

# KIC 009529744

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009529744-01	OBS	1806.01	2.404478	131.701925	143.9	6.695	101.2	48.3	1.77	6426	2.75	3484.14
009529744-02	OBS	1806.02	17.934775	138.221478	136.2	5.309	15.1	16.7	1.77	6426	2.43	239.07
009529744-03	OBS	1806.03	8.371643	137.680577	88.0	4.061	12.5	14.3	1.77	6426	1.99	660.25
009529744-04	OBS	No	470.162593	154.886986	452.9	12.500	12.9	-1.0	1.77	6426	3.79	3.07

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009529744-01	OBS	FP	0.00	1	0	1	1	LPP_DV—CENT_RESOLVED_OFFSET—EPHEM_MATCH
009529744-02	OBS	PC	0.97	0	0	0	0	NO_COMMENT
009529744-03	OBS	PC	1.00	0	0	0	0	NO_COMMENT
009529744-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_CHASES_MARSHALL_SKYE—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT—INCONSISTENT_TRANS—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 009529744-01

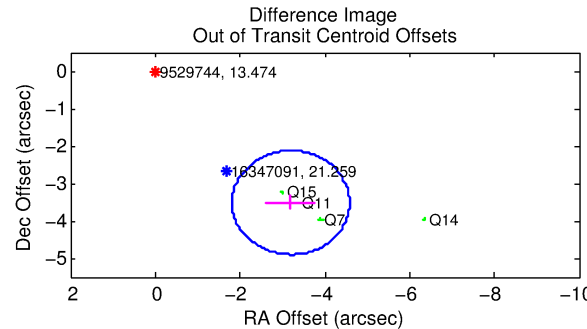
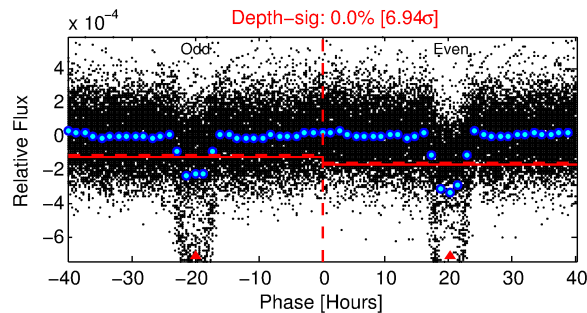
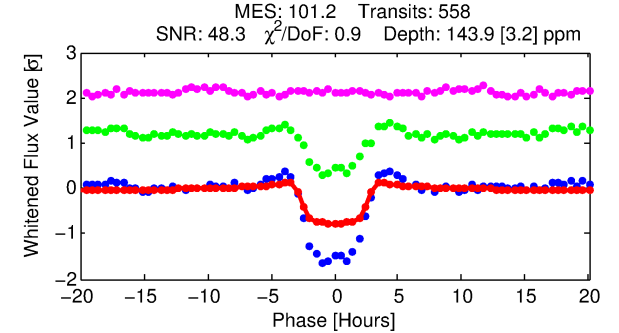
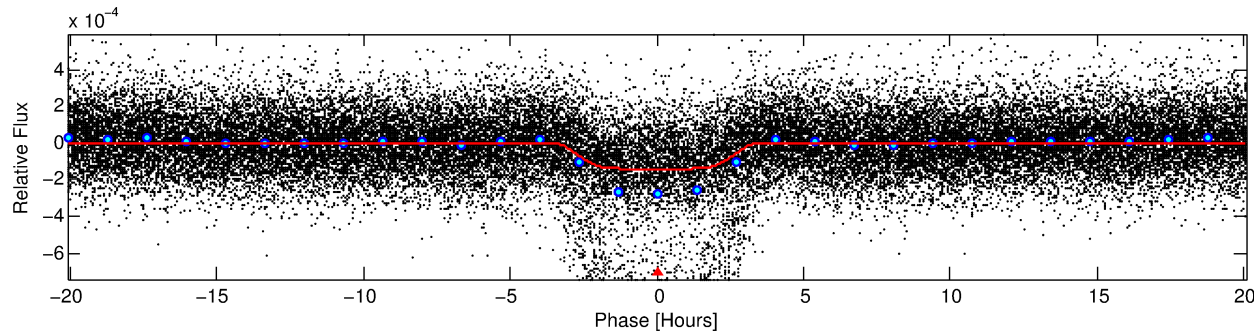
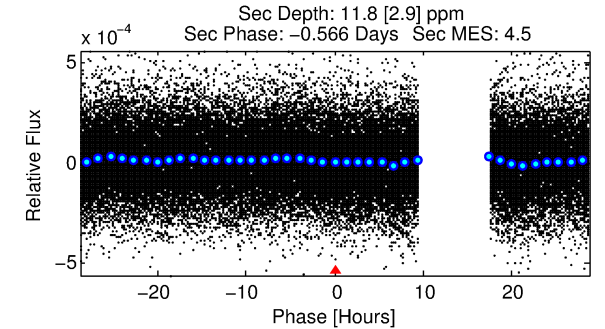
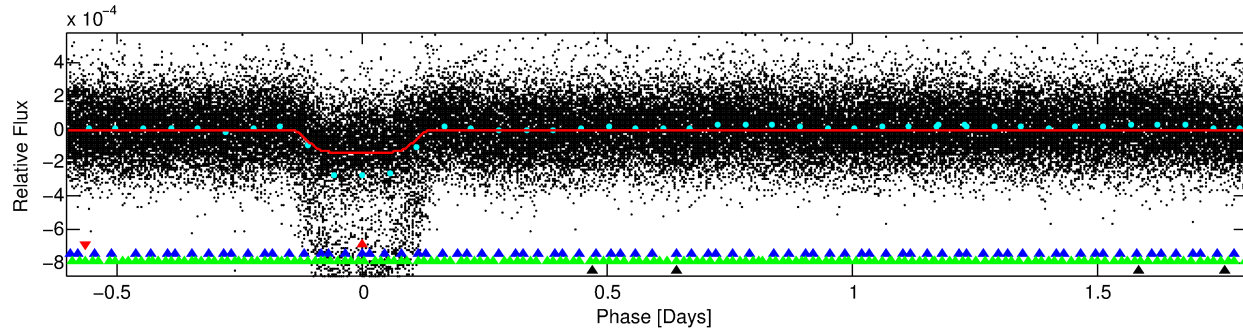
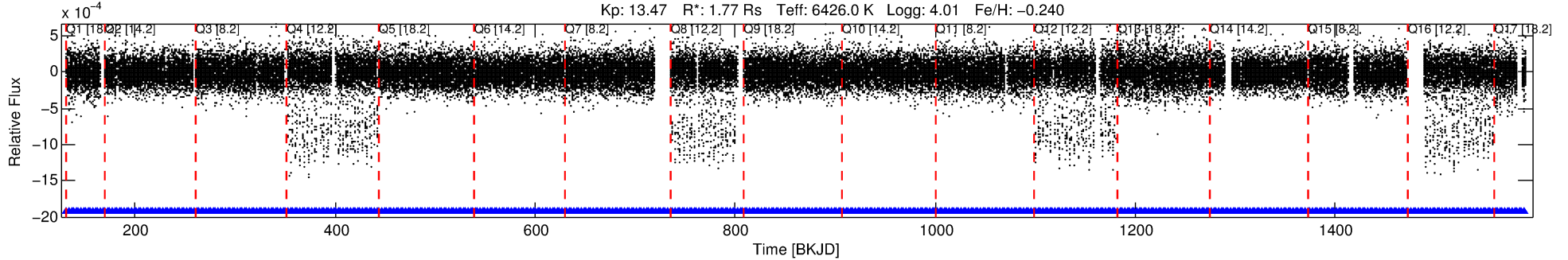
TCE (1)	KIC	Parent (2)	Parent KIC	P <sub>1</sub> :P <sub>2</sub>	Dist ( $''$ )	$\Delta$ Row	$\Delta$ Col	m <sub>2</sub>	m <sub>1</sub>	D <sub>2</sub> /D <sub>1</sub>	Mechanism	Flag	$\sigma_P$	$\sigma_T$
009529744-01	9529744	009529733-pri	9529733	1:2	14.0	4	0	14.04	13.48	972.92	Direct-PRF	0	4.87	1.59

**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: 9529744 Candidate: 1 of 4 Period: 2.404 d  
KOI: K01806.01 Corr: 0.947

Kp: 13.47 R\*: 1.77 Rs Teff: 6426.0 K Logg: 4.01 Fe/H: -0.240



## DV Fit Results:

Period = 2.40448 [0.00001] d  
Epoch = 131.7019 [0.0019] BKJD  
Rp/R\* = 0.0142 [0.0002]  
a/R\* = 1.27 [0.03]  
b = 0.97 [0.00]  
Seff = 3484.14 [1579.92]  
Teq = 1959 [222] K  
Rp = 2.75 [0.78] Re  
a = 0.0372 [0.0102] AU  
Ag = 1.19 [0.60] [0.31σ]  
Teff = 3160 [213] K [3.90σ]

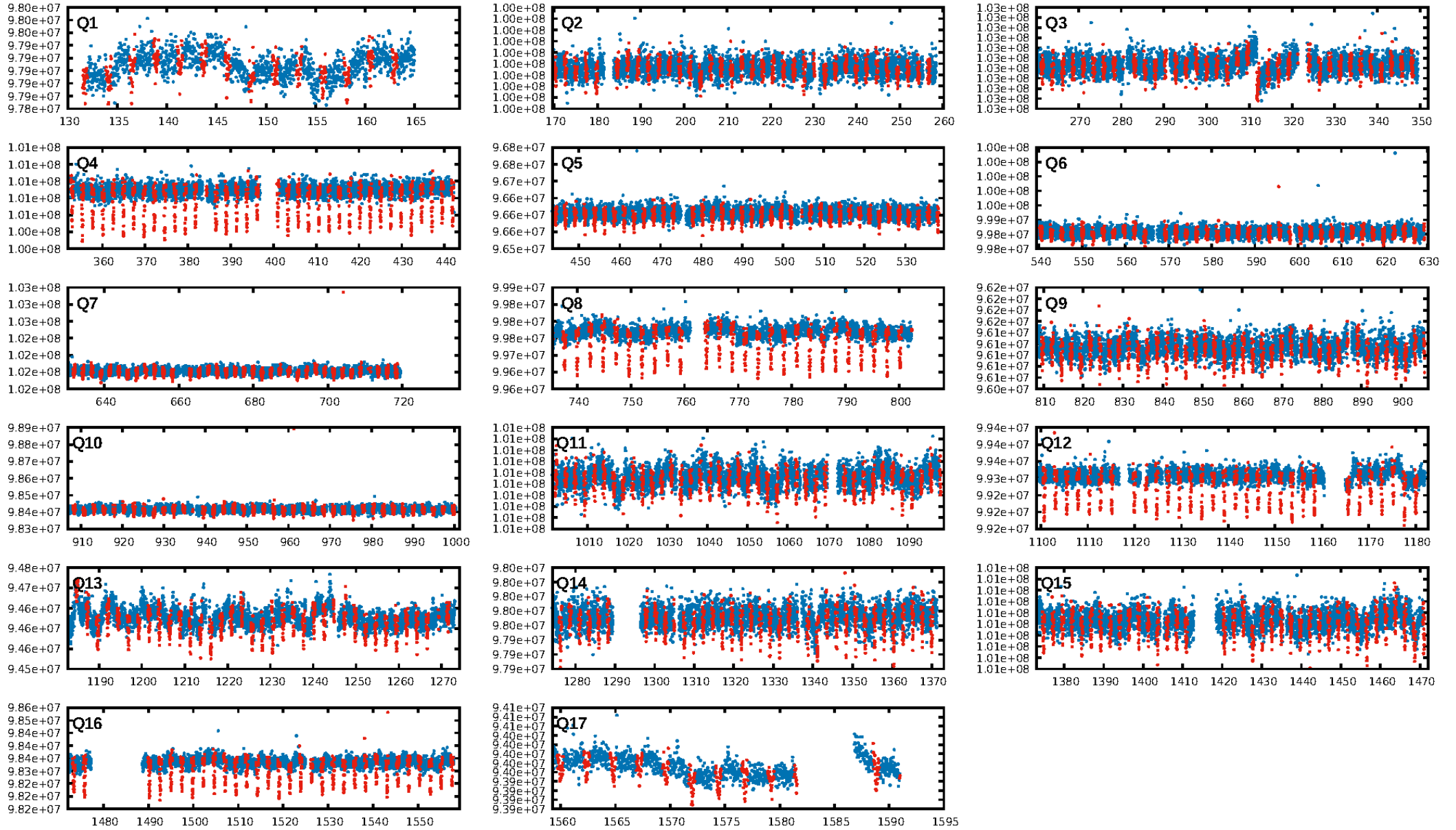
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [18.29σ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [533/533]  
GhostDiagnostic-chr: -0.3661  
Centroid-sig: N/A  
Centroid-so: 87.554 arcsec [369.81σ]  
OotOffset-rm: 4.750 arcsec [10.27σ]  
KicOffset-rm: 4.708 arcsec [9.28σ]  
OotOffset-st: 1/3/0/0 [4]  
KicOffset-st: 1/3/0/0 [4]  
DiffImageQuality-fgm: 1.00 [4/4]  
DiffImageOverlap-fno: 1.00 [17/17]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 22:49:48 Z

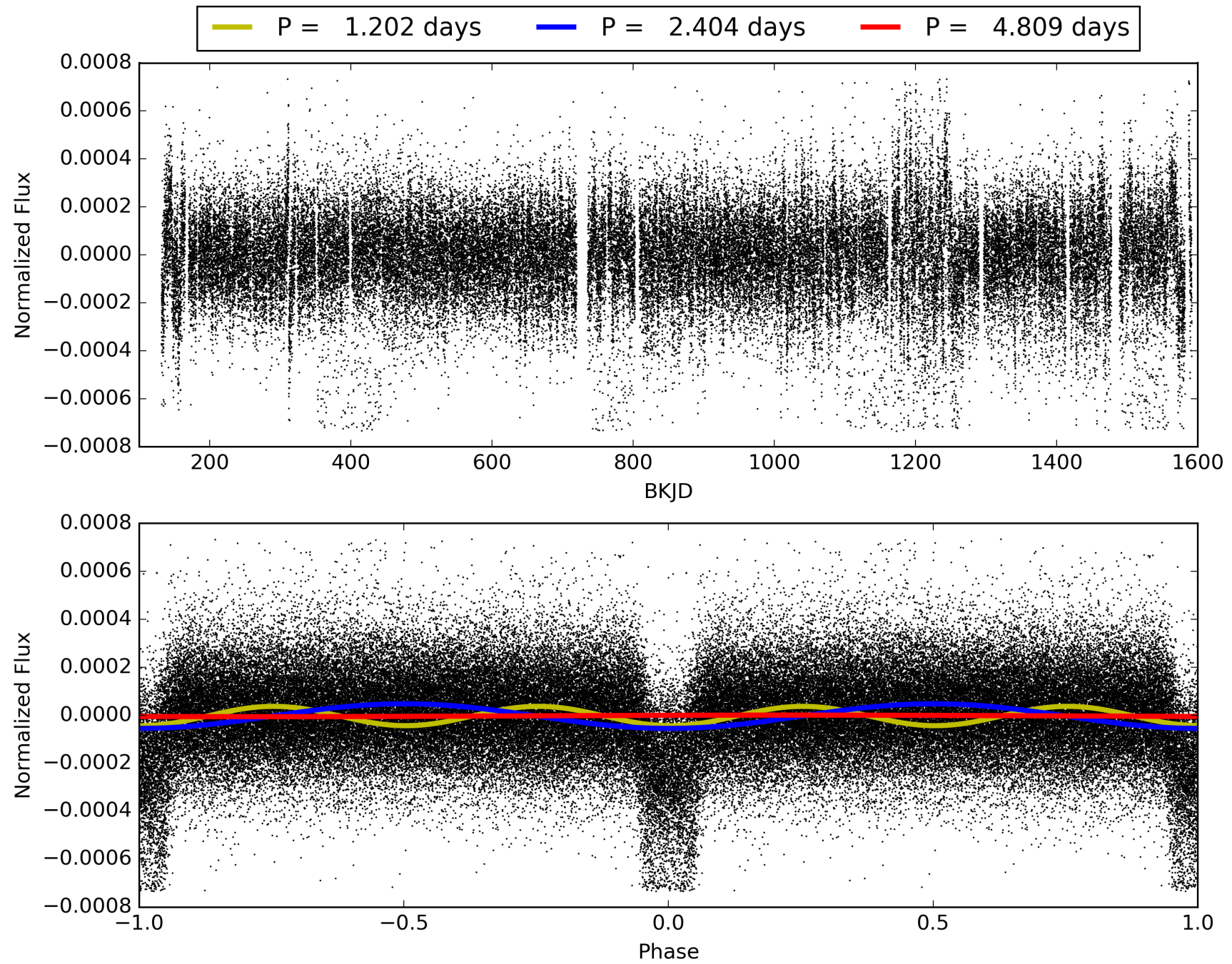
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 009529744-01, PDC Light Curves





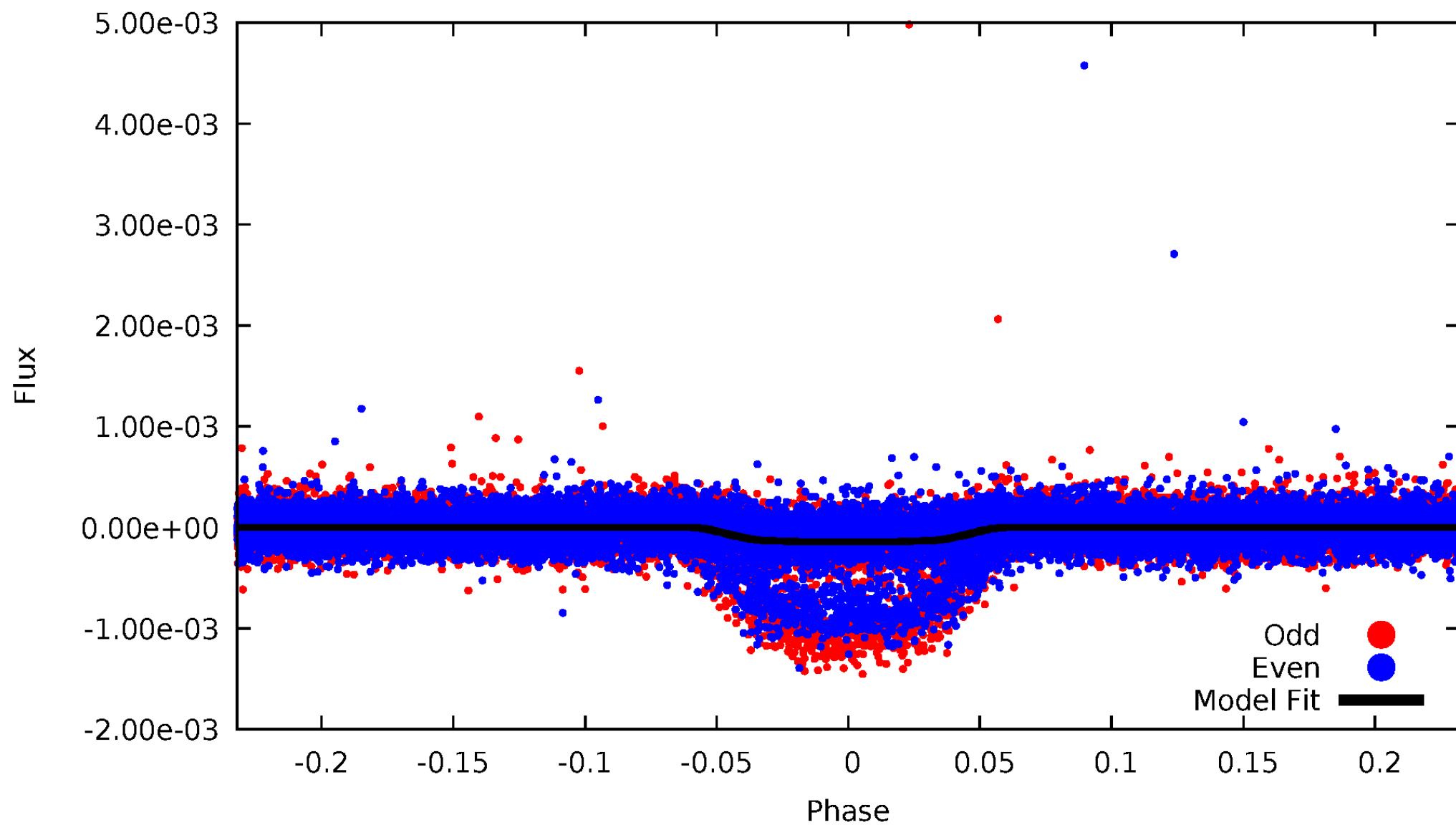
TCE 009529744-01





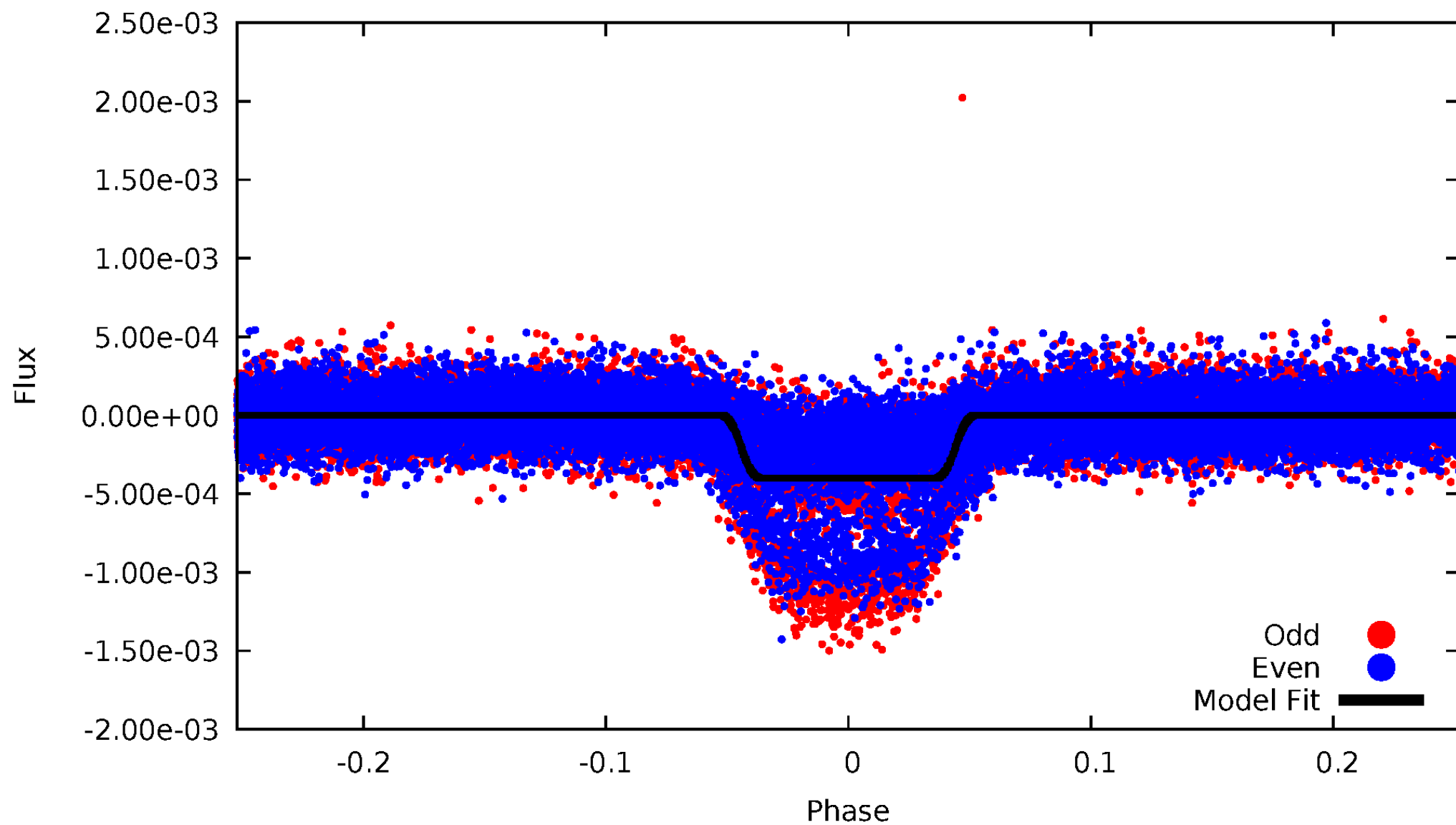
# DV Odd/Even

TCE 009529744-01



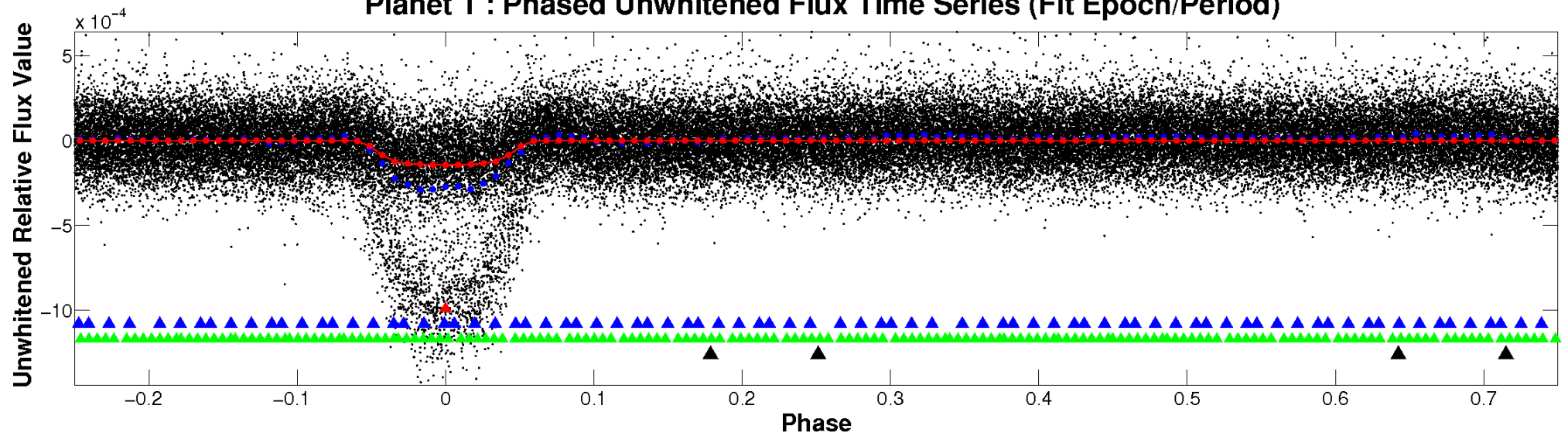
# ALT Odd/Even

TCE 009529744-01

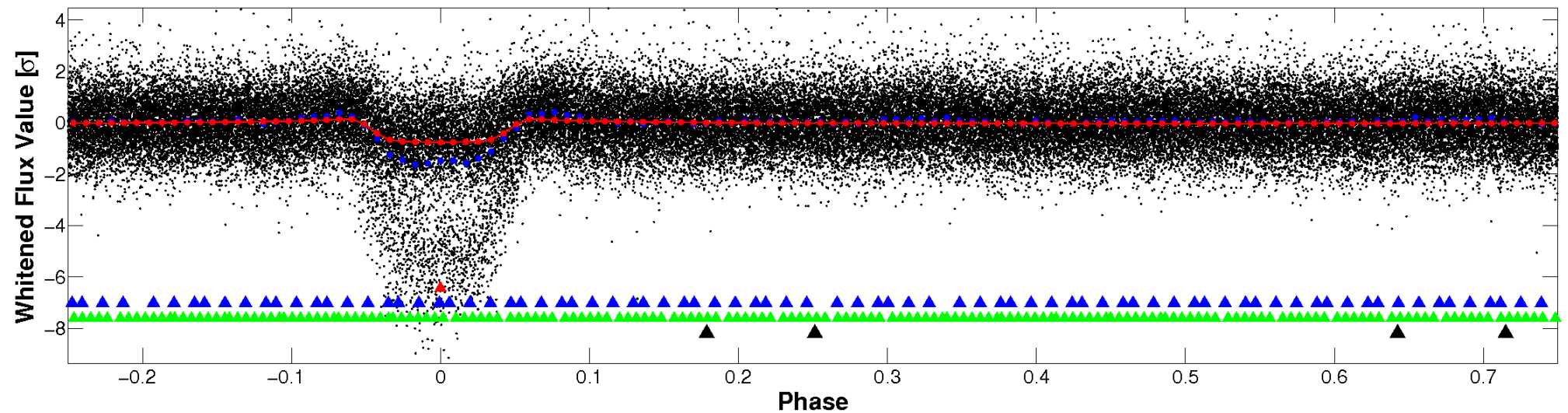


# Non-Whitened Vs. Whitened Light Curve

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



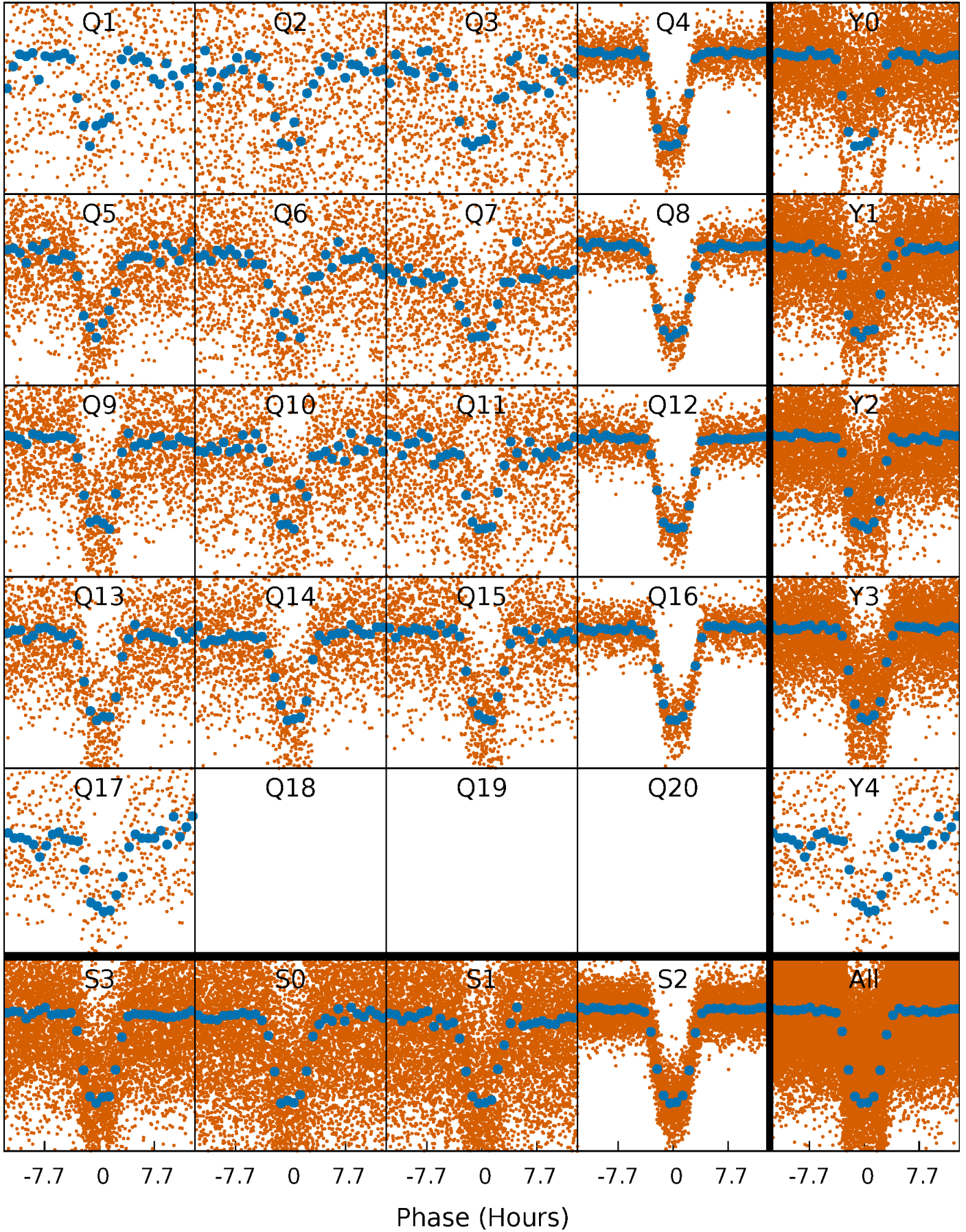
**Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)**





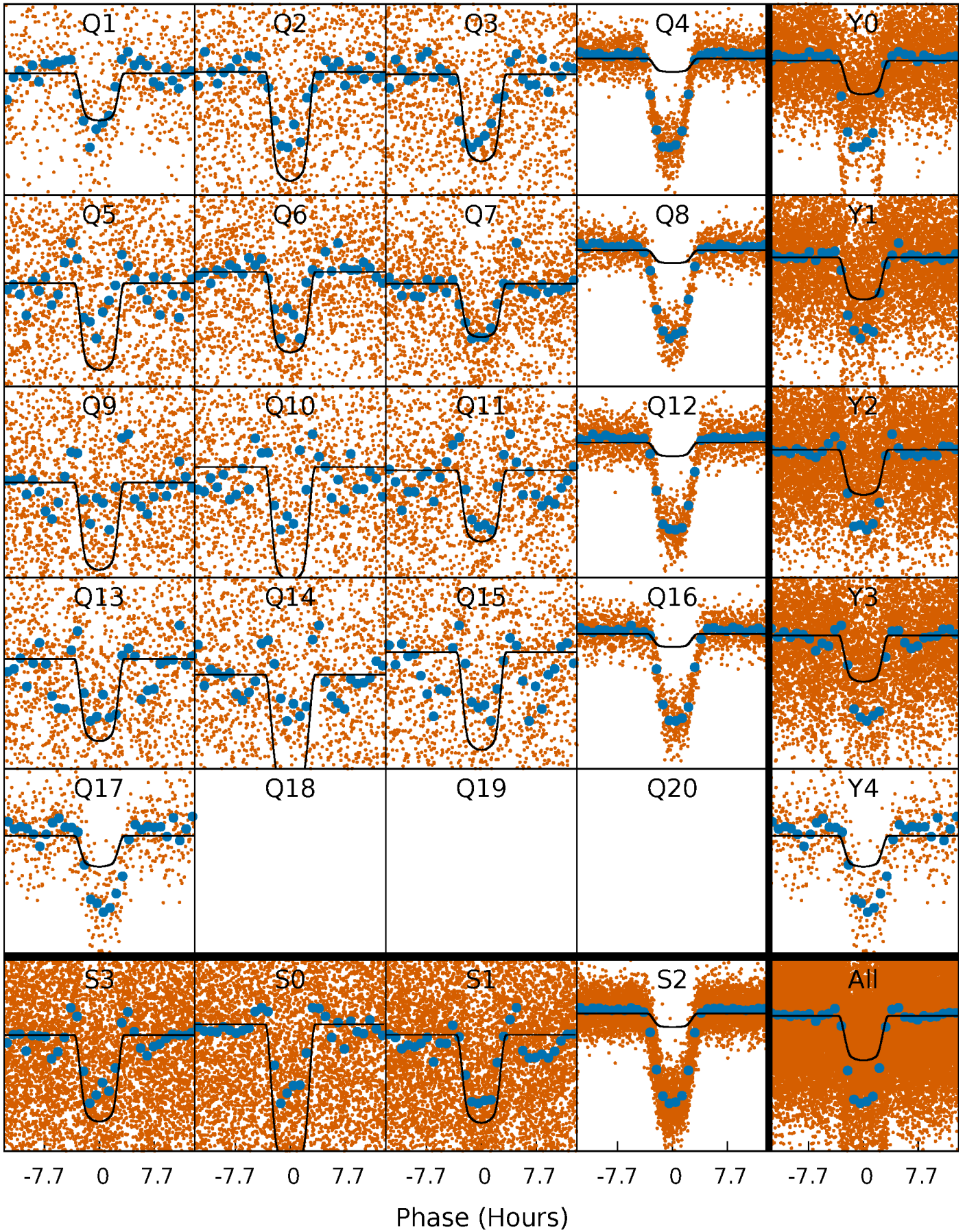
# PDC Quarter-Phased Transit Curves

TCE 009529744-01 P= 2.404478 Days  $T_0=131.701925$  (BKJD)



# DV Quarter-Phased Transit Curves

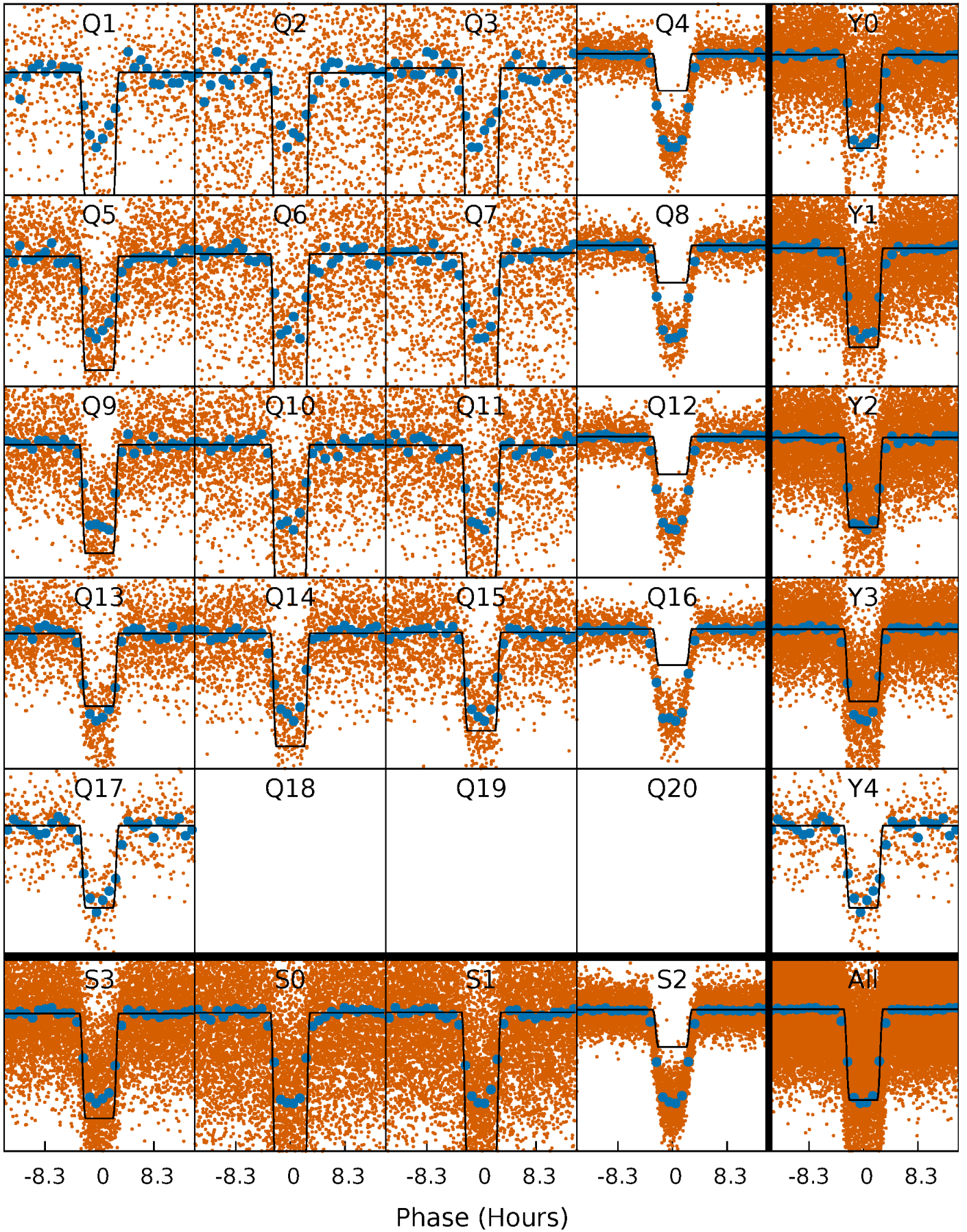
TCE 009529744-01 P= 2.404478 Days  $T_0=131.701925$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

TCE 009529744-01 P= 2.404568 Days  $T_0=131.672547$  (BKJD)

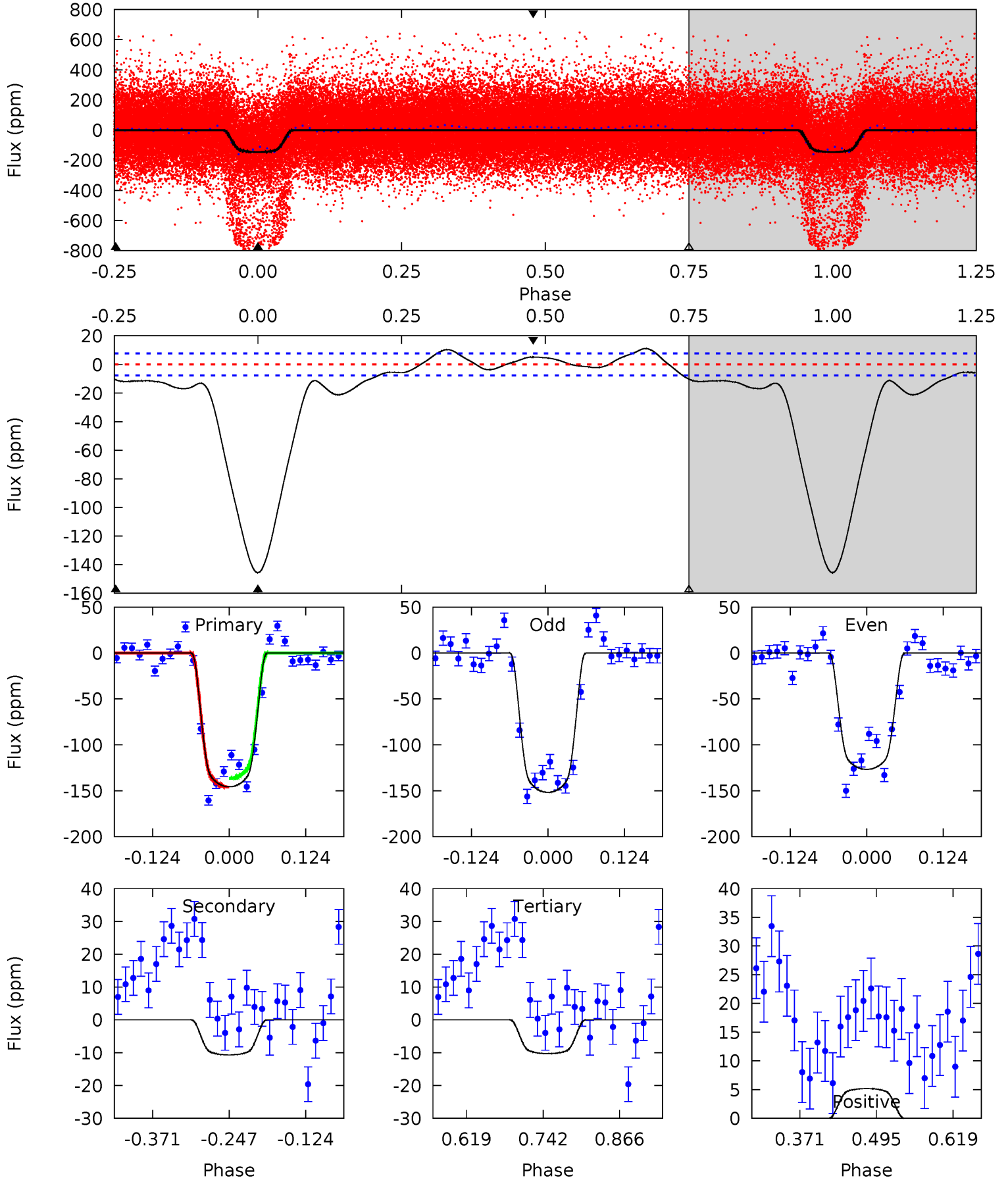




# DV Model-Shift Uniqueness Test

009529744-01, P = 2.404478 Days, E = 129.297447 Days

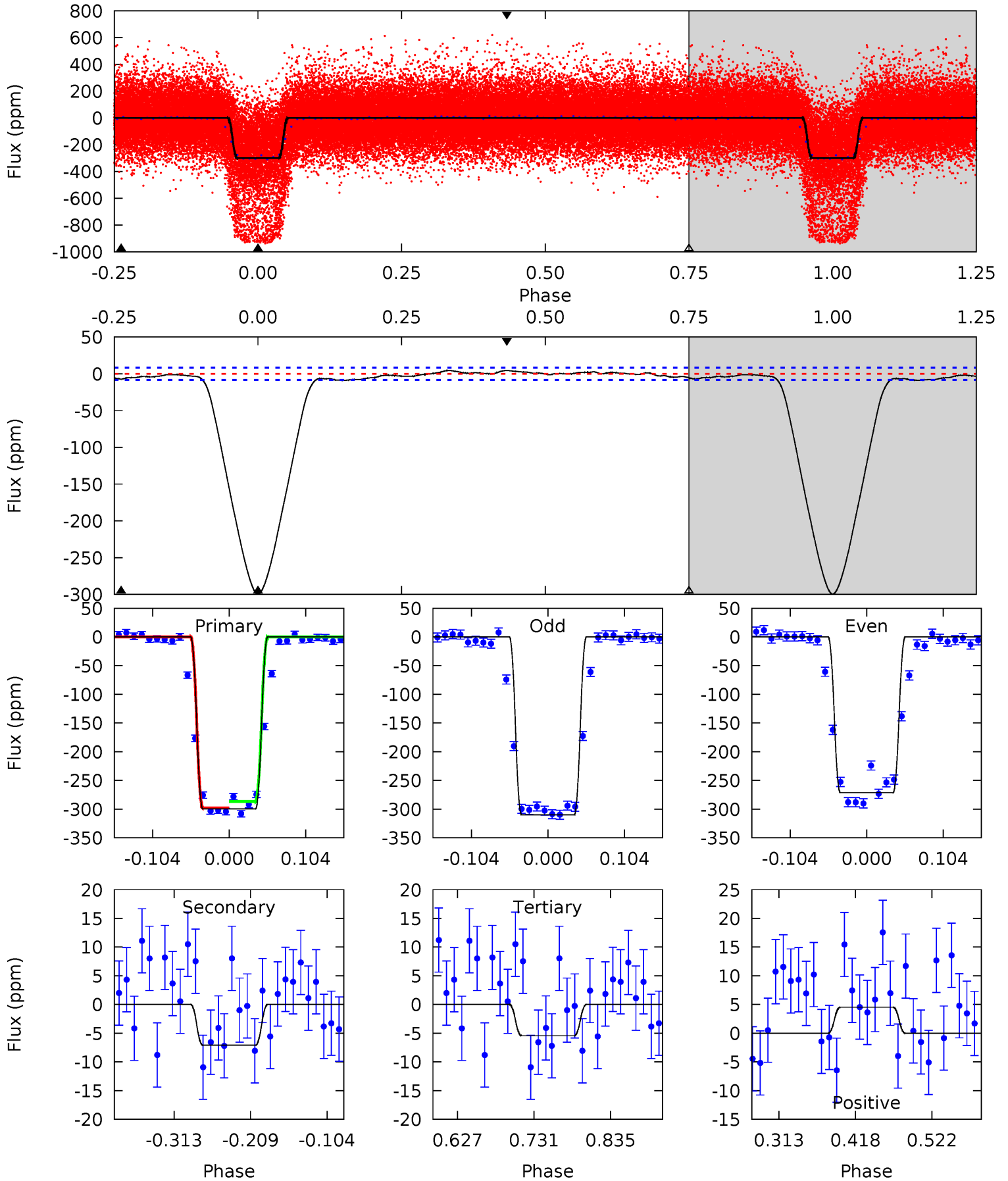
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
84.8	6.23	5.99	3.02	4.52	1.54	4.51	78.8	81.8	0.24	3.21	7.29	2.35	0.07	0



# Alt Model-Shift Uniqueness Test

009529744-01, P = 2.404568 Days, E = 129.267979 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
166.4	3.94	3.03	2.51	4.56	1.62	1.90	163.3	163.9	0.91	1.42	10.7	1.51	0.01	0



### Stellar Parameters For KIC 009529744

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$\rho_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6426^{+175}_{-175}$	$4.013^{+0.259}_{-0.130}$	$-0.240^{+0.300}_{-0.250}$	$1.775^{+0.411}_{-0.503}$	$1.182^{+0.209}_{-0.157}$	$0.298^{+0.438}_{-0.115}$
	+3%/-3%	+6%/-3%	+125%/-104%	+23%/-28%	+18%/-13%	+147%/-39%
Source	PHO1	FLK73	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 009529744-01 / KOI 1806.01

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-11 \pm 2$	$2.72^{+0.34}_{-0.41}$	$2718^{+166}_{-215}$	$3379^{+141}_{-145}$	$1.121^{+0.459}_{-0.291}$
Alt.	$-7 \pm 2$	$3.84^{+0.52}_{-0.63}$	$2711^{+175}_{-227}$	$2418^{+334}_{-4780}$	$0.369^{+0.173}_{-0.114}$

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



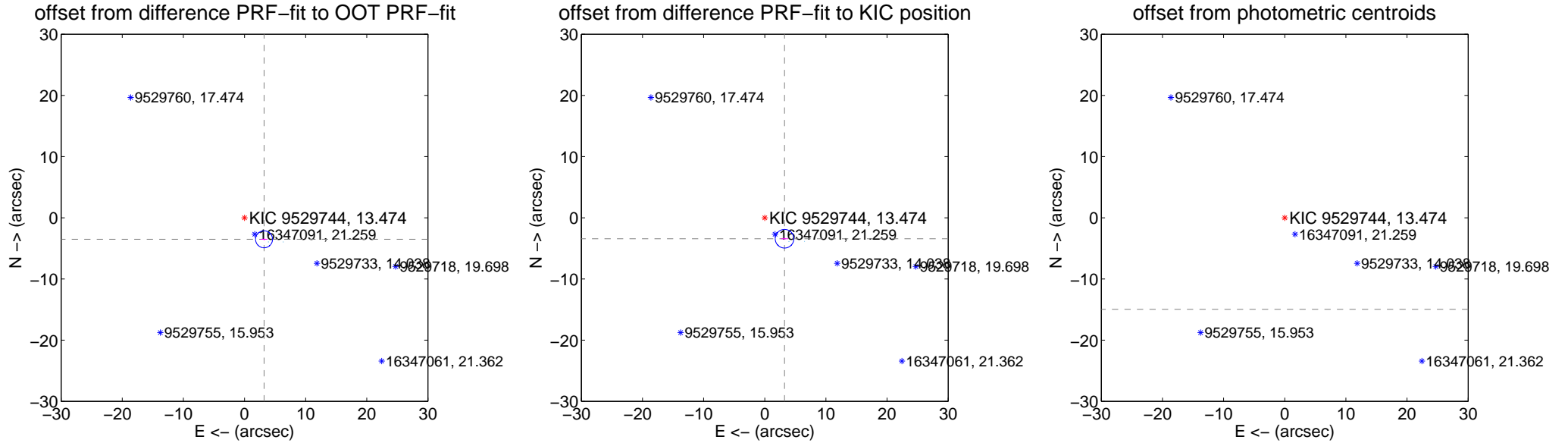
## DV Centroid Data

Supplemental centroid analysis for 009529744-01. Kepler magnitude: 13.47. Transit SNR 48.25

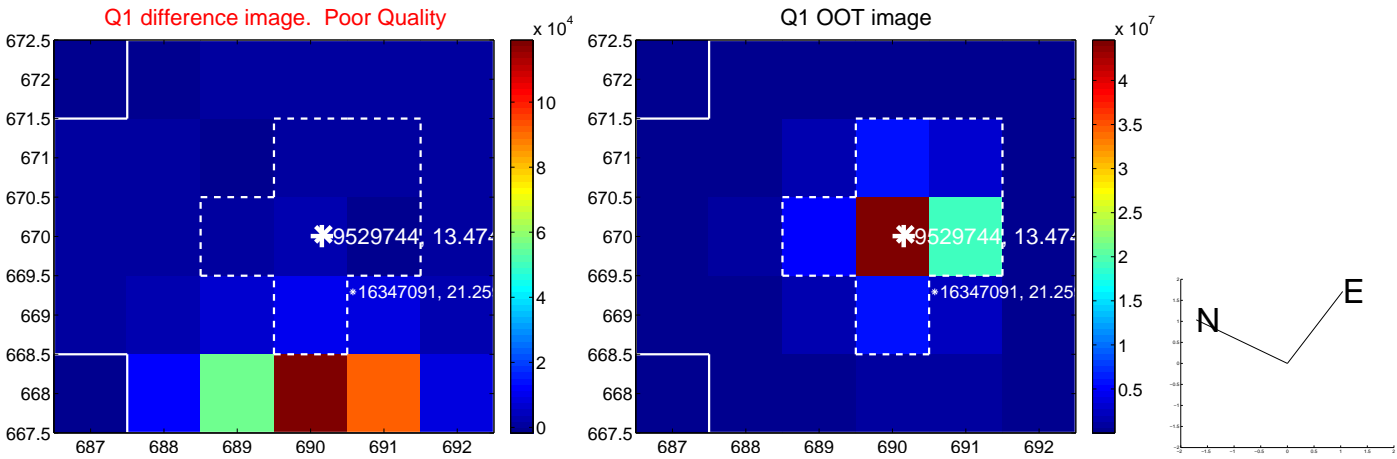
There are 4 quarters with good PRF difference image offsets

The direct PRF centroid is offset from the target star catalog position by about 0.12 arcsec

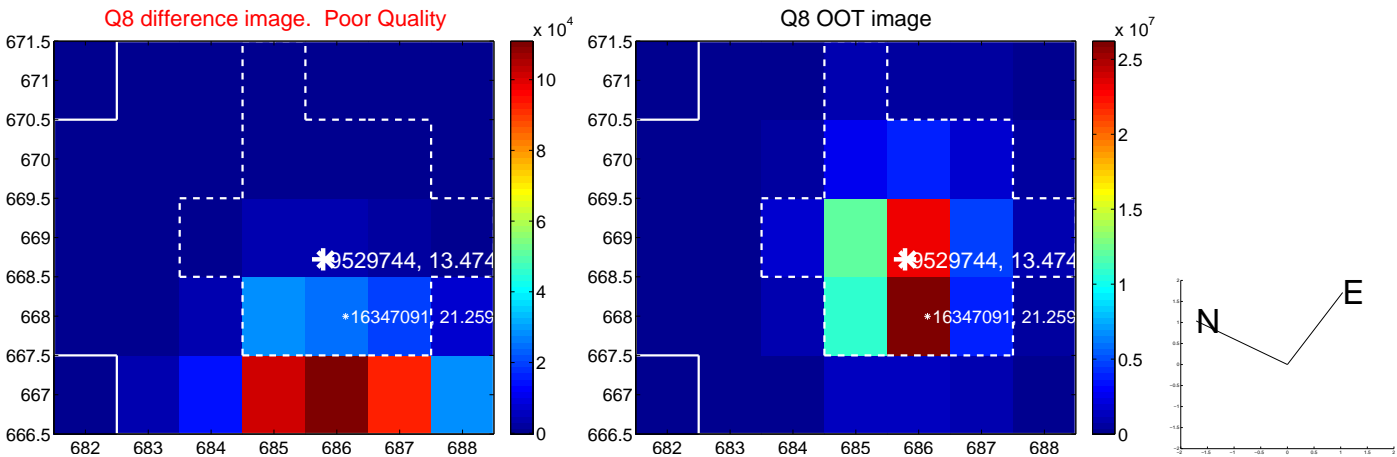
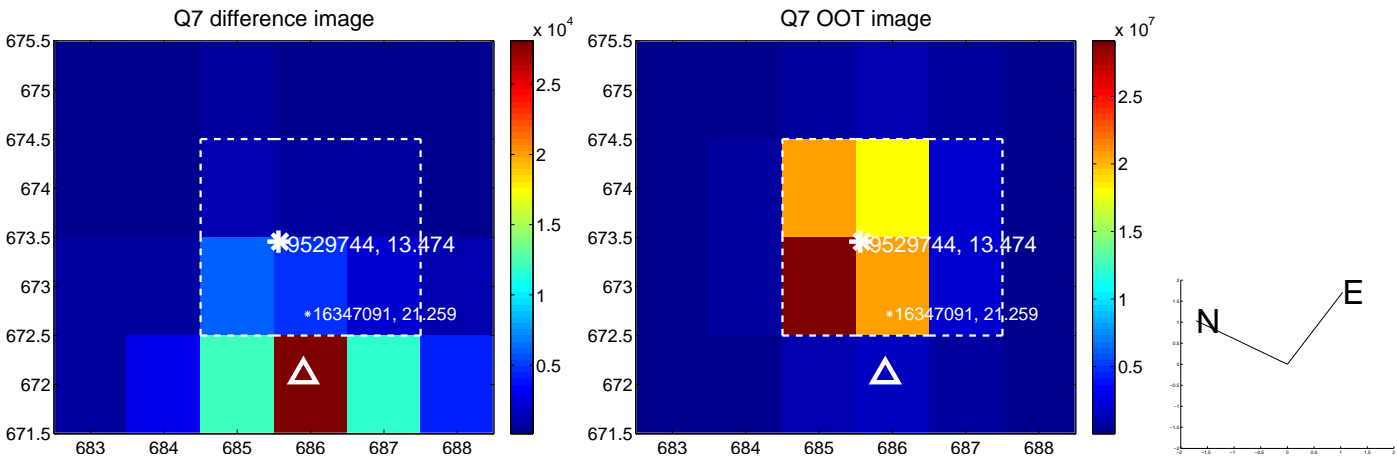
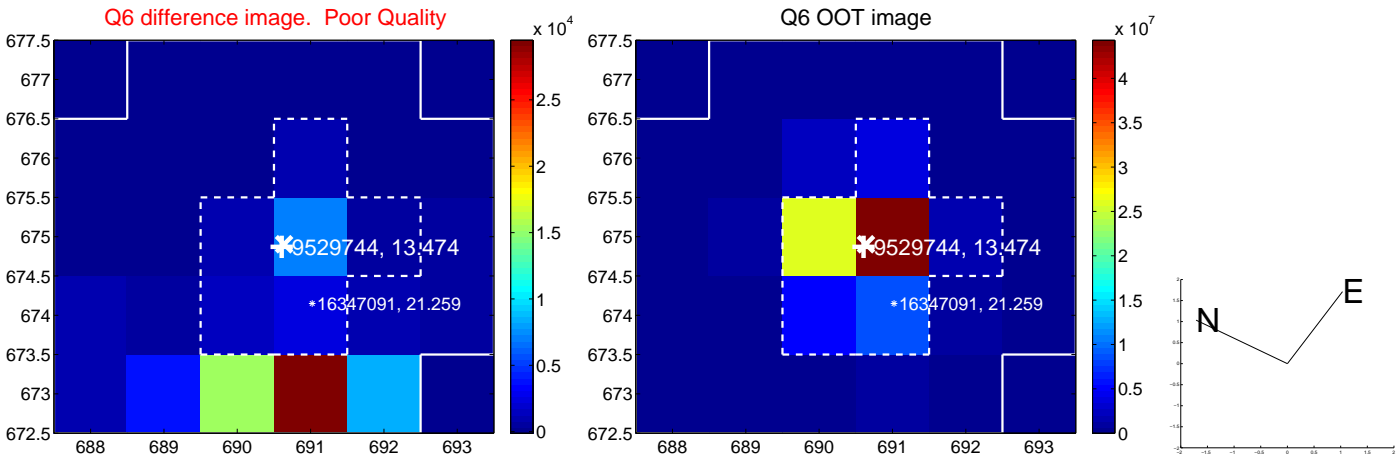
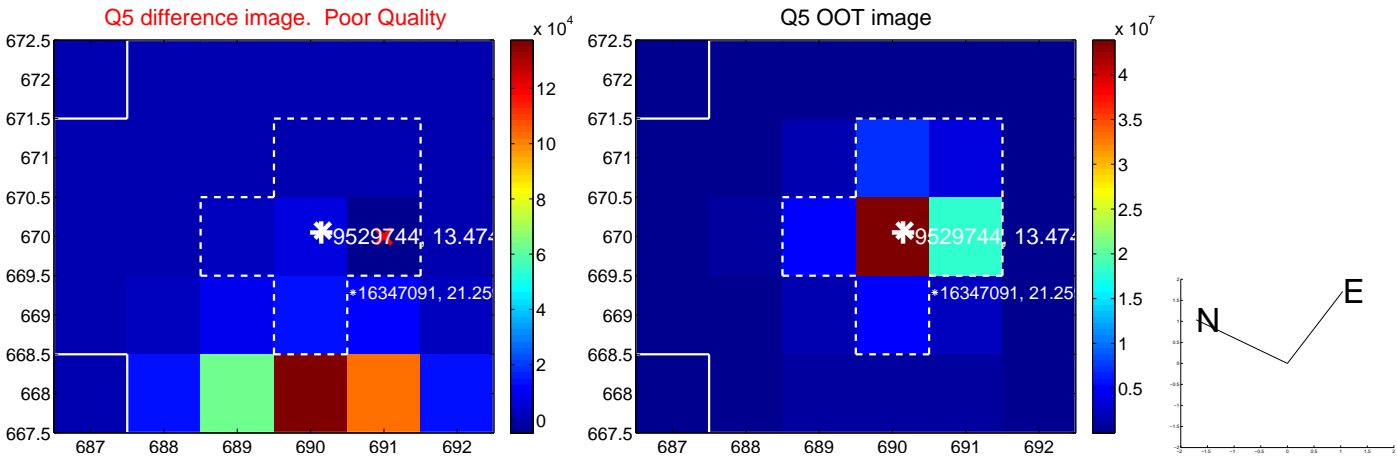
	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$4.750 \pm 0.463$	10.27	$-3.195 \pm 0.564$	$-3.514 \pm 0.164$
PRF-fit source offset from KIC position	$4.708 \pm 0.507$	9.28	$-3.233 \pm 0.601$	$-3.422 \pm 0.173$
photometric centroid source offset	$87.56 \pm 0.24$	369.81	$-86.27 \pm 0.24$	$-14.95 \pm 0.24$



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

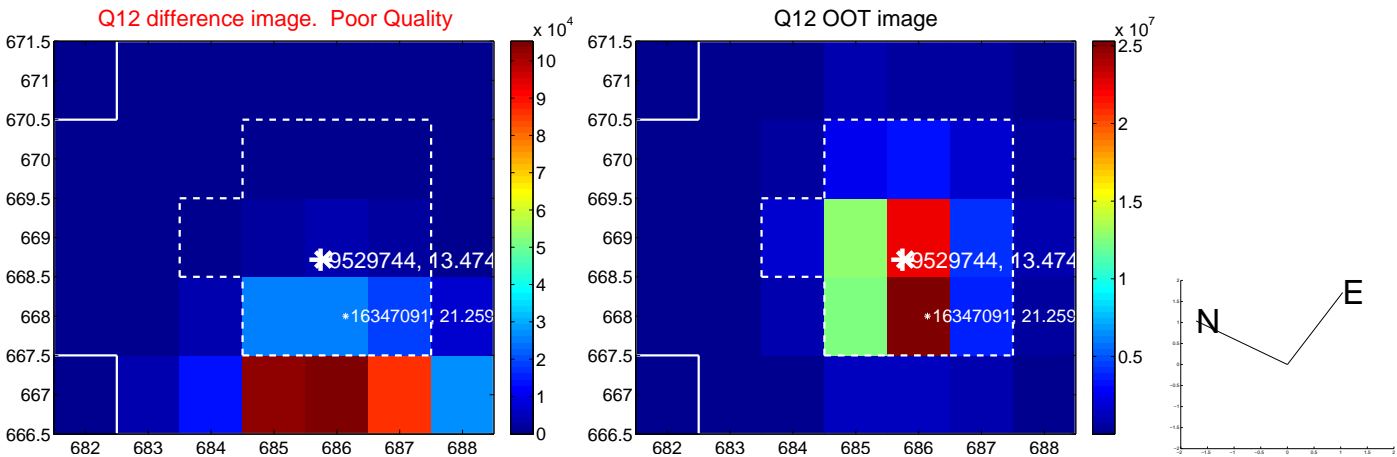
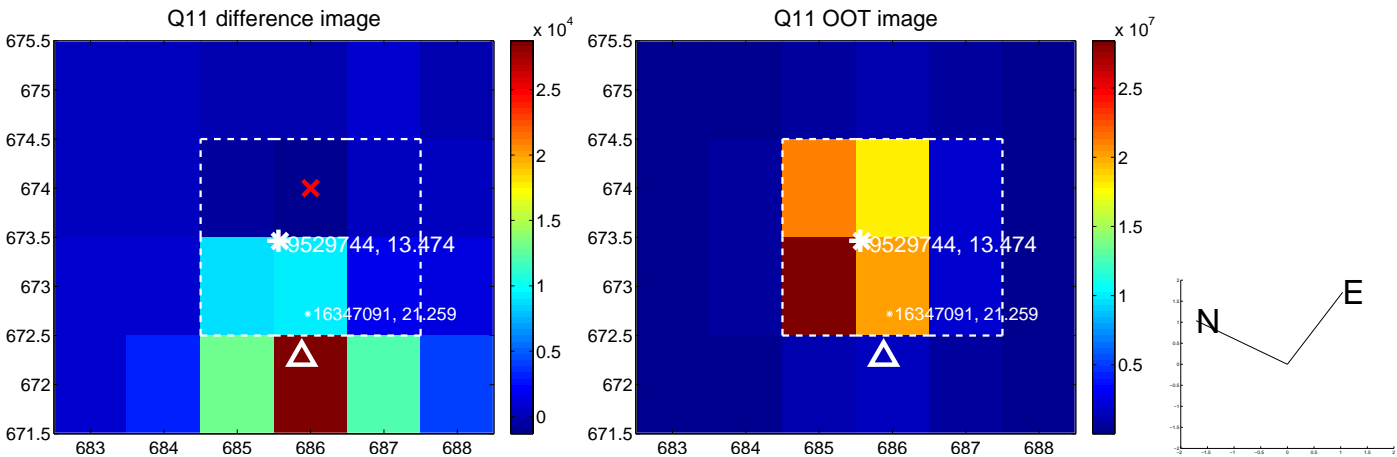
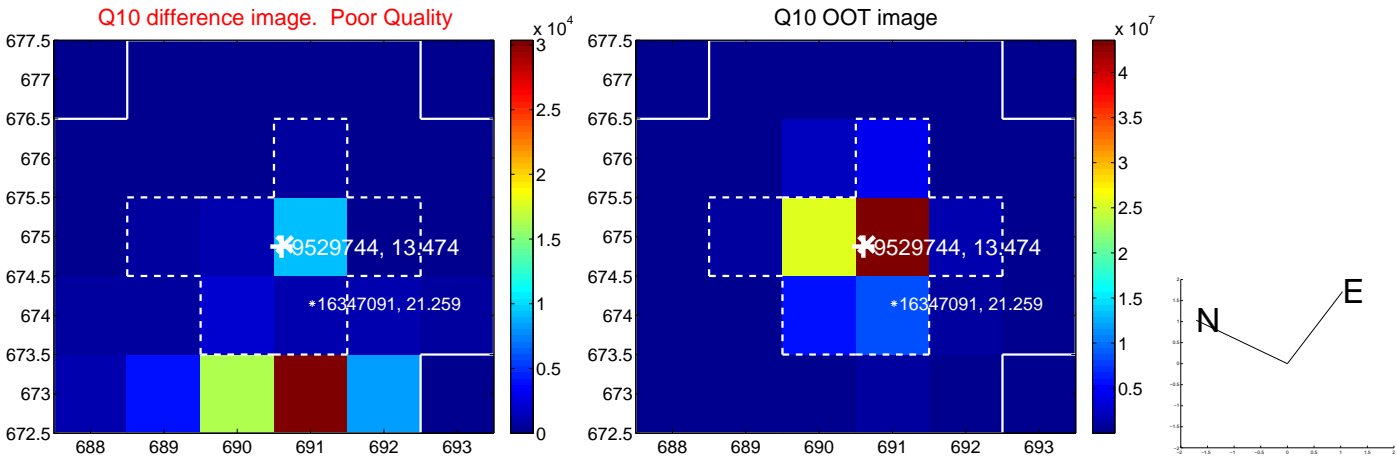
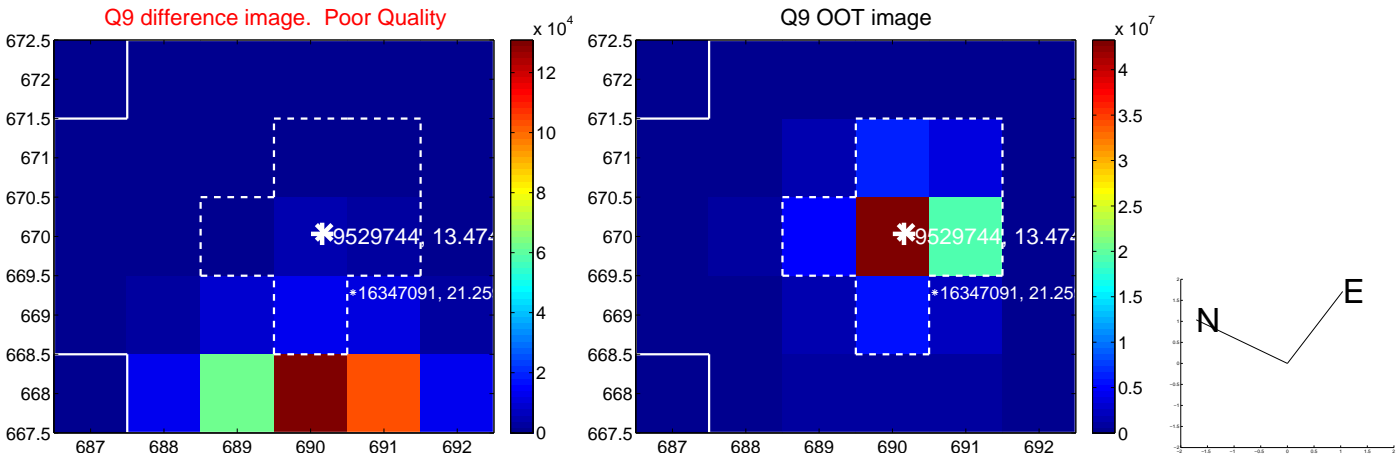


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

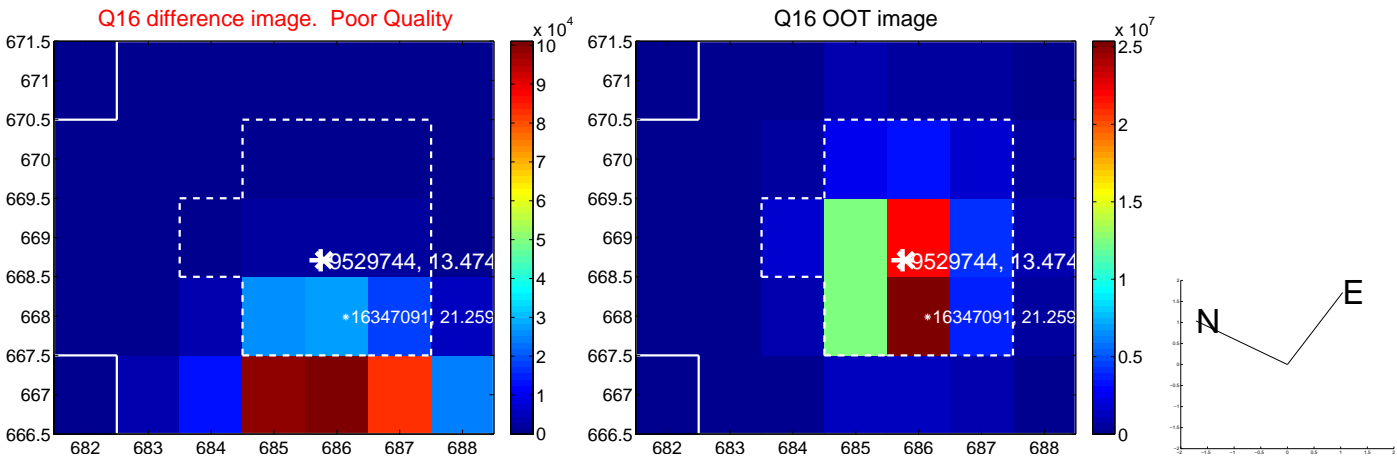
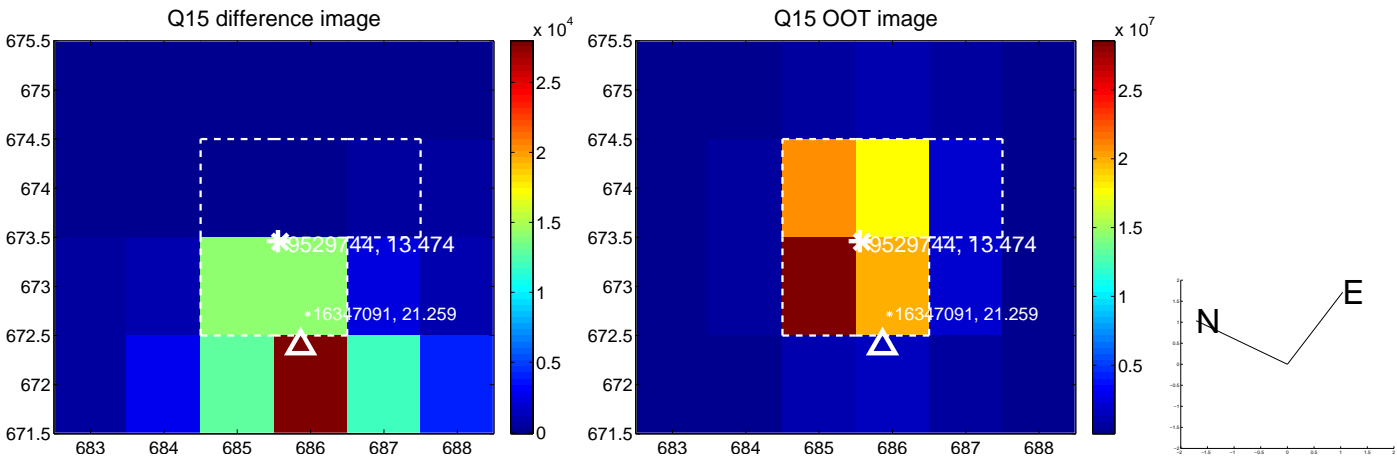
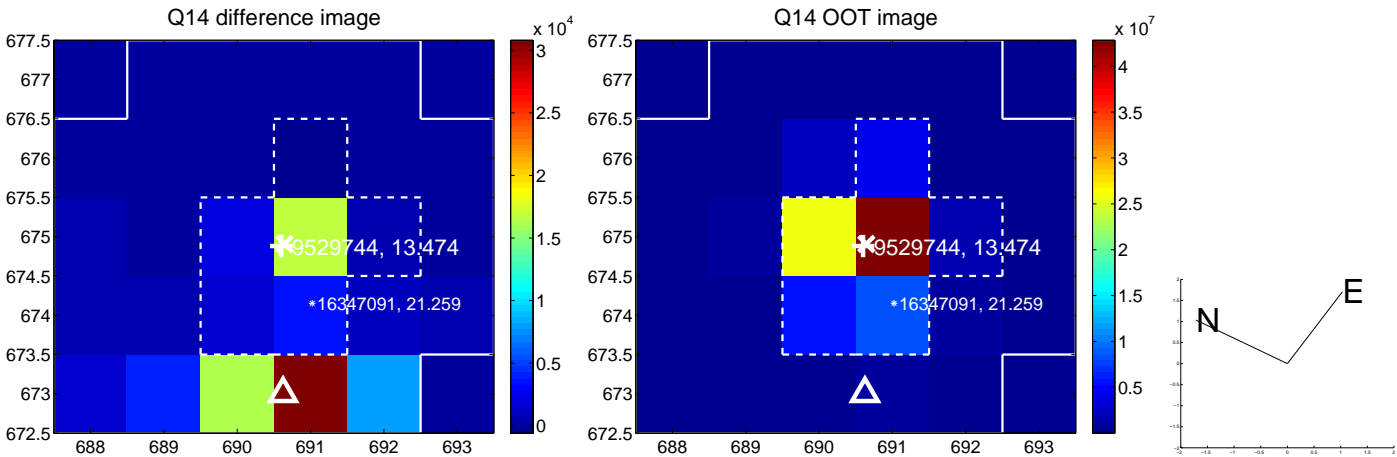
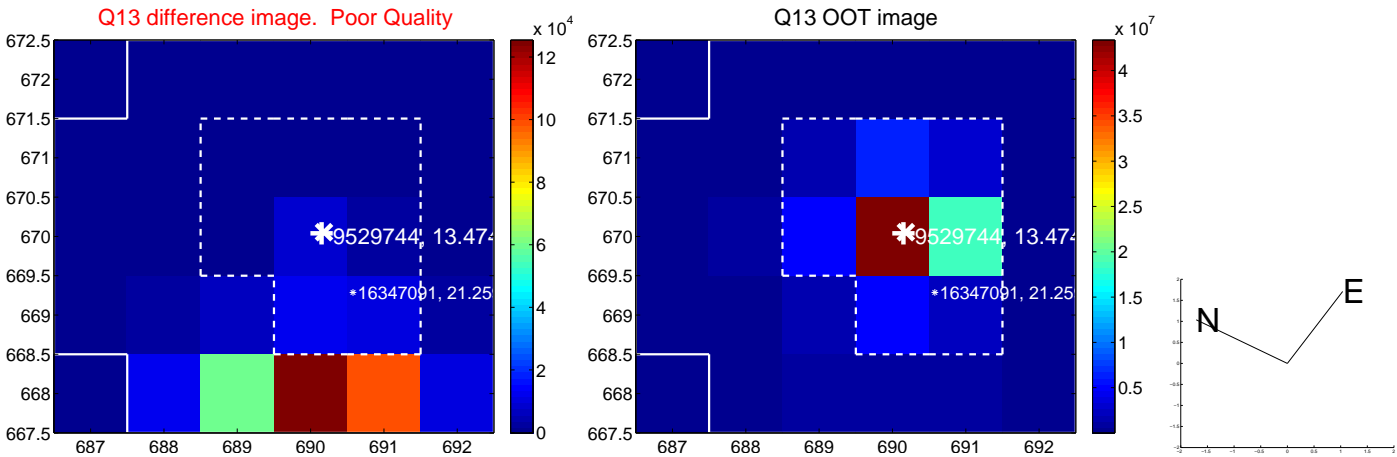




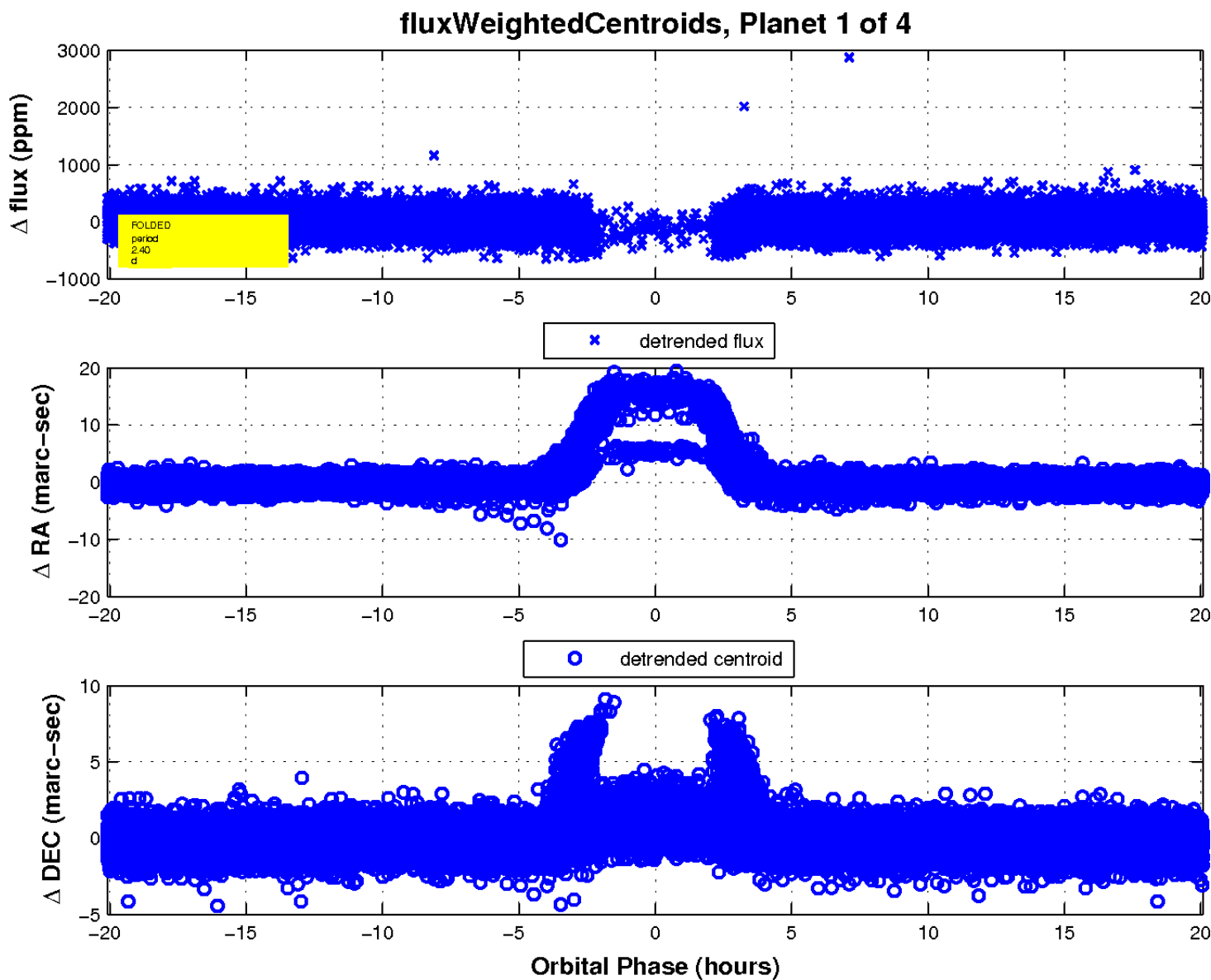
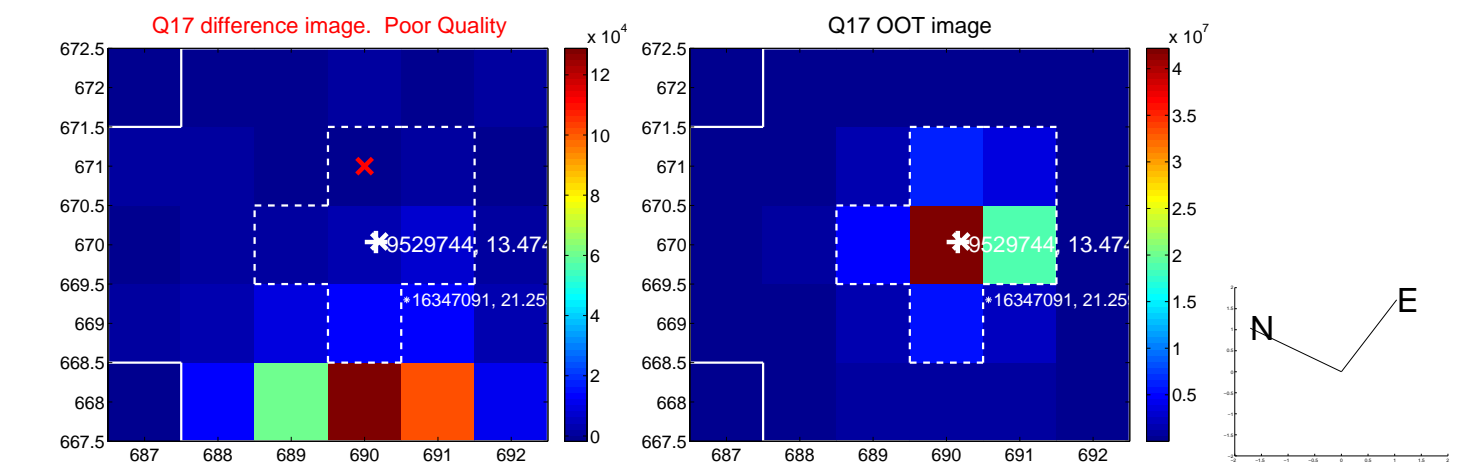
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



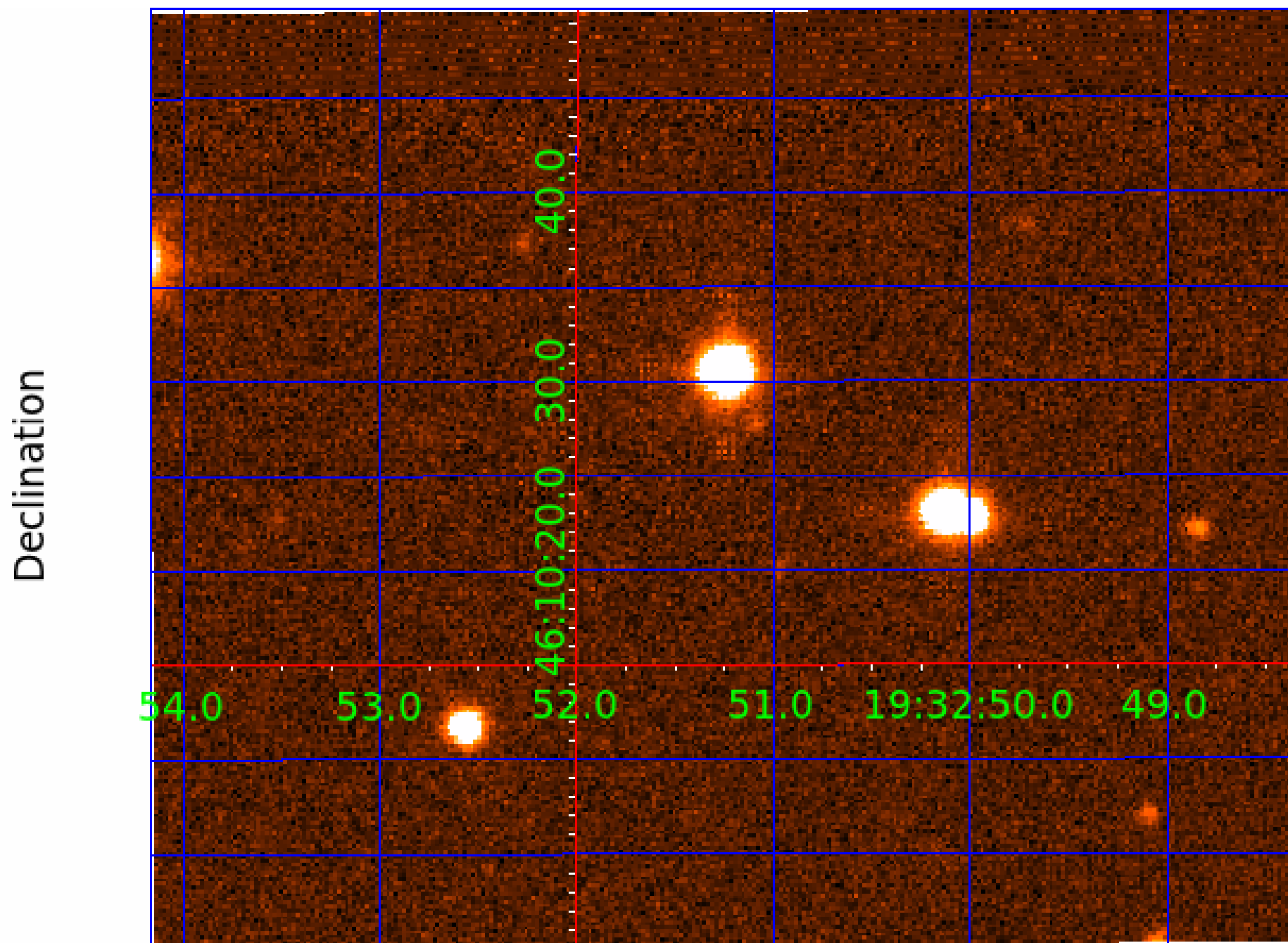
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



UKIRT Image



# KIC 009529744

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009529744-01	OBS	1806.01	2.404478	131.701925	143.9	6.695	101.2	48.3	1.77	6426	2.75	3484.14
009529744-02	OBS	1806.02	17.934775	138.221478	136.2	5.309	15.1	16.7	1.77	6426	2.43	239.07
009529744-03	OBS	1806.03	8.371643	137.680577	88.0	4.061	12.5	14.3	1.77	6426	1.99	660.25
009529744-04	OBS	No	470.162593	154.886986	452.9	12.500	12.9	-1.0	1.77	6426	3.79	3.07

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009529744-01	OBS	FP	0.00	1	0	1	1	LPP_DV—CENT_RESOLVED_OFFSET—EPHEM_MATCH
009529744-02	OBS	PC	0.97	0	0	0	0	NO_COMMENT
009529744-03	OBS	PC	1.00	0	0	0	0	NO_COMMENT
009529744-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_CHASES_MARSHALL_SKYE—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT—INCONSISTENT_TRANS—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 009529744-02

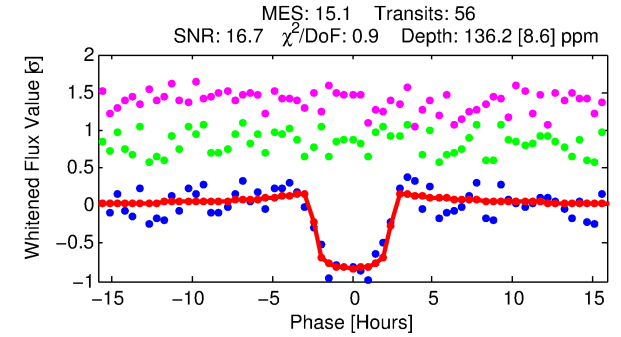
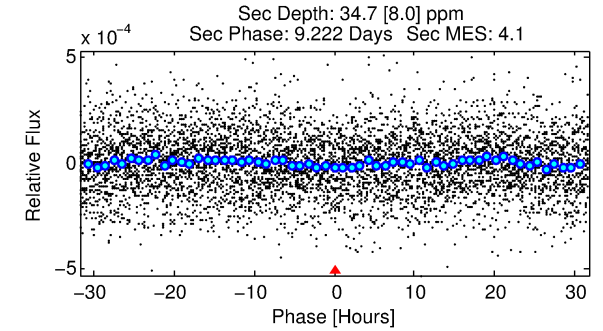
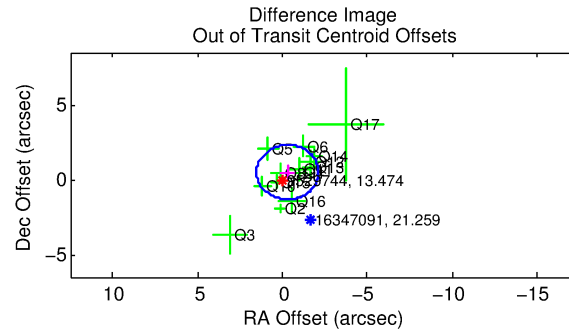
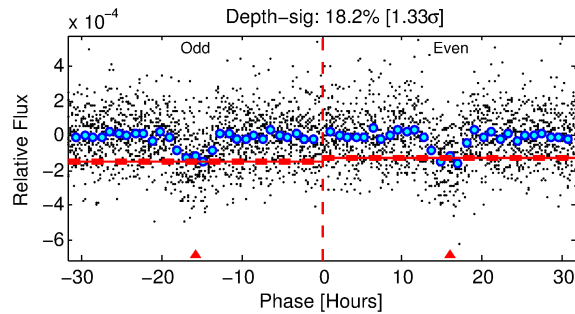
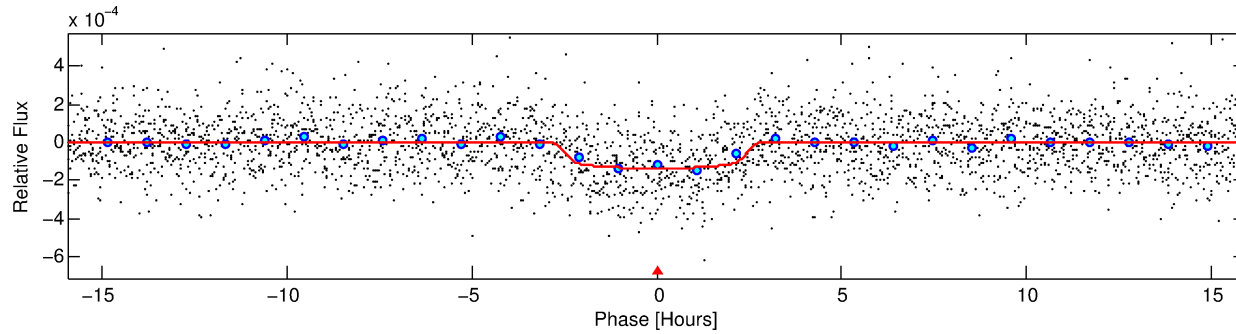
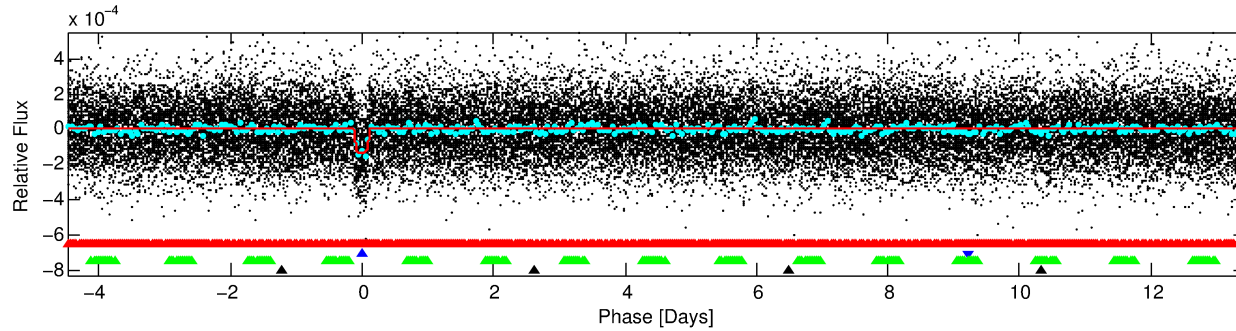
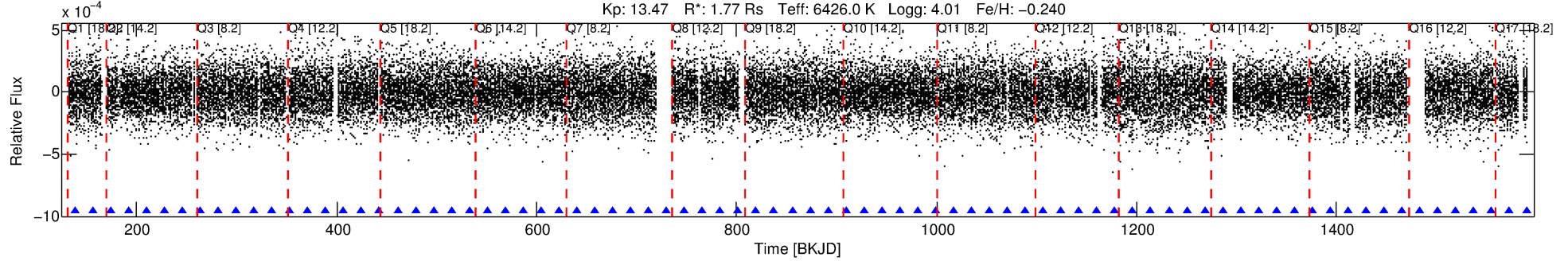
No Significant Match Found



# DV One-Page Summary

KIC: 9529744 Candidate: 2 of 4 Period: 17.935 d  
KOI: K01806.02 Name: Kepler-320c Corr: 0.974

Kp: 13.47 R\*: 1.77 Rs Teff: 6426.0 K Logg: 4.01 Fe/H: -0.240



## DV Fit Results:

Period = 17.93478 [0.00013] d  
Epoch = 138.2215 [0.0060] BKJD  
Rp/R\* = 0.0126 [0.0022]  
a/R\* = 11.77 [11.29]  
b = 0.90 [0.20]  
Seff = 239.07 [108.41]  
Teq = 1003 [114] K  
Rp = 2.43 [0.81] Re  
a = 0.1419 [0.0389] AU  
Ag = 65.04 [39.42] [1.62σ]  
Teffp = 4402 [474] K [6.97σ]

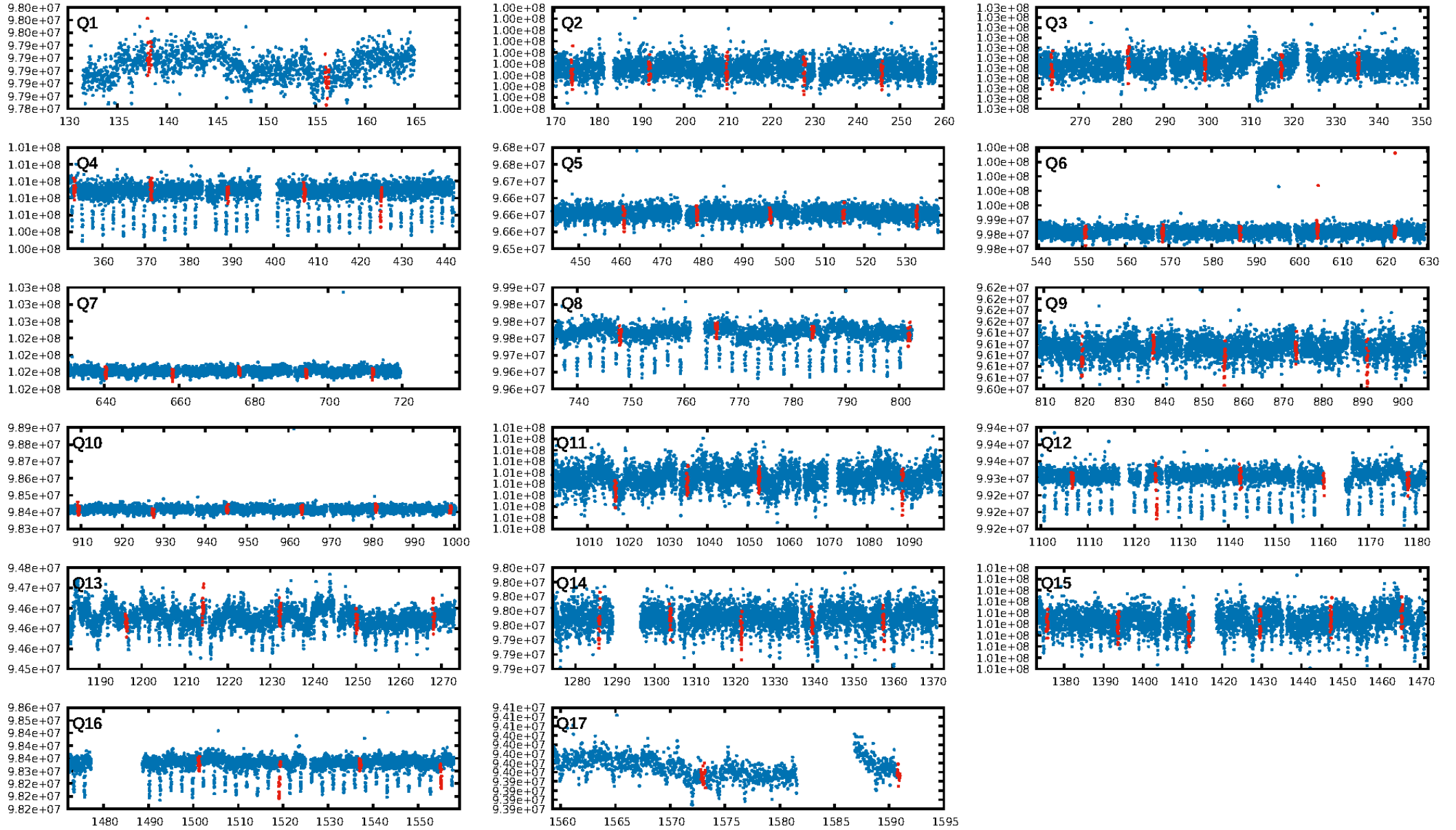
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [34.34σ]  
LongPeriod-sig: 100.0% [799.17σ]  
ModelChiSquare2-sig: 59.7%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [53/53]  
GhostDiagnostic-chr: 12.45  
Centroid-sig: N/A  
Centroid-so: 1.621 arcsec [2.36σ]  
OotOffset-rm: 0.577 arcsec [0.95σ]  
KicOffset-rm: 0.723 arcsec [1.26σ]  
OotOffset-st: 4/3/4/3 [14]  
KicOffset-st: 4/3/4/3 [14]  
DiffImageQuality-fgm: 0.86 [12/14]  
DiffImageOverlap-fno: 0.94 [16/17]

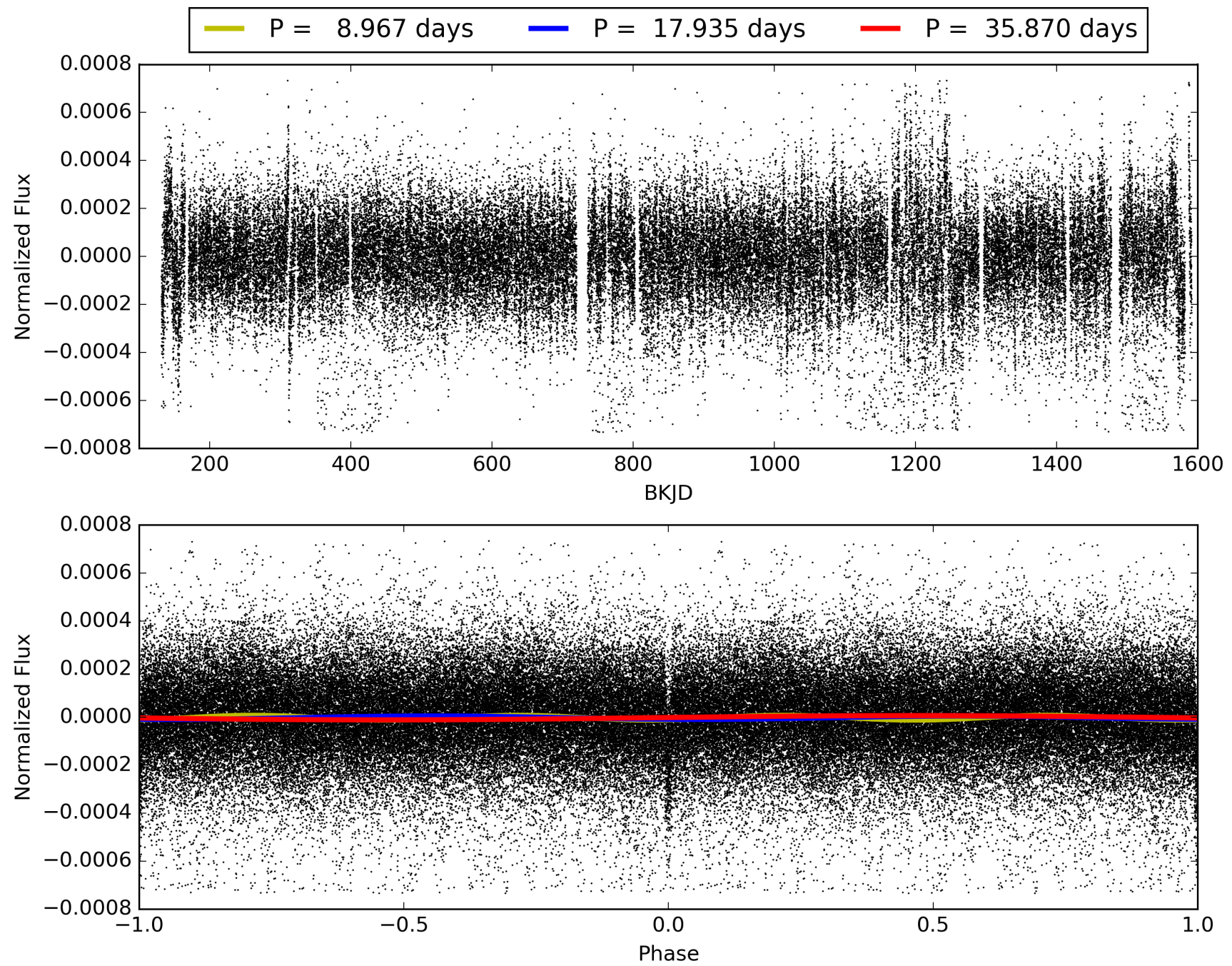
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 22:49:57 Z

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

# TCE 009529744-02, PDC Light Curves

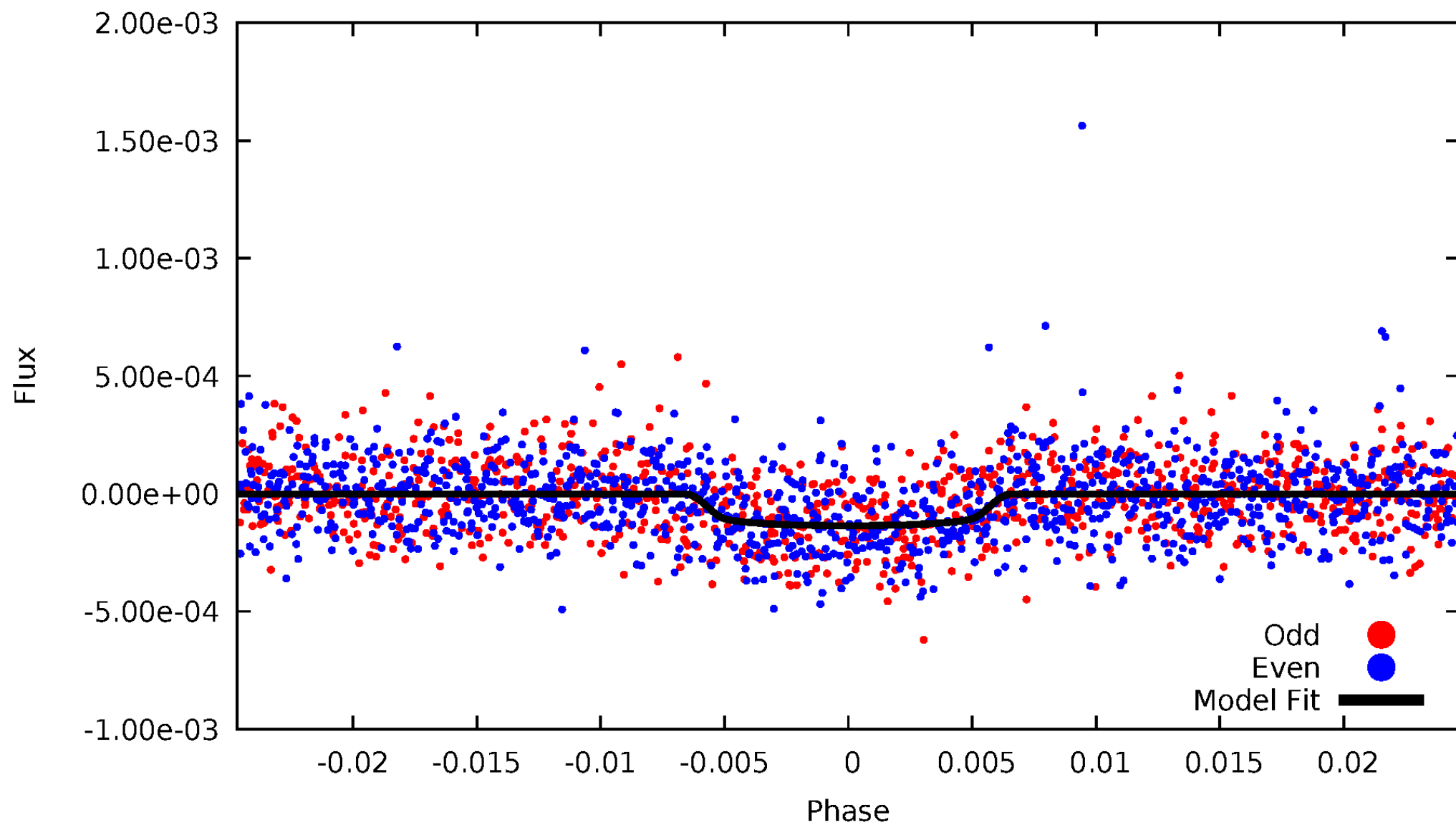


TCE 009529744-02



# DV Odd/Even

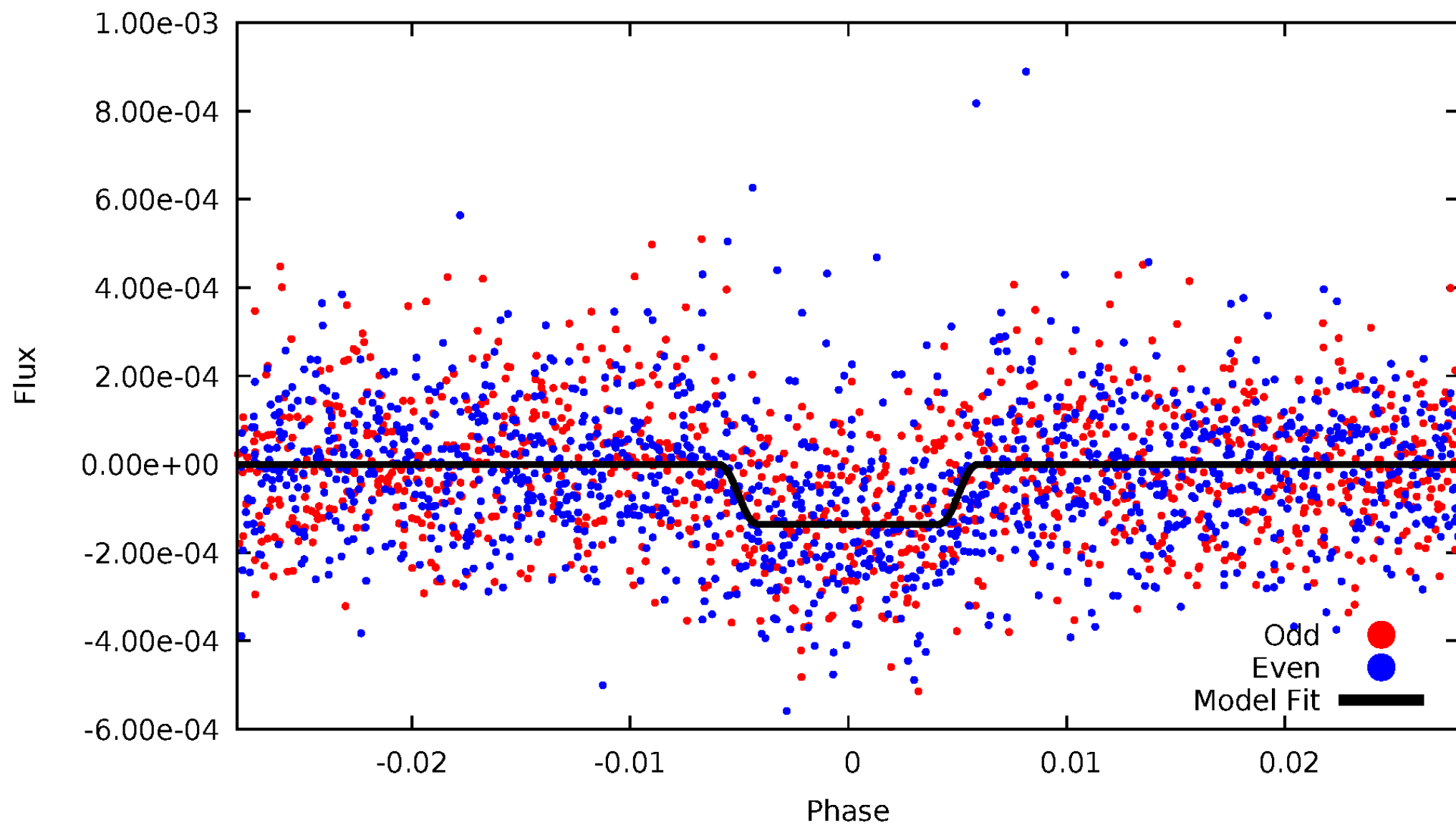
TCE 009529744-02





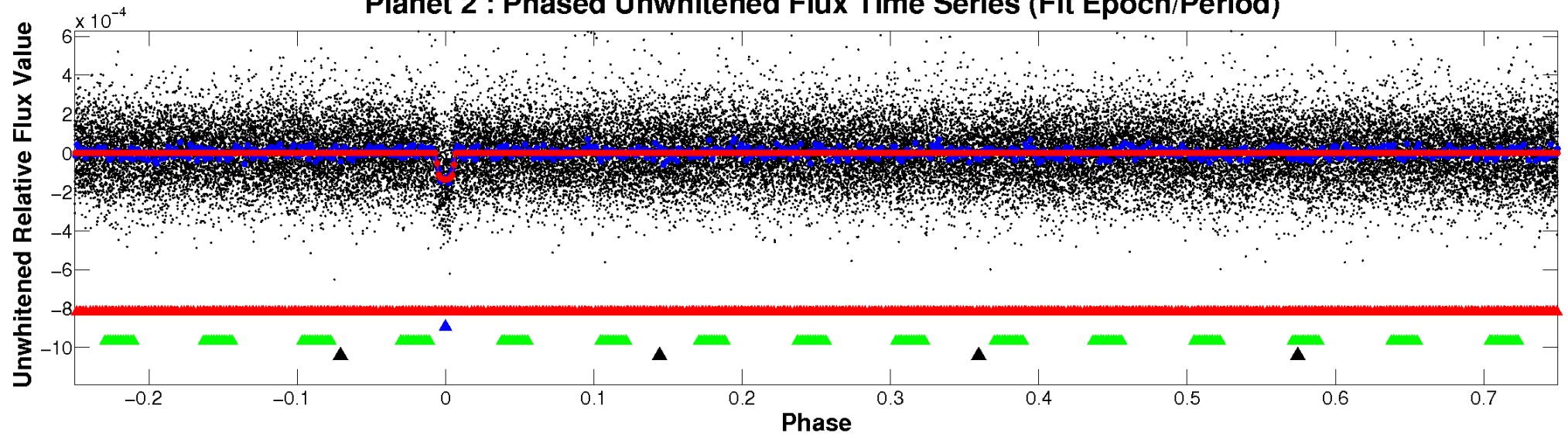
# ALT Odd/Even

TCE 009529744-02

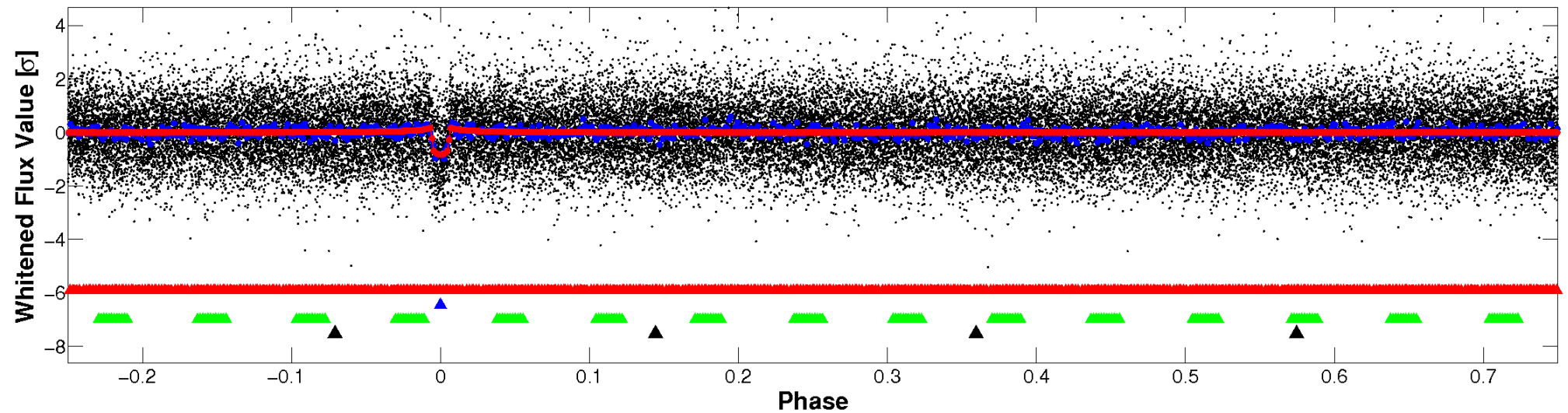


# Non-Whitened Vs. Whitened Light Curve

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

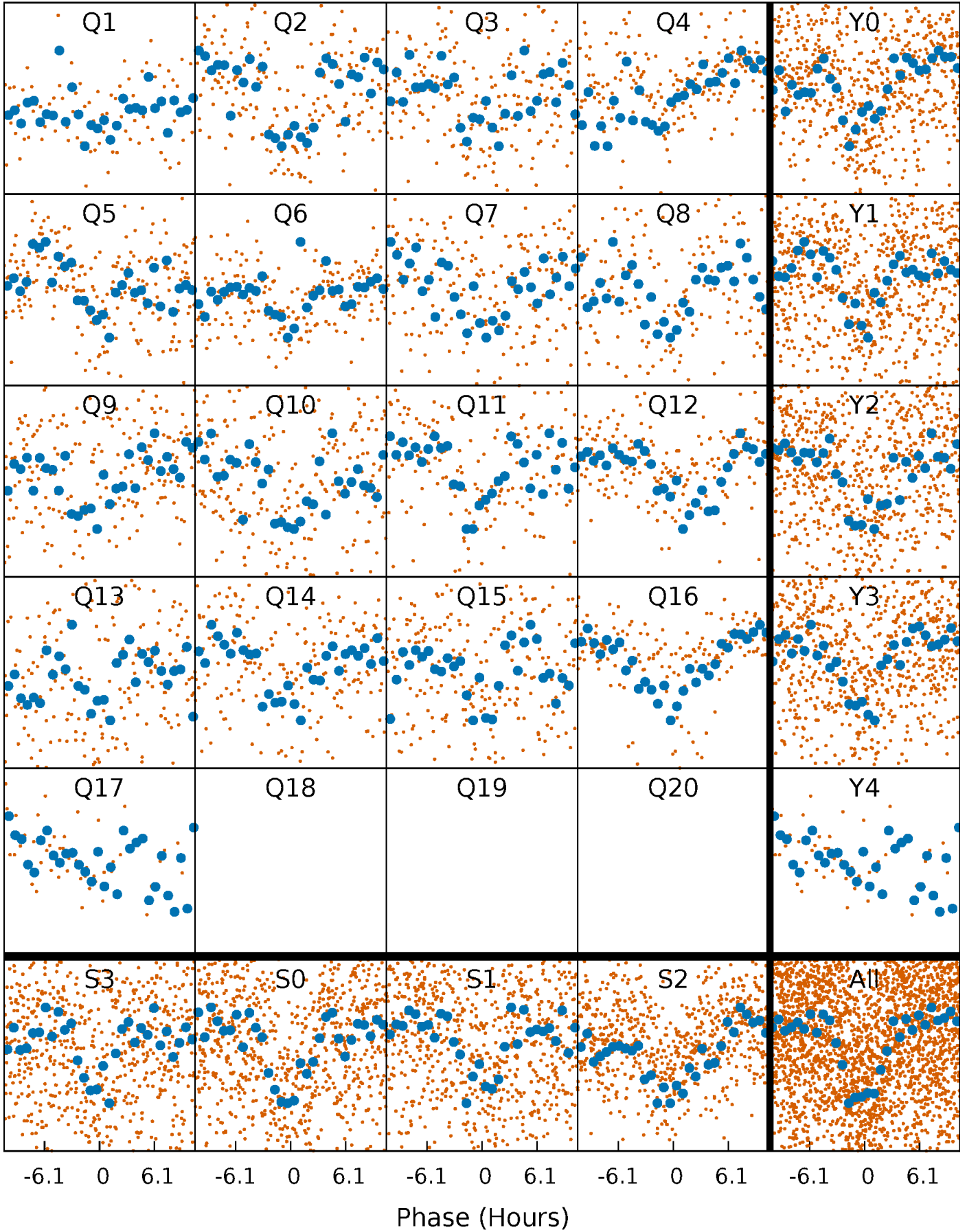


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



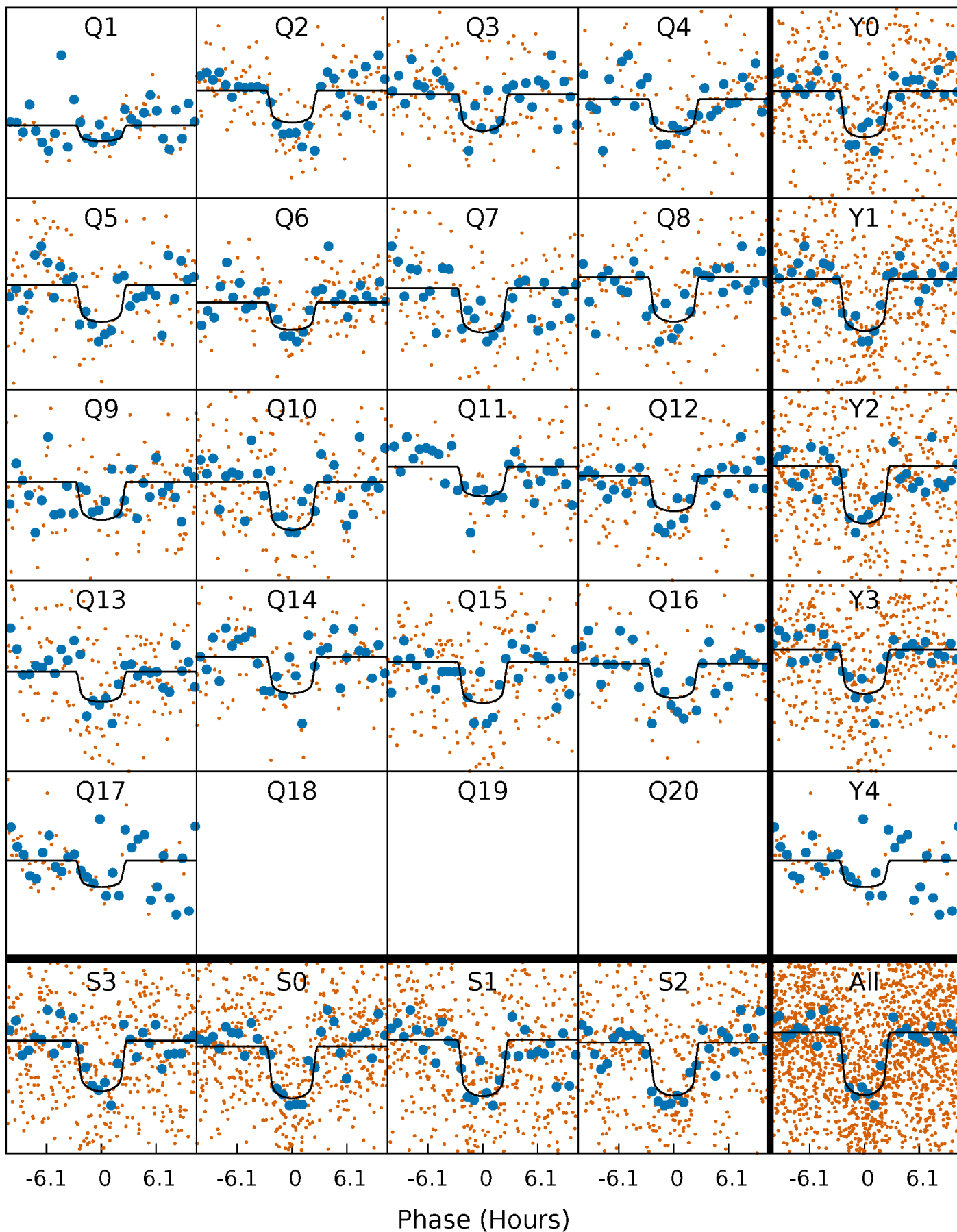
# PDC Quarter-Phased Transit Curves

TCE 009529744-02   P= 17.934775 Days    $T_0=138.221478$  (BKJD)



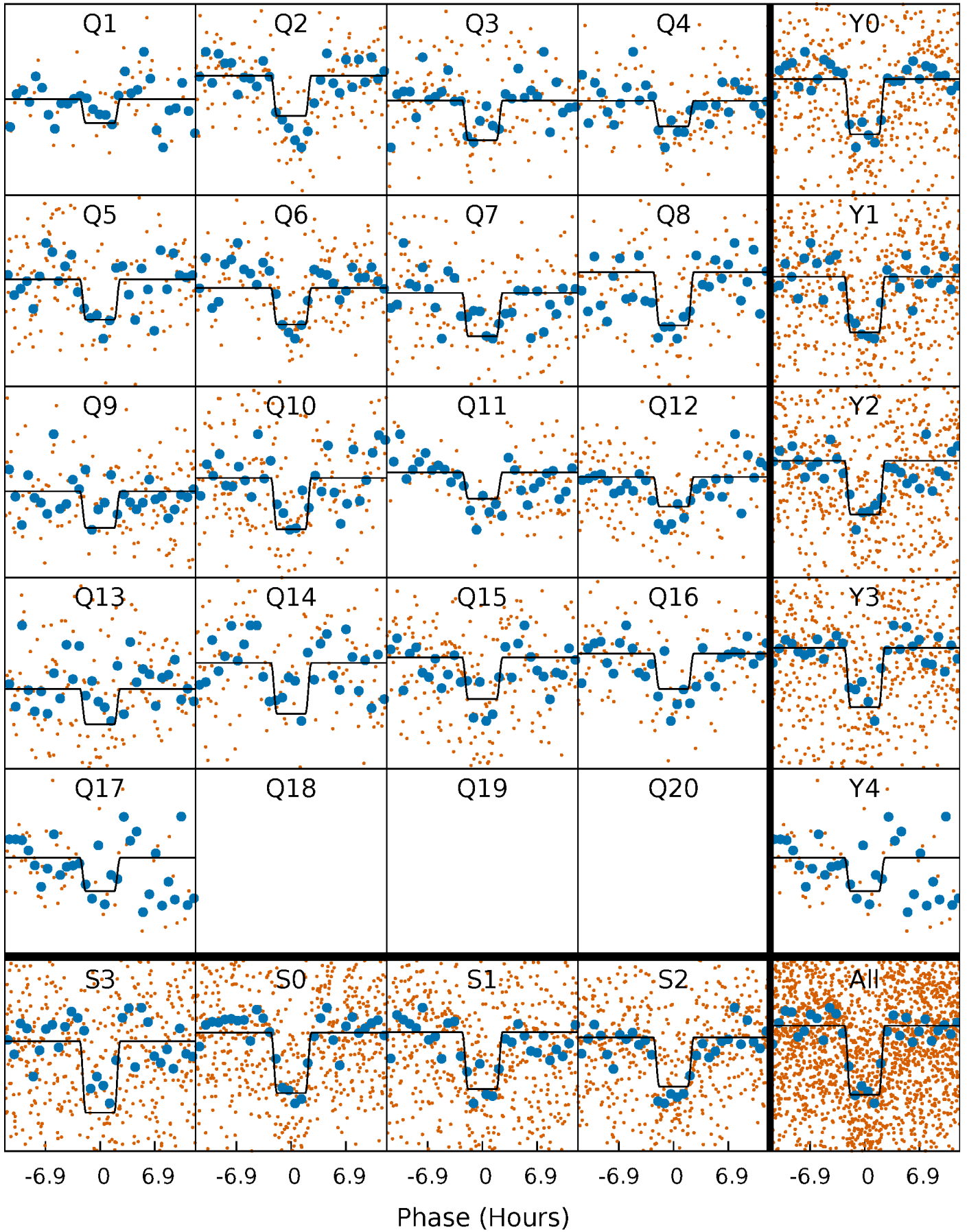
# DV Quarter-Phased Transit Curves

TCE 009529744-02   P= 17.934775 Days    $T_0=138.221478$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

TCE 009529744-02 P= 17.934864 Days  $T_0=138.212949$  (BKJD)

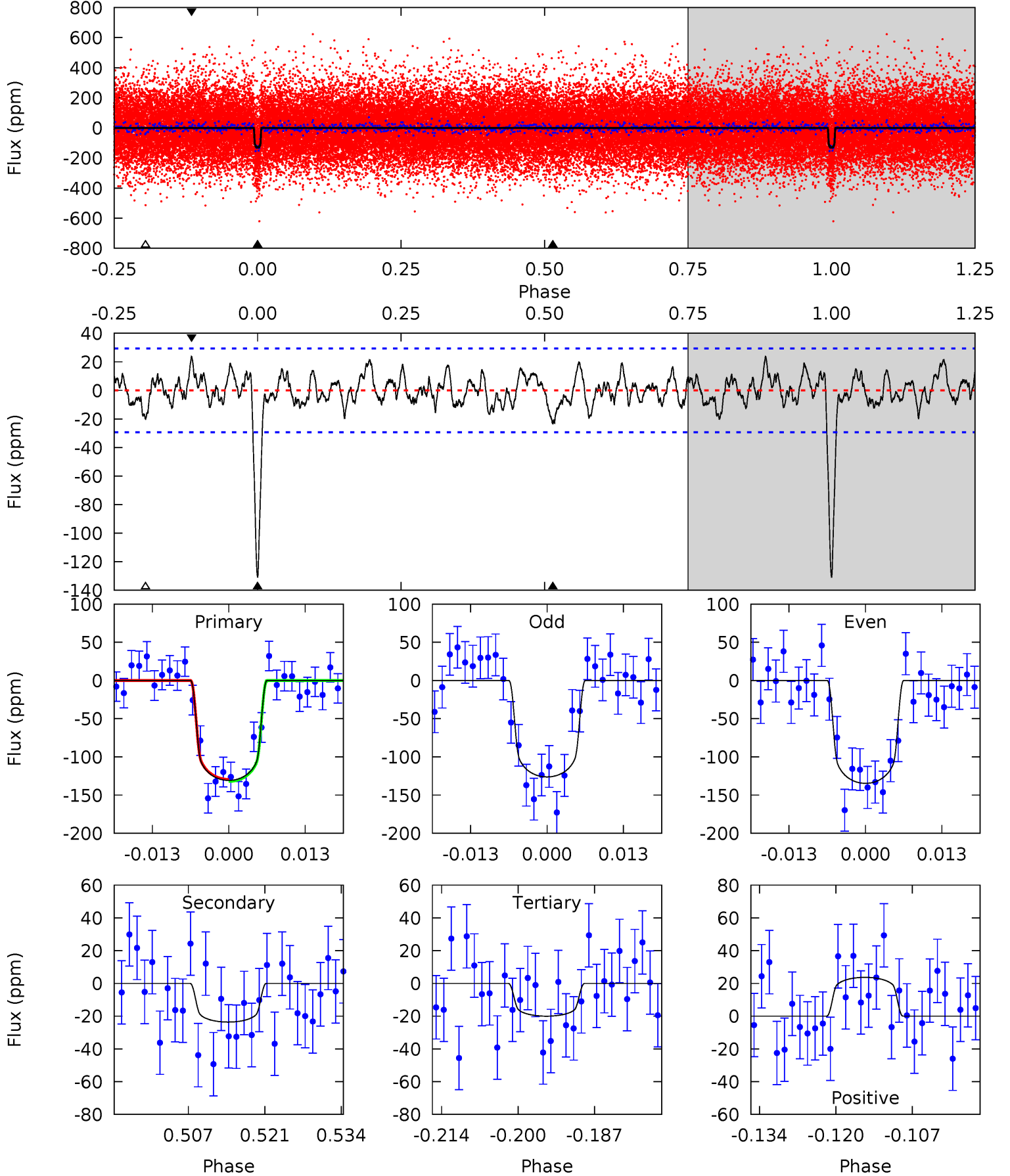




# DV Model-Shift Uniqueness Test

009529744-02, P = 17.934775 Days, E = 120.286703 Days

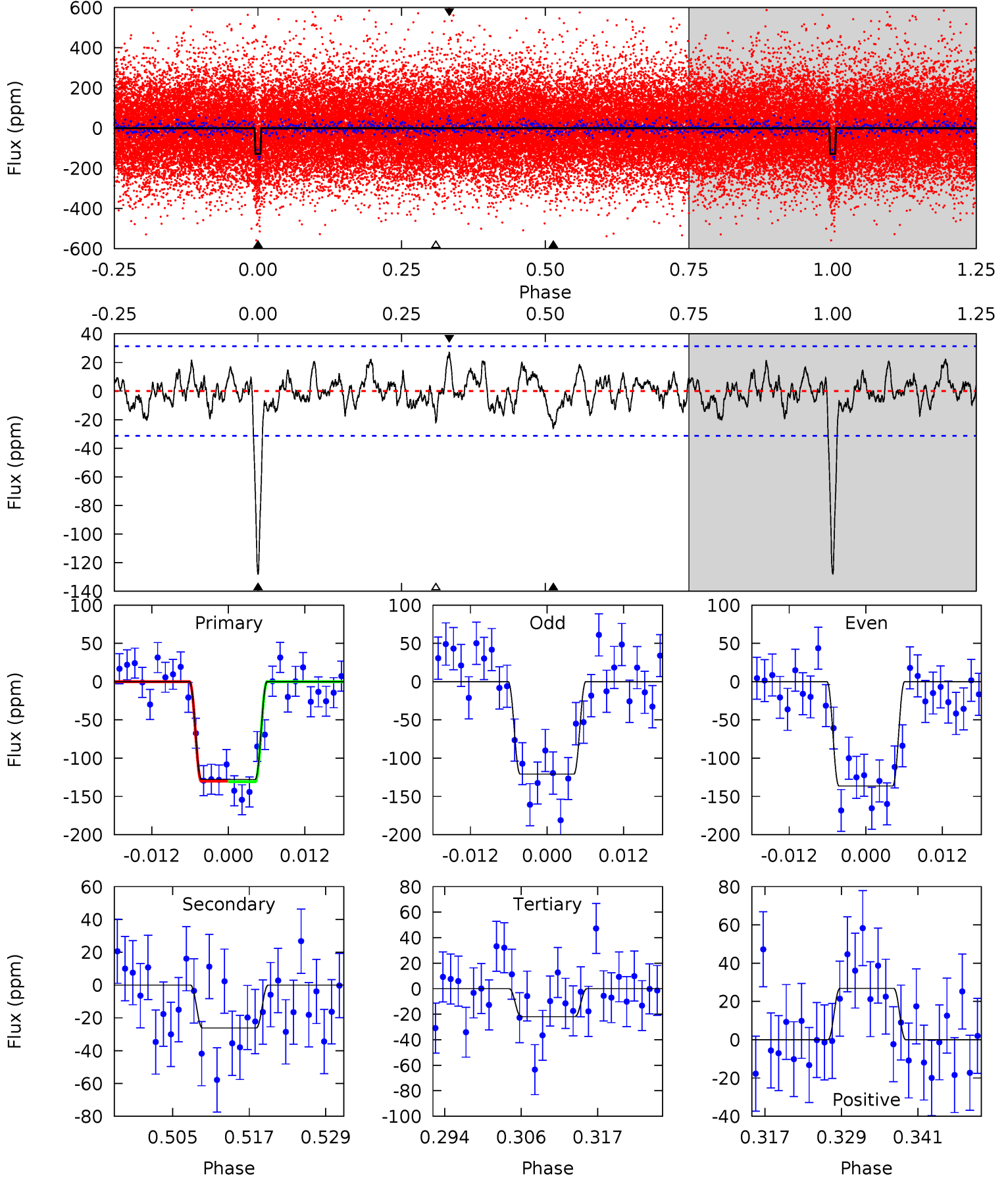
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
22.1	4.00	3.39	4.01	4.97	2.47	1.41	18.7	18.1	0.61	-0.01	0.71	1.02	0.15	0.22



# Alt Model-Shift Uniqueness Test

009529744-02, P = 17.934864 Days, E = 120.278085 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
20.4	4.17	3.49	4.28	5.00	2.52	1.36	16.9	16.1	0.68	-0.10	1.25	0.89	0.17	0.05



### Stellar Parameters For KIC 009529744

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6426^{+175}_{-175}$	$4.013^{+0.259}_{-0.130}$	$-0.240^{+0.300}_{-0.250}$	$1.775^{+0.411}_{-0.503}$	$1.182^{+0.209}_{-0.157}$	$0.298^{+0.438}_{-0.115}$
	+3%/-3%	+6%/-3%	+125%/-104%	+23%/-28%	+18%/-13%	+147%/-39%
Source	PHO1	FLK73	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 009529744-02 / KOI 1806.02

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-24 \pm 6$	$2.37^{+0.58}_{-0.52}$	$1383^{+94}_{-112}$	$4233^{+390}_{-320}$	$47^{+32}_{-18}$
Alt.	$-26 \pm 6$	$2.18^{+0.58}_{-0.50}$	$1384^{+90}_{-113}$	$4430^{+465}_{-356}$	$61^{+47}_{-25}$

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

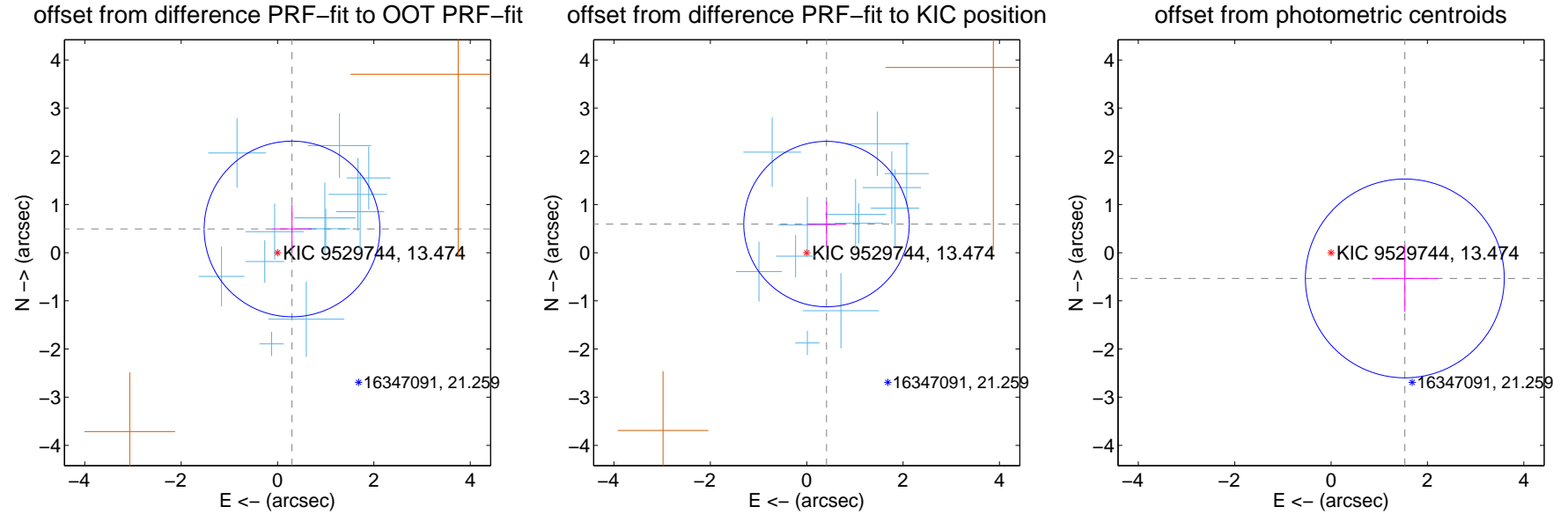
## DV Centroid Data

Supplemental centroid analysis for 009529744-02. Kepler magnitude: 13.47. Transit SNR 16.66

There are 12 quarters with good PRF difference image offsets

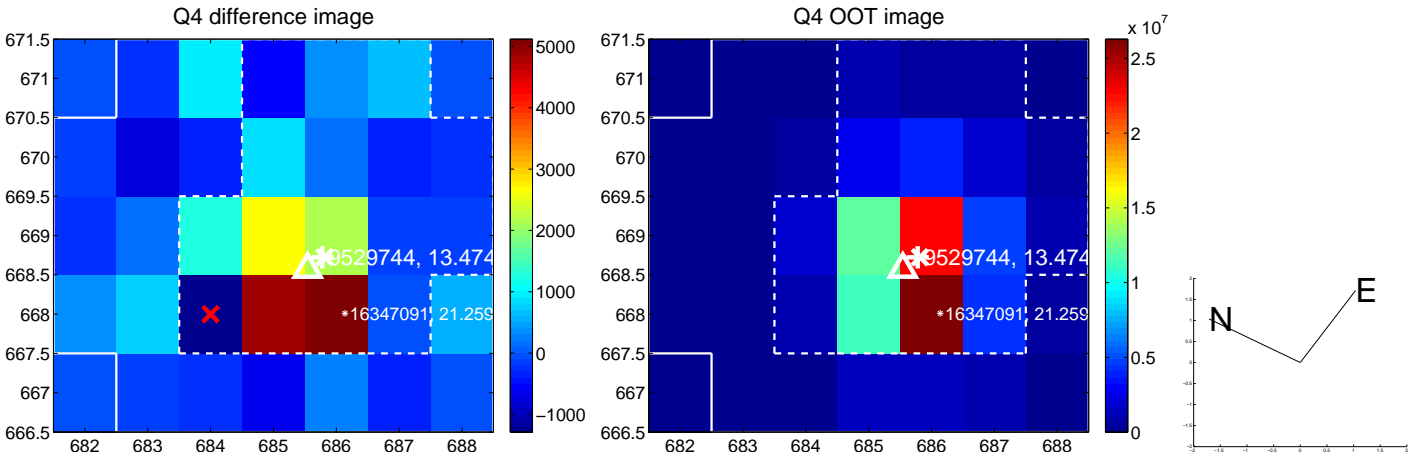
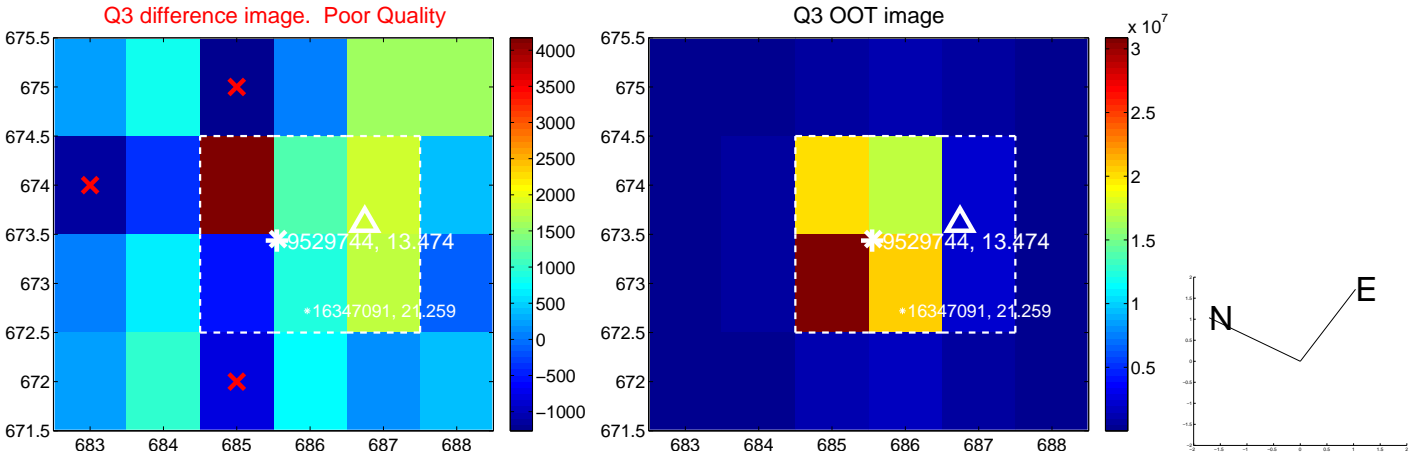
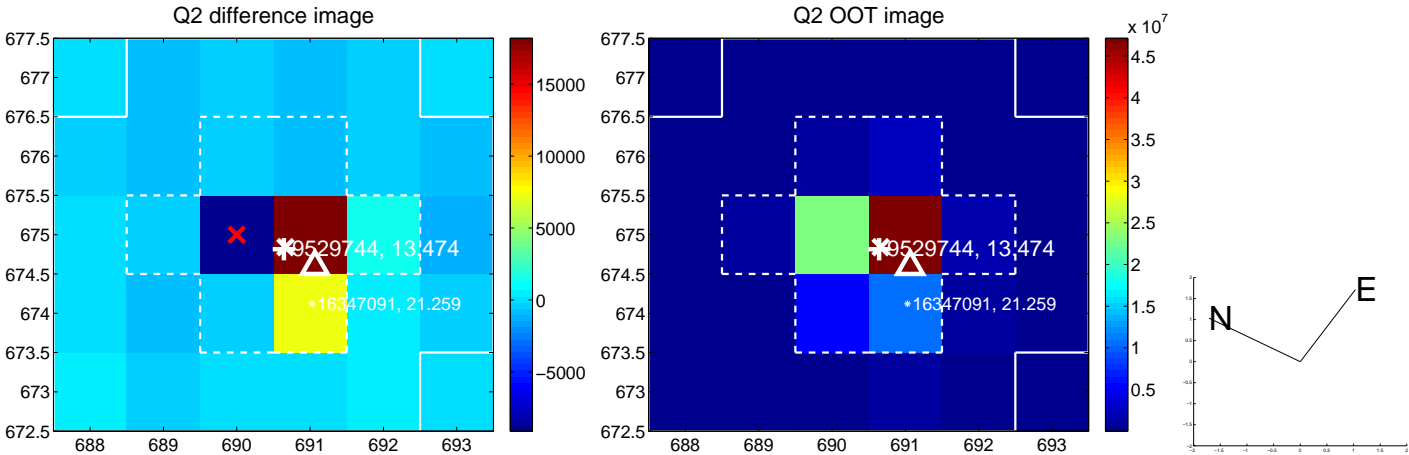
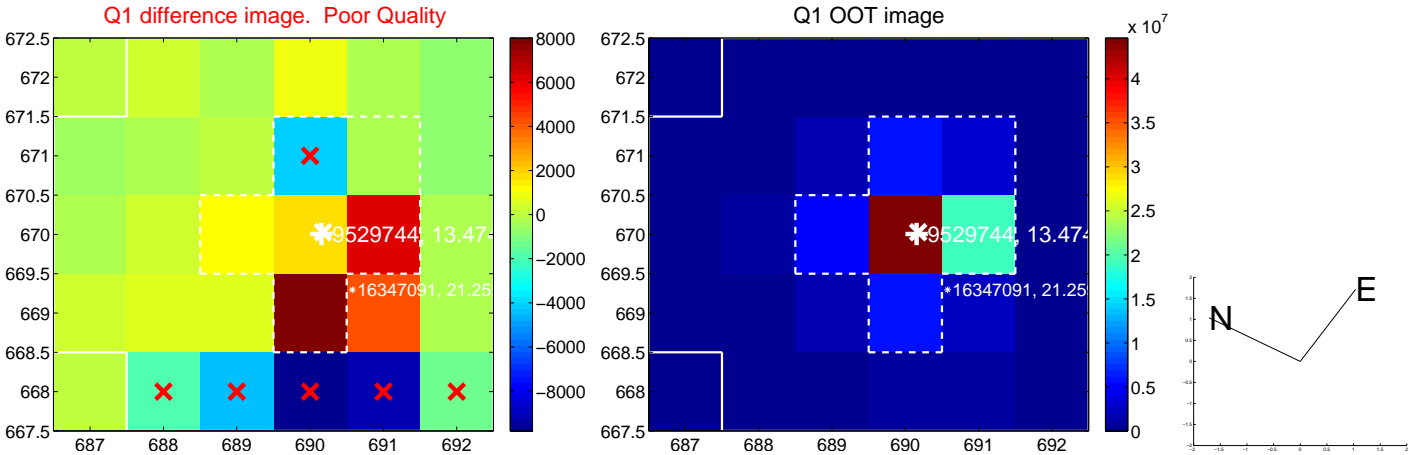
The direct PRF centroid is offset from the target star catalog position by about 0.19 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.577 \pm 0.608$	0.95	$-0.300 \pm 0.409$	$0.492 \pm 0.501$
PRF-fit source offset from KIC position	$0.723 \pm 0.572$	1.26	$-0.411 \pm 0.408$	$0.594 \pm 0.459$
photometric centroid source offset	$1.62 \pm 0.69$	2.36	$-1.53 \pm 0.69$	$-0.53 \pm 0.69$



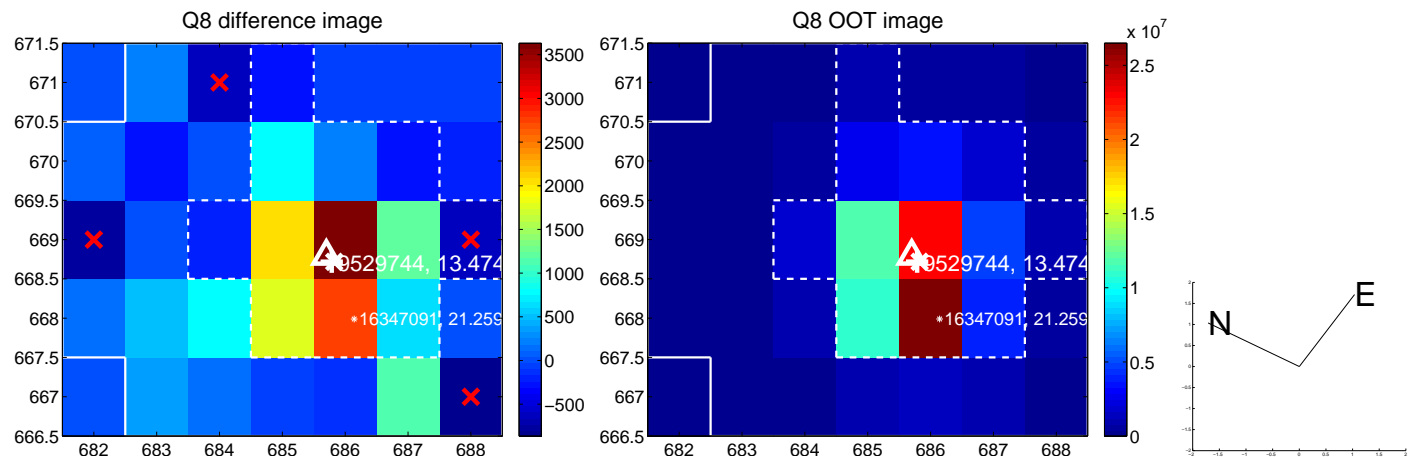
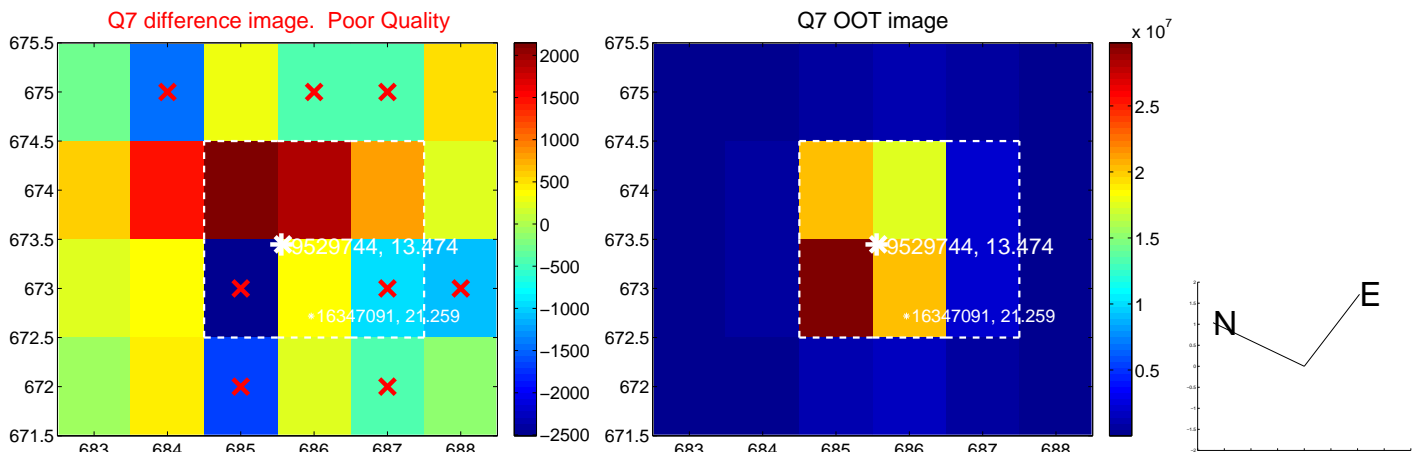
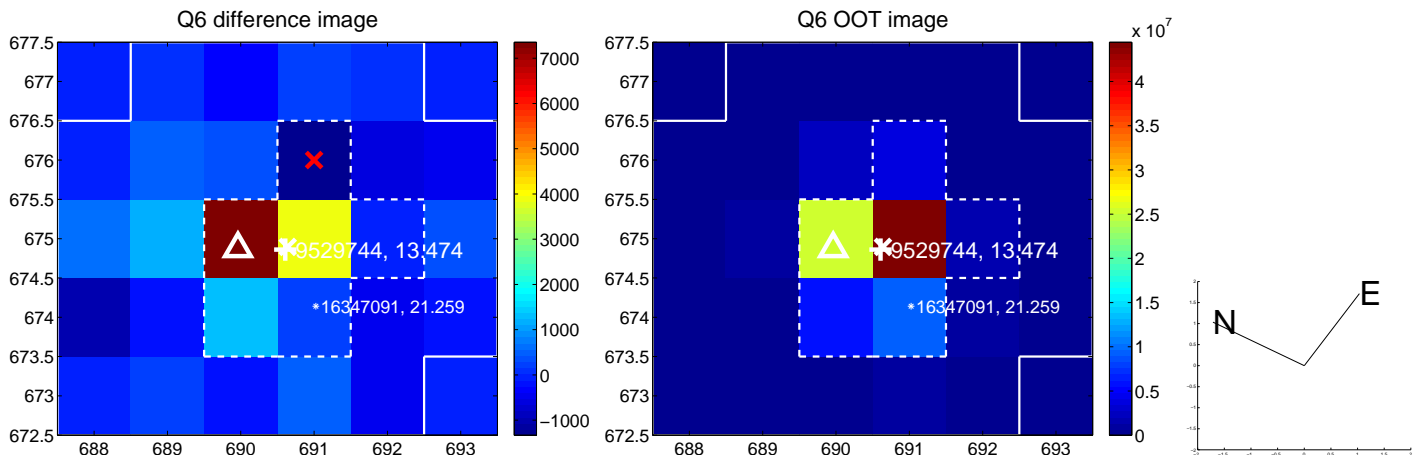
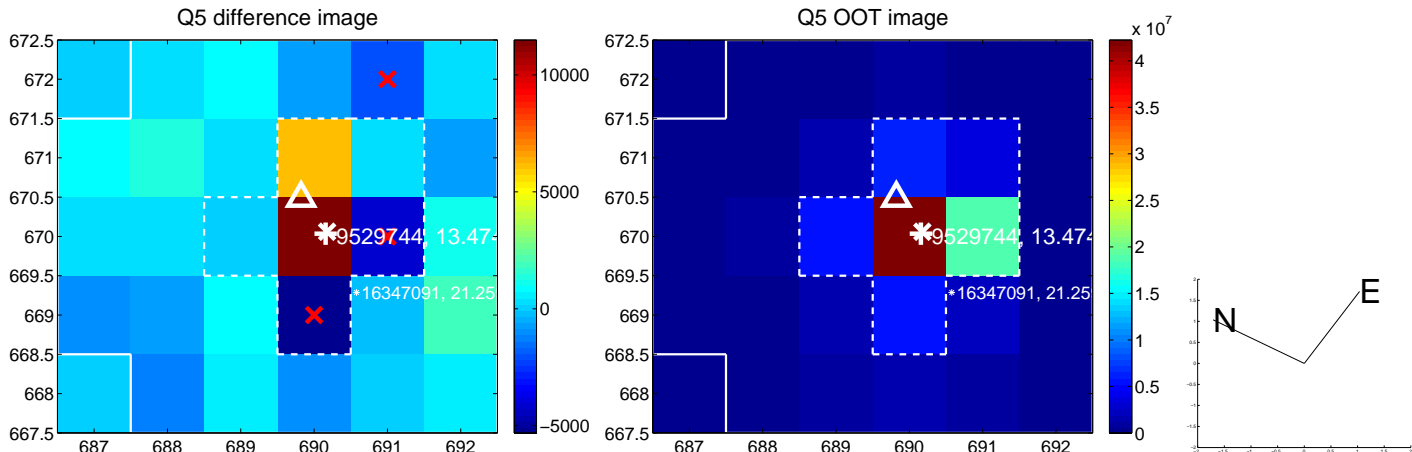
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

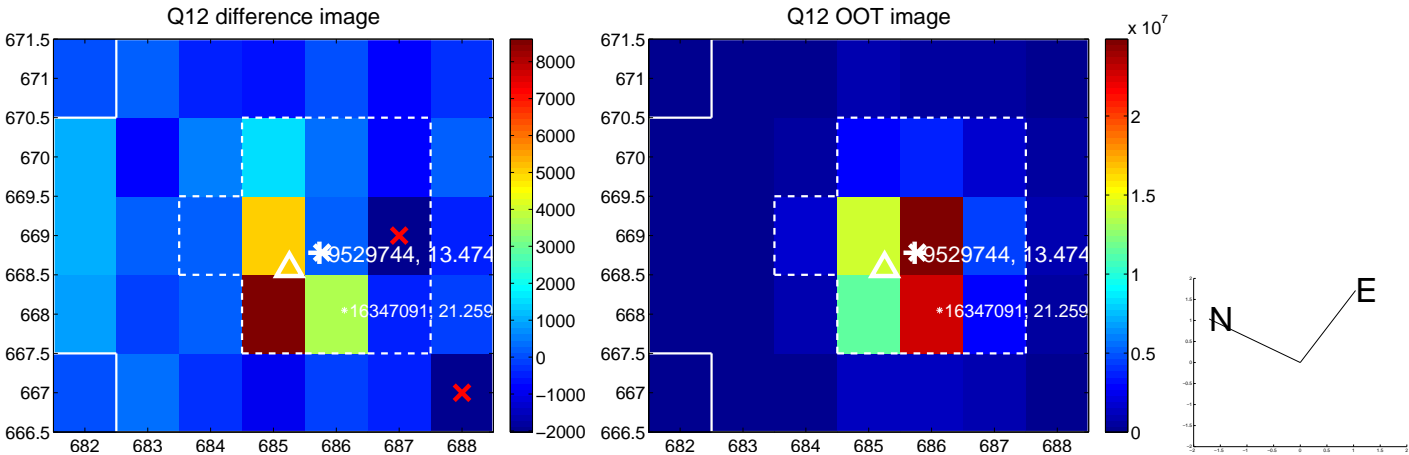
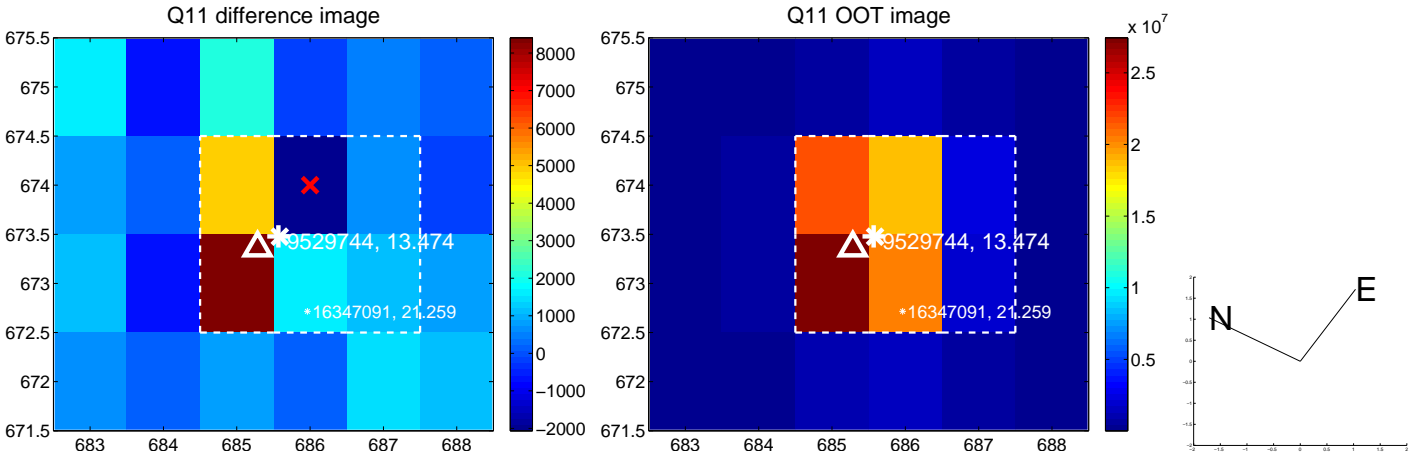
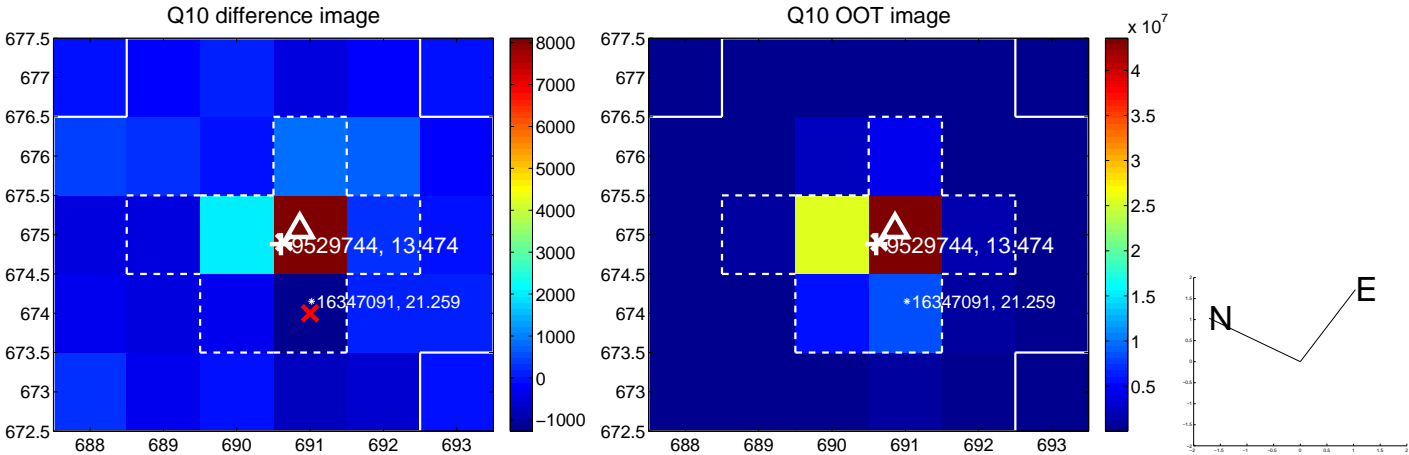
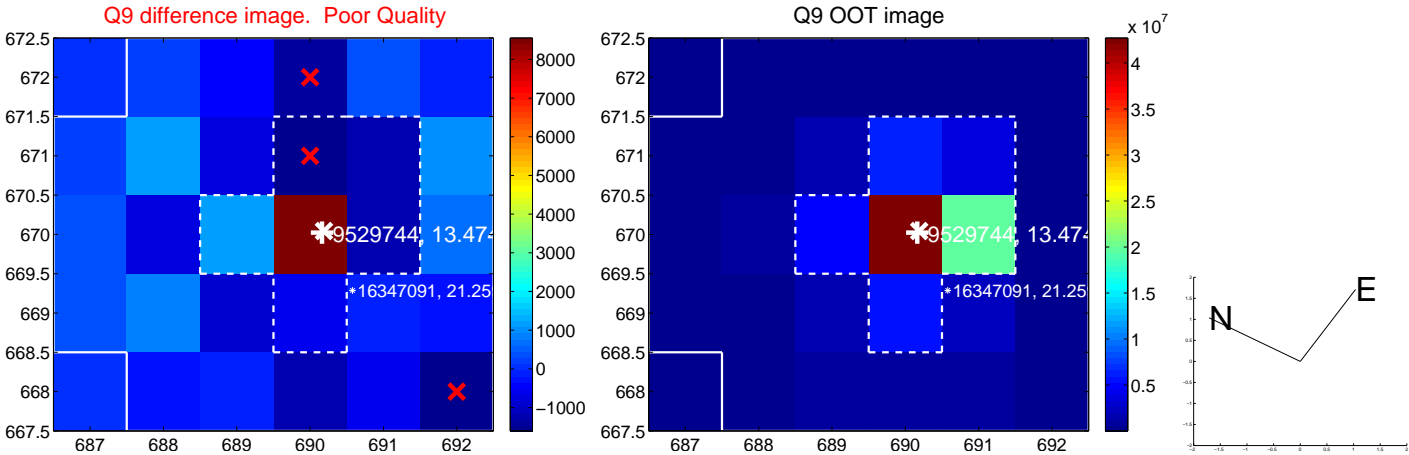




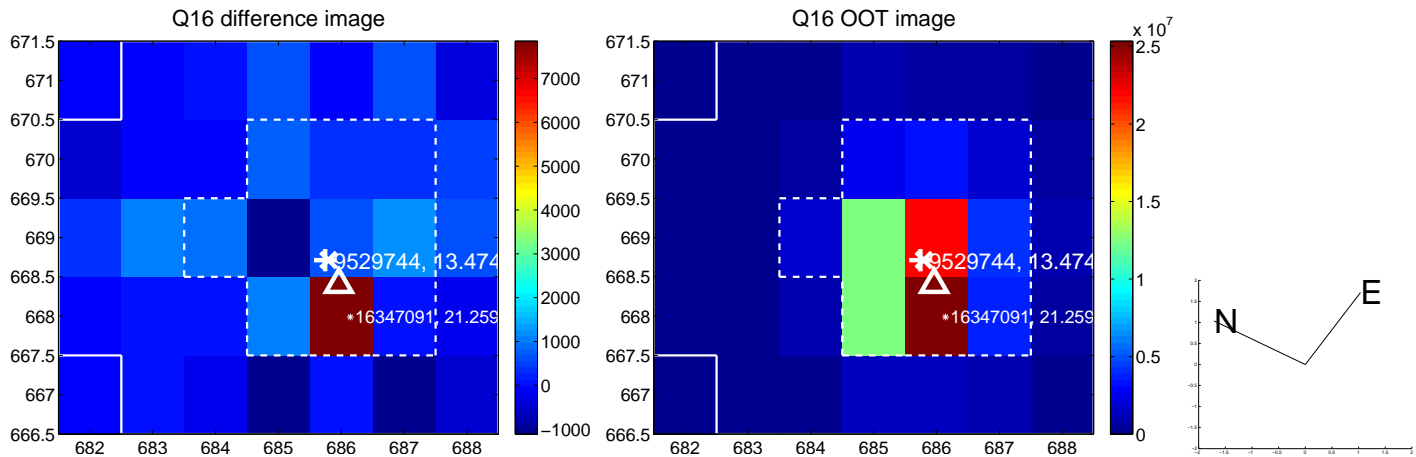
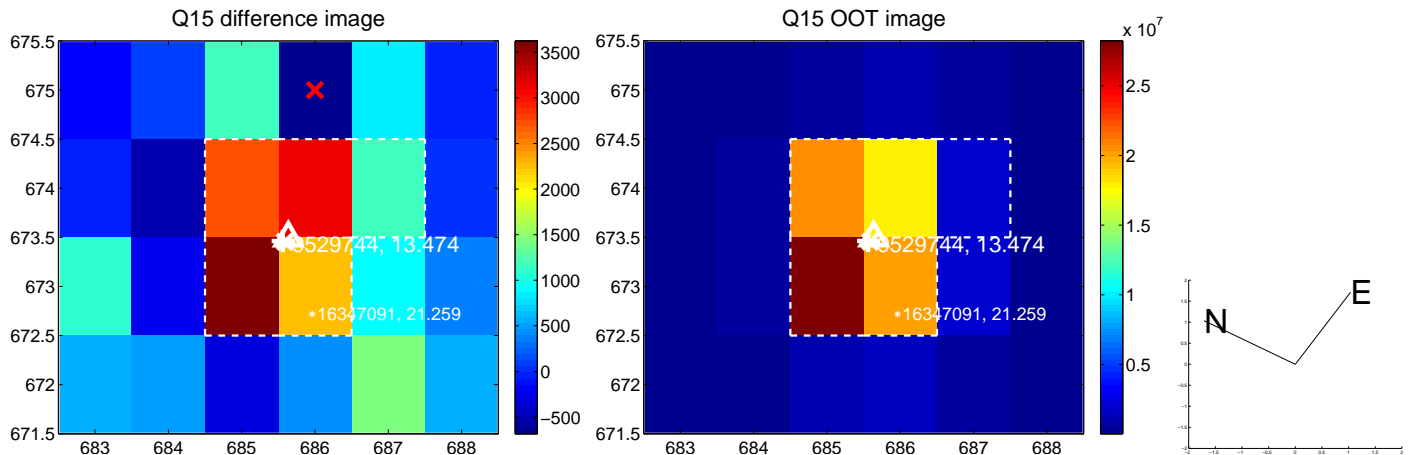
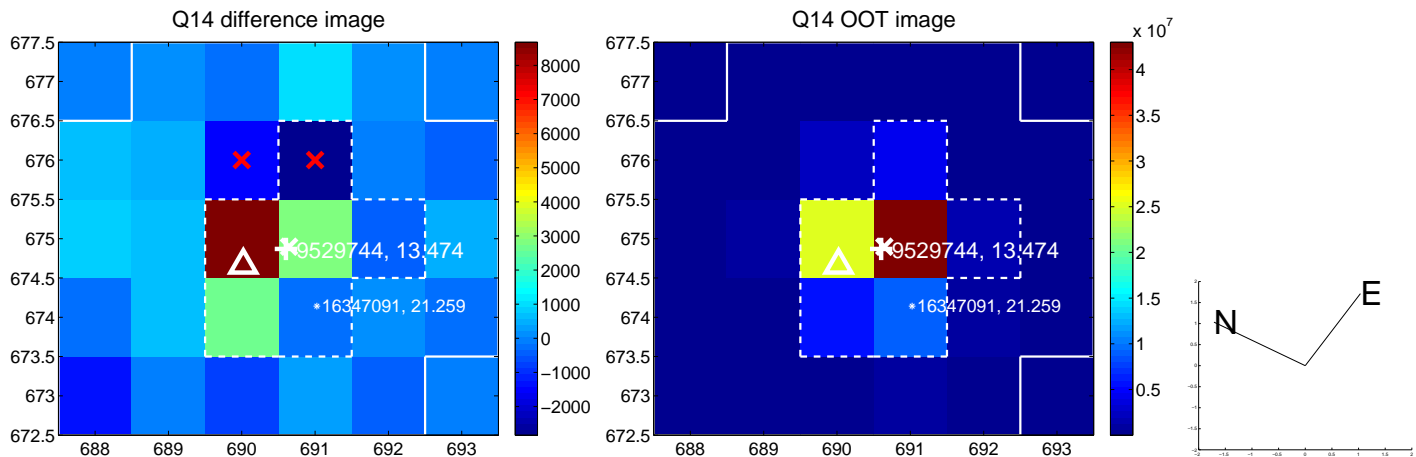
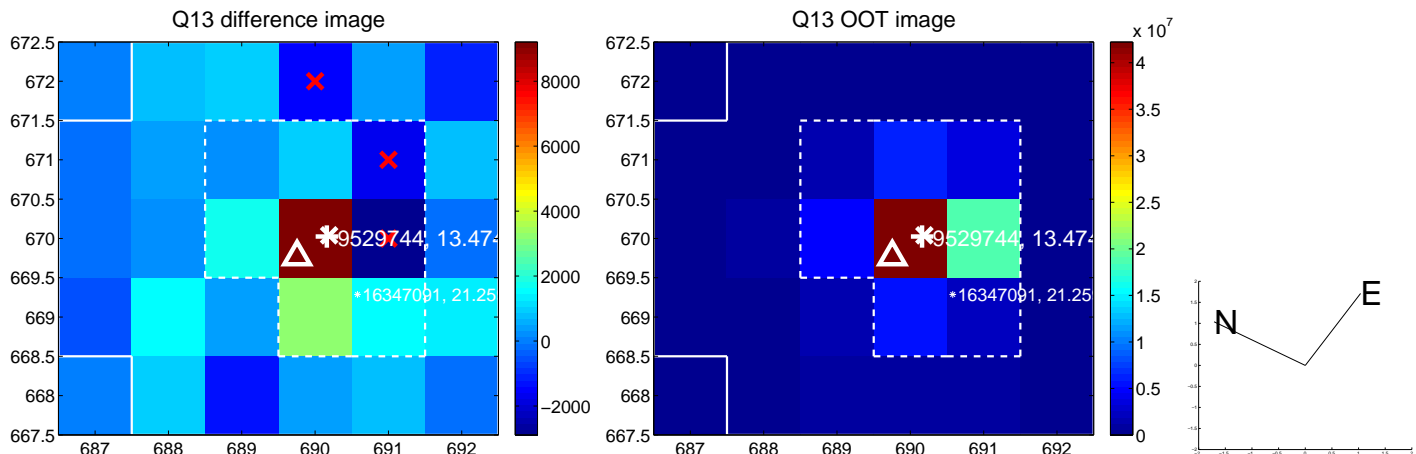
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



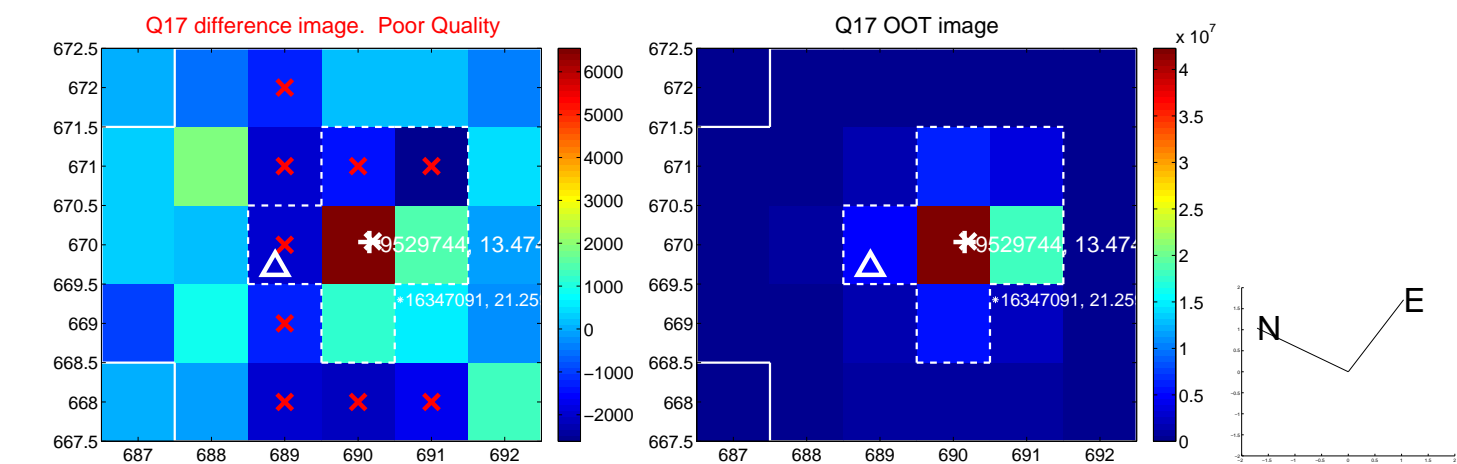
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



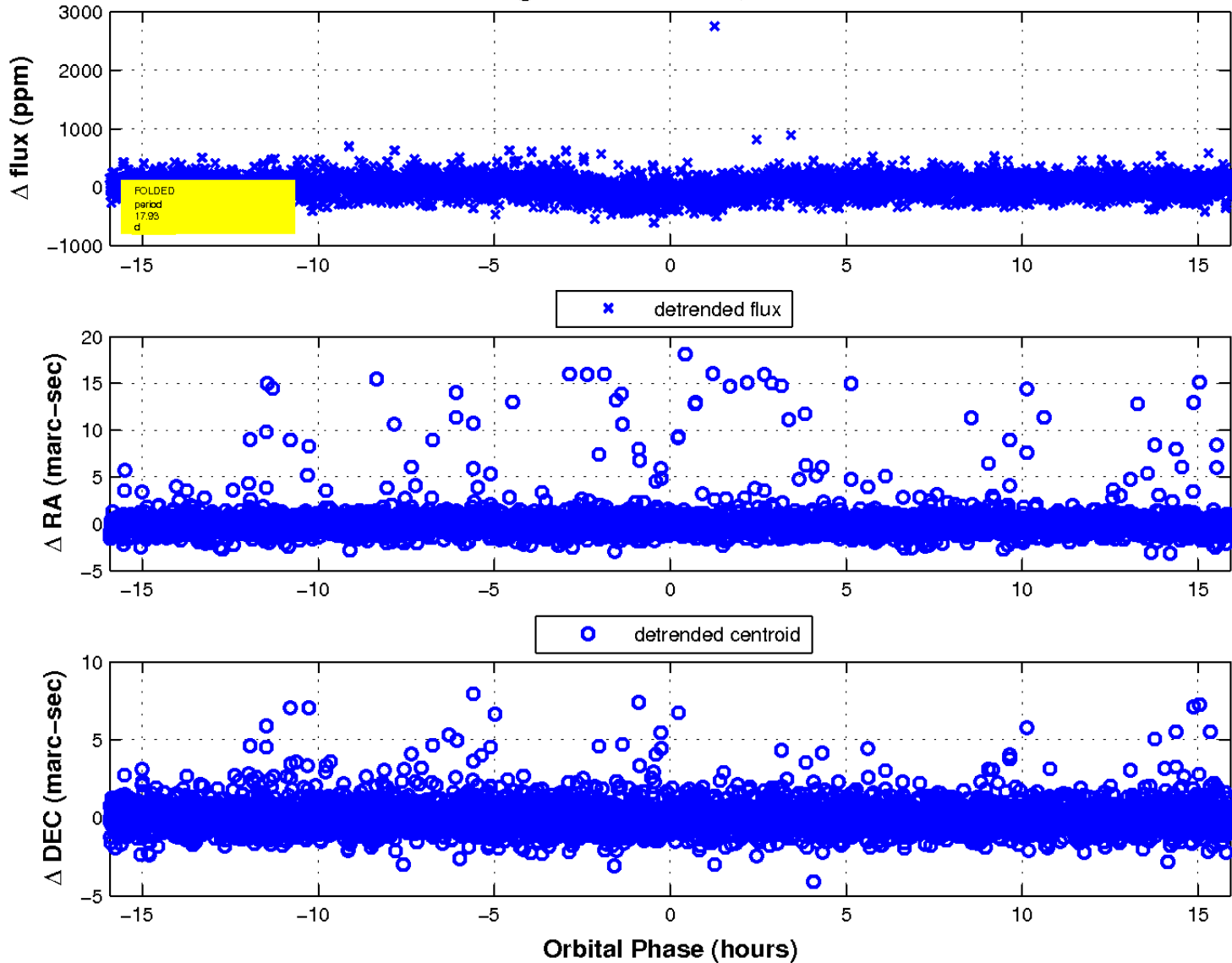
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



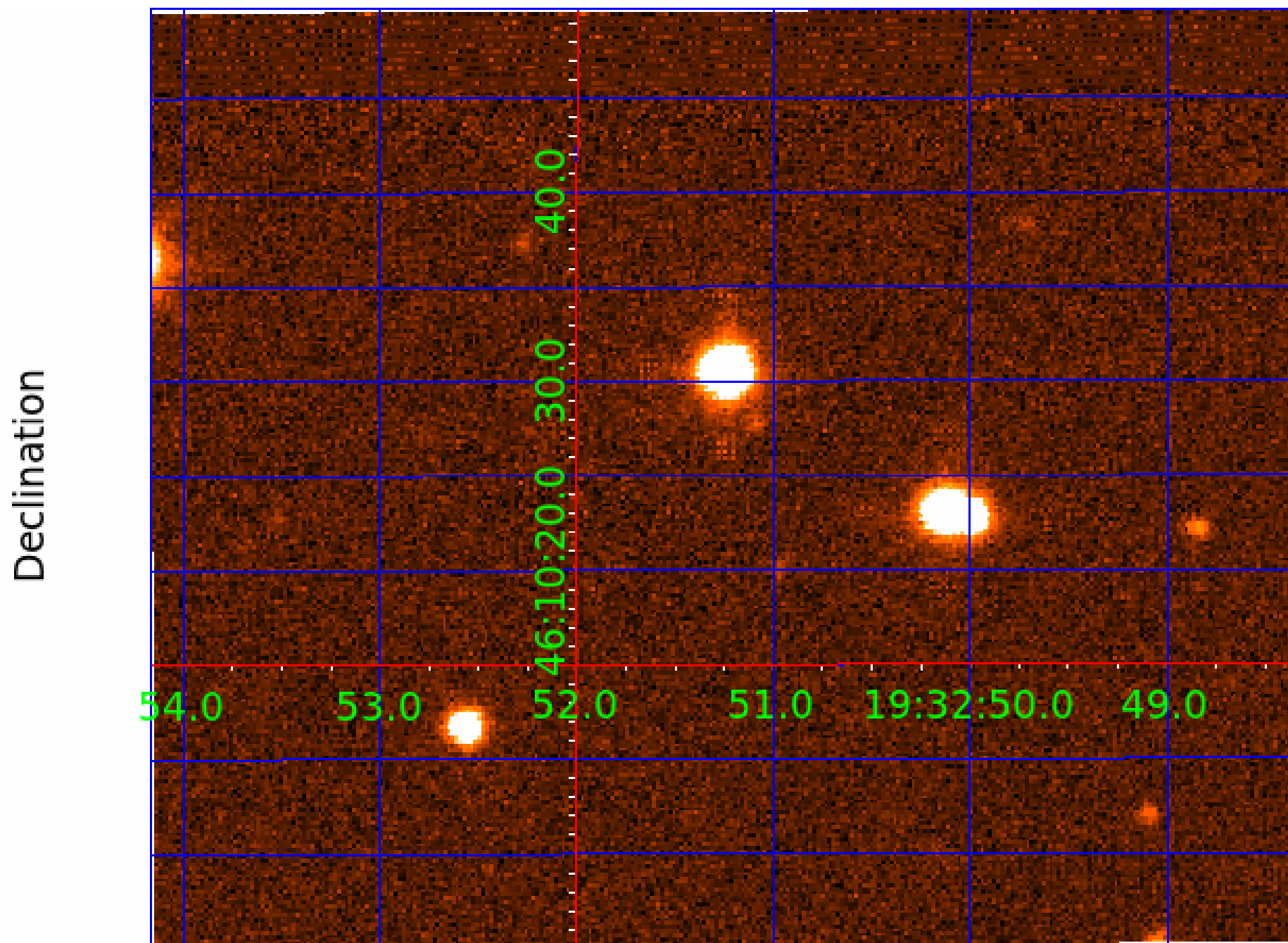
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



fluxWeightedCentroids, Planet 2 of 4



UKIRT Image



# KIC 009529744

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009529744-01	OBS	1806.01	2.404478	131.701925	143.9	6.695	101.2	48.3	1.77	6426	2.75	3484.14
009529744-02	OBS	1806.02	17.934775	138.221478	136.2	5.309	15.1	16.7	1.77	6426	2.43	239.07
009529744-03	OBS	1806.03	8.371643	137.680577	88.0	4.061	12.5	14.3	1.77	6426	1.99	660.25
009529744-04	OBS	No	470.162593	154.886986	452.9	12.500	12.9	-1.0	1.77	6426	3.79	3.07

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009529744-01	OBS	FP	0.00	1	0	1	1	LPP_DV—CENT_RESOLVED_OFFSET—EPHEM_MATCH
009529744-02	OBS	PC	0.97	0	0	0	0	NO_COMMENT
009529744-03	OBS	PC	1.00	0	0	0	0	NO_COMMENT
009529744-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_CHASES_MARSHALL_SKYE—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT—INCONSISTENT_TRANS—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 009529744-03

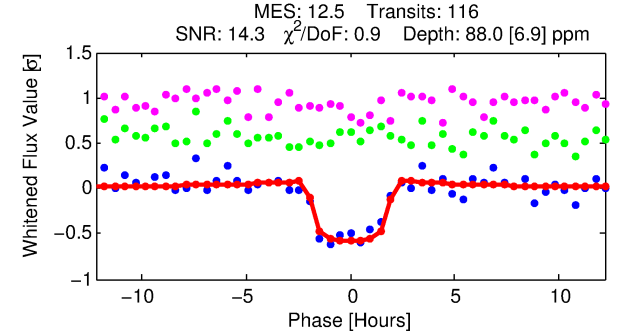
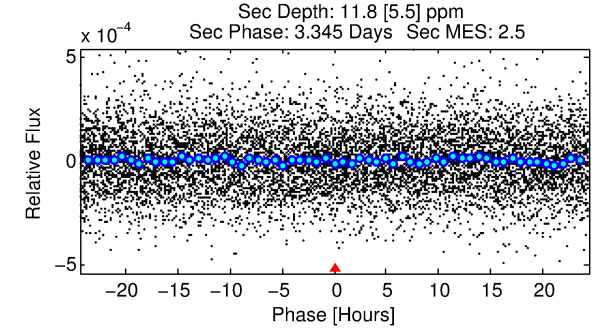
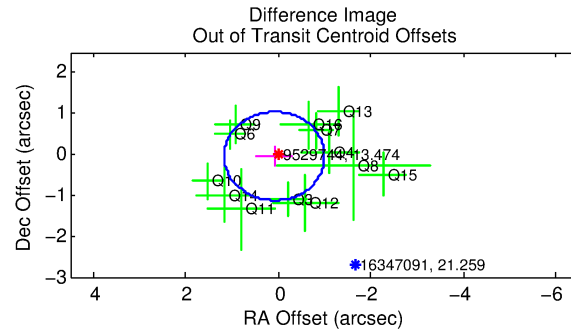
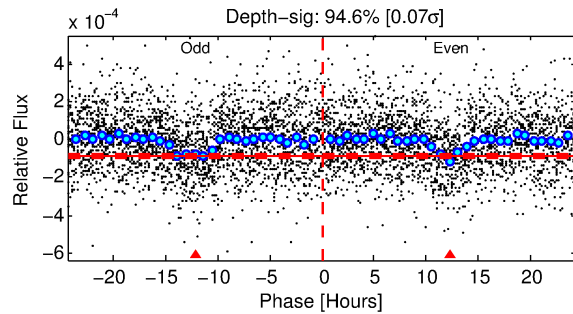
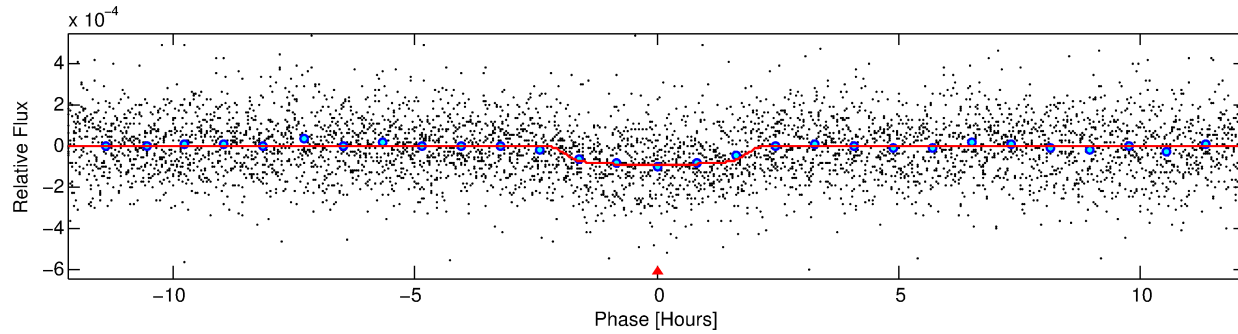
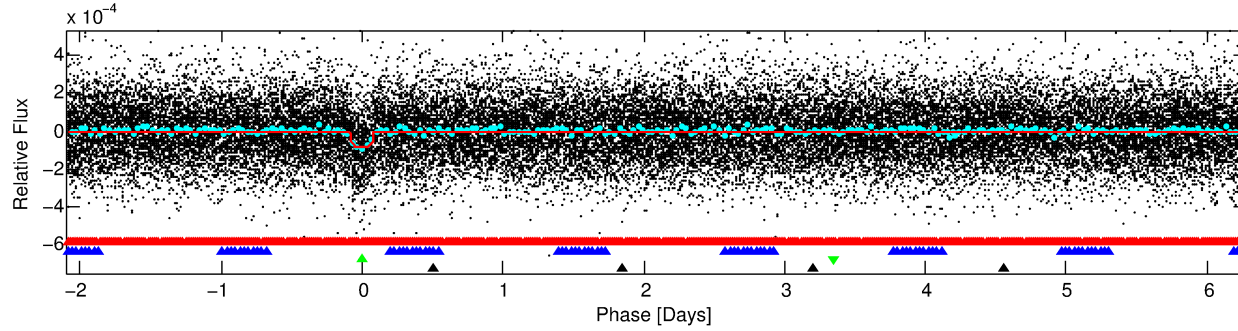
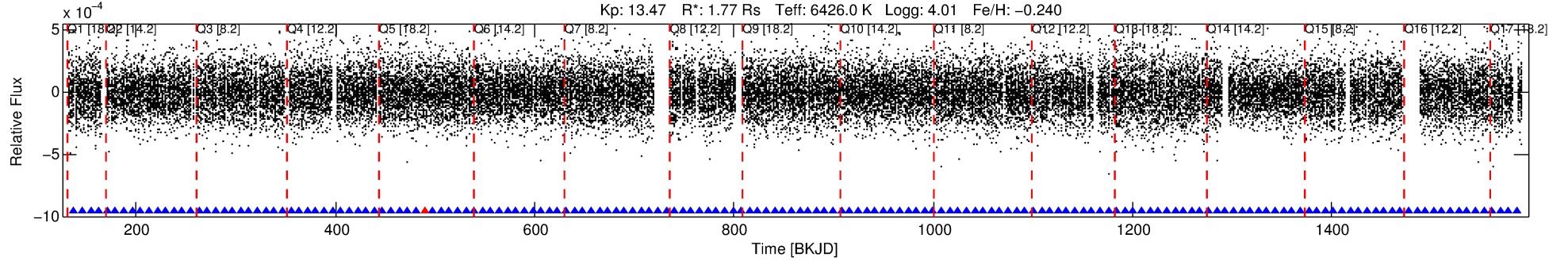
No Significant Match Found



# DV One-Page Summary

KIC: 9529744 Candidate: 3 of 4 Period: 8.372 d  
KOI: K01806.03 Name: Kepler-320b Corr: 0.973

Kp: 13.47 R\*: 1.77 Rs Teff: 6426.0 K Logg: 4.01 Fe/H: -0.240



## DV Fit Results:

Period = 8.37164 [0.00006] d  
Epoch = 137.6806 [0.0053] BKJD  
Rp/R\* = 0.0103 [0.0024]  
a/R\* = 6.51 [8.56]  
b = 0.92 [0.22]  
Seff = 660.25 [299.40]  
Teq = 1293 [147] K  
Rp = 1.99 [0.73] Re  
a = 0.0854 [0.0234] AU  
Ag = 11.91 [9.49] [1.15σ]  
Teffp = 3713 [625] K [3.77σ]

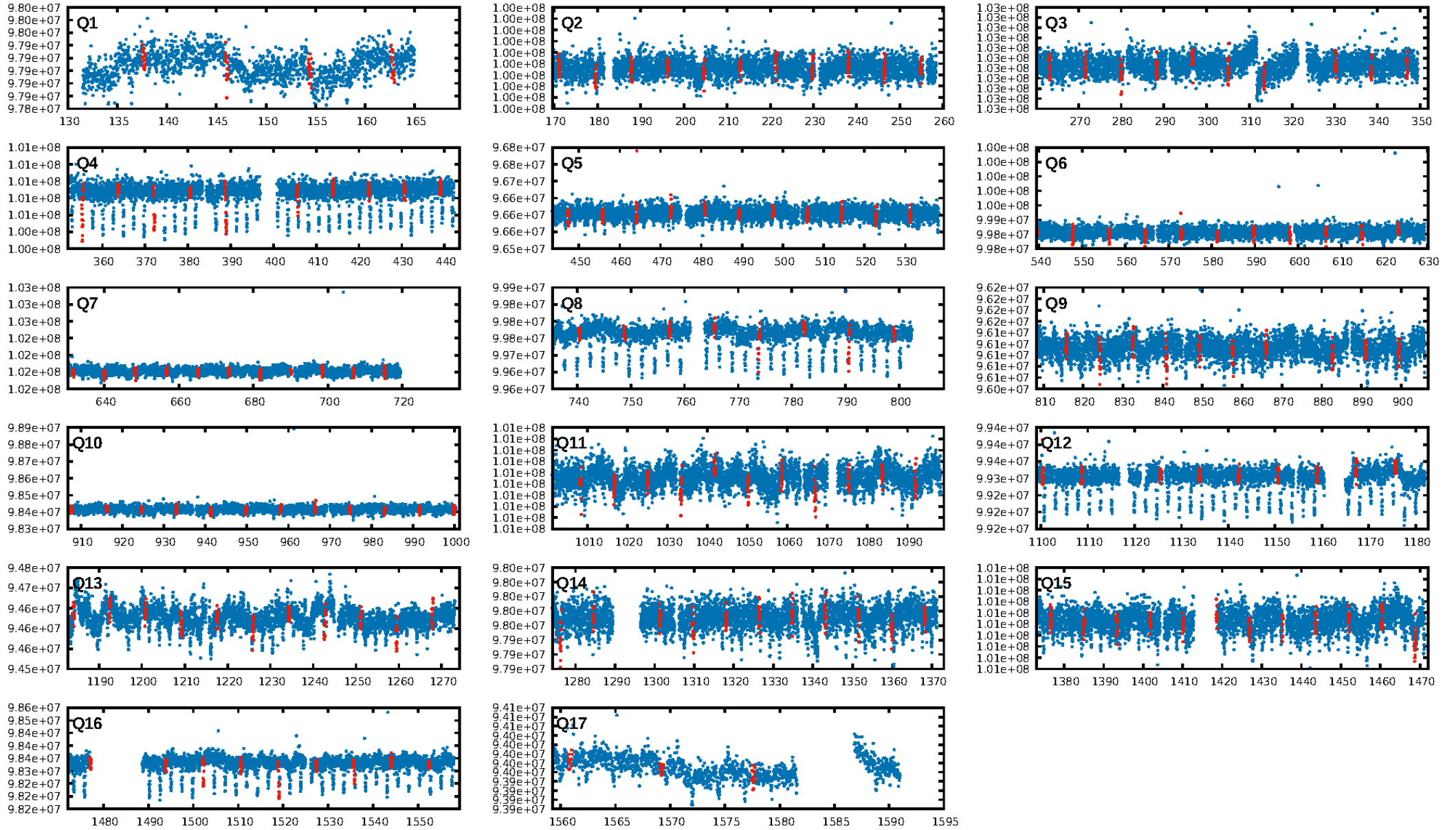
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [18.29σ]  
LongPeriod-sig: 100.0% [34.34σ]  
ModelChiSquare2-sig: 43.4%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 0.99 [111/112]  
GhostDiagnostic-chr: -5.083  
Centroid-sig: N/A  
Centroid-so: 1.026 arcsec [1.26σ]  
OotOffset-rm: 0.098 arcsec [0.27σ]  
KicOffset-rm: 0.049 arcsec [0.17σ]  
OotOffset-st: 3/4/4/2 [13]  
KicOffset-st: 3/4/4/2 [13]  
DiffImageQuality-fgm: 1.00 [13/13]  
DiffImageOverlap-fno: 1.00 [17/17]

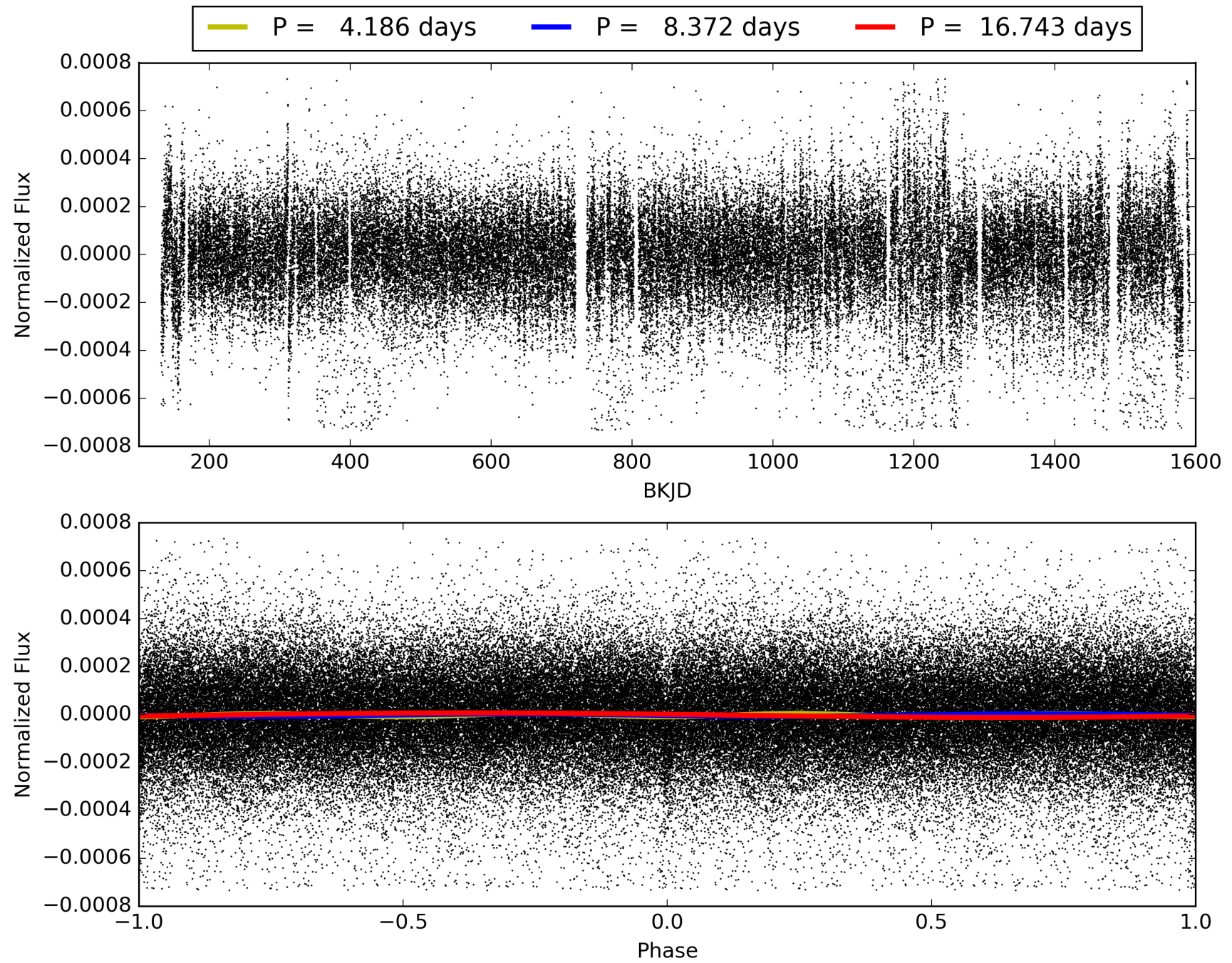
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 22:50:03 Z

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

# TCE 009529744-03, PDC Light Curves

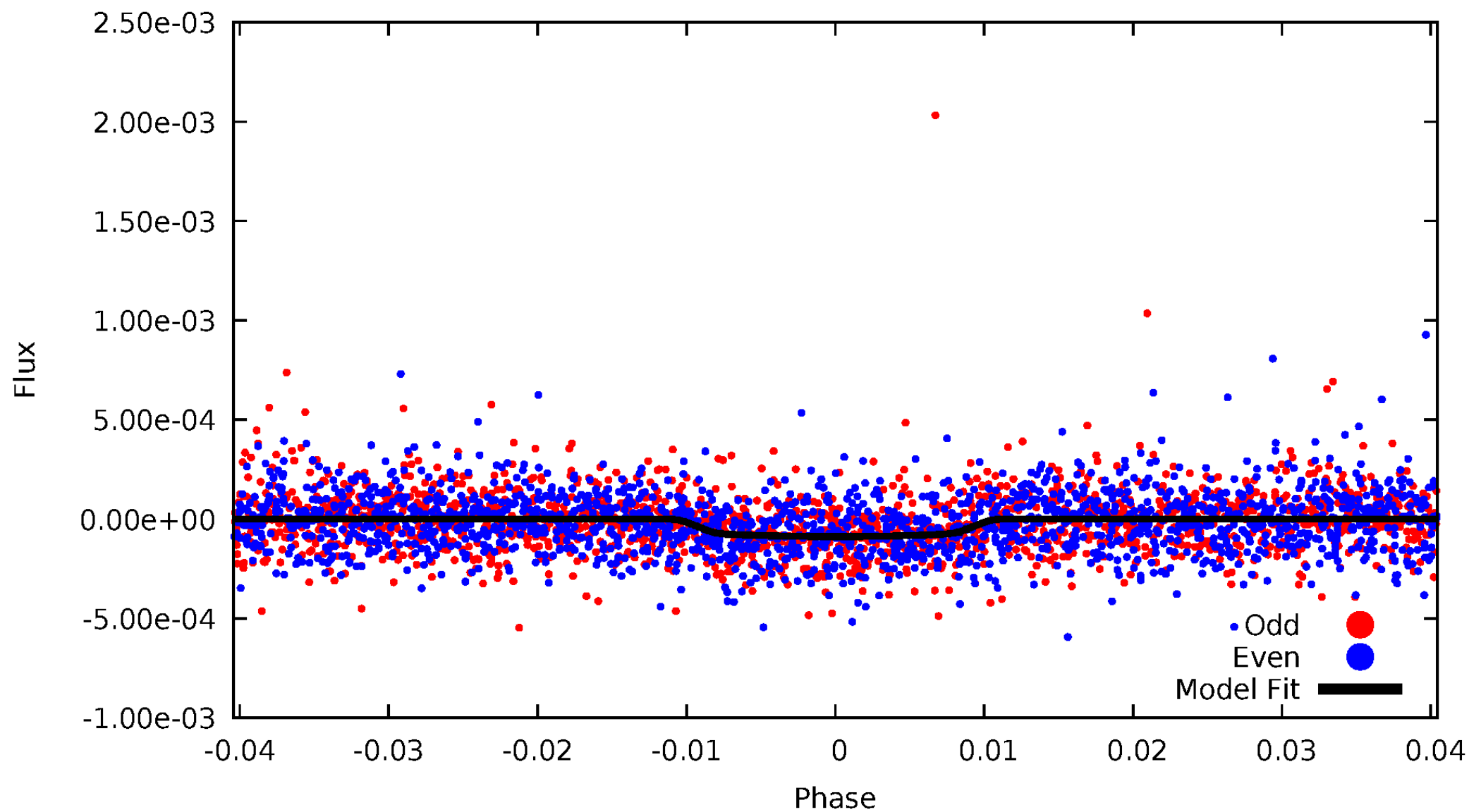


TCE 009529744-03



# DV Odd/Even

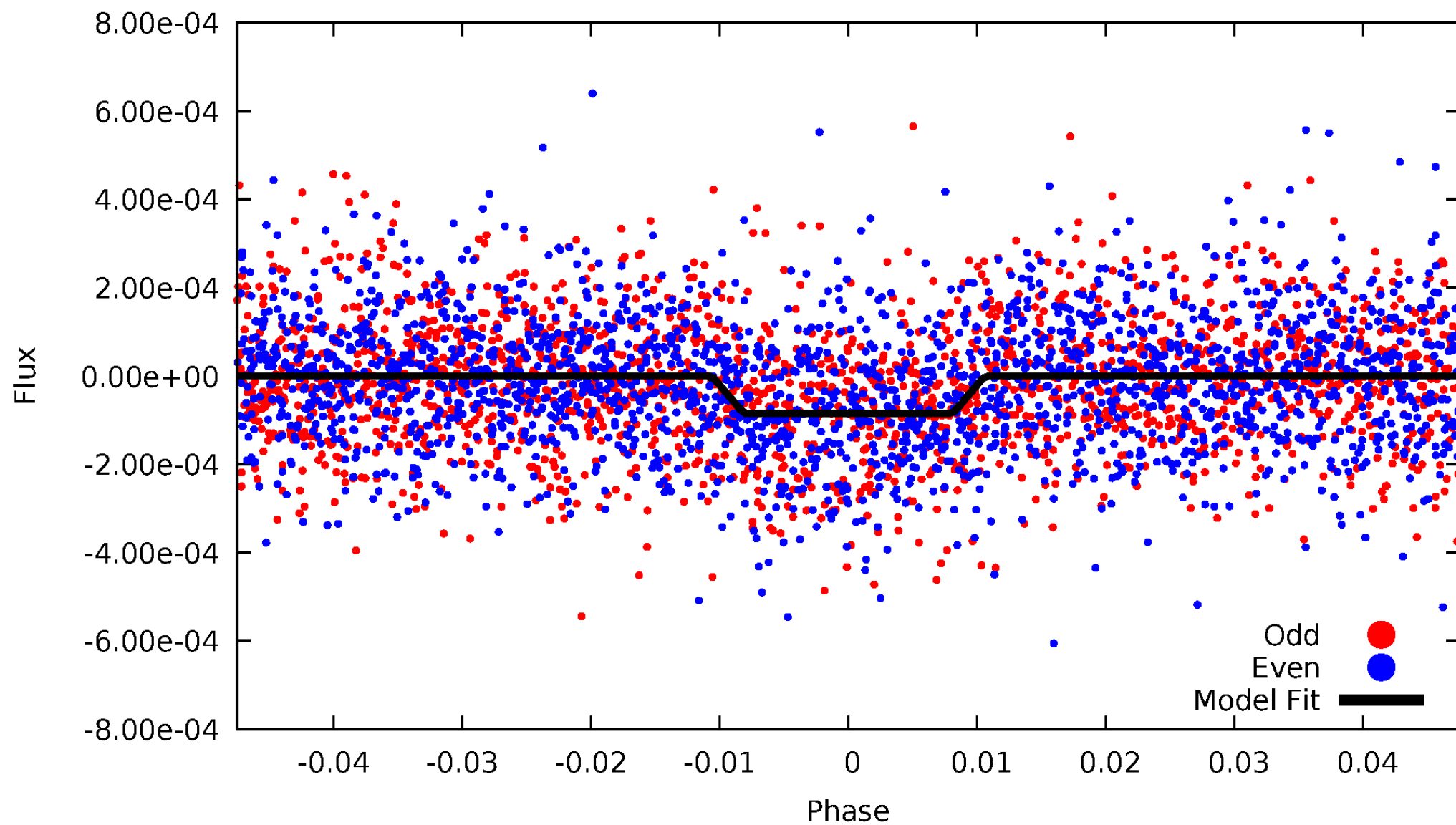
TCE 009529744-03





# ALT Odd/Even

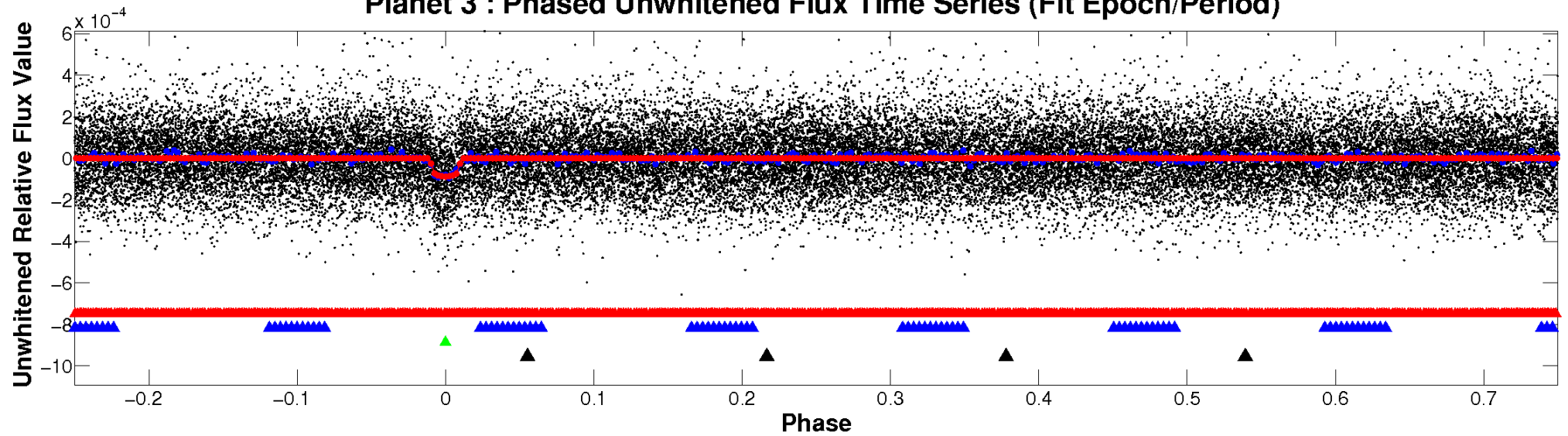
TCE 009529744-03



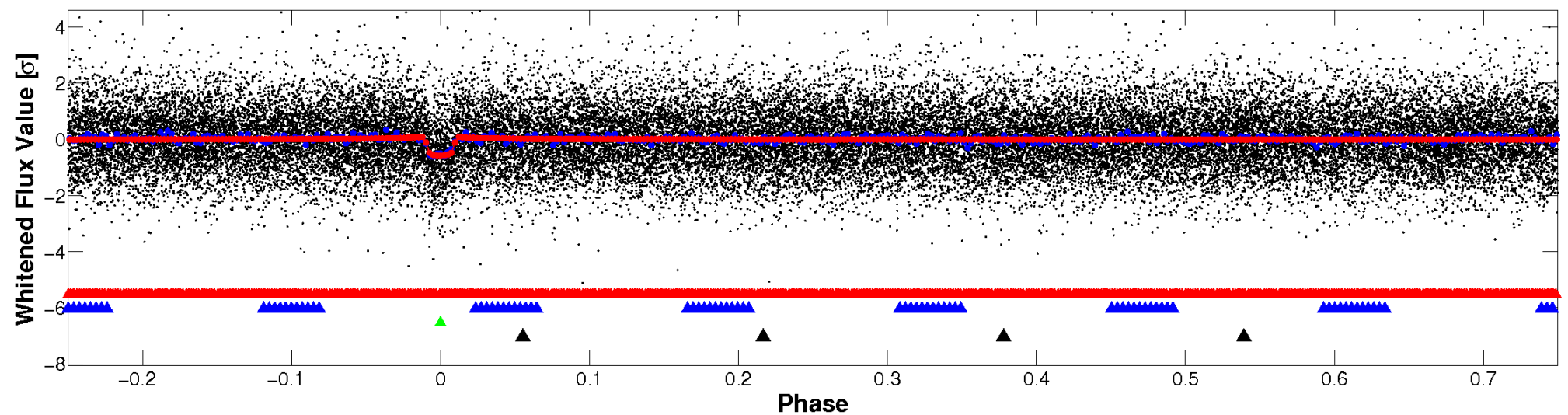


# Non-Whitened Vs. Whitened Light Curve

Planet 3 : Phased Unwhitened Flux Time Series (Fit Epoch/Period)

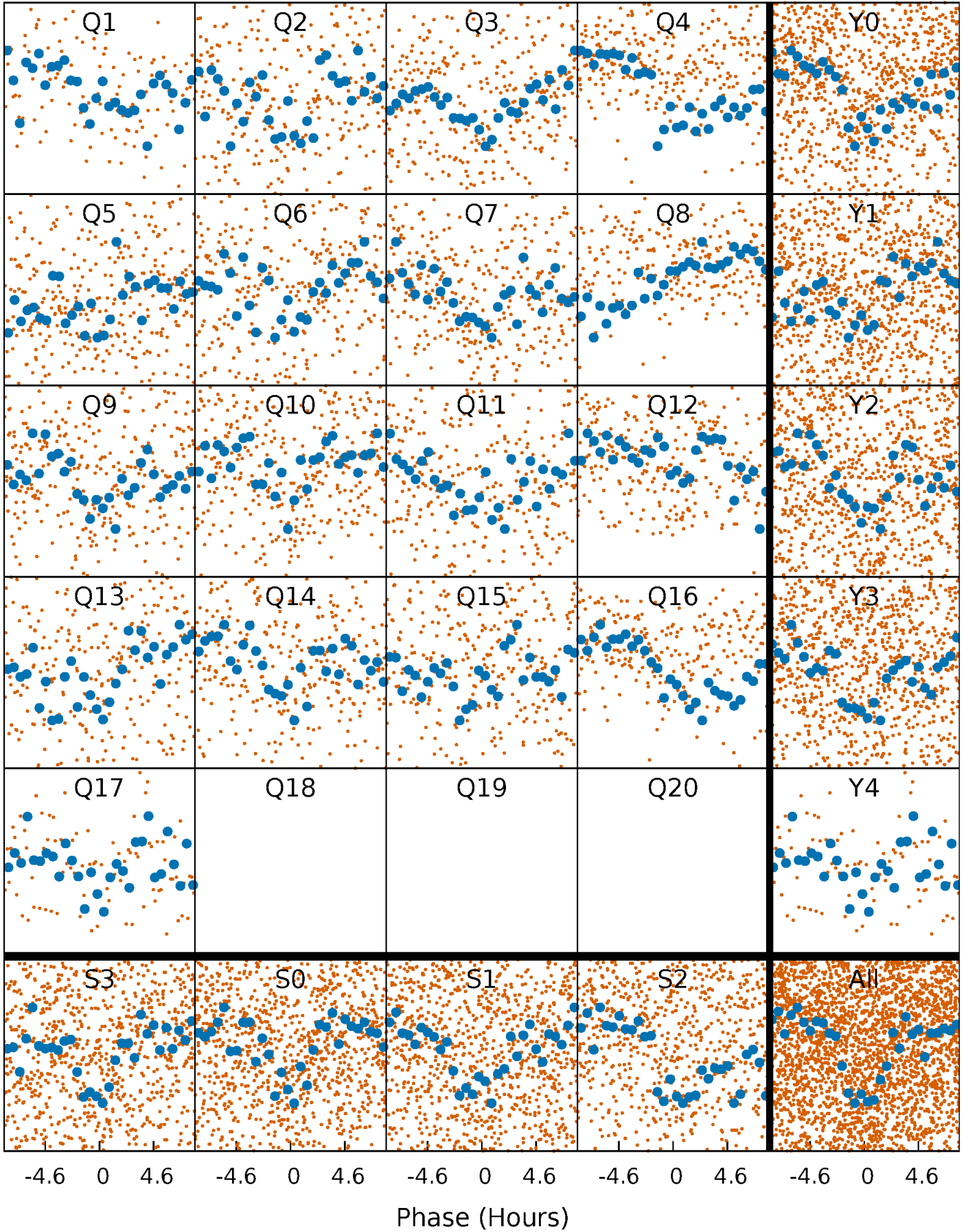


Planet 3 : Phased Whitened Flux Time Series (Fit Epoch/Period)



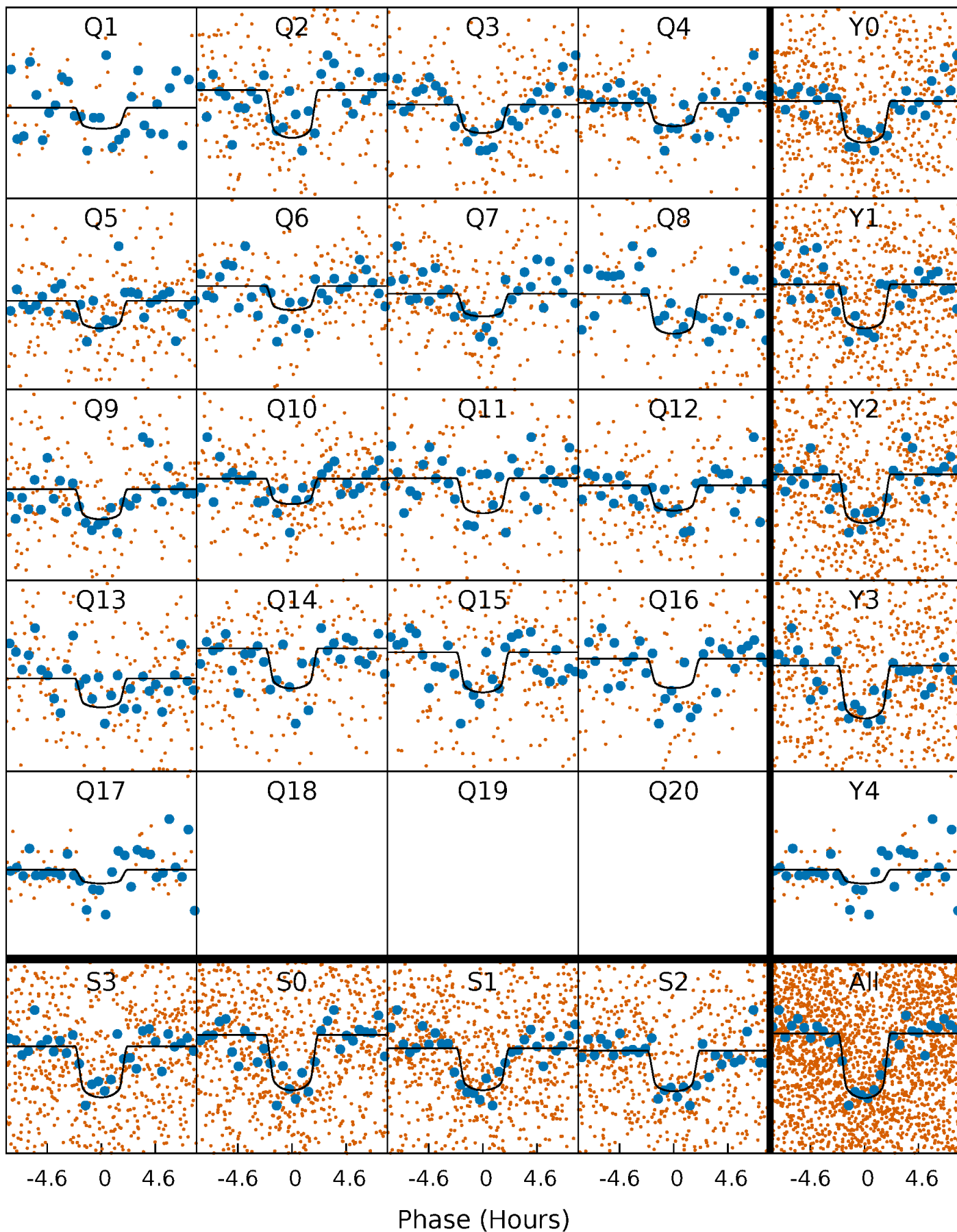
# PDC Quarter-Phased Transit Curves

TCE 009529744-03   P= 8.371643 Days    $T_0=137.680577$  (BKJD)



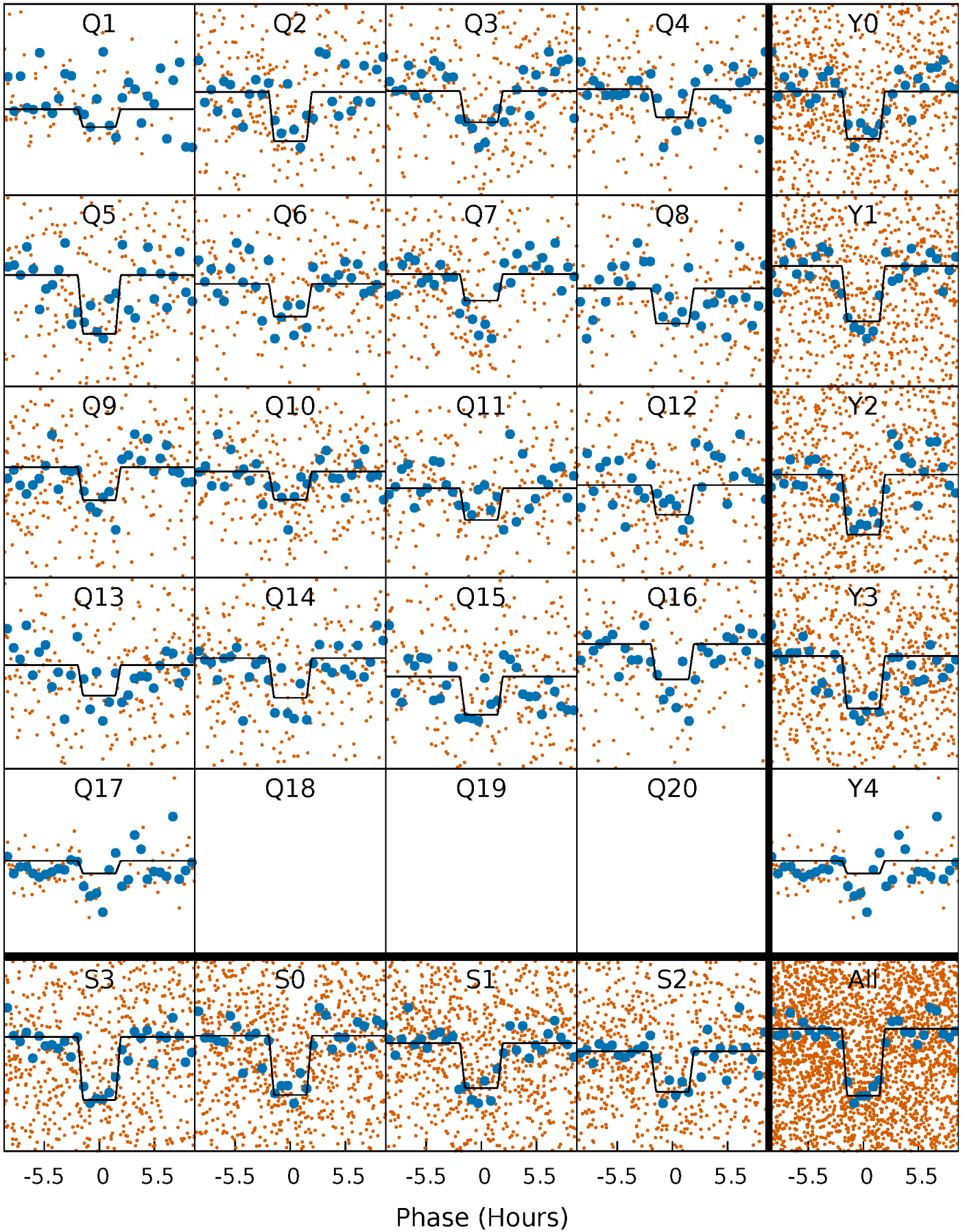
# DV Quarter-Phased Transit Curves

TCE 009529744-03   P= 8.371643 Days    $T_0=137.680577$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

TCE 009529744-03 P= 8.371603 Days  $T_0=137.681861$  (BKJD)

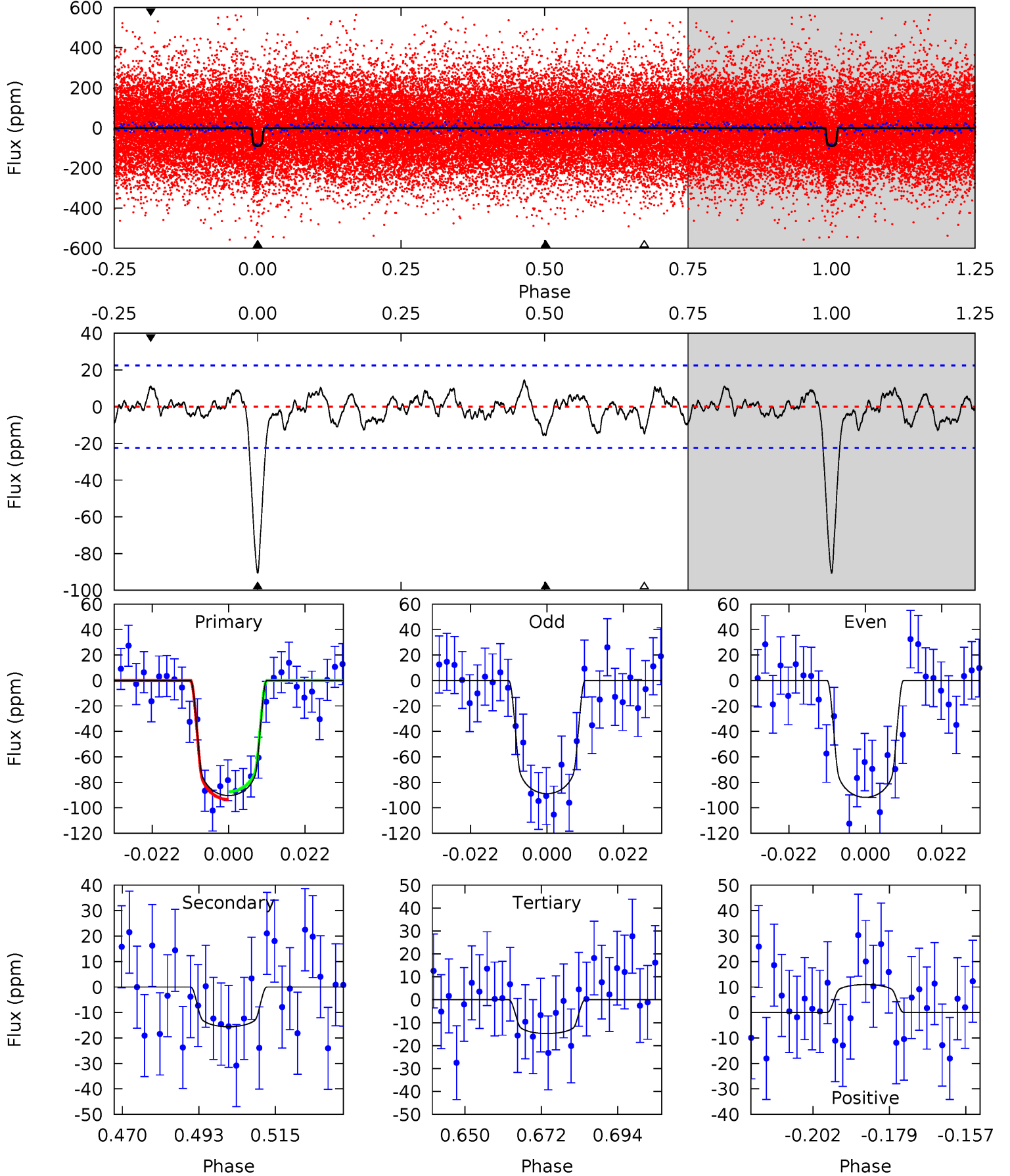




# DV Model-Shift Uniqueness Test

009529744-03, P = 8.371643 Days, E = 129.308934 Days

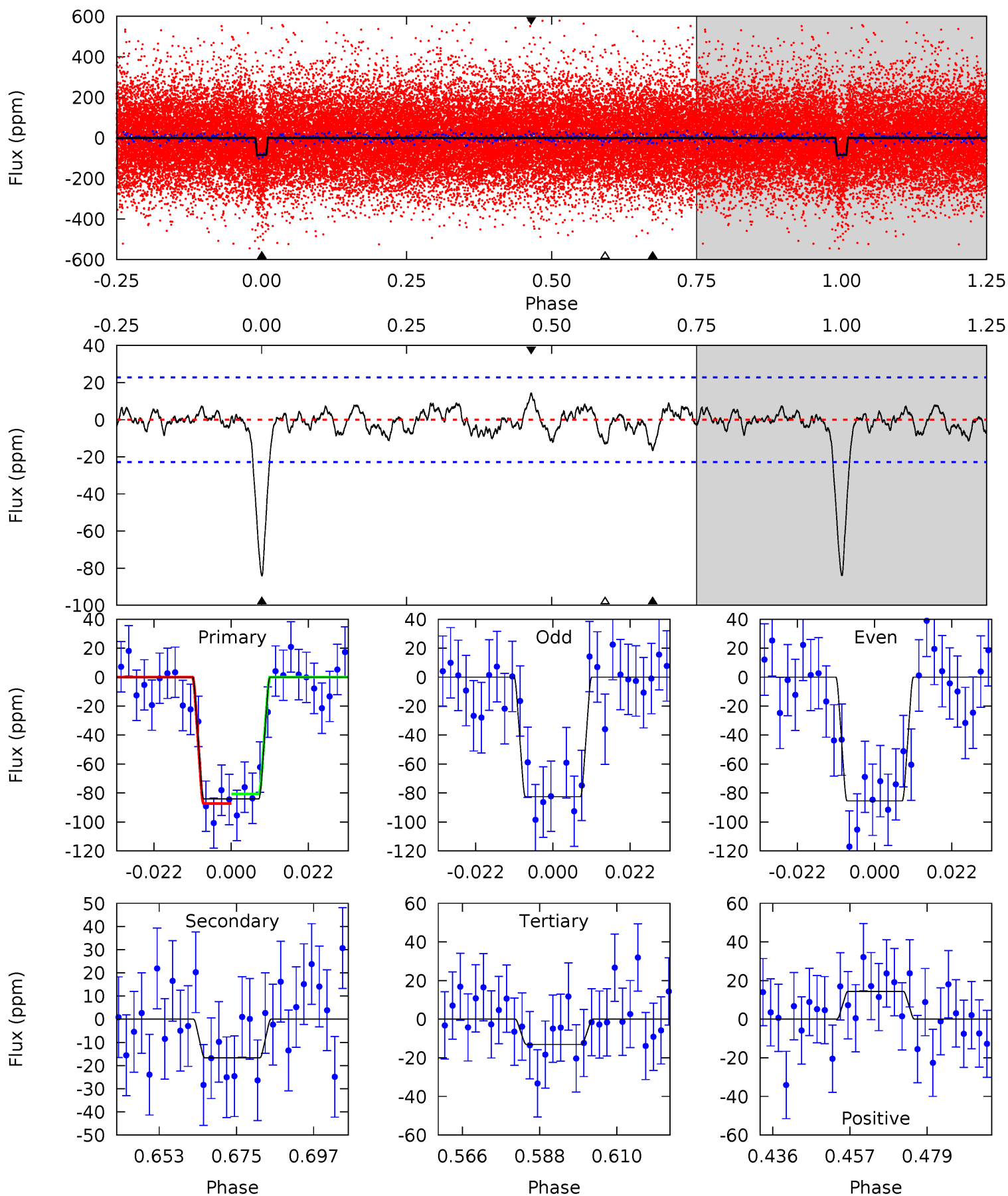
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
19.6	3.38	3.20	2.37	4.87	2.28	1.17	16.4	17.2	0.18	1.01	0.32	1.00	0.14	0.67



# Alt Model-Shift Uniqueness Test

009529744-03, P = 8.371603 Days, E = 129.310258 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
18.0	3.55	2.80	3.08	4.87	2.29	1.02	15.2	14.9	0.76	0.48	0.31	0.97	0.15	0.71





### Stellar Parameters For KIC 009529744

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6426^{+175}_{-175}$	$4.013^{+0.259}_{-0.130}$	$-0.240^{+0.300}_{-0.250}$	$1.775^{+0.411}_{-0.503}$	$1.182^{+0.209}_{-0.157}$	$0.298^{+0.438}_{-0.115}$
	+3%/-3%	+6%/-3%	+125%/-104%	+23%/-28%	+18%/-13%	+147%/-39%
Source	PHO1	FLK73	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 009529744-03 / KOI 1806.03

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-16 \pm 5$	$1.94^{+0.57}_{-0.55}$	$1783^{+124}_{-139}$	$4203^{+577}_{-408}$	$17^{+17}_{-8}$
Alt.	$-17 \pm 5$	$1.72^{+0.57}_{-0.45}$	$1780^{+121}_{-133}$	$4464^{+610}_{-502}$	$22^{+22}_{-11}$

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

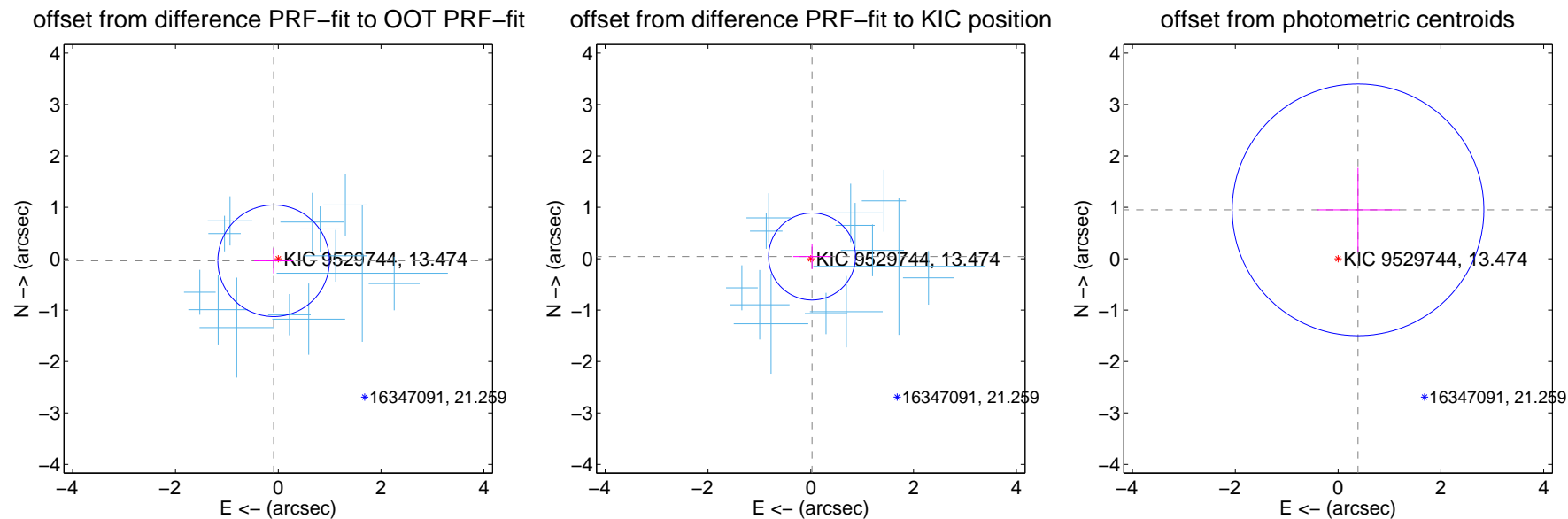
## DV Centroid Data

Supplemental centroid analysis for 009529744-03. Kepler magnitude: 13.47. Transit SNR 14.28

There are 13 quarters with good PRF difference image offsets

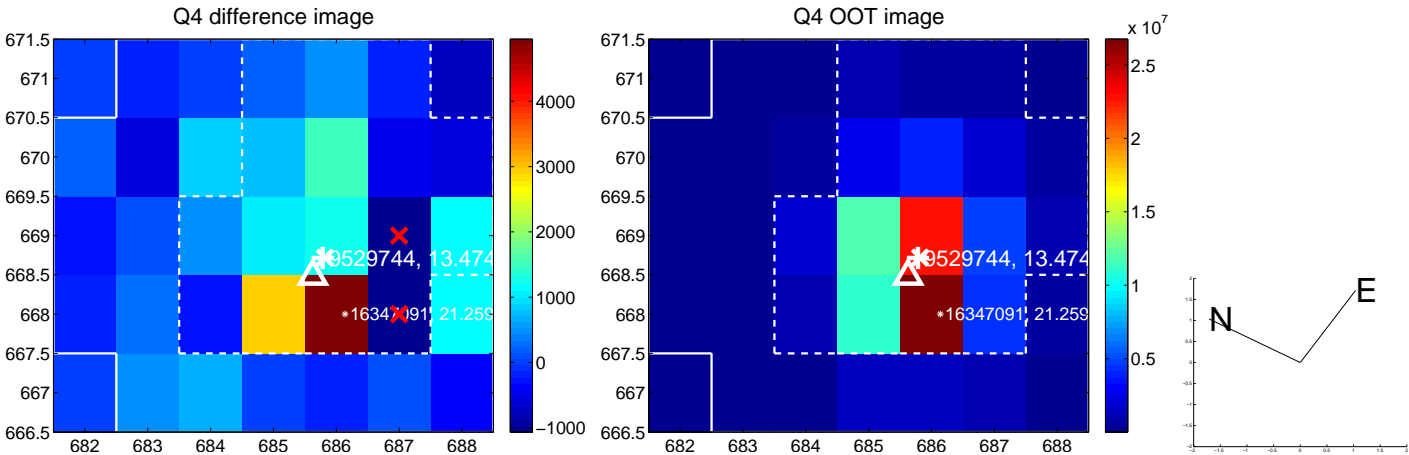
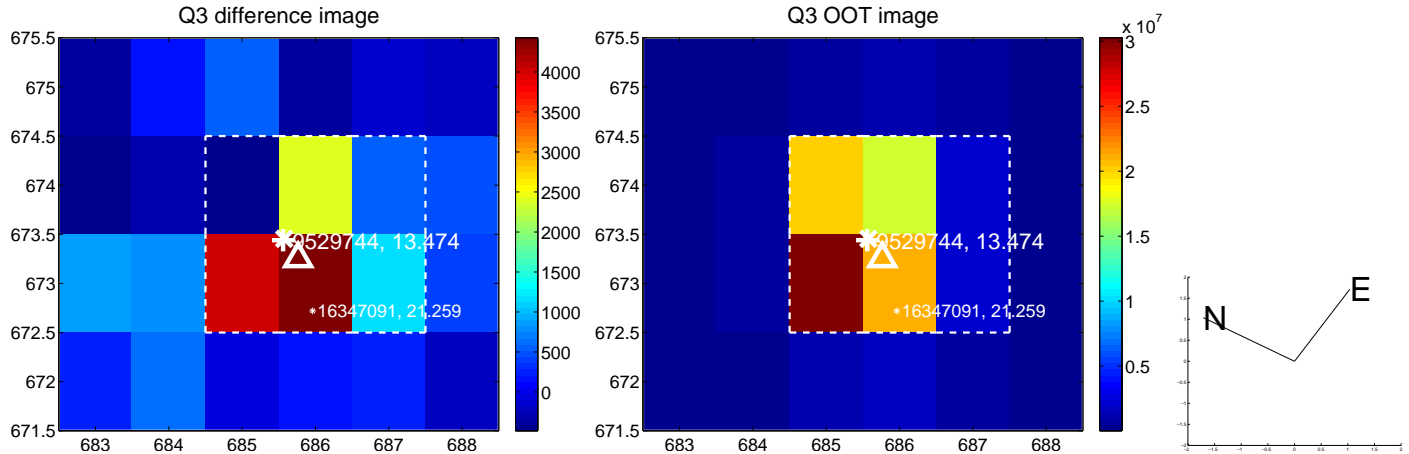
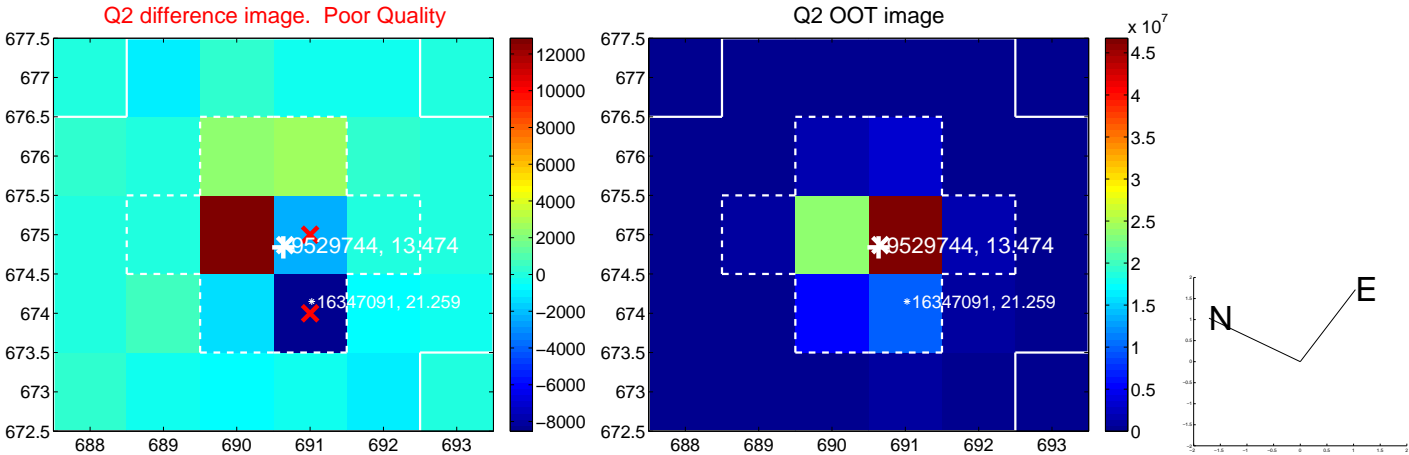
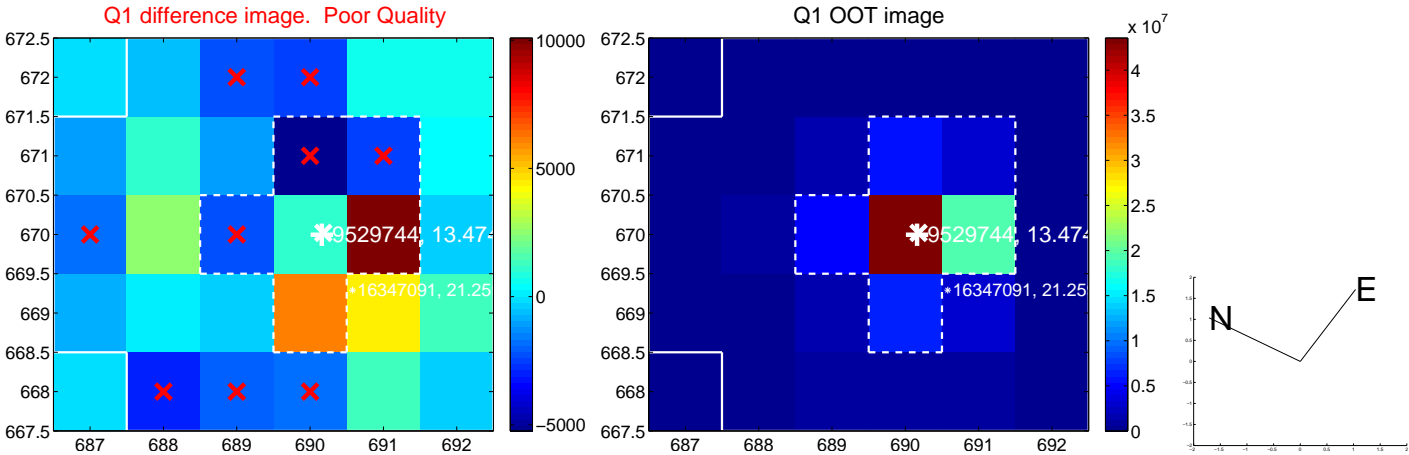
The direct PRF centroid is offset from the target star catalog position by about 0.21 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.098 \pm 0.362$	0.27	$0.089 \pm 0.381$	$-0.040 \pm 0.246$
PRF-fit source offset from KIC position	$0.049 \pm 0.282$	0.17	$-0.025 \pm 0.368$	$0.043 \pm 0.247$
photometric centroid source offset	$1.03 \pm 0.82$	1.26	$-0.39 \pm 0.81$	$0.95 \pm 0.82$

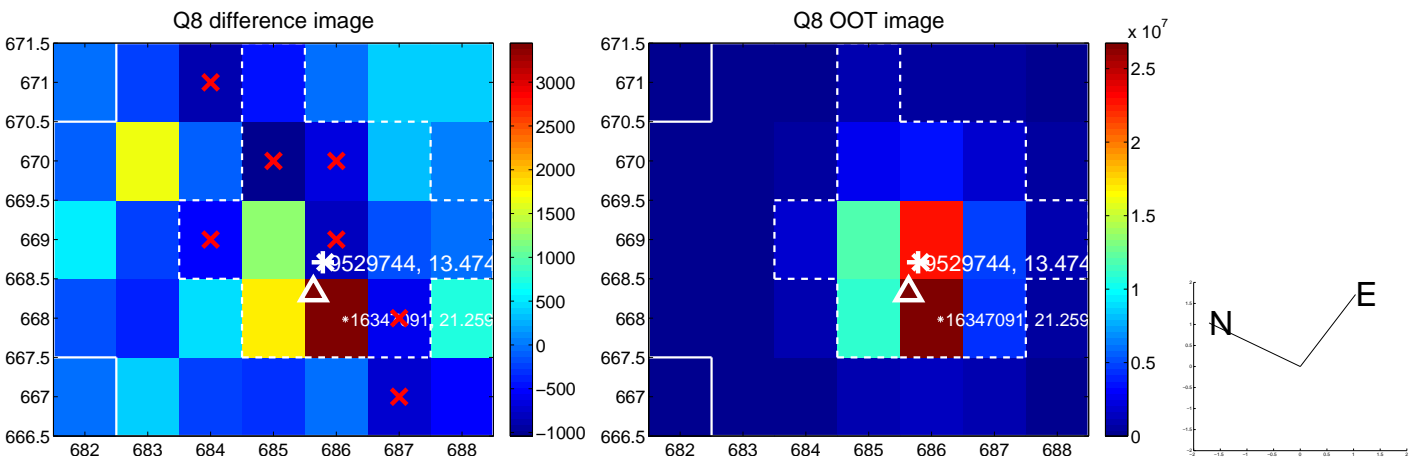
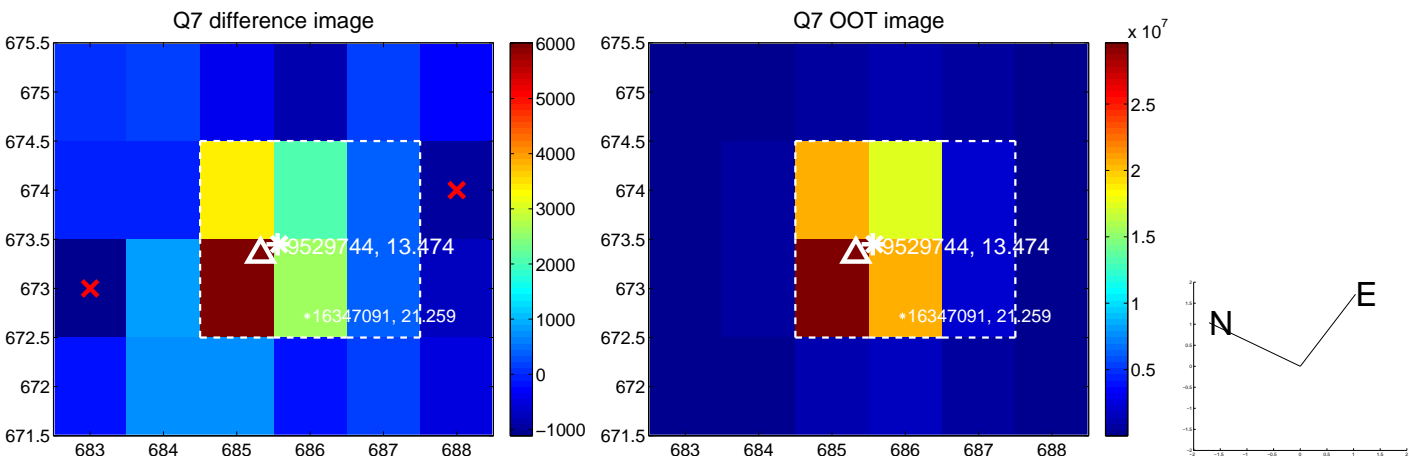
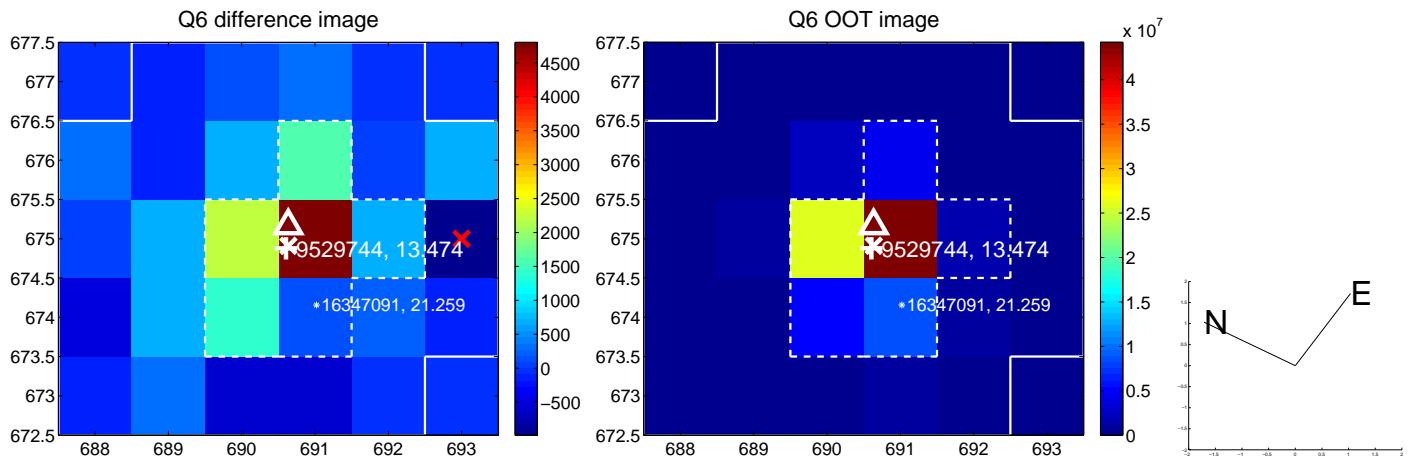
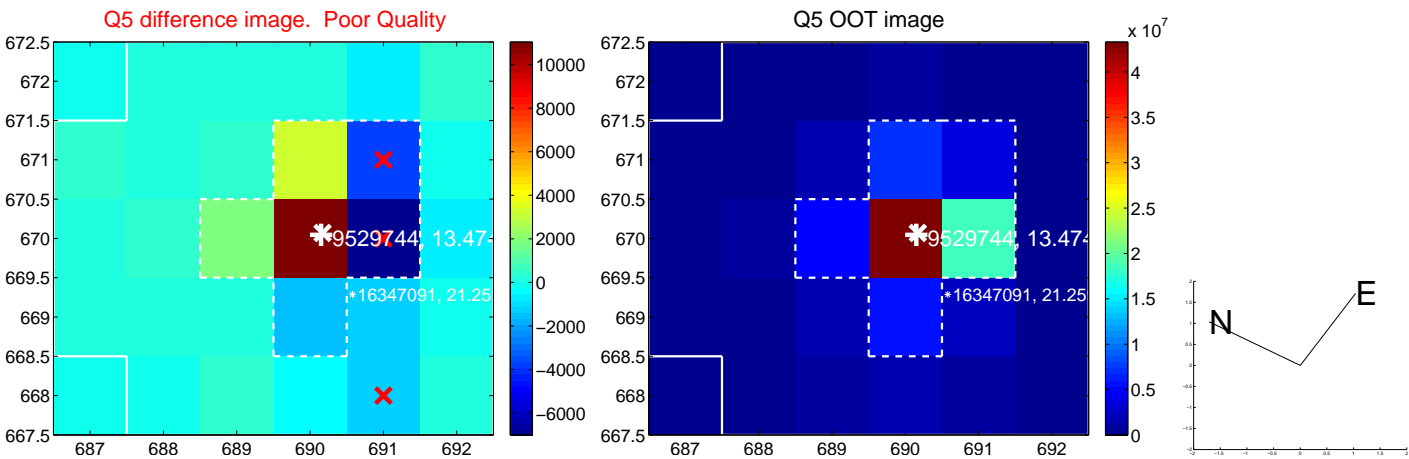


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

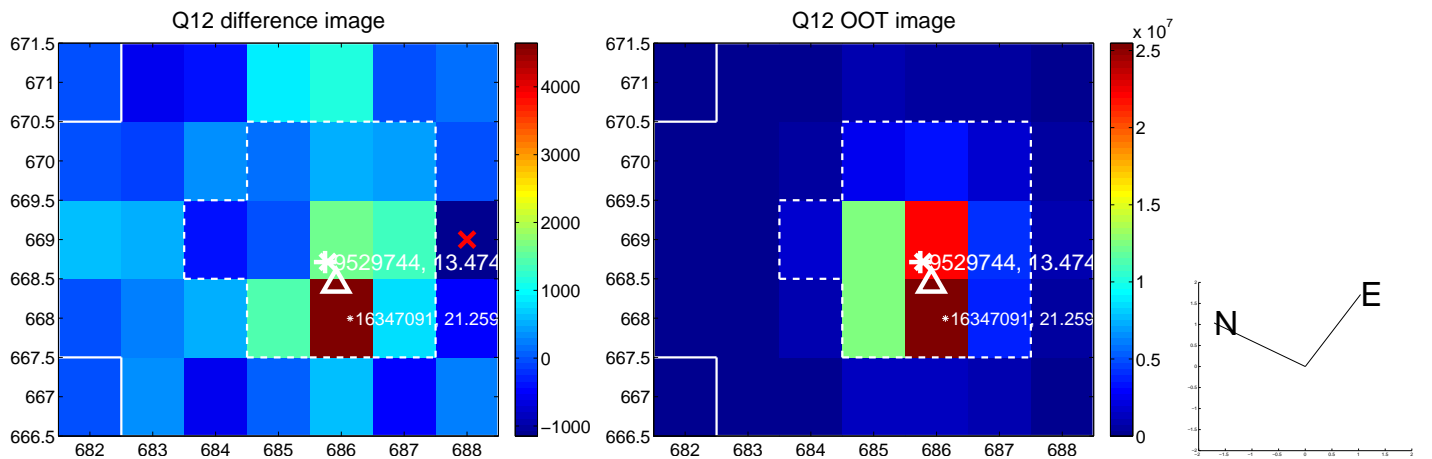
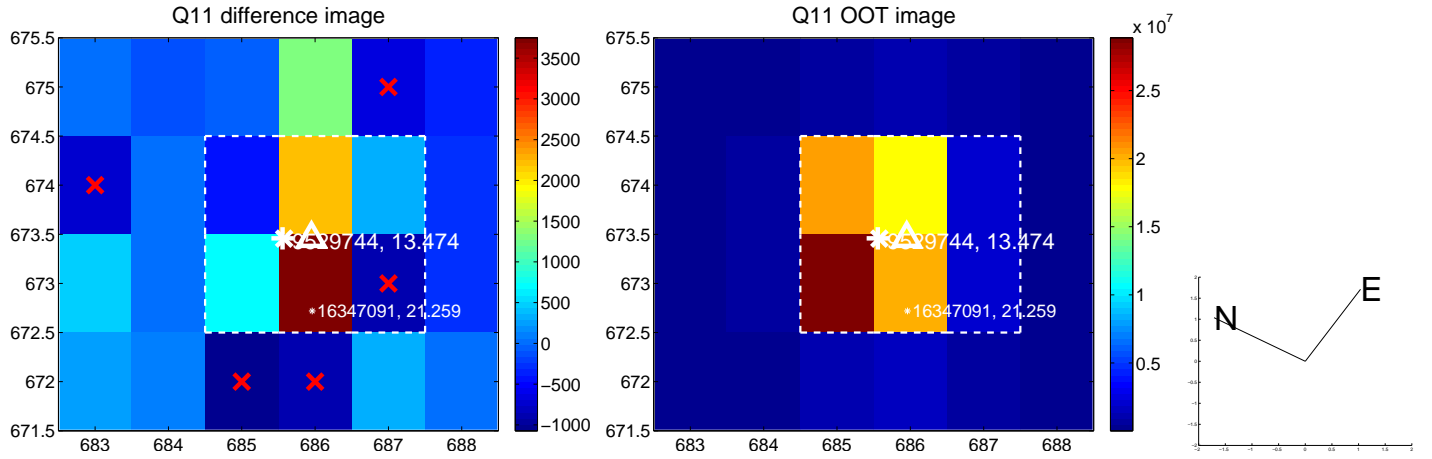
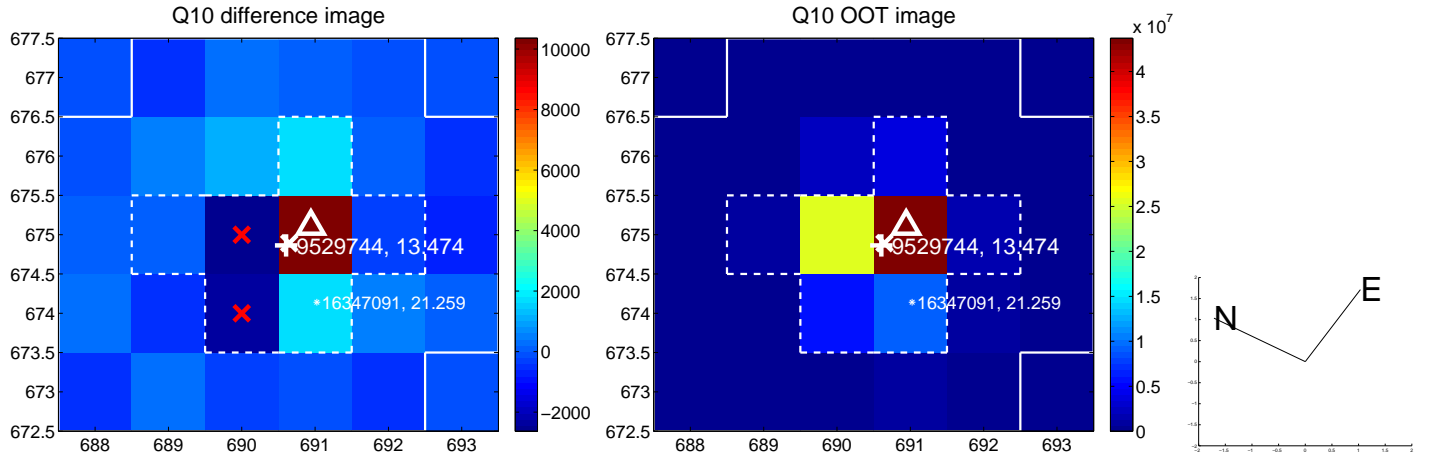
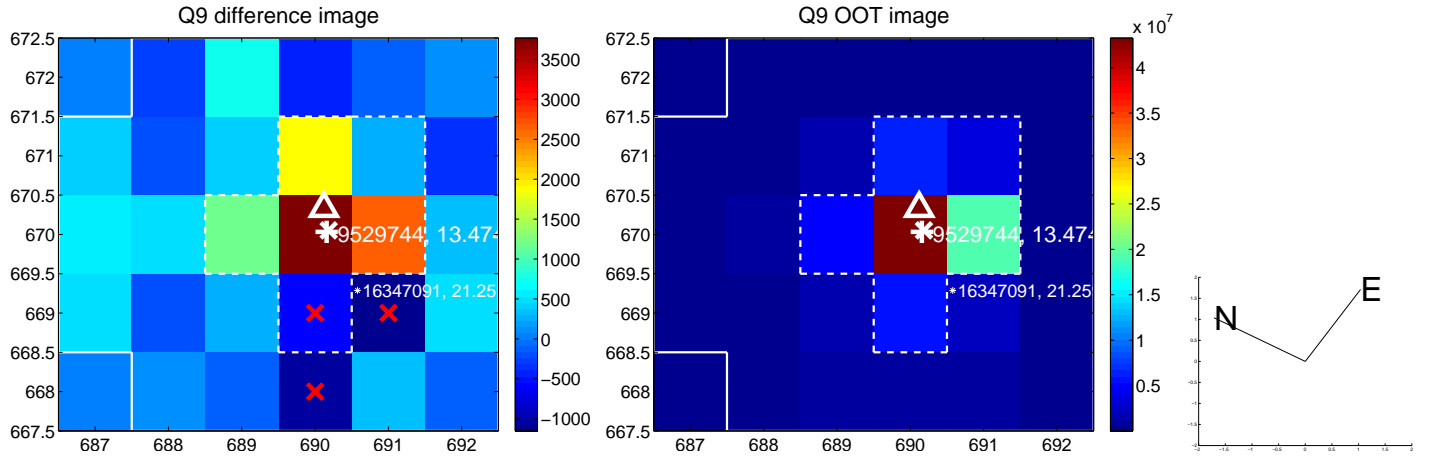
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



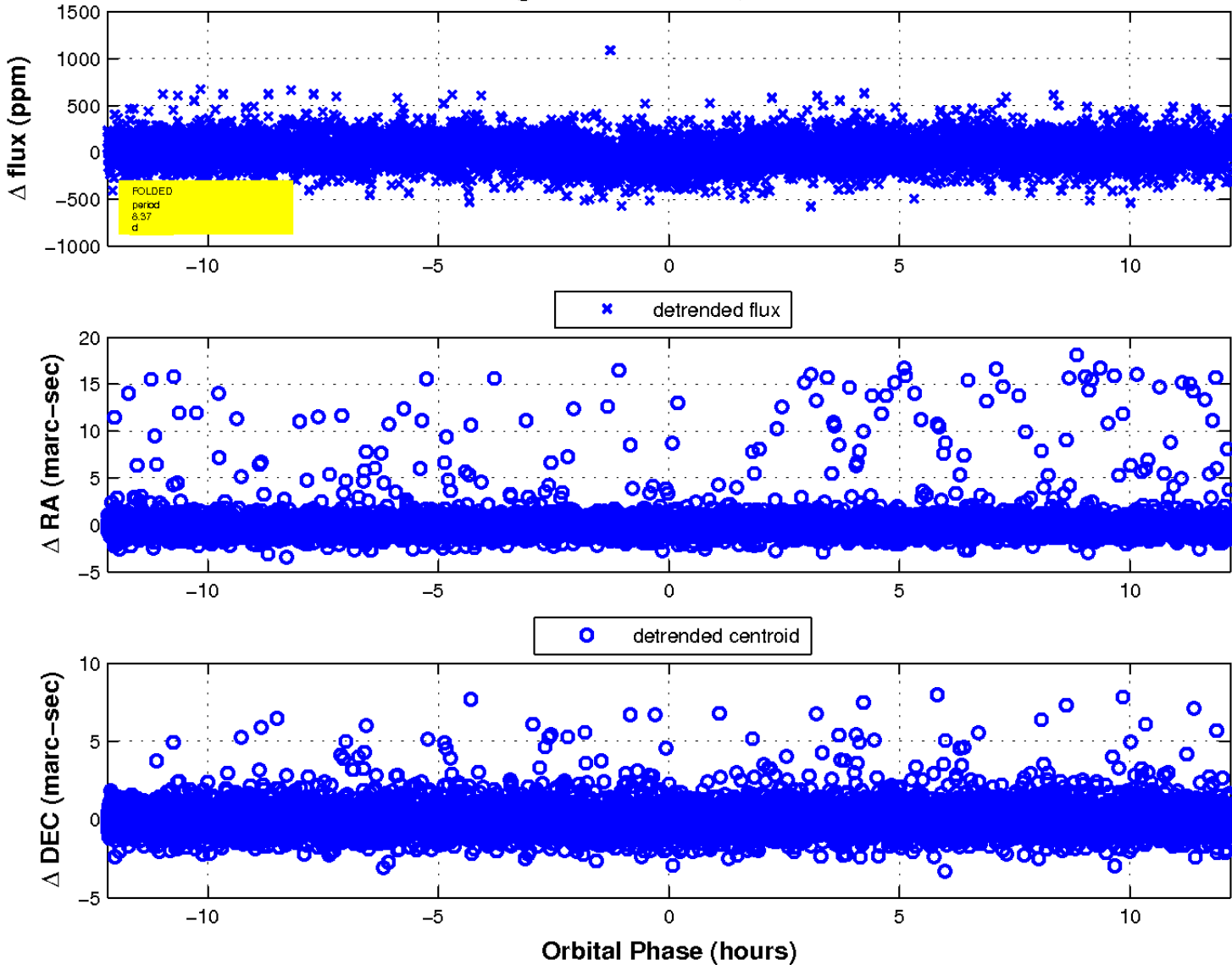
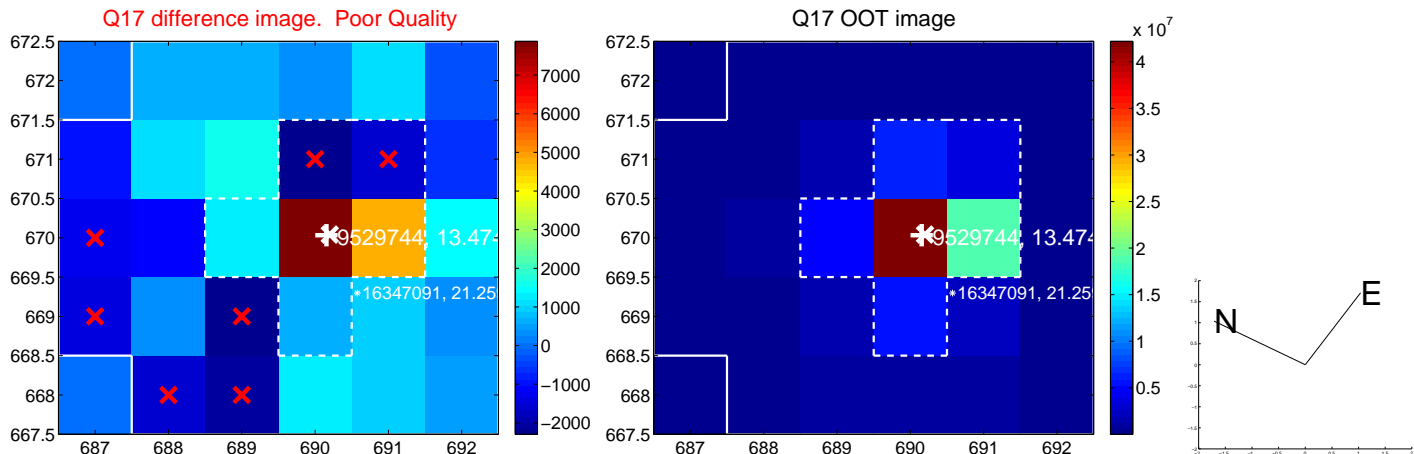
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



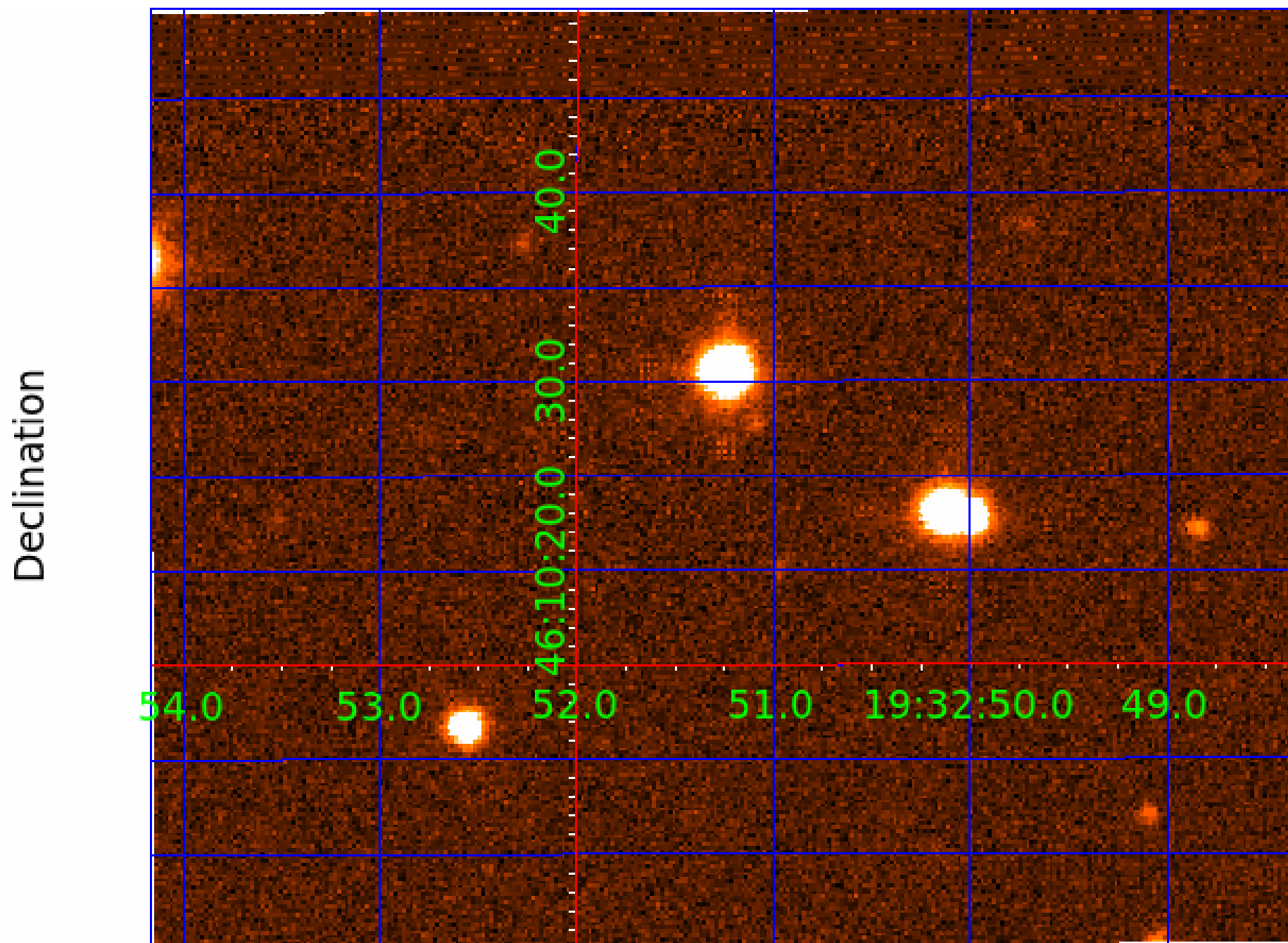




white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\Delta$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image



# KIC 009529744

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009529744-01	OBS	1806.01	2.404478	131.701925	143.9	6.695	101.2	48.3	1.77	6426	2.75	3484.14
009529744-02	OBS	1806.02	17.934775	138.221478	136.2	5.309	15.1	16.7	1.77	6426	2.43	239.07
009529744-03	OBS	1806.03	8.371643	137.680577	88.0	4.061	12.5	14.3	1.77	6426	1.99	660.25
009529744-04	OBS	No	470.162593	154.886986	452.9	12.500	12.9	-1.0	1.77	6426	3.79	3.07

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009529744-01	OBS	FP	0.00	1	0	1	1	LPP_DV—CENT_RESOLVED_OFFSET—EPHEM_MATCH
009529744-02	OBS	PC	0.97	0	0	0	0	NO_COMMENT
009529744-03	OBS	PC	1.00	0	0	0	0	NO_COMMENT
009529744-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_CHASES_MARSHALL_SKYE—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT—INCONSISTENT_TRANS—CENT_NOFITS

**Notes:** OBS = Observed. INJ = Injected. INV = Inverted. SCR = Scrambled.

N = Not Transit-Like. S = Stellar Eclipse. C = Centroid Offset. E = Ephemeris Match.

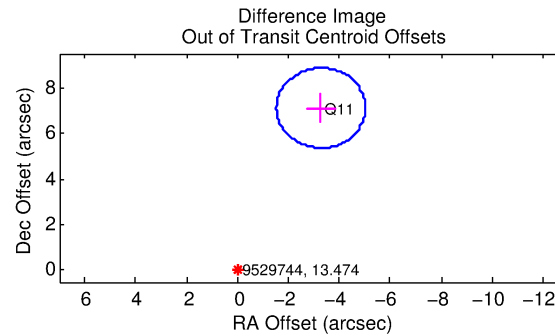
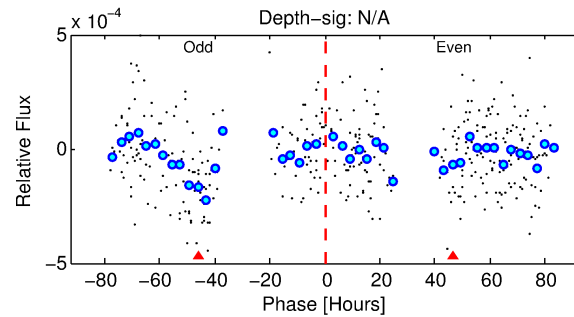
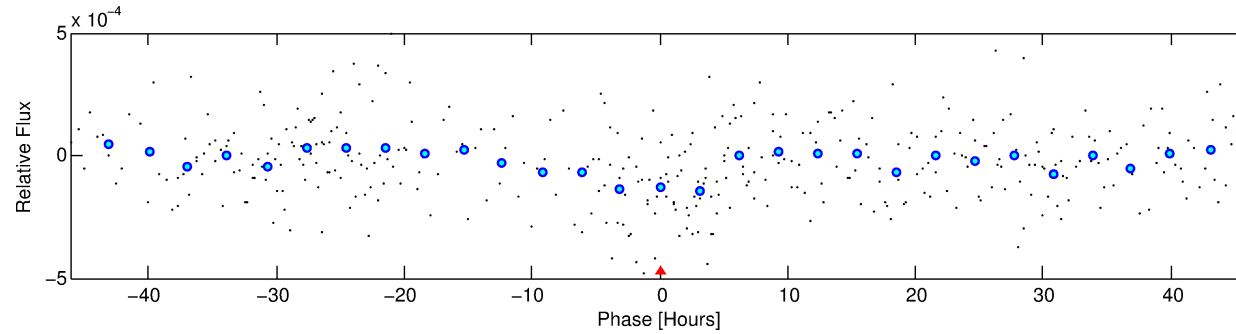
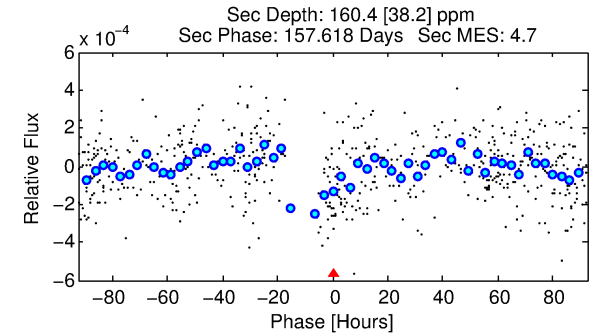
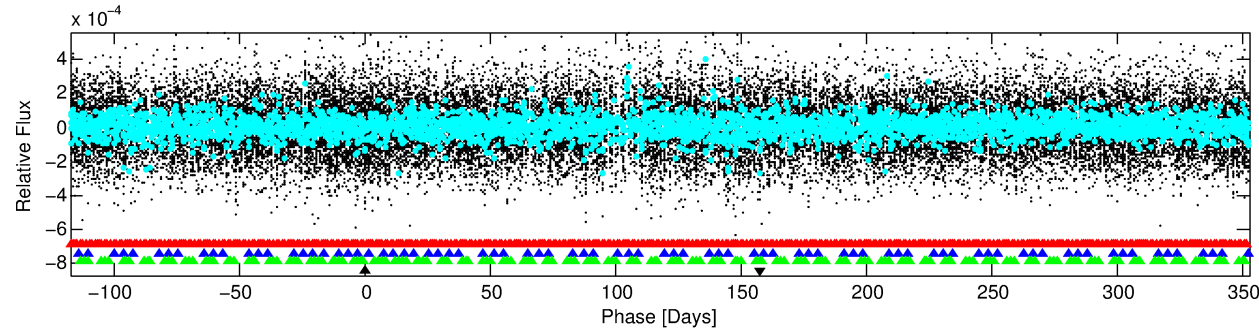
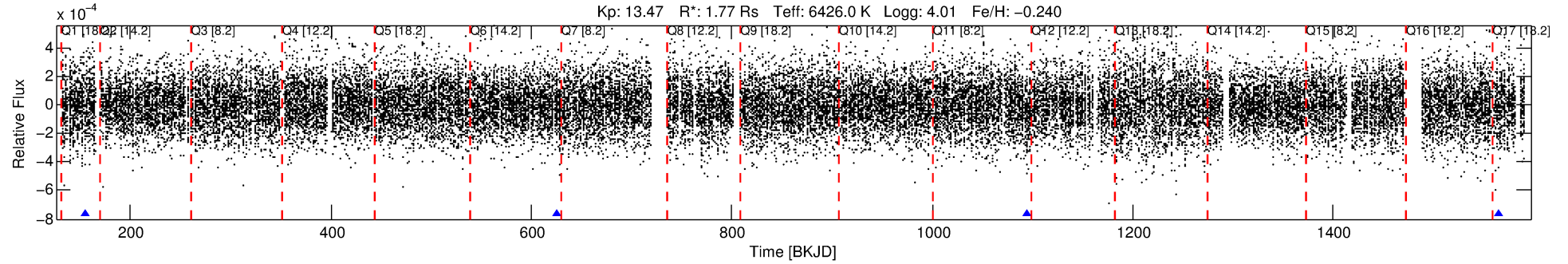
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 009529744-04

No Significant Match Found

# DV One-Page Summary

KIC: 9529744 Candidate: 4 of 4 Period: 470.163 d  
KOI: K01806 Name: Kepler-320 Corr: No Ephemeris Match



## TPS TCE Results:

Period = 470.16259 d  
Epoch = 154.8870 BKJD

DV fit results are unavailable

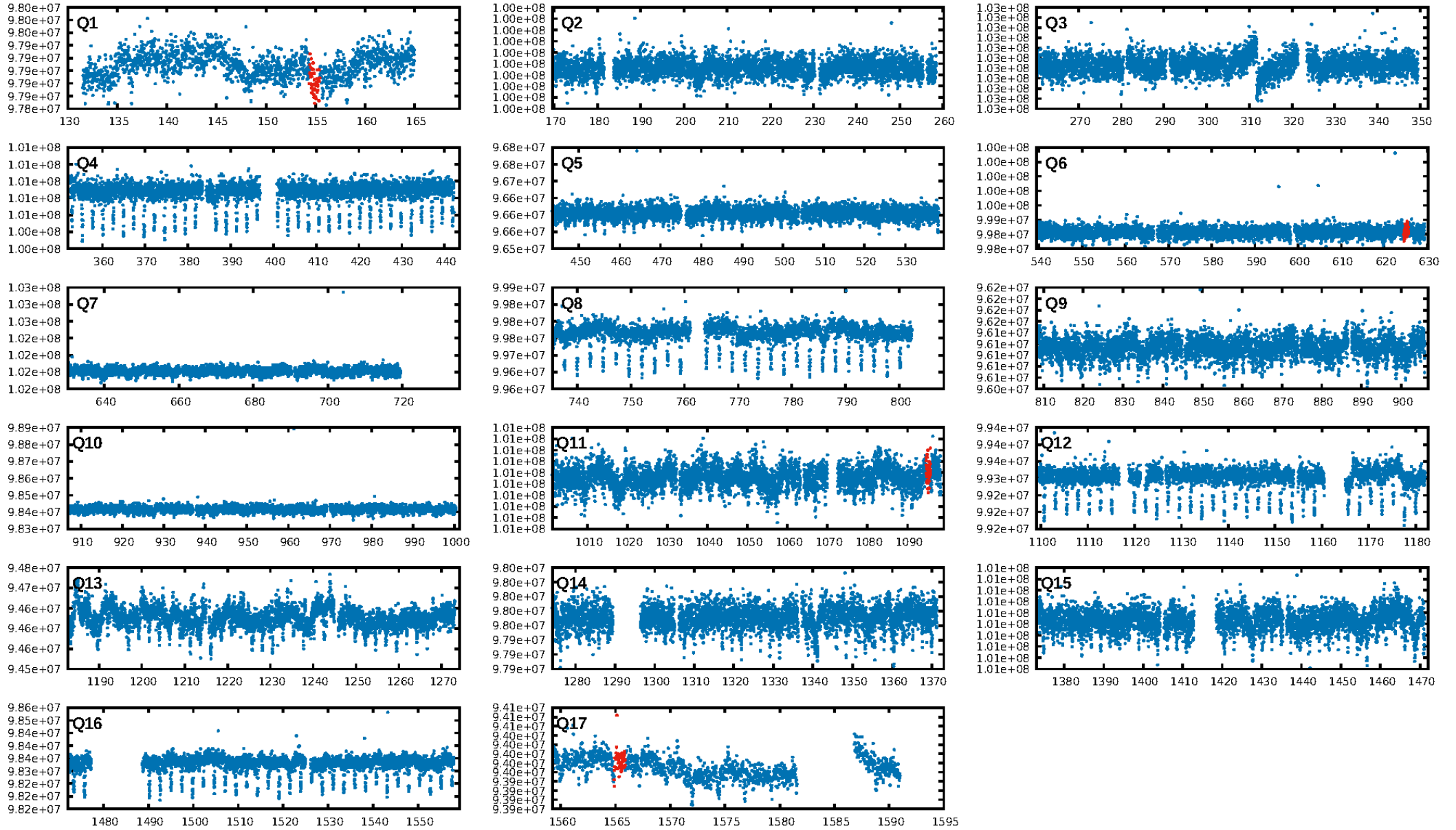
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [799.17σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [2/2]  
GhostDiagnostic-chr: -0.332  
Centroid-sig: N/A  
Centroid-so: 1.919 arcsec [0.92σ]  
OotOffset-rm: 7.840 arcsec [13.45σ]  
KicOffset-rm: 7.928 arcsec [13.60σ]  
OotOffset-st: 0/1/0/0 [1]  
KicOffset-st: 0/1/0/0 [1]  
DiffImageQuality-fgm: 0.00 [0/1]  
DiffImageOverlap-fno: 0.00 [0/4]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 22:50:10 Z

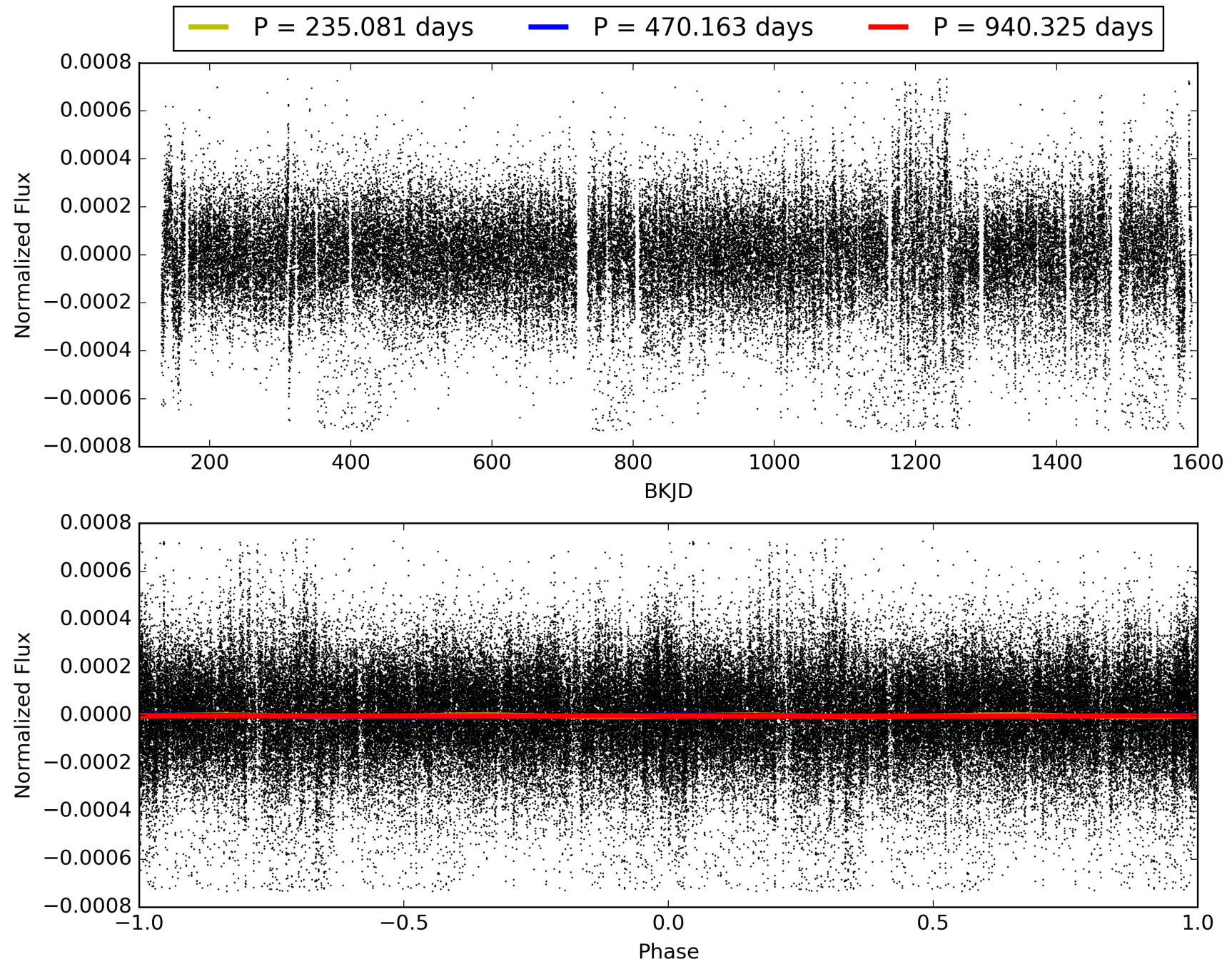
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 009529744-04, PDC Light Curves





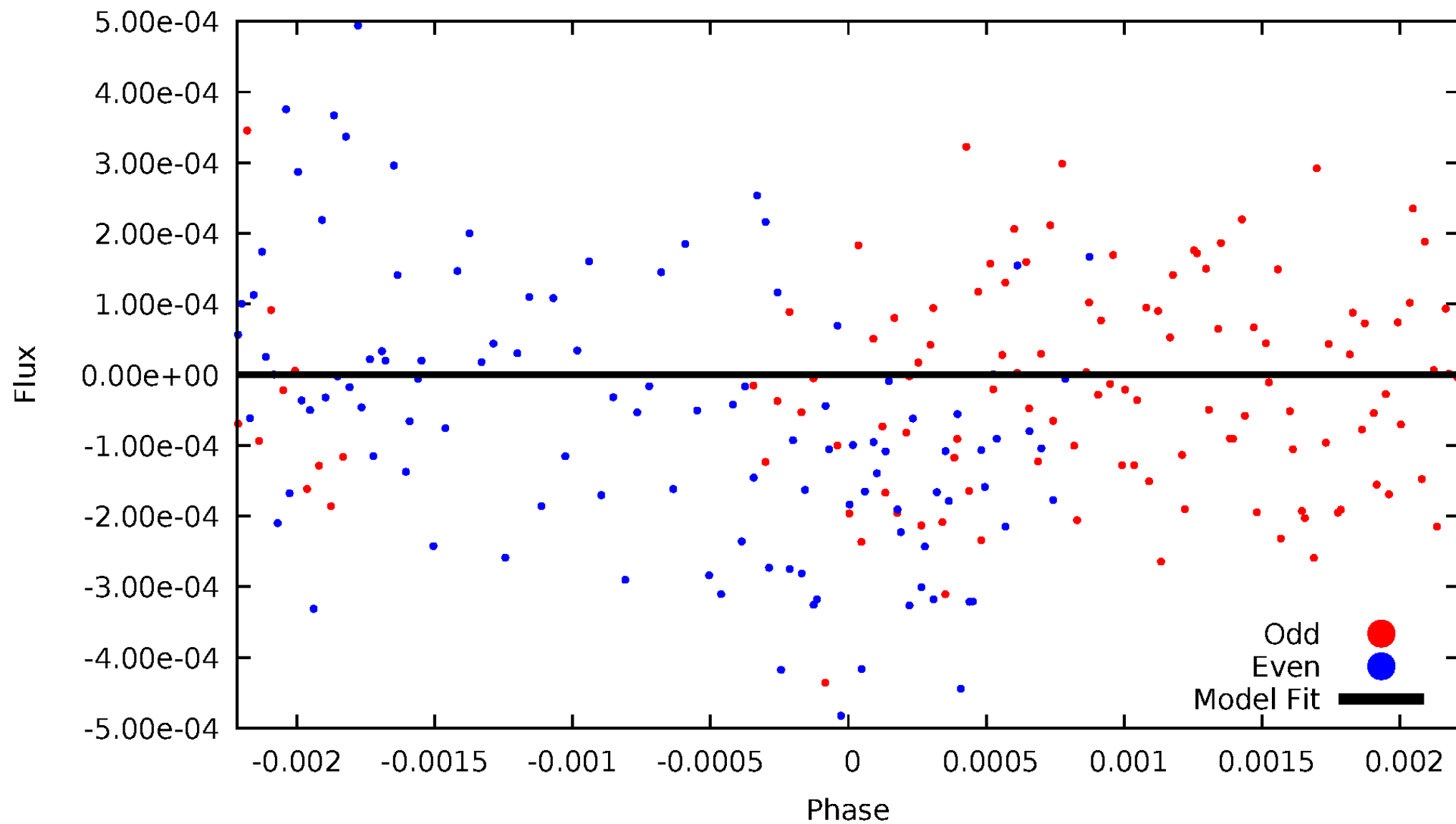
TCE 009529744-04





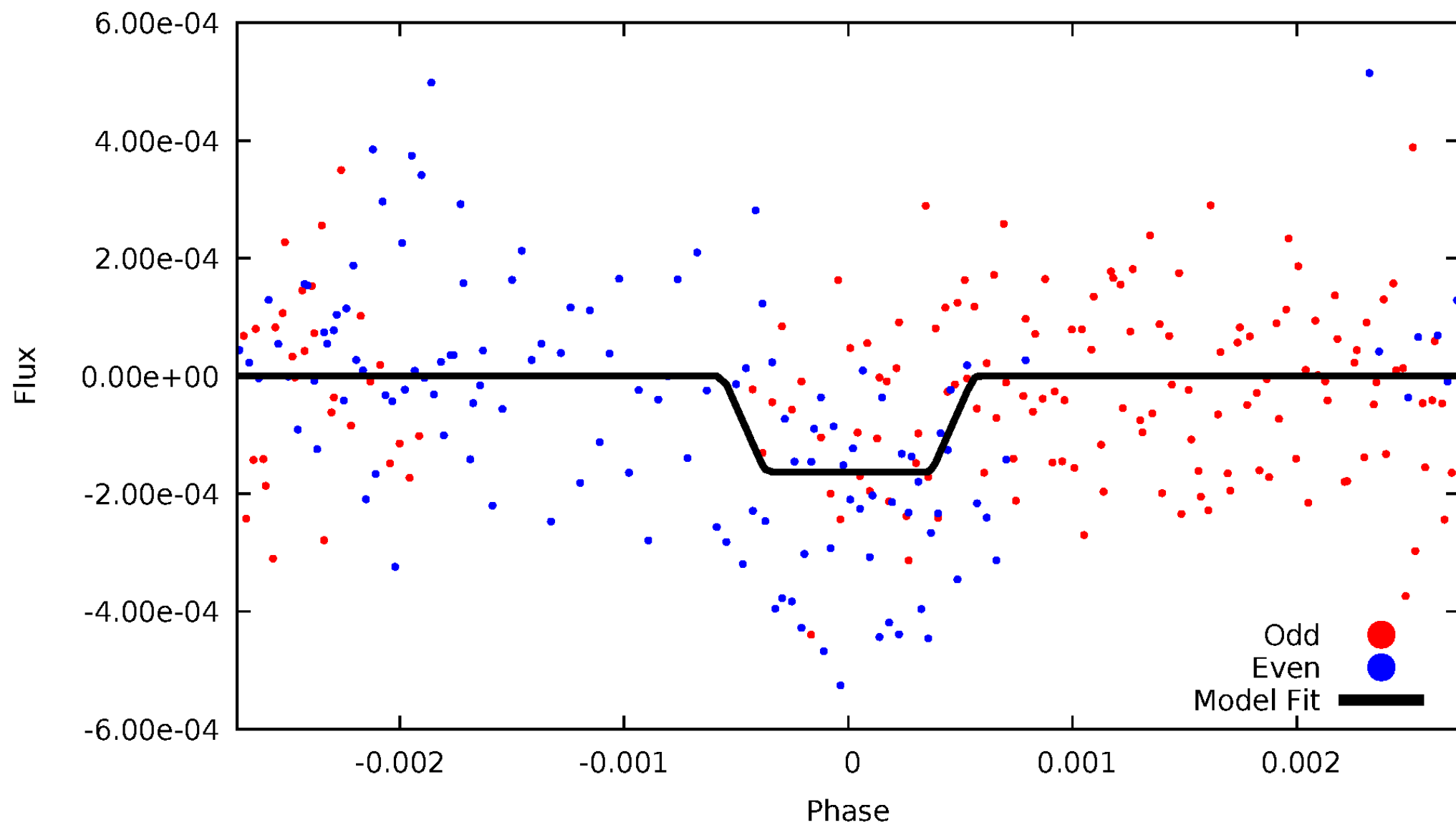
# DV Odd/Even

TCE 009529744-04



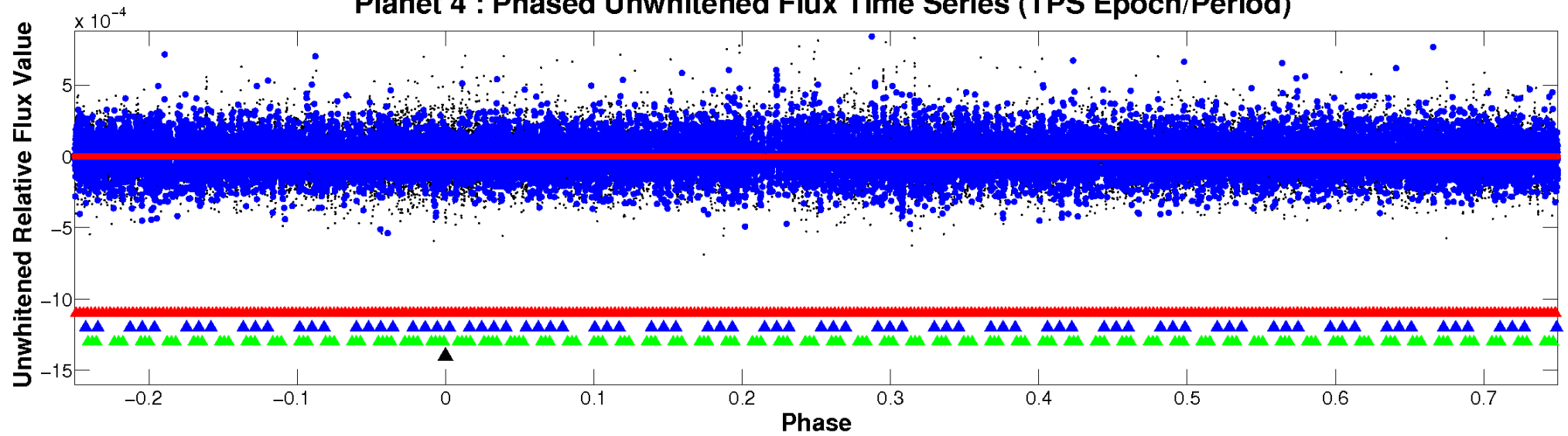
# ALT Odd/Even

TCE 009529744-04



# Non-Whitened Vs. Whitened Light Curve

**Planet 4 : Phased Unwhitened Flux Time Series (TPS Epoch/Period)**



**Planet 4 : Phased Whitened Flux Time Series (TPS Epoch/Period)**



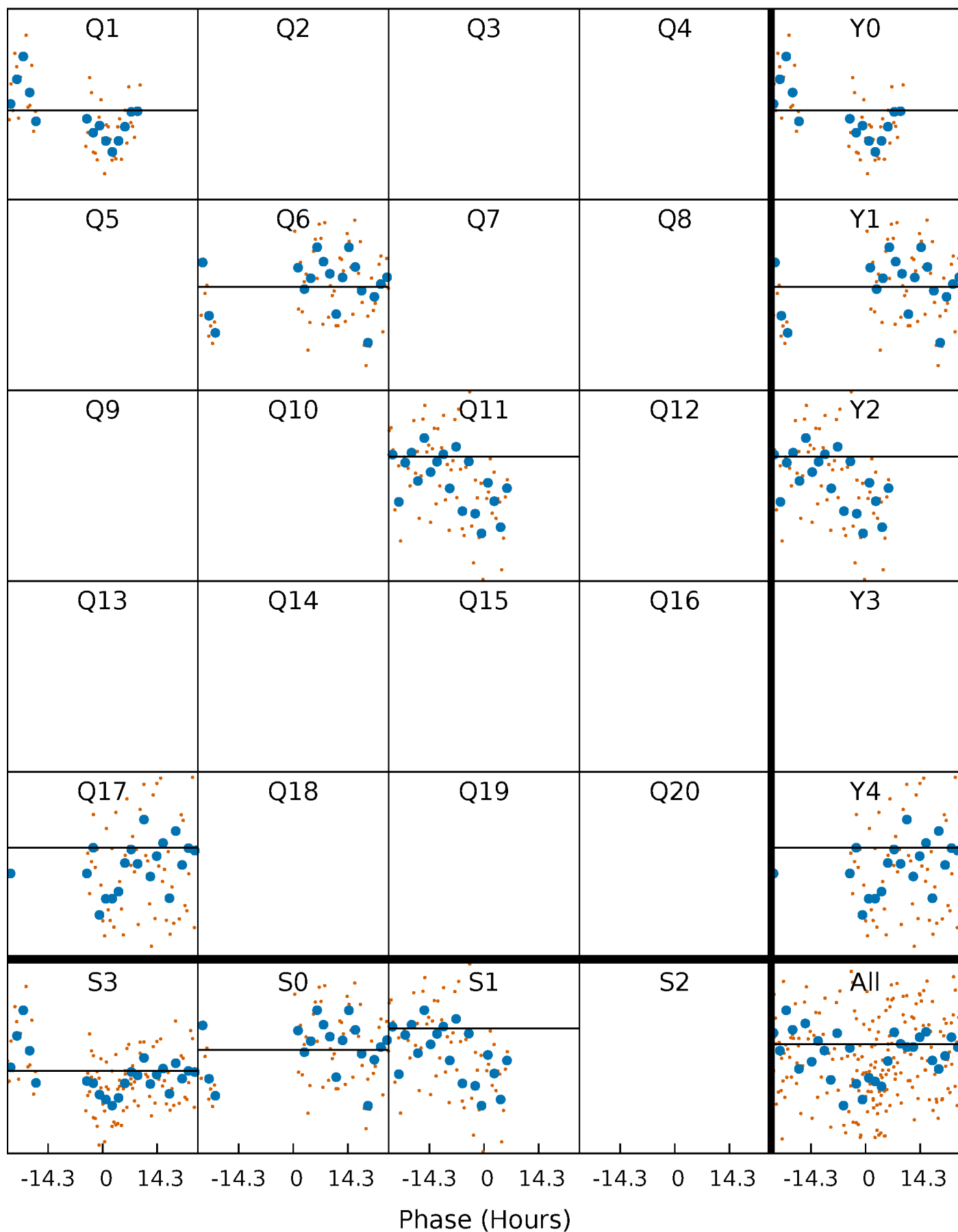
# PDC Quarter-Phased Transit Curves

TCE 009529744-04     $P=470.162593$  Days     $T_0=154.886987$  (BKJD)



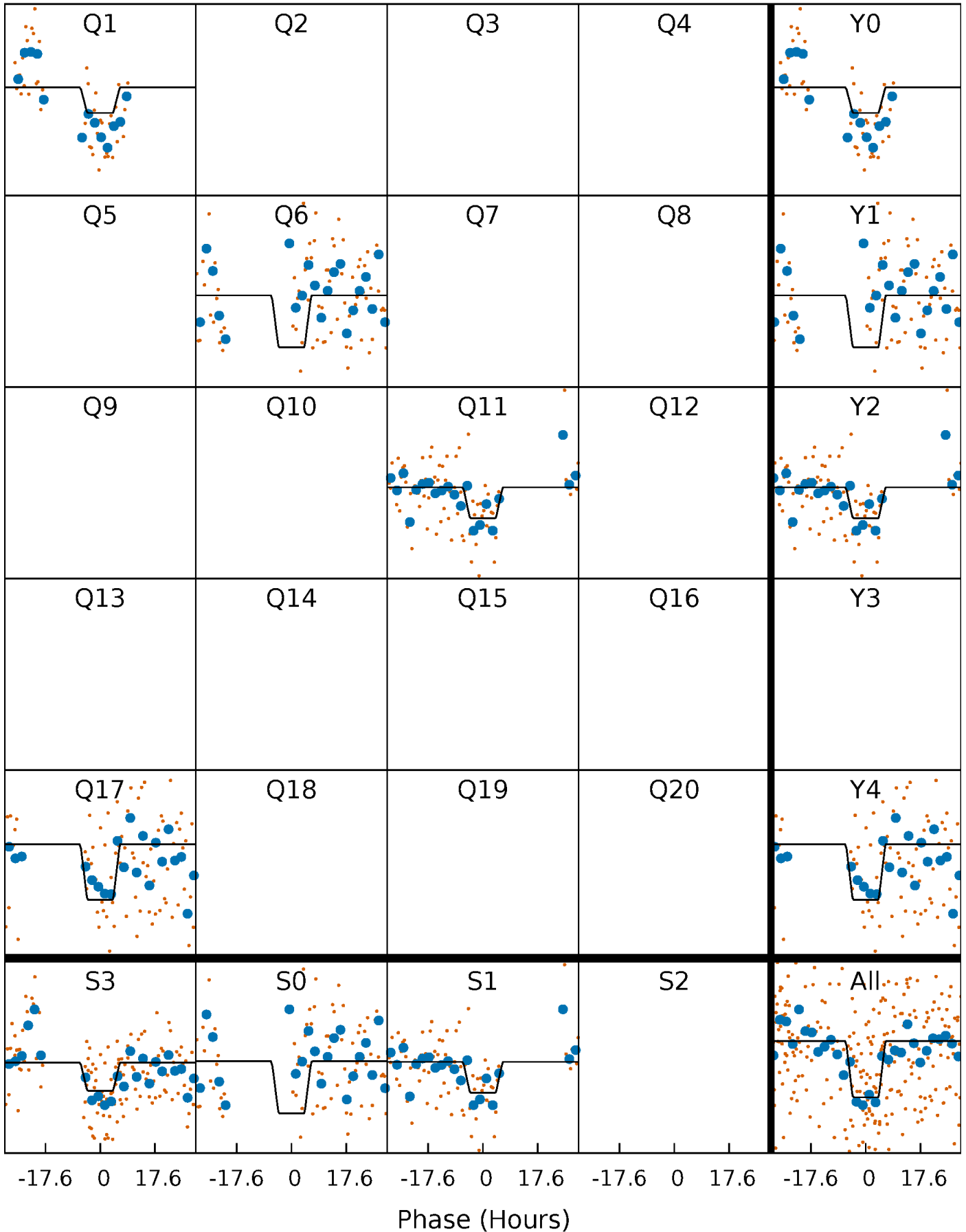
# DV Quarter-Phased Transit Curves

TCE 009529744-04     $P=470.162593$  Days     $T_0=154.886987$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

TCE 009529744-04     $P=470.162593$  Days     $T_0=154.925826$  (BKJD)

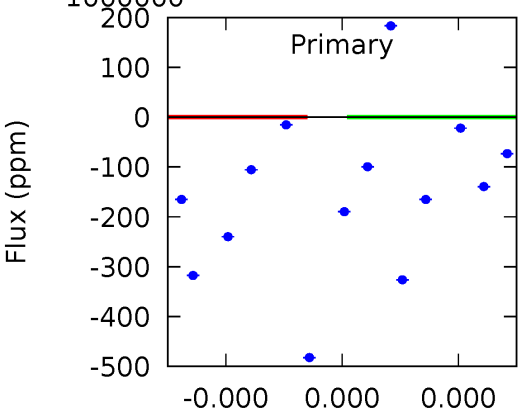
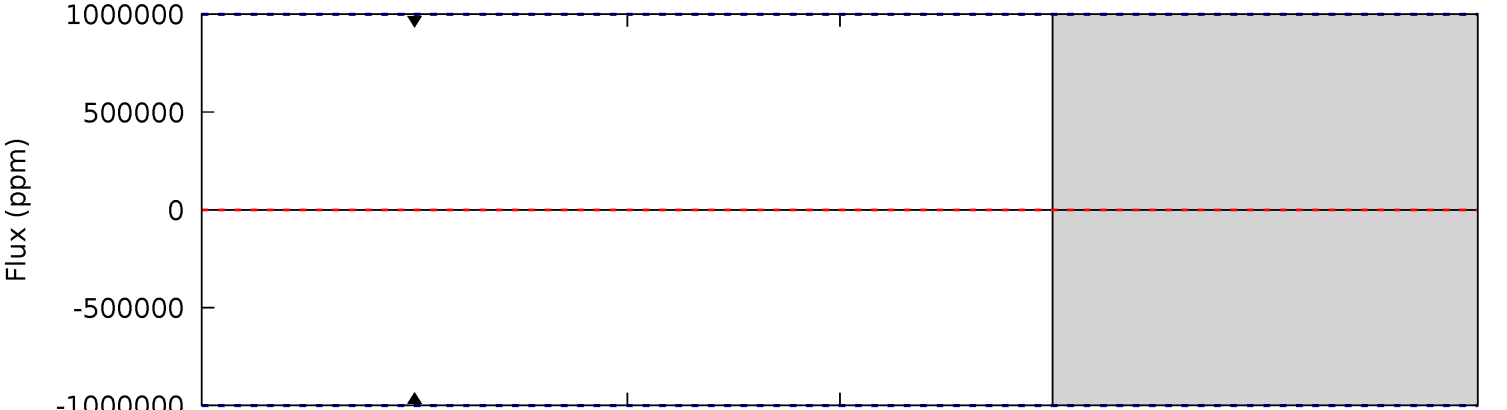
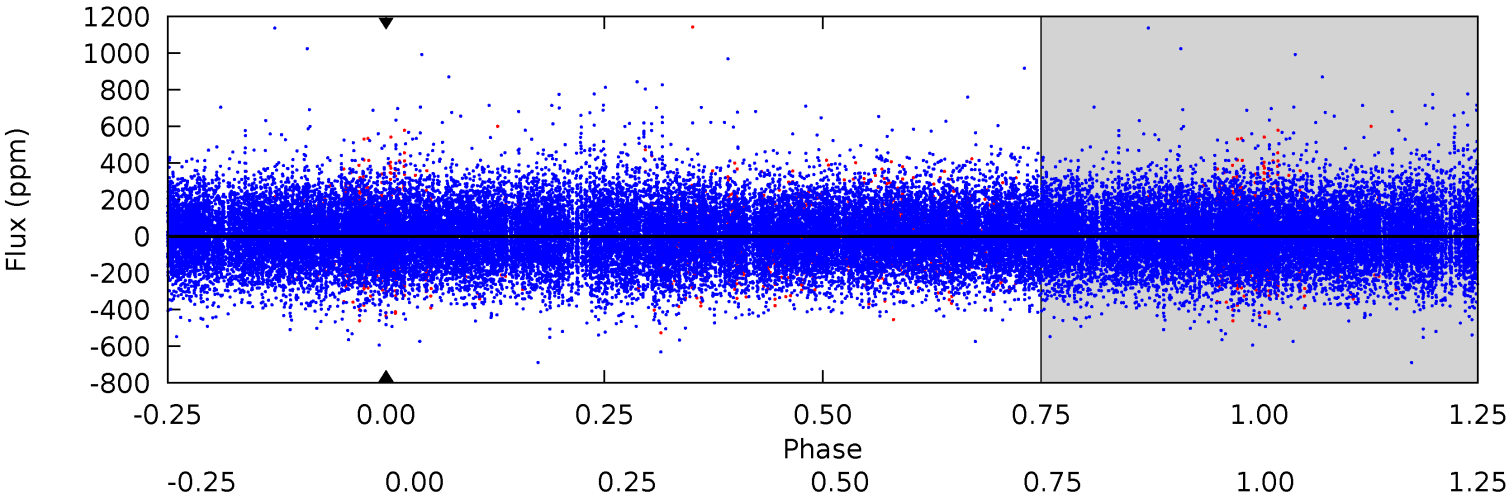




# DV Model-Shift Uniqueness Test

009529744-04, P = 470.162593 Days, E = 154.886987 Days

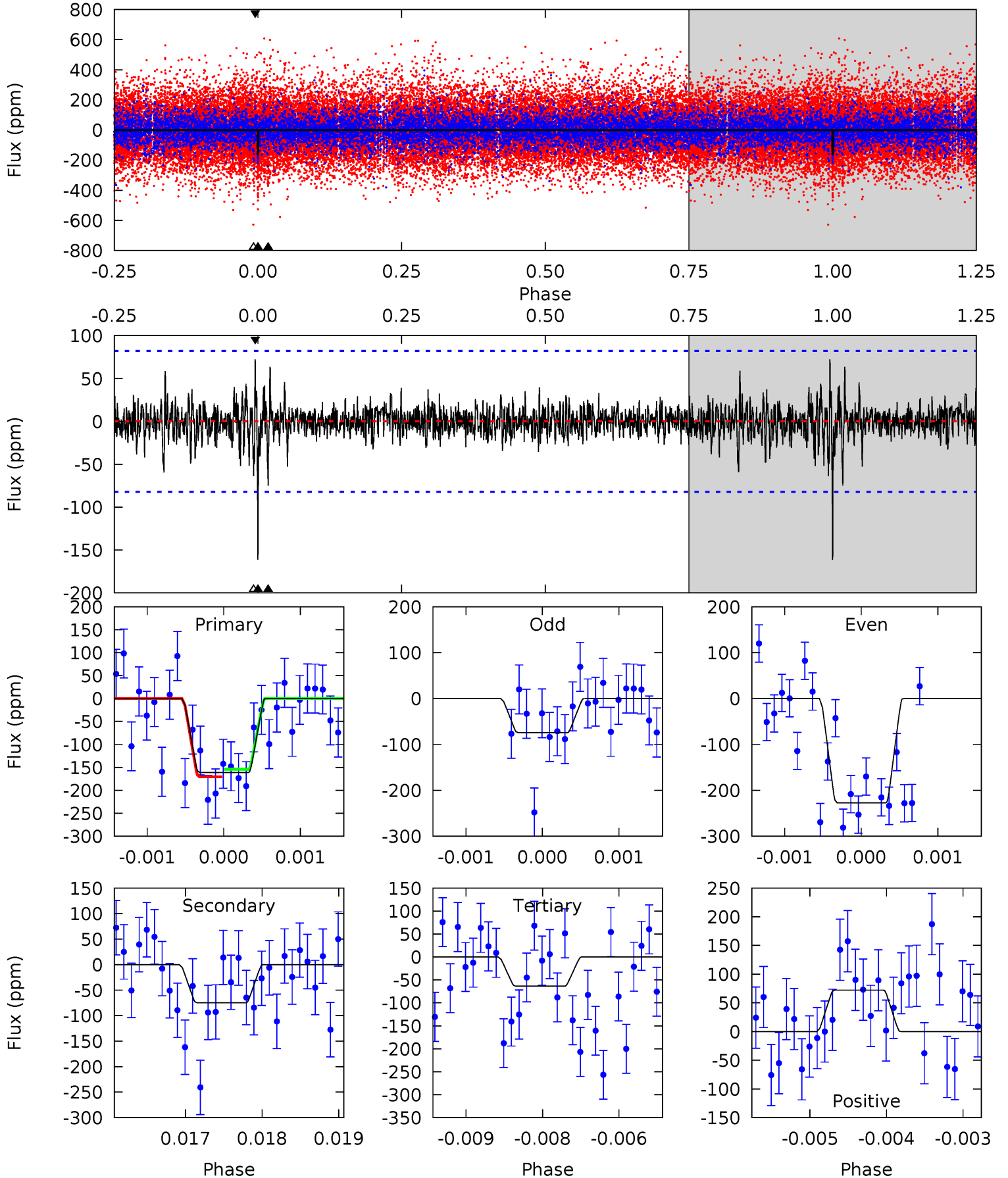
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
0	0	0	0	1.00	1.00	1.00	0	0	0	0	0	0	0	0



# Alt Model-Shift Uniqueness Test

009529744-04, P = 470.162593 Days, E = 154.925826 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
10.7	4.95	4.21	4.78	5.44	3.27	0.91	6.46	5.89	0.74	0.17	5.06	0.98	0.31	0.54



### Stellar Parameters For KIC 009529744

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6426^{+175}_{-175}$	$4.013^{+0.259}_{-0.130}$	$-0.240^{+0.300}_{-0.250}$	$1.775^{+0.411}_{-0.503}$	$1.182^{+0.209}_{-0.157}$	$0.298^{+0.438}_{-0.115}$
	+3%/-3%	+6%/-3%	+125%/-104%	+23%/-28%	+18%/-13%	+147%/-39%
Source	PHO1	FLK73	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 009529744-04 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$0 \pm 1000000$	$14.97^{+14.88}_{-10.72}$	$466^{+31}_{-34}$	$4353^{+21994}_{-28817}$	$4021^{+800162}_{-704790}$
Alt.	$-75 \pm 15$	$14.00^{+13.95}_{-9.81}$	$466^{+29}_{-38}$	$2878^{+1310}_{-452}$	$336^{+3242}_{-257}$

$T_{max}$  = 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

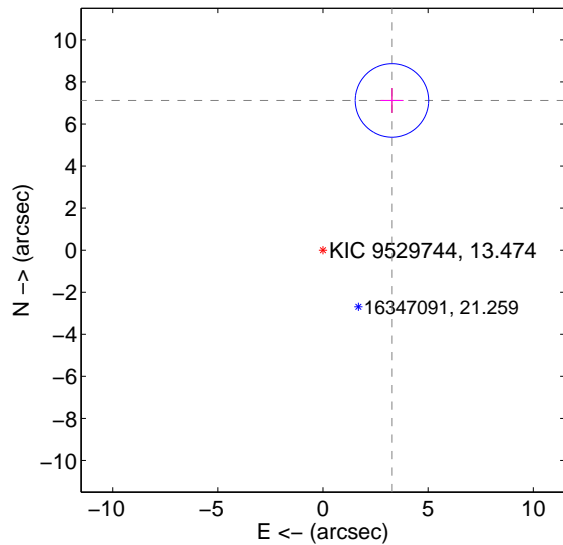
Supplemental centroid analysis for 009529744-04. Kepler magnitude: 13.47. Transit SNR -1.00

There are 0 quarters with good PRF difference image offsets

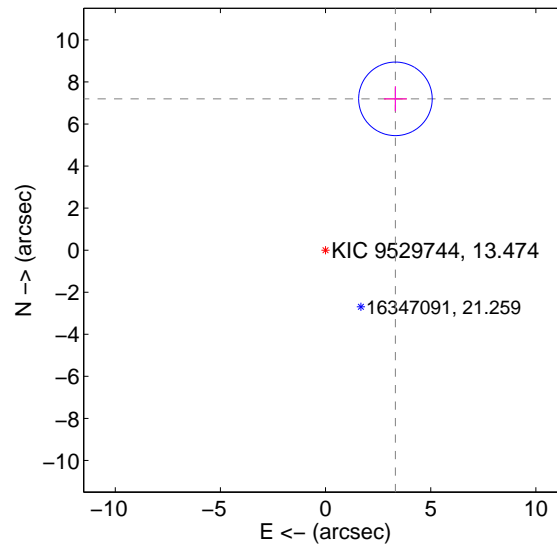
The direct PRF centroid is offset from the target star catalog position by about 0.09 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$7.840 \pm 0.583$	13.45	$-3.278 \pm 0.545$	$7.122 \pm 0.591$
PRF-fit source offset from KIC position	$7.928 \pm 0.583$	13.60	$-3.322 \pm 0.545$	$7.198 \pm 0.591$
photometric centroid source offset	$1.92 \pm 2.09$	0.92	$1.91 \pm 2.09$	$0.13 \pm 2.04$

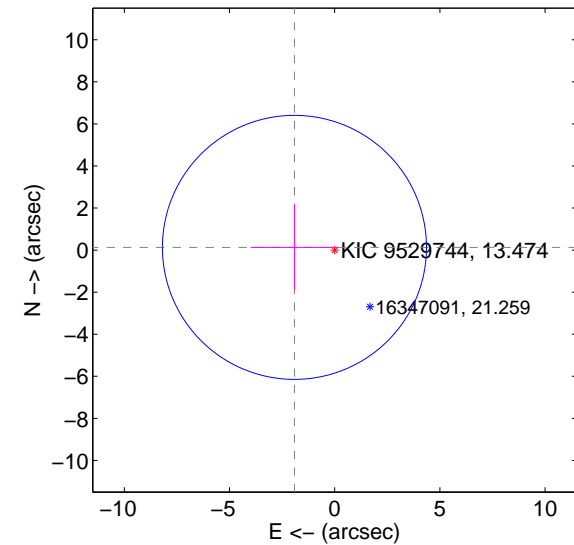
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

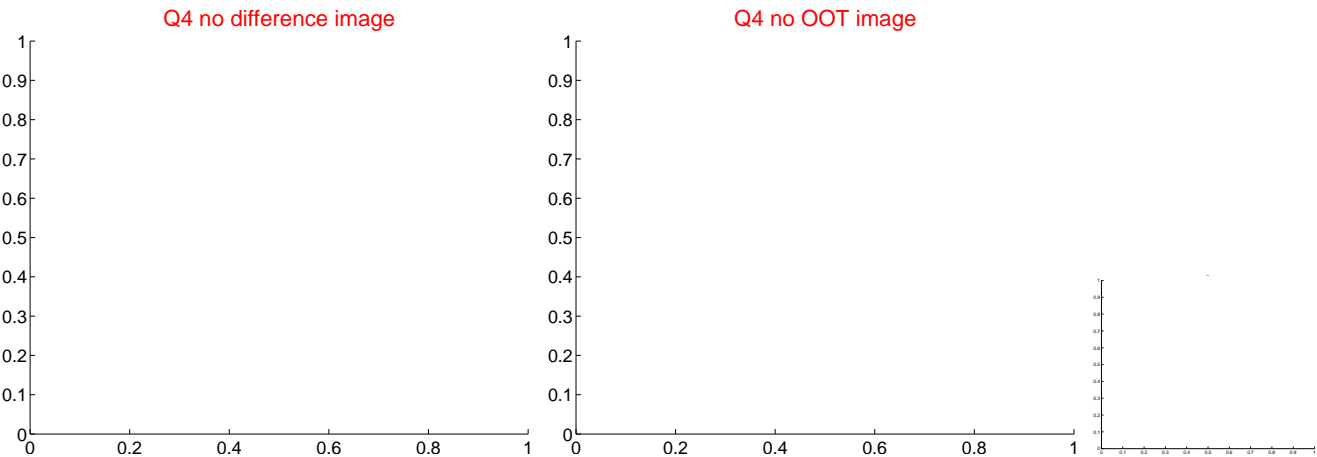
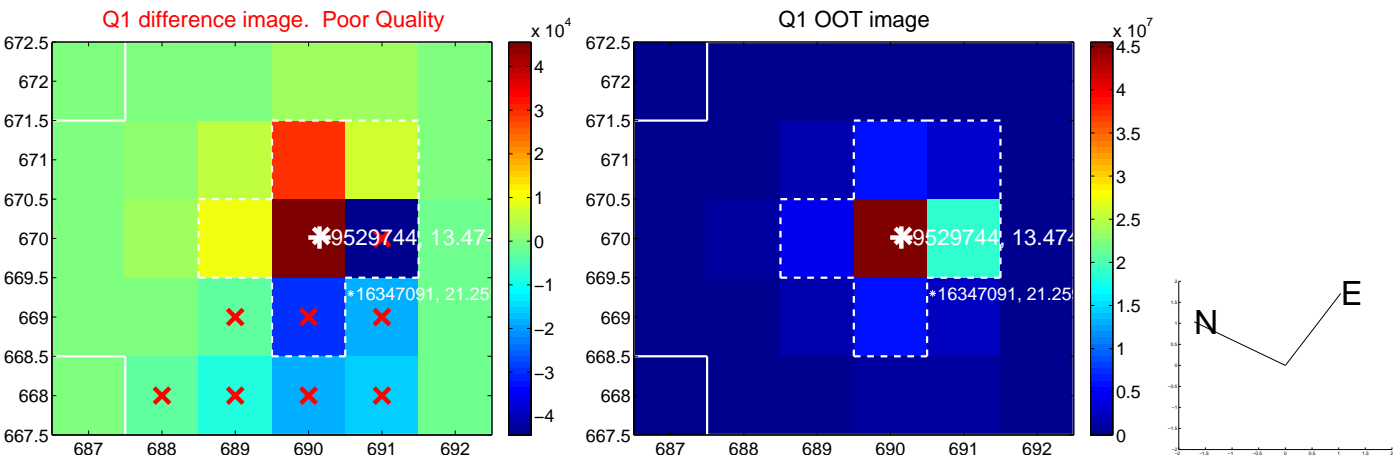


offset from photometric centroids

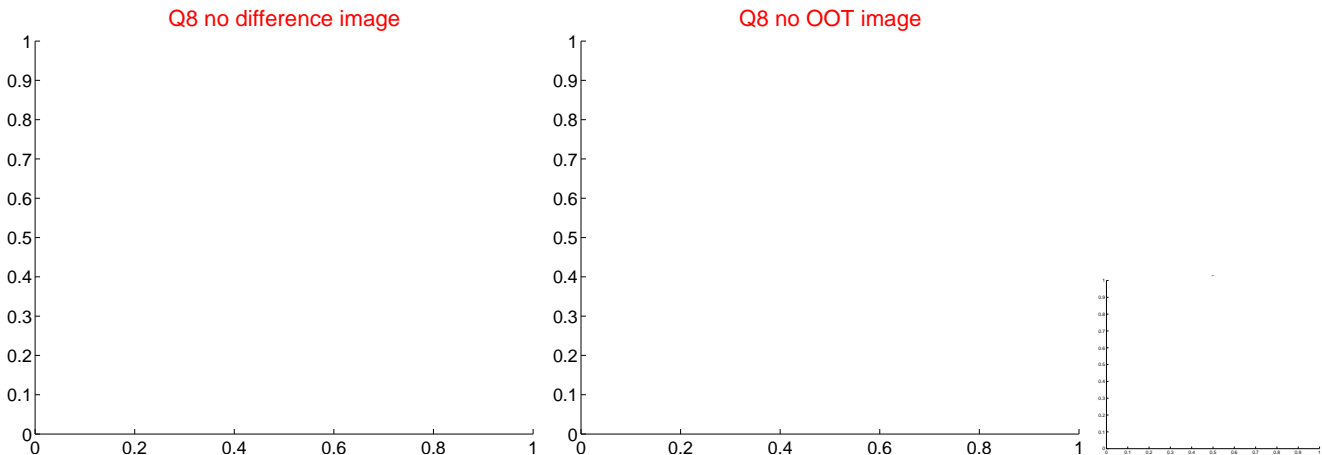
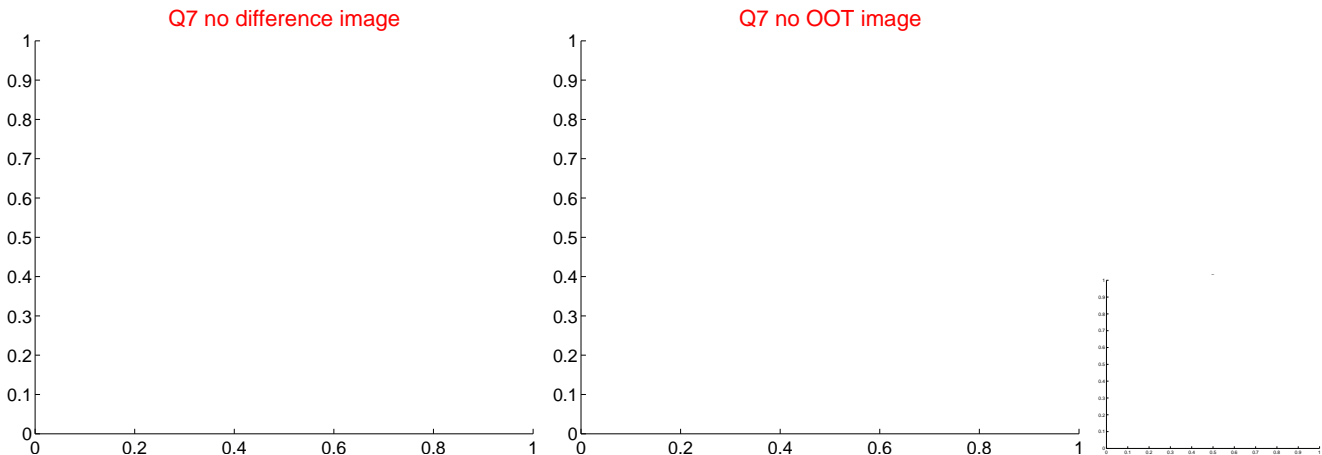
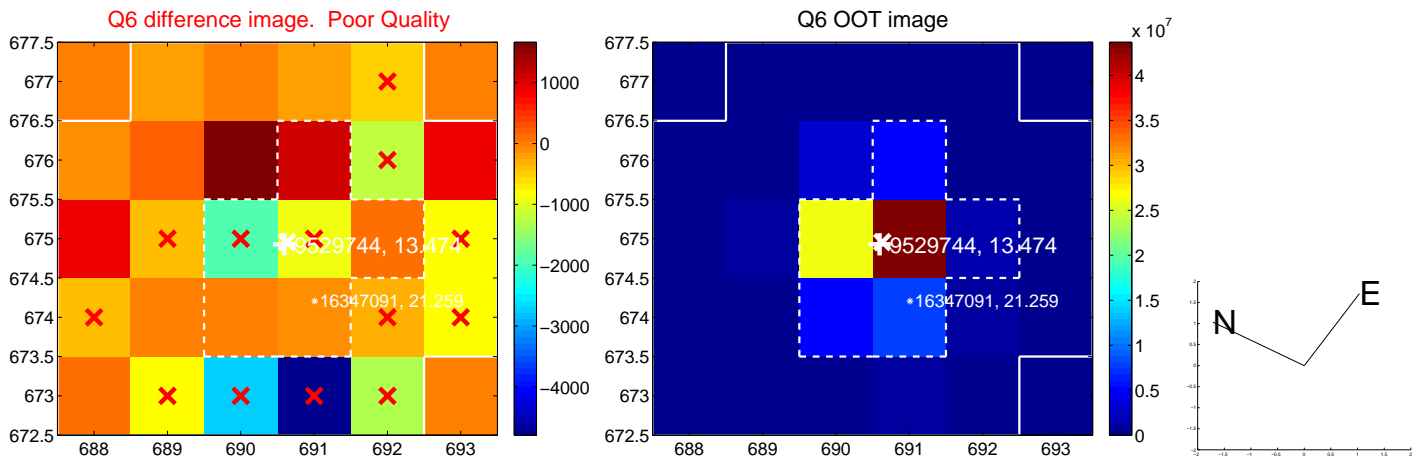
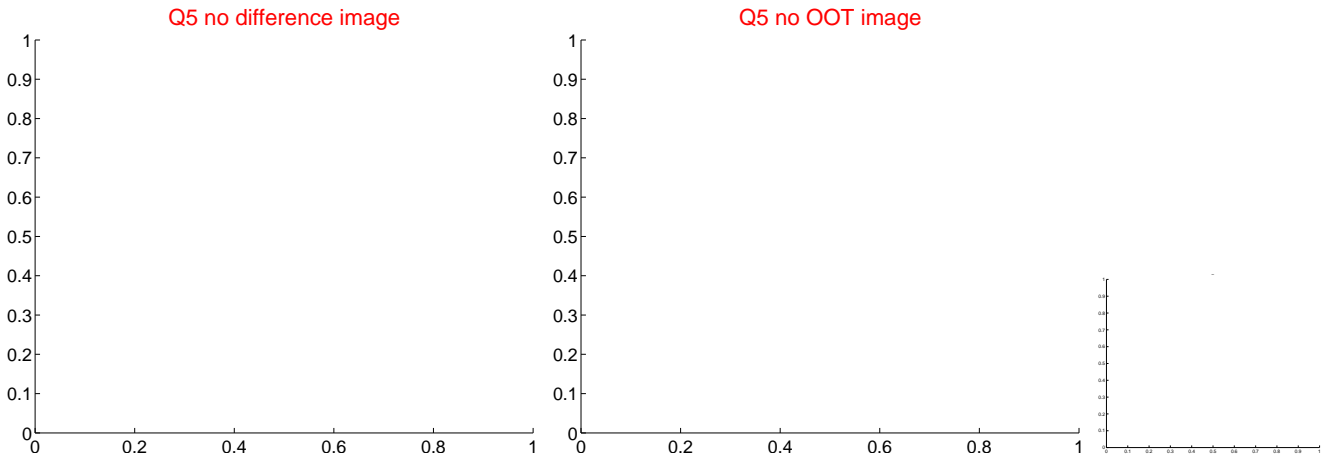


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three- $\sigma$ . 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 ×: KIC target position; +: OOT centroid; △: difference centroid. red ×: large negative pixel value.

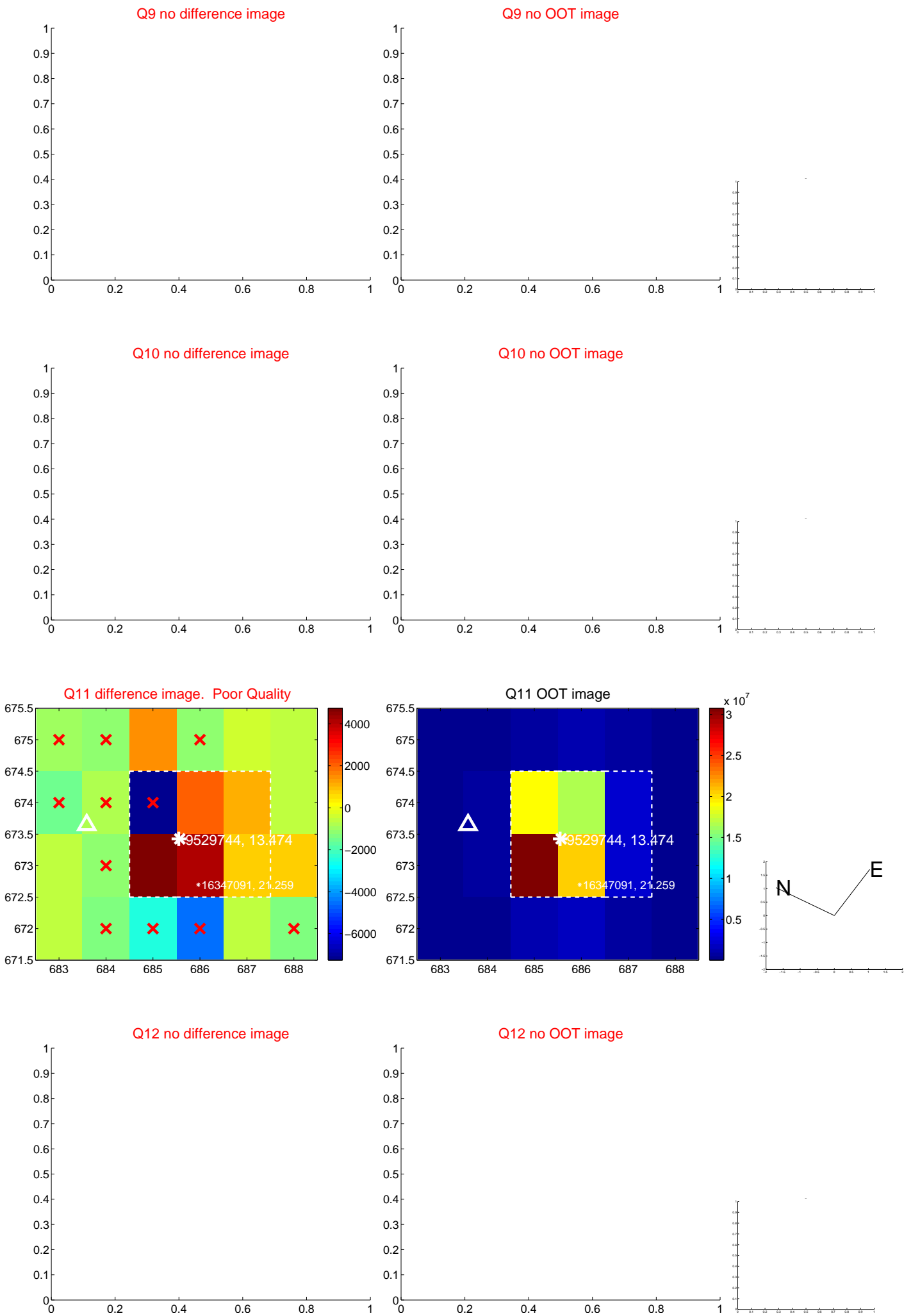


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value





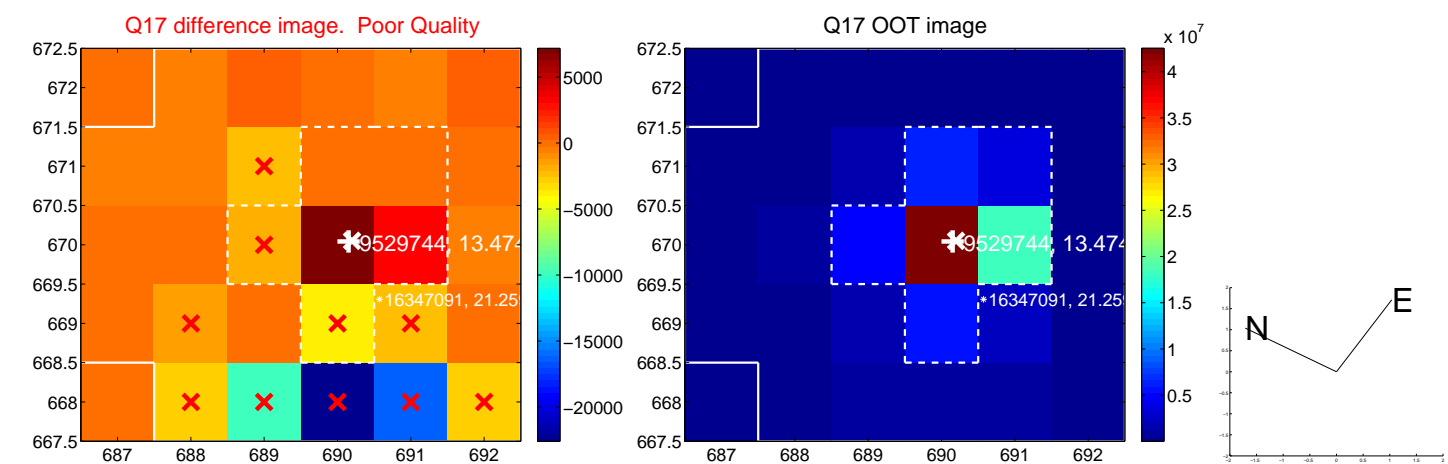
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



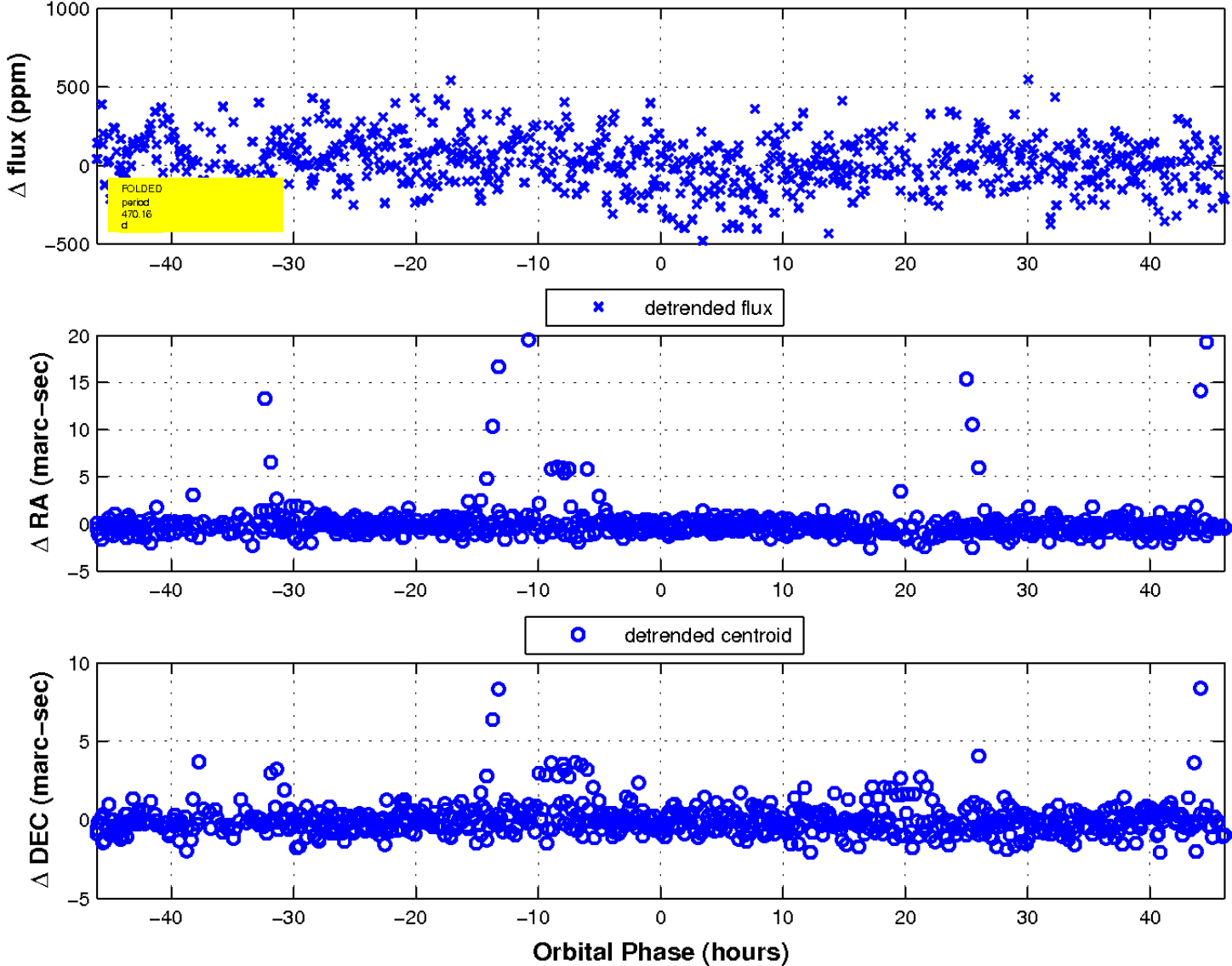
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



fluxWeightedCentroids, Planet 4 of 4



UKIRT Image

