

# KIC 009178185

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009178185-01	OBS	3868.01	2.992697	133.297184	369.6	1.651	35.1	43.7	3.92	5908	10.49	6956.55
009178185-02	OBS	No	2.992762	131.787552	64.0	1.642	8.3	9.1	3.92	5908	3.73	6956.35

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009178185-01	OBS	FP	0.00	0	1	1	0	MOD_SEC_DV—MOD_SEC_ALT—HAS_SEC_TCE—CENT_UNRESOLVED_OFFSET
009178185-02	OBS	FP	0.00	1	1	0	0	IS_SEC_TCE—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.

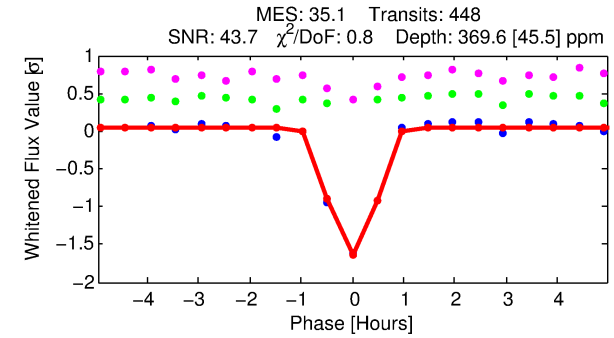
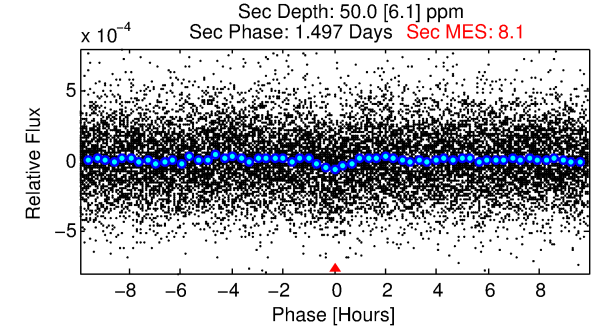
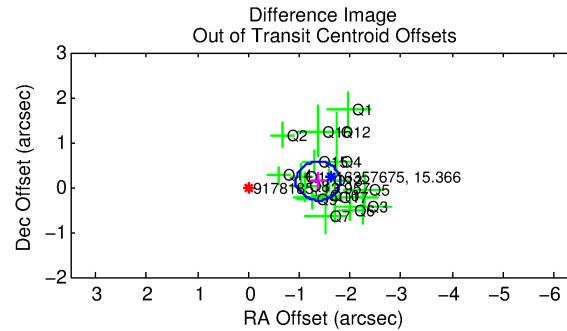
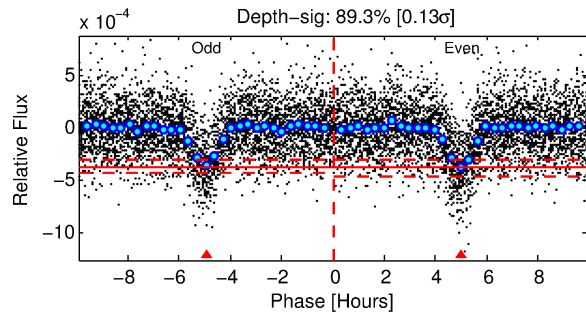
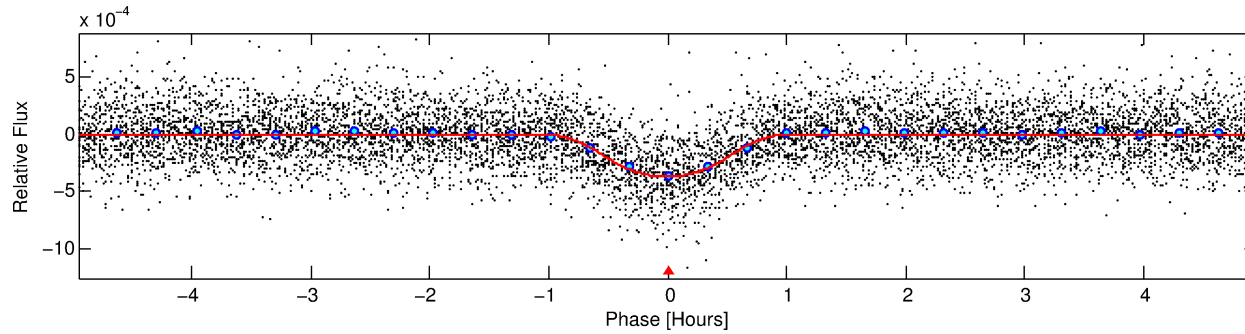
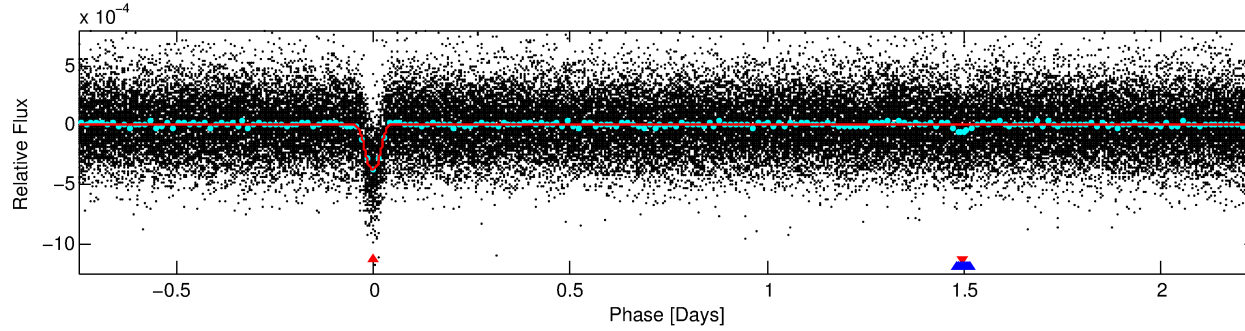
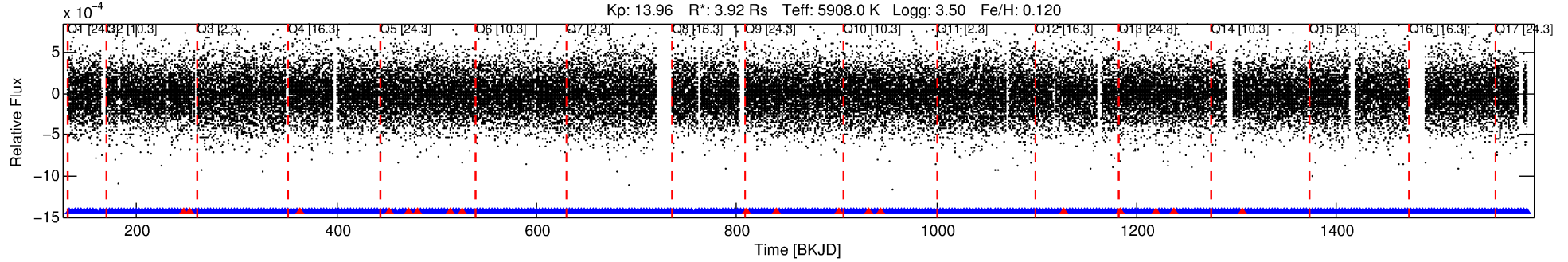
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 009178185-01

No Significant Match Found

# DV One-Page Summary

KIC: 9178185 Candidate: 1 of 2 Period: 2.993 d  
KOI: K03868.01 Corr: 0.865



## DV Fit Results:

Period = 2.99270 [0.00000] d  
Epoch = 133.2972 [0.0006] BKJD  
Rp/R\* = 0.0245 [0.0035]  
a/R\* = 4.35 [0.56]  
b = 0.98 [0.01]  
Seff = 6956.55 [8731.57]  
Teq = 2329 [731] K  
Rp = 10.49 [7.35] Re  
a = 0.0490 [0.0362] AU  
Ag = 0.60 [0.77] [-0.52 $\sigma$ ]  
Teffp = 3171 [268] K [1.08 $\sigma$ ]

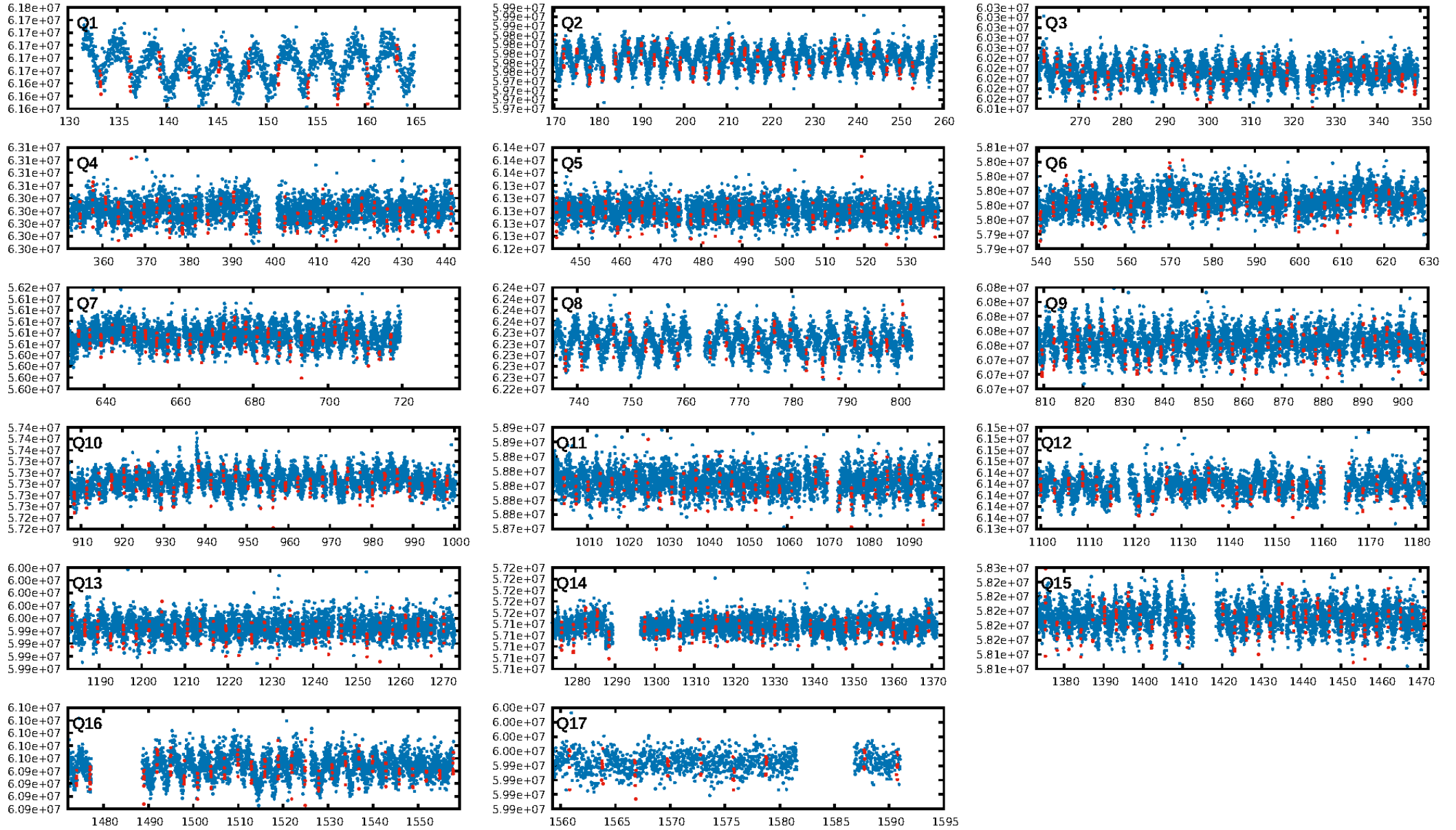
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 0.1% [0.00 $\sigma$ ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: 3.52e-269  
RollingBand-fgt: 0.96 [410/428]  
GhostDiagnostic-chr: 3.519  
Centroid-sig: 0.0%  
Centroid-so: 0.803 arcsec [3.05 $\sigma$ ]  
OotOffset-rm: 1.377 arcsec [9.53 $\sigma$ ]  
KicOffset-rm: 1.354 arcsec [9.65 $\sigma$ ]  
OotOffset-st: 4/4/4/5 [17]  
KicOffset-st: 4/4/4/5 [17]  
DiffImageQuality-fgm: 1.00 [17/17]  
DiffImageOverlap-fno: 1.00 [17/17]

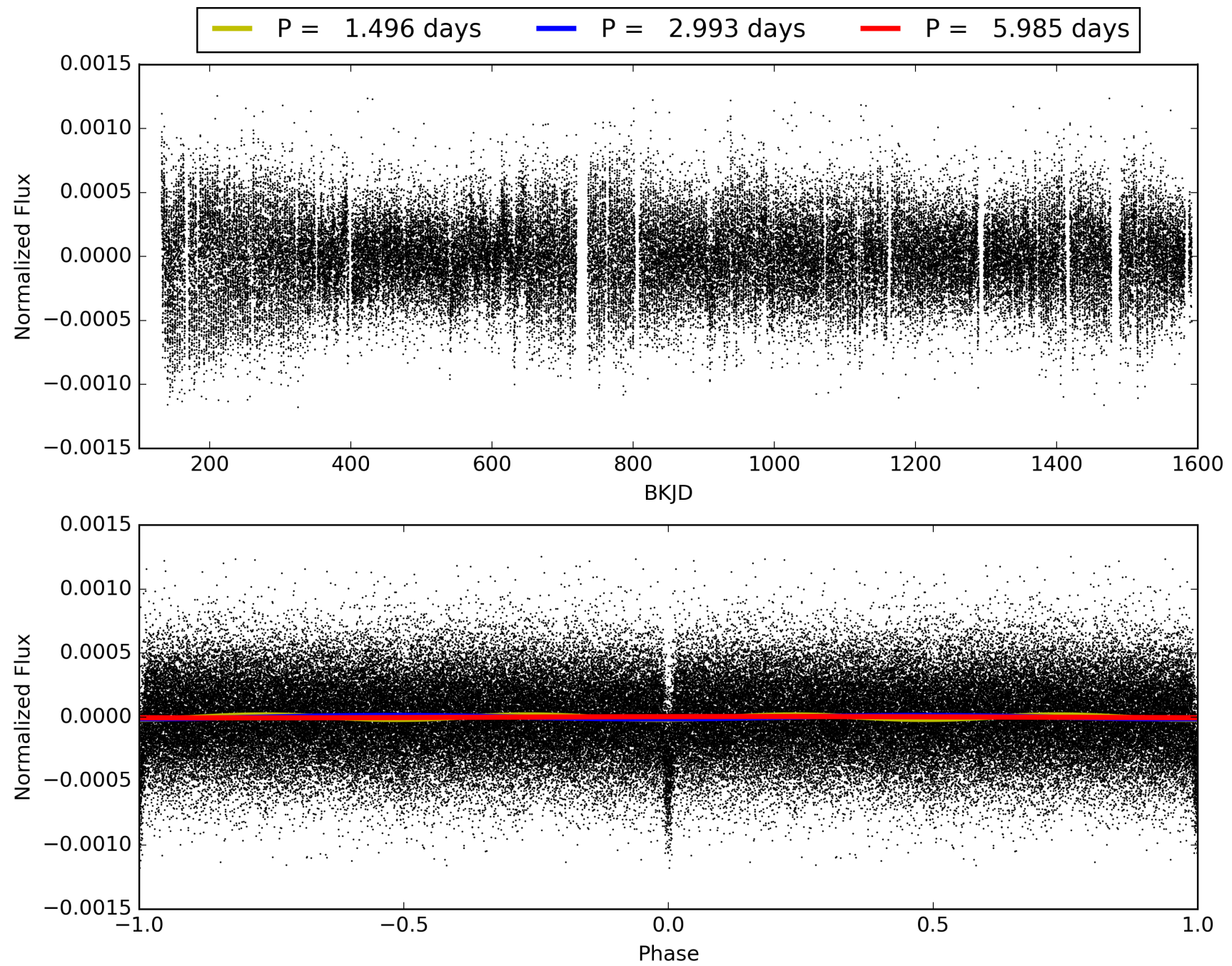
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 15:11:11 Z

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

# TCE 009178185-01, PDC Light Curves



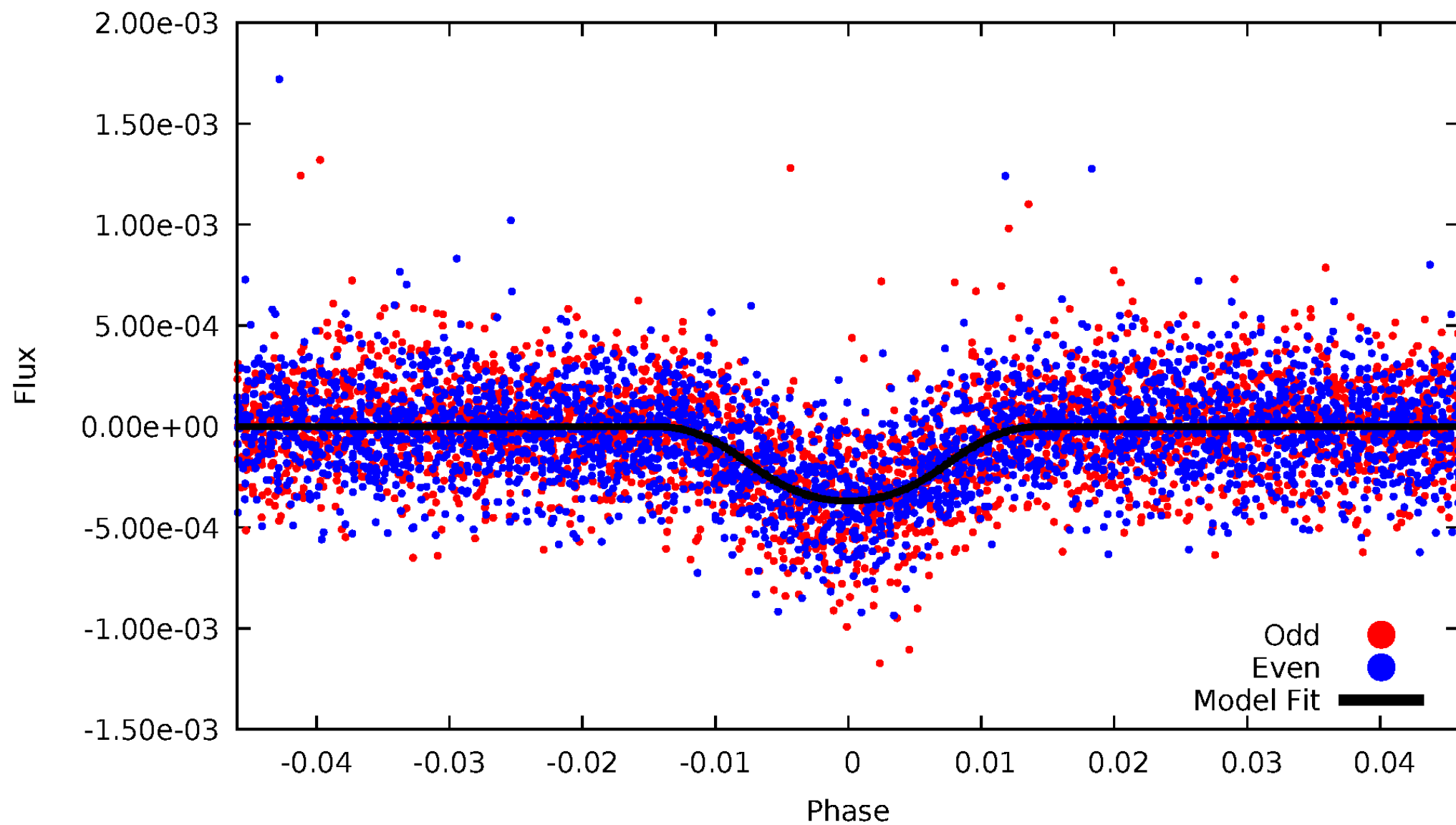
TCE 009178185-01





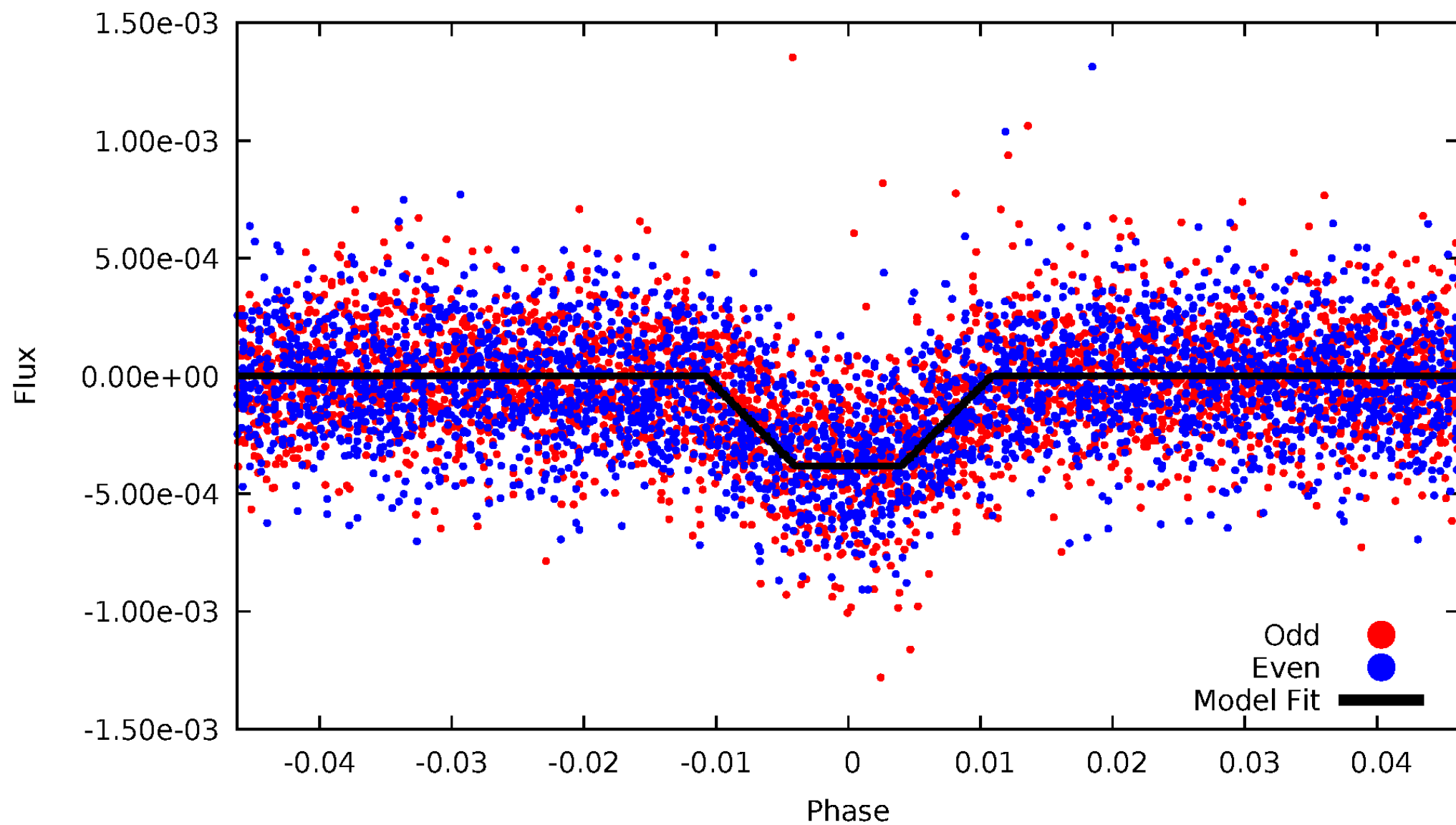
# DV Odd/Even

TCE 009178185-01



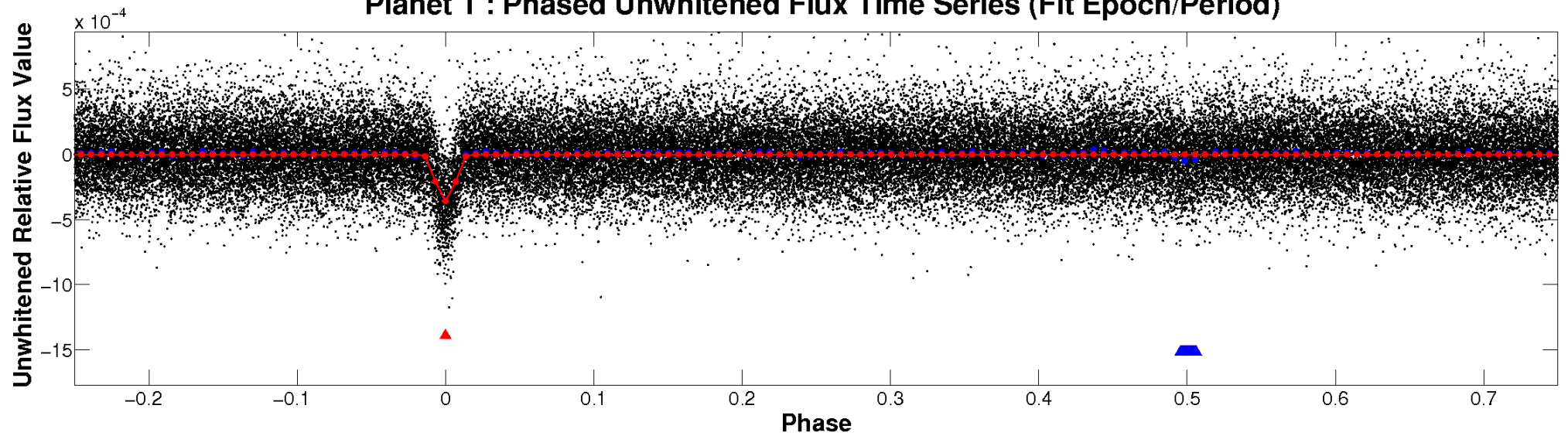
# ALT Odd/Even

TCE 009178185-01

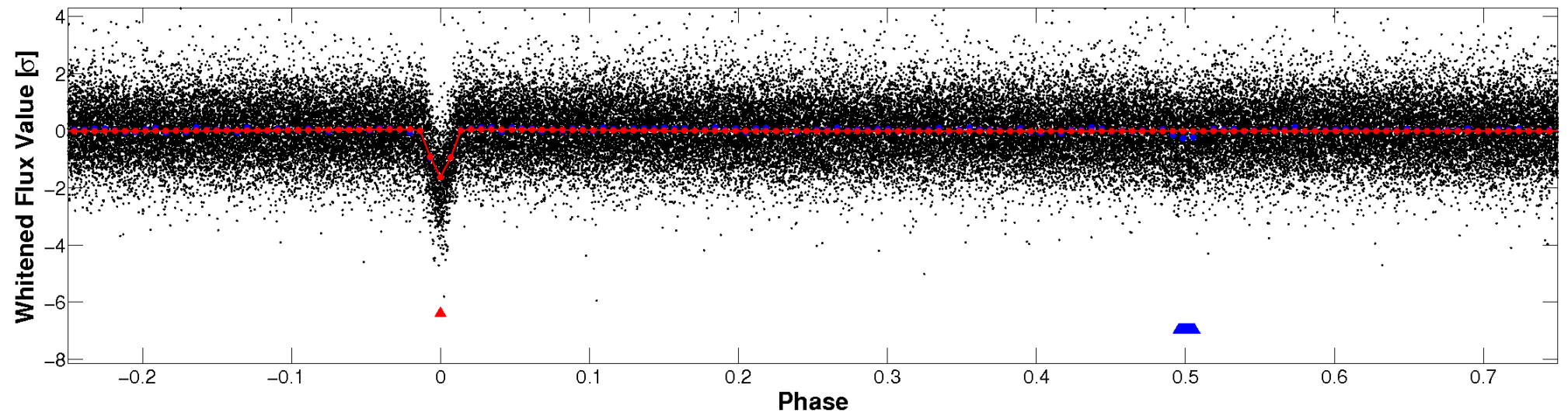


# Non-Whitened Vs. Whitened Light Curve

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

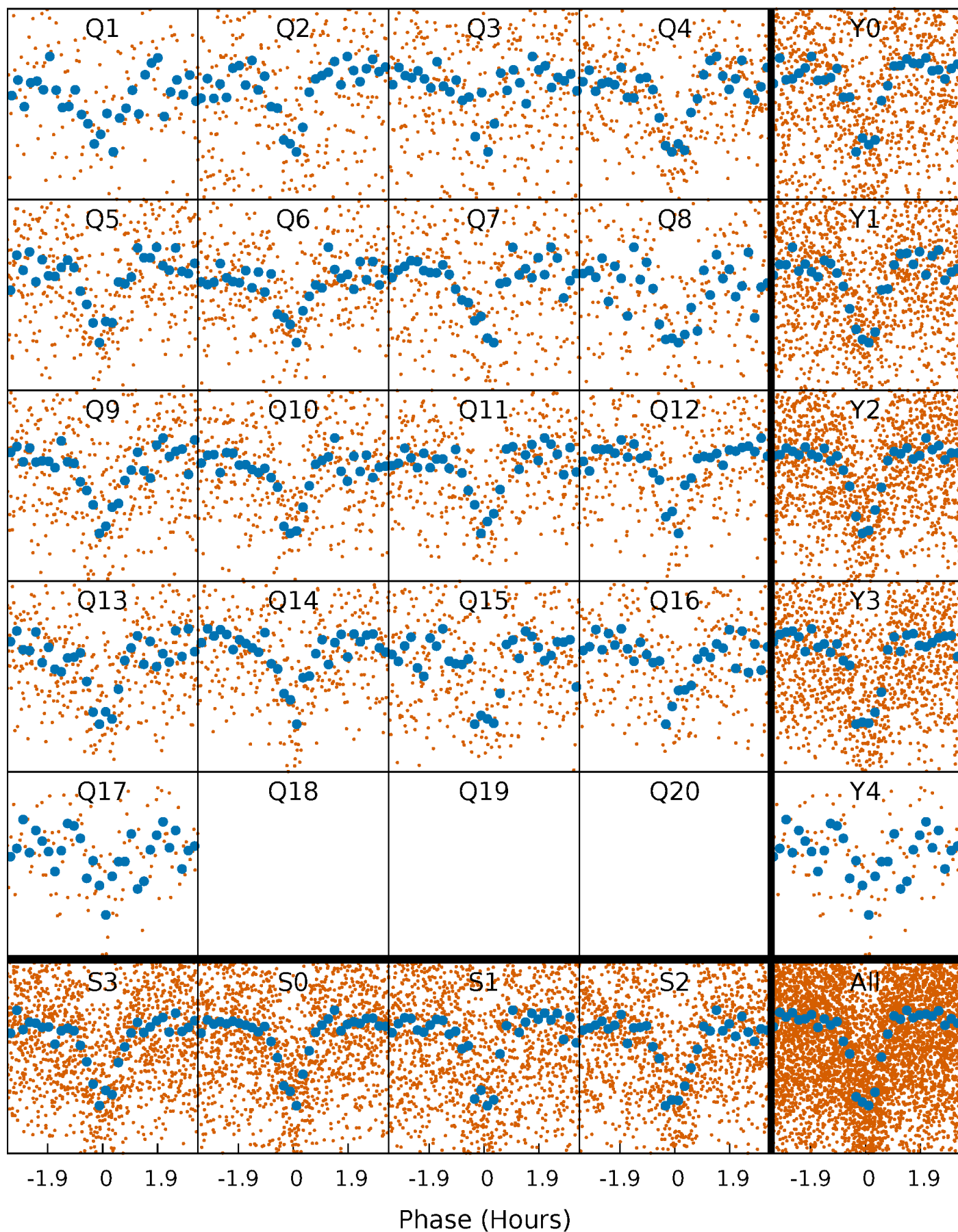


**Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



# PDC Quarter-Phased Transit Curves

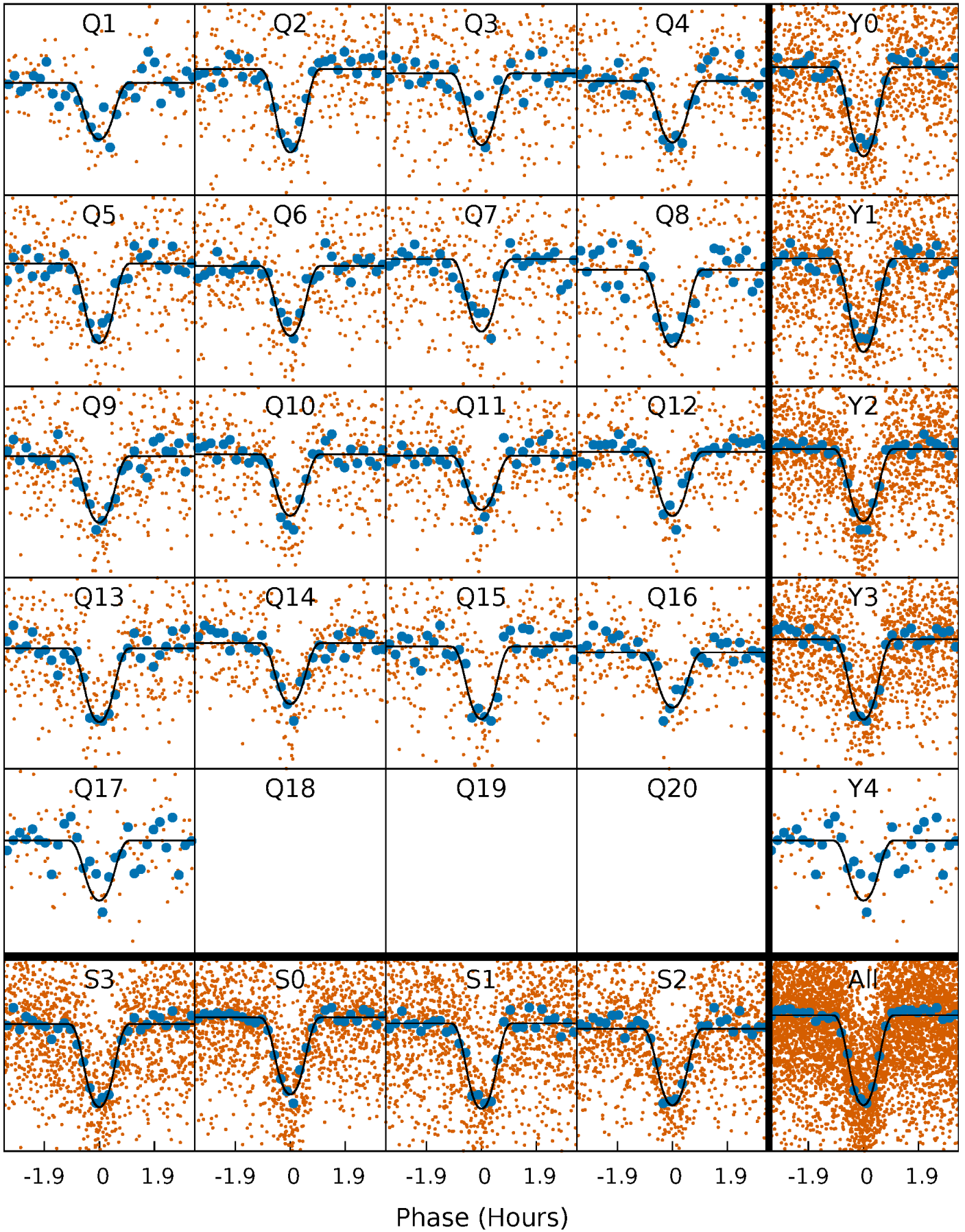
TCE 009178185-01 P= 2.992697 Days  $T_0=133.297184$  (BKJD)





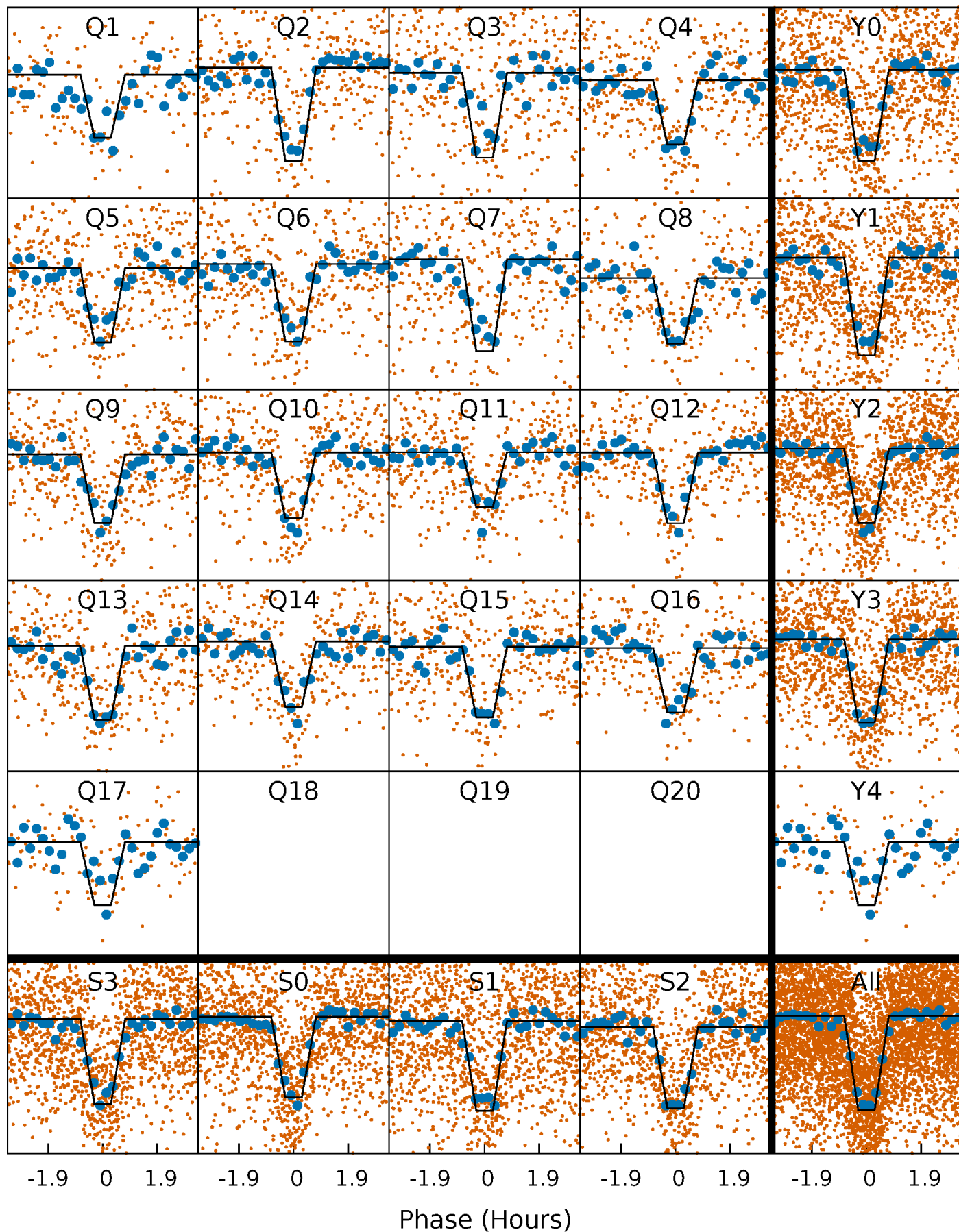
# DV Quarter-Phased Transit Curves

TCE 009178185-01 P= 2.992697 Days  $T_0=133.297184$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

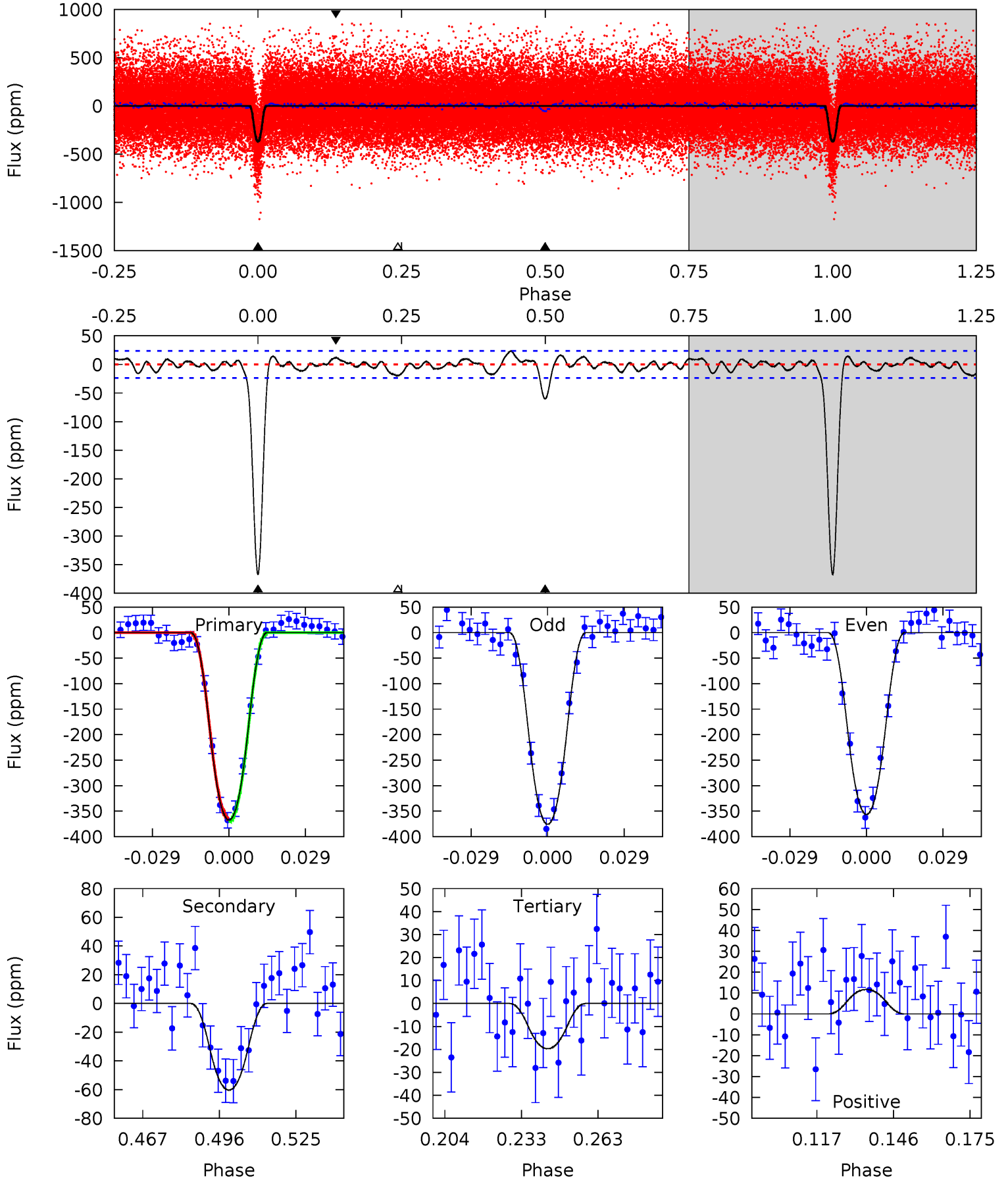
TCE 009178185-01 P= 2.992698 Days  $T_0=133.296673$  (BKJD)



# DV Model-Shift Uniqueness Test

009178185-01, P = 2.992697 Days, E = 130.304487 Days

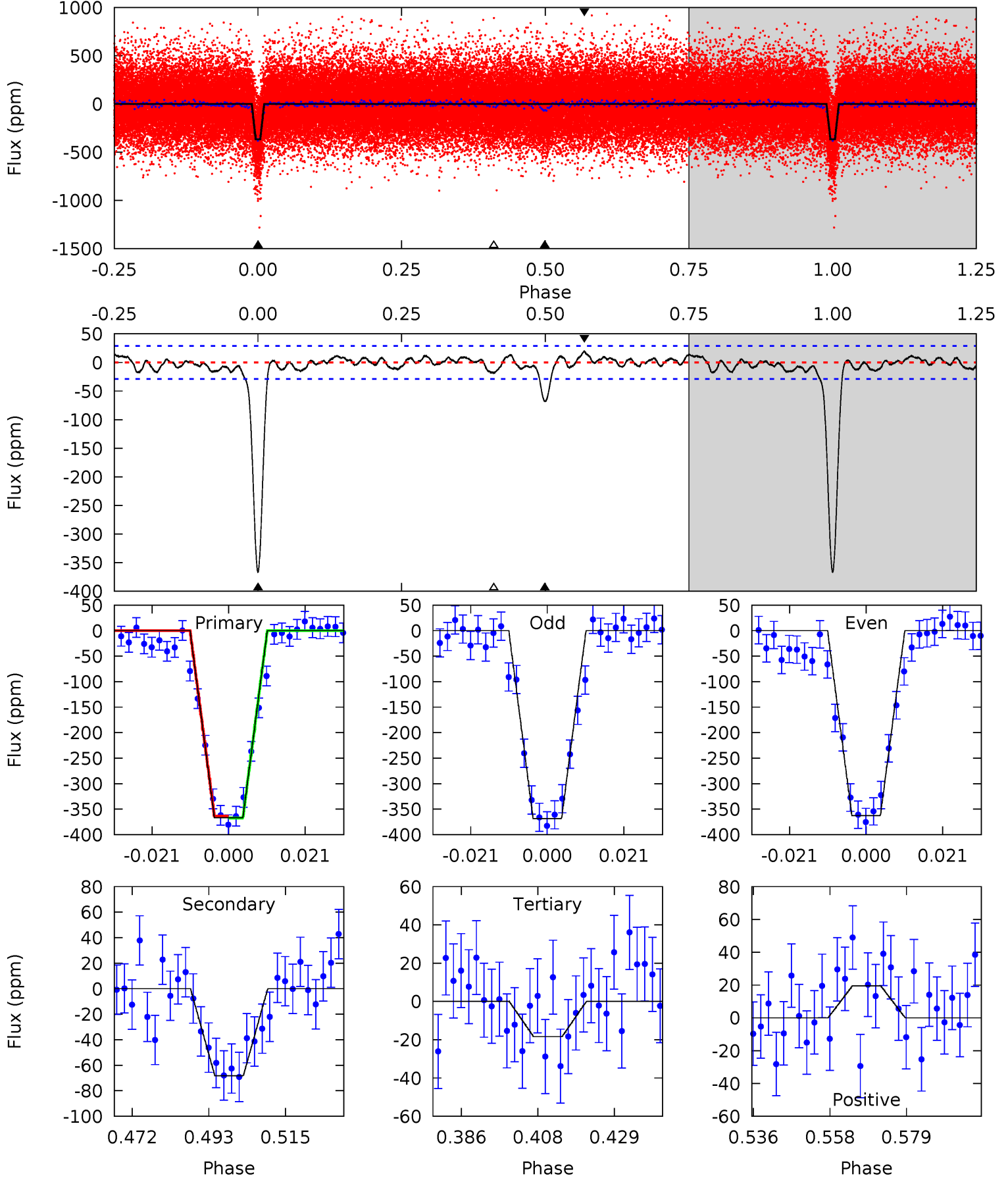
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
74.7	12.3	4.01	2.39	4.82	2.18	1.54	70.7	72.3	8.27	9.89	1.96	0.98	0.06	0.58



# Alt Model-Shift Uniqueness Test

009178185-01, P = 2.992698 Days, E = 130.303975 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
61.9	11.5	3.10	3.29	4.88	2.30	1.35	58.8	58.6	8.42	8.23	0.48	0.98	0.05	0.32





### Stellar Parameters For KIC 009178185

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5908^{+206}_{-206}$	$3.497^{+0.756}_{-0.133}$	$0.120^{+0.250}_{-0.300}$	$3.915^{+0.895}_{-2.686}$	$1.755^{+0.123}_{-0.694}$	$0.041^{+0.680}_{-0.016}$
	+3%/-3%	+22%/-4%	+208%/-250%	+23%/-69%	+7%/-40%	+1650%/-39%
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 009178185-01 / KOI 3868.01

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-60 \pm 5$	$9.39^{+2.68}_{-3.35}$	$3129^{+328}_{-514}$	$3500^{+271}_{-308}$	$0.885^{+0.995}_{-0.332}$
Alt.	$-68 \pm 6$	$7.21^{+2.61}_{-2.49}$	$3121^{+330}_{-540}$	$3982^{+363}_{-318}$	$1.671^{+2.055}_{-0.714}$

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

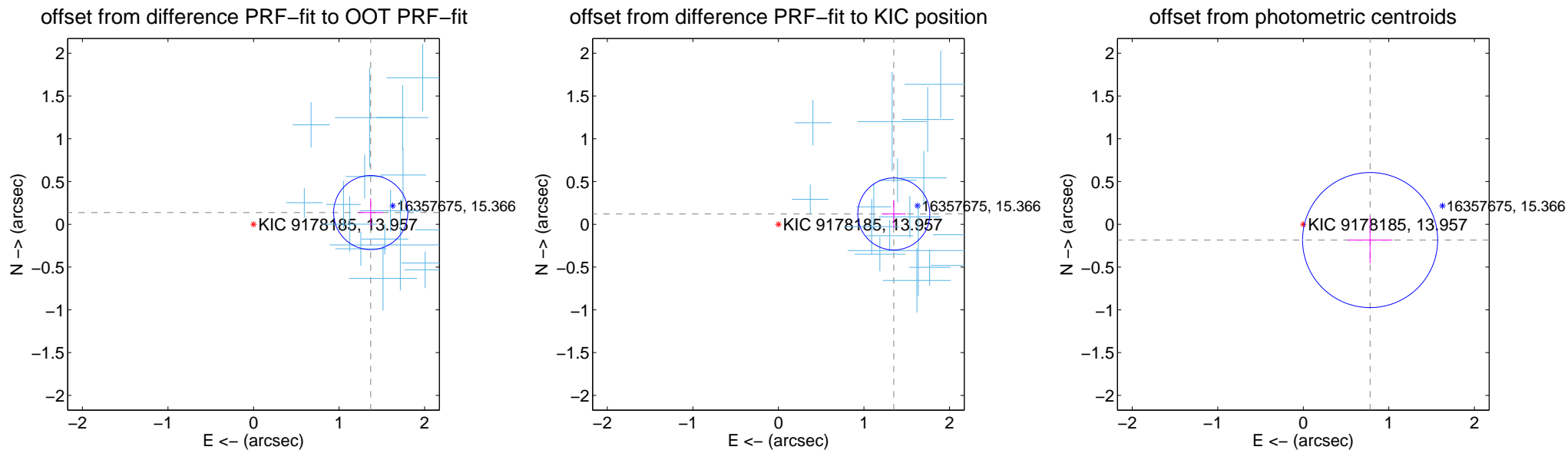
## DV Centroid Data

Supplemental centroid analysis for 009178185-01. Kepler magnitude: 13.96. Transit SNR 43.69

There are 17 quarters with good PRF difference image offsets

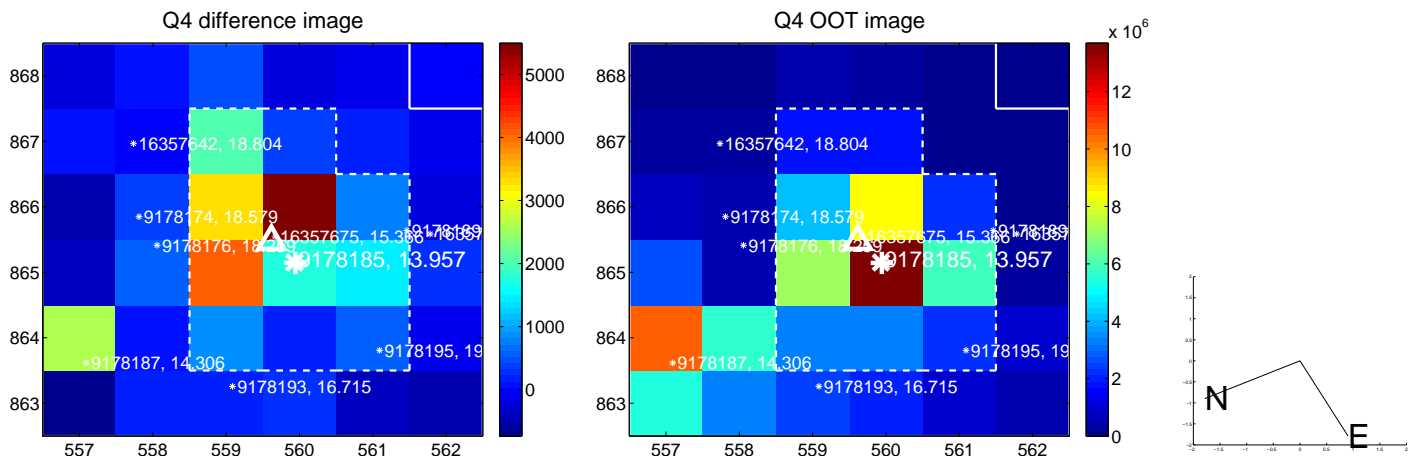
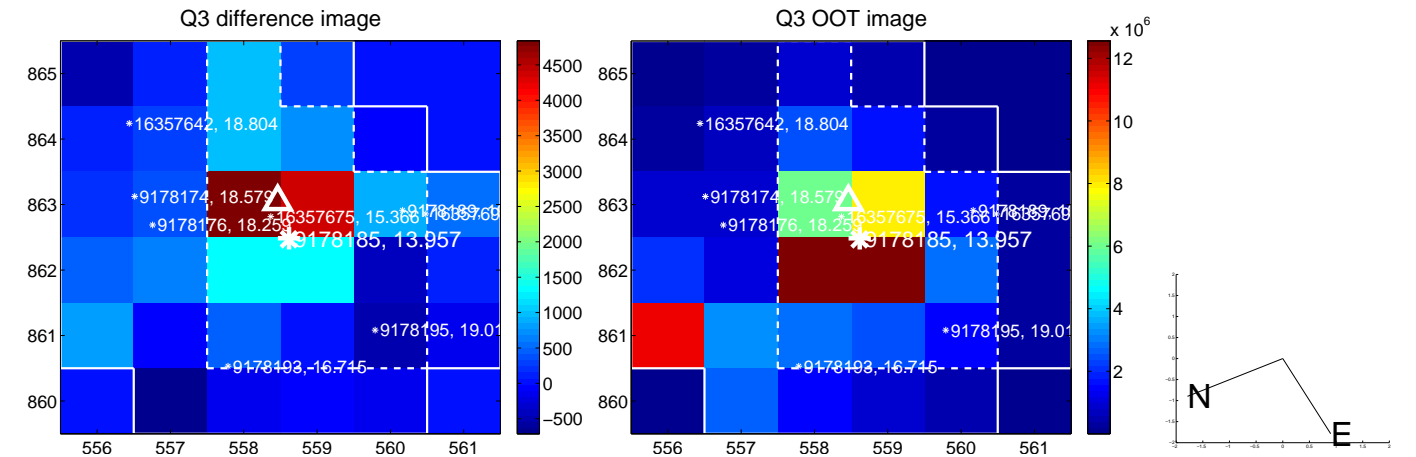
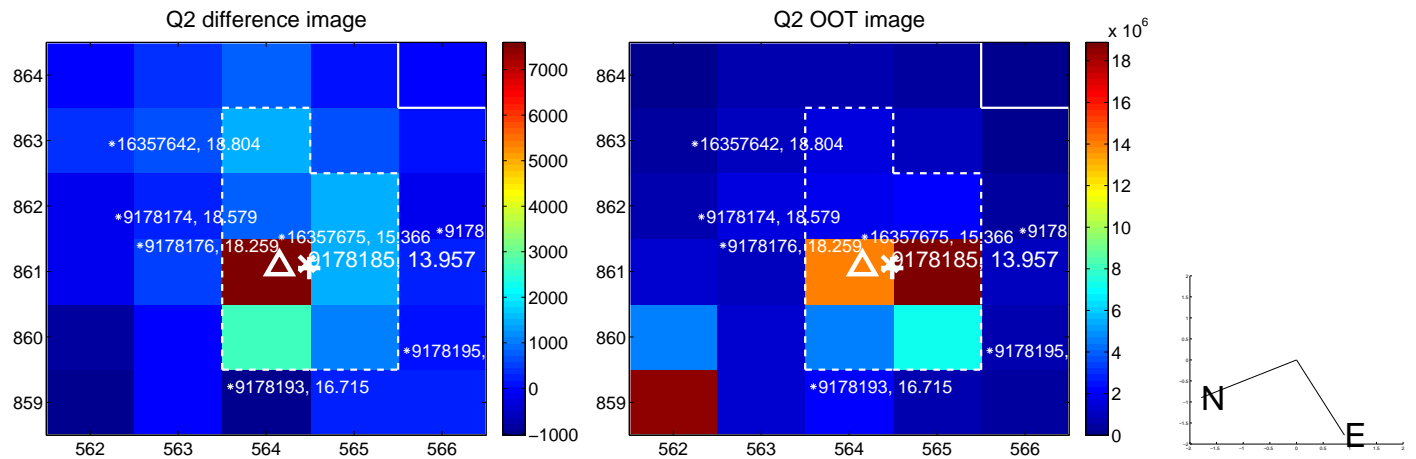
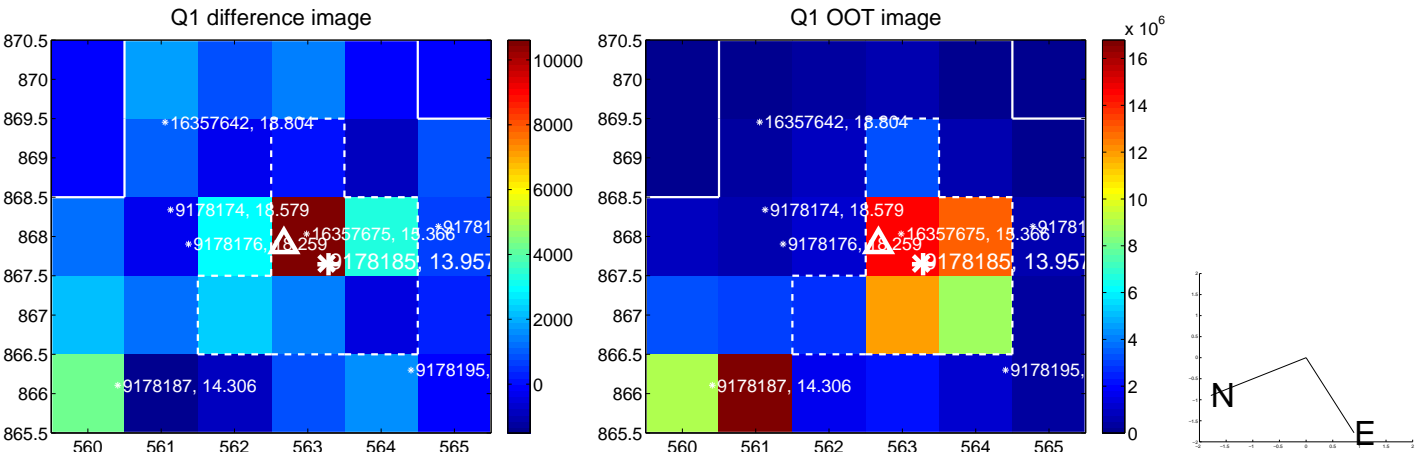
The direct PRF centroid is offset from the target star catalog position by about 0.10 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.377 \pm 0.145$	9.53	$-1.370 \pm 0.144$	$0.137 \pm 0.164$
PRF-fit source offset from KIC position	$1.354 \pm 0.140$	9.65	$-1.349 \pm 0.140$	$0.121 \pm 0.165$
photometric centroid source offset	$0.80 \pm 0.26$	3.05	$-0.78 \pm 0.26$	$-0.18 \pm 0.27$

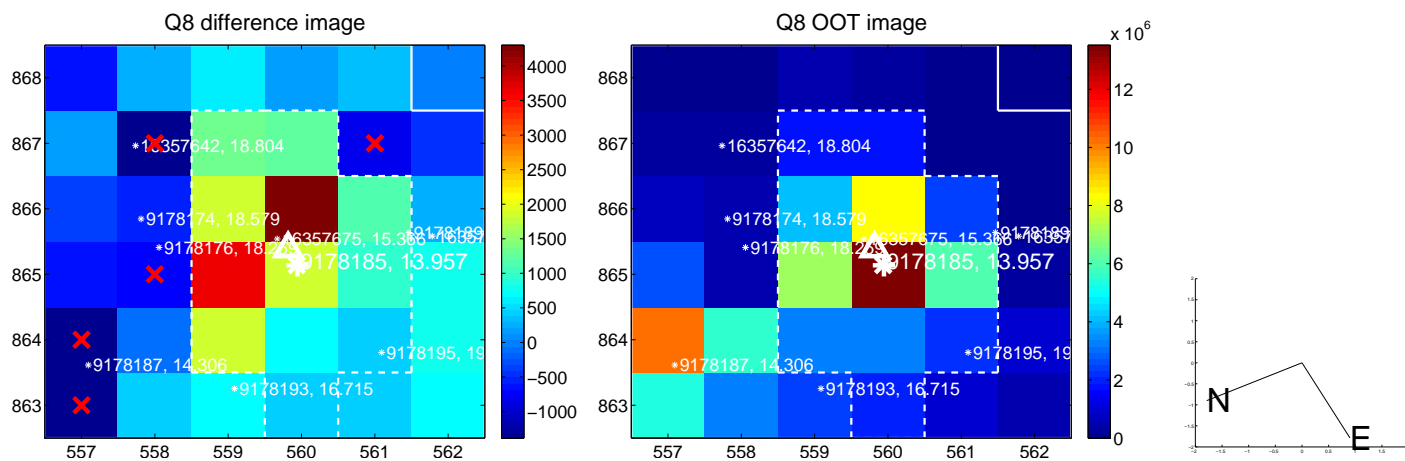
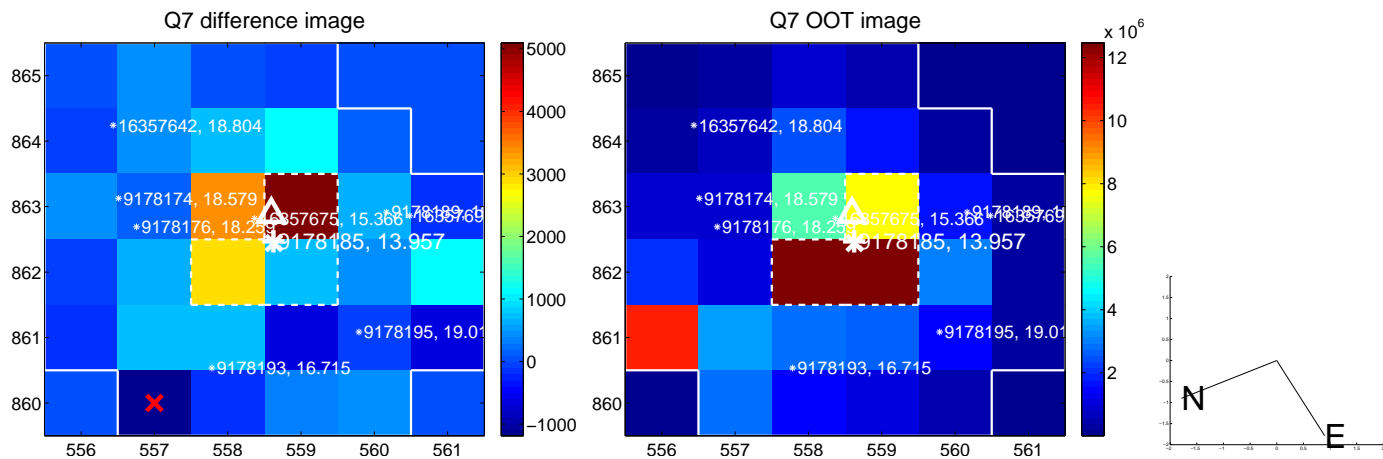
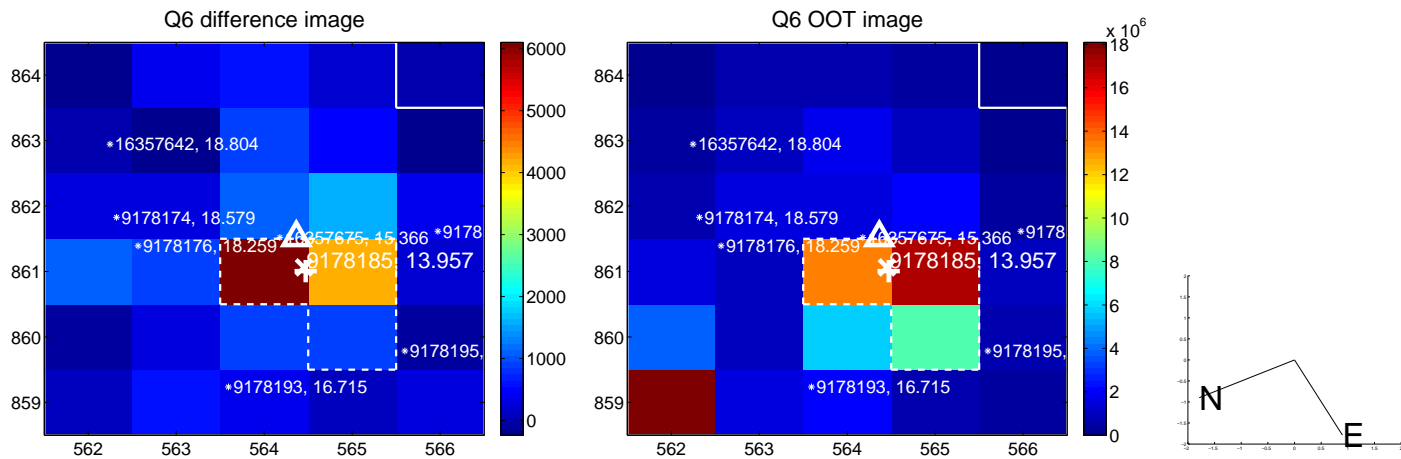
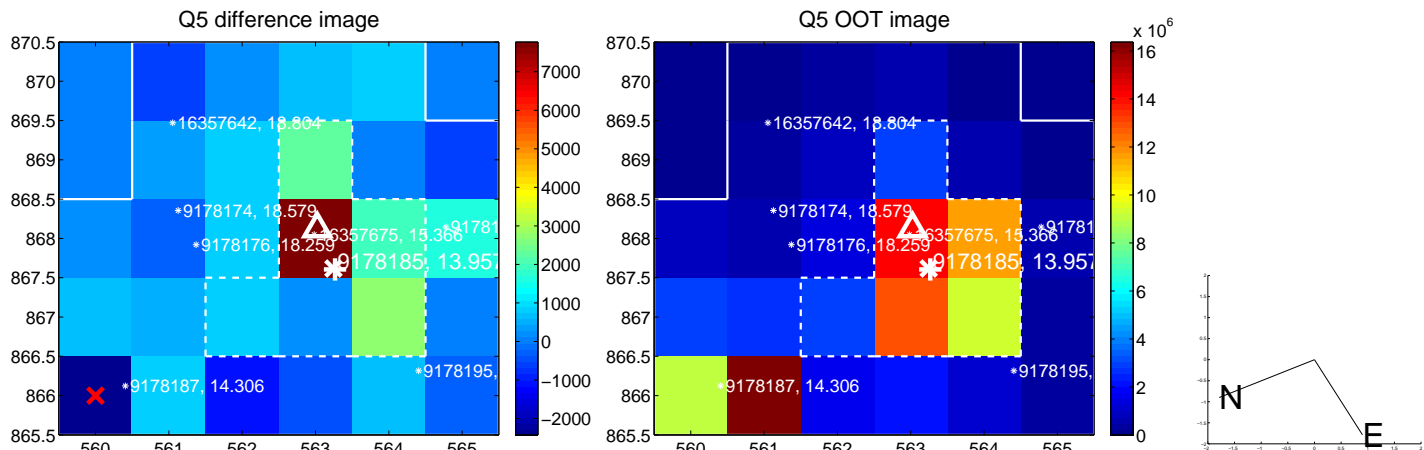


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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



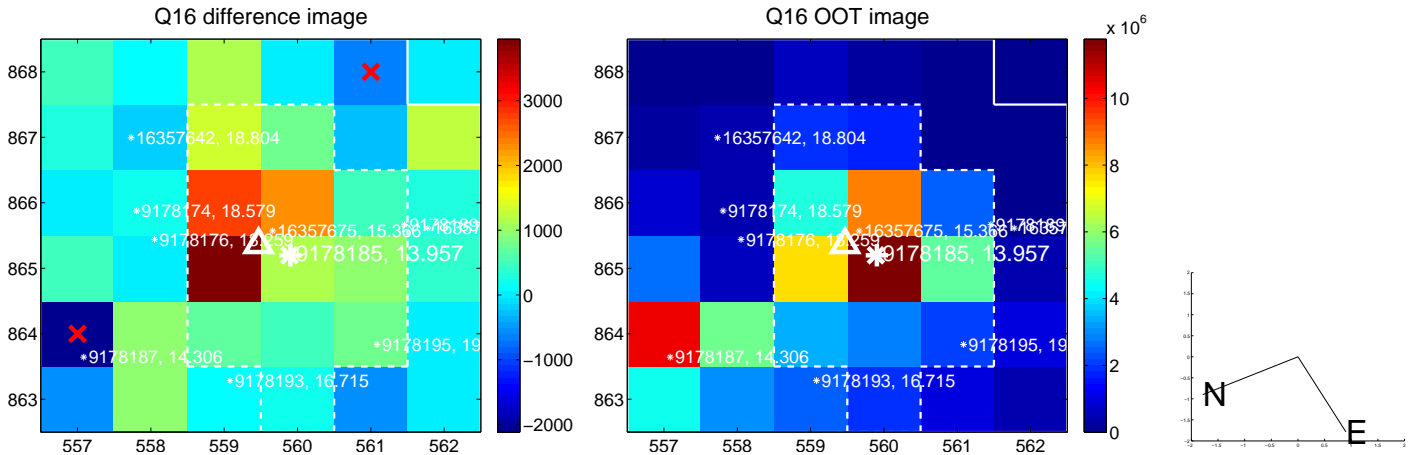
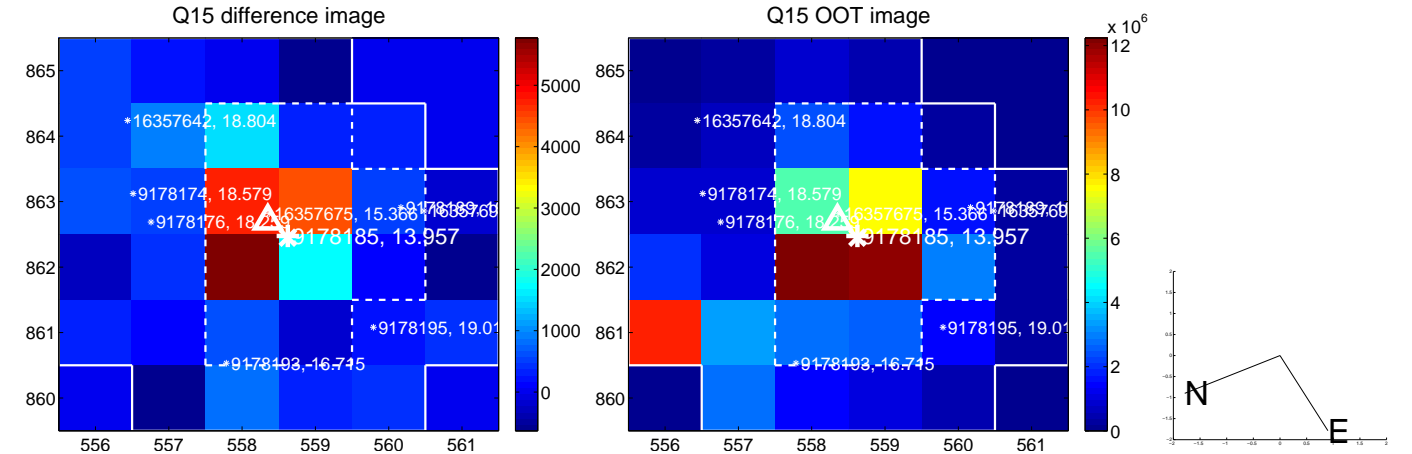
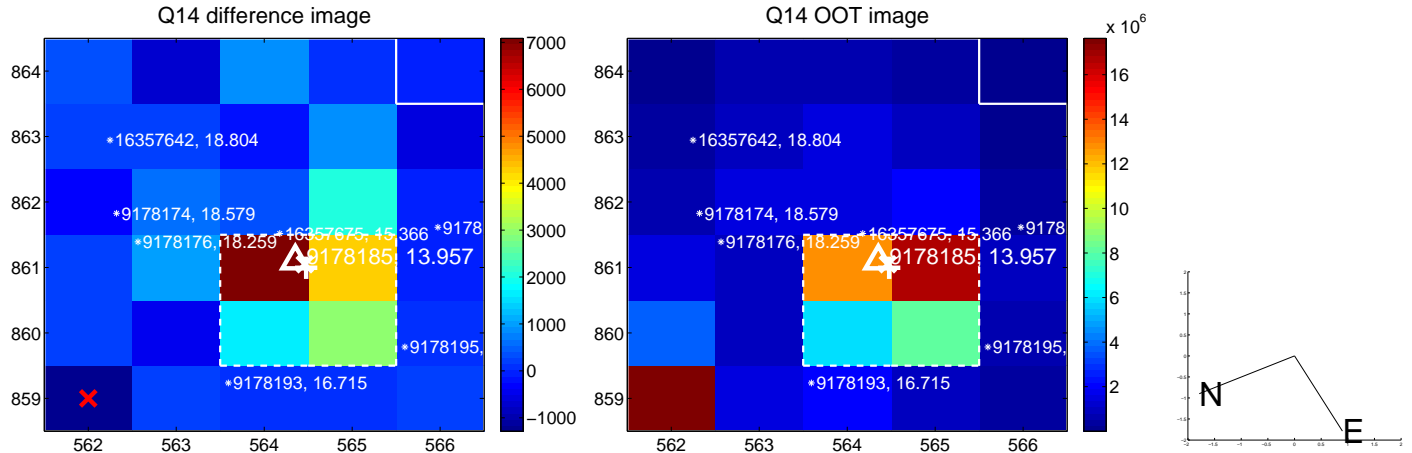
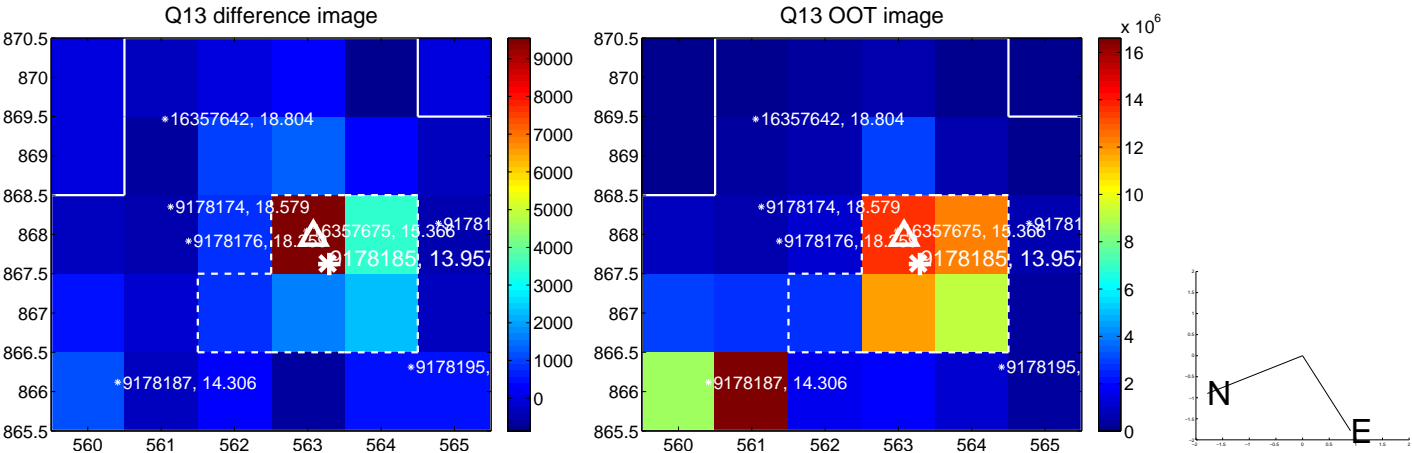
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



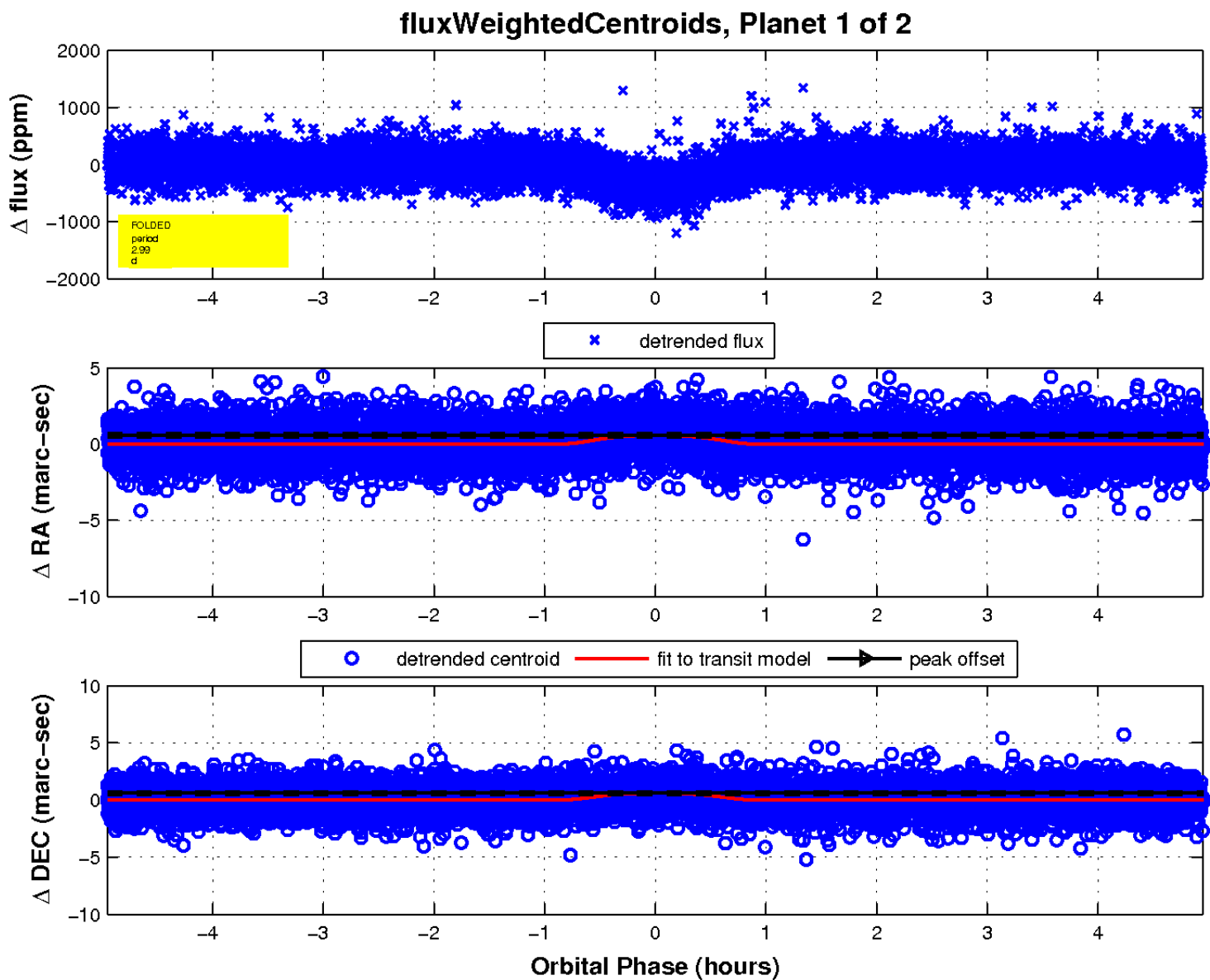
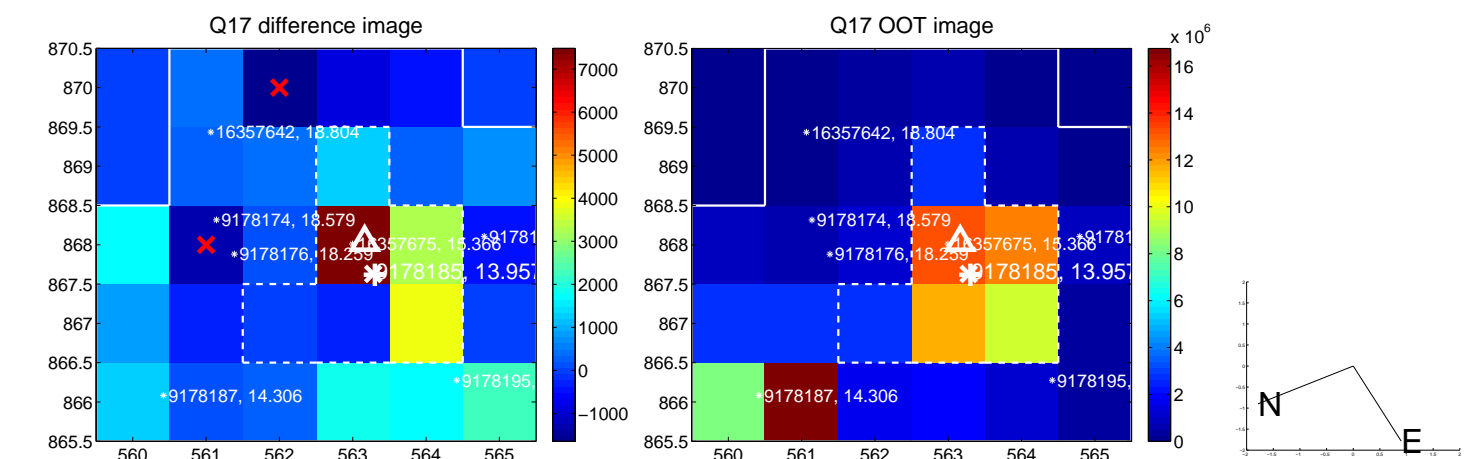




white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

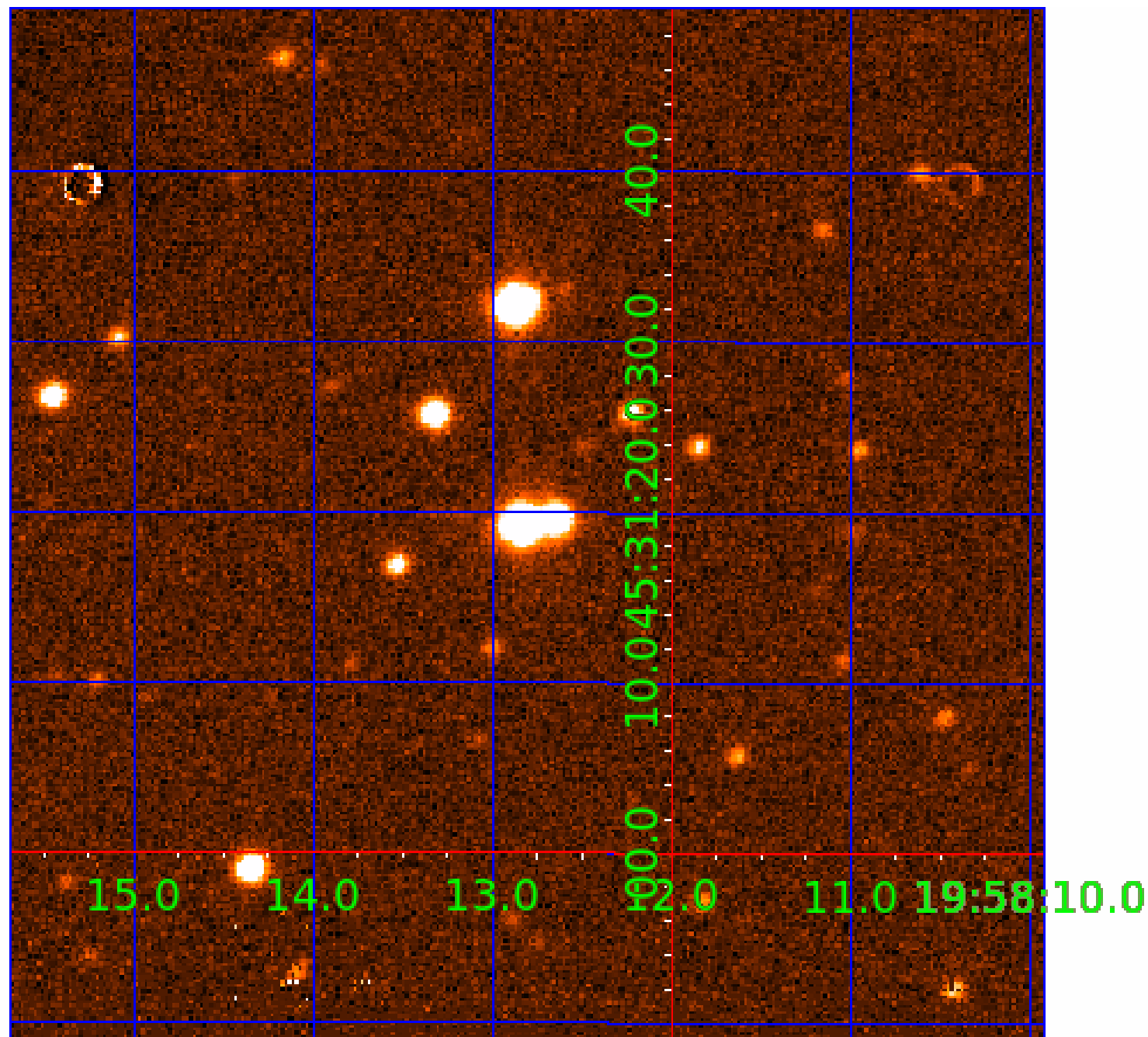


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination





# KIC 009178185

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009178185-01	OBS	3868.01	2.992697	133.297184	369.6	1.651	35.1	43.7	3.92	5908	10.49	6956.55
009178185-02	OBS	No	2.992762	131.787552	64.0	1.642	8.3	9.1	3.92	5908	3.73	6956.35

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009178185-01	OBS	FP	0.00	0	1	1	0	MOD_SEC_DV—MOD_SEC_ALT—HAS_SEC_TCE—CENT_UNRESOLVED_OFFSET
009178185-02	OBS	FP	0.00	1	1	0	0	IS_SEC_TCE—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.

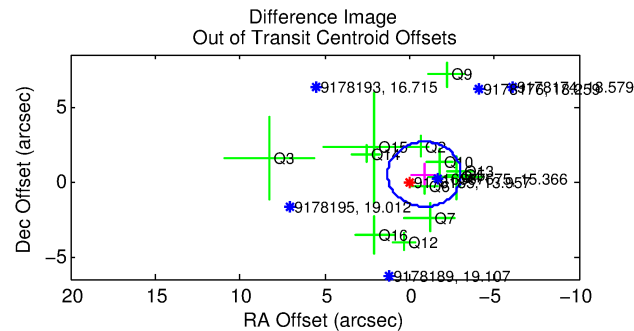
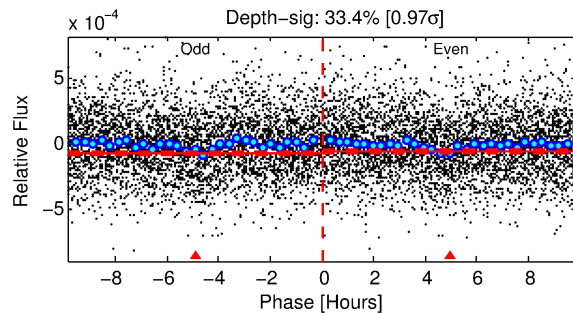
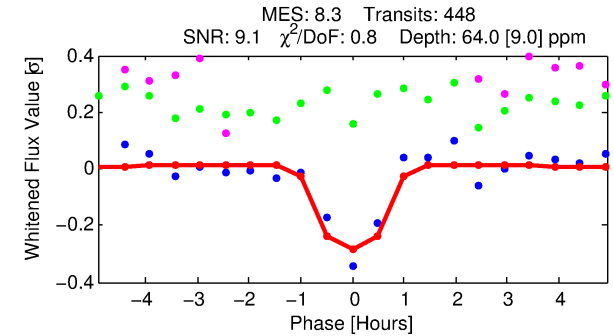
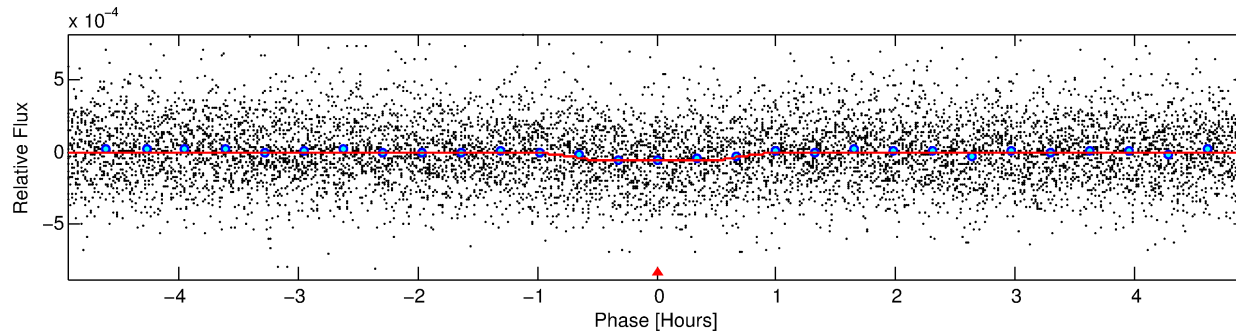
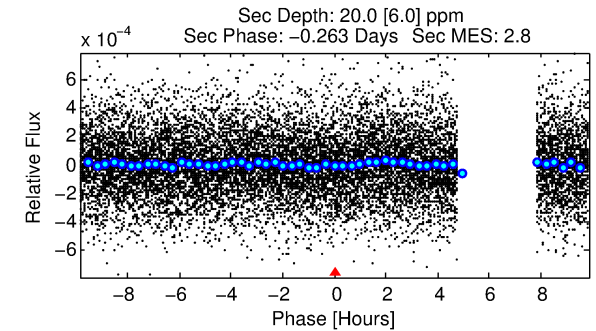
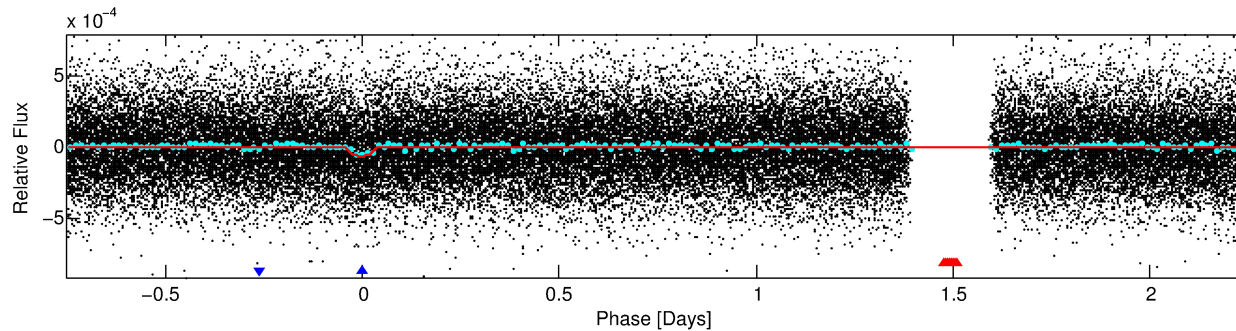
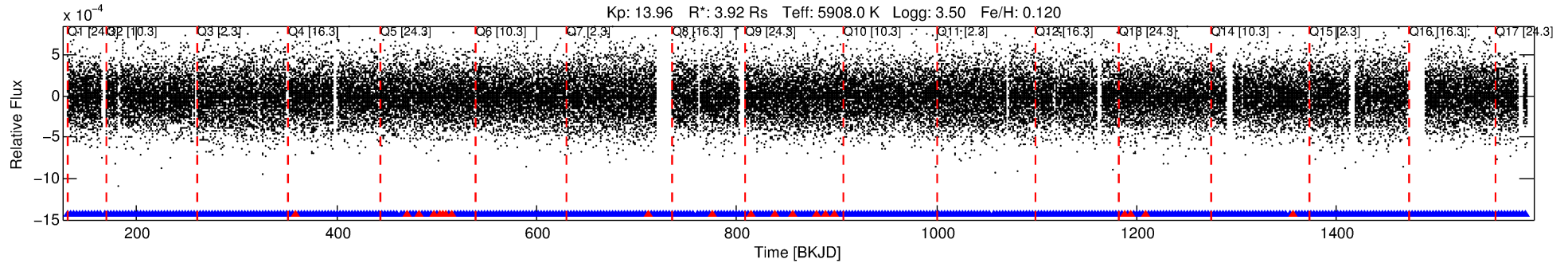
## Ephemeris Match Information For 009178185-02

No Significant Match Found

# DV One-Page Summary

KIC: 9178185 Candidate: 2 of 2 Period: 2.993 d  
KOI: K03868 Corr: No Ephemeris Match

Kp: 13.96 R\*: 3.92 Rs Teff: 5908.0 K Logg: 3.50 Fe/H: 0.120



## DV Fit Results:

Period = 2.99276 [0.00002] d  
Epoch = 131.7876 [0.0033] BKJD  
Rp/R\* = 0.0087 [0.0064]  
a/R\* = 6.35 [22.79]  
b = 0.90 [0.77]  
Seff = 6956.35 [8731.31]  
Teq = 2329 [731] K  
Rp = 3.73 [3.74] Re  
a = 0.0490 [0.0362] AU  
Ag = 1.91 [3.72] [0.24σ]  
Teffp = 4231 [1592] K [1.09σ]

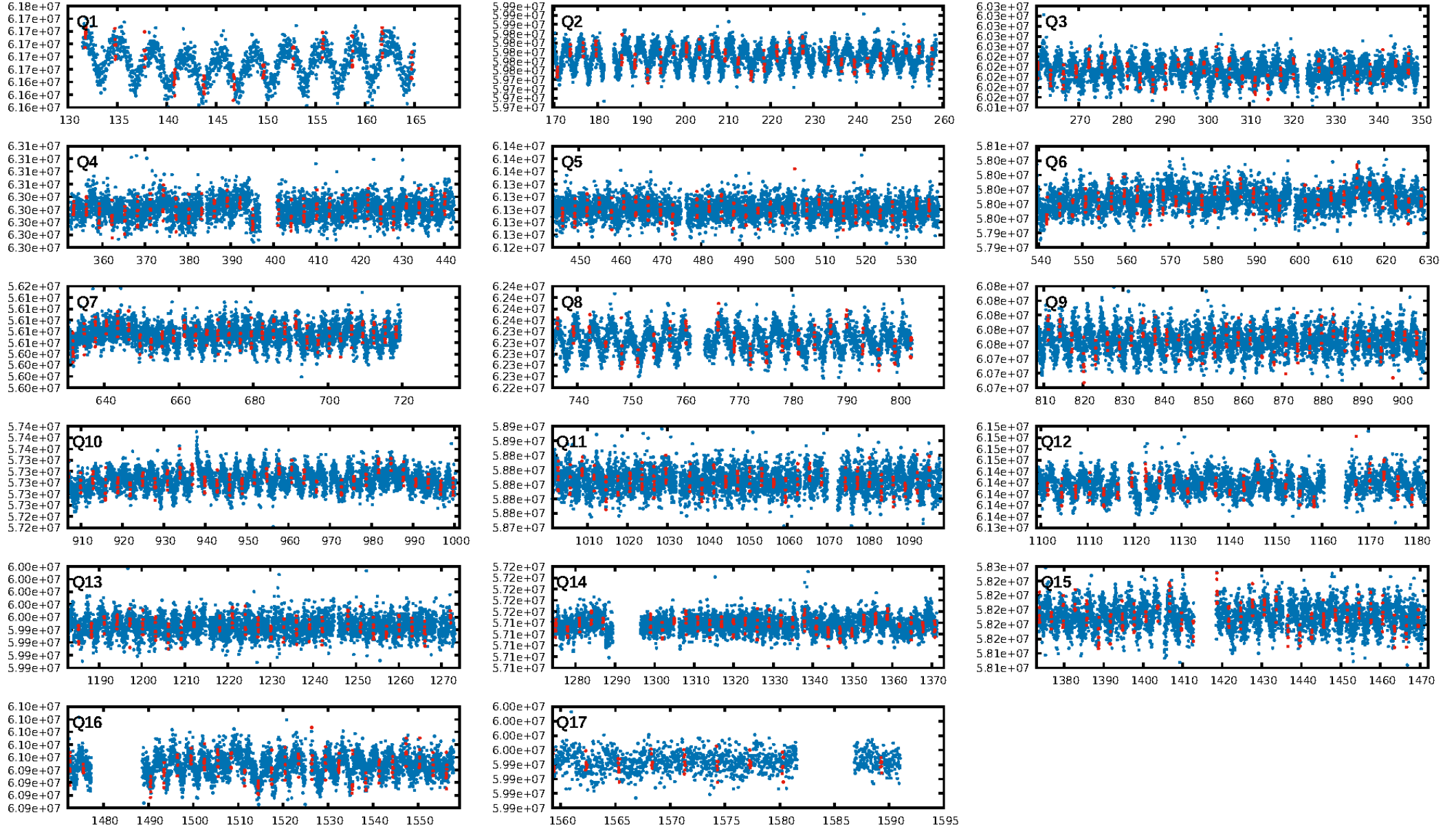
## DV Diagnostic Results:

ShortPeriod-sig: 0.1% [0.00σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: 2.64e-17  
RollingBand-fgt: 0.95 [407/427]  
GhostDiagnostic-chr: 7.837  
Centroid-sig: 1.8%  
Centroid-so: 2.547 arcsec [2.00σ]  
OotOffset-rm: 1.001 arcsec [1.39σ]  
OotOffset-st: 4/3/3/3 [13]  
KicOffset-rm: 0.871 arcsec [1.01σ]  
KicOffset-st: 4/3/3/3 [13]  
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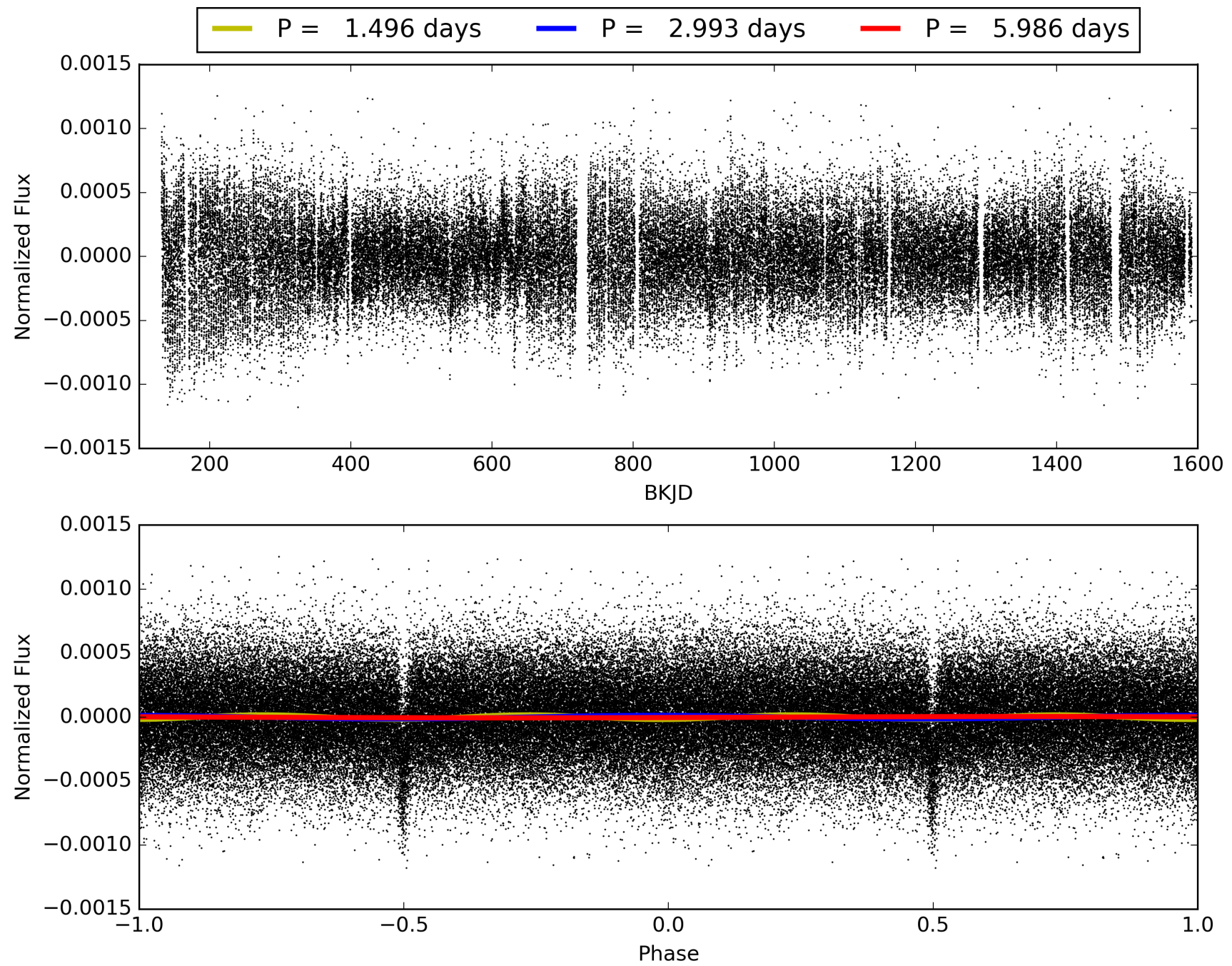
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 15:11:18 Z

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

# TCE 009178185-02, PDC Light Curves



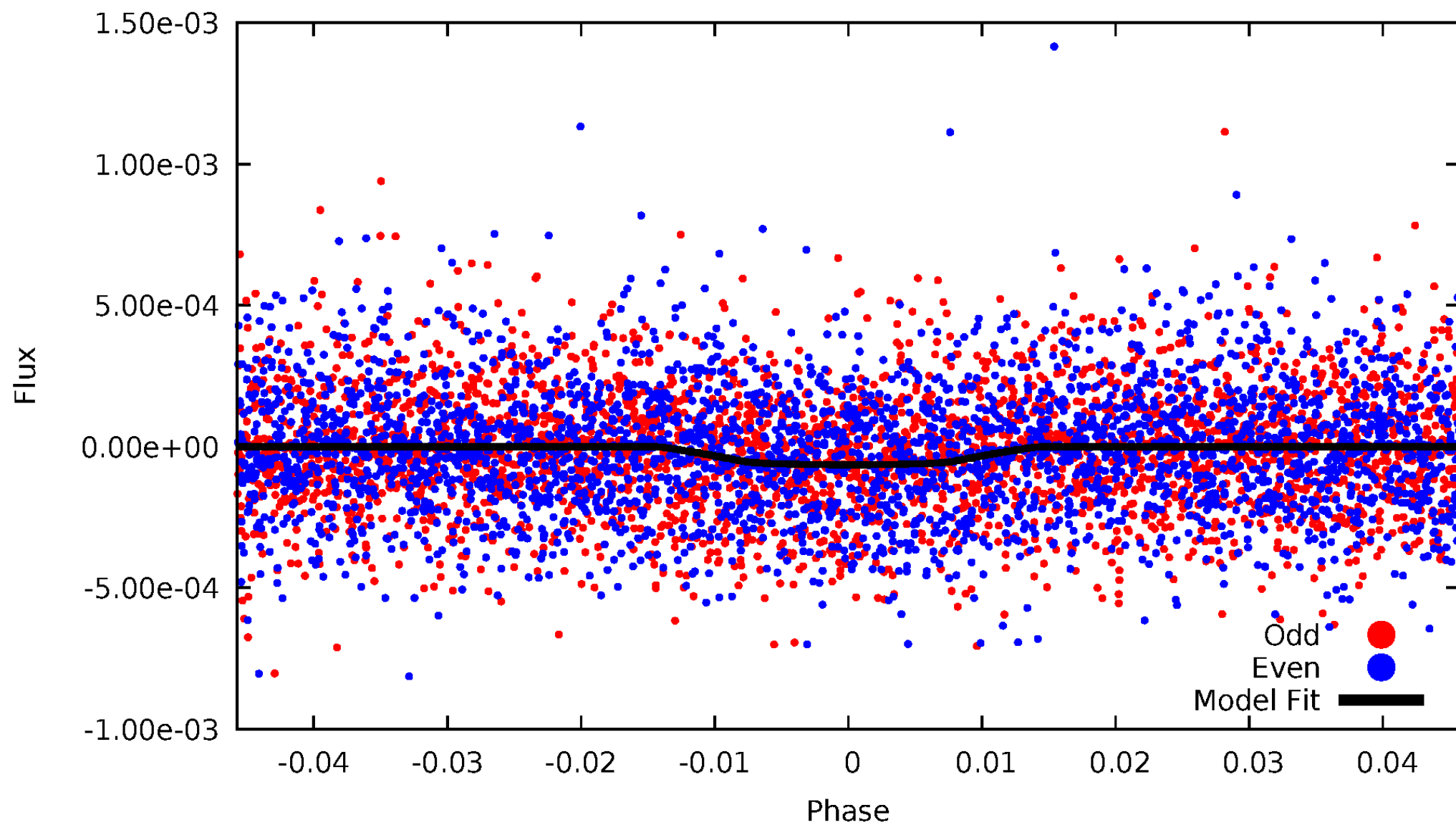
TCE 009178185-02





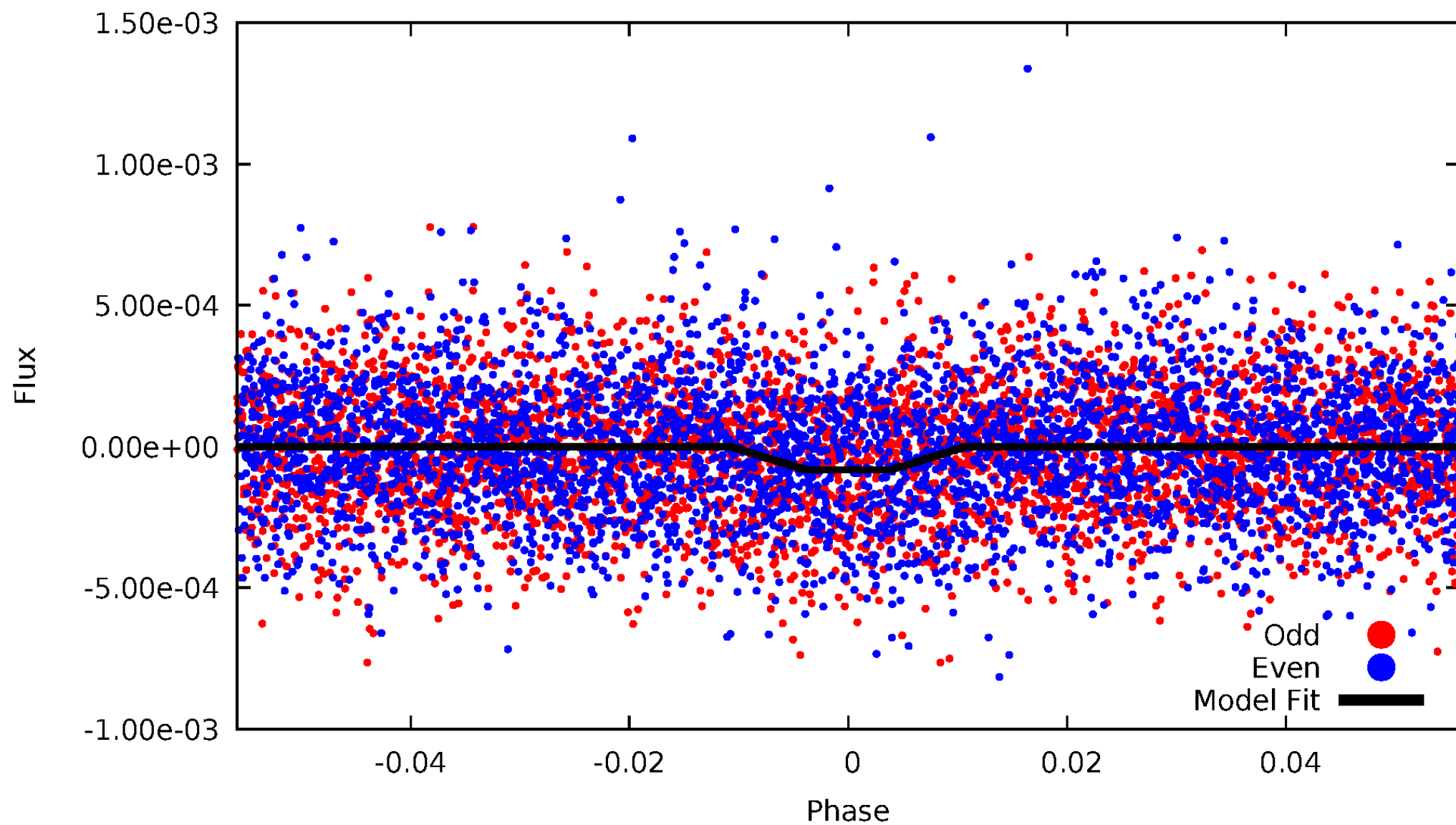
# DV Odd/Even

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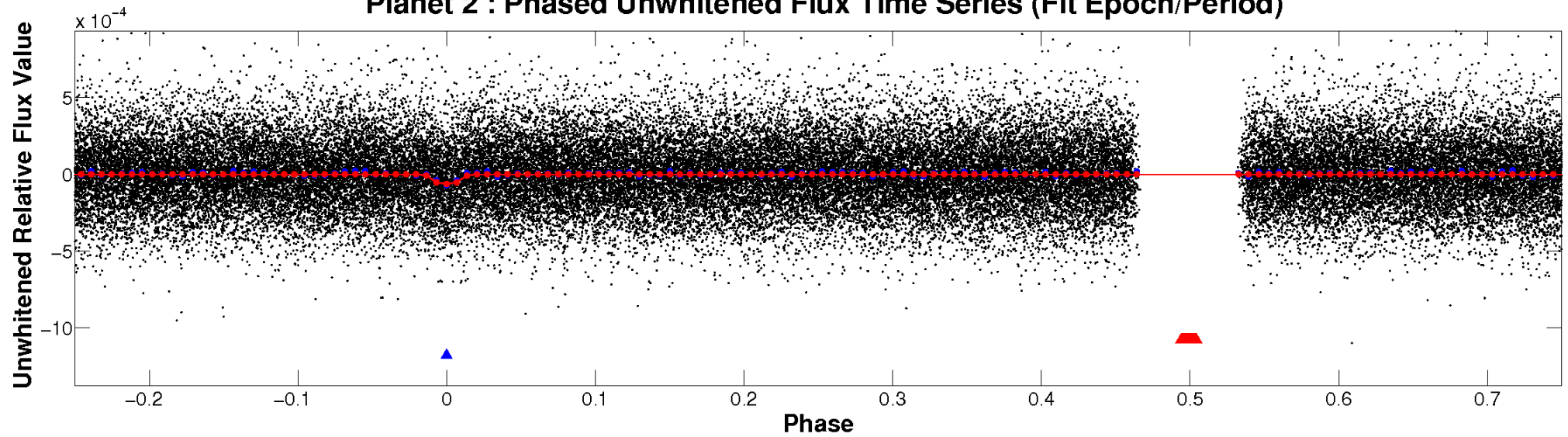
# ALT Odd/Even

TCE 009178185-02

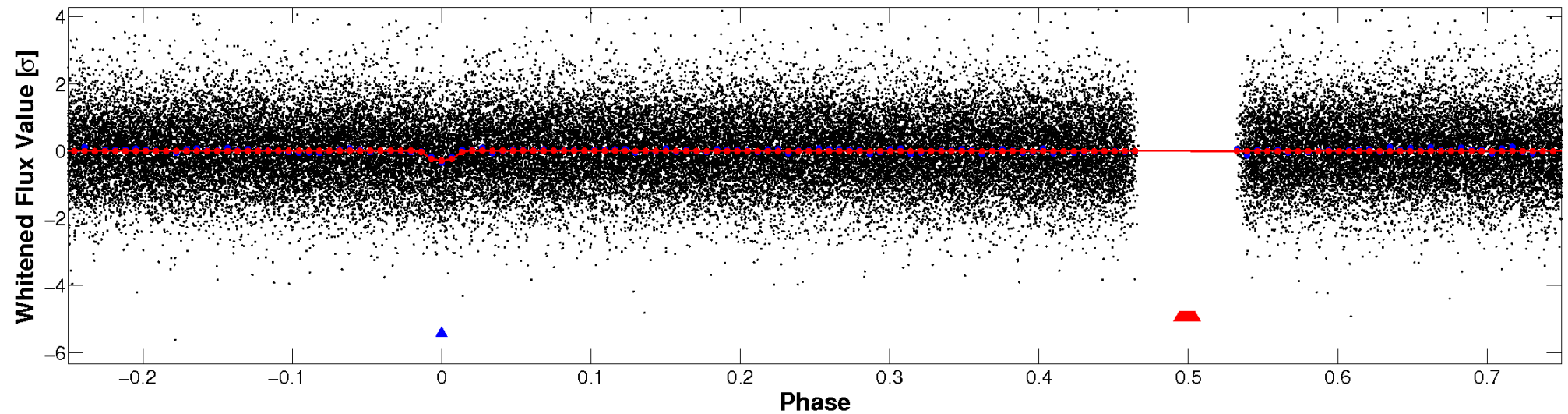


# Non-Whitened Vs. Whitened Light Curve

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

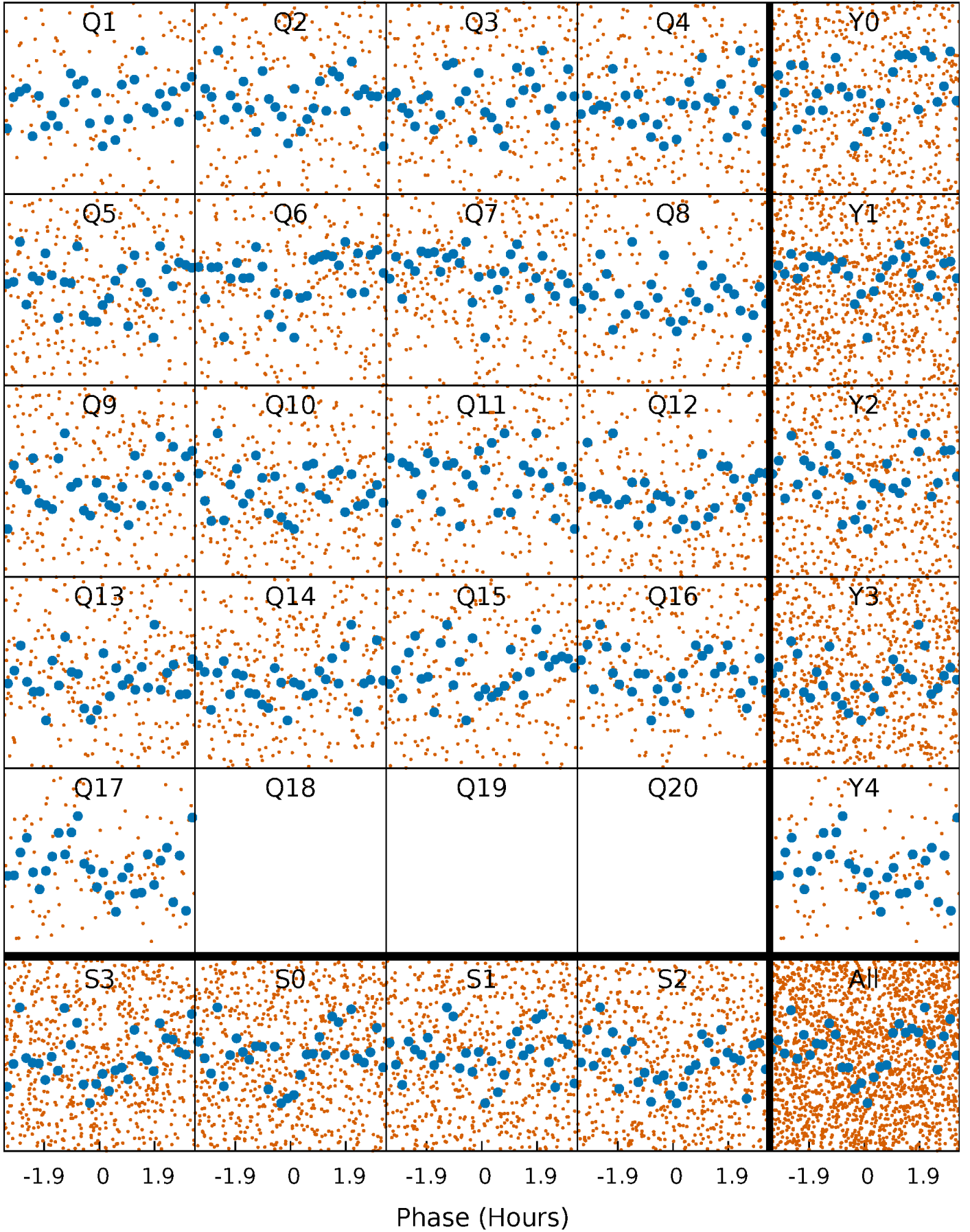


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



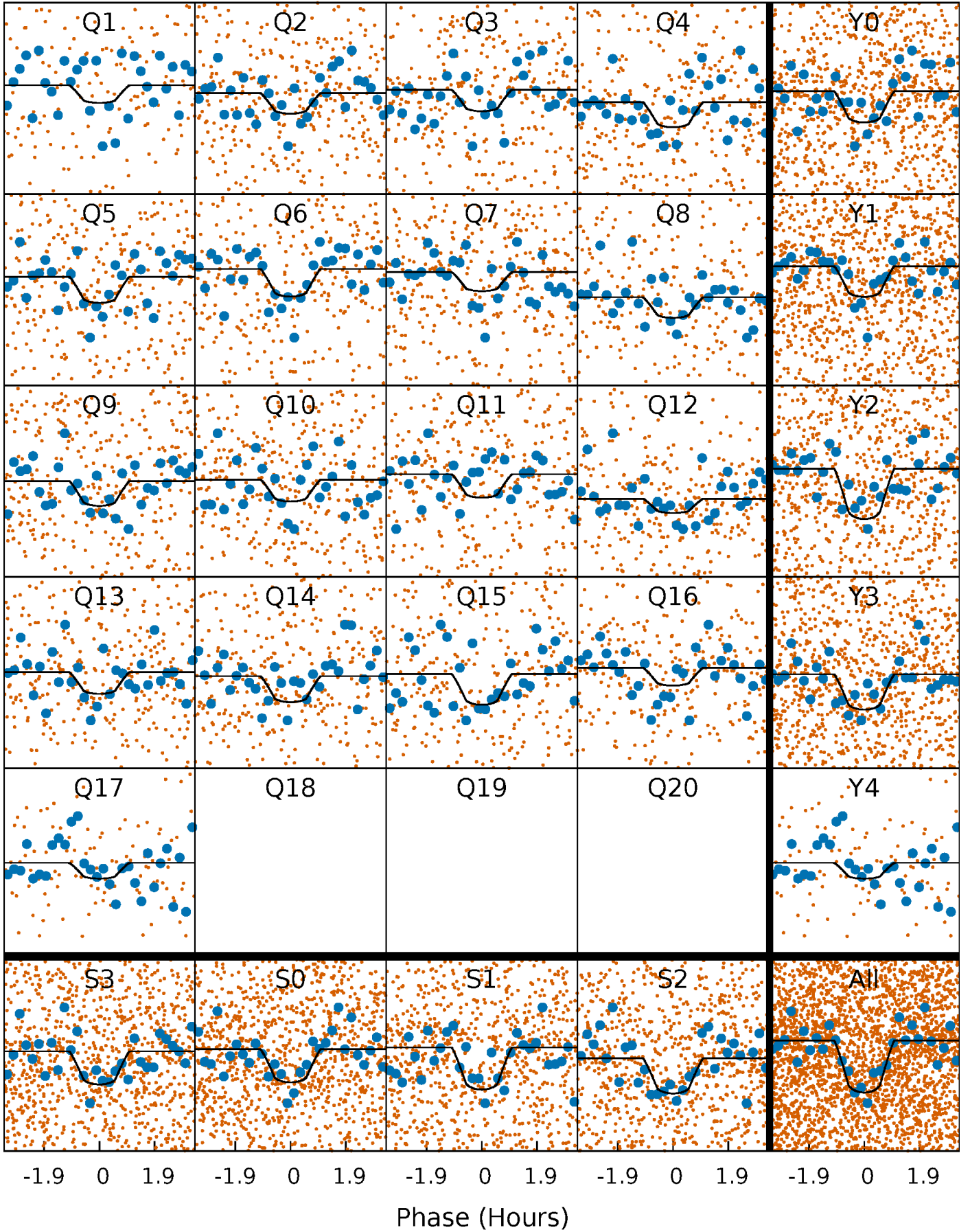
# PDC Quarter-Phased Transit Curves

TCE 009178185-02   P= 2.992762 Days    $T_0=131.787552$  (BKJD)



# DV Quarter-Phased Transit Curves

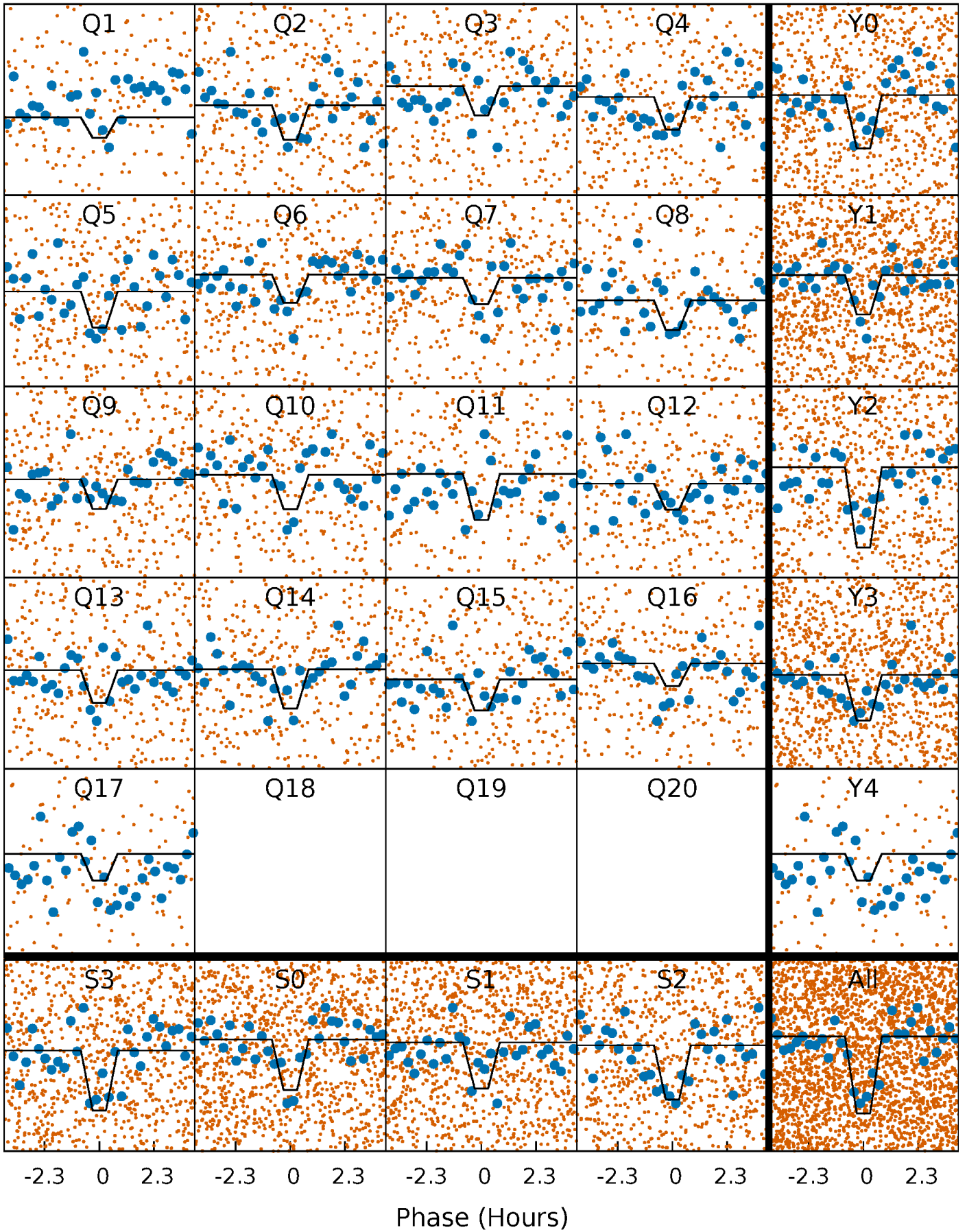
TCE 009178185-02   P= 2.992762 Days    $T_0=131.787552$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

TCE 009178185-02 P= 2.992747 Days  $T_0=131.789617$  (BKJD)

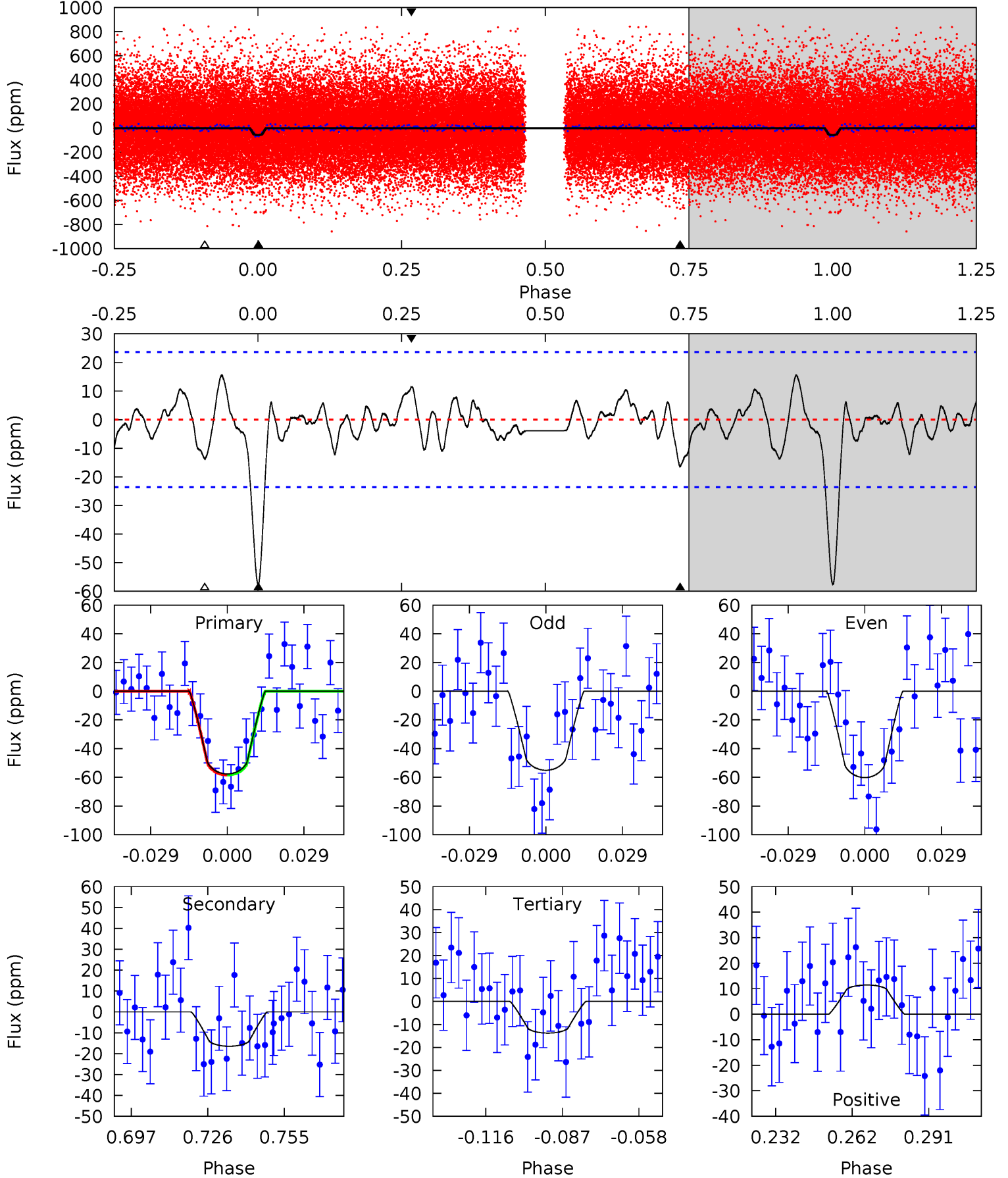




# DV Model-Shift Uniqueness Test

009178185-02, P = 2.992762 Days, E = 128.794790 Days

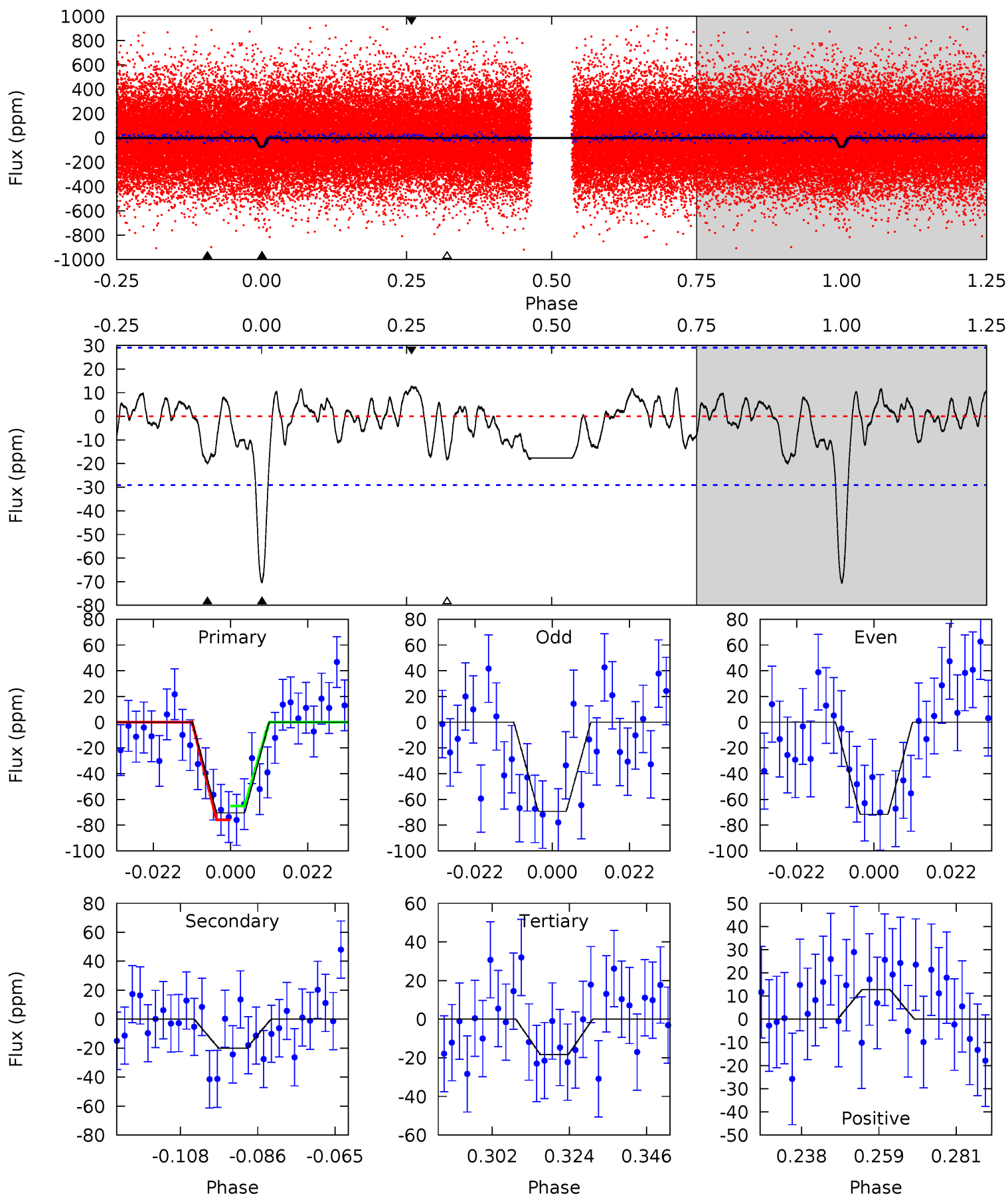
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
11.8	3.36	2.81	2.34	4.82	2.18	1.09	8.95	9.42	0.55	1.02	0.52	1.00	0.21	0.00



# Alt Model-Shift Uniqueness Test

009178185-02, P = 2.992747 Days, E = 128.796870 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
11.8	3.36	3.07	2.14	4.88	2.30	1.19	8.74	9.67	0.29	1.22	0.19	0.97	0.15	0.90



### Stellar Parameters For KIC 009178185

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$5908^{+206}_{-206}$	$3.497^{+0.756}_{-0.133}$	$0.120^{+0.250}_{-0.300}$	$3.915^{+0.895}_{-2.686}$	$1.755^{+0.123}_{-0.694}$	$0.041^{+0.680}_{-0.016}$
	+3%/-3%	+22%/-4%	+208%/-250%	+23%/-69%	+7%/-40%	+1650%/-39%
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 009178185-02 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	$-16 \pm 5$	$3.40^{+2.84}_{-2.02}$	$3155^{+285}_{-561}$	$3936^{+1733}_{-931}$	$1.797^{+8.570}_{-1.282}$
Alt.	$-20 \pm 6$	$3.27^{+2.75}_{-1.99}$	$3125^{+305}_{-548}$	$4184^{+2331}_{-910}$	$2.415^{+13.451}_{-1.704}$

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

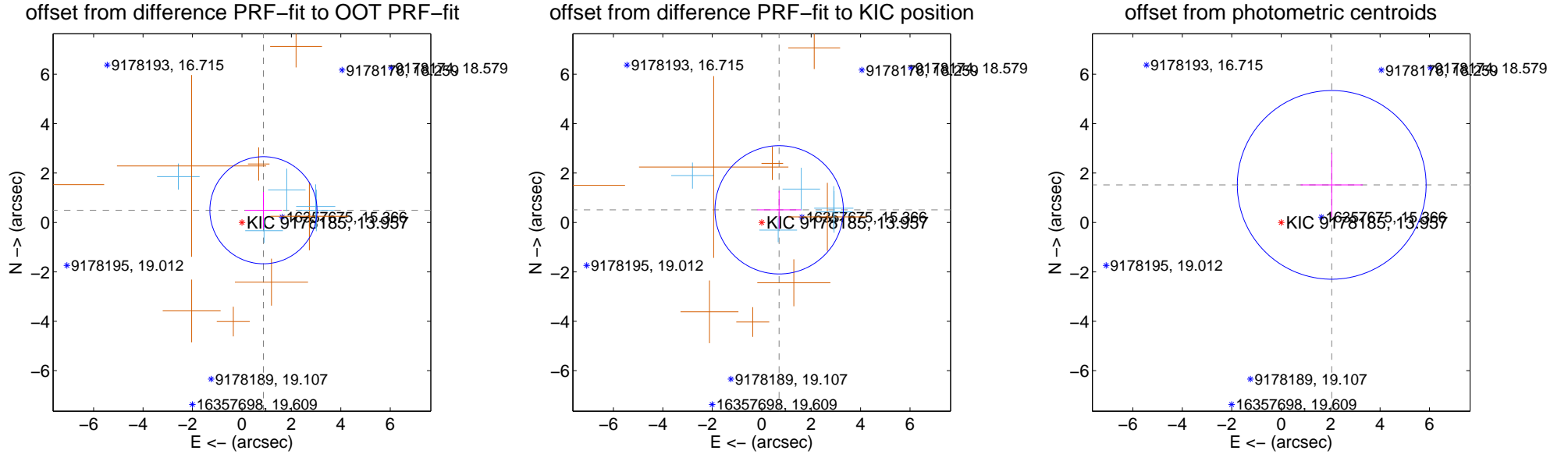
## DV Centroid Data

Supplemental centroid analysis for 009178185-02. Kepler magnitude: 13.96. Transit SNR 9.15

There are 5 quarters with good PRF difference image offsets

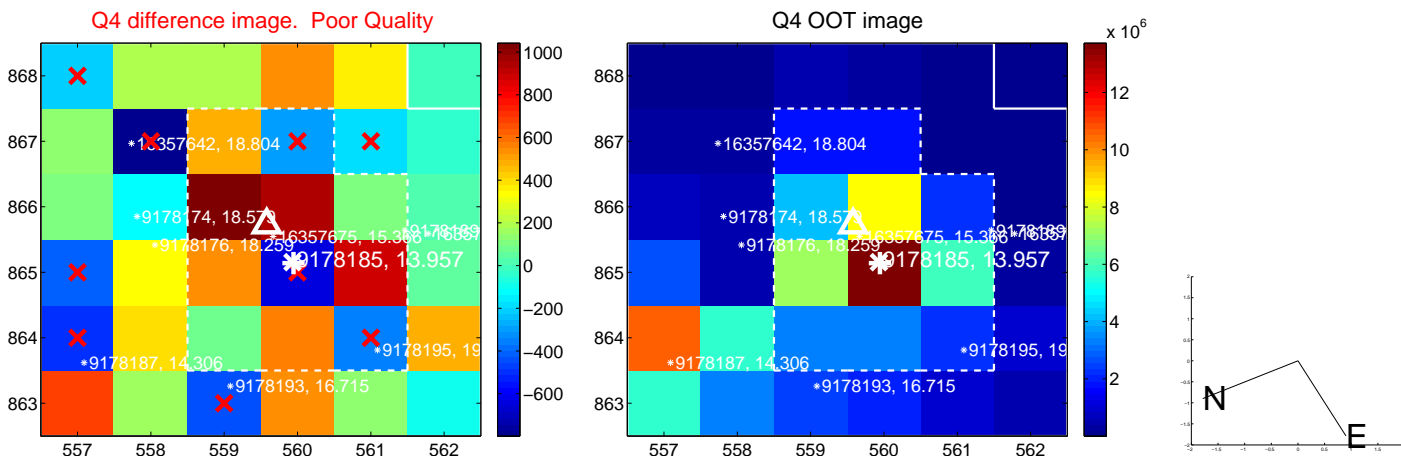
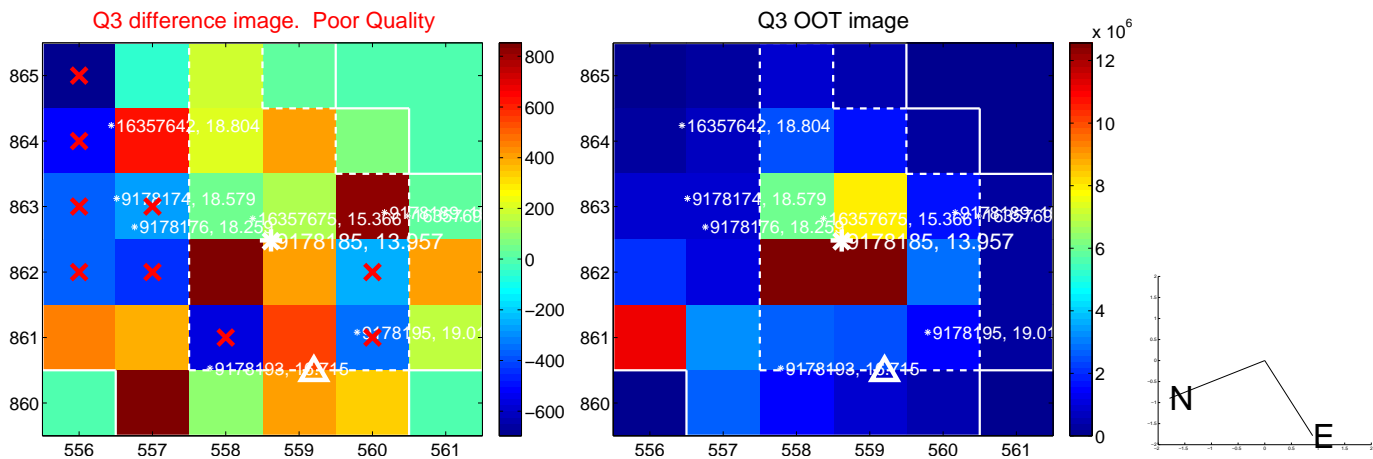
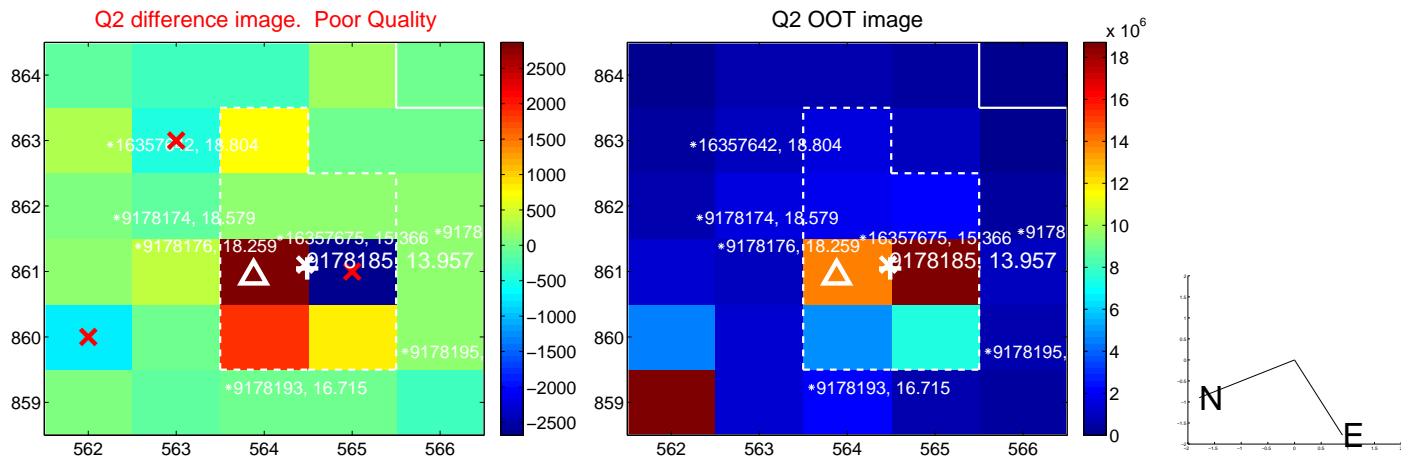
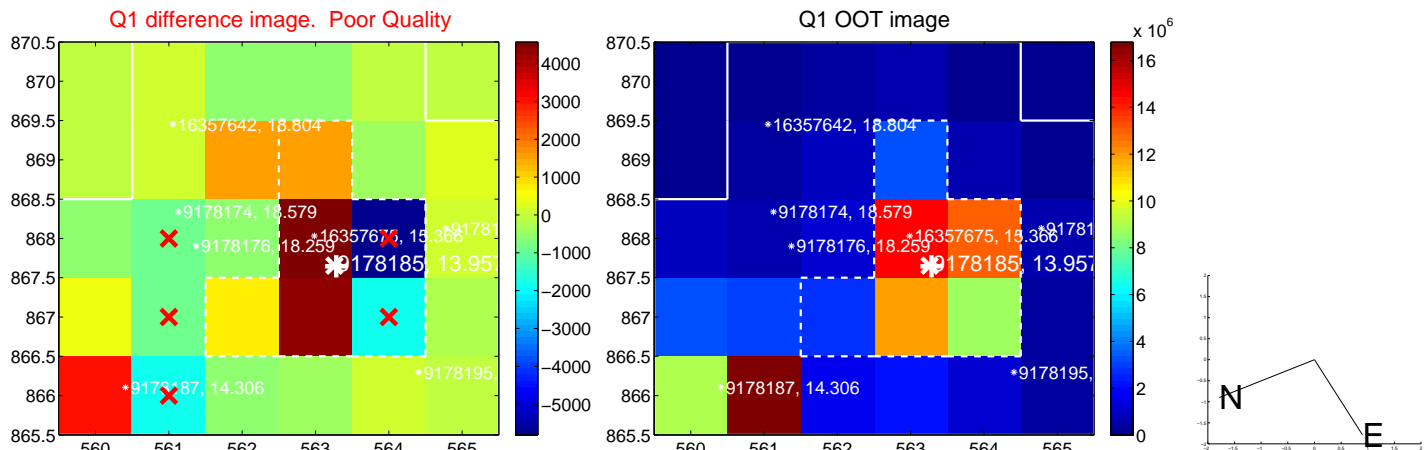
The direct PRF centroid is offset from the target star catalog position by about 0.09 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.001 \pm 0.722$	1.39	$-0.870 \pm 0.739$	$0.494 \pm 0.744$
PRF-fit source offset from KIC position	$0.871 \pm 0.865$	1.01	$-0.705 \pm 0.889$	$0.511 \pm 0.771$
photometric centroid source offset	$2.55 \pm 1.27$	2.00	$-2.04 \pm 1.26$	$1.52 \pm 1.30$

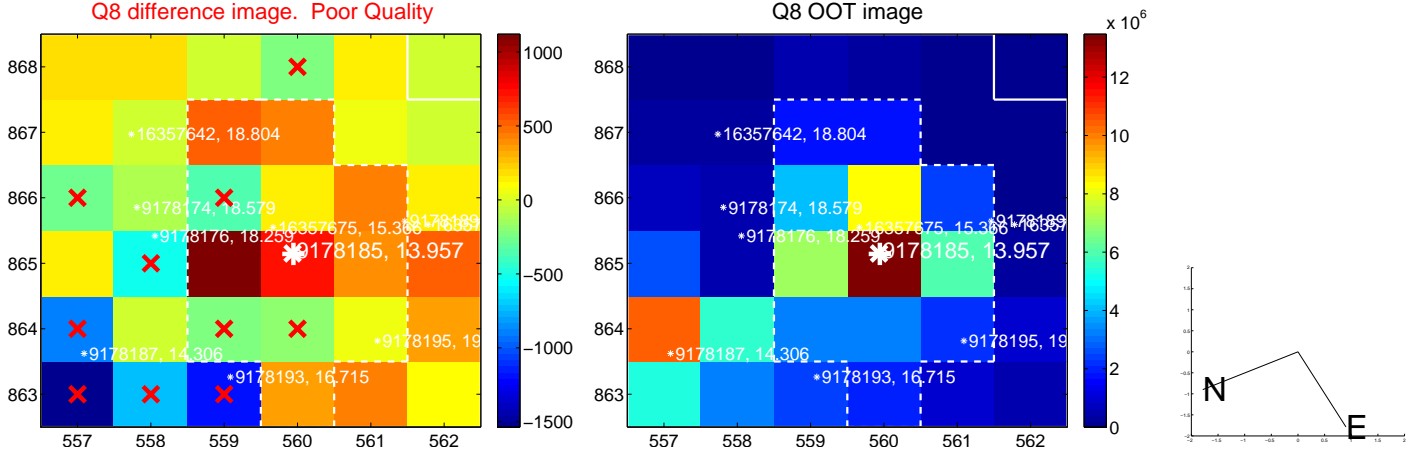
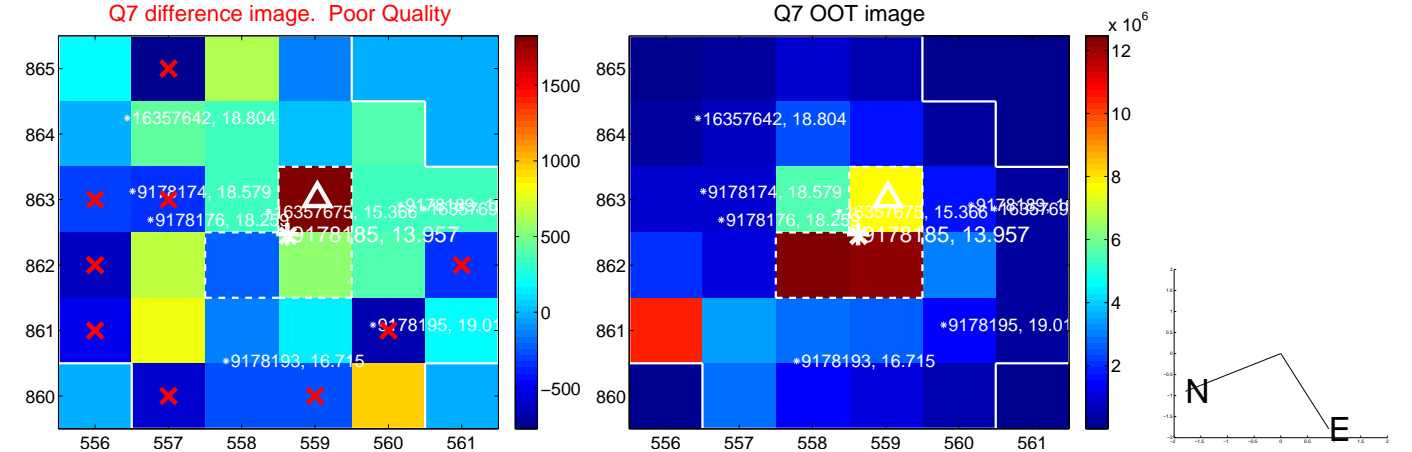
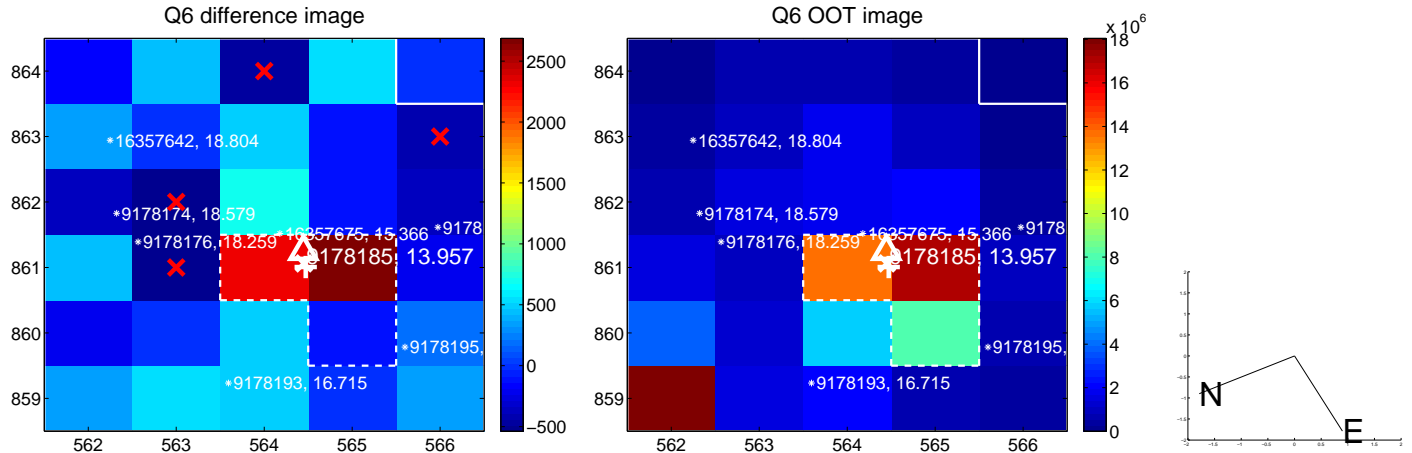
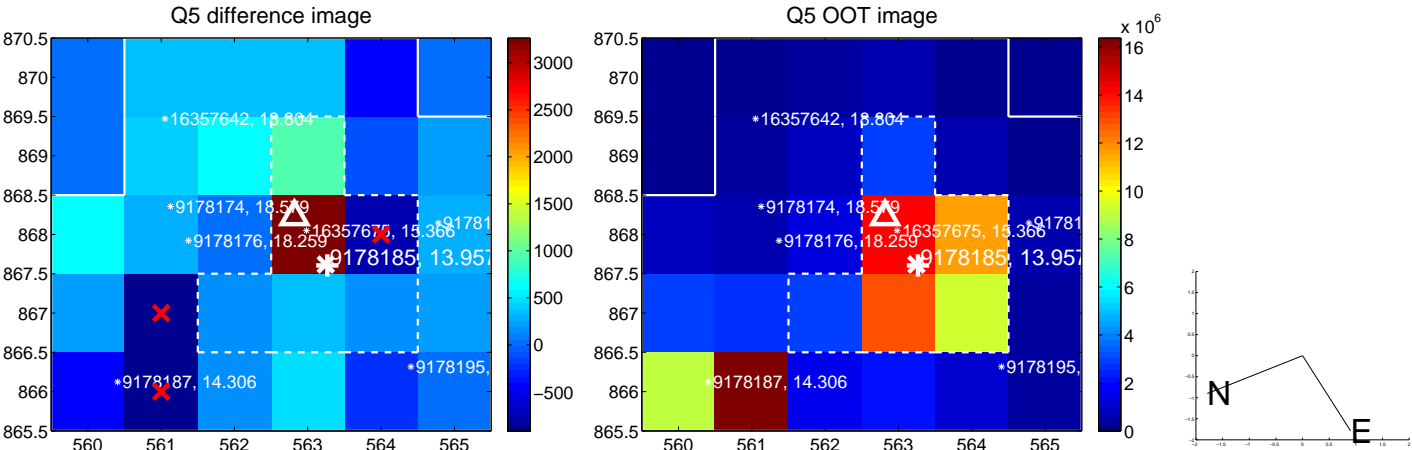


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

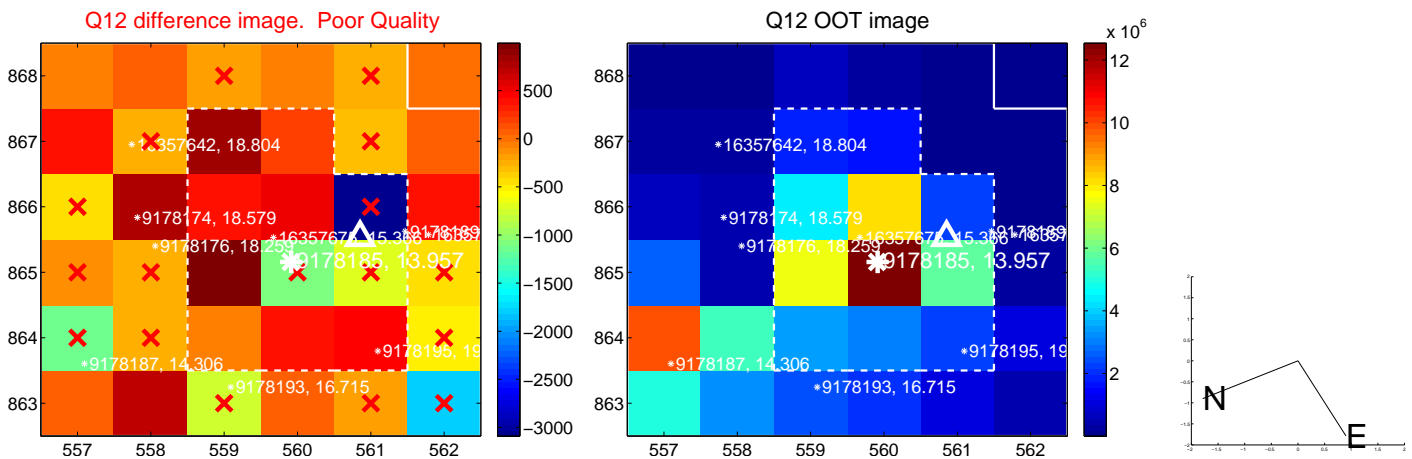
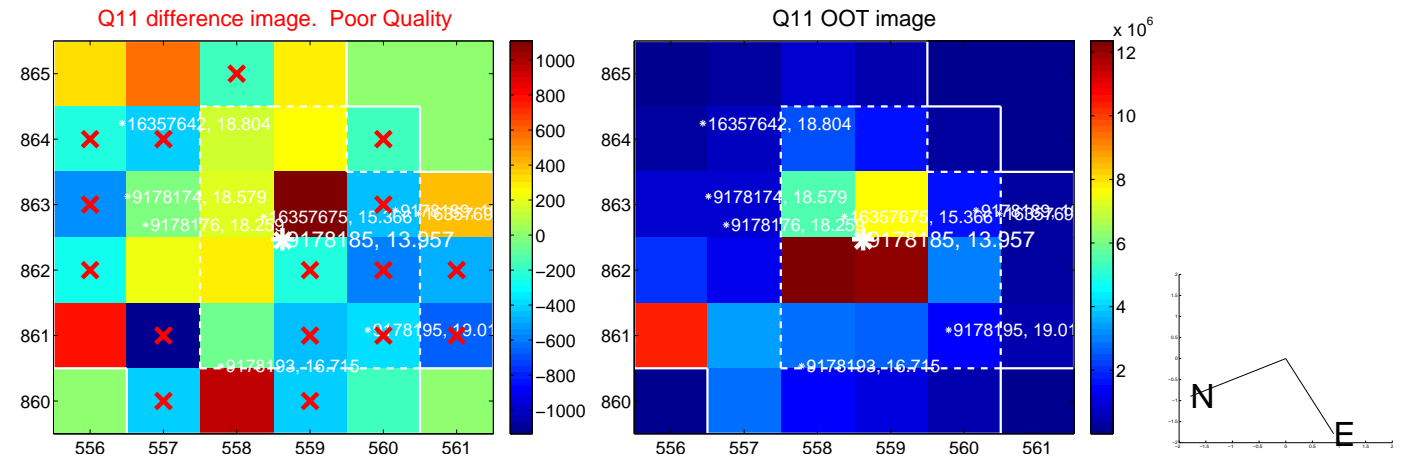
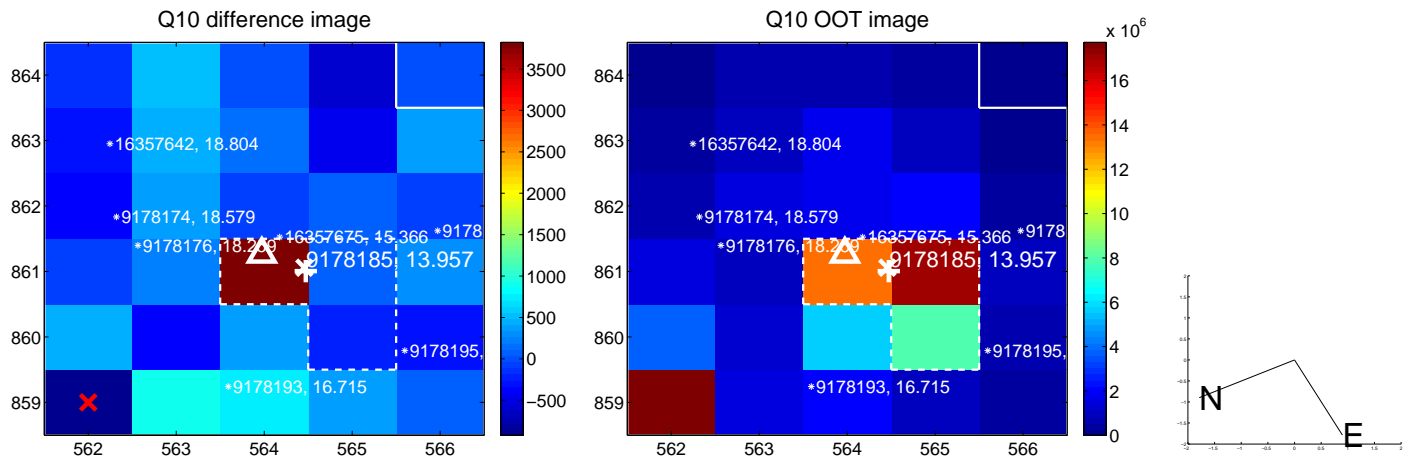
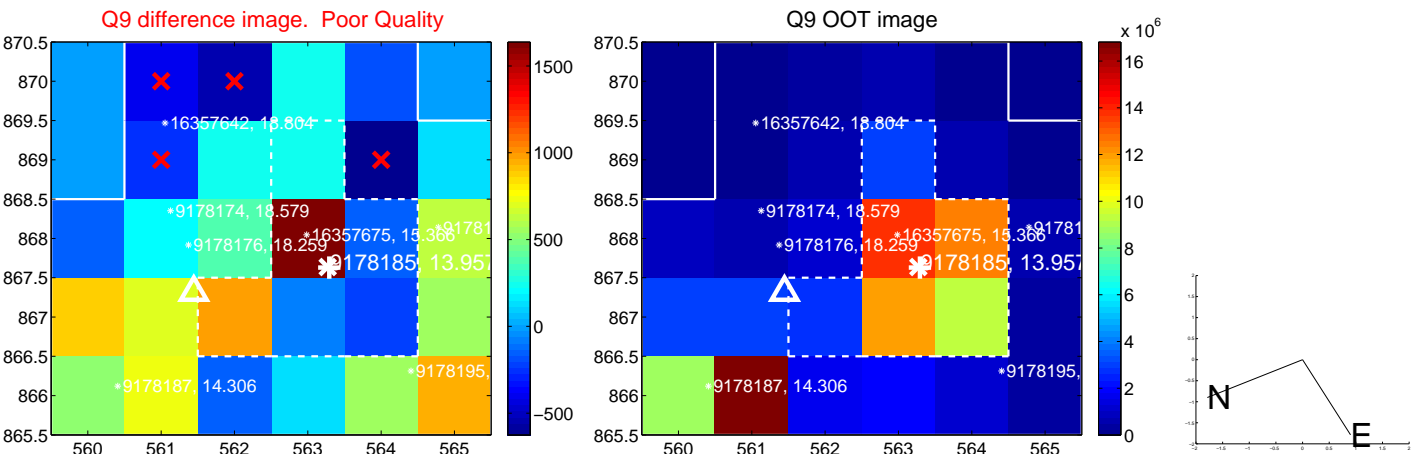


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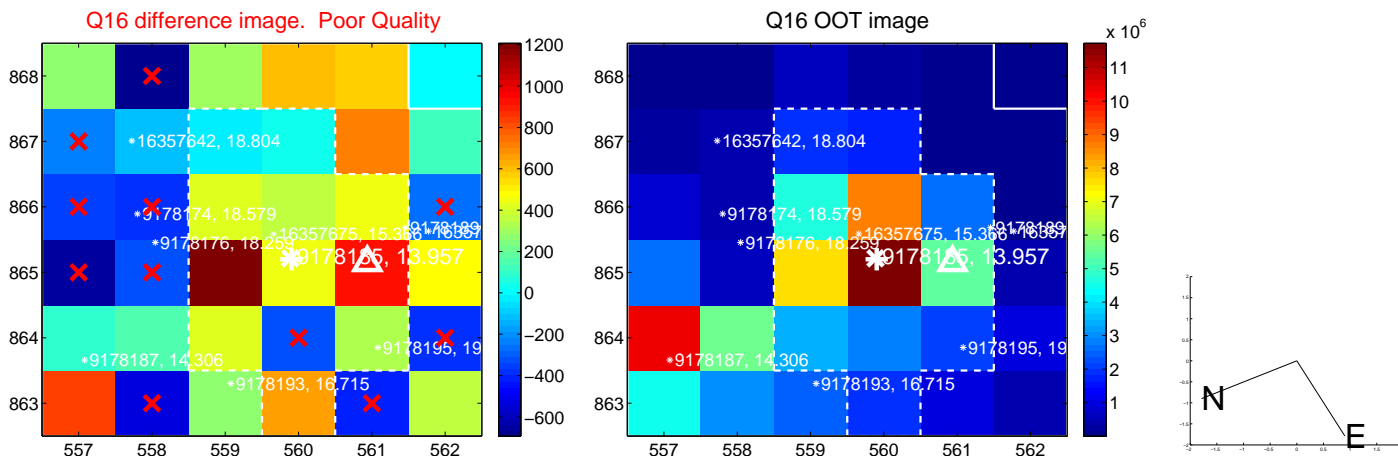
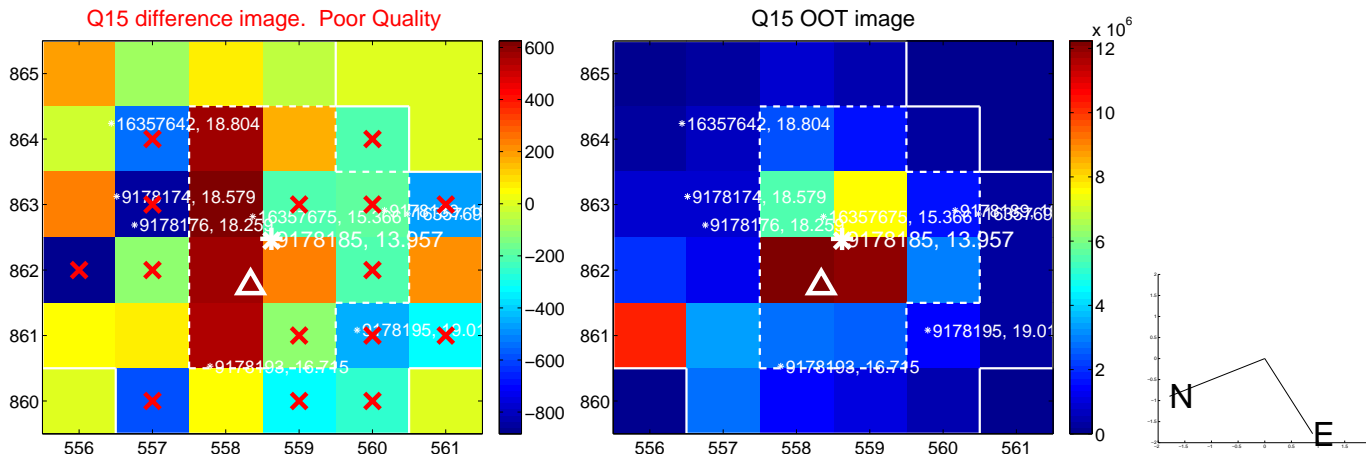
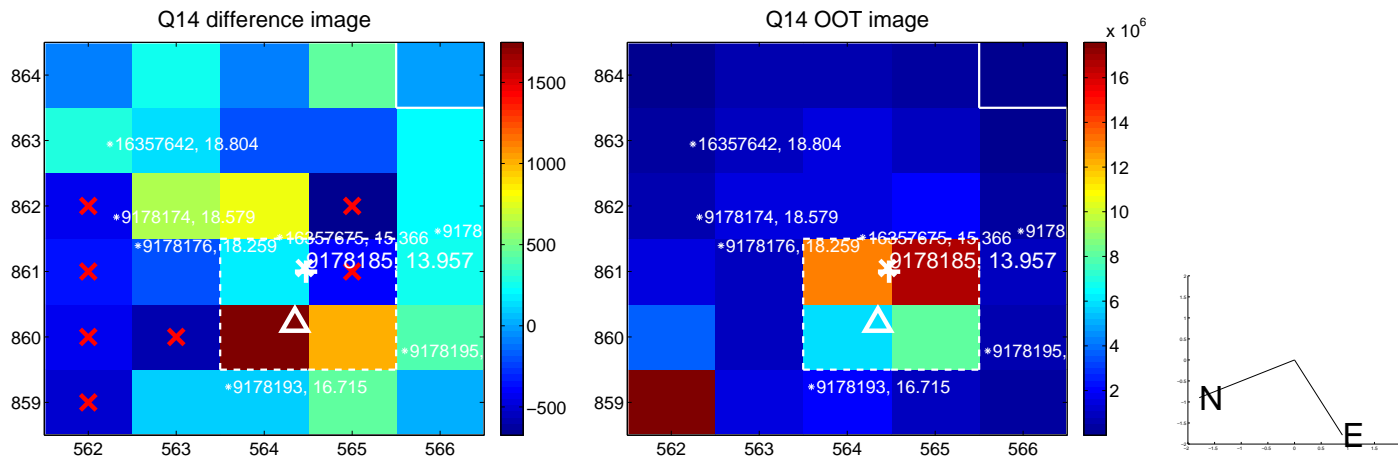
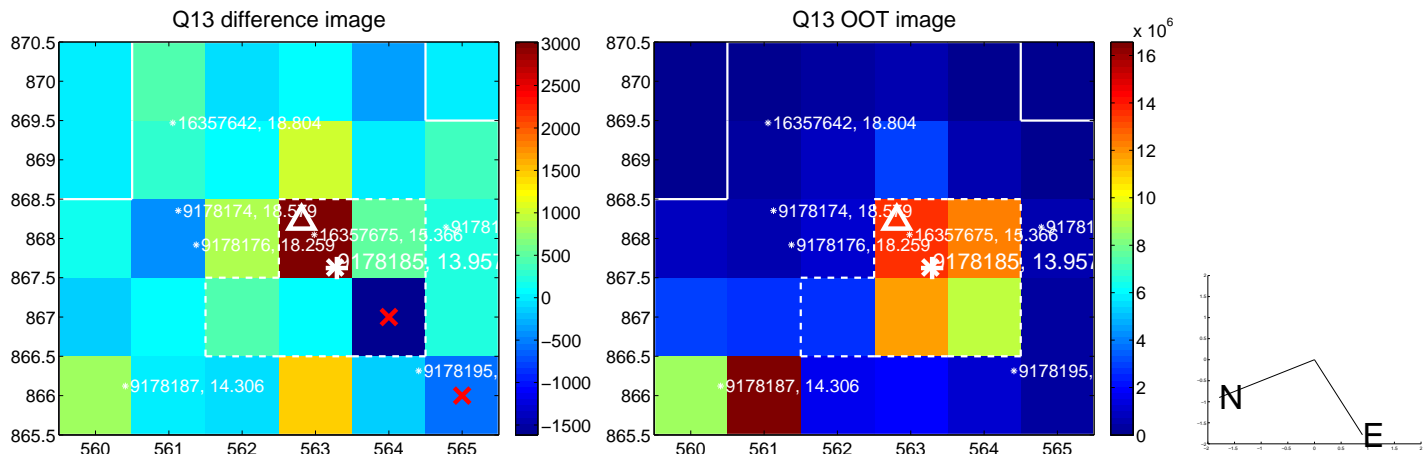




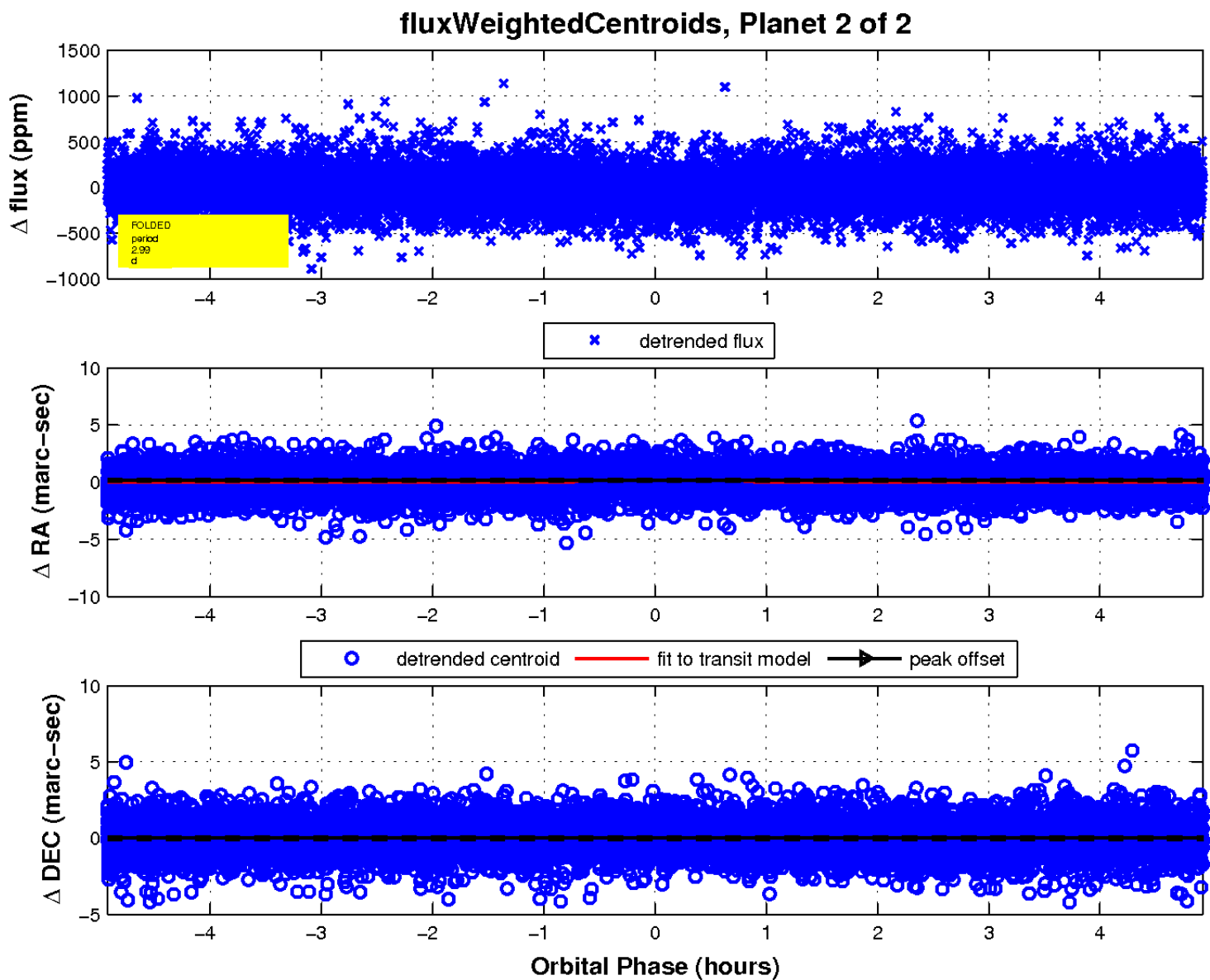
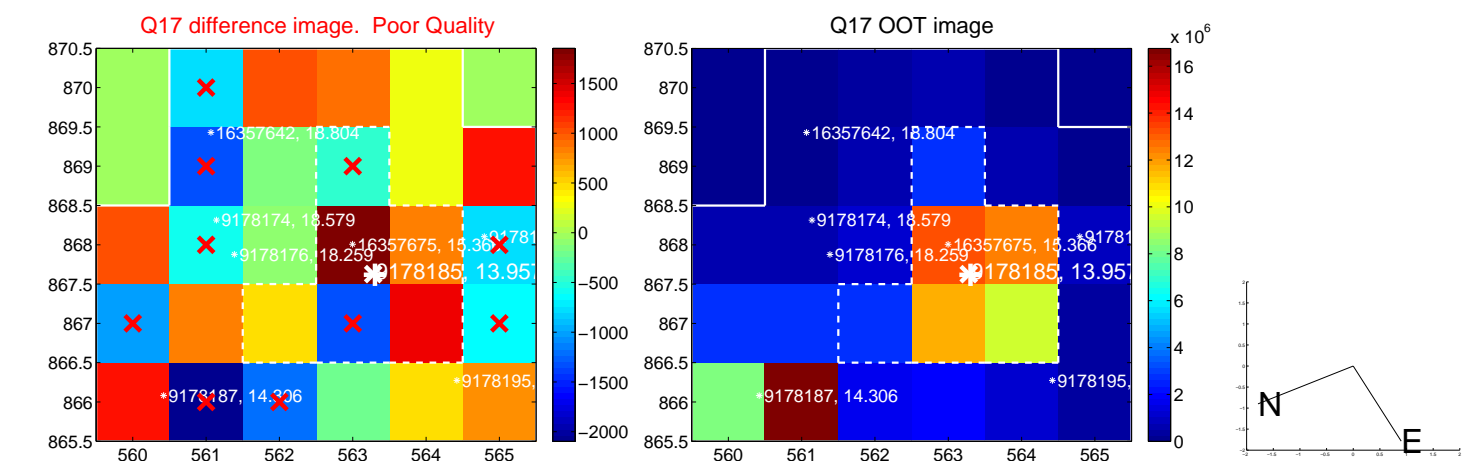
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white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination

