

# KIC 004276002

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
004276002-01	OBS	No	1.566041	133.022504	86.1	7.701	10.8	9.4	1.98	7559	2.50	11443.60
004276002-02	OBS	No	0.521976	132.018887	129.7	5.332	9.8	16.7	1.98	7559	2.30	49518.38

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
004276002-01	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT
004276002-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE_ZUMA—LPP_DV—LPP_ALT—SAME_NTL_PERIOD

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

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

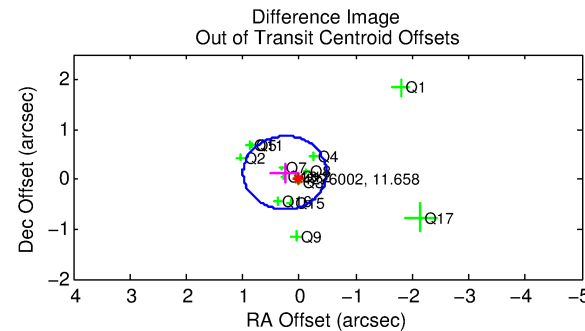
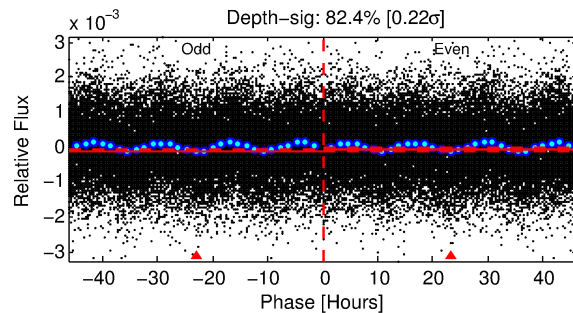
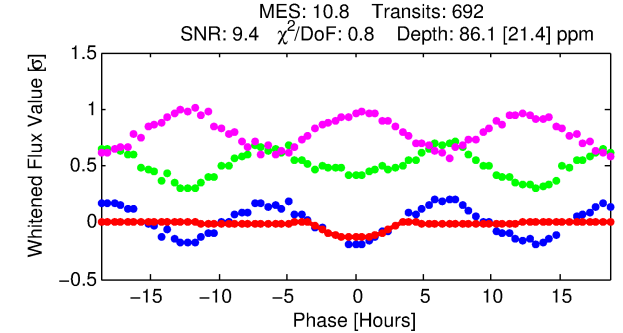
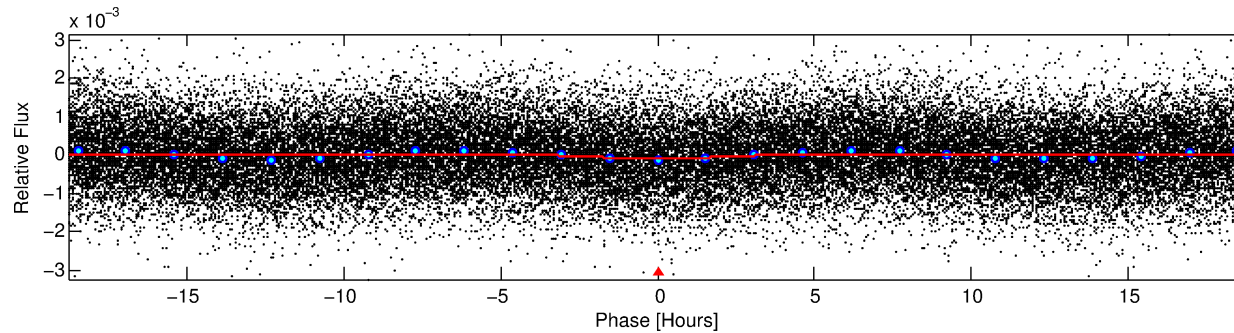
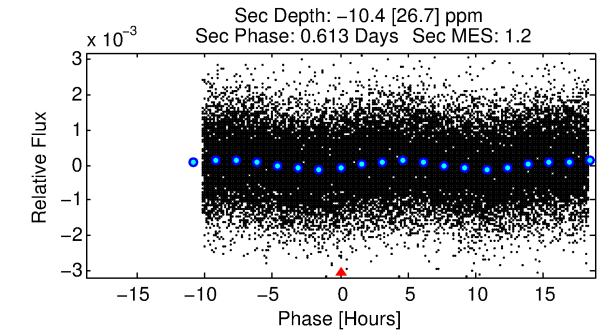
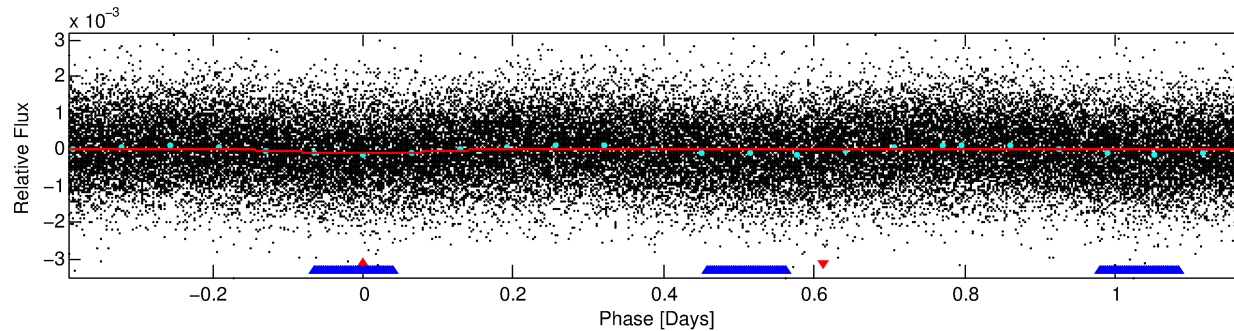
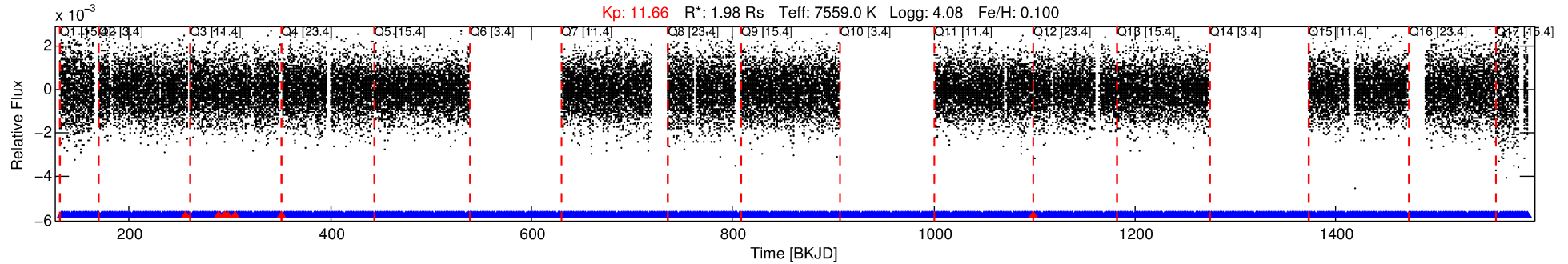
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 004276002-01

No Significant Match Found

# DV One-Page Summary

KIC: 4276002 Candidate: 1 of 2 Period: 1.566 d



## DV Fit Results:

Period = 1.56604 [0.00003] d  
Epoch = 133.0225 [0.0124] BKJD  
Rp/R\* = 0.0116 [0.0021]  
a/R\* = 1.05 [0.02]  
b = 0.99 [0.01]  
Seff = 11443.60 [4091.32]  
Teq = 2637 [236] K  
Rp = 2.50 [0.80] Re  
a = 0.0317 [0.0069] AU  
Ag = N/A  
Teffp = N/A

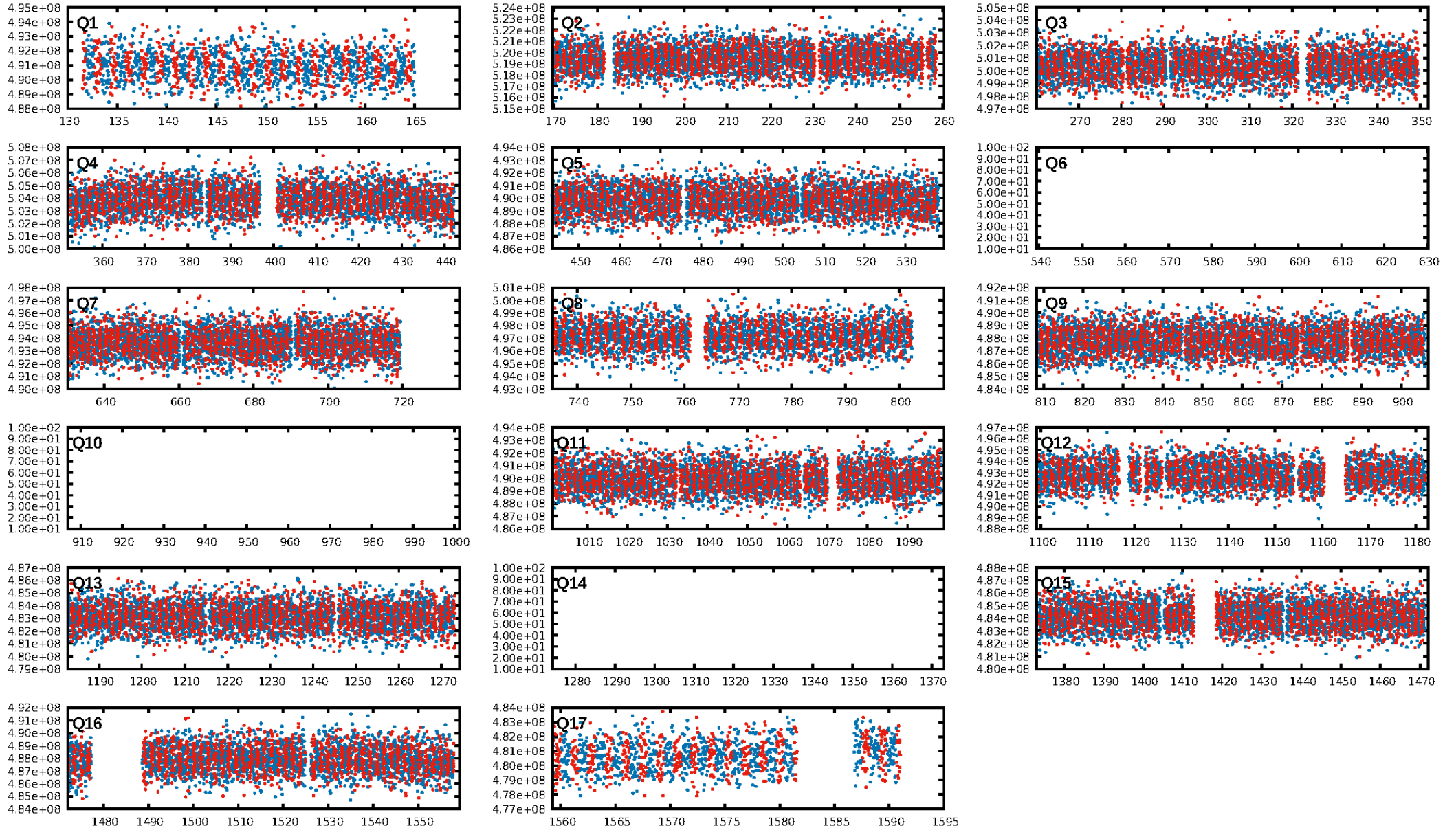
## DV Diagnostic Results:

ShortPeriod-sig: 99.3% [2.68 $\sigma$ ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: N/A  
RollingBand-fgt: 0.99 [645/652]  
GhostDiagnostic-chr: 1.053  
Centroid-sig: 34.0%  
Centroid-so: 0.239 arcsec [1.17 $\sigma$ ]  
OotOffset-rm: 0.286 arcsec [1.16 $\sigma$ ]  
KicOffset-rm: 0.217 arcsec [1.06 $\sigma$ ]  
OotOffset-st: 1/4/4/5 [14]  
KicOffset-st: 1/4/4/5 [14]  
DiffImageQuality-fgm: 0.93 [13/14]  
DiffImageOverlap-fno: 0.00 [0/14]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 18:30:42 Z

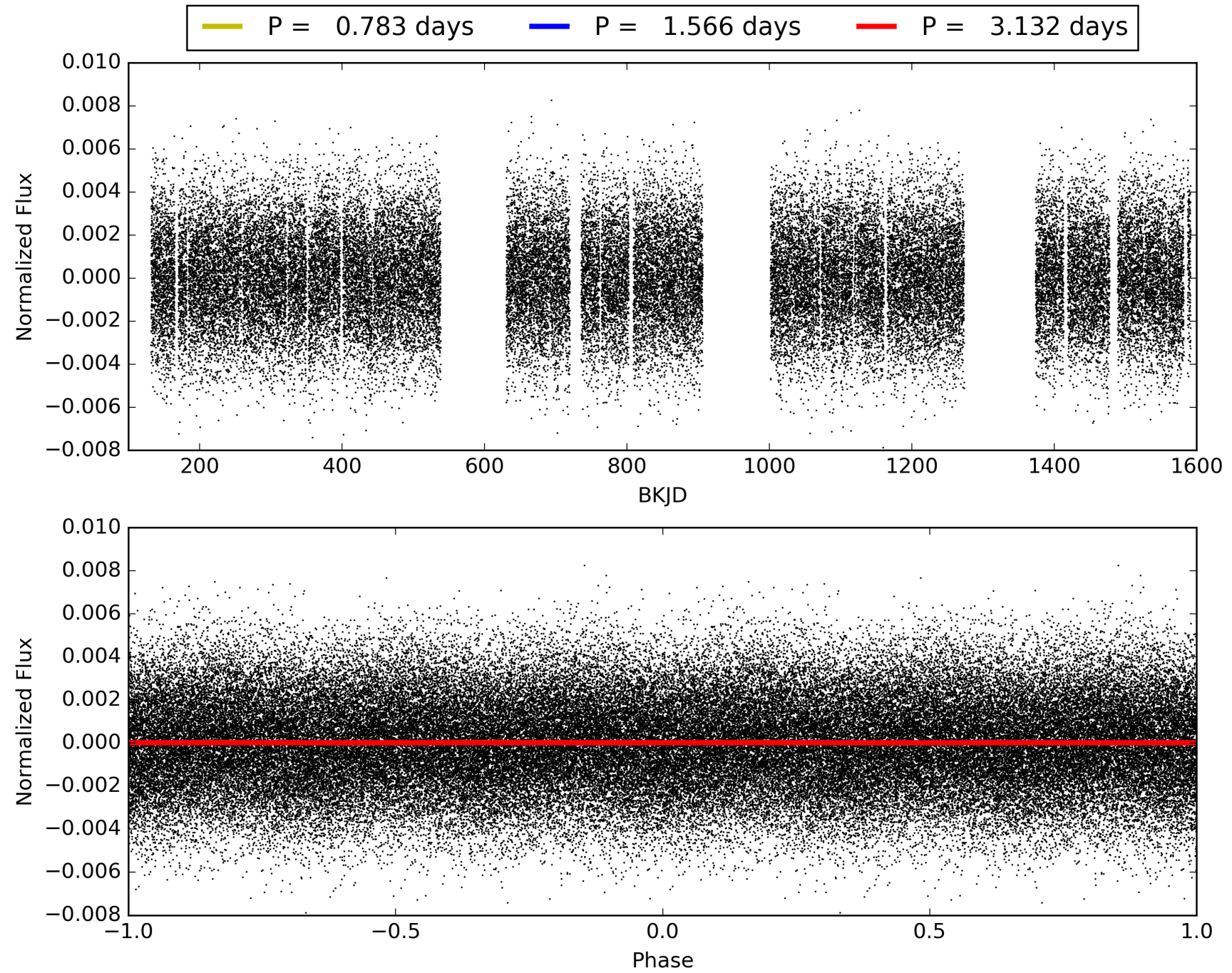
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 004276002-01, PDC Light Curves



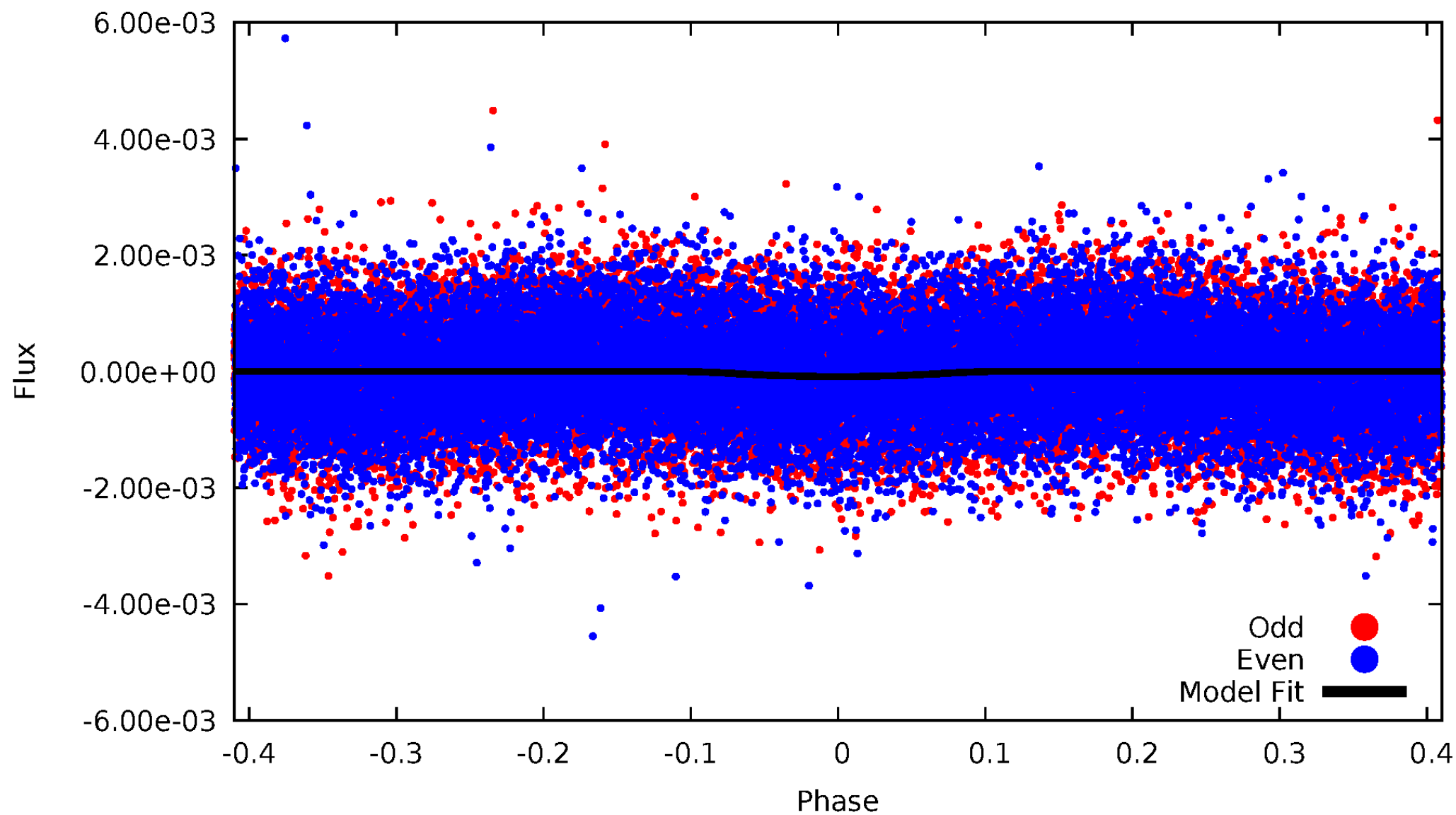


TCE 004276002-01



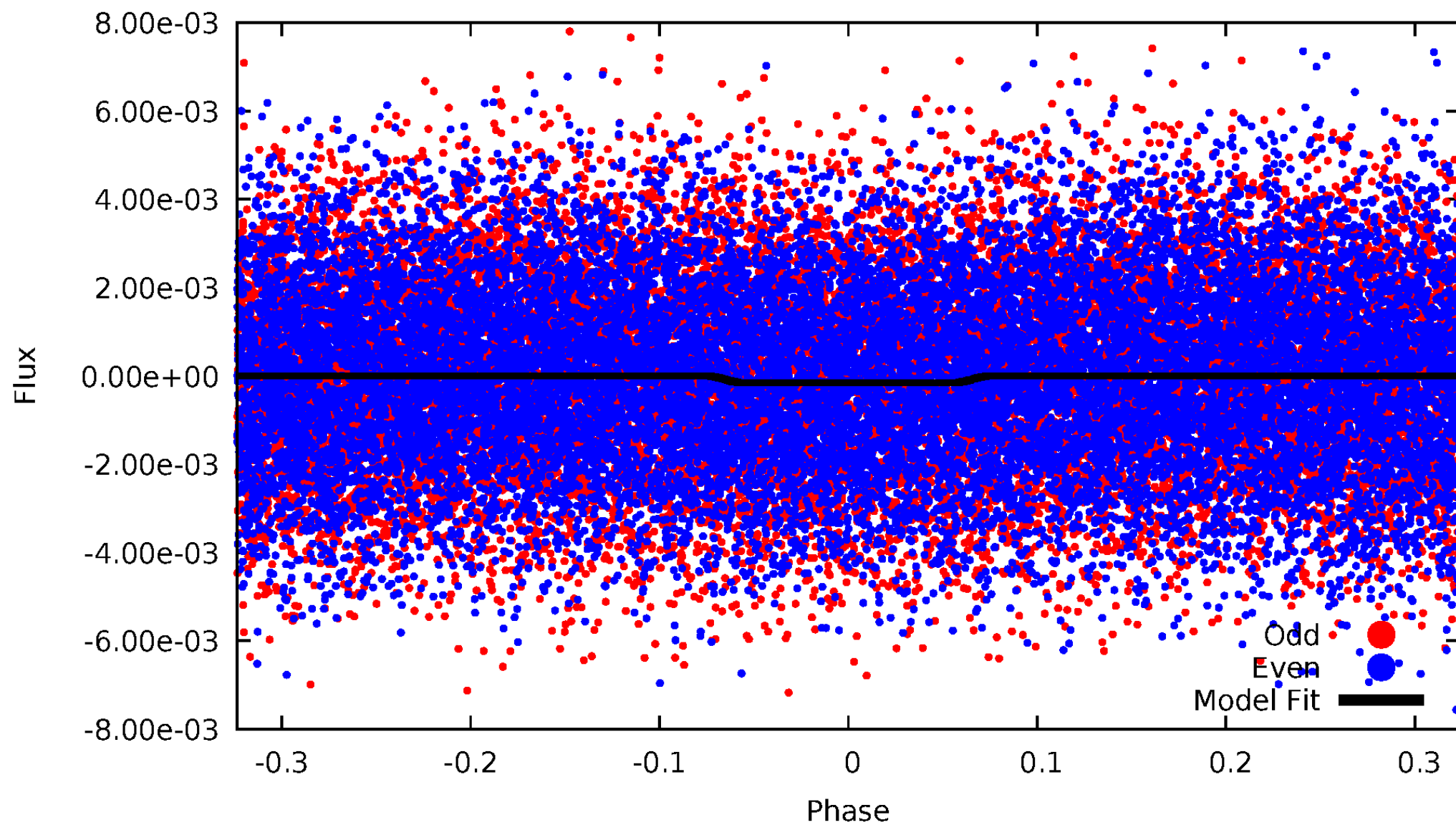
# DV Odd/Even

TCE 004276002-01



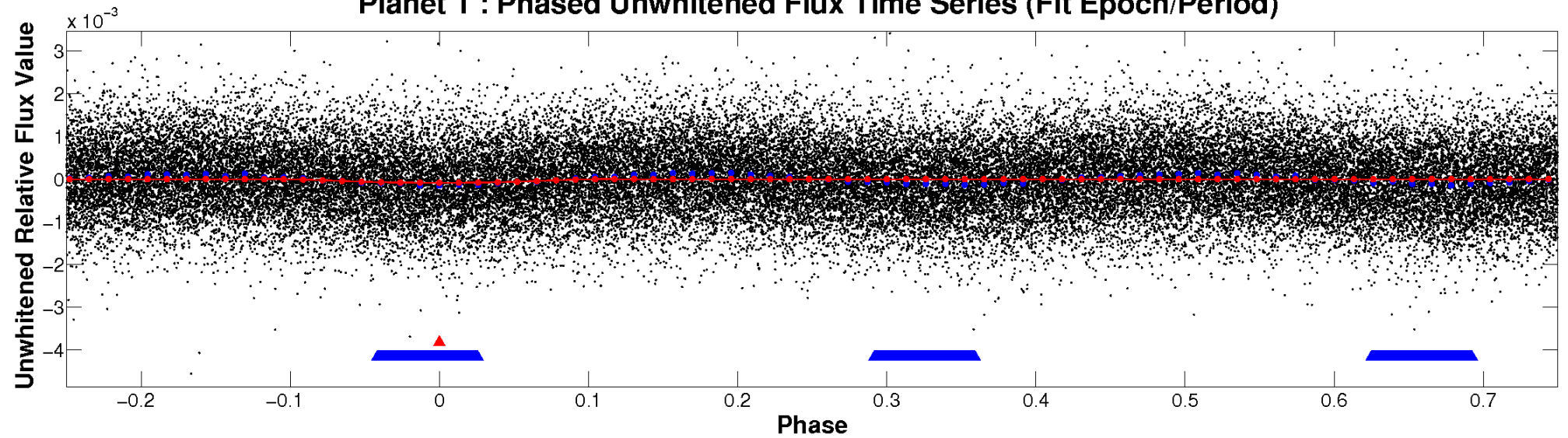
# ALT Odd/Even

TCE 004276002-01

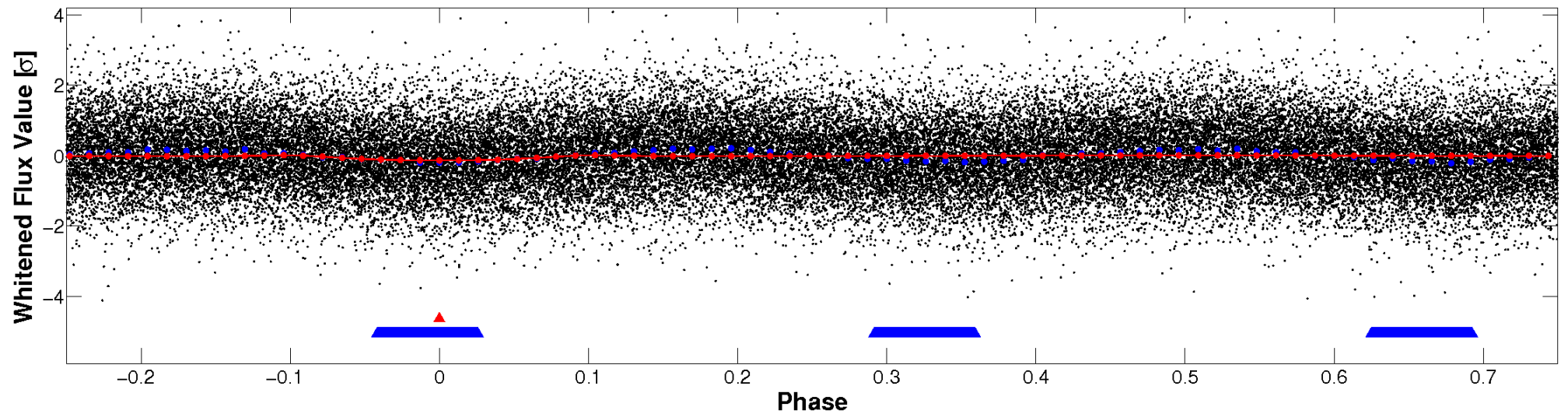


# Non-Whitened Vs. Whitened Light Curve

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



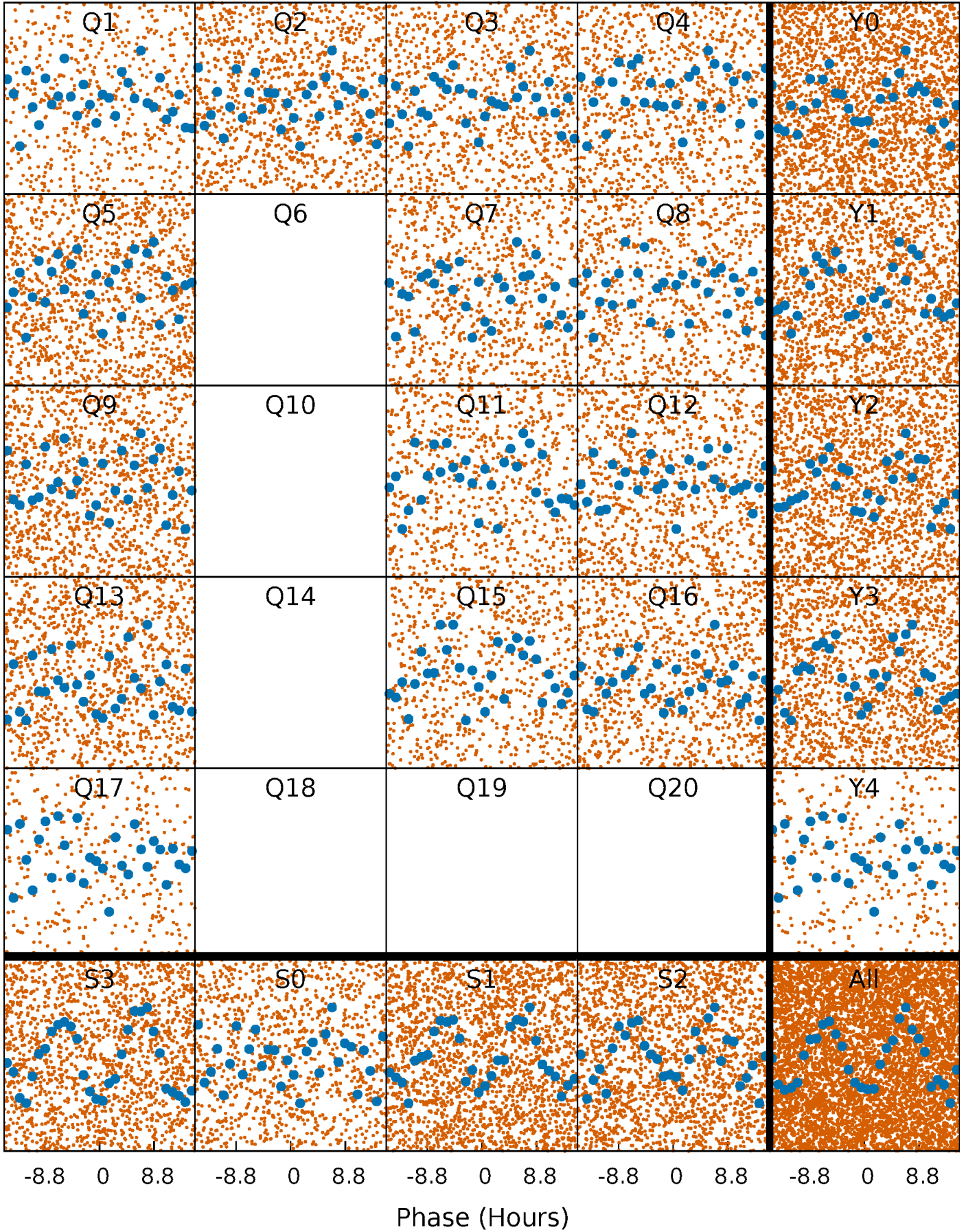
**Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)**





# PDC Quarter-Phased Transit Curves

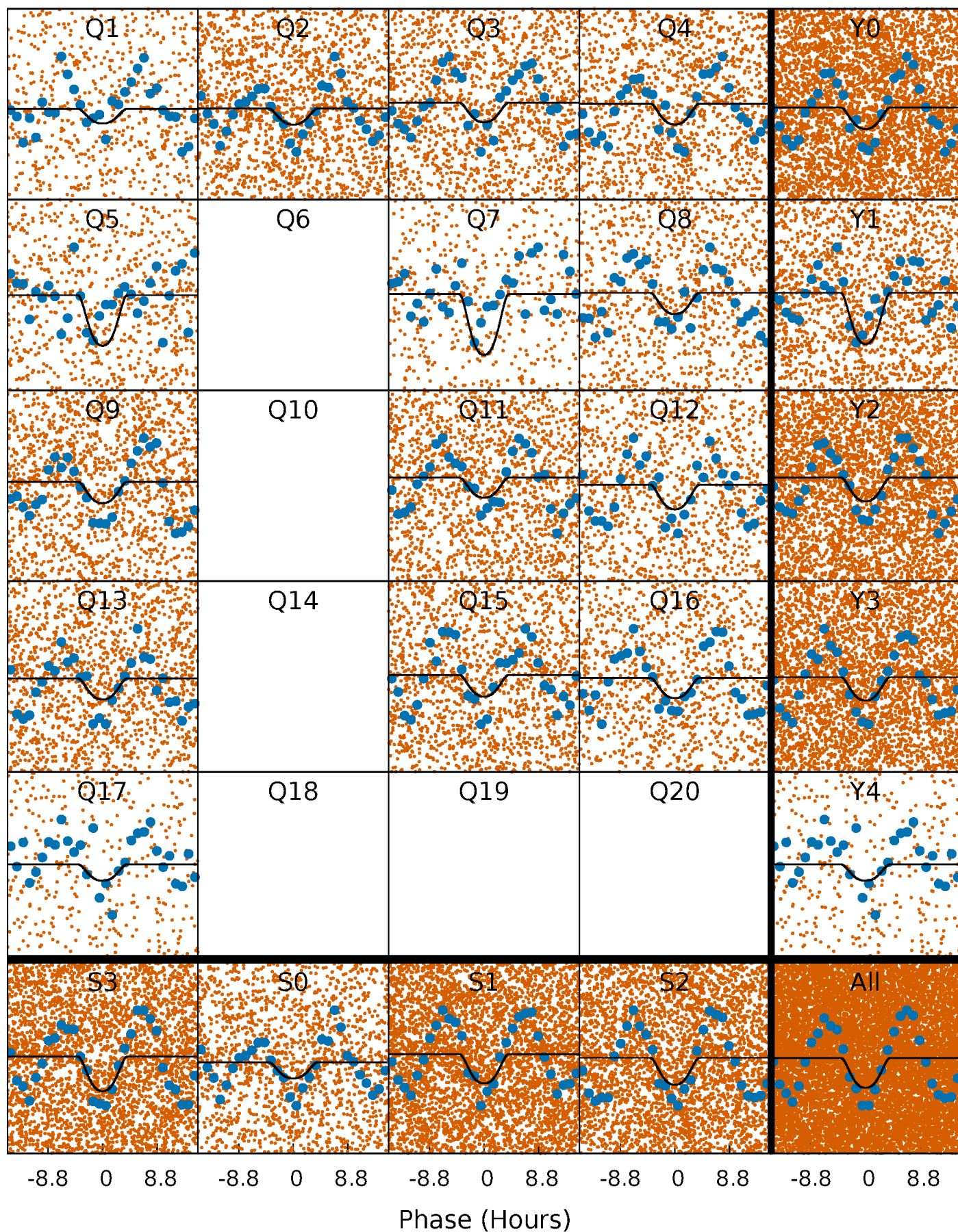
TCE 004276002-01 P= 1.566041 Days  $T_0=133.022504$  (BKJD)





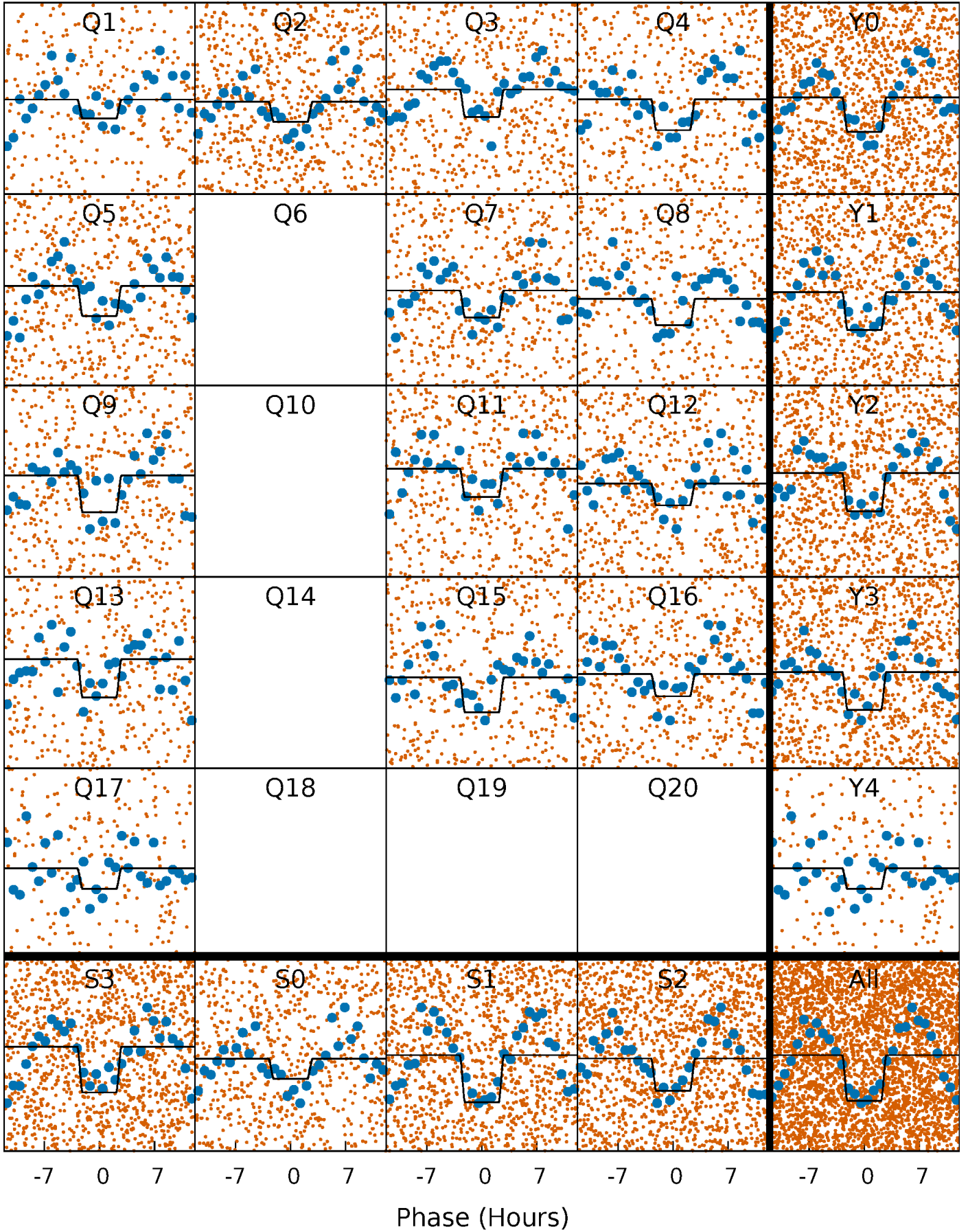
# DV Quarter-Phased Transit Curves

TCE 004276002-01 P= 1.566041 Days  $T_0=133.022504$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

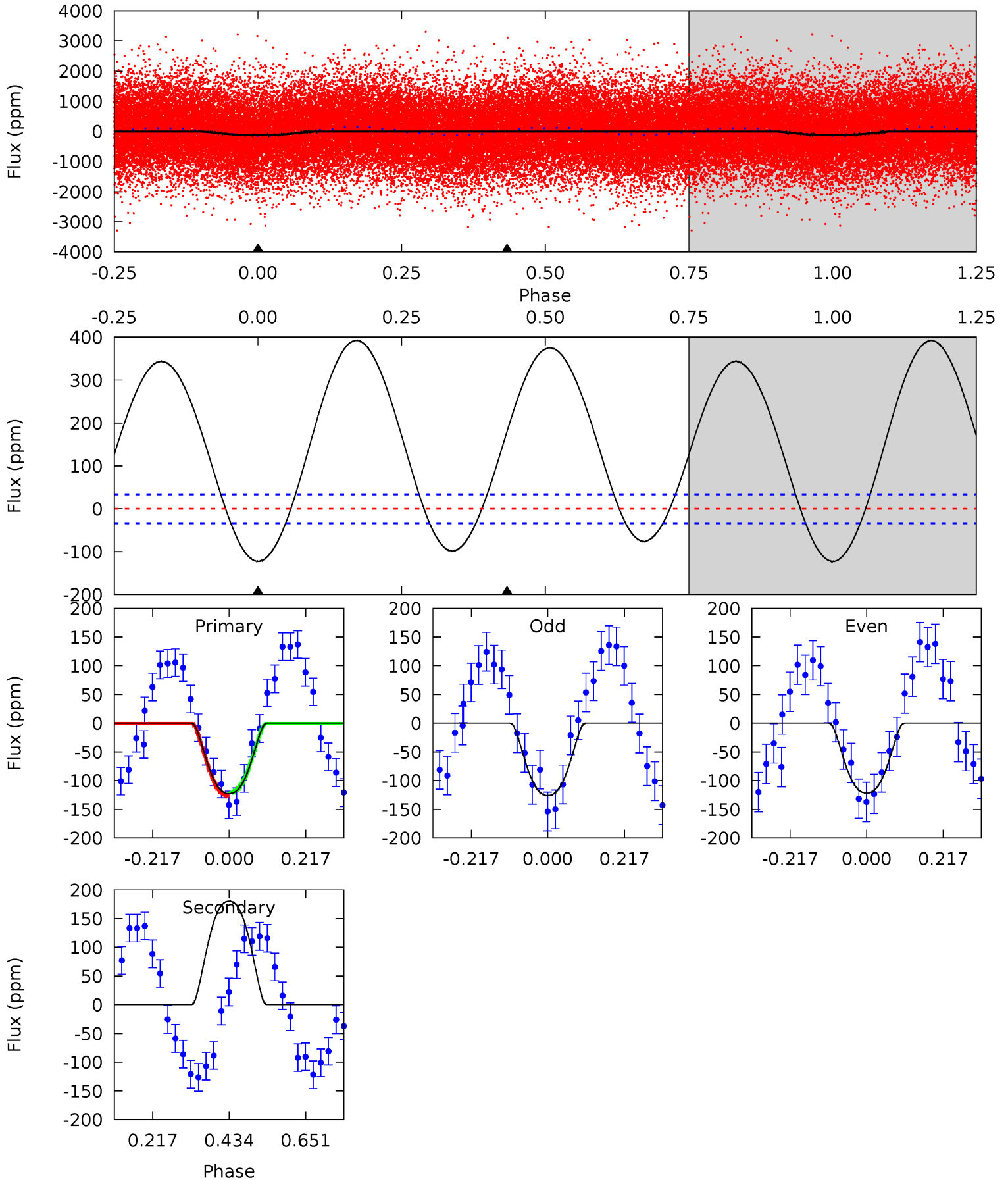
TCE 004276002-01 P= 1.566089 Days  $T_0=133.006463$  (BKJD)



# DV Model-Shift Uniqueness Test

004276002-01, P = 1.566041 Days, E = 131.456463 Days

Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
16.1	-23.7	0	0	4.40	1.23	14.1	16.1	16.1	-23.7	-23.7	0.27	0.93	0.76	0.39

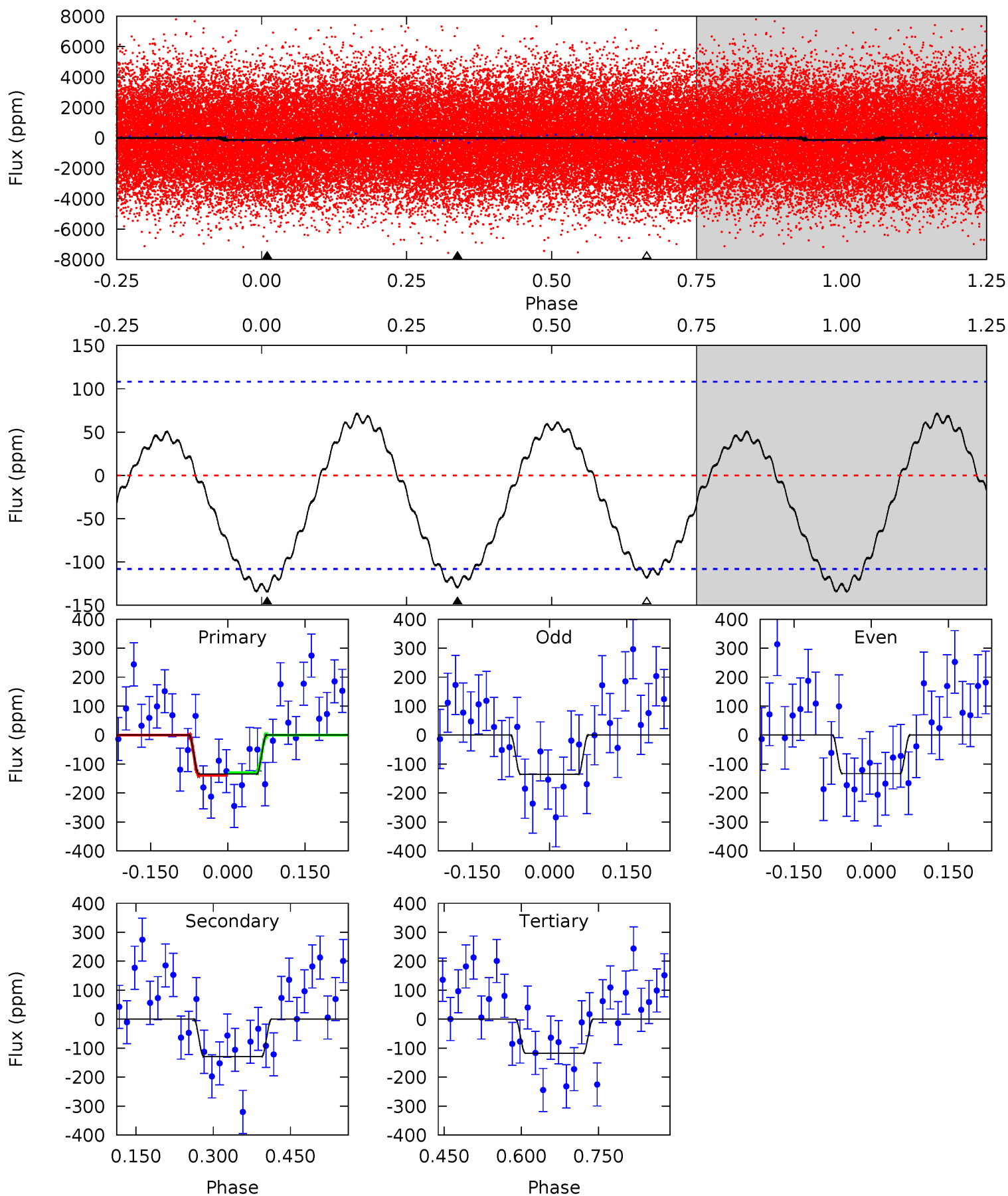




# Alt Model-Shift Uniqueness Test

004276002-01, P = 1.566089 Days, E = 131.440374 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
5.56	5.36	4.89	0	4.48	1.44	2.58	0.67	5.56	0.47	5.36	0.05	1.11	0.35	0.19





### Stellar Parameters For KIC 004276002

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$7559^{+211}_{-342}$	$4.082^{+0.135}_{-0.165}$	$0.100^{+0.150}_{-0.350}$	$1.983^{+0.523}_{-0.380}$	$1.732^{+0.204}_{-0.272}$	$0.313^{+0.217}_{-0.150}$
	+3%/-5%	+3%/-4%	+150%/-350%	+26%/-19%	+12%/-16%	+69%/-48%
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 004276002-01 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$181 \pm 8$	$2.47^{+0.59}_{-0.49}$	$3675^{+263}_{-239}$	$-8377^{+934}_{-1250}$	$-16.161^{+5.590}_{-8.763}$
Alt.	$-129 \pm 24$	$2.66^{+0.61}_{-0.56}$	$3686^{+245}_{-218}$	$7151^{+1012}_{-802}$	$9.874^{+5.432}_{-3.484}$

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

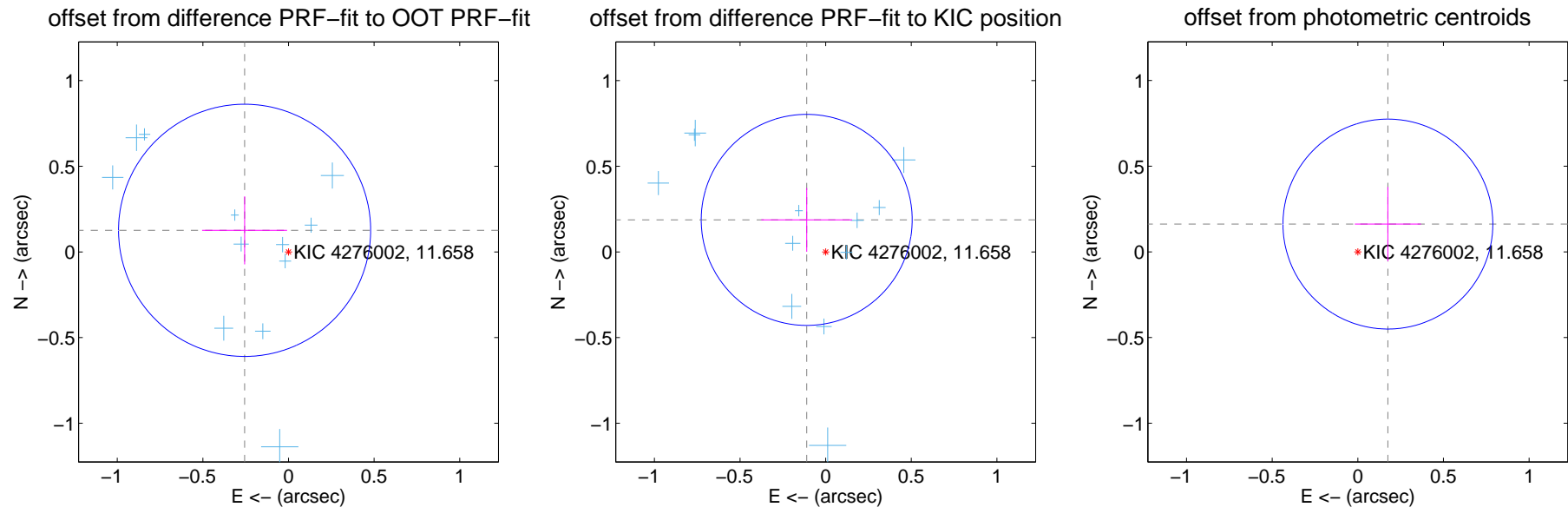
## DV Centroid Data

Supplemental centroid analysis for 004276002-01. **Kepler magnitude: 11.66.** Transit SNR 9.41

There are 13 quarters with good PRF difference image offsets

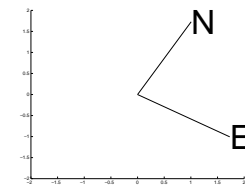
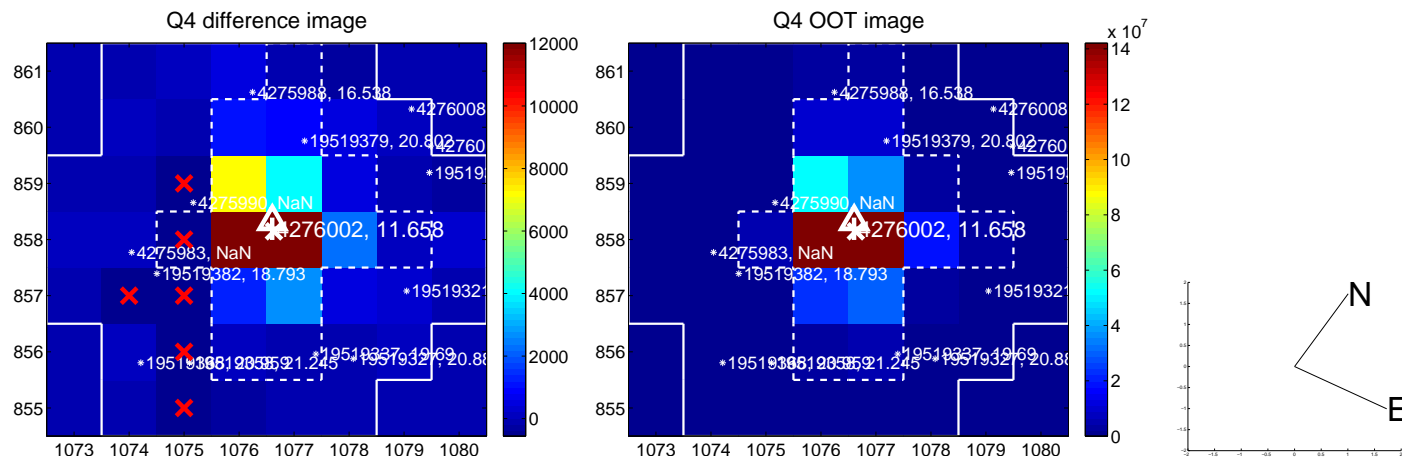
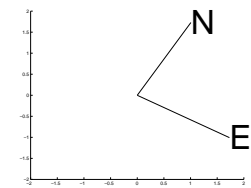
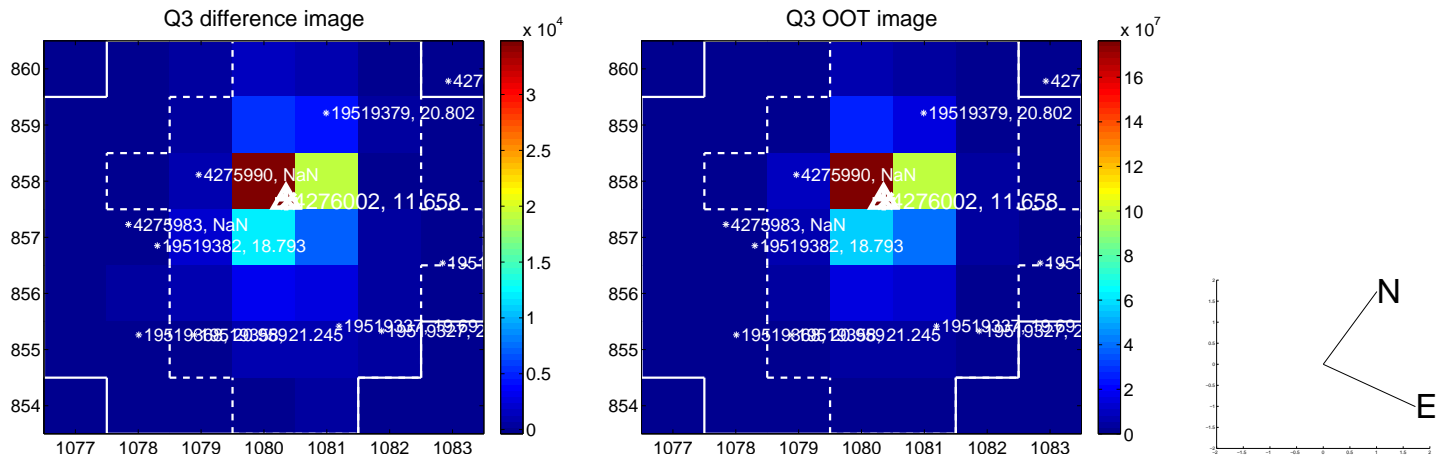
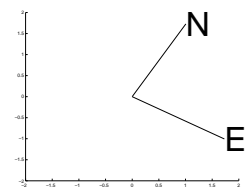
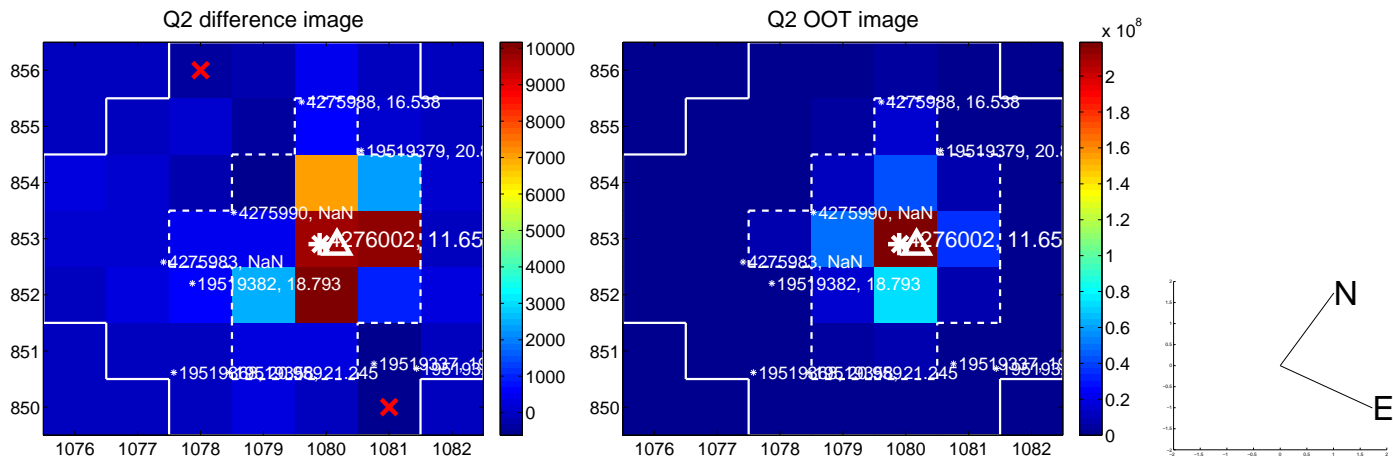
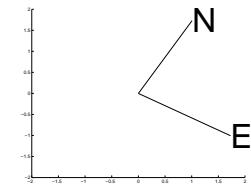
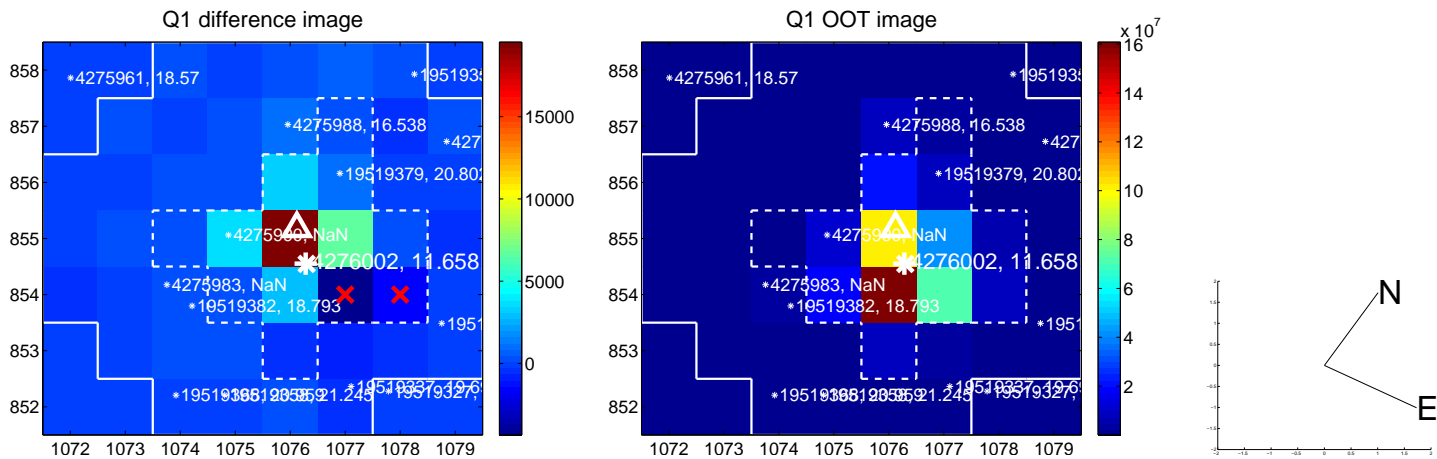
The direct PRF centroid is offset from the target star catalog position by about 0.10 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.286 \pm 0.245$	1.16	$0.256 \pm 0.248$	$0.126 \pm 0.199$
PRF-fit source offset from KIC position	$0.217 \pm 0.205$	1.06	$0.111 \pm 0.265$	$0.187 \pm 0.186$
photometric centroid source offset	$0.24 \pm 0.20$	1.17	$-0.18 \pm 0.19$	$0.16 \pm 0.22$

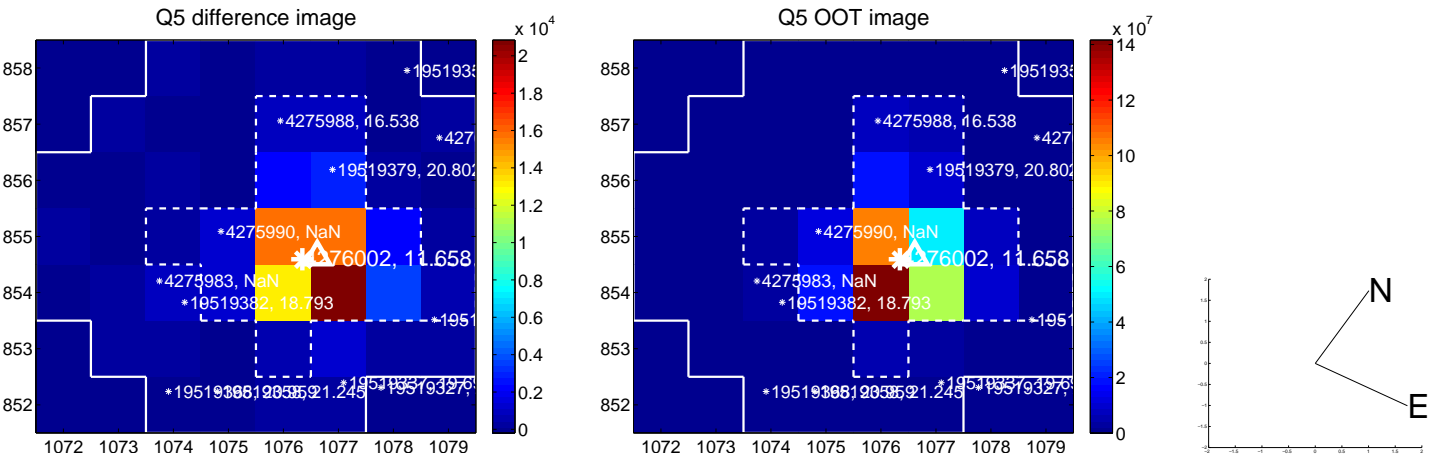


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three- $\sigma$ . Red \*: target star. Blue \*: Other stars. Text next to a star gives its KIC ID and kepmag. KIC IDs > 15,000,000 are from the UKIRT catalog.

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

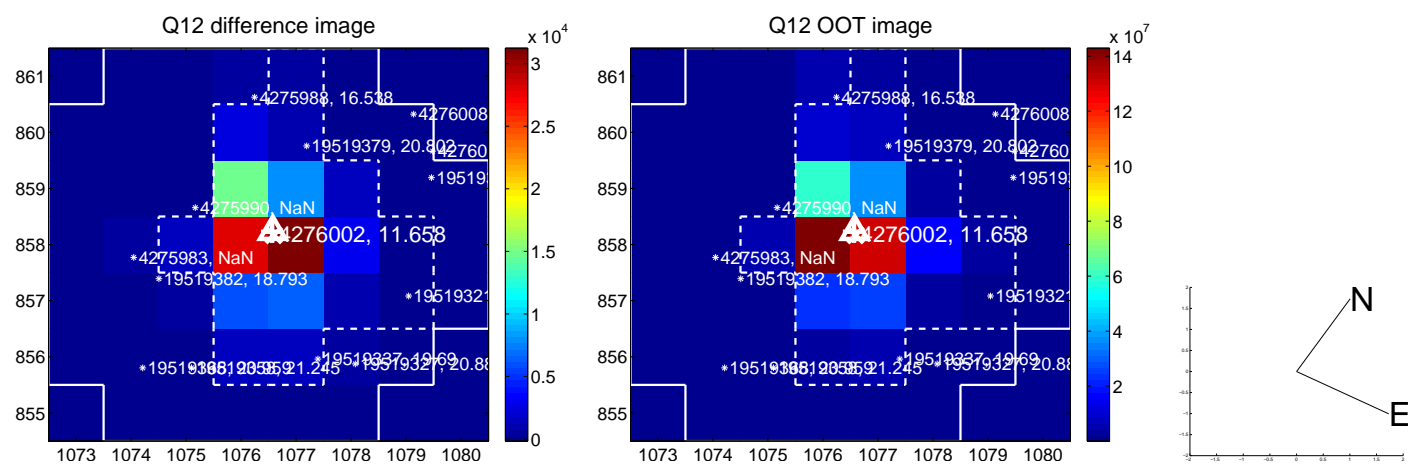
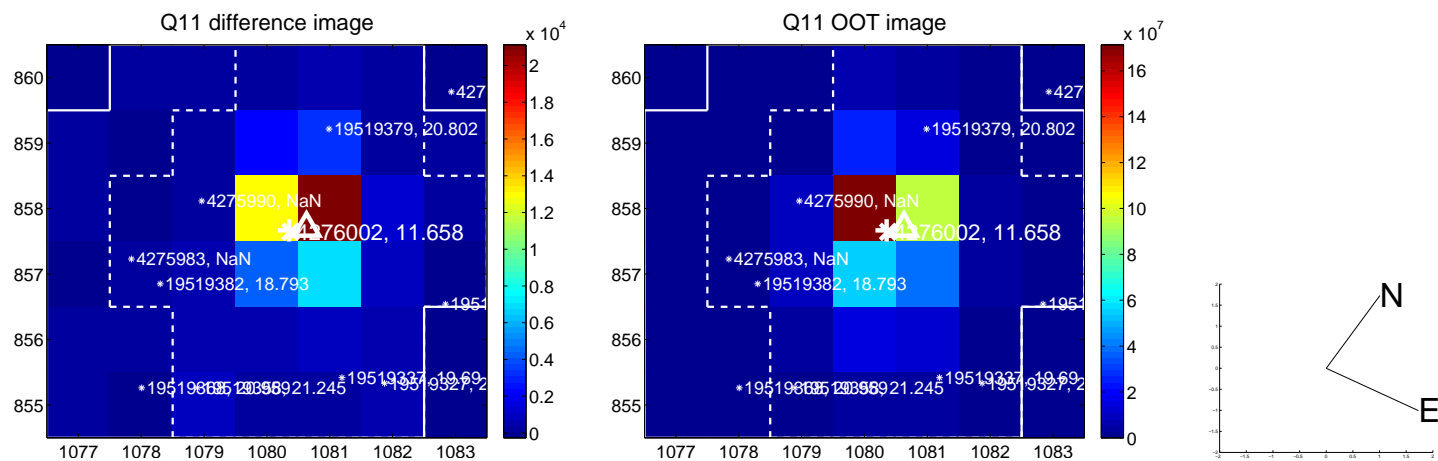
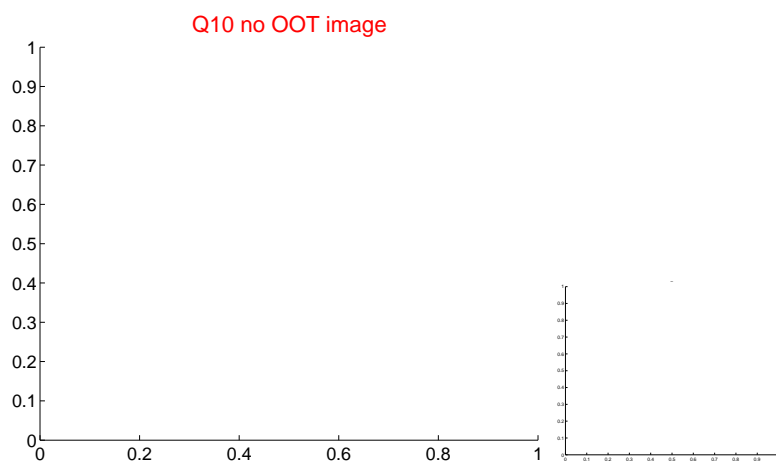
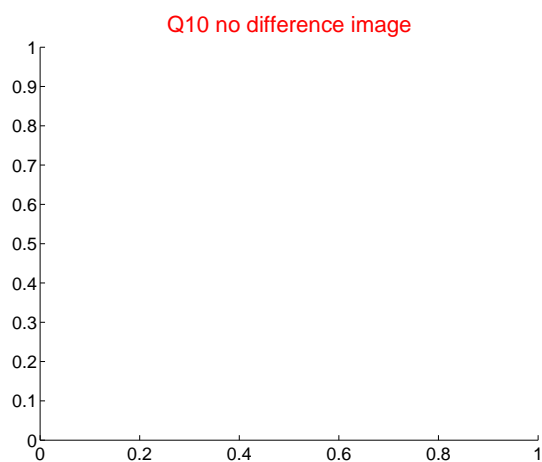
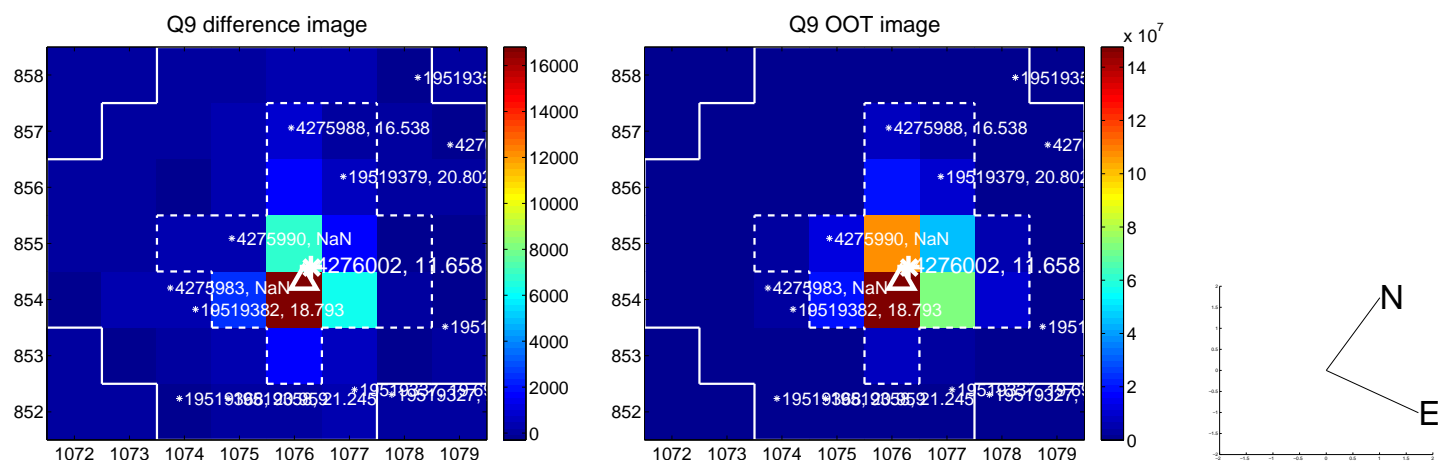


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



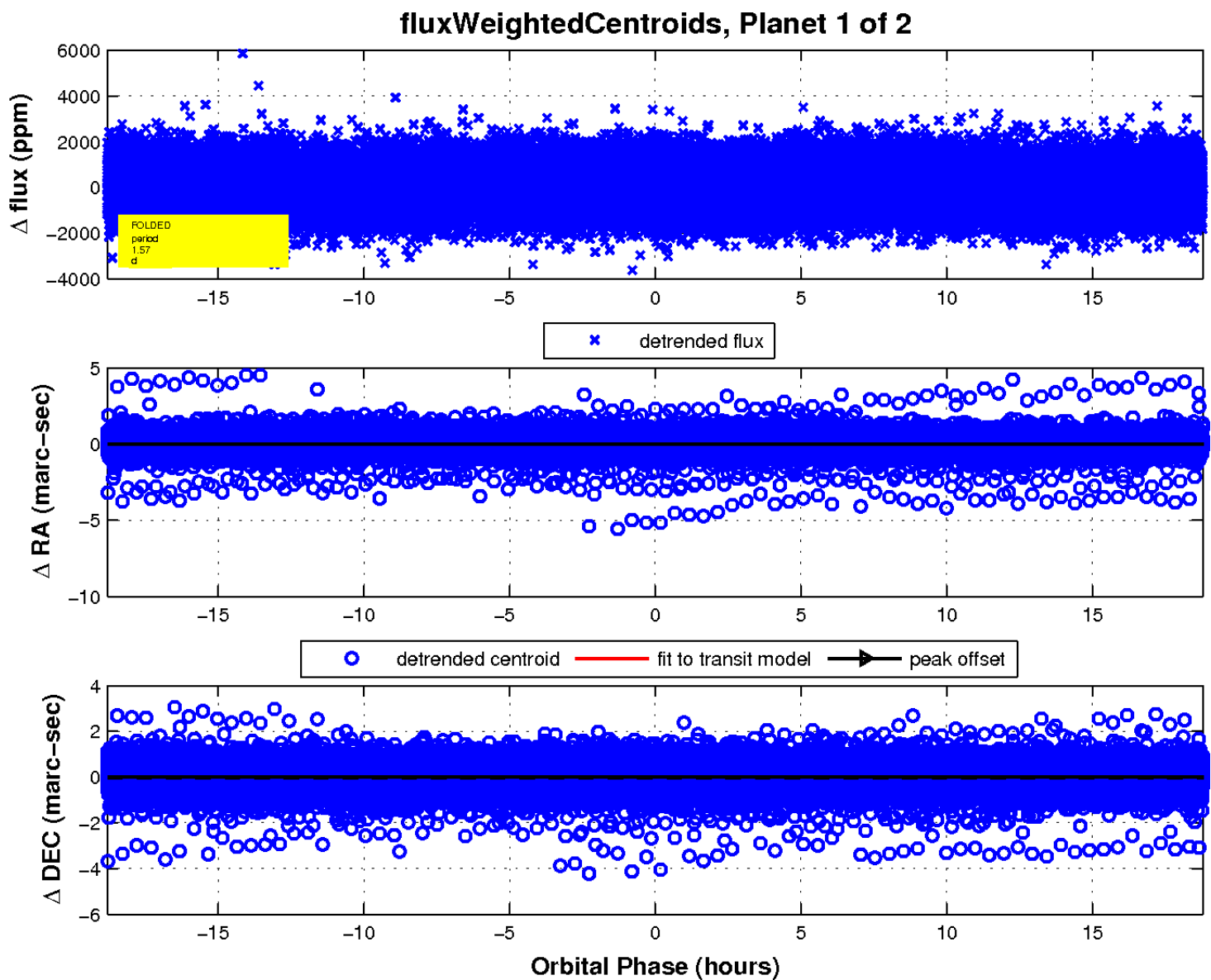
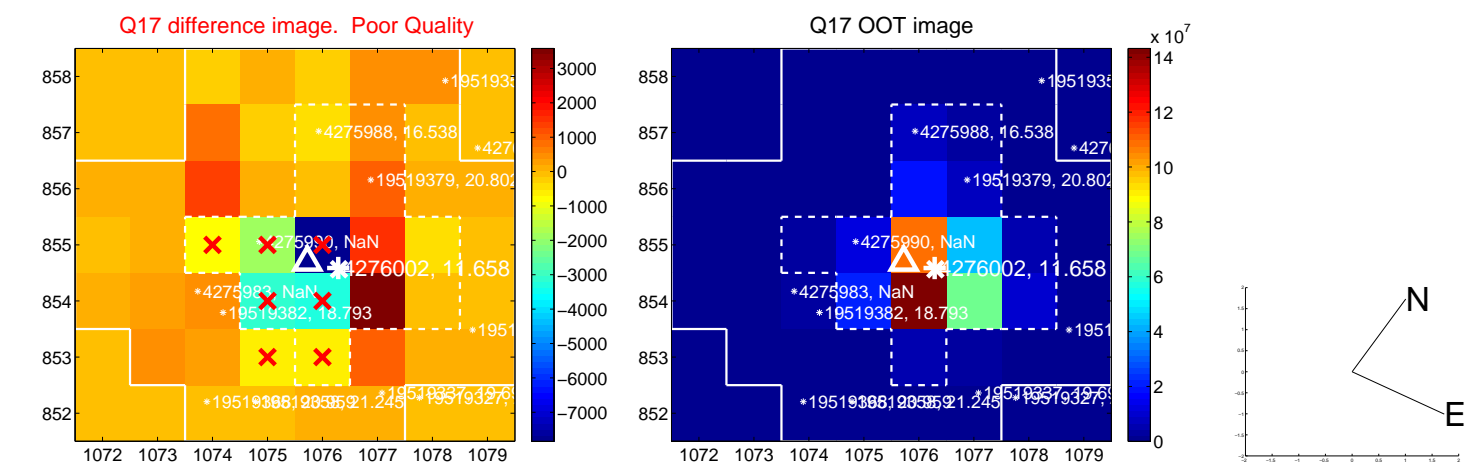


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



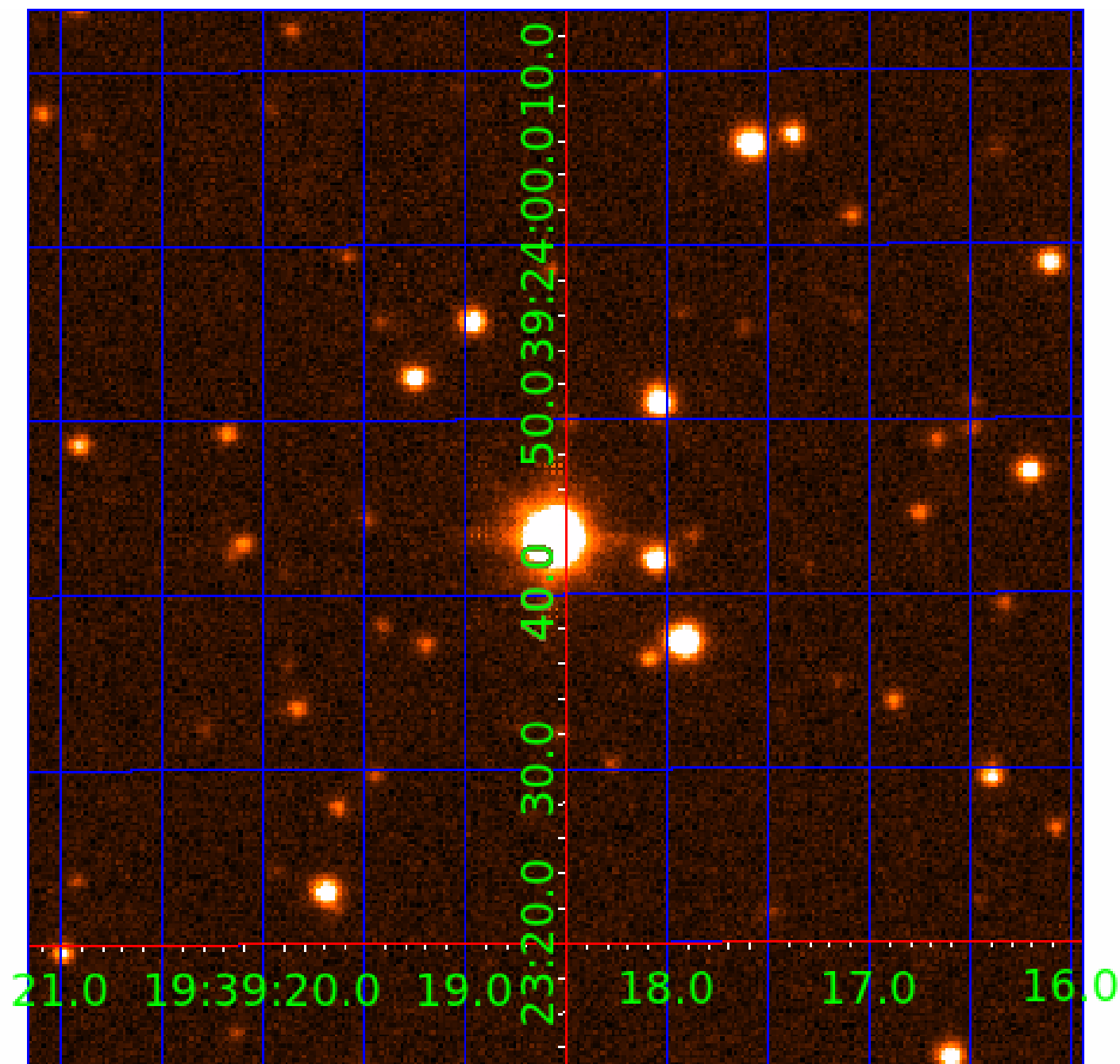


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination





# KIC 004276002

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
004276002-01	OBS	No	1.566041	133.022504	86.1	7.701	10.8	9.4	1.98	7559	2.50	11443.60
004276002-02	OBS	No	0.521976	132.018887	129.7	5.332	9.8	16.7	1.98	7559	2.30	49518.38

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
004276002-01	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT
004276002-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE_ZUMA—LPP_DV—LPP_ALT—SAME_NTL_PERIOD

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

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

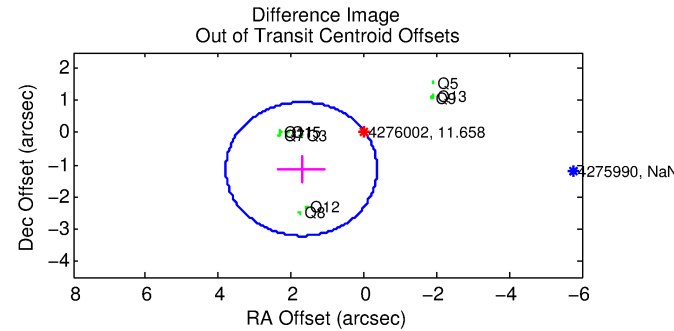
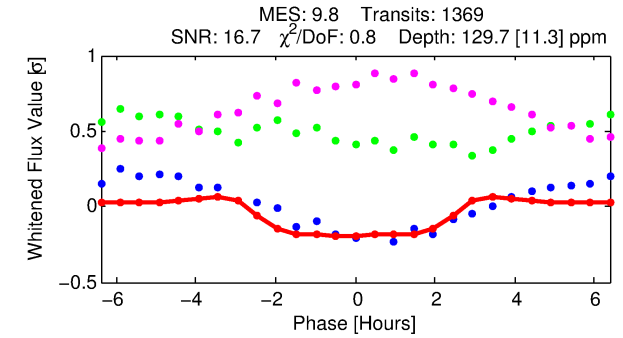
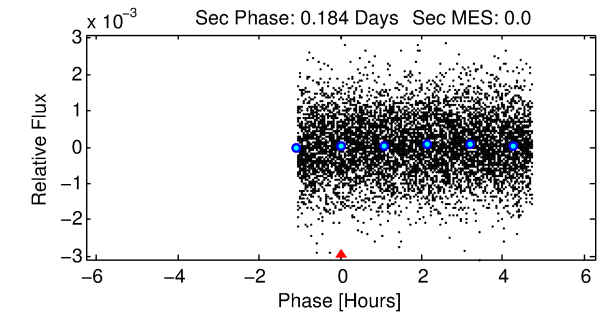
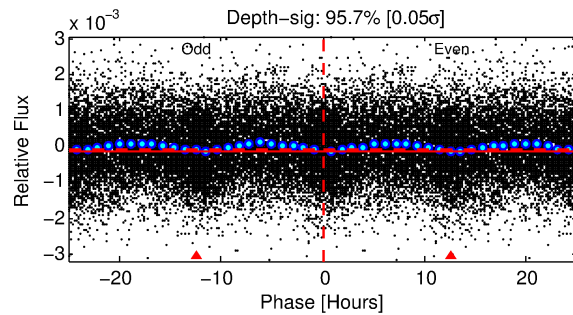
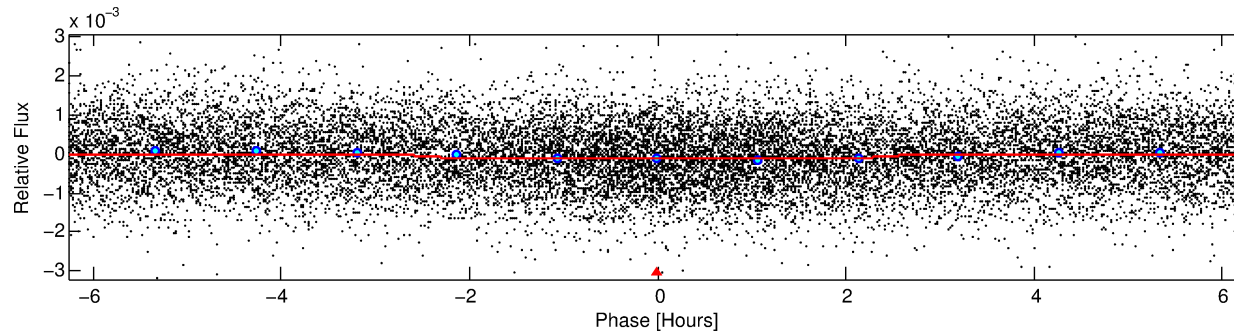
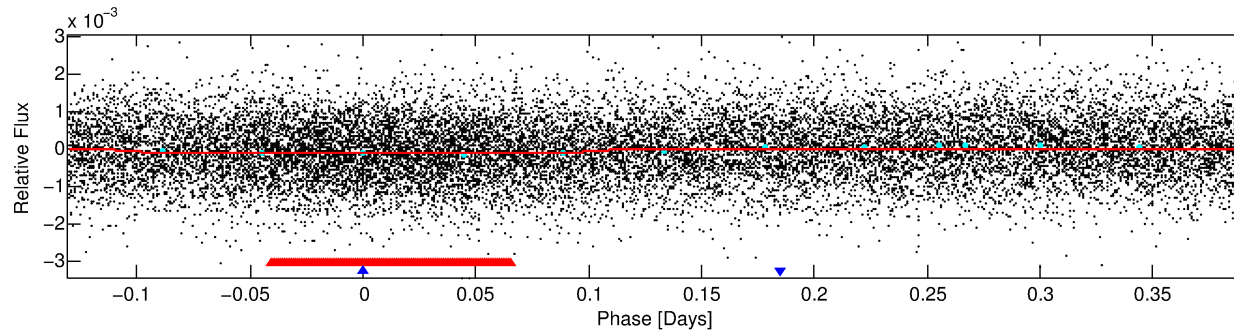
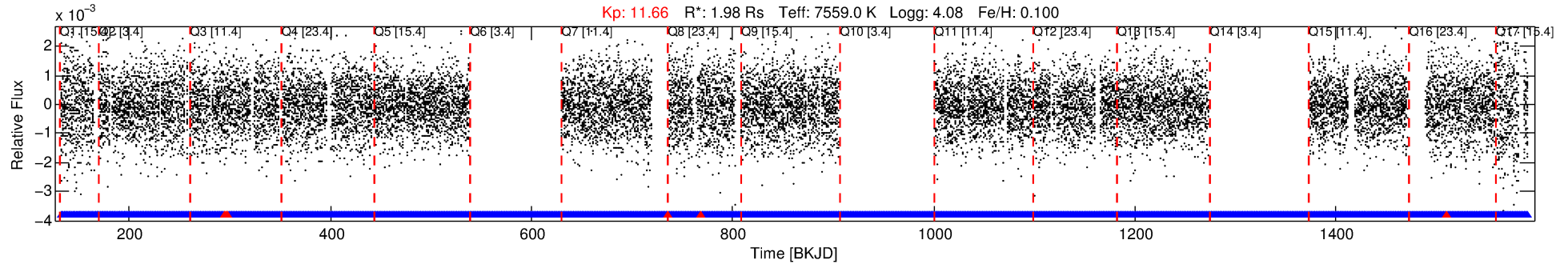
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 004276002-02

No Significant Match Found

# DV One-Page Summary

KIC: 4276002 Candidate: 2 of 2 Period: 0.522 d



## DV Fit Results:

Period = 0.52198 [0.00001] d  
Epoch = 132.0189 [0.0036] BKJD  
Rp/R\* = 0.0106 [0.0062]  
a/R\* = 1.04 [0.25]  
b = 0.14 [24.68]  
Seff = 49518.38 [17703.83]  
Teq = 3804 [340] K  
Rp = 2.30 [1.47] Re  
a = 0.0152 [0.0033] AU  
Ag = N/A  
Teffp = N/A

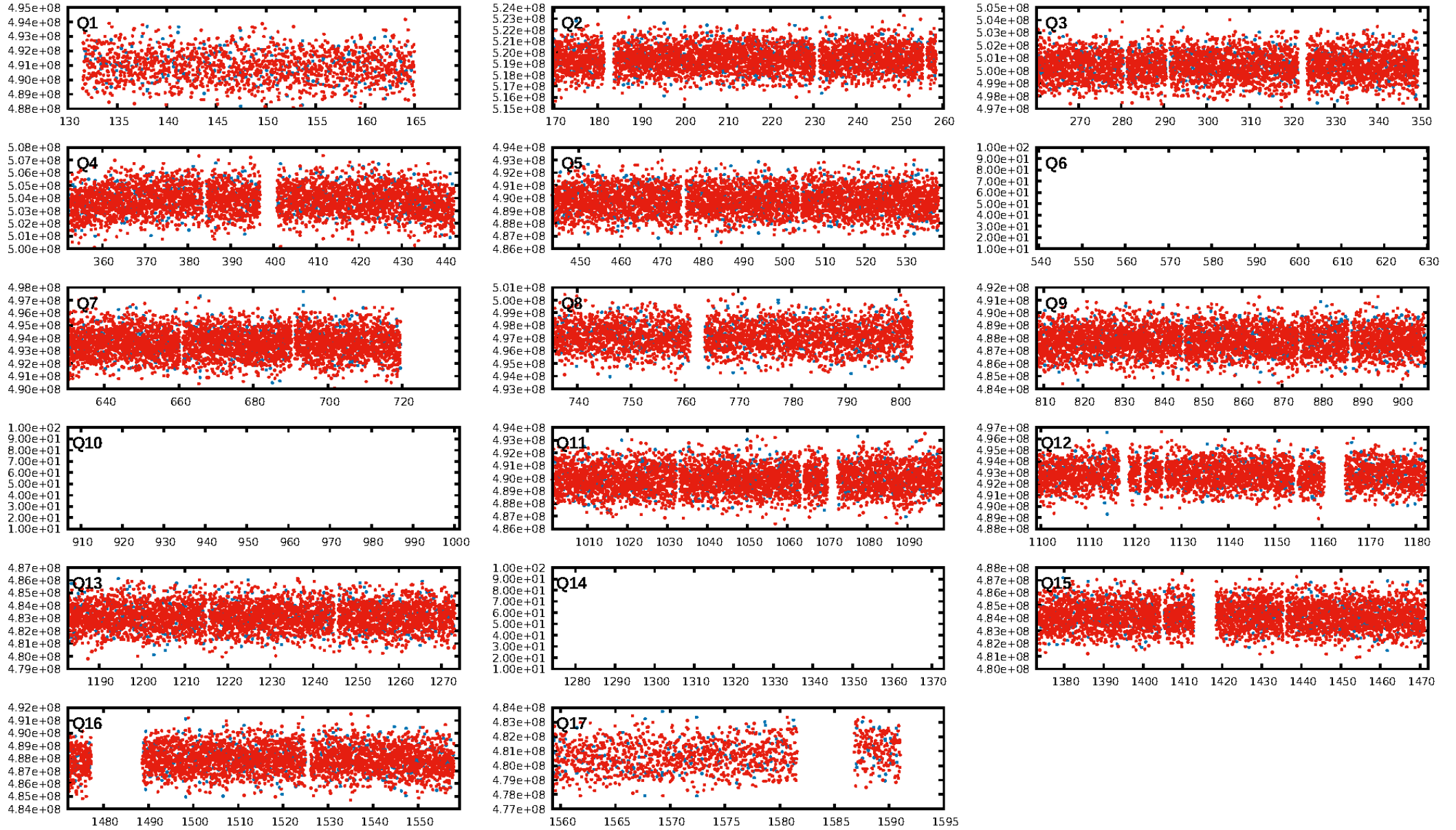
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 99.3% [2.68 $\sigma$ ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: N/A  
RollingBand-fgt: 0.99 [1285/1292]  
GhostDiagnostic-chr: 2.176  
Centroid-sig: 0.2%  
Centroid-so: 0.288 arcsec [4.22 $\sigma$ ]  
OotOffset-rm: 2.060 arcsec [2.96 $\sigma$ ]  
KicOffset-rm: 1.860 arcsec [2.69 $\sigma$ ]  
OotOffset-st: 0/4/2/3 [9]  
KicOffset-st: 0/4/2/3 [9]  
DiffImageQuality-fgm: 0.67 [6/9]  
DiffImageOverlap-fno: 1.00 [14/14]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 18:30:58 Z

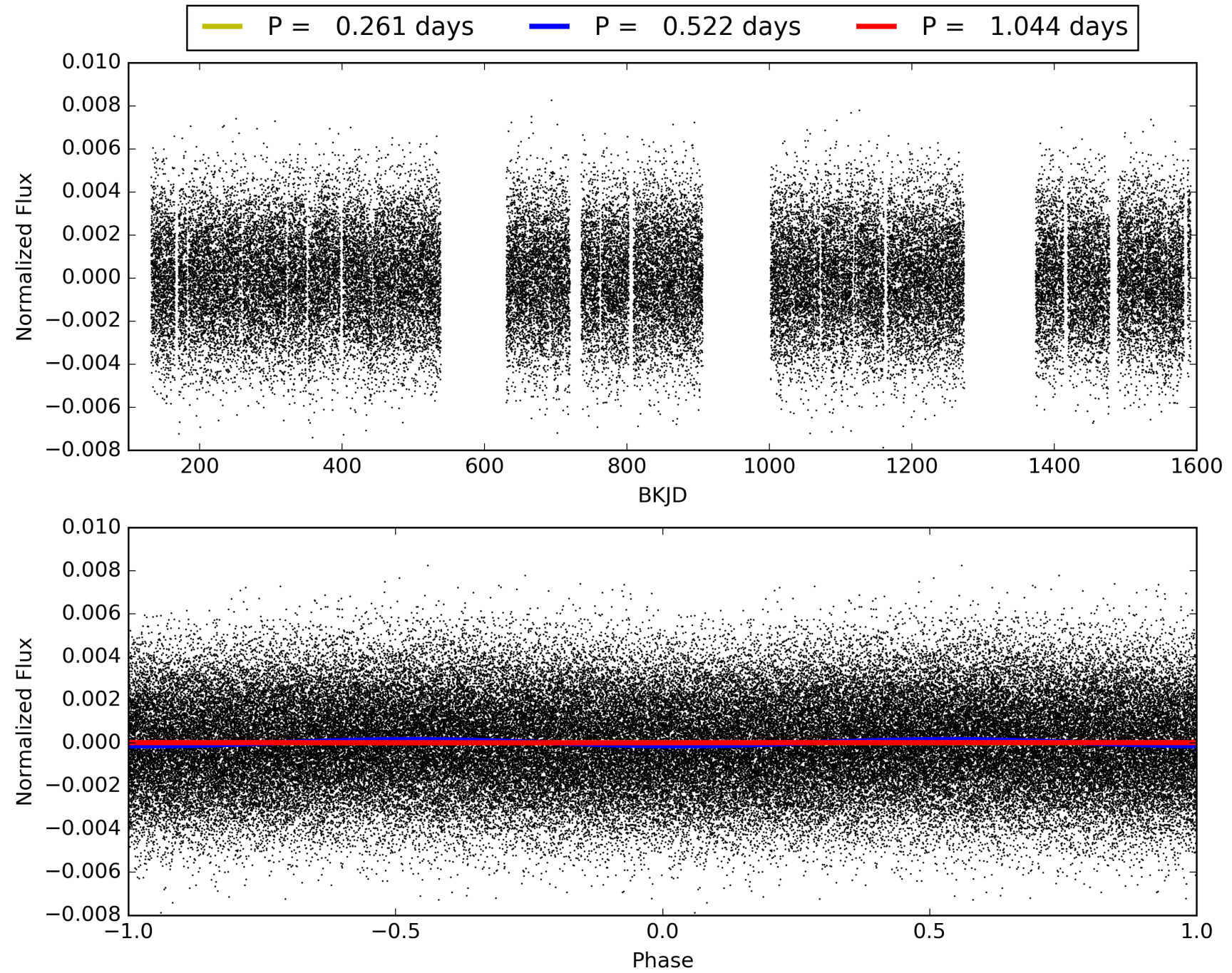
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 004276002-02, PDC Light Curves





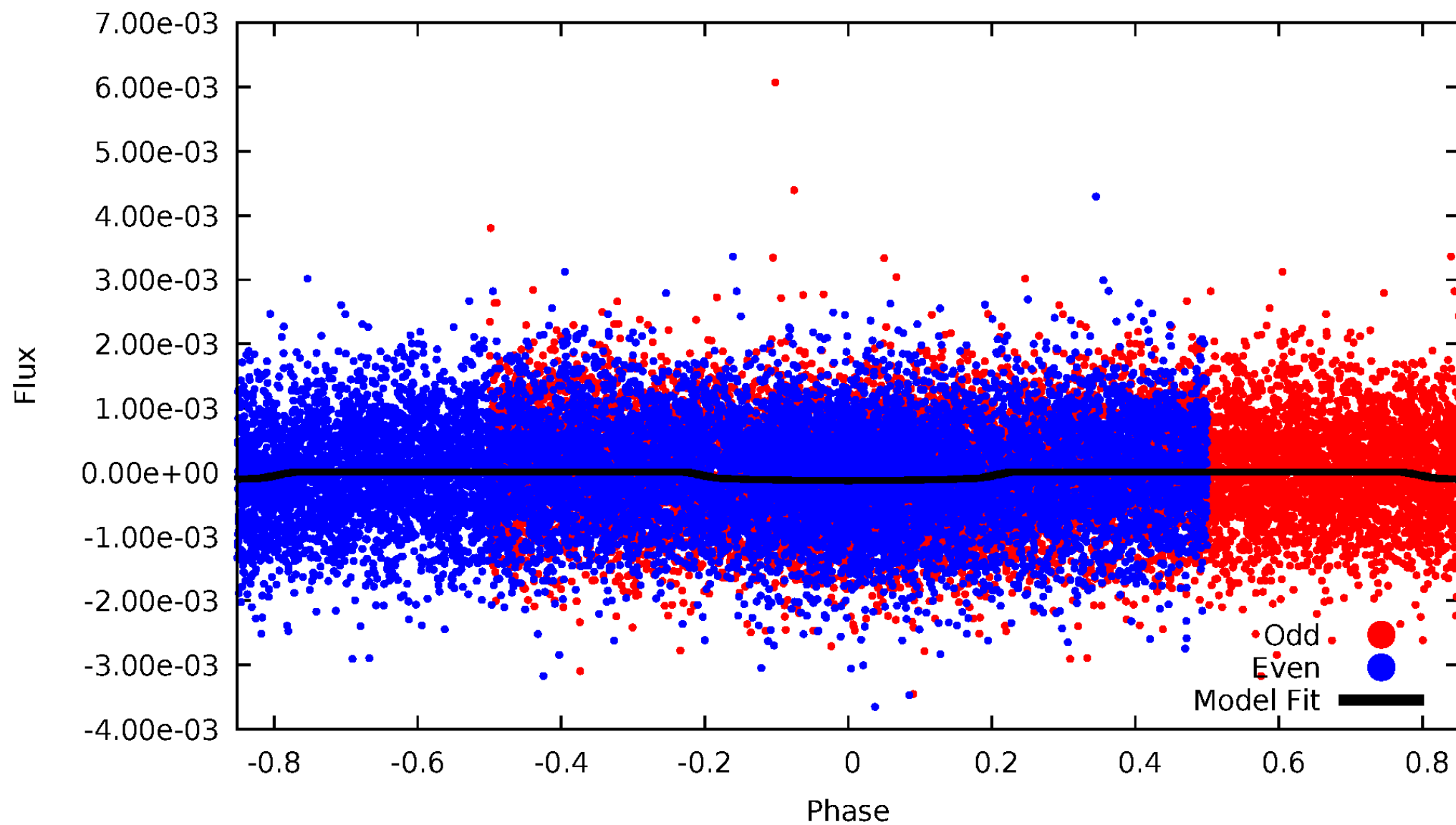
TCE 004276002-02





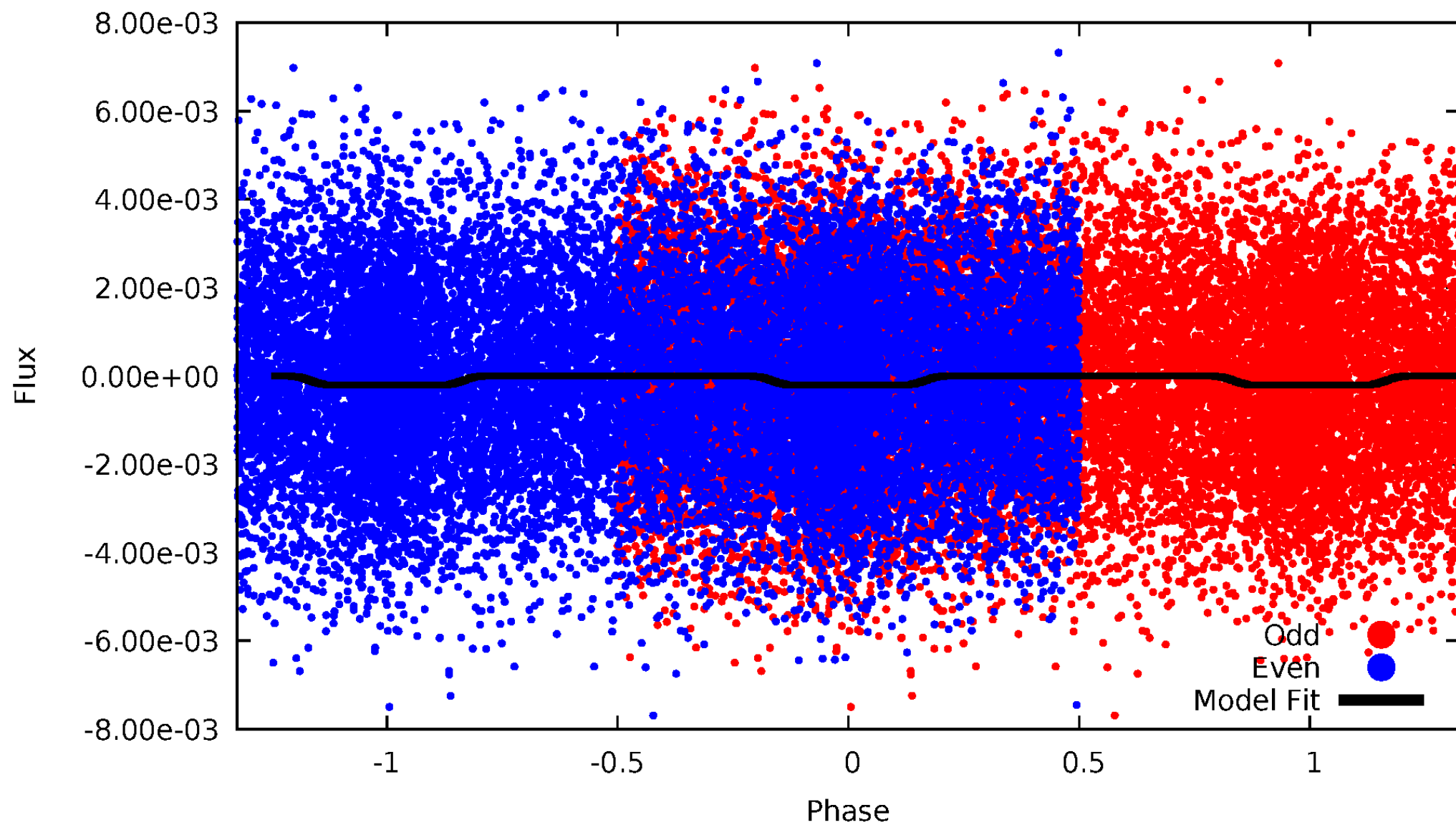
# DV Odd/Even

TCE 004276002-02



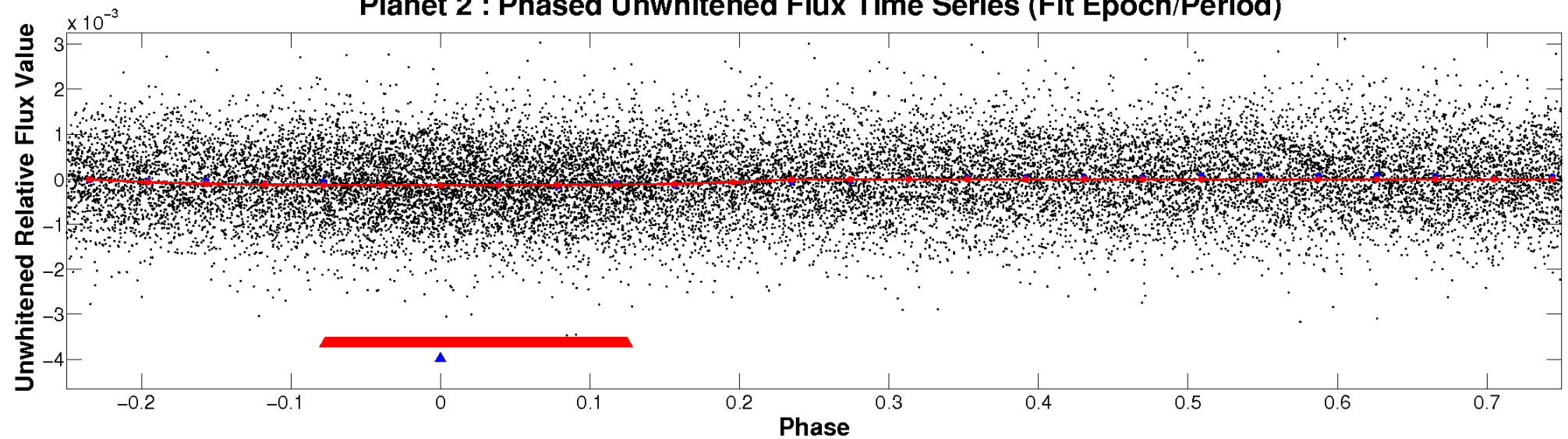
# ALT Odd/Even

TCE 004276002-02

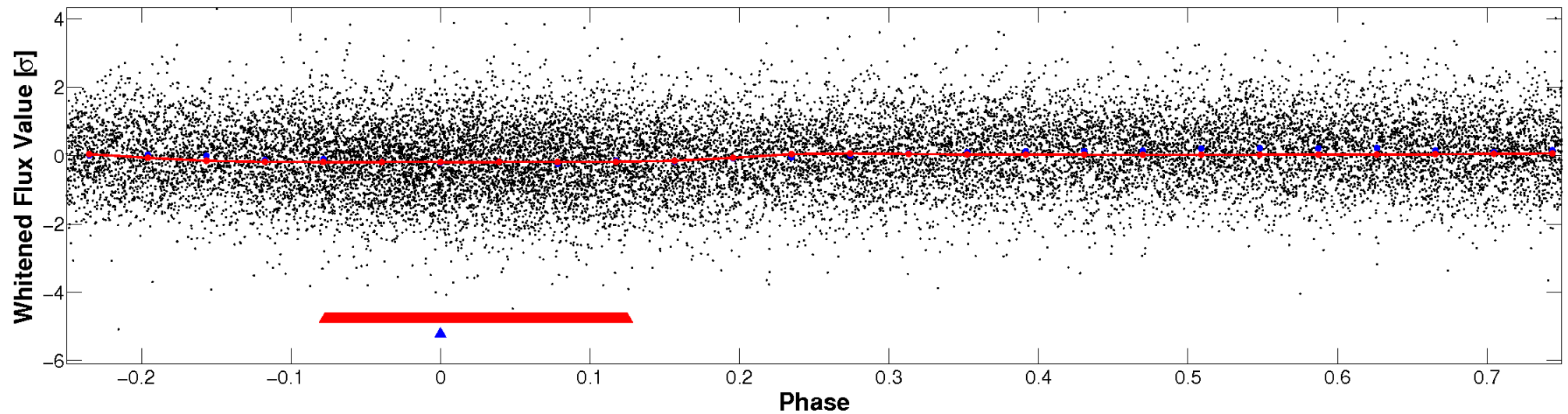


# Non-Whitened Vs. Whitened Light Curve

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

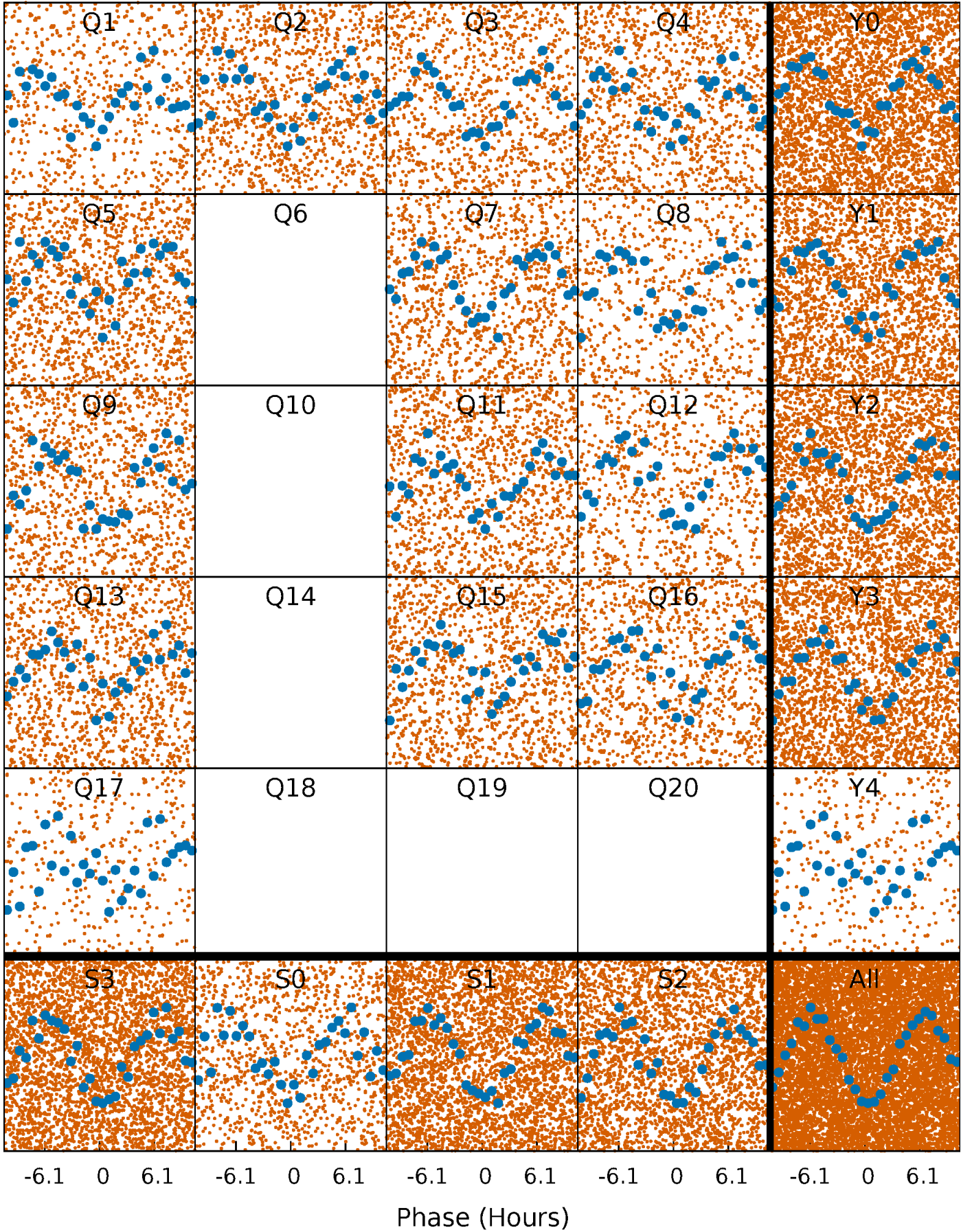


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

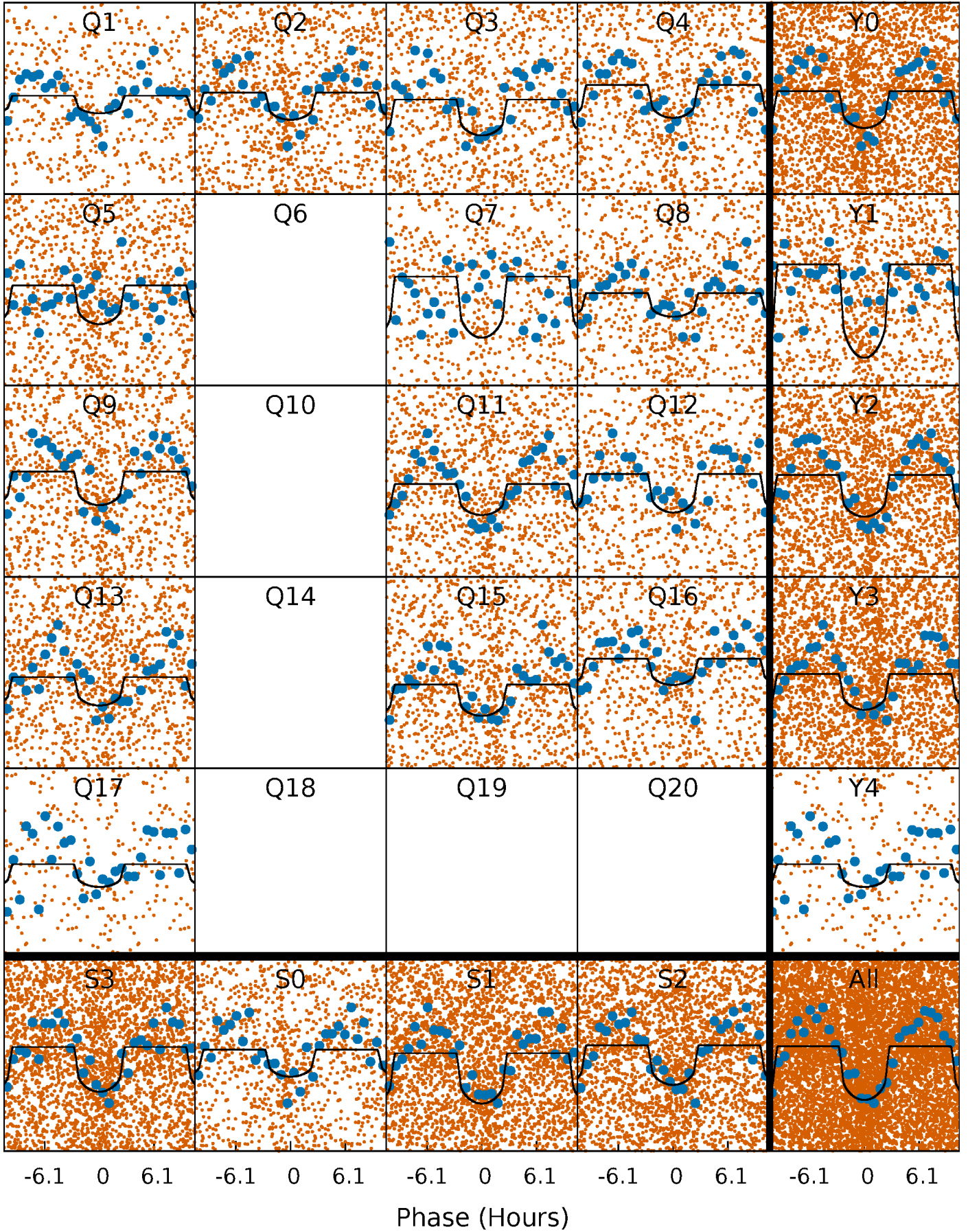
TCE 004276002-02     $P = 0.521976$  Days     $T_0 = 132.018887$  (BKJD)





# DV Quarter-Phased Transit Curves

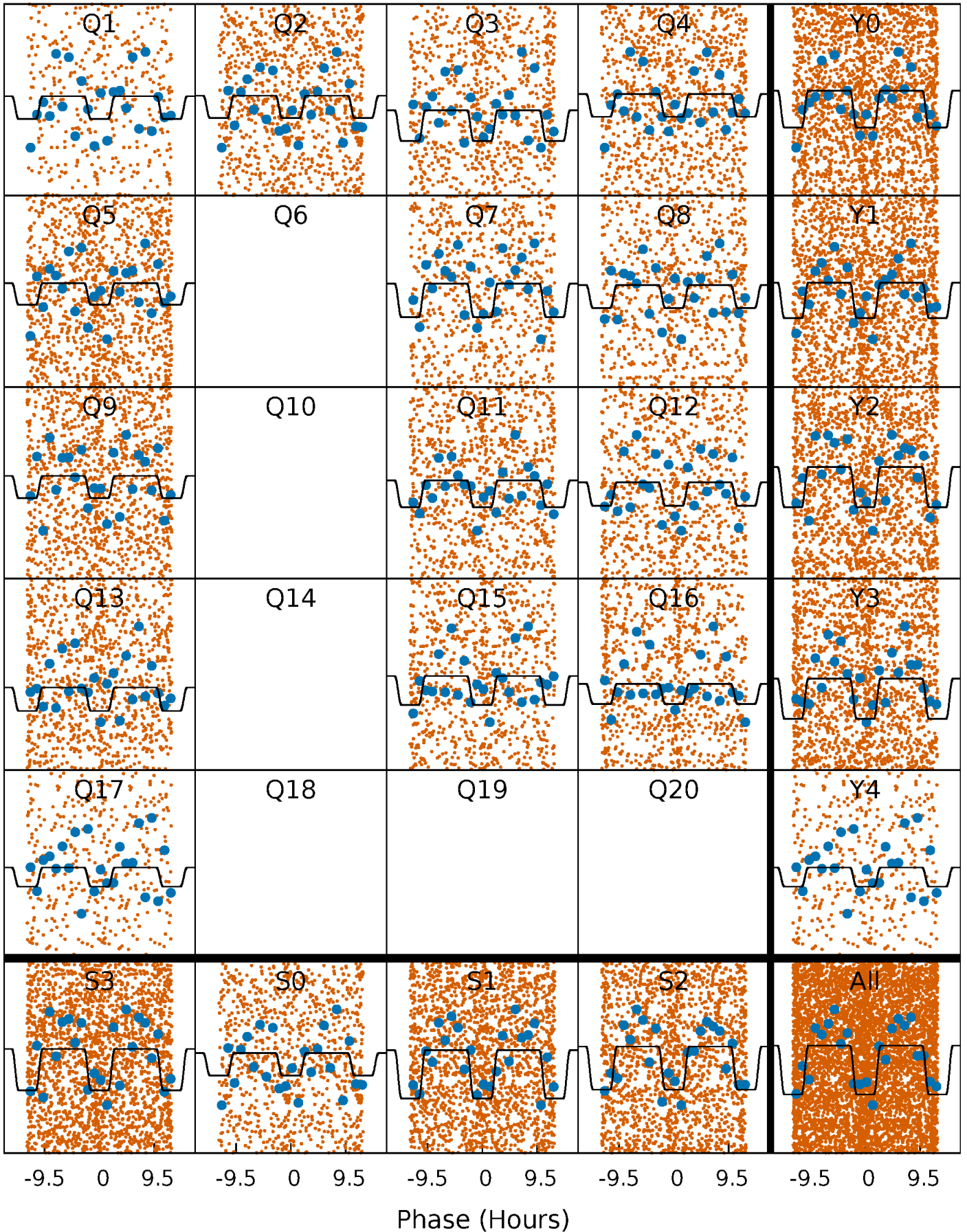
TCE 004276002-02     $P = 0.521976$  Days     $T_0 = 132.018887$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

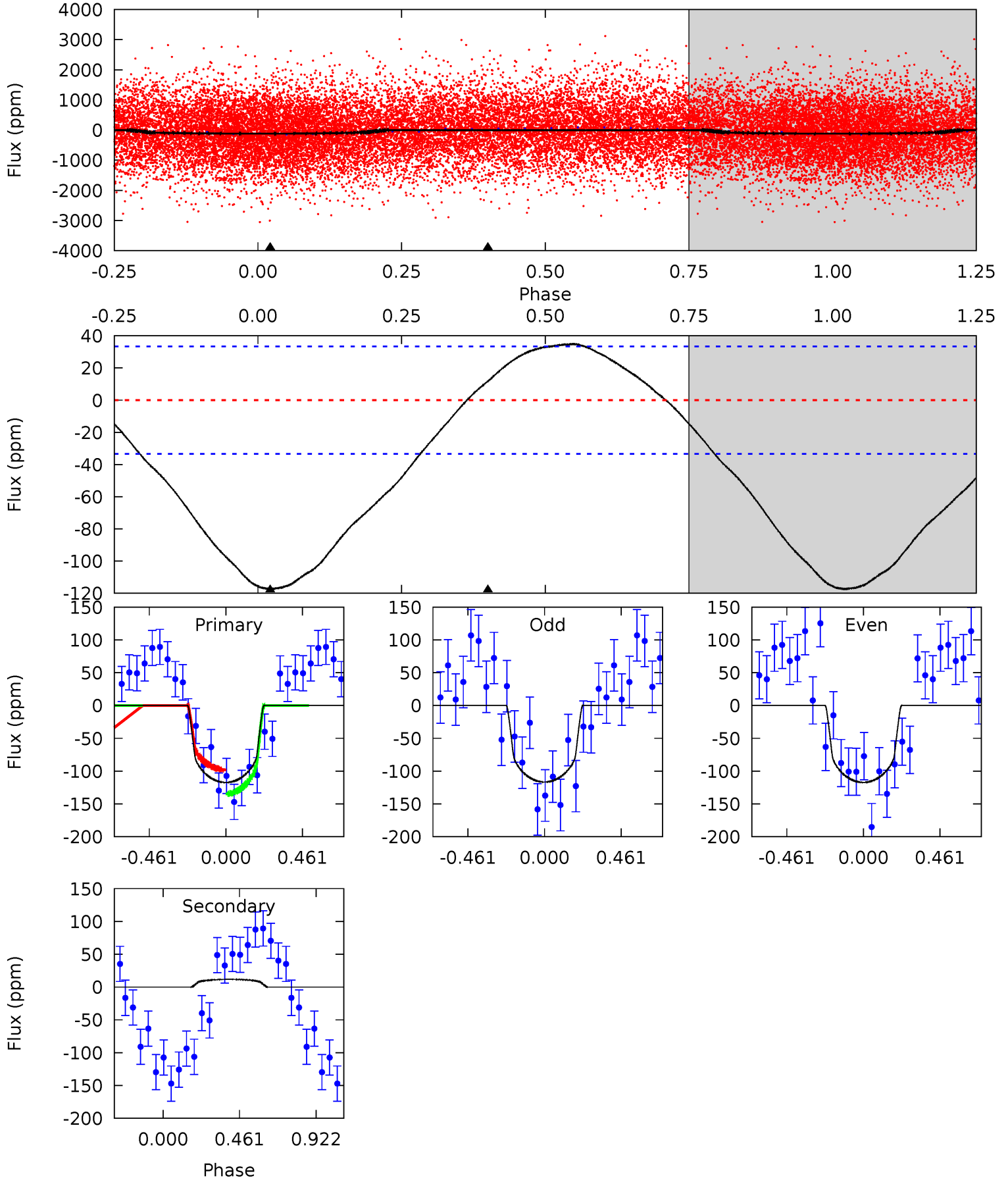
TCE 004276002-02     $P = 0.521994$  Days     $T_0 = 132.011106$  (BKJD)



# DV Model-Shift Uniqueness Test

004276002-02, P = 0.521976 Days, E = 131.496911 Days

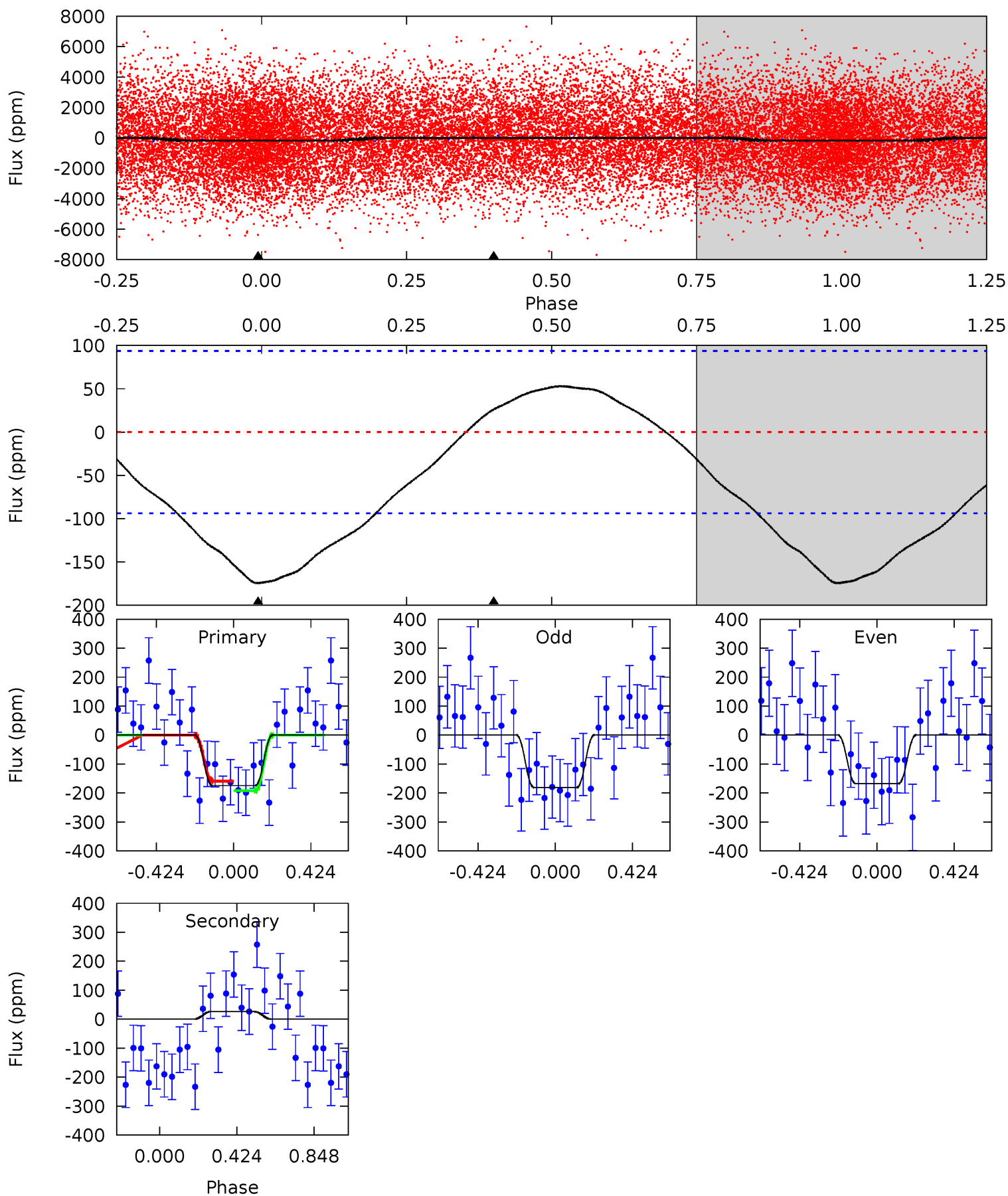
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
14.9	-1.49	0	0	4.23	0.74	1.38	14.9	14.9	-1.49	-1.49	0.04	0.98	0.23	2.39



# Alt Model-Shift Uniqueness Test

004276002-02, P = 0.521994 Days, E = 131.489112 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
7.91	-1.18	0	0	4.25	0.80	0.79	7.91	7.91	-1.18	-1.18	0.31	1.05	0.23	0.75



### Stellar Parameters For KIC 004276002

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$7559^{+211}_{-342}$	$4.082^{+0.135}_{-0.165}$	$0.100^{+0.150}_{-0.350}$	$1.983^{+0.523}_{-0.380}$	$1.732^{+0.204}_{-0.272}$	$0.313^{+0.217}_{-0.150}$
	+3%/-5%	+3%/-4%	+150%/-350%	+26%/-19%	+12%/-16%	+69%/-48%
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 004276002-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$12 \pm 8$	$2.40^{+1.32}_{-1.20}$	$5319^{+386}_{-355}$	$-5092^{+485}_{-1183}$	$-0.234^{+0.182}_{-0.883}$
Alt.	$26 \pm 22$	$3.11^{+1.40}_{-1.34}$	$5329^{+361}_{-335}$	$-5188^{+613}_{-1178}$	$-0.296^{+0.260}_{-0.870}$

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

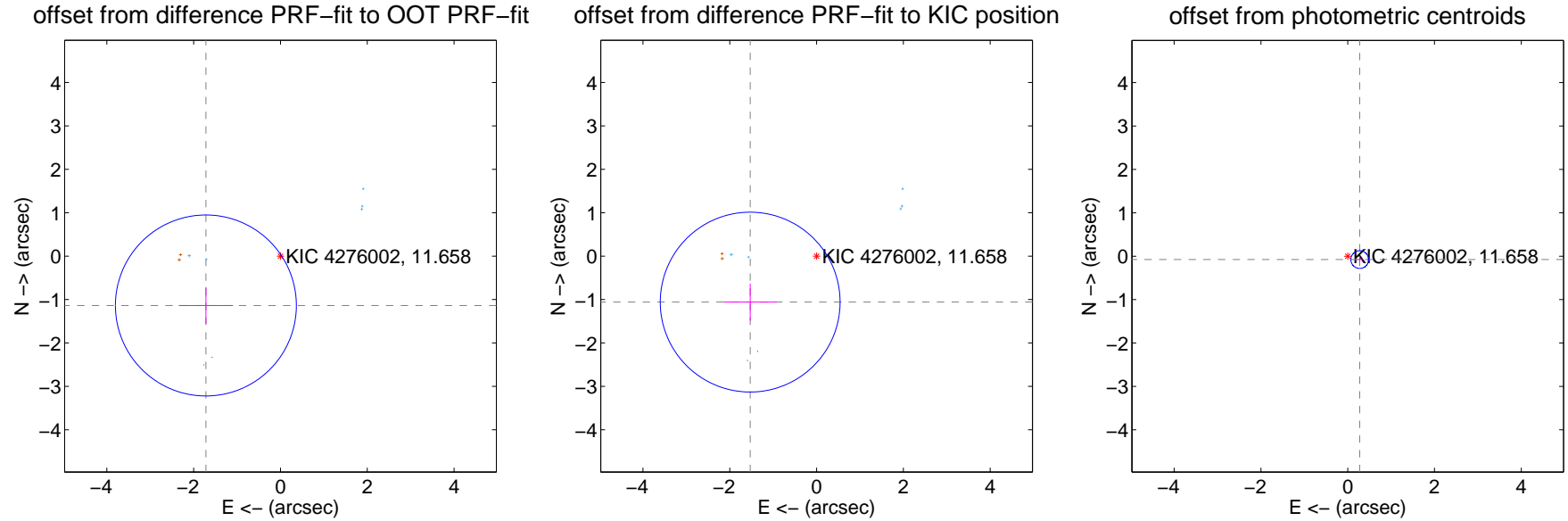
## DV Centroid Data

Supplemental centroid analysis for 004276002-02. **Kepler magnitude: 11.66.** Transit SNR 16.69

There are 6 quarters with good PRF difference image offsets

The direct PRF centroid is offset from the target star catalog position by about 0.14 arcsec

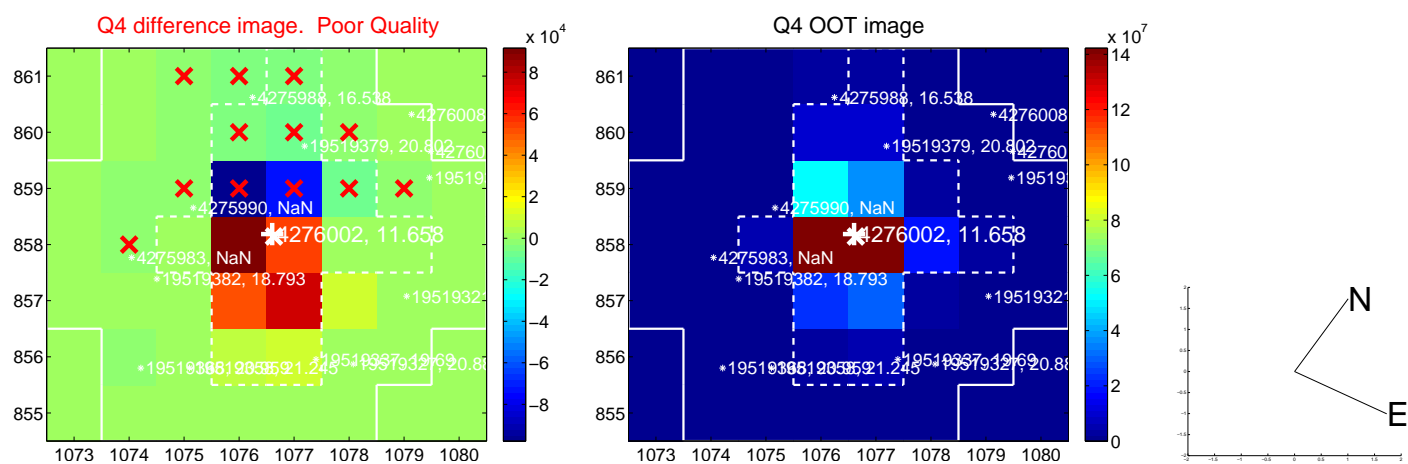
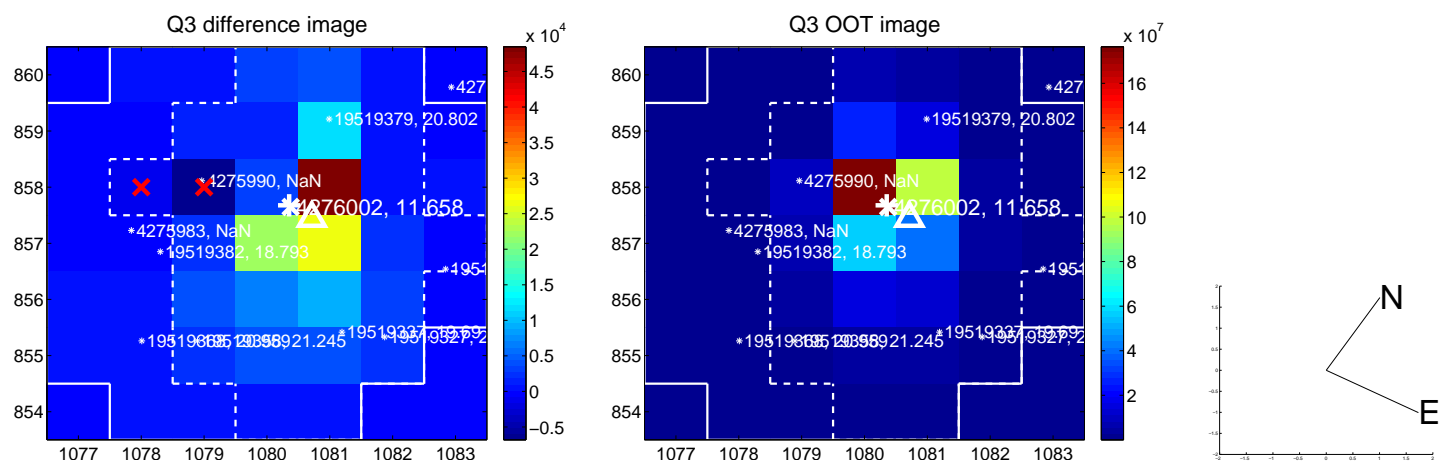
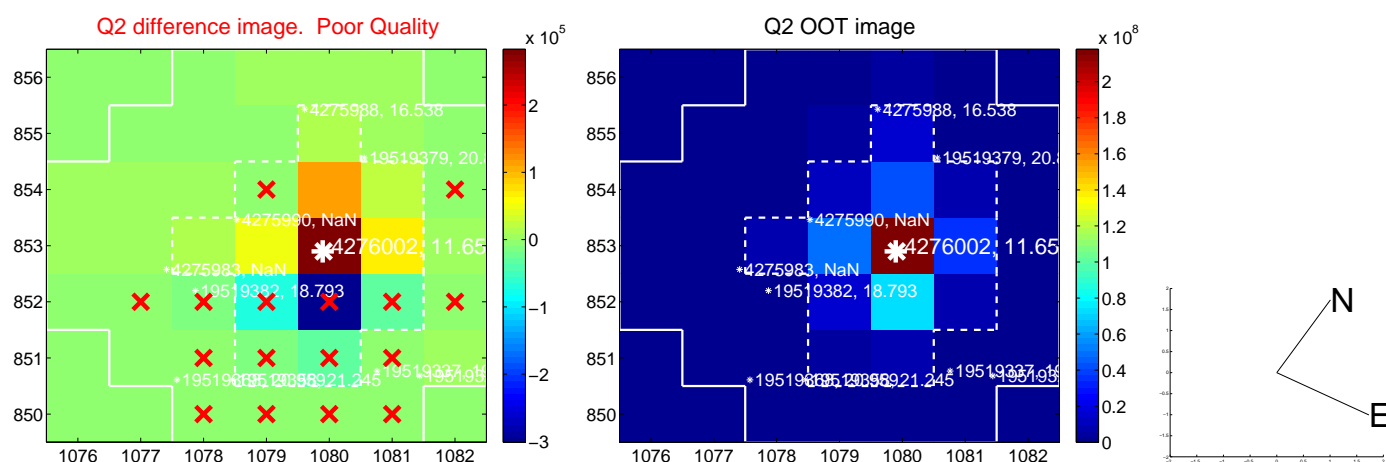
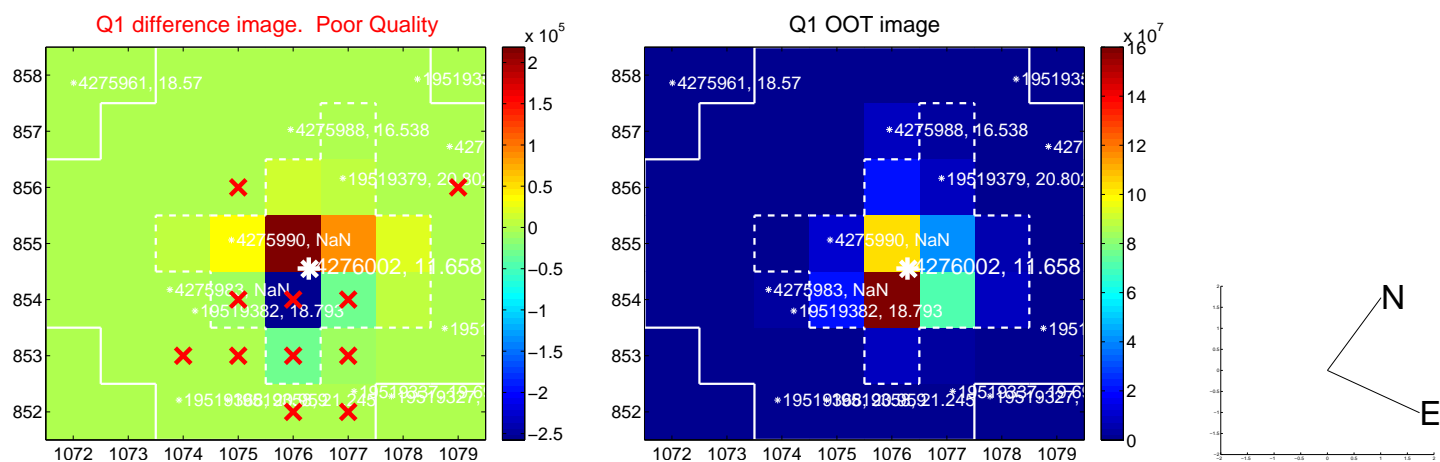
	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$2.060 \pm 0.695$	2.96	$1.718 \pm 0.626$	$-1.137 \pm 0.426$
PRF-fit source offset from KIC position	$1.860 \pm 0.690$	2.69	$1.530 \pm 0.611$	$-1.059 \pm 0.427$
photometric centroid source offset	<b><math>0.29 \pm 0.07</math></b>	<b>4.22</b>	$-0.28 \pm 0.07$	$-0.08 \pm 0.07$



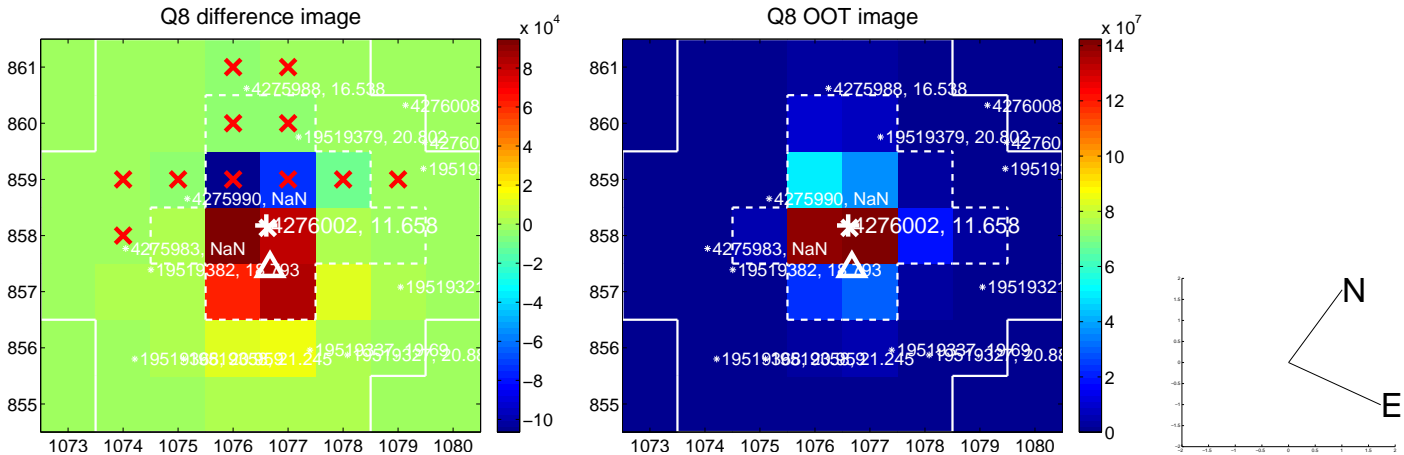
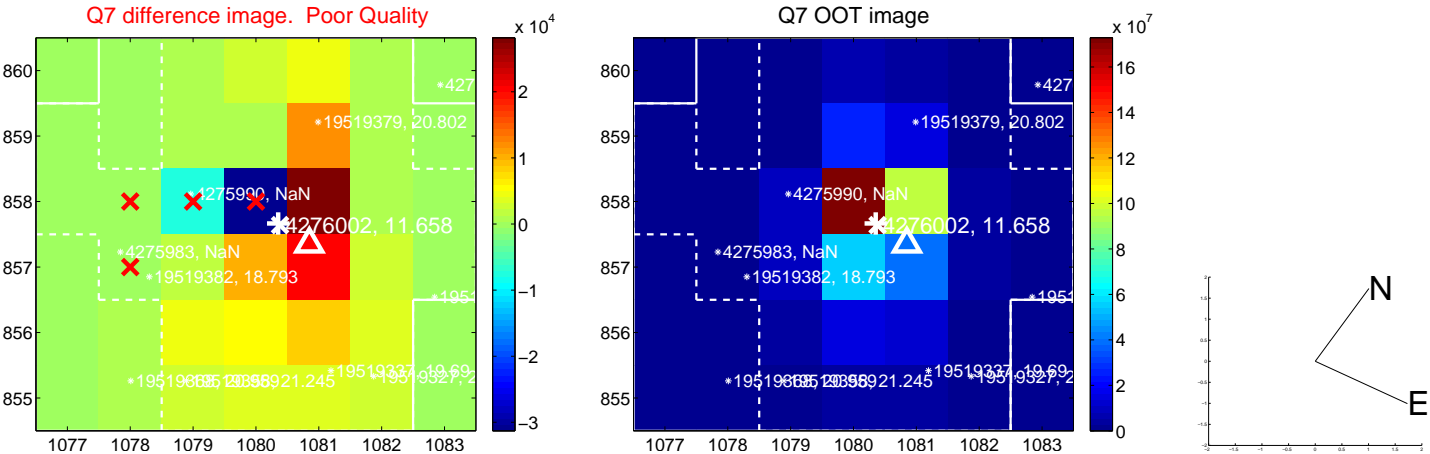
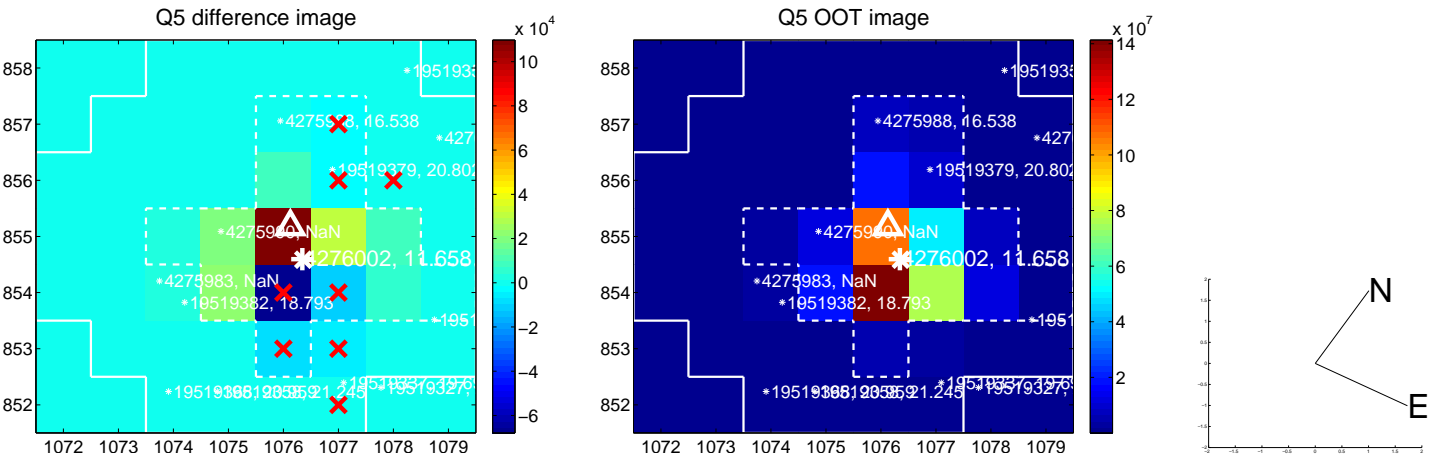
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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



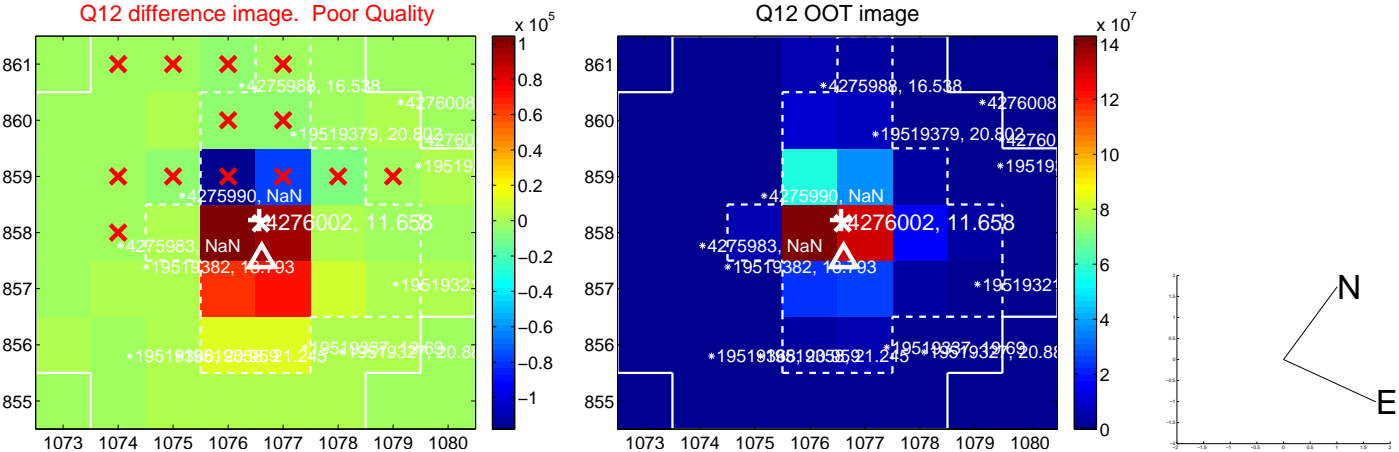
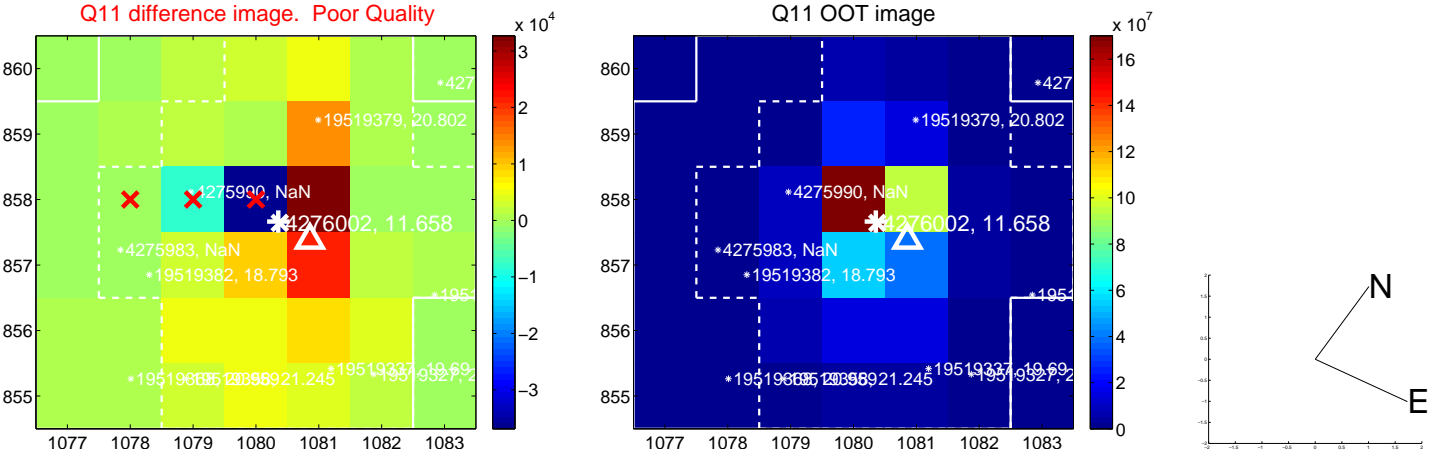
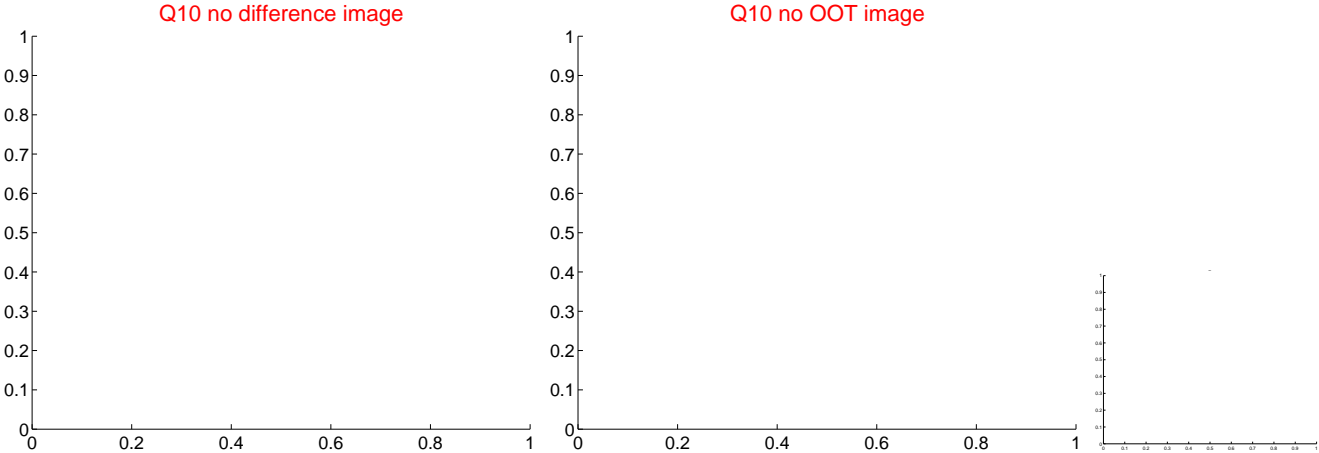
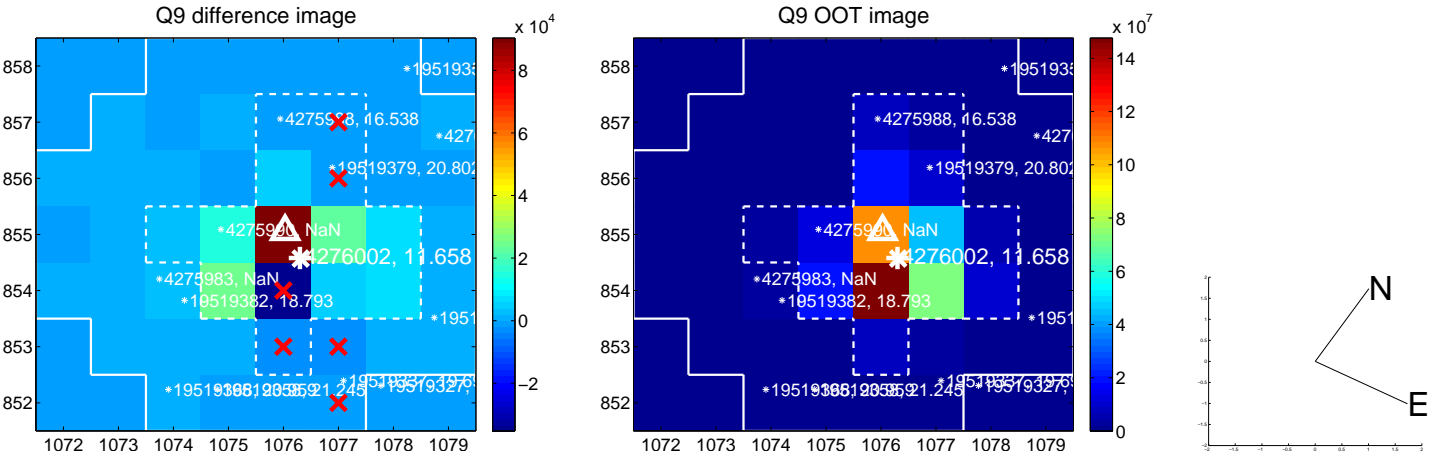
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



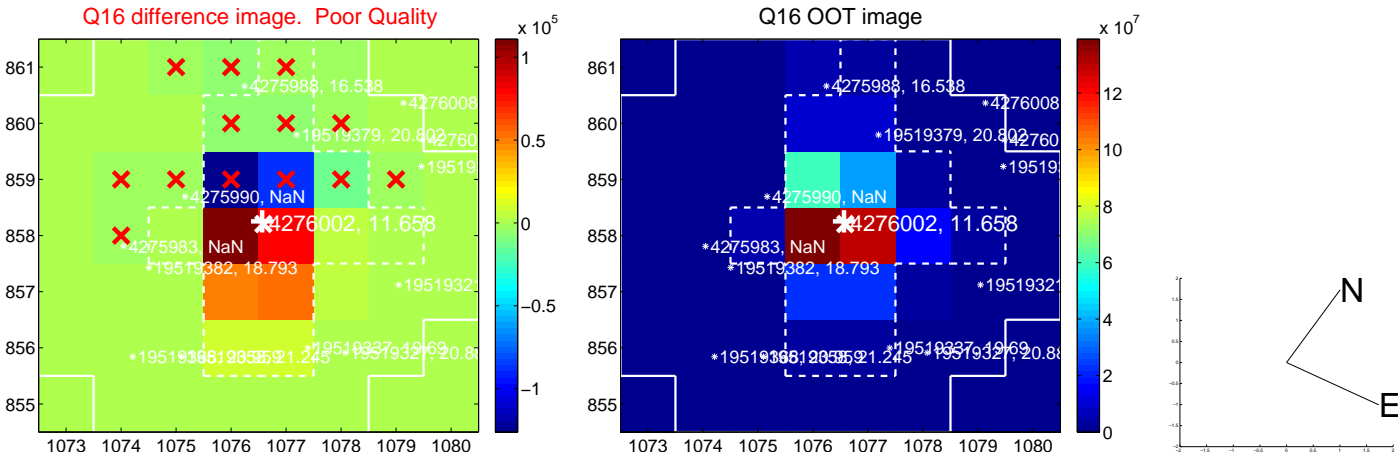
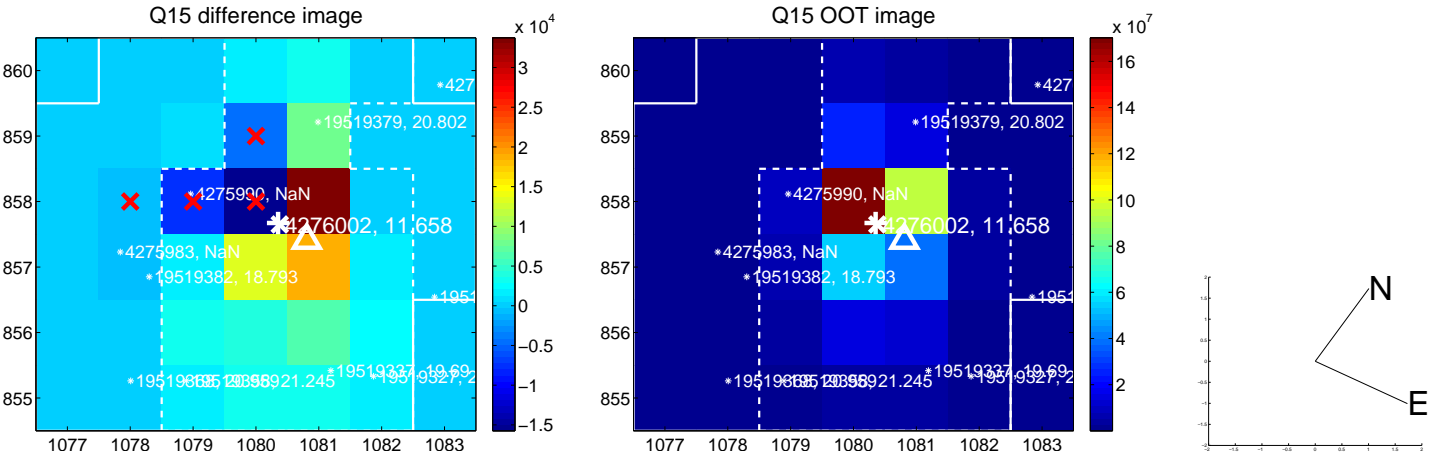
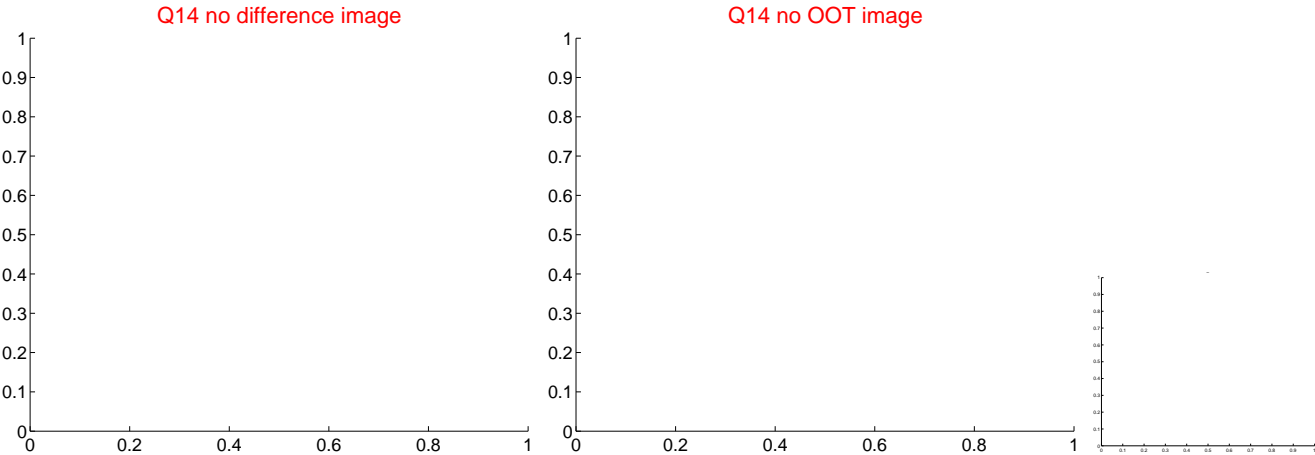
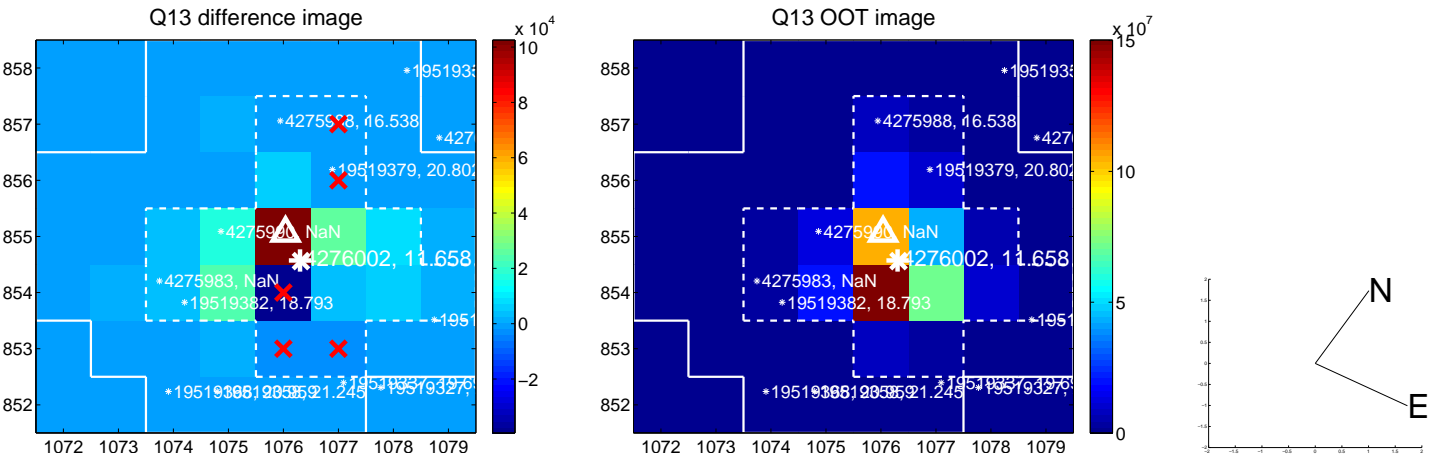
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



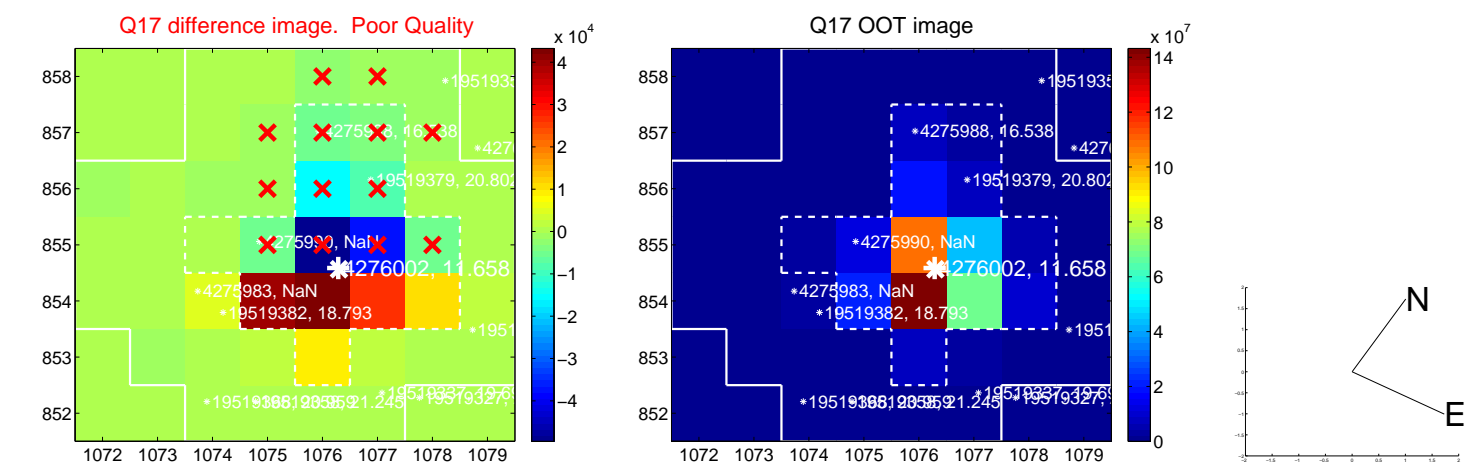
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



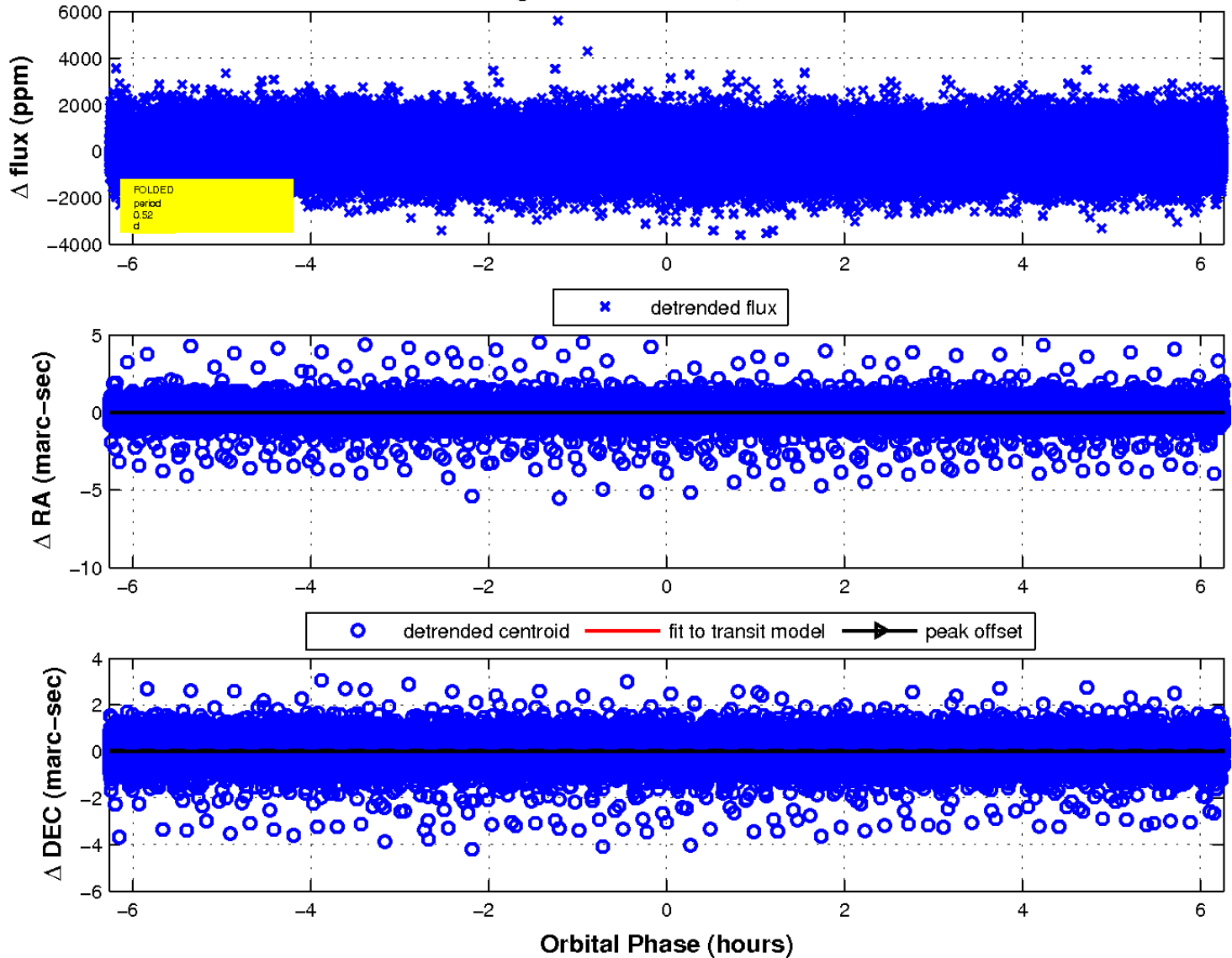
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



fluxWeightedCentroids, Planet 2 of 2





UKIRT Image

Declination

