

# KIC 009162503

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009162503-01	OBS	No	1.654782	131.582027	197.3	3.000	9.6	-1.0	1.60	6425	2.26	4369.00
009162503-02	OBS	No	0.827460	131.969327	210.1	2.500	9.2	-1.0	1.60	6425	2.34	11007.97

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009162503-01	OBS	FP	0.00	1	0	0	0	SWEET_NTL—LPP_DV—LPP_ALT—MOD_NONUNIQ_ALT—CENT_NOFITS
009162503-02	OBS	FP	0.00	1	0	0	0	SWEET_NTL—LPP_DV—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.

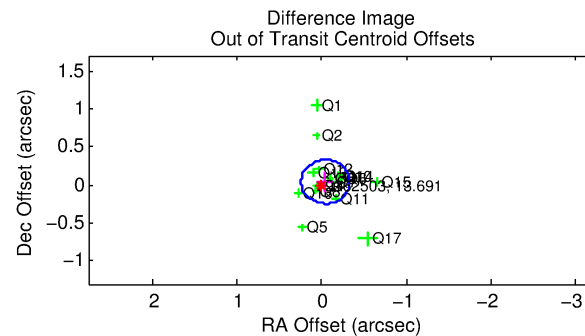
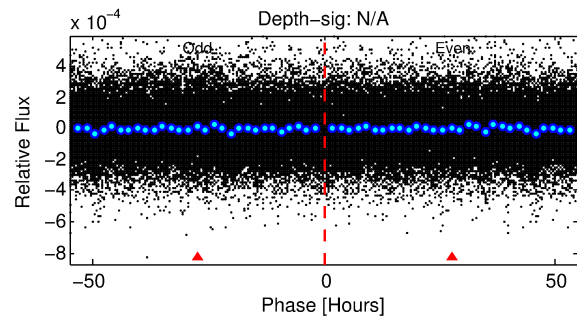
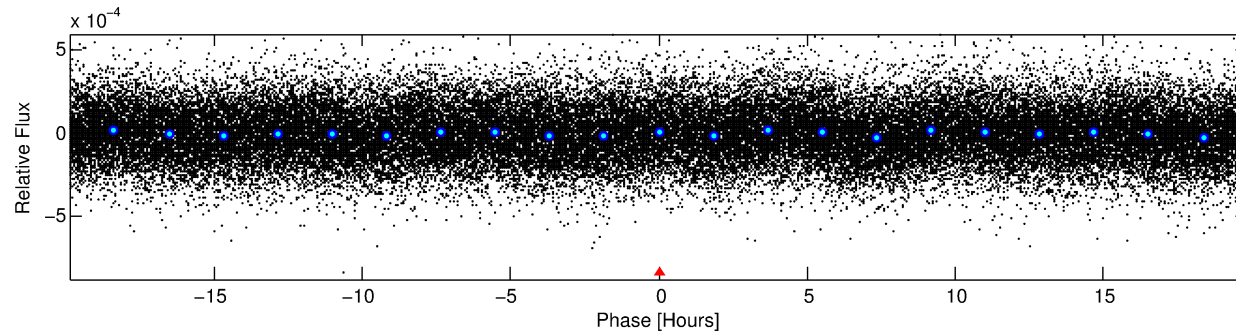
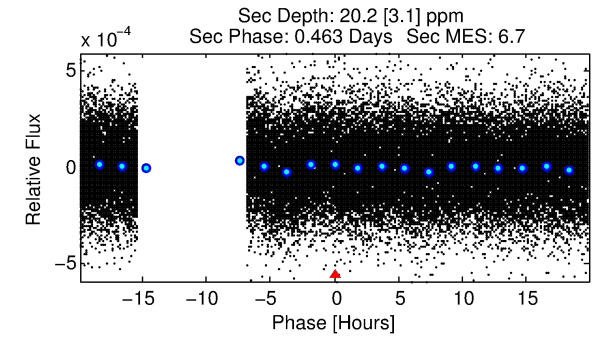
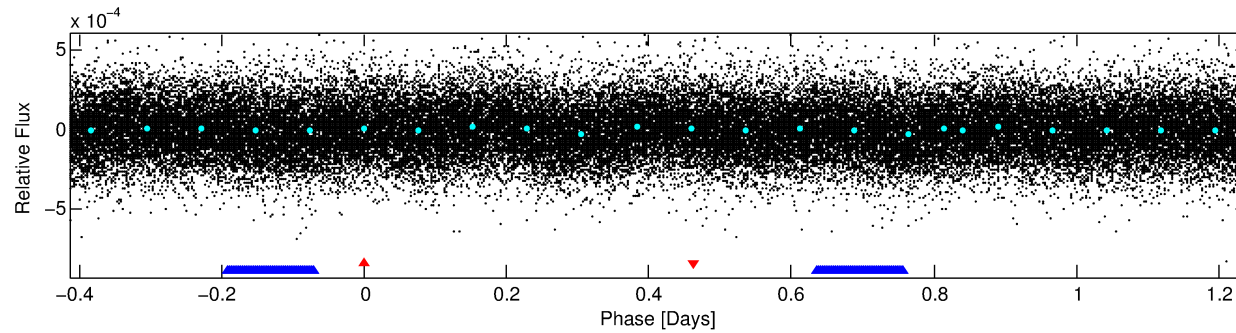
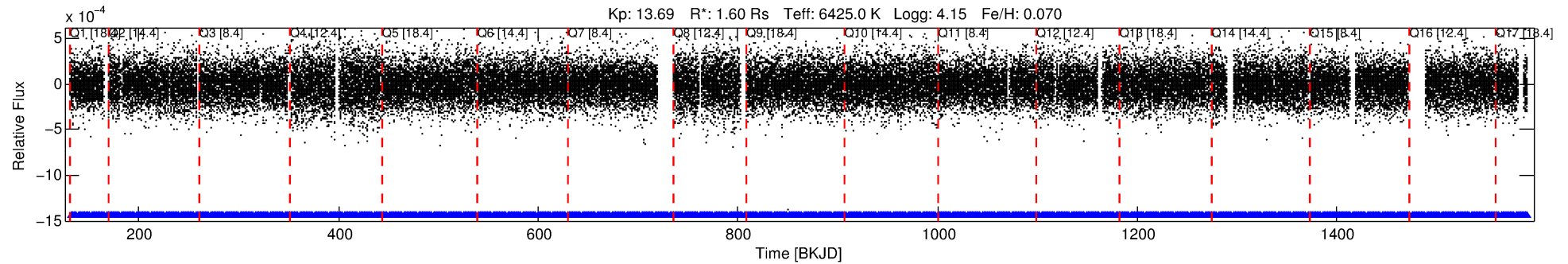
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 009162503-01

No Significant Match Found

# DV One-Page Summary

KIC: 9162503 Candidate: 1 of 2 Period: 1.655 d



## TPS TCE Results:

Period = 1.65478 d  
Epoch = 131.5820 BKJD

DV fit results are unavailable

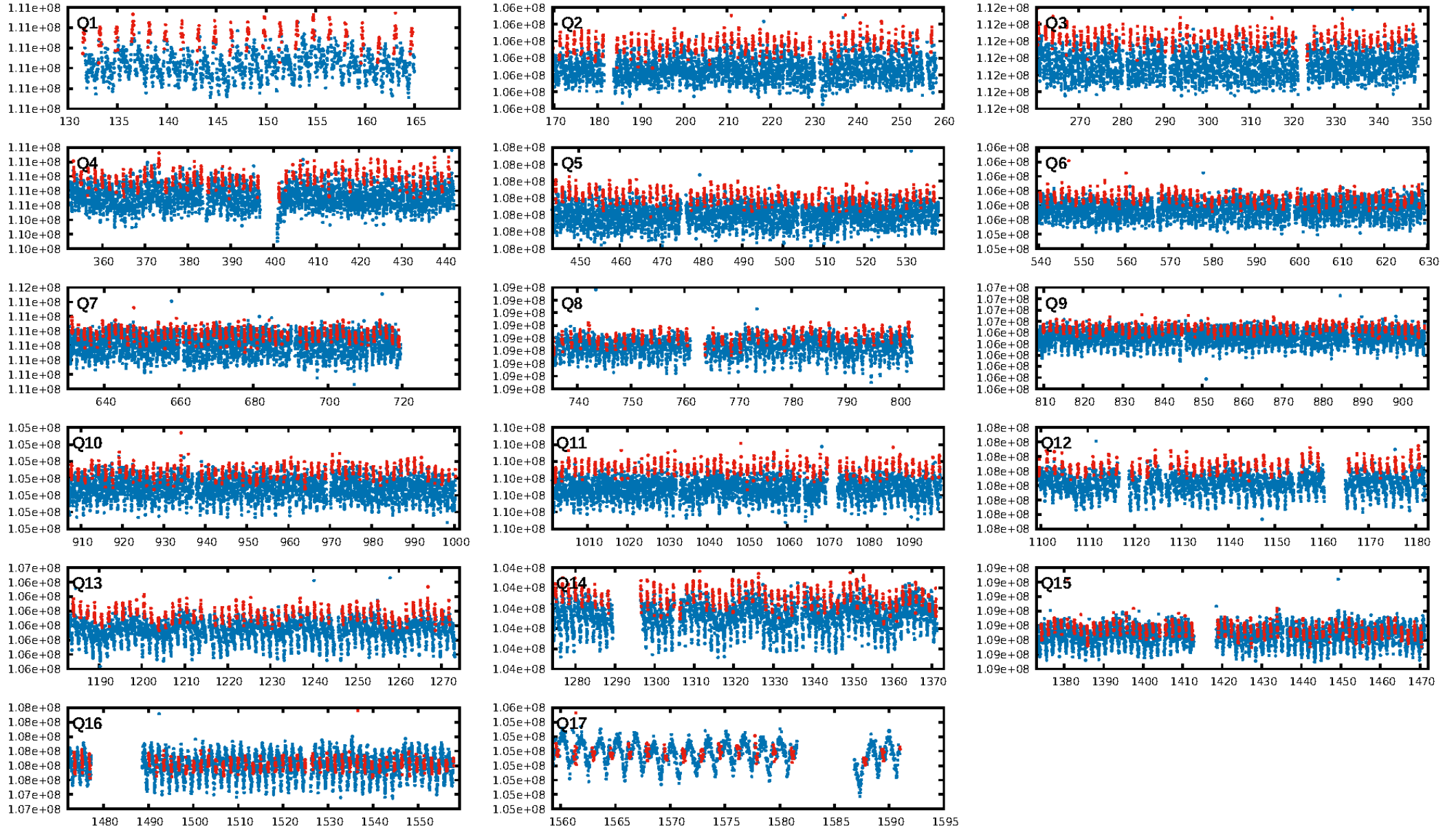
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [5.08 $\sigma$ ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: 1.60e-14  
RollingBand-fgt: 1.00 [789/789]  
GhostDiagnostic-chr: 0.424  
Centroid-sig: 0.1%  
Centroid-so: 0.267 arcsec [4.64 $\sigma$ ]  
OotOffset-rm: 0.063 arcsec [0.66 $\sigma$ ]  
KicOffset-rm: 0.104 arcsec [1.14 $\sigma$ ]  
OotOffset-st: 4/4/4/5 [17]  
KicOffset-st: 4/4/4/5 [17]  
DiffImageQuality-fgm: 1.00 [17/17]  
DiffImageOverlap-fno: 0.00 [0/17]

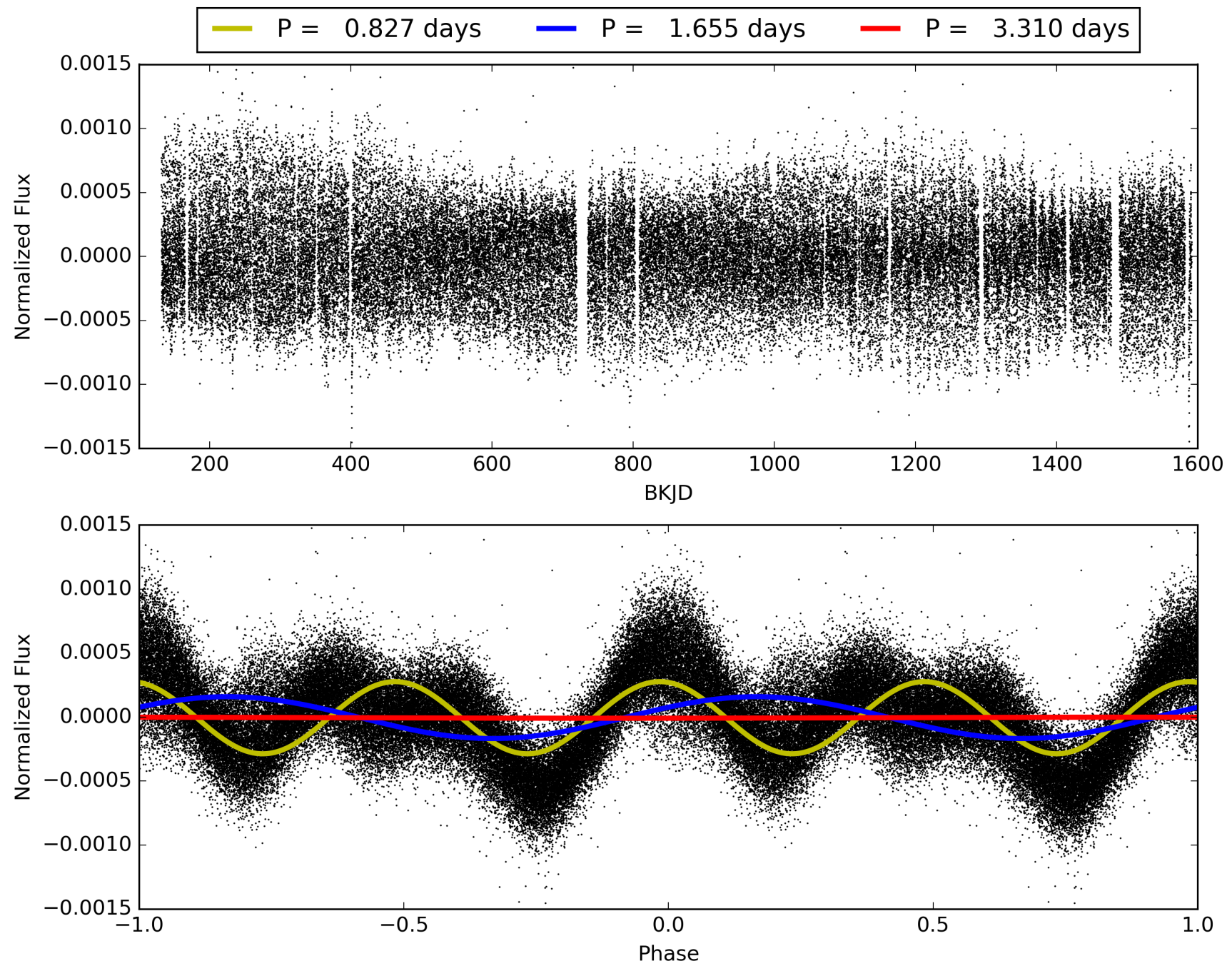
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 08:13:13 Z

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

# TCE 009162503-01, PDC Light Curves

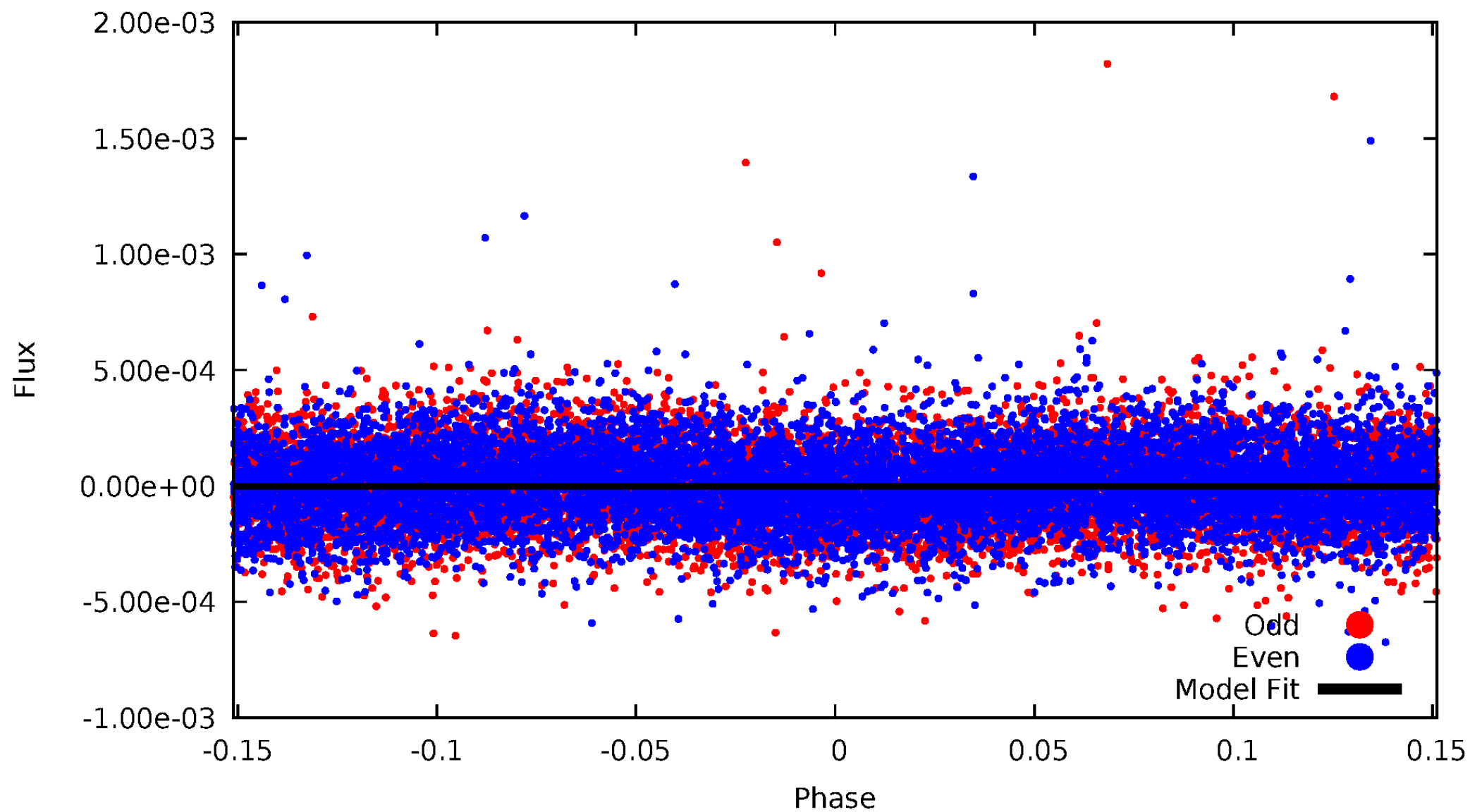


TCE 009162503-01



# DV Odd/Even

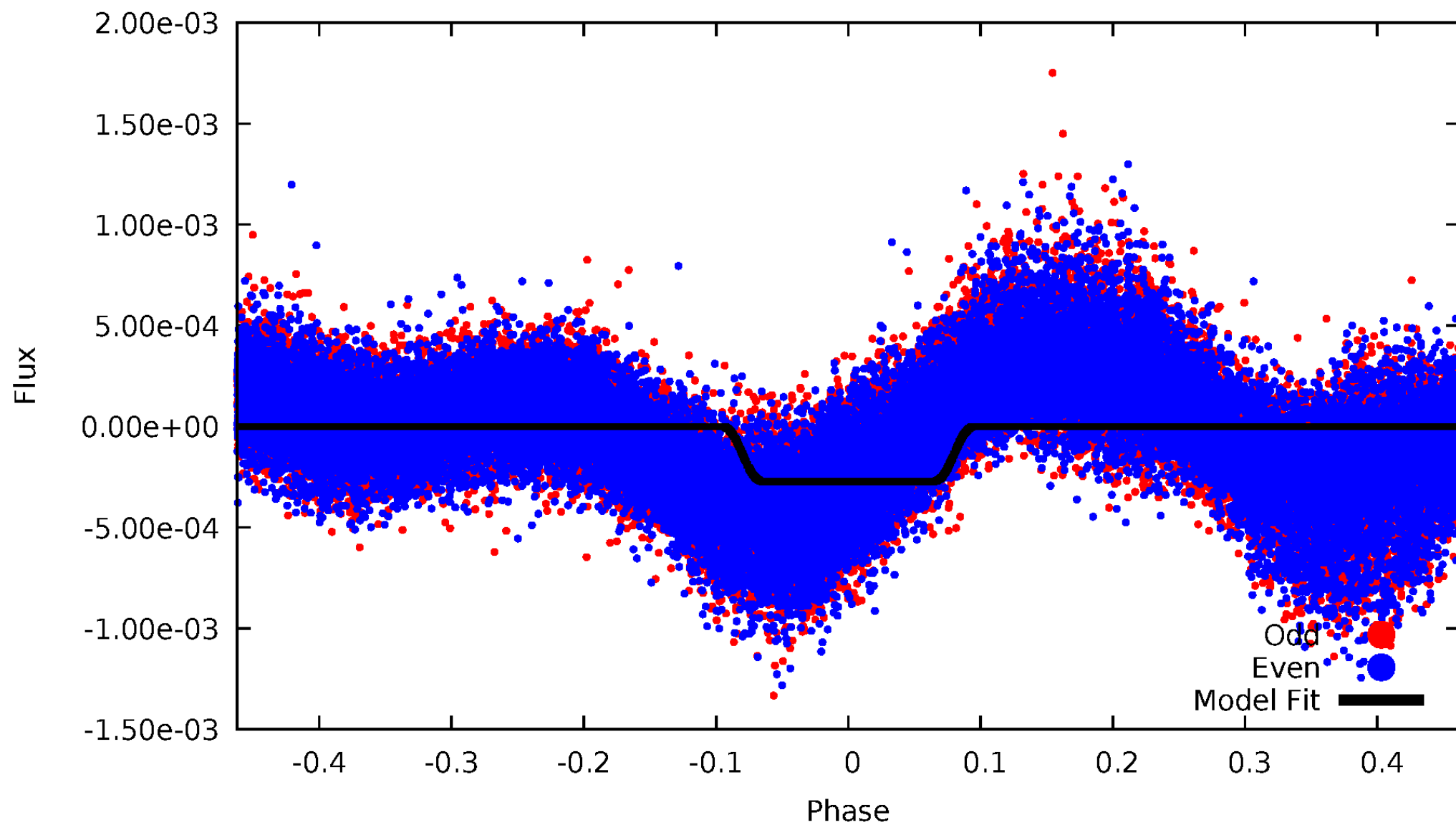
TCE 009162503-01





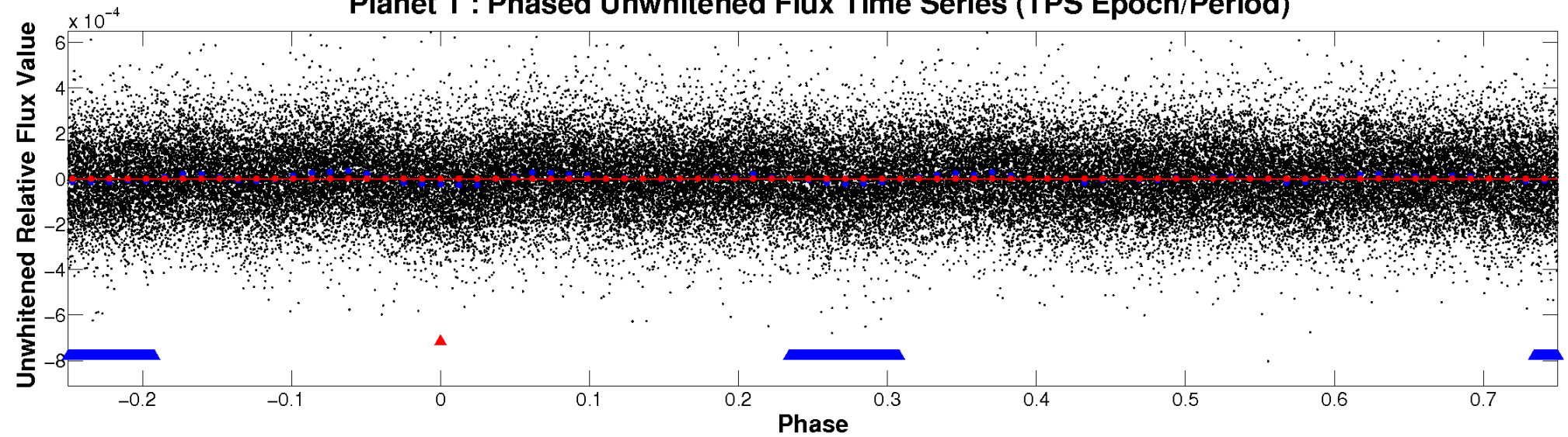
# ALT Odd/Even

TCE 009162503-01

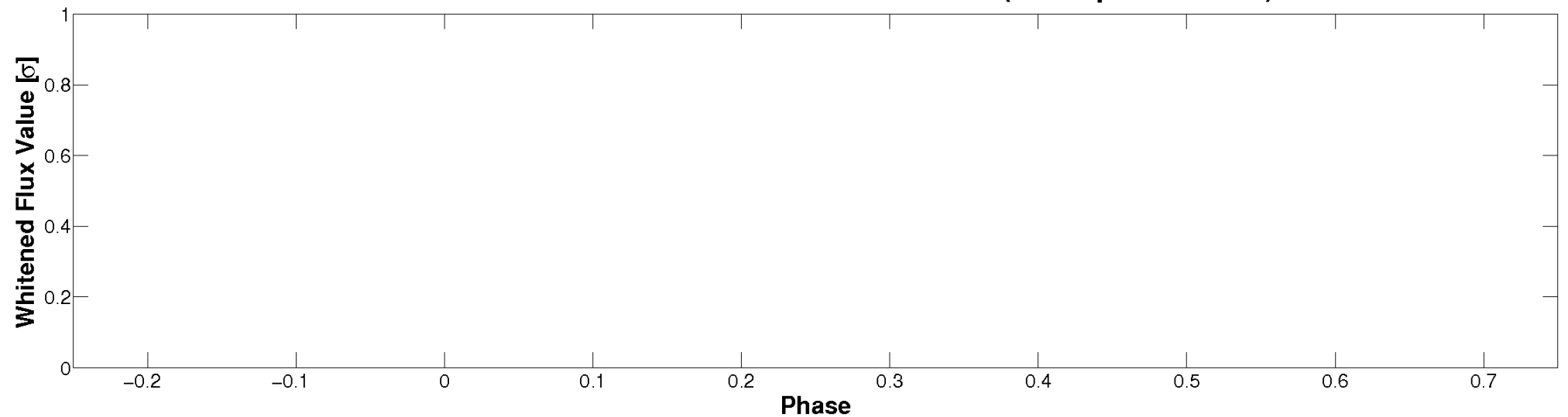


# Non-Whitened Vs. Whitened Light Curve

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

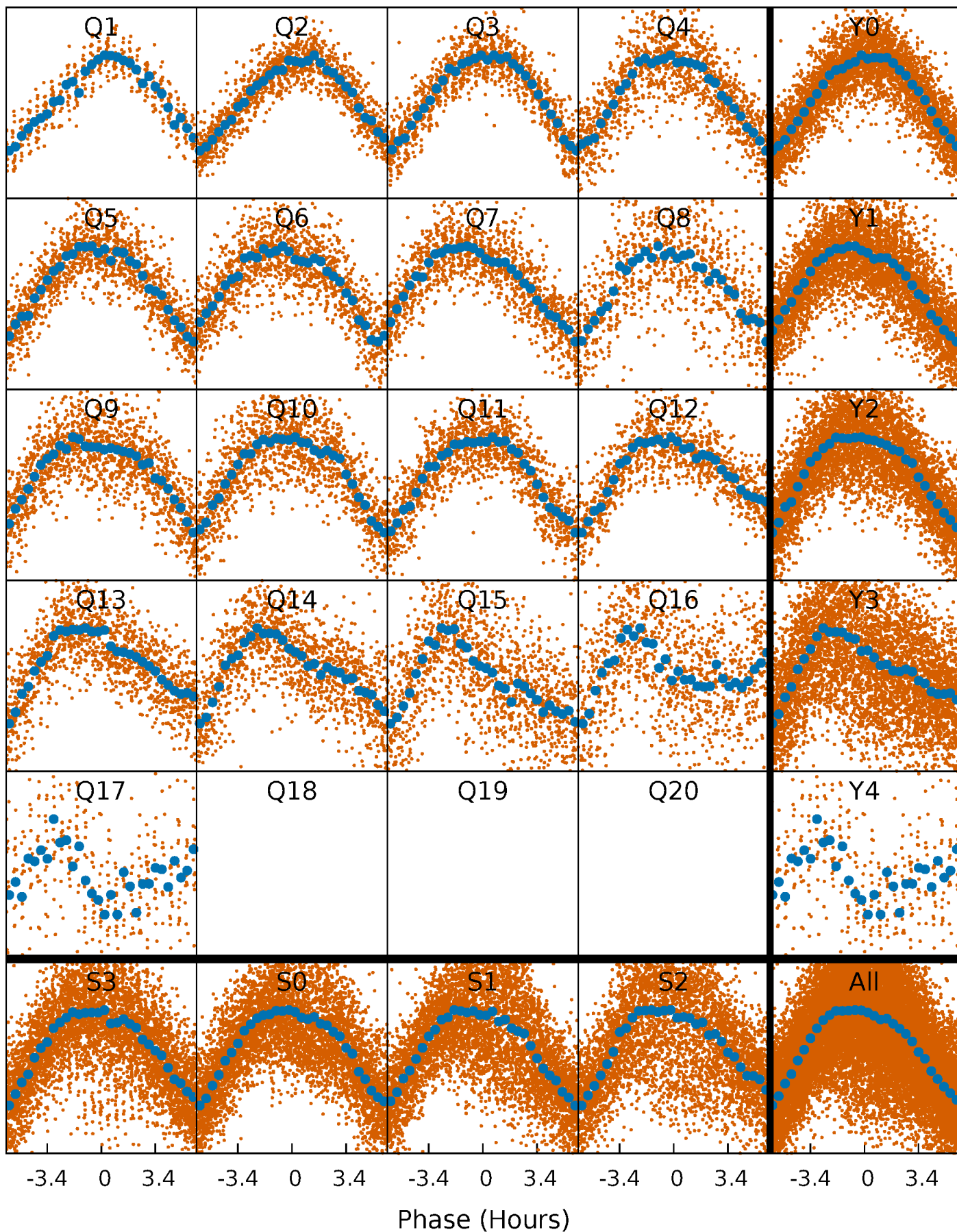


**Planet 1 : Phased Whitened Flux Time Series (TPS Epoch/Period)**



# PDC Quarter-Phased Transit Curves

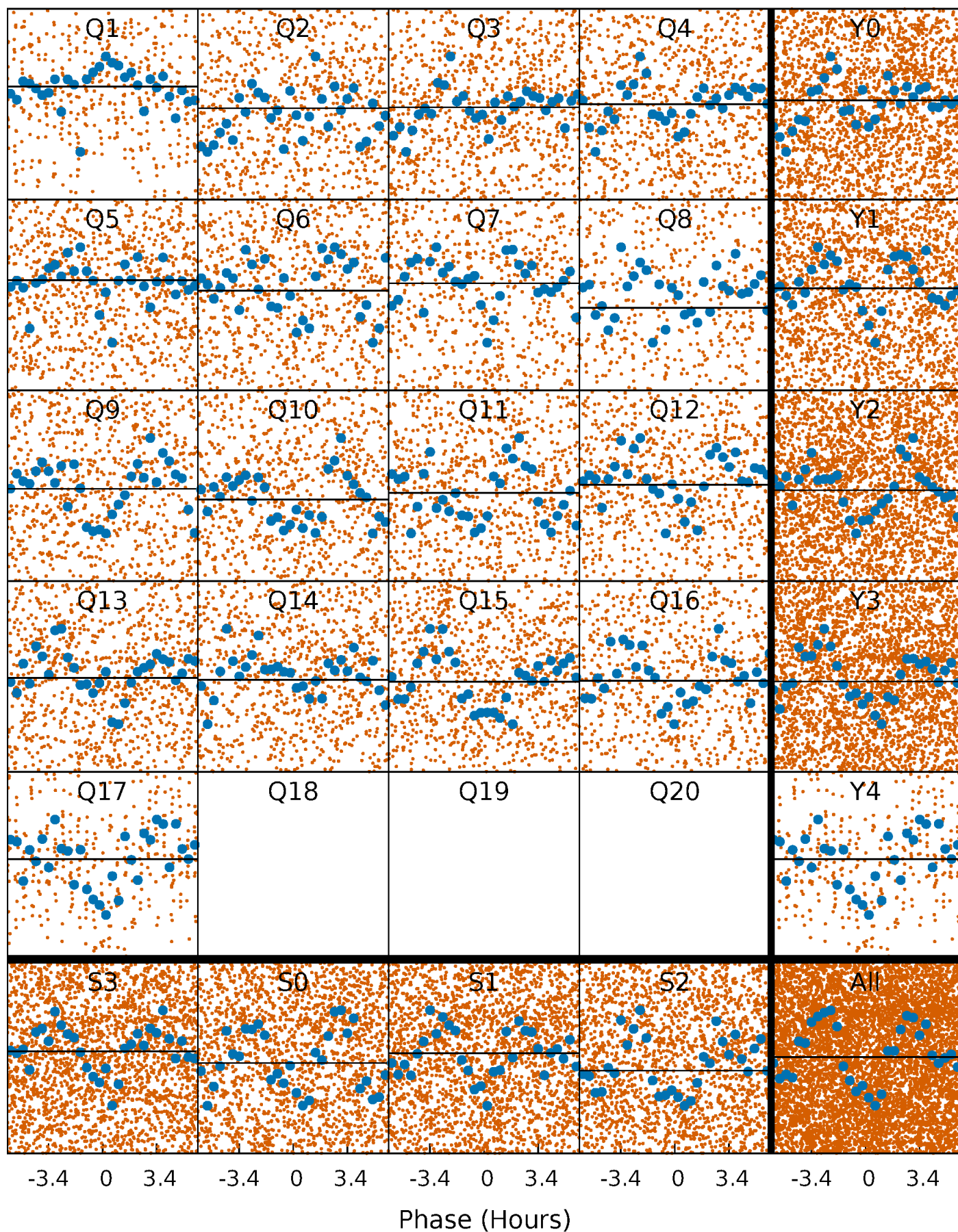
TCE 009162503-01   P= 1.654782 Days    $T_0=131.582027$  (BKJD)





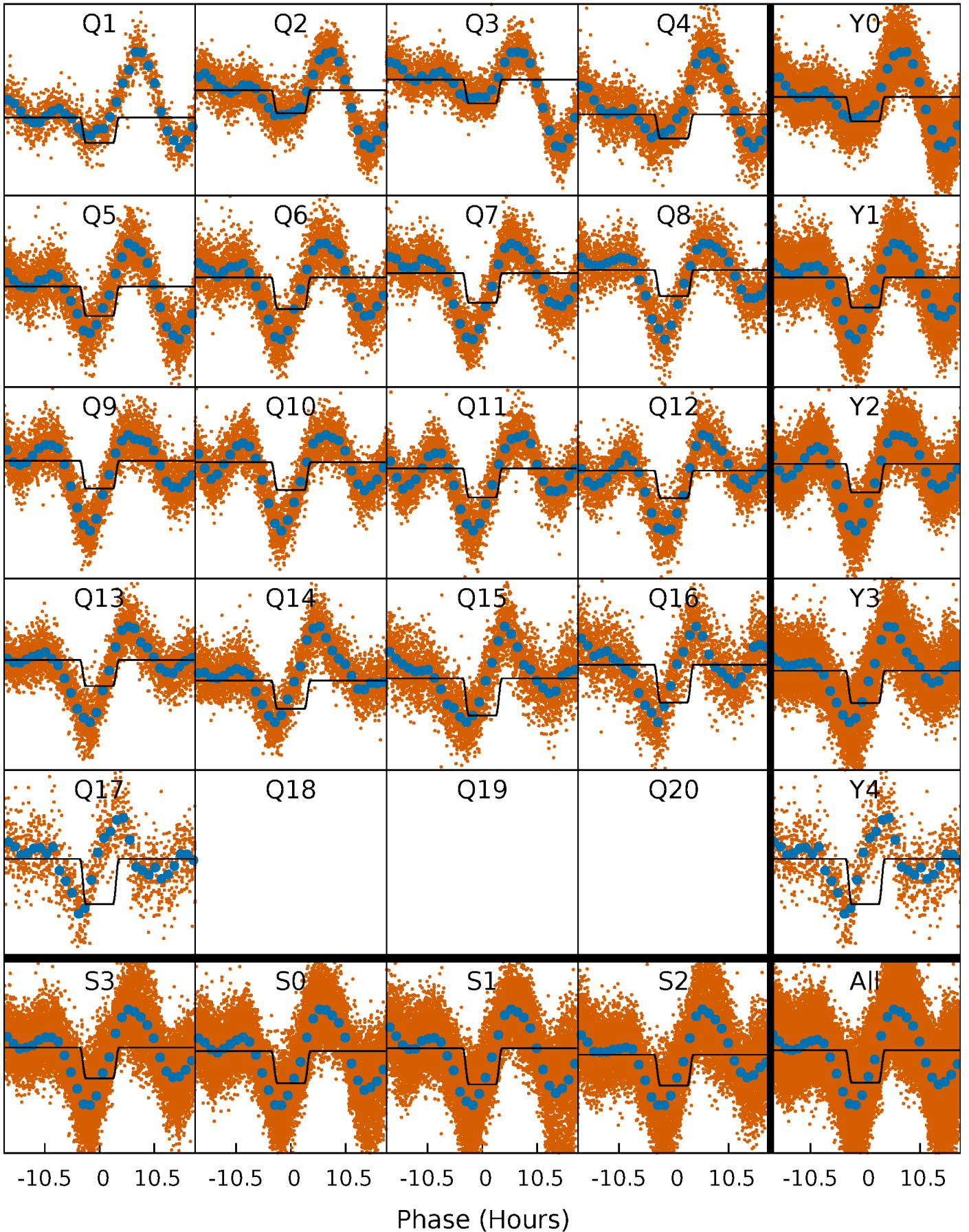
# DV Quarter-Phased Transit Curves

TCE 009162503-01 P= 1.654782 Days  $T_0=131.582027$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

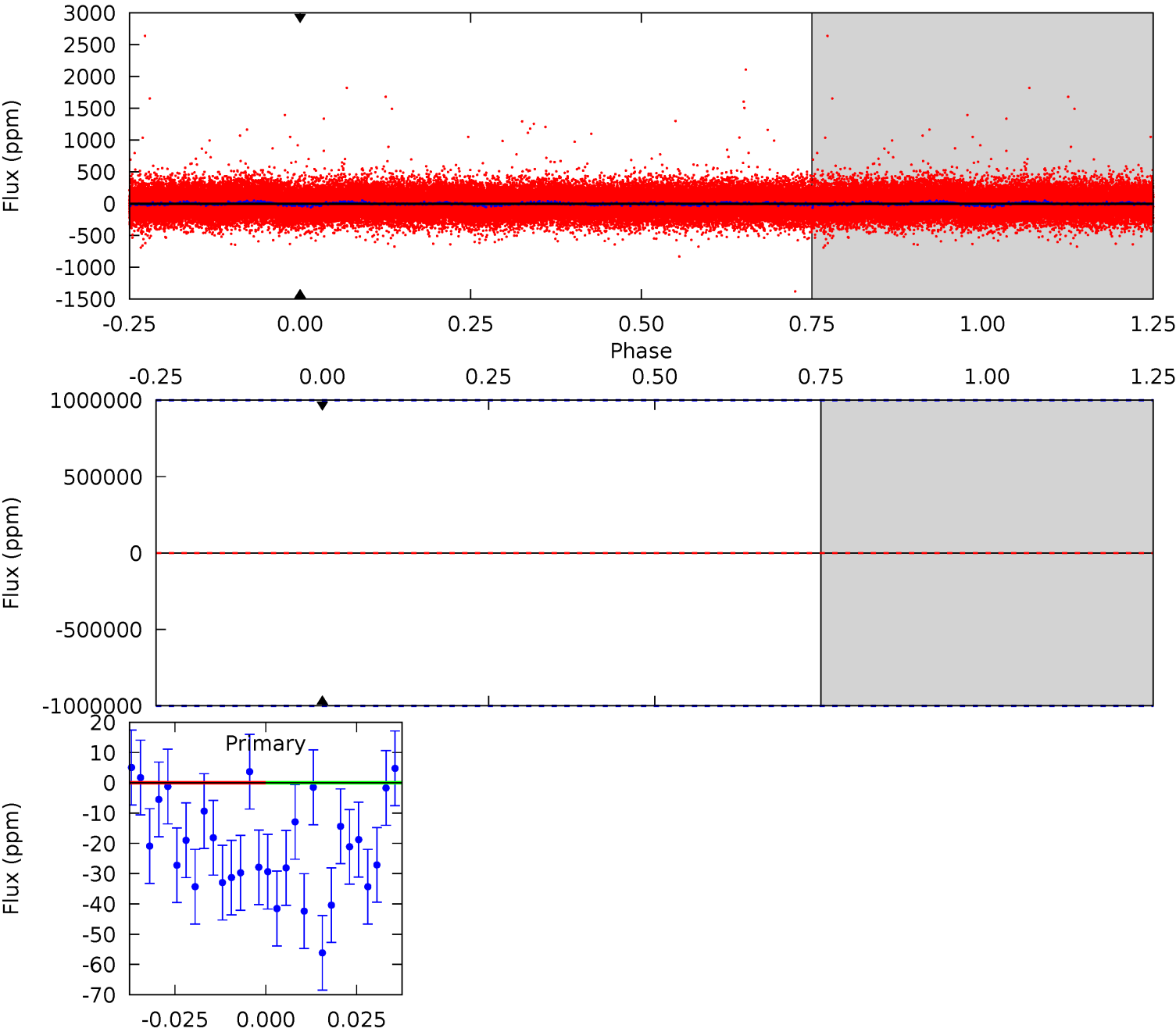
TCE 009162503-01 P= 1.654782 Days  $T_0=132.944029$  (BKJD)



DV Model-Shift Uniqueness Test

009162503-01, P = 1.654782 Days, E = 129.927245 Days

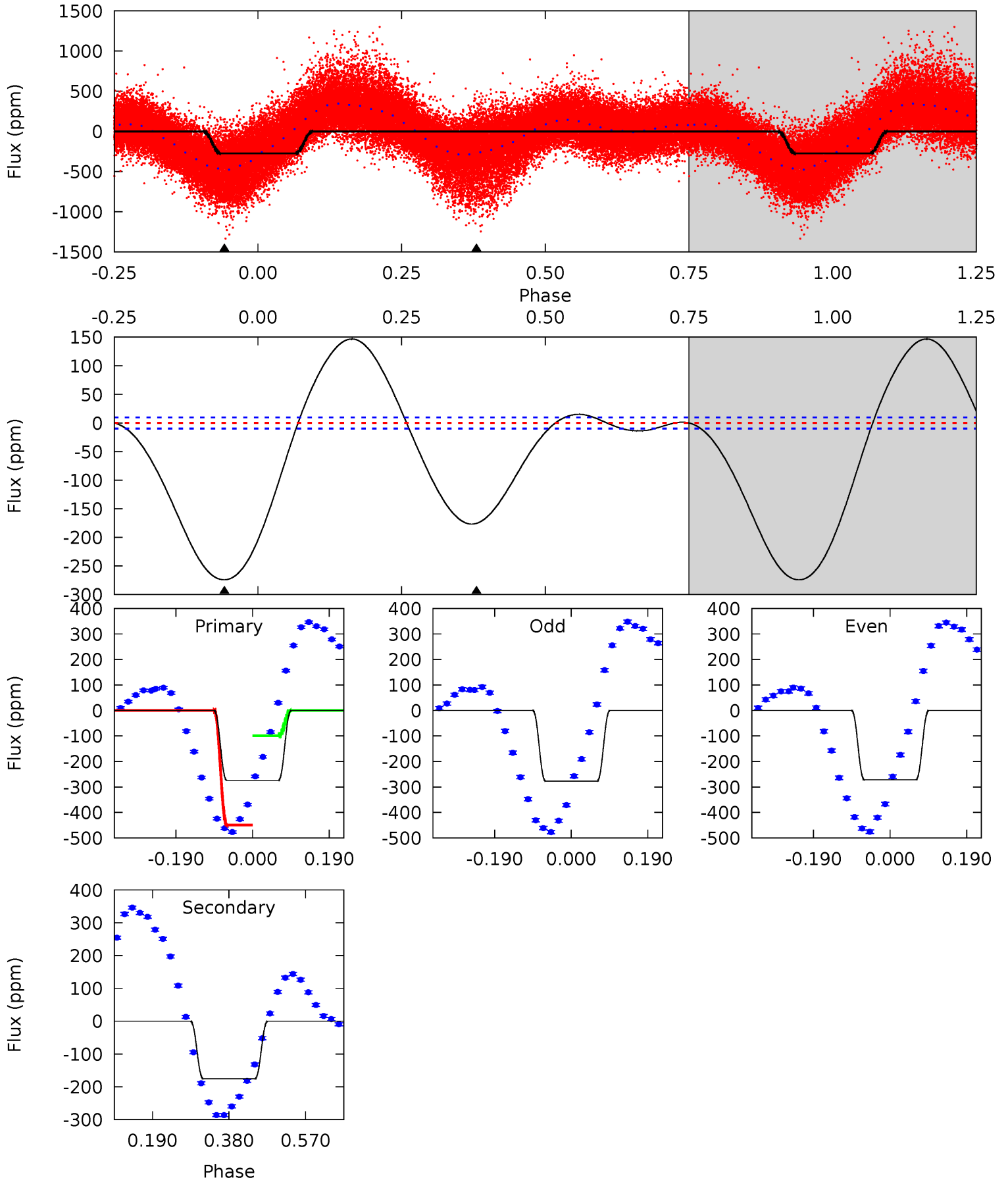
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
0	0	0	0	1.00	1.00	1.00	0	0	0	0	0	0	0	0



# Alt Model-Shift Uniqueness Test

009162503-01, P = 1.654782 Days, E = 131.289247 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
124.9	80.0	0	0	4.43	1.31	28.6	124.9	124.9	80.0	80.0	1.16	0.95	0.35	83.9



### Stellar Parameters For KIC 009162503

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$\rho_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6425^{+179}_{-247}$	$4.146^{+0.190}_{-0.190}$	$0.070^{+0.250}_{-0.300}$	$1.605^{+0.501}_{-0.410}$	$1.316^{+0.185}_{-0.226}$	$0.448^{+0.470}_{-0.230}$
	+3%/-4%	+5%/-5%	+357%/-429%	+31%/-26%	+14%/-17%	+105%/-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 009162503-01 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$0 \pm 1000000$	$12.97^{+13.94}_{-8.53}$	$2878^{+240}_{-211}$	$4300^{+20765}_{-26787}$	$2.184^{+506.213}_{-418.481}$
Alt.	$-176 \pm 2$	$12.67^{+14.98}_{-8.96}$	$2901^{+226}_{-225}$	$2917^{+1995}_{-5764}$	$0.548^{+5.462}_{-0.438}$

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



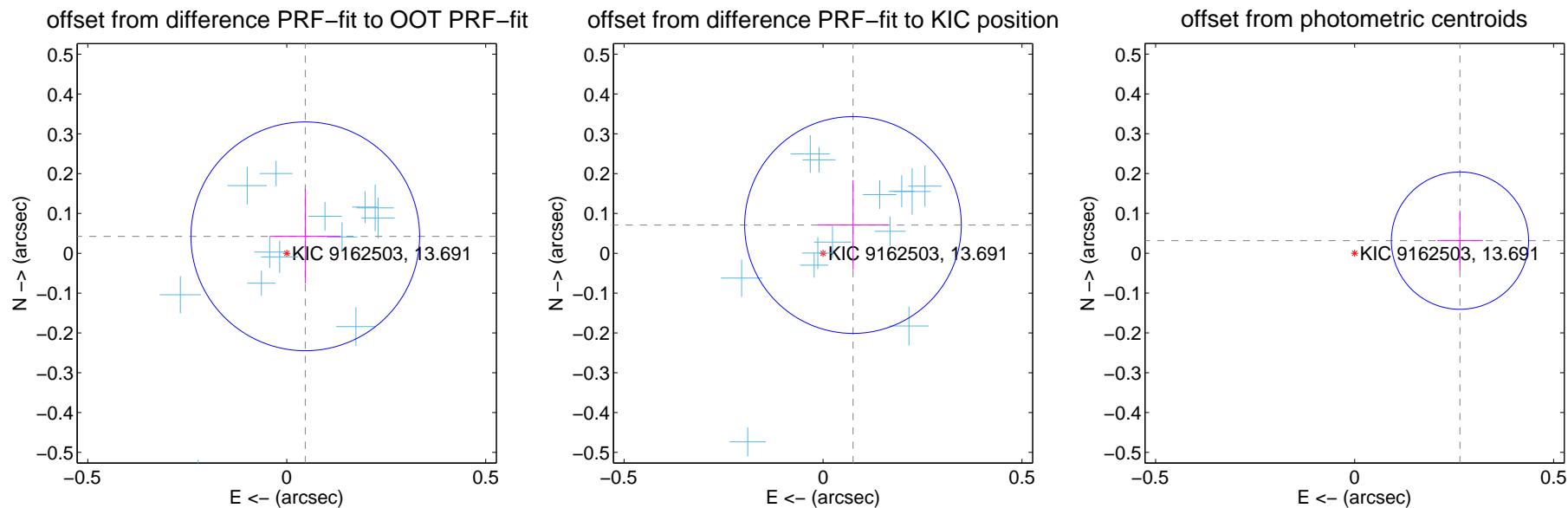
## DV Centroid Data

Supplemental centroid analysis for 009162503-01. Kepler magnitude: 13.69. Transit SNR -1.00

There are 17 quarters with good PRF difference image offsets

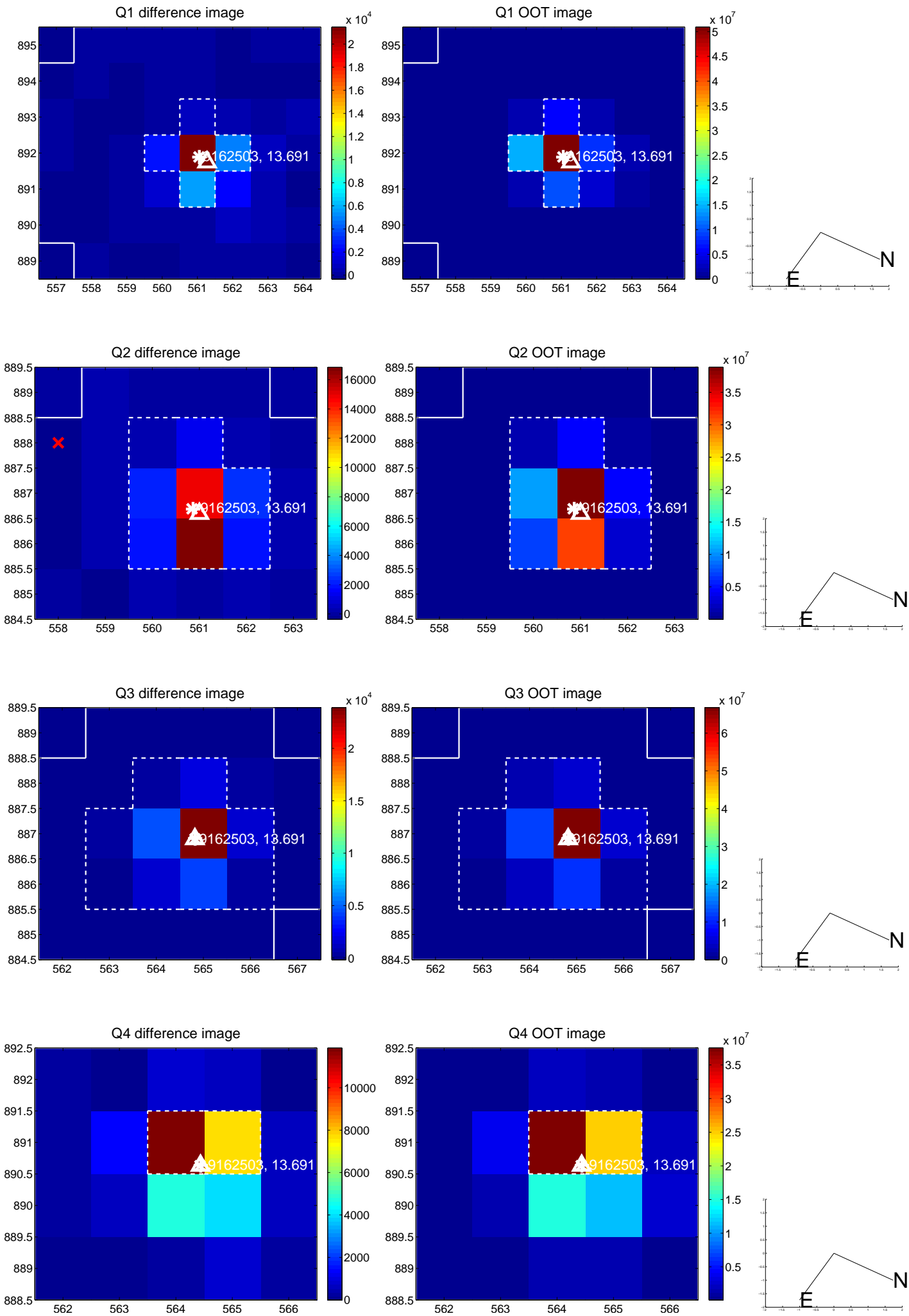
The direct PRF centroid is offset from the target star catalog position by about 0.09 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.063 \pm 0.096$	0.66	$-0.047 \pm 0.089$	$0.043 \pm 0.119$
PRF-fit source offset from KIC position	$0.104 \pm 0.091$	1.14	$-0.075 \pm 0.089$	$0.071 \pm 0.113$
photometric centroid source offset	$0.27 \pm 0.06$	4.64	$-0.26 \pm 0.06$	$0.03 \pm 0.07$

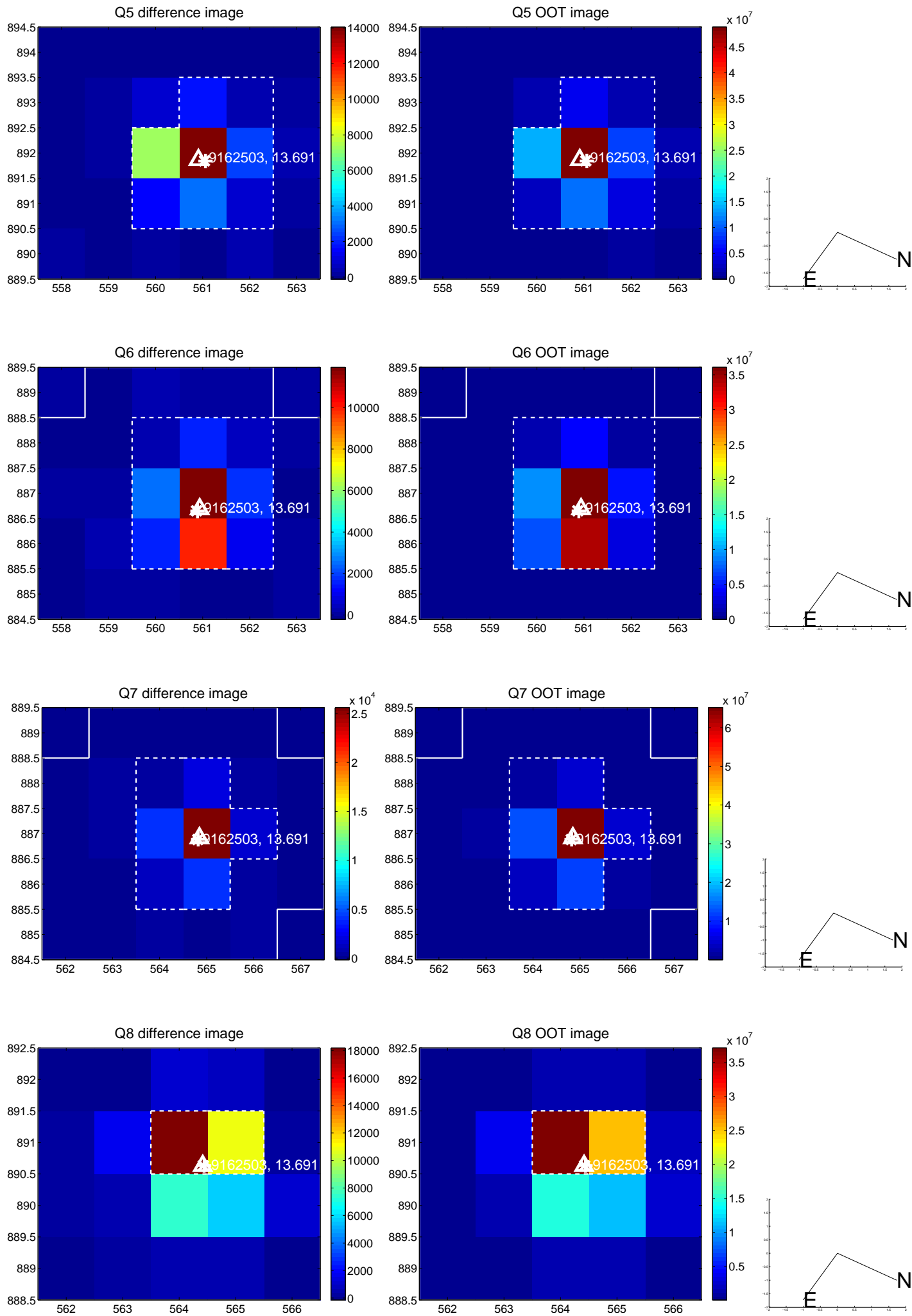


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

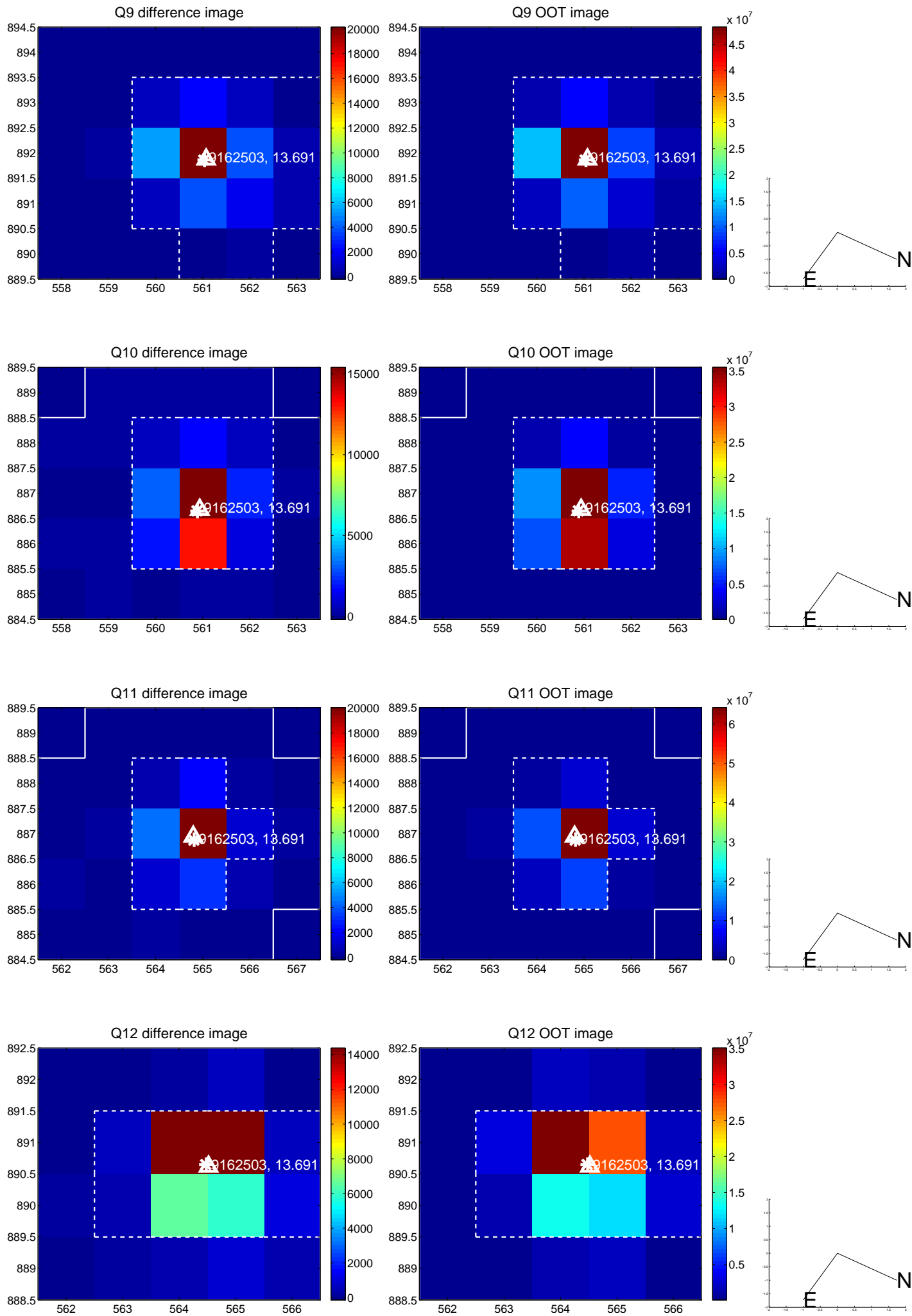
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



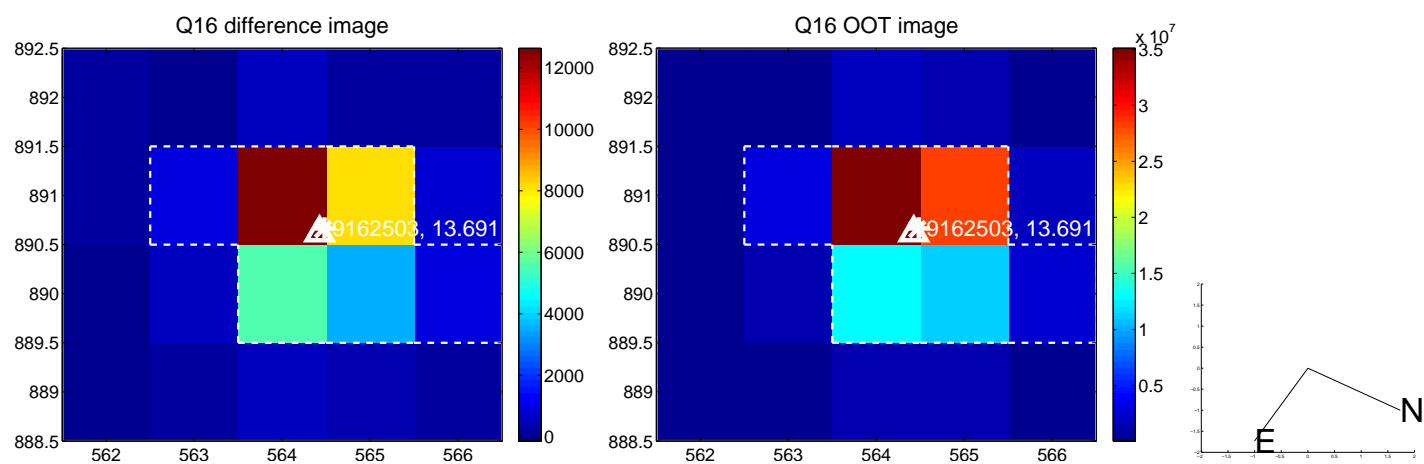
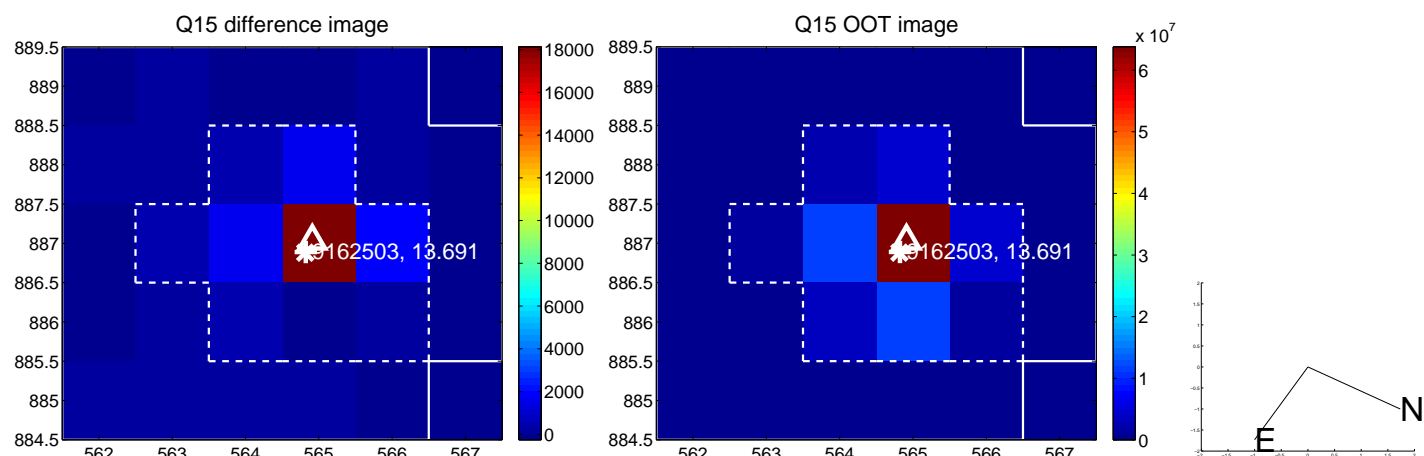
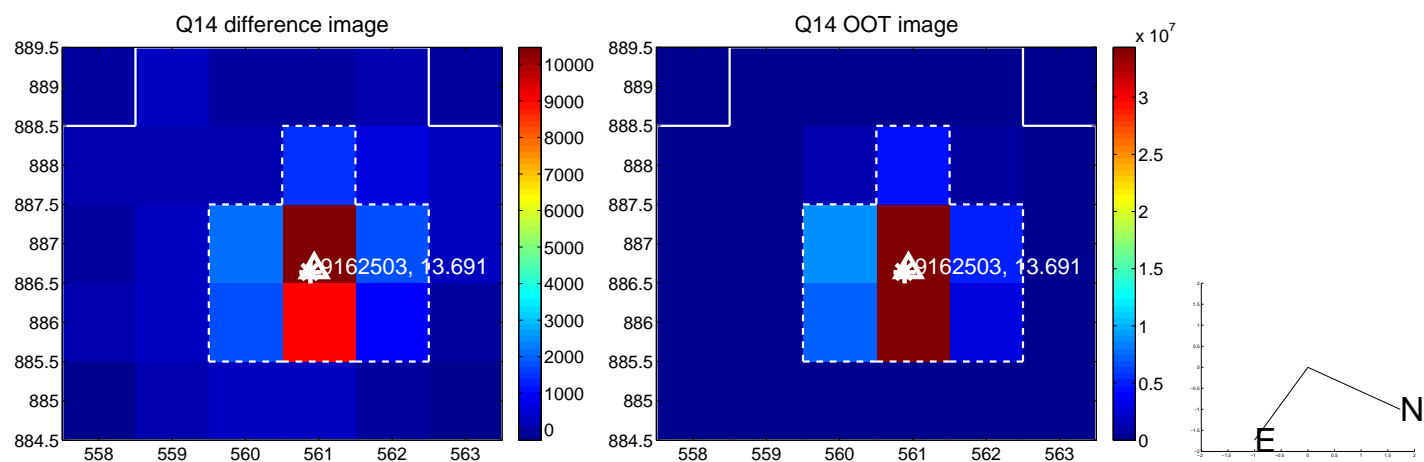
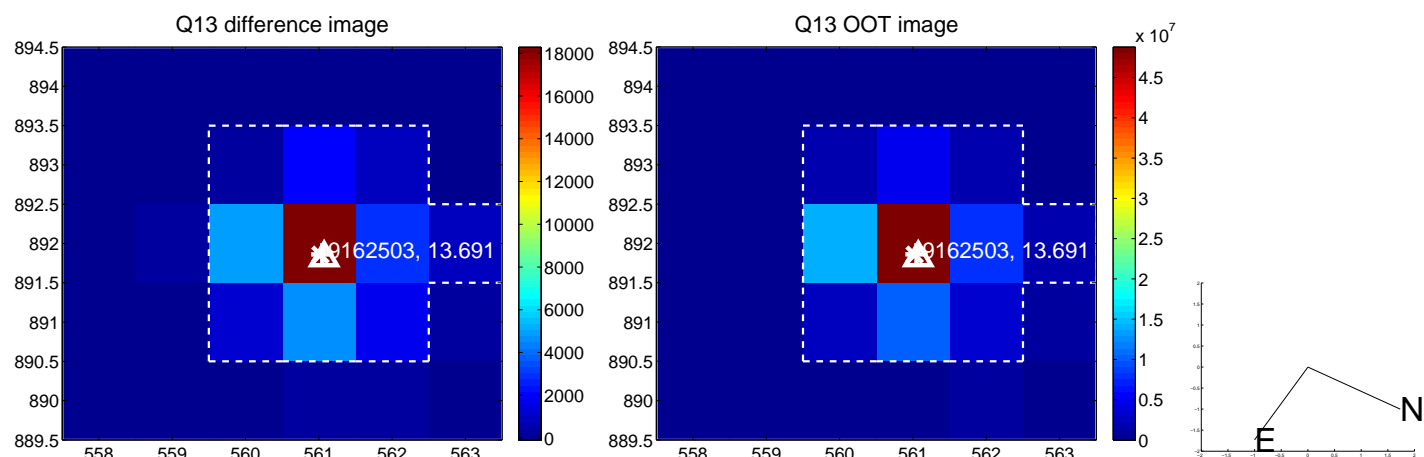
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

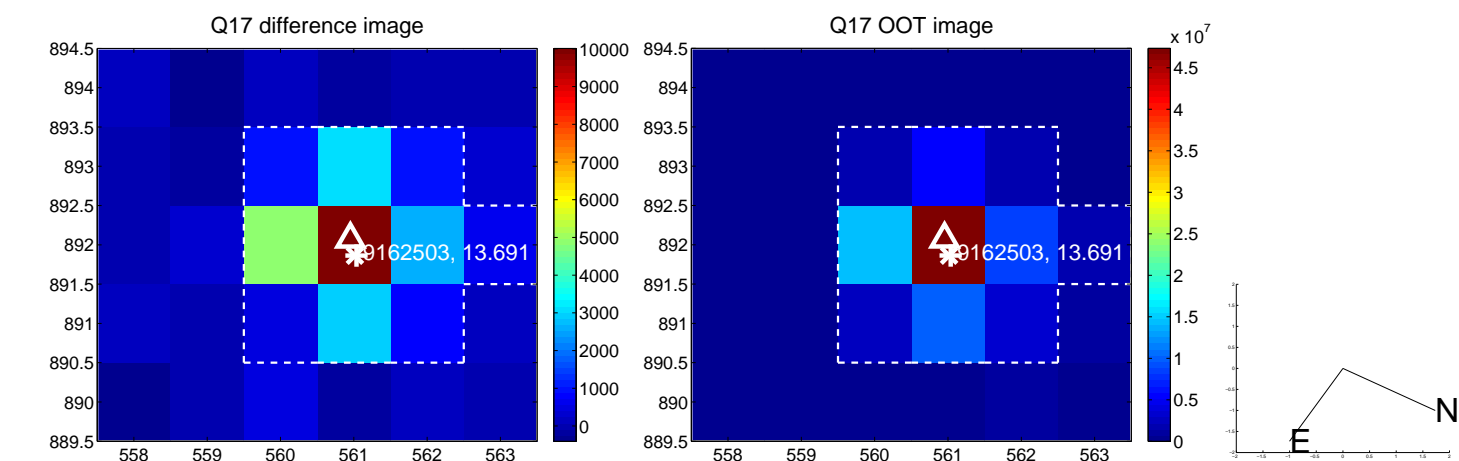


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

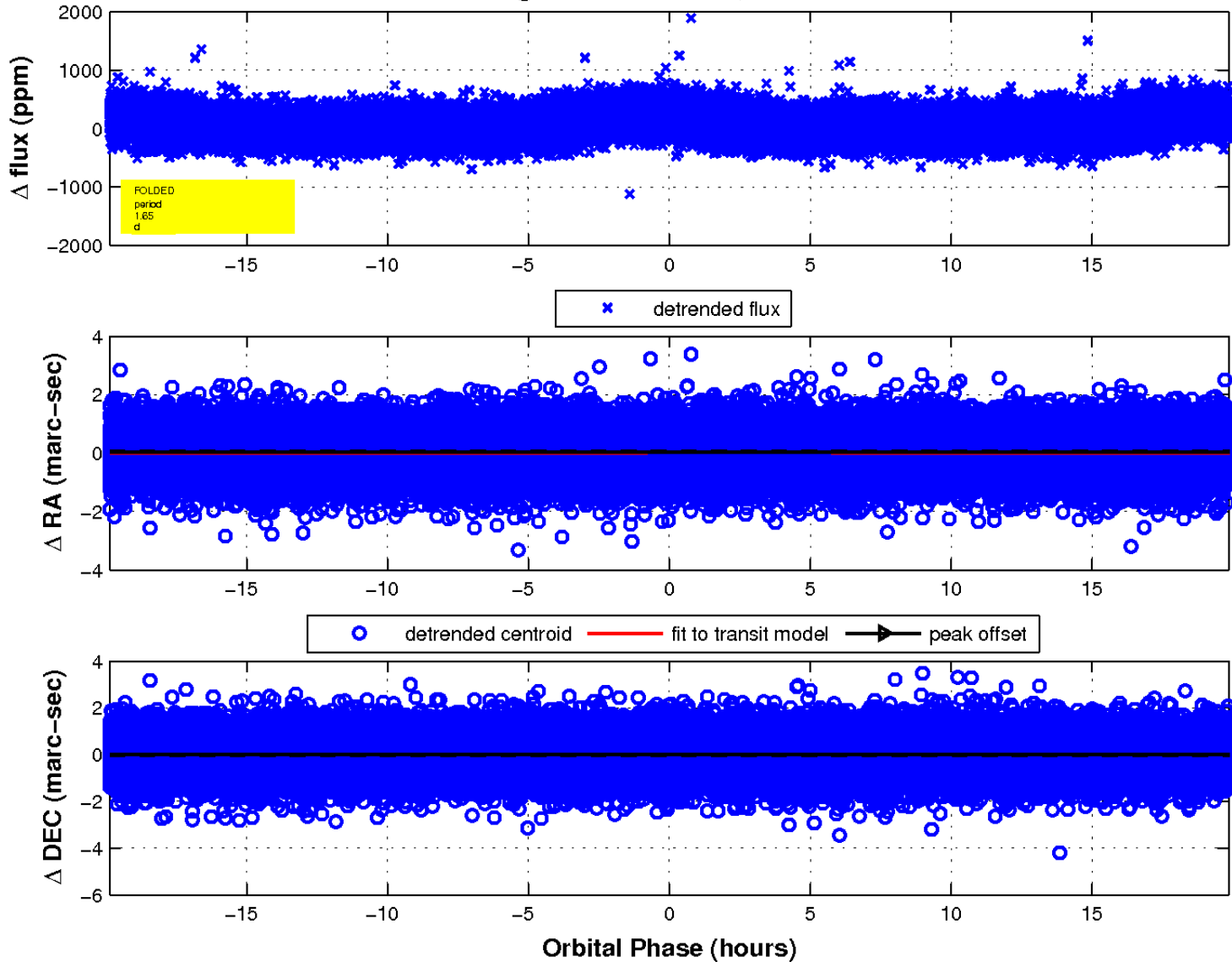




white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

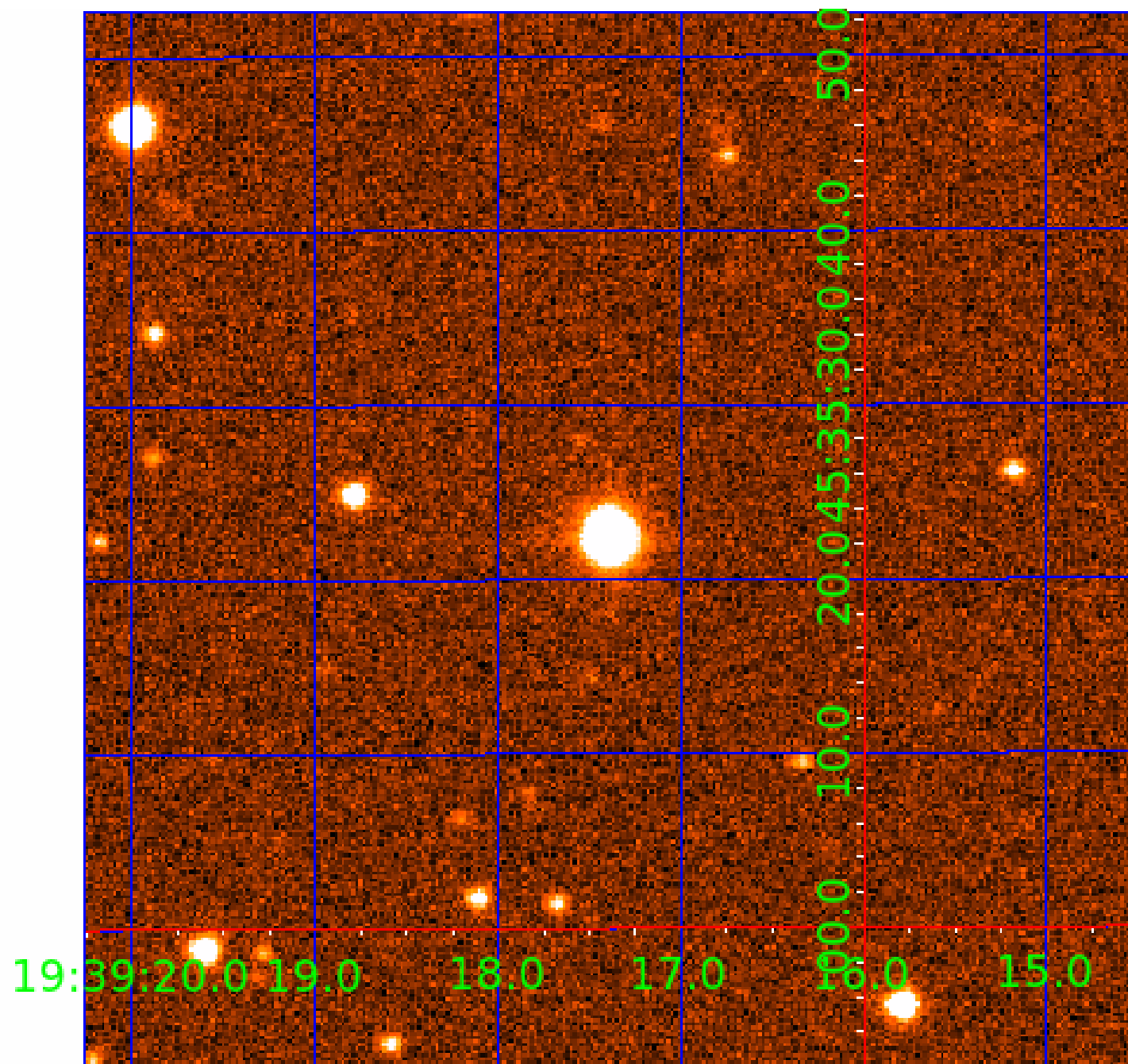


fluxWeightedCentroids, Planet 1 of 2



UKIRT Image

Declination



# KIC 009162503

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009162503-01	OBS	No	1.654782	131.582027	197.3	3.000	9.6	-1.0	1.60	6425	2.26	4369.00
009162503-02	OBS	No	0.827460	131.969327	210.1	2.500	9.2	-1.0	1.60	6425	2.34	11007.97

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009162503-01	OBS	FP	0.00	1	0	0	0	SWEET_NTL—LPP_DV—LPP_ALT—MOD_NONUNIQ_ALT—CENT_NOFITS
009162503-02	OBS	FP	0.00	1	0	0	0	SWEET_NTL—LPP_DV—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.

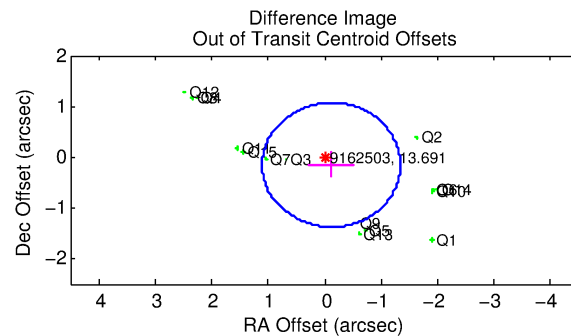
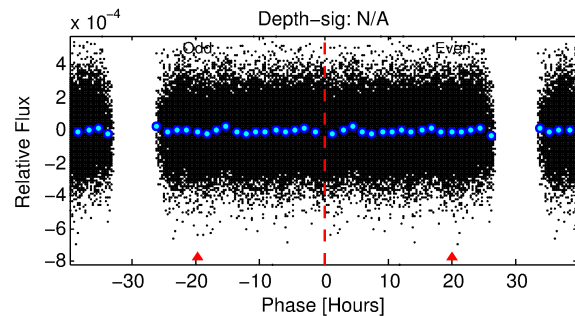
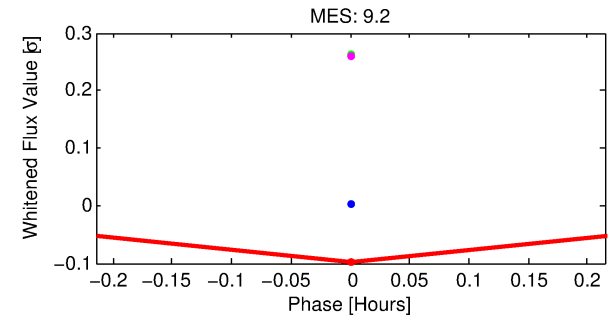
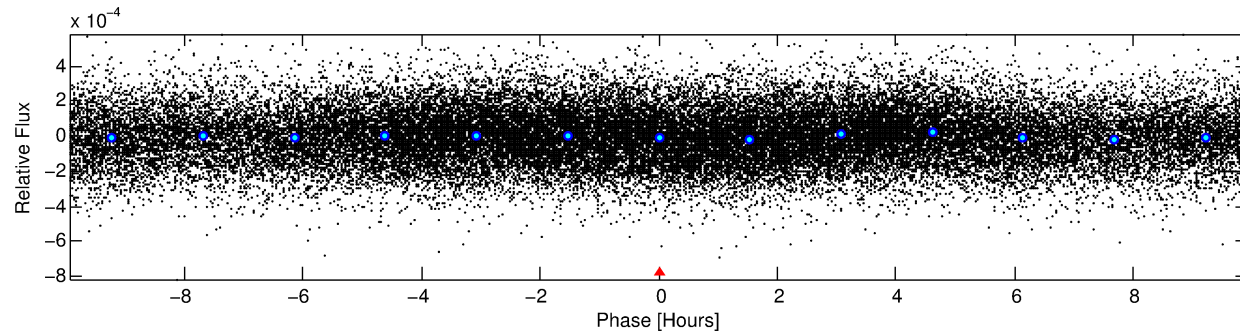
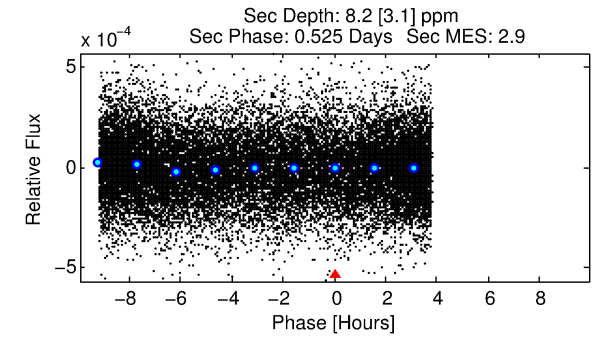
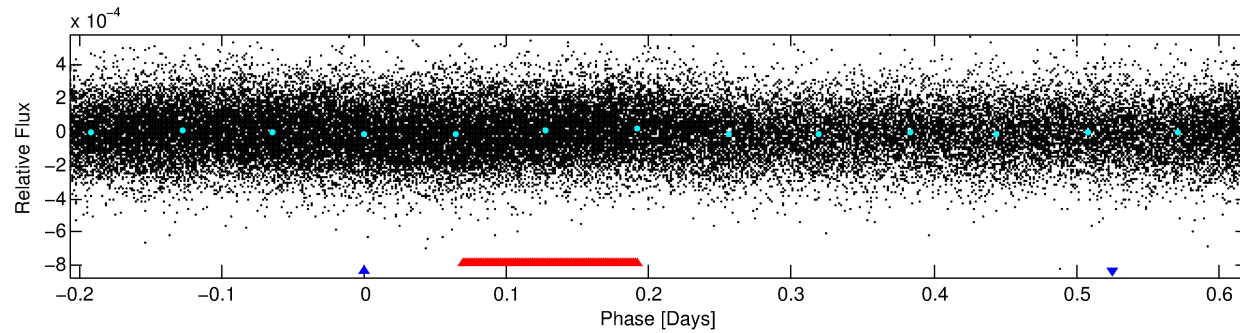
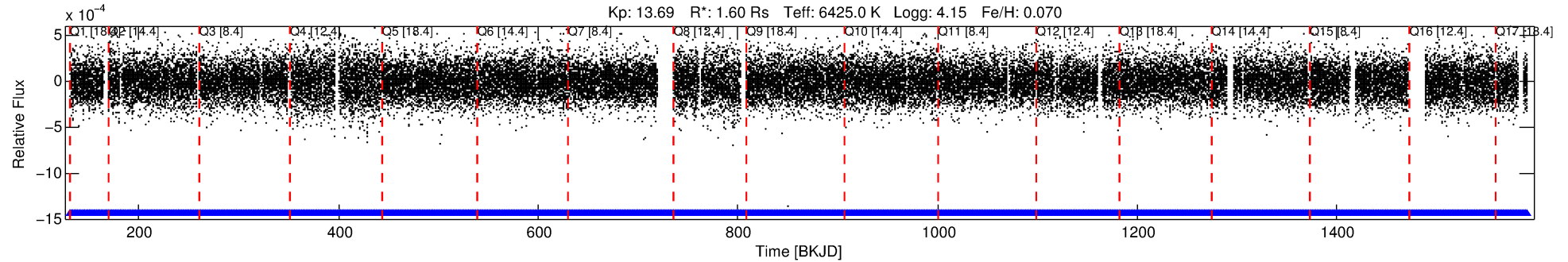
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 009162503-02

No Significant Match Found

# DV One-Page Summary

KIC: 9162503 Candidate: 2 of 2 Period: 0.827 d



## TPS TCE Results:

Period = 0.82746 d  
Epoch = 131.9693 BKJD

DV fit results are unavailable

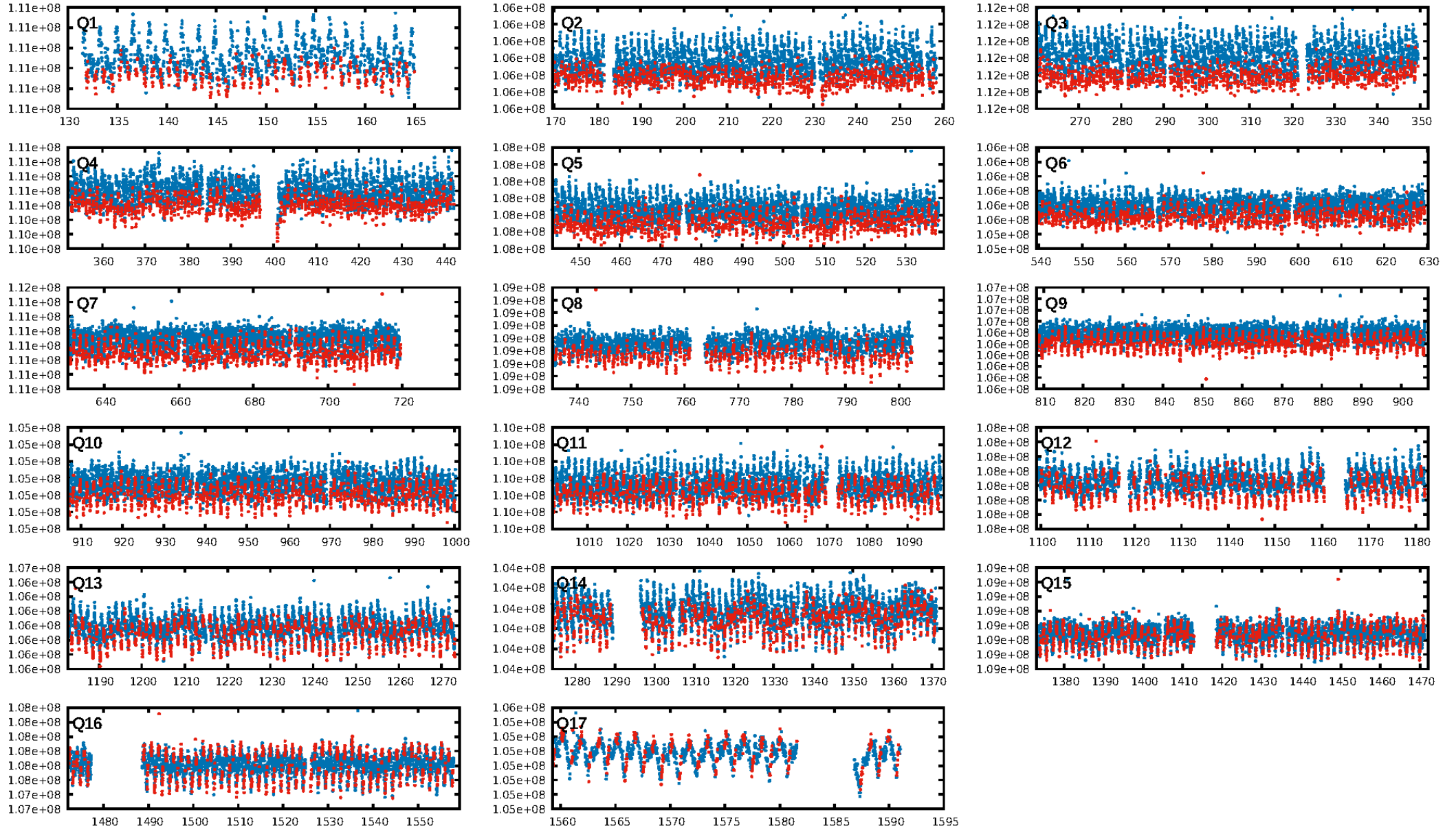
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [5.08σ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: 4.63e-13  
RollingBand-fgt: 1.00 [1562/1562]  
GhostDiagnostic-chr: 0.383  
Centroid-sig: 11.3%  
Centroid-so: 0.120 arcsec [2.14σ]  
OotOffset-rm: 0.195 arcsec [0.48σ]  
KicOffset-rm: 0.180 arcsec [0.39σ]  
OotOffset-st: 4/4/3/4 [15]  
KicOffset-st: 4/4/3/4 [15]  
DiffImageQuality-fgm: 0.93 [14/15]  
DiffImageOverlap-fno: 0.00 [0/17]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 08:13:28 Z

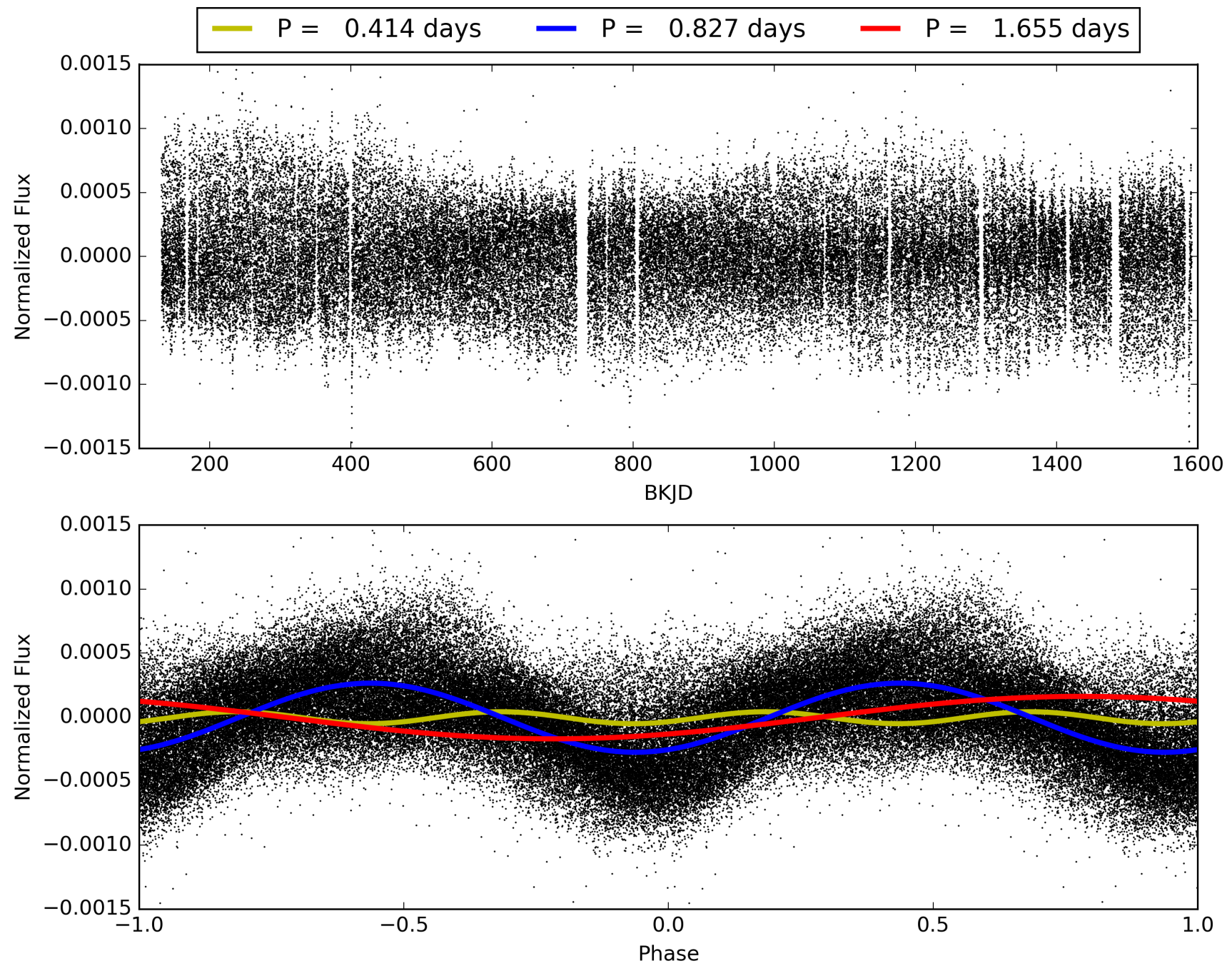
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 009162503-02, PDC Light Curves



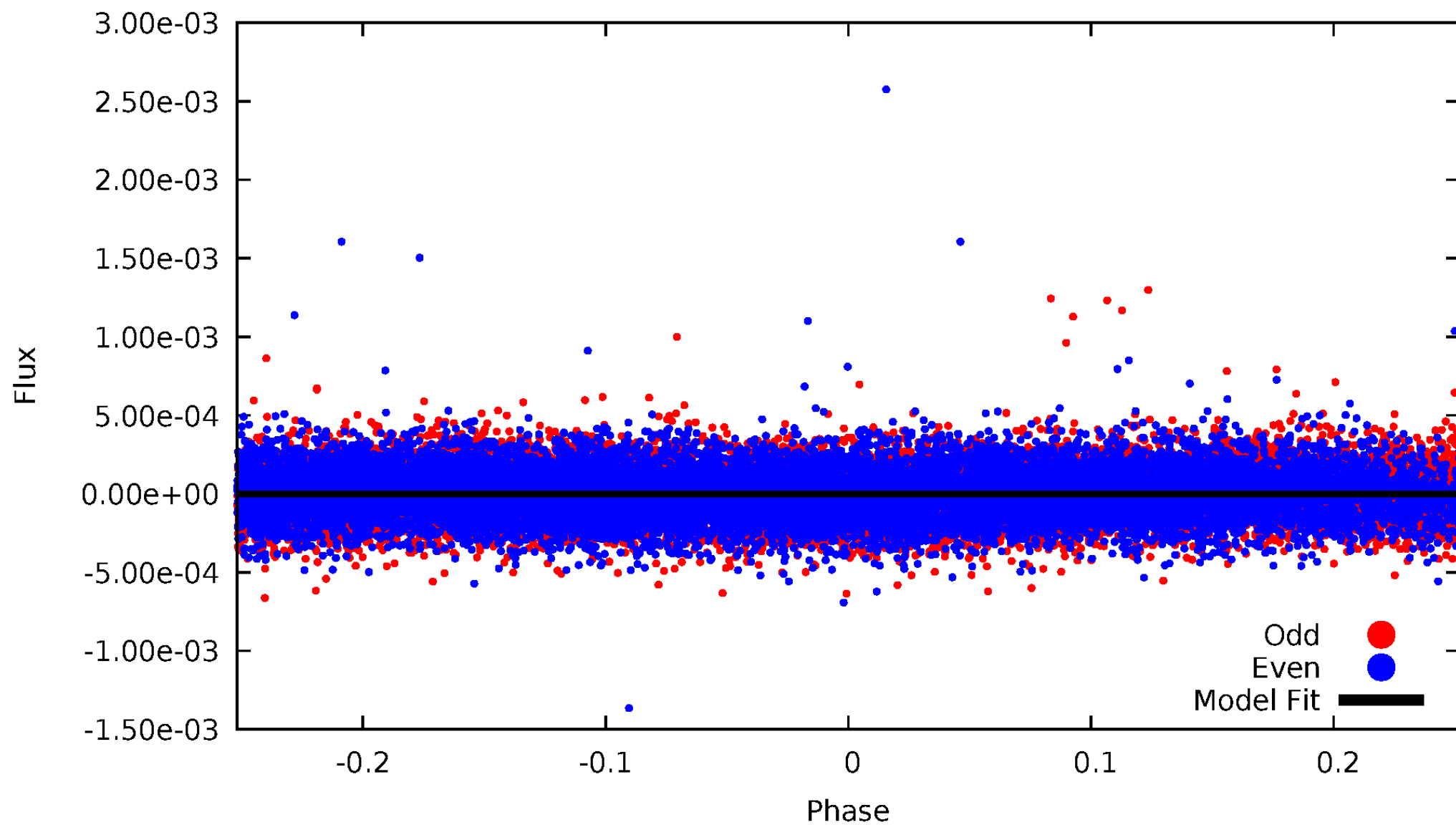


TCE 009162503-02



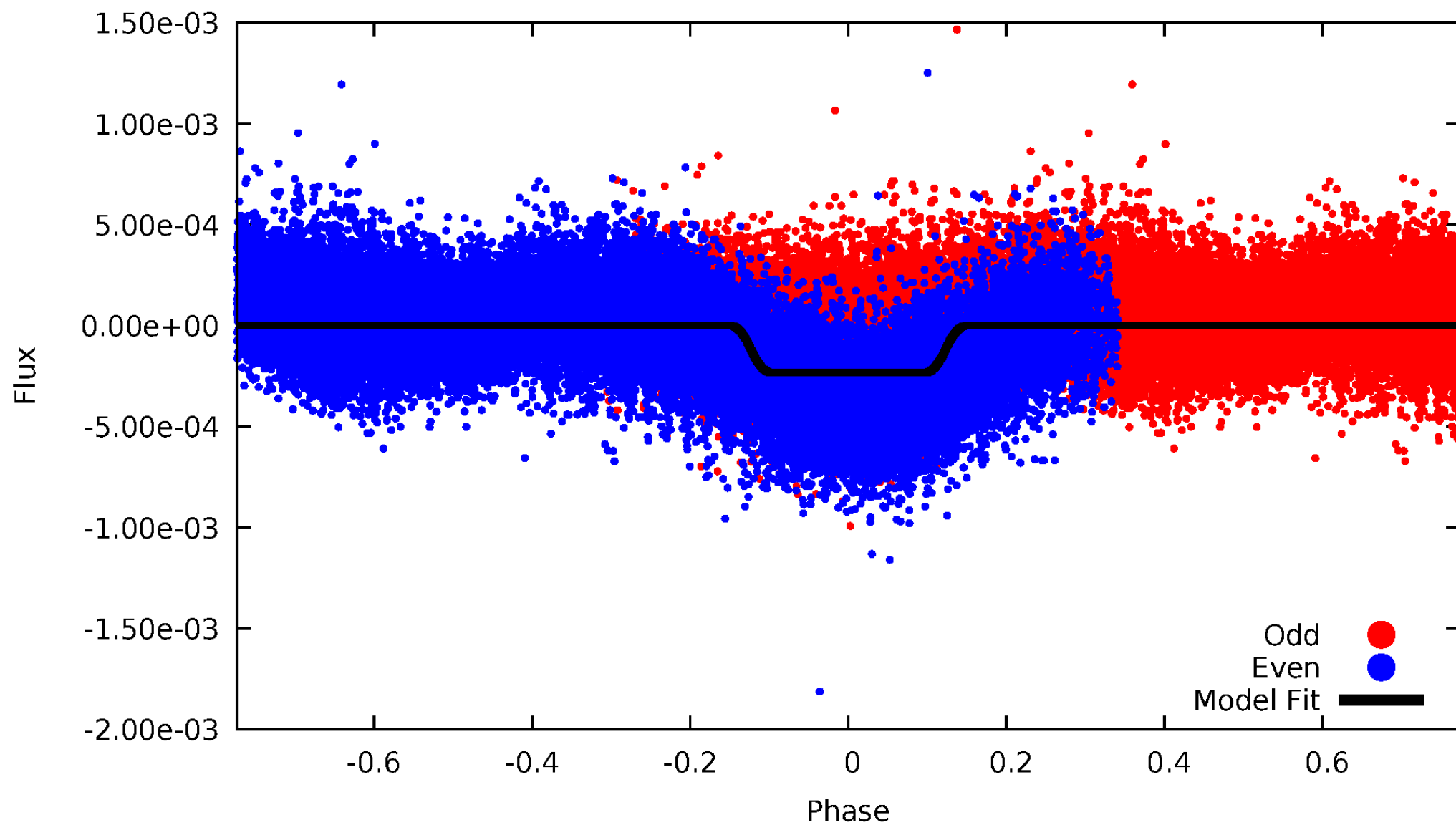
# DV Odd/Even

TCE 009162503-02



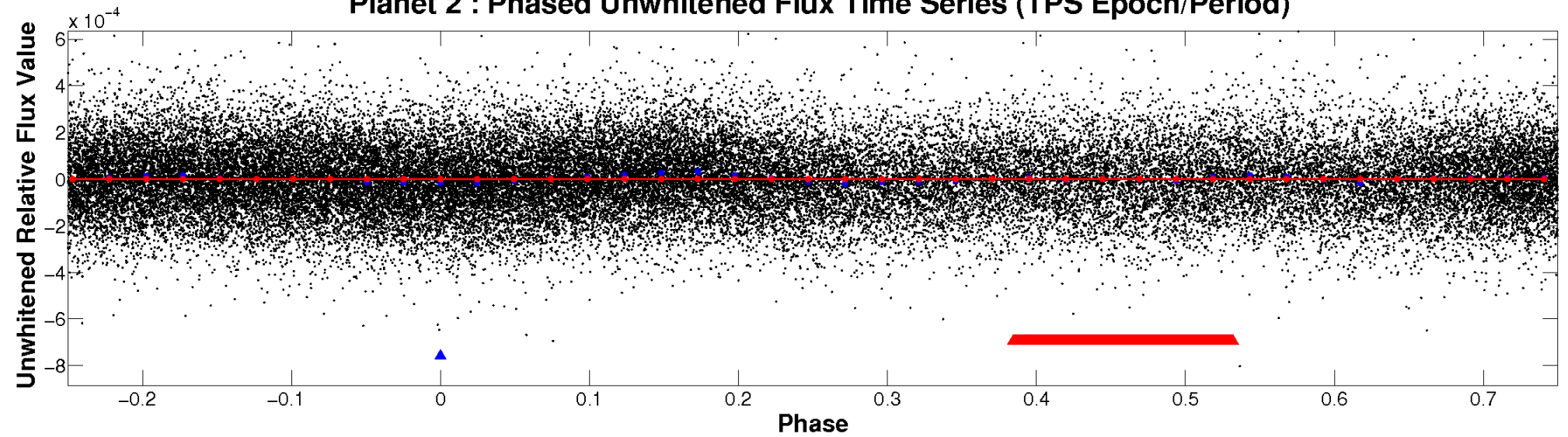
ALT Odd/Even

TCE 009162503-02

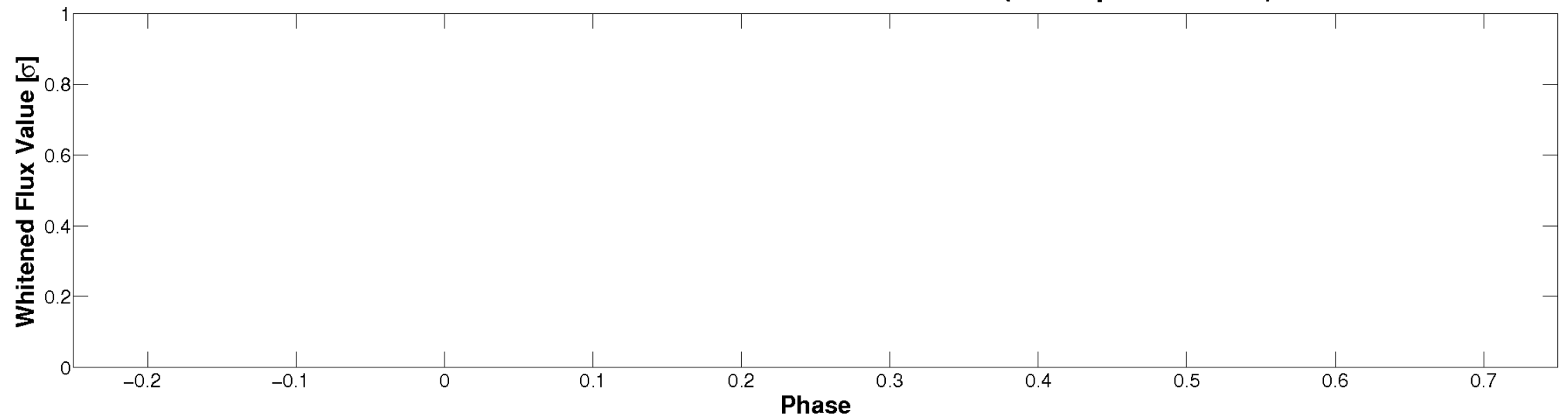


# Non-Whitened Vs. Whitened Light Curve

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



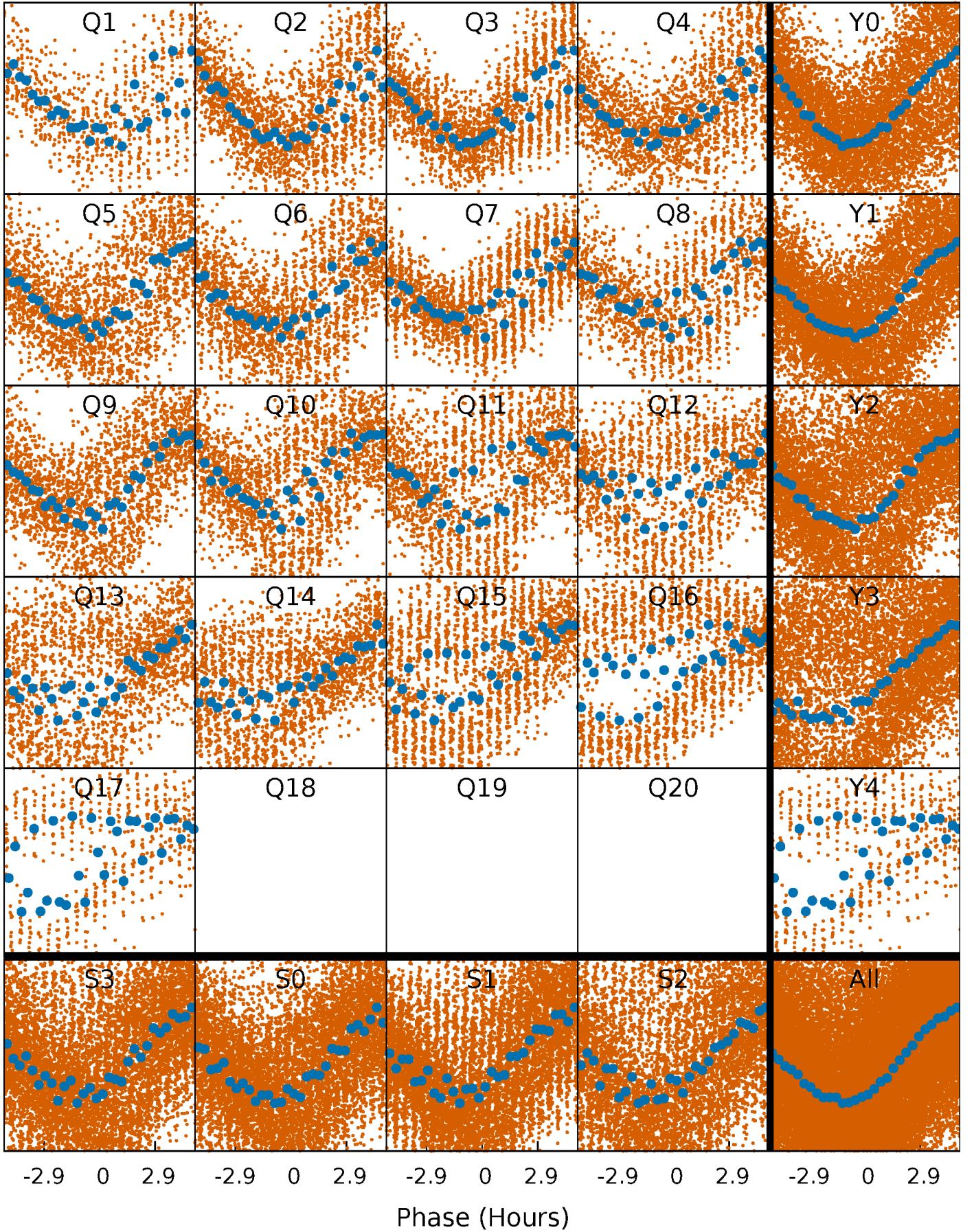
**Planet 2 : Phased Whitened Flux Time Series (TPS Epoch/Period)**





# PDC Quarter-Phased Transit Curves

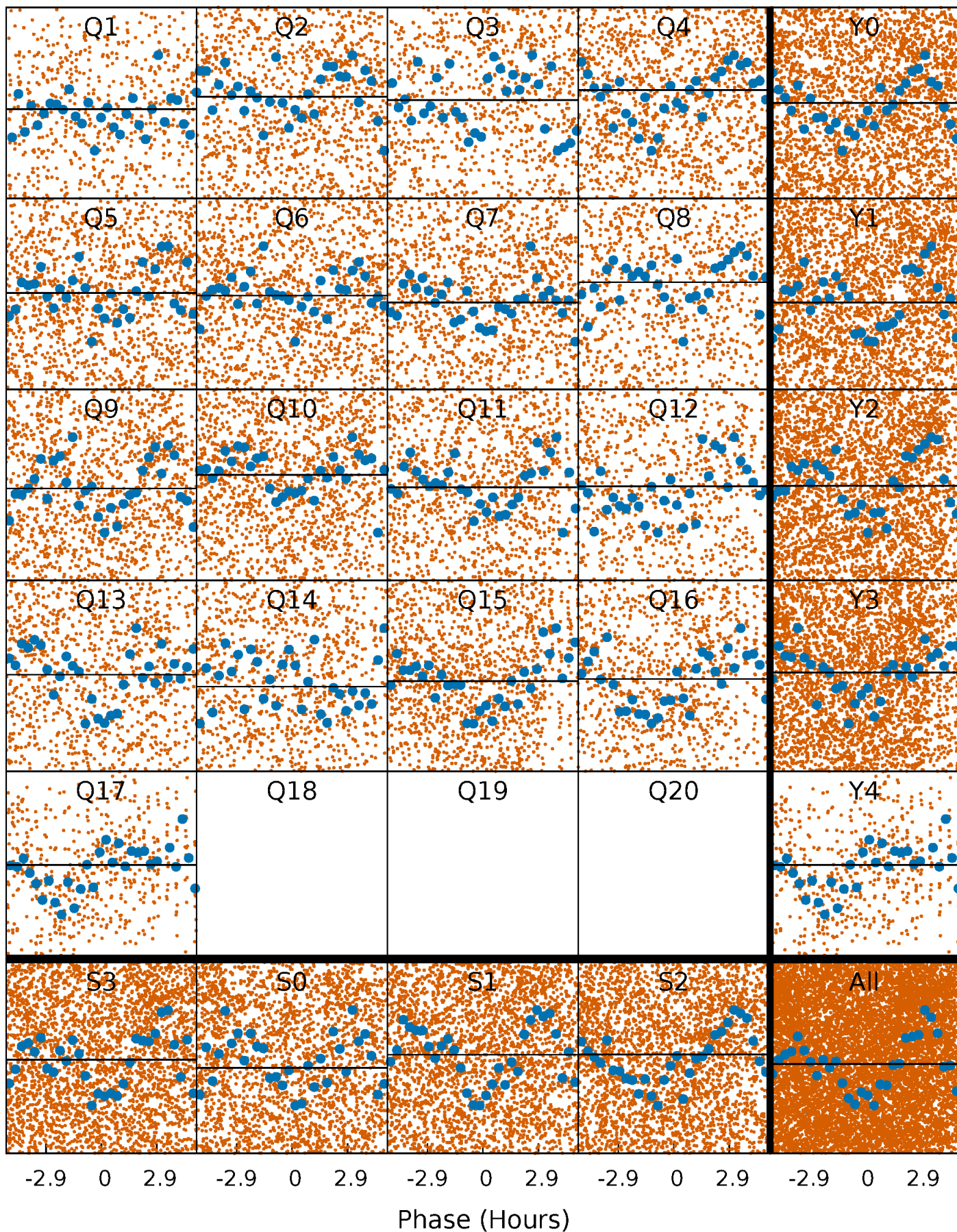
TCE 009162503-02   P= 0.827460 Days    $T_0=131.969327$  (BKJD)





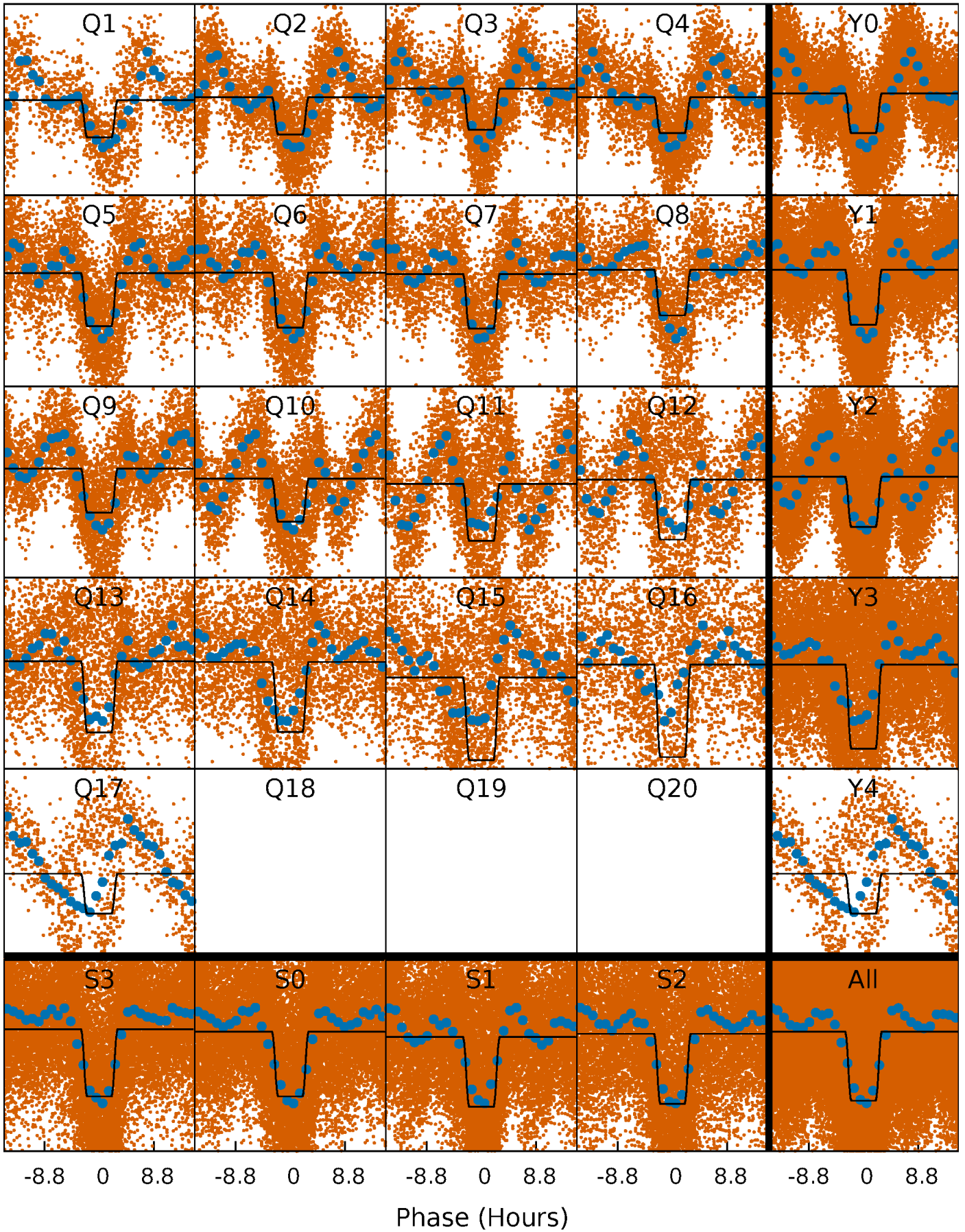
# DV Quarter-Phased Transit Curves

TCE 009162503-02 P= 0.827460 Days  $T_0=131.969327$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

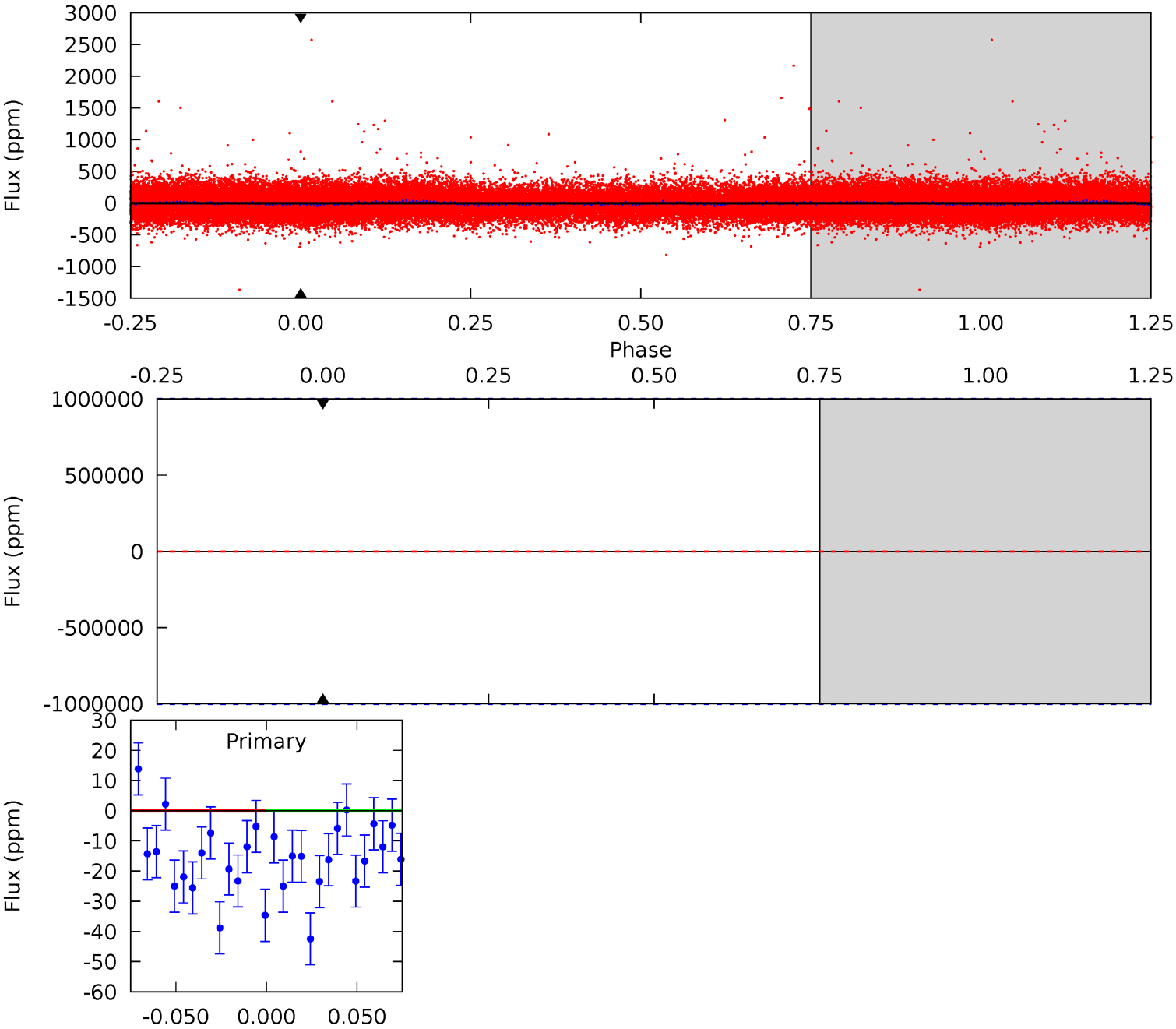
TCE 009162503-02   P= 0.827460 Days    $T_0=131.924474$  (BKJD)



DV Model-Shift Uniqueness Test

009162503-02, P = 0.827460 Days, E = 131.141867 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

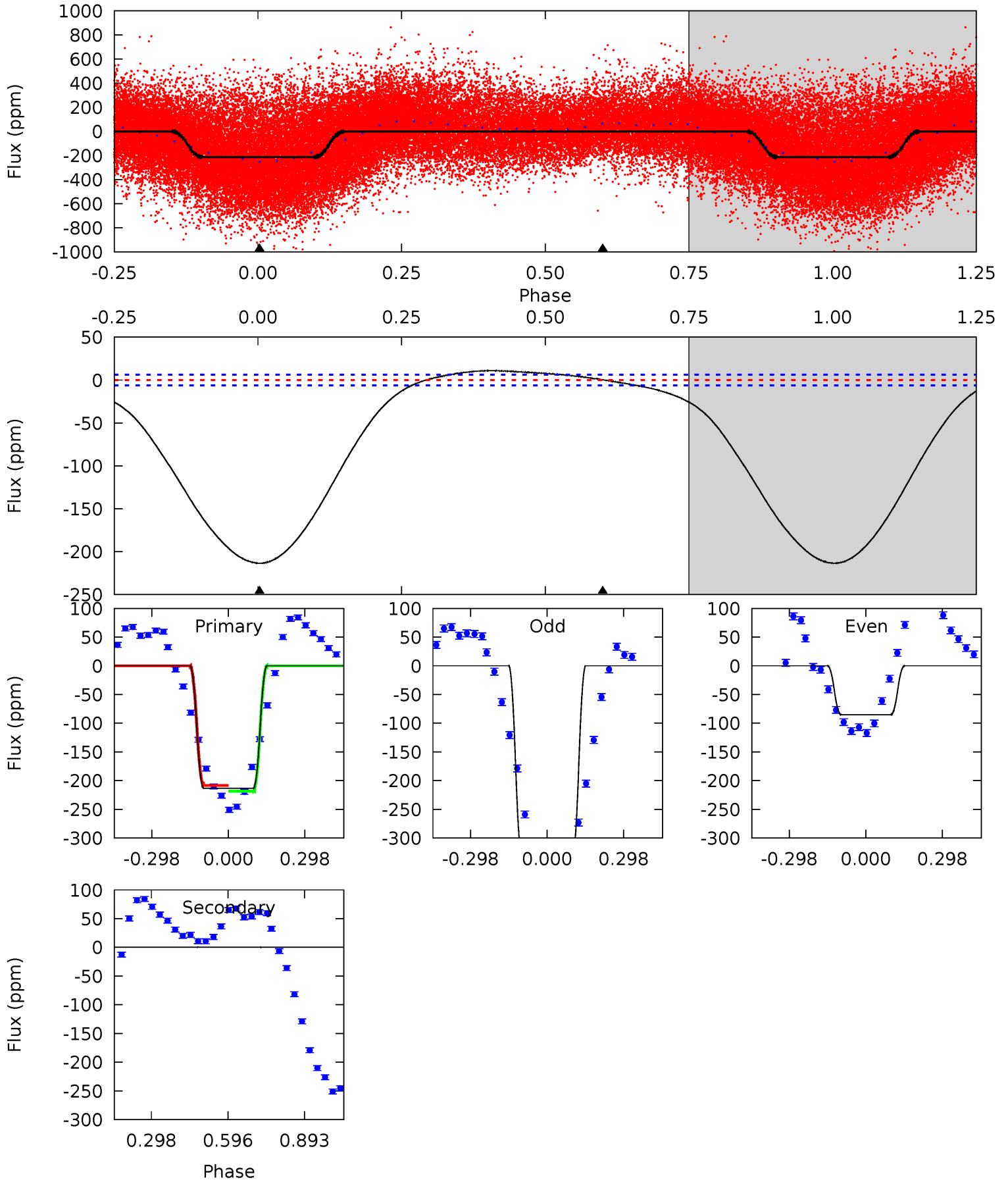




# Alt Model-Shift Uniqueness Test

009162503-02, P = 0.827460 Days, E = 131.097014 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
147.2	-0.19	0	0	4.33	1.04	4.90	147.2	147.2	-0.19	-0.19	87.2	0.88	0.05	3.19



### Stellar Parameters For KIC 009162503

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6425^{+179}_{-247}$	$4.146^{+0.190}_{-0.190}$	$0.070^{+0.250}_{-0.300}$	$1.605^{+0.501}_{-0.410}$	$1.316^{+0.185}_{-0.226}$	$0.448^{+0.470}_{-0.230}$
	+3%/-4%	+5%/-5%	+357%/-429%	+31%/-26%	+14%/-17%	+105%/-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 009162503-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$0 \pm 1000000$	$13.56^{+12.99}_{-9.69}$	$3636^{+291}_{-266}$	$4331^{+26071}_{-28499}$	$1.220^{+255.341}_{-170.378}$
Alt.	$0 \pm 1$	$12.60^{+12.96}_{-9.15}$	$3637^{+270}_{-281}$	$-3482^{+186}_{-181}$	$-0.000^{+0.002}_{-0.006}$

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

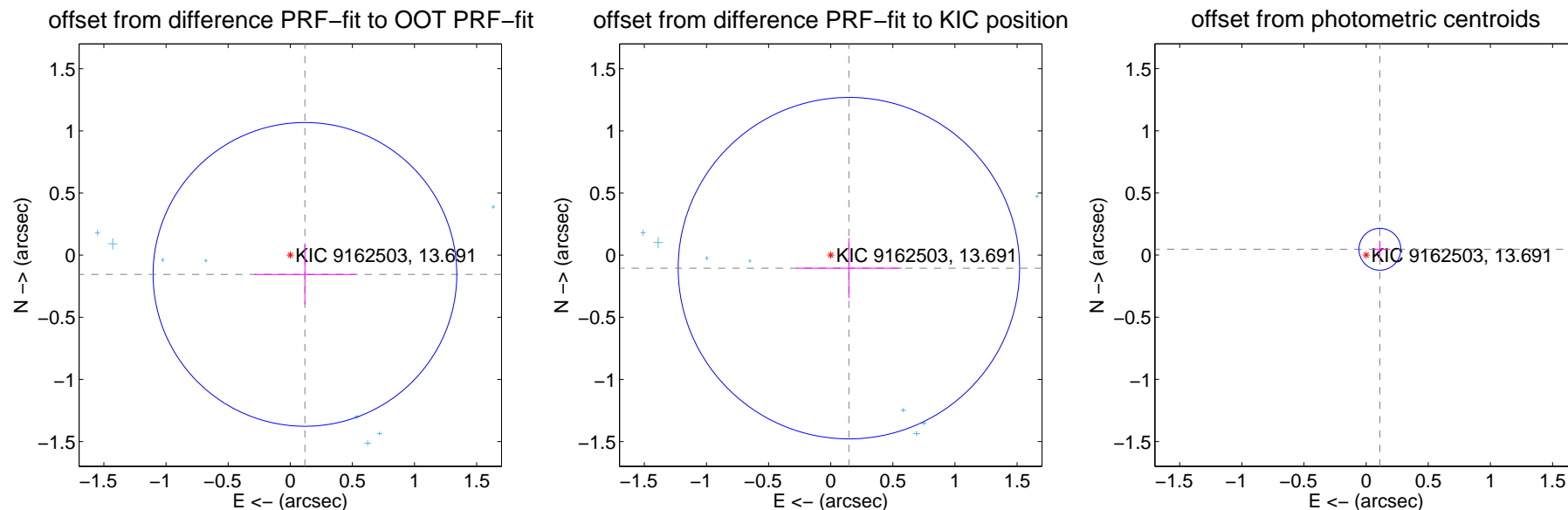
## DV Centroid Data

Supplemental centroid analysis for 009162503-02. Kepler magnitude: 13.69. Transit SNR -1.00

There are 14 quarters with good PRF difference image offsets

The direct PRF centroid is offset from the target star catalog position by about 0.04 arcsec

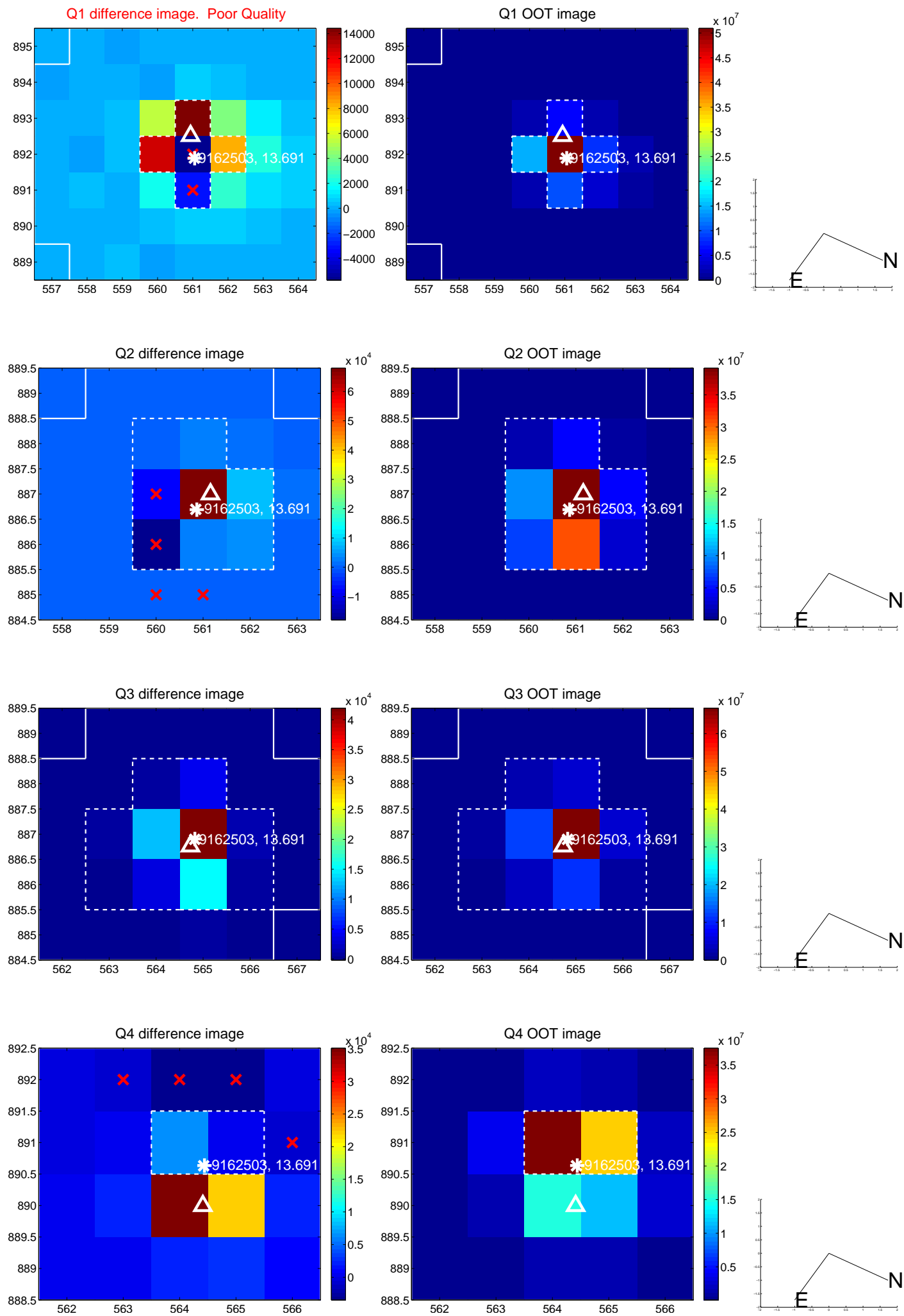
	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.195 \pm 0.407$	0.48	$-0.118 \pm 0.409$	$-0.155 \pm 0.241$
PRF-fit source offset from KIC position	$0.180 \pm 0.458$	0.39	$-0.146 \pm 0.425$	$-0.105 \pm 0.242$
photometric centroid source offset	$0.12 \pm 0.06$	2.14	$-0.11 \pm 0.05$	$0.05 \pm 0.07$



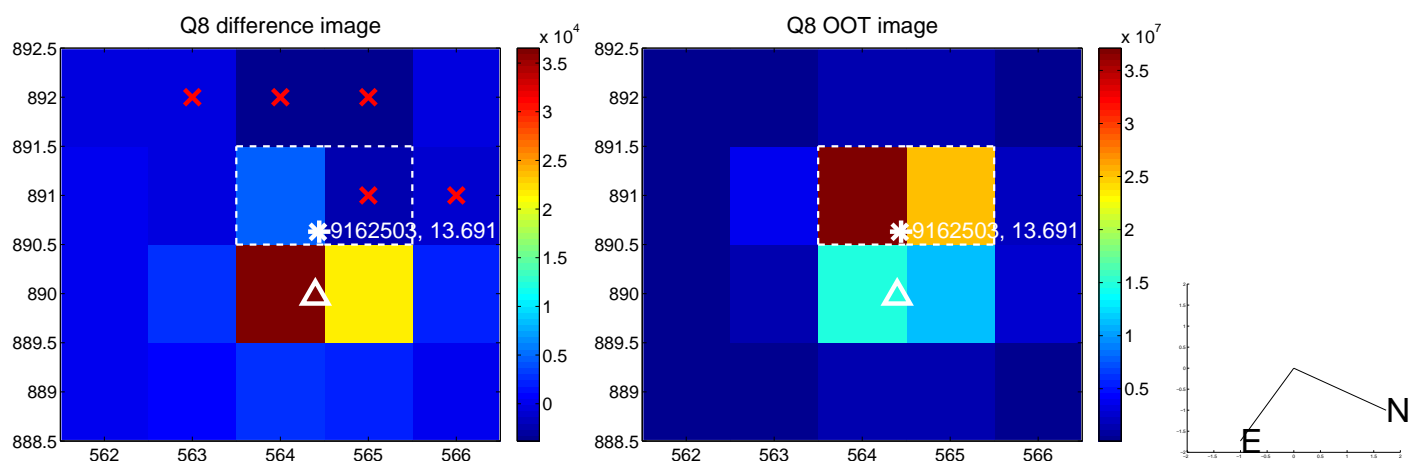
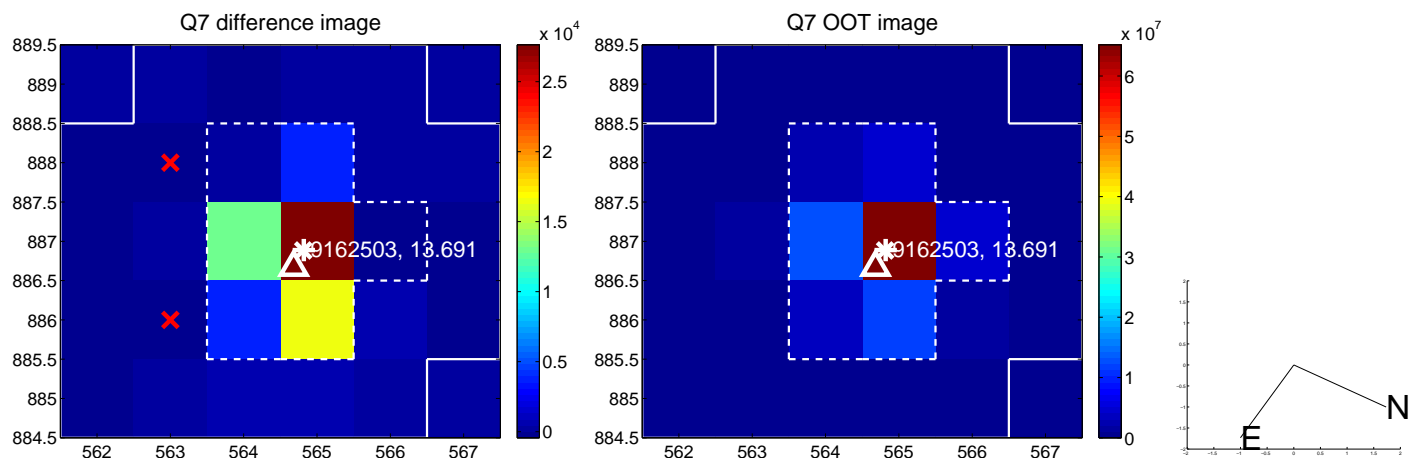
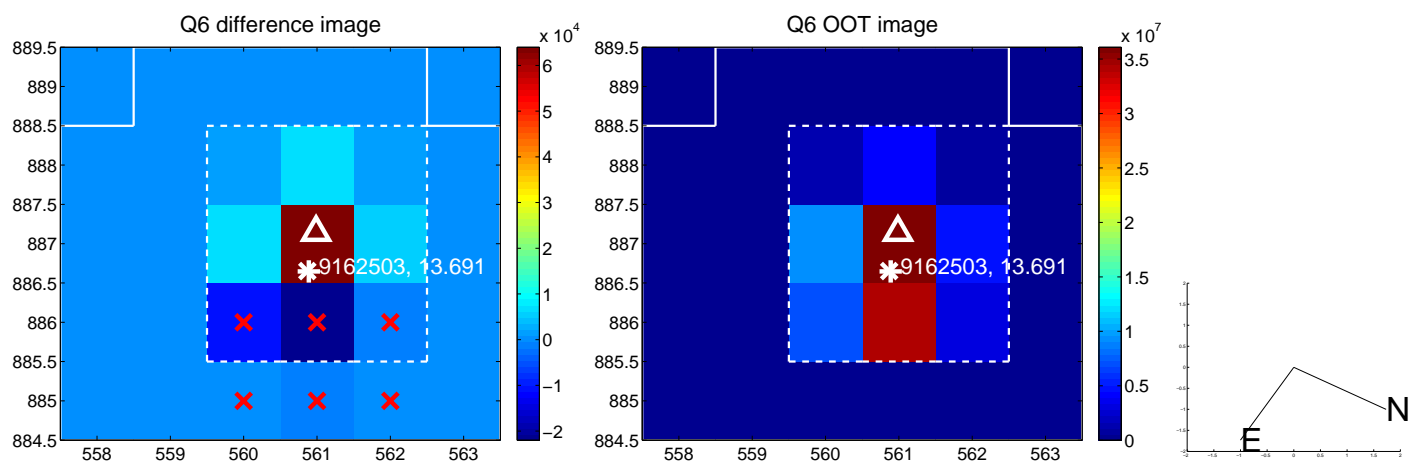
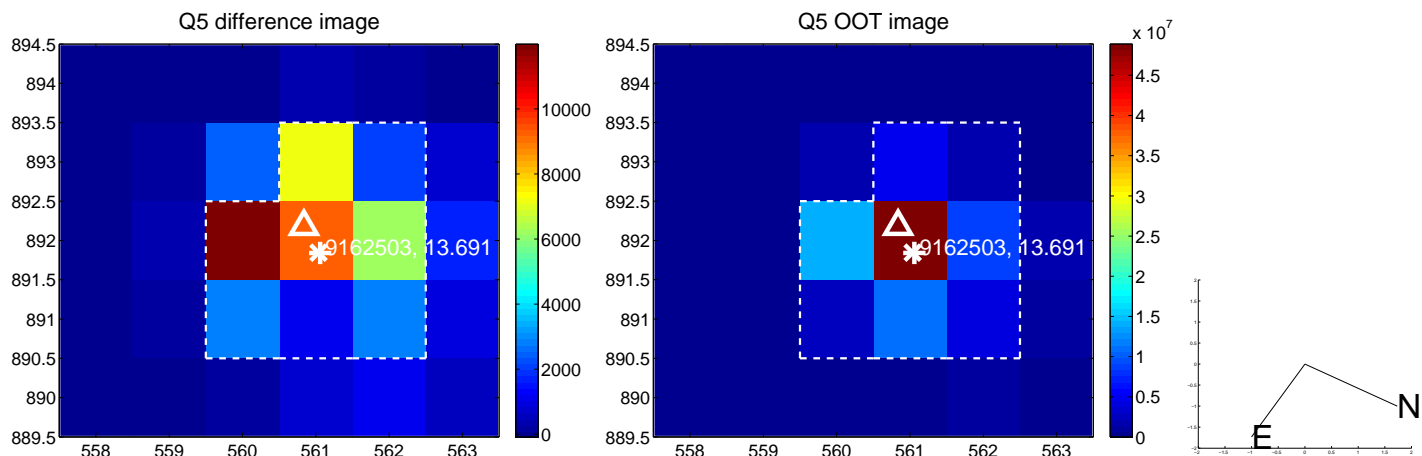
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets**; **Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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



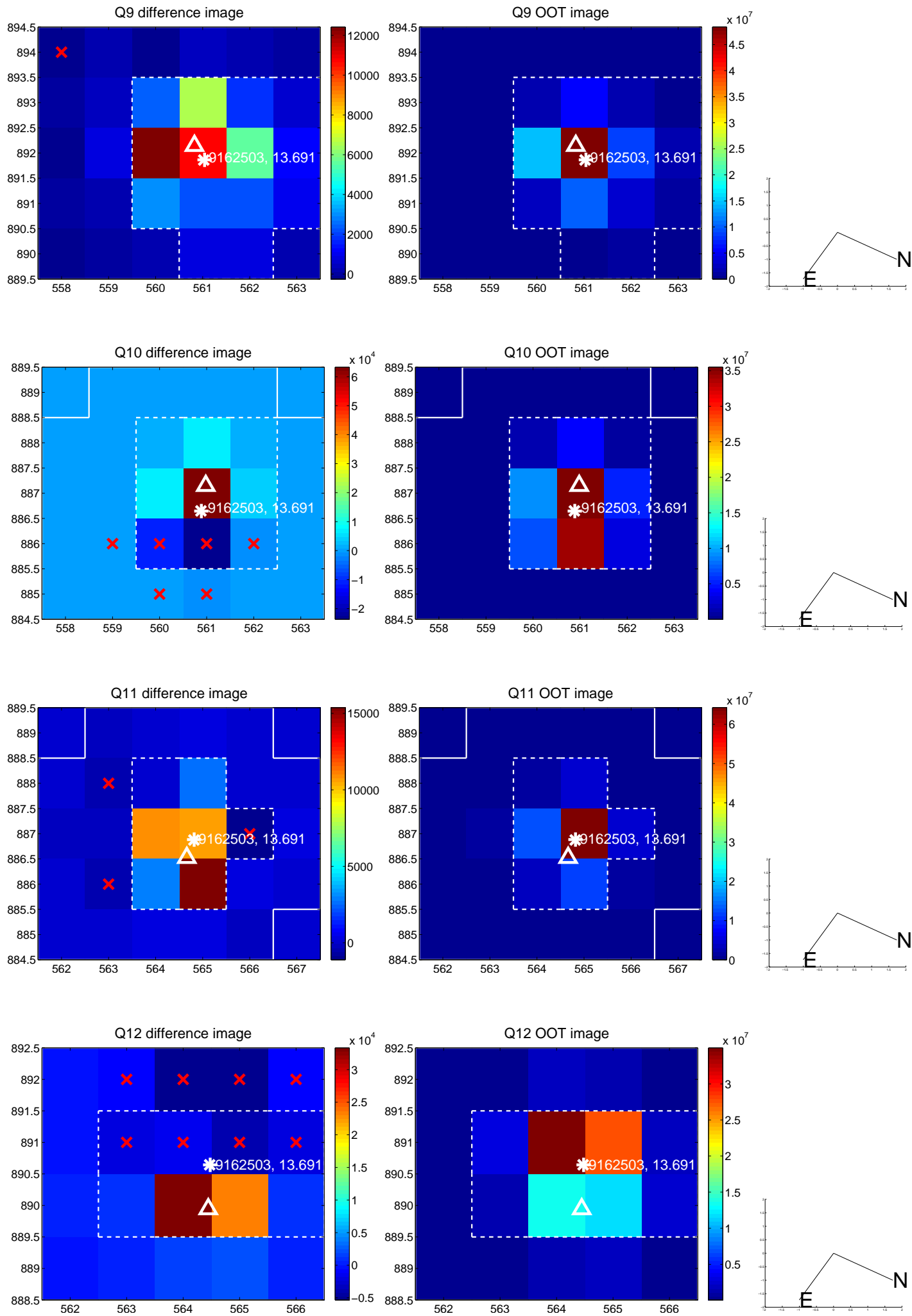
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



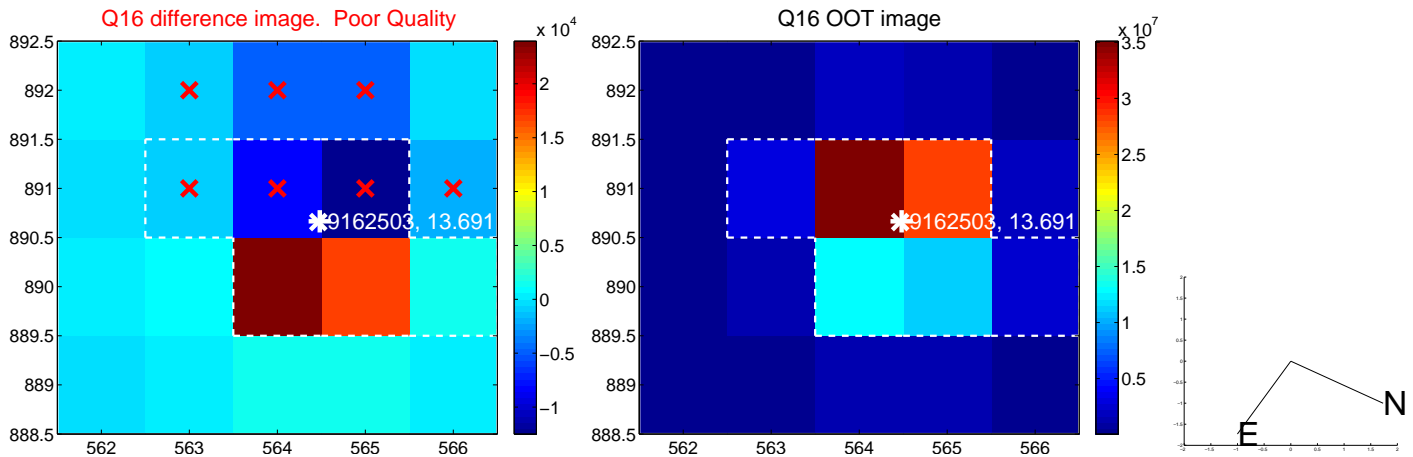
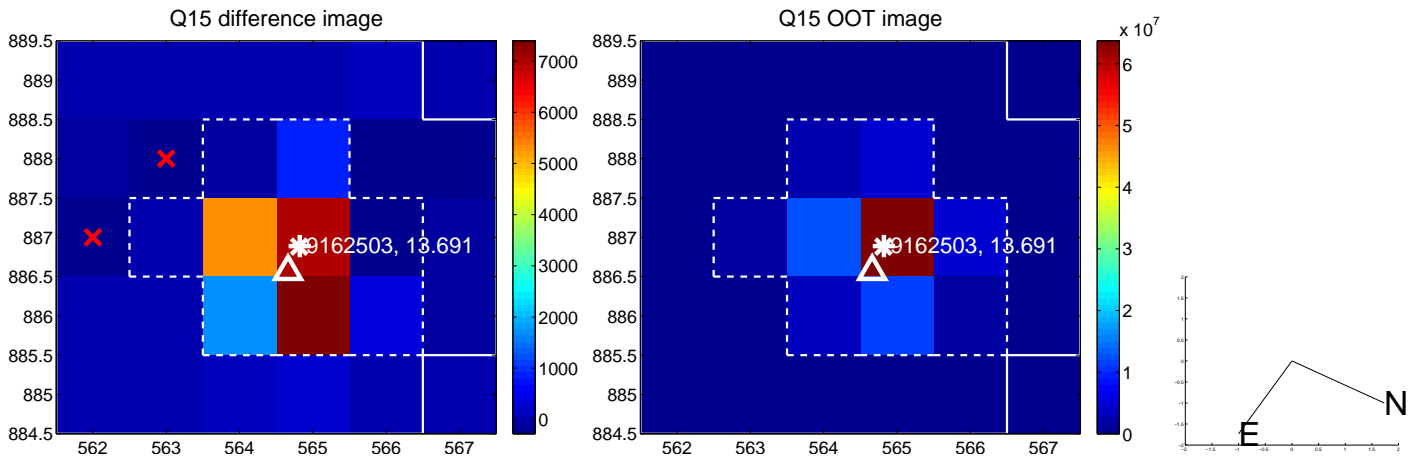
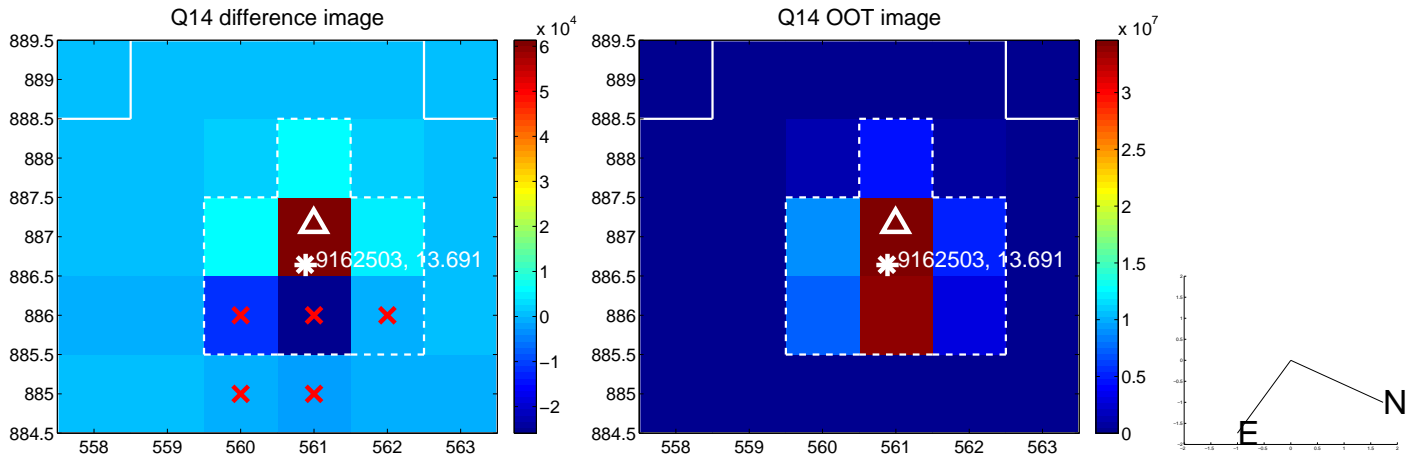
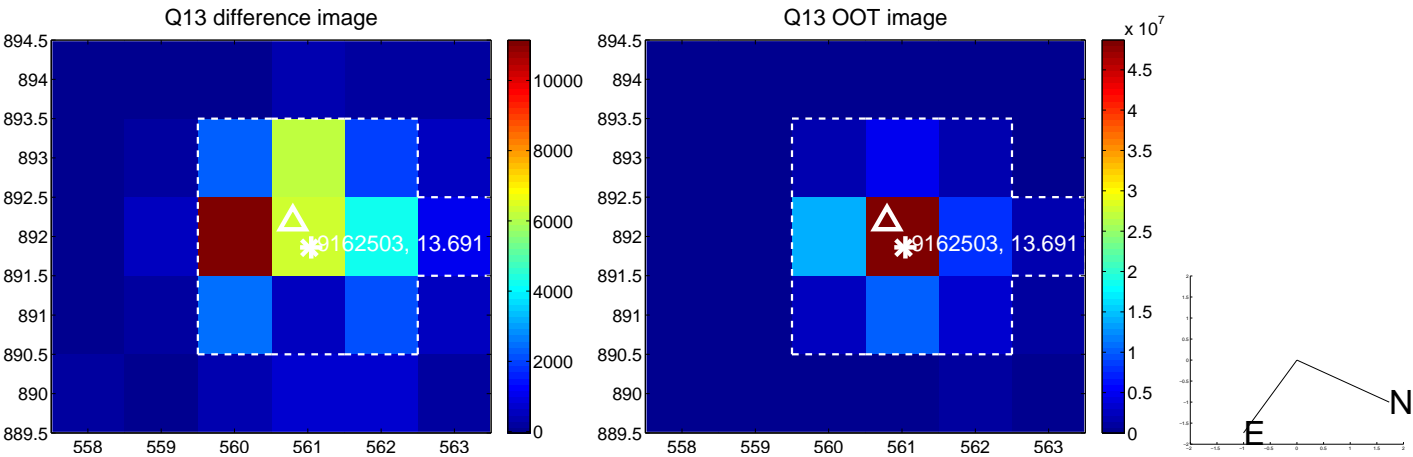
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



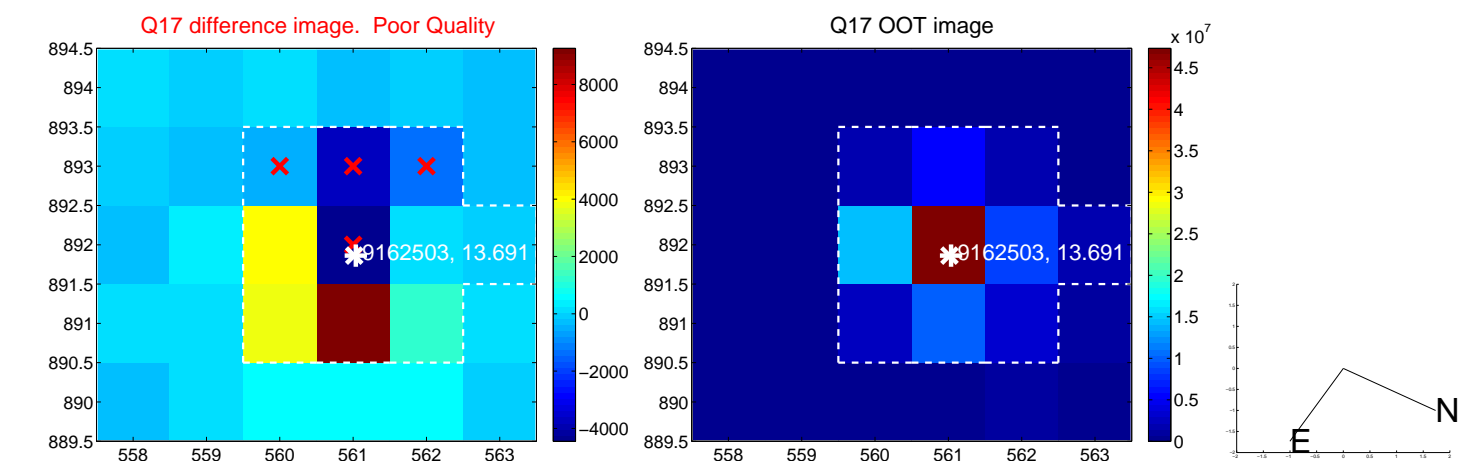
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



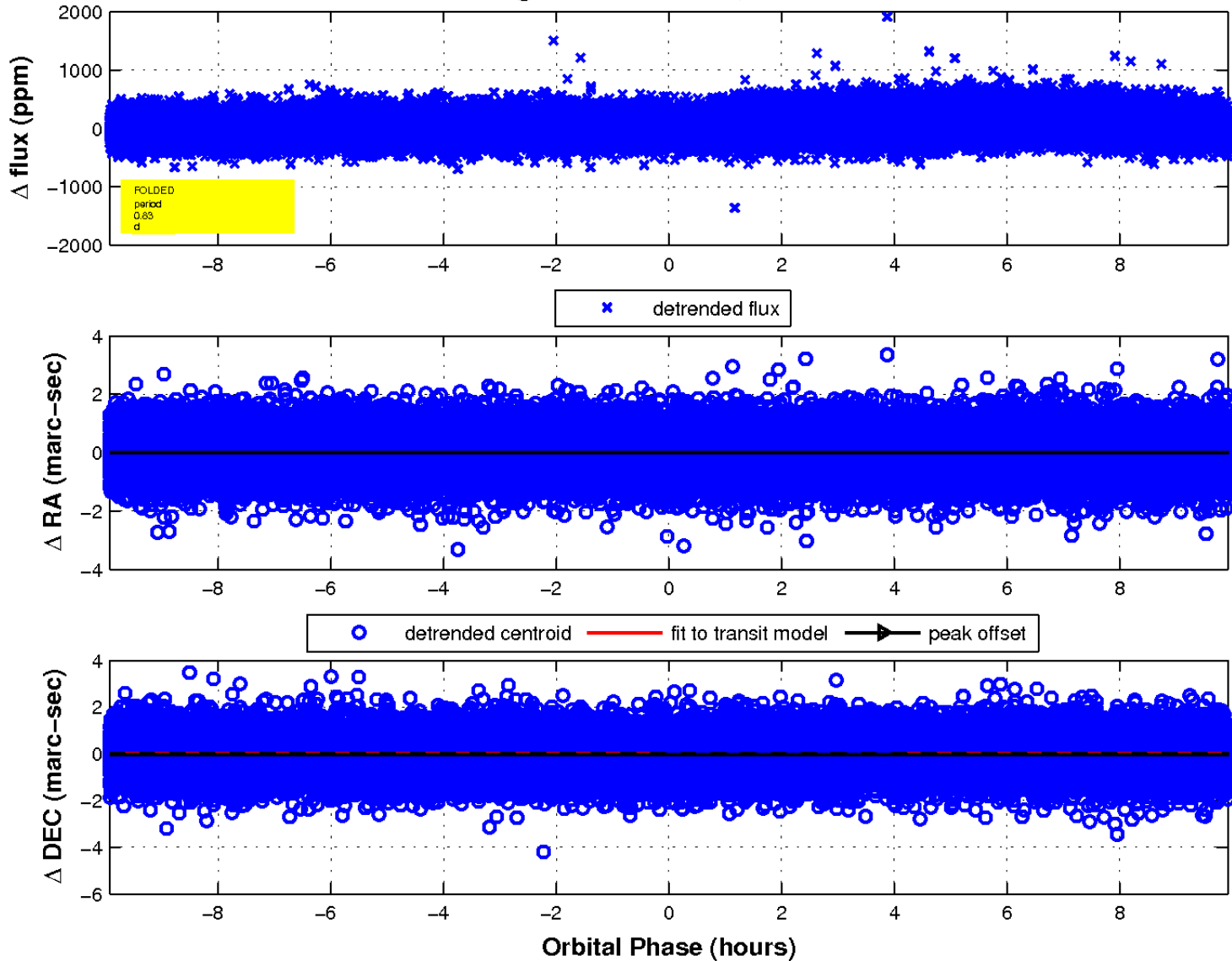
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



fluxWeightedCentroids, Planet 2 of 2



UKIRT Image

Declination

