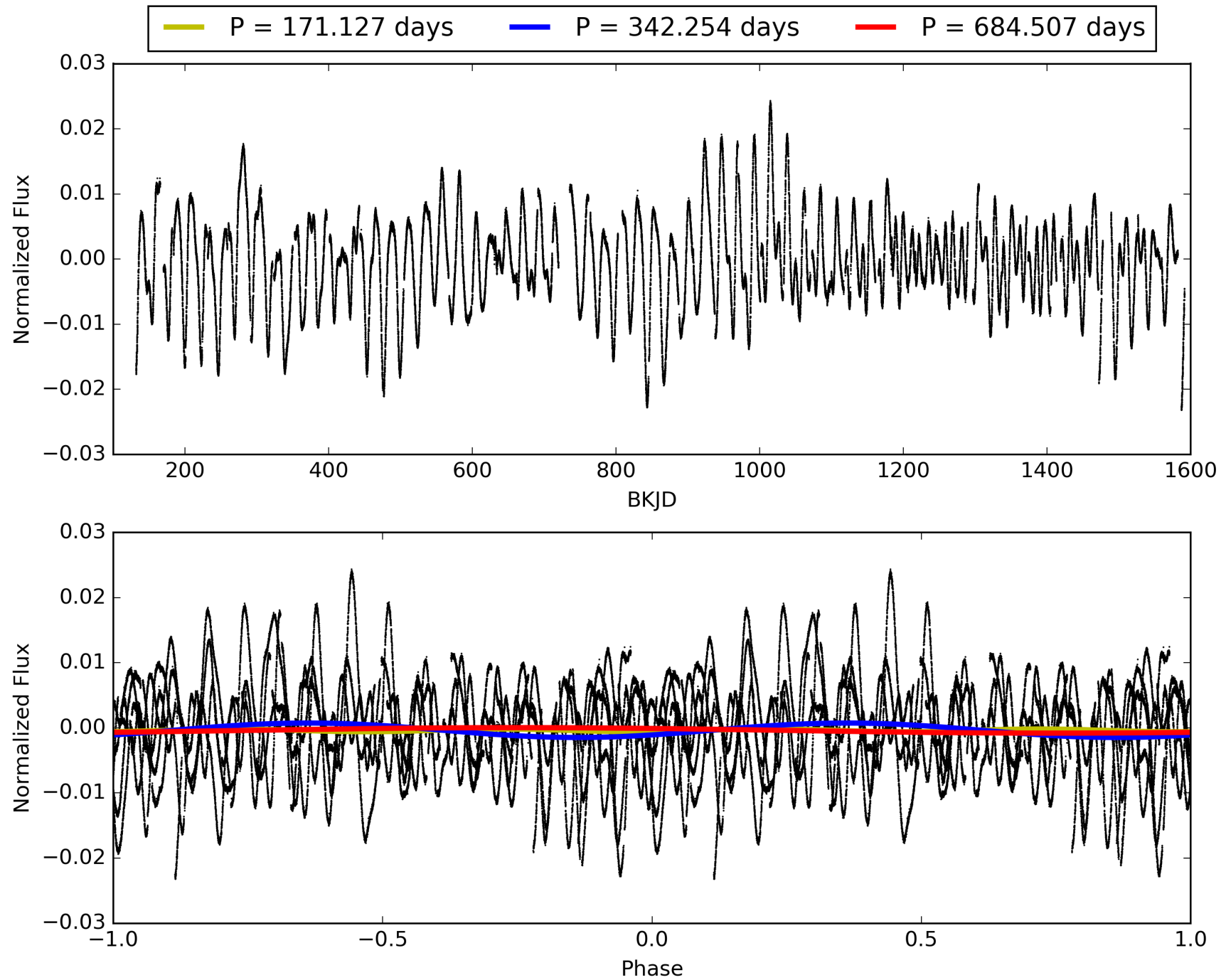
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 009591593-02, PDC Light Curves



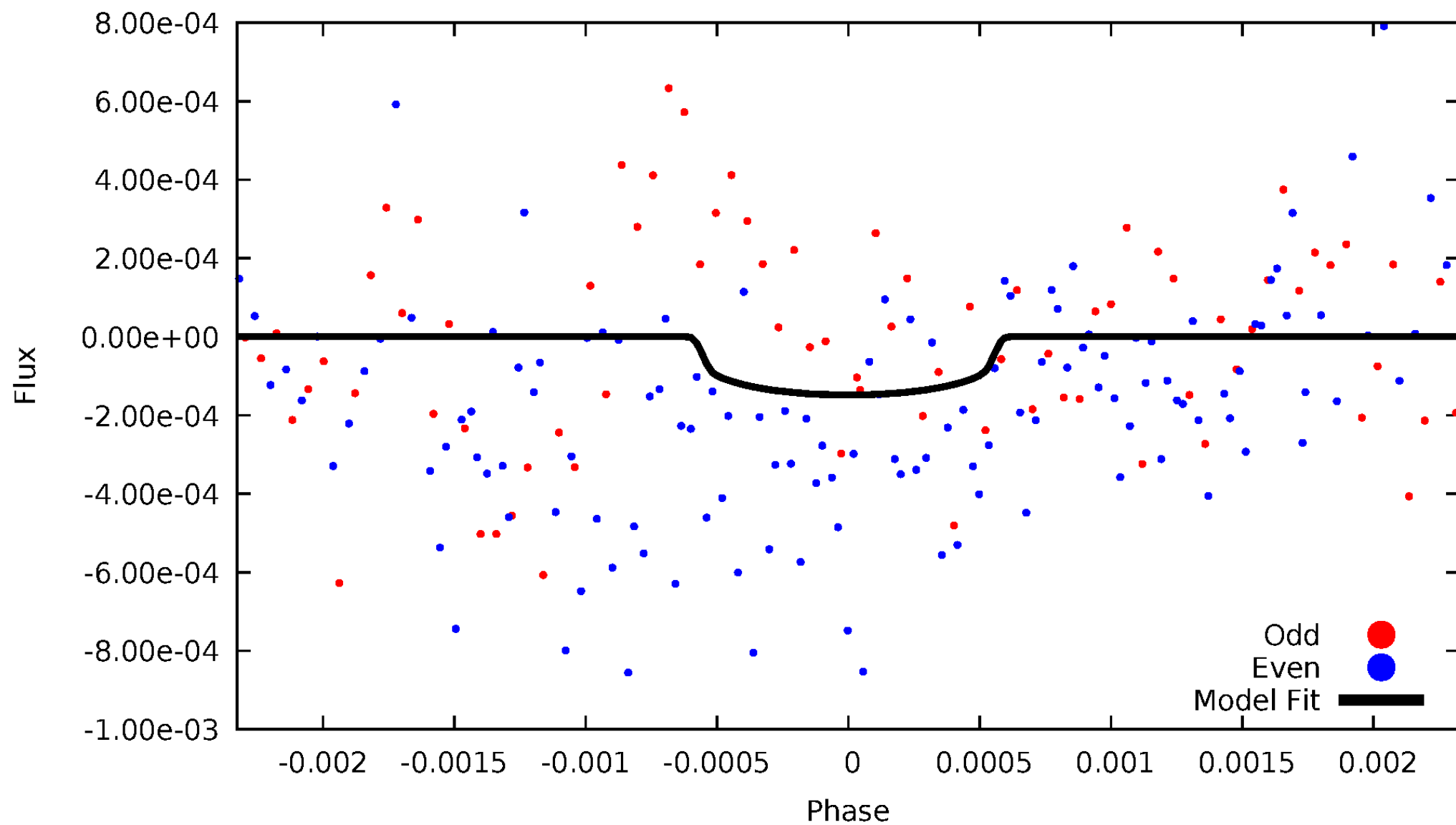


TCE 009591593-02



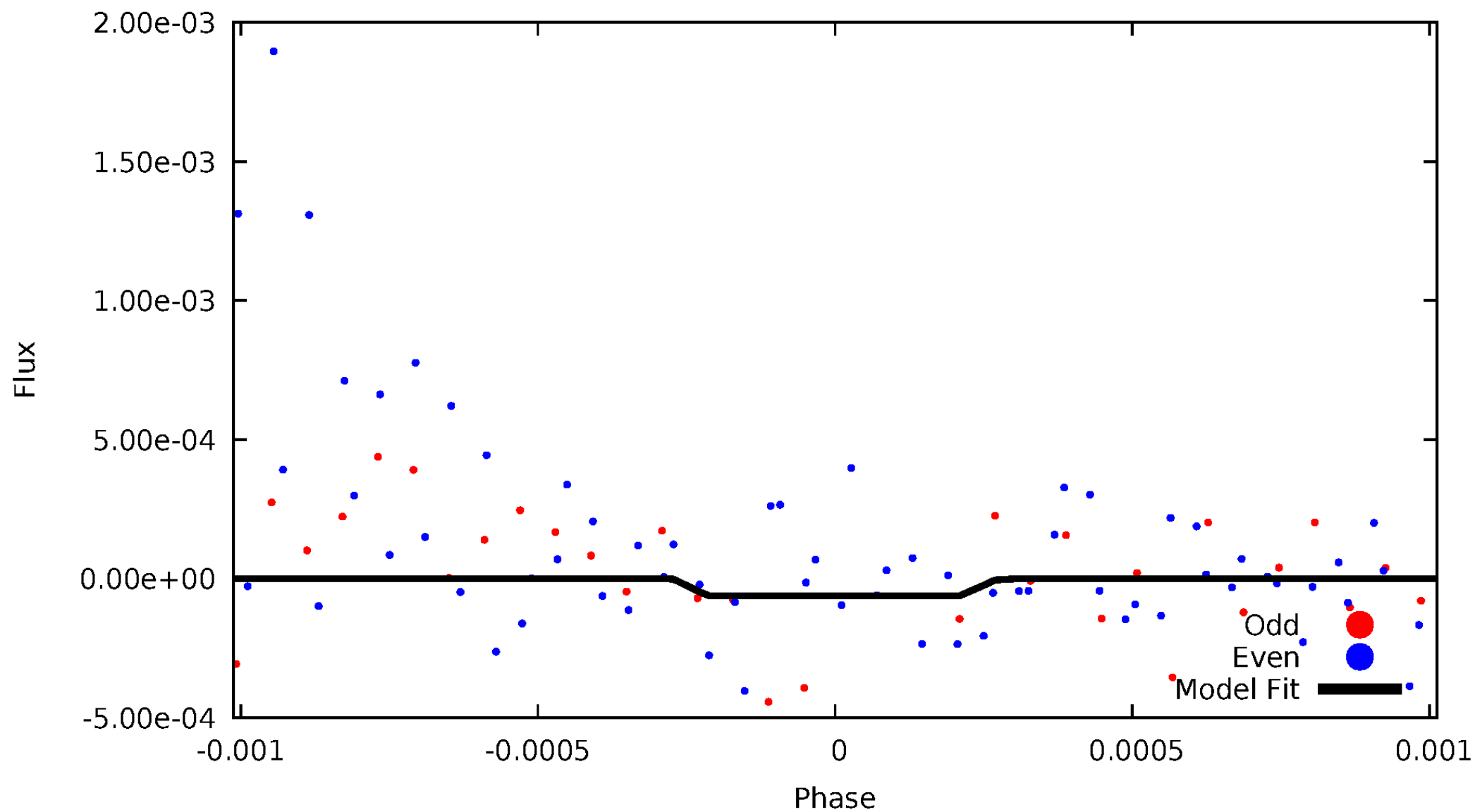
# DV Odd/Even

TCE 009591593-02



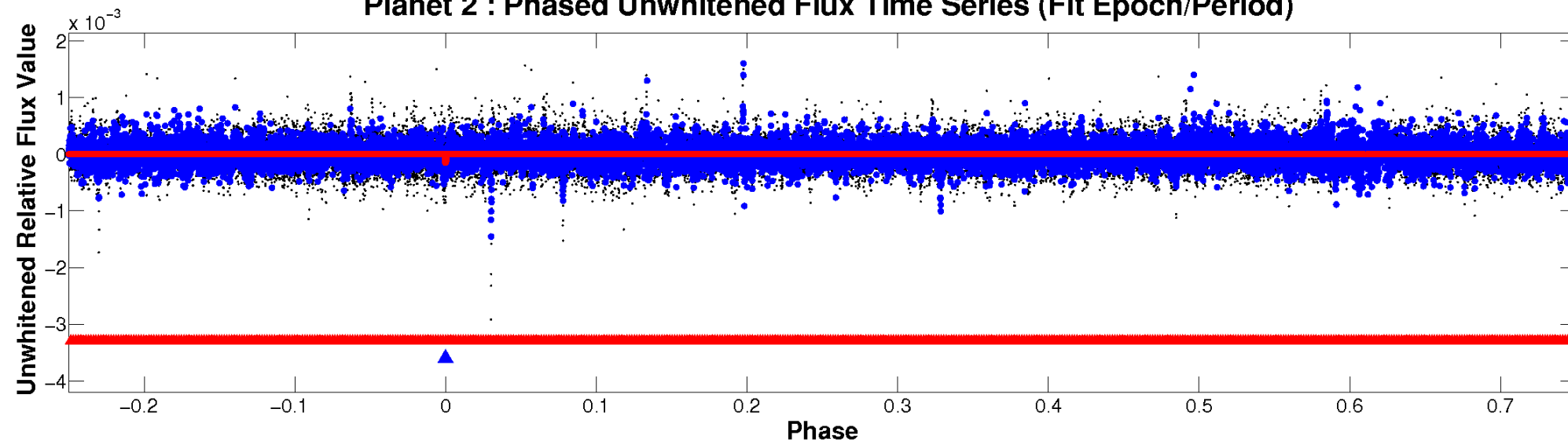
# ALT Odd/Even

TCE 009591593-02

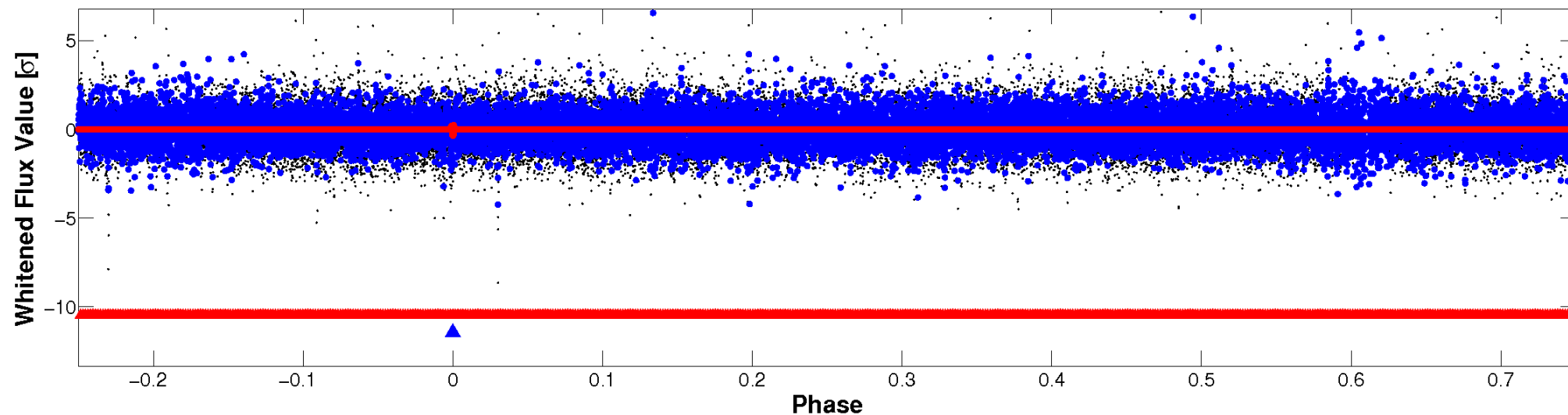


# Non-Whitened Vs. Whitened Light Curve

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

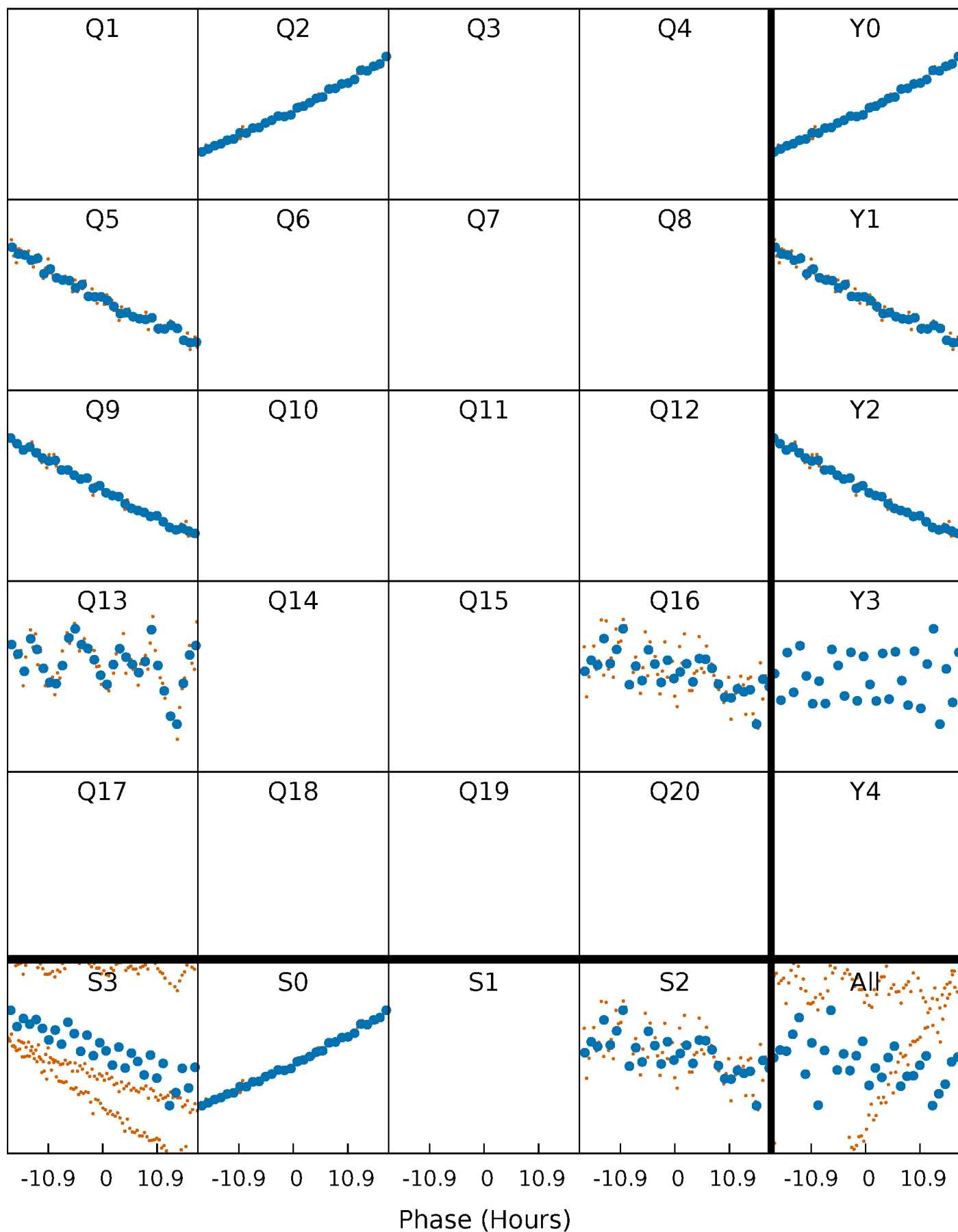


**Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



# PDC Quarter-Phased Transit Curves

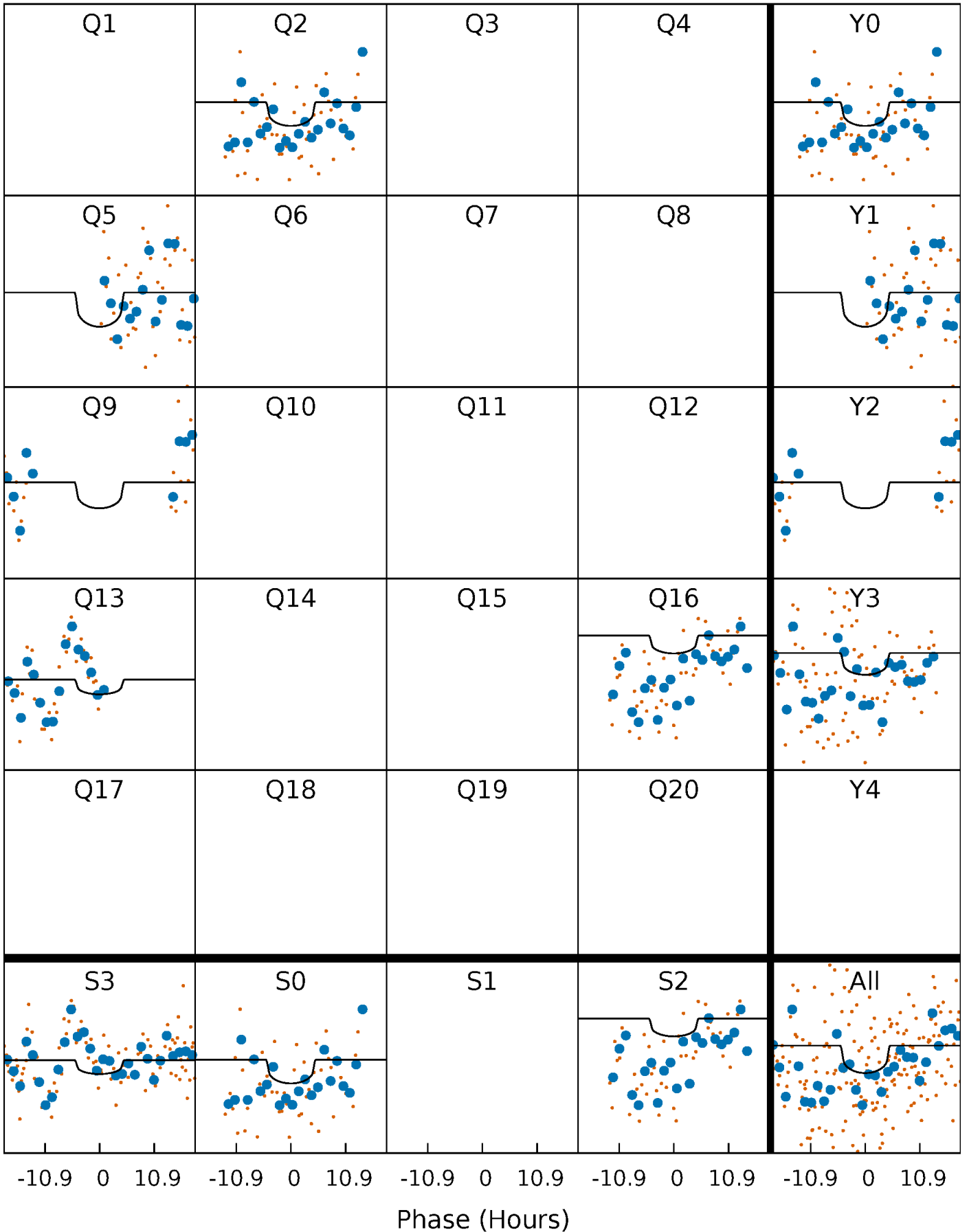
TCE 009591593-02     $P=342.253514$  Days     $T_0=178.626619$  (BKJD)





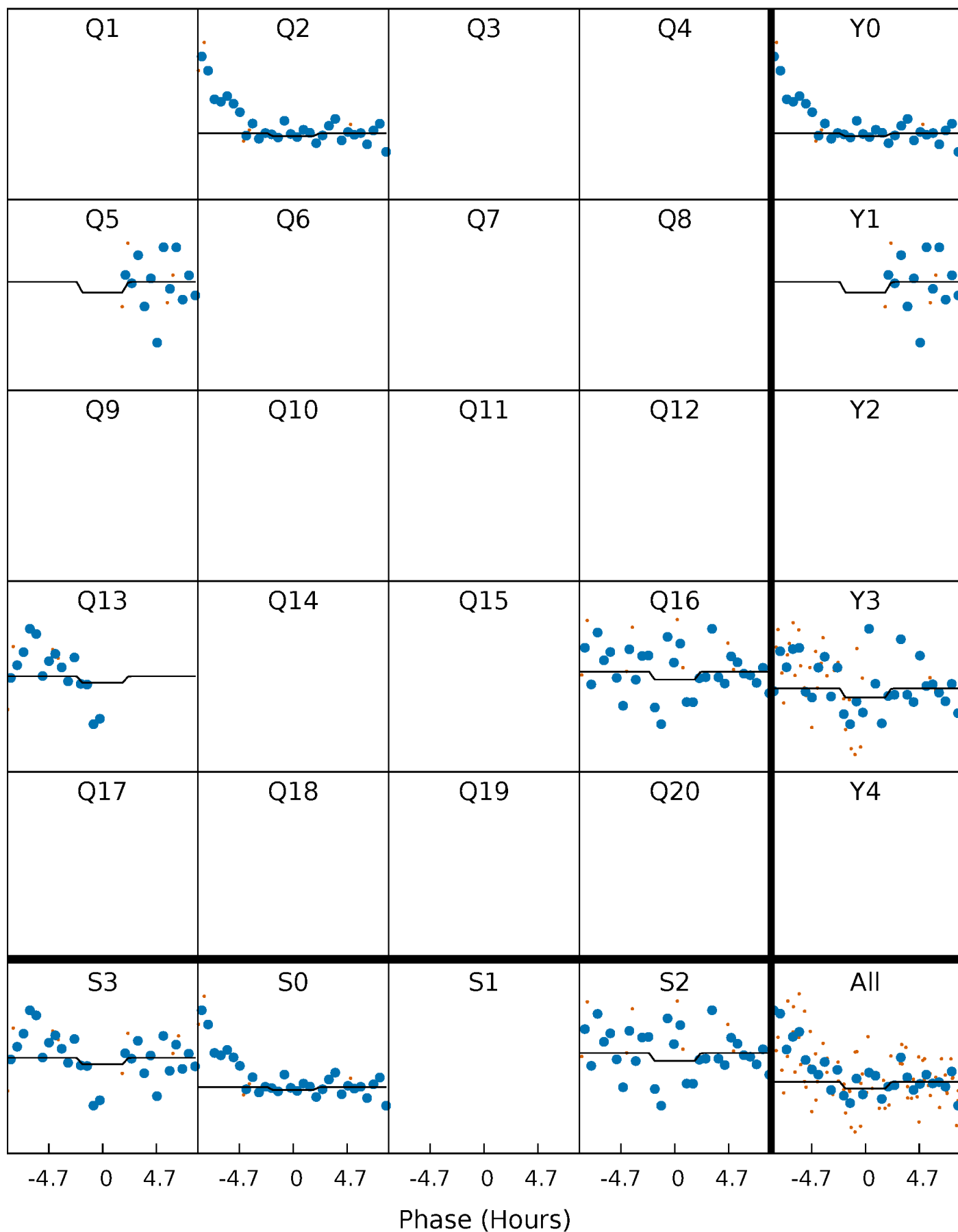
# DV Quarter-Phased Transit Curves

TCE 009591593-02     $P=342.253514$  Days     $T_0=178.626619$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

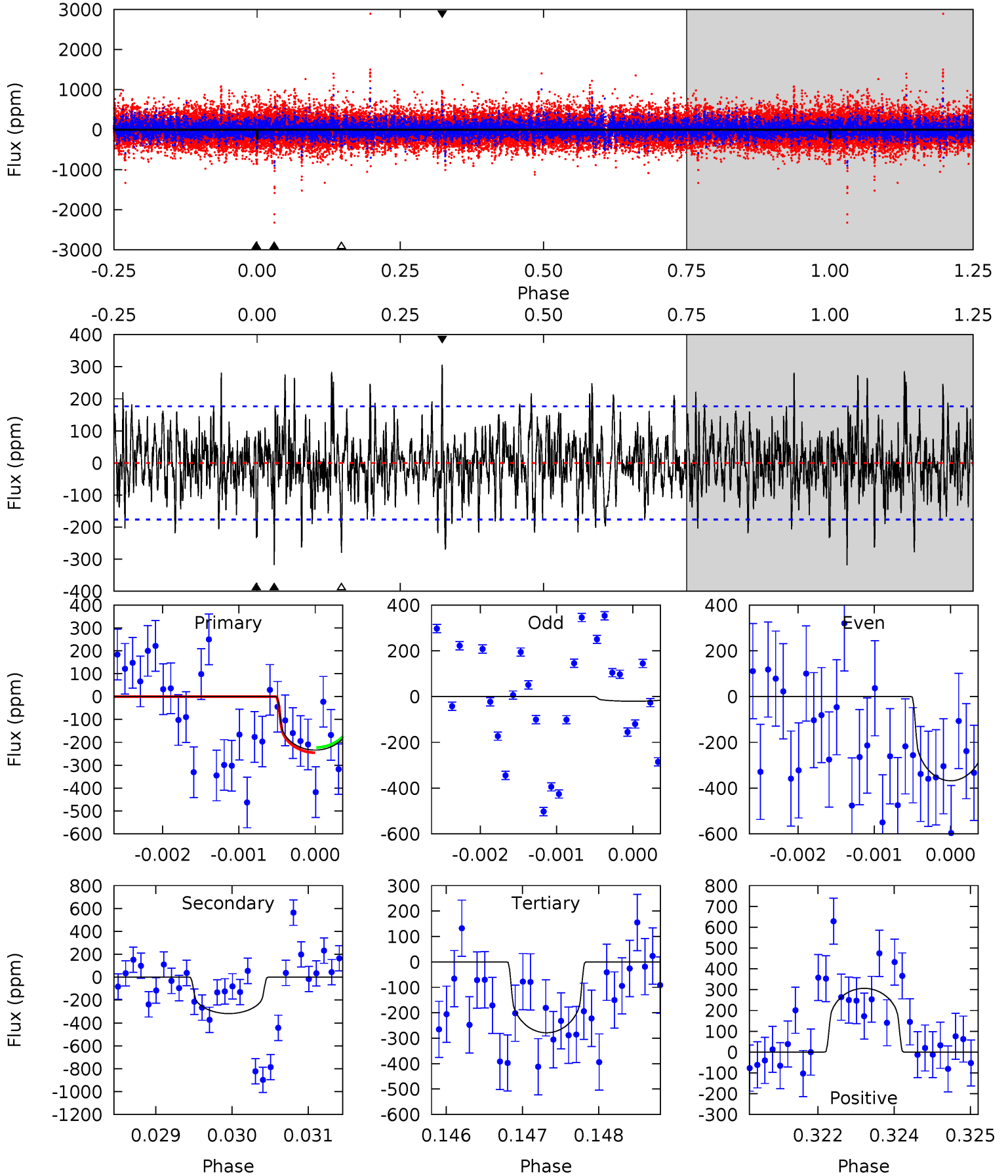
TCE 009591593-02 P=342.296186 Days  $T_0=178.527674$  (BKJD)



# DV Model-Shift Uniqueness Test

009591593-02, P = 342.253514 Days, E = 178.626619 Days

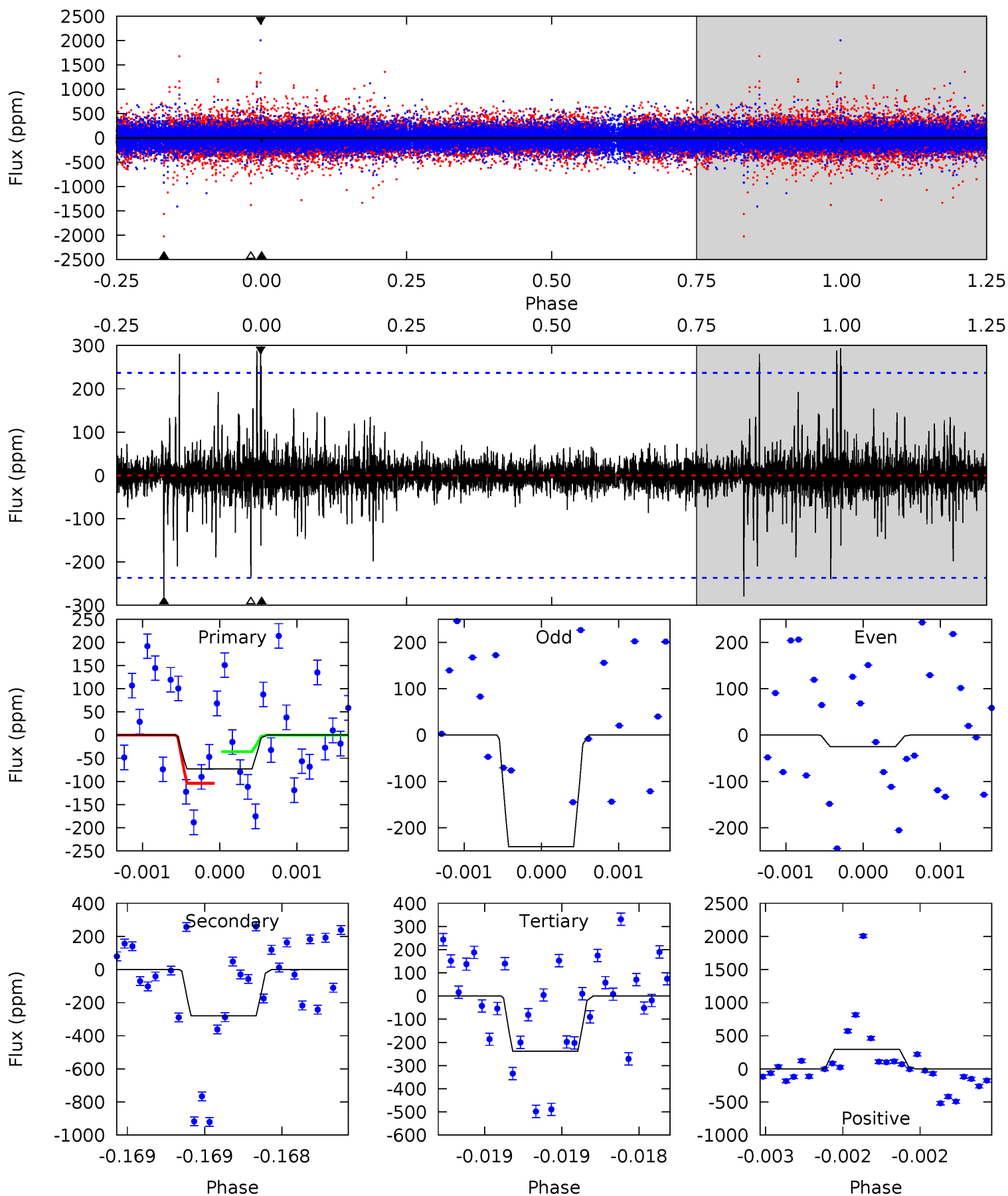
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
7.18	9.77	8.56	9.41	5.42	3.24	2.37	-1.37	-2.23	1.22	0.36	5.00	1.16	0.49	0.35



# Alt Model-Shift Uniqueness Test

009591593-02, P = 342.296186 Days, E = 178.527674 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
1.72	6.58	5.61	6.92	5.57	3.48	0.73	-3.88	-5.20	0.98	-0.33	1.93	1.29	0.51	0.81



### Stellar Parameters For KIC 009591593

	$T_{\text{eff}}(K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$4764^{+143}_{-129}$	$4.503^{+0.086}_{-0.731}$	$0.480^{+0.050}_{-0.250}$	$0.827^{+0.048}_{-0.048}$	$0.794^{+0.051}_{-0.038}$	$1.977^{+0.686}_{-1.865}$
	+3%/-3%	+2%/-16%	+10%/-52%	+6%/-6%	+6%/-5%	+35%/-94%
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 009591593-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-318 \pm 33$	$1.88^{+1.70}_{-1.14}$	$285^{+12}_{-11}$	$4528^{+2385}_{-979}$	$39323^{+202827}_{-28425}$
Alt.	$-279 \pm 42$	$1.67^{+1.69}_{-1.18}$	$285^{+11}_{-10}$	$4603^{+3864}_{-1034}$	$44993^{+433989}_{-34652}$

$T_{\text{max}}$  = 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

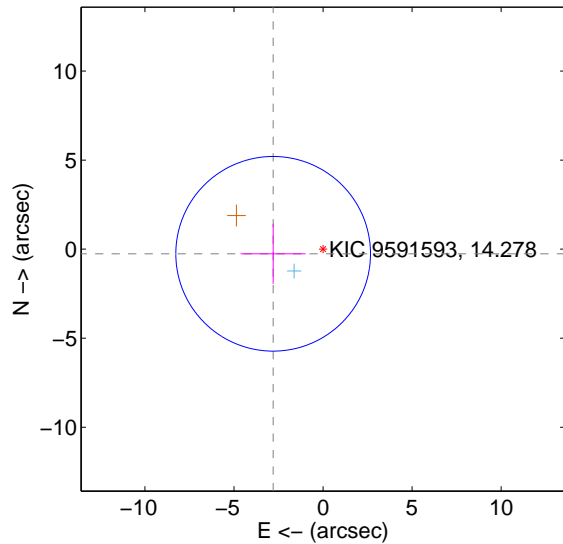
Supplemental centroid analysis for 009591593-02. Kepler magnitude: 14.28. Transit SNR 2.57

There are 1 quarters with good PRF difference image offsets

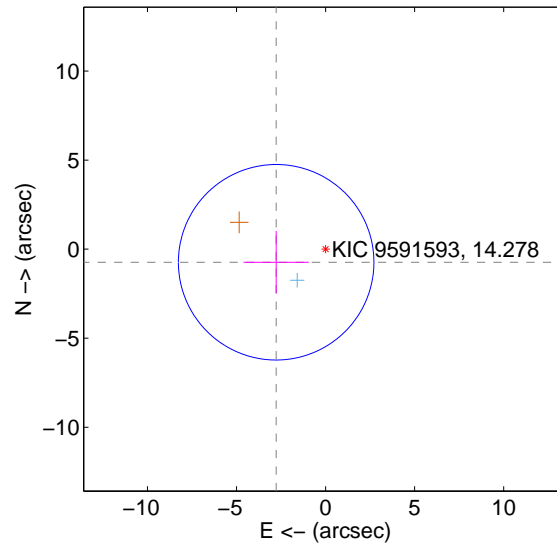
The direct PRF centroid is offset from the target star catalog position by about 0.52 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$2.811 \pm 1.821$	1.54	$2.799 \pm 1.822$	$-0.260 \pm 1.683$
PRF-fit source offset from KIC position	$2.870 \pm 1.829$	1.57	$2.774 \pm 1.834$	$-0.735 \pm 1.757$
photometric centroid source offset	$2.68 \pm 2.88$	0.93	$-0.58 \pm 2.48$	$2.62 \pm 2.90$

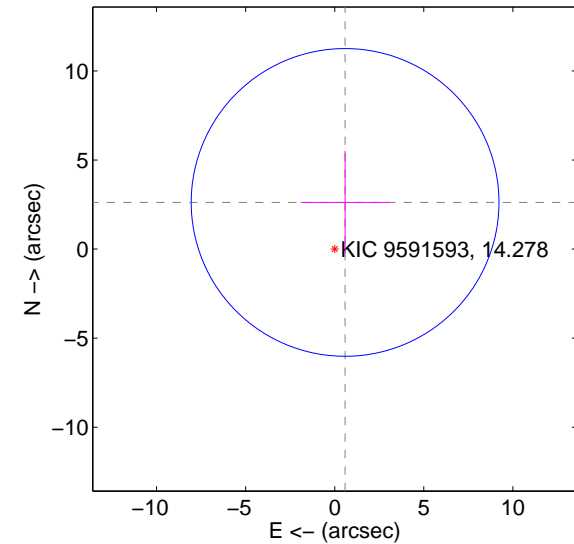
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

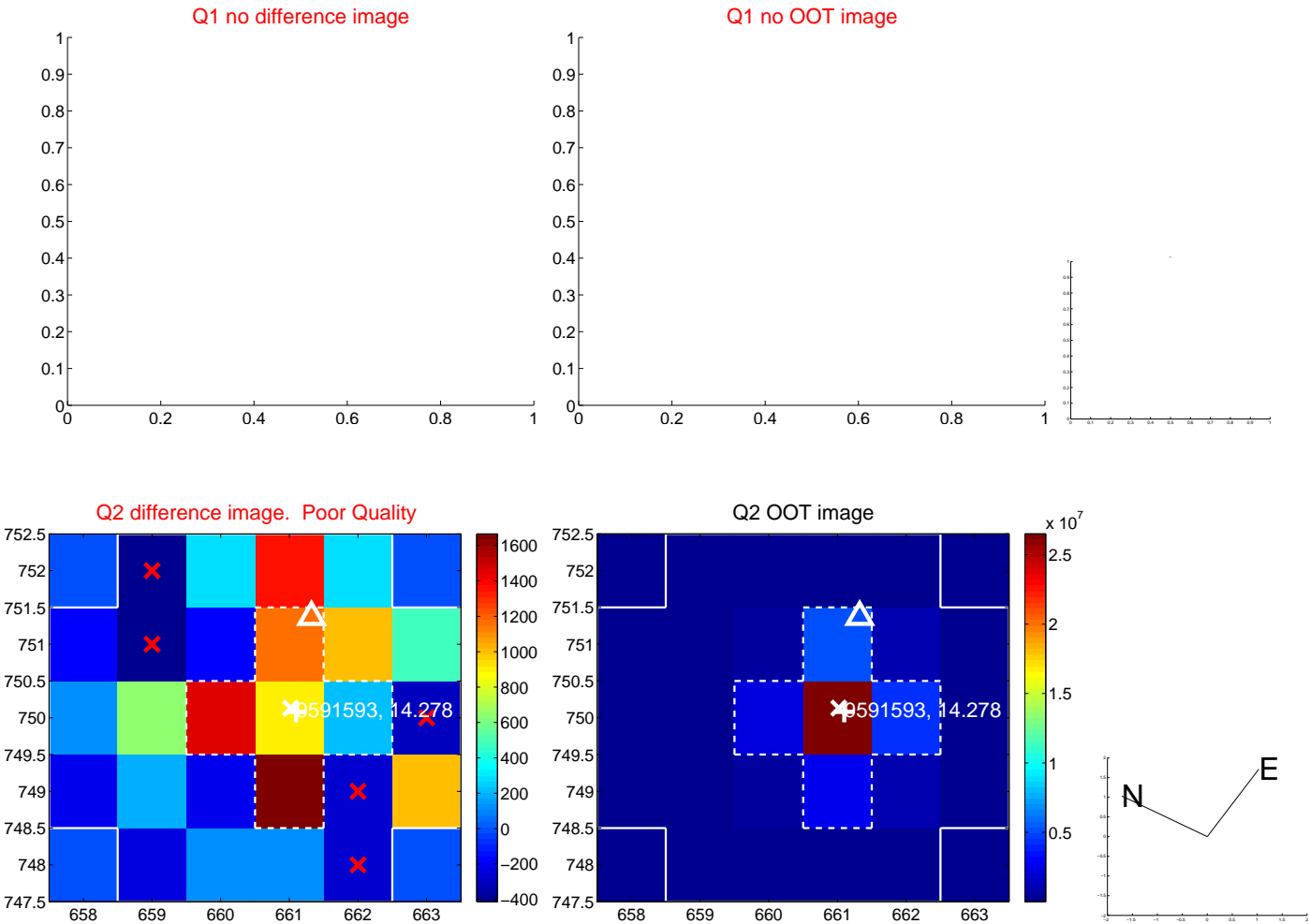


offset from photometric centroids



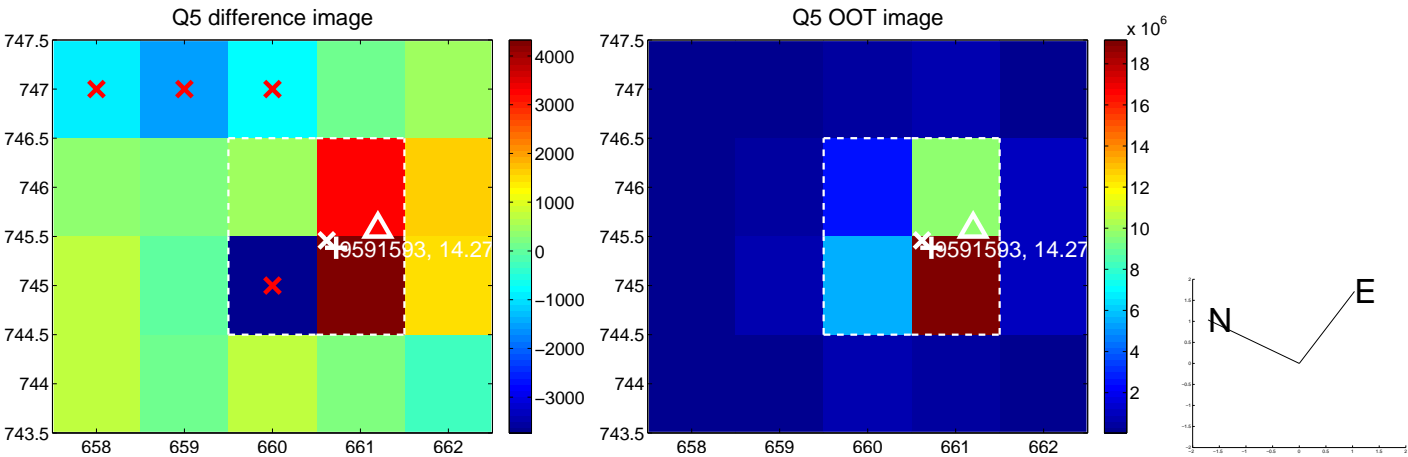
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

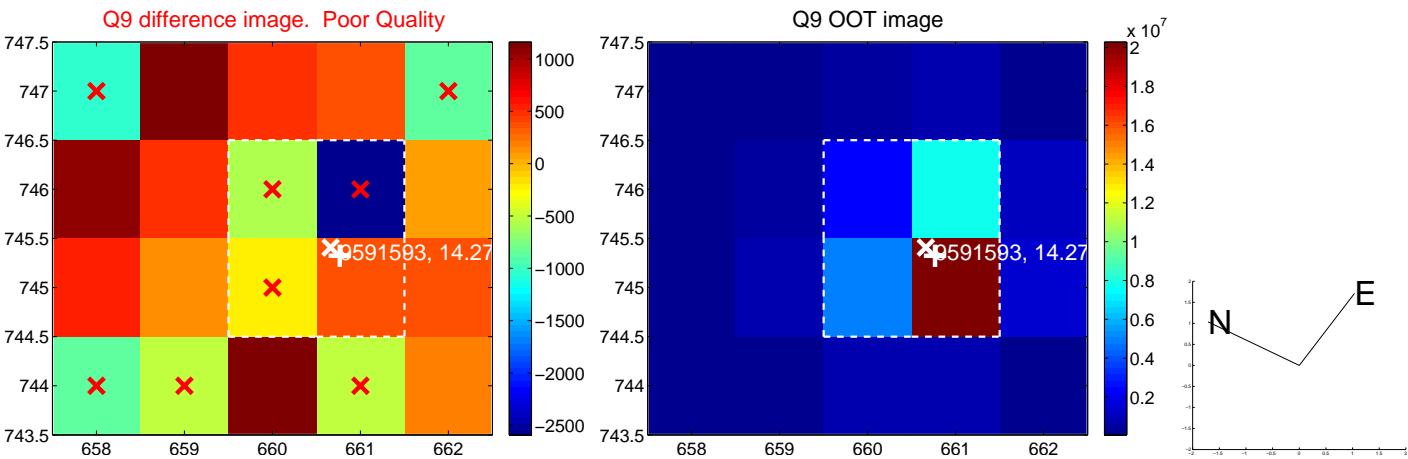




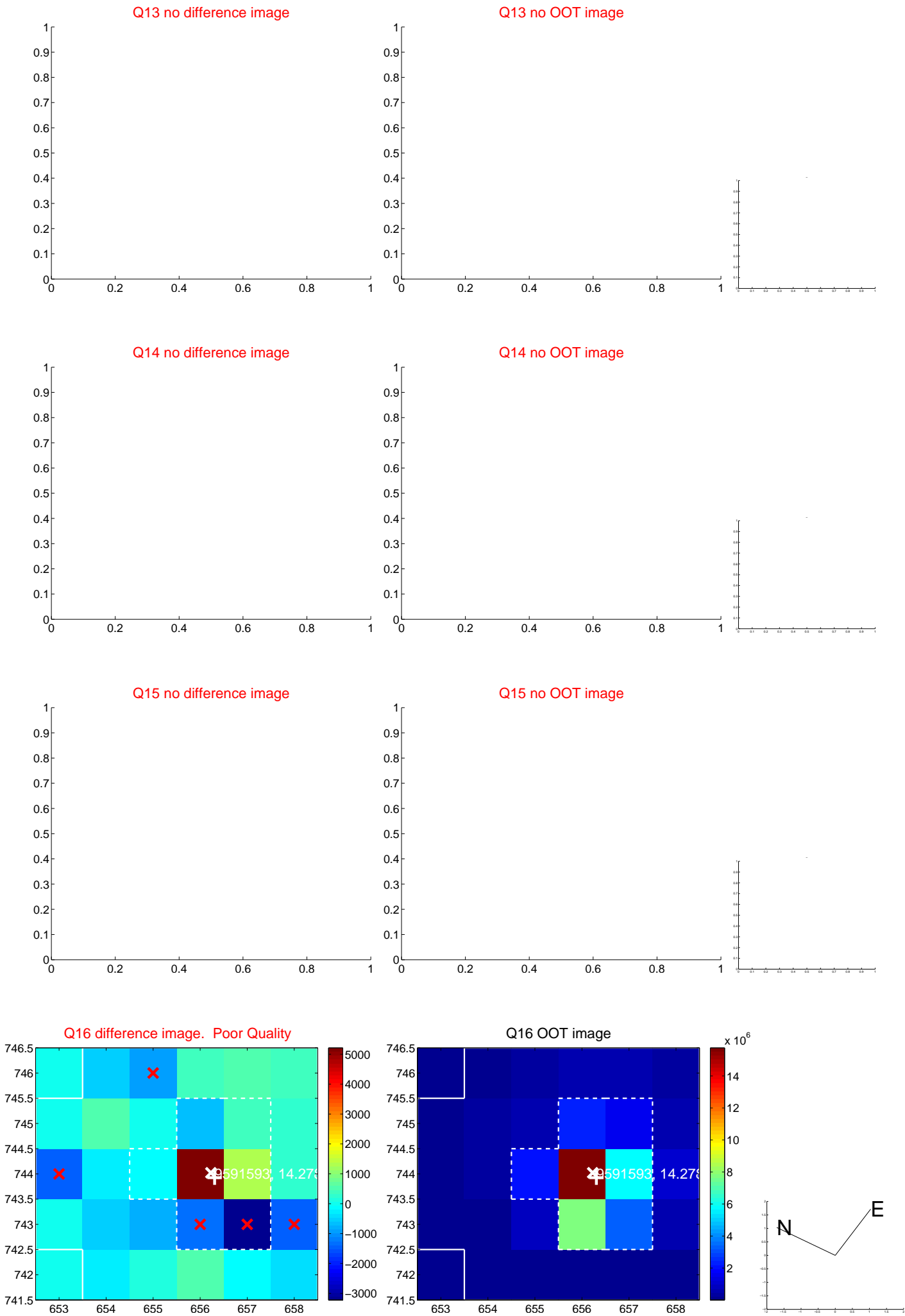
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



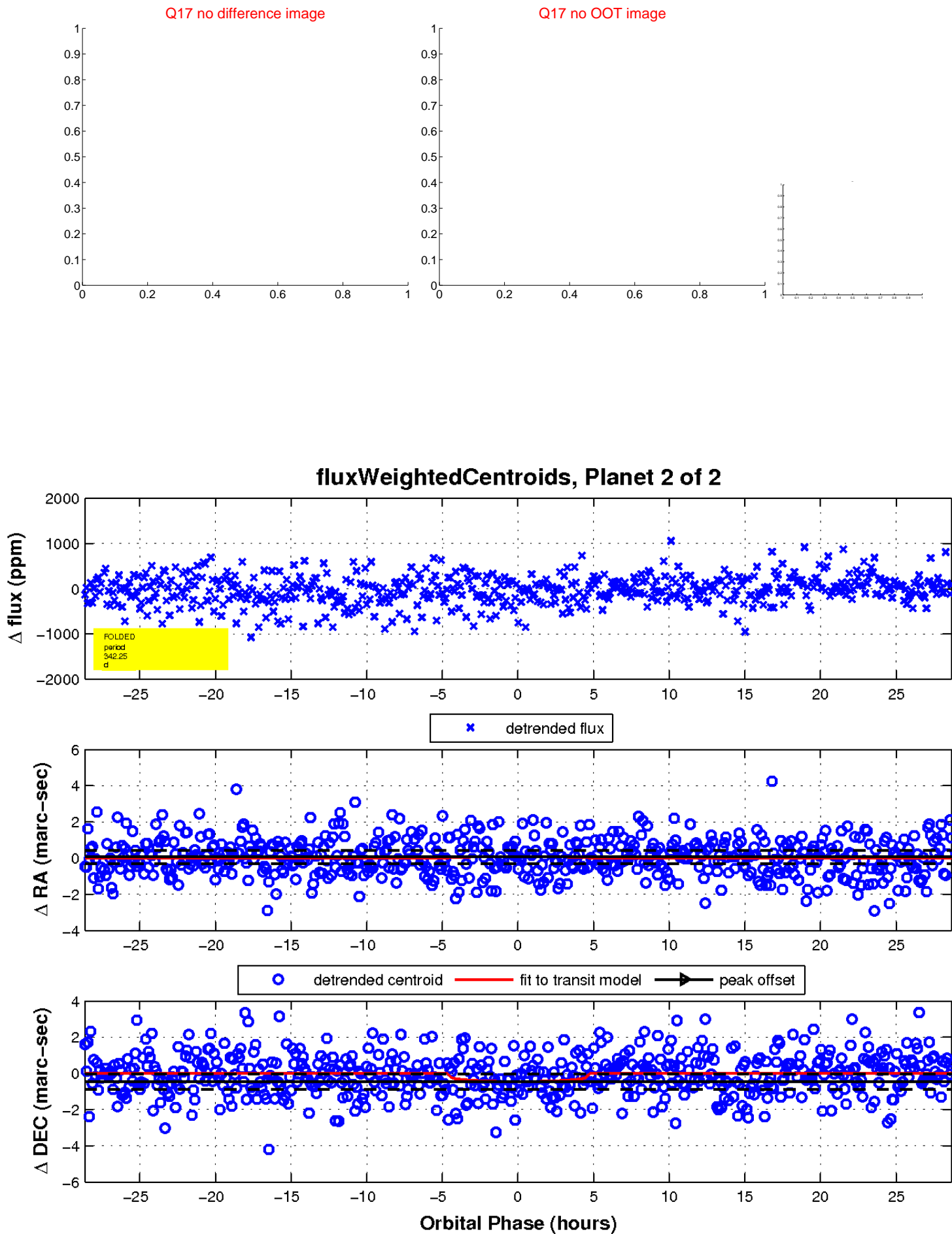
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

