

# KIC 009777251

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009777251-01	OBS	2600.01	1.332518	132.085984	112.9	4.083	15.9	16.9	1.05	5774	1.36	2110.88
009777251-02	OBS	No	428.423881	461.560008	691.1	3.933	7.5	6.2	1.05	5774	3.10	0.96

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009777251-01	OBS	FP	0.00	0	0	0	1	CENT_FEW_DIFFS—EPHEM_MATCH
009777251-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_CHASES_MARSHALL_SKYE—ALL_TRANS_CHASES—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT— 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.

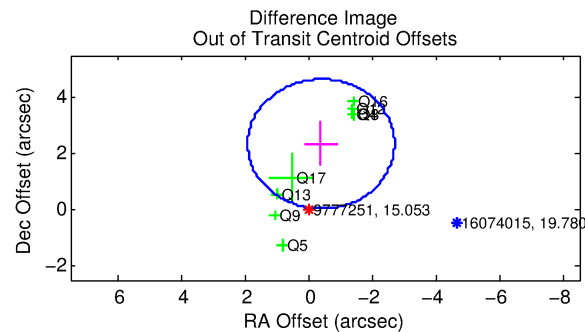
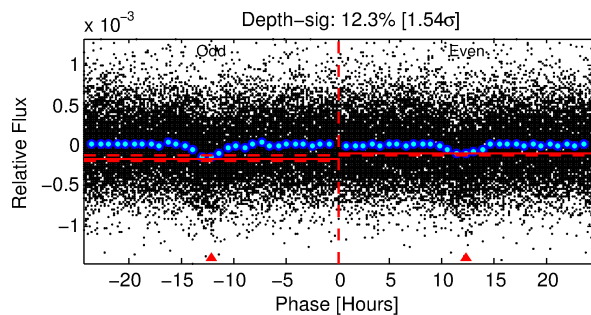
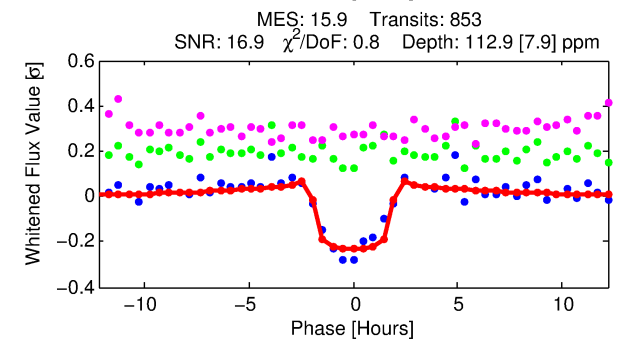
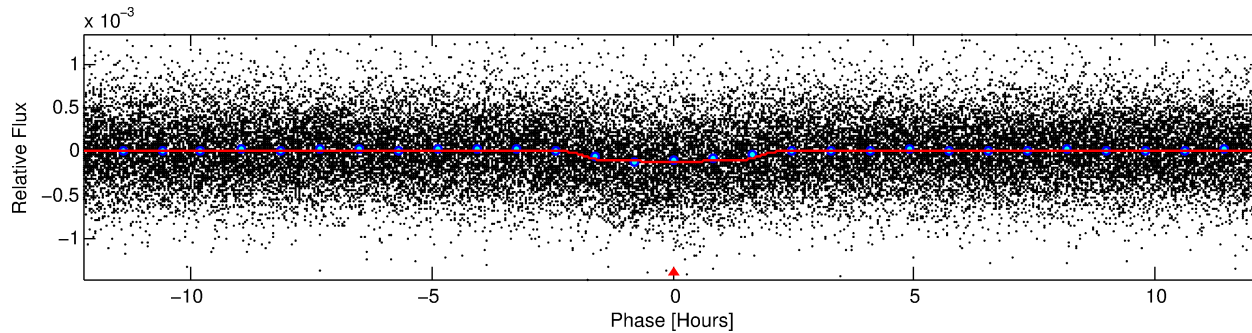
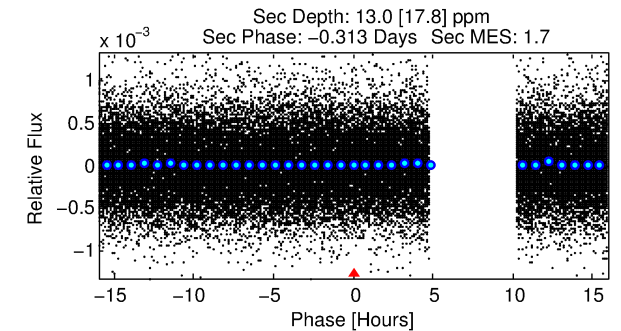
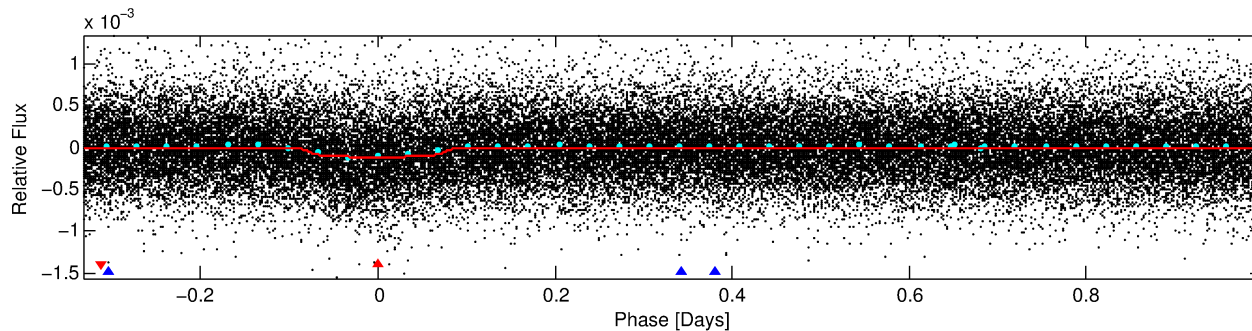
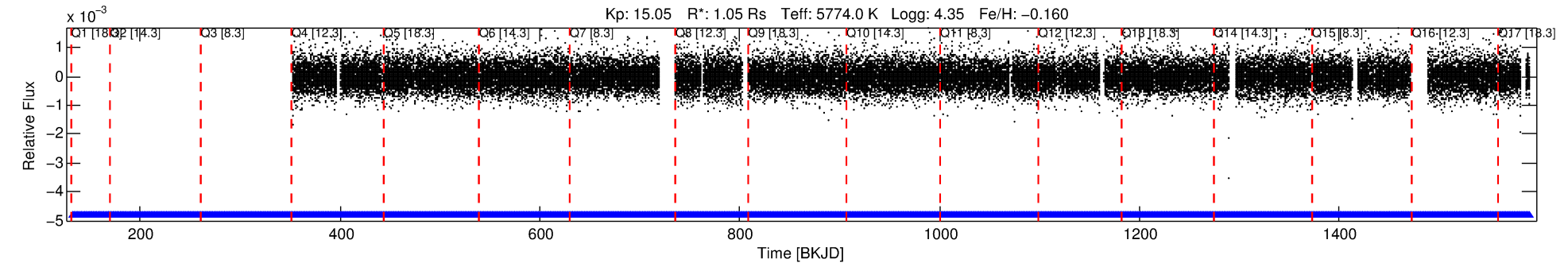
## Ephemeris Match Information For 009777251-01

TCE (1)	KIC	Parent (2)	Parent KIC	P <sub>1</sub> :P <sub>2</sub>	Dist ( $''$ )	$\Delta$ Row	$\Delta$ Col	m <sub>2</sub>	m <sub>1</sub>	D <sub>2</sub> /D <sub>1</sub>	Mechanism	Flag	$\sigma_P$	$\sigma_T$
009777251-01	9777251	BR-Cyg-pri	9899416	1:1	1984.9	499	3	10.03	15.06	5919.20	Col-Anomaly	0	2.83	2.52

**Notes:** P<sub>1</sub>:P<sub>2</sub> is the period ratio. Dist is the distance in arcseconds.  $\Delta$ Row and  $\Delta$ Col are the number of pixels apart in row and column. m<sub>2</sub> and m<sub>1</sub> are the magnitudes of the parent and child. D<sub>2</sub>/D<sub>1</sub> is the parent's transit depth divided by the child's.  $\sigma_P$  and  $\sigma_T$  are the significance of the match in period and epoch. For a match to be considered significant  $\sigma_P < 5.0$  and  $\sigma_T < 5.0$ . Matches which have  $\sigma_P$  and  $\sigma_T$  very close to this cutoff should receive extra scrutiny, especially if the period ratio is very large.

# DV One-Page Summary

KIC: 9777251 Candidate: 1 of 2 Period: 1.333 d  
KOI: K02600.01 Corr: 0.849



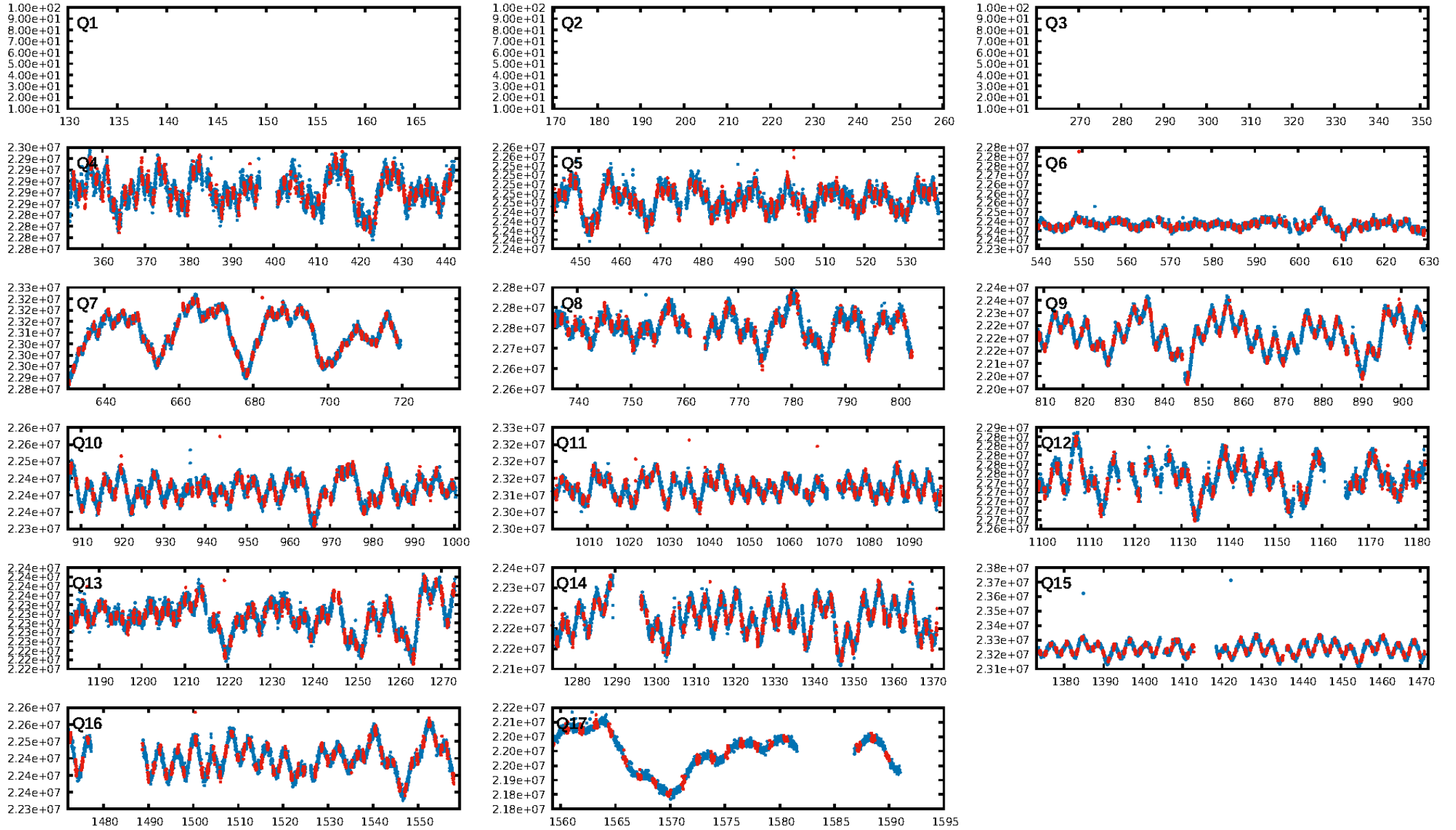
## DV Fit Results:

Period = 1.33252 [0.00001] d  
Epoch = 132.0860 [0.0024] BKJD  
Rp/R\* = 0.0118 [0.0021]  
a/R\* = 1.42 [0.62]  
b = 0.92 [0.15]  
Seff = 2110.88 [796.32]  
Teq = 1728 [163] K  
Rp = 1.36 [0.46] Re  
a = 0.0229 [0.0056] AU  
Ag = 2.03 [2.96] [0.35σ]  
Teffp = 3192 [1133] K [1.28σ]

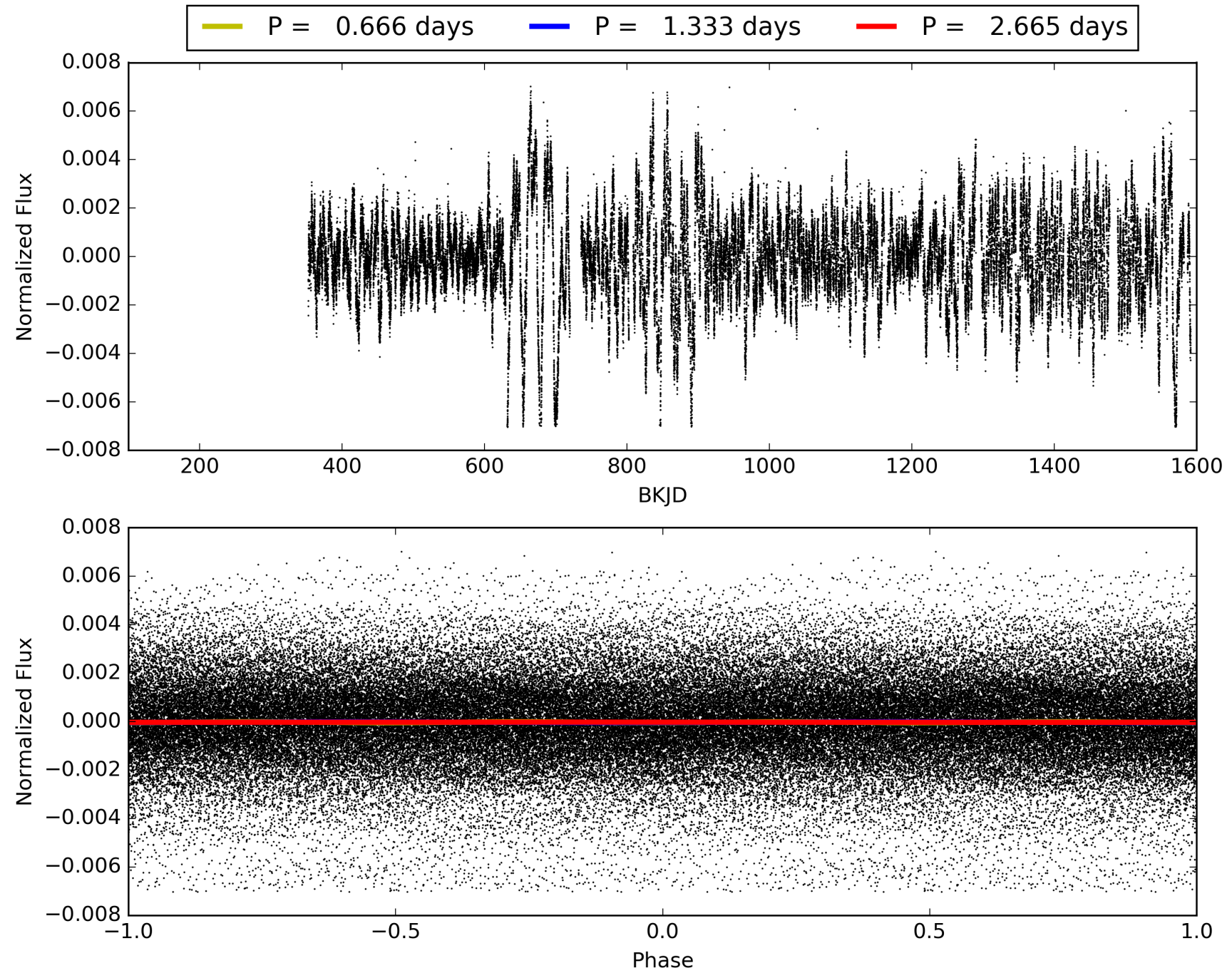
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [1808.09σ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: 1.33e-46  
RollingBand-fgt: 1.00 [833/833]  
GhostDiagnostic-chr: 1.012  
Centroid-sig: 0.0%  
Centroid-so: 2.896 arcsec [4.92σ]  
OotOffset-rm: 2.374 arcsec [3.09σ]  
KicOffset-rm: 2.416 arcsec [3.15σ]  
OotOffset-st: 0/0/4/4 [8]  
KicOffset-st: 0/0/4/4 [8]  
DiffImageQuality-fgm: 0.00 [0/8]  
DiffImageOverlap-fno: 1.00 [14/14]

# TCE 009777251-01, PDC Light Curves

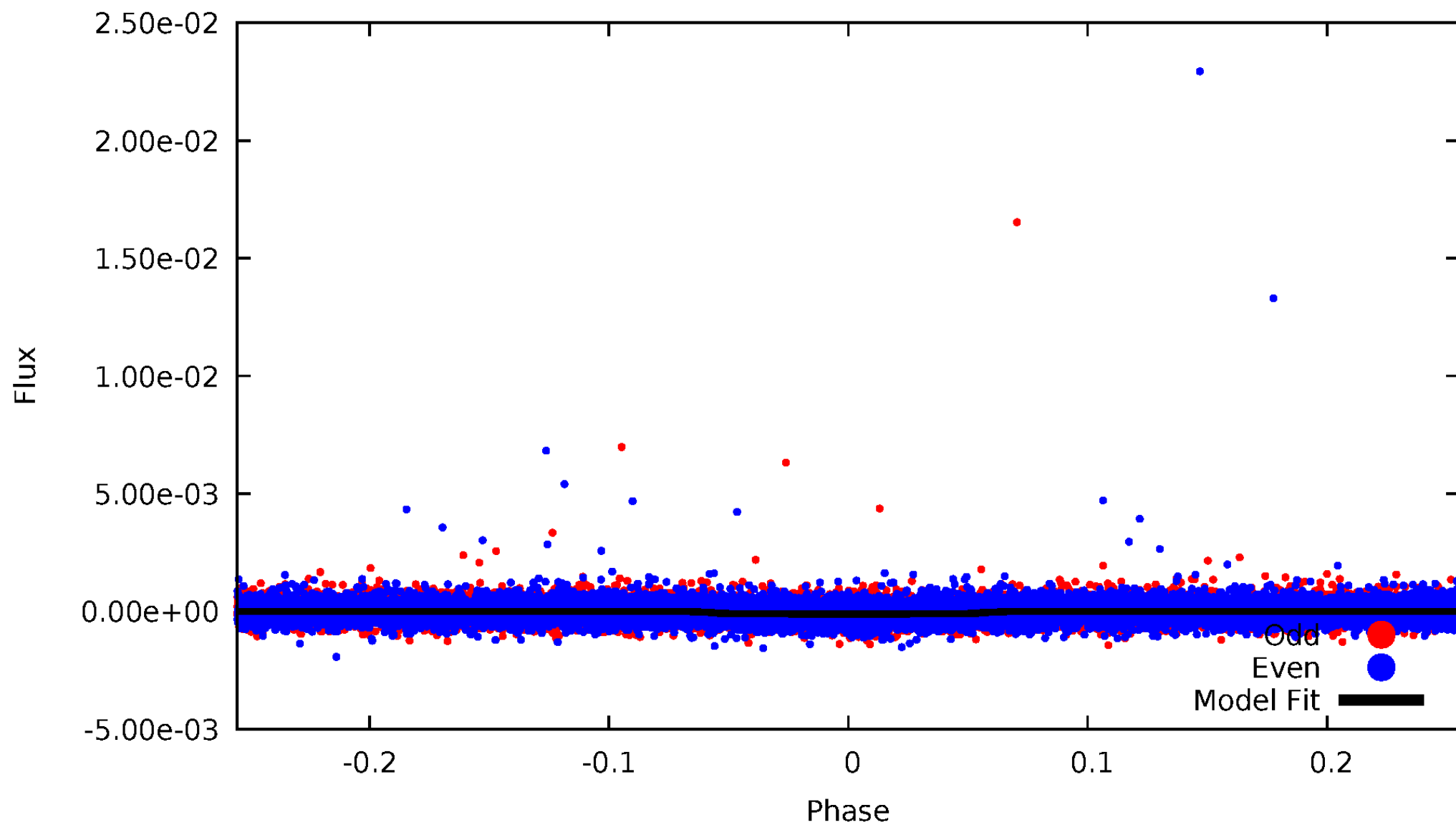


TCE 009777251-01



# DV Odd/Even

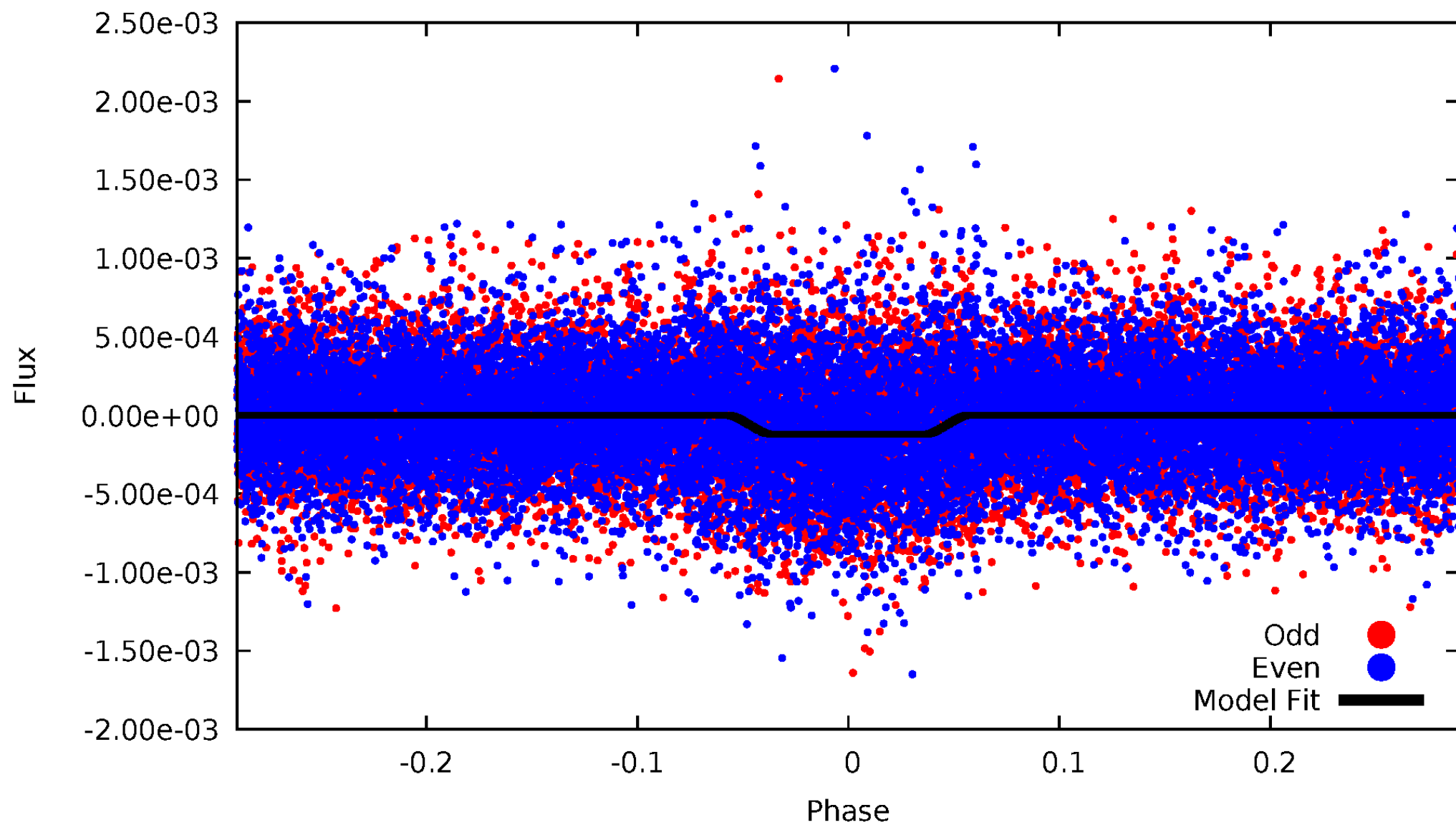
TCE 009777251-01





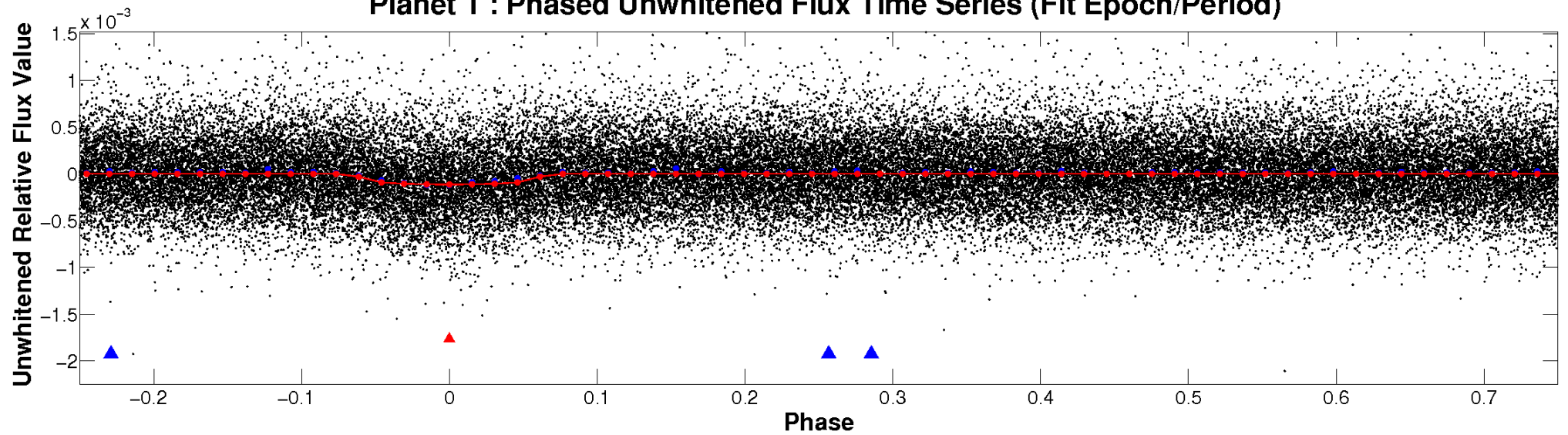
# ALT Odd/Even

TCE 009777251-01

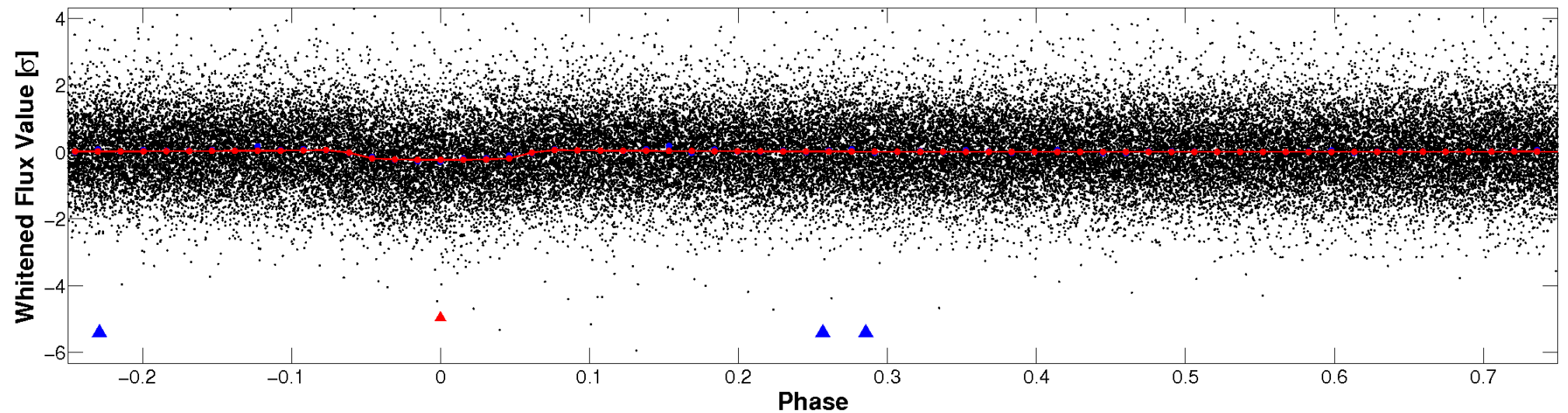


# Non-Whitened Vs. Whitened Light Curve

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

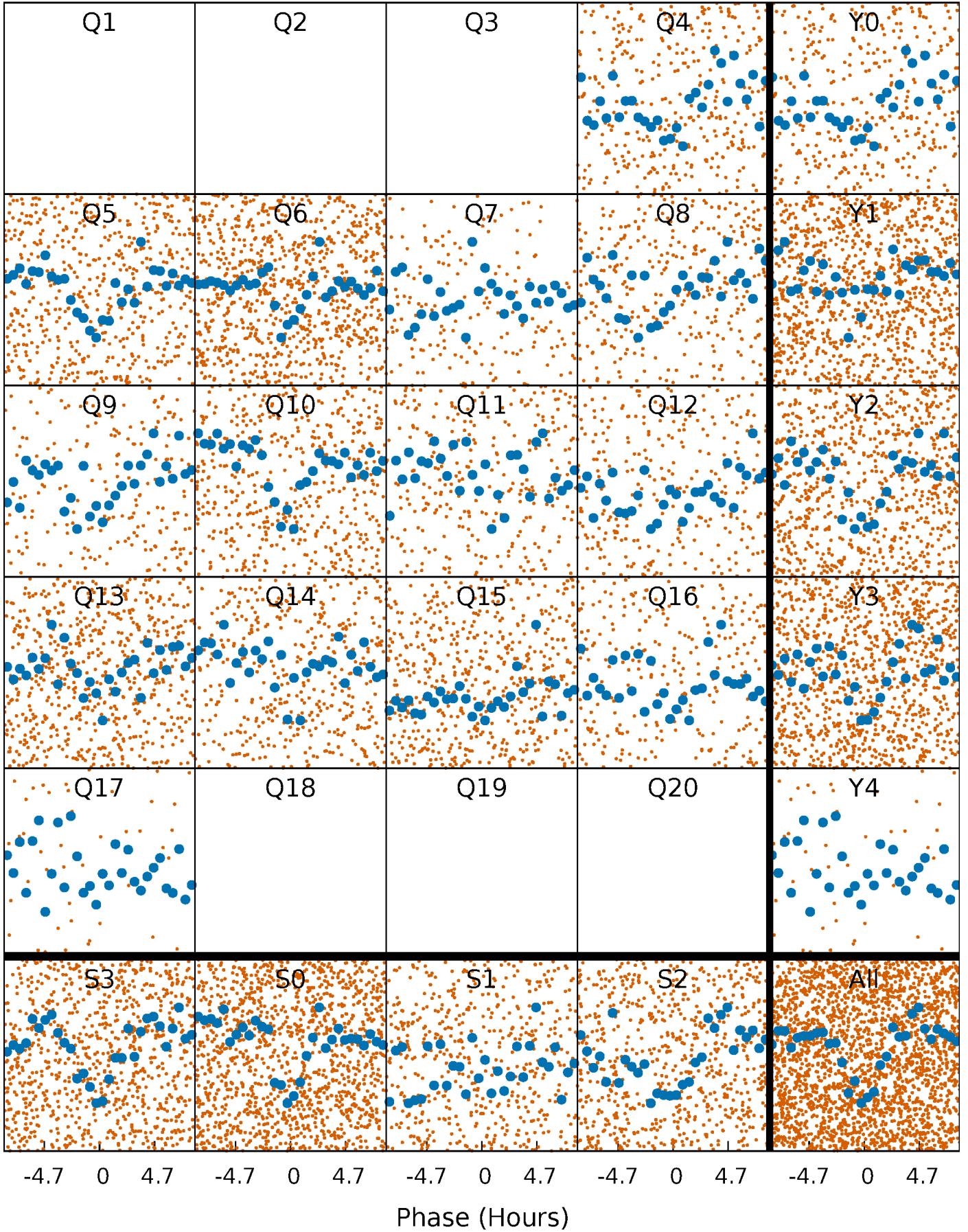


**Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



# PDC Quarter-Phased Transit Curves

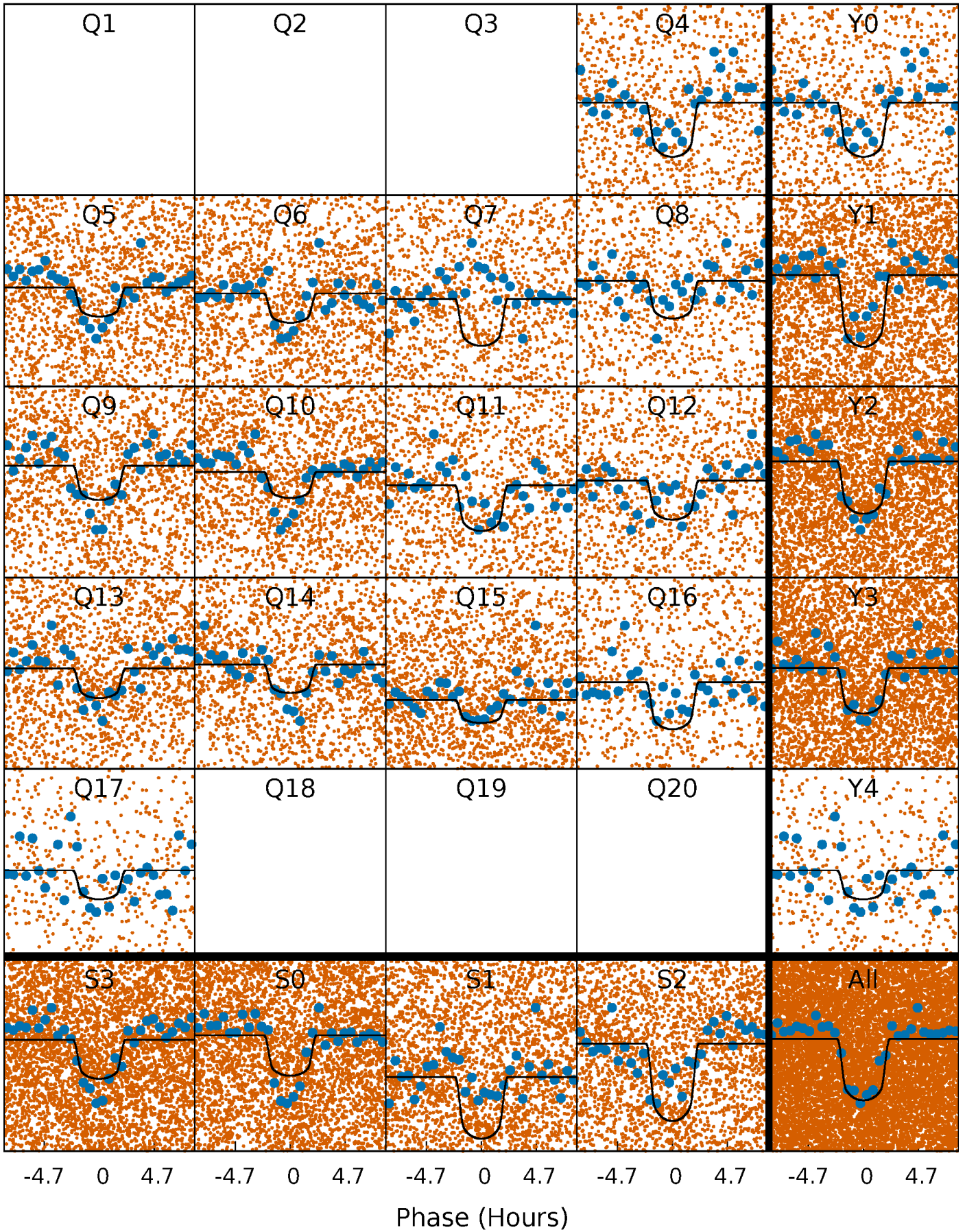
TCE 009777251-01 P= 1.332518 Days  $T_0=132.085984$  (BKJD)





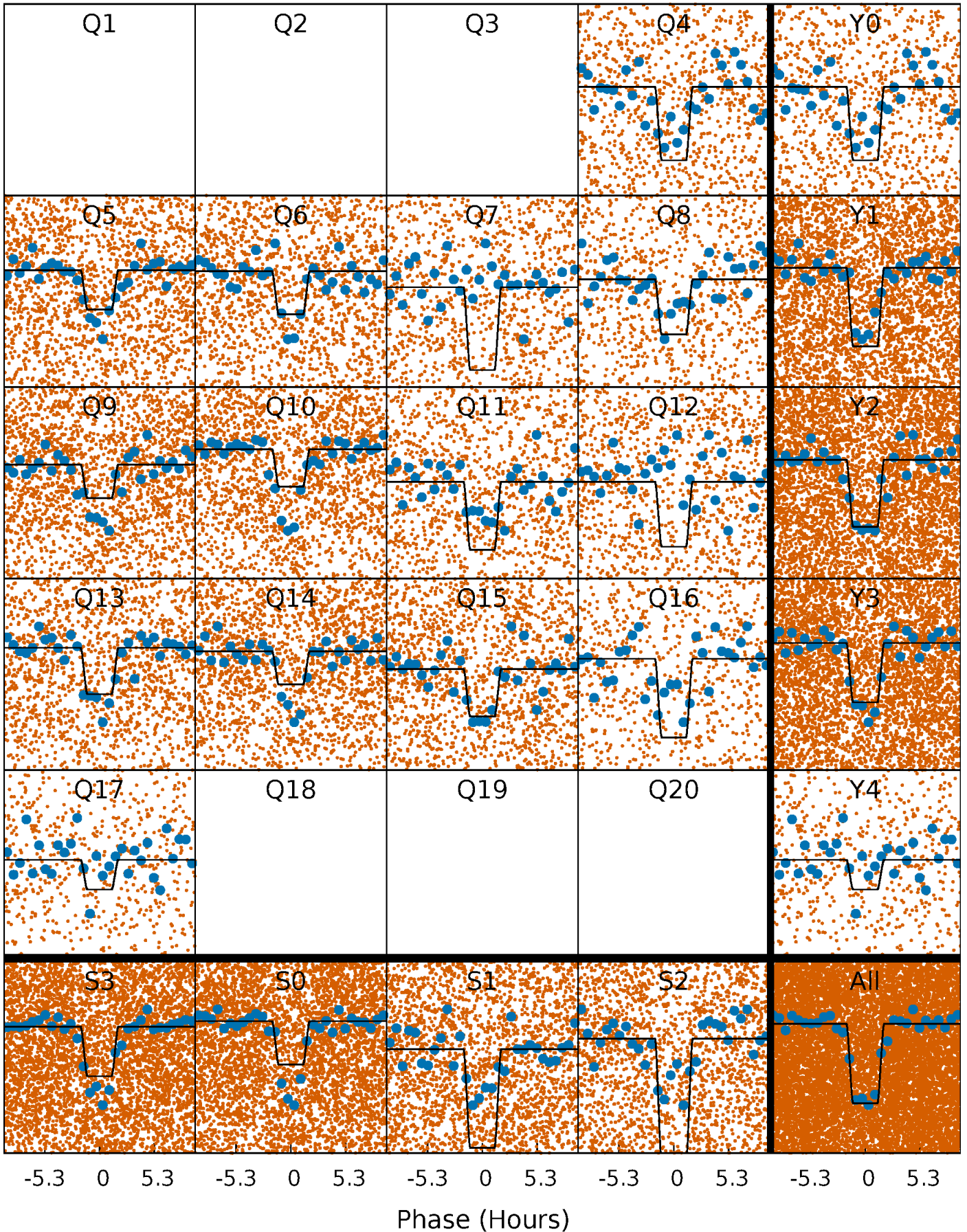
# DV Quarter-Phased Transit Curves

TCE 009777251-01 P= 1.332518 Days  $T_0=132.085984$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

TCE 009777251-01 P= 1.332556 Days  $T_0=132.053499$  (BKJD)

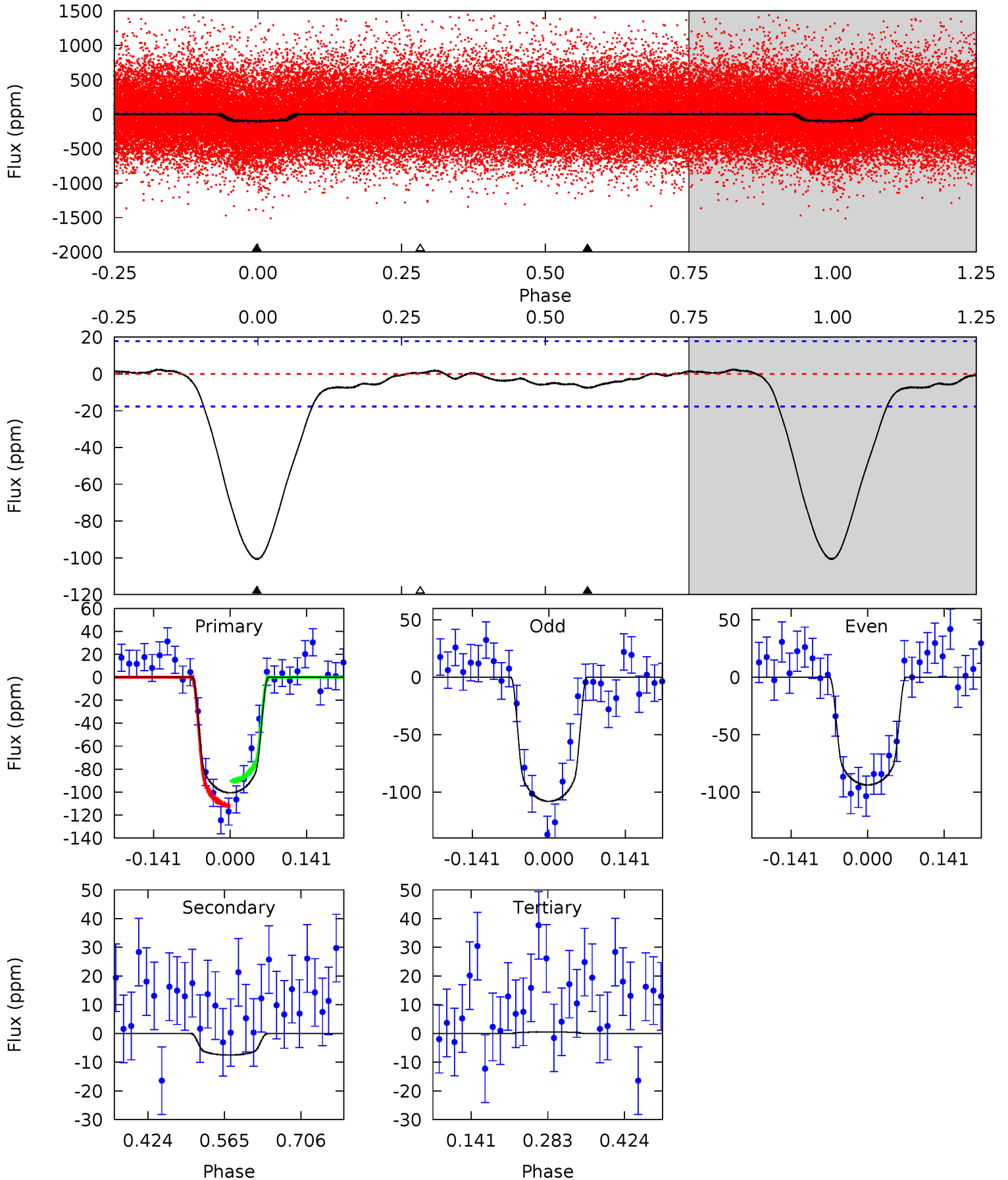




# DV Model-Shift Uniqueness Test

009777251-01, P = 1.332518 Days, E = 132.085984 Days

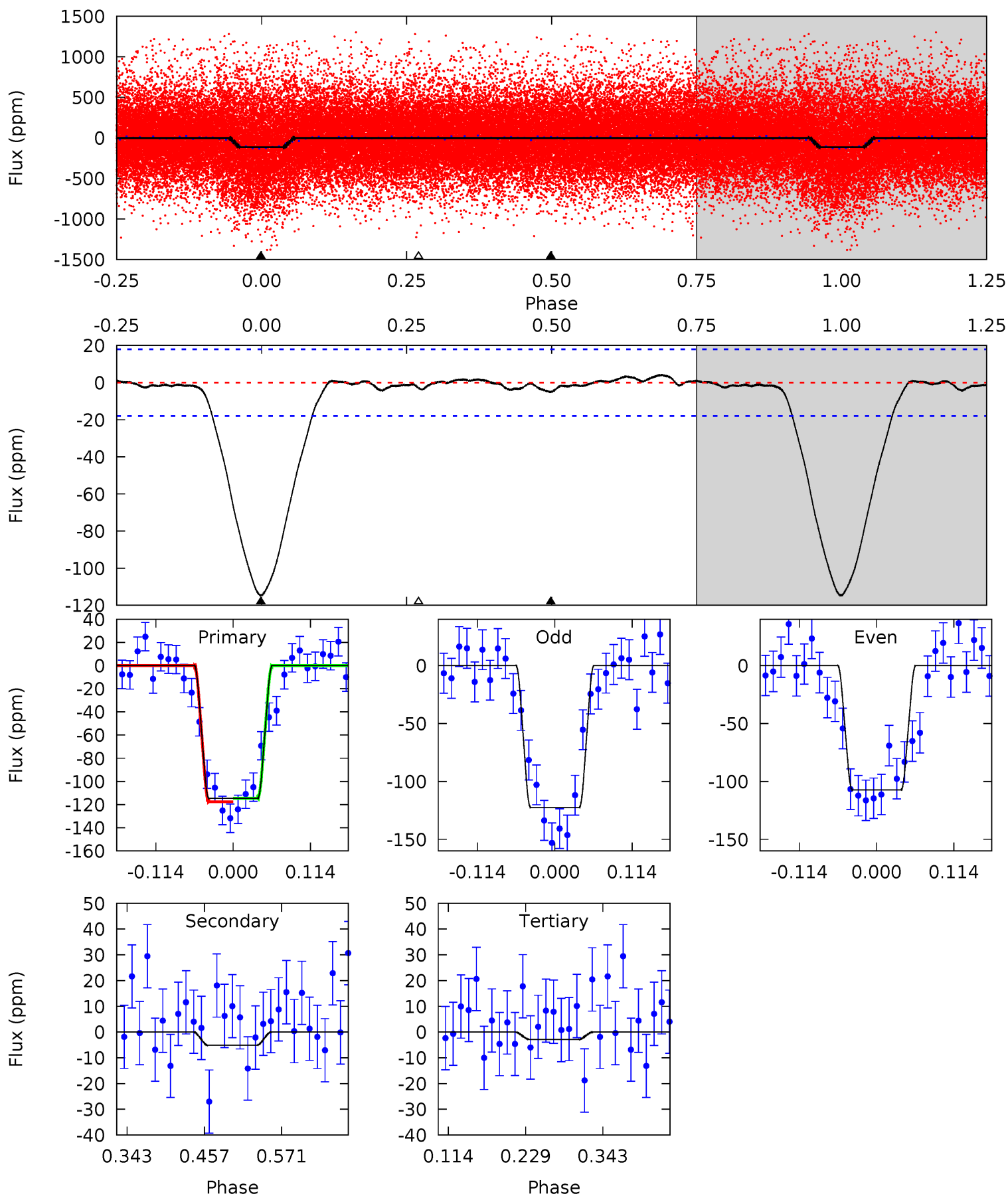
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
25.4	1.90	-0.13	0	4.49	1.47	0.71	25.6	25.4	2.03	1.90	1.80	0.95	0.02	2.66



# Alt Model-Shift Uniqueness Test

009777251-01, P = 1.332556 Days, E = 132.053499 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
28.9	1.29	0.73	0	4.54	1.58	0.46	28.2	28.9	0.56	1.29	1.91	0.90	0.03	0.38



### Stellar Parameters For KIC 009777251

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5774^{+172}_{-190}$	$4.347^{+0.158}_{-0.193}$	$-0.160^{+0.300}_{-0.300}$	$1.054^{+0.305}_{-0.178}$	$0.903^{+0.134}_{-0.089}$	$1.085^{+0.835}_{-0.552}$
	+3%/-3%	+4%/-4%	+188%/-188%	+29%/-17%	+15%/-10%	+77%/-51%
Source	KIC0	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 009777251-01 / KOI 2600.01

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-8 \pm 4$	$1.36^{+0.35}_{-0.28}$	$2414^{+169}_{-146}$	$3156^{+390}_{-583}$	$1.099^{+1.019}_{-0.644}$
Alt.	$-5 \pm 4$	$1.27^{+0.34}_{-0.28}$	$2422^{+184}_{-152}$	$3000^{+503}_{-5514}$	$0.857^{+1.136}_{-0.693}$

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



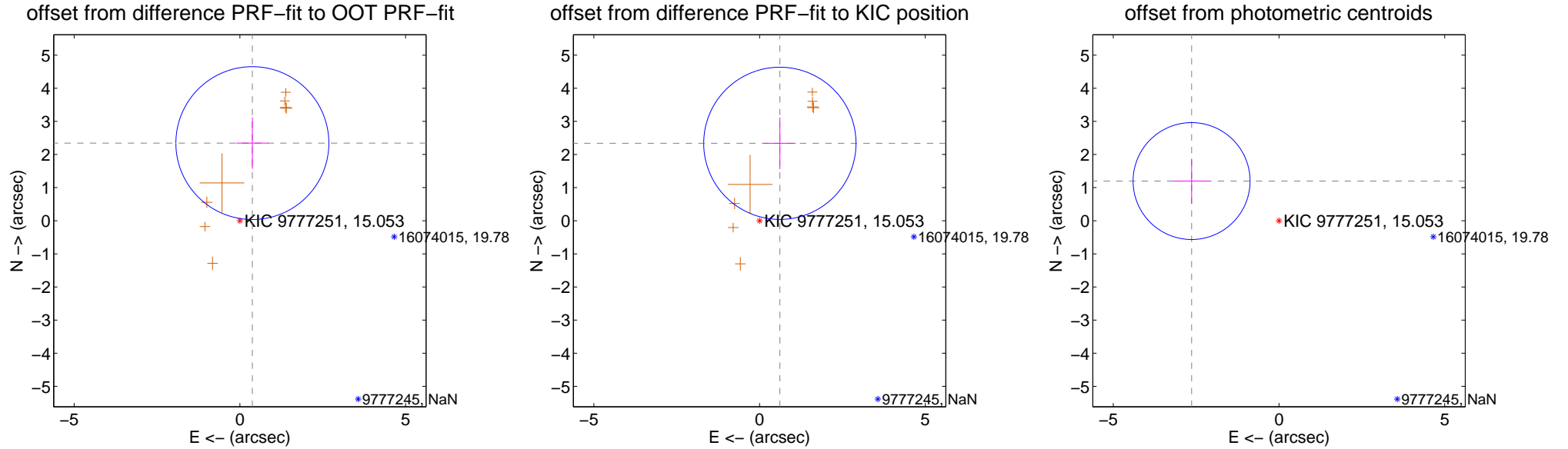
## DV Centroid Data

Supplemental centroid analysis for 009777251-01. Kepler magnitude: 15.05. Transit SNR 16.94

There are 0 quarters with good PRF difference image offsets

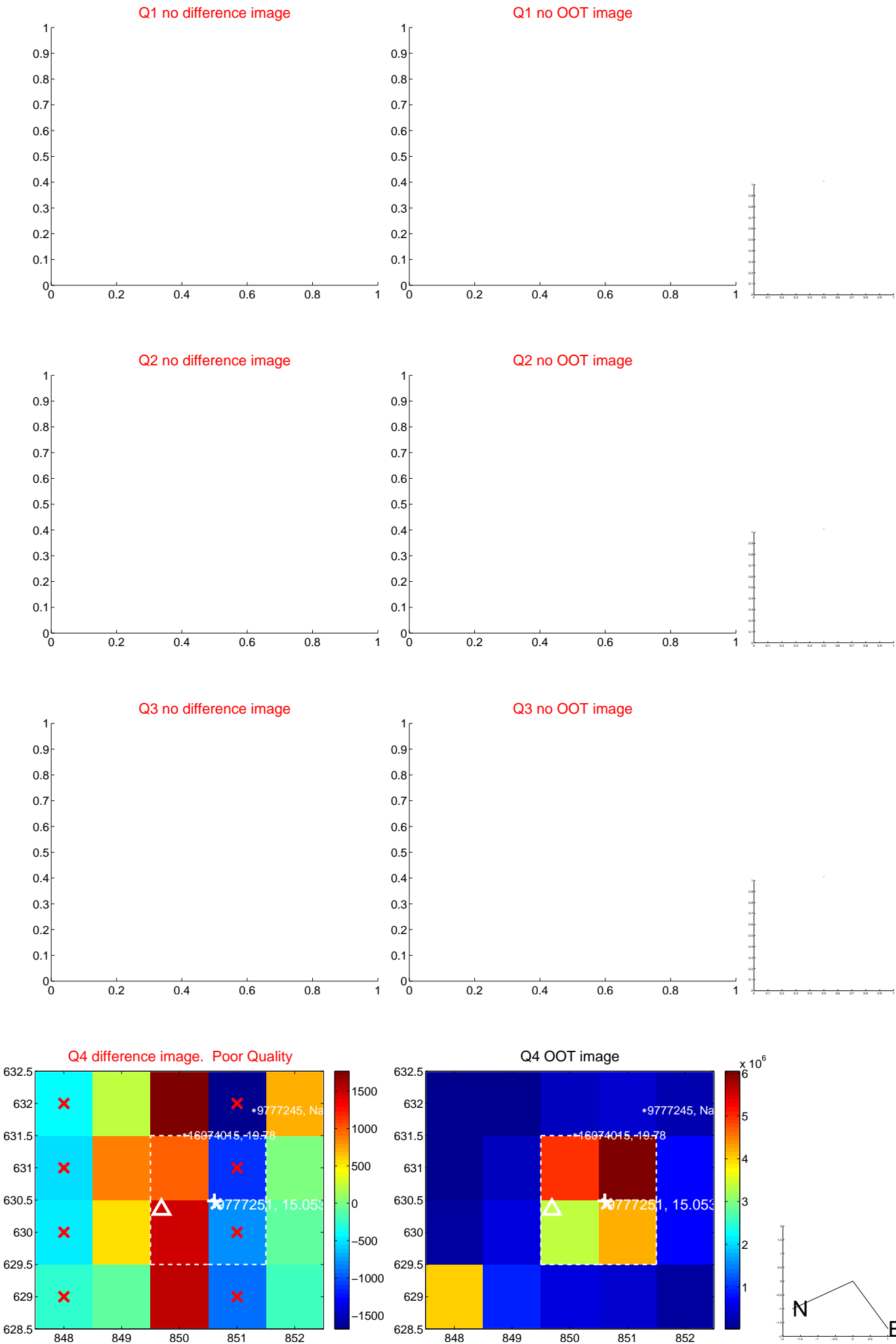
The direct PRF centroid is offset from the target star catalog position by about 0.26 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$2.374 \pm 0.769$	3.09	$-0.377 \pm 0.485$	$2.344 \pm 0.775$
PRF-fit source offset from KIC position	$2.416 \pm 0.766$	3.15	$-0.612 \pm 0.481$	$2.337 \pm 0.782$
photometric centroid source offset	$2.90 \pm 0.59$	4.92	$2.64 \pm 0.57$	$1.20 \pm 0.68$

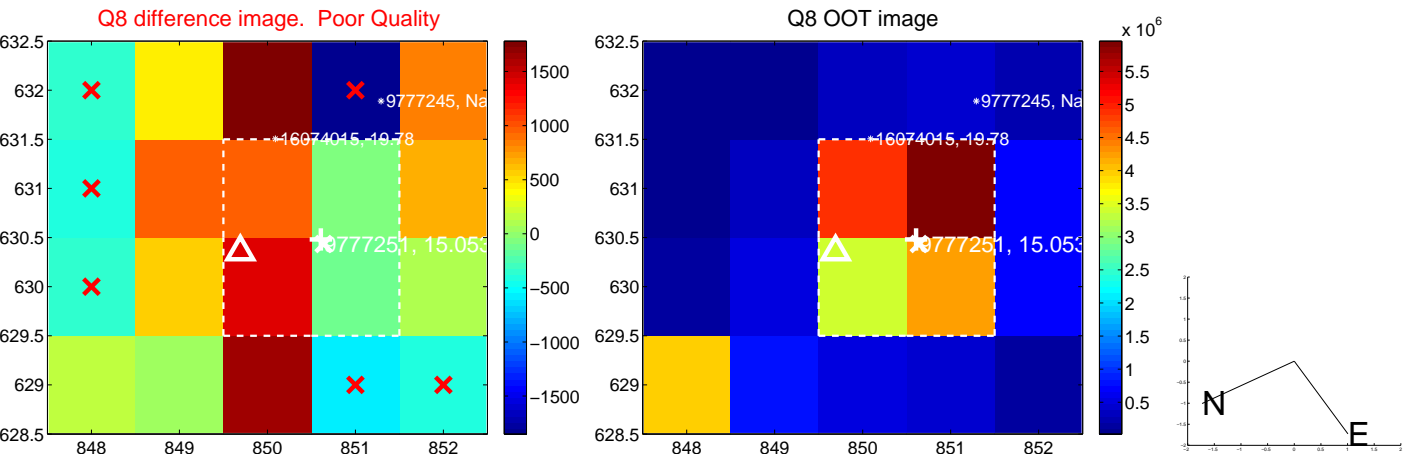
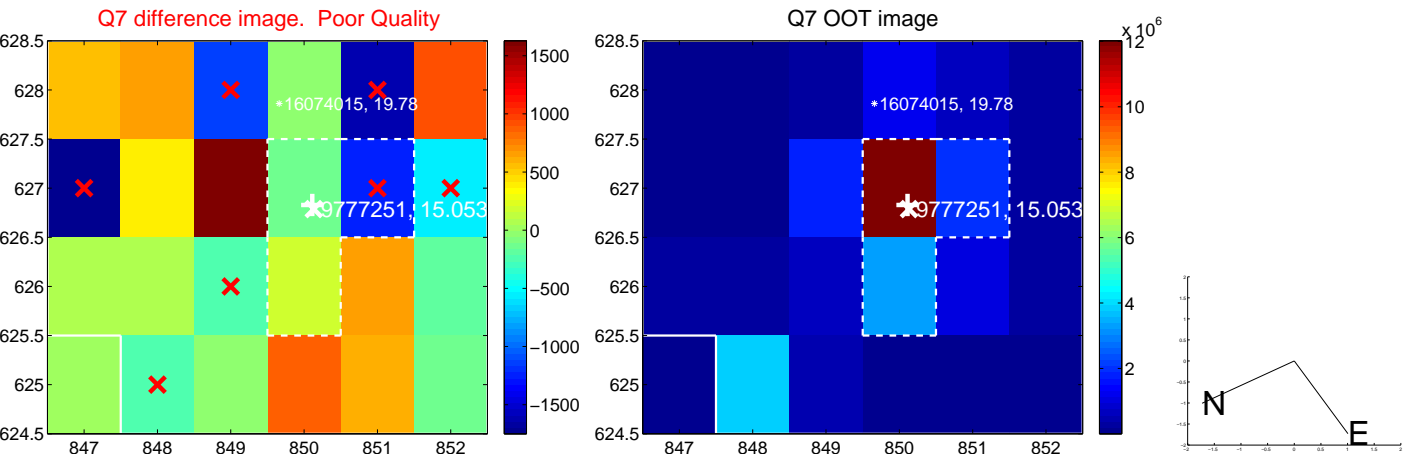
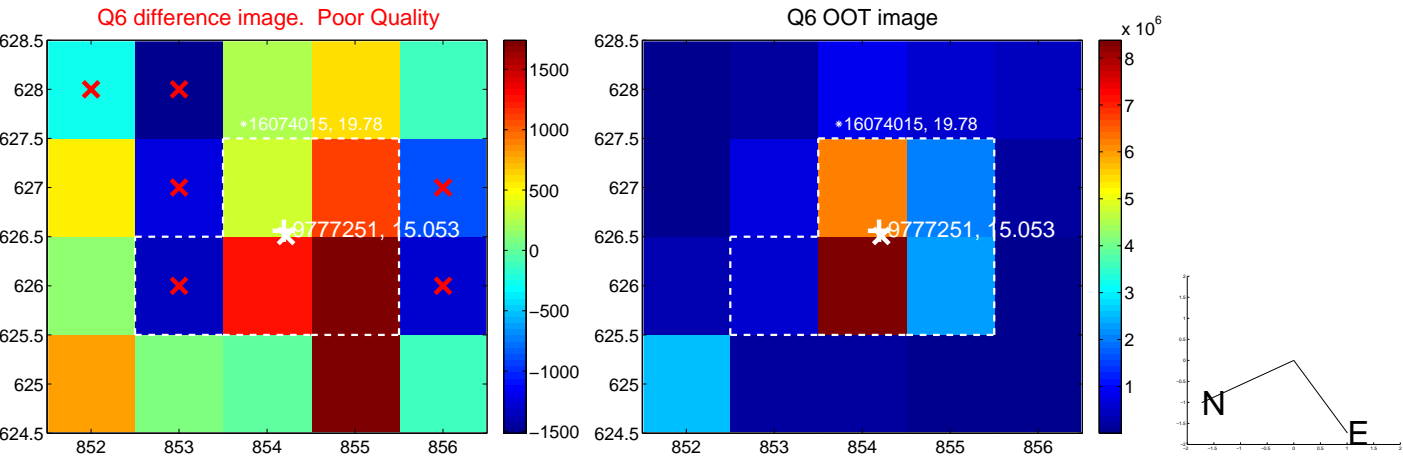
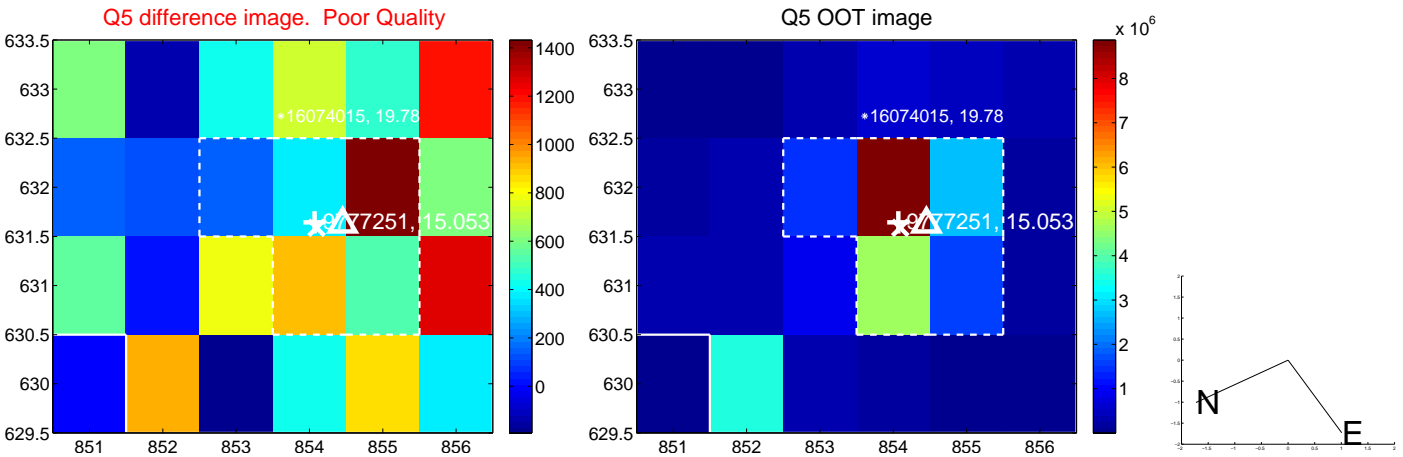


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

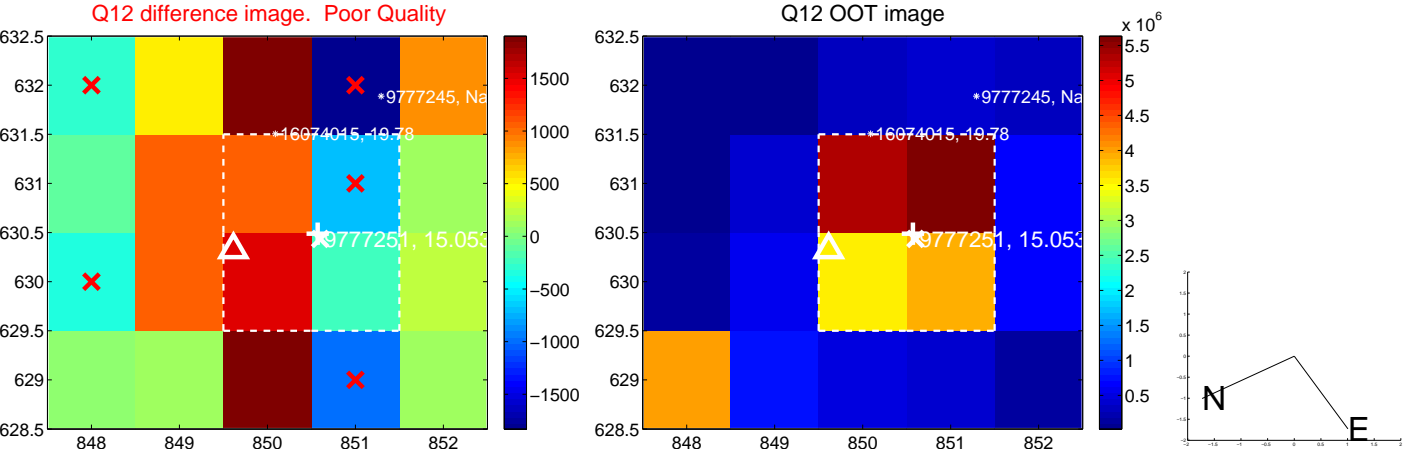
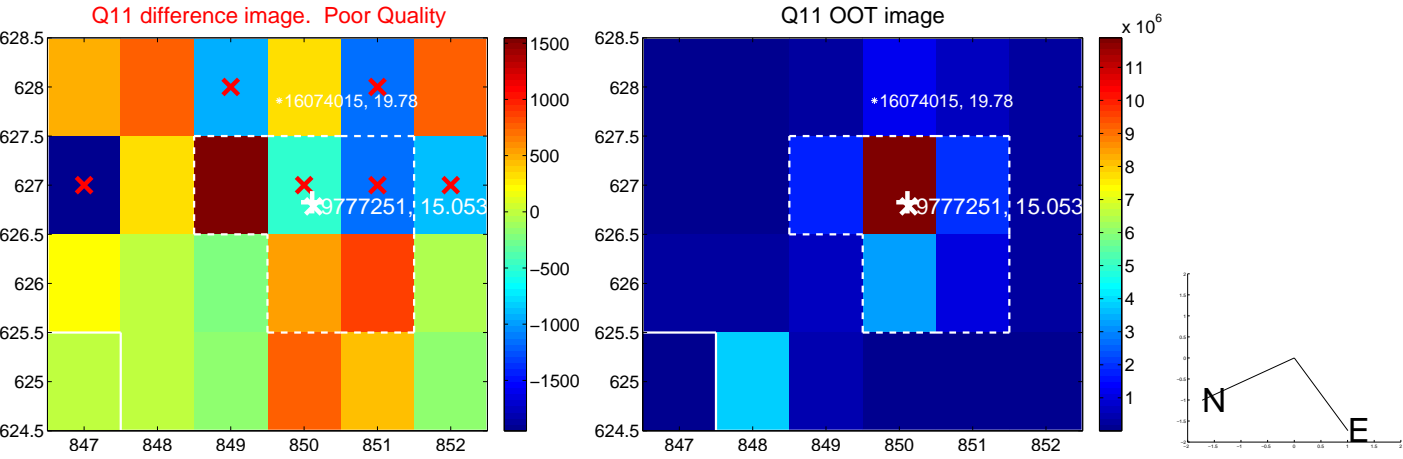
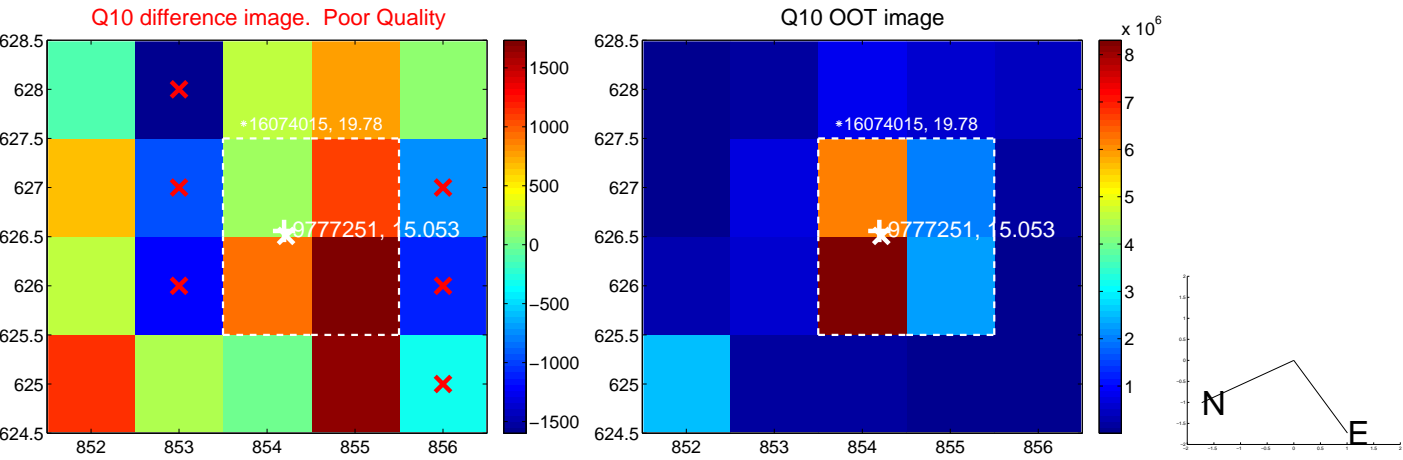
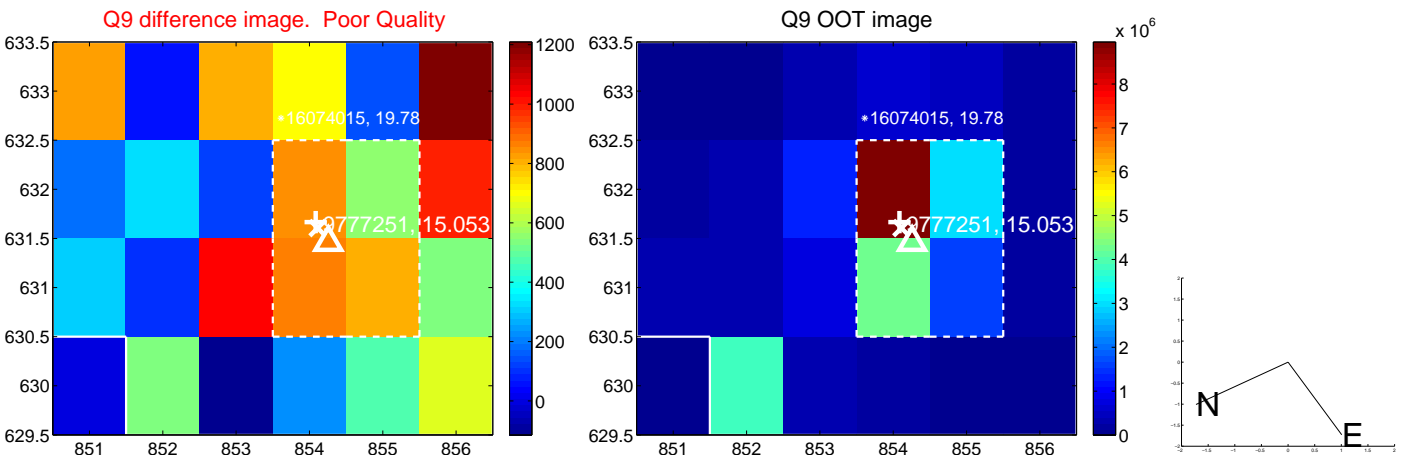
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



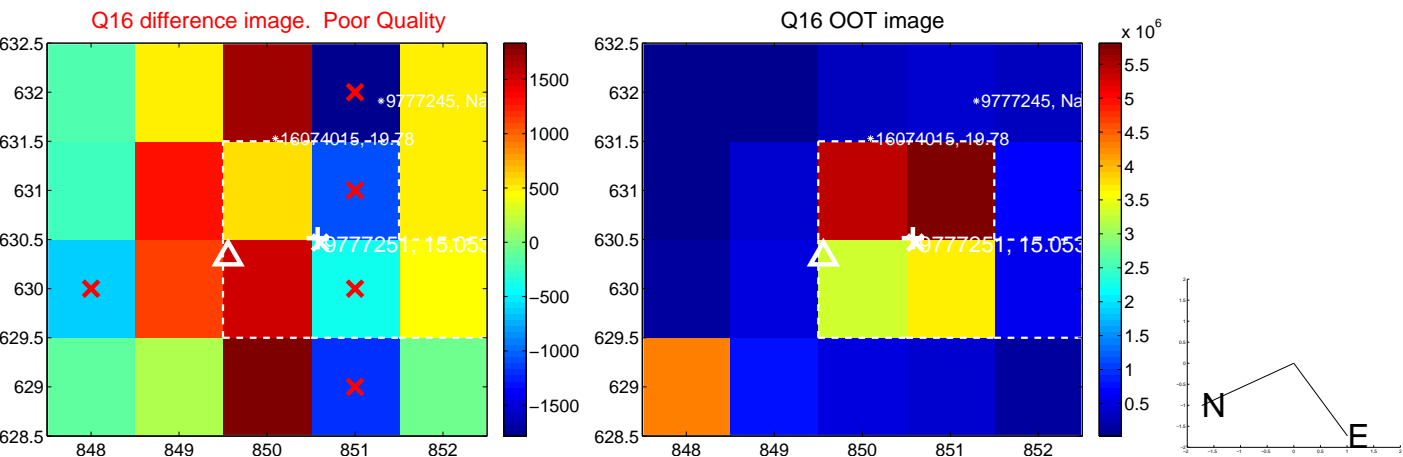
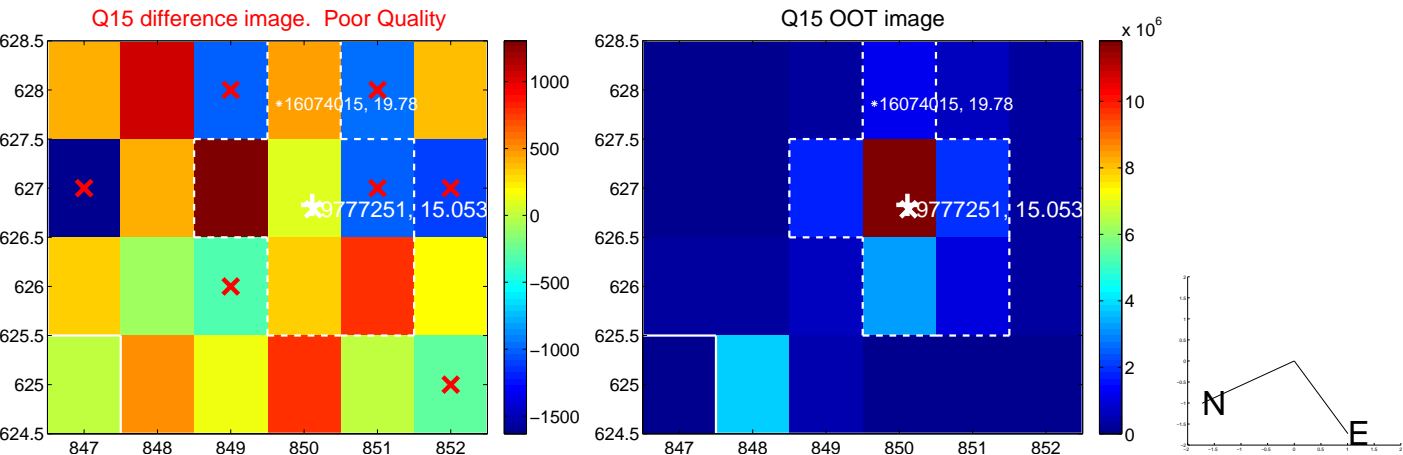
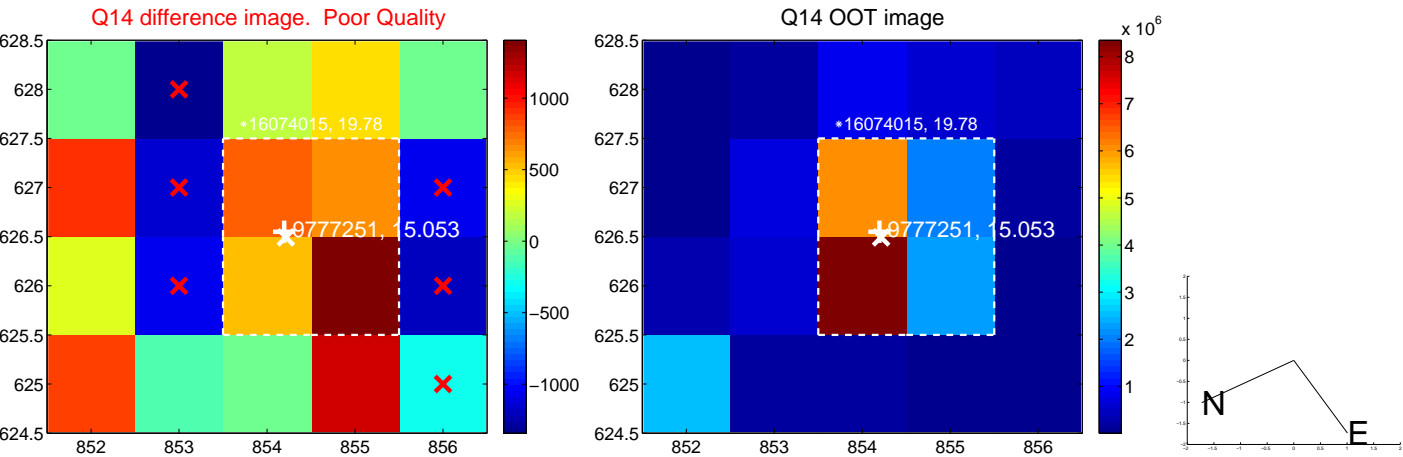
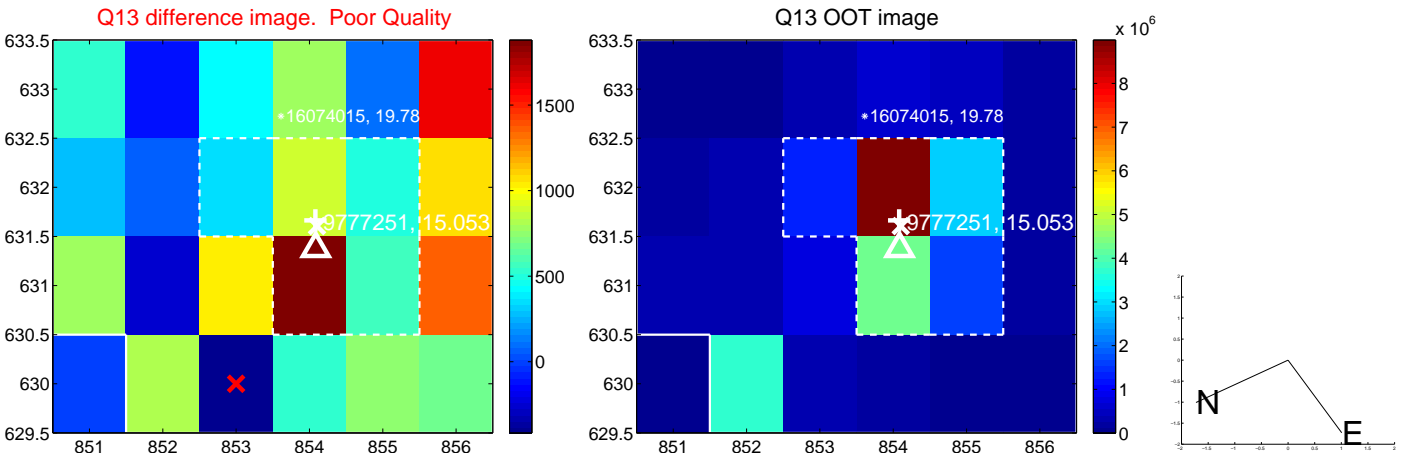
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white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

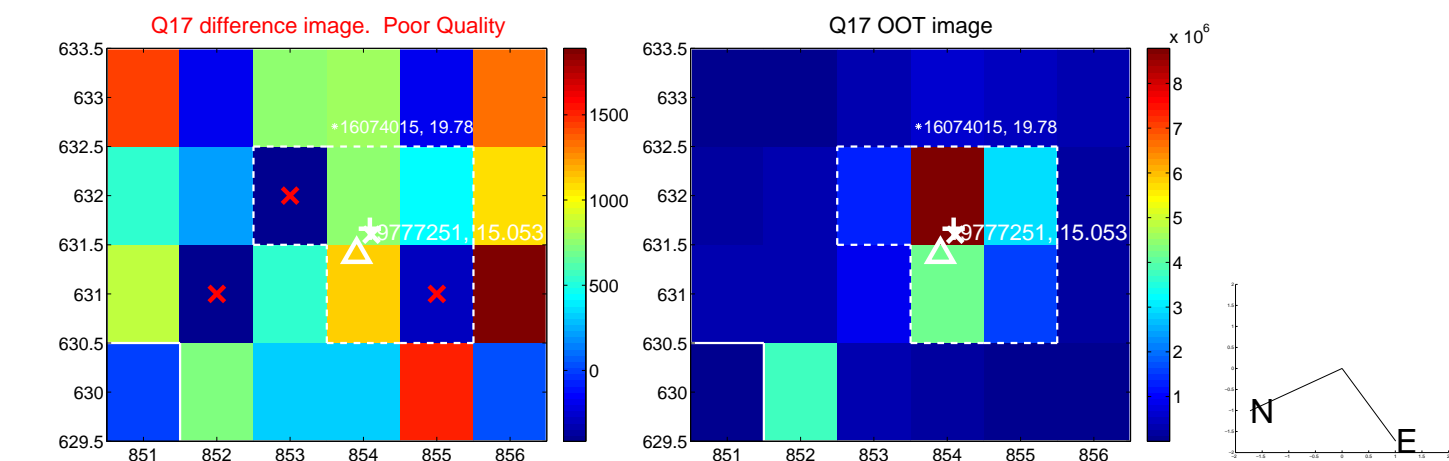


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

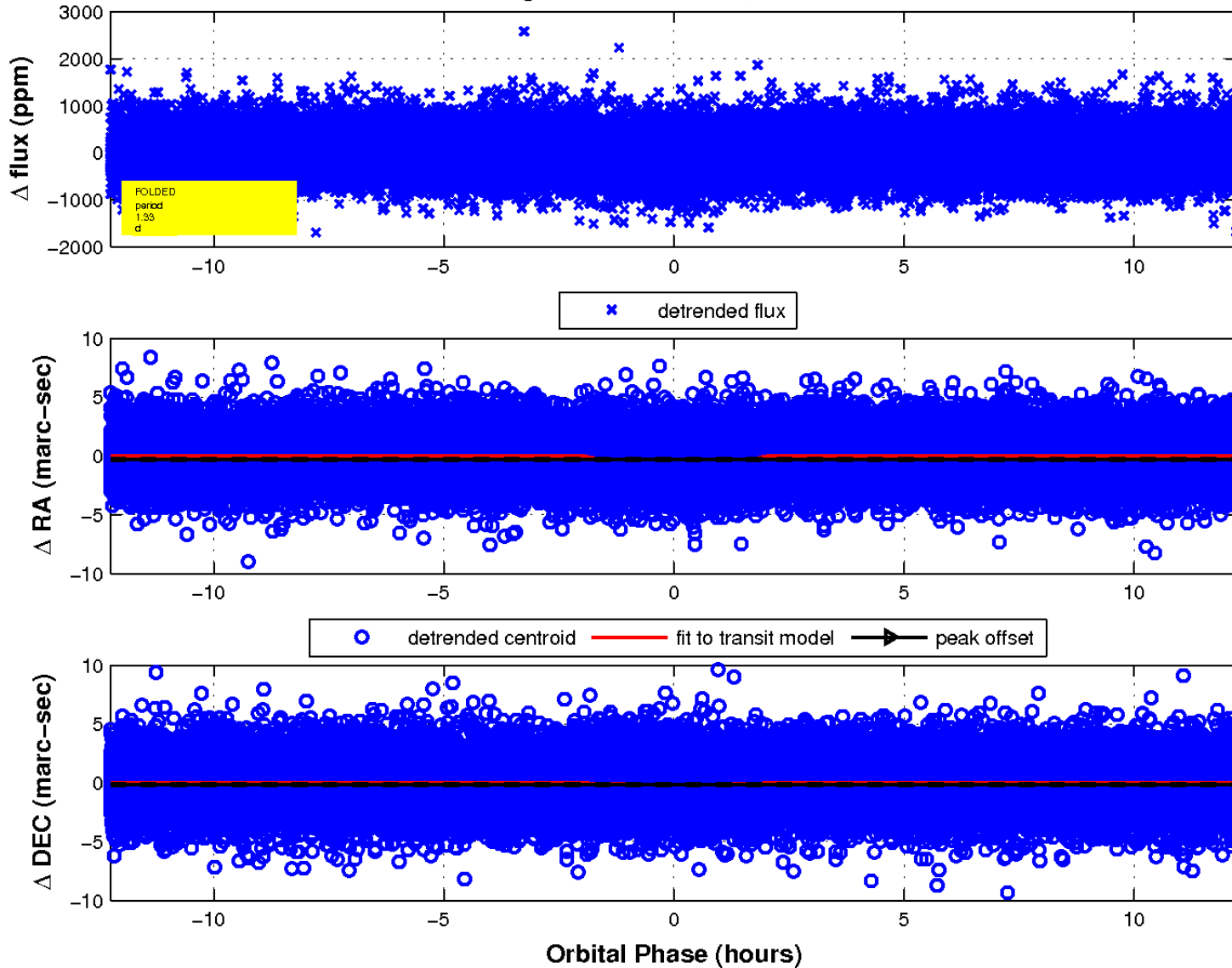




white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

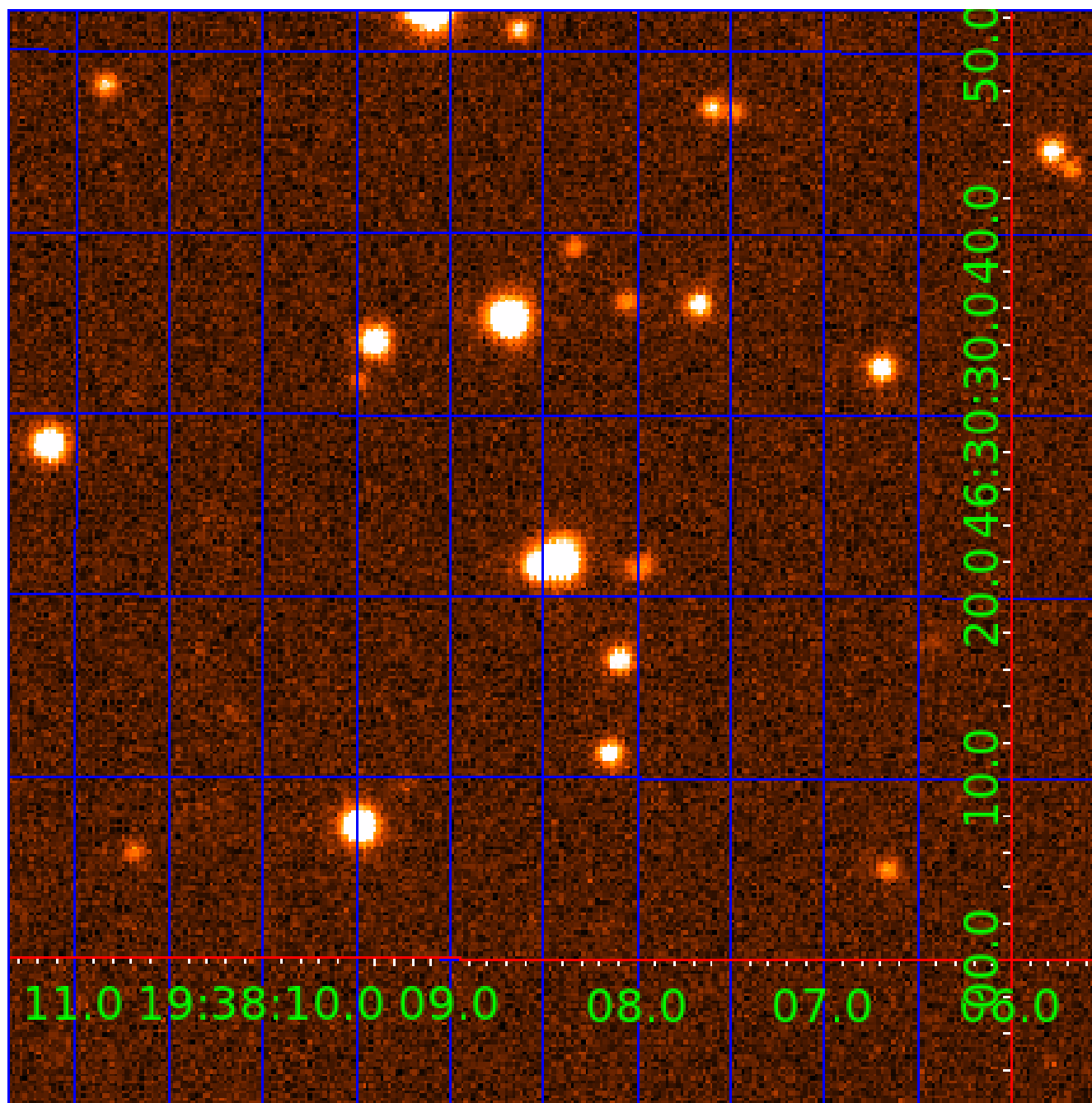


fluxWeightedCentroids, Planet 1 of 2



UKIRT Image

Declination



# KIC 009777251

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
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## Robovetter Results

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009777251-01	OBS	FP	0.00	0	0	0	1	CENT_FEW_DIFFS—EPHEM_MATCH
009777251-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_CHASES_MARSHALL_SKYE—ALL_TRANS_CHASES—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT— INCONSISTENT_TRANS—CENT_FEW_DIFFS

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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.

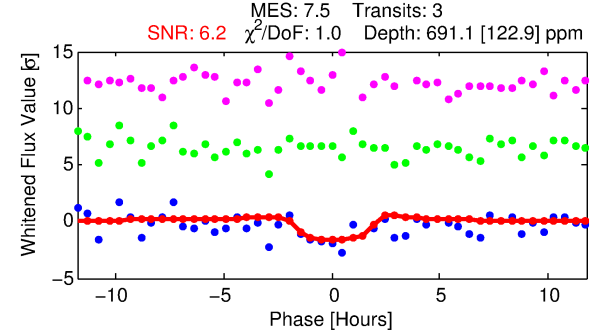
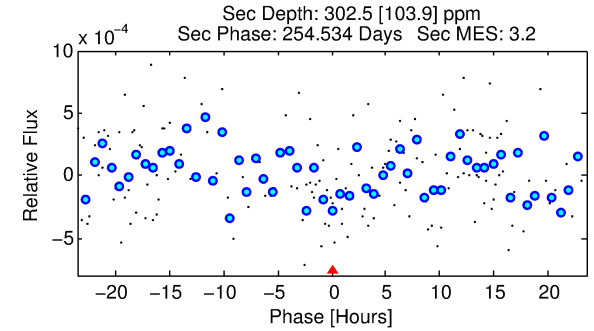
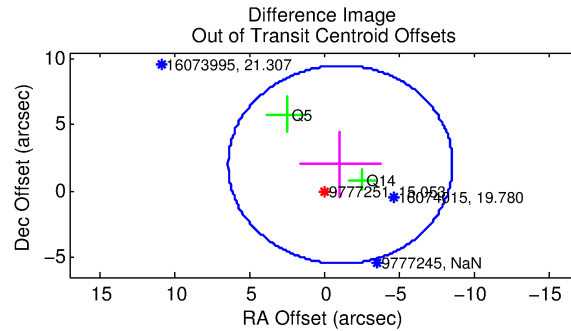
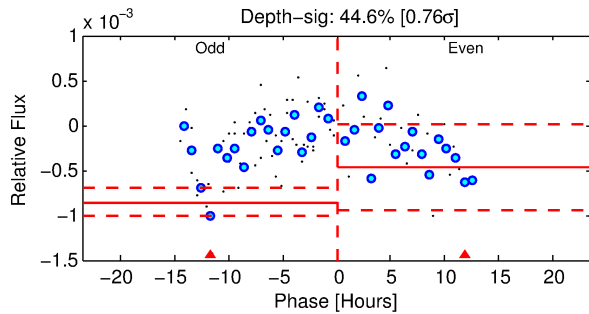
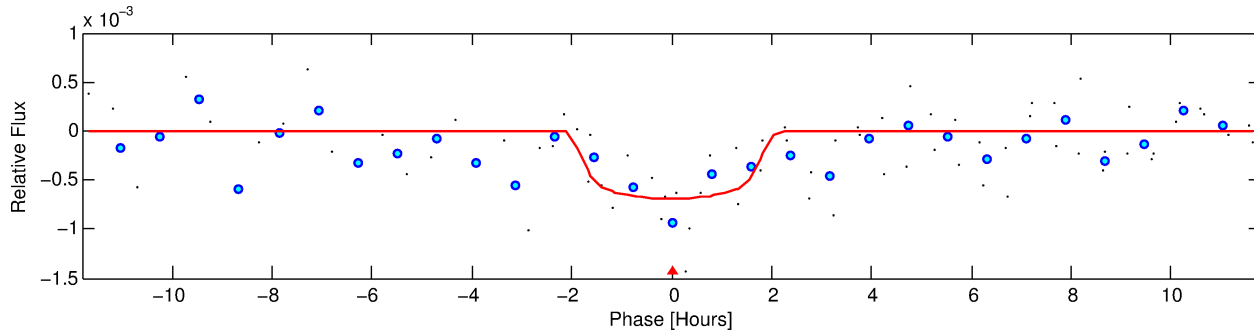
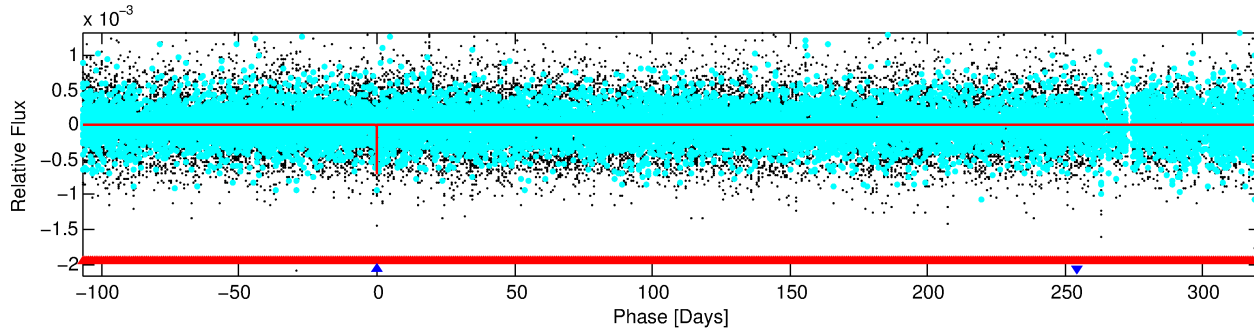
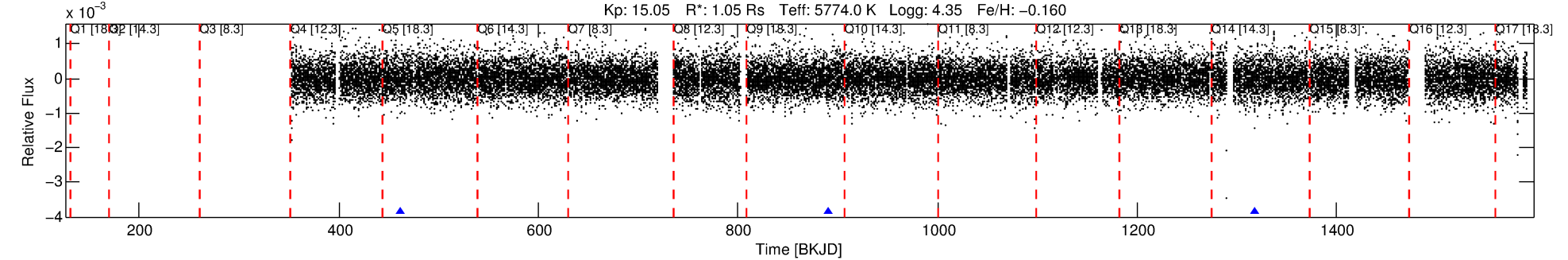
## Ephemeris Match Information For 009777251-02

No Significant Match Found

# DV One-Page Summary

KIC: 9777251 Candidate: 2 of 2 Period: 428.424 d  
KOI: K02600 Corr: No Ephemeris Match

Kp: 15.05 R\*: 1.05 Rs Teff: 5774.0 K Logg: 4.35 Fe/H: -0.160



## DV Fit Results:

Period = 428.42388 [0.00776] d  
Epoch = 461.5600 [0.0114] BKJD  
Rp/R\* = 0.0269 [0.0581]  
a/R\* = 519.58 [5194.54]  
b = 0.82 [4.15]  
Seff = 0.96 [0.36]  
Teq = 252 [24] K  
Rp = 3.10 [6.74] Re  
a = 1.0744 [0.2613] AU  
Ag = 20000.21 [86833.53] [0.23σ]  
Teffp = 4639 [5021] K [0.87σ]

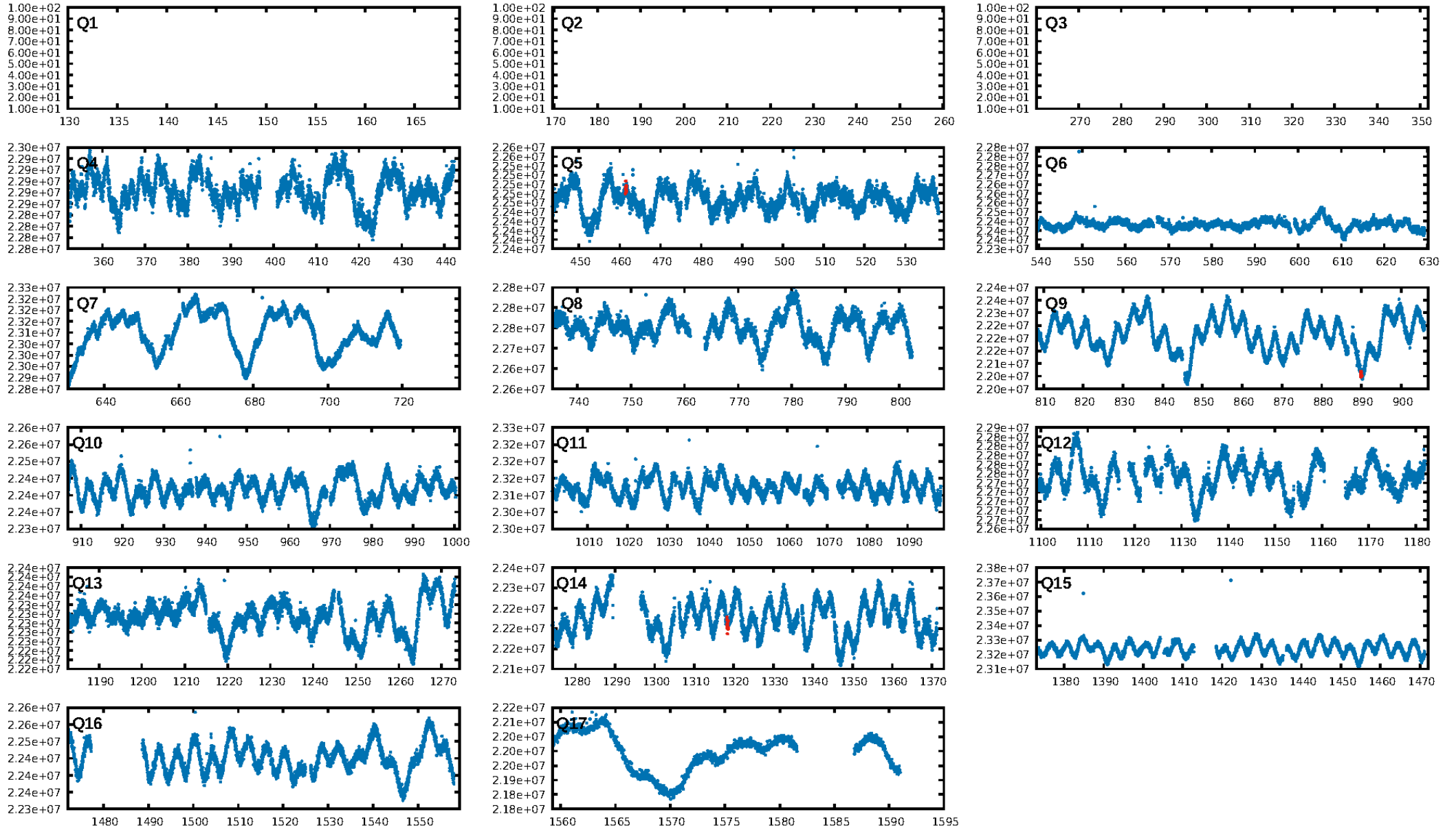
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [1808.09σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 11.1%  
ModelChiSquareGof-sig: 99.6%  
**Bootstrap-pfa: 2.98e-10**  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: -19.25  
Centroid-sig: 52.0%  
Centroid-so: 2.026 arcsec [1.10σ]  
OotOffset-rm: 2.294 arcsec [0.92σ]  
OotOffset-st: 1/0/0/1 [2]  
KicOffset-rm: 2.388 arcsec [0.94σ]  
KicOffset-st: 1/0/0/1 [2]  
DiffImageQuality-fgm: 0.50 [1/2]  
DiffImageOverlap-fno: 0.00 [0/3]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 30-Jan-2016 08:13:10 Z

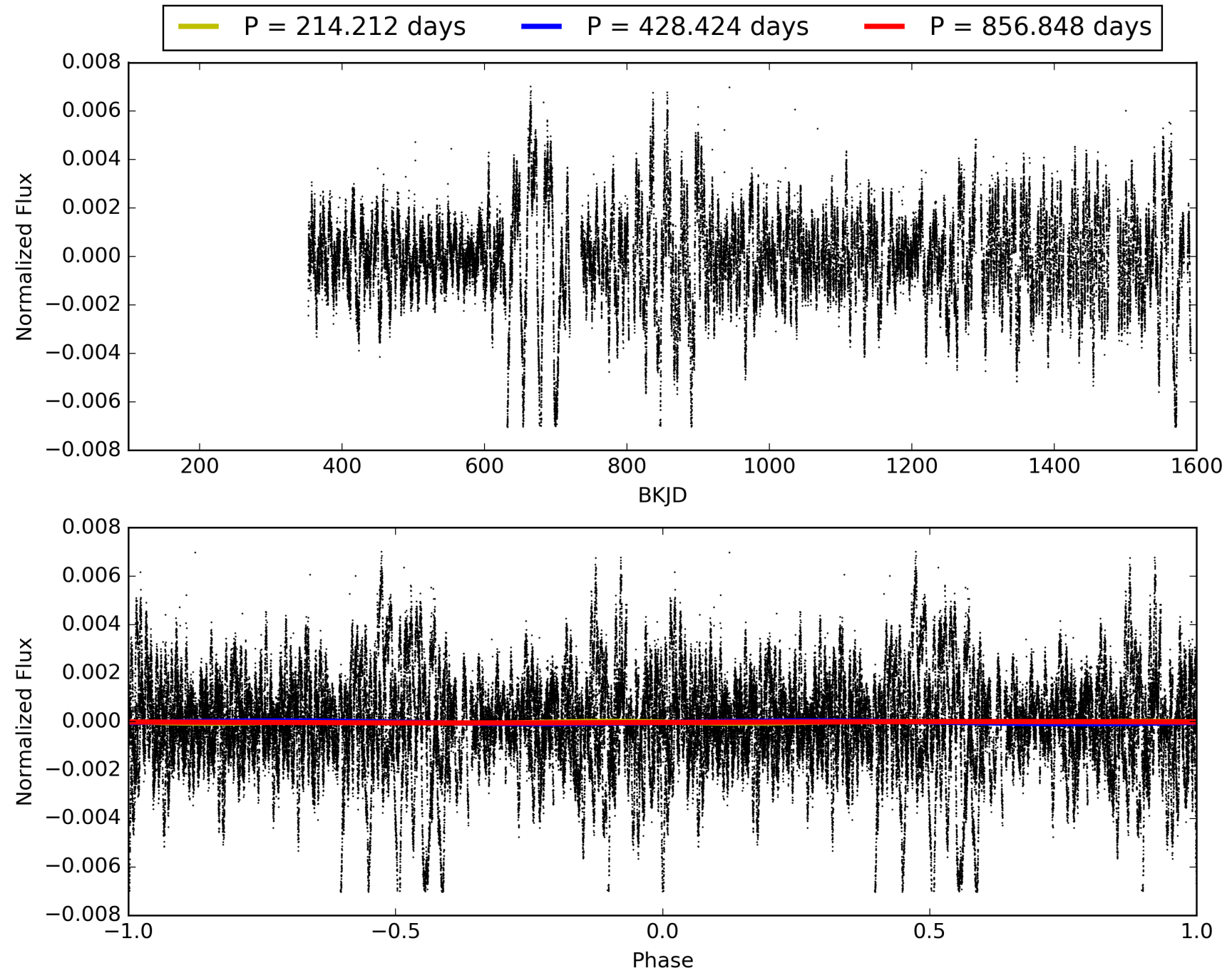
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 009777251-02, PDC Light Curves



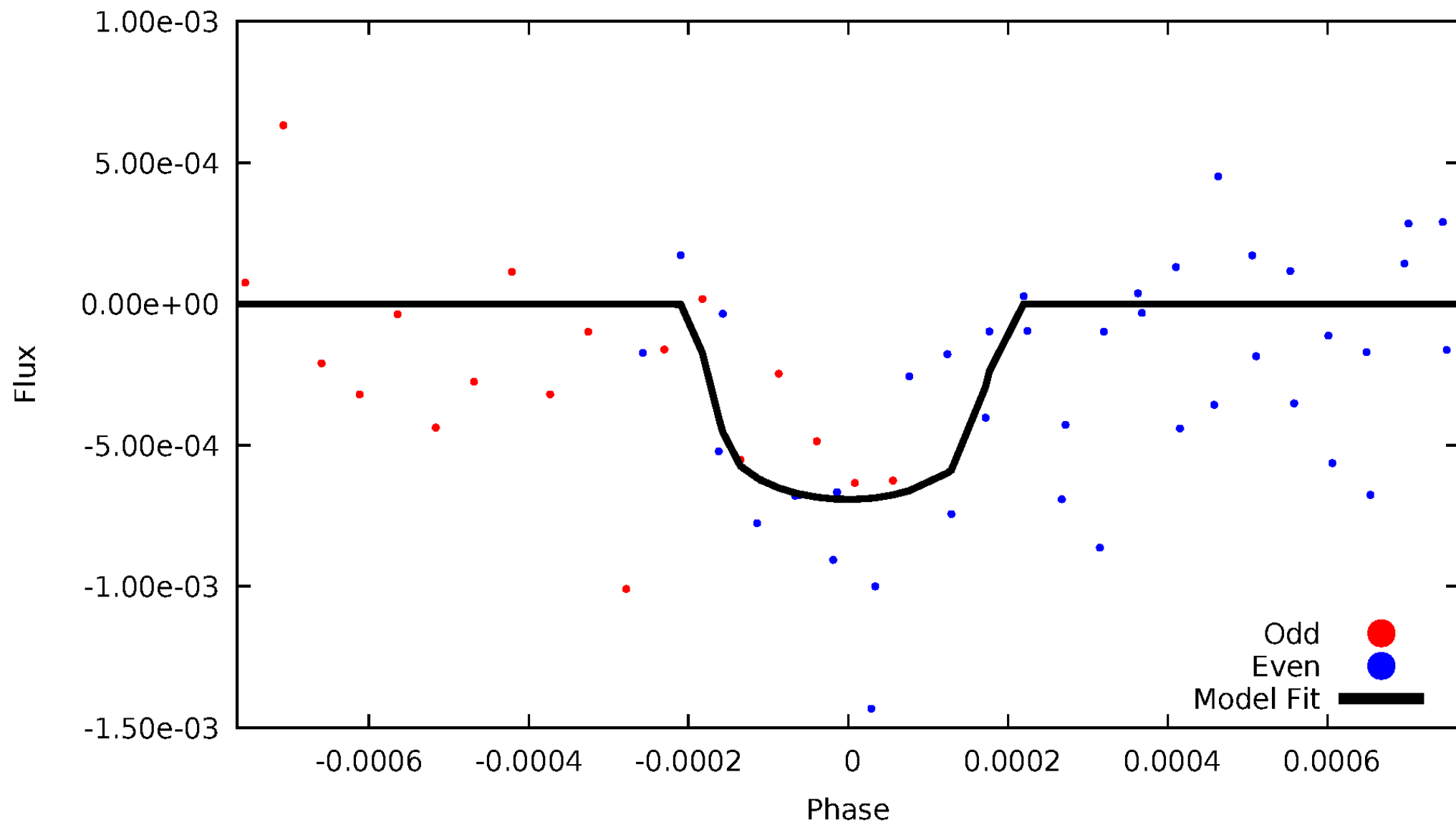


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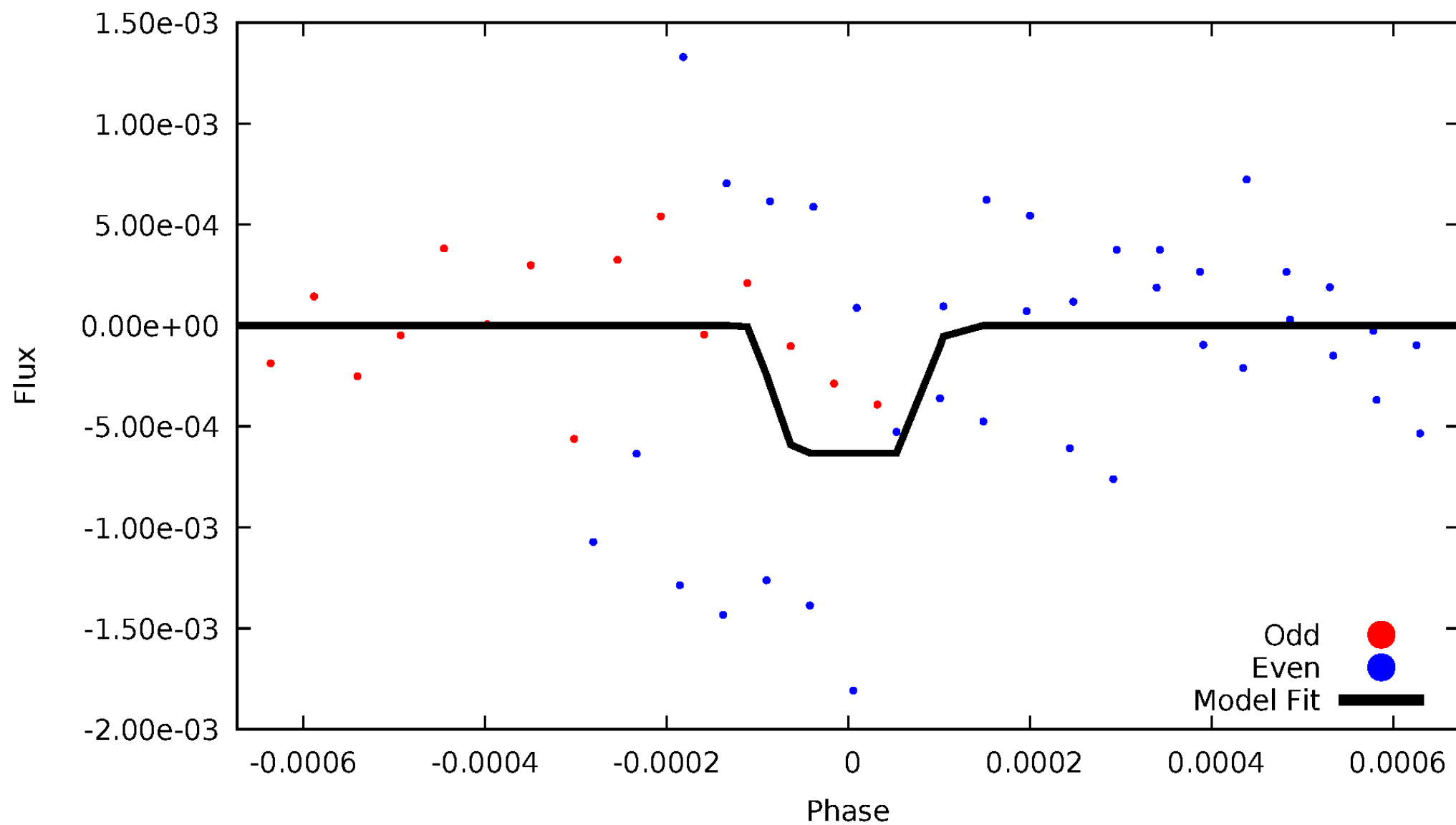
# DV Odd/Even

TCE 009777251-02



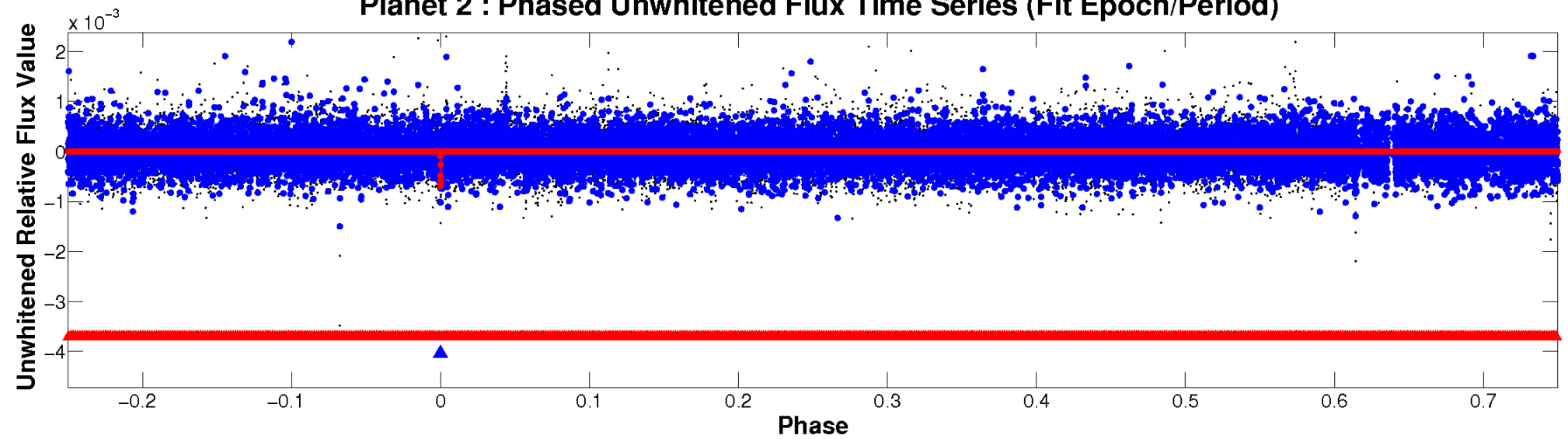
# ALT Odd/Even

TCE 009777251-02

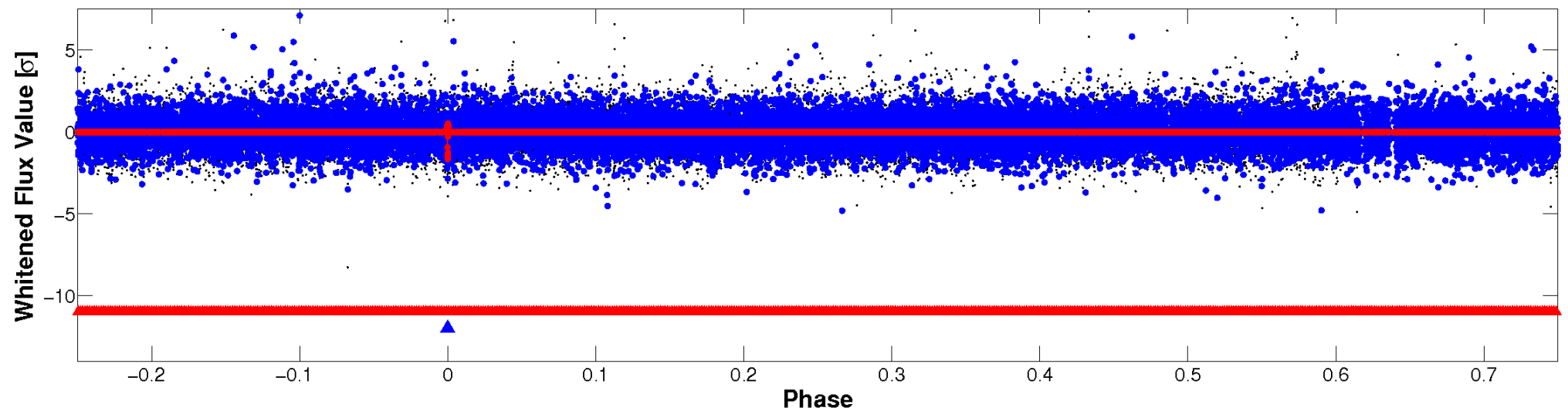


# Non-Whitened Vs. Whitened Light Curve

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

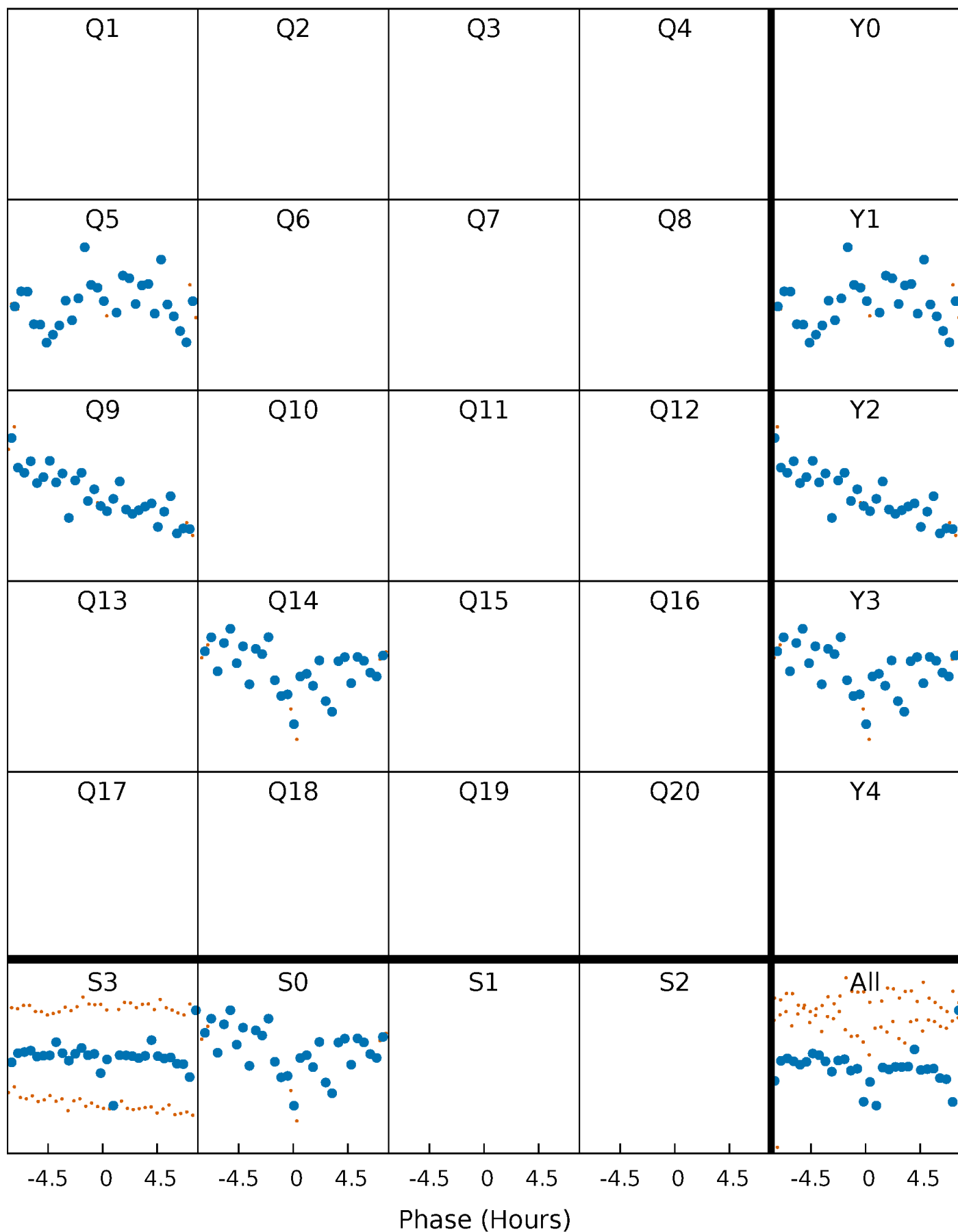


Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

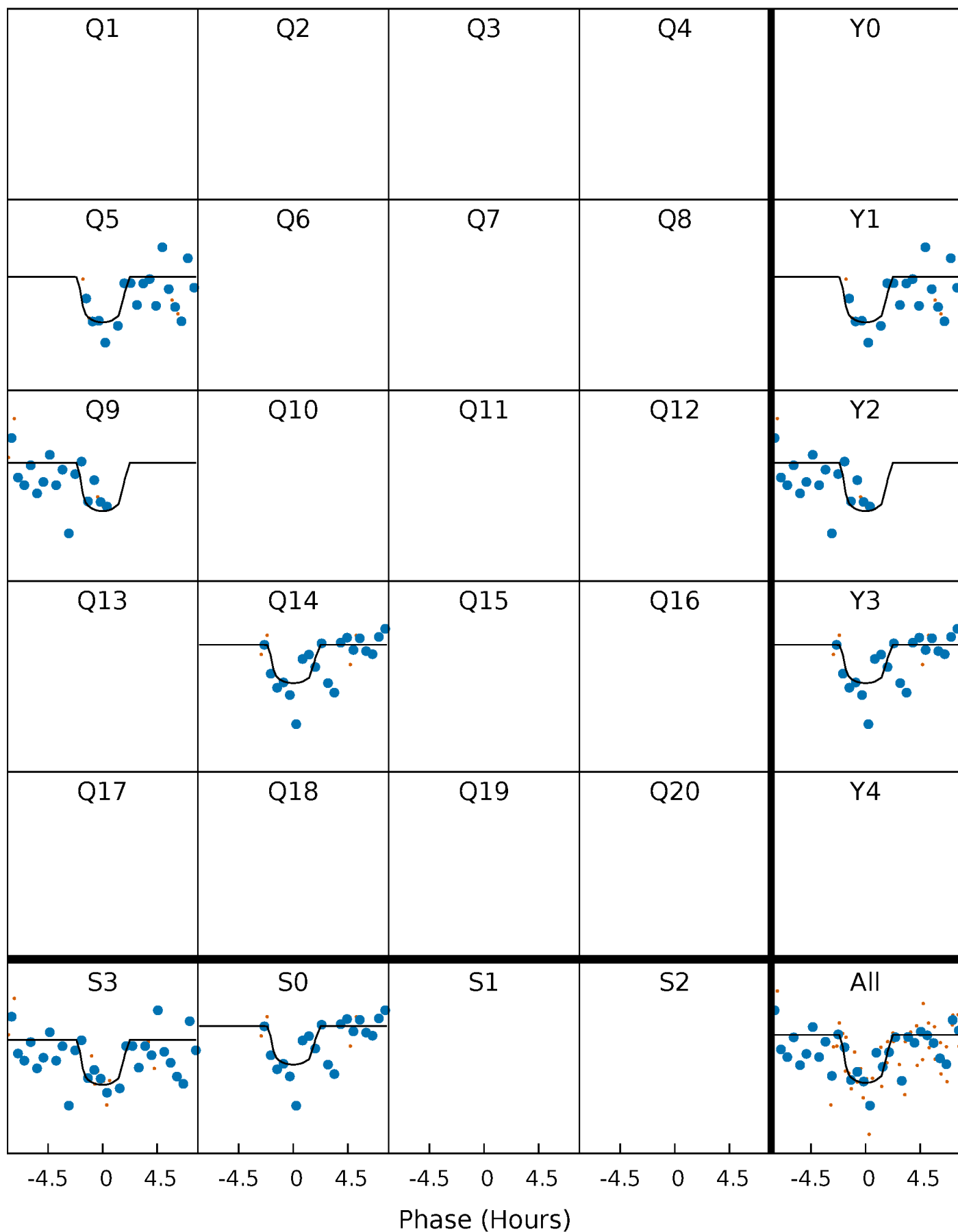
TCE 009777251-02     $P=428.423881$  Days     $T_0=461.560008$  (BKJD)





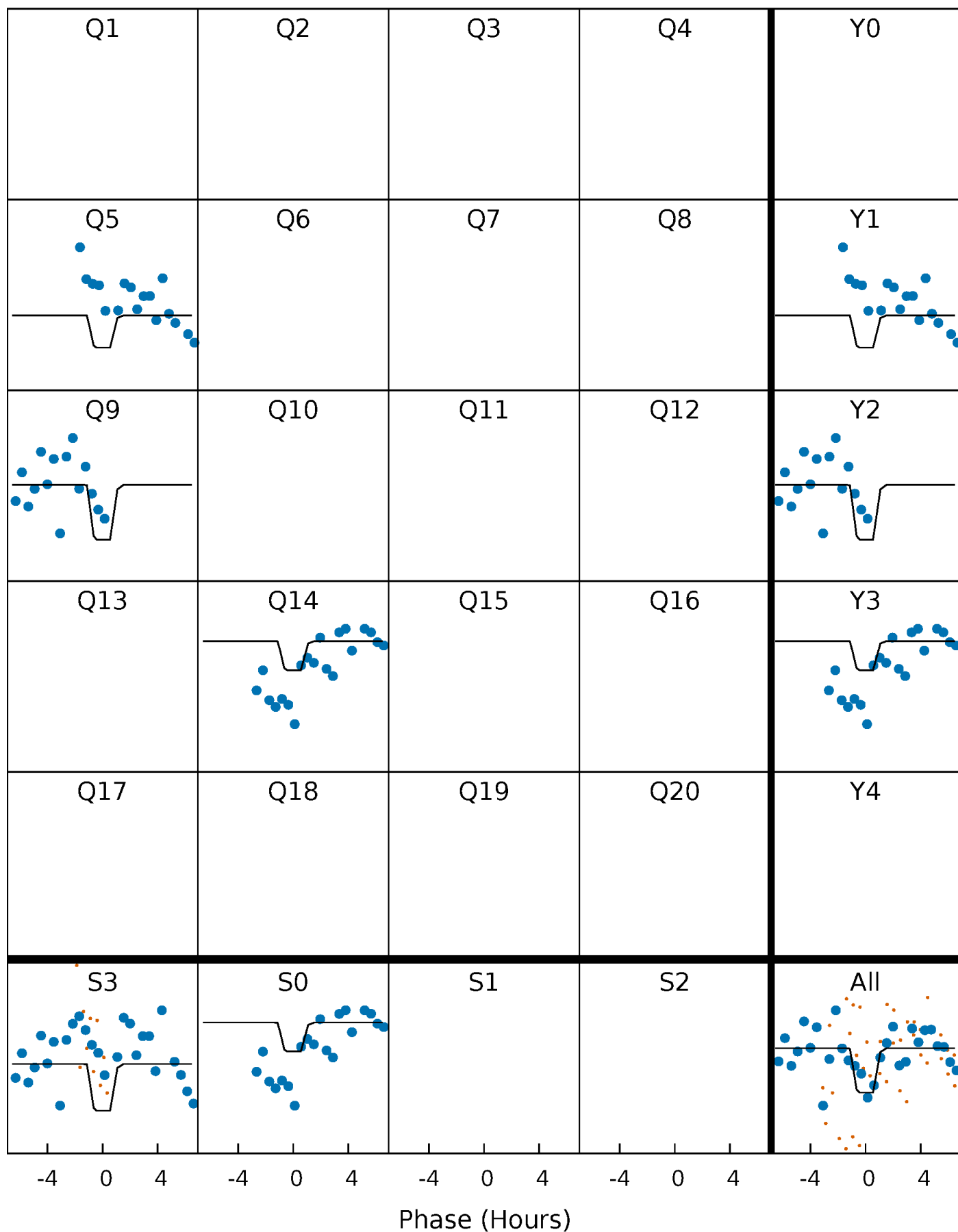
# DV Quarter-Phased Transit Curves

TCE 009777251-02 P=428.423881 Days  $T_0=461.560008$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

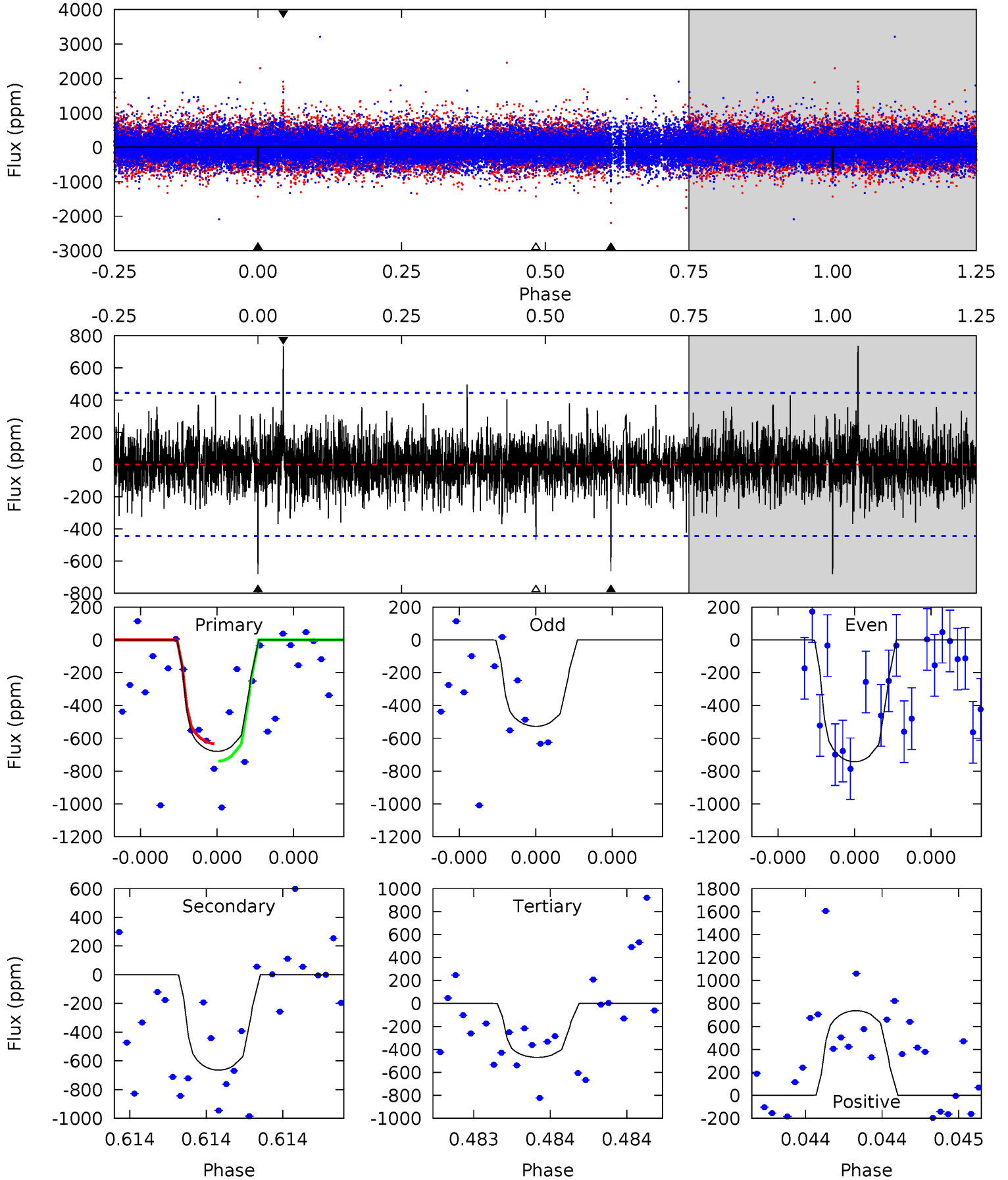
TCE 009777251-02 P=428.423641 Days  $T_0=461.570468$  (BKJD)



# DV Model-Shift Uniqueness Test

009777251-02,  $P = 428.423881$  Days,  $E = 33.136127$  Days

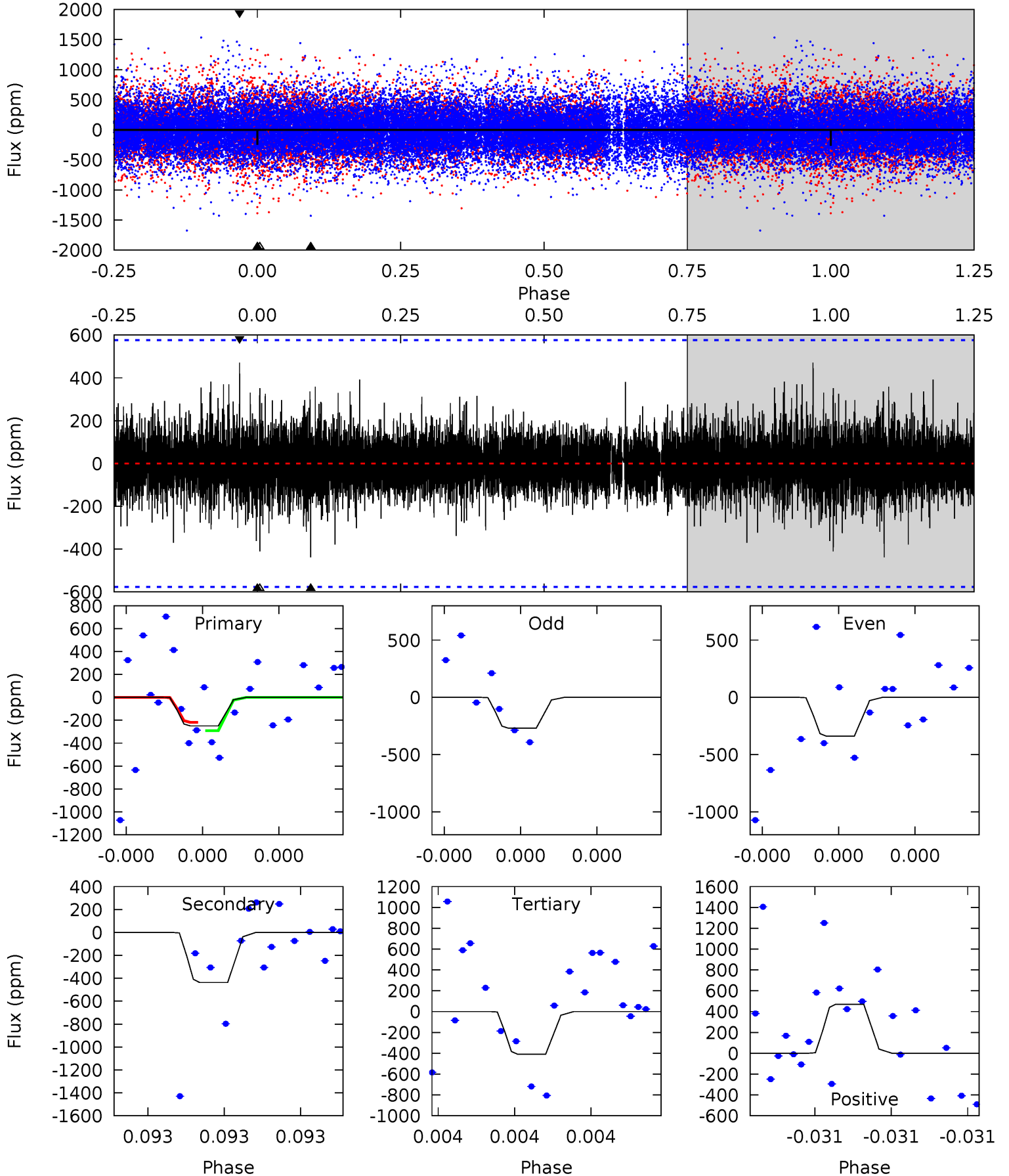
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
8.58	8.39	5.93	9.31	5.61	3.54	1.34	2.65	-0.73	2.46	-0.92	1.20	0.94	0.52	0.67



# Alt Model-Shift Uniqueness Test

009777251-02, P = 428.423641 Days, E = 33.146827 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
2.46	4.31	4.04	4.64	5.69	3.65	0.83	-1.58	-2.18	0.28	-0.33	0.33	1.46	0.52	0.36



### Stellar Parameters For KIC 009777251

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5774^{+172}_{-190}$	$4.347^{+0.158}_{-0.193}$	$-0.160^{+0.300}_{-0.300}$	$1.054^{+0.305}_{-0.178}$	$0.903^{+0.134}_{-0.089}$	$1.085^{+0.835}_{-0.552}$
	+3%/-3%	+4%/-4%	+188%/-188%	+29%/-17%	+15%/-10%	+77%/-51%
Source	KIC0	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 009777251-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-664 \pm 79$	$6.04^{+5.65}_{-3.94}$	$354^{+25}_{-23}$	$4275^{+2597}_{-866}$	$11256^{+82926}_{-8268}$
Alt.	$-437 \pm 101$	$5.96^{+6.22}_{-4.00}$	$354^{+26}_{-24}$	$3959^{+2502}_{-786}$	$7659^{+66211}_{-5867}$

$T_{max}$  = 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

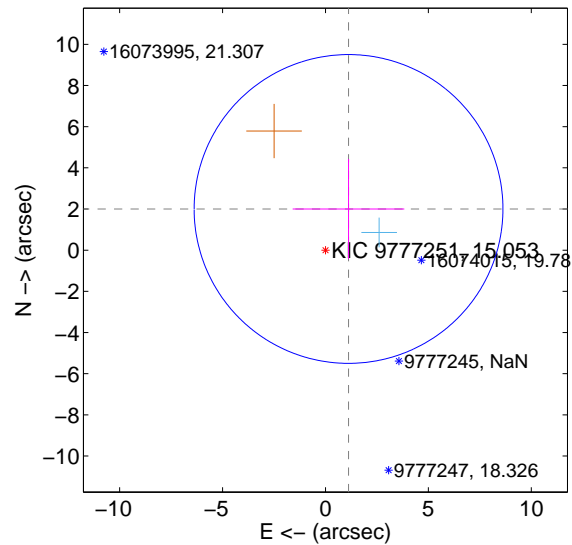
Supplemental centroid analysis for 009777251-02. Kepler magnitude: 15.05. Transit SNR 6.23

There are 1 quarters with good PRF difference image offsets

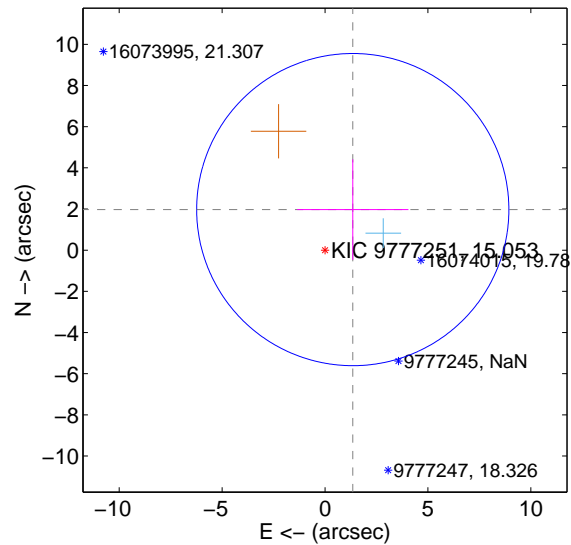
The direct PRF centroid is offset from the target star catalog position by about 0.23 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$2.294 \pm 2.500$	0.92	$-1.121 \pm 2.712$	$2.002 \pm 2.430$
PRF-fit source offset from KIC position	$2.388 \pm 2.528$	0.94	$-1.348 \pm 2.702$	$1.971 \pm 2.442$
photometric centroid source offset	$2.03 \pm 1.83$	1.10	$-2.01 \pm 1.83$	$-0.23 \pm 1.89$

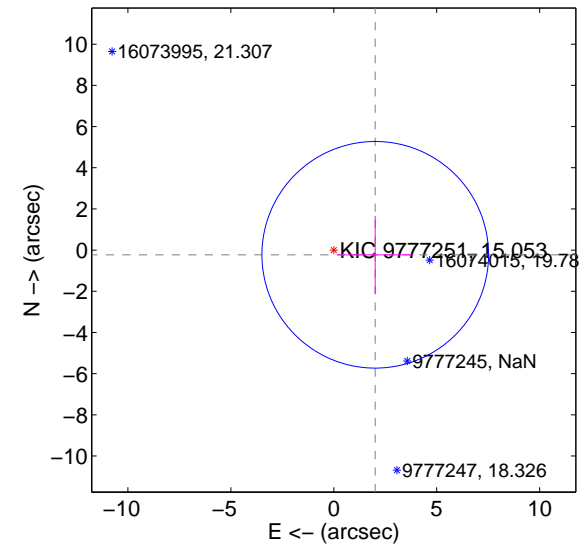
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position



offset from photometric centroids



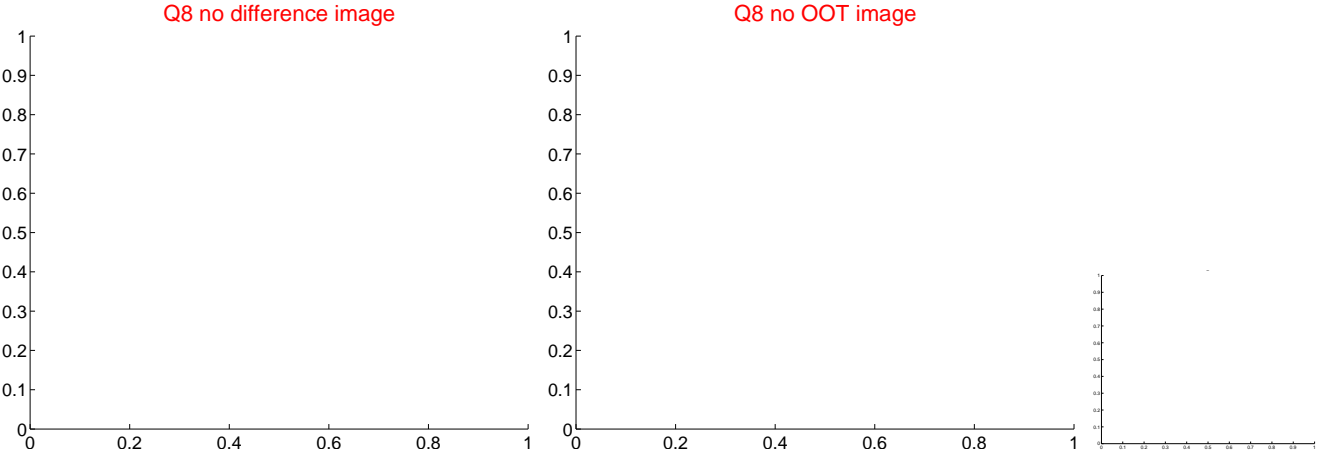
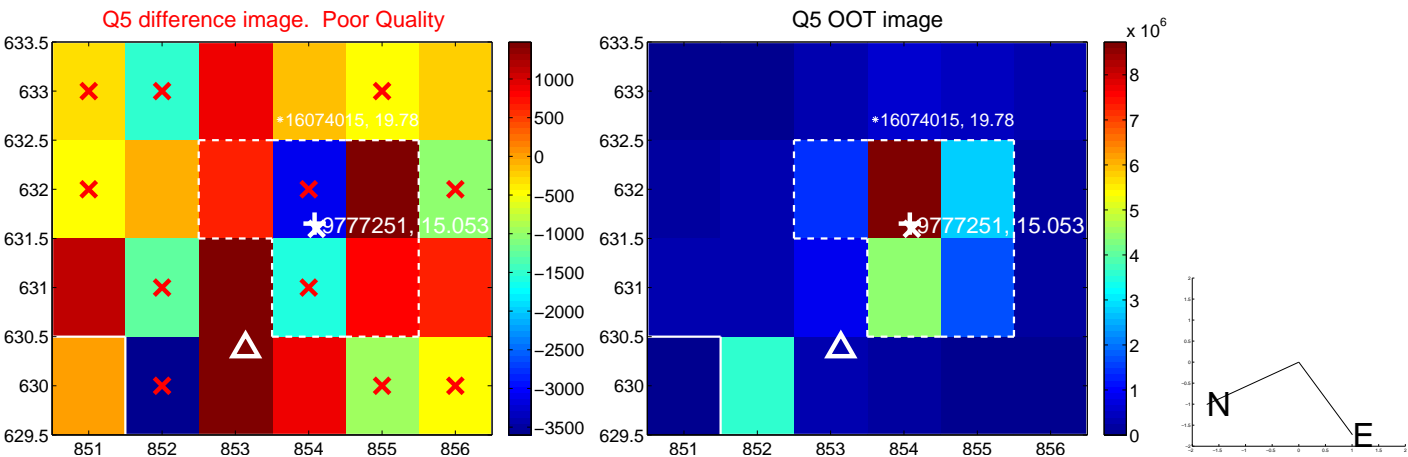
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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



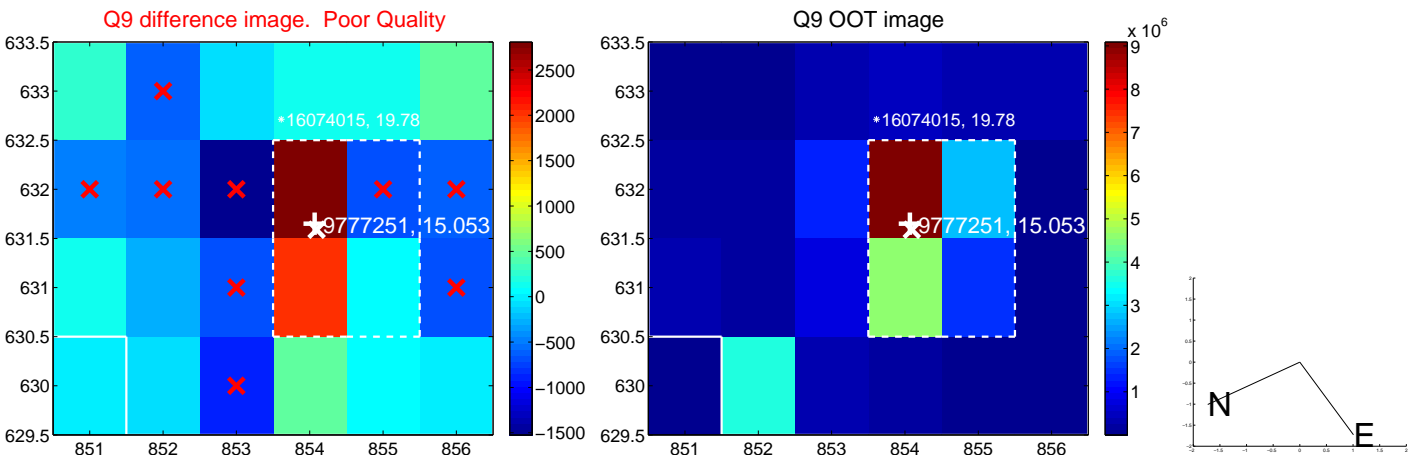
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



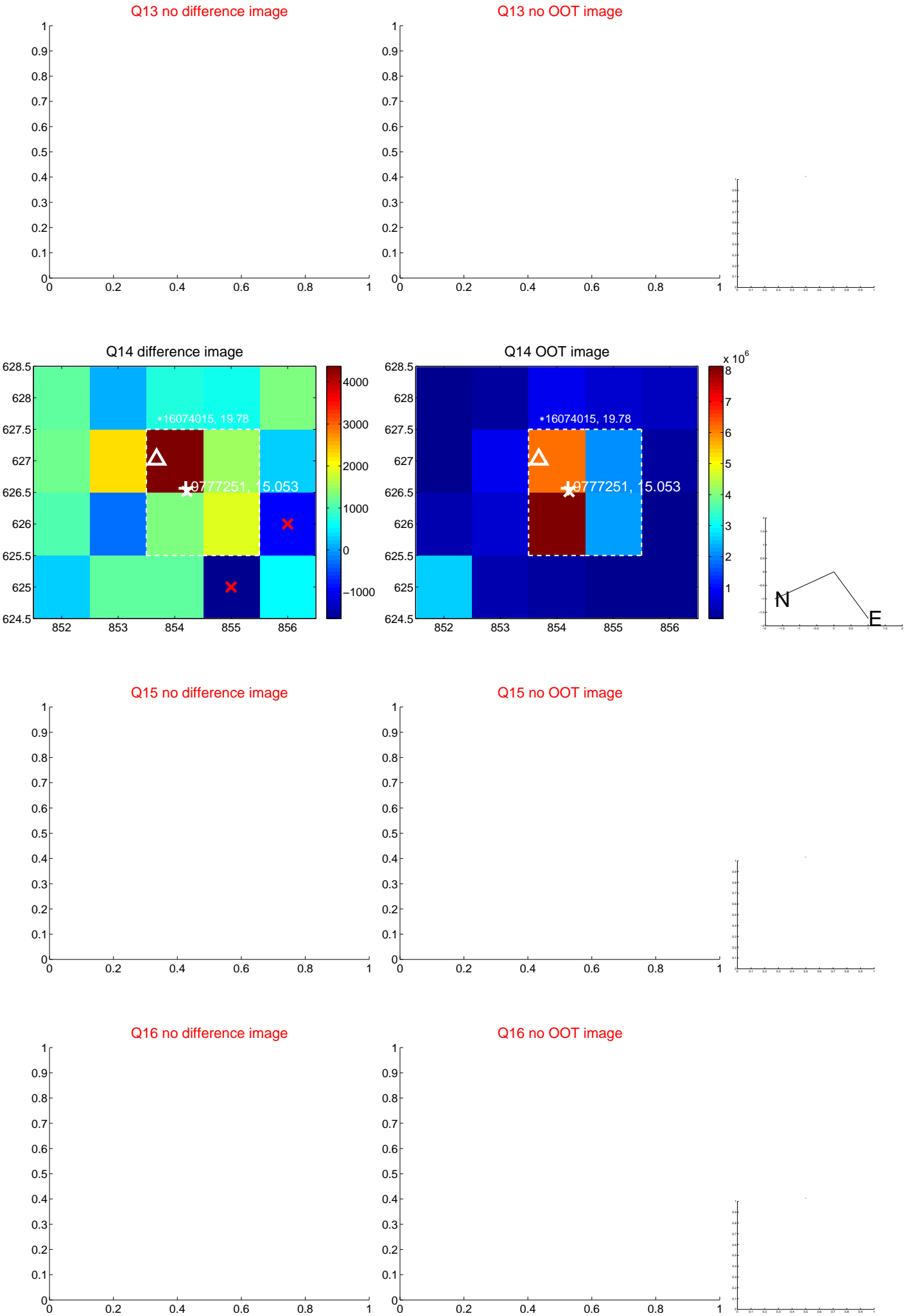
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



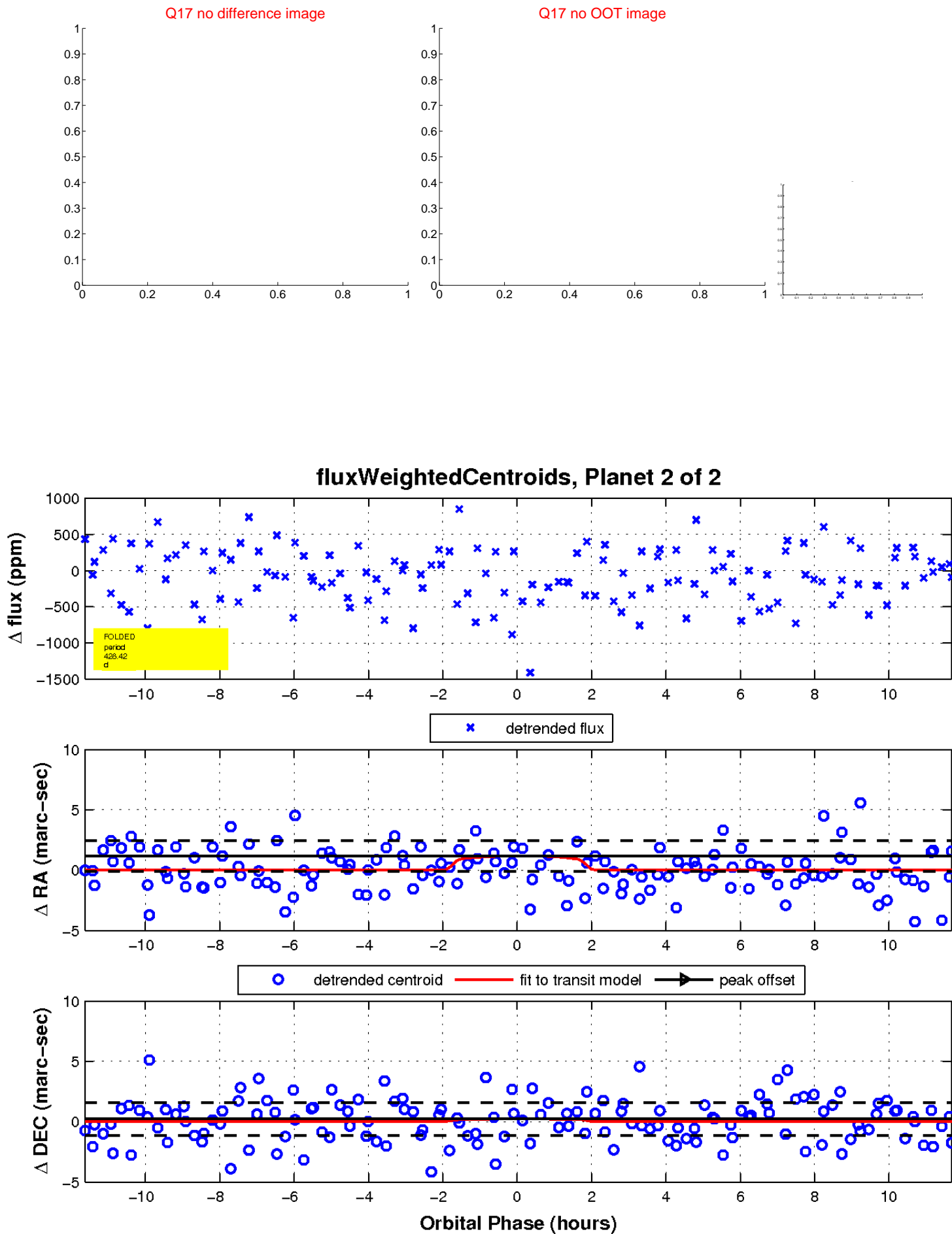
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

