

# KIC 004819423

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
004819423-01	OBS	No	282.284484	197.192543	2307.5	3.084	13.0	6.5	0.76	4562	4.08	0.38
004819423-02	OBS	No	348.350153	454.454916	4386.6	12.880	12.6	6.8	0.76	4562	5.94	0.29
004819423-03	OBS	No	604.745146	233.626301	2308.9	4.878	13.2	5.5	0.76	4562	3.63	0.14
004819423-04	OBS	No	222.195401	264.478608	2274.1	3.524	11.4	7.1	0.76	4562	3.77	0.53

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
004819423-01	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
004819423-02	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_MARSHALL_SKYE—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS—HALO_GHOST
004819423-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_SKYE—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS
004819423-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL—LPP_DV—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—CENT_KIC_POS

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

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

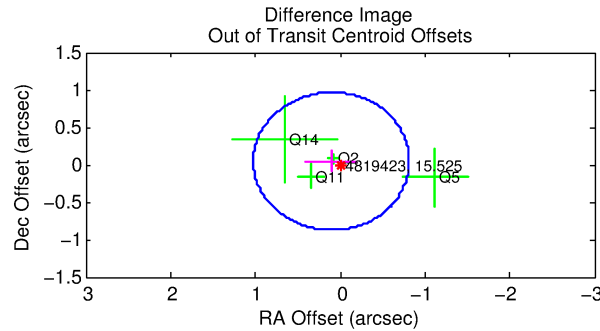
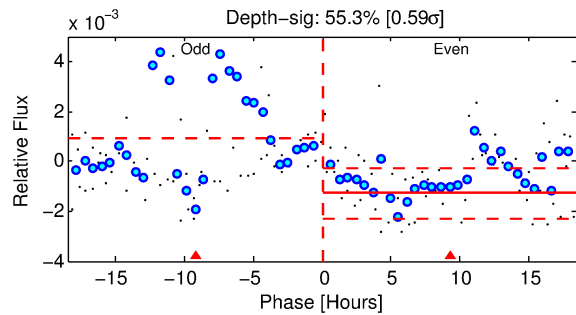
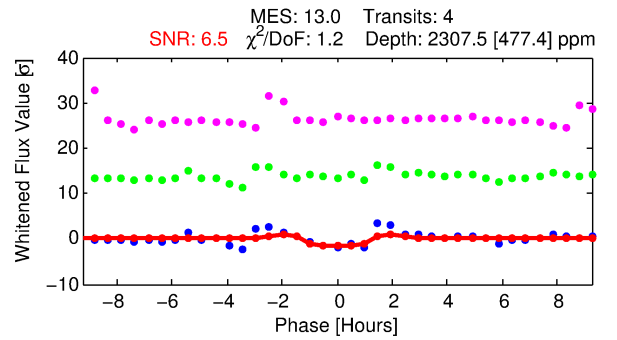
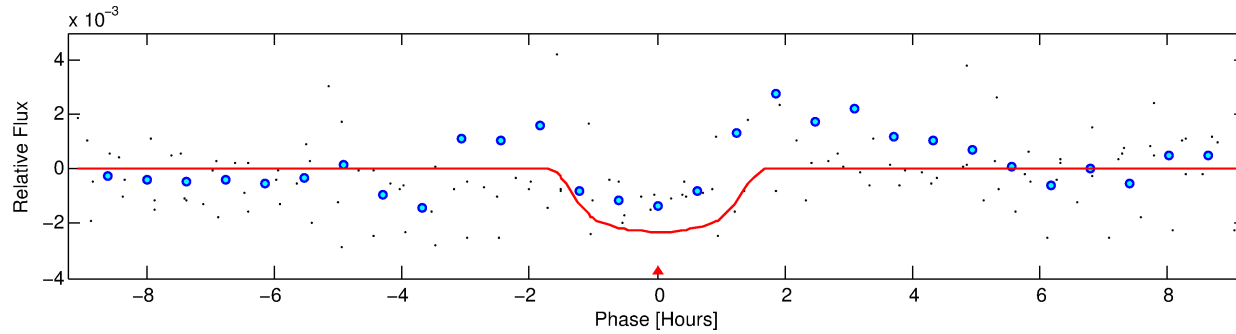
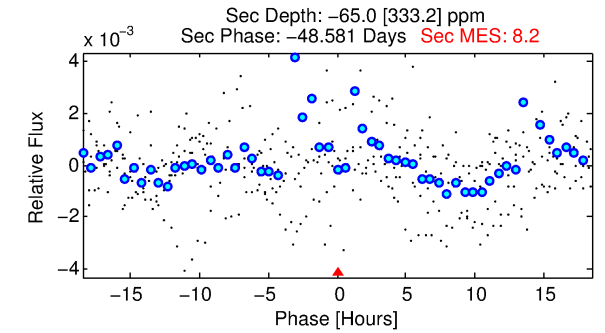
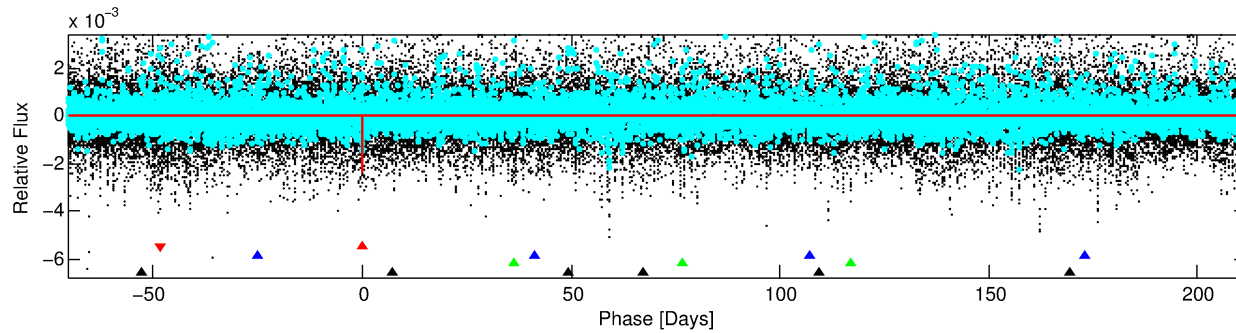
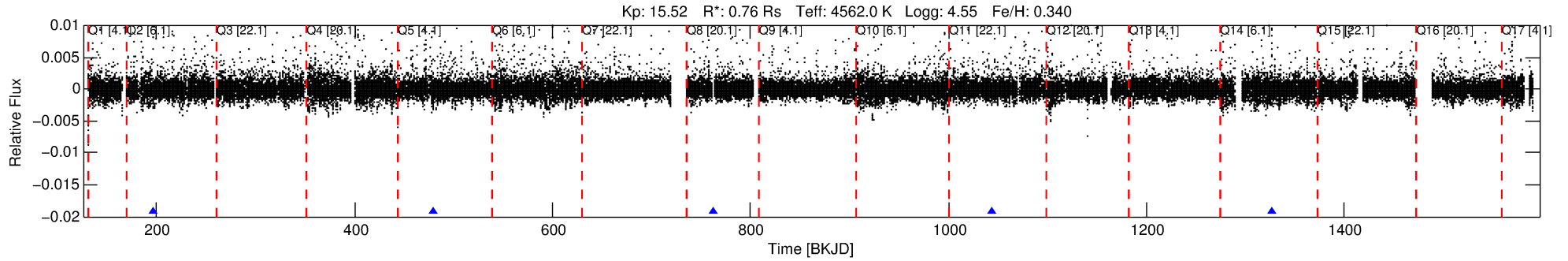
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 004819423-01

No Significant Match Found

# DV One-Page Summary

KIC: 4819423 Candidate: 1 of 4 Period: 282.284 d



## DV Fit Results:

Period = 282.28448 [0.00272] d  
Epoch = 197.1925 [0.0062] BKJD  
Rp/R\* = 0.0493 [0.0319]  
a/R\* = 486.10 [931.66]  
b = 0.79 [0.97]  
Seff = 0.38 [0.07]  
Teff = 200 [9] K  
Rp = 4.08 [2.67] Re  
a = 0.7650 [0.0586] AU  
Ag = N/A  
Teffp = N/A

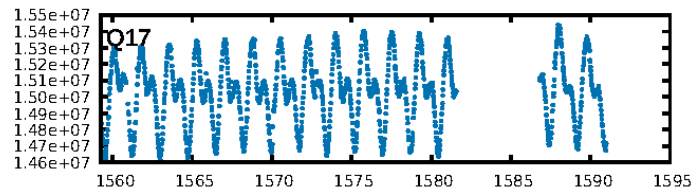
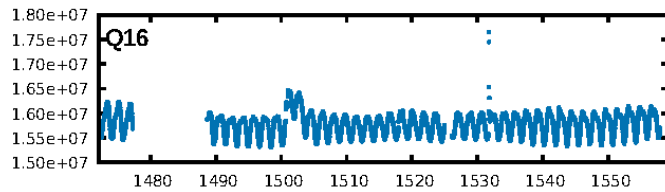
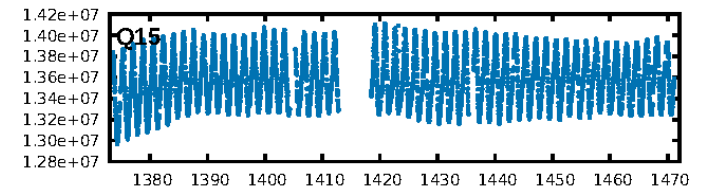
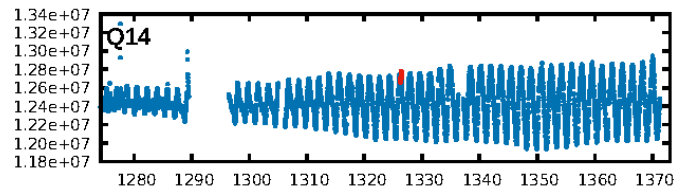
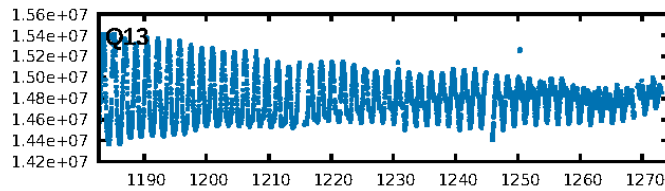
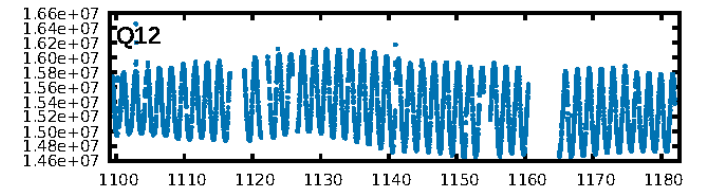
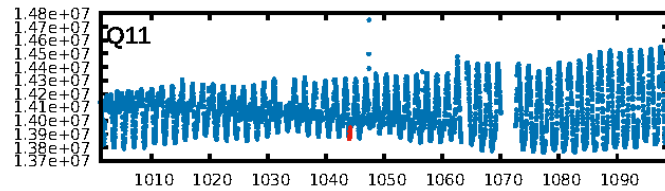
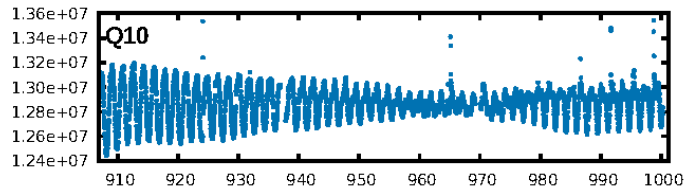
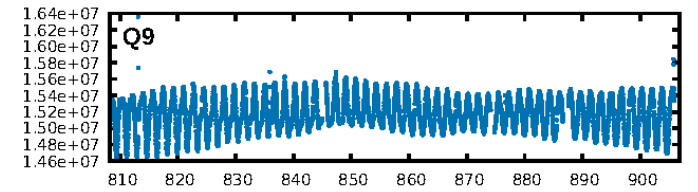
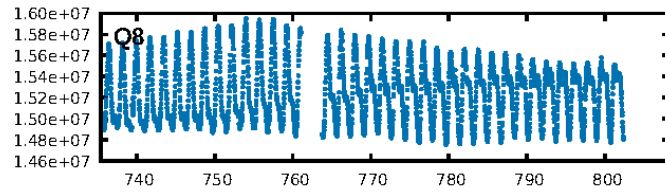
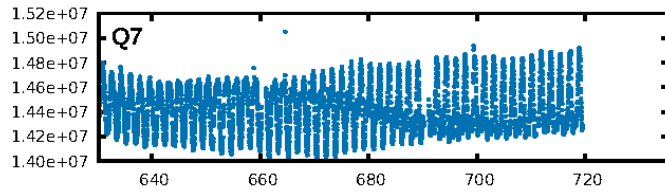
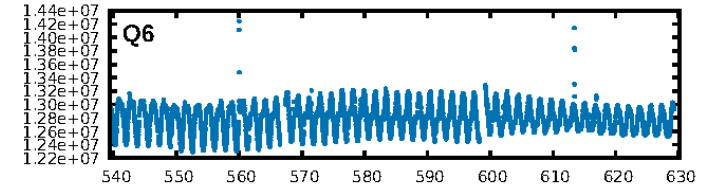
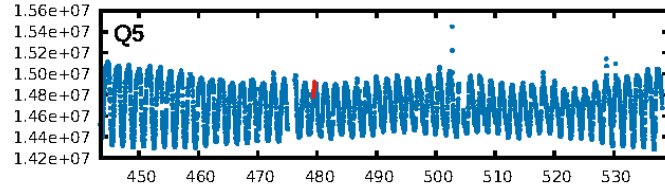
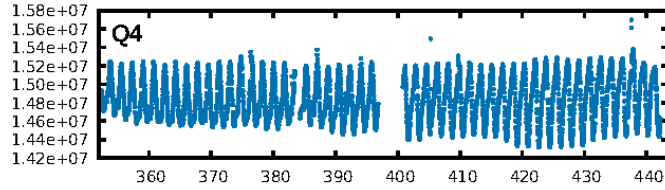
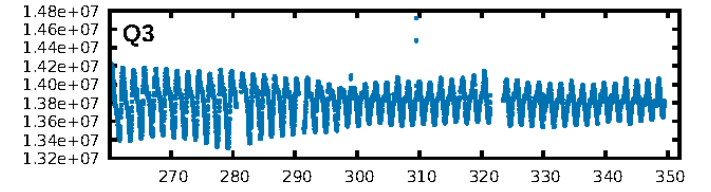
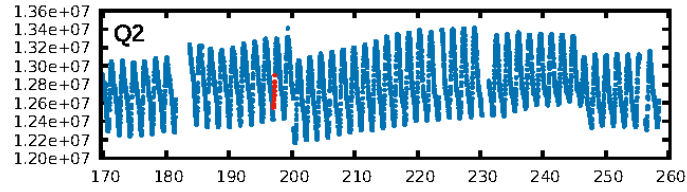
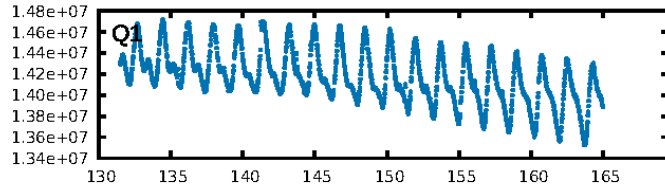
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [307.94σ]  
LongPeriod-sig: 100.0% [119.72σ]  
ModelChiSquare2-sig: 4.6%  
ModelChiSquareGof-sig: 41.2%  
**Bootstrap-pfa: 7.08e-11**  
RollingBand-fgt: 1.00 [4/4]  
**GhostDiagnostic-chr: 0.2986**  
Centroid-sig: 69.2%  
Centroid-so: 0.816 arcsec [1.03σ]  
OotOffset-rm: 0.113 arcsec [0.37σ]  
OotOffset-st: 2/1/0/1 [4]  
KicOffset-rm: **0.918 arcsec [4.16σ]**  
KicOffset-st: 2/1/0/1 [4]  
DiffImageQuality-fgm: 0.50 [2/4]  
DiffImageOverlap-fno: 1.00 [4/4]

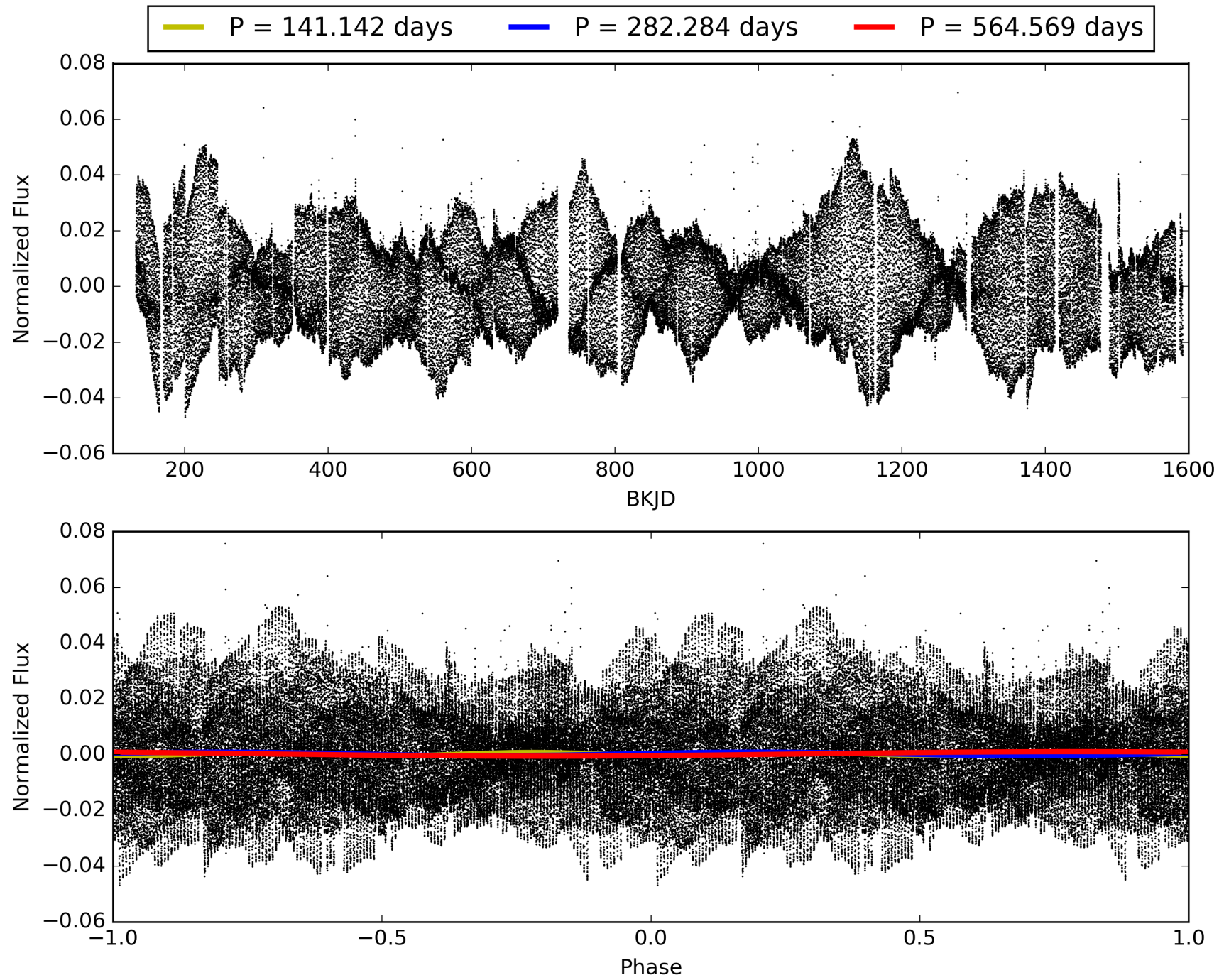
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 23:02:29 Z

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

# TCE 004819423-01, PDC Light Curves



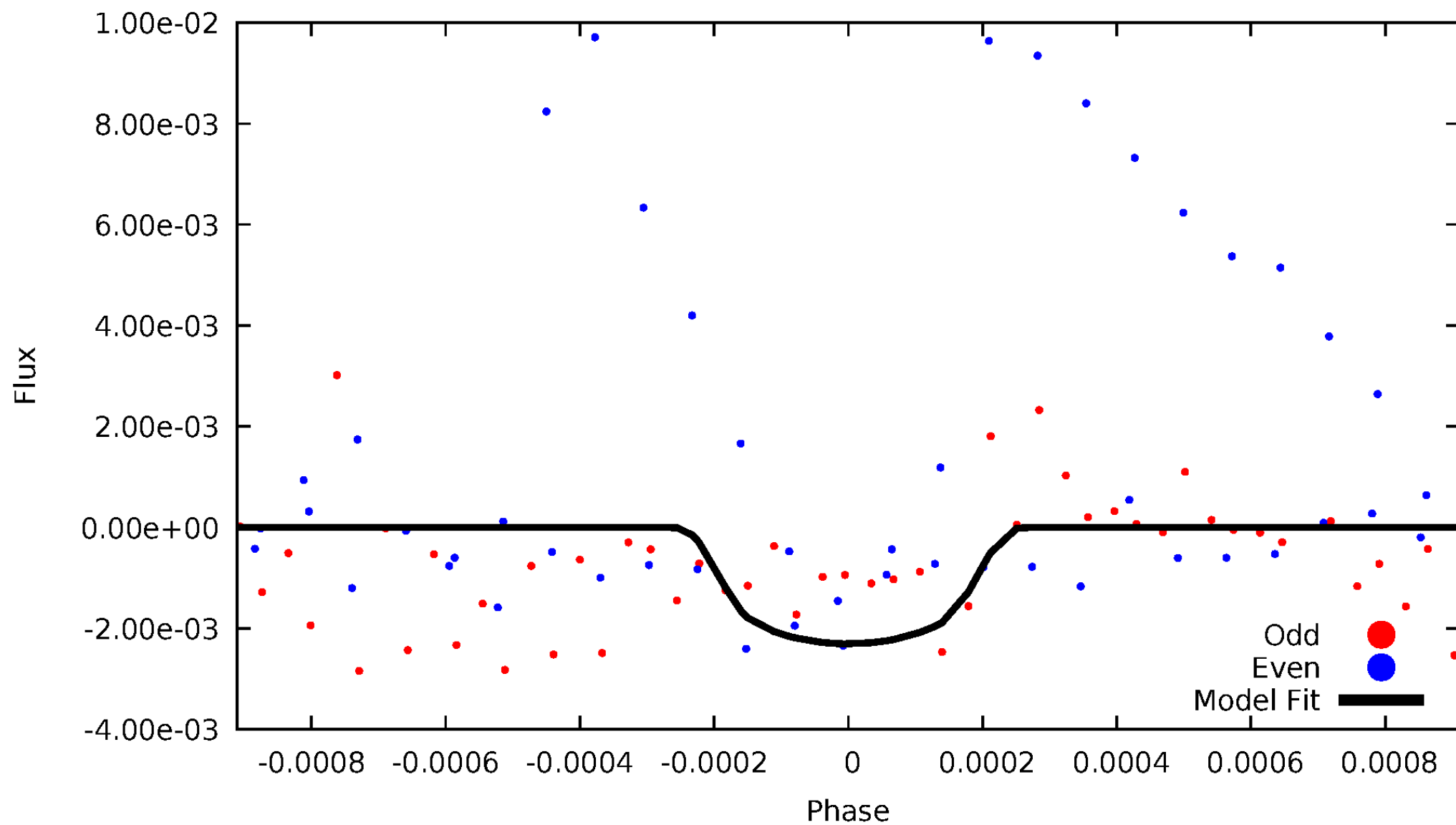
TCE 004819423-01





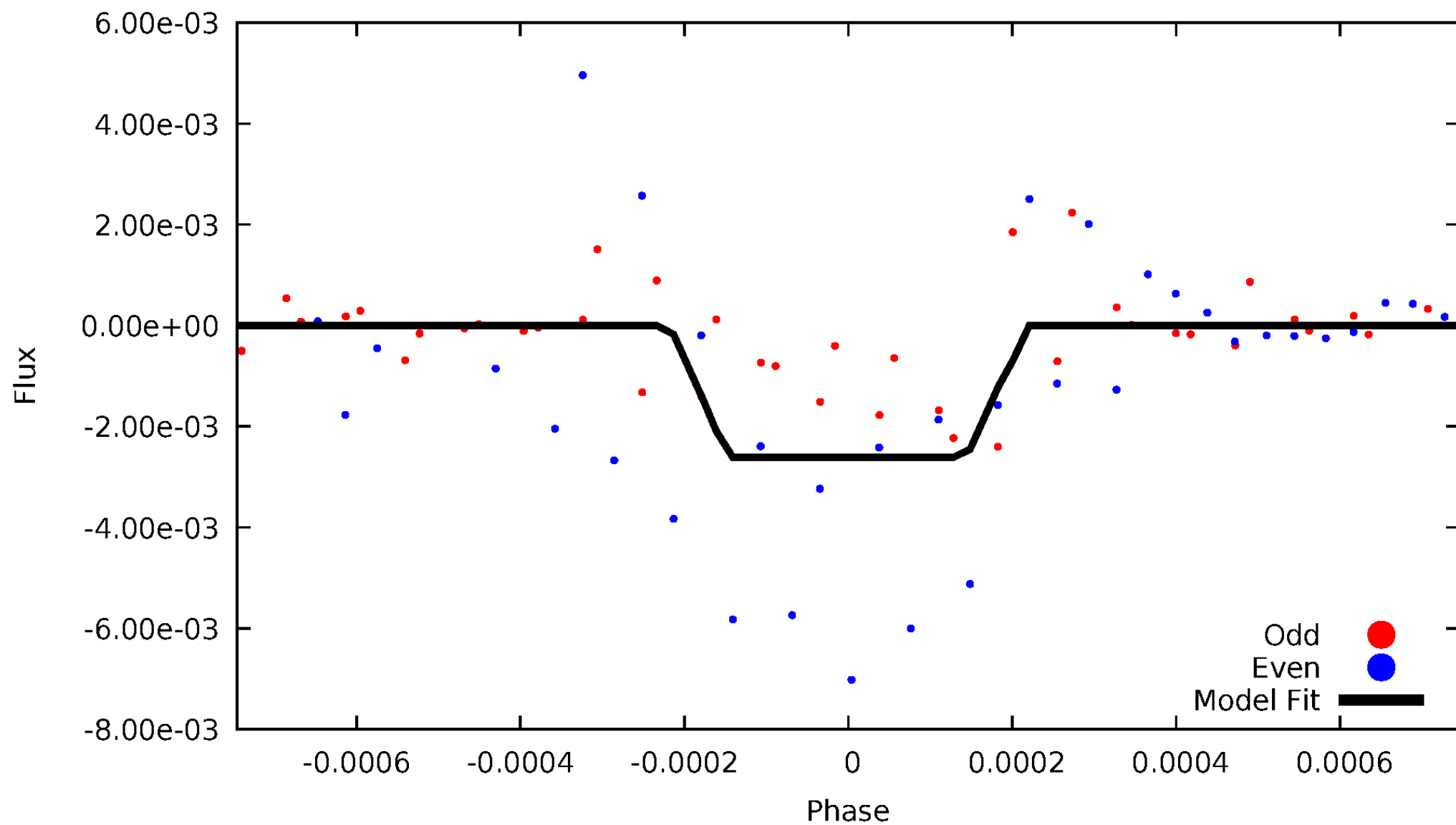
# DV Odd/Even

TCE 004819423-01



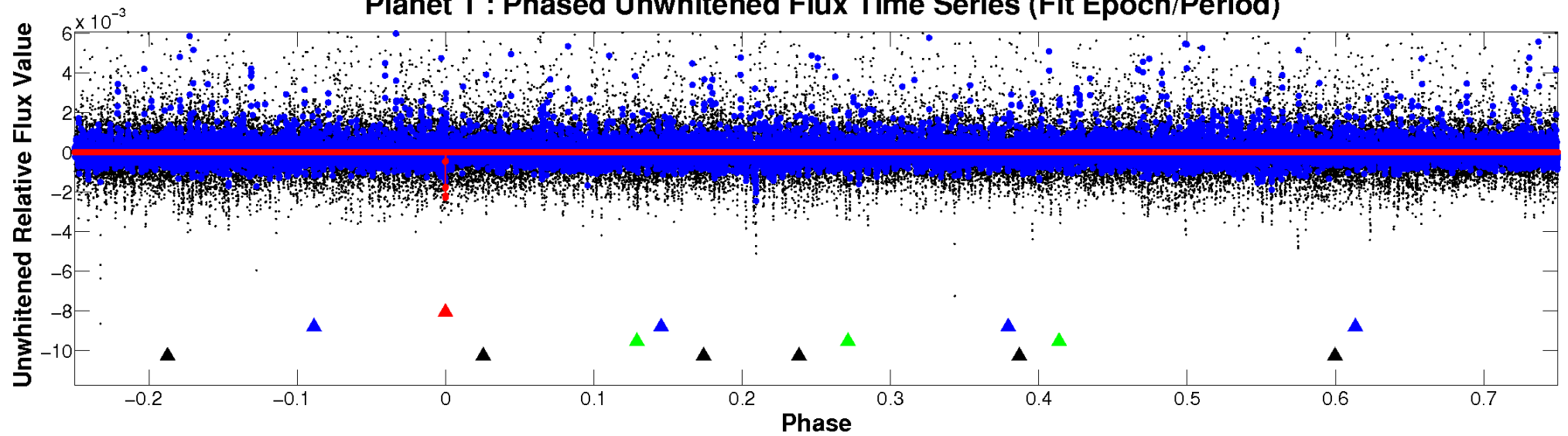
# ALT Odd/Even

TCE 004819423-01

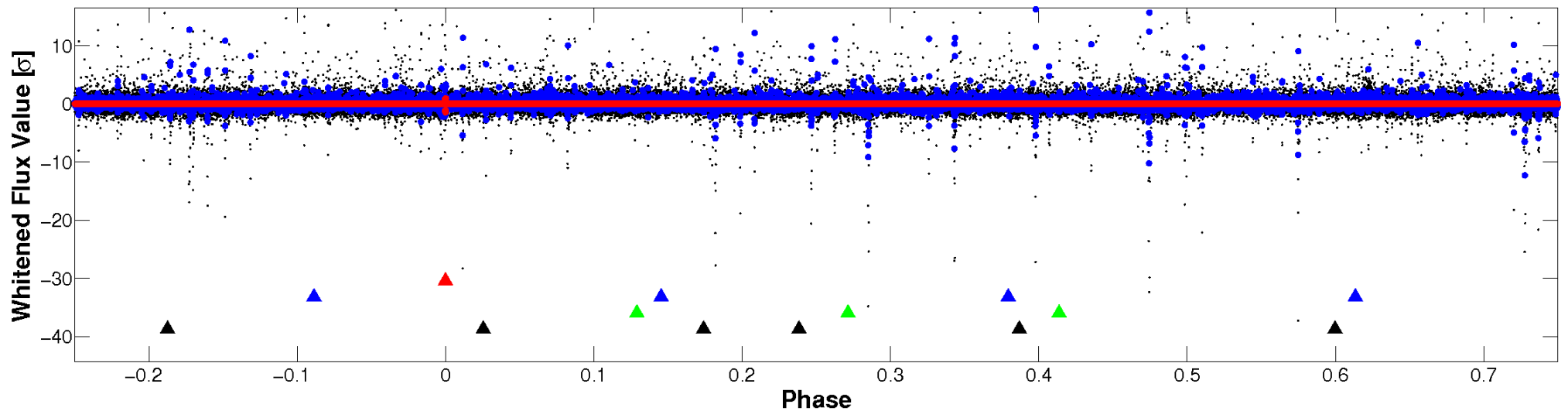


# Non-Whitened Vs. Whitened Light Curve

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

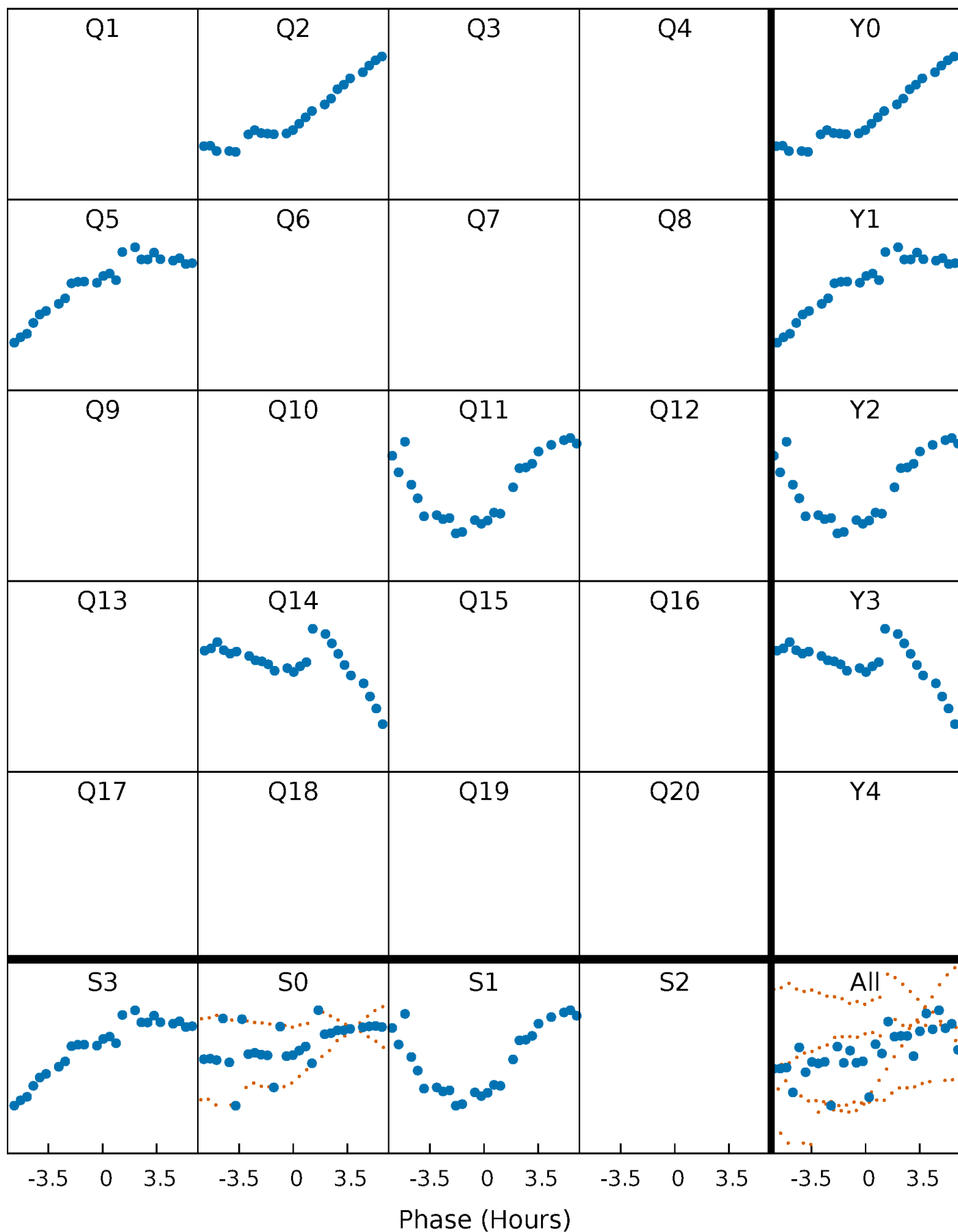


Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

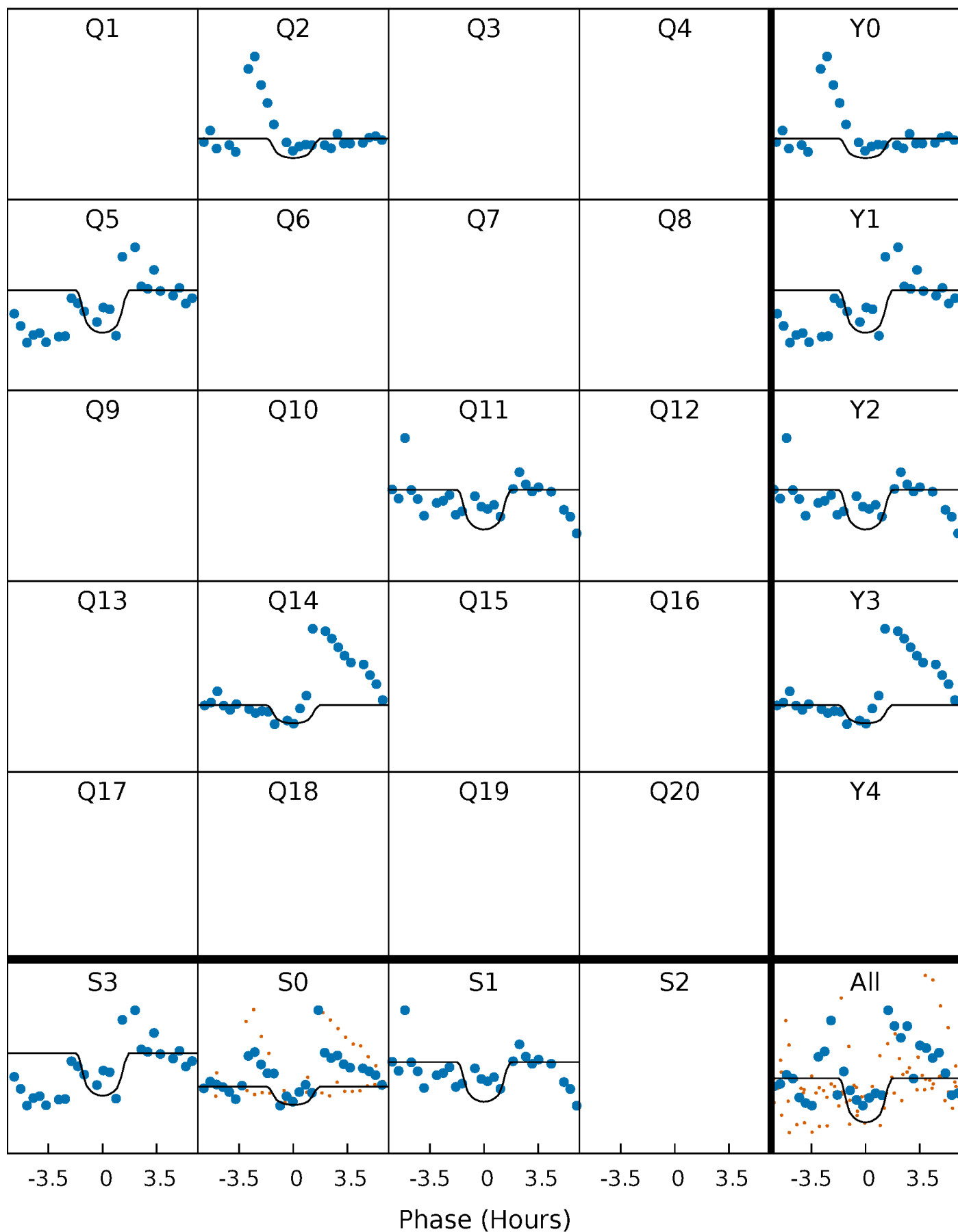
TCE 004819423-01 P=282.284484 Days  $T_0=197.192543$  (BKJD)





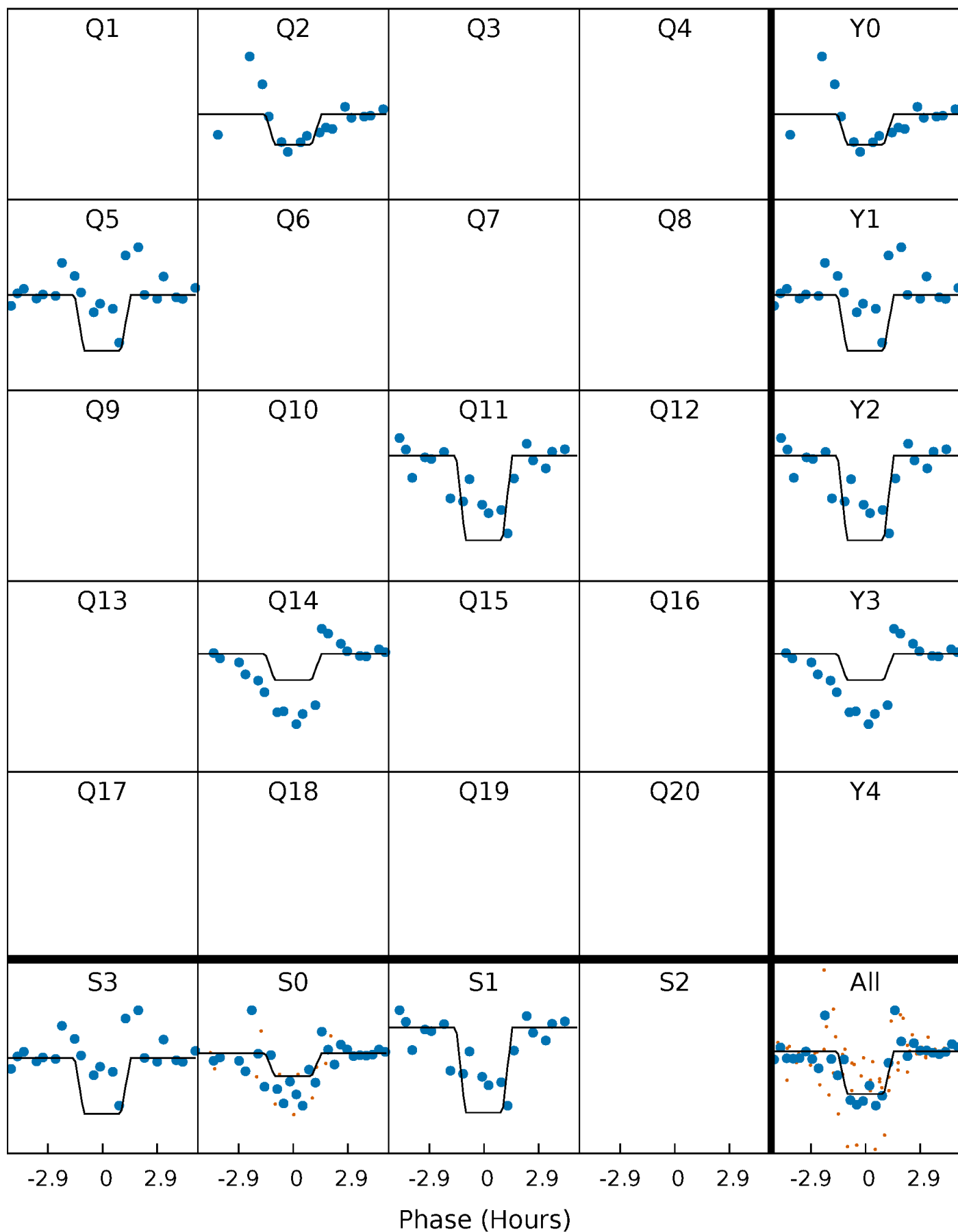
# DV Quarter-Phased Transit Curves

TCE 004819423-01 P=282.284484 Days  $T_0=197.192543$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

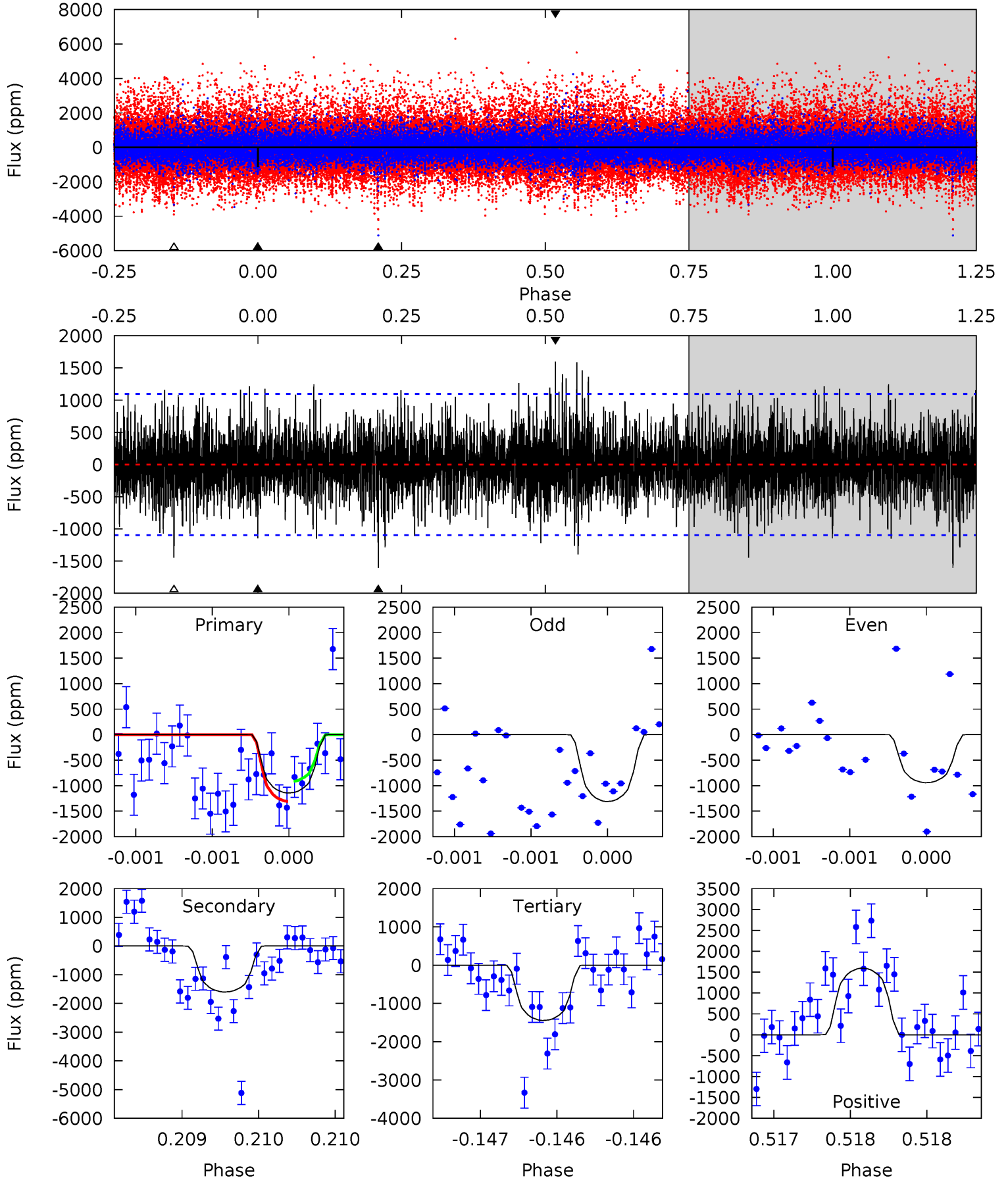
TCE 004819423-01 P=282.282334 Days  $T_0=197.197948$  (BKJD)



# DV Model-Shift Uniqueness Test

004819423-01, P = 282.284484 Days, E = 197.192543 Days

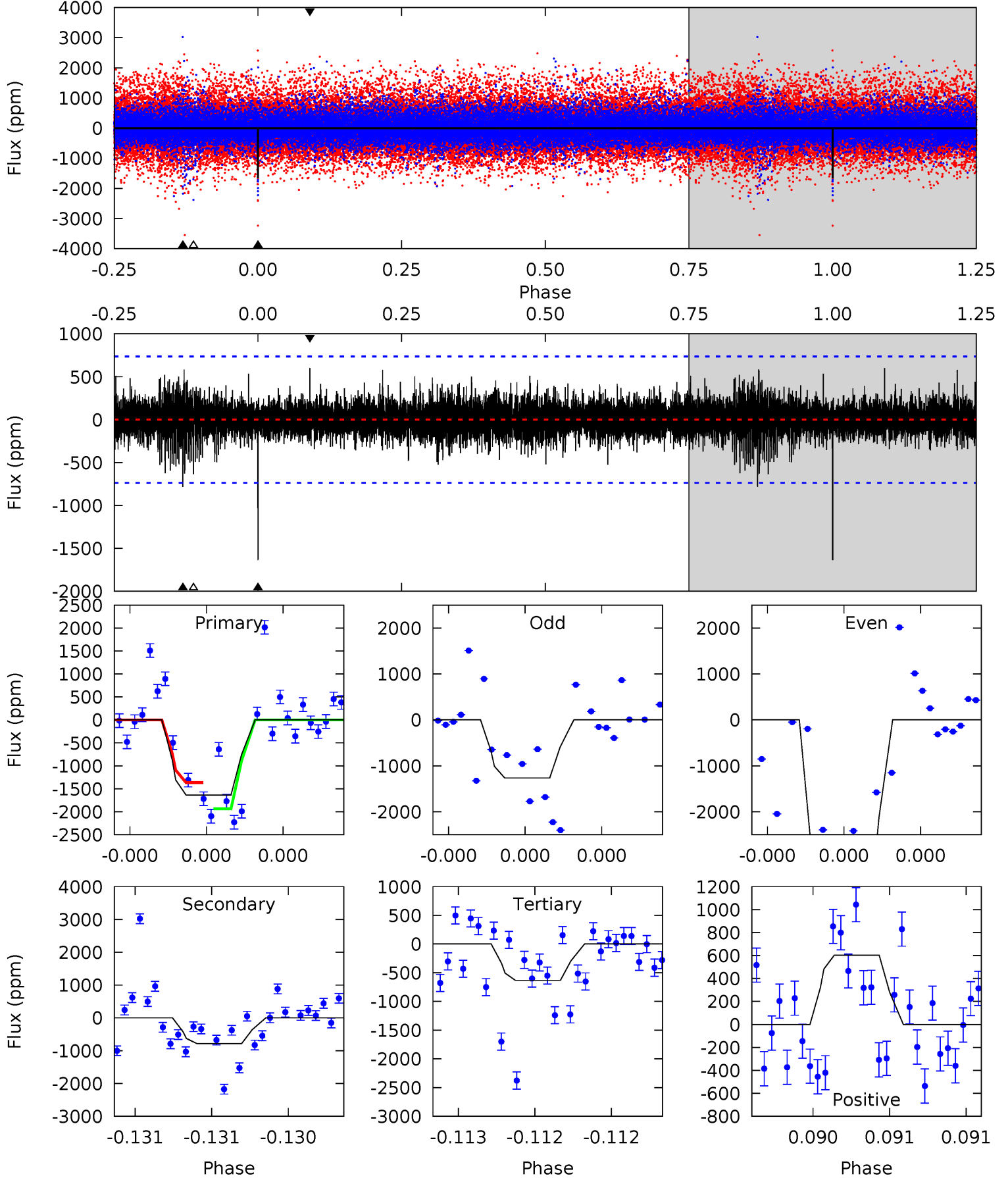
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
5.80	8.12	7.33	8.09	5.56	3.47	1.84	-1.53	-2.29	0.79	0.03	0.91	1.03	0.50	1.00



# Alt Model-Shift Uniqueness Test

004819423-01, P = 282.282334 Days, E = 197.197948 Days

Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
12.5	5.97	4.83	4.59	5.61	3.54	1.00	7.64	7.88	1.14	1.38	13.9	1.34	0.27	2.19





### Stellar Parameters For KIC 004819423

	$T_{\text{eff}}(K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$4562^{+150}_{-150}$	$4.552^{+0.064}_{-0.020}$	$0.340^{+0.100}_{-0.300}$	$0.759^{+0.026}_{-0.067}$	$0.749^{+0.043}_{-0.048}$	$2.410^{+0.657}_{-0.199}$
	+3%/-3%	+1%/-0%	+29%/-88%	+3%/-9%	+6%/-6%	+27%/-8%
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 004819423-01 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-1602 \pm 197$	$4.34^{+2.56}_{-2.29}$	$278^{+10}_{-11}$	$4113^{+1528}_{-592}$	$28331^{+100153}_{-17408}$
Alt.	$-783 \pm 131$	$4.51^{+2.44}_{-2.46}$	$278^{+10}_{-11}$	$3590^{+1168}_{-477}$	$12591^{+46121}_{-7427}$

$T_{max}$  = 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

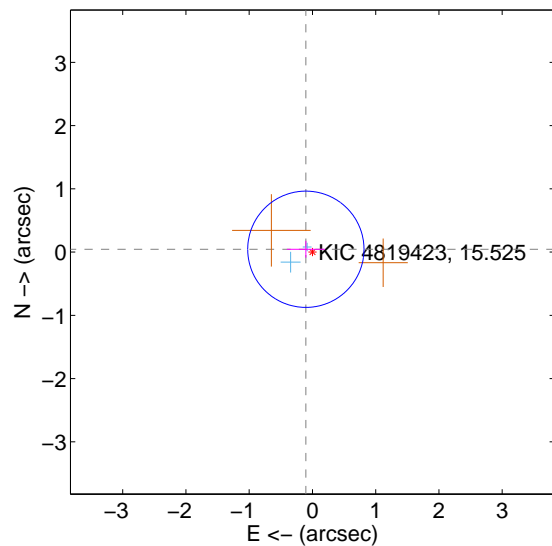
Supplemental centroid analysis for 004819423-01. Kepler magnitude: 15.53. Transit SNR 6.47

There are 2 quarters with good PRF difference image offsets

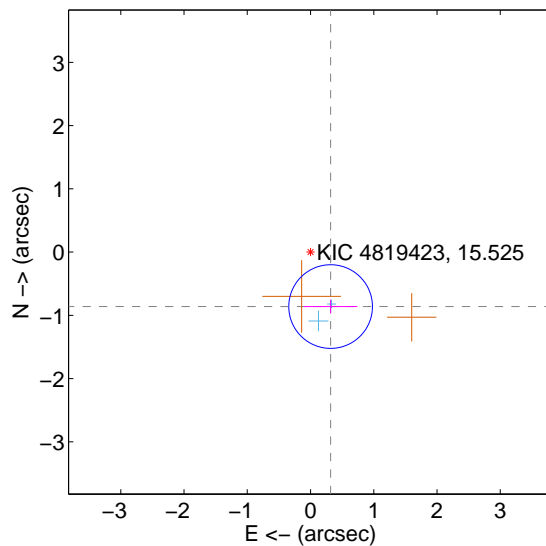
The direct PRF centroid is offset from the target star catalog position by about 1.16 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.113 \pm 0.307$	0.37	$0.104 \pm 0.300$	$0.045 \pm 0.133$
PRF-fit source offset from KIC position	<b><math>0.918 \pm 0.221</math></b>	<b>4.16</b>	$-0.318 \pm 0.423$	$-0.861 \pm 0.110$
photometric centroid source offset	$0.82 \pm 0.79$	1.03	$-0.69 \pm 0.80$	$-0.43 \pm 0.77$

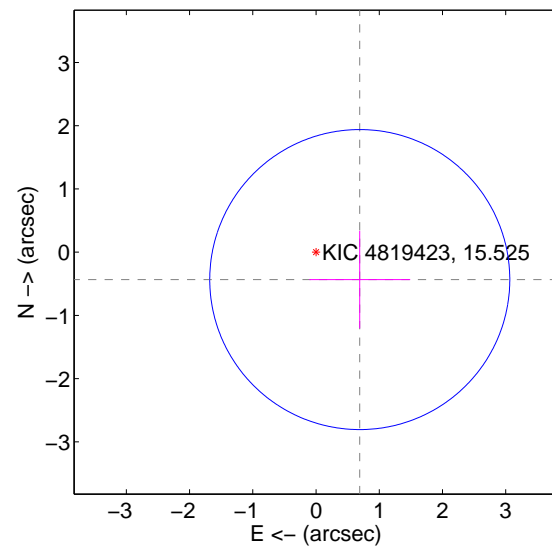
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position



offset from photometric centroids



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

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

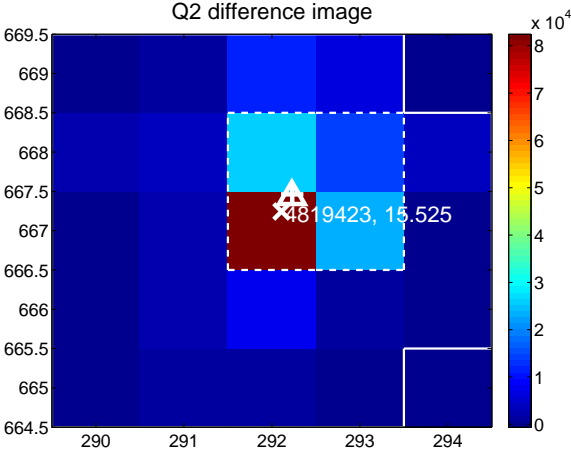
Q1 no difference image



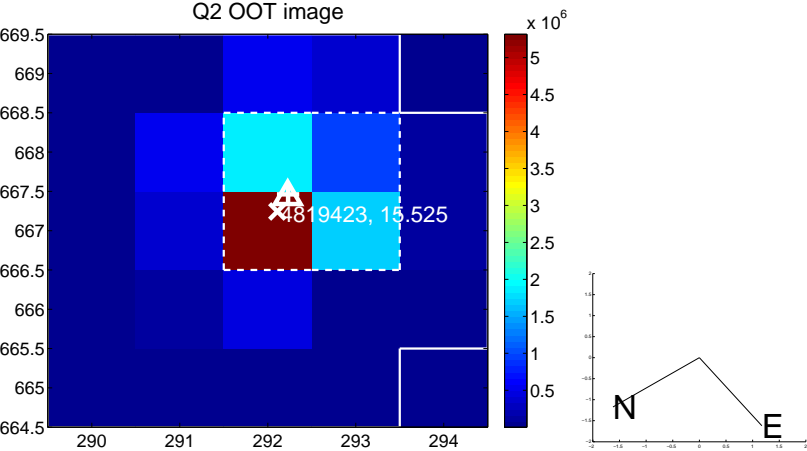
Q1 no OOT image



Q2 difference image



Q2 OOT image



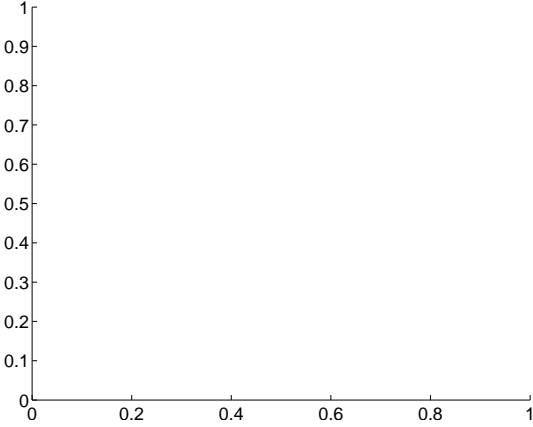
Q3 no difference image



Q3 no OOT image



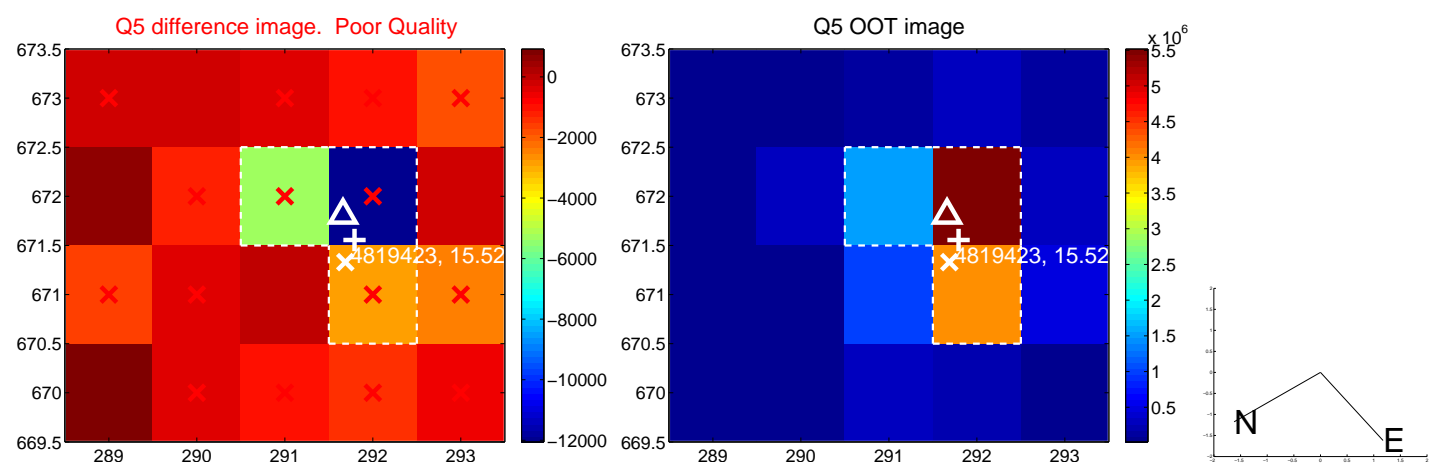
Q4 no difference image



Q4 no OOT image



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





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

Q9 no difference image



Q9 no OOT image



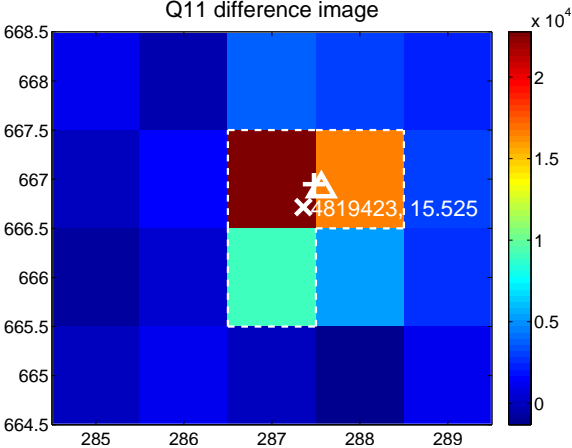
Q10 no difference image



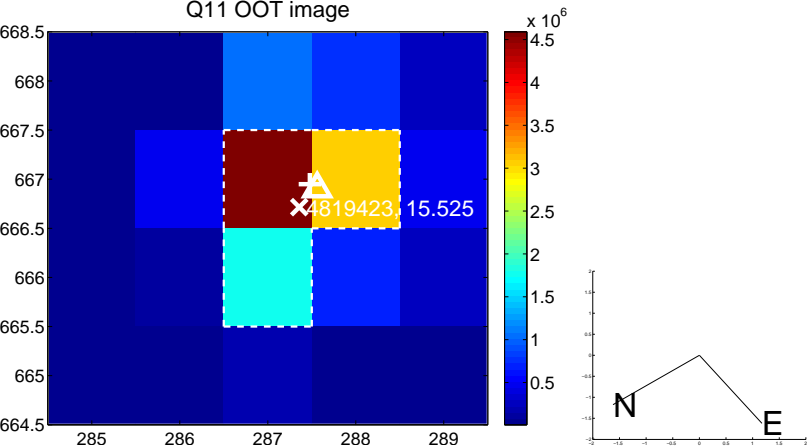
Q10 no OOT image



Q11 difference image



Q11 OOT image



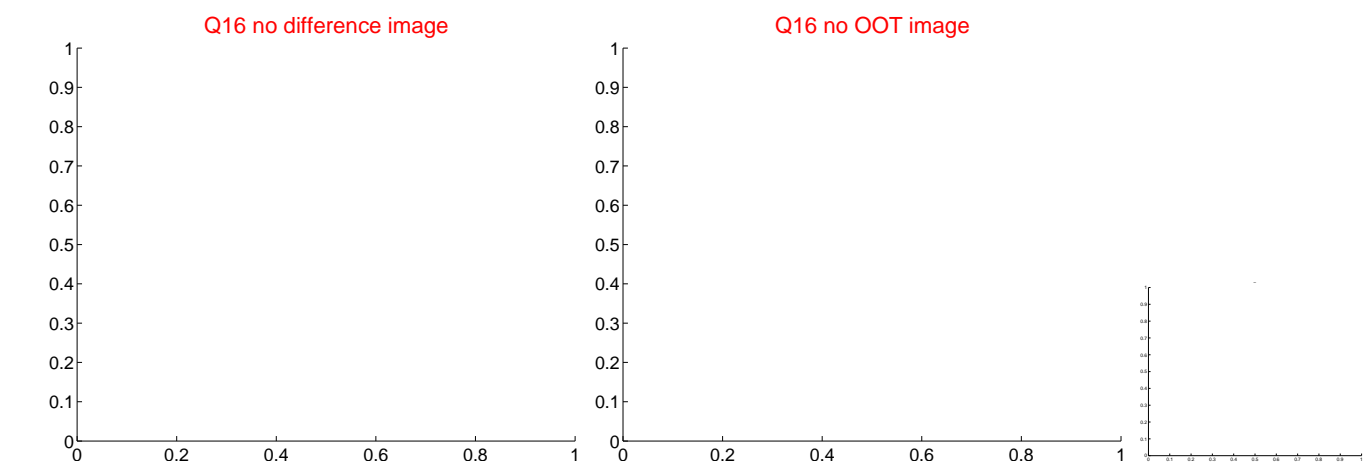
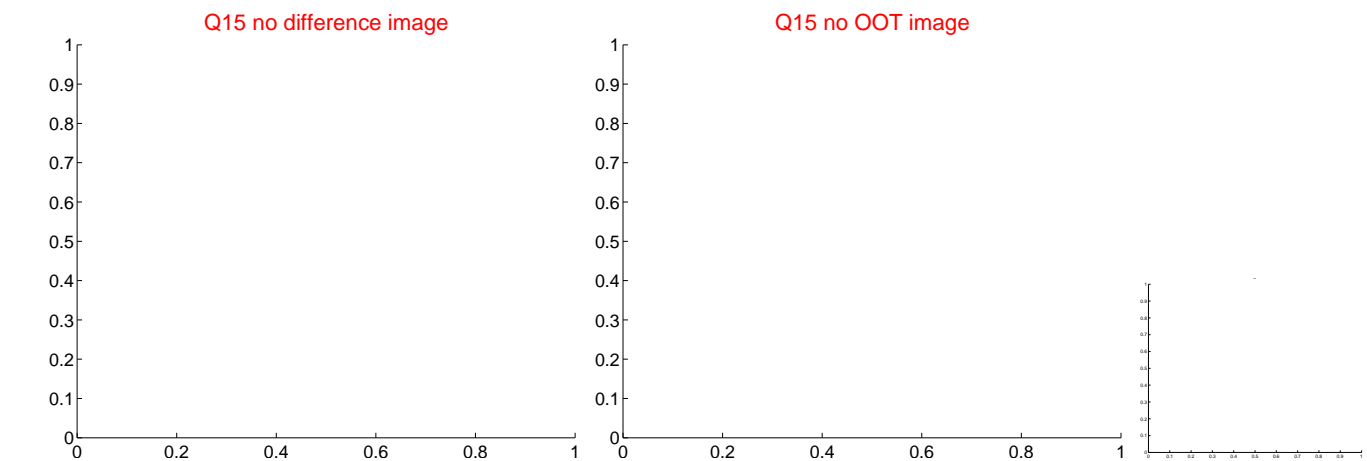
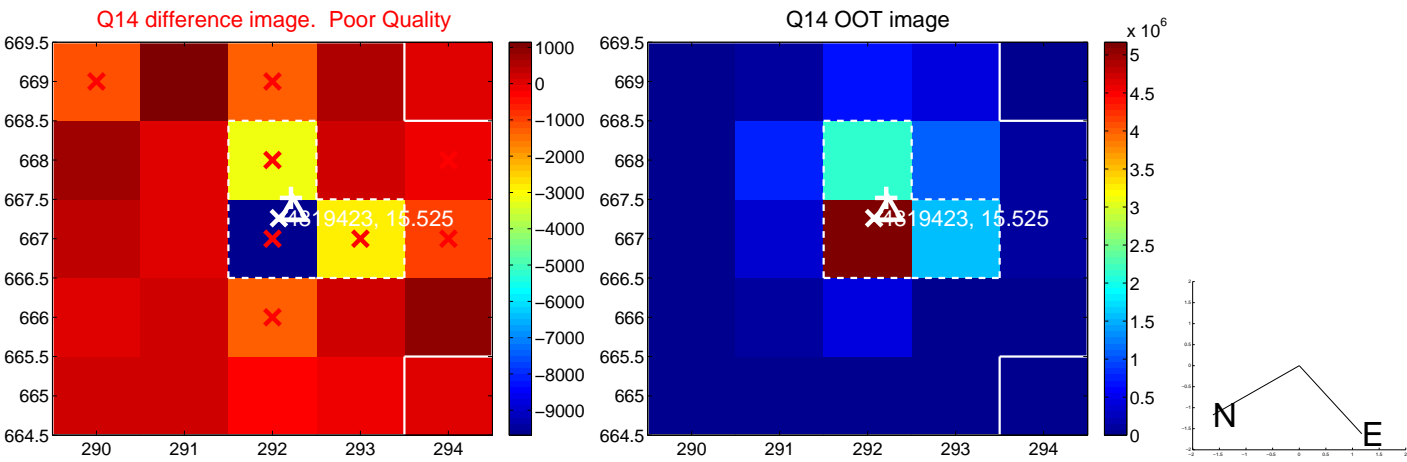
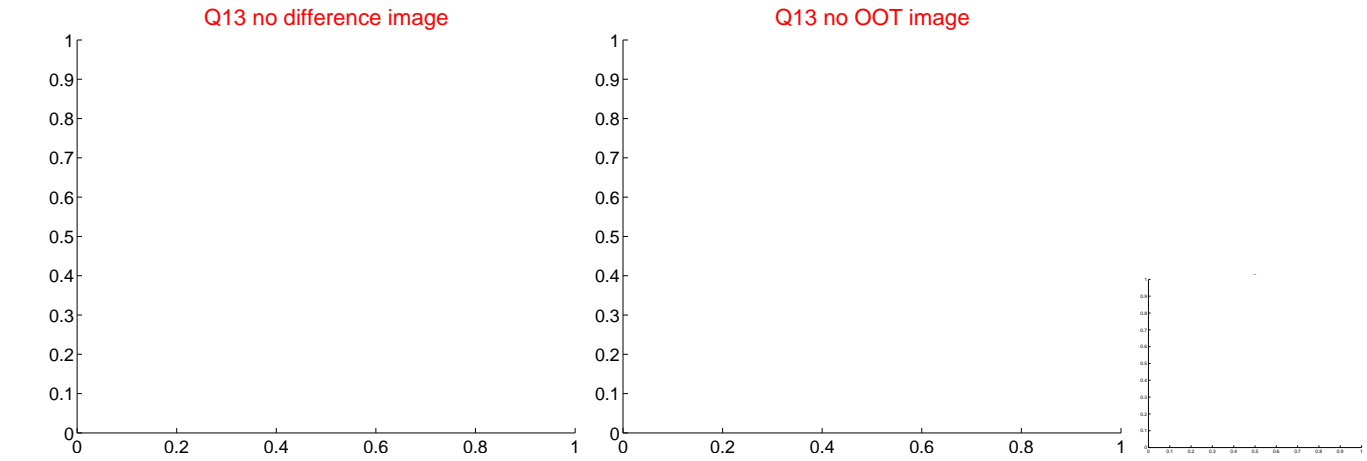
Q12 no difference image



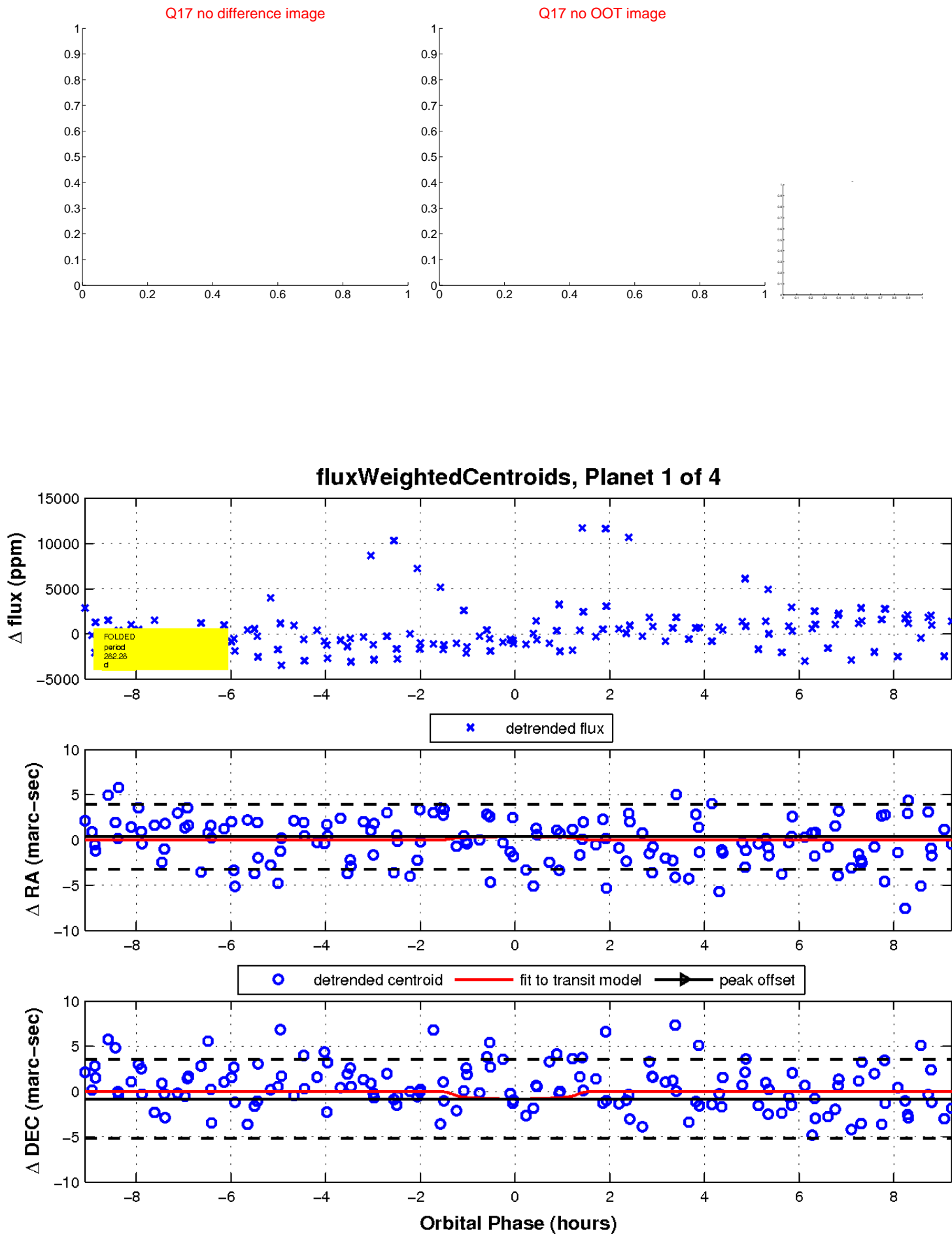
Q12 no OOT image



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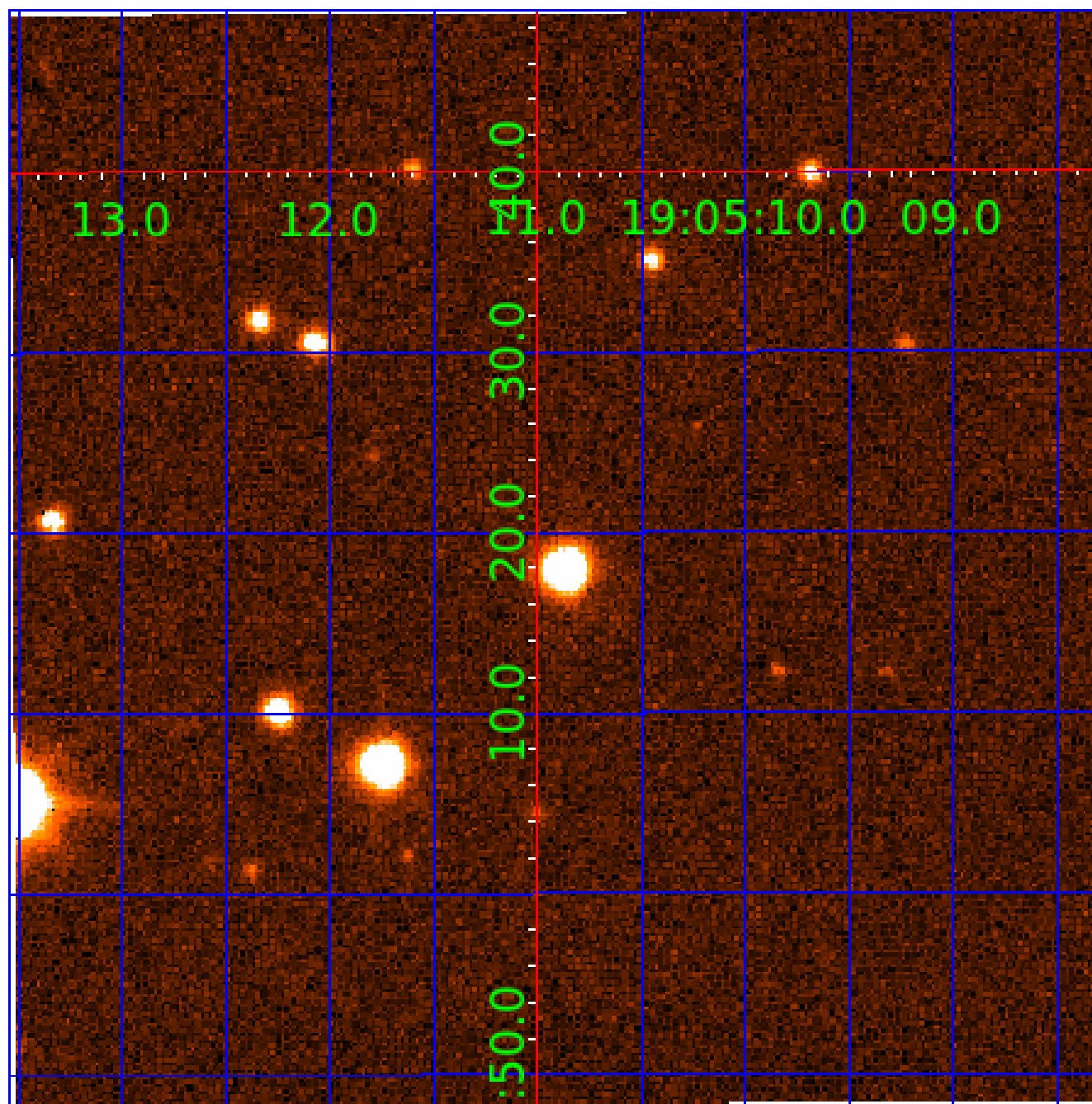


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UKIRT Image

Declination





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## Q1-17 DR25 TCE Parameters

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004819423-02	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_MARSHALL_SKYE—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS—HALO_GHOST
004819423-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_SKYE—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS
004819423-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL—LPP_DV—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—CENT_KIC_POS

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

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

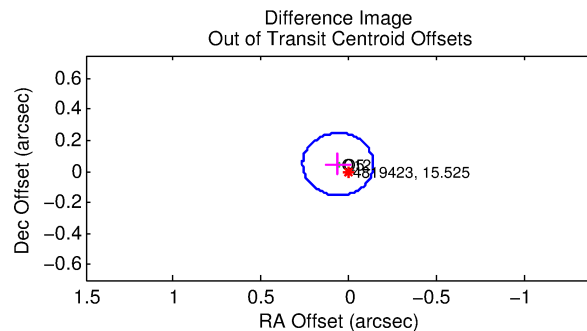
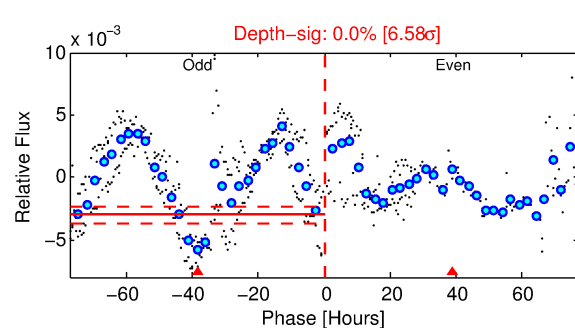
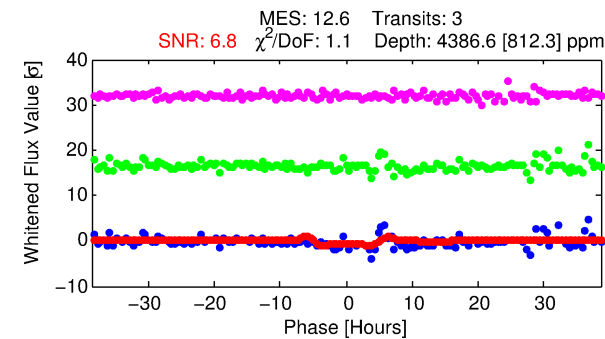
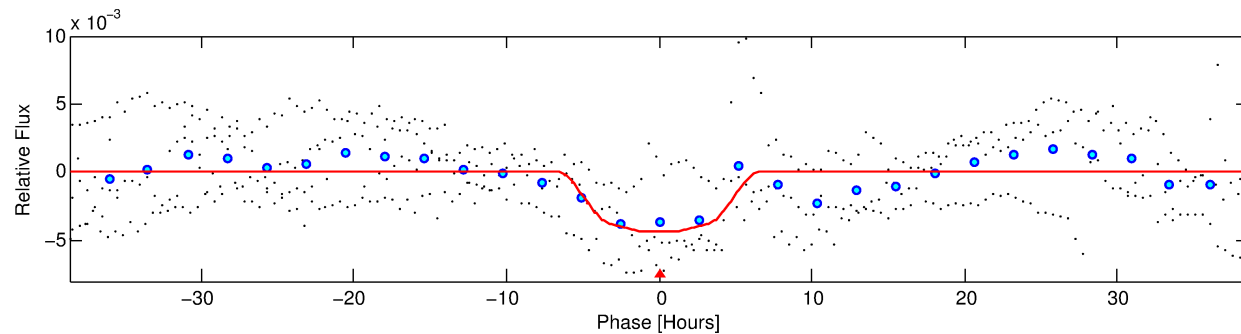
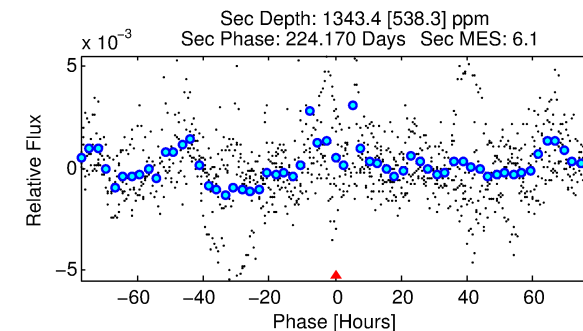
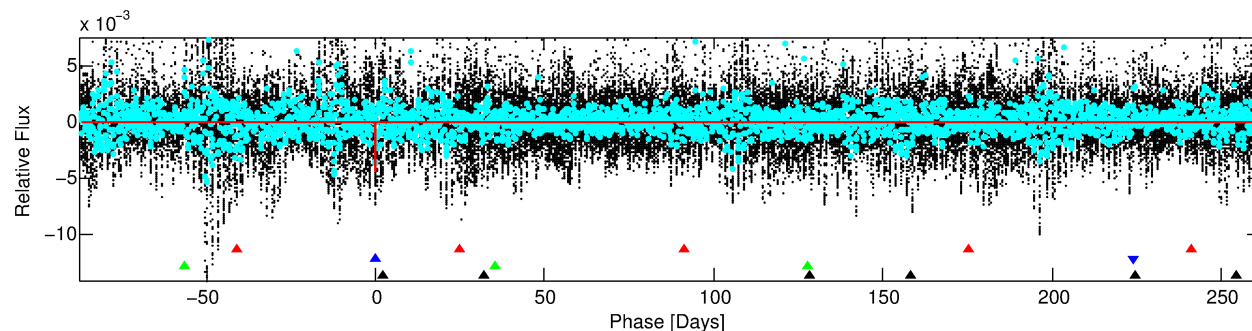
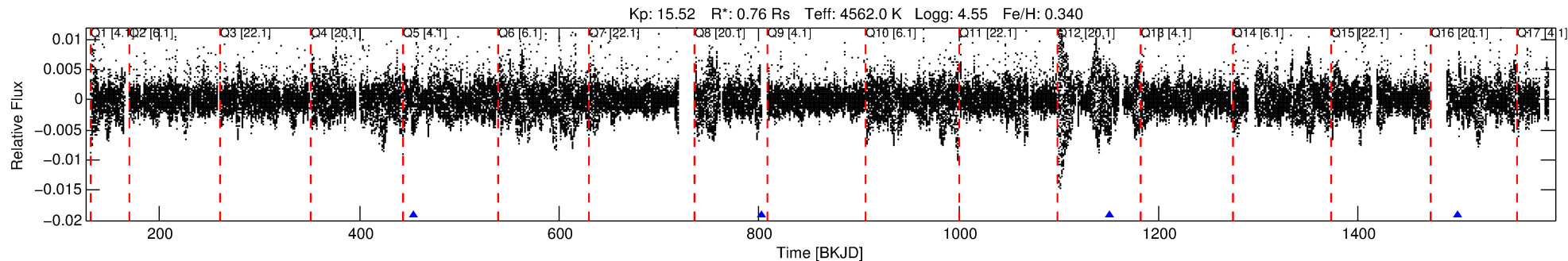
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 004819423-02

No Significant Match Found

# DV One-Page Summary

KIC: 4819423 Candidate: 2 of 4 Period: 348.350 d



## DV Fit Results:

Period = 348.35015 [0.00848] d  
Epoch = 454.4549 [0.0181] BKJD  
Rp/R\* = 0.0717 [0.0075]  
a/R\* = 133.40 [16.25]  
b = 0.86 [0.04]  
Seff = 0.29 [0.05]  
Teq = 187 [8] K  
Rp = 5.94 [0.81] Re  
a = 0.8801 [0.0675] AU  
Ag = 16211.52 [7556.78] [2.15σ]  
Teffp = 3261 [384] K [8.01σ]

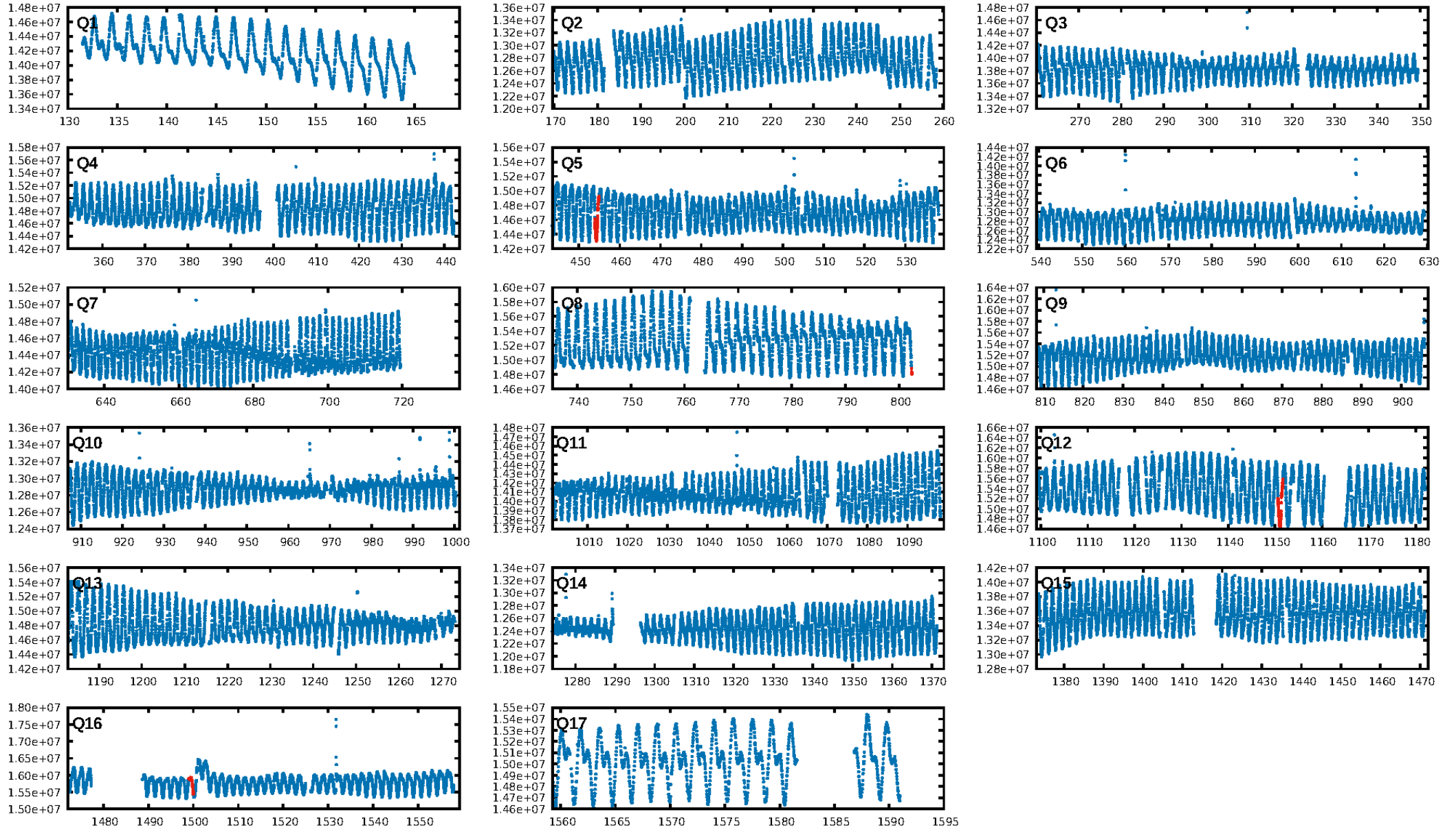
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [119.72σ]  
LongPeriod-sig: 100.0% [446.79σ]  
ModelChiSquare2-sig: 25.2%  
ModelChiSquareGof-sig: 96.7%  
Bootstrap-pfa: 1.38e-10  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: -0.0214  
Centroid-sig: 33.1%  
Centroid-so: 0.769 arcsec [3.48σ]  
OotOffset-rm: 0.078 arcsec [1.17σ]  
KicOffset-rm: 0.948 arcsec [9.26σ]  
OotOffset-st: 0/0/1/1 [2]  
KicOffset-st: 0/0/1/1 [2]  
DiffImageQuality-fgm: 1.00 [2/2]  
DiffImageOverlap-fno: 1.00 [2/2]

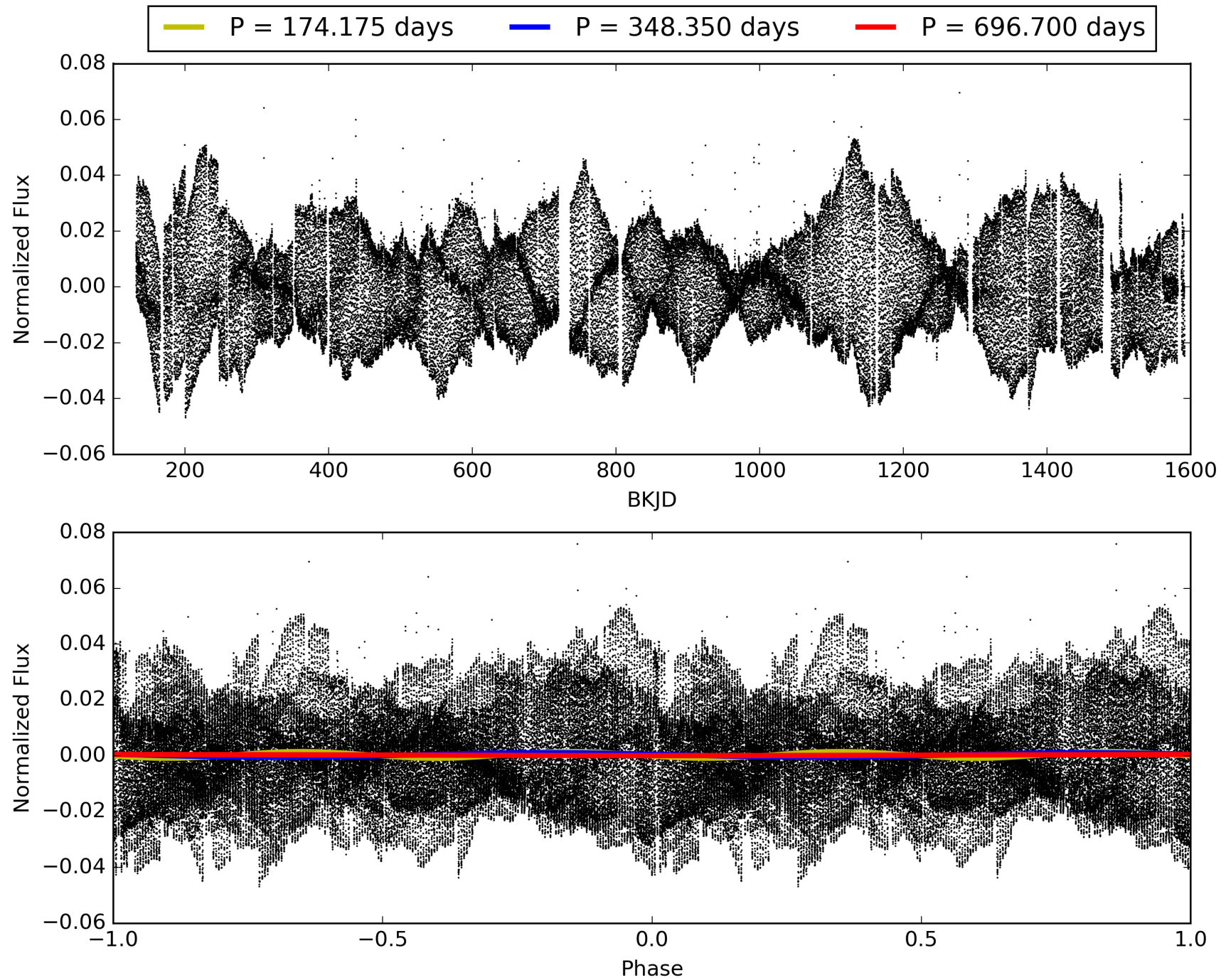
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 23:02:38 Z

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

# TCE 004819423-02, PDC Light Curves

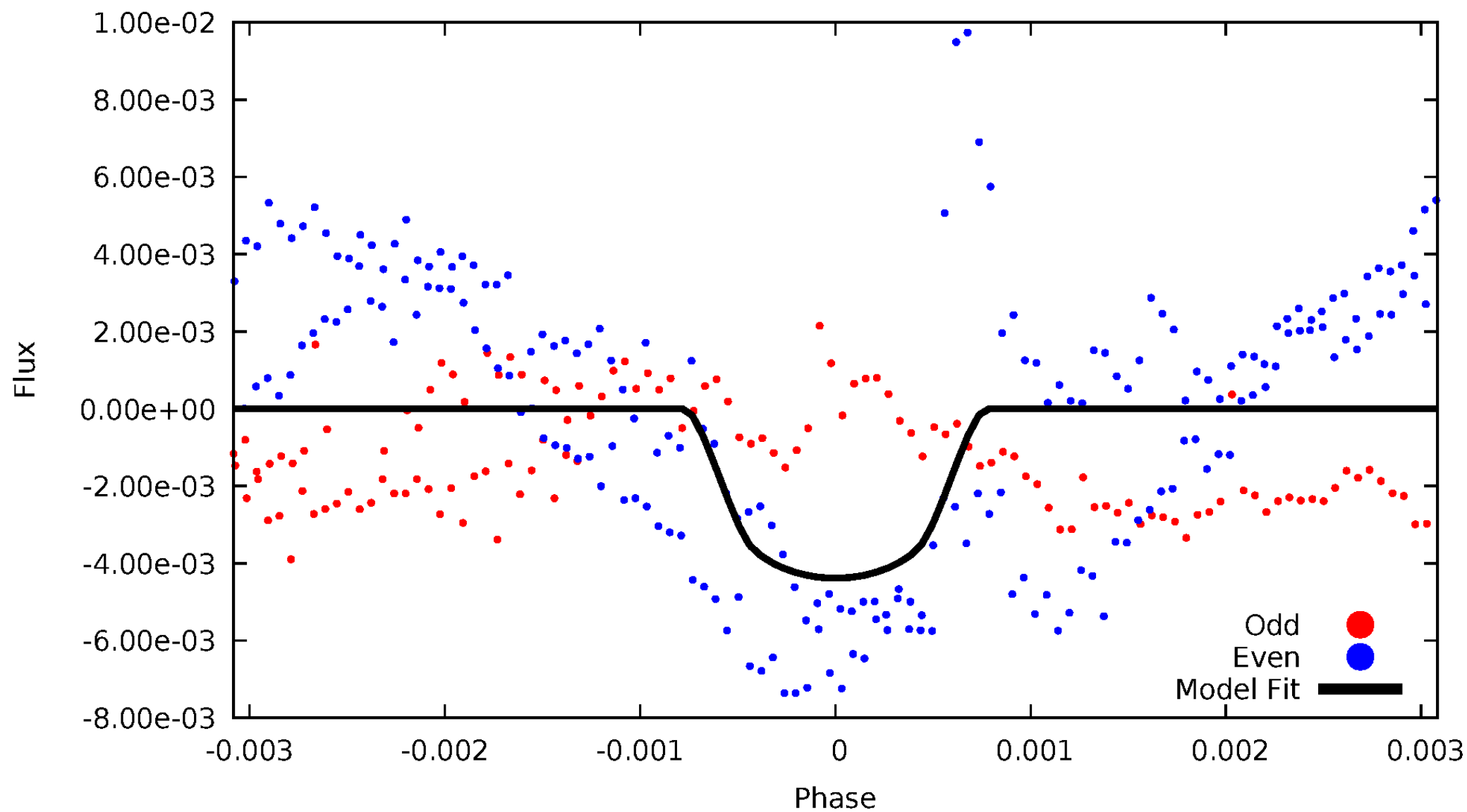


TCE 004819423-02



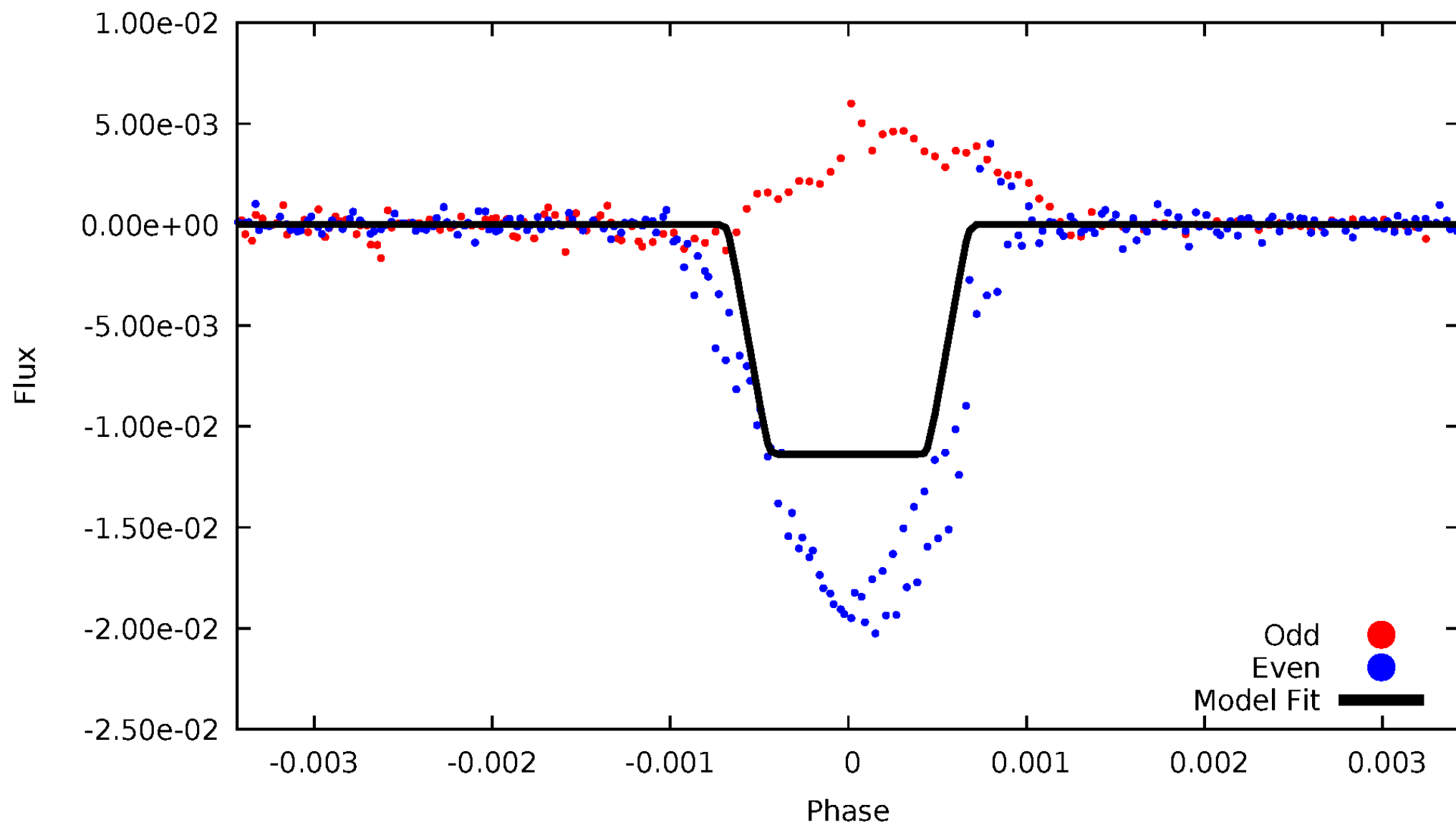
# DV Odd/Even

TCE 004819423-02



# ALT Odd/Even

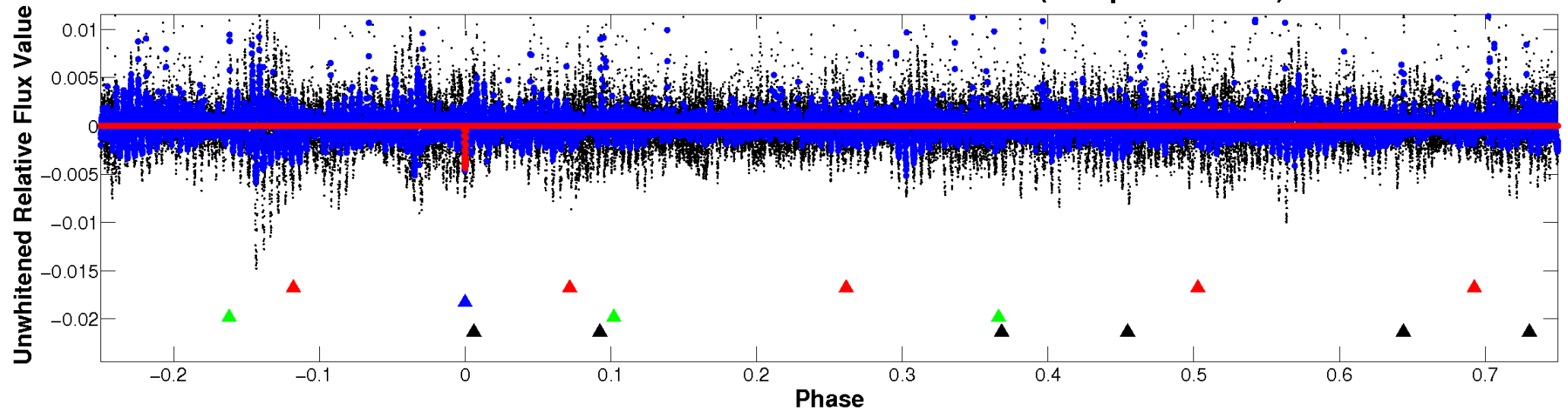
TCE 004819423-02



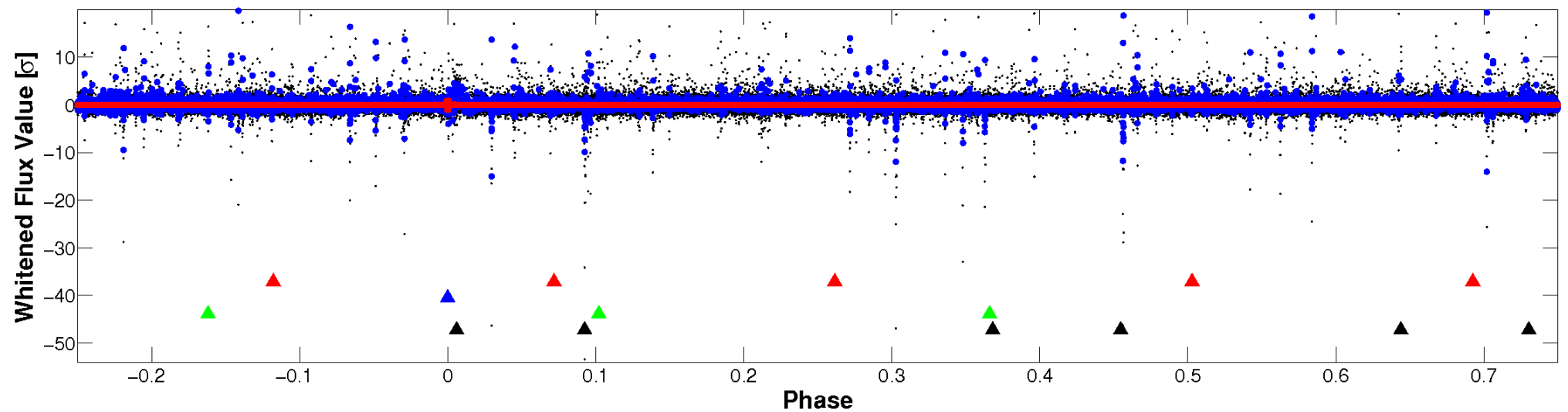


# Non-Whitened Vs. Whitened Light Curve

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



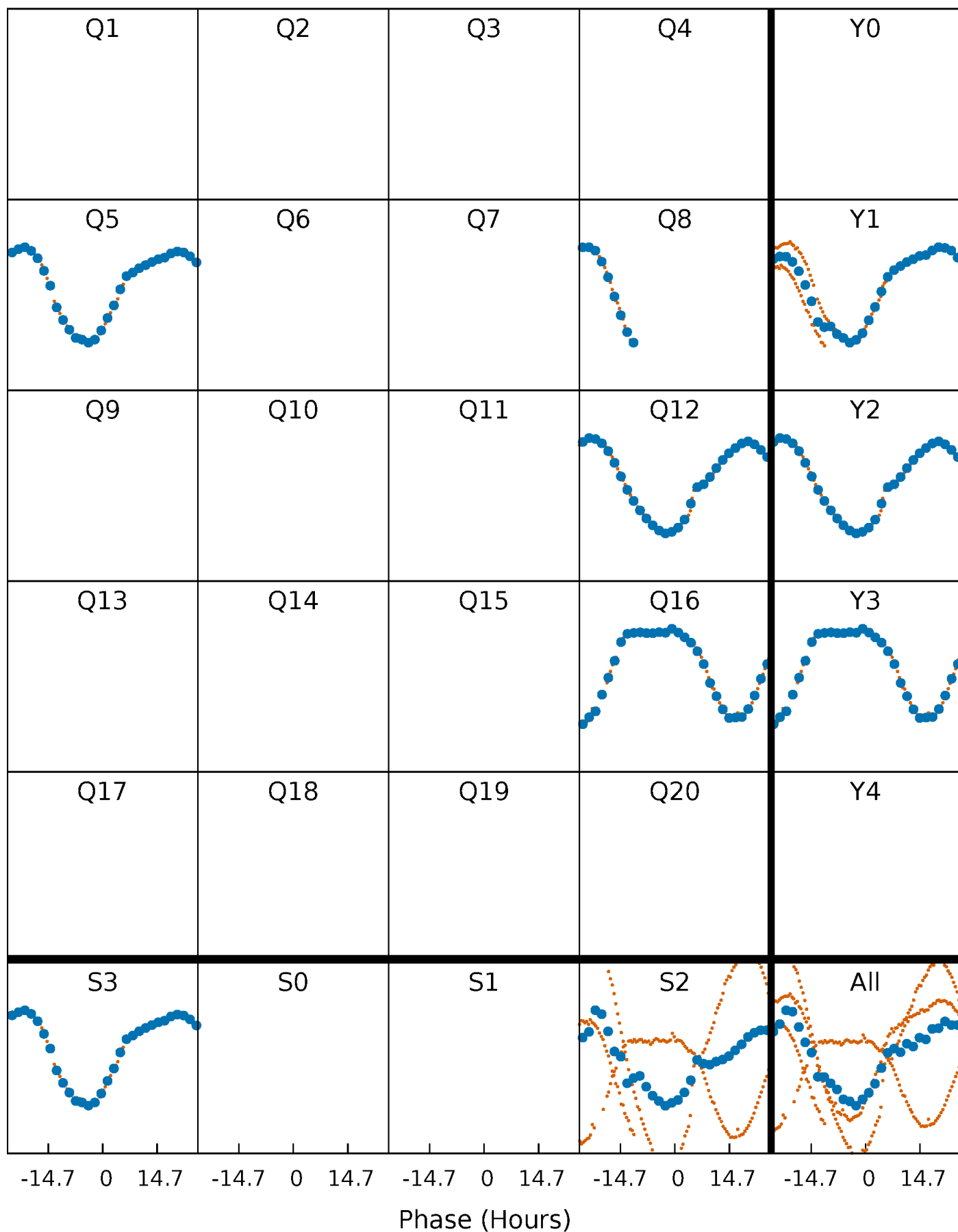
Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)





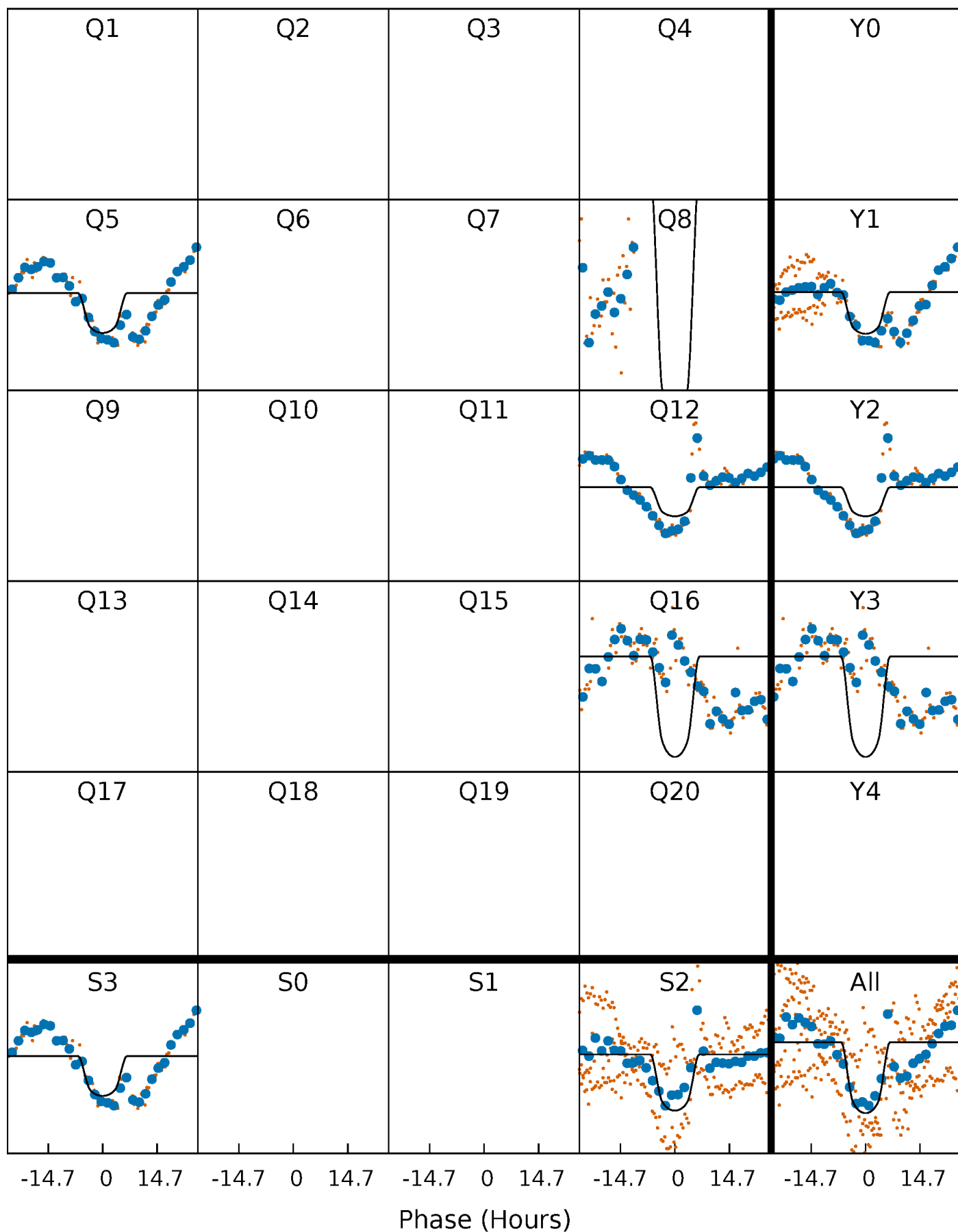
# PDC Quarter-Phased Transit Curves

TCE 004819423-02 P=348.350152 Days  $T_0=454.454916$  (BKJD)



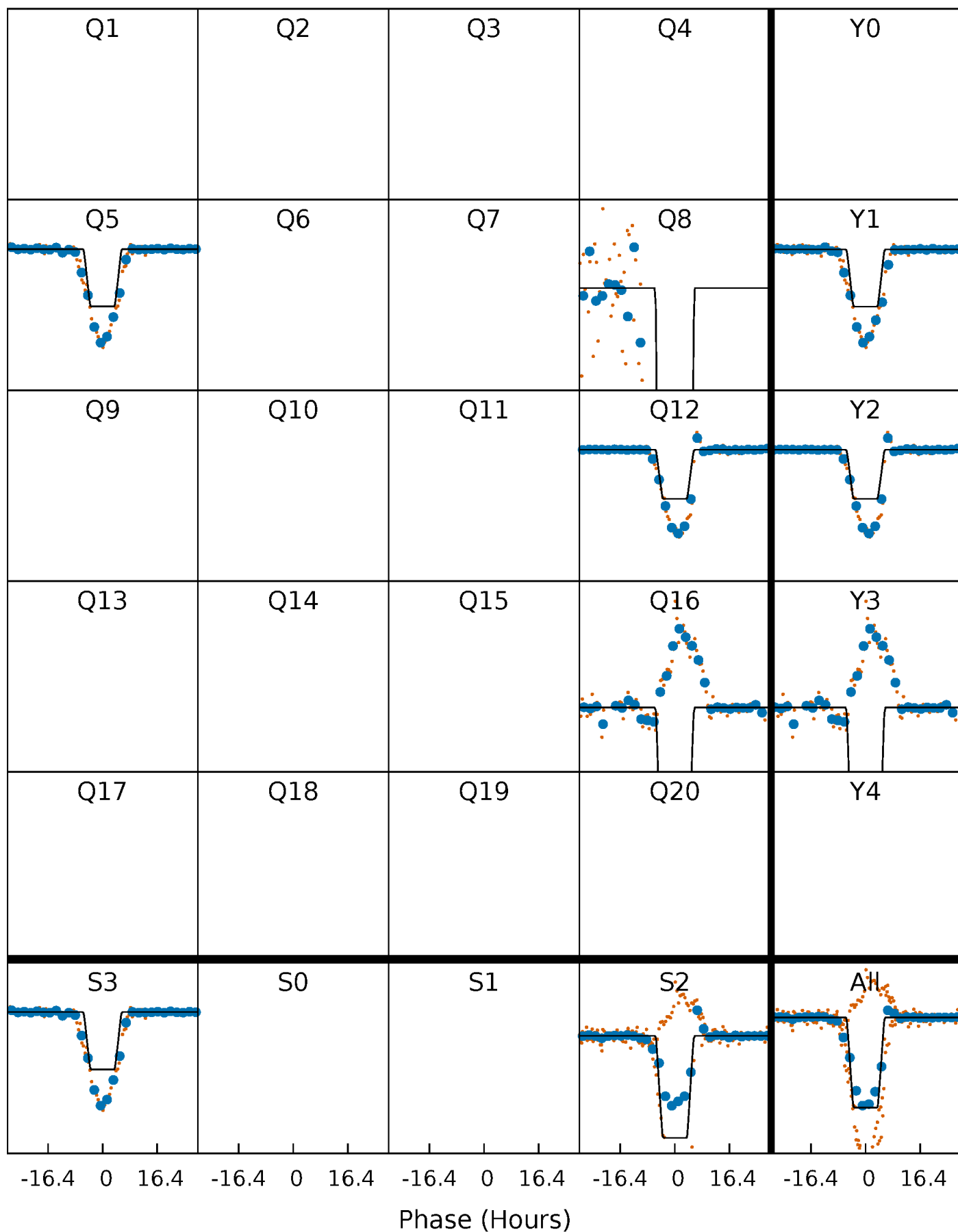
# DV Quarter-Phased Transit Curves

TCE 004819423-02     $P=348.350152$  Days     $T_0=454.454916$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

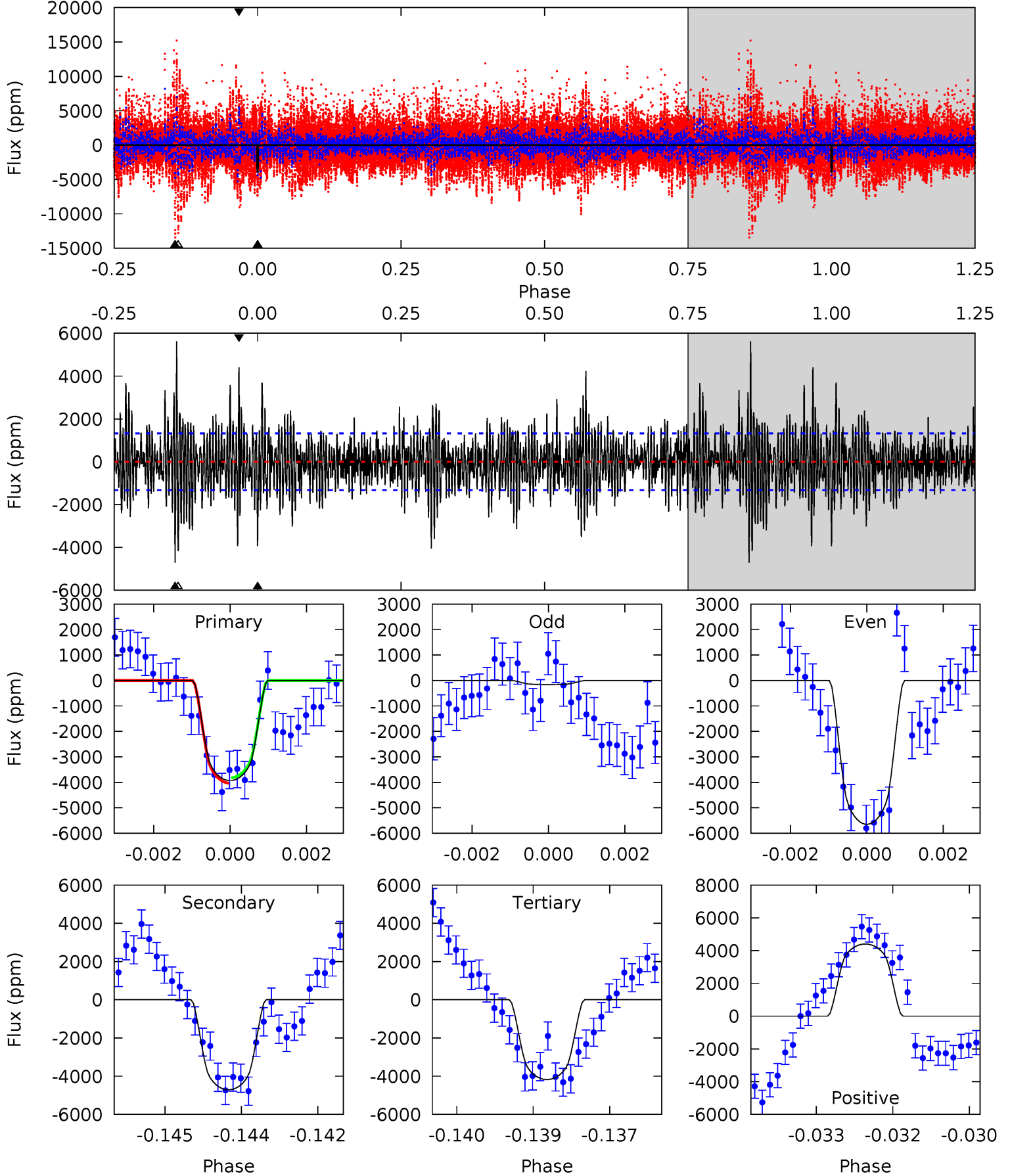
TCE 004819423-02 P=348.358142 Days  $T_0=454.396889$  (BKJD)



# DV Model-Shift Uniqueness Test

004819423-02, P = 348.350152 Days, E = 106.104764 Days

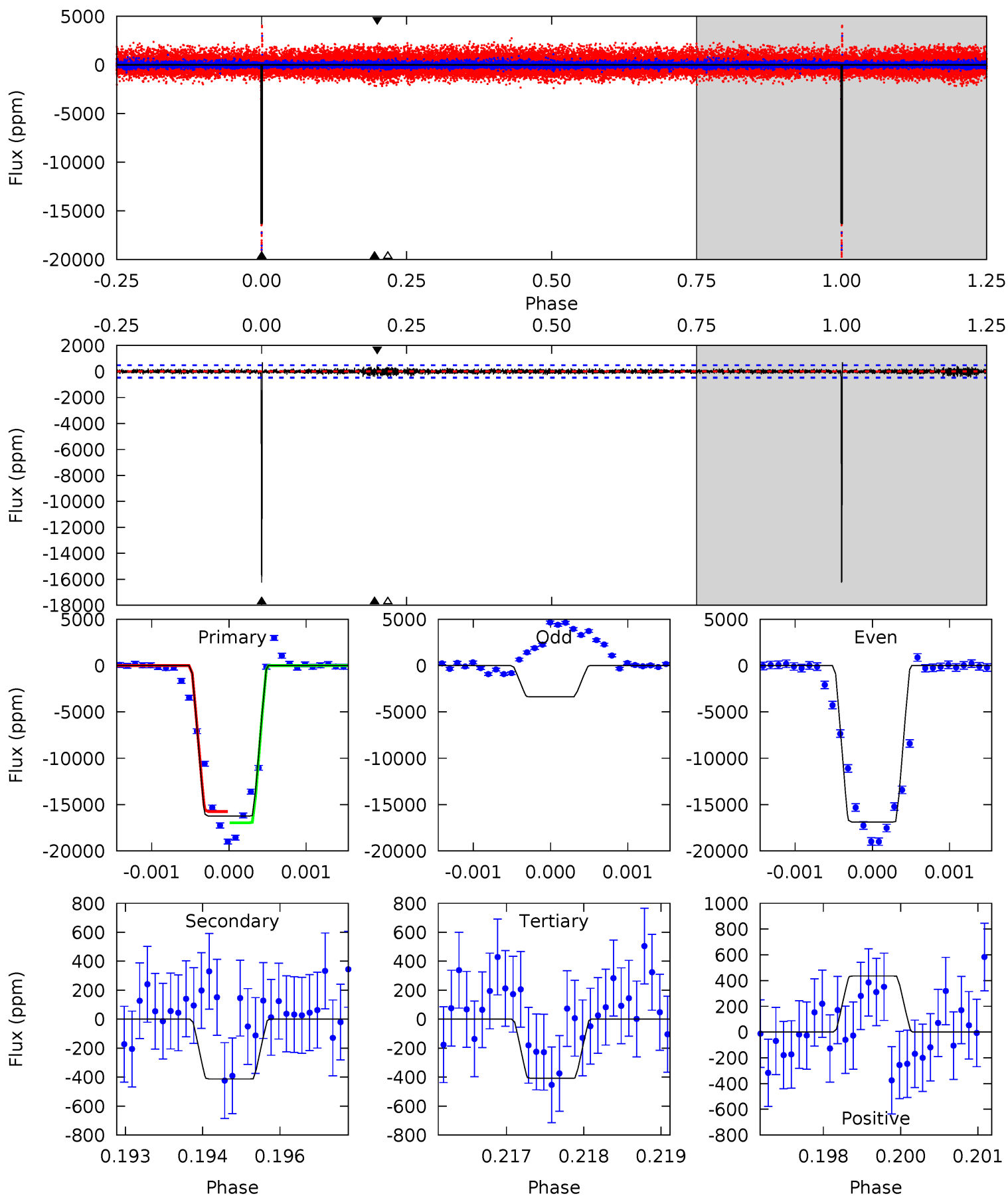
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
16.0	19.1	16.9	17.9	5.37	3.16	4.34	-0.99	-1.92	2.18	1.25	10.4	0.75	0.54	0.43



# Alt Model-Shift Uniqueness Test

004819423-02, P = 348.358142 Days, E = 106.038747 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
183.1	4.65	4.60	4.91	5.39	3.19	0.85	178.5	178.2	0.05	-0.26	97.5	0.62	0.04	6.73



### Stellar Parameters For KIC 004819423

	$T_{\text{eff}}(K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$4562^{+150}_{-150}$	$4.552^{+0.064}_{-0.020}$	$0.340^{+0.100}_{-0.300}$	$0.759^{+0.026}_{-0.067}$	$0.749^{+0.043}_{-0.048}$	$2.410^{+0.657}_{-0.199}$
	+3%/-3%	+1%/-0%	+29%/-88%	+3%/-9%	+6%/-6%	+27%/-8%
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 004819423-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-4712 \pm 246$	$5.81^{+0.66}_{-0.62}$	$260^{+10}_{-9}$	$4516^{+262}_{-237}$	$60034^{+15351}_{-11738}$
Alt.	$-413 \pm 89$	$8.74^{+0.67}_{-0.73}$	$259^{+9}_{-9}$	$2701^{+111}_{-113}$	$2347^{+729}_{-562}$

$T_{\text{max}}$  = 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

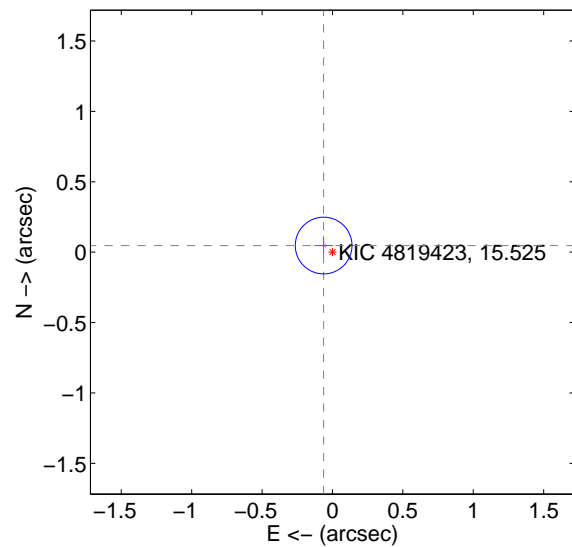
Supplemental centroid analysis for 004819423-02. Kepler magnitude: 15.53. Transit SNR 6.78

There are 2 quarters with good PRF difference image offsets

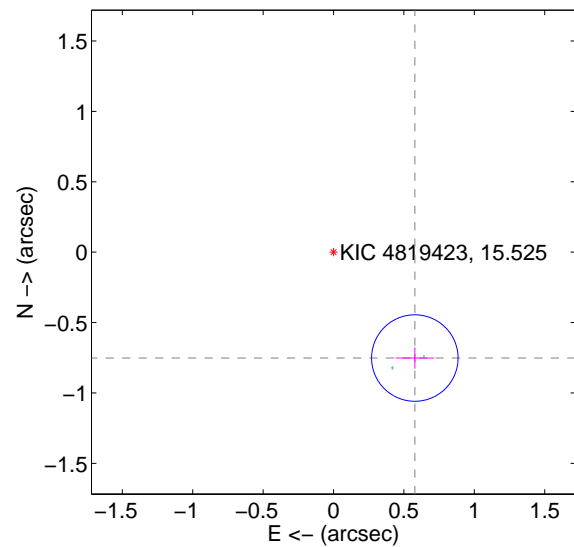
The direct PRF centroid is offset from the target star catalog position by about 1.06 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.078 \pm 0.067$	1.17	$0.063 \pm 0.067$	$0.047 \pm 0.067$
PRF-fit source offset from KIC position	$0.948 \pm 0.102$	9.26	$-0.578 \pm 0.136$	$-0.752 \pm 0.076$
photometric centroid source offset	$0.77 \pm 0.22$	3.48	$-0.44 \pm 0.22$	$-0.63 \pm 0.22$

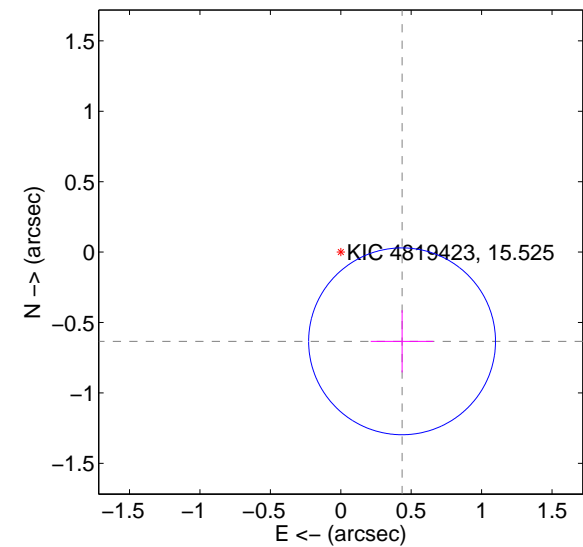
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position



offset from photometric centroids



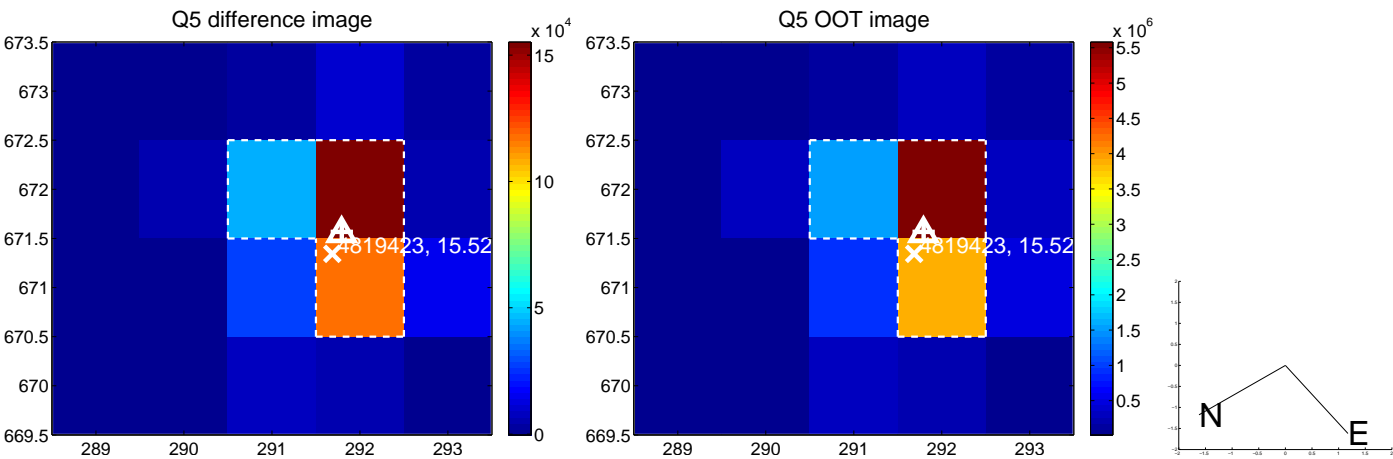
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

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

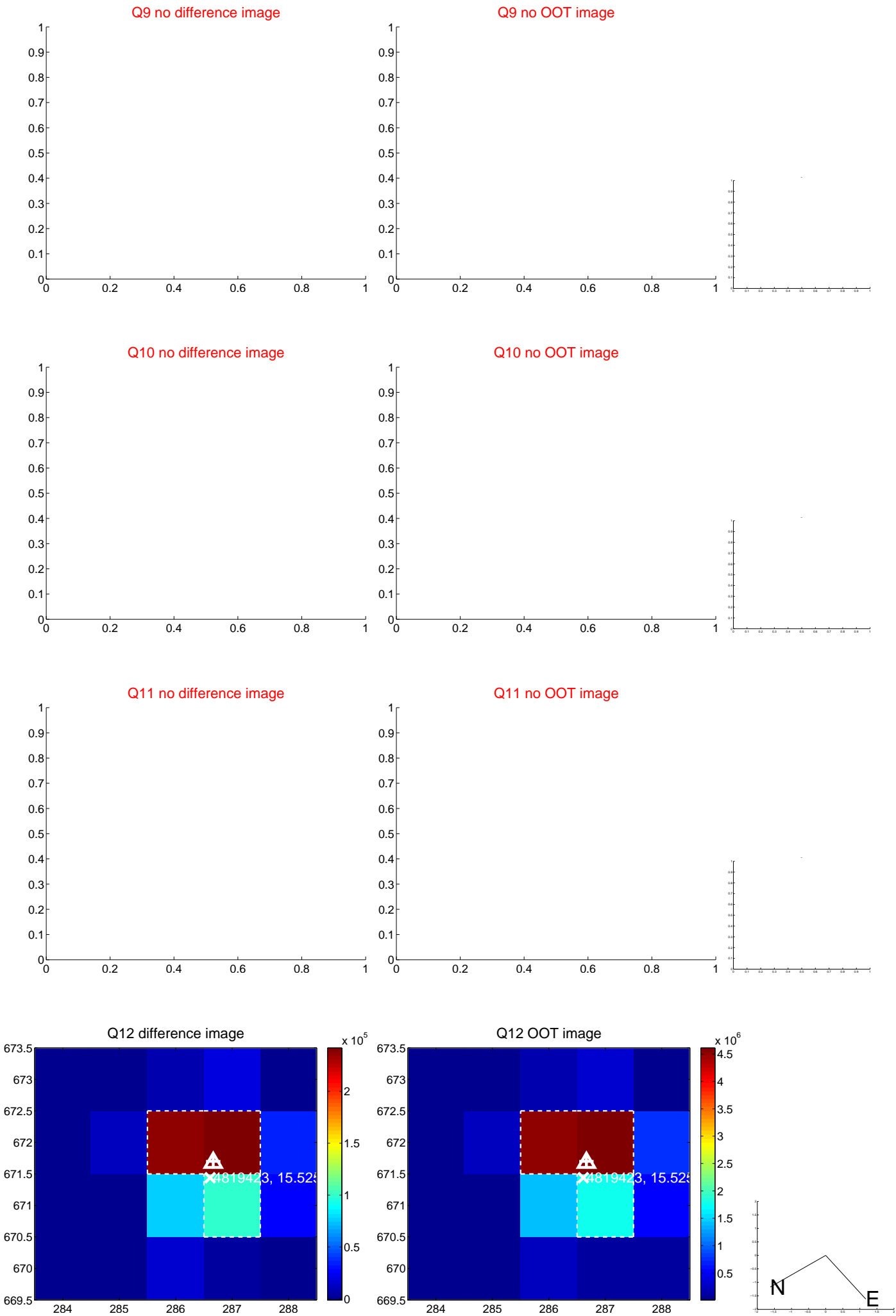




white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



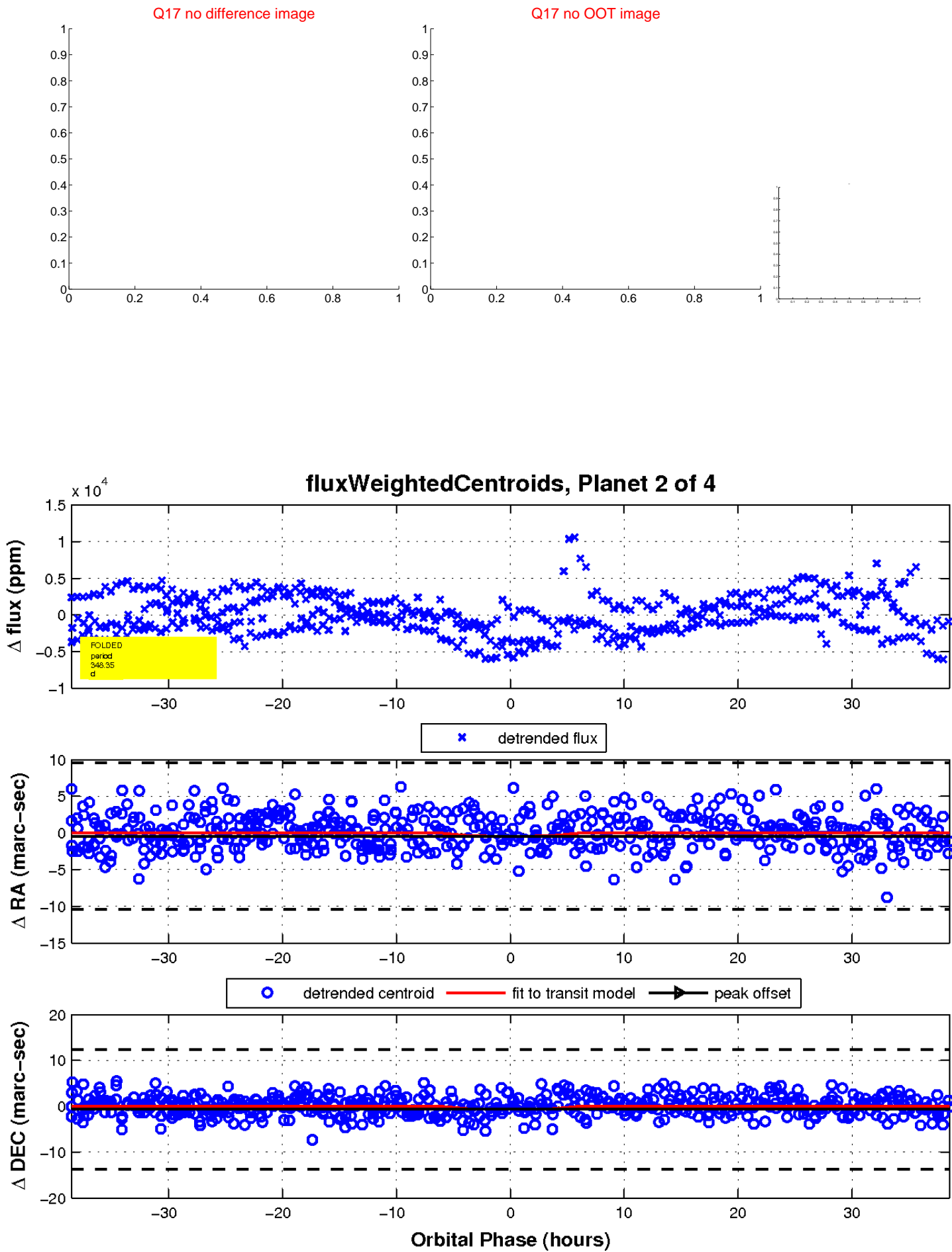
white ×: KIC target position; +: OOT centroid; △: difference centroid. red ✕: large negative pixel value.



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

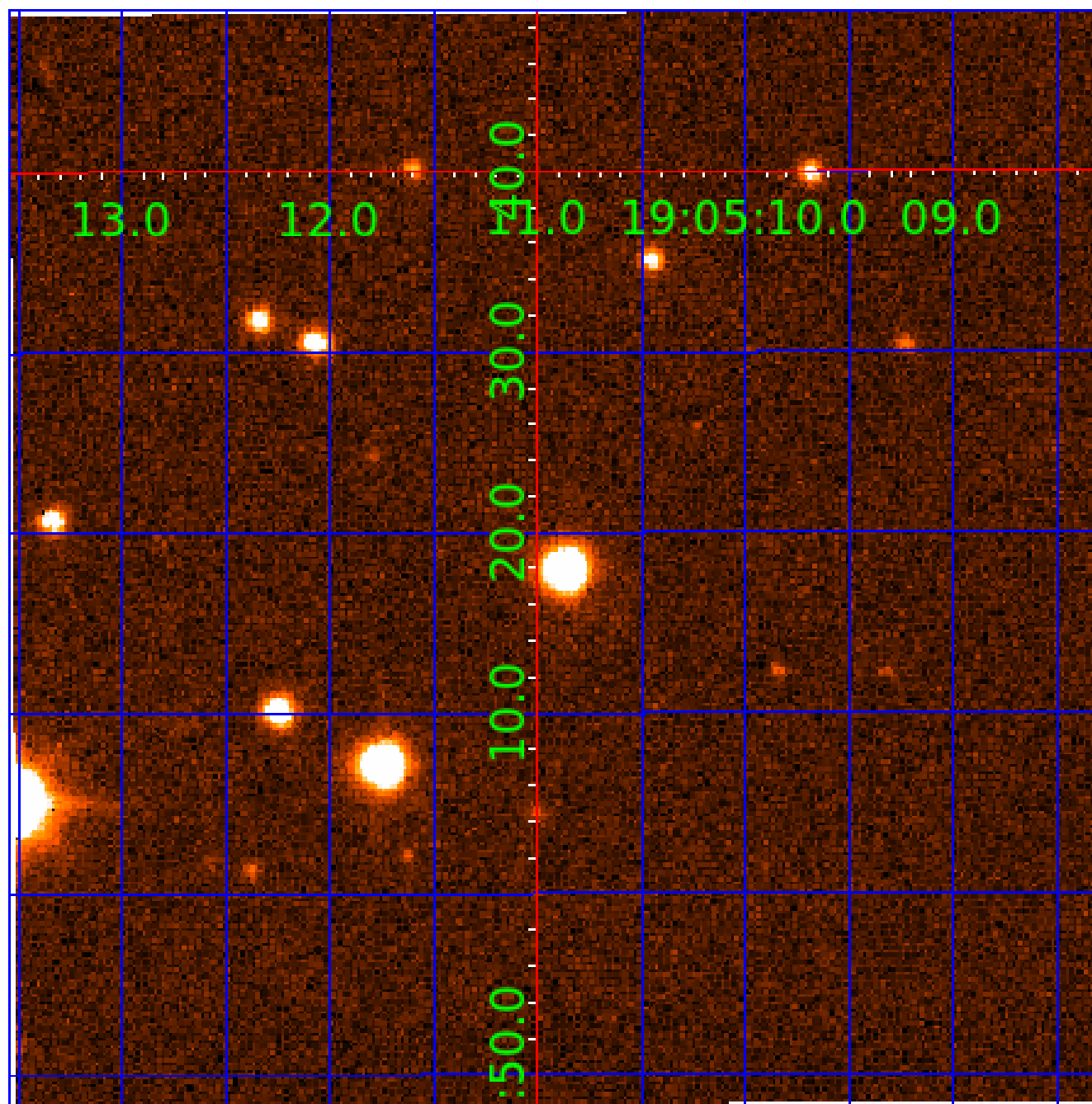


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 004819423

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
004819423-01	OBS	No	282.284484	197.192543	2307.5	3.084	13.0	6.5	0.76	4562	4.08	0.38
004819423-02	OBS	No	348.350153	454.454916	4386.6	12.880	12.6	6.8	0.76	4562	5.94	0.29
004819423-03	OBS	No	604.745146	233.626301	2308.9	4.878	13.2	5.5	0.76	4562	3.63	0.14
004819423-04	OBS	No	222.195401	264.478608	2274.1	3.524	11.4	7.1	0.76	4562	3.77	0.53

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
004819423-01	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
004819423-02	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_MARSHALL_SKYE—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS—HALO_GHOST
004819423-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_SKYE—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS
004819423-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL—LPP_DV—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—CENT_KIC_POS

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

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

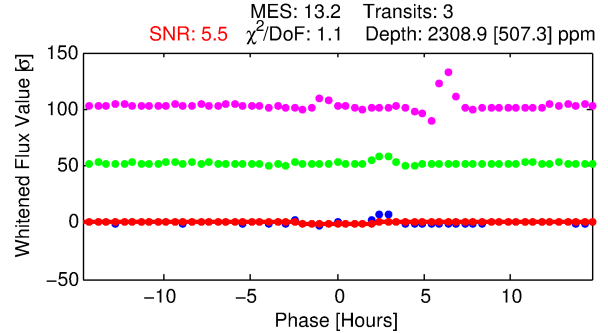
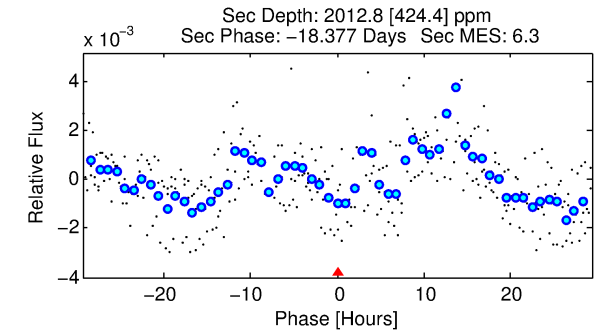
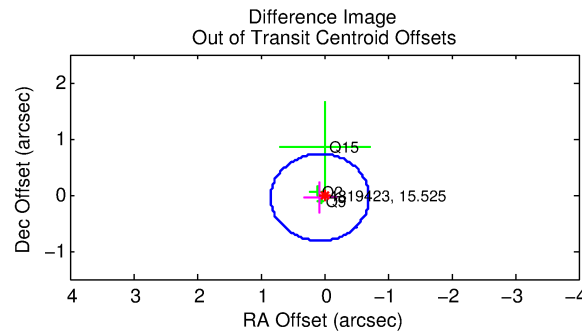
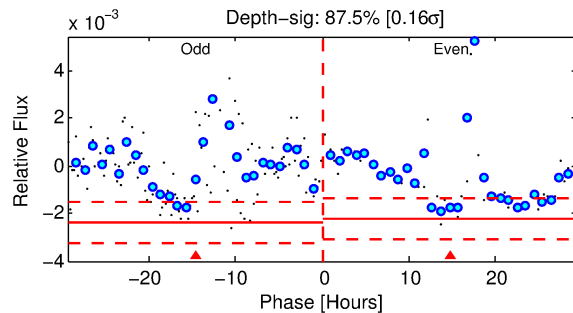
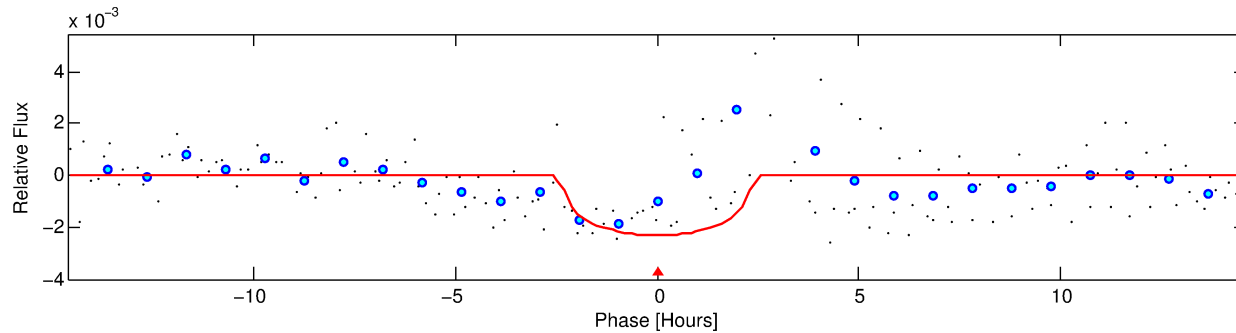
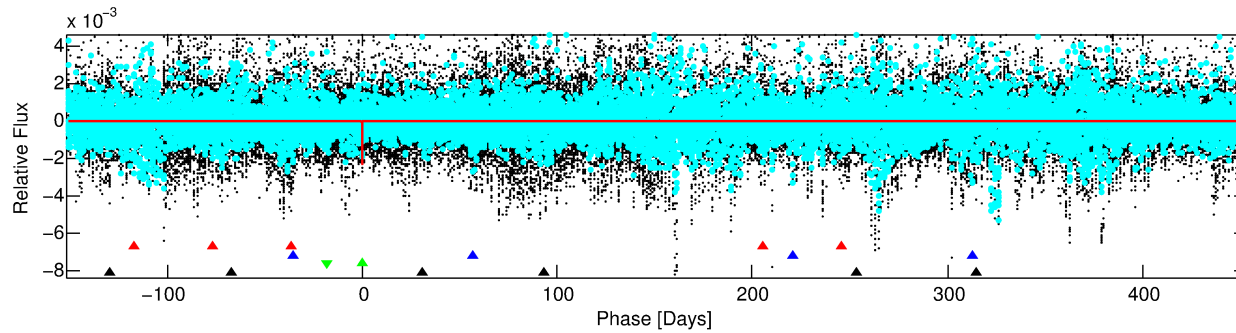
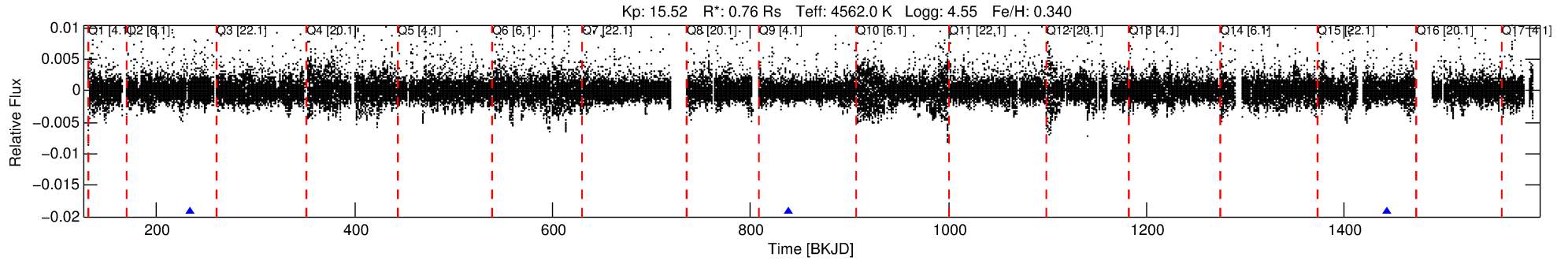
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 004819423-03

No Significant Match Found

# DV One-Page Summary

KIC: 4819423 Candidate: 3 of 4 Period: 604.745 d



## DV Fit Results:

Period = 604.74515 [0.00761] d  
Epoch = 233.6263 [0.0102] BKJD  
Rp/R\* = 0.0438 [0.0544]  
a/R\* = 881.64 [3158.01]  
b = 0.47 [6.05]  
Seff = 0.14 [0.02]  
Teq = 156 [7] K  
Rp = 3.63 [4.51] Re  
a = 1.2713 [0.0975] AU  
Ag = 136059.84 [339459.06] [0.40σ]  
Teffp = 4618 [2881] K [1.55σ]

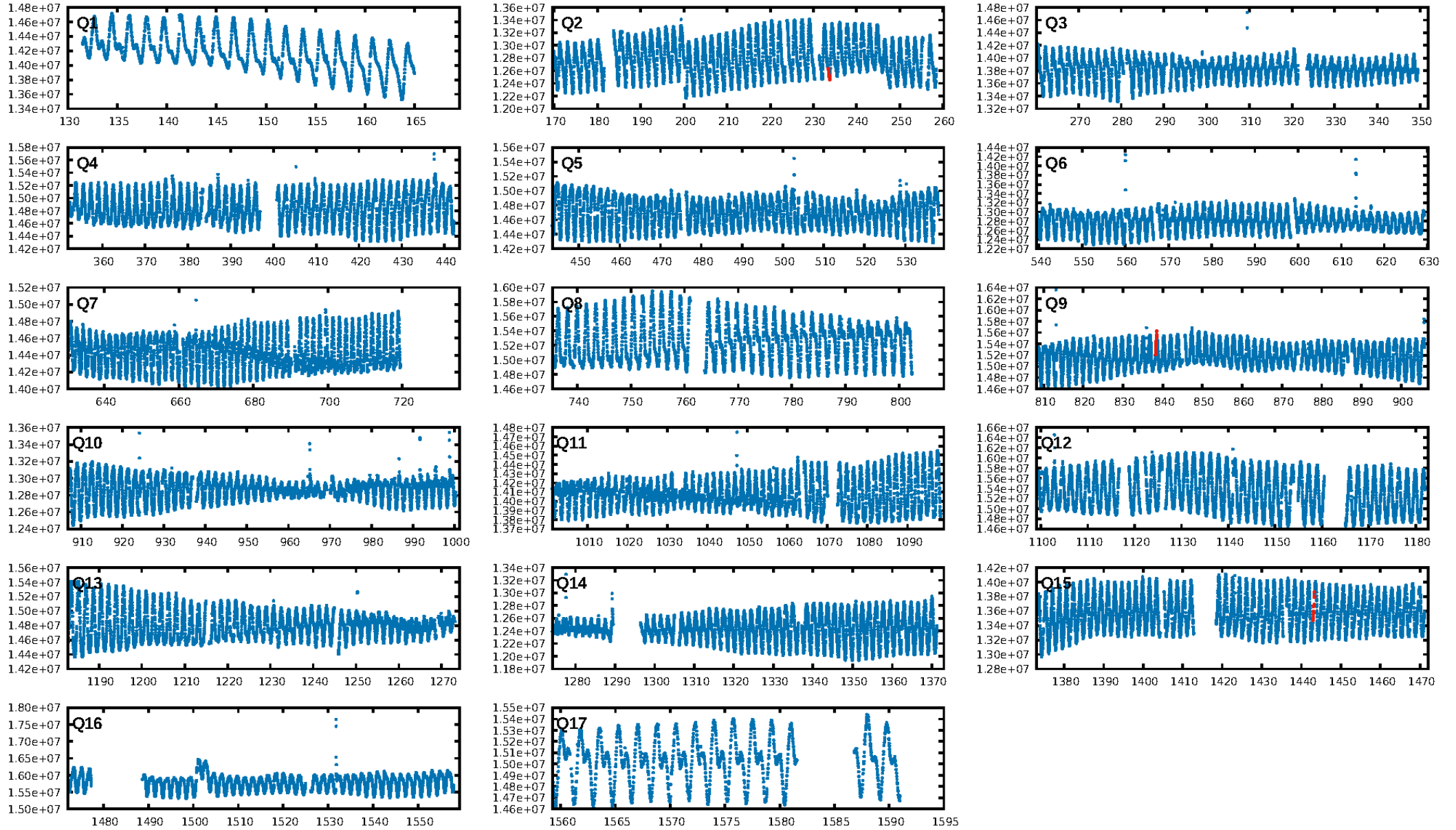
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [446.79σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 59.0%  
ModelChiSquareGof-sig: 94.5%  
Bootstrap-pfa: 2.63e-10  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: -4.097  
Centroid-sig: 74.3%  
Centroid-so: 0.668 arcsec [0.94σ]  
OotOffset-rm: 0.085 arcsec [0.33σ]  
OotOffset-st: 1/1/0/1 [3]  
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 23:02:56 Z

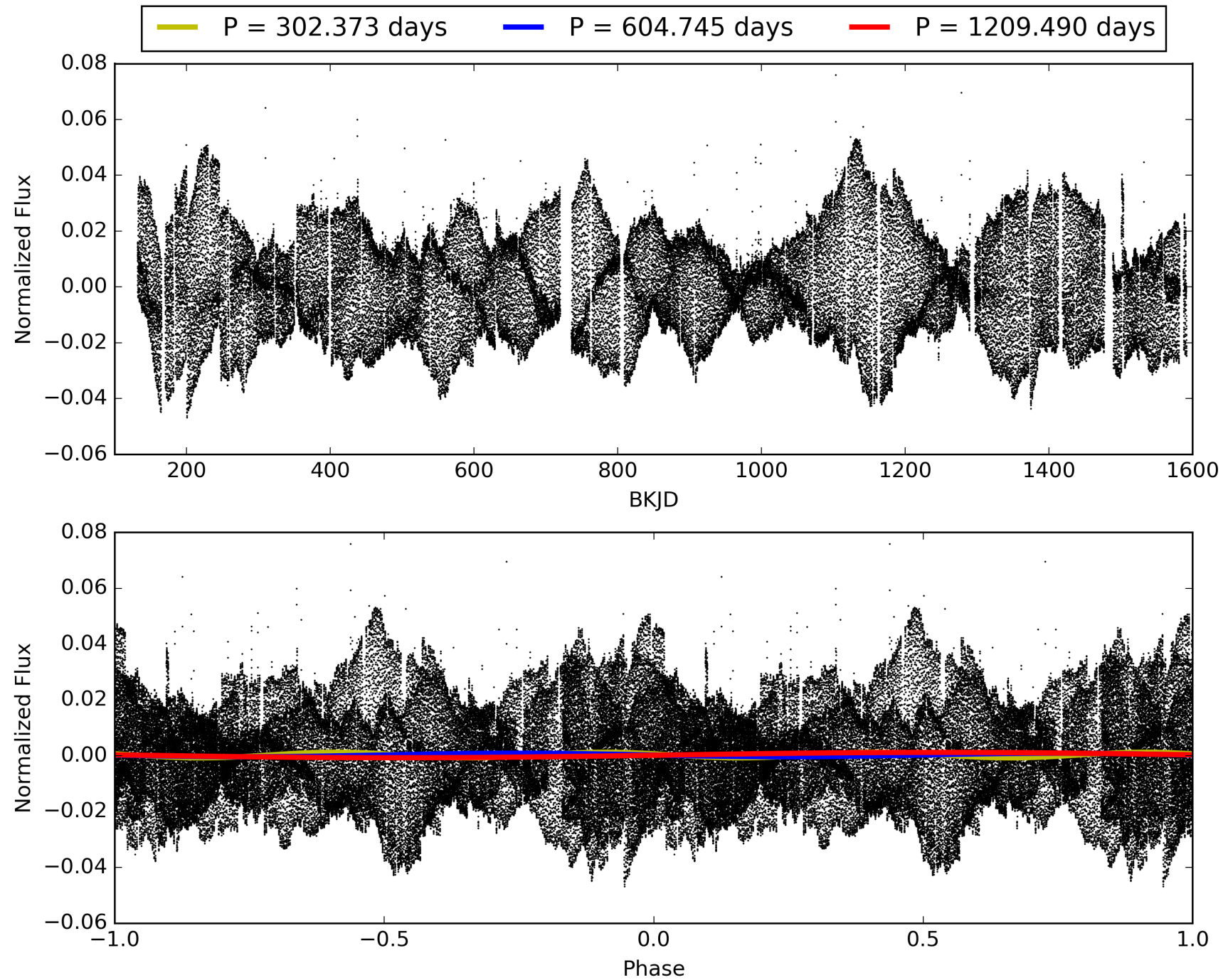
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 004819423-03, PDC Light Curves



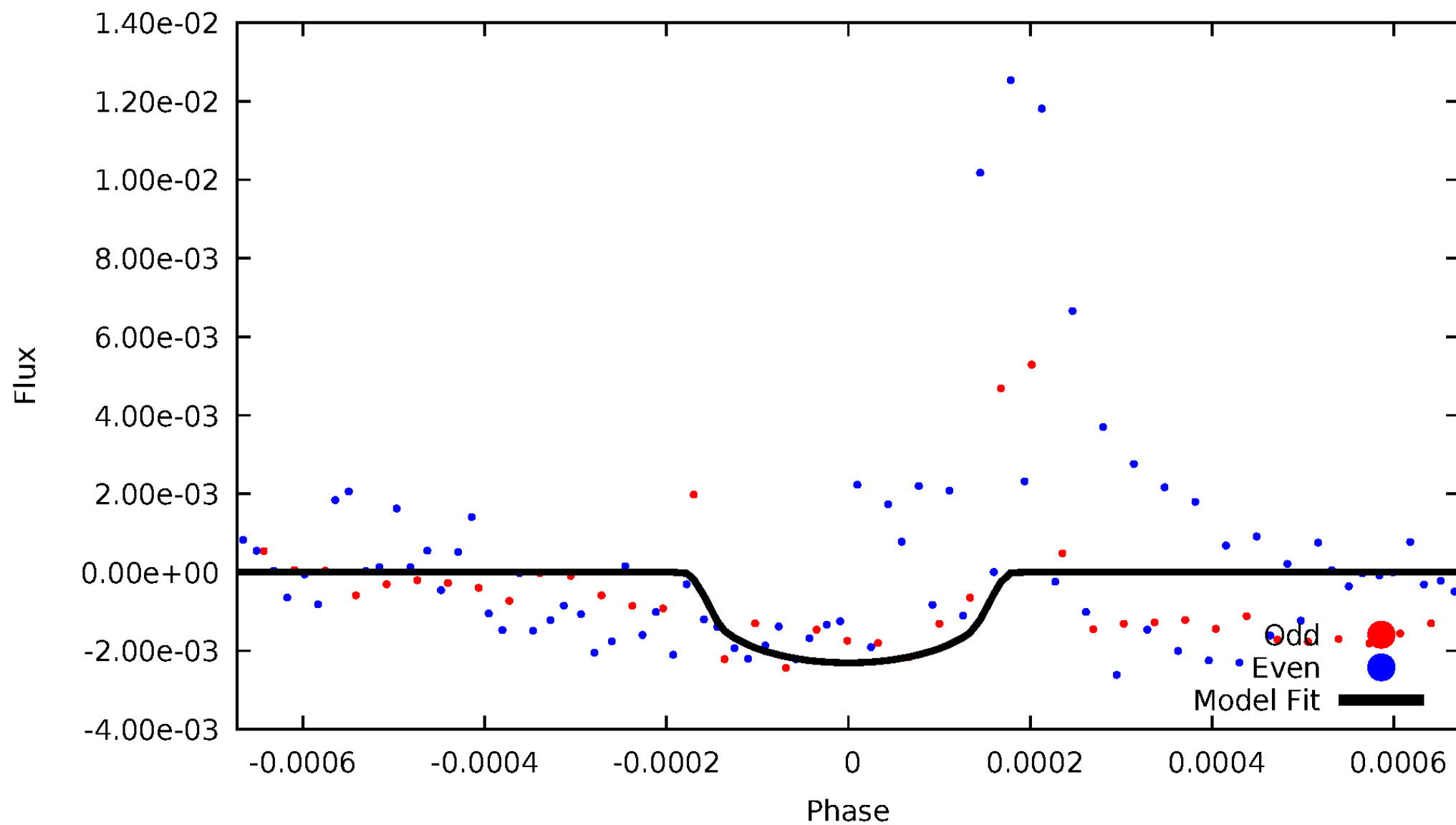


TCE 004819423-03



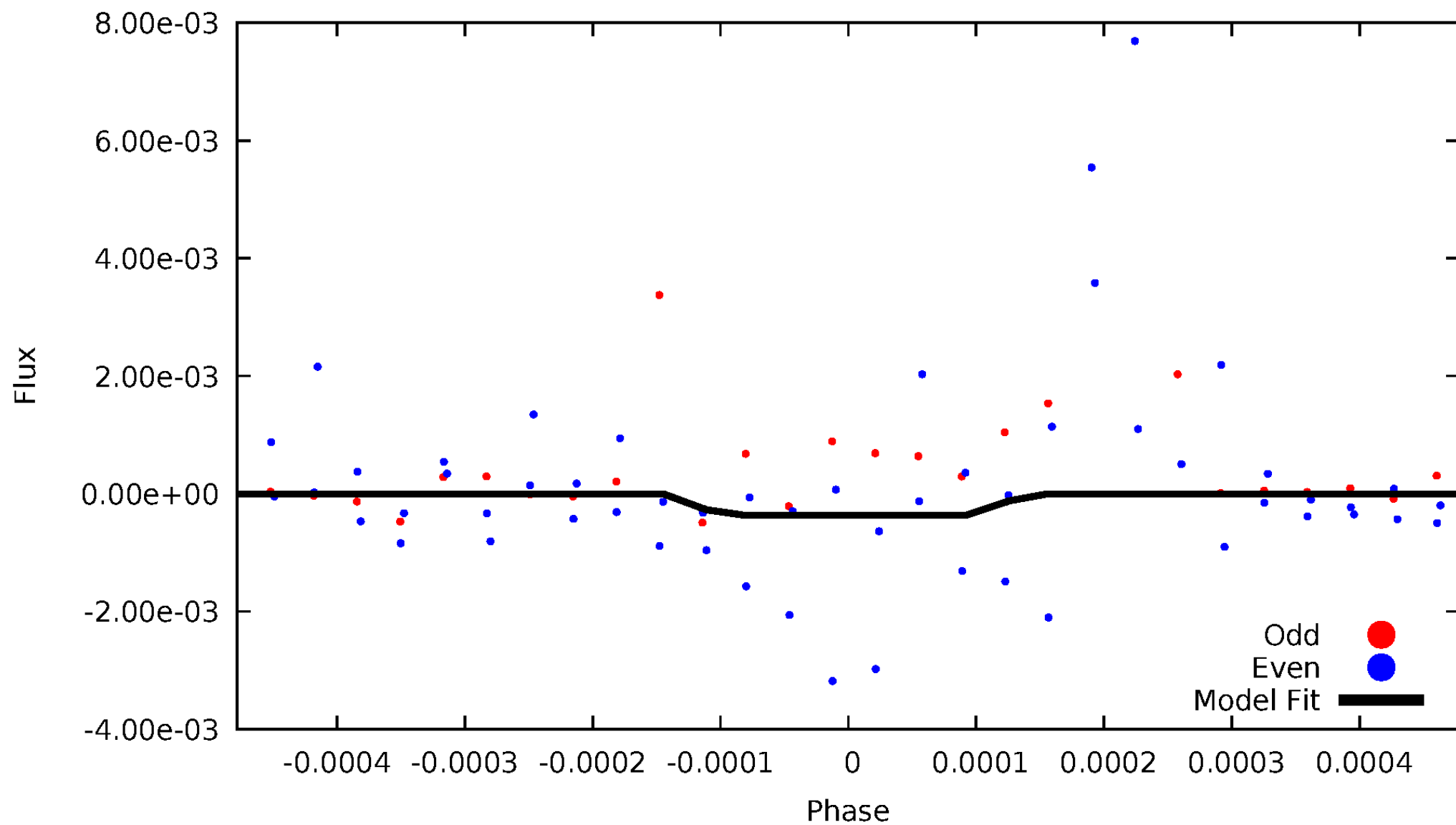
# DV Odd/Even

TCE 004819423-03



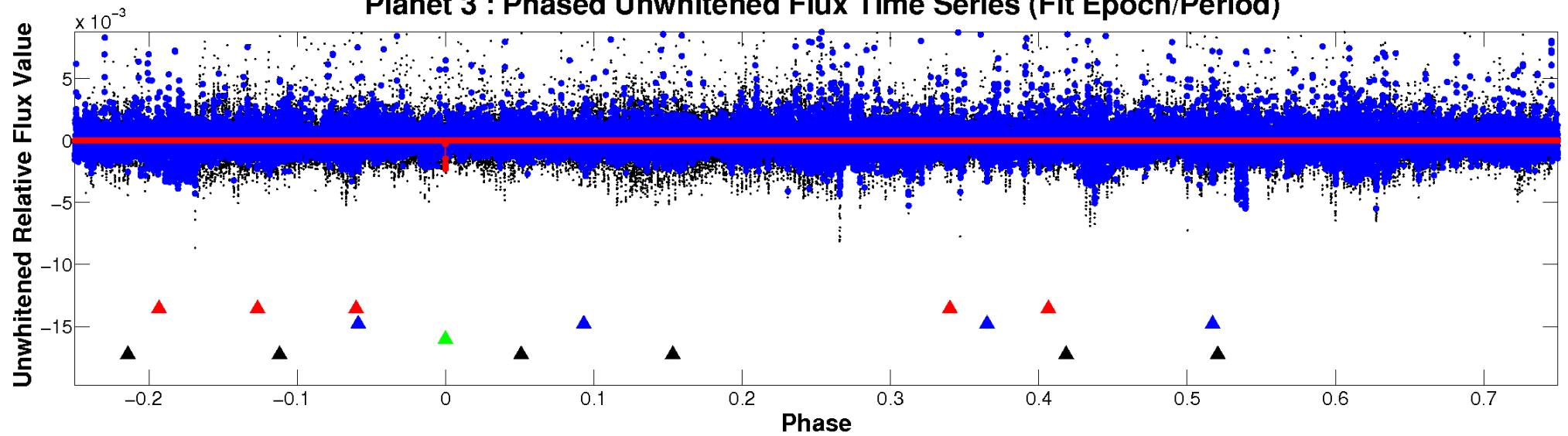
# ALT Odd/Even

TCE 004819423-03

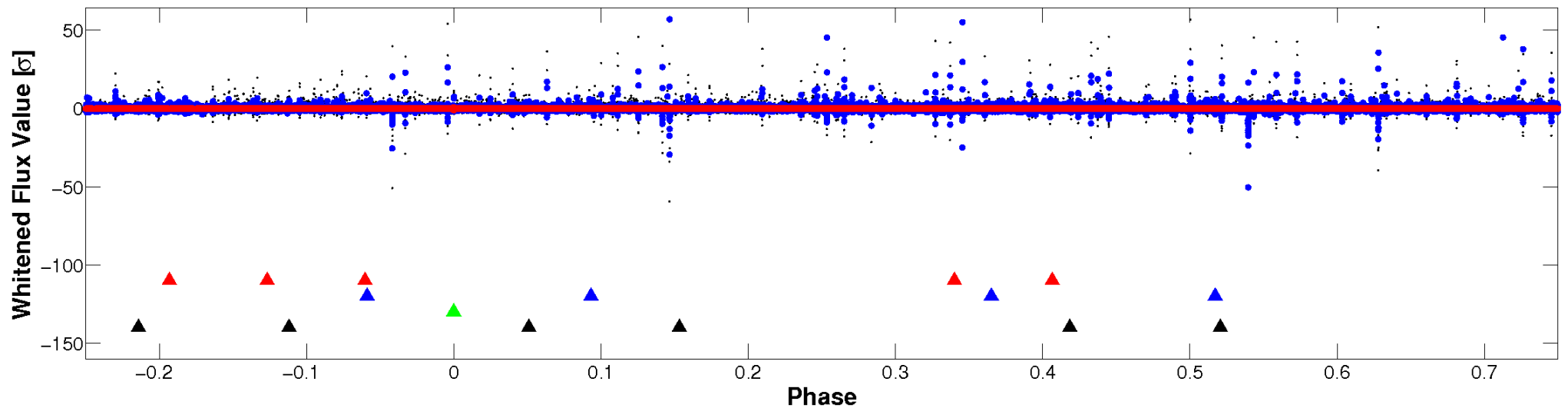


# Non-Whitened Vs. Whitened Light Curve

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

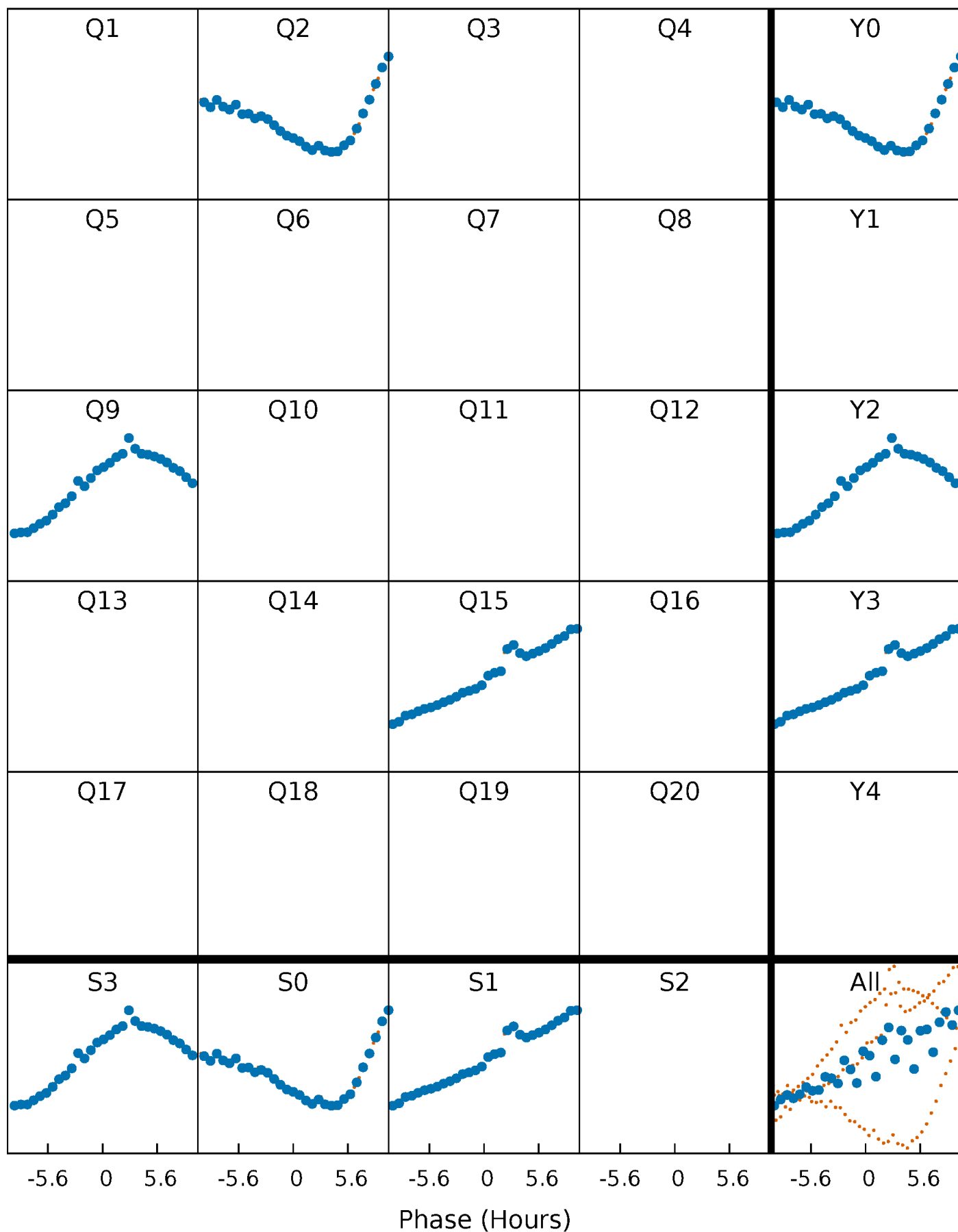


Planet 3 : Phased Whitened Flux Time Series (Fit Epoch/Period)



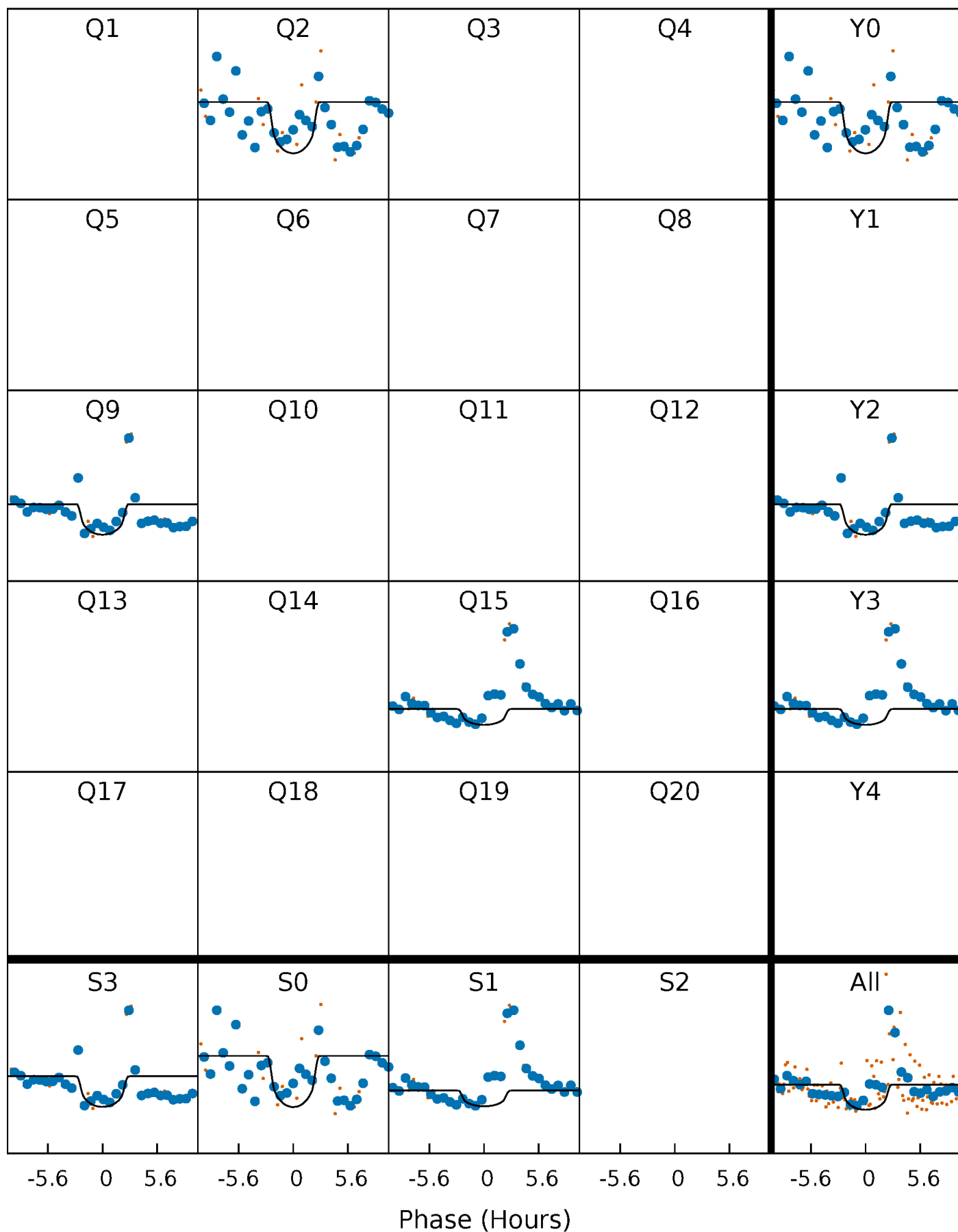
# PDC Quarter-Phased Transit Curves

TCE 004819423-03     $P=604.745146$  Days     $T_0=233.626301$  (BKJD)



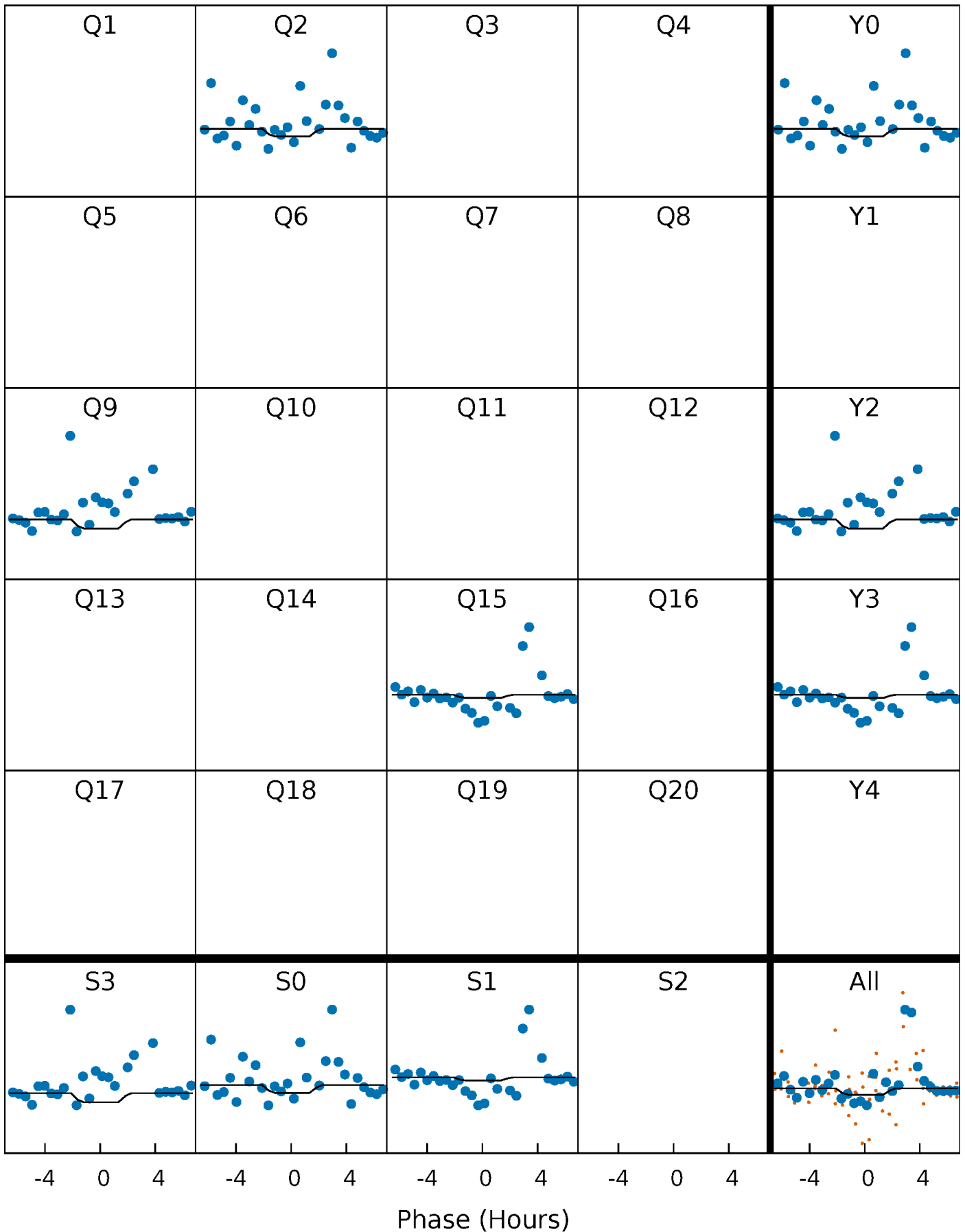
# DV Quarter-Phased Transit Curves

TCE 004819423-03     $P=604.745146$  Days     $T_0=233.626301$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

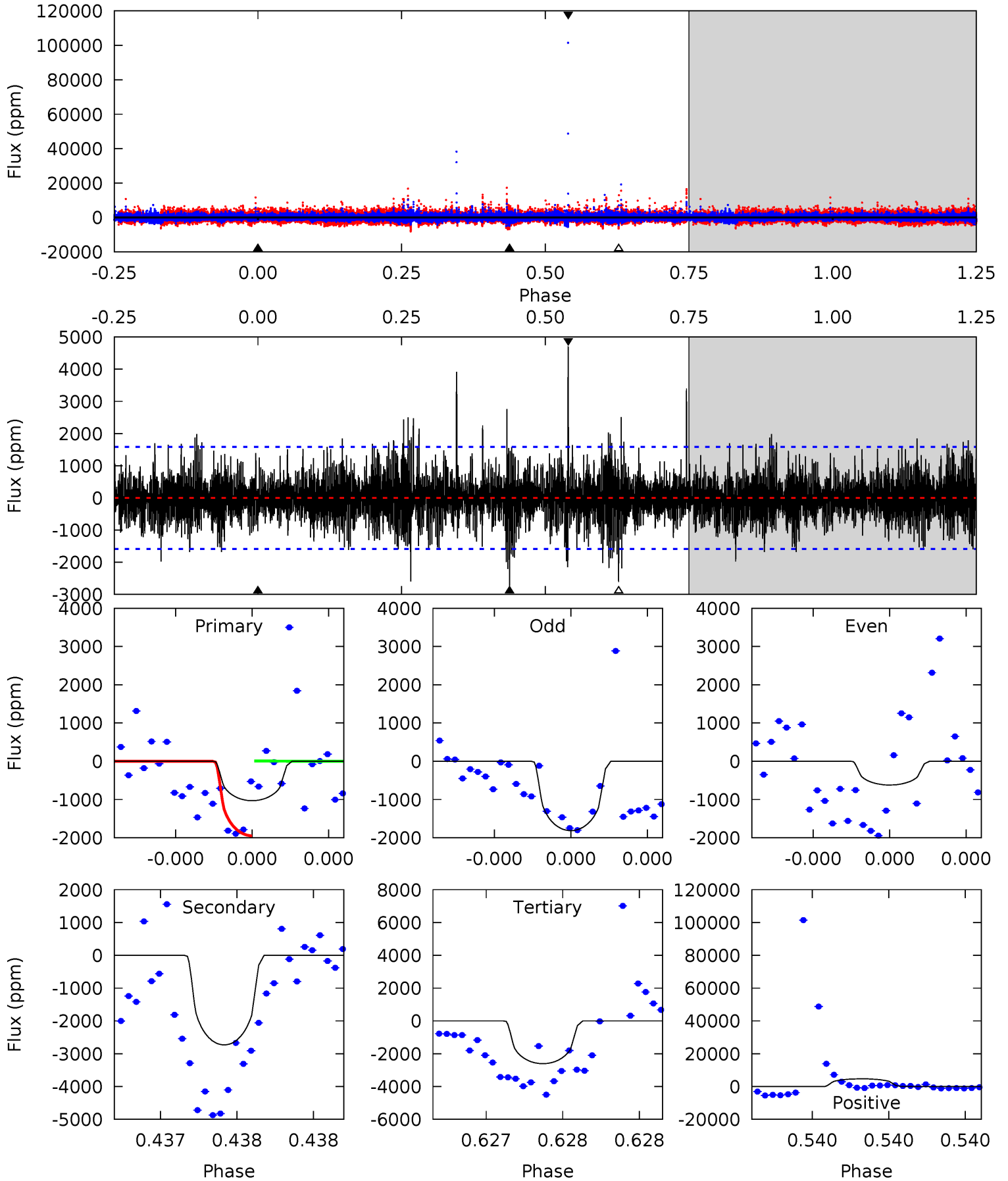
TCE 004819423-03     $P=604.731208$  Days     $T_0=233.626816$  (BKJD)



# DV Model-Shift Uniqueness Test

004819423-03, P = 604.745146 Days, E = 233.626301 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
3.66	9.69	9.25	16.6	5.62	3.56	2.04	-5.60	-13.0	0.44	-6.95	1.64	0.56	0.63	3.63

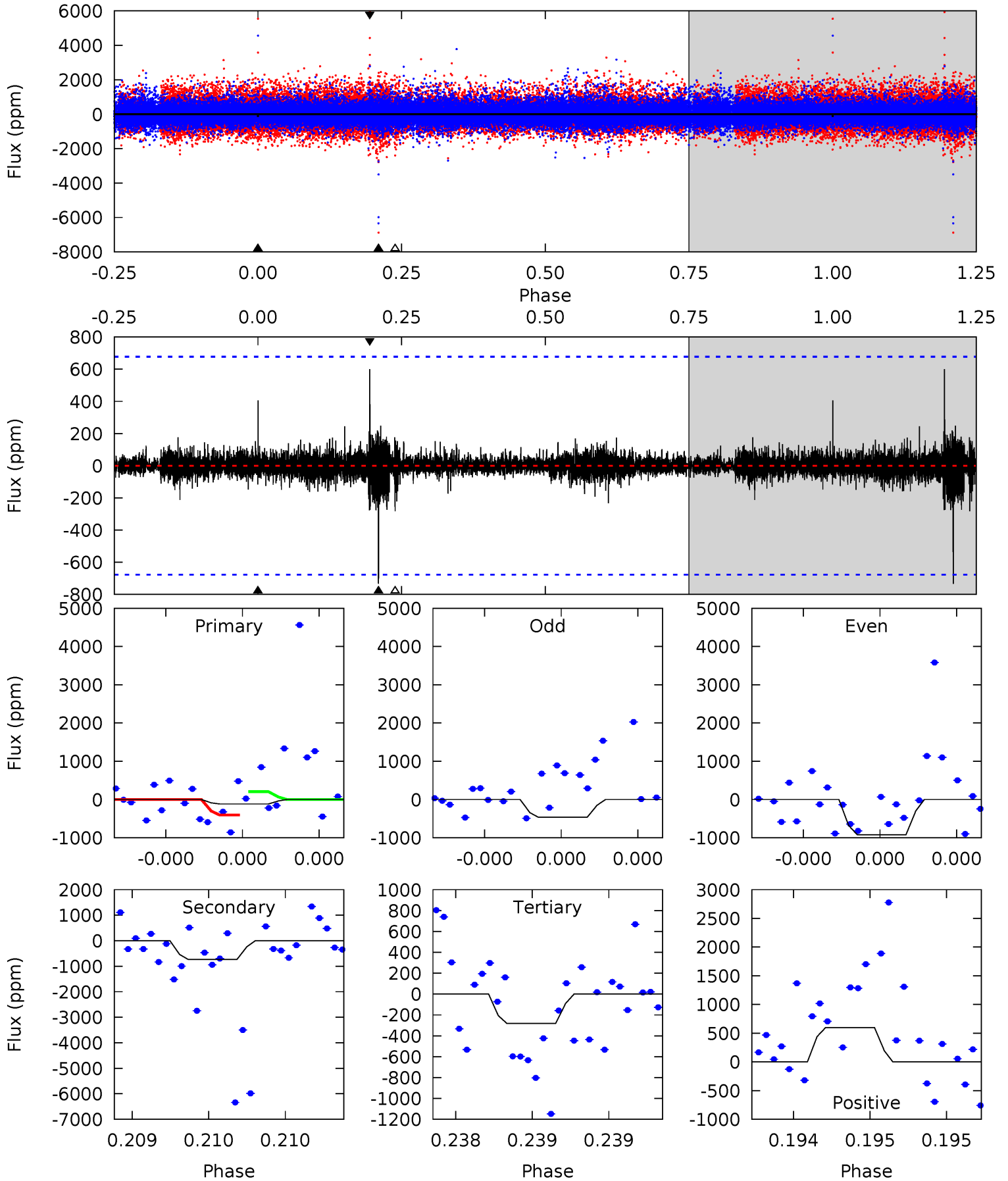




# Alt Model-Shift Uniqueness Test

004819423-03, P = 604.731208 Days, E = 233.626816 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
0.97	6.15	2.36	5.02	5.68	3.64	0.38	-1.38	-4.05	3.79	1.12	1.79	-3.73	0.45	0.83



### Stellar Parameters For KIC 004819423

	$T_{\text{eff}}(K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$4562^{+150}_{-150}$	$4.552^{+0.064}_{-0.020}$	$0.340^{+0.100}_{-0.300}$	$0.759^{+0.026}_{-0.067}$	$0.749^{+0.043}_{-0.048}$	$2.410^{+0.657}_{-0.199}$
	+3%/-3%	+1%/-0%	+29%/-88%	+3%/-9%	+6%/-6%	+27%/-8%
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 004819423-03 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-2732 \pm 282$	$4.89^{+4.00}_{-3.22}$	$216^{+8}_{-8}$	$4344^{+2803}_{-819}$	$99567^{+787307}_{-67666}$
Alt.	$-734 \pm 119$	$3.58^{+3.66}_{-2.48}$	$215^{+8}_{-7}$	$3844^{+2309}_{-782}$	$53692^{+496851}_{-41836}$

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

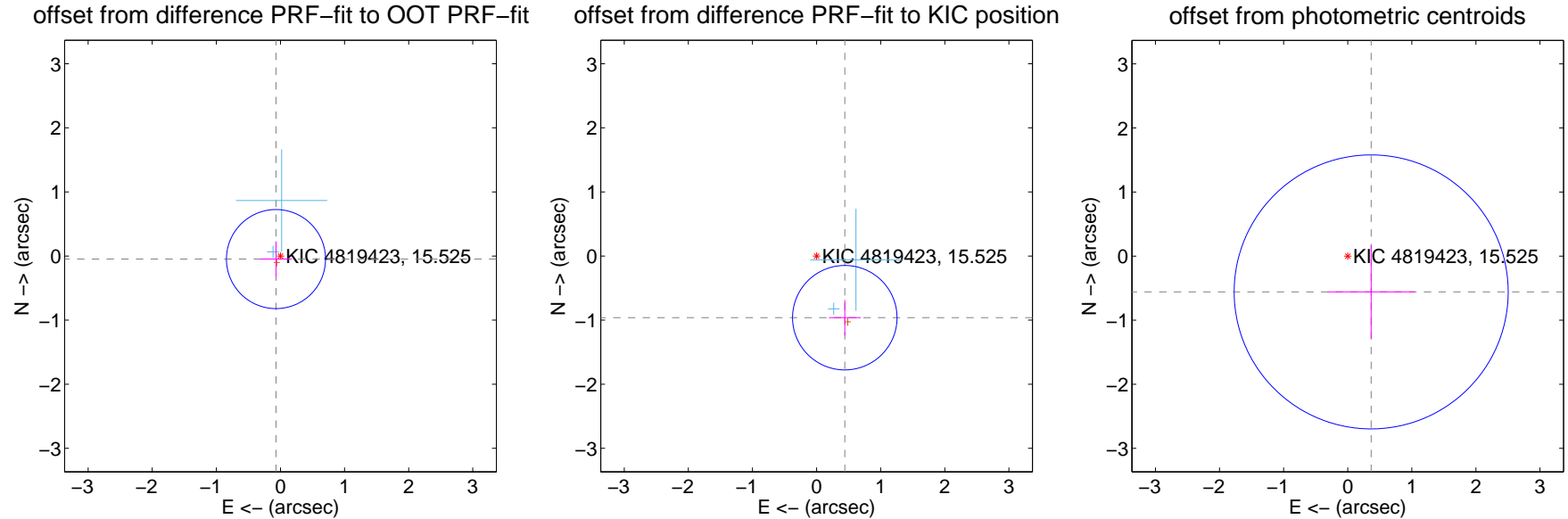
## DV Centroid Data

Supplemental centroid analysis for 004819423-03. Kepler magnitude: 15.53. Transit SNR 5.53

There are 2 quarters with good PRF difference image offsets

The direct PRF centroid is offset from the target star catalog position by about 1.10 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.085 \pm 0.258$	0.33	$0.070 \pm 0.248$	$-0.048 \pm 0.276$
PRF-fit source offset from KIC position	$1.058 \pm 0.272$	3.90	$-0.440 \pm 0.248$	$-0.962 \pm 0.276$
photometric centroid source offset	$0.67 \pm 0.71$	0.94	$-0.37 \pm 0.68$	$-0.56 \pm 0.73$



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.

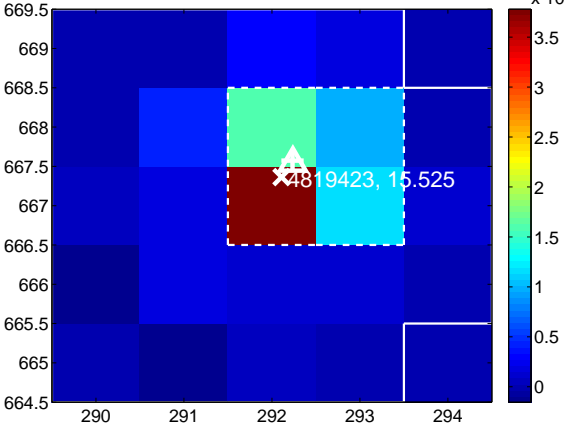
Q1 no difference image



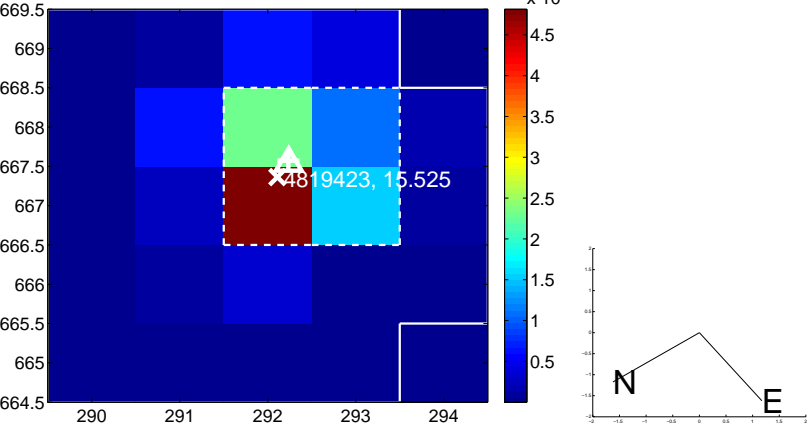
Q1 no OOT image



Q2 difference image



Q2 OOT image



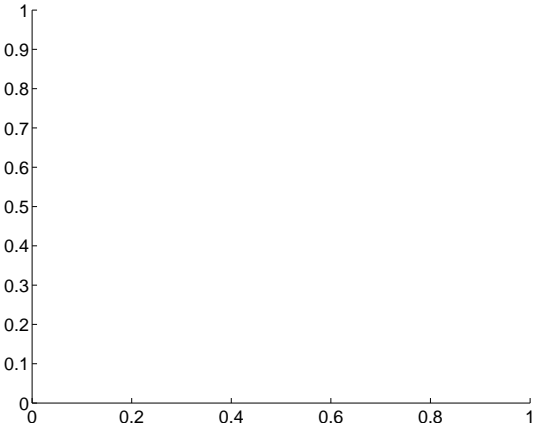
Q3 no difference image



Q3 no OOT image



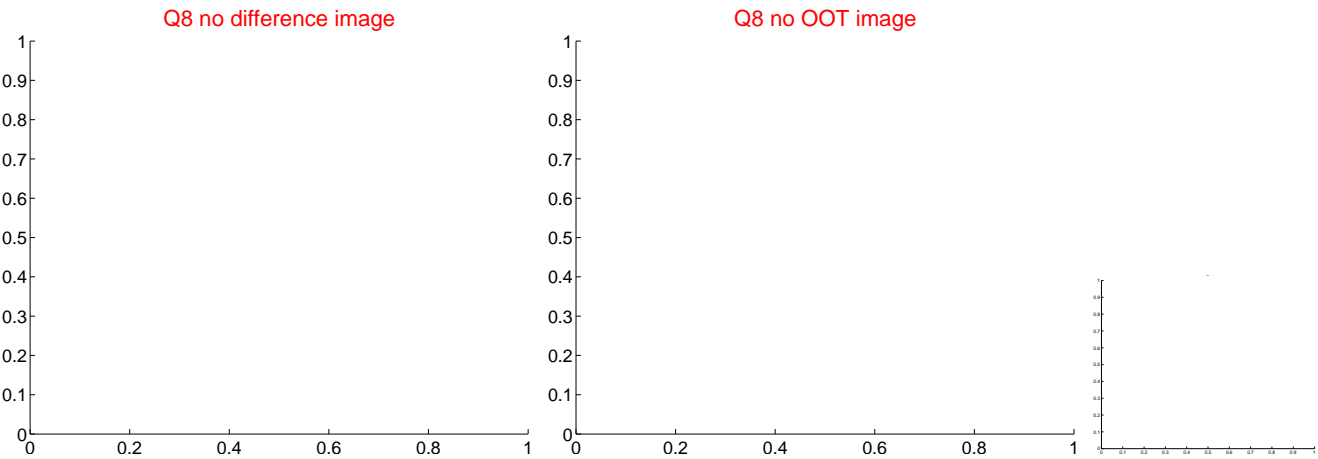
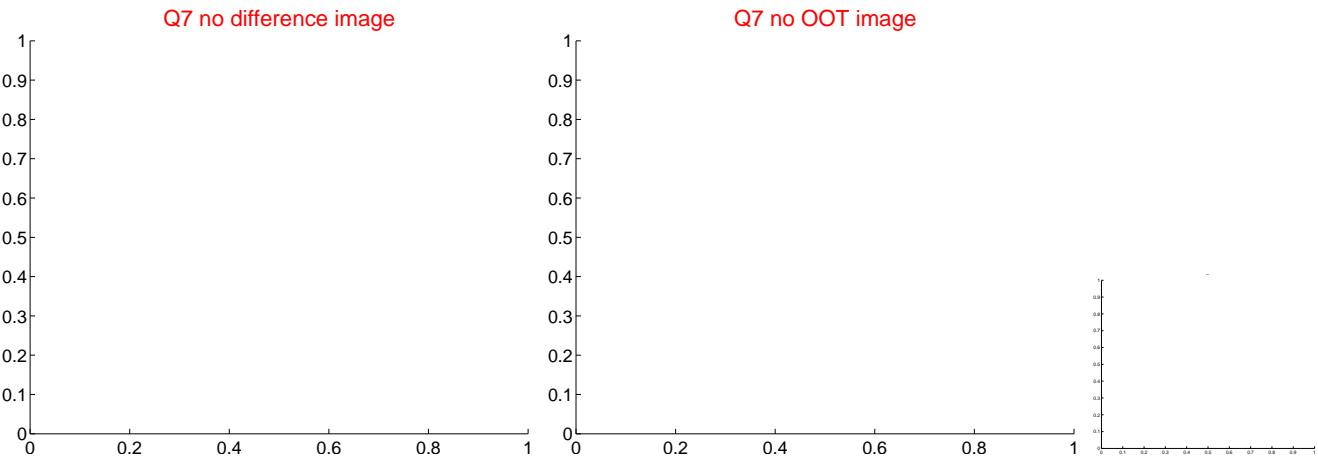
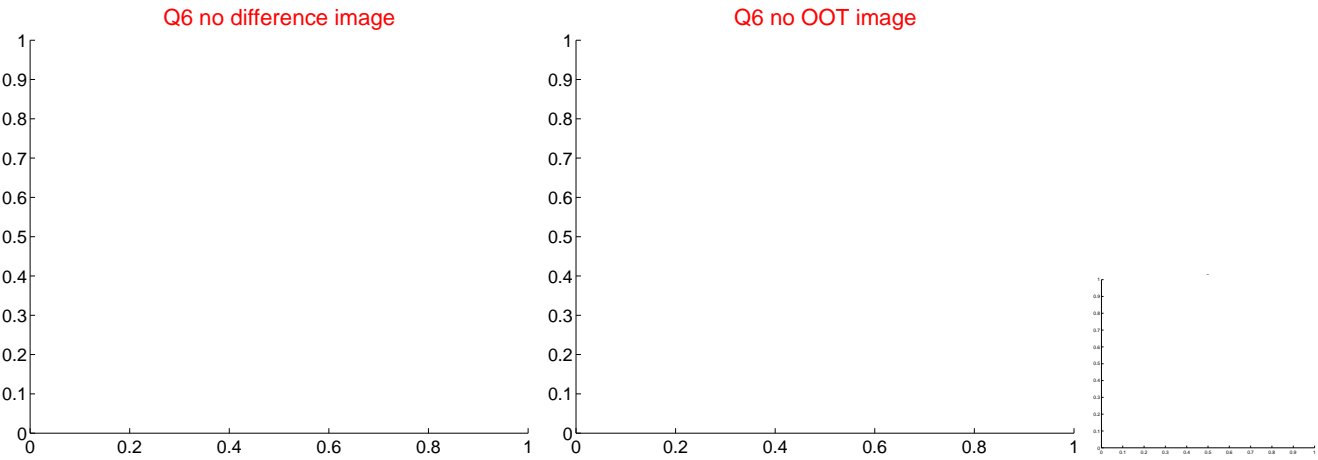
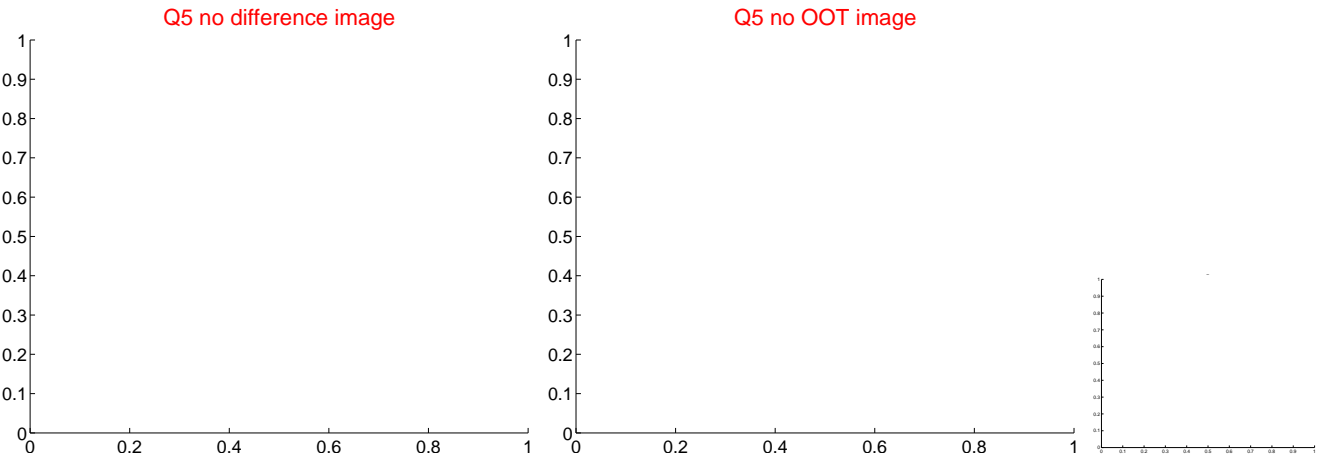
Q4 no difference image



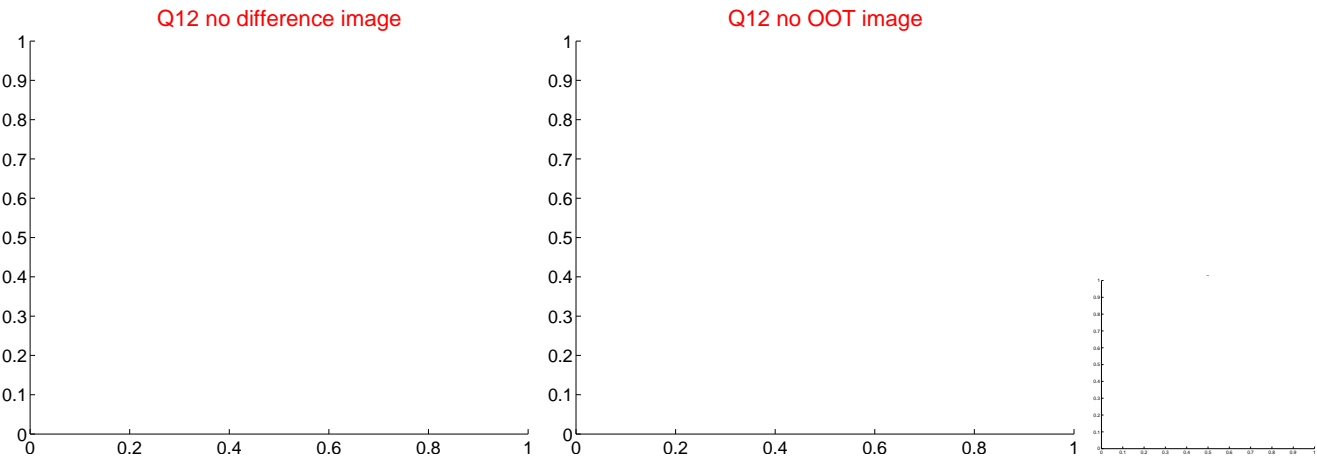
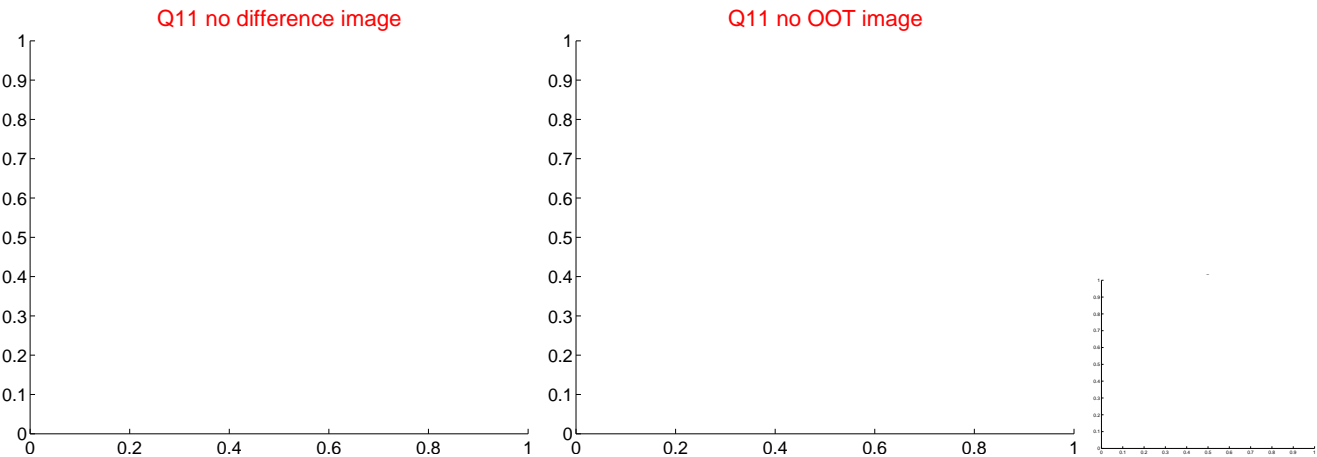
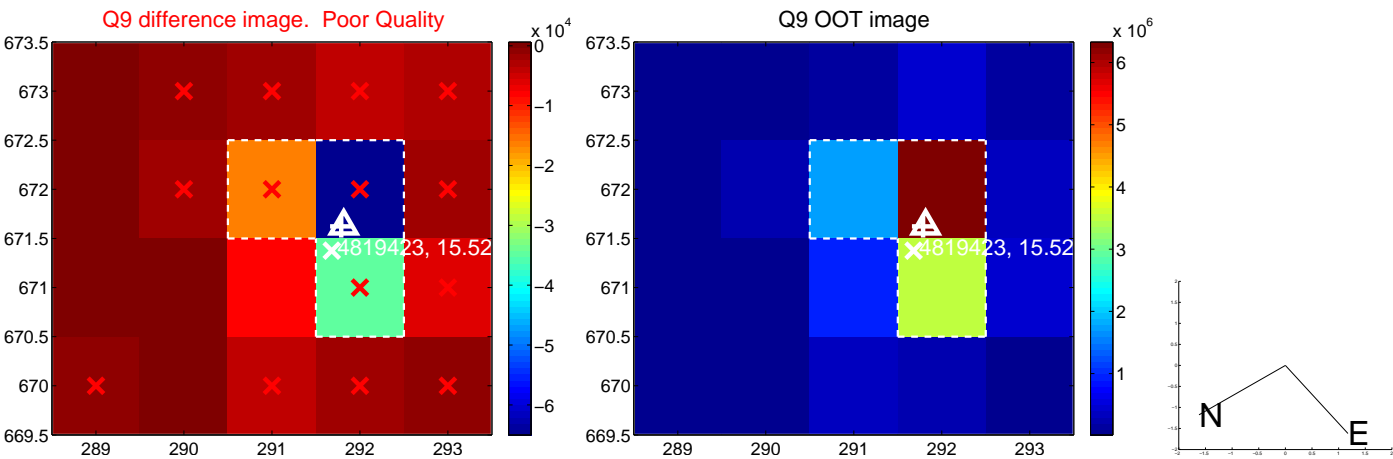
Q4 no OOT image



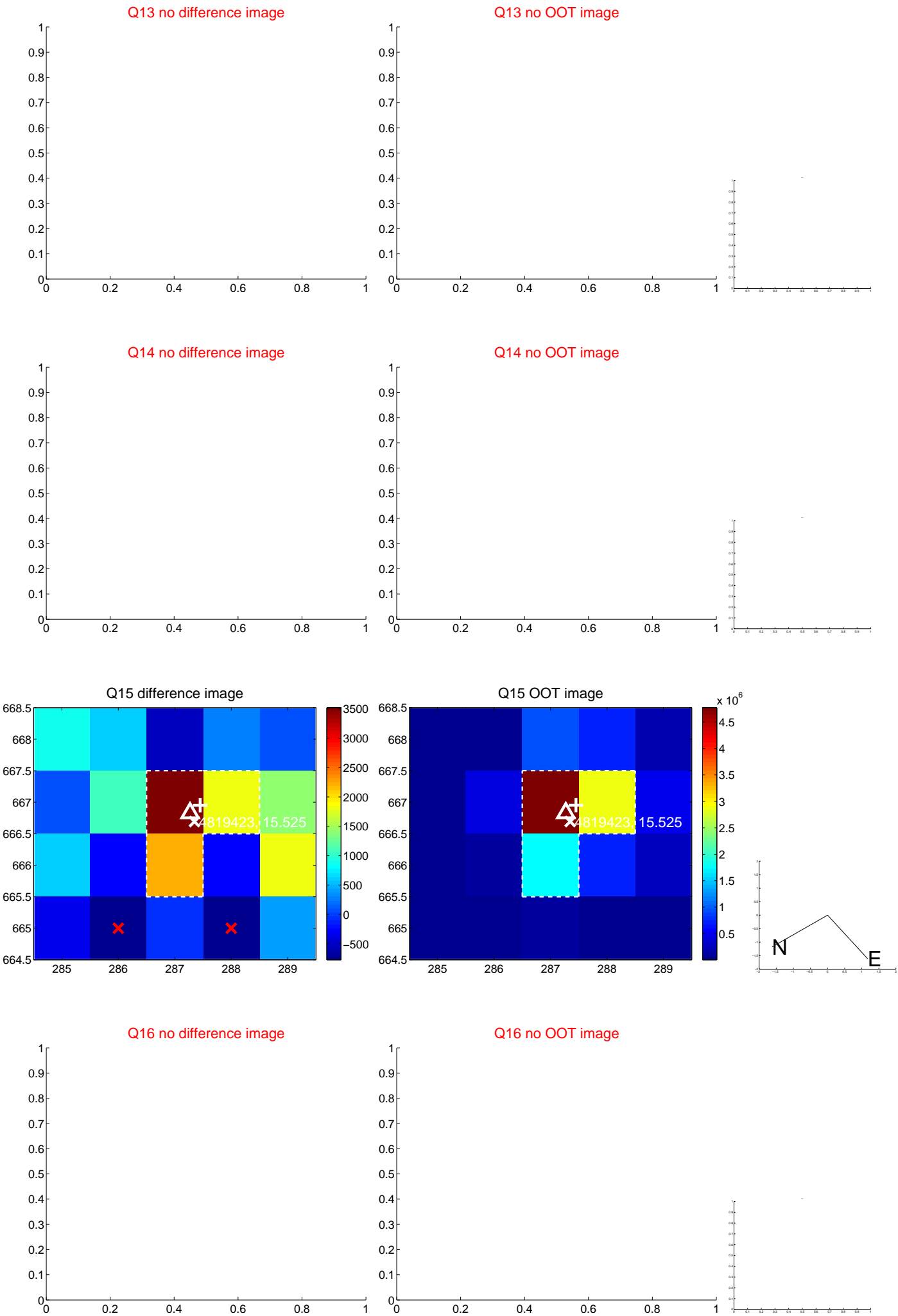
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



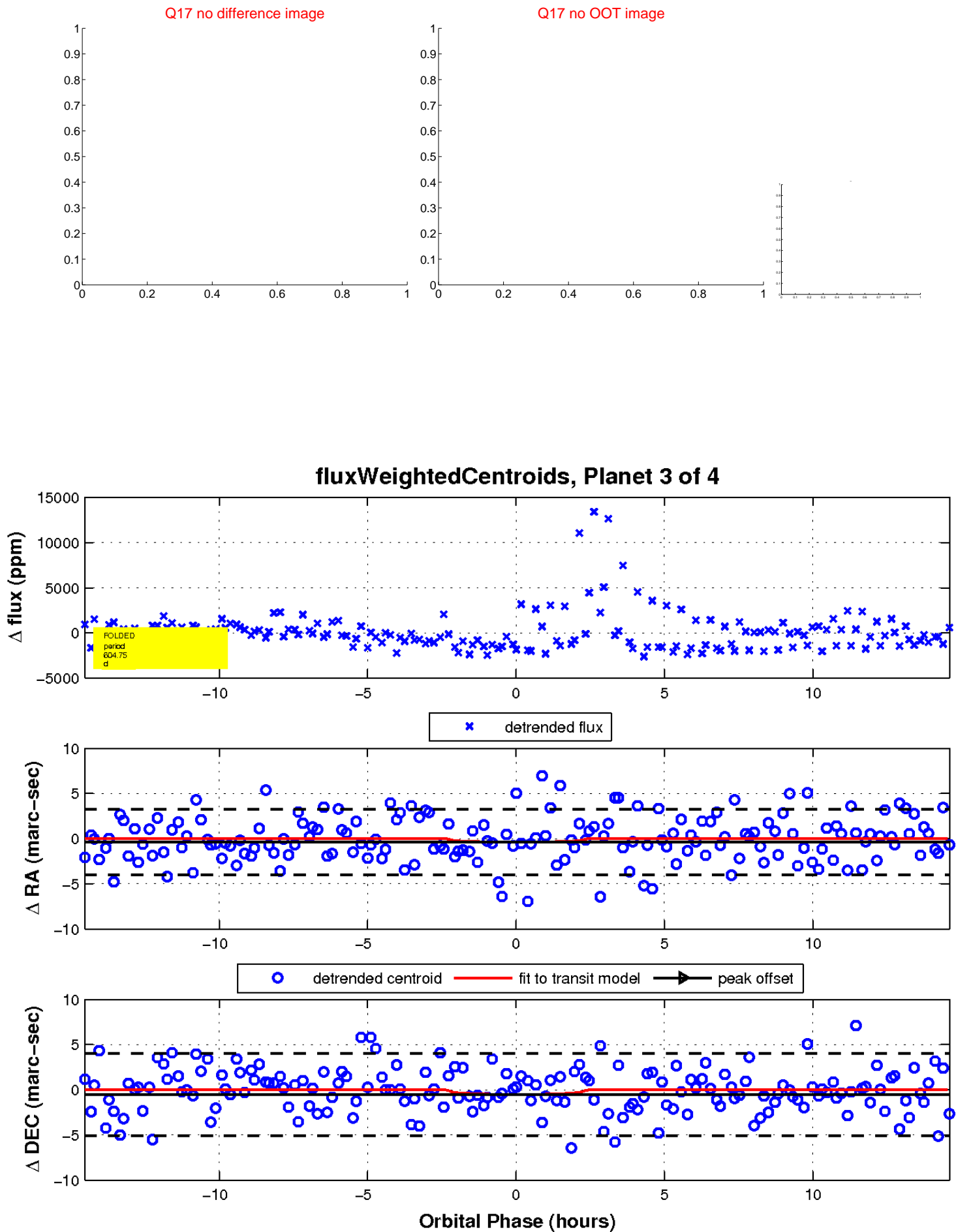
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



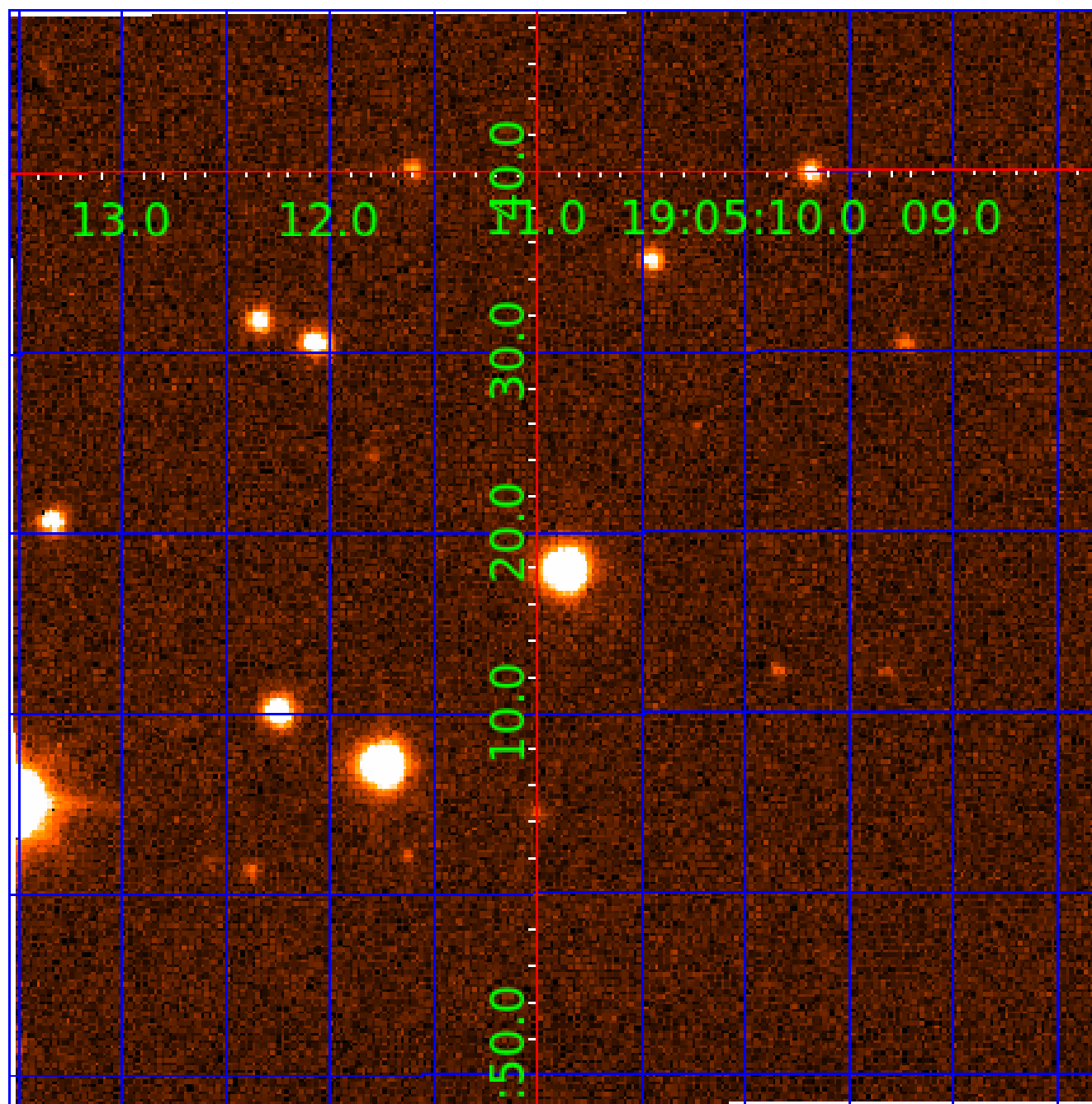
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





UKIRT Image

Declination



# KIC 004819423

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
004819423-01	OBS	No	282.284484	197.192543	2307.5	3.084	13.0	6.5	0.76	4562	4.08	0.38
004819423-02	OBS	No	348.350153	454.454916	4386.6	12.880	12.6	6.8	0.76	4562	5.94	0.29
004819423-03	OBS	No	604.745146	233.626301	2308.9	4.878	13.2	5.5	0.76	4562	3.63	0.14
004819423-04	OBS	No	222.195401	264.478608	2274.1	3.524	11.4	7.1	0.76	4562	3.77	0.53

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
004819423-01	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
004819423-02	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_MARSHALL_SKYE—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS—HALO_GHOST
004819423-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_SKYE—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS
004819423-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL—LPP_DV—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—CENT_KIC_POS

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

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

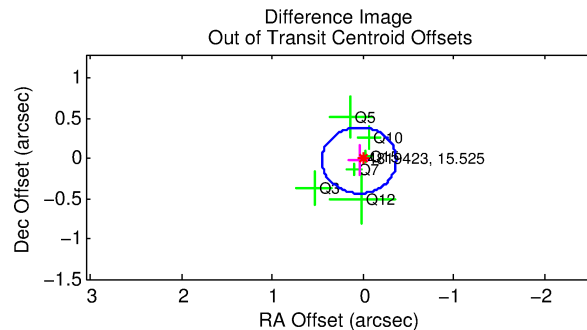
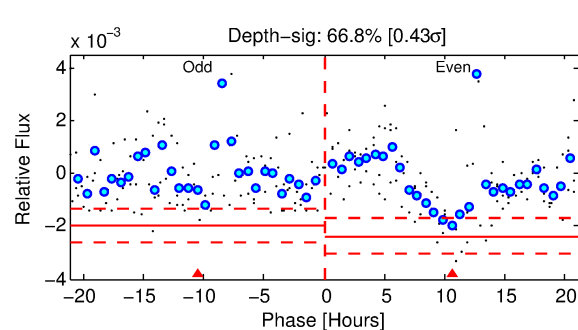
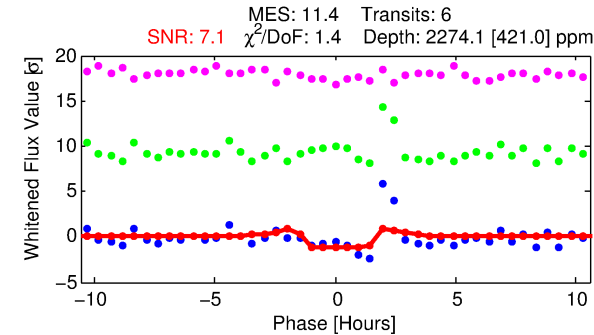
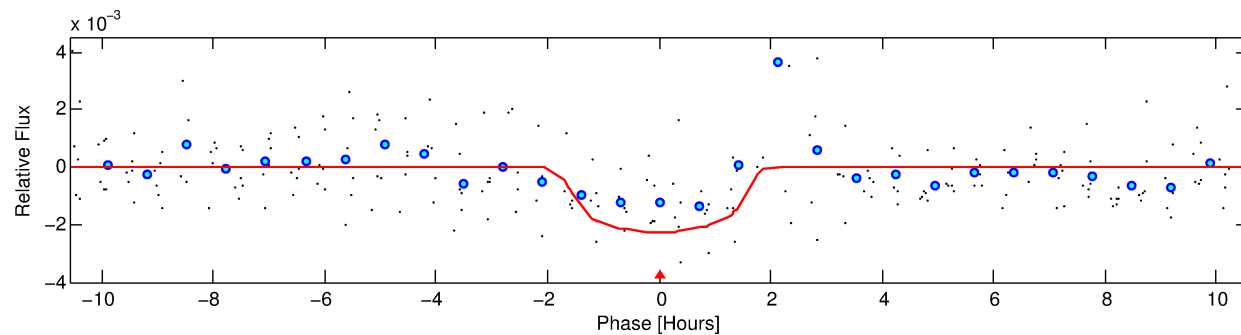
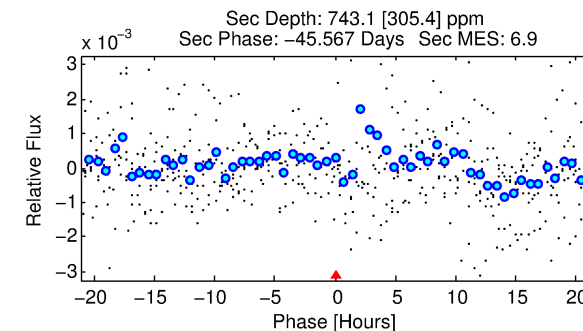
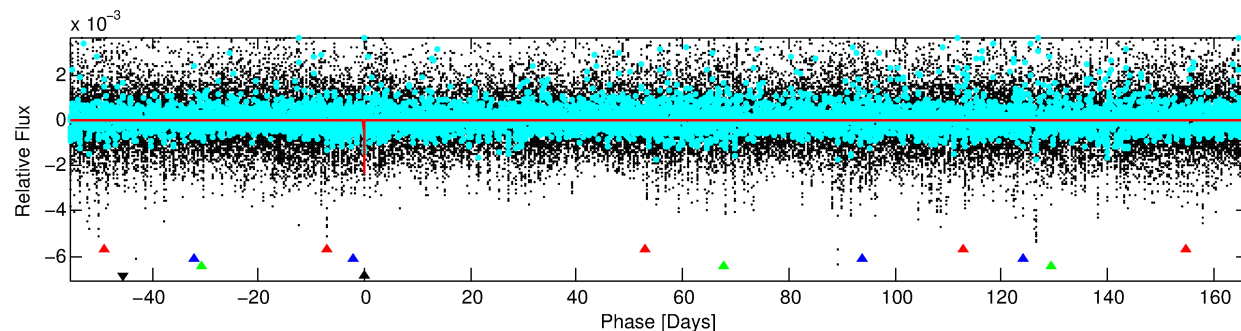
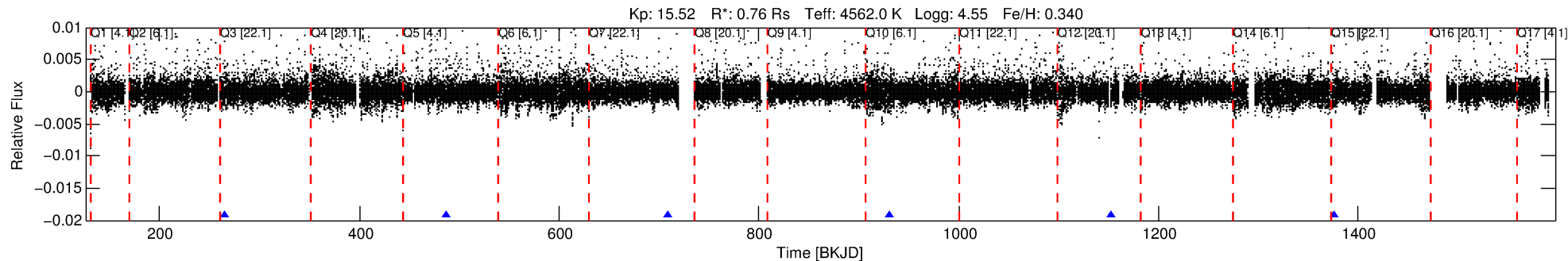
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 004819423-04

No Significant Match Found

# DV One-Page Summary

KIC: 4819423 Candidate: 4 of 4 Period: 222.195 d



## DV Fit Results:

Period = 222.19540 [0.00244] d  
Epoch = 264.4786 [0.0075] BKJD  
Rp/R\* = 0.0455 [0.0447]  
a/R\* = 401.01 [1149.91]  
b = 0.63 [2.81]  
Seff = 0.53 [0.09]  
Teq = 217 [9] K  
Rp = 3.77 [3.72] Re  
a = 0.6522 [0.0500] AU  
Ag = 12261.52 [24660.06] [0.50 $\sigma$ ]  
Teff = 3532 [1777] K [1.87 $\sigma$ ]

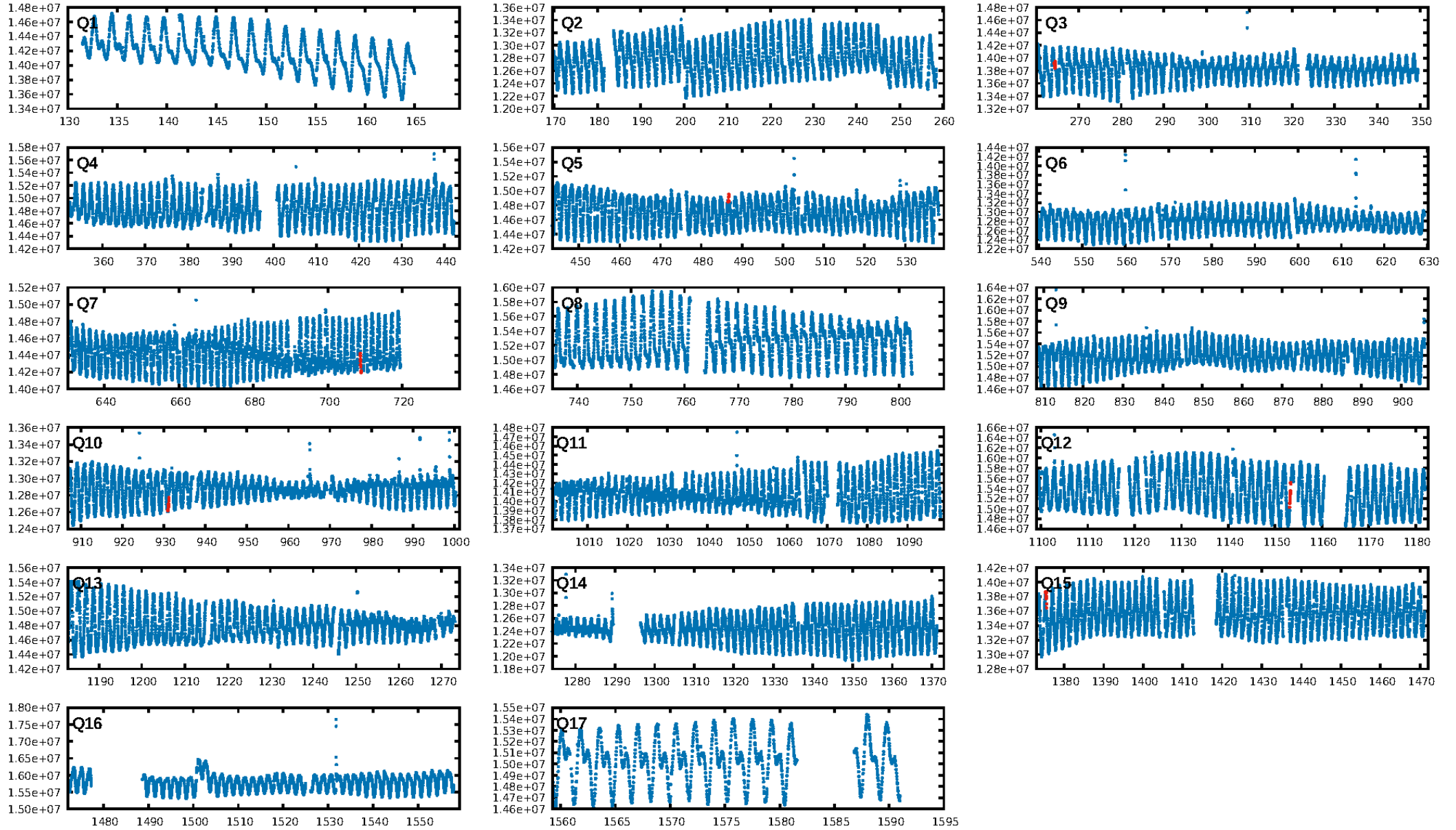
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [307.94 $\sigma$ ]  
ModelChiSquare2-sig: 4.7%  
ModelChiSquareGof-sig: 79.6%  
**Bootstrap-pfa: 7.27e-10**  
RollingBand-fgt: 1.00 [6/6]  
GhostDiagnostic-chr: 4.545  
Centroid-sig: 43.5%  
Centroid-so: 1.382 arcsec [2.35 $\sigma$ ]  
OotOffset-rm: 0.047 arcsec [0.34 $\sigma$ ]  
**KicOffset-rm: 1.027 arcsec [6.39 $\sigma$ ]**  
OotOffset-st: 1/3/1/1 [6]  
KicOffset-st: 1/3/1/1 [6]  
DiffImageQuality-fgm: 0.50 [3/6]  
DiffImageOverlap-fno: 1.00 [6/6]

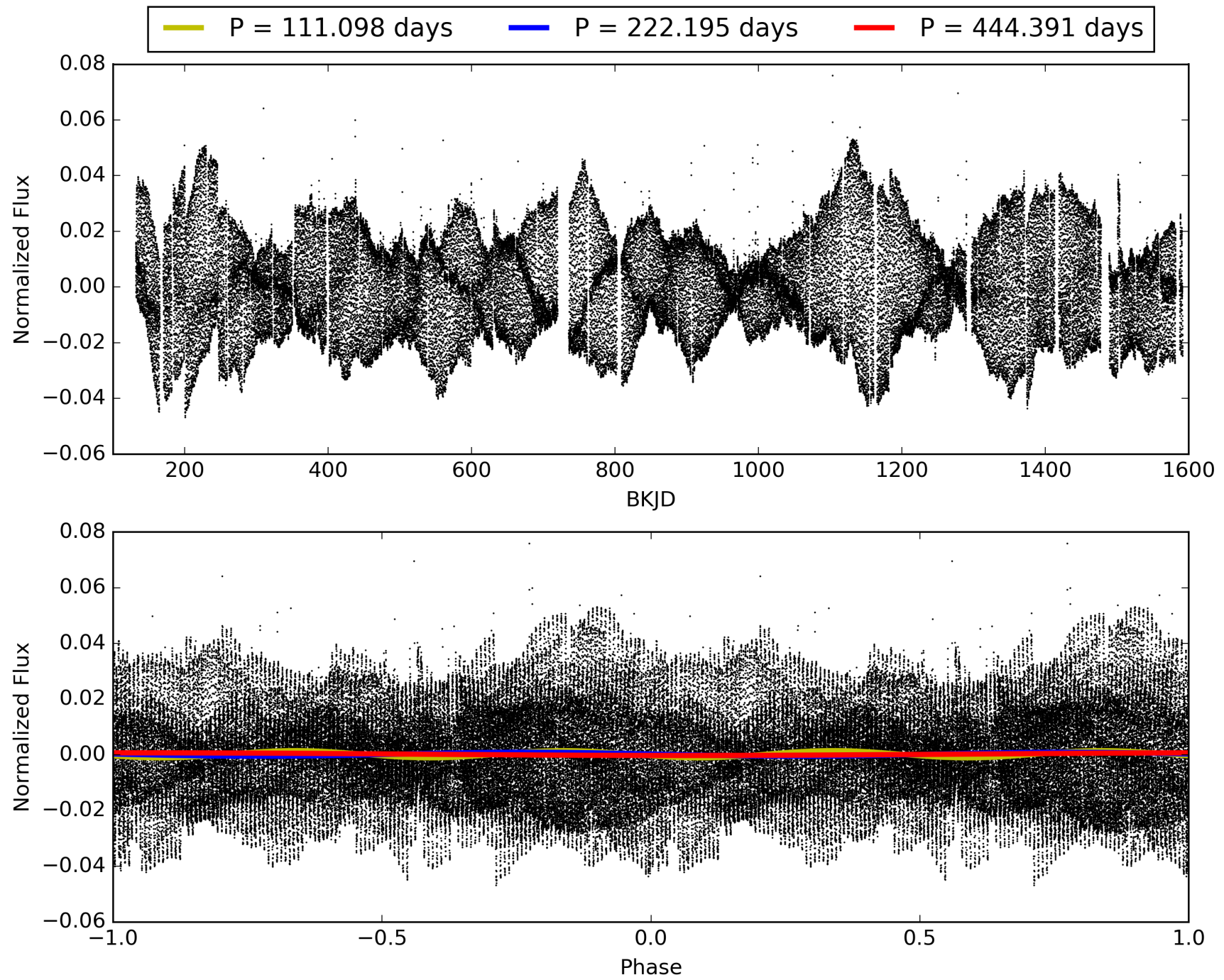
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 23:03:08 Z

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

# TCE 004819423-04, PDC Light Curves

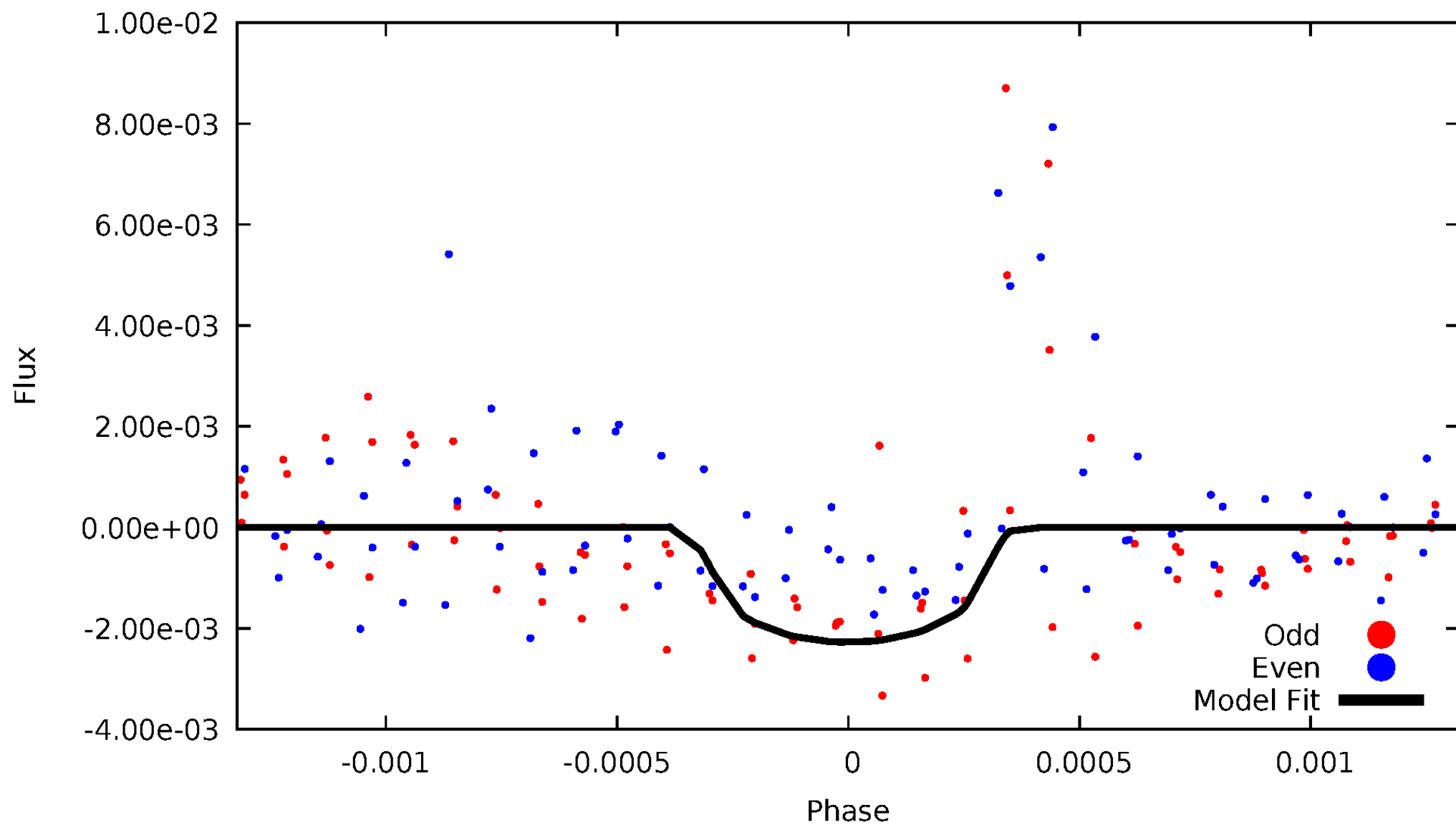


TCE 004819423-04



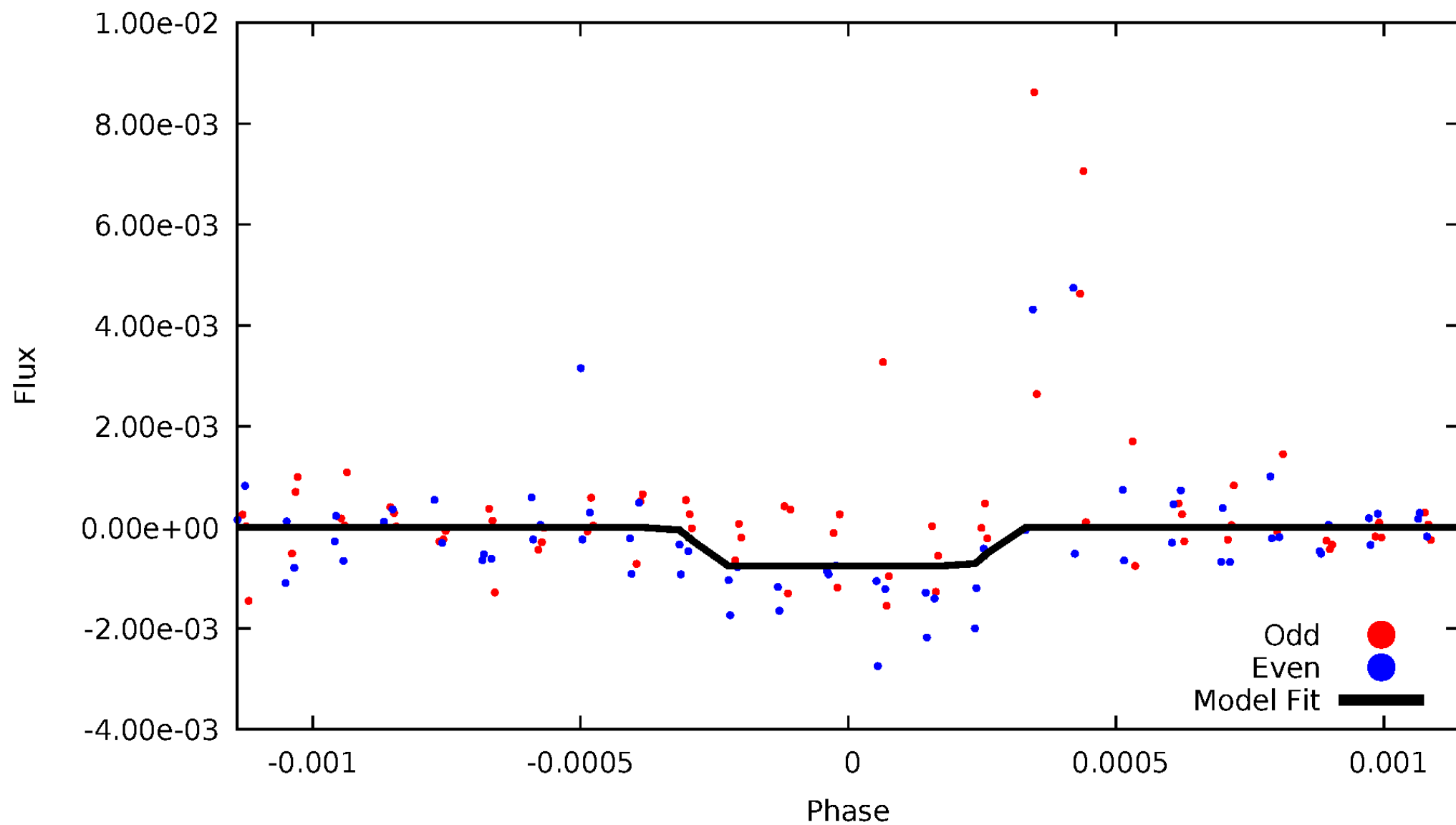
# DV Odd/Even

TCE 004819423-04



# ALT Odd/Even

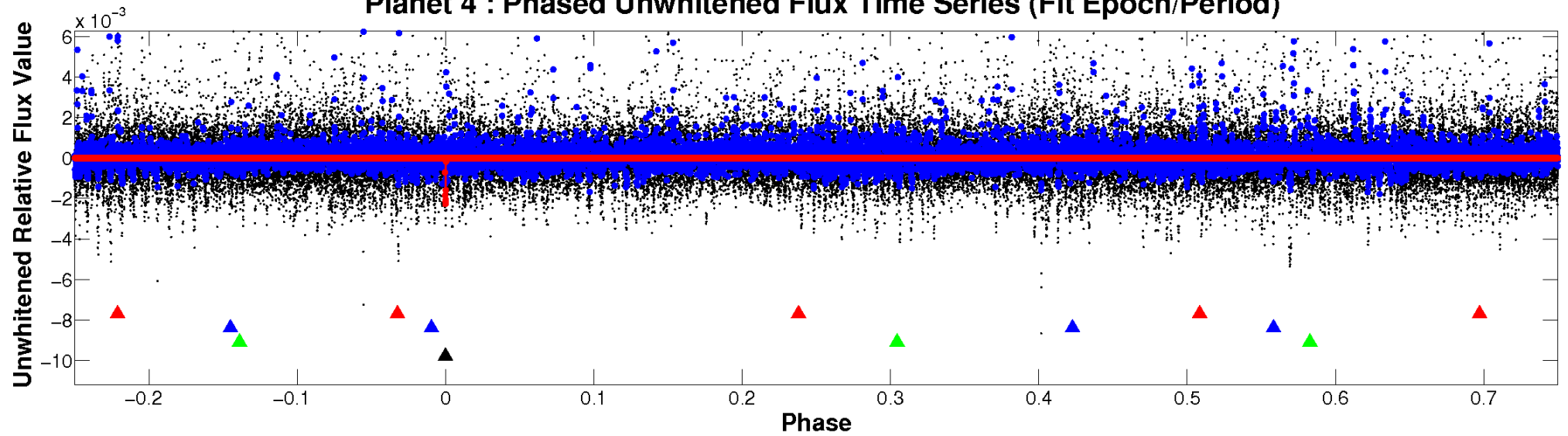
TCE 004819423-04



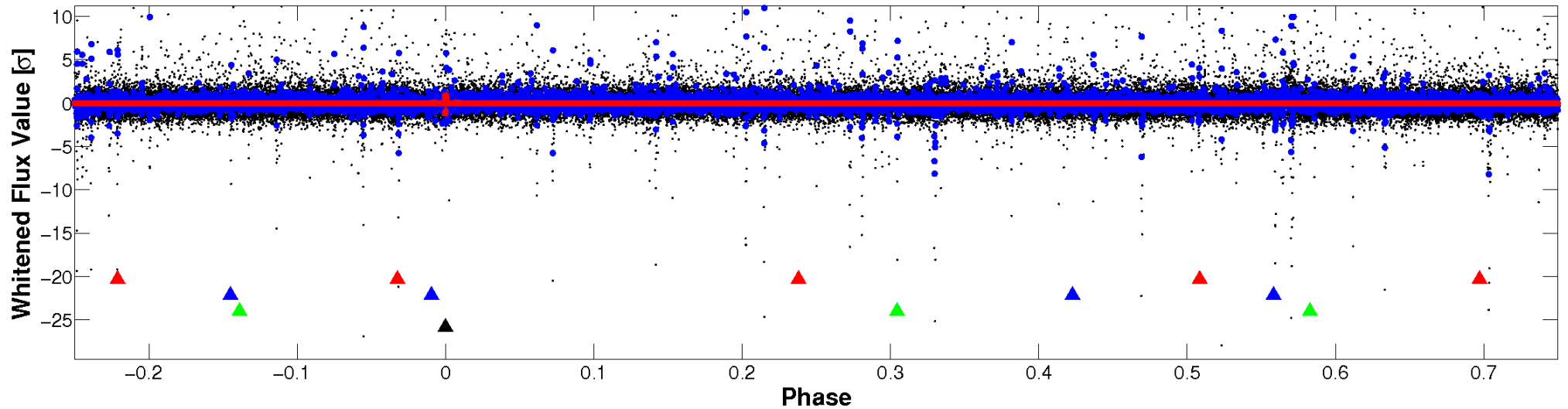


# Non-Whitened Vs. Whitened Light Curve

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



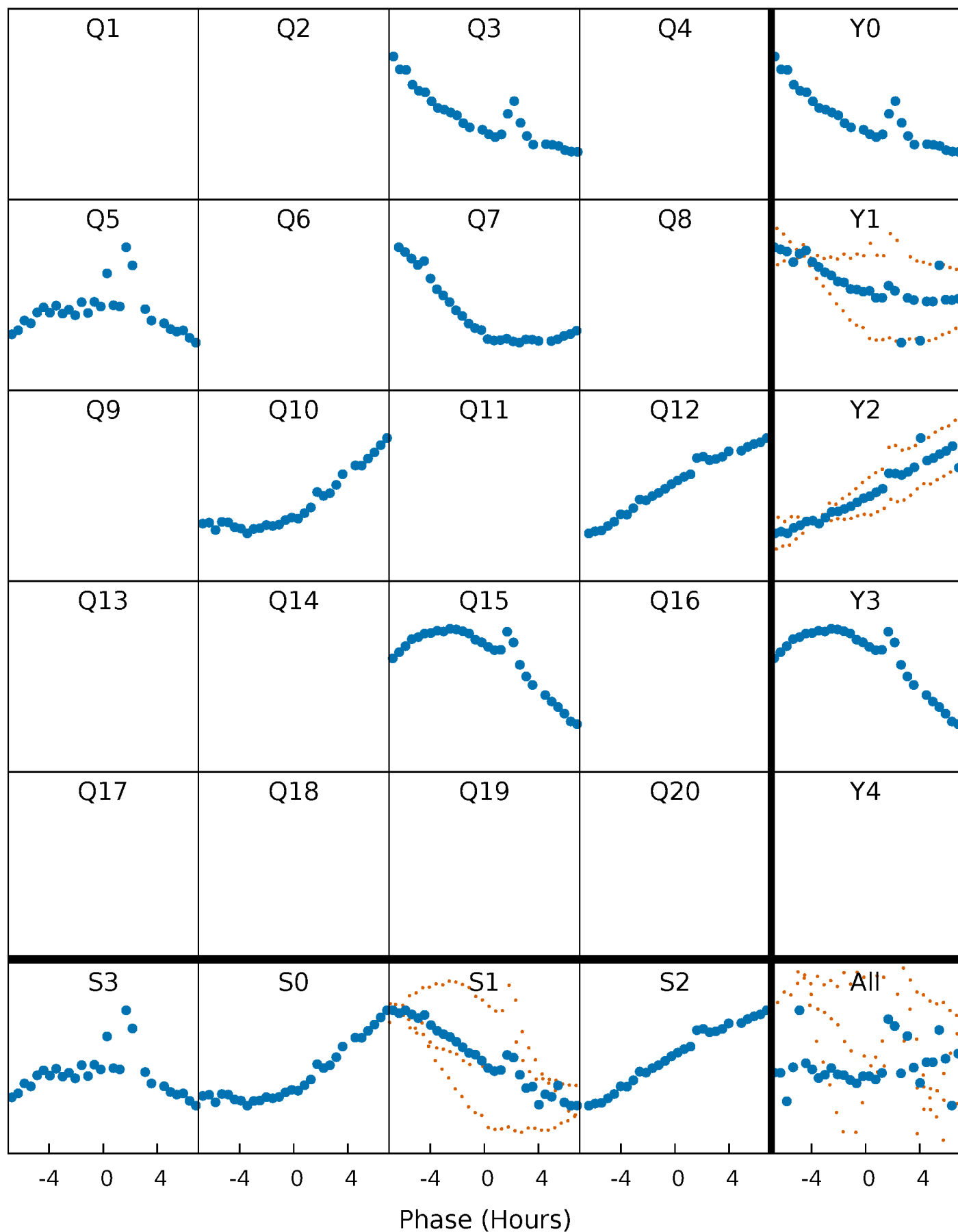
## Planet 4 : Phased Whitened Flux Time Series (Fit Epoch/Period)





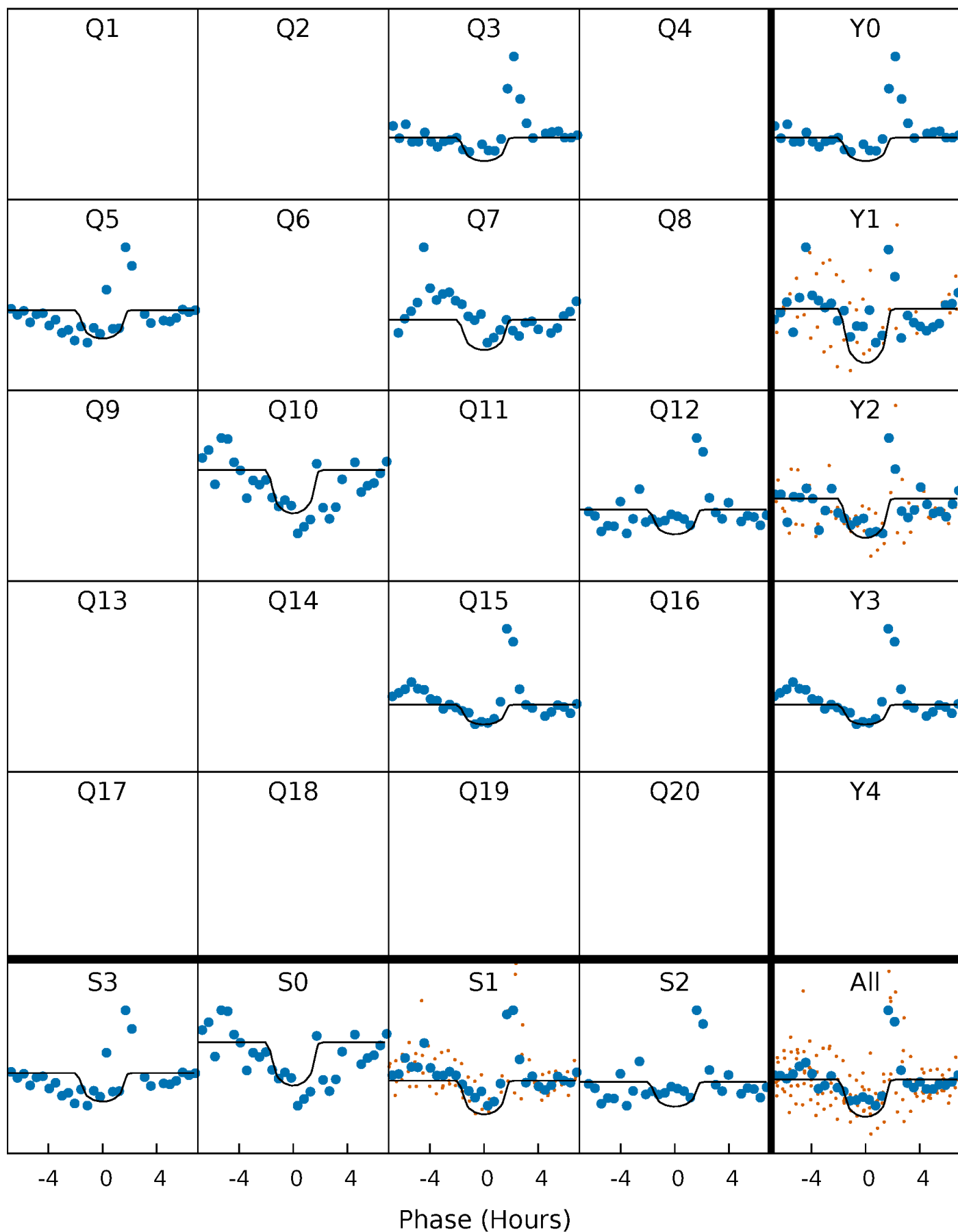
# PDC Quarter-Phased Transit Curves

TCE 004819423-04     $P=222.195401$  Days     $T_0=264.478608$  (BKJD)



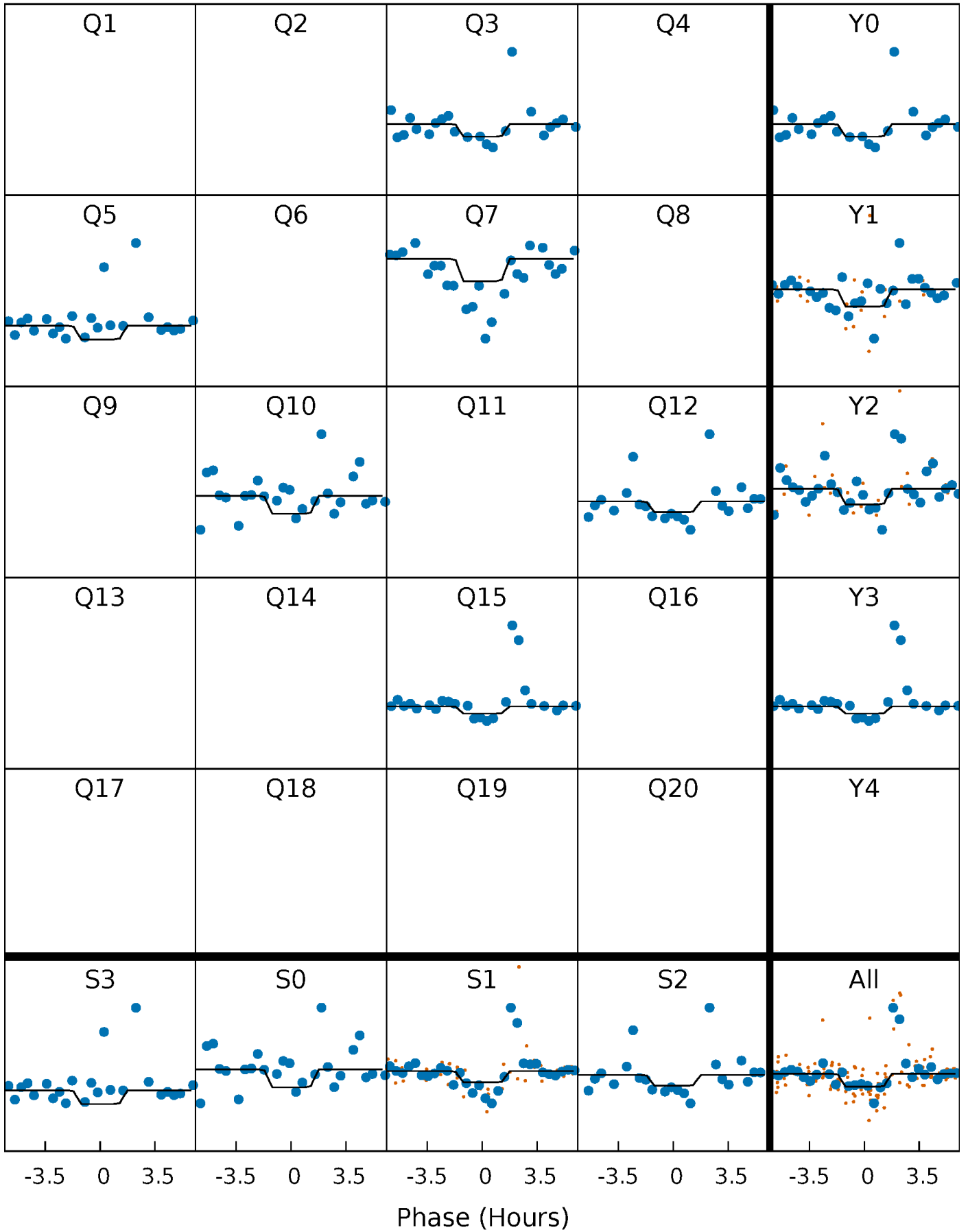
# DV Quarter-Phased Transit Curves

TCE 004819423-04     $P=222.195401$  Days     $T_0=264.478608$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

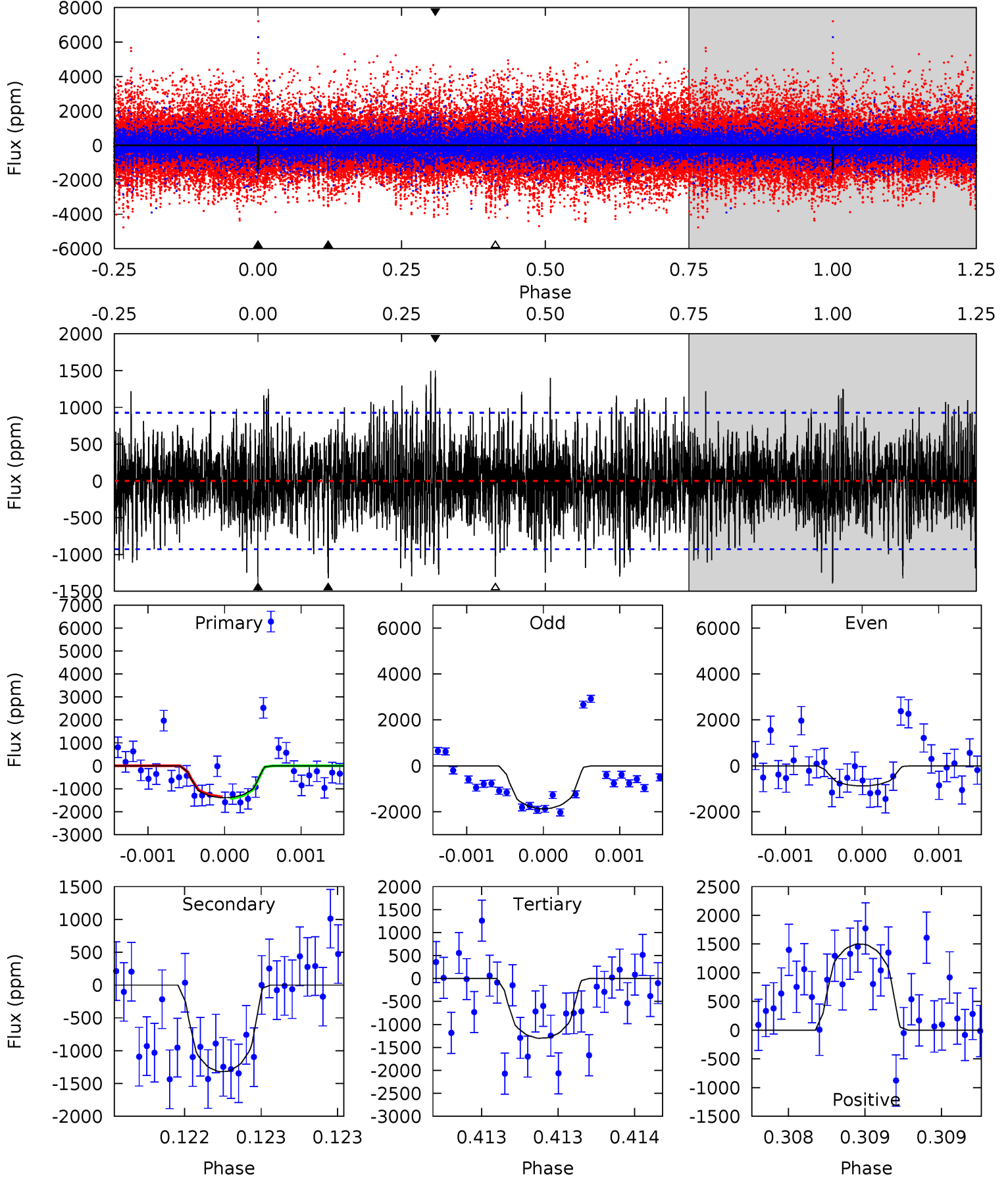
TCE 004819423-04     $P=222.194879$  Days     $T_0=264.479760$  (BKJD)



# DV Model-Shift Uniqueness Test

004819423-04, P = 222.195401 Days, E = 42.283207 Days

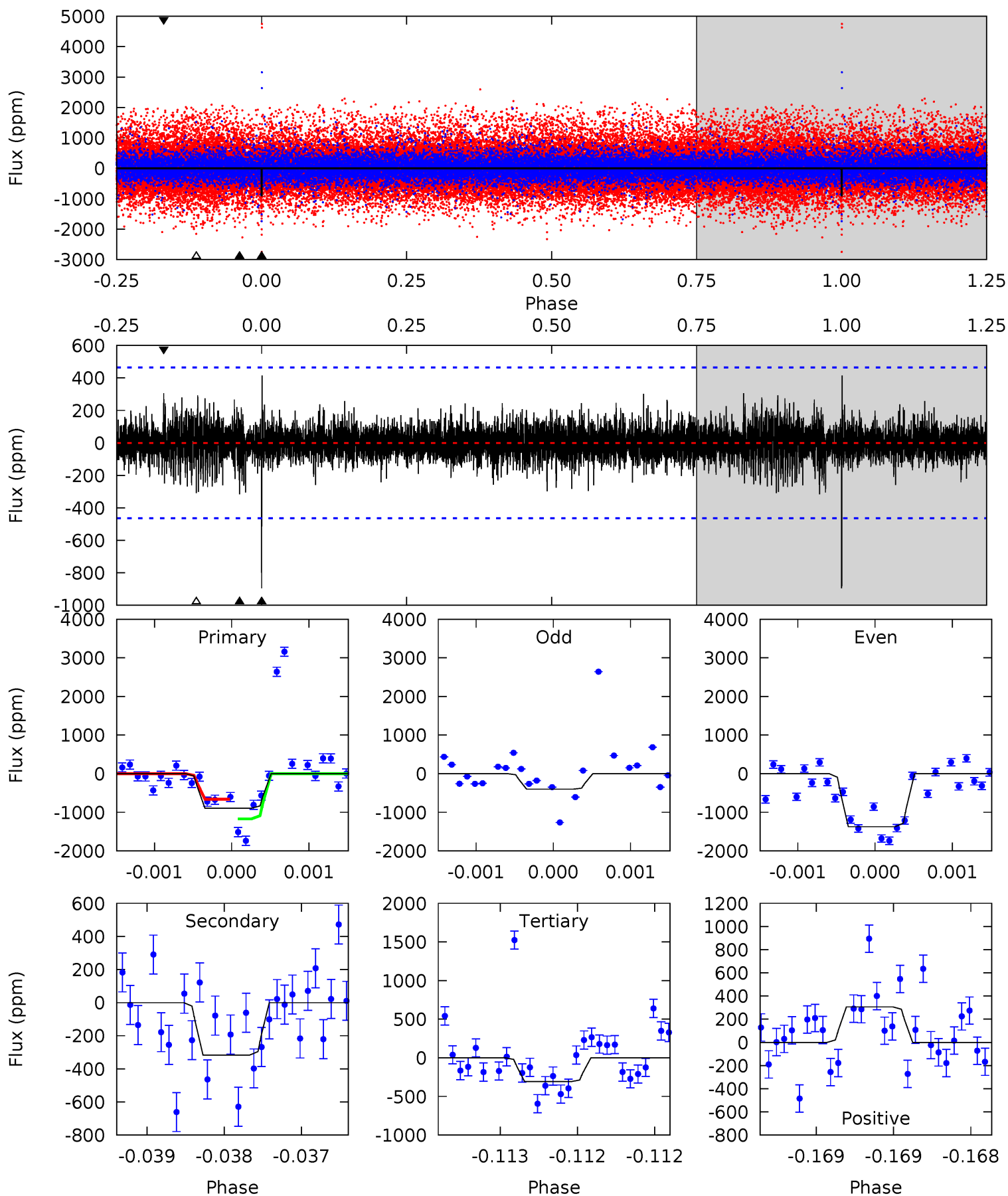
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
8.28	7.87	7.75	8.95	5.52	3.40	2.30	0.53	-0.67	0.12	-1.08	2.92	1.11	0.52	0.23



# Alt Model-Shift Uniqueness Test

004819423-04, P = 222.194879 Days, E = 42.284881 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
10.7	3.77	3.67	3.65	5.53	3.41	0.88	6.99	7.01	0.10	0.12	5.77	0.82	0.32	3.02



### Stellar Parameters For KIC 004819423

	$T_{\text{eff}}(K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$4562^{+150}_{-150}$	$4.552^{+0.064}_{-0.020}$	$0.340^{+0.100}_{-0.300}$	$0.759^{+0.026}_{-0.067}$	$0.749^{+0.043}_{-0.048}$	$2.410^{+0.657}_{-0.199}$
	+3%/-3%	+1%/-0%	+29%/-88%	+3%/-9%	+6%/-6%	+27%/-8%
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 004819423-04 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-1321 \pm 168$	$4.24^{+3.48}_{-2.79}$	$301^{+11}_{-11}$	$4008^{+2266}_{-728}$	$17426^{+119601}_{-12006}$
Alt.	$-317 \pm 84$	$3.56^{+2.89}_{-2.30}$	$301^{+10}_{-11}$	$3343^{+1375}_{-553}$	$5757^{+37536}_{-4116}$

$T_{max}$  = 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

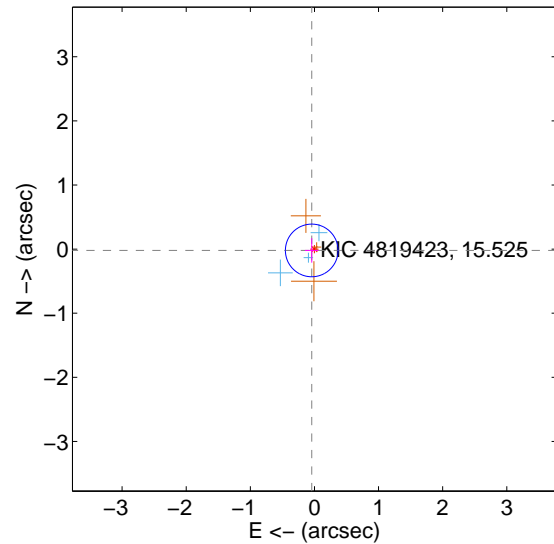
Supplemental centroid analysis for 004819423-04. Kepler magnitude: 15.53. Transit SNR 7.08

There are 3 quarters with good PRF difference image offsets

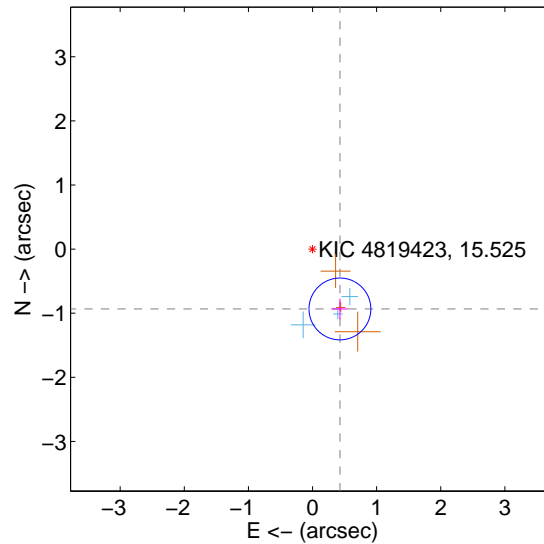
The direct PRF centroid is offset from the target star catalog position by about 1.02 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.047 \pm 0.137$	0.34	$0.042 \pm 0.106$	$-0.021 \pm 0.190$
PRF-fit source offset from KIC position	$1.027 \pm 0.161$	6.39	$-0.427 \pm 0.132$	$-0.934 \pm 0.160$
photometric centroid source offset	$1.38 \pm 0.59$	2.35	$-0.82 \pm 0.57$	$-1.11 \pm 0.60$

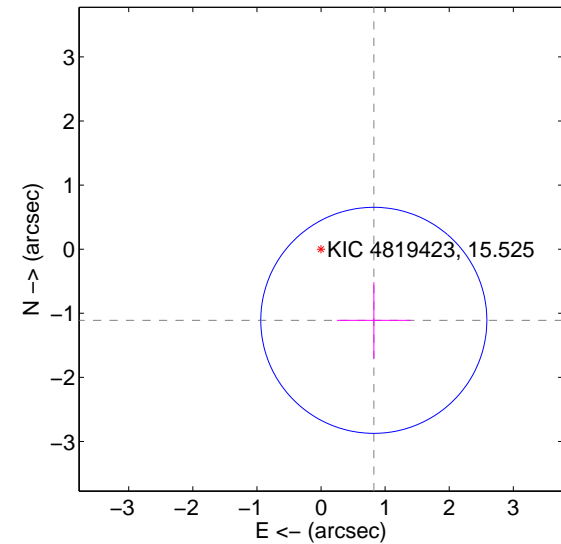
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

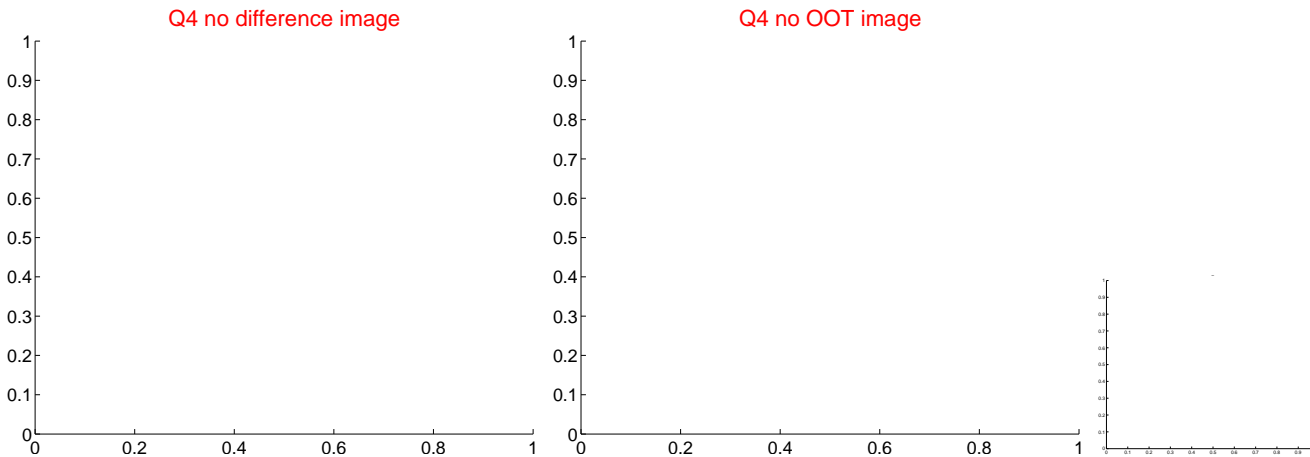
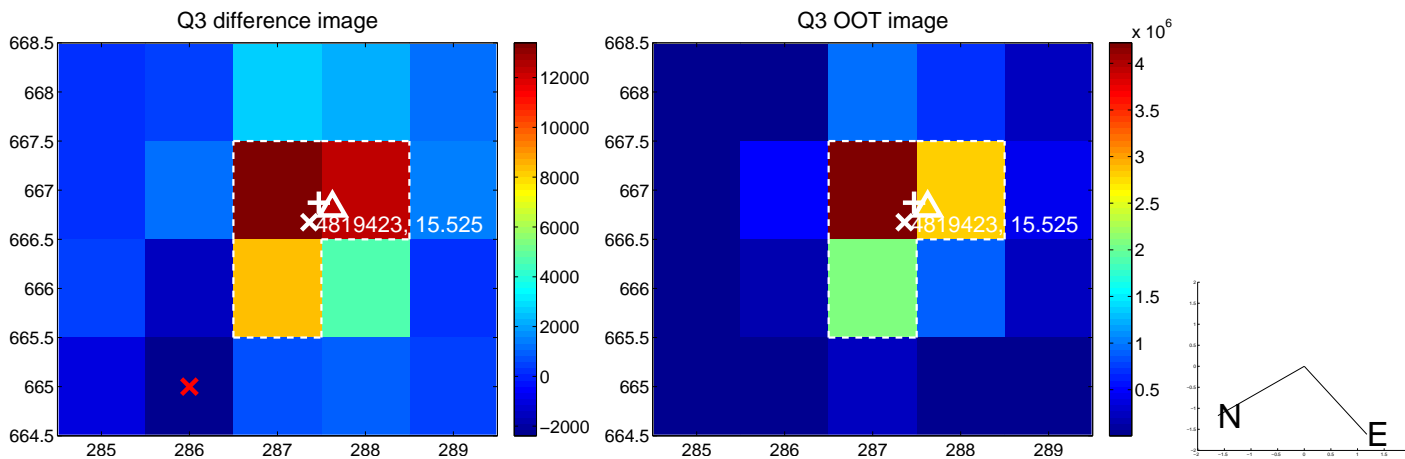
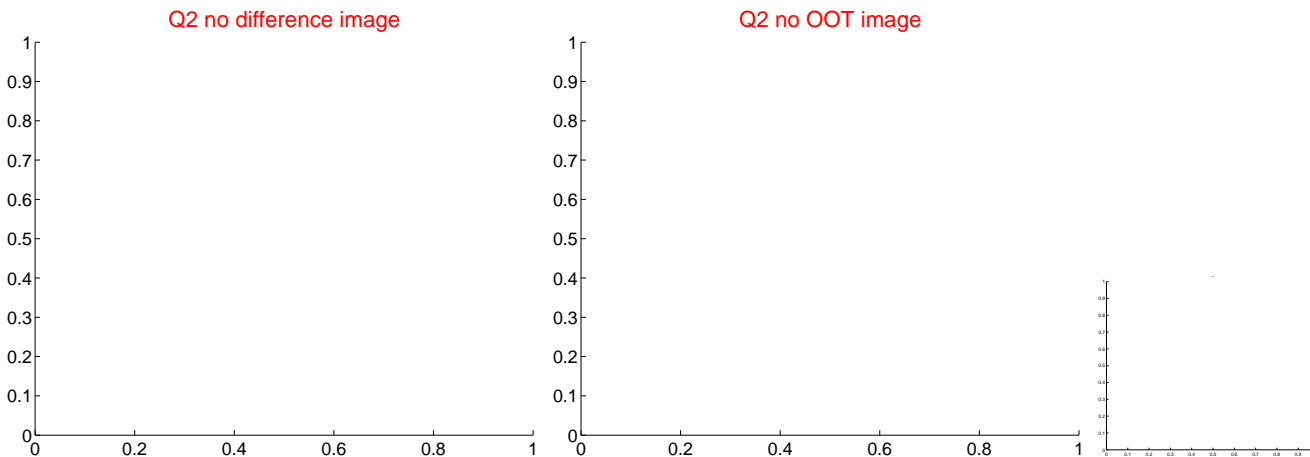
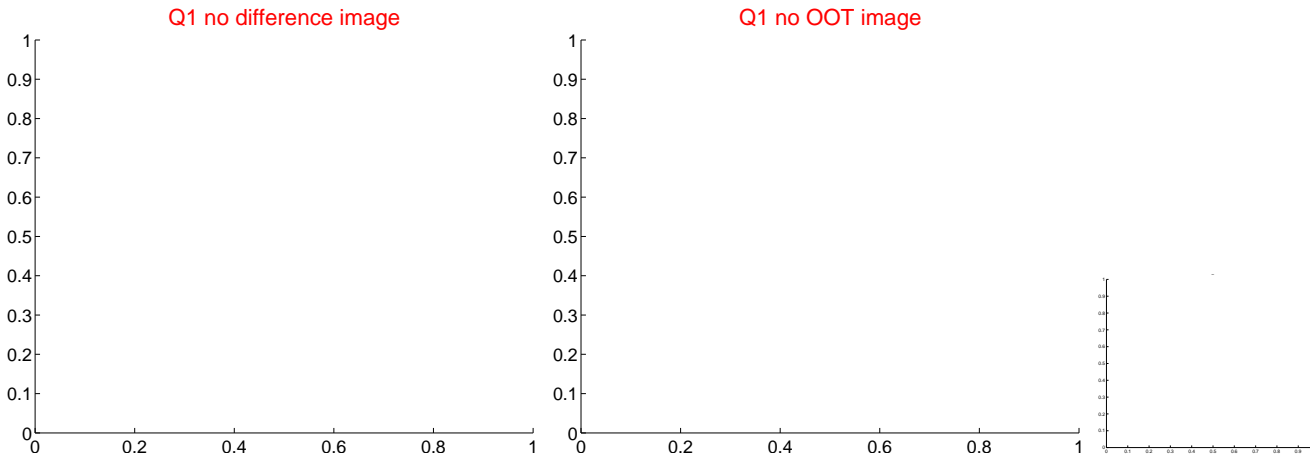


offset from photometric centroids



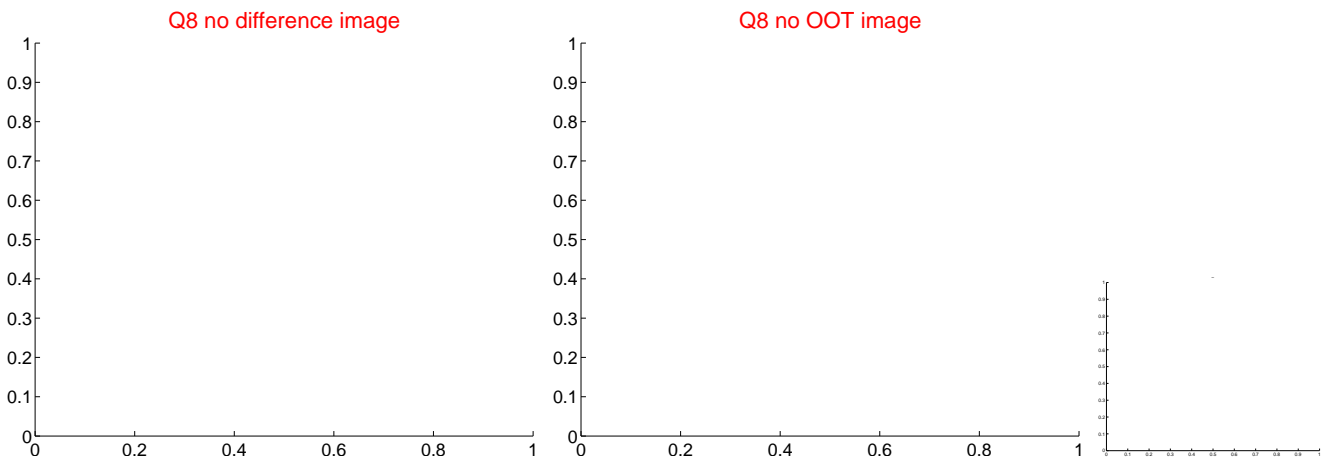
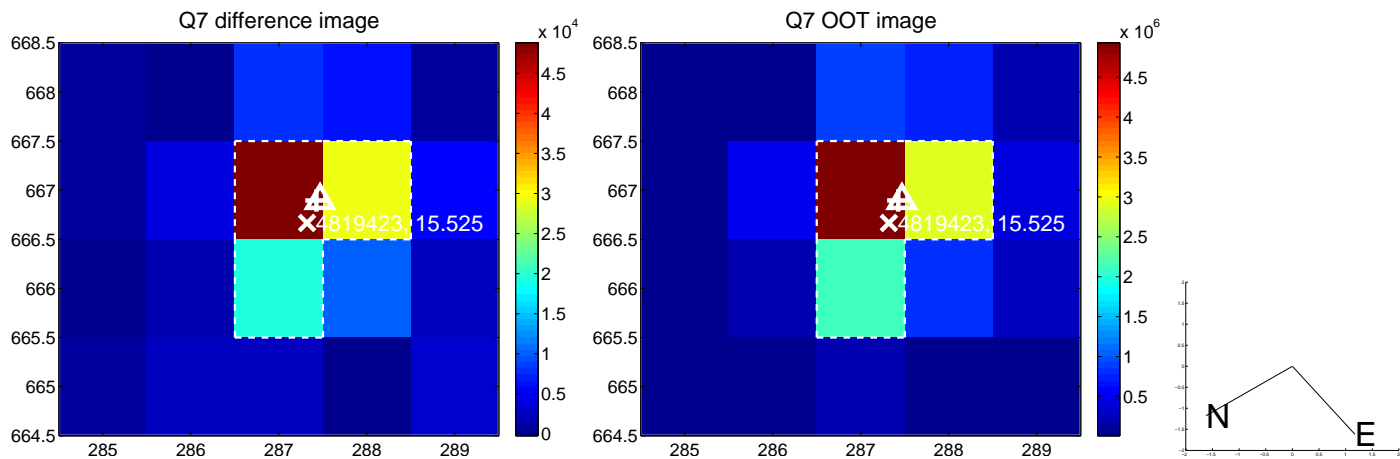
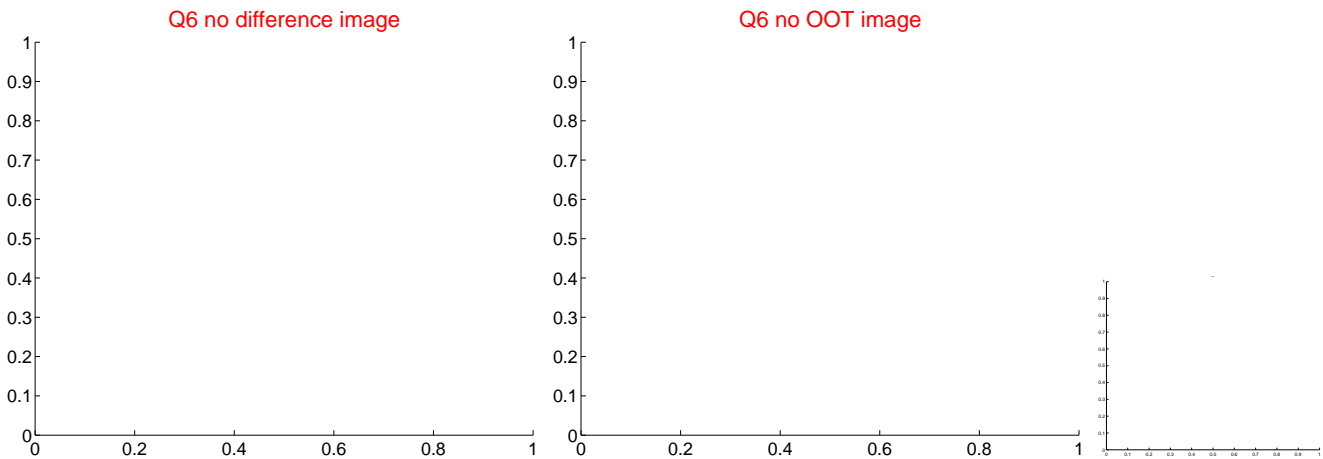
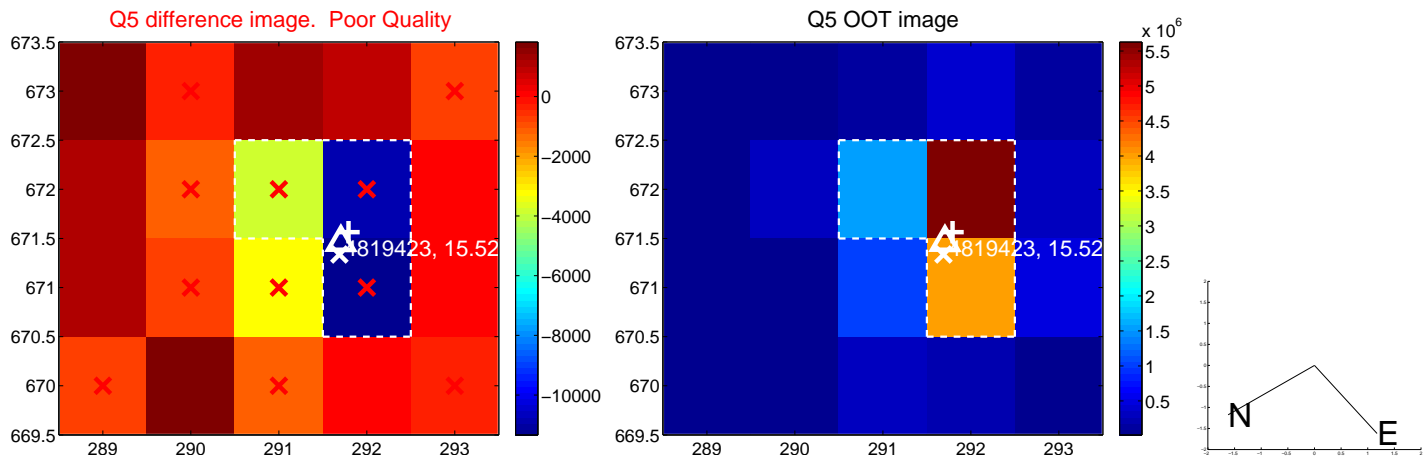
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

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

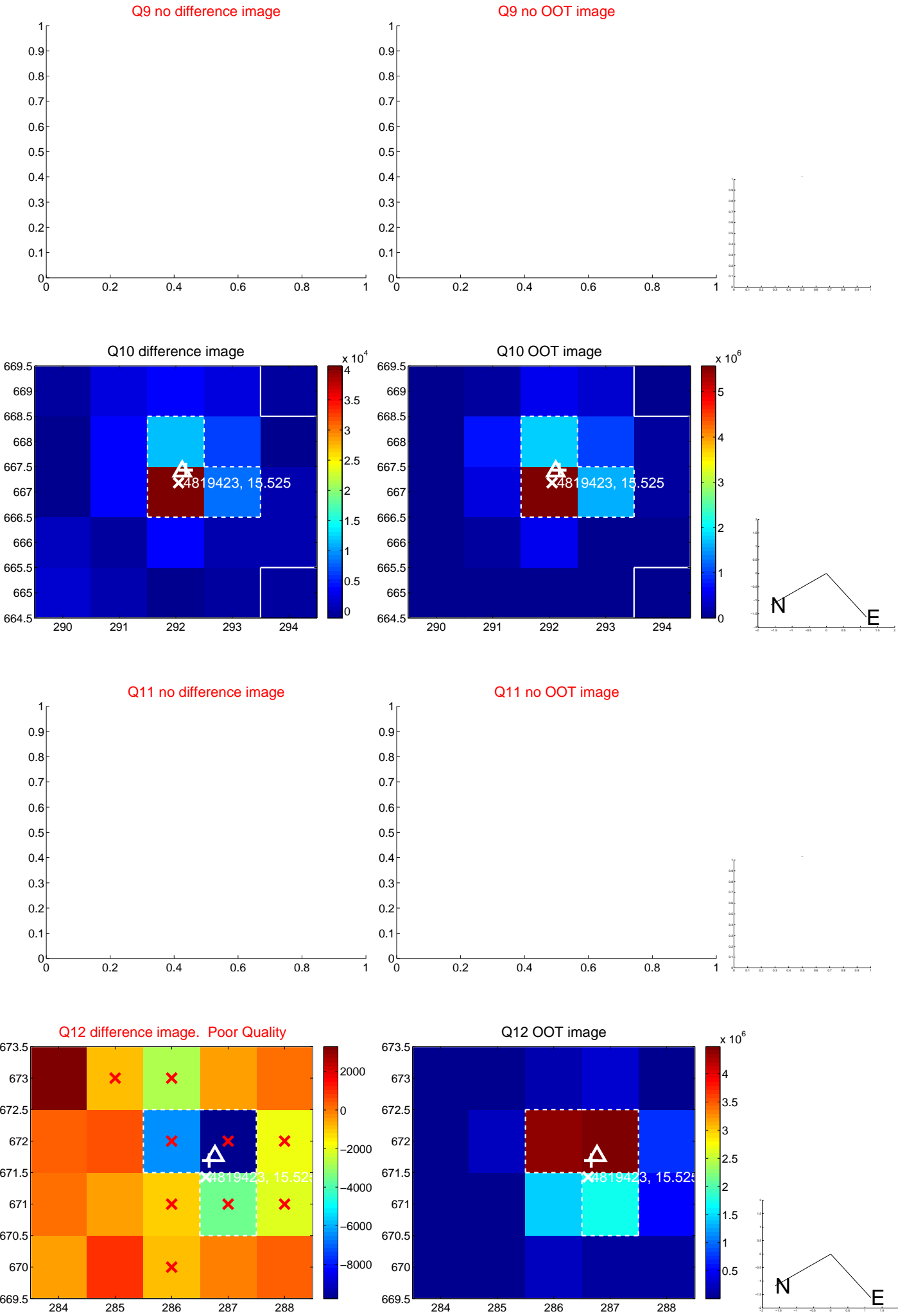




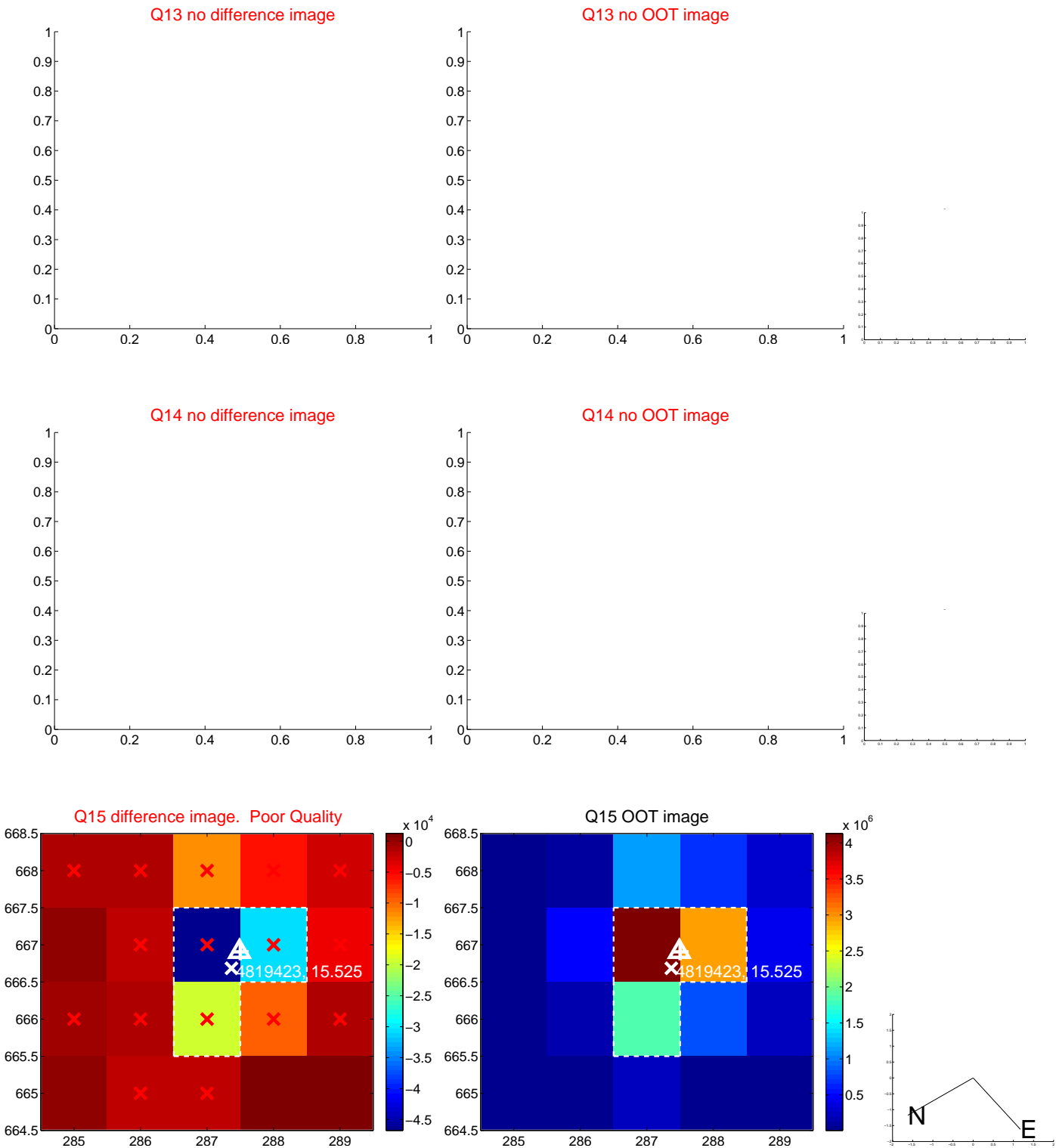
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



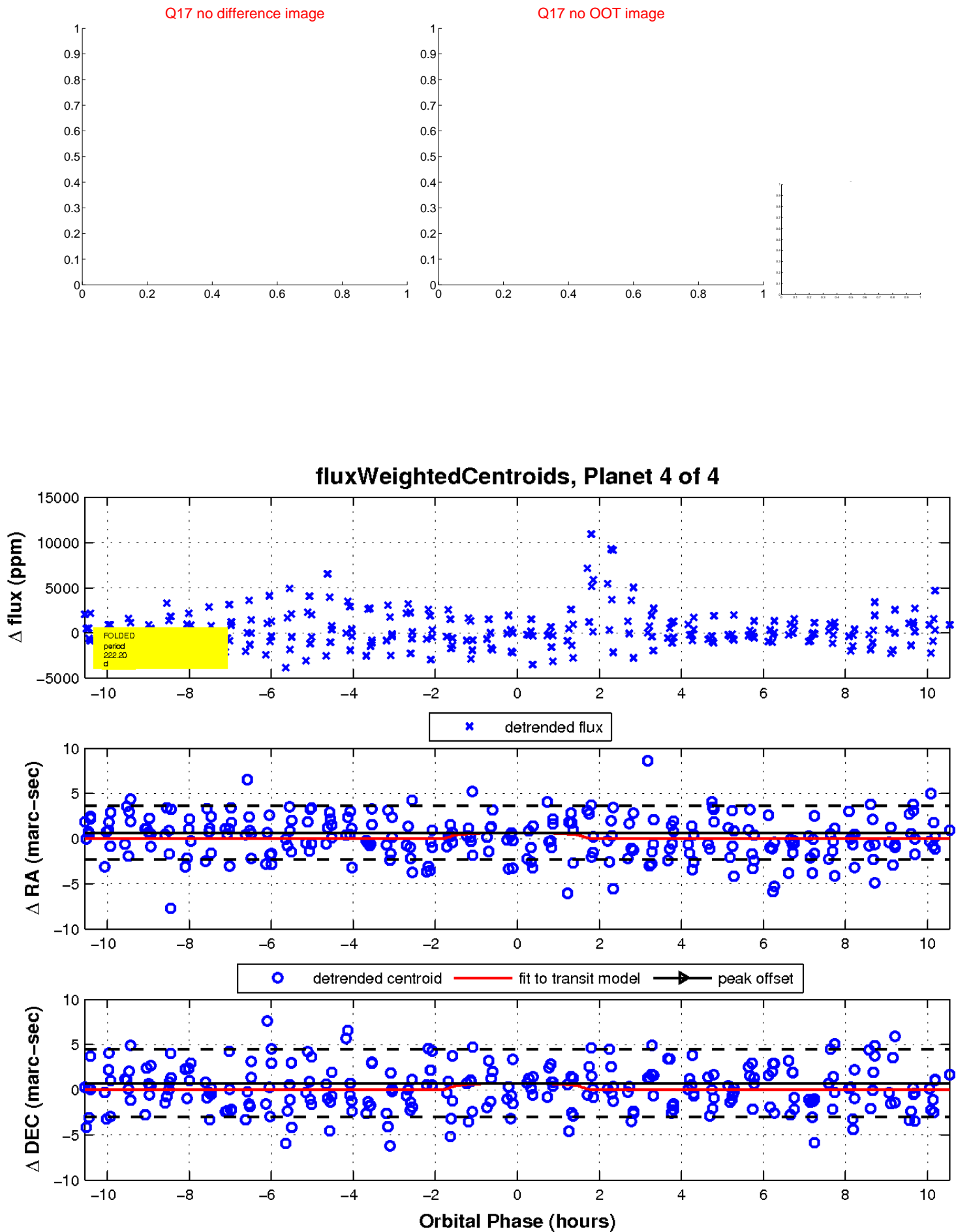
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



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



UKIRT Image

Declination

