

# KIC 009021047

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009021047-01	OBS	7919.01	351.699095	261.769896	2799.6	9.084	29.2	27.9	1.01	6340	8.39	1.49
009021047-02	OBS	No	351.717175	293.699522	3303.8	9.040	25.3	27.9	1.01	6340	10.55	1.49
009021047-03	OBS	No	351.702382	229.799412	1927.4	6.689	17.9	17.7	1.01	6340	7.13	1.49

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009021047-01	OBS	FP	0.00	0	1	0	0	MOD_SEC_DV—MOD_SEC_ALT—DEEP_V_SHAPED—HAS_SEC_TCE—PERIOD_ALIAS_DV—PERIOD_ALIAS_ALT—CENT_FEW_DIFFS
009021047-02	OBS	FP	0.00	1	1	0	0	IS_SEC_TCE—CENT_FEW_DIFFS
009021047-03	OBS	FP	0.00	1	0	1	1	INDIV_TRANS_SKYE—SAME_NTL_PERIOD—CENT_FEW_DIFFS—HALO_GHOST—EPHEM_MATCH

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

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

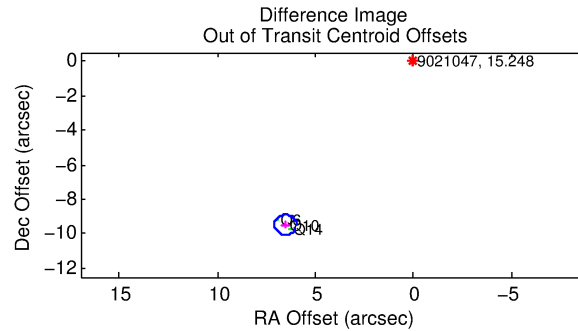
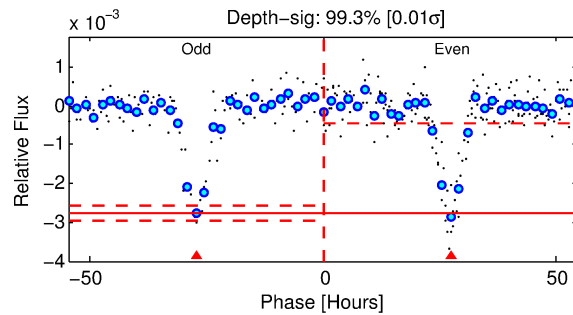
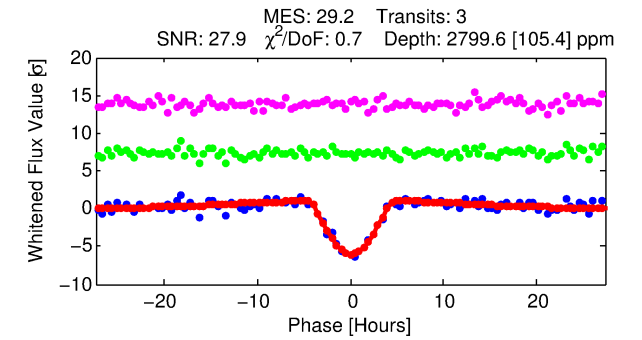
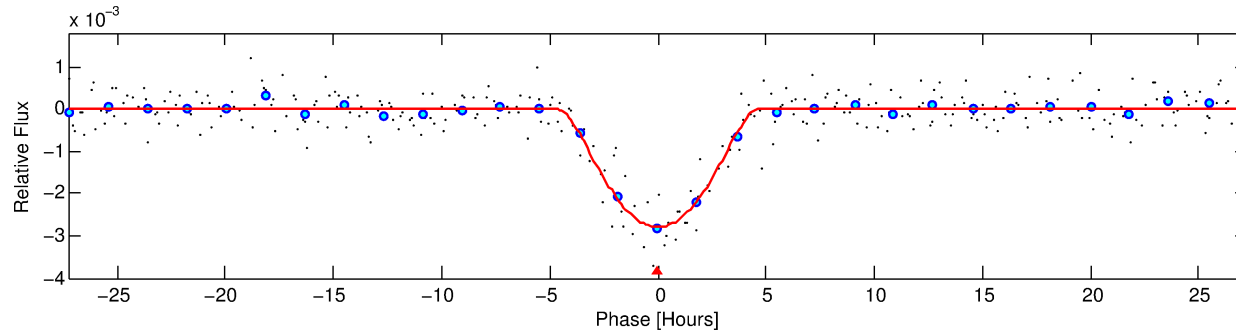
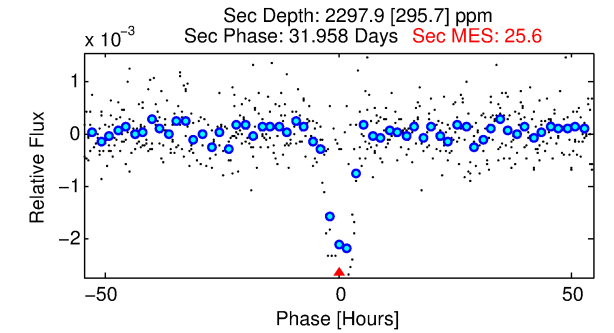
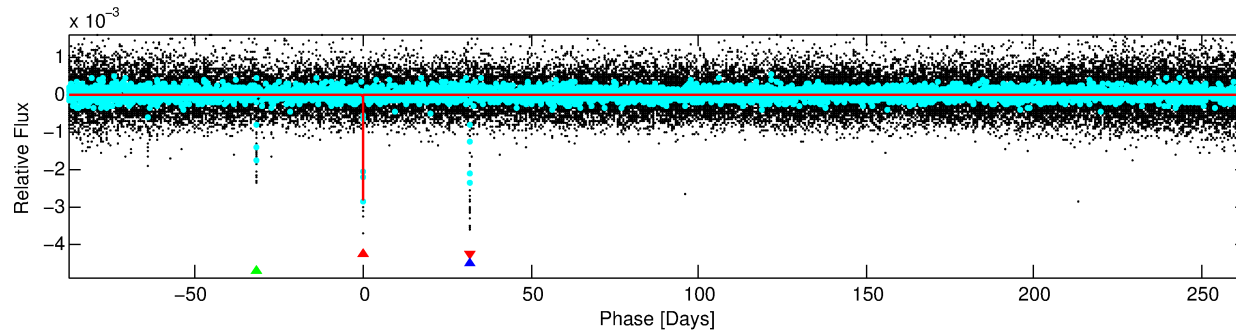
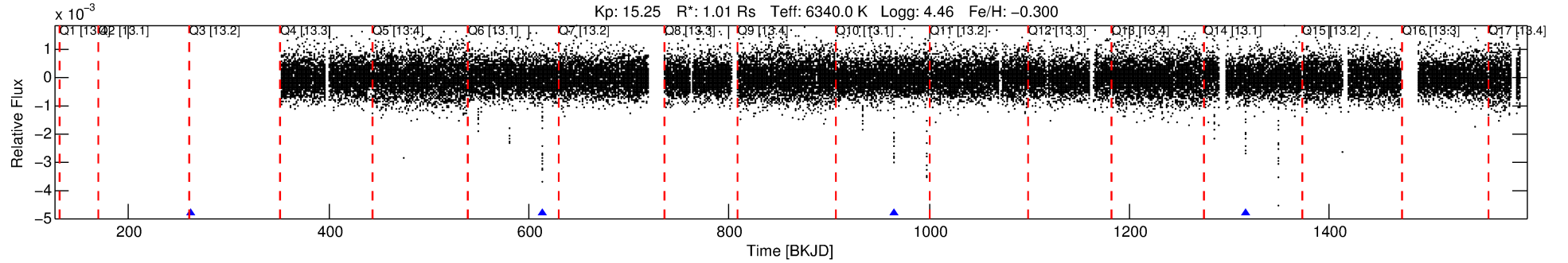
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 009021047-01

No Significant Match Found

# DV One-Page Summary

KIC: 9021047 Candidate: 1 of 3 Period: 351.699 d



## DV Fit Results:

Period = 351.69909 [0.00367] d  
Epoch = 261.7699 [0.0081] BKJD  
Rp/R\* = 0.0761 [0.0455]  
a/R\* = 131.62 [22.59]  
b = 0.98 [0.08]  
Seff = 1.49 [0.60]  
Teq = 282 [29] K  
Rp = 8.39 [5.68] Re  
a = 0.9962 [0.2610] AU  
Ag = 17834.90 [22488.12] [0.79 $\sigma$ ]  
**Teff = 5032 [1526] K [3.1 $\sigma$ ]**

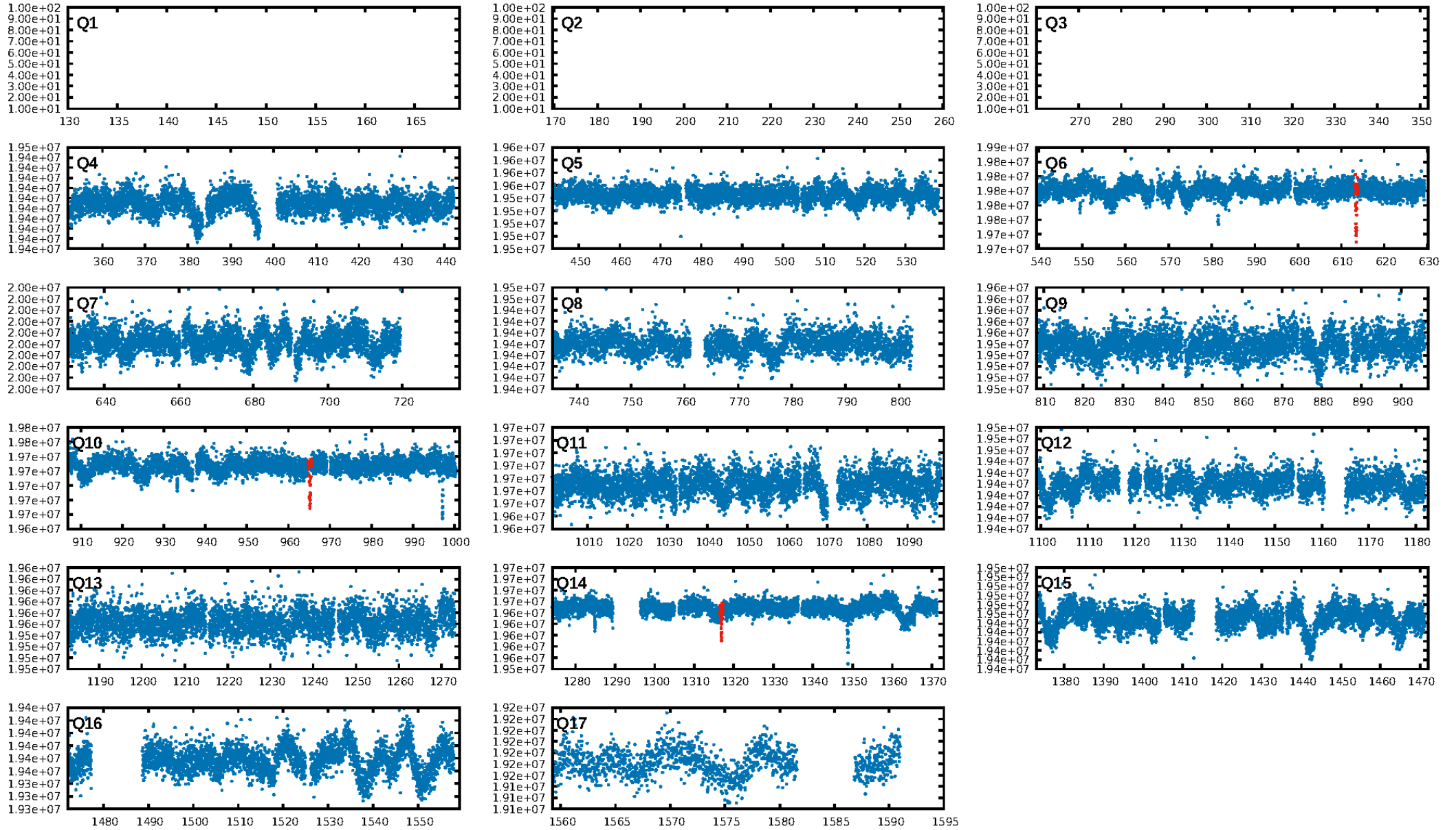
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 0.6% [0.01 $\sigma$ ]  
ModelChiSquare2-sig: 0.5%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 3.70e-109  
RollingBand-fgt: 1.00 [3/3]  
**GhostDiagnostic-chr: 0.4227**  
Centroid-sig: 0.0%  
Centroid-so: 10.027 arcsec [16.73 $\sigma$ ]  
OotOffset-rm: 11.527 arcsec [60.21 $\sigma$ ]  
KicOffset-rm: 5.589 arcsec [30.66 $\sigma$ ]  
OotOffset-st: 3/0/0/0 [3]  
KicOffset-st: 3/0/0/0 [3]  
DiffImageQuality-fgm: 1.00 [3/3]  
DiffImageOverlap-fno: 1.00 [3/3]

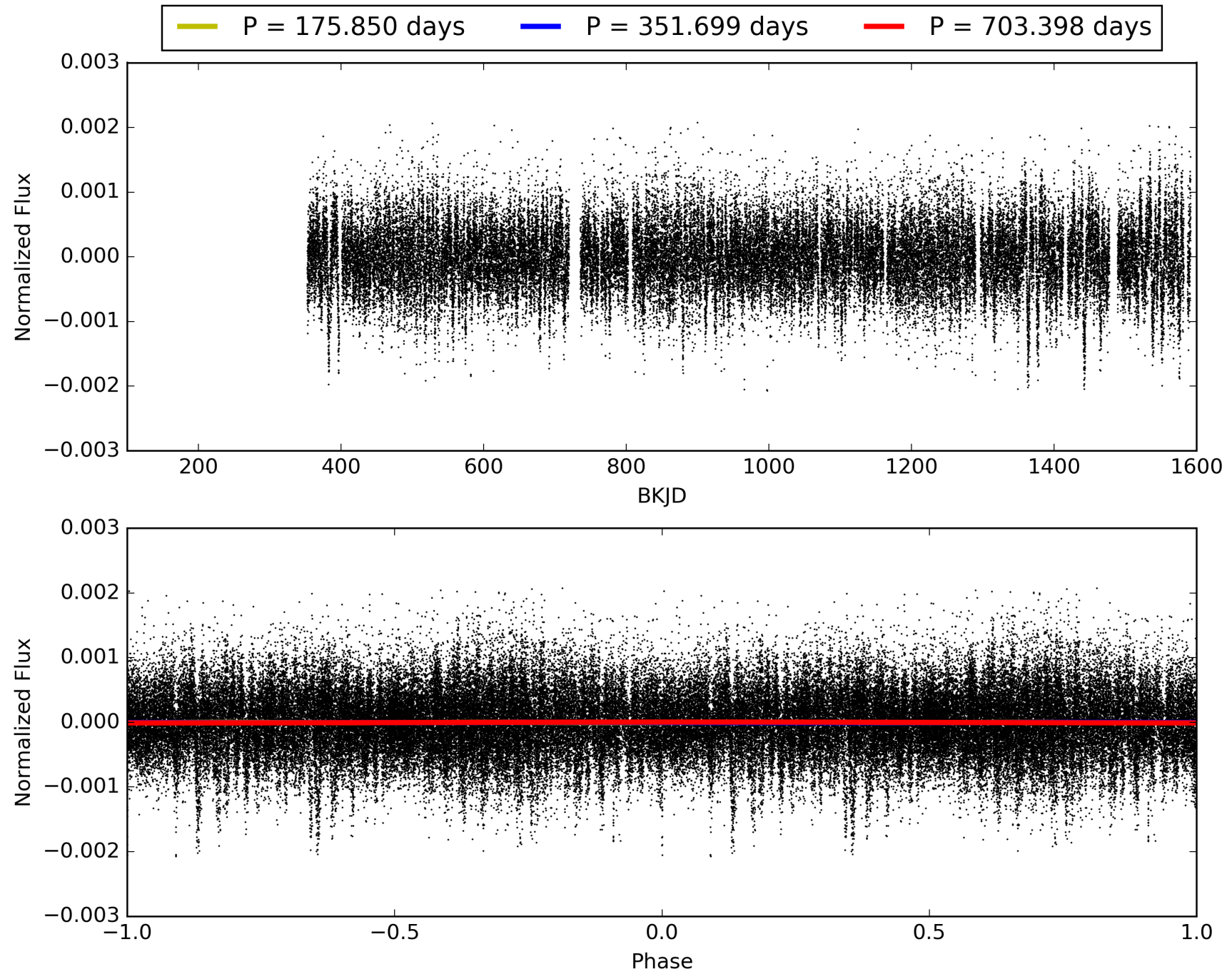
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 30-Jan-2016 21:32:44 Z

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

# TCE 009021047-01, PDC Light Curves

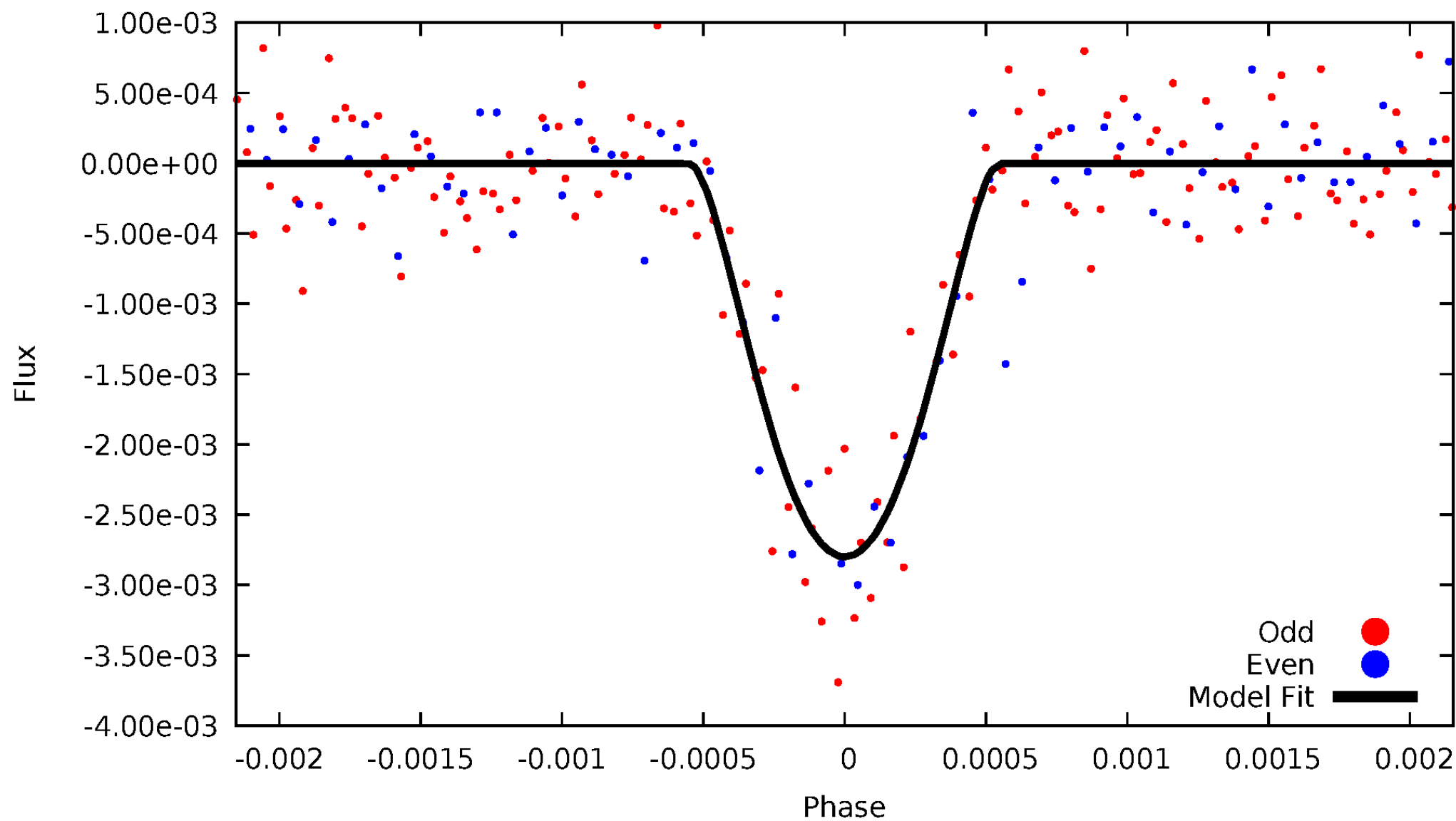


TCE 009021047-01



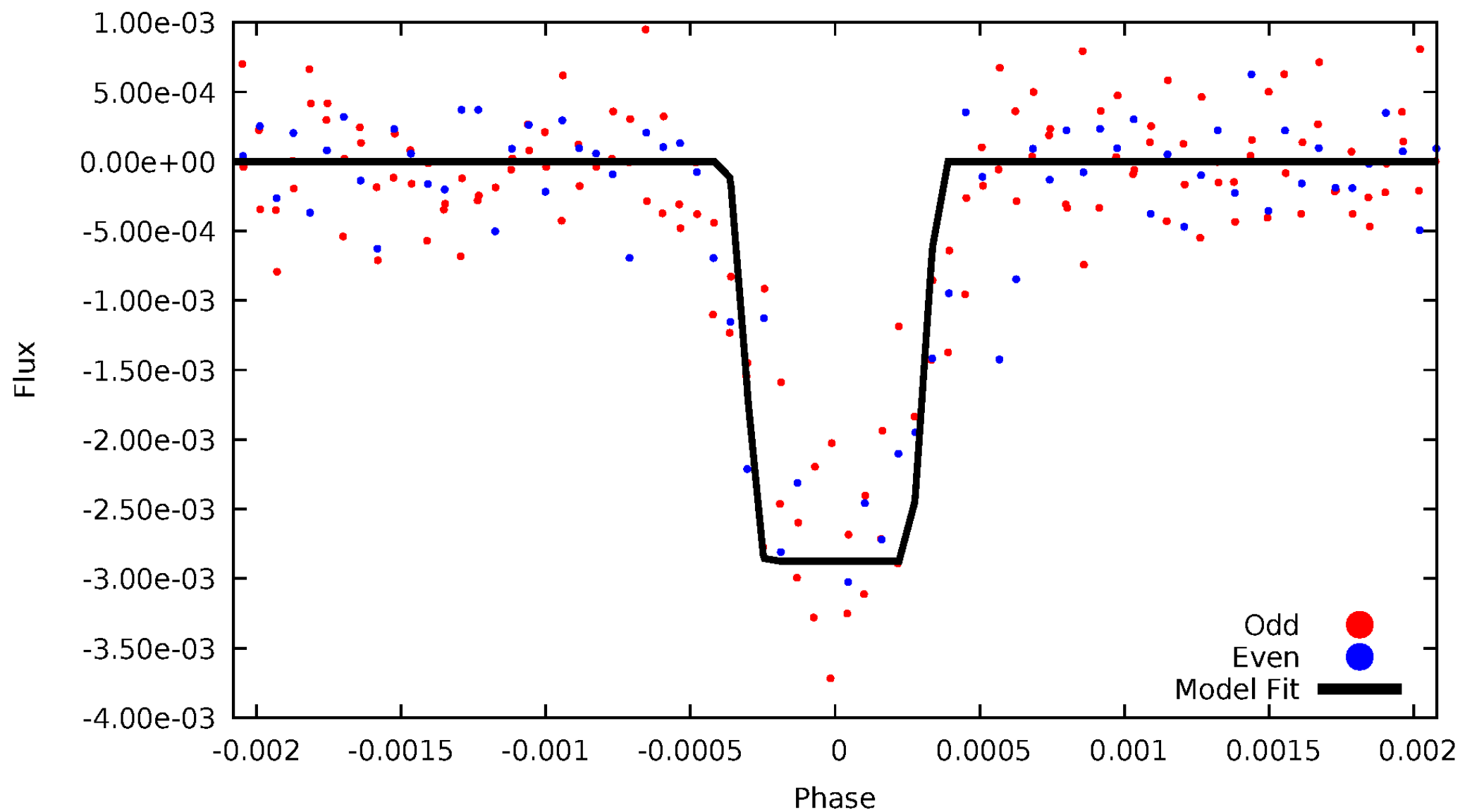
# DV Odd/Even

TCE 009021047-01



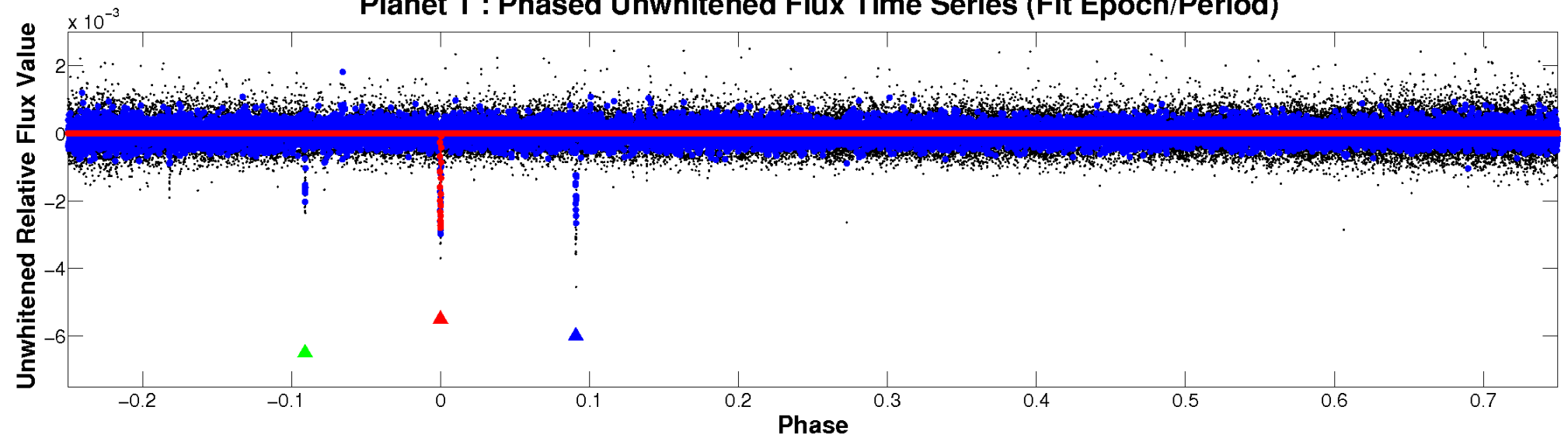
# ALT Odd/Even

TCE 009021047-01

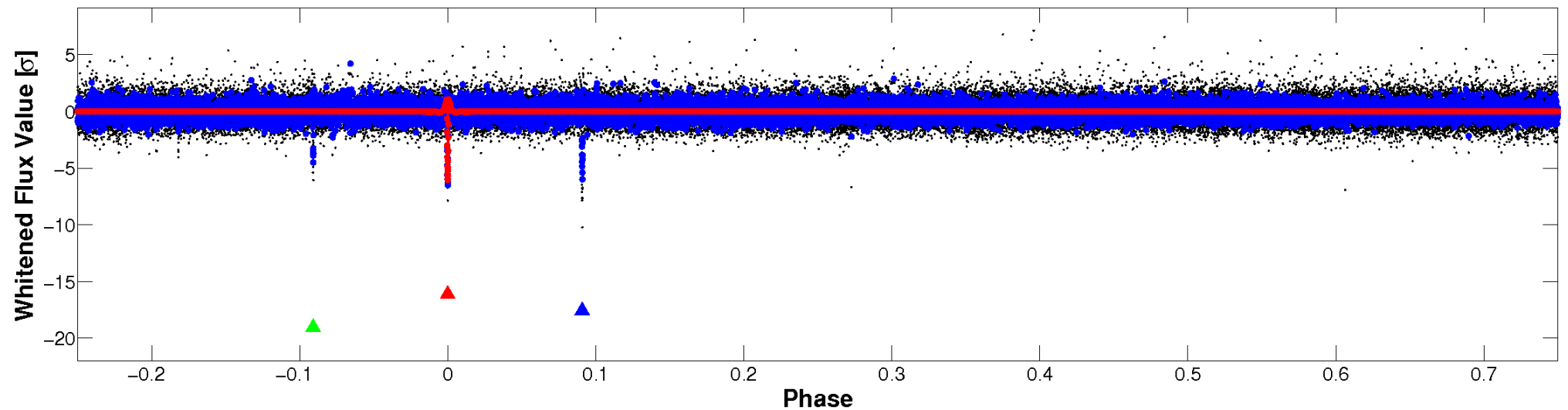


# Non-Whitened Vs. Whitened Light Curve

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

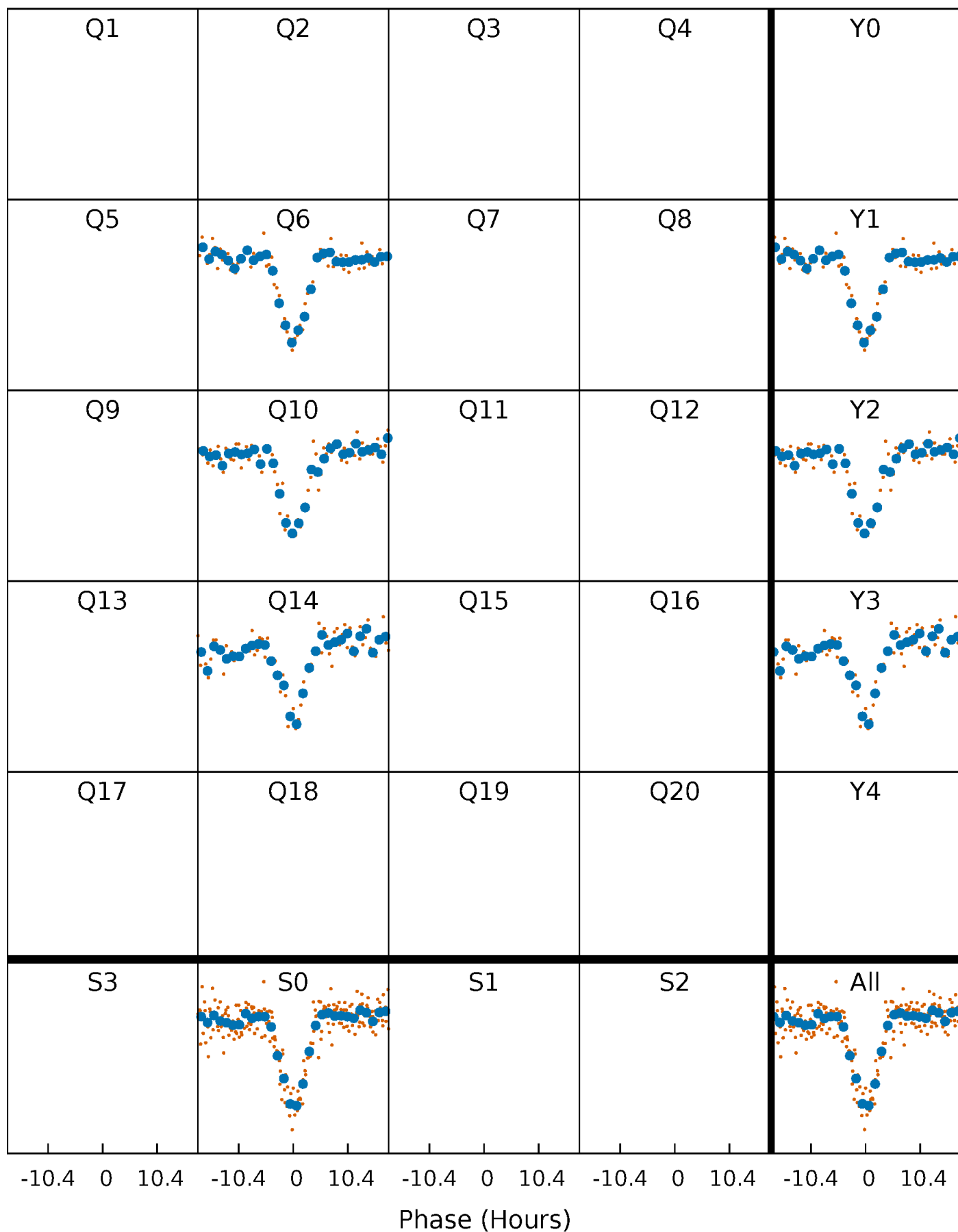


**Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



# PDC Quarter-Phased Transit Curves

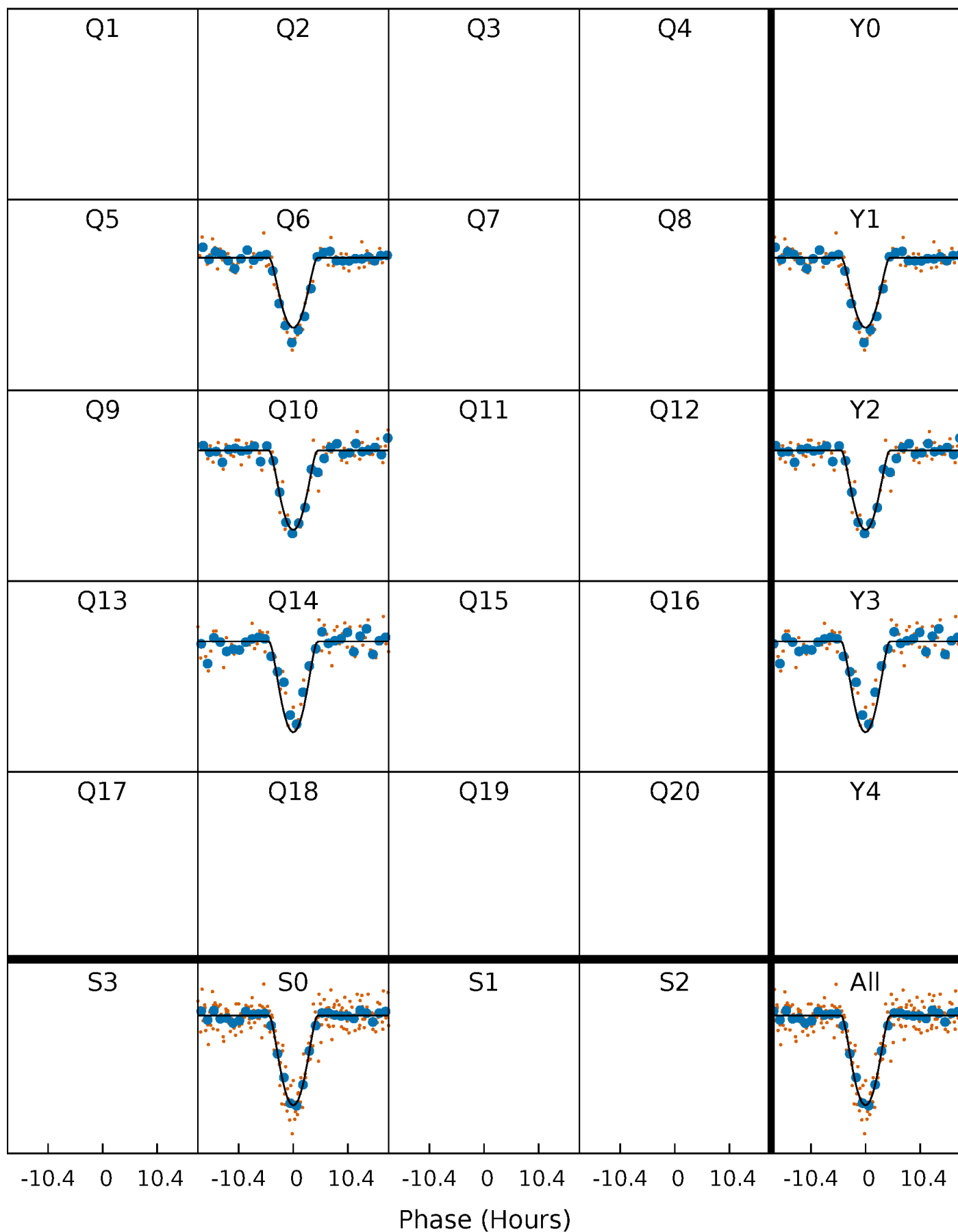
TCE 009021047-01 P=351.699095 Days  $T_0=261.769896$  (BKJD)





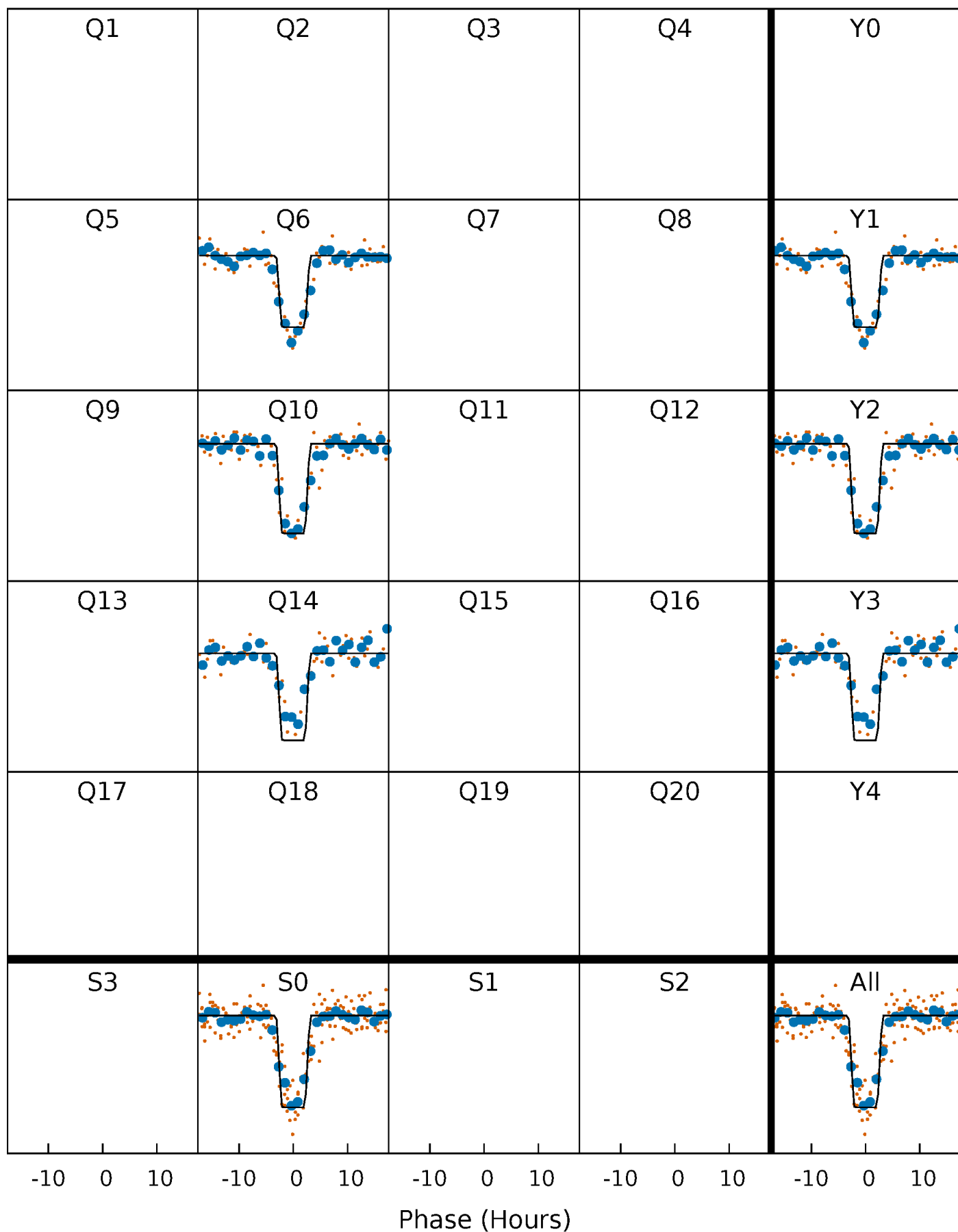
# DV Quarter-Phased Transit Curves

TCE 009021047-01 P=351.699095 Days  $T_0=261.769896$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

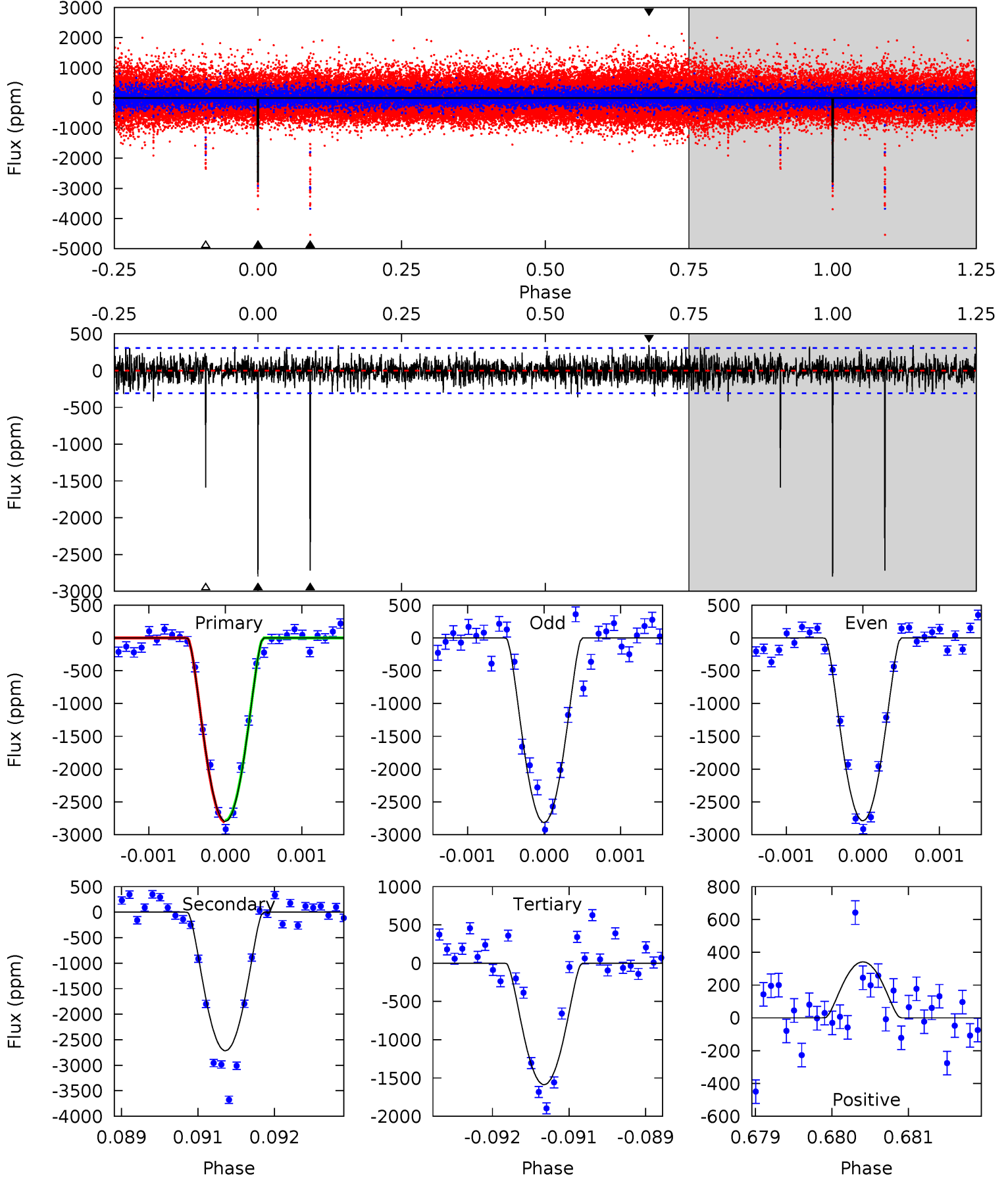
TCE 009021047-01 P=351.702435 Days  $T_0=261.763892$  (BKJD)



# DV Model-Shift Uniqueness Test

009021047-01, P = 351.699095 Days, E = 261.769896 Days

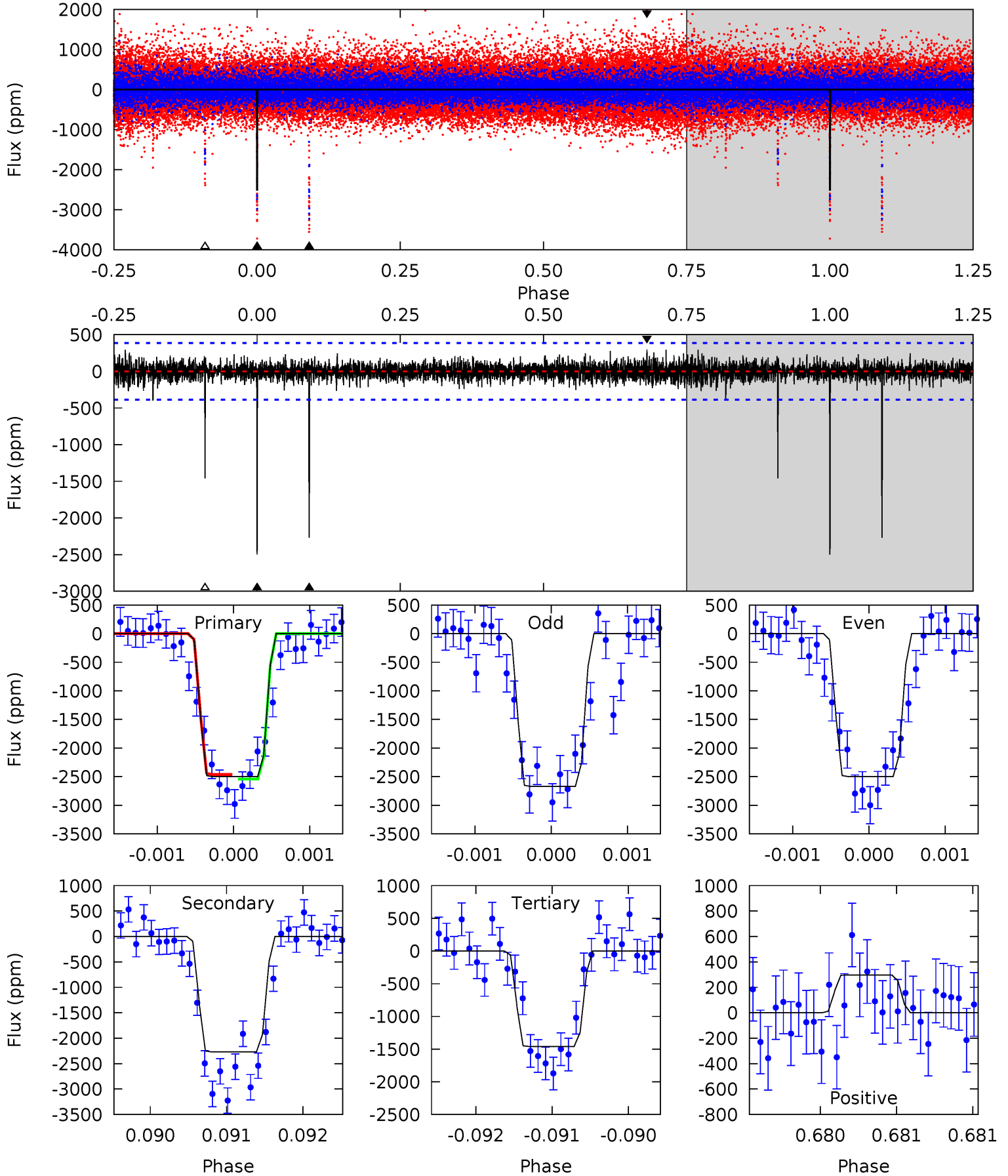
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
49.4	48.0	28.0	6.03	5.43	3.26	1.78	21.4	43.4	19.9	41.9	0.22	0.99	0.11	0.20



# Alt Model-Shift Uniqueness Test

009021047-01, P = 351.702435 Days, E = 261.763892 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
35.7	32.4	20.9	4.25	5.51	3.39	1.14	14.9	31.5	11.5	28.2	1.12	0.99	0.11	0.57



### Stellar Parameters For KIC 009021047

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6340^{+176}_{-242}$	$4.457^{+0.067}_{-0.202}$	$-0.300^{+0.250}_{-0.350}$	$1.010^{+0.320}_{-0.107}$	$1.066^{+0.143}_{-0.143}$	$1.458^{+0.405}_{-0.755}$
	+3%/-4%	+2%/-5%	+83%/-117%	+32%/-11%	+13%/-13%	+28%/-52%
Source	KIC0	KIC0	KIC0	DSEP		

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

### Secondary Eclipse Parameters for KIC 009021047-01 / KOI 7919.01

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-2716 \pm 57$	$8.86^{+5.41}_{-4.71}$	$398^{+29}_{-19}$	$5217^{+2486}_{-876}$	$18493^{+64366}_{-11250}$
Alt.	$-2269 \pm 70$	$7.14^{+5.32}_{-4.36}$	$399^{+33}_{-20}$	$5612^{+3542}_{-1156}$	$24729^{+131924}_{-17033}$

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

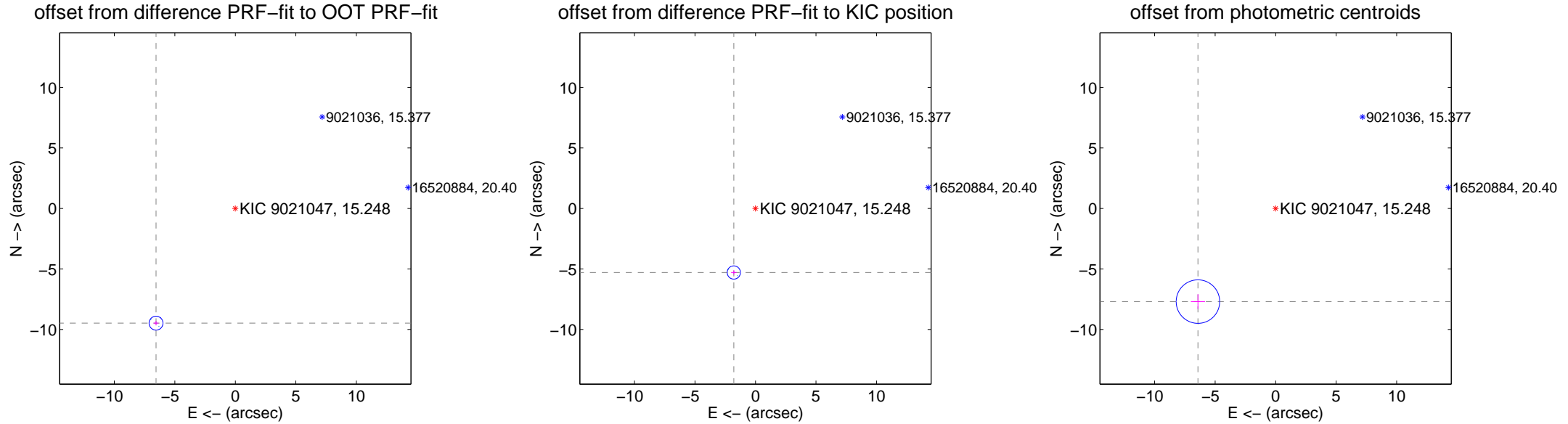
## DV Centroid Data

Supplemental centroid analysis for 009021047-01. Kepler magnitude: 15.25. Transit SNR 27.94

There are 3 quarters with good PRF difference image offsets

The OOT PRF centroid is offset from the target star catalog position by about 6.38 arcsec so the offset from difference PRF-fit to OOT-fit may be invalid.

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$11.527 \pm 0.191$	60.21	$6.556 \pm 0.208$	$-9.481 \pm 0.183$
PRF-fit source offset from KIC position	$5.589 \pm 0.182$	30.66	$1.792 \pm 0.229$	$-5.294 \pm 0.176$
photometric centroid source offset	$10.03 \pm 0.60$	16.73	$6.42 \pm 0.59$	$-7.70 \pm 0.61$



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

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



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

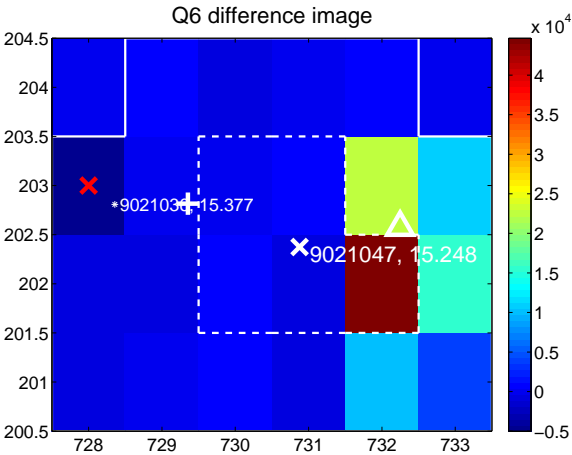
Q5 no difference image



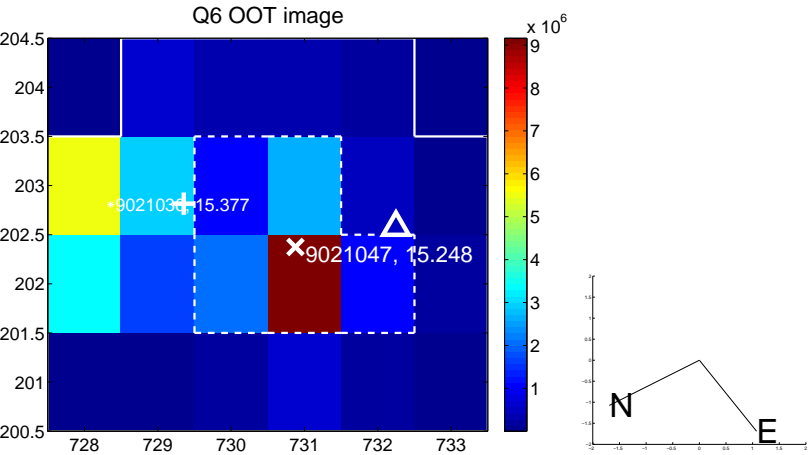
Q5 no OOT image



Q6 difference image



Q6 OOT image



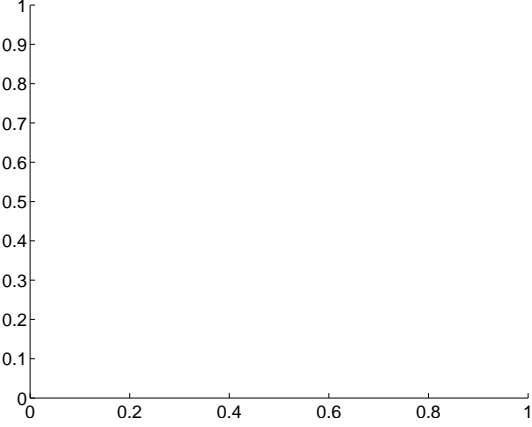
Q7 no difference image



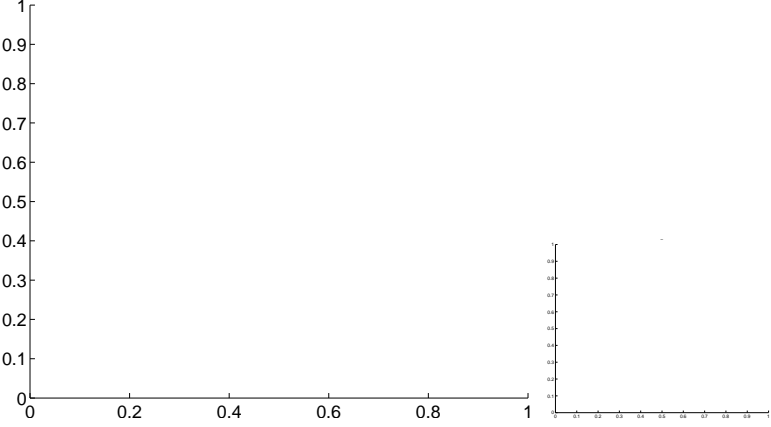
Q7 no OOT image



Q8 no difference image



Q8 no OOT image





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

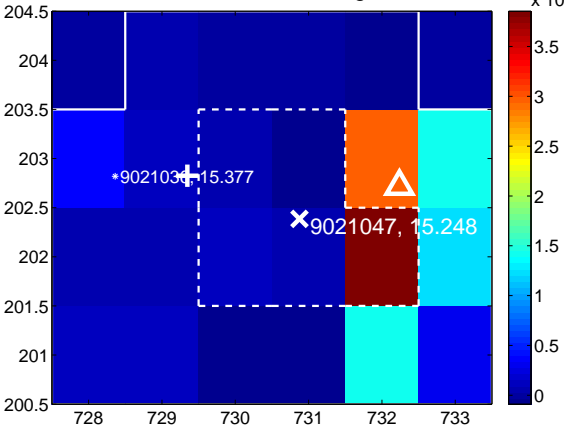
Q9 no difference image



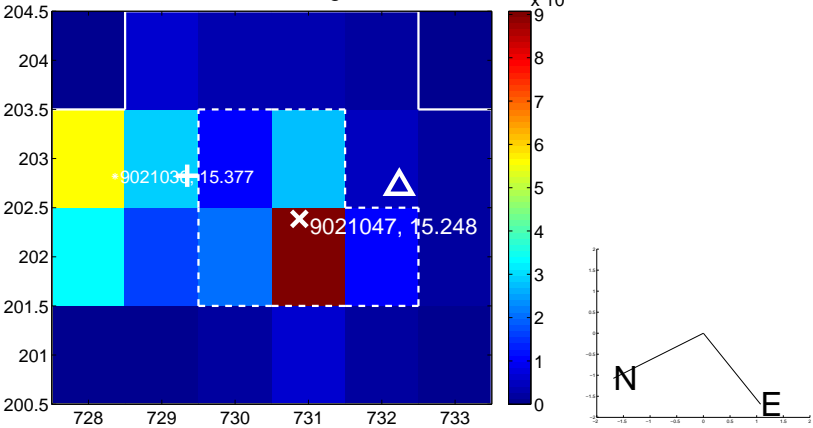
Q9 no OOT image



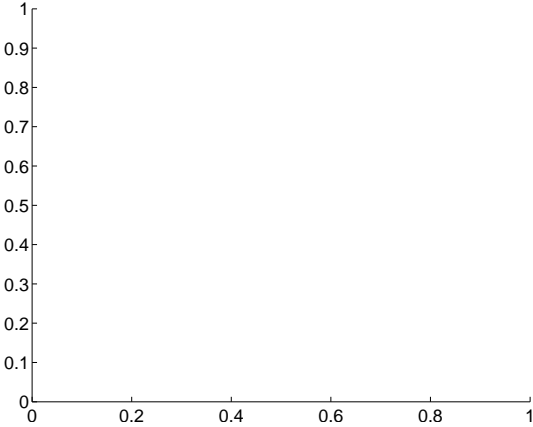
Q10 difference image



Q10 OOT image



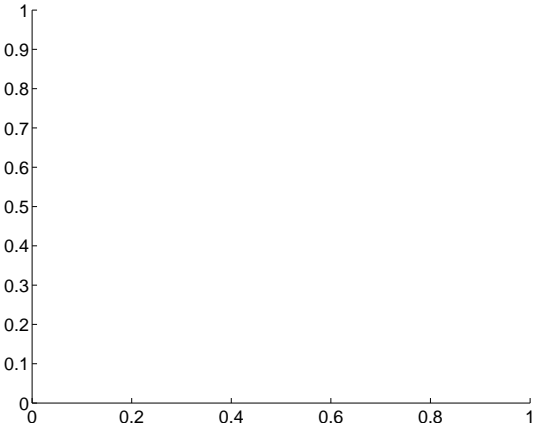
Q11 no difference image



Q11 no OOT image



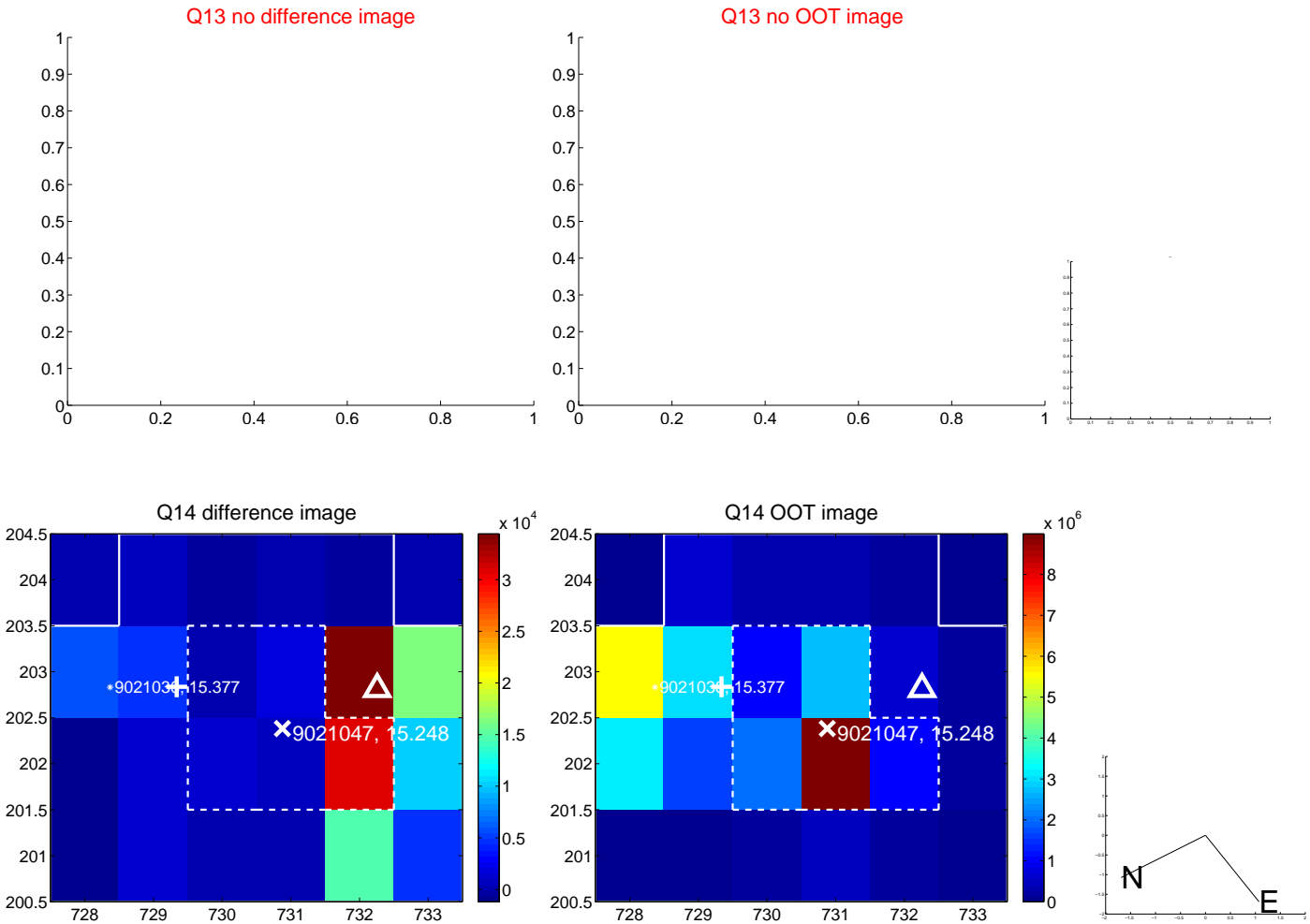
Q12 no difference image



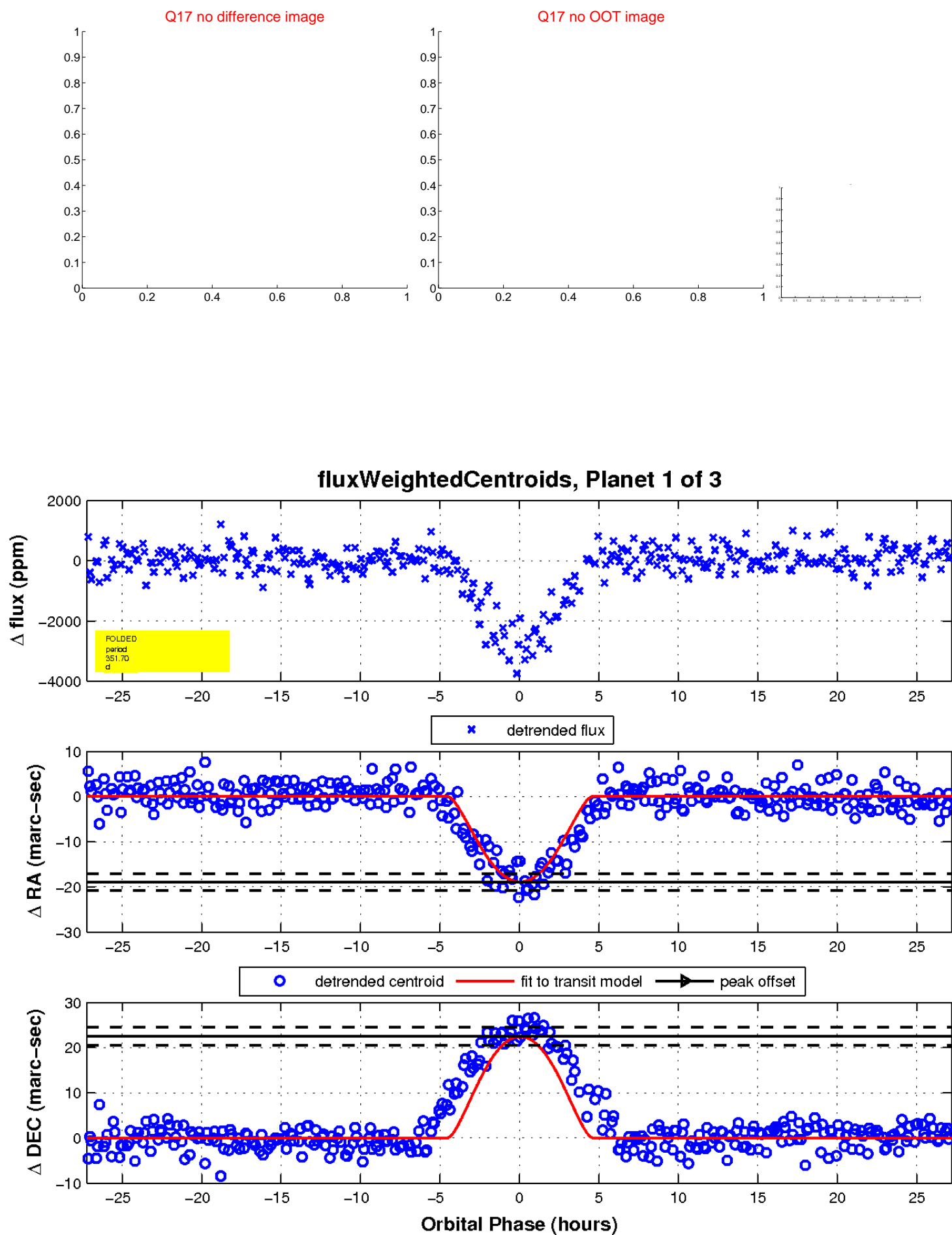
Q12 no OOT image



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

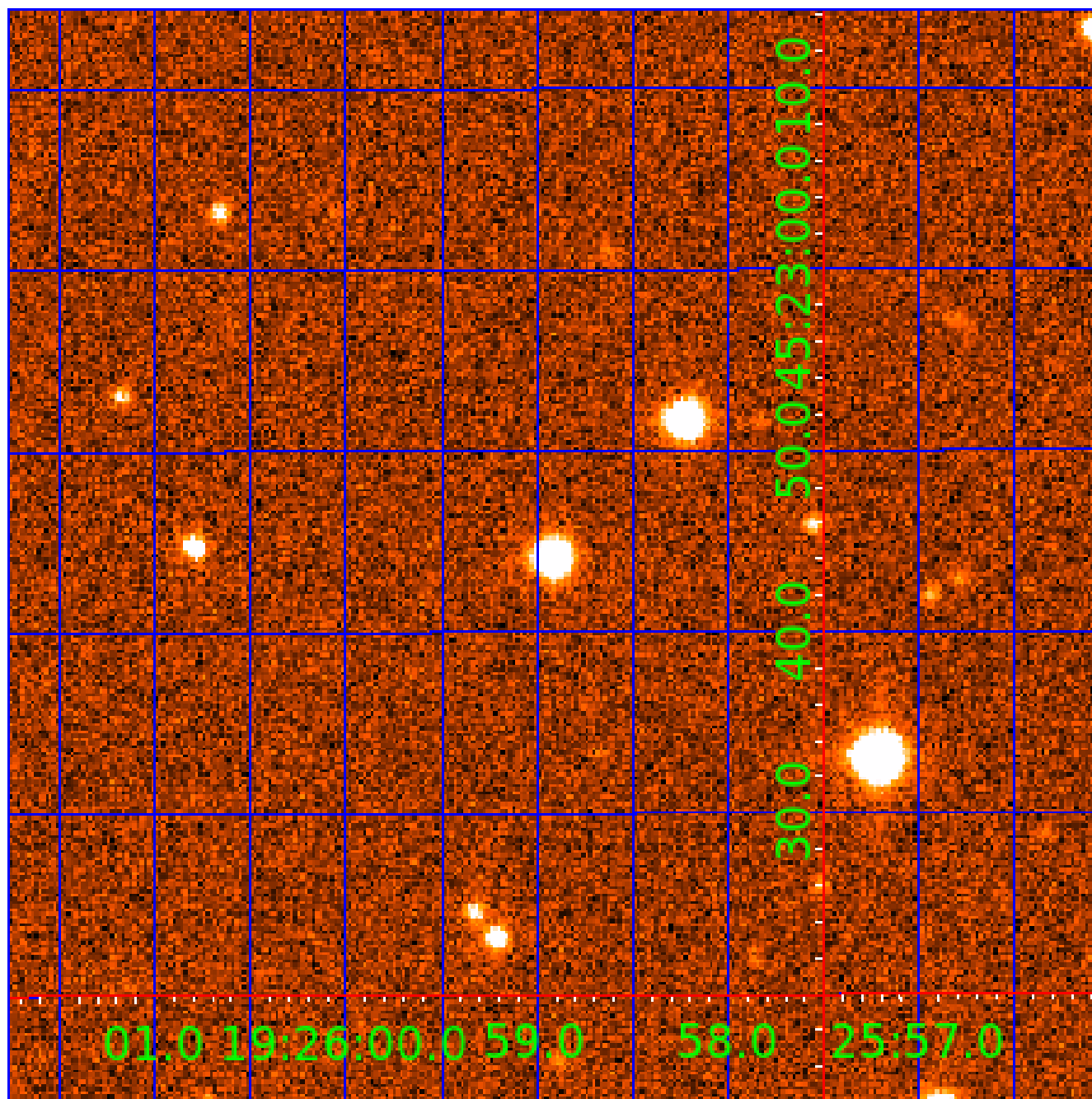


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 009021047

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009021047-01	OBS	7919.01	351.699095	261.769896	2799.6	9.084	29.2	27.9	1.01	6340	8.39	1.49
009021047-02	OBS	No	351.717175	293.699522	3303.8	9.040	25.3	27.9	1.01	6340	10.55	1.49
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## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009021047-01	OBS	FP	0.00	0	1	0	0	MOD_SEC_DV—MOD_SEC_ALT—DEEP_V_SHAPED—HAS_SEC_TCE—PERIOD_ALIAS_DV—PERIOD_ALIAS_ALT—CENT_FEW_DIFFS
009021047-02	OBS	FP	0.00	1	1	0	0	IS_SEC_TCE—CENT_FEW_DIFFS
009021047-03	OBS	FP	0.00	1	0	1	1	INDIV_TRANS_SKYE—SAME_NTL_PERIOD—CENT_FEW_DIFFS—HALO_GHOST—EPHEM_MATCH

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

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

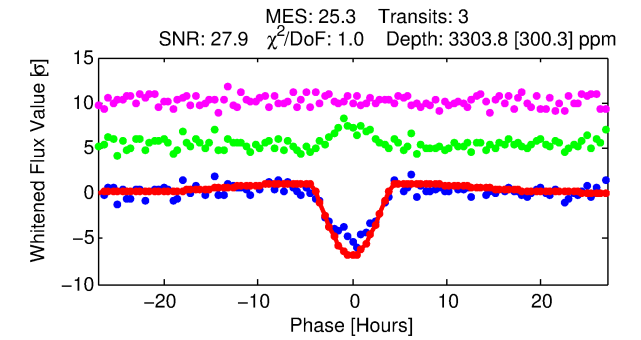
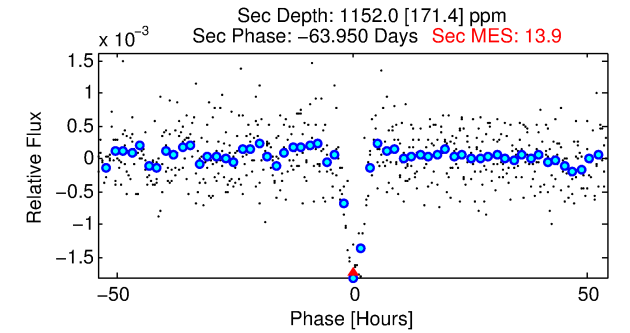
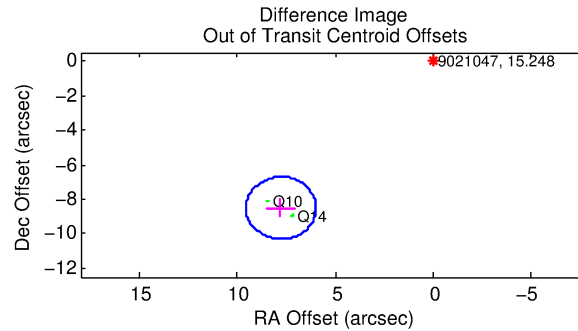
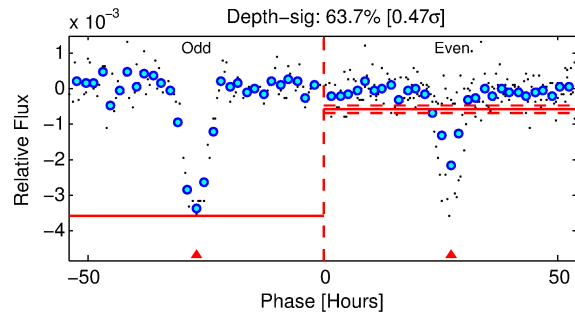
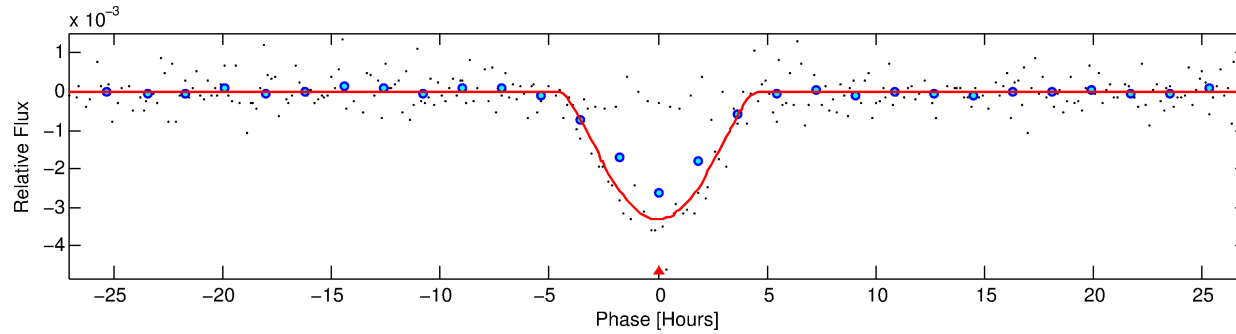
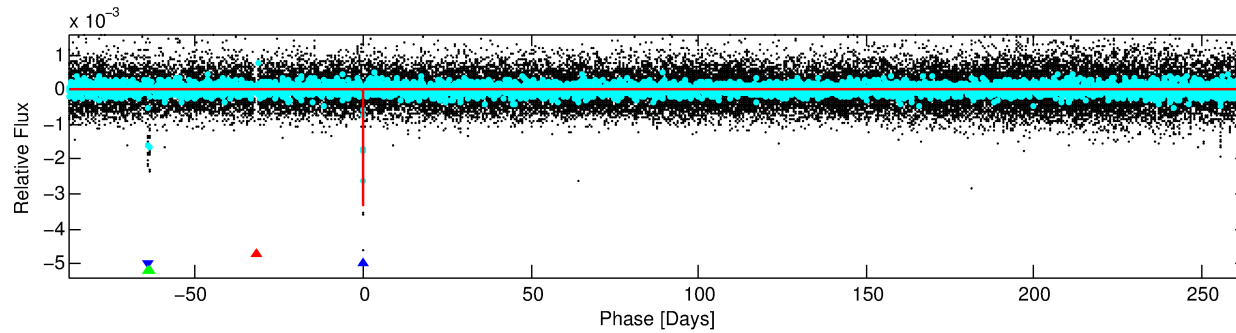
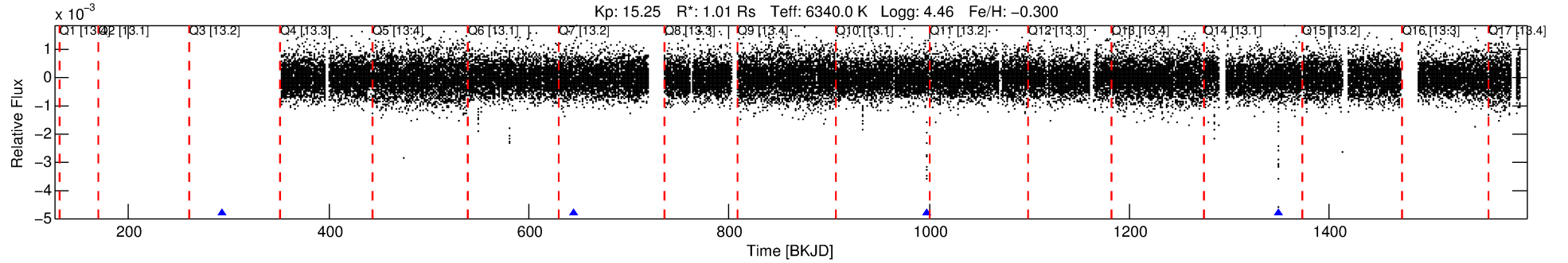
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 009021047-02

No Significant Match Found

# DV One-Page Summary

KIC: 9021047 Candidate: 2 of 3 Period: 351.717 d



## DV Fit Results:

Period = 351.71717 [0.00411] d  
Epoch = 293.6995 [0.0088] BKJD  
Rp/R\* = 0.0958 [0.1259]  
a/R\* = 133.60 [36.19]  
b = 1.00 [0.19]  
Seff = 1.49 [0.60]  
Teq = 282 [29] K  
Rp = 10.55 [14.27] Re  
a = 0.9963 [0.2610] AU  
Ag = 5646.97 [15021.70] [0.38 $\sigma$ ]  
Teff = 3774 [2489] K [1.40 $\sigma$ ]

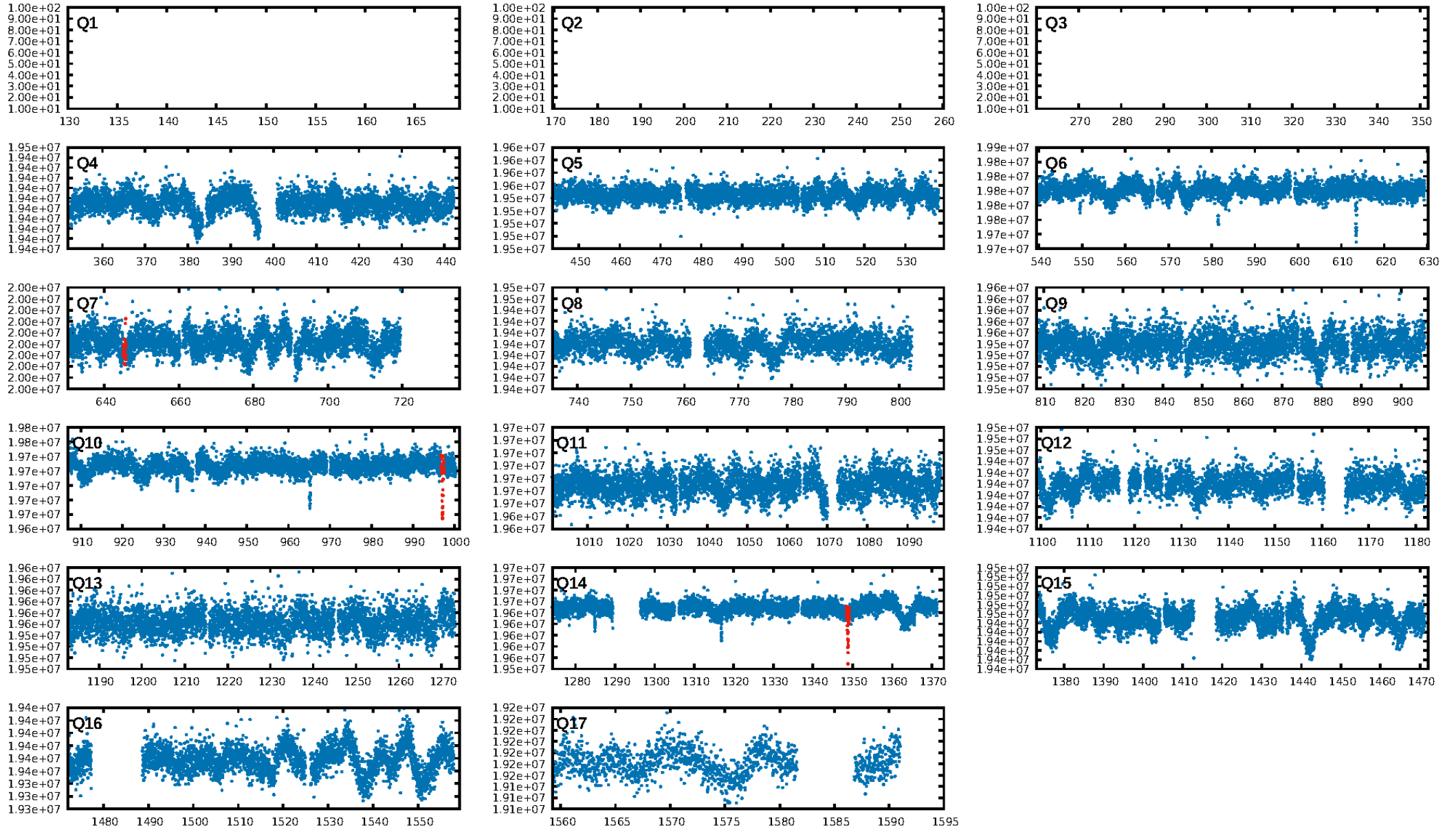
## DV Diagnostic Results:

ShortPeriod-sig: 2.5% [0.03 $\sigma$ ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 0.1%  
ModelChiSquareGoF-sig: 99.6%  
Bootstrap-pfa: 7.46e-53  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: 1.086  
Centroid-sig: 0.0%  
Centroid-so: 4.694 arcsec [11.52 $\sigma$ ]  
OotOffset-rm: 11.523 arcsec [19.21 $\sigma$ ]  
KicOffset-rm: 5.300 arcsec [9.05 $\sigma$ ]  
OotOffset-st: 2/0/0/0 [2]  
KicOffset-st: 2/0/0/0 [2]  
DiffImageQuality-fgm: 1.00 [2/2]  
DiffImageOverlap-fno: 1.00 [3/3]

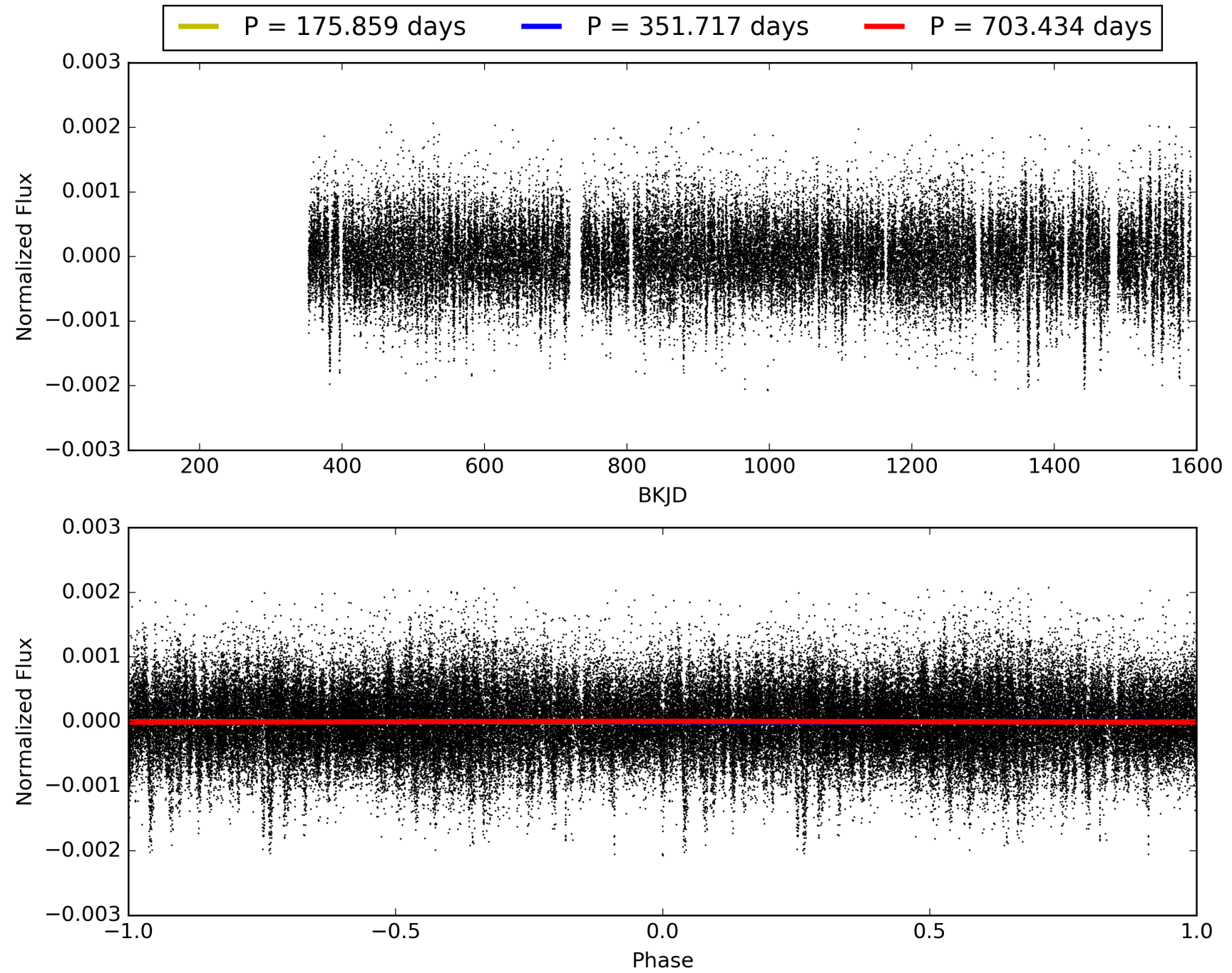
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 30-Jan-2016 21:32:53 Z

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

# TCE 009021047-02, PDC Light Curves



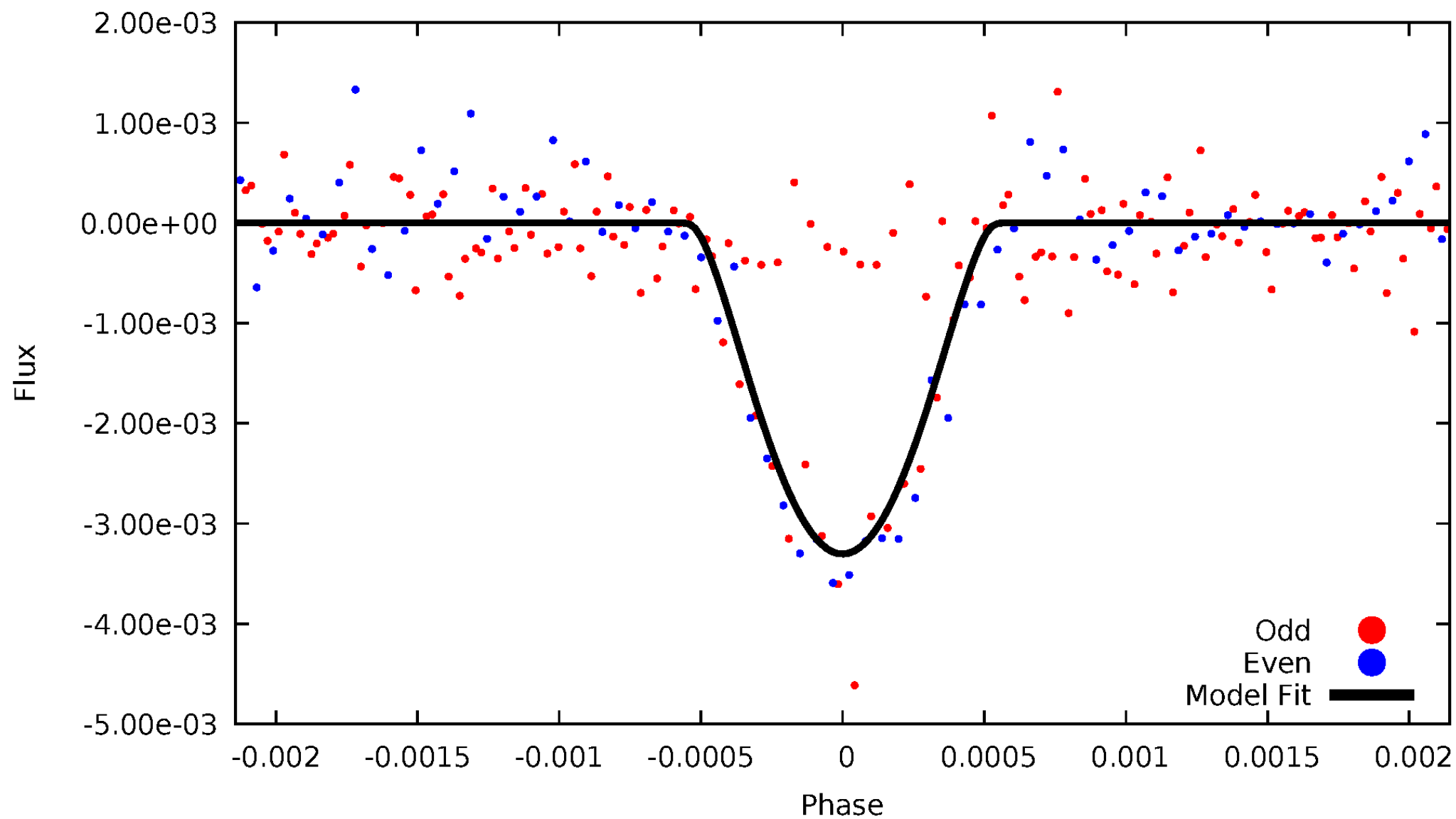
TCE 009021047-02





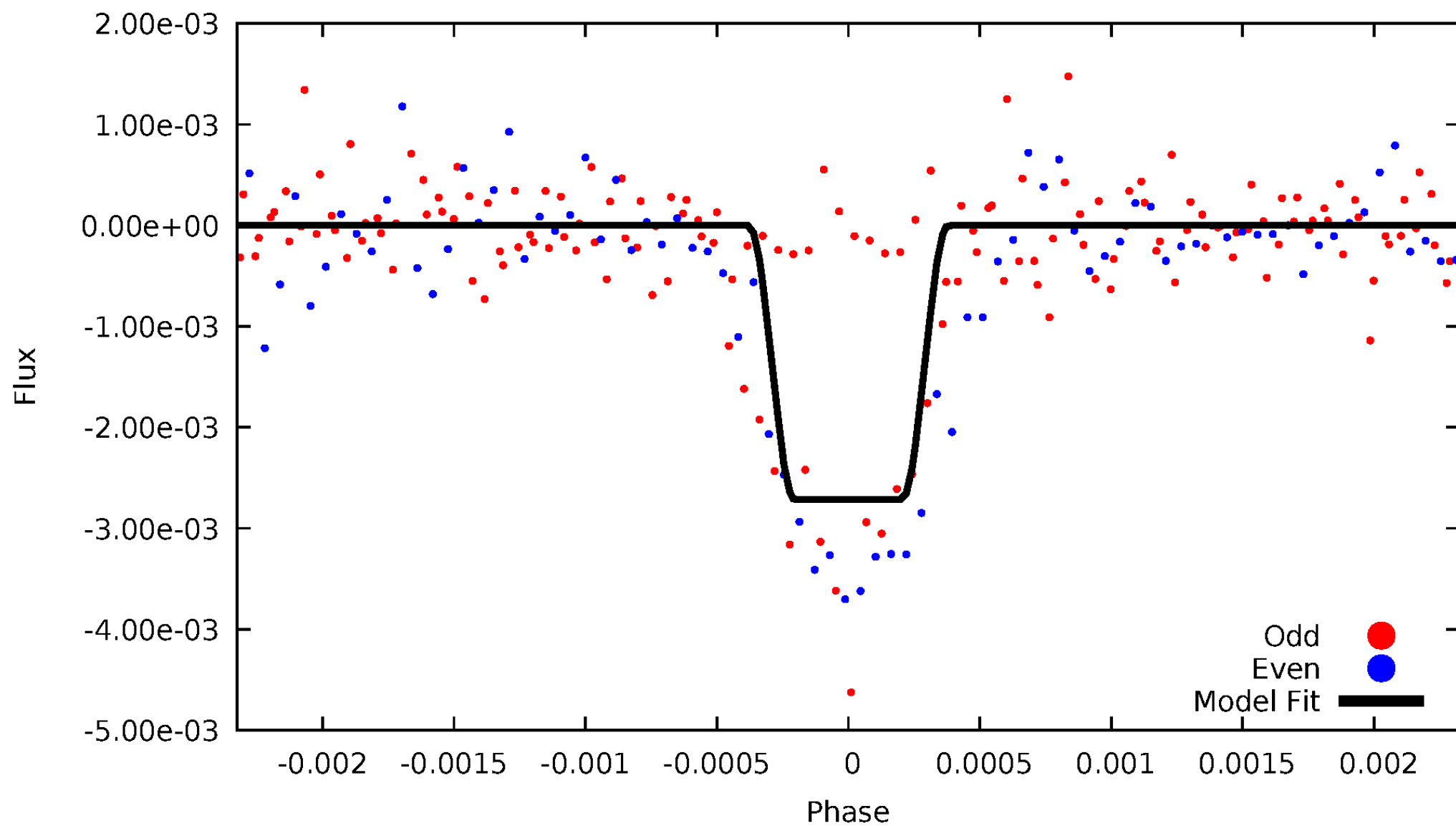
# DV Odd/Even

TCE 009021047-02



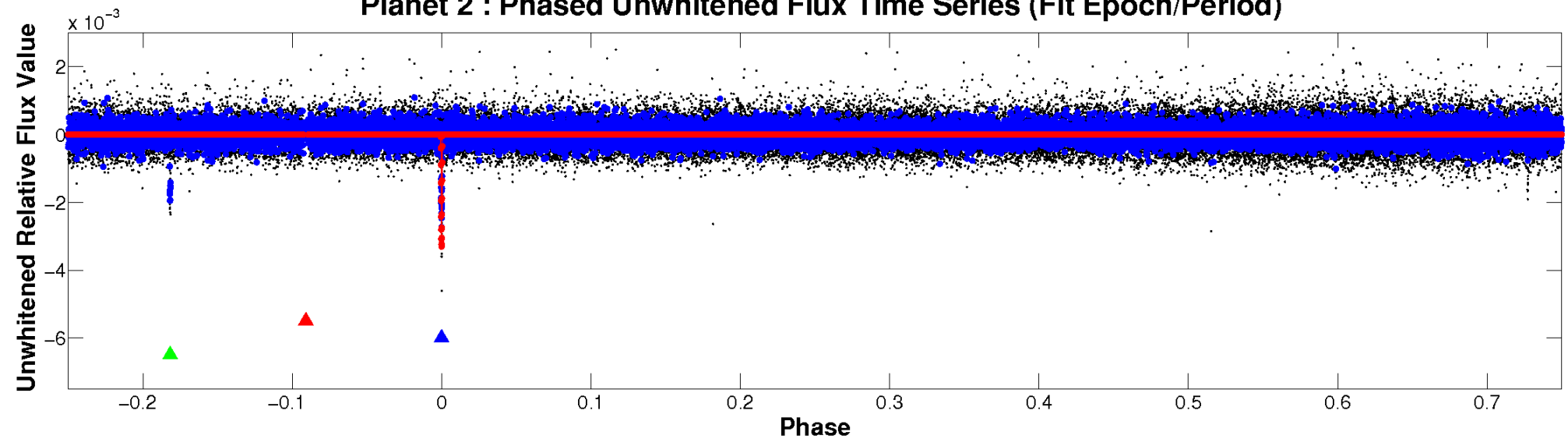
# ALT Odd/Even

TCE 009021047-02

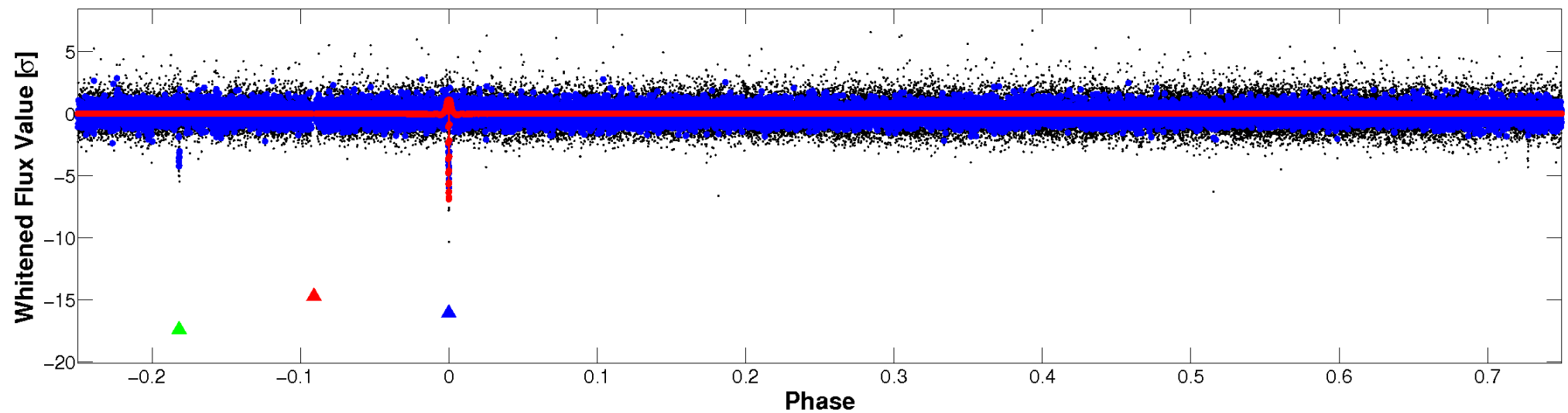


# Non-Whitened Vs. Whitened Light Curve

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

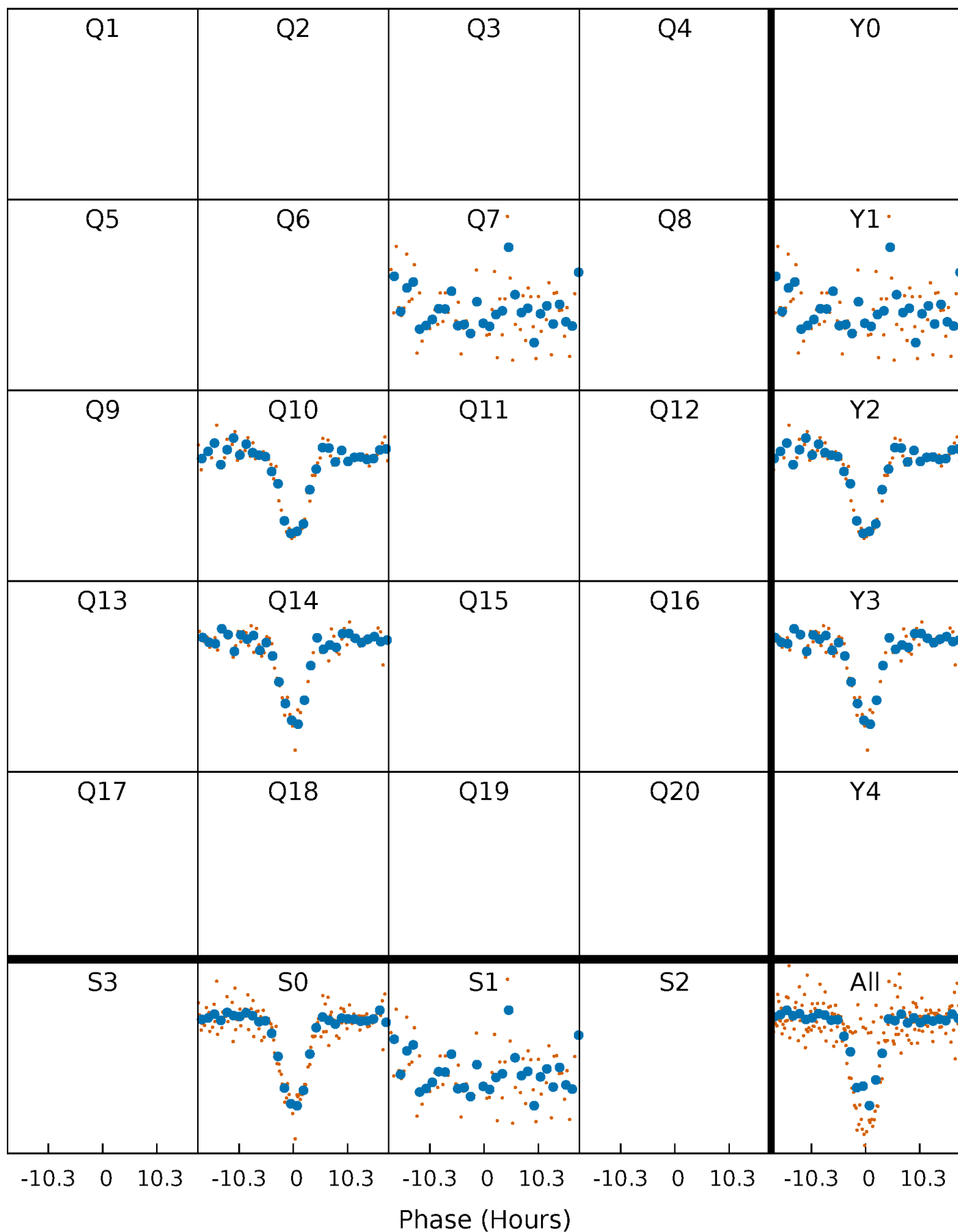


Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



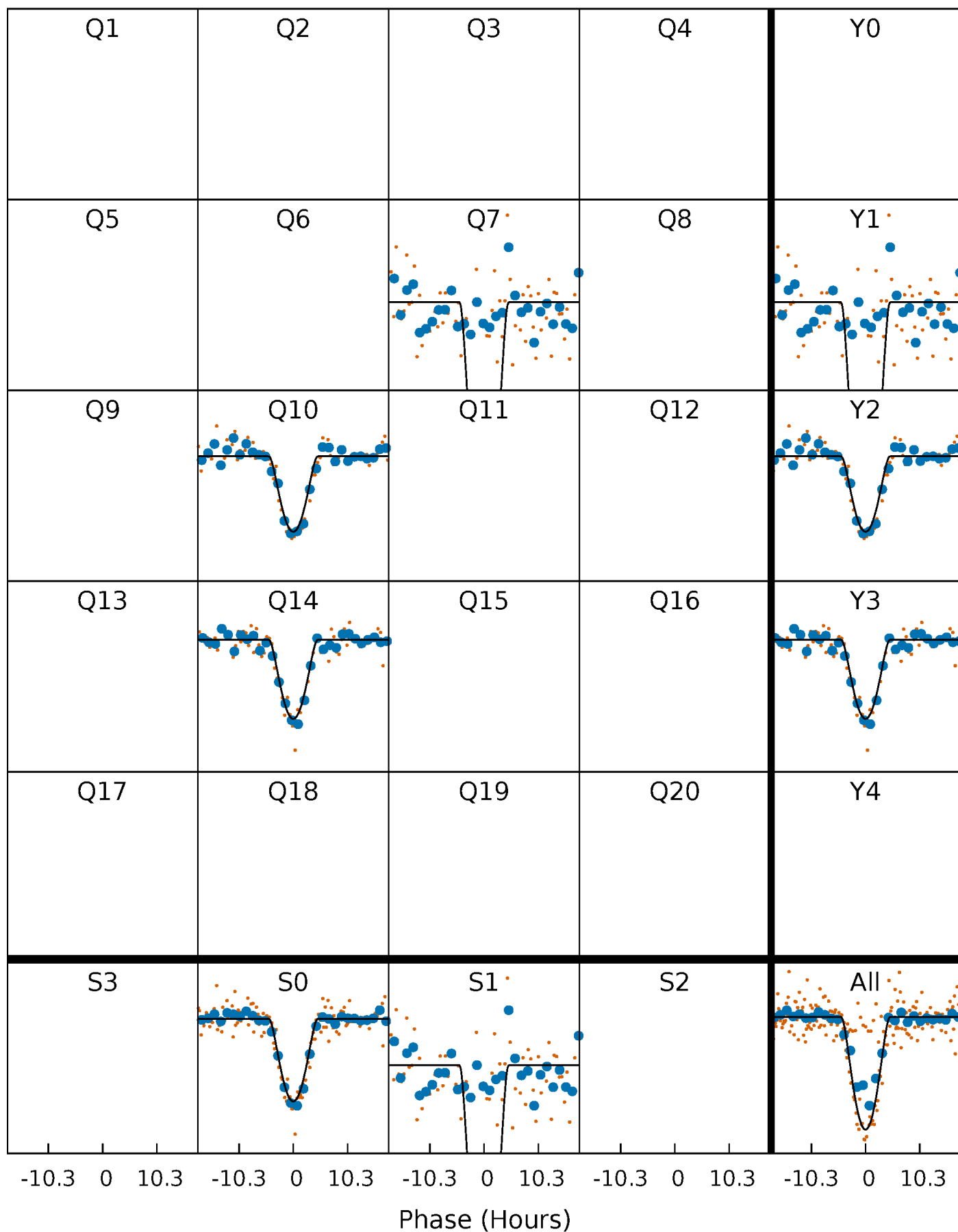
# PDC Quarter-Phased Transit Curves

TCE 009021047-02 P=351.717175 Days  $T_0=293.699522$  (BKJD)



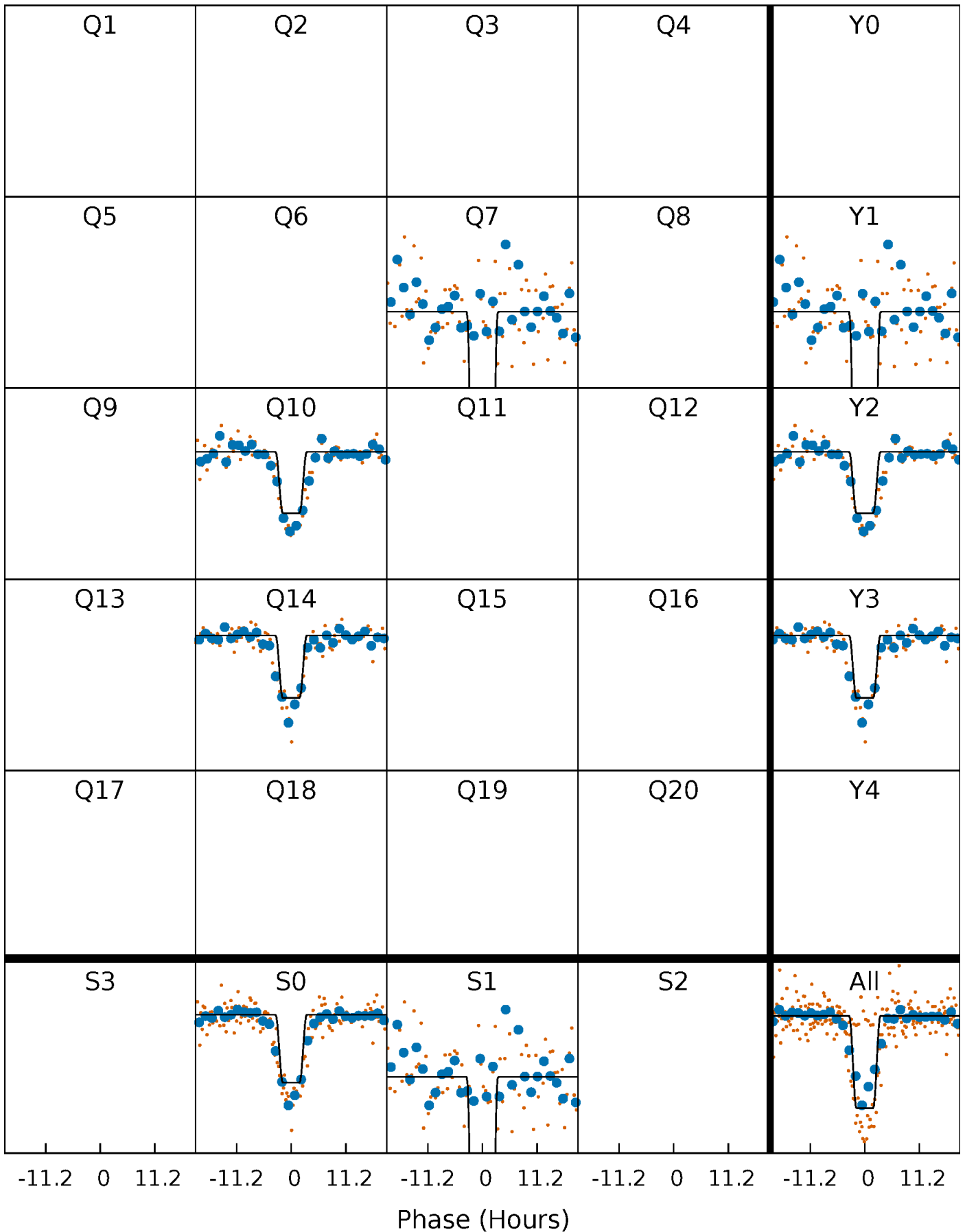
# DV Quarter-Phased Transit Curves

TCE 009021047-02     $P=351.717175$  Days     $T_0=293.699522$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

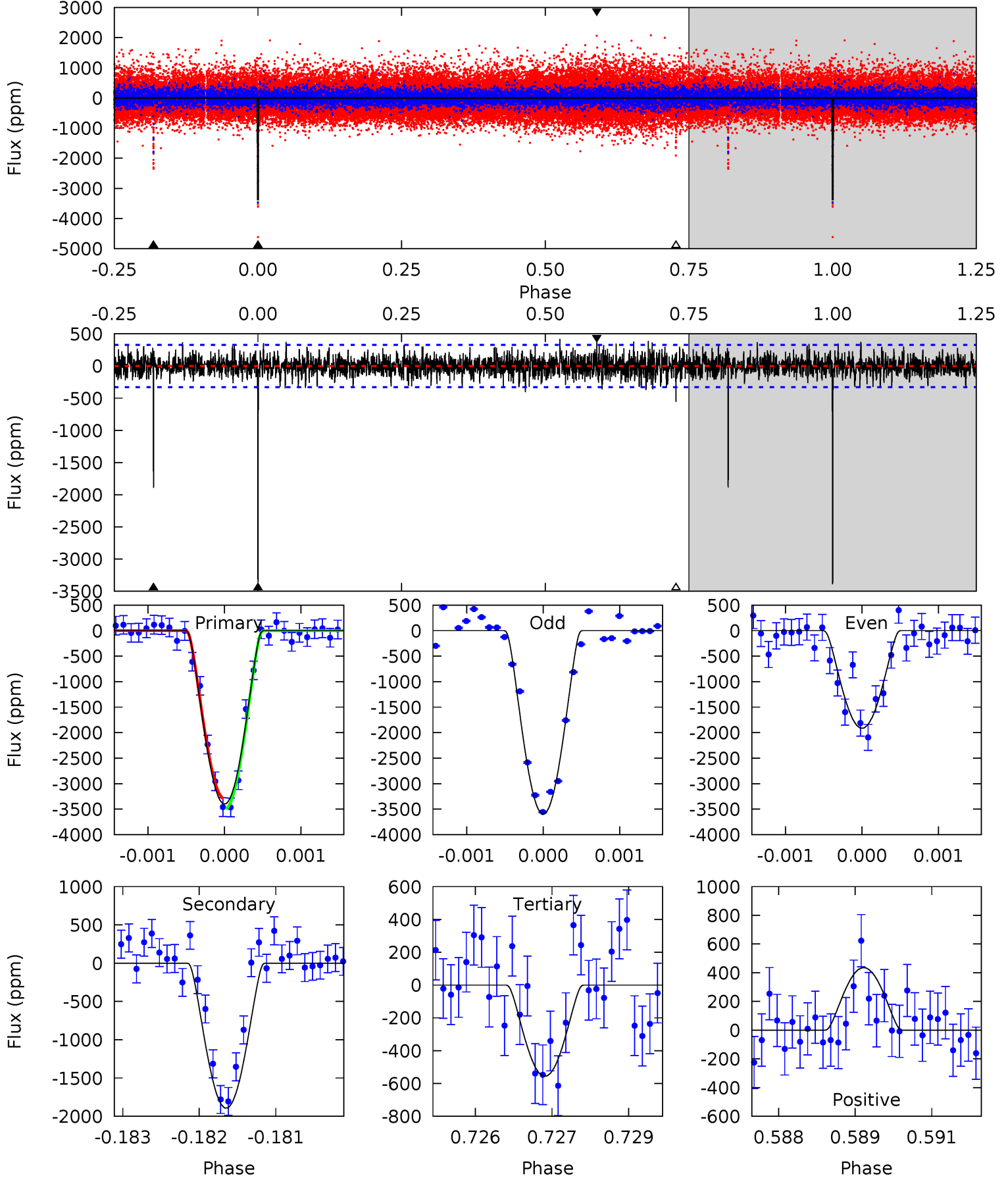
TCE 009021047-02 P=351.736491 Days  $T_0=293.653101$  (BKJD)



# DV Model-Shift Uniqueness Test

009021047-02, P = 351.717175 Days, E = 293.699522 Days

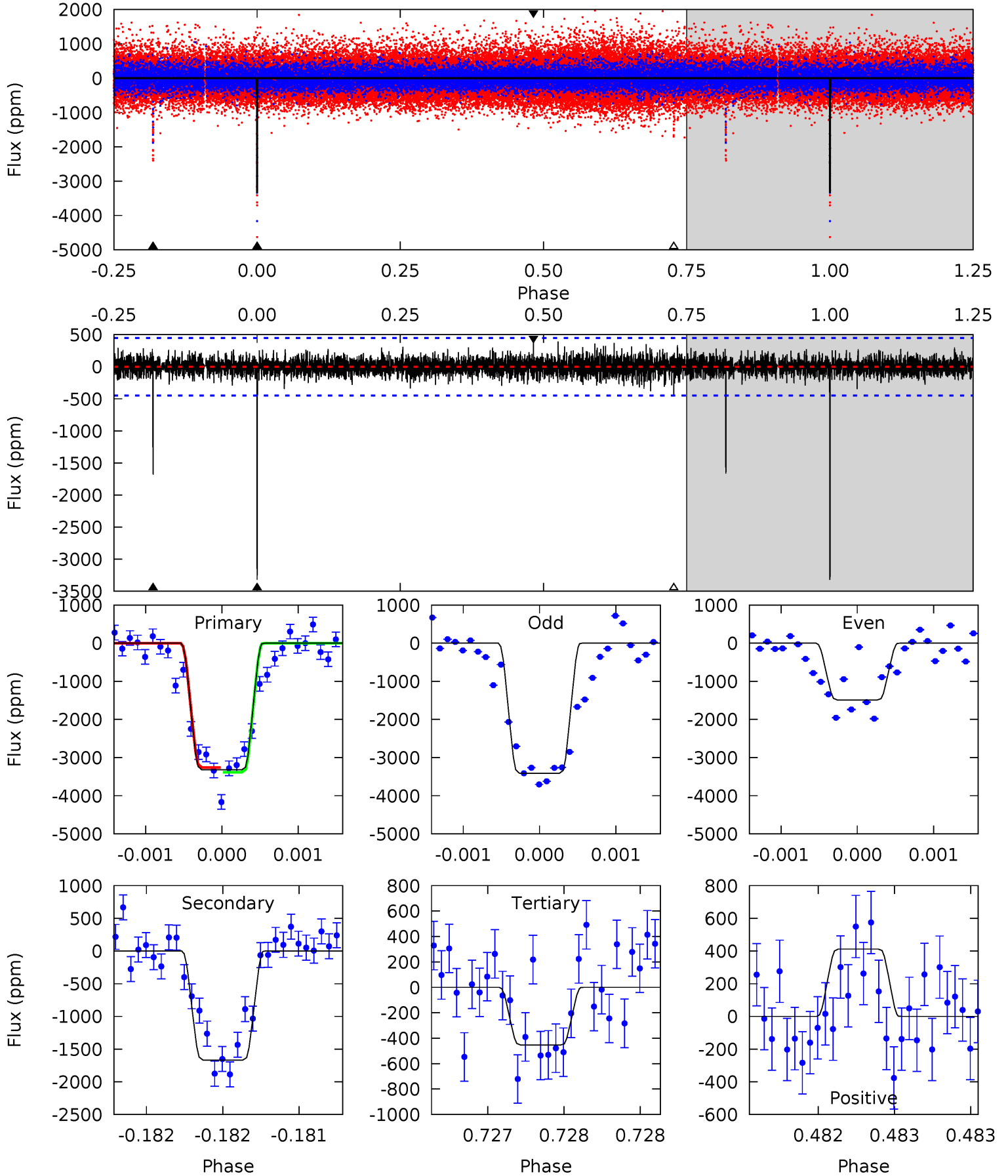
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
56.1	31.3	9.18	7.19	5.43	3.26	1.79	47.0	48.9	22.1	24.1	14.4	0.69	0.11	1.68



# Alt Model-Shift Uniqueness Test

009021047-02, P = 351.736491 Days, E = 293.653101 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
40.8	20.5	5.58	5.06	5.51	3.39	1.14	35.3	35.8	14.9	15.4	13.3	0.69	0.11	0.76





### Stellar Parameters For KIC 009021047

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M$ ( $M_{\odot}$ )	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6340^{+176}_{-242}$	$4.457^{+0.067}_{-0.202}$	$-0.300^{+0.250}_{-0.350}$	$1.010^{+0.320}_{-0.107}$	$1.066^{+0.143}_{-0.143}$	$1.458^{+0.405}_{-0.755}$
	+3%/-4%	+2%/-5%	+83%/-117%	+32%/-11%	+13%/-13%	+28%/-52%
Source	KIC0	KIC0	KIC0	DSEP		

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

### Secondary Eclipse Parameters for KIC 009021047-02 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-1890 \pm 60$	$14.61^{+12.97}_{-9.18}$	$399^{+28}_{-20}$	$4030^{+2069}_{-747}$	$4716^{+30309}_{-3379}$
Alt.	$-1668 \pm 81$	$11.61^{+11.99}_{-7.81}$	$399^{+27}_{-21}$	$4286^{+2792}_{-958}$	$6608^{+52411}_{-4987}$

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

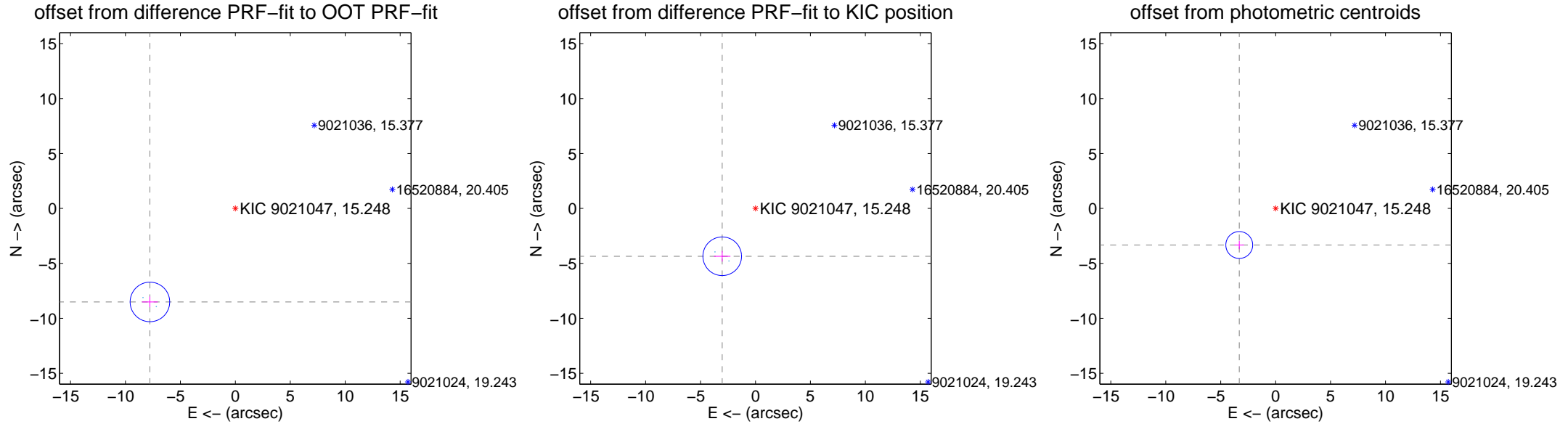
## DV Centroid Data

Supplemental centroid analysis for 009021047-02. Kepler magnitude: 15.25. Transit SNR 27.95

There are 2 quarters with good PRF difference image offsets

The OOT PRF centroid is offset from the target star catalog position by about 6.33 arcsec so the offset from difference PRF-fit to OOT-fit may be invalid.

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$11.523 \pm 0.600$	19.21	$7.773 \pm 0.711$	$-8.506 \pm 0.487$
PRF-fit source offset from KIC position	$5.300 \pm 0.586$	9.05	$3.027 \pm 0.746$	$-4.351 \pm 0.490$
photometric centroid source offset	$4.69 \pm 0.41$	11.52	$3.31 \pm 0.43$	$-3.33 \pm 0.38$

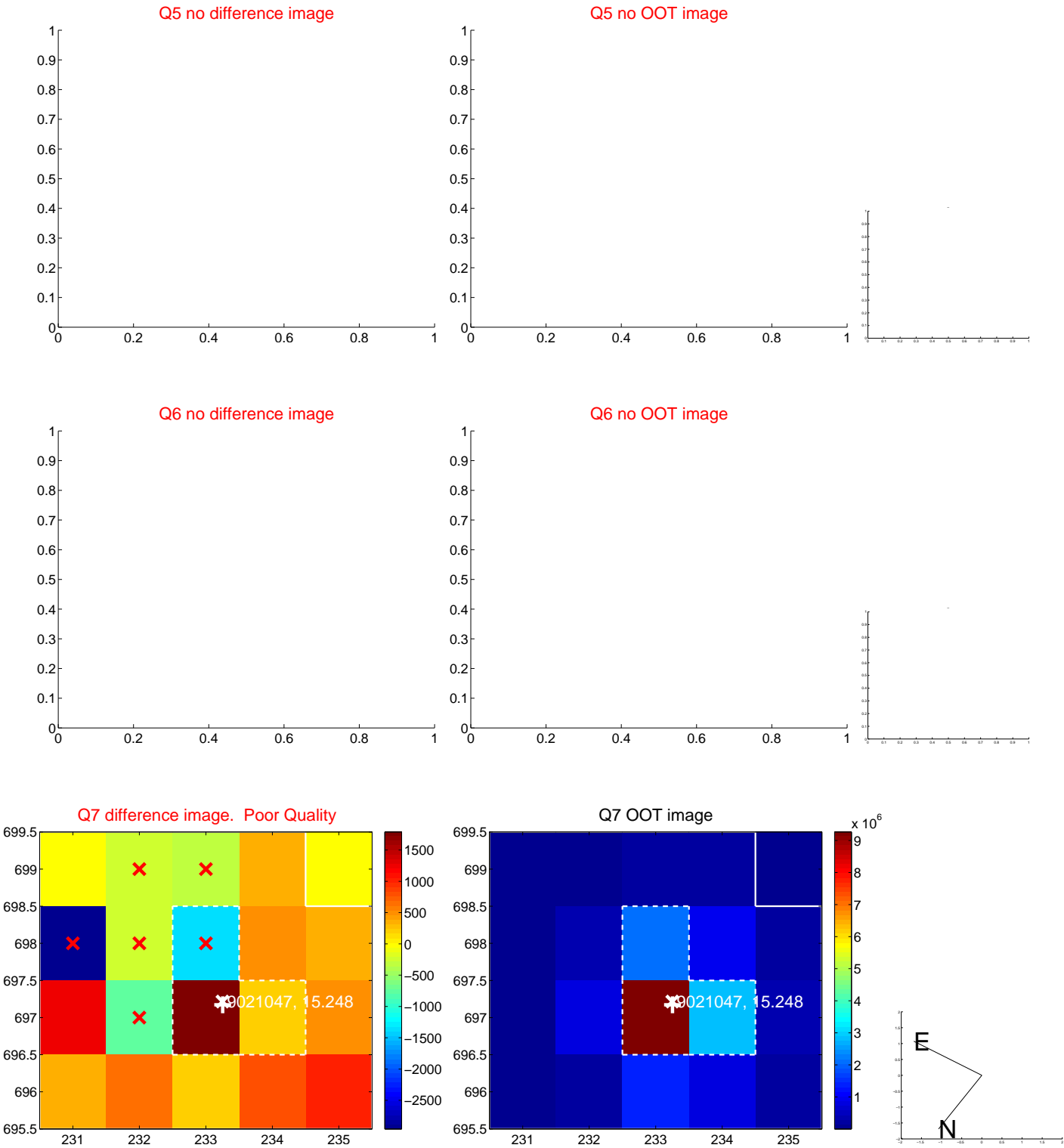


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

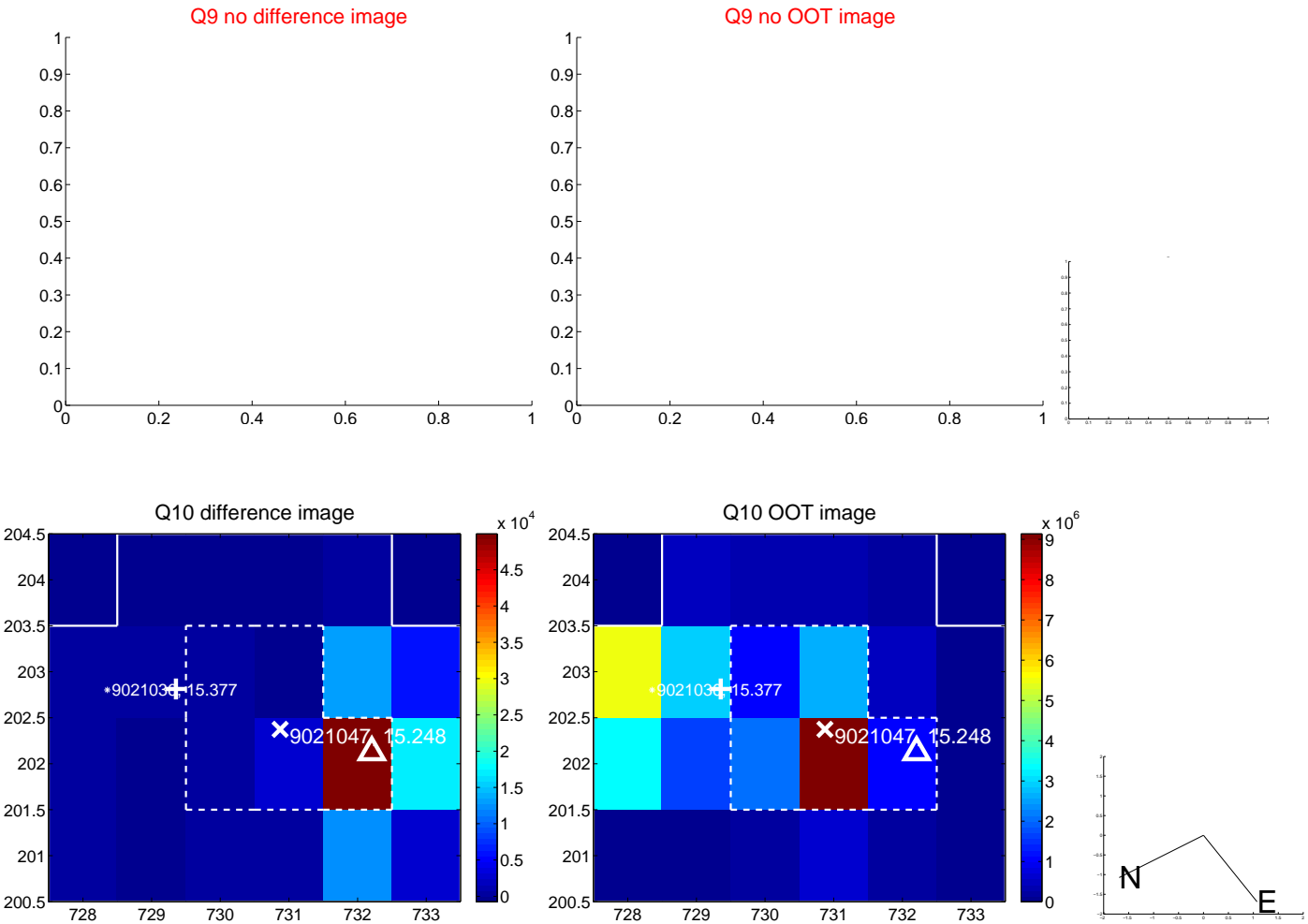
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



white ×: 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.

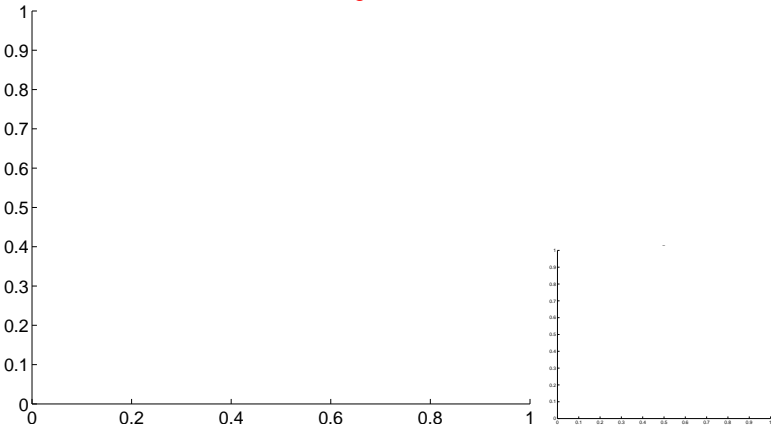


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

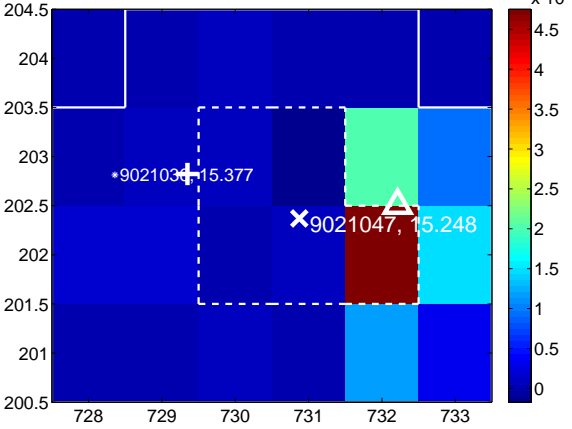
Q13 no difference image



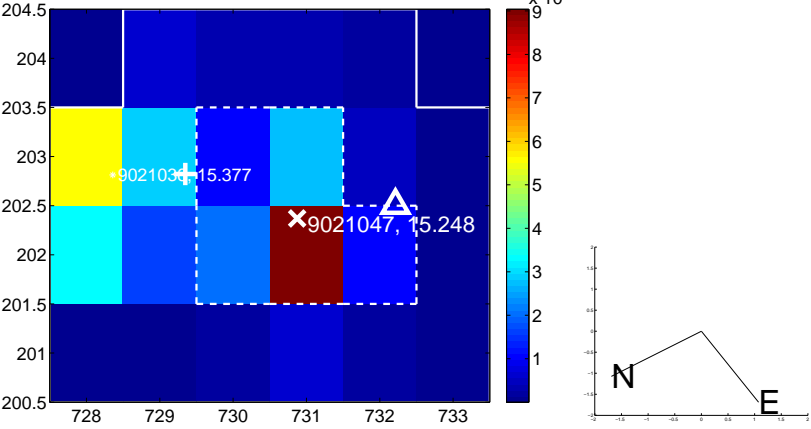
Q13 no OOT image



Q14 difference image



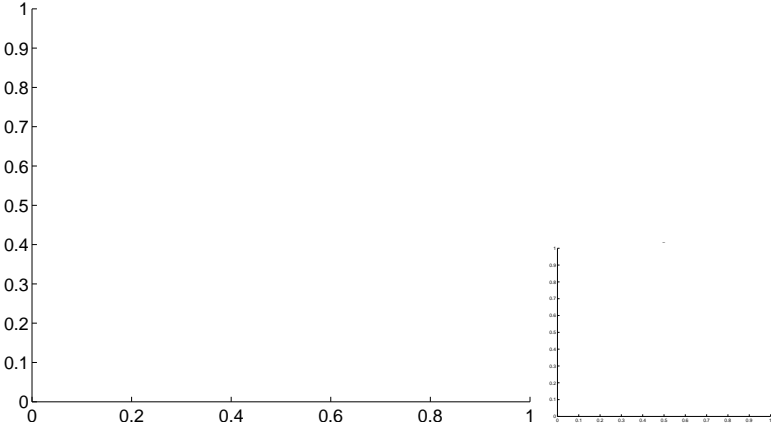
Q14 OOT image



Q15 no difference image



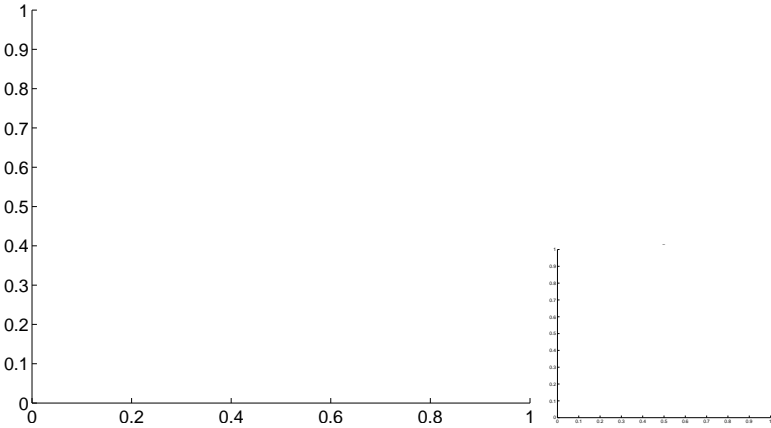
Q15 no OOT image



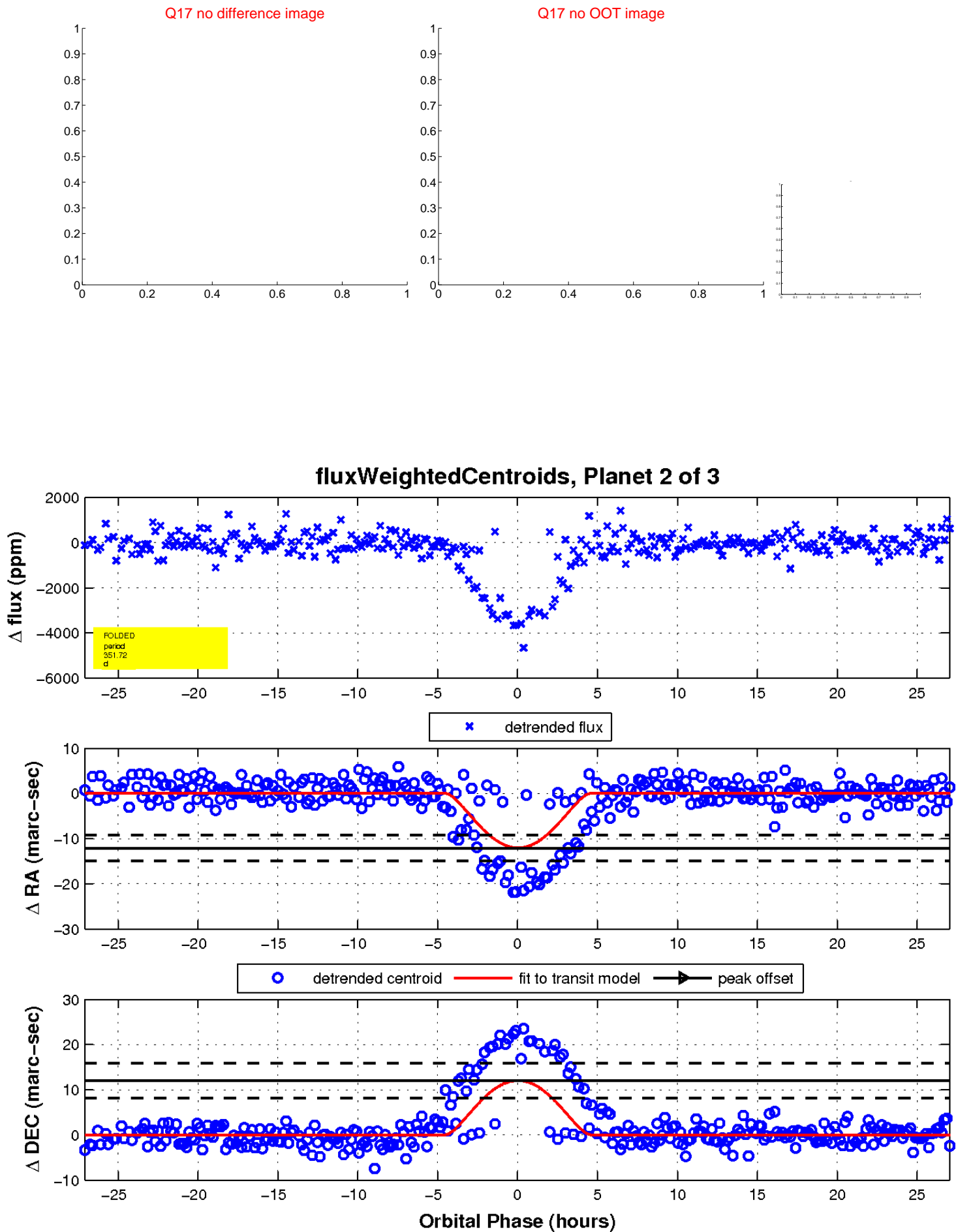
Q16 no difference image



Q16 no OOT image

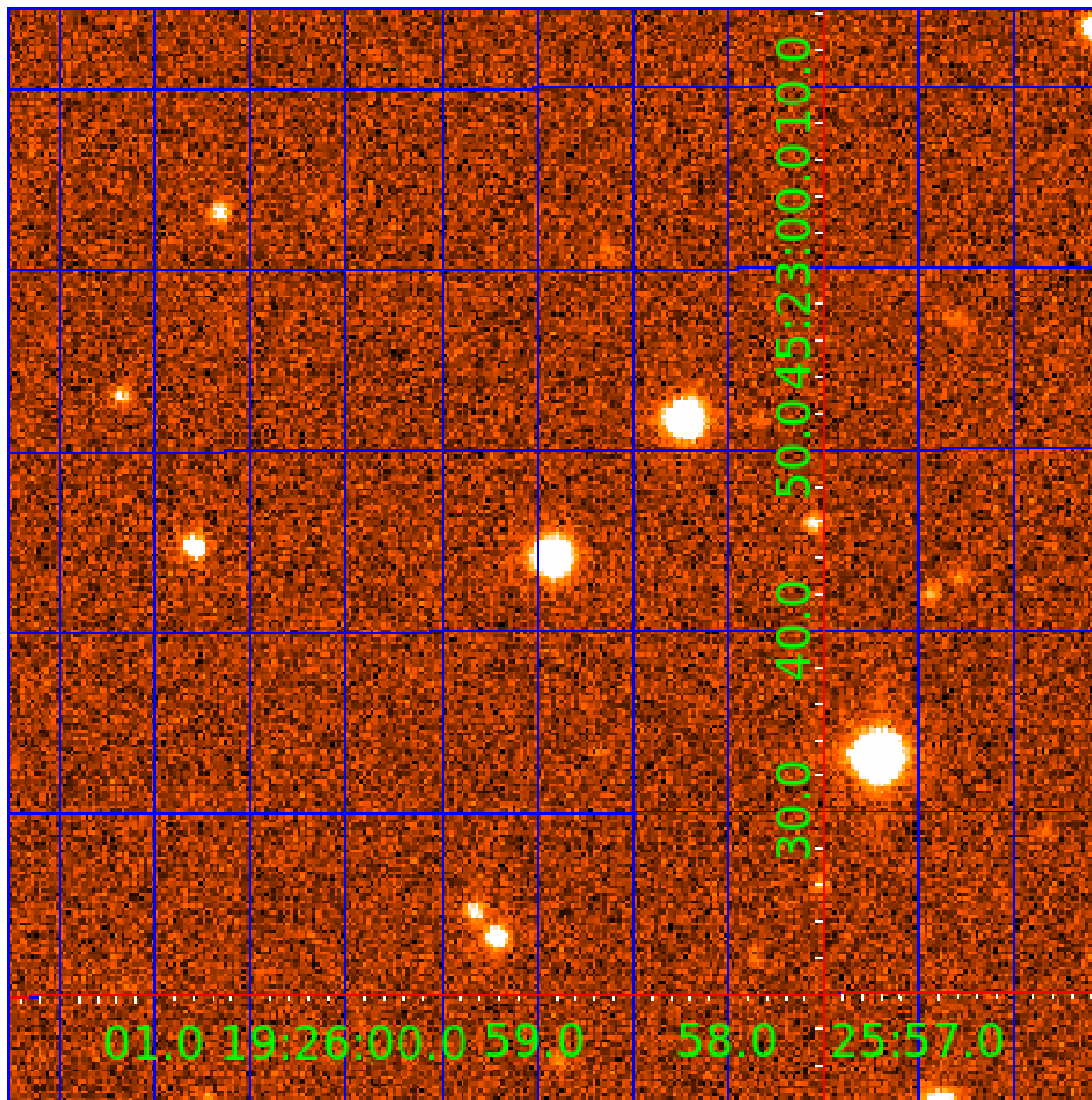


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination





# KIC 009021047

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009021047-01	OBS	7919.01	351.699095	261.769896	2799.6	9.084	29.2	27.9	1.01	6340	8.39	1.49
009021047-02	OBS	No	351.717175	293.699522	3303.8	9.040	25.3	27.9	1.01	6340	10.55	1.49
009021047-03	OBS	No	351.702382	229.799412	1927.4	6.689	17.9	17.7	1.01	6340	7.13	1.49

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009021047-01	OBS	FP	0.00	0	1	0	0	MOD_SEC_DV—MOD_SEC_ALT—DEEP_V_SHAPED—HAS_SEC_TCE—PERIOD_ALIAS_DV—PERIOD_ALIAS_ALT—CENT_FEW_DIFFS
009021047-02	OBS	FP	0.00	1	1	0	0	IS_SEC_TCE—CENT_FEW_DIFFS
009021047-03	OBS	FP	0.00	1	0	1	1	INDIV_TRANS_SKYE—SAME_NTL_PERIOD—CENT_FEW_DIFFS—HALO_GHOST—EPHEM_MATCH

**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.

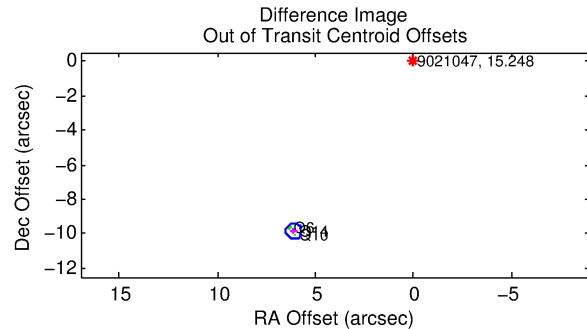
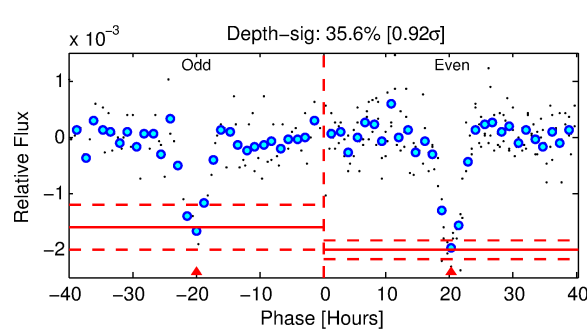
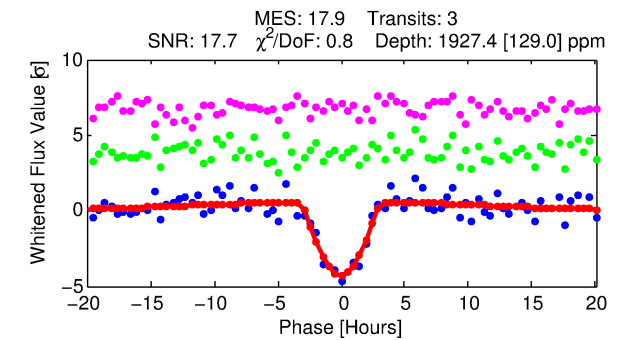
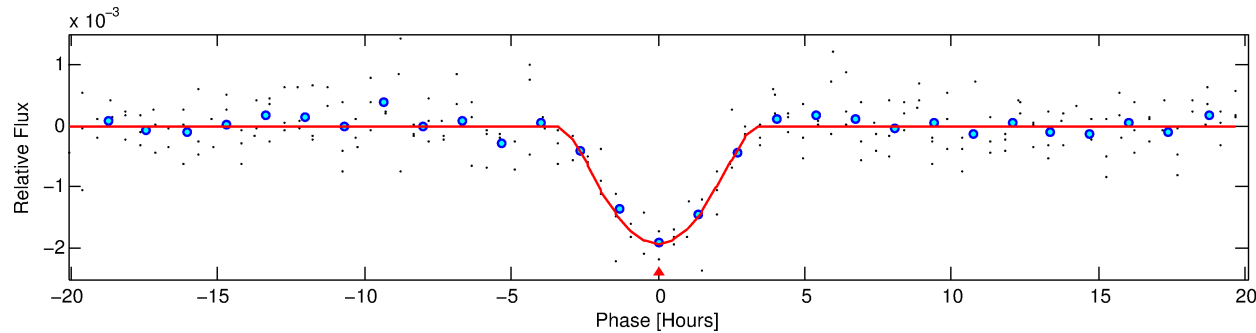
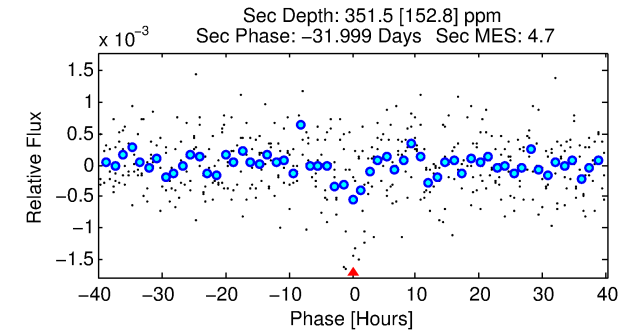
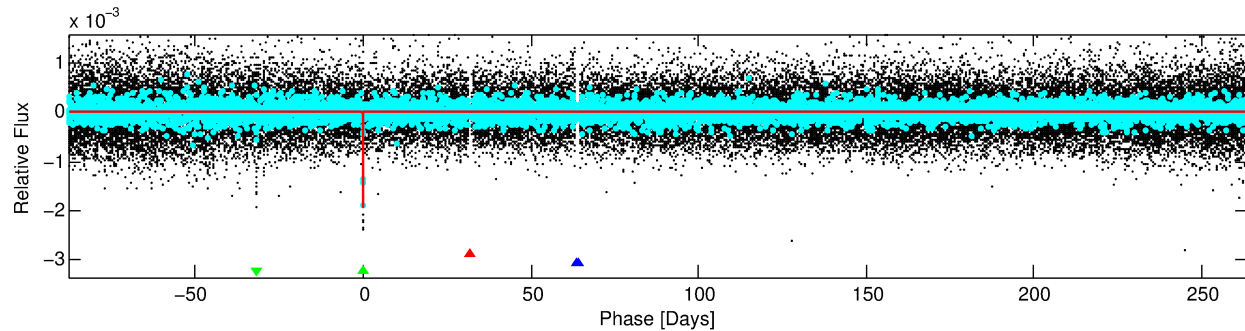
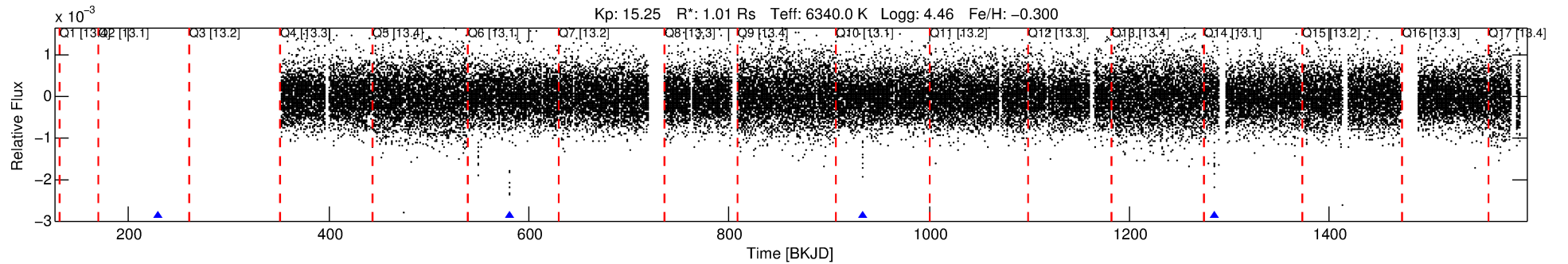
## Ephemeris Match Information For 009021047-03

TCE (1)	KIC	Parent (2)	Parent KIC	$P_1:P_2$	Dist ( $''$ )	$\Delta$ Row	$\Delta$ Col	$m_2$	$m_1$	$D_2/D_1$	Mechanism	Flag	$\sigma_P$	$\sigma_T$
009021047-03	9021047	008560861-01	8560861	11:1	3024.5	7	-1	8.50	15.25	39.21	Col-Anomaly	1	2.96	0.25

**Notes:**  $P_1:P_2$  is the period ratio. Dist is the distance in arcseconds.  $\Delta$ Row and  $\Delta$ Col are the number of pixels apart in row and column.  $m_2$  and  $m_1$  are the magnitudes of the parent and child.  $D_2/D_1$  is the parent's transit depth divided by the child's.  $\sigma_P$  and  $\sigma_T$  are the significance of the match in period and epoch. For a match to be considered significant  $\sigma_P < 5.0$  and  $\sigma_T < 5.0$ . Matches which have  $\sigma_P$  and  $\sigma_T$  very close to this cutoff should receive extra scrutiny, especially if the period ratio is very large.

# DV One-Page Summary

KIC: 9021047 Candidate: 3 of 3 Period: 351.702 d



## DV Fit Results:

Period = 351.70238 [0.00562] d  
Epoch = 229.7994 [0.0119] BKJD  
Rp/R\* = 0.0647 [0.0817]  
a/R\* = 163.00 [60.88]  
b = 0.98 [0.14]  
Seff = 1.49 [0.60]  
Teq = 282 [29] K  
Rp = 7.13 [9.28] Re  
a = 0.9962 [0.2610] AU  
Ag = 3772.17 [9765.23] [0.39 $\sigma$ ]  
Teff = 3412 [2189] K [1.43 $\sigma$ ]

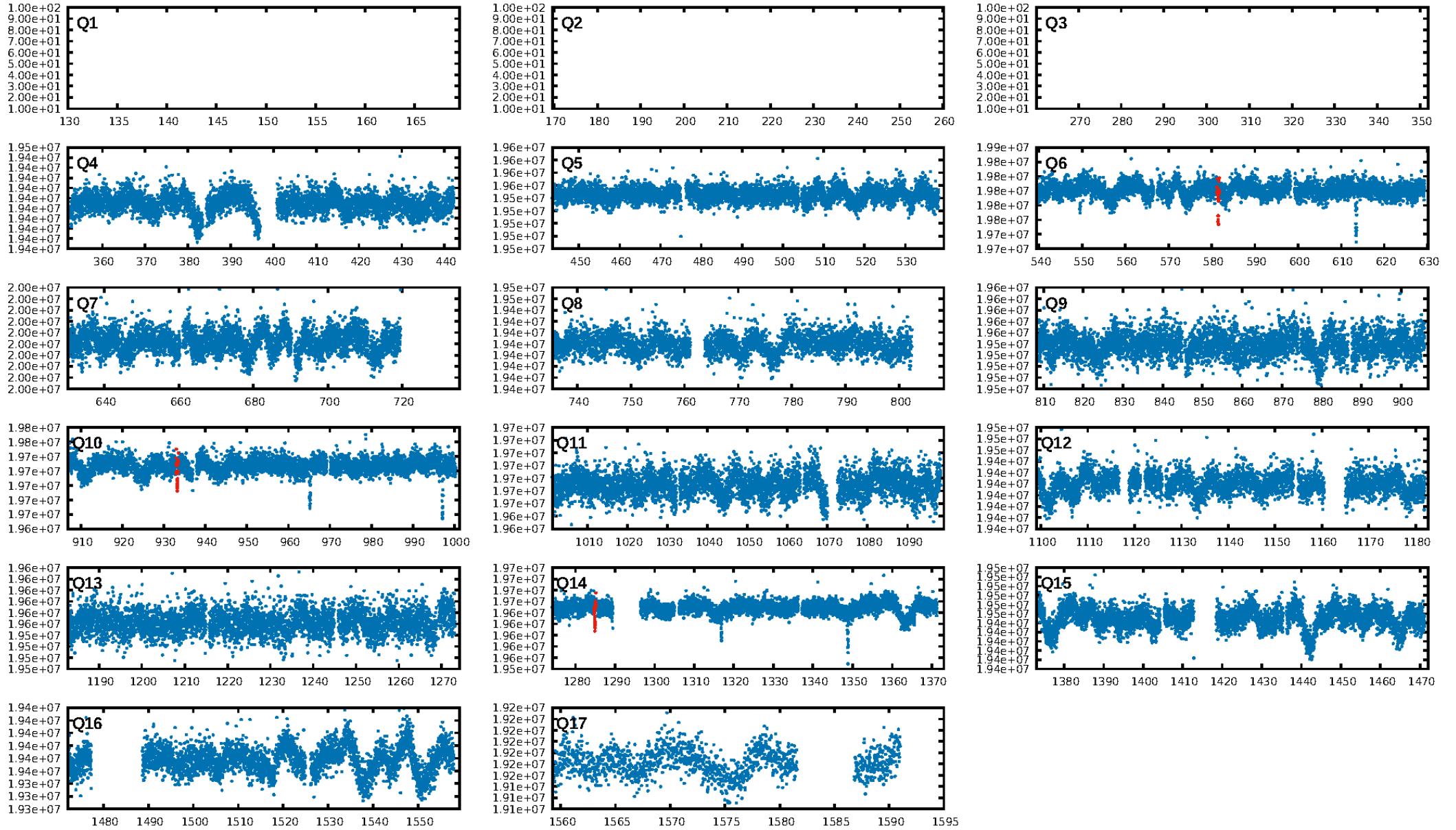
## DV Diagnostic Results:

ShortPeriod-sig: 0.6% [0.01 $\sigma$ ]  
LongPeriod-sig: 2.5% [0.03 $\sigma$ ]  
ModelChiSquare2-sig: 27.1%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 4.22e-45  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: 0.0295  
Centroid-sig: 0.0%  
Centroid-so: 15.083 arcsec [16.43 $\sigma$ ]  
OotOffset-rm: 11.611 arcsec [80.91 $\sigma$ ]  
KicOffset-rm: 5.812 arcsec [43.43 $\sigma$ ]  
OotOffset-st: 3/0/0/0 [3]  
KicOffset-st: 3/0/0/0 [3]  
DiffImageQuality-fgm: 1.00 [3/3]  
DiffImageOverlap-fno: 1.00 [3/3]

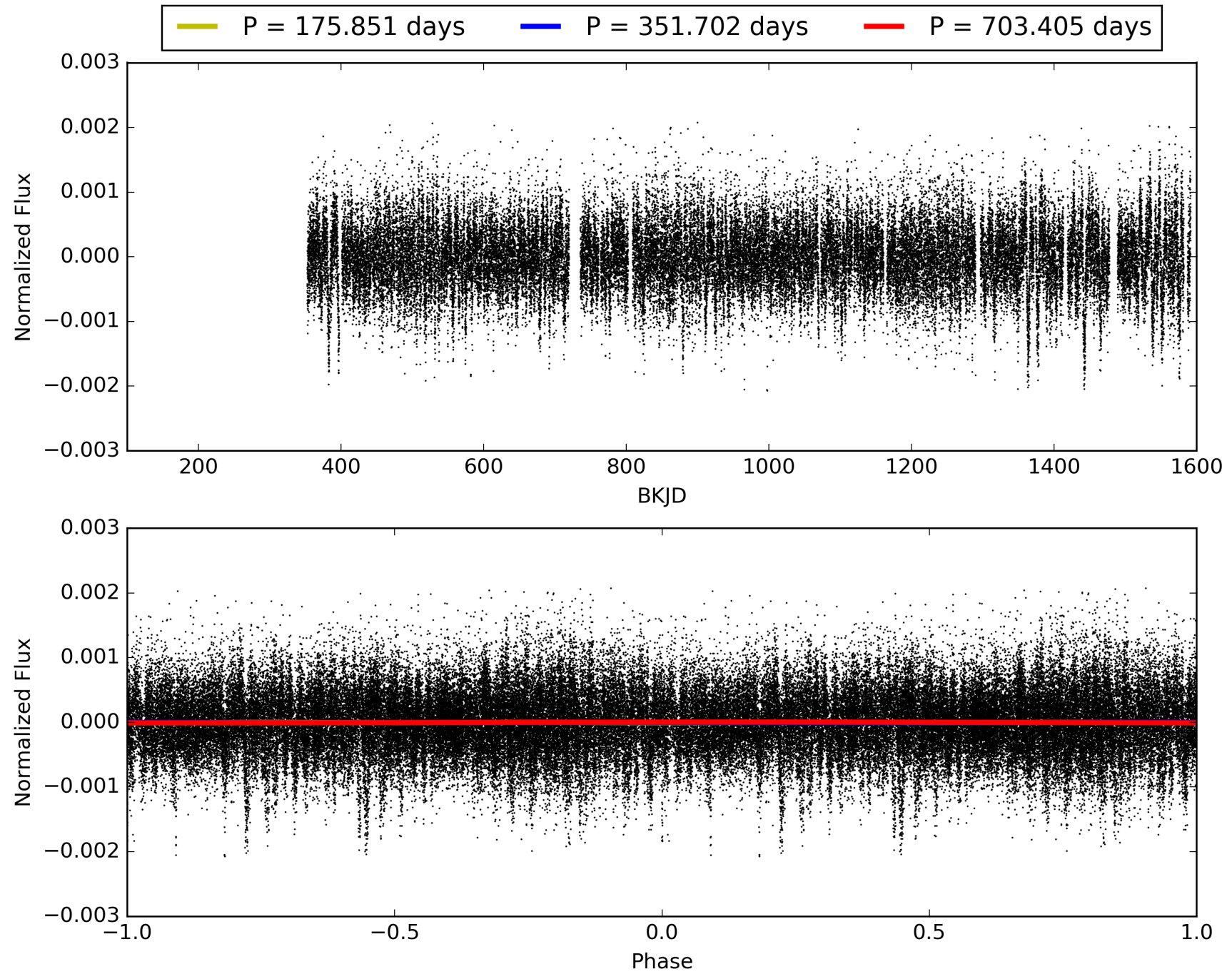
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 30-Jan-2016 21:33:03 Z

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

# TCE 009021047-03, PDC Light Curves

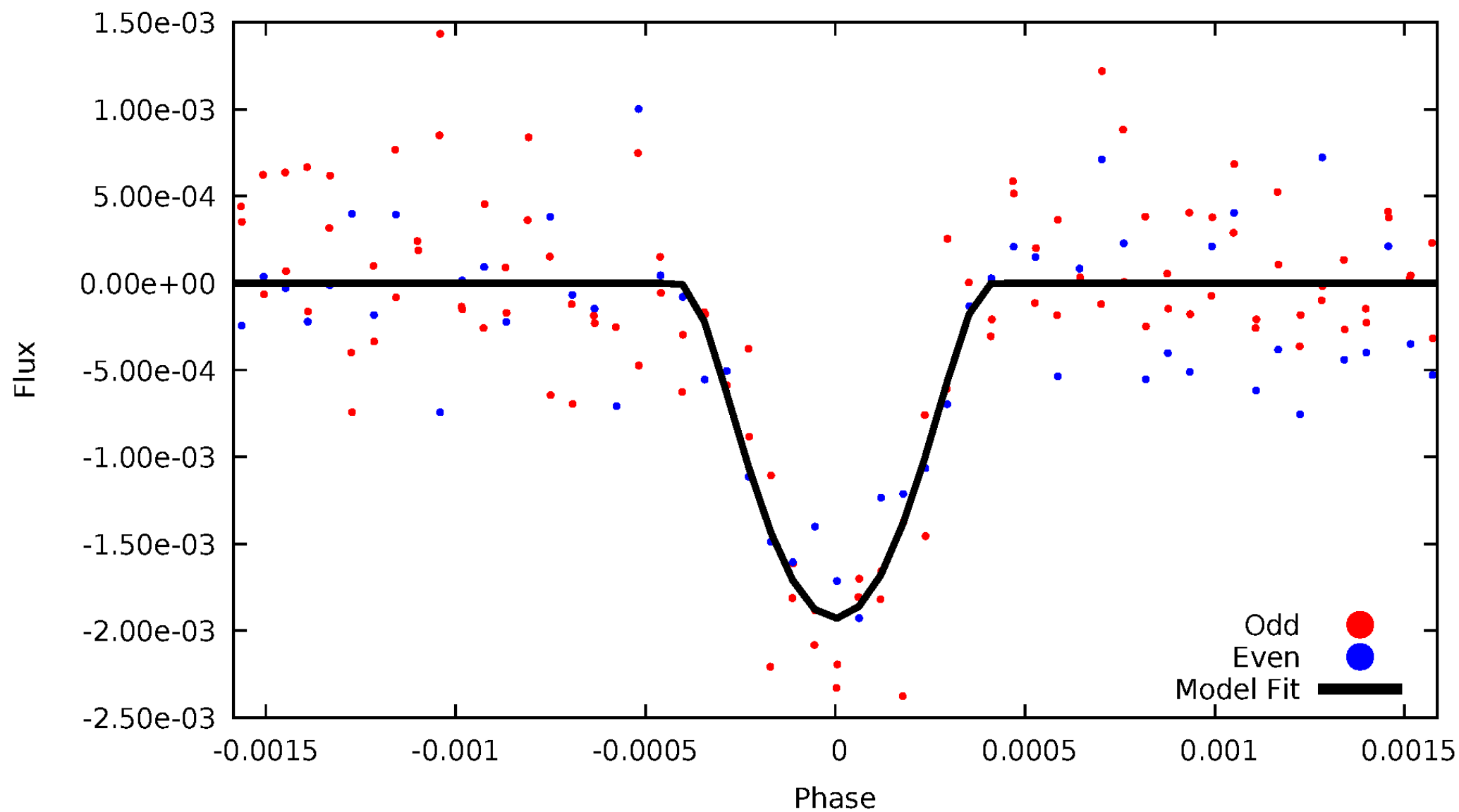


TCE 009021047-03



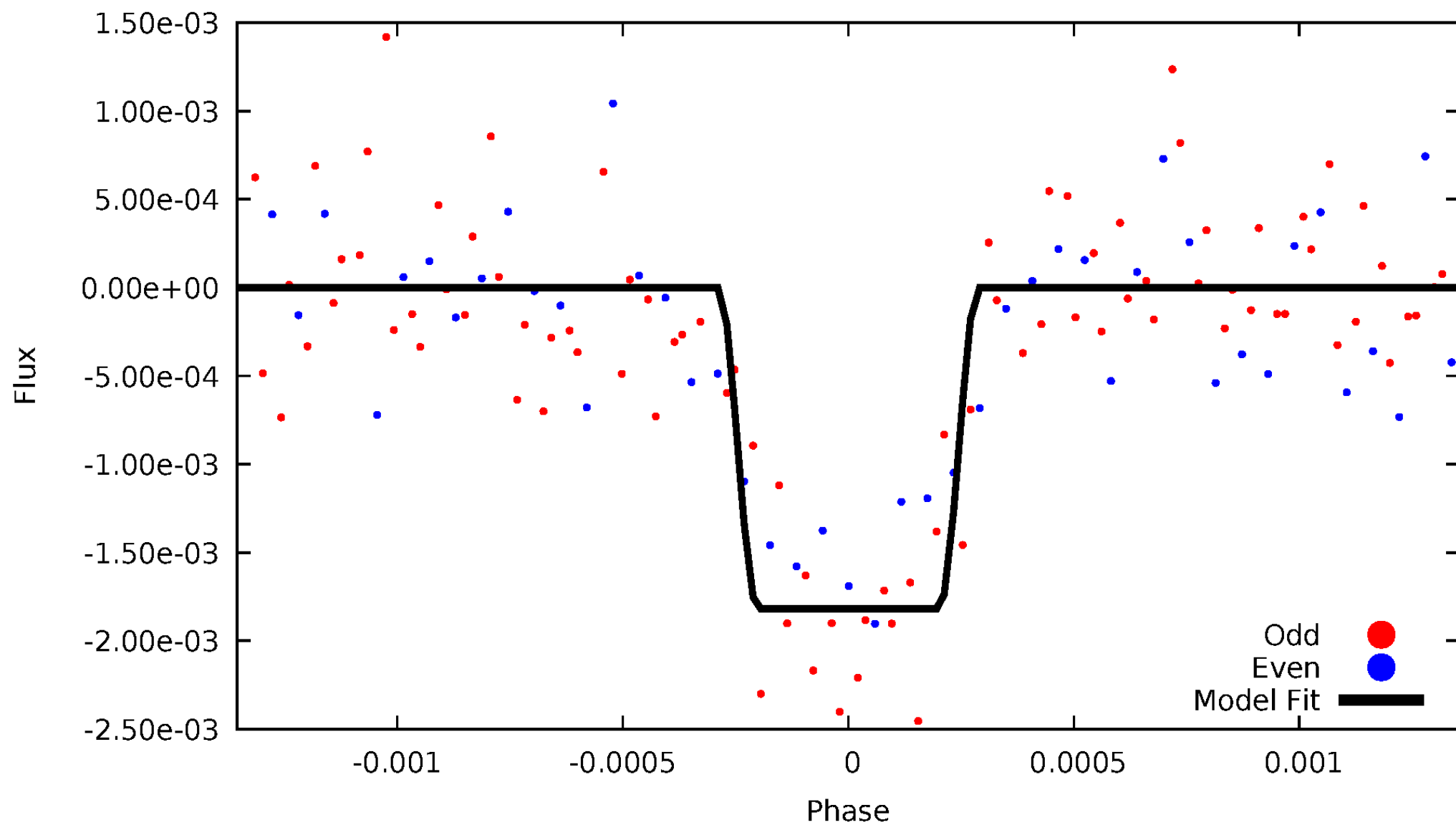
# DV Odd/Even

TCE 009021047-03



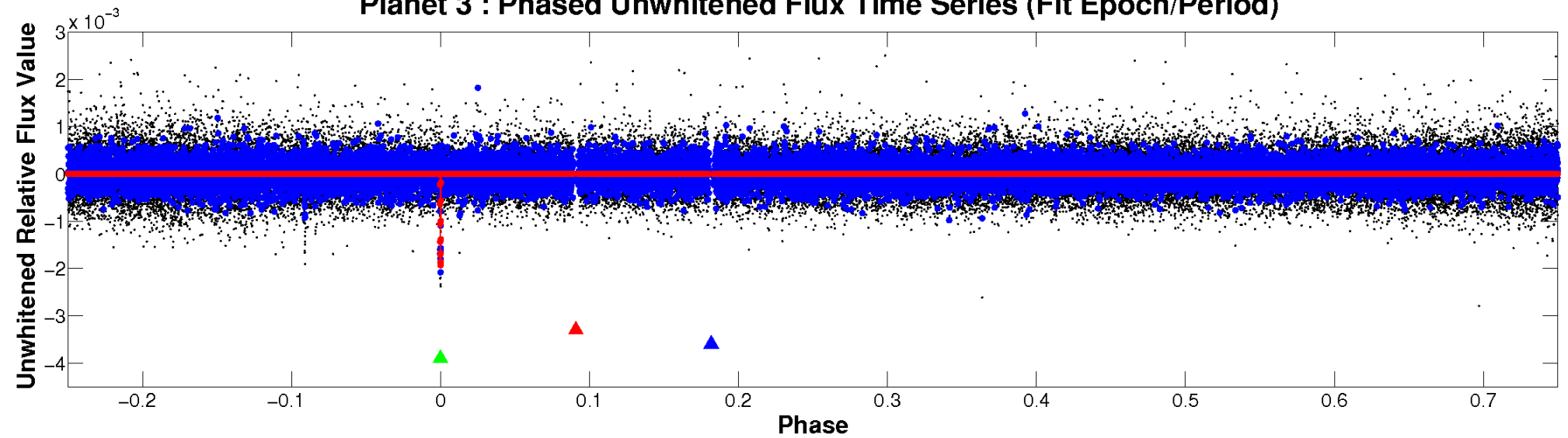
# ALT Odd/Even

TCE 009021047-03

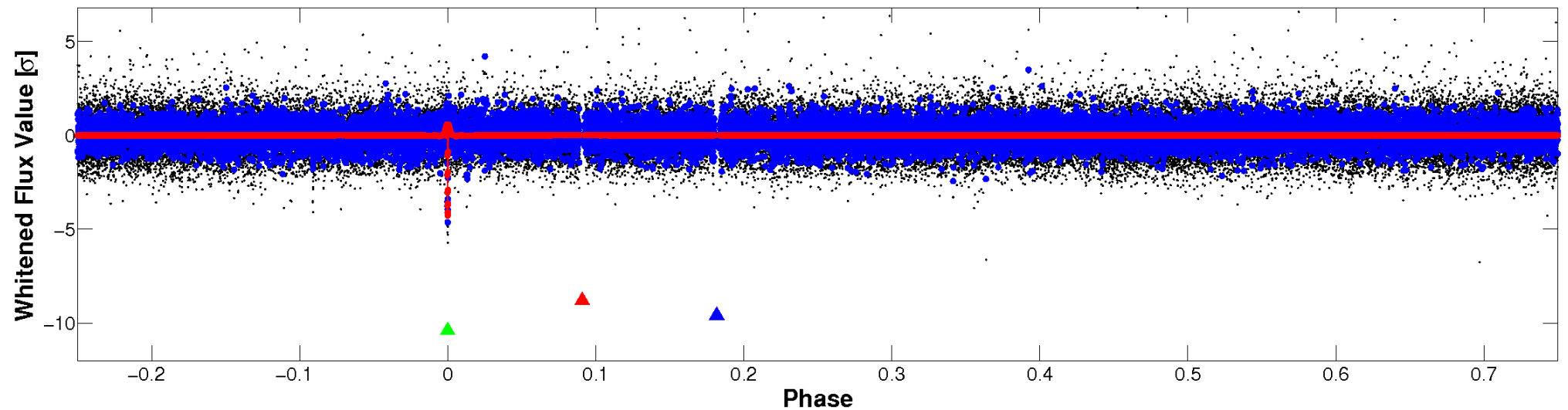


# Non-Whitened Vs. Whitened Light Curve

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

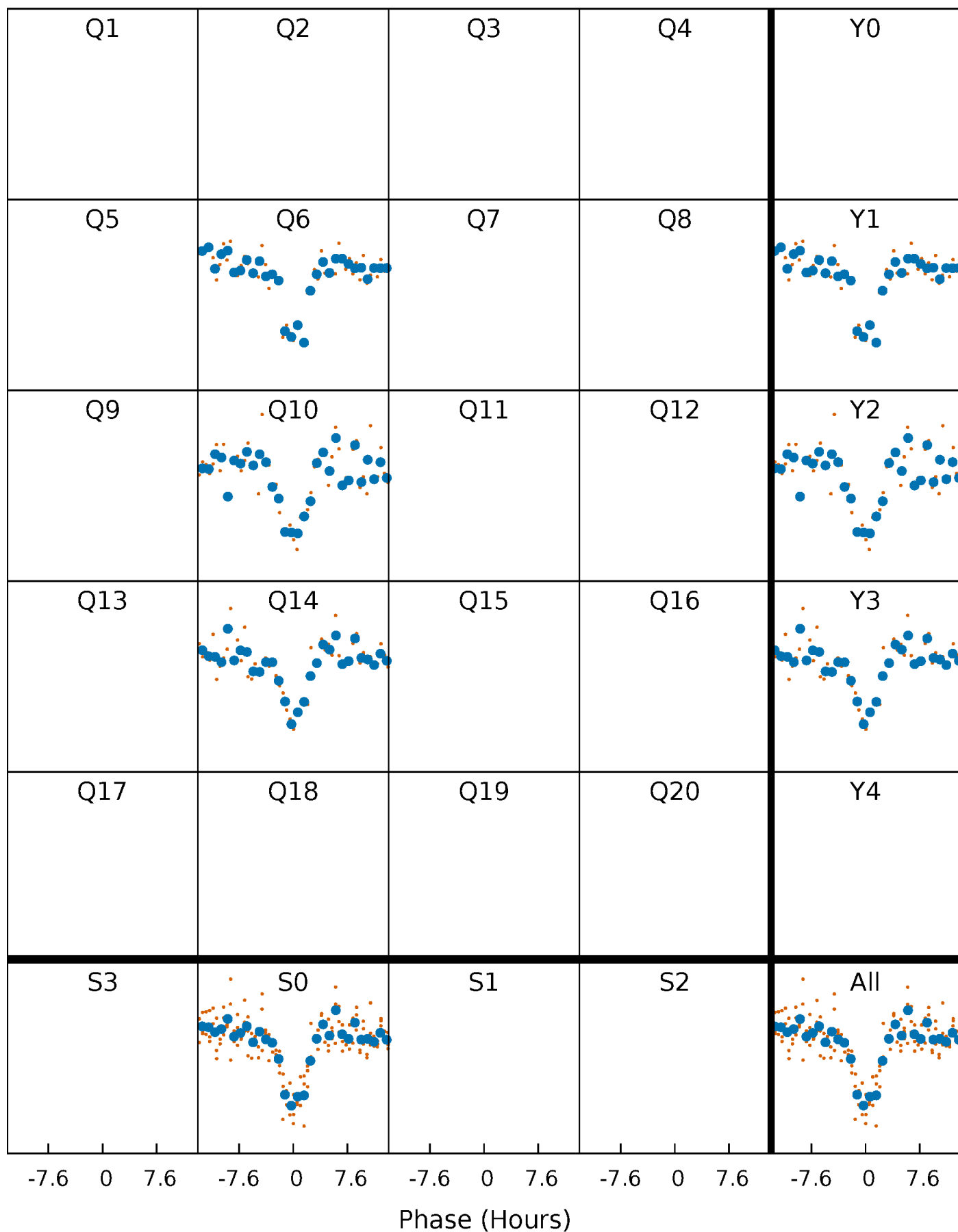


Planet 3 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

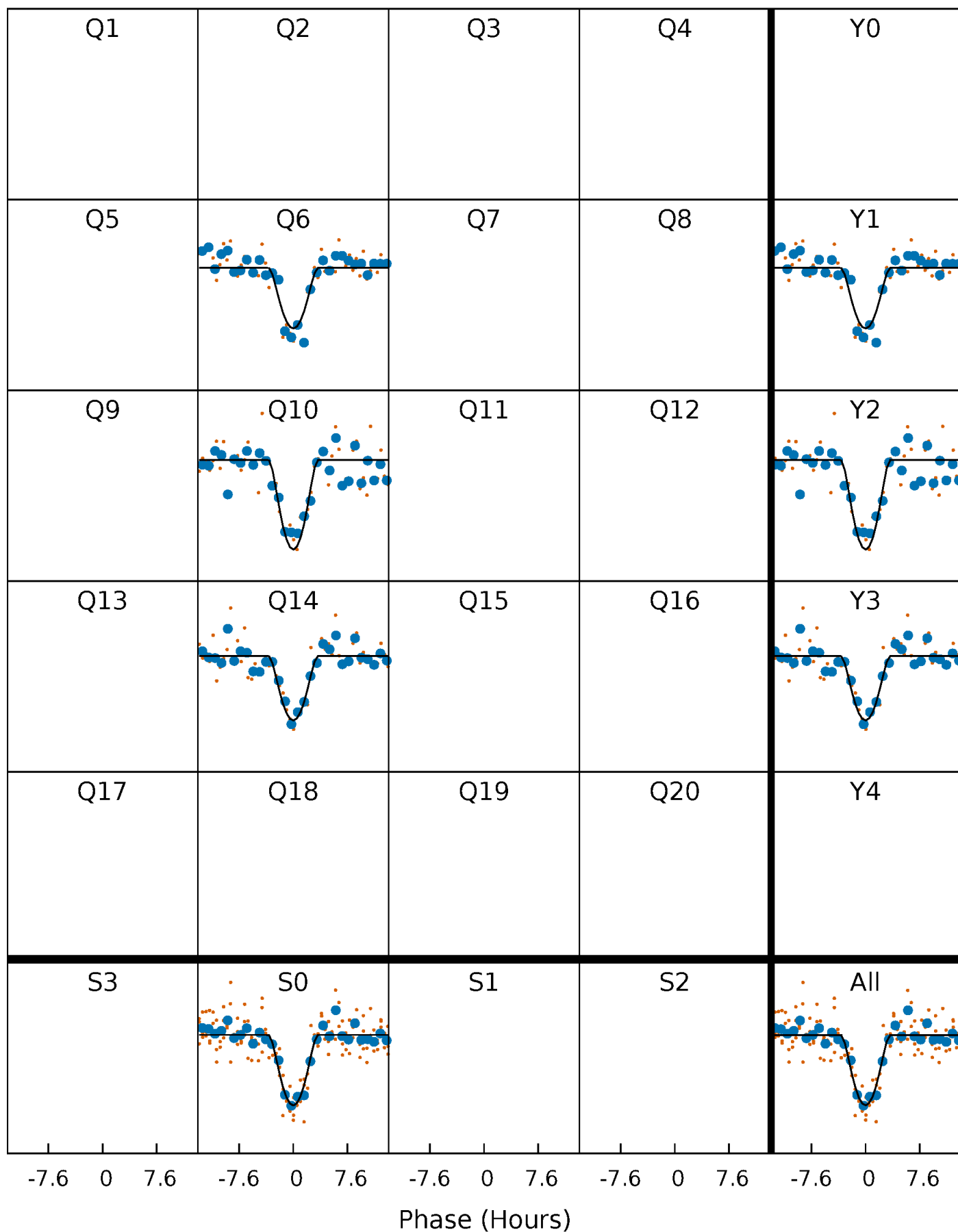
TCE 009021047-03 P=351.702382 Days  $T_0=229.799412$  (BKJD)





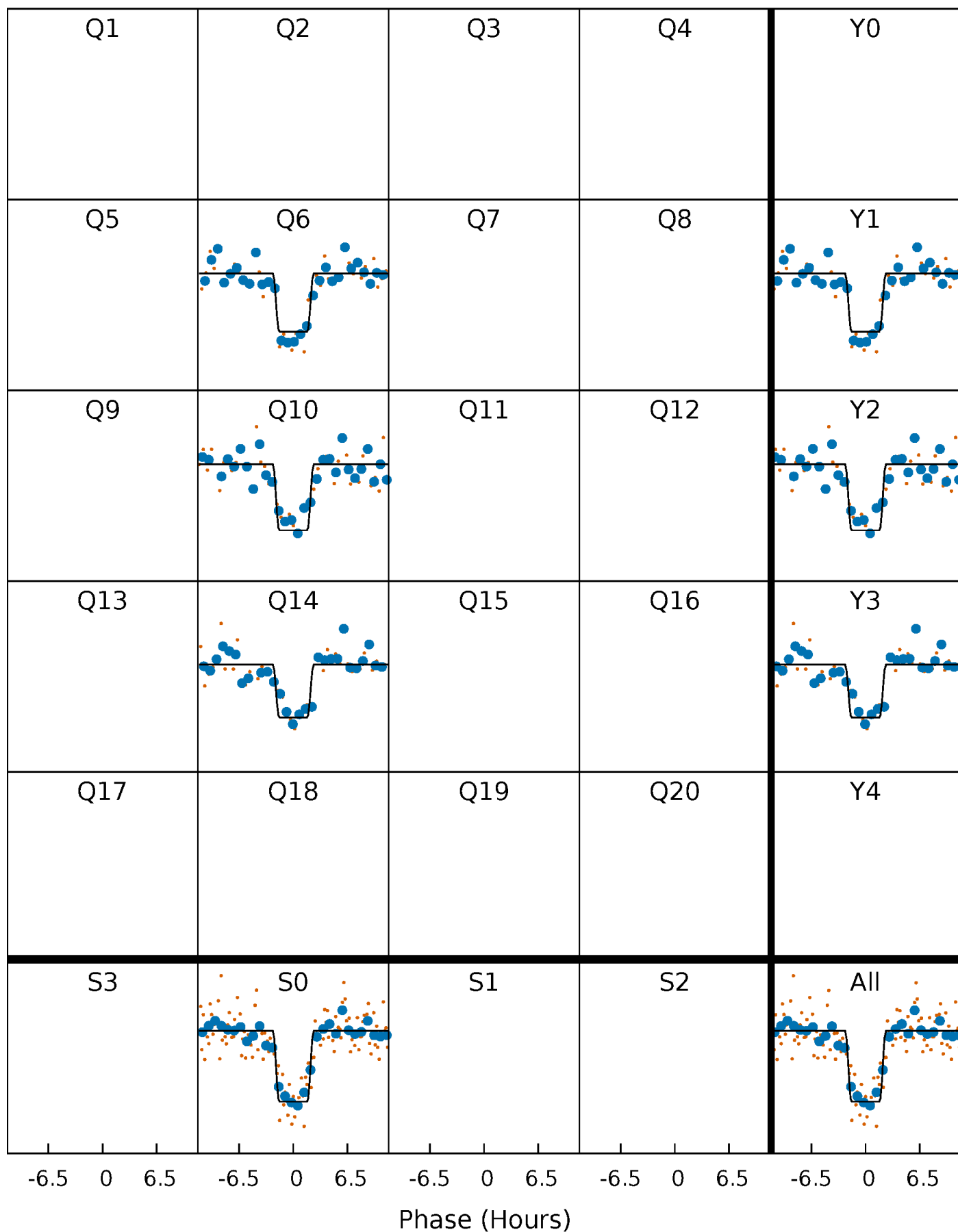
# DV Quarter-Phased Transit Curves

TCE 009021047-03     $P=351.702382$  Days     $T_0=229.799412$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

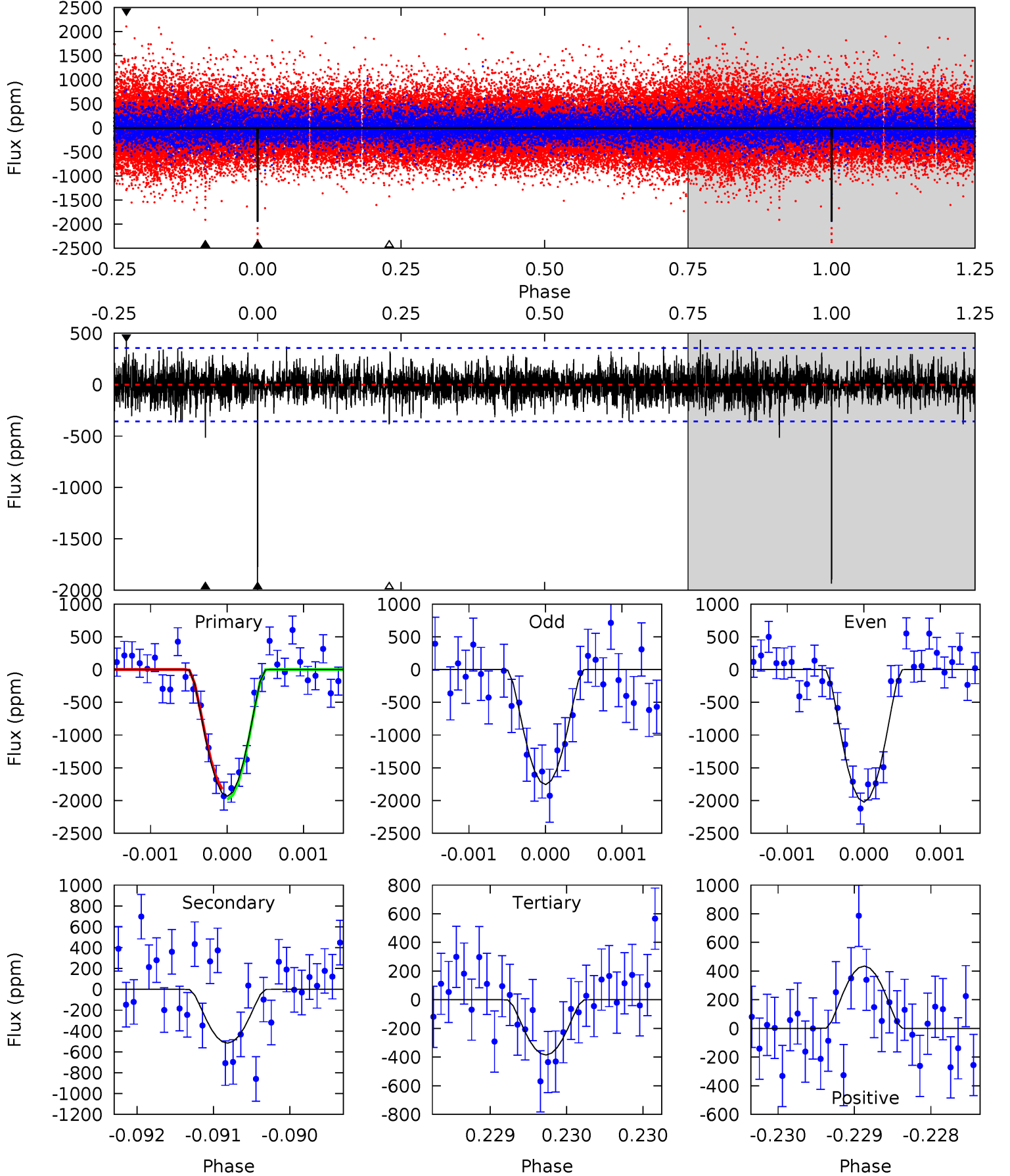
TCE 009021047-03     $P=351.695624$  Days     $T_0=229.814173$  (BKJD)



# DV Model-Shift Uniqueness Test

009021047-03, P = 351.702382 Days, E = 229.799412 Days

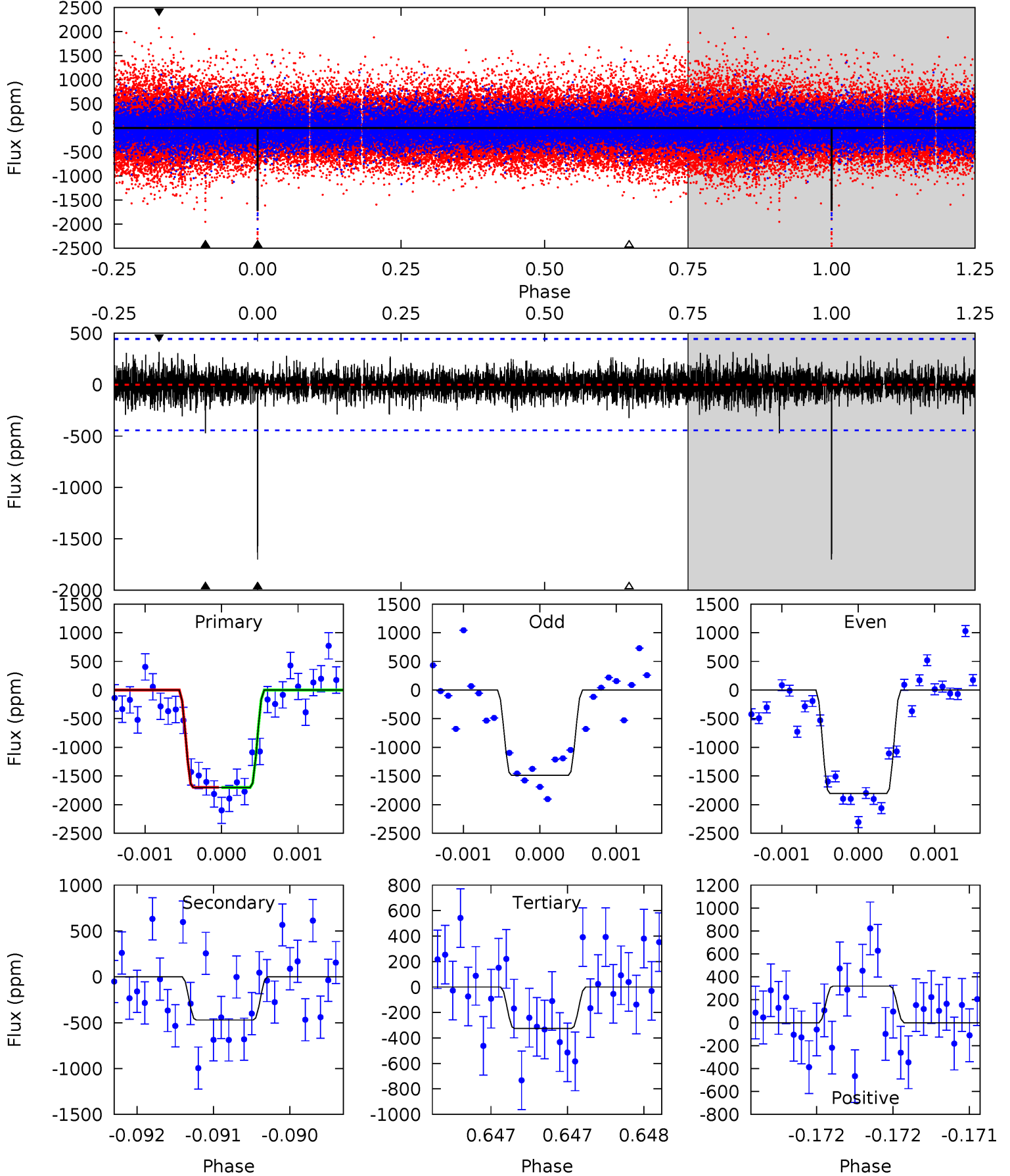
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
29.7	7.93	5.92	6.69	5.49	3.35	1.53	23.8	23.0	2.01	1.25	1.96	1.03	0.18	1.19



# Alt Model-Shift Uniqueness Test

009021047-03, P = 351.695624 Days, E = 229.814173 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
21.3	5.90	4.07	4.00	5.57	3.47	1.01	17.2	17.3	1.83	1.90	1.91	1.05	0.16	0.02



### Stellar Parameters For KIC 009021047

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M$ ( $M_{\odot}$ )	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6340^{+176}_{-242}$	$4.457^{+0.067}_{-0.202}$	$-0.300^{+0.250}_{-0.350}$	$1.010^{+0.320}_{-0.107}$	$1.066^{+0.143}_{-0.143}$	$1.458^{+0.405}_{-0.755}$
	+3%/-4%	+2%/-5%	+83%/-117%	+32%/-11%	+13%/-13%	+28%/-52%
Source	KIC0	KIC0	KIC0	DSEP		

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

### Secondary Eclipse Parameters for KIC 009021047-03 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-516 \pm 65$	$9.77^{+8.75}_{-6.27}$	$399^{+29}_{-20}$	$3678^{+1731}_{-640}$	$2935^{+19920}_{-2125}$
Alt.	$-471 \pm 80$	$8.43^{+8.25}_{-5.89}$	$399^{+30}_{-19}$	$3805^{+2420}_{-738}$	$3546^{+34990}_{-2647}$

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

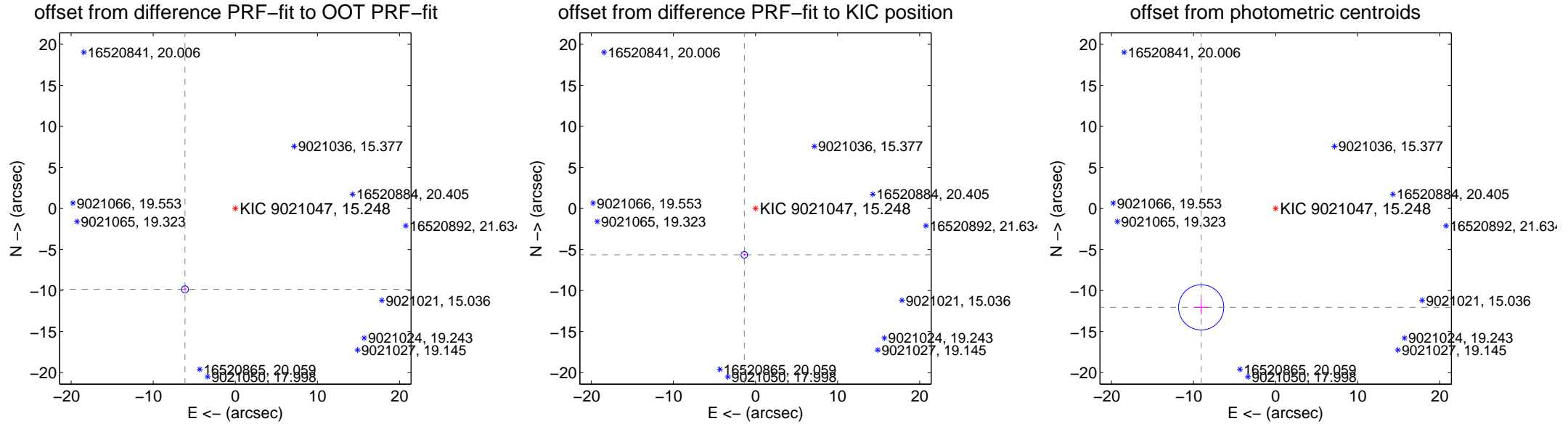
## DV Centroid Data

Supplemental centroid analysis for 009021047-03. Kepler magnitude: 15.25. Transit SNR 17.71

There are 3 quarters with good PRF difference image offsets

The OOT PRF centroid is offset from the target star catalog position by about 6.38 arcsec so the offset from difference PRF-fit to OOT-fit may be invalid.

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$11.611 \pm 0.144$	80.91	$6.133 \pm 0.133$	$-9.859 \pm 0.147$
PRF-fit source offset from KIC position	$5.812 \pm 0.134$	43.43	$1.361 \pm 0.141$	$-5.650 \pm 0.133$
photometric centroid source offset	$15.08 \pm 0.92$	16.43	$9.07 \pm 0.91$	$-12.05 \pm 0.93$

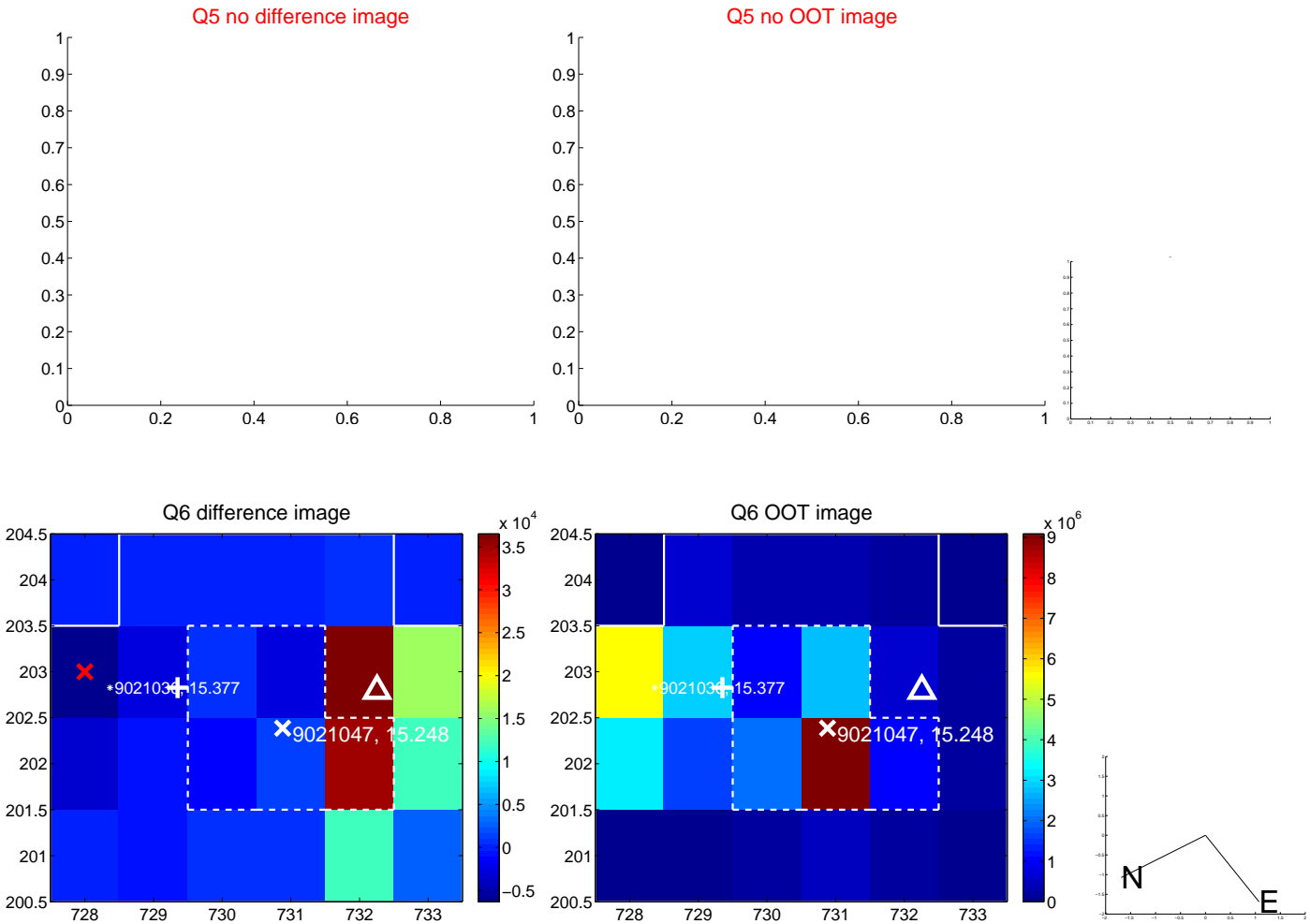


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

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

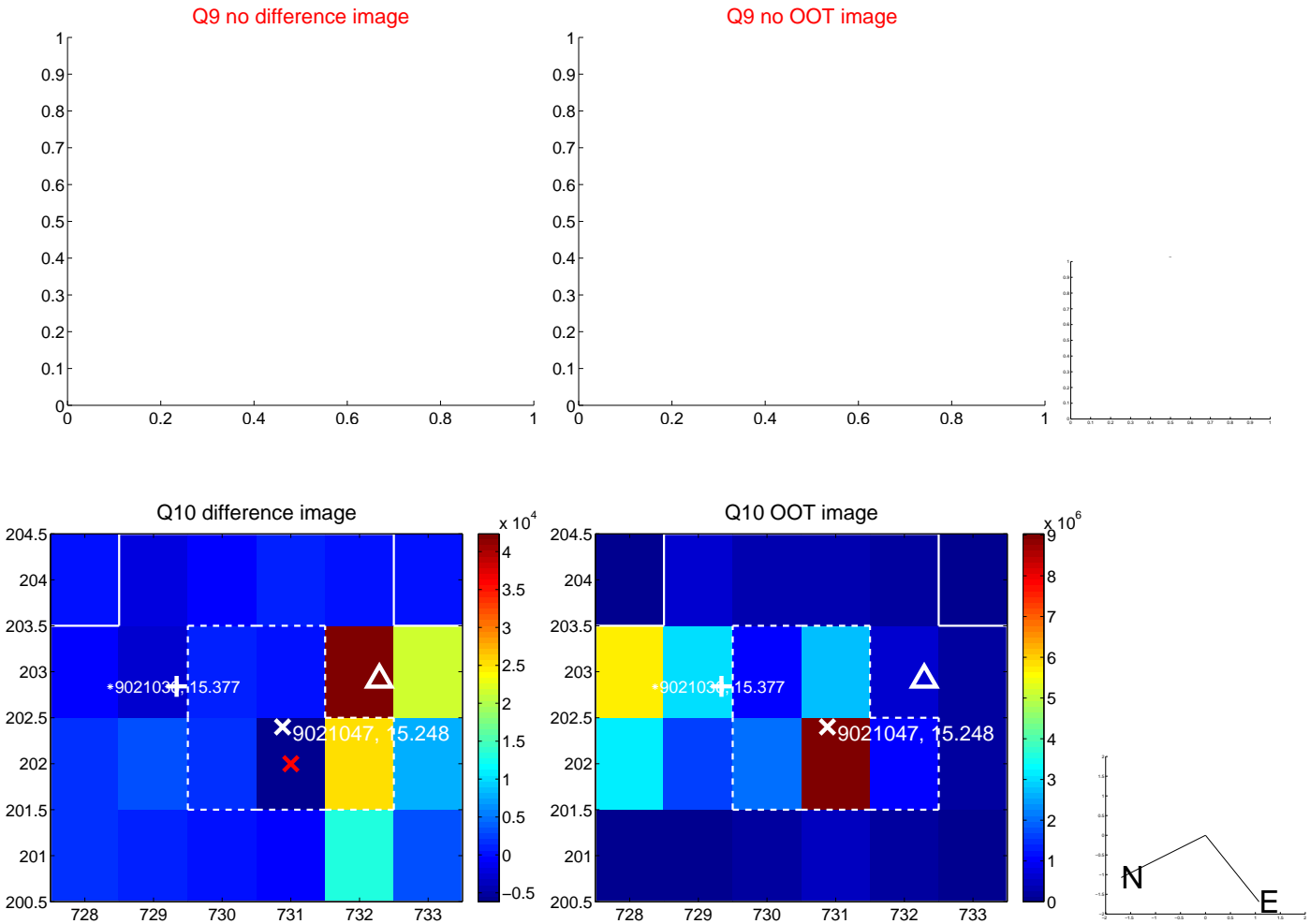


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

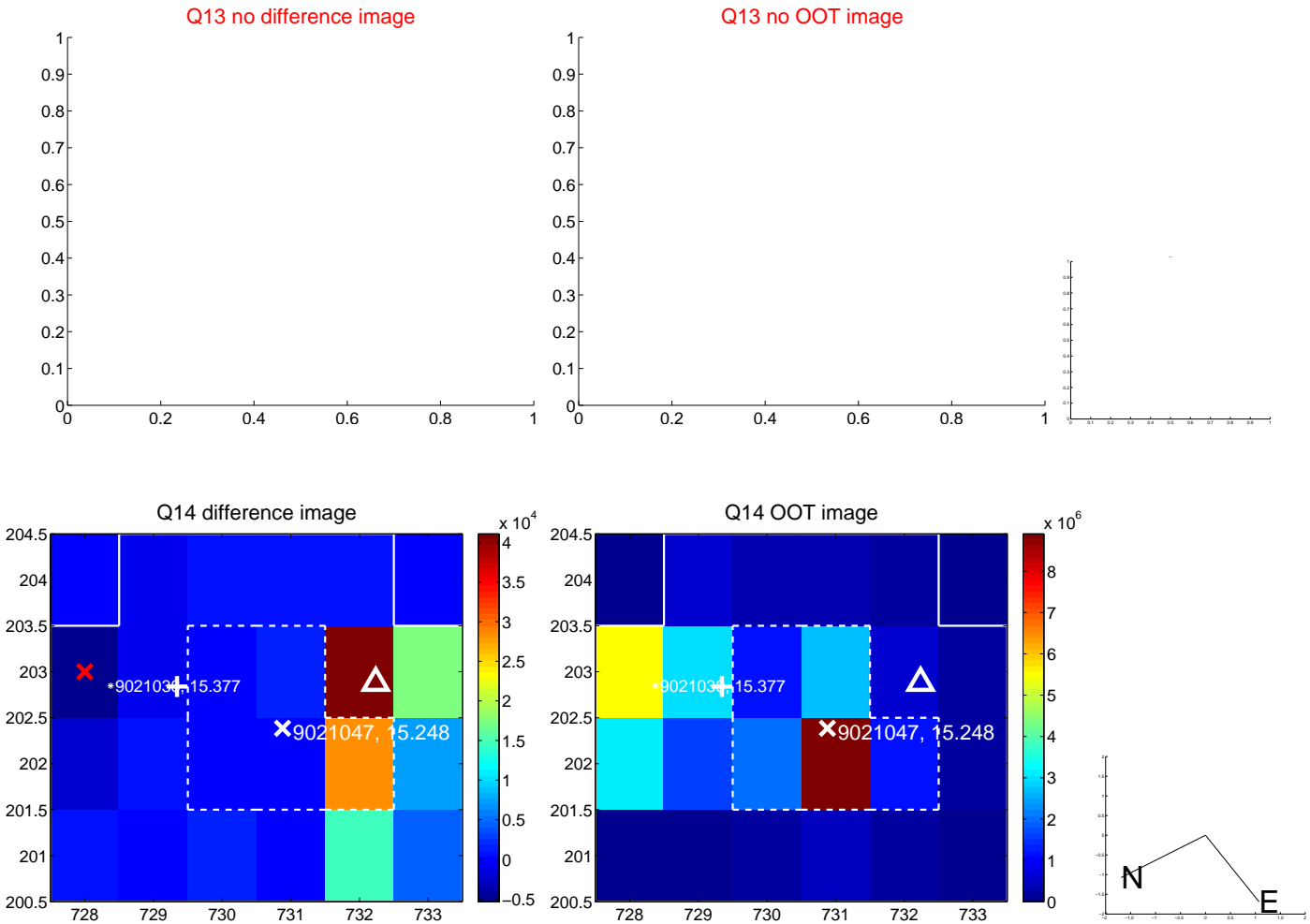




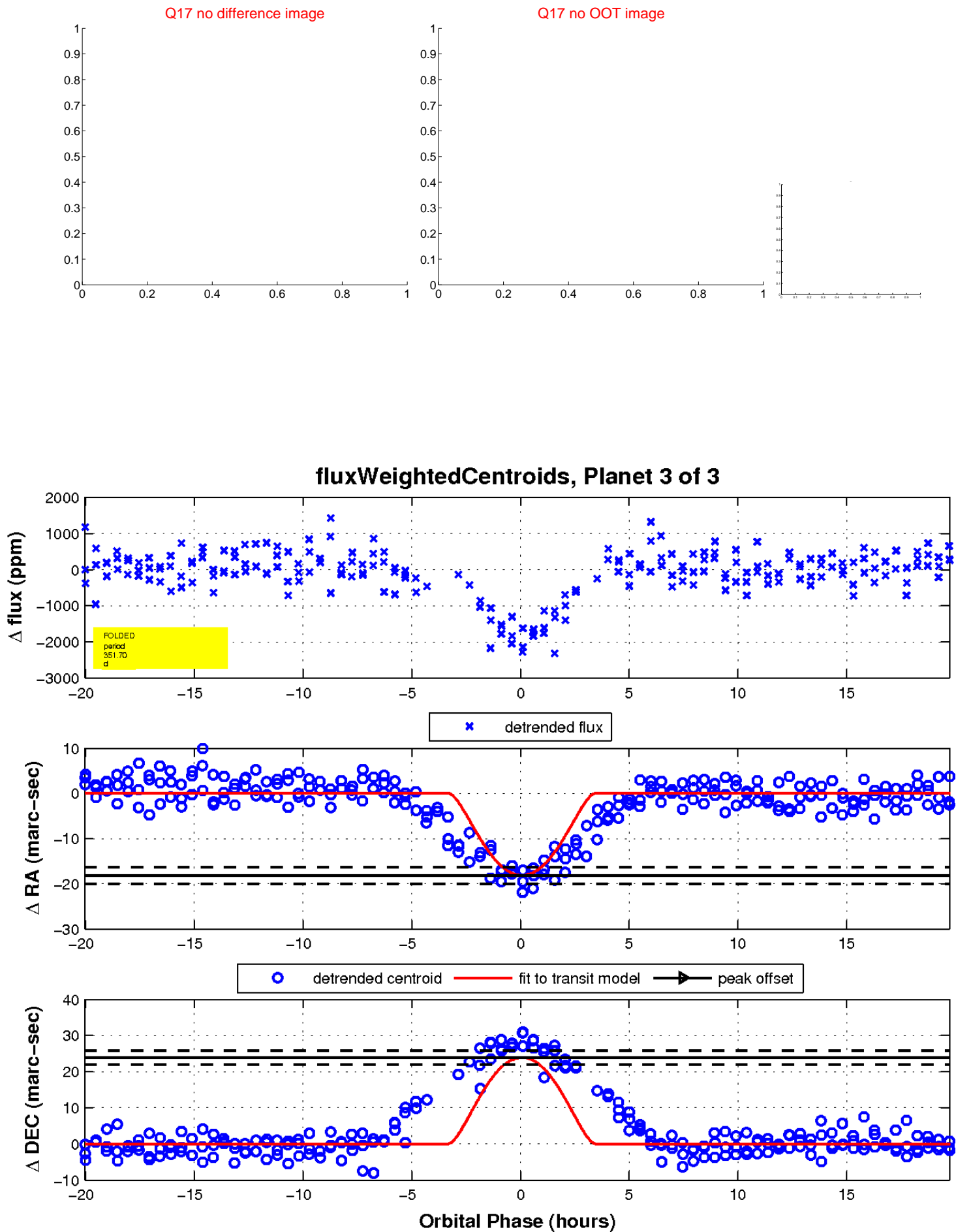
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

