

# KIC 004037163

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
004037163-01	OBS	No	0.635446	131.639483	123867.3	1.692	1111.2	724.0	1.00	5780	53.85	4777.14
004037163-02	OBS	3793.01	0.635445	131.960994	161357.5	1.500	1293.6	-1.0	1.00	5780	40.48	4777.15

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
004037163-01	OBS	FP	0.00	1	0	0	0	LPP_DV—CENT_KIC_POS
004037163-02	OBS	FP	0.00	1	0	0	0	SAME_NTL_PERIOD—CENT_NOFITS

**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 004037163-01

No Significant Match Found

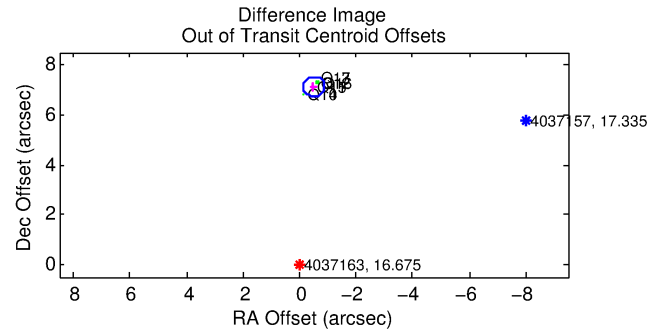
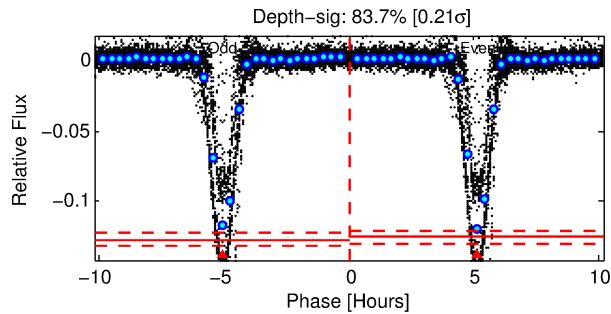
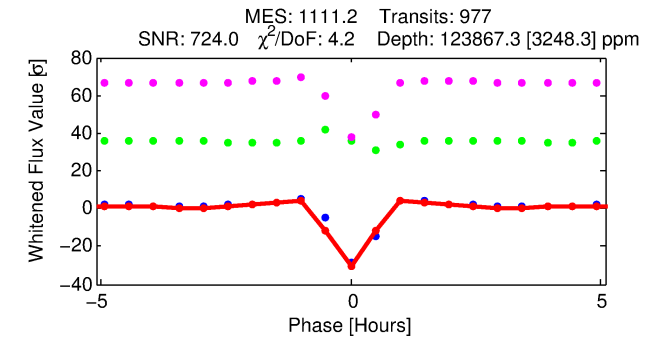
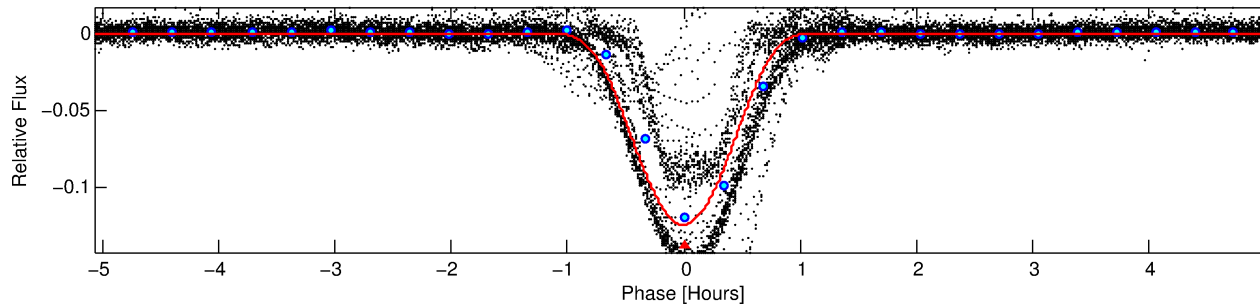
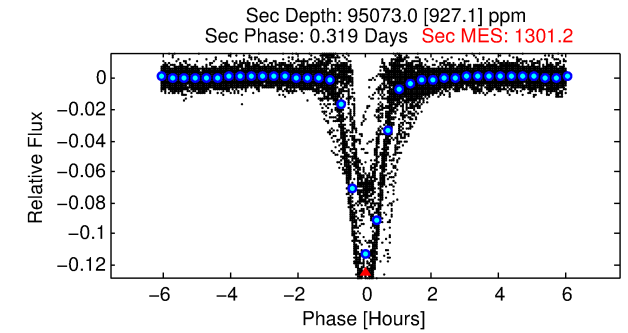
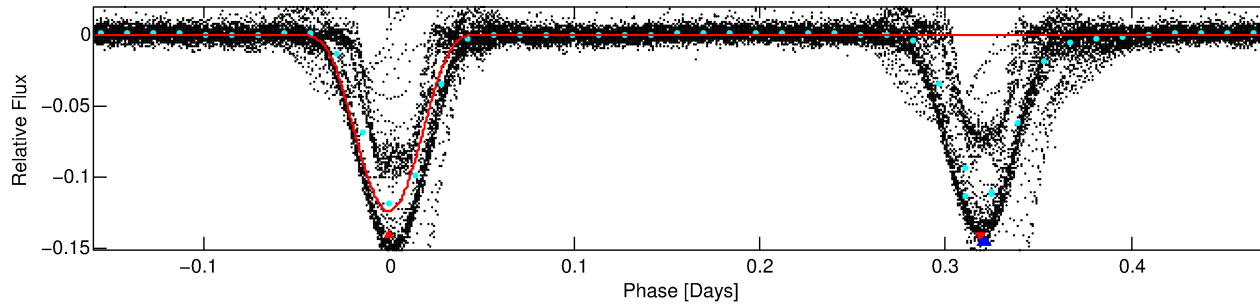
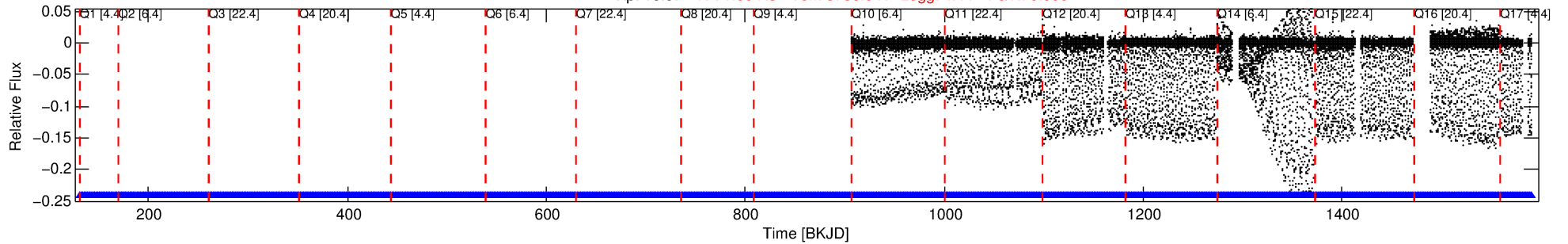


# DV One-Page Summary

KIC: 4037163 Candidate: 1 of 2 Period: 0.635 d

KOI: K03793 Corr: No Ephemeris Match

Kp: 16.67 R\*: 1.00 Rs Teff: 5780.0 K Logg: 4.44 Fe/H: 0.000



## DV Fit Results:

Period = 0.63545 [0.00000] d  
Epoch = 131.6395 [0.0000] BKJD  
Rp/R\* = 0.4935 [0.9212]  
a/R\* = 3.59 [0.81]  
b = 0.91 [1.30]  
Seff = 4777.14 [0.00]  
Teff = 2120 [0] K  
Rp = 53.85 [100.52] Re  
a = 0.0145 [0.0000] AU  
Ag = 3.78 [14.10] [0.20σ]  
Teffp = 4569 [4264] K [0.57σ]

## DV Diagnostic Results:

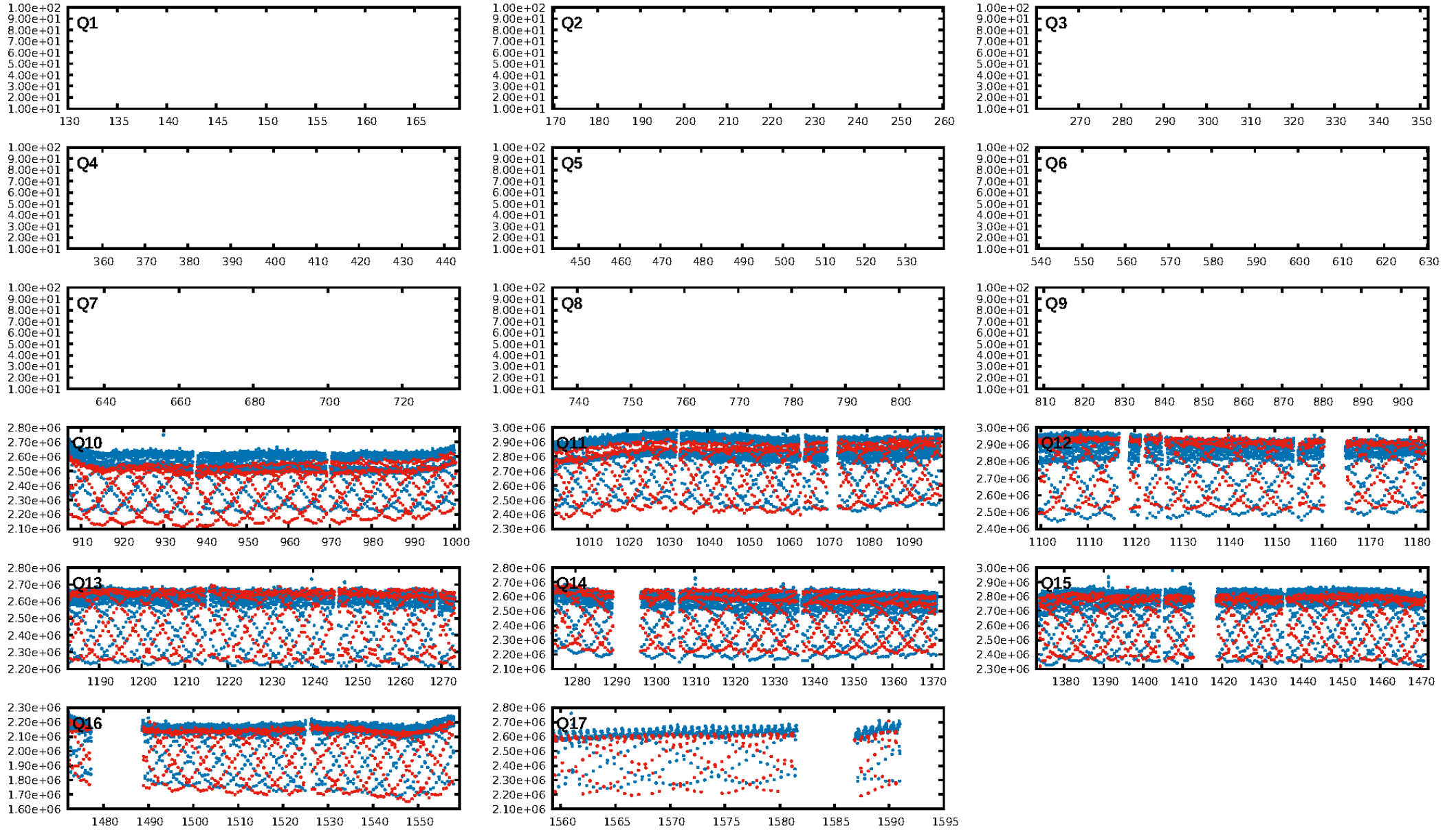
ShortPeriod-sig: 0.0% [0.00σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [935/935]  
GhostDiagnostic-chr: 1.136  
Centroid-sig: 0.0%  
Centroid-so: 3.402 arcsec [1037.85σ]  
OotOffset-rm: 7.143 arcsec [55.49σ]  
KicOffset-rm: 0.288 arcsec [3.20σ]  
OotOffset-st: 2/2/2/2 [8]  
KicOffset-st: 2/2/2/2 [8]  
DiffImageQuality-fgm: 1.00 [8/8]  
DiffImageOverlap-fno: 1.00 [8/8]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 02-Feb-2016 08:30:19 Z

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

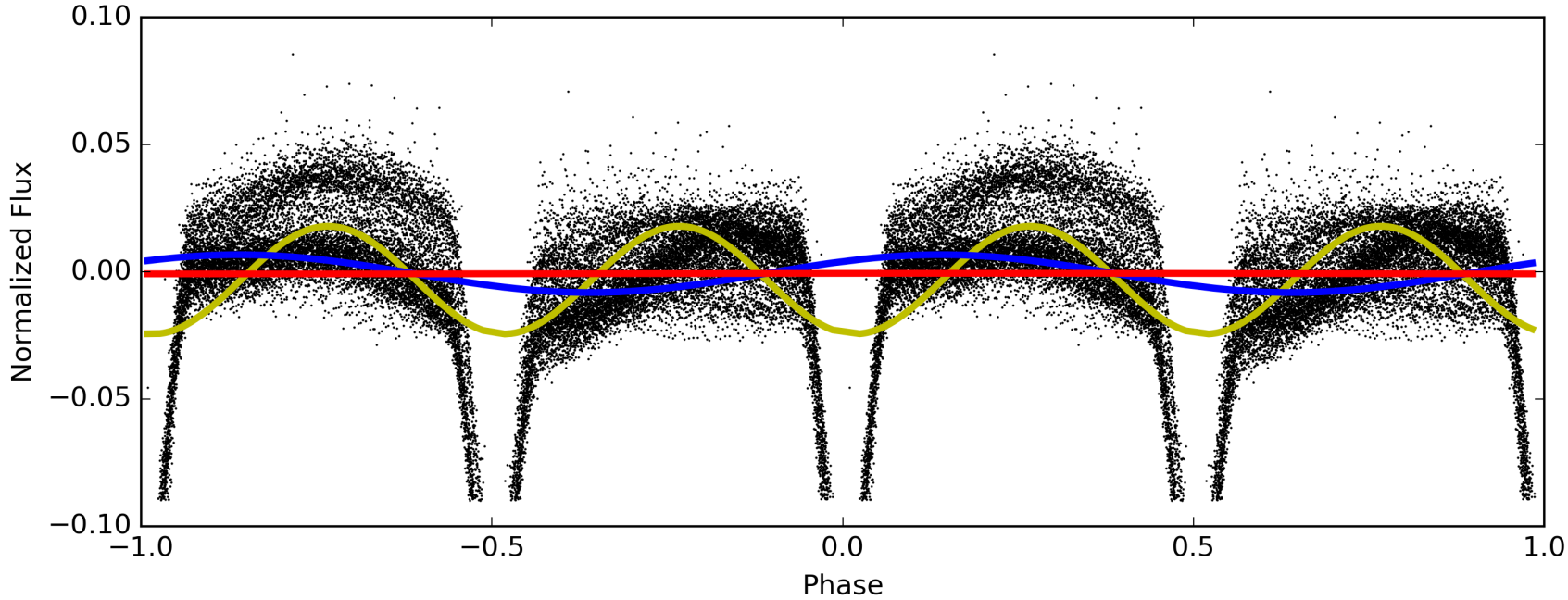
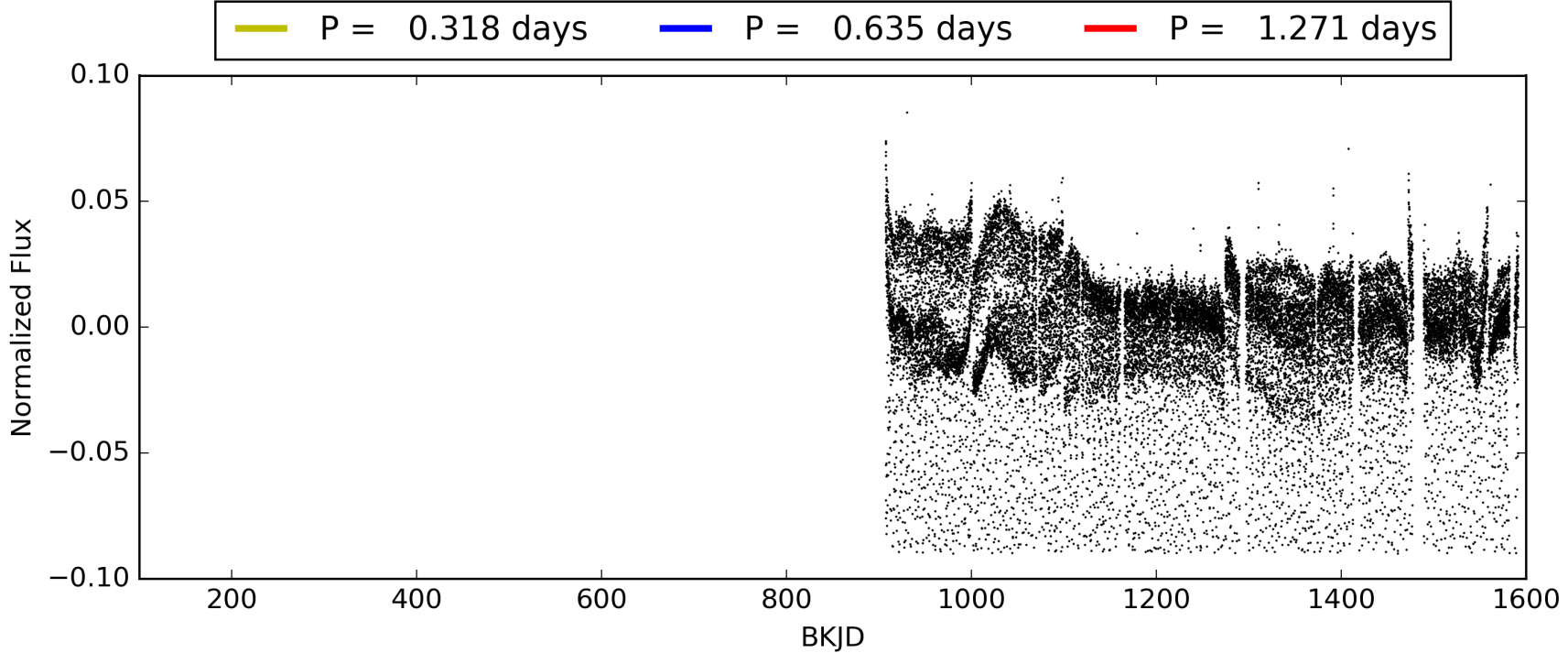


# TCE 004037163-01, PDC Light Curves





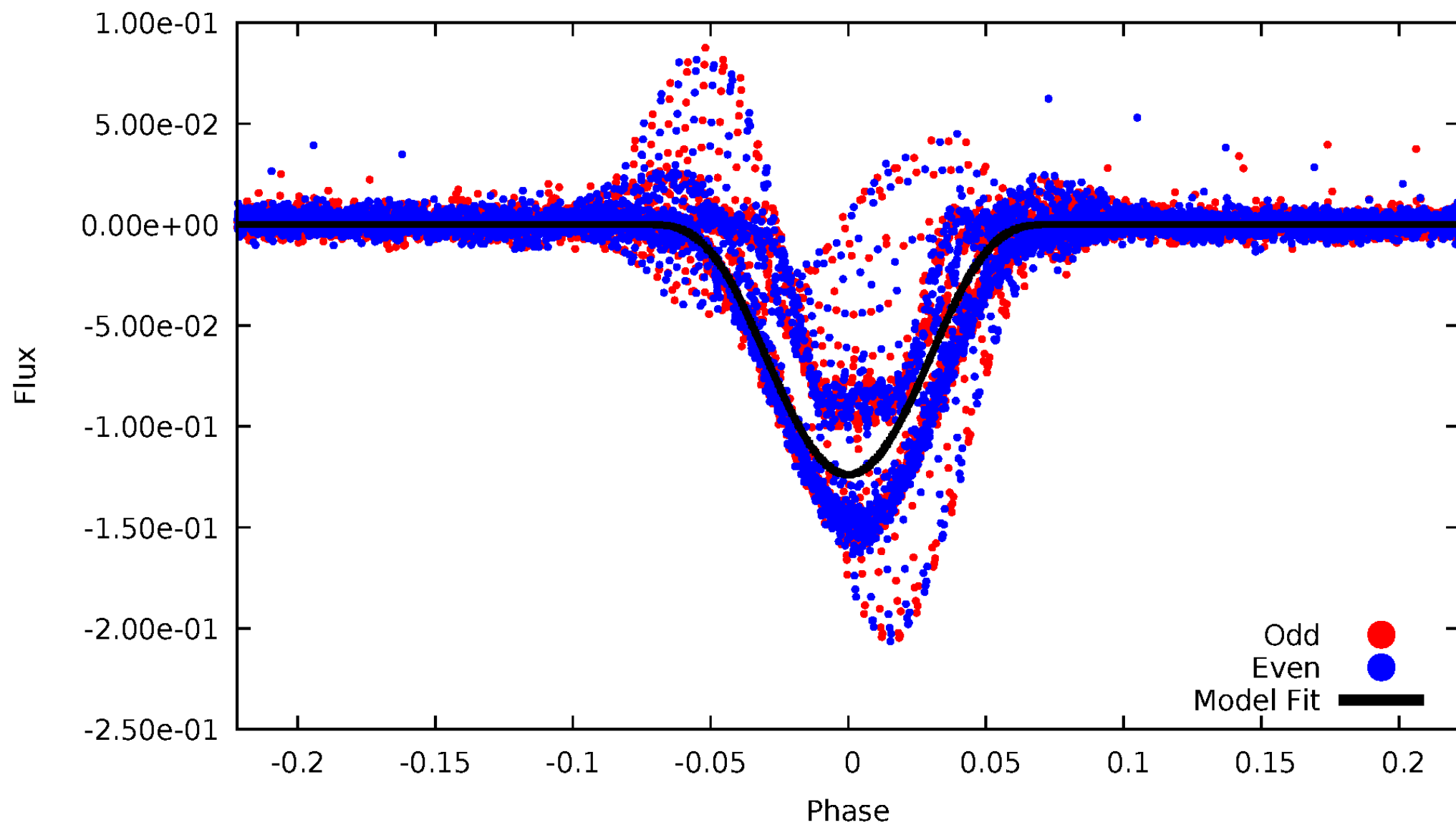
TCE 004037163-01





# DV Odd/Even

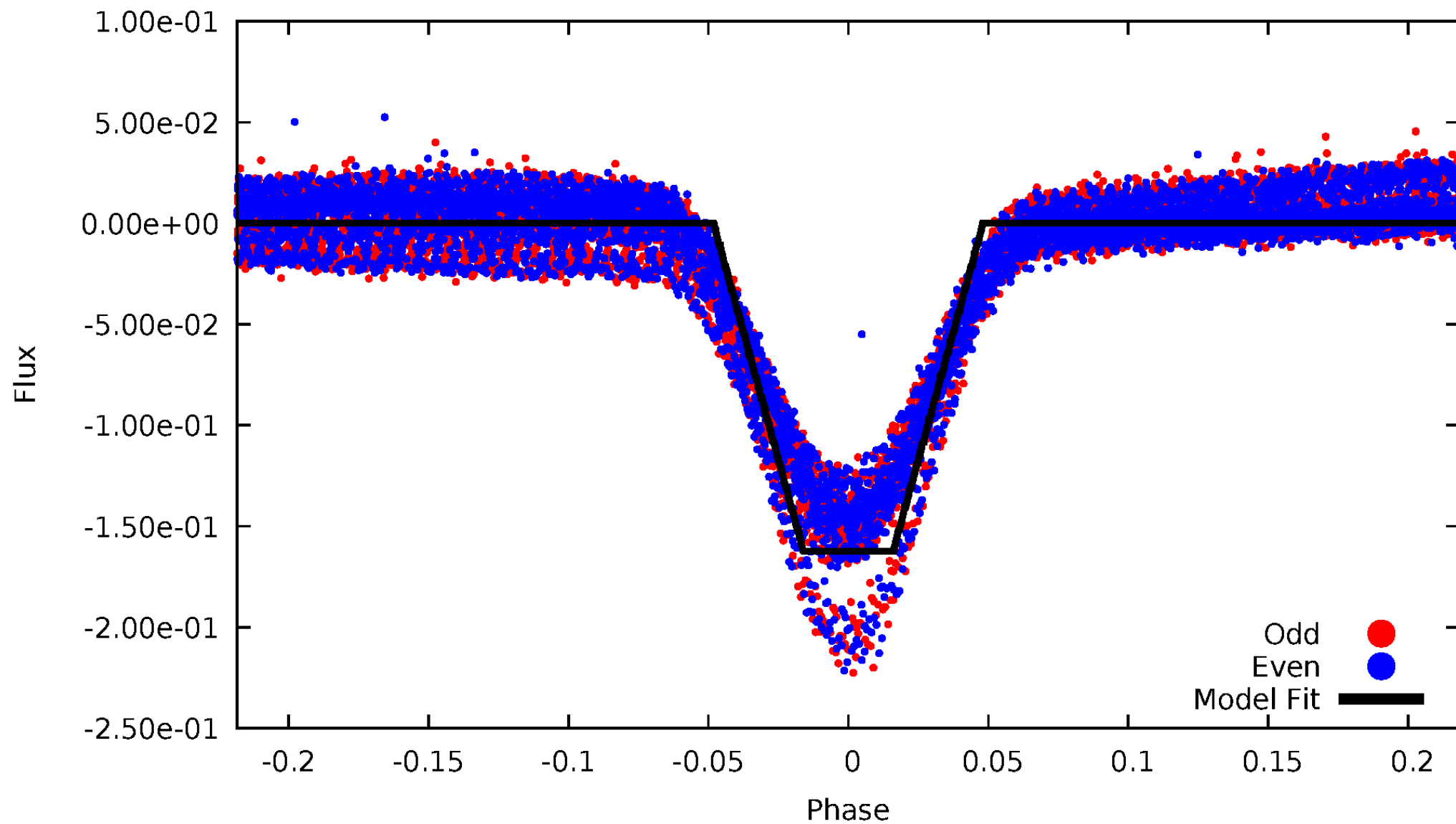
TCE 004037163-01





# ALT Odd/Even

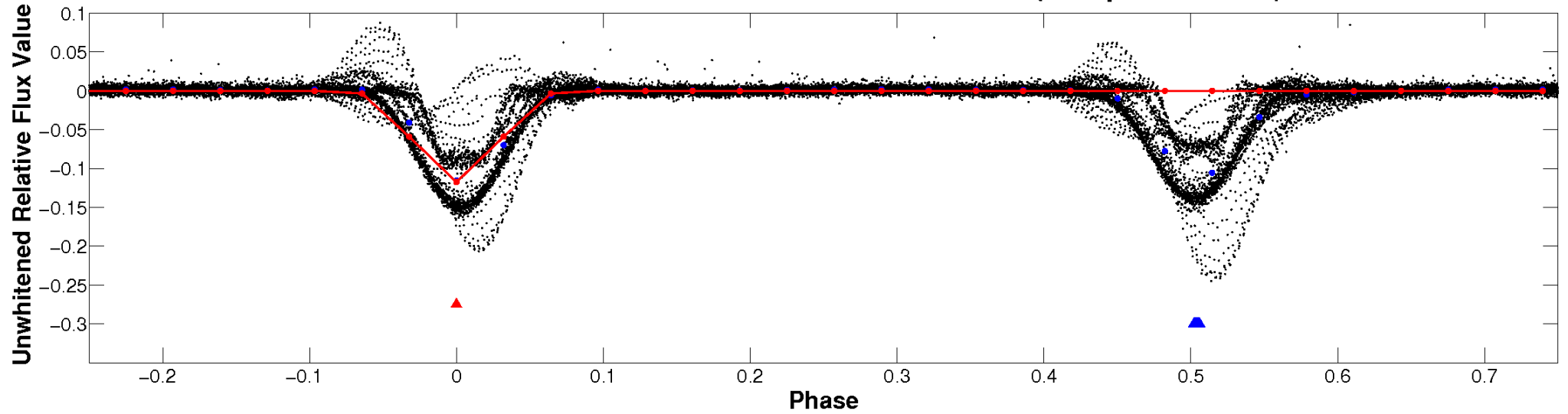
TCE 004037163-01



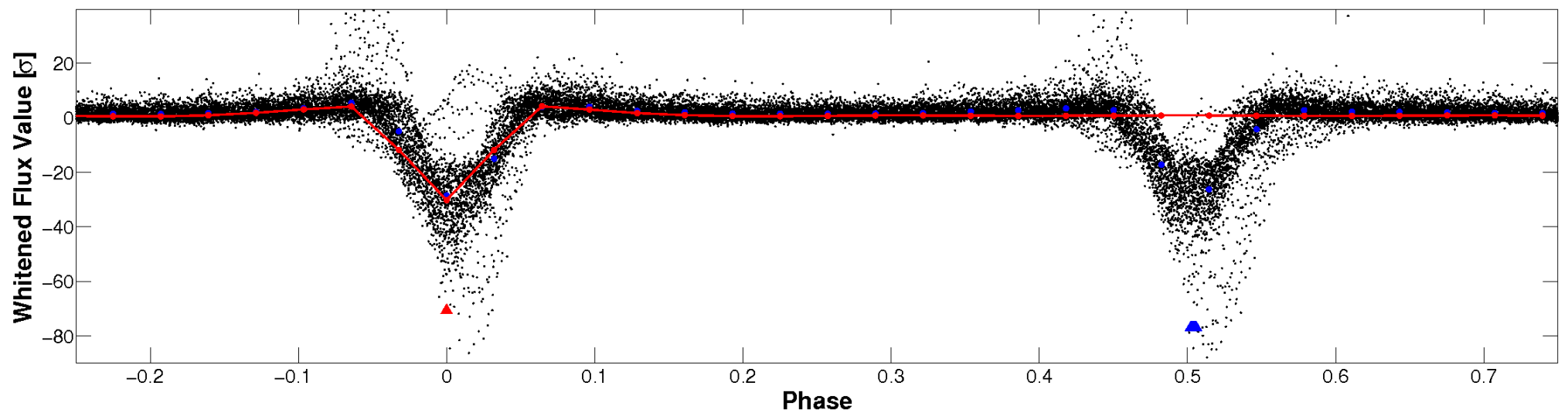


# Non-Whitened Vs. Whitened Light Curve

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



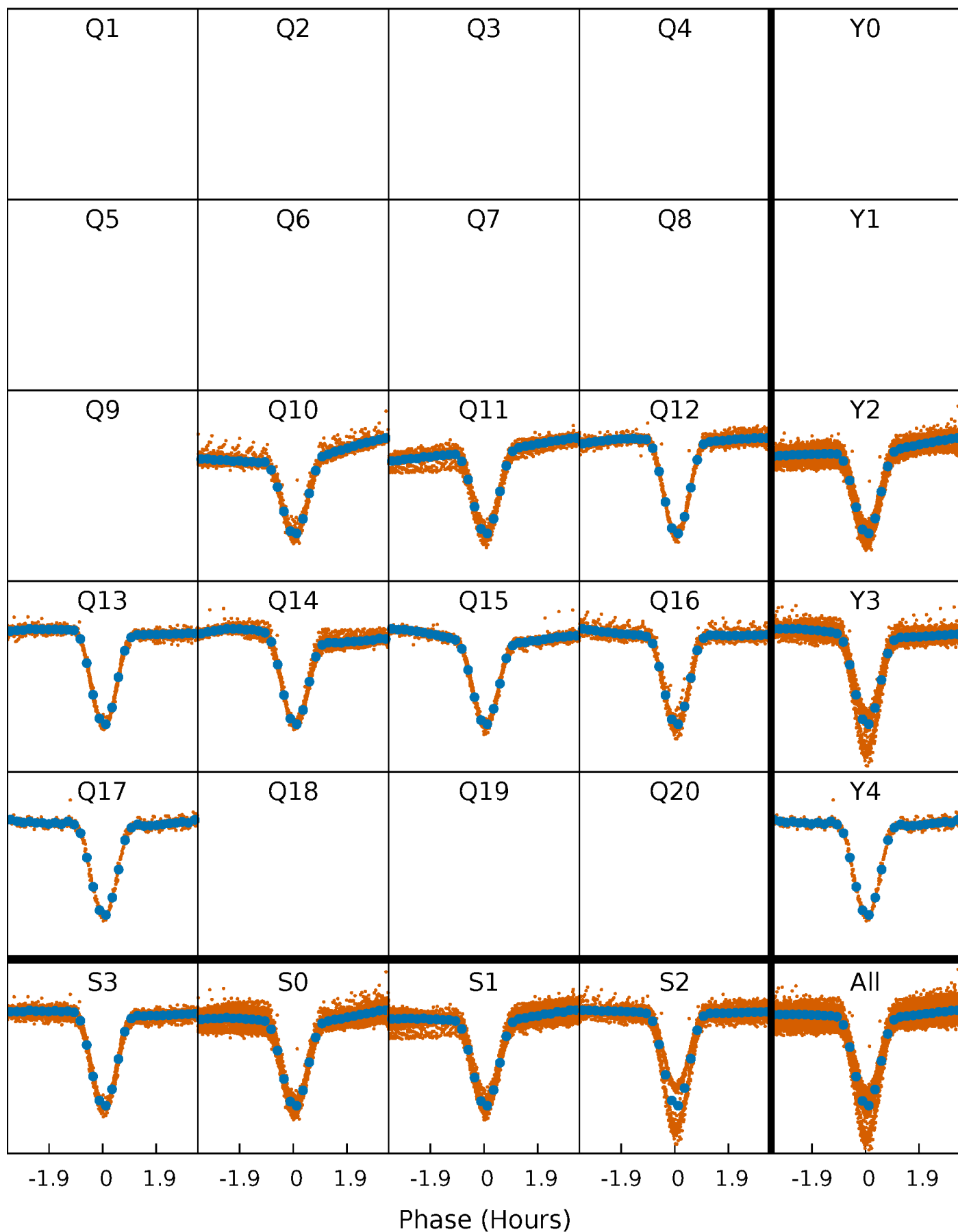
**Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)**





# PDC Quarter-Phased Transit Curves

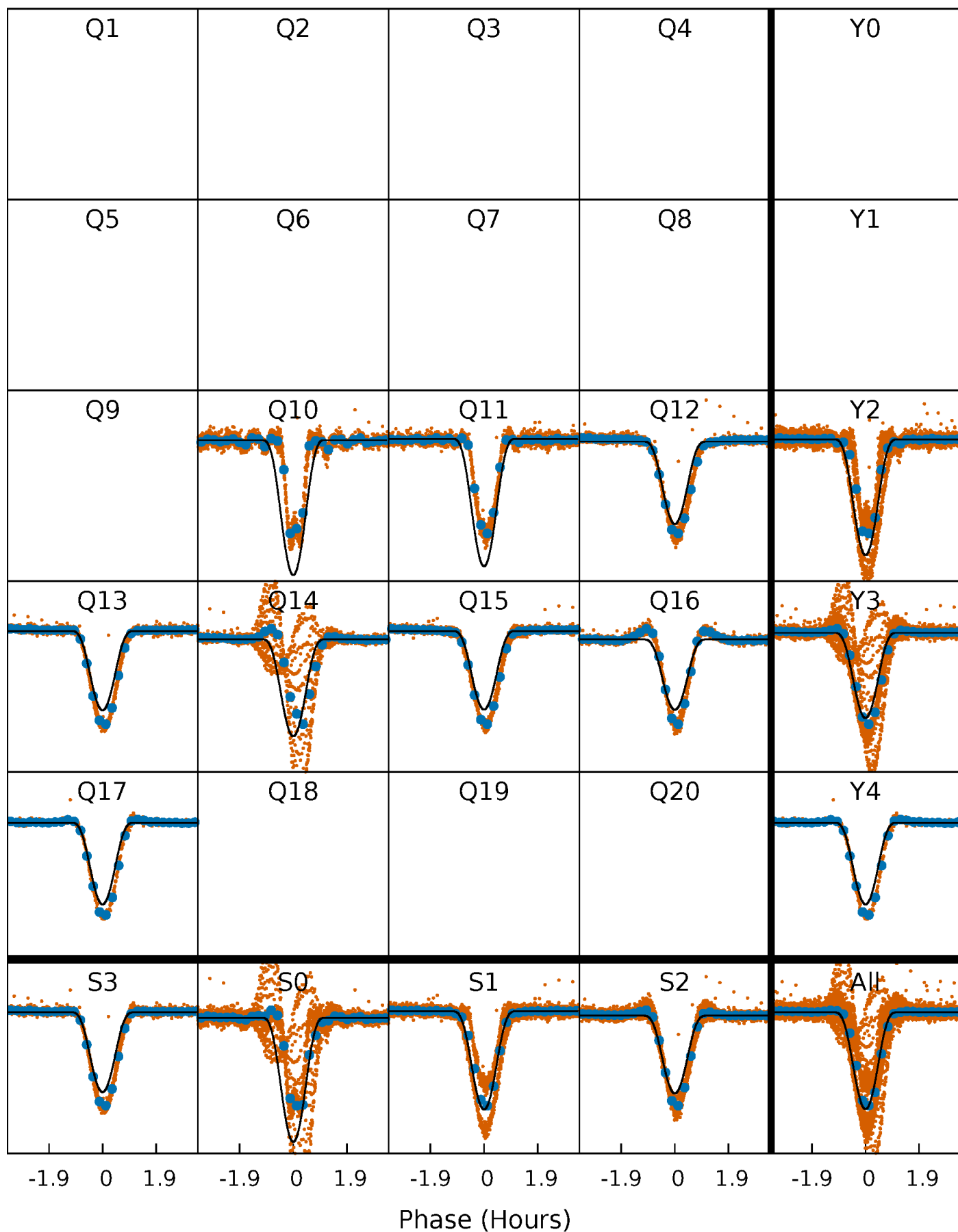
TCE 004037163-01 P= 0.635446 Days  $T_0=131.639483$  (BKJD)





# DV Quarter-Phased Transit Curves

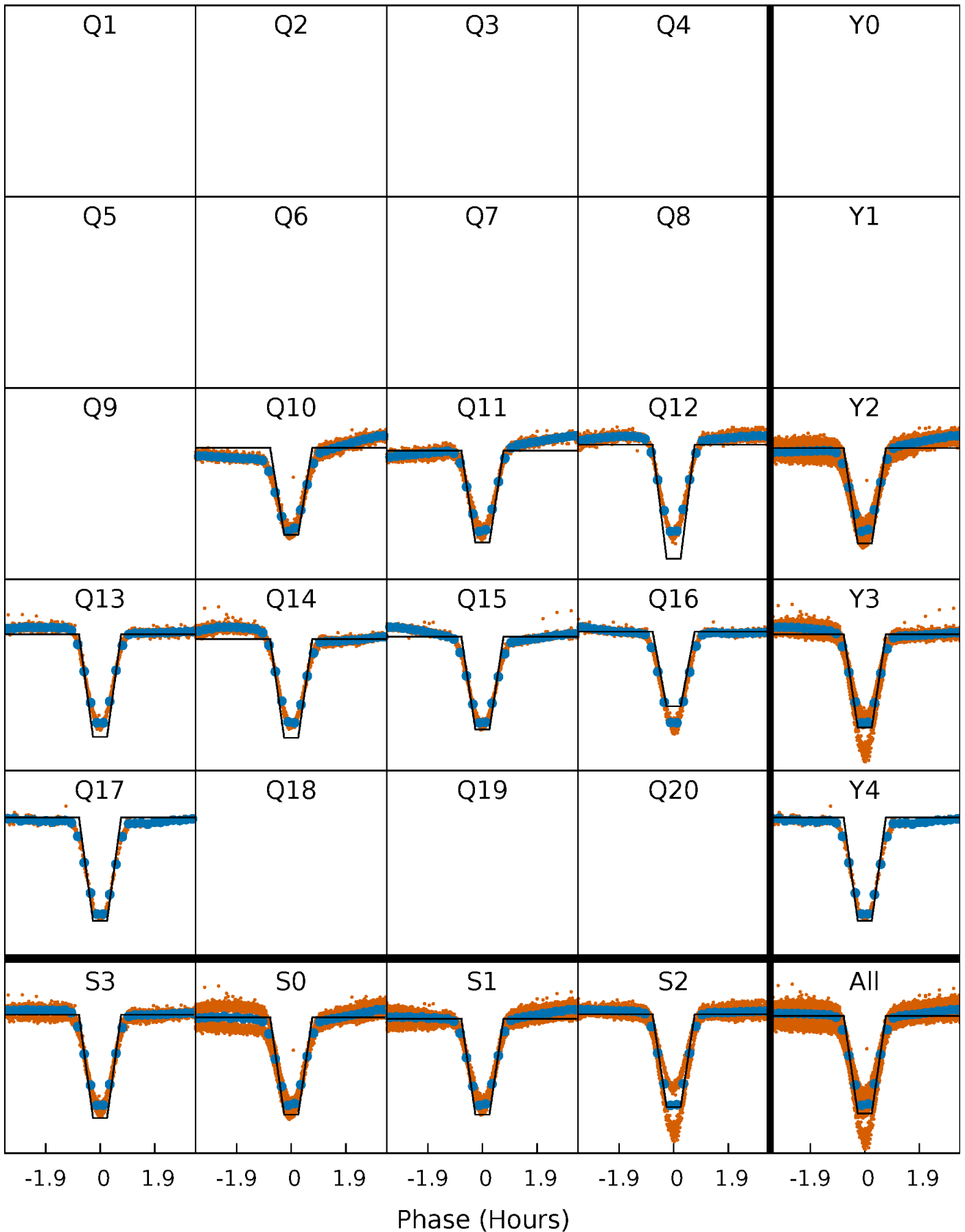
TCE 004037163-01   P= 0.635446 Days    $T_0=131.639483$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

TCE 004037163-01   P= 0.635445 Days    $T_0=131.643753$  (BKJD)

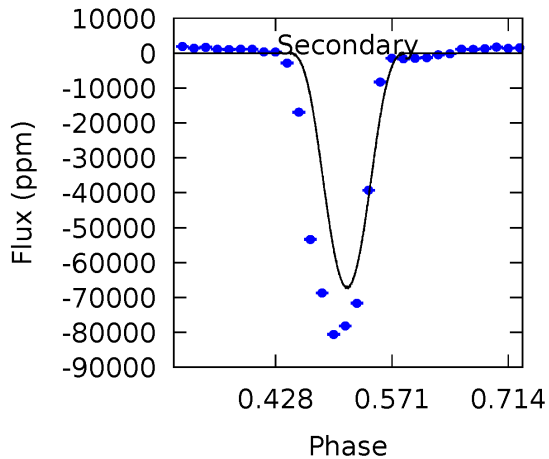
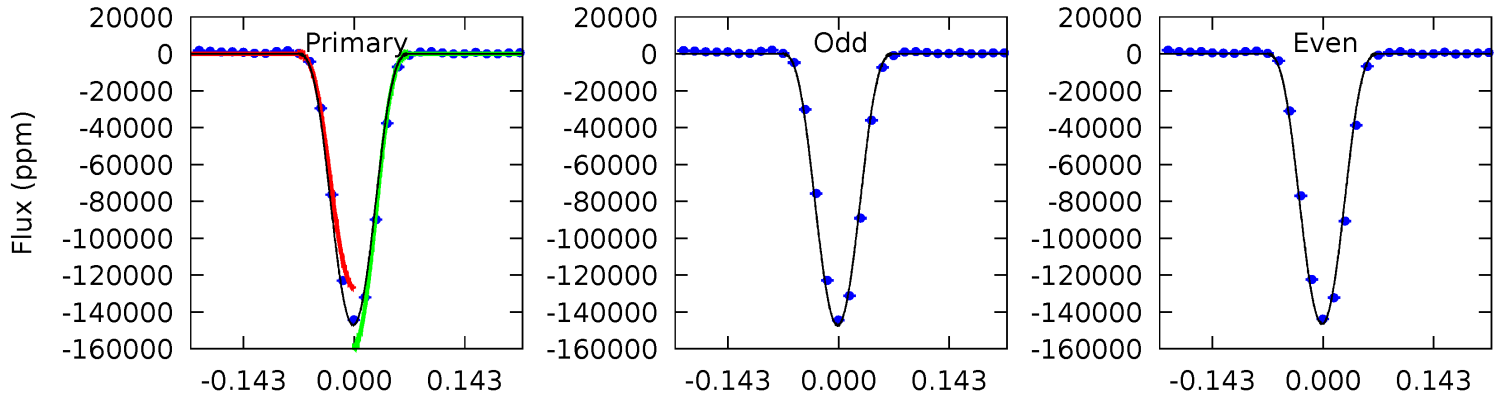
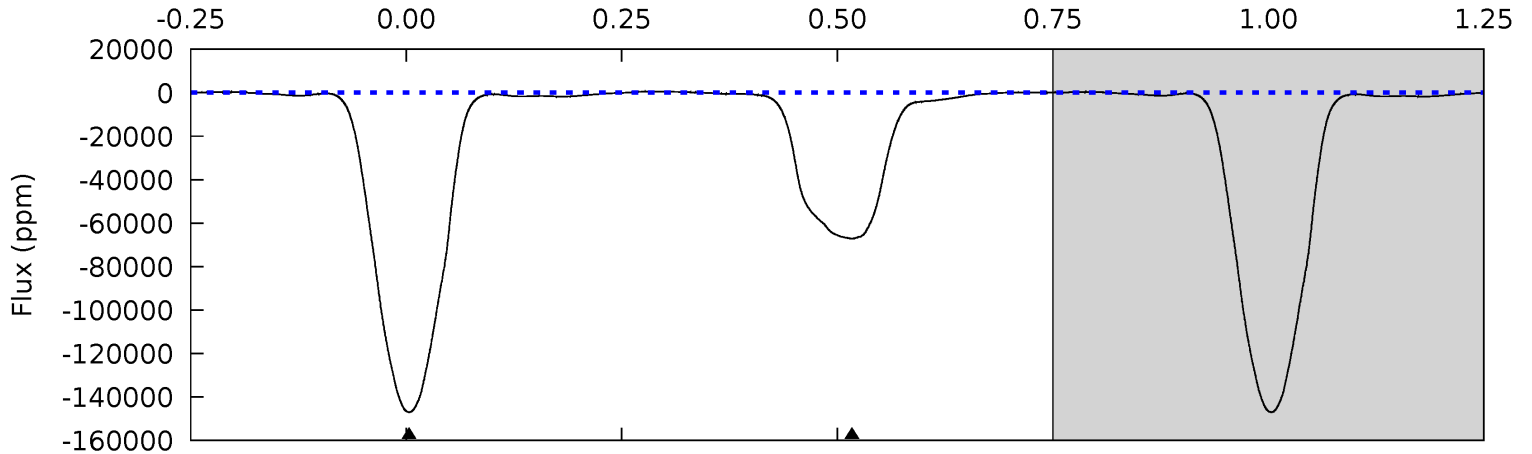
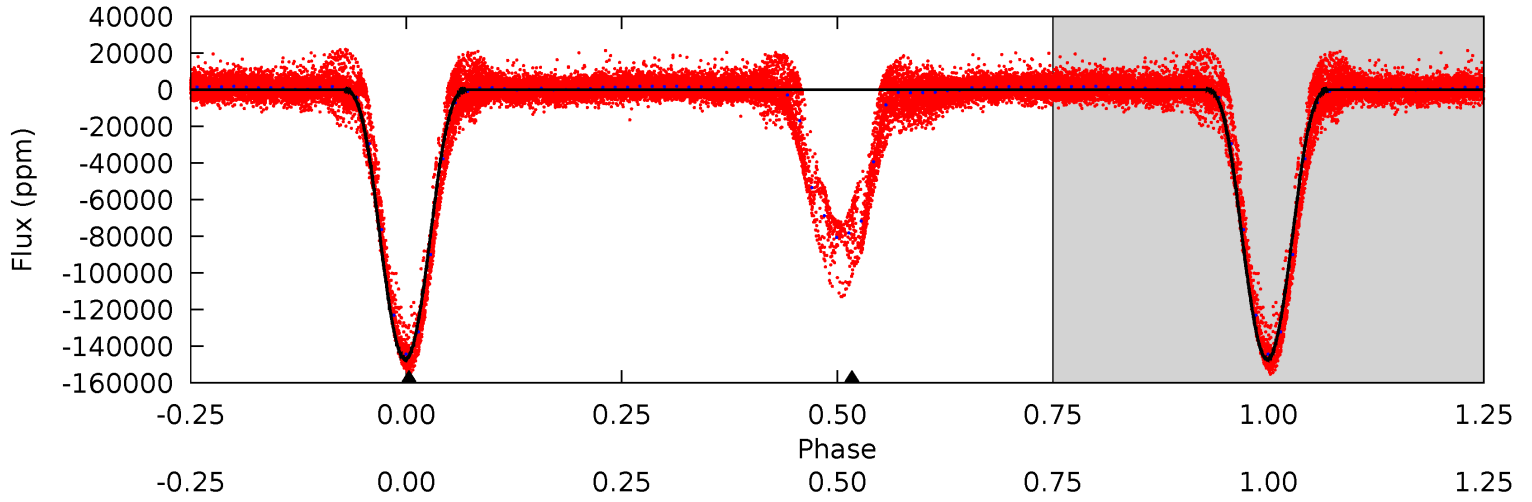




# DV Model-Shift Uniqueness Test

004037163-01, P = 0.635446 Days, E = 131.639483 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
2044	933.3	0	0	4.49	1.47	9.00	2044	2044	933.3	933.3	5.79	0.83	0.00	0

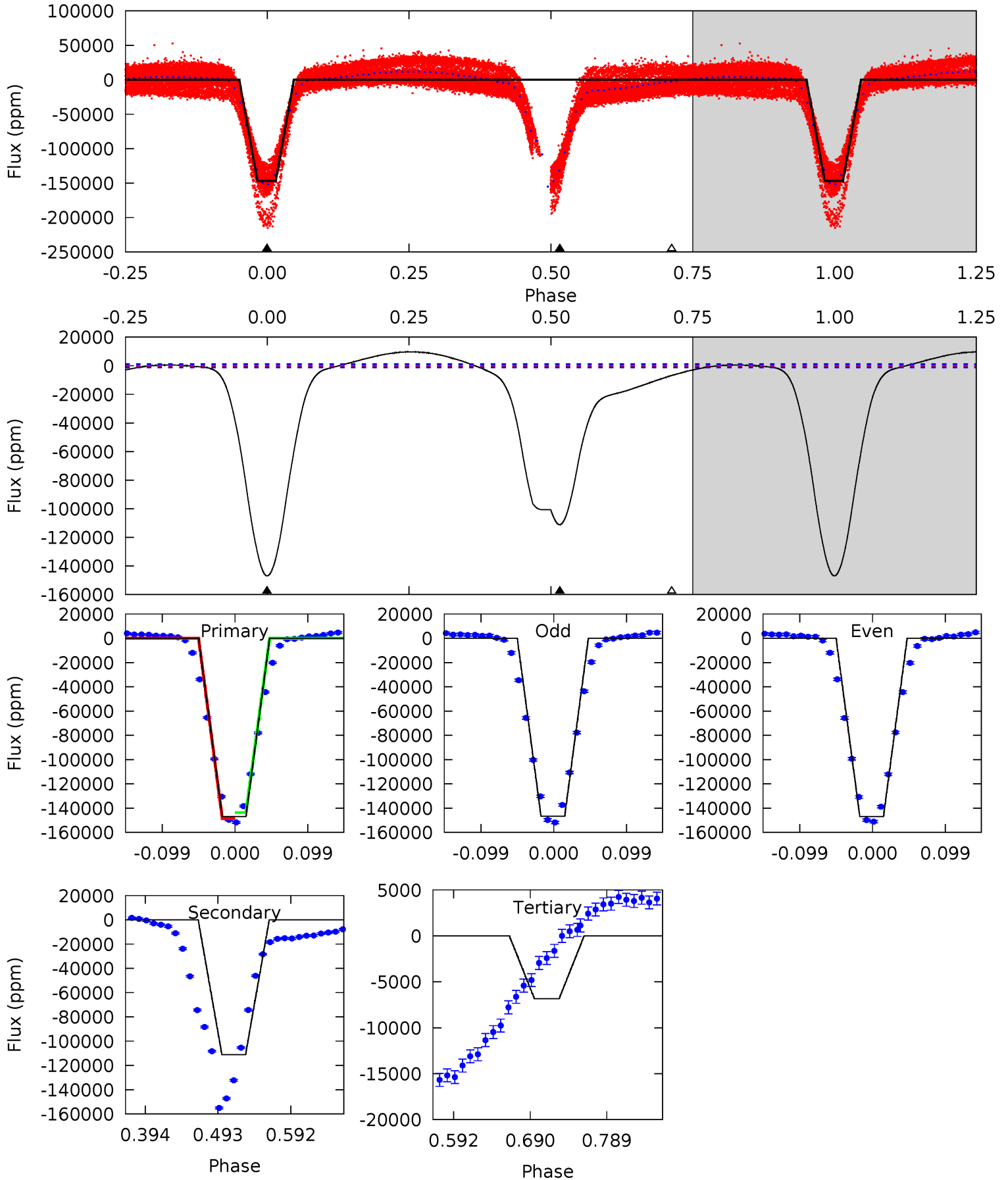




# Alt Model-Shift Uniqueness Test

004037163-01, P = 0.635445 Days, E = 131.643753 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
569.7	431.0	26.5	0	4.57	1.65	28.5	543.2	569.7	404.5	431.0	0.39	1.03	0.06	9.36





### Stellar Parameters For KIC 004037163

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5780^{+1}_{-1}$	$4.438^{+1.000}_{-1.000}$	$0.000^{+1.000}_{-1.000}$	$1.000^{+1.000}_{-1.000}$	$-1.000^{+1.000}_{-1.000}$	$-1.000^{+1.000}_{-1.000}$
	+0%/-0%	+23%/-23%	+inf%/-inf%	+100%/-100%	+100%/-100%	+100%/-100%
Source	Solar	Solar	Solar	Solar		

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

### Secondary Eclipse Parameters for KIC 004037163-01 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-67121 \pm 72$	$89.59^{+93.01}_{-58.65}$	$2957^{+149}_{-130}$	$3515^{+2009}_{-5948}$	$1.040^{+7.667}_{-0.788}$
Alt.	$-111128 \pm 258$	$86.55^{+80.27}_{-60.13}$	$2973^{+151}_{-145}$	$4034^{+3013}_{-1110}$	$1.951^{+18.259}_{-1.427}$

$T_{\text{max}}$  = 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

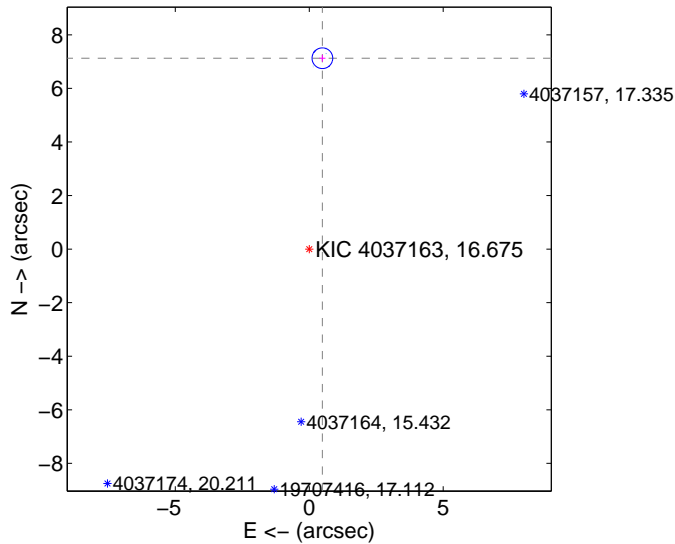
Supplemental centroid analysis for 004037163-01. Kepler magnitude: 16.68. Transit SNR 723.95

There are 8 quarters with good PRF difference image offsets

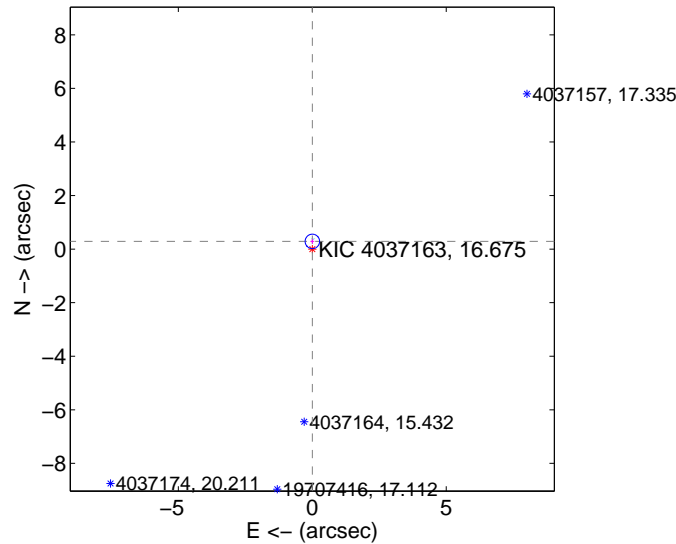
The OOT PRF centroid is offset from the target star catalog position by about 7.13 arcsec so the offset from difference PRF-fit to OOT-fit may be invalid.

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	7.143 $\pm$ 0.129	55.49	-0.491 $\pm$ 0.113	7.126 $\pm$ 0.129
PRF-fit source offset from KIC position	0.288 $\pm$ 0.090	3.20	-0.003 $\pm$ 0.073	0.288 $\pm$ 0.090
photometric centroid source offset	3.40 $\pm$ 0.00	1037.85	0.04 $\pm$ 0.00	-3.40 $\pm$ 0.00

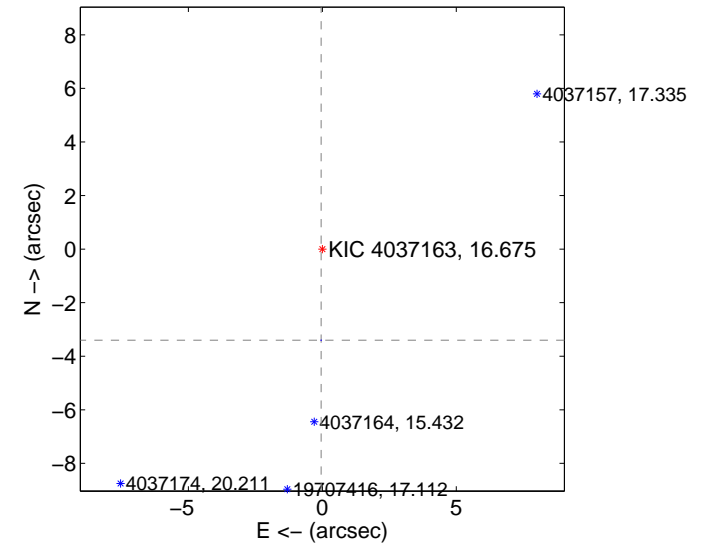
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position



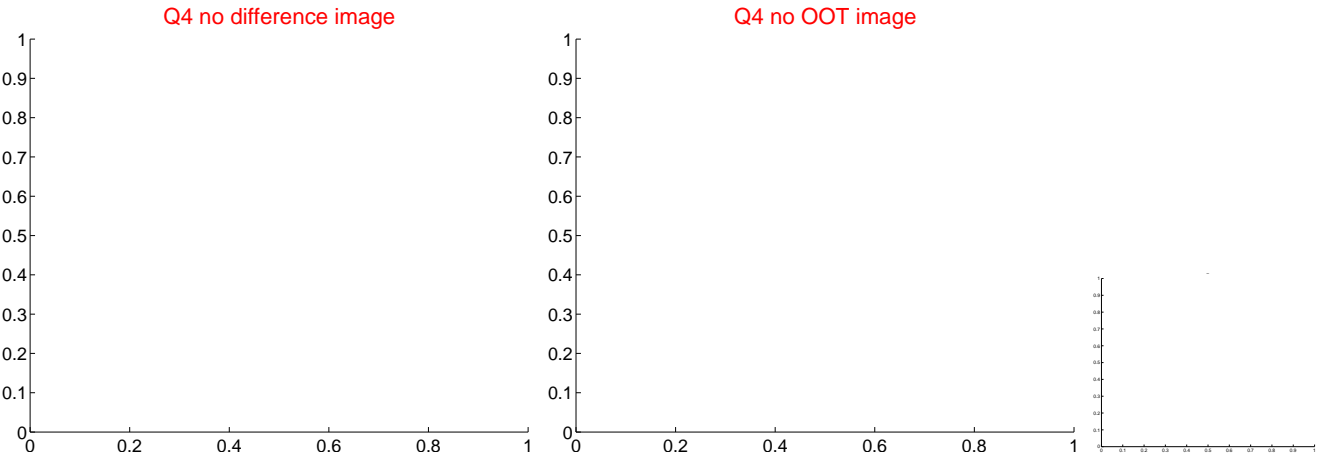
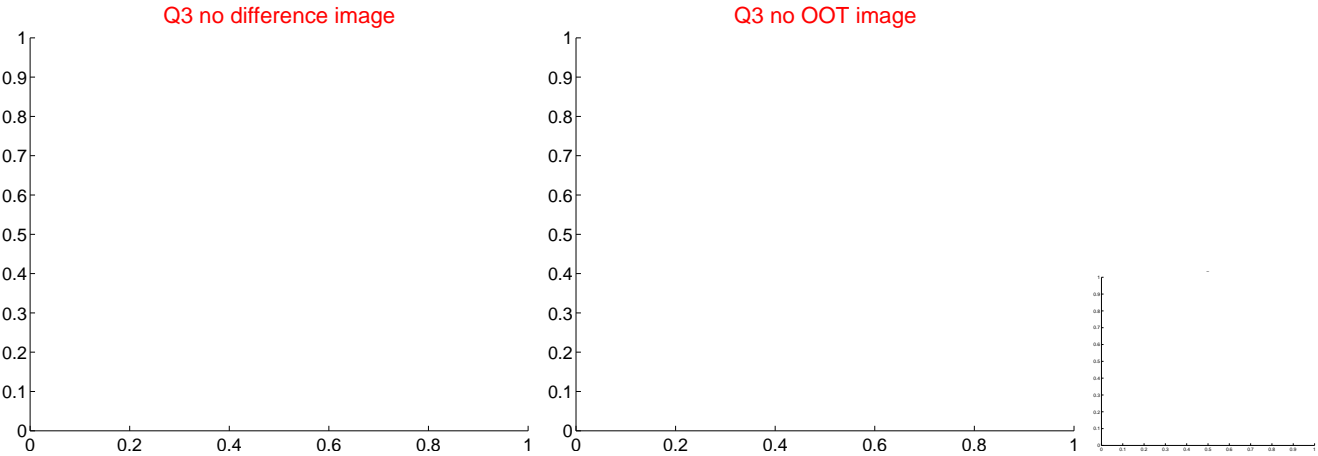
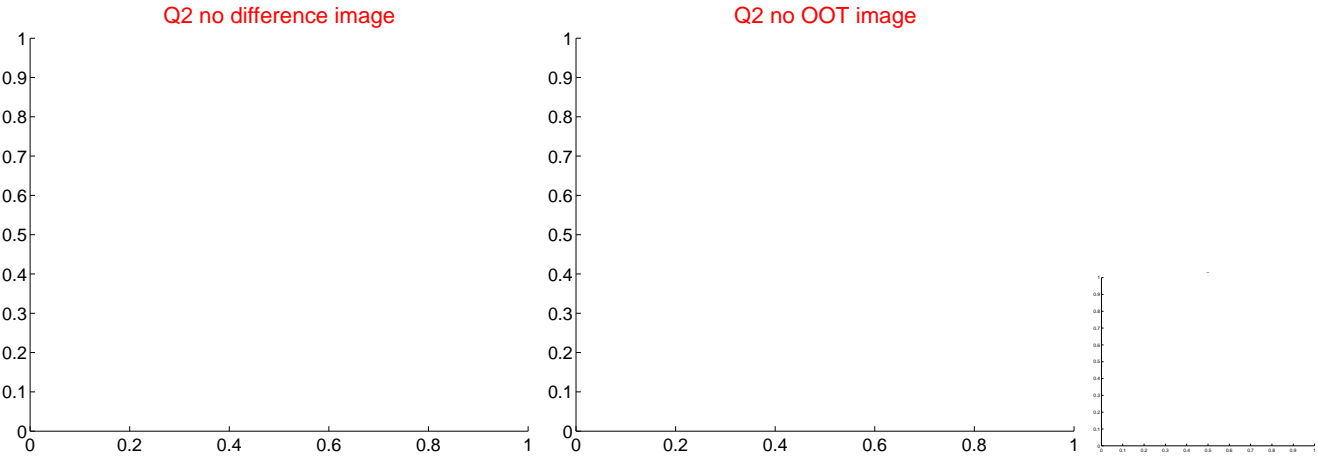
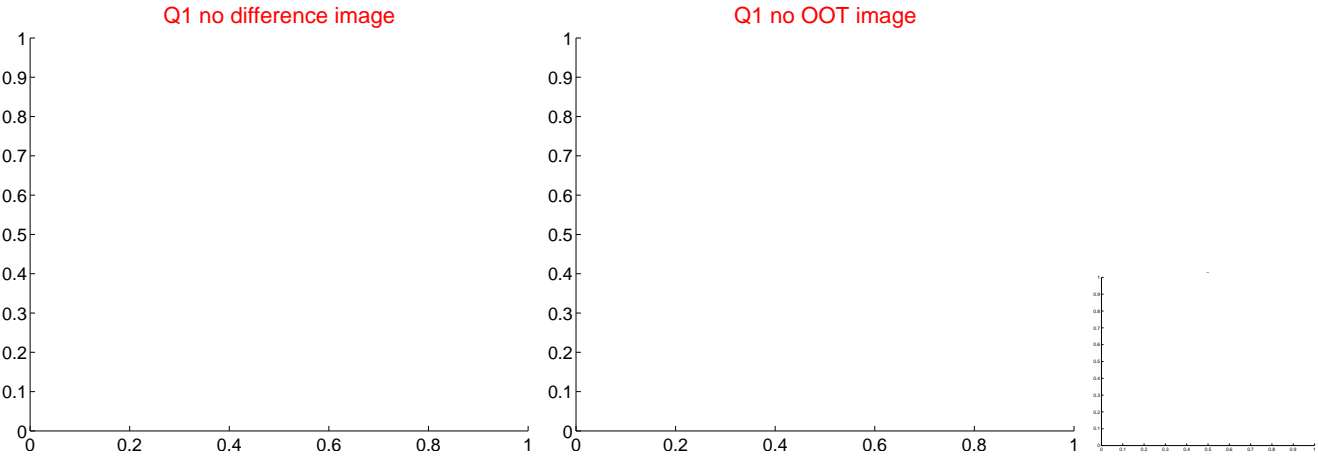
offset from photometric centroids



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

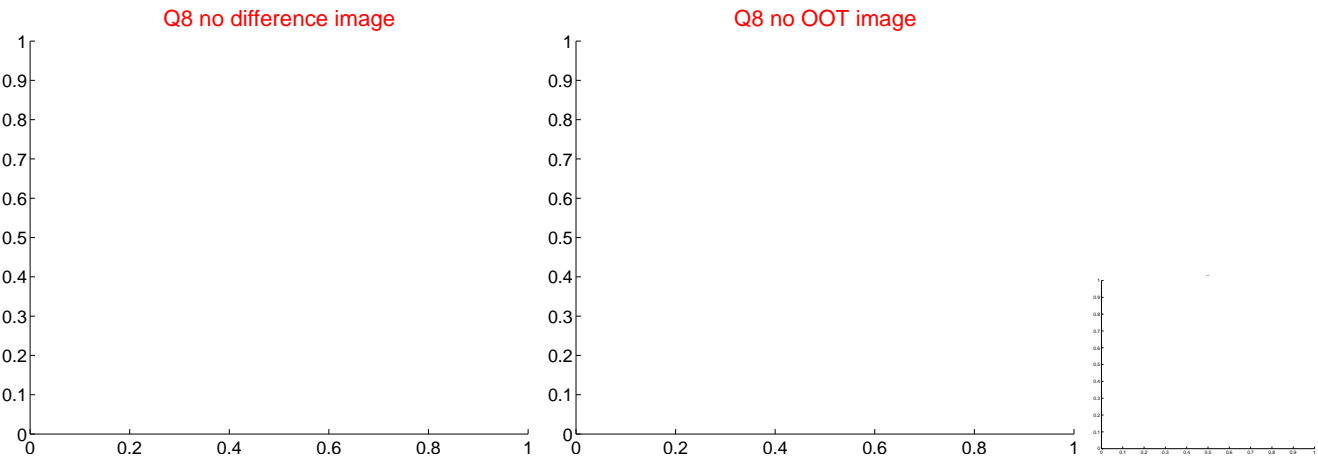
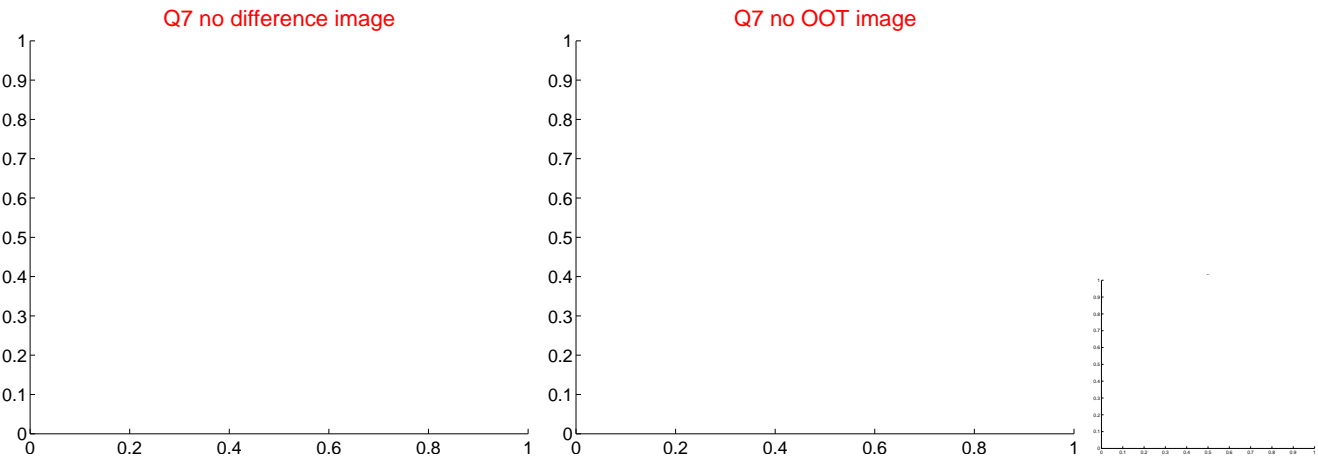
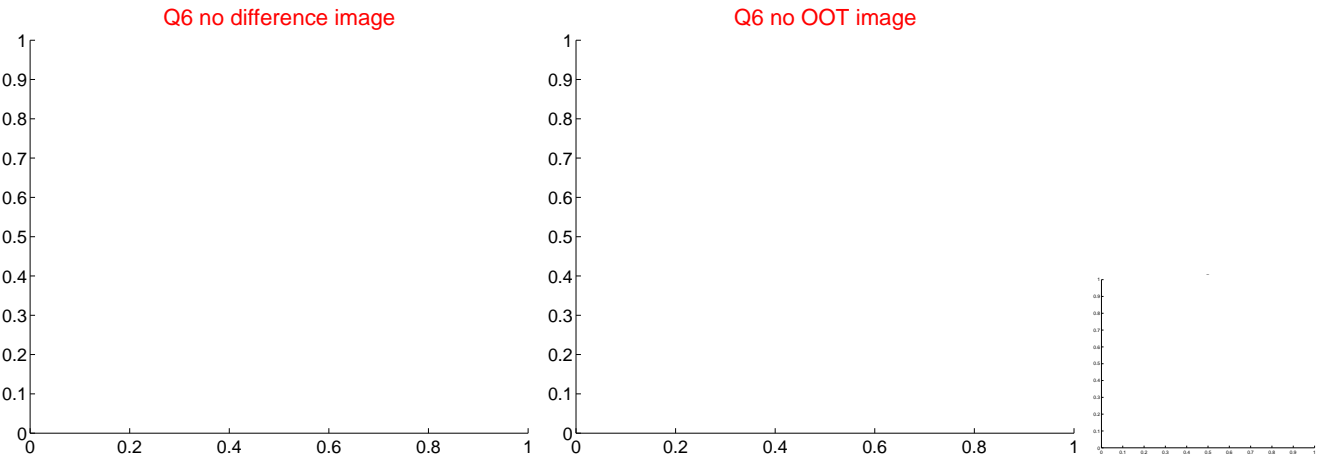
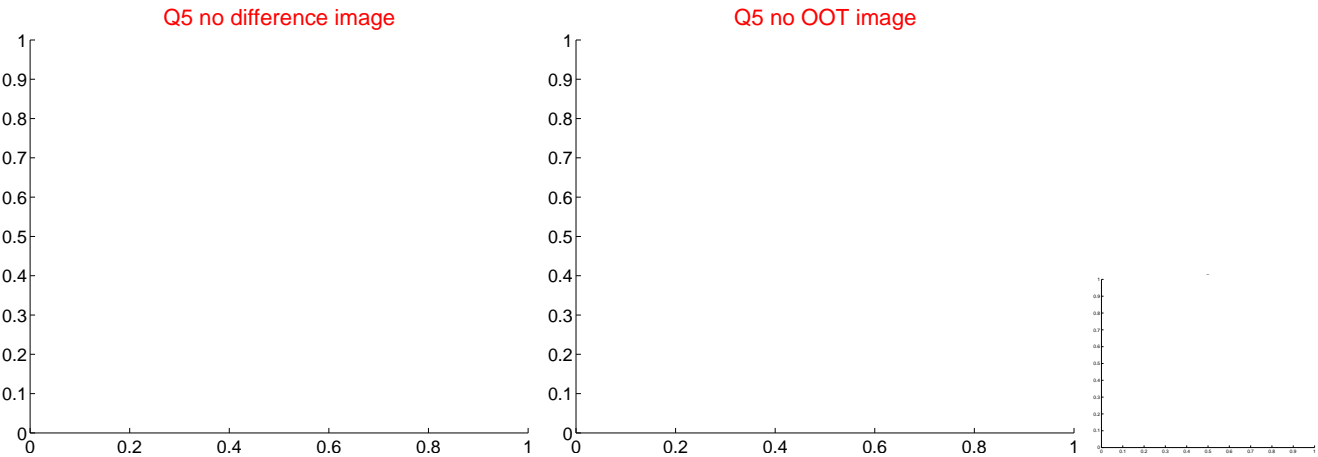


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



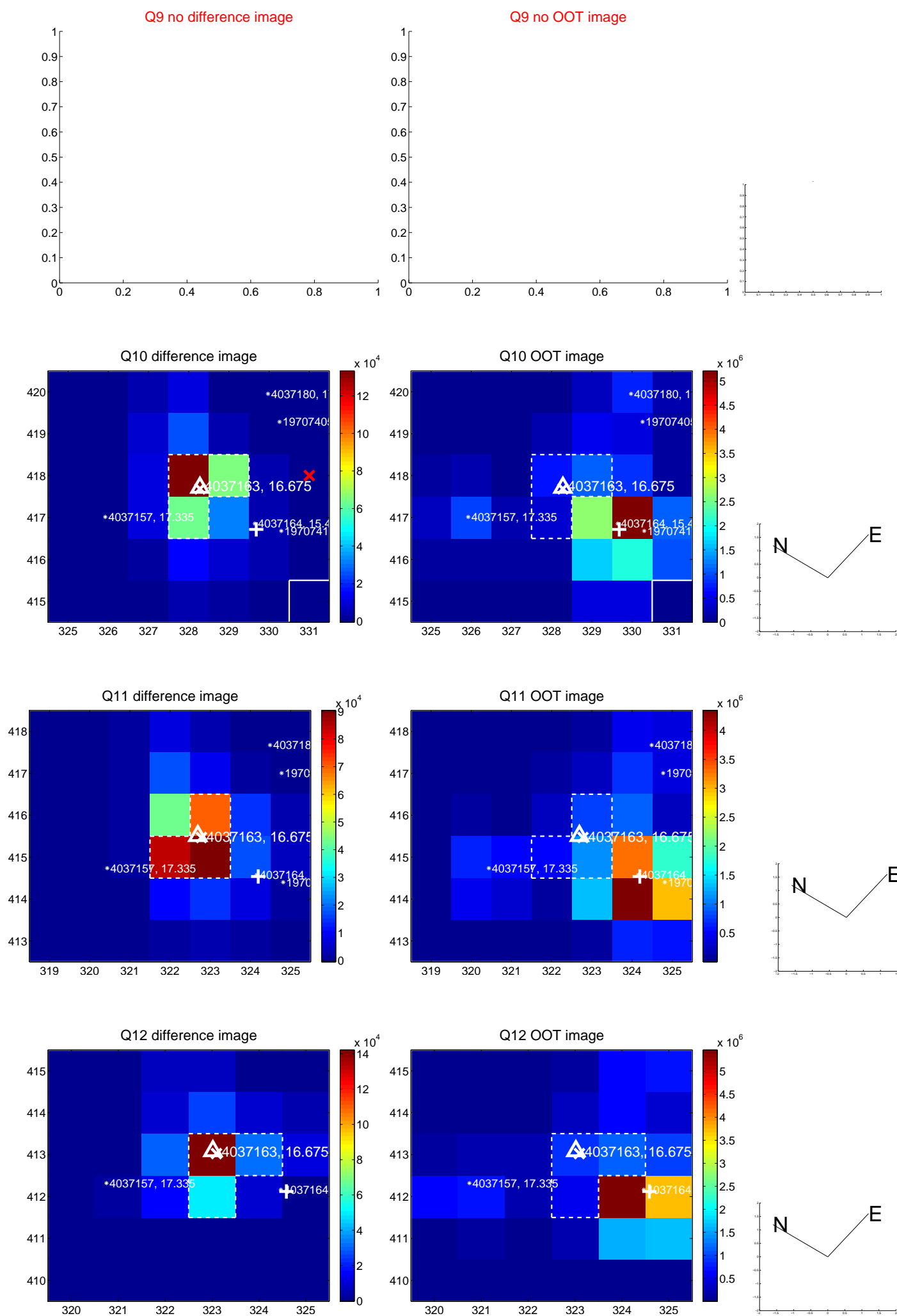


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



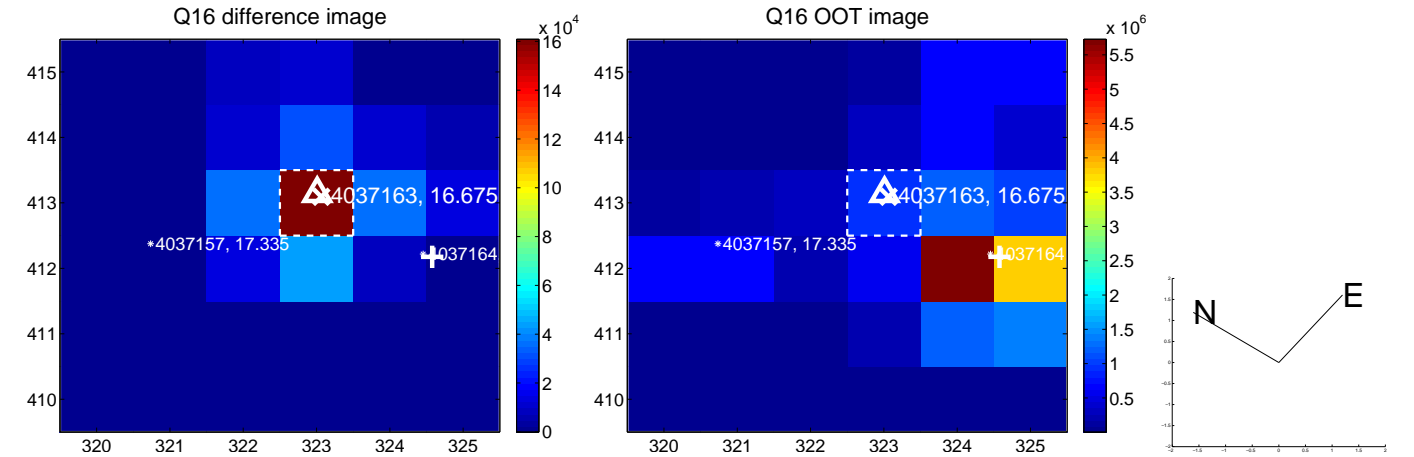
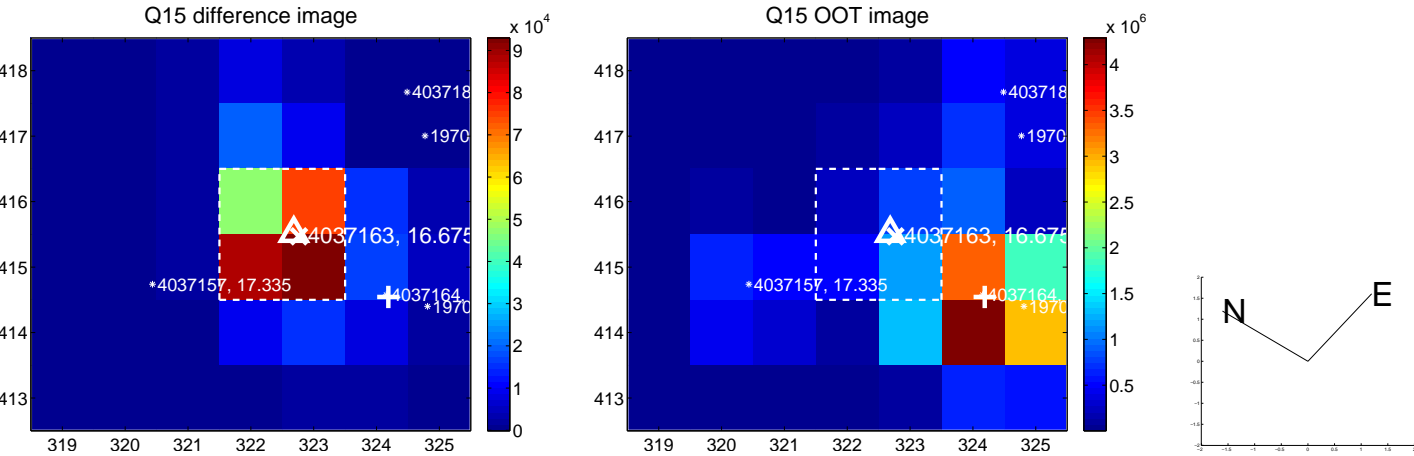
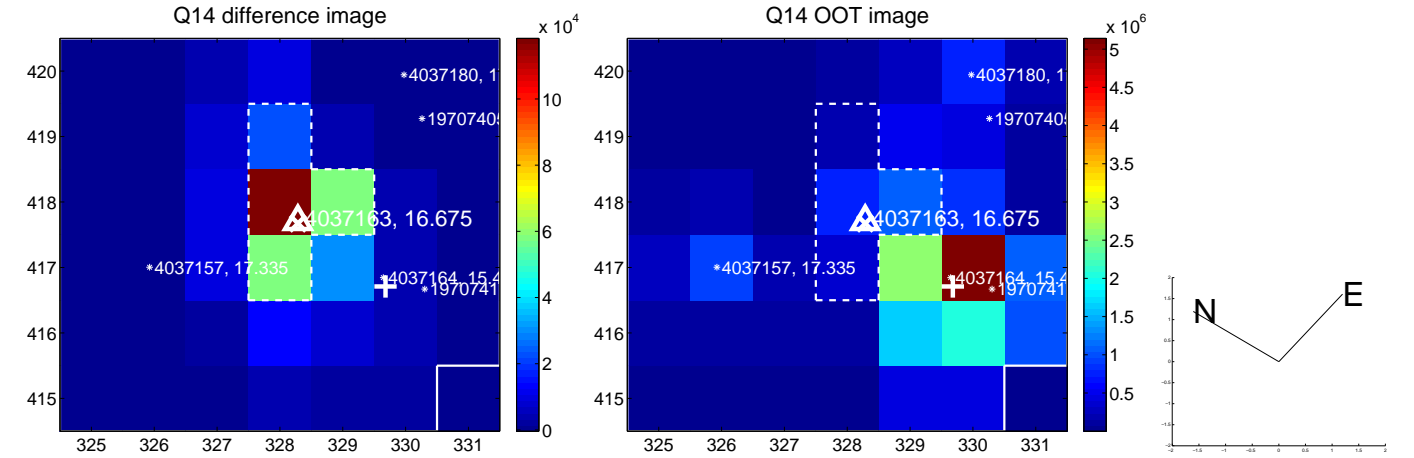
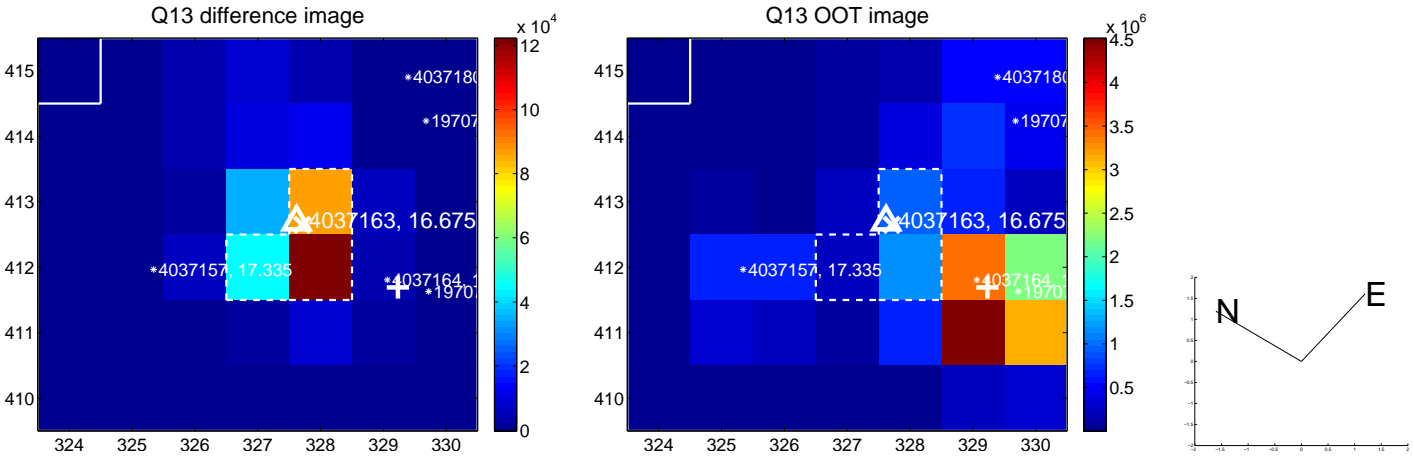


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value



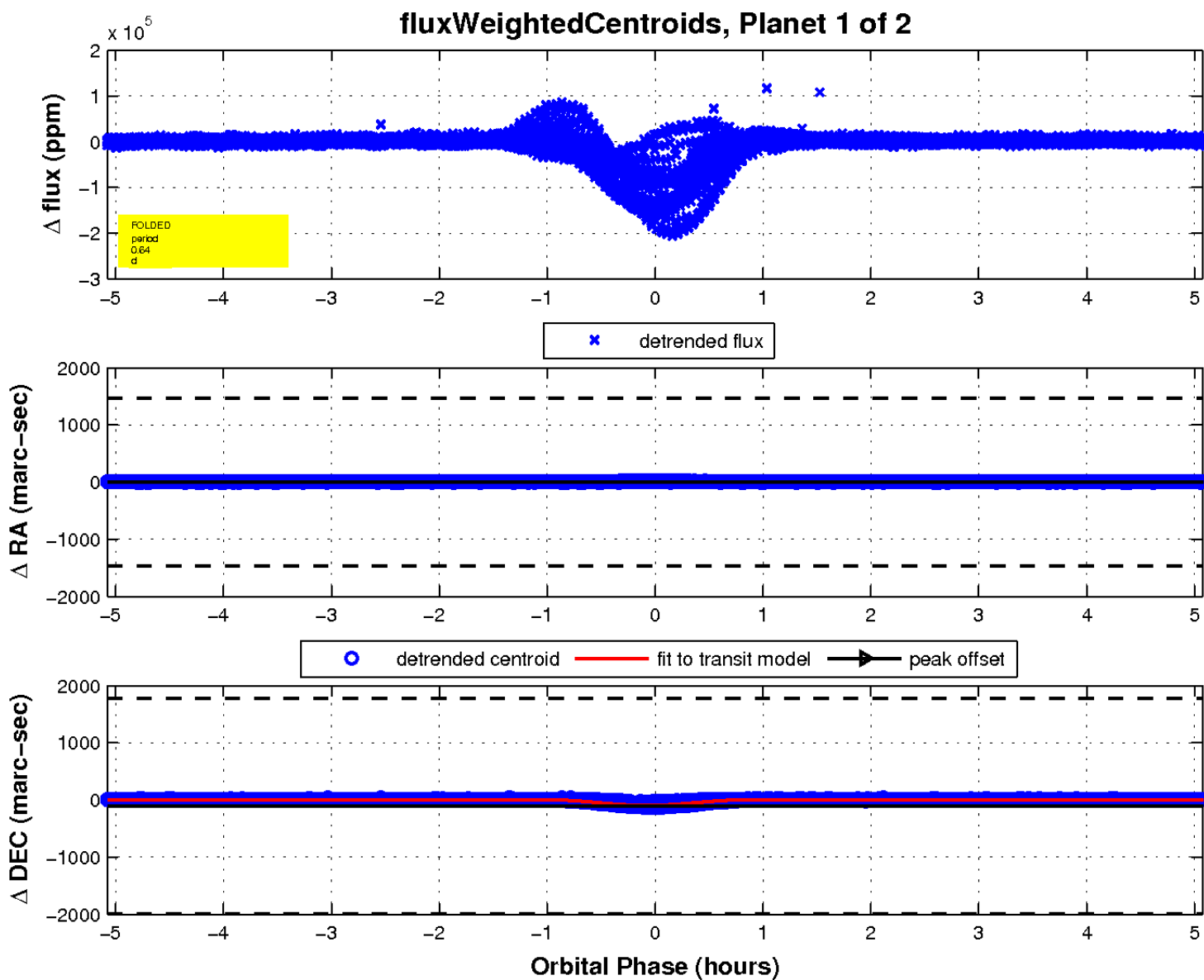
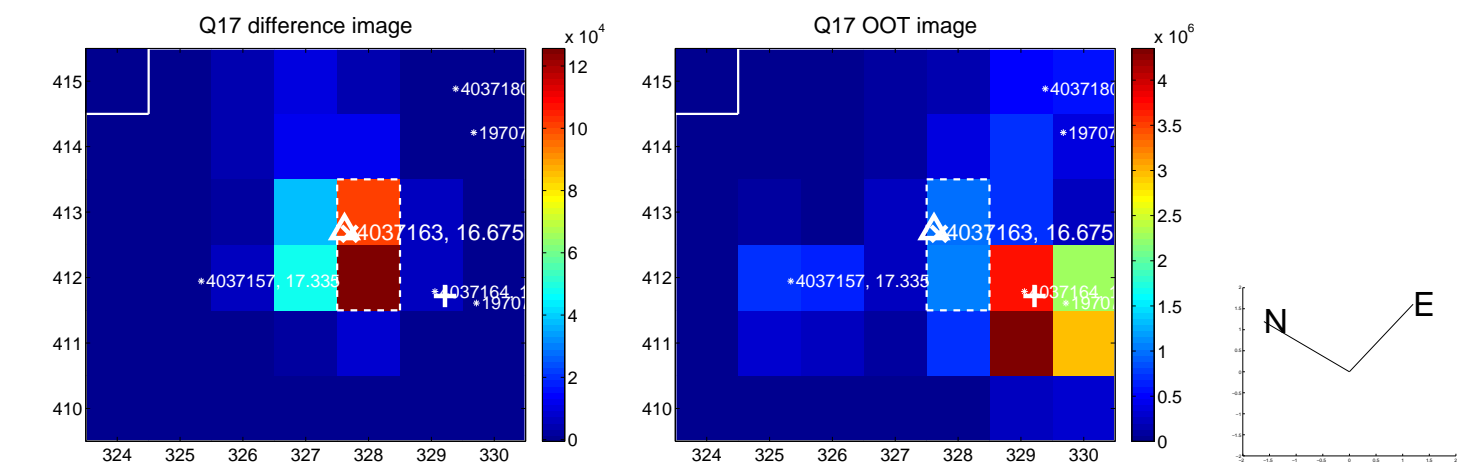


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





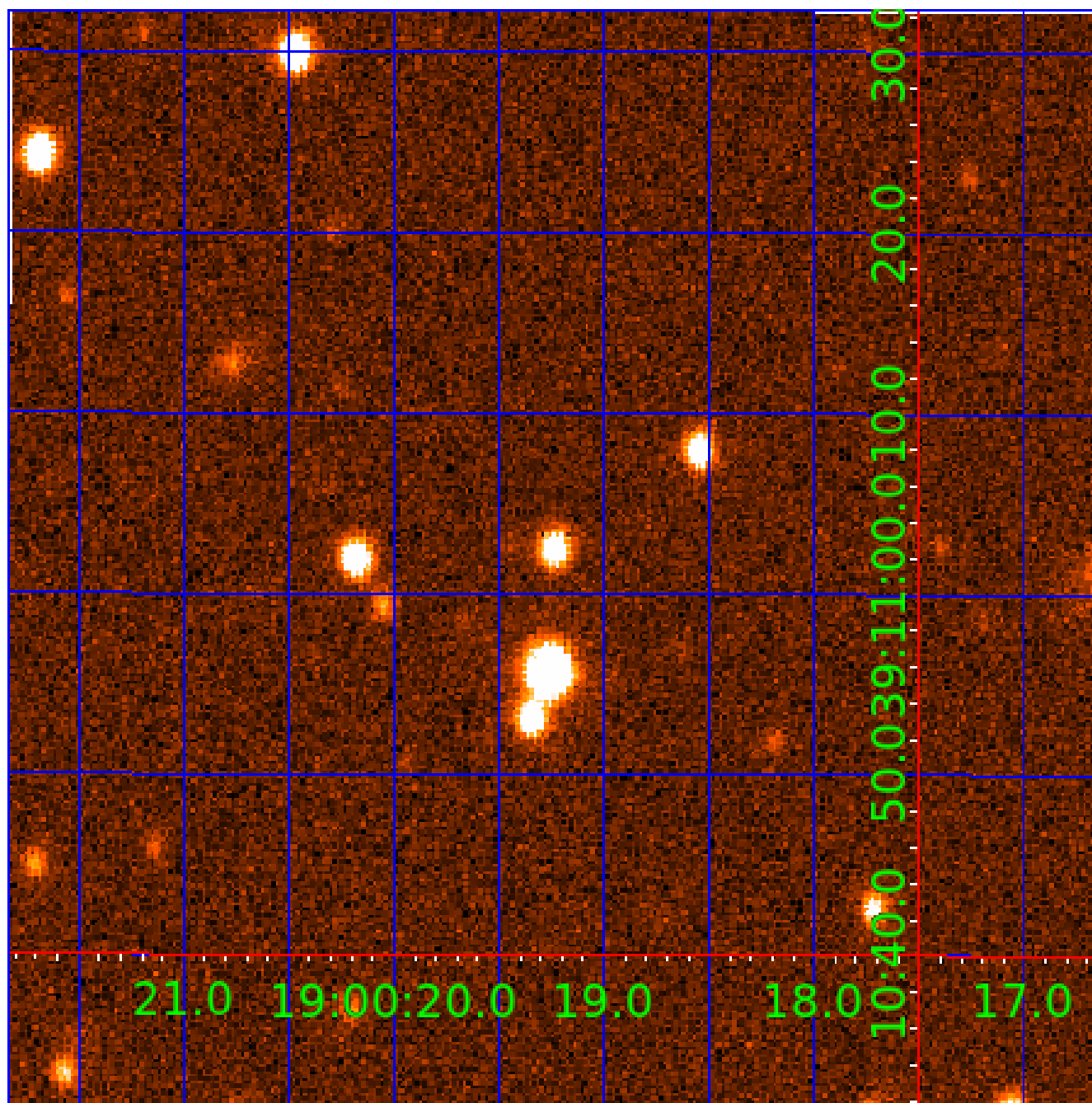
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





UKIRT Image

Declination





# KIC 004037163

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
004037163-01	OBS	No	0.635446	131.639483	123867.3	1.692	1111.2	724.0	1.00	5780	53.85	4777.14
004037163-02	OBS	3793.01	0.635445	131.960994	161357.5	1.500	1293.6	-1.0	1.00	5780	40.48	4777.15

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
004037163-01	OBS	FP	0.00	1	0	0	0	LPP_DV—CENT_KIC_POS
004037163-02	OBS	FP	0.00	1	0	0	0	SAME_NTL_PERIOD—CENT_NOFITS

**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 004037163-02

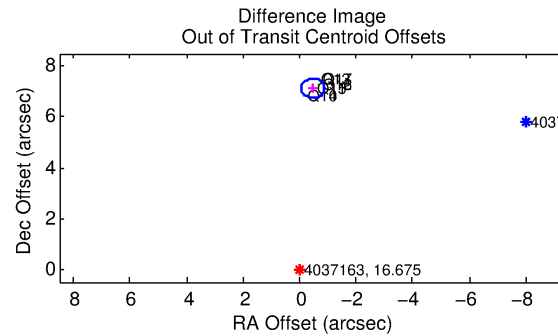
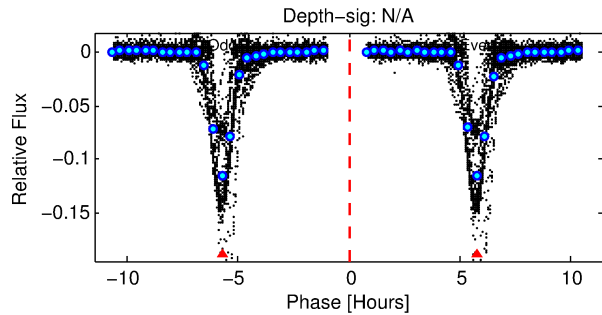
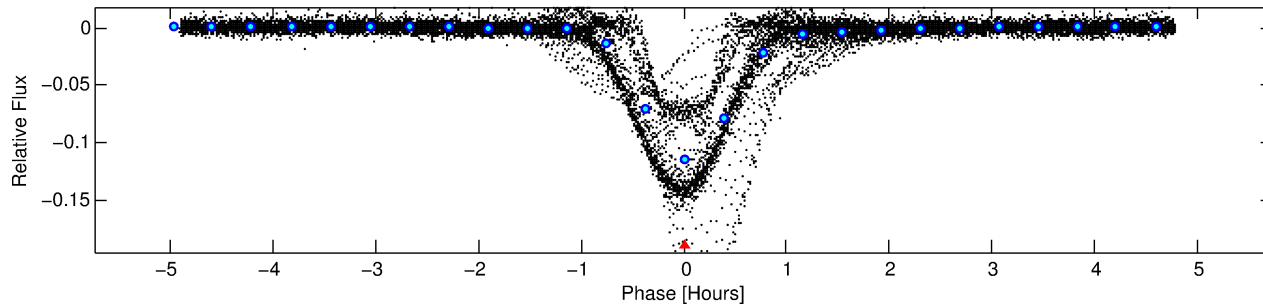
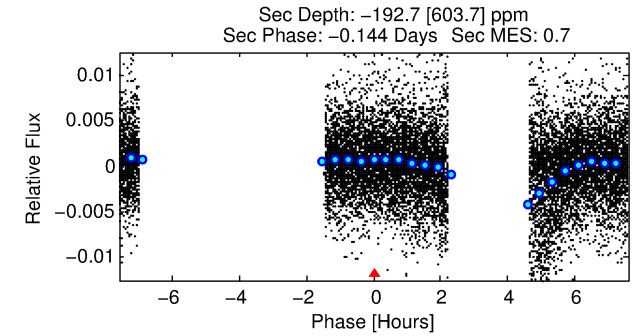
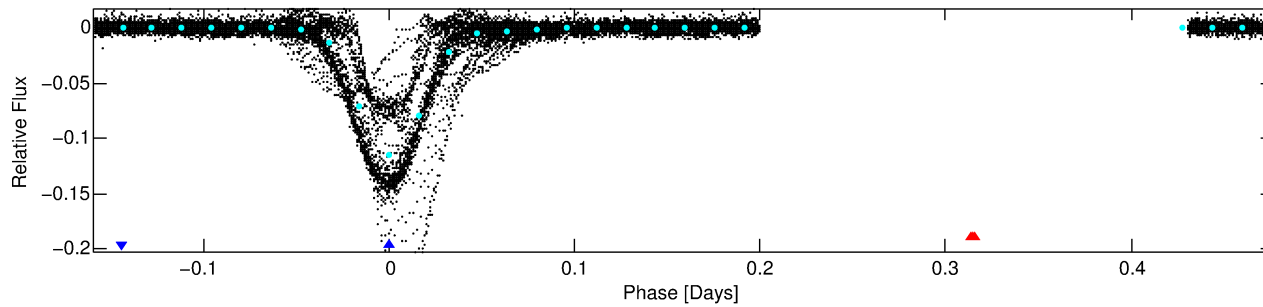
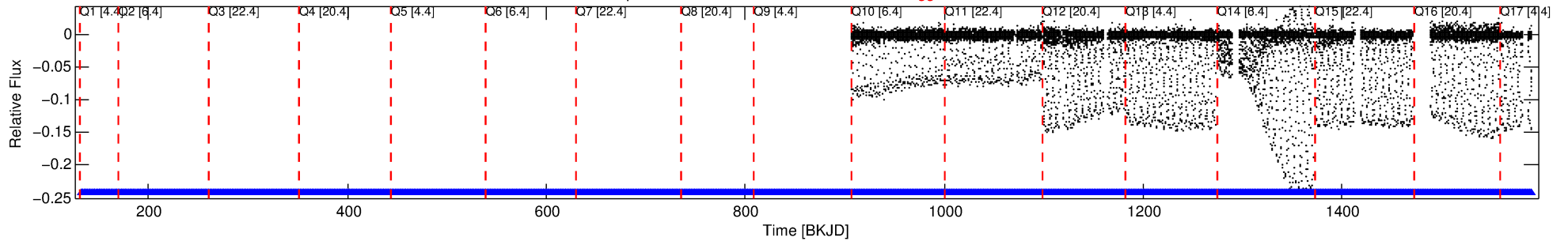
No Significant Match Found



# DV One-Page Summary

KIC: 4037163 Candidate: 2 of 2 Period: 0.635 d  
KOI: K03793.01 Corr: 0.882

Kp: 16.67  $R^*$ : 1.00  $R_s$   $T_{\text{eff}}$ : 5780.0 K  $\text{Logg}$ : 4.44 Fe/H: 0.000



## TPS TCE Results:

Period = 0.63544 d  
Epoch = 131.9610 BKJD

DV fit results are unavailable

## DV Diagnostic Results:

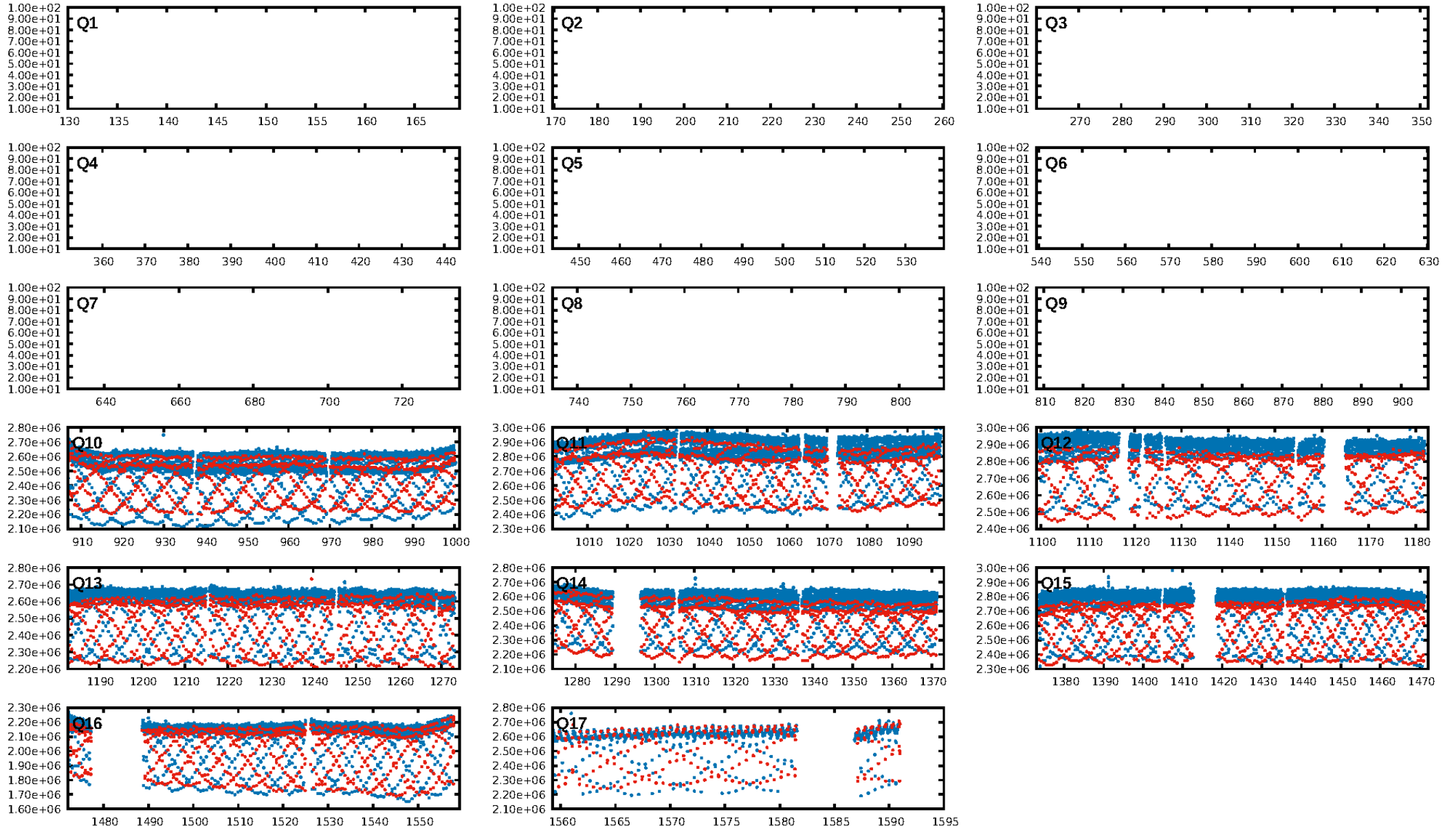
ShortPeriod-sig: N/A  
LongPeriod-sig: 0.0% [0.00 $\sigma$ ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [937/937]  
GhostDiagnostic-chr: 1.196  
Centroid-sig: 0.0%  
Centroid-so: 3.685 arcsec [1630.53 $\sigma$ ]  
OotOffset-rm: 7.145 arcsec [54.00 $\sigma$ ]  
KicOffset-rm: 0.375 arcsec [4.73 $\sigma$ ]  
OotOffset-st: 2/2/2/2 [8]  
KicOffset-st: 2/2/2/2 [8]  
DiffImageQuality-fgm: 1.00 [8/8]  
DiffImageOverlap-fno: 1.00 [8/8]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 02-Feb-2016 08:30:26 Z

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

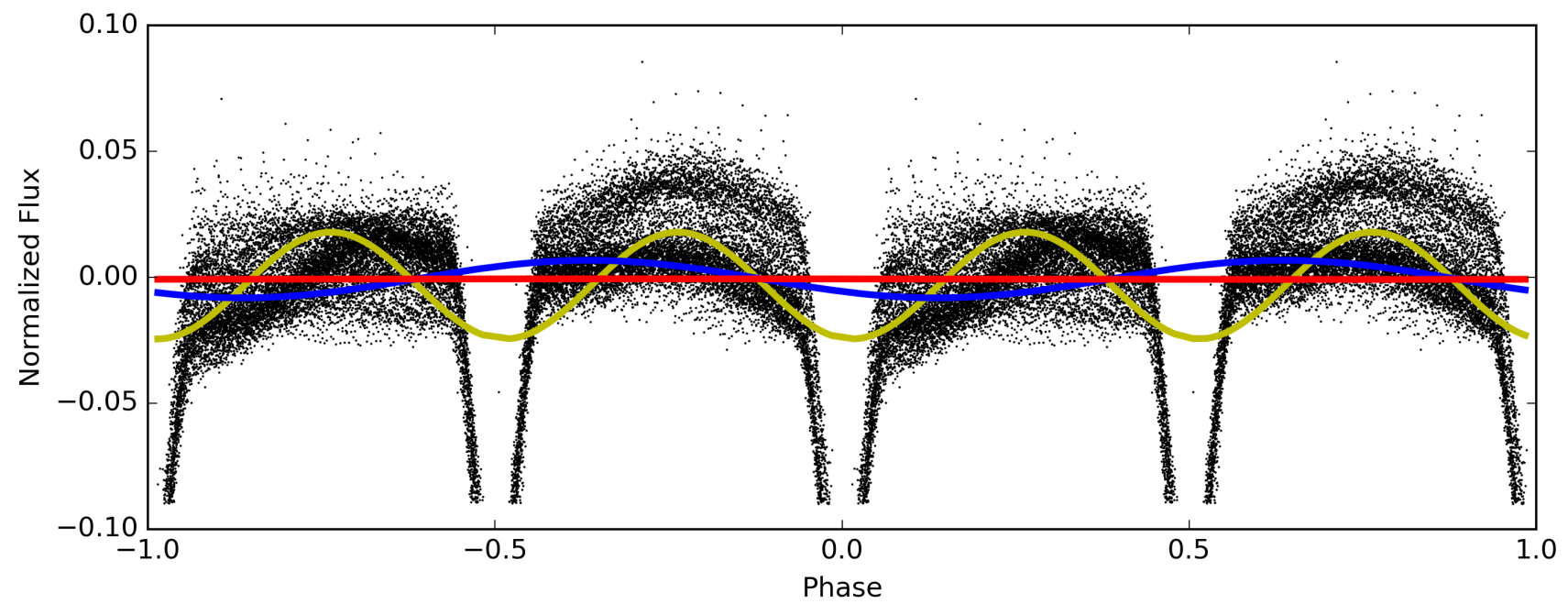
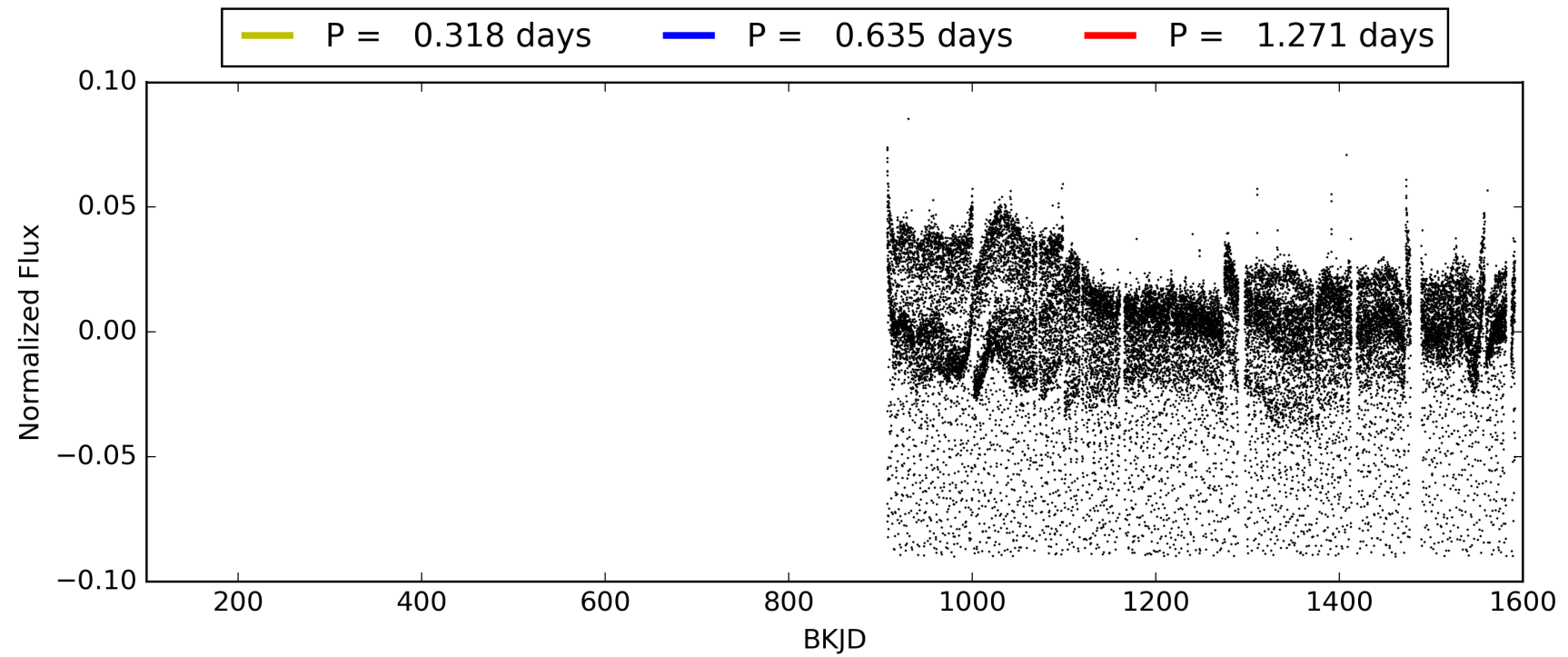


# TCE 004037163-02, PDC Light Curves





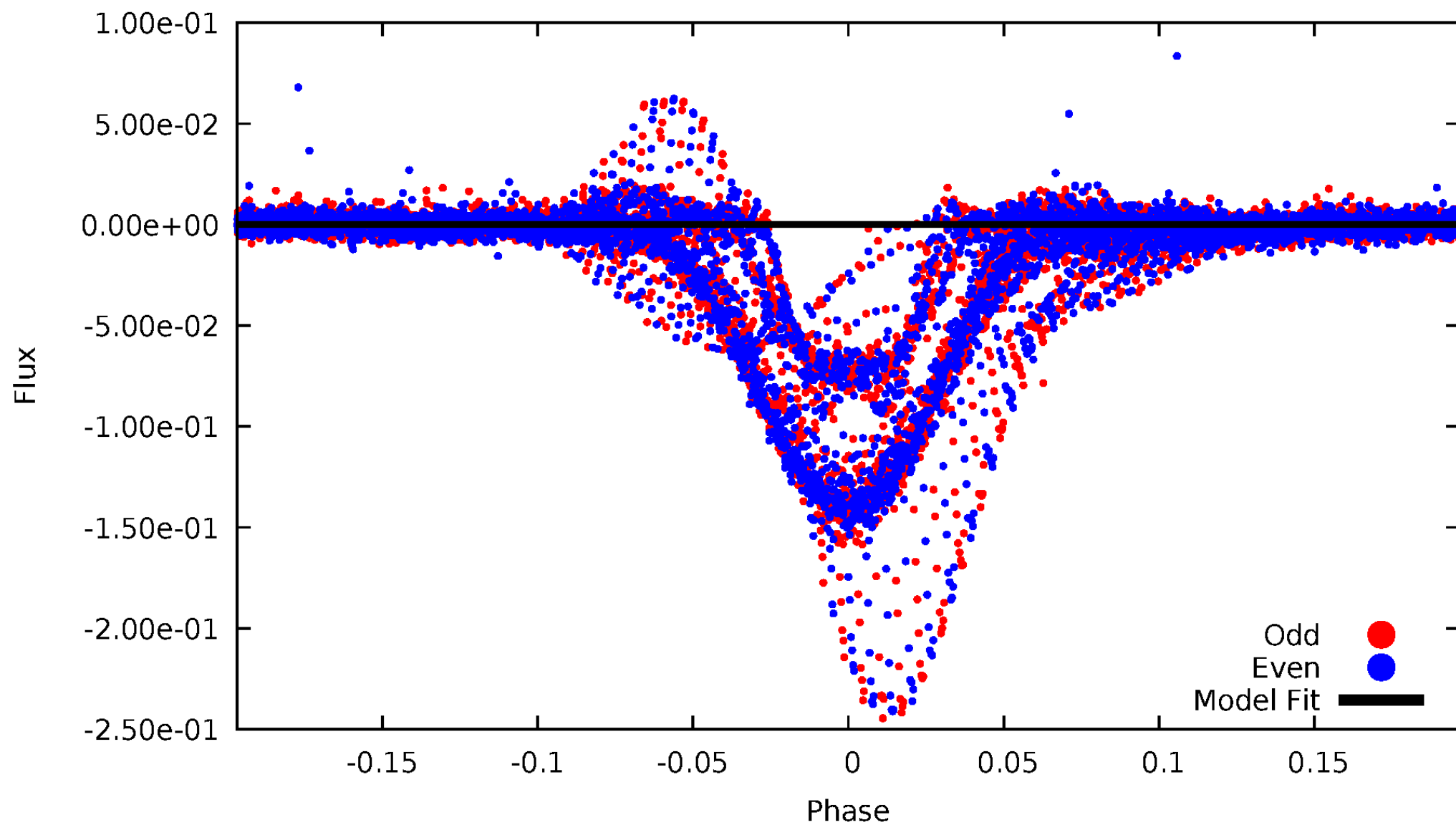
TCE 004037163-02





# DV Odd/Even

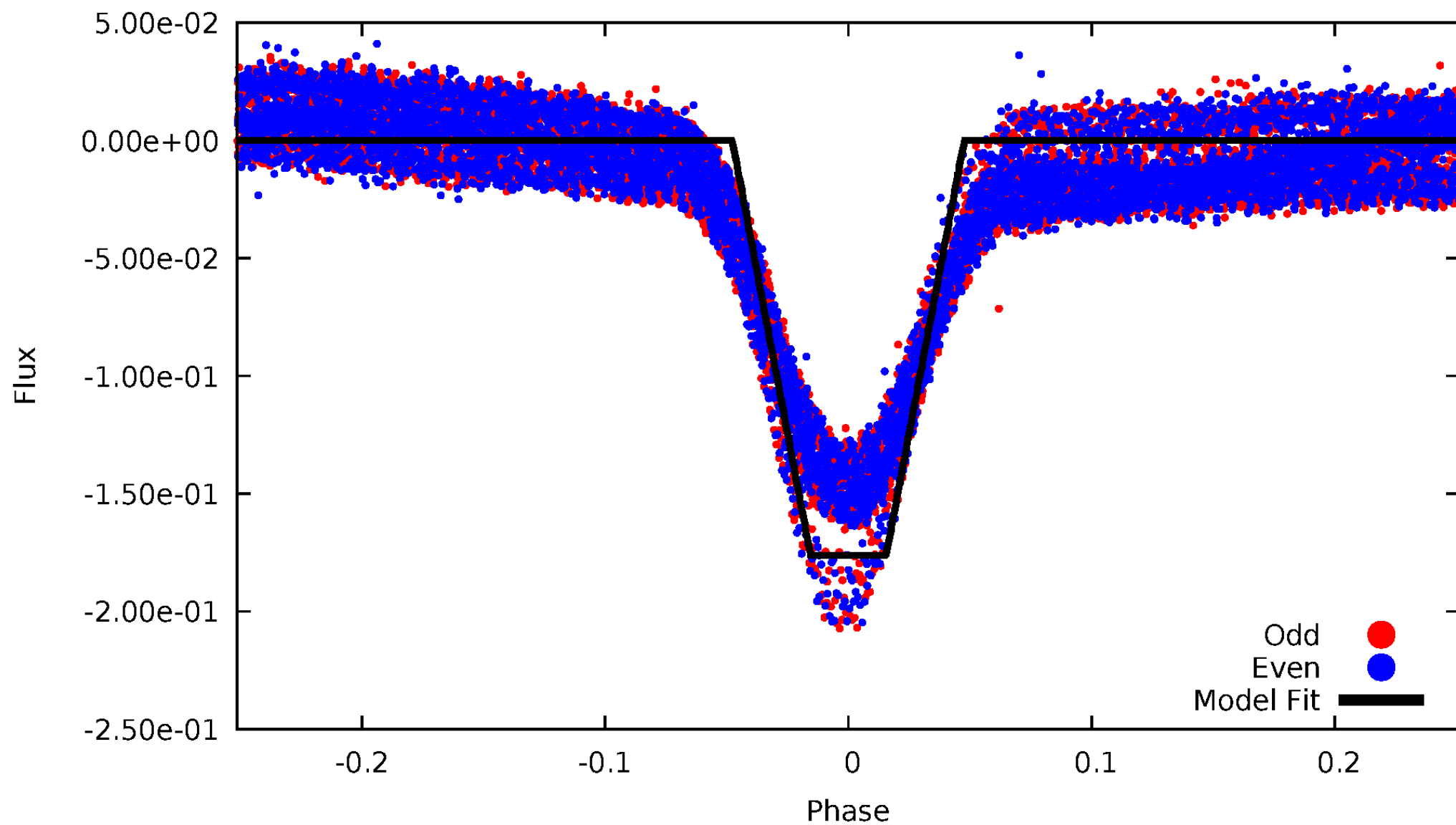
TCE 004037163-02





# ALT Odd/Even

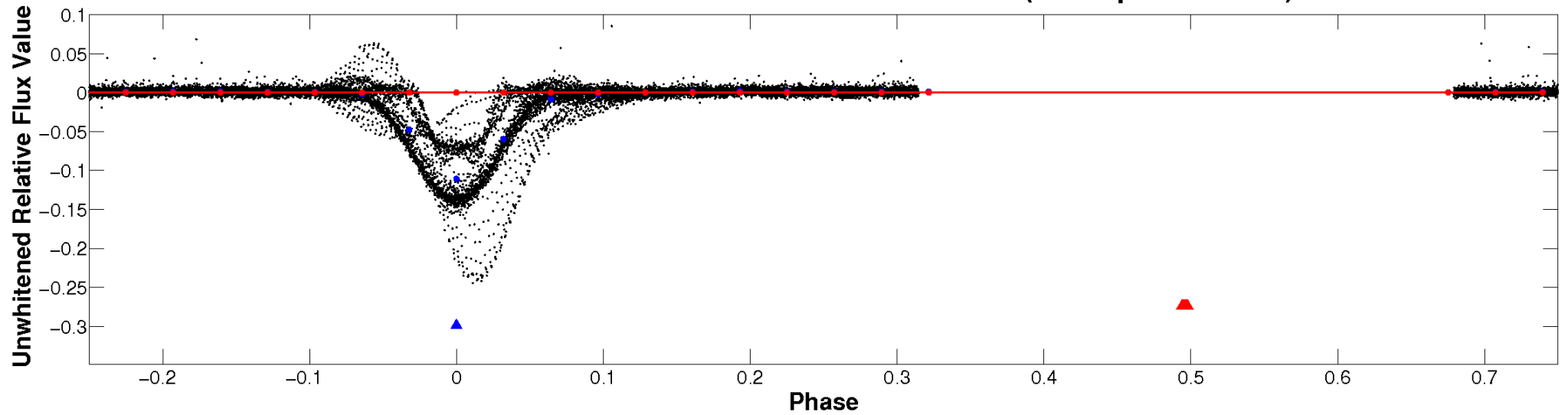
TCE 004037163-02



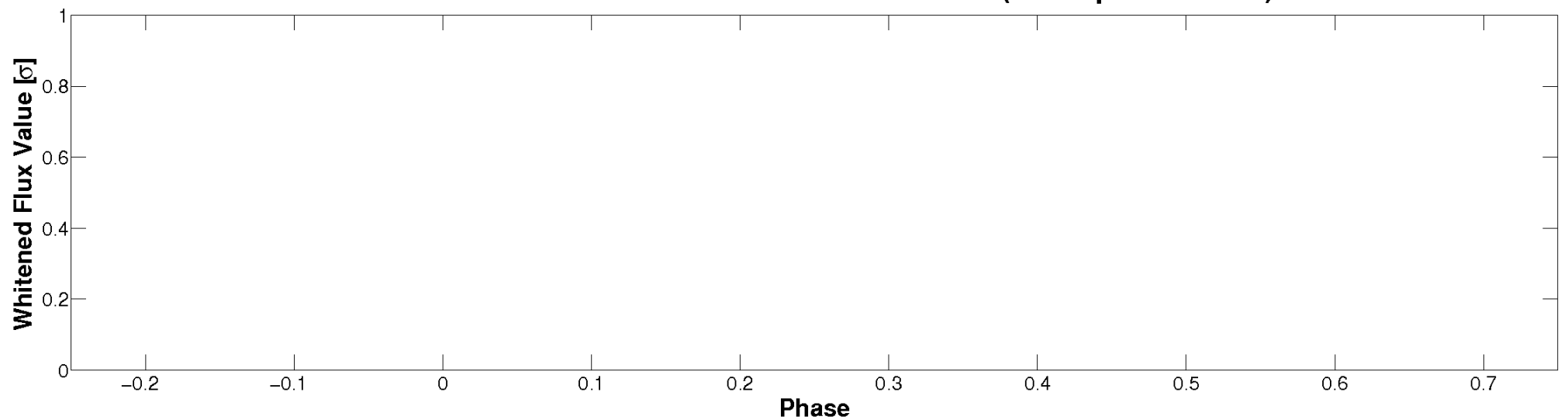


# Non-Whitened Vs. Whitened Light Curve

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



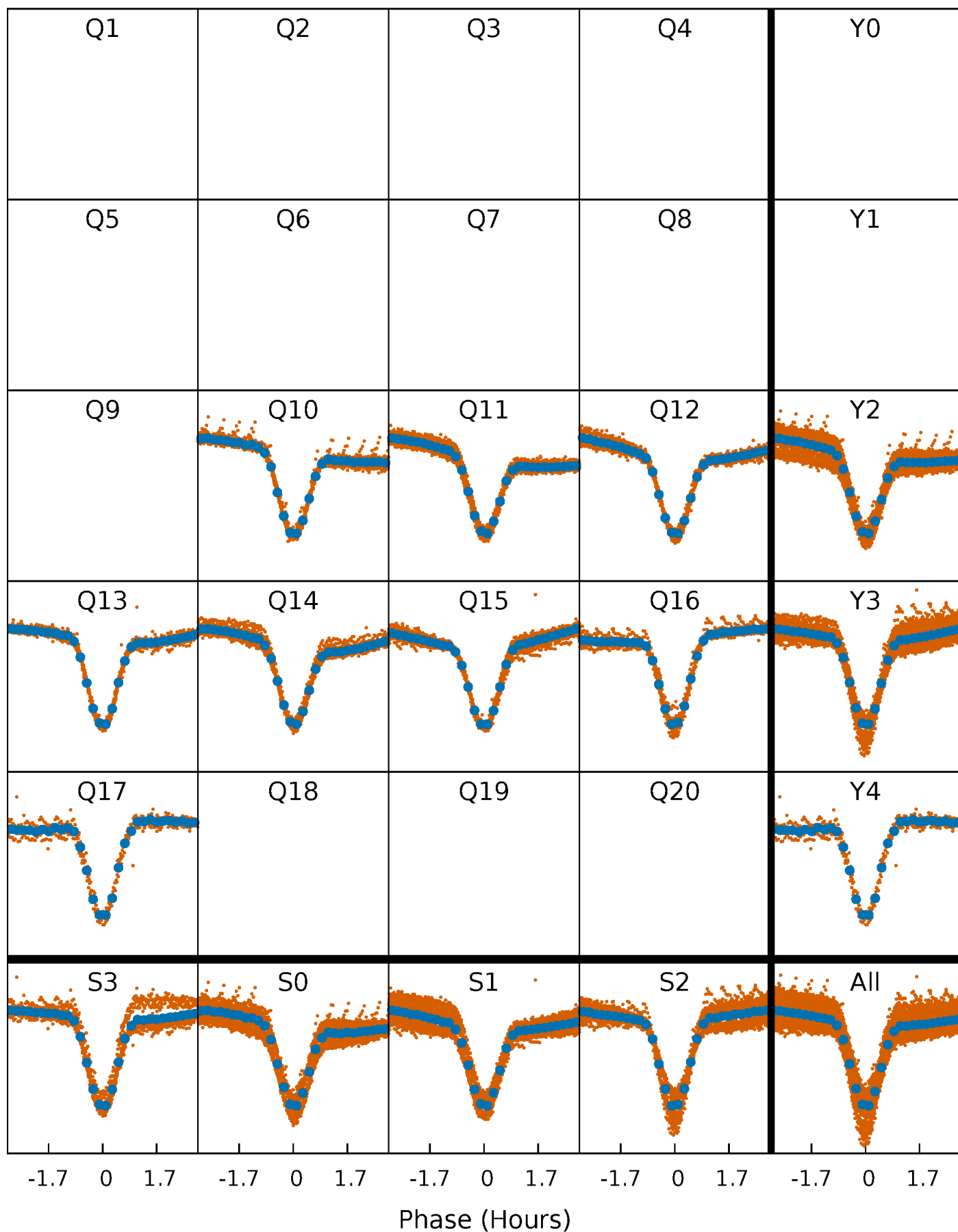
**Planet 2 : Phased Whitened Flux Time Series (TPS Epoch/Period)**





# PDC Quarter-Phased Transit Curves

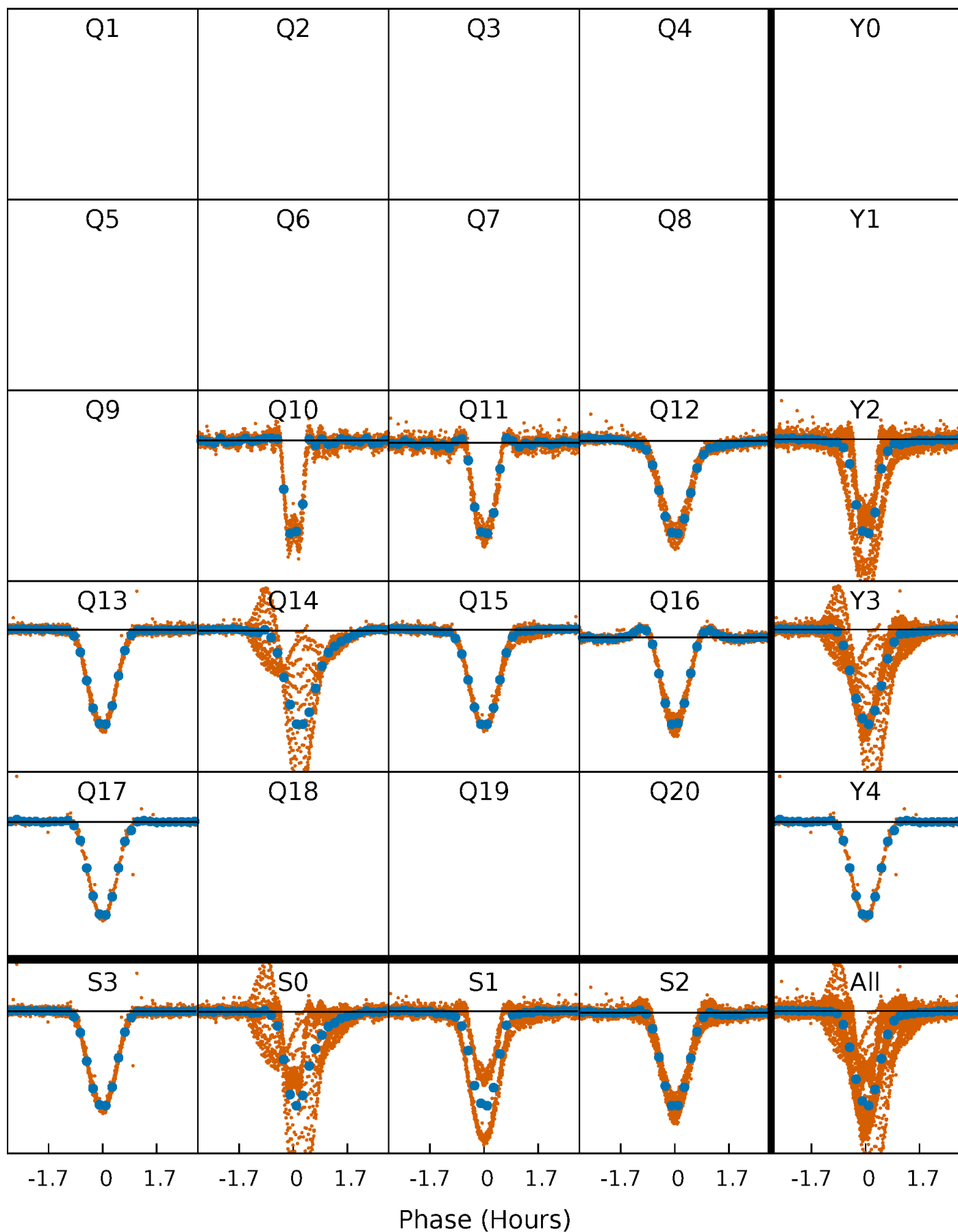
TCE 004037163-02   P= 0.635445 Days    $T_0=131.960994$  (BKJD)





# DV Quarter-Phased Transit Curves

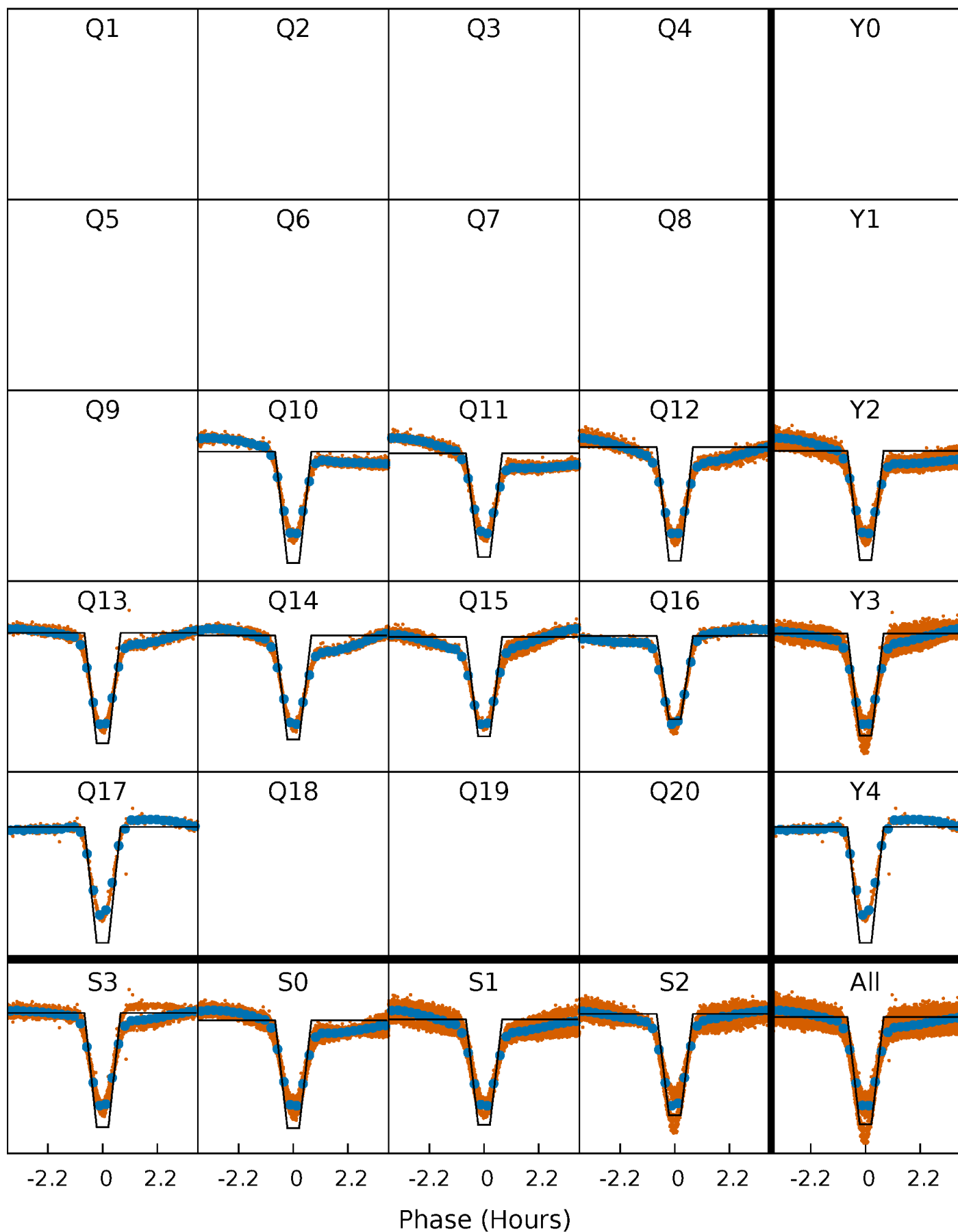
TCE 004037163-02   P= 0.635445 Days    $T_0=131.960994$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

TCE 004037163-02   P= 0.635445 Days    $T_0=131.961561$  (BKJD)

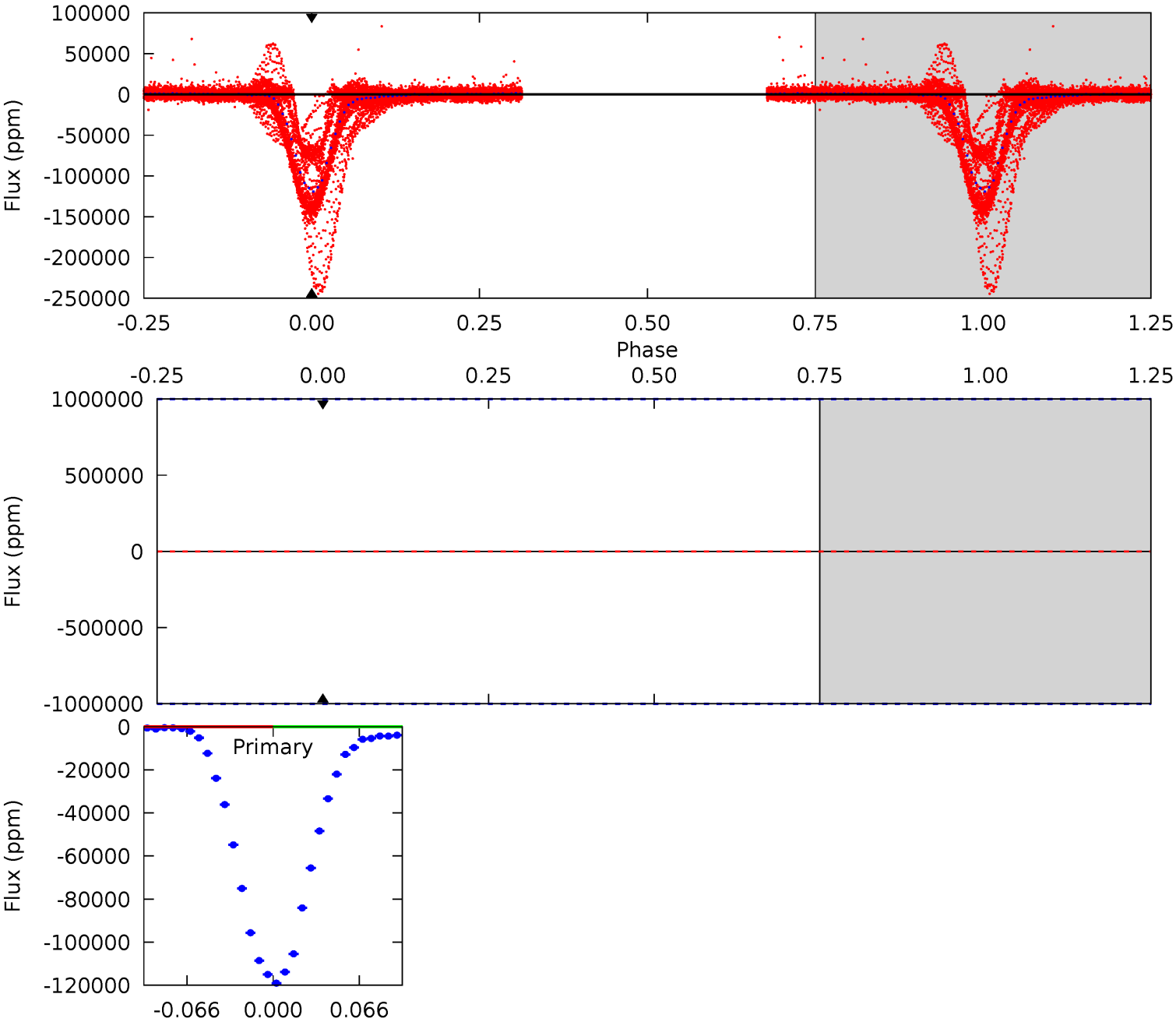




# DV Model-Shift Uniqueness Test

004037163-02, P = 0.635445 Days, E = 131.960994 Days

Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
0	0	0	0	1.00	1.00	1.00	0	0	0	0	0	0	0	0

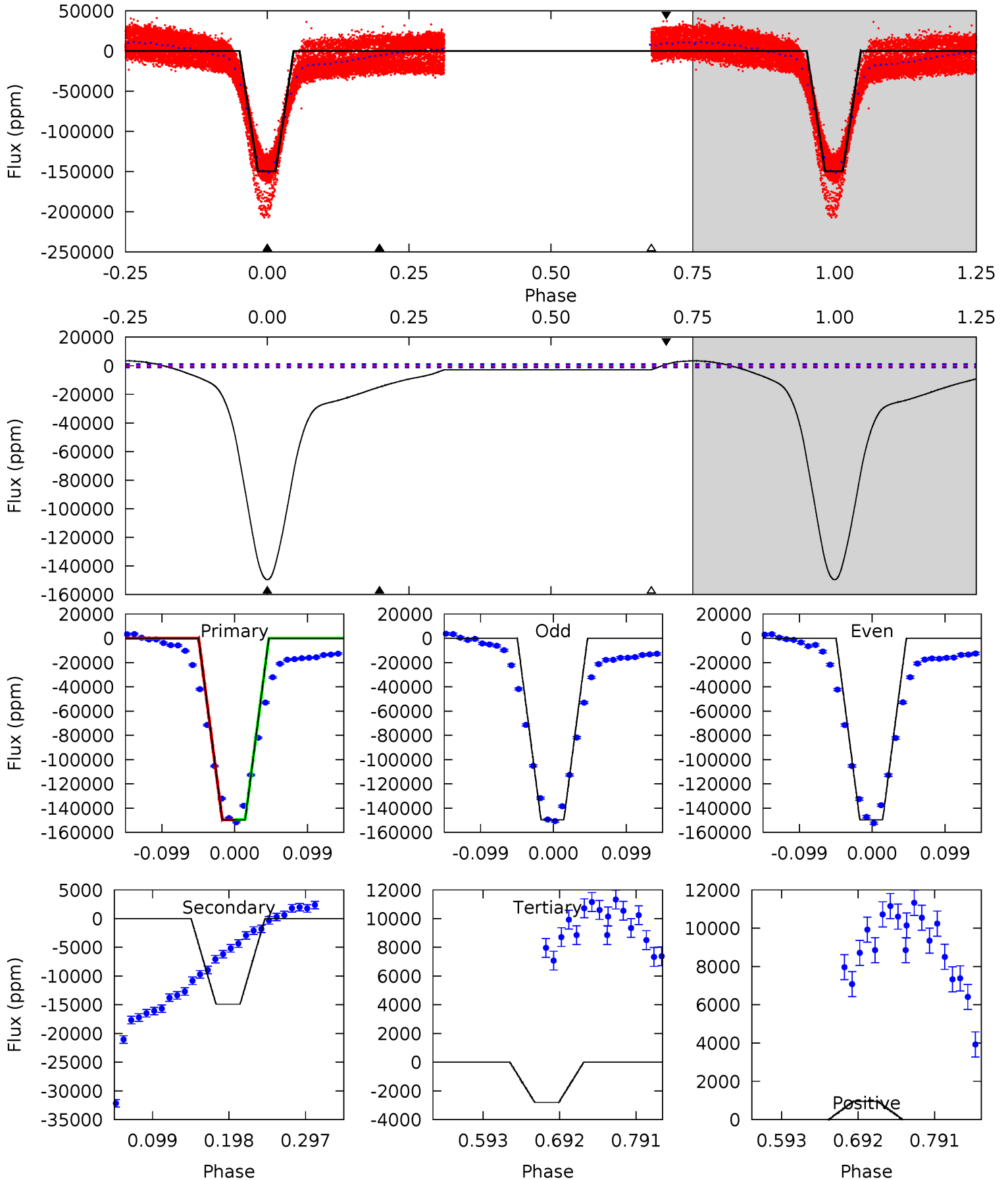




# Alt Model-Shift Uniqueness Test

004037163-02, P = 0.635445 Days, E = 131.961561 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
587.0	58.5	11.0	3.75	4.57	1.65	16.7	576.0	583.2	47.5	54.7	0.22	1.02	0.02	0.49





### Stellar Parameters For KIC 004037163

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5780^{+1}_{-1}$	$4.438^{+1.000}_{-1.000}$	$0.000^{+1.000}_{-1.000}$	$1.000^{+1.000}_{-1.000}$	$-1.000^{+1.000}_{-1.000}$	$-1.000^{+1.000}_{-1.000}$
	+0%/-0%	+23%/-23%	+inf%/-inf%	+100%/-100%	+100%/-100%	+100%/-100%
Source	Solar	Solar	Solar	Solar		

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

### Secondary Eclipse Parameters for KIC 004037163-02 / KOI 3793.01

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$0 \pm 1000000$	$40.80^{+11.69}_{-11.89}$	$2963^{+150}_{-142}$	$-2805^{+8459}_{-2592}$	$0.123^{+9.175}_{-6.835}$
Alt.	$-14900 \pm 255$	$46.10^{+11.36}_{-11.44}$	$2958^{+160}_{-134}$	$3315^{+478}_{-362}$	$0.822^{+0.634}_{-0.287}$

$T_{max}$  = 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

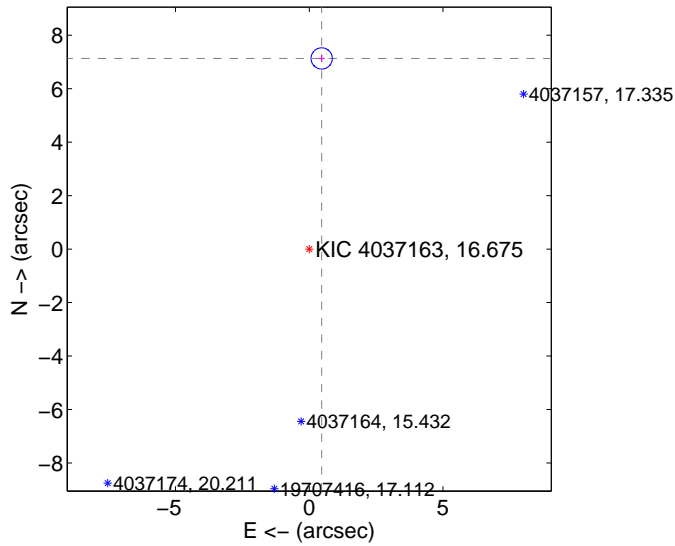
Supplemental centroid analysis for 004037163-02. Kepler magnitude: 16.68. Transit SNR -1.00

There are 8 quarters with good PRF difference image offsets

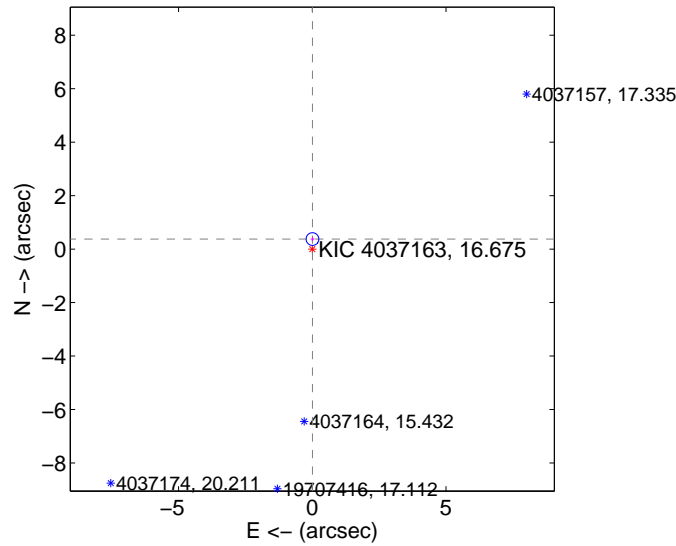
The OOT PRF centroid is offset from the target star catalog position by about 7.13 arcsec so the offset from difference PRF-fit to OOT-fit may be invalid.

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	7.145 $\pm$ 0.132	54.00	-0.465 $\pm$ 0.113	7.129 $\pm$ 0.132
PRF-fit source offset from KIC position	0.375 $\pm$ 0.079	4.73	-0.007 $\pm$ 0.069	0.375 $\pm$ 0.079
photometric centroid source offset	3.69 $\pm$ 0.00	1630.53	0.04 $\pm$ 0.00	-3.68 $\pm$ 0.00

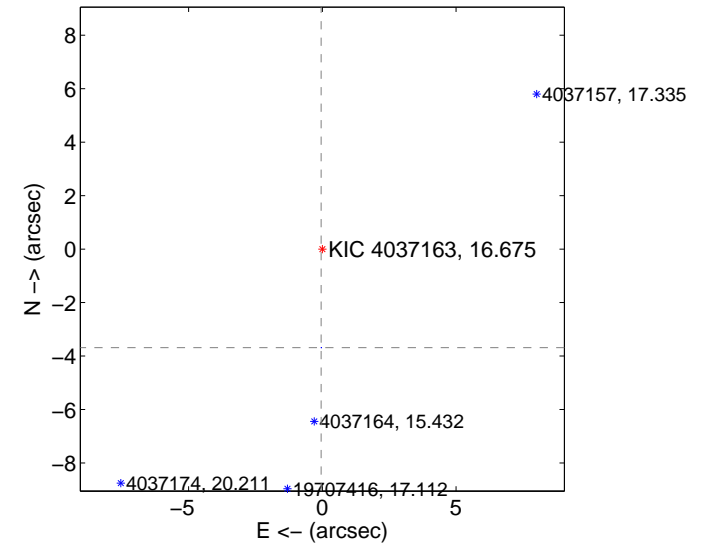
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position



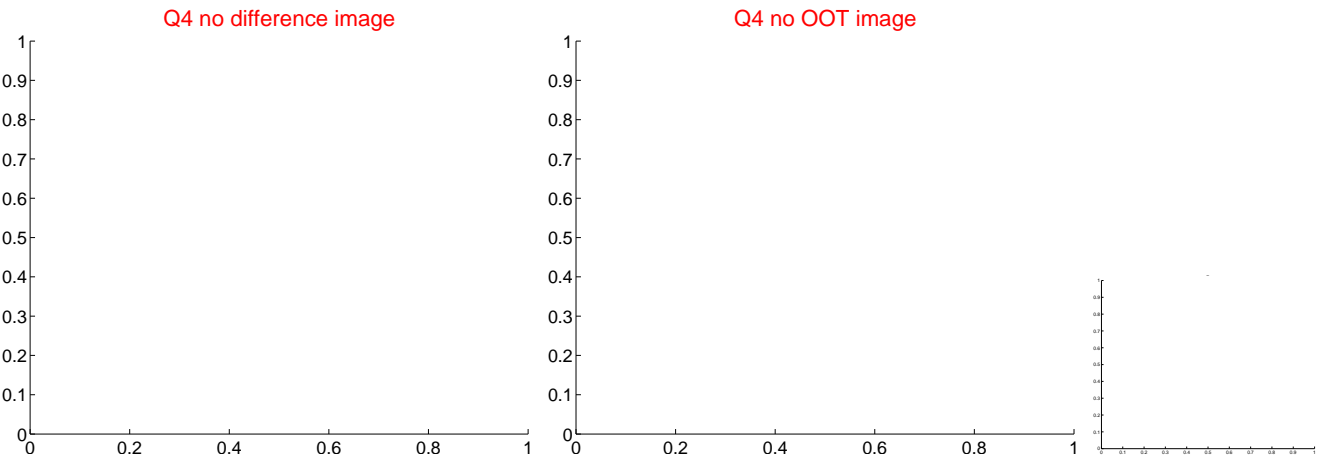
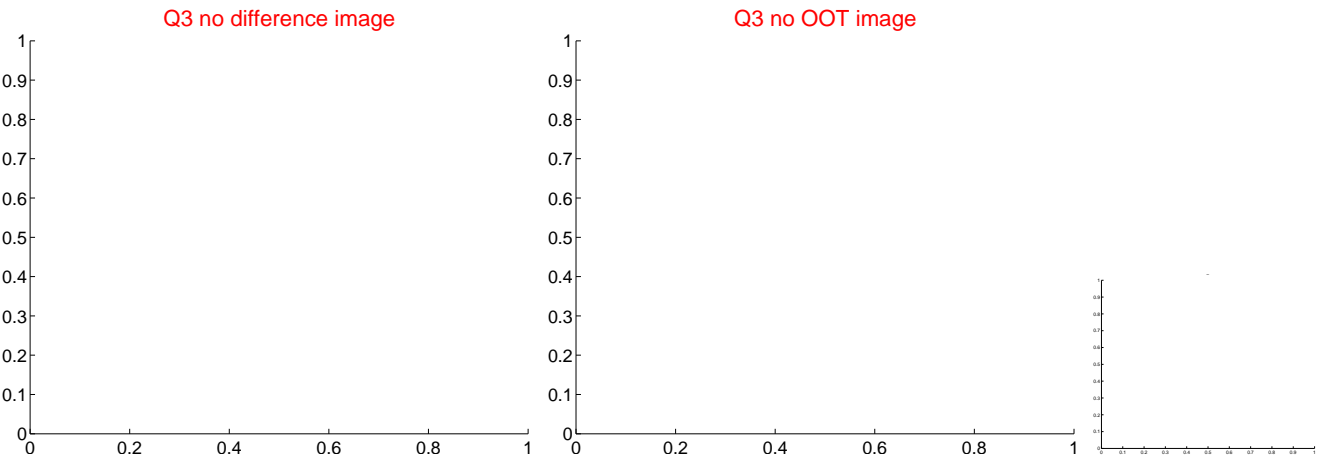
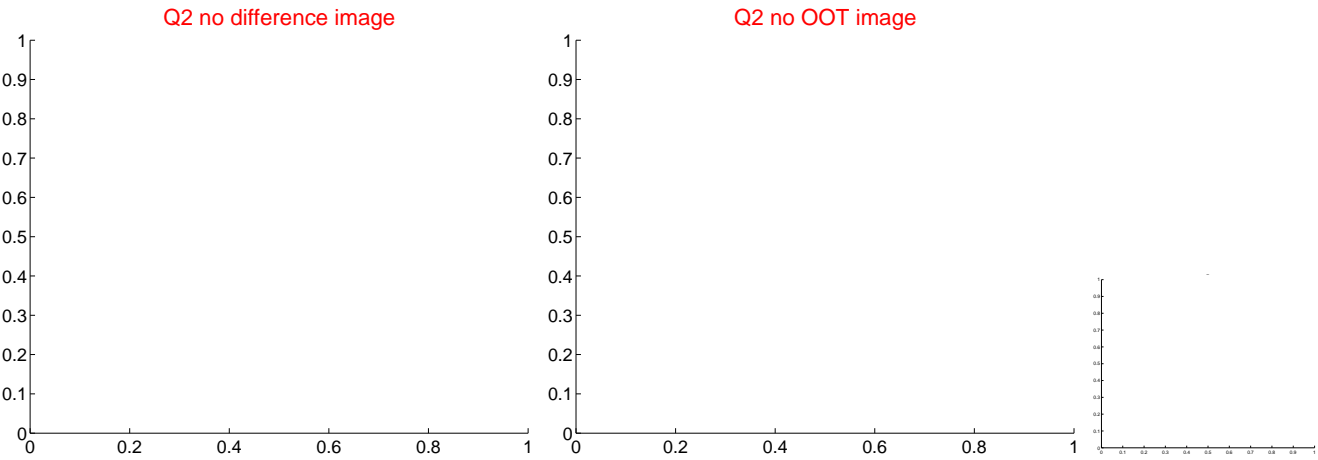
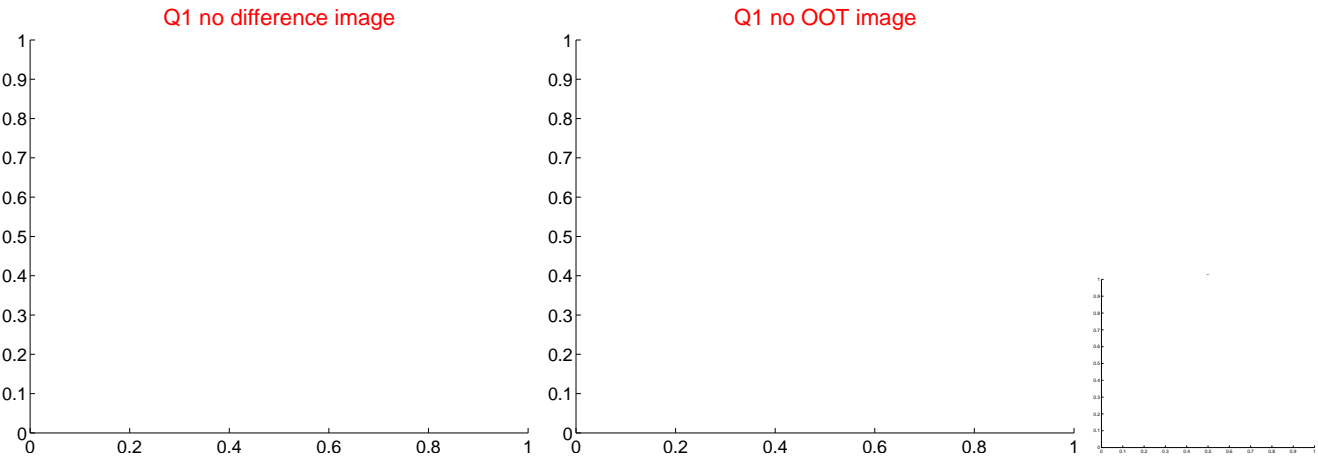
offset from photometric centroids



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

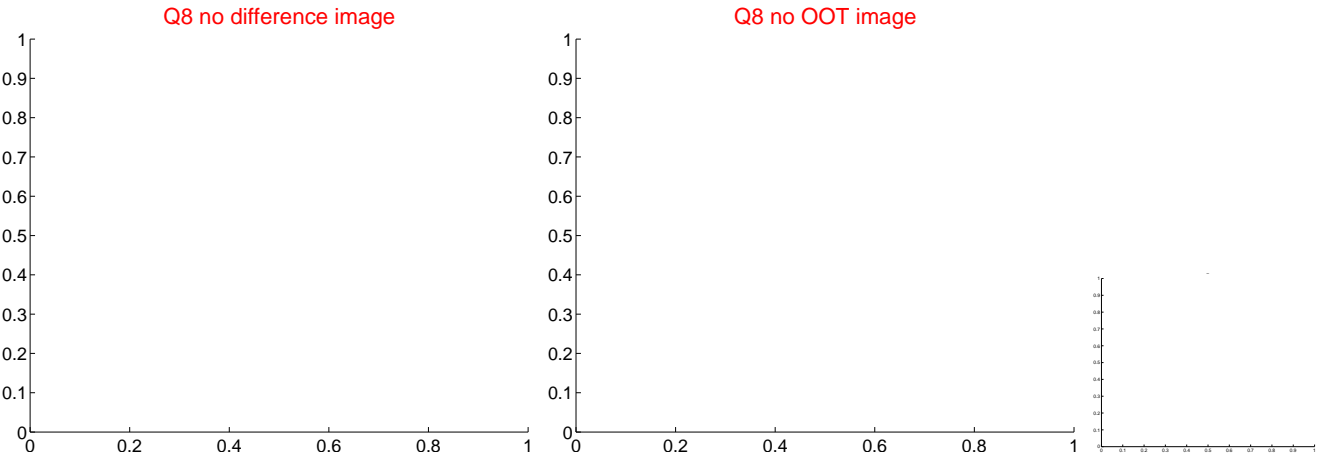
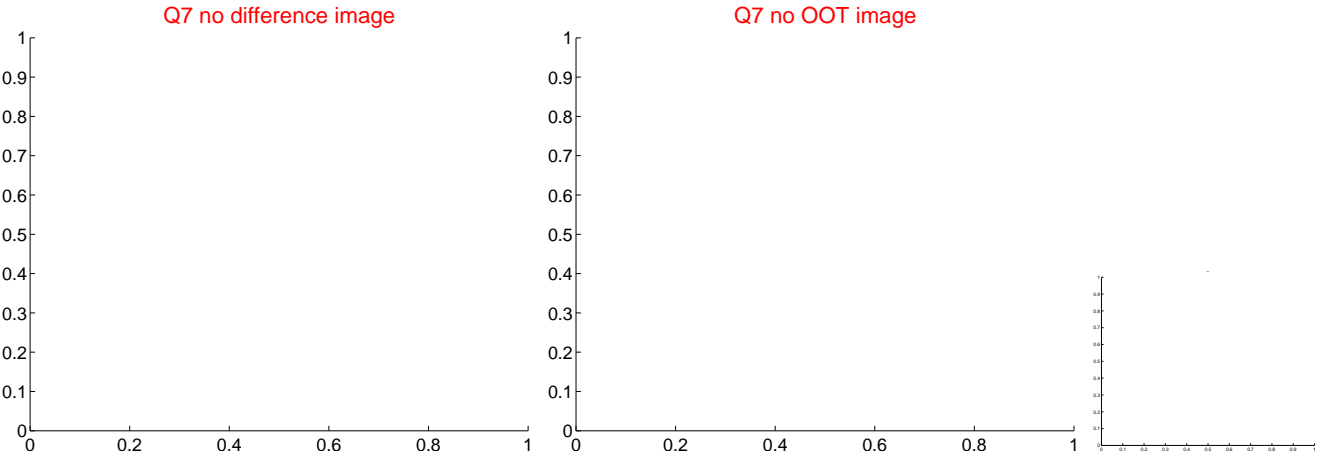
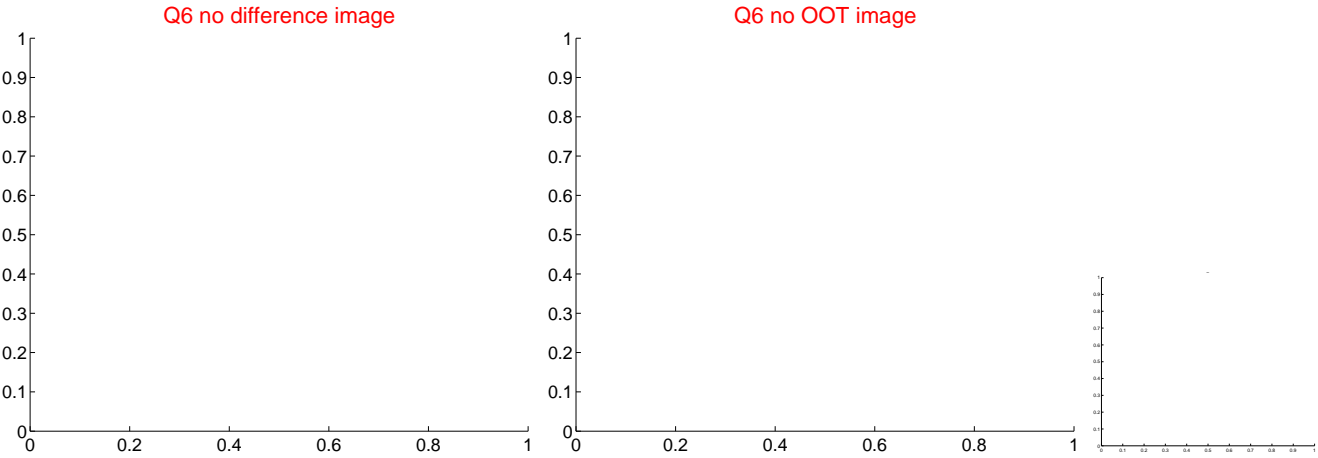
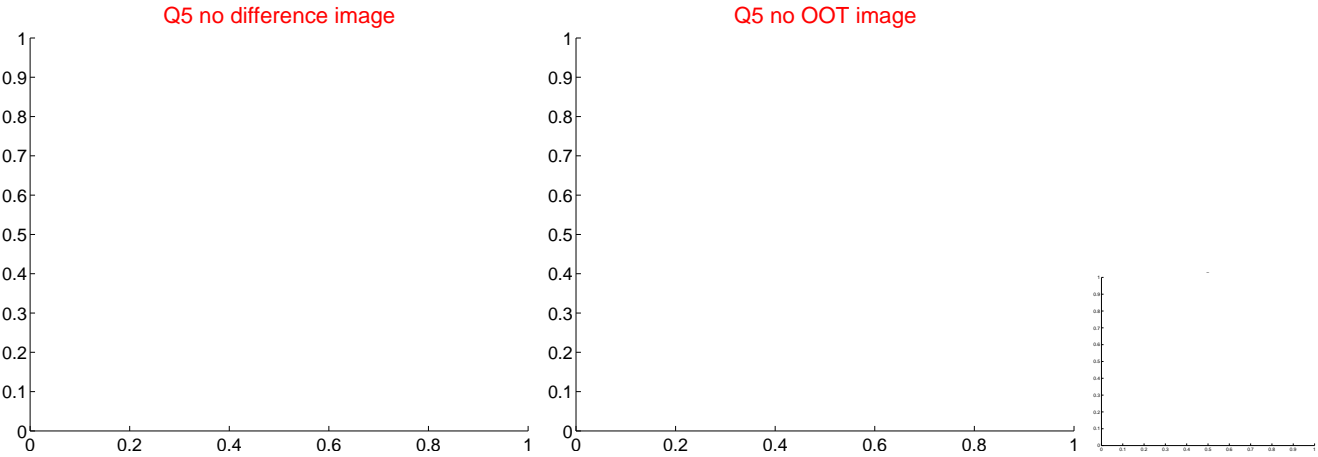


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



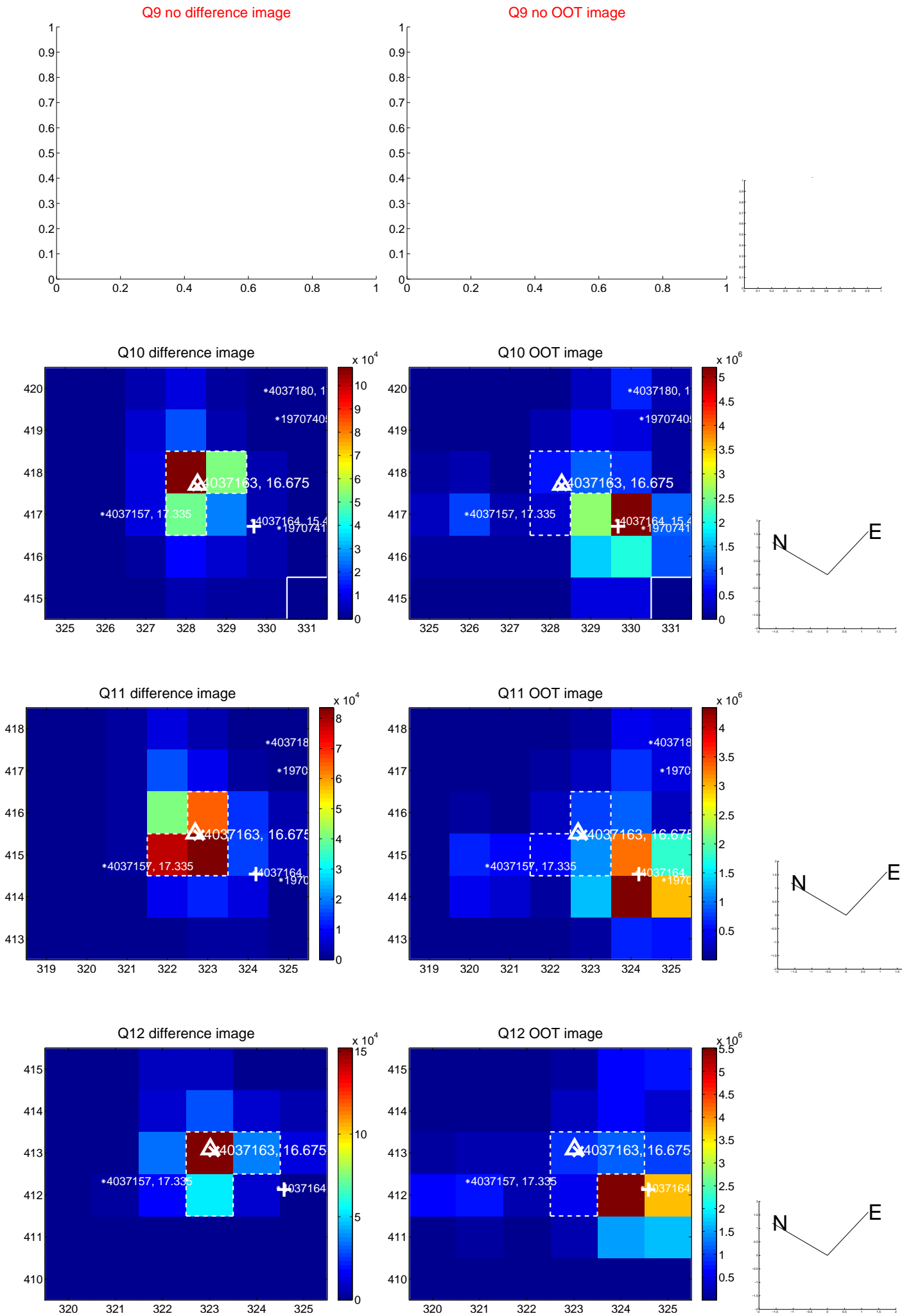


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



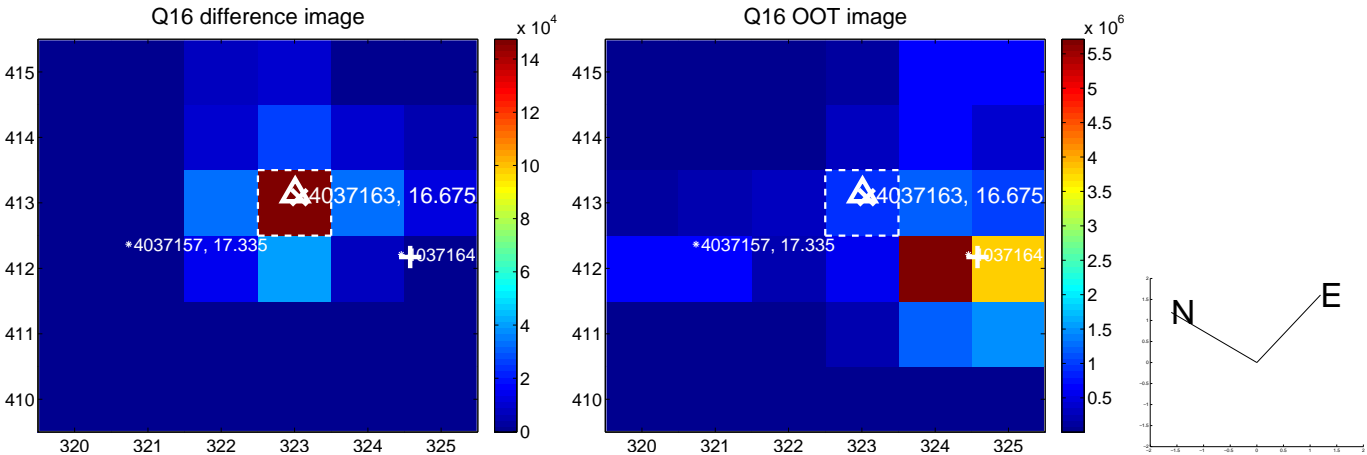
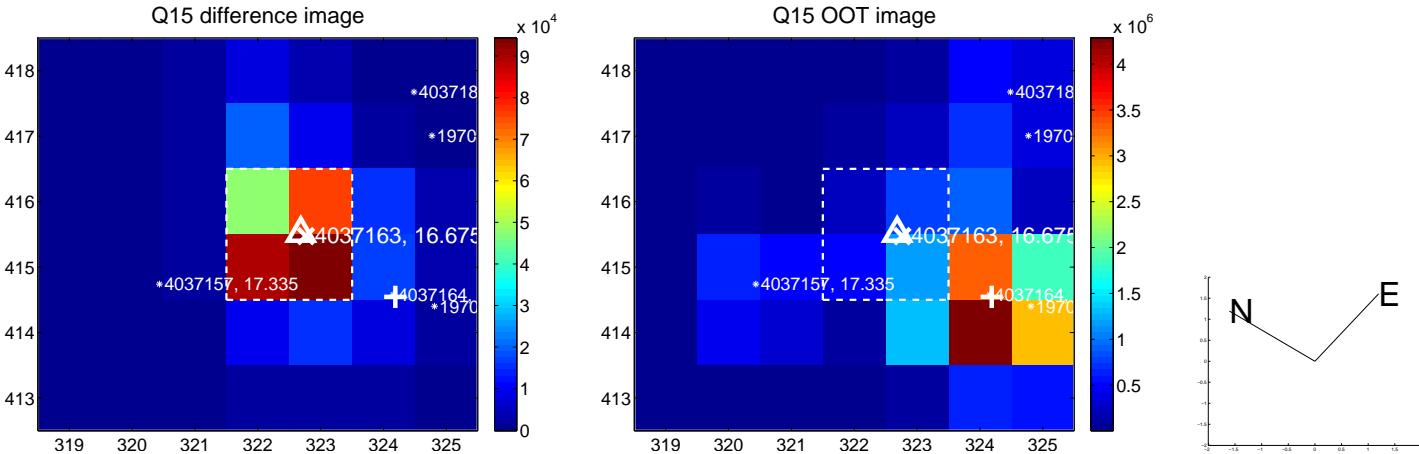
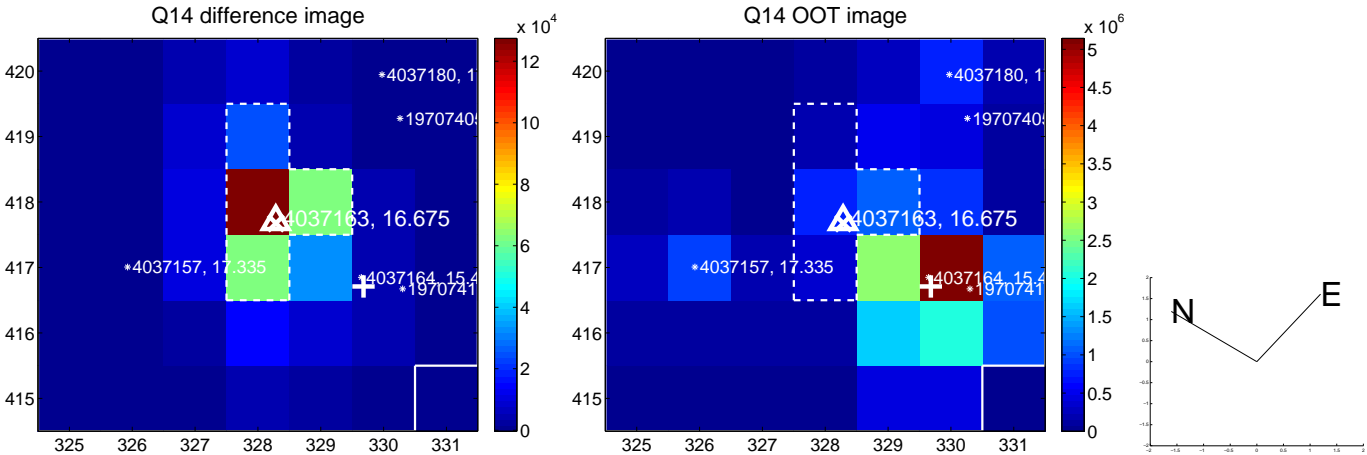
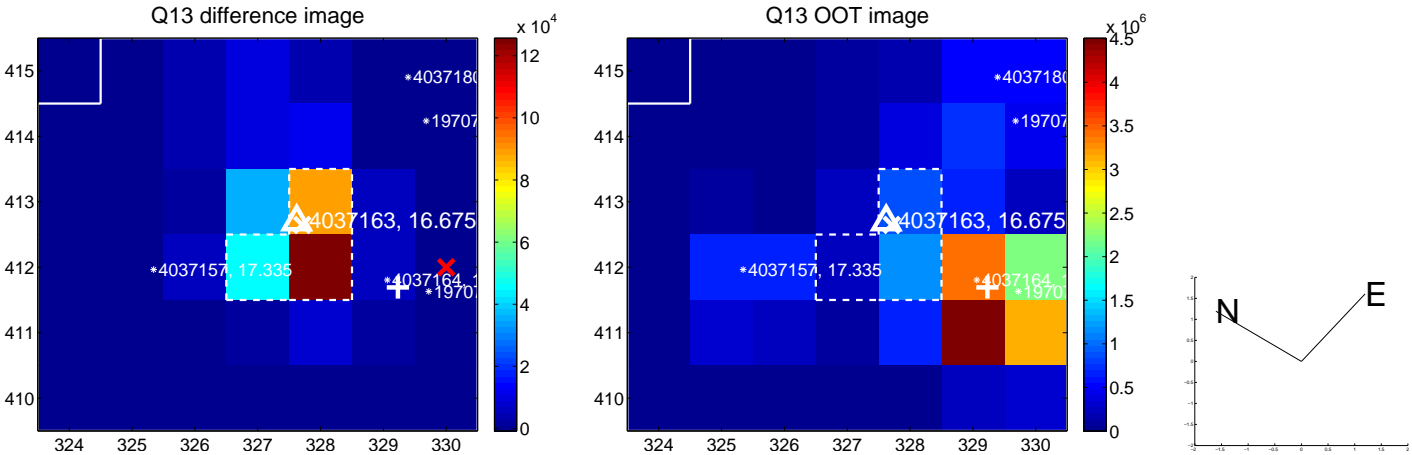


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



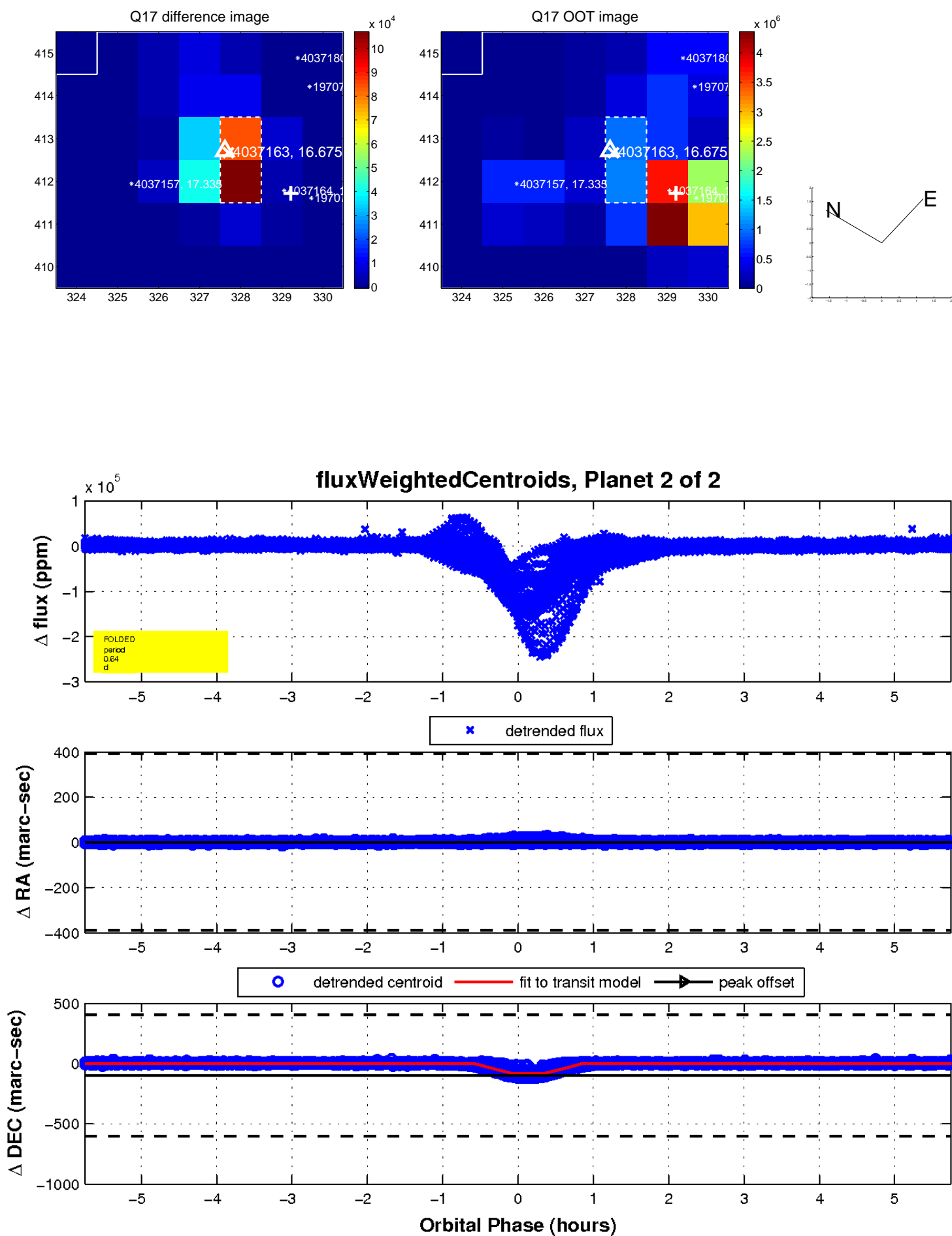


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





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





UKIRT Image

Declination

