

# KIC 009398382

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009398382-01	OBS	No	3.722935	134.371425	110.5	18.921	9.1	8.1	0.85	5534	0.88	281.71
009398382-02	OBS	No	383.968644	206.033420	1679.8	24.208	19.5	9.9	0.85	5534	6.48	0.58
009398382-03	OBS	No	295.081040	284.537925	944.7	15.000	9.8	-1.0	0.85	5534	2.56	0.83
009398382-04	OBS	No	3.722660	132.460227	119.8	13.753	9.2	11.3	0.85	5534	1.07	281.74

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009398382-01	OBS	FP	0.00	1	0	0	0	LPP_DV
009398382-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009398382-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—NO_FITS—INCONSISTENT_TRANS—CENT_NOFITS
009398382-04	OBS	FP	0.00	1	0	0	0	LPP_ALT—SAME_NTL_PERIOD

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

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

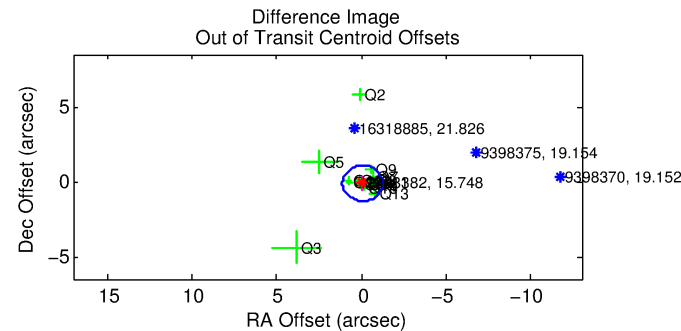
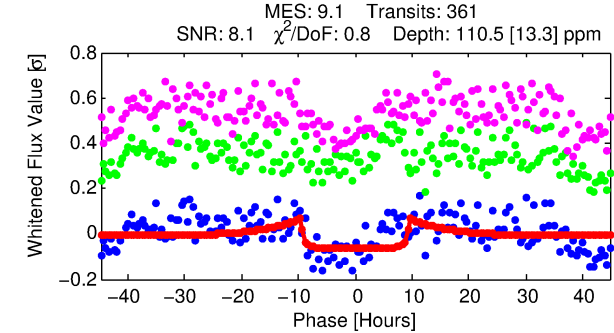
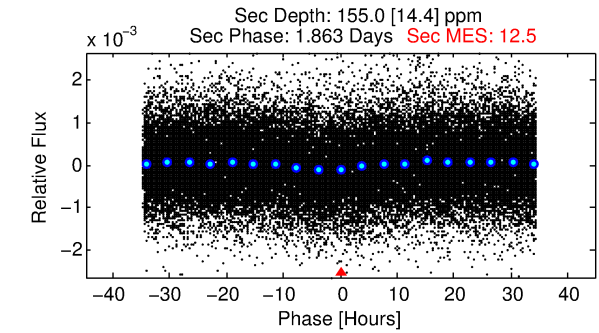
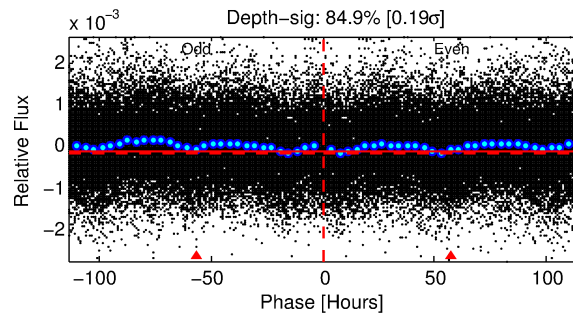
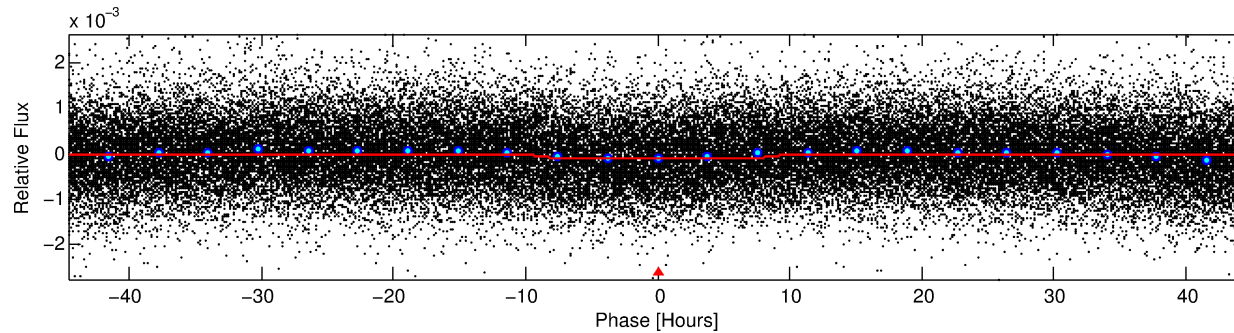
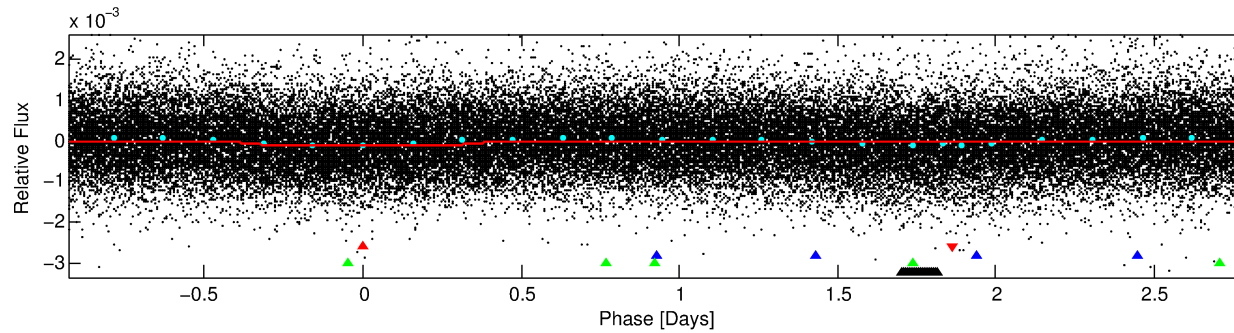
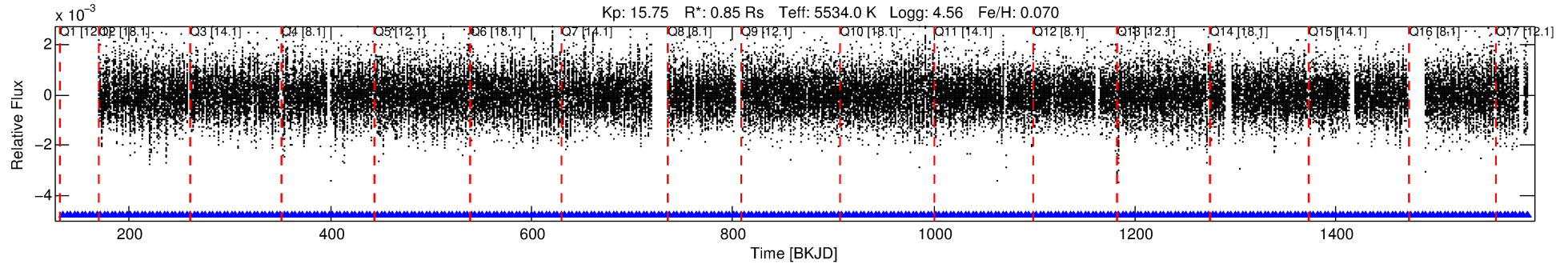
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 009398382-01

No Significant Match Found

# DV One-Page Summary

KIC: 9398382 Candidate: 1 of 4 Period: 3.723 d



## DV Fit Results:

Period = 3.72294 [0.00006] d  
Epoch = 134.3714 [0.0109] BKJD  
Rp/R\* = 0.0095 [0.0083]  
a/R\* = 1.63 [3.62]  
b = 0.10 [36.71]  
Seff = 281.71 [96.72]  
Teq = 1045 [90] K  
Rp = 0.88 [0.80] Re  
a = 0.0464 [0.0100] AU  
Ag = 238.41 [426.84] [0.56 $\sigma$ ]  
Teffp = 6347 [2801] K [1.89 $\sigma$ ]

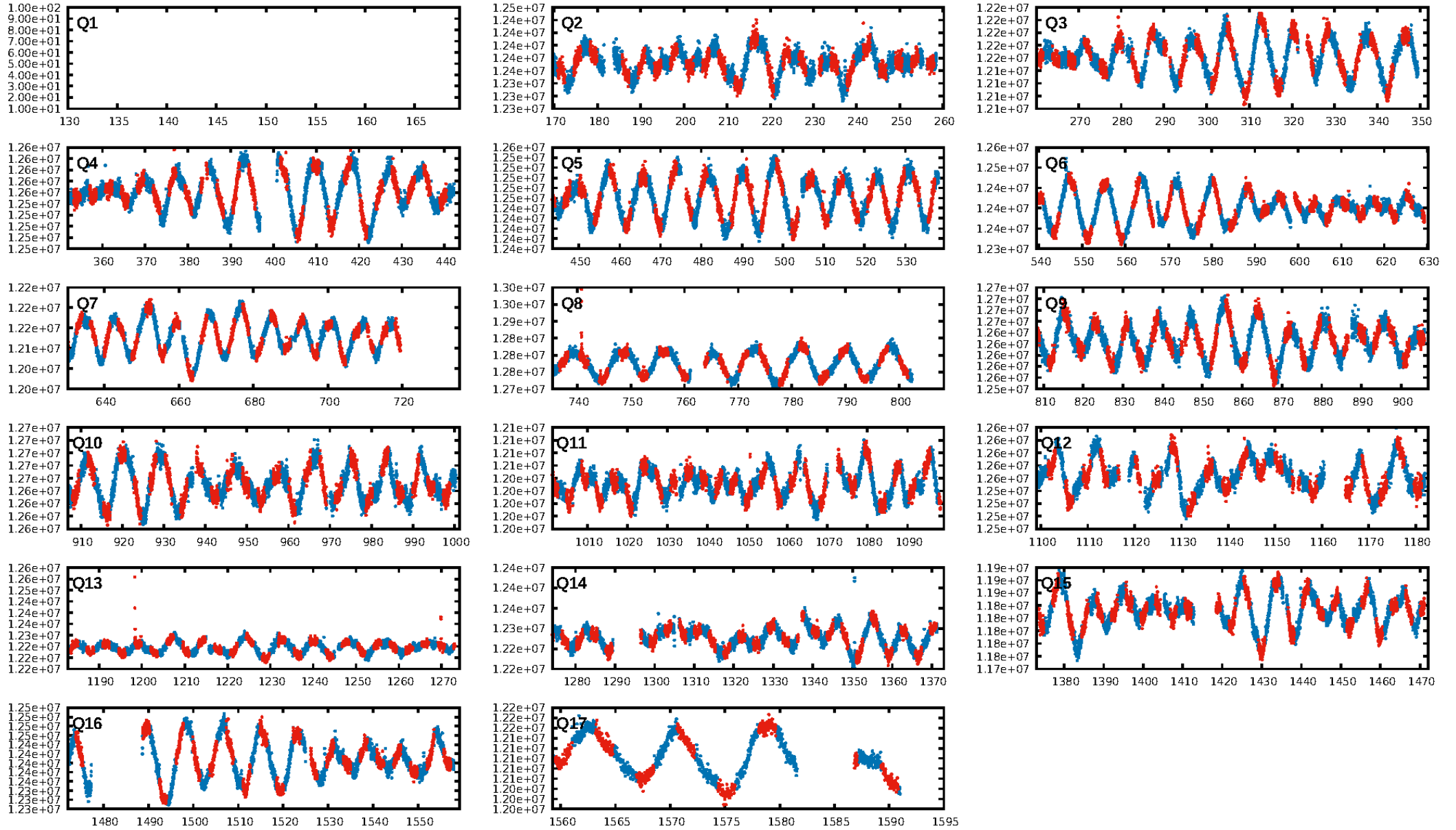
## DV Diagnostic Results:

**ShortPeriod-sig: 0.0% [0.00 $\sigma$ ]**  
LongPeriod-sig: 100.0% [289.60 $\sigma$ ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [354/354]  
**GhostDiagnostic-chr: 0.5376**  
Centroid-sig: 1.0%  
Centroid-so: 1.293 arcsec [1.98 $\sigma$ ]  
OotOffset-rm: 0.122 arcsec [0.31 $\sigma$ ]  
KicOffset-rm: 0.218 arcsec [0.45 $\sigma$ ]  
OotOffset-st: 4/4/4/4 [16]  
KicOffset-st: 4/4/4/4 [16]  
DiffImageQuality-fgm: 0.88 [14/16]  
DiffImageOverlap-fno: 1.00 [16/16]

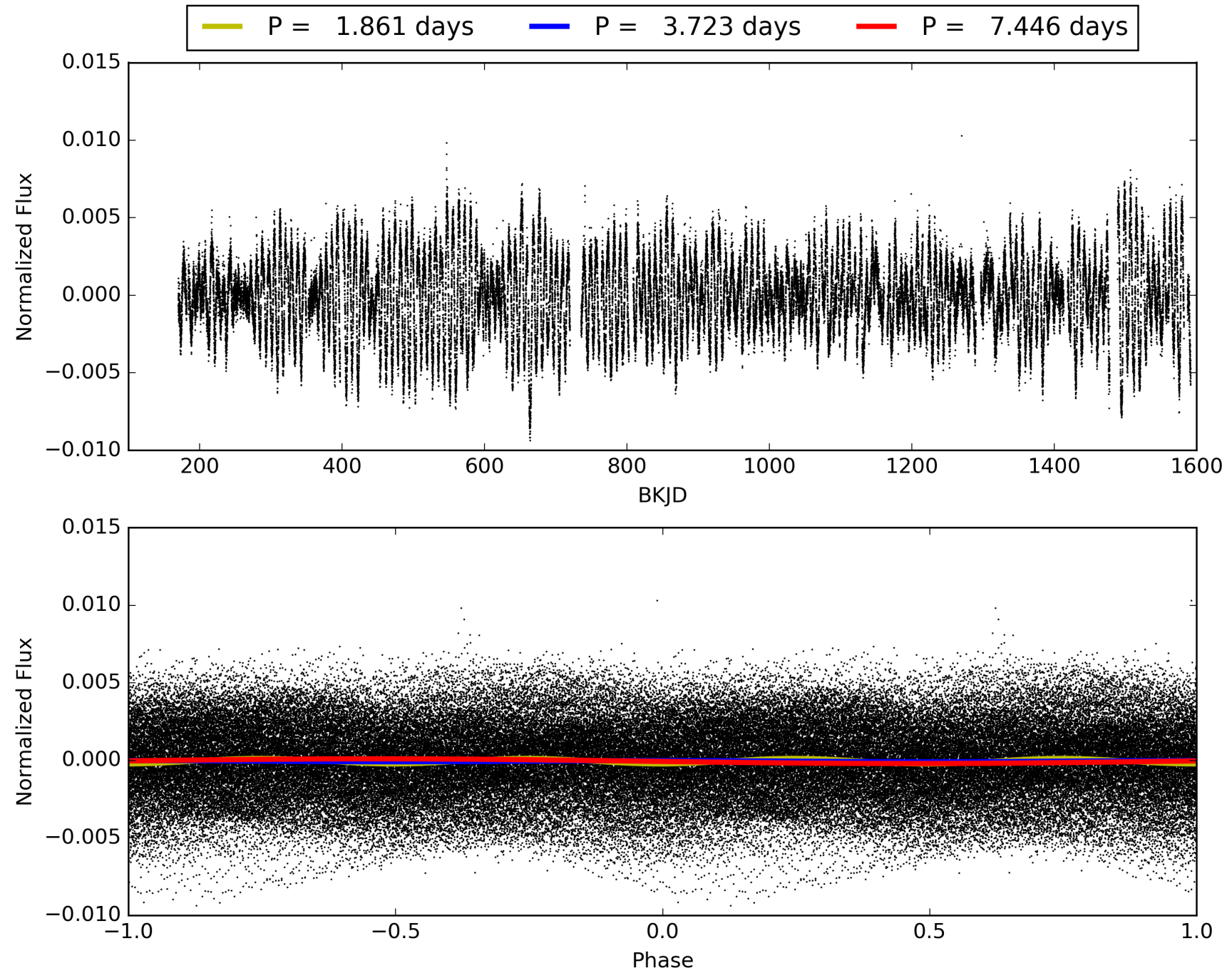
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This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 009398382-01, PDC Light Curves



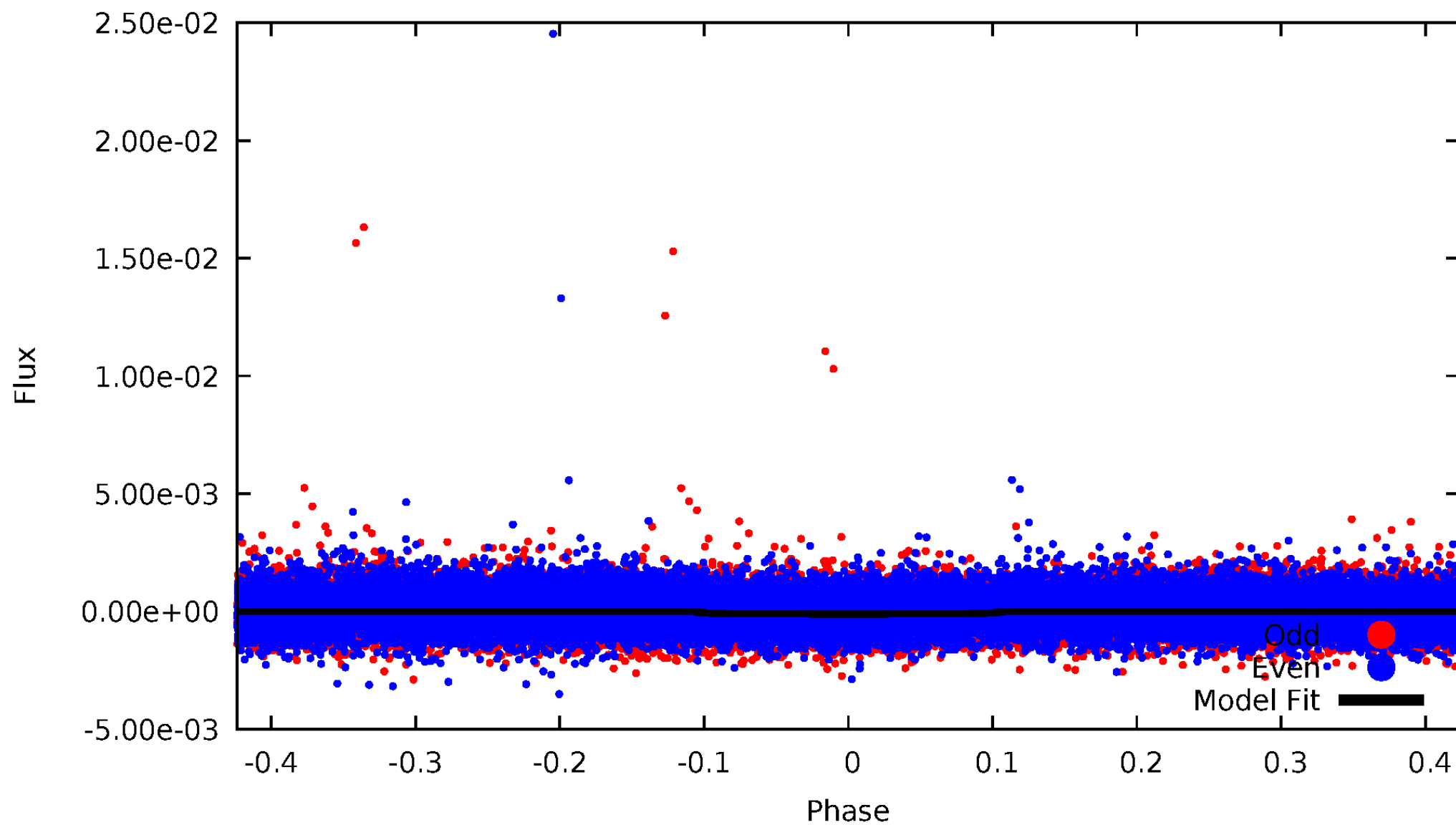
TCE 009398382-01





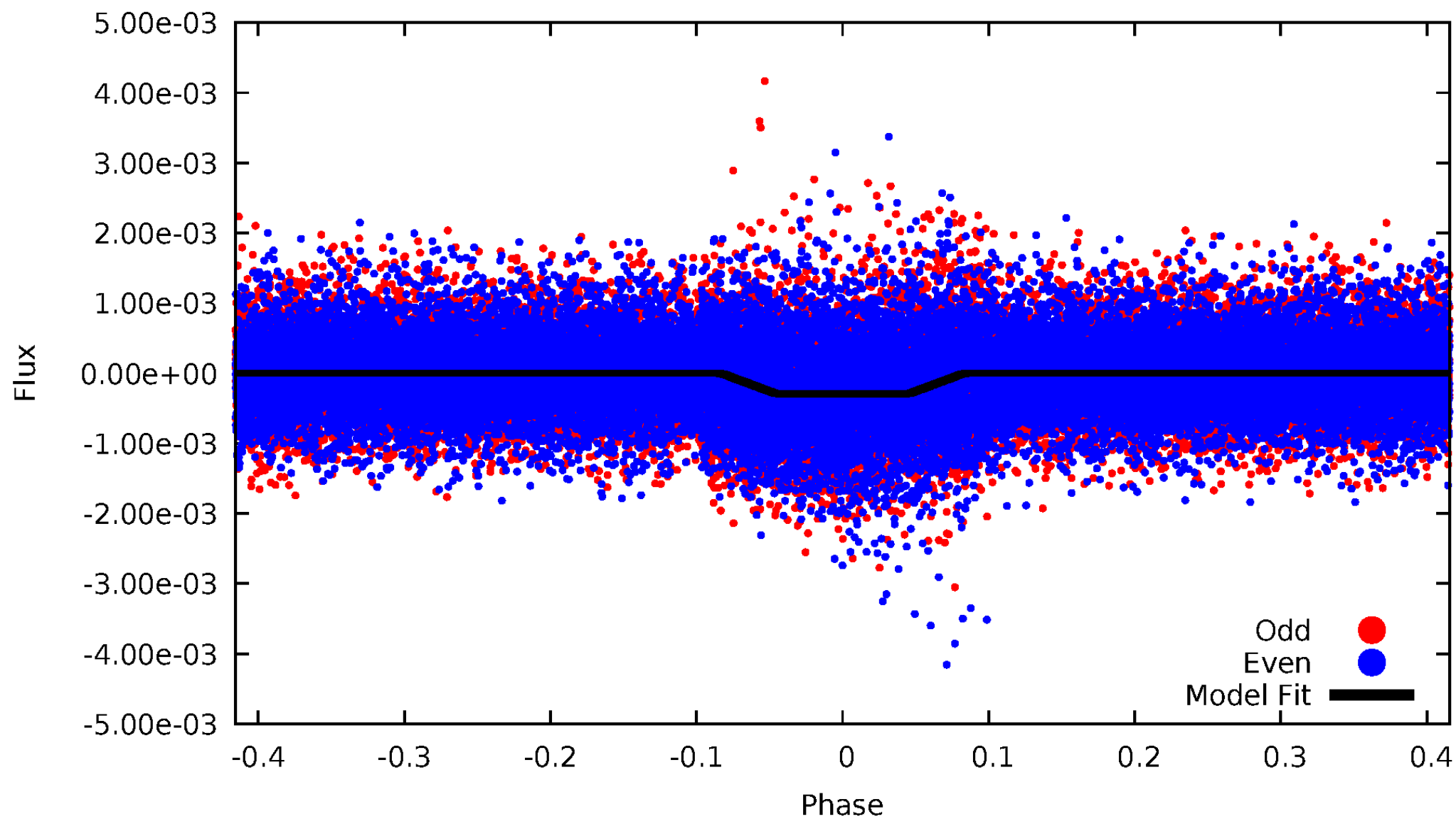
# DV Odd/Even

TCE 009398382-01



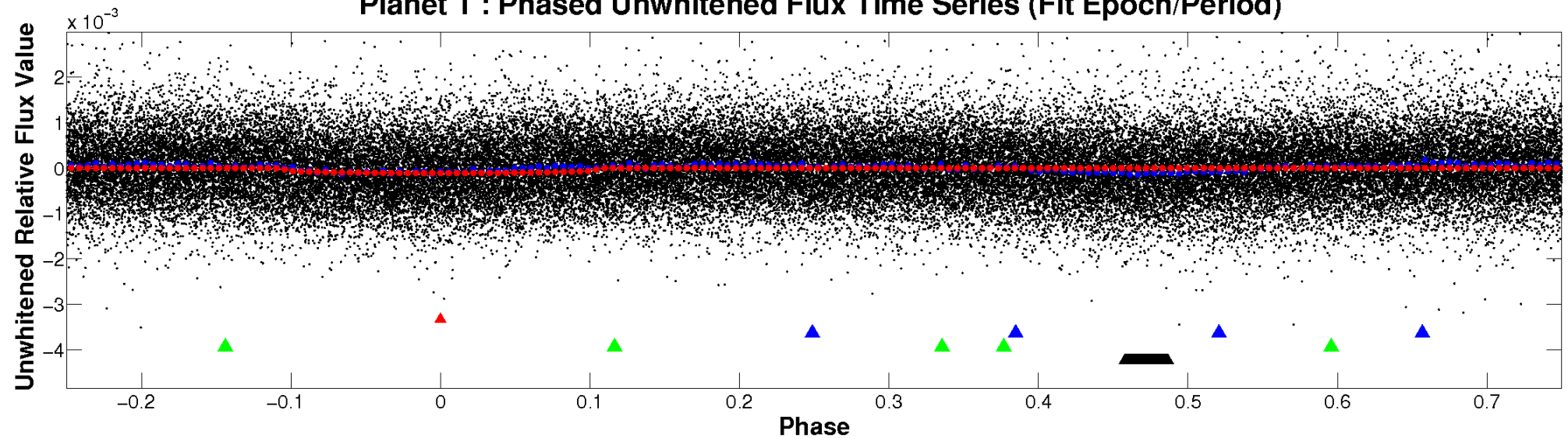
# ALT Odd/Even

TCE 009398382-01

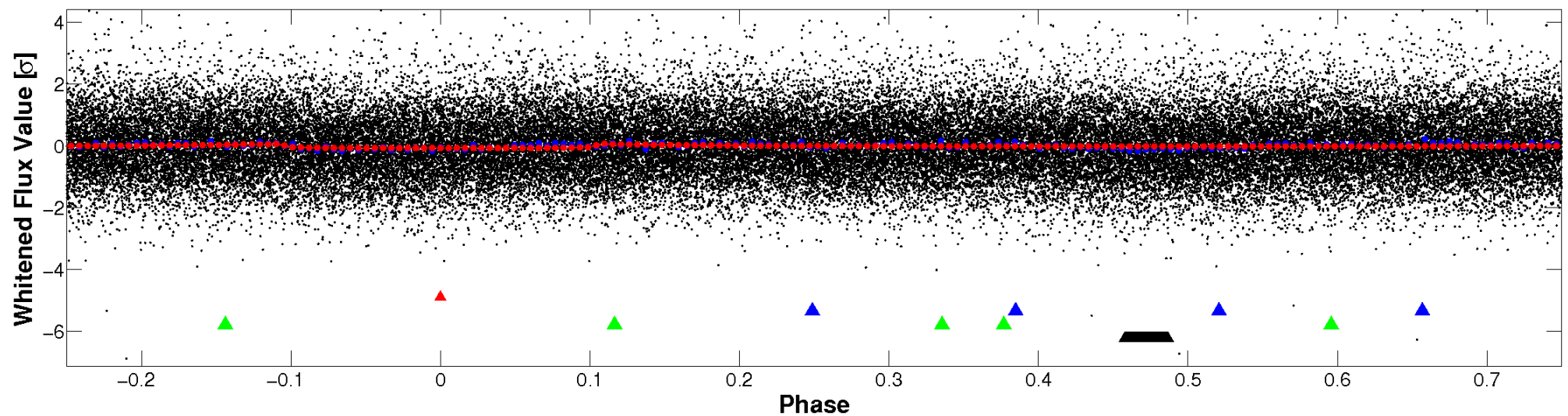


# Non-Whitened Vs. Whitened Light Curve

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

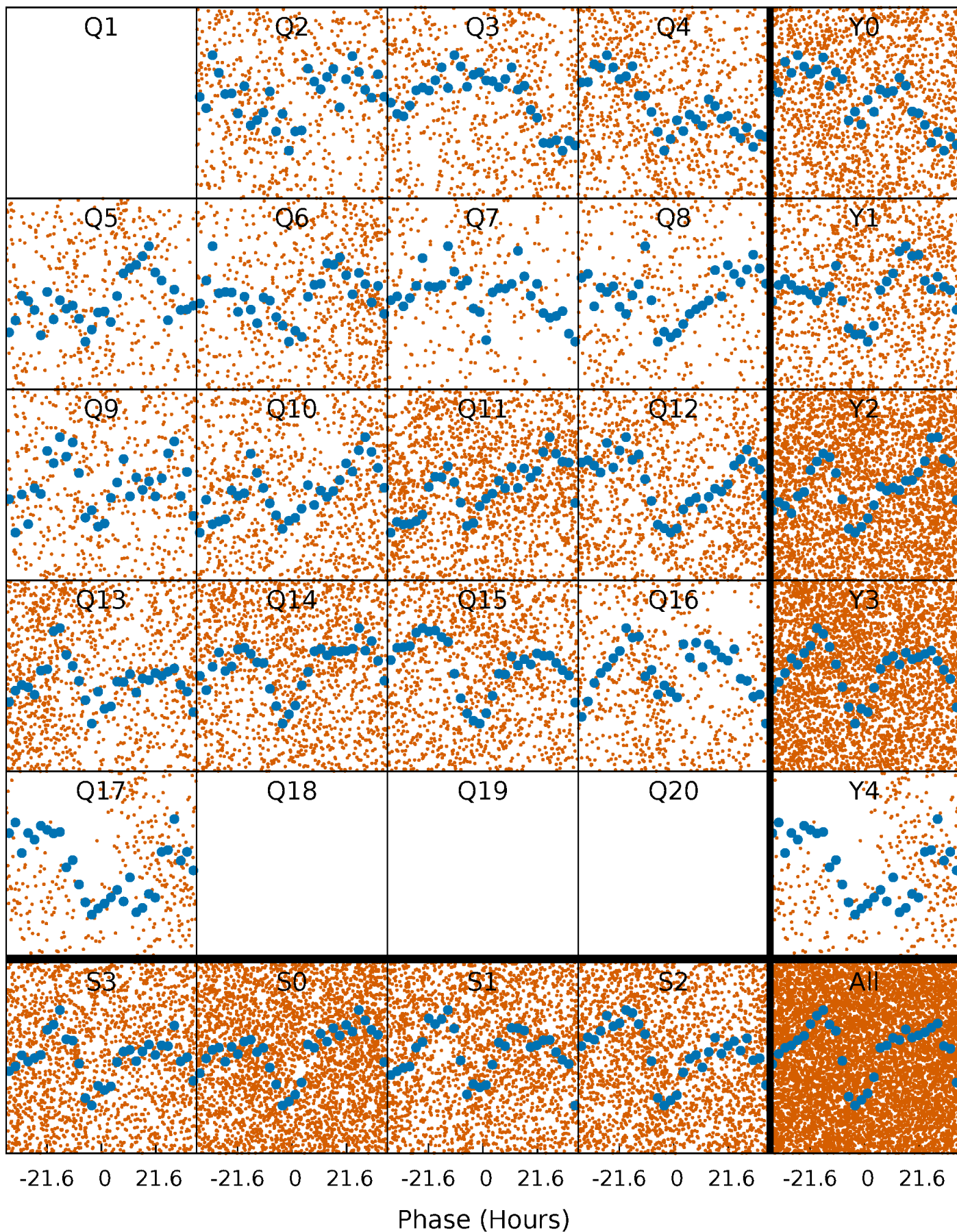


**Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



# PDC Quarter-Phased Transit Curves

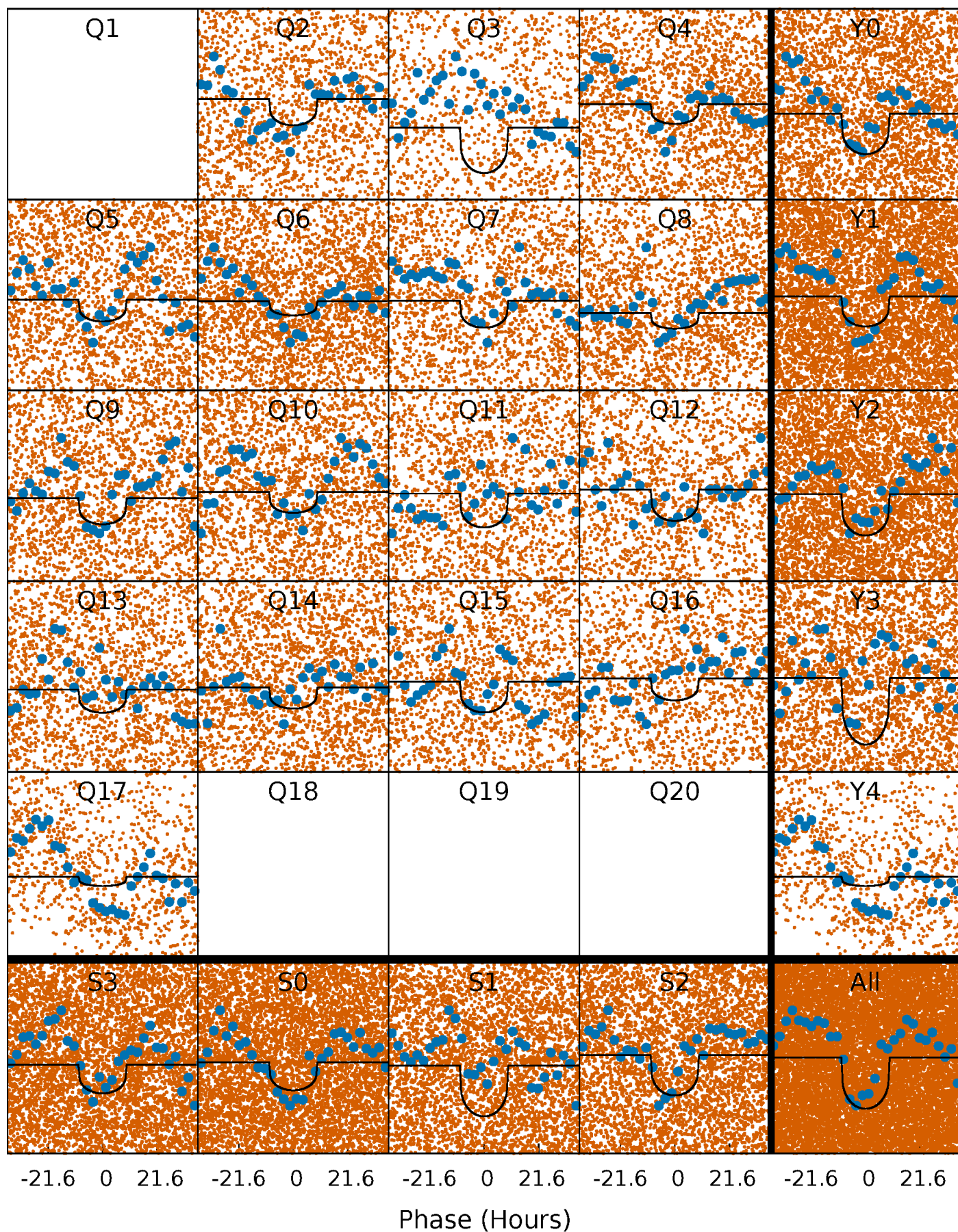
TCE 009398382-01 P= 3.722935 Days  $T_0=134.371425$  (BKJD)





# DV Quarter-Phased Transit Curves

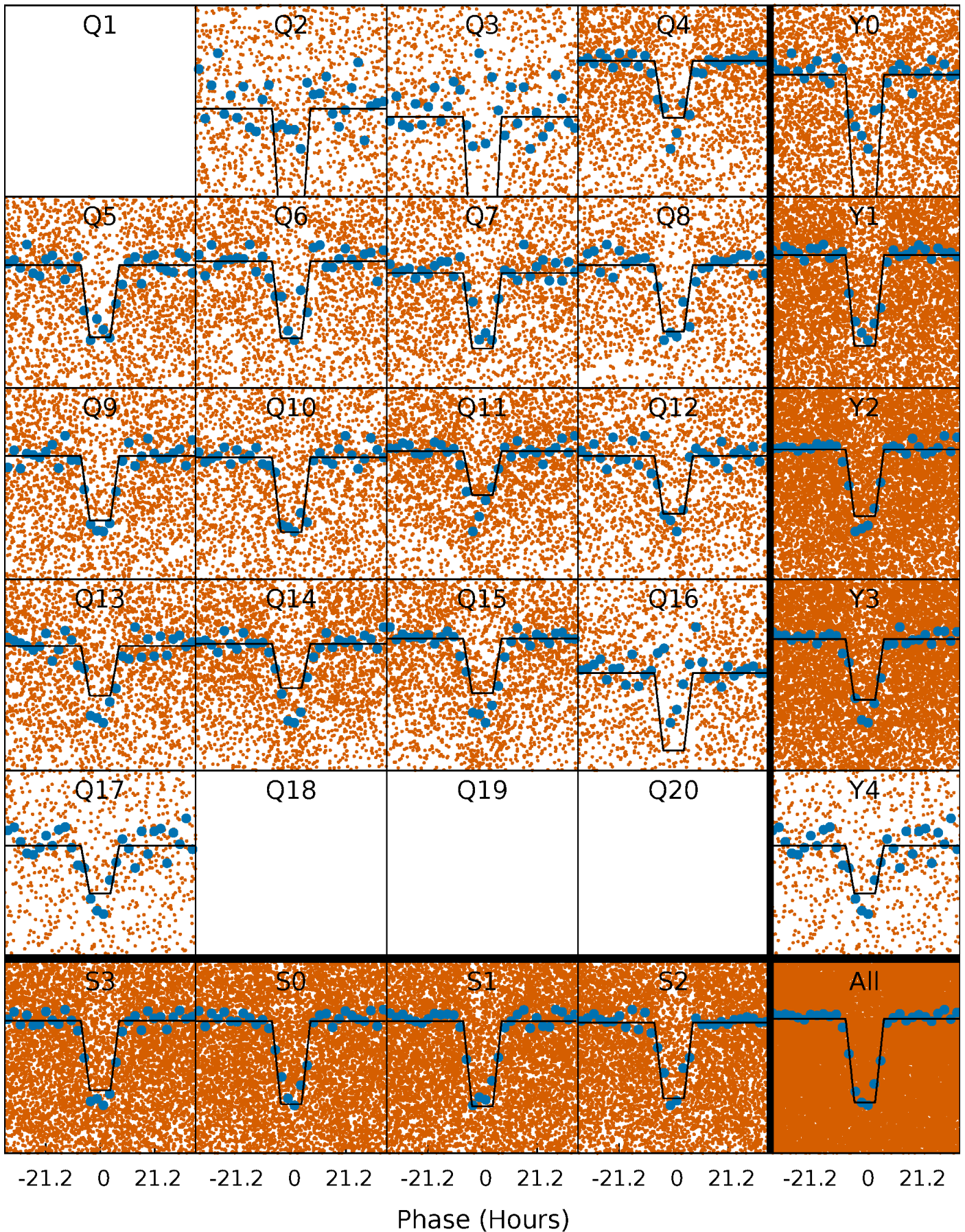
TCE 009398382-01 P= 3.722935 Days  $T_0=134.371425$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

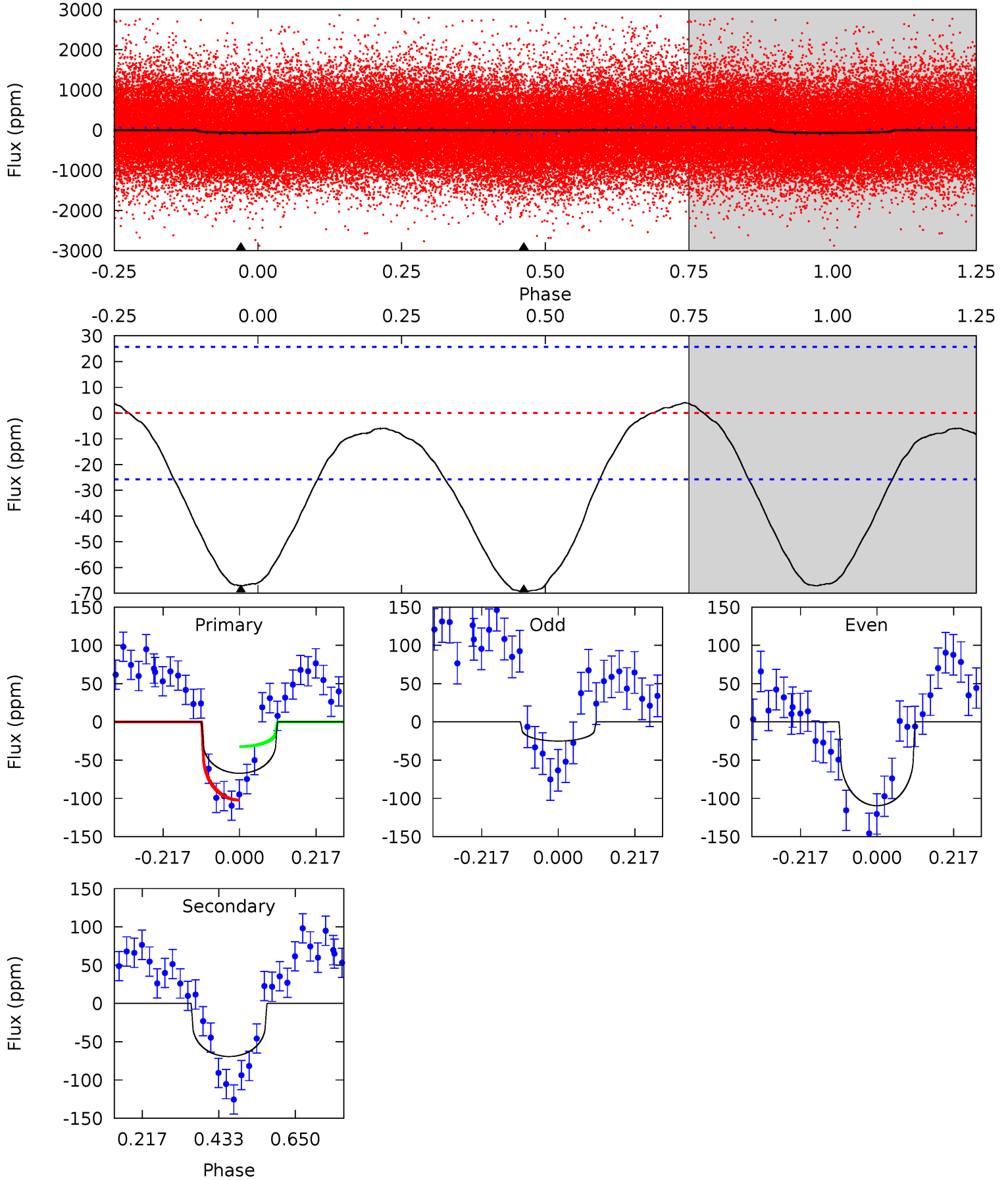
TCE 009398382-01 P= 3.722588 Days  $T_0=134.336791$  (BKJD)



# DV Model-Shift Uniqueness Test

009398382-01, P = 3.722935 Days, E = 134.371425 Days

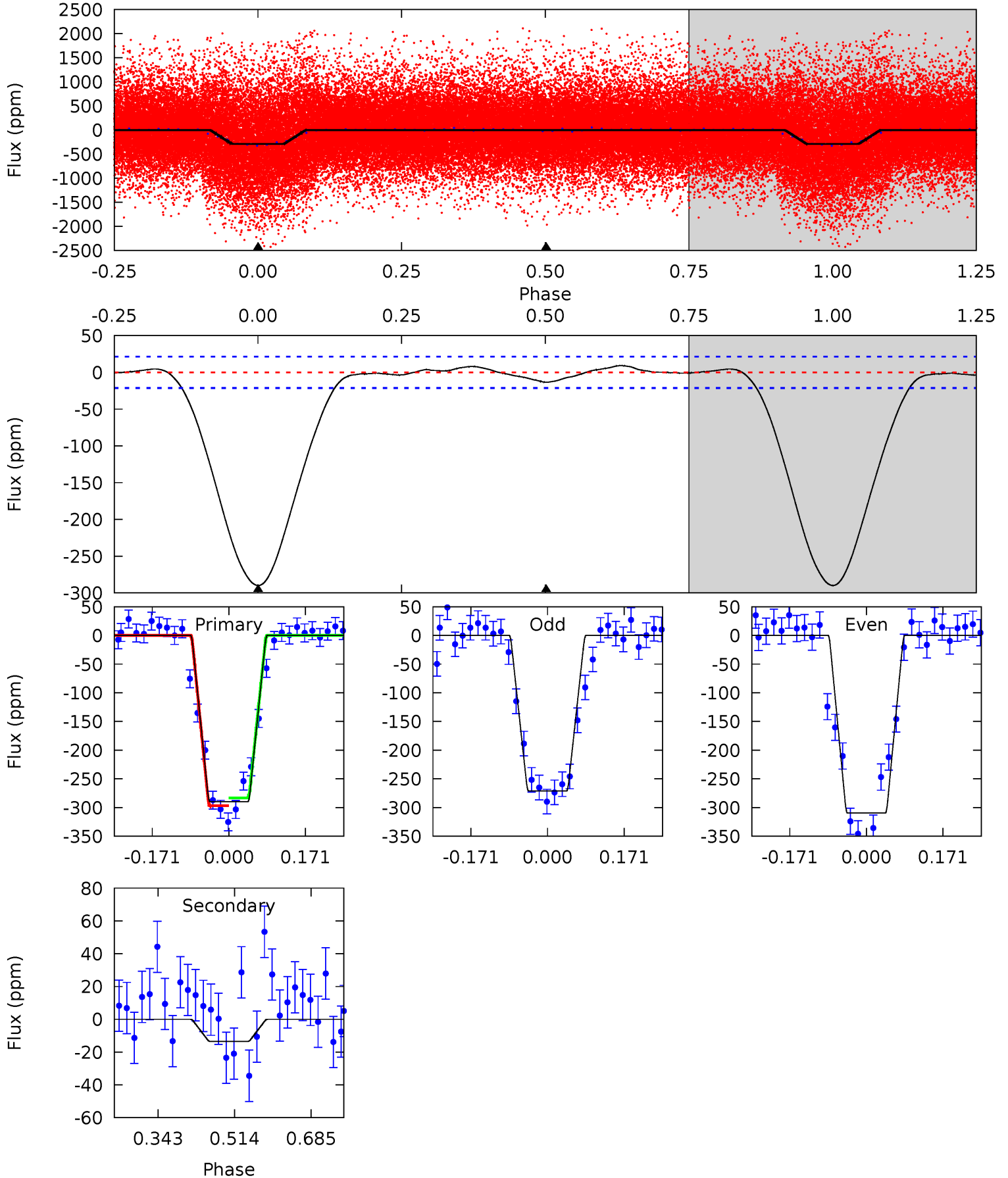
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
11.5	11.9	0	0	4.40	1.24	0.78	11.5	11.5	11.9	11.9	7.25	0.77	0.05	5.98



# Alt Model-Shift Uniqueness Test

009398382-01, P = 3.722588 Days, E = 134.336791 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
60.5	2.81	0	0	4.45	1.37	0.46	60.5	60.5	2.81	2.81	4.01	0.95	0.03	1.41





### Stellar Parameters For KIC 009398382

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M$ ( $M_{\odot}$ )	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$5534^{+166}_{-166}$	$4.562^{+0.032}_{-0.179}$	$0.070^{+0.250}_{-0.300}$	$0.849^{+0.213}_{-0.071}$	$0.960^{+0.083}_{-0.111}$	$2.205^{+0.386}_{-1.048}$
	+3%/-3%	+1%/-4%	+357%/-429%	+25%/-8%	+9%/-12%	+17%/-48%
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 009398382-01 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	$-69 \pm 6$	$1.03^{+0.78}_{-0.65}$	$1499^{+83}_{-64}$	$4987^{+3523}_{-1008}$	$75^{+491}_{-52}$
Alt.	$-13 \pm 5$	$1.68^{+0.90}_{-0.78}$	$1496^{+87}_{-66}$	$3109^{+688}_{-426}$	$5.314^{+13.092}_{-3.265}$

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

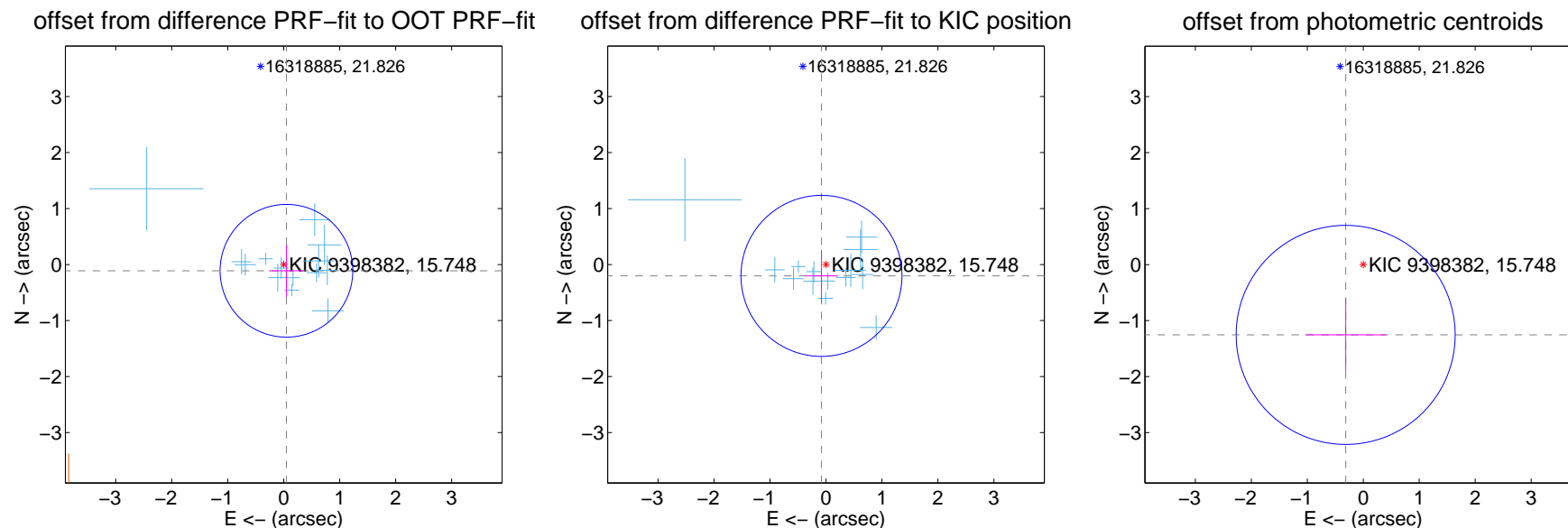
## DV Centroid Data

Supplemental centroid analysis for 009398382-01. Kepler magnitude: 15.75. Transit SNR 8.10

There are 14 quarters with good PRF difference image offsets

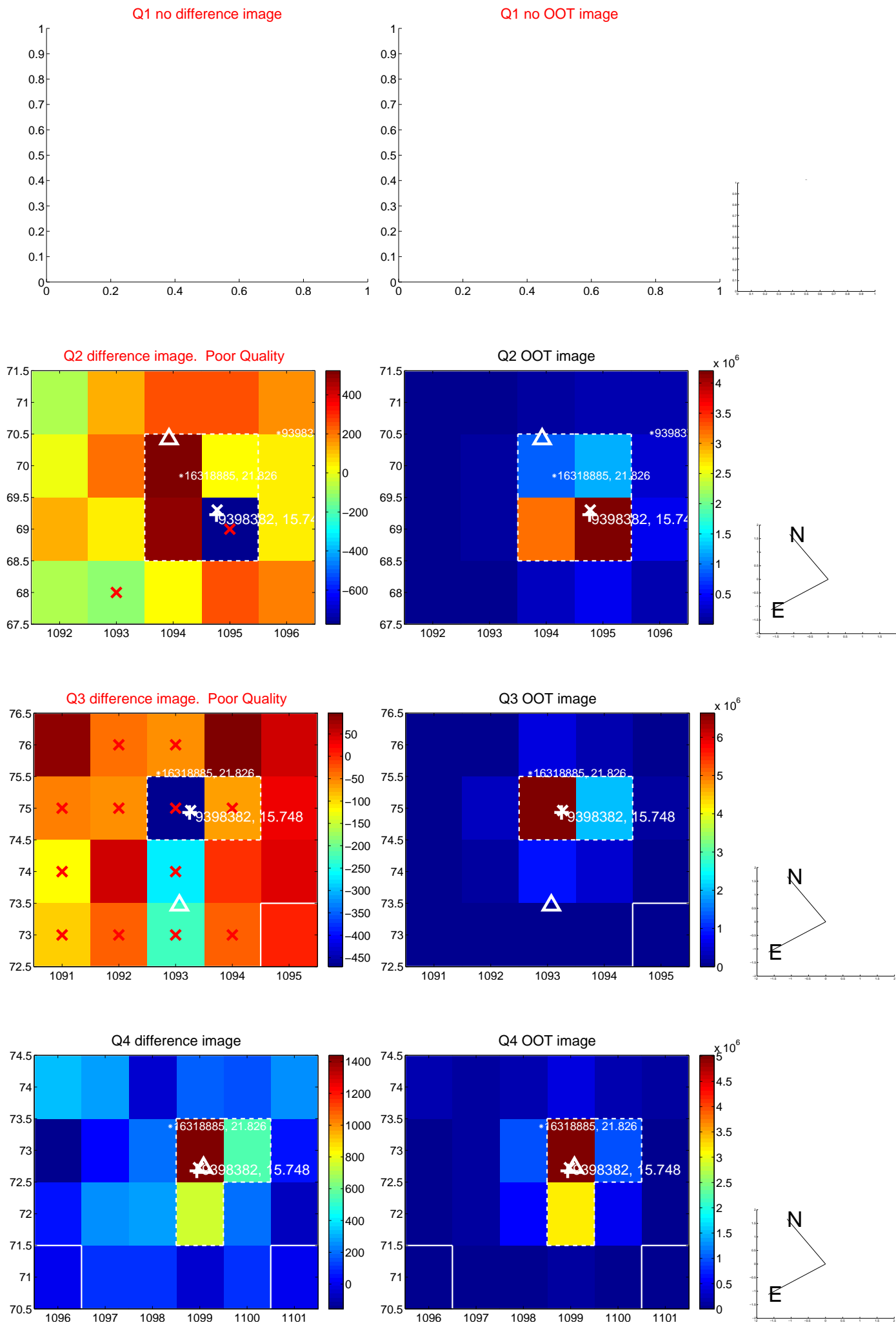
The direct PRF centroid is offset from the target star catalog position by about 0.27 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.122 \pm 0.395$	0.31	$-0.050 \pm 0.313$	$-0.111 \pm 0.465$
PRF-fit source offset from KIC position	$0.218 \pm 0.479$	0.45	$0.081 \pm 0.298$	$-0.202 \pm 0.467$
photometric centroid source offset	$1.29 \pm 0.65$	1.98	$0.31 \pm 0.72$	$-1.25 \pm 0.65$

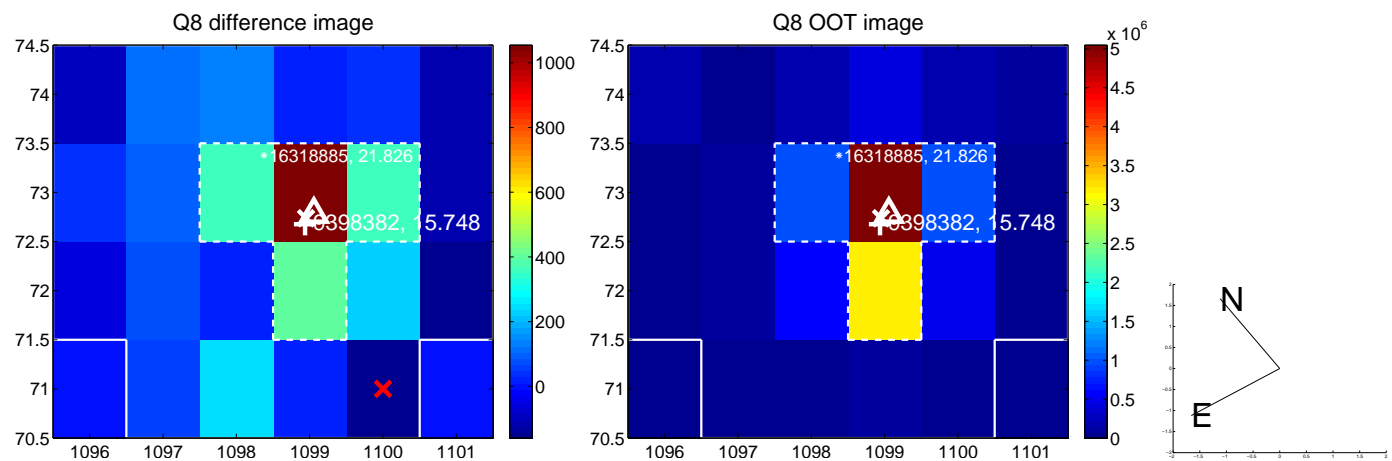
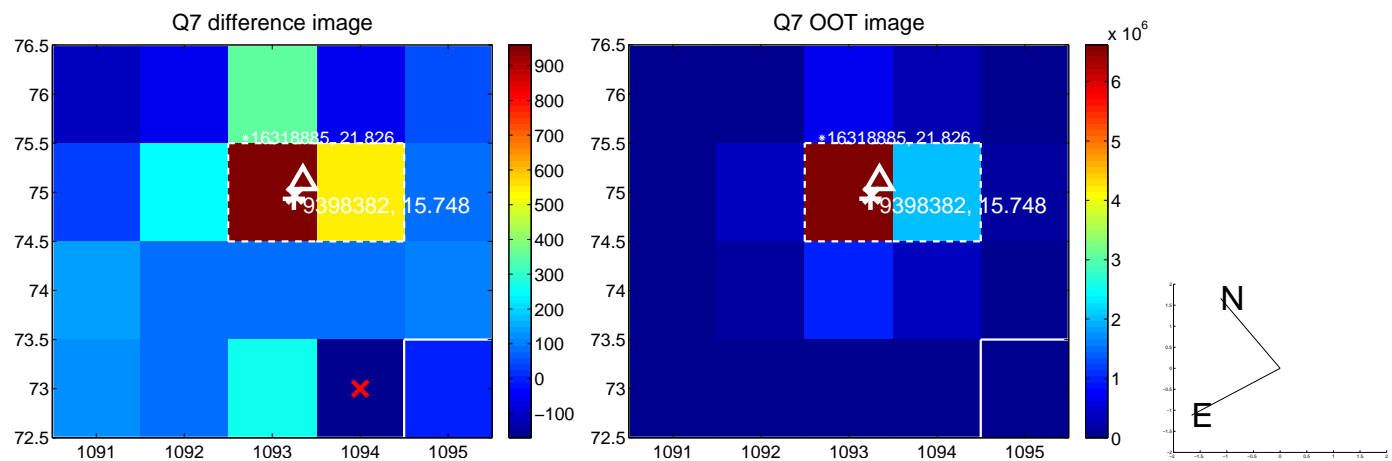
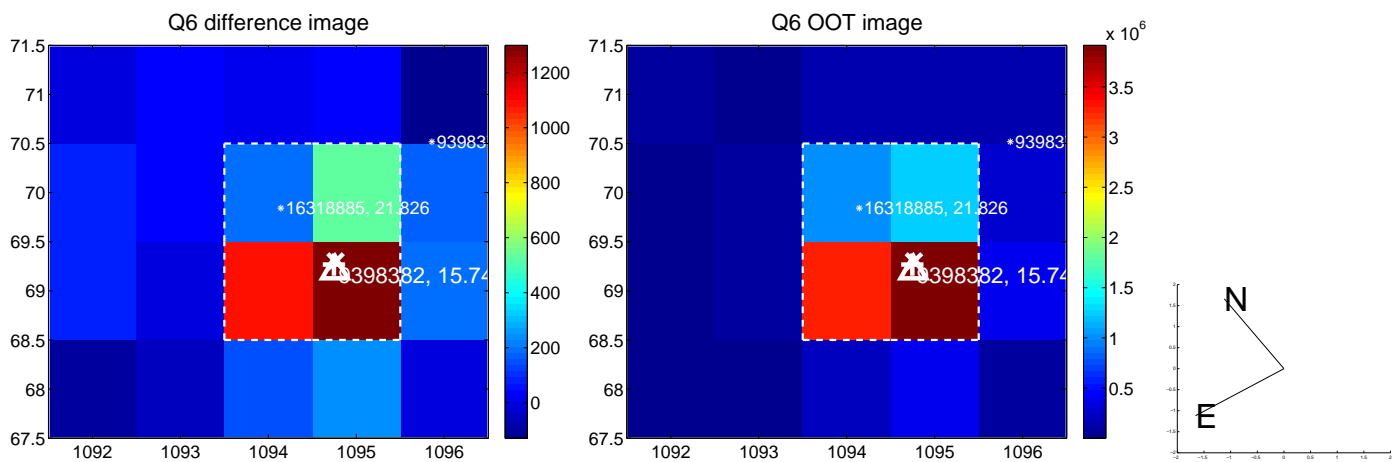
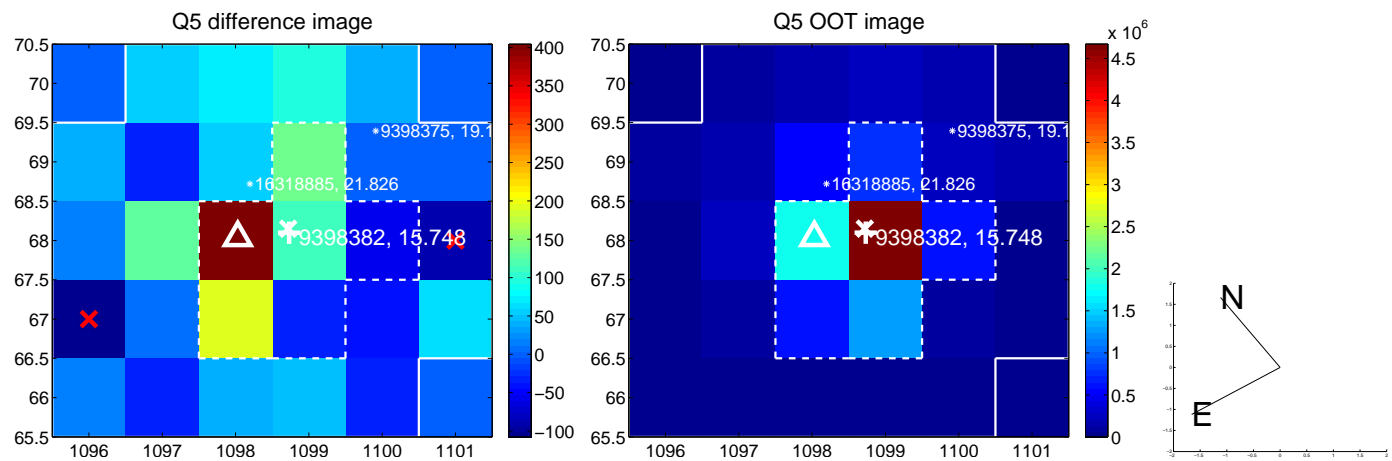


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

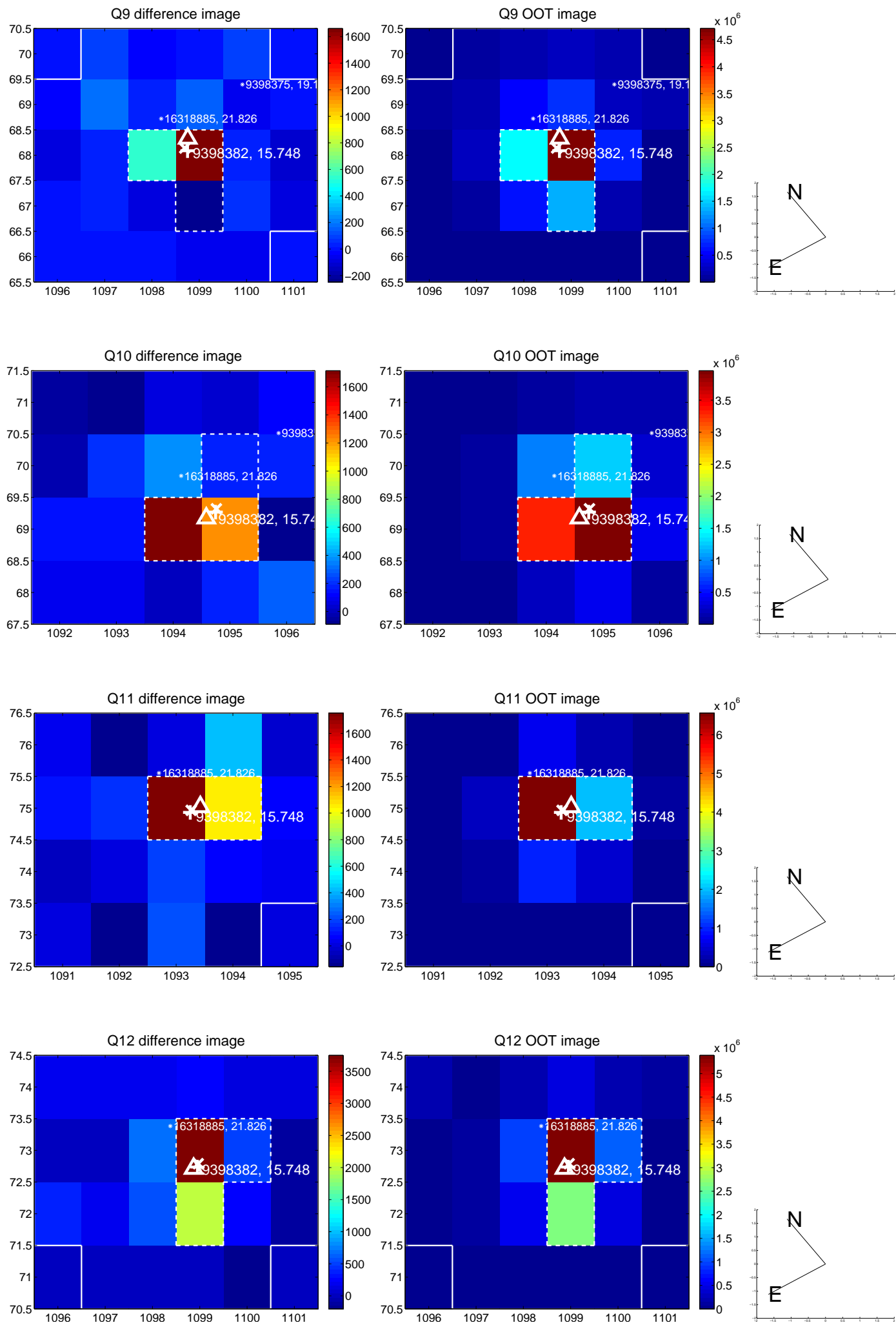


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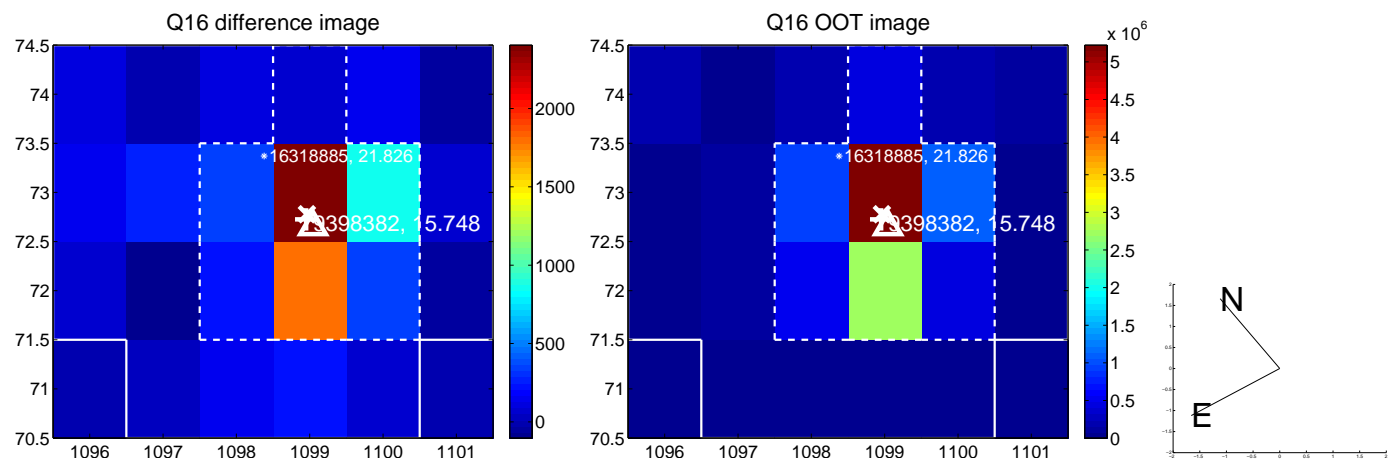
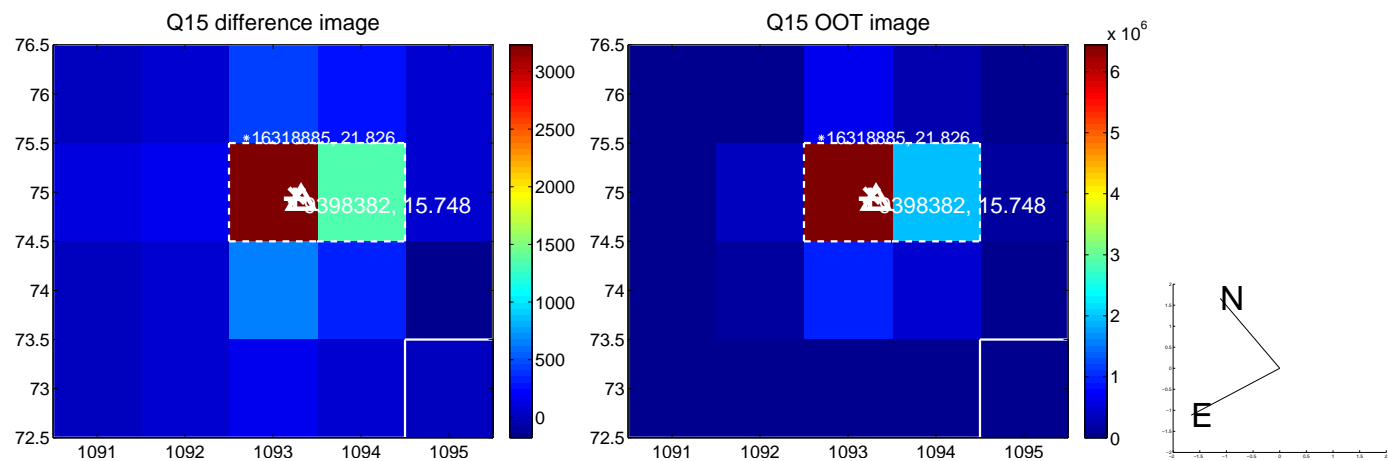
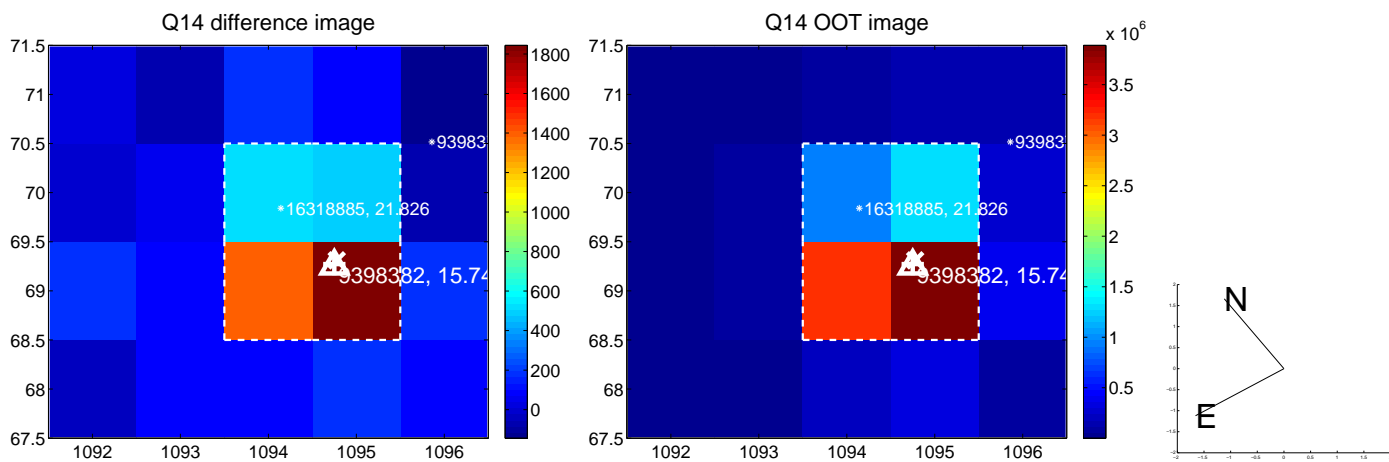
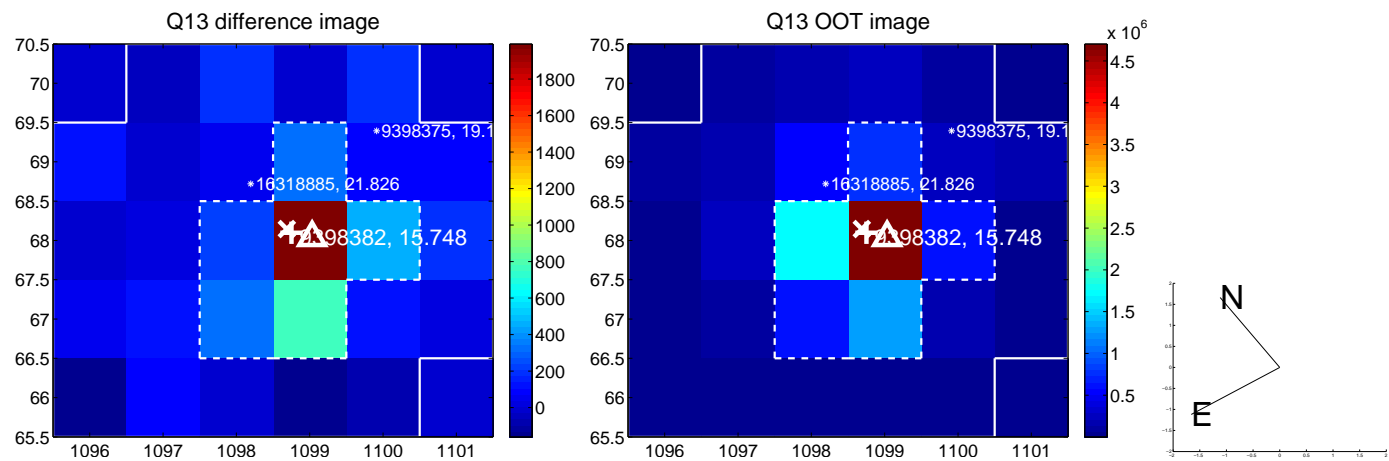




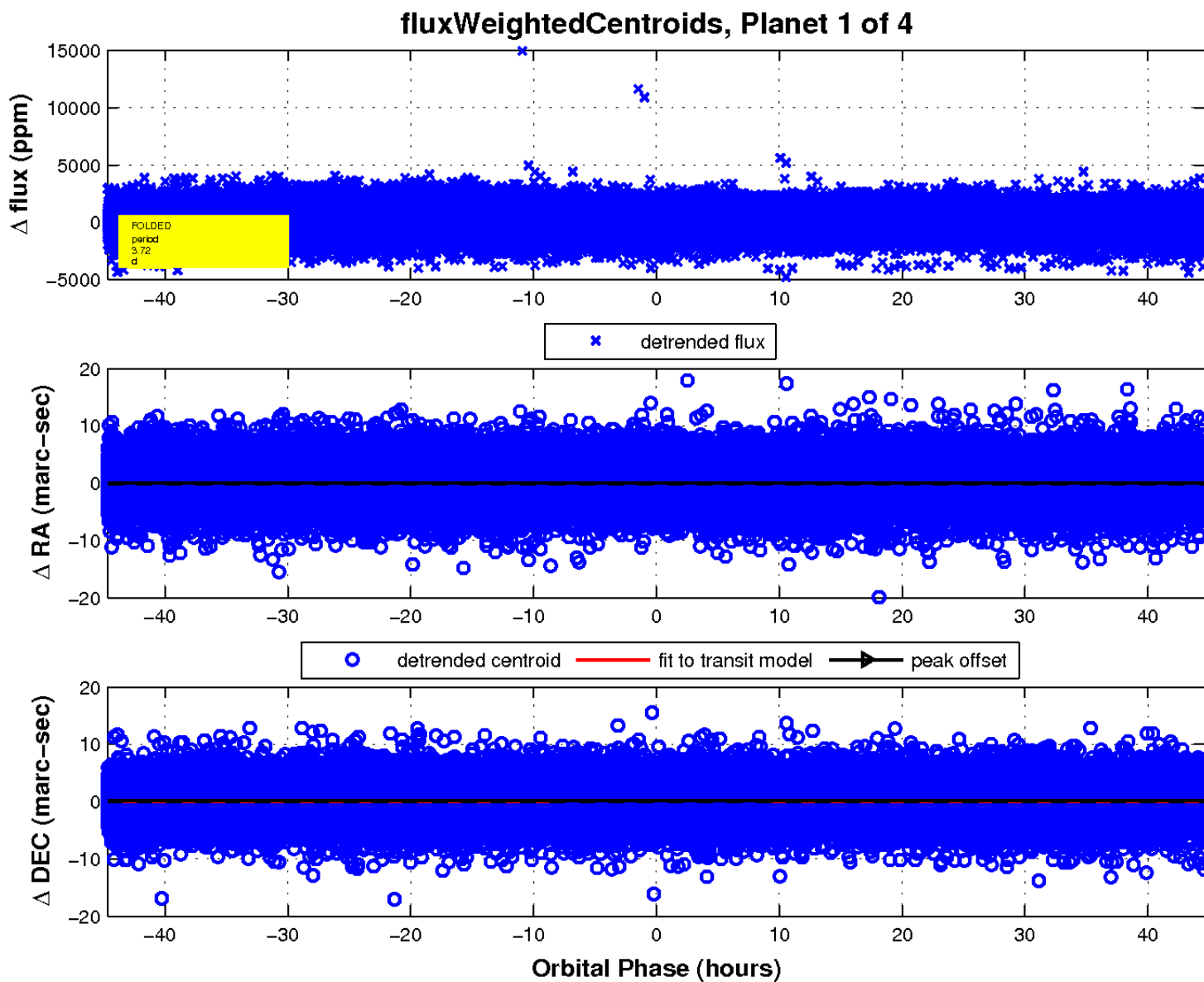
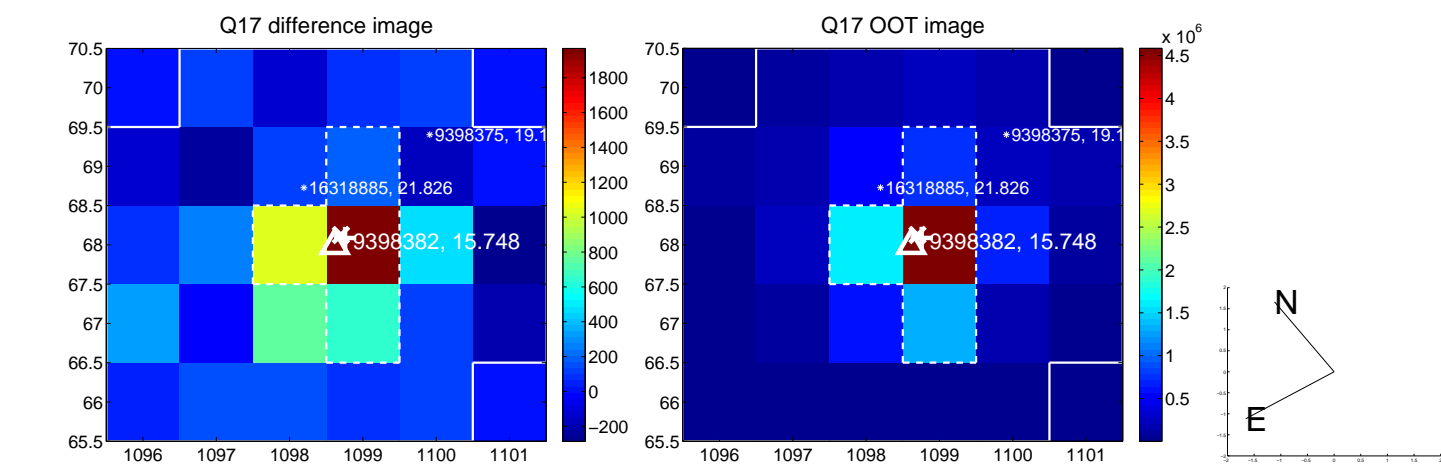
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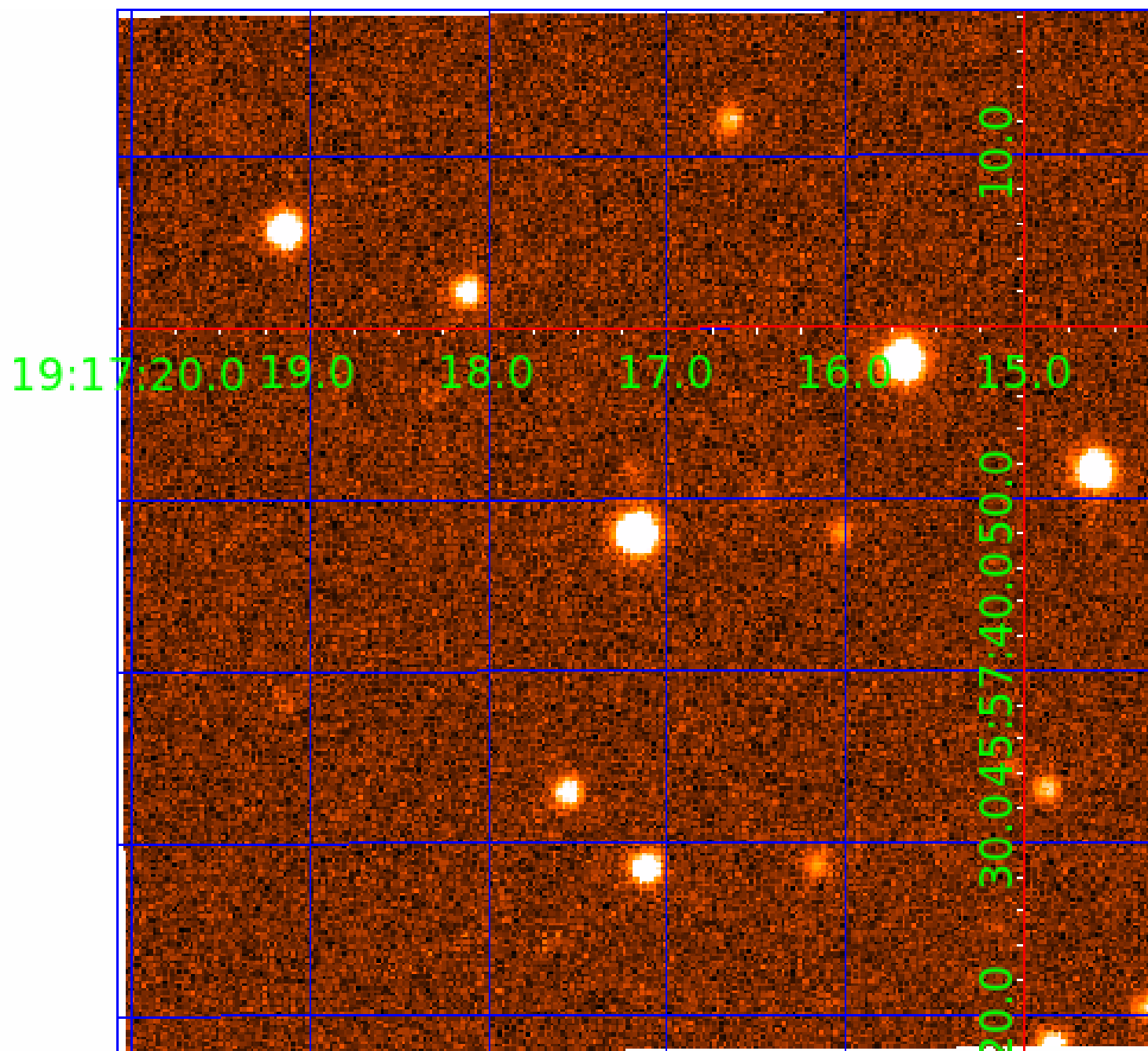


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination





# KIC 009398382

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
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## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
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009398382-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009398382-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—NO_FITS—INCONSISTENT_TRANS—CENT_NOFITS
009398382-04	OBS	FP	0.00	1	0	0	0	LPP_ALT—SAME_NTL_PERIOD

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

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

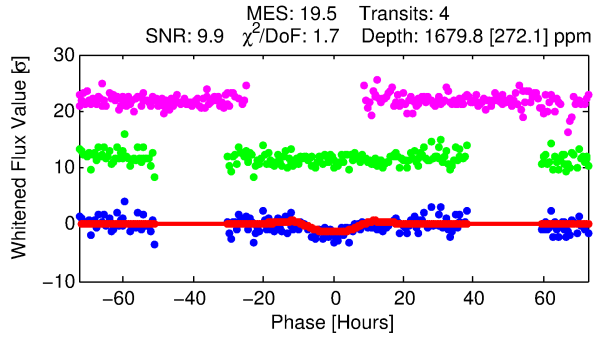
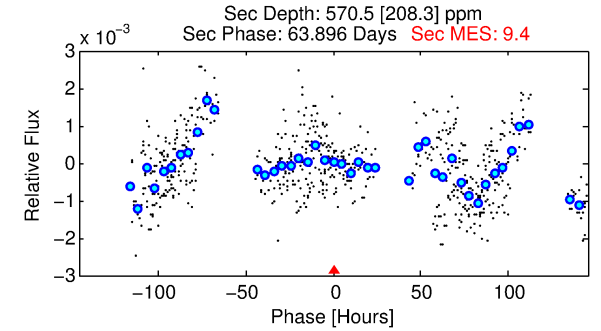
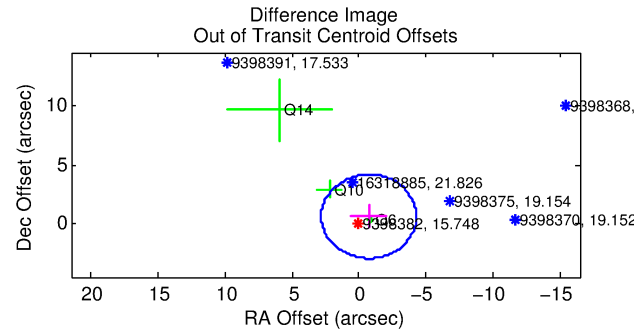
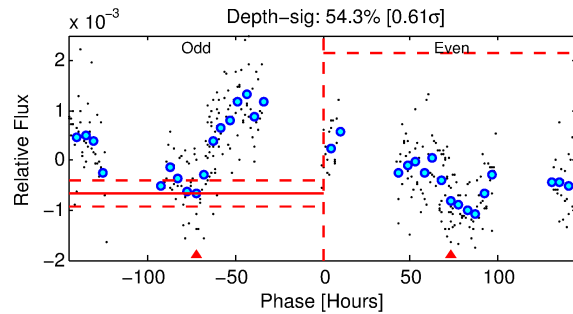
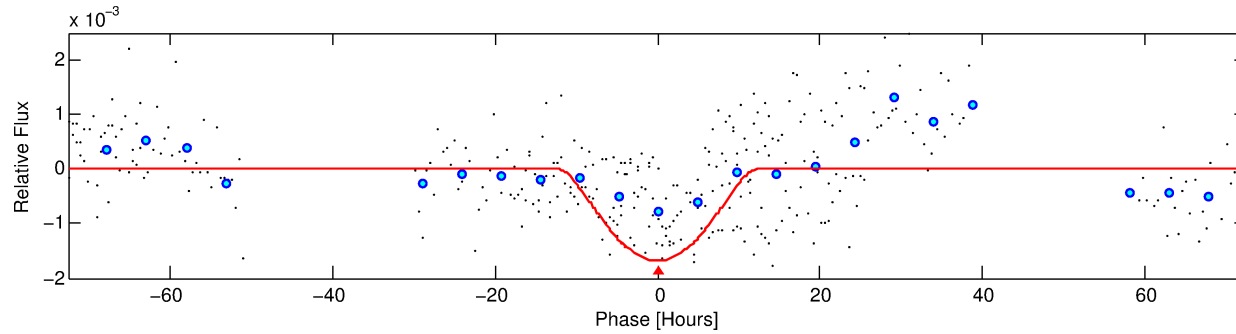
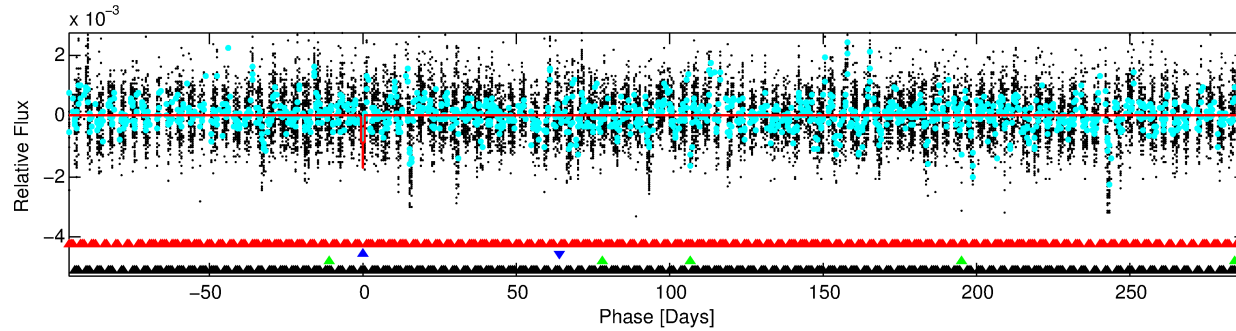
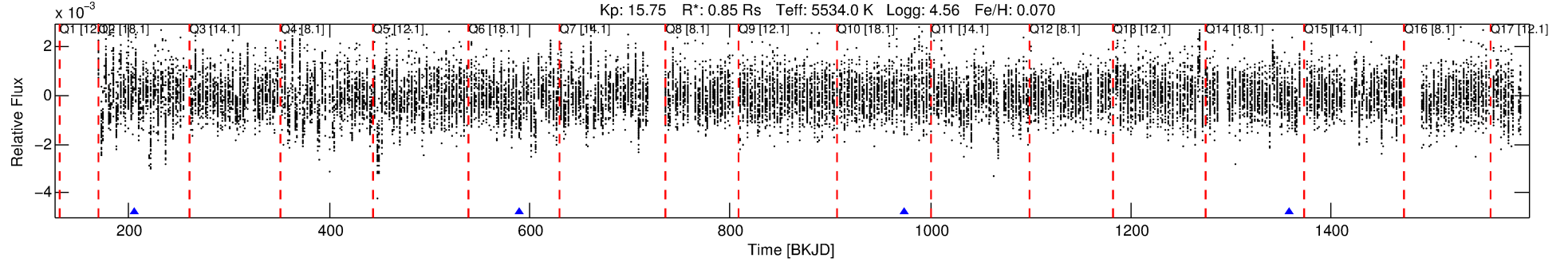
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 009398382-02

No Significant Match Found

# DV One-Page Summary

KIC: 9398382 Candidate: 2 of 4 Period: 383.969 d



## DV Fit Results:

Period = 383.96864 [0.03931] d  
Epoch = 206.0334 [0.0757] BKJD  
Rp/R\* = 0.0699 [0.1634]  
a/R\* = 47.54 [26.09]  
b = 1.00 [0.25]  
Seff = 0.58 [0.20]  
Teq = 223 [19] K  
Rp = 6.48 [15.22] Re  
a = 1.0198 [0.2207] AU  
Ag = 7782.62 [36579.55] [0.21 $\sigma$ ]  
Teffp = 3235 [3793] K [0.79 $\sigma$ ]

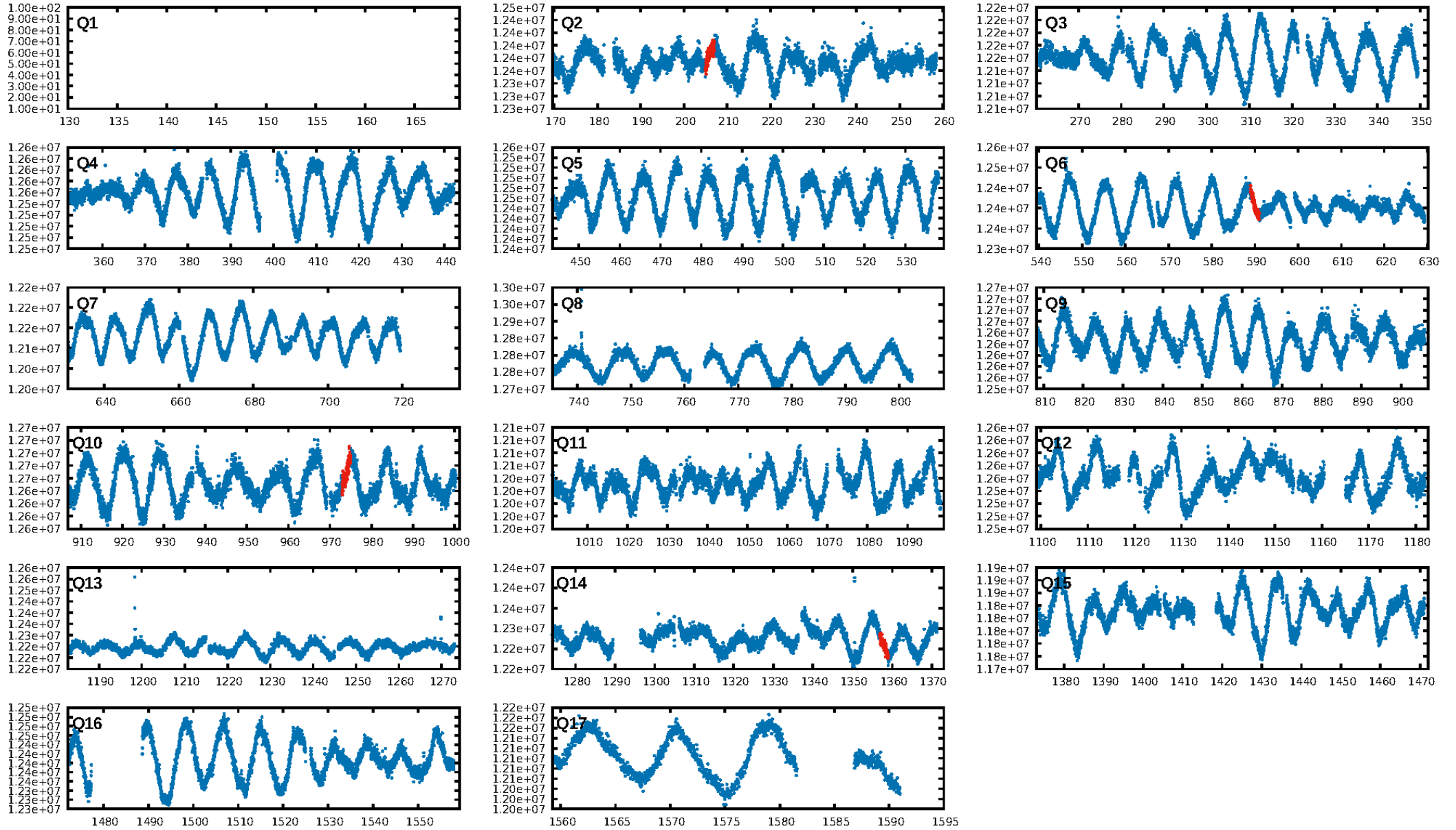
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [74.91 $\sigma$ ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 0.0%  
ModelChiSquareGof-sig: 98.5%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [4/4]  
GhostDiagnostic-chr: 45.89  
Centroid-sig: 32.6%  
Centroid-so: 0.265 arcsec [0.51 $\sigma$ ]  
OotOffset-rm: 0.952 arcsec [0.80 $\sigma$ ]  
KicOffset-rm: 0.809 arcsec [0.69 $\sigma$ ]  
OotOffset-st: 3/0/0/0 [3]  
KicOffset-st: 3/0/0/0 [3]  
DiffImageQuality-fgm: 0.33 [1/3]  
DiffImageOverlap-fno: 0.00 [0/4]

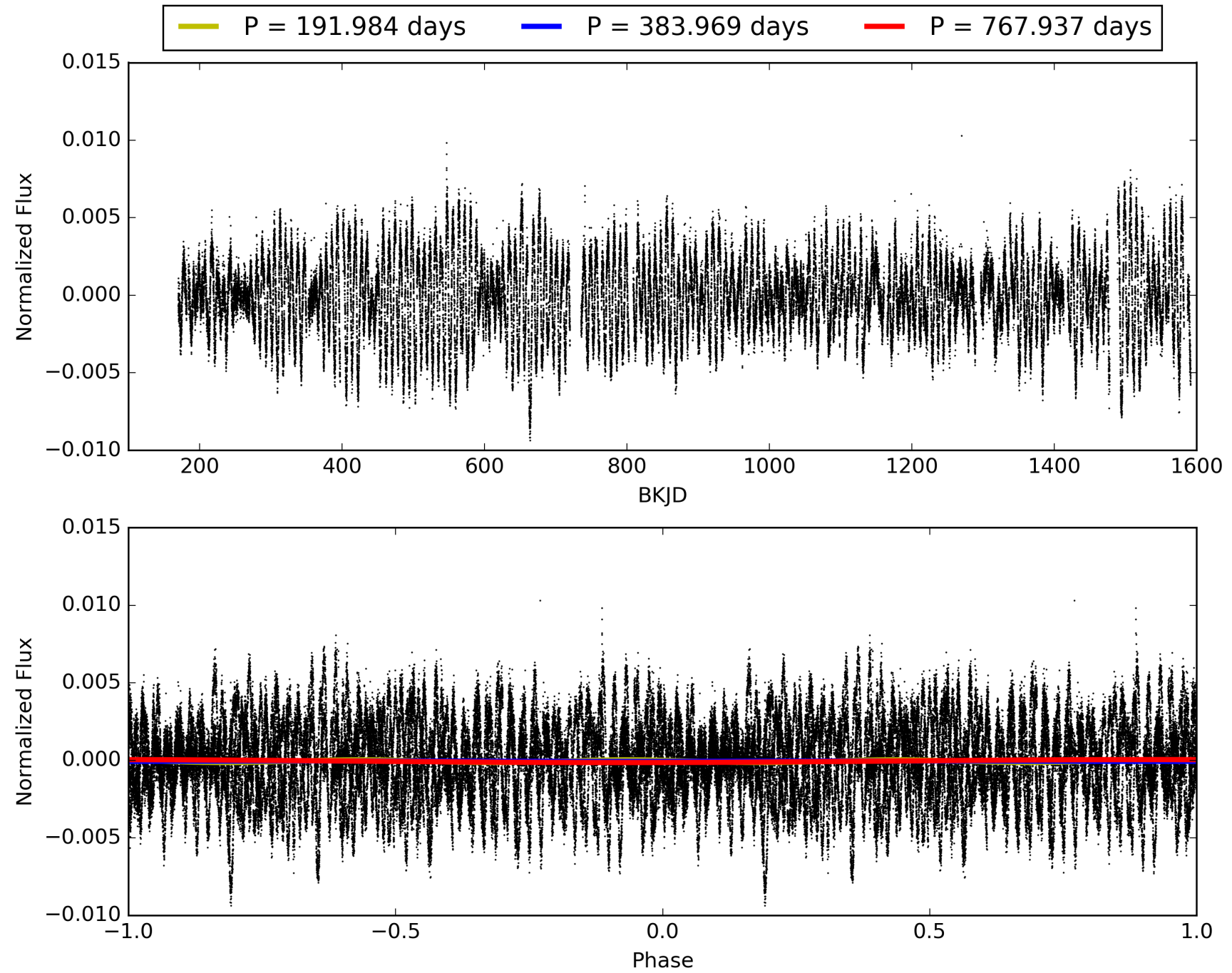
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This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 009398382-02, PDC Light Curves

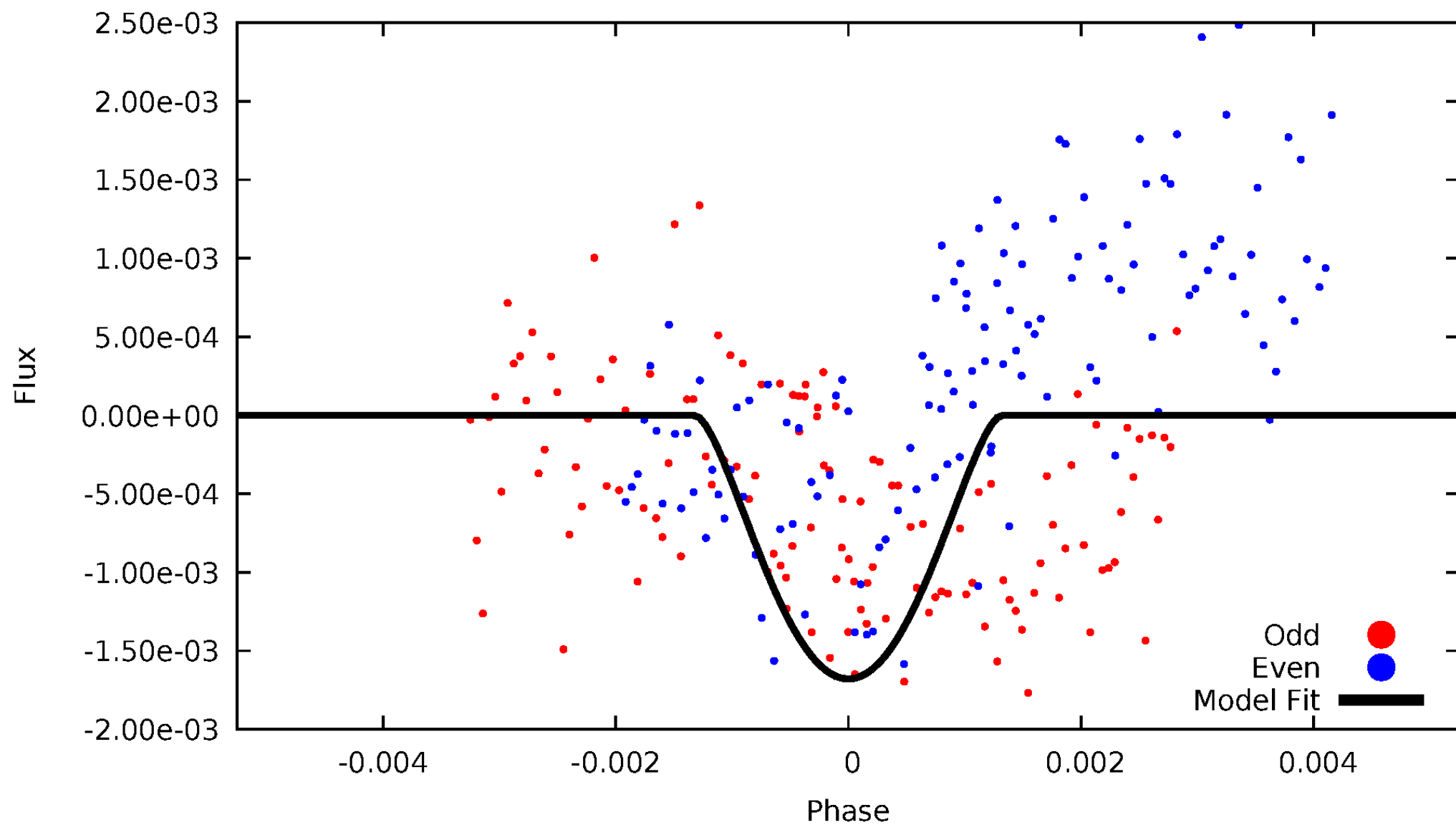


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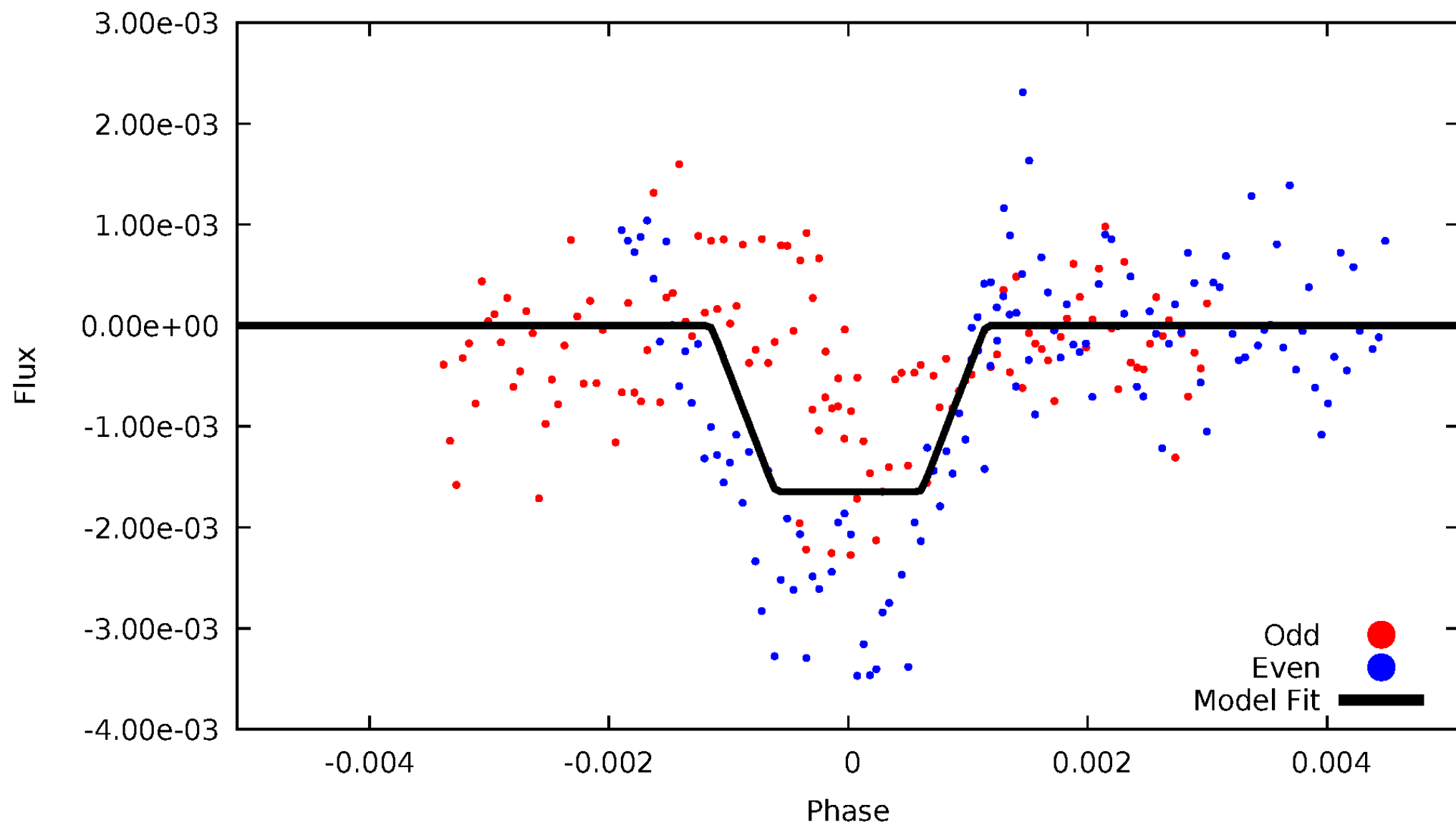
# DV Odd/Even

TCE 009398382-02



# ALT Odd/Even

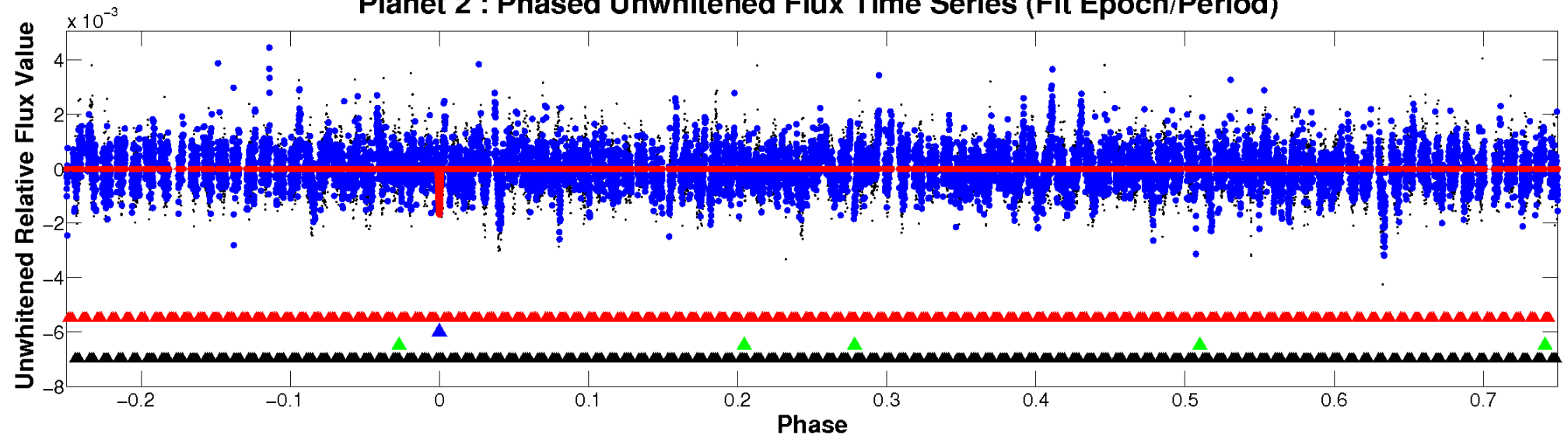
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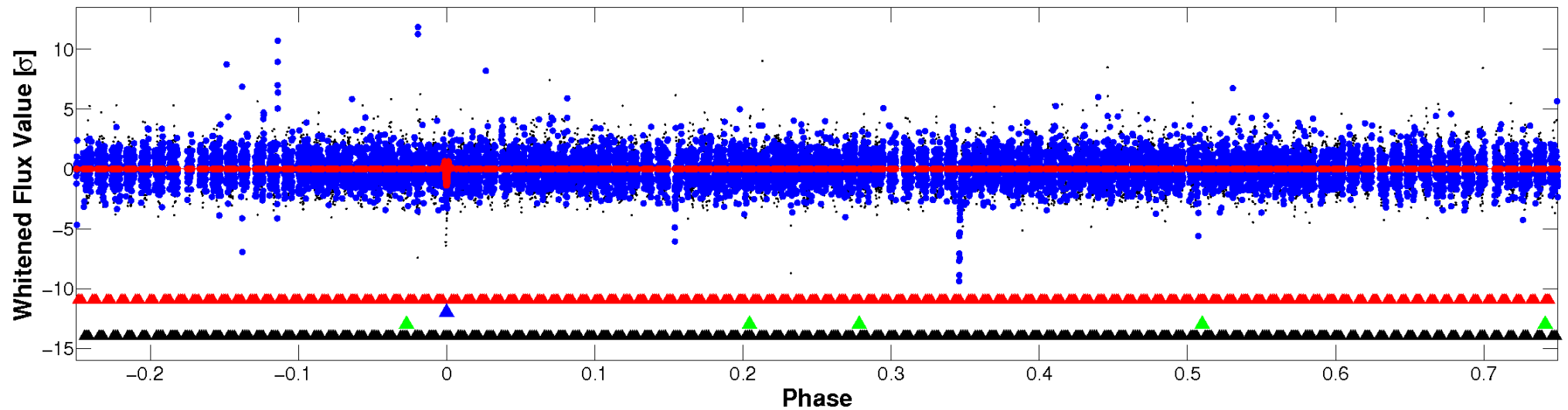


# Non-Whitened Vs. Whitened Light Curve

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

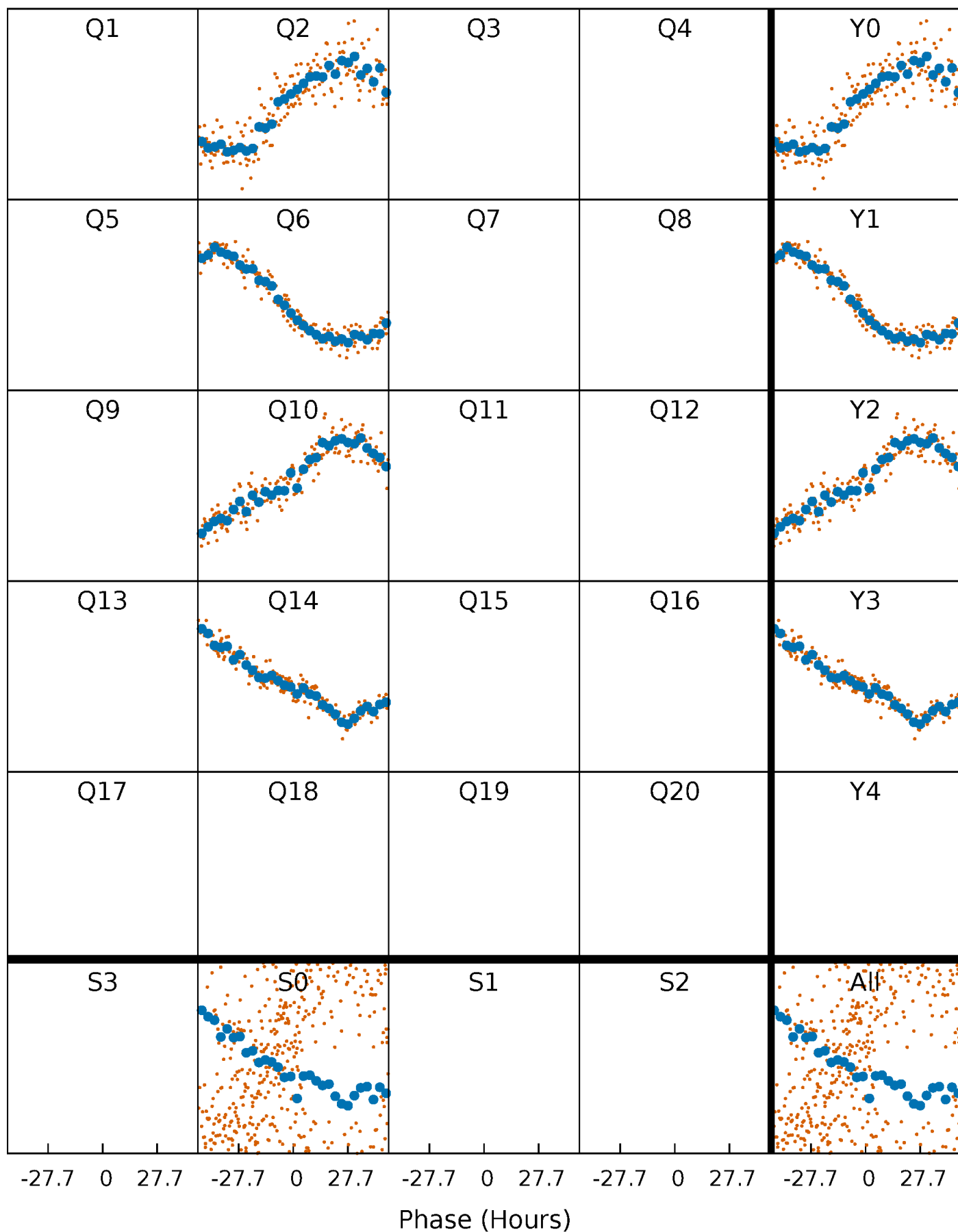


Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



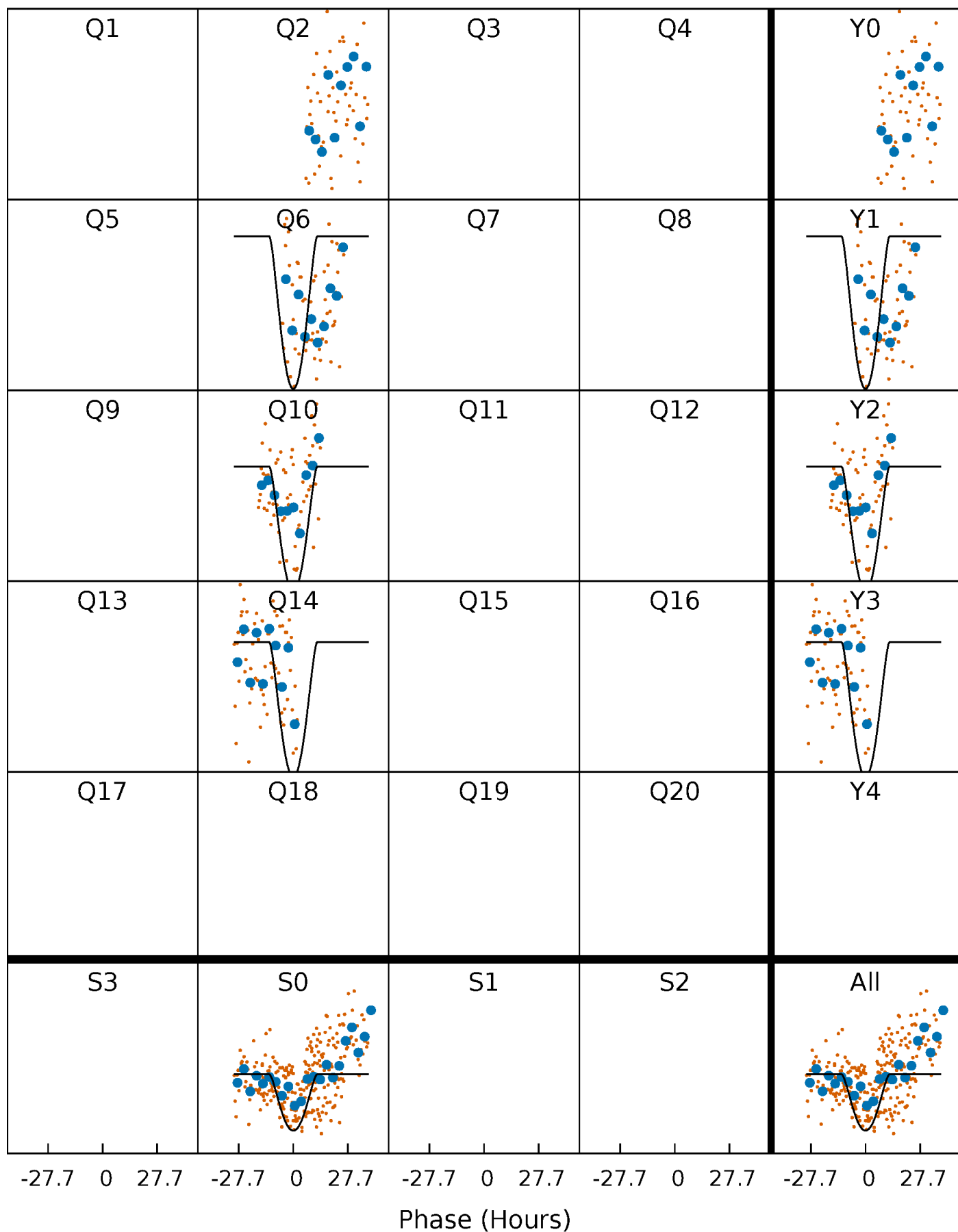
# PDC Quarter-Phased Transit Curves

TCE 009398382-02     $P=383.968644$  Days     $T_0=206.033420$  (BKJD)



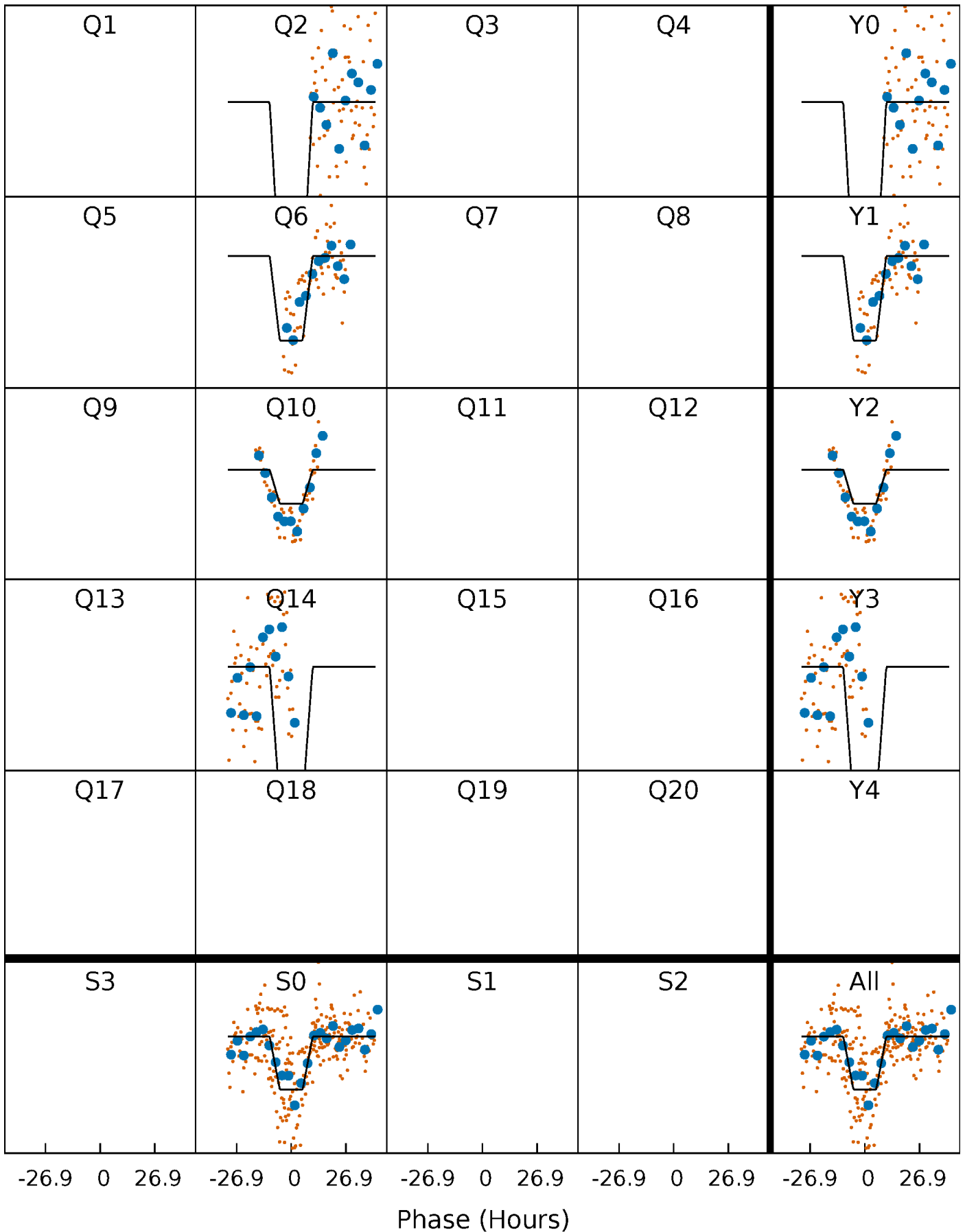
# DV Quarter-Phased Transit Curves

TCE 009398382-02 P=383.968644 Days  $T_0=206.033420$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

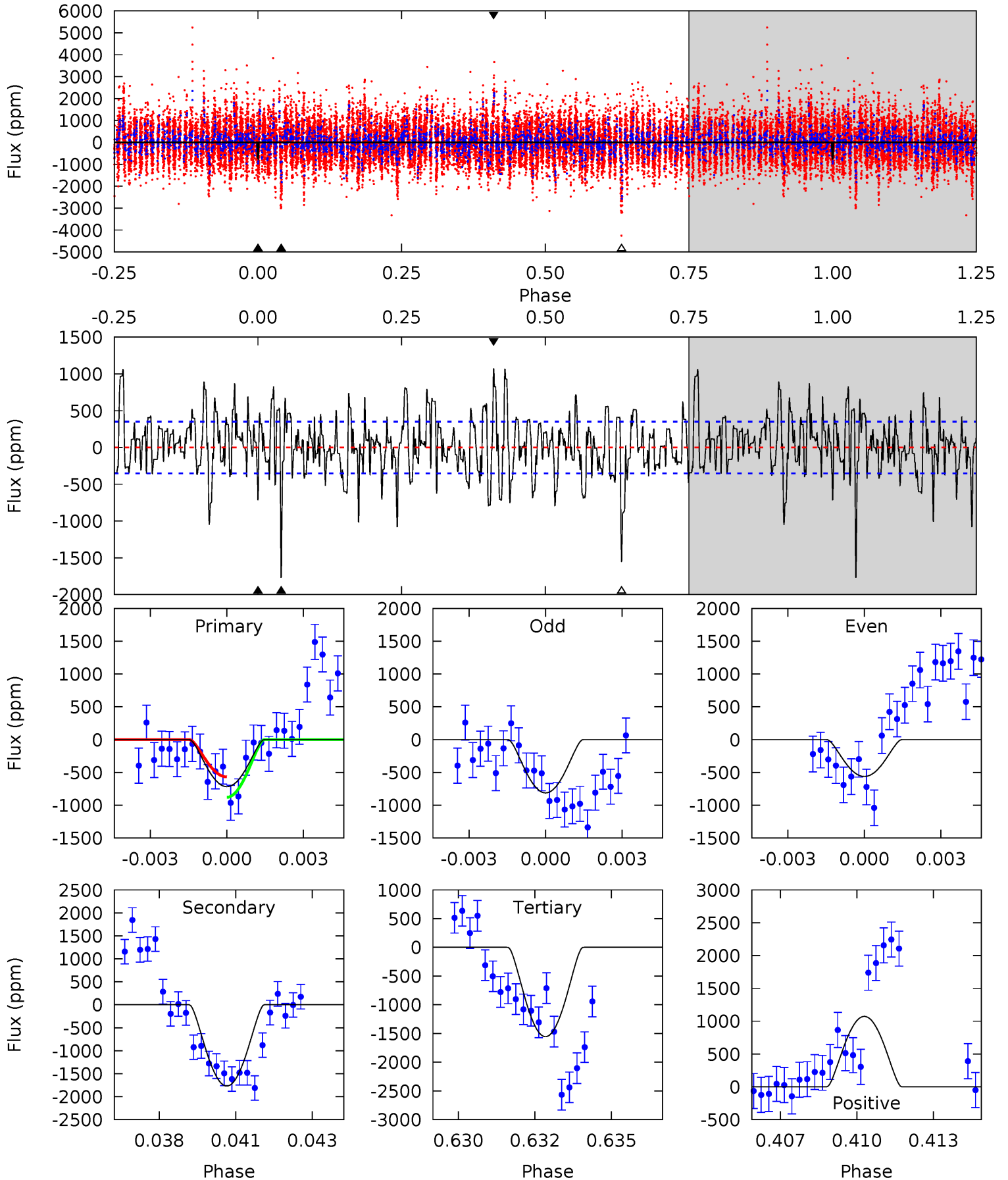
TCE 009398382-02 P=384.028327 Days  $T_0=205.906063$  (BKJD)



# DV Model-Shift Uniqueness Test

009398382-02, P = 383.968644 Days, E = 206.033420 Days

Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
10.8	26.6	23.4	16.1	5.27	3.00	4.95	-12.6	-5.35	3.20	10.5	1.90	0.27	0.38	2.36

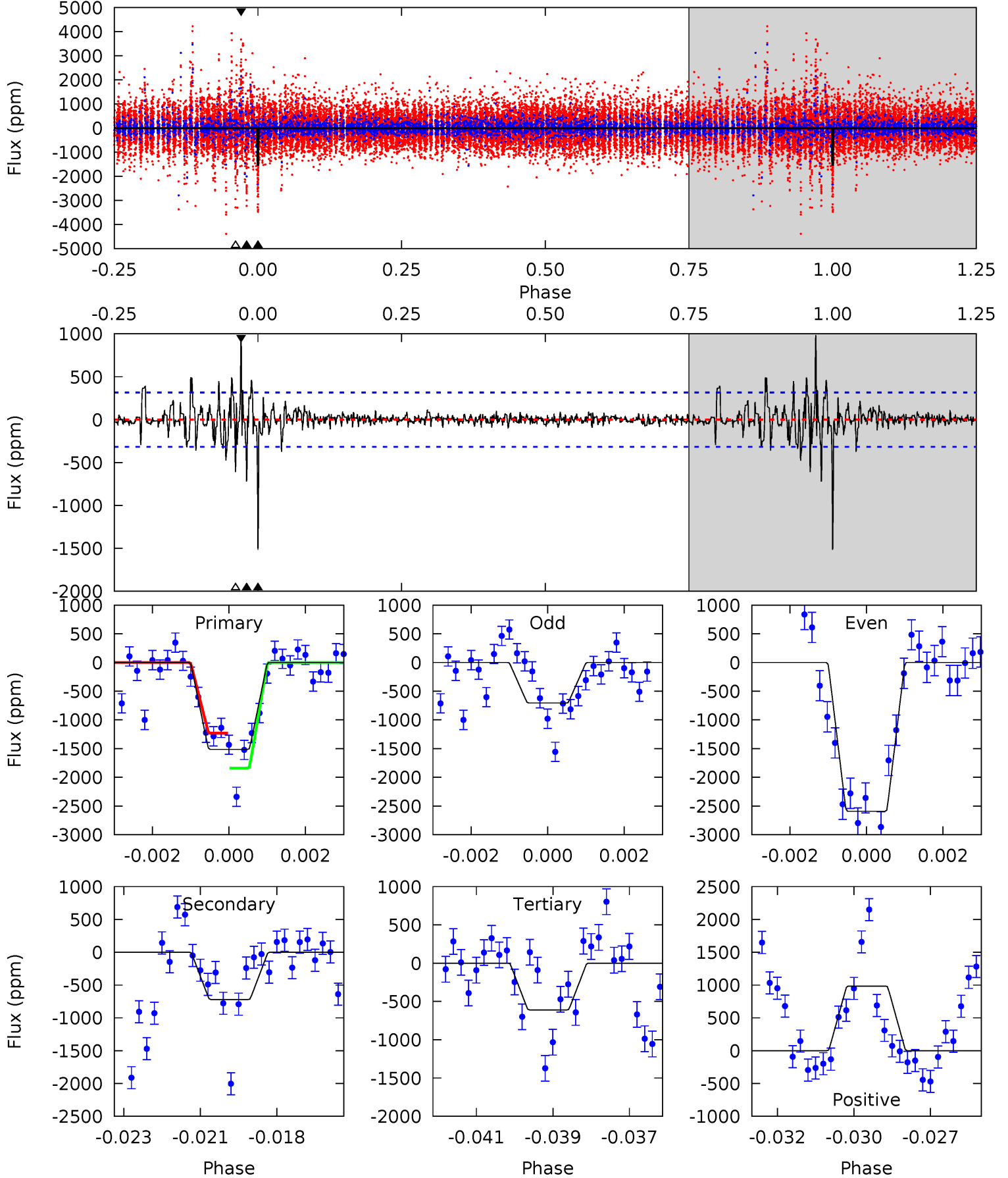




# Alt Model-Shift Uniqueness Test

009398382-02, P = 384.028327 Days, E = 205.906063 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
25.4	12.1	10.2	16.5	5.30	3.05	1.79	15.1	8.89	1.82	-4.43	15.7	1.10	0.39	5.05



### Stellar Parameters For KIC 009398382

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5534^{+166}_{-166}$	$4.562^{+0.032}_{-0.179}$	$0.070^{+0.250}_{-0.300}$	$0.849^{+0.213}_{-0.071}$	$0.960^{+0.083}_{-0.111}$	$2.205^{+0.386}_{-1.048}$
	+3%/-3%	+1%/-4%	+357%/-429%	+25%/-8%	+9%/-12%	+17%/-48%
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 009398382-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-1769 \pm 67$	$14.34^{+12.63}_{-9.51}$	$318^{+20}_{-14}$	$3484^{+1755}_{-612}$	$4974^{+38666}_{-3636}$
Alt.	$-719 \pm 60$	$12.17^{+12.14}_{-8.32}$	$318^{+20}_{-14}$	$3166^{+1525}_{-561}$	$2735^{+23878}_{-2055}$

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

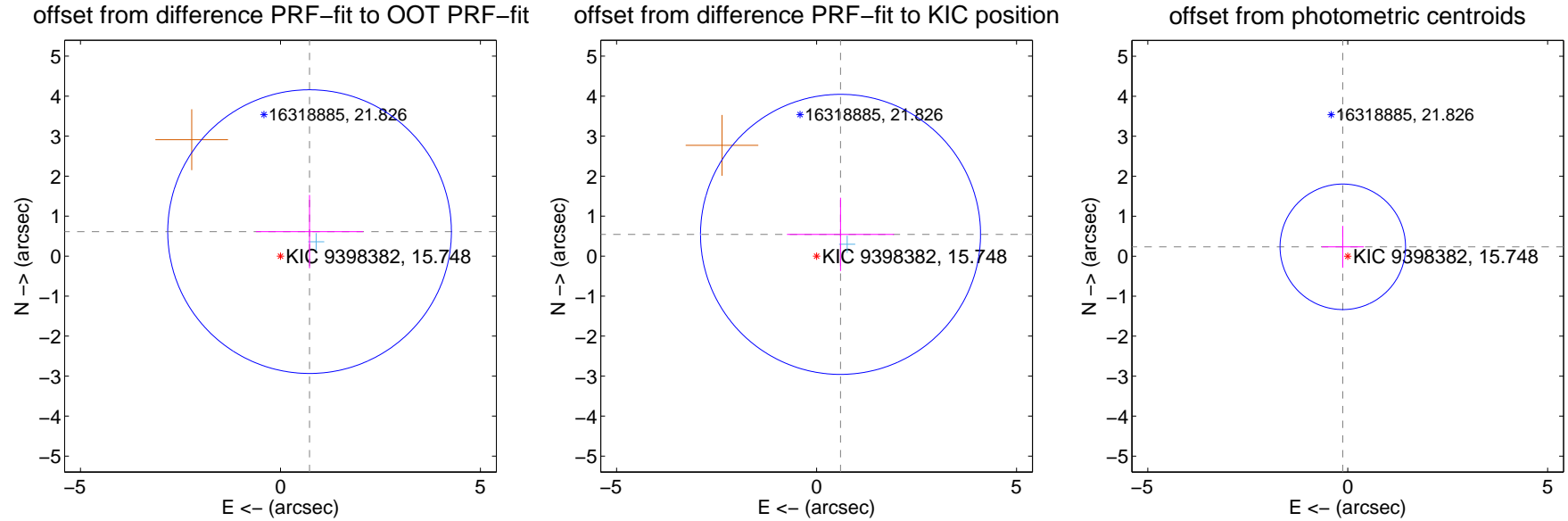
## DV Centroid Data

Supplemental centroid analysis for 009398382-02. Kepler magnitude: 15.75. Transit SNR 9.94

There are 1 quarters with good PRF difference image offsets

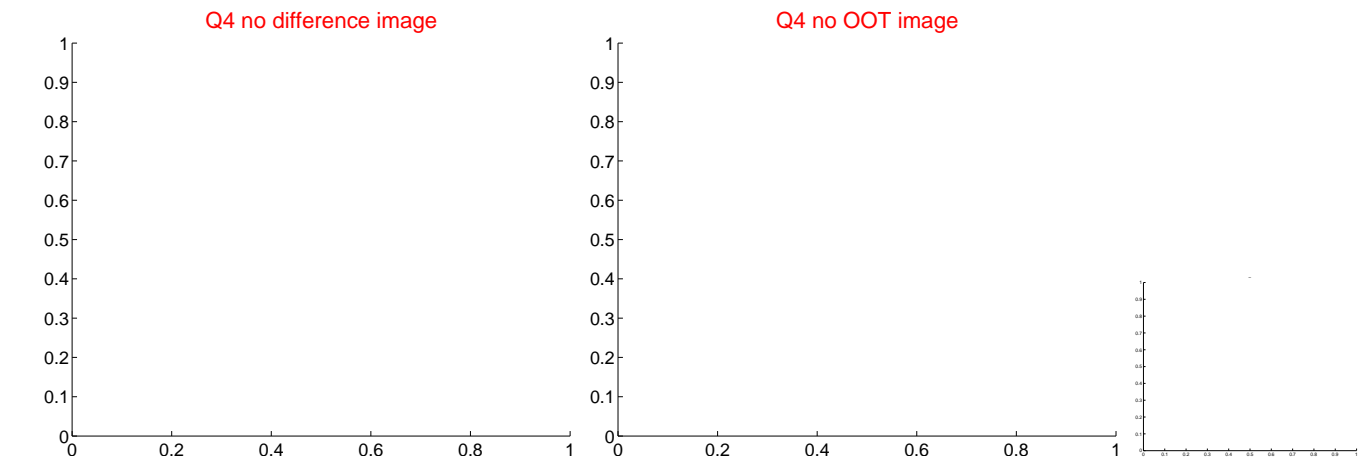
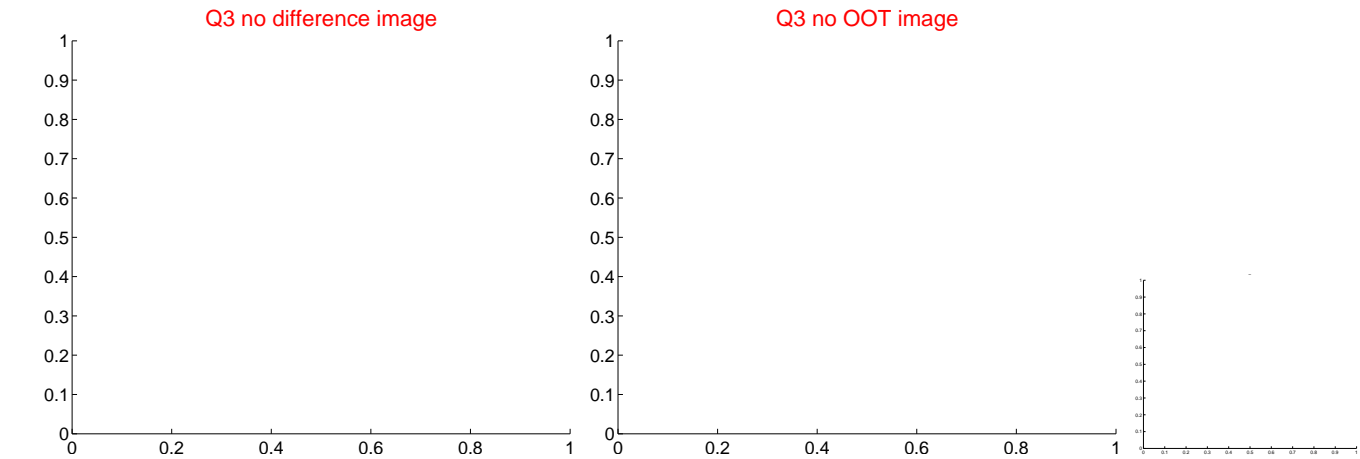
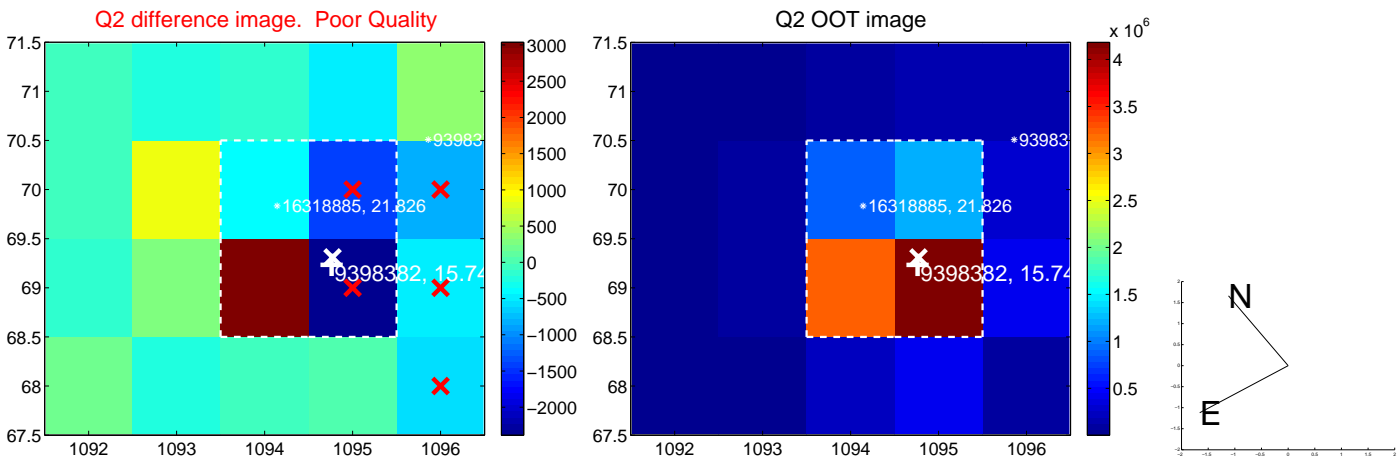
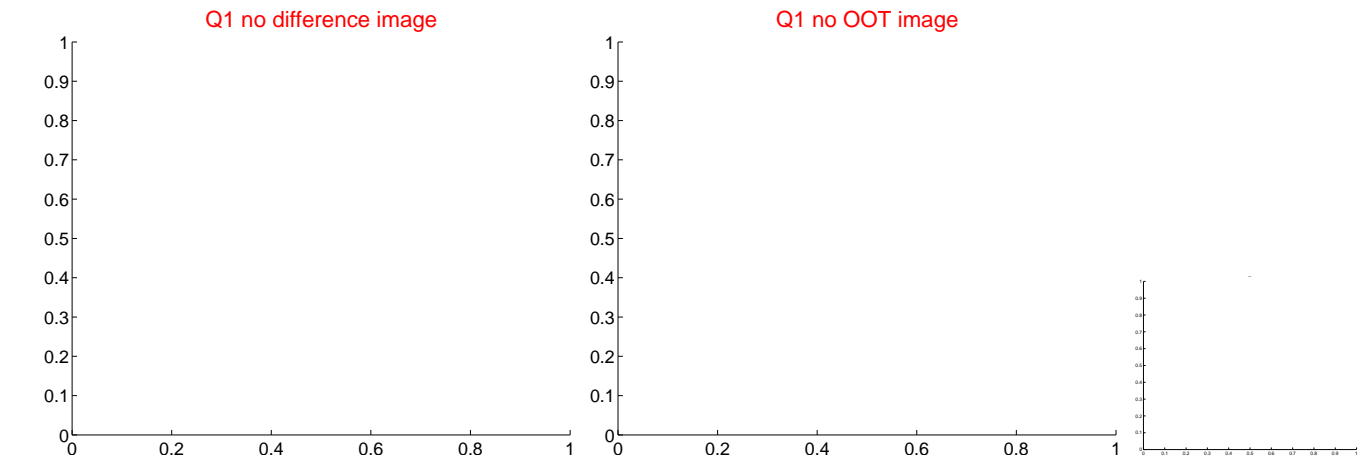
The direct PRF centroid is offset from the target star catalog position by about 0.16 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.952 \pm 1.182$	0.80	$-0.728 \pm 1.339$	$0.613 \pm 0.916$
PRF-fit source offset from KIC position	$0.809 \pm 1.167$	0.69	$-0.599 \pm 1.339$	$0.544 \pm 0.916$
photometric centroid source offset	$0.27 \pm 0.52$	0.51	$0.12 \pm 0.53$	$0.23 \pm 0.52$



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

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



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

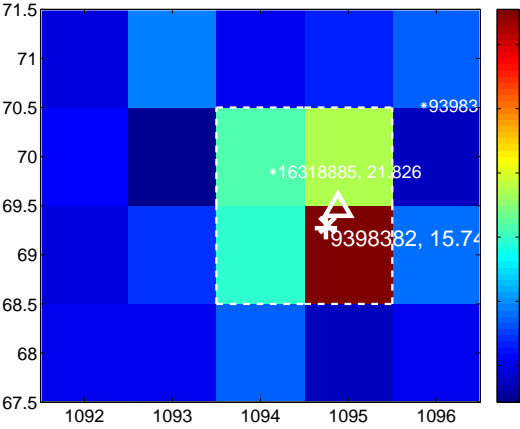
Q5 no difference image



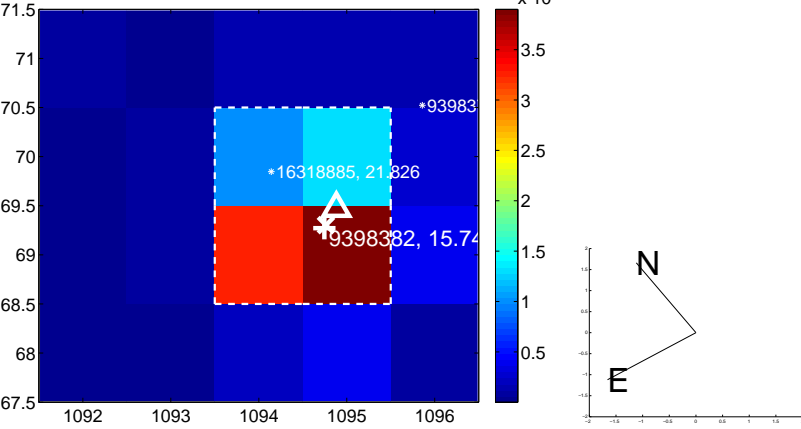
Q5 no OOT image



Q6 difference image



Q6 OOT image



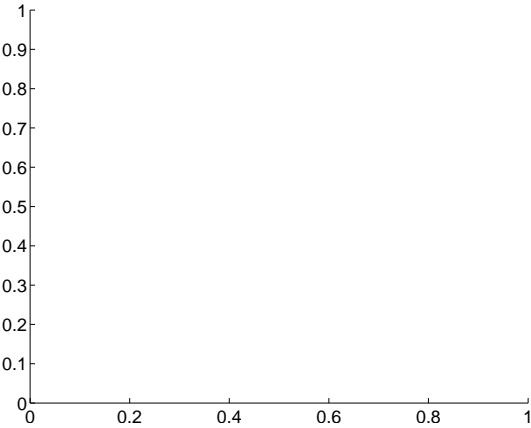
Q7 no difference image



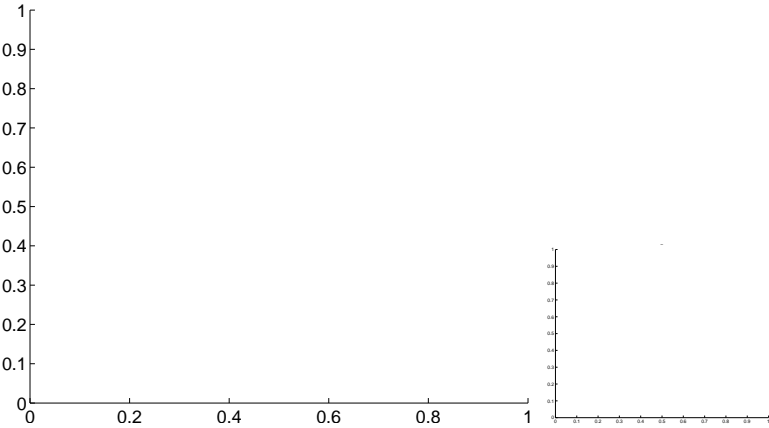
Q7 no OOT image



Q8 no difference image

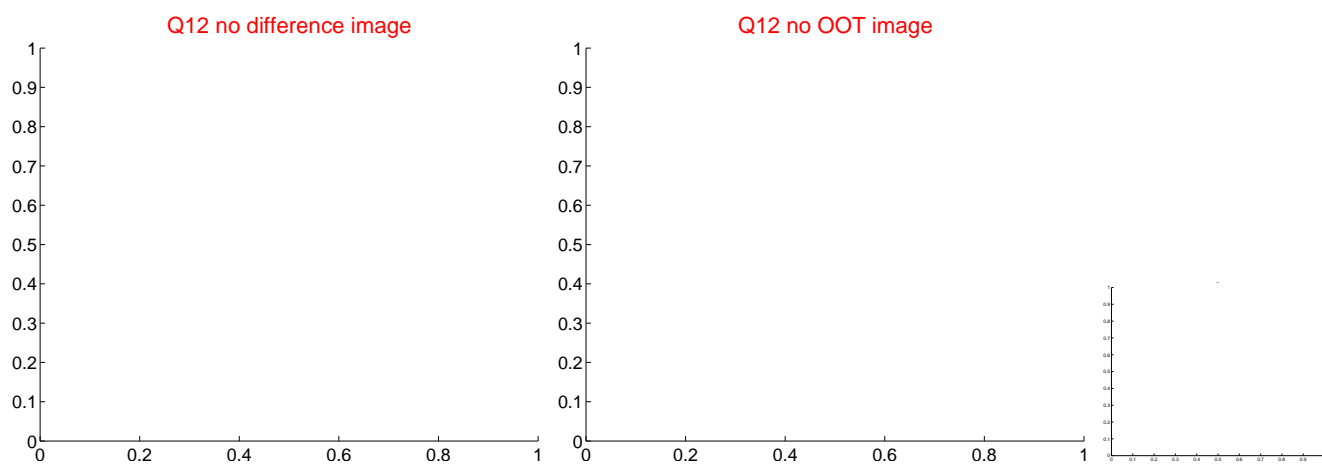
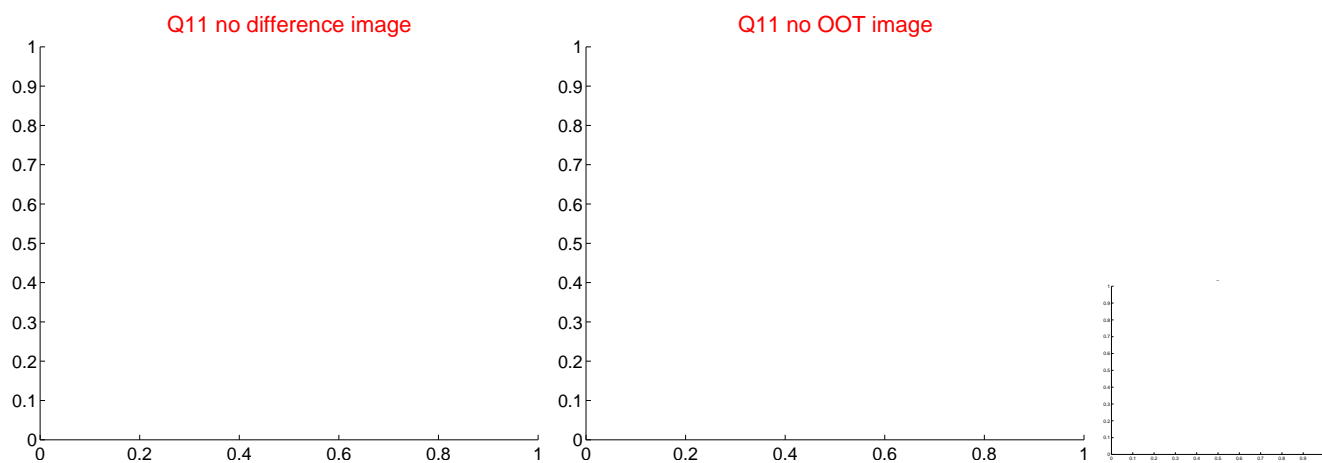
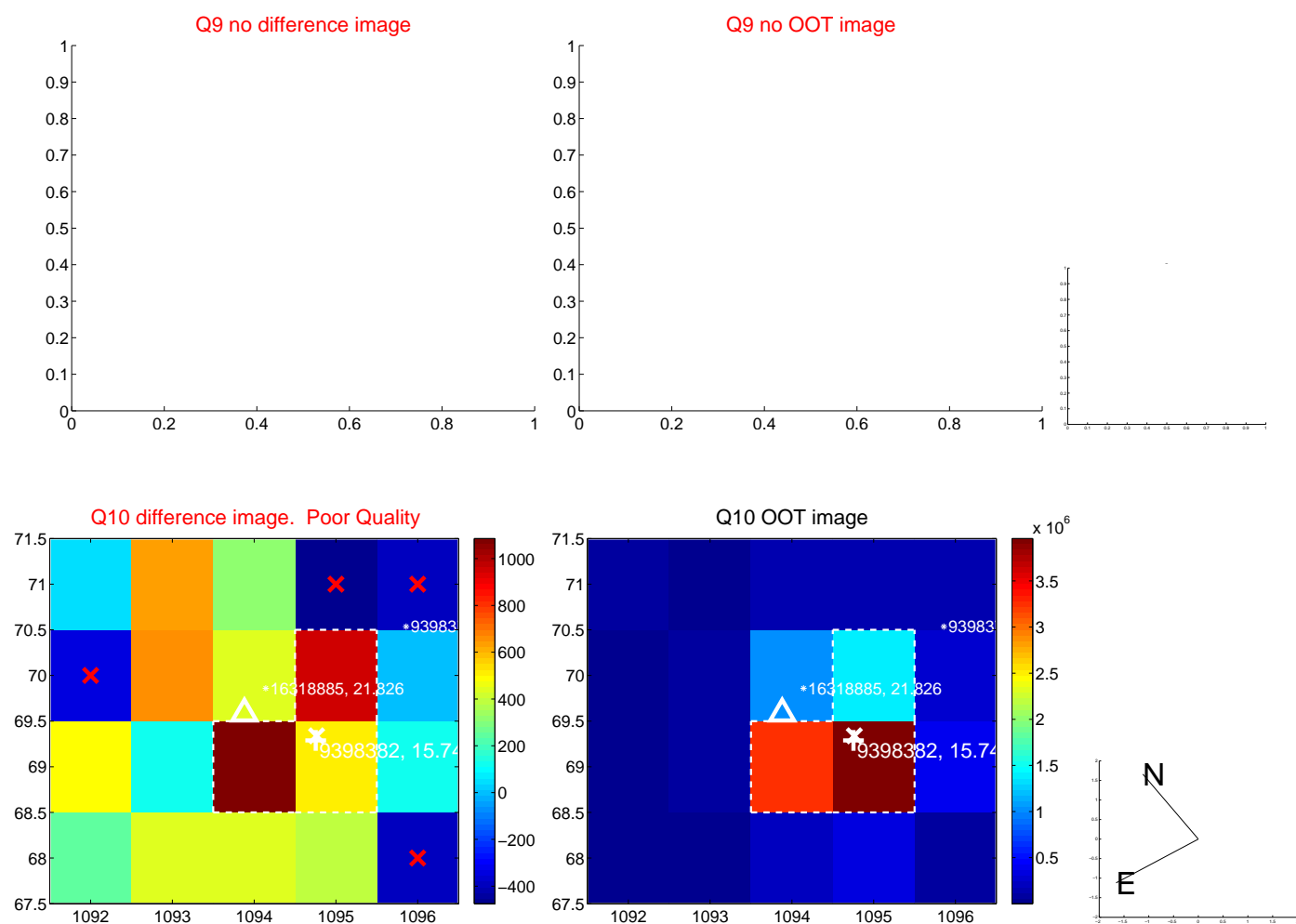


Q8 no OOT image





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



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

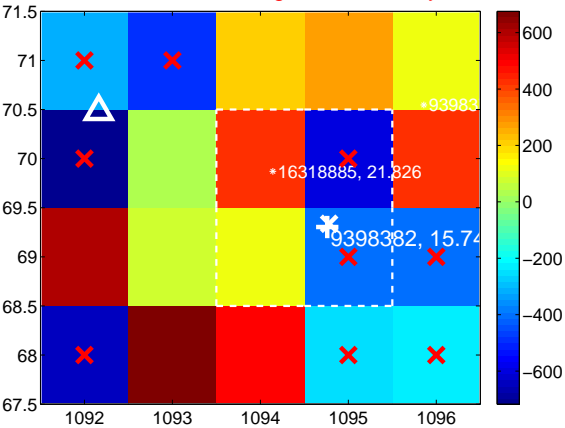
Q13 no difference image



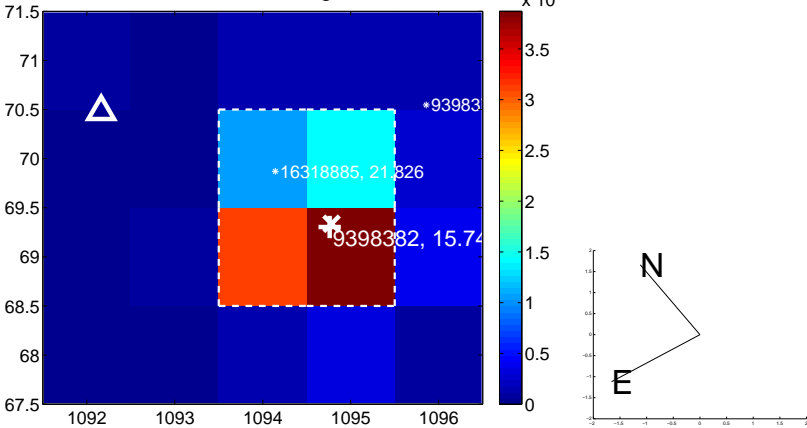
Q13 no OOT image



Q14 difference image. Poor Quality



Q14 OOT image



Q15 no difference image



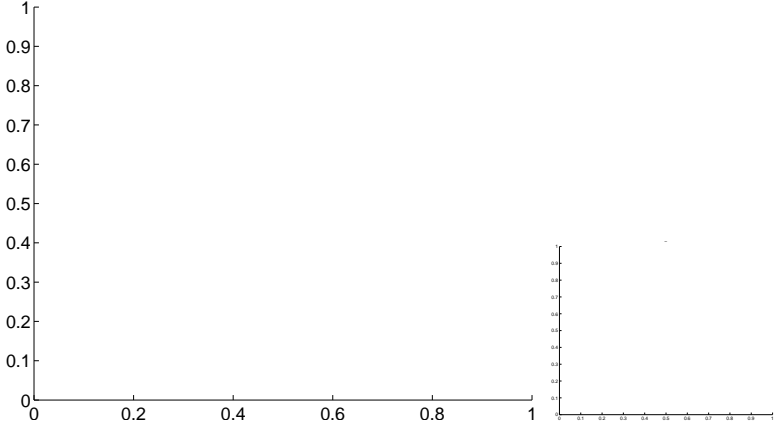
Q15 no OOT image



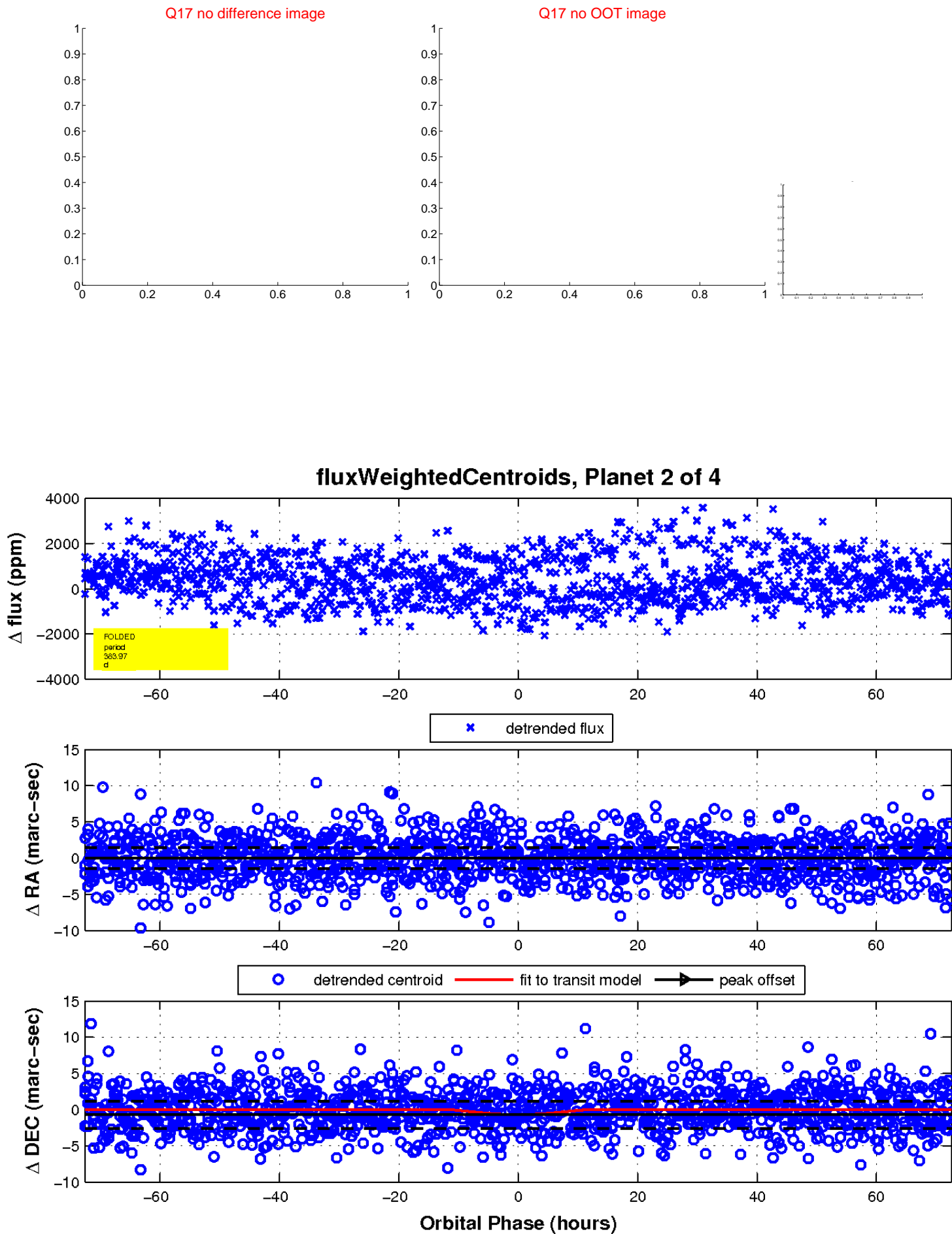
Q16 no difference image



Q16 no OOT image

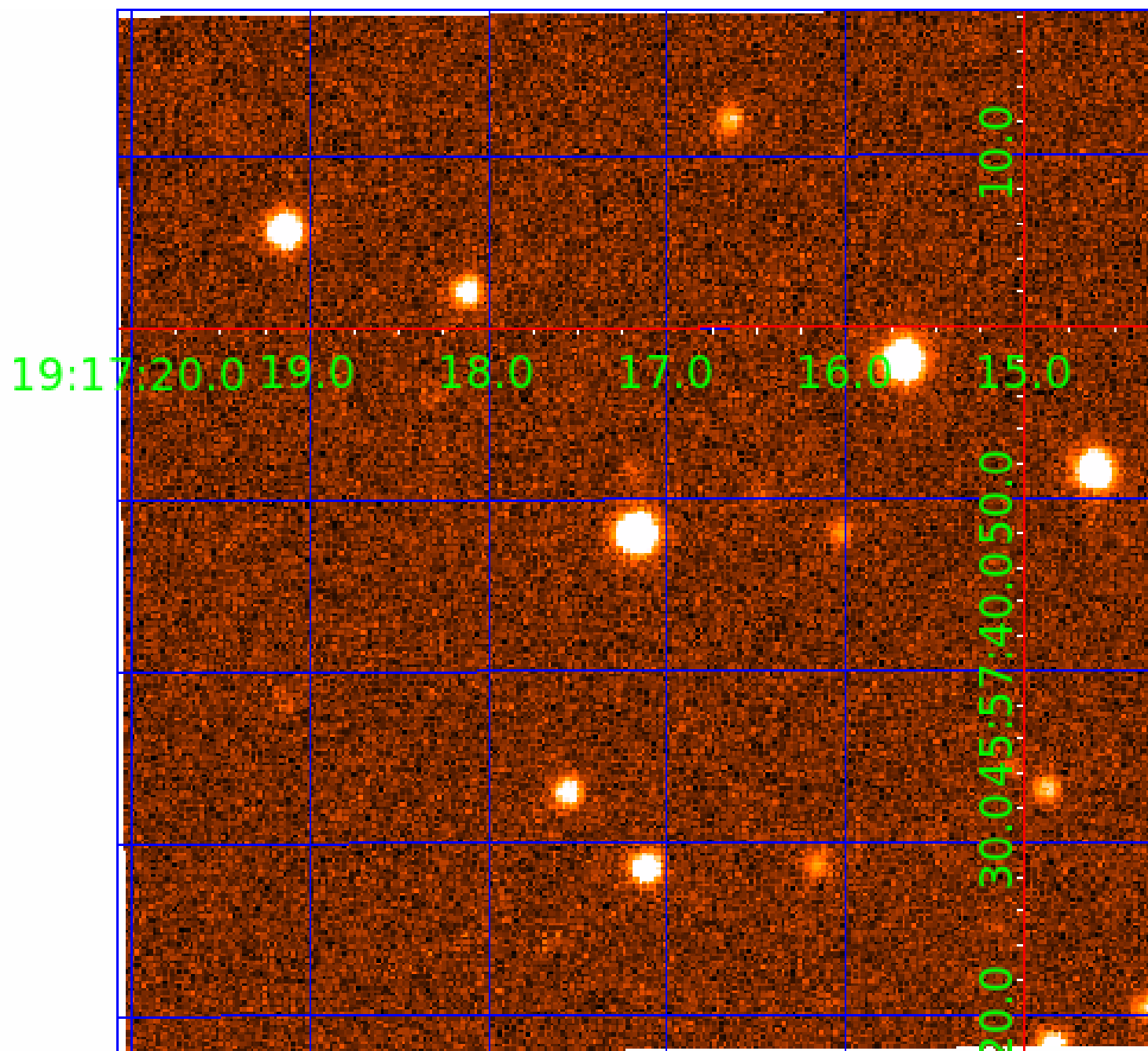


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 009398382

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009398382-01	OBS	No	3.722935	134.371425	110.5	18.921	9.1	8.1	0.85	5534	0.88	281.71
009398382-02	OBS	No	383.968644	206.033420	1679.8	24.208	19.5	9.9	0.85	5534	6.48	0.58
009398382-03	OBS	No	295.081040	284.537925	944.7	15.000	9.8	-1.0	0.85	5534	2.56	0.83
009398382-04	OBS	No	3.722660	132.460227	119.8	13.753	9.2	11.3	0.85	5534	1.07	281.74

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009398382-01	OBS	FP	0.00	1	0	0	0	LPP_DV
009398382-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009398382-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—NO_FITS—INCONSISTENT_TRANS—CENT_NOFITS
009398382-04	OBS	FP	0.00	1	0	0	0	LPP_ALT—SAME_NTL_PERIOD

**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.

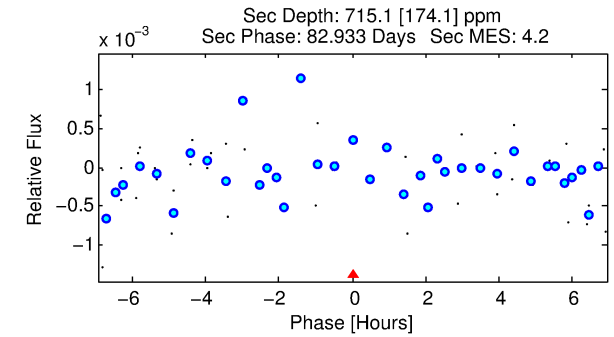
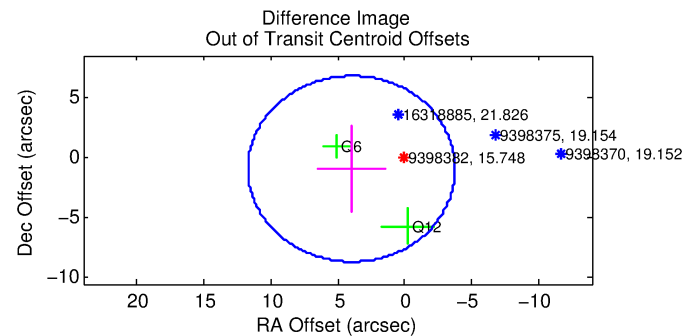
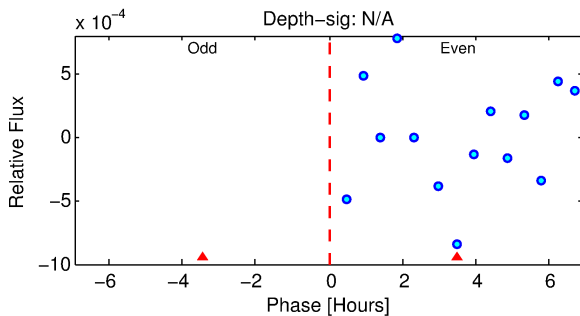
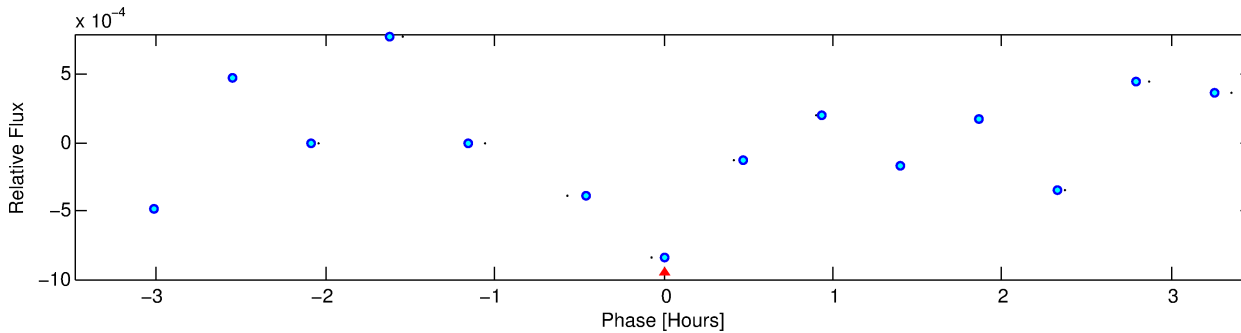
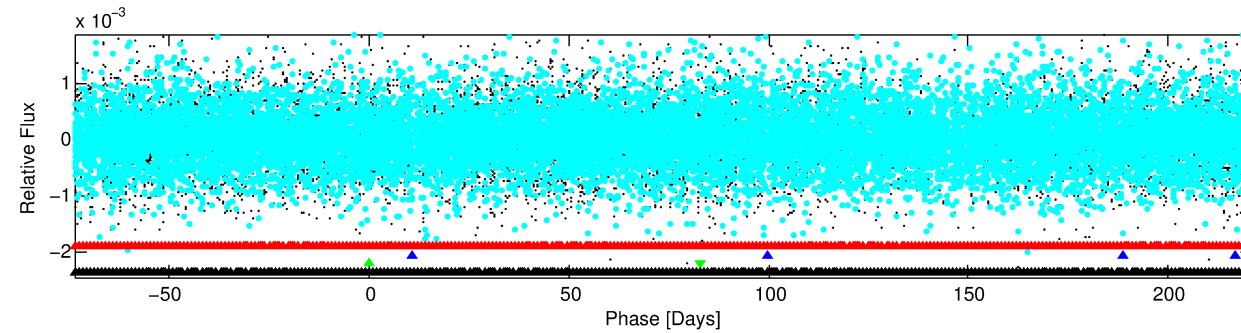
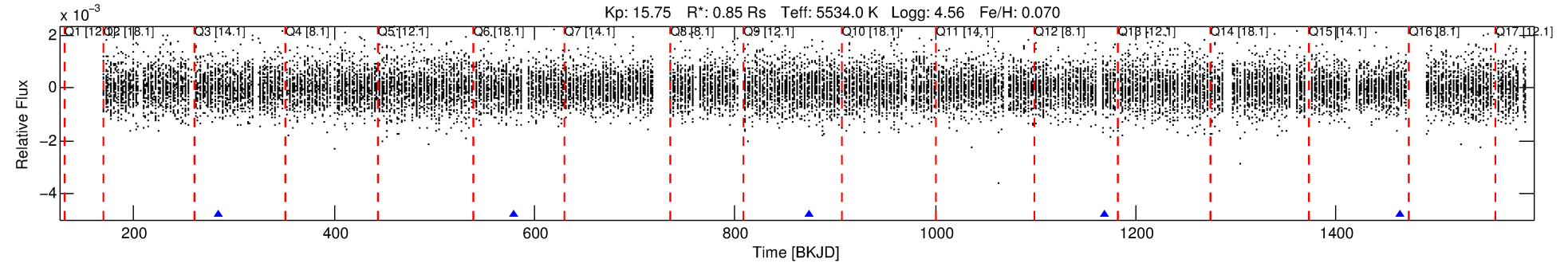
## Ephemeris Match Information For 009398382-03

No Significant Match Found



# DV One-Page Summary

KIC: 9398382 Candidate: 3 of 4 Period: 295.081 d



## TPS TCE Results:

Period = 295.08104 d  
Epoch = 284.5379 BKJD

DV fit results are unavailable

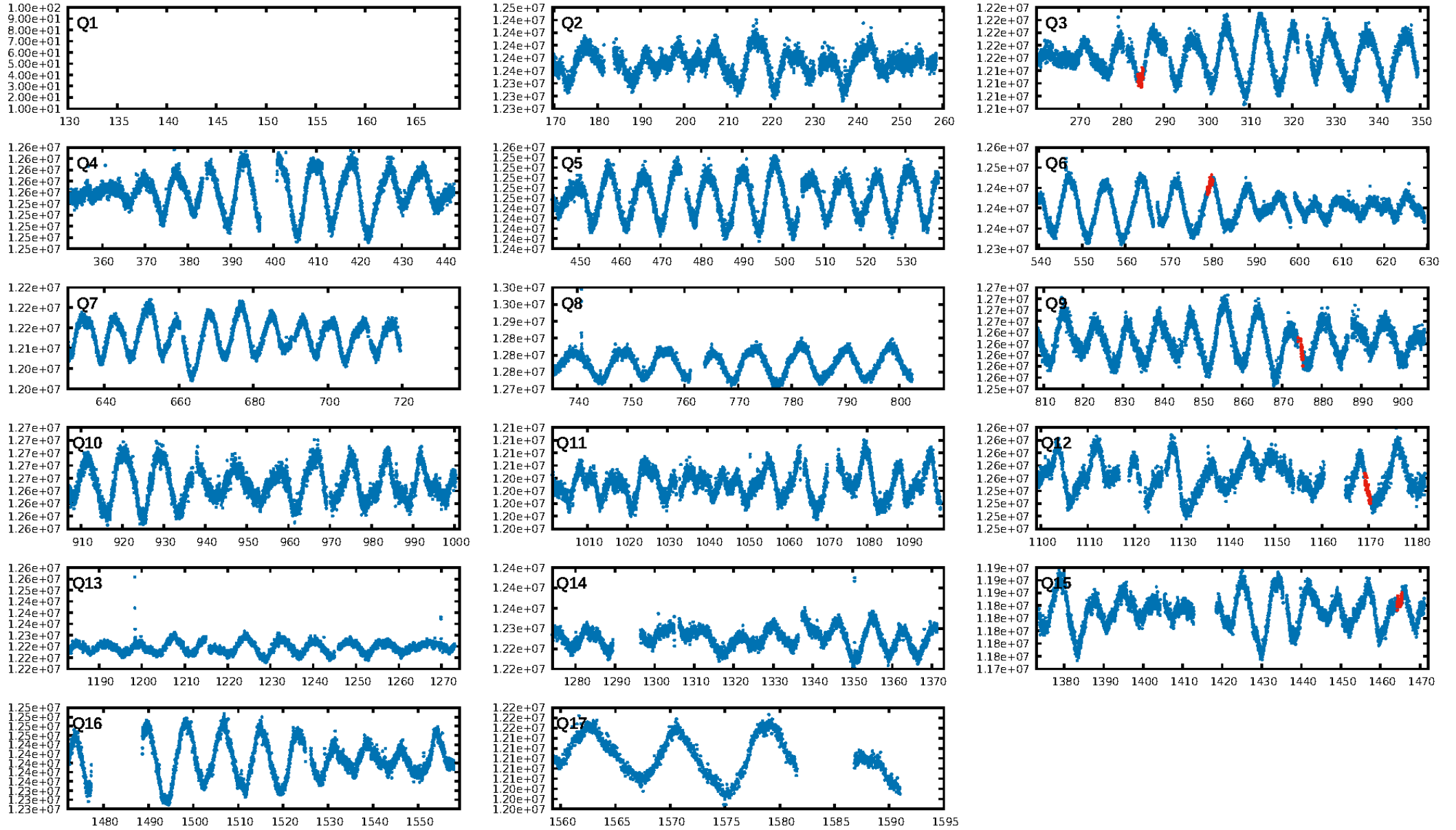
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [289.60σ]  
LongPeriod-sig: 100.0% [74.91σ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [1/1]  
GhostDiagnostic-chr: 3.143  
Centroid-sig: 58.1%  
Centroid-so: 10.731 arcsec [0.65σ]  
OotOffset-rm: 4.069 arcsec [1.58σ]  
KicOffset-rm: 4.227 arcsec [1.64σ]  
OotOffset-st: 1/0/1/0 [2]  
KicOffset-st: 1/0/1/0 [2]  
DiffImageQuality-fgm: 0.00 [0/2]  
DiffImageOverlap-fno: 0.50 [2/4]

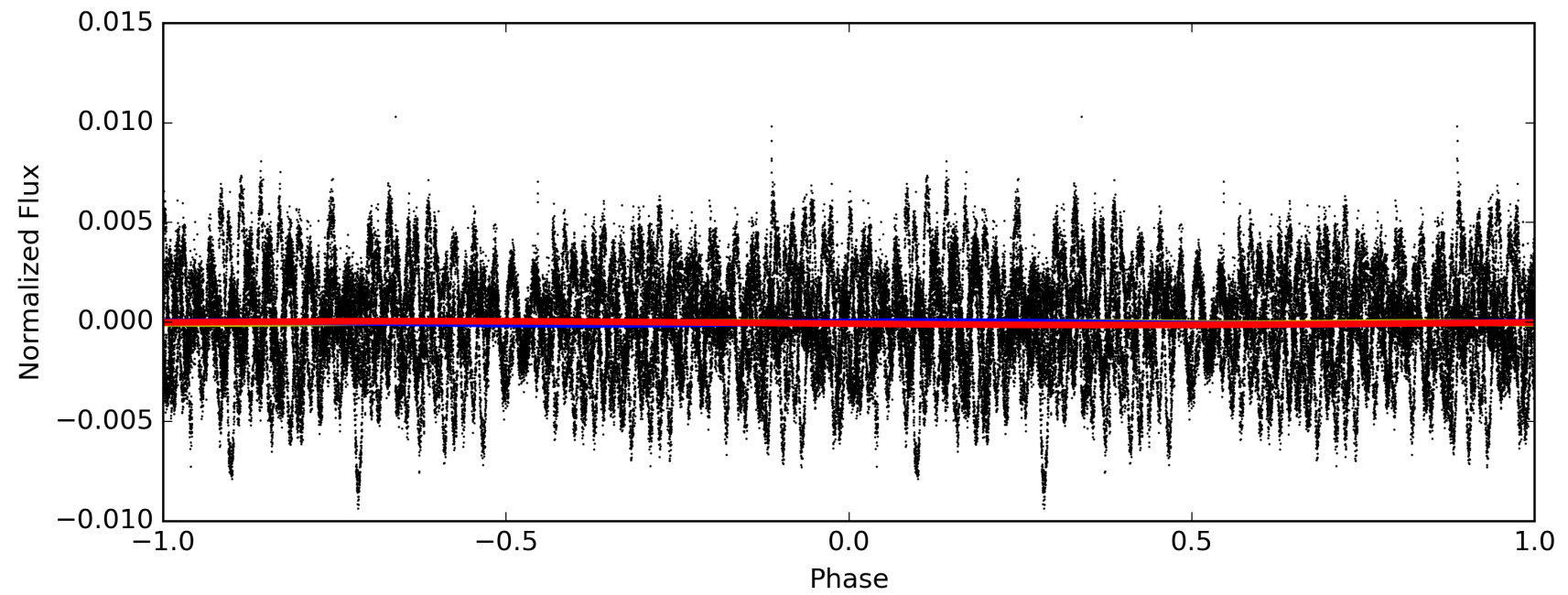
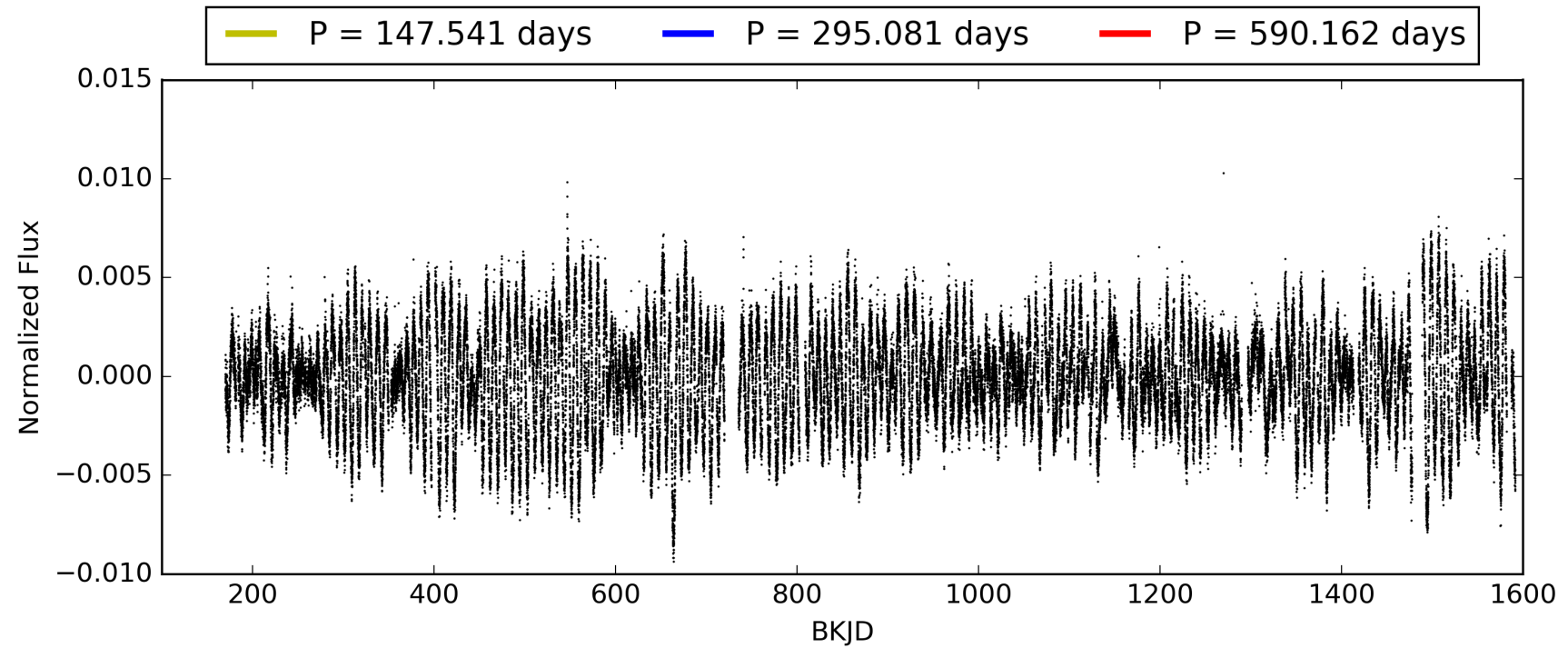
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 29-Jan-2016 19:04:03 Z

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

# TCE 009398382-03, PDC Light Curves

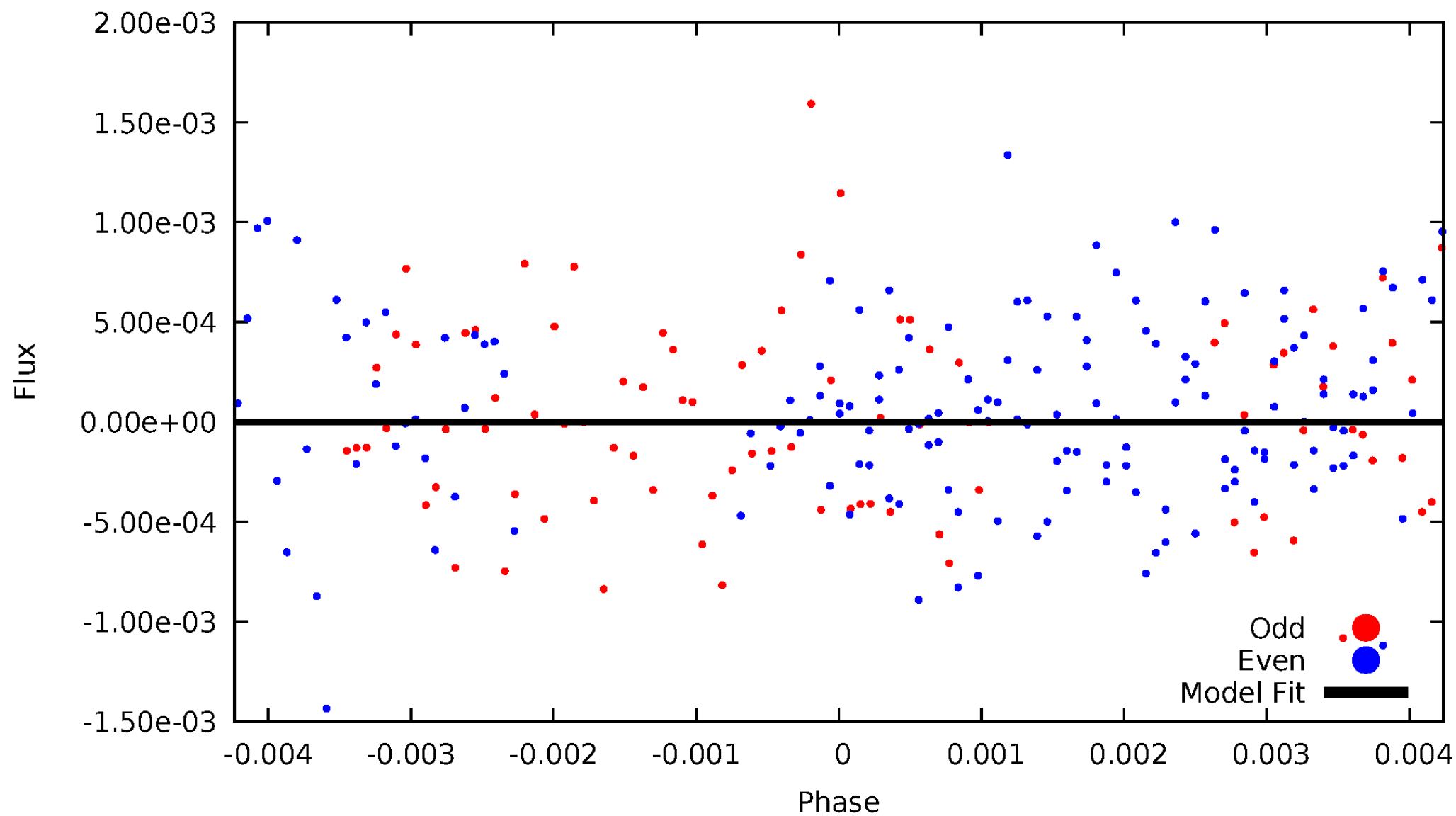


TCE 009398382-03



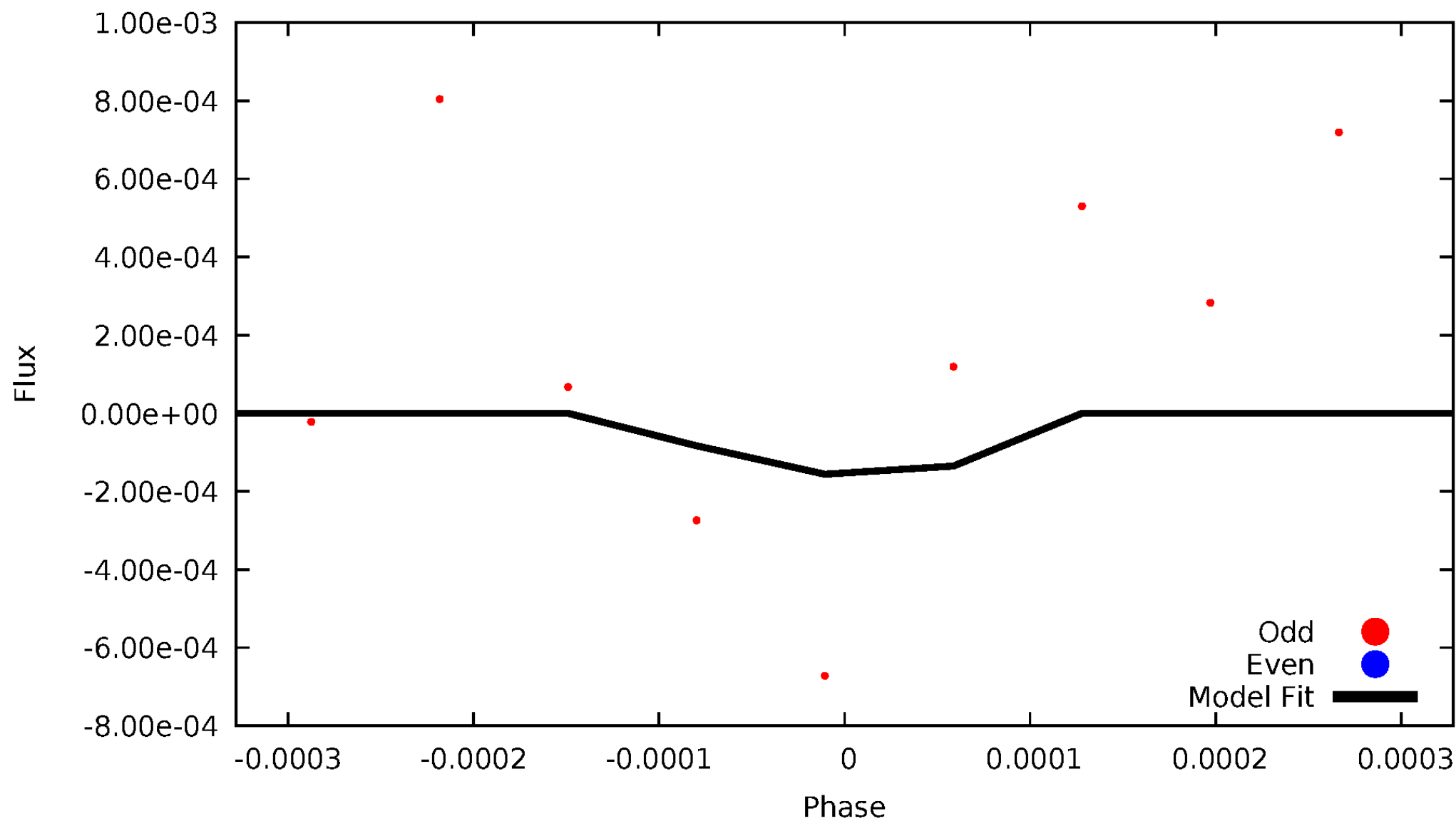
# DV Odd/Even

TCE 009398382-03



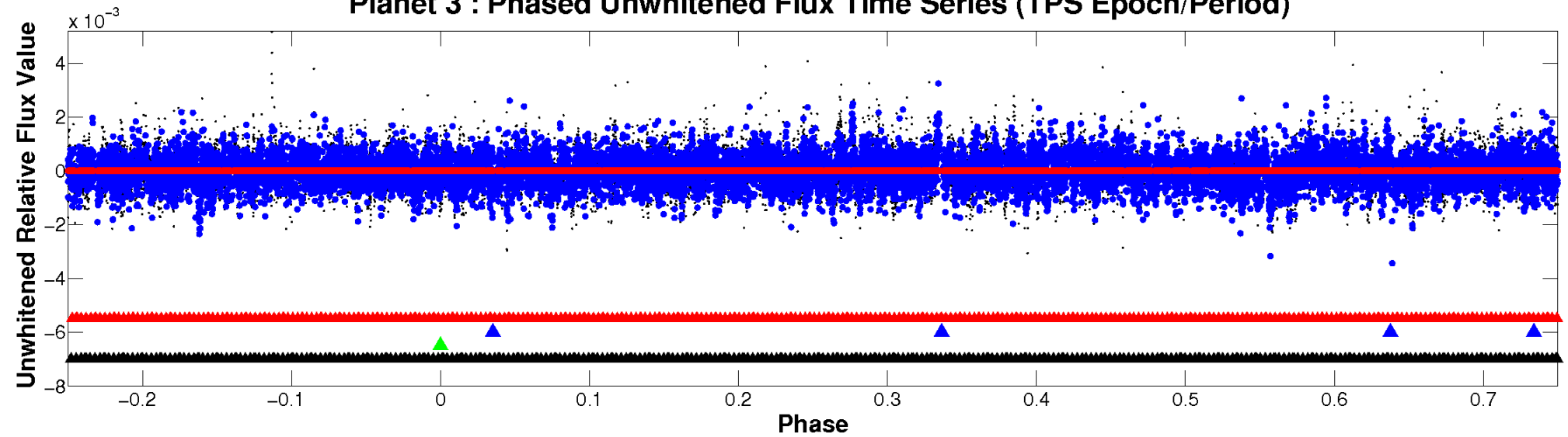
ALT Odd/Even

TCE 009398382-03

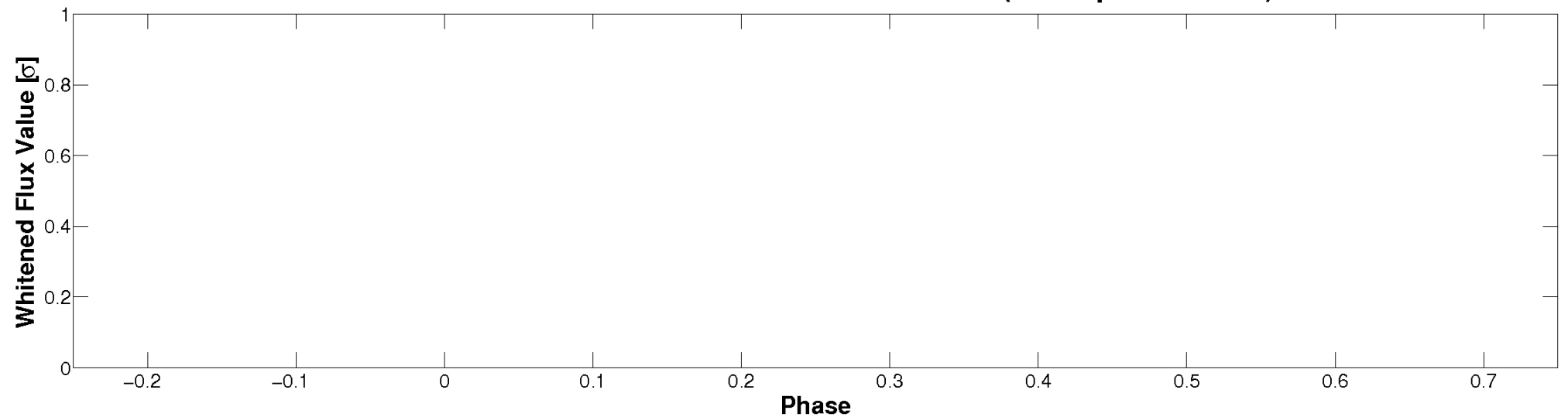


# Non-Whitened Vs. Whitened Light Curve

**Planet 3 : Phased Unwhitened Flux Time Series (TPS Epoch/Period)**

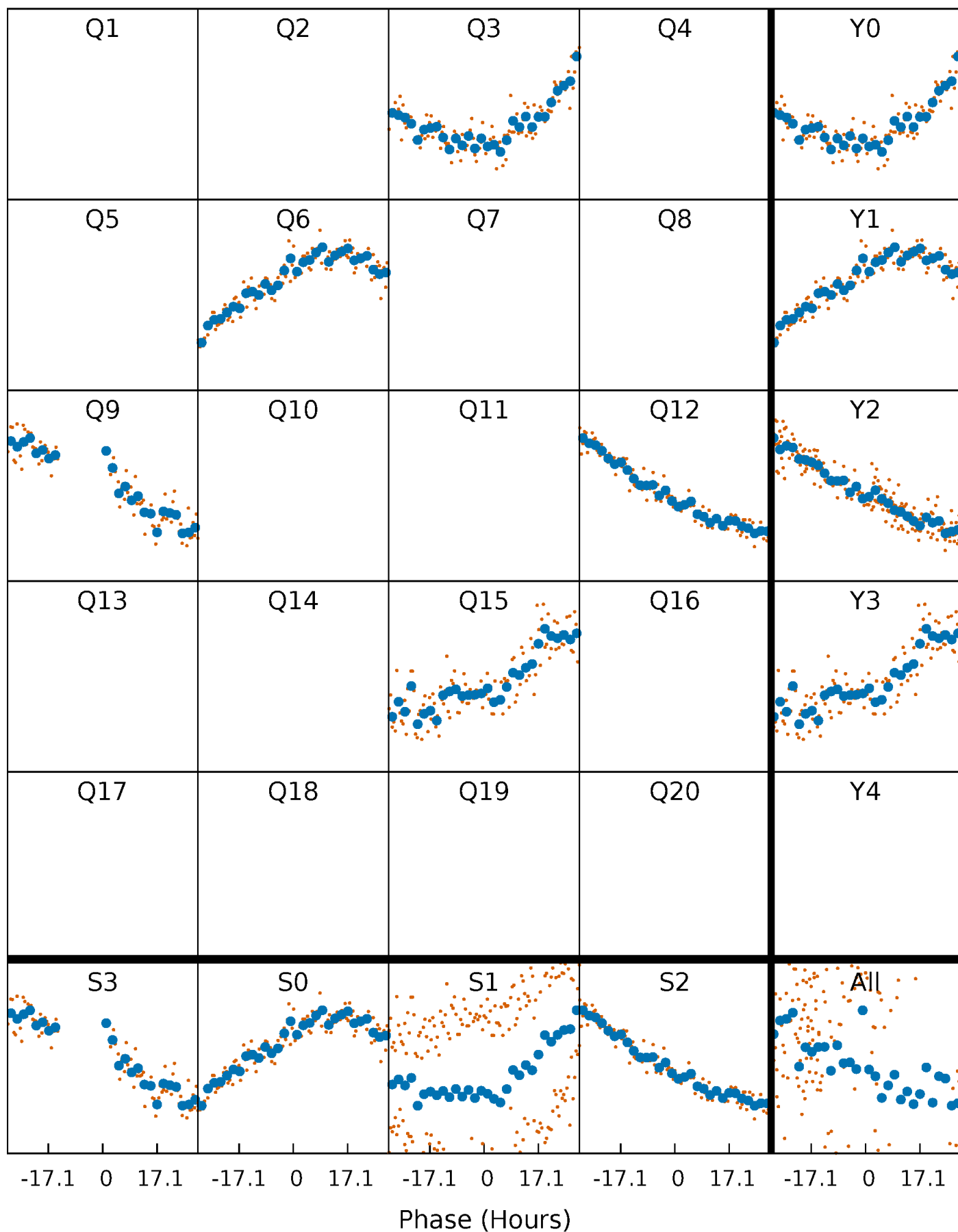


**Planet 3 : Phased Whitened Flux Time Series (TPS Epoch/Period)**



# PDC Quarter-Phased Transit Curves

TCE 009398382-03     $P=295.081040$  Days     $T_0=284.537925$  (BKJD)





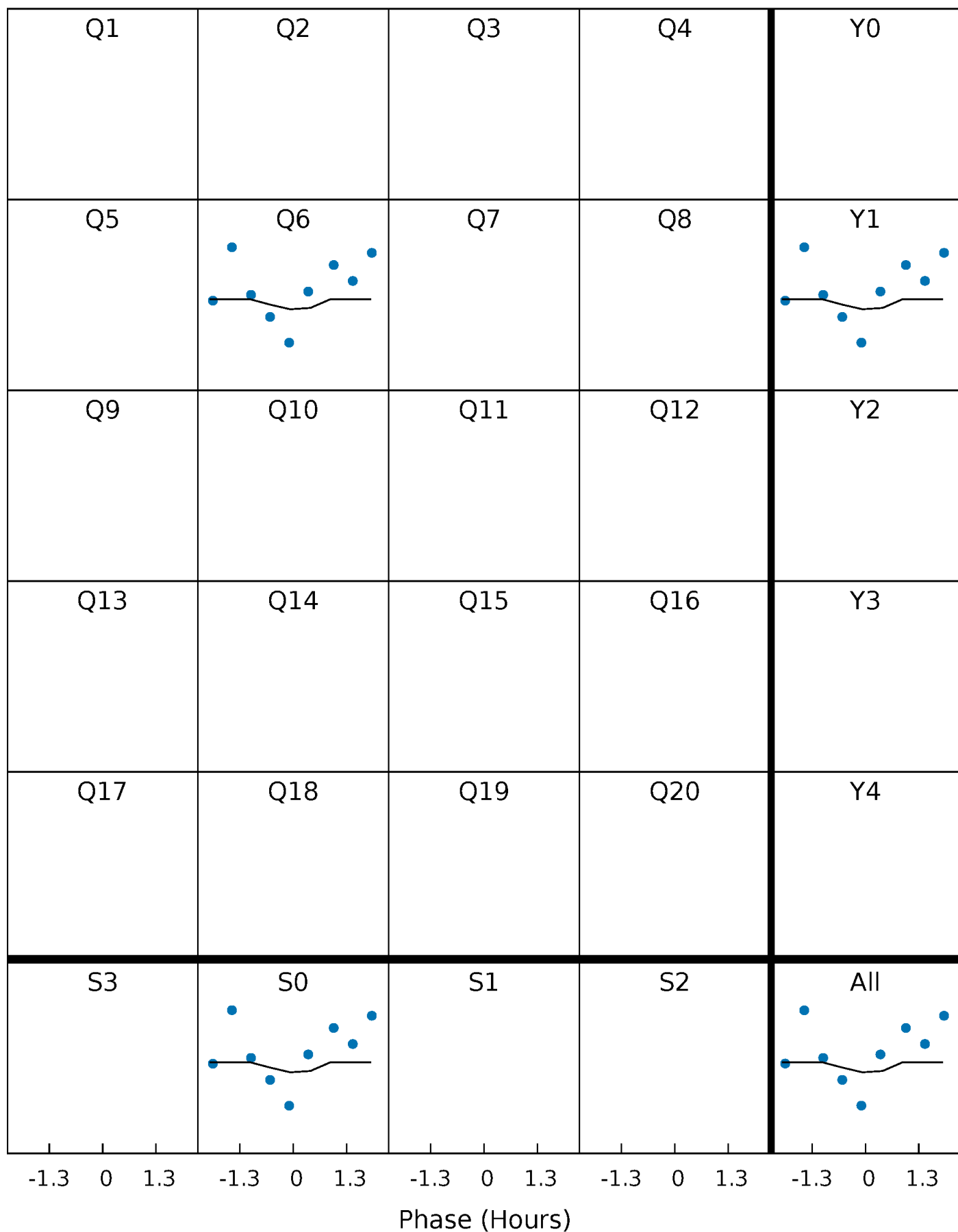
# DV Quarter-Phased Transit Curves

TCE 009398382-03     $P=295.081040$  Days     $T_0=284.537925$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

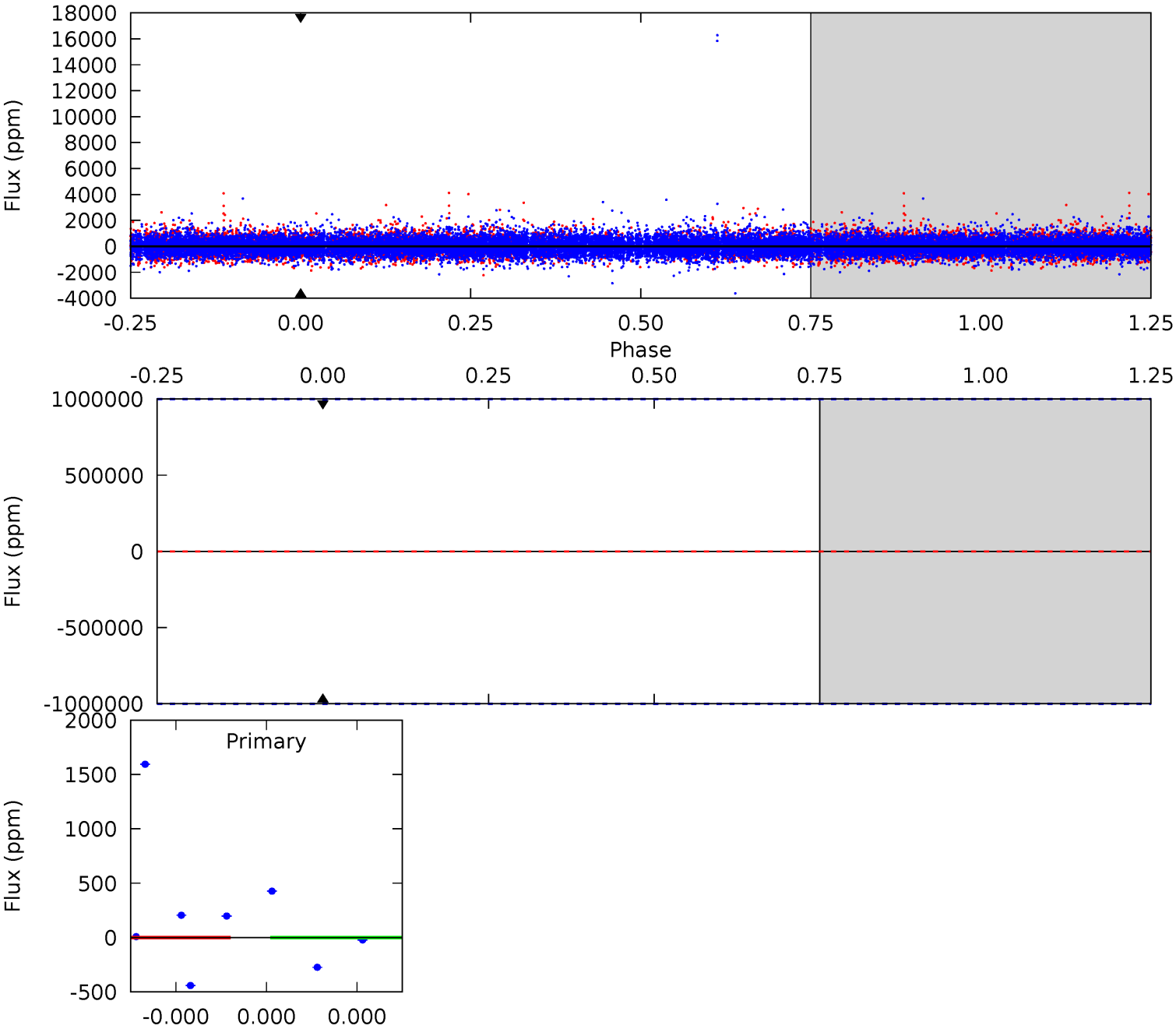
TCE 009398382-03 P=295.081040 Days  $T_0=284.054572$  (BKJD)



DV Model-Shift Uniqueness Test

009398382-03, P = 295.081040 Days, E = 284.537925 Days

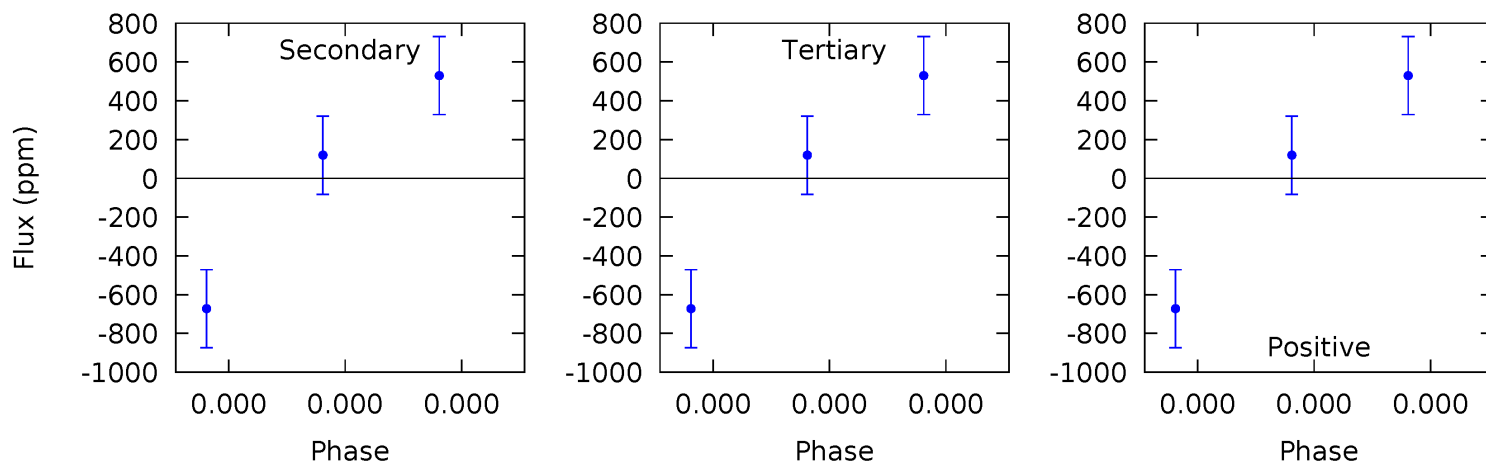
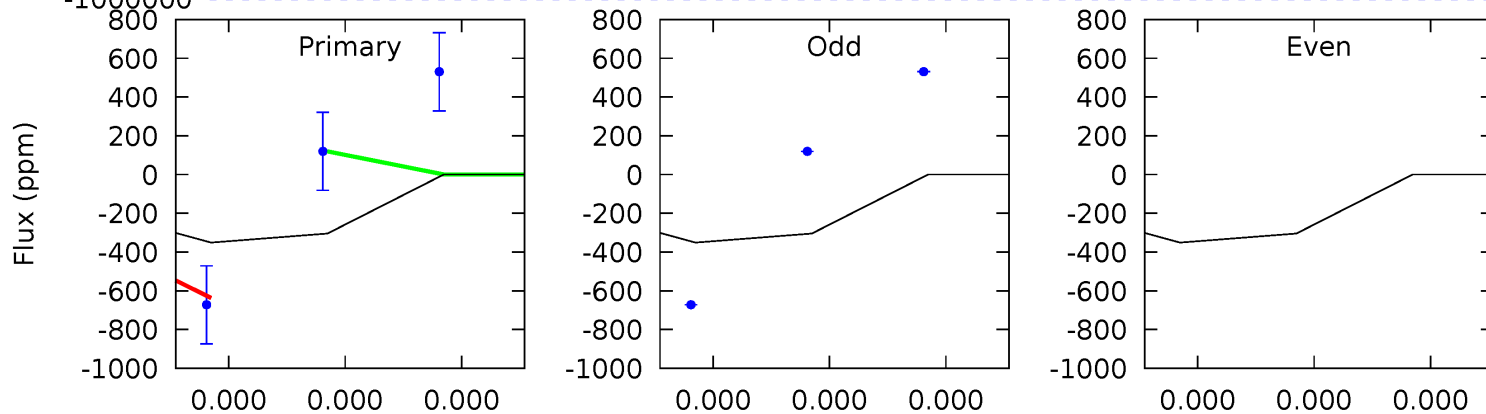
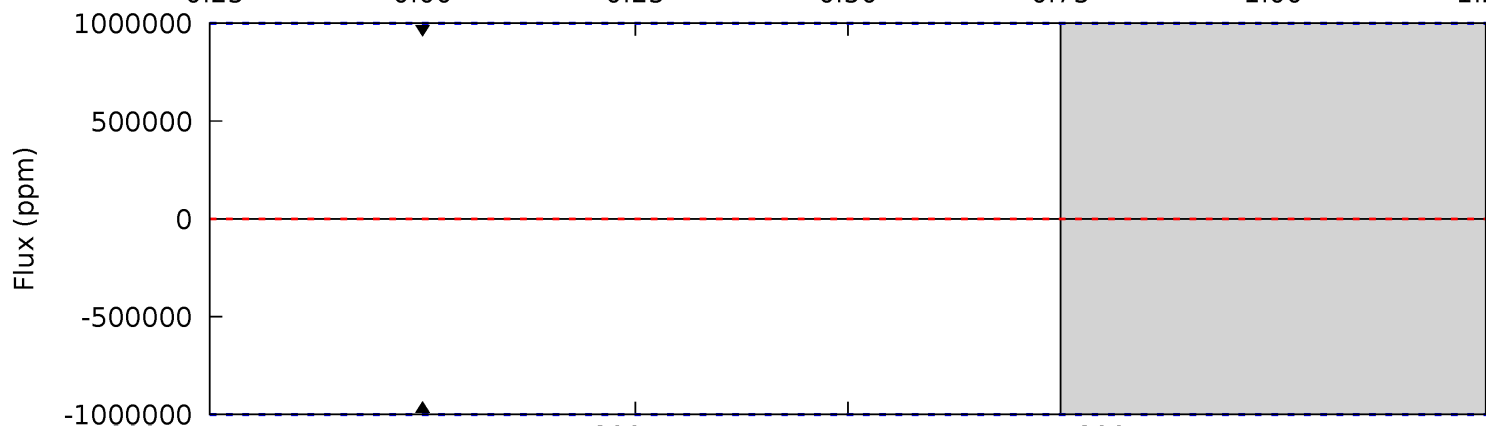
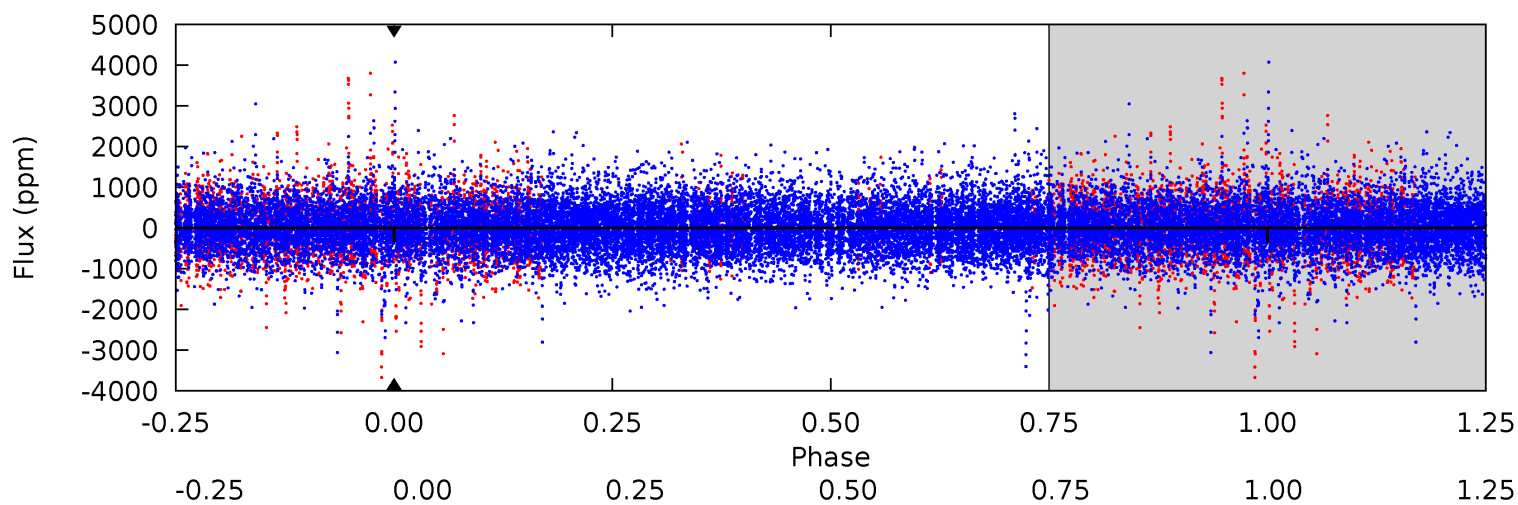
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
0	0	0	0	1.00	1.00	1.00	0	0	0	0	0	0	0	0



# Alt Model-Shift Uniqueness Test

009398382-03, P = 295.081040 Days, E = 284.054572 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
0	0	0	0	1.00	1.00	1.00	0	0	0	0	0	0	0	0.00



### Stellar Parameters For KIC 009398382

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5534^{+166}_{-166}$	$4.562^{+0.032}_{-0.179}$	$0.070^{+0.250}_{-0.300}$	$0.849^{+0.213}_{-0.071}$	$0.960^{+0.083}_{-0.111}$	$2.205^{+0.386}_{-1.048}$
	+3%/-3%	+1%/-4%	+357%/-429%	+25%/-8%	+9%/-12%	+17%/-48%
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 009398382-03 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$0 \pm 1000000$	$7.85^{+8.37}_{-5.42}$	$349^{+21}_{-15}$	$-4531^{+21114}_{-12471}$	$-17528.165^{+1182790.752}_{-1083753.774}$
Alt.	$-0 \pm 1000000$	$6.99^{+7.86}_{-4.98}$	$348^{+22}_{-15}$	$4190^{+18216}_{-22412}$	$12765^{+1804488}_{-1381047}$

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

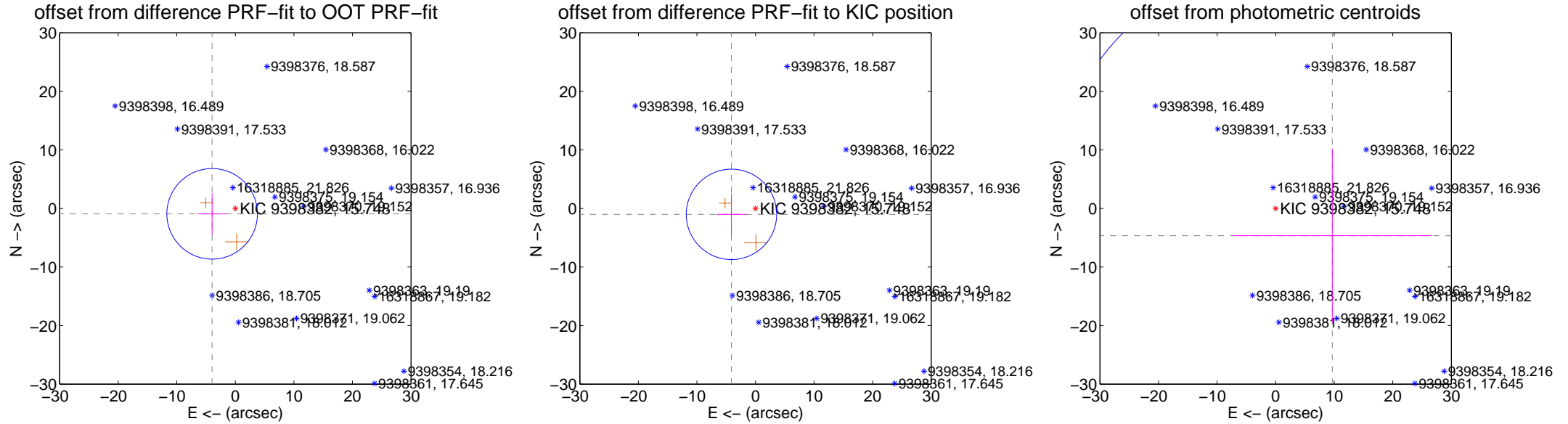
## DV Centroid Data

Supplemental centroid analysis for 009398382-03. Kepler magnitude: 15.75. Transit SNR -1.00

There are 0 quarters with good PRF difference image offsets

The direct PRF centroid is offset from the target star catalog position by about 0.22 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$4.069 \pm 2.578$	1.58	$3.962 \pm 2.517$	$-0.924 \pm 3.510$
PRF-fit source offset from KIC position	$4.227 \pm 2.573$	1.64	$4.104 \pm 2.502$	$-1.011 \pm 3.552$
photometric centroid source offset	$10.73 \pm 16.59$	0.65	$-9.67 \pm 16.97$	$-4.65 \pm 14.85$



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



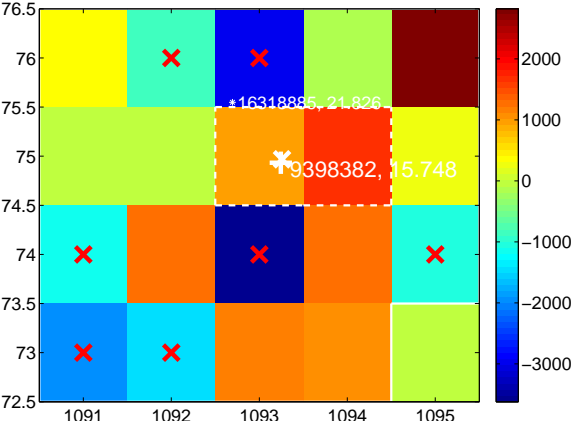
Q2 no difference image



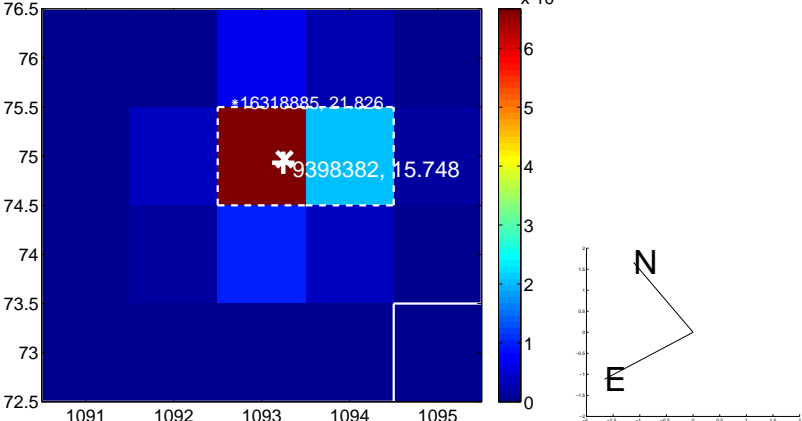
Q2 no OOT image



Q3 difference image. Poor Quality



Q3 OOT image



Q4 no difference image

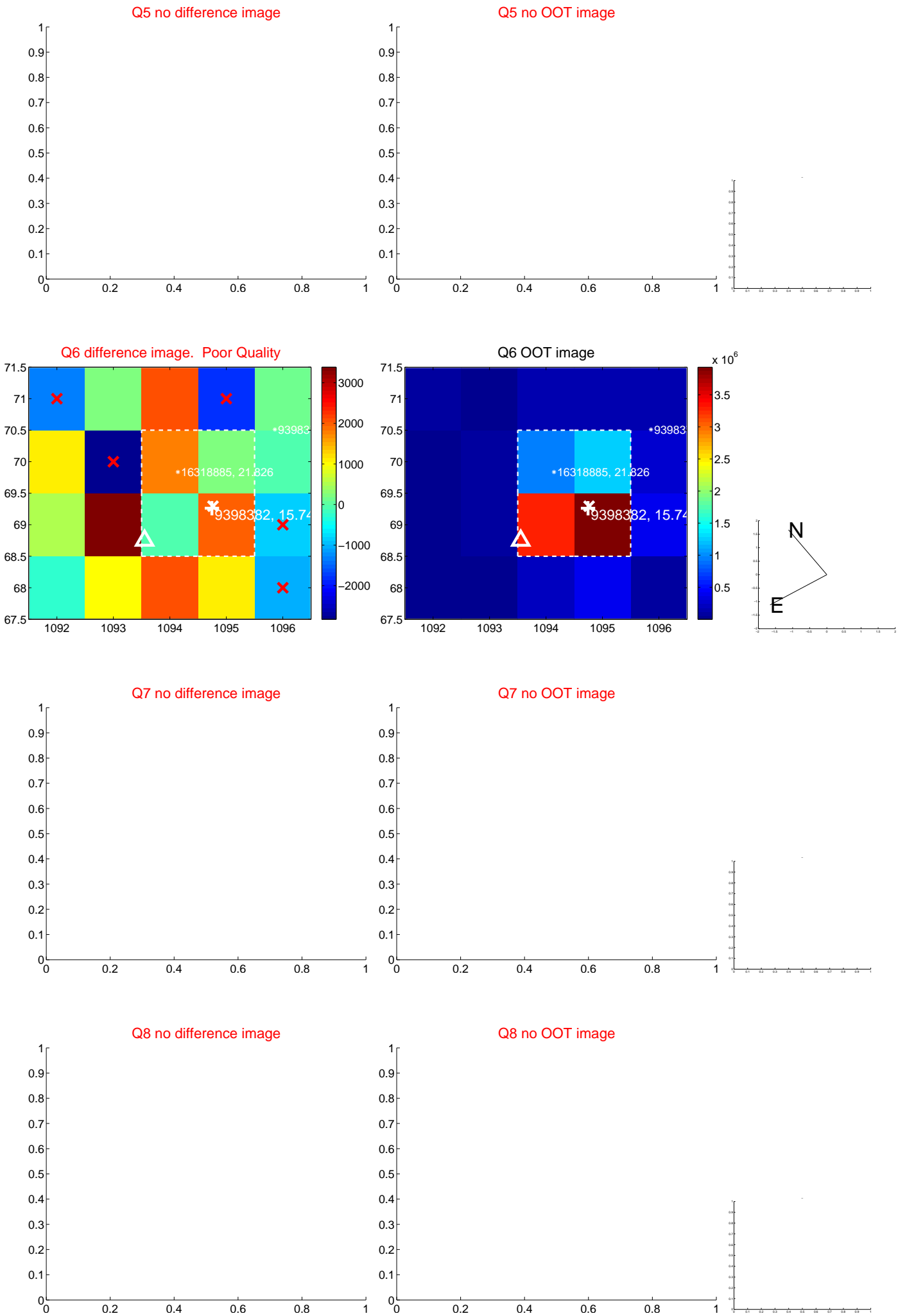


Q4 no OOT image

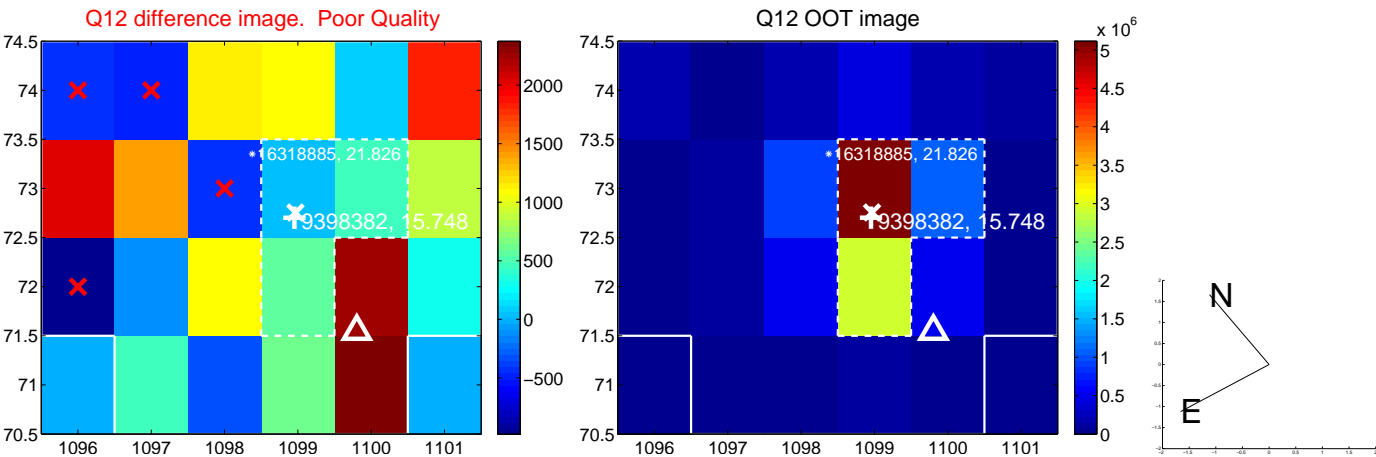




white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



white ×: 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.

Q13 no difference image



Q13 no OOT image



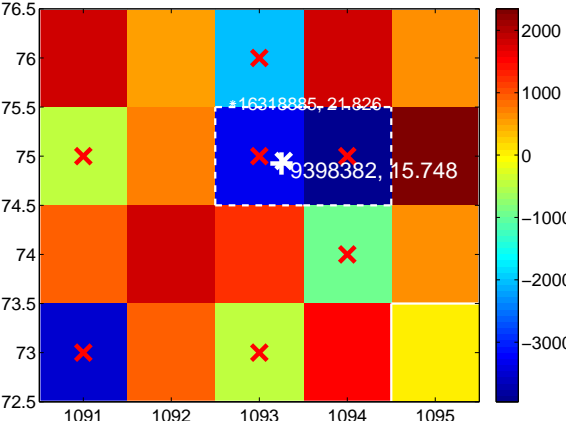
Q14 no difference image



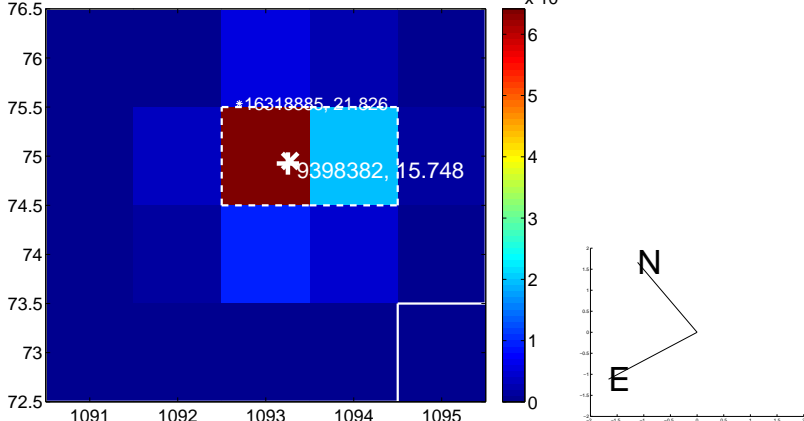
Q14 no OOT image



Q15 difference image. Poor Quality



Q15 OOT image



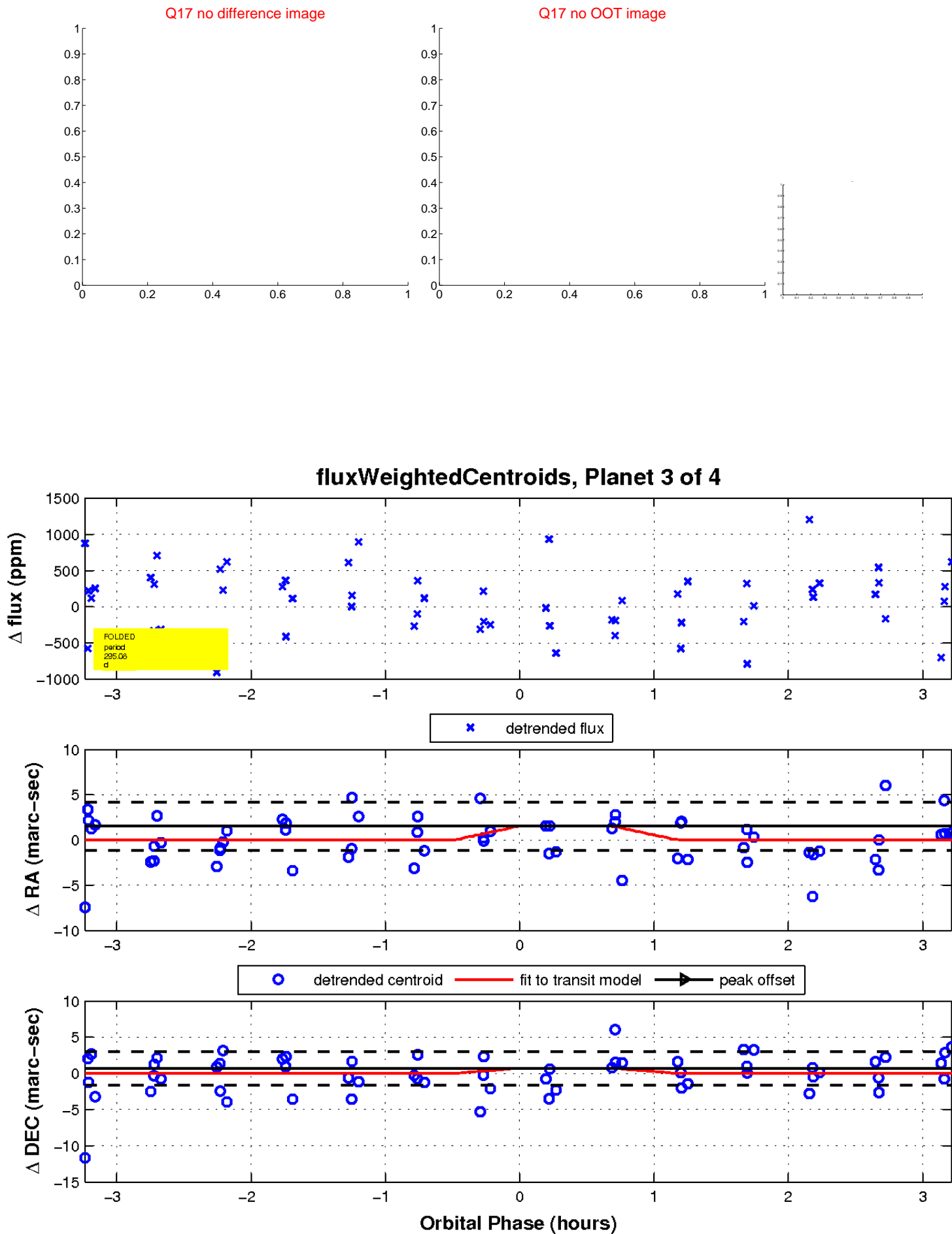
Q16 no difference image



Q16 no OOT image

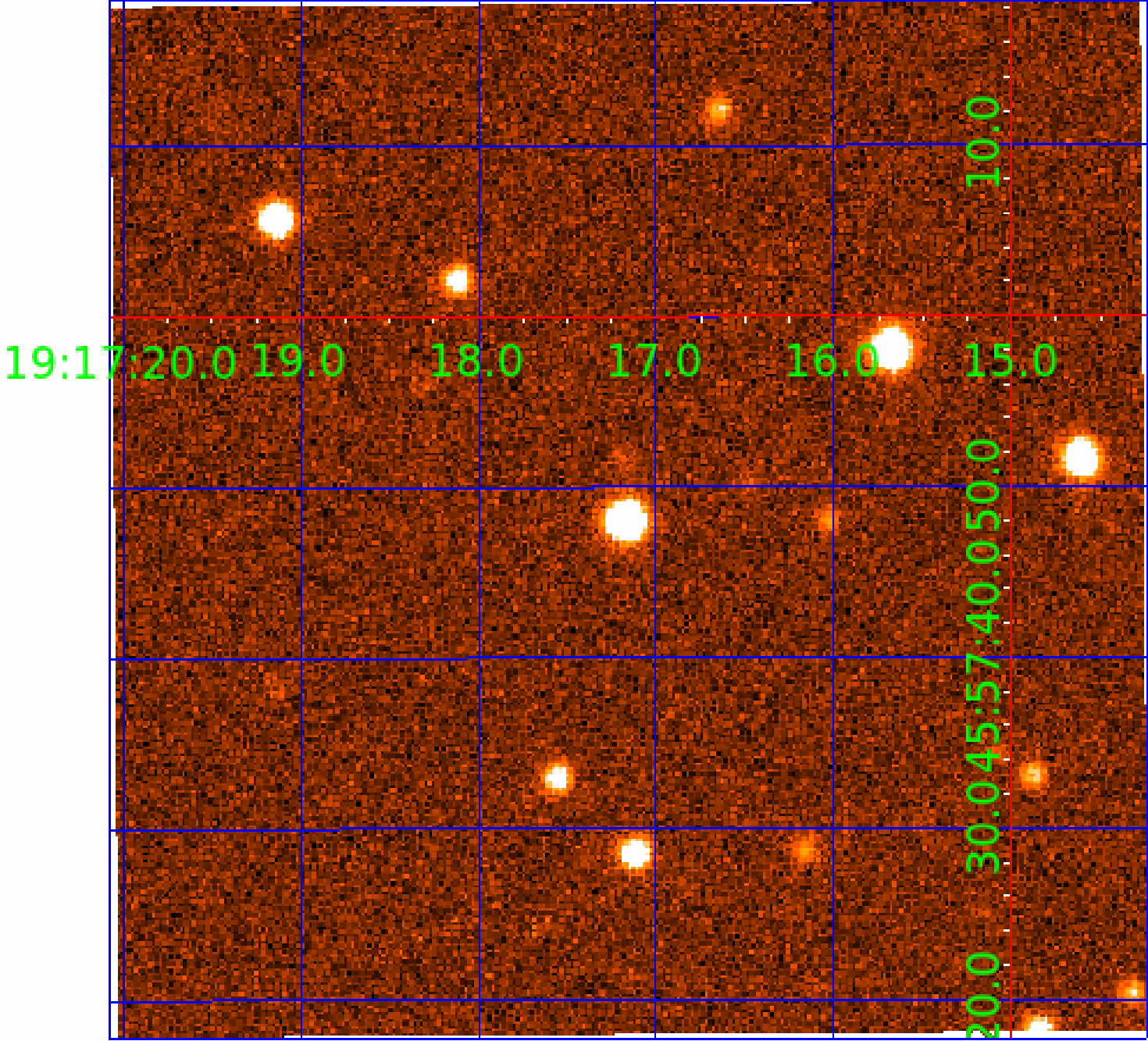


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 009398382

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009398382-01	OBS	No	3.722935	134.371425	110.5	18.921	9.1	8.1	0.85	5534	0.88	281.71
009398382-02	OBS	No	383.968644	206.033420	1679.8	24.208	19.5	9.9	0.85	5534	6.48	0.58
009398382-03	OBS	No	295.081040	284.537925	944.7	15.000	9.8	-1.0	0.85	5534	2.56	0.83
009398382-04	OBS	No	3.722660	132.460227	119.8	13.753	9.2	11.3	0.85	5534	1.07	281.74

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009398382-01	OBS	FP	0.00	1	0	0	0	LPP_DV
009398382-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009398382-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—NO_FITS—INCONSISTENT_TRANS—CENT_NOFITS
009398382-04	OBS	FP	0.00	1	0	0	0	LPP_ALT—SAME_NTL_PERIOD

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

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

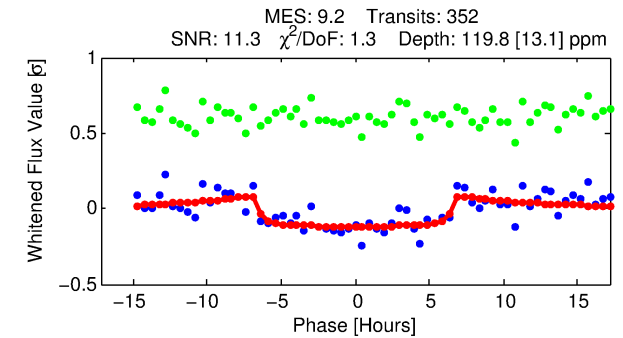
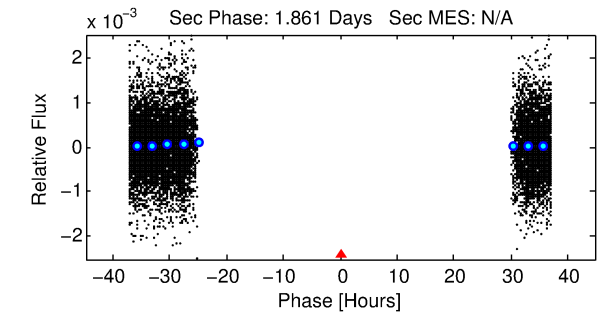
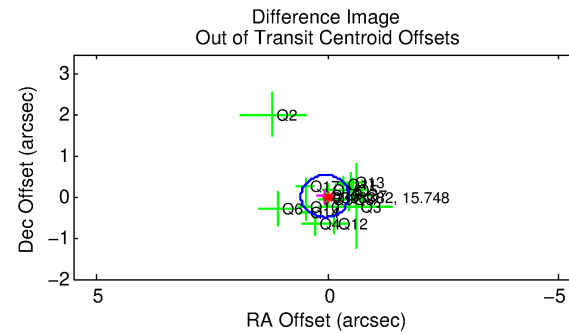
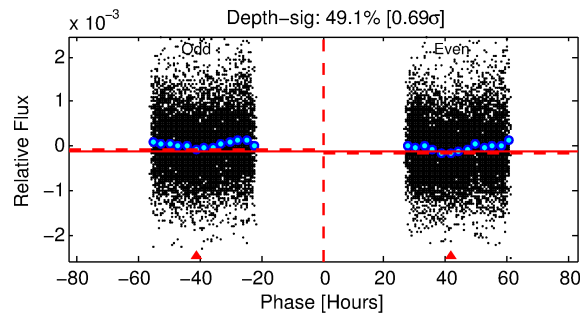
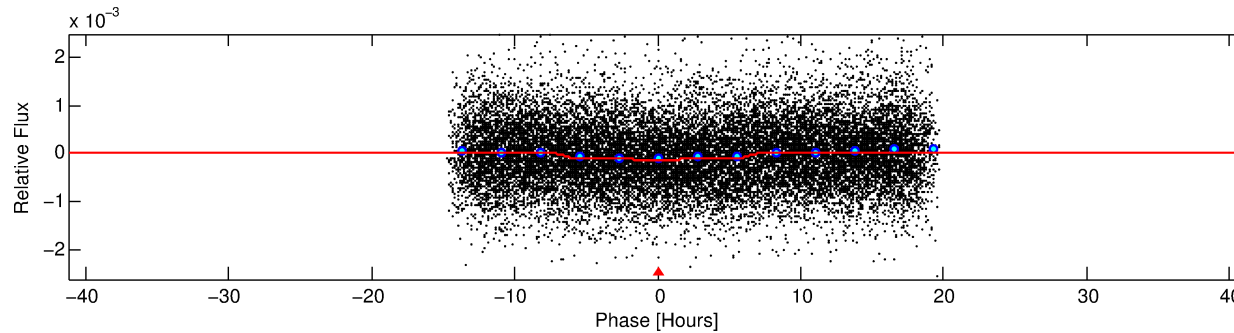
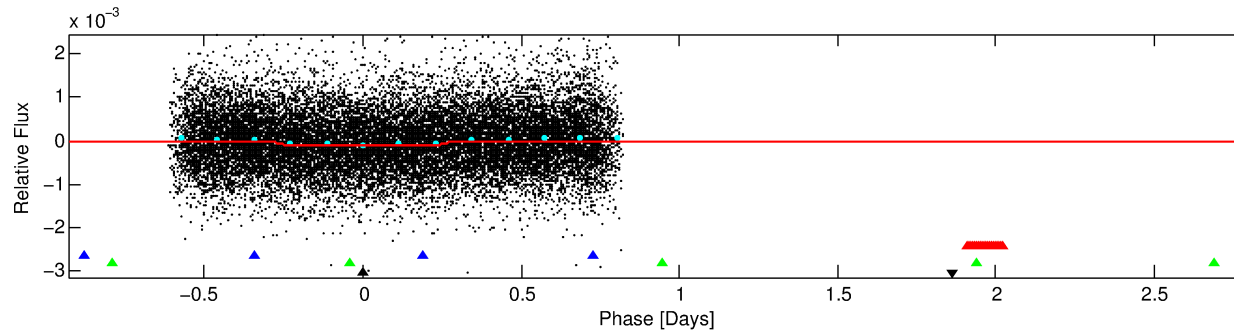
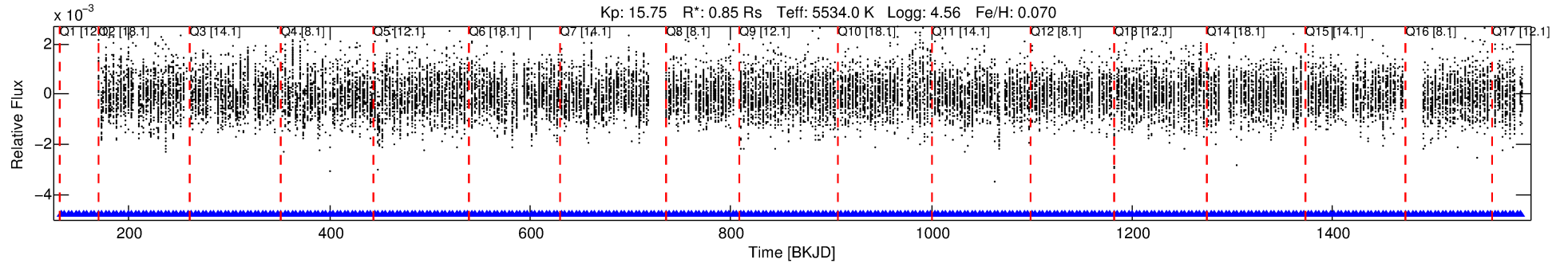
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 009398382-04

No Significant Match Found

# DV One-Page Summary

KIC: 9398382 Candidate: 4 of 4 Period: 3.723 d



## DV Fit Results:

Period = 3.72266 [0.00006] d  
Epoch = 132.4602 [0.0108] BKJD  
Rp/R\* = 0.0115 [0.0023]  
a/R\* = 1.44 [0.63]  
b = 0.85 [0.27]  
Seff = 281.74 [96.73]  
Teq = 1045 [90] K  
Rp = 1.07 [0.34] Re  
a = 0.0464 [0.0100] AU

## DV Diagnostic Results:

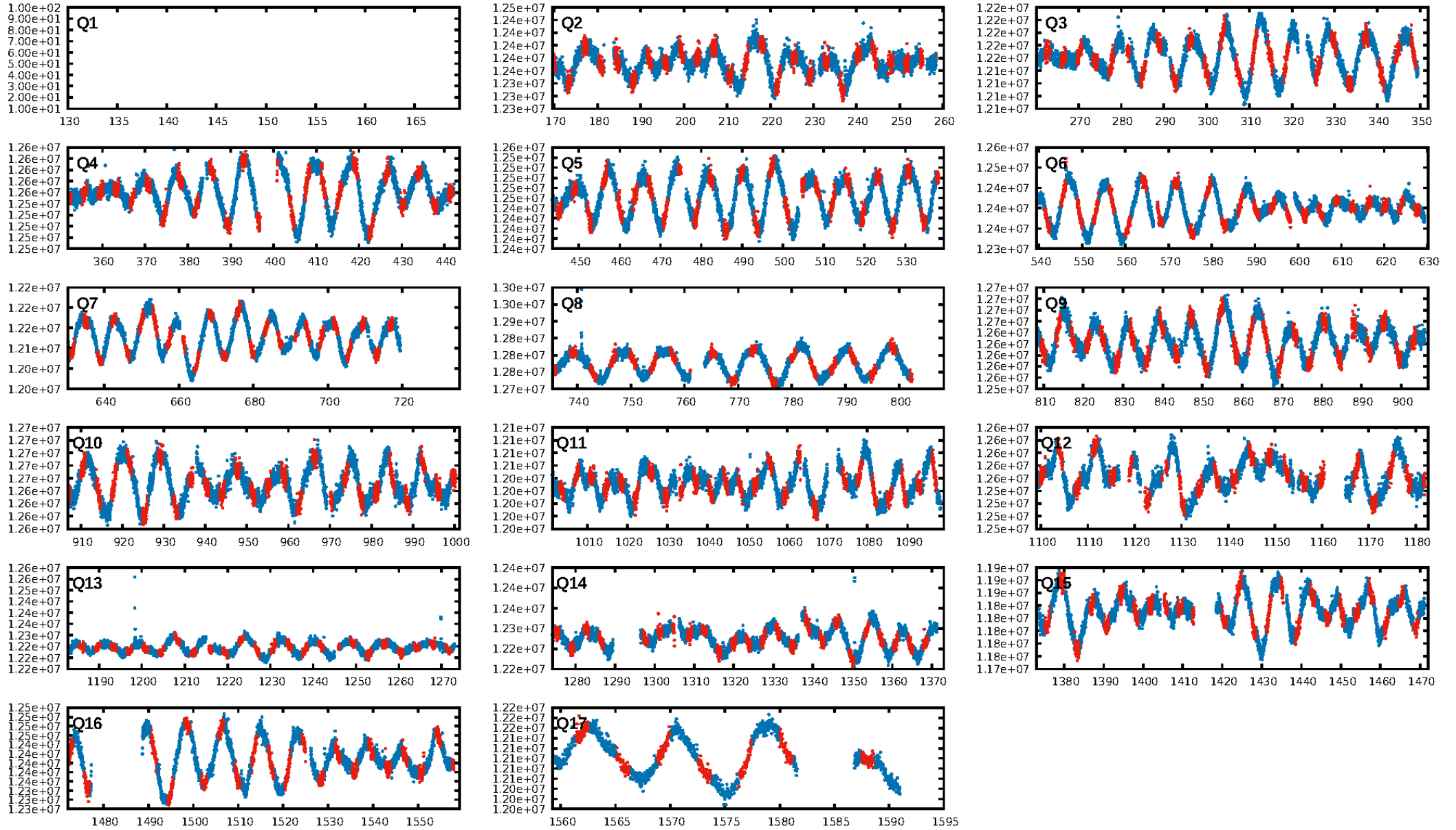
ShortPeriod-sig: N/A  
LongPeriod-sig: 0.0% [0.00 $\sigma$ ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [345/345]  
GhostDiagnostic-chr: 3.213  
Centroid-sig: 0.1%  
Centroid-so: 2.308 arcsec [2.97 $\sigma$ ]  
OotOffset-rm: 0.066 arcsec [0.38 $\sigma$ ]  
KicOffset-rm: 0.203 arcsec [1.50 $\sigma$ ]  
OotOffset-st: 4/4/4/4 [16]  
KicOffset-st: 4/4/4/4 [16]  
DiffImageQuality-fgm: 0.94 [15/16]  
DiffImageOverlap-fno: 1.00 [16/16]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 29-Jan-2016 19:04:11 Z

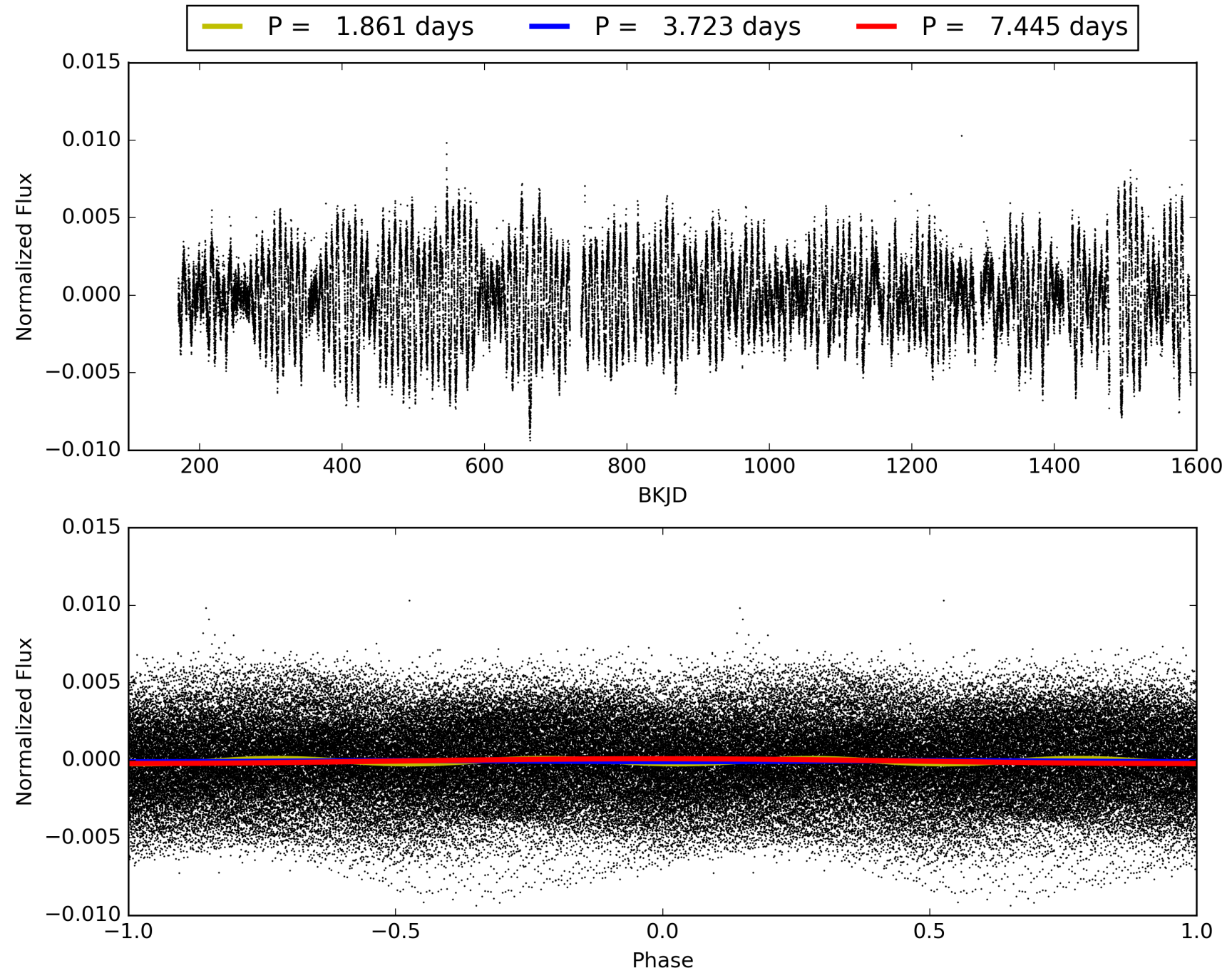
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center



# TCE 009398382-04, PDC Light Curves

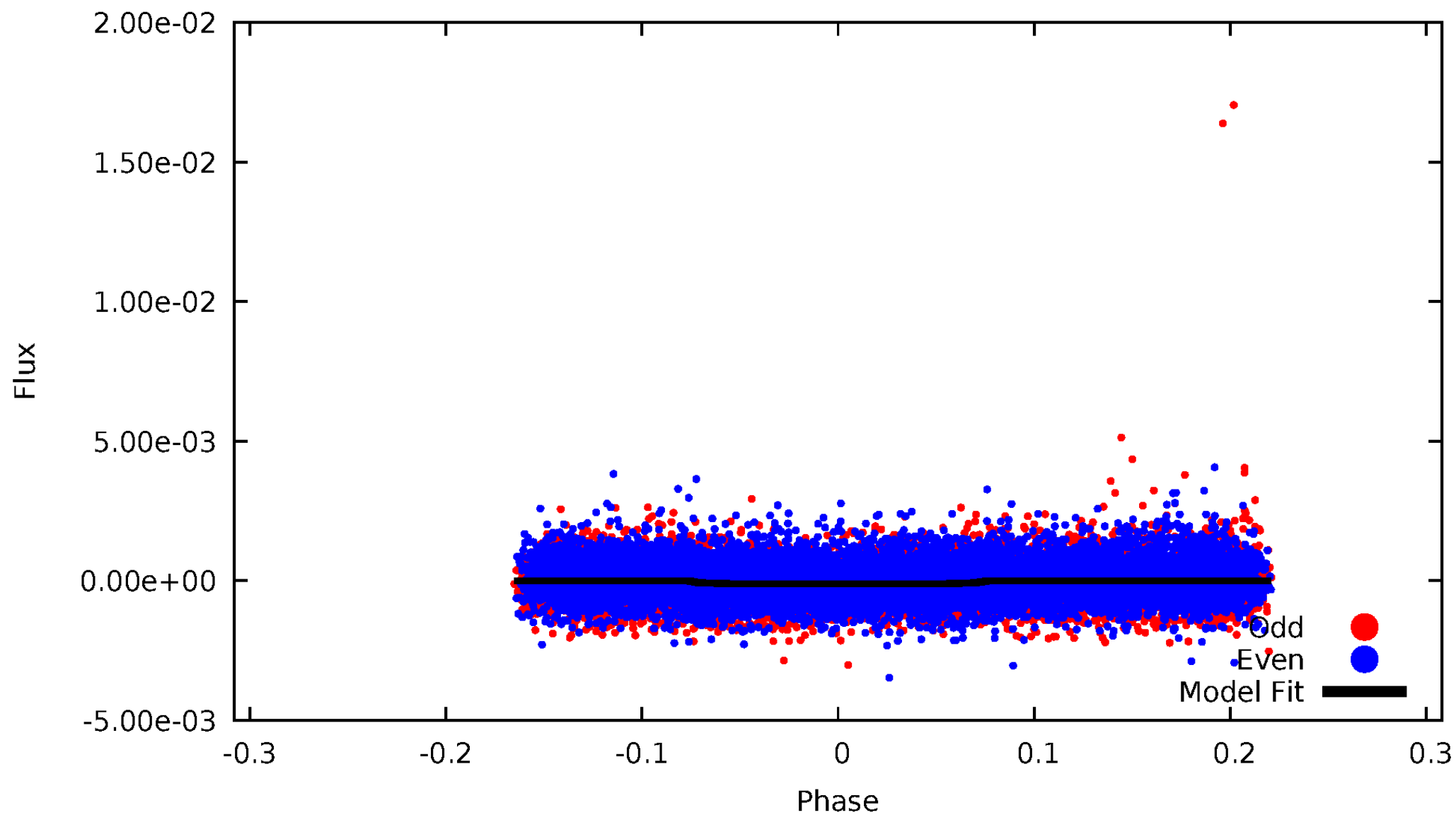


TCE 009398382-04



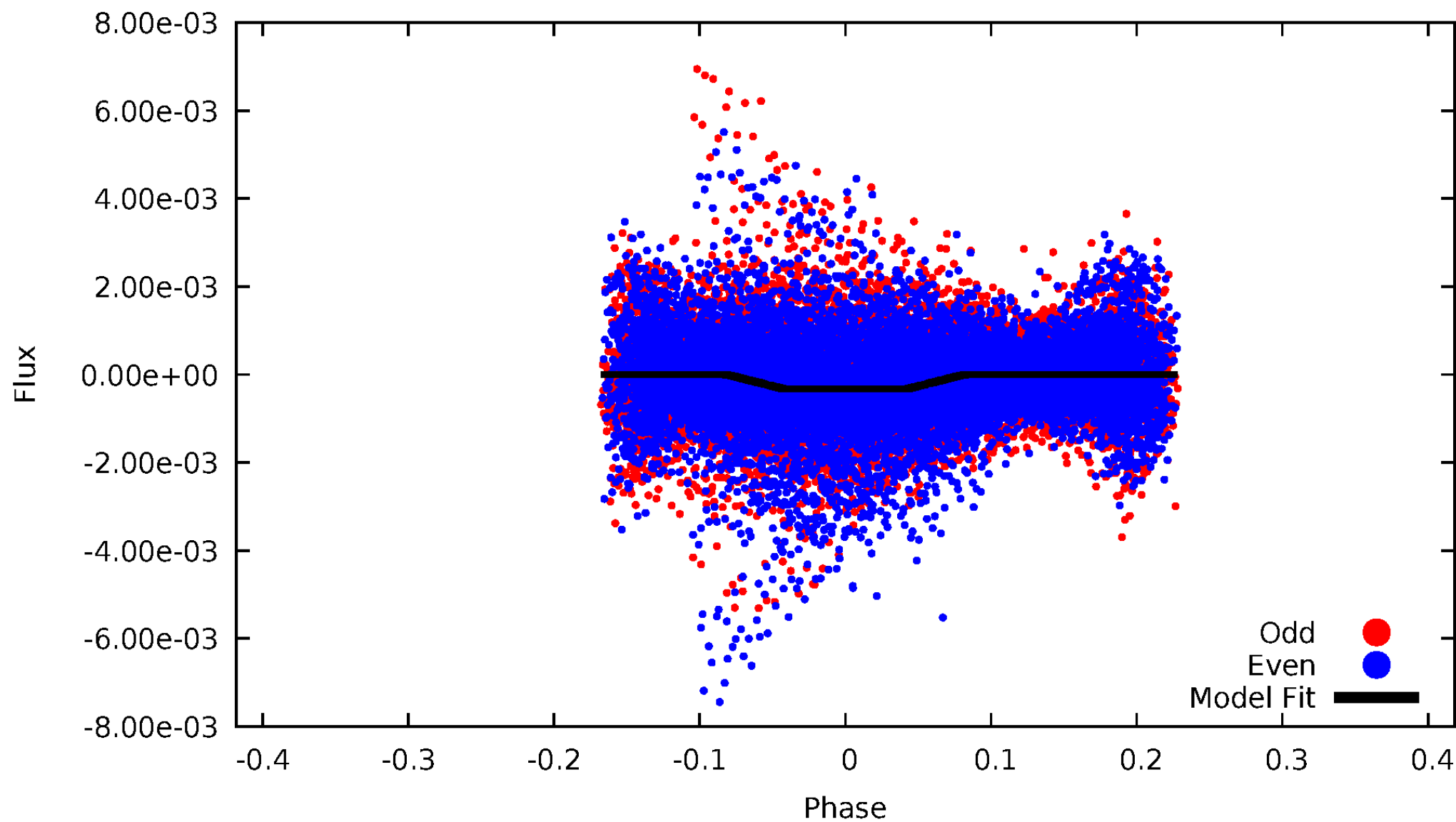
# DV Odd/Even

TCE 009398382-04



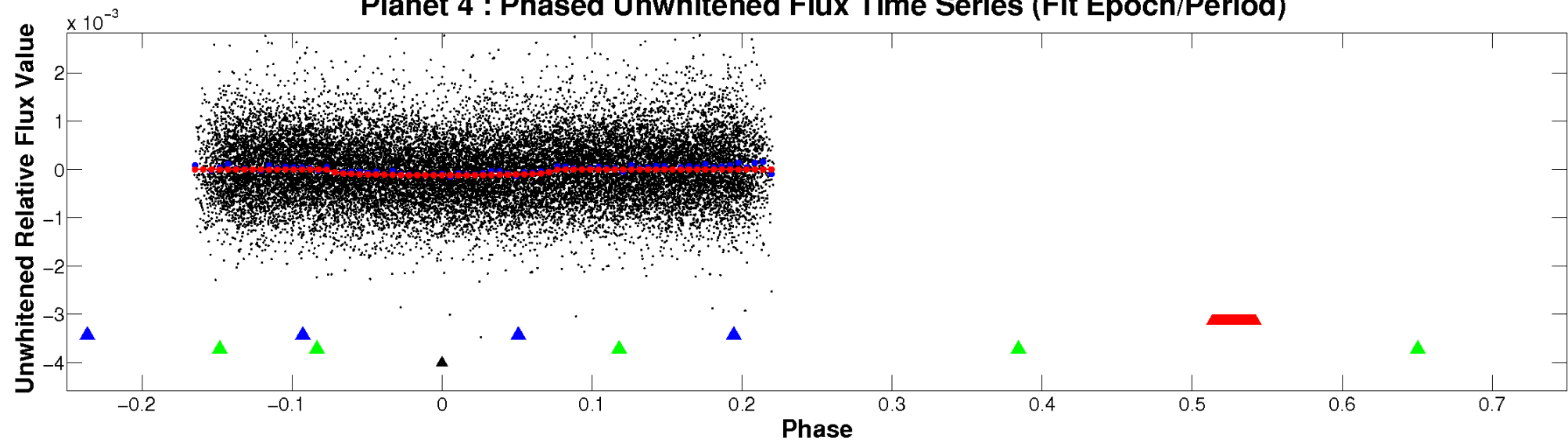
# ALT Odd/Even

TCE 009398382-04

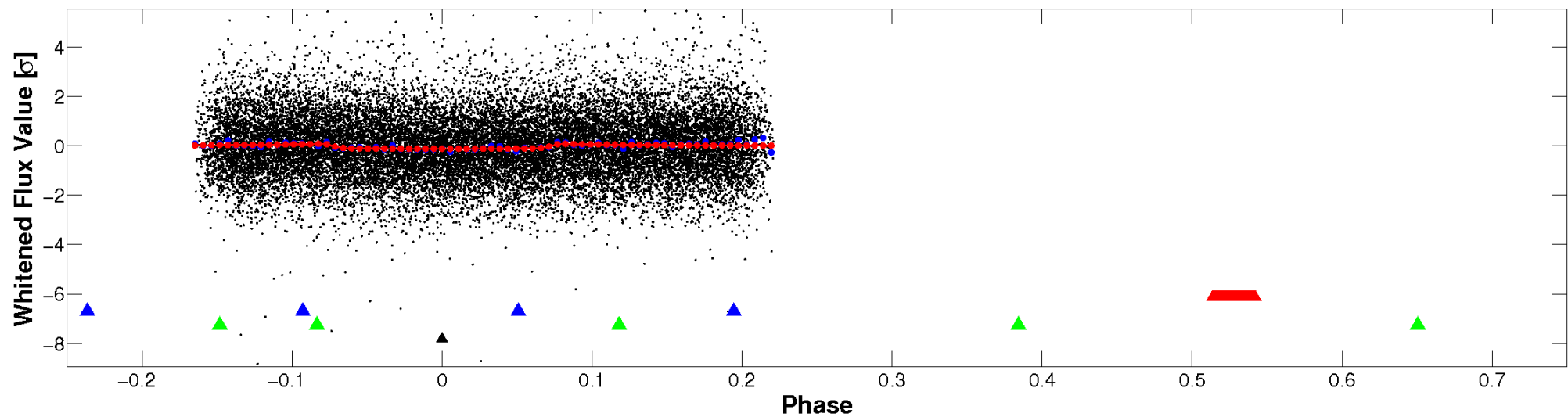


# Non-Whitened Vs. Whitened Light Curve

## Planet 4 : Phased Unwhitened Flux Time Series (Fit Epoch/Period)



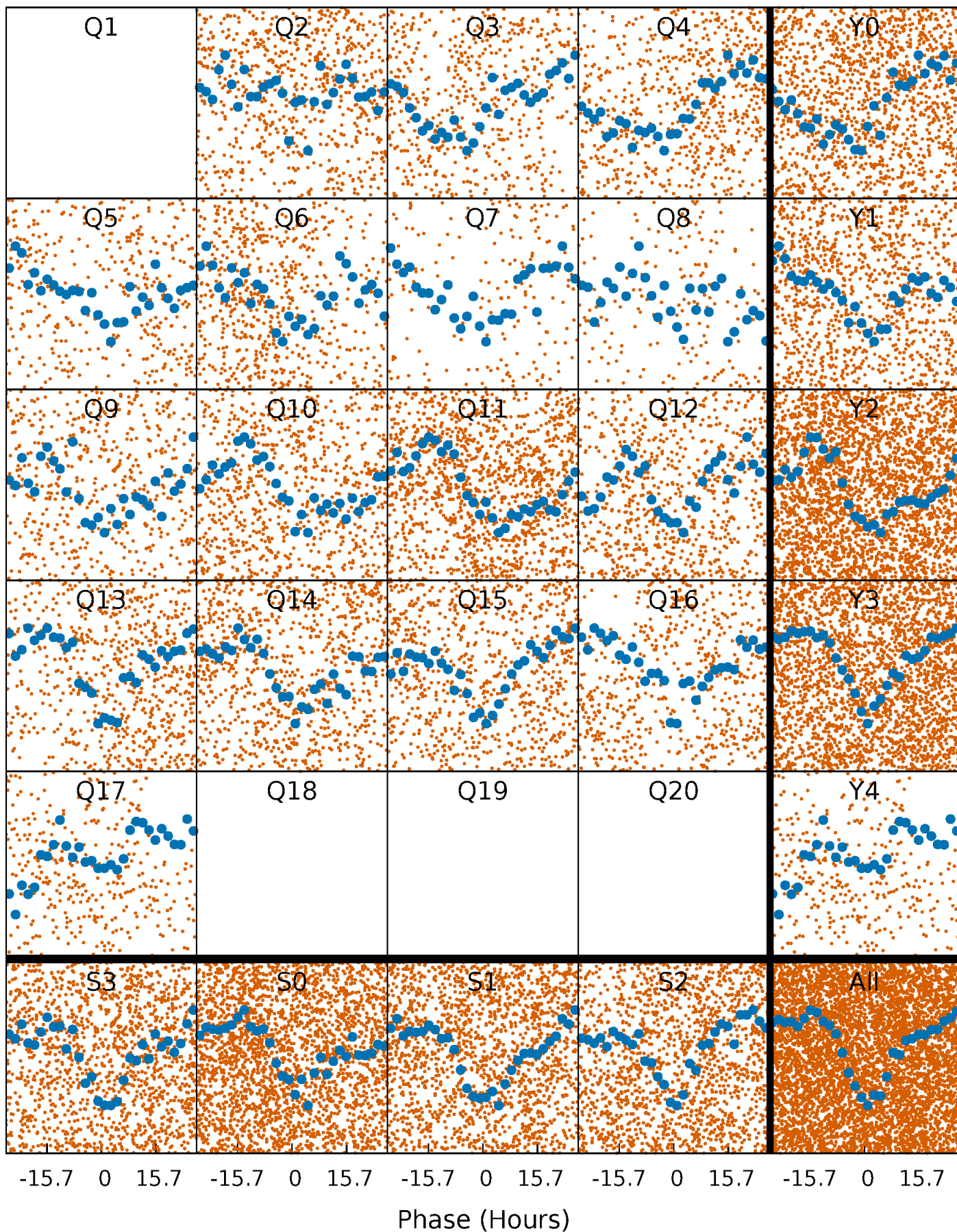
## Planet 4 : Phased Whitened Flux Time Series (Fit Epoch/Period)





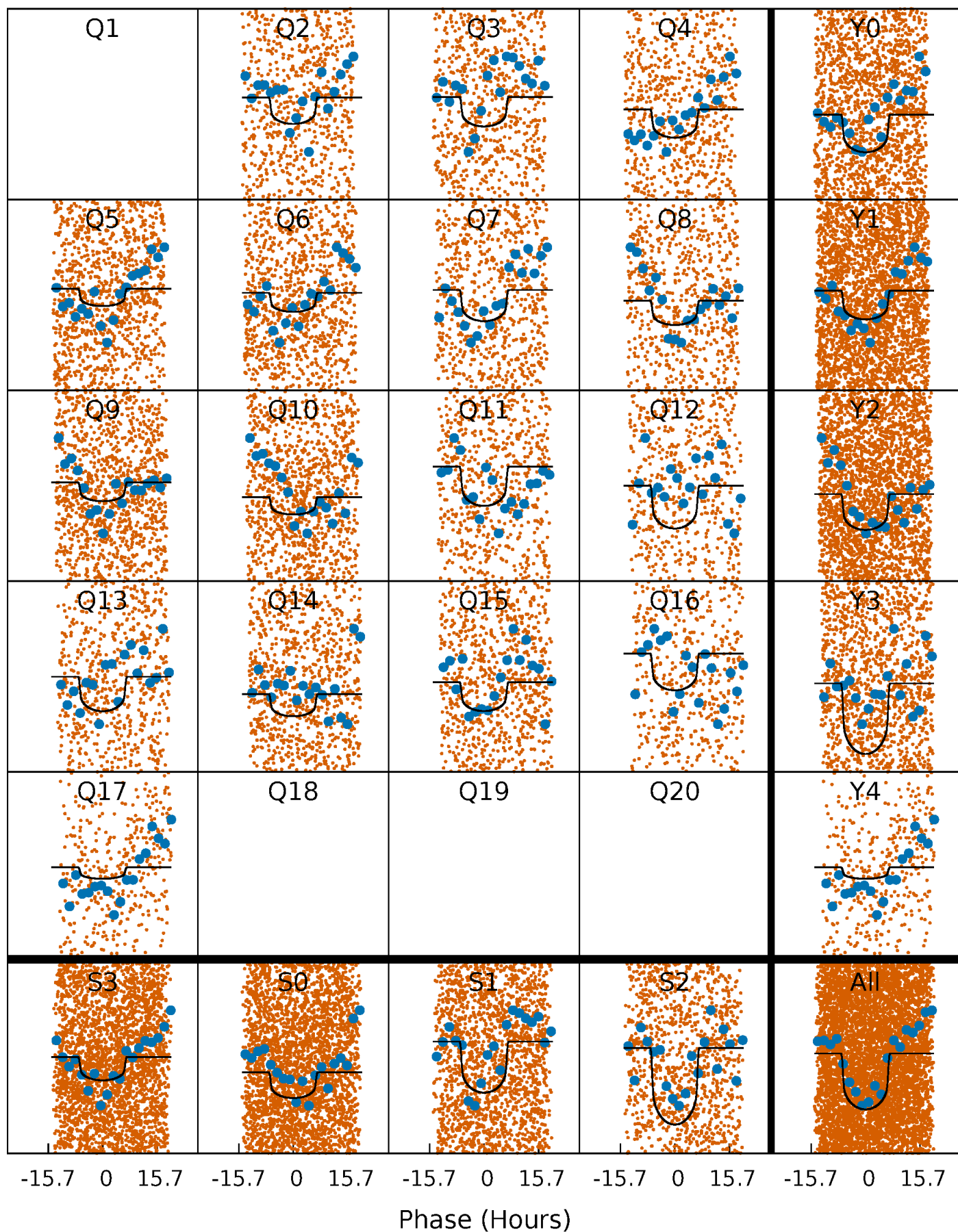
# PDC Quarter-Phased Transit Curves

TCE 009398382-04   P= 3.722660 Days    $T_0=132.460227$  (BKJD)



# DV Quarter-Phased Transit Curves

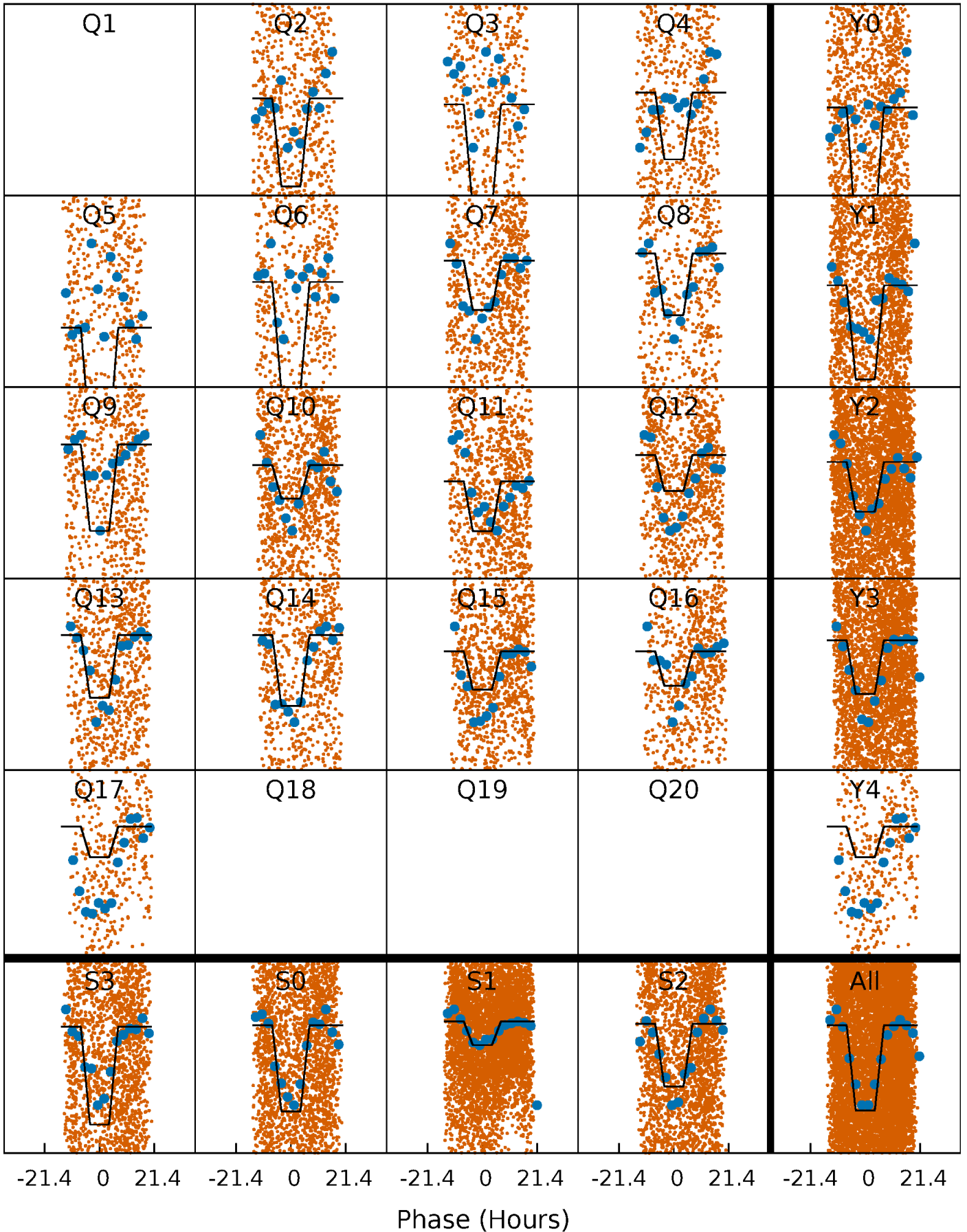
TCE 009398382-04   P= 3.722660 Days    $T_0=132.460227$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

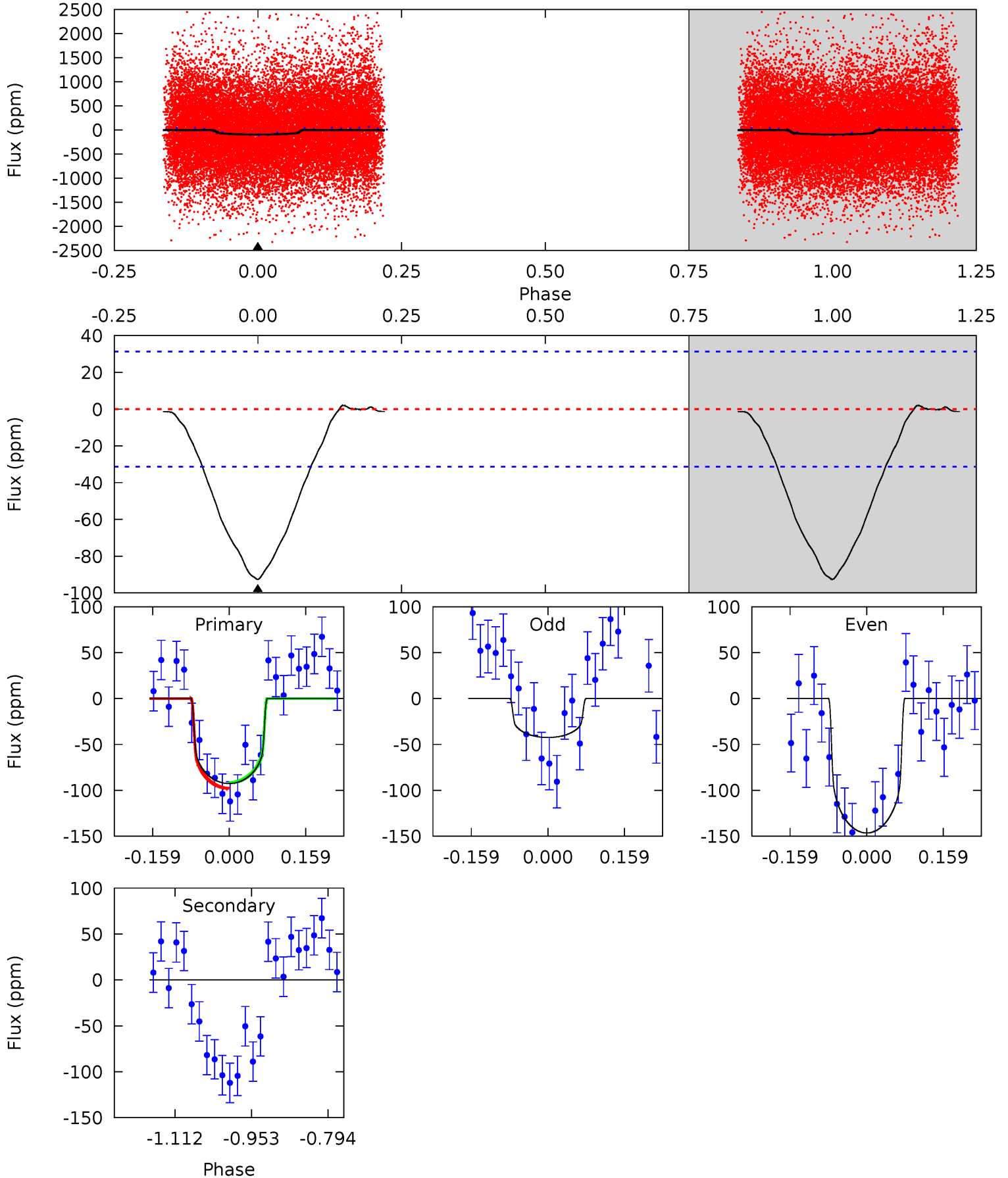
TCE 009398382-04     $P = 3.722559$  Days     $T_0 = 132.472203$  (BKJD)



# DV Model-Shift Uniqueness Test

009398382-04, P = 3.722660 Days, E = 132.460227 Days

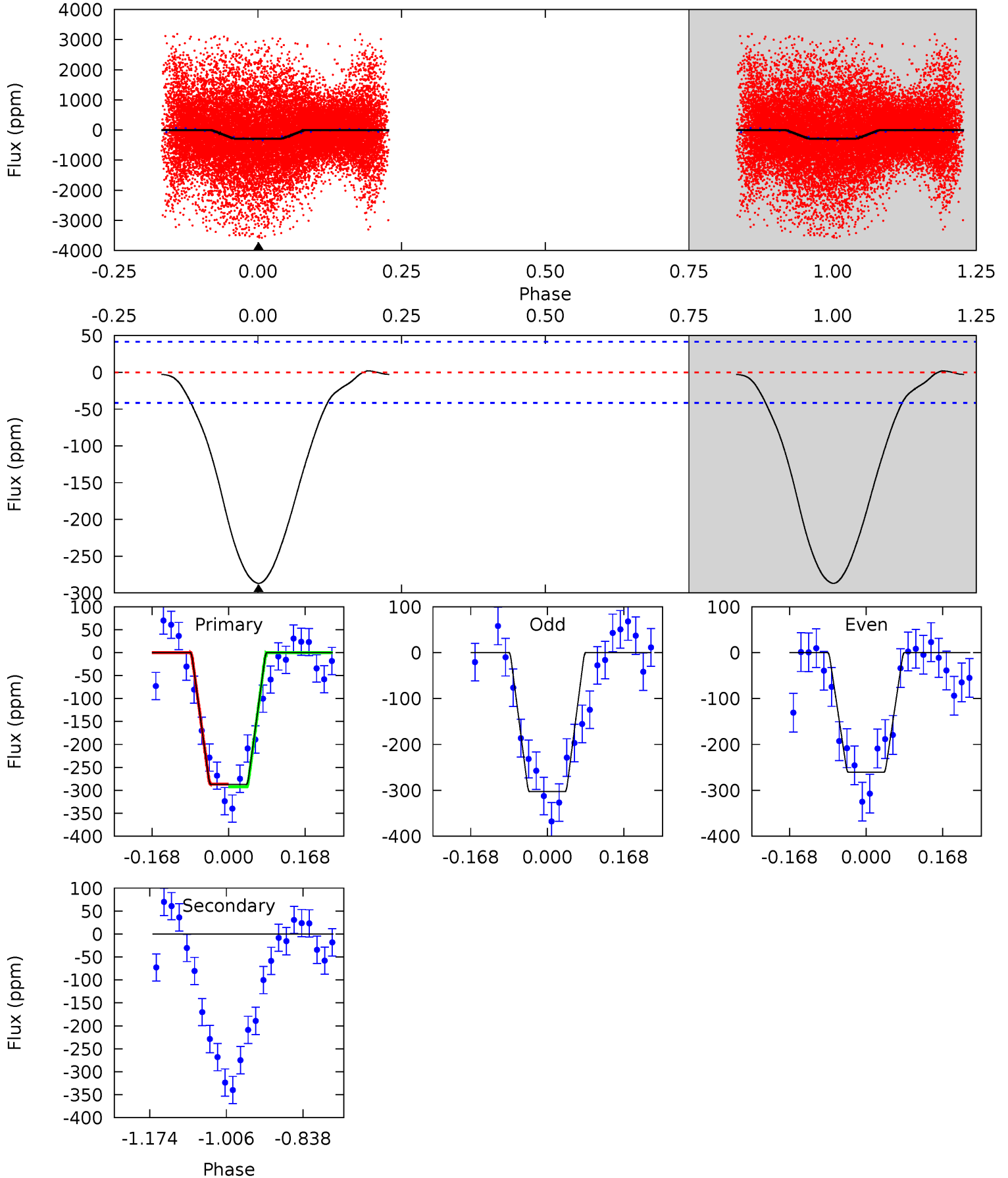
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
13.2	0	0	0	4.47	1.41	0.08	13.2	13.2	0	0	7.44	0.93	0.02	0.47



# Alt Model-Shift Uniqueness Test

009398382-04, P = 3.722559 Days, E = 132.472203 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
30.8	0	0	0	4.46	1.38	0.30	30.8	30.8	0	0	2.25	1.02	0.01	0.29



### Stellar Parameters For KIC 009398382

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5534^{+166}_{-166}$	$4.562^{+0.032}_{-0.179}$	$0.070^{+0.250}_{-0.300}$	$0.849^{+0.213}_{-0.071}$	$0.960^{+0.083}_{-0.111}$	$2.205^{+0.386}_{-1.048}$
	+3%/-3%	+1%/-4%	+357%/-429%	+25%/-8%	+9%/-12%	+17%/-48%
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 009398382-04 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$0 \pm 7$	$1.11^{+0.27}_{-0.23}$	$1494^{+88}_{-68}$	$-2216^{+5437}_{-1097}$	$-0.023^{+6.934}_{-7.614}$
Alt.	$0 \pm 9$	$1.74^{+0.30}_{-0.25}$	$1498^{+83}_{-66}$	$-2164^{+5080}_{-839}$	$0.003^{+3.395}_{-3.625}$

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

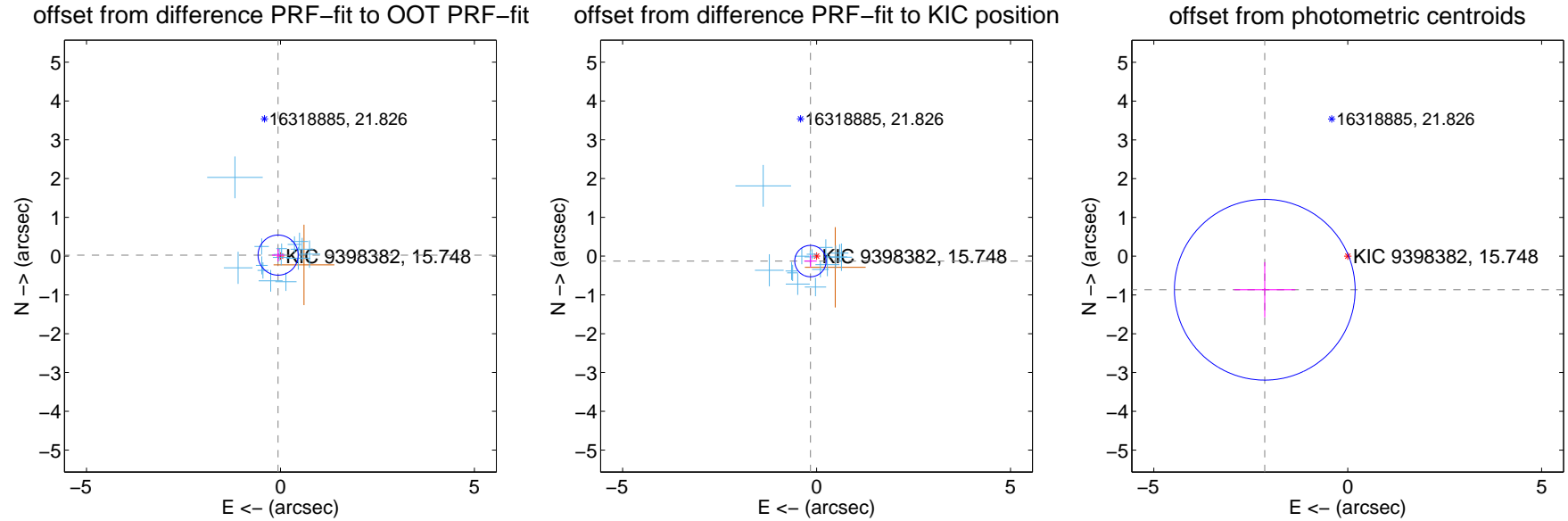
## DV Centroid Data

Supplemental centroid analysis for 009398382-04. Kepler magnitude: 15.75. Transit SNR 11.25

There are 15 quarters with good PRF difference image offsets

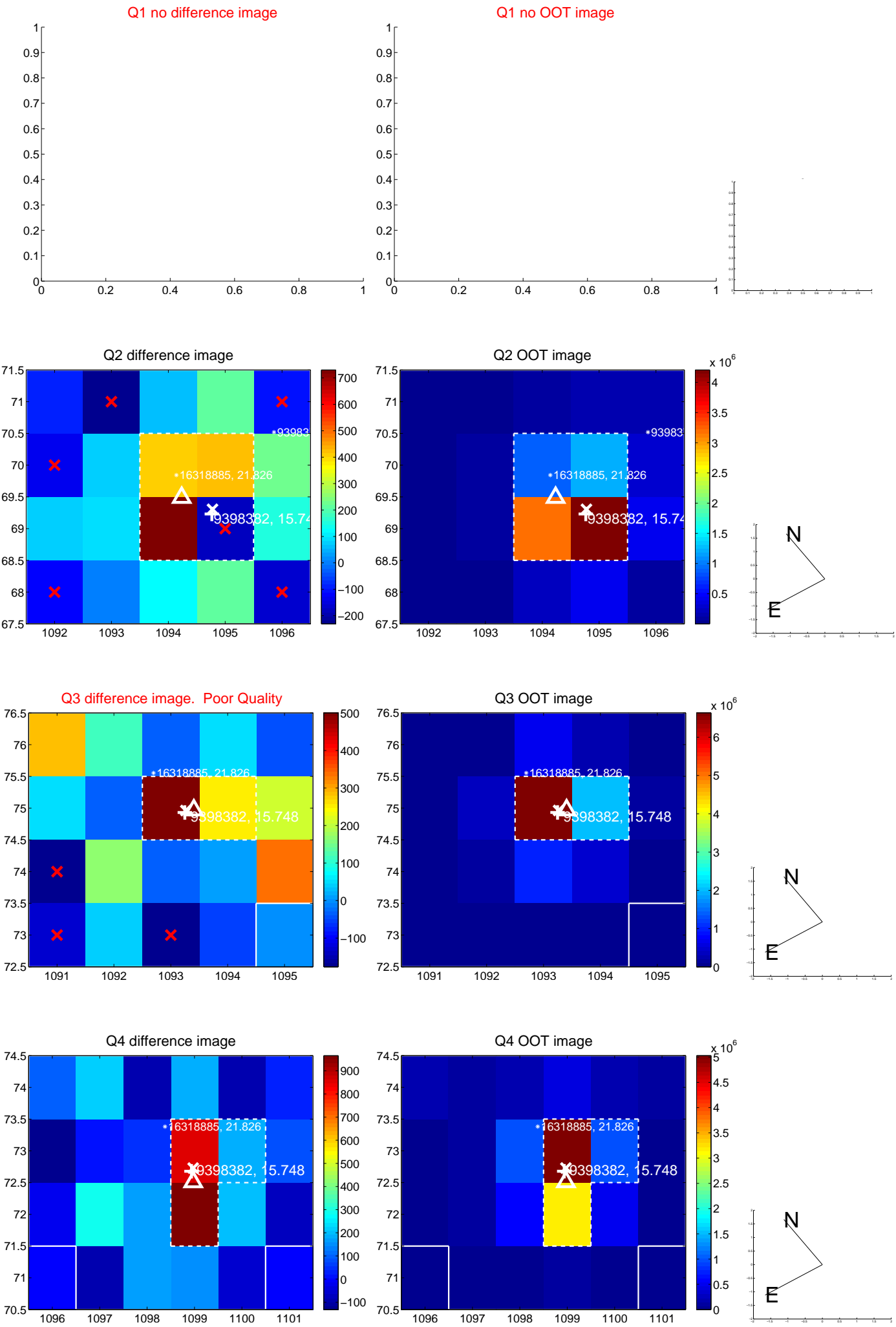
The direct PRF centroid is offset from the target star catalog position by about 0.27 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.066 \pm 0.172$	0.38	$0.061 \pm 0.156$	$0.026 \pm 0.164$
PRF-fit source offset from KIC position	$0.203 \pm 0.135$	1.50	$0.158 \pm 0.161$	$-0.128 \pm 0.158$
photometric centroid source offset	$2.31 \pm 0.78$	2.97	$2.14 \pm 0.79$	$-0.86 \pm 0.71$

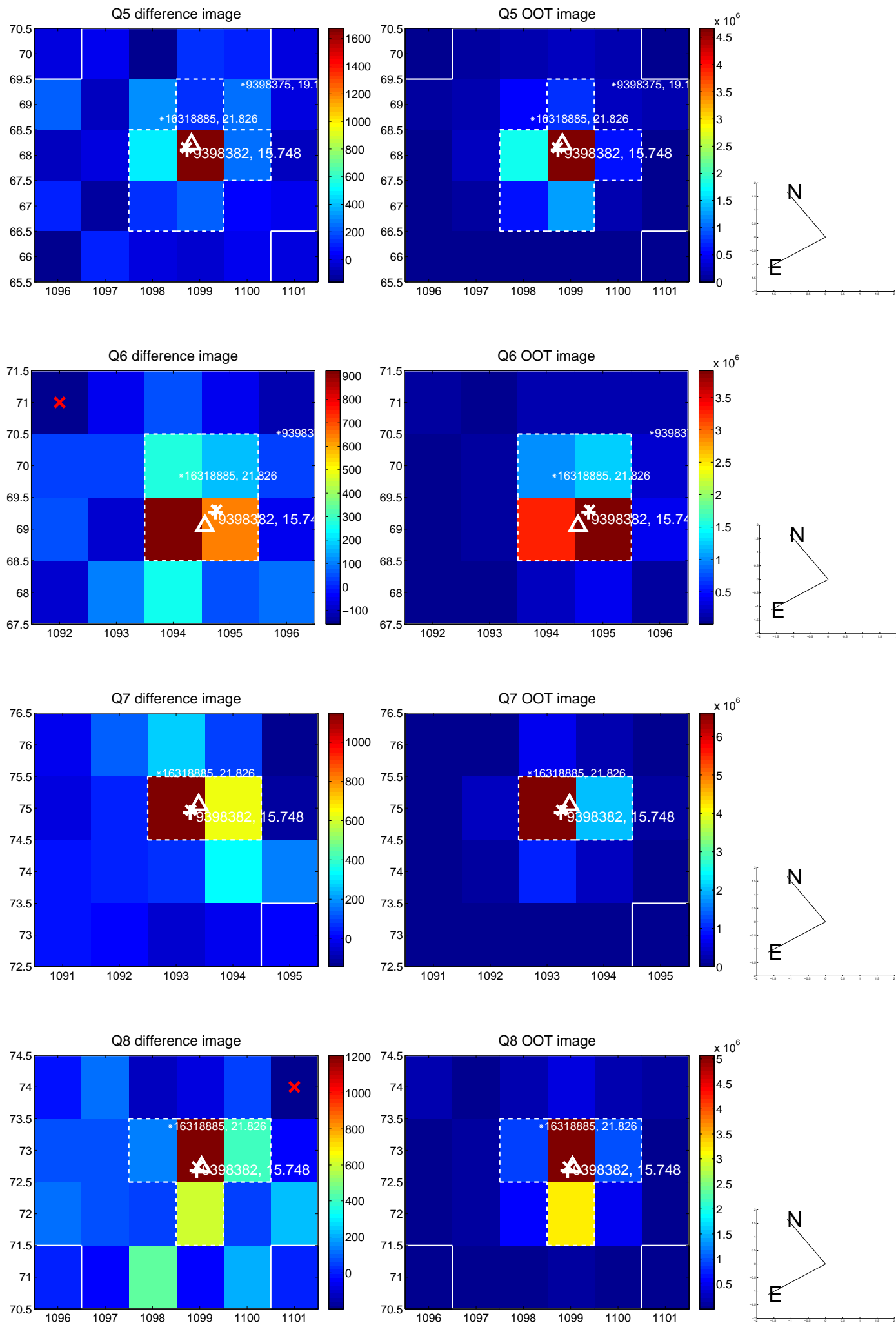


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

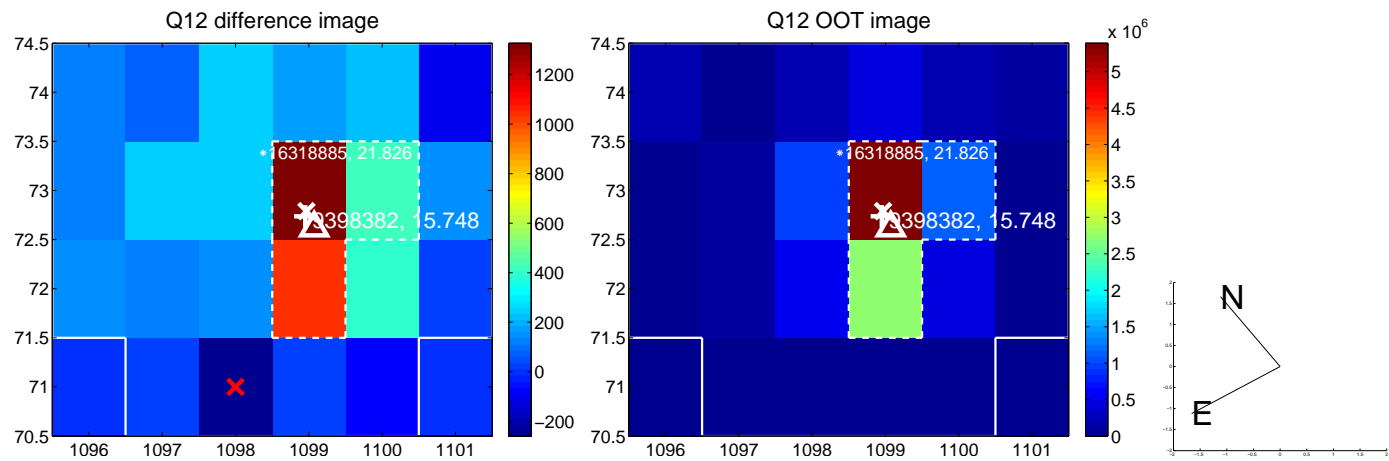
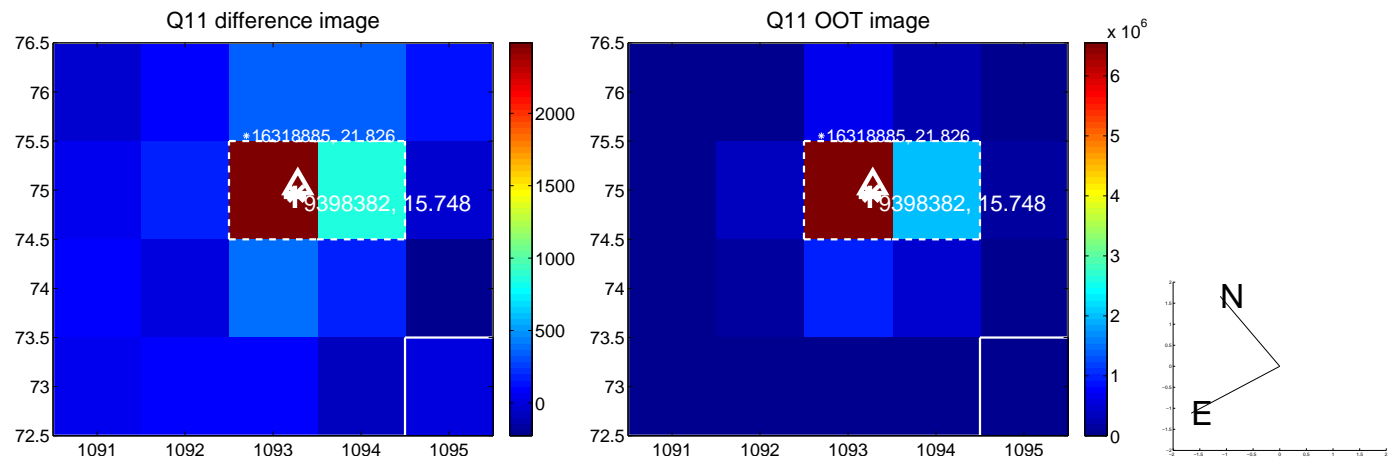
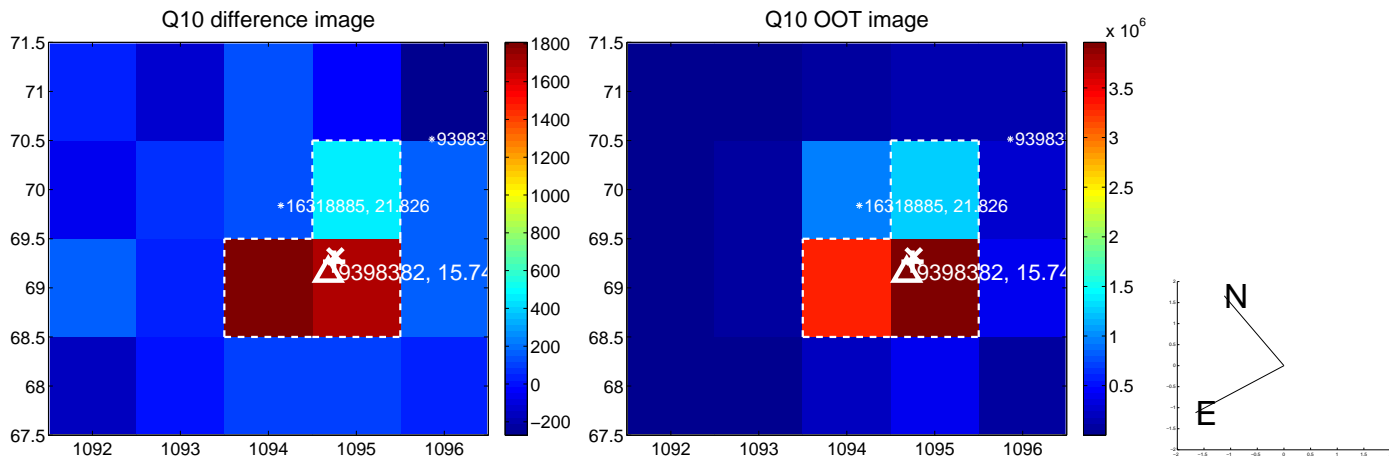
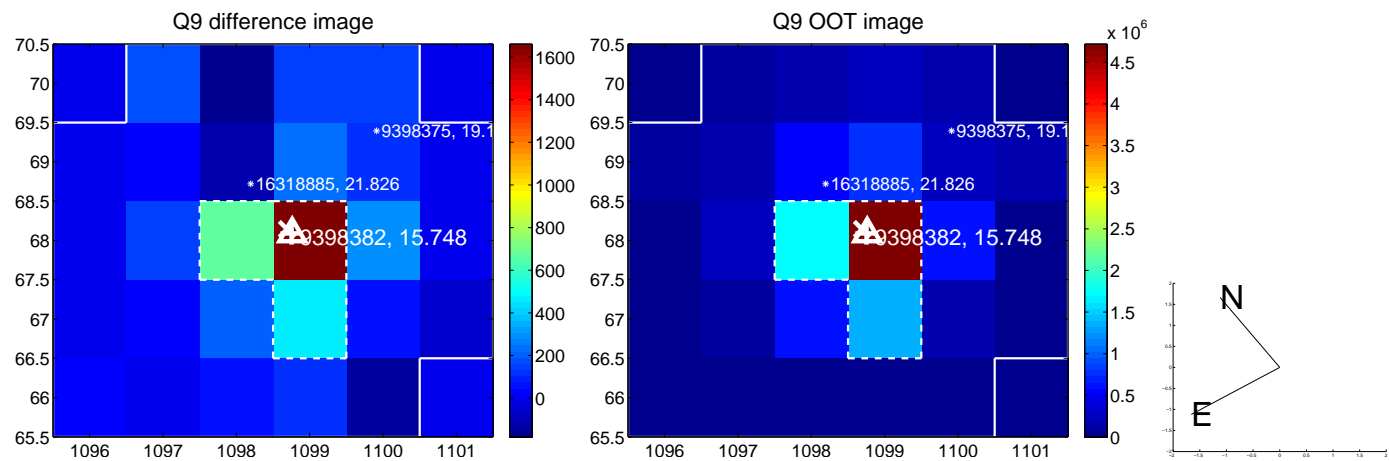
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

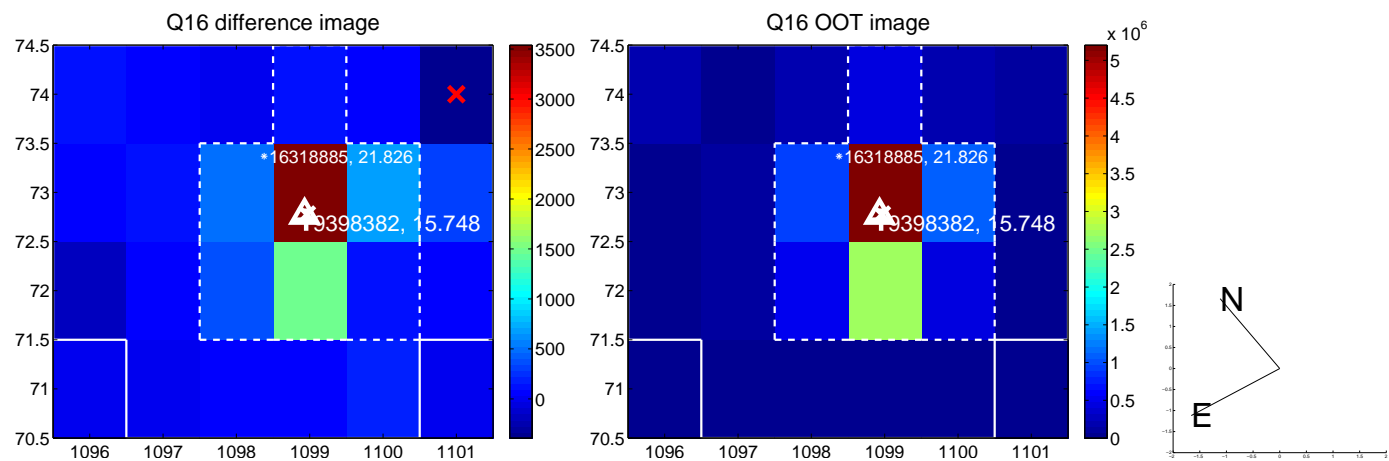
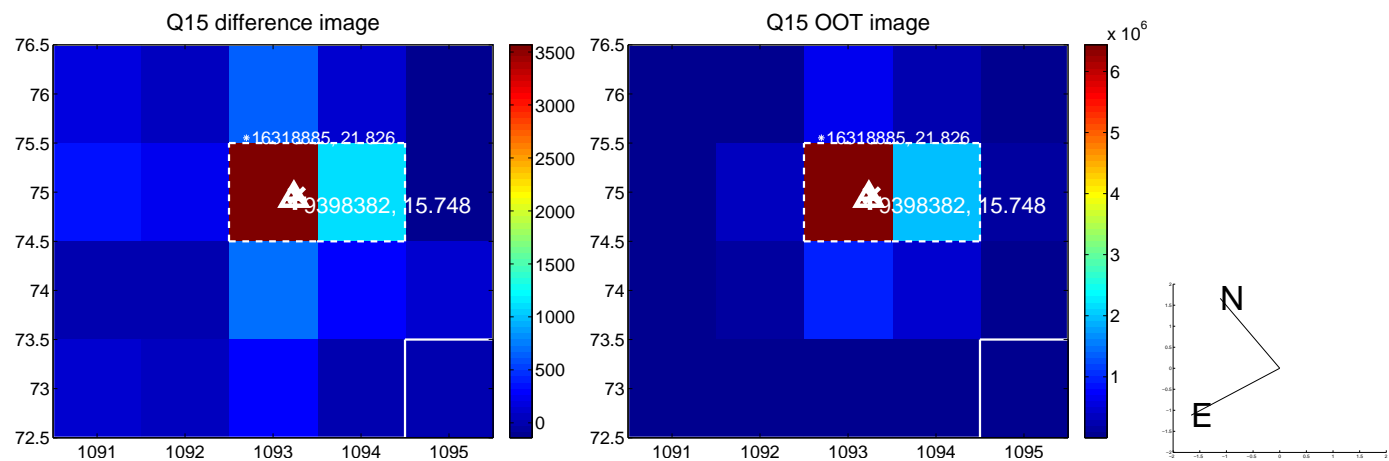
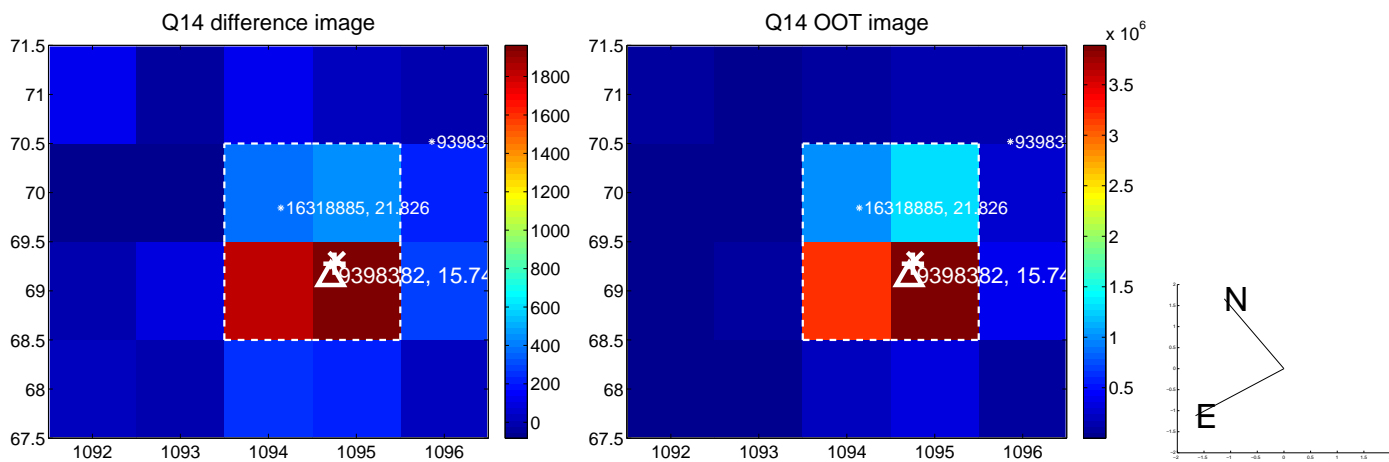
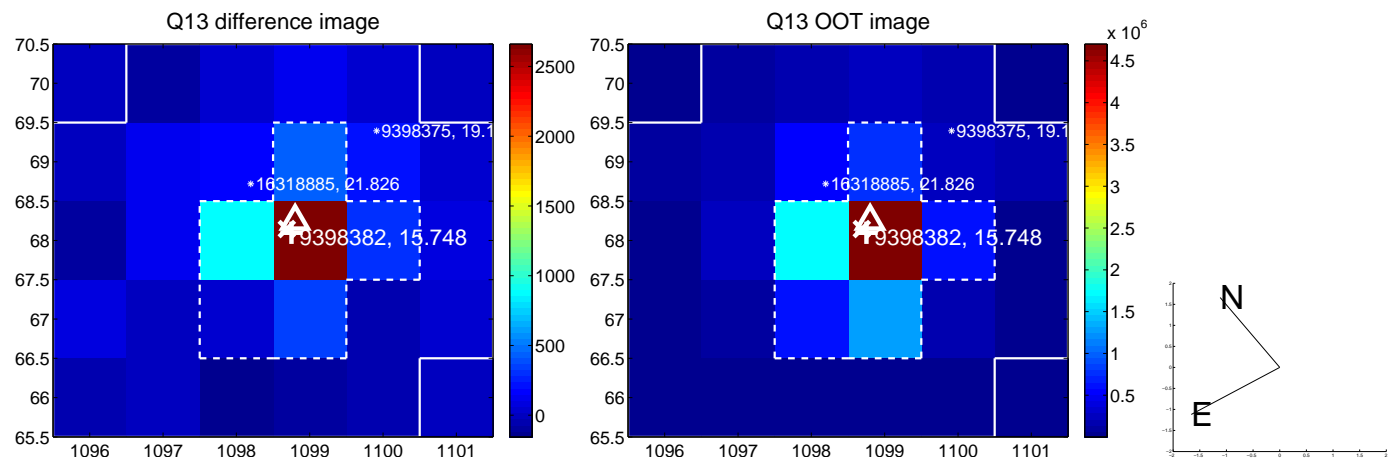


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

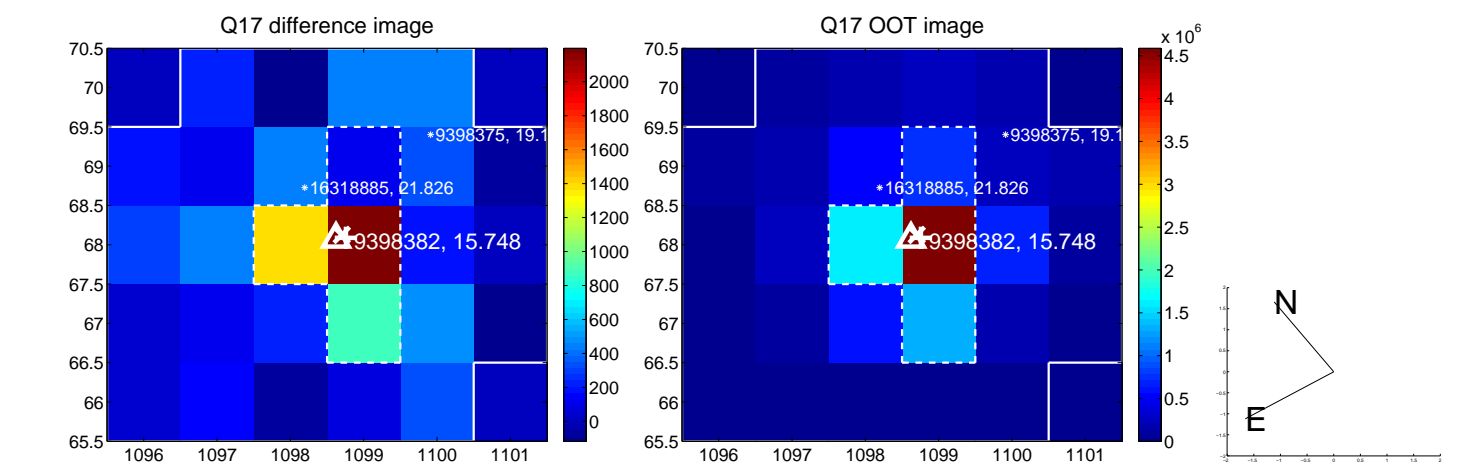




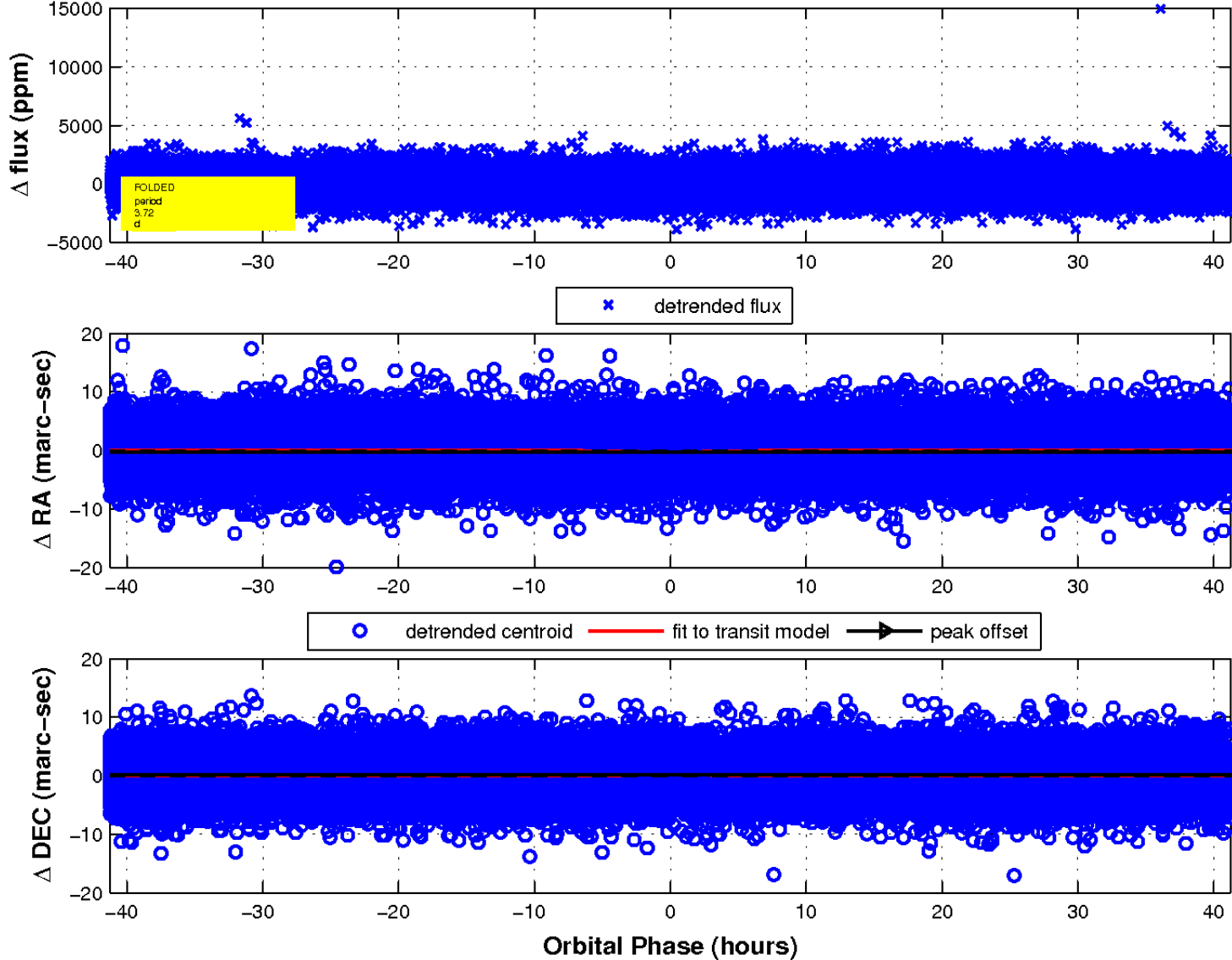
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



fluxWeightedCentroids, Planet 4 of 4



UKIRT Image

Declination

