

# KIC 009116222

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009116222-01	OBS	No	489.779016	380.468831	1913.8	3.398	21.7	12.3	4.24	5152	18.87	6.96
009116222-02	OBS	No	443.783301	513.691712	1371.8	5.673	16.8	8.9	4.24	5152	15.64	7.94
009116222-03	OBS	No	594.203615	238.435061	1212.8	8.119	17.4	7.1	4.24	5152	16.19	5.38
009116222-04	OBS	No	472.123627	304.092546	1110.6	10.451	16.9	6.0	4.24	5152	14.13	7.31
009116222-05	OBS	No	388.636869	218.442355	1603.7	6.328	17.1	11.7	4.24	5152	17.72	9.47

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009116222-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009116222-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009116222-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—CENT_FEW_DIFFS
009116222-04	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_CHASES—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—HALO_GHOST
009116222-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—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.

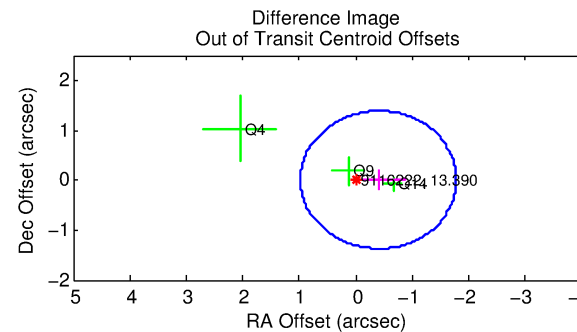
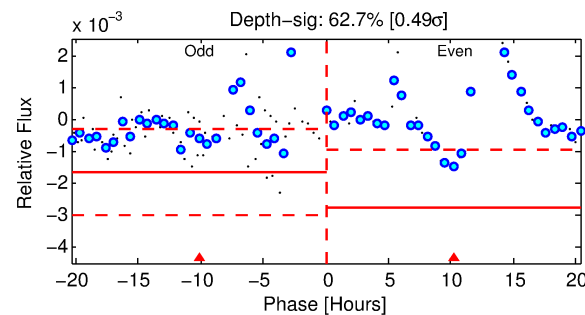
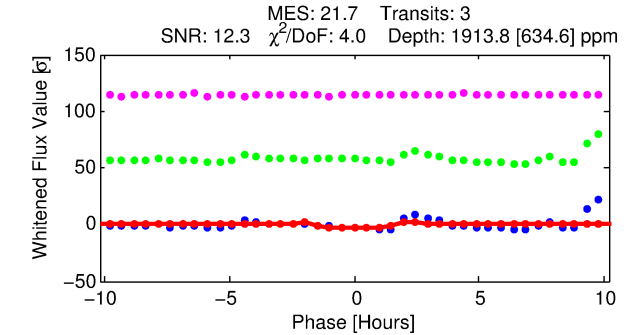
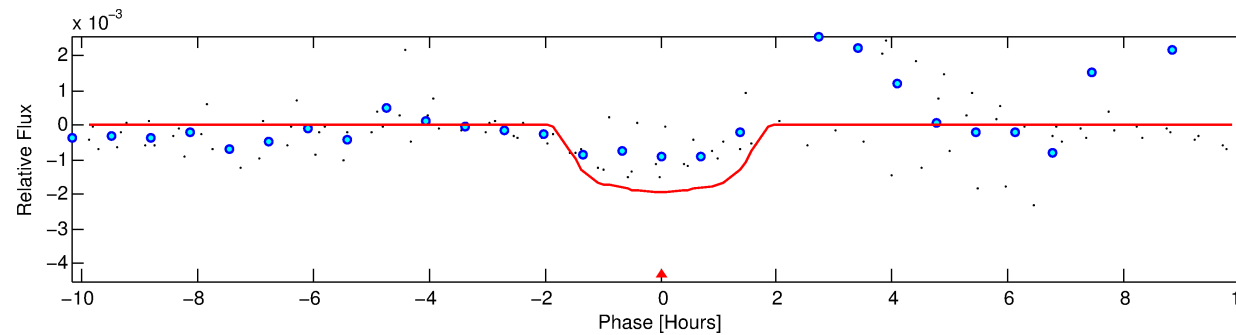
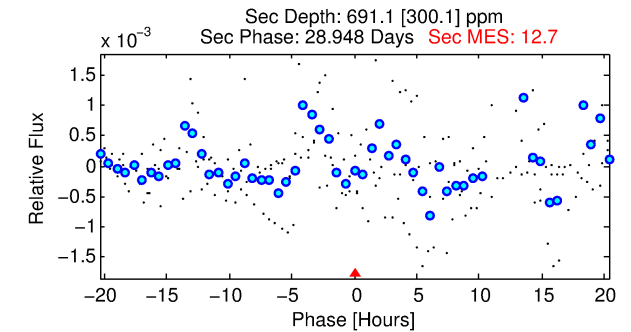
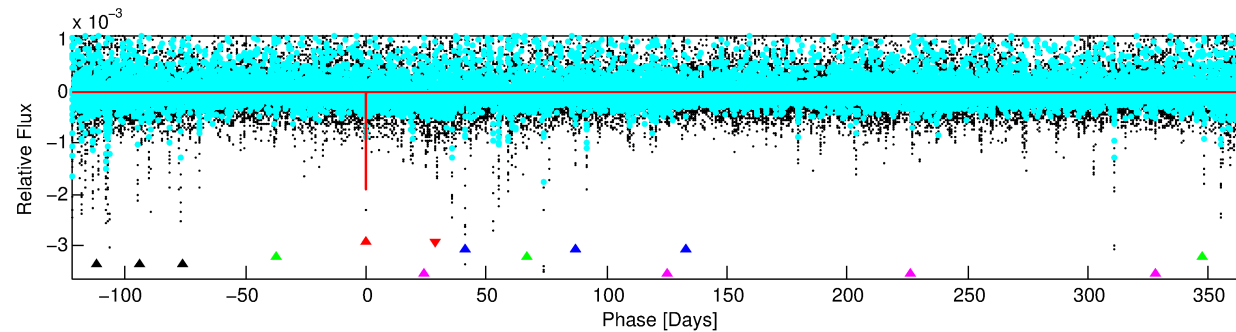
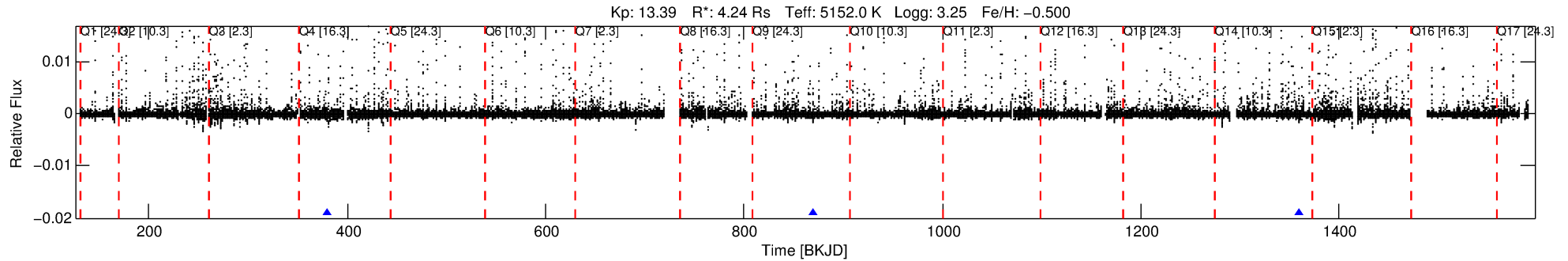
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 009116222-01

No Significant Match Found

## KIC: 9116222    Candidate: 1 of 5    Period: 489.779 d

KIC: 9116222    Candidate: 1 of 5    Period: 489.779 d

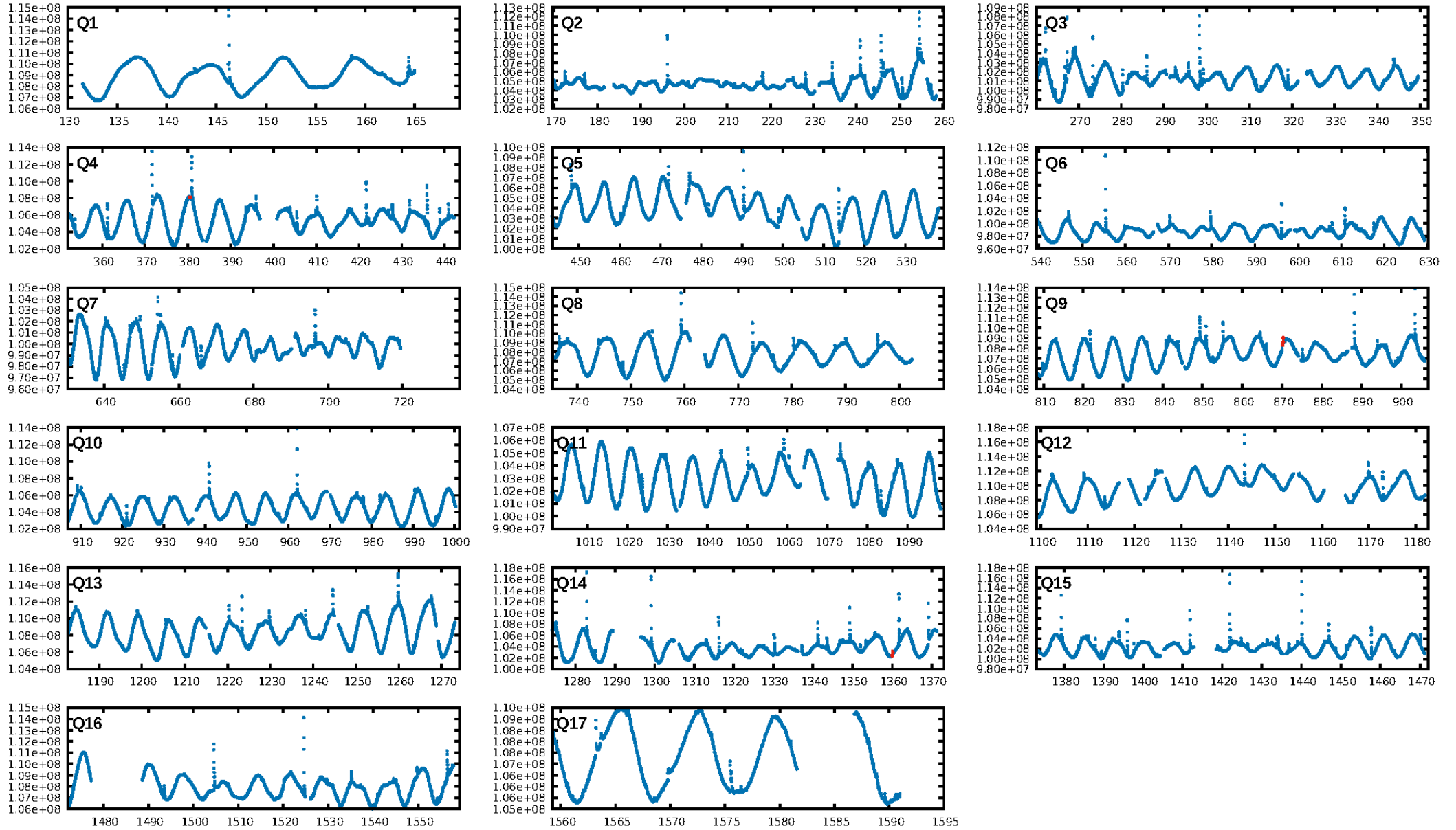


DV Diagnostic Results:

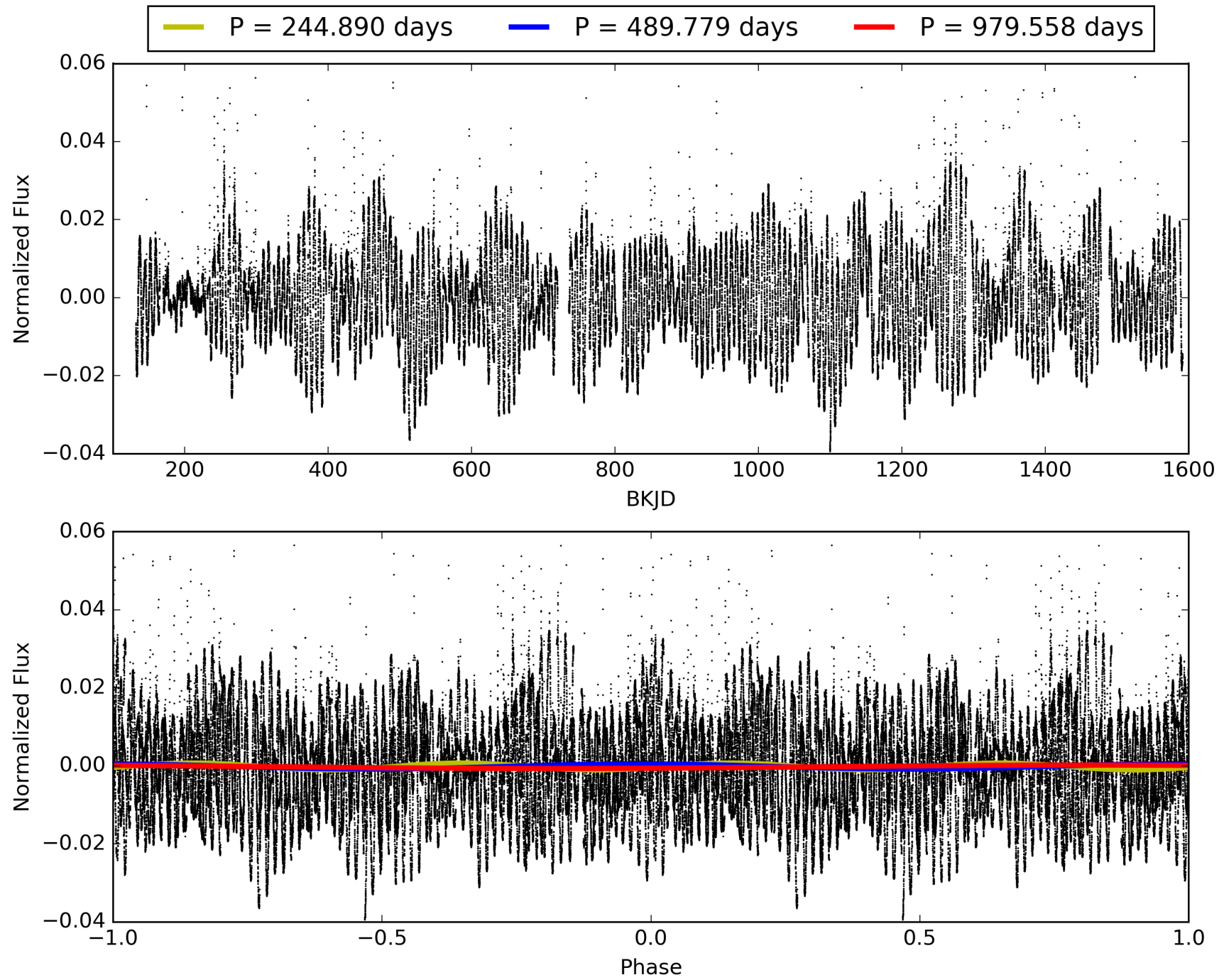
ShortPeriod-sig: 100.0% [38.56σ]  
LongPeriod-sig: 100.0% [284.75σ]  
ModelChiSquare2-sig: 48.6%  
ModelChiSquareGof-sig: 3.7%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: 1.347  
  
Centroid-sig: 42.1%  
Centroid-so: 0.305 arcsec [0.77σ]  
OotOffset-rm: 0.400 arcsec [0.87σ]  
KicOffset-rm: 0.355 arcsec [0.46σ]  
OotOffset-st: 1/0/1/1 [3]  
KicOffset-st: 1/0/1/1 [3]  
DiffImageQuality-fgm: 0.67 [2/3]  
DiffImageOverlap-fno: 1.00 [3/3]

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

# TCE 009116222-01, PDC Light Curves



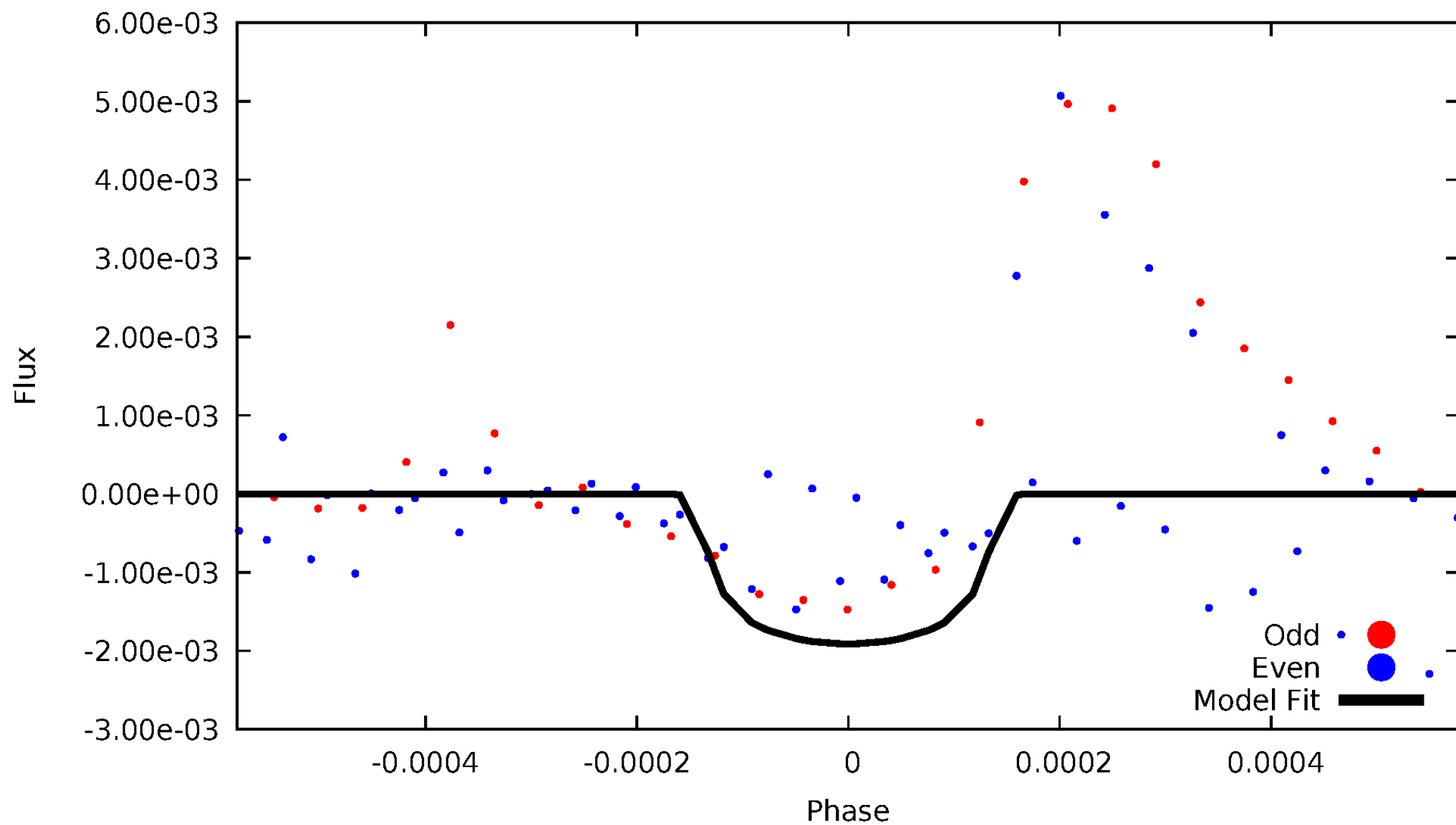
TCE 009116222-01





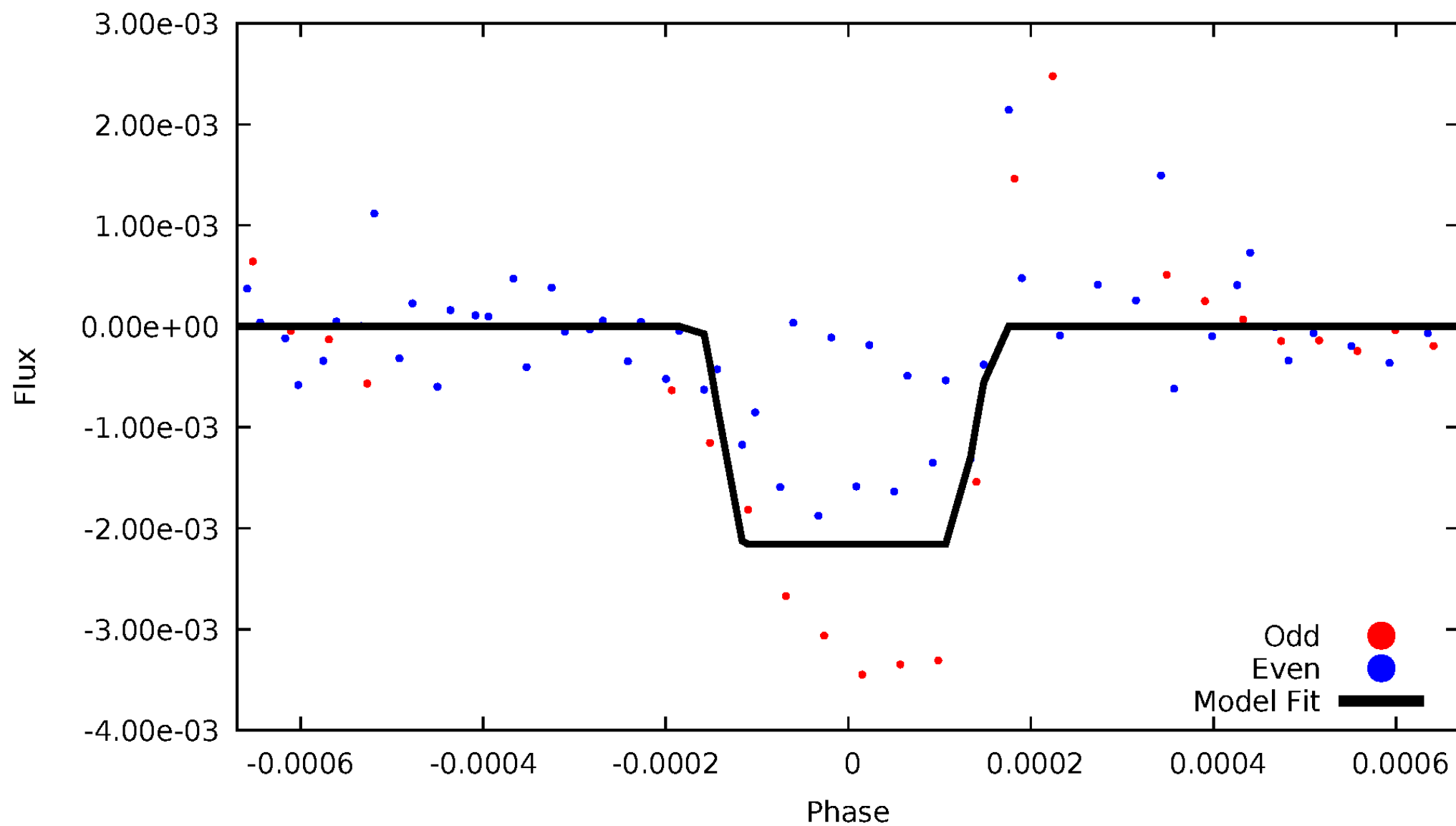
# DV Odd/Even

TCE 009116222-01



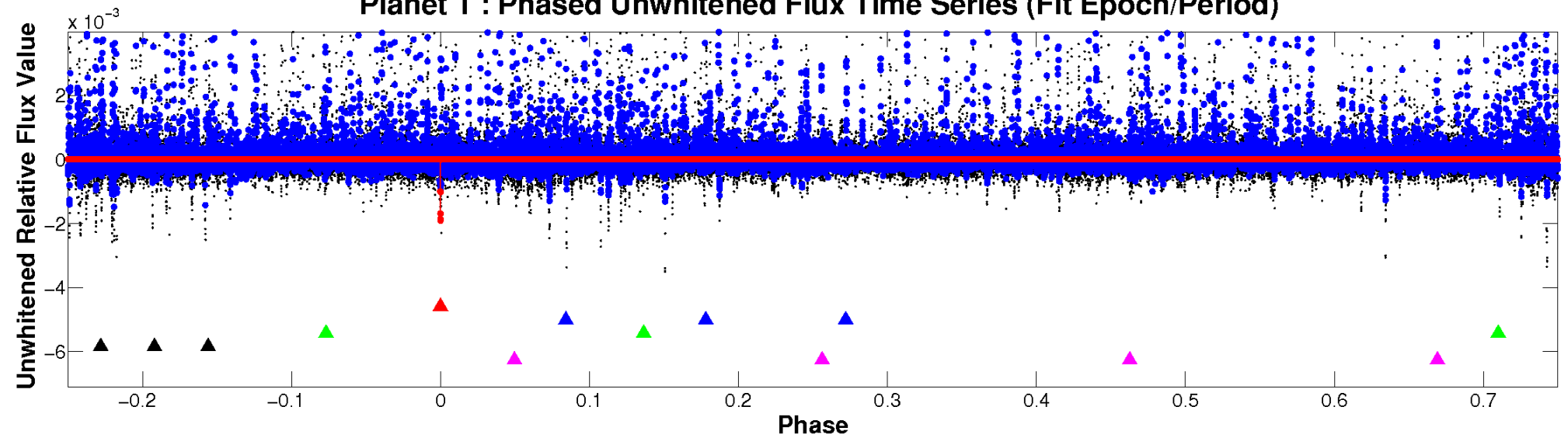
# ALT Odd/Even

TCE 009116222-01

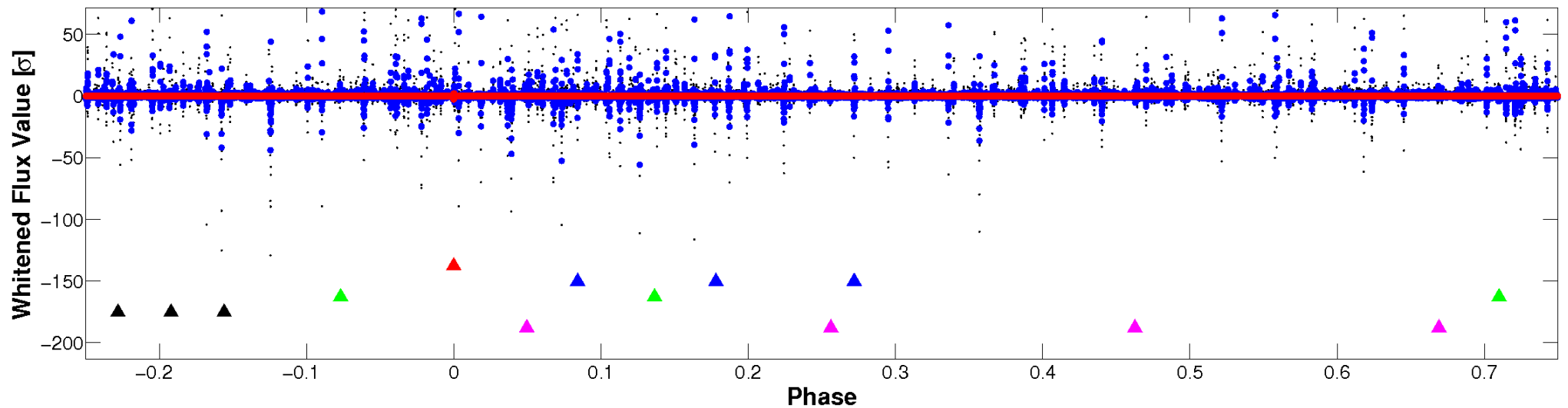


# Non-Whitened Vs. Whitened Light Curve

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

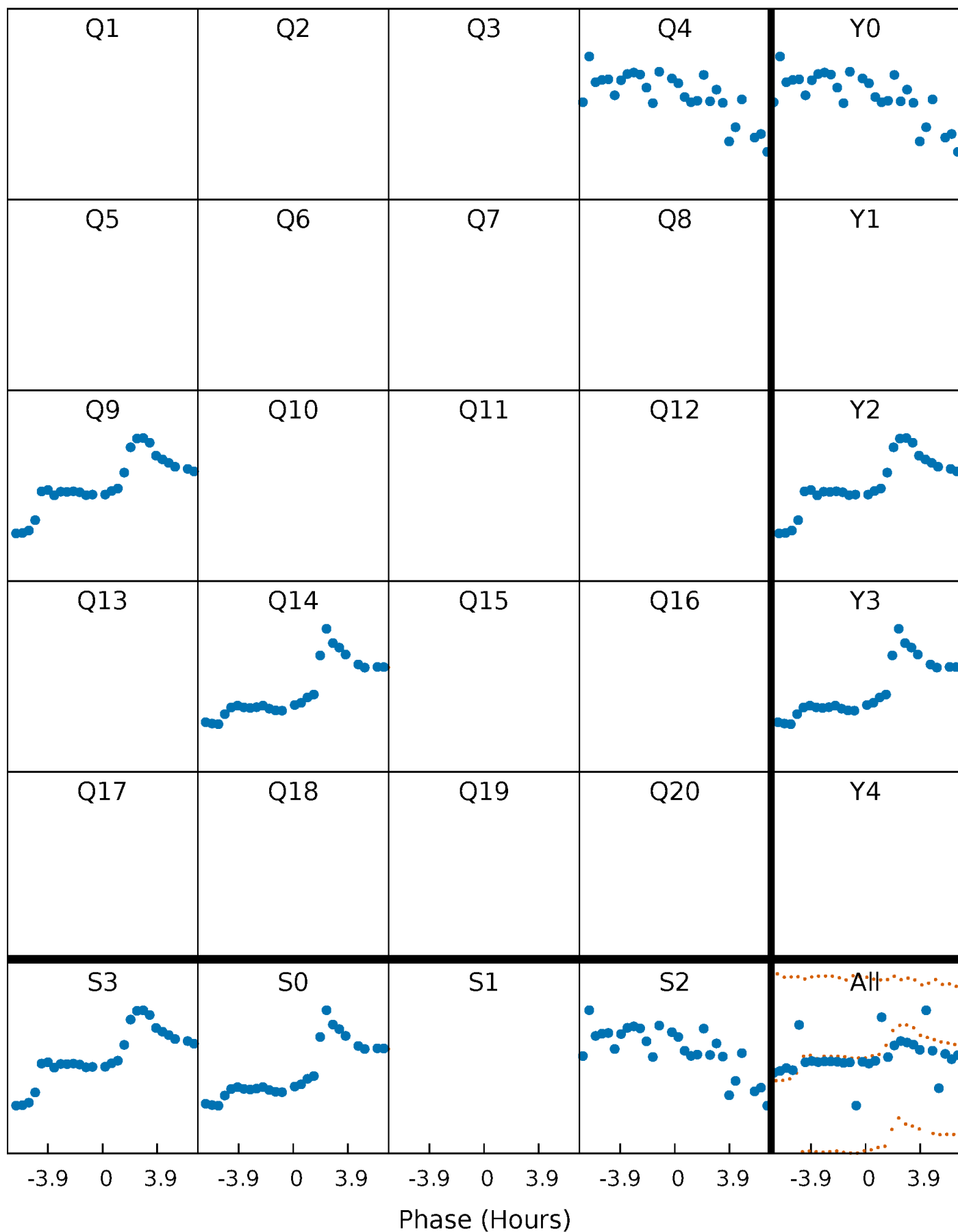


**Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



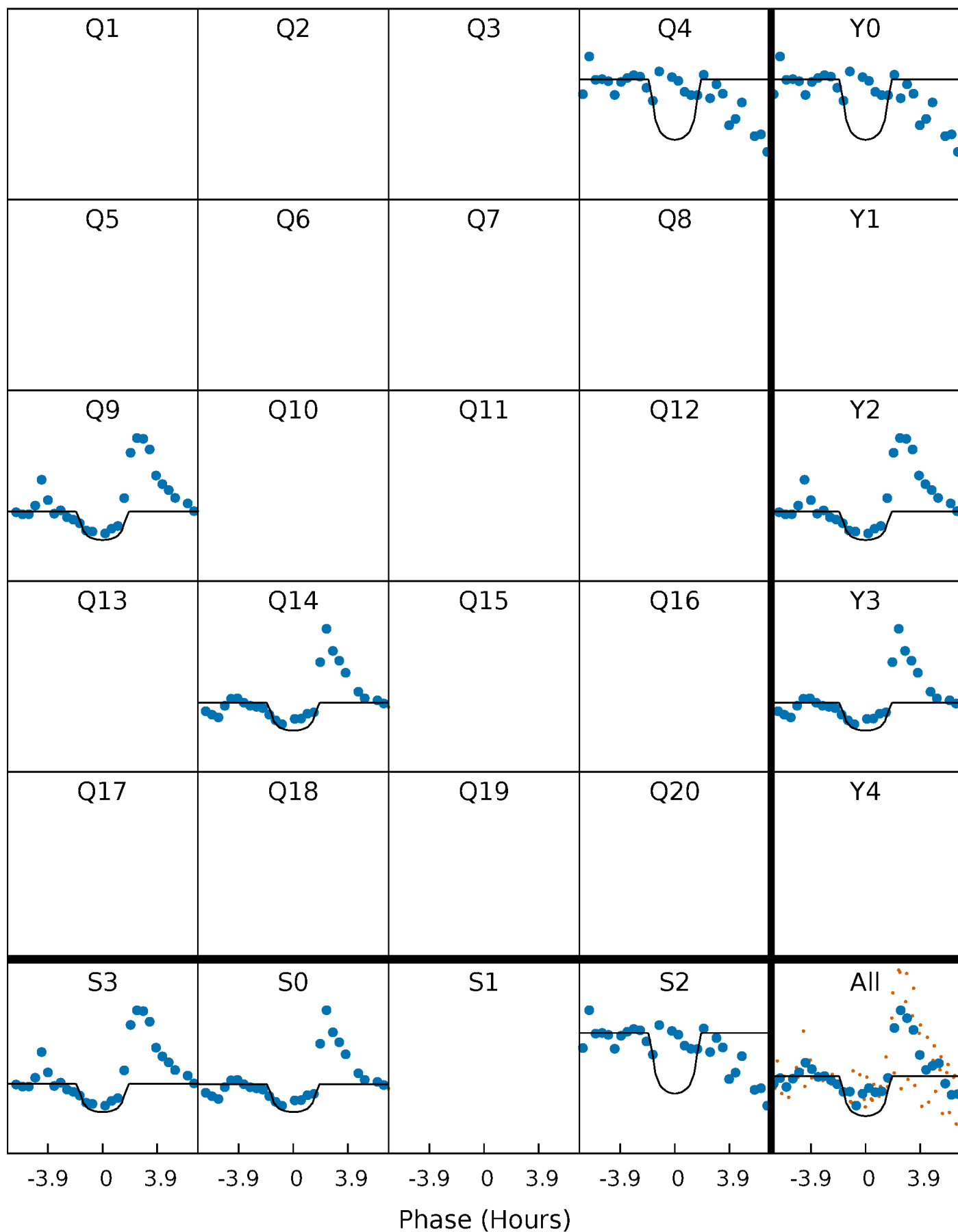
# PDC Quarter-Phased Transit Curves

TCE 009116222-01 P=489.779016 Days  $T_0=380.468831$  (BKJD)



# DV Quarter-Phased Transit Curves

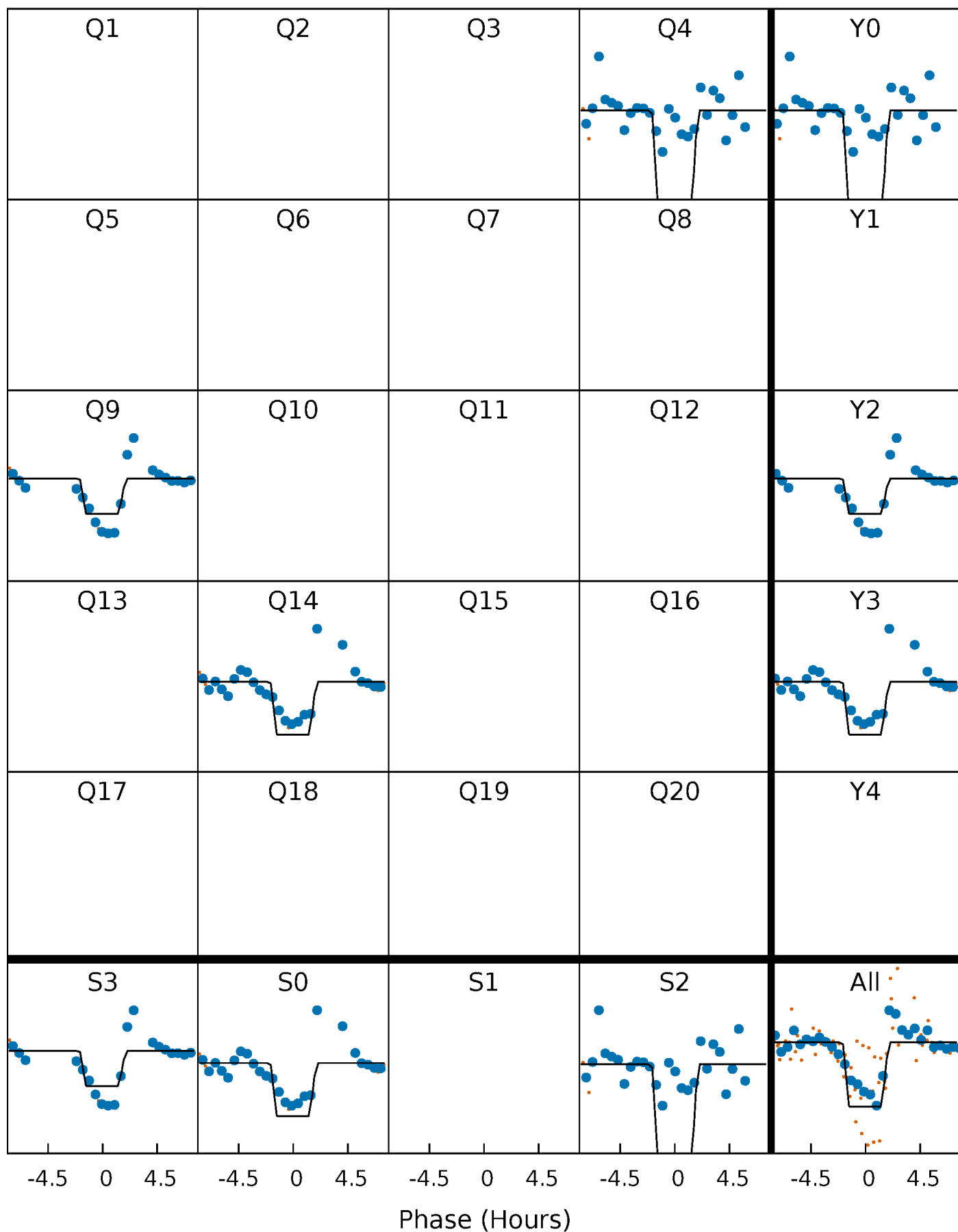
TCE 009116222-01 P=489.779016 Days  $T_0=380.468831$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

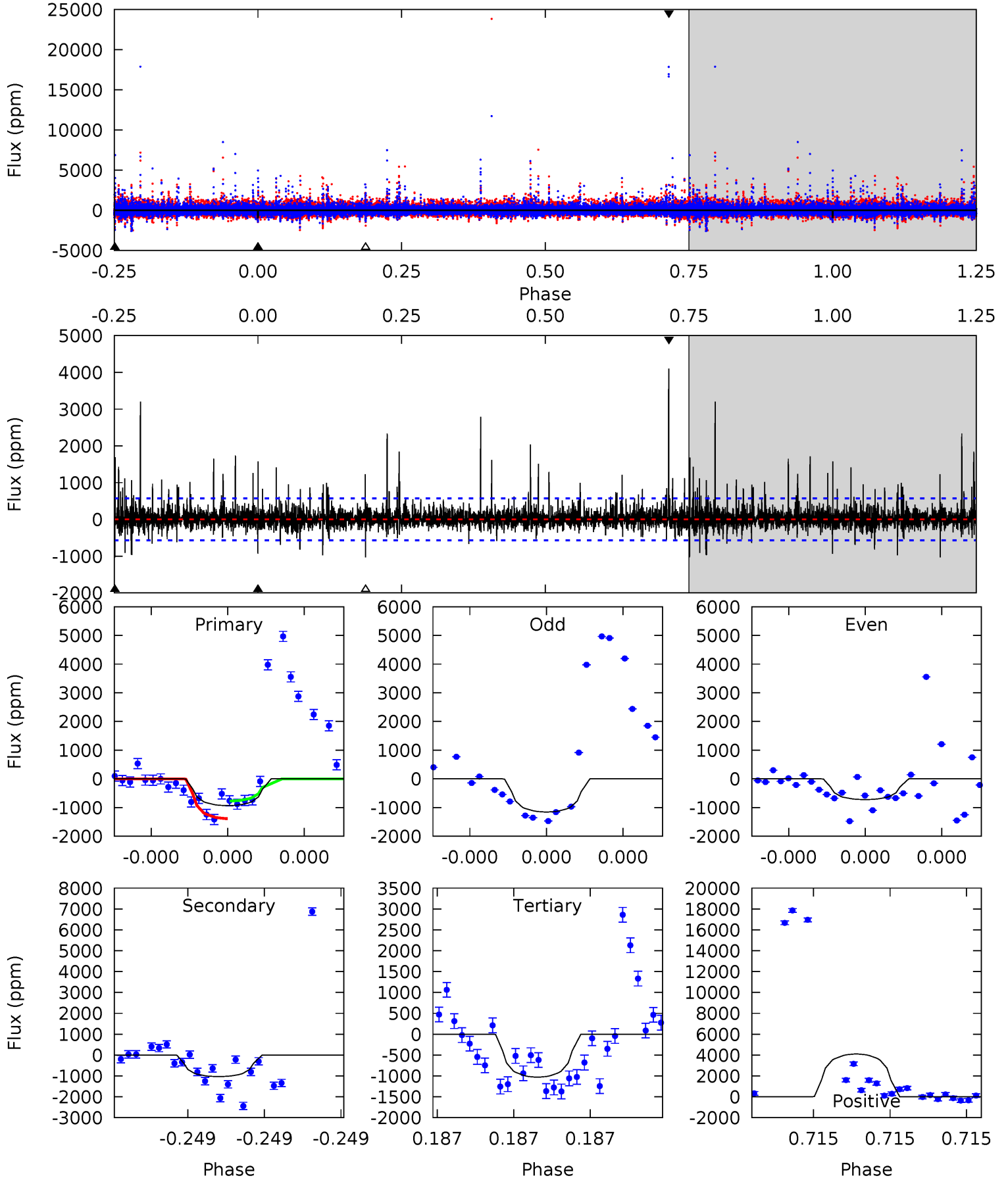
TCE 009116222-01 P=489.778811 Days  $T_0=380.461166$  (BKJD)



# DV Model-Shift Uniqueness Test

009116222-01, P = 489.779016 Days, E = 380.468831 Days

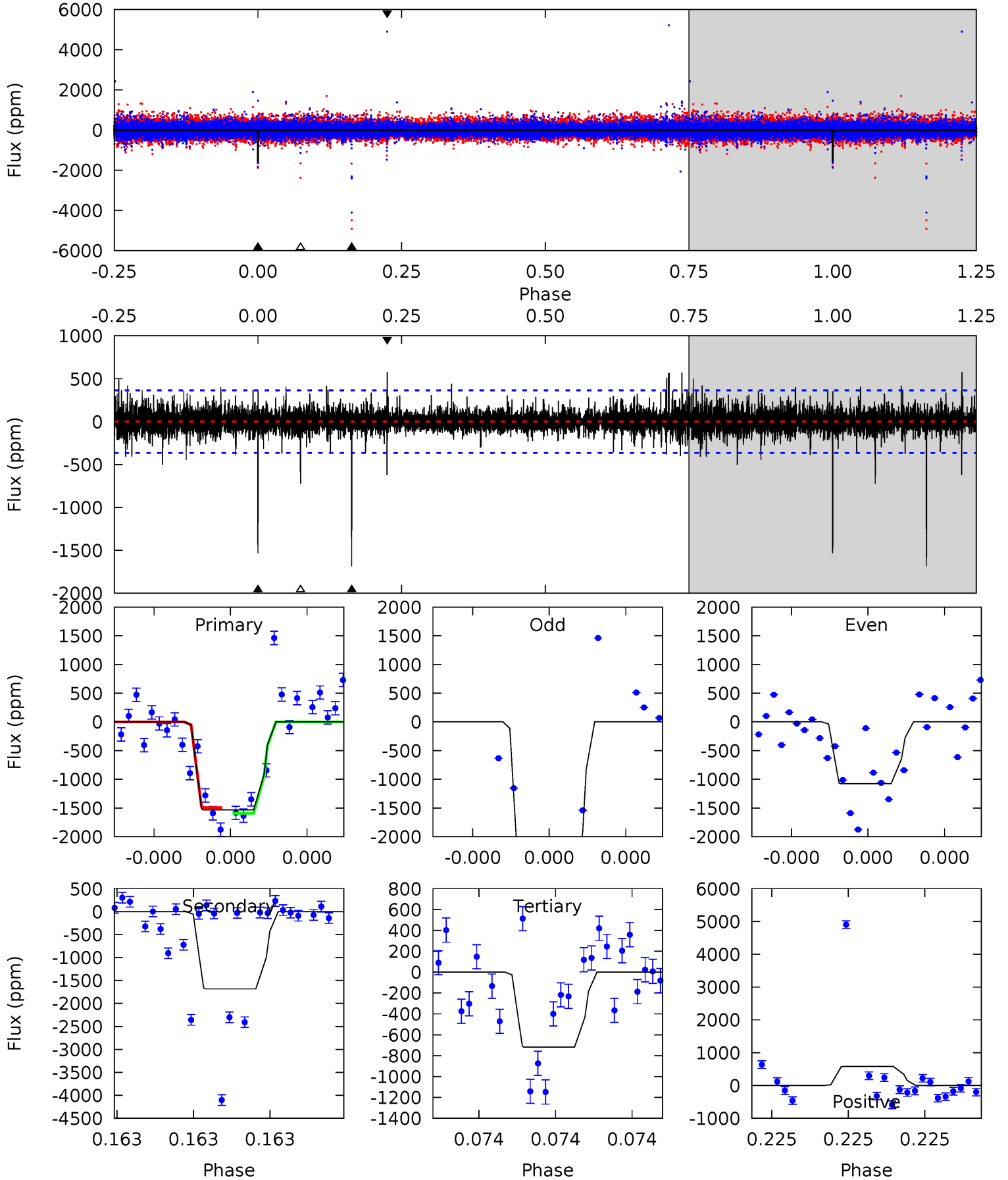
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
9.27	10.2	10.2	40.6	5.67	3.62	2.10	-0.96	-31.4	0.02	-30.4	0.71	0.75	0.80	2.89



# Alt Model-Shift Uniqueness Test

009116222-01, P = 489.778811 Days, E = 380.461166 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
23.8	26.1	11.2	8.94	5.66	3.61	1.18	12.6	14.8	15.0	17.2	18.8	1.04	0.26	0



### Stellar Parameters For KIC 009116222

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$5152^{+128}_{-128}$	$3.247^{+0.319}_{-0.261}$	$-0.500^{+0.250}_{-0.250}$	$4.243^{+1.726}_{-1.412}$	$1.158^{+0.209}_{-0.256}$	$0.021^{+0.044}_{-0.013}$
	+2%/-2%	+10%/-8%	+50%/-50%	+41%/-33%	+18%/-22%	+208%/-59%
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 009116222-01 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-1033 \pm 101$	$41.12^{+45.12}_{-27.90}$	$575^{+61}_{-56}$	$3480^{+1977}_{-647}$	$528^{+4673}_{-404}$
Alt.	$-1684 \pm 64$	$44.97^{+42.82}_{-31.42}$	$577^{+61}_{-54}$	$3673^{+2343}_{-635}$	$724^{+7369}_{-532}$

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

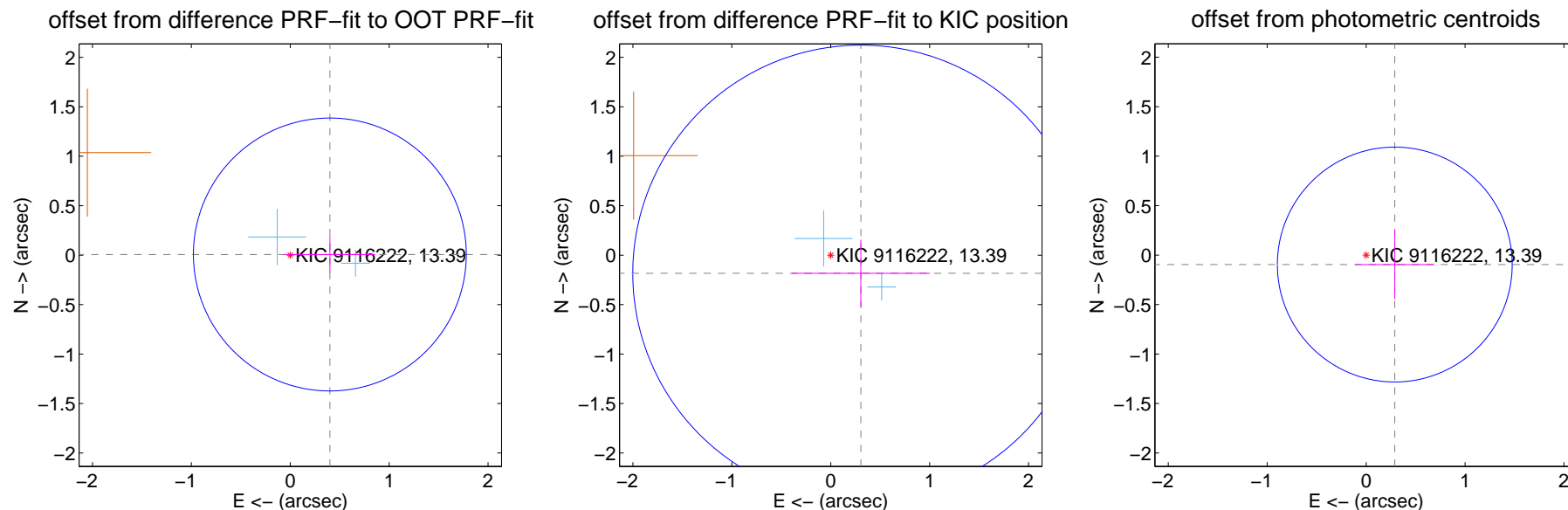
## DV Centroid Data

Supplemental centroid analysis for 009116222-01. Kepler magnitude: 13.39. Transit SNR 12.32

There are 2 quarters with good PRF difference image offsets

The direct PRF centroid is offset from the target star catalog position by about 0.28 arcsec

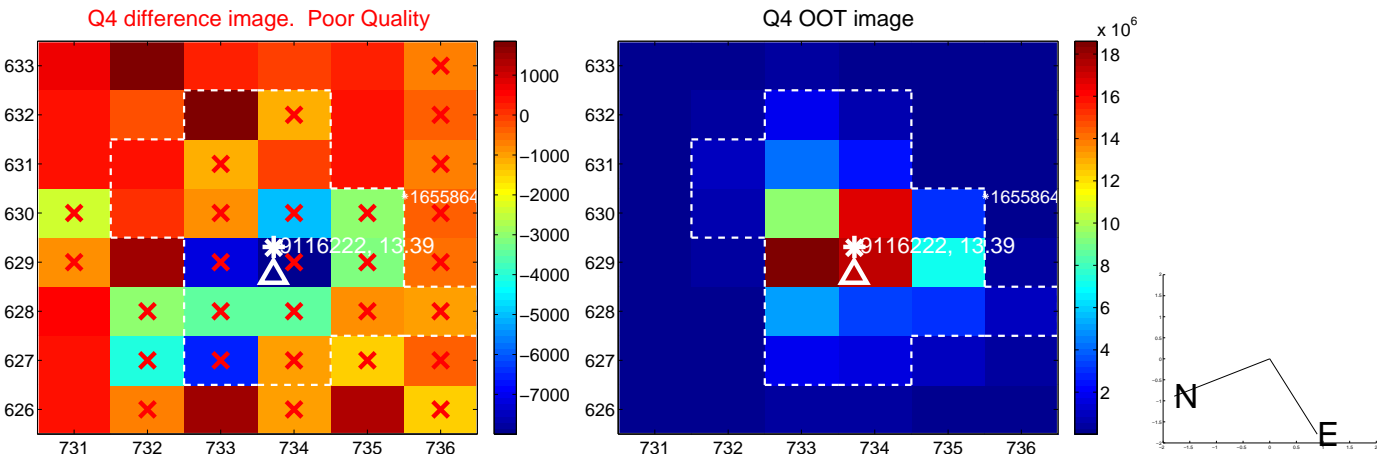
	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.400 \pm 0.460$	0.87	$-0.400 \pm 0.460$	$0.007 \pm 0.186$
PRF-fit source offset from KIC position	$0.355 \pm 0.769$	0.46	$-0.305 \pm 0.698$	$-0.183 \pm 0.340$
photometric centroid source offset	$0.31 \pm 0.40$	0.77	$-0.29 \pm 0.40$	$-0.10 \pm 0.35$



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.



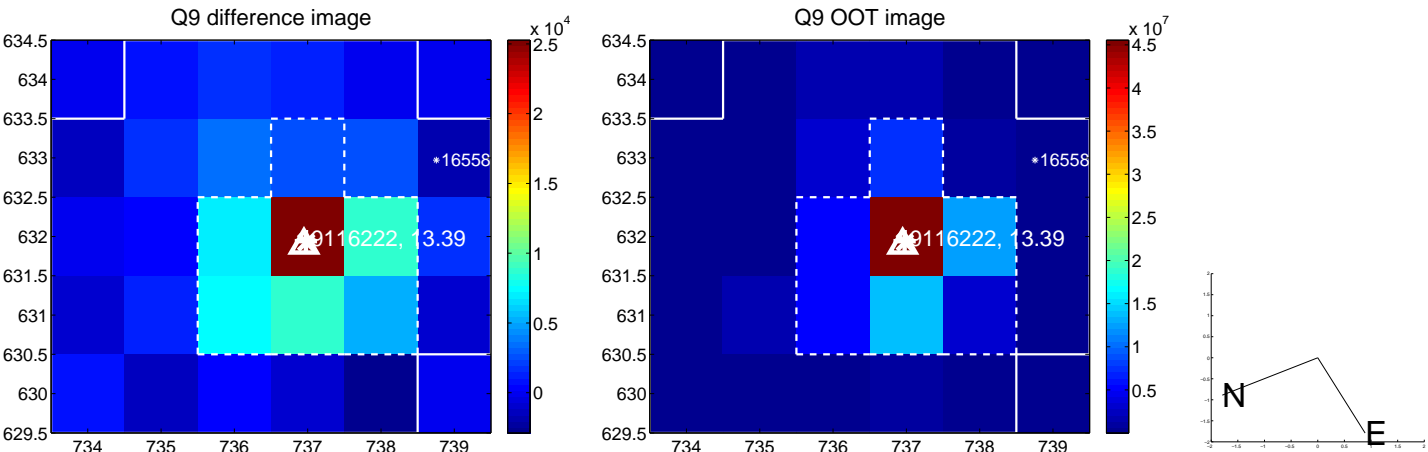
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



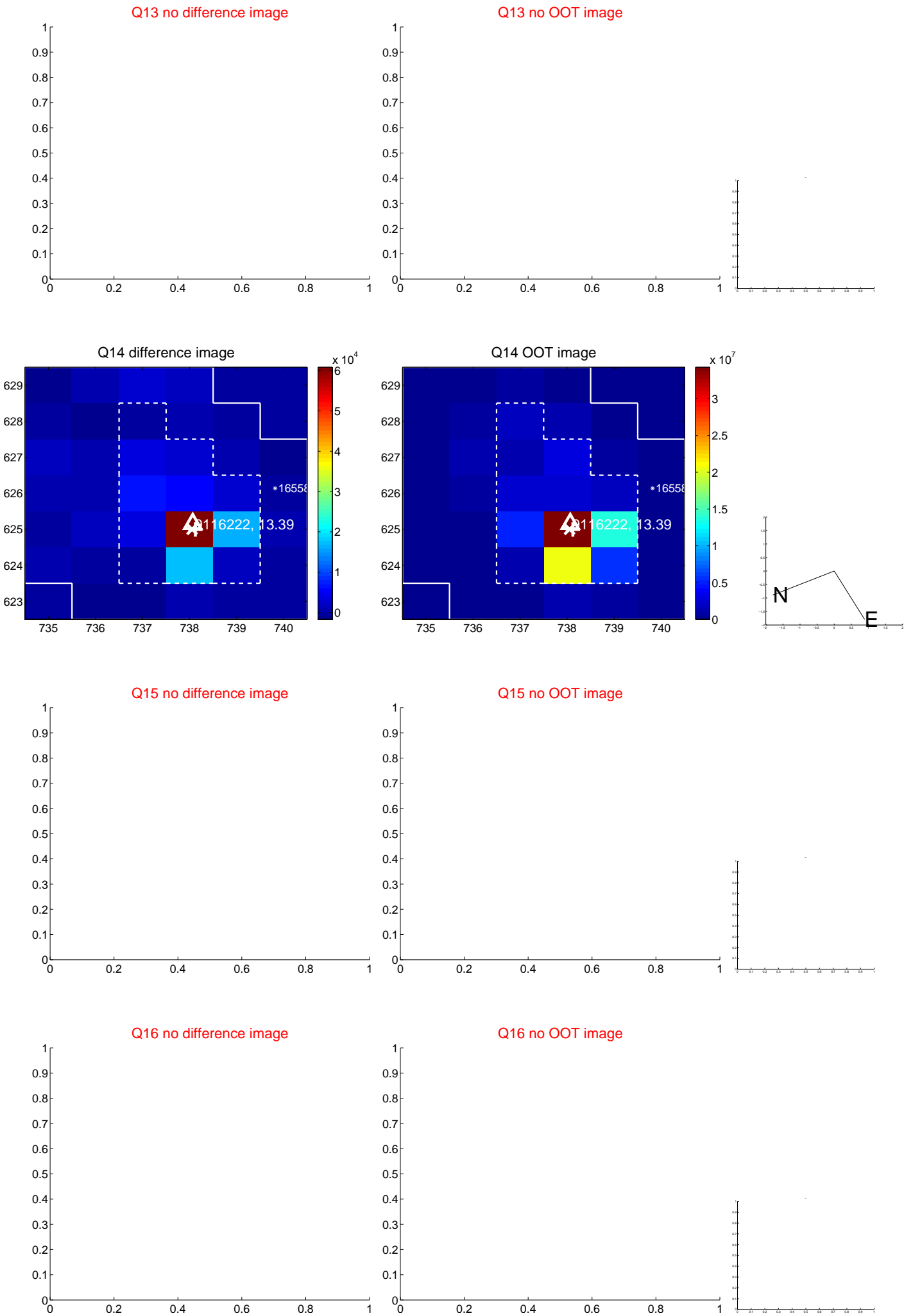
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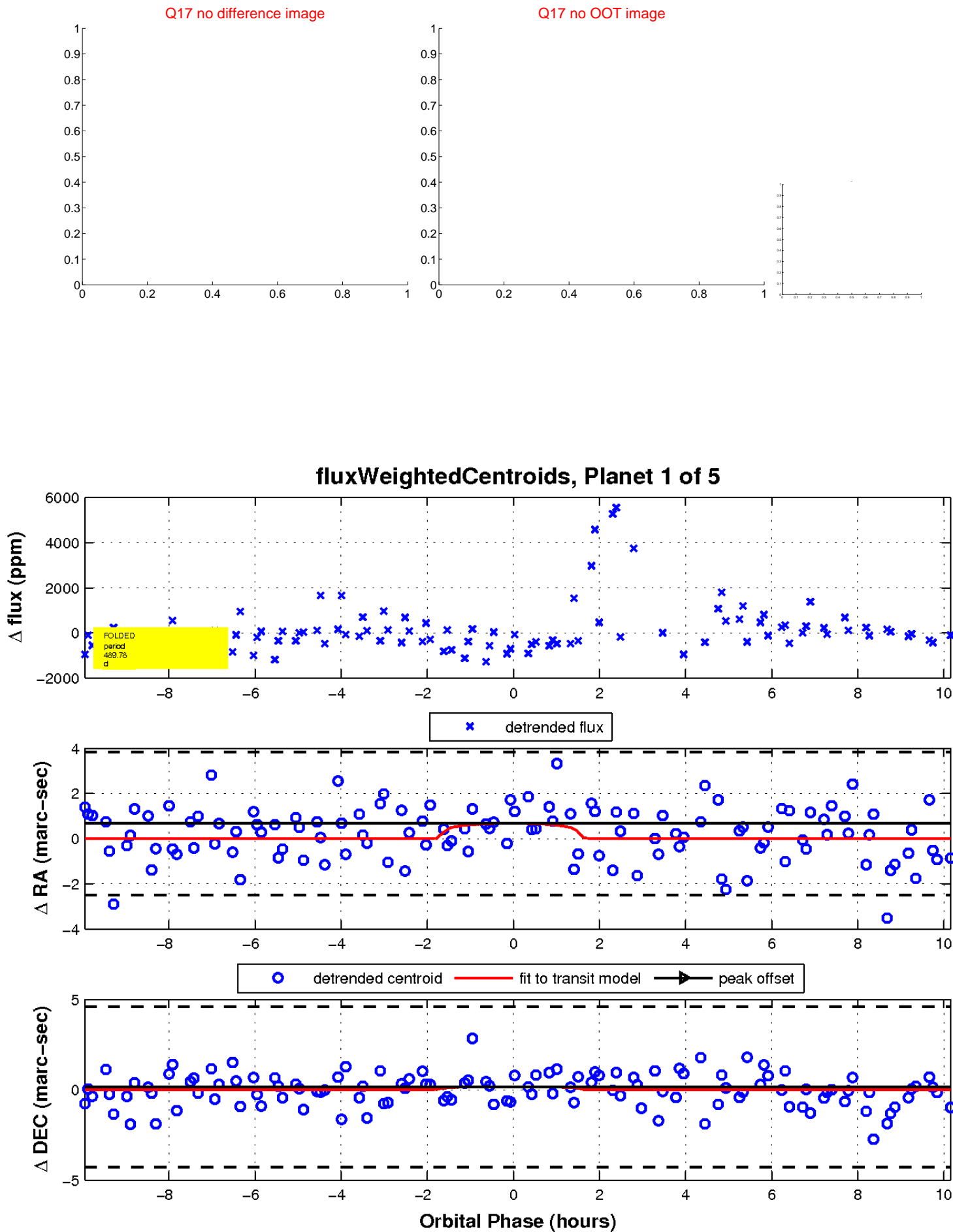
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



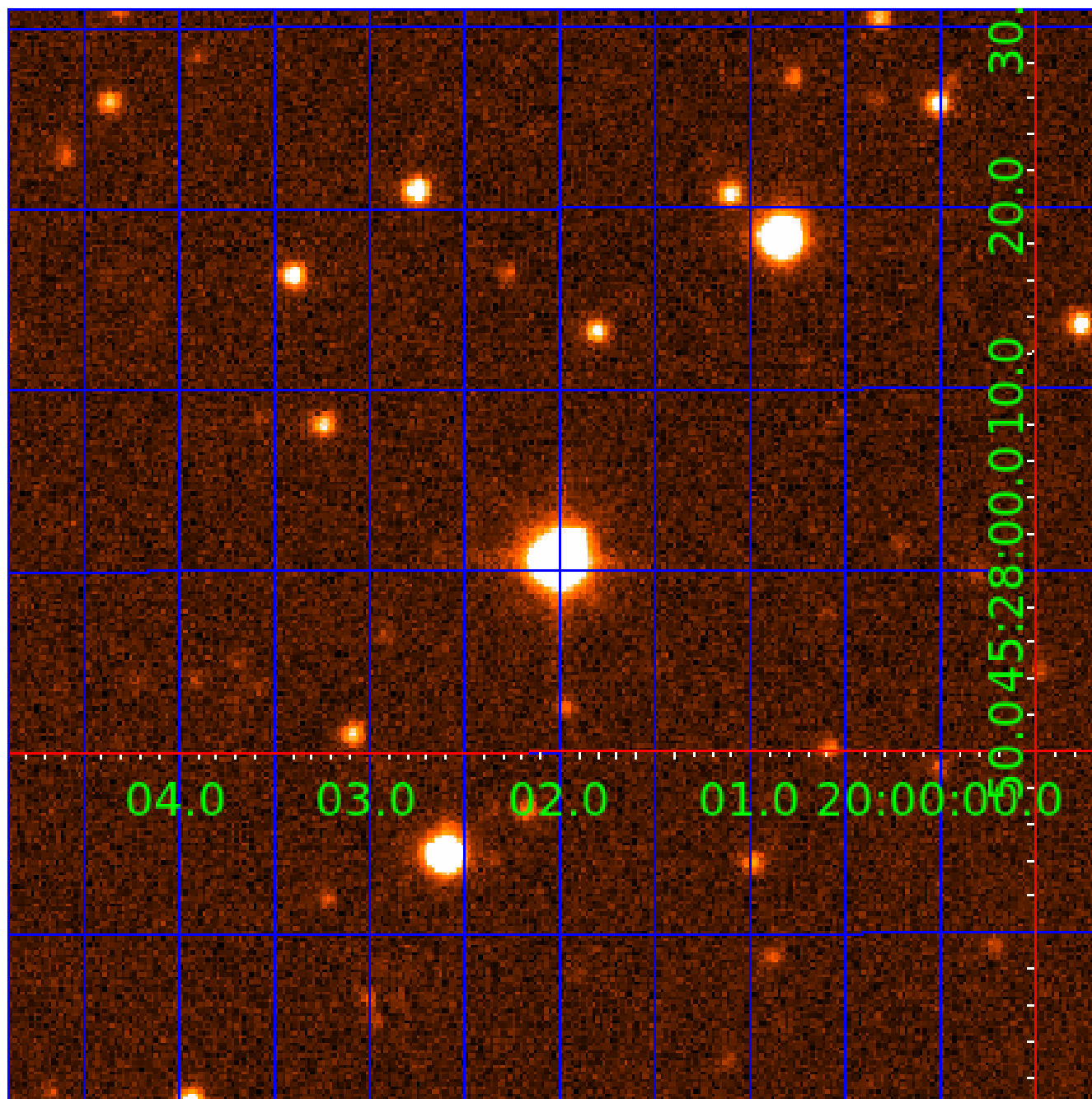
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





UKIRT Image

Declination



# KIC 009116222

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009116222-01	OBS	No	489.779016	380.468831	1913.8	3.398	21.7	12.3	4.24	5152	18.87	6.96
009116222-02	OBS	No	443.783301	513.691712	1371.8	5.673	16.8	8.9	4.24	5152	15.64	7.94
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009116222-04	OBS	No	472.123627	304.092546	1110.6	10.451	16.9	6.0	4.24	5152	14.13	7.31
009116222-05	OBS	No	388.636869	218.442355	1603.7	6.328	17.1	11.7	4.24	5152	17.72	9.47

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009116222-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009116222-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009116222-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—CENT_FEW_DIFFS
009116222-04	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_CHASES—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—HALO_GHOST
009116222-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—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.

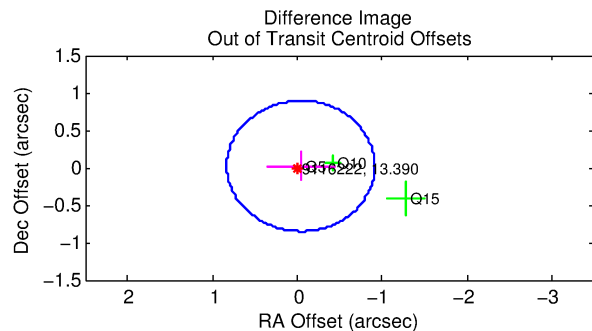
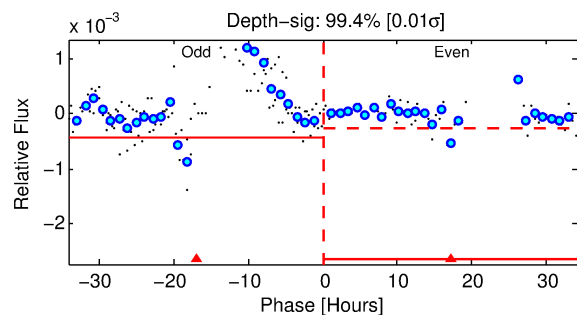
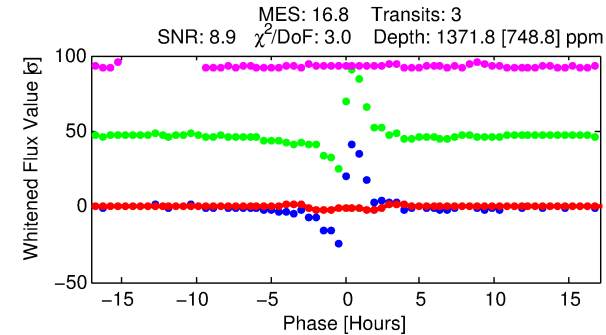
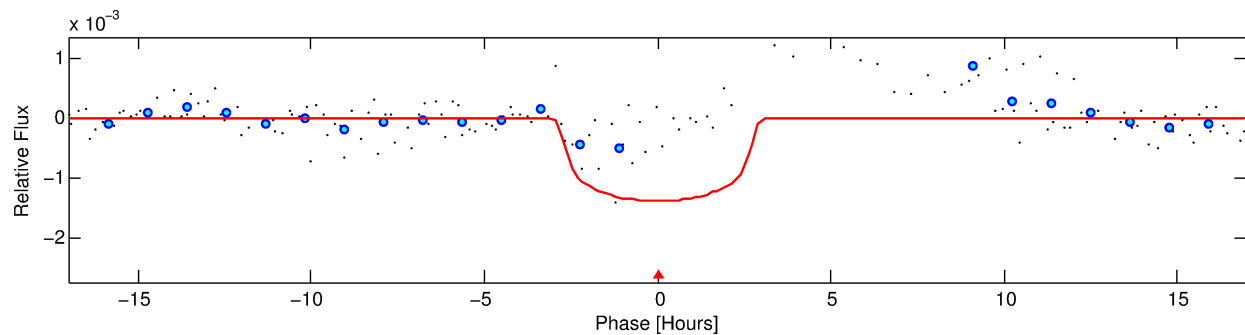
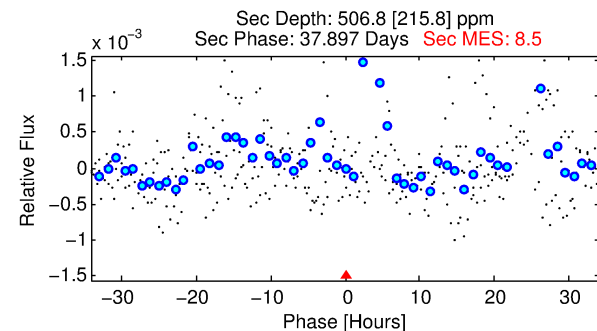
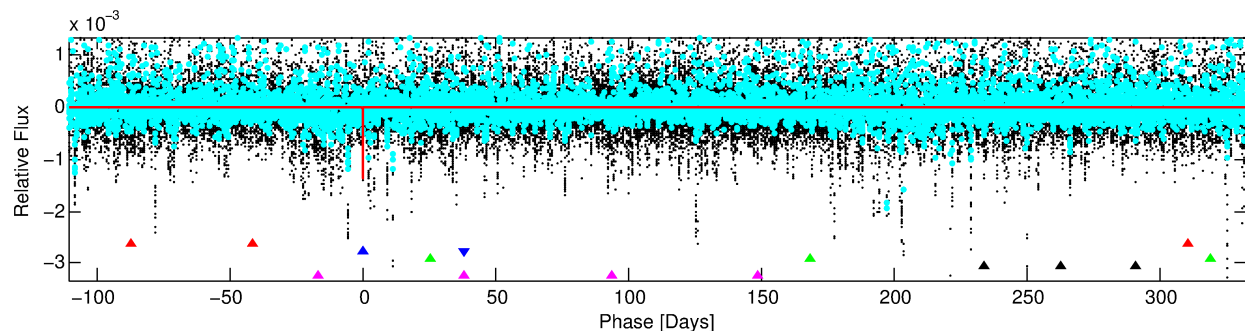
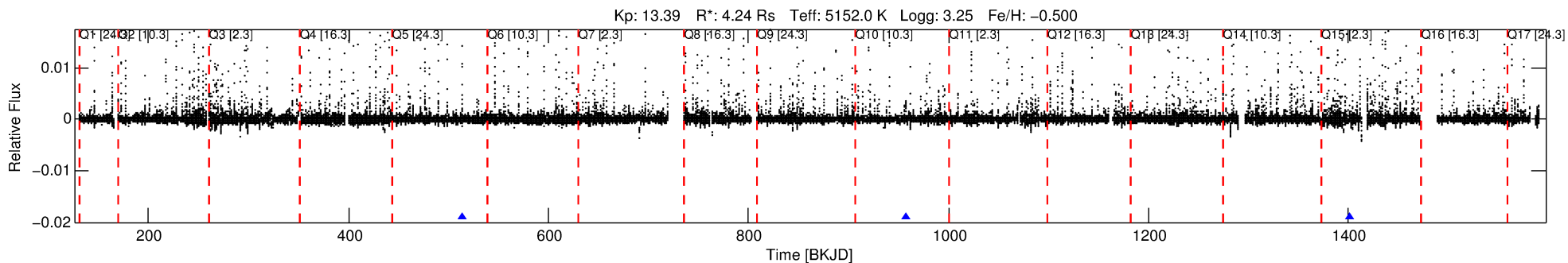
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 009116222-02

No Significant Match Found

# DV One-Page Summary

KIC: 9116222 Candidate: 2 of 5 Period: 443.783 d



## DV Fit Results:

Period = 443.78330 [0.02165] d  
Epoch = 513.6917 [0.0217] BKJD  
Rp/R\* = 0.0338 [0.1458]  
a/R\* = 583.19 [9743.34]  
b = 0.34 [43.77]  
Seff = 7.94 [4.51]  
Teq = 428 [61] K  
Rp = 15.64 [67.80] Re  
a = 1.1965 [0.4372] AU  
Ag = 1632.52 [14141.07] [0.12σ]  
Teffp = 4206 [9090] K [0.42σ]

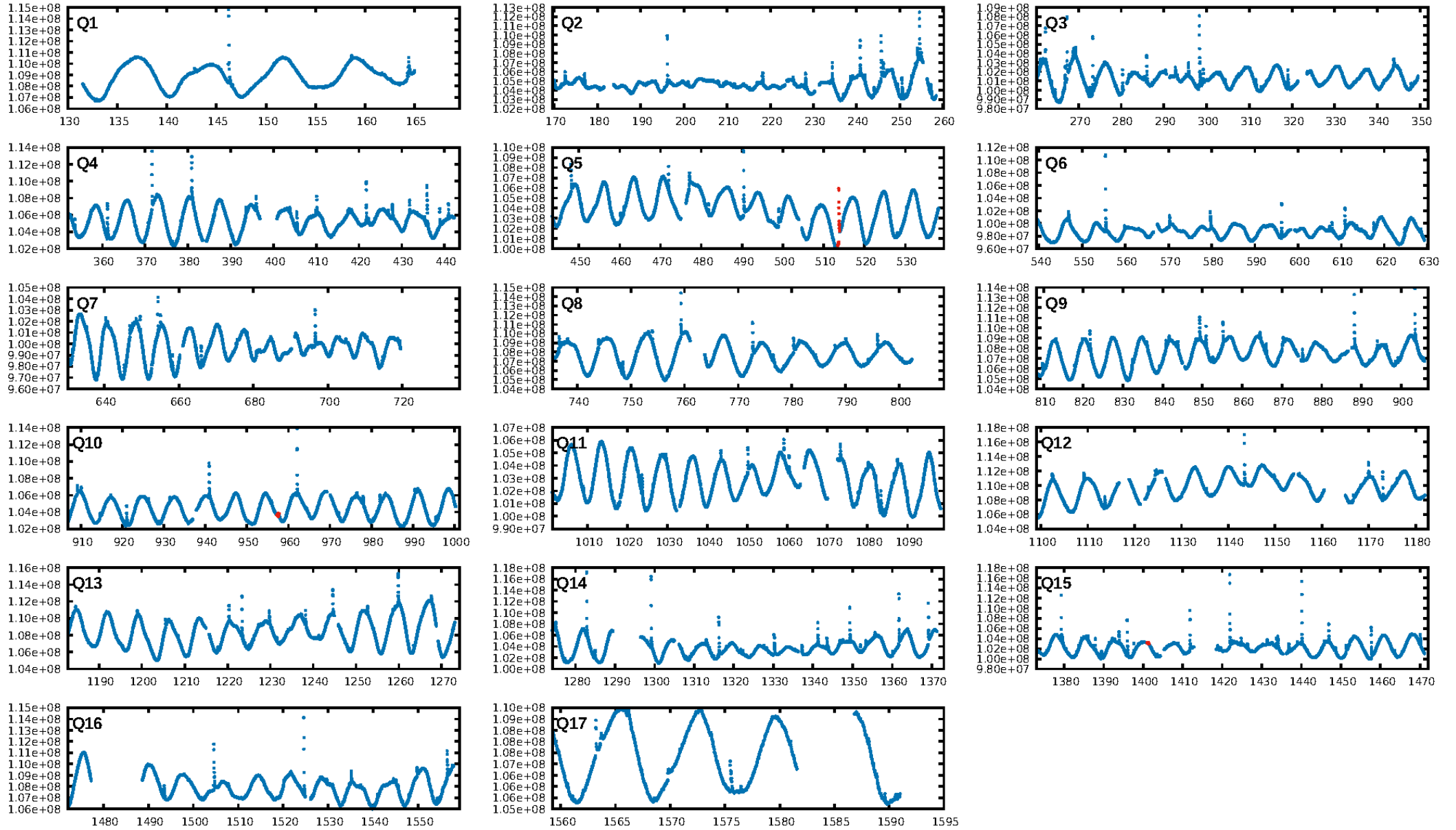
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [155.72σ]  
LongPeriod-sig: 100.0% [57.20σ]  
ModelChiSquare2-sig: 20.9%  
ModelChiSquareGof-sig: 20.4%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: -0.4302  
Centroid-sig: 73.1%  
Centroid-so: 0.156 arcsec [0.37σ]  
OotOffset-rm: 0.047 arcsec [0.16σ]  
OotOffset-st: 1/1/0/1 [3]  
KicOffset-rm: 0.103 arcsec [0.50σ]  
KicOffset-st: 1/1/0/1 [3]  
DiffImageQuality-fgm: 0.33 [1/3]  
DiffImageOverlap-fno: 1.00 [3/3]

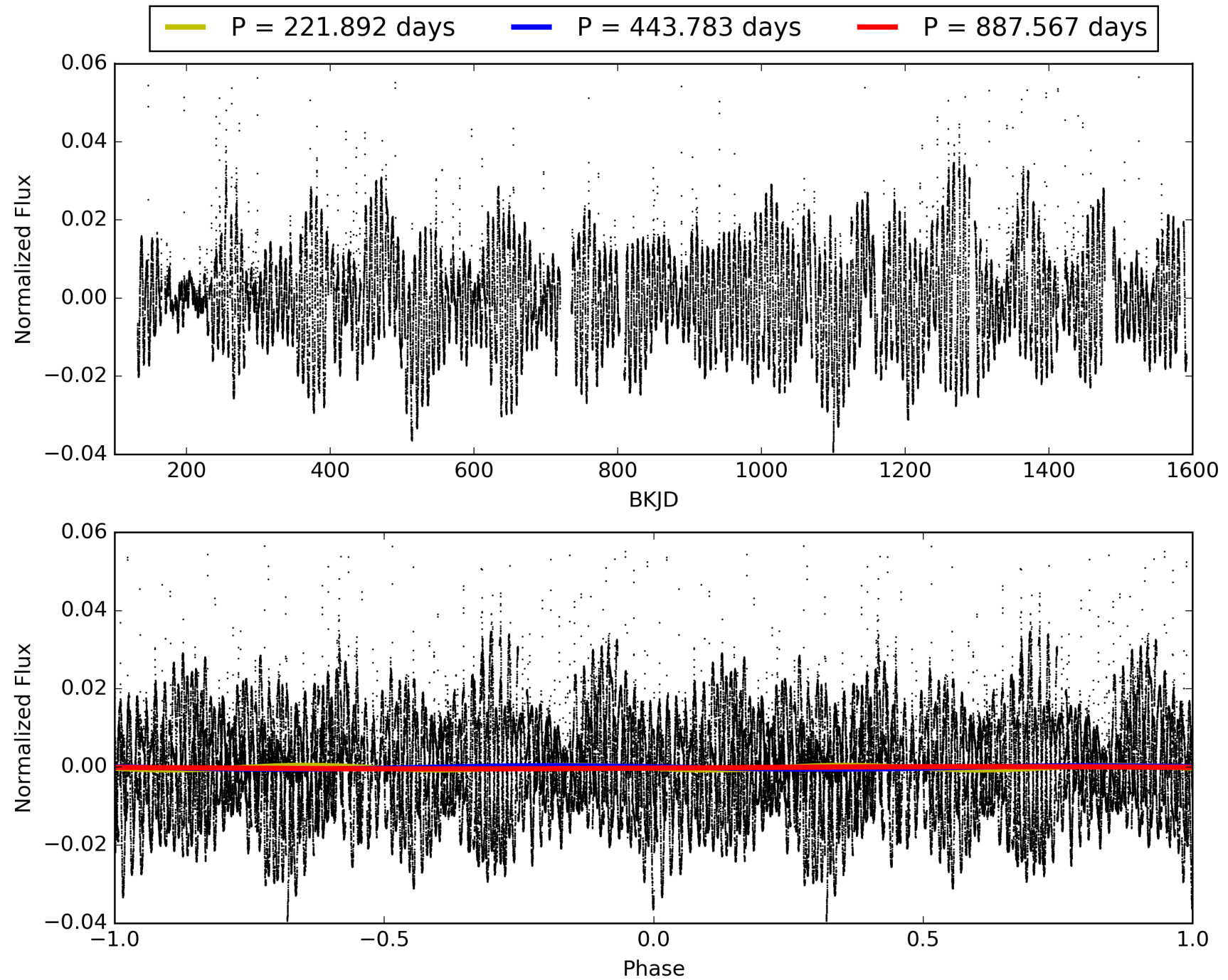
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 13:11:10 Z

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

# TCE 009116222-02, PDC Light Curves



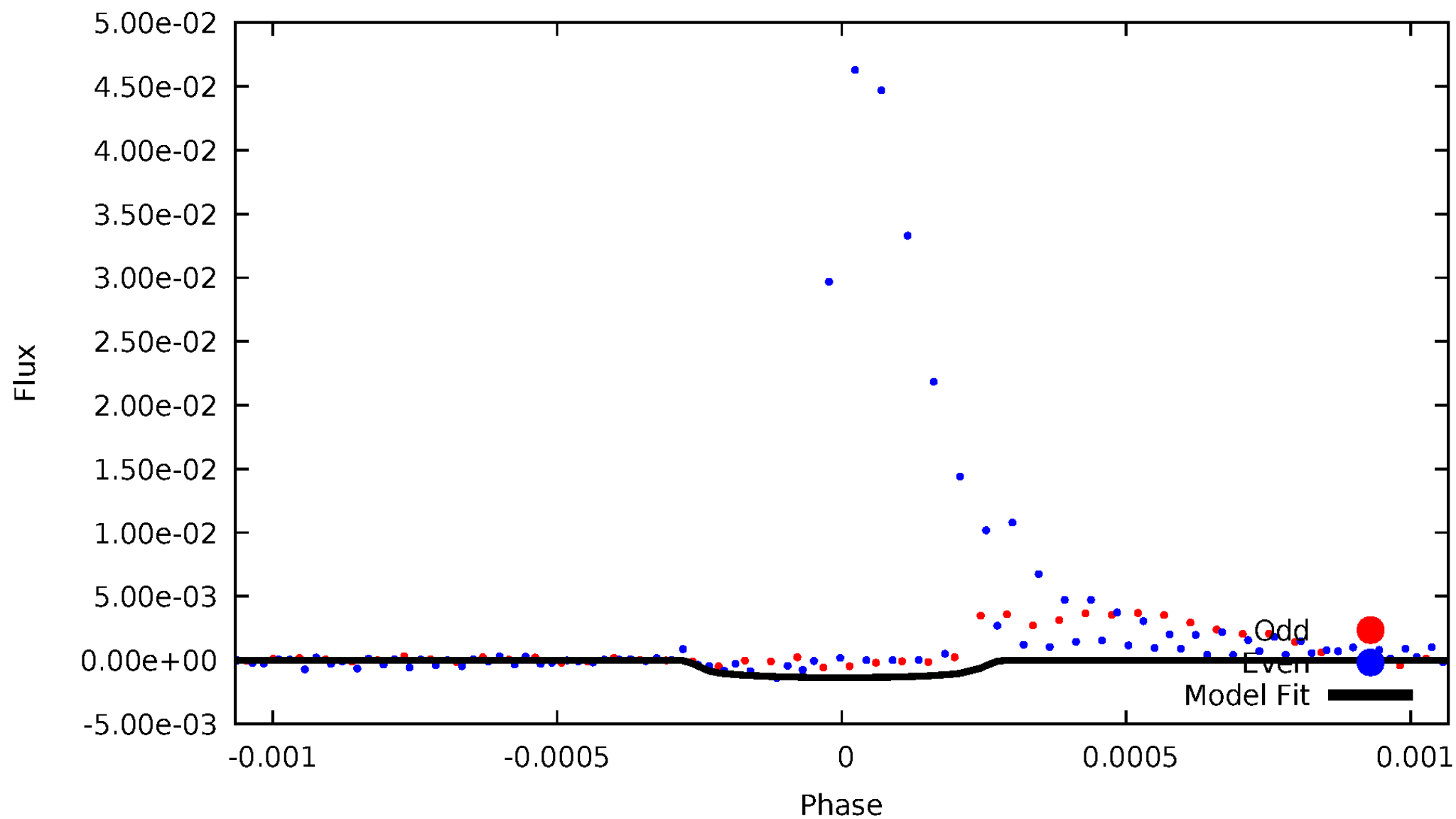
TCE 009116222-02





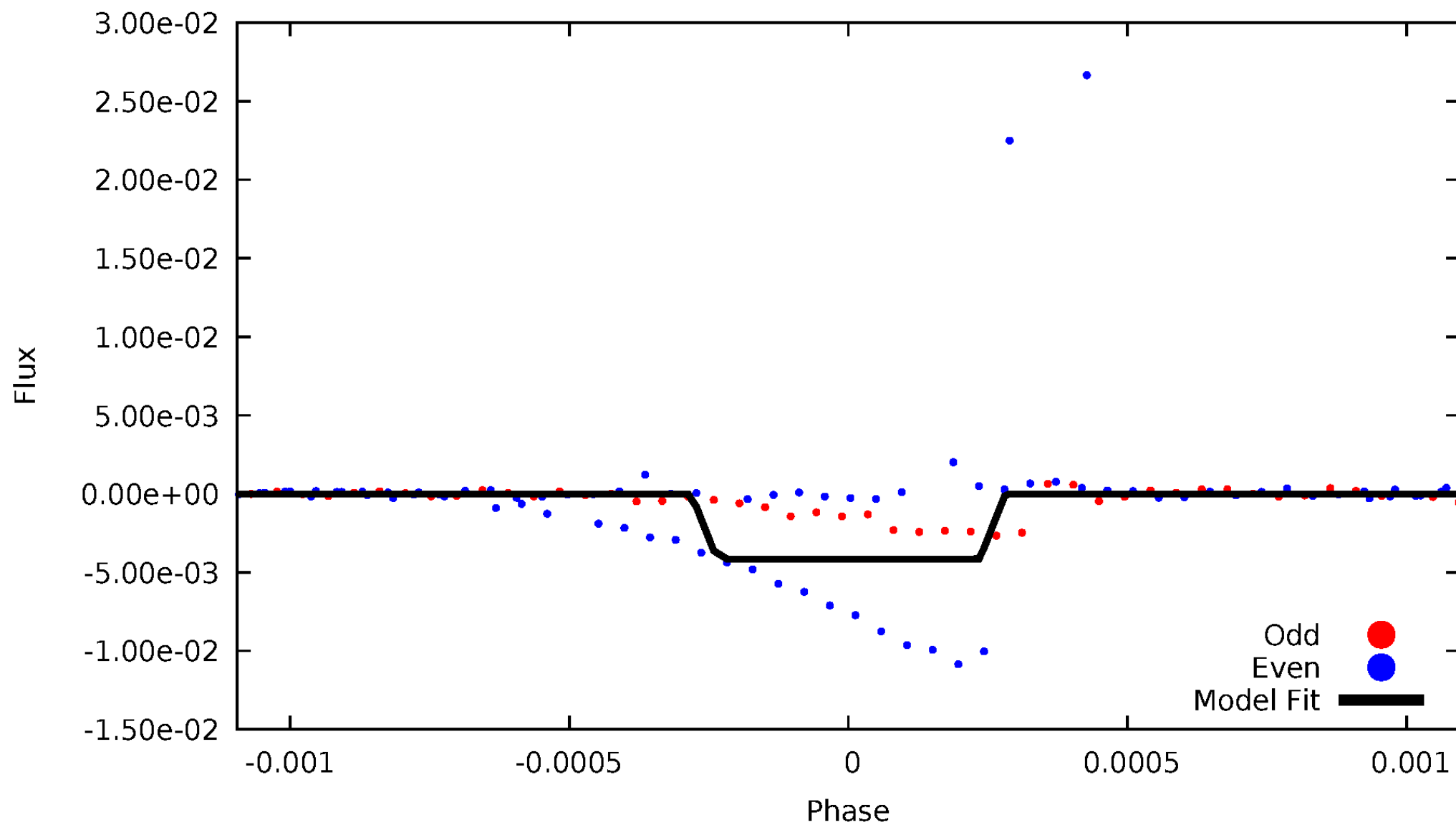
# DV Odd/Even

TCE 009116222-02



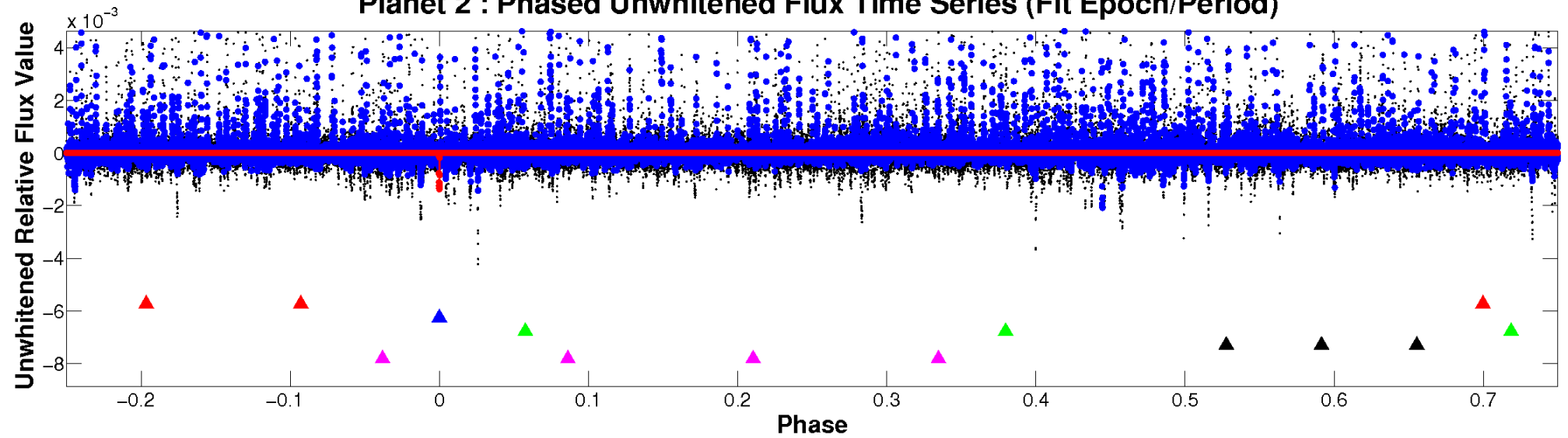
# ALT Odd/Even

TCE 009116222-02

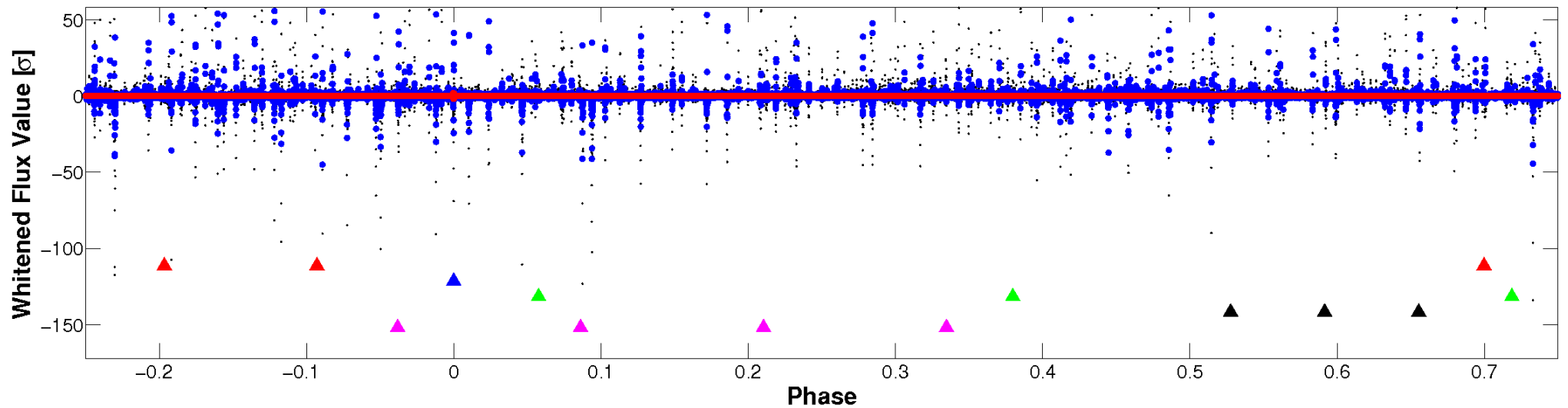


# Non-Whitened Vs. Whitened Light Curve

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

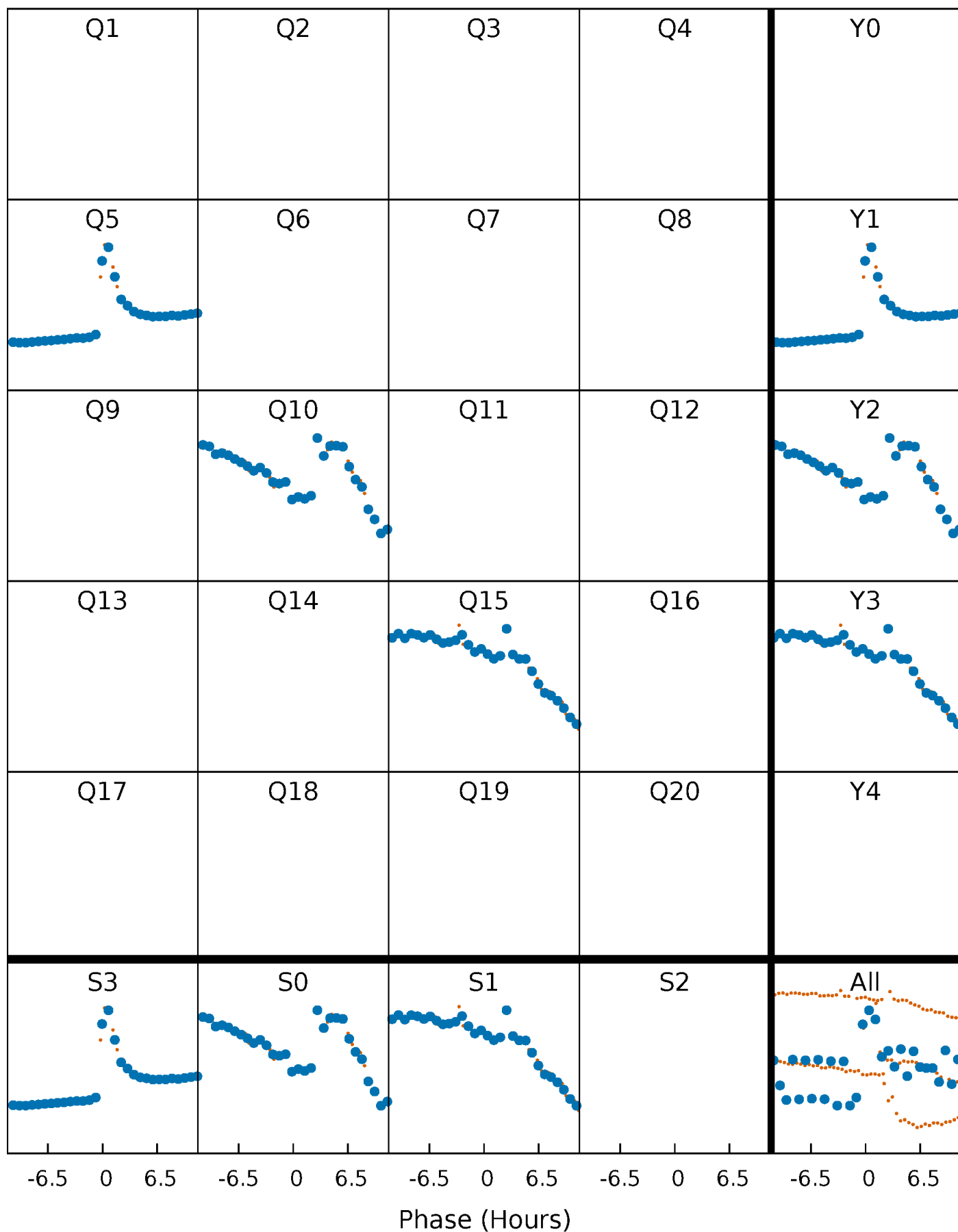


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



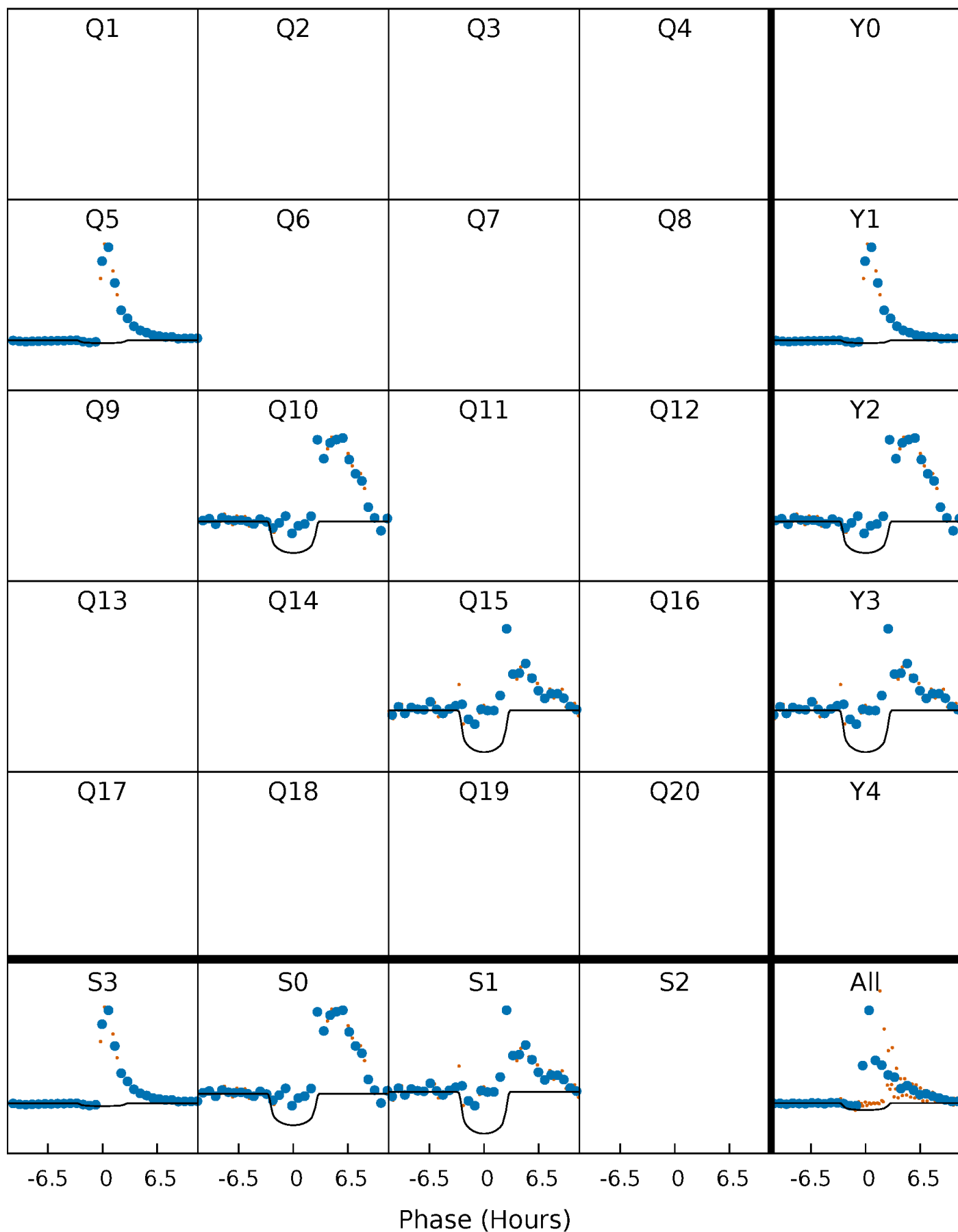
# PDC Quarter-Phased Transit Curves

TCE 009116222-02 P=443.783301 Days  $T_0=513.691712$  (BKJD)



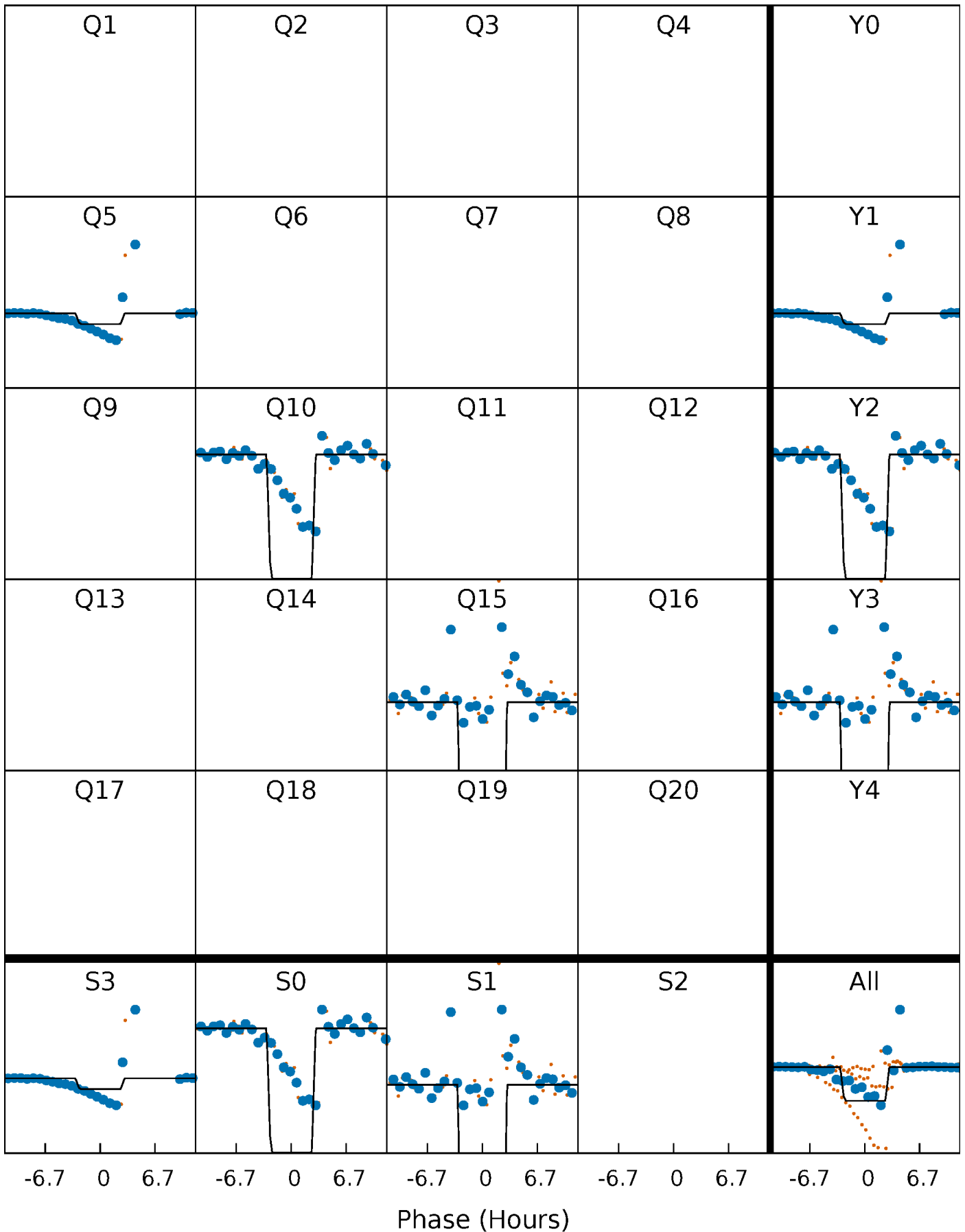
# DV Quarter-Phased Transit Curves

TCE 009116222-02 P=443.783301 Days  $T_0=513.691712$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

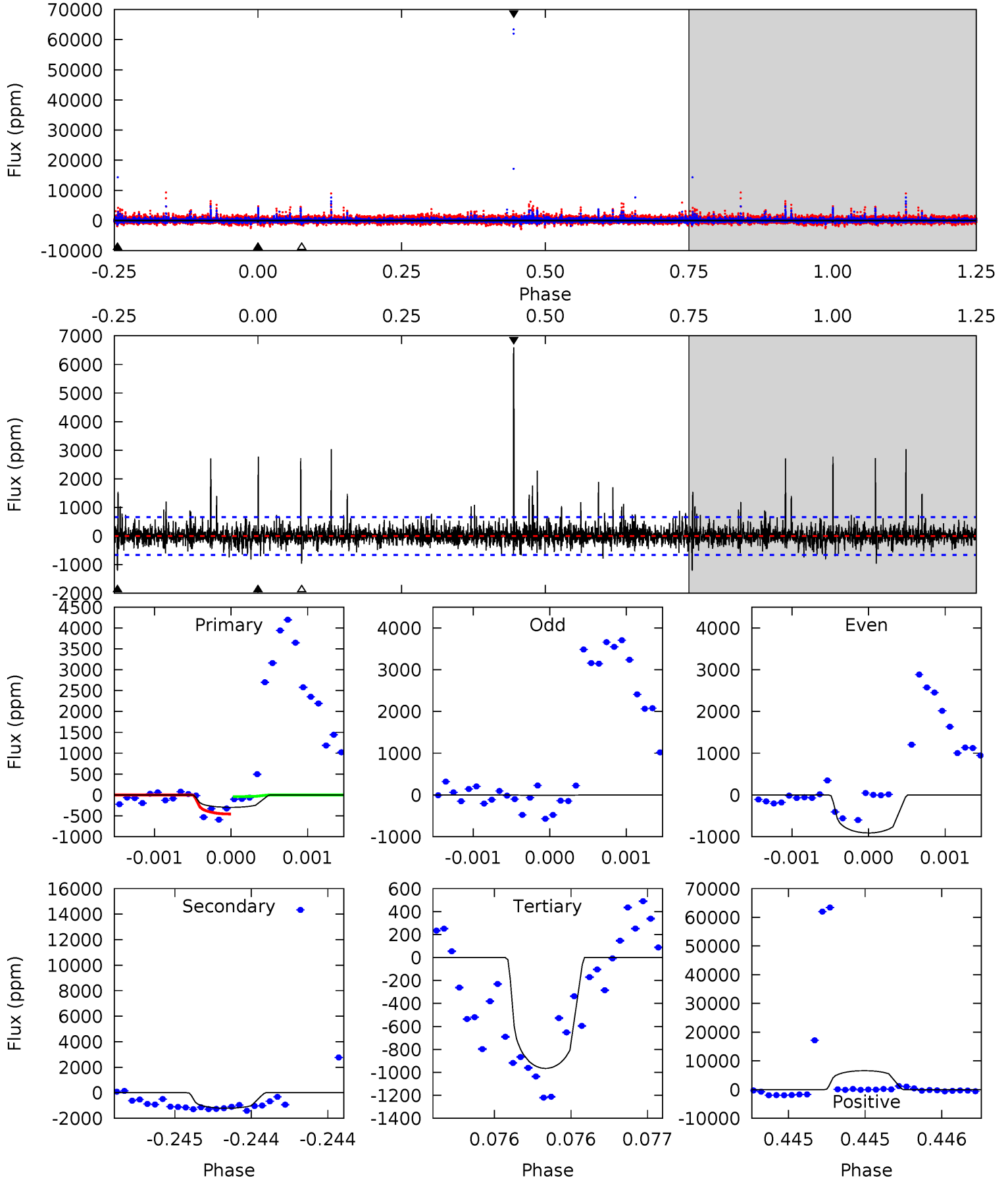
TCE 009116222-02 P=443.871413 Days  $T_0=513.553451$  (BKJD)



# DV Model-Shift Uniqueness Test

009116222-02, P = 443.783301 Days, E = 69.908411 Days

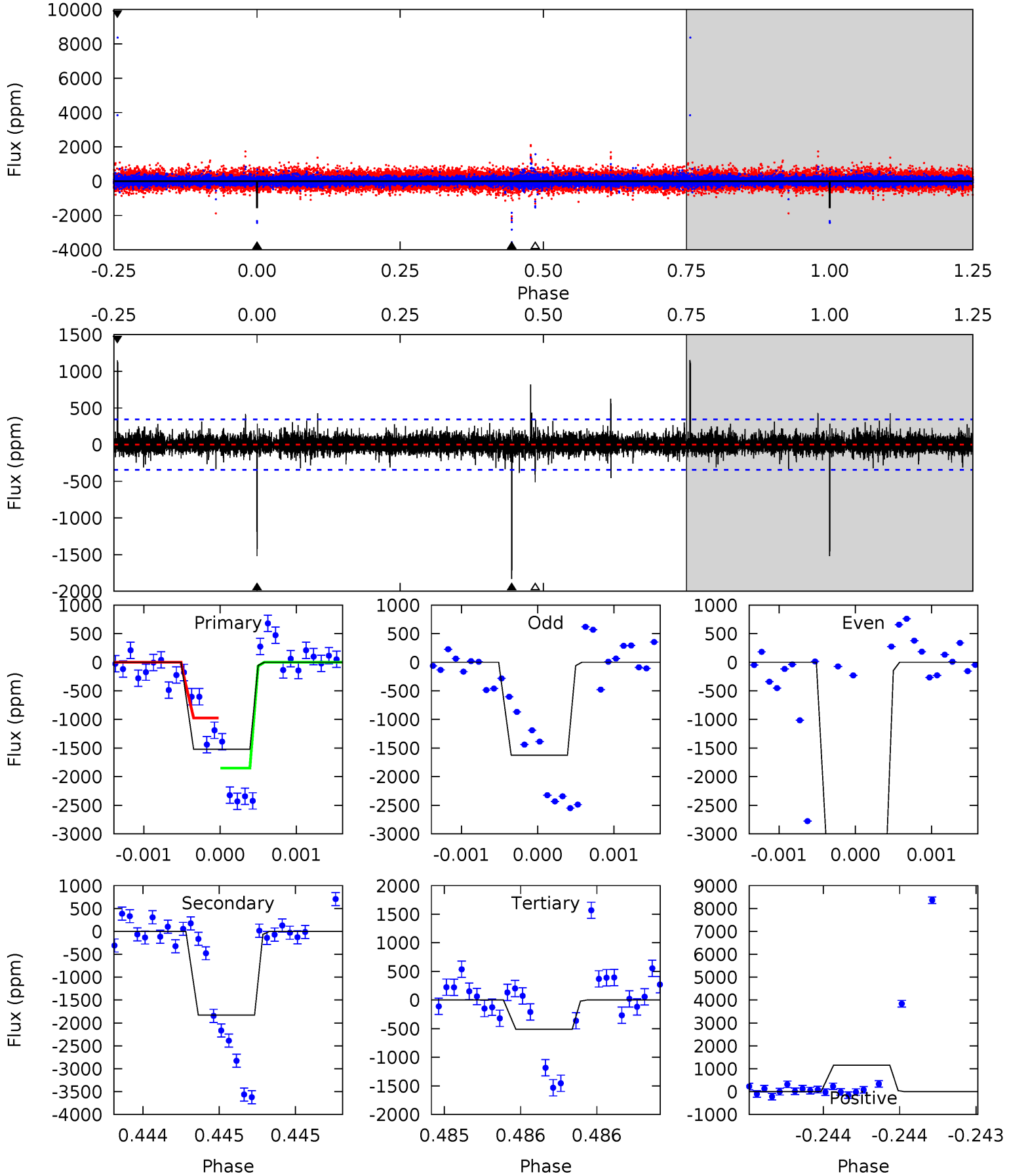
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
2.49	10.1	8.09	55.2	5.55	3.45	2.18	-5.60	-52.7	2.05	-45.0	2.11	914.0	0.84	2.15



# Alt Model-Shift Uniqueness Test

009116222-02, P = 443.871413 Days, E = 69.682038 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
24.6	29.6	8.28	18.6	5.55	3.45	1.08	16.3	5.94	21.3	10.9	22.5	1.91	0.39	7.37





### Stellar Parameters For KIC 009116222

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M$ ( $M_{\odot}$ )	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$5152^{+128}_{-128}$	$3.247^{+0.319}_{-0.261}$	$-0.500^{+0.250}_{-0.250}$	$4.243^{+1.726}_{-1.412}$	$1.158^{+0.209}_{-0.256}$	$0.021^{+0.044}_{-0.013}$
	+2%/-2%	+10%/-8%	+50%/-50%	+41%/-33%	+18%/-22%	+208%/-59%
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 009116222-02 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-1211 \pm 119$	$54.88^{+56.20}_{-37.05}$	$599^{+68}_{-60}$	$3290^{+1710}_{-551}$	$304^{+2728}_{-228}$
Alt.	$-1830 \pm 62$	$58.52^{+58.39}_{-38.36}$	$598^{+63}_{-58}$	$3438^{+1630}_{-605}$	$418^{+3064}_{-315}$

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

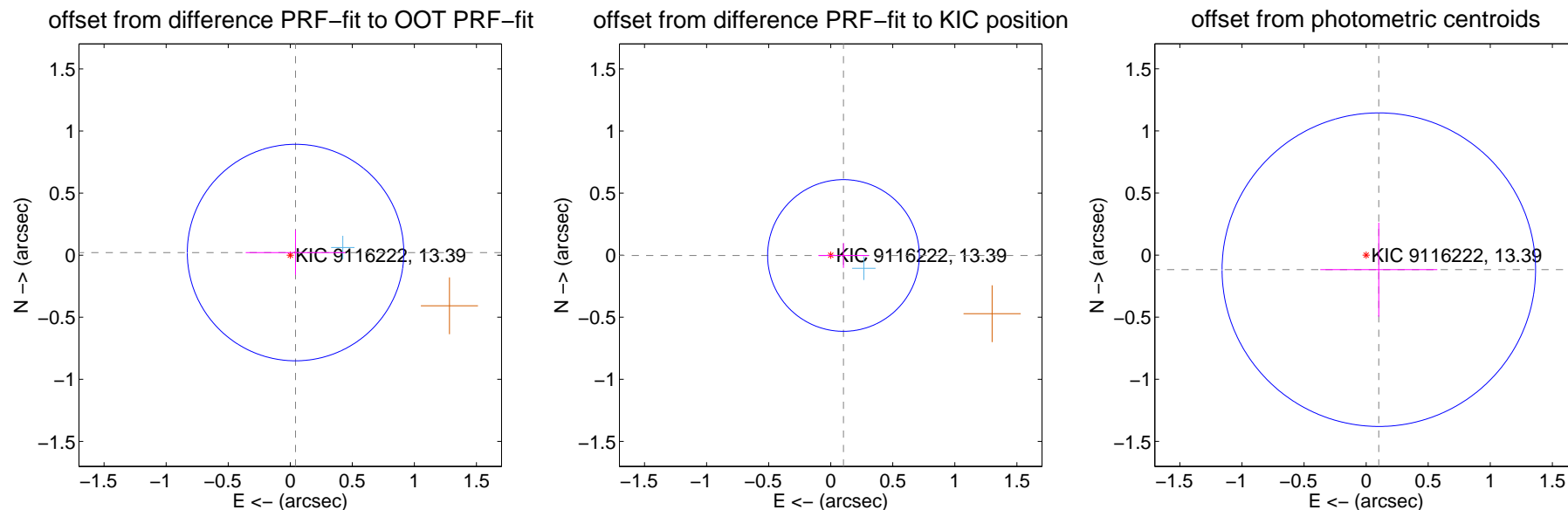
## DV Centroid Data

Supplemental centroid analysis for 009116222-02. Kepler magnitude: 13.39. Transit SNR 8.94

There are 1 quarters with good PRF difference image offsets

The direct PRF centroid is offset from the target star catalog position by about 0.07 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.047 \pm 0.291$	0.16	$-0.043 \pm 0.401$	$0.021 \pm 0.180$
PRF-fit source offset from KIC position	$0.103 \pm 0.204$	0.50	$-0.103 \pm 0.202$	$-0.003 \pm 0.100$
photometric centroid source offset	$0.16 \pm 0.42$	0.37	$-0.10 \pm 0.47$	$-0.12 \pm 0.38$

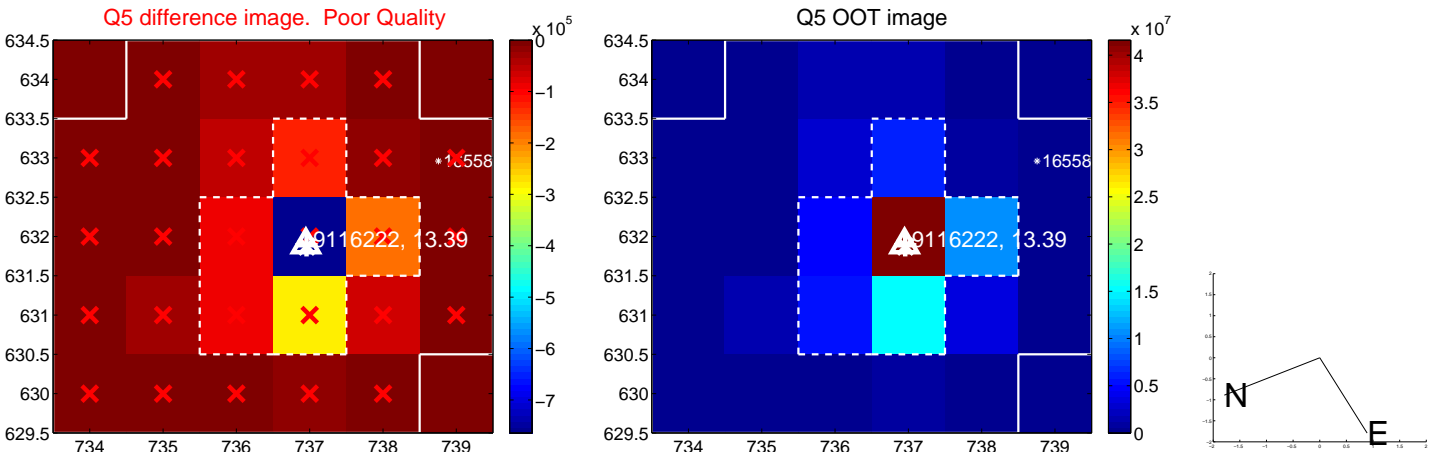


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

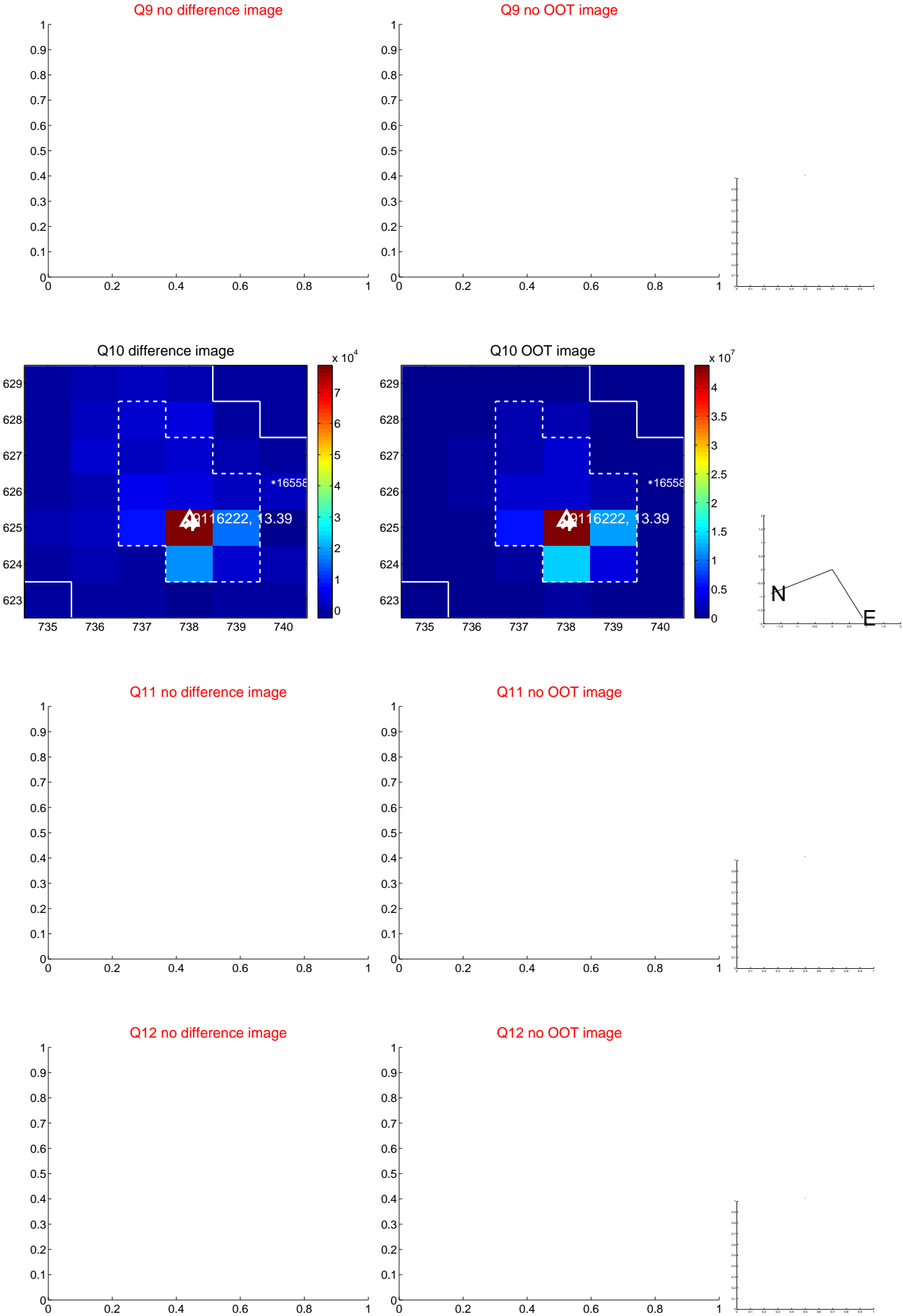
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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.

Q13 no difference image



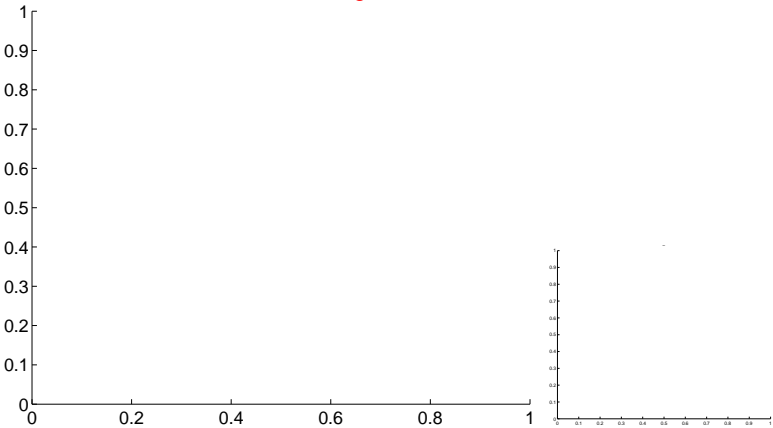
Q13 no OOT image



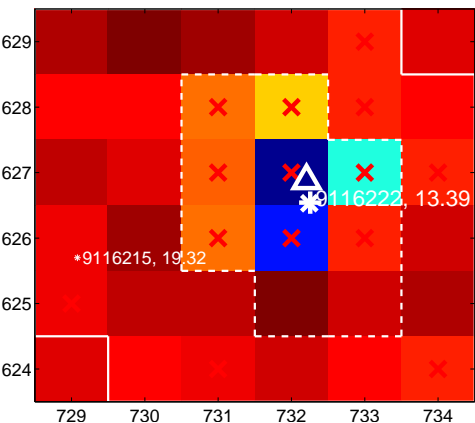
Q14 no difference image



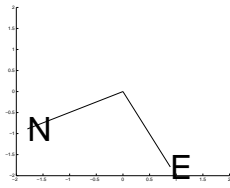
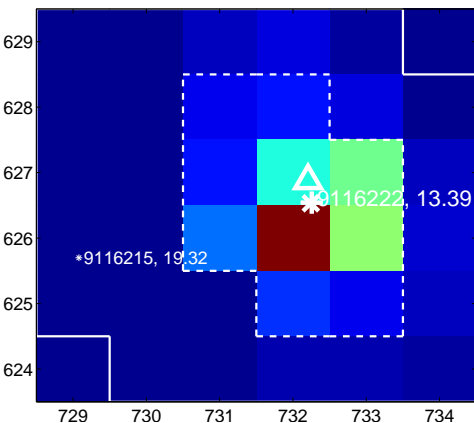
Q14 no OOT image



Q15 difference image. Poor Quality



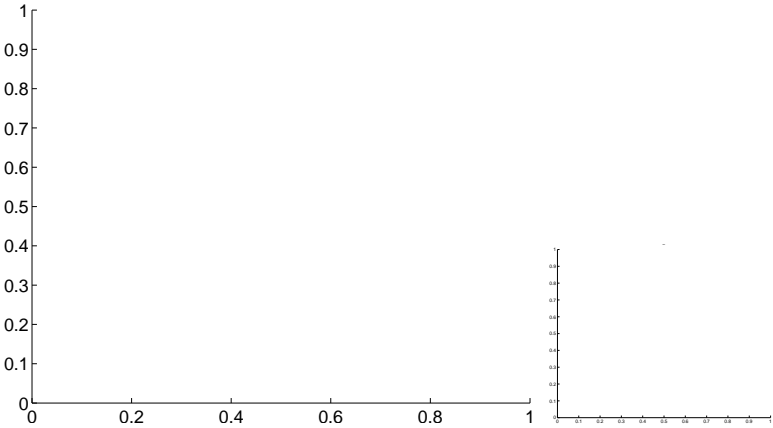
Q15 OOT image



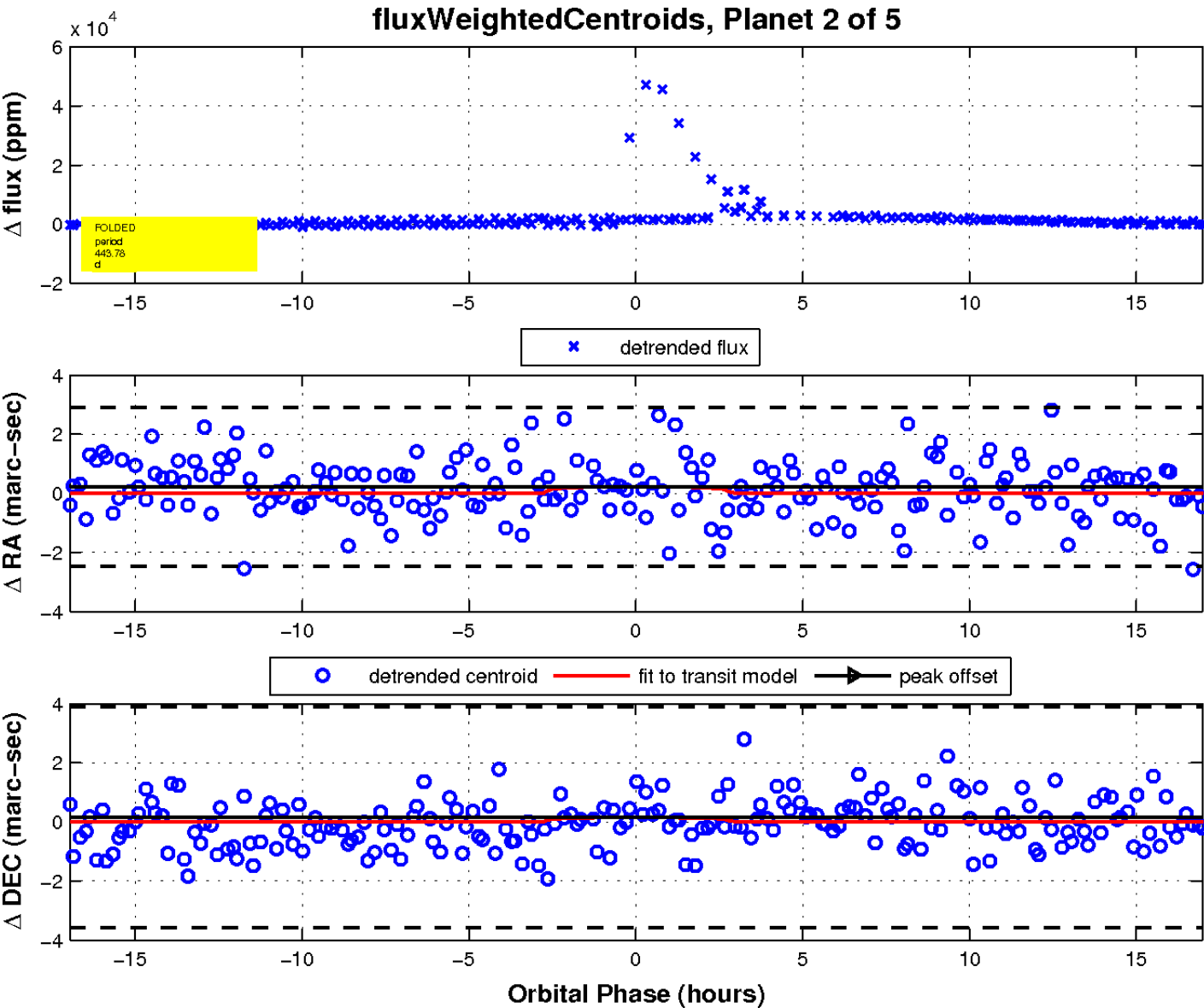
Q16 no difference image



Q16 no OOT image

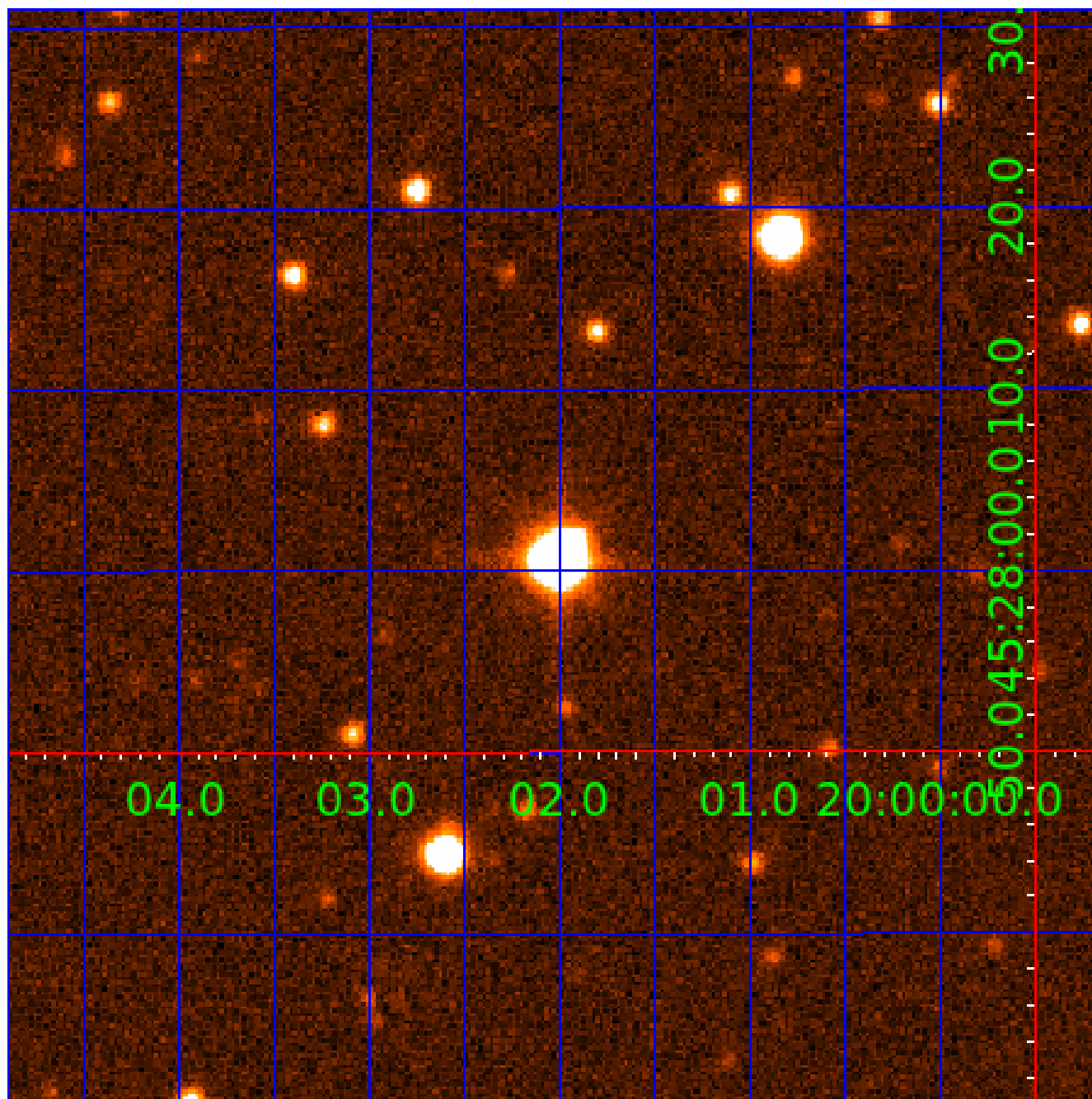


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination





# KIC 009116222

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009116222-01	OBS	No	489.779016	380.468831	1913.8	3.398	21.7	12.3	4.24	5152	18.87	6.96
009116222-02	OBS	No	443.783301	513.691712	1371.8	5.673	16.8	8.9	4.24	5152	15.64	7.94
009116222-03	OBS	No	594.203615	238.435061	1212.8	8.119	17.4	7.1	4.24	5152	16.19	5.38
009116222-04	OBS	No	472.123627	304.092546	1110.6	10.451	16.9	6.0	4.24	5152	14.13	7.31
009116222-05	OBS	No	388.636869	218.442355	1603.7	6.328	17.1	11.7	4.24	5152	17.72	9.47

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009116222-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009116222-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009116222-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—CENT_FEW_DIFFS
009116222-04	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_CHASES—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—HALO_GHOST
009116222-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—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.

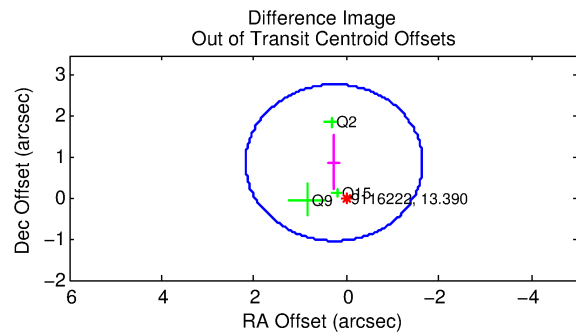
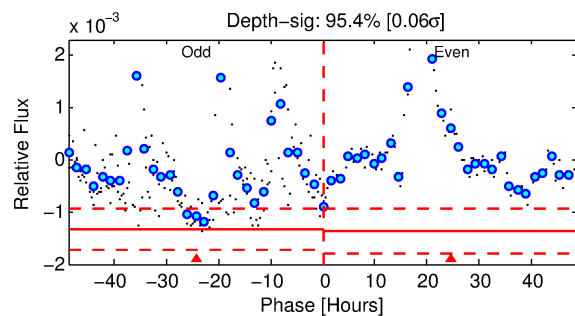
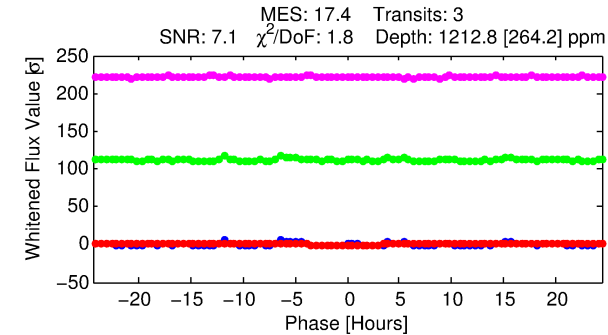
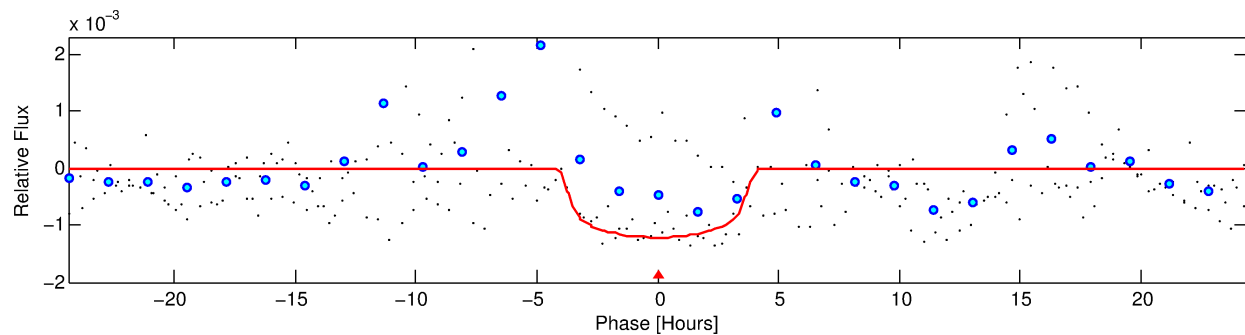
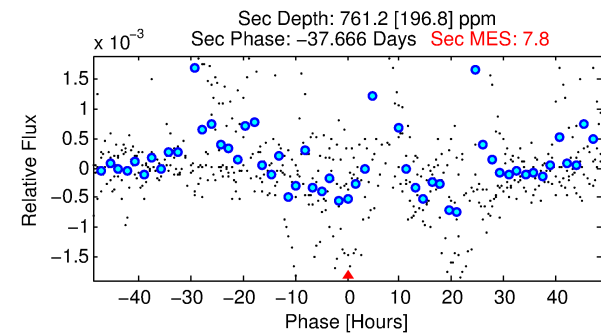
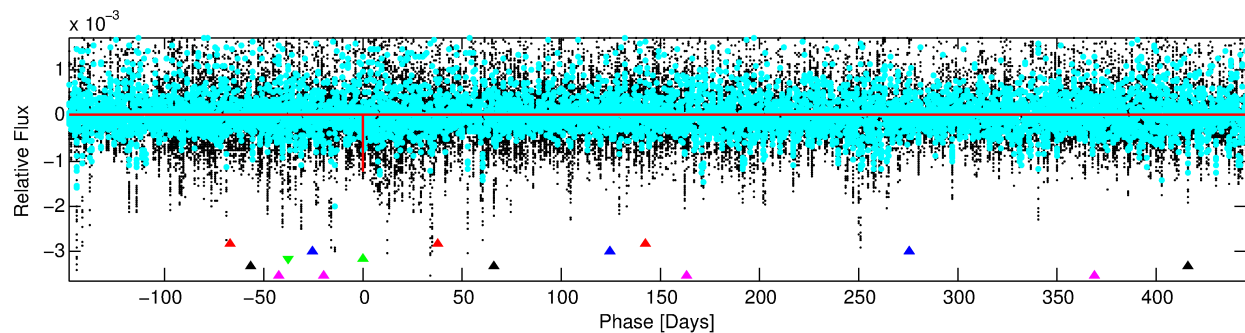
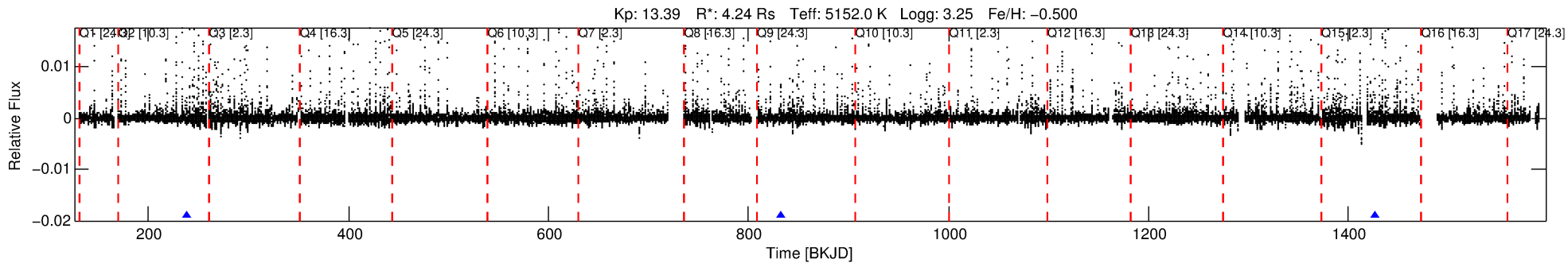
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 009116222-03

No Significant Match Found

# DV One-Page Summary

KIC: 9116222 Candidate: 3 of 5 Period: 594.204 d



## DV Fit Results:

Period = 594.20362 [0.00807] d  
Epoch = 238.4351 [0.0090] BKJD  
Rp/R\* = 0.0350 [0.0094]  
a/R\* = 388.43 [344.26]  
b = 0.77 [0.48]  
Seff = 5.38 [3.06]  
Teq = 388 [55] K  
Rp = 16.19 [7.90] Re  
a = 1.4536 [0.5311] AU  
Ag = 3375.65 [2765.30] [1.22σ]  
Teffp = 4576 [694] K [6.02σ]

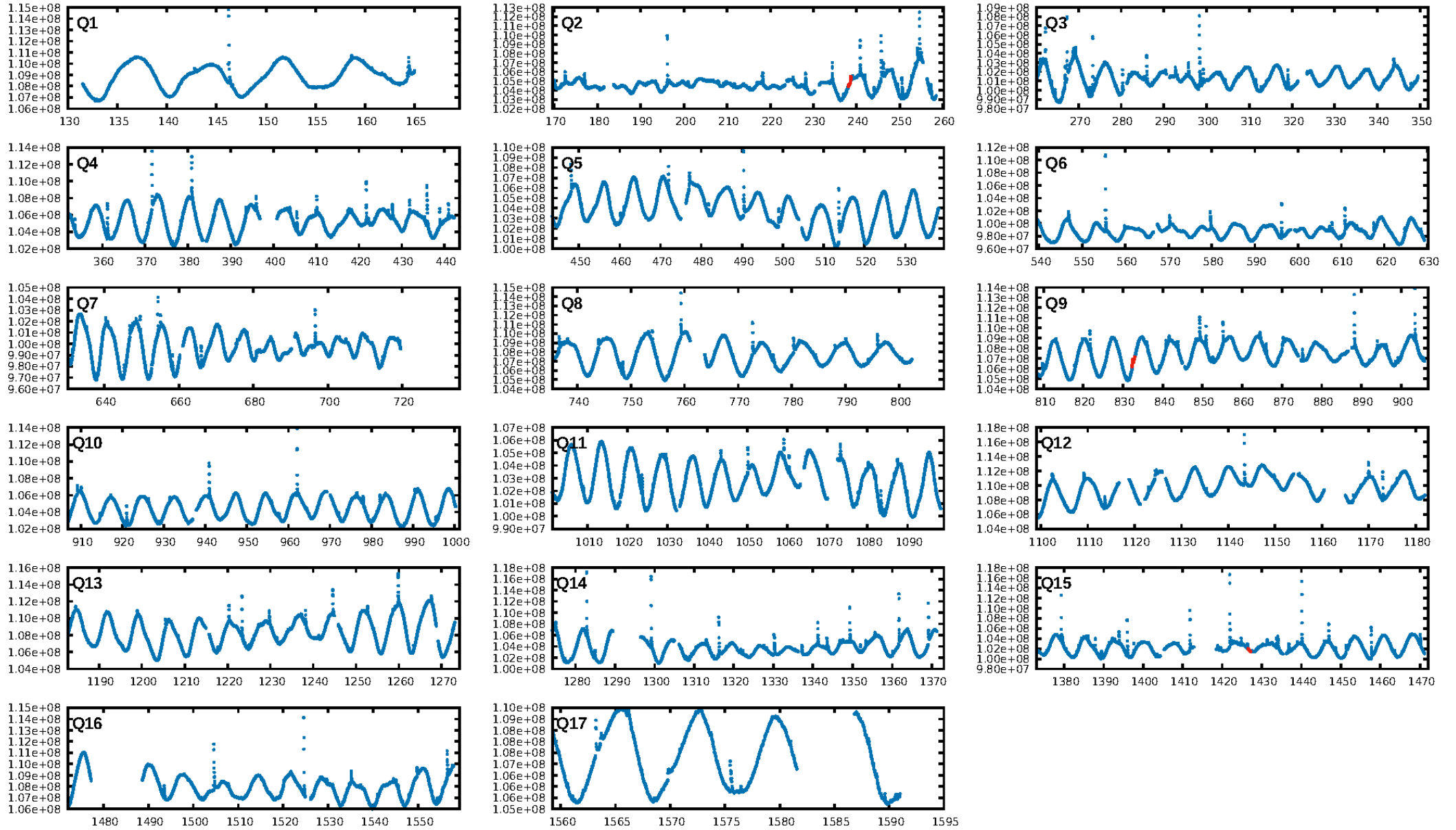
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [284.75σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 2.2%  
ModelChiSquareGof-sig: 75.9%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: 0.6155  
Centroid-sig: 38.2%  
Centroid-so: 0.343 arcsec [0.83σ]  
OotOffset-rm: 0.912 arcsec [1.43σ]  
OotOffset-st: 1/1/0/1 [3]  
KicOffset-rm: 0.825 arcsec [1.40σ]  
KicOffset-st: 1/1/0/1 [3]  
DiffImageQuality-fgm: 0.67 [2/3]  
DiffImageOverlap-fno: 1.00 [3/3]

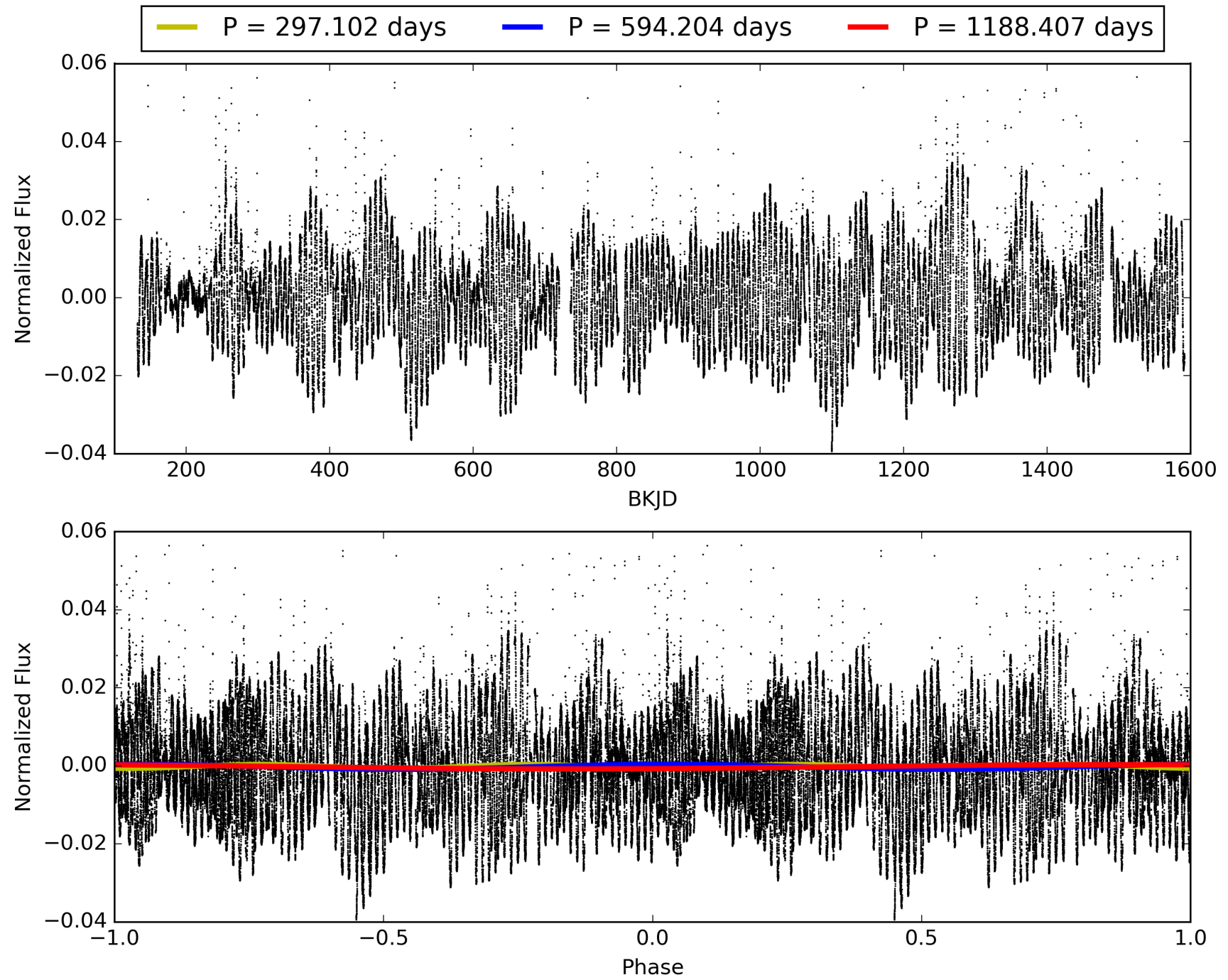
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 13:11:23 Z

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

# TCE 009116222-03, PDC Light Curves

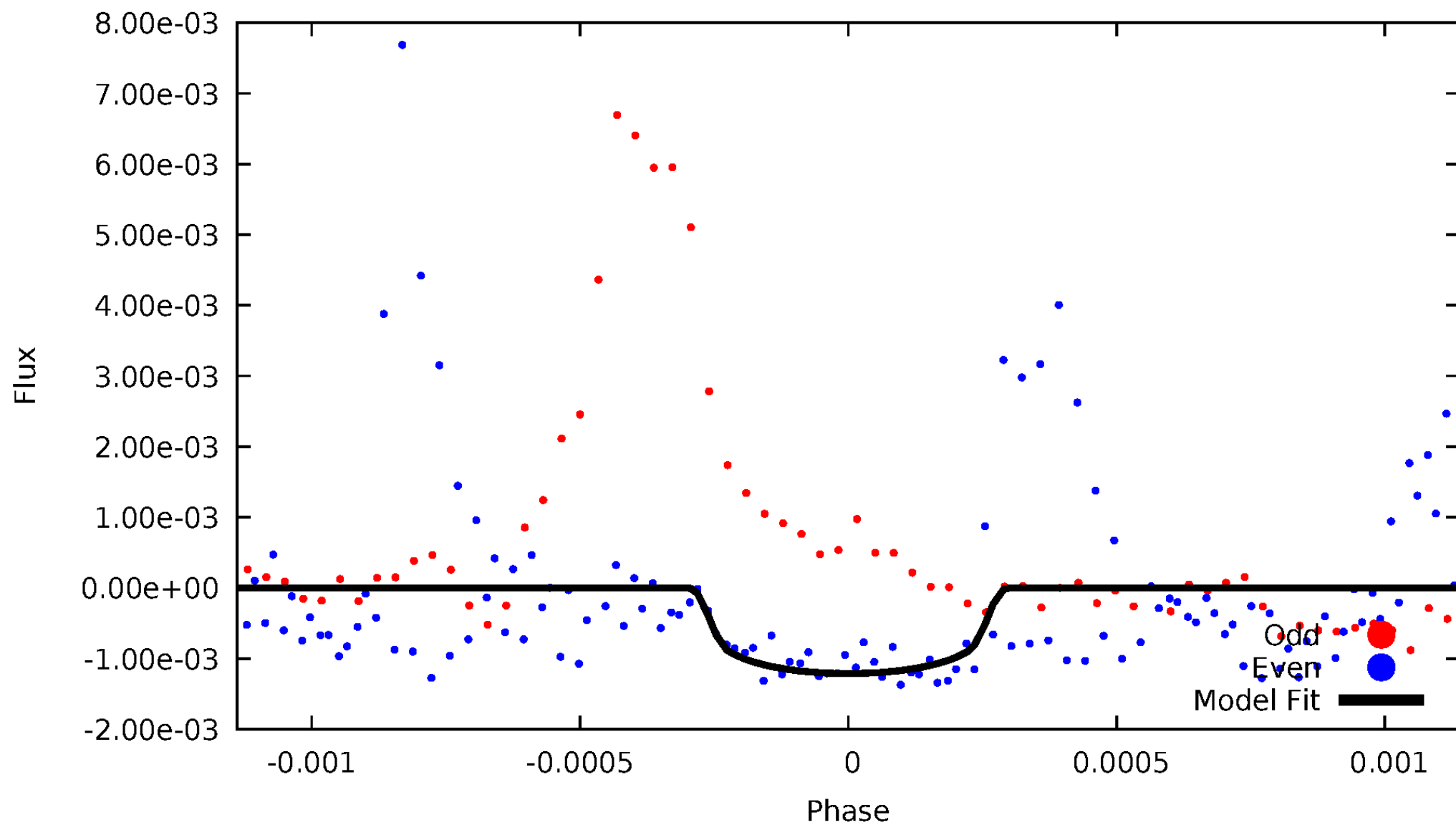


TCE 009116222-03



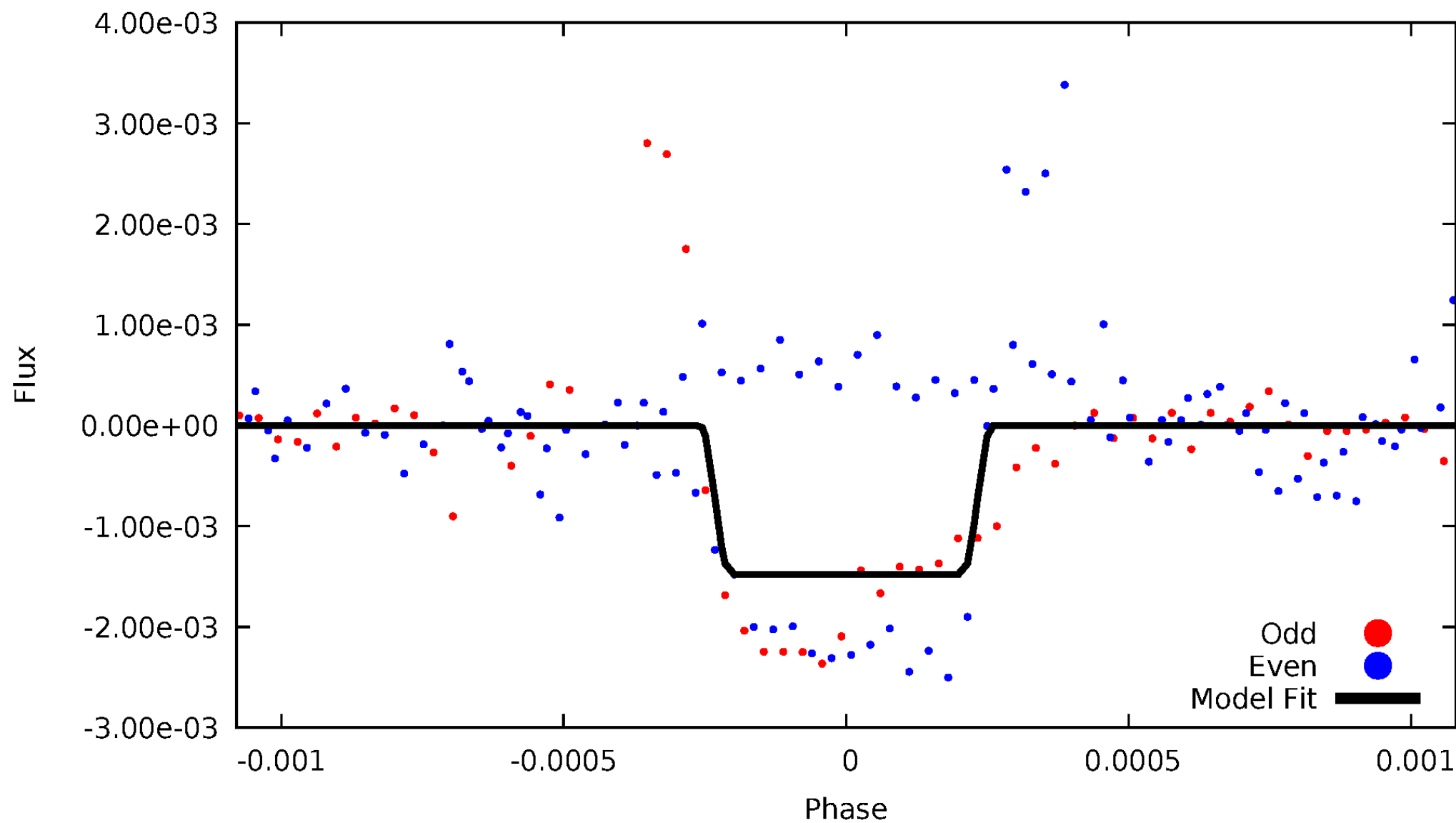
# DV Odd/Even

TCE 009116222-03



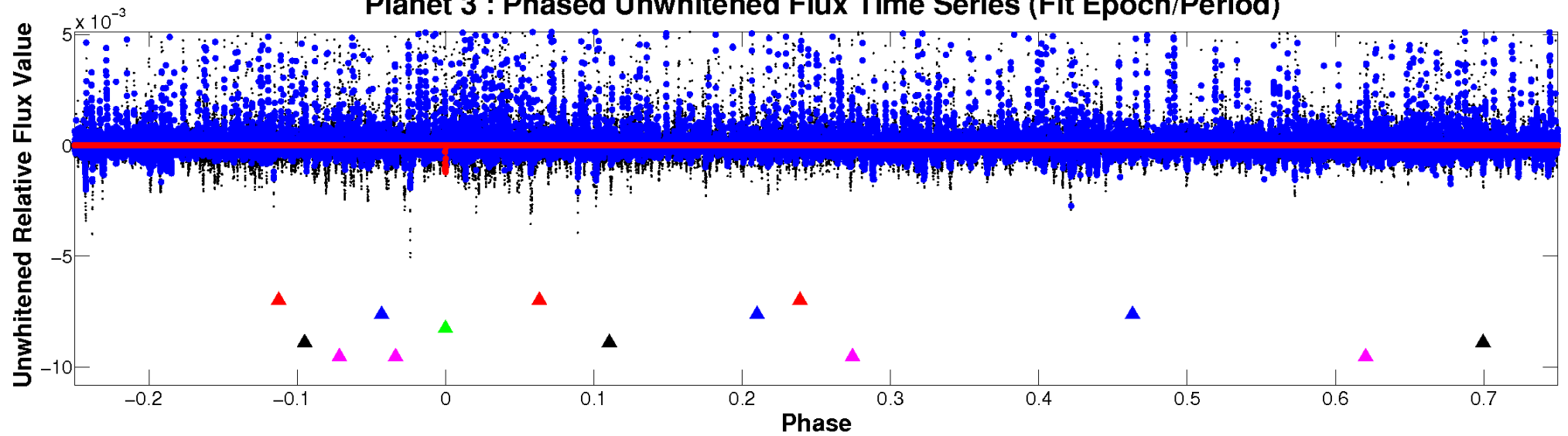
# ALT Odd/Even

TCE 009116222-03

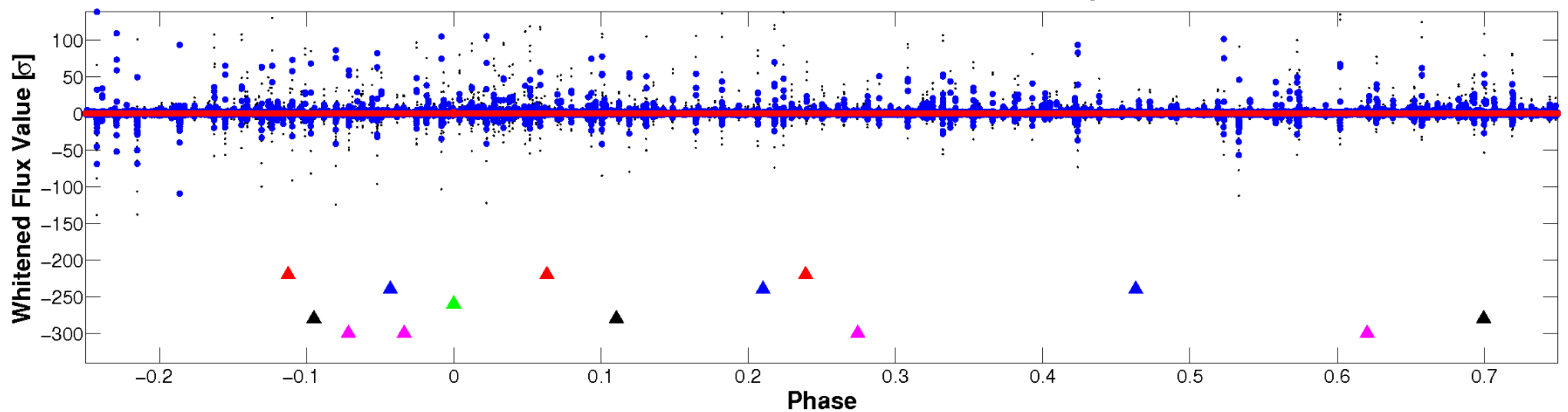


# Non-Whitened Vs. Whitened Light Curve

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

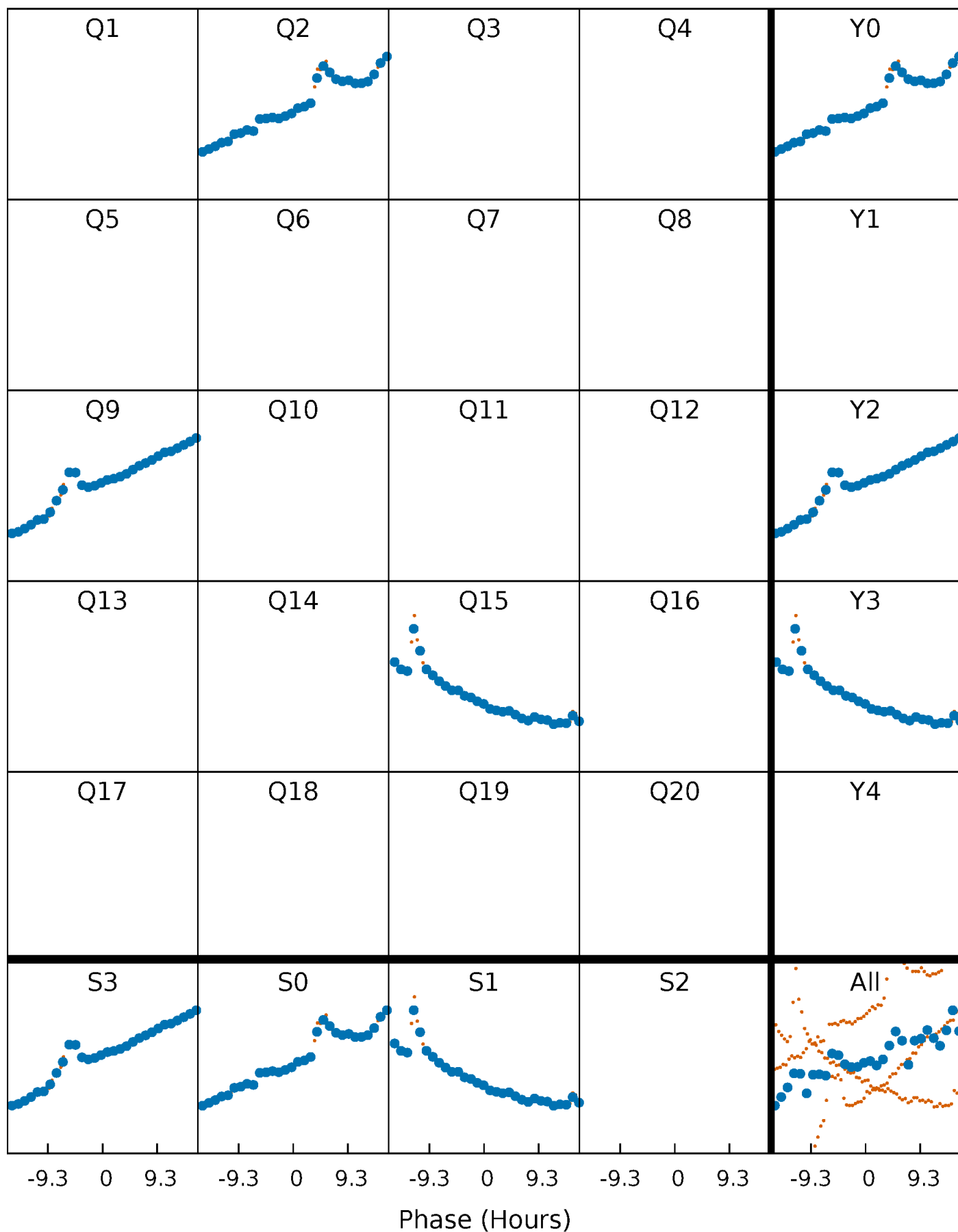


**Planet 3 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



# PDC Quarter-Phased Transit Curves

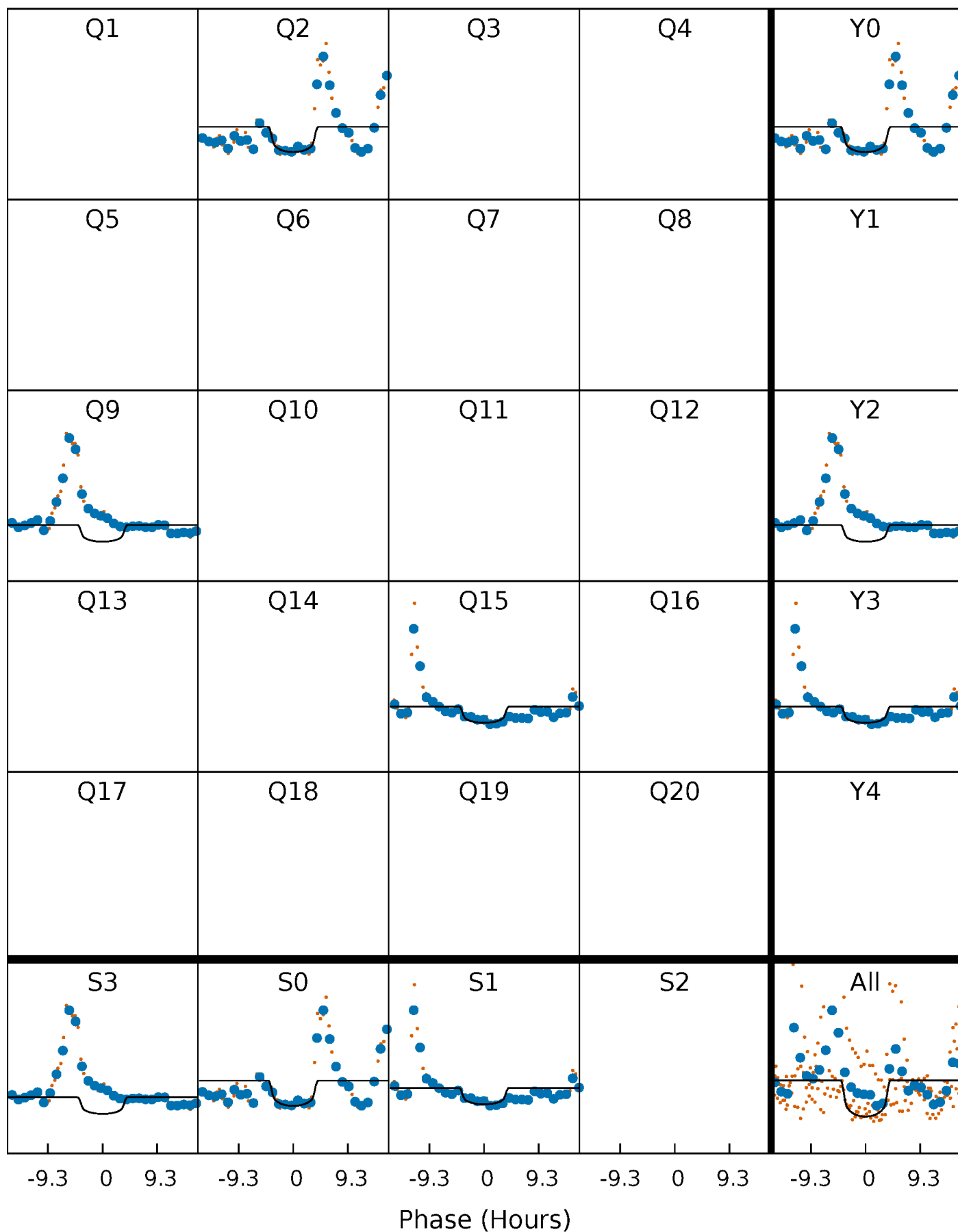
TCE 009116222-03 P=594.203615 Days  $T_0=238.435061$  (BKJD)





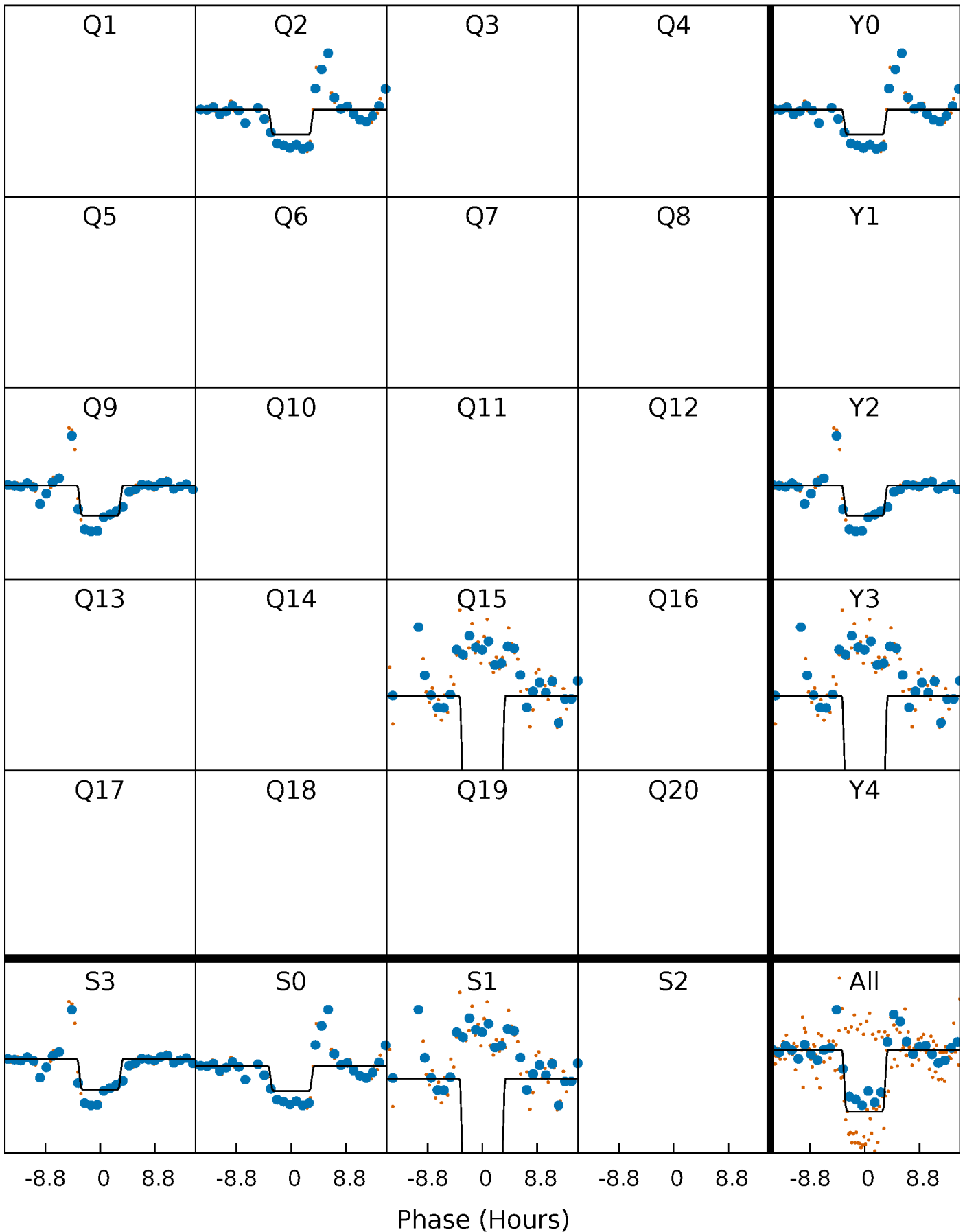
# DV Quarter-Phased Transit Curves

TCE 009116222-03     $P=594.203615$  Days     $T_0=238.435061$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

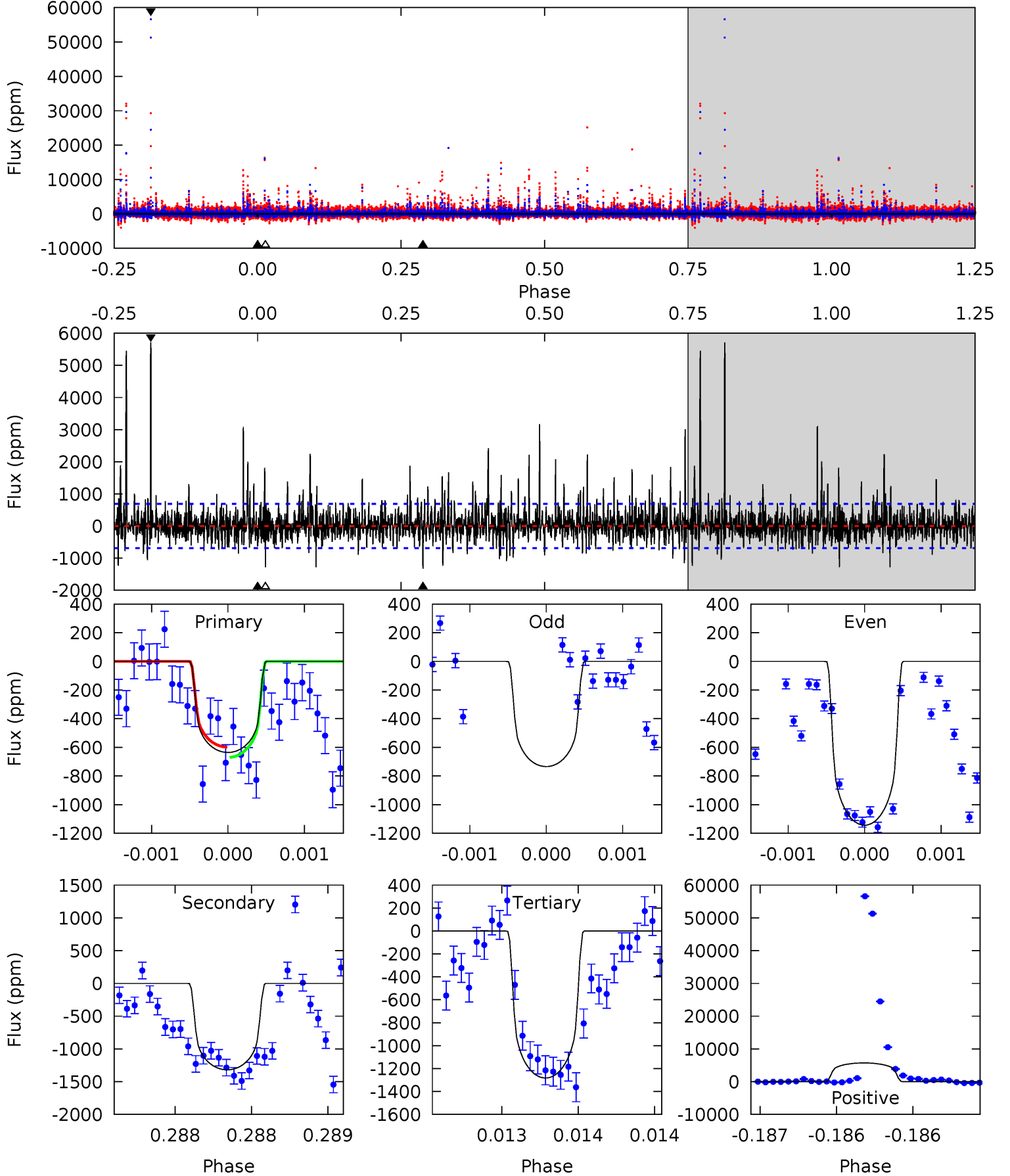
TCE 009116222-03 P=594.194302 Days  $T_0=238.438357$  (BKJD)



# DV Model-Shift Uniqueness Test

009116222-03, P = 594.203615 Days, E = 238.435061 Days

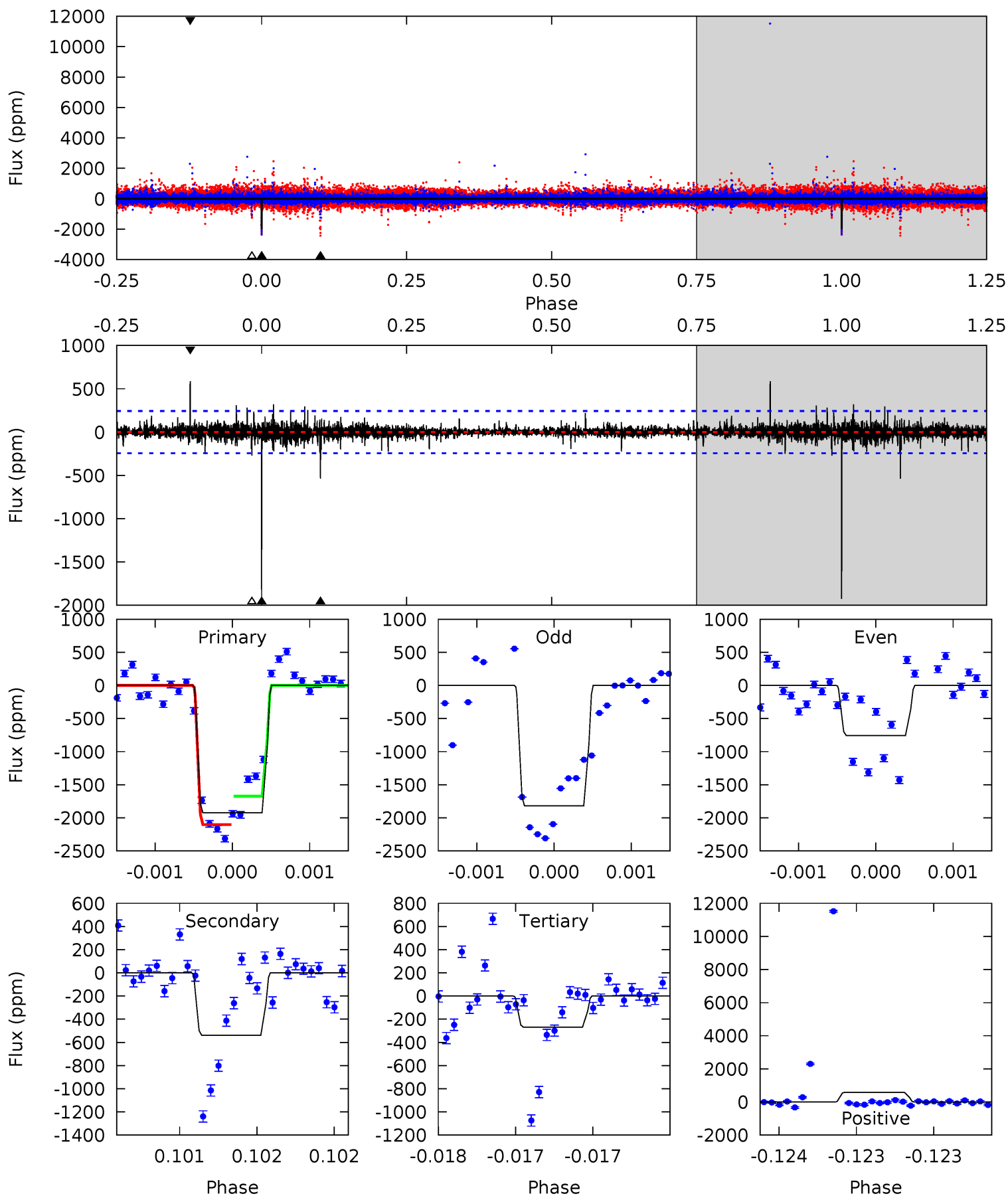
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
5.11	10.6	10.3	45.9	5.54	3.43	3.38	-5.20	-40.8	0.29	-35.3	0.85	0.46	0.81	0.29



# Alt Model-Shift Uniqueness Test

009116222-03, P = 594.194302 Days, E = 238.438357 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
43.9	12.3	6.14	13.4	5.57	3.47	0.92	37.7	30.5	6.14	-1.13	12.4	0.63	0.23	4.86



### Stellar Parameters For KIC 009116222

	$T_{\text{eff}} (K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5152^{+128}_{-128}$	$3.247^{+0.319}_{-0.261}$	$-0.500^{+0.250}_{-0.250}$	$4.243^{+1.726}_{-1.412}$	$1.158^{+0.209}_{-0.256}$	$0.021^{+0.044}_{-0.013}$
	+2%/-2%	+10%/-8%	+50%/-50%	+41%/-33%	+18%/-22%	+208%/-59%
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 009116222-03 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-1319 \pm 124$	$15.89^{+6.32}_{-5.16}$	$539^{+62}_{-48}$	$5249^{+816}_{-571}$	$5877^{+7294}_{-2800}$
Alt.	$-538 \pm 44$	$17.33^{+6.95}_{-5.17}$	$544^{+56}_{-54}$	$4209^{+533}_{-358}$	$2016^{+2162}_{-957}$

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

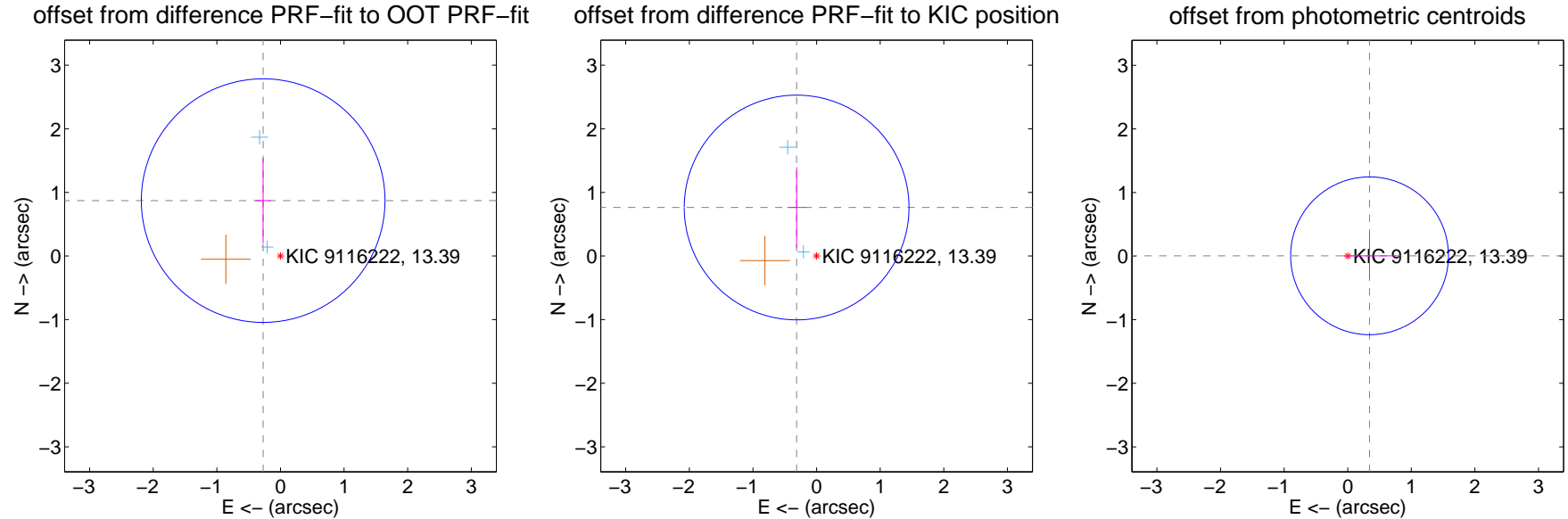
## DV Centroid Data

Supplemental centroid analysis for 009116222-03. Kepler magnitude: 13.39. Transit SNR 7.10

There are 2 quarters with good PRF difference image offsets

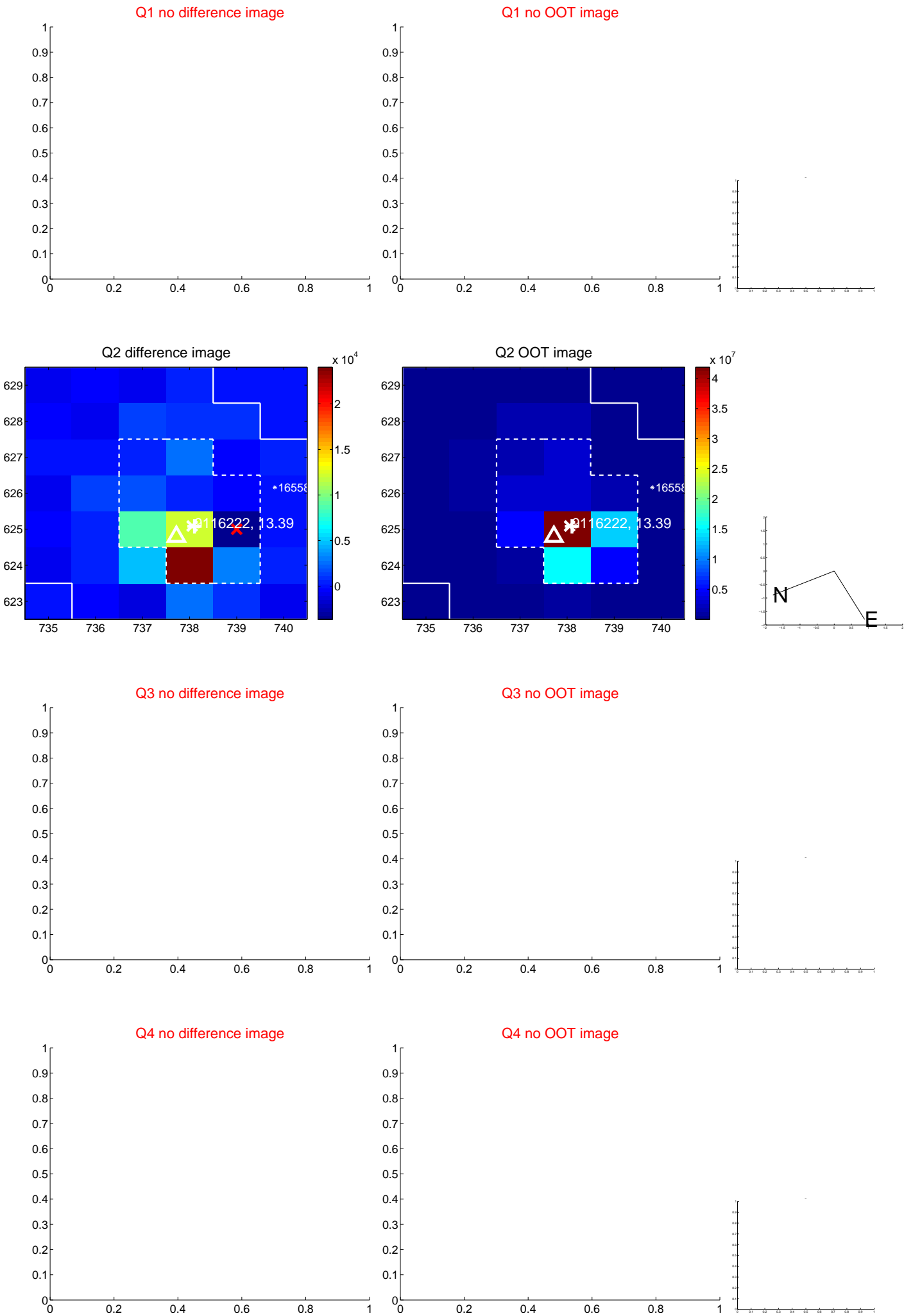
The direct PRF centroid is offset from the target star catalog position by about 0.08 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.912 \pm 0.638$	1.43	$0.272 \pm 0.122$	$0.871 \pm 0.667$
PRF-fit source offset from KIC position	$0.825 \pm 0.589$	1.40	$0.314 \pm 0.146$	$0.763 \pm 0.634$
photometric centroid source offset	$0.34 \pm 0.41$	0.83	$-0.34 \pm 0.41$	$0.00 \pm 0.36$



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.

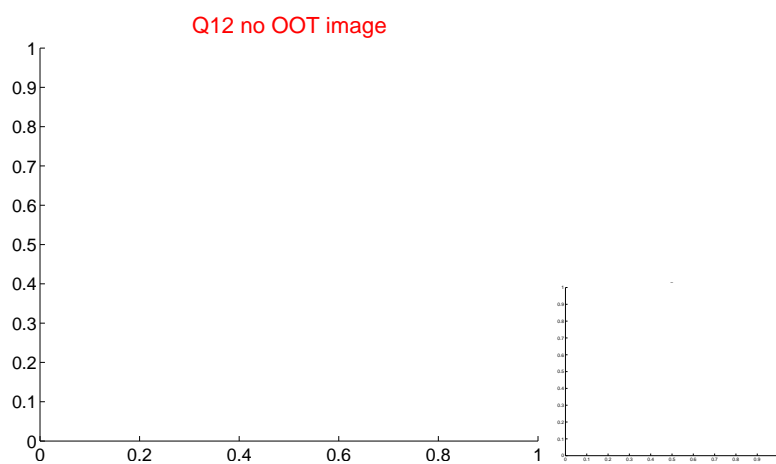
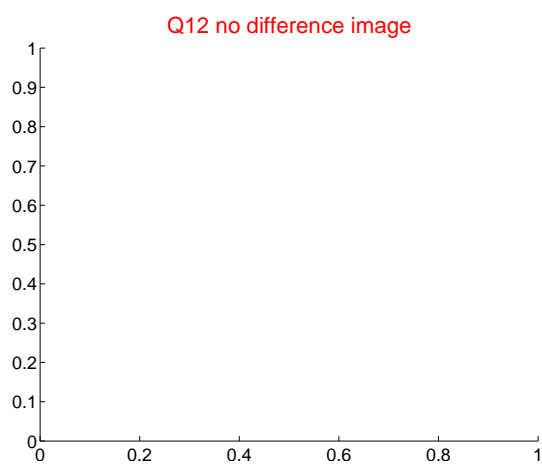
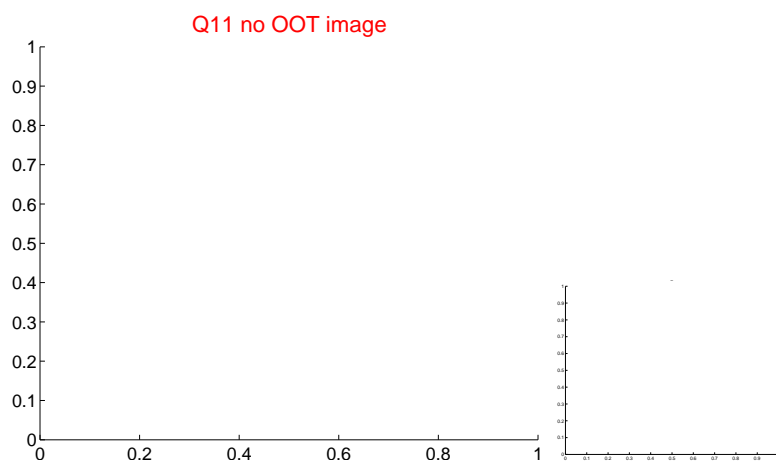
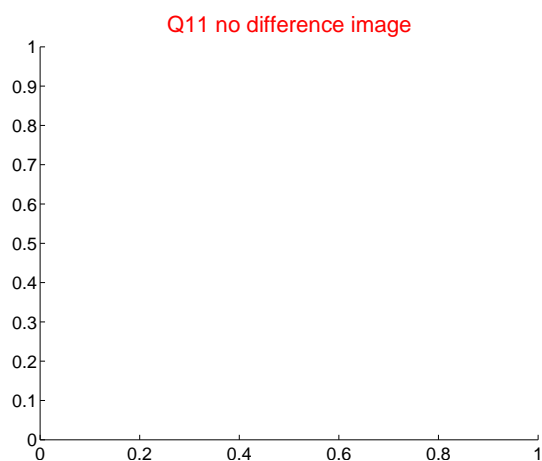
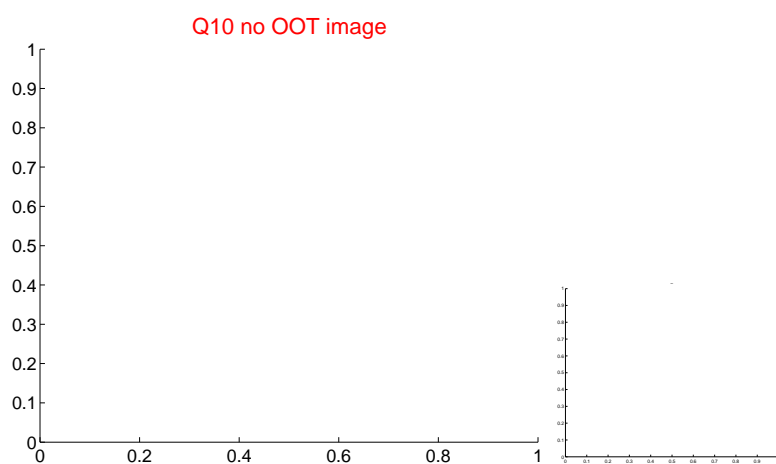
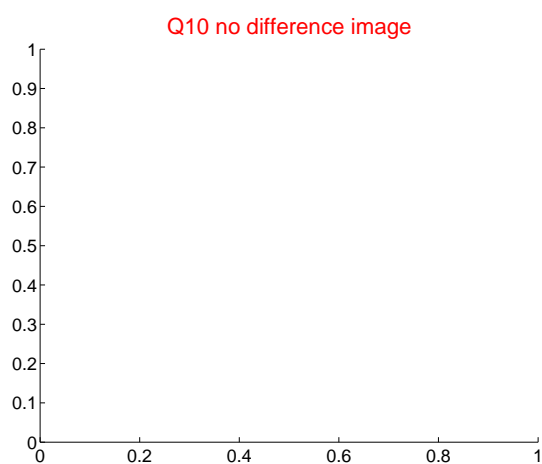
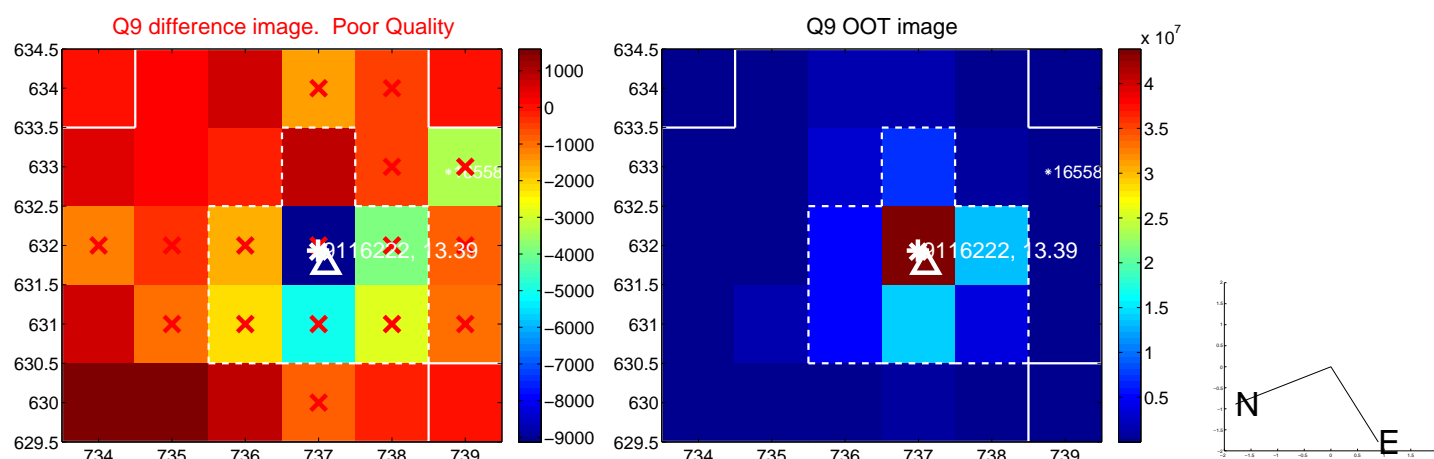


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





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.

Q13 no difference image



Q13 no OOT image



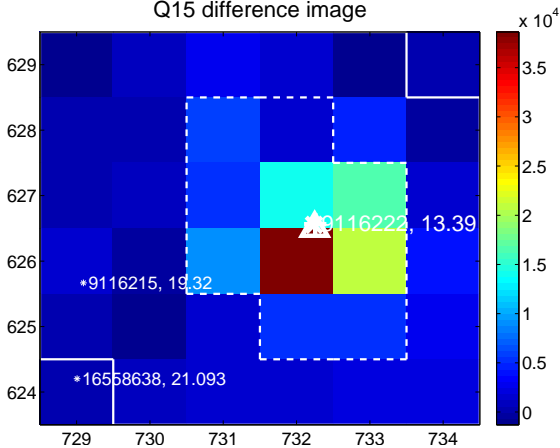
Q14 no difference image



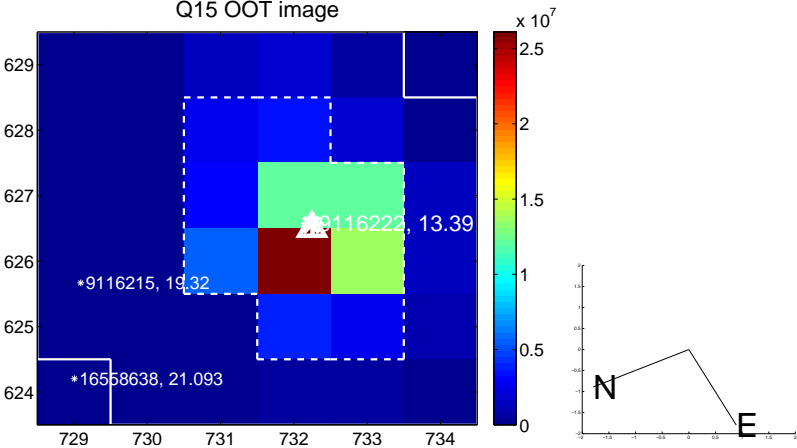
Q14 no OOT image



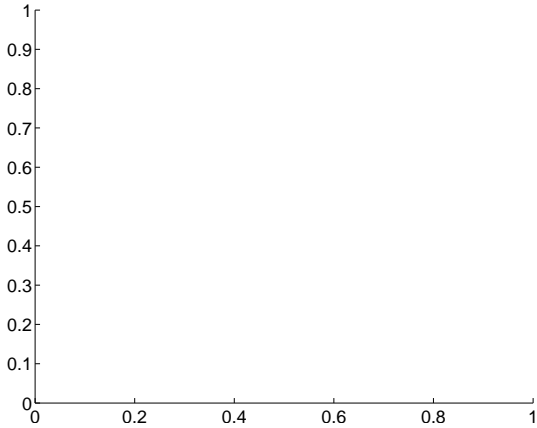
Q15 difference image



Q15 OOT image



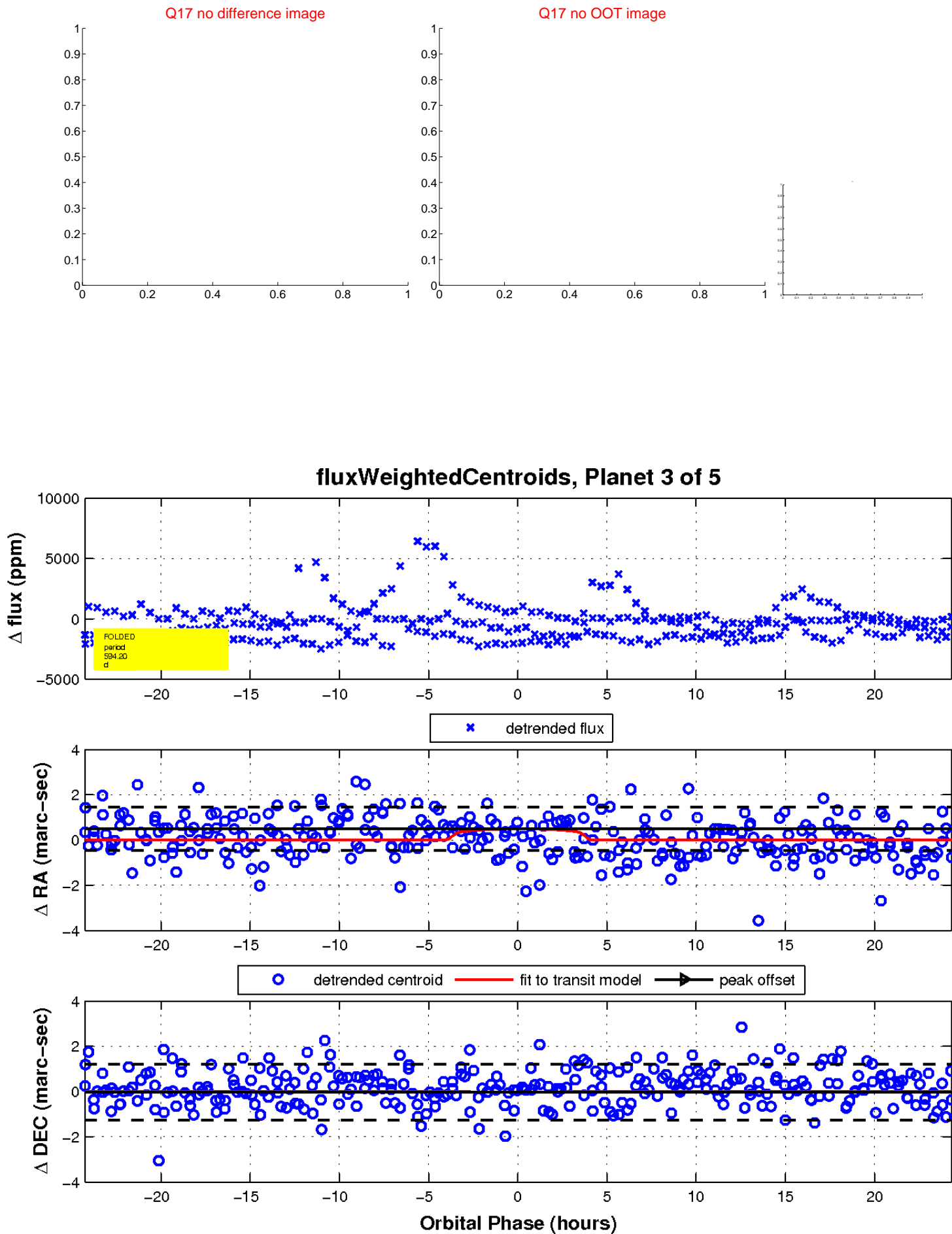
Q16 no difference image



Q16 no OOT image

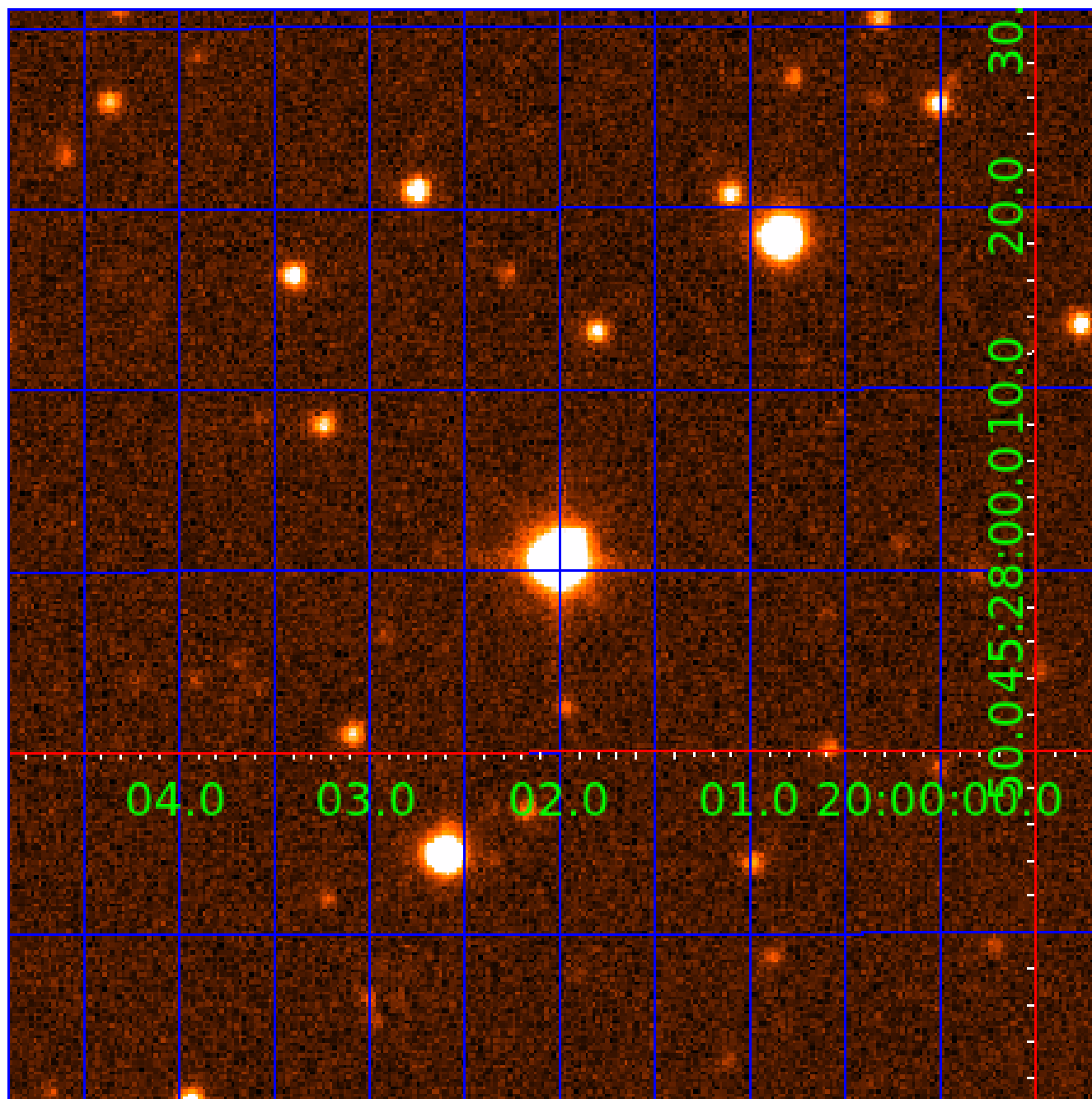


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 009116222

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009116222-01	OBS	No	489.779016	380.468831	1913.8	3.398	21.7	12.3	4.24	5152	18.87	6.96
009116222-02	OBS	No	443.783301	513.691712	1371.8	5.673	16.8	8.9	4.24	5152	15.64	7.94
009116222-03	OBS	No	594.203615	238.435061	1212.8	8.119	17.4	7.1	4.24	5152	16.19	5.38
009116222-04	OBS	No	472.123627	304.092546	1110.6	10.451	16.9	6.0	4.24	5152	14.13	7.31
009116222-05	OBS	No	388.636869	218.442355	1603.7	6.328	17.1	11.7	4.24	5152	17.72	9.47

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009116222-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009116222-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009116222-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—CENT_FEW_DIFFS
009116222-04	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_CHASES—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—HALO_GHOST
009116222-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—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.

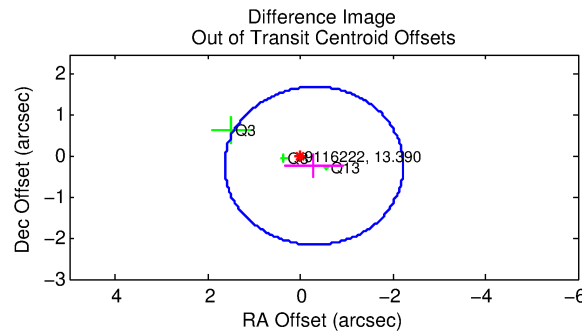
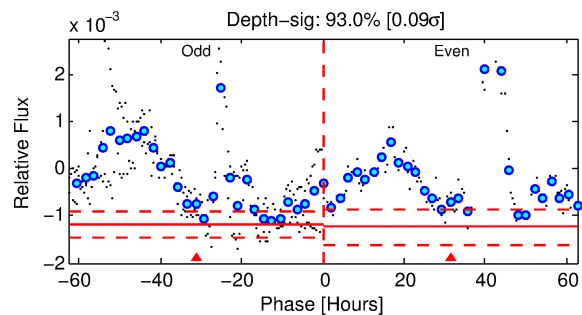
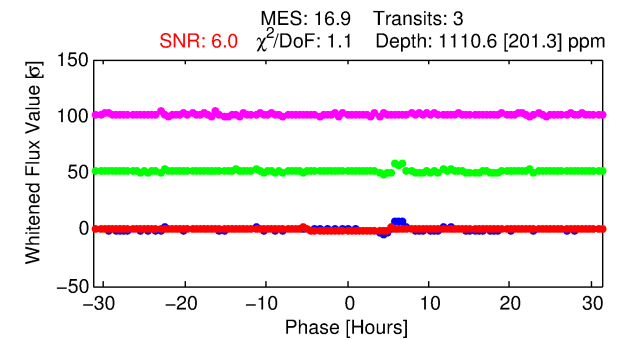
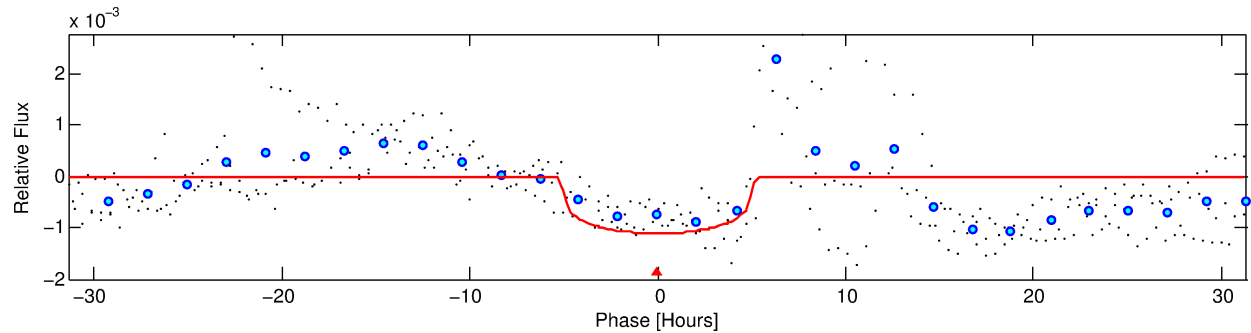
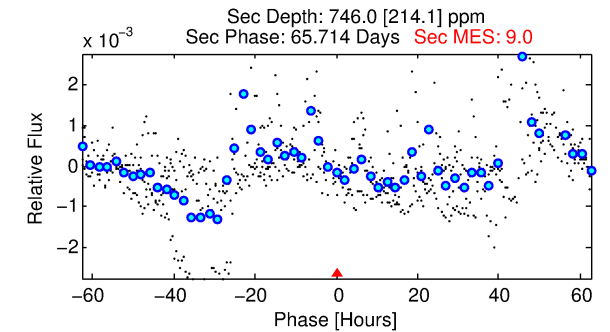
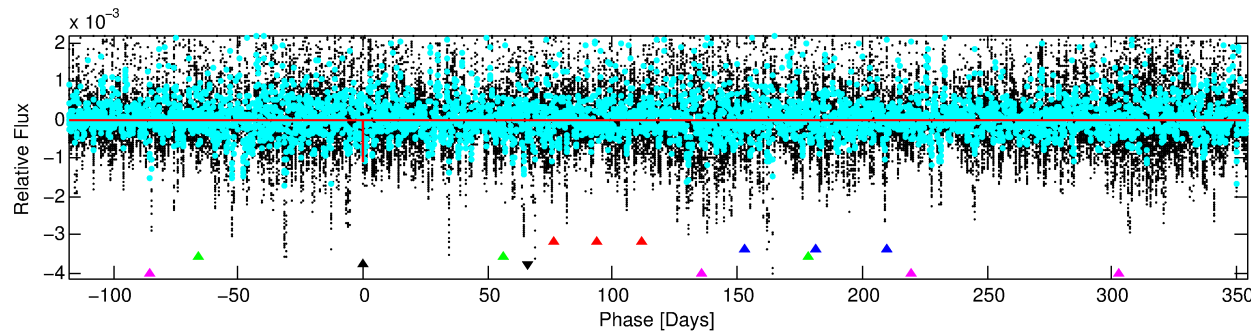
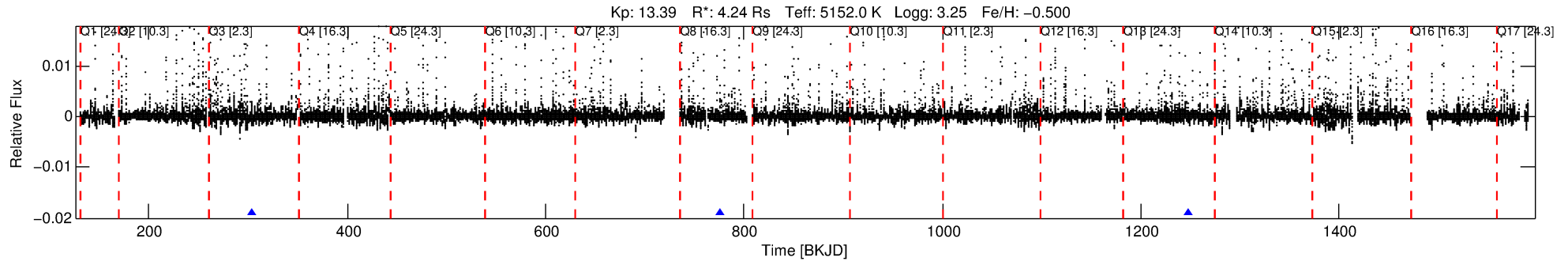
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 009116222-04

No Significant Match Found

# DV One-Page Summary

KIC: 9116222 Candidate: 4 of 5 Period: 472.124 d



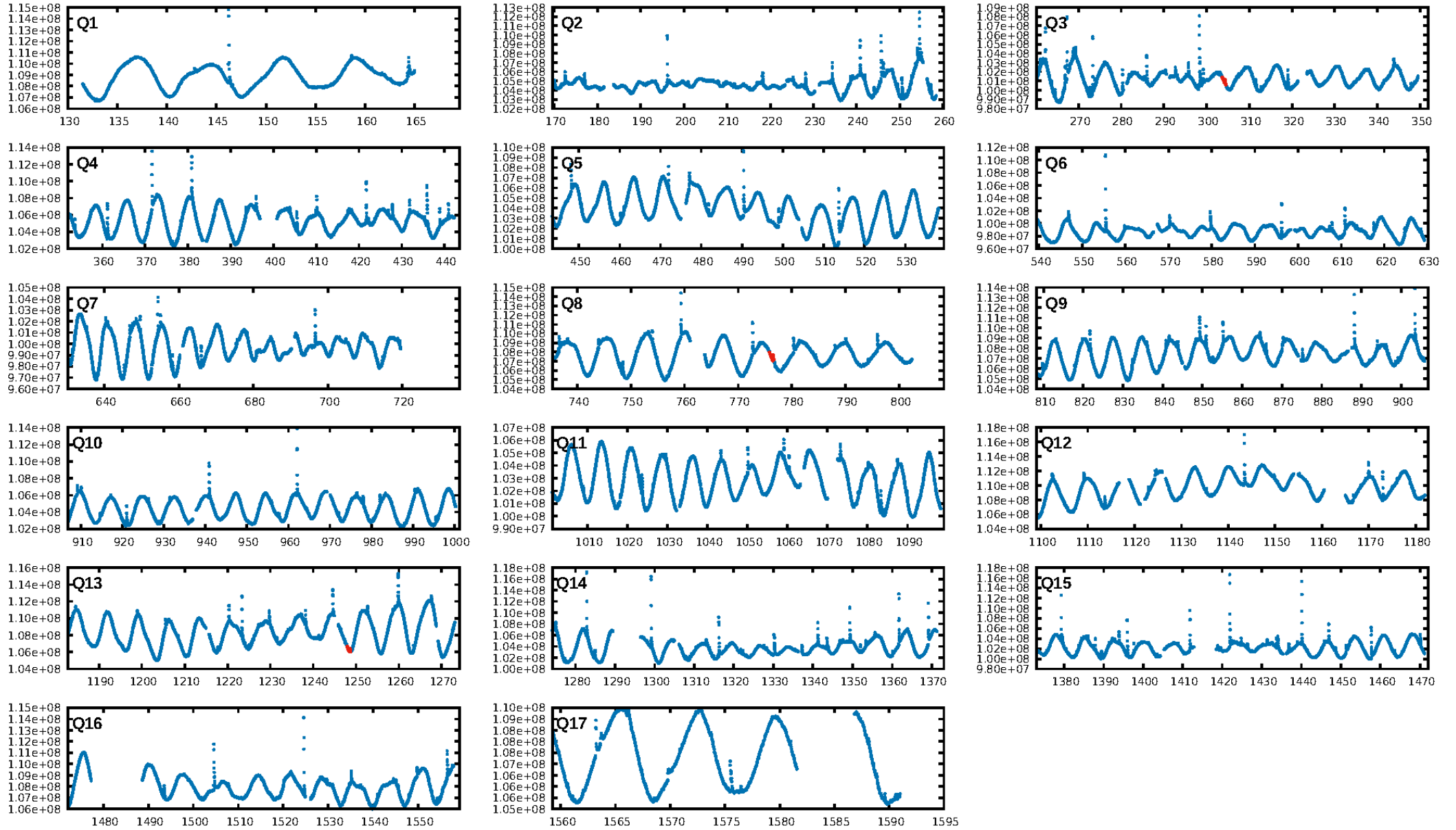
## DV Fit Results:

Period = 472.12363 [0.00560] d  
Epoch = 304.0925 [0.0075] BKJD  
Rp/R\* = 0.0305 [0.0147]  
a/R\* = 329.77 [593.34]  
b = 0.39 [4.00]  
Seff = 7.31 [4.16]  
Teq = 419 [60] K  
Rp = 14.13 [8.92] Re  
a = 1.2470 [0.4556] AU  
Ag = 3194.39 [3679.79] [0.87σ]  
Teffp = 4873 [1233] K [3.61σ]

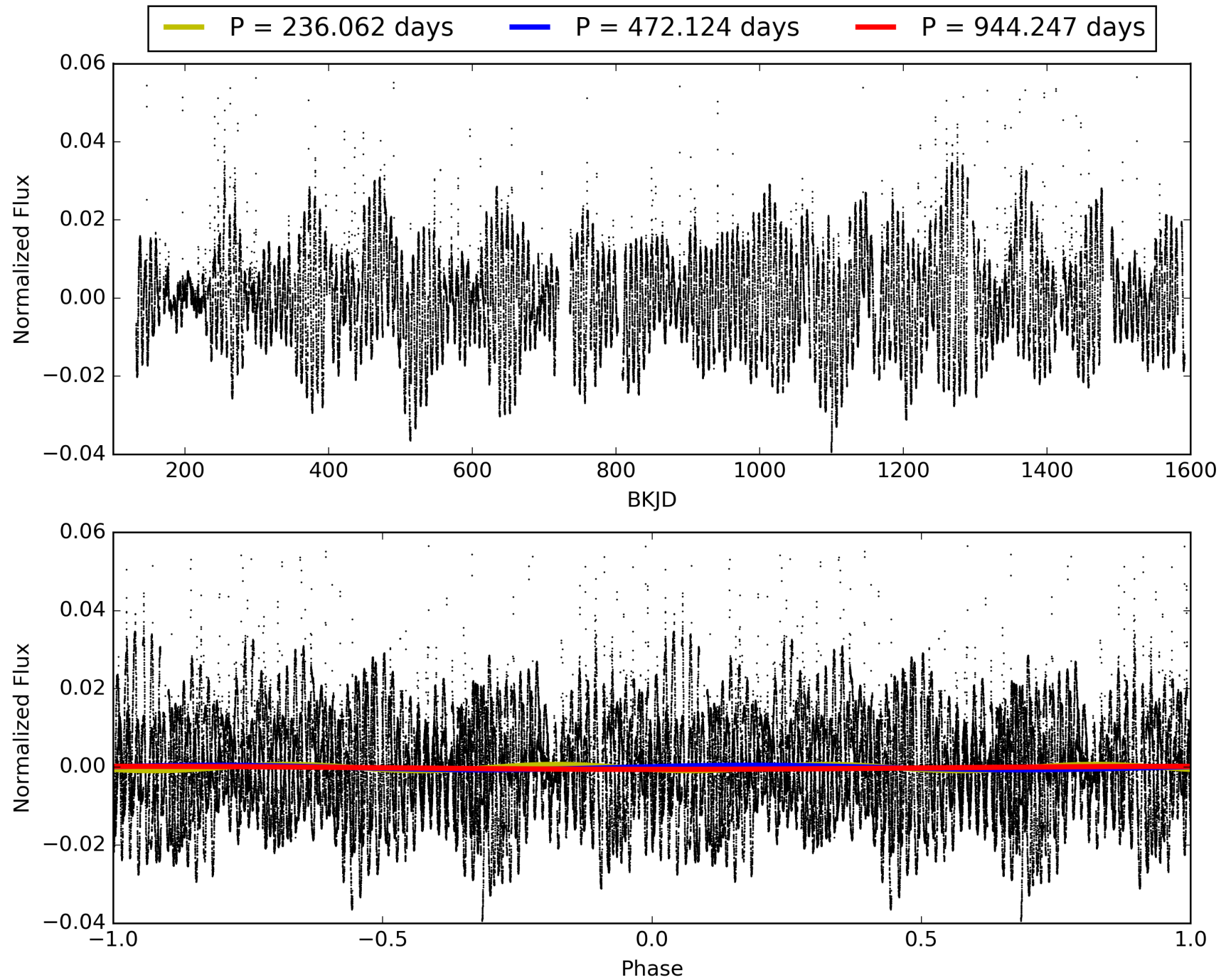
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [57.20σ]  
LongPeriod-sig: 100.0% [38.56σ]  
ModelChiSquare2-sig: 95.2%  
ModelChiSquareGof-sig: 98.8%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: 0.1122  
Centroid-sig: 5.5%  
Centroid-so: 0.517 arcsec [1.32σ]  
OotOffset-rm: 0.375 arcsec [0.58σ]  
OotOffset-st: 0/1/1/1 [3]  
KicOffset-rm: 0.453 arcsec [0.83σ]  
KicOffset-st: 0/1/1/1 [3]  
DiffImageQuality-fgm: 1.00 [3/3]  
DiffImageOverlap-fno: 1.00 [3/3]

# TCE 009116222-04, PDC Light Curves



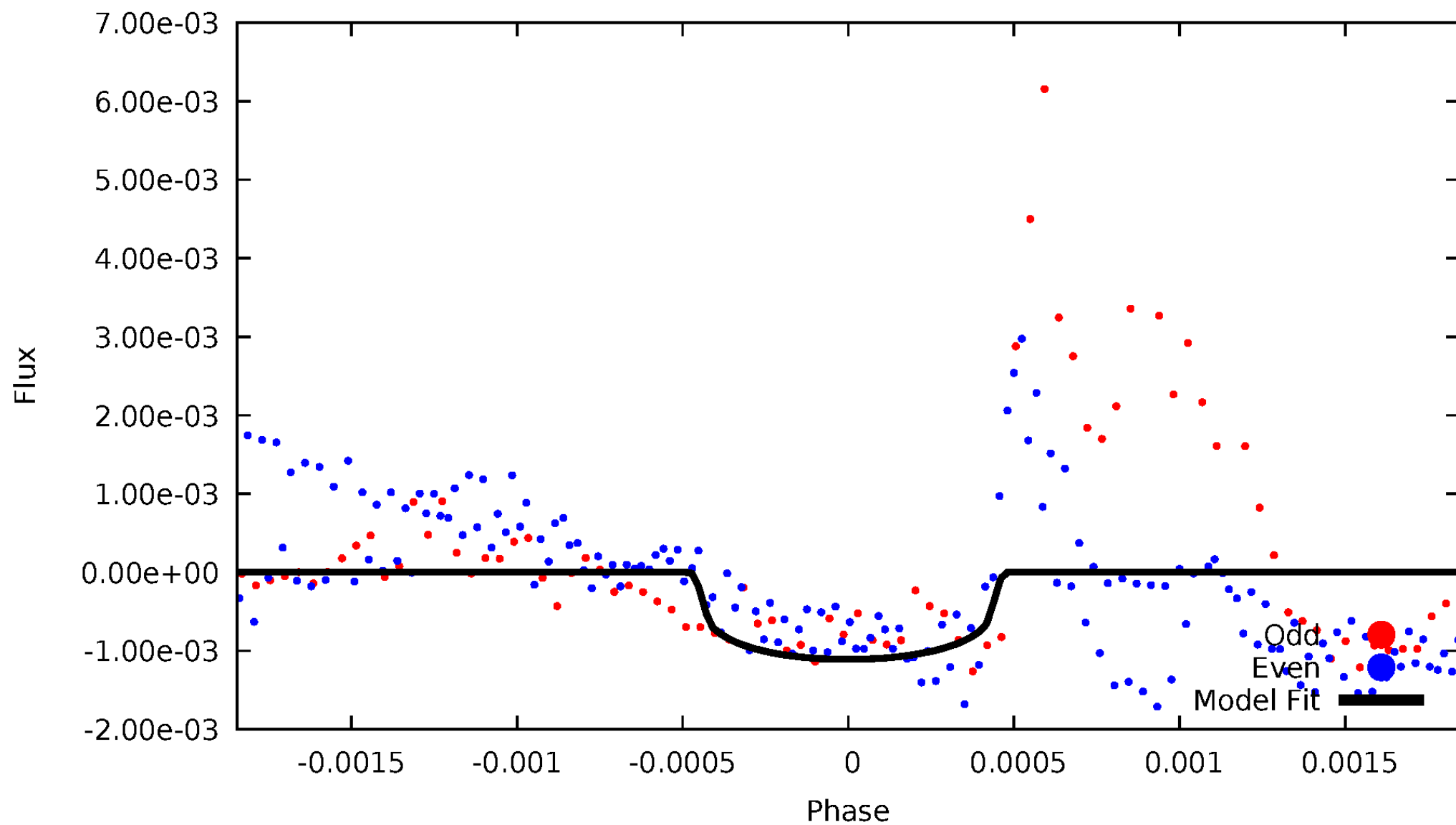
TCE 009116222-04





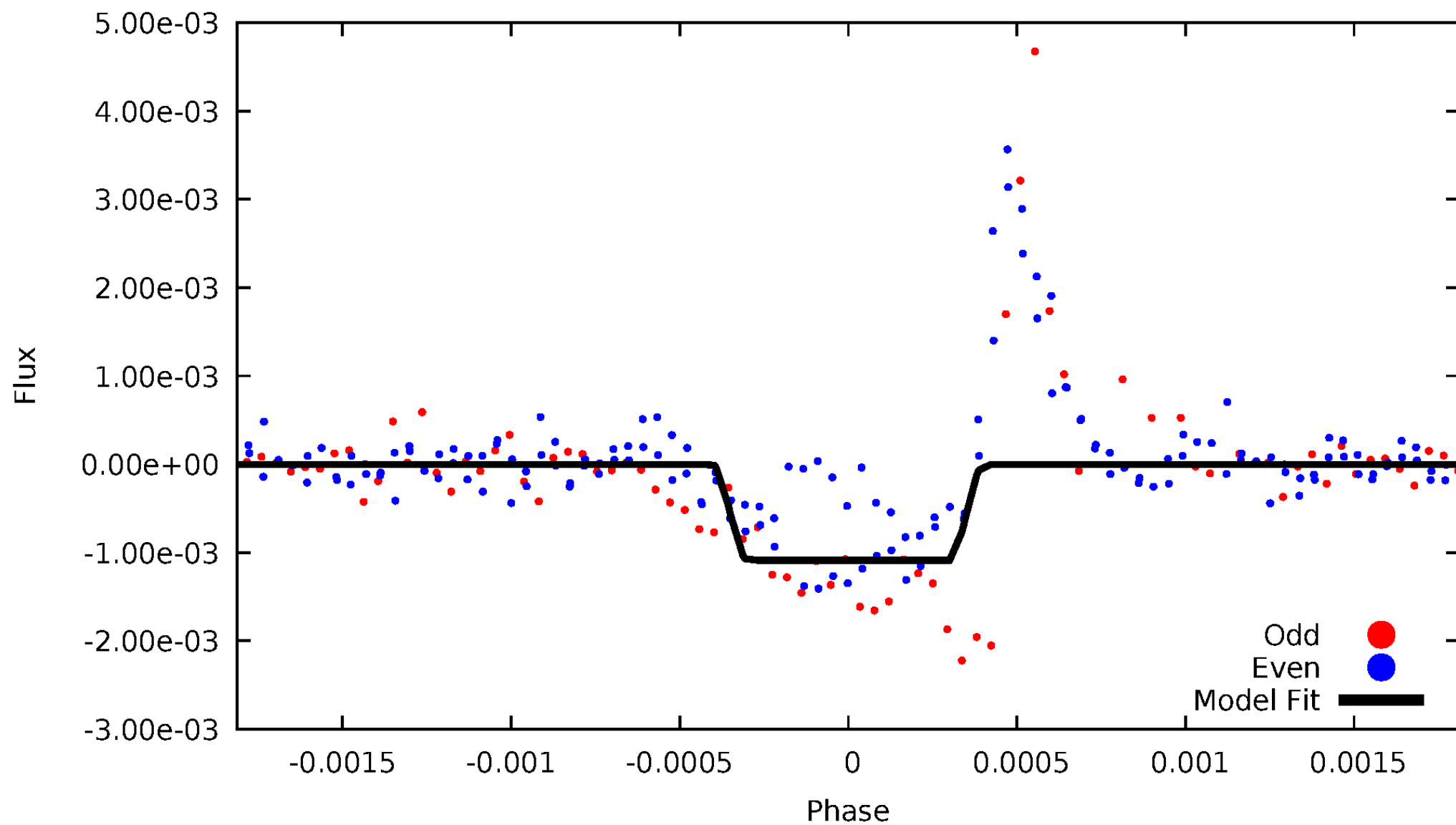
# DV Odd/Even

TCE 009116222-04



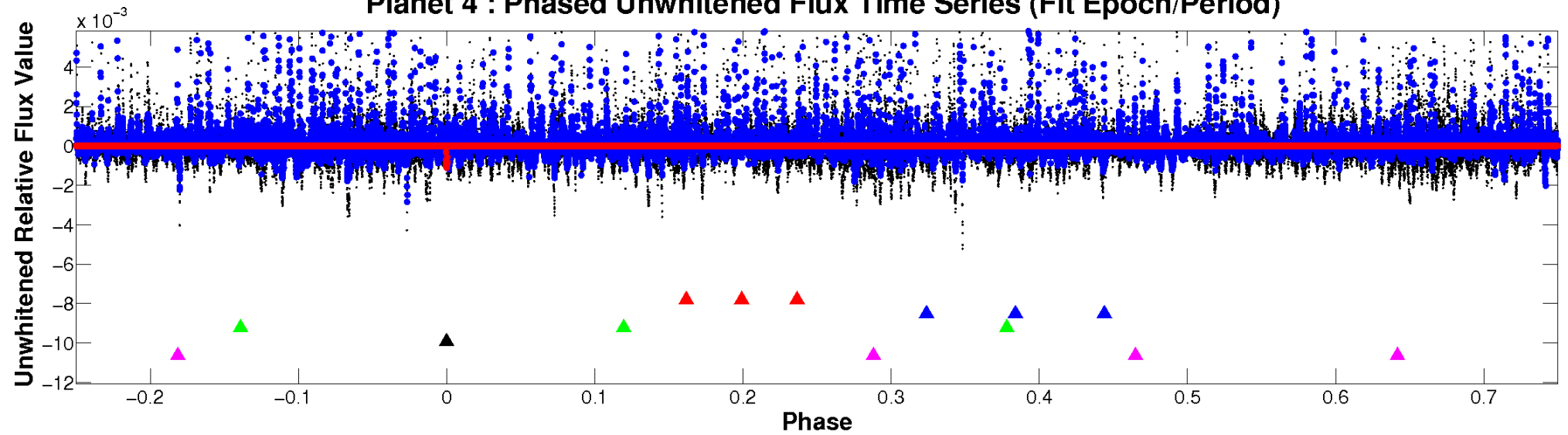
# ALT Odd/Even

TCE 009116222-04

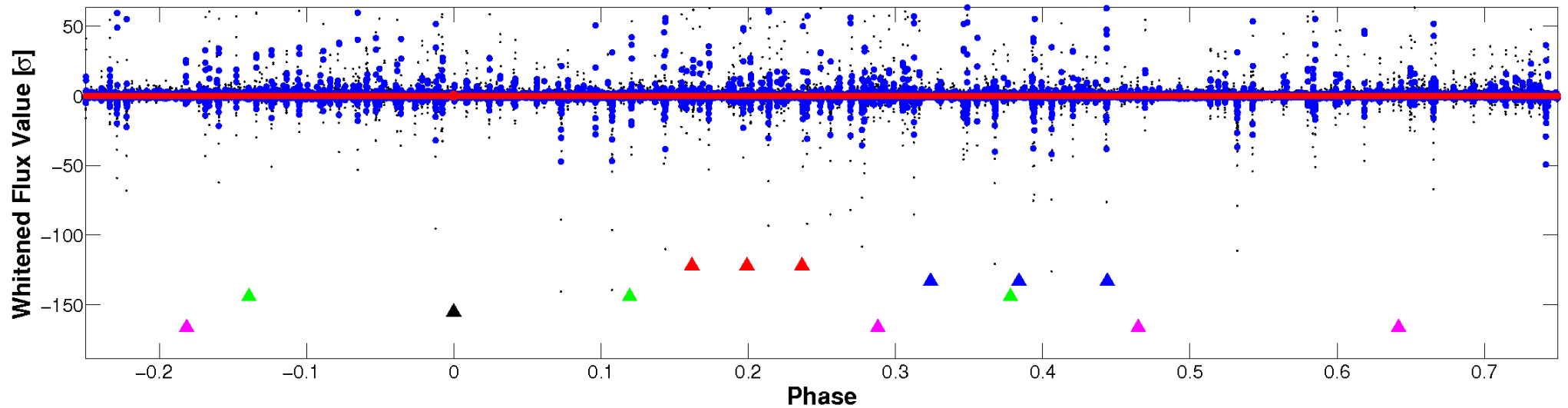


# Non-Whitened Vs. Whitened Light Curve

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

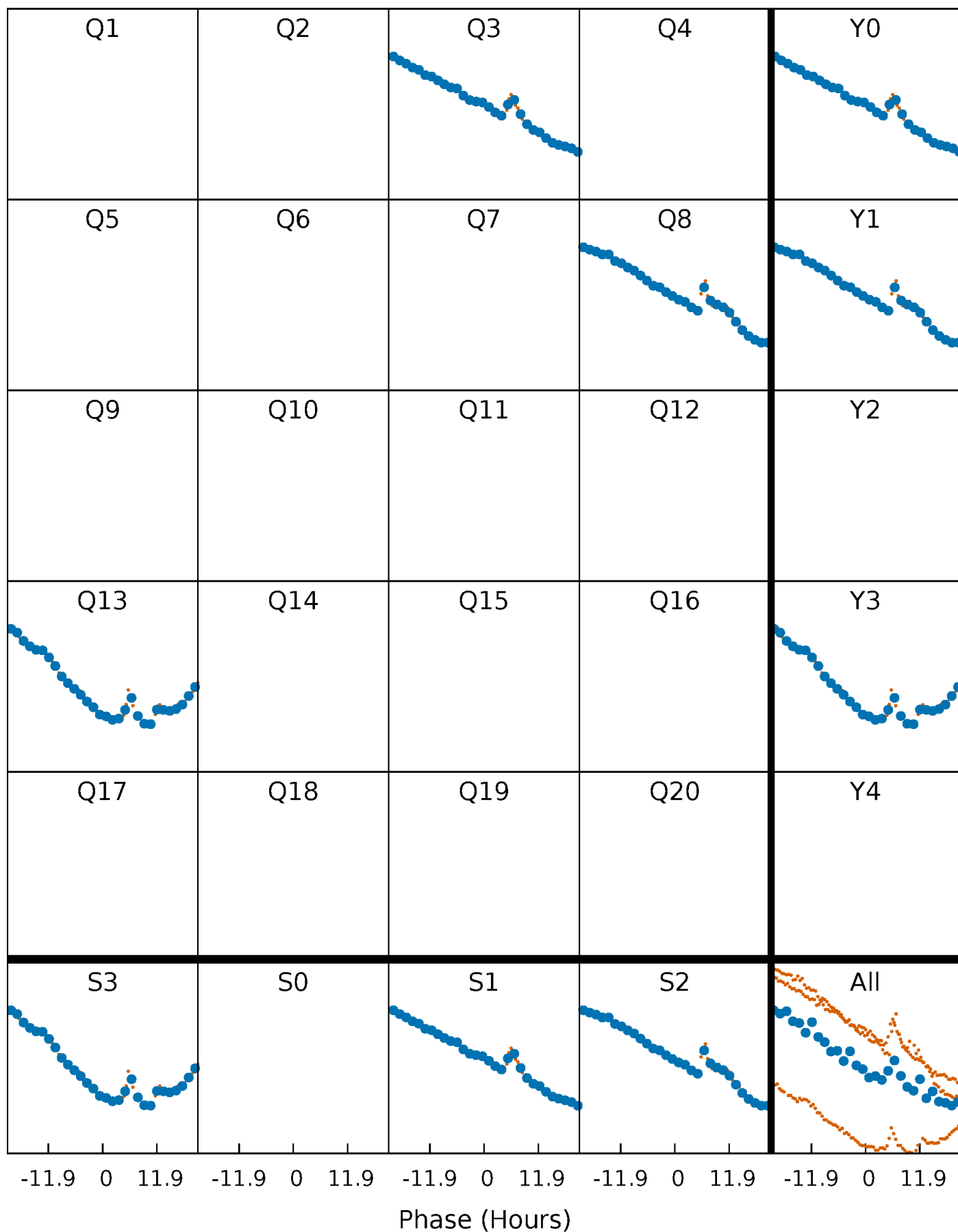


Planet 4 : Phased Whitened Flux Time Series (Fit Epoch/Period)



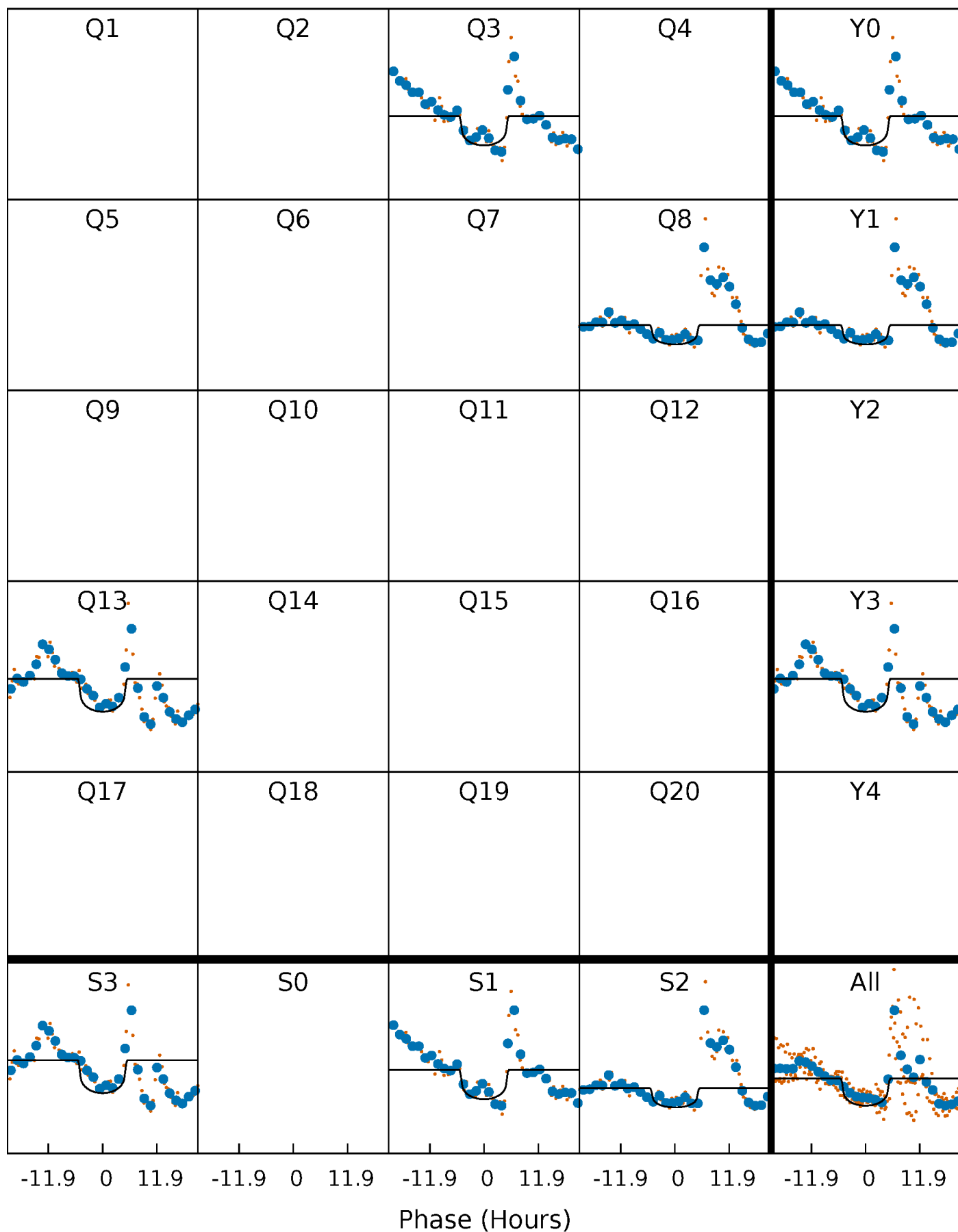
# PDC Quarter-Phased Transit Curves

TCE 009116222-04 P=472.123627 Days  $T_0=304.092547$  (BKJD)



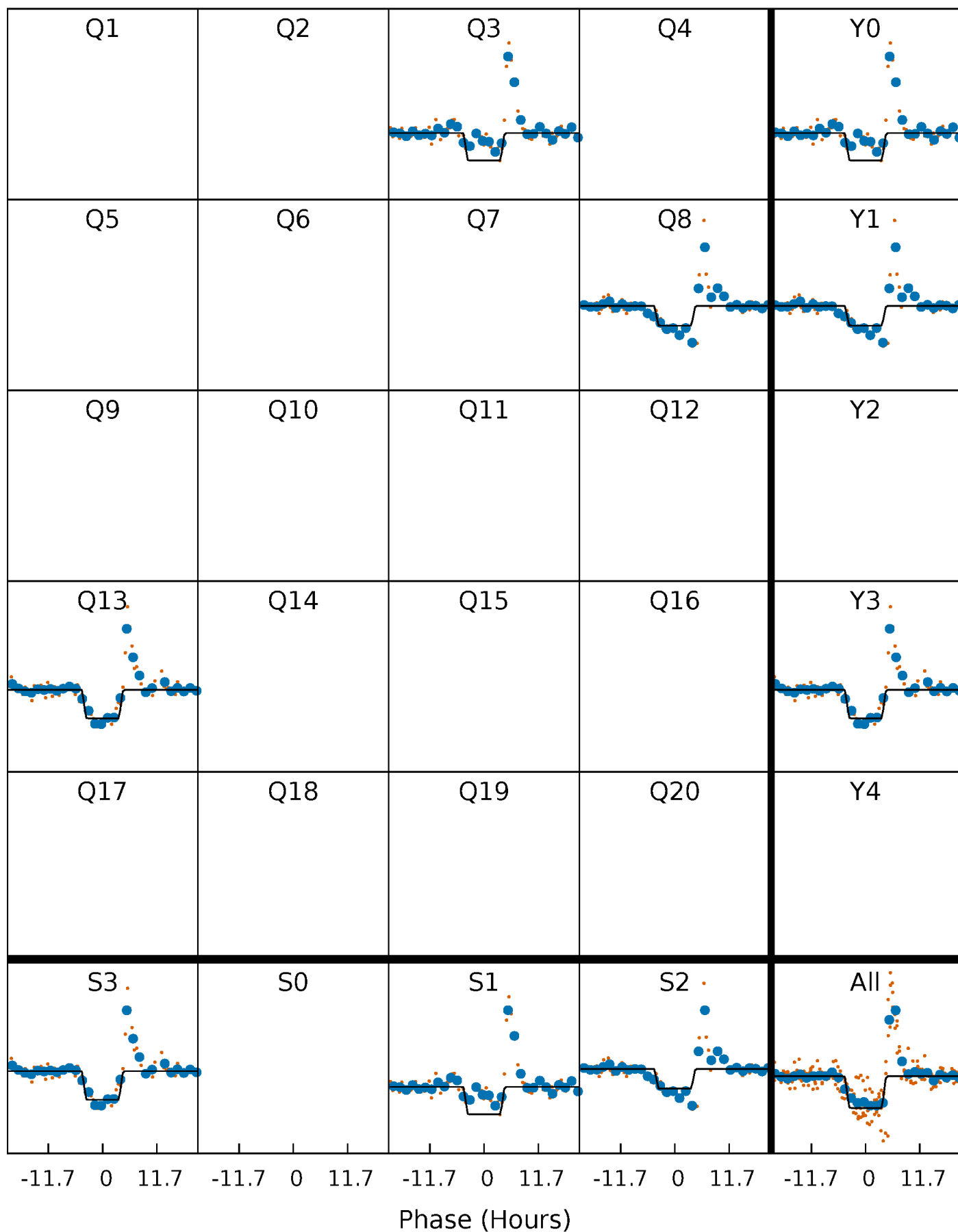
# DV Quarter-Phased Transit Curves

TCE 009116222-04   P=472.123627 Days    $T_0=304.092547$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

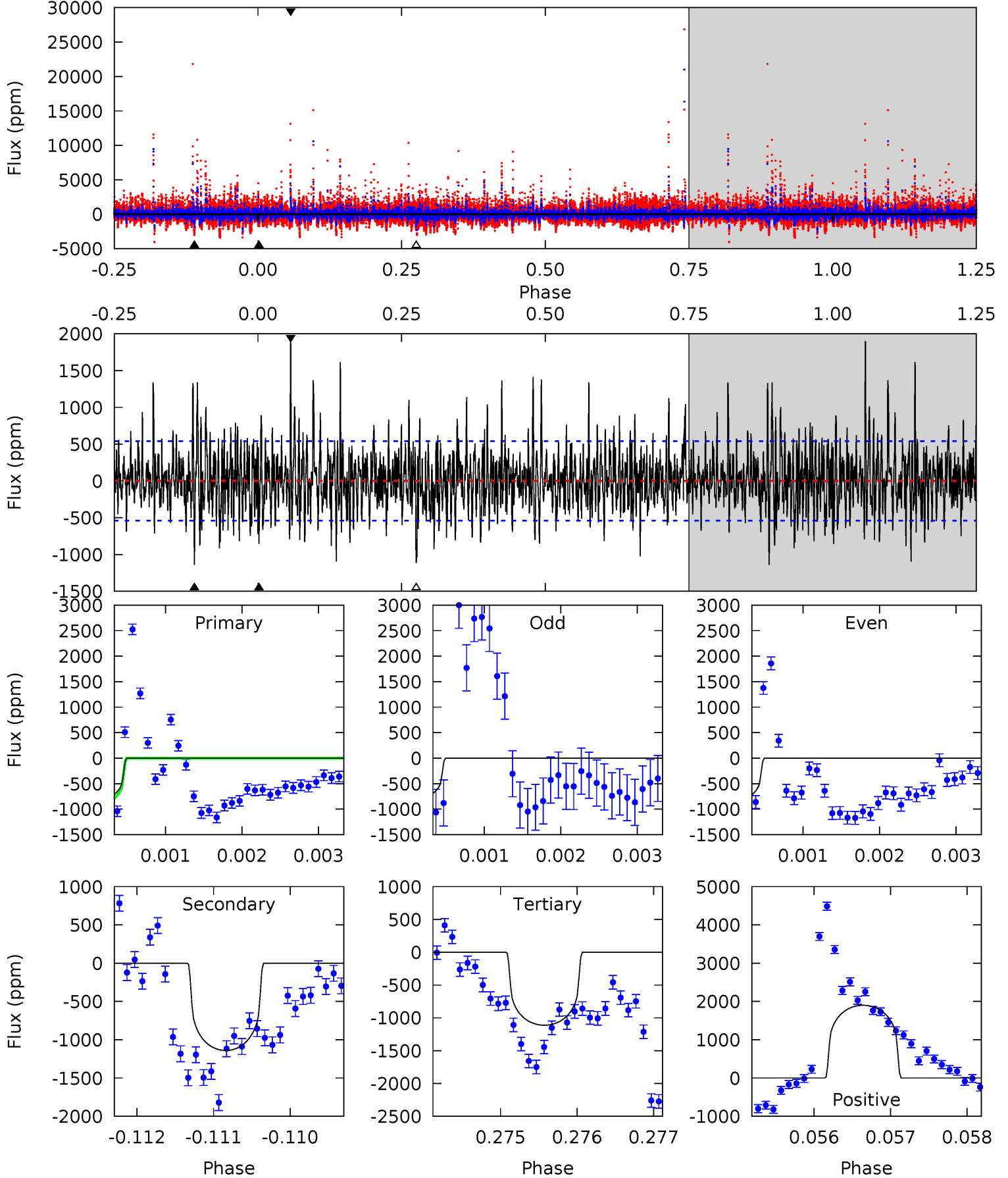
TCE 009116222-04     $P=472.117404$  Days     $T_0=304.117044$  (BKJD)



# DV Model-Shift Uniqueness Test

009116222-04, P = 472.123627 Days, E = 304.092547 Days

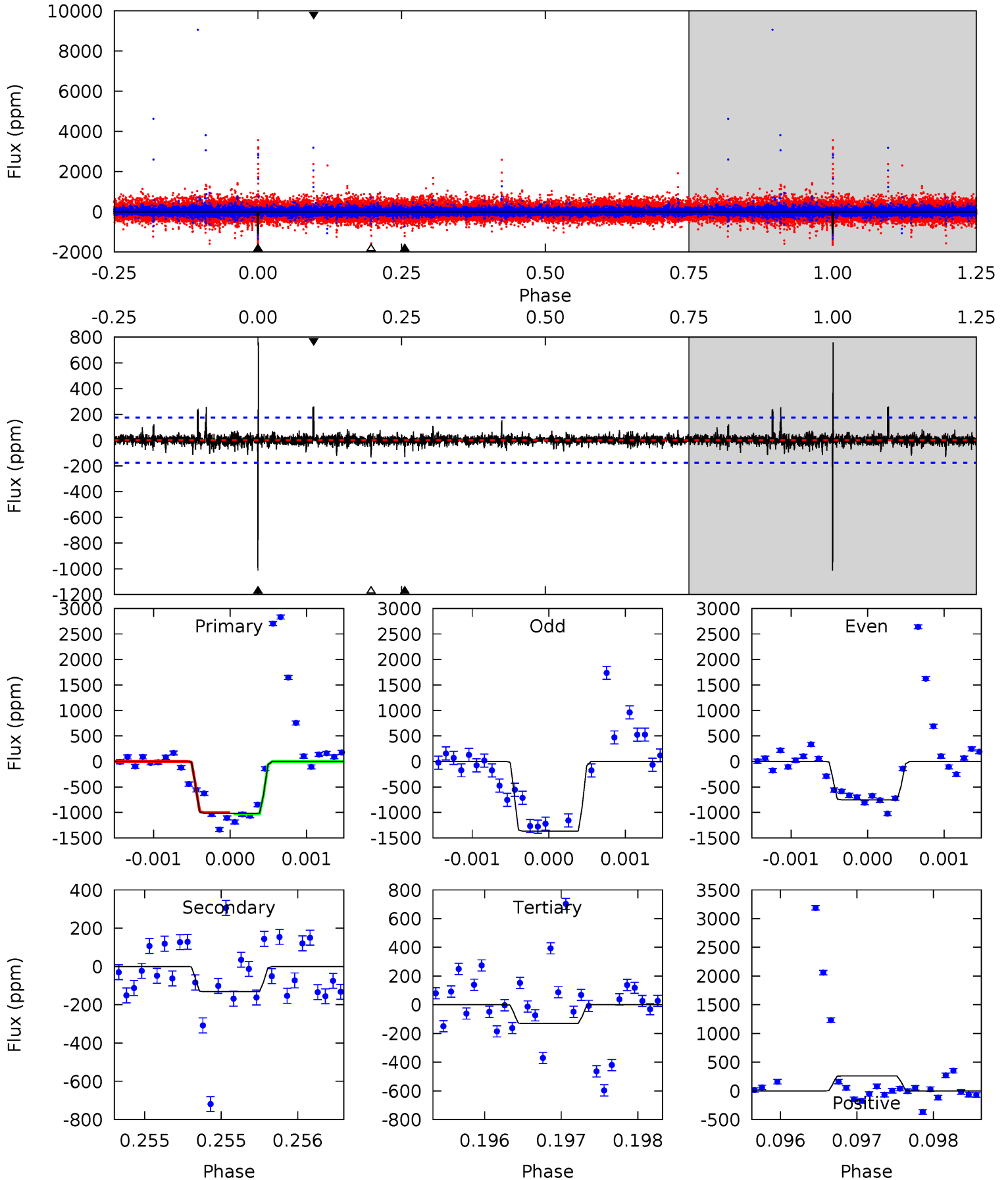
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
8.62	11.5	11.2	19.2	5.46	3.30	3.41	-2.62	-10.6	0.28	-7.68	0.09	1.03	0.62	0.95



# Alt Model-Shift Uniqueness Test

009116222-04, P = 472.117404 Days, E = 304.117044 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
31.7	4.11	4.06	8.14	5.50	3.36	0.75	27.6	23.5	0.04	-4.04	8.41	0.92	0.43	0.44





### Stellar Parameters For KIC 009116222

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M$ ( $M_{\odot}$ )	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$5152^{+128}_{-128}$	$3.247^{+0.319}_{-0.261}$	$-0.500^{+0.250}_{-0.250}$	$4.243^{+1.726}_{-1.412}$	$1.158^{+0.209}_{-0.256}$	$0.021^{+0.044}_{-0.013}$
	+2%/-2%	+10%/-8%	+50%/-50%	+41%/-33%	+18%/-22%	+208%/-59%
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 009116222-04 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	$-1140 \pm 99$	$13.55^{+7.84}_{-6.81}$	$582^{+61}_{-59}$	$5434^{+2146}_{-892}$	$5225^{+15911}_{-3071}$
Alt.	$-131 \pm 32$	$15.36^{+8.32}_{-7.40}$	$586^{+60}_{-57}$	$3451^{+822}_{-375}$	$472^{+1249}_{-280}$

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

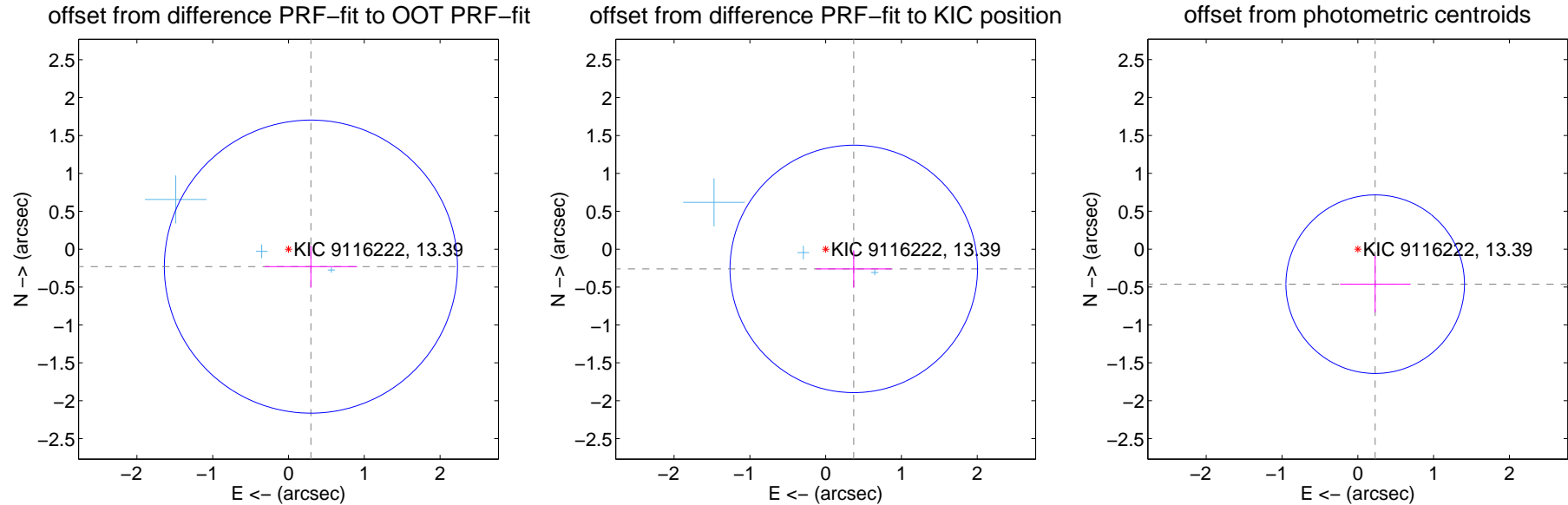
## DV Centroid Data

Supplemental centroid analysis for 009116222-04. Kepler magnitude: 13.39. Transit SNR 5.97

There are 3 quarters with good PRF difference image offsets

The direct PRF centroid is offset from the target star catalog position by about 0.09 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.375 \pm 0.645$	0.58	$-0.296 \pm 0.611$	$-0.230 \pm 0.275$
PRF-fit source offset from KIC position	$0.453 \pm 0.544$	0.83	$-0.371 \pm 0.500$	$-0.260 \pm 0.246$
photometric centroid source offset	$0.52 \pm 0.39$	1.32	$-0.23 \pm 0.46$	$-0.46 \pm 0.37$



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.

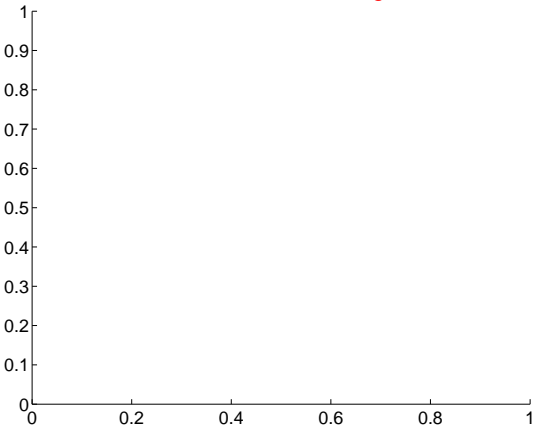
Q1 no difference image



Q1 no OOT image



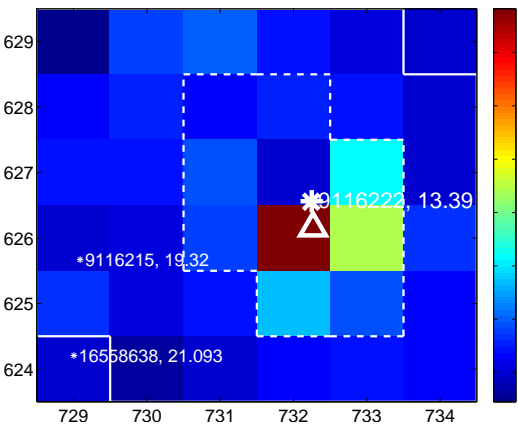
Q2 no difference image



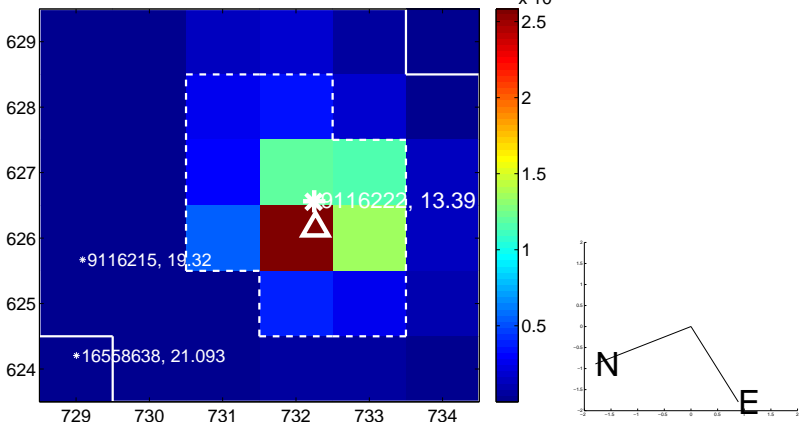
Q2 no OOT image



Q3 difference image



Q3 OOT image



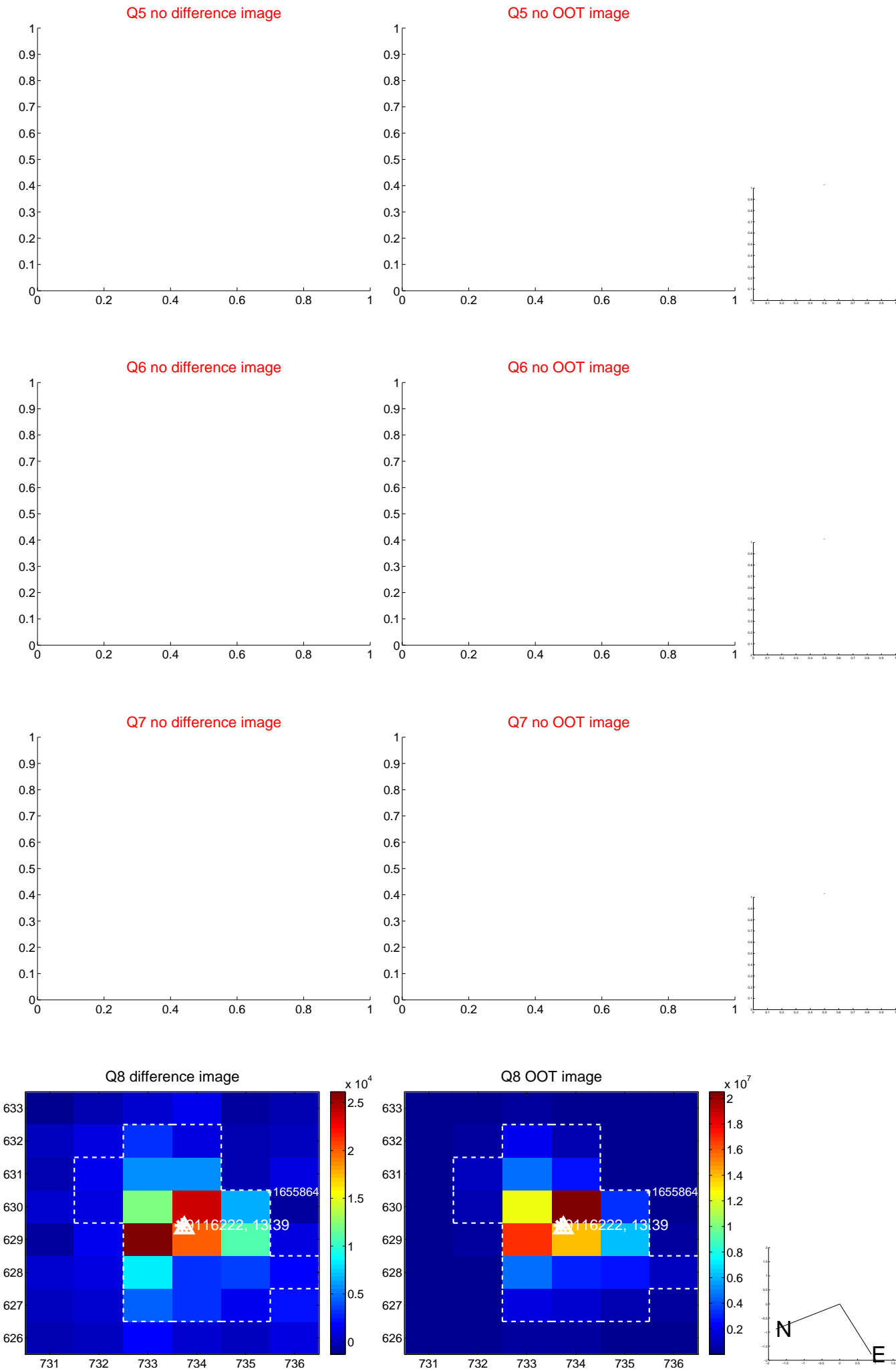
Q4 no difference image



Q4 no OOT image



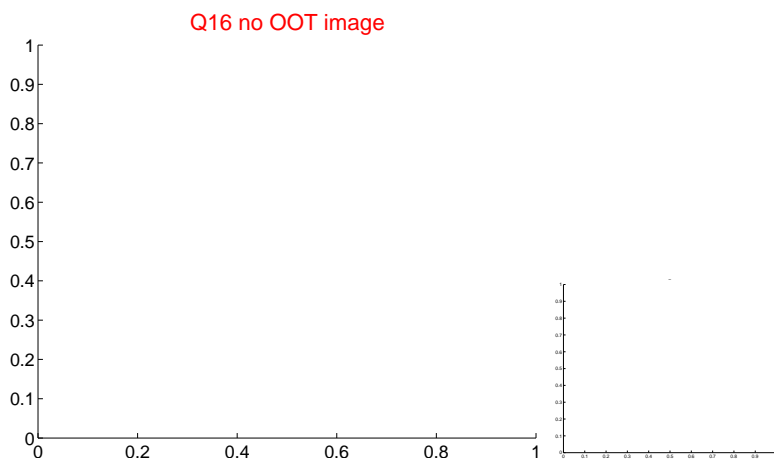
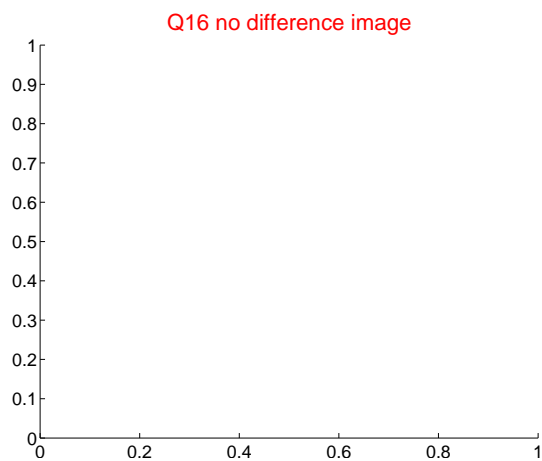
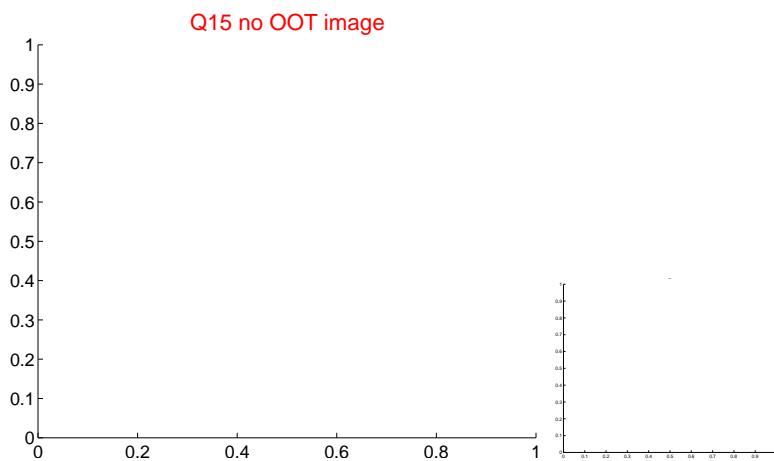
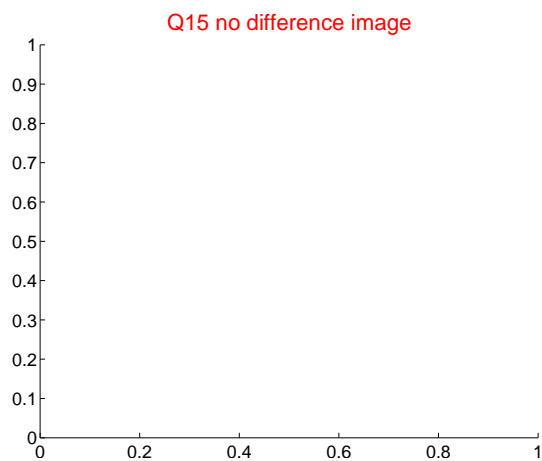
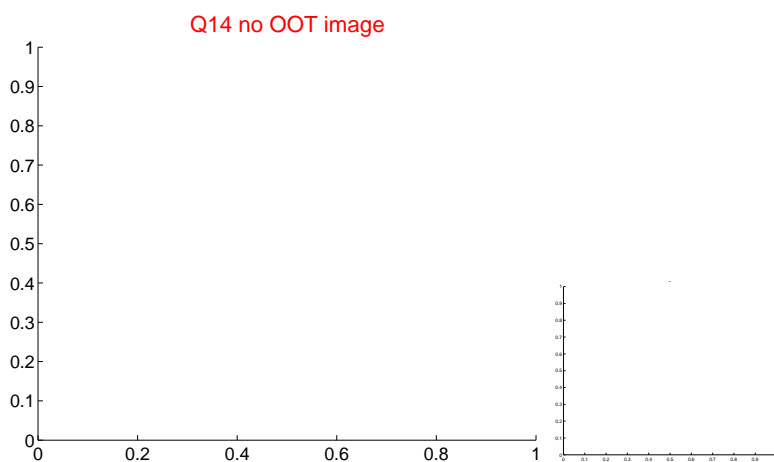
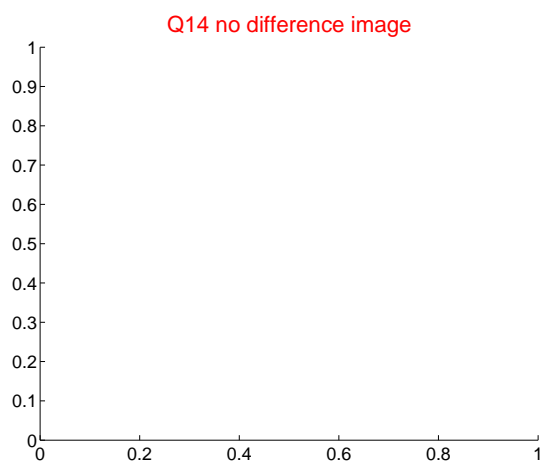
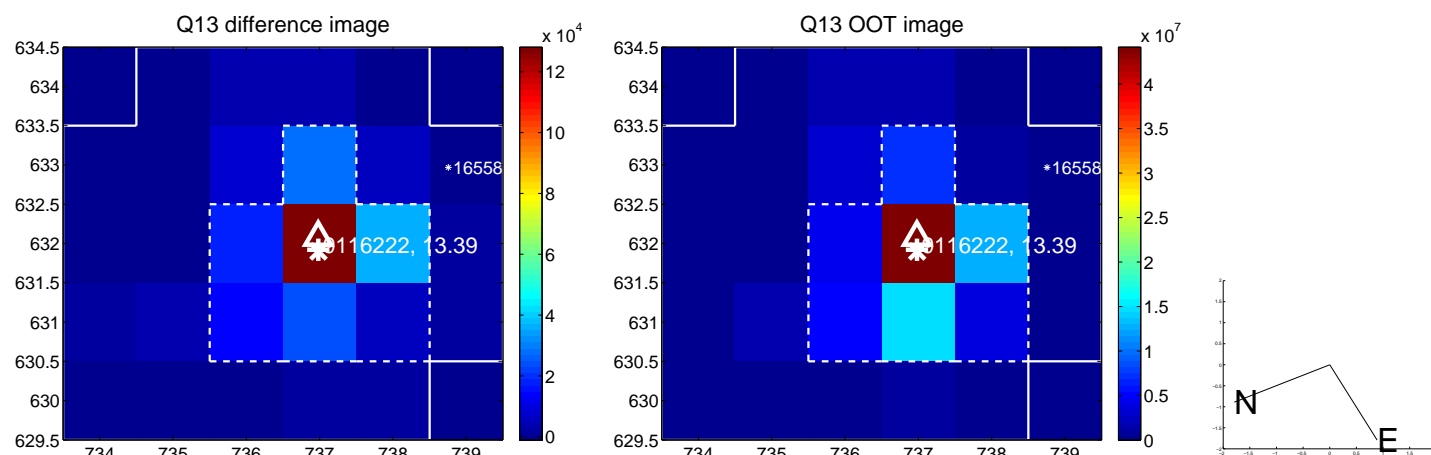
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



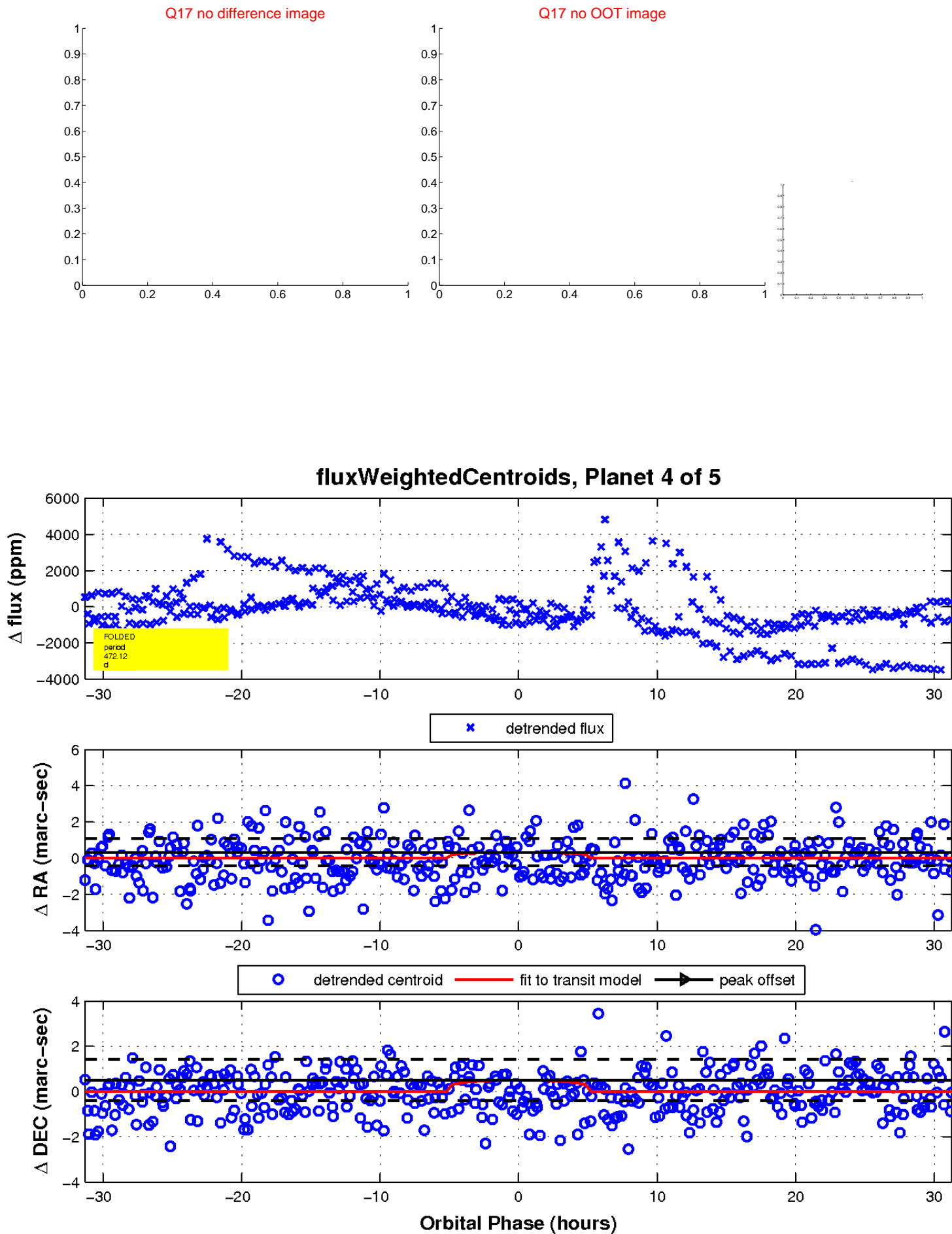
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

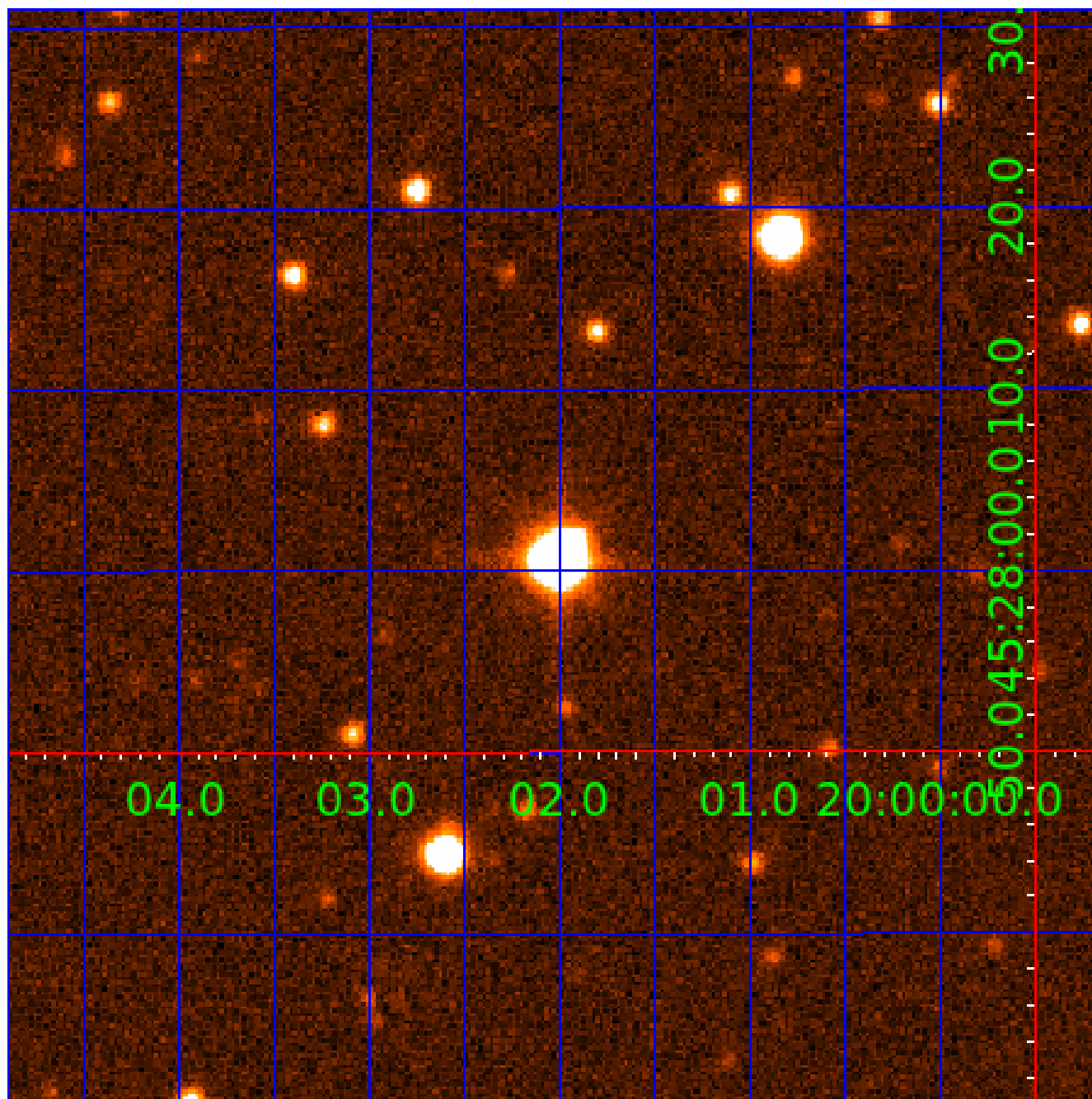


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination





# KIC 009116222

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009116222-01	OBS	No	489.779016	380.468831	1913.8	3.398	21.7	12.3	4.24	5152	18.87	6.96
009116222-02	OBS	No	443.783301	513.691712	1371.8	5.673	16.8	8.9	4.24	5152	15.64	7.94
009116222-03	OBS	No	594.203615	238.435061	1212.8	8.119	17.4	7.1	4.24	5152	16.19	5.38
009116222-04	OBS	No	472.123627	304.092546	1110.6	10.451	16.9	6.0	4.24	5152	14.13	7.31
009116222-05	OBS	No	388.636869	218.442355	1603.7	6.328	17.1	11.7	4.24	5152	17.72	9.47

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009116222-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009116222-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009116222-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—CENT_FEW_DIFFS
009116222-04	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_CHASES—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—HALO_GHOST
009116222-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—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.

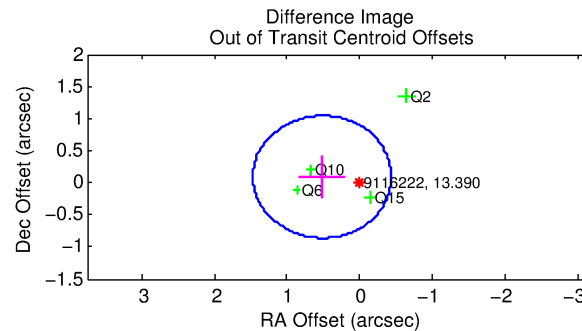
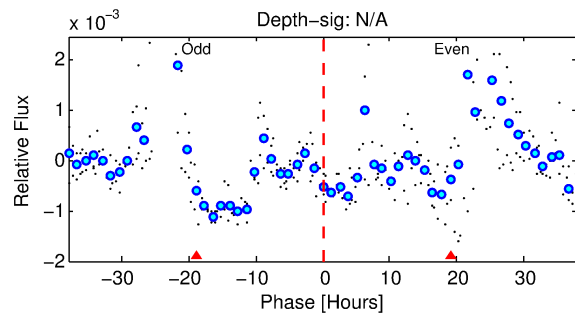
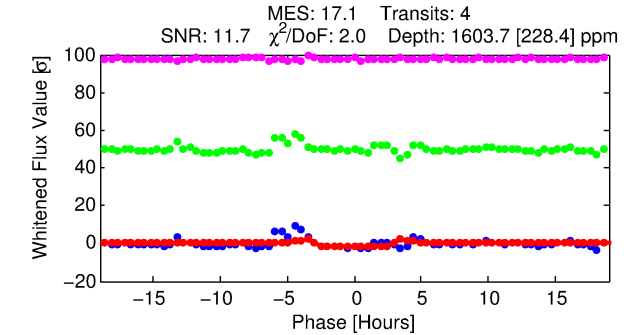
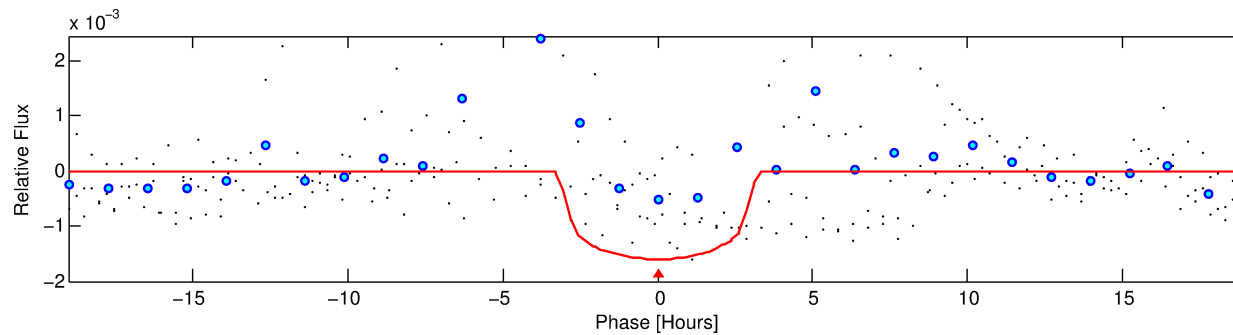
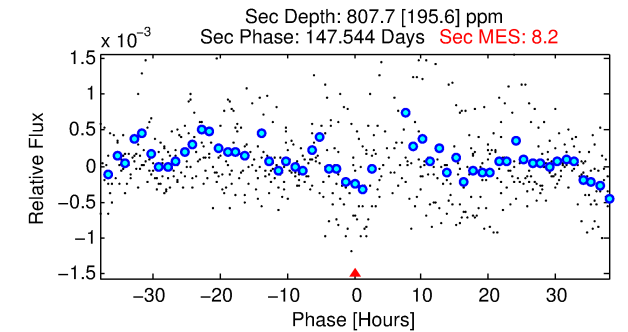
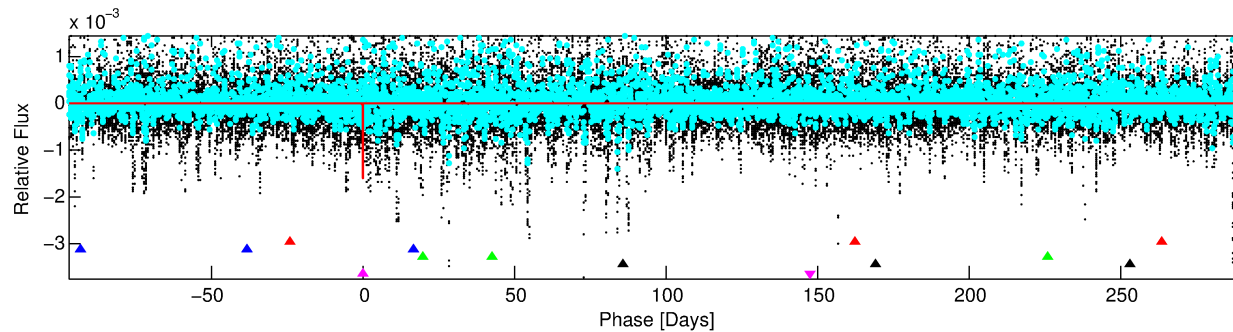
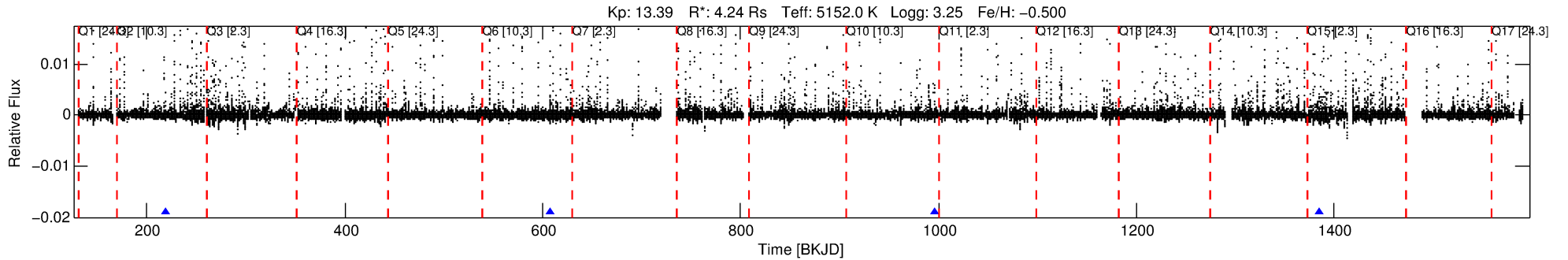
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 009116222-05

No Significant Match Found

# DV One-Page Summary

KIC: 9116222 Candidate: 5 of 5 Period: 388.637 d



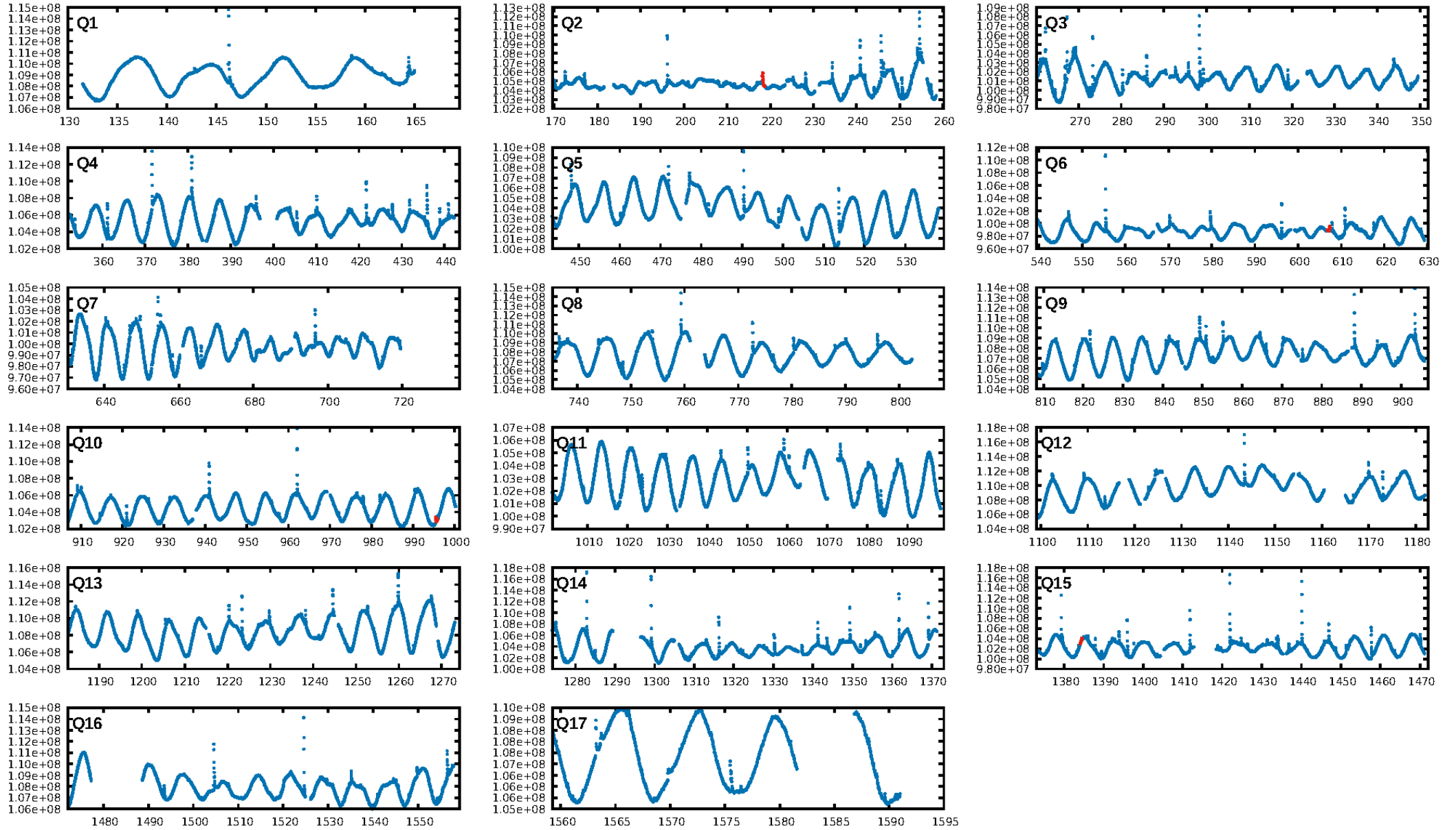
## DV Fit Results:

Period = 388.63687 [0.00326] d  
Epoch = 218.4424 [0.0059] BKJD  
Rp/R\* = 0.0383 [0.0169]  
a/R\* = 389.25 [644.18]  
b = 0.62 [1.63]  
Seff = 9.47 [5.39]  
Teq = 447 [64] K  
Rp = 17.72 [10.63] Re  
a = 1.0952 [0.4002] AU  
Ag = 1697.17 [1818.86] [0.93σ]  
**Teffp = 4439 [1020] K [3.91σ]**

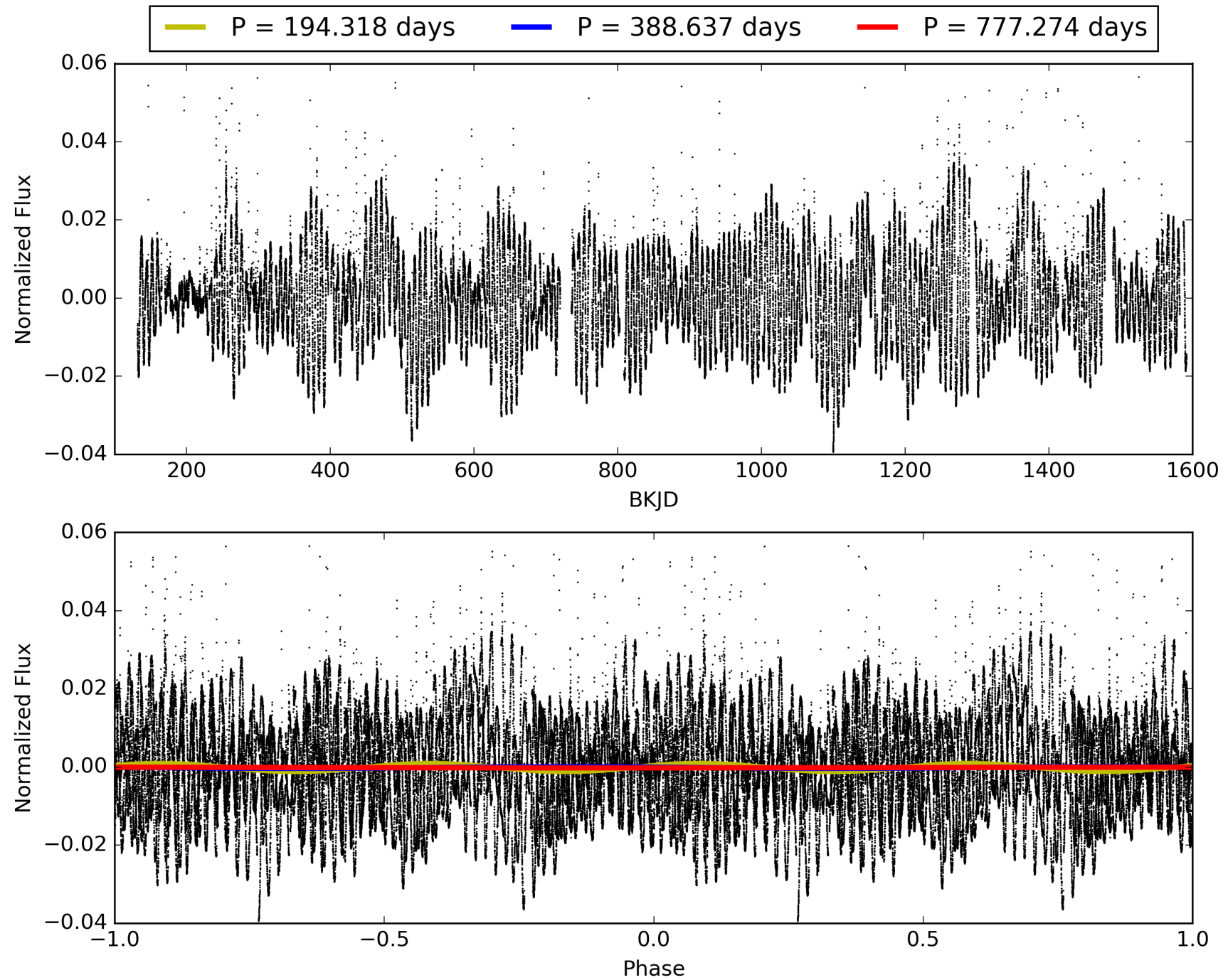
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [155.72σ]  
ModelChiSquare2-sig: 85.3%  
ModelChiSquareGof-sig: 37.4%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [4/4]  
**GhostDiagnostic-chr: 0.9387**  
Centroid-sig: 19.5%  
Centroid-so: 0.570 arcsec [1.54σ]  
OotOffset-rm: 0.525 arcsec [1.66σ]  
KicOffset-rm: 0.637 arcsec [1.59σ]  
OotOffset-st: 3/1/0/0 [4]  
KicOffset-st: 3/1/0/0 [4]  
DiffImageQuality-fgm: 0.75 [3/4]  
DiffImageOverlap-fno: 1.00 [4/4]

# TCE 009116222-05, PDC Light Curves

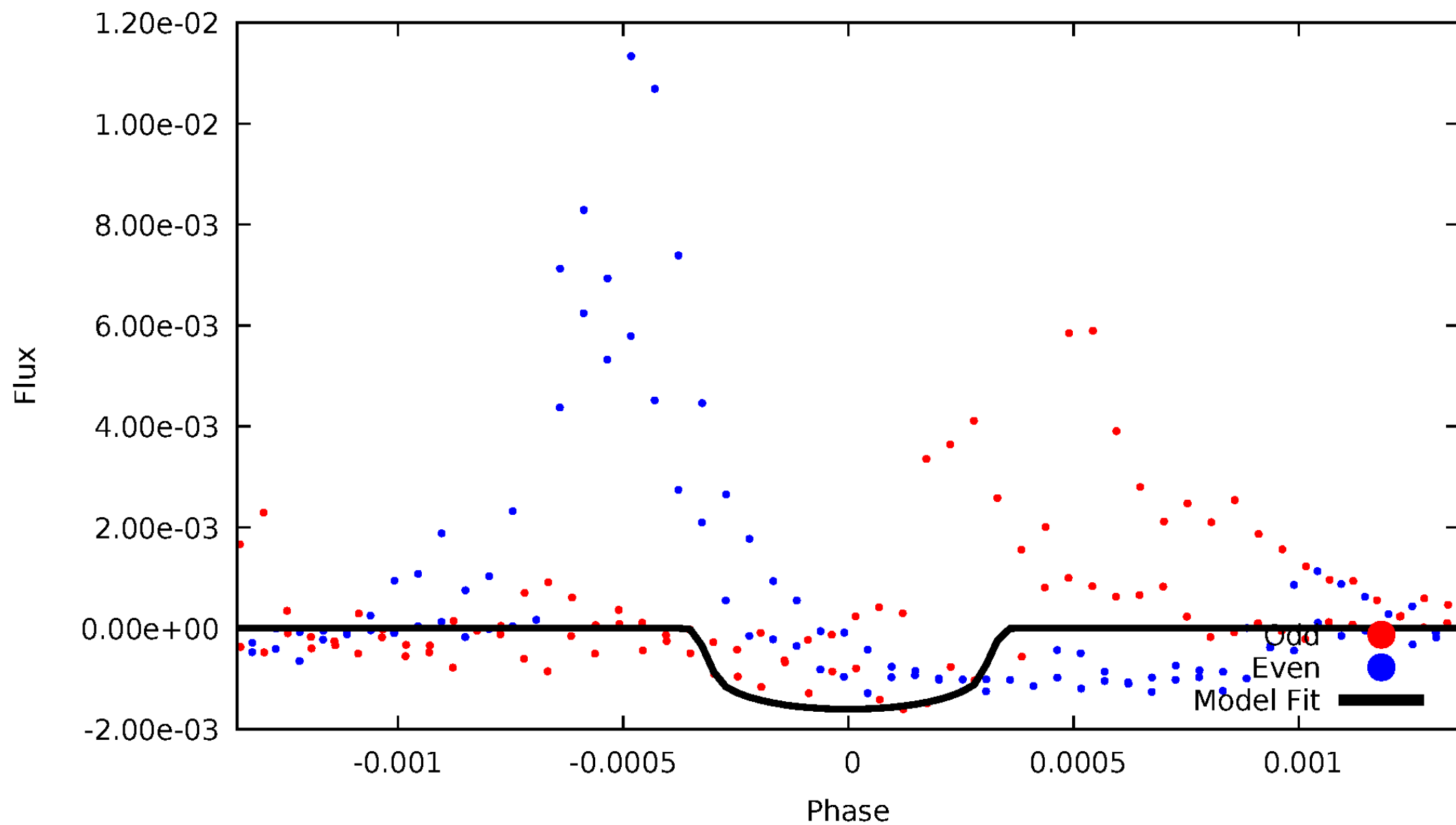


TCE 009116222-05



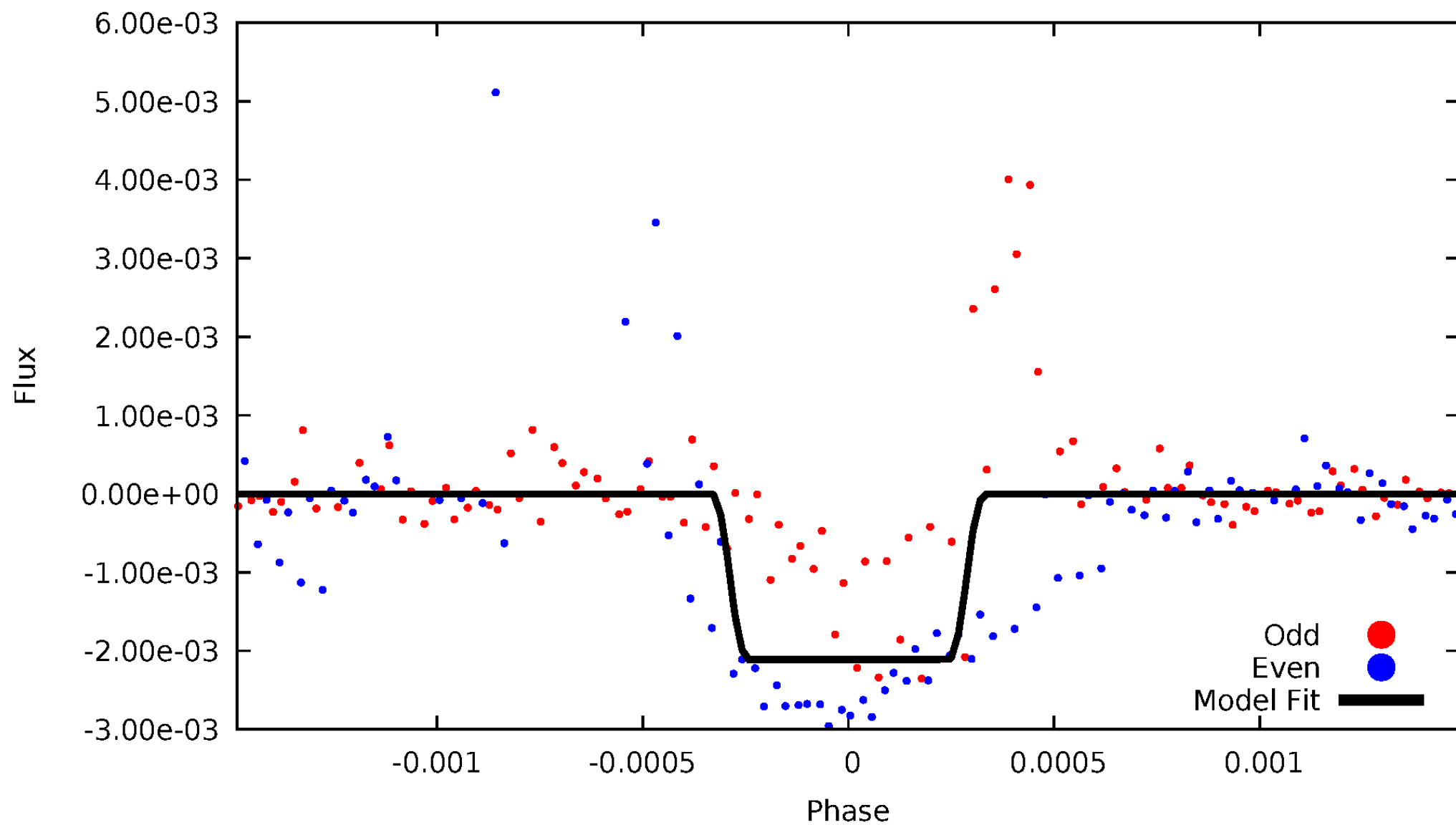
# DV Odd/Even

TCE 009116222-05



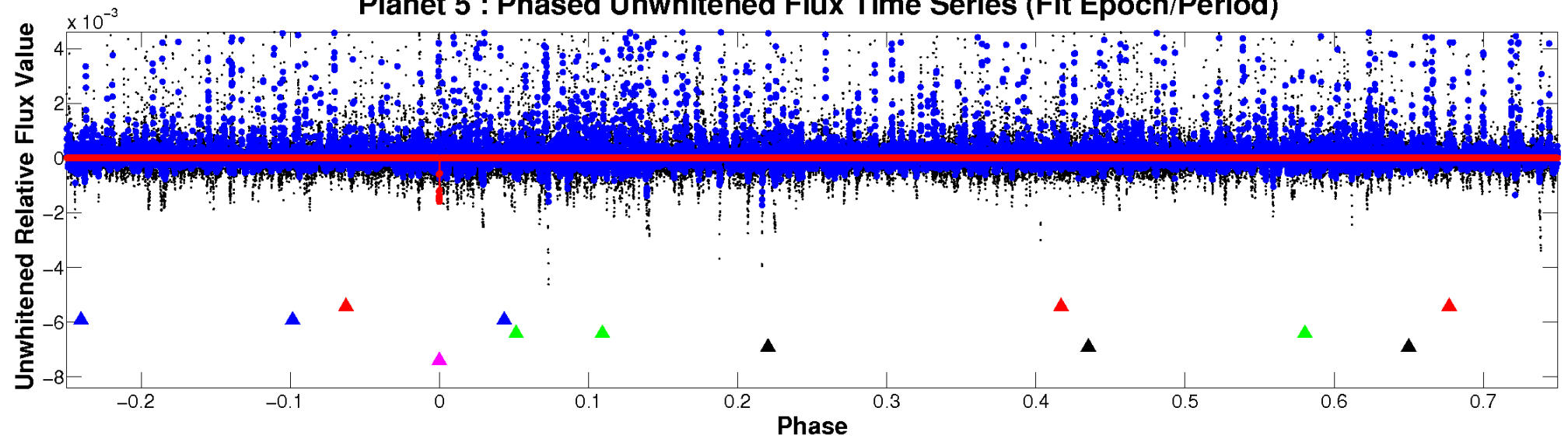
# ALT Odd/Even

TCE 009116222-05

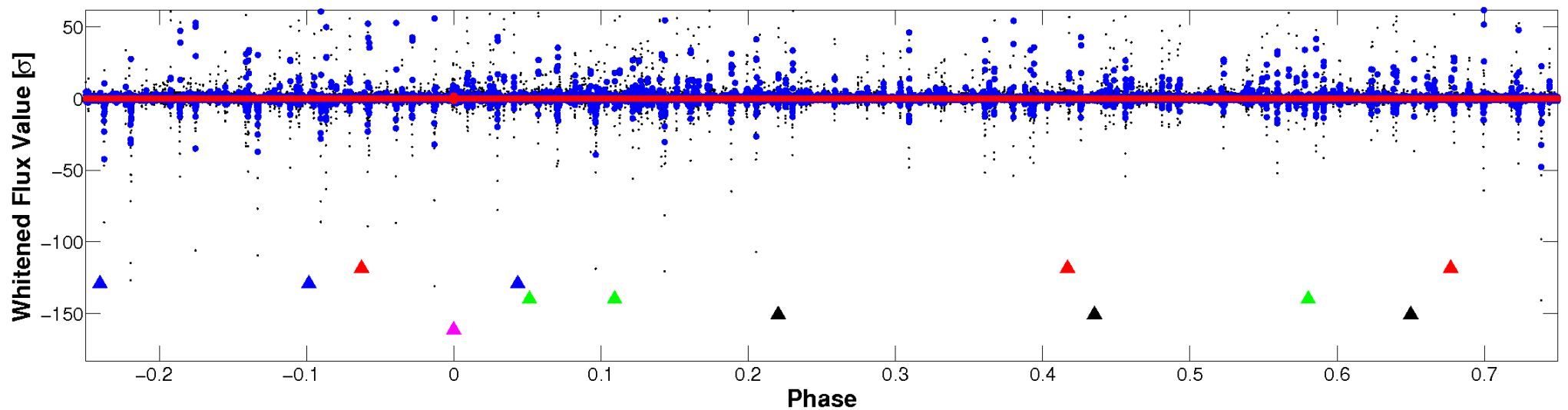


# Non-Whitened Vs. Whitened Light Curve

Planet 5 : Phased Unwhitened Flux Time Series (Fit Epoch/Period)

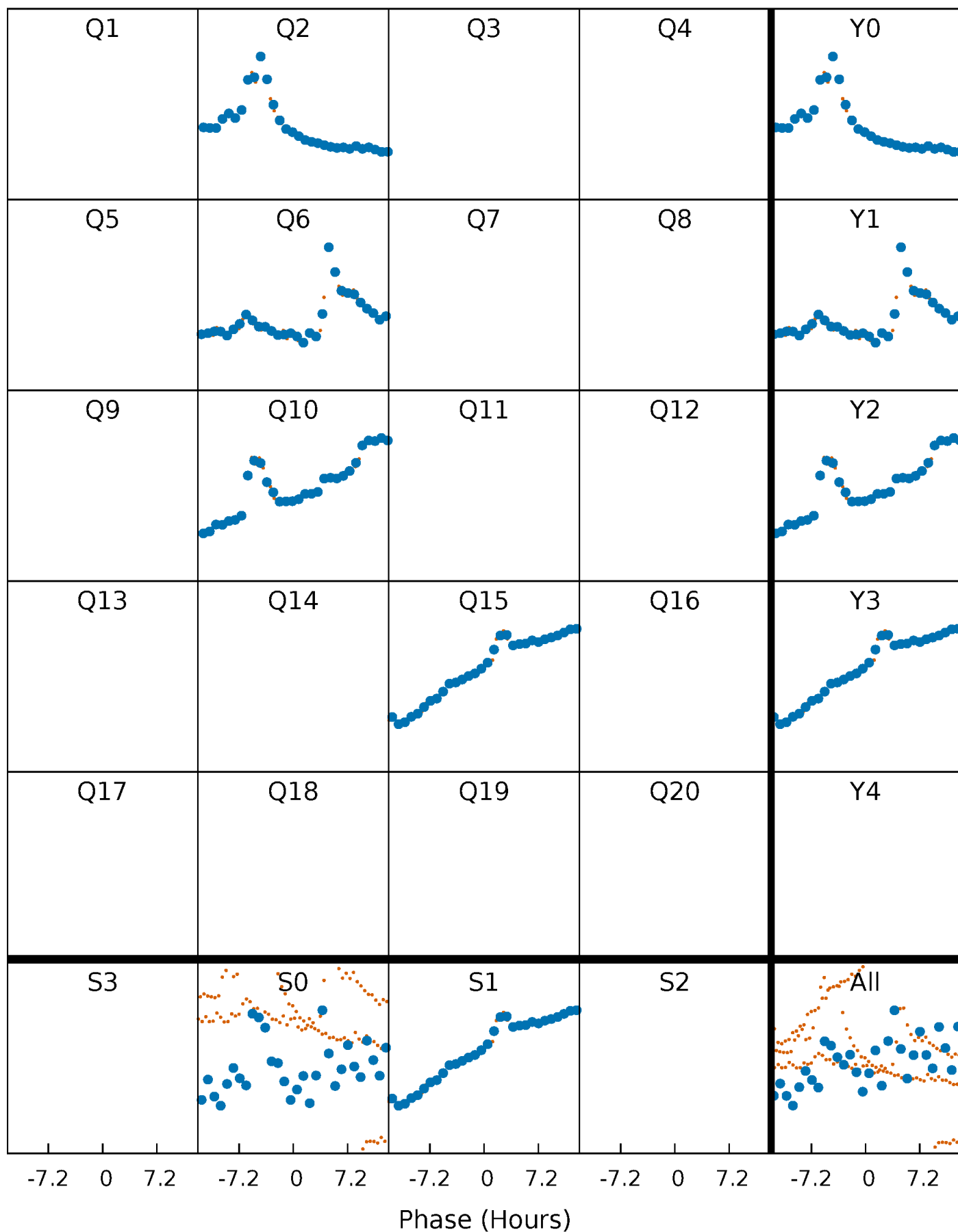


Planet 5 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

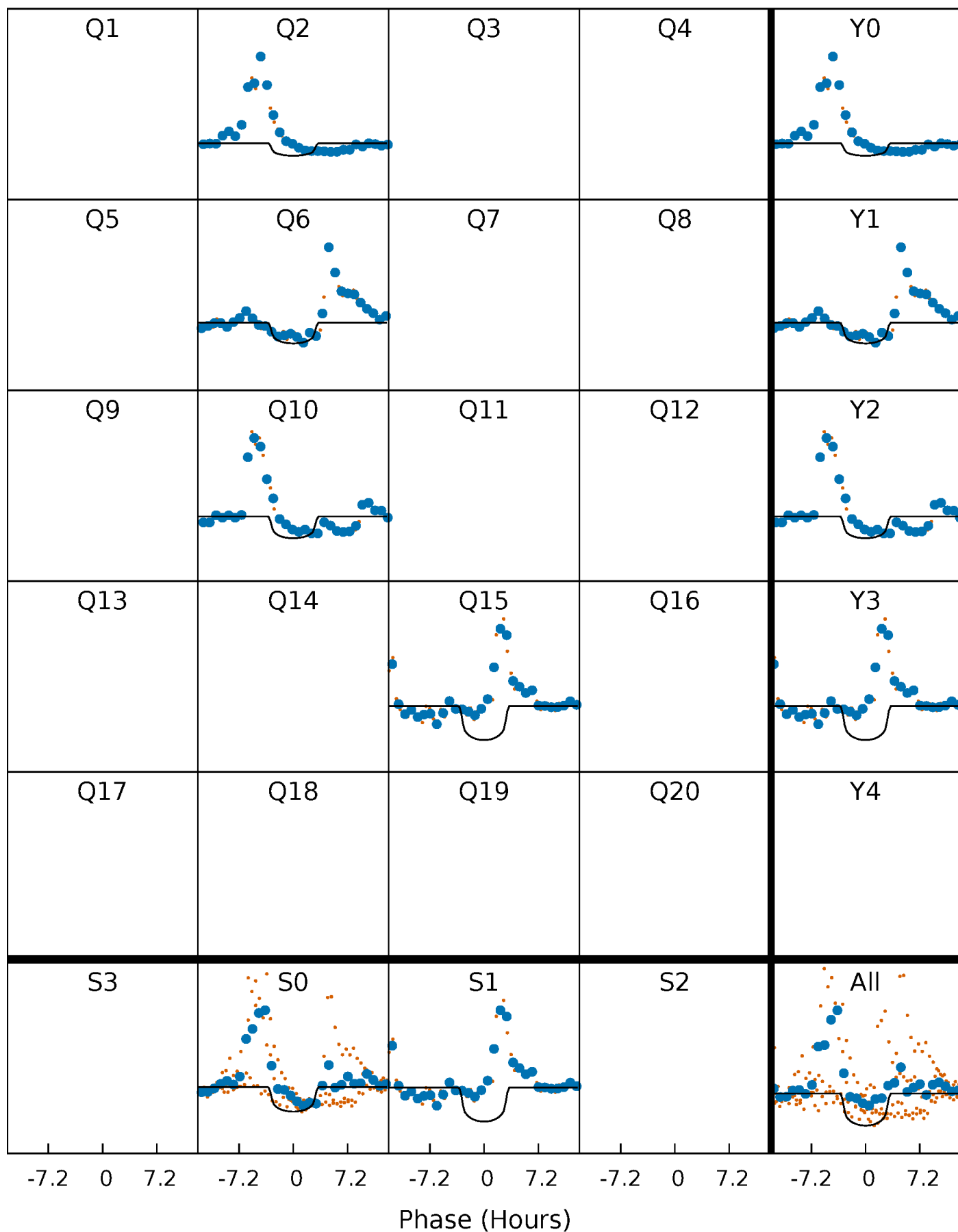
TCE 009116222-05 P=388.636869 Days  $T_0=218.442355$  (BKJD)





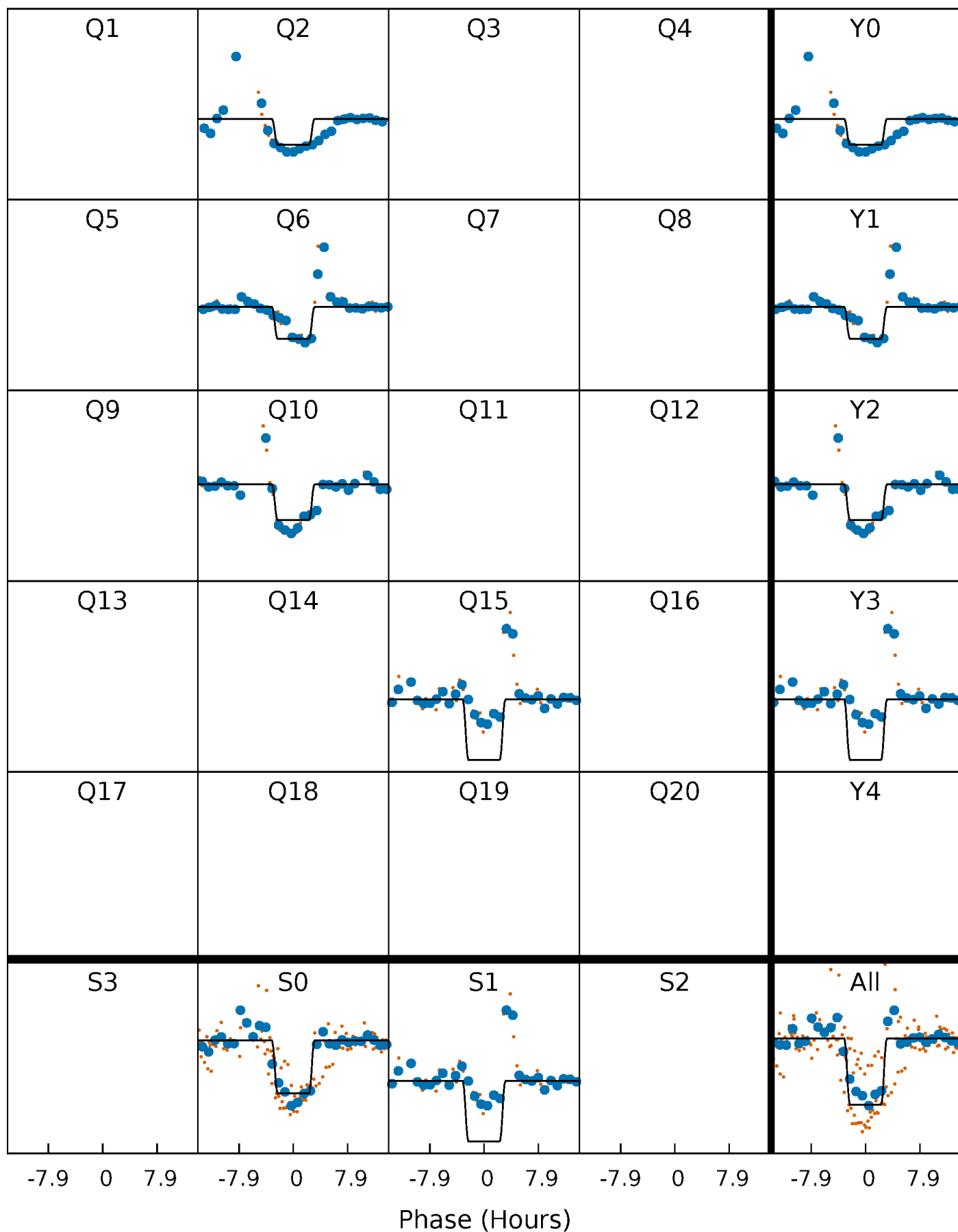
# DV Quarter-Phased Transit Curves

TCE 009116222-05 P=388.636869 Days  $T_0=218.442355$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

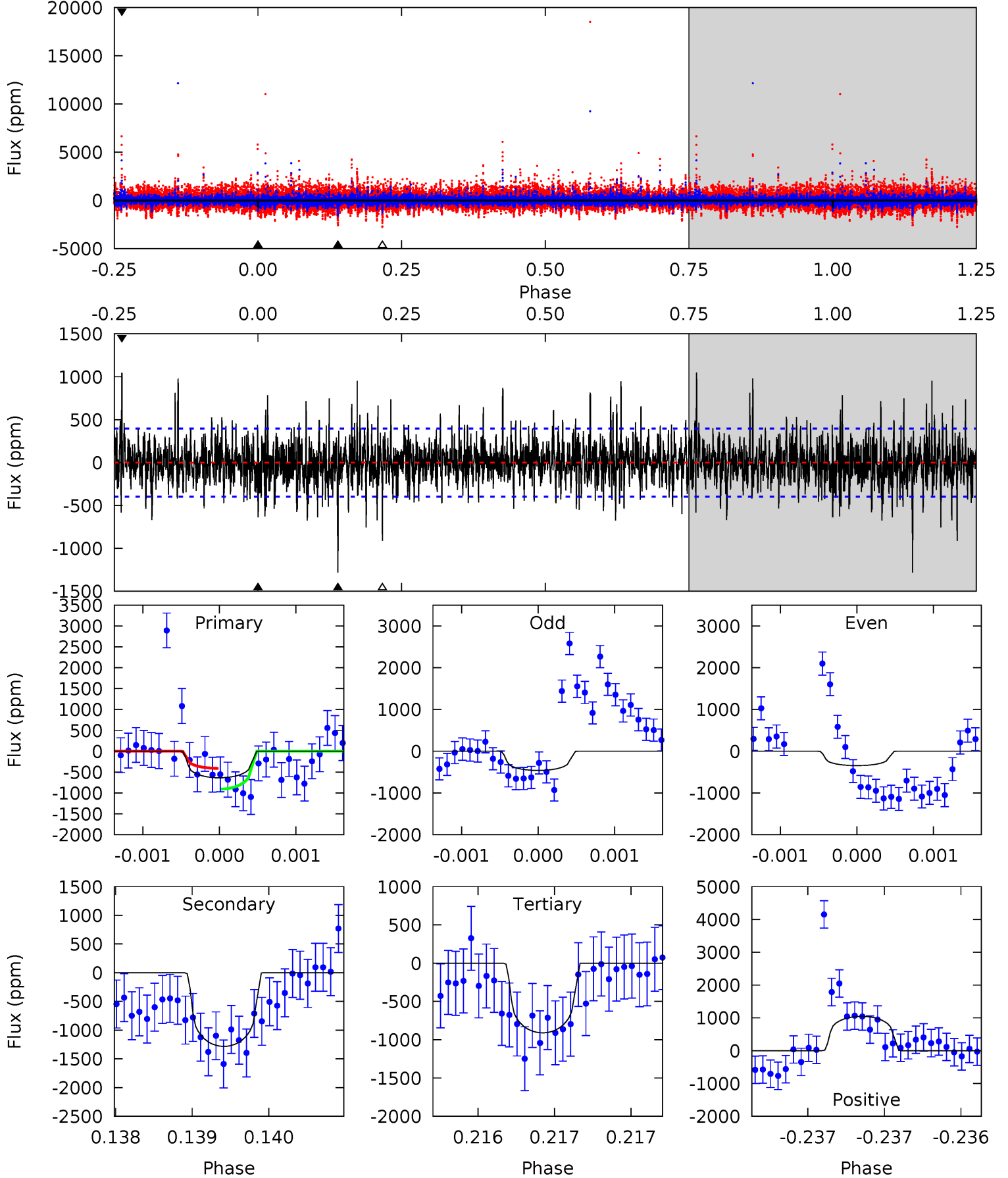
TCE 009116222-05 P=388.591822 Days  $T_0=218.526826$  (BKJD)



# DV Model-Shift Uniqueness Test

009116222-05, P = 388.636869 Days, E = 218.442355 Days

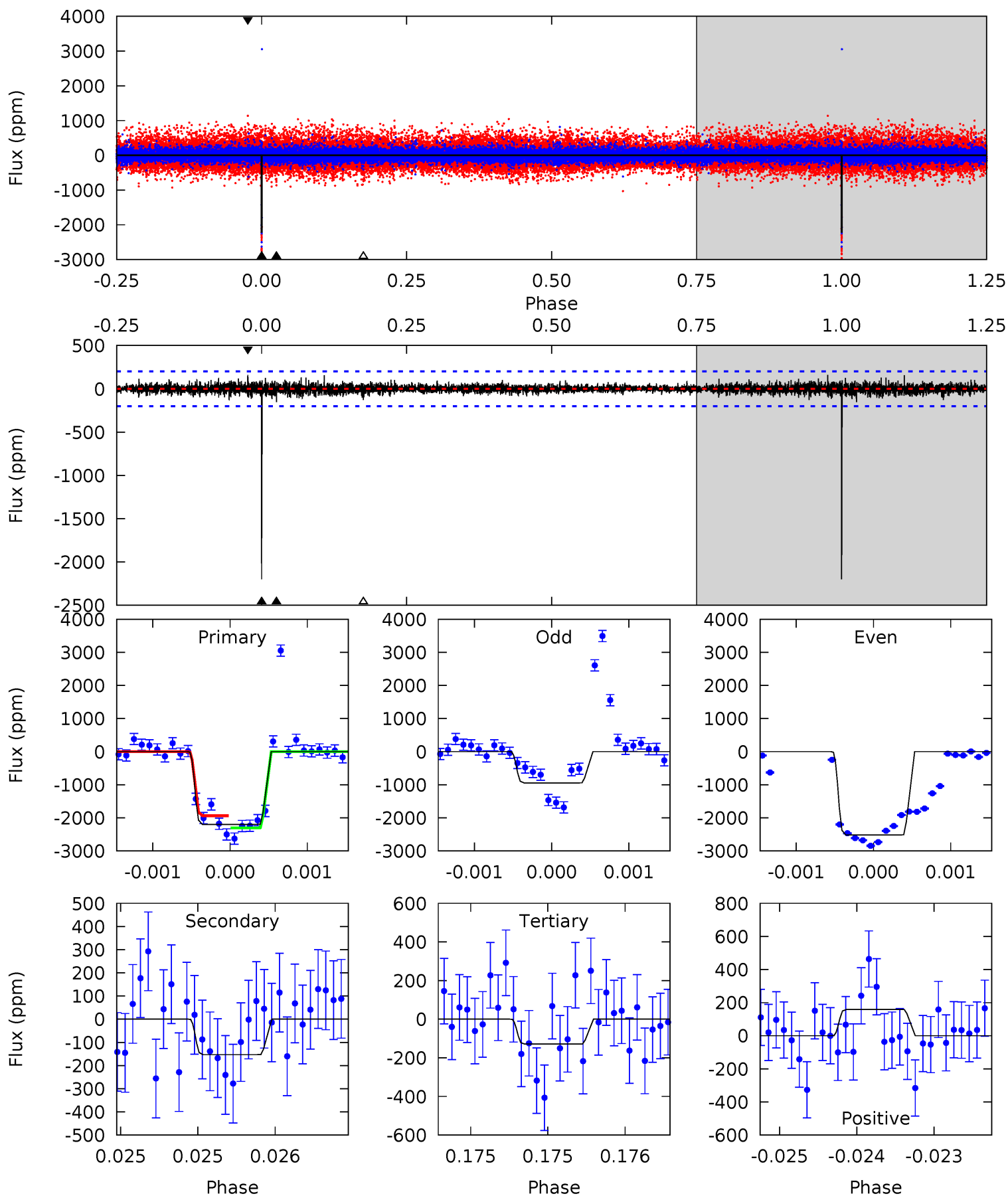
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
8.83	17.8	12.6	14.5	5.51	3.38	2.73	-3.78	-5.67	5.16	3.27	0.41	0.74	0.45	3.47



# Alt Model-Shift Uniqueness Test

009116222-05, P = 388.591822 Days, E = 218.526826 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	4.20	3.54	4.36	5.53	3.42	0.77	56.9	56.1	0.66	-0.15	22.7	0.87	0.07	5.05



### Stellar Parameters For KIC 009116222

	$T_{\text{eff}} (K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5152^{+128}_{-128}$	$3.247^{+0.319}_{-0.261}$	$-0.500^{+0.250}_{-0.250}$	$4.243^{+1.726}_{-1.412}$	$1.158^{+0.209}_{-0.256}$	$0.021^{+0.044}_{-0.013}$
	+2%/-2%	+10%/-8%	+50%/-50%	+41%/-33%	+18%/-22%	+208%/-59%
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 009116222-05 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-1282 \pm 72$	$17.44^{+10.14}_{-7.56}$	$625^{+69}_{-61}$	$4985^{+1428}_{-676}$	$2733^{+5691}_{-1594}$
Alt.	$-153 \pm 36$	$21.11^{+9.61}_{-8.23}$	$624^{+70}_{-65}$	$3192^{+499}_{-290}$	$222^{+352}_{-127}$

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

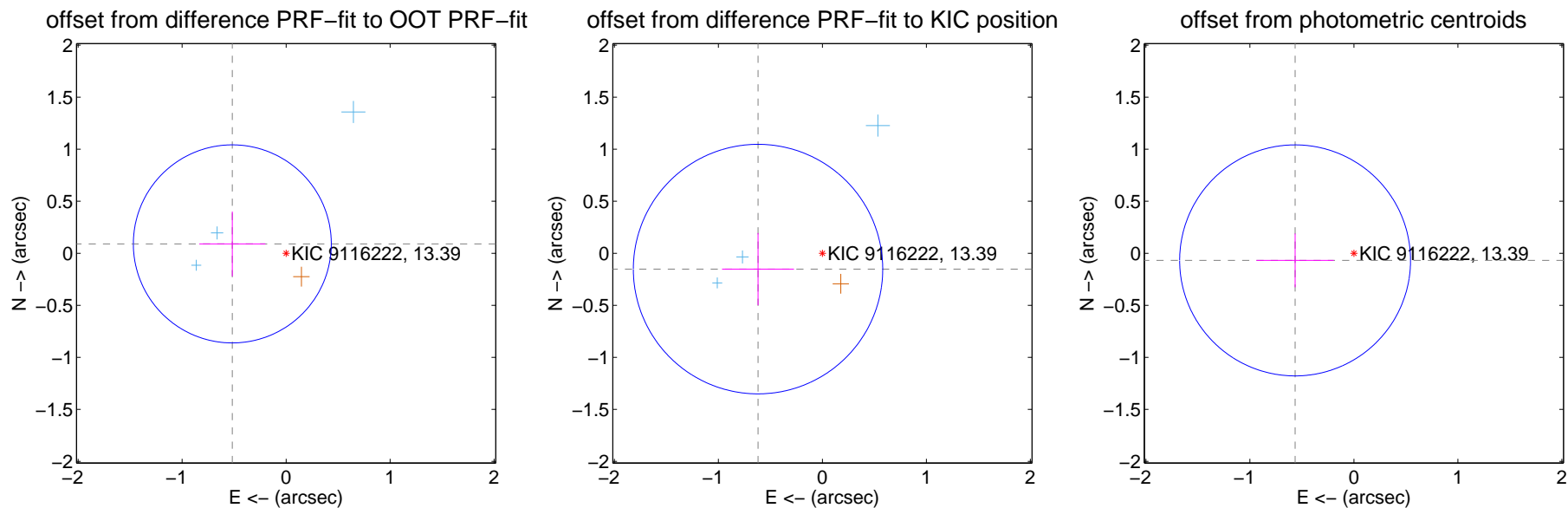
## DV Centroid Data

Supplemental centroid analysis for 009116222-05. Kepler magnitude: 13.39. Transit SNR 11.74

There are 3 quarters with good PRF difference image offsets

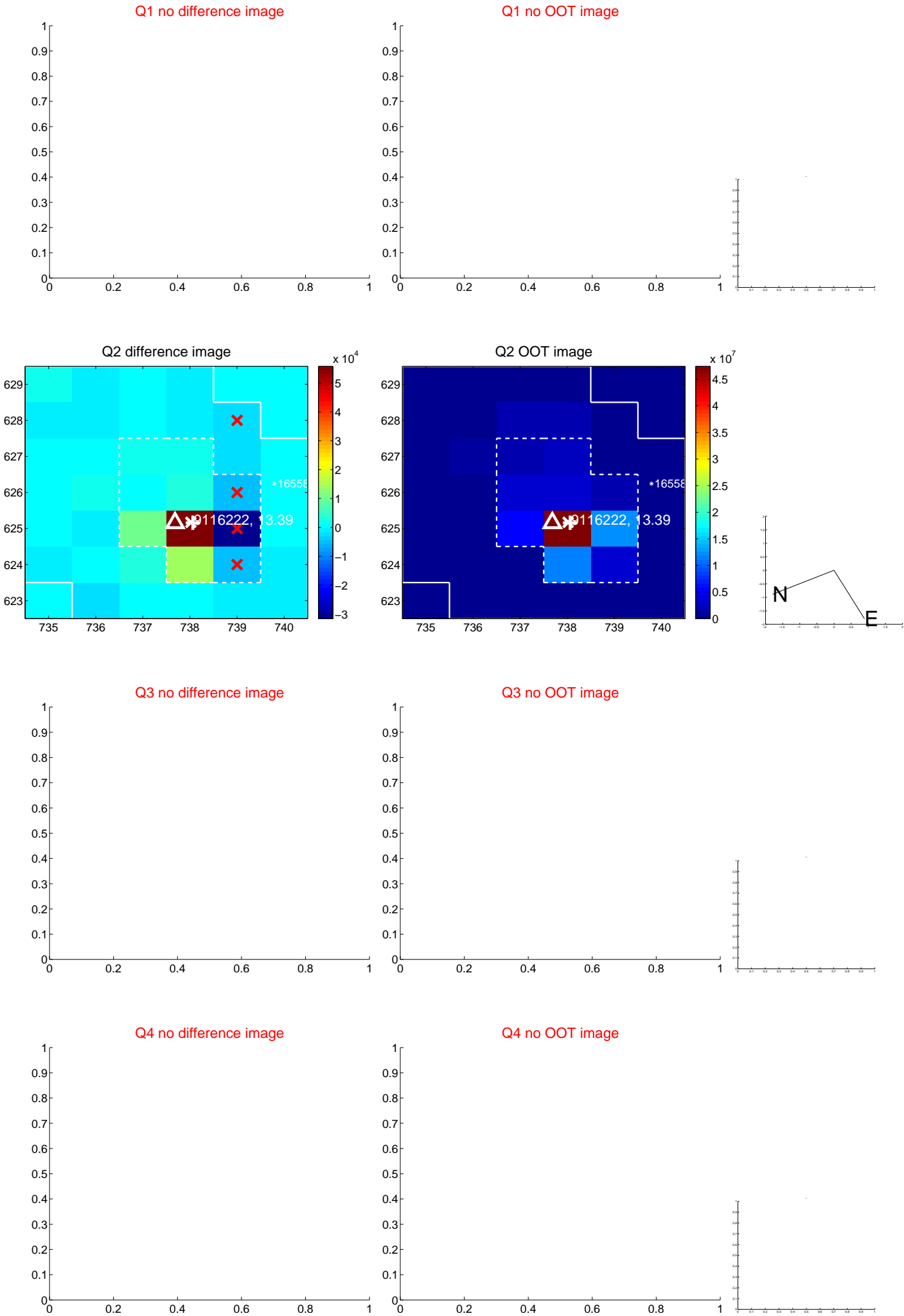
The direct PRF centroid is offset from the target star catalog position by about 0.07 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.525 \pm 0.317$	1.66	$0.517 \pm 0.318$	$0.090 \pm 0.311$
PRF-fit source offset from KIC position	$0.637 \pm 0.400$	1.59	$0.619 \pm 0.346$	$-0.152 \pm 0.347$
photometric centroid source offset	$0.57 \pm 0.37$	1.54	$0.57 \pm 0.37$	$-0.07 \pm 0.26$

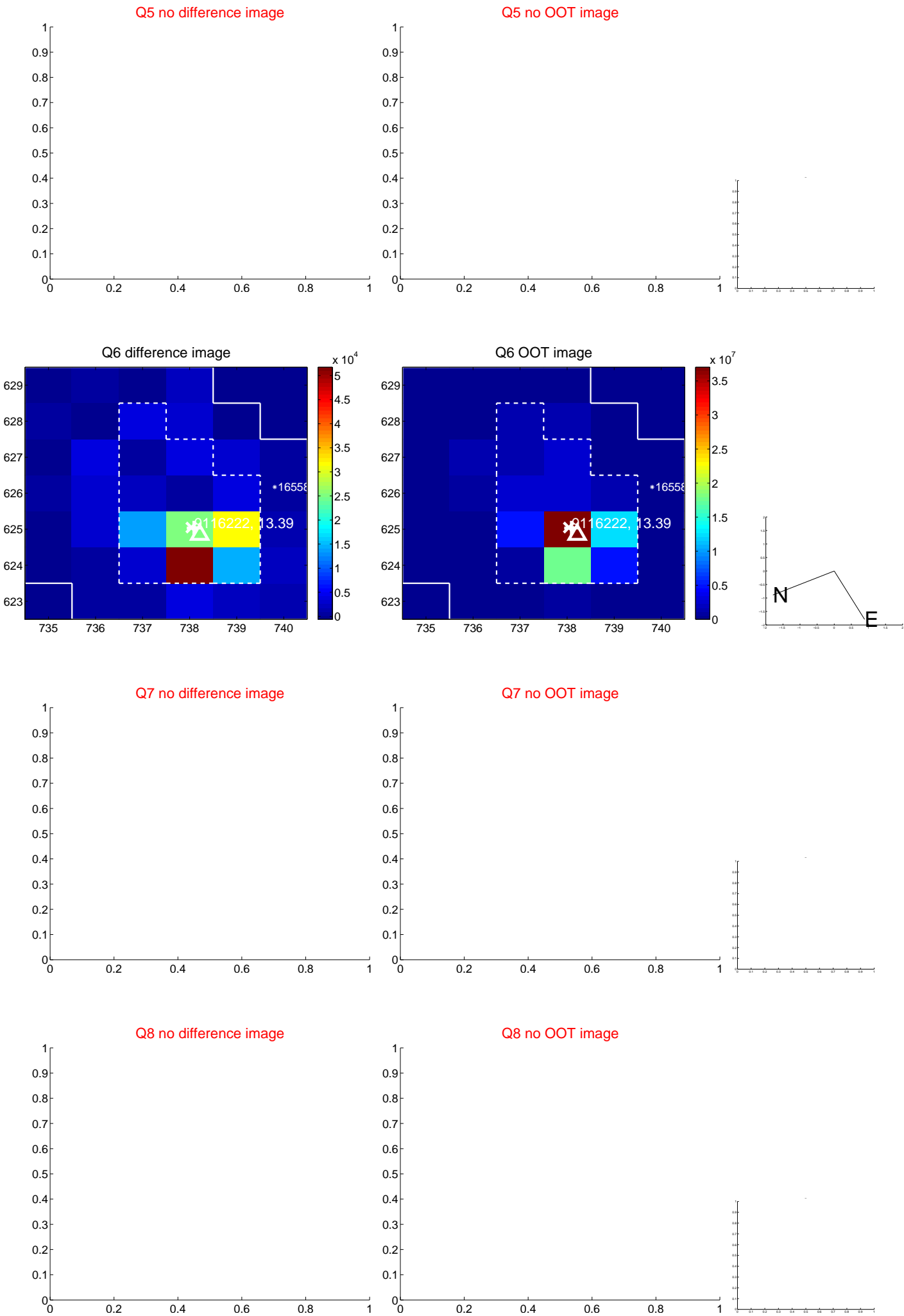


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

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

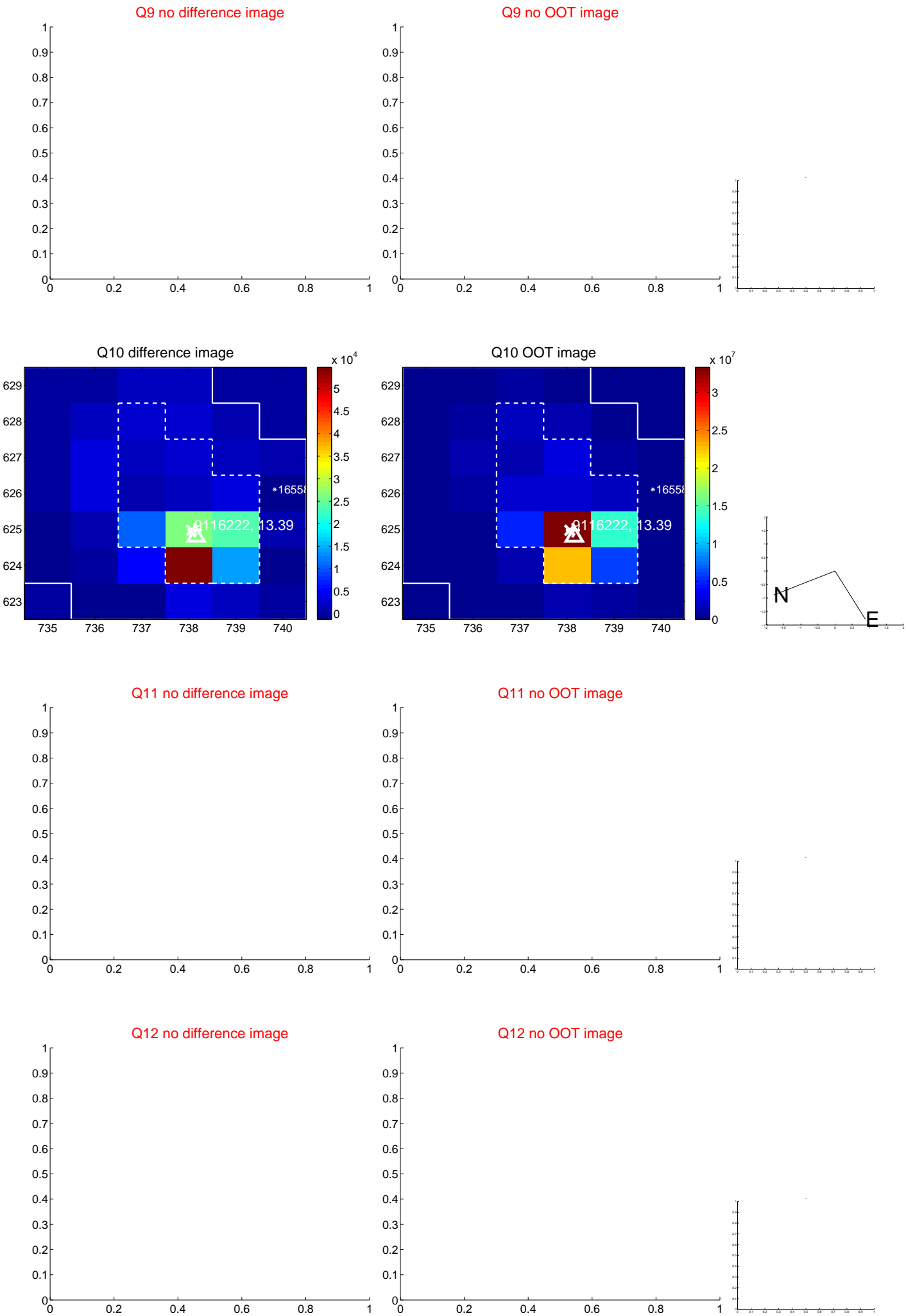


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

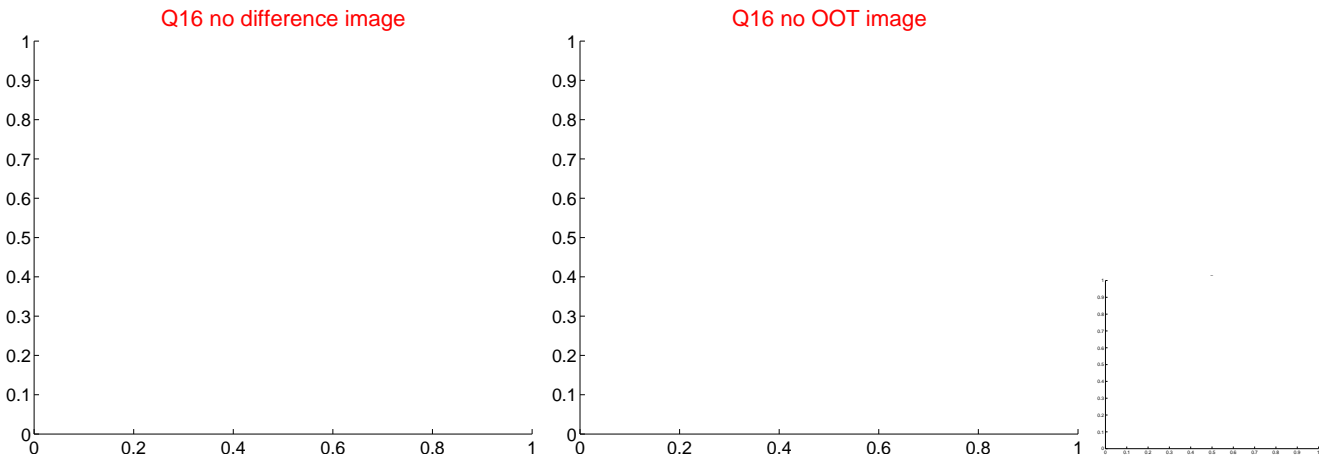
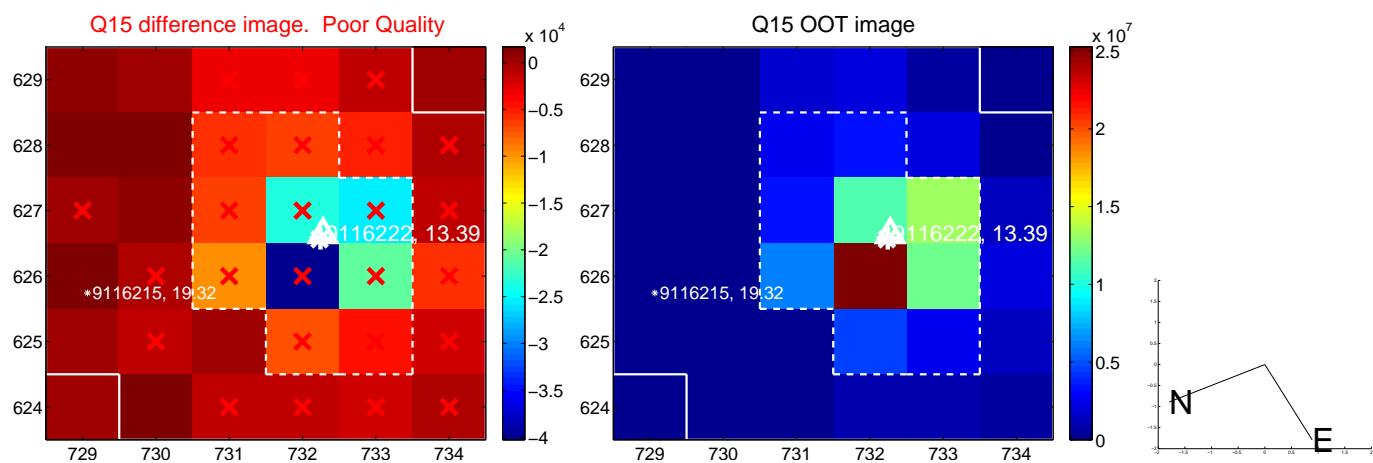
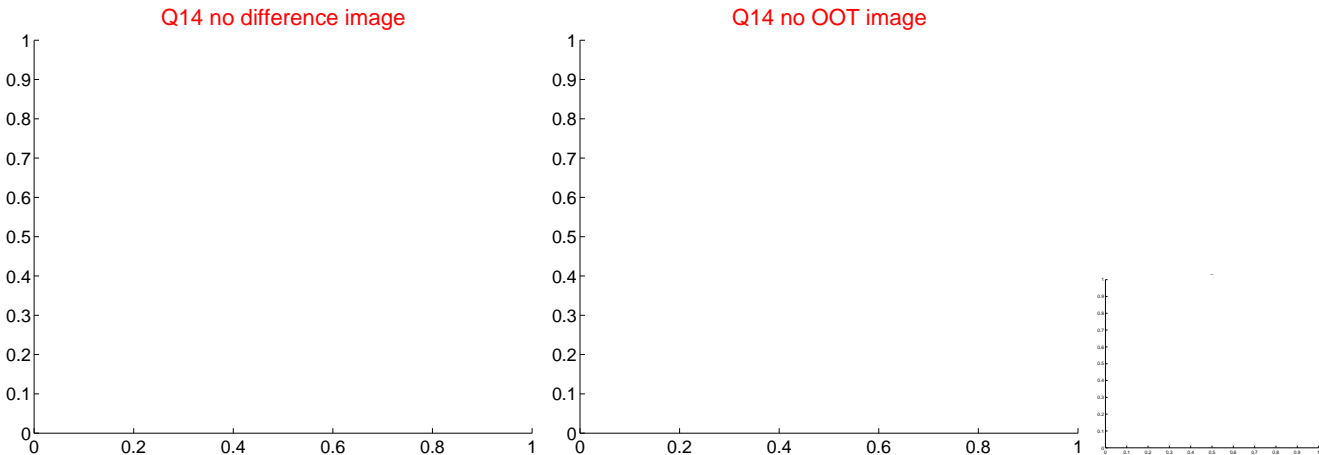
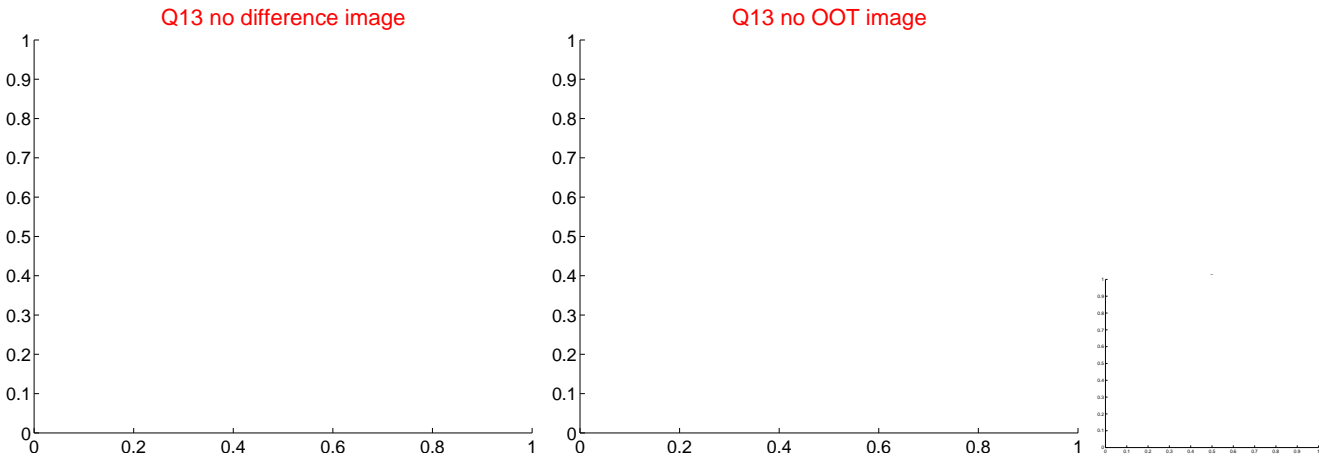




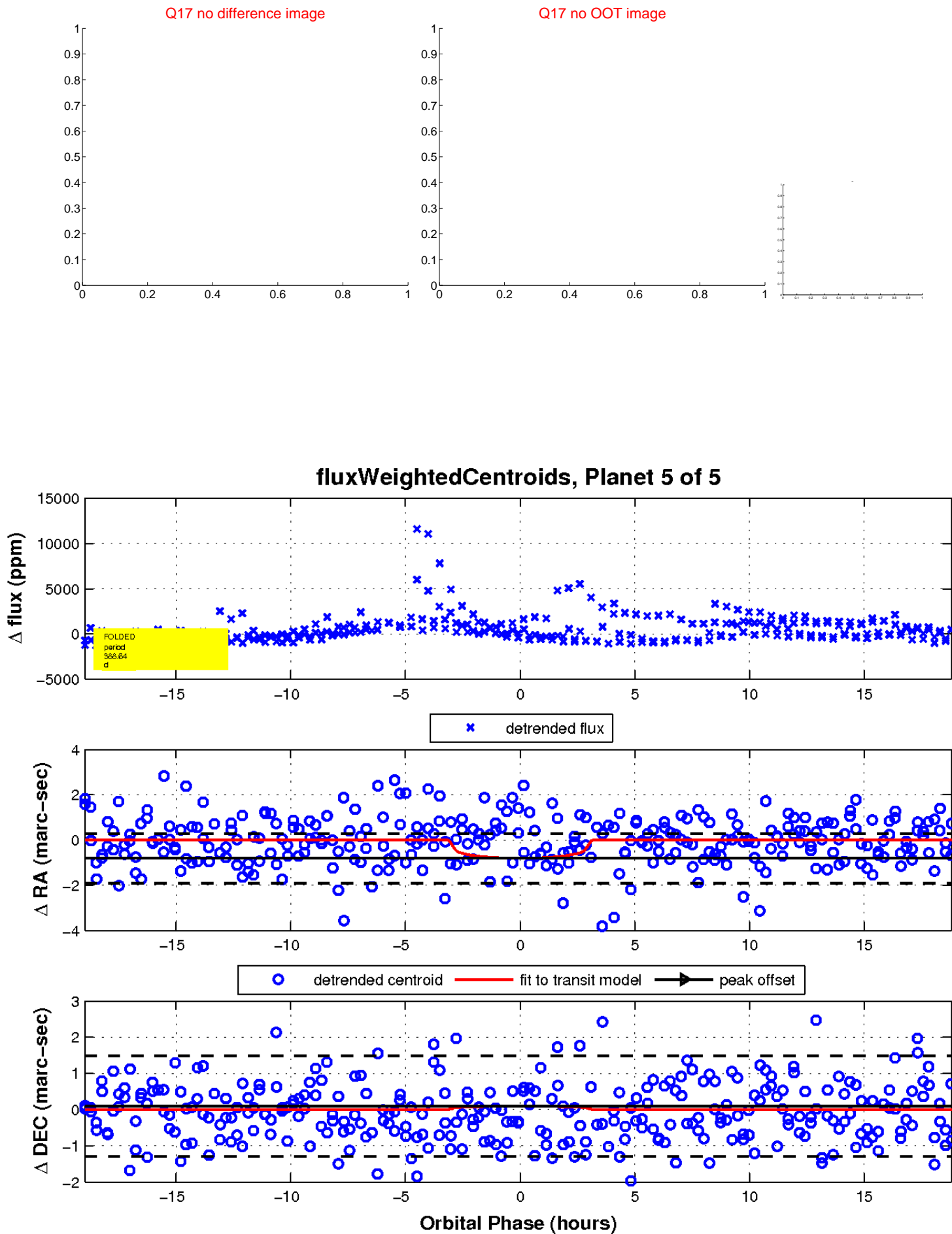
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



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



UKIRT Image

Declination

