

# KIC 009643210

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009643210-01	OBS	No	560.395990	434.623249	1487.3	15.160	9.9	8.1	0.22	3274	1.07	0.01
009643210-02	OBS	7952.01	3.850440	132.088570	193.6	2.027	8.1	7.7	0.22	3274	0.36	6.48

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009643210-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
009643210-02	OBS	FP	0.04	1	0	0	0	MOD_NONUNIQ_ALT

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

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

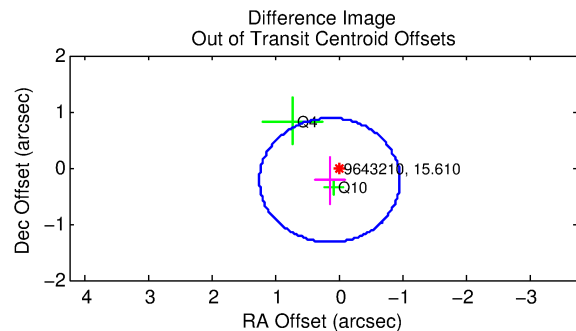
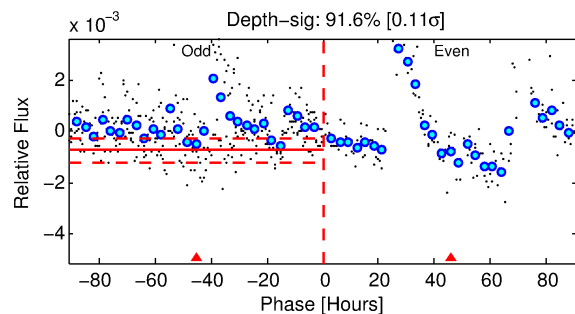
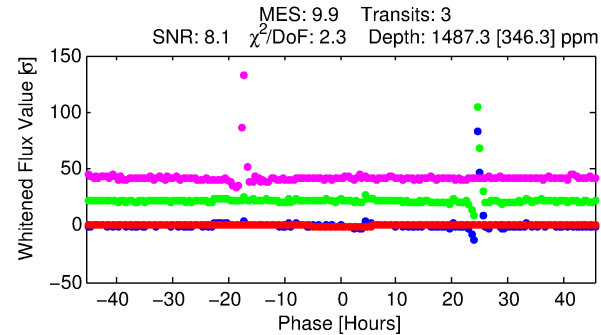
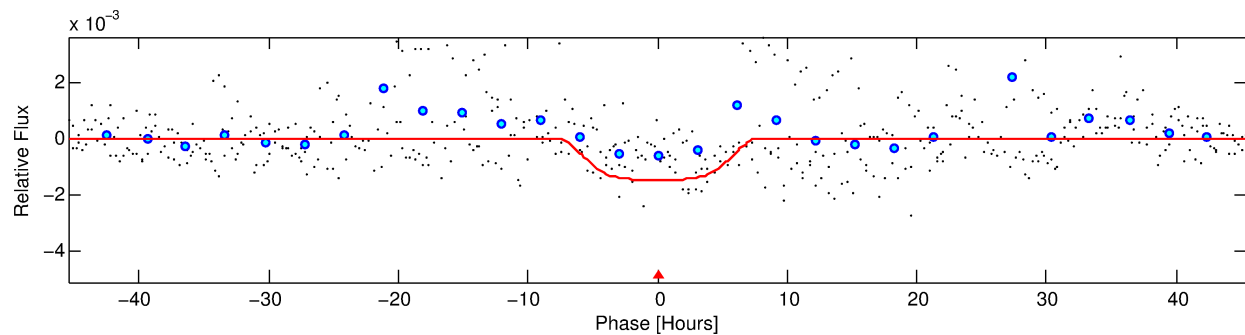
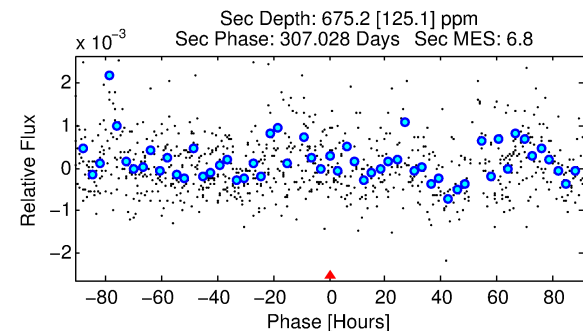
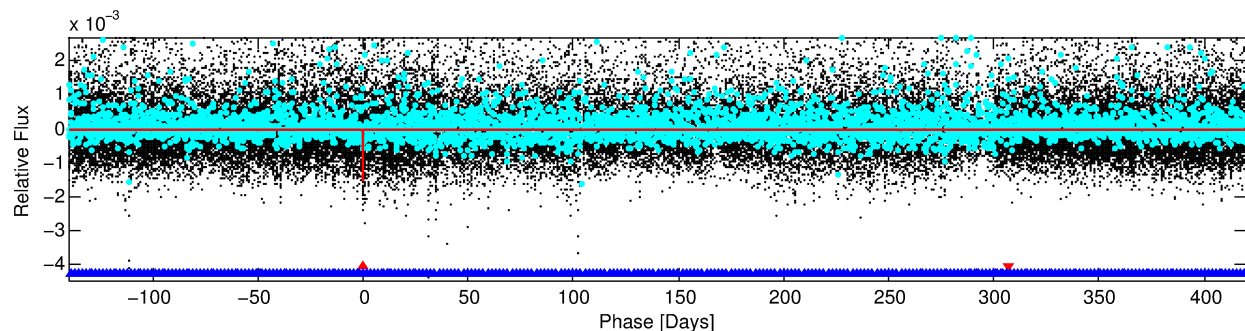
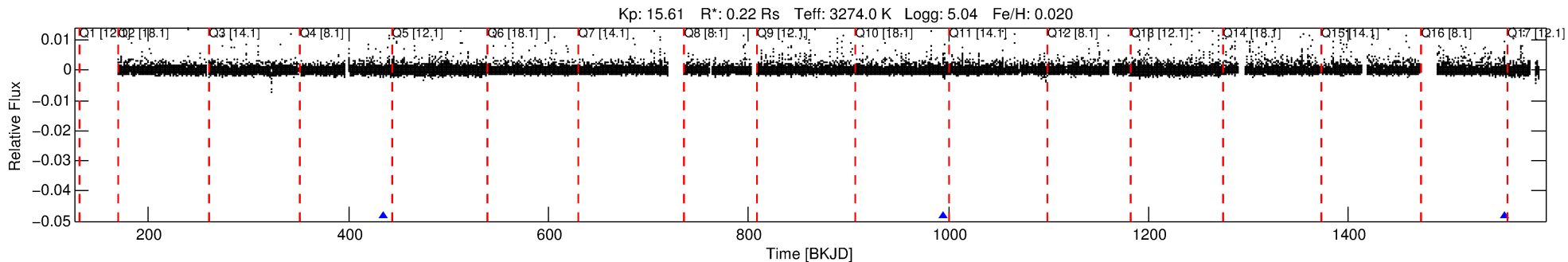
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 009643210-01

No Significant Match Found

# DV One-Page Summary

KIC: 9643210 Candidate: 1 of 2 Period: 560.396 d



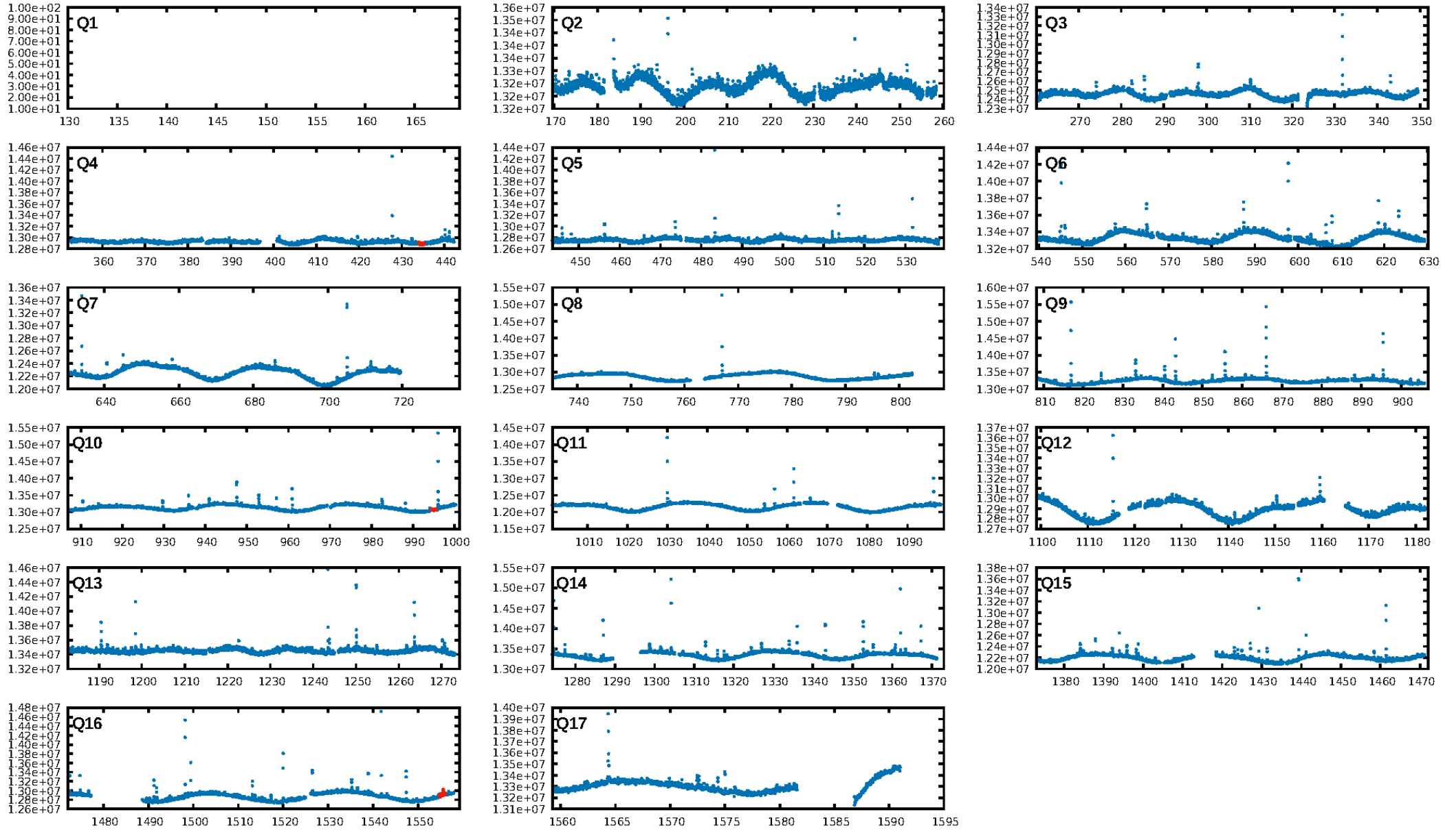
## DV Fit Results:

Period = 560.39599 [0.03604] d  
Epoch = 434.6232 [0.0492] BKJD  
Rp/R\* = 0.0436 [0.0075]  
a/R\* = 136.26 [53.35]  
b = 0.93 [0.07]  
Seff = 0.01 [0.00]  
Teq = 77 [2] K  
Rp = 1.07 [0.24] Re  
a = 0.7814 [0.0790] AU  
Ag = 199461.52 [81241.96] [2.46σ]  
Teffp = 2527 [249] K [9.85σ]

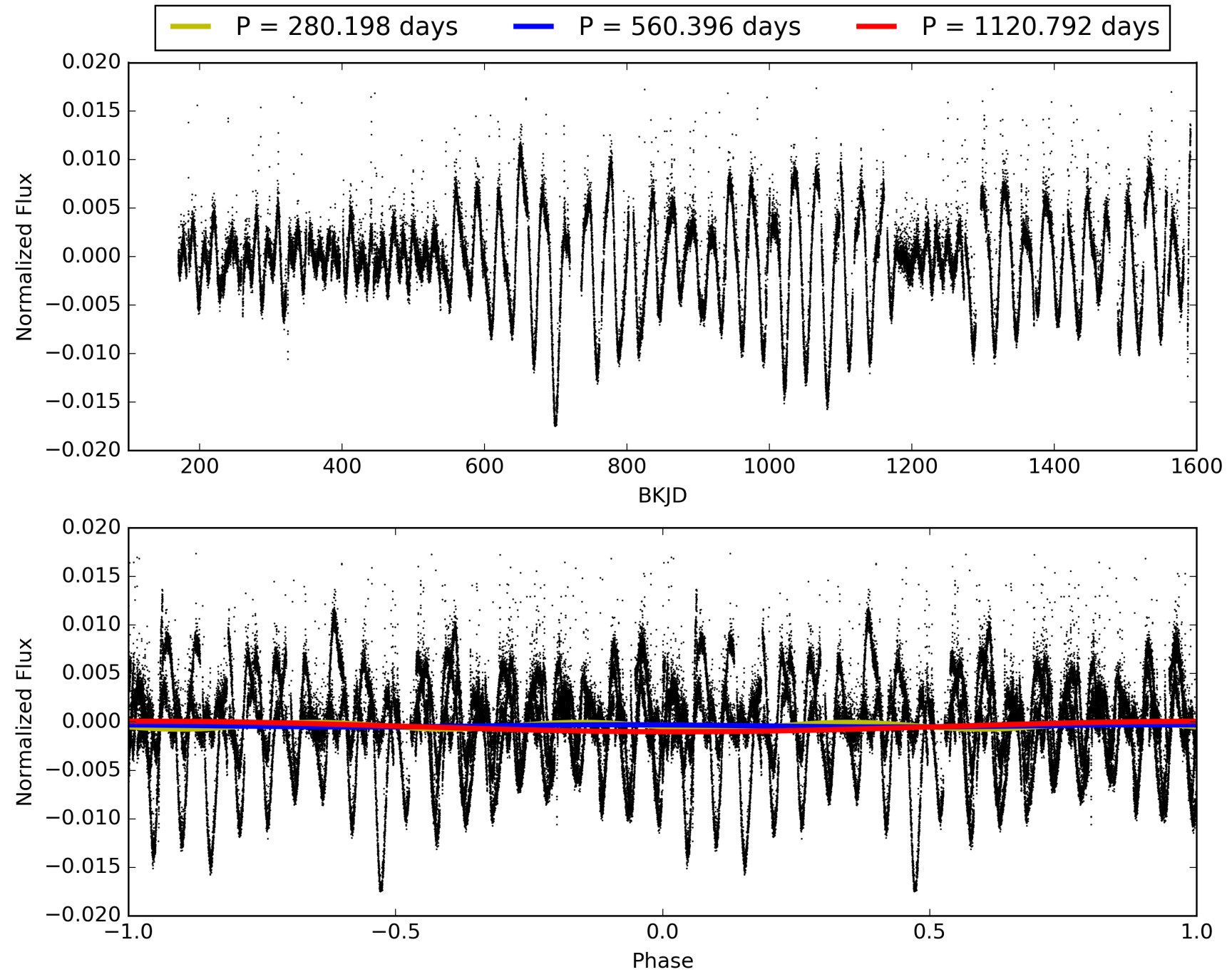
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [873.32σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 17.6%  
ModelChiSquareGof-sig: 59.8%  
**Bootstrap-pfa: 1.79e-11**  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: 3.294  
Centroid-sig: 48.9%  
Centroid-so: 0.749 arcsec [1.05σ]  
OotOffset-rm: 0.271 arcsec [0.74σ]  
KicOffset-rm: 0.622 arcsec [2.03σ]  
OotOffset-st: 1/0/1/0 [2]  
KicOffset-st: 1/0/1/0 [2]  
DiffImageQuality-fgm: 1.00 [2/2]  
DiffImageOverlap-fno: 0.67 [2/3]

# TCE 009643210-01, PDC Light Curves

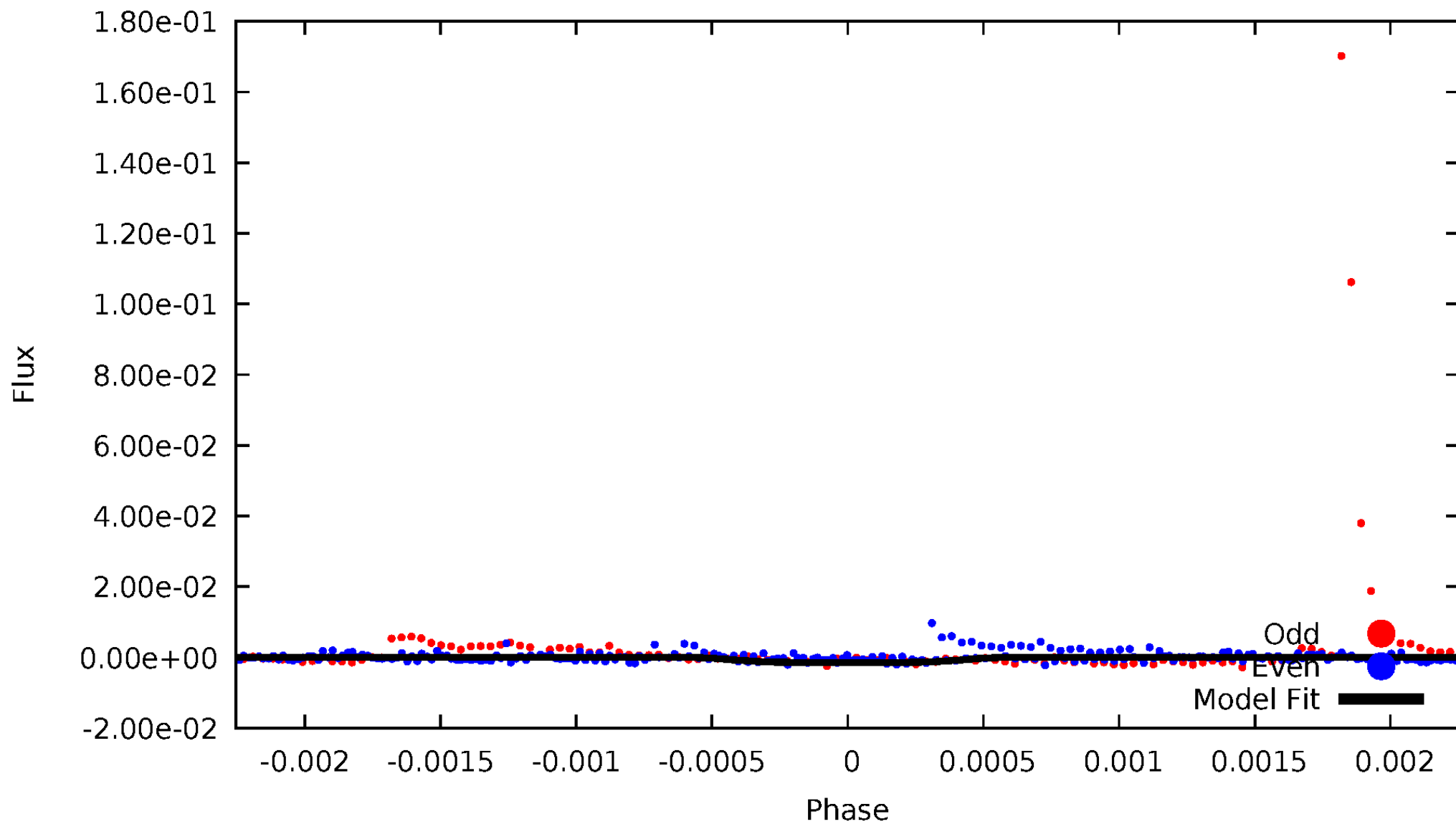


TCE 009643210-01



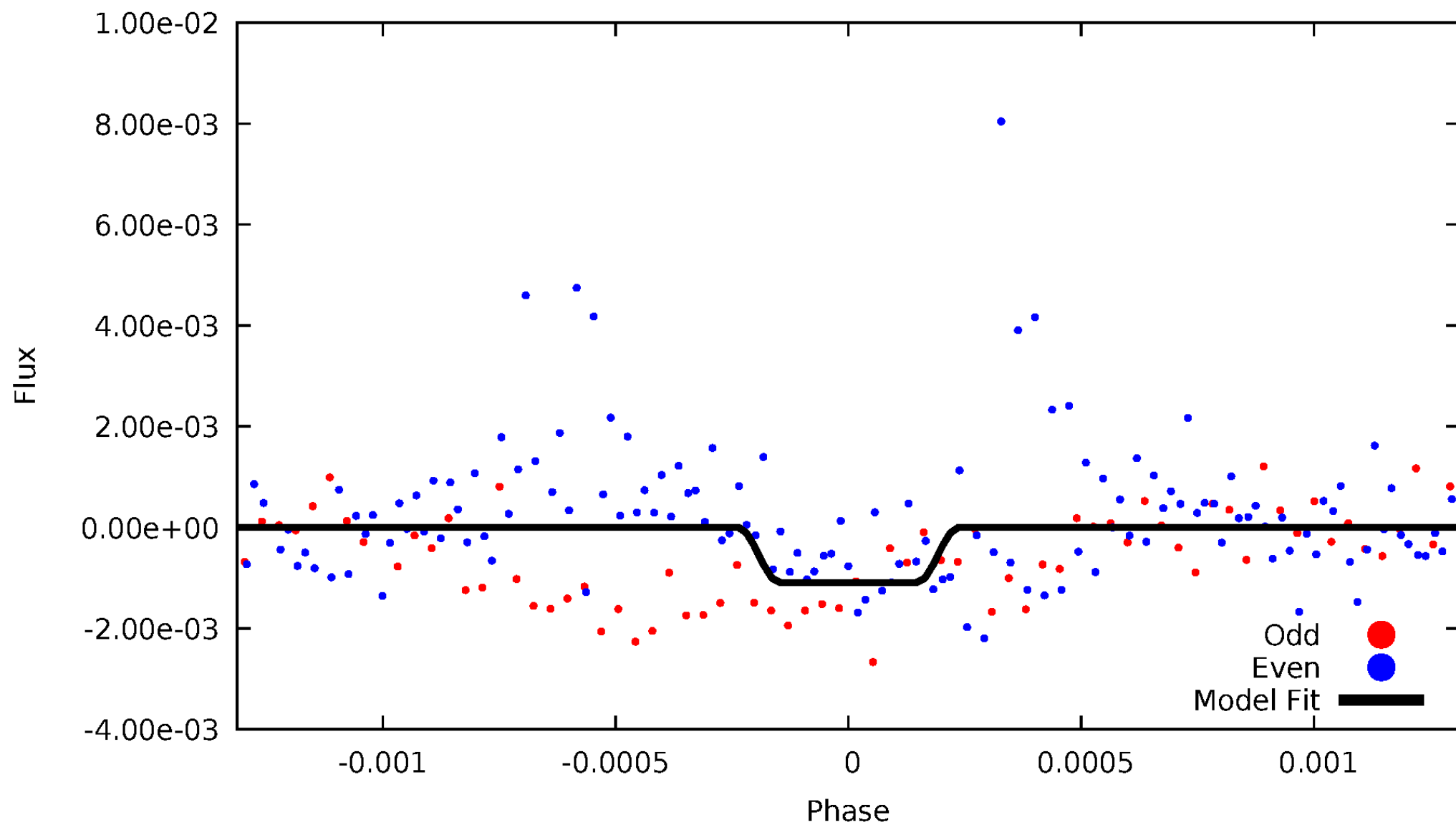
# DV Odd/Even

TCE 009643210-01



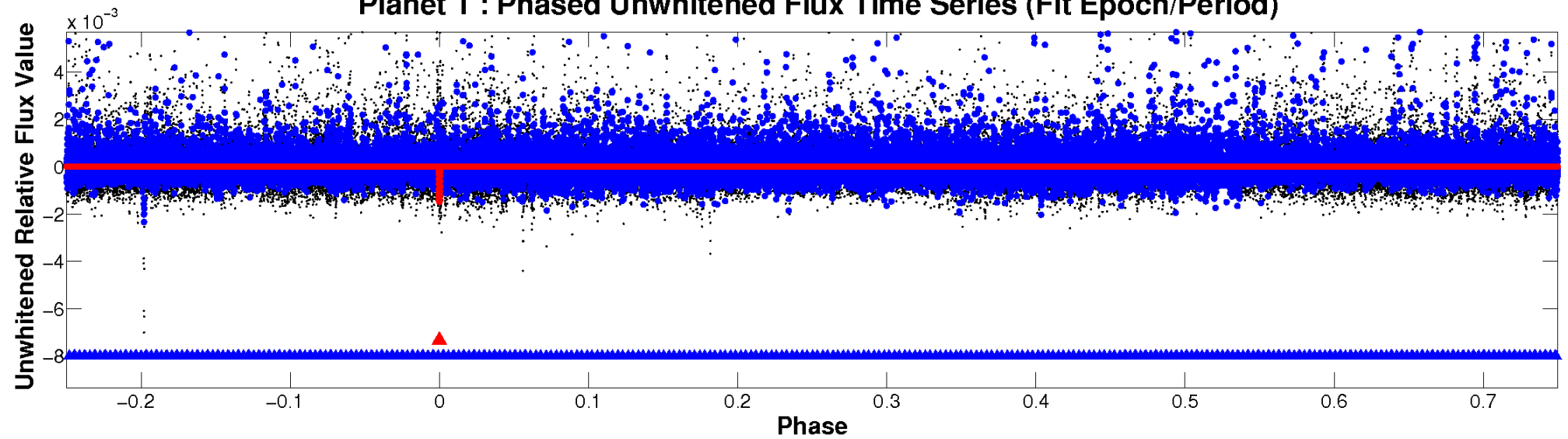
# ALT Odd/Even

TCE 009643210-01

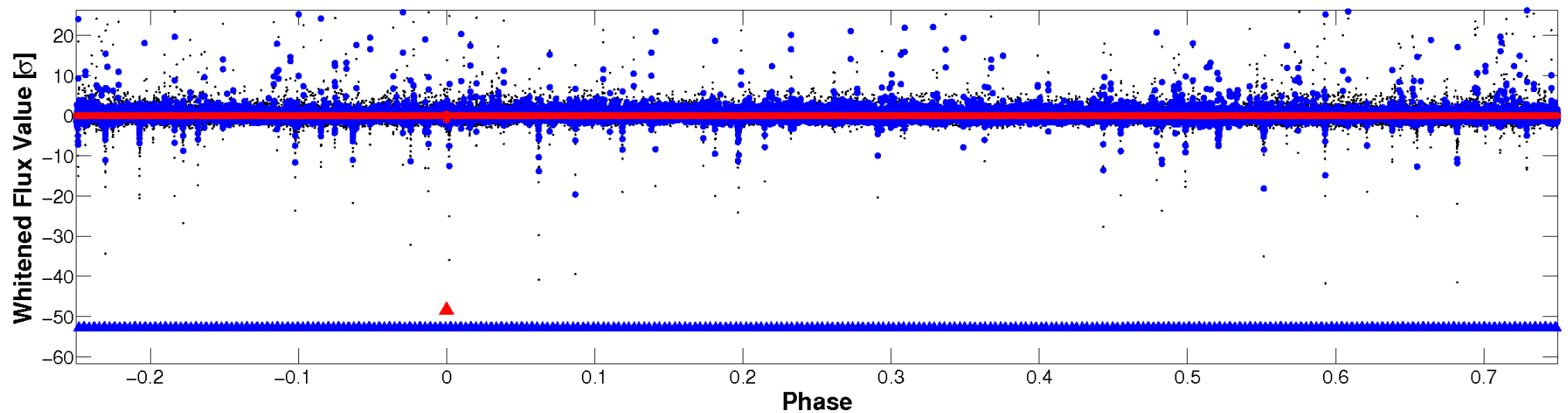


# Non-Whitened Vs. Whitened Light Curve

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

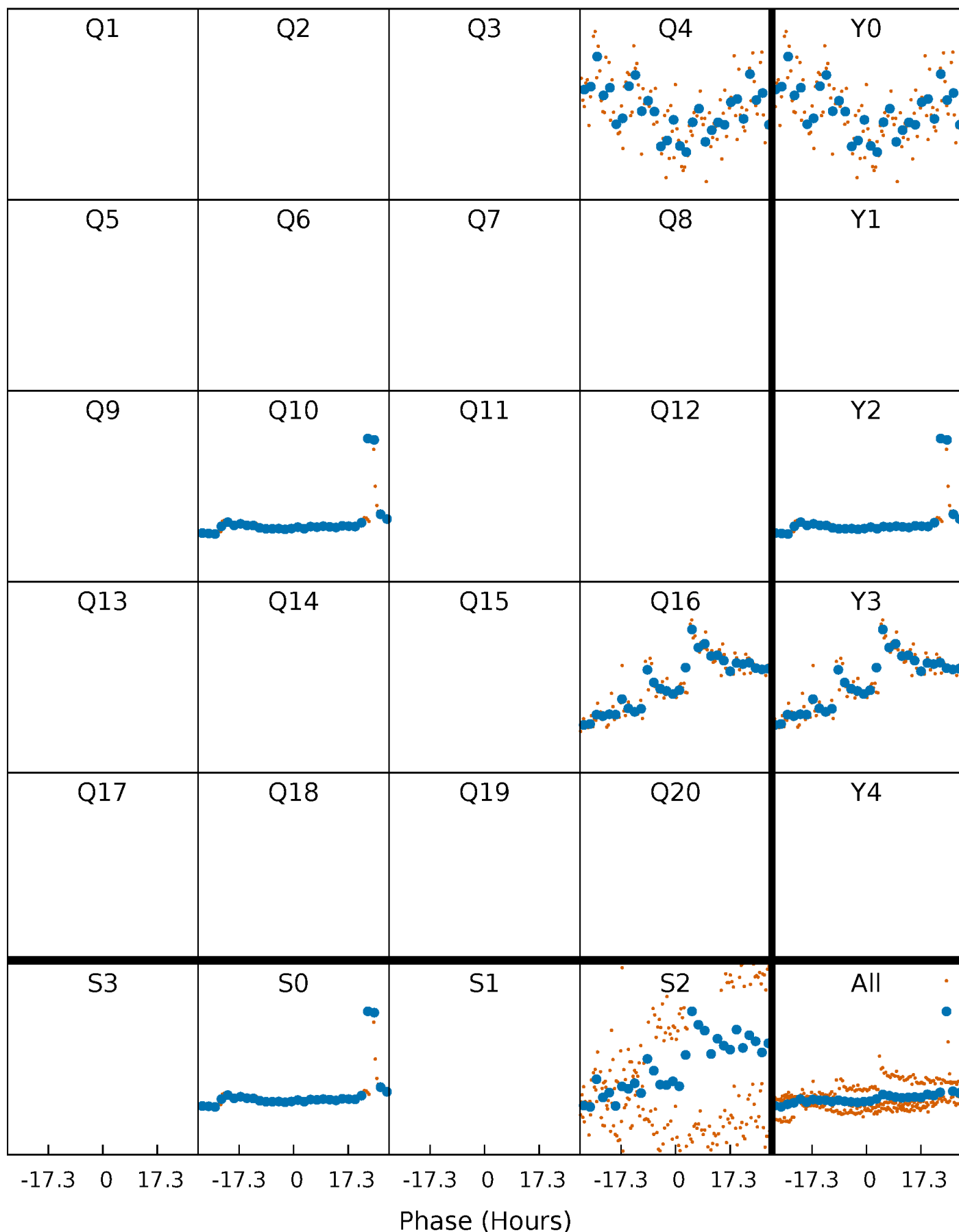


Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

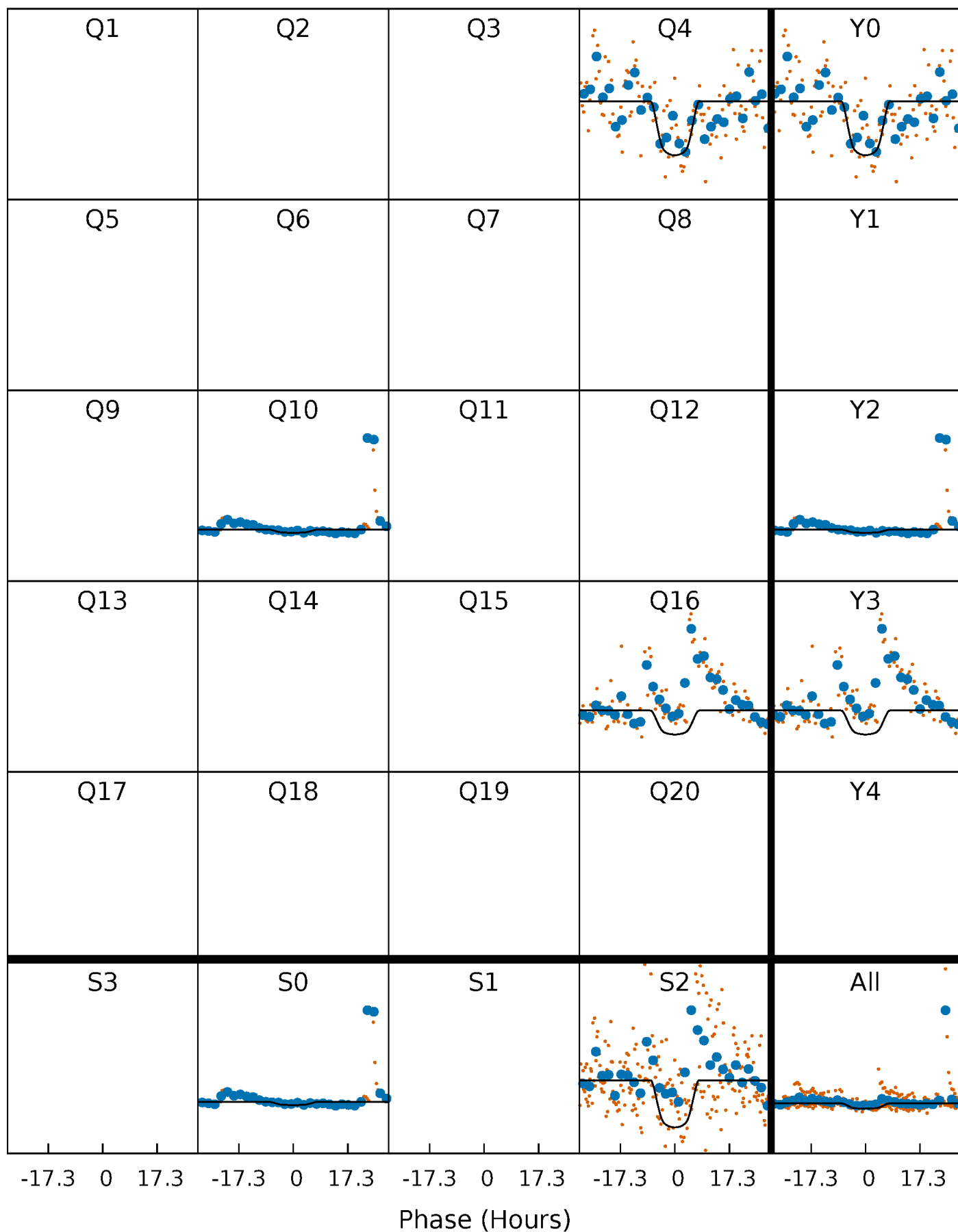
TCE 009643210-01 P=560.395990 Days  $T_0=434.623248$  (BKJD)





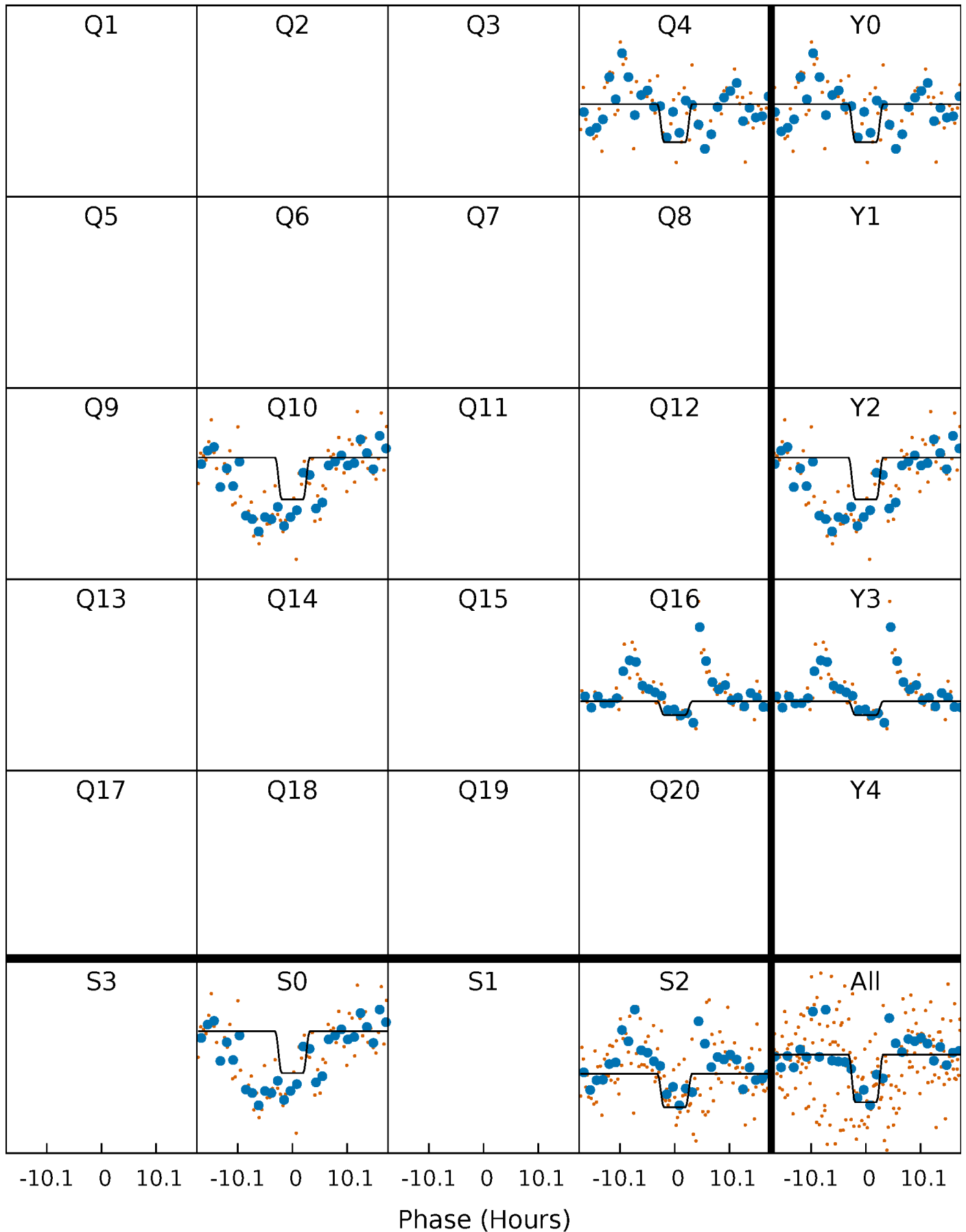
# DV Quarter-Phased Transit Curves

TCE 009643210-01 P=560.395990 Days  $T_0=434.623248$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

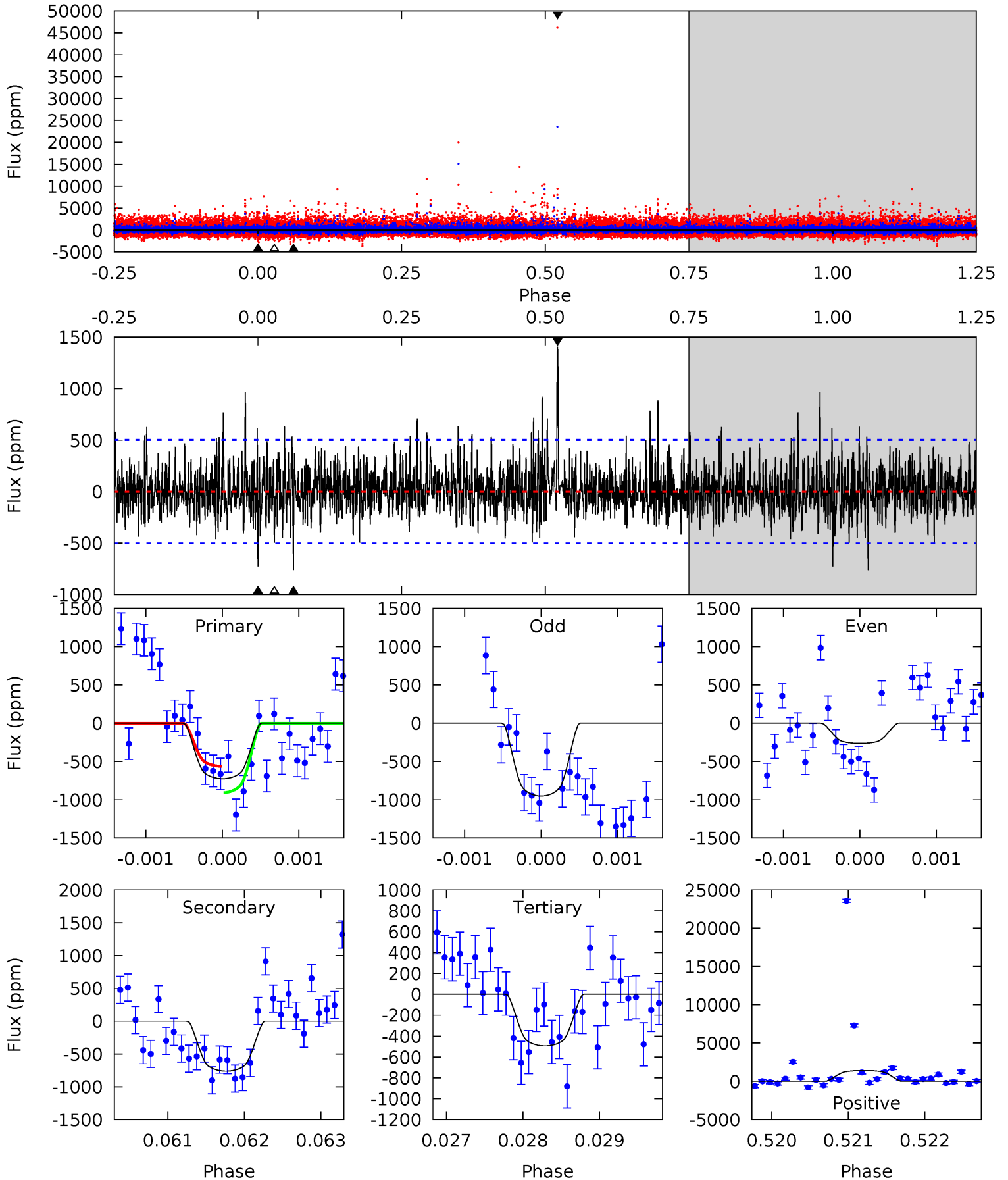
TCE 009643210-01 P=560.458495 Days  $T_0=434.488055$  (BKJD)



# DV Model-Shift Uniqueness Test

009643210-01, P = 560.395990 Days, E = 434.623248 Days

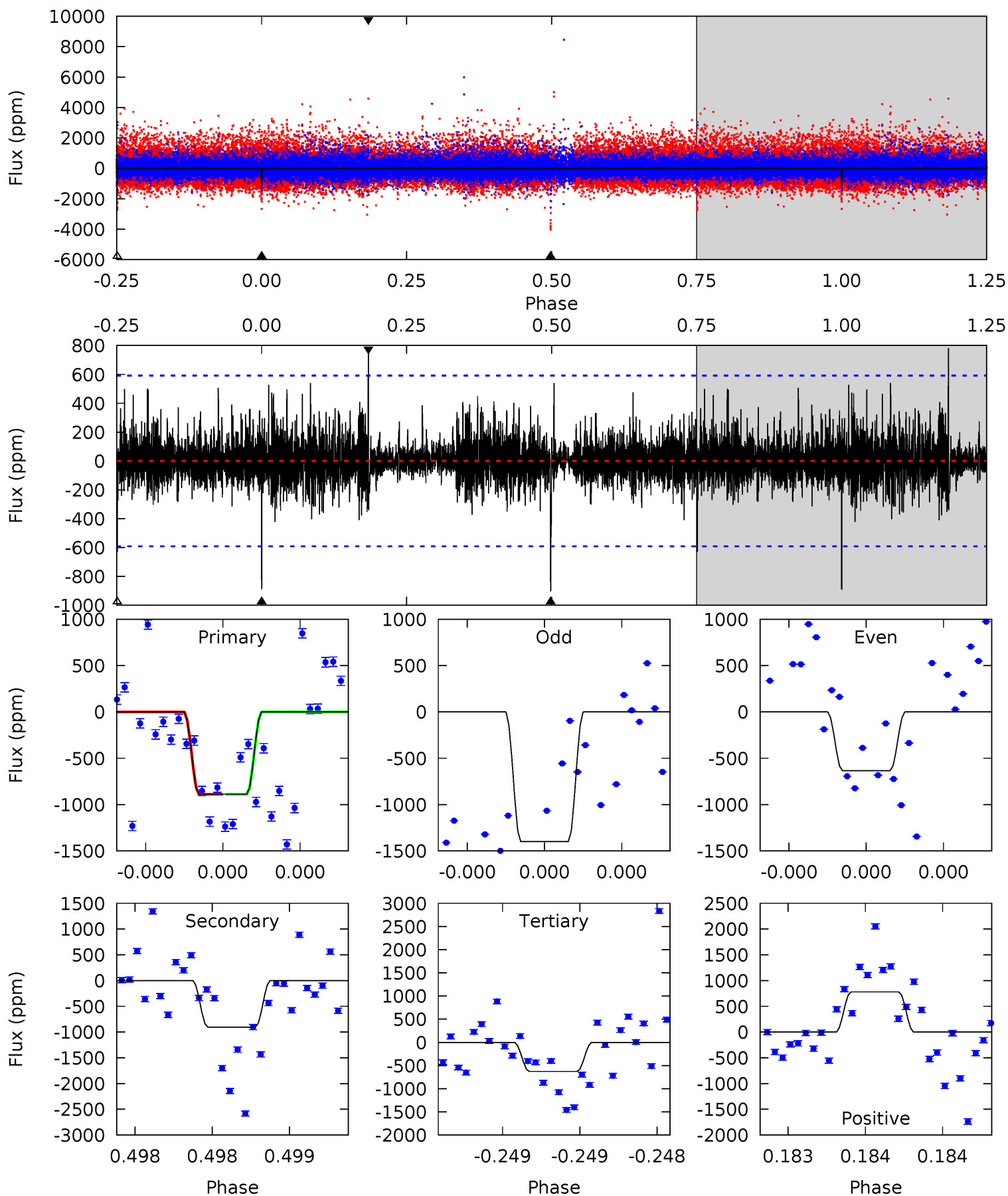
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
7.83	8.23	5.34	15.2	5.43	3.26	2.01	2.50	-7.37	2.89	-6.97	1.50	0.36	0.65	1.85



# Alt Model-Shift Uniqueness Test

009643210-01, P = 560.458495 Days, E = 434.488055 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
8.39	8.52	5.94	7.36	5.58	3.50	1.04	2.45	1.03	2.59	1.16	3.09	1.29	0.46	0.00



### Stellar Parameters For KIC 009643210

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$3274^{+42}_{-32}$	$5.044^{+0.044}_{-0.044}$	$0.020^{+0.100}_{-0.100}$	$0.224^{+0.032}_{-0.026}$	$0.202^{+0.042}_{-0.026}$	$25.440^{+6.603}_{-5.245}$
	+1%/-1%	+1%/-1%	+500%/-500%	+14%/-12%	+21%/-13%	+26%/-21%
Source	PHO2	PHO2	PHO2	DSEP		

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

### Secondary Eclipse Parameters for KIC 009643210-01 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-762 \pm 93$	$1.06^{+0.22}_{-0.21}$	$108^{+3}_{-3}$	$2883^{+168}_{-138}$	$226407^{+126411}_{-71091}$
Alt.	$-903 \pm 106$	$0.81^{+0.20}_{-0.18}$	$108^{+3}_{-2}$	$3191^{+264}_{-200}$	$468033^{+334589}_{-167941}$

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

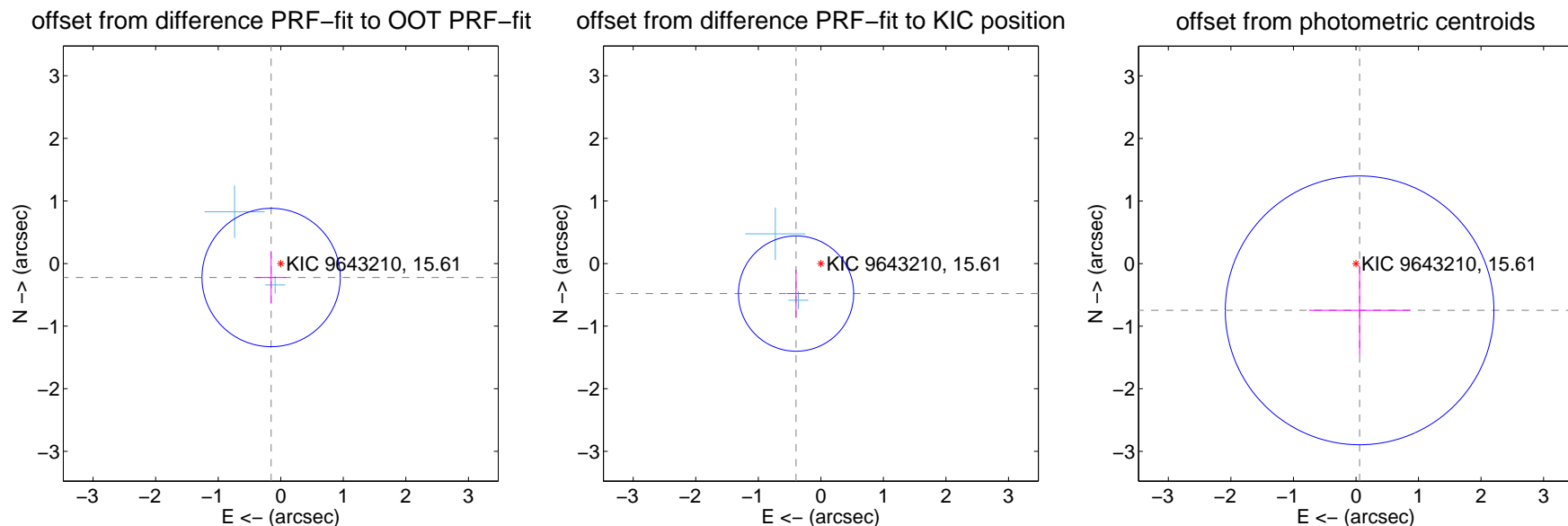
## DV Centroid Data

Supplemental centroid analysis for 009643210-01. Kepler magnitude: 15.61. Transit SNR 8.12

There are 2 quarters with good PRF difference image offsets

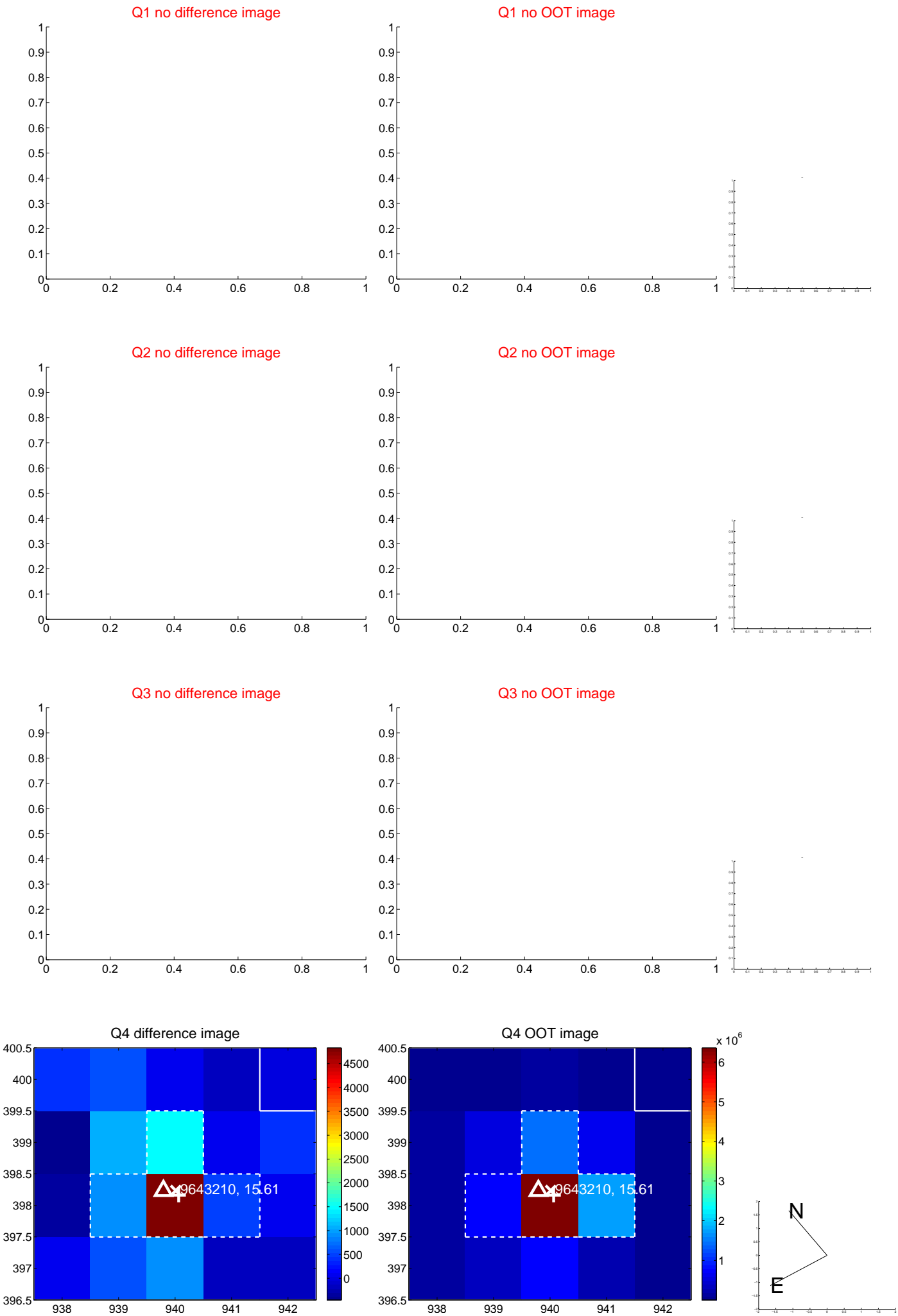
The direct PRF centroid is offset from the target star catalog position by about 0.37 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.271 \pm 0.368$	0.74	$0.154 \pm 0.236$	$-0.223 \pm 0.417$
PRF-fit source offset from KIC position	$0.622 \pm 0.307$	2.03	$0.396 \pm 0.145$	$-0.480 \pm 0.380$
photometric centroid source offset	$0.75 \pm 0.72$	1.05	$-0.06 \pm 0.81$	$-0.75 \pm 0.72$



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 ×: KIC target position; +: OOT centroid; △: difference centroid. red ×: large negative pixel value.

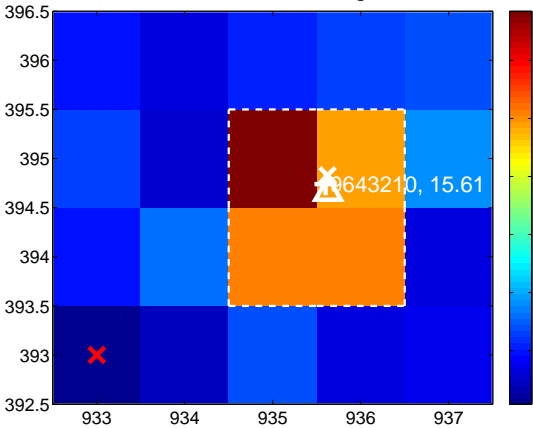
Q9 no difference image



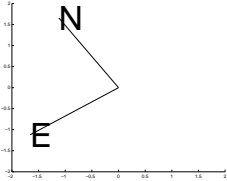
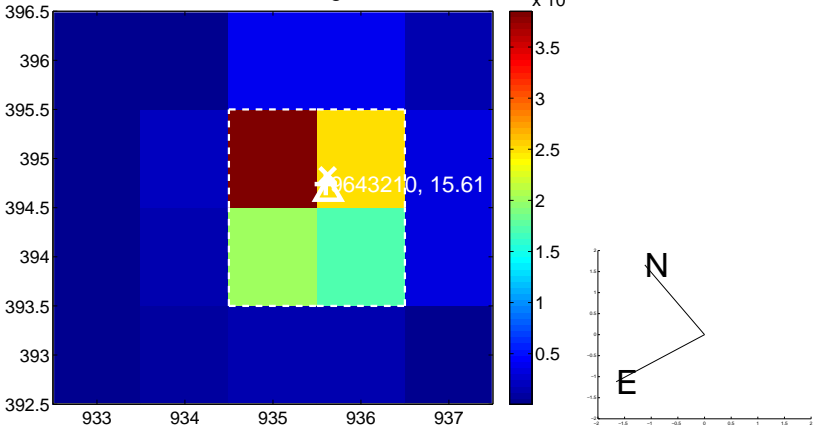
Q9 no OOT image



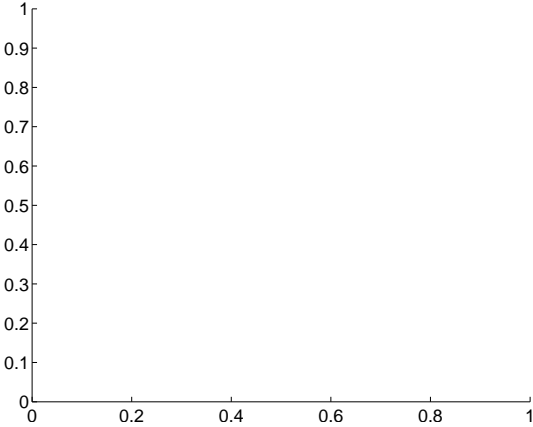
Q10 difference image



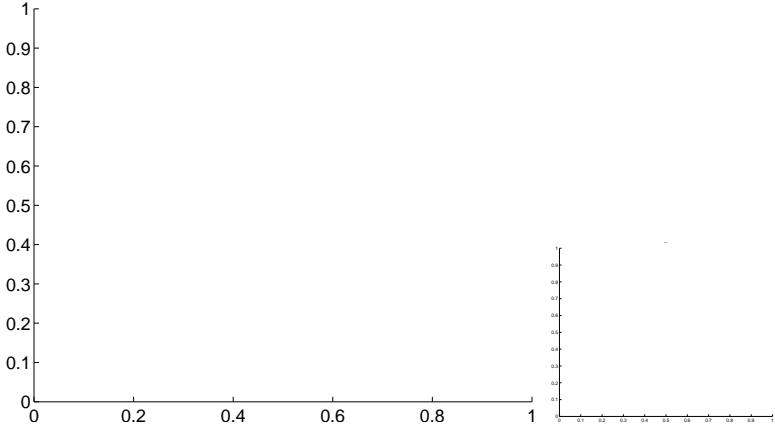
Q10 OOT image



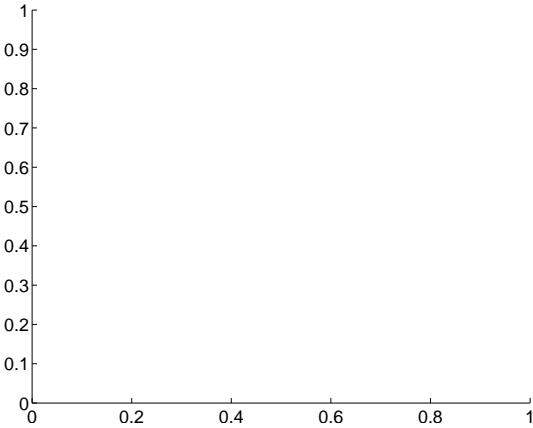
Q11 no difference image



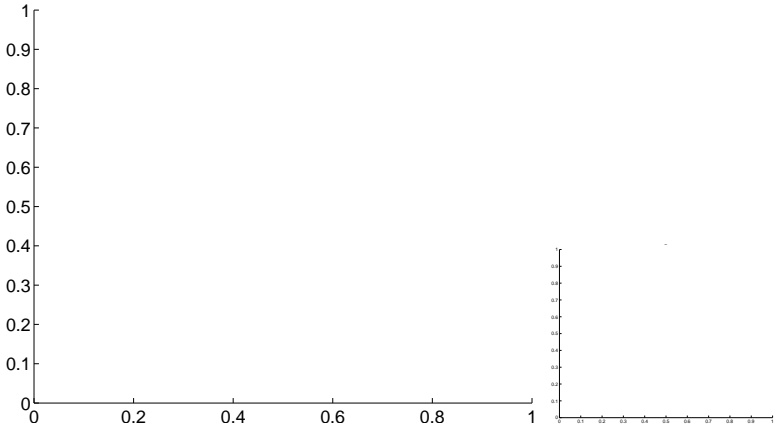
Q11 no OOT image



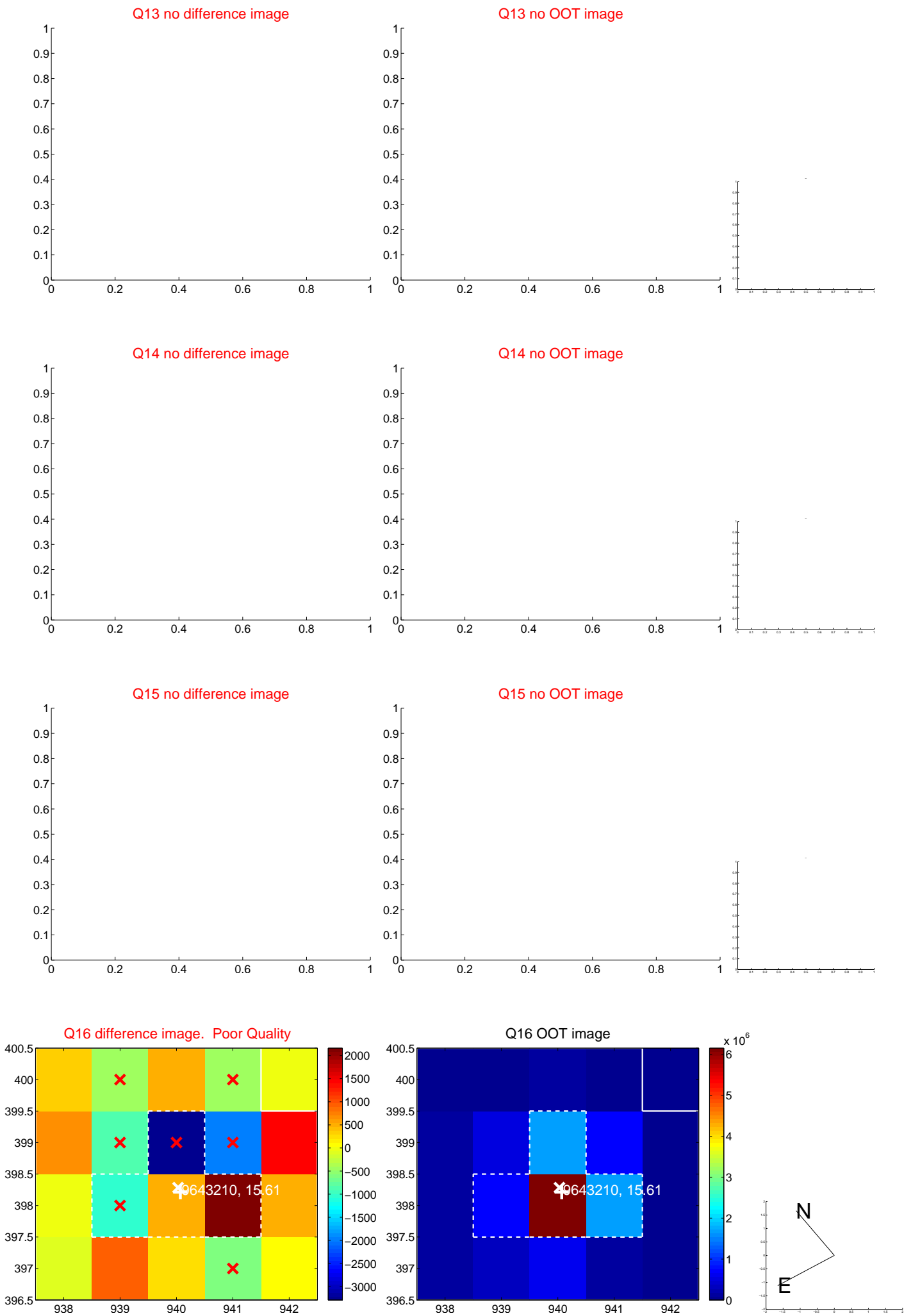
Q12 no difference image



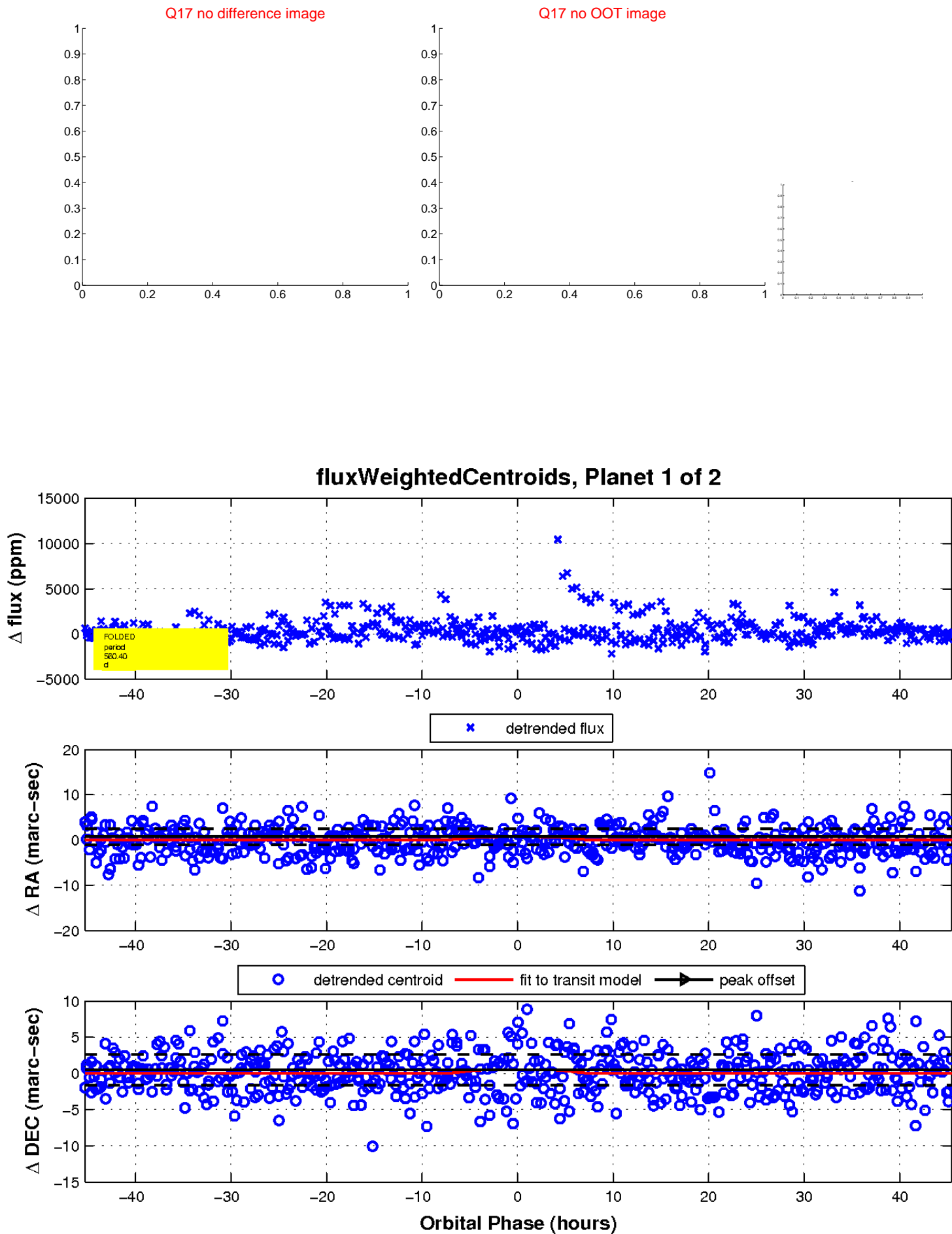
Q12 no OOT image



white ×: KIC target position; +: OOT centroid; △: difference centroid. red ✕: large negative pixel value.

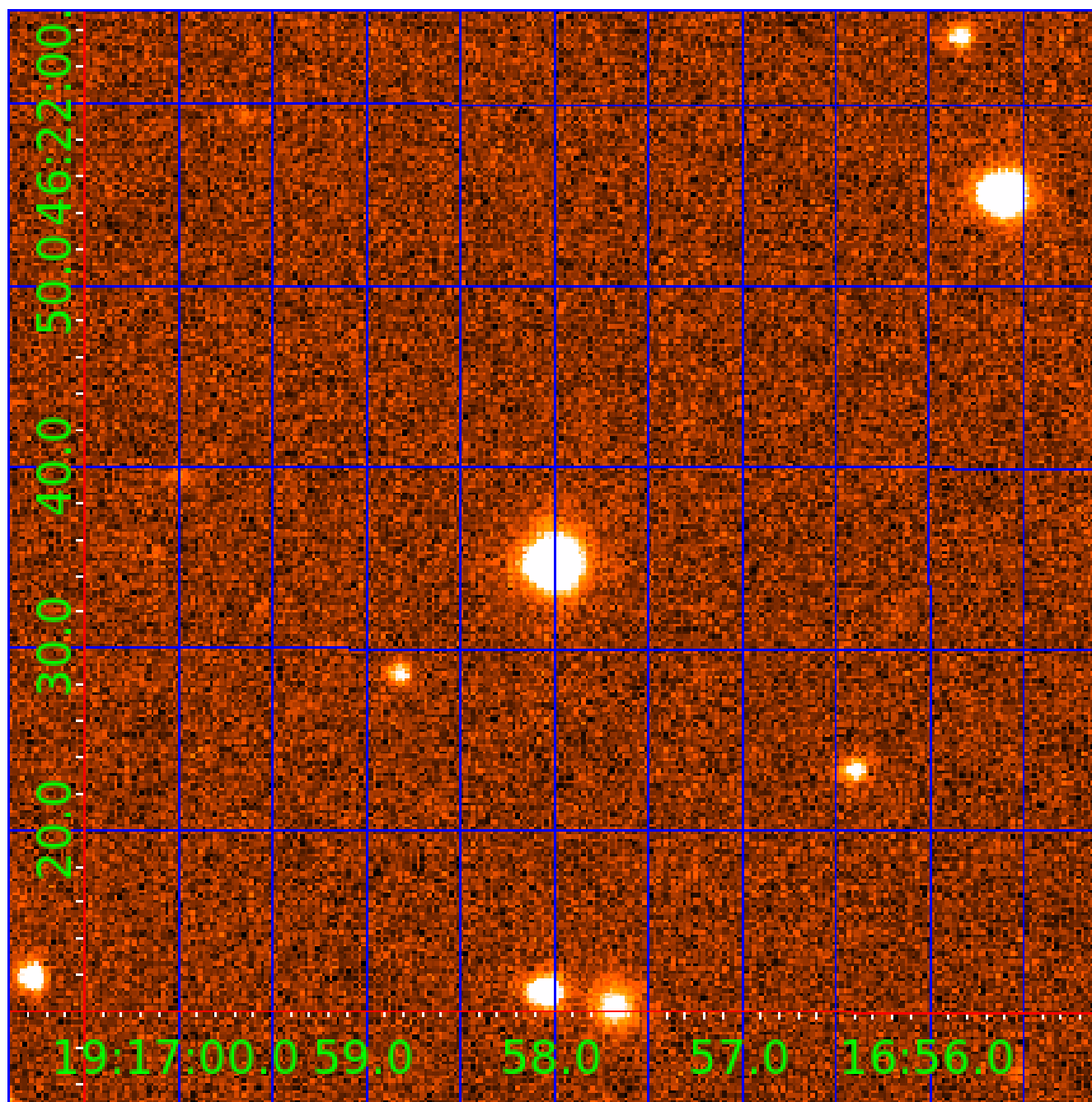


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 009643210

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009643210-01	OBS	No	560.395990	434.623249	1487.3	15.160	9.9	8.1	0.22	3274	1.07	0.01
009643210-02	OBS	7952.01	3.850440	132.088570	193.6	2.027	8.1	7.7	0.22	3274	0.36	6.48

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009643210-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT— MOD_POS_ALT—CENT_FEW_DIFFS
009643210-02	OBS	FP	0.04	1	0	0	0	MOD_NONUNIQ_ALT

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

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

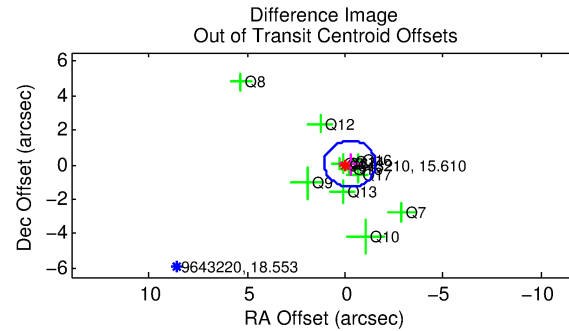
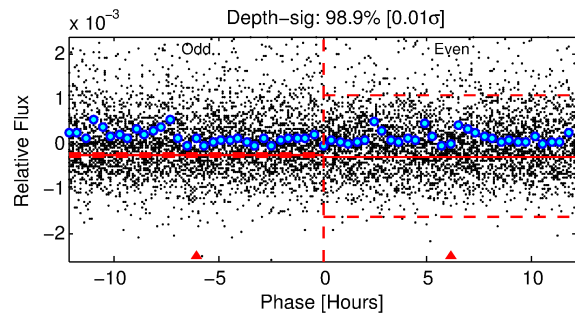
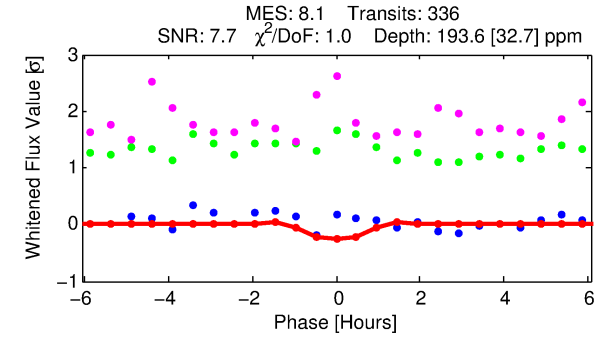
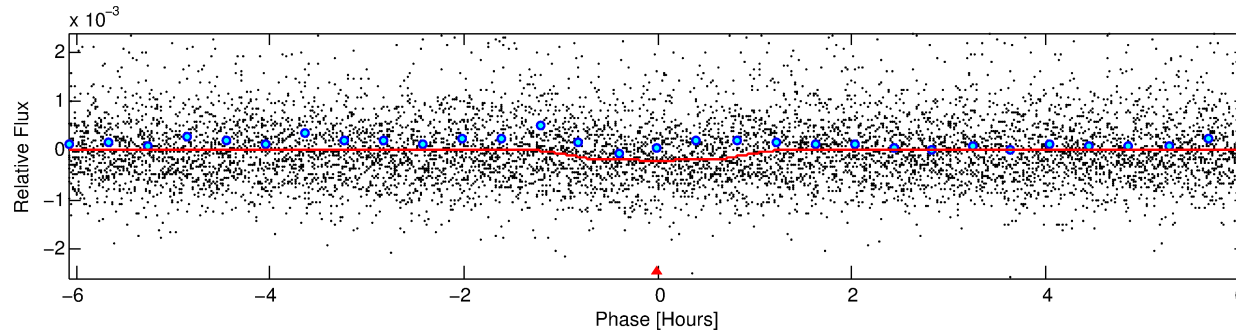
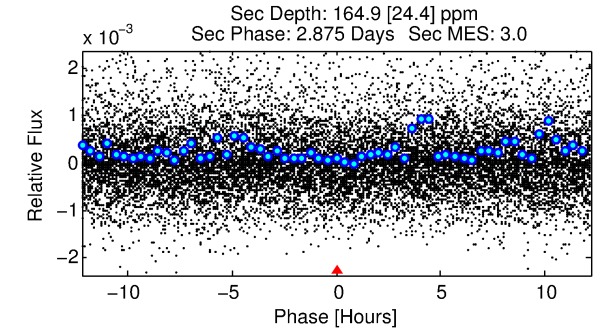
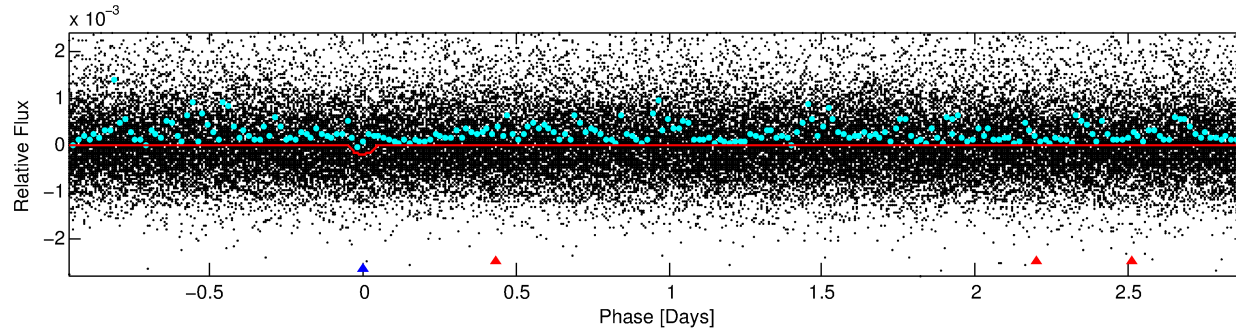
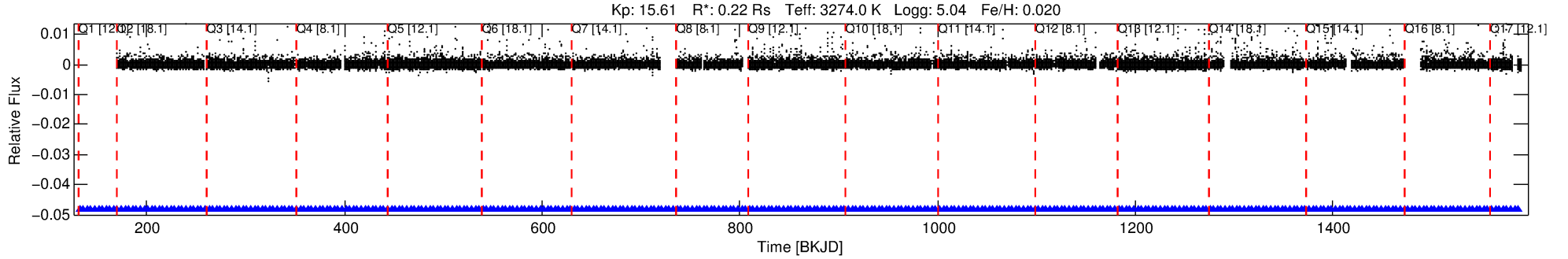
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 009643210-02

No Significant Match Found

# DV One-Page Summary

KIC: 9643210 Candidate: 2 of 2 Period: 3.850 d



## DV Fit Results:

Period = 3.85044 [0.00003] d  
Epoch = 132.0886 [0.0043] BKJD  
Rp/R\* = 0.0147 [0.0183]  
a/R\* = 7.96 [42.09]  
b = 0.86 [1.70]  
Seff = 6.48 [0.83]  
Teq = 407 [13] K  
Rp = 0.36 [0.45] Re  
a = 0.0282 [0.0029] AU  
Ag = 563.77 [1413.14] [0.40σ]  
Teffp = 3065 [1919] K [1.39σ]

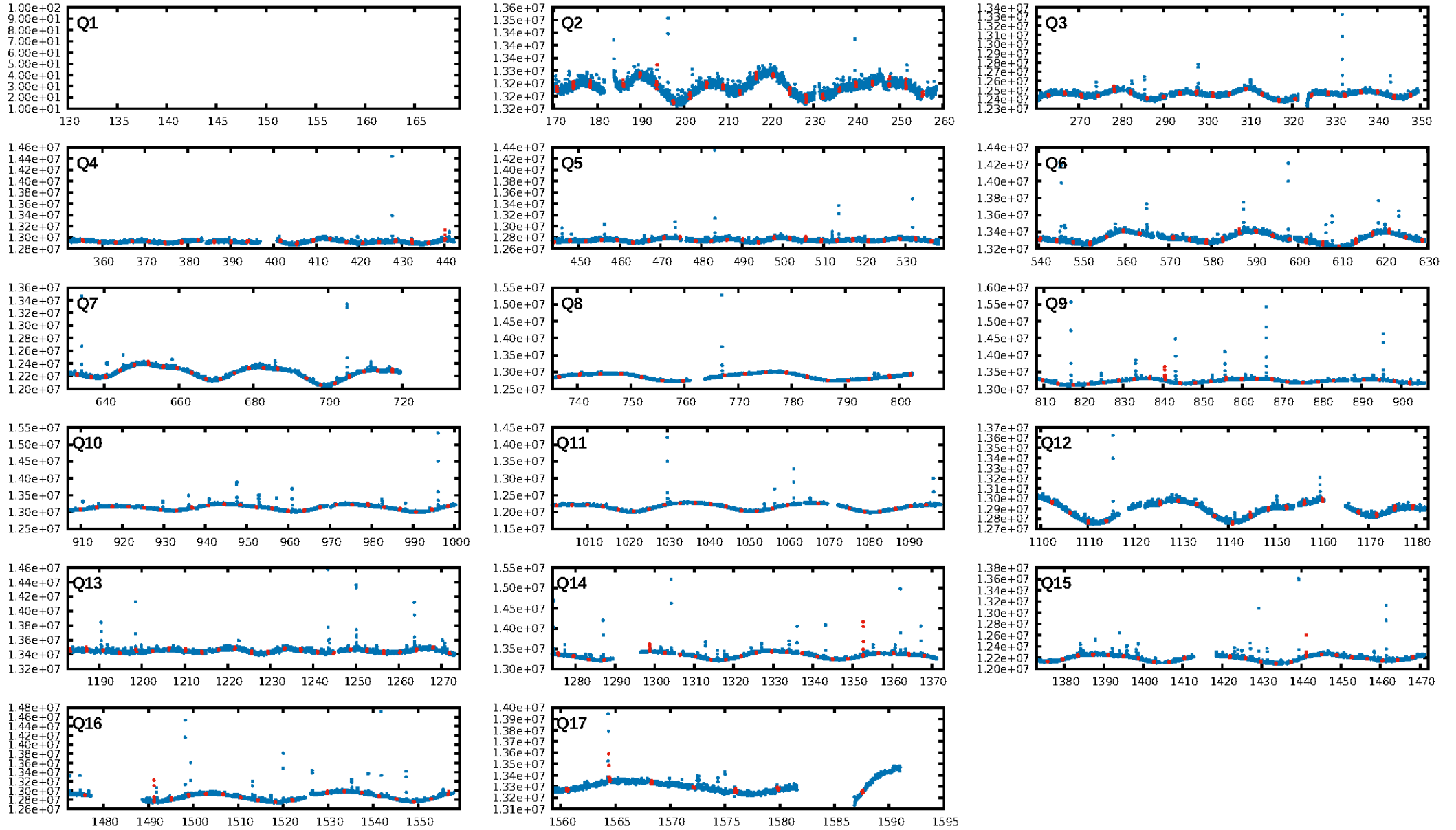
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [873.32σ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
**Bootstrap-pfa: 7.49e-11**  
RollingBand-fgt: 1.00 [329/329]  
GhostDiagnostic-chr: 6.471  
Centroid-sig: 11.5%  
Centroid-so: 1.752 arcsec [1.36σ]  
OotOffset-rm: 0.249 arcsec [0.56σ]  
KicOffset-rm: 0.224 arcsec [0.38σ]  
OotOffset-st: 3/3/3 [12]  
KicOffset-st: 3/3/3 [12]  
DiffImageQuality-fgm: 0.50 [6/12]  
DiffImageOverlap-fno: 1.00 [16/16]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 29-Jan-2016 10:31:39 Z

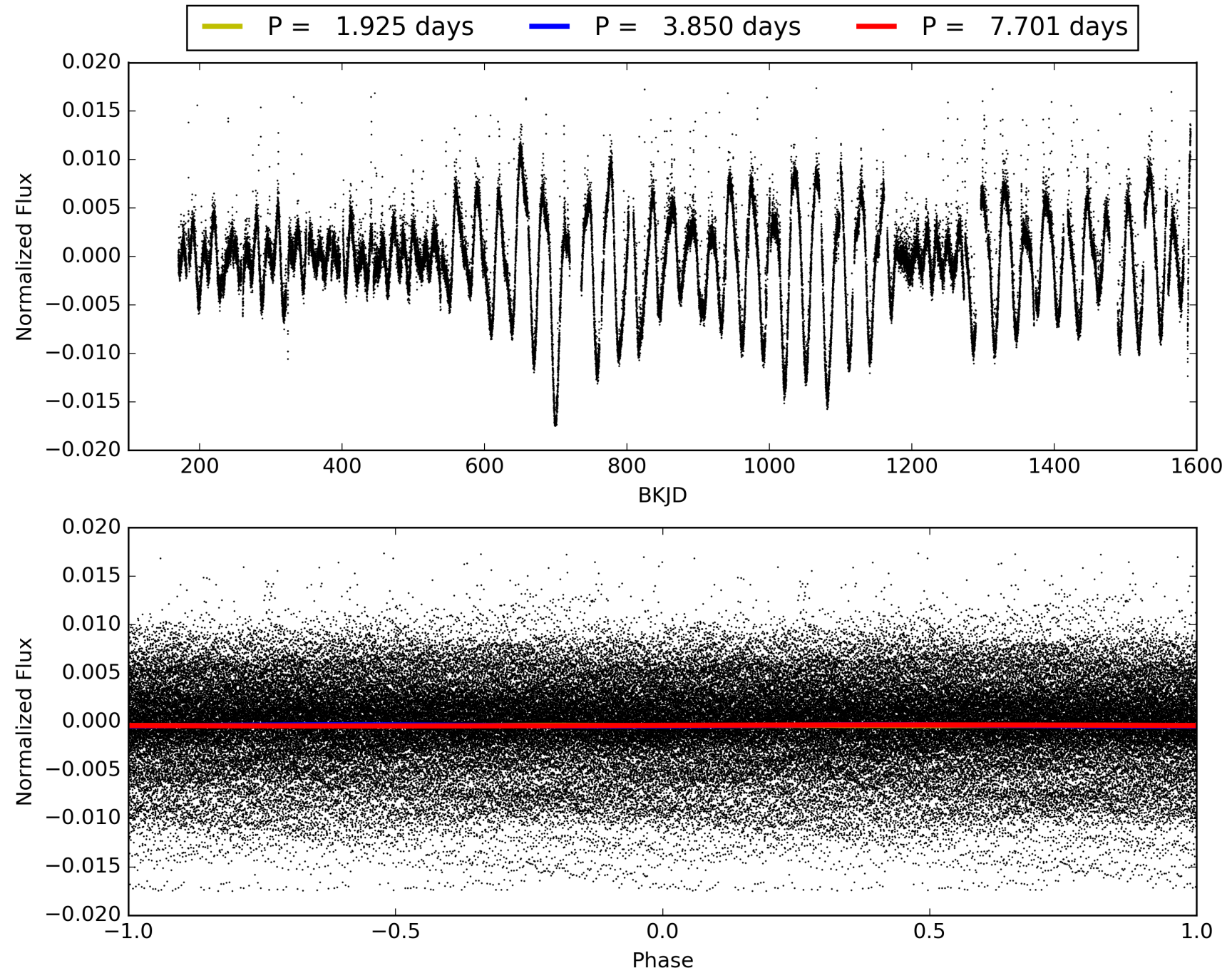
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 009643210-02, PDC Light Curves





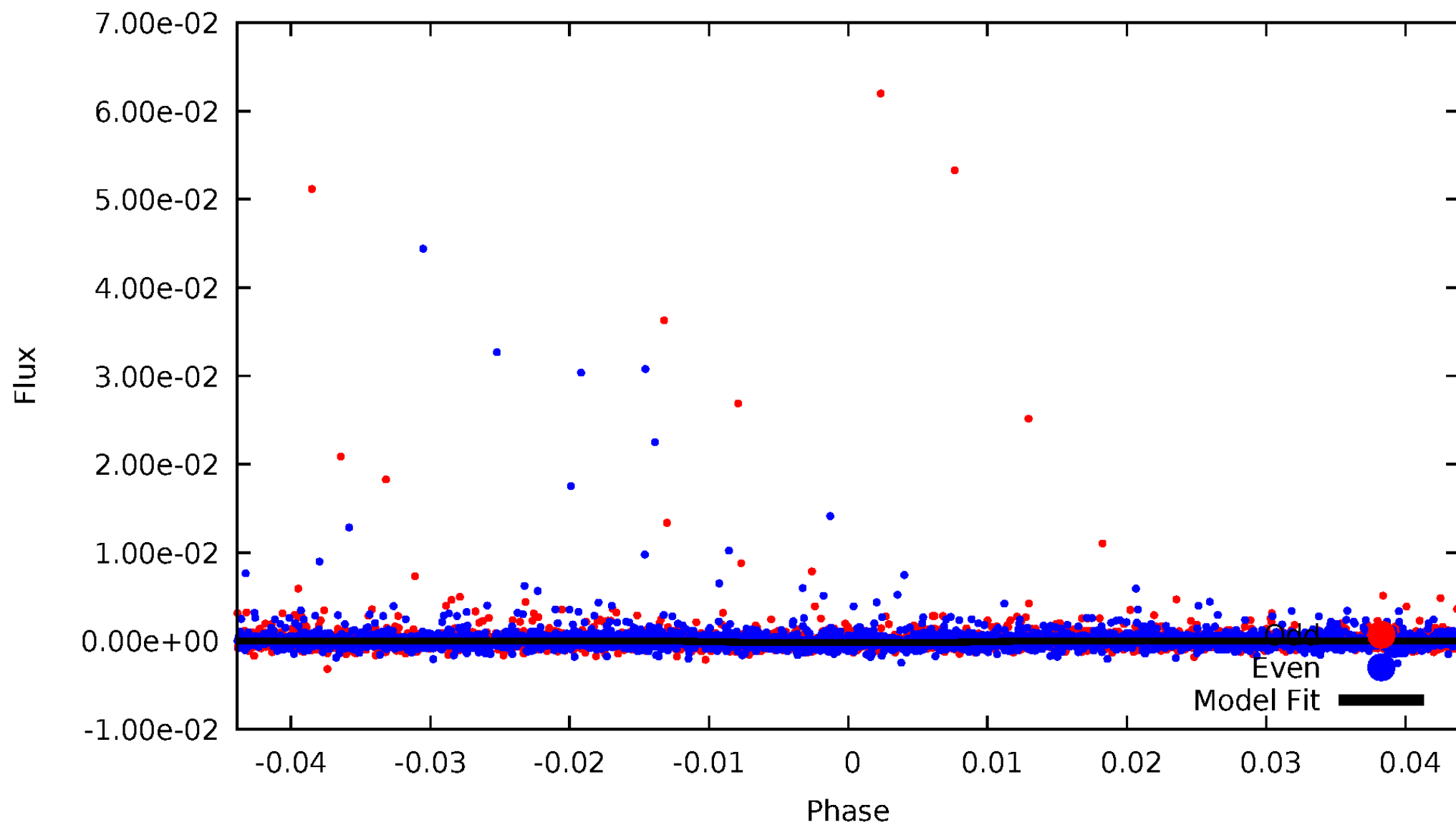
TCE 009643210-02





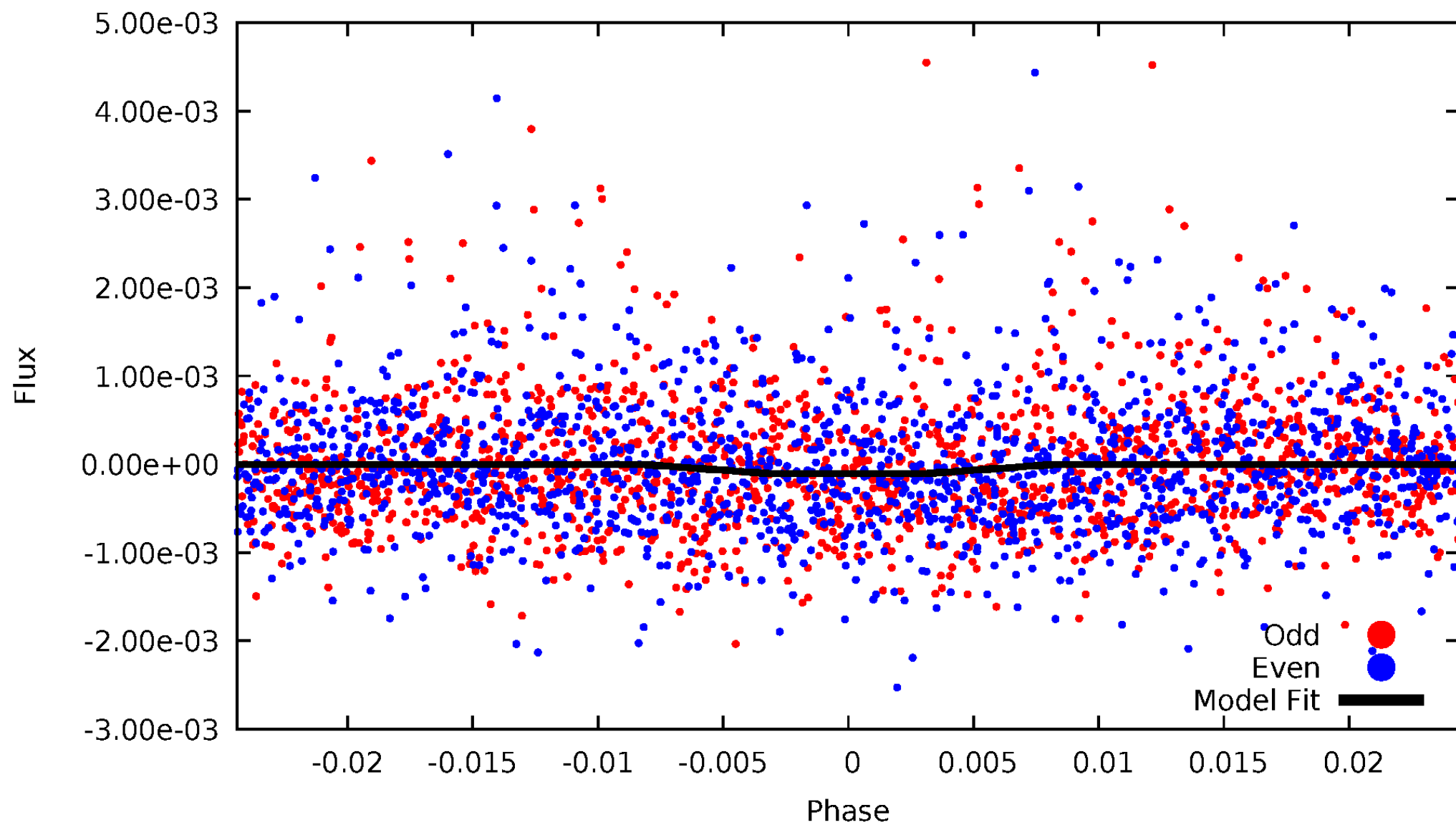
# DV Odd/Even

TCE 009643210-02



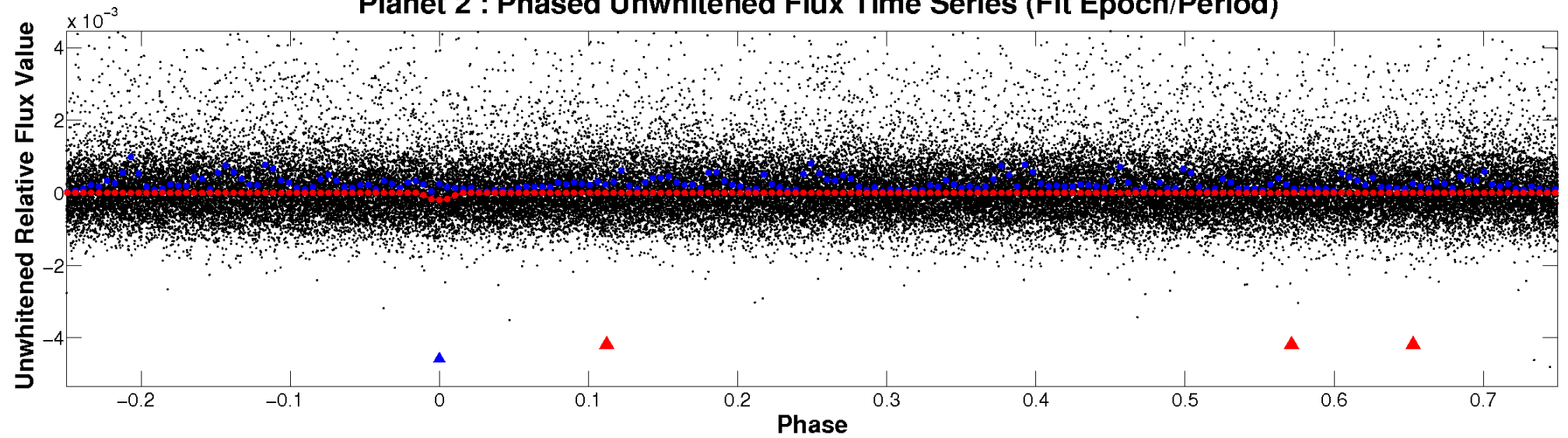
# ALT Odd/Even

TCE 009643210-02

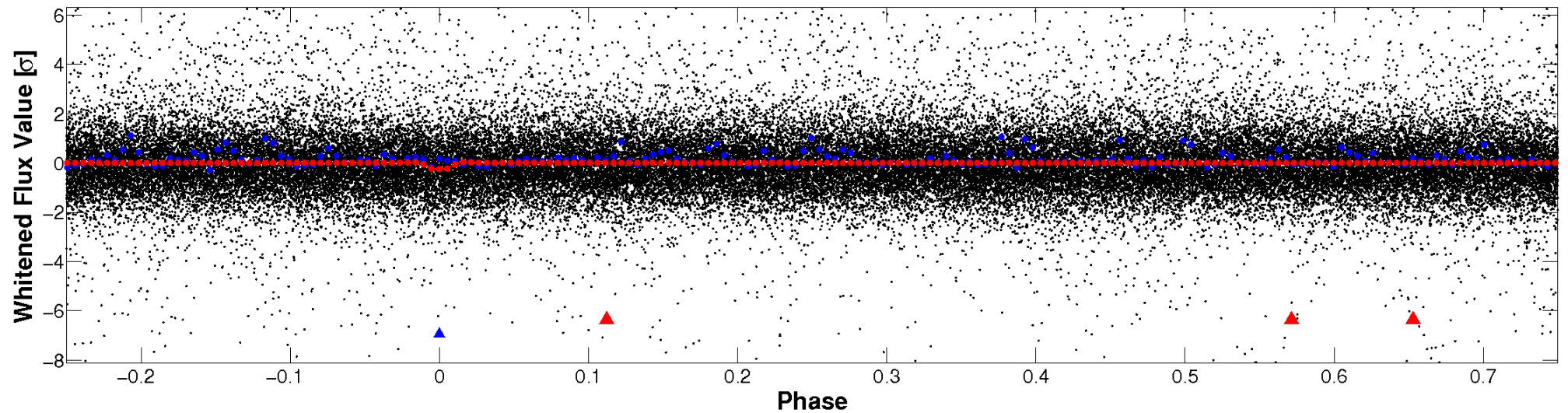


# Non-Whitened Vs. Whitened Light Curve

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

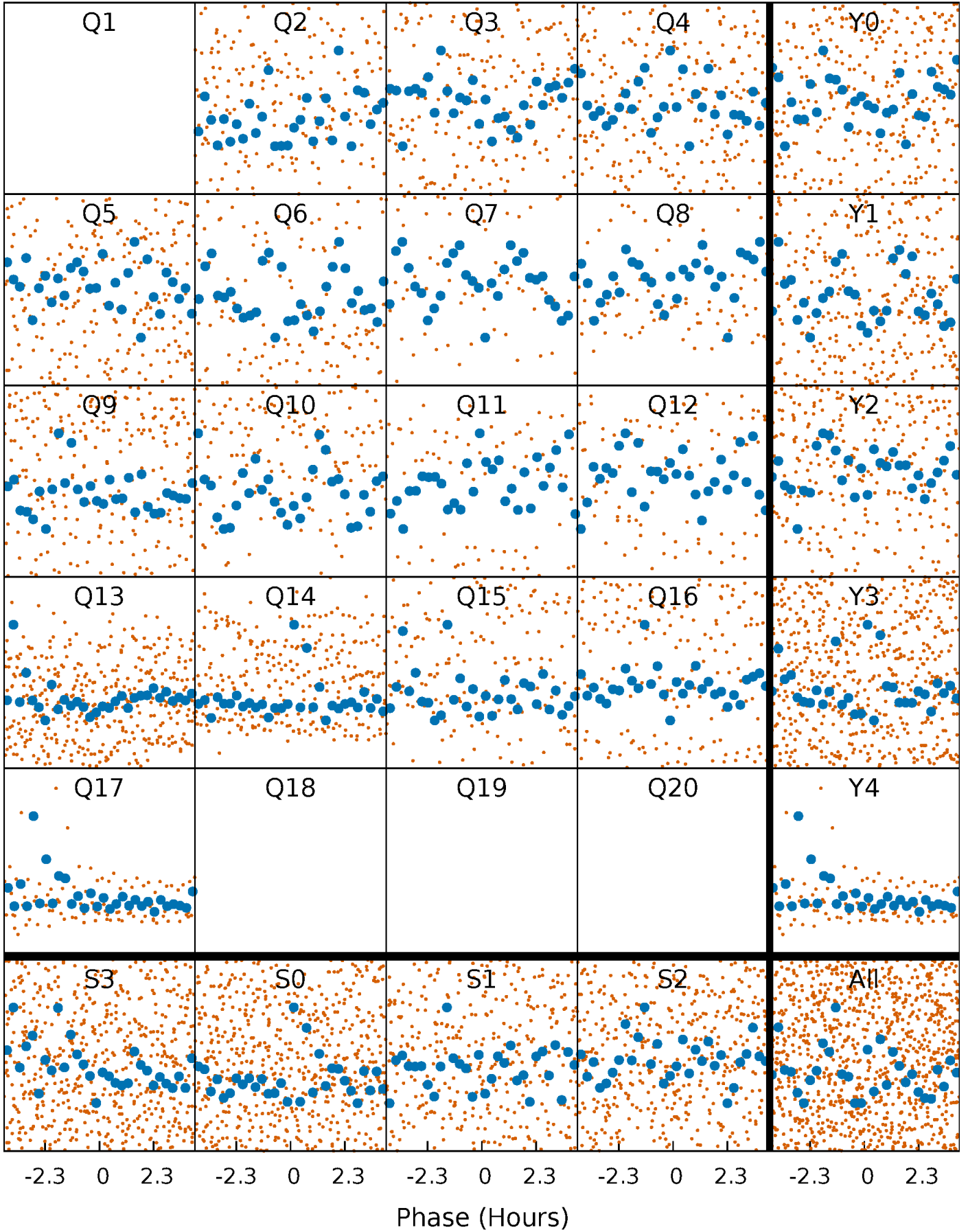


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



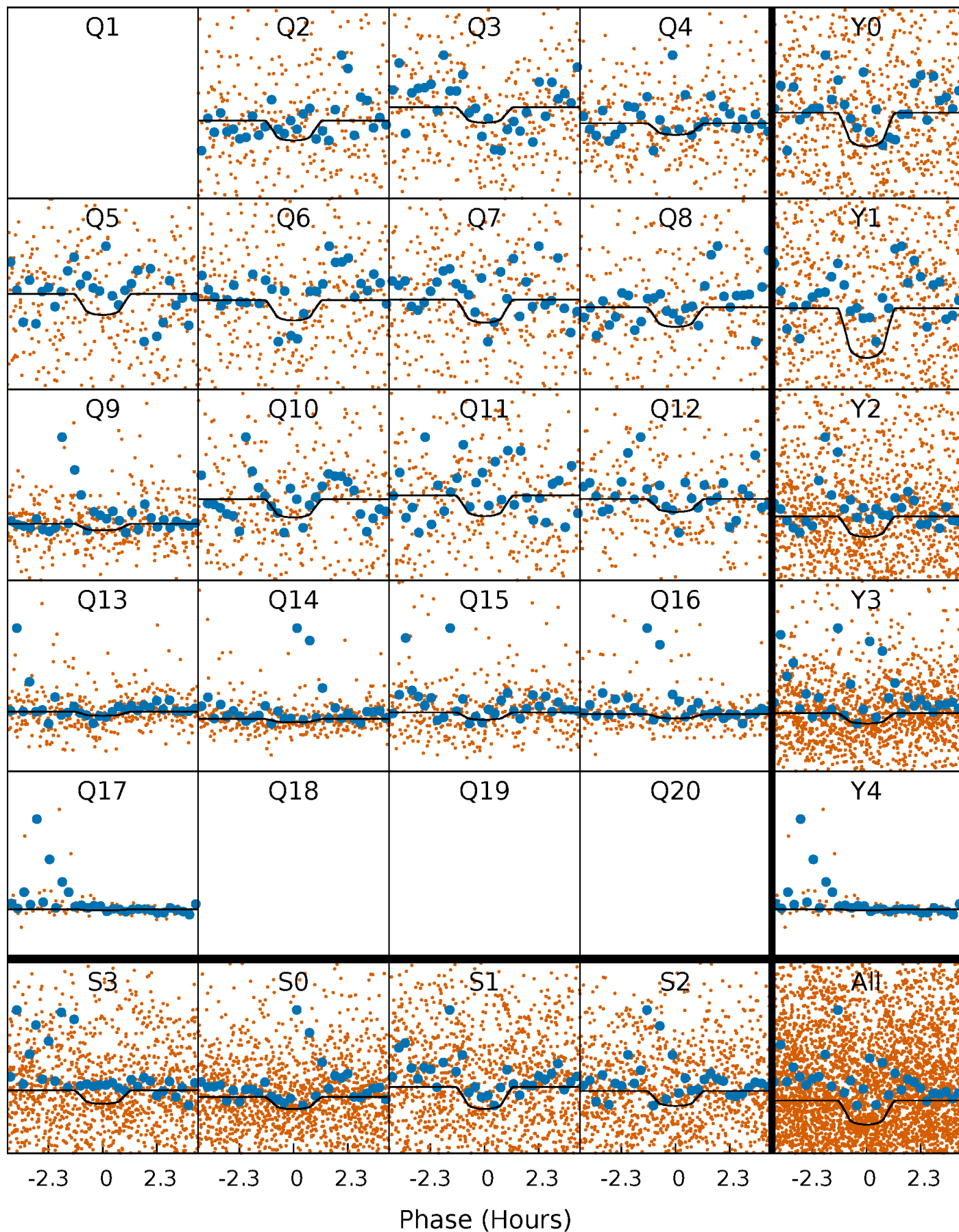
# PDC Quarter-Phased Transit Curves

TCE 009643210-02   P= 3.850440 Days    $T_0=132.088570$  (BKJD)



# DV Quarter-Phased Transit Curves

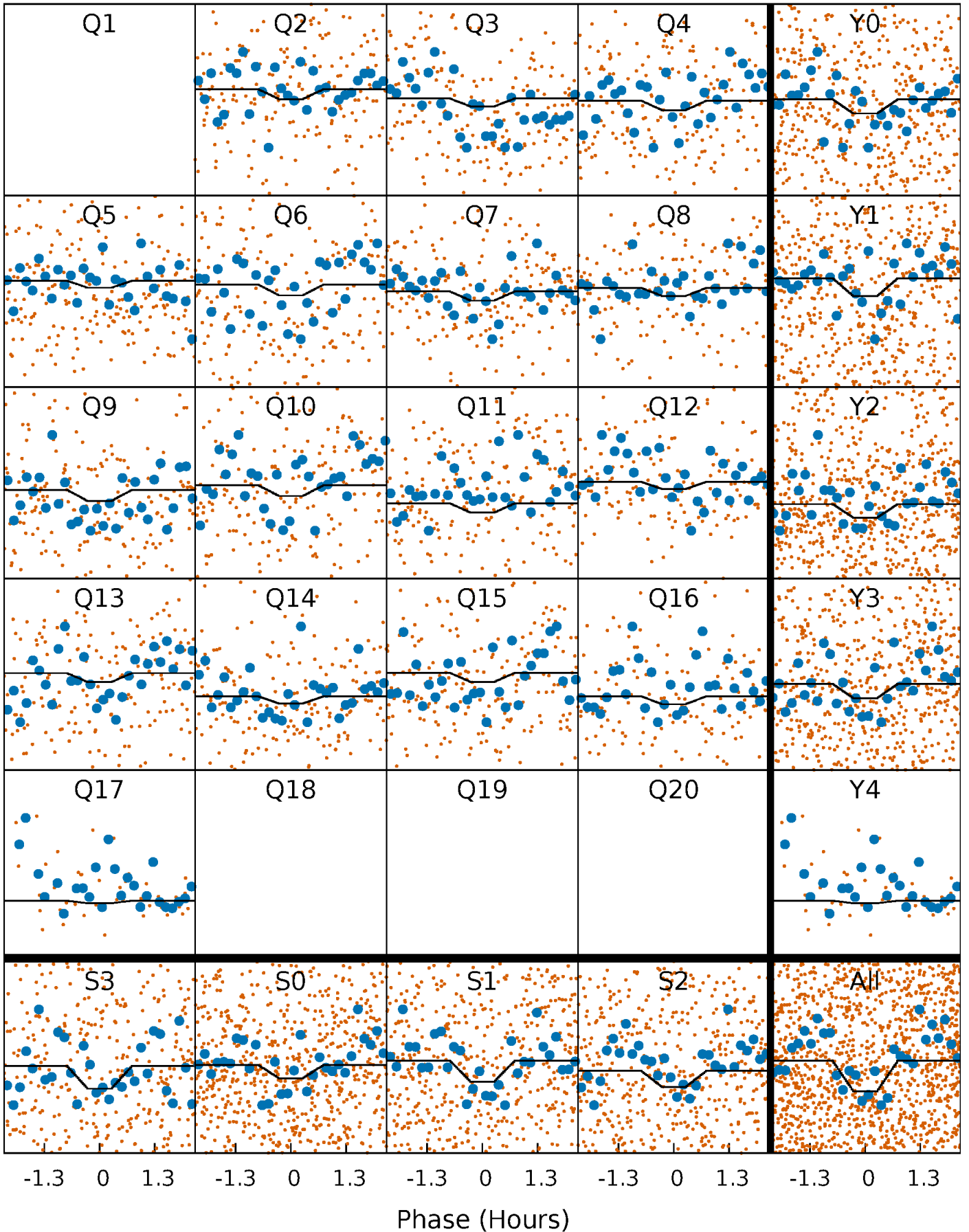
TCE 009643210-02   P= 3.850440 Days    $T_0=132.088570$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

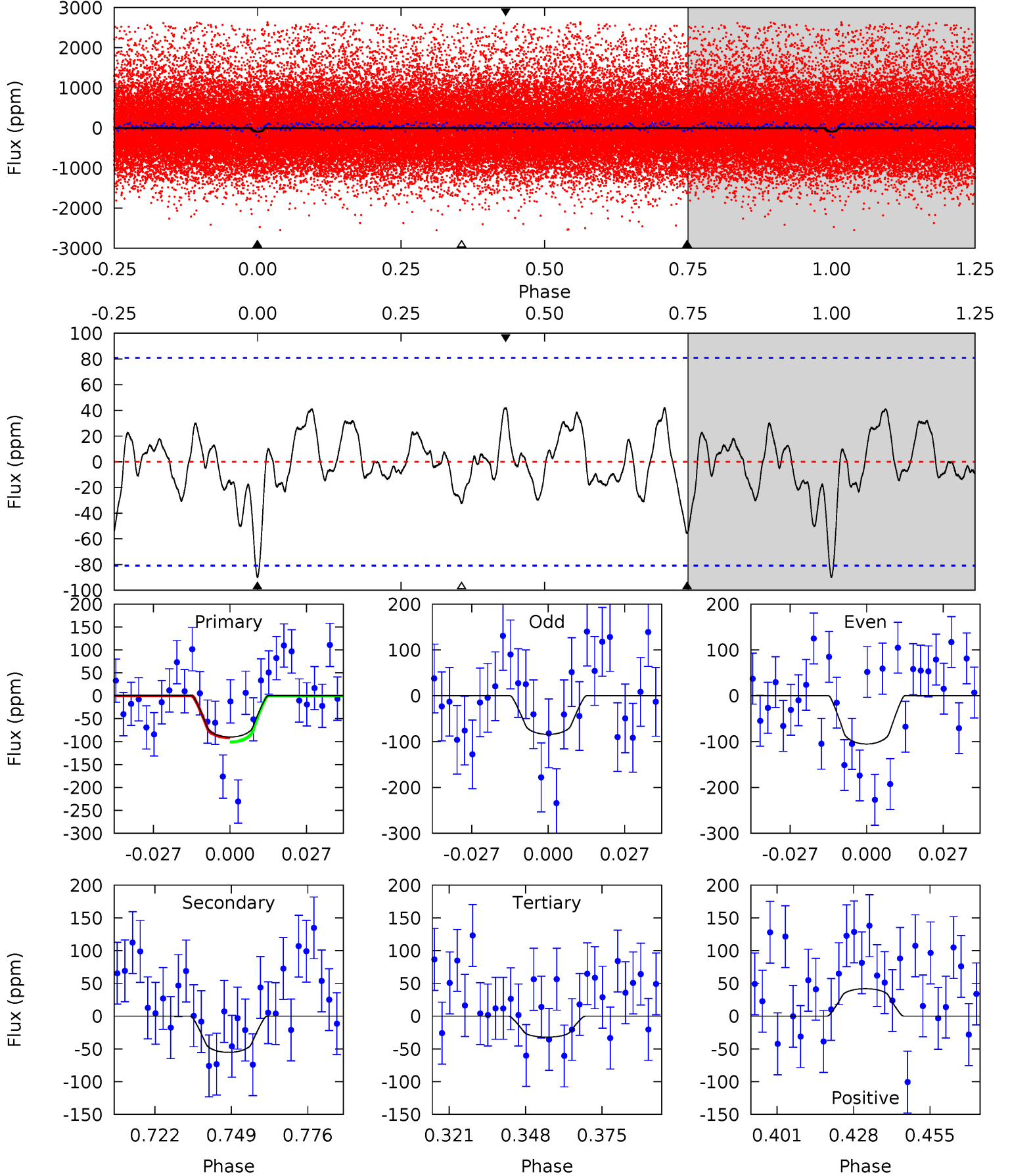
TCE 009643210-02 P= 3.850321 Days  $T_0=132.103298$  (BKJD)



# DV Model-Shift Uniqueness Test

009643210-02, P = 3.850440 Days, E = 132.088570 Days

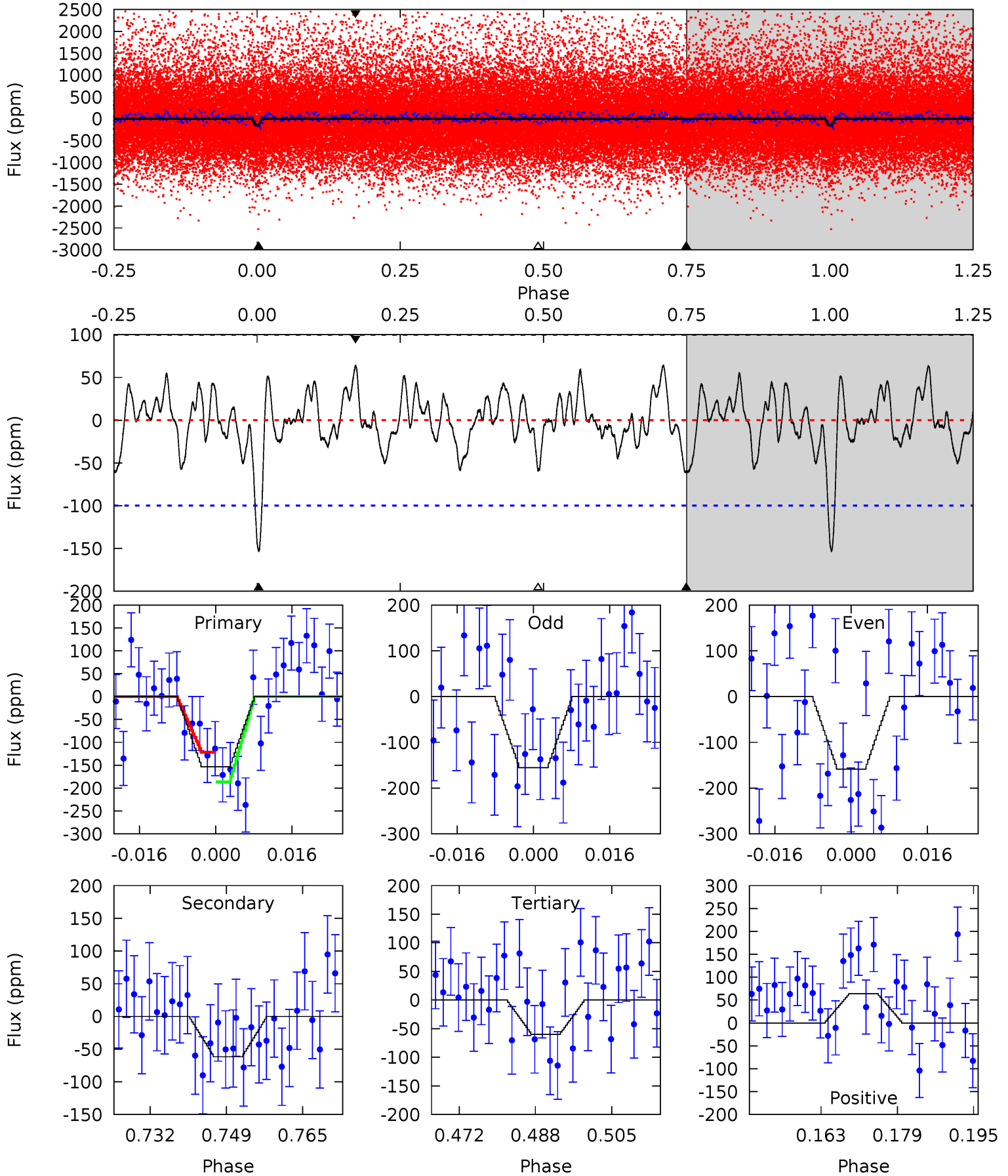
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
5.38	3.31	1.92	2.50	4.83	2.22	1.10	3.47	2.88	1.39	0.80	0.64	-1.24	0.32	0.28



# Alt Model-Shift Uniqueness Test

009643210-02, P = 3.850321 Days, E = 132.103298 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
7.59	3.05	2.96	3.16	4.93	2.40	1.24	4.63	4.42	0.09	-0.12	0.07	0.35	0.30	1.62





### Stellar Parameters For KIC 009643210

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$3274^{+42}_{-32}$	$5.044^{+0.044}_{-0.044}$	$0.020^{+0.100}_{-0.100}$	$0.224^{+0.032}_{-0.026}$	$0.202^{+0.042}_{-0.026}$	$25.440^{+6.603}_{-5.245}$
	+1%/-1%	+1%/-1%	+500%/-500%	+14%/-12%	+21%/-13%	+26%/-21%
Source	PHO2	PHO2	PHO2	DSEP		

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

### Secondary Eclipse Parameters for KIC 009643210-02 / KOI 7952.01

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-55 \pm 17$	$0.51^{+0.41}_{-0.33}$	$570^{+15}_{-13}$	$2474^{+850}_{-314}$	$94^{+721}_{-67}$
Alt.	$-62 \pm 20$	$0.42^{+0.40}_{-0.29}$	$569^{+13}_{-13}$	$2613^{+1108}_{-381}$	$140^{+1506}_{-102}$

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

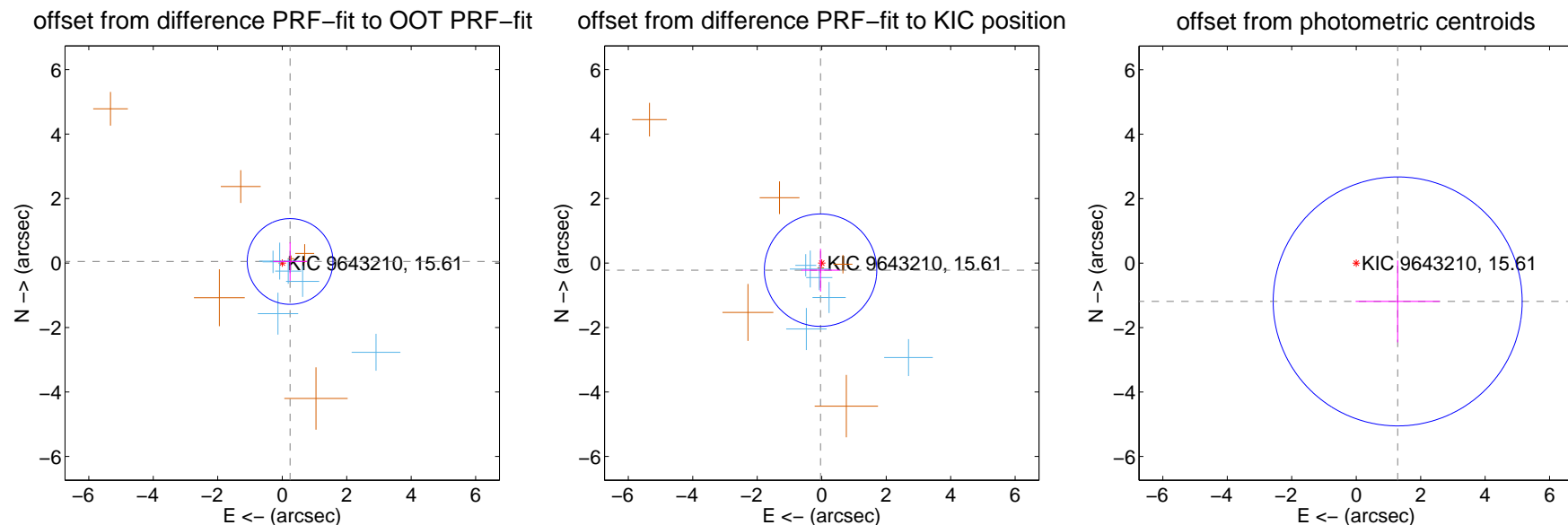
## DV Centroid Data

Supplemental centroid analysis for 009643210-02. Kepler magnitude: 15.61. Transit SNR 7.68

There are 6 quarters with good PRF difference image offsets

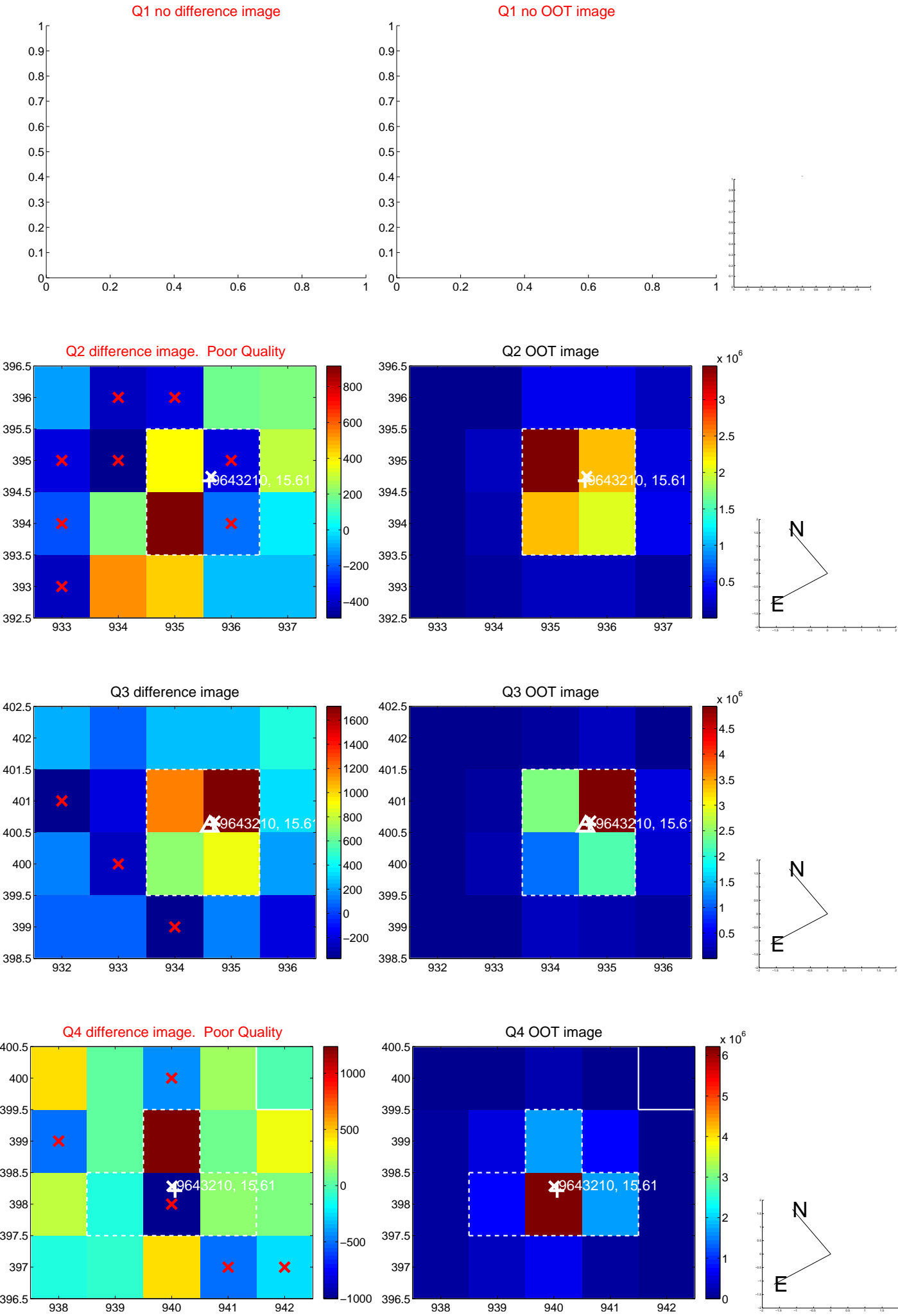
The direct PRF centroid is offset from the target star catalog position by about 0.64 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.249 \pm 0.443$	0.56	$-0.244 \pm 0.529$	$0.048 \pm 0.593$
PRF-fit source offset from KIC position	$0.224 \pm 0.581$	0.38	$0.035 \pm 0.590$	$-0.221 \pm 0.664$
photometric centroid source offset	$1.75 \pm 1.29$	1.36	$-1.29 \pm 1.30$	$-1.19 \pm 1.27$

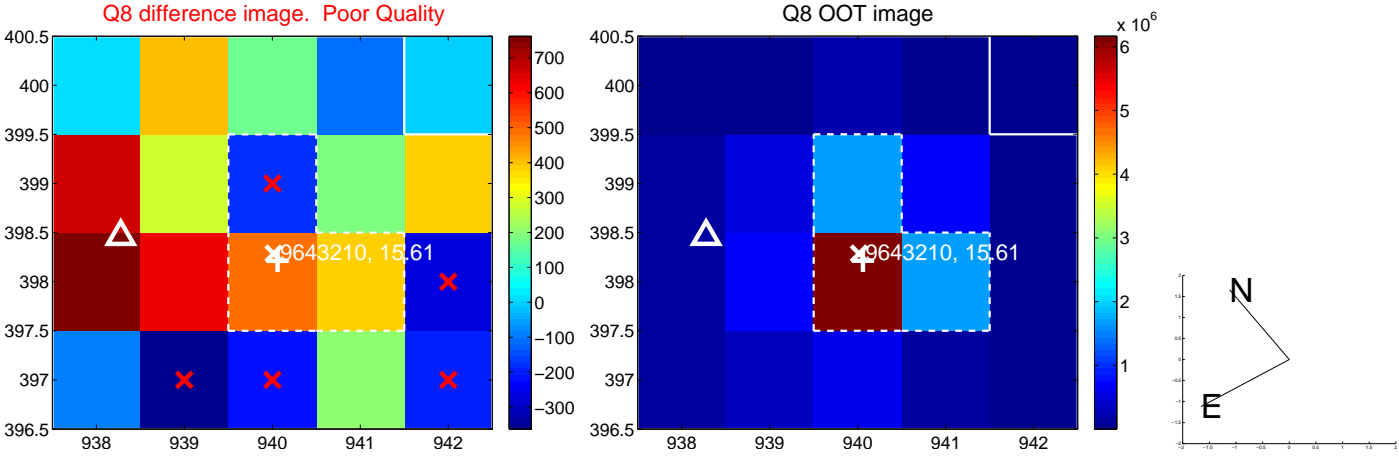
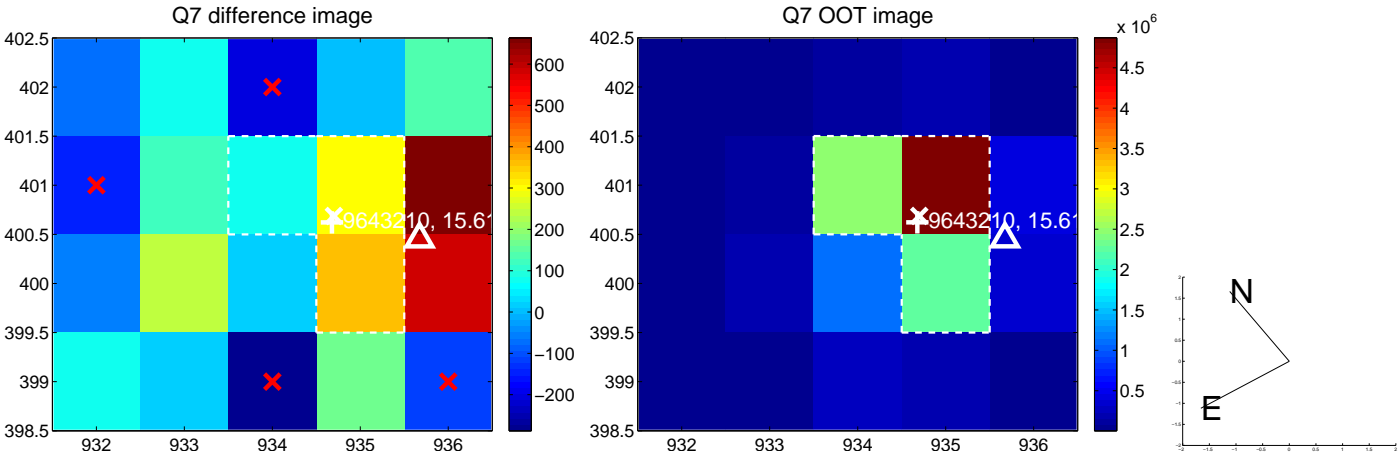
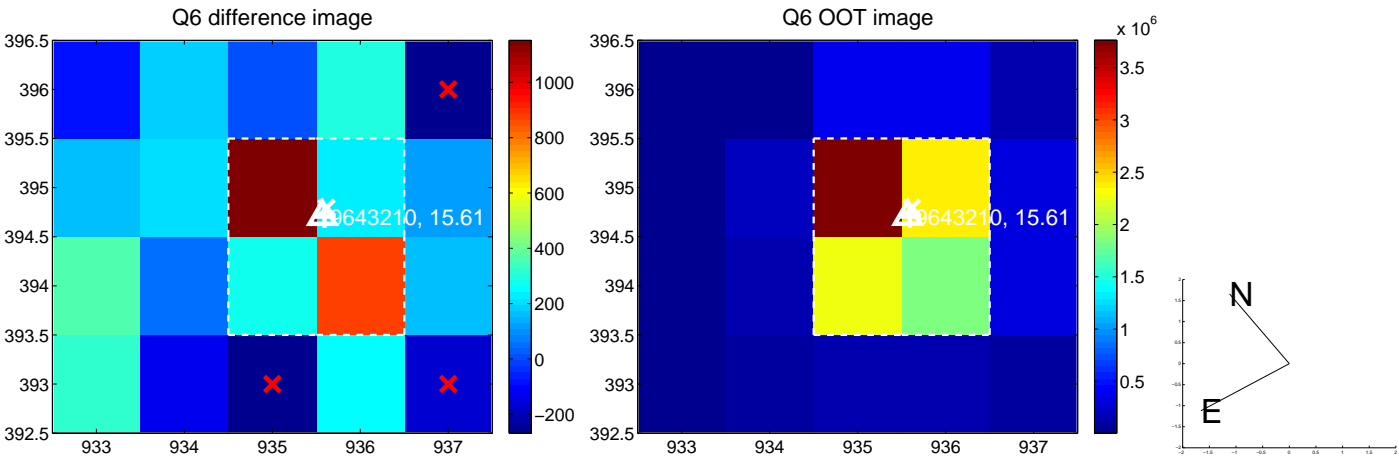
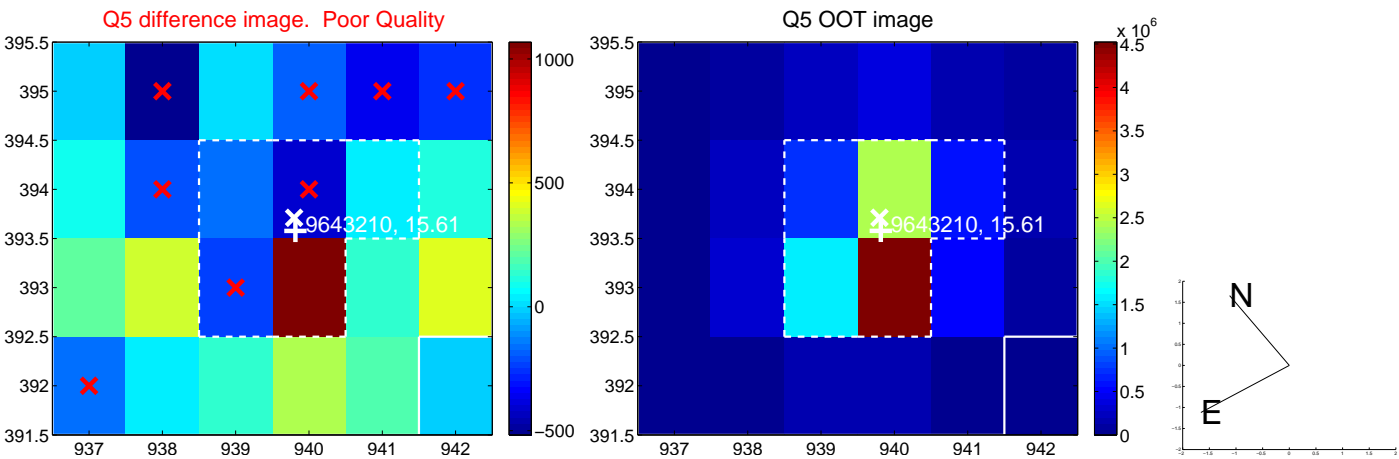


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets**; **Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

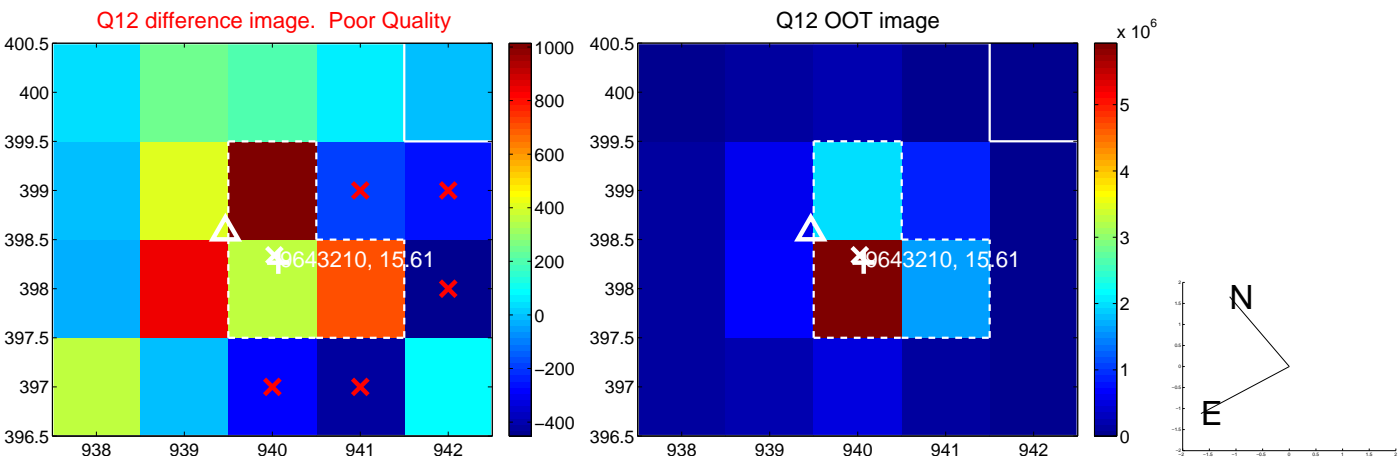
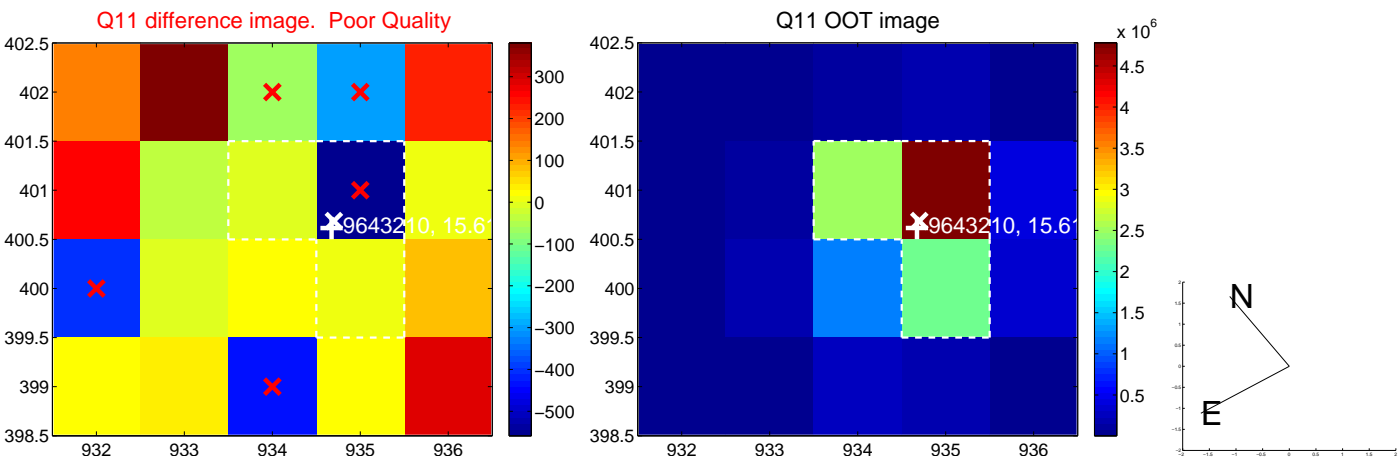
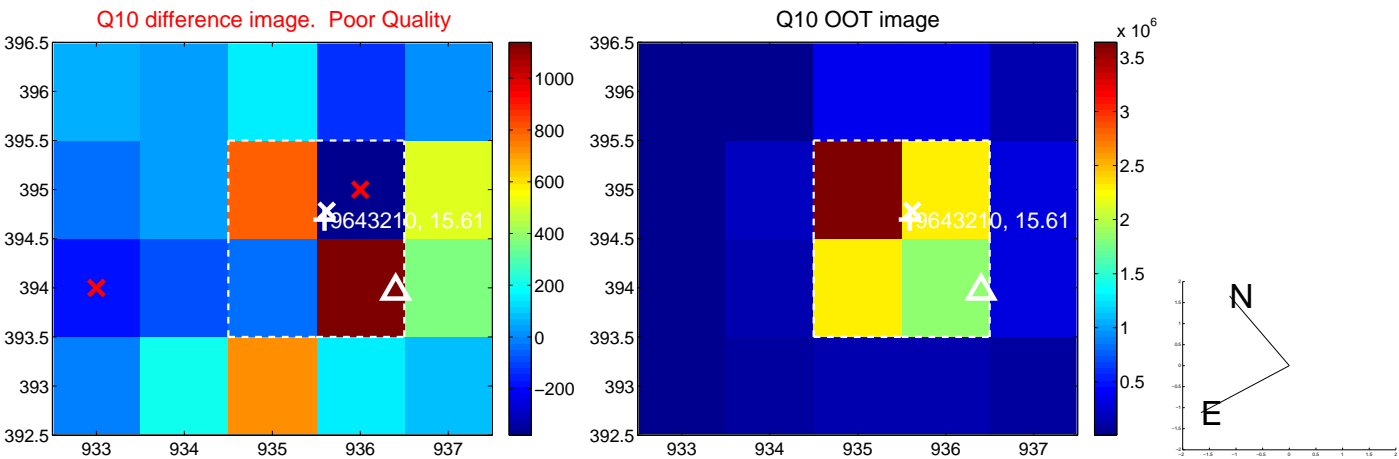
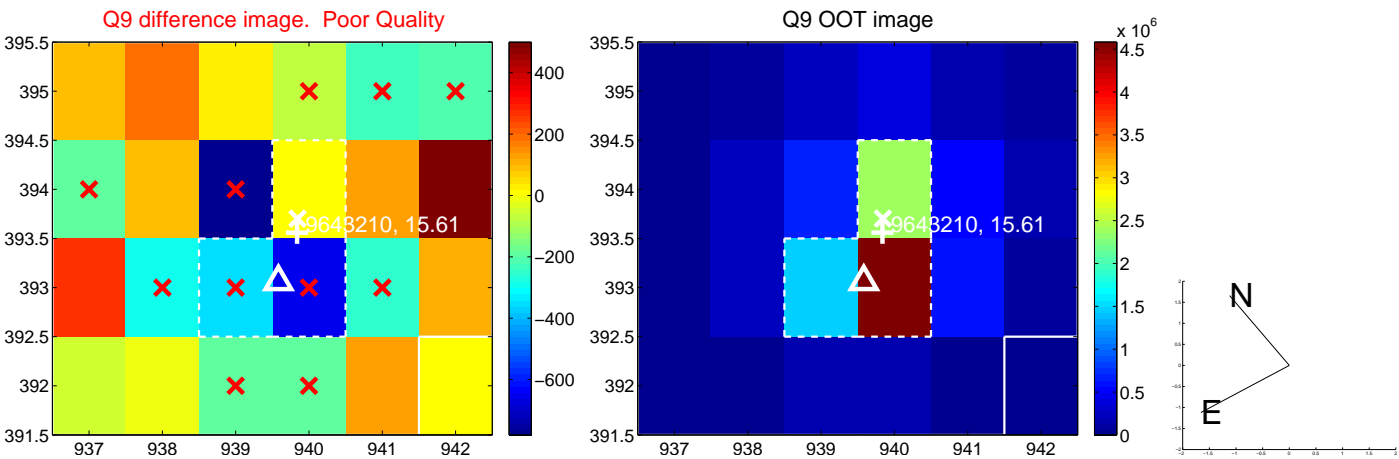
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



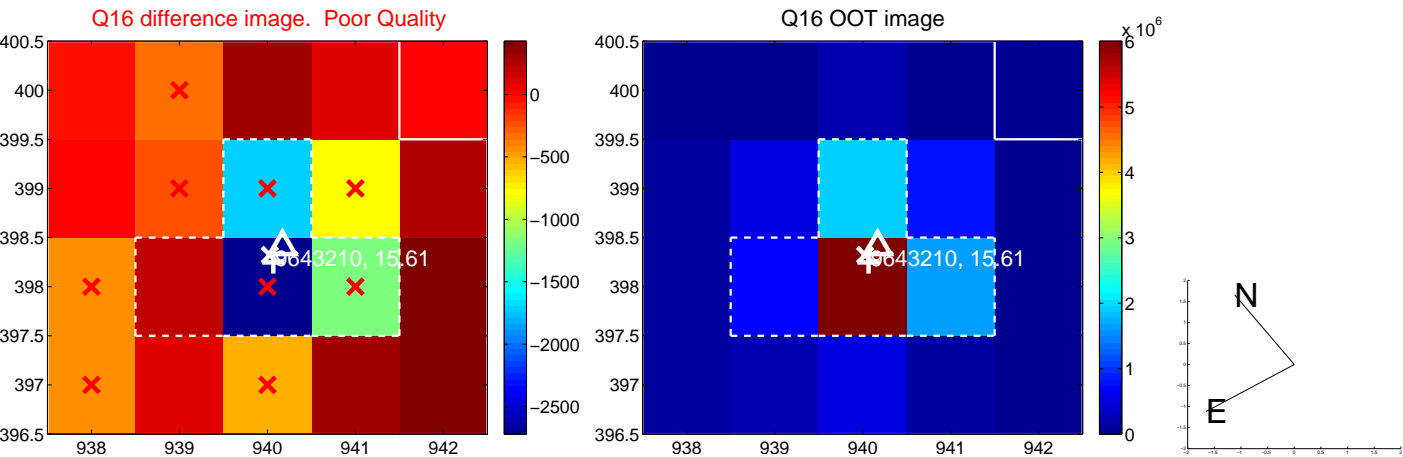
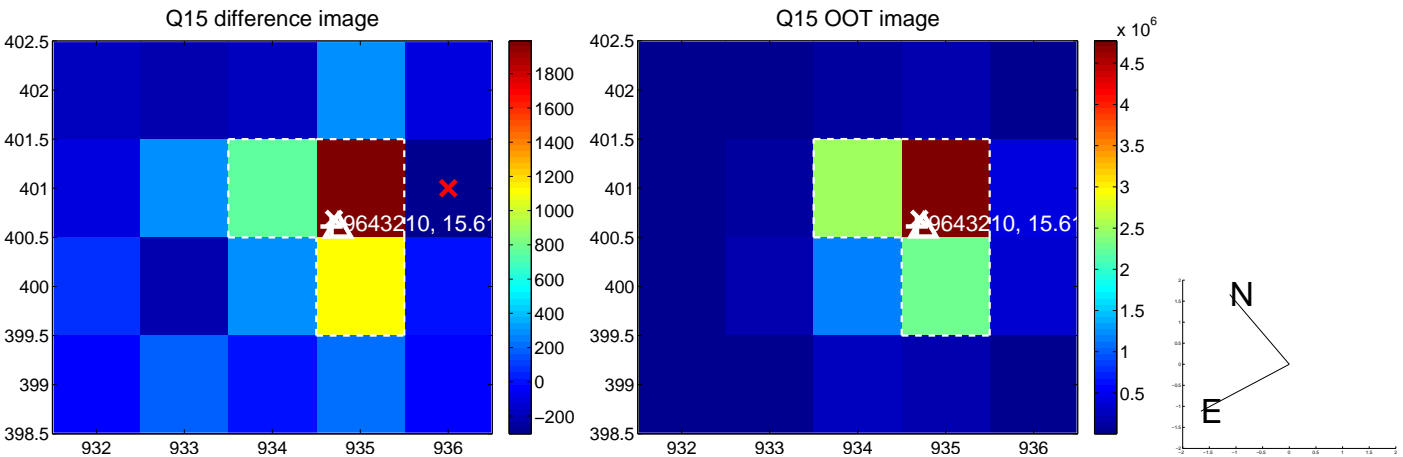
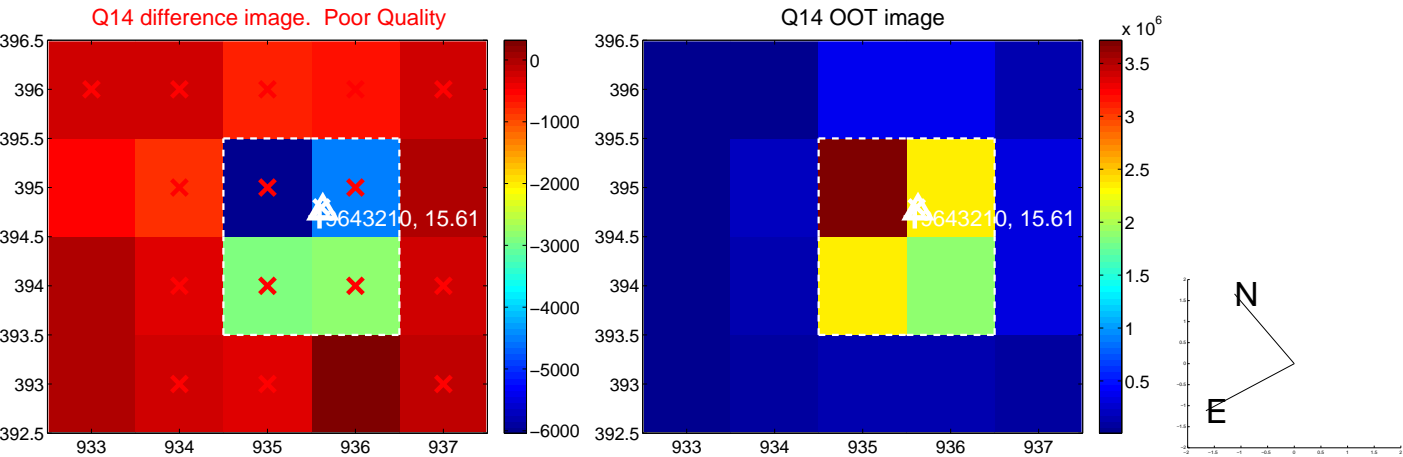
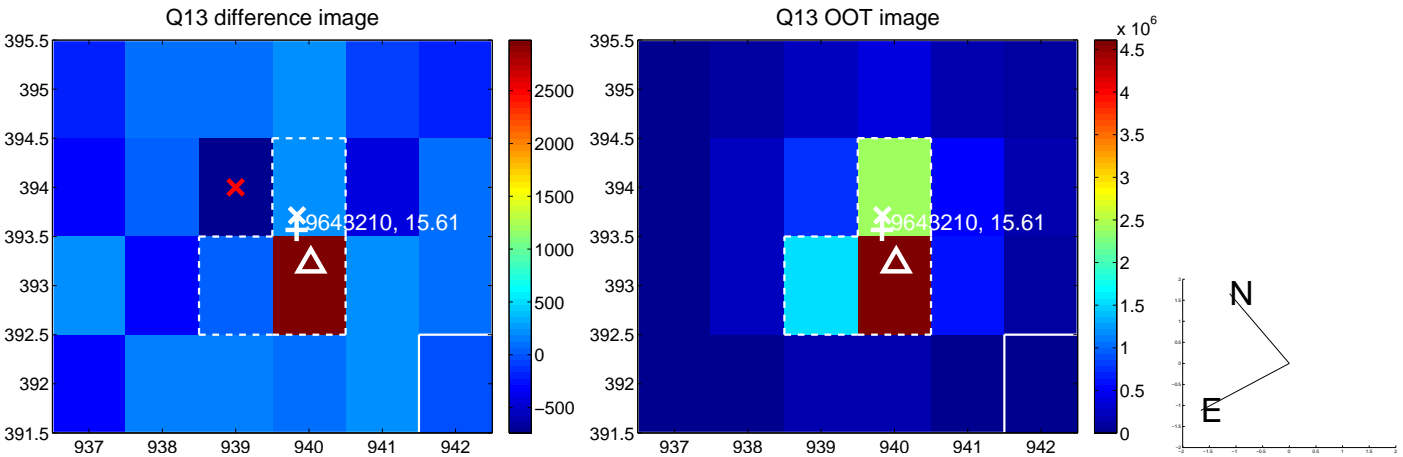
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



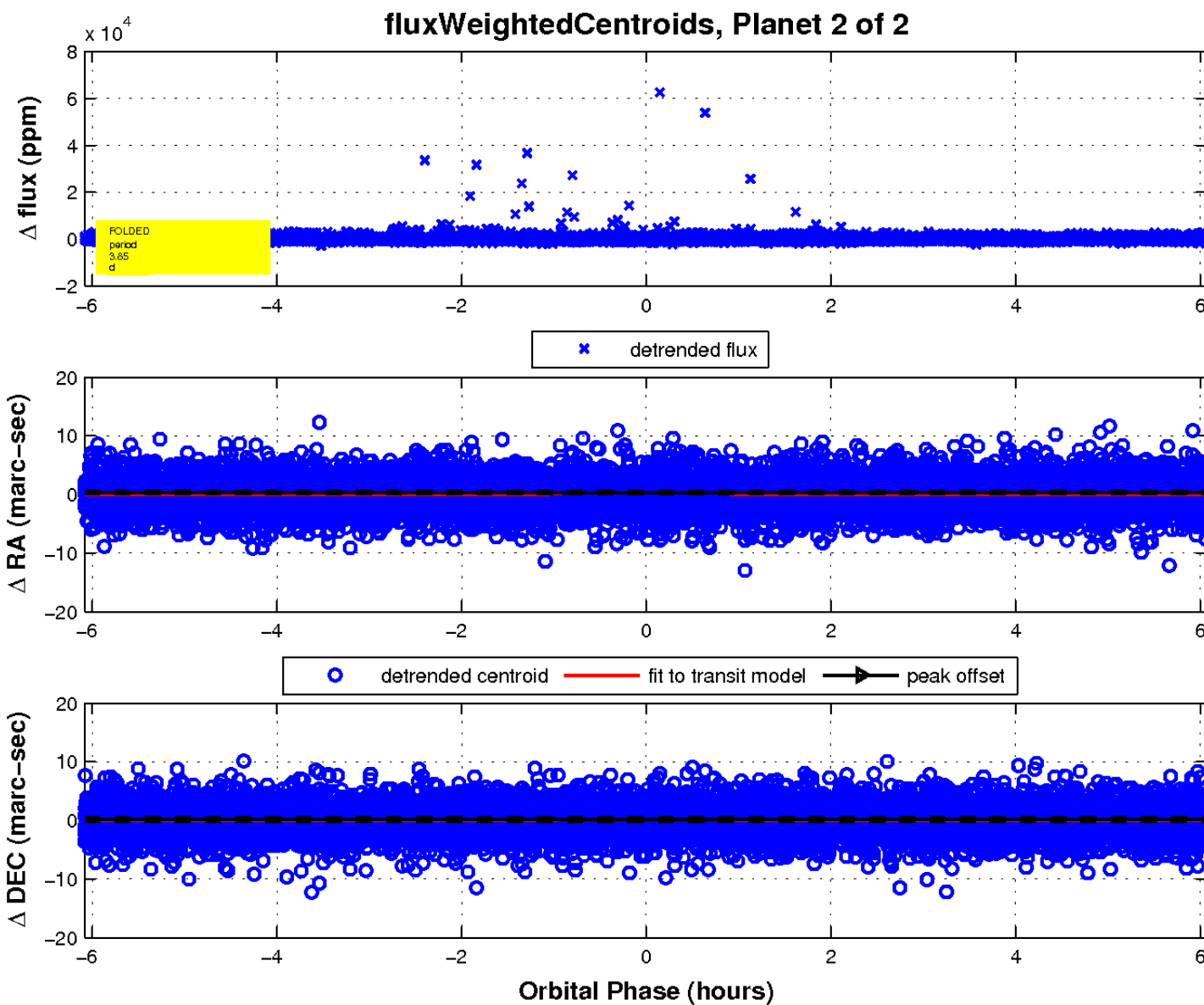
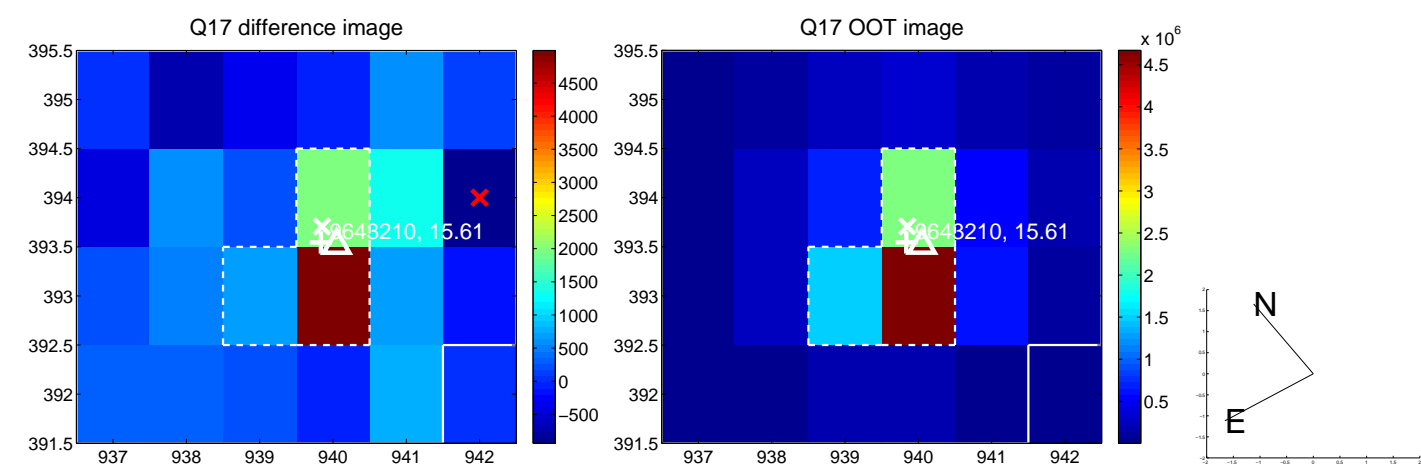
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

