

# KIC 009533489

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009533489-01	OBS	3783.01	197.144841	300.177779	4679.7	1.679	99.2	125.9	1.94	7214	15.02	14.55
009533489-02	OBS	No	1.190736	132.525925	16.6	4.307	10.6	10.3	1.94	7214	0.82	13232.21

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009533489-01	OBS	PC	0.52	0	0	0	0	NO_COMMENT
009533489-02	OBS	FP	0.00	1	0	0	0	LPP_DV—MOD_NONUNIQ_ALT

**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 009533489-01

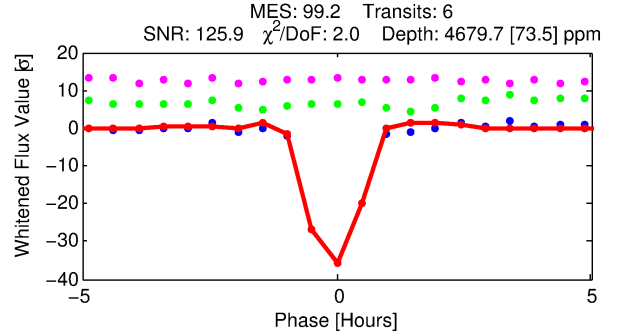
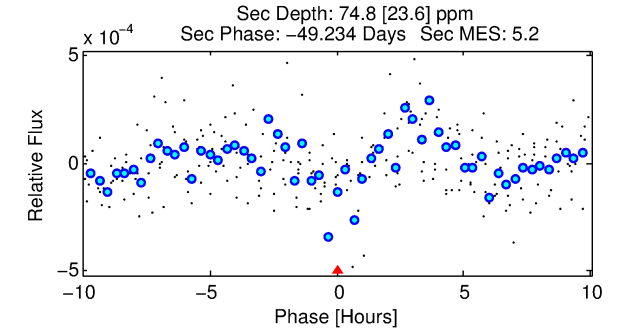
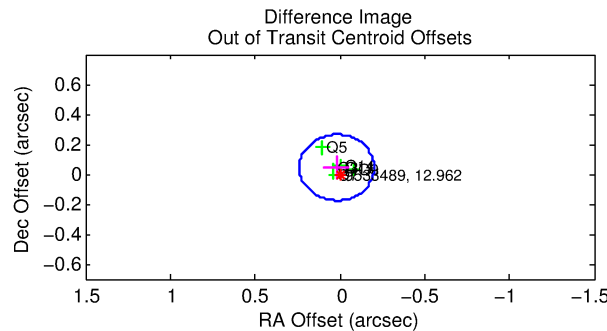
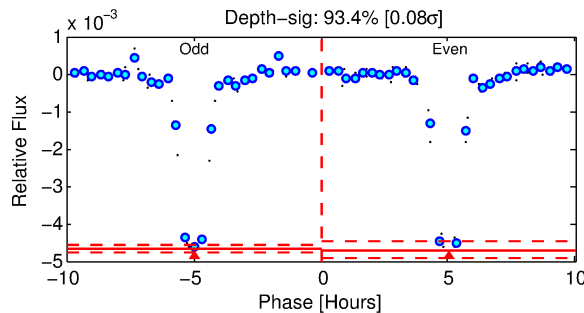
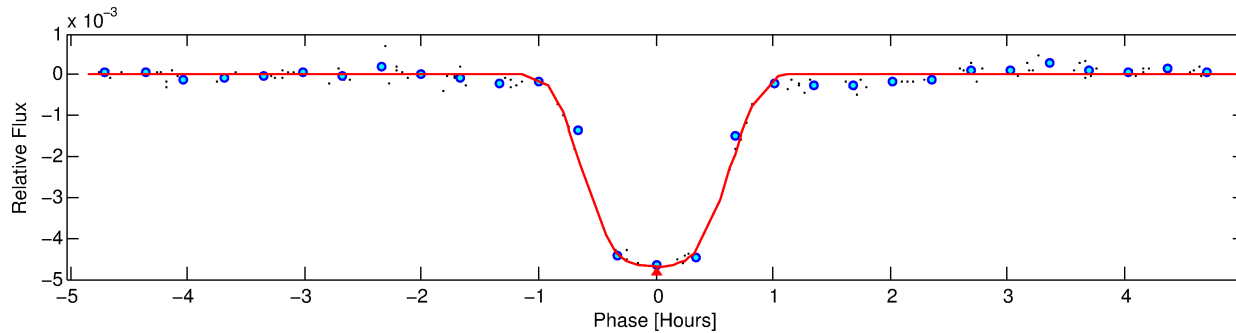
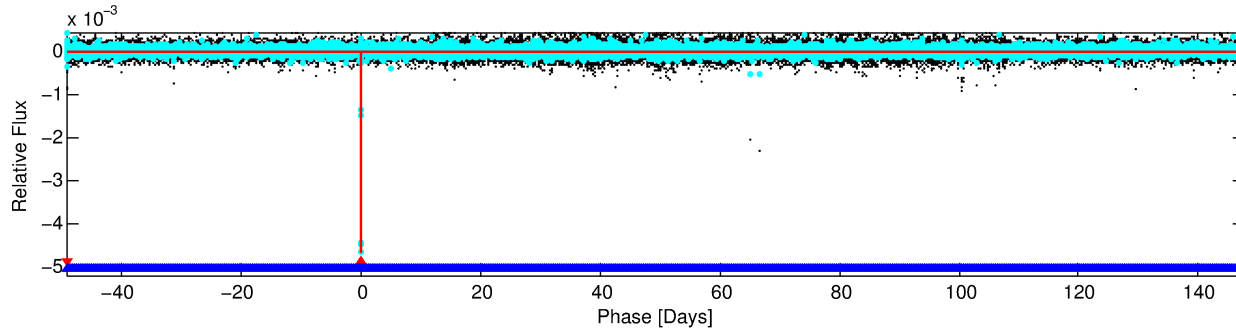
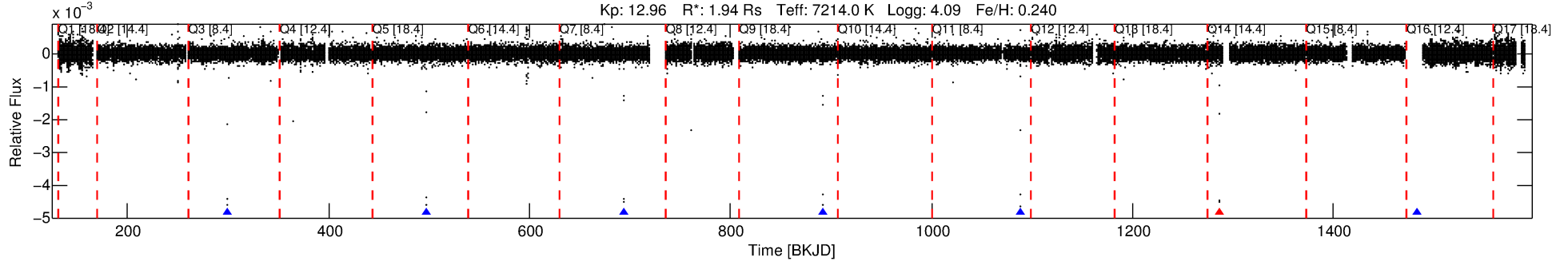
No Significant Match Found

# DV One-Page Summary

KIC: 9533489 Candidate: 1 of 2 Period: 197.145 d

KOI: K03783.01 Corr: 0.885

Kp: 12.96 R\*: 1.94 Rs Teff: 7214.0 K Logg: 4.09 Fe/H: 0.240



## DV Fit Results:

Period = 197.14484 [0.00017] d  
Epoch = 300.1778 [0.0005] BKJD  
Rp/R\* = 0.0711 [0.0024]  
a/R\* = 581.49 [93.54]  
b = 0.85 [0.05]  
Seff = 14.55 [5.90]  
Teq = 498 [51] K  
Rp = 15.02 [4.63] Re  
a = 0.7901 [0.1990] AU  
Ag = 113.90 [54.91] [2.06σ]  
Teff = 2516 [235] K [8.39σ]

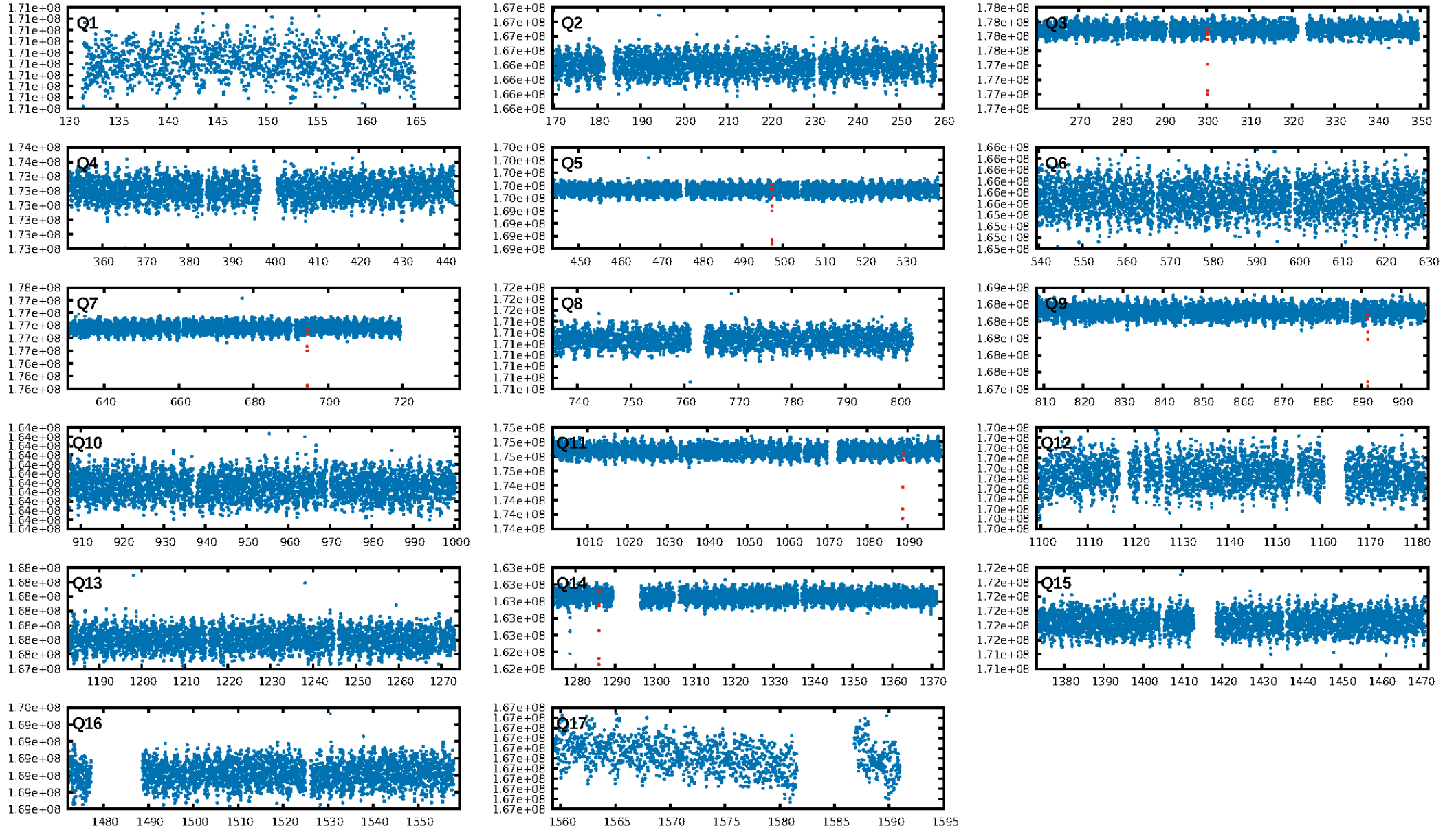
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [1017.31σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 57.3%  
ModelChiSquareGof-sig: 88.4%  
Bootstrap-pfa: 0.00e+00  
RollingBand-fgt: 0.83 [5/6]  
GhostDiagnostic-chr: 14.34  
Centroid-sig: 18.7%  
Centroid-so: 0.104 arcsec [1.25σ]  
OotOffset-rm: 0.048 arcsec [0.65σ]  
KicOffset-rm: 0.068 arcsec [0.90σ]  
OotOffset-st: 1/3/0/2 [6]  
KicOffset-st: 1/3/0/2 [6]  
DiffImageQuality-fgm: 1.00 [6/6]  
DiffImageOverlap-fno: 0.50 [3/6]

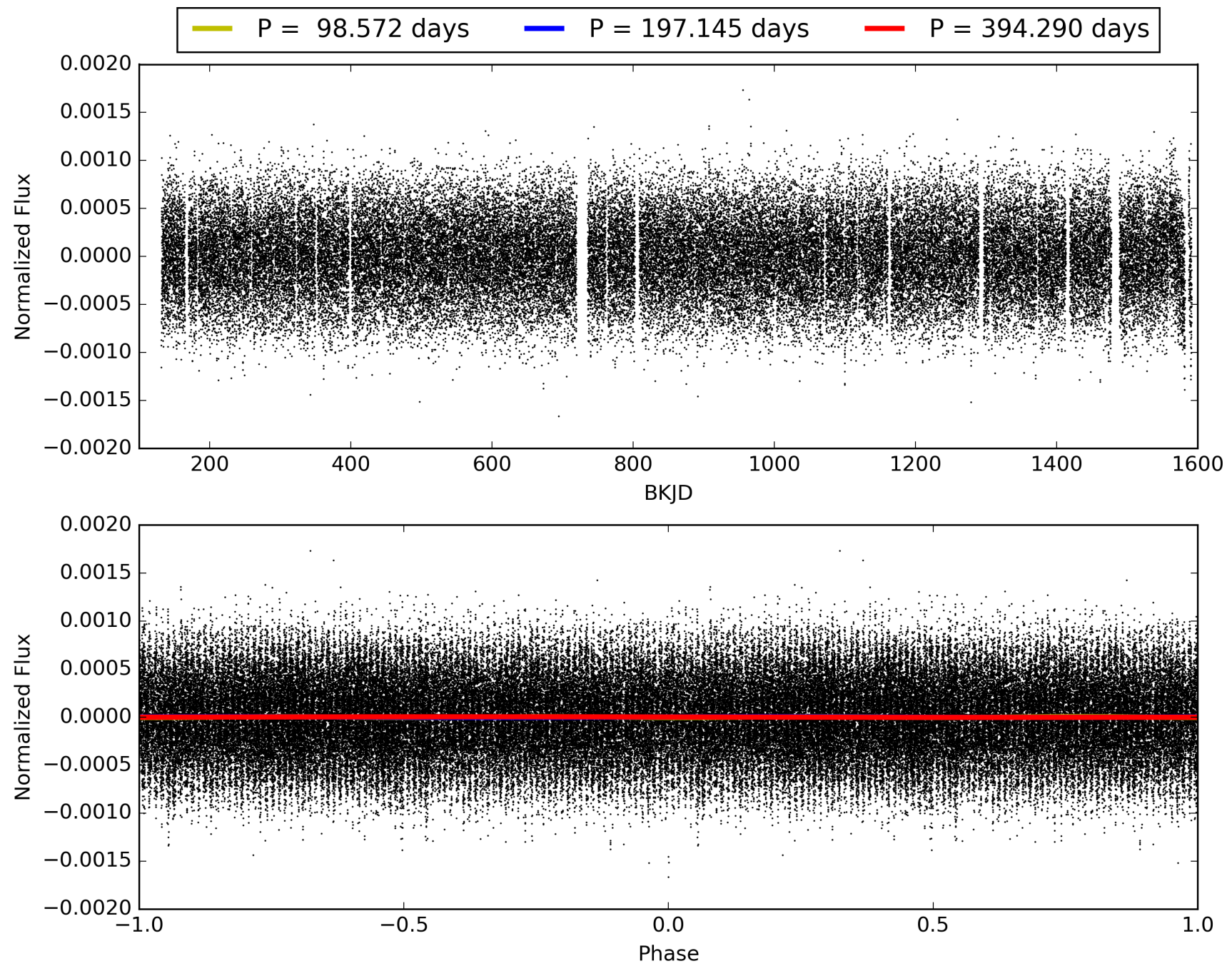
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 14:06:40 Z

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

# TCE 009533489-01, PDC Light Curves

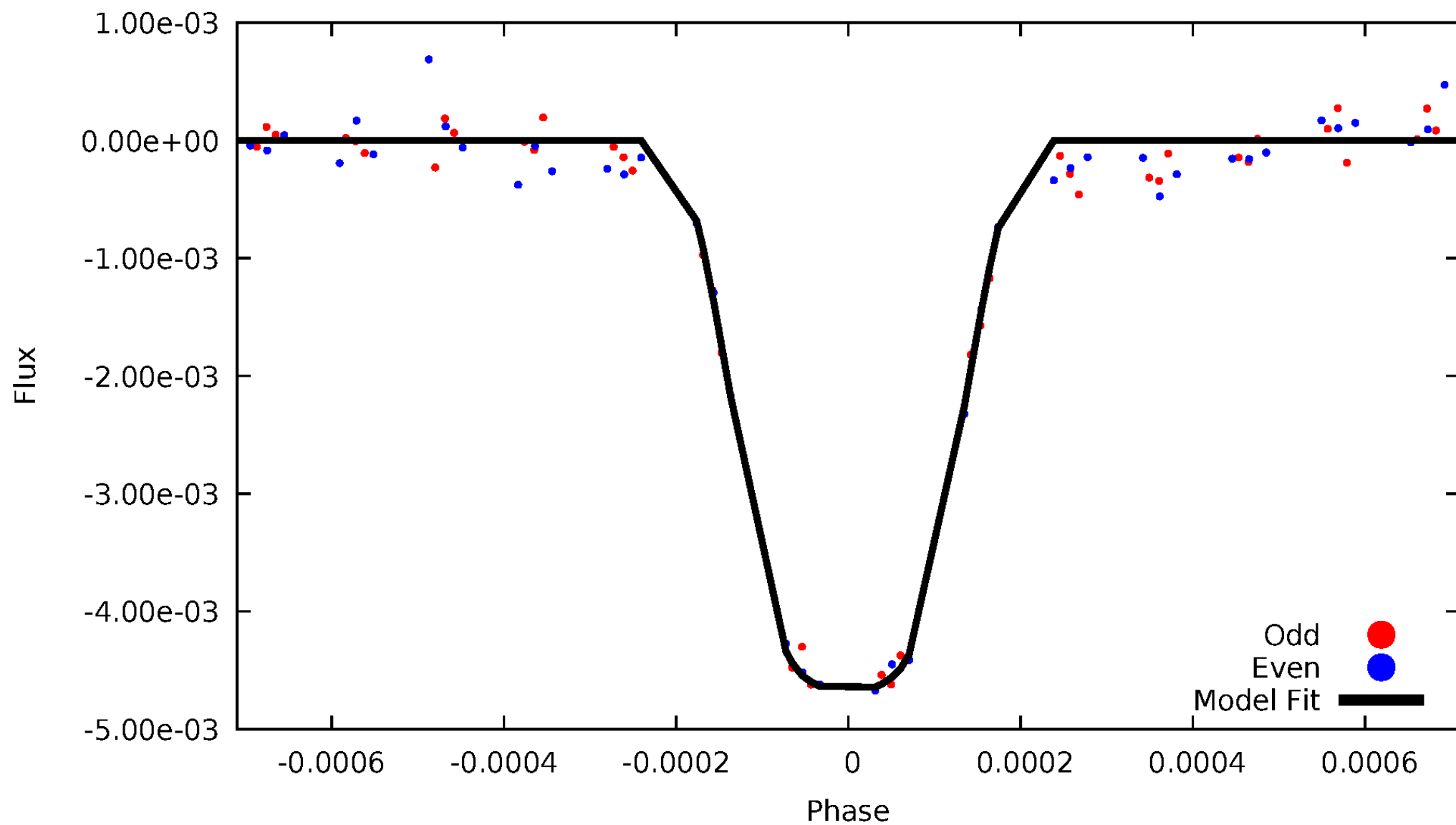


TCE 009533489-01



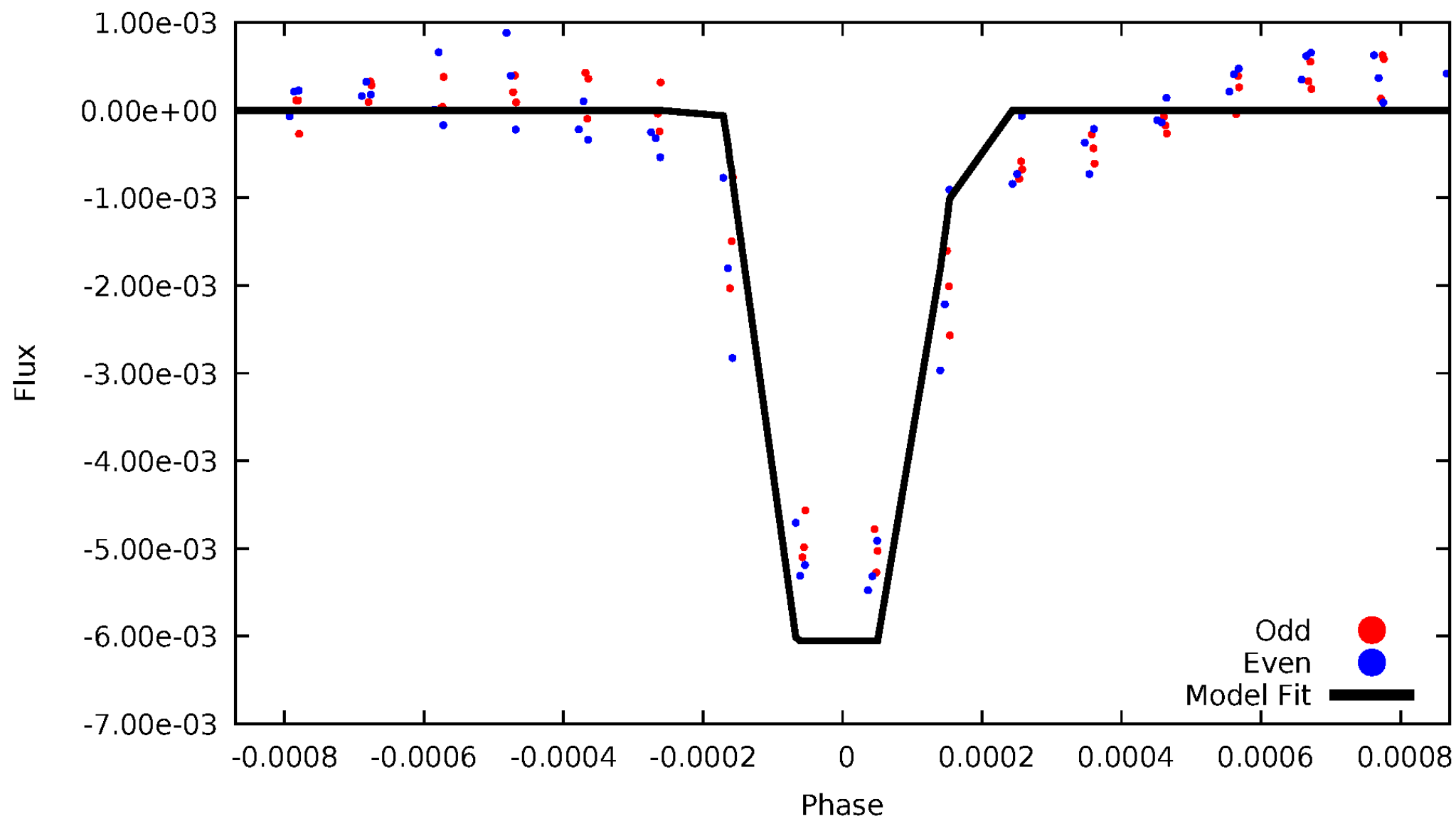
# DV Odd/Even

TCE 009533489-01



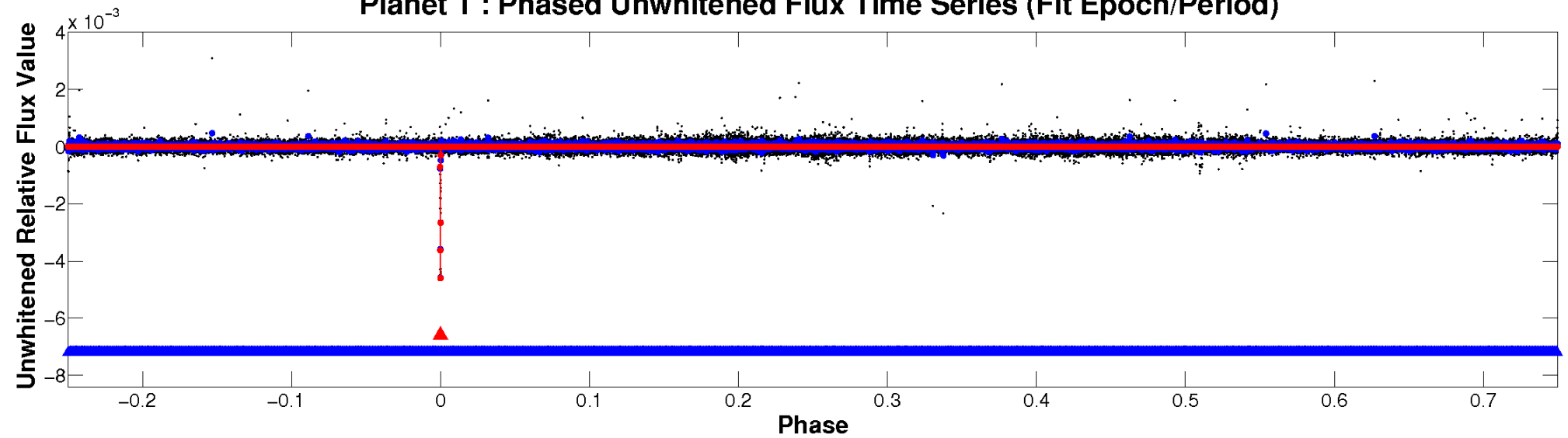
# ALT Odd/Even

TCE 009533489-01

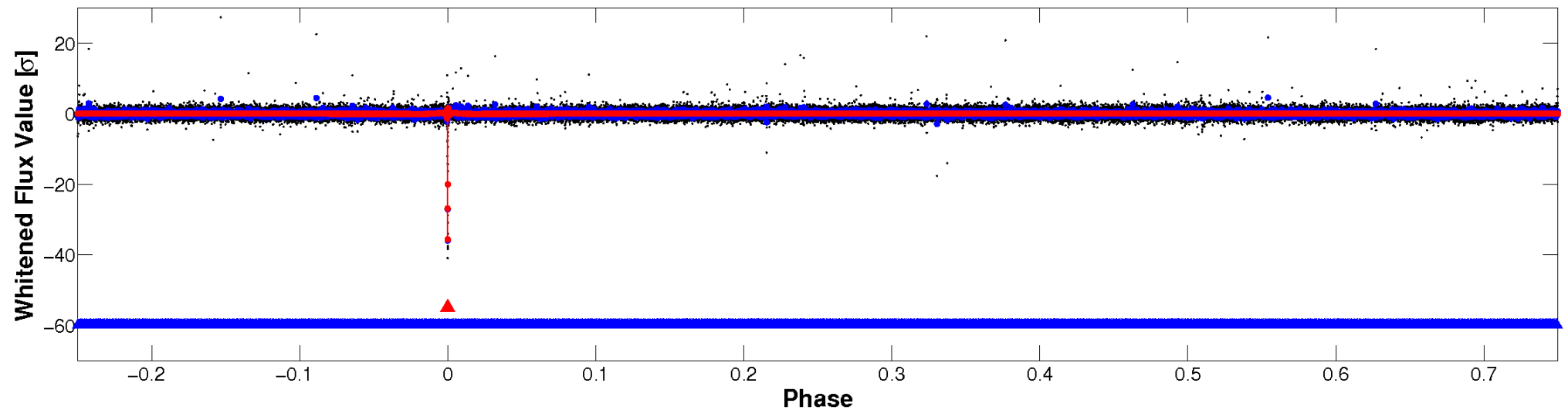


# Non-Whitened Vs. Whitened Light Curve

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

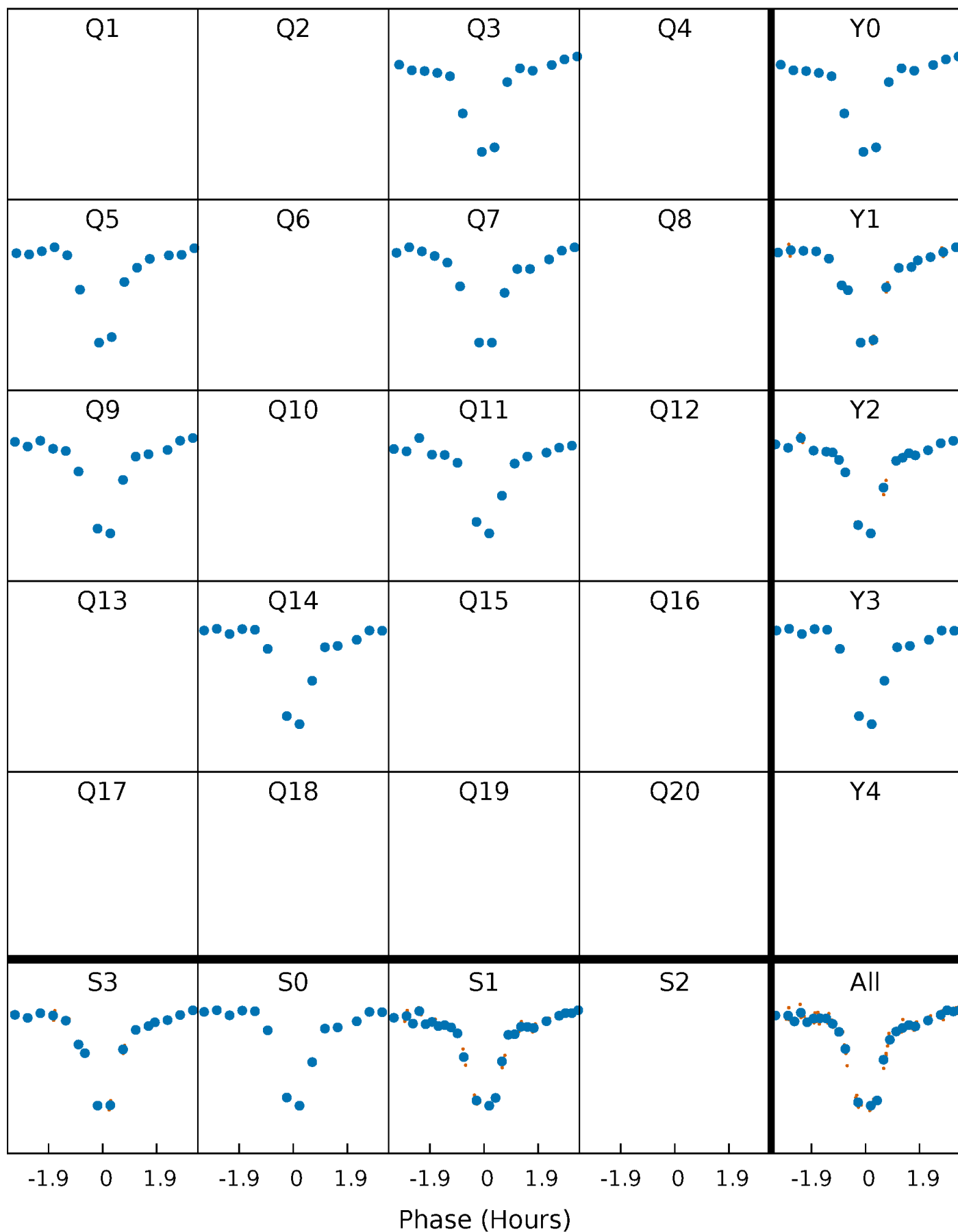


Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

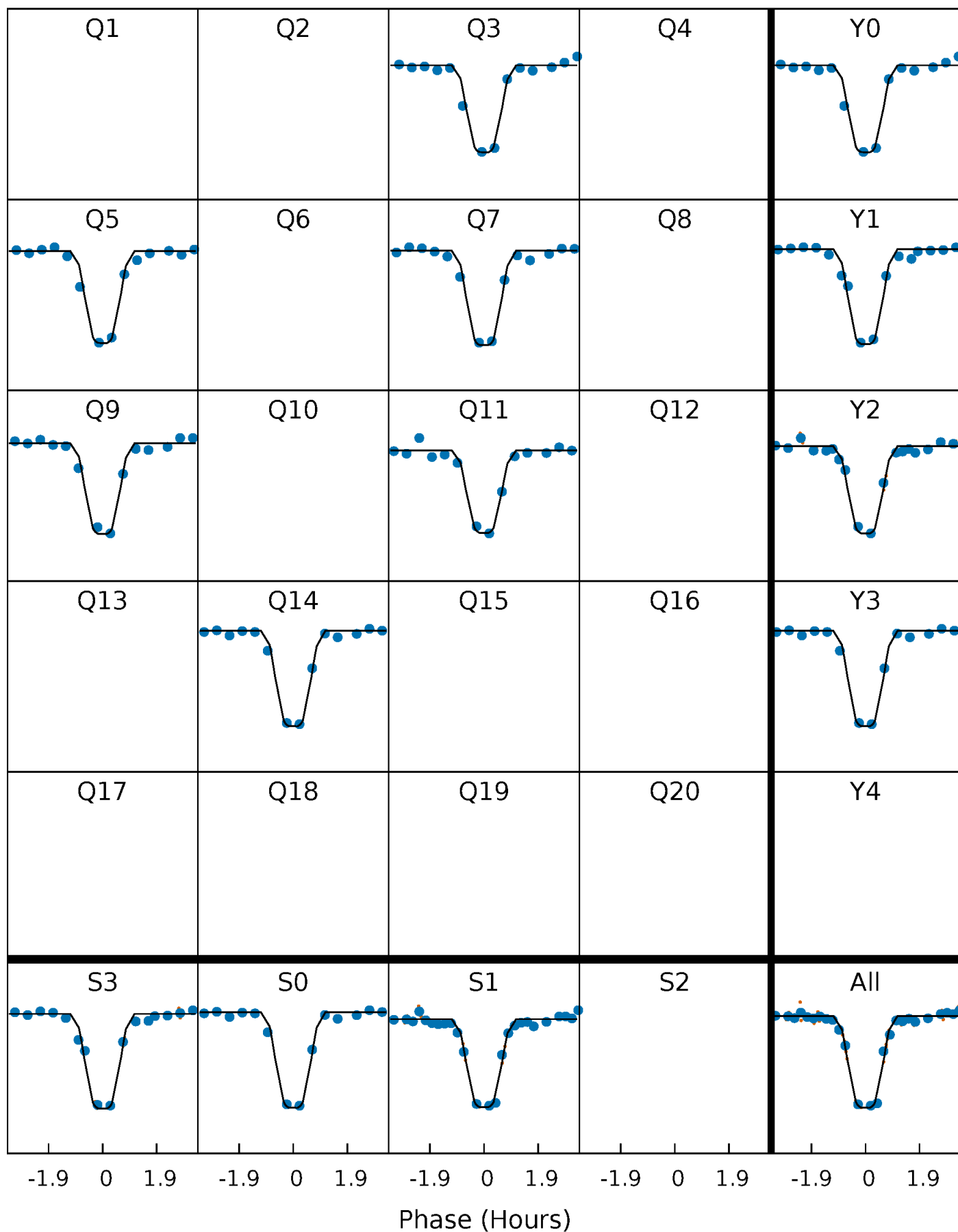
TCE 009533489-01     $P=197.144841$  Days     $T_0=300.177779$  (BKJD)





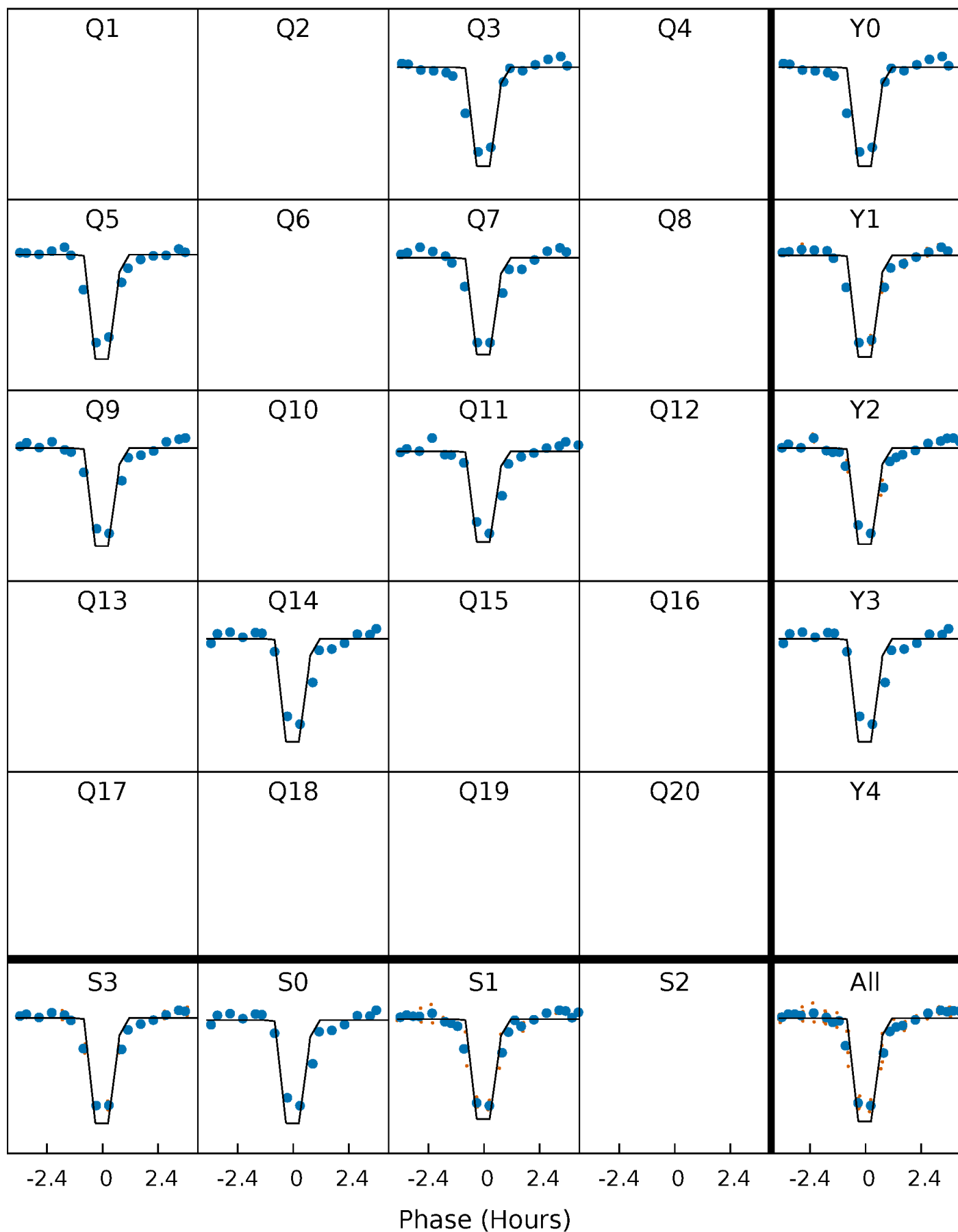
# DV Quarter-Phased Transit Curves

TCE 009533489-01 P=197.144841 Days  $T_0=300.177779$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

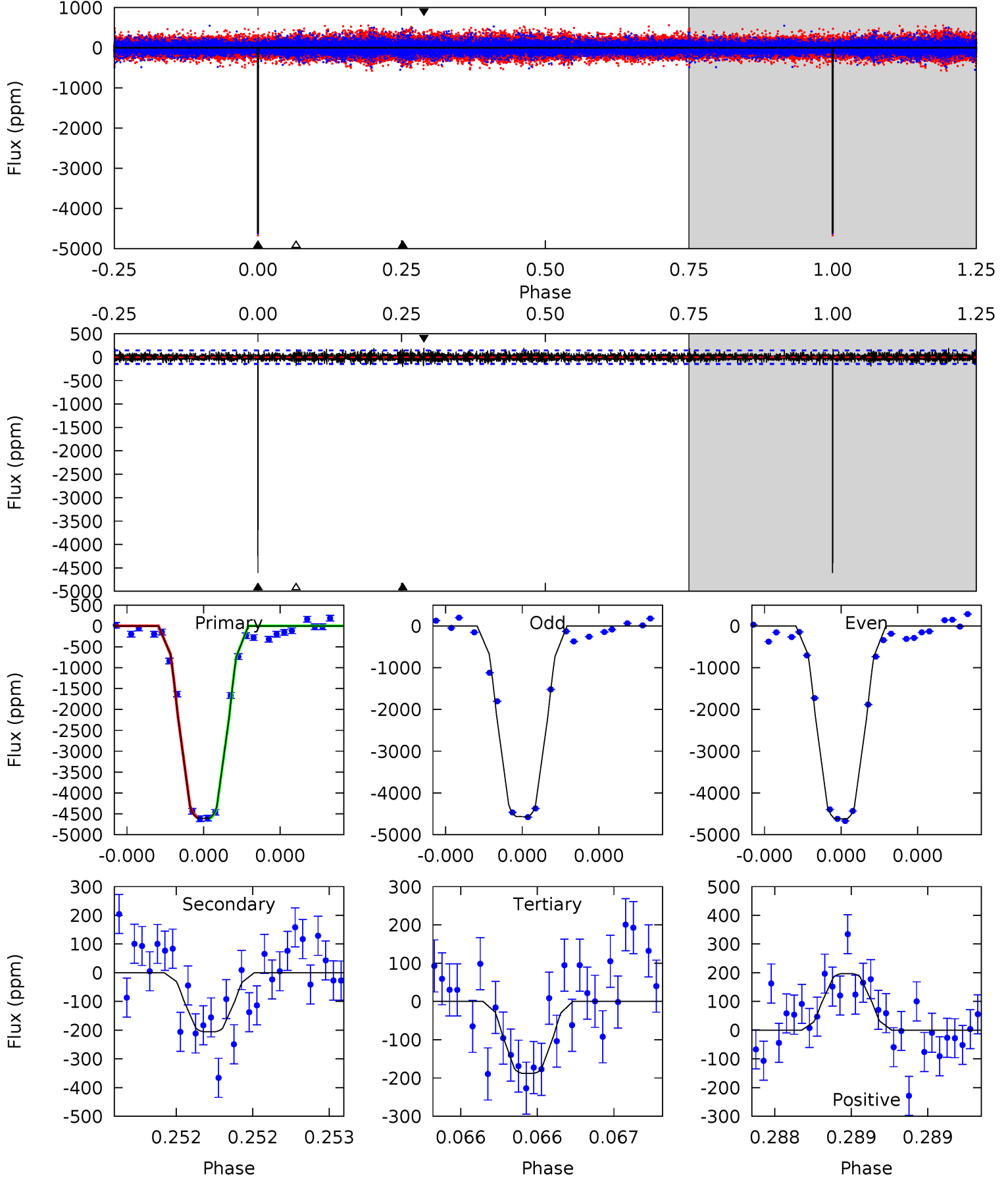
TCE 009533489-01 P=197.143553 Days  $T_0=300.181895$  (BKJD)



# DV Model-Shift Uniqueness Test

009533489-01, P = 197.144841 Days, E = 103.032938 Days

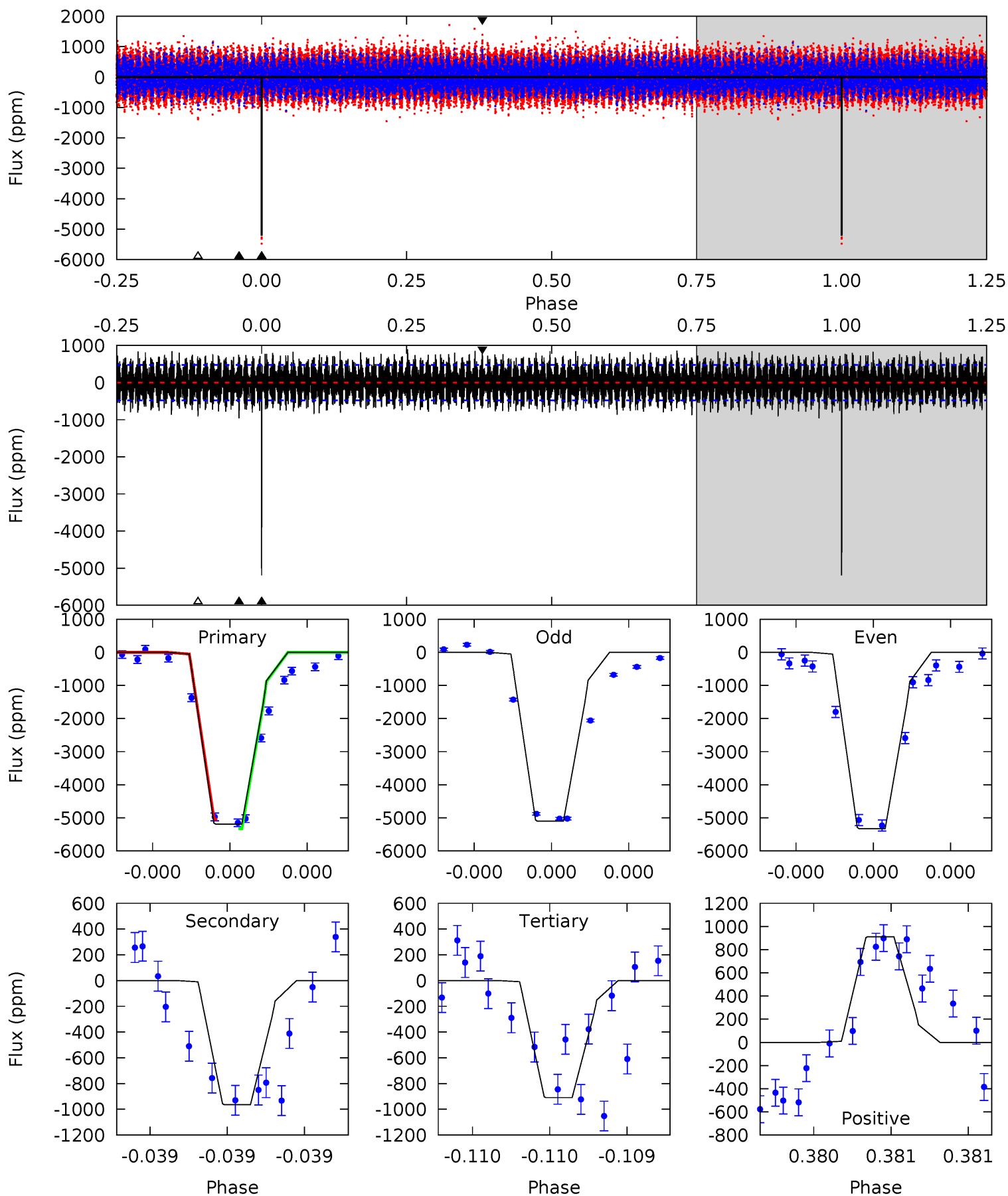
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
178.8	7.98	7.29	7.63	5.61	3.54	1.83	171.5	171.2	0.69	0.34	1.00	1.00	0.04	0.55



# Alt Model-Shift Uniqueness Test

009533489-01, P = 197.143553 Days, E = 103.038342 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
61.4	11.4	10.8	10.8	5.65	3.59	3.77	50.7	50.6	0.64	0.62	1.38	1.00	0.15	1.71



### Stellar Parameters For KIC 009533489

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M$ ( $M_{\odot}$ )	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$7214^{+200}_{-342}$	$4.093^{+0.112}_{-0.192}$	$0.240^{+0.150}_{-0.350}$	$1.935^{+0.593}_{-0.396}$	$1.690^{+0.187}_{-0.257}$	$0.329^{+0.203}_{-0.168}$
	+3%/-5%	+3%/-5%	+62%/-146%	+31%/-20%	+11%/-15%	+62%/-51%
Source	PHO54	PHO54	PHO54	DSEP		

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

### Secondary Eclipse Parameters for KIC 009533489-01 / KOI 3783.01

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-206 \pm 26$	$15.47^{+2.64}_{-1.74}$	$701^{+58}_{-46}$	$3617^{+115}_{-116}$	$291^{+80}_{-76}$
Alt.	$-963 \pm 84$	$16.54^{+2.71}_{-1.66}$	$699^{+54}_{-45}$	$4642^{+157}_{-168}$	$1178^{+281}_{-293}$

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

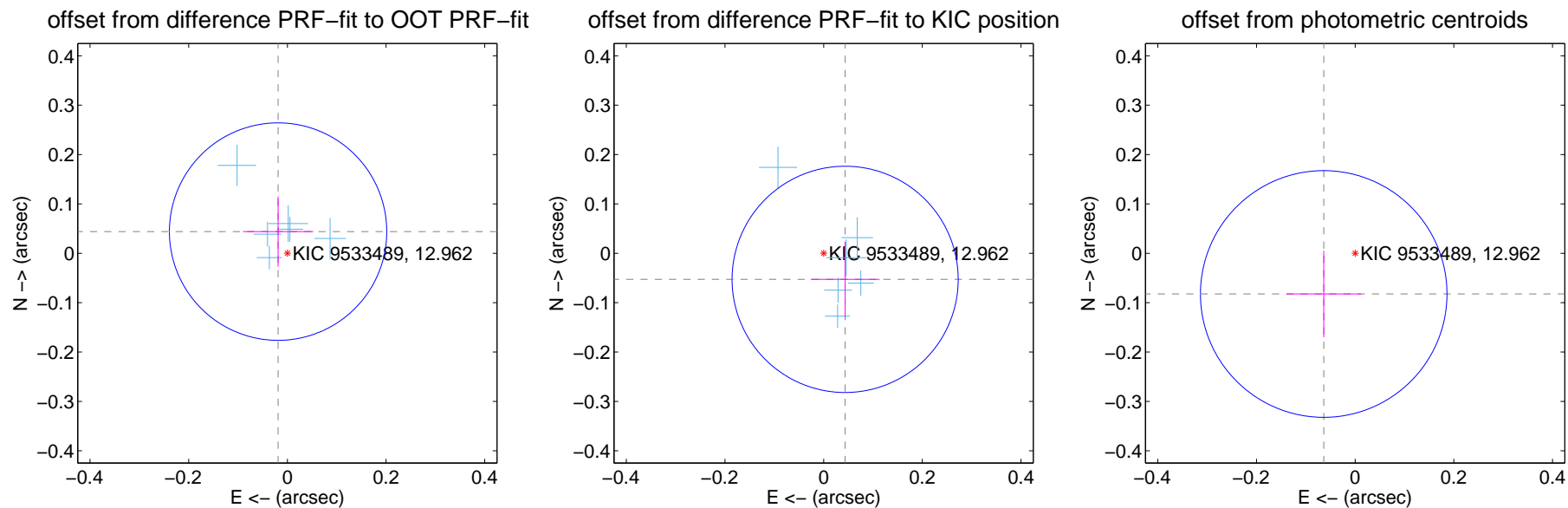
## DV Centroid Data

Supplemental centroid analysis for 009533489-01. Kepler magnitude: 12.96. Transit SNR 125.92

There are 6 quarters with good PRF difference image offsets

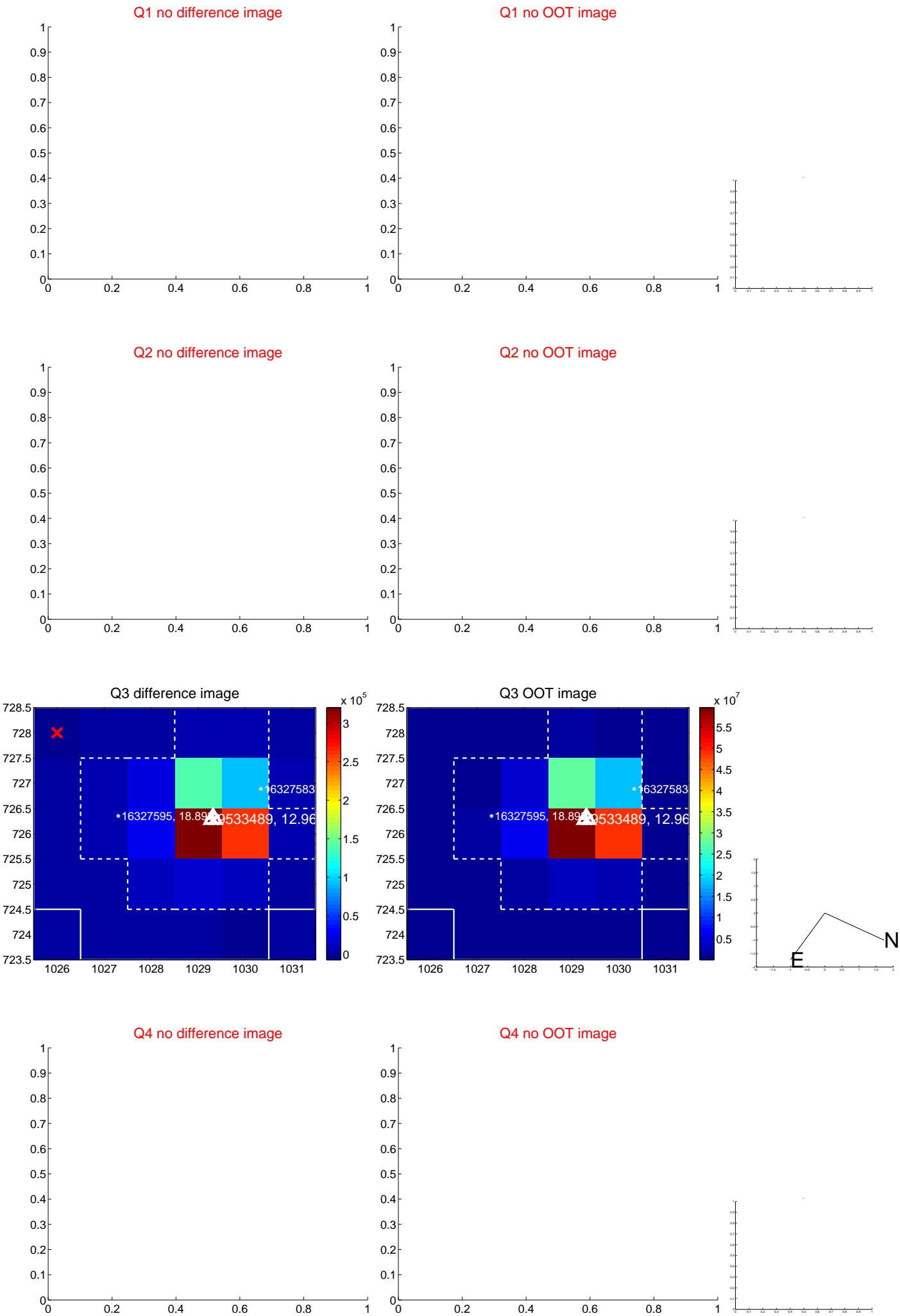
The direct PRF centroid is offset from the target star catalog position by about 0.08 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.048 \pm 0.073$	0.65	$0.019 \pm 0.071$	$0.044 \pm 0.071$
PRF-fit source offset from KIC position	$0.068 \pm 0.076$	0.90	$-0.044 \pm 0.070$	$-0.053 \pm 0.076$
photometric centroid source offset	$0.10 \pm 0.08$	1.25	$0.06 \pm 0.08$	$-0.08 \pm 0.09$

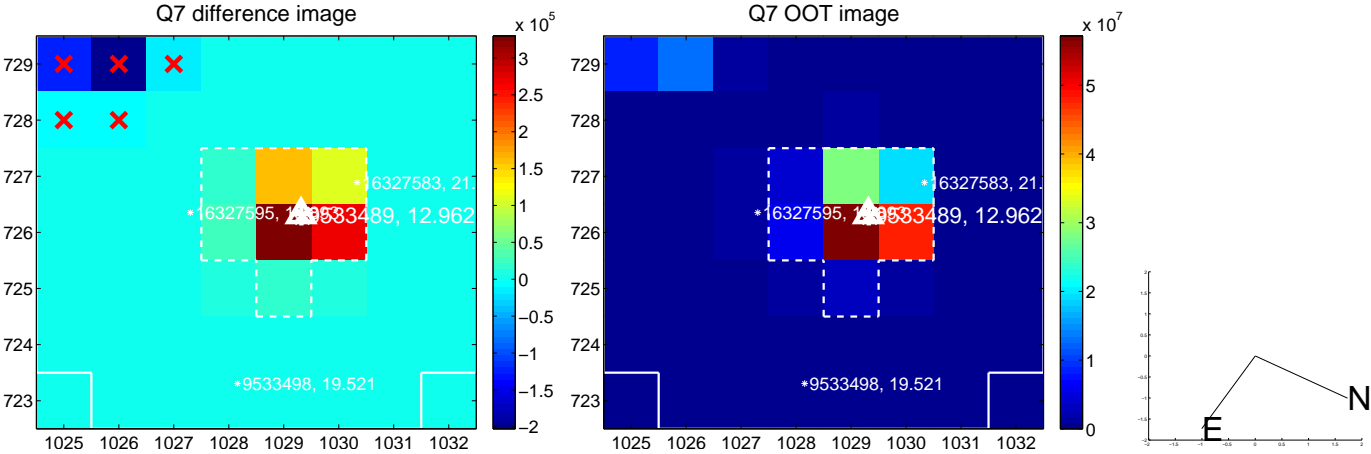
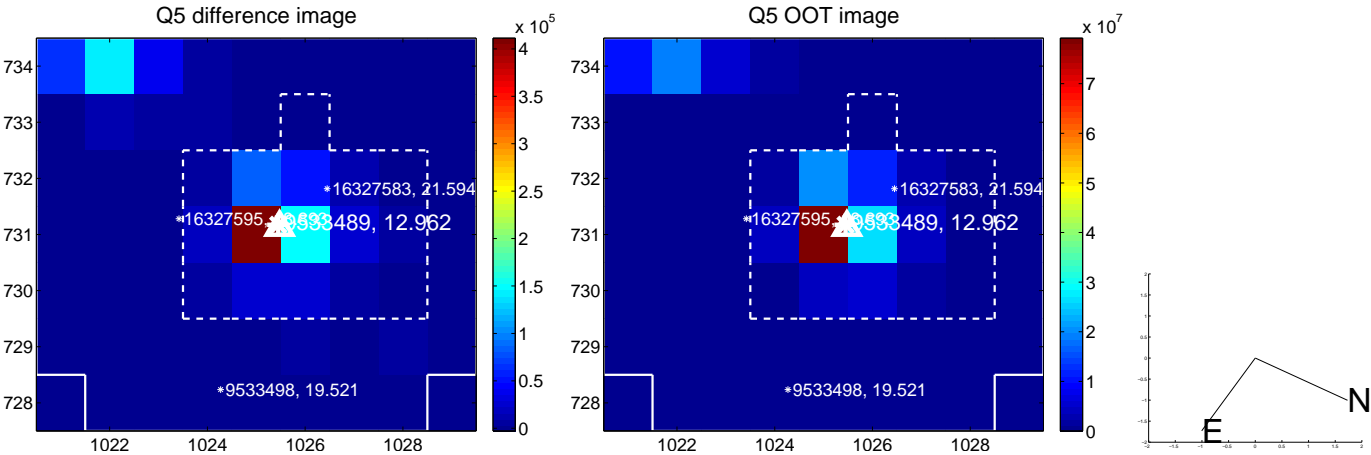


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

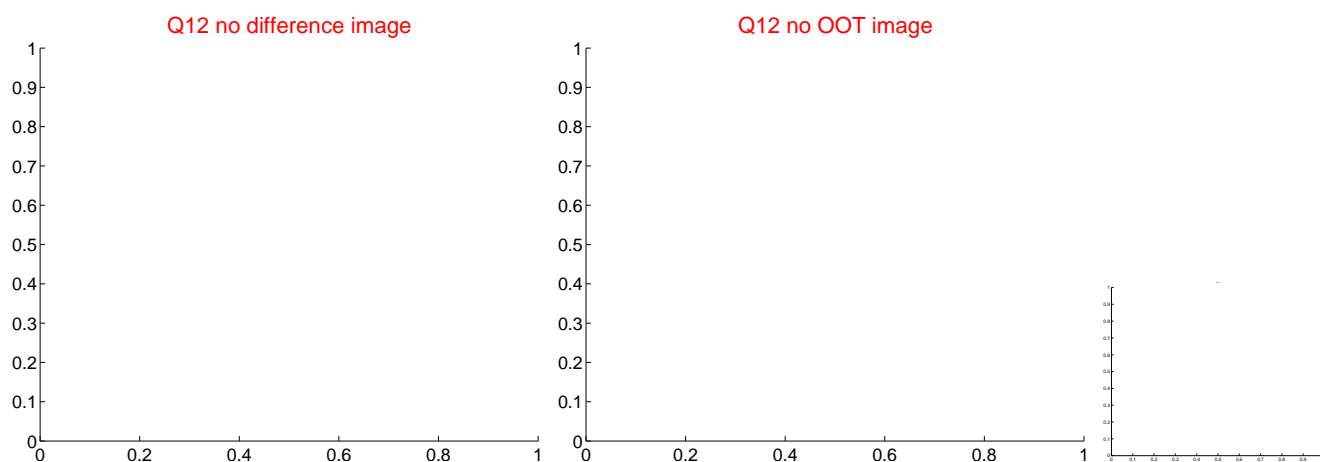
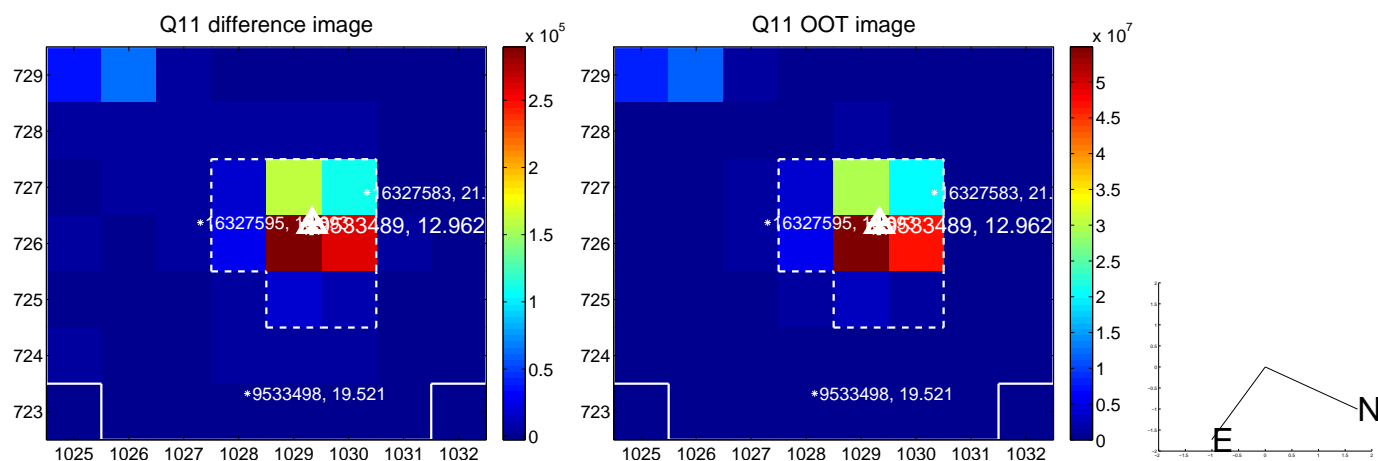
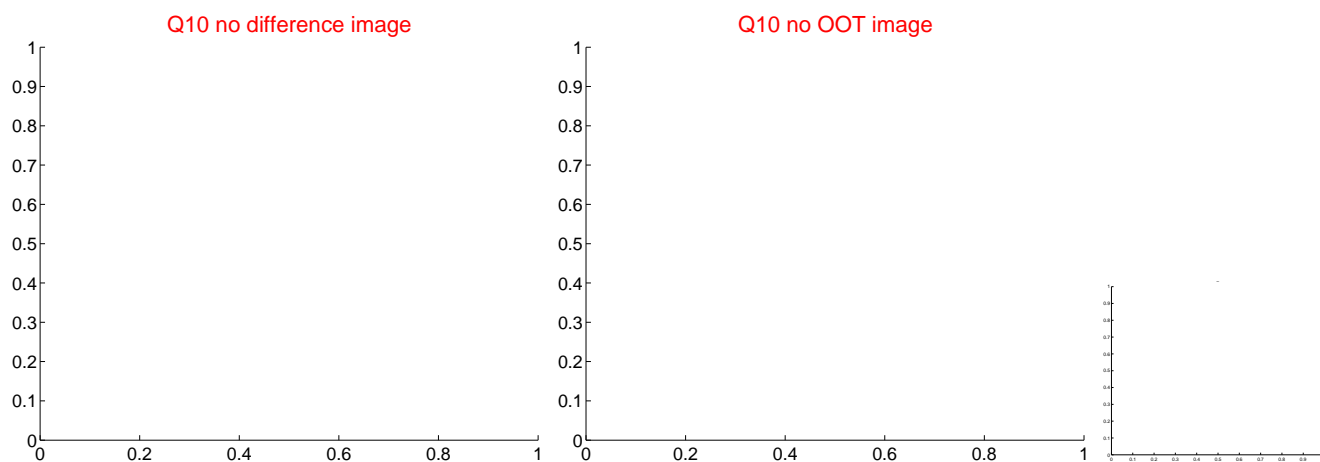
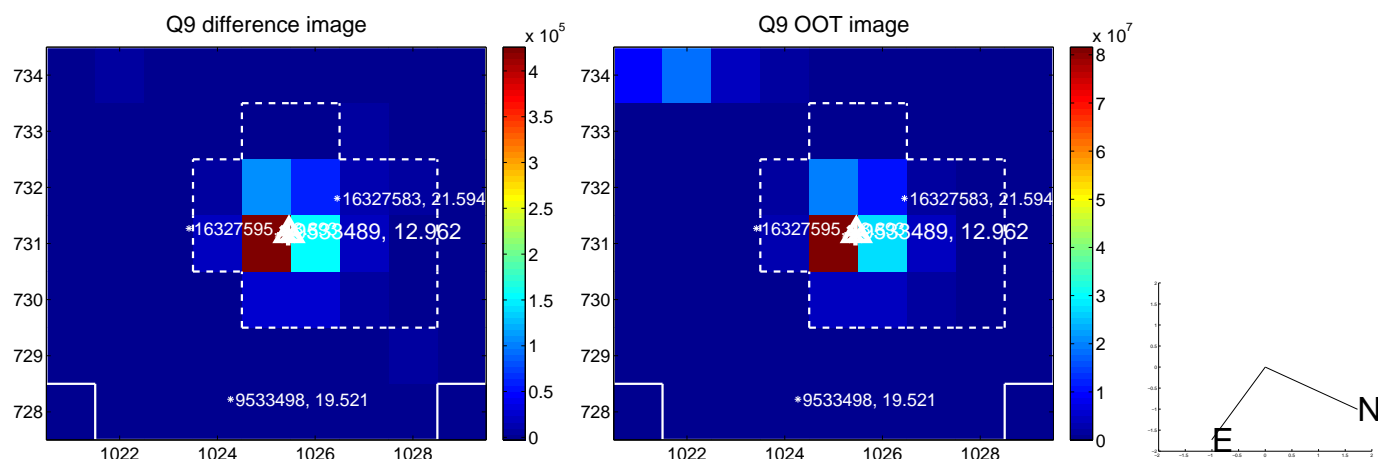


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

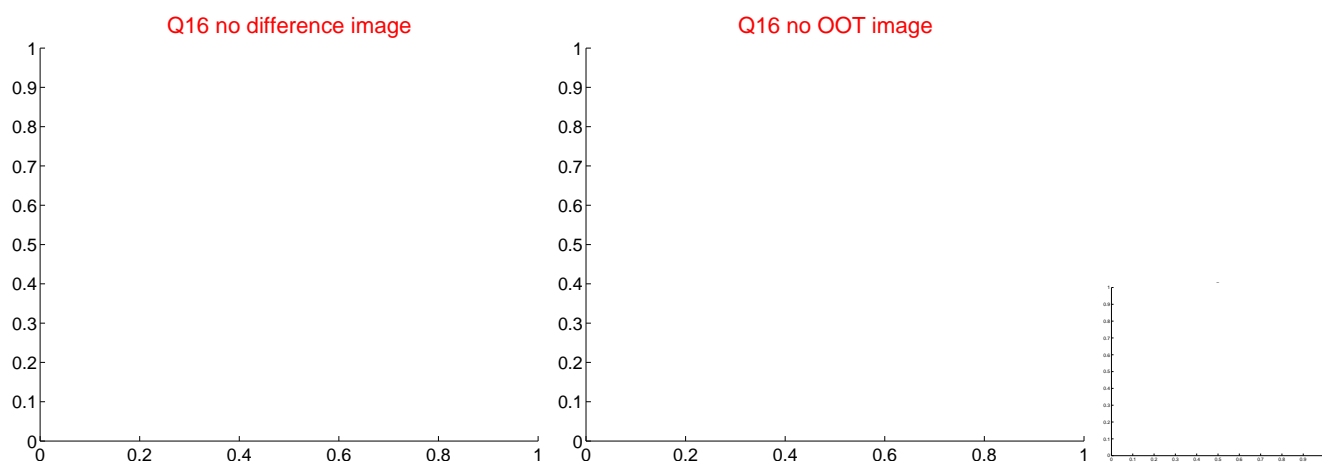
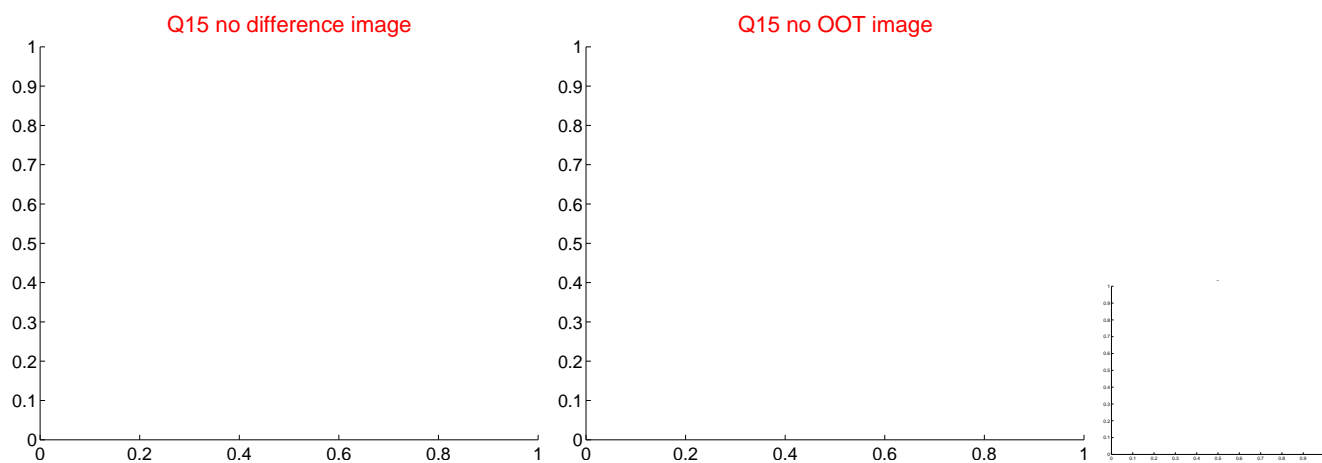
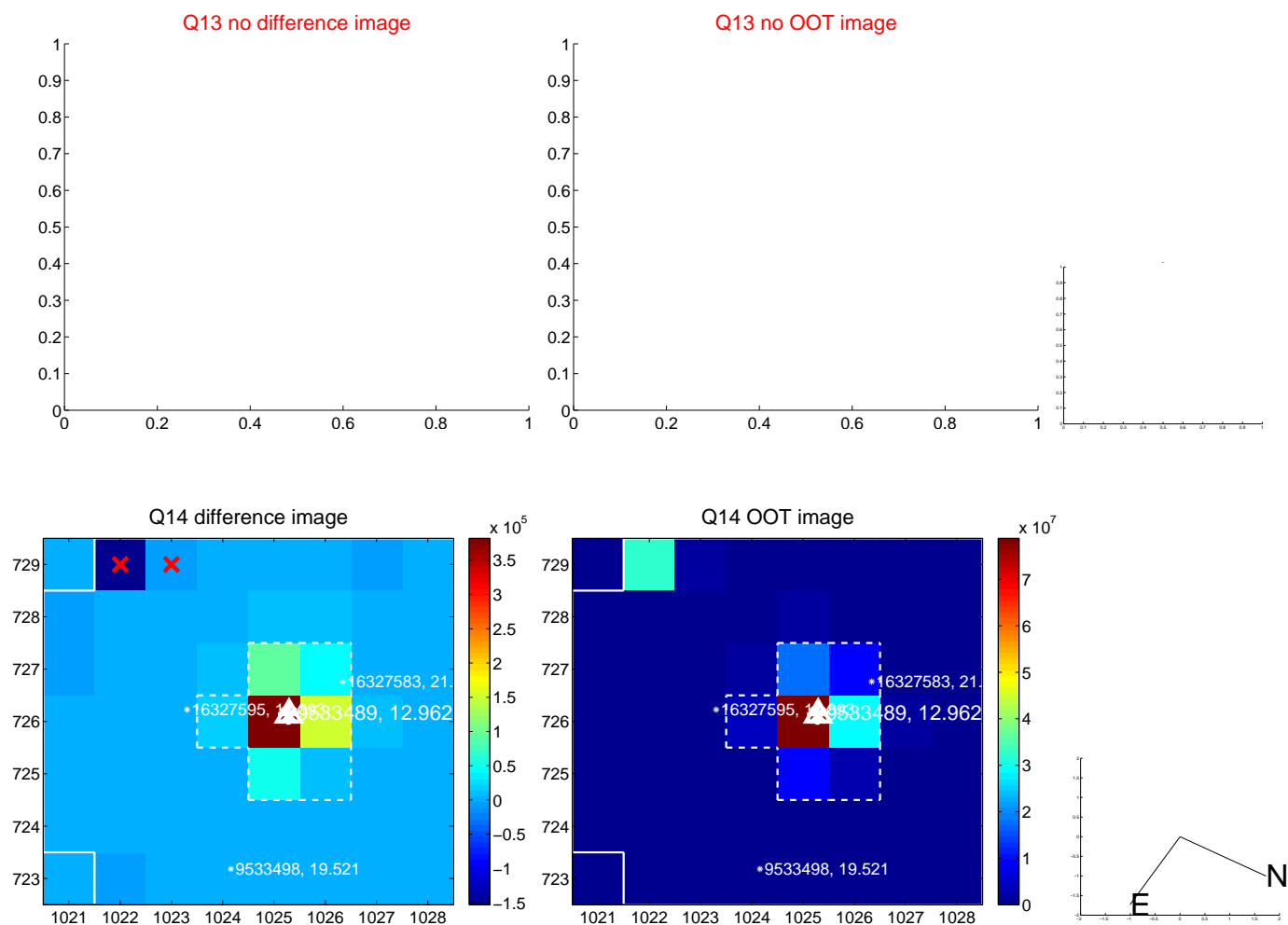




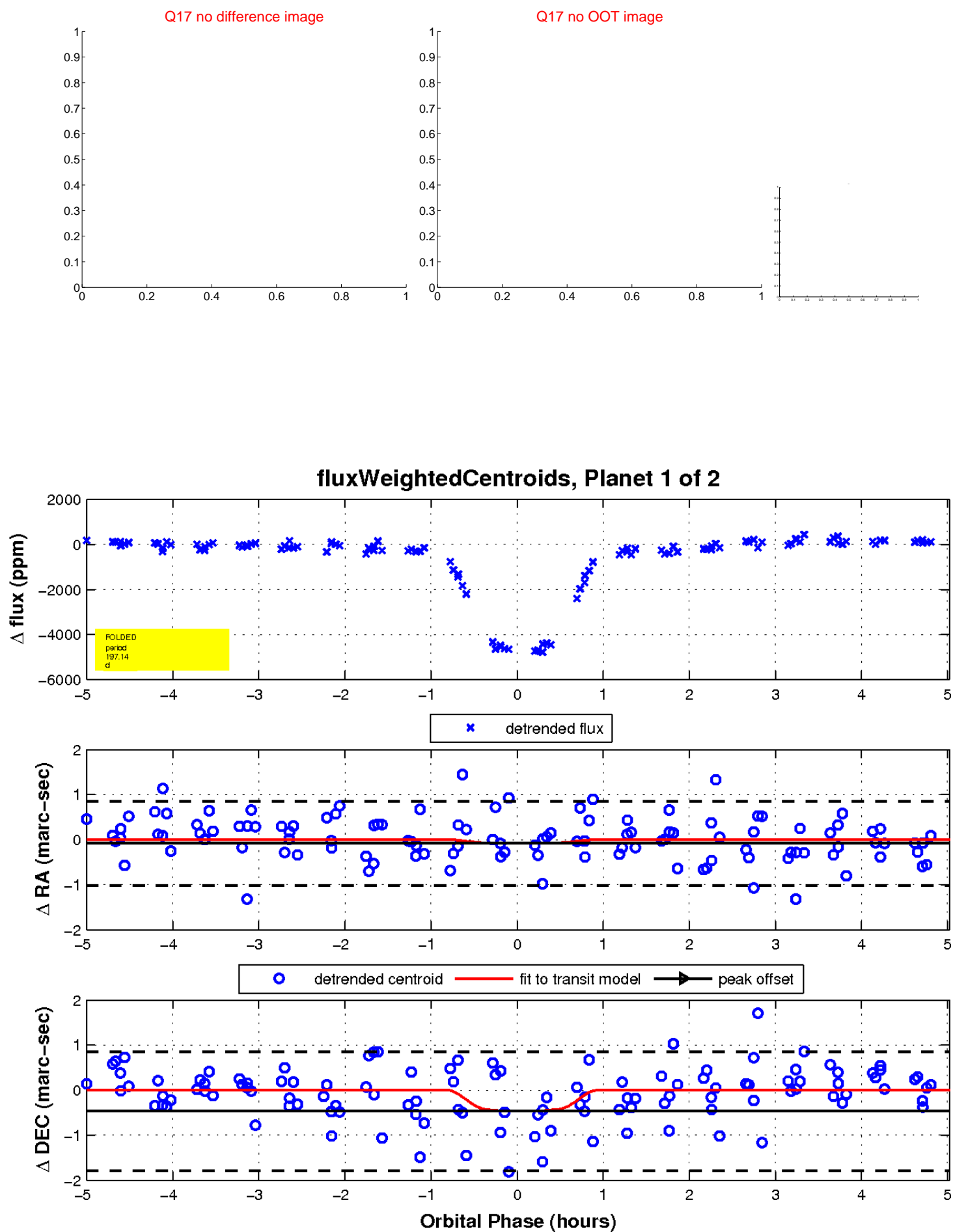
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value



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

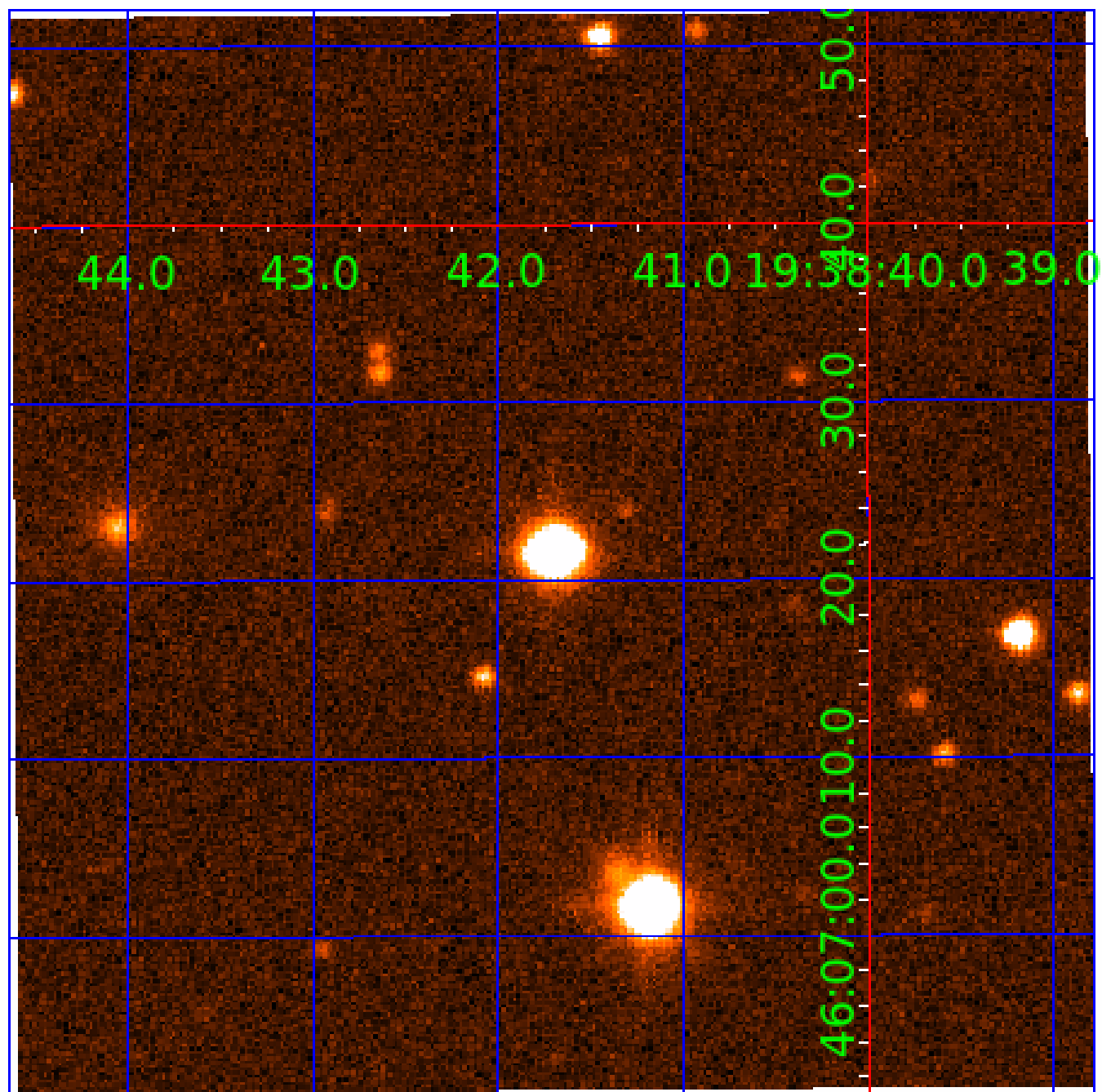


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 009533489

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009533489-01	OBS	3783.01	197.144841	300.177779	4679.7	1.679	99.2	125.9	1.94	7214	15.02	14.55
009533489-02	OBS	No	1.190736	132.525925	16.6	4.307	10.6	10.3	1.94	7214	0.82	13232.21

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009533489-01	OBS	PC	0.52	0	0	0	0	NO_COMMENT
009533489-02	OBS	FP	0.00	1	0	0	0	LPP_DV—MOD_NONUNIQ_ALT

**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.

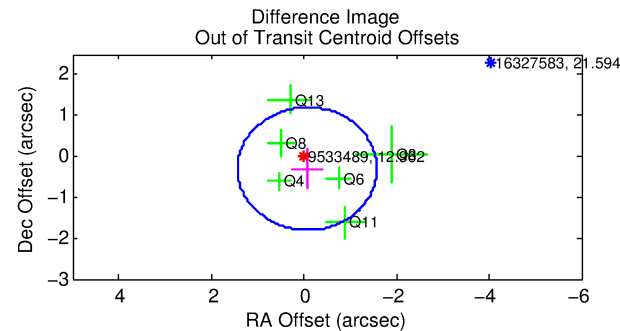
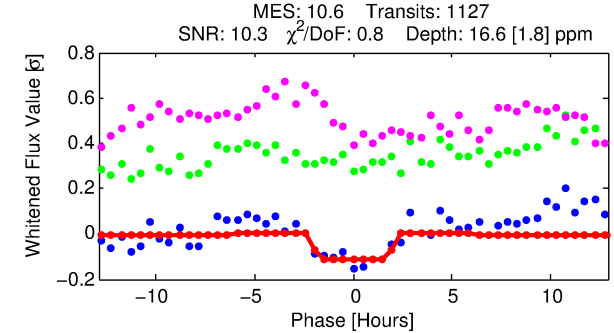
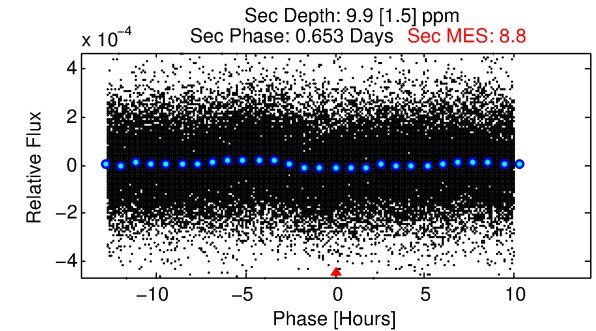
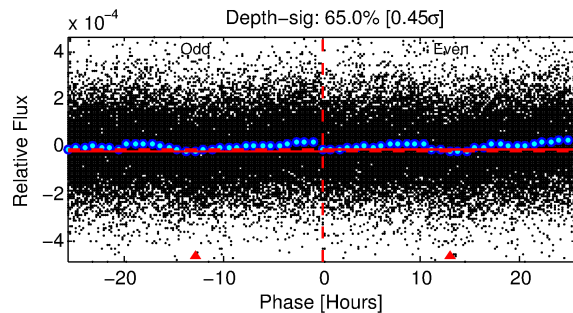
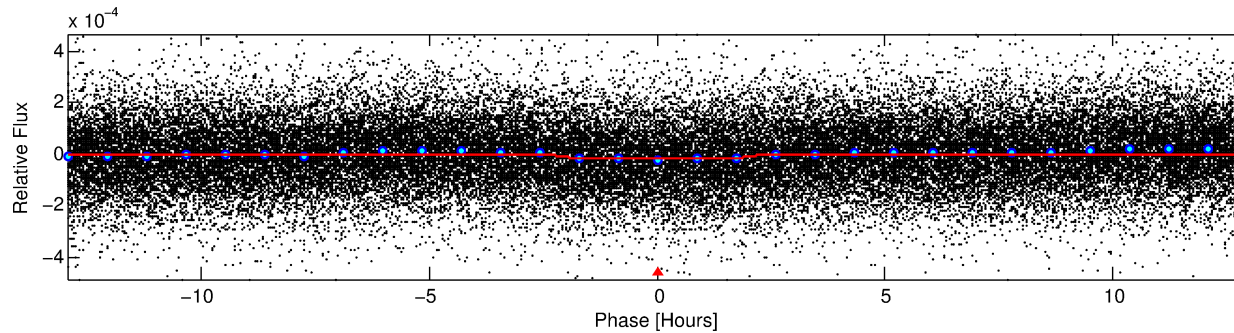
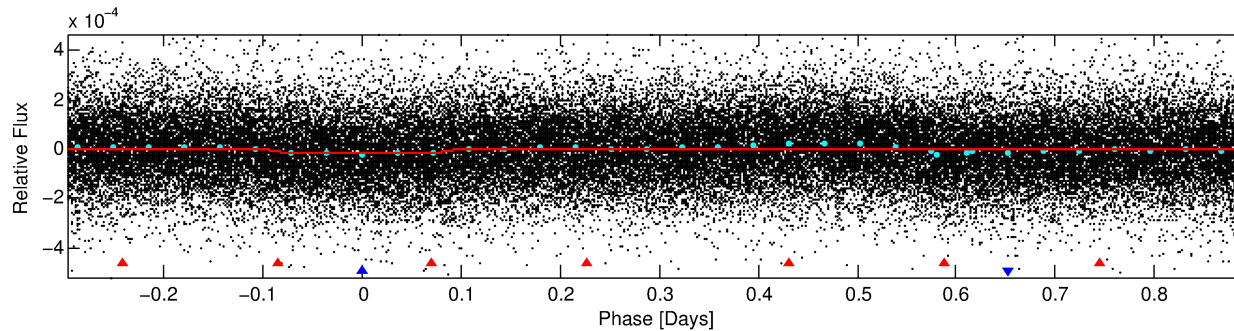
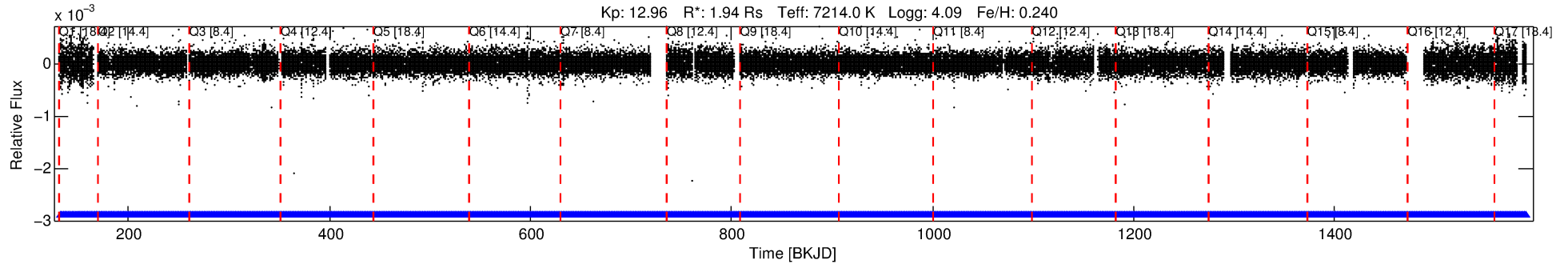
## Ephemeris Match Information For 009533489-02

No Significant Match Found

# DV One-Page Summary

KIC: 9533489 Candidate: 2 of 2 Period: 1.191 d  
KOI: K03783 Corr: No Ephemeris Match

Kp: 12.96 R\*: 1.94 Rs Teff: 7214.0 K Logg: 4.09 Fe/H: 0.240



## DV Fit Results:

Period = 1.19074 [0.00001] d  
Epoch = 132.5259 [0.0043] BKJD  
Rp/R\* = 0.0039 [0.0008]  
a/R\* = 1.90 [1.57]  
b = 0.57 [1.37]  
Seff = 13232.21 [5367.90]  
Teq = 2735 [277] K  
Rp = 0.82 [0.30] Re  
a = 0.0262 [0.0066] AU  
Ag = 5.53 [3.07] [1.48σ]  
Teffp = 6483 [752] K [4.68σ]

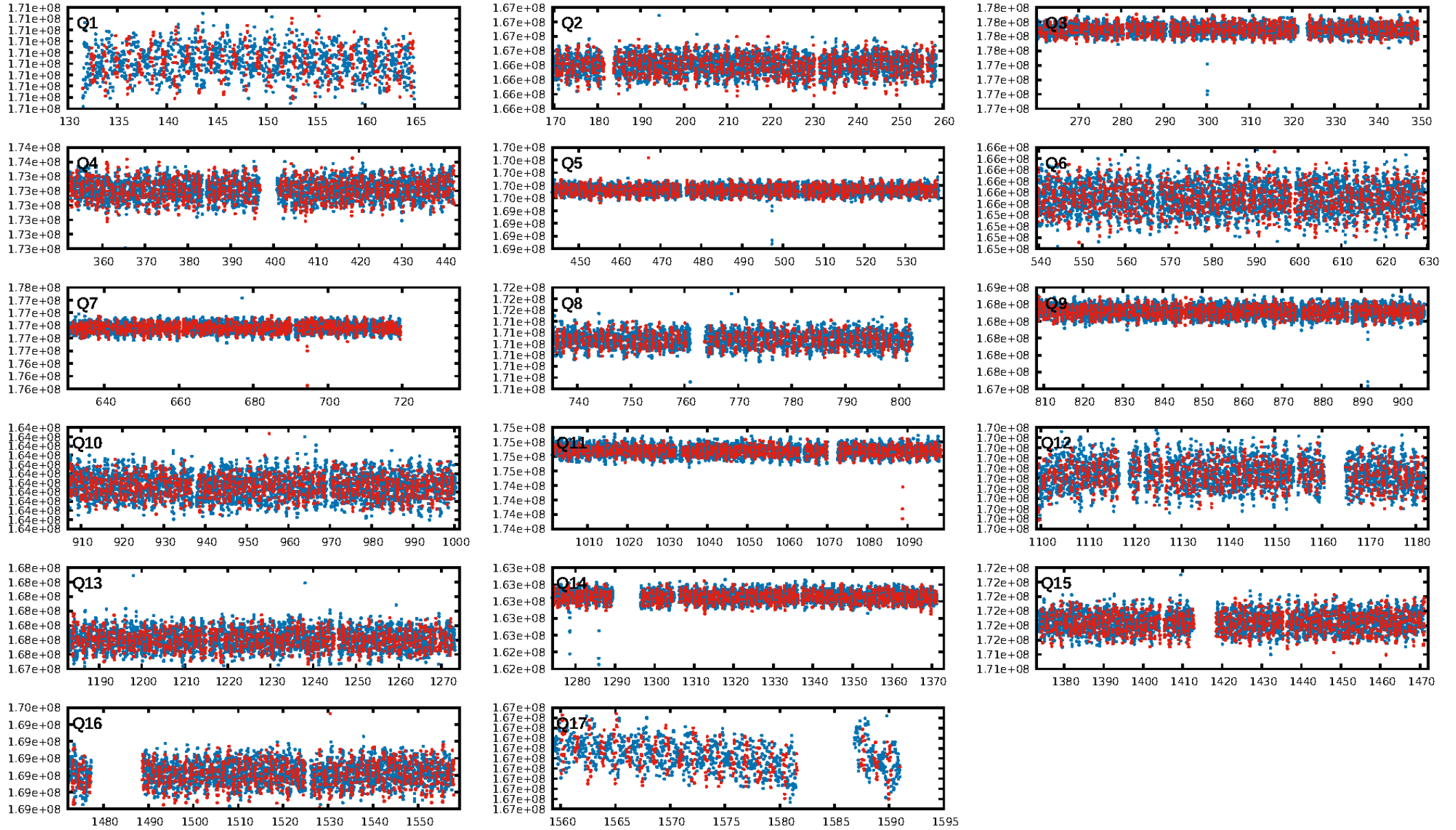
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [1017.31σ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: 7.85e-22  
RollingBand-fgt: 1.00 [1077/1077]  
GhostDiagnostic-chr: 33.86  
Centroid-sig: 8.7%  
Centroid-so: 1.400 arcsec [1.20σ]  
OotOffset-rm: 0.309 arcsec [0.62σ]  
OotOffset-st: 1/2/2/1 [6]  
KicOffset-rm: 0.371 arcsec [0.79σ]  
KicOffset-st: 1/2/2/1 [6]  
DiffImageQuality-fgm: 0.67 [4/6]  
DiffImageOverlap-fno: 1.00 [17/17]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 14:06:48 Z

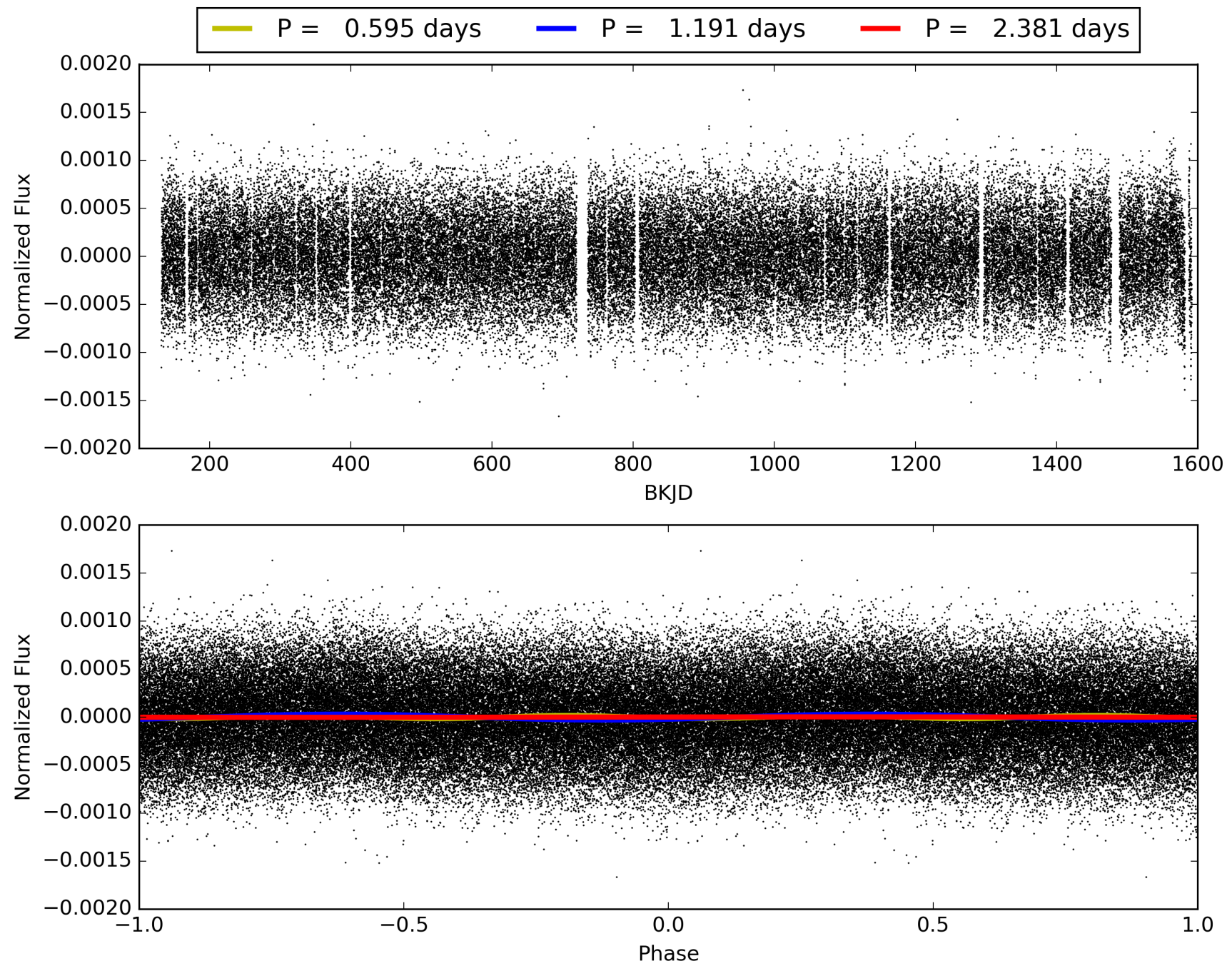
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 009533489-02, PDC Light Curves





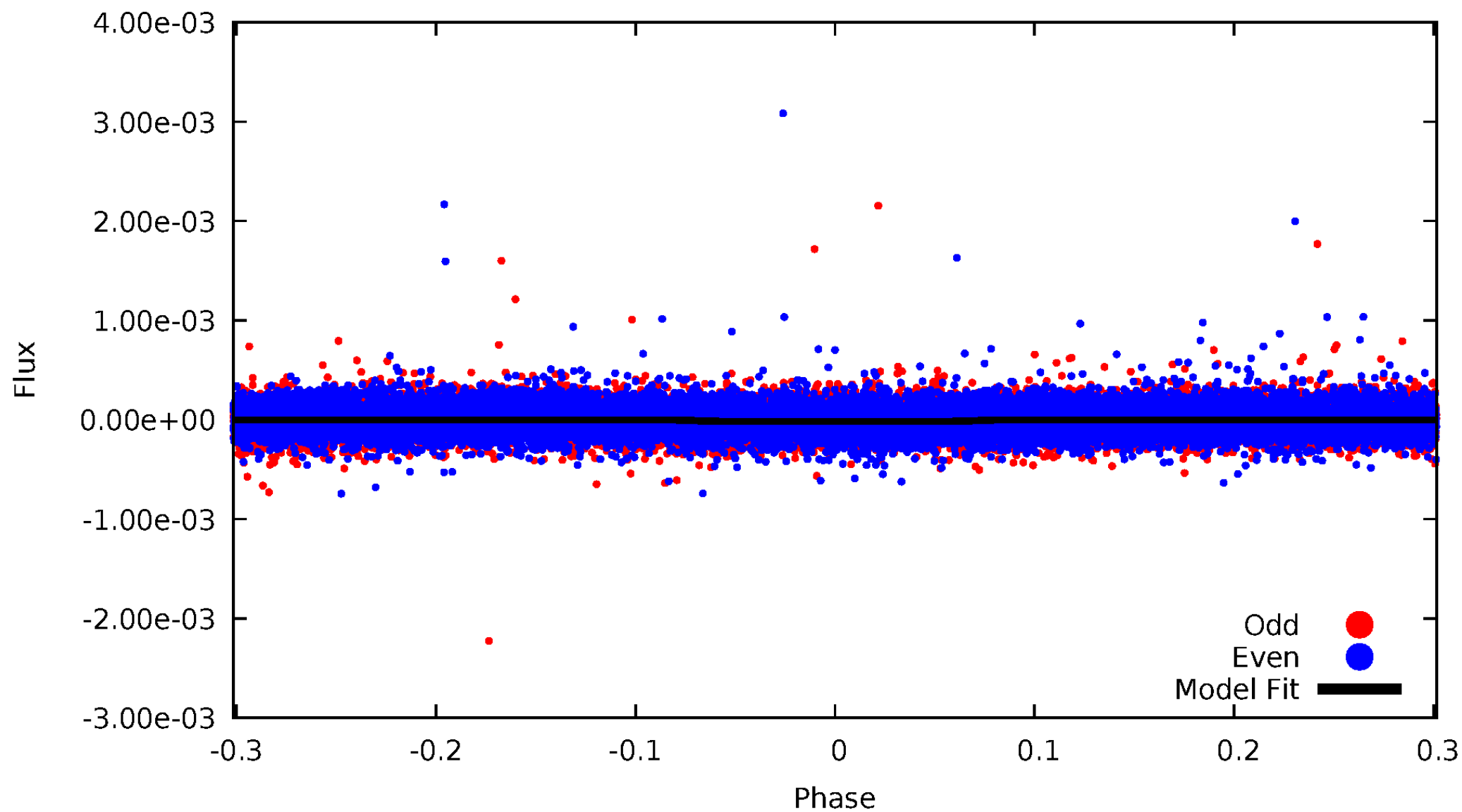
TCE 009533489-02





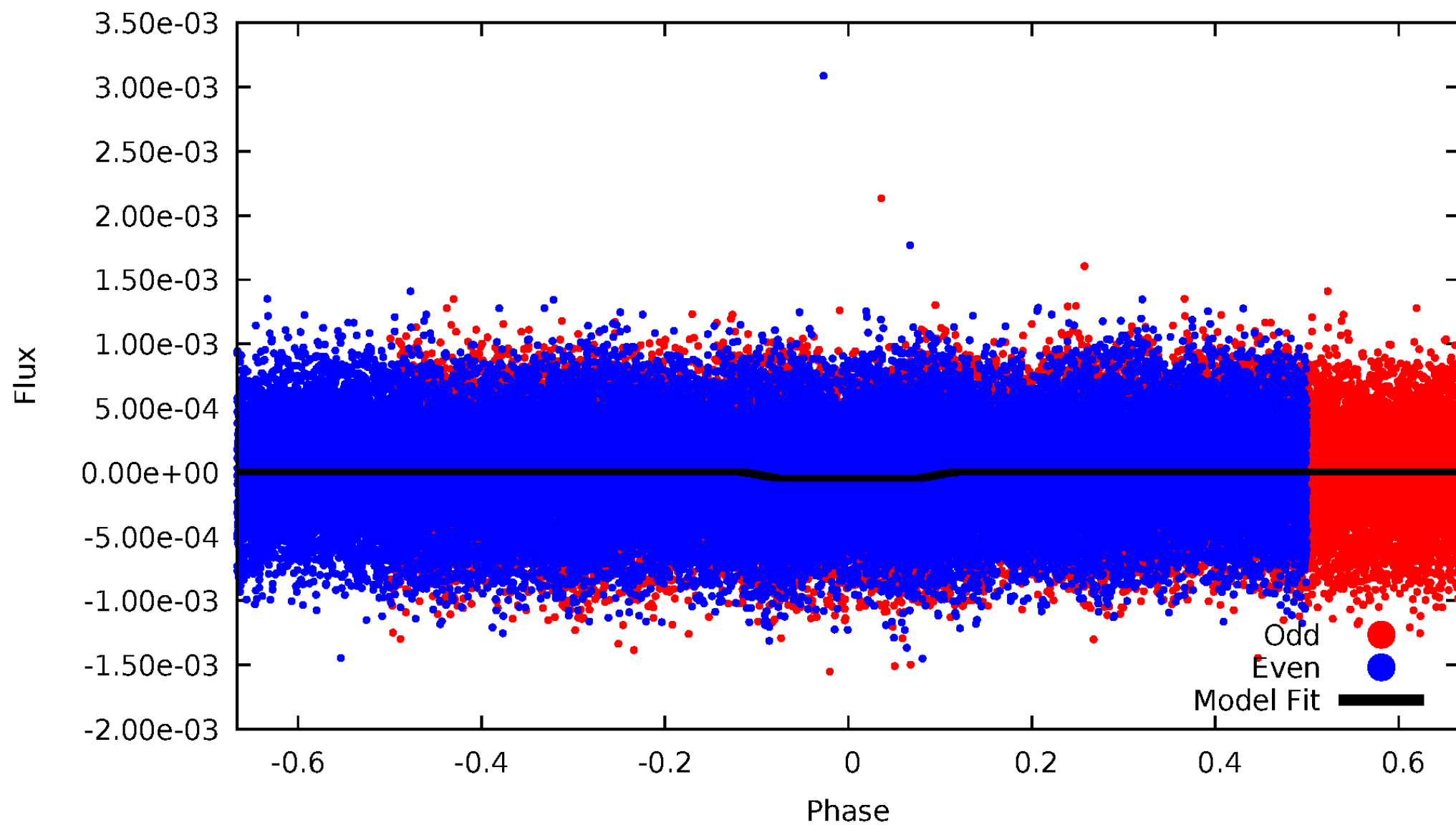
# DV Odd/Even

TCE 009533489-02



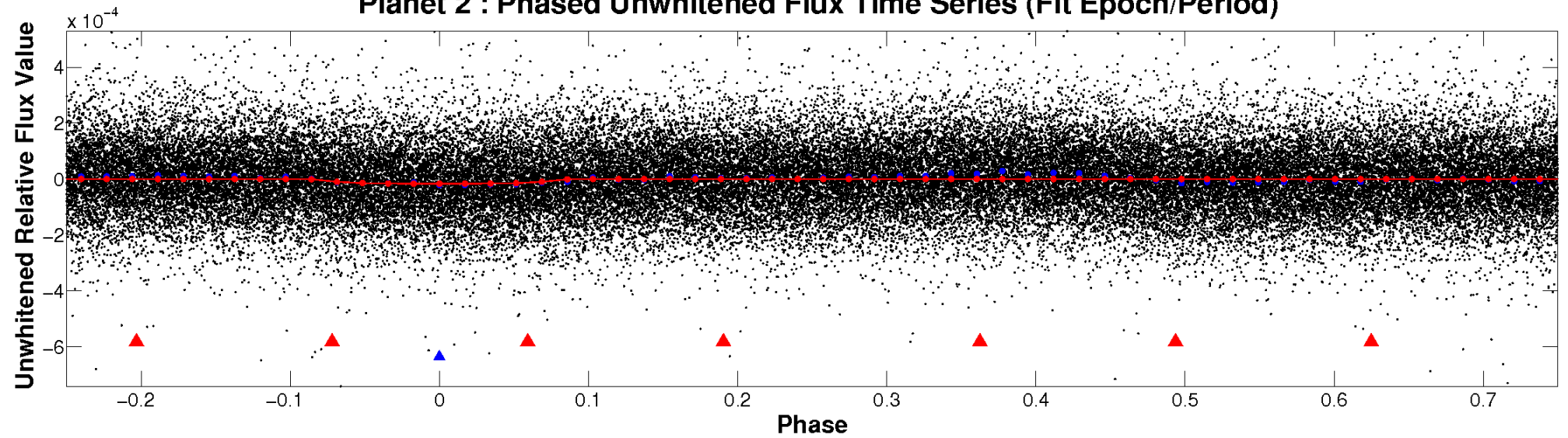
# ALT Odd/Even

TCE 009533489-02

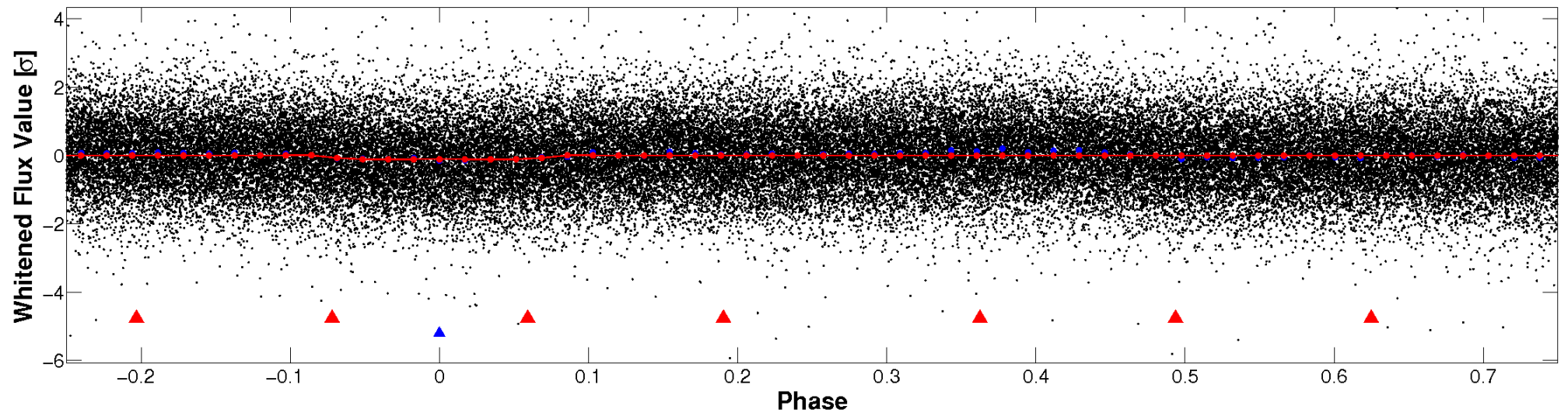


# Non-Whitened Vs. Whitened Light Curve

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

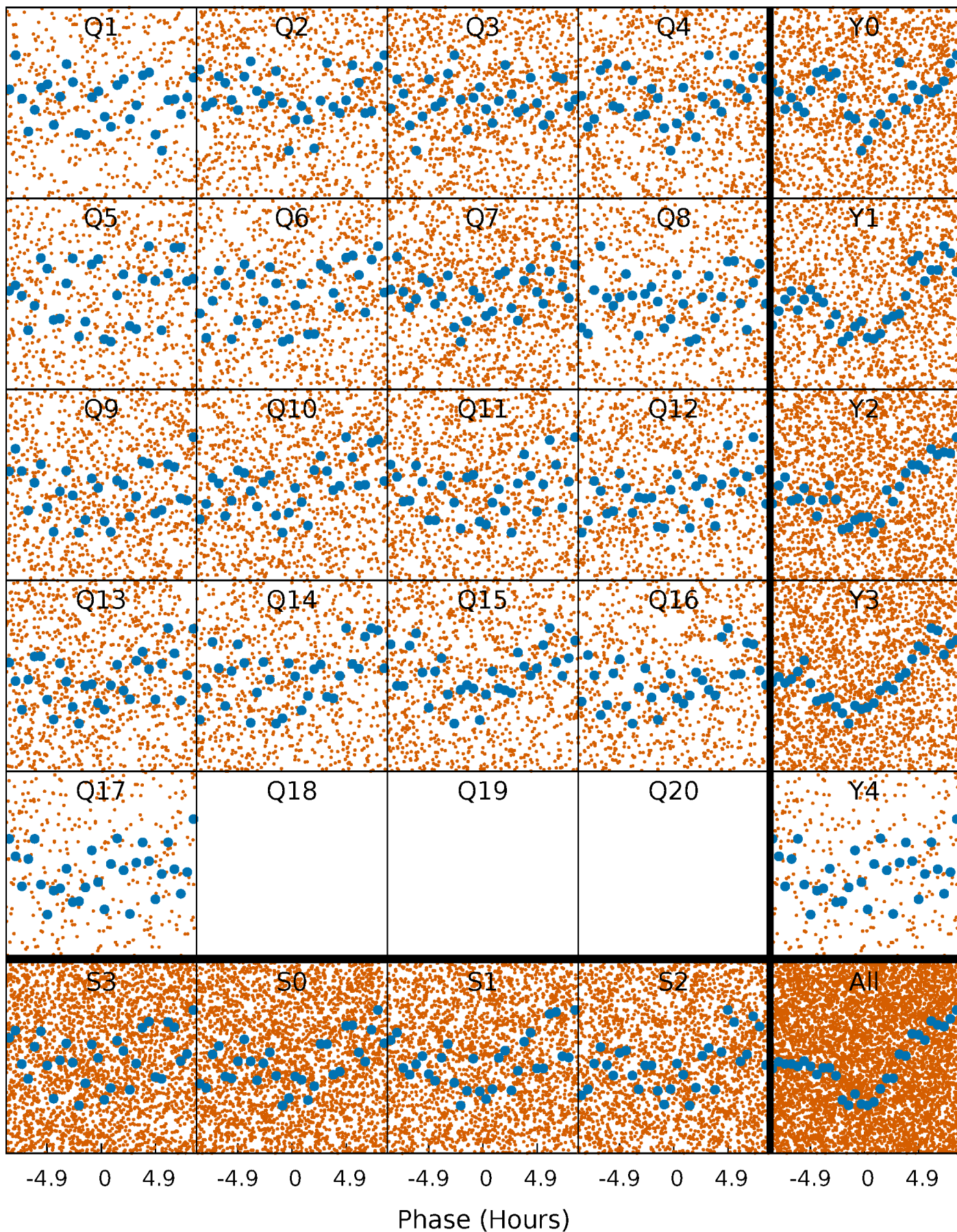


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

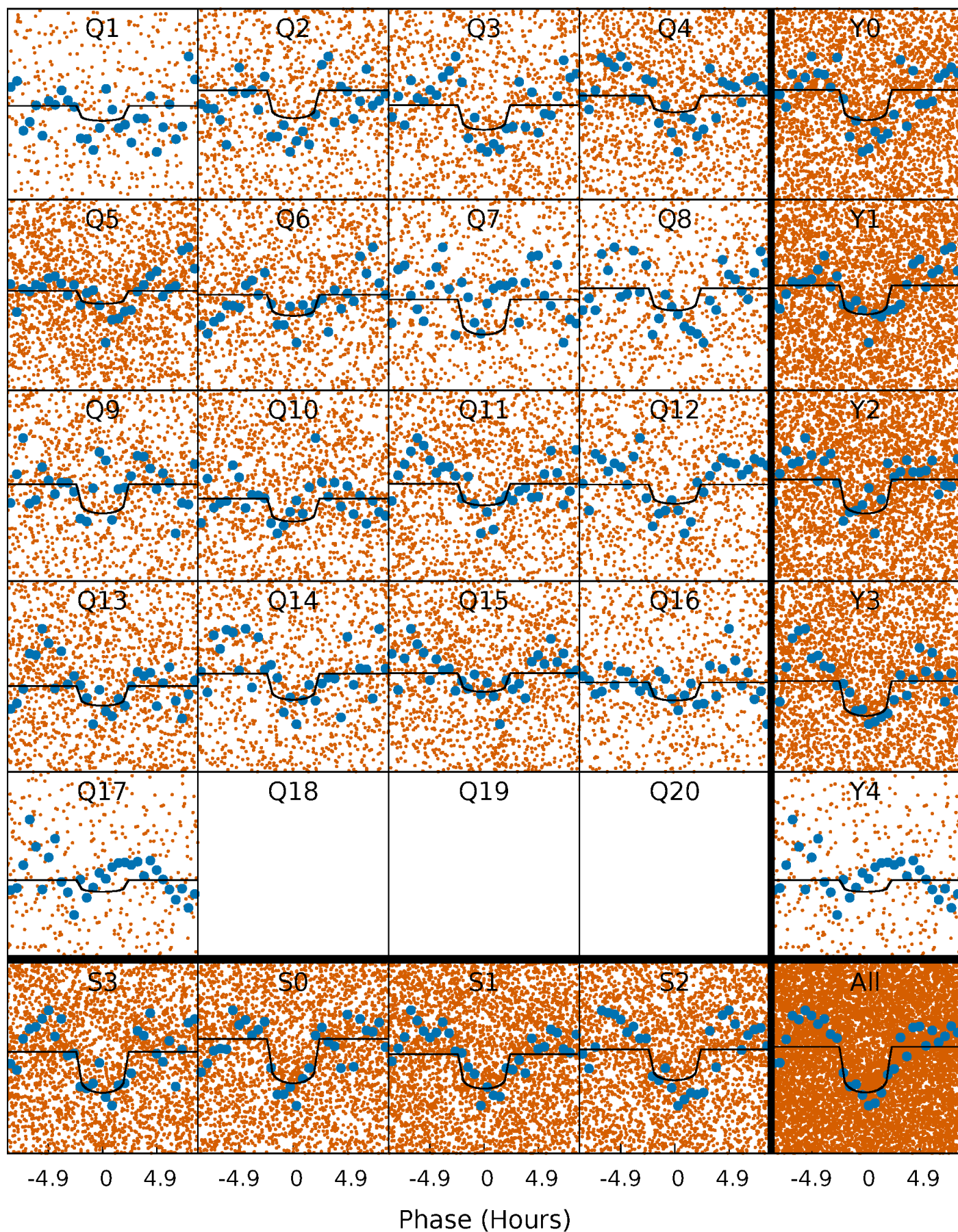
TCE 009533489-02   P= 1.190736 Days    $T_0=132.525925$  (BKJD)





# DV Quarter-Phased Transit Curves

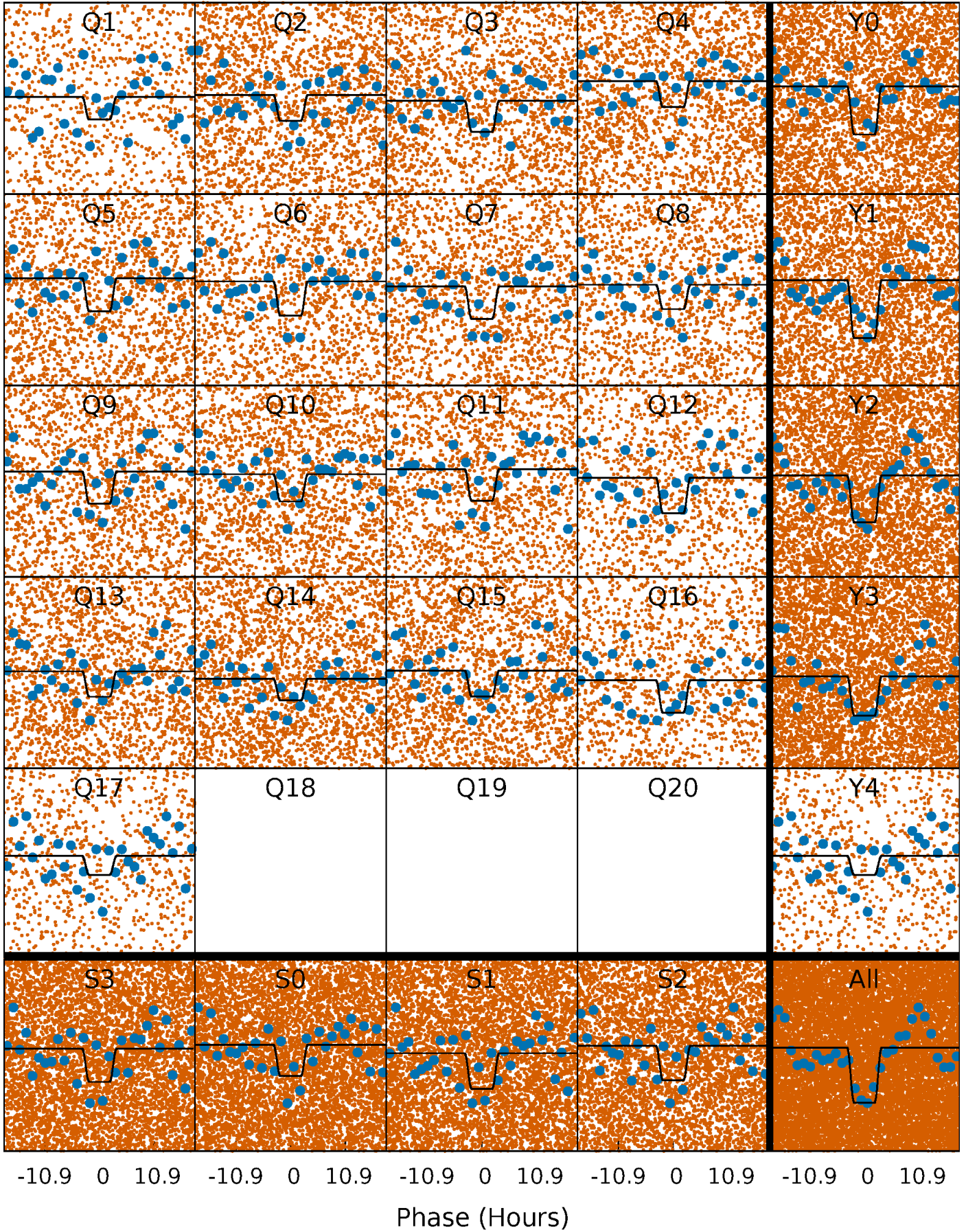
TCE 009533489-02   P= 1.190736 Days    $T_0=132.525925$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

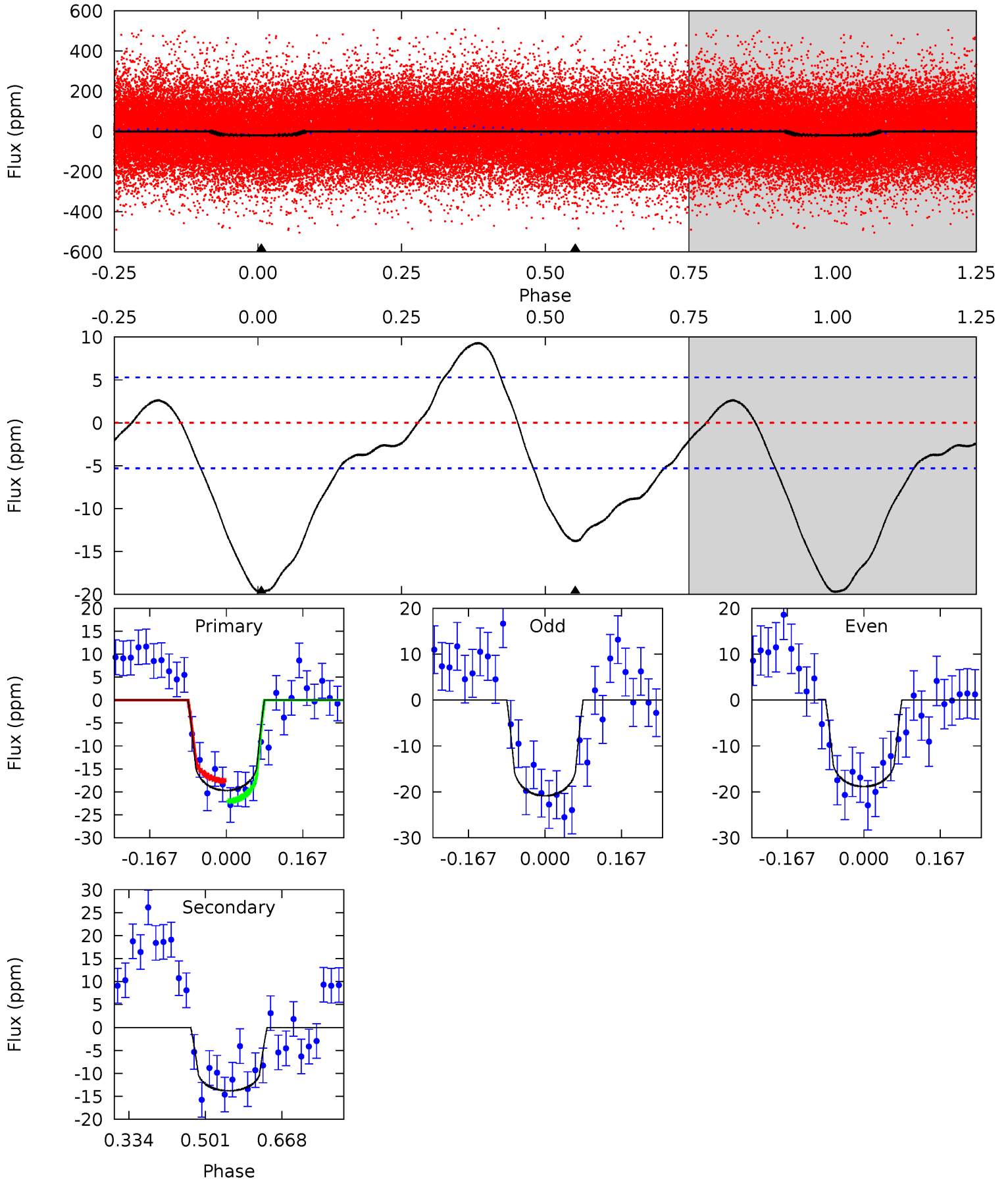
TCE 009533489-02 P= 1.190715 Days  $T_0=132.532828$  (BKJD)



# DV Model-Shift Uniqueness Test

009533489-02, P = 1.190736 Days, E = 131.335189 Days

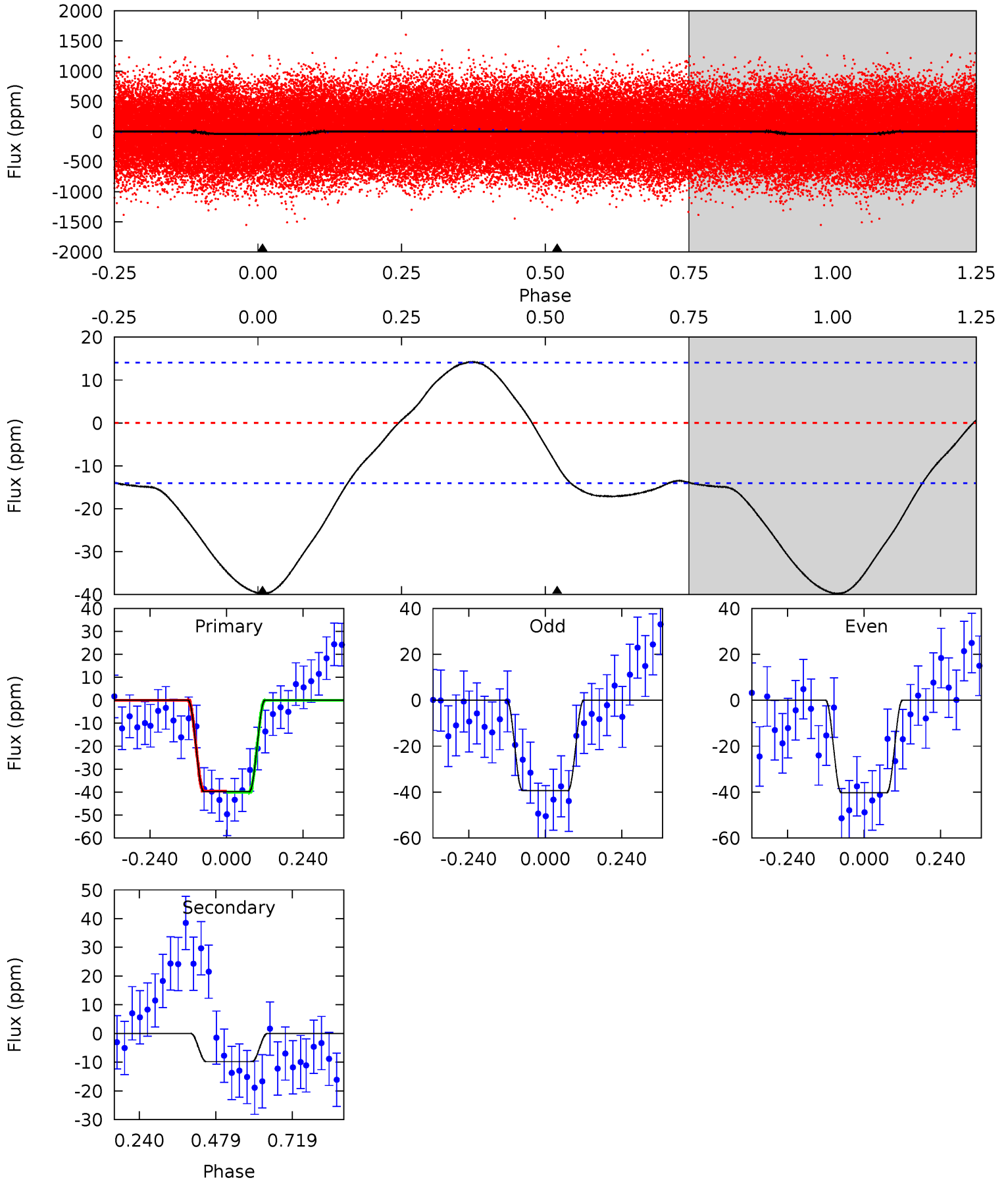
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
16.6	11.6	0	0	4.46	1.38	3.40	16.6	16.6	11.6	11.6	0.85	0.94	0.32	1.88



# Alt Model-Shift Uniqueness Test

009533489-02, P = 1.190715 Days, E = 131.342113 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
12.4	3.06	0	0	4.38	1.18	2.62	12.4	12.4	3.06	3.06	0.15	1.03	0.26	0.07





### Stellar Parameters For KIC 009533489

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$7214^{+200}_{-342}$	$4.093^{+0.112}_{-0.192}$	$0.240^{+0.150}_{-0.350}$	$1.935^{+0.593}_{-0.396}$	$1.690^{+0.187}_{-0.257}$	$0.329^{+0.203}_{-0.168}$
	+3%/-5%	+3%/-5%	+62%/-146%	+31%/-20%	+11%/-15%	+62%/-51%
Source	PHO54	PHO54	PHO54	DSEP		

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

### Secondary Eclipse Parameters for KIC 009533489-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-14 \pm 1$	$0.85^{+0.20}_{-0.19}$	$3852^{+279}_{-269}$	$6903^{+998}_{-763}$	$7.236^{+4.424}_{-2.585}$
Alt.	$-10 \pm 3$	$1.46^{+0.26}_{-0.23}$	$3850^{+312}_{-241}$	$4750^{+497}_{-543}$	$1.691^{+1.029}_{-0.694}$

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

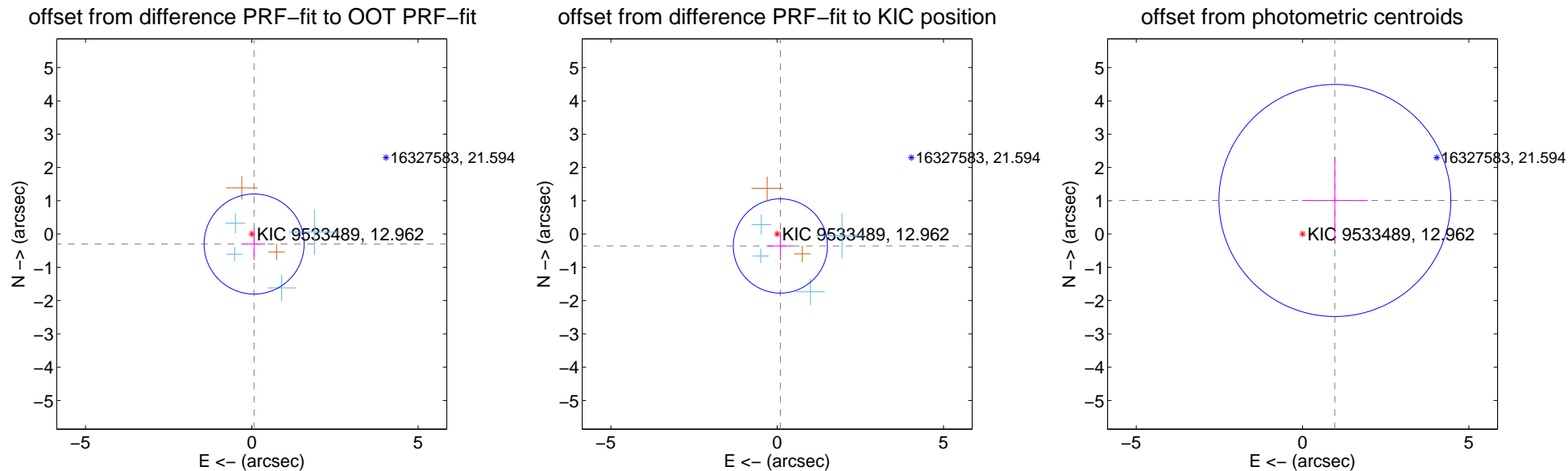
## DV Centroid Data

Supplemental centroid analysis for 009533489-02. Kepler magnitude: 12.96. Transit SNR 10.30

There are 4 quarters with good PRF difference image offsets

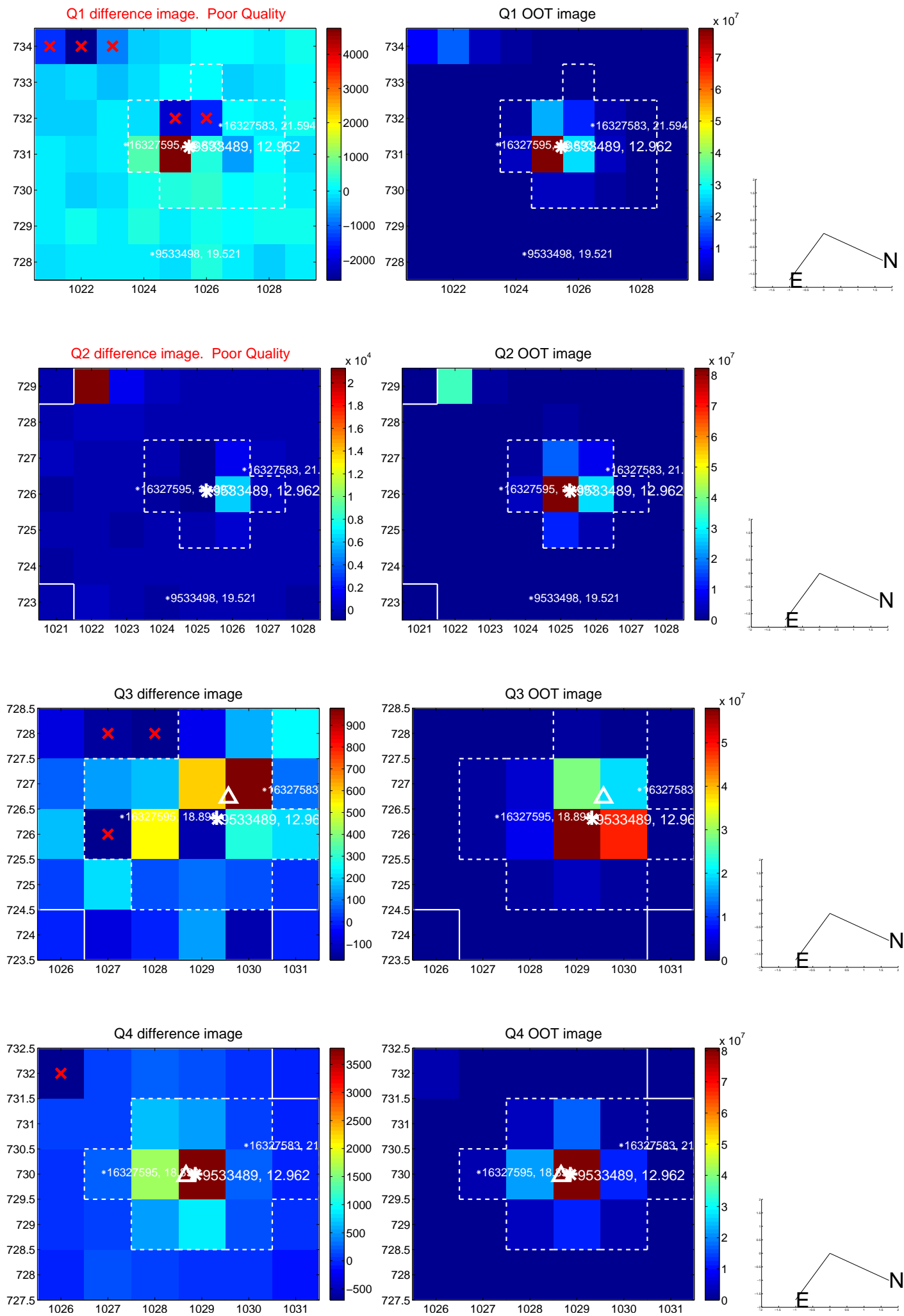
The direct PRF centroid is offset from the target star catalog position by about 0.01 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.309 \pm 0.501$	0.62	$-0.069 \pm 0.335$	$-0.301 \pm 0.477$
PRF-fit source offset from KIC position	$0.371 \pm 0.472$	0.79	$-0.095 \pm 0.377$	$-0.359 \pm 0.426$
photometric centroid source offset	$1.40 \pm 1.16$	1.20	$-0.97 \pm 0.99$	$1.01 \pm 1.30$

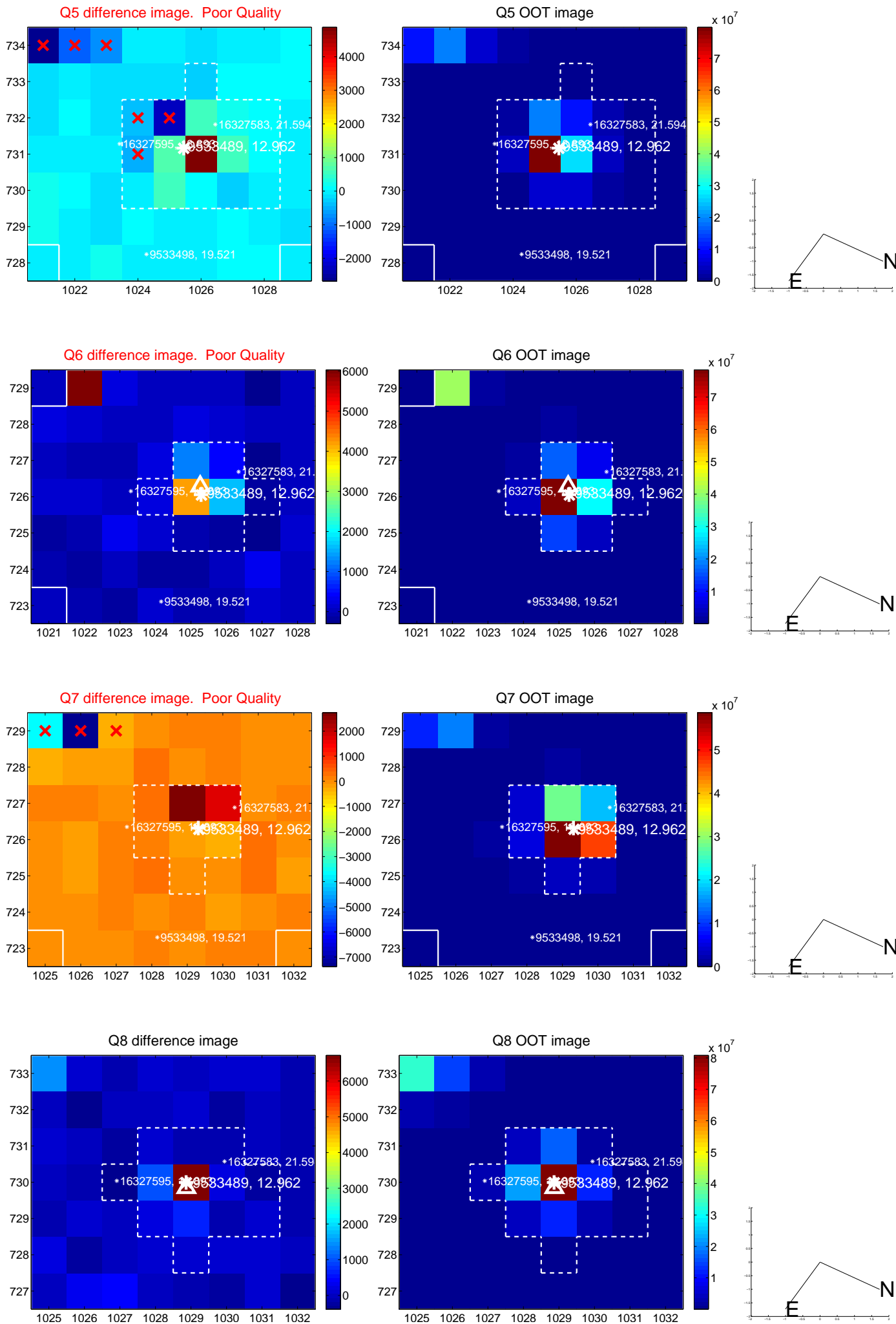


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

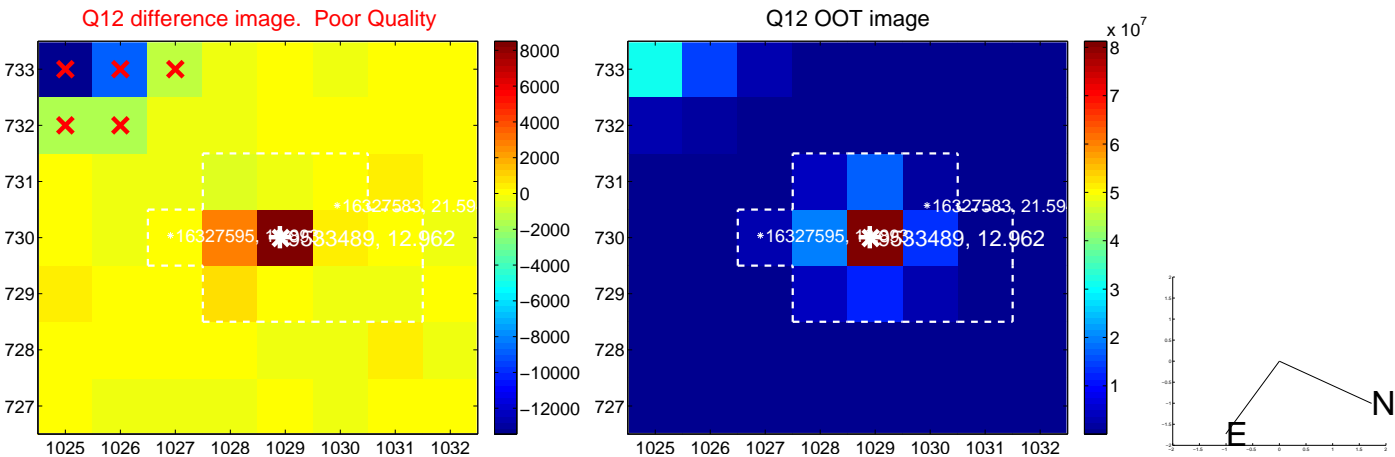
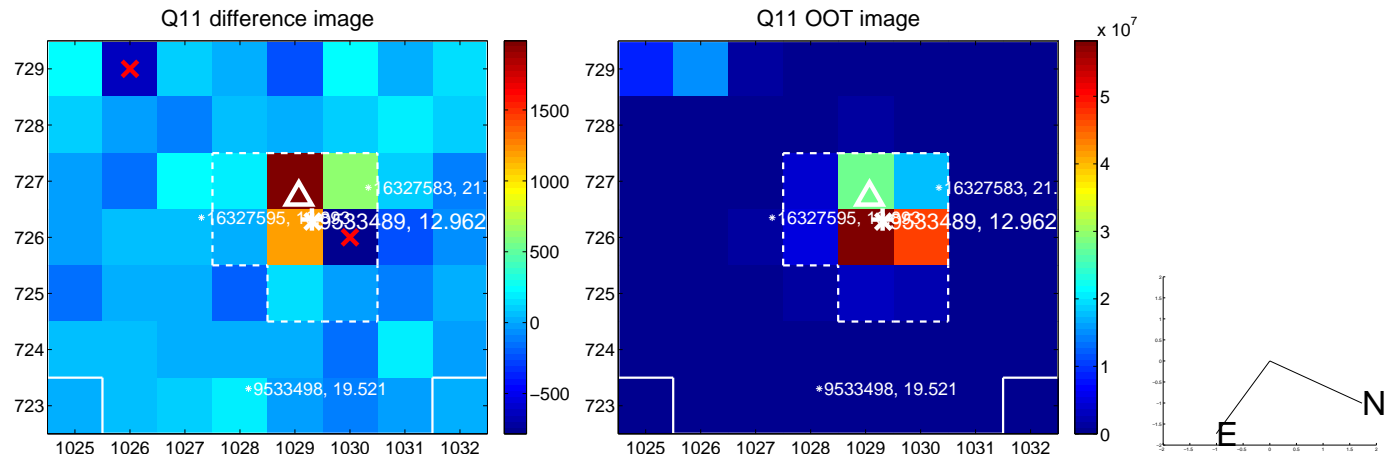
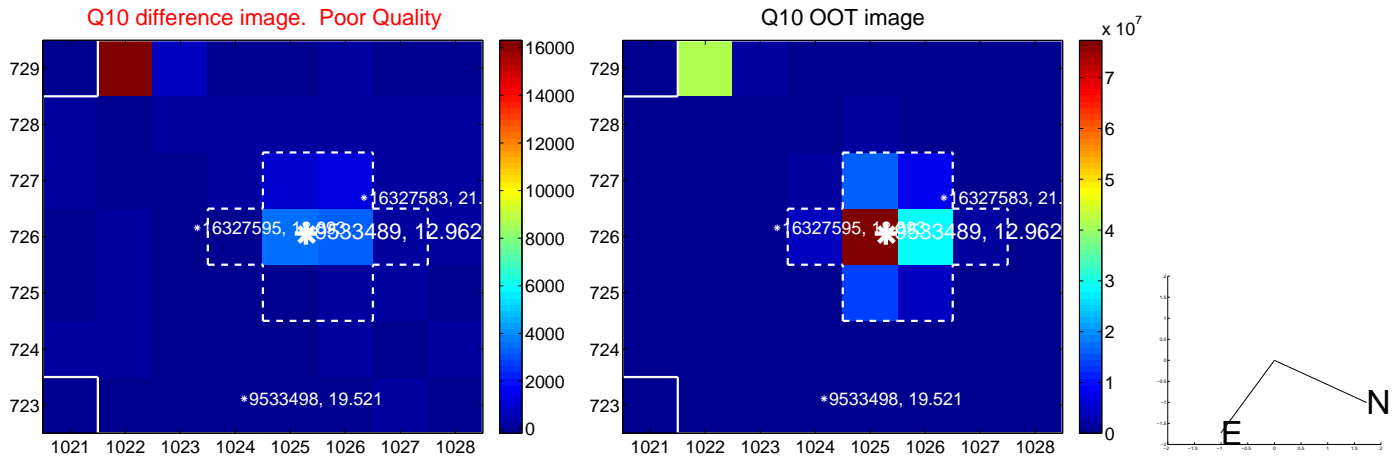
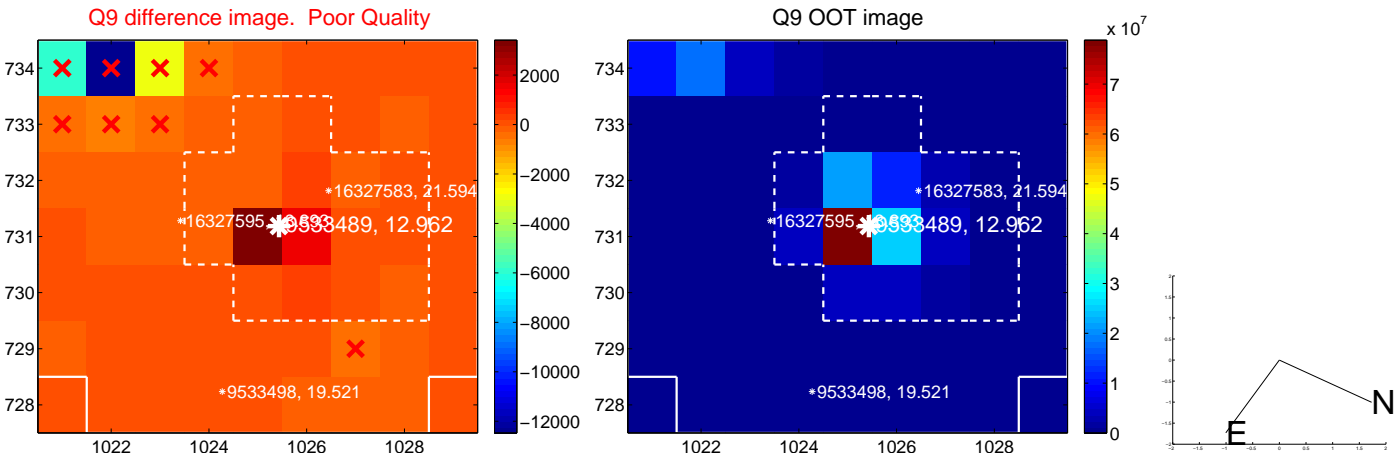
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



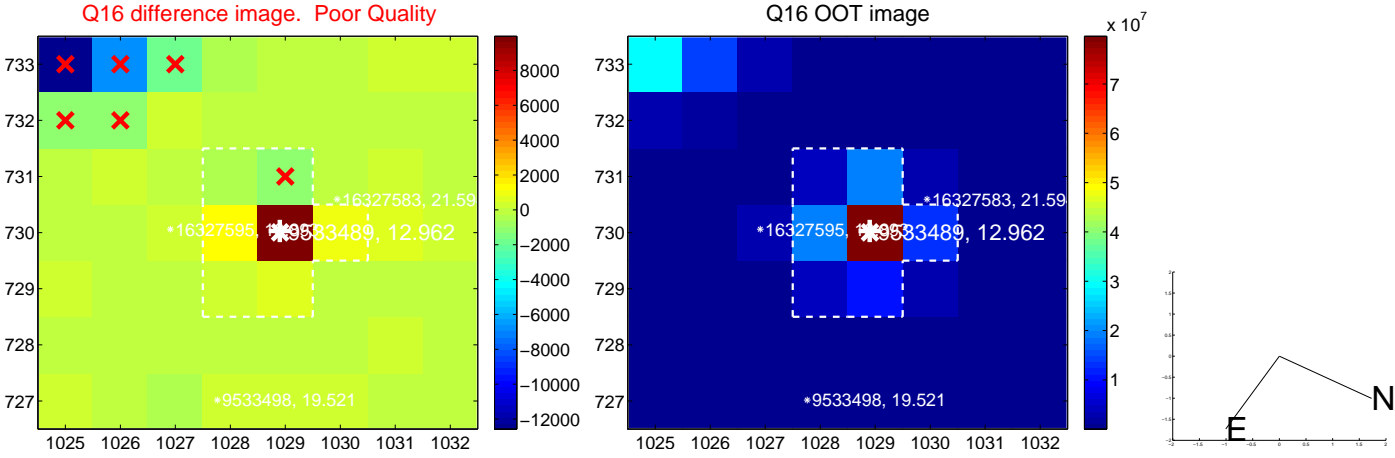
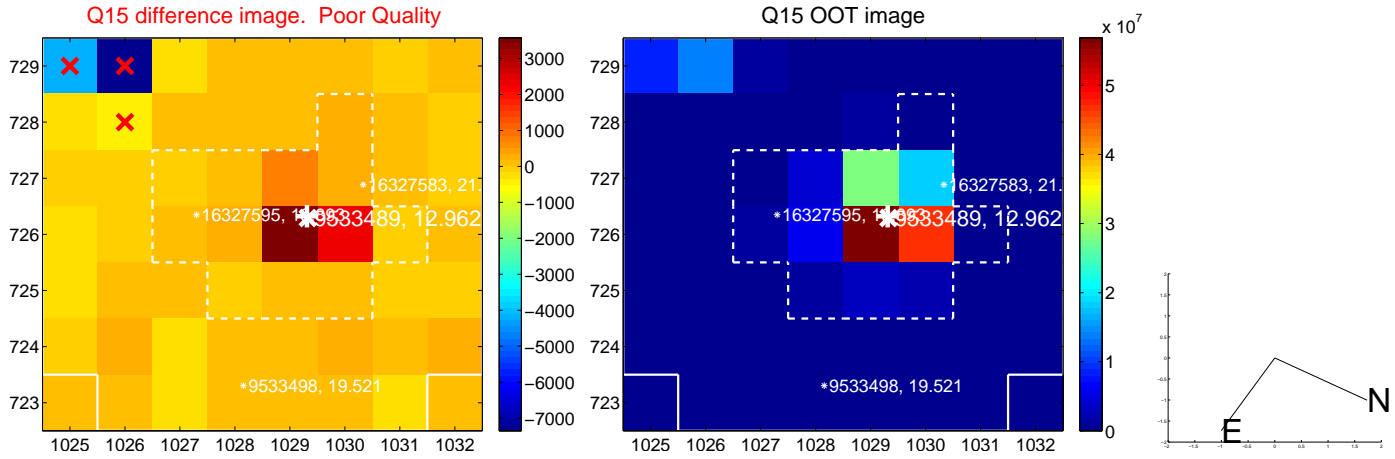
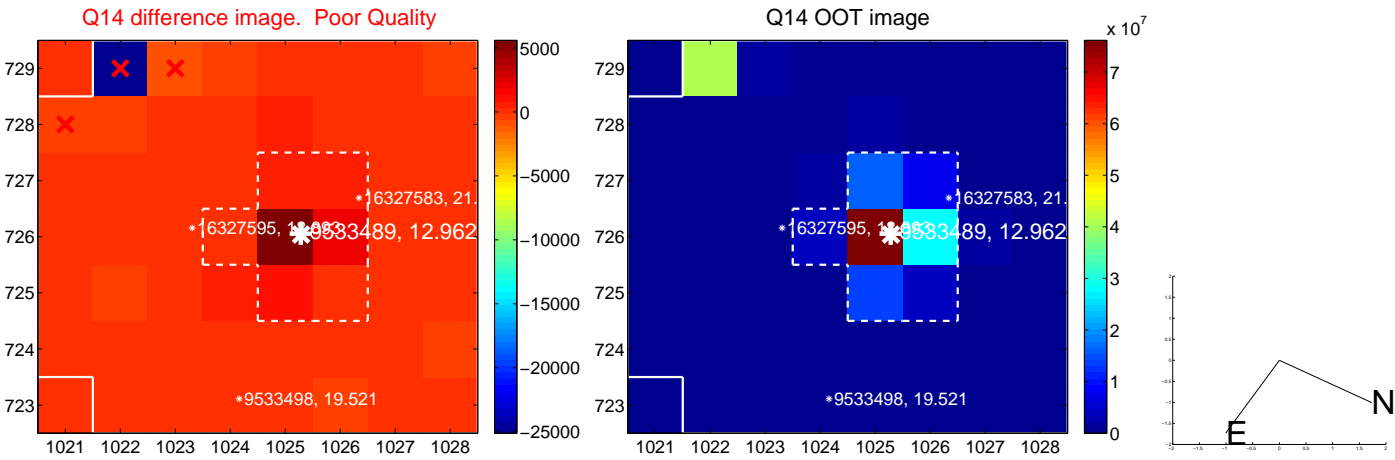
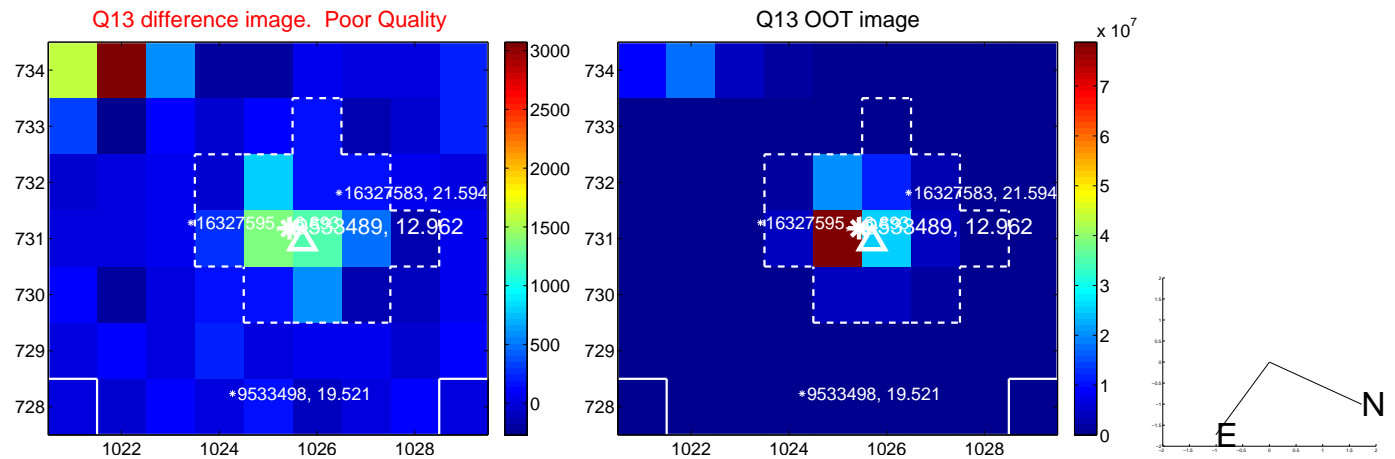
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



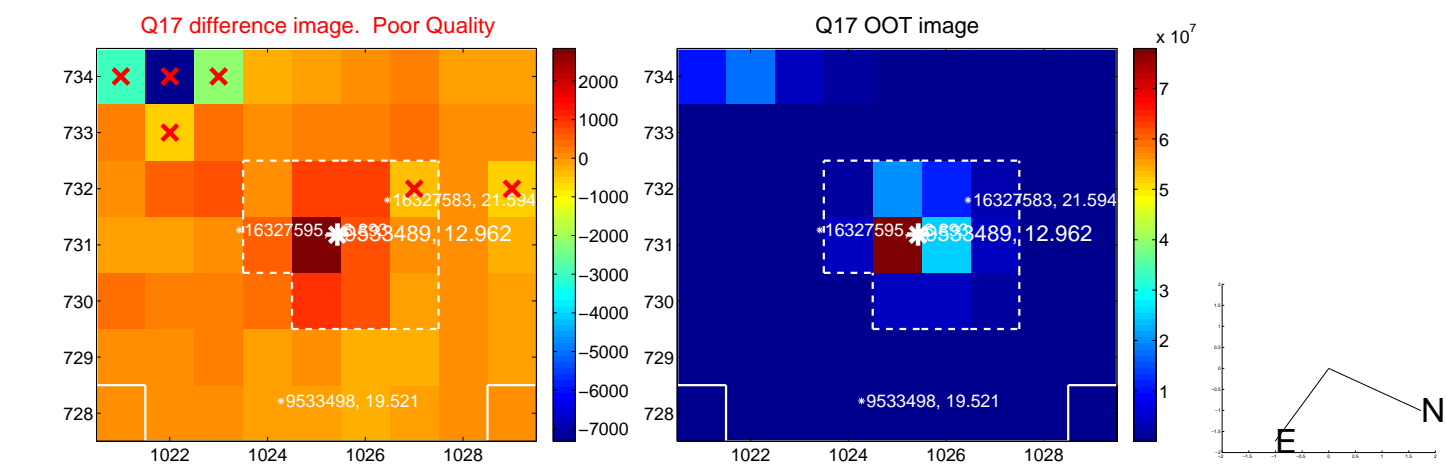
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



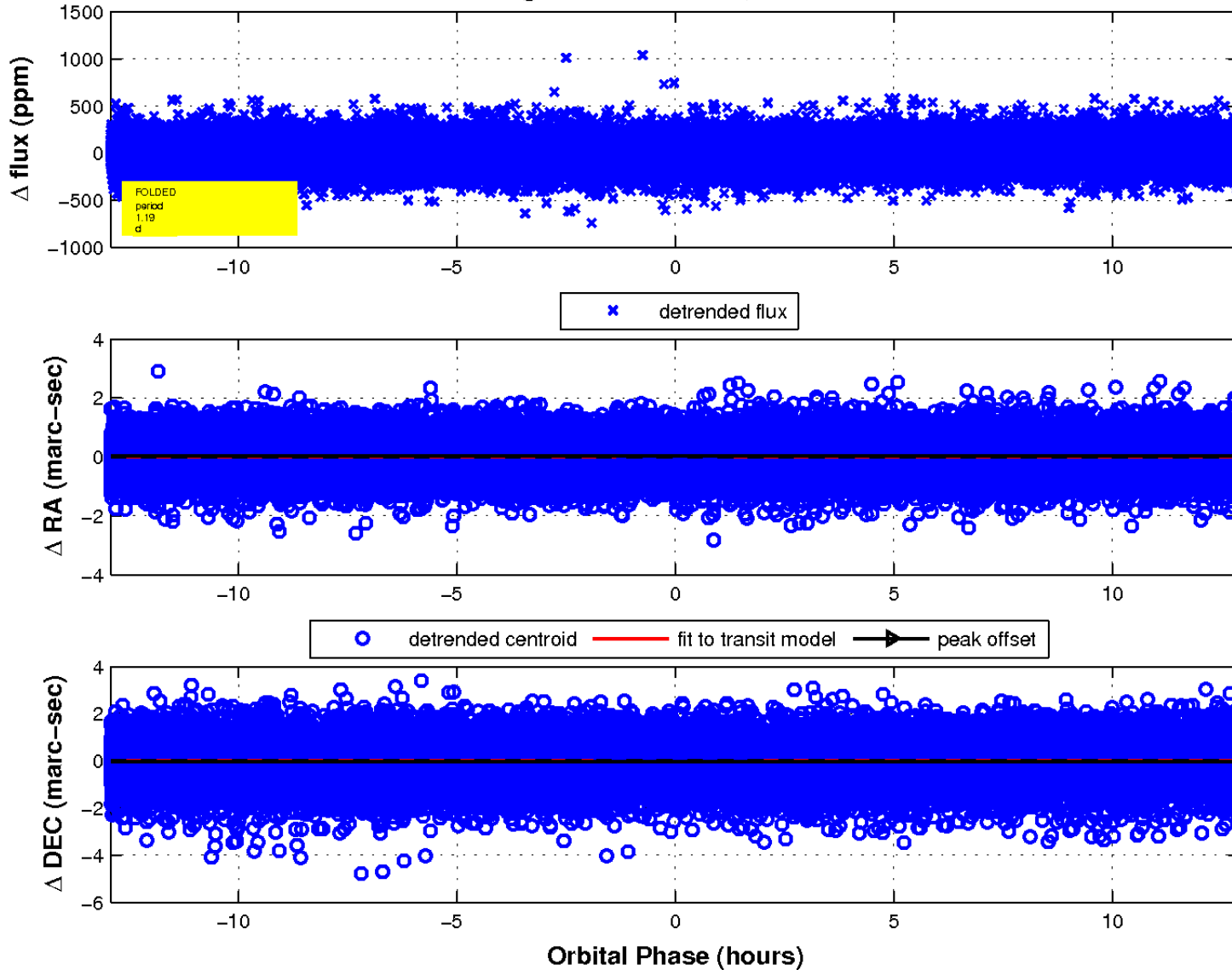
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



fluxWeightedCentroids, Planet 2 of 2



UKIRT Image

Declination

