

# KIC 009663113

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009663113-01	OBS	0179.01	20.740289	142.799972	1026.1	10.462	117.7	120.9	1.30	6226	4.32	95.88
009663113-02	OBS	0179.02	286.187068	306.511845	1263.4	24.210	28.8	39.9	1.30	6226	5.06	2.90

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009663113-01	OBS	PC	1.00	0	0	0	0	NO_COMMENT
009663113-02	OBS	FP	0.00	1	0	0	0	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.

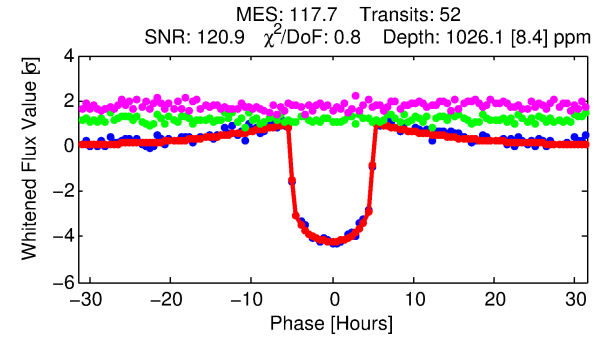
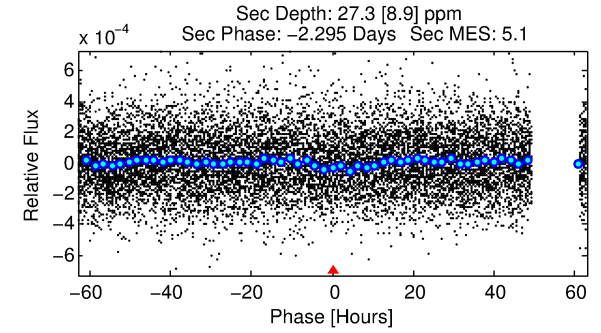
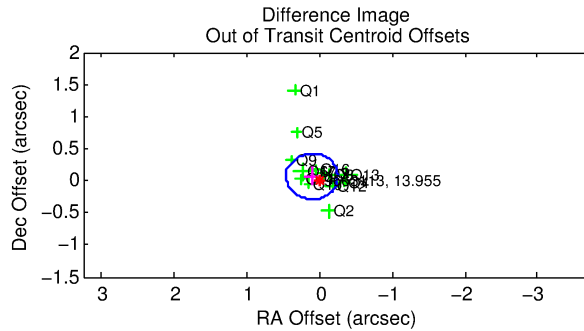
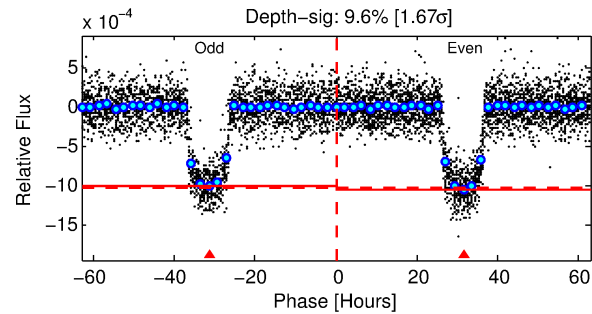
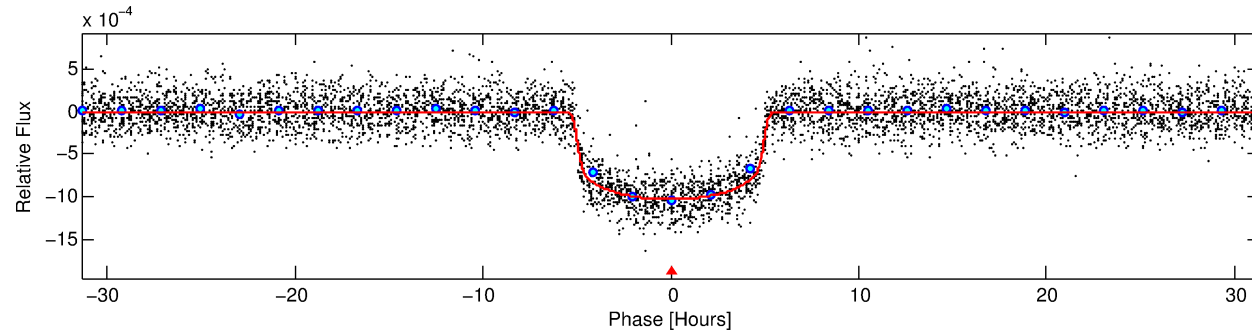
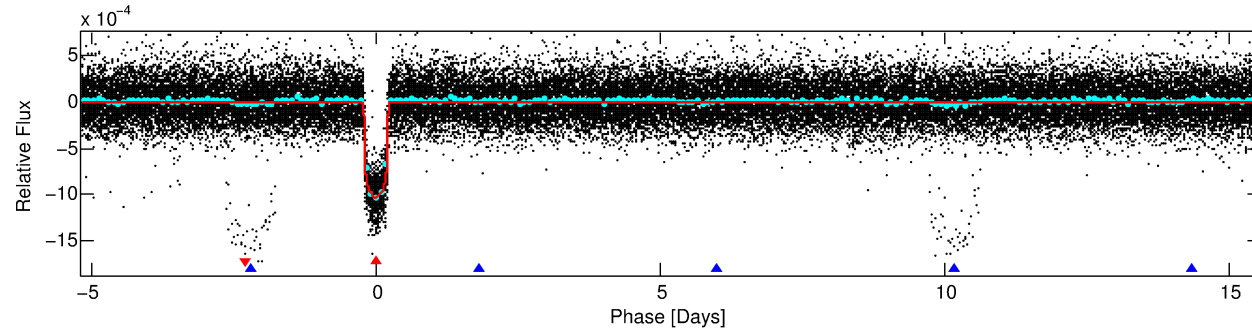
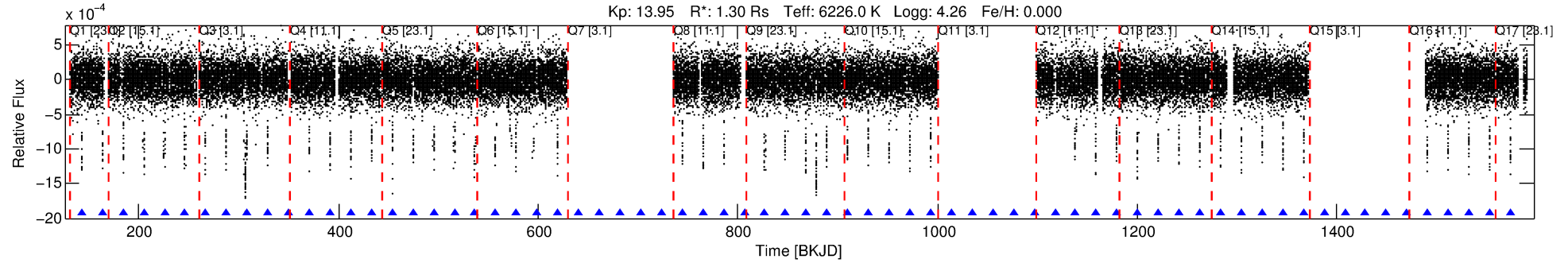
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 009663113-01

No Significant Match Found

# DV One-Page Summary

KIC: 9663113 Candidate: 1 of 2 Period: 20.740 d  
KOI: K00179.01 Corr: 0.996



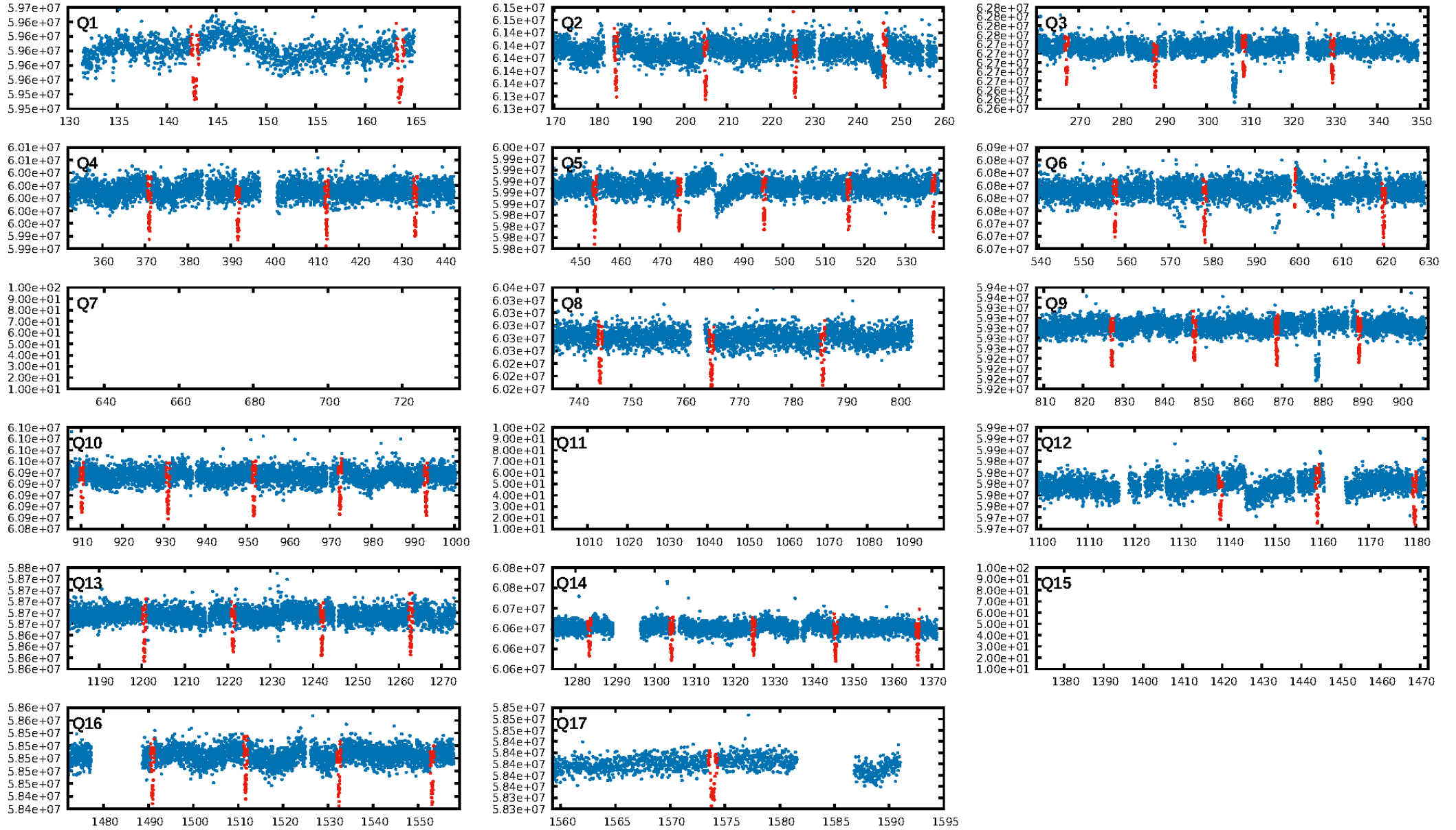
## DV Fit Results:

Period = 20.74029 [0.00003] d  
Epoch = 142.8000 [0.0012] BKJD  
Rp/R\* = 0.0305 [0.0010]  
a/R\* = 13.10 [2.03]  
b = 0.56 [0.19]  
Seff = 95.88 [21.77]  
Teq = 798 [45] K  
Rp = 4.32 [0.78] Re  
a = 0.1539 [0.0228] AU  
Ag = 19.06 [7.50] [2.41 $\sigma$ ]  
Teffp = 2578 [219] K [7.94 $\sigma$ ]

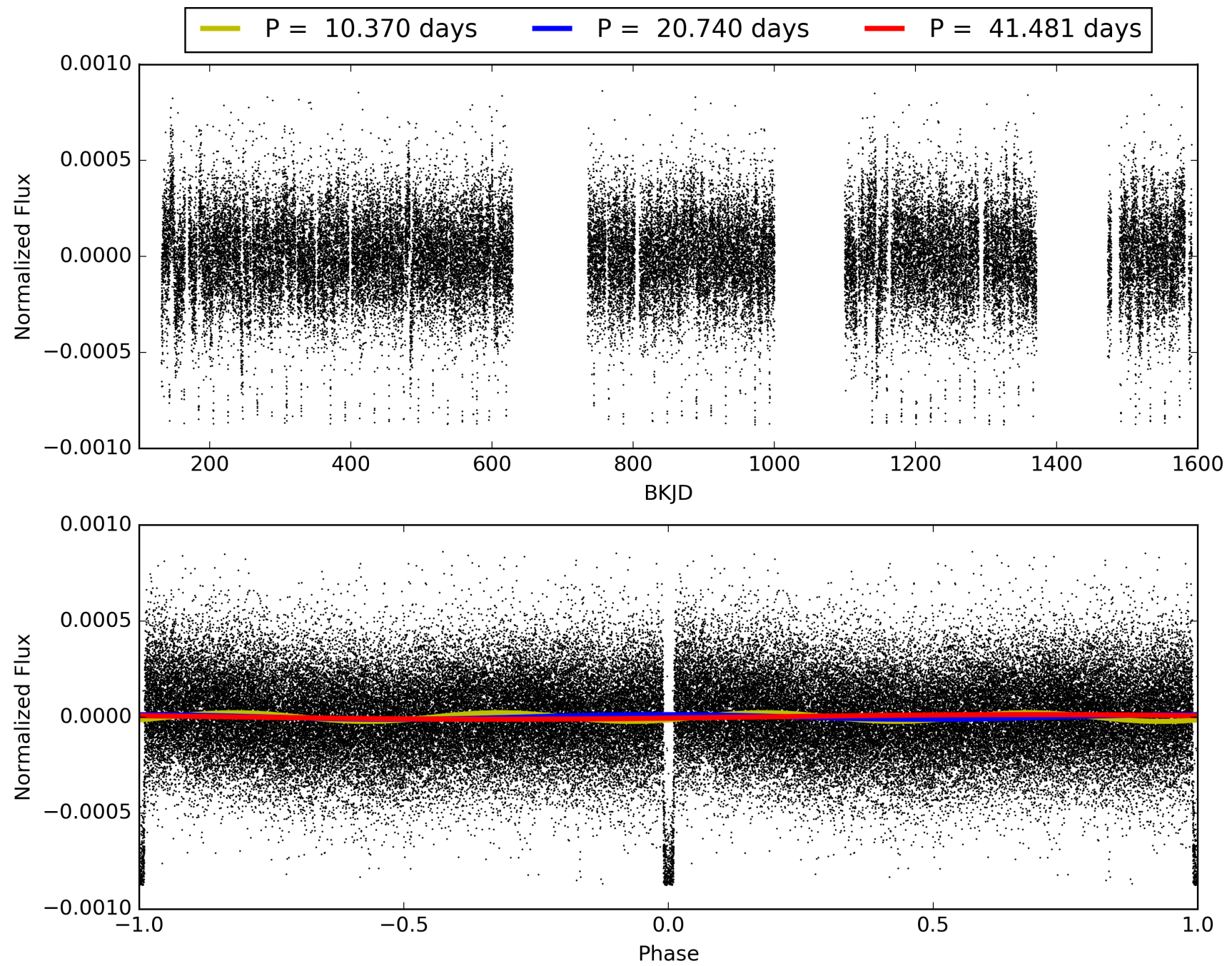
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [241.56 $\sigma$ ]  
ModelChiSquare2-sig: 97.2%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 0.00e+00  
RollingBand-fgt: 1.00 [49/49]  
GhostDiagnostic-chr: 8.66  
Centroid-sig: 0.0%  
Centroid-so: 0.213 arcsec [2.37 $\sigma$ ]  
OotOffset-rm: 0.122 arcsec [1.03 $\sigma$ ]  
KicOffset-rm: 0.149 arcsec [1.55 $\sigma$ ]  
OotOffset-st: 4/1/4/5 [14]  
KicOffset-st: 4/1/4/5 [14]  
DiffImageQuality-fgm: 1.00 [14/14]  
DiffImageOverlap-fno: 1.00 [14/14]

# TCE 009663113-01, PDC Light Curves

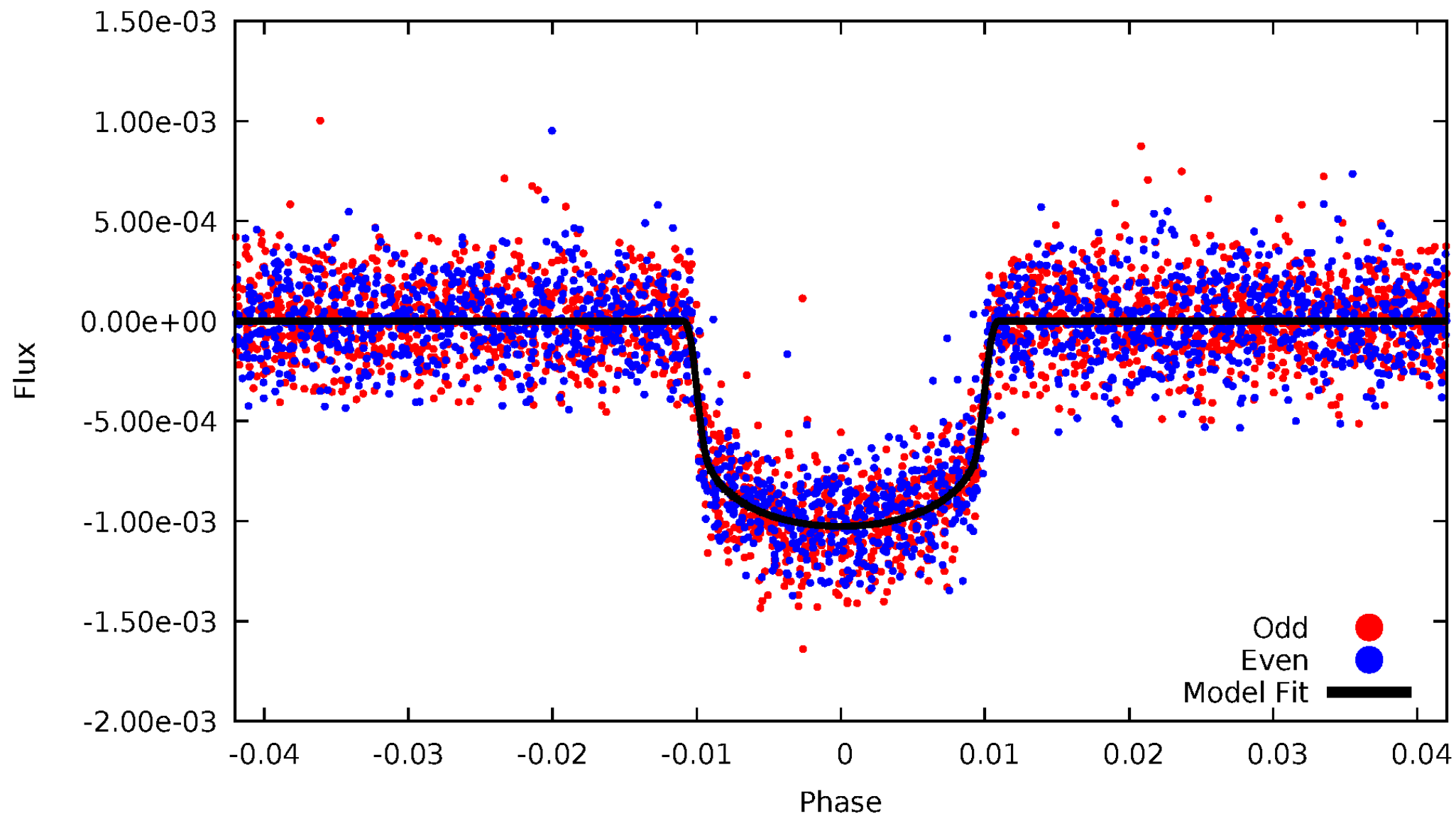


TCE 009663113-01



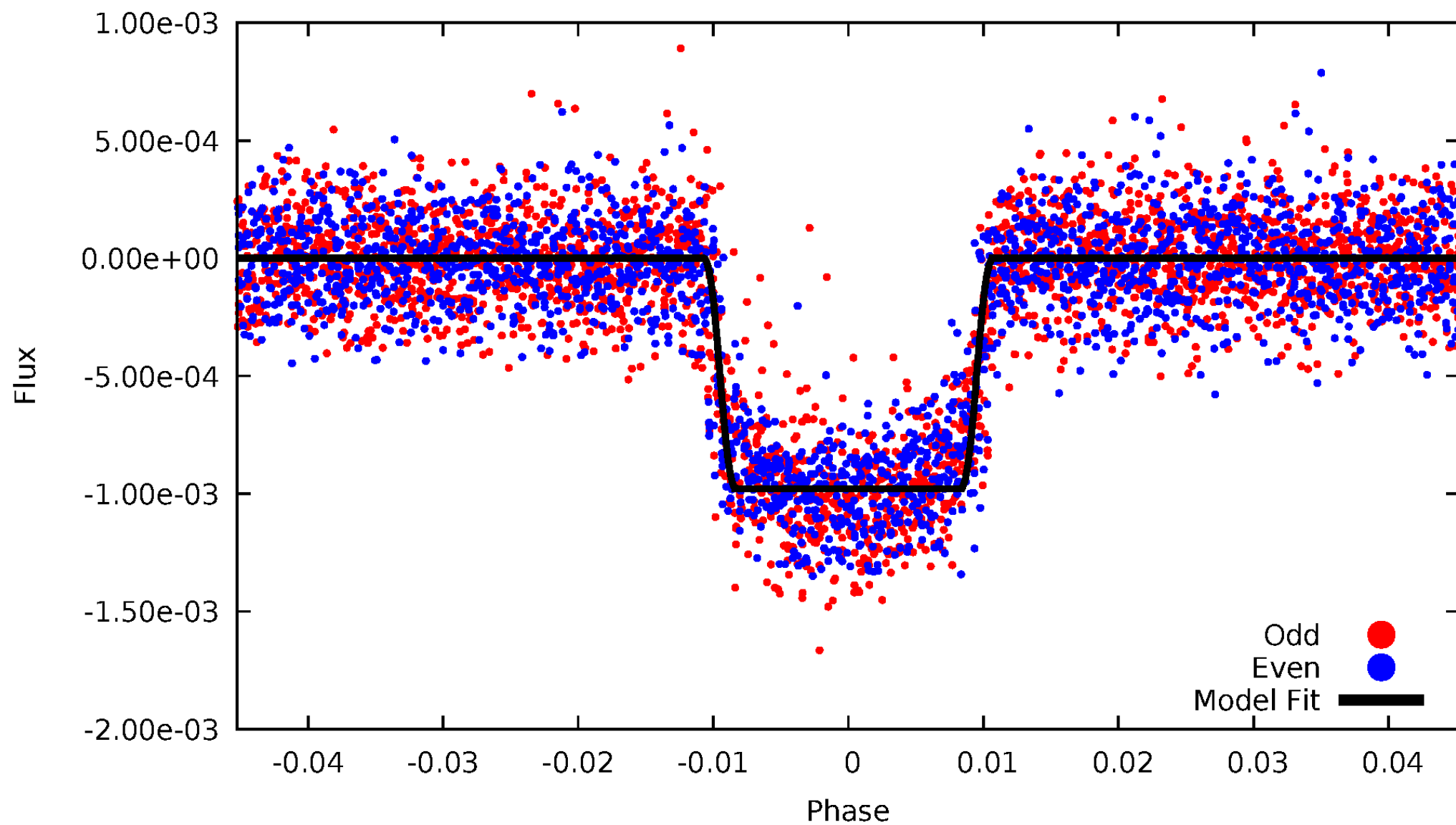
# DV Odd/Even

TCE 009663113-01



# ALT Odd/Even

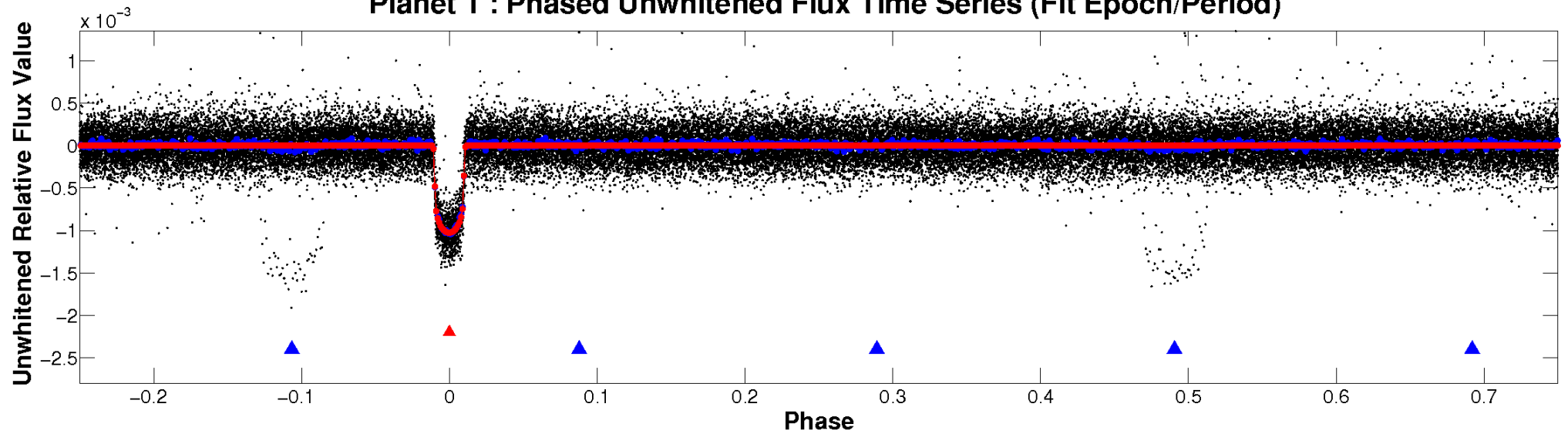
TCE 009663113-01



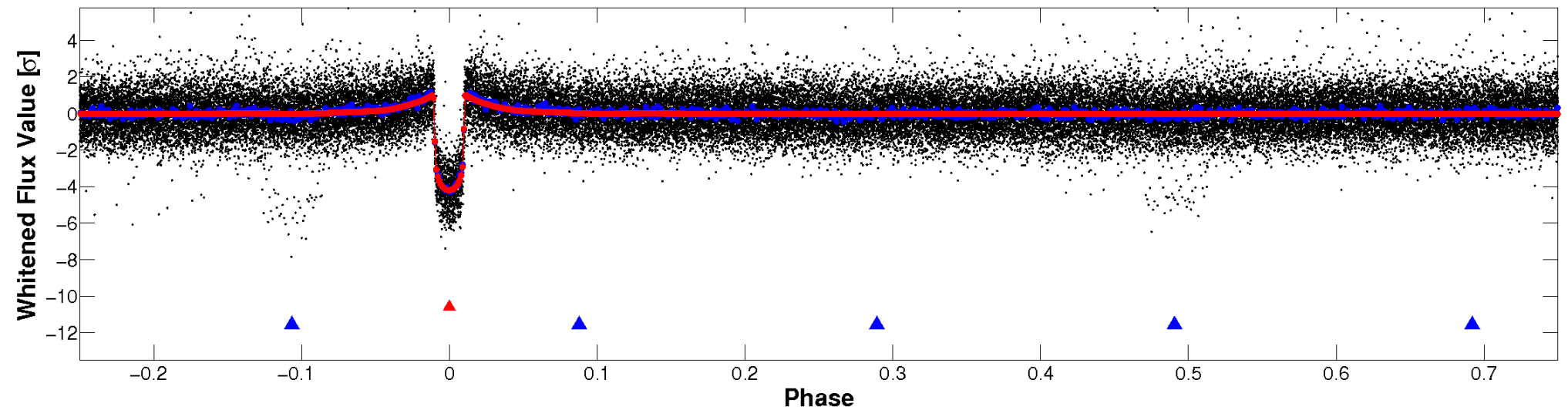


# Non-Whitened Vs. Whitened Light Curve

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

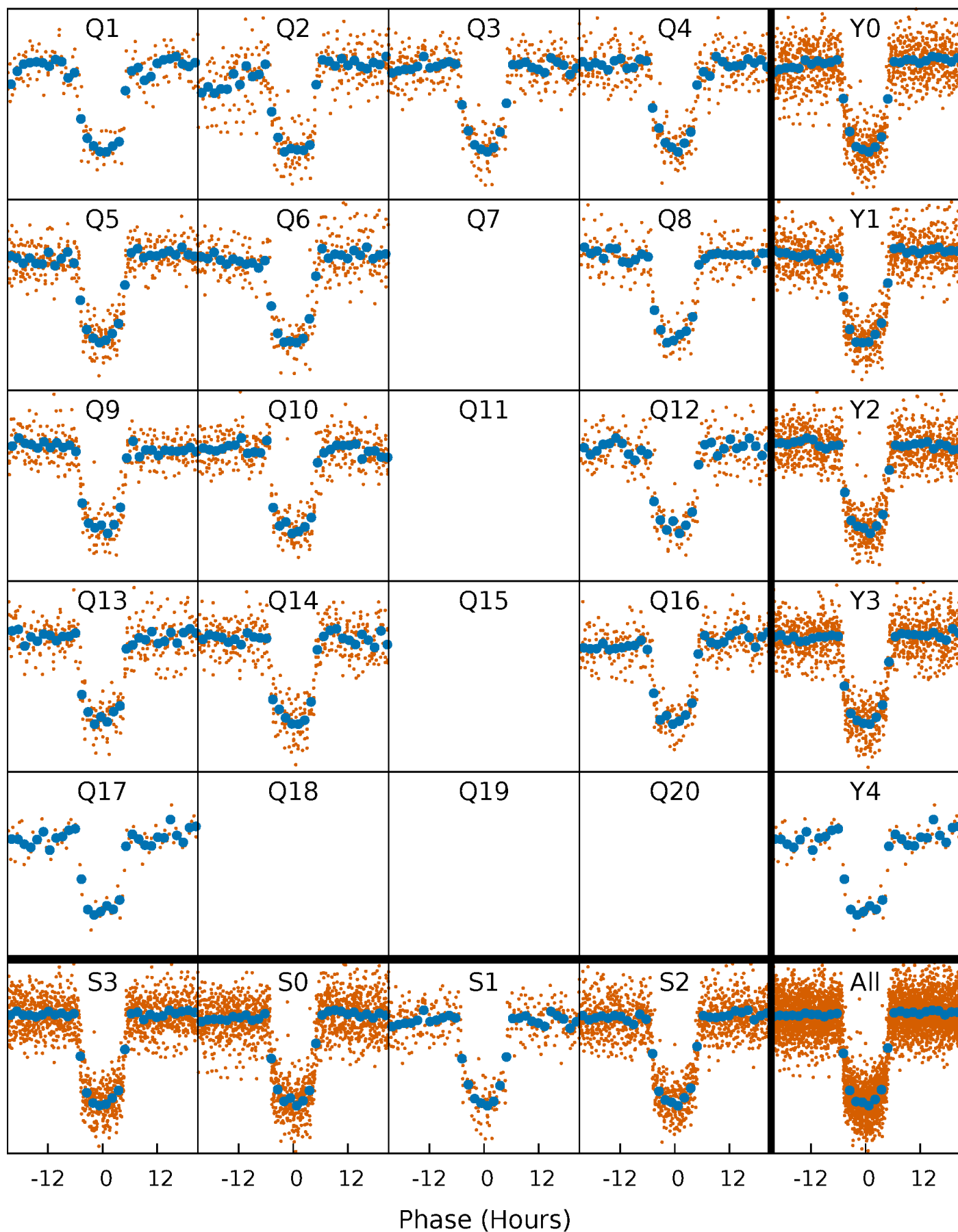


**Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



# PDC Quarter-Phased Transit Curves

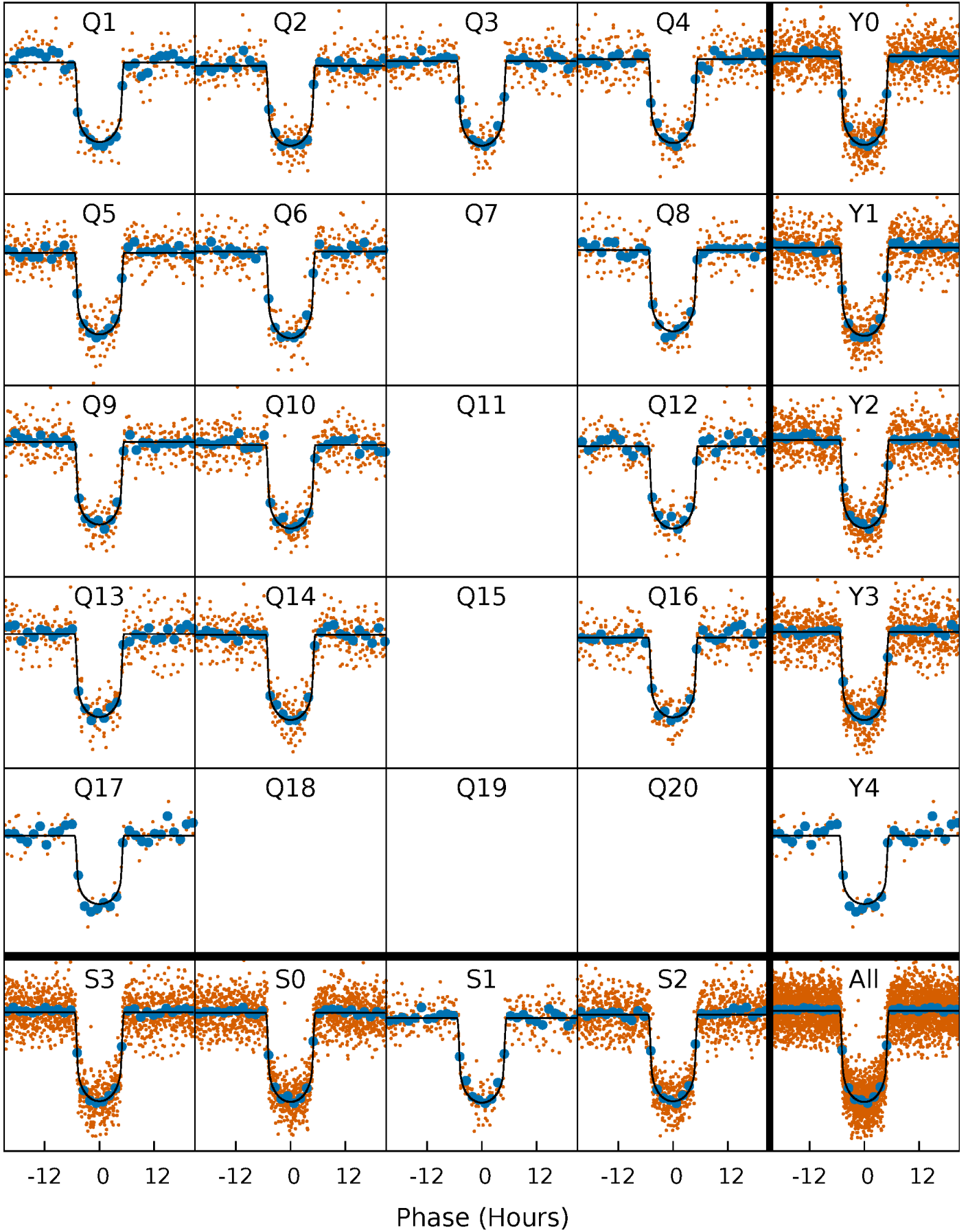
TCE 009663113-01 P= 20.740289 Days  $T_0=142.799972$  (BKJD)





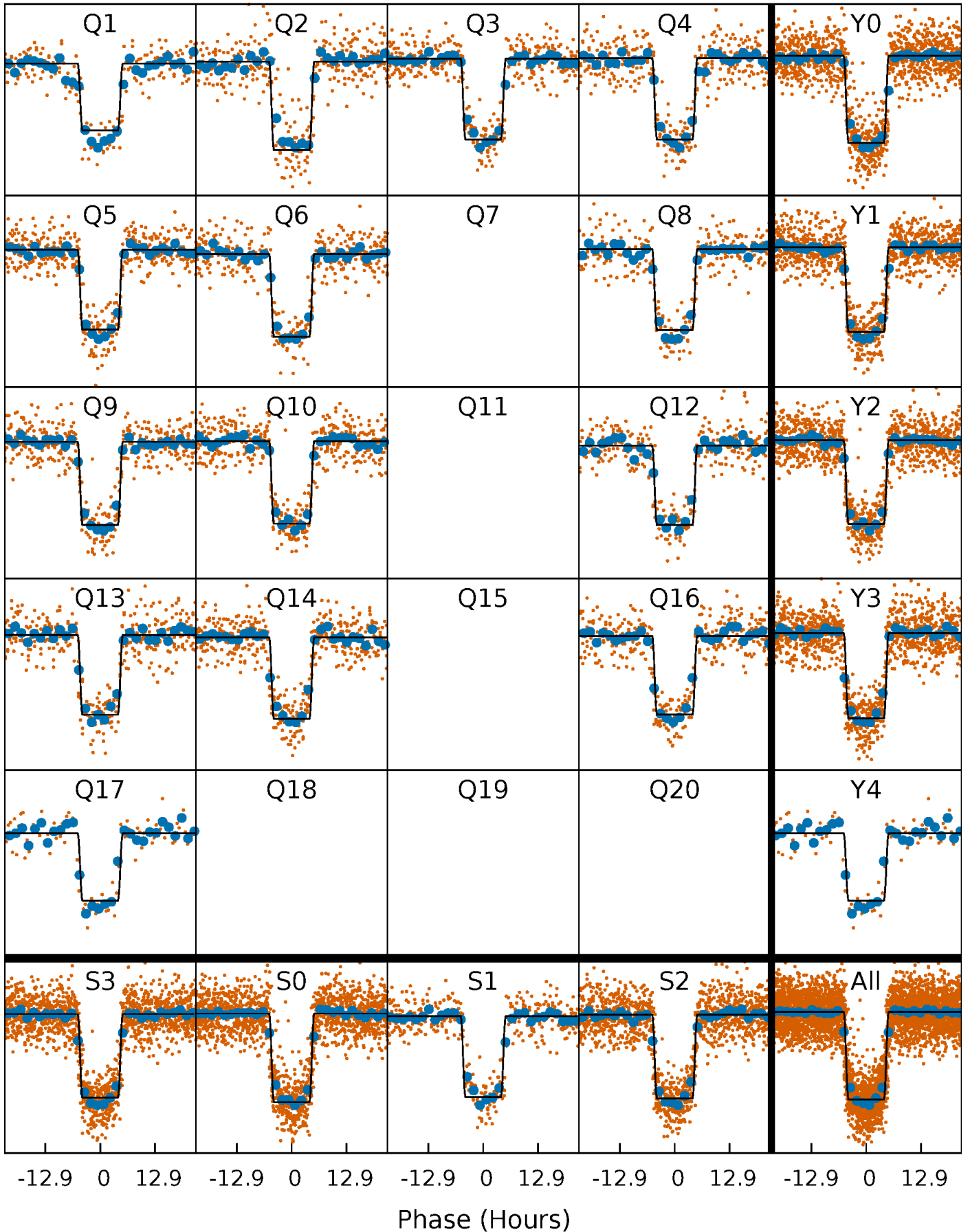
# DV Quarter-Phased Transit Curves

TCE 009663113-01 P= 20.740289 Days  $T_0=142.799972$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

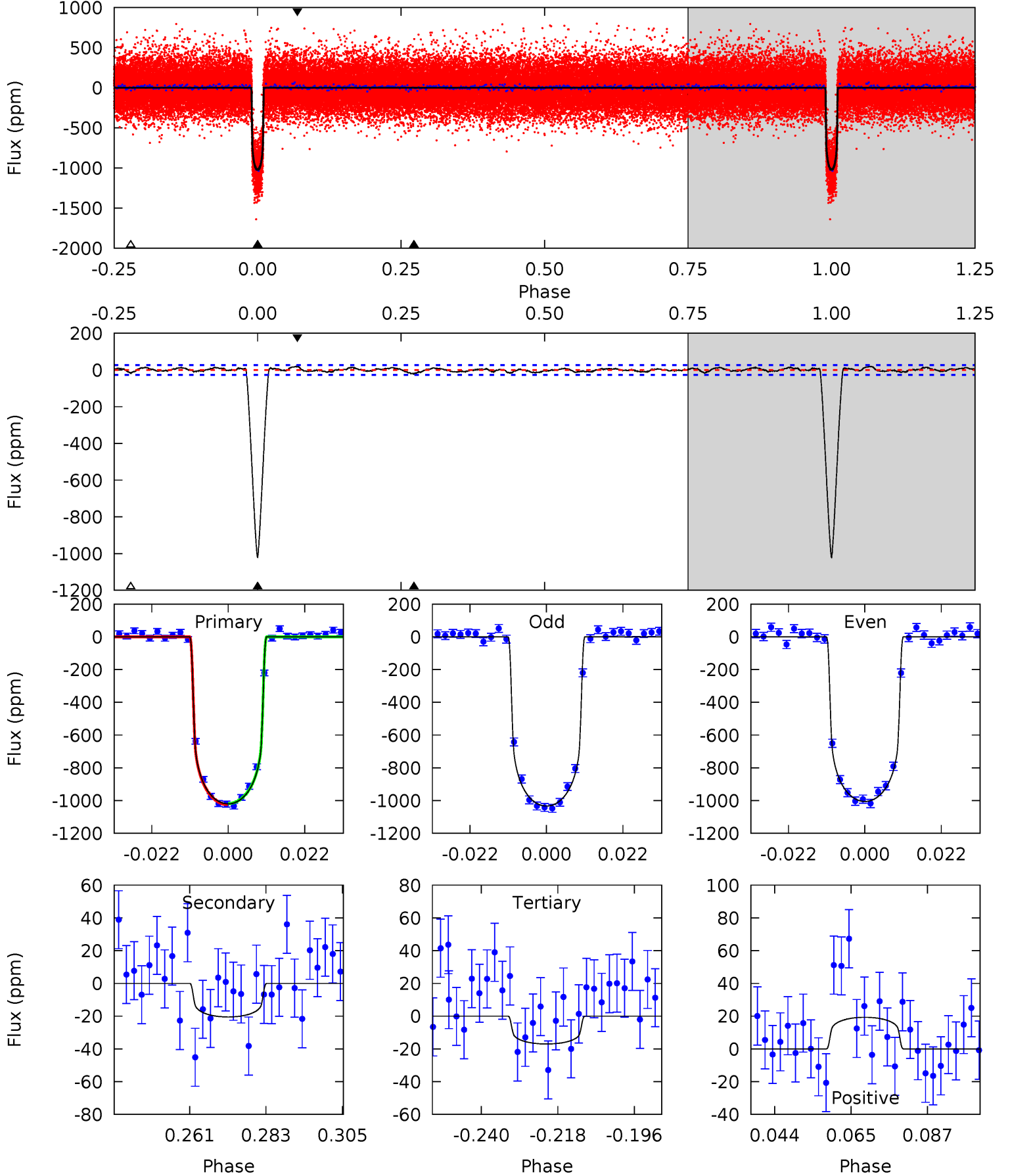
TCE 009663113-01 P= 20.740835 Days  $T_0=142.781910$  (BKJD)



# DV Model-Shift Uniqueness Test

009663113-01,  $P = 20.740289$  Days,  $E = 122.059683$  Days

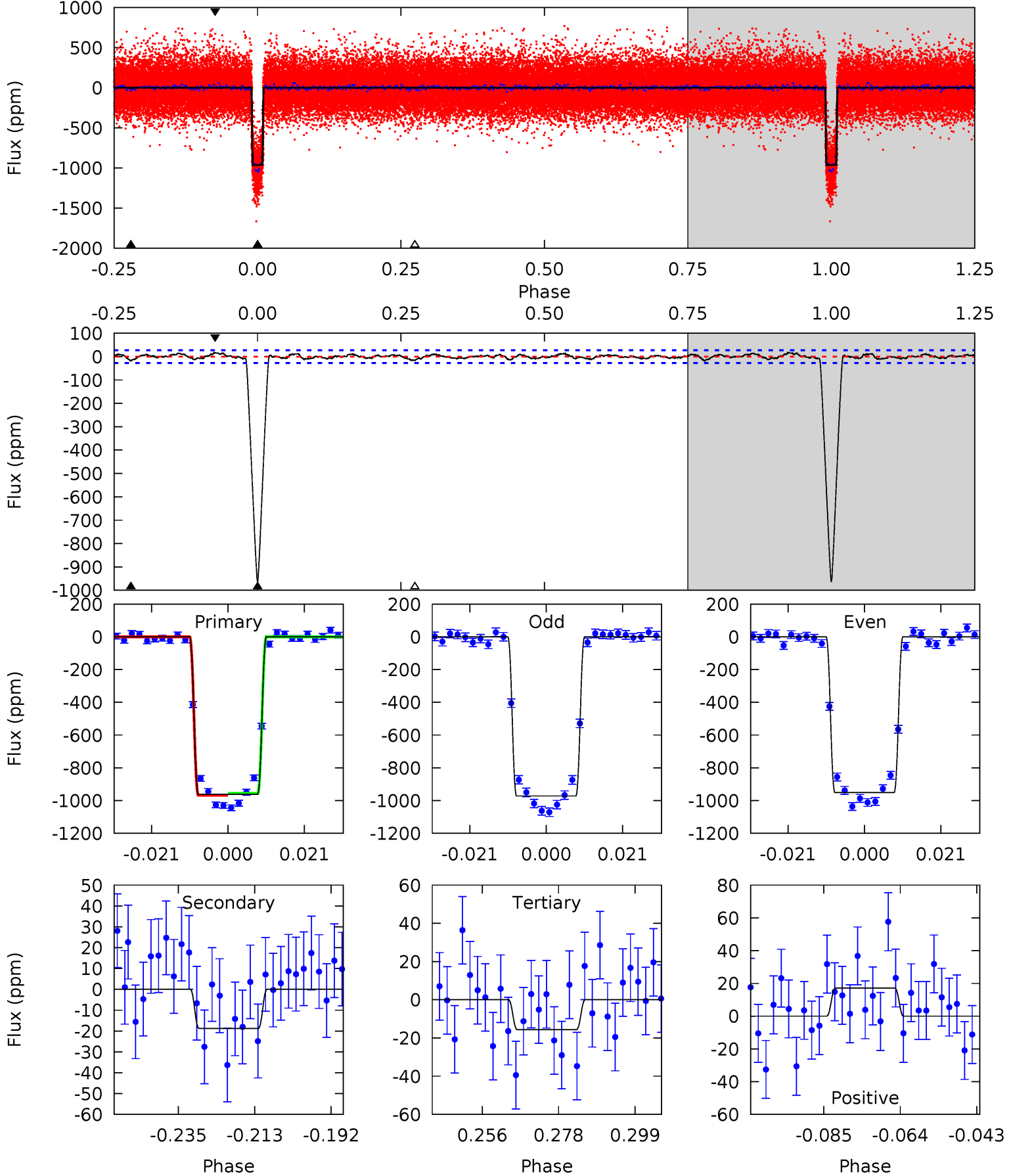
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
183.7	3.69	3.06	3.47	4.87	2.29	1.27	180.6	180.2	0.63	0.22	2.52	0.99	0.02	0.63



# Alt Model-Shift Uniqueness Test

009663113-01, P = 20.740835 Days, E = 122.041075 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
173.2	3.37	2.80	3.08	4.88	2.30	1.14	170.4	170.1	0.56	0.29	1.99	1.00	0.02	1.14



### Stellar Parameters For KIC 009663113

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6226^{+112}_{-124}$	$4.264^{+0.115}_{-0.115}$	$0.000^{+0.150}_{-0.150}$	$1.299^{+0.231}_{-0.173}$	$1.129^{+0.106}_{-0.077}$	$0.726^{+0.371}_{-0.245}$
	+2%/-2%	+3%/-3%	+inf%/-inf%	+18%/-13%	+9%/-7%	+51%/-34%
Source	SPE57	SPE57	SPE57	DSEP		

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

### Secondary Eclipse Parameters for KIC 009663113-01 / KOI 0179.01

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-21 \pm 6$	$4.33^{+0.46}_{-0.36}$	$1116^{+55}_{-45}$	$3039^{+124}_{-126}$	$14^{+5}_{-4}$
Alt.	$-19 \pm 6$	$4.45^{+0.48}_{-0.40}$	$1115^{+53}_{-52}$	$2974^{+123}_{-156}$	$12^{+4}_{-4}$

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

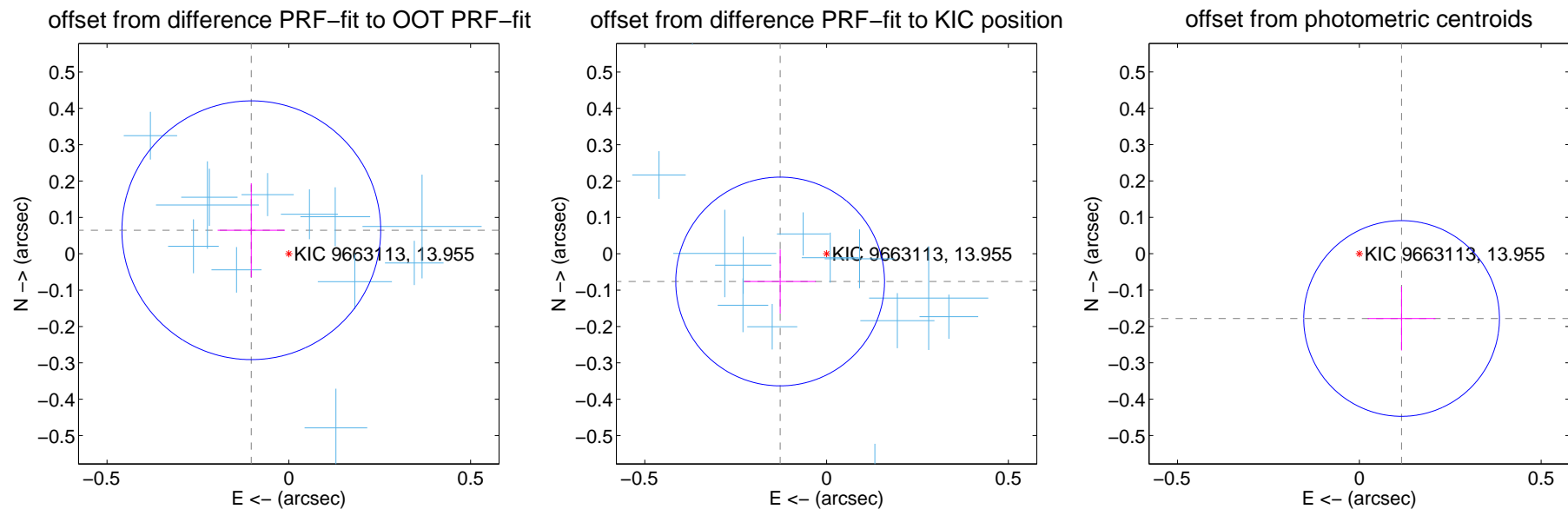
## DV Centroid Data

Supplemental centroid analysis for 009663113-01. Kepler magnitude: 13.96. Transit SNR 120.92

There are 14 quarters with good PRF difference image offsets

The direct PRF centroid is offset from the target star catalog position by about 0.14 arcsec

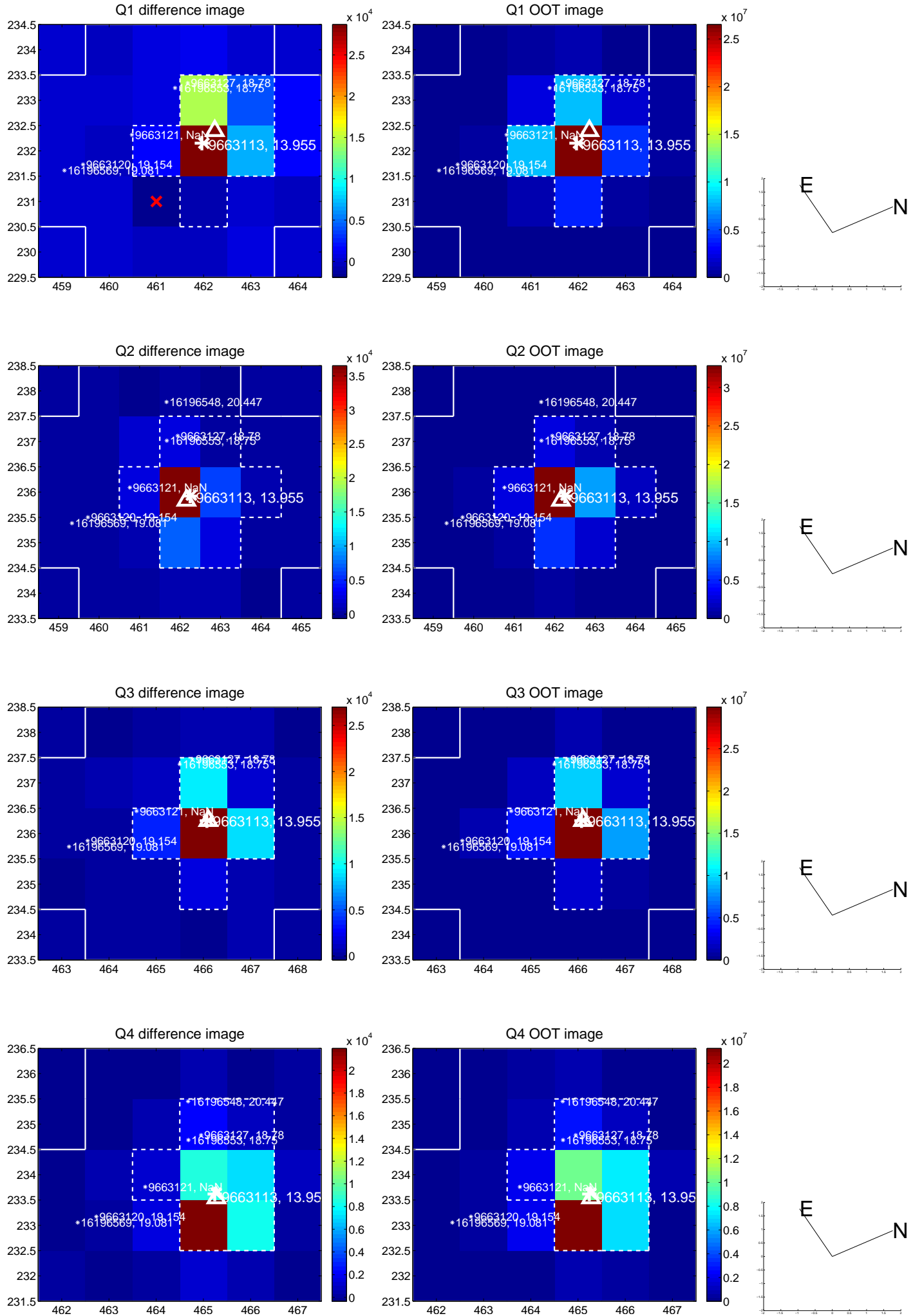
	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.122 \pm 0.119$	1.03	$0.103 \pm 0.092$	$0.065 \pm 0.129$
PRF-fit source offset from KIC position	$0.149 \pm 0.096$	1.55	$0.128 \pm 0.098$	$-0.076 \pm 0.088$
photometric centroid source offset	$0.21 \pm 0.09$	2.37	$-0.12 \pm 0.09$	$-0.18 \pm 0.09$



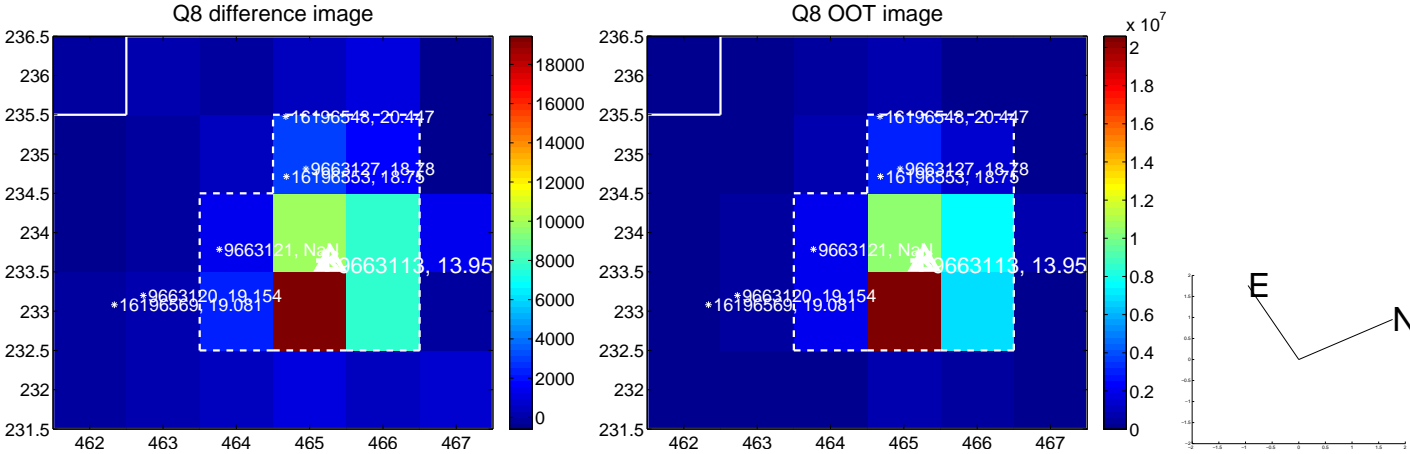
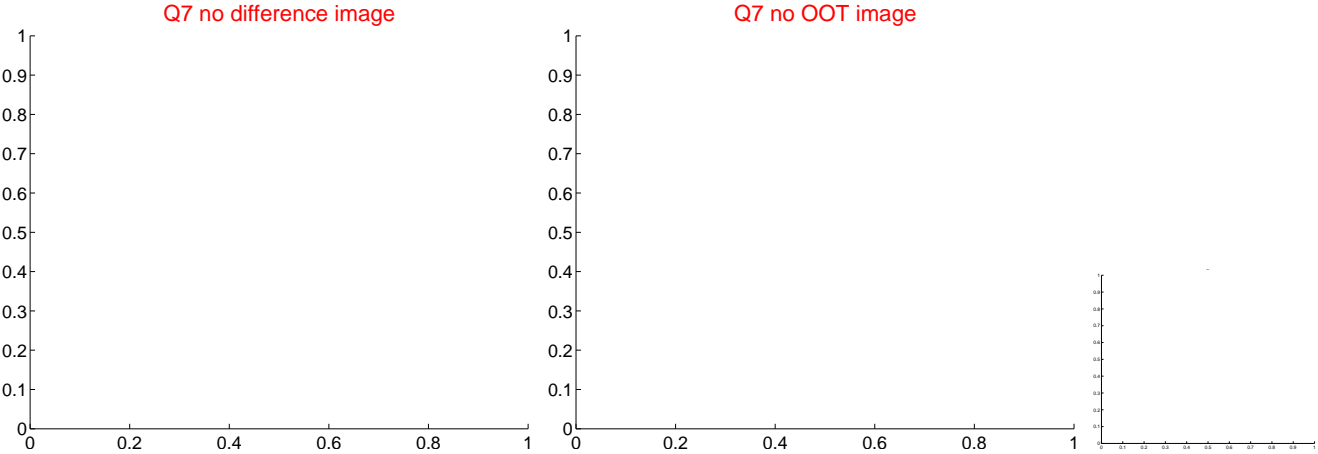
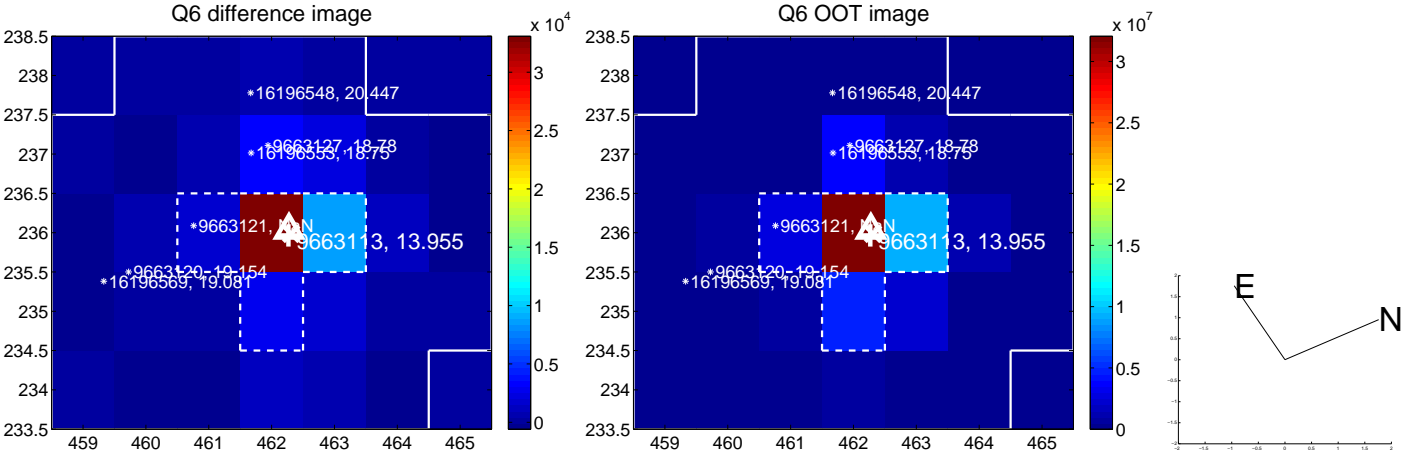
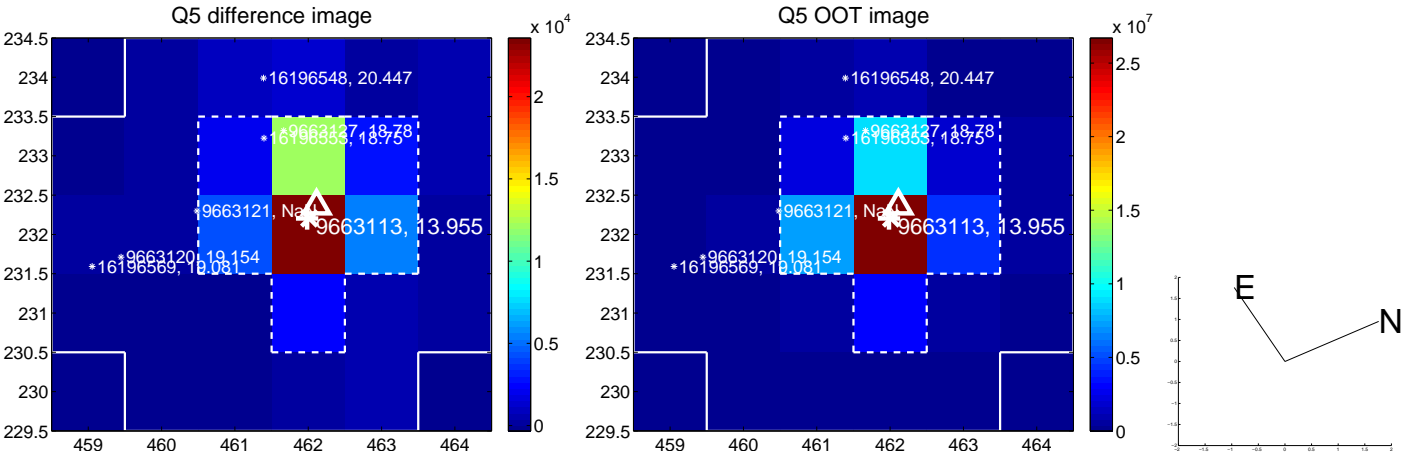
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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



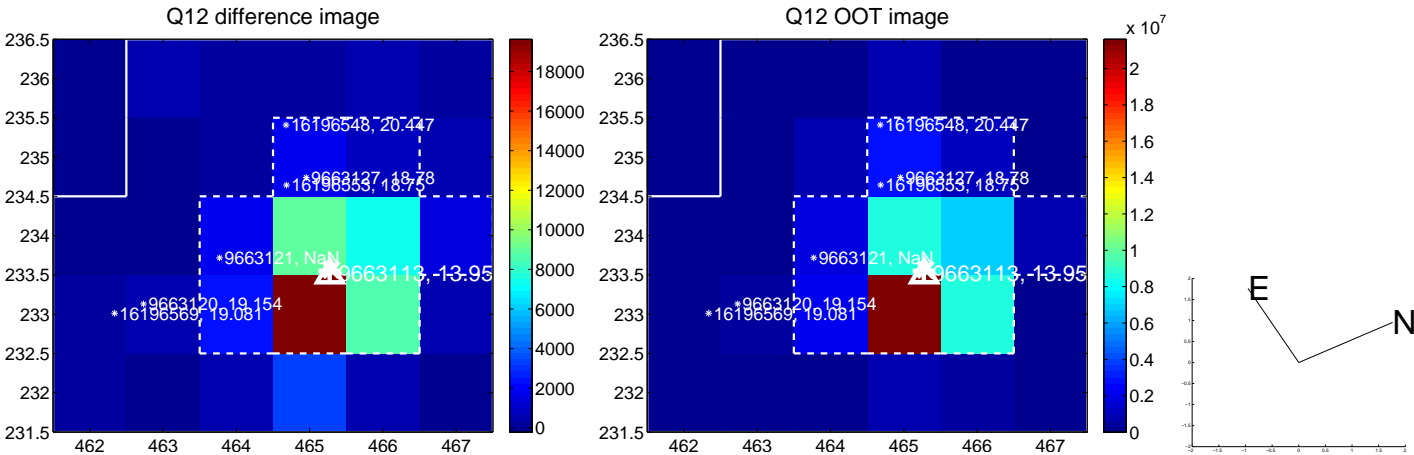
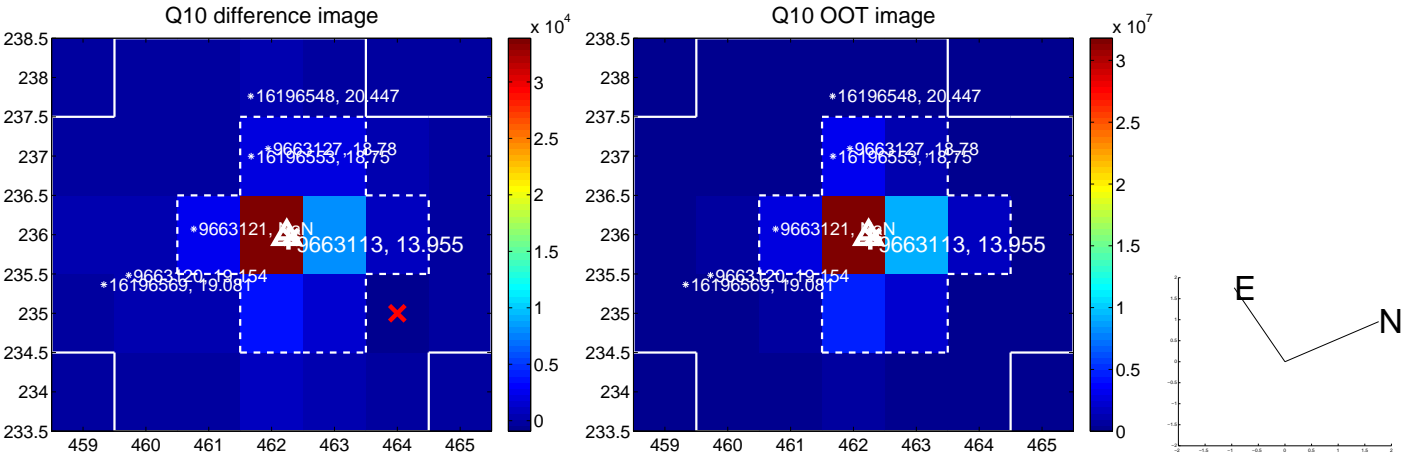
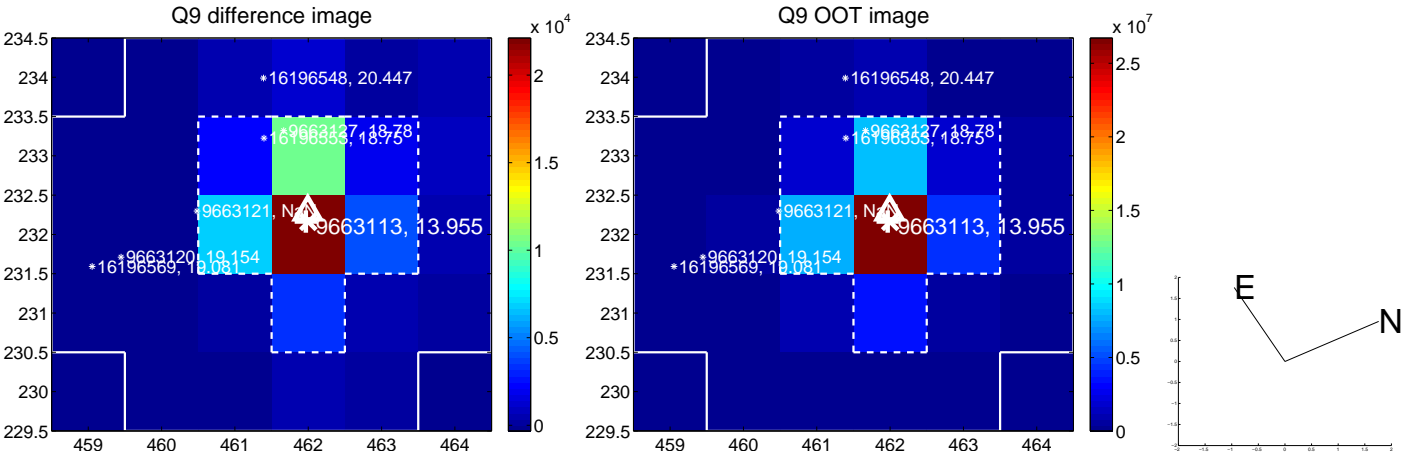
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



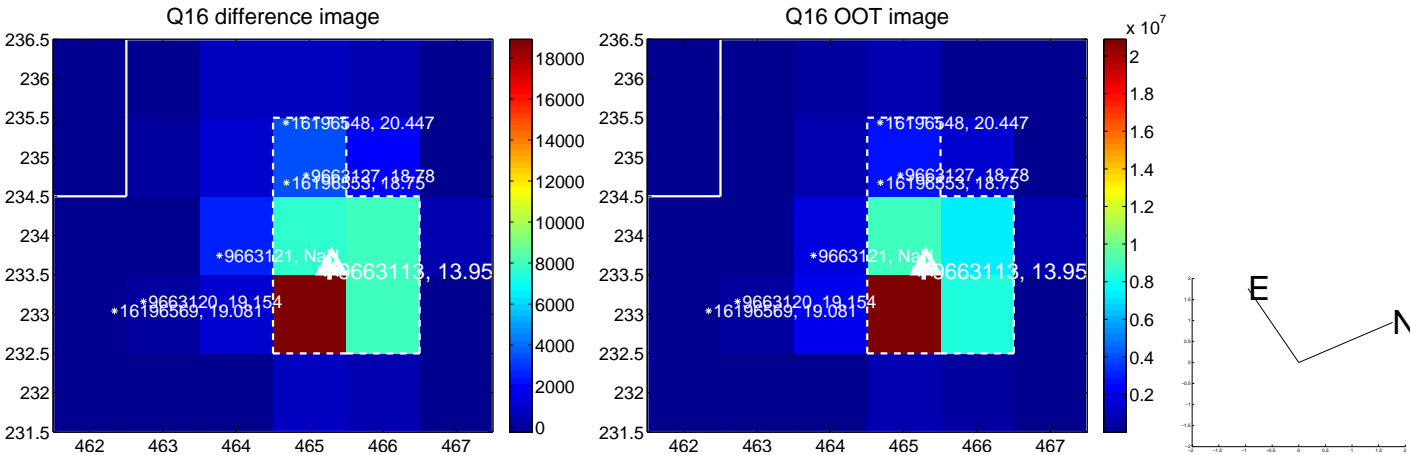
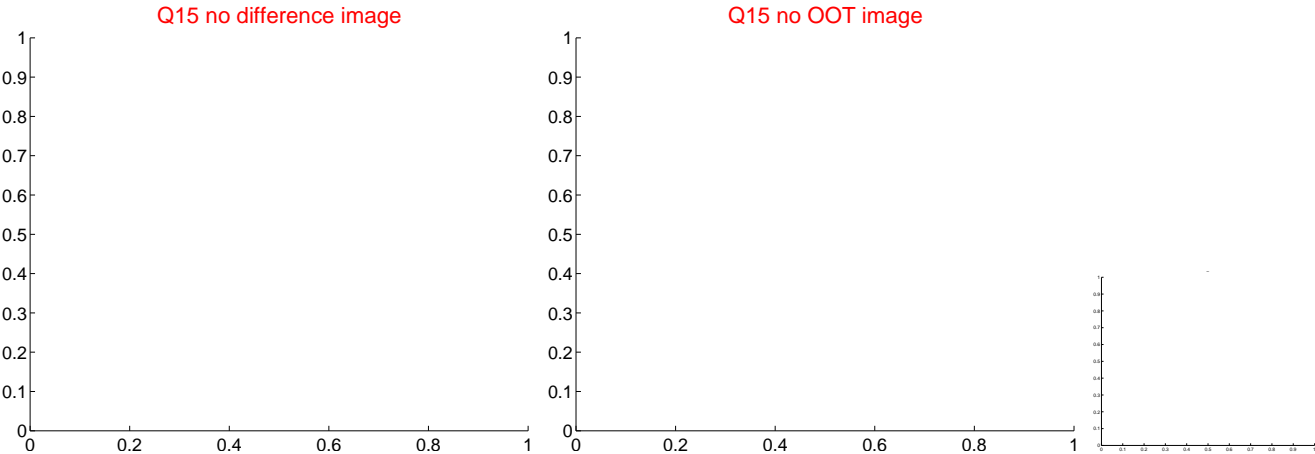
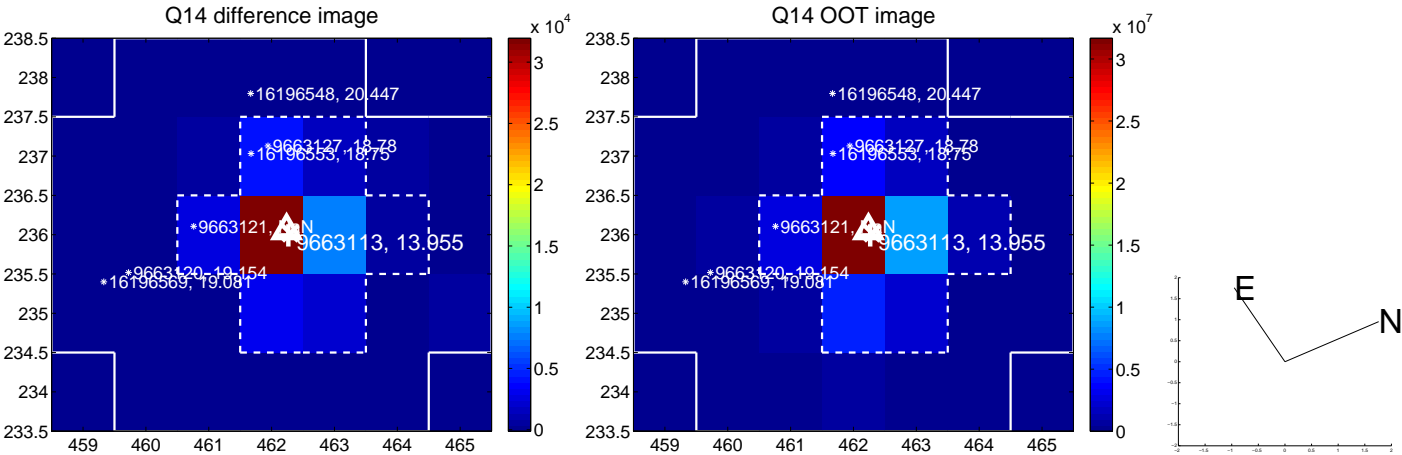
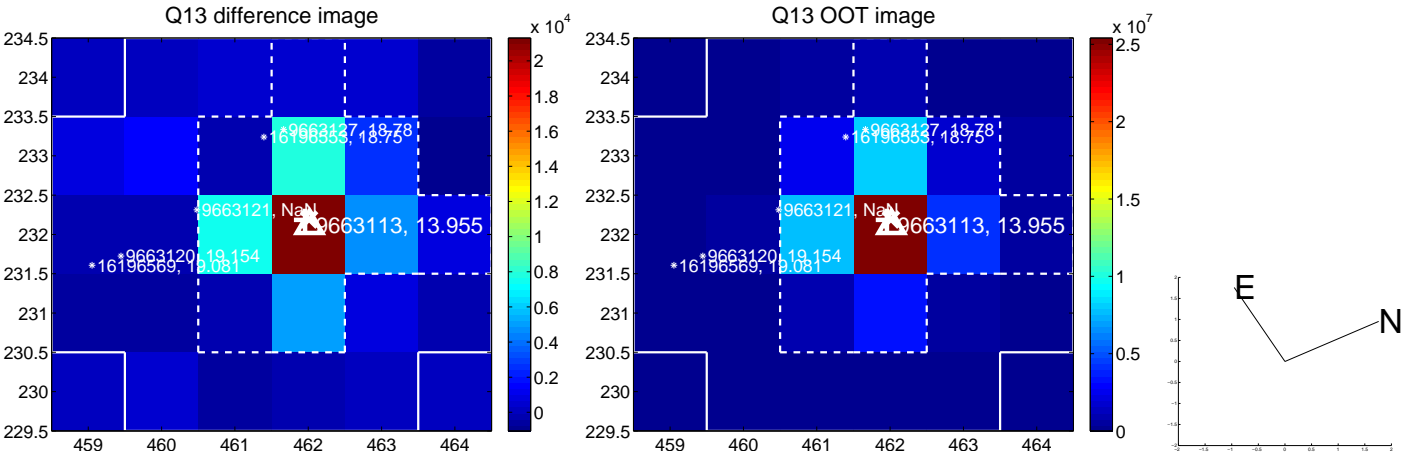
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



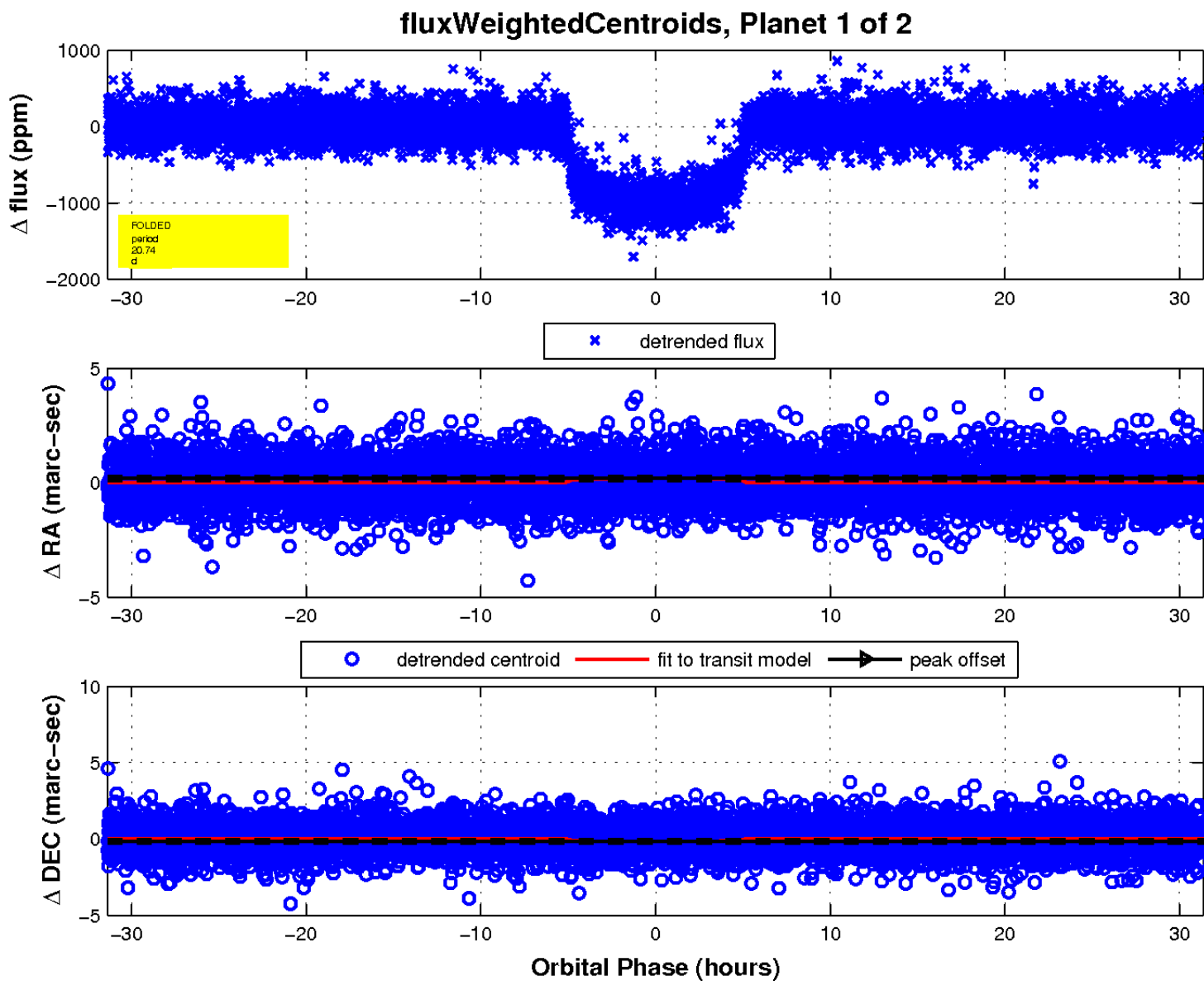
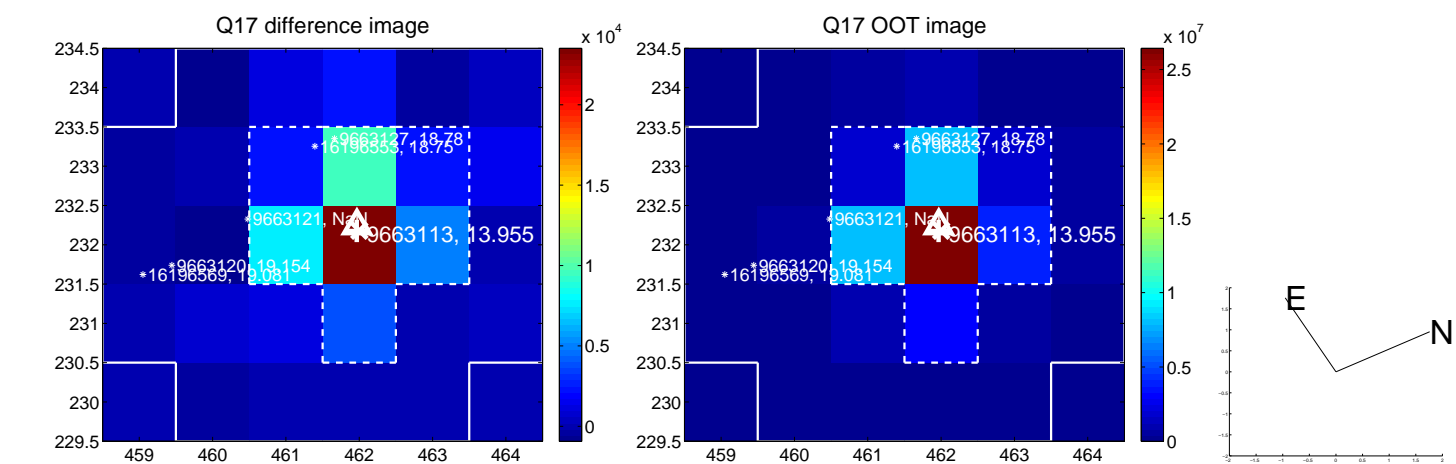
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

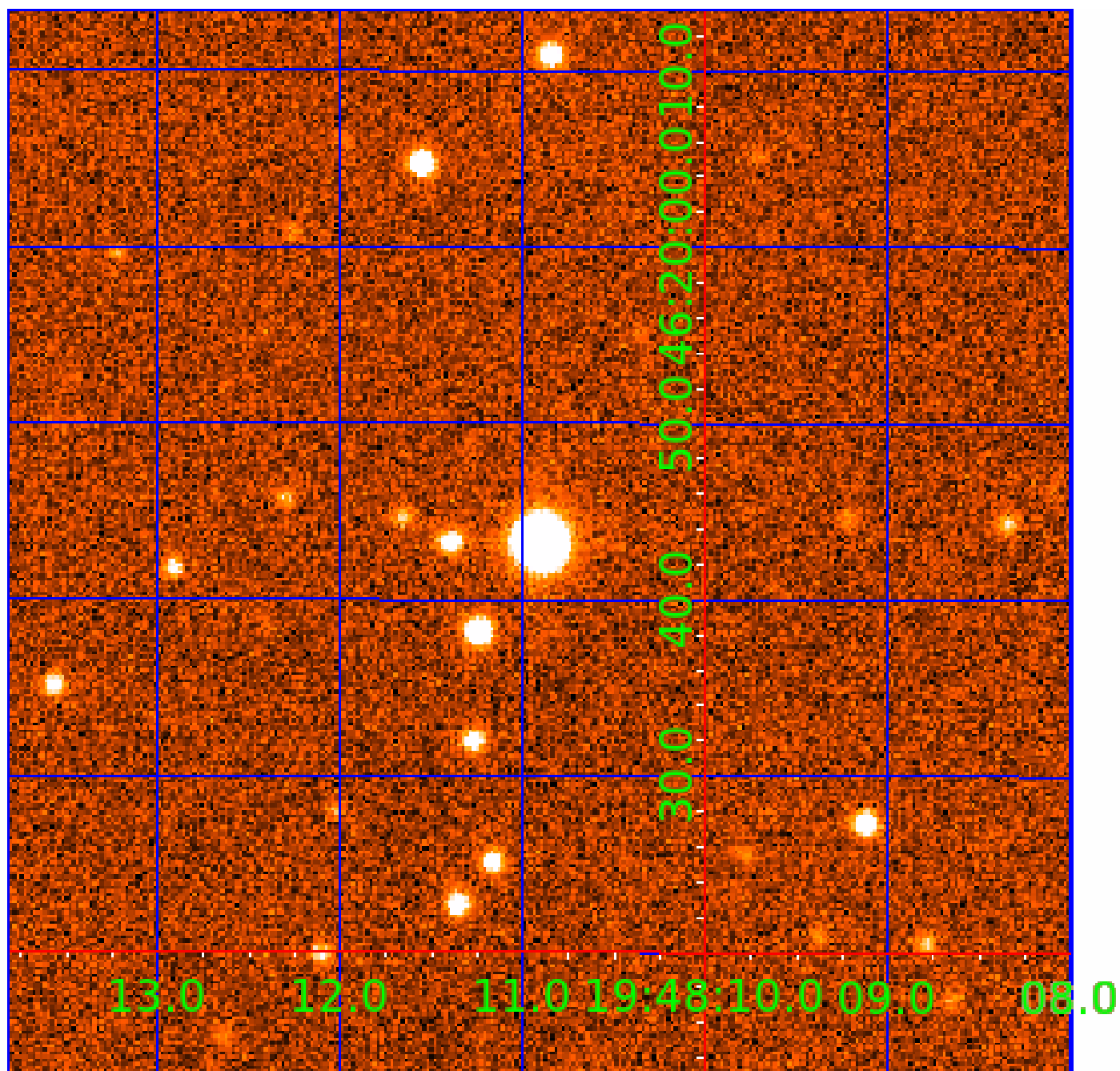


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination





# KIC 009663113

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009663113-01	OBS	0179.01	20.740289	142.799972	1026.1	10.462	117.7	120.9	1.30	6226	4.32	95.88
009663113-02	OBS	0179.02	286.187068	306.511845	1263.4	24.210	28.8	39.9	1.30	6226	5.06	2.90

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009663113-01	OBS	PC	1.00	0	0	0	0	NO_COMMENT
009663113-02	OBS	FP	0.00	1	0	0	0	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.

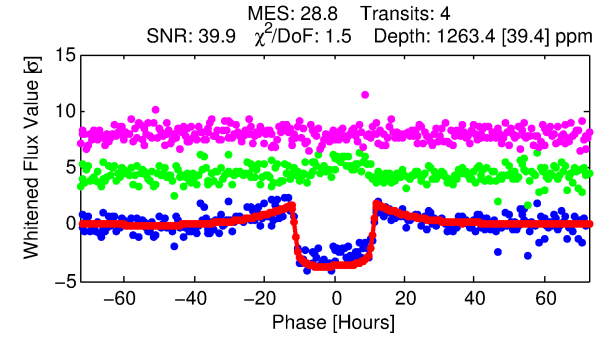
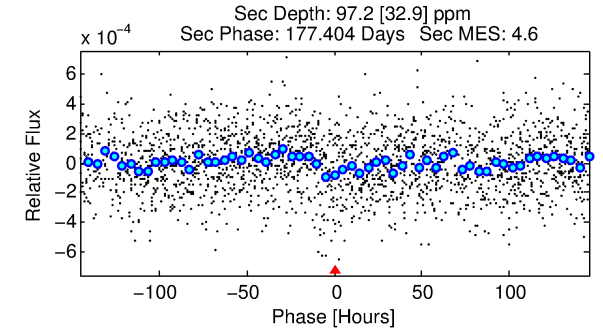
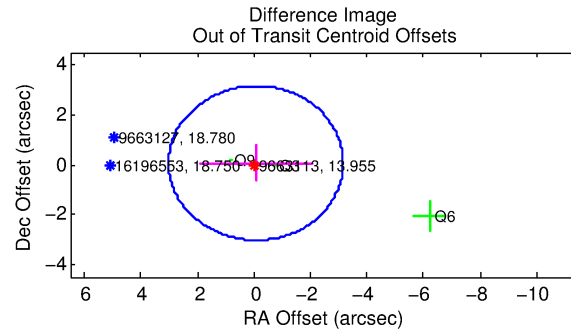
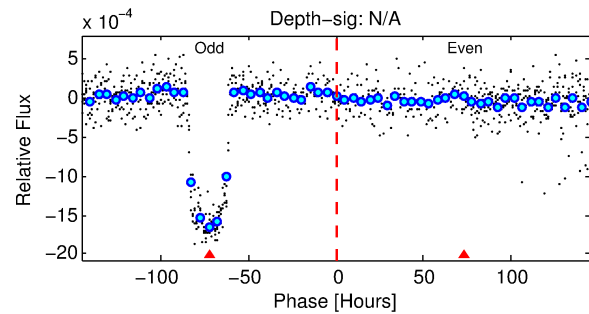
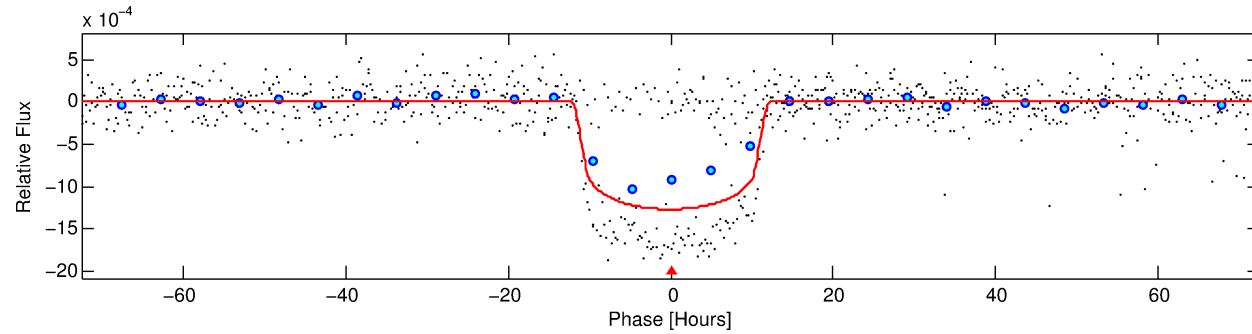
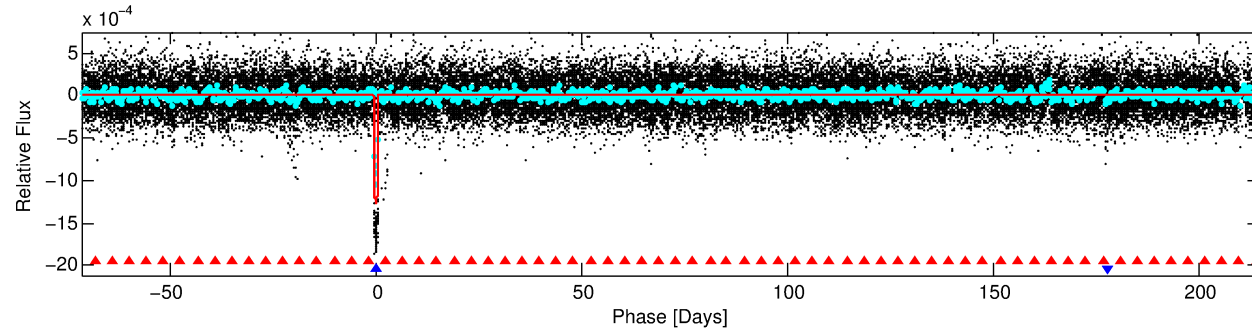
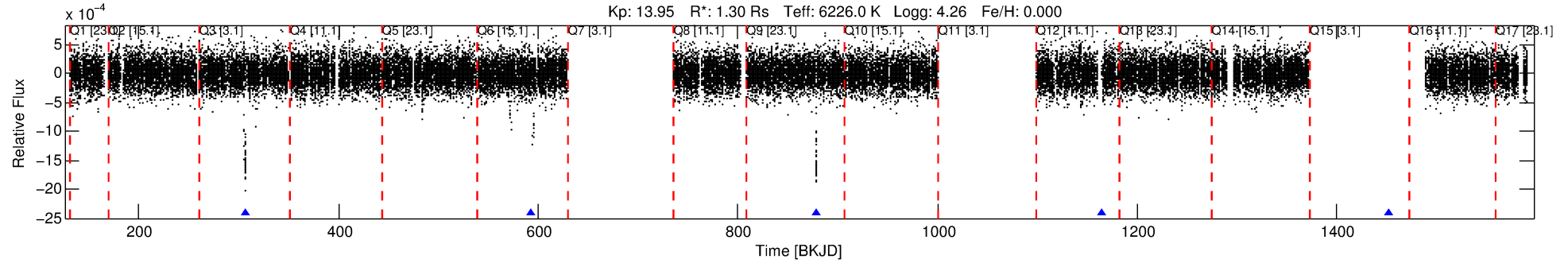
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 009663113-02

No Significant Match Found

# DV One-Page Summary

KIC: 9663113 Candidate: 2 of 2 Period: 286.187 d  
KOI: K00179.02 Corr: 0.757



## DV Fit Results:

Period = 286.18707 [0.00463] d  
Epoch = 306.5118 [0.0073] BKJD  
Rp/R\* = 0.0357 [0.0011]  
a/R\* = 61.83 [8.06]  
b = 0.78 [0.07]  
Seff = 2.90 [0.66]  
Teq = 333 [19] K  
Rp = 5.06 [0.91] Re  
a = 0.8855 [0.1309] AU  
Ag = 1637.30 [663.16] [2.47] $\sigma$   
Teffp = 3272 [289] K [10.13] $\sigma$

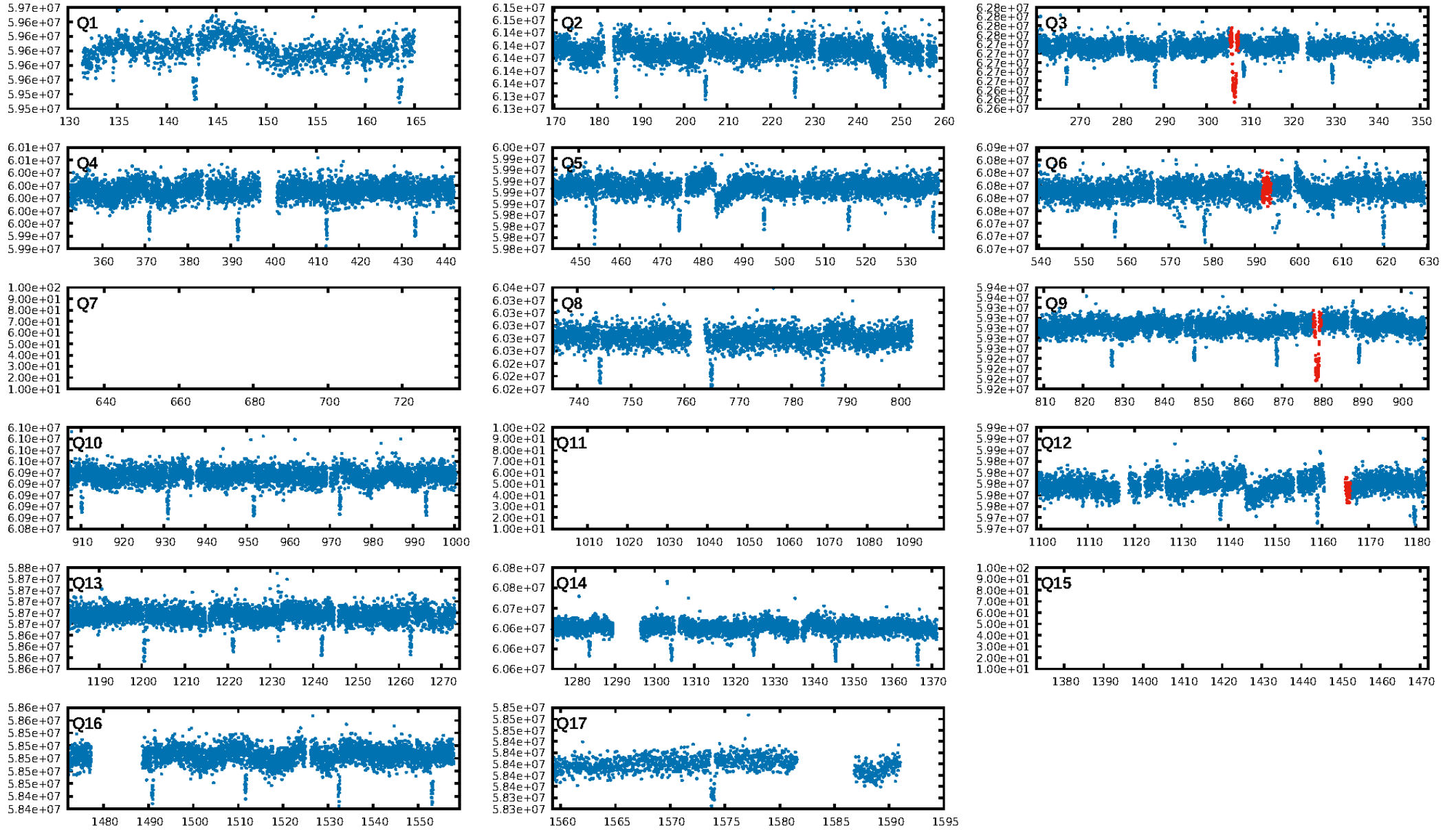
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [241.56] $\sigma$   
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 0.0%  
ModelChiSquareGof-sig: 0.0%  
Bootstrap-pfa: 1.84e-61  
RollingBand-fgt: 1.00 [4/4]  
GhostDiagnostic-chr: 5.69  
Centroid-sig: 91.1%  
Centroid-so: 0.306 arcsec [1.67] $\sigma$   
OotOffset-rm: 0.090 arcsec [0.09] $\sigma$   
KicOffset-rm: 0.061 arcsec [0.10] $\sigma$   
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]

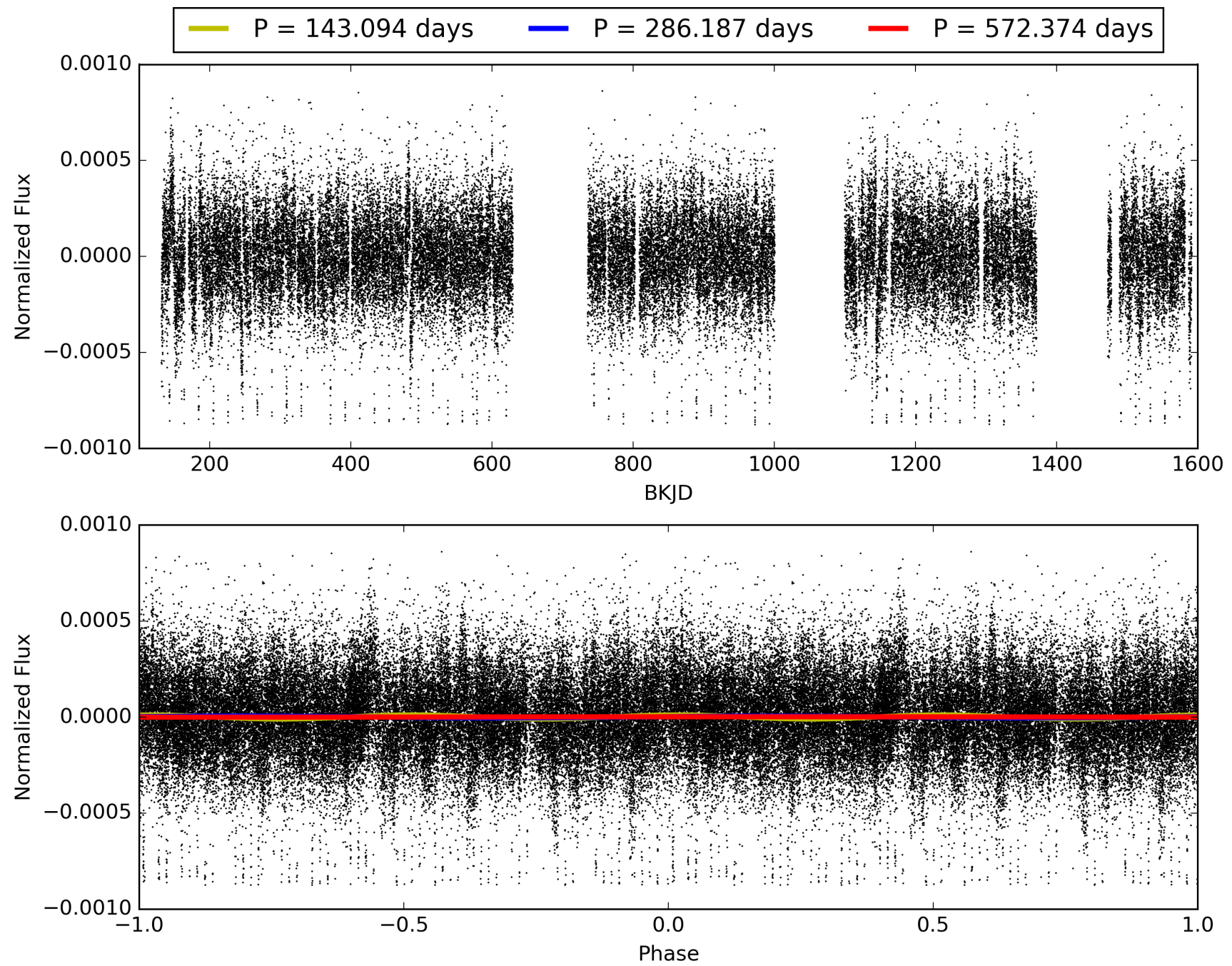
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 14:19:02 Z

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

# TCE 009663113-02, PDC Light Curves

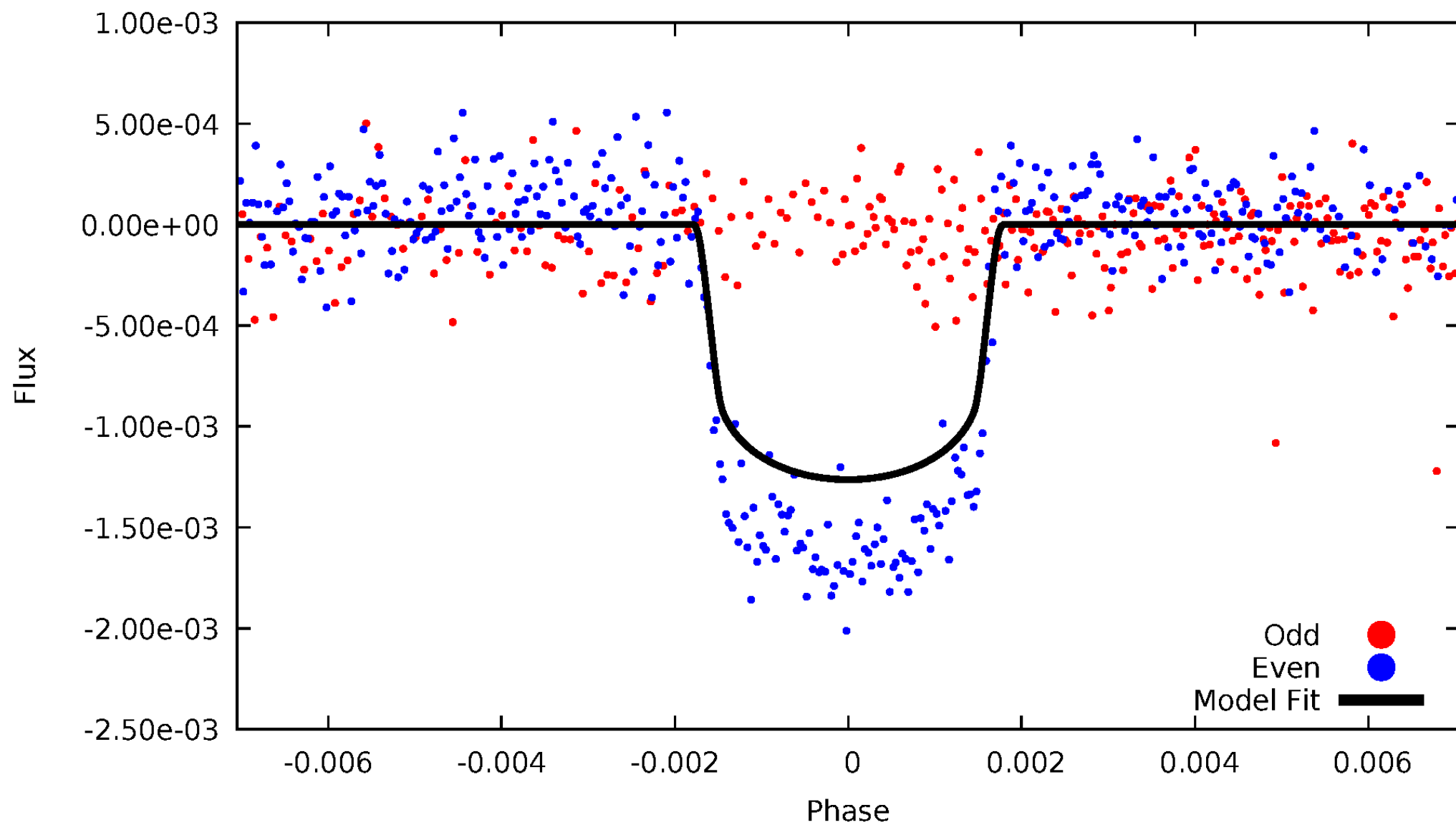


TCE 009663113-02



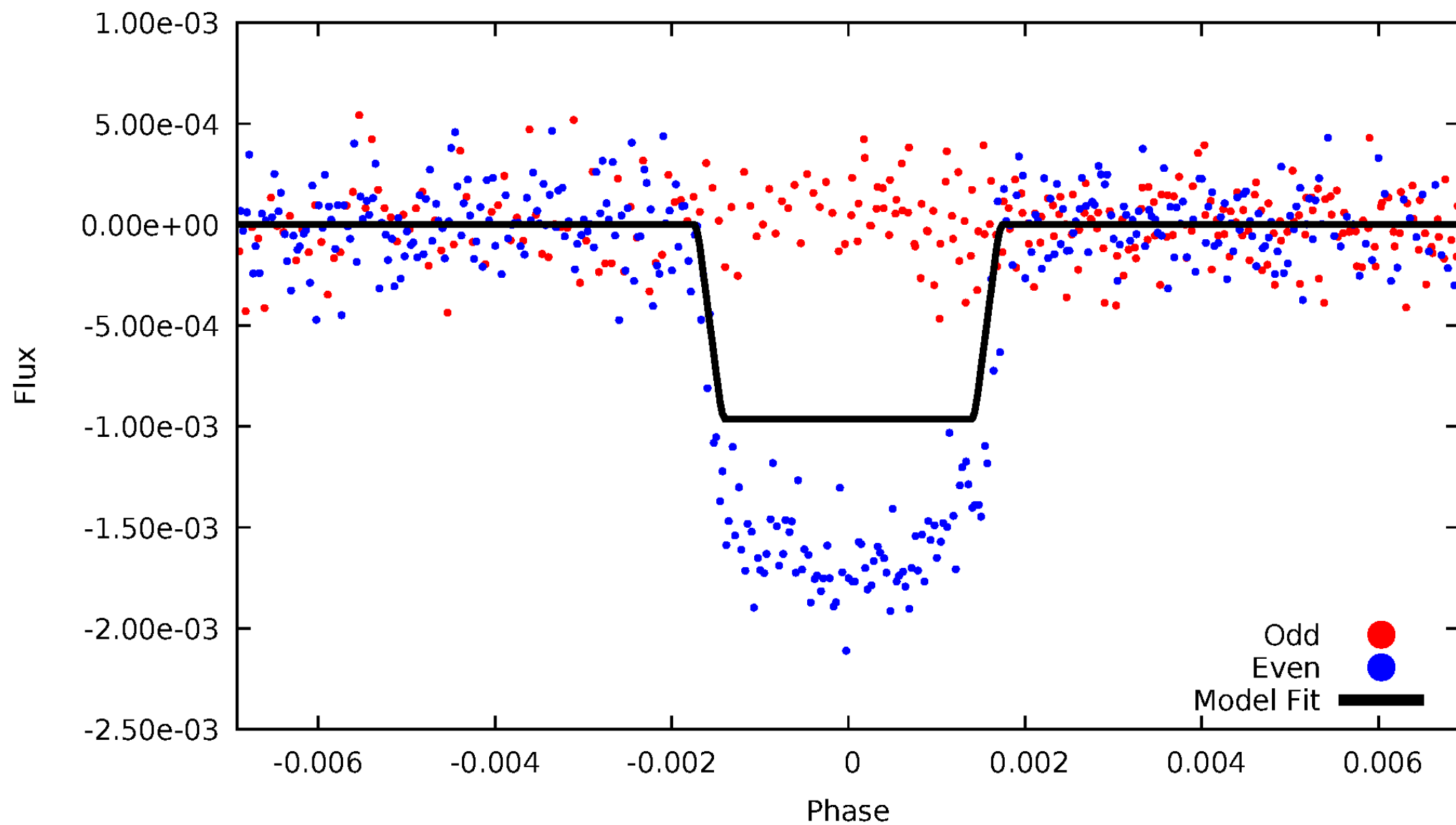
# DV Odd/Even

TCE 009663113-02



# ALT Odd/Even

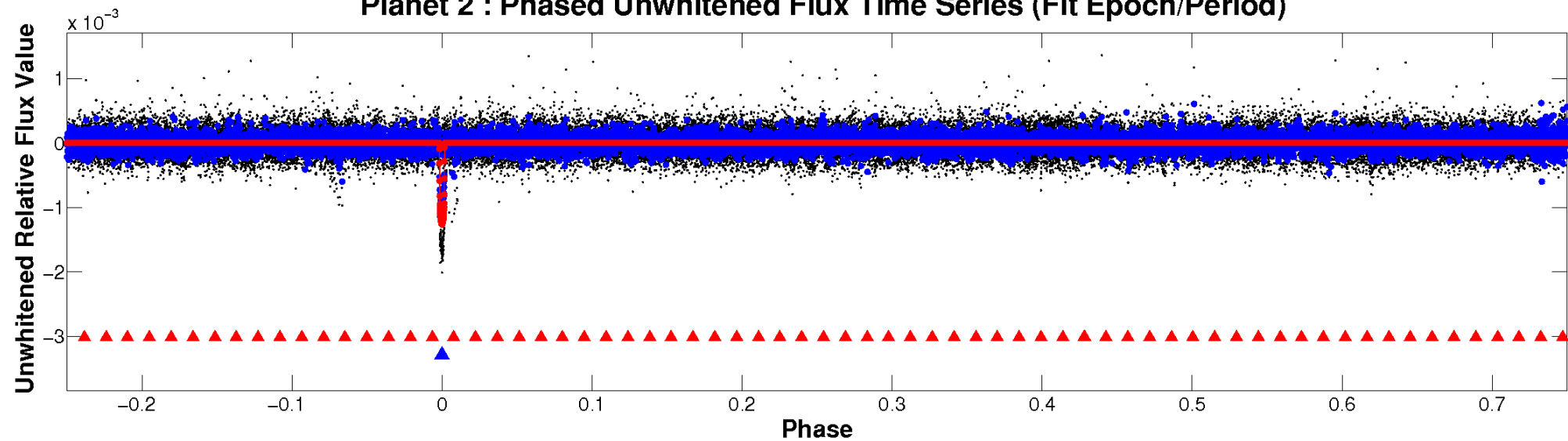
TCE 009663113-02



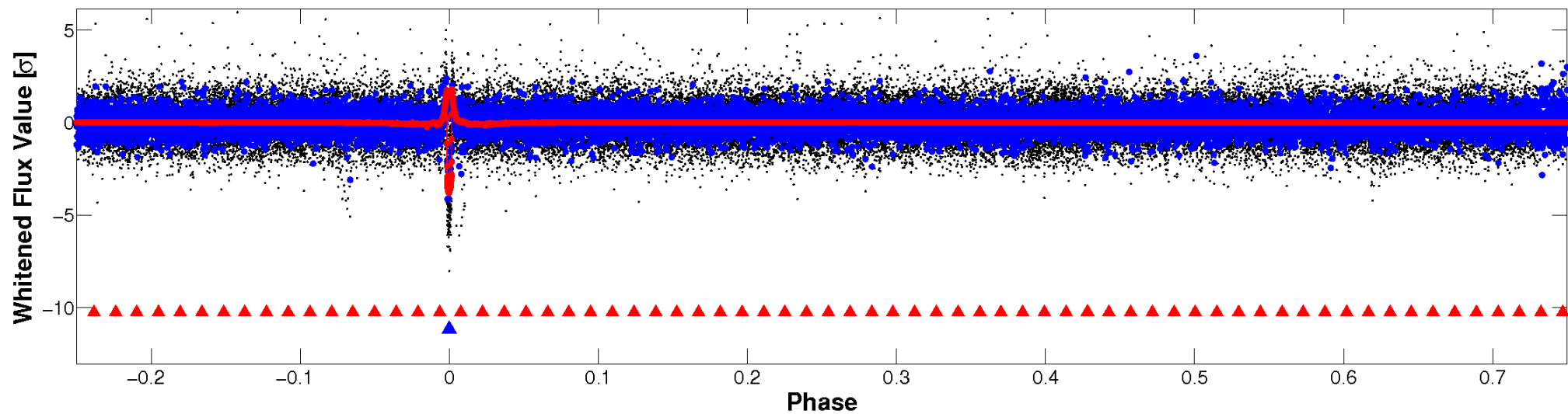


# Non-Whitened Vs. Whitened Light Curve

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

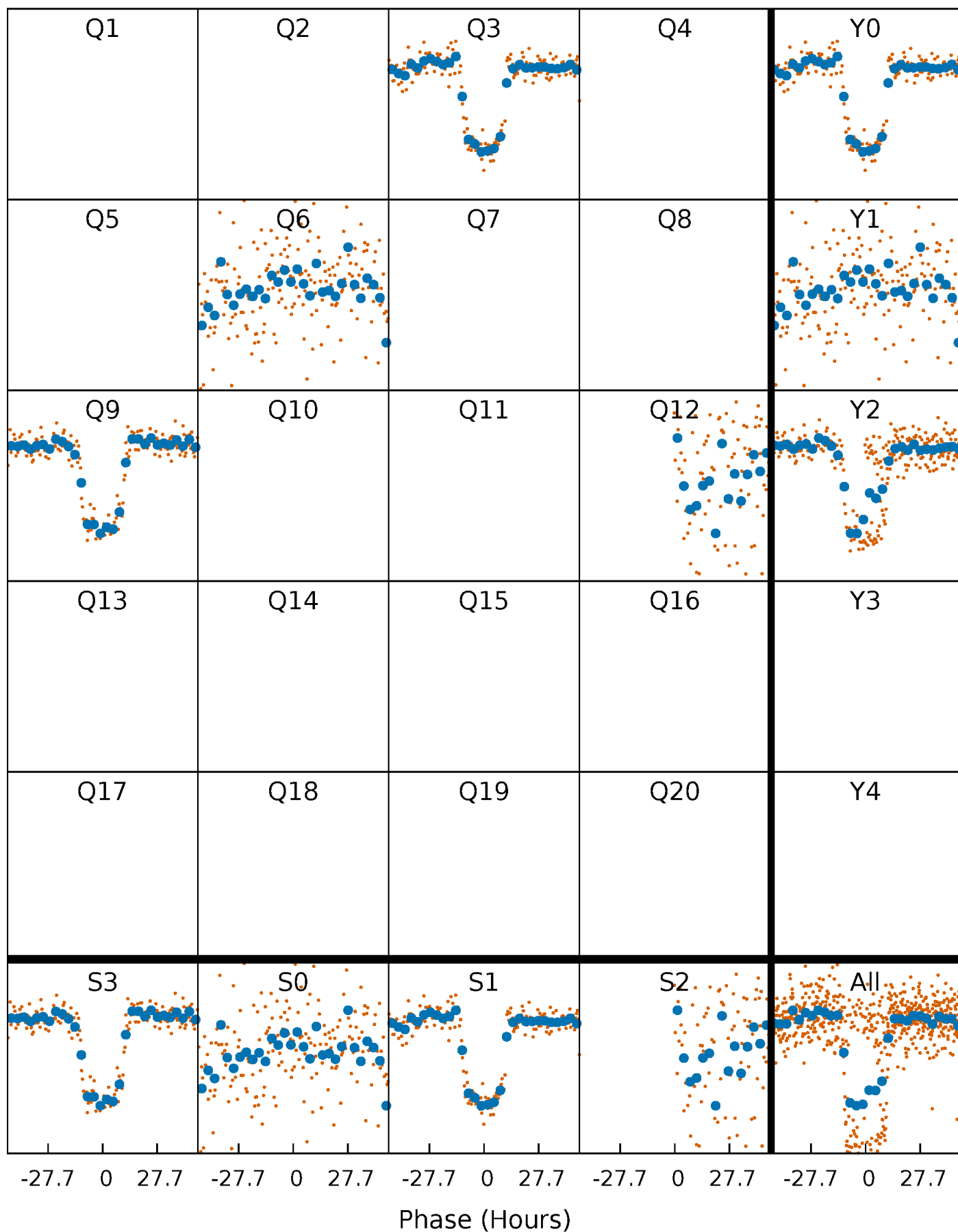


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



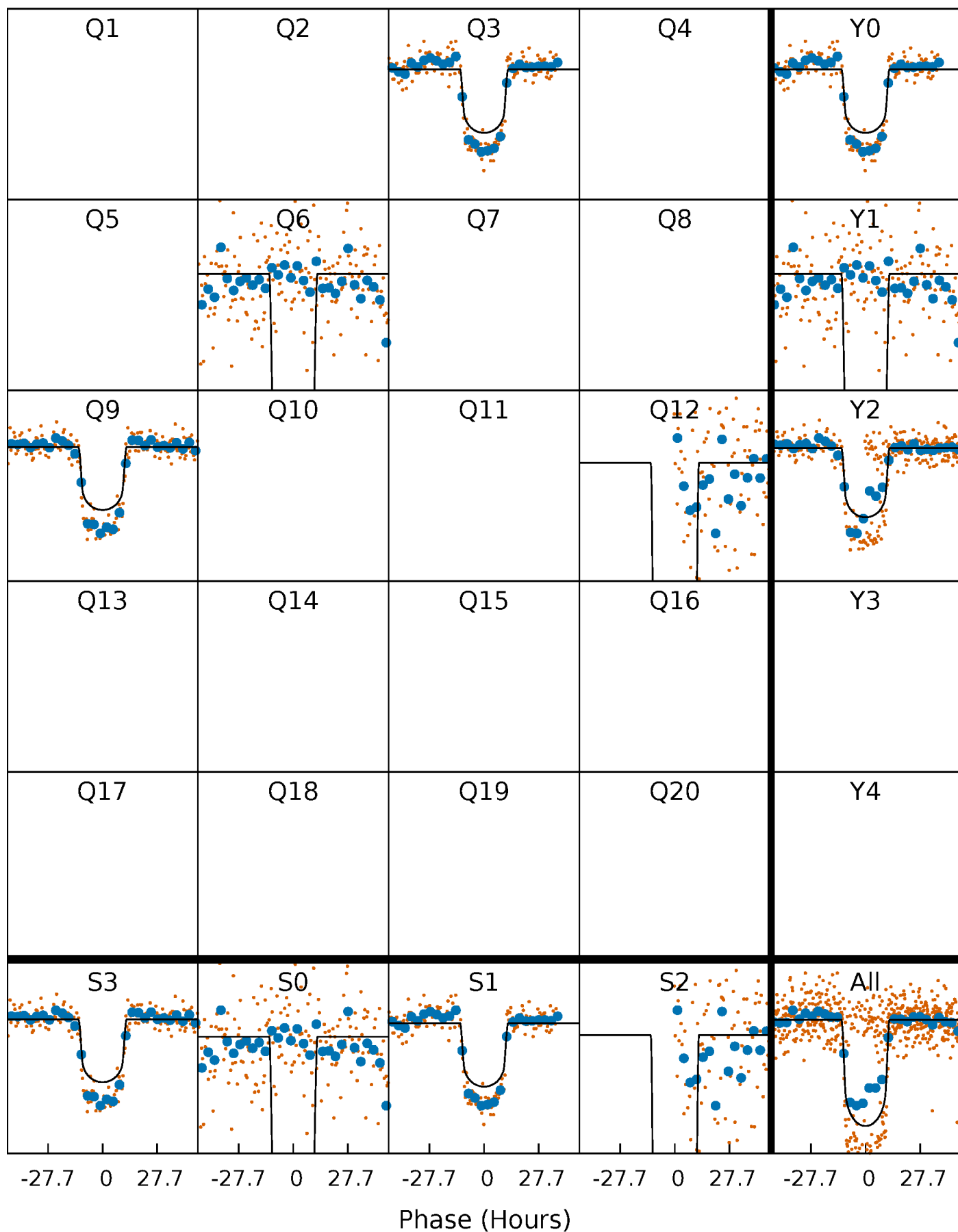
# PDC Quarter-Phased Transit Curves

TCE 009663113-02 P=286.187068 Days  $T_0=306.511845$  (BKJD)



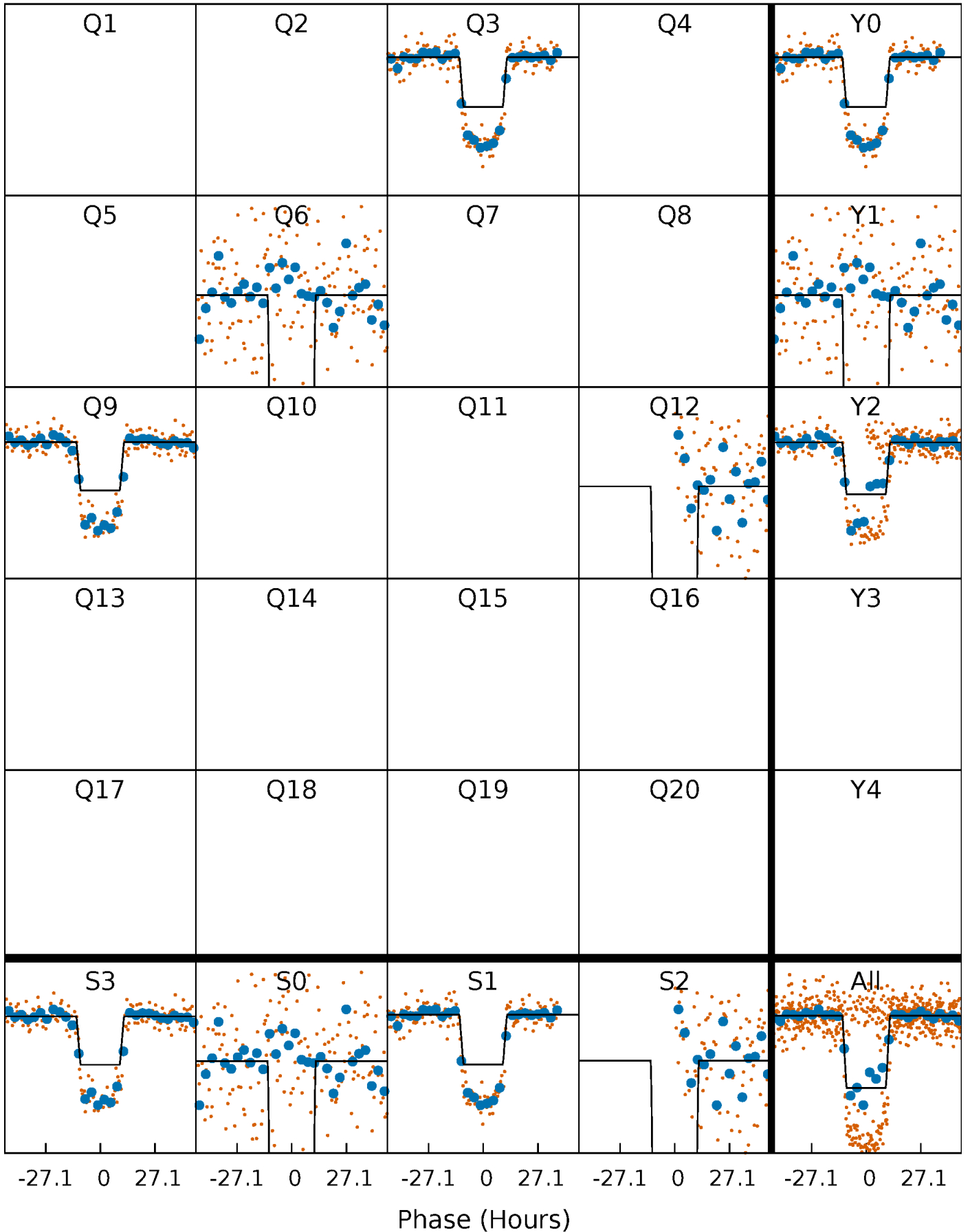
# DV Quarter-Phased Transit Curves

TCE 009663113-02 P=286.187068 Days  $T_0=306.511845$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

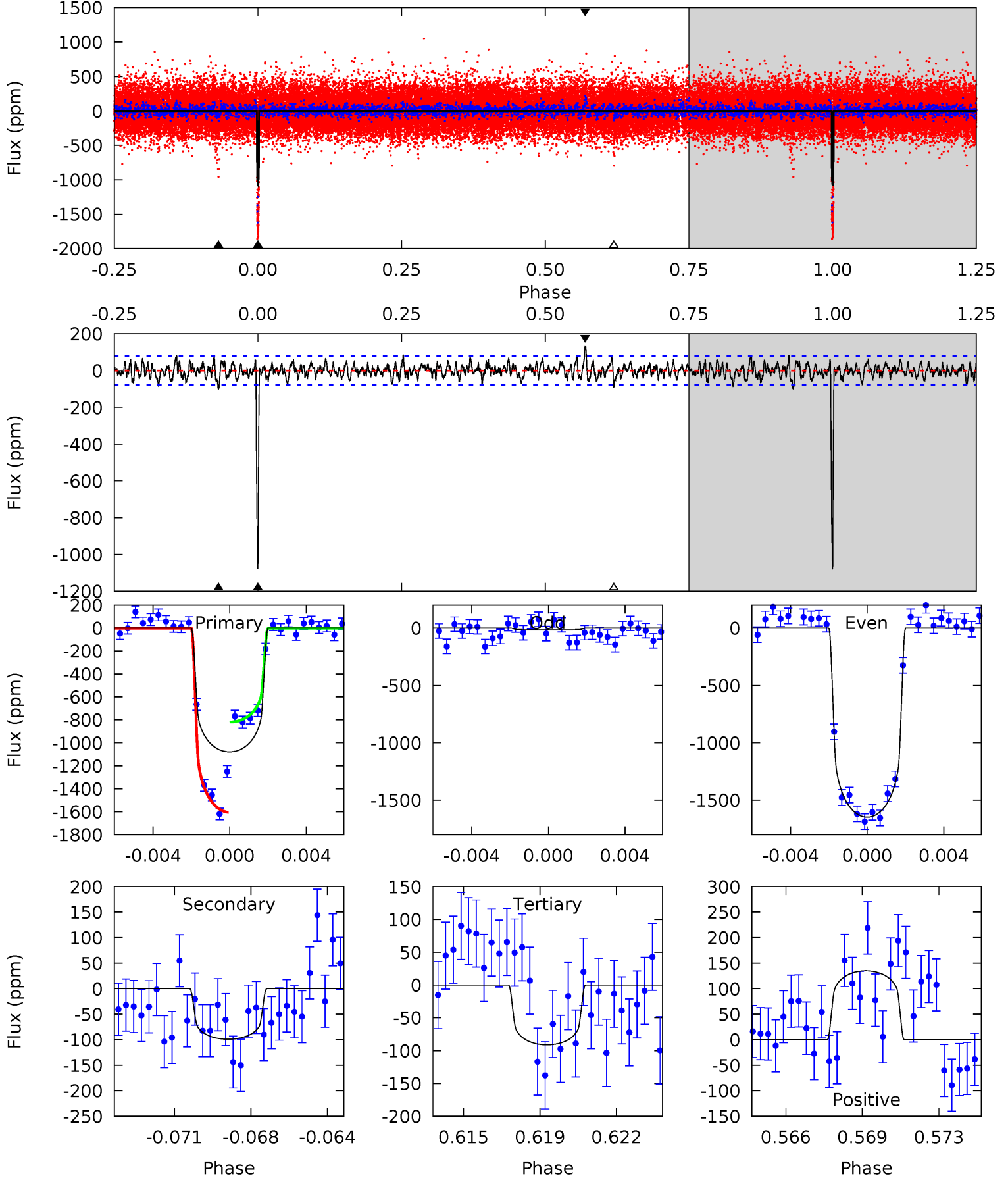
TCE 009663113-02 P=286.178819 Days  $T_0=306.512489$  (BKJD)



# DV Model-Shift Uniqueness Test

009663113-02, P = 286.187068 Days, E = 20.324777 Days

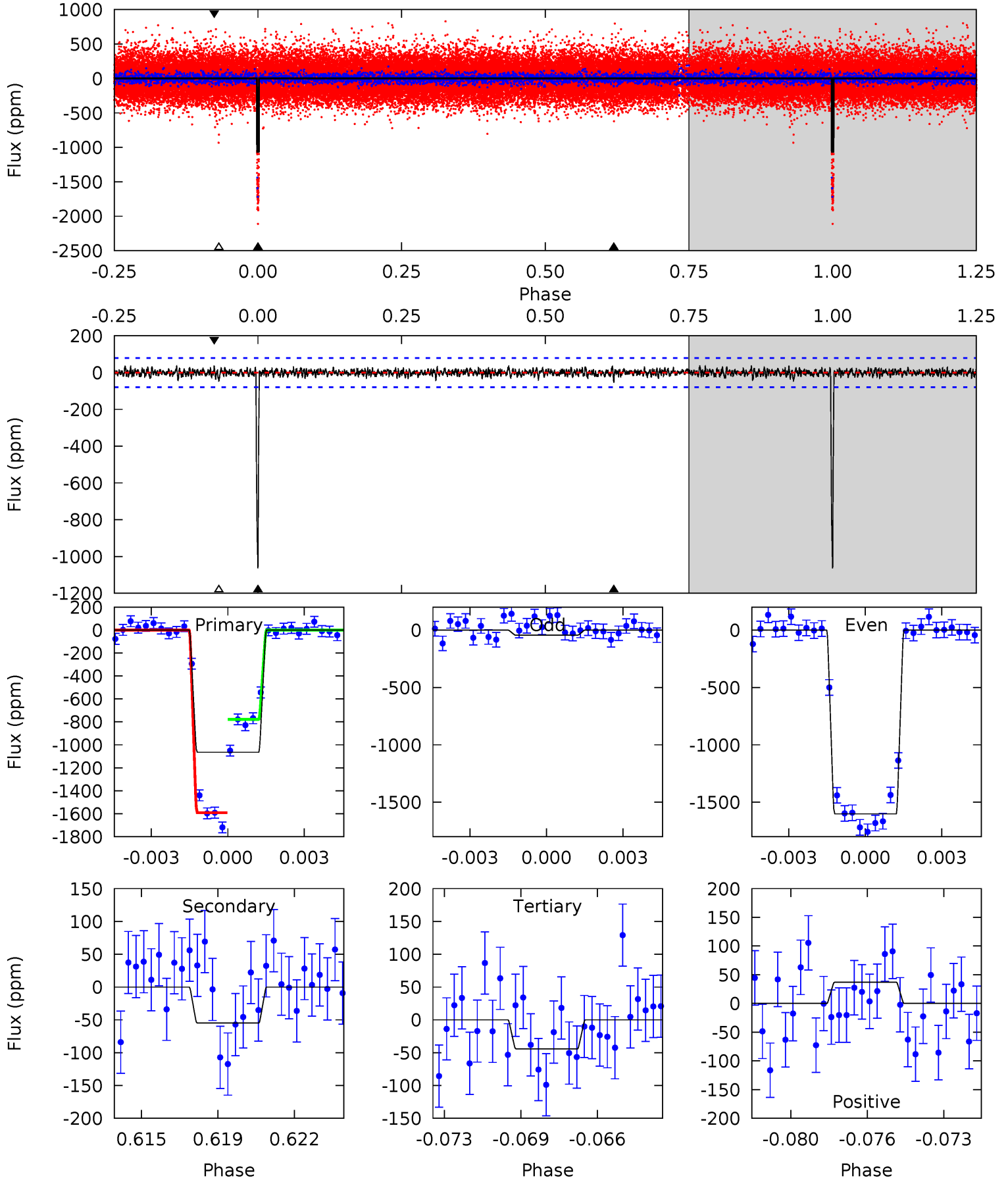
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
70.7	6.49	5.98	8.85	5.22	2.92	1.89	64.8	61.9	0.51	-2.37	56.1	1.01	0.11	0



# Alt Model-Shift Uniqueness Test

009663113-02,  $P = 286.178819$  Days,  $E = 20.333670$  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
70.2	3.62	2.91	2.45	5.23	2.92	0.78	67.3	67.8	0.71	1.17	54.8	1.00	0.03	25.4



### Stellar Parameters For KIC 009663113

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6226^{+112}_{-124}$	$4.264^{+0.115}_{-0.115}$	$0.000^{+0.150}_{-0.150}$	$1.299^{+0.231}_{-0.173}$	$1.129^{+0.106}_{-0.077}$	$0.726^{+0.371}_{-0.245}$
	+2%/-2%	+3%/-3%	+inf%/-inf%	+18%/-13%	+9%/-7%	+51%/-34%
Source	SPE57	SPE57	SPE57	DSEP		

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

### Secondary Eclipse Parameters for KIC 009663113-02 / KOI 0179.02

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-99 \pm 15$	$5.06^{+0.53}_{-0.42}$	$465^{+22}_{-22}$	$3692^{+111}_{-104}$	$1656^{+401}_{-368}$
Alt.	$-55 \pm 15$	$4.42^{+0.46}_{-0.37}$	$465^{+22}_{-20}$	$3509^{+156}_{-174}$	$1184^{+431}_{-357}$

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



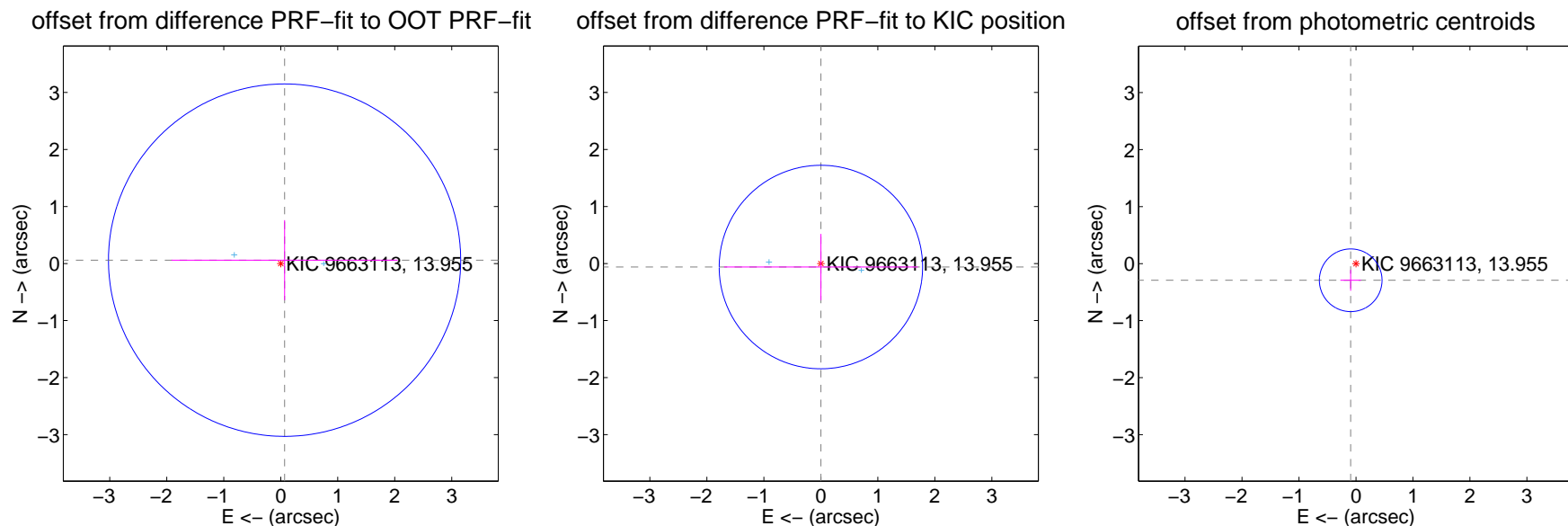
## DV Centroid Data

Supplemental centroid analysis for 009663113-02. Kepler magnitude: 13.96. Transit SNR 39.90

There are 2 quarters with good PRF difference image offsets

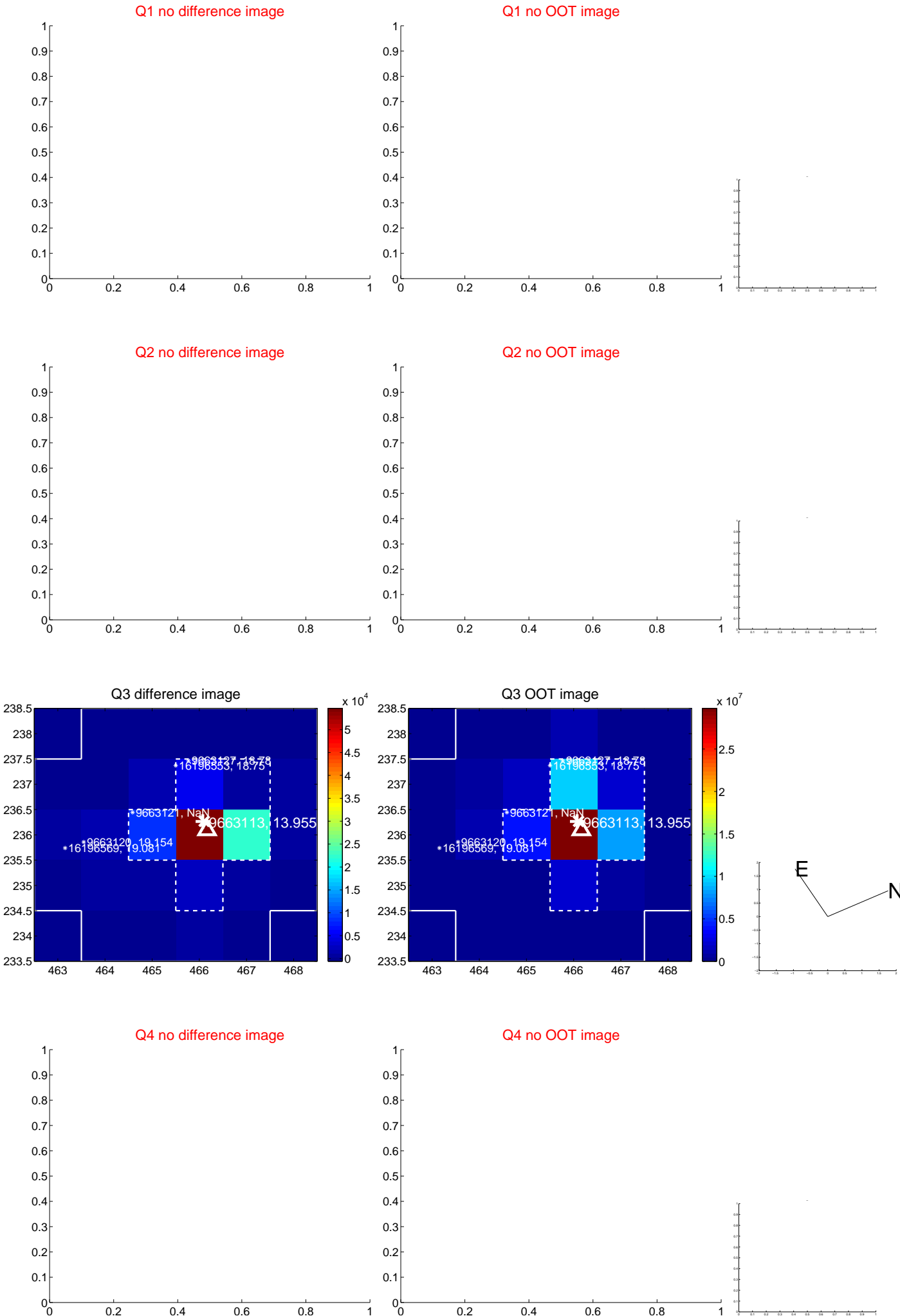
The direct PRF centroid is offset from the target star catalog position by about 0.16 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.090 \pm 1.030$	0.09	$-0.067 \pm 1.984$	$0.059 \pm 0.702$
PRF-fit source offset from KIC position	$0.061 \pm 0.595$	0.10	$-0.001 \pm 1.699$	$-0.061 \pm 0.580$
photometric centroid source offset	$0.31 \pm 0.18$	1.67	$0.09 \pm 0.18$	$-0.29 \pm 0.18$



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.

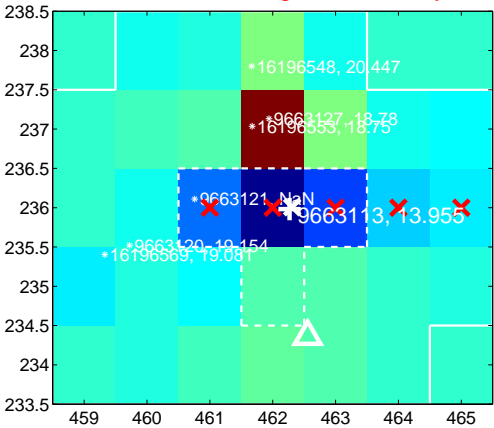
Q5 no difference image



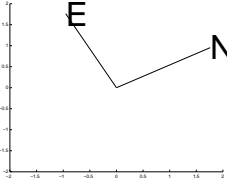
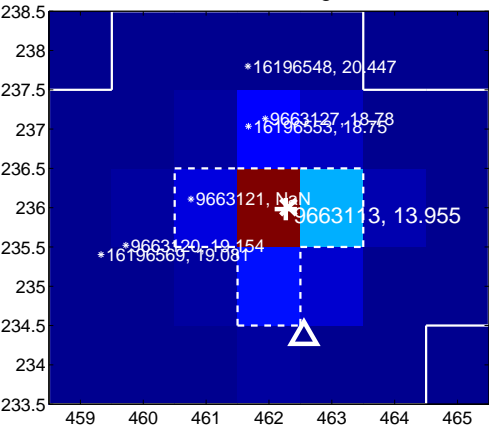
Q5 no OOT image



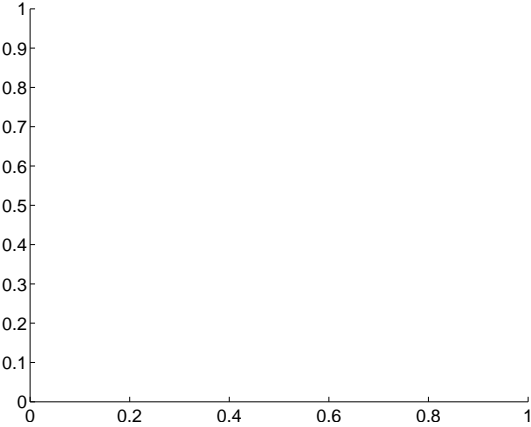
Q6 difference image. Poor Quality



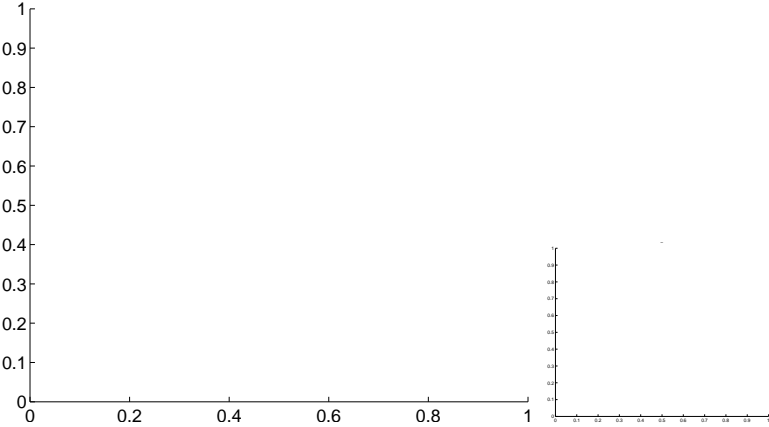
Q6 OOT image



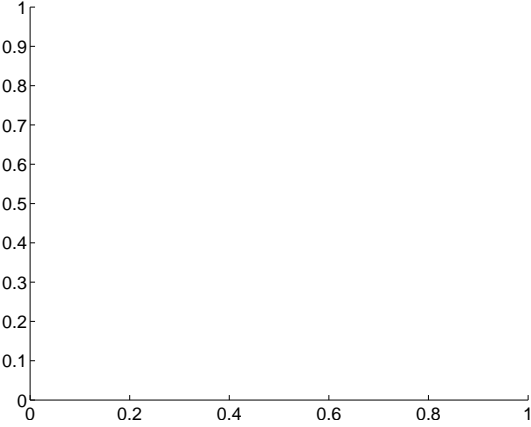
Q7 no difference image



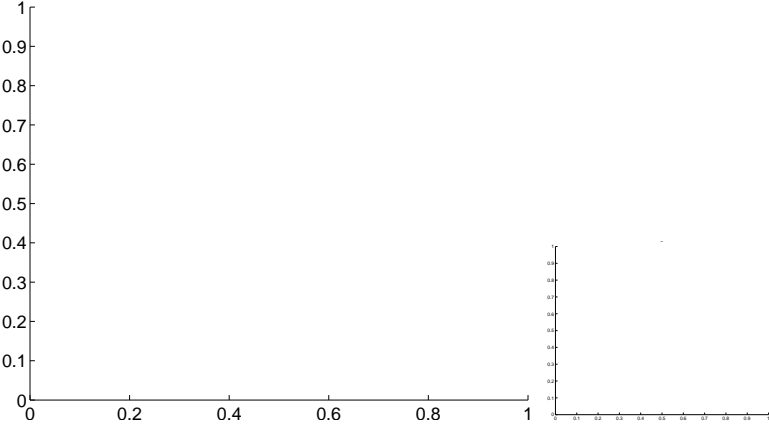
Q7 no OOT image



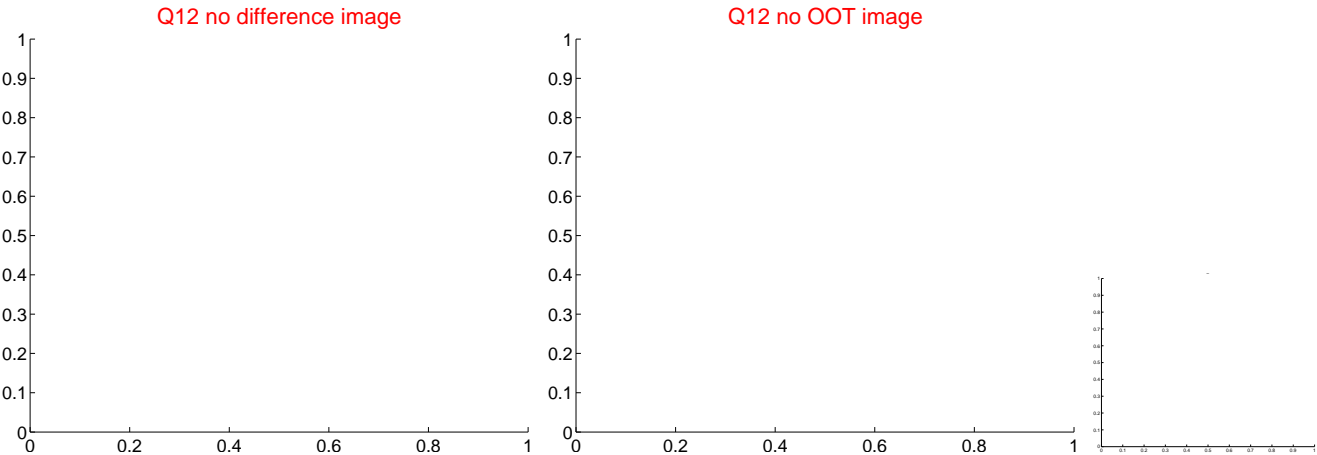
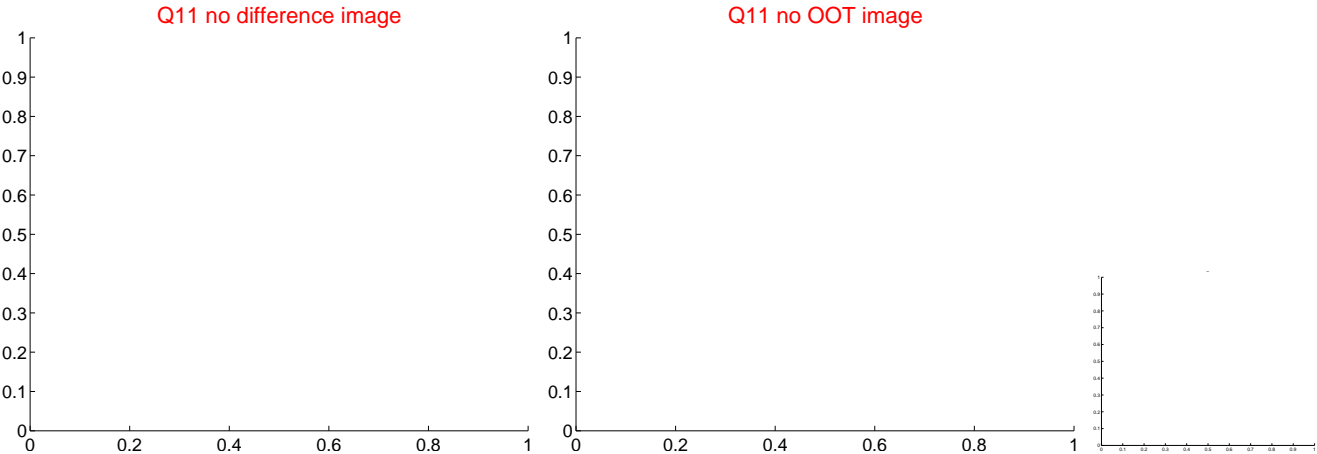
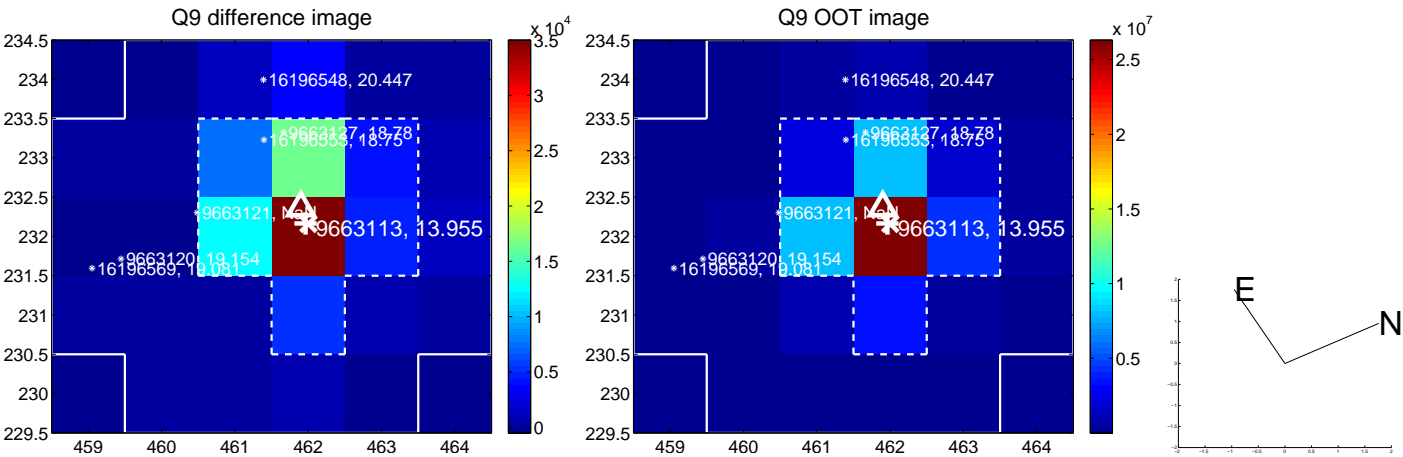
Q8 no difference image



Q8 no OOT image



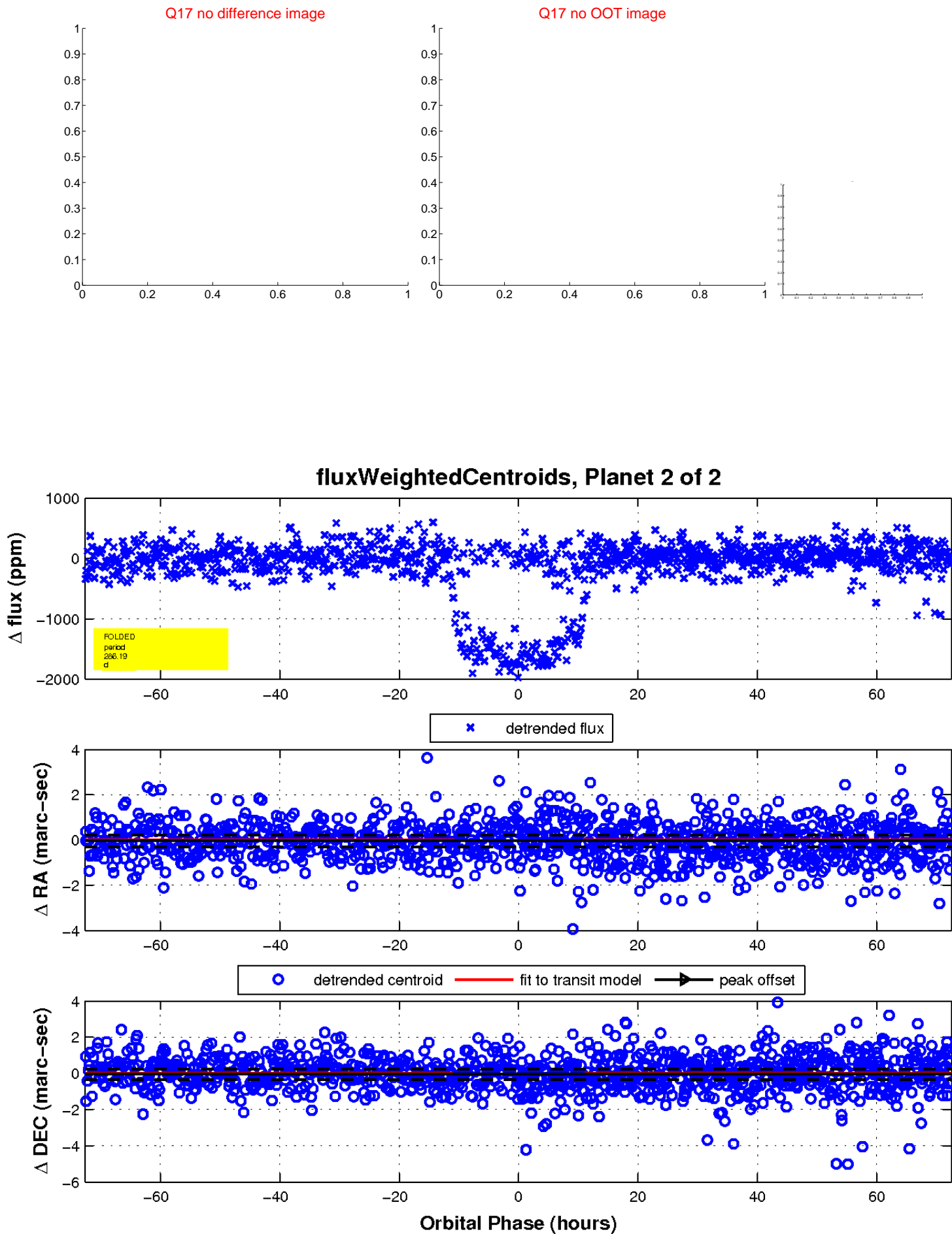
white ×: KIC target position; +: OOT centroid; △: difference centroid. red ✕: large negative pixel value.



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



UKIRT Image

Declination

