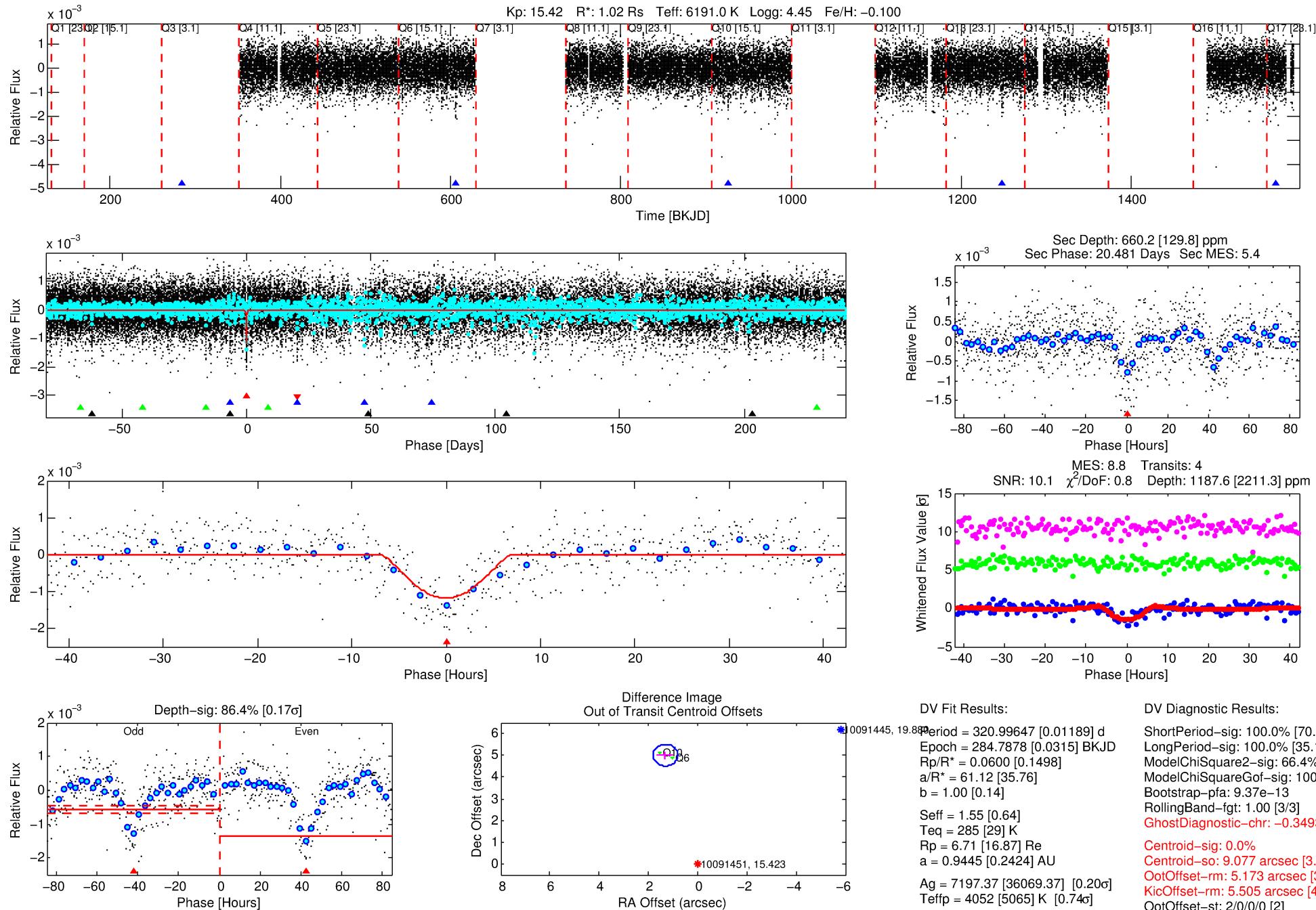


**WARNING: THIS DATA IS  
SIMULATED, NOT OBSERVED**

## DV One-Page Summary

KIC: 10091451 Candidate: 1 of 4 Period: 320.996 d



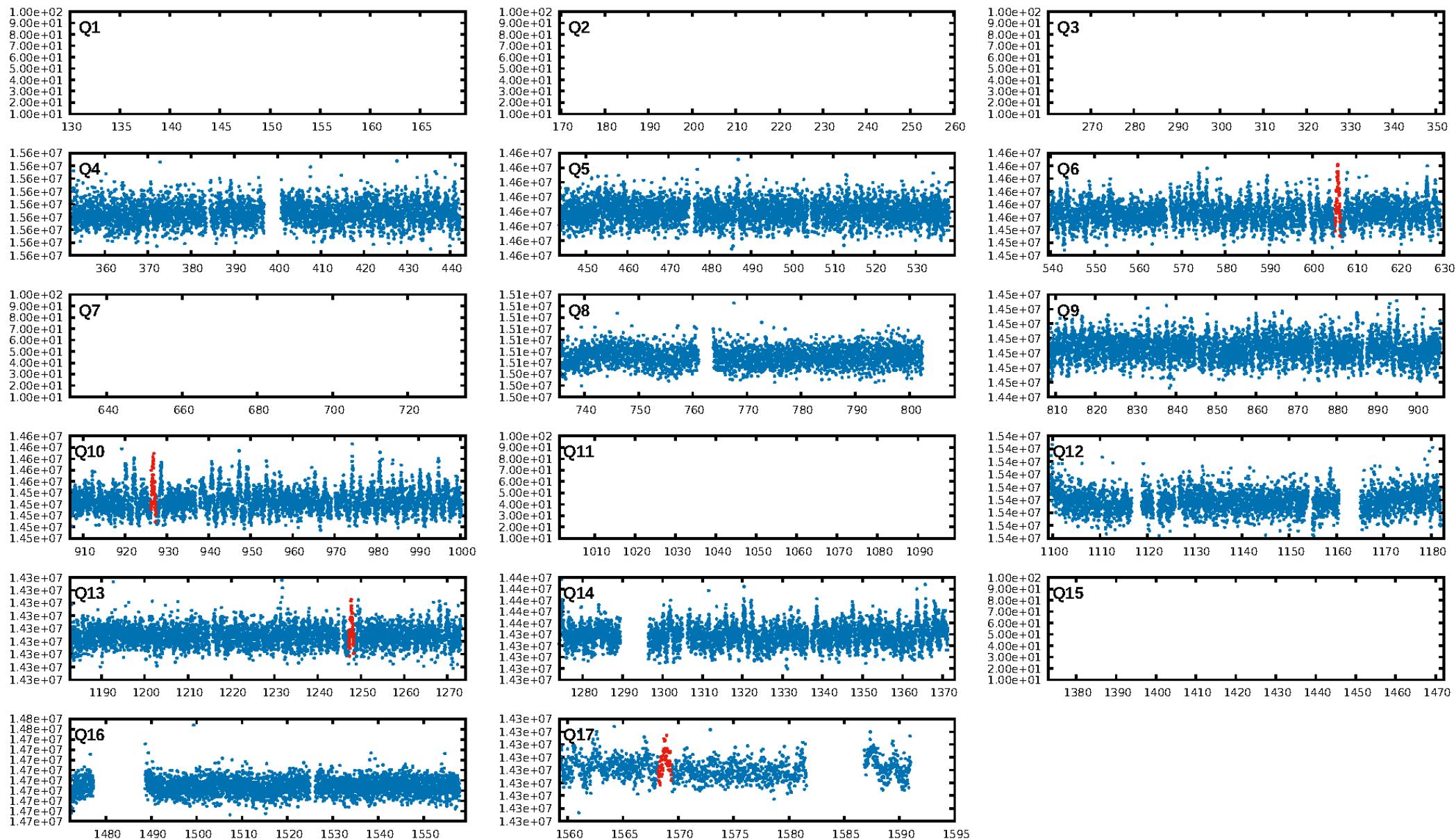
**WARNING: THIS DATA IS  
SIMULATED, NOT OBSERVED**

DV Fit Results:

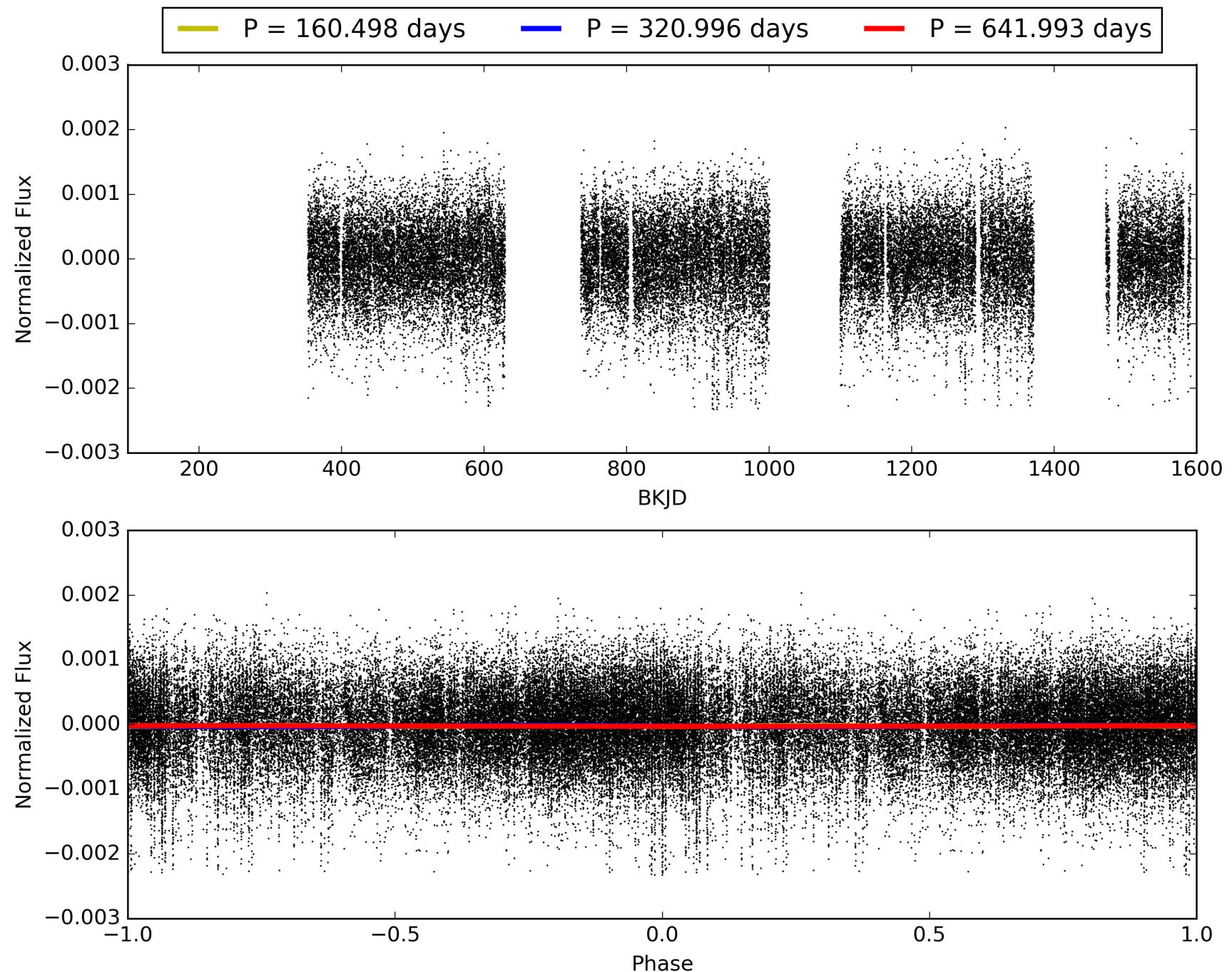
Period = 320.99647 [0.01189] d  
Epoch = 284.7878 [0.0315] BKJD  
Rp/R\* = 0.0600 [0.1498]  
a/R\* = 61.12 [35.76]  
b = 1.00 [0.14]  
Seff = 1.55 [0.64]  
Teq = 285 [29] K  
Rp = 6.71 [16.87] Re  
a = 0.9445 [0.2424] AU  
Ag = 7197.37 [36069.37] [0.20d]  
Teffp = 4052 [5065] K [0.74 $\sigma$ ]

DV Diagnostic Results:  
ShortPeriod-sig: 100.0% [70.63]  
LongPeriod-sig: 100.0% [35.14]  
ModelChiSquare2-sig: 66.4%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 9.37e-13  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: -0.3493  
Centroid-sig: 0.0%  
Centroid-so: 9.077 arcsec [3.47]  
OotOffset-rm: 5.173 arcsec [31.17]  
KicOffset-rm: 5.505 arcsec [40.05]  
OotOffset-st: 2/0/0/0 [2]  
KicOffset-st: 2/0/0/0 [2]  
DiffImageQuality-fgm: 1.00 [2/2]  
DiffImageOverlap-fno: 1.00 [4/4]

# TCE 010091451-01, PDC Light Curves

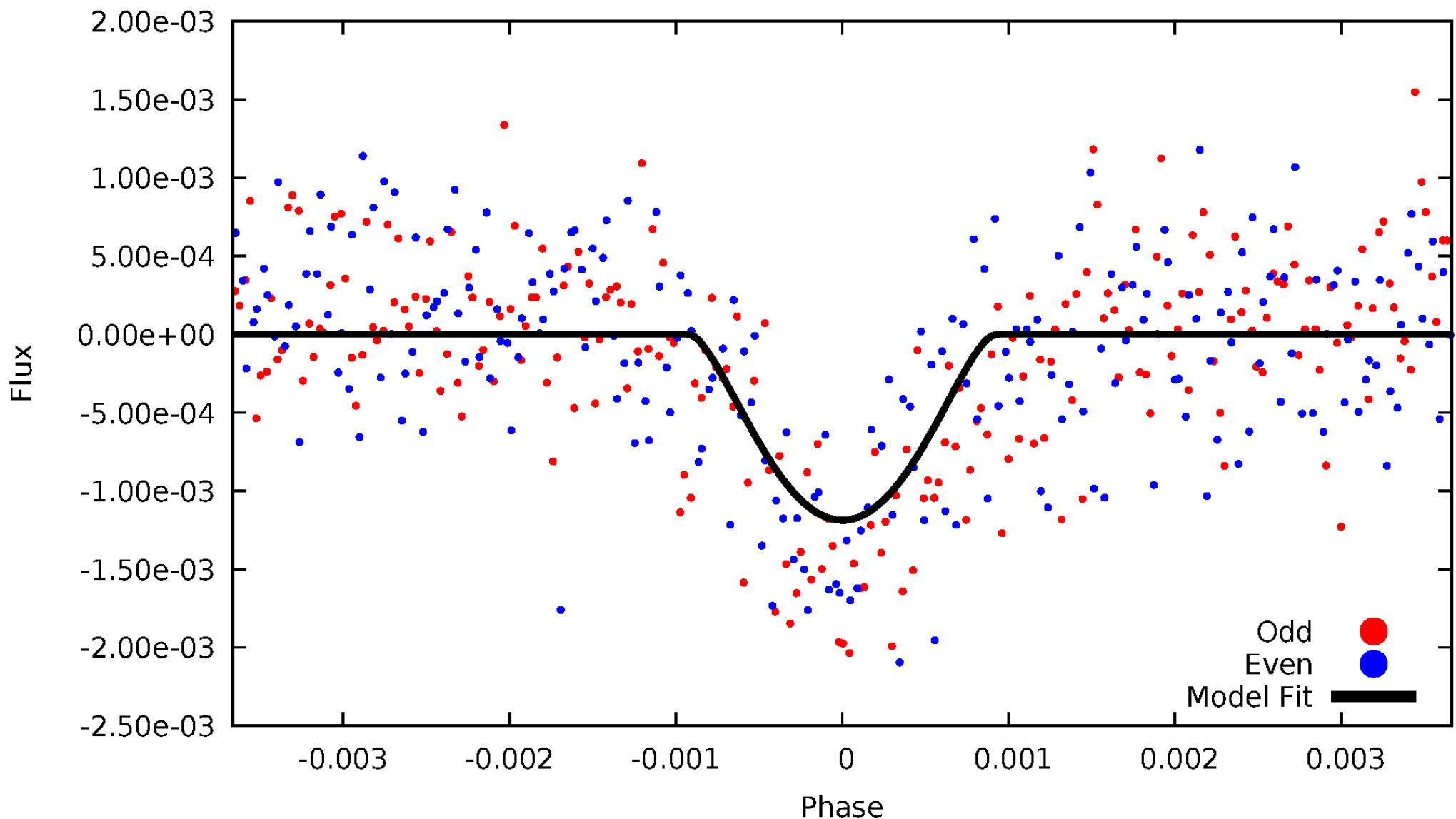


# TCE 010091451-01



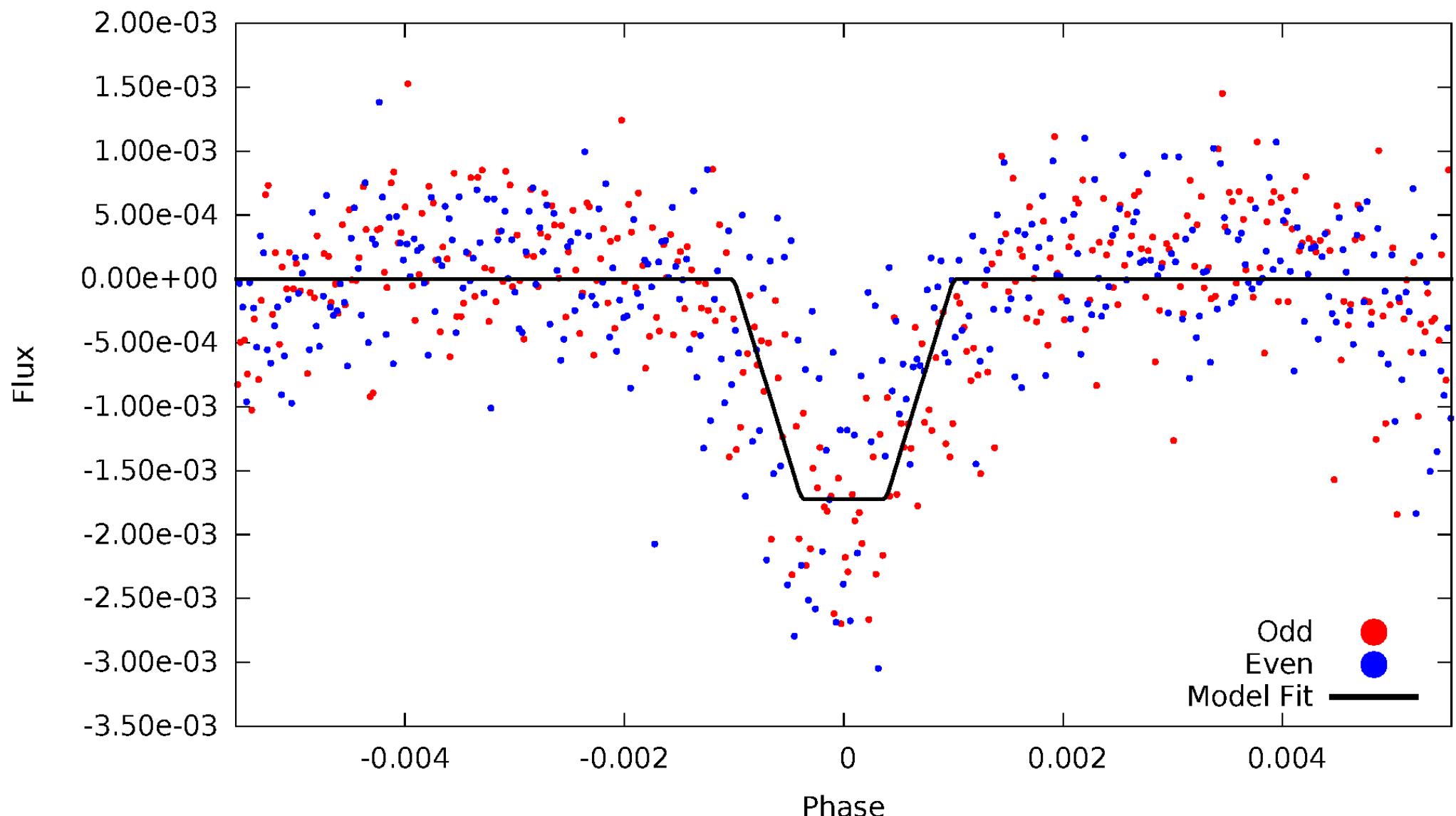
# DV Odd/Even

TCE 010091451-01

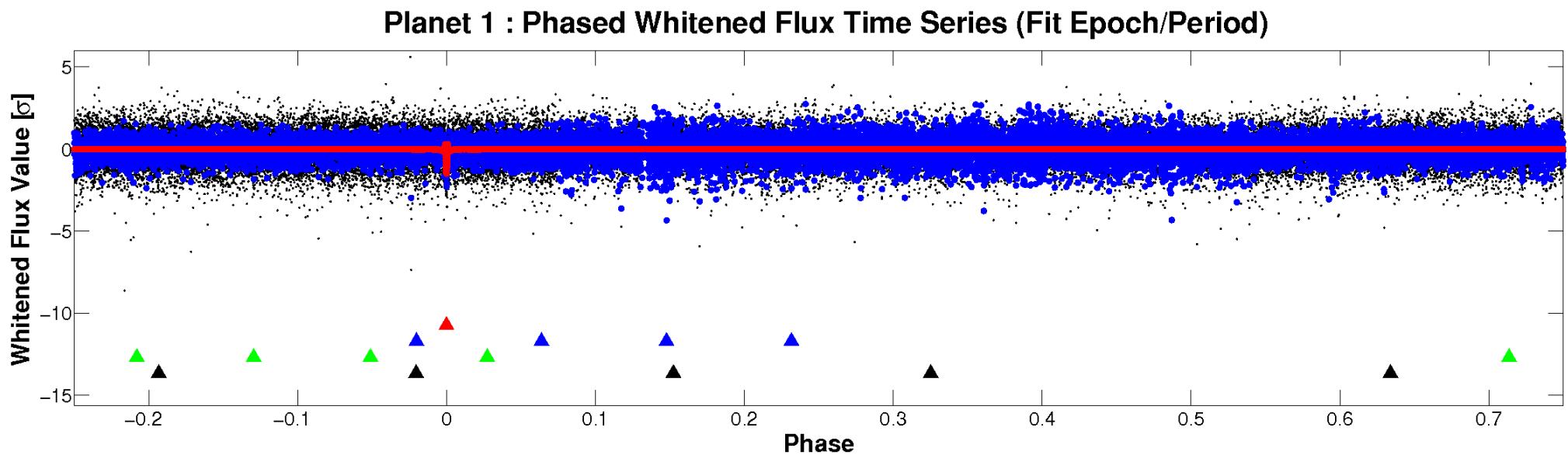
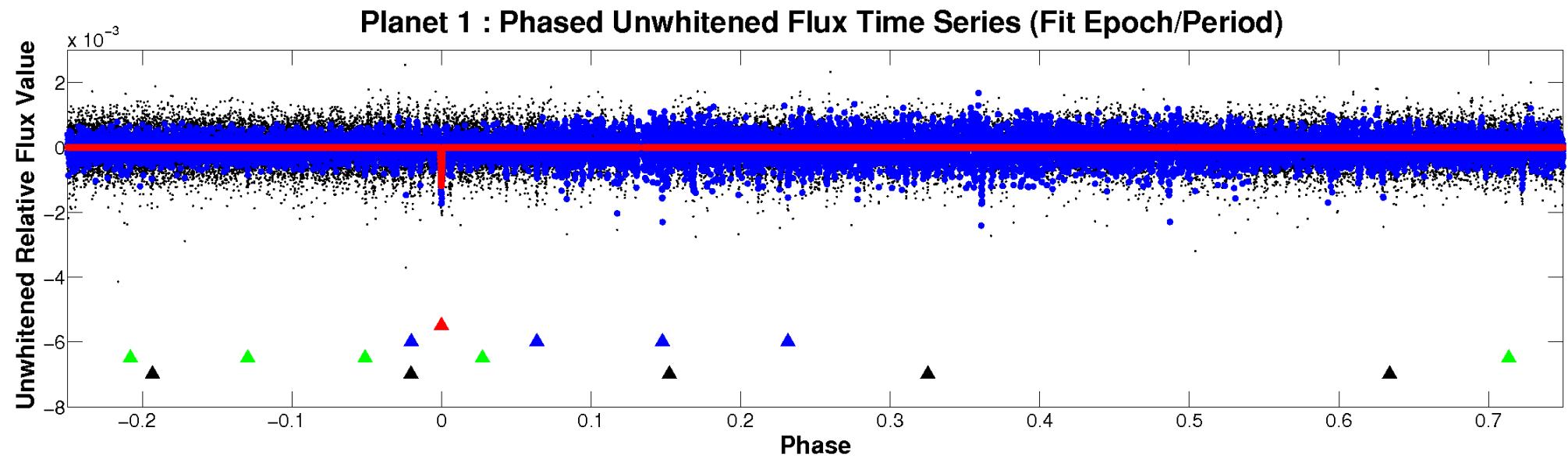


# ALT Odd/Even

TCE 010091451-01

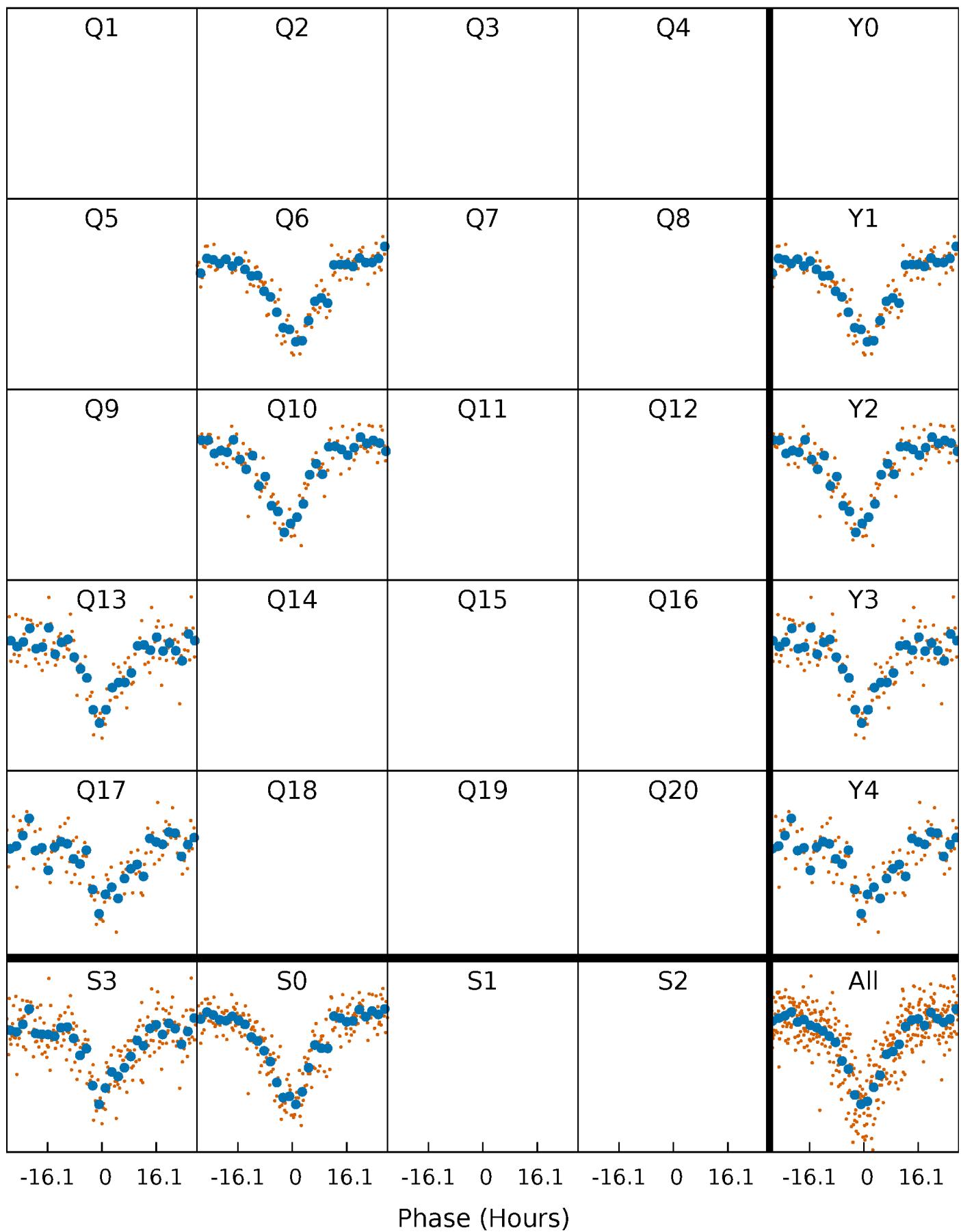


# Non-Whitened Vs. Whitened Light Curve



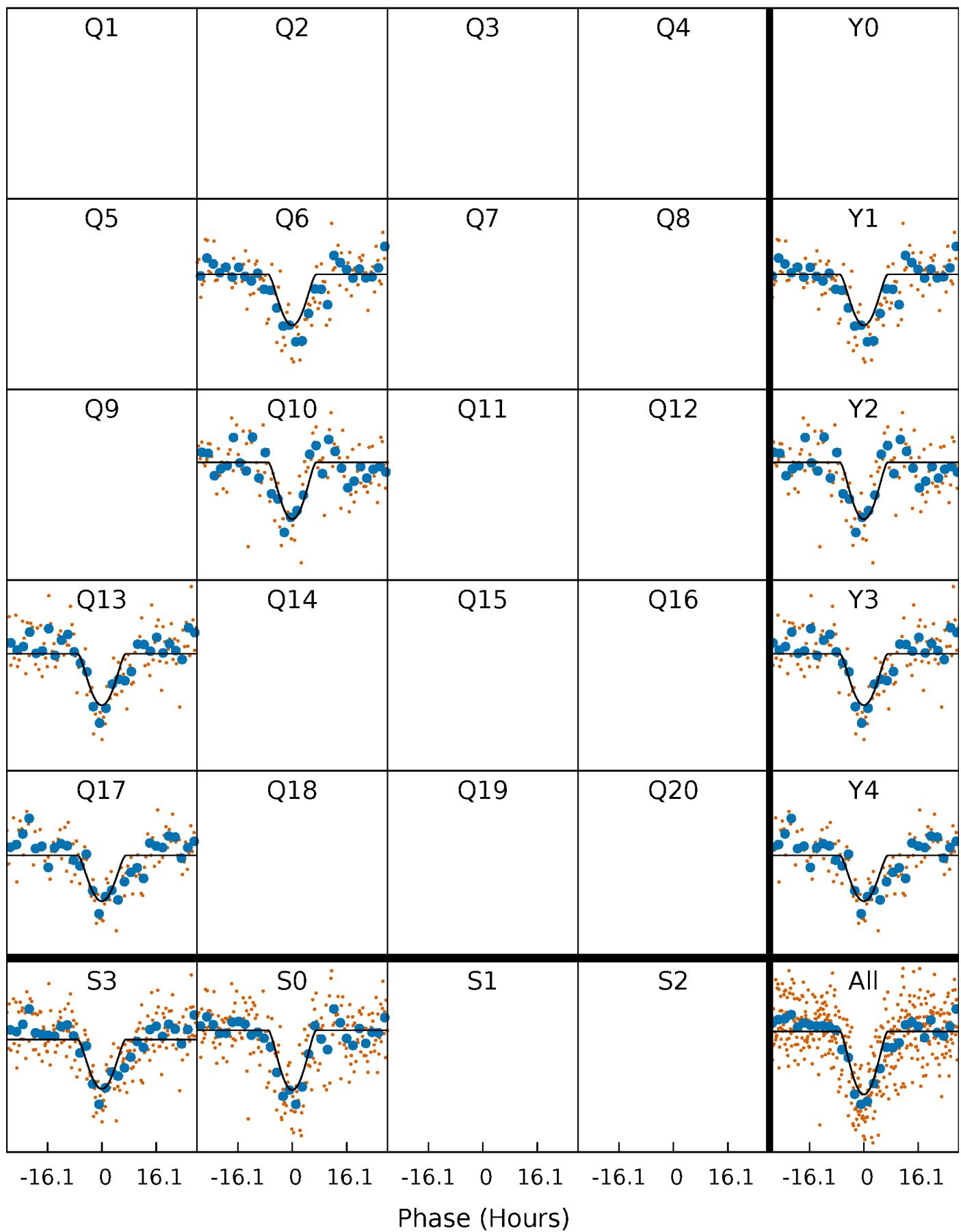
# PDC Quarter-Phased Transit Curves

TCE 010091451-01 P=320.996471 Days  $T_0=284.787792$  (BKJD)



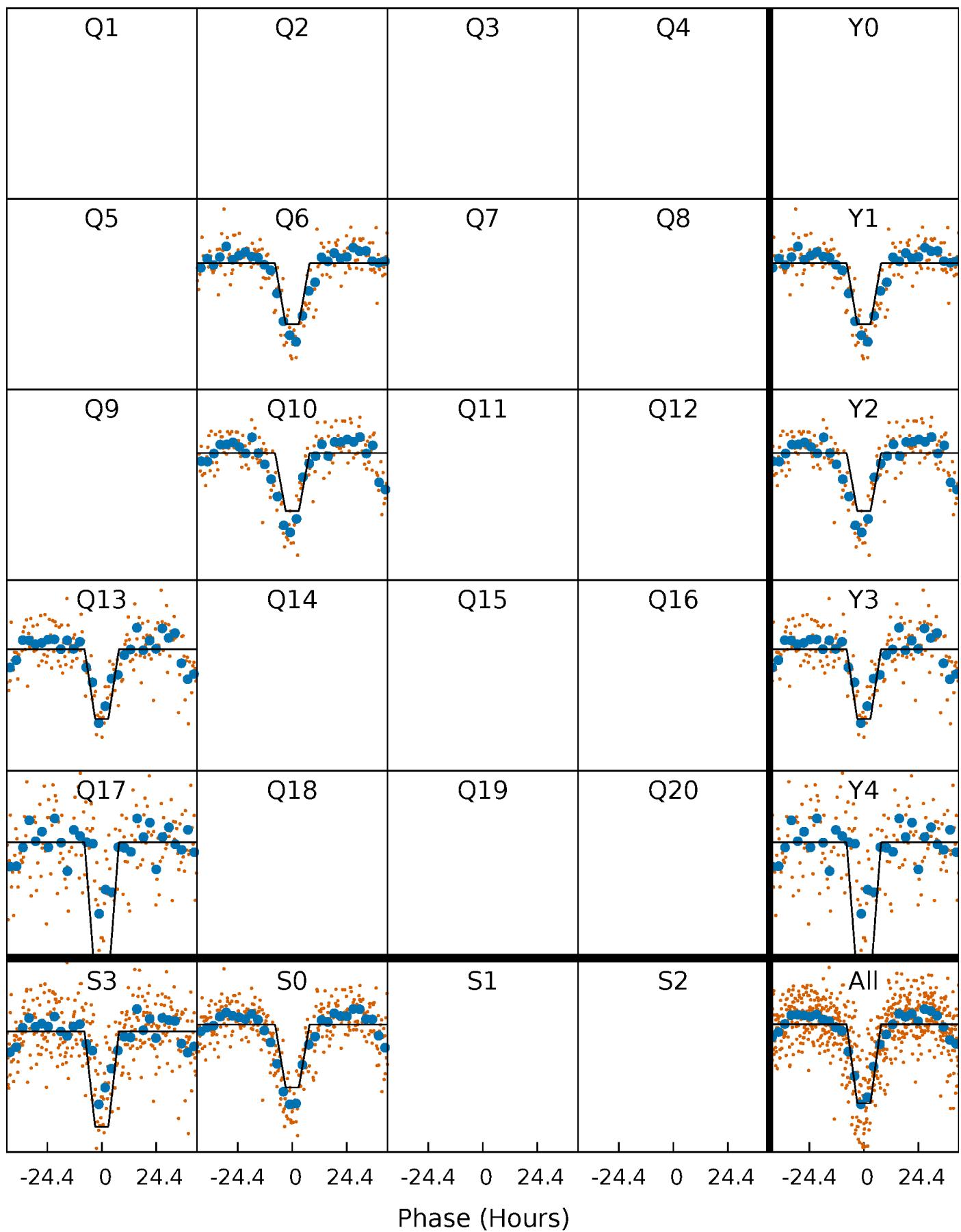
# DV Quarter-Phased Transit Curves

TCE 010091451-01 P=320.996471 Days  $T_0=284.787792$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

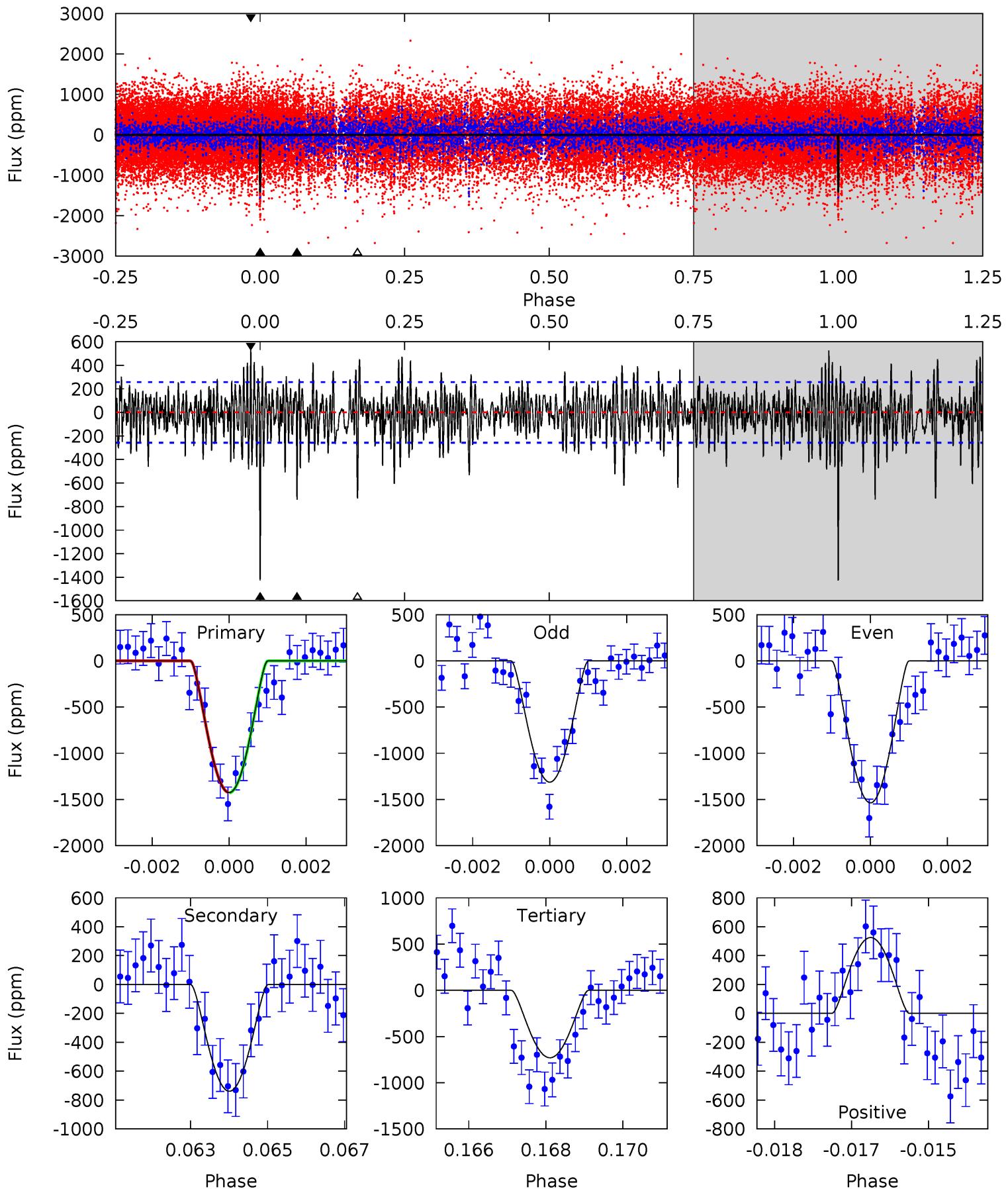
TCE 010091451-01 P=320.983983 Days  $T_0=284.822605$  (BKJD)



# DV Model-Shift Uniqueness Test

010091451-01,  $P = 320.996471$  Days,  $E = 284.787792$  Days

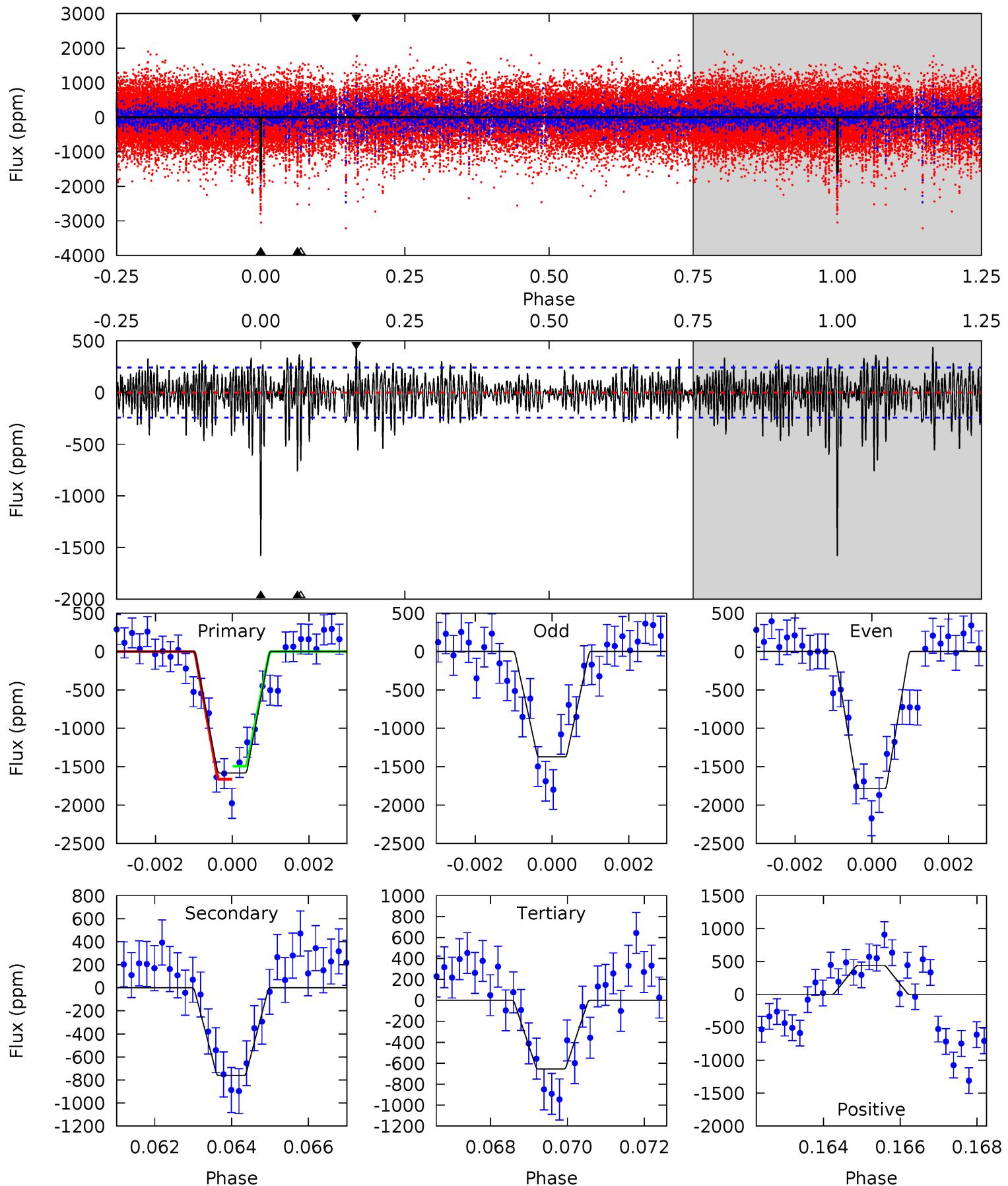
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
29.6	15.3	15.1	10.9	5.34	3.11	3.34	14.4	18.7	0.19	4.44	2.33	1.03	0.27	0.04



# Alt Model-Shift Uniqueness Test

010091451-01,  $P = 320.983983$  Days,  $E = 284.822605$  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
34.7	16.7	14.4	9.65	5.32	3.08	3.21	20.3	25.1	2.30	7.06	4.56	0.89	0.22	1.85



## Stellar Parameters For KIC 010091451

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6191^{+194}_{-259}$	$4.454^{+0.065}_{-0.208}$	$-0.100^{+0.250}_{-0.350}$	$1.025^{+0.309}_{-0.111}$	$1.088^{+0.141}_{-0.155}$	$1.423^{+0.484}_{-0.734}$
	$+3\%/-4\%$	$+1\%/-5\%$	$+250\%/-350\%$	$+30\%/-11\%$	$+13\%/-14\%$	$+34\%/-52\%$
Source	KIC0	KIC0	KIC0	DSEP		

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

## Secondary Eclipse Parameters for KIC 010091451-01 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (\text{K})$	$T_{obs} (\text{K})$	$A_{obs}$
DV	$-739 \pm 48$	$14.76^{+14.89}_{-10.14}$	$405^{+27}_{-22}$	$3391^{+1779}_{-607}$	$1645^{+14922}_{-1234}$
Alt.	$-760 \pm 45$	$14.12^{+15.06}_{-9.95}$	$404^{+29}_{-22}$	$3438^{+2063}_{-645}$	$1854^{+20222}_{-1415}$

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

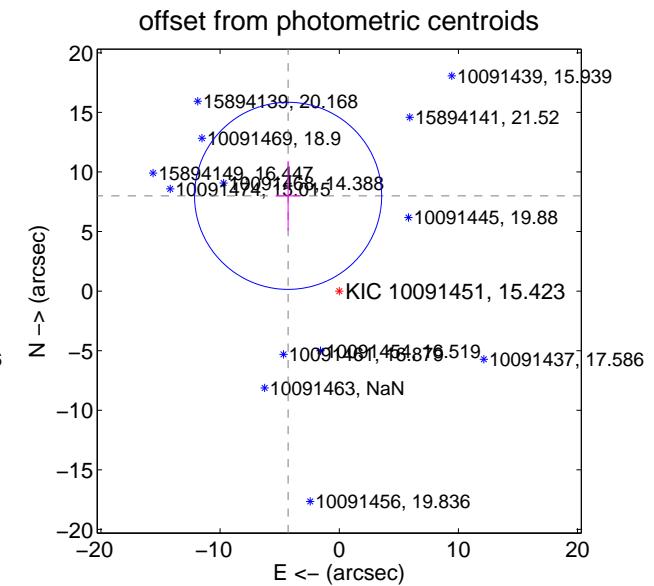
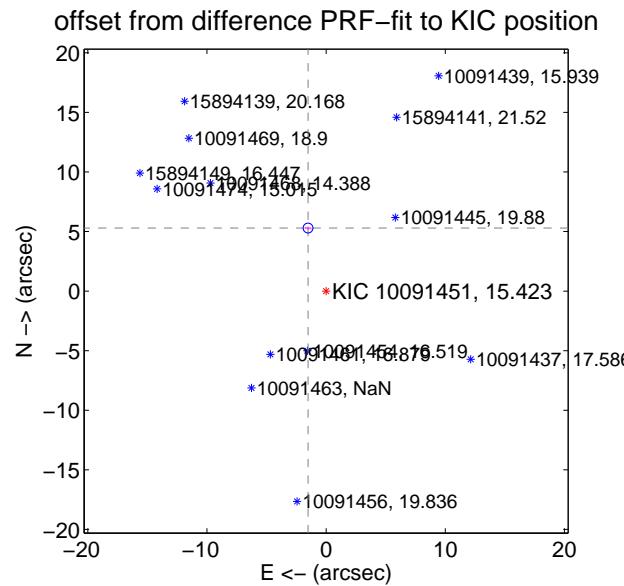
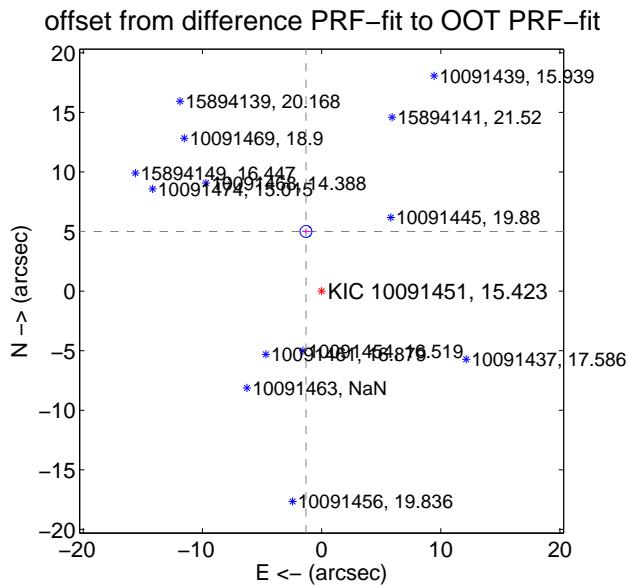
## DV Centroid Data

Supplemental centroid analysis for 010091451-01. Kepler magnitude: 15.42. Transit SNR 10.05

**There are 2 quarters with good PRF difference image offsets**

The direct PRF centroid is offset from the target star catalog position by about 0.32 arcsec

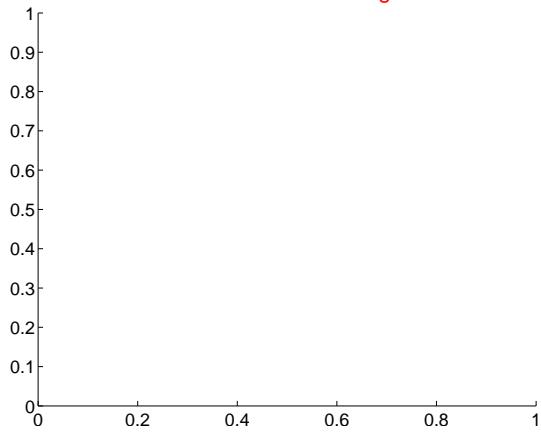
	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$5.173 \pm 0.166$	31.17	$1.314 \pm 0.307$	$5.003 \pm 0.152$
PRF-fit source offset from KIC position	$5.505 \pm 0.137$	40.05	$1.517 \pm 0.280$	$5.292 \pm 0.118$
photometric centroid source offset	$9.08 \pm 2.62$	3.47	$4.29 \pm 1.04$	$8.00 \pm 2.92$



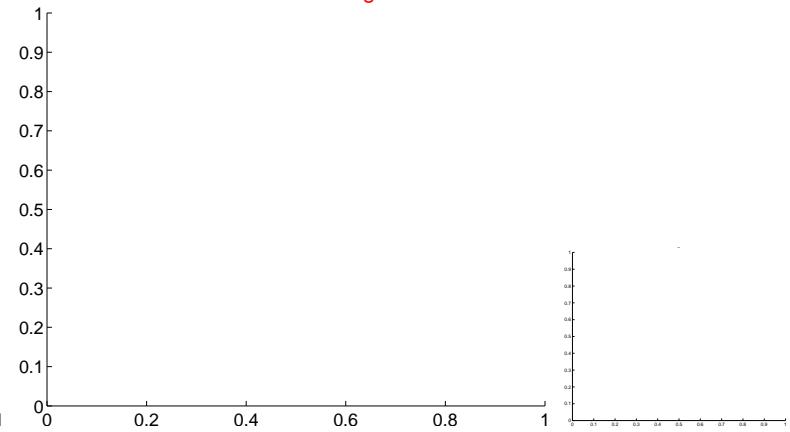
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

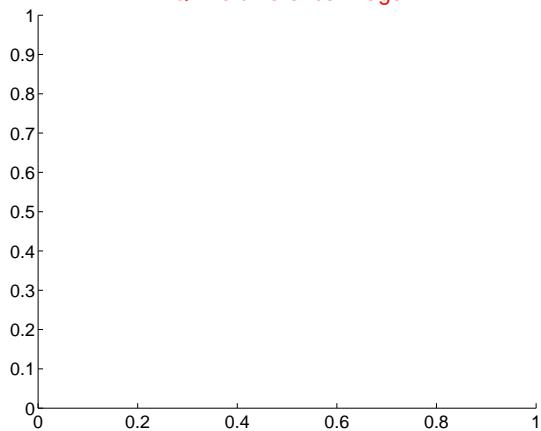
Q1 no difference image



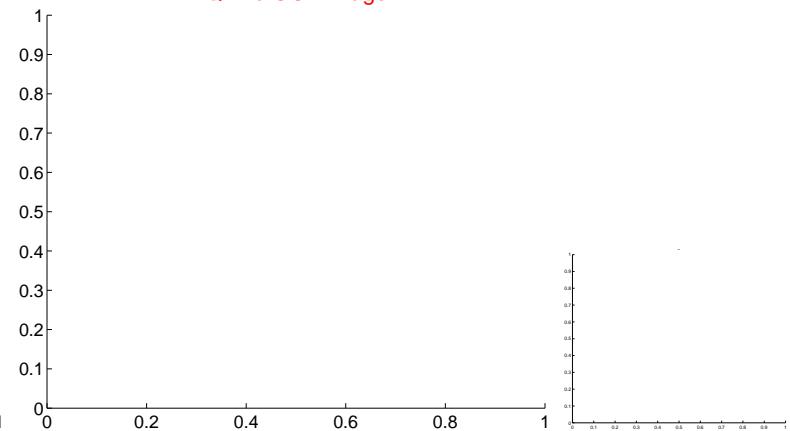
Q1 no OOT image



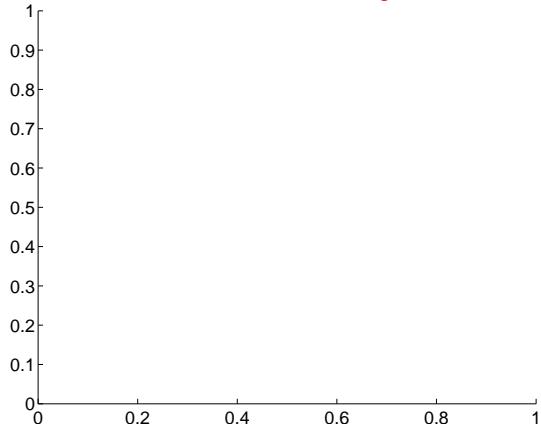
Q2 no difference image



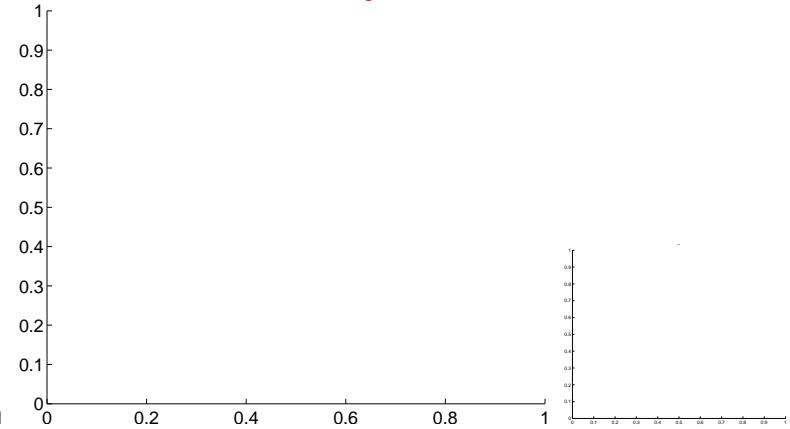
Q2 no OOT image



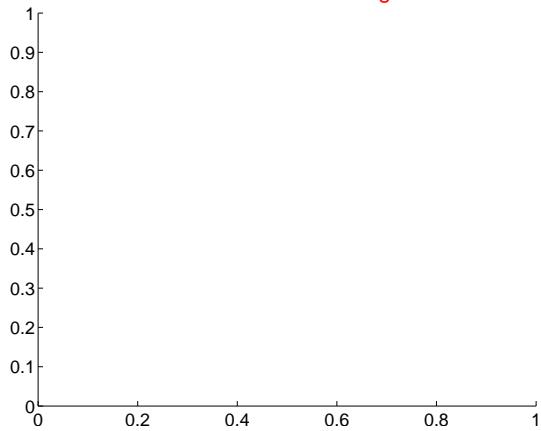
Q3 no difference image



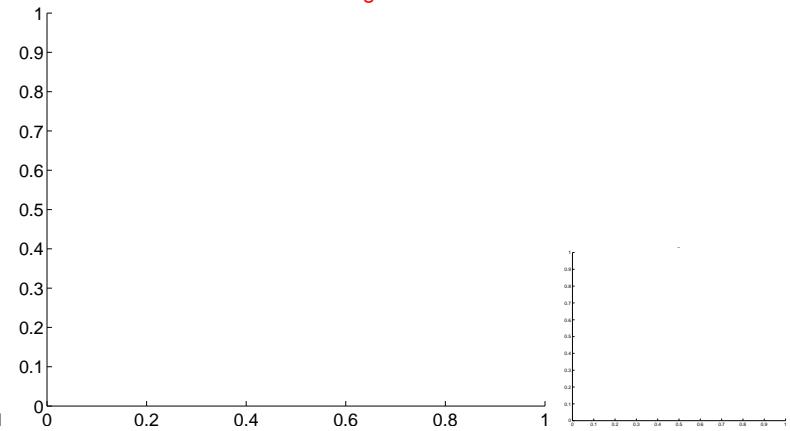
Q3 no OOT image



Q4 no difference image

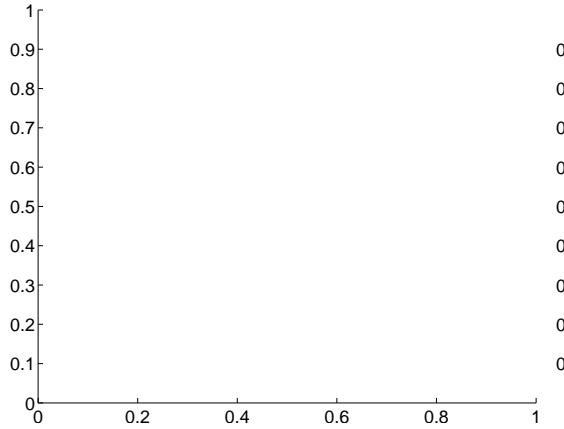


Q4 no OOT image

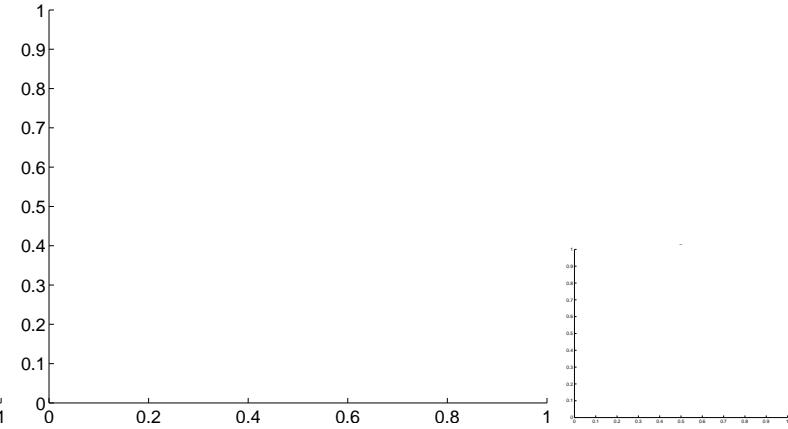


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

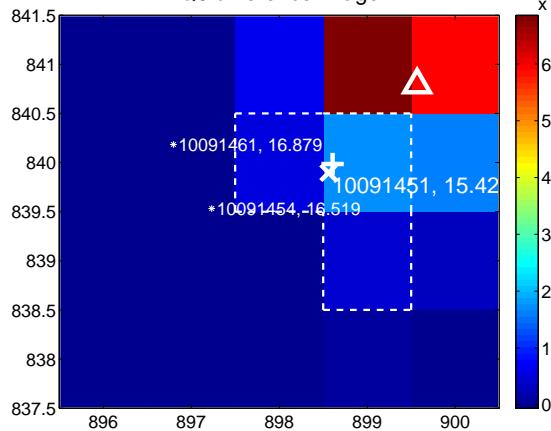
Q5 no difference image



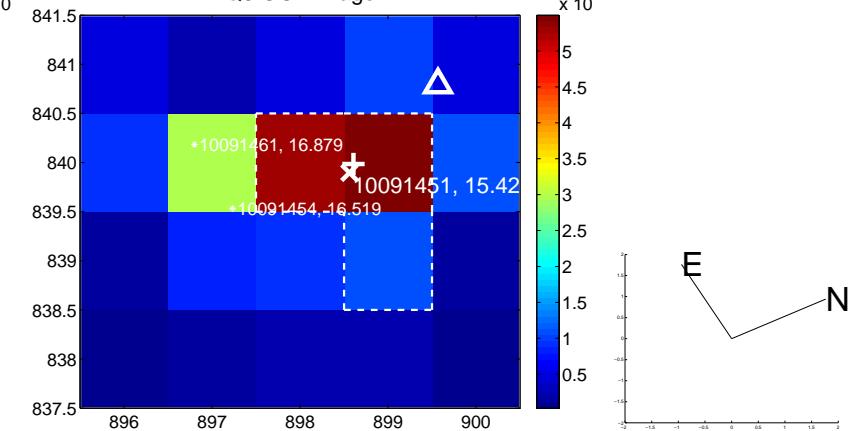
Q5 no OOT image



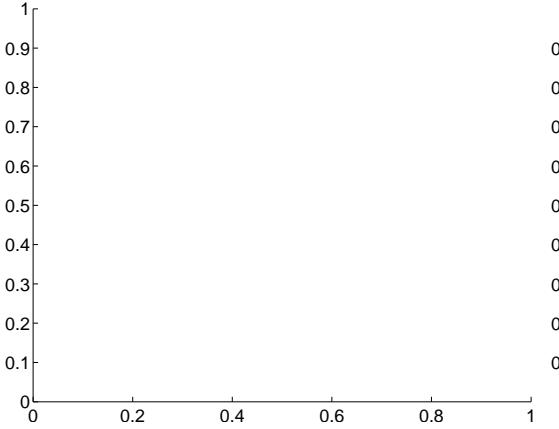
Q6 difference image



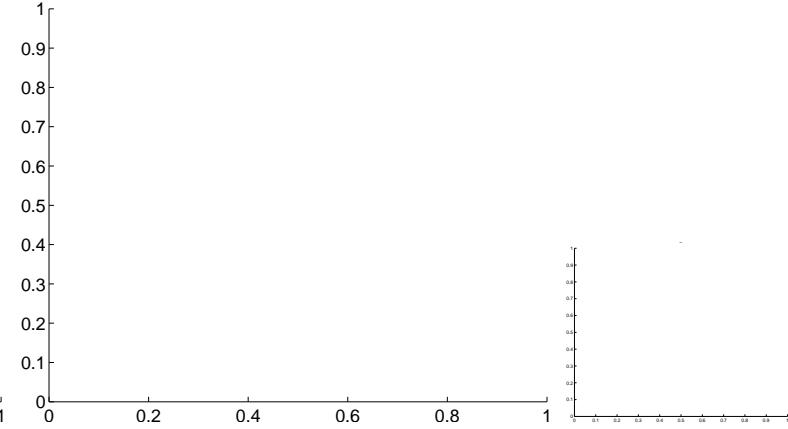
Q6 OOT image



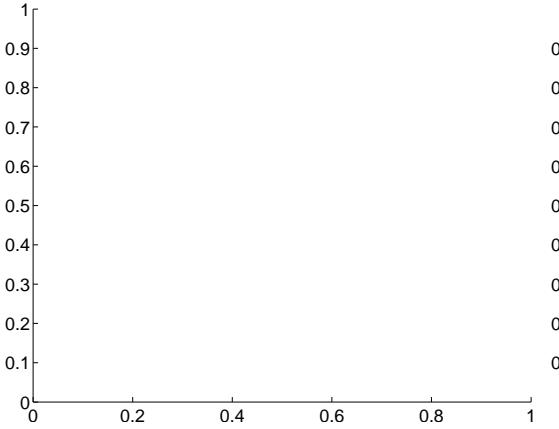
Q7 no difference image



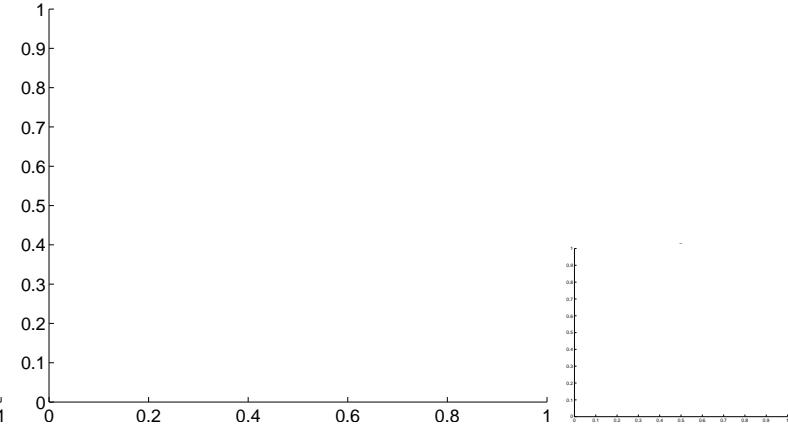
Q7 no OOT image



Q8 no difference image

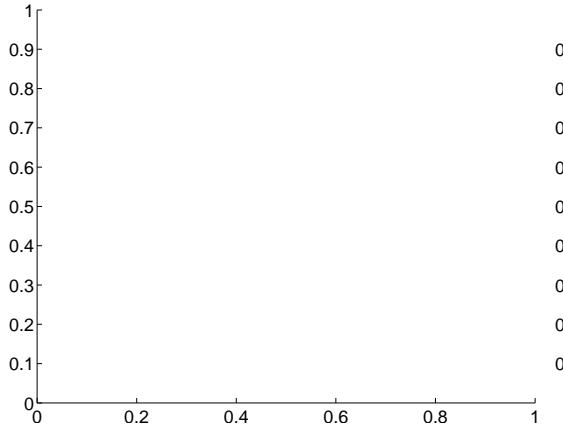


Q8 no OOT image

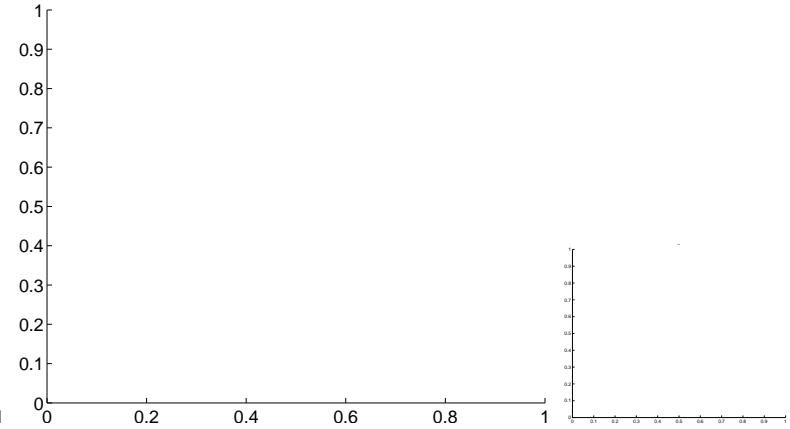


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

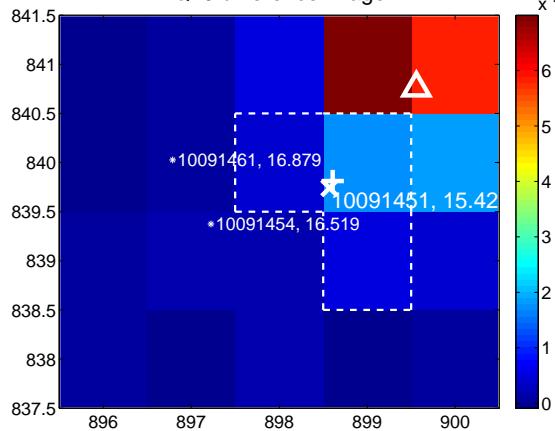
Q9 no difference image



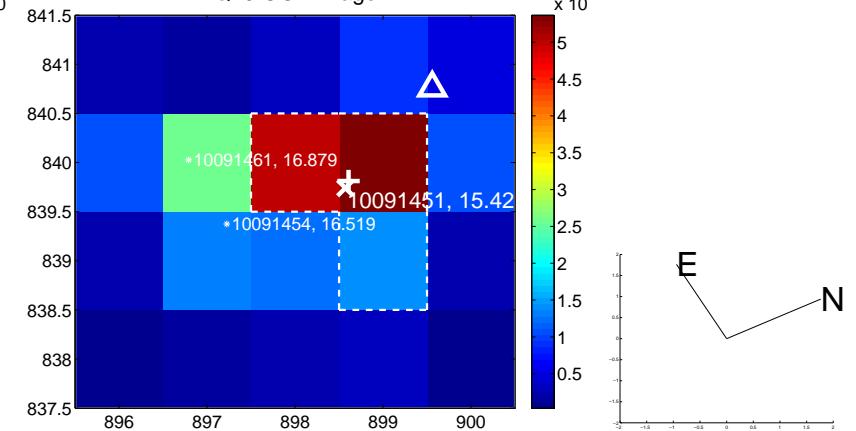
Q9 no OOT image



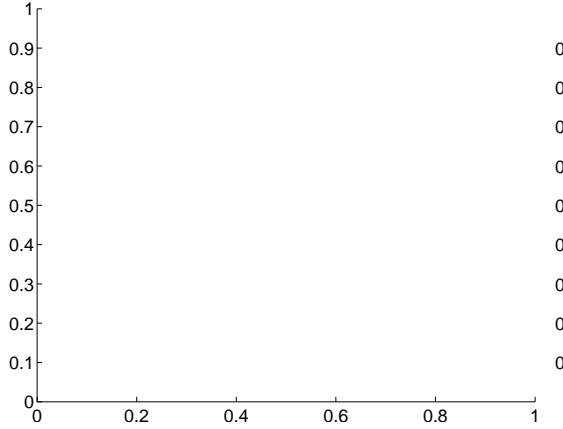
Q10 difference image



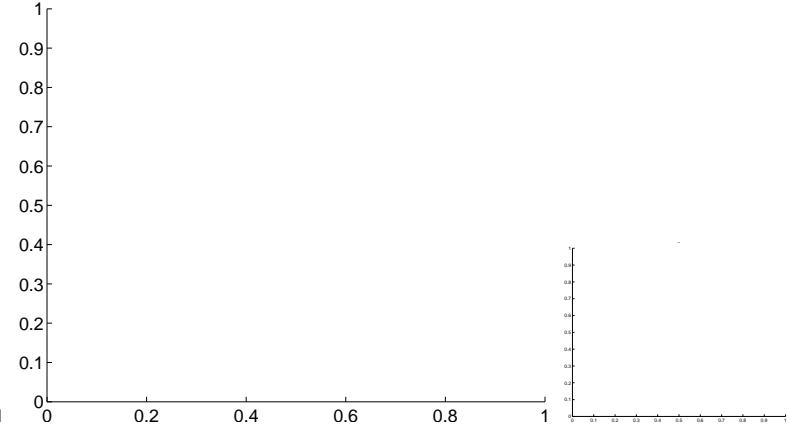
Q10 OOT image



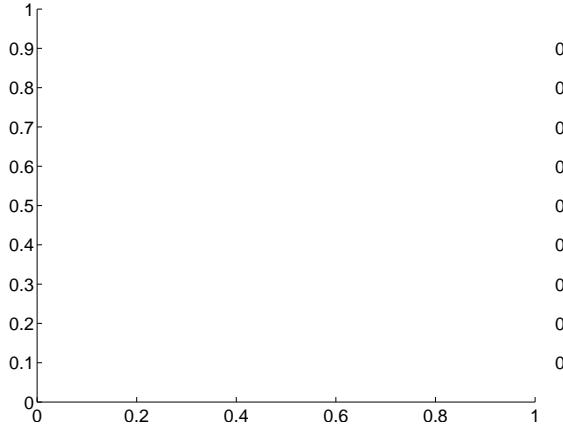
Q11 no difference image



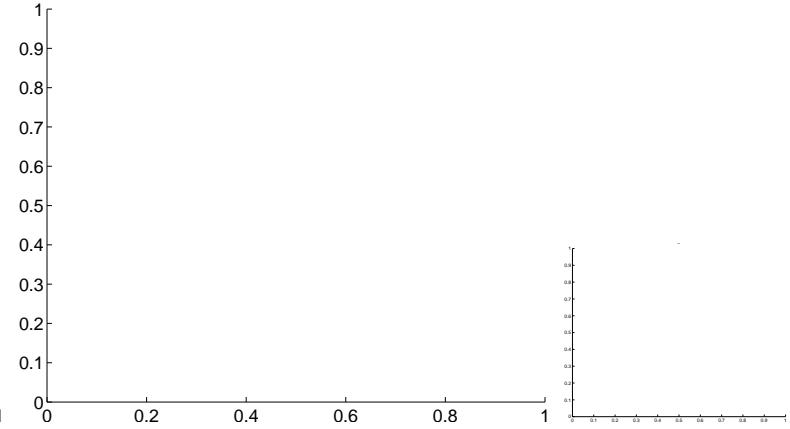
Q11 no OOT image



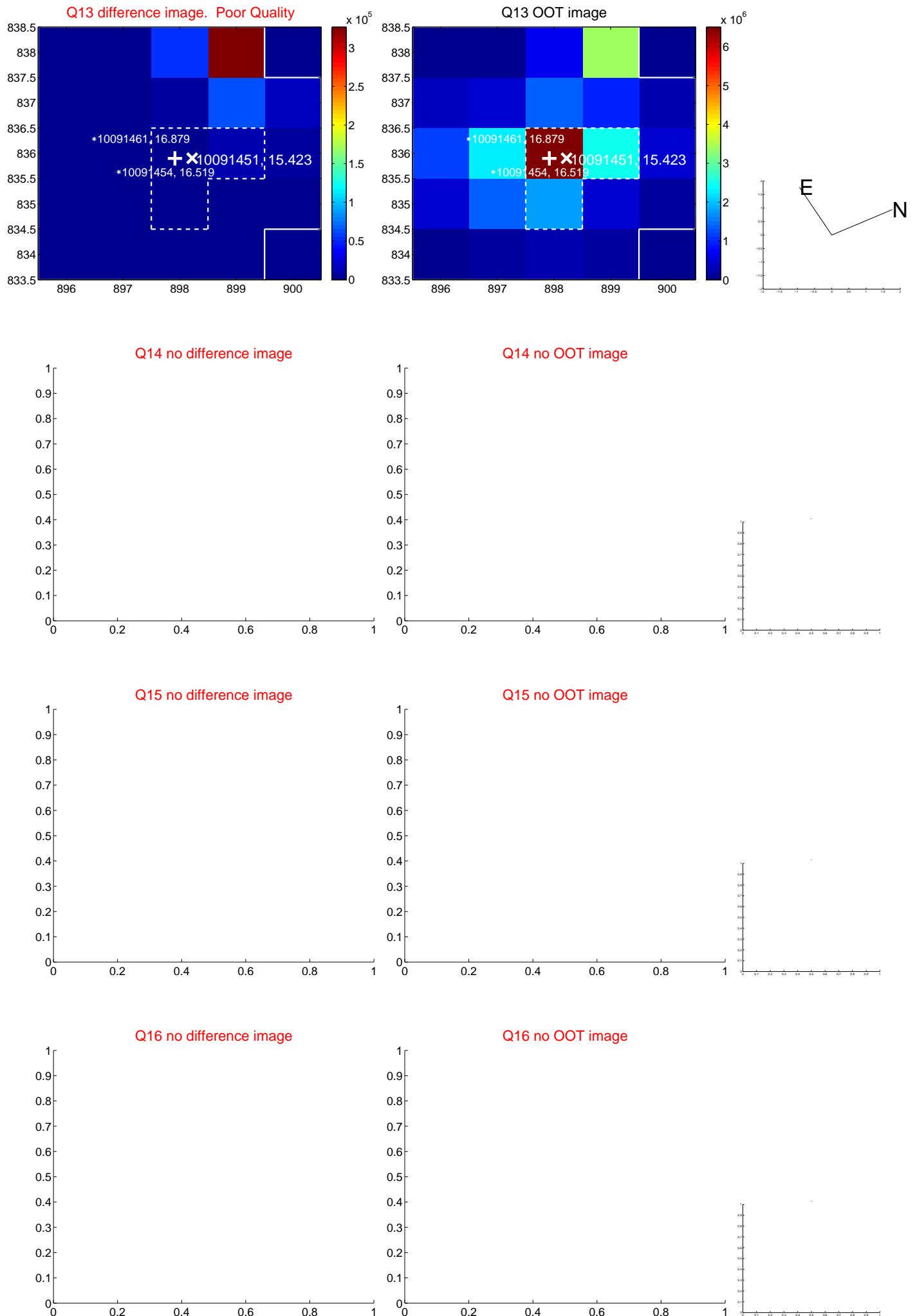
Q12 no difference image



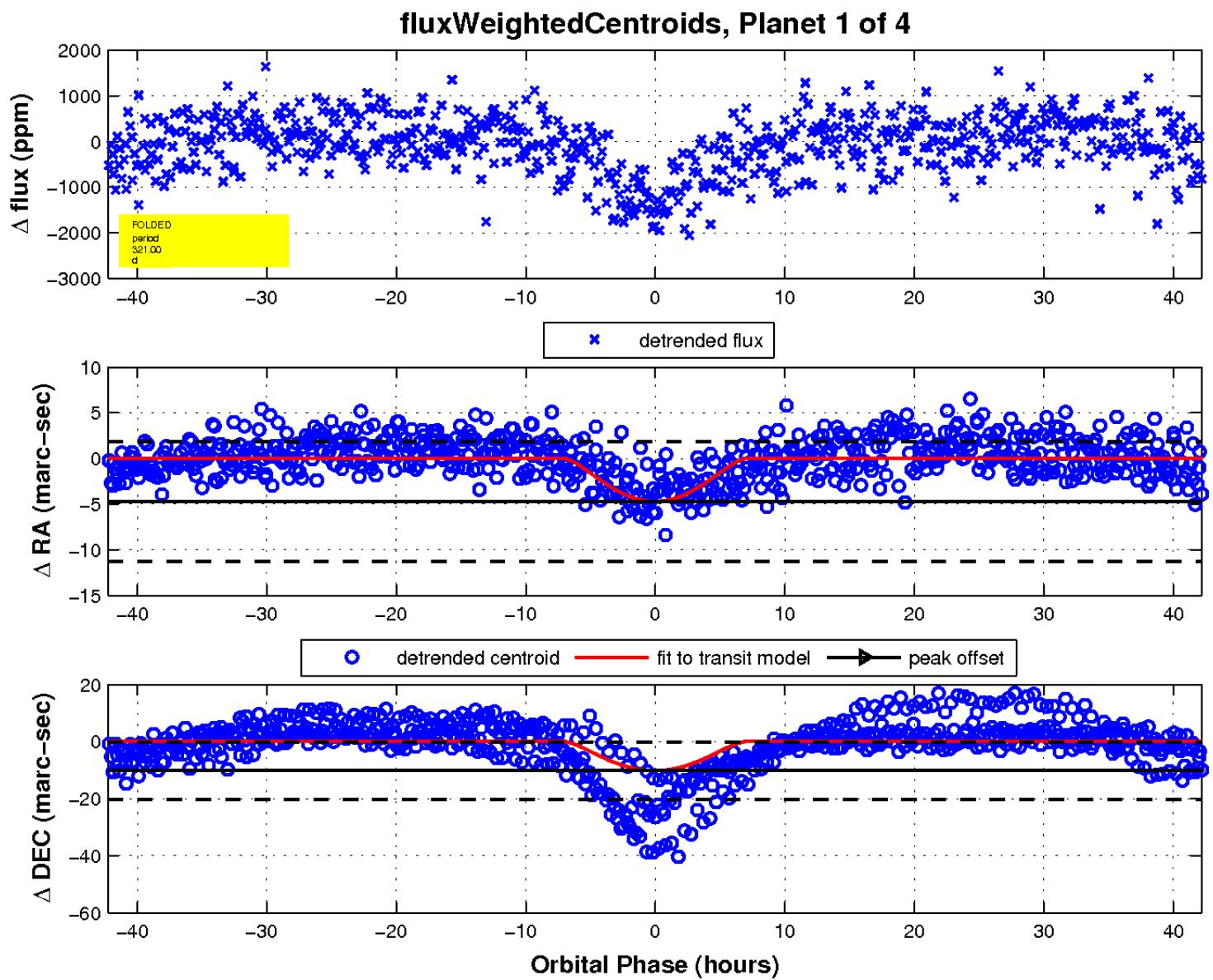
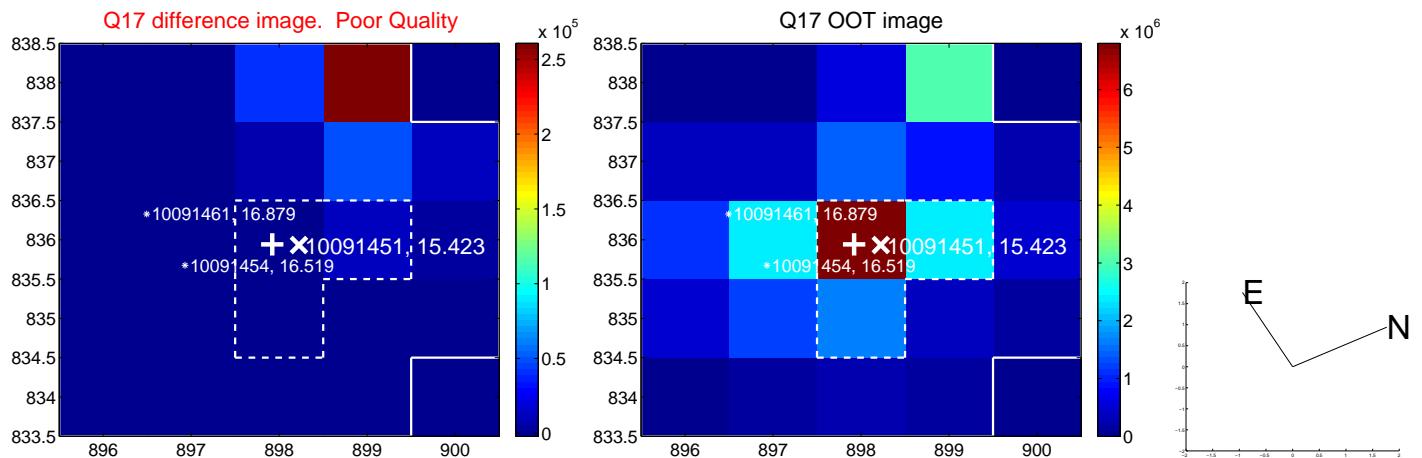
Q12 no OOT image



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

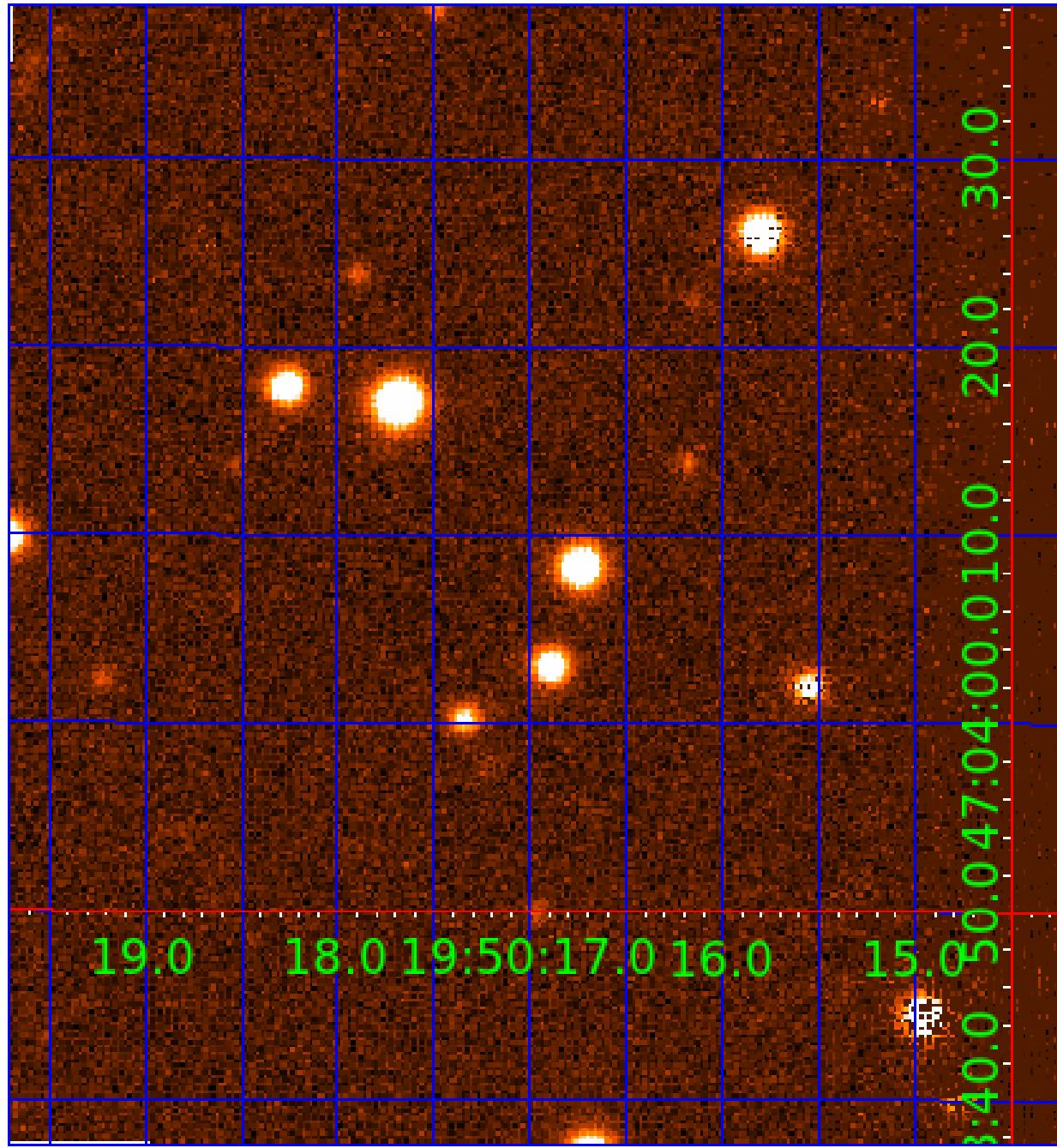


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 010091451

## Q1-17 DR25 TCE Parameters

TCE	Run Type	KOI?	Period (Days)	Epoch (BKJD)	Depth (ppm)	Duration (Hours)	MES	SNR	$R_*$ ( $R_{\odot}$ )	$T_*$ (K)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
010091451-01	INV	No	320.996471	284.787792	1187.6	14.105	8.8	10.1	1.02	6191	6.71	1.55
010091451-02	INV	No	347.939030	278.324326	1147.4	12.252	7.4	7.7	1.02	6191	6.60	1.39
010091451-03	INV	No	346.178931	192.856885	950.4	9.839	7.3	9.0	1.02	6191	3.95	1.40
010091451-04	INV	No	265.522594	389.189240	729.3	12.507	7.3	7.0	1.02	6191	2.79	2.00

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
010091451-01	INV	FP	0.00	0	1	1	0	DEEP_V_SHAPED—CENT_RESOLVED_OFFSET
010091451-02	INV	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL—CENT_FEW_DIFFS
010091451-03	INV	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—MOD_NONUNIQ_ALT—MOD_TER_ALT—CENT_FEW_DIFFS
010091451-04	INV	PC	0.05	0	0	0	0	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.

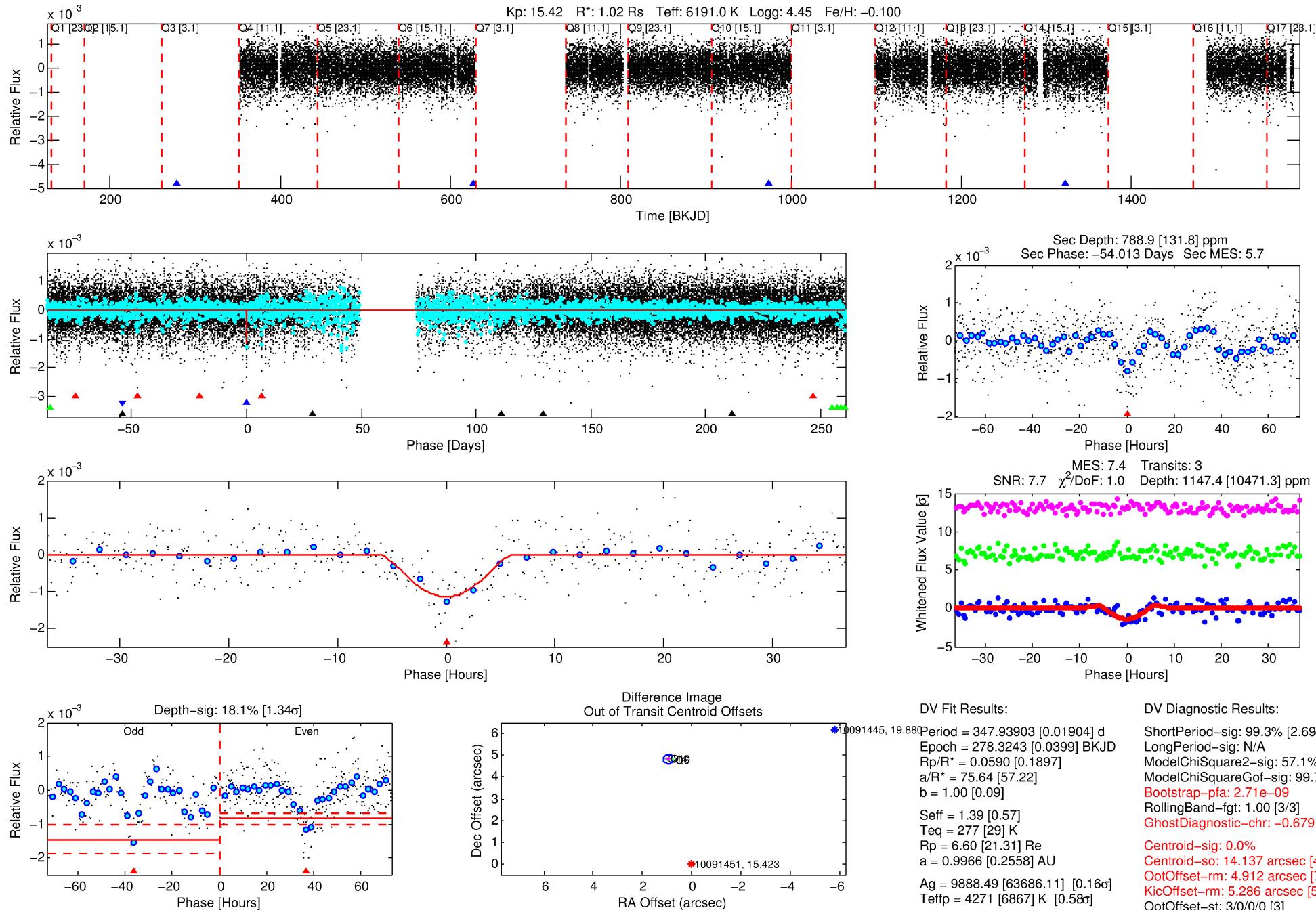
## Ephemeris Match Information For 010091451-02

No Significant Match Found

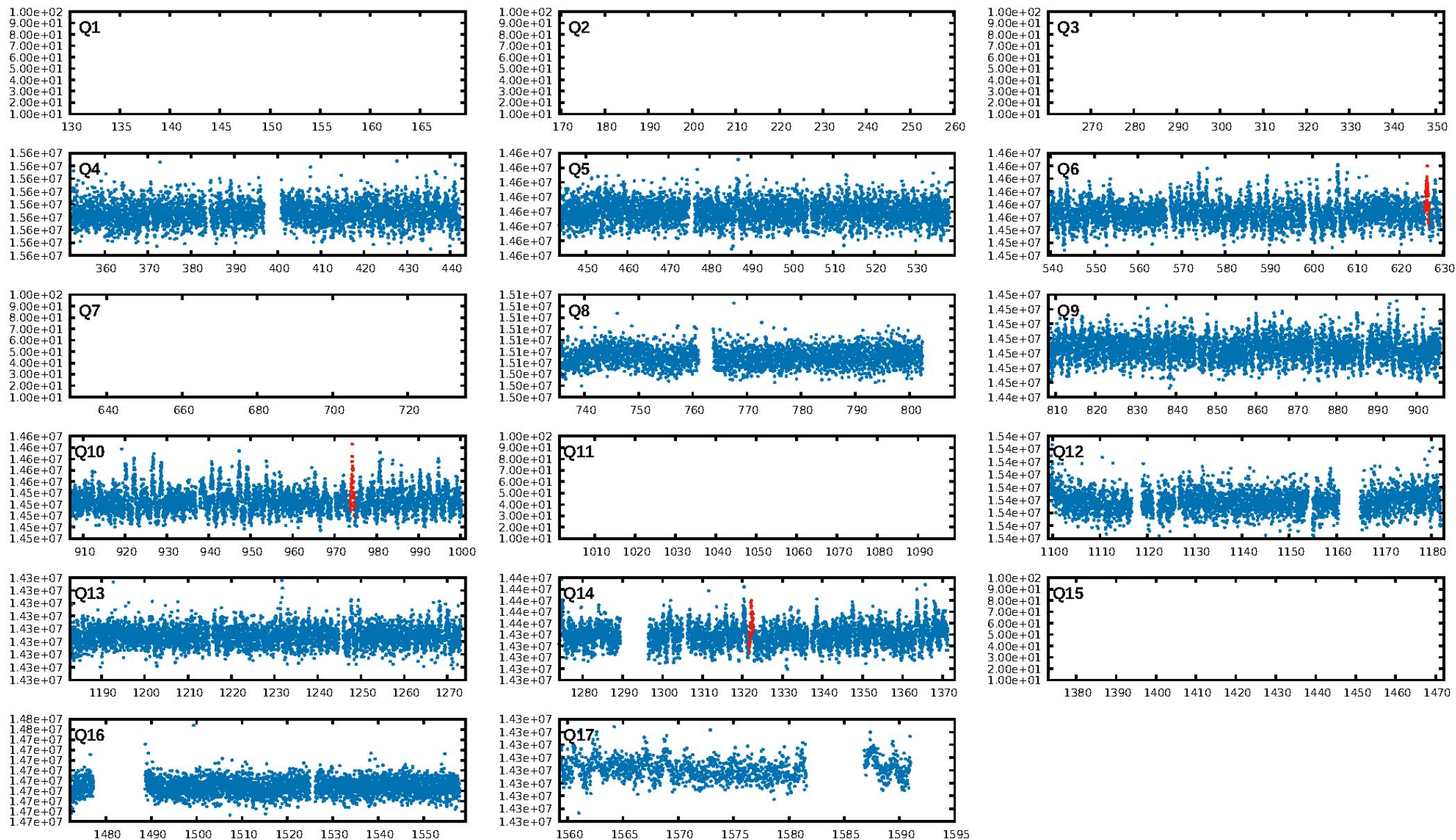
**WARNING: THIS DATA IS  
SIMULATED, NOT OBSERVED**

## DV One-Page Summary

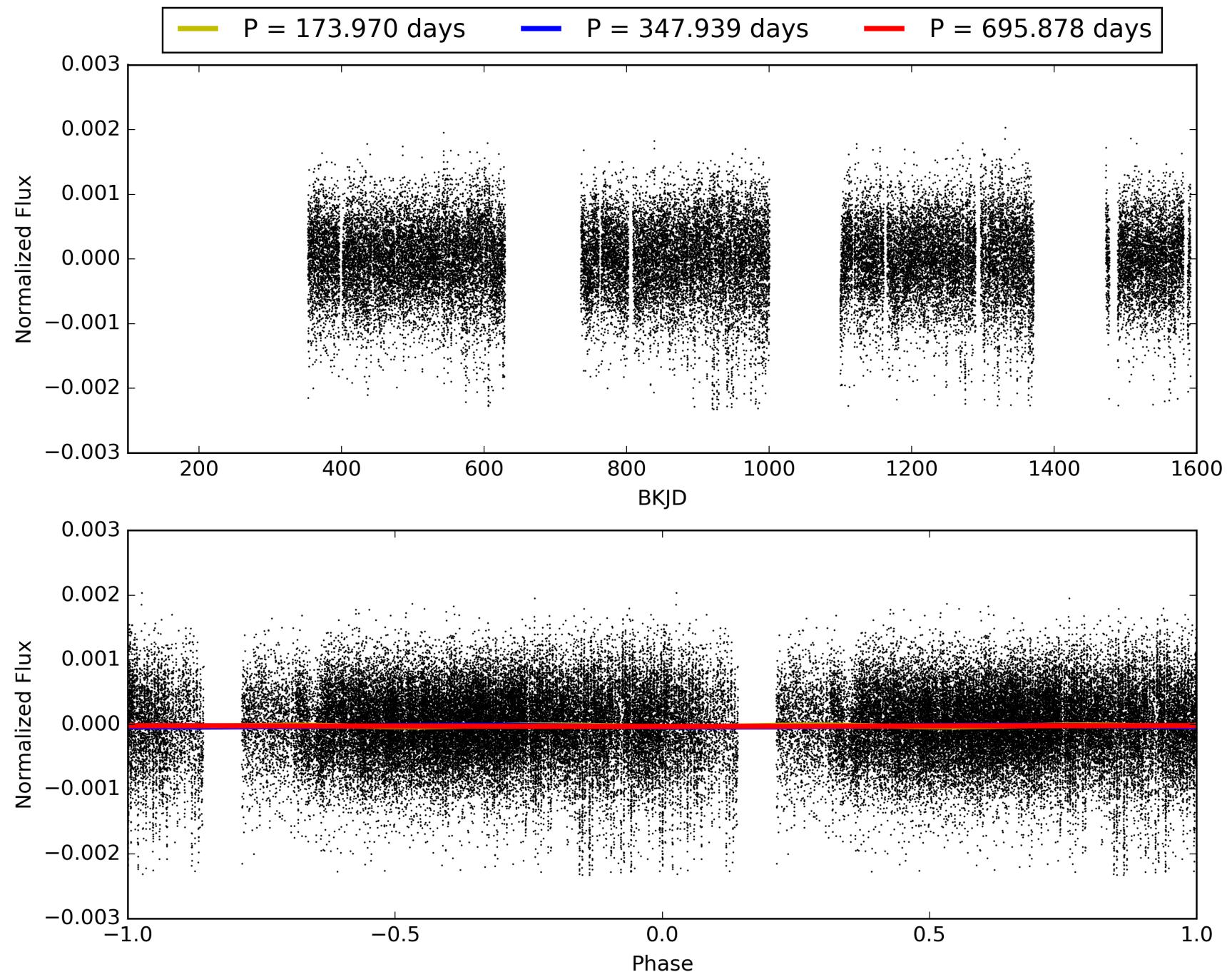
KIC: 10091451 Candidate: 2 of 4 Period: 347.939 d



# TCE 010091451-02, PDC Light Curves

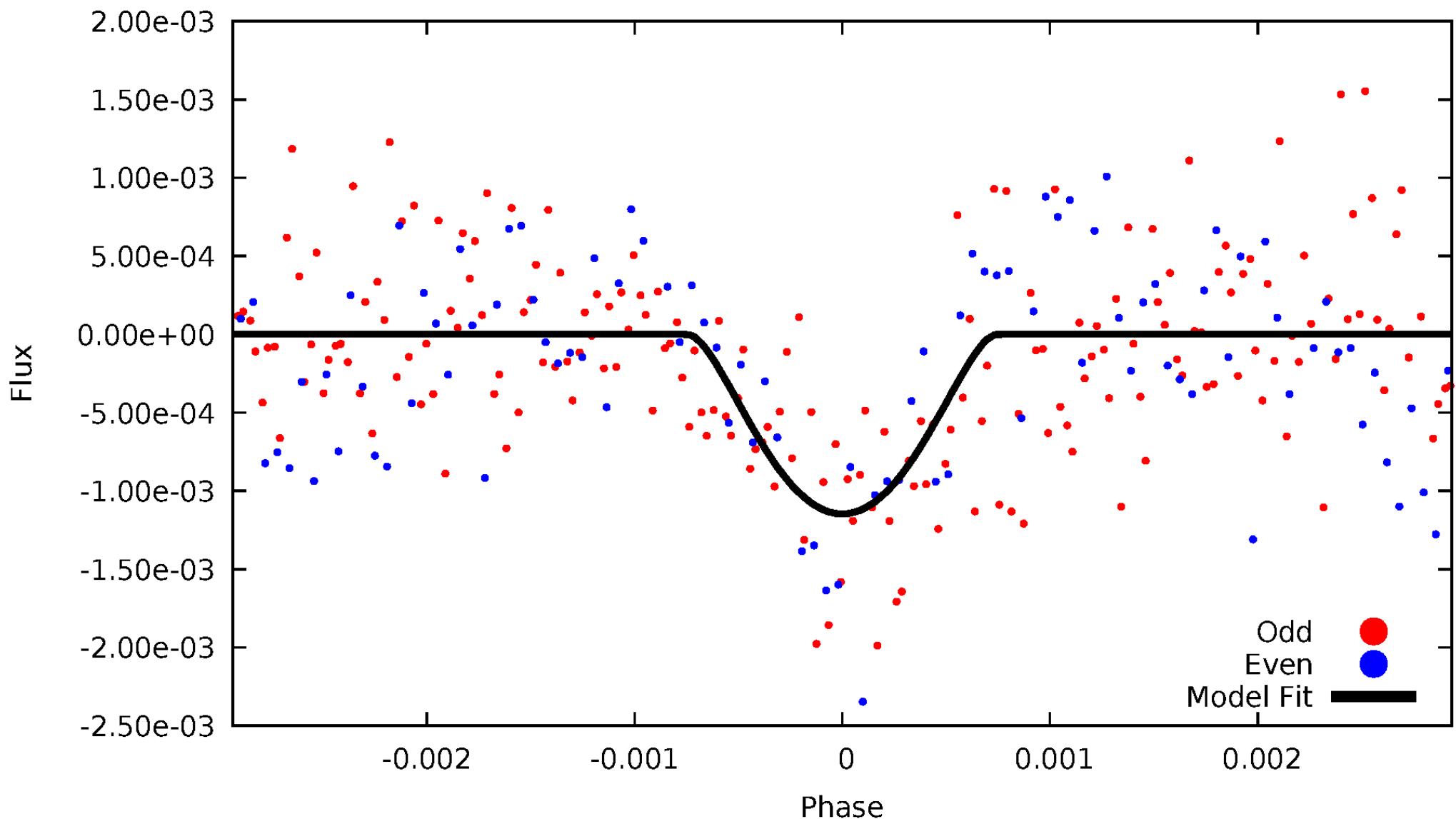


# TCE 010091451-02



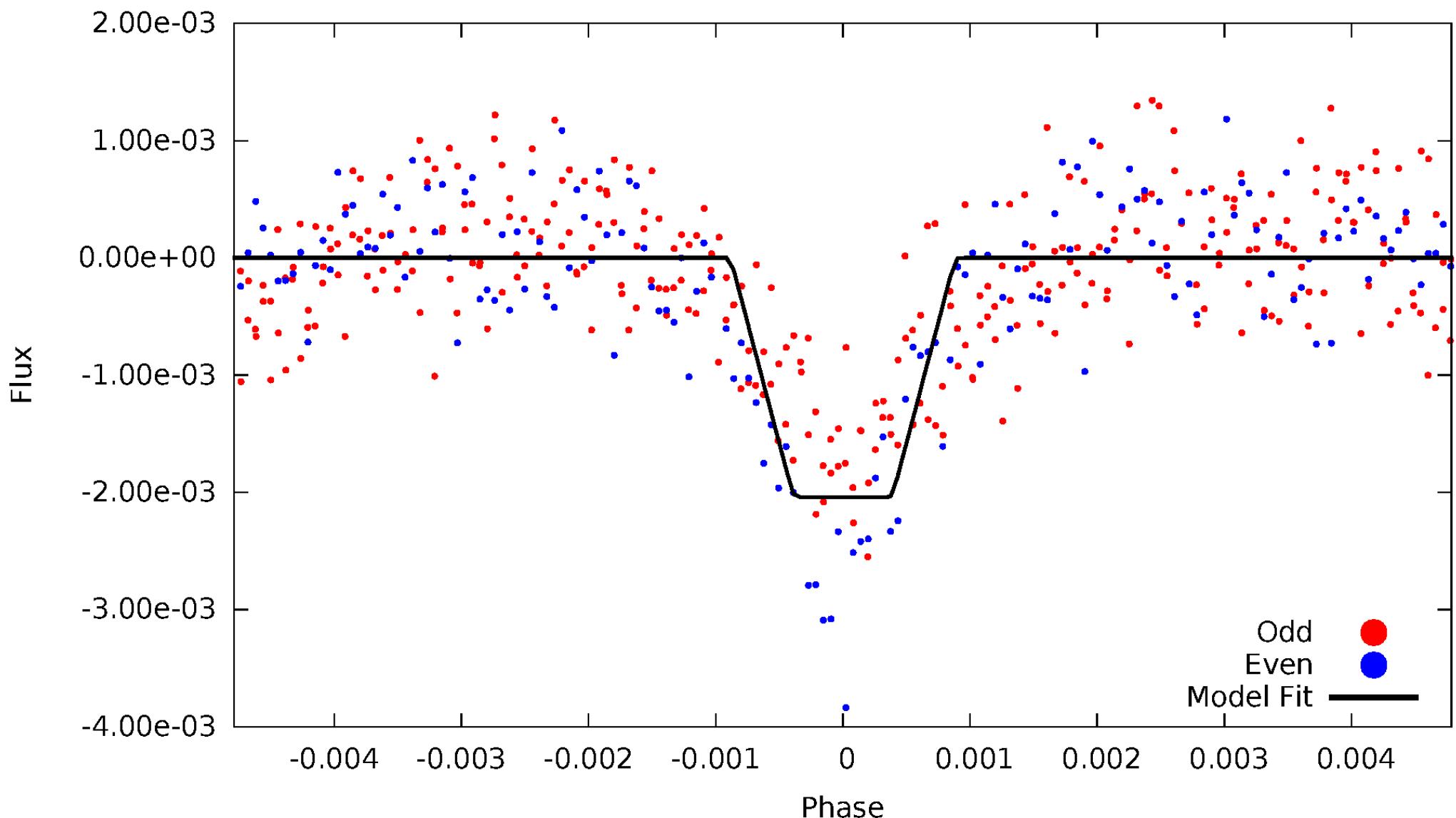
# DV Odd/Even

TCE 010091451-02

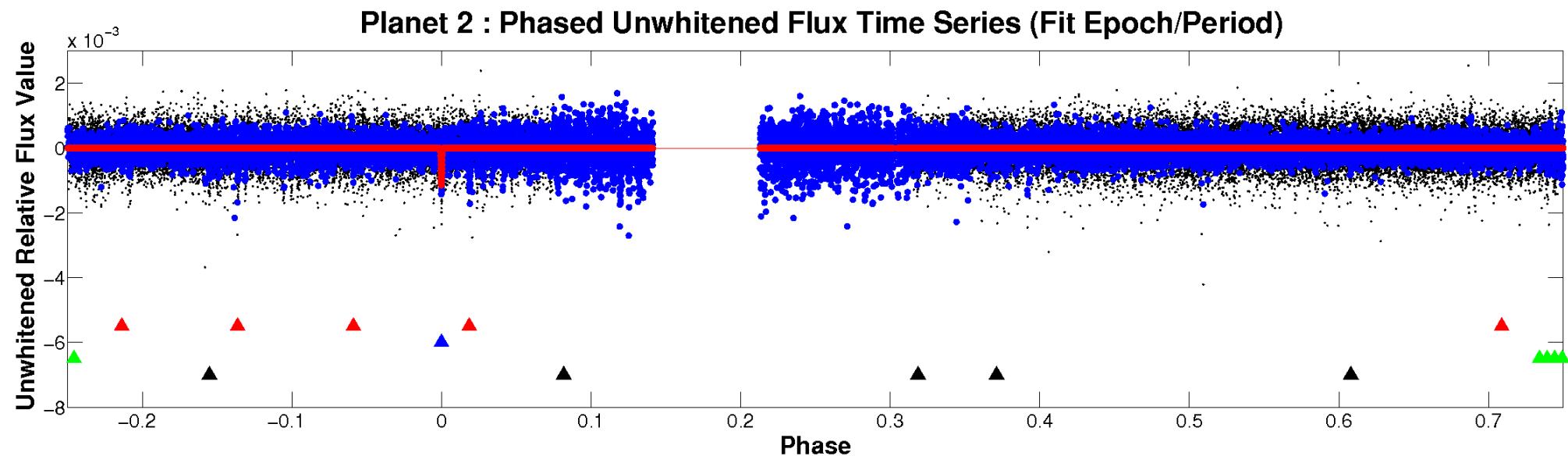


# ALT Odd/Even

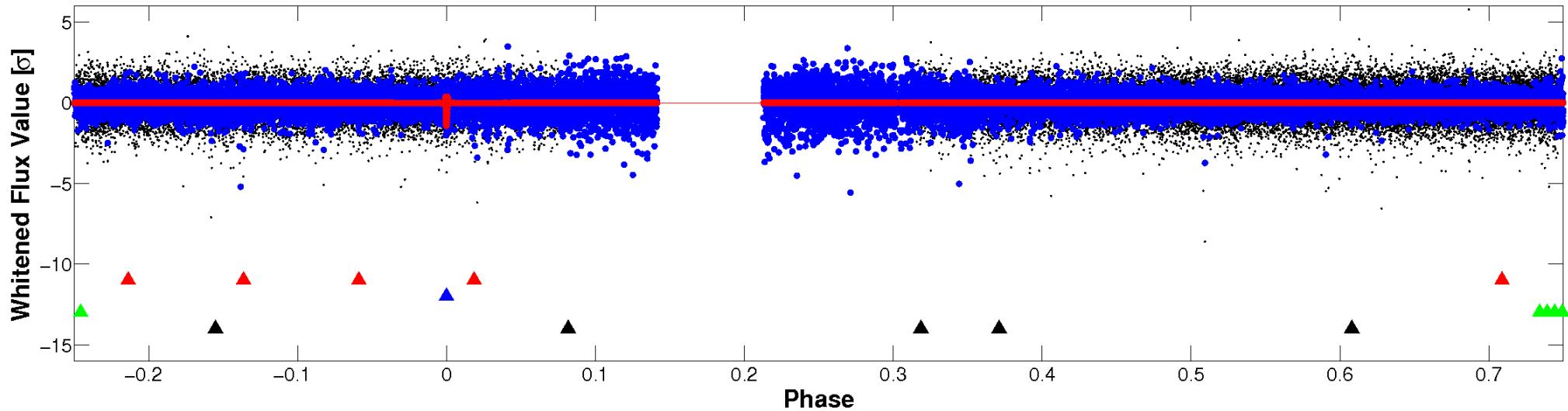
TCE 010091451-02



## Non-Whitened Vs. Whitened Light Curve

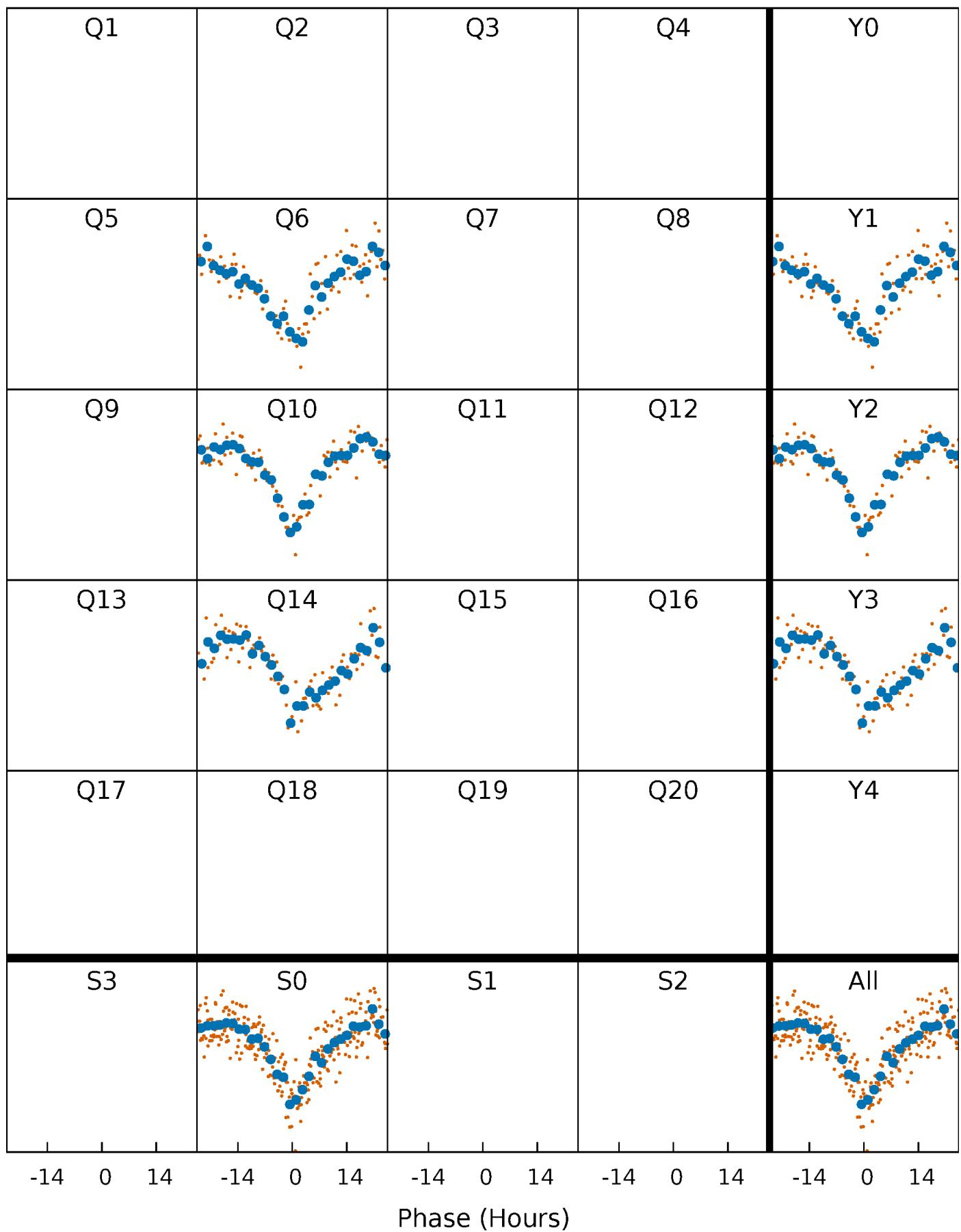


**Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



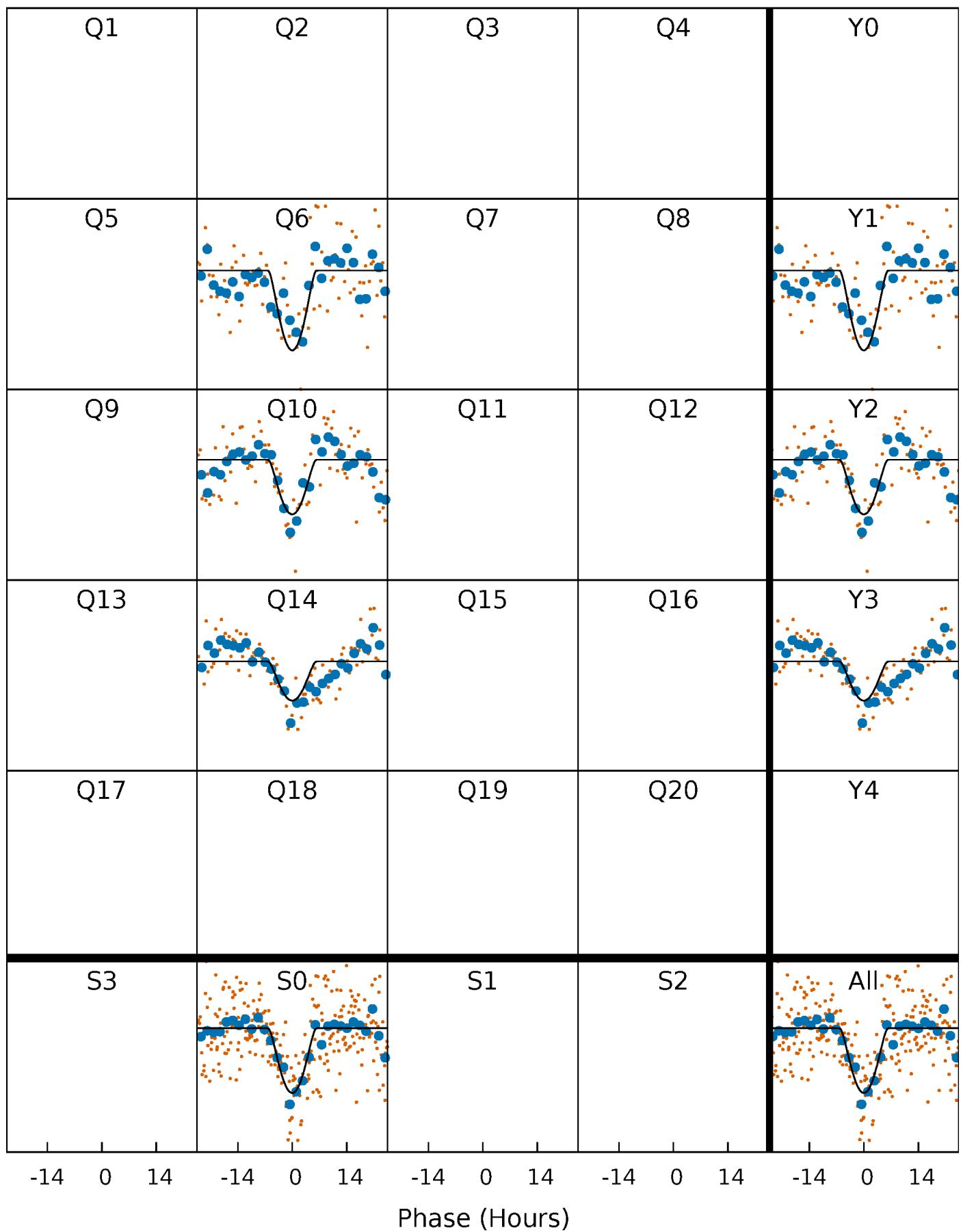
# PDC Quarter-Phased Transit Curves

TCE 010091451-02   P=347.939030 Days    $T_0=278.324326$  (BKJD)



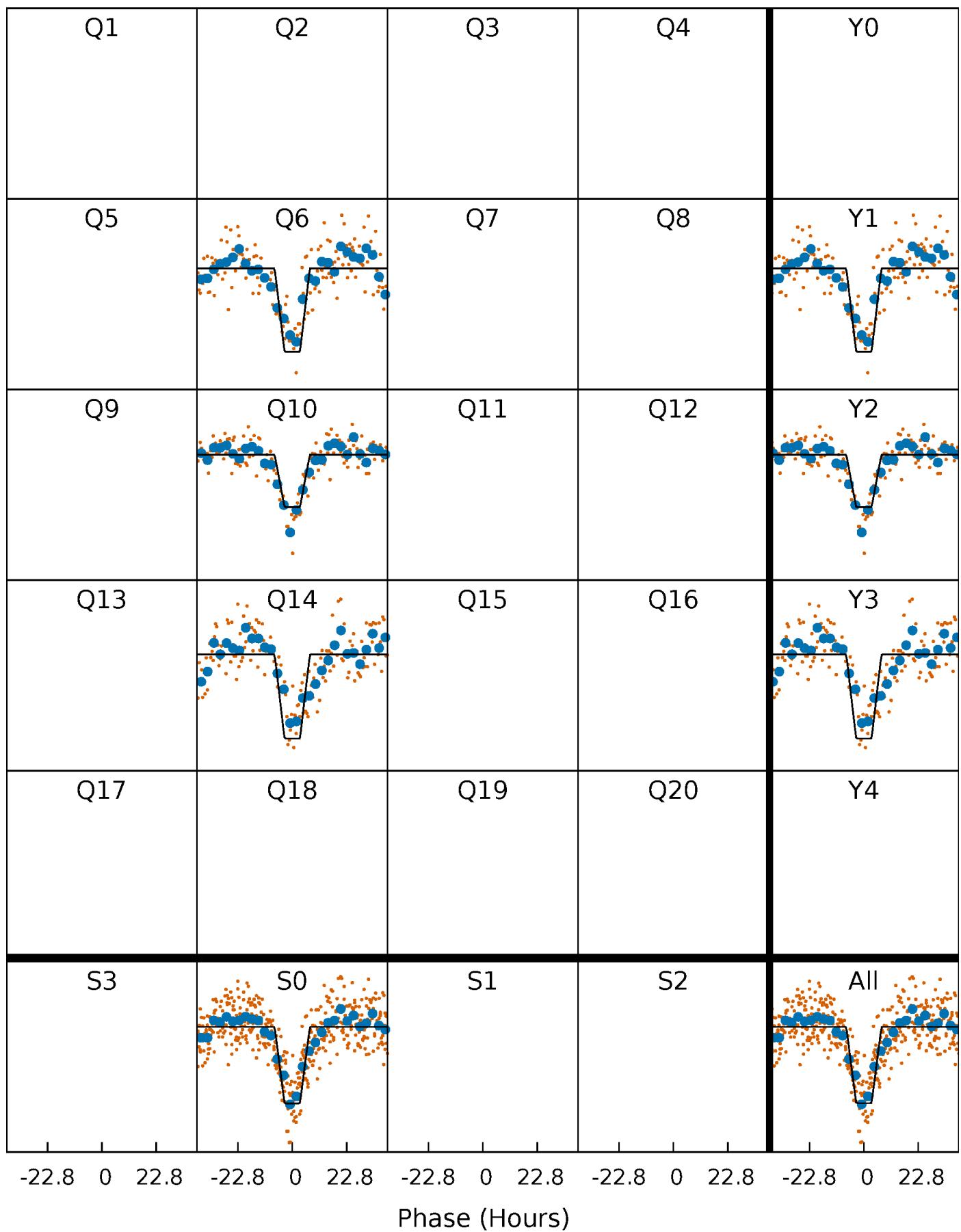
# DV Quarter-Phased Transit Curves

TCE 010091451-02 P=347.939030 Days  $T_0=278.324326$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

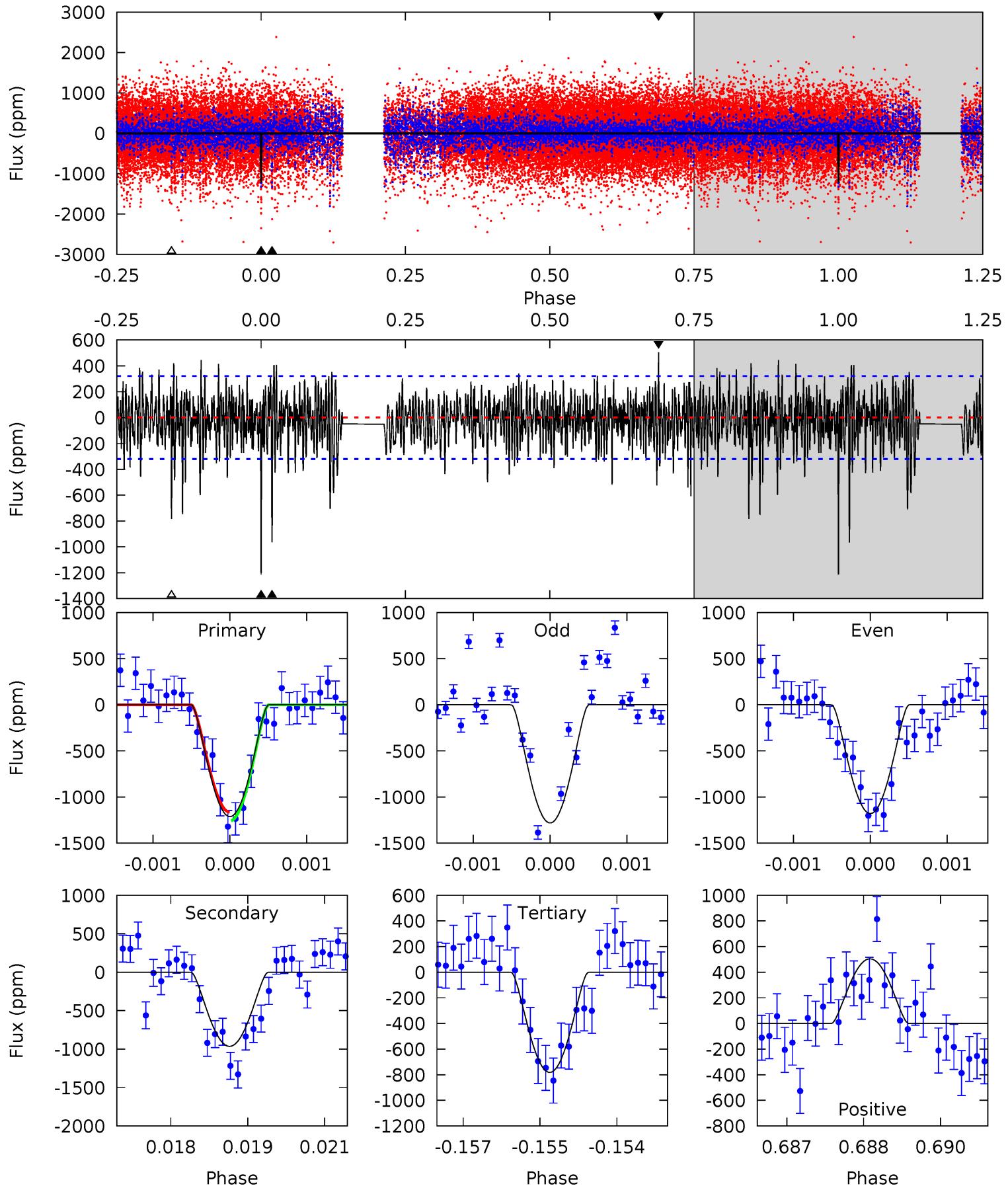
TCE 010091451-02 P=347.942660 Days  $T_0=278.343408$  (BKJD)



# DV Model-Shift Uniqueness Test

010091451-02,  $P = 347.939030$  Days,  $E = 278.324326$  Days

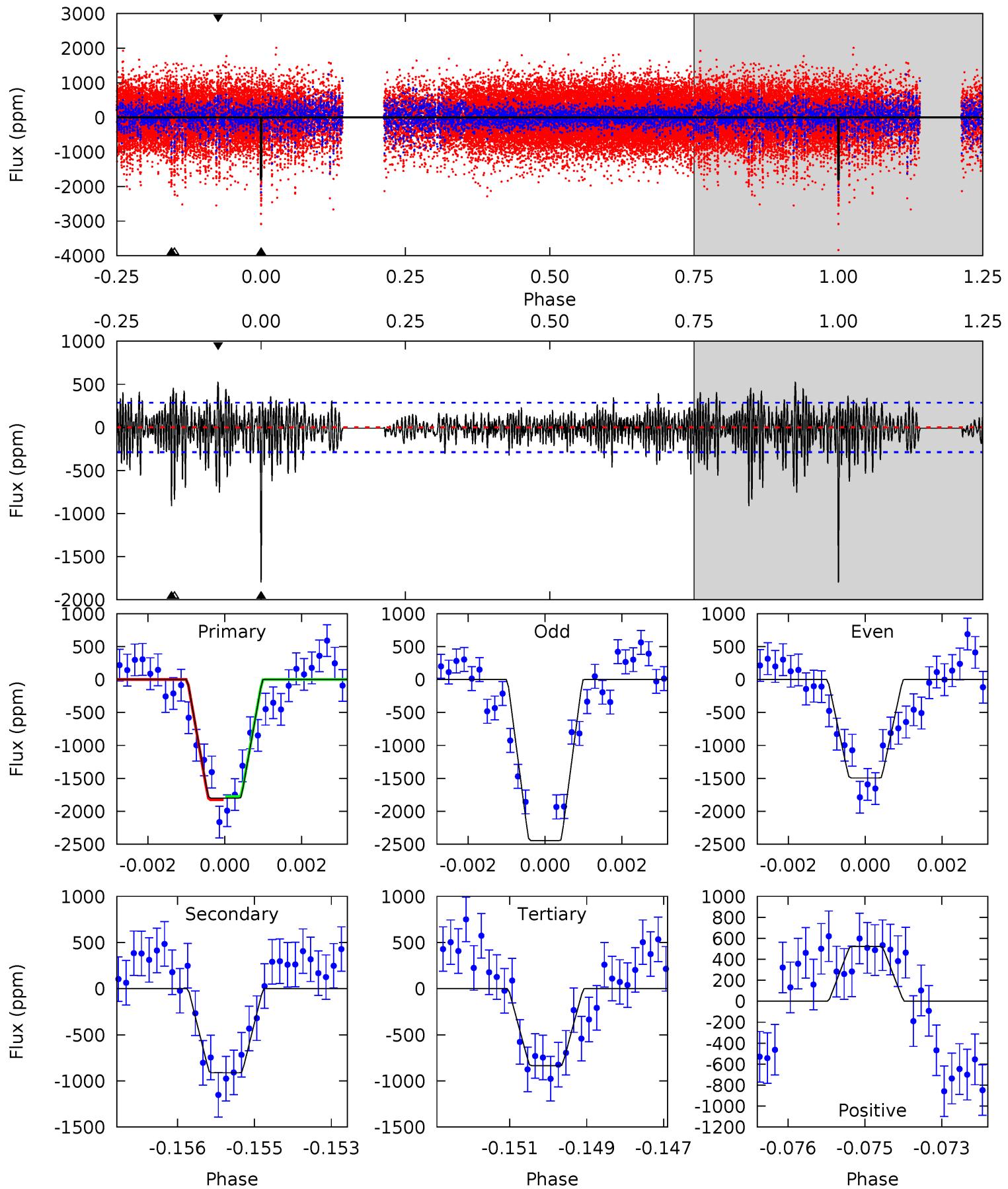
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
20.3	16.2	13.1	8.46	5.38	3.18	2.64	7.22	11.9	3.06	7.72	0.81	0.95	0.29	0.77



# Alt Model-Shift Uniqueness Test

010091451-02,  $P = 347.942660$  Days,  $E = 278.343408$  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
33.5	17.0	15.5	9.71	5.34	3.12	2.95	18.0	23.8	1.42	7.26	8.25	1.18	0.22	0.47



## Stellar Parameters For KIC 010091451

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6191^{+194}_{-259}$	$4.454^{+0.065}_{-0.208}$	$-0.100^{+0.250}_{-0.350}$	$1.025^{+0.309}_{-0.111}$	$1.088^{+0.141}_{-0.155}$	$1.423^{+0.484}_{-0.734}$
	$+3\%/-4\%$	$+1\%/-5\%$	$+250\%/-350\%$	$+30\%/-11\%$	$+13\%/-14\%$	$+34\%/-52\%$
Source	KIC0	KIC0	KIC0	DSEP		

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

## Secondary Eclipse Parameters for KIC 010091451-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (\text{K})$	$T_{obs} (\text{K})$	$A_{obs}$
DV	$-964 \pm 60$	$17.34^{+19.22}_{-11.90}$	$394^{+29}_{-22}$	$3346^{+1688}_{-625}$	$1703^{+15356}_{-1312}$
Alt.	$-912 \pm 54$	$17.07^{+17.06}_{-11.81}$	$393^{+29}_{-22}$	$3374^{+1727}_{-640}$	$1667^{+16942}_{-1248}$

$T_{max}$  = 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

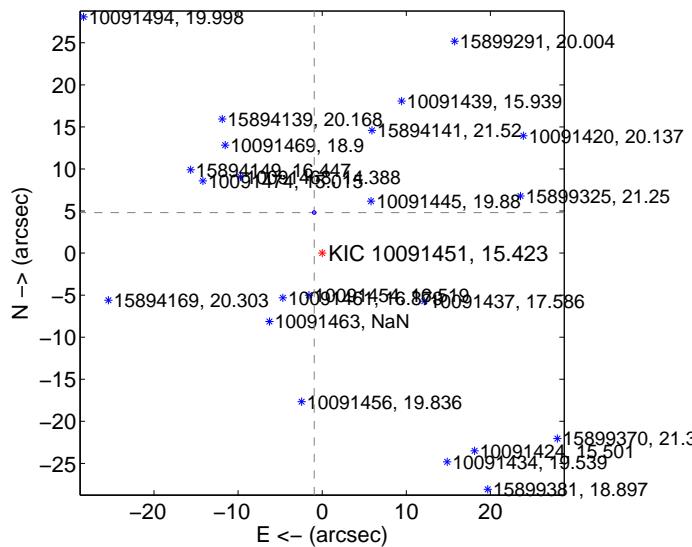
Supplemental centroid analysis for 010091451-02. Kepler magnitude: 15.42. Transit SNR 7.65

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

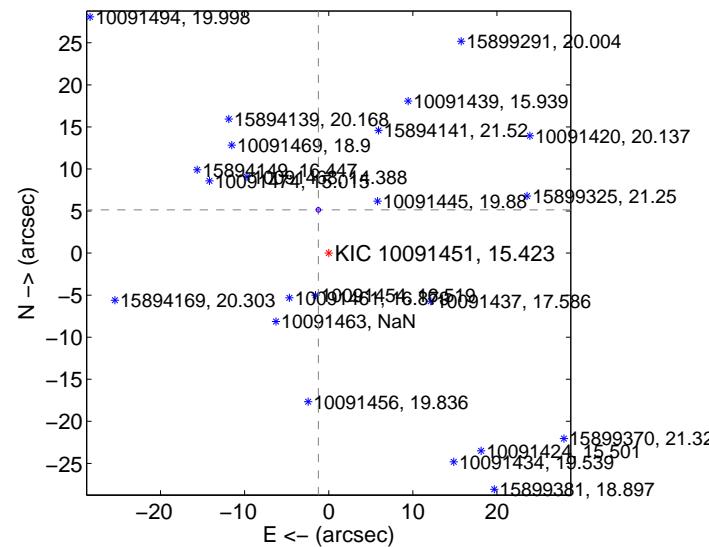
The direct PRF centroid is offset from the target star catalog position by about 0.55 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$4.912 \pm 0.070$	70.26	$0.952 \pm 0.097$	$4.819 \pm 0.067$
PRF-fit source offset from KIC position	$5.286 \pm 0.089$	59.22	$1.229 \pm 0.150$	$5.141 \pm 0.073$
photometric centroid source offset	$14.14 \pm 3.28$	4.31	$3.11 \pm 1.40$	$13.79 \pm 3.35$

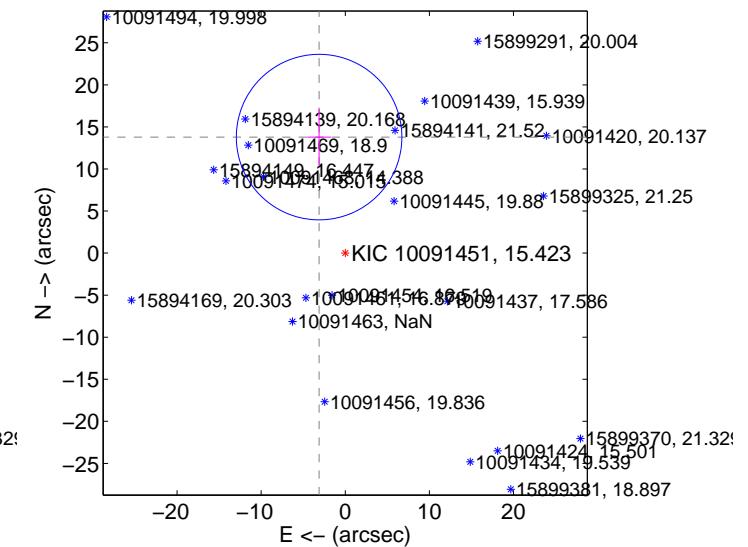
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position



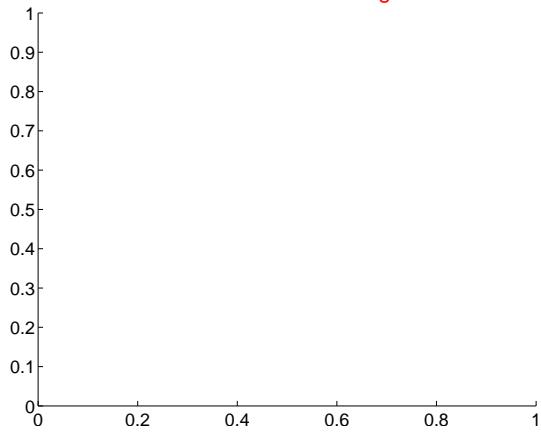
offset from photometric centroids



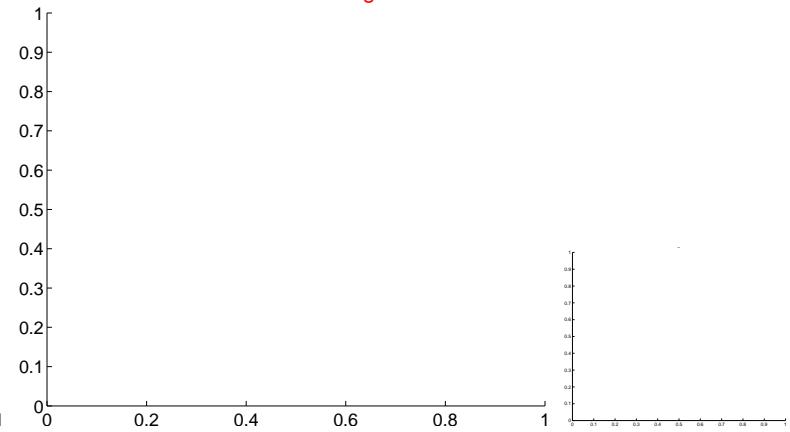
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

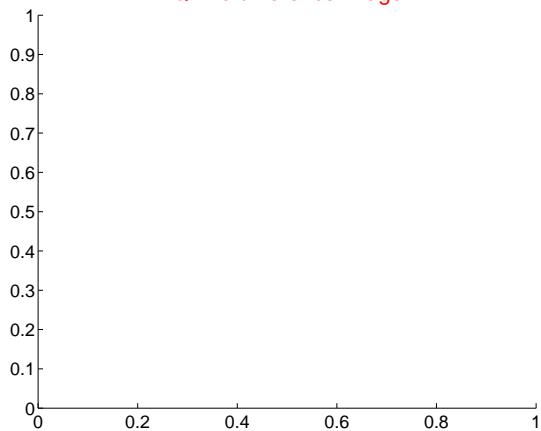
Q1 no difference image



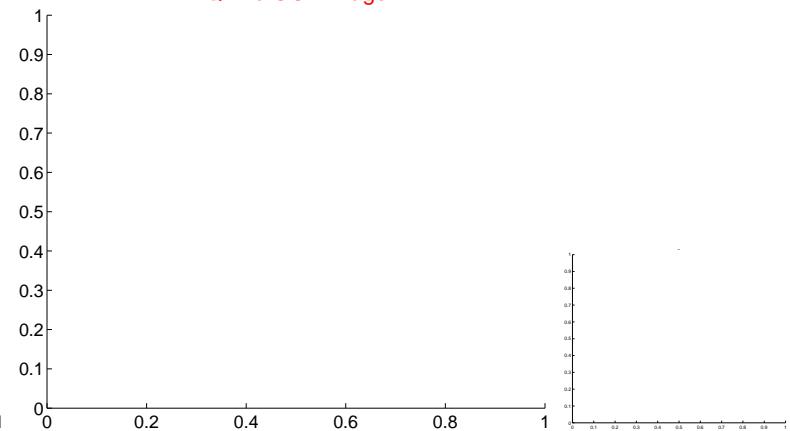
Q1 no OOT image



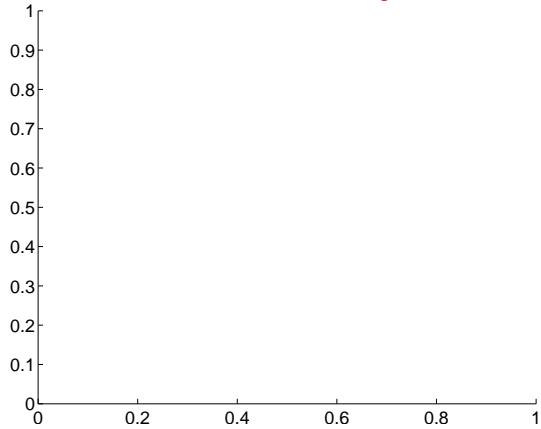
Q2 no difference image



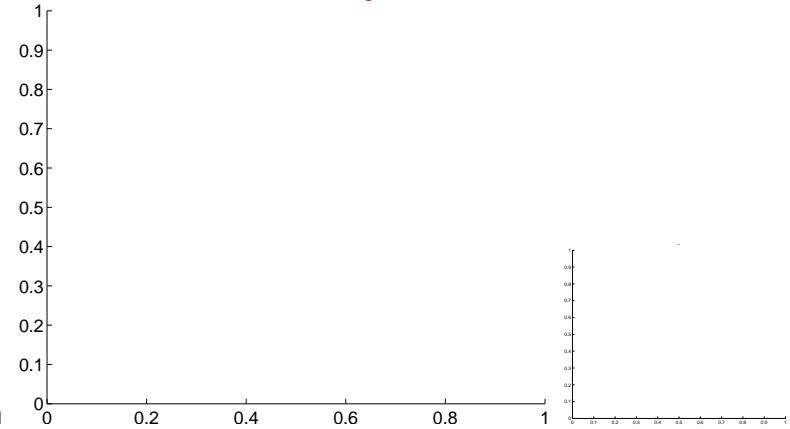
Q2 no OOT image



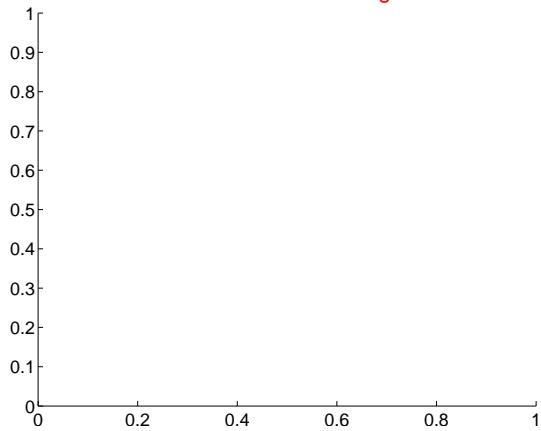
Q3 no difference image



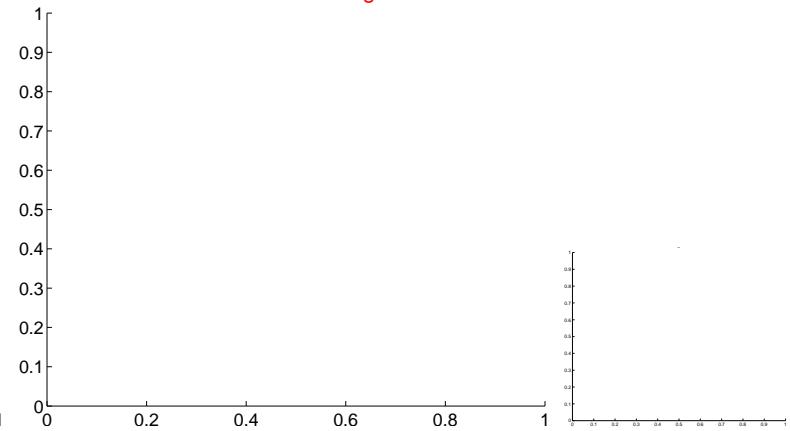
Q3 no OOT image



Q4 no difference image

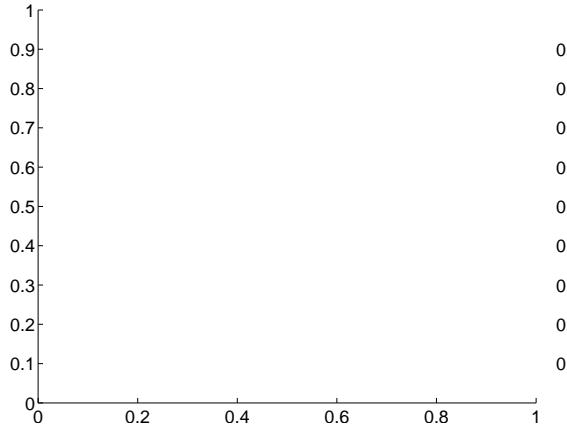


Q4 no OOT image

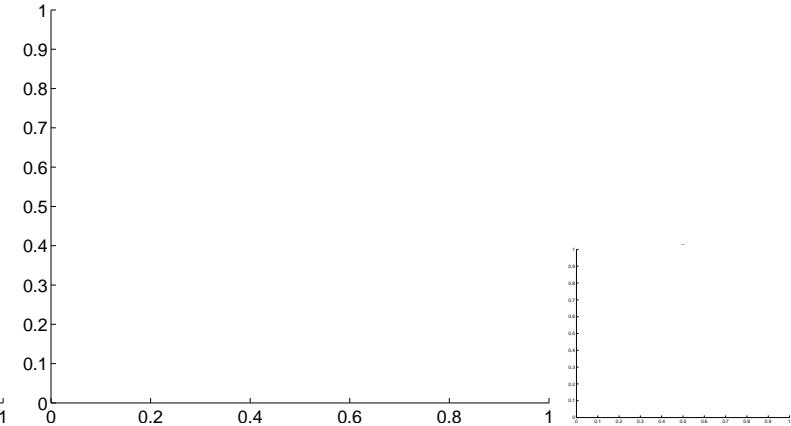


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

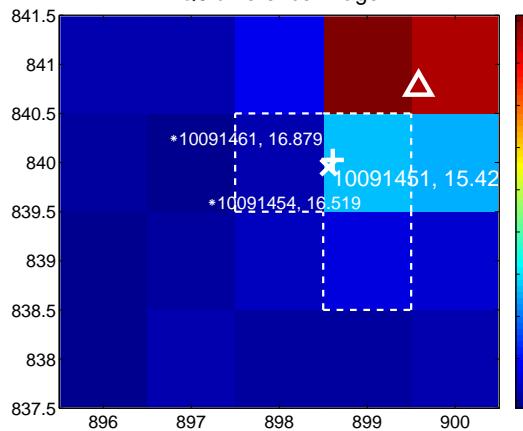
Q5 no difference image



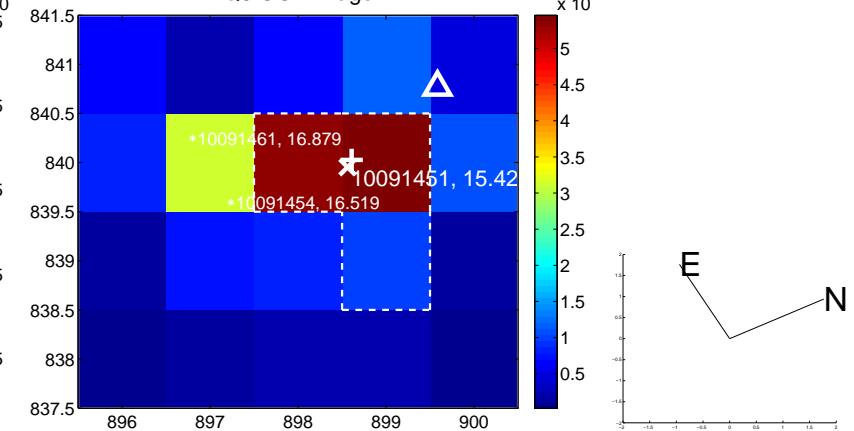
Q5 no OOT image



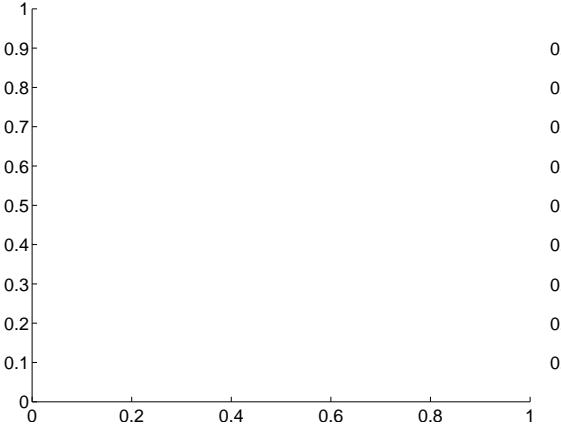
Q6 difference image



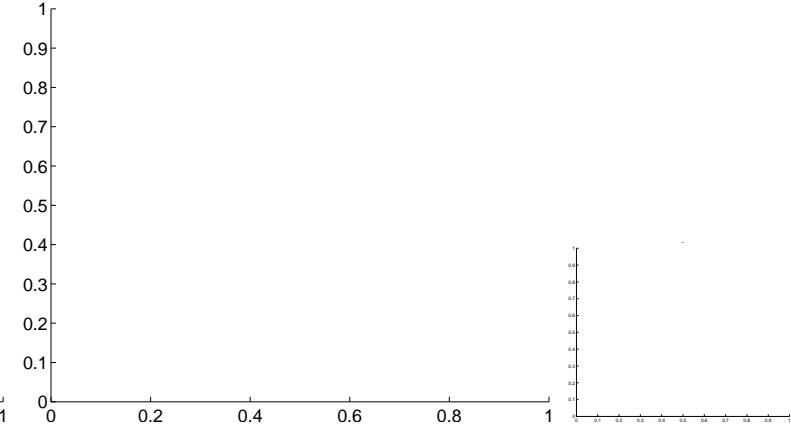
Q6 OOT image



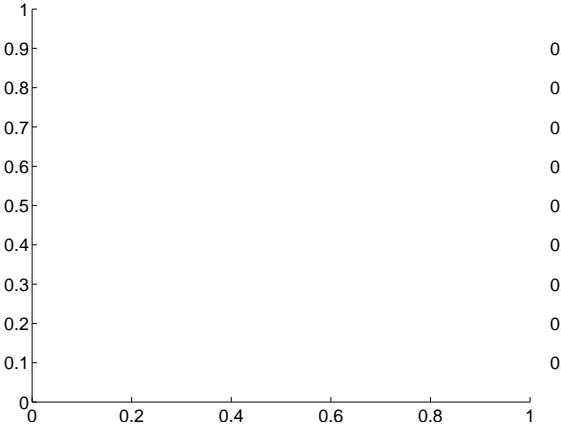
Q7 no difference image



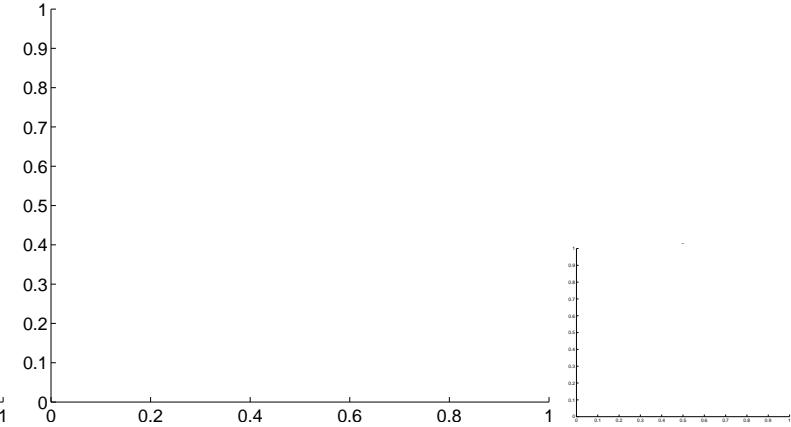
Q7 no OOT image



Q8 no difference image

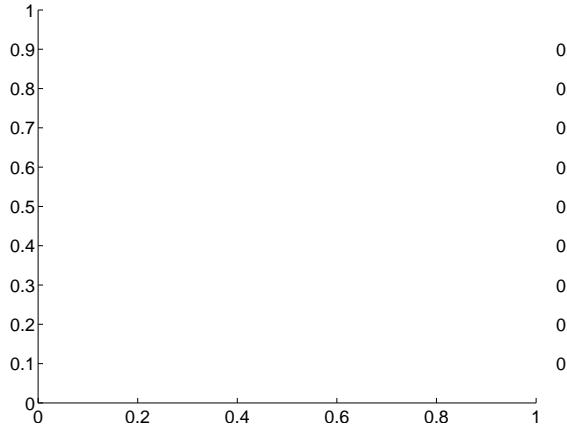


Q8 no OOT image

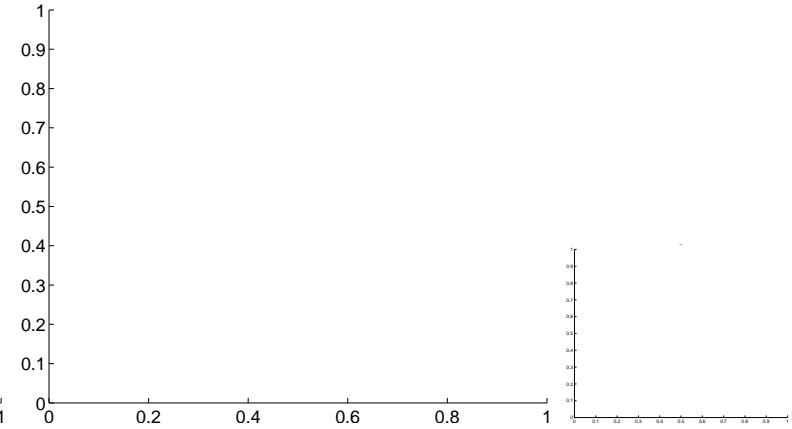


white  $\times$ : KIC target position; +: OOT centroid;  $\Delta$ : difference centroid. red  $\times$ : large negative pixel value.

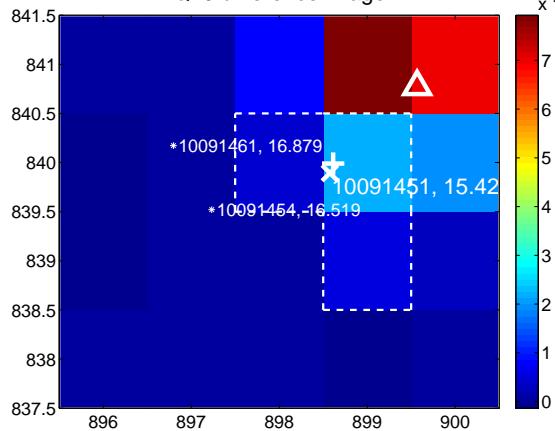
Q9 no difference image



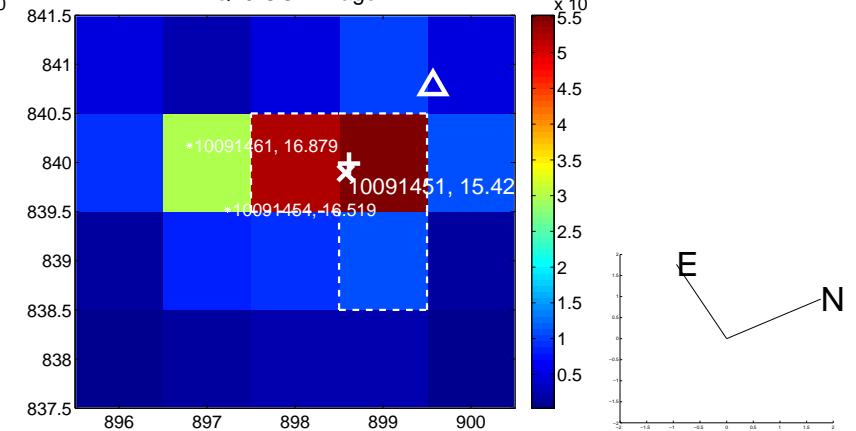
Q9 no OOT image



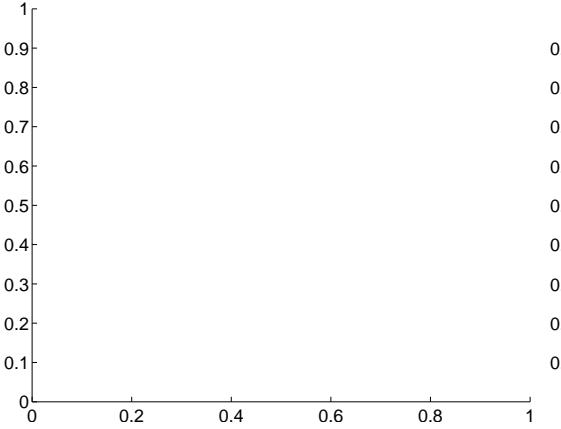
Q10 difference image



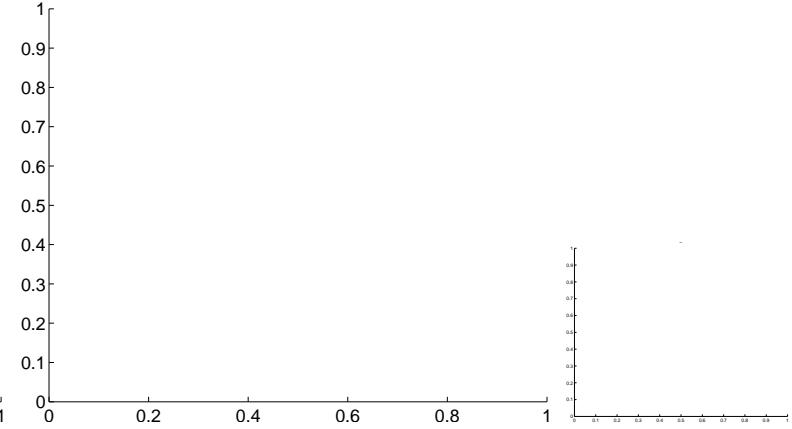
Q10 OOT image



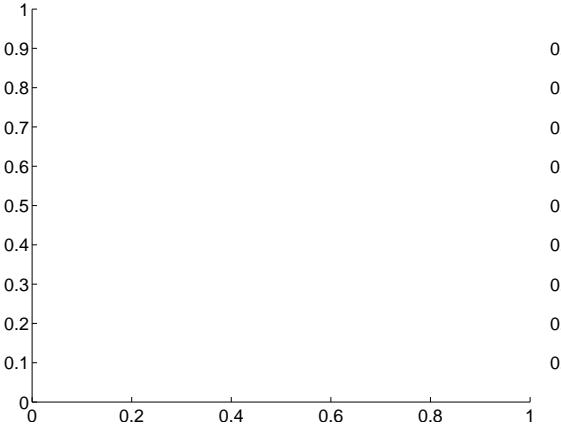
Q11 no difference image



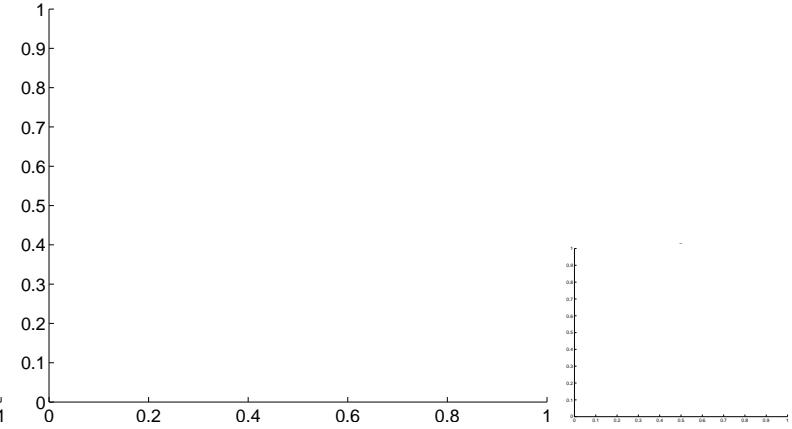
Q11 no OOT image



Q12 no difference image

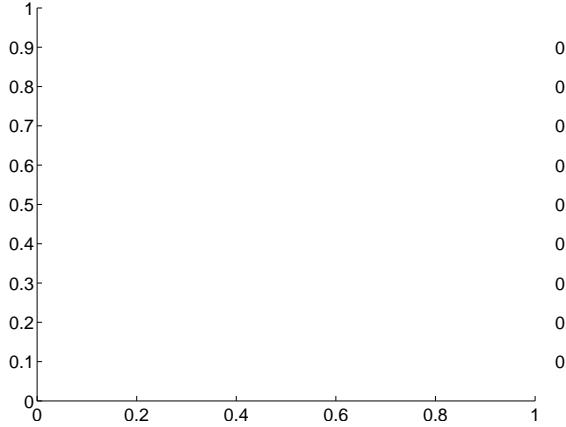


Q12 no OOT image

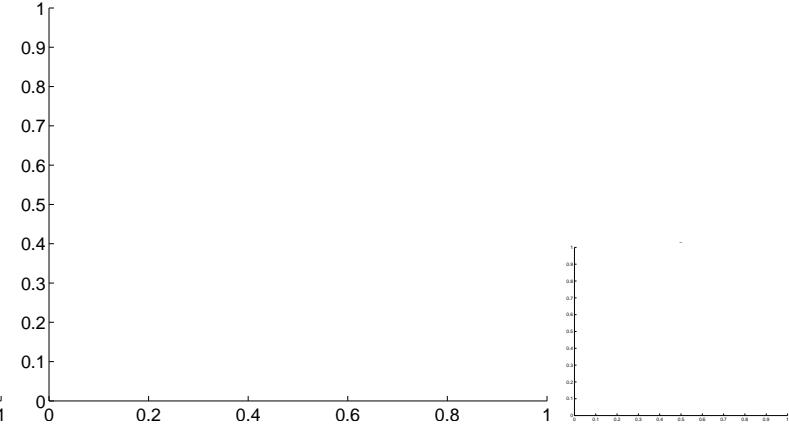


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

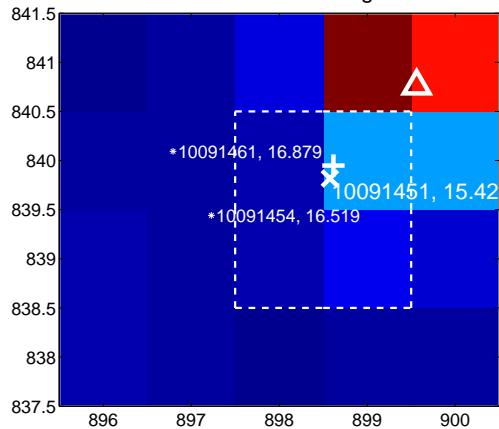
Q13 no difference image



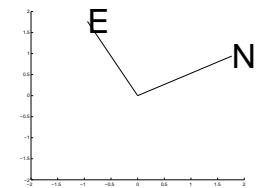
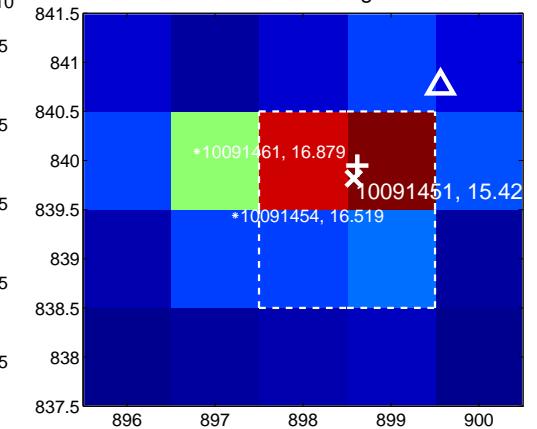
Q13 no OOT image



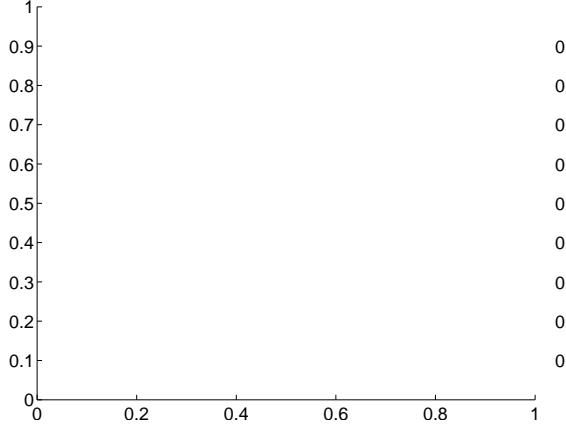
Q14 difference image



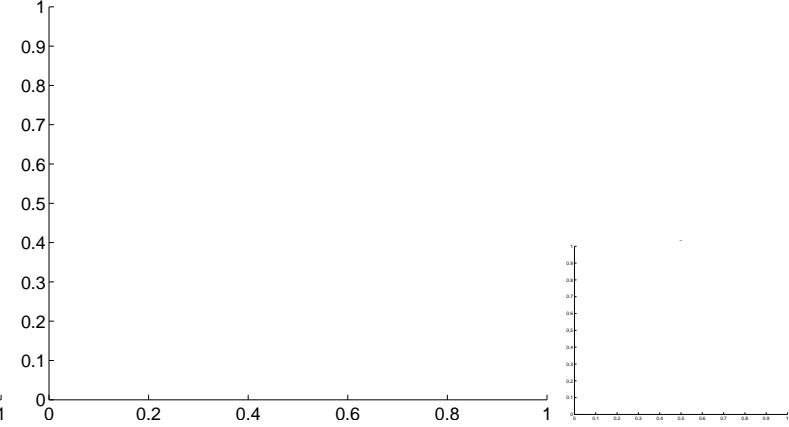
Q14 OOT image



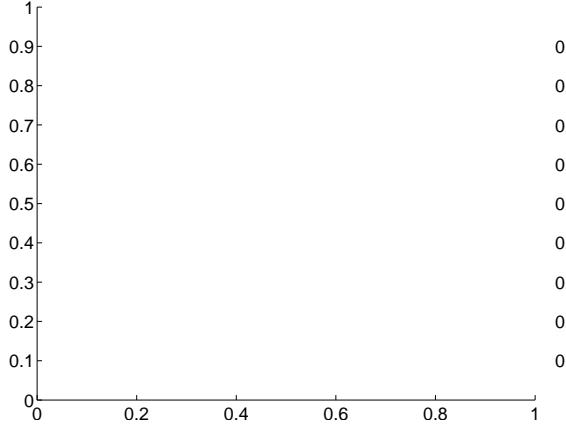
Q15 no difference image



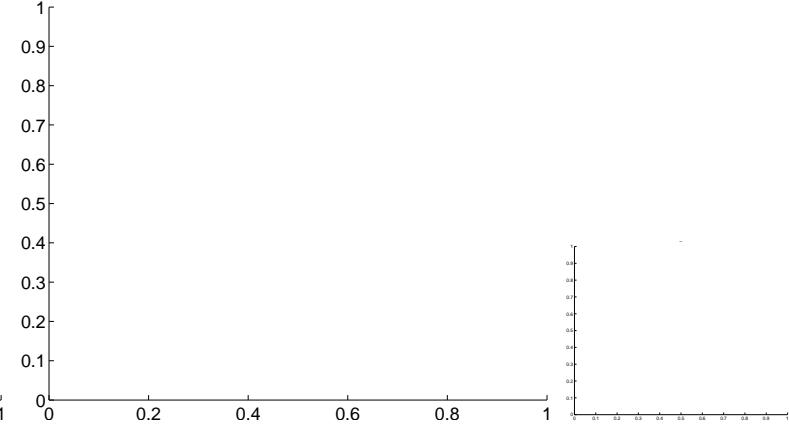
Q15 no OOT image



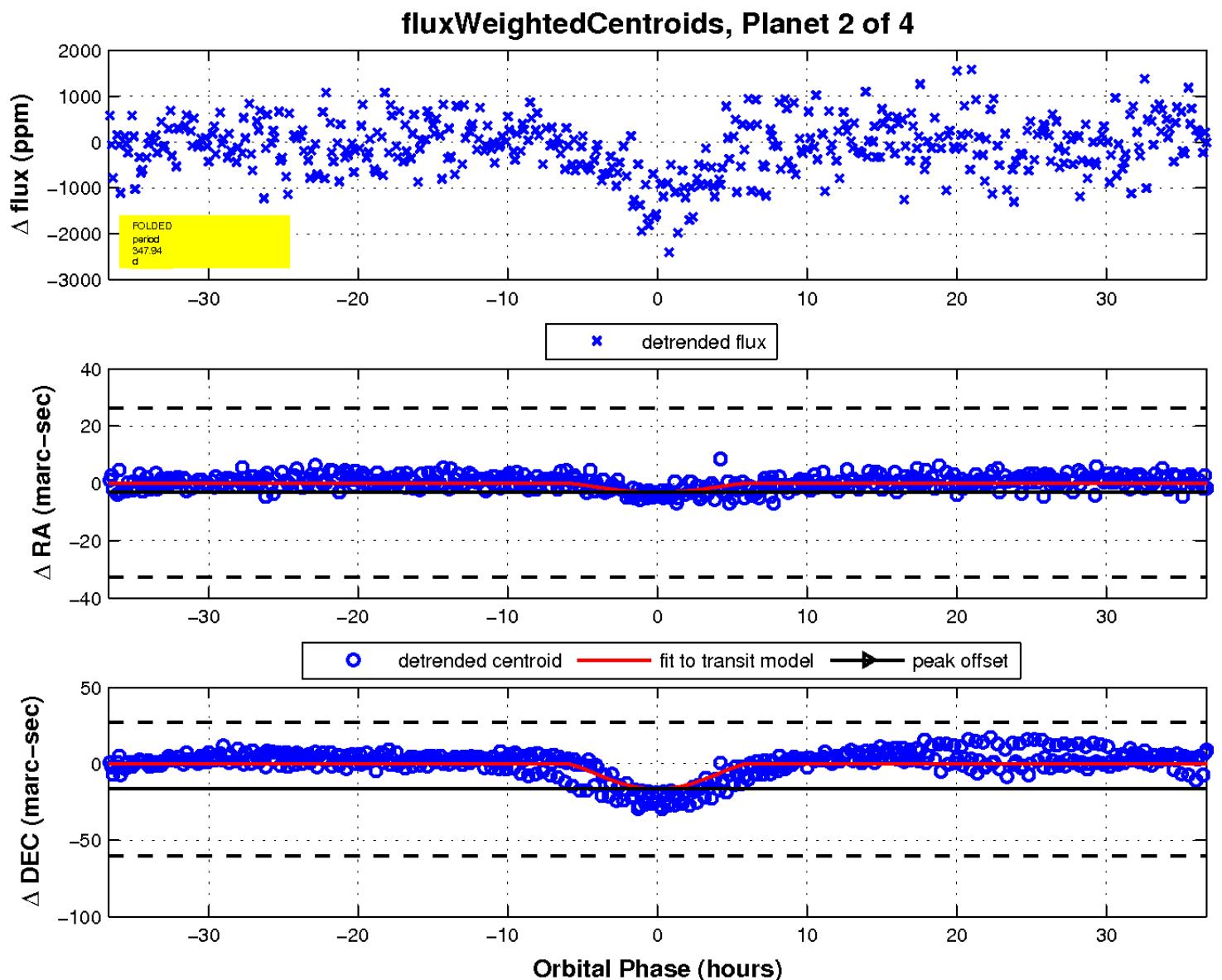
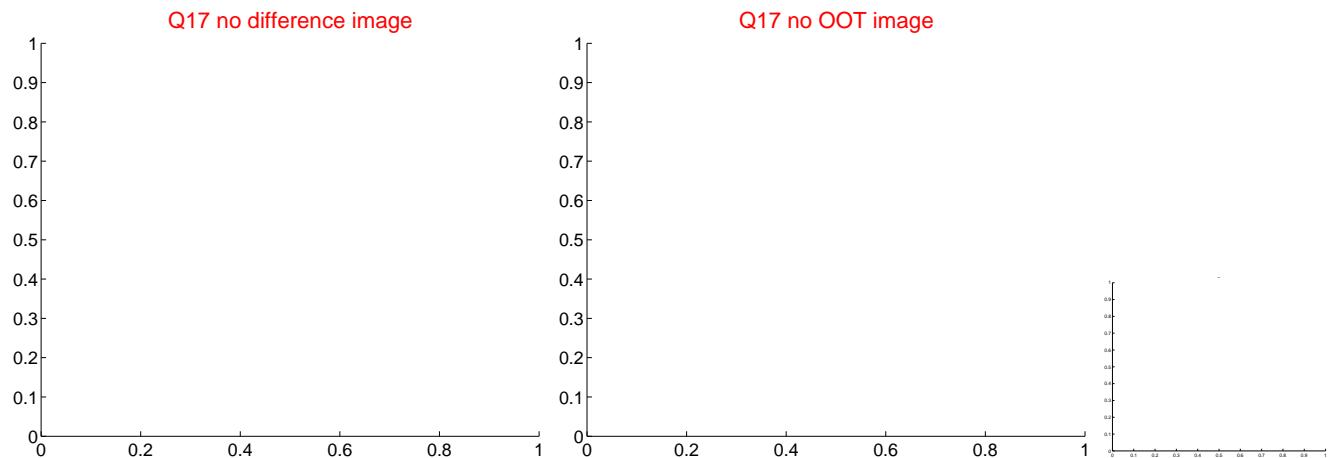
Q16 no difference image



Q16 no OOT image

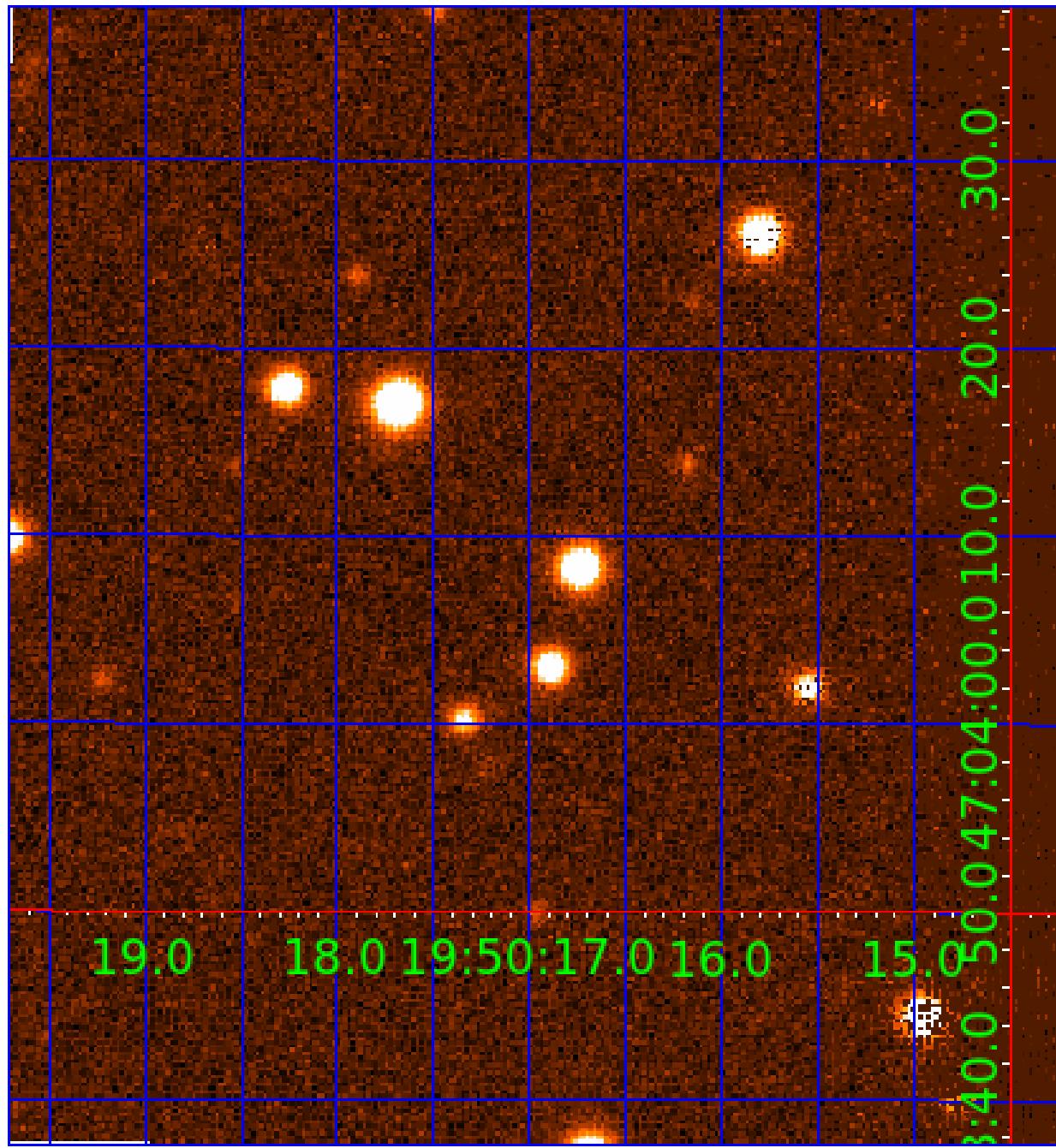


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\text{X}$ : large negative pixel value.



UKIRT Image

Declination



# KIC 010091451

## Q1-17 DR25 TCE Parameters

TCE	Run Type	KOI?	Period (Days)	Epoch (BKJD)	Depth (ppm)	Duration (Hours)	MES	SNR	$R_*$ ( $R_{\odot}$ )	$T_*$ (K)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
010091451-01	INV	No	320.996471	284.787792	1187.6	14.105	8.8	10.1	1.02	6191	6.71	1.55
010091451-02	INV	No	347.939030	278.324326	1147.4	12.252	7.4	7.7	1.02	6191	6.60	1.39
010091451-03	INV	No	346.178931	192.856885	950.4	9.839	7.3	9.0	1.02	6191	3.95	1.40
010091451-04	INV	No	265.522594	389.189240	729.3	12.507	7.3	7.0	1.02	6191	2.79	2.00

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
010091451-01	INV	FP	0.00	0	1	1	0	DEEP_V_SHAPED—CENT_RESOLVED_OFFSET
010091451-02	INV	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL—CENT_FEW_DIFFS
010091451-03	INV	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—MOD_NONUNIQ_ALT—MOD_TER_ALT—CENT_FEW_DIFFS
010091451-04	INV	PC	0.05	0	0	0	0	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.

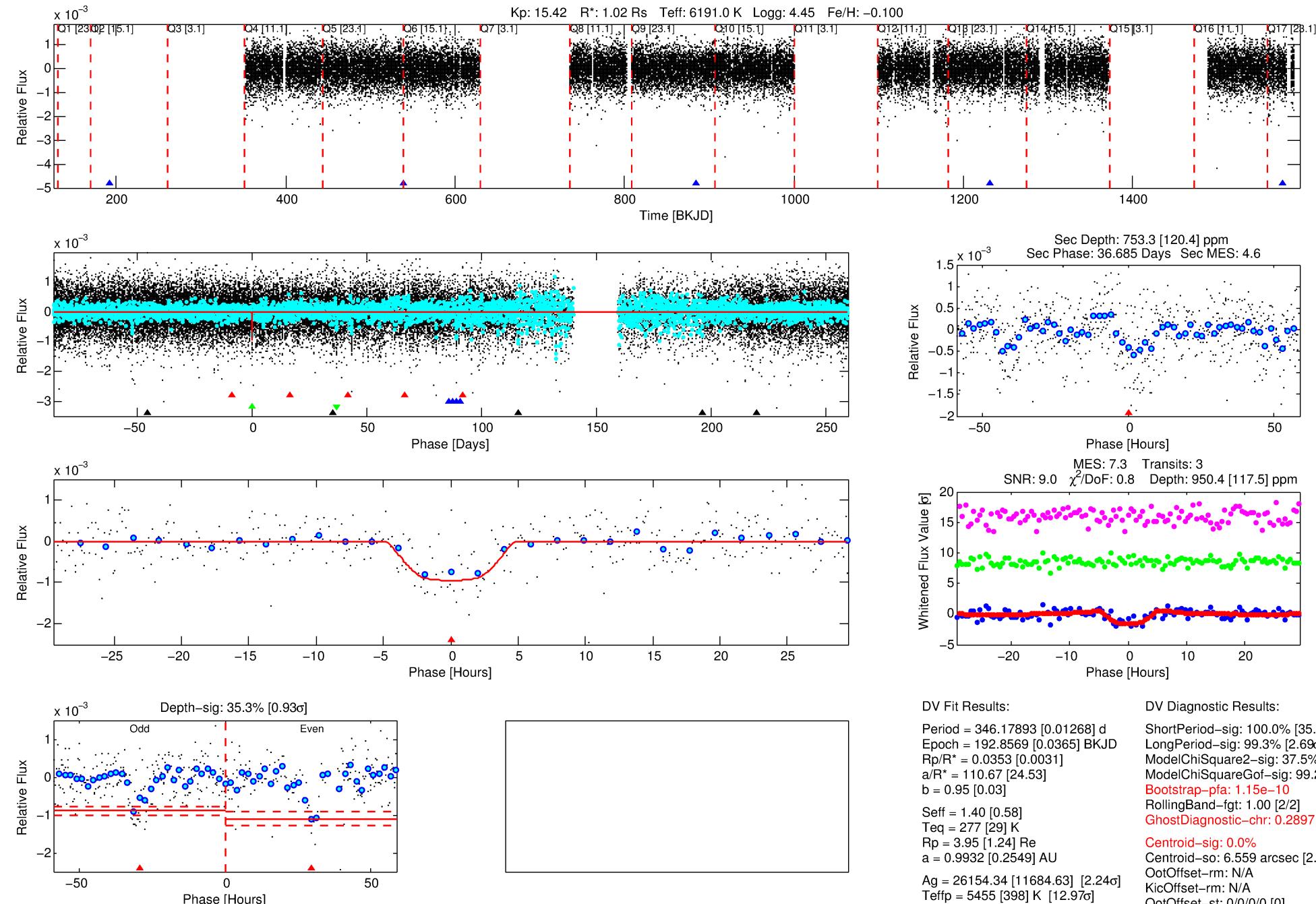
## Ephemeris Match Information For 010091451-03

No Significant Match Found

**WARNING: THIS DATA IS  
SIMULATED, NOT OBSERVED**

## DV One-Page Summary

KIC: 10091451 Candidate: 3 of 4 Period: 346.179 d



**WARNING: THIS DATA IS  
SIMULATED, NOT OBSERVED**

Software Revision: svn+ssh://murzim/repo/soc/branches/integ/ksop-2320@61025

Date Generated: 04-Mar-2016 09:24:15 Z

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

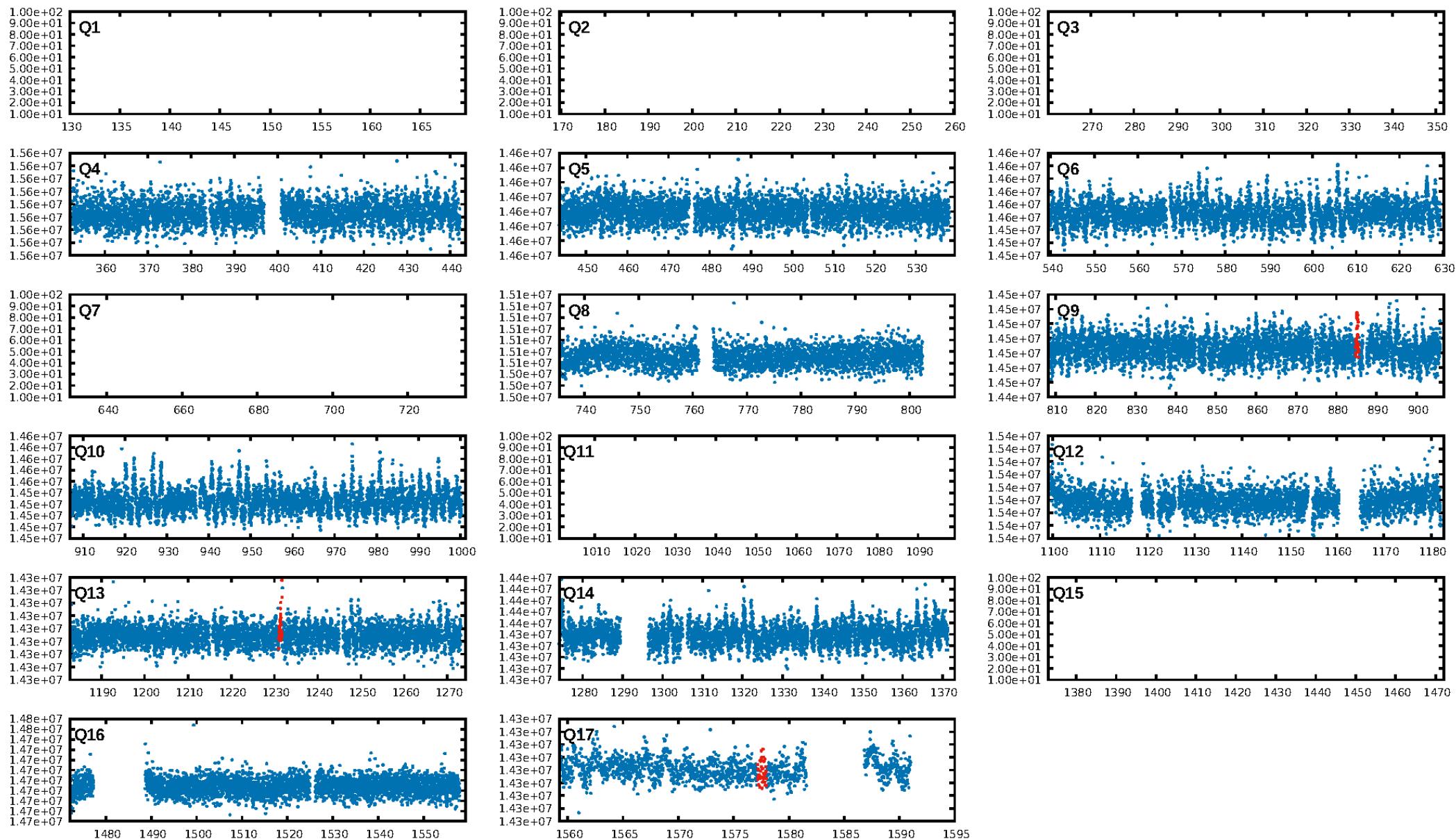
### DV Fit Results:

Period = 346.17893 [0.01268] d  
Epoch = 192.8569 [0.0365] BKJD  
Rp/R\* = 0.0353 [0.0031]  
a/R\* = 110.67 [24.53]  
b = 0.95 [0.03]  
Seff = 1.40 [0.58]  
Teq = 277 [29] K  
Rp = 3.95 [1.24] Re  
a = 0.9932 [0.2549] AU  
Ag = 26154.34 [11684.63] [2.24 $\sigma$ ]  
Tepp = 5455 [398] K [12.97 $\sigma$ ]

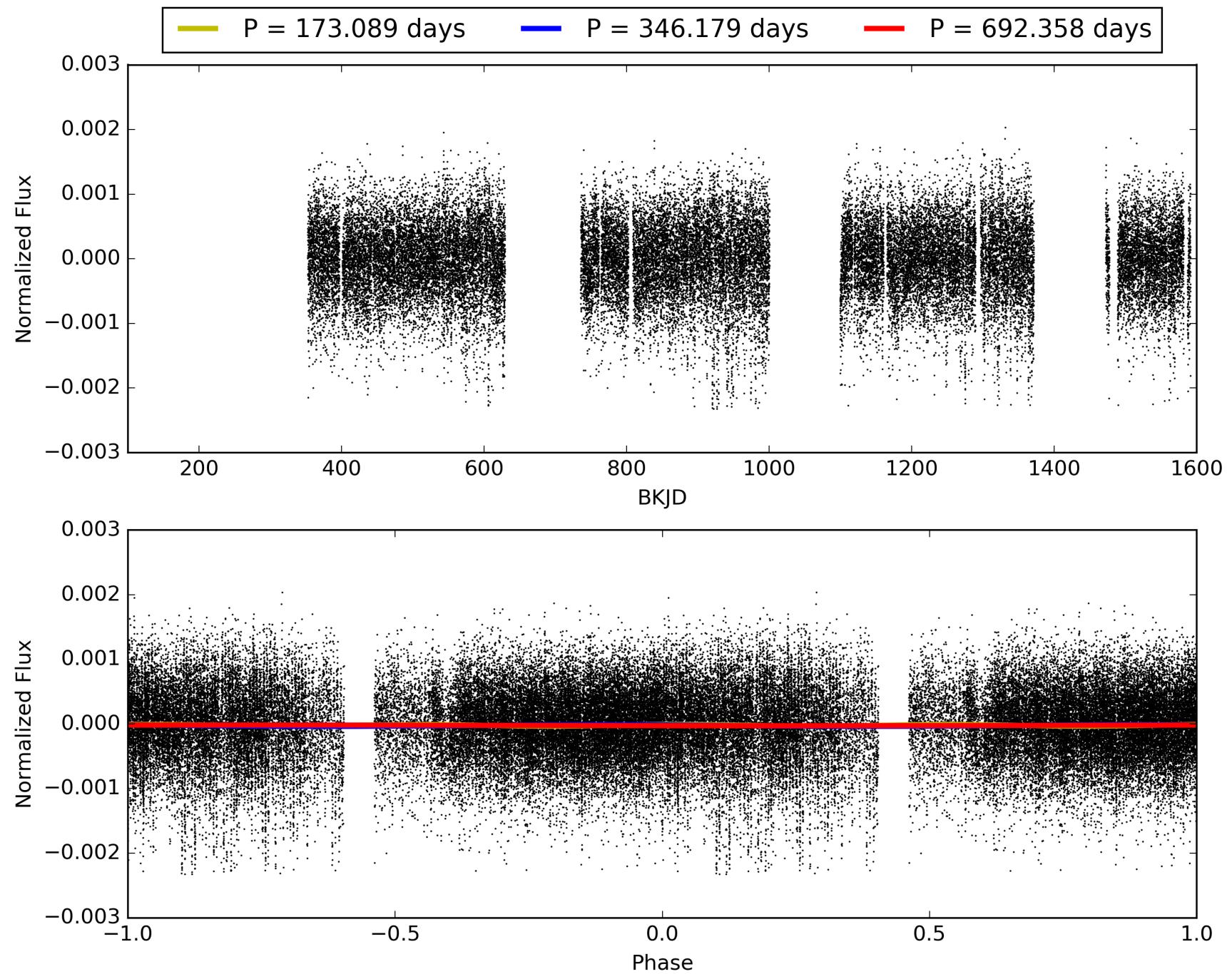
### DV Diagnostic Results:

ShortPeriod-sig: 100.0% [35.14 $\sigma$ ]  
LongPeriod-sig: 99.3% [2.69 $\sigma$ ]  
ModelChiSquare2-sig: 37.5%  
ModelChiSquareGof-sig: 99.2%  
Bootstrap-pfa: 1.15e-10  
RollingBand-fgt: 1.00 [2/2]  
GhostDiagnostic-chr: 0.2897  
Centroid-sig: 0.0%  
Centroid-so: 6.559 arcsec [2.39 $\sigma$ ]  
OotOffset-rm: N/A  
KicOffset-rm: N/A  
OotOffset-st: 0/0/0 [0]  
KicOffset-st: 0/0/0 [0]  
DiffImageQuality-fgm: N/A  
DiffImageOverlap-fno: 1.00 [2/2]

# TCE 010091451-03, PDC Light Curves

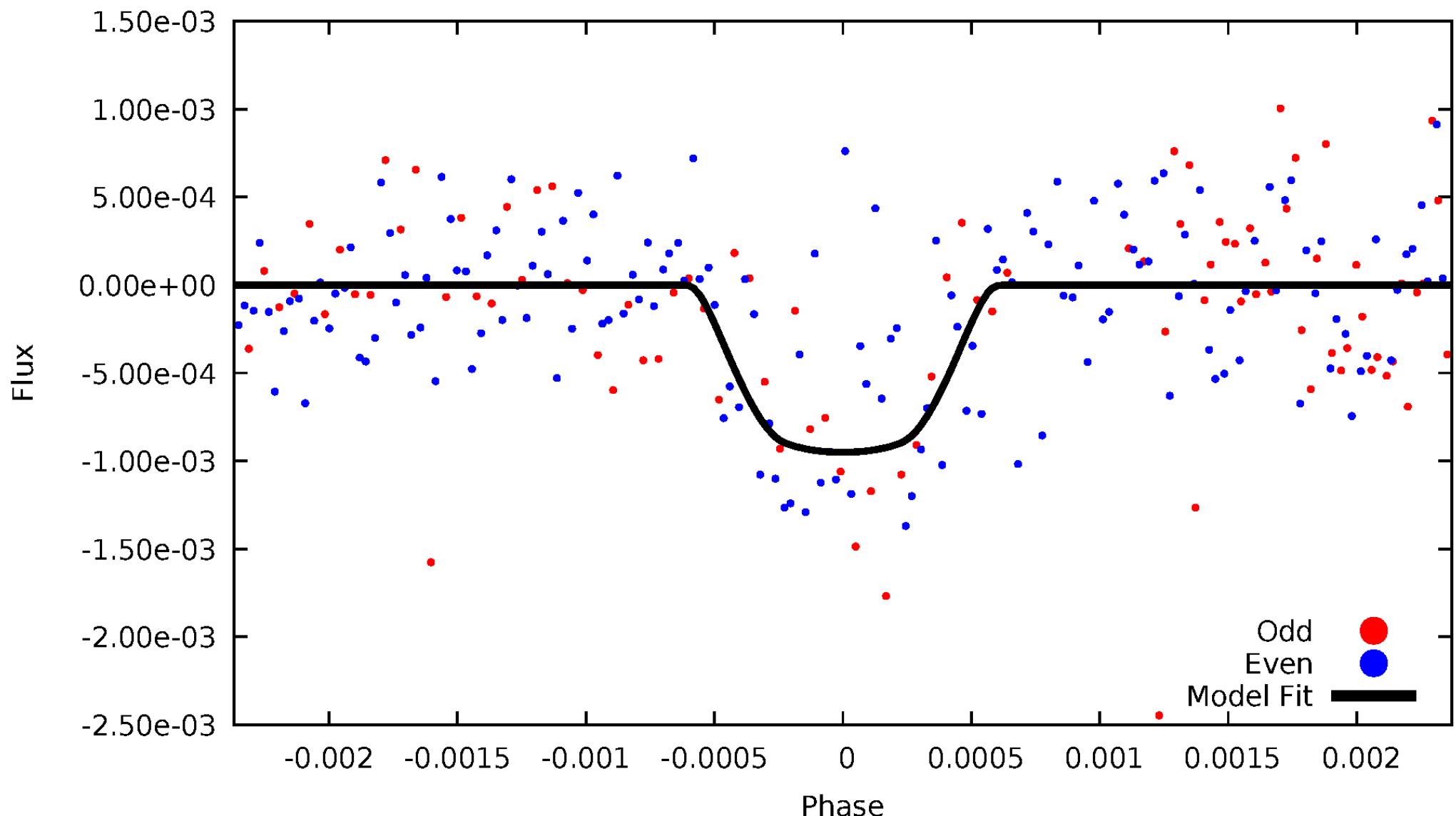


# TCE 010091451-03



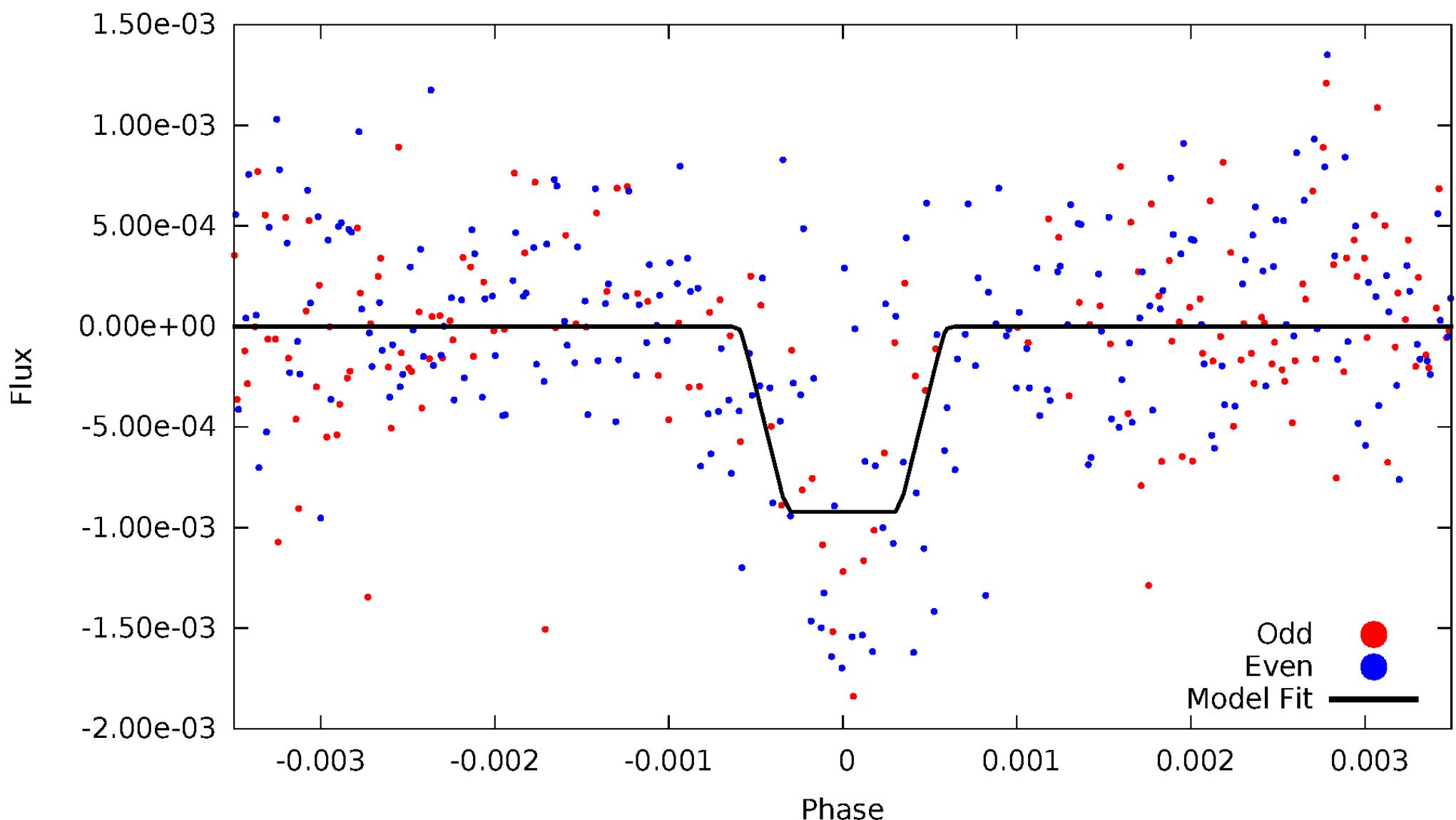
# DV Odd/Even

TCE 010091451-03

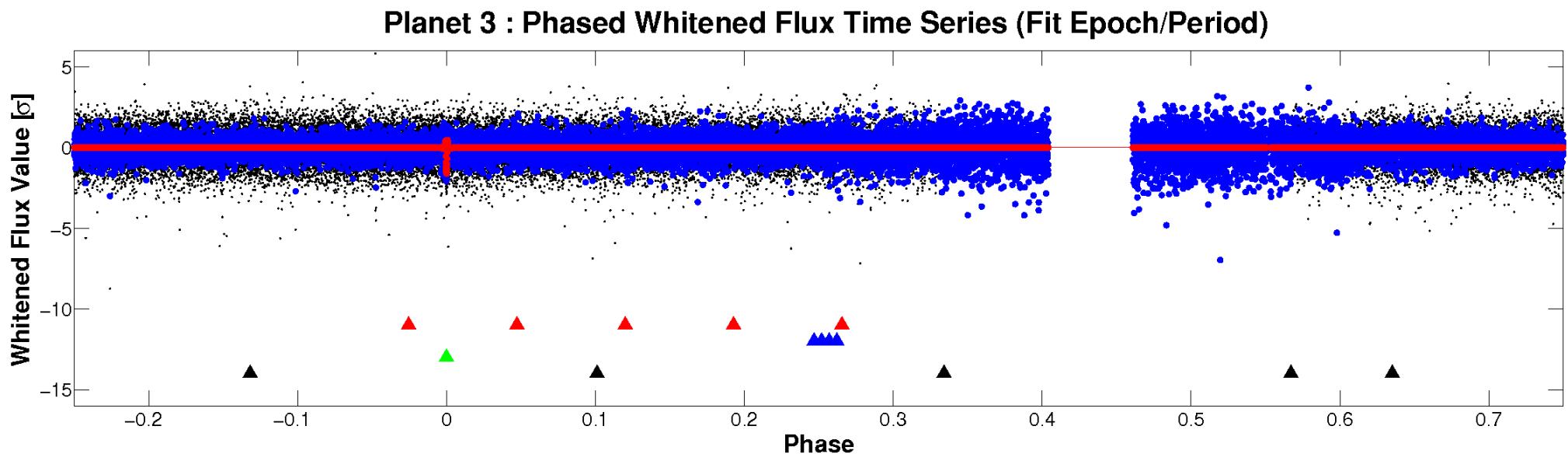
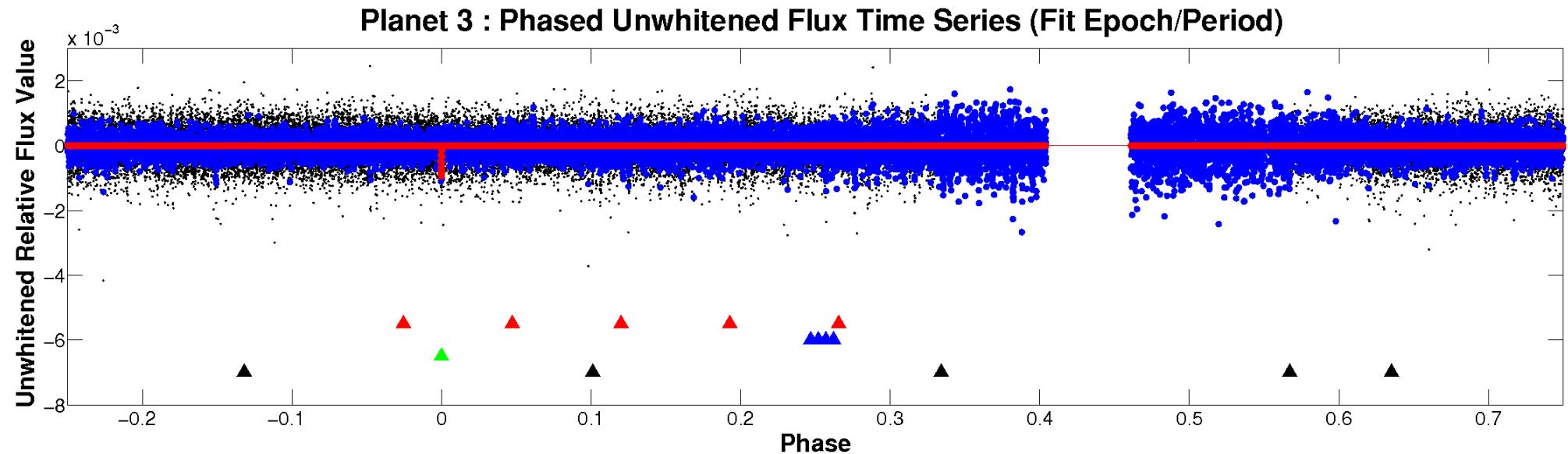


# ALT Odd/Even

TCE 010091451-03

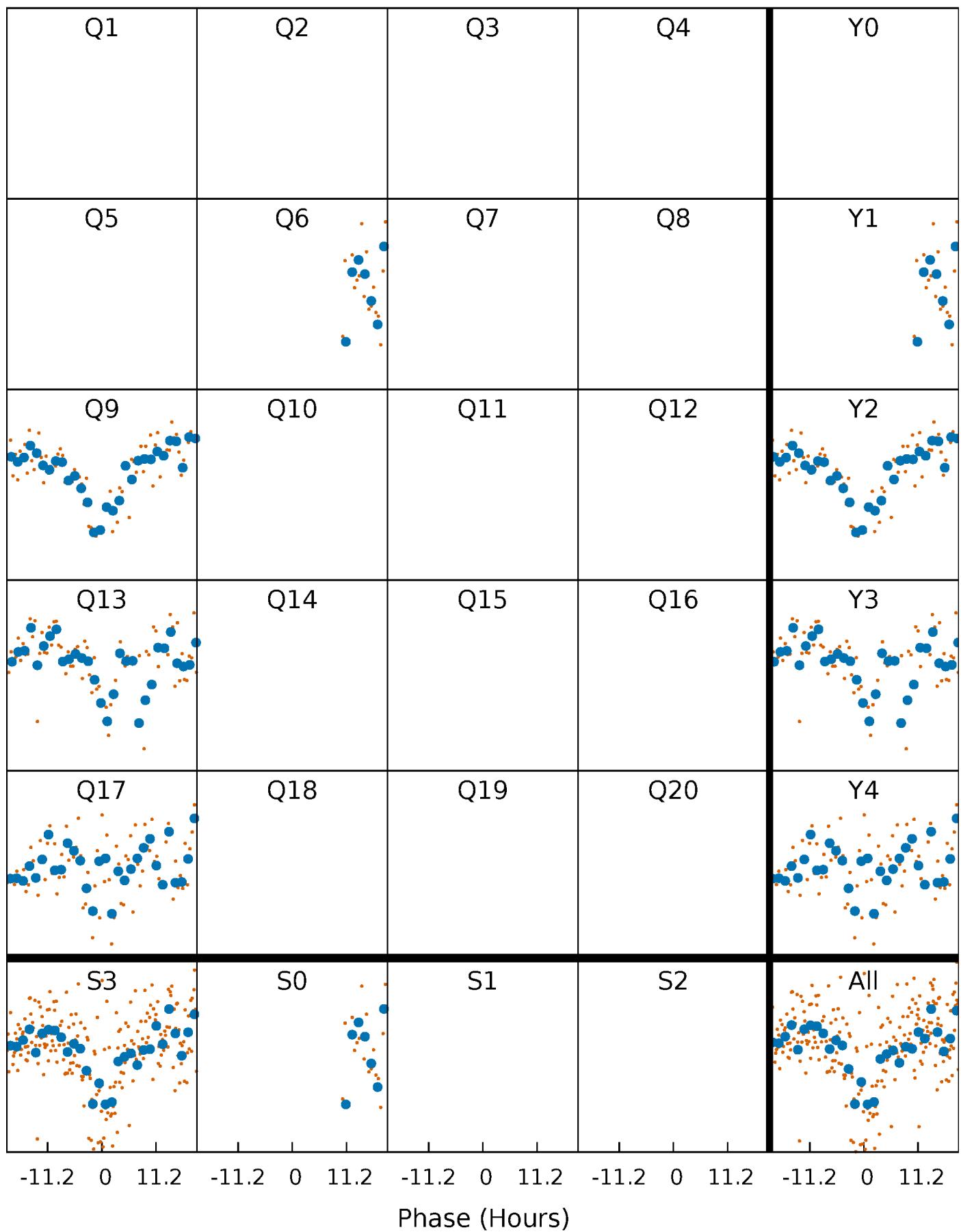


# Non-Whitened Vs. Whitened Light Curve



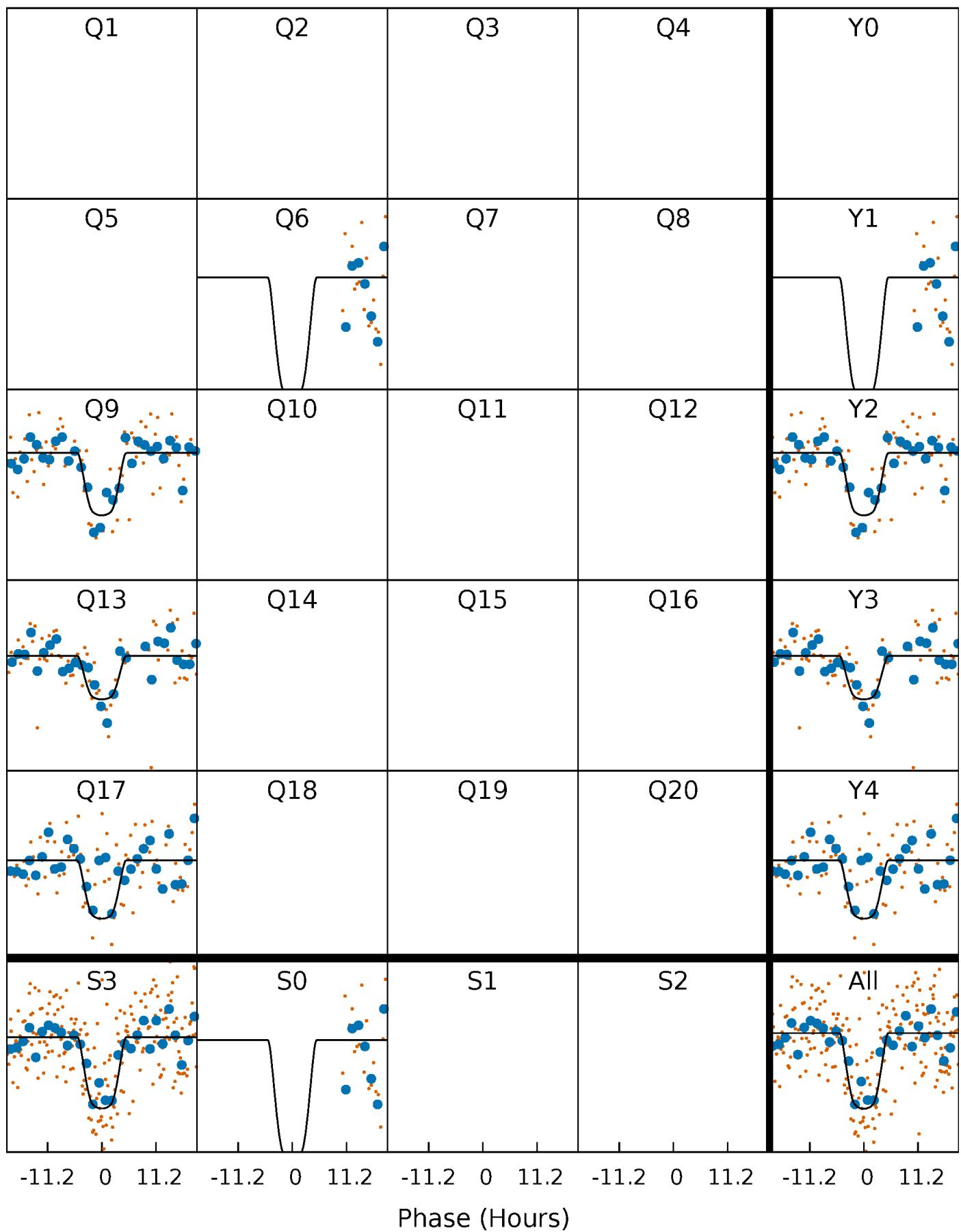
# PDC Quarter-Phased Transit Curves

TCE 010091451-03     $P=346.178931$  Days    $T_0=192.856885$  (BKJD)



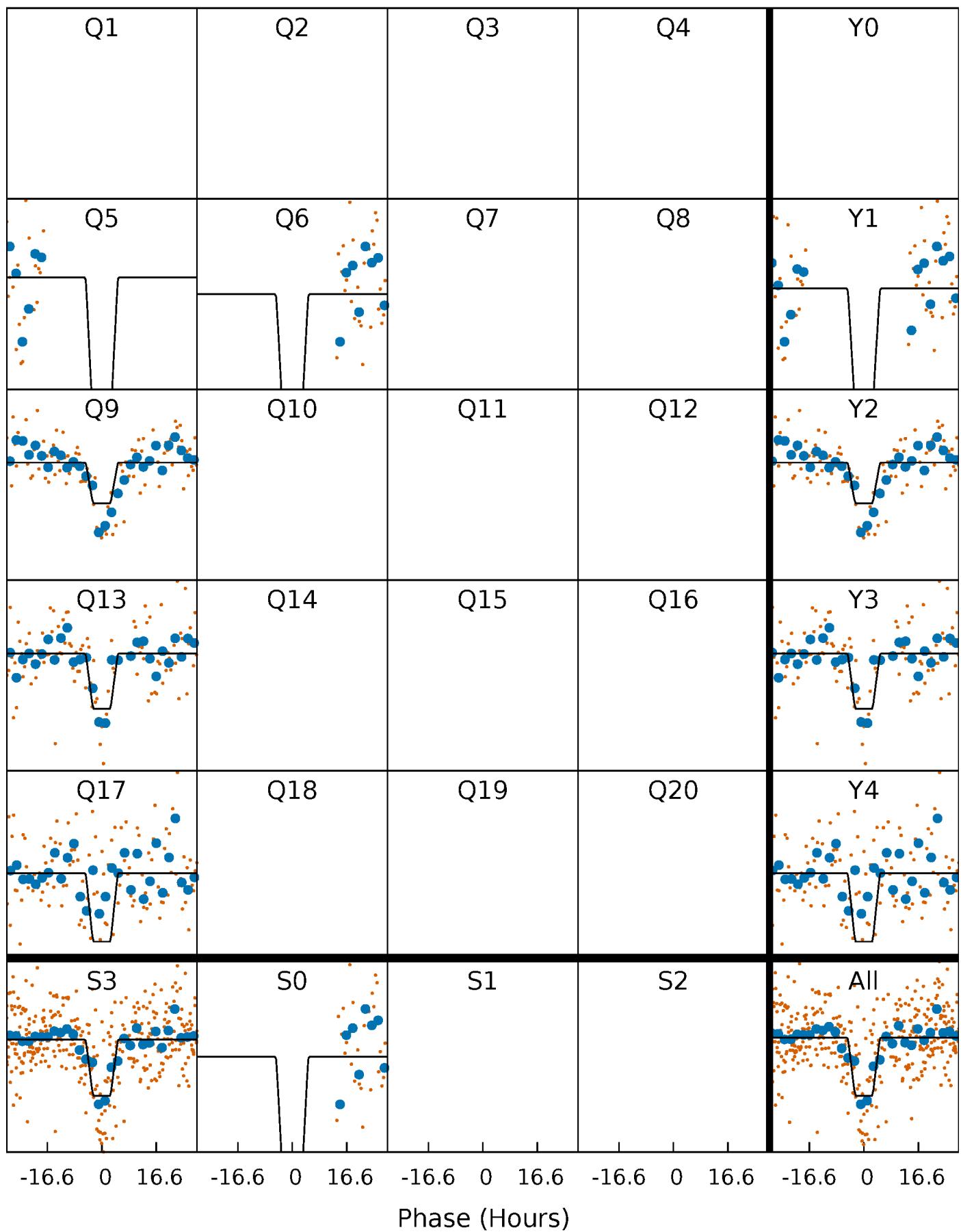
# DV Quarter-Phased Transit Curves

TCE 010091451-03 P=346.178931 Days  $T_0=192.856885$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

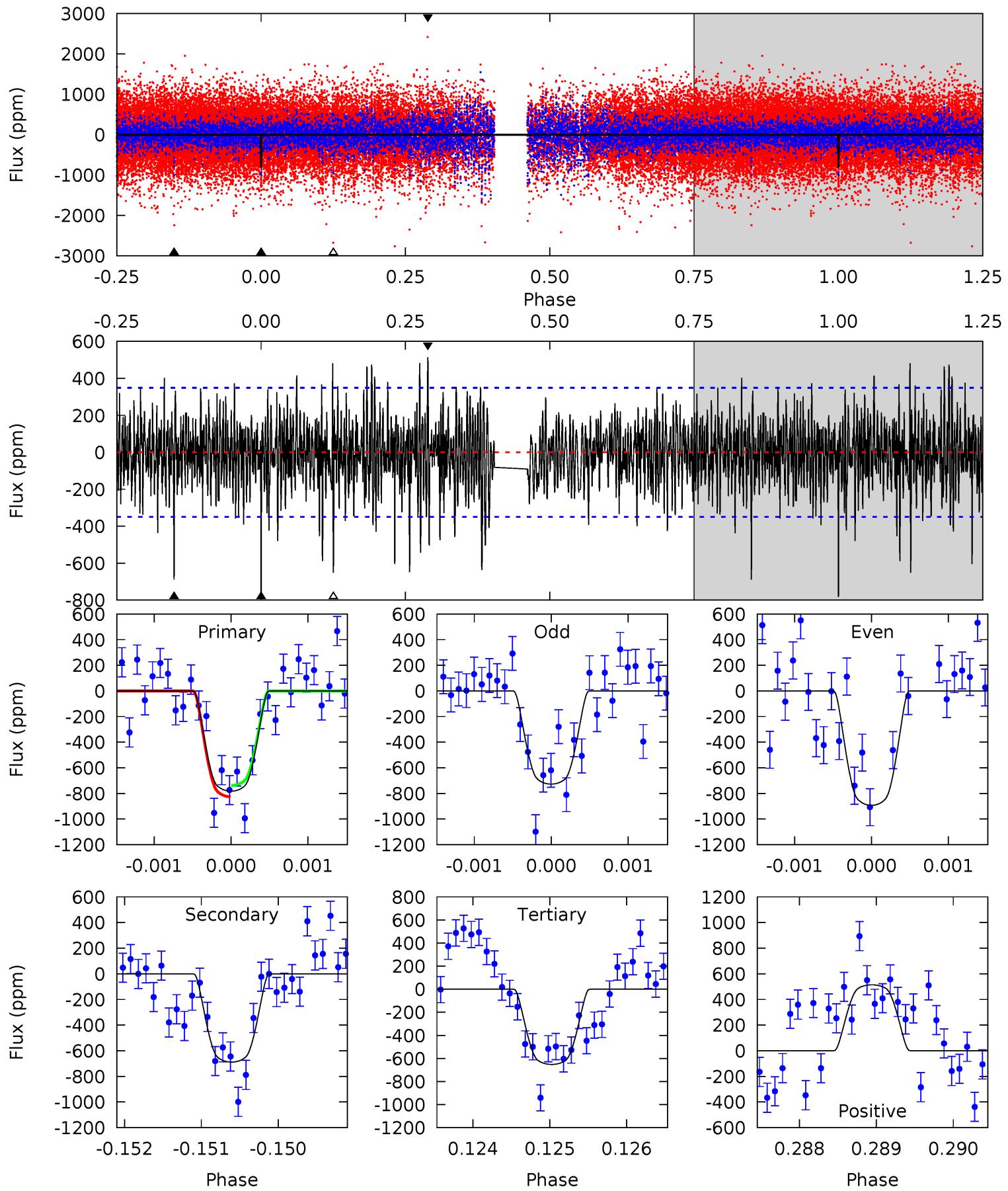
TCE 010091451-03 P=346.264076 Days  $T_0=192.638593$  (BKJD)



# DV Model-Shift Uniqueness Test

010091451-03,  $P = 346.178931$  Days,  $E = 192.856885$  Days

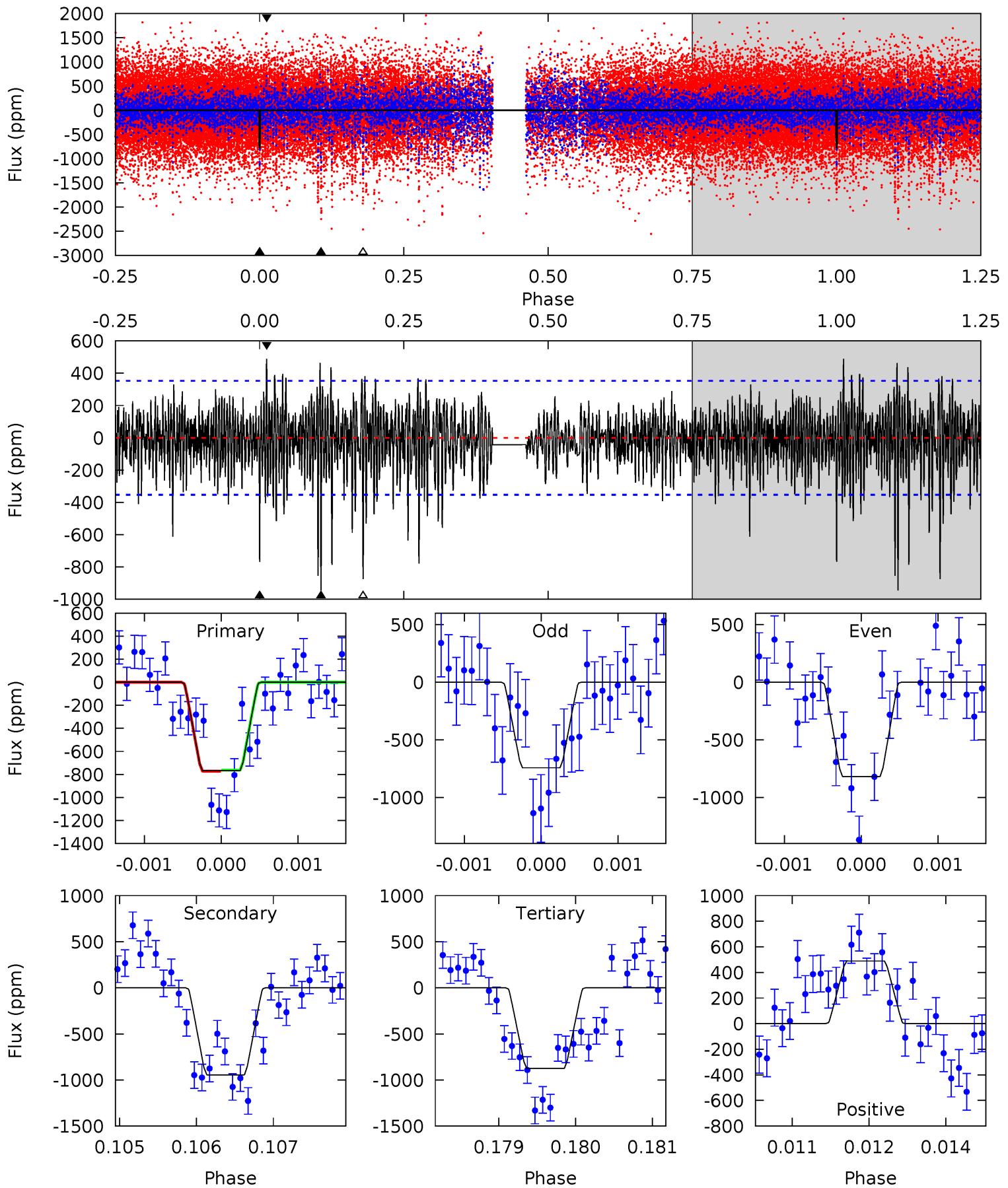
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
12.1	10.7	10.1	7.97	5.41	3.23	2.30	2.02	4.16	0.57	2.70	1.21	0.88	0.40	0.69



# Alt Model-Shift Uniqueness Test

010091451-03,  $P = 346.264076$  Days,  $E = 192.638593$  Days

Pri	Sec	Ter	Pos	$FA_1$	$FA_2$	$F_{\text{Red}}$	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
11.8	14.5	13.4	7.51	5.41	3.23	2.40	-1.63	4.27	1.08	6.98	0.55	0.94	0.34	0.06



## Stellar Parameters For KIC 010091451

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6191^{+194}_{-259}$	$4.454^{+0.065}_{-0.208}$	$-0.100^{+0.250}_{-0.350}$	$1.025^{+0.309}_{-0.111}$	$1.088^{+0.141}_{-0.155}$	$1.423^{+0.484}_{-0.734}$
	$+3\%/-4\%$	$+1\%/-5\%$	$+250\%/-350\%$	$+30\%/-11\%$	$+13\%/-14\%$	$+34\%/-52\%$
Source	KIC0	KIC0	KIC0	DSEP		

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

## Secondary Eclipse Parameters for KIC 010091451-03 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (\text{K})$	$T_{obs} (\text{K})$	$A_{obs}$
DV	$-689 \pm 65$	$4.06^{+0.74}_{-0.51}$	$394^{+30}_{-22}$	$5367^{+335}_{-289}$	$21920^{+7331}_{-5740}$
Alt.	$-944 \pm 65$	$3.51^{+0.58}_{-0.48}$	$395^{+27}_{-21}$	$6234^{+400}_{-409}$	$41130^{+13775}_{-11061}$

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

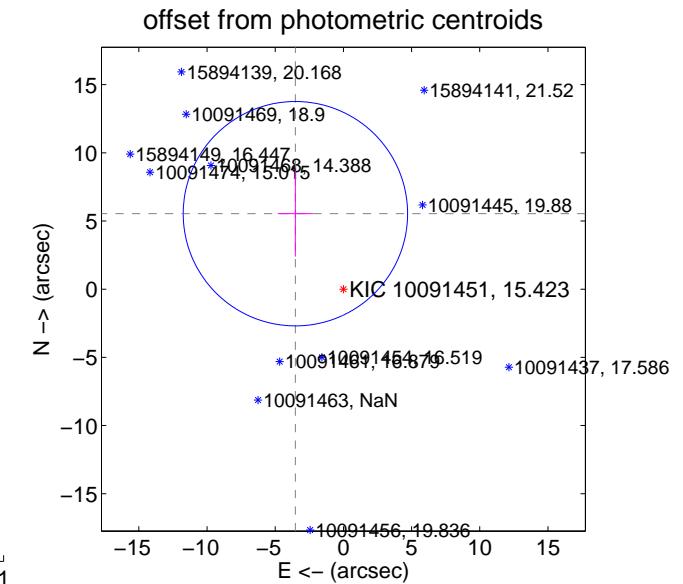
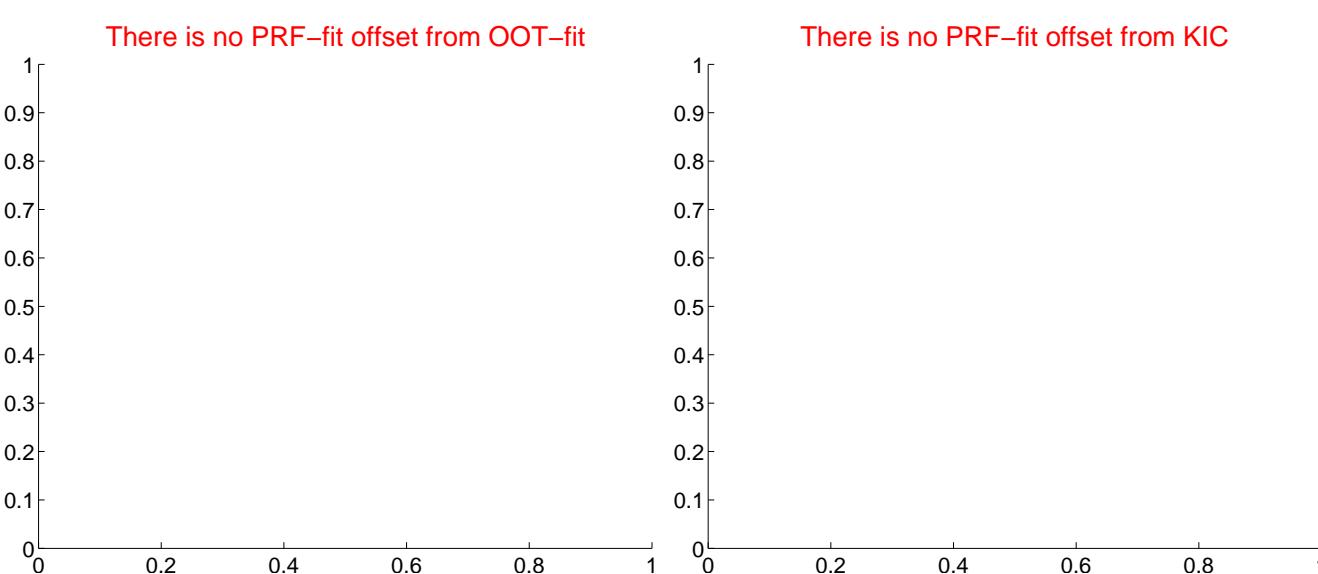
## DV Centroid Data

Supplemental centroid analysis for 010091451-03. Kepler magnitude: 15.42. Transit SNR 9.04

**There are 0 quarters with good PRF difference image offsets**

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

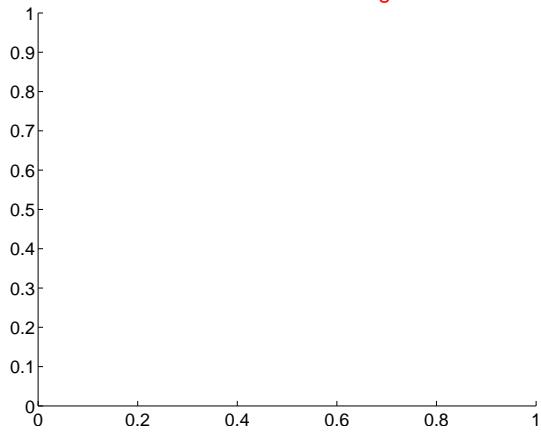
	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	—	—	—	—
PRF-fit source offset from KIC position	—	—	—	—
photometric centroid source offset	$6.56 \pm 2.74$	2.39	$3.52 \pm 1.30$	$5.53 \pm 3.14$



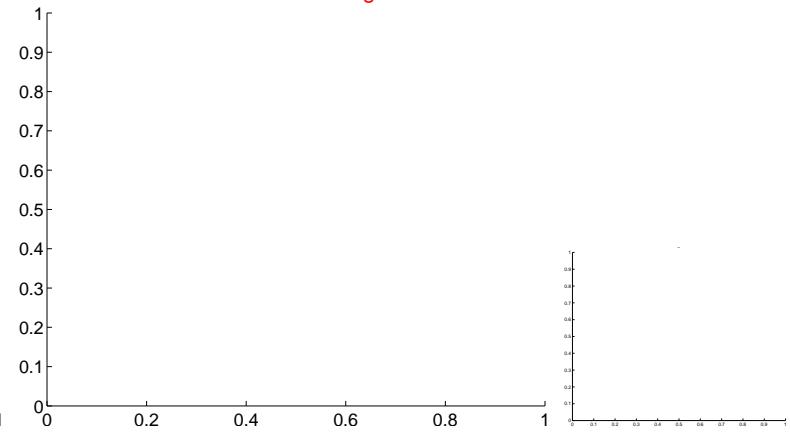
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

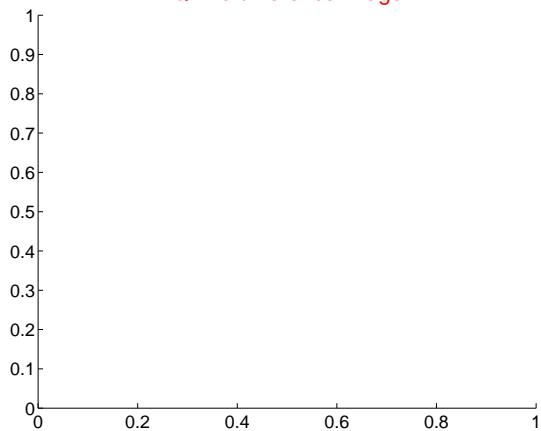
Q1 no difference image



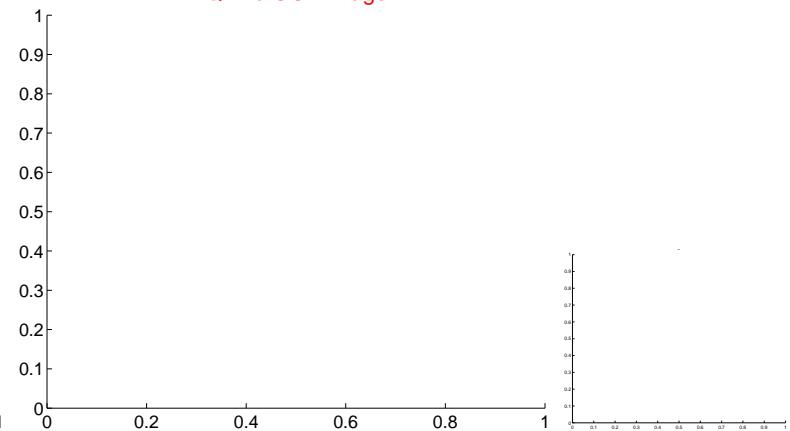
Q1 no OOT image



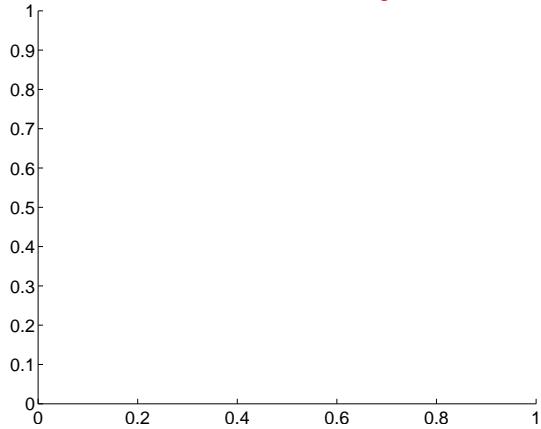
Q2 no difference image



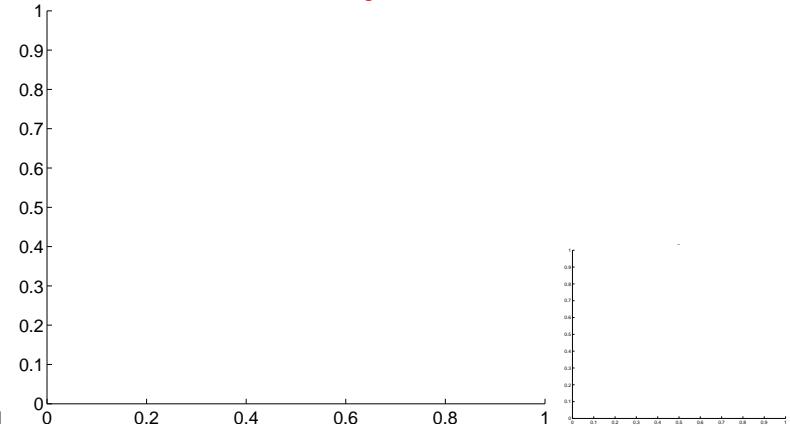
Q2 no OOT image



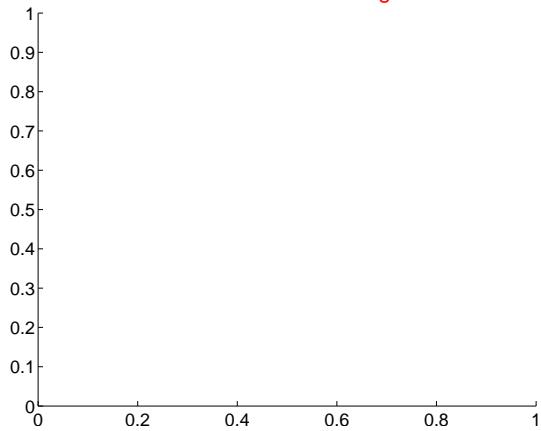
Q3 no difference image



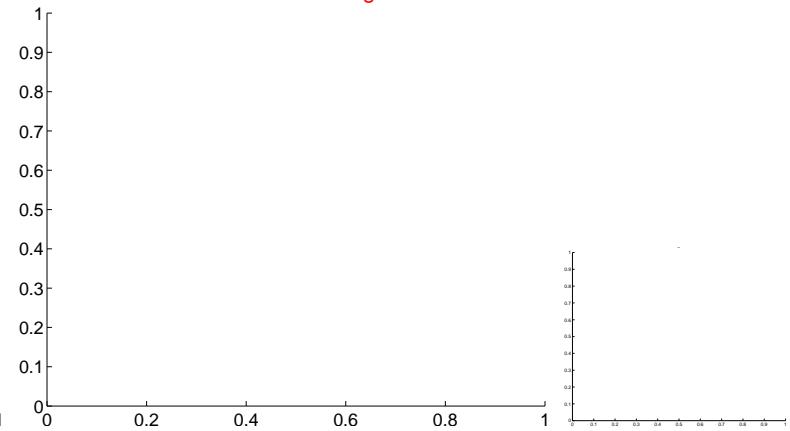
Q3 no OOT image



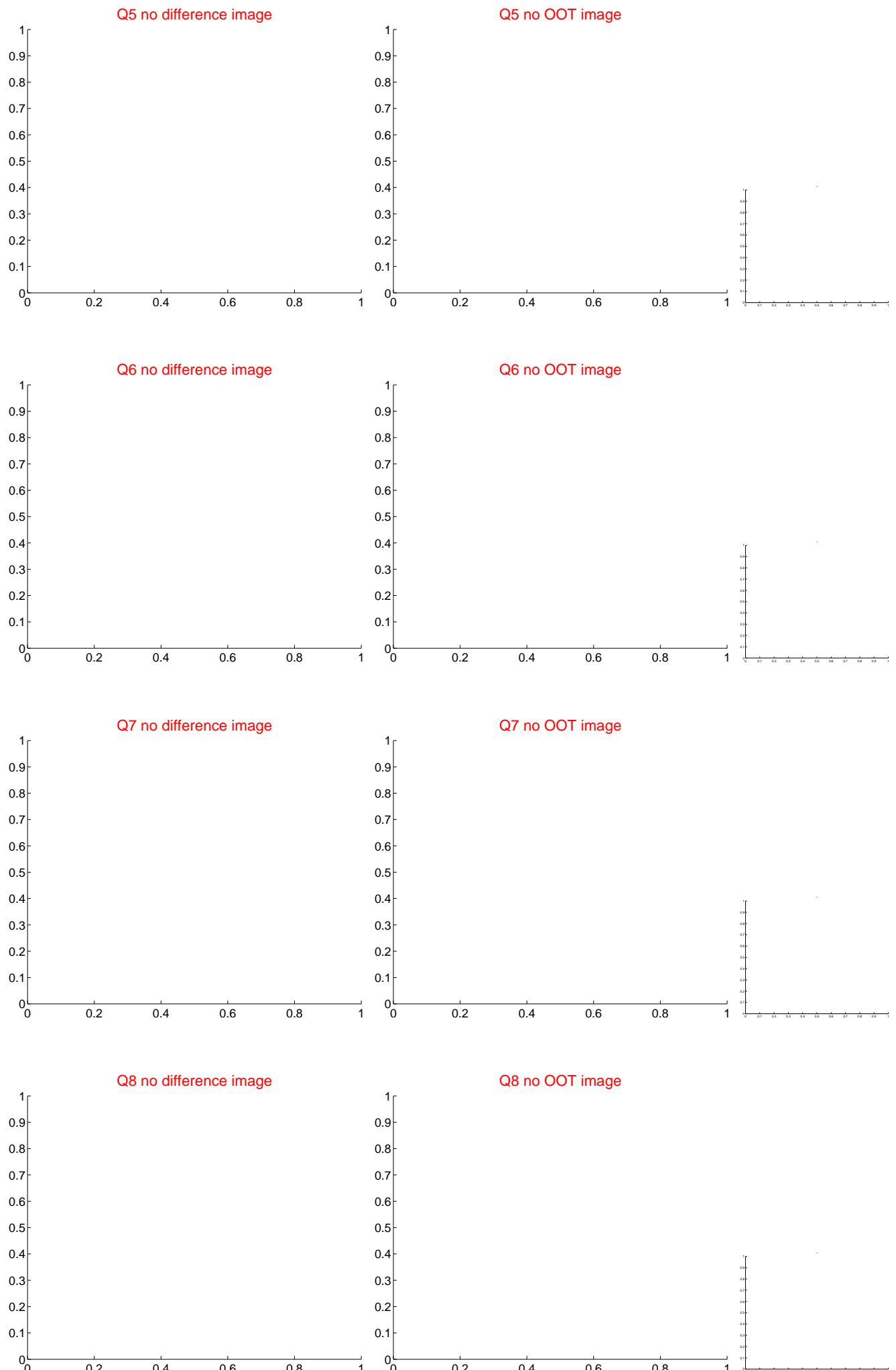
Q4 no difference image



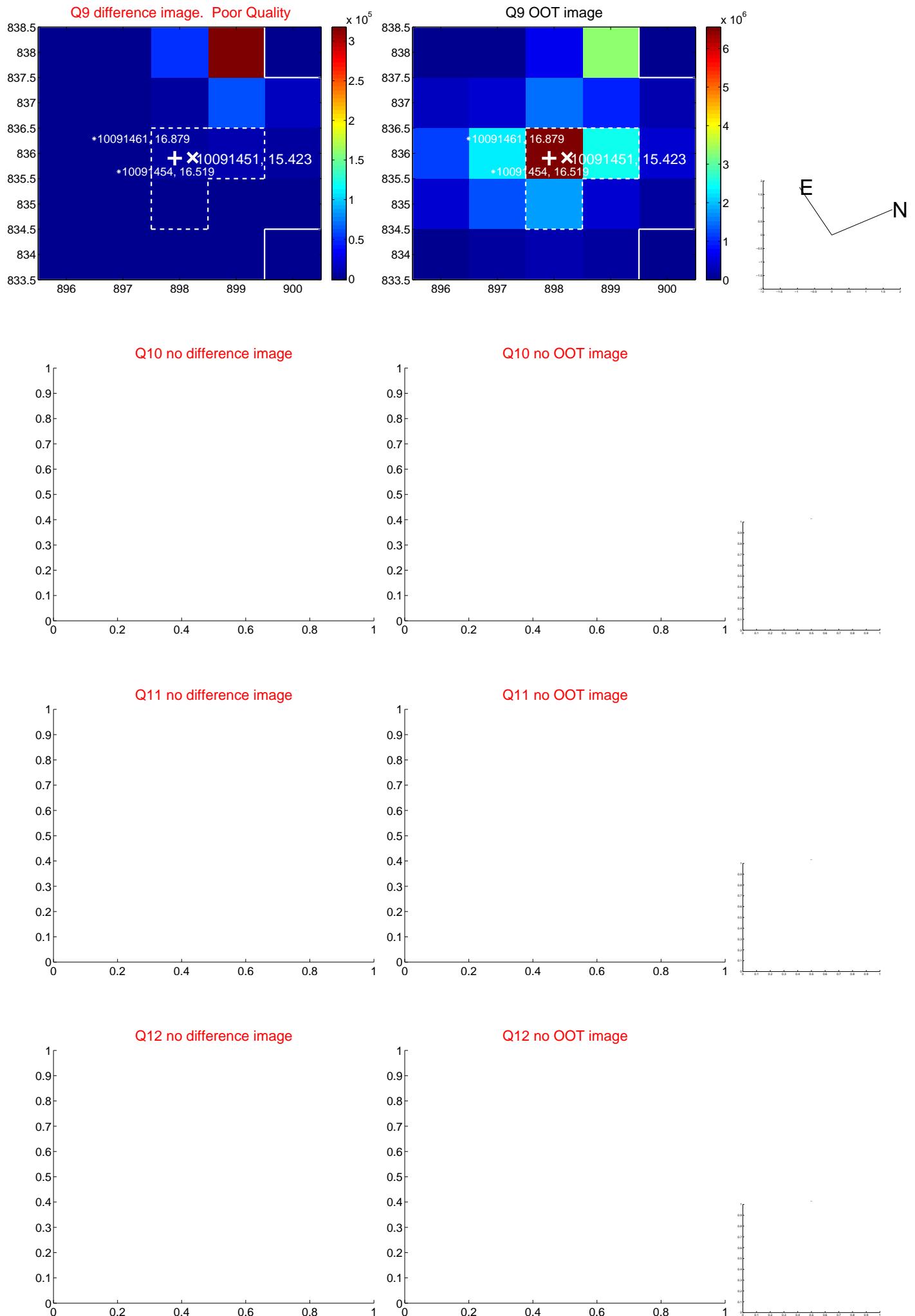
Q4 no OOT image



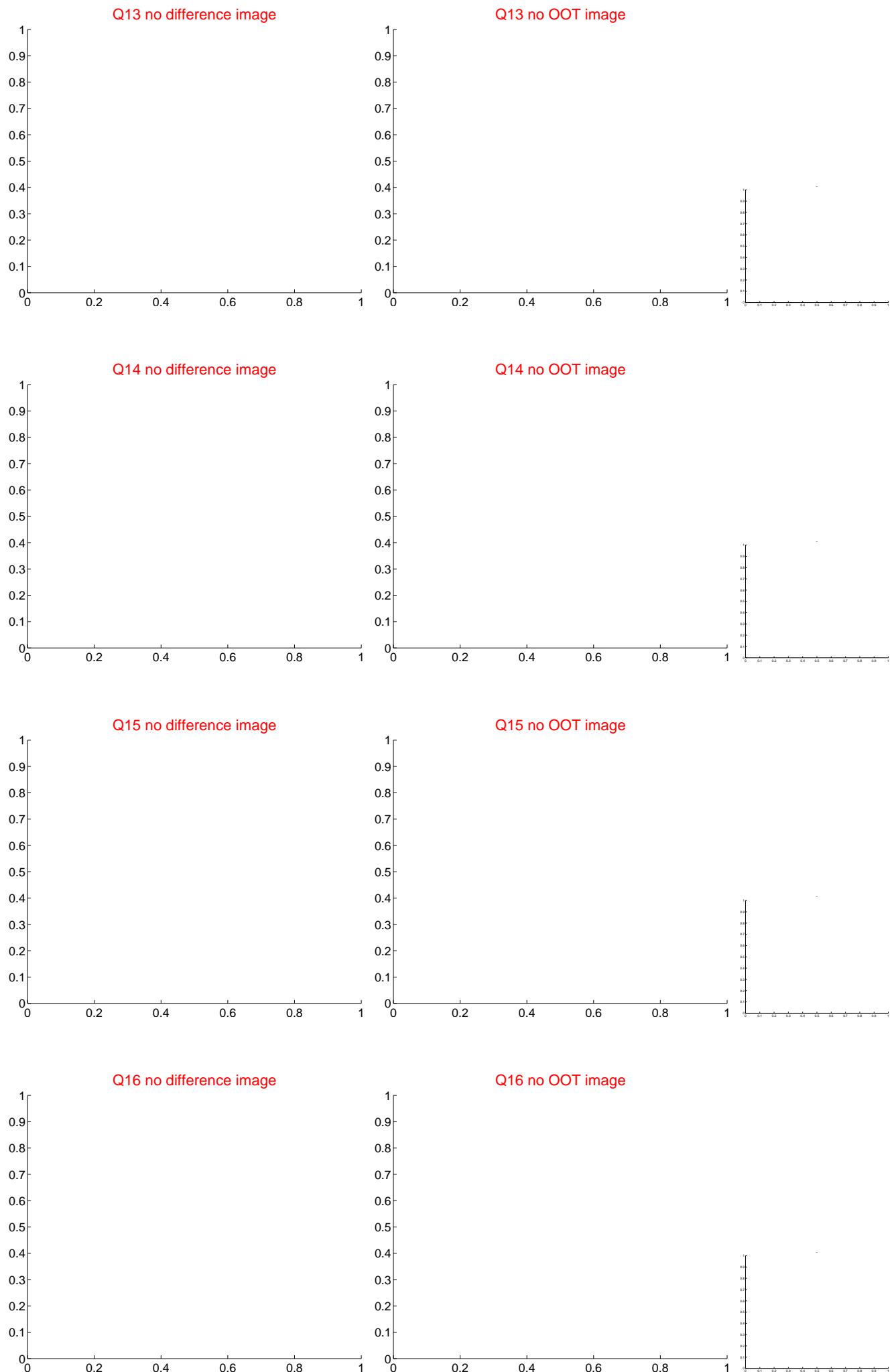
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



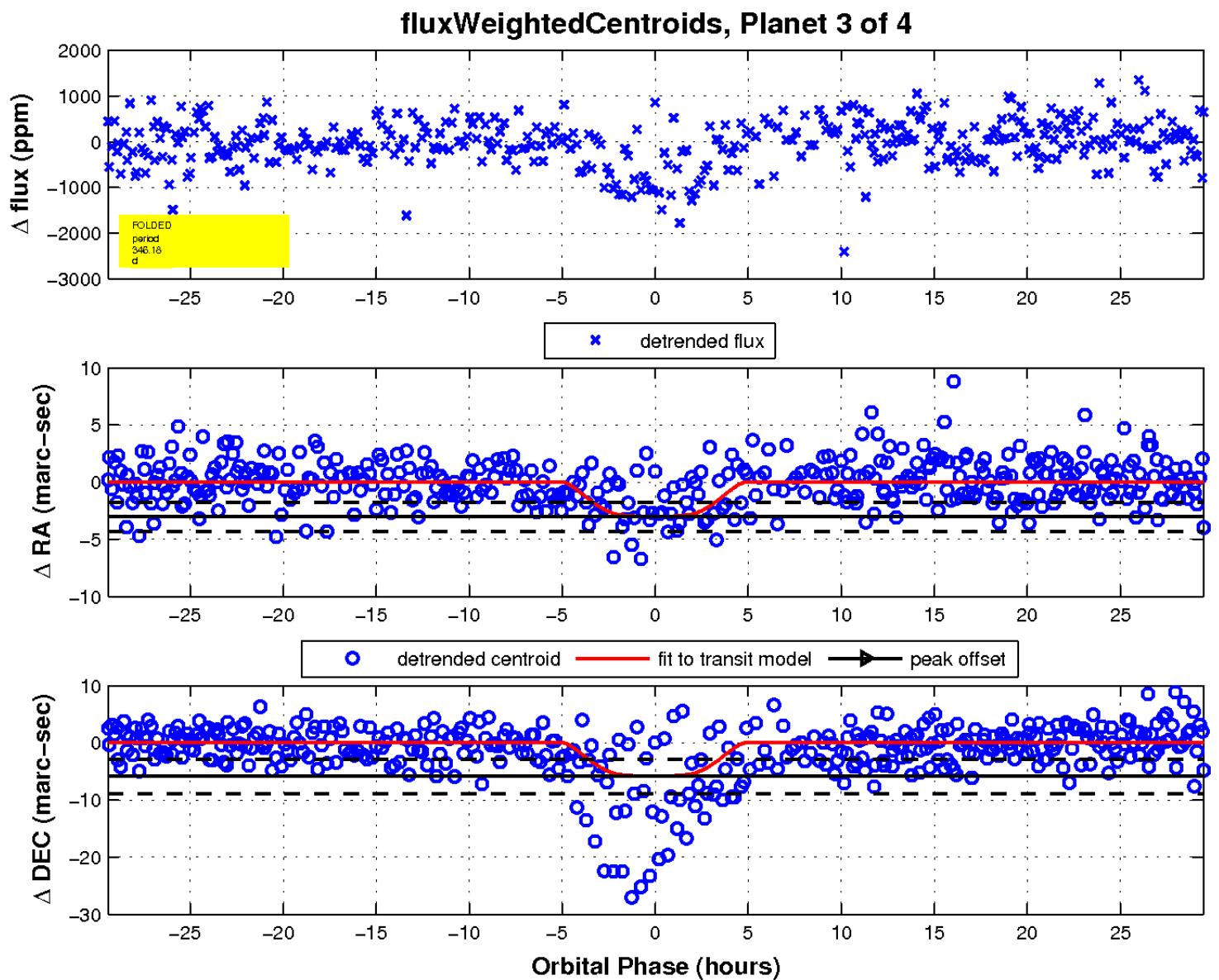
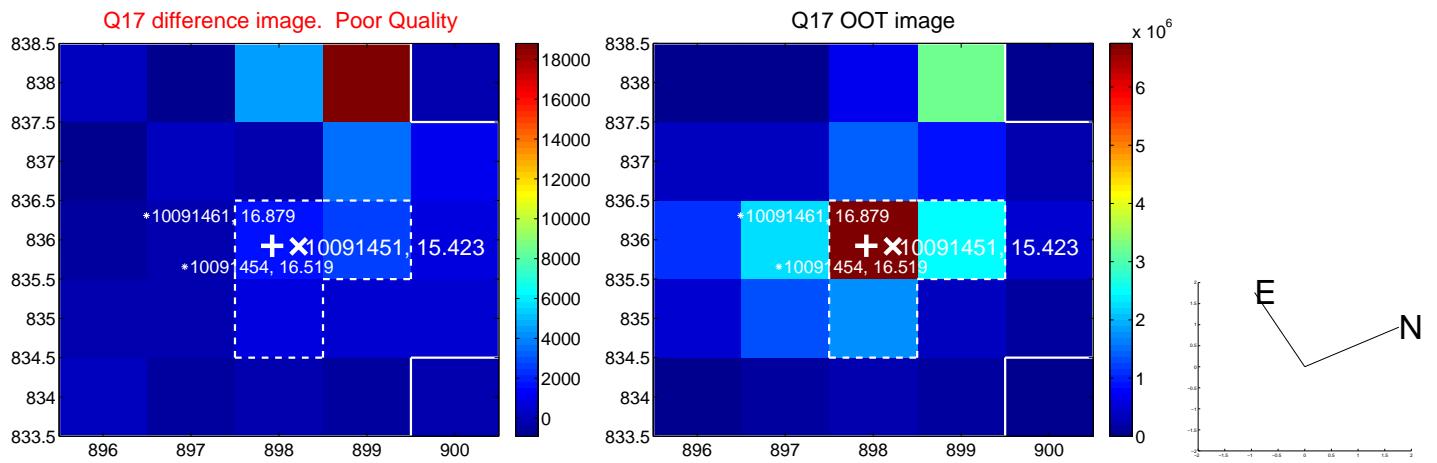
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

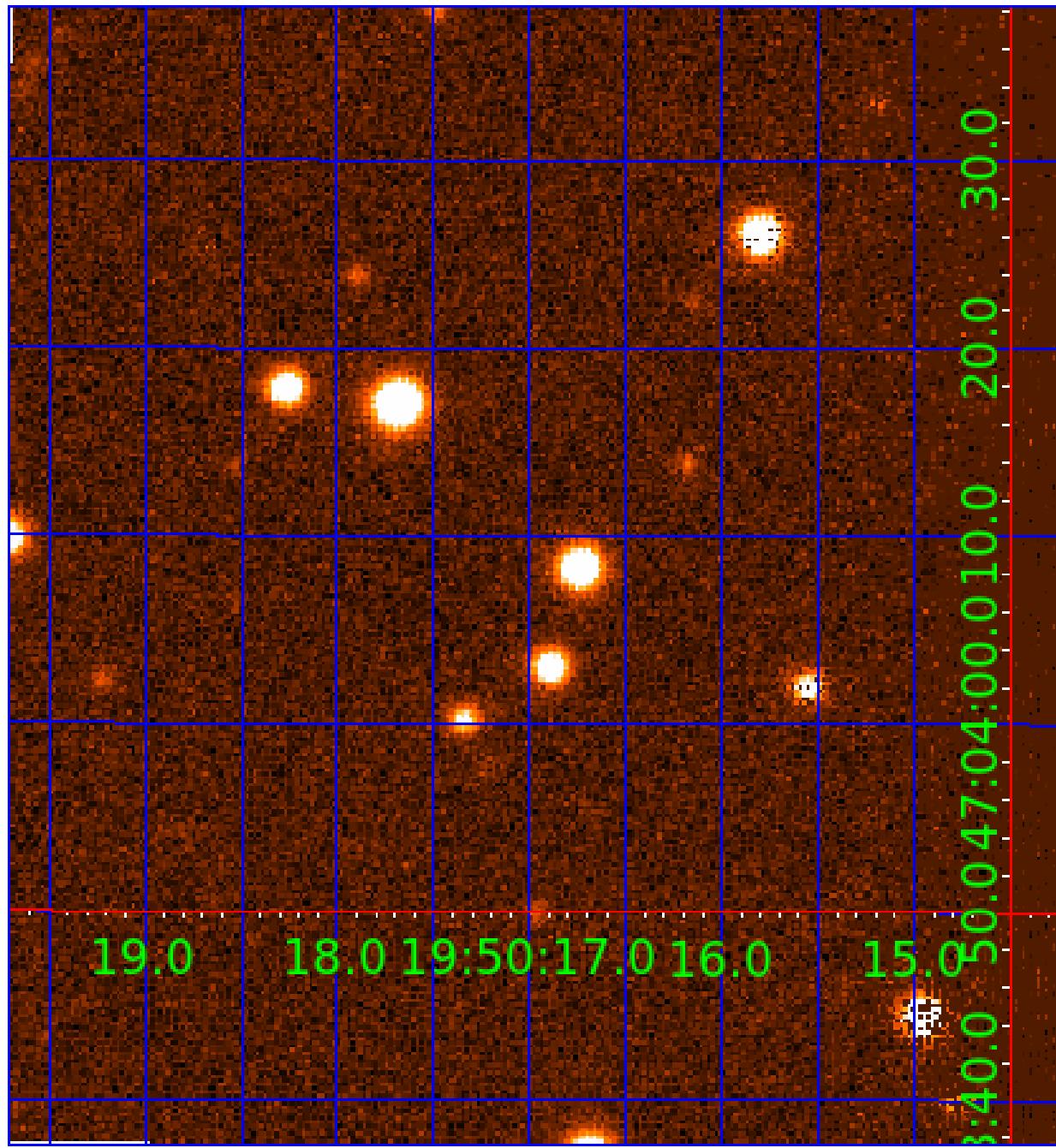


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 010091451

## Q1-17 DR25 TCE Parameters

TCE	Run Type	KOI?	Period (Days)	Epoch (BKJD)	Depth (ppm)	Duration (Hours)	MES	SNR	$R_*$ ( $R_{\odot}$ )	$T_*$ (K)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
010091451-01	INV	No	320.996471	284.787792	1187.6	14.105	8.8	10.1	1.02	6191	6.71	1.55
010091451-02	INV	No	347.939030	278.324326	1147.4	12.252	7.4	7.7	1.02	6191	6.60	1.39
010091451-03	INV	No	346.178931	192.856885	950.4	9.839	7.3	9.0	1.02	6191	3.95	1.40
010091451-04	INV	No	265.522594	389.189240	729.3	12.507	7.3	7.0	1.02	6191	2.79	2.00

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
010091451-01	INV	FP	0.00	0	1	1	0	DEEP_V_SHAPED—CENT_RESOLVED_OFFSET
010091451-02	INV	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL—CENT_FEW_DIFFS
010091451-03	INV	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—MOD_NONUNIQ_ALT—MOD_TER_ALT—CENT_FEW_DIFFS
010091451-04	INV	PC	0.05	0	0	0	0	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.

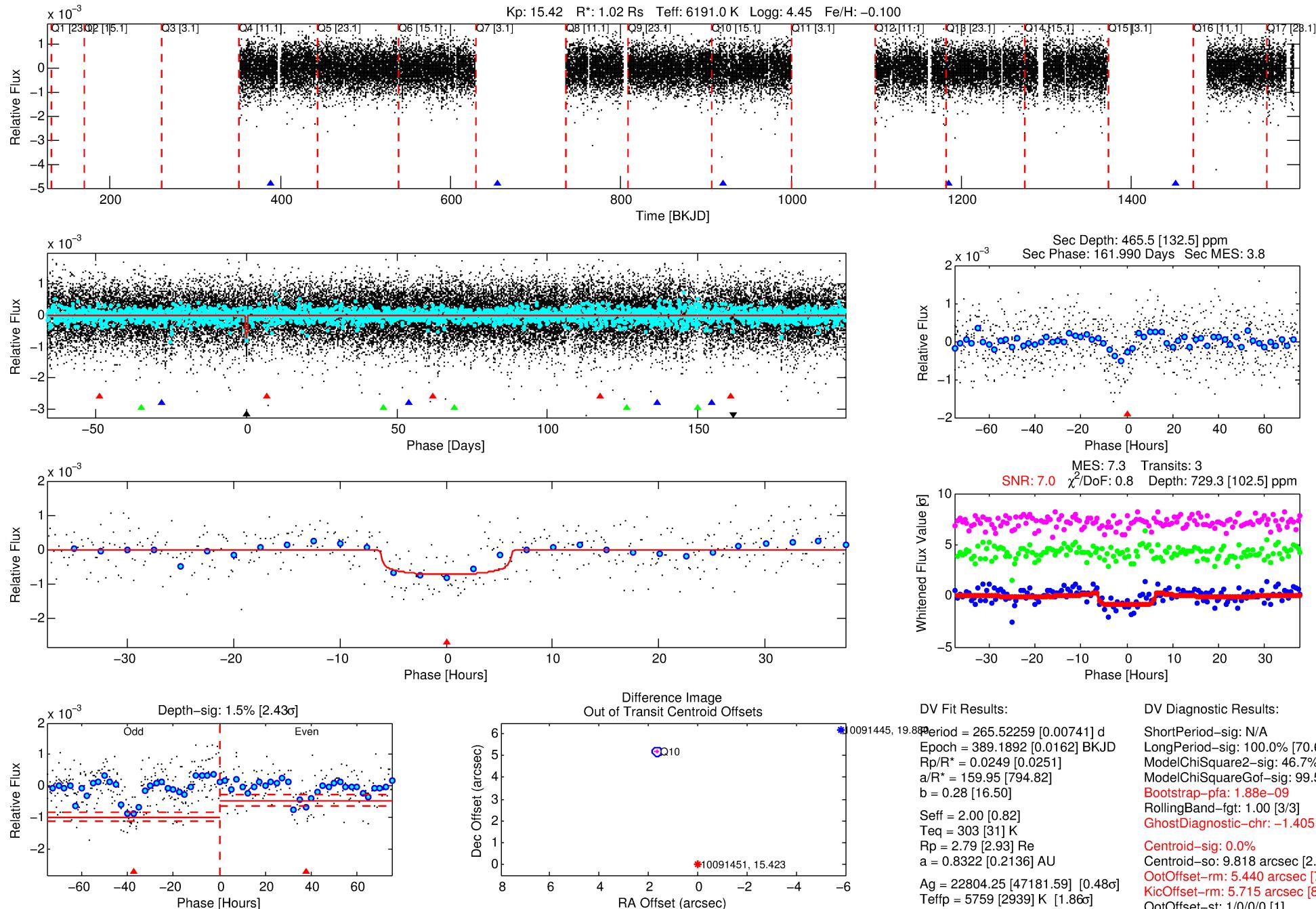
## Ephemeris Match Information For 010091451-04

No Significant Match Found

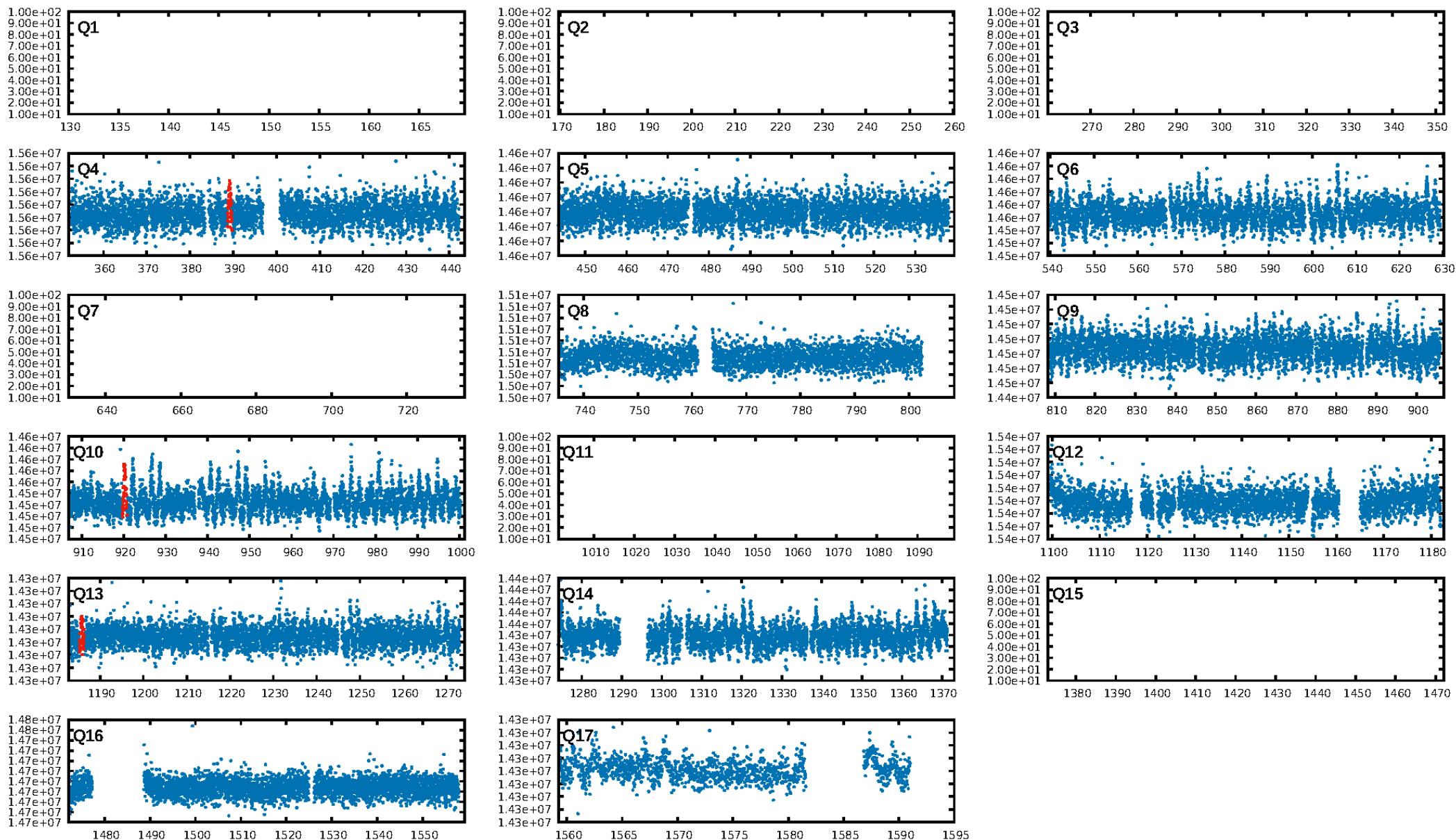
**WARNING: THIS DATA IS  
SIMULATED, NOT OBSERVED**

## DV One-Page Summary

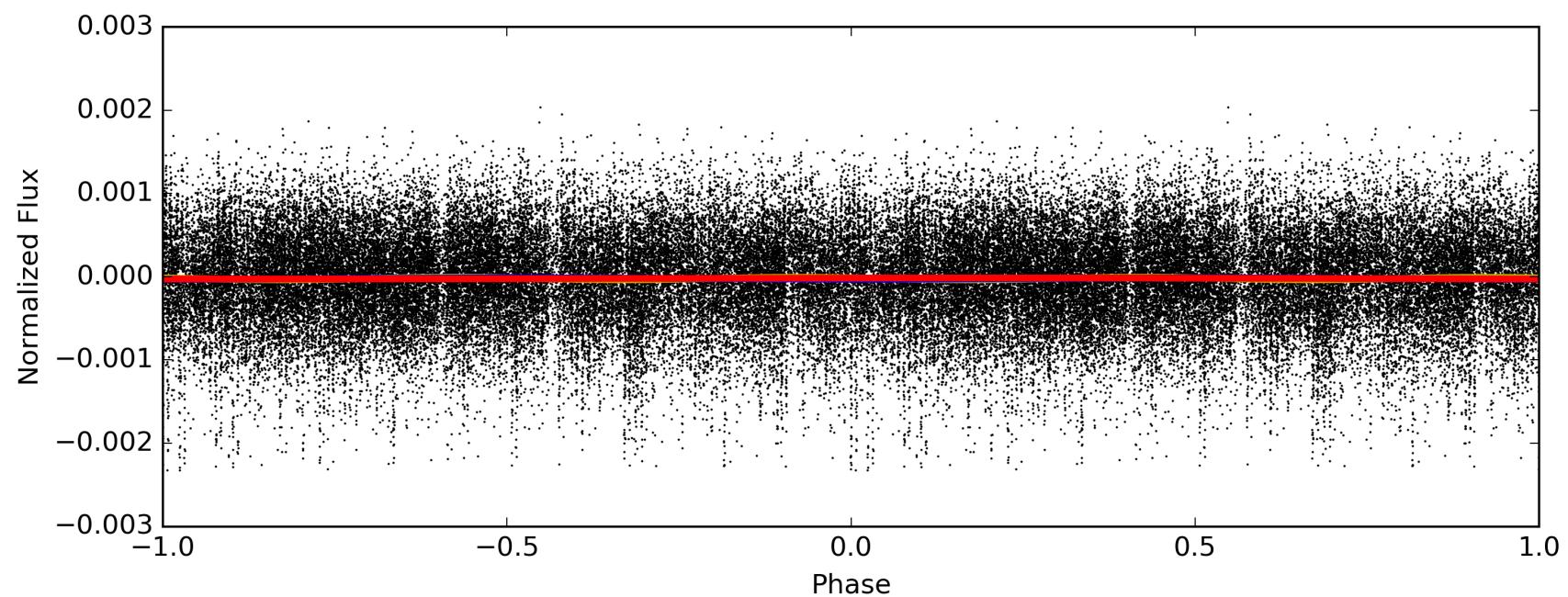
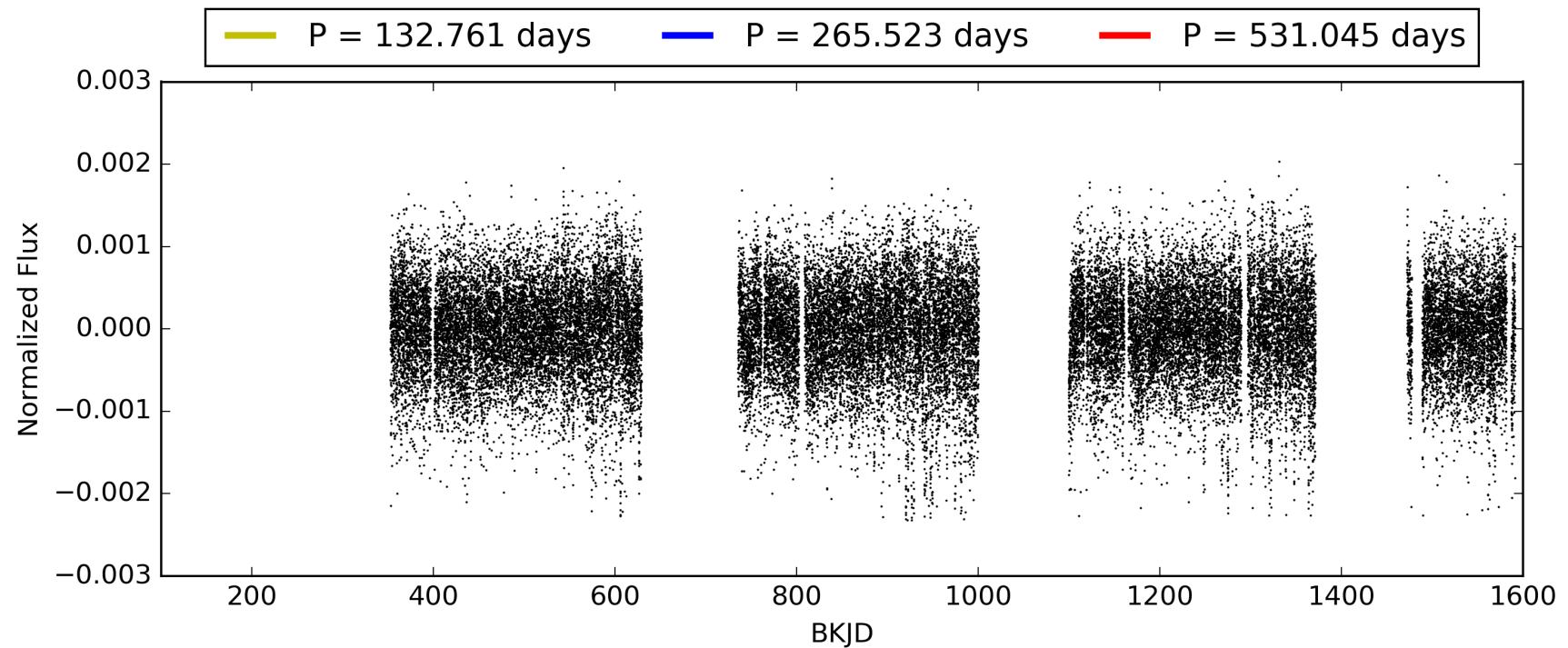
KIC: 10091451 Candidate: 4 of 4 Period: 265.523 d



TCE 010091451-04, PDC Light Curves

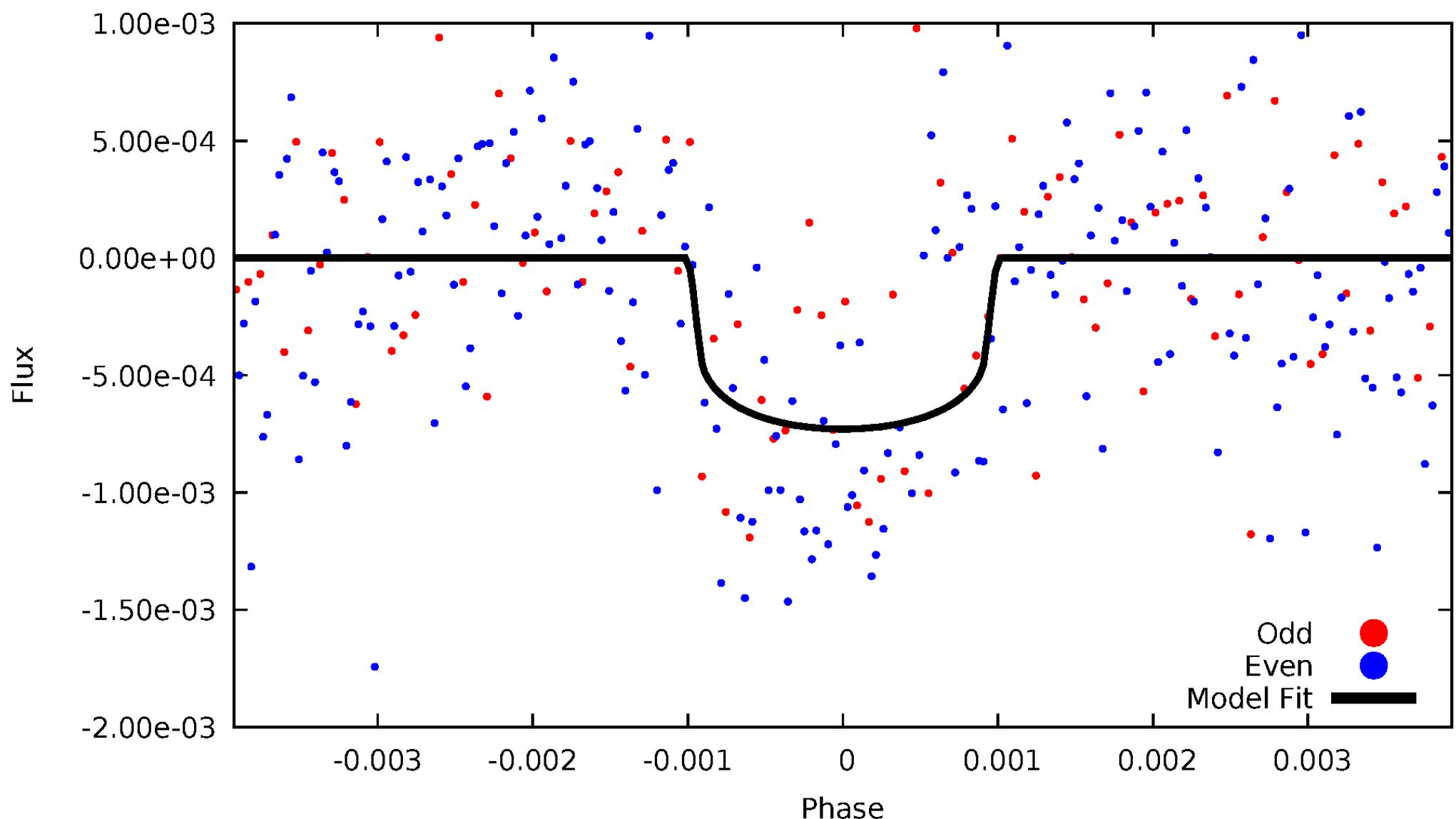


# TCE 010091451-04



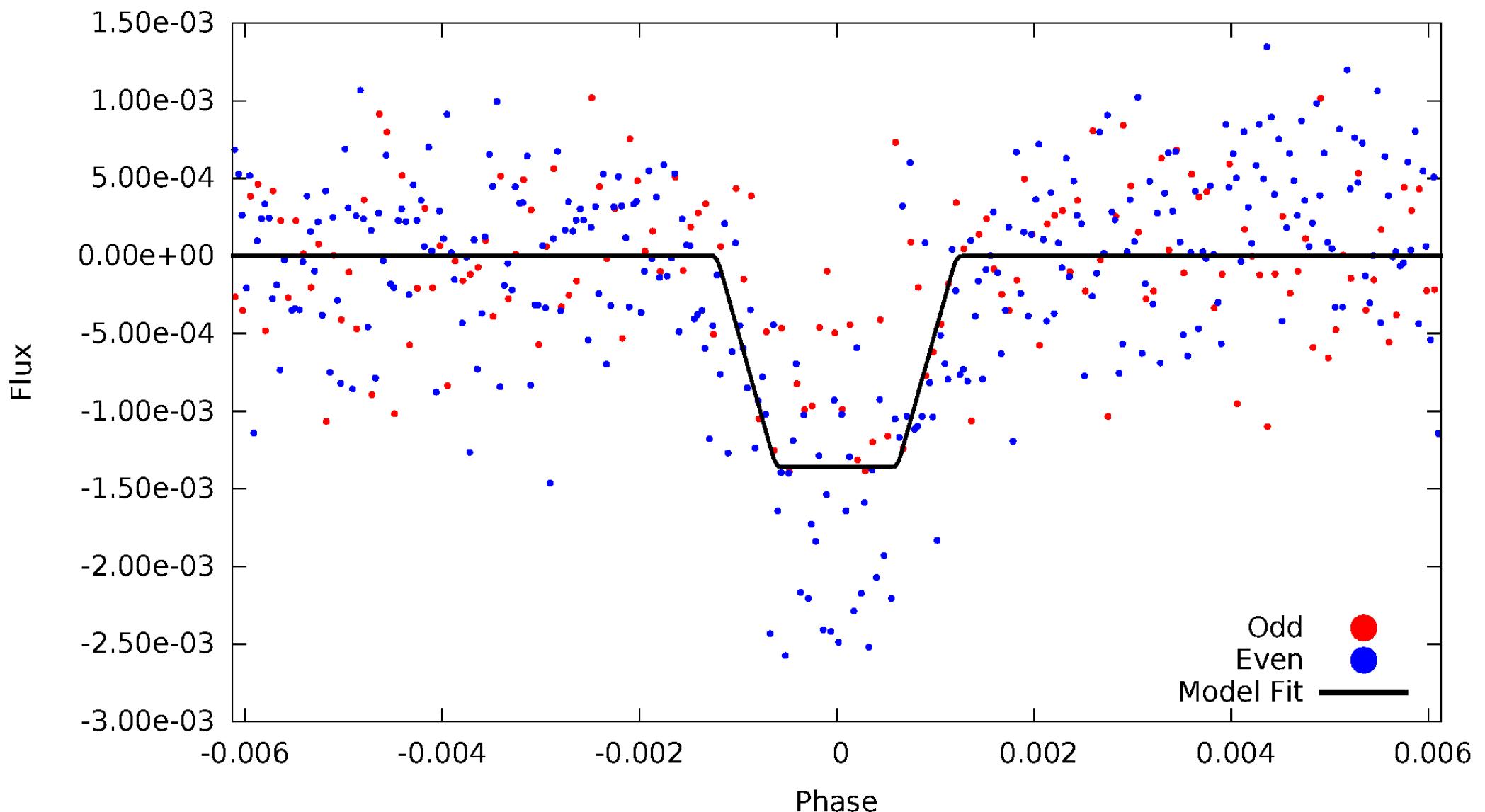
# DV Odd/Even

TCE 010091451-04

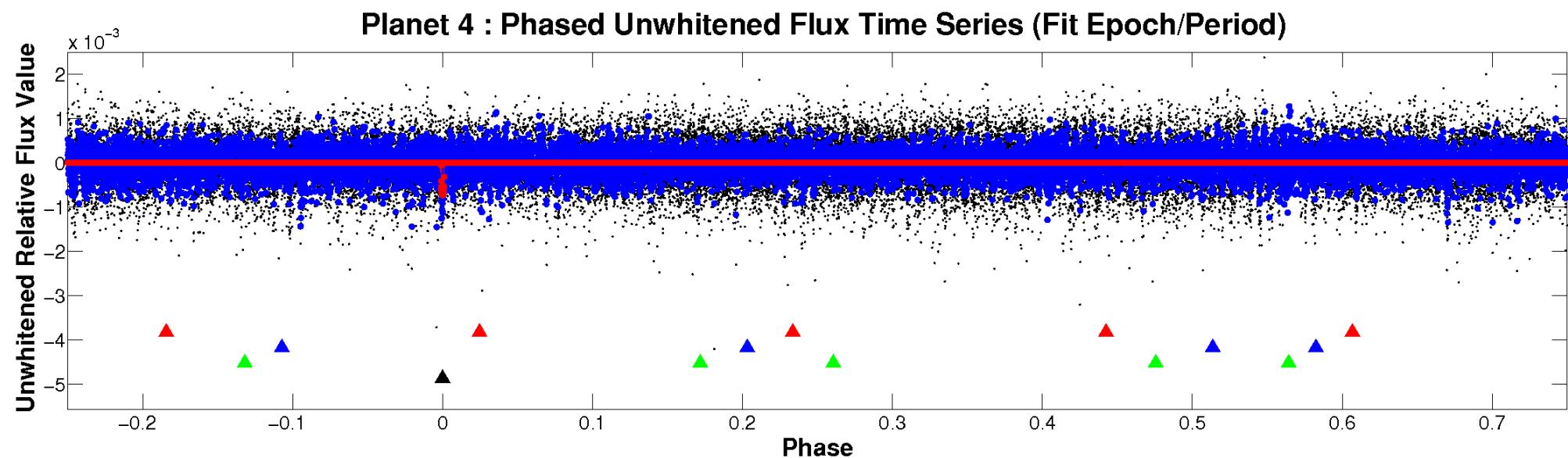


# ALT Odd/Even

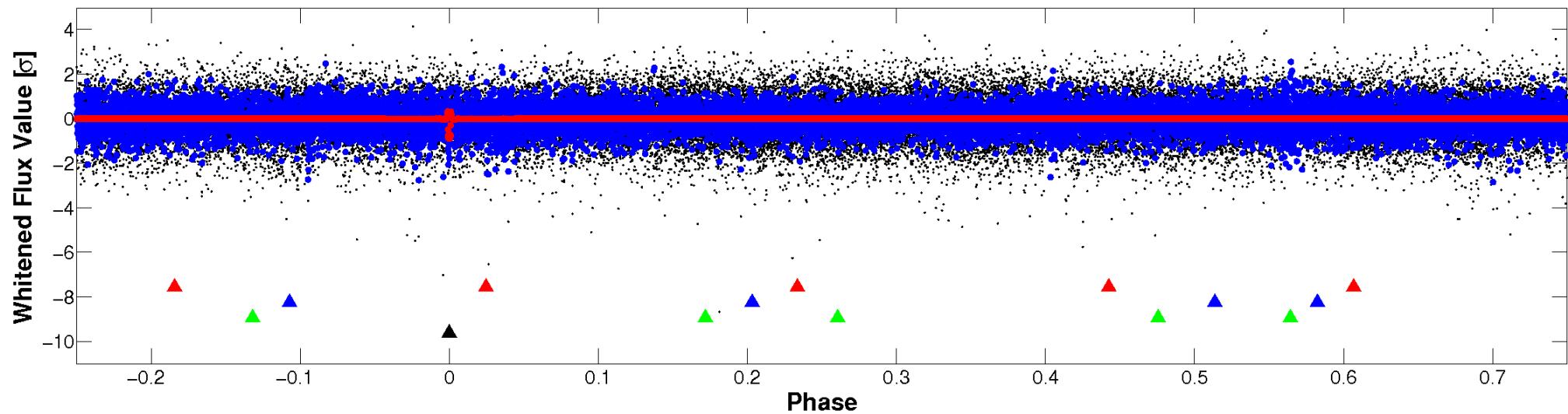
TCE 010091451-04



# Non-Whitened Vs. Whitened Light Curve

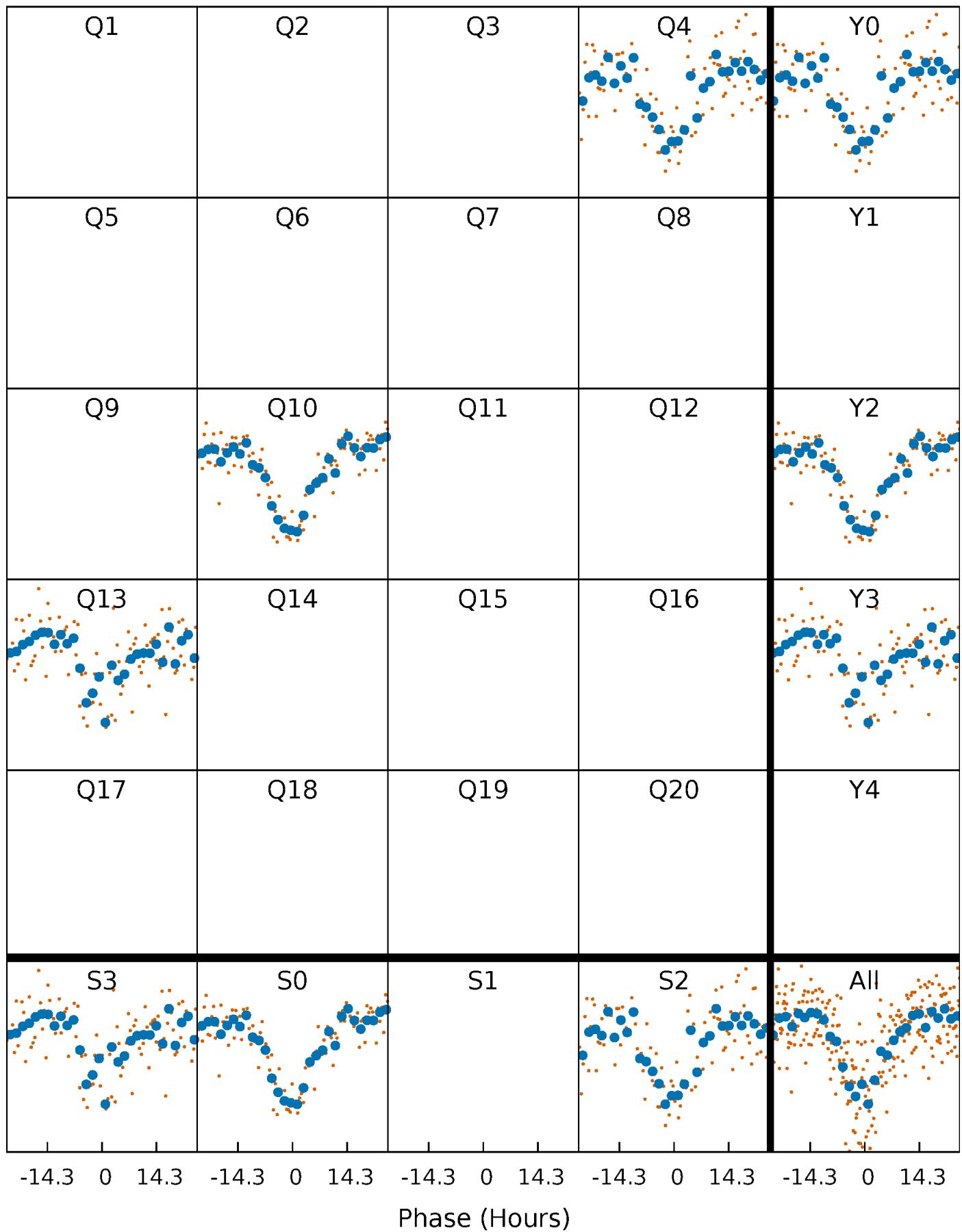


**Planet 4 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



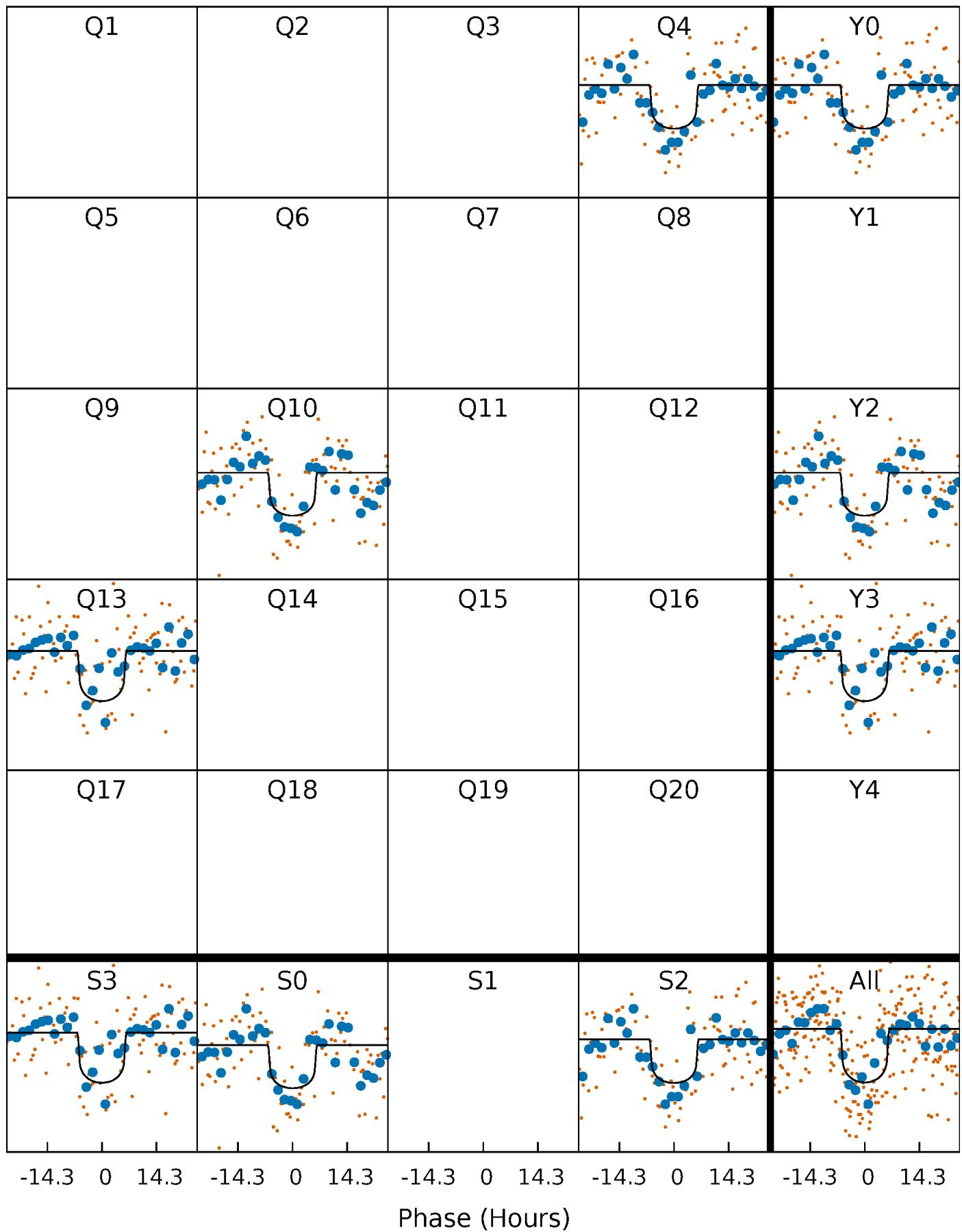
# PDC Quarter-Phased Transit Curves

TCE 010091451-04     $P=265.522594$  Days    $T_0=389.189240$  (BKJD)



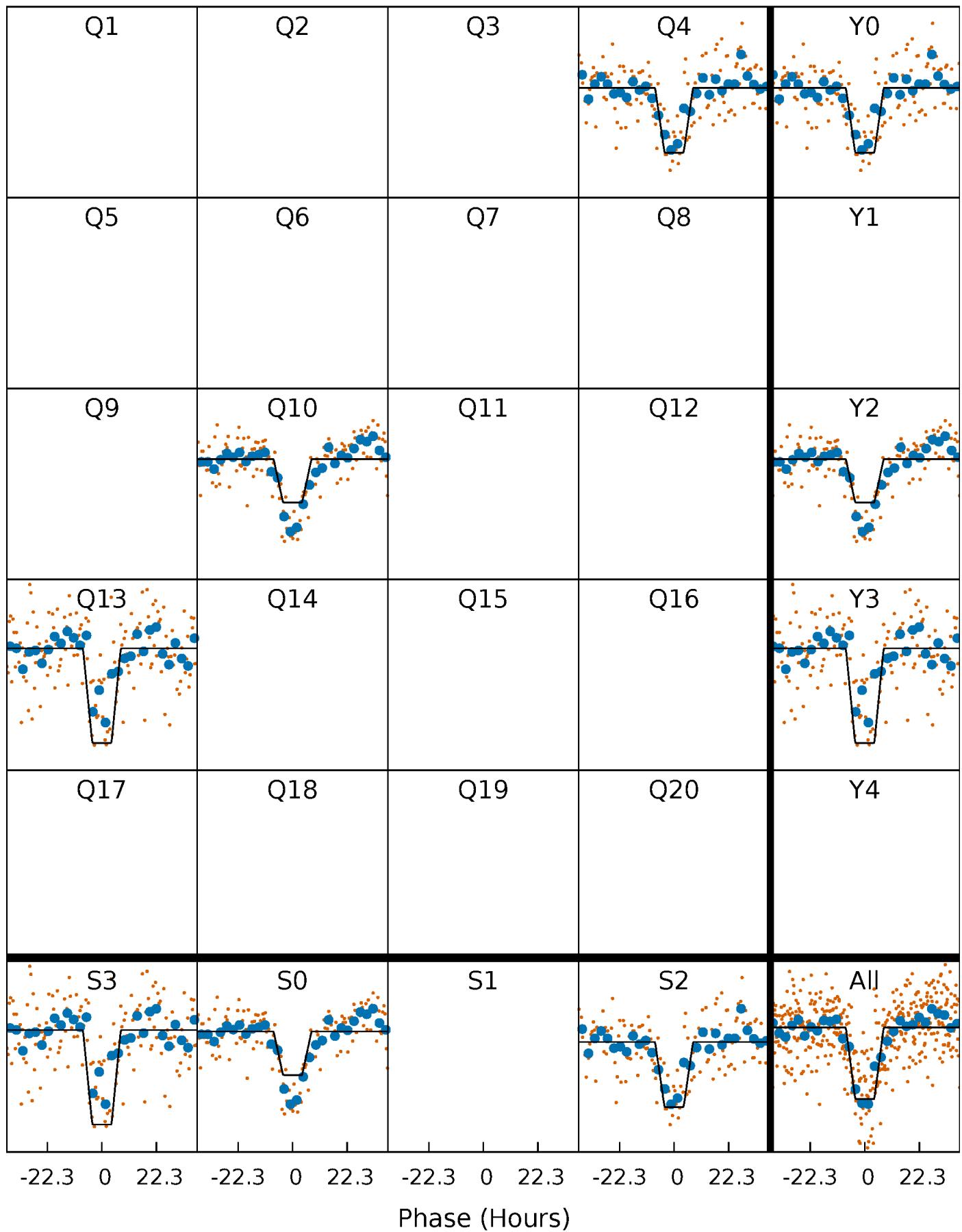
# DV Quarter-Phased Transit Curves

TCE 010091451-04 P=265.522594 Days  $T_0=389.189240$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

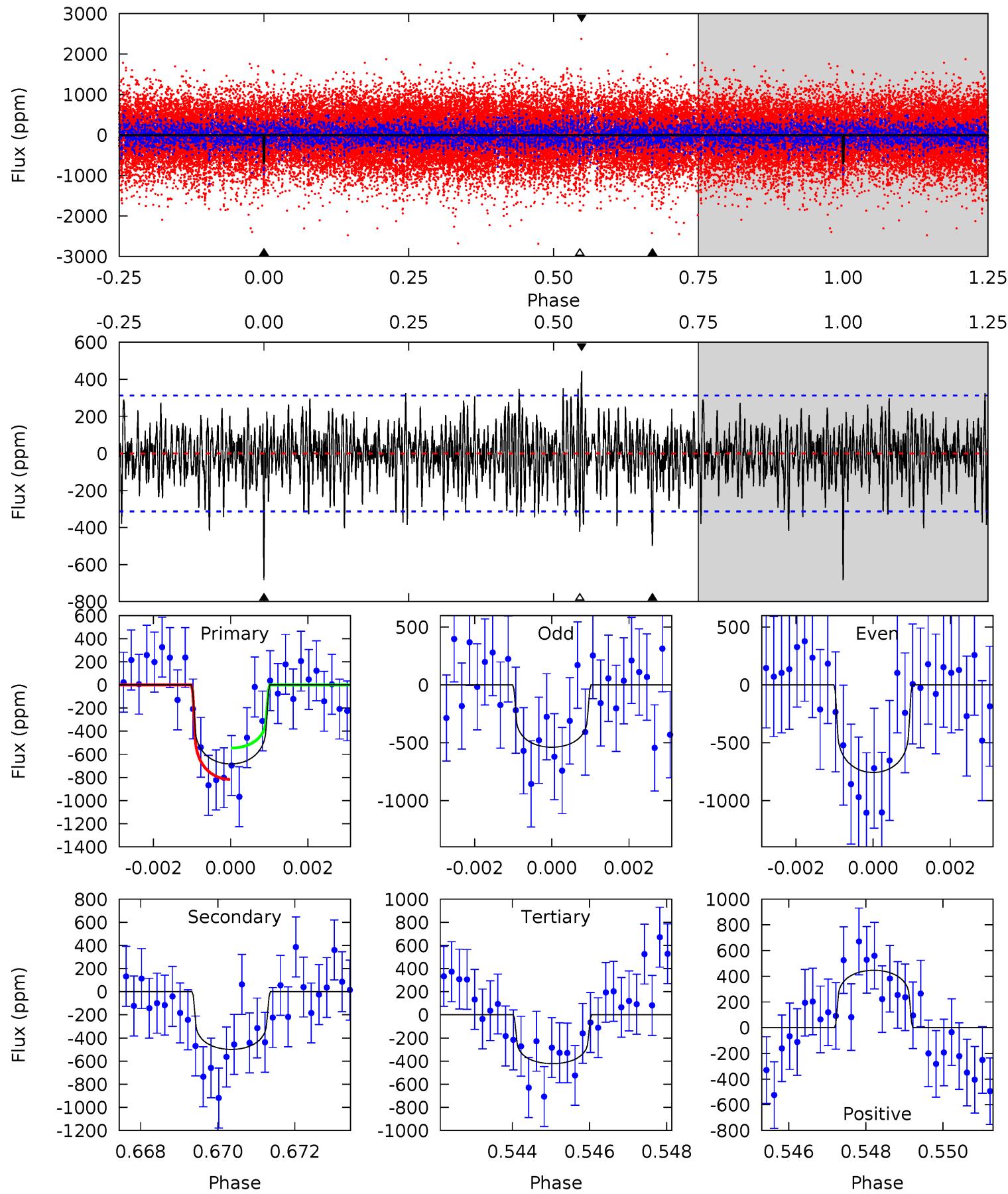
TCE 010091451-04     $P=265.520490$  Days     $T_0=389.163670$  (BKJD)



## DV Model-Shift Uniqueness Test

010091451-04, P = 265.522594 Days, E = 123.666646 Days

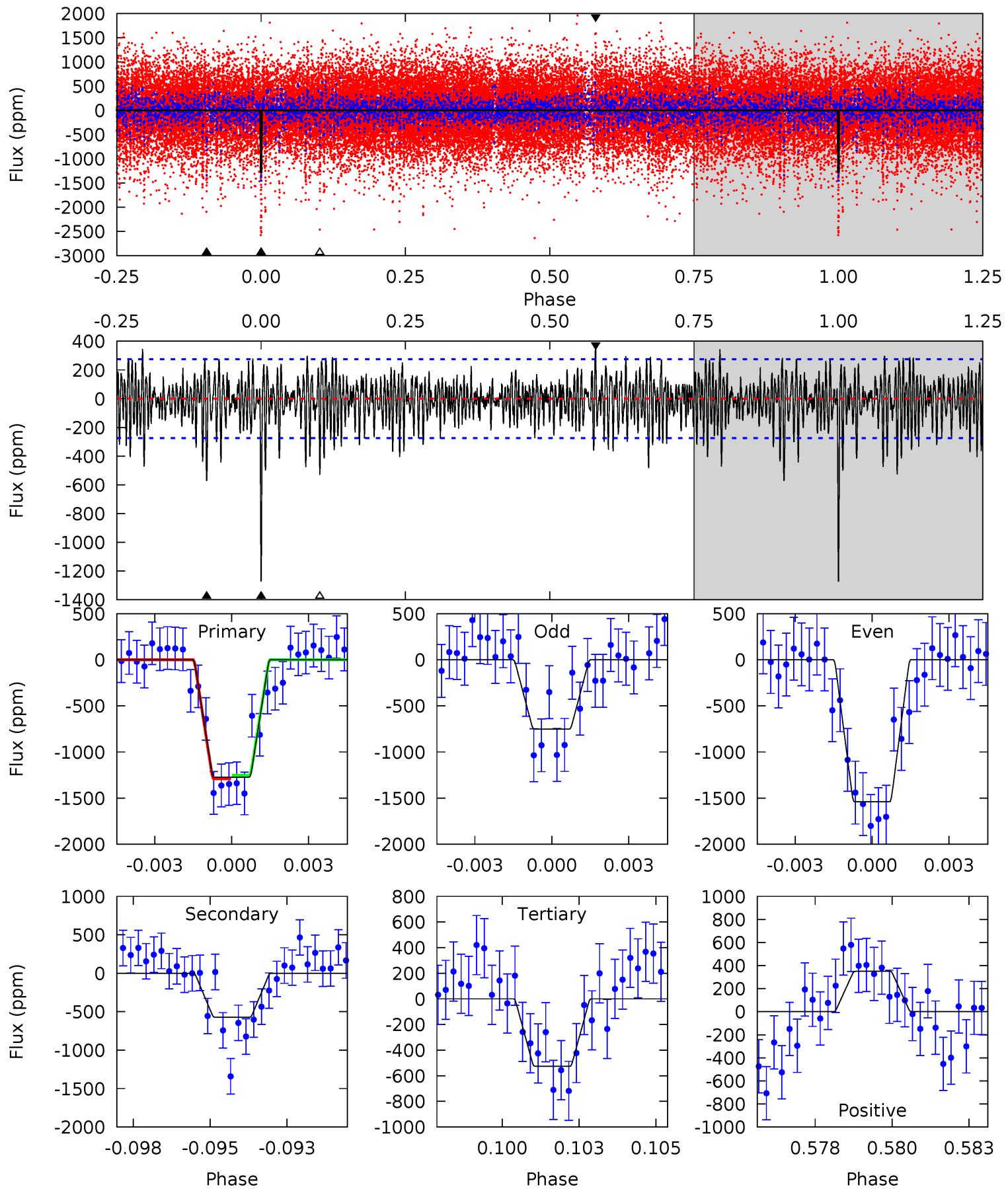
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
11.6	8.50	7.19	7.60	5.33	3.09	2.09	4.44	4.03	1.31	0.90	1.77	0.92	0.40	2.30



# Alt Model-Shift Uniqueness Test

010091451-04,  $P = 265.520490$  Days,  $E = 123.643180$  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
24.5	11.0	10.1	6.73	5.29	3.02	2.50	14.4	17.8	0.87	4.25	7.18	1.22	0.22	0.37



## Stellar Parameters For KIC 010091451

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6191^{+194}_{-259}$	$4.454^{+0.065}_{-0.208}$	$-0.100^{+0.250}_{-0.350}$	$1.025^{+0.309}_{-0.111}$	$1.088^{+0.141}_{-0.155}$	$1.423^{+0.484}_{-0.734}$
	$+3\%/-4\%$	$+1\%/-5\%$	$+250\%/-350\%$	$+30\%/-11\%$	$+13\%/-14\%$	$+34\%/-52\%$
Source	KIC0	KIC0	KIC0	DSEP		

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

## Secondary Eclipse Parameters for KIC 010091451-04 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (\text{K})$	$T_{obs} (\text{K})$	$A_{obs}$
DV	$-499 \pm 59$	$3.49^{+2.62}_{-2.10}$	$431^{+32}_{-23}$	$5359^{+3770}_{-1087}$	$15378^{+84774}_{-10467}$
Alt.	$-571 \pm 52$	$4.50^{+2.91}_{-2.55}$	$432^{+33}_{-25}$	$4907^{+2509}_{-785}$	$10258^{+44233}_{-6420}$

$T_{max}$  = 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

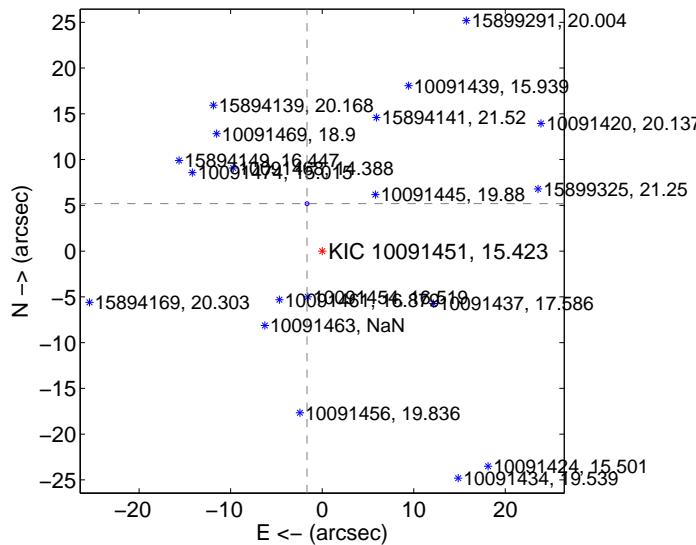
Supplemental centroid analysis for 010091451-04. Kepler magnitude: 15.42. Transit SNR 6.97

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

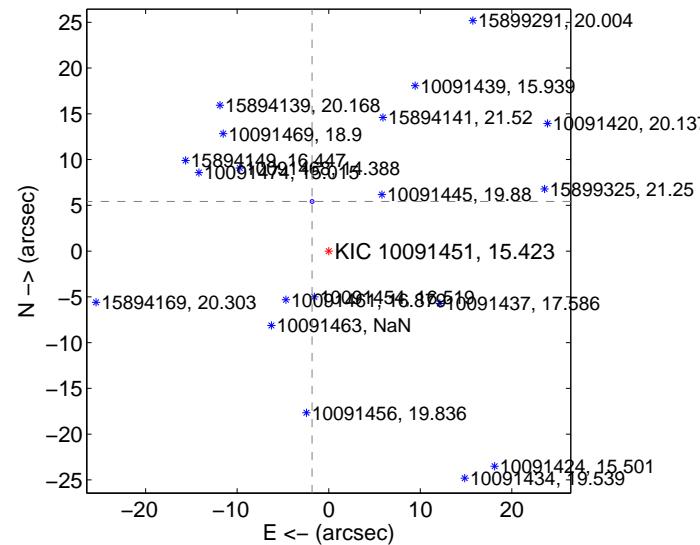
The direct PRF centroid is offset from the target star catalog position by about 0.29 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$5.440 \pm 0.069$	78.31	$1.658 \pm 0.074$	$5.181 \pm 0.069$
PRF-fit source offset from KIC position	$5.715 \pm 0.070$	82.22	$1.814 \pm 0.074$	$5.420 \pm 0.069$
photometric centroid source offset	$9.82 \pm 4.07$	2.41	$3.67 \pm 1.73$	$9.10 \pm 4.33$

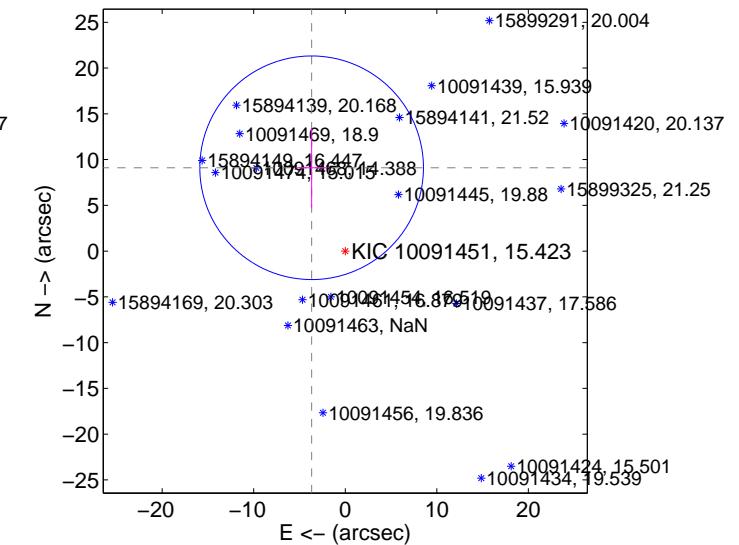
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position



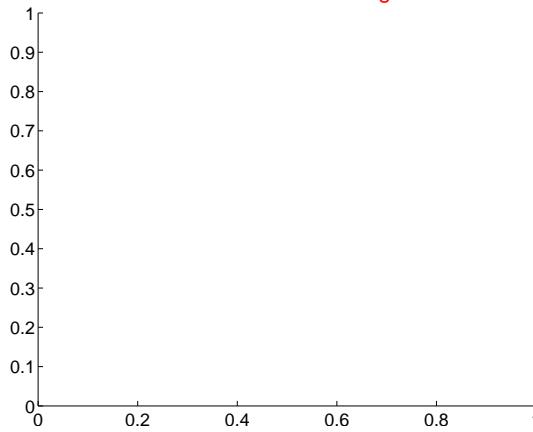
offset from photometric centroids



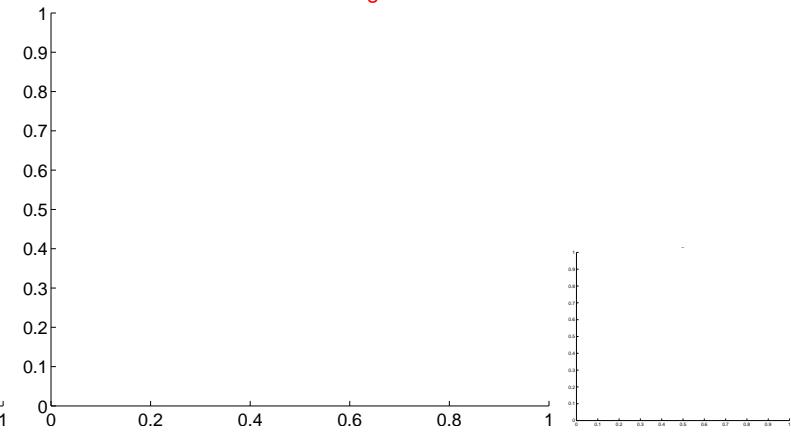
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

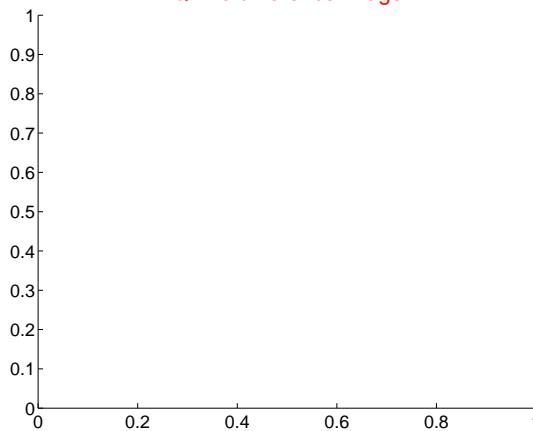
Q1 no difference image



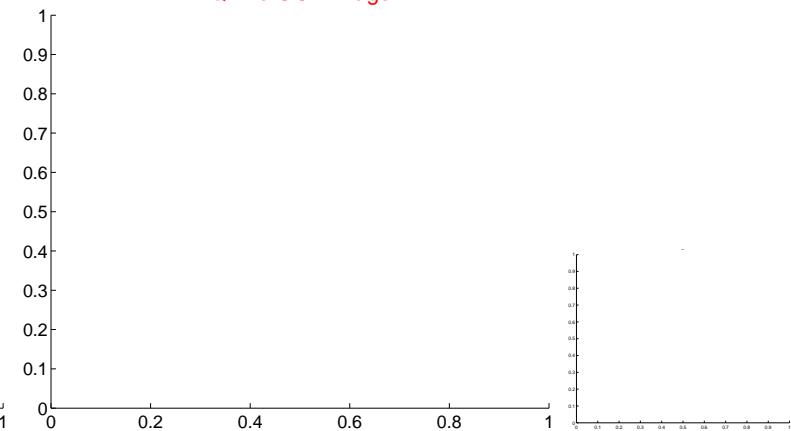
Q1 no OOT image



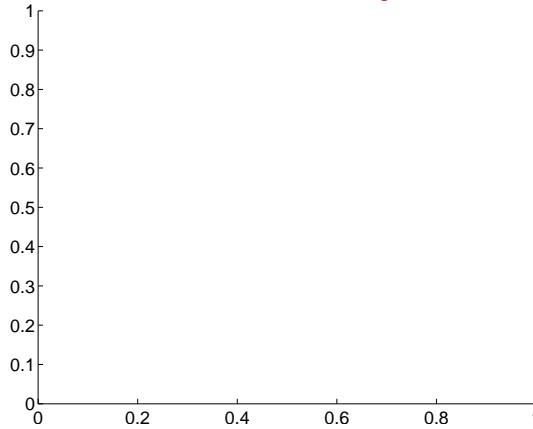
Q2 no difference image



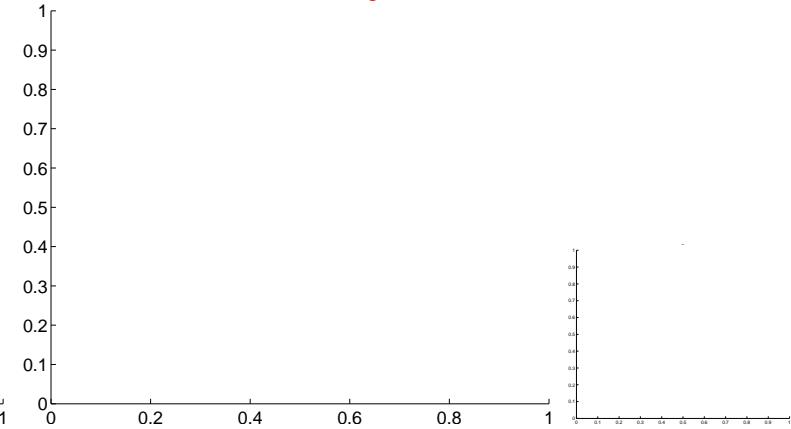
Q2 no OOT image



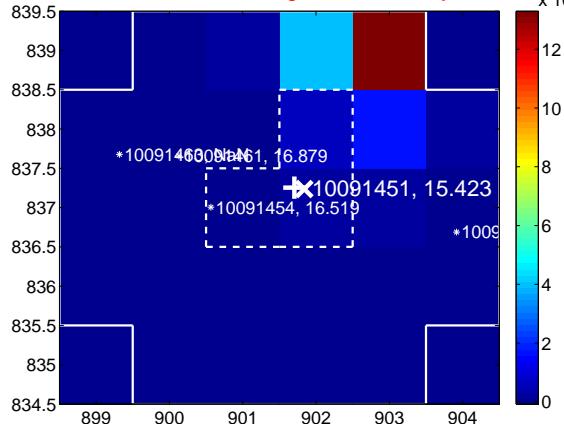
Q3 no difference image



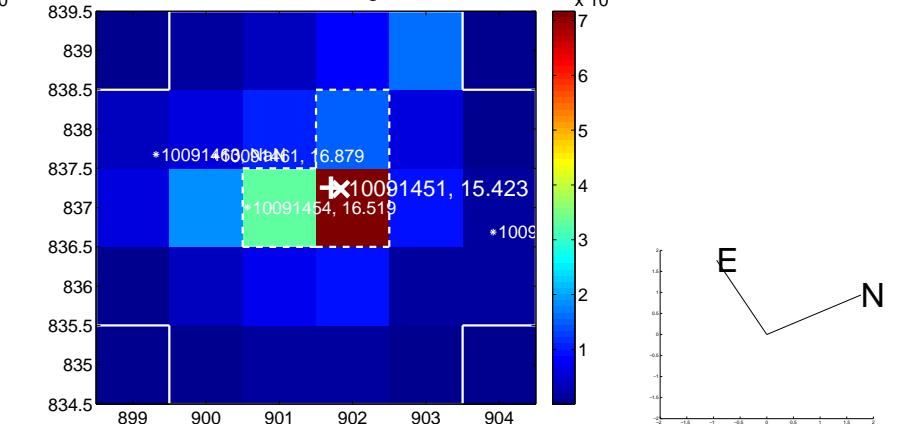
Q3 no OOT image



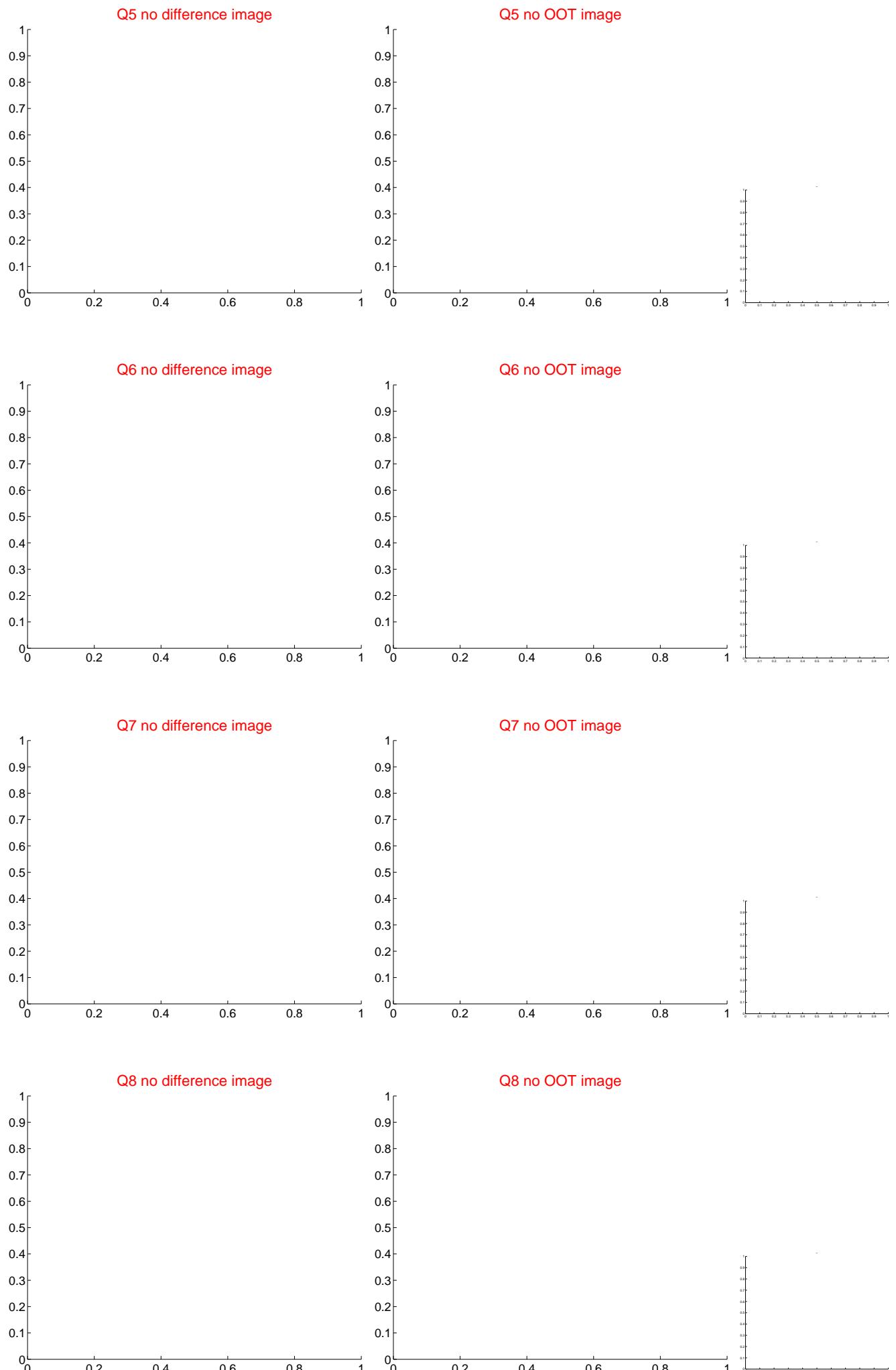
Q4 difference image. Poor Quality



Q4 OOT image

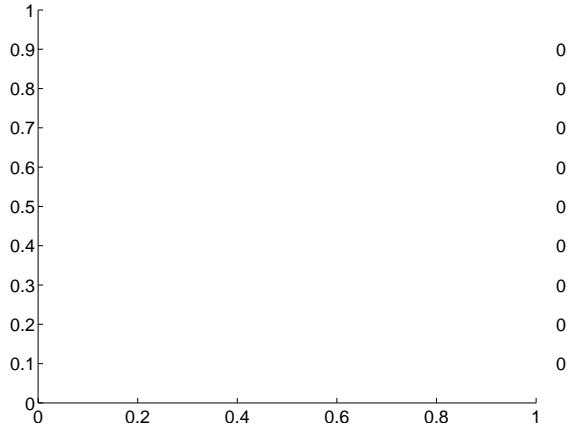


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

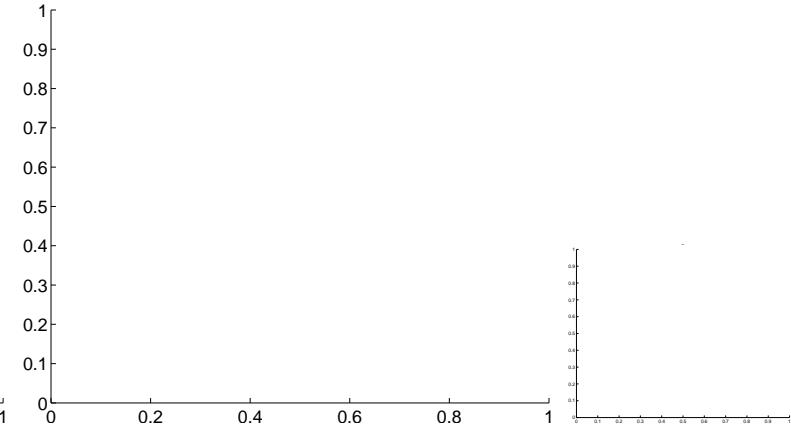


white  $\times$ : KIC target position; +: OOT centroid;  $\Delta$ : difference centroid. red  $\times$ : large negative pixel value.

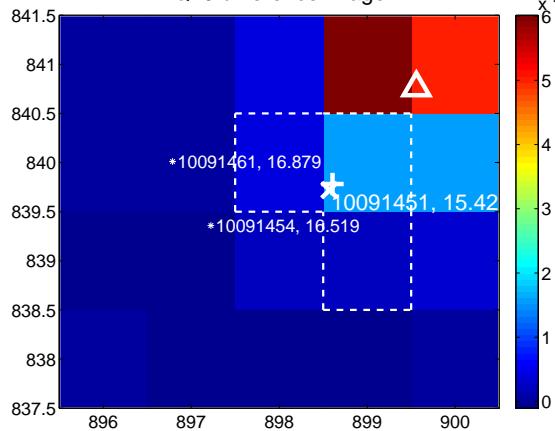
Q9 no difference image



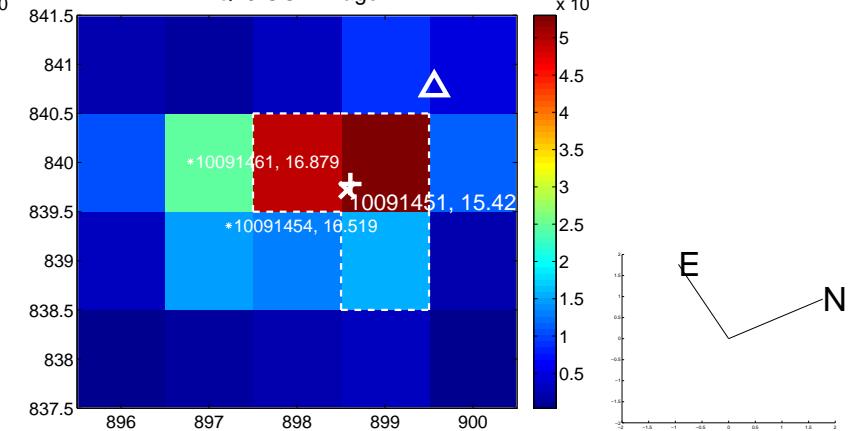
Q9 no OOT image



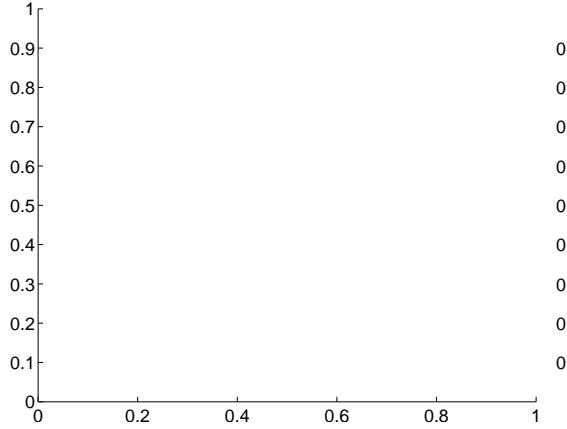
Q10 difference image



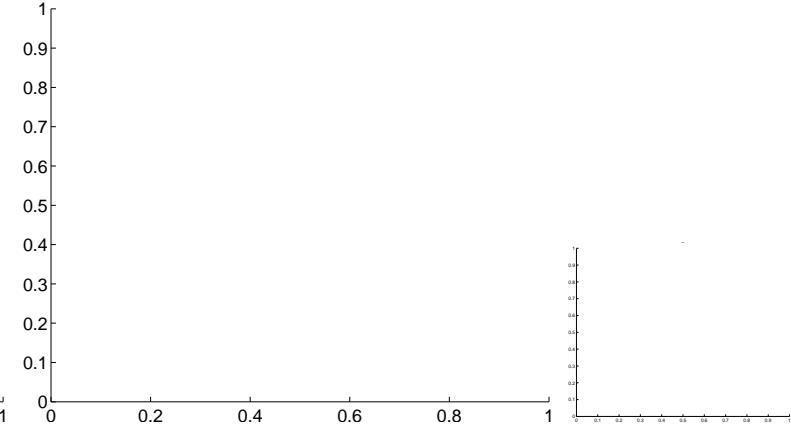
Q10 OOT image



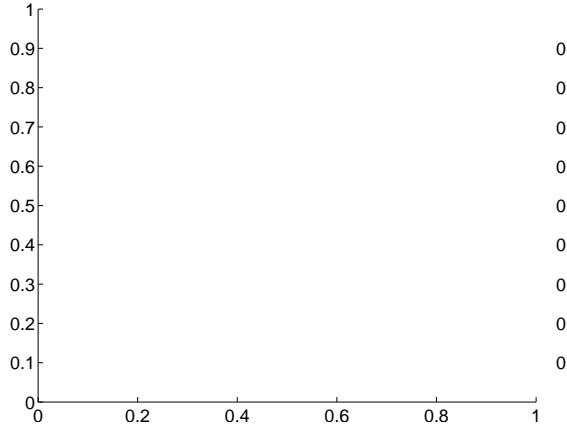
Q11 no difference image



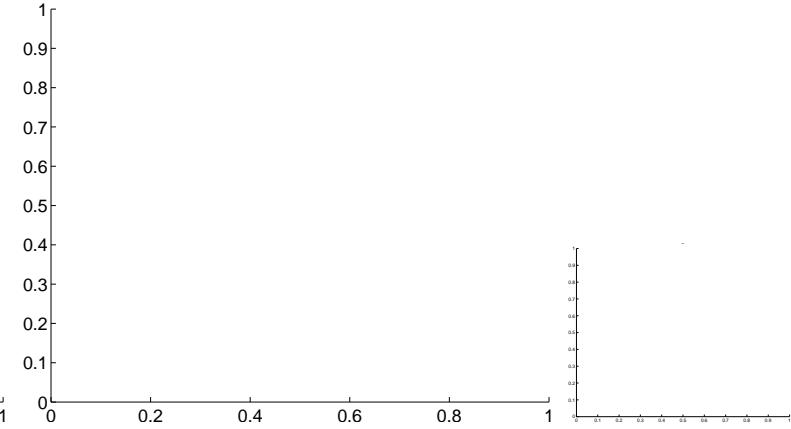
Q11 no OOT image



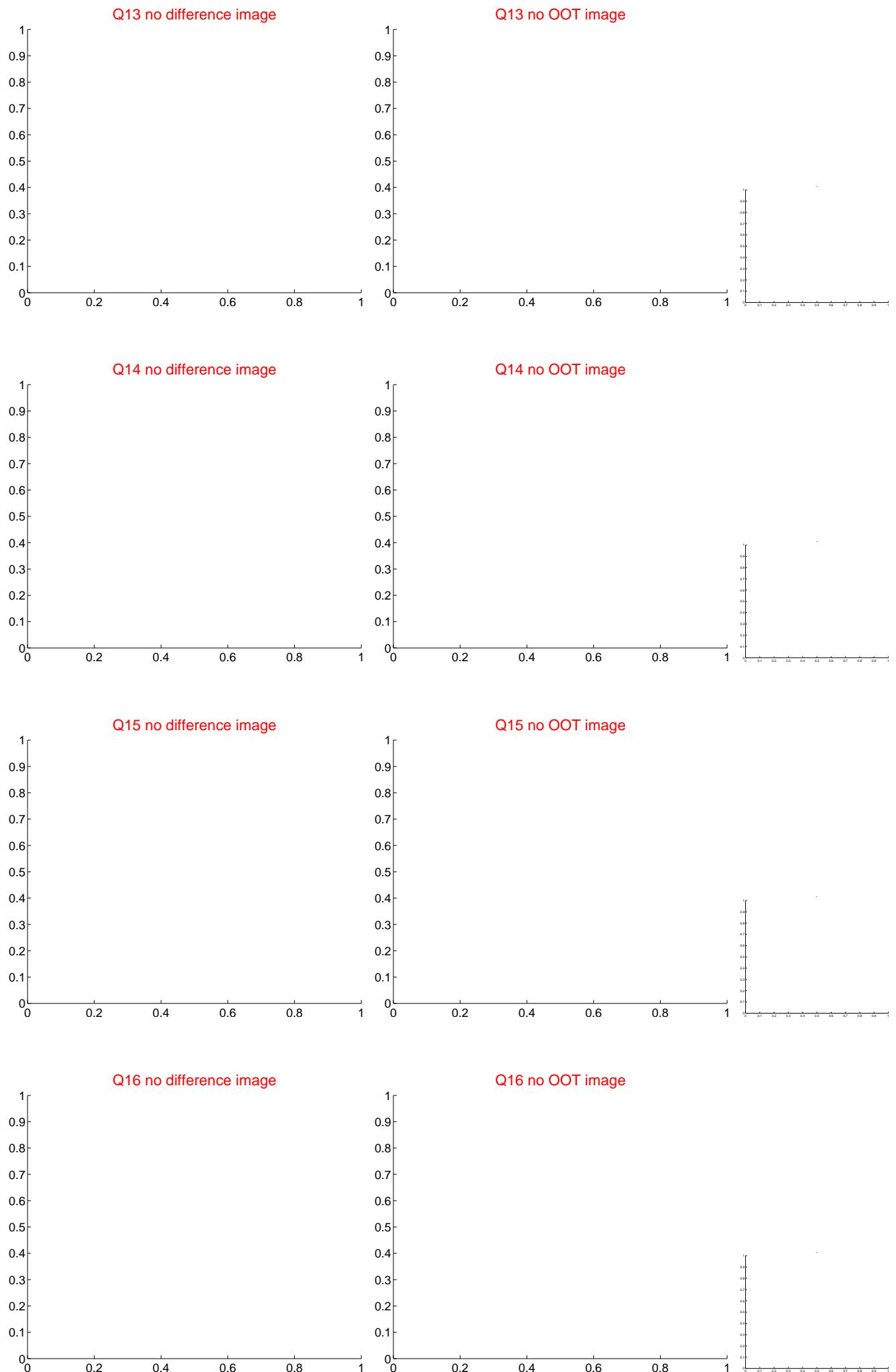
Q12 no difference image



Q12 no OOT image

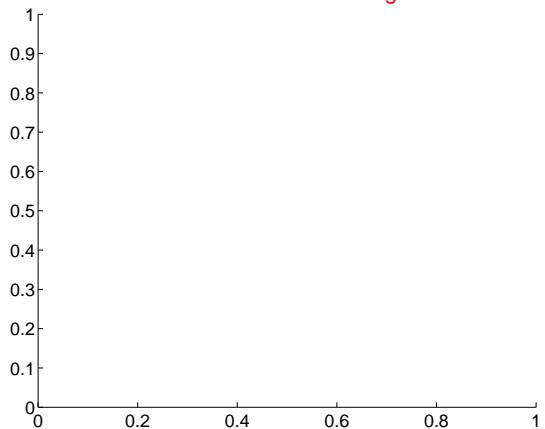


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

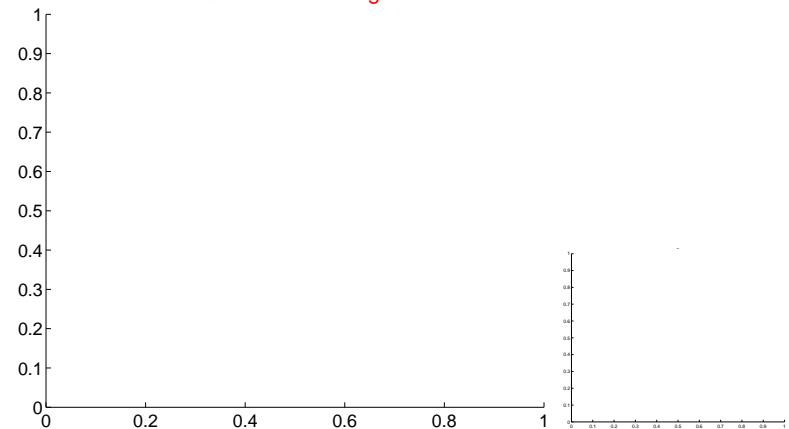


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

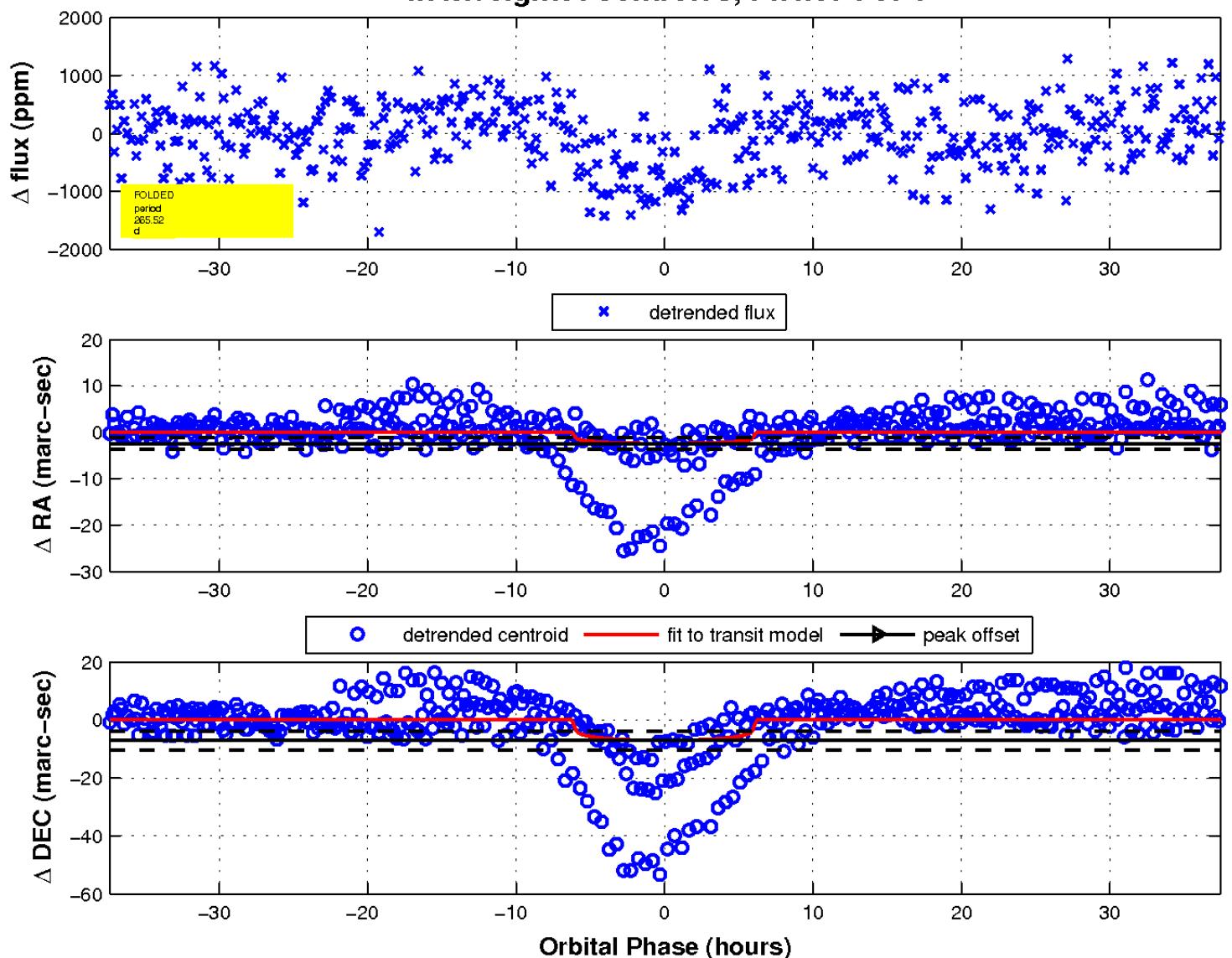
Q17 no difference image



Q17 no OOT image



### fluxWeightedCentroids, Planet 4 of 4



UKIRT Image

Declination

