

# KIC 012071053

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
012071053-01	OBS	No	335.121246	408.008440	4028.6	9.036	14.8	7.1	0.70	4447	5.55	0.23
012071053-02	OBS	No	599.780185	221.647453	2437.3	4.168	11.9	6.1	0.70	4447	3.64	0.11

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
012071053-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_ZUMA—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
012071053-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS

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

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

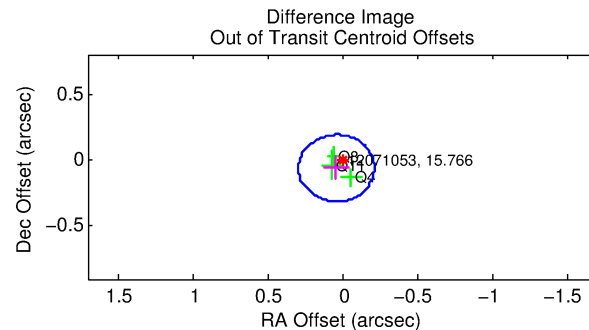
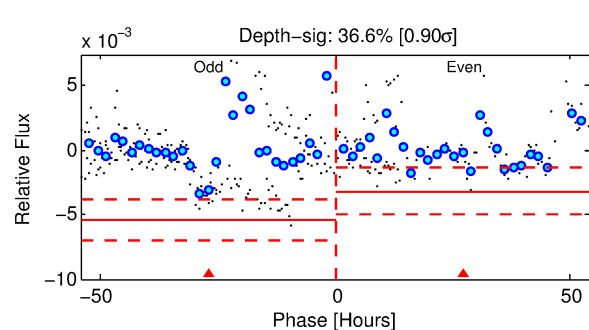
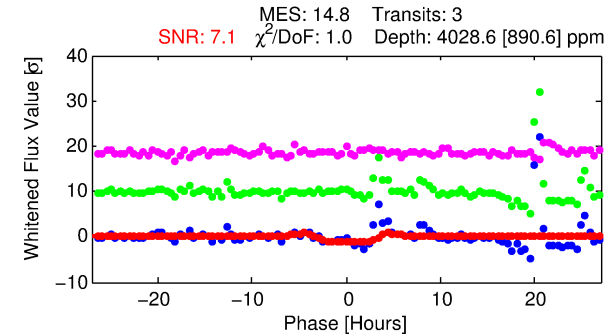
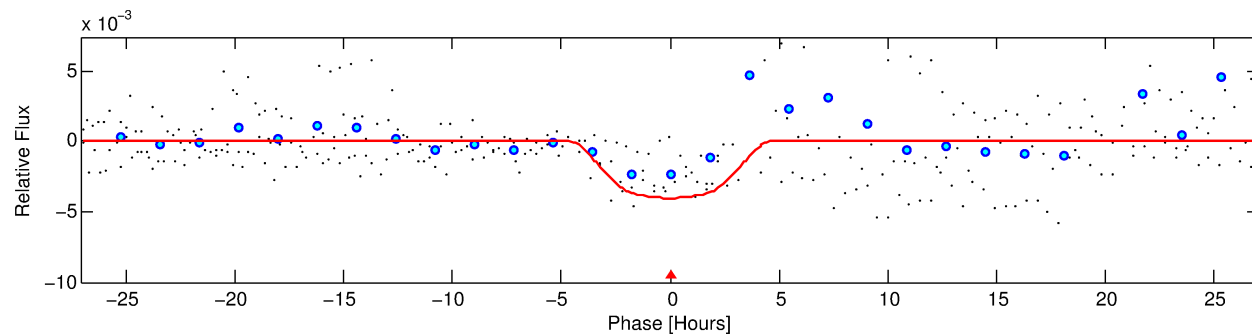
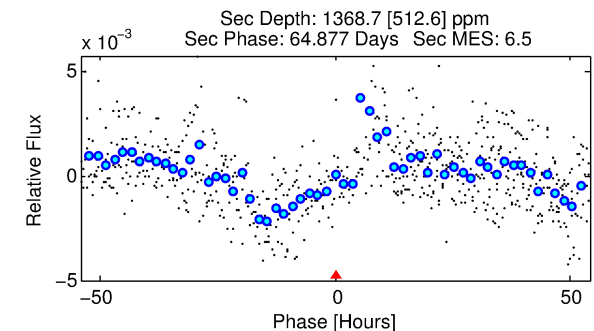
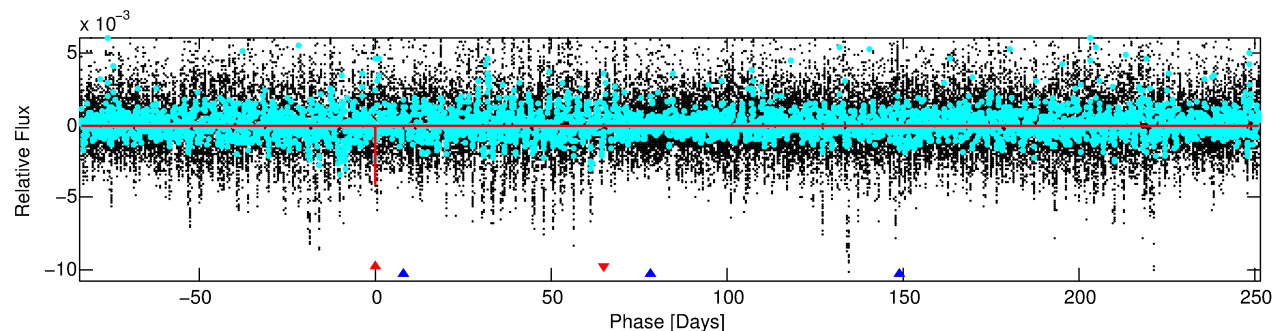
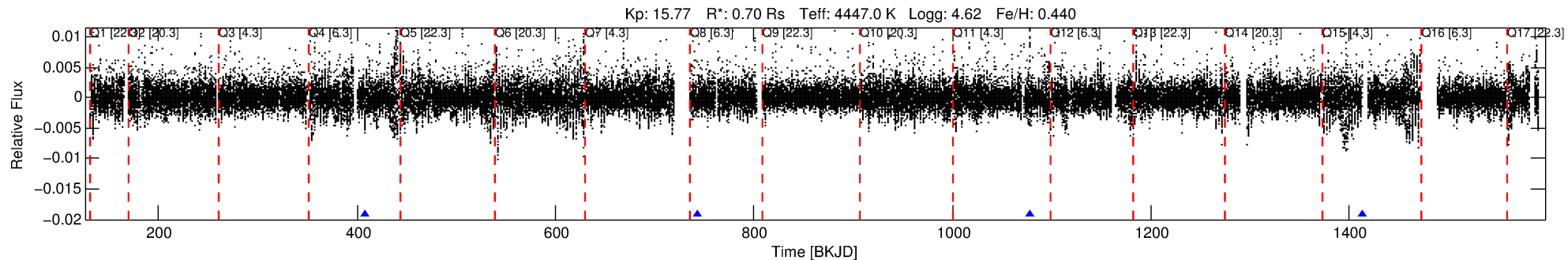
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 012071053-01

No Significant Match Found

# DV One-Page Summary

KIC: 12071053 Candidate: 1 of 2 Period: 335.121 d



## DV Fit Results:

Period = 335.12125 [0.01618] d  
Epoch = 408.0084 [0.0239] BKJD  
Rp/R\* = 0.0723 [0.0103]  
a/R\* = 166.57 [35.94]  
b = 0.90 [0.05]  
Seff = 0.23 [0.04]  
Teq = 177 [7] K  
Rp = 5.55 [0.86] Re  
a = 0.8621 [0.0429] AU  
Ag = 18151.98 [8655.04] [2.10σ]  
Teff = 3182 [391] K [7.69σ]

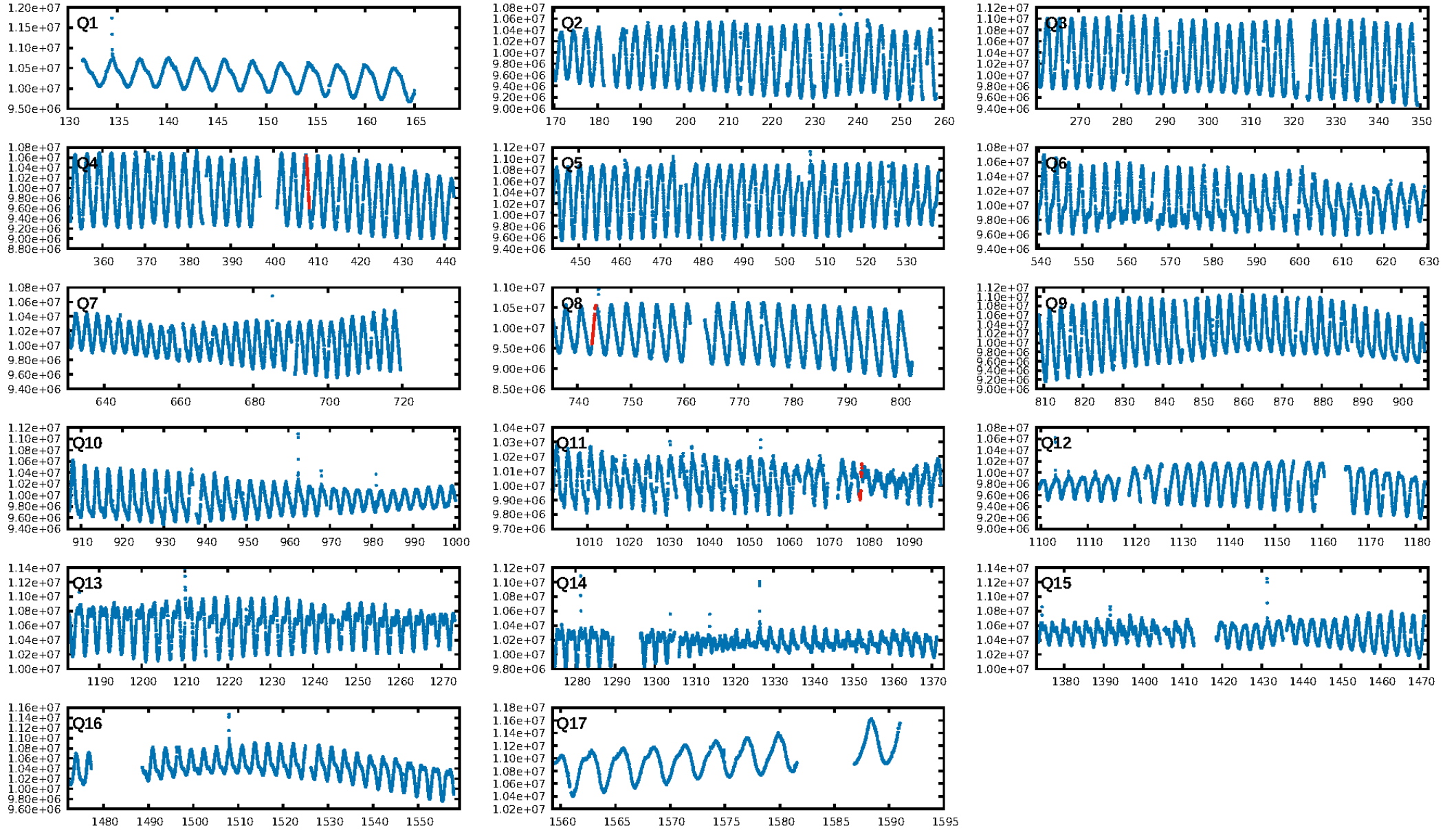
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [638.33σ]  
ModelChiSquare2-sig: 0.0%  
ModelChiSquareGof-sig: 97.4%  
Bootstrap-pfa: 5.07e-16  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: 0.9893  
Centroid-sig: 4.2%  
Centroid-so: 0.378 arcsec [0.54σ]  
OotOffset-rm: 0.073 arcsec [0.86σ]  
OotOffset-st: 0/1/2/0 [3]  
KicOffset-st: 0/1/2/0 [3]  
DiffImageQuality-fgm: 0.33 [1/3]  
DiffImageOverlap-fno: 1.00 [3/3]

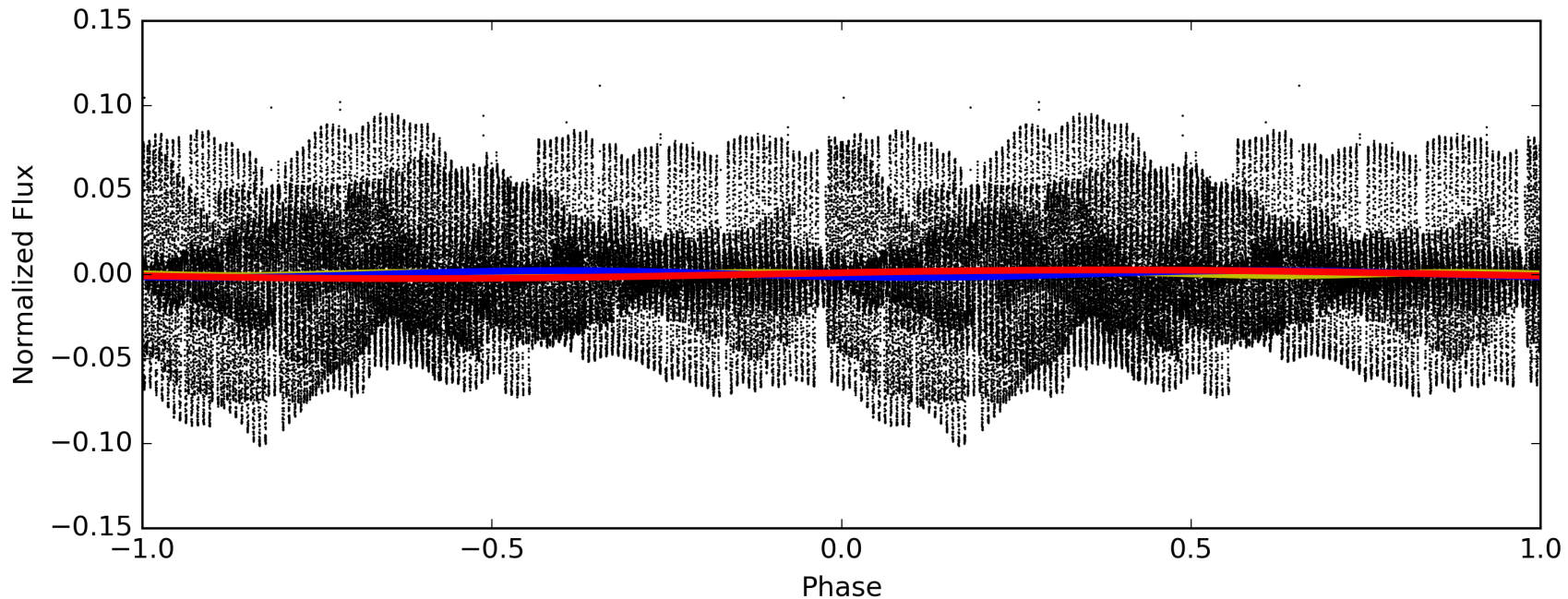
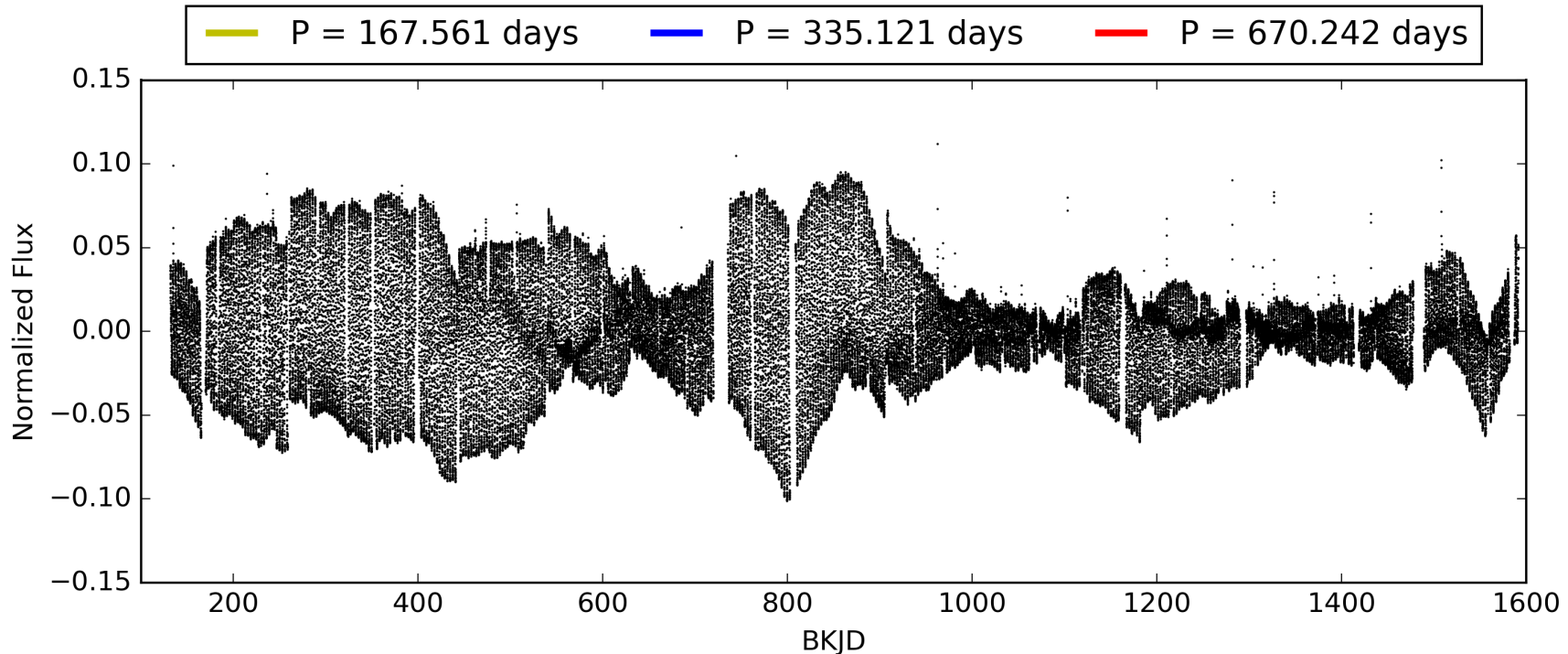
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 29-Jan-2016 08:17:12 Z

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

# TCE 012071053-01, PDC Light Curves

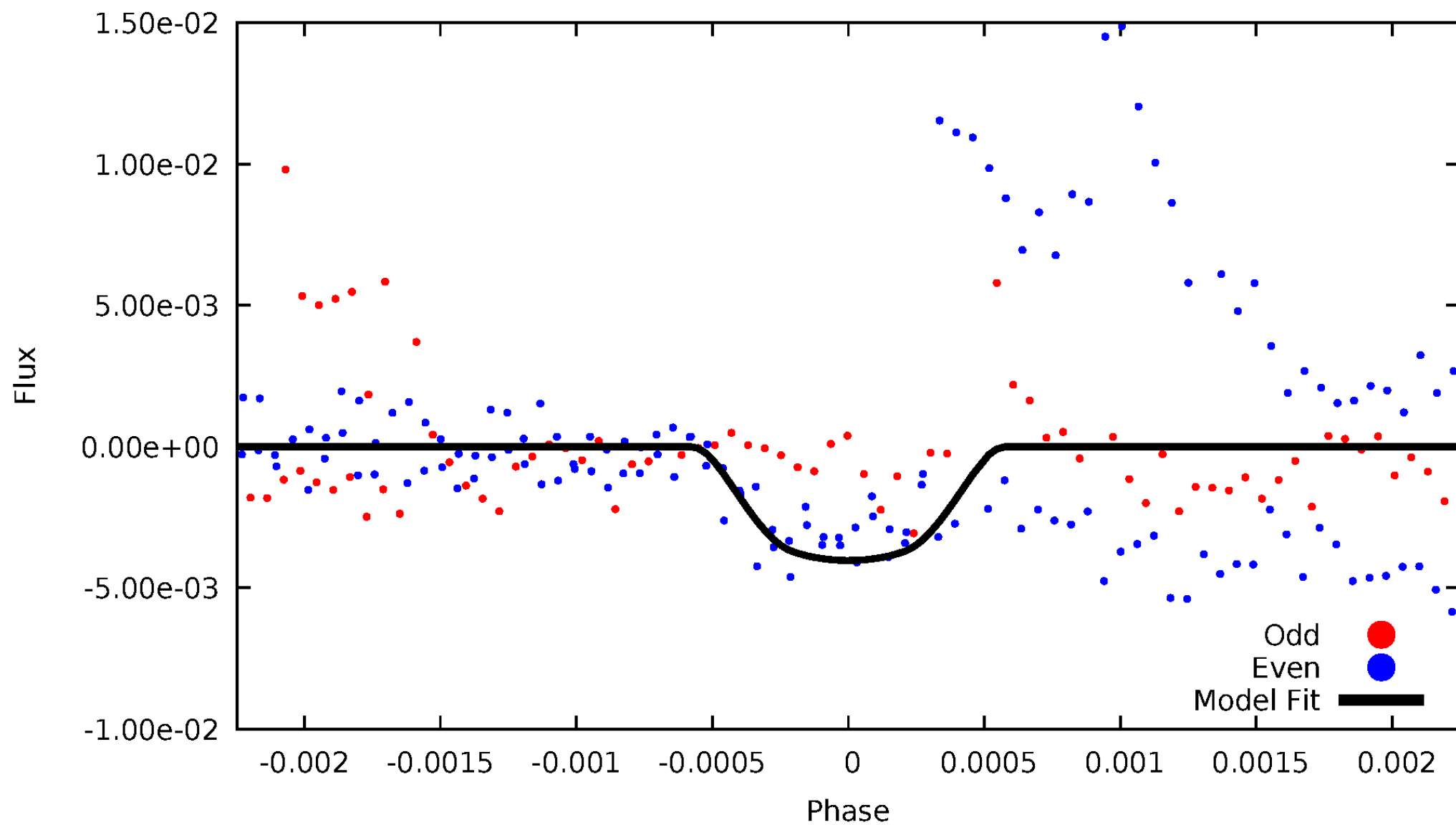


TCE 012071053-01



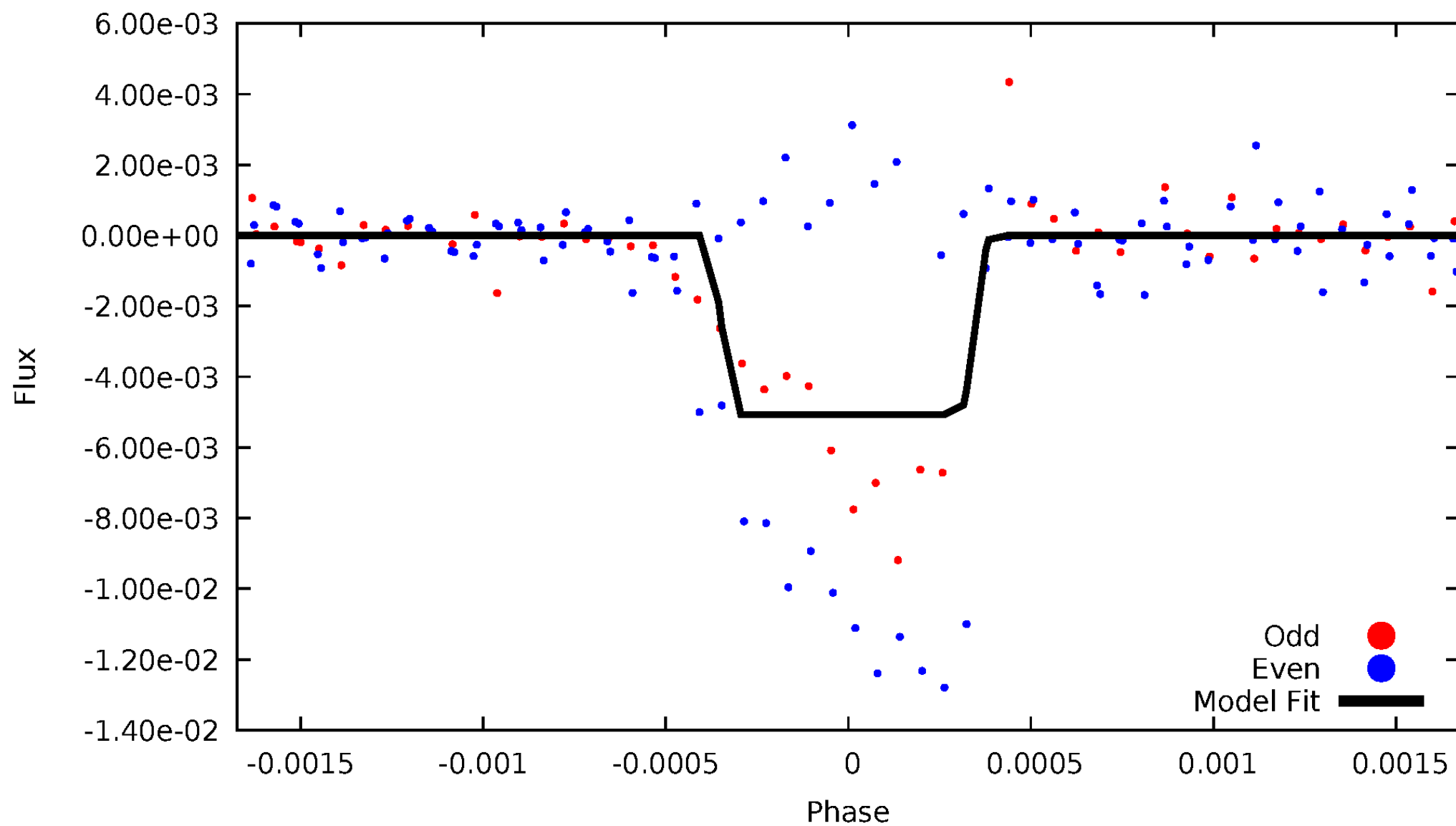
# DV Odd/Even

TCE 012071053-01



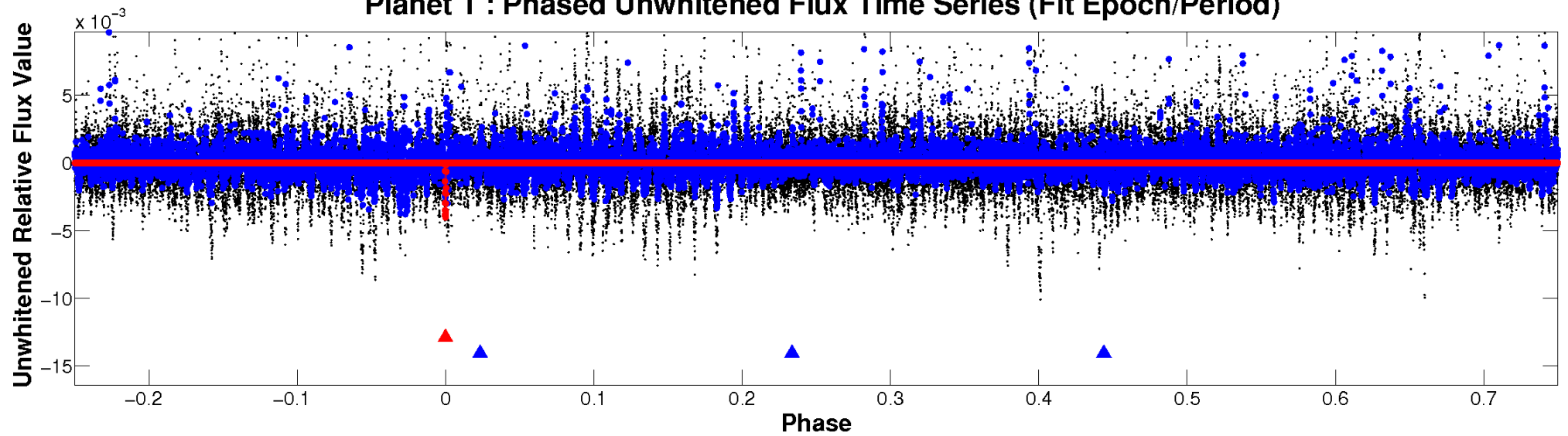
# ALT Odd/Even

TCE 012071053-01

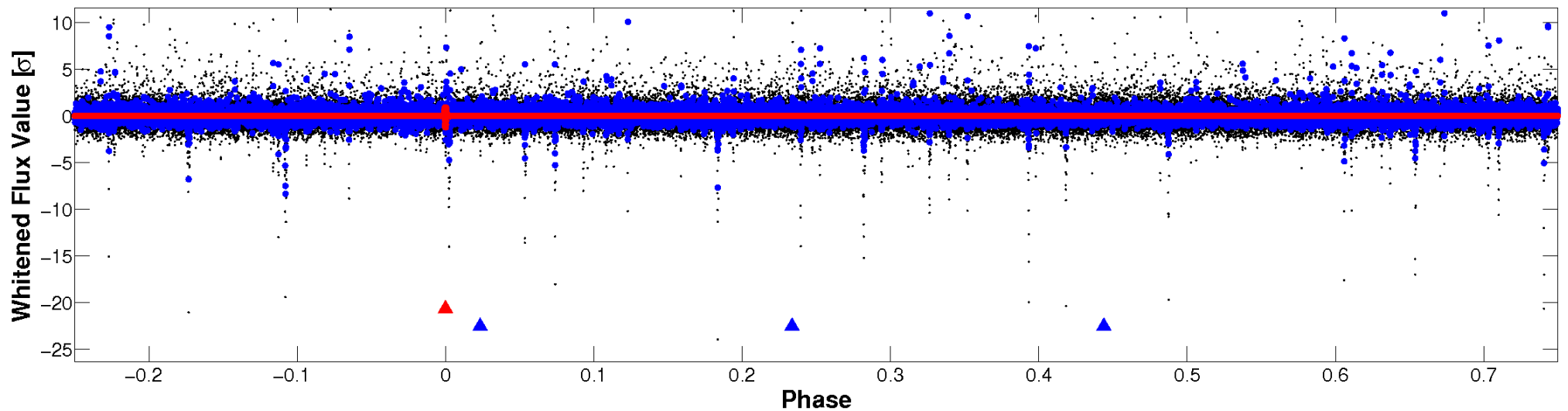


# Non-Whitened Vs. Whitened Light Curve

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

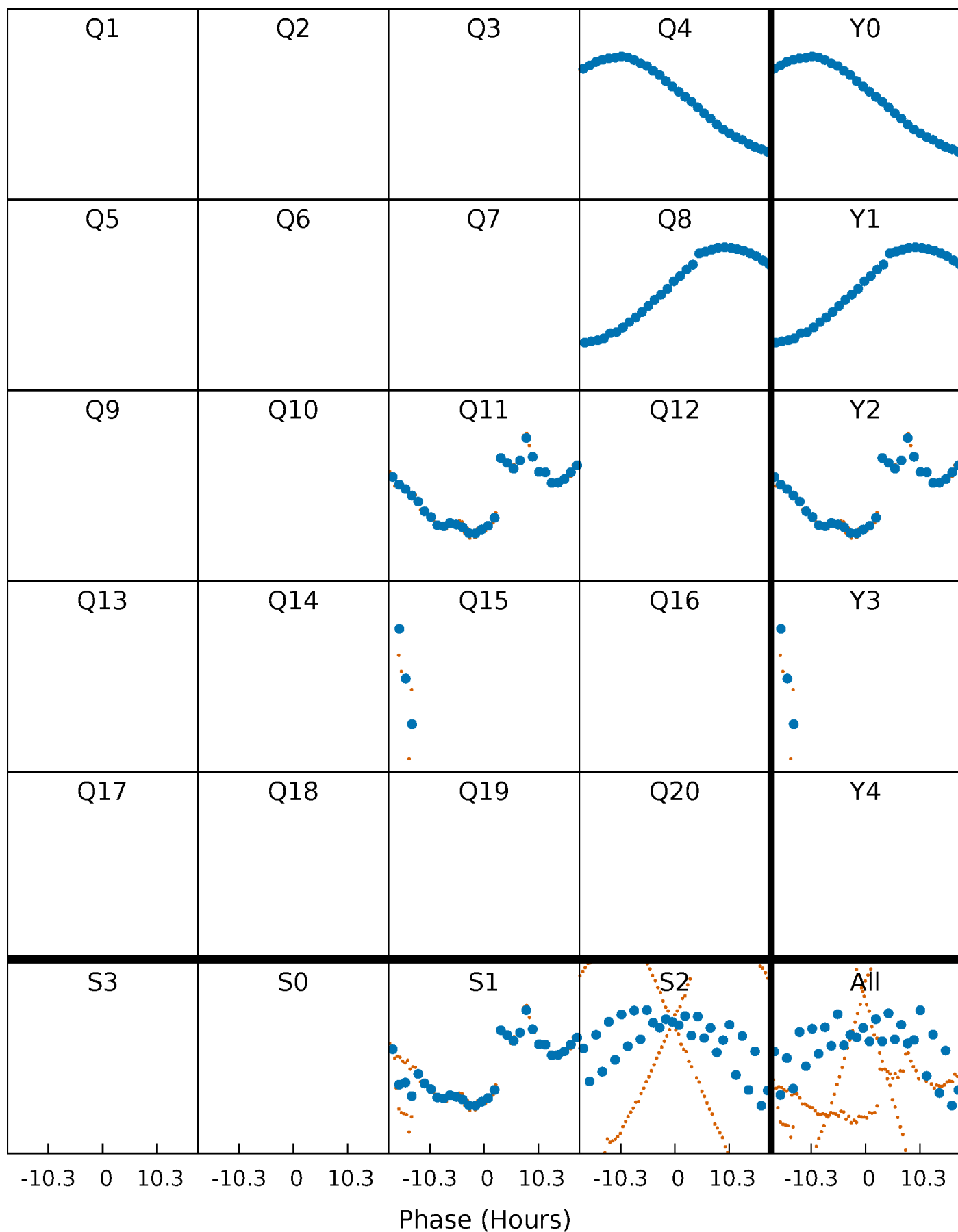


**Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



# PDC Quarter-Phased Transit Curves

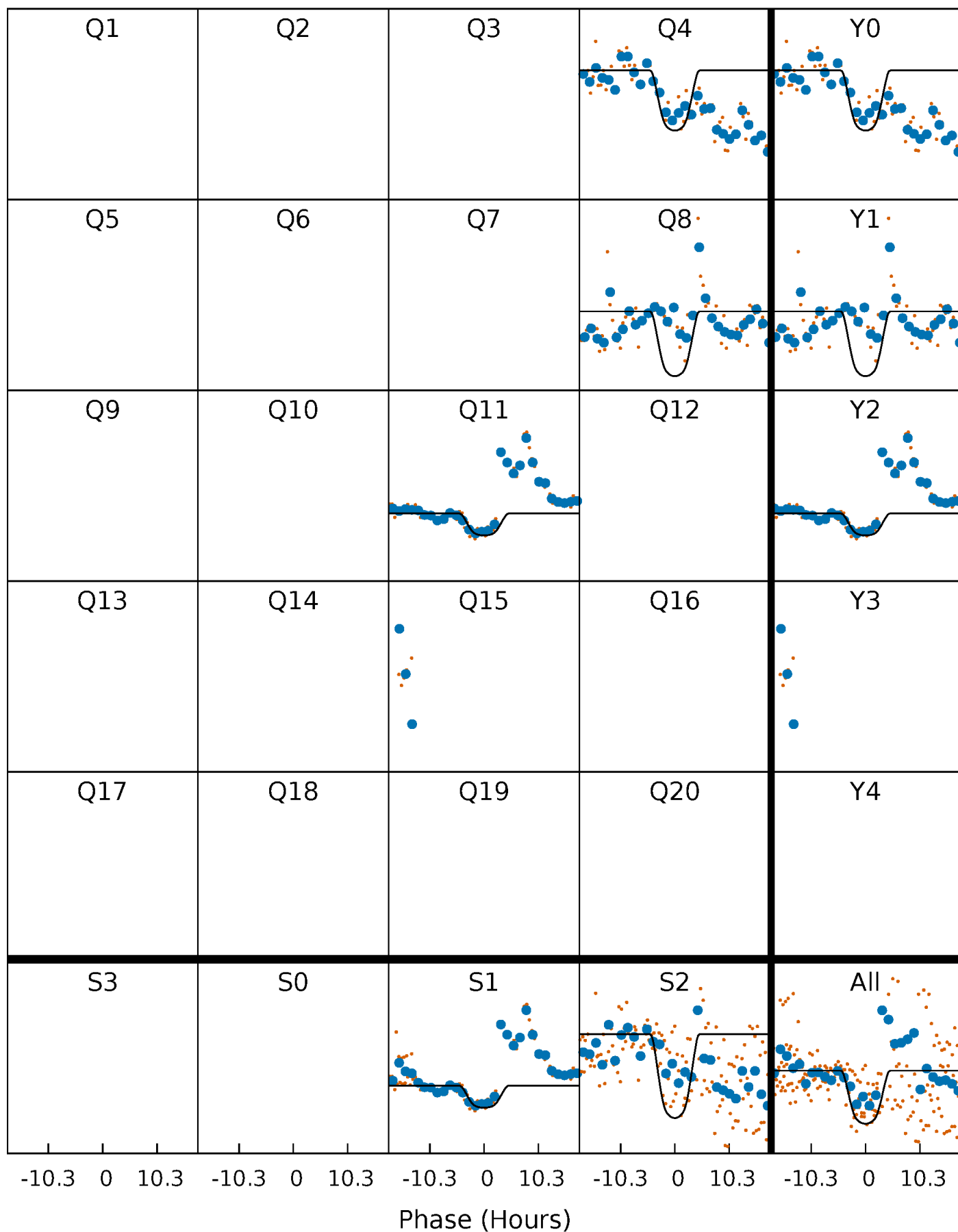
TCE 012071053-01 P=335.121246 Days  $T_0=408.008440$  (BKJD)





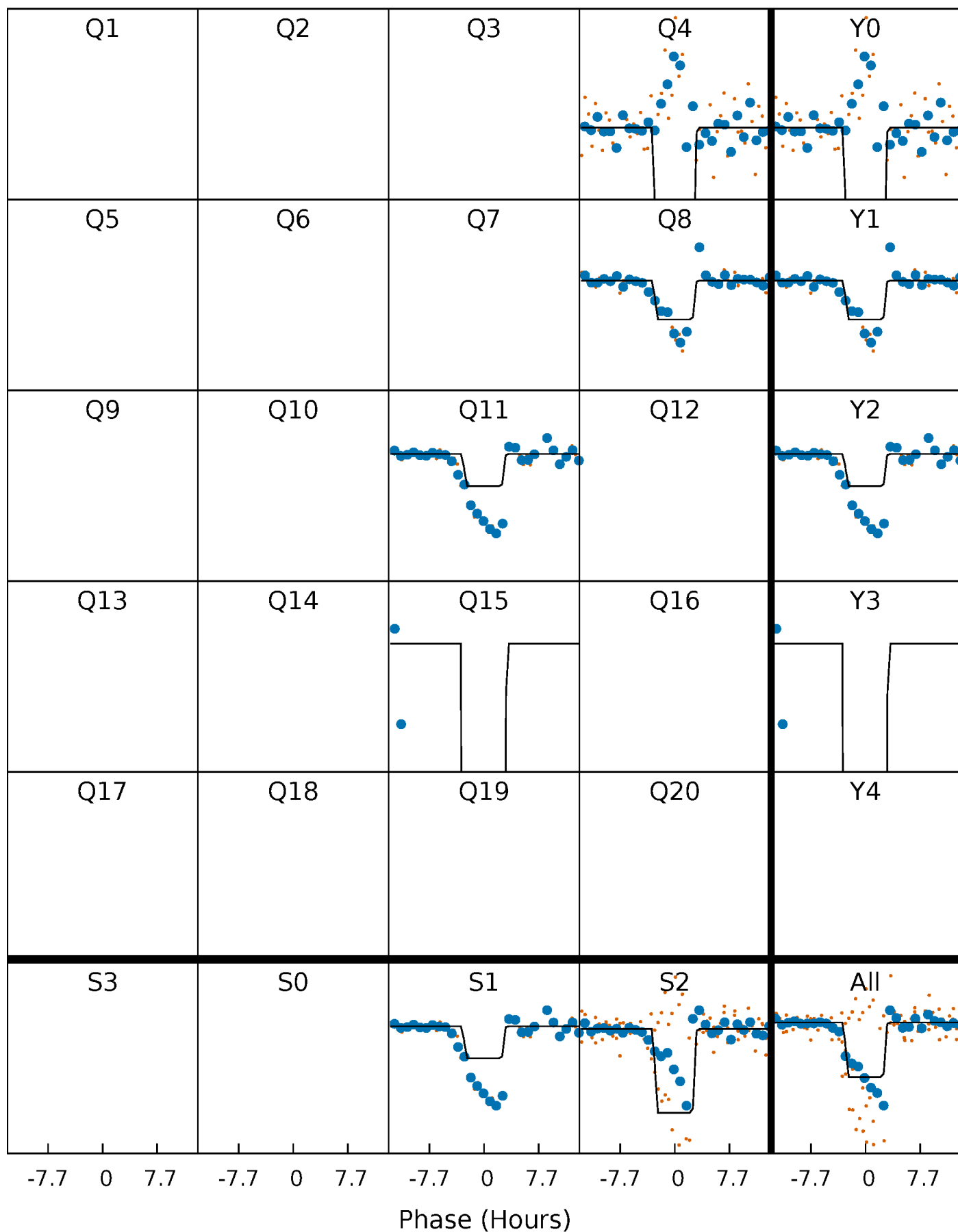
# DV Quarter-Phased Transit Curves

TCE 012071053-01 P=335.121246 Days  $T_0=408.008440$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

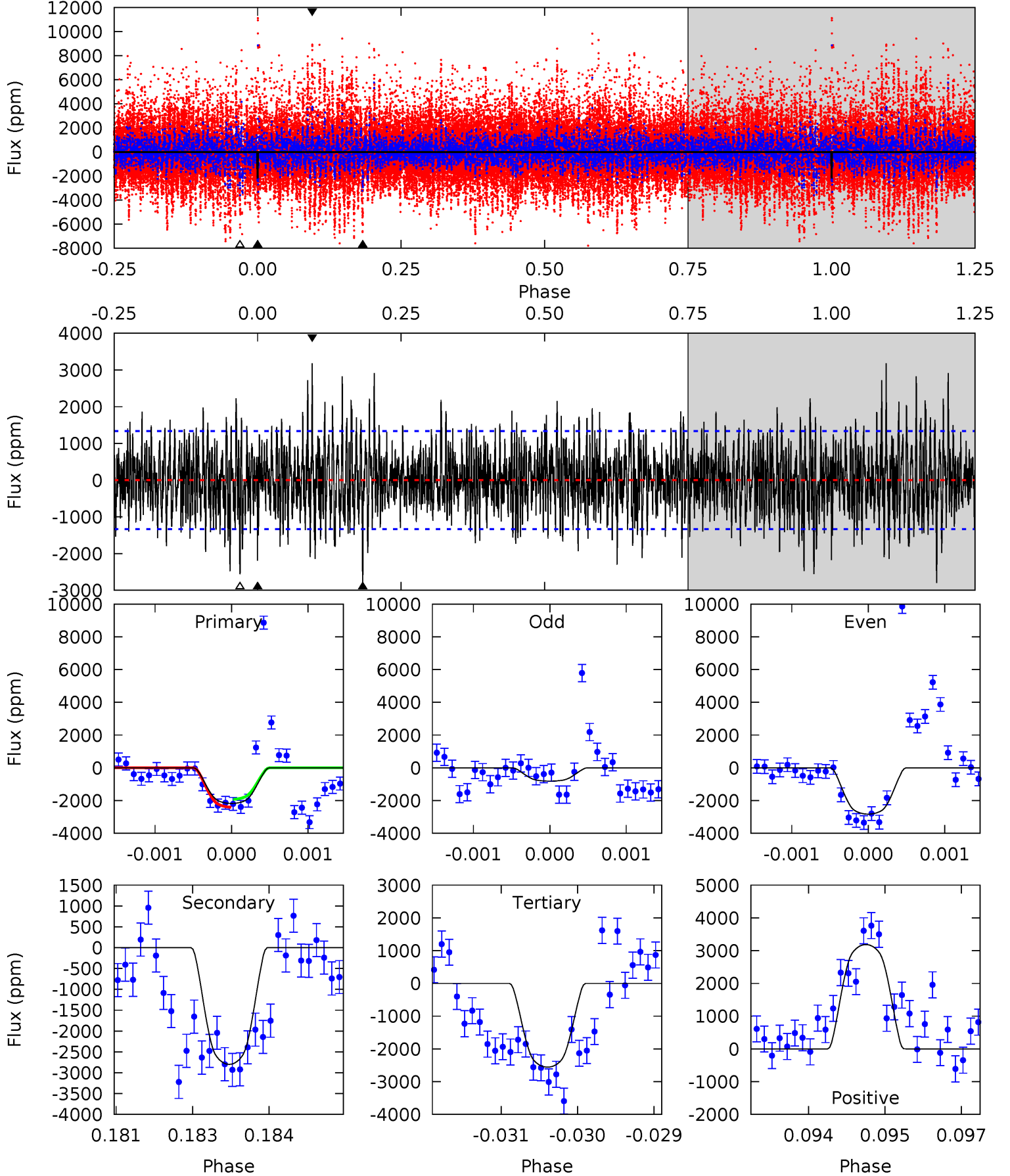
TCE 012071053-01 P=335.069517 Days  $T_0=408.095347$  (BKJD)



# DV Model-Shift Uniqueness Test

012071053-01, P = 335.121246 Days, E = 72.887194 Days

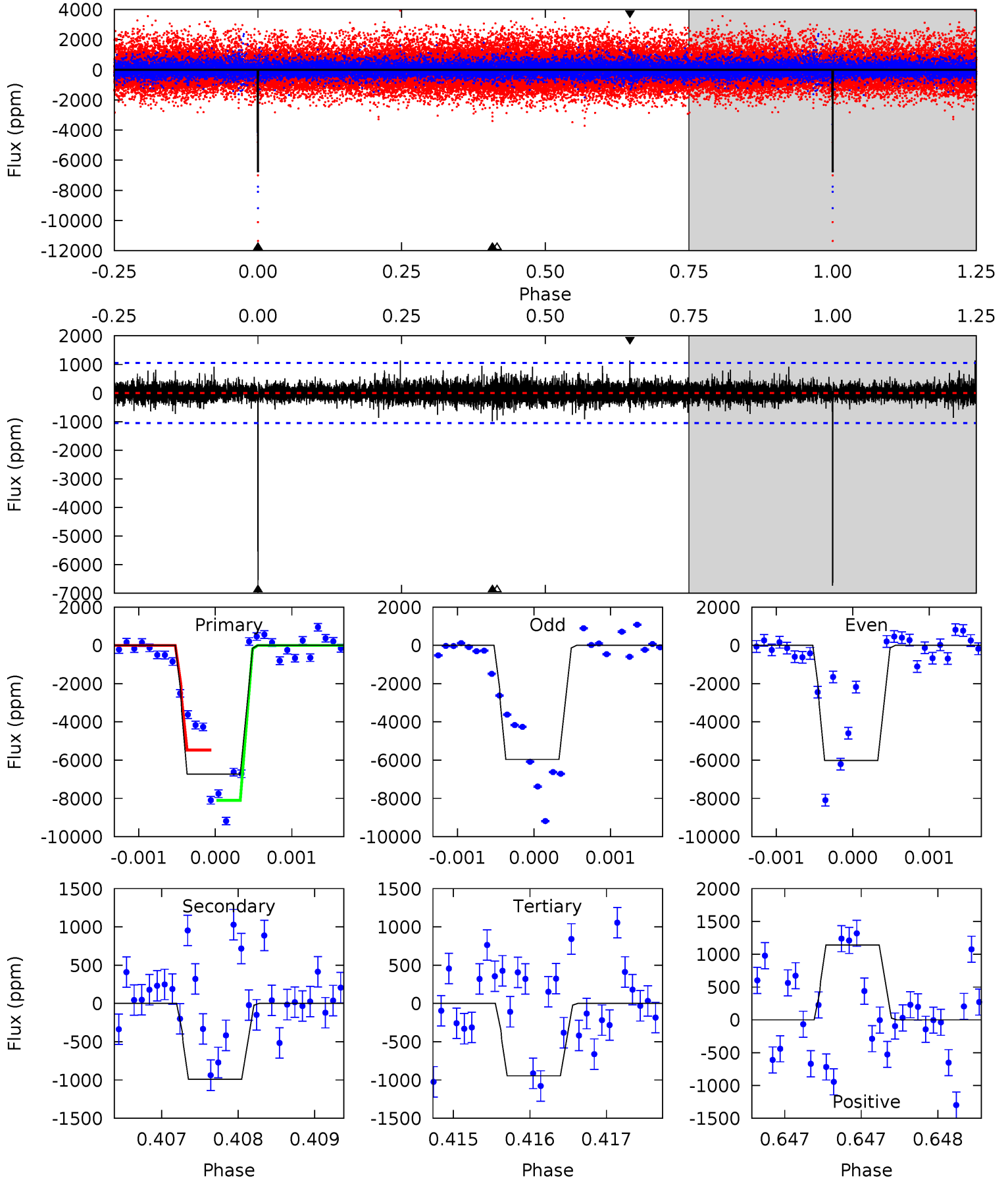
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
8.85	11.4	10.4	12.9	5.42	3.25	2.99	-1.54	-4.08	0.98	-1.56	3.50	1.11	0.53	0.97



# Alt Model-Shift Uniqueness Test

012071053-01, P = 335.069517 Days, E = 73.025830 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
35.1	5.17	4.93	5.95	5.49	3.36	0.96	30.2	29.2	0.24	-0.78	0.20	0.87	0.14	6.86



### Stellar Parameters For KIC 012071053

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$4447^{+154}_{-154}$	$4.624^{+0.021}_{-0.039}$	$0.440^{+0.050}_{-0.300}$	$0.704^{+0.038}_{-0.042}$	$0.767^{+0.028}_{-0.064}$	$3.100^{+0.361}_{-0.399}$
	+3%/-3%	+0%/-1%	+11%/-68%	+5%/-6%	+4%/-8%	+12%/-13%
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 012071053-01 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	$-2799 \pm 246$	$5.59^{+0.85}_{-0.85}$	$249^{+9}_{-9}$	$3964^{+292}_{-224}$	$37228^{+14687}_{-10322}$
Alt.	$-991 \pm 192$	$5.42^{+0.89}_{-0.74}$	$249^{+9}_{-10}$	$3367^{+221}_{-202}$	$13626^{+6093}_{-4236}$

$T_{\text{max}}$  = 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

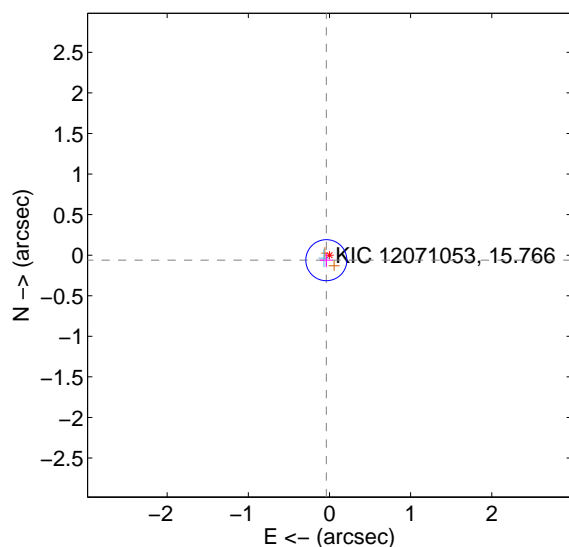
Supplemental centroid analysis for 012071053-01. Kepler magnitude: 15.77. Transit SNR 7.09

There are 1 quarters with good PRF difference image offsets

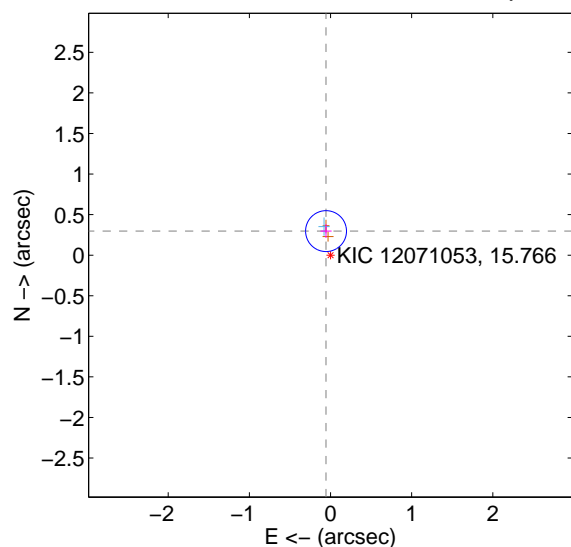
The direct PRF centroid is offset from the target star catalog position by about 0.39 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.073 \pm 0.084$	0.86	$0.039 \pm 0.079$	$-0.062 \pm 0.086$
PRF-fit source offset from KIC position	$0.302 \pm 0.084$	3.59	$0.055 \pm 0.068$	$0.297 \pm 0.085$
photometric centroid source offset	$0.38 \pm 0.70$	0.54	$0.38 \pm 0.70$	$0.04 \pm 0.91$

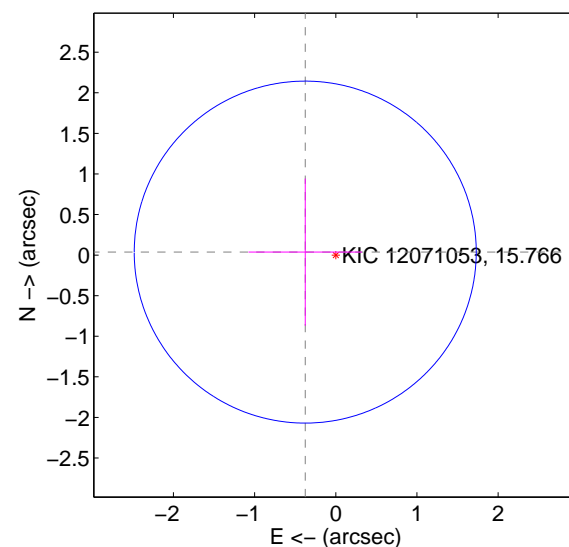
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

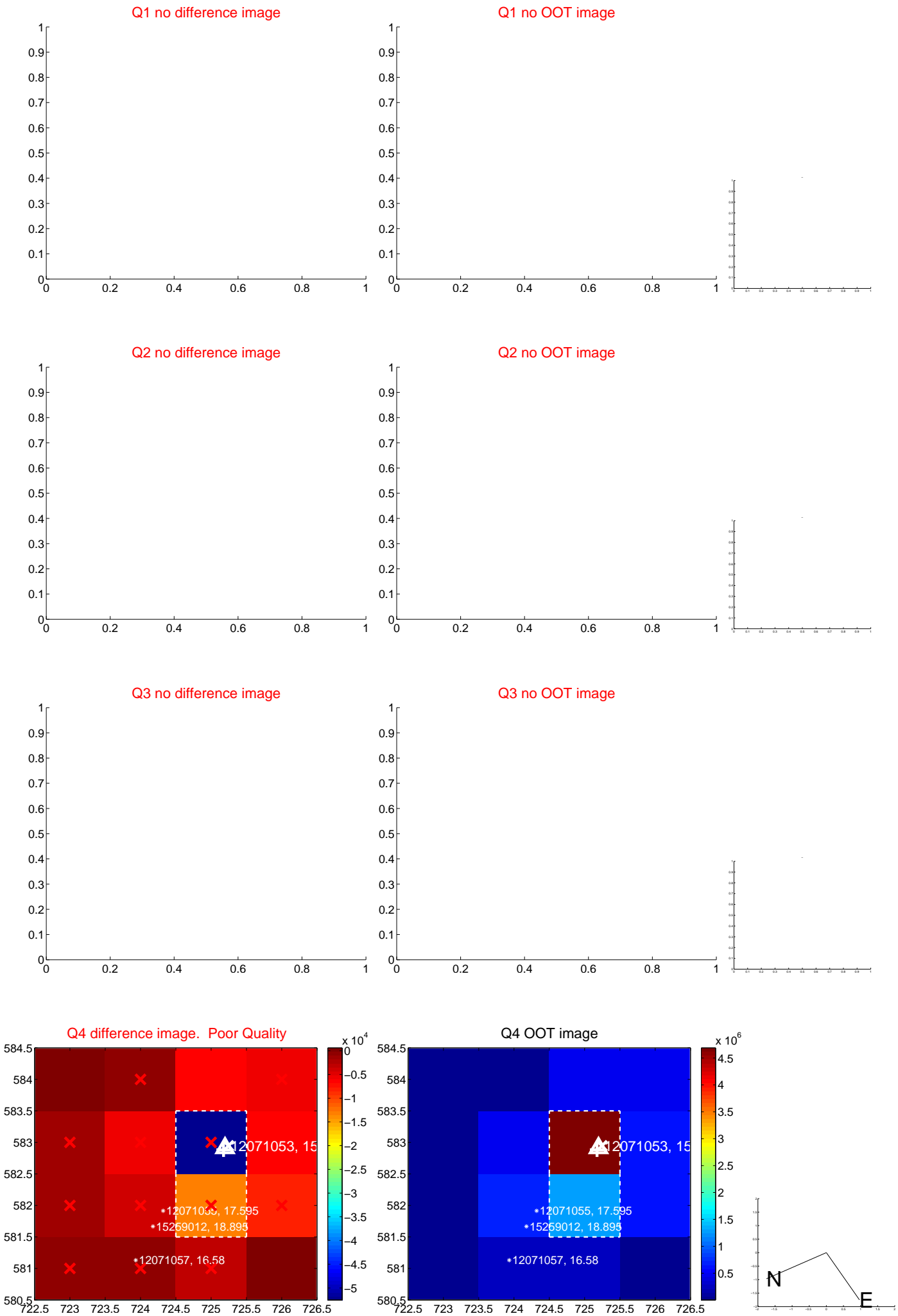


offset from photometric centroids

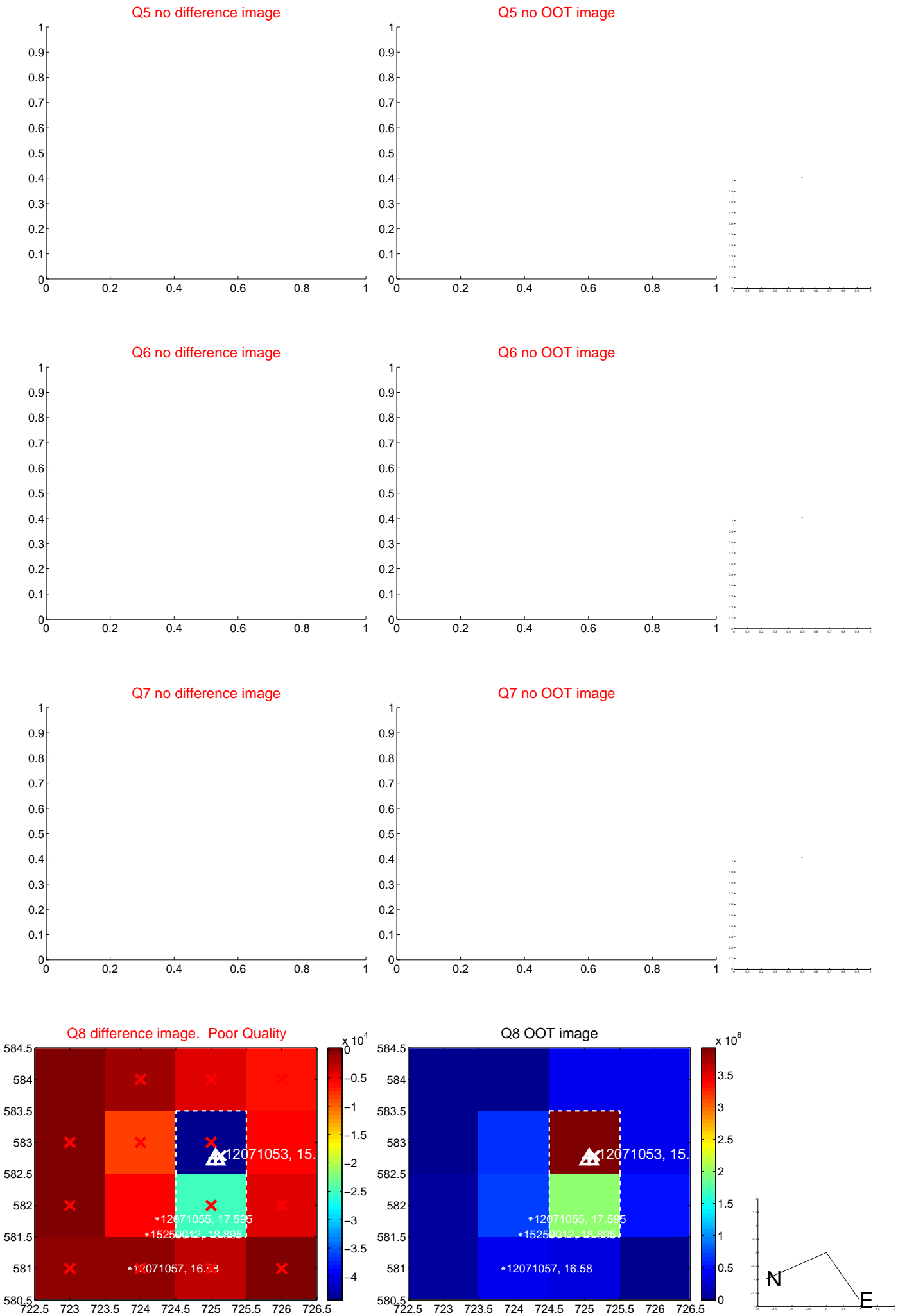


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

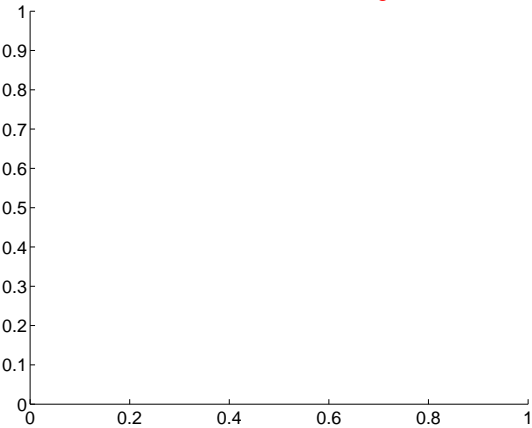
Q9 no difference image



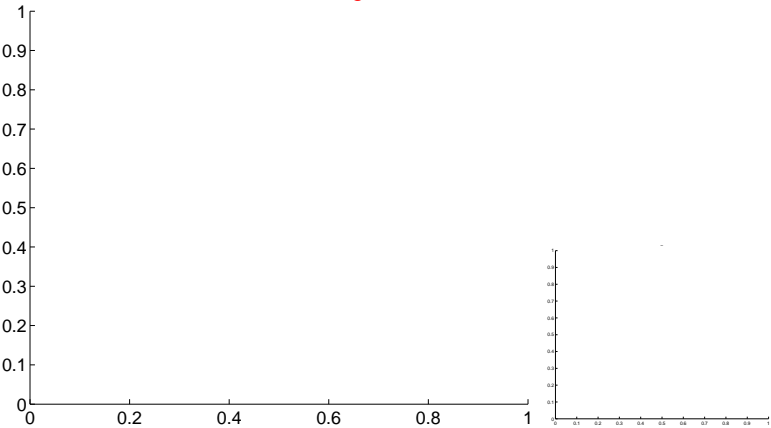
Q9 no OOT image



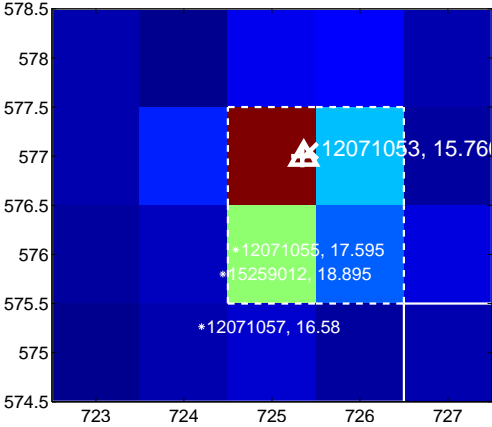
Q10 no difference image



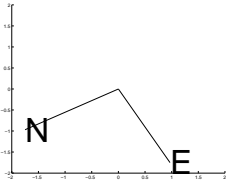
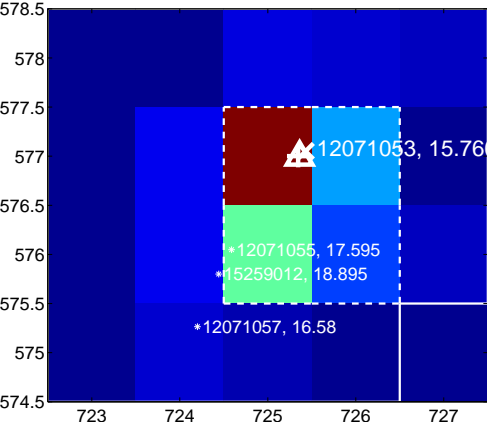
Q10 no OOT image



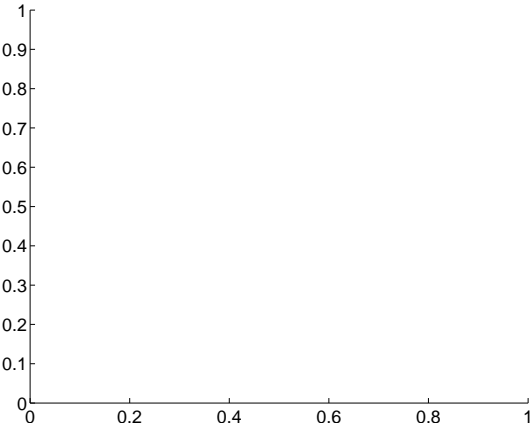
Q11 difference image



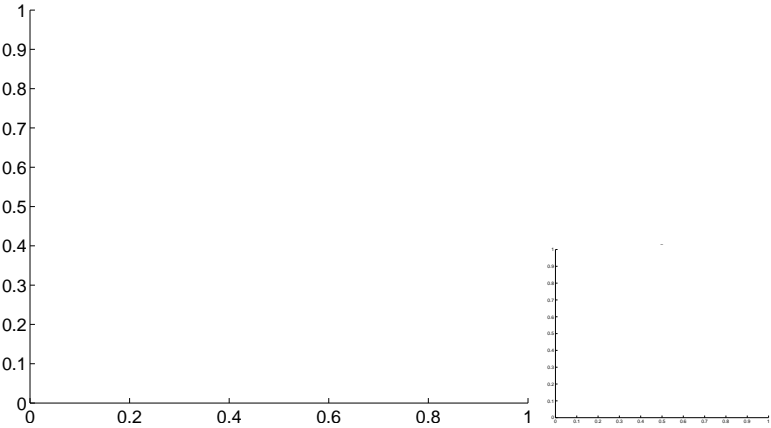
Q11 OOT image



Q12 no difference image



Q12 no OOT image



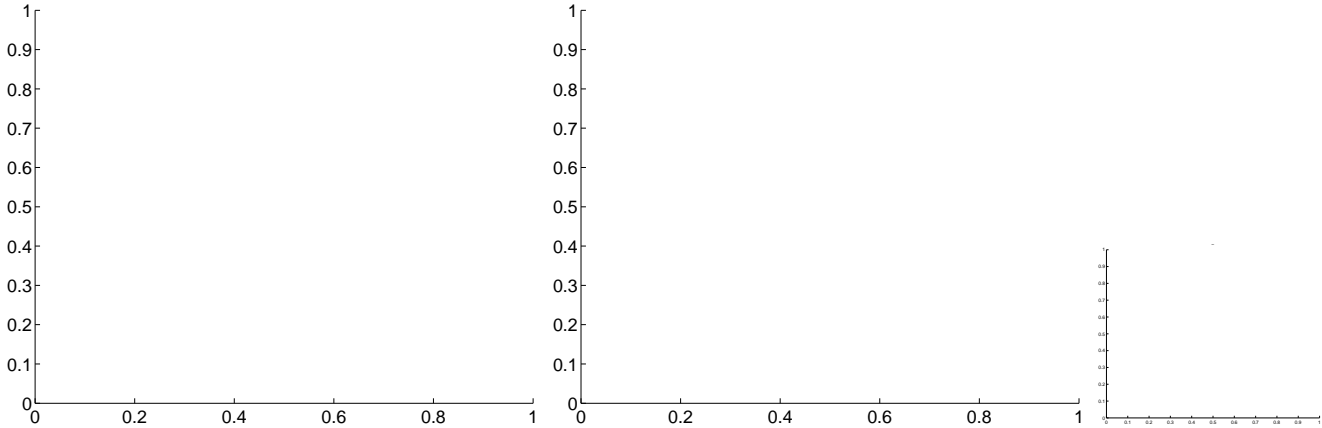
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



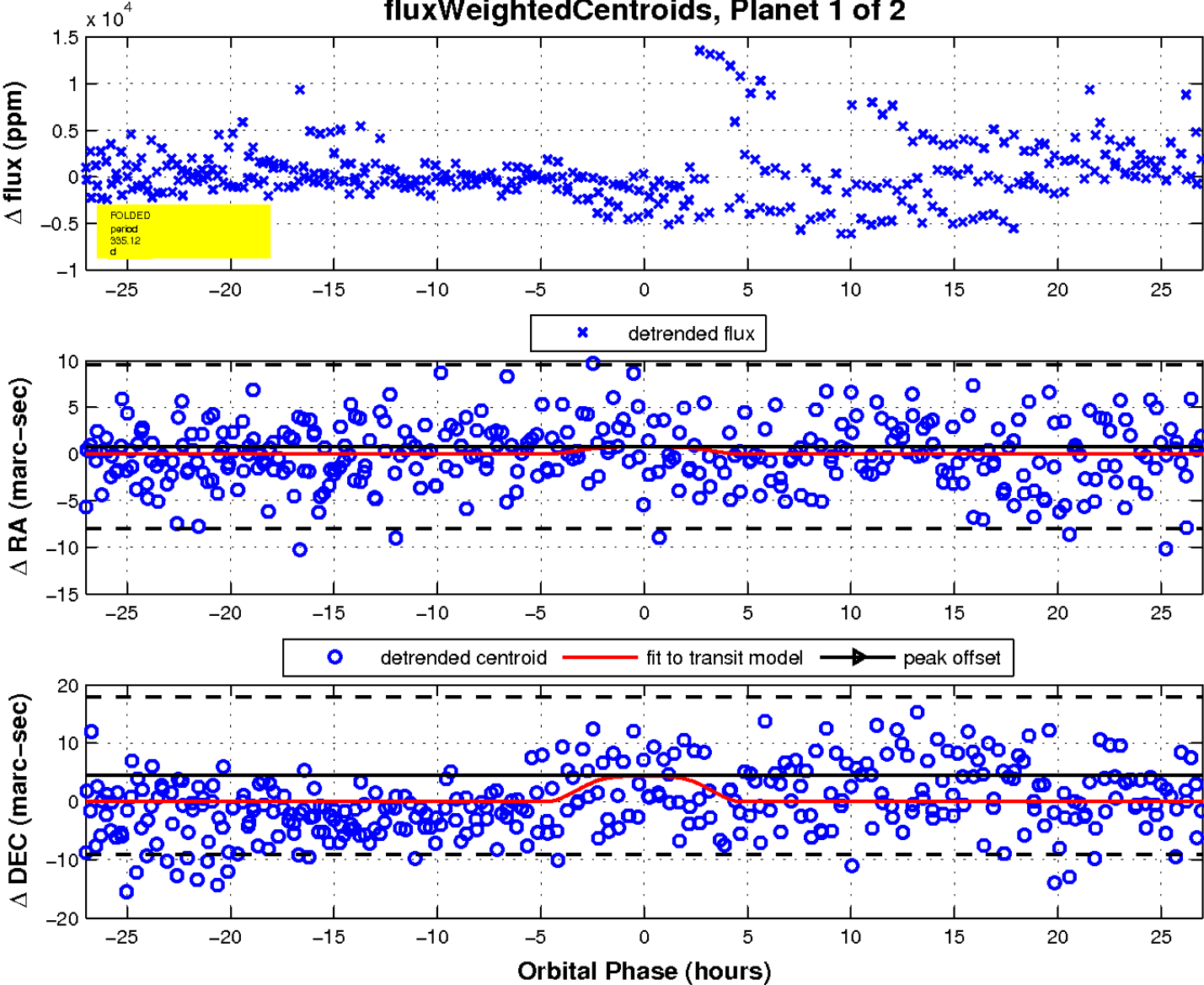
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

Q17 no difference image

Q17 no OOT image

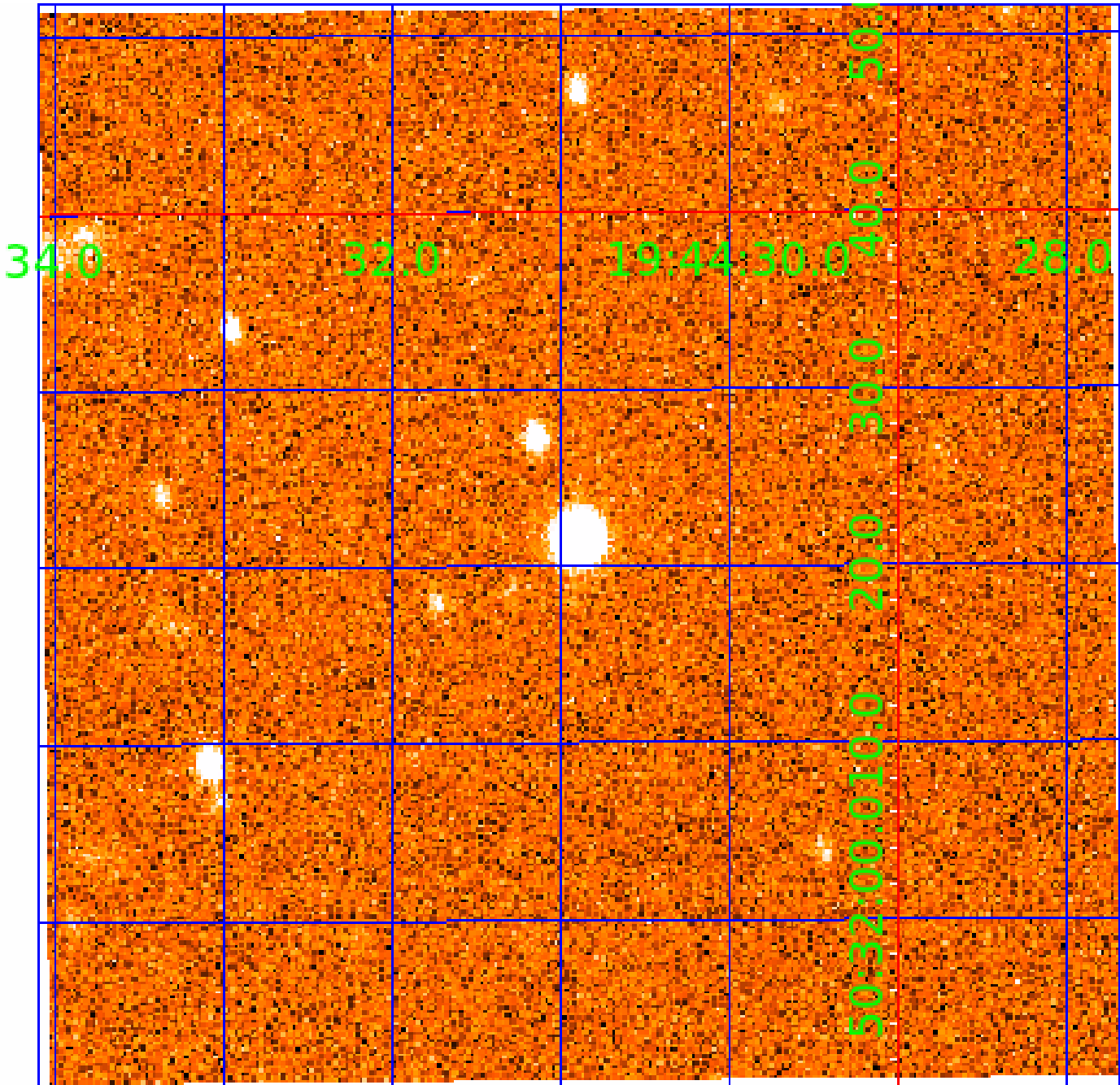


fluxWeightedCentroids, Planet 1 of 2



UKIRT Image

Declination



# KIC 012071053

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
012071053-01	OBS	No	335.121246	408.008440	4028.6	9.036	14.8	7.1	0.70	4447	5.55	0.23
012071053-02	OBS	No	599.780185	221.647453	2437.3	4.168	11.9	6.1	0.70	4447	3.64	0.11

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
012071053-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_ZUMA—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
012071053-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS

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

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

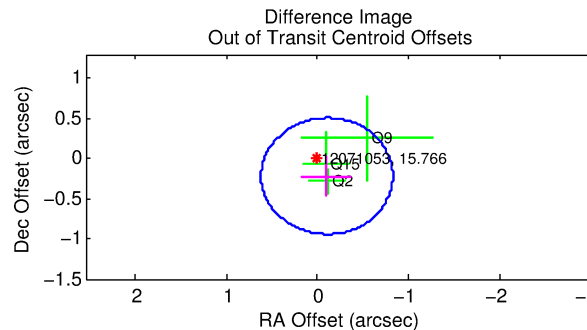
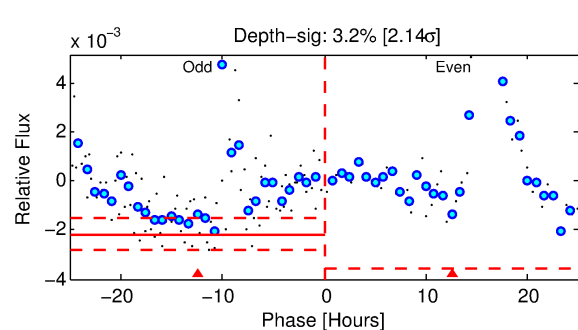
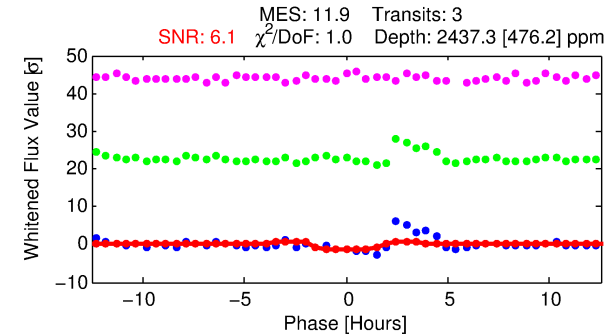
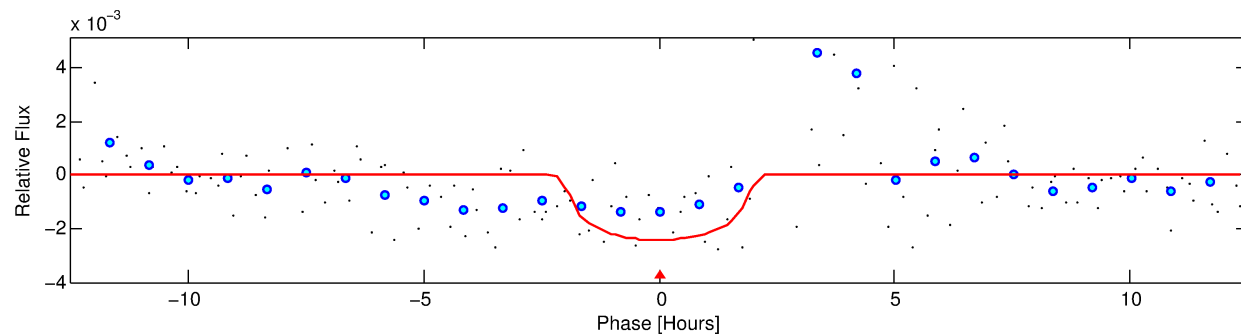
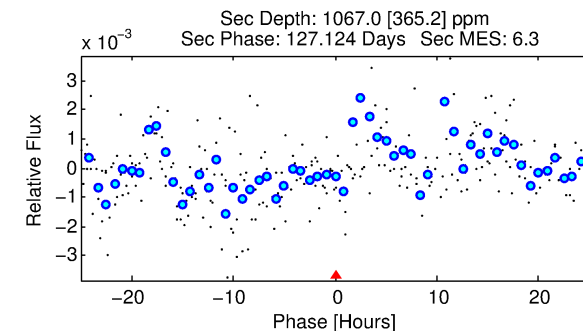
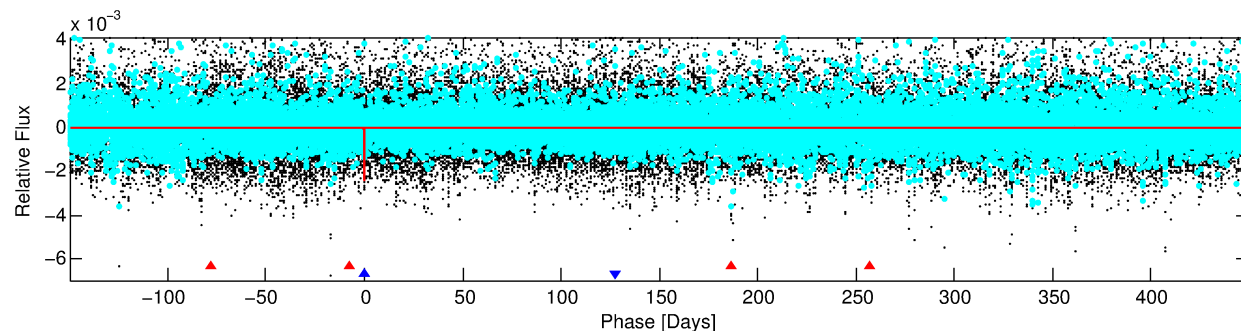
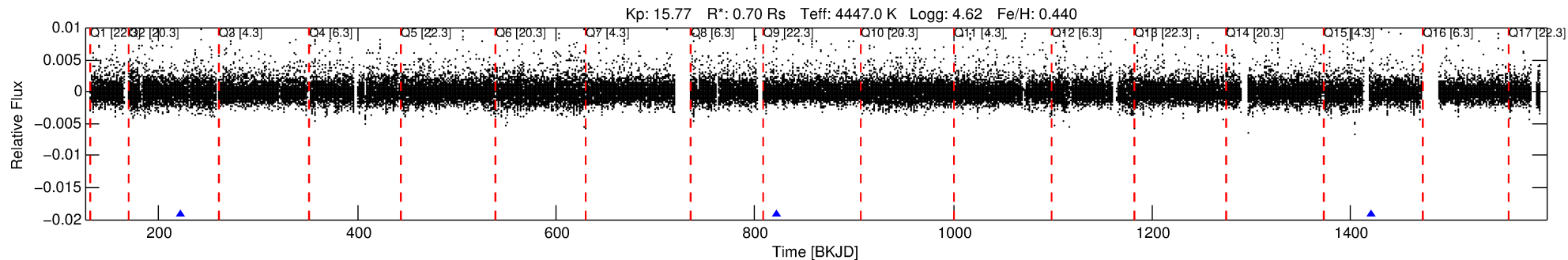
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 012071053-02

No Significant Match Found

# DV One-Page Summary

KIC: 12071053 Candidate: 2 of 2 Period: 599.780 d



## DV Fit Results:

Period = 599.78019 [0.00778] d  
Epoch = 221.6475 [0.0103] BKJD  
Rp/R\* = 0.0473 [0.0585]  
a/R\* = 902.19 [3181.94]  
b = 0.65 [3.24]  
Seff = 0.11 [0.02]  
Teq = 146 [6] K  
Rp = 3.64 [4.50] Re  
a = 1.2708 [0.0633] AU  
Ag = 71709.67 [178968.06] [0.40σ]  
Teff = 3694 [2308] K [1.54σ]

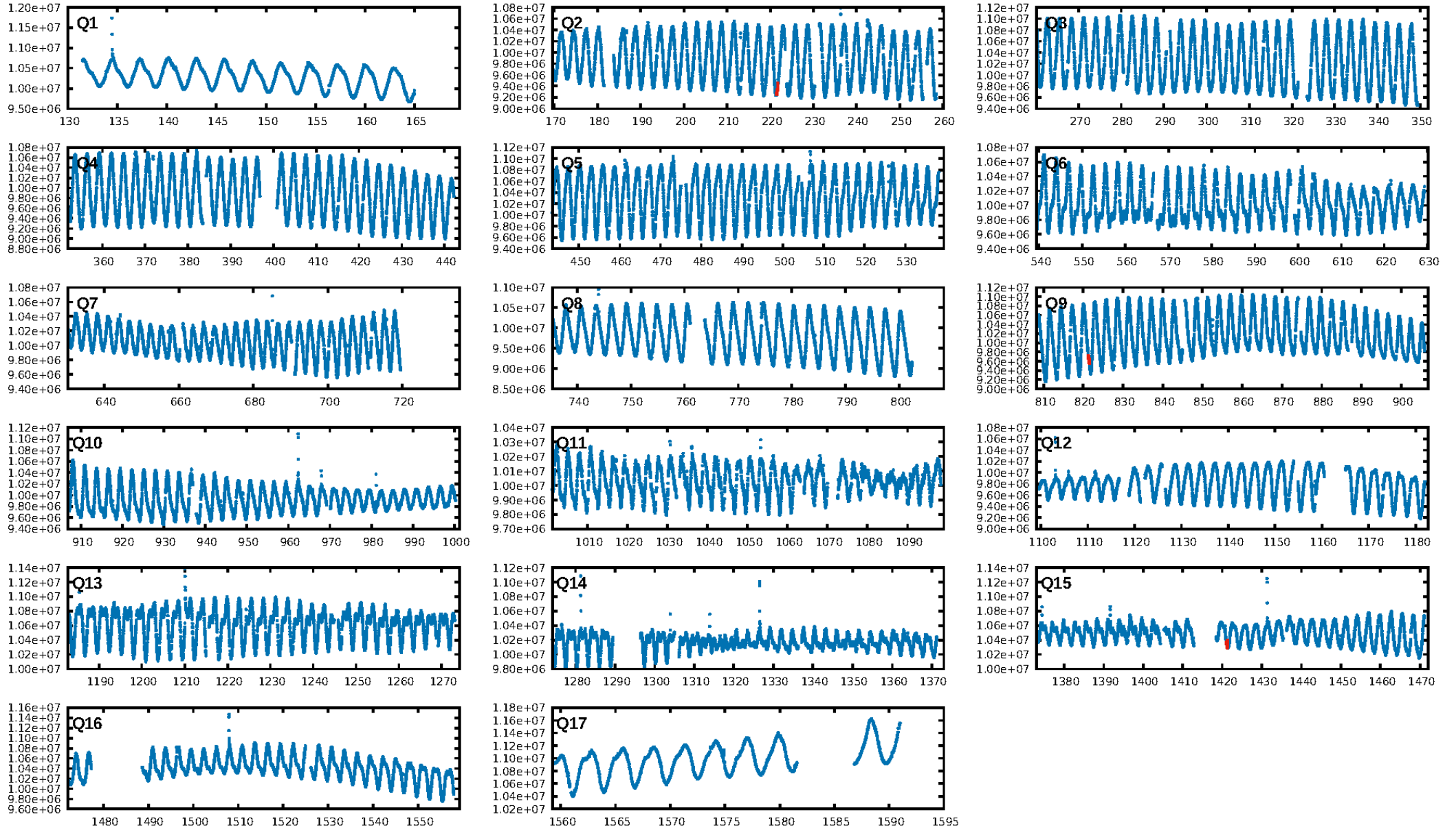
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [638.33σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 31.5%  
ModelChiSquareGof-sig: 91.5%  
**Bootstrap-pfa: 8.52e-11**  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: 1.633  
Centroid-sig: 73.9%  
Centroid-so: 1.465 arcsec [0.98σ]  
OotOffset-rm: 0.241 arcsec [1.00σ]  
KicOffset-st: 1/1/0/1 [3]  
KicOffset-st: 1/1/0/1 [3]  
DiffImageQuality-fgm: 1.00 [3/3]  
DiffImageOverlap-fno: 1.00 [3/3]

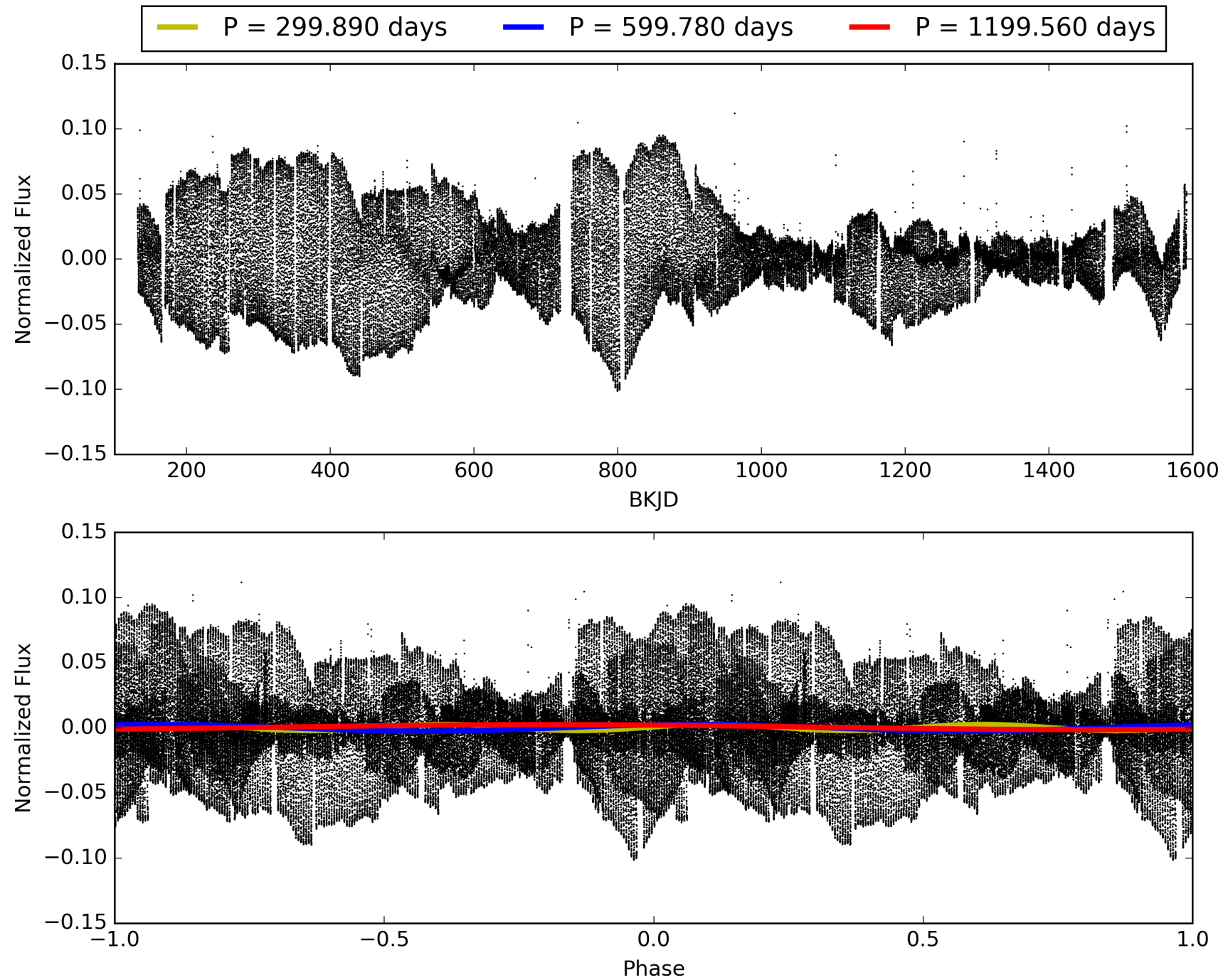
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 29-Jan-2016 08:17:31 Z

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

# TCE 012071053-02, PDC Light Curves



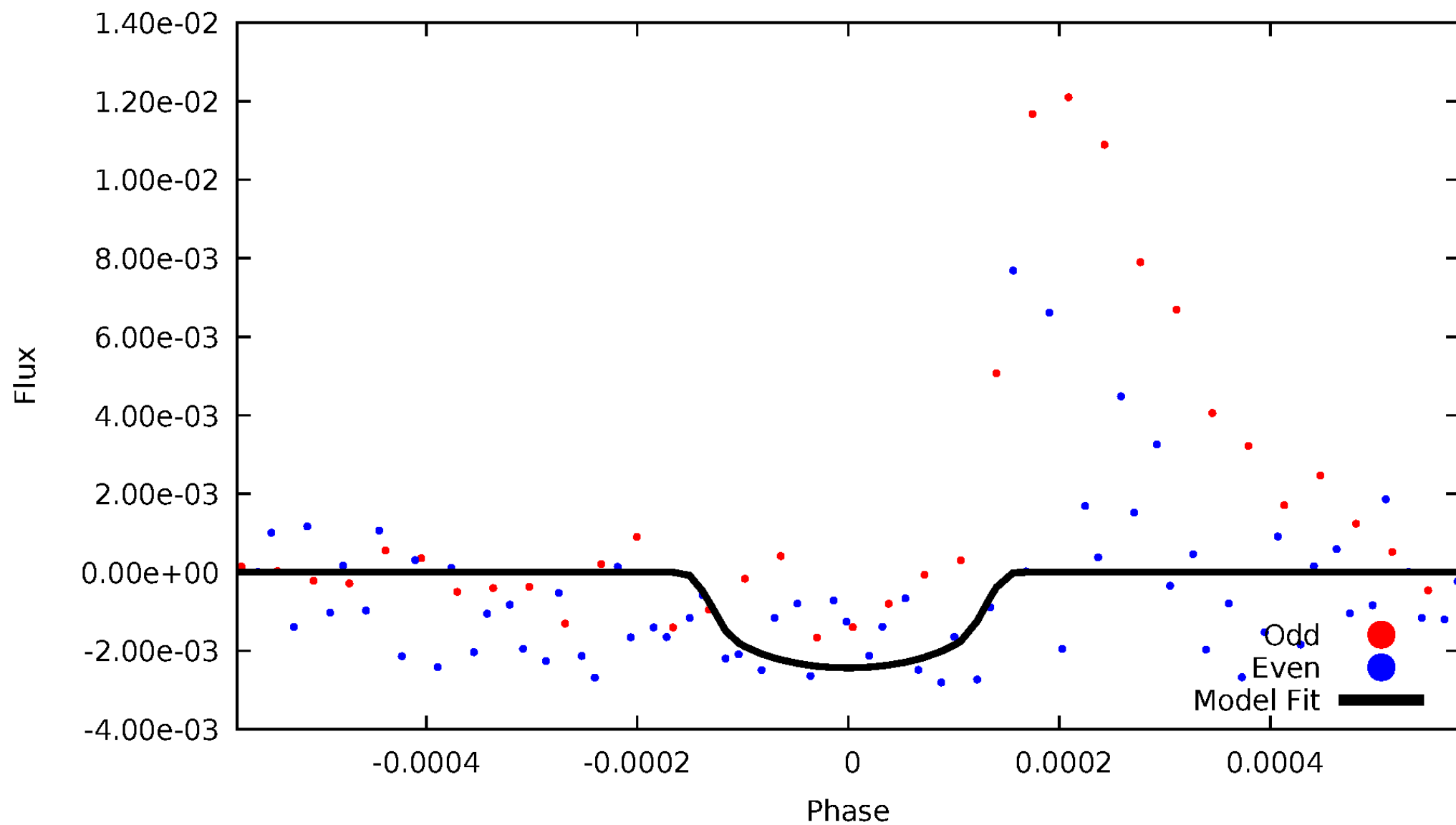
TCE 012071053-02





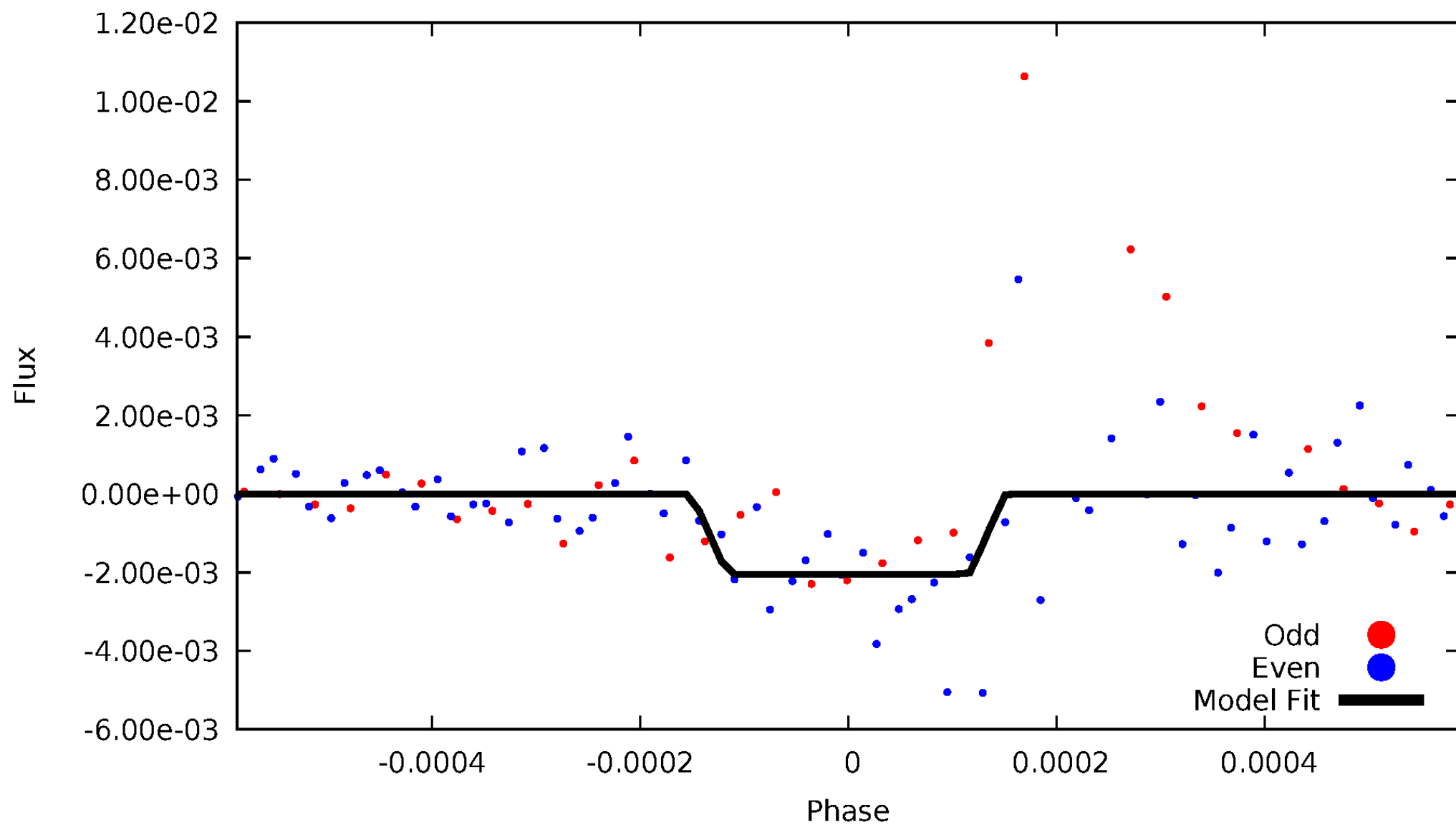
# DV Odd/Even

TCE 012071053-02



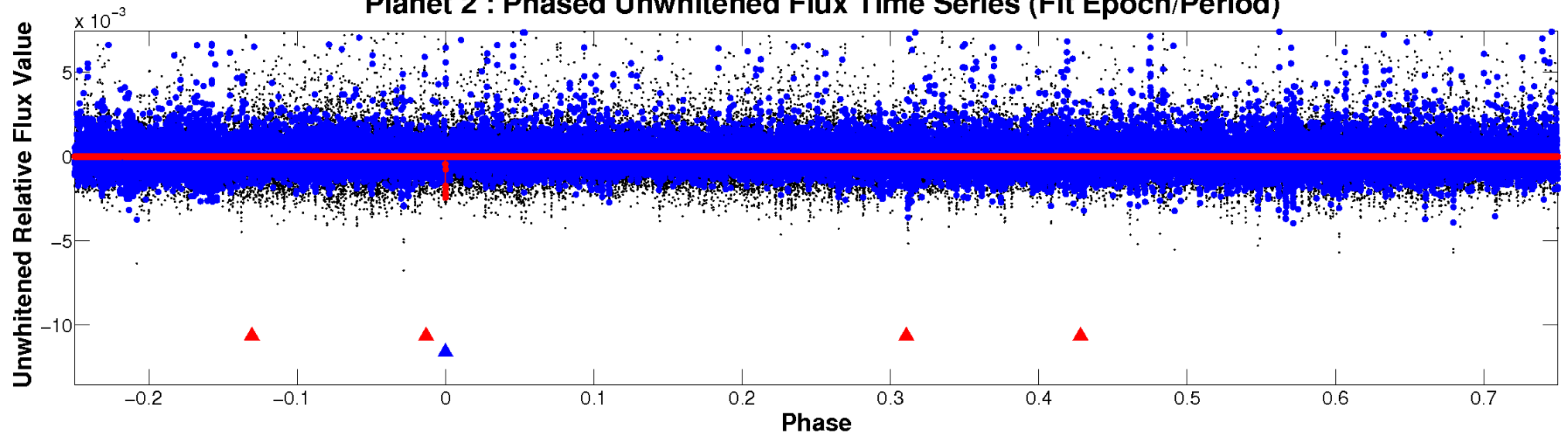
# ALT Odd/Even

TCE 012071053-02

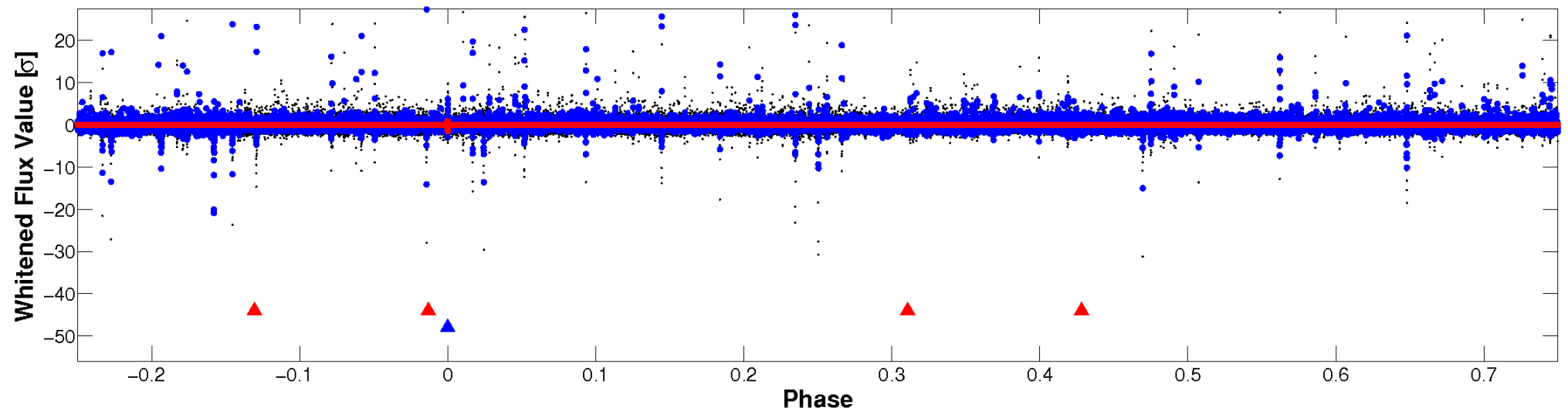


# Non-Whitened Vs. Whitened Light Curve

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

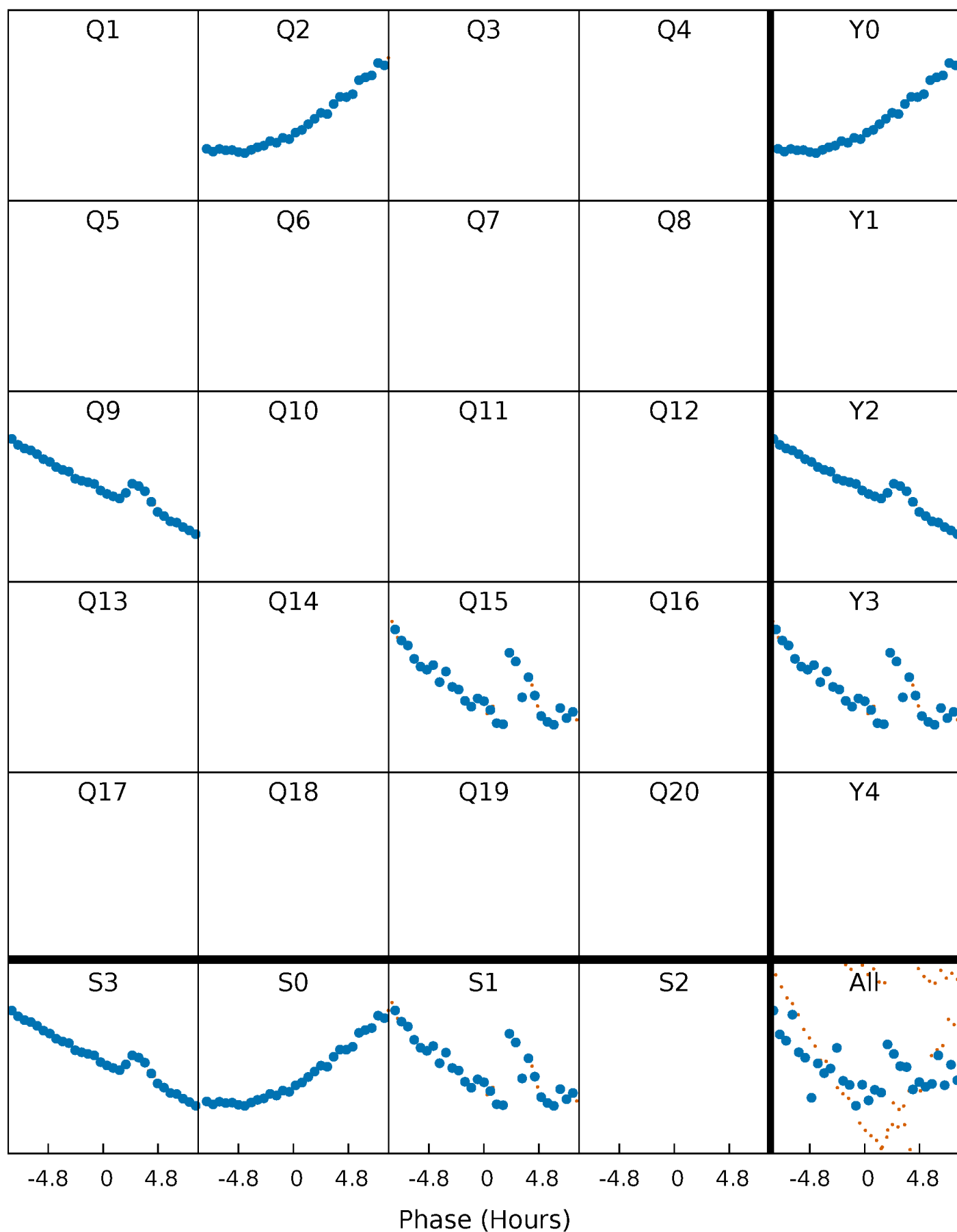


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



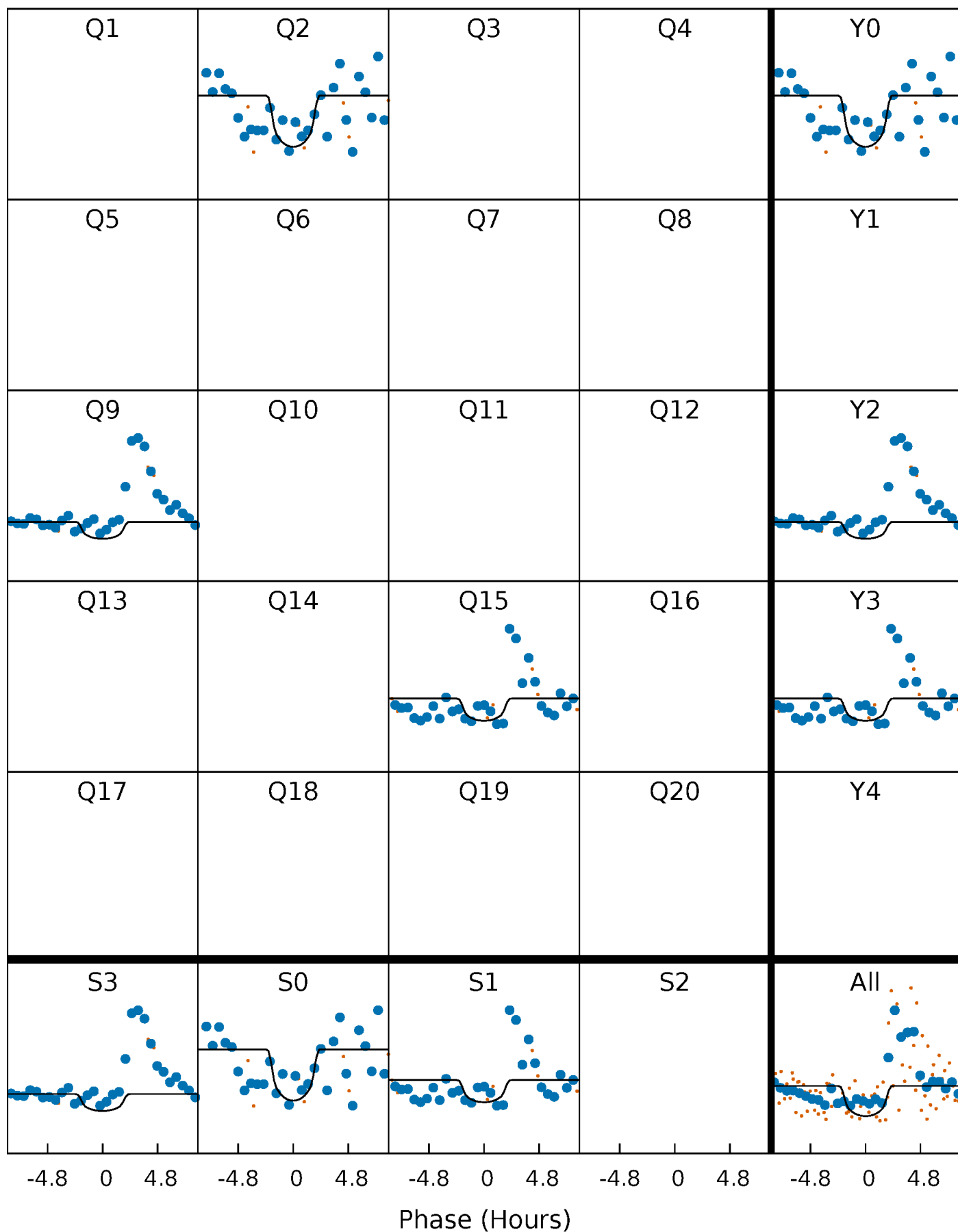
# PDC Quarter-Phased Transit Curves

TCE 012071053-02 P=599.780185 Days  $T_0=221.647453$  (BKJD)



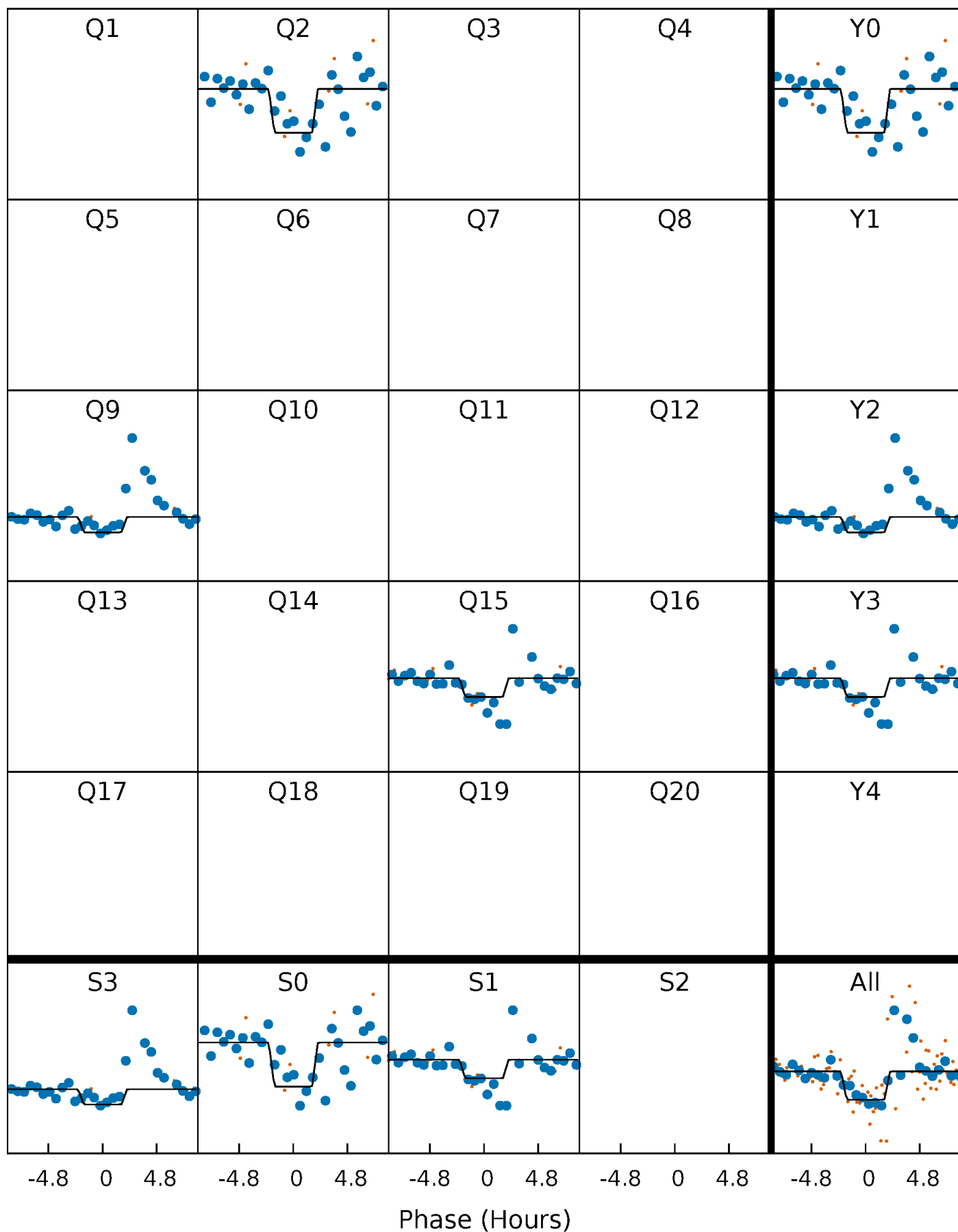
# DV Quarter-Phased Transit Curves

TCE 012071053-02 P=599.780185 Days  $T_0=221.647453$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

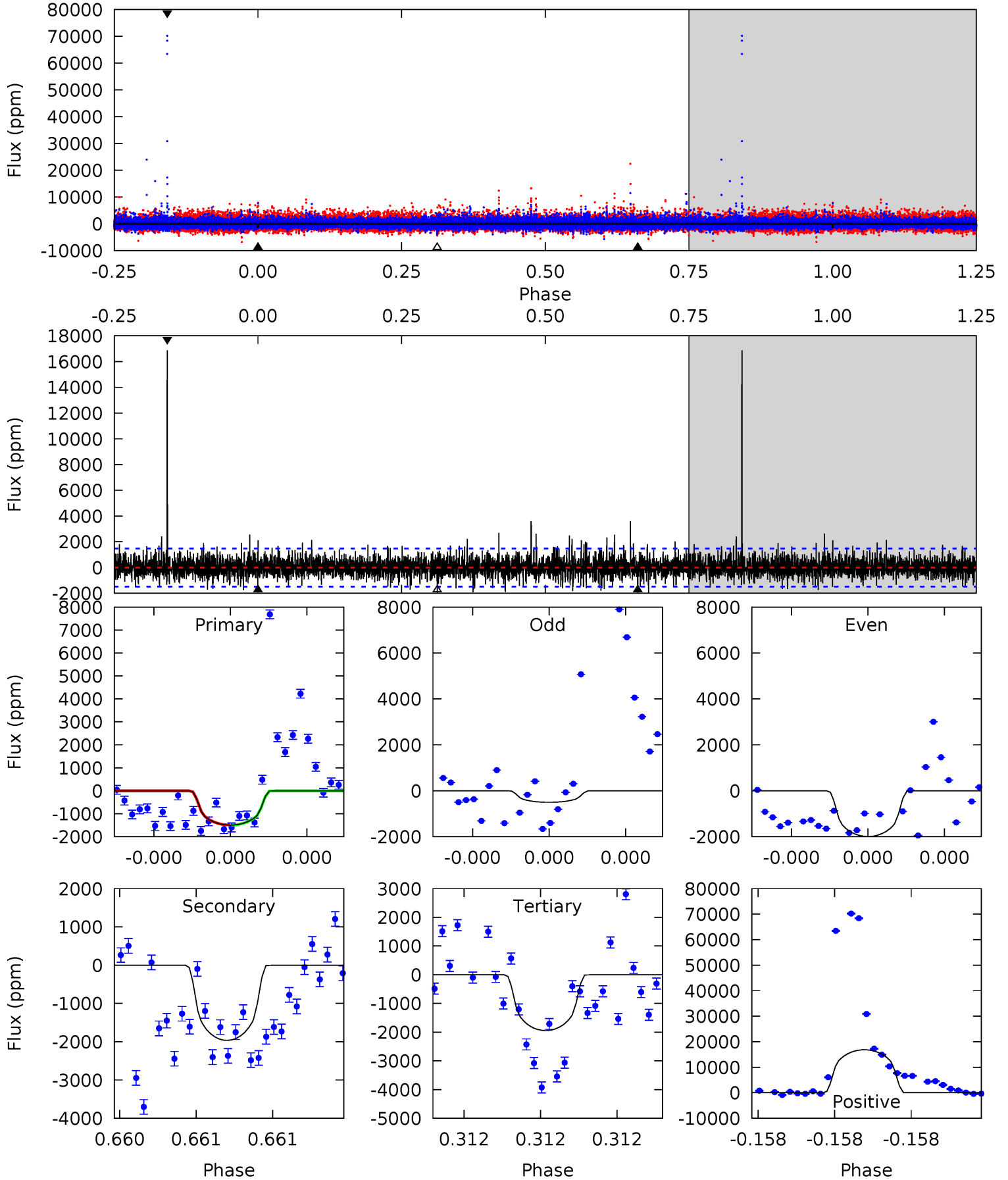
TCE 012071053-02 P=599.772664 Days  $T_0=221.658236$  (BKJD)



# DV Model-Shift Uniqueness Test

012071053-02, P = 599.780185 Days, E = 221.647453 Days

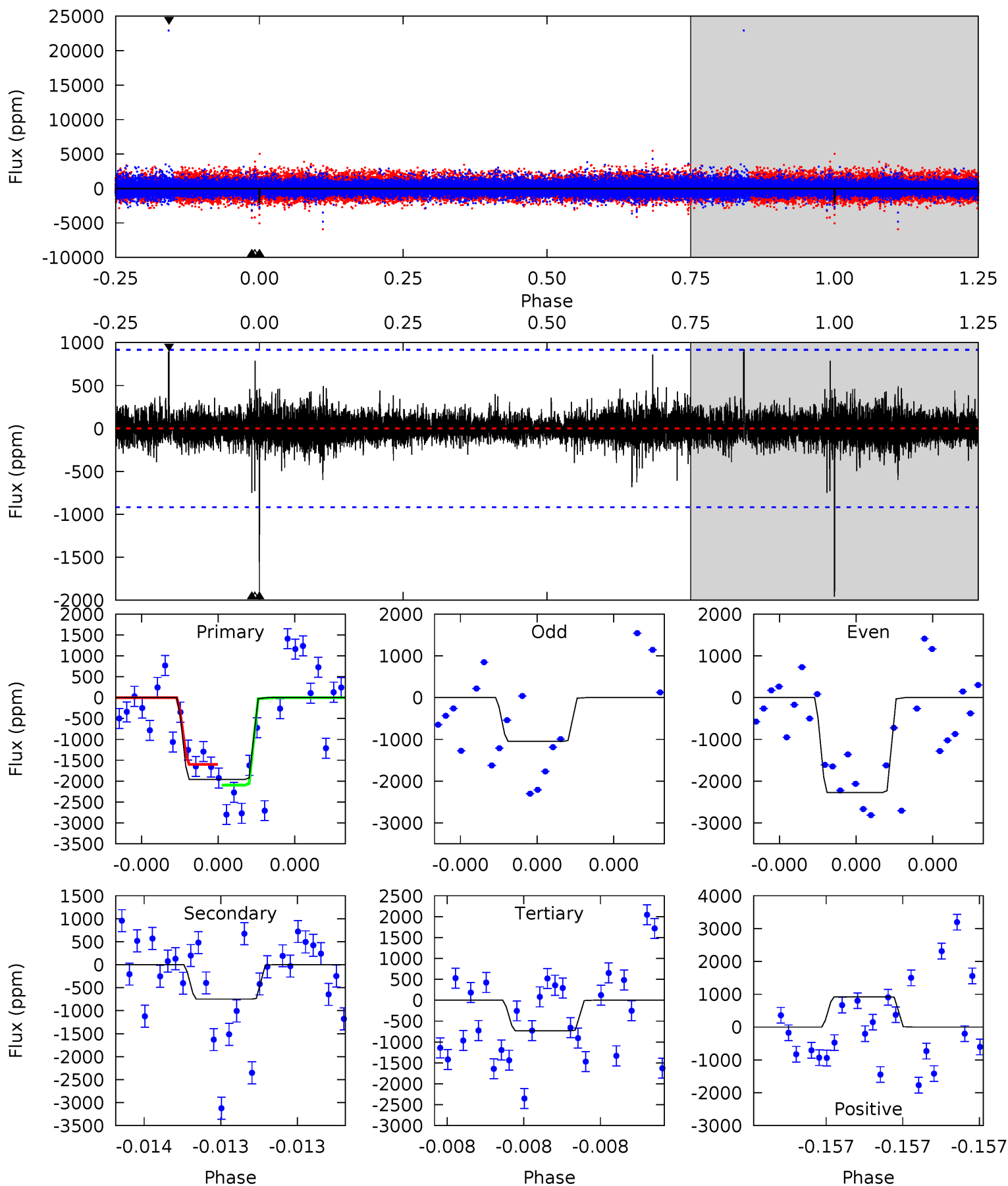
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
5.70	7.49	7.42	64.3	5.66	3.61	2.28	-1.72	-58.6	0.08	-56.8	2.05	0.76	0.90	0.00



# Alt Model-Shift Uniqueness Test

012071053-02, P = 599.772664 Days, E = 221.658236 Days

Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
12.1	4.62	4.51	5.72	5.67	3.63	0.65	7.61	6.40	0.11	-1.09	3.48	1.18	0.32	1.50





### Stellar Parameters For KIC 012071053

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$4447^{+154}_{-154}$	$4.624^{+0.021}_{-0.039}$	$0.440^{+0.050}_{-0.300}$	$0.704^{+0.038}_{-0.042}$	$0.767^{+0.028}_{-0.064}$	$3.100^{+0.361}_{-0.399}$
	+3%/-3%	+0%/-1%	+11%/-68%	+5%/-6%	+4%/-8%	+12%/-13%
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 012071053-02 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-1965 \pm 262$	$4.75^{+4.07}_{-3.02}$	$205^{+7}_{-7}$	$3959^{+1995}_{-732}$	$76888^{+549328}_{-54302}$
Alt.	$-747 \pm 162$	$4.54^{+4.28}_{-3.15}$	$206^{+7}_{-8}$	$3420^{+1862}_{-603}$	$32825^{+307323}_{-24537}$

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

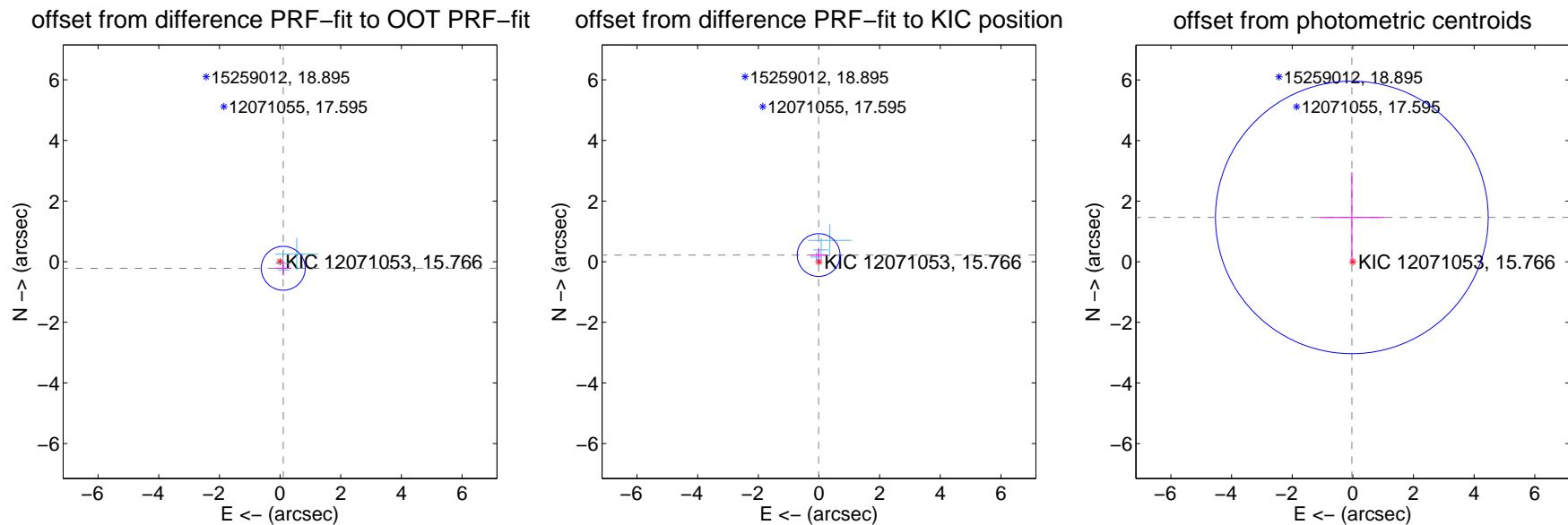
## DV Centroid Data

Supplemental centroid analysis for 012071053-02. Kepler magnitude: 15.77. Transit SNR 6.10

There are 3 quarters with good PRF difference image offsets

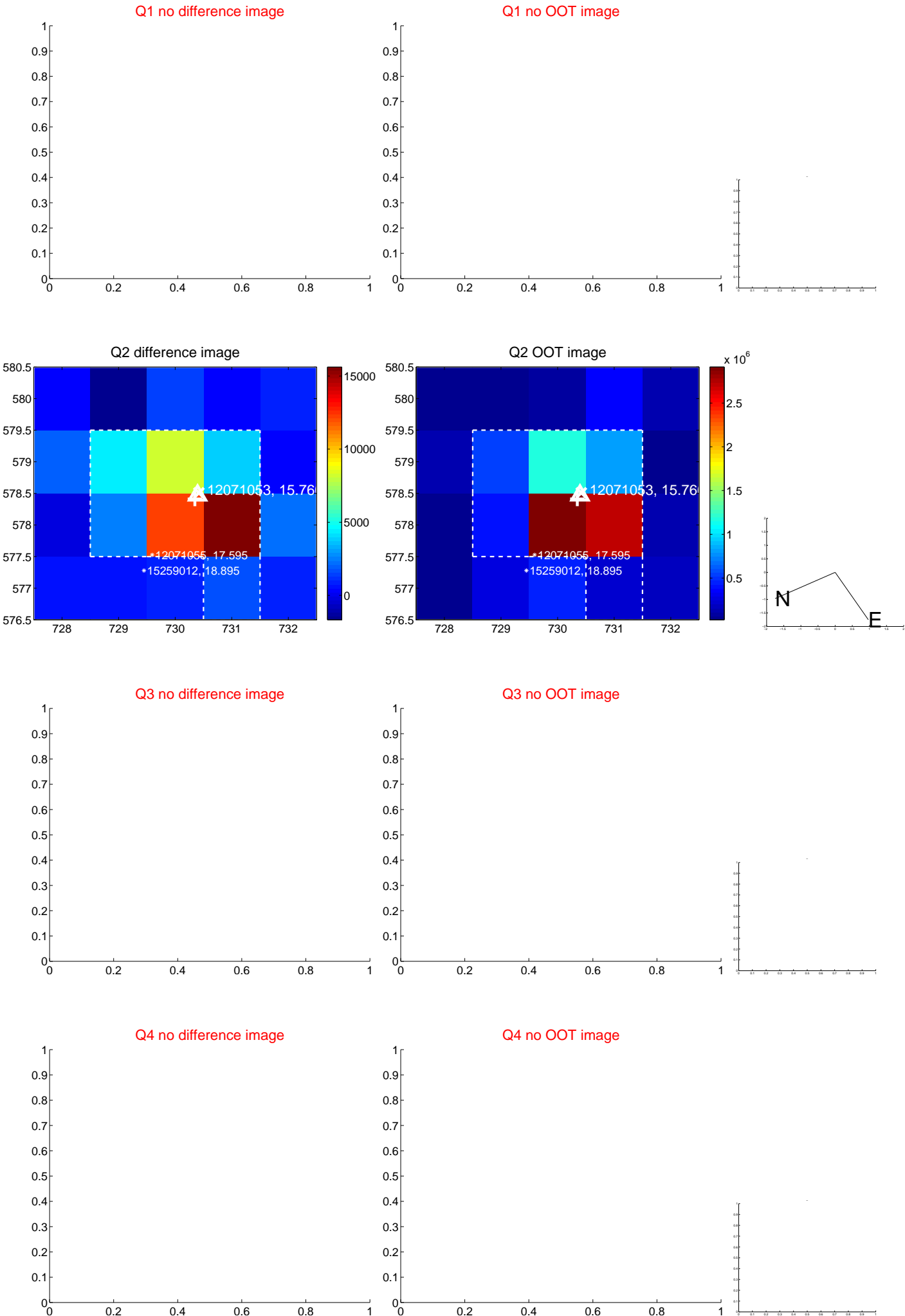
The direct PRF centroid is offset from the target star catalog position by about 0.45 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.241 \pm 0.242$	1.00	$-0.104 \pm 0.269$	$-0.217 \pm 0.235$
PRF-fit source offset from KIC position	$0.219 \pm 0.235$	0.93	$0.011 \pm 0.269$	$0.219 \pm 0.235$
photometric centroid source offset	$1.46 \pm 1.50$	0.98	$0.03 \pm 1.09$	$1.46 \pm 1.50$

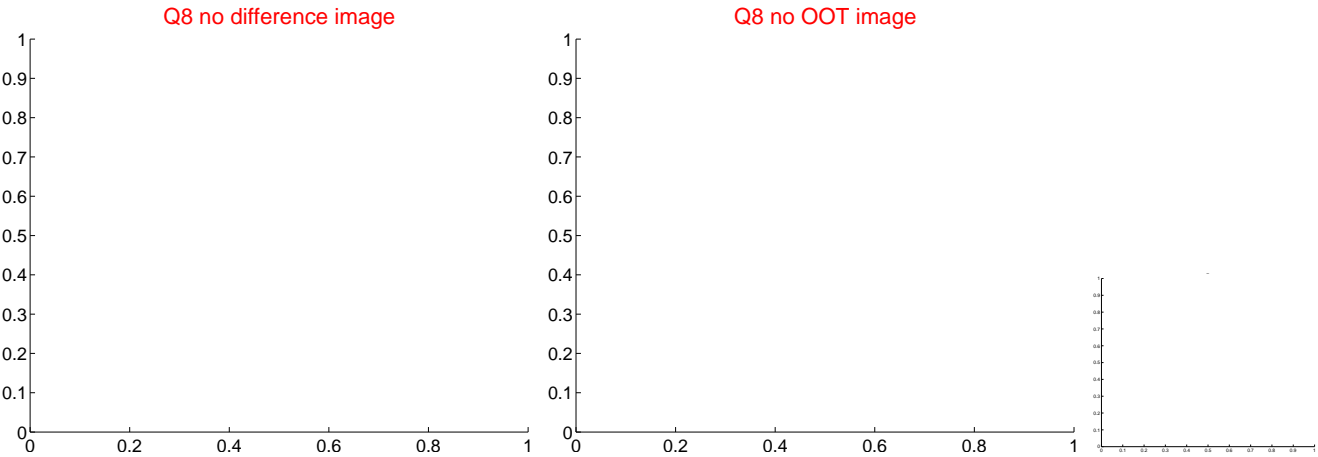
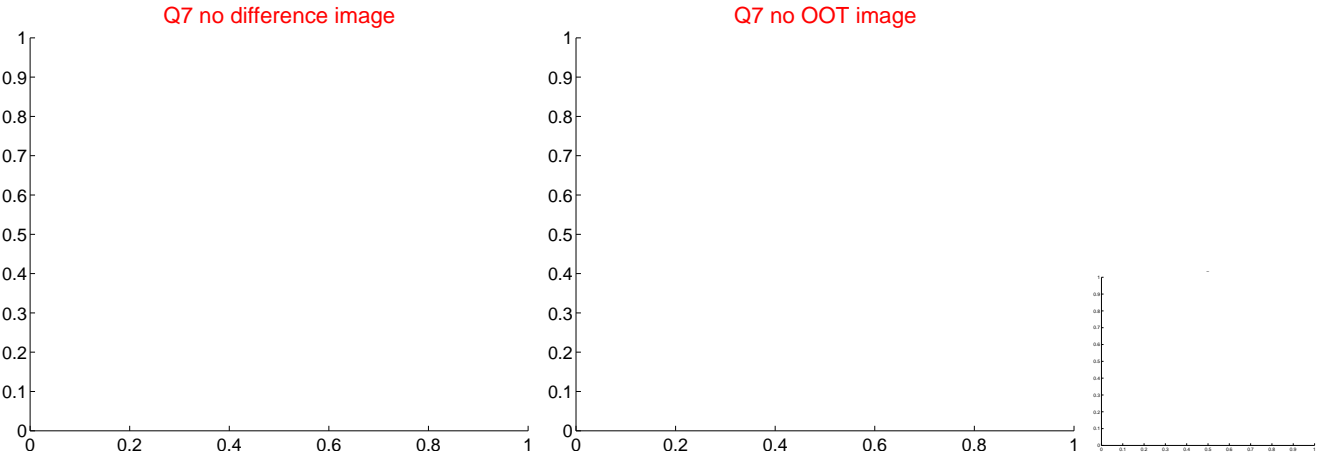
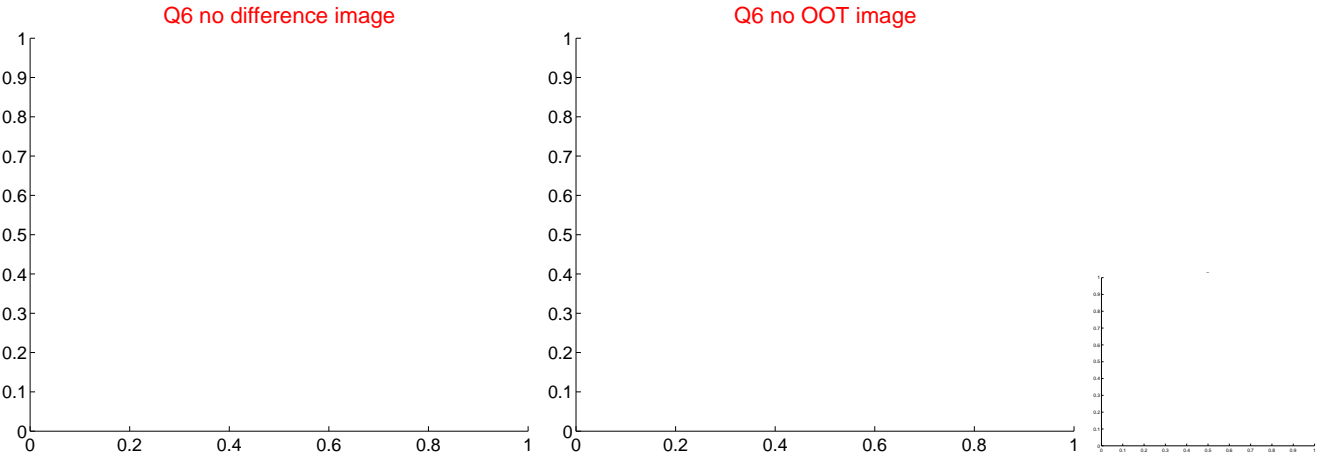
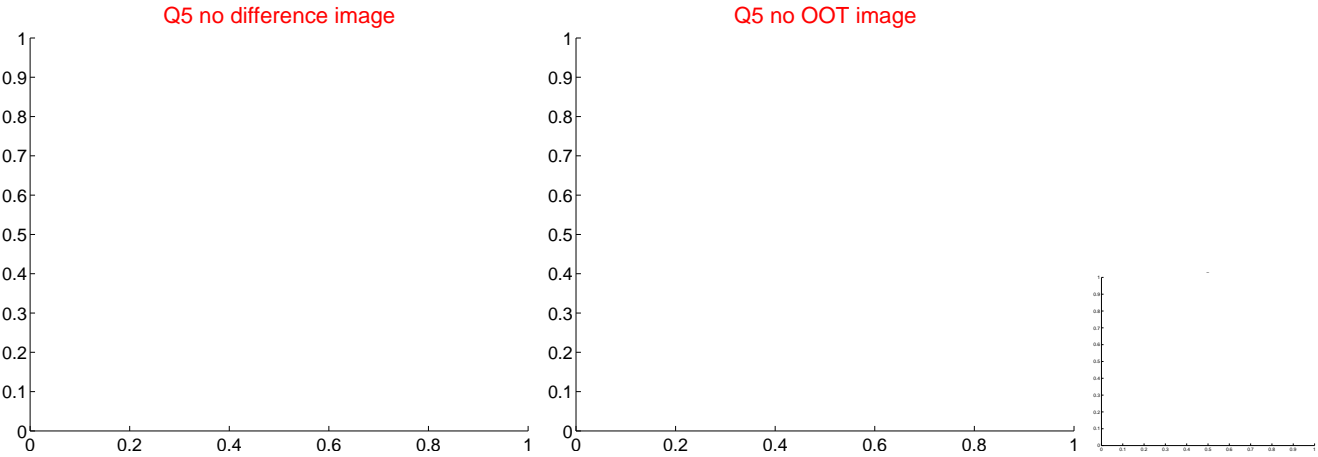


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

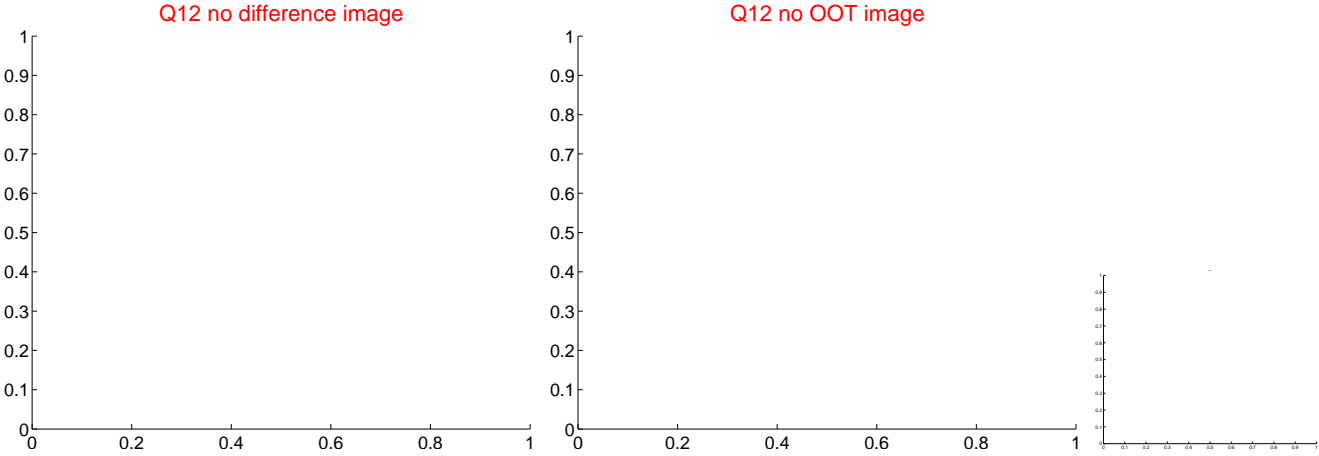
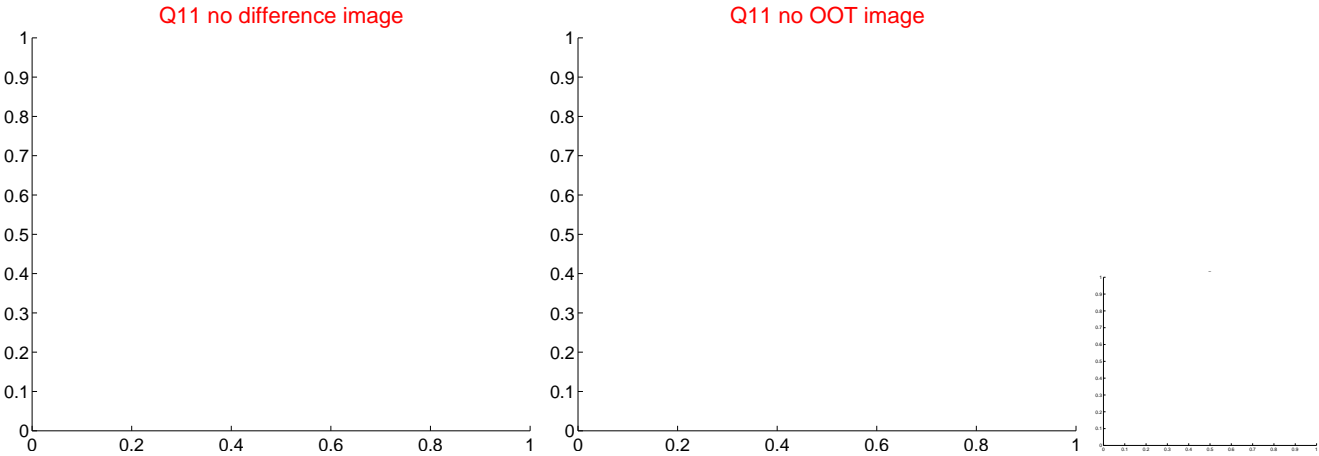
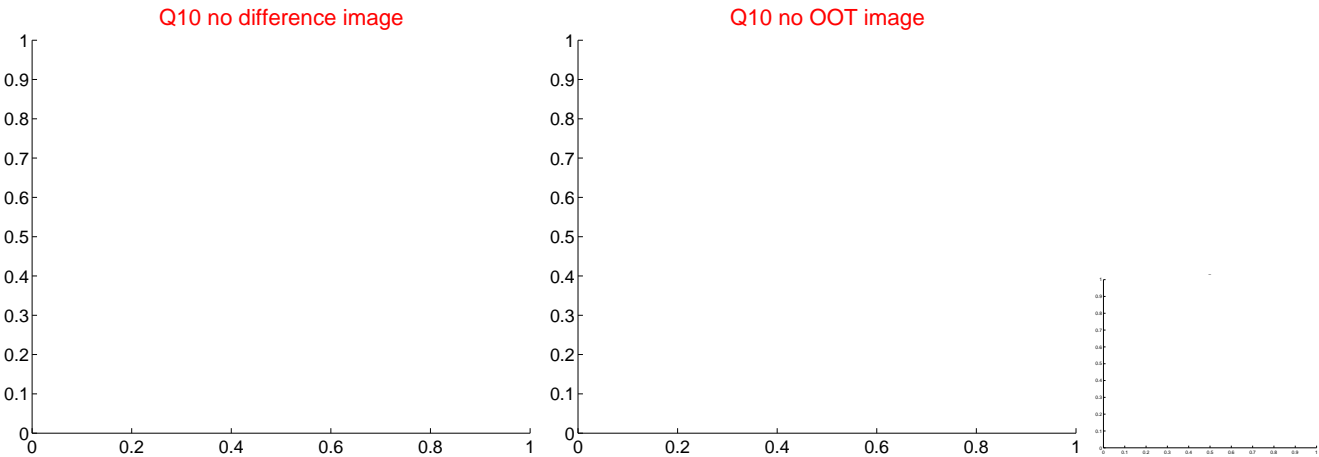
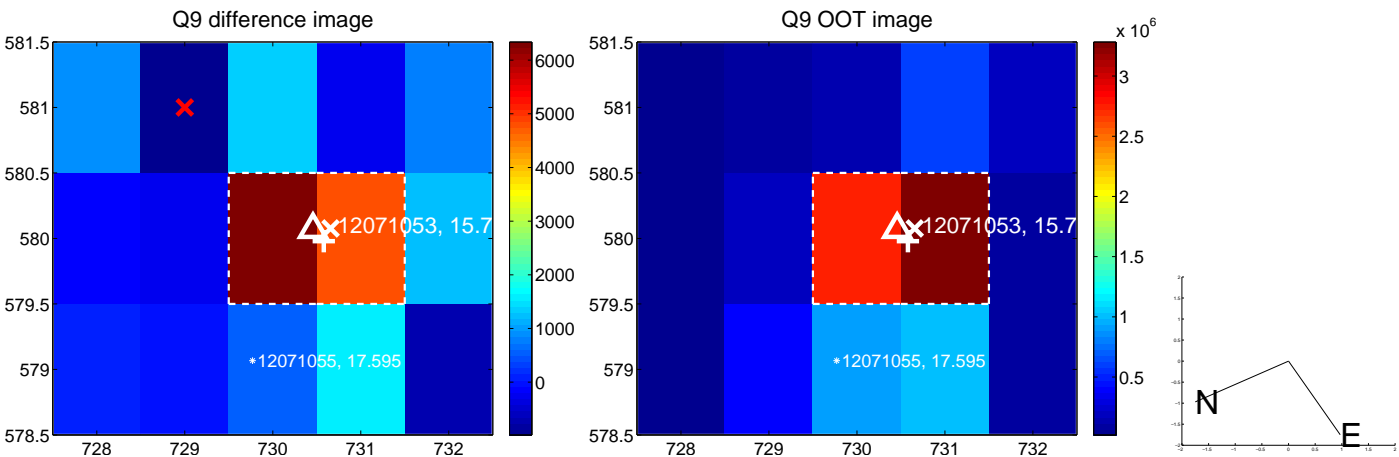
white ×: KIC target position; +: OOT centroid; △: difference centroid. red ✕: large negative pixel value.



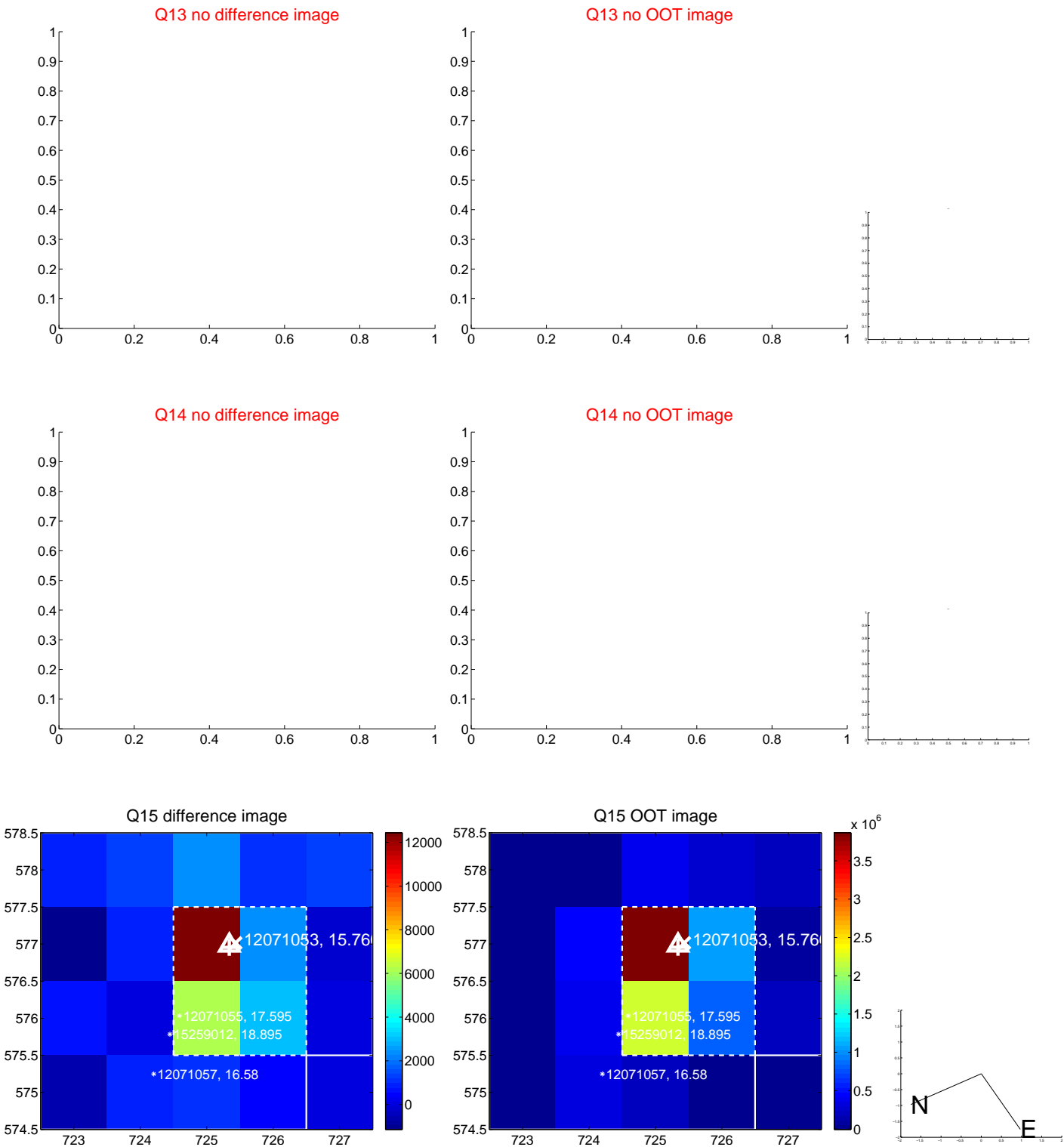
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



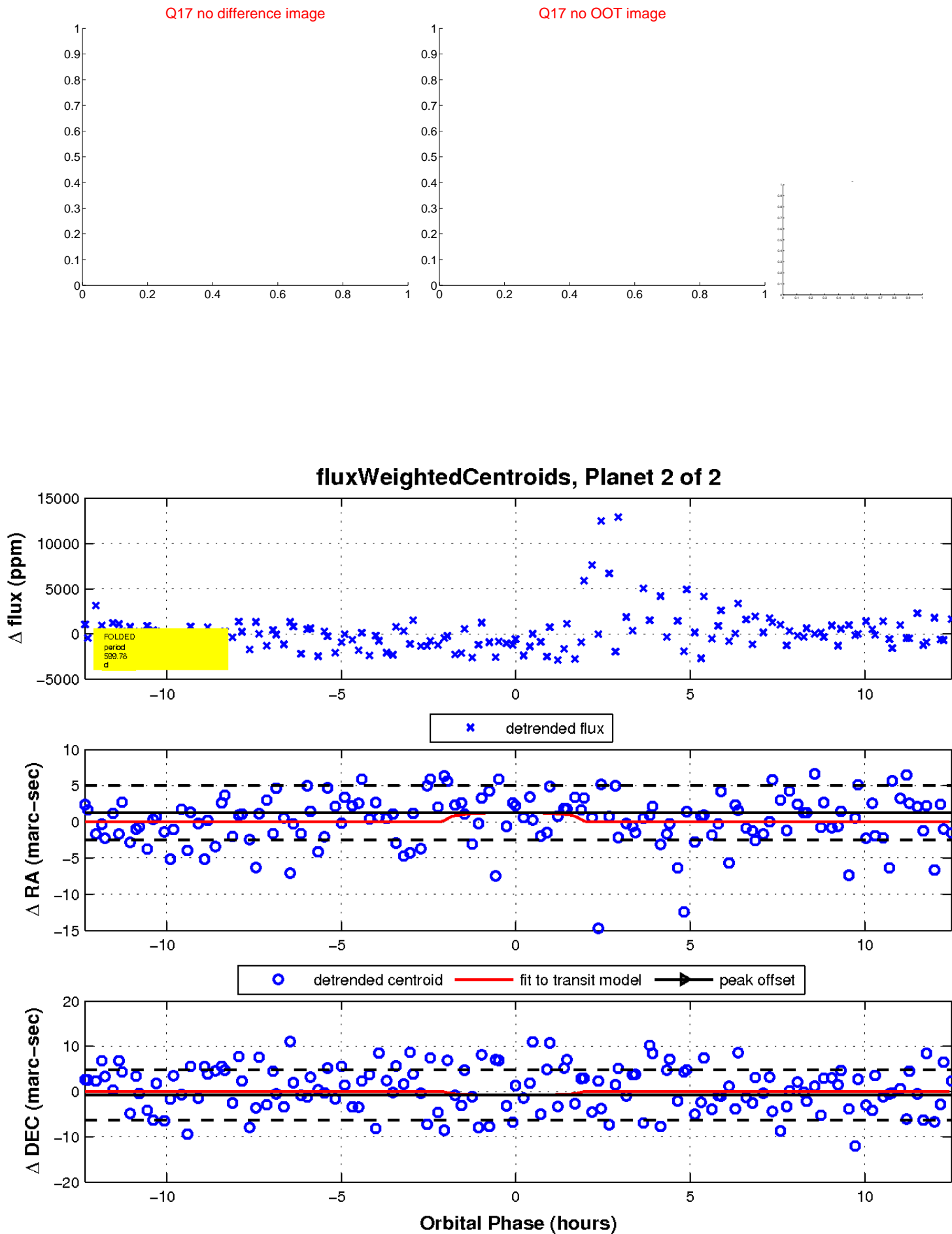
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

