

# KIC 008458616

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
008458616-01	OBS	No	2.569852	133.990424	44.2	5.775	8.3	6.4	1.58	6997	1.22	3225.17
008458616-02	OBS	No	1.284796	132.020153	13.5	10.262	8.6	2.6	1.58	6997	0.61	8128.01

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
008458616-01	OBS	FP	0.00	1	0	0	0	LPP_DV—MOD_NONUNIQ_DV
008458616-02	OBS	FP	0.00	1	0	0	0	SWEET_NTL—LPP_DV—MOD_NONUNIQ_DV—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.

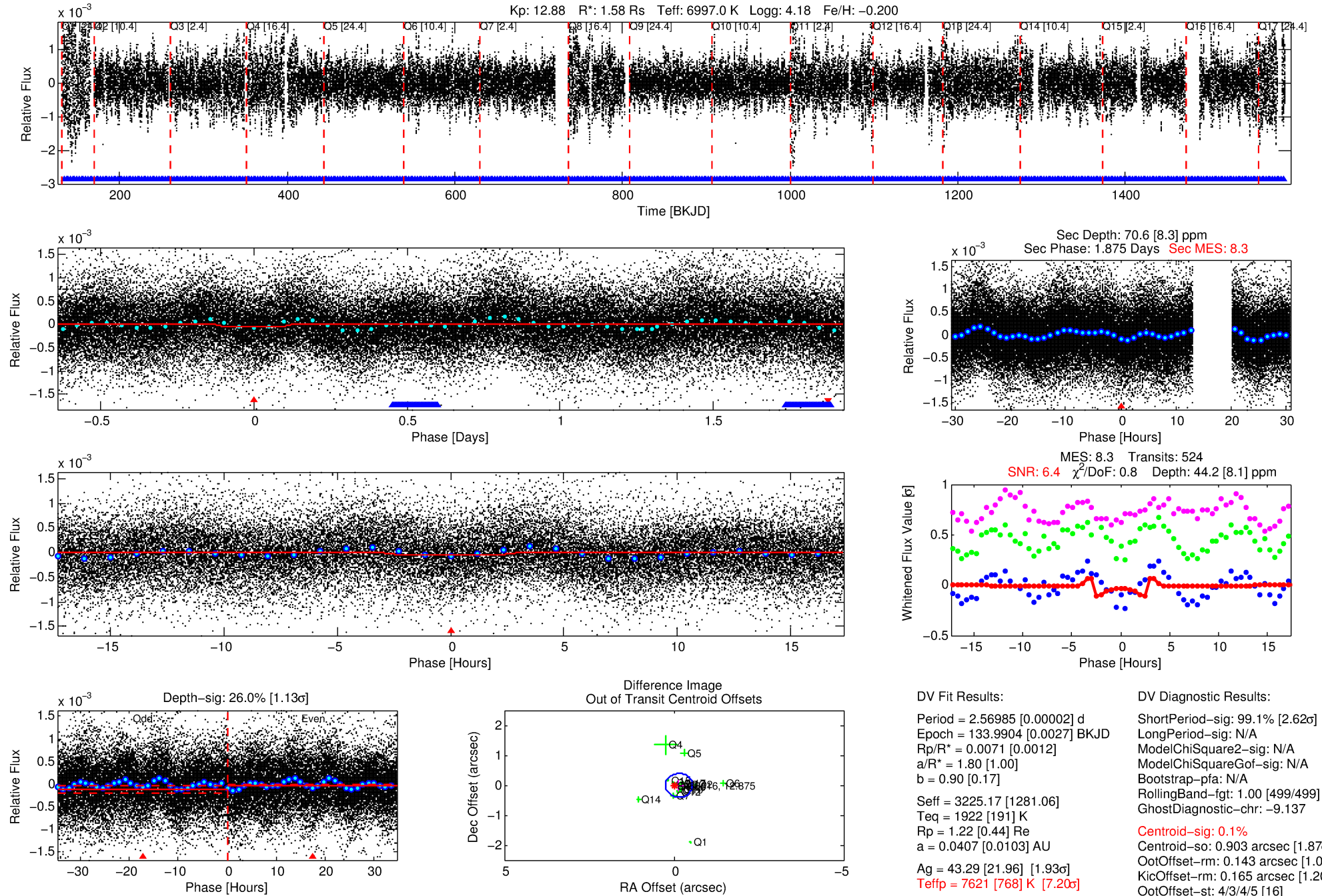
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 008458616-01

No Significant Match Found

# DV One-Page Summary

KIC: 8458616 Candidate: 1 of 2 Period: 2.570 d



## DV Fit Results:

Period = 2.56985 [0.00002] d  
Epoch = 133.9904 [0.0027] BKJD  
Rp/R\* = 0.0071 [0.0012]  
a/R\* = 1.80 [1.00]  
b = 0.90 [0.17]  
Seff = 3225.17 [1281.06]  
Teq = 1922 [191] K  
Rp = 1.22 [0.44] Re  
a = 0.0407 [0.0103] AU  
Ag = 43.29 [21.96] [1.93 $\sigma$ ]  
Teffp = 7621 [768] K [7.20 $\sigma$ ]

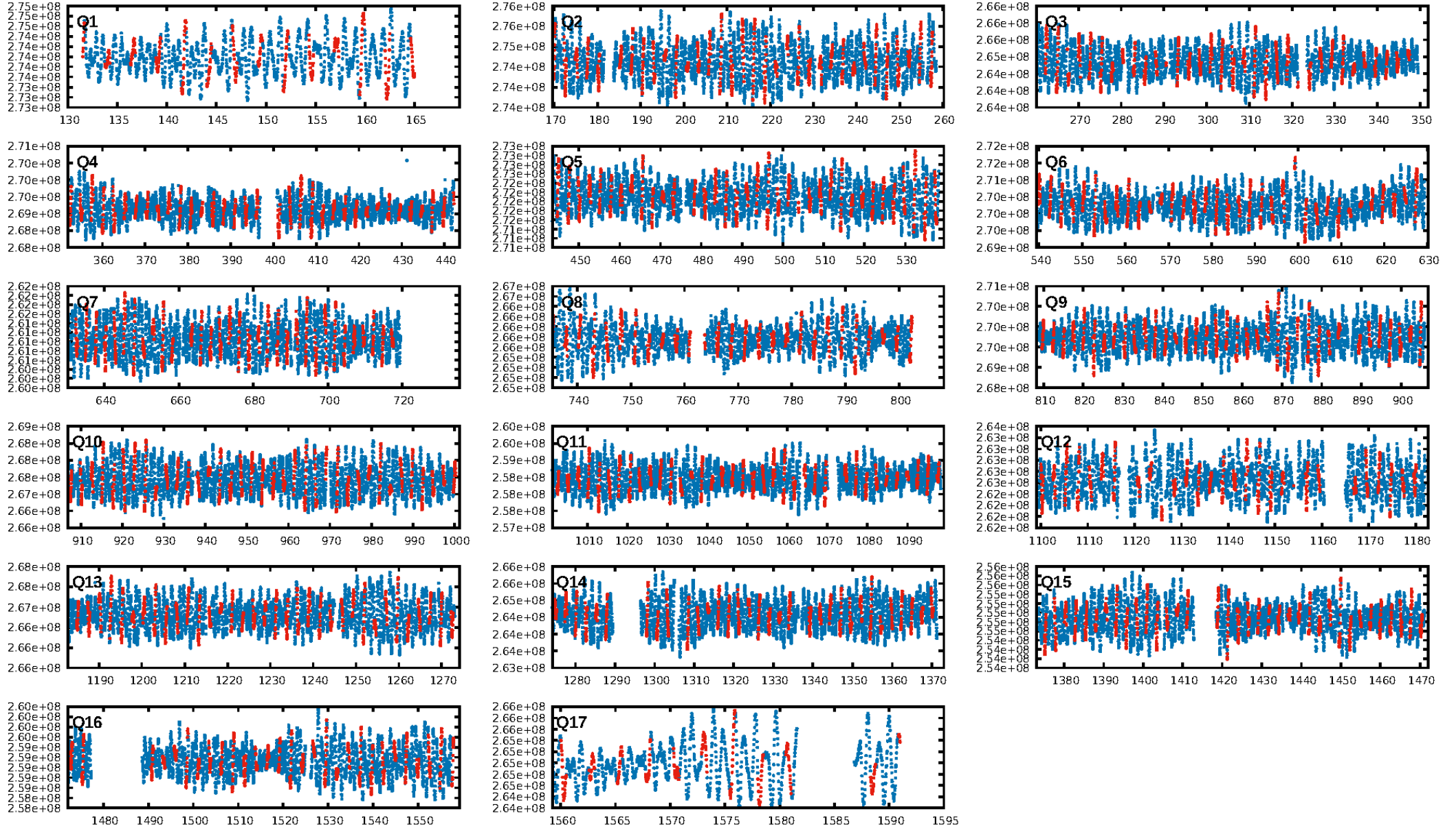
## DV Diagnostic Results:

ShortPeriod-sig: 99.1% [2.62 $\sigma$ ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [499/499]  
GhostDiagnostic-chr: -9.137  
Centroid-sig: 0.1%  
Centroid-so: 0.903 arcsec [1.87 $\sigma$ ]  
OotOffset-rm: 0.143 arcsec [1.08 $\sigma$ ]  
KicOffset-rm: 0.165 arcsec [1.20 $\sigma$ ]  
OotOffset-st: 4/3/4/5 [16]  
KicOffset-st: 4/3/4/5 [16]  
DiffImageQuality-fgm: 0.94 [15/16]  
DiffImageOverlap-fno: 0.00 [0/17]

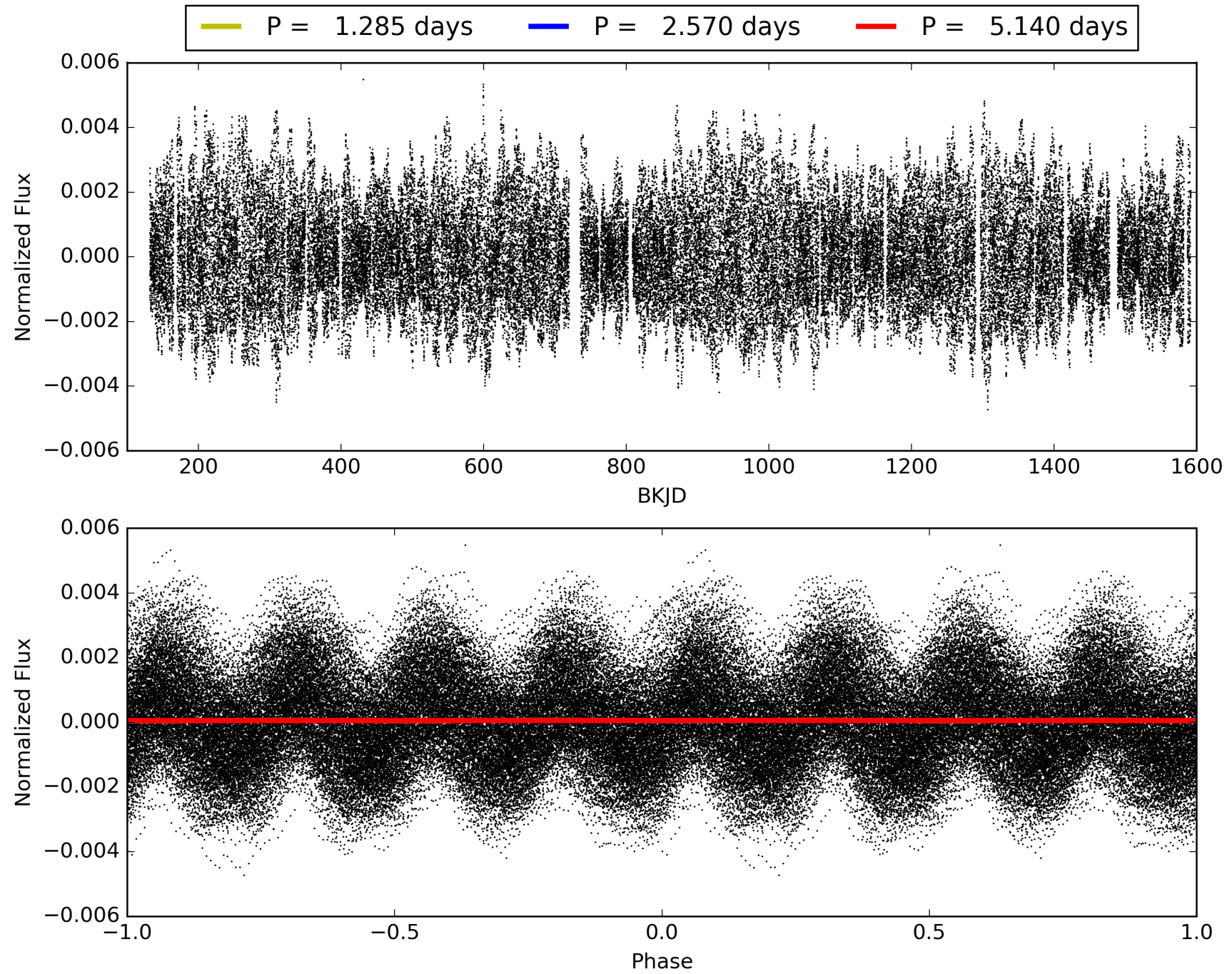
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 30-Jan-2016 10:13:58 Z

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

# TCE 008458616-01, PDC Light Curves

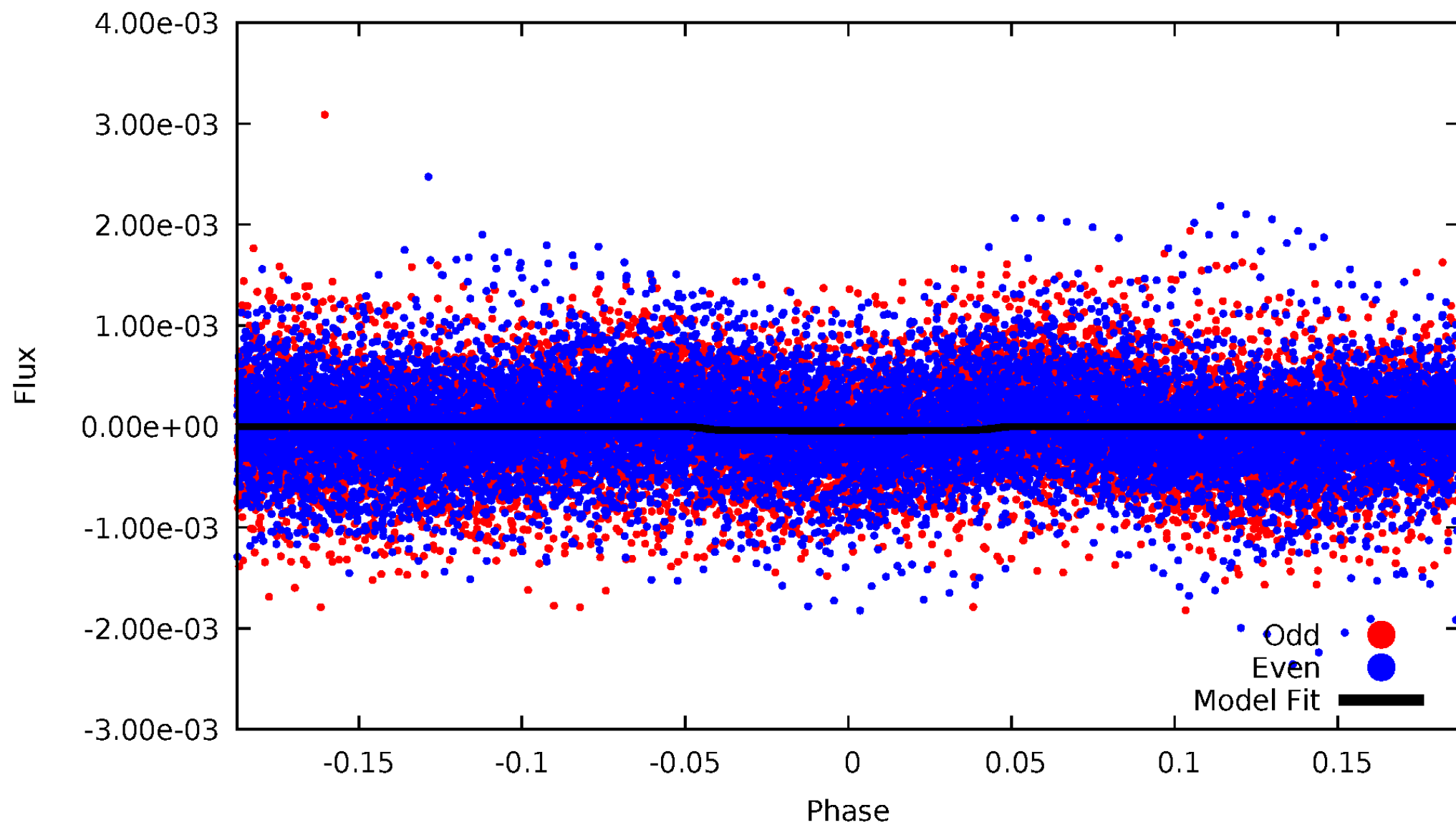


TCE 008458616-01



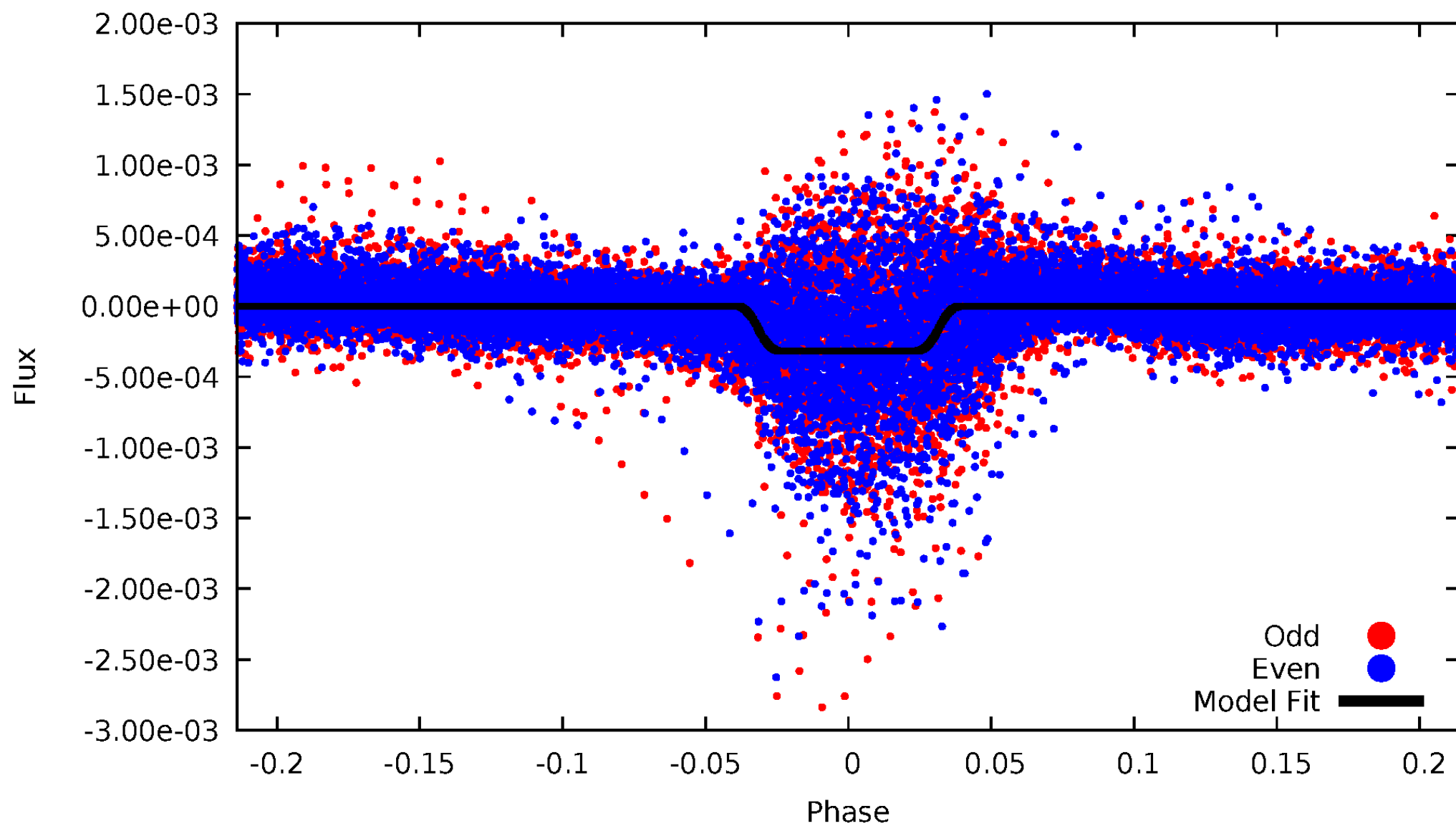
# DV Odd/Even

TCE 008458616-01

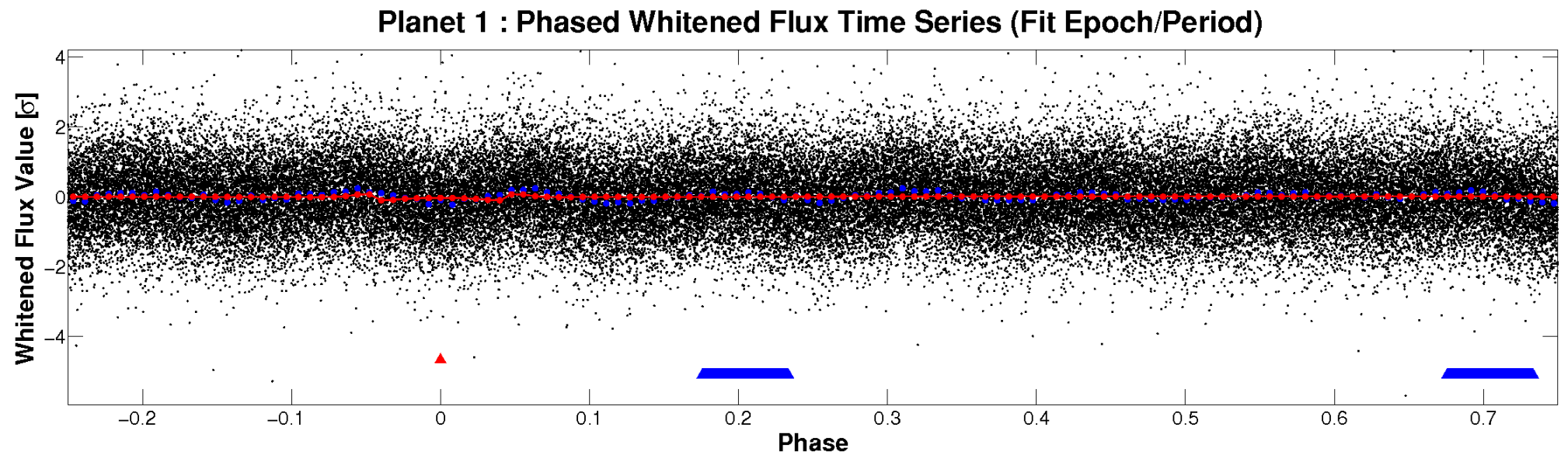
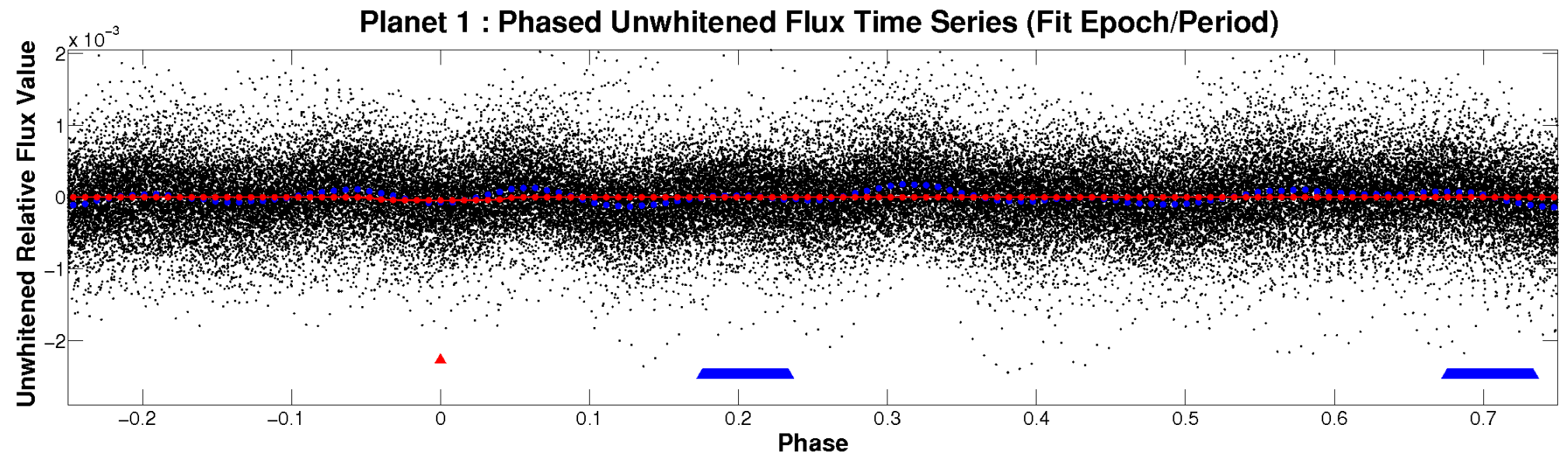


# ALT Odd/Even

TCE 008458616-01

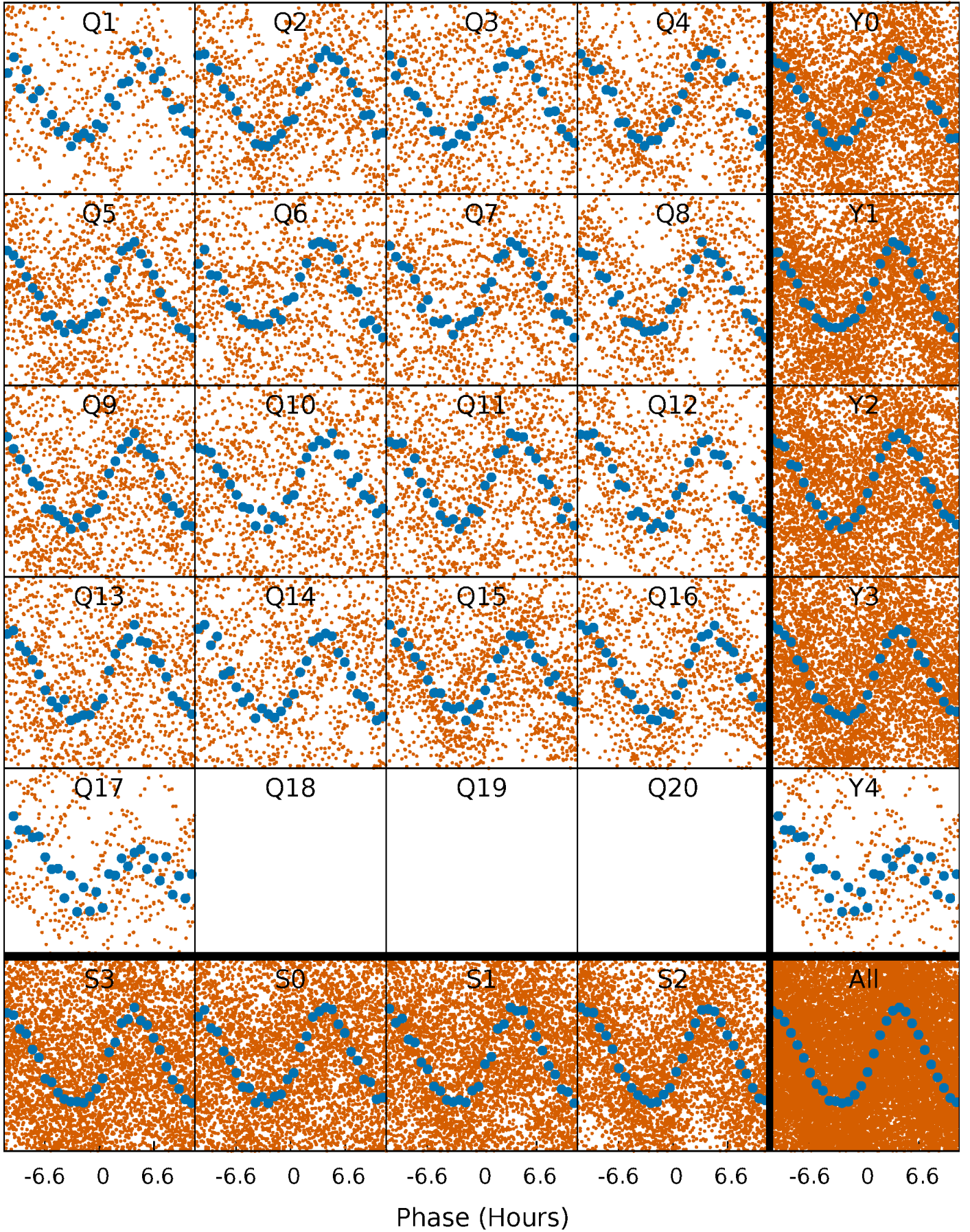


# Non-Whitened Vs. Whitened Light Curve



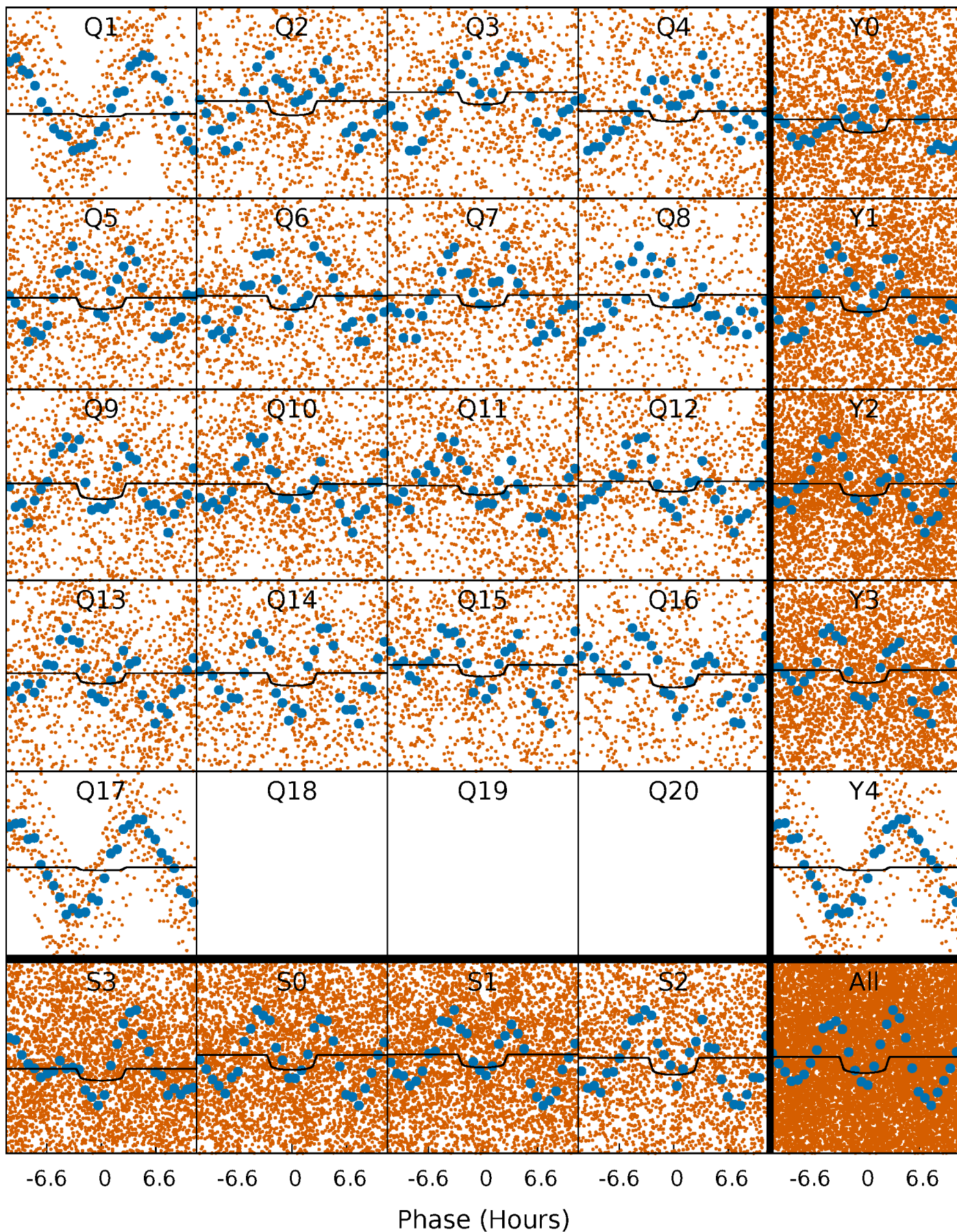
# PDC Quarter-Phased Transit Curves

TCE 008458616-01 P= 2.569852 Days  $T_0=133.990424$  (BKJD)



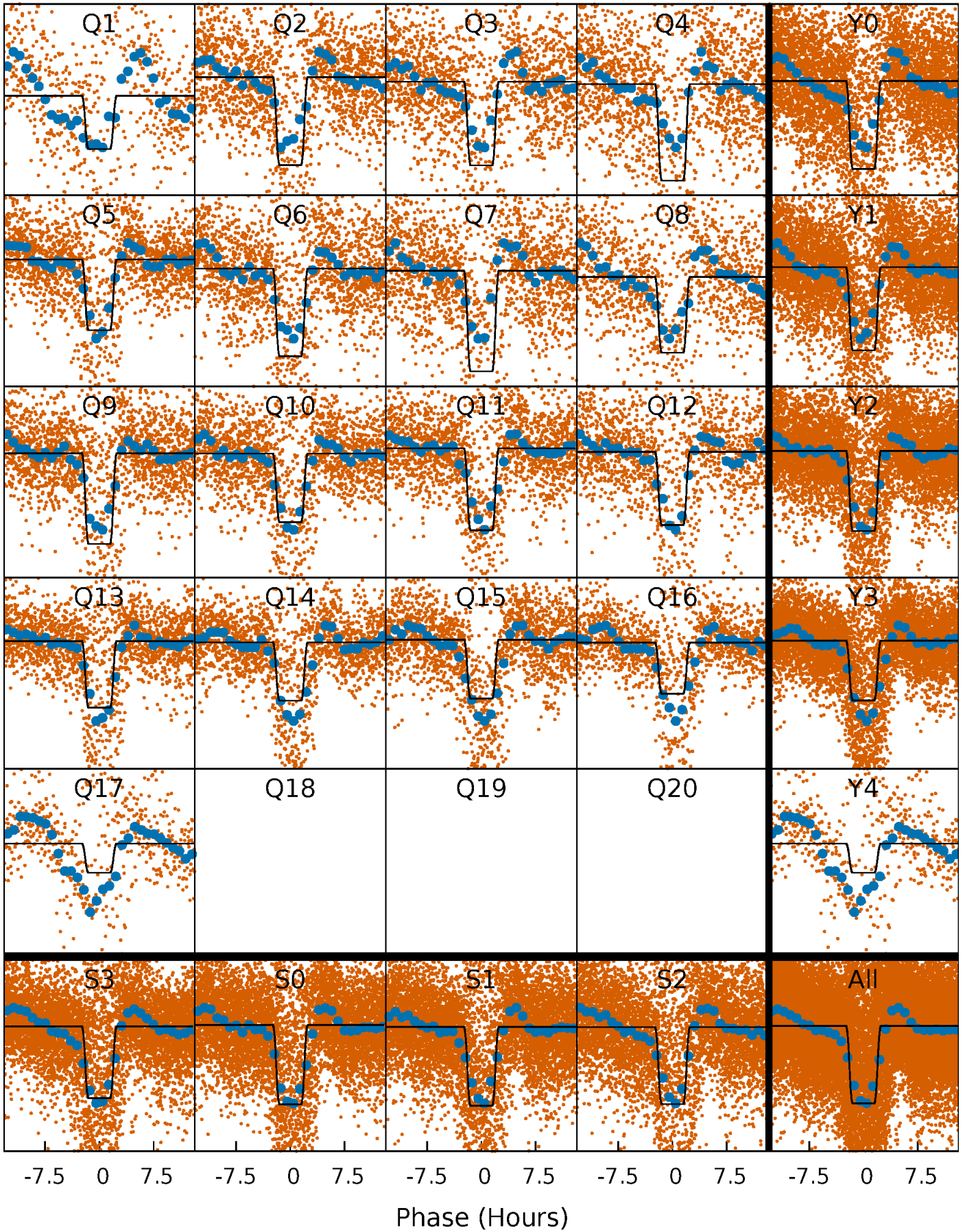
# DV Quarter-Phased Transit Curves

TCE 008458616-01 P= 2.569852 Days  $T_0=133.990424$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

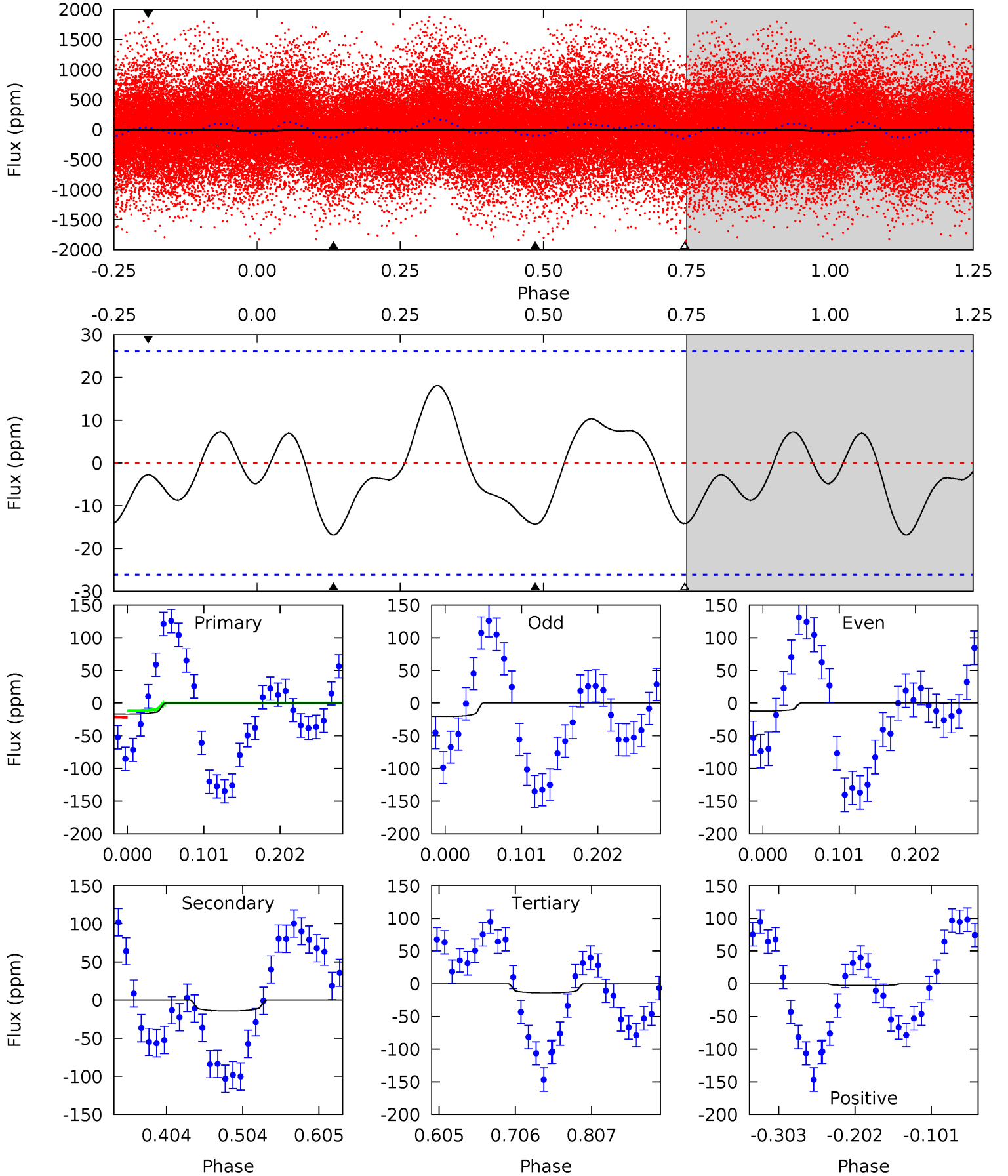
TCE 008458616-01 P= 2.569771 Days  $T_0=133.997162$  (BKJD)



# DV Model-Shift Uniqueness Test

008458616-01, P = 2.569852 Days, E = 131.420572 Days

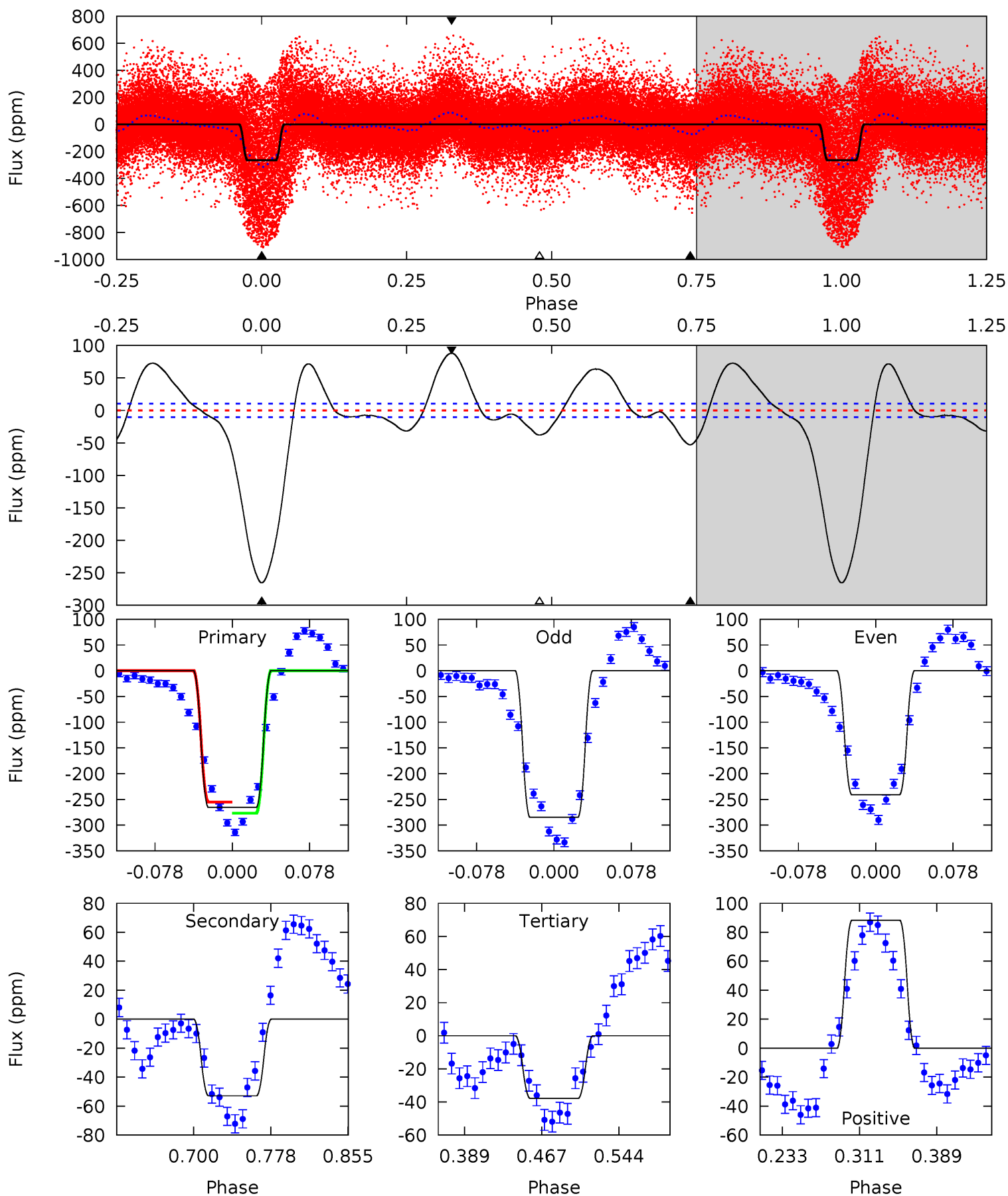
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
2.94	2.50	2.48	-0.47	4.56	1.64	1.41	0.46	3.41	0.02	2.97	0.73	1.77	0.52	0.87



# Alt Model-Shift Uniqueness Test

008458616-01, P = 2.569771 Days, E = 131.427391 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
117.5	23.4	16.8	39.1	4.62	1.76	15.1	100.8	78.4	6.67	-15.6	9.73	1.08	0.25	4.70



### Stellar Parameters For KIC 008458616

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6997^{+225}_{-310}$	$4.176^{+0.136}_{-0.187}$	$-0.200^{+0.250}_{-0.350}$	$1.577^{+0.496}_{-0.330}$	$1.369^{+0.195}_{-0.239}$	$0.491^{+0.381}_{-0.249}$
	+3%/-4%	+3%/-4%	+125%/-175%	+31%/-21%	+14%/-17%	+78%/-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 008458616-01 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-14 \pm 6$	$1.21^{+0.29}_{-0.24}$	$2686^{+202}_{-184}$	$5044^{+657}_{-579}$	$8.168^{+6.313}_{-3.678}$
Alt.	$-53 \pm 2$	$3.07^{+0.51}_{-0.43}$	$2695^{+196}_{-184}$	$4552^{+176}_{-195}$	$5.047^{+1.744}_{-1.230}$

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

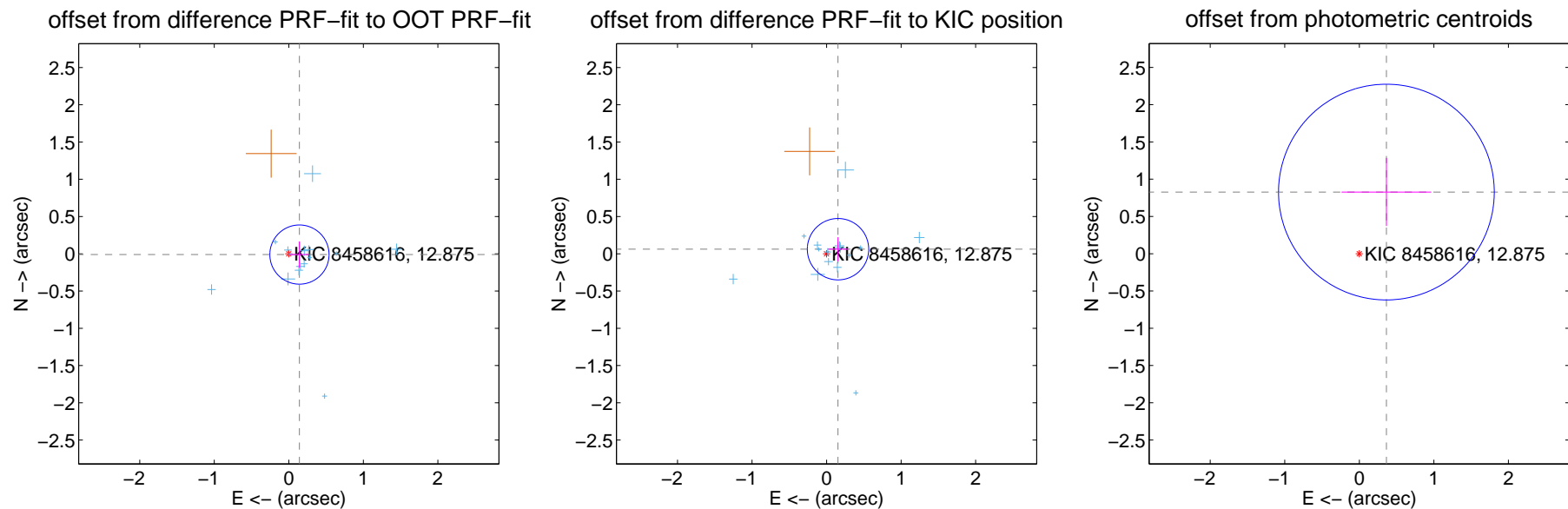
## DV Centroid Data

Supplemental centroid analysis for 008458616-01. Kepler magnitude: 12.88. Transit SNR 6.35

There are 15 quarters with good PRF difference image offsets

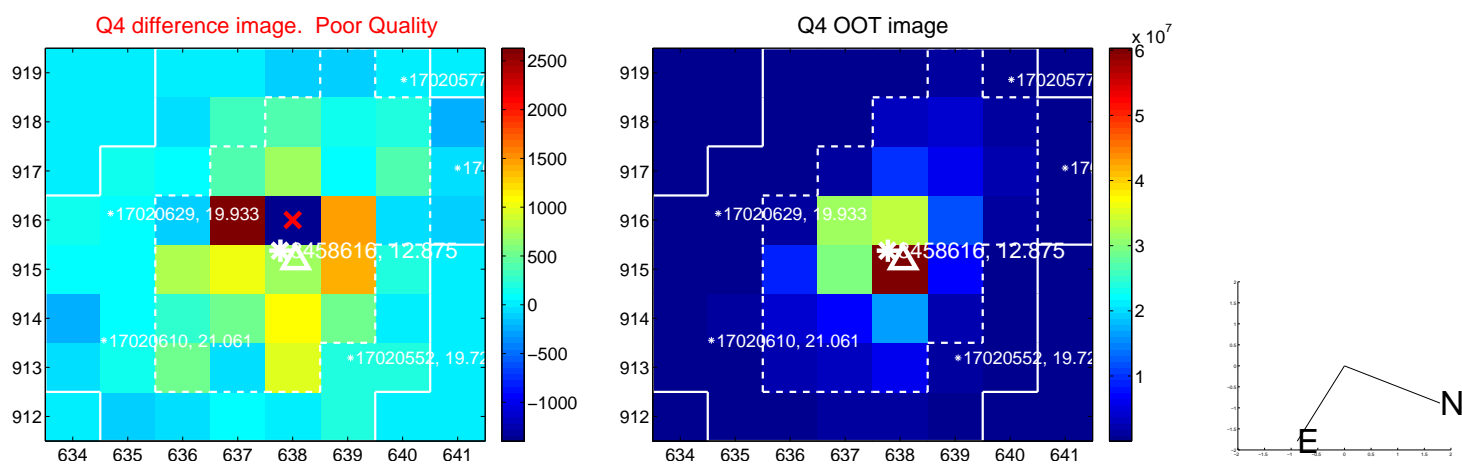
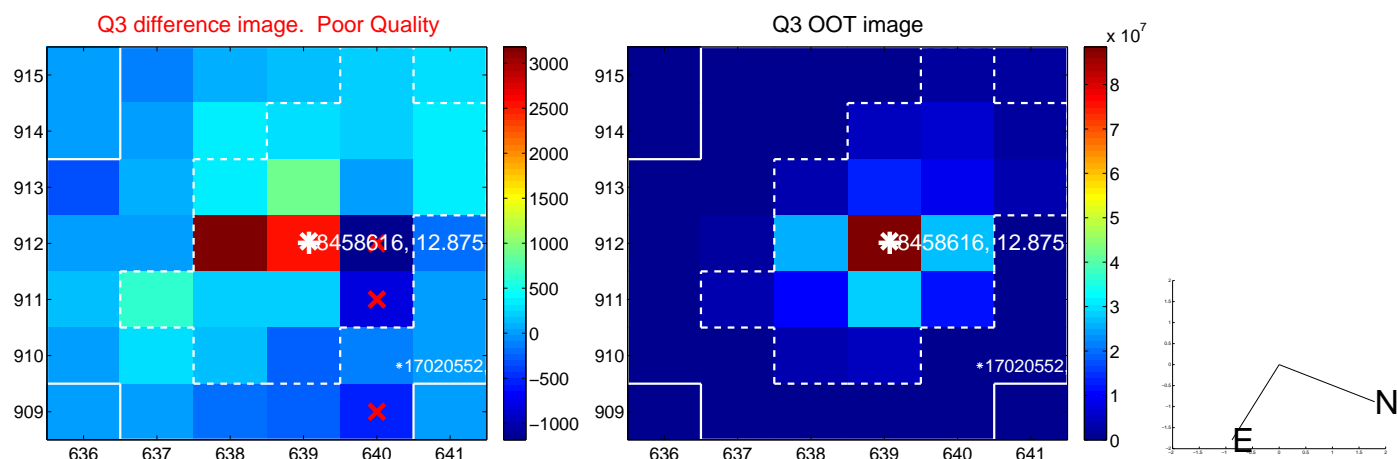
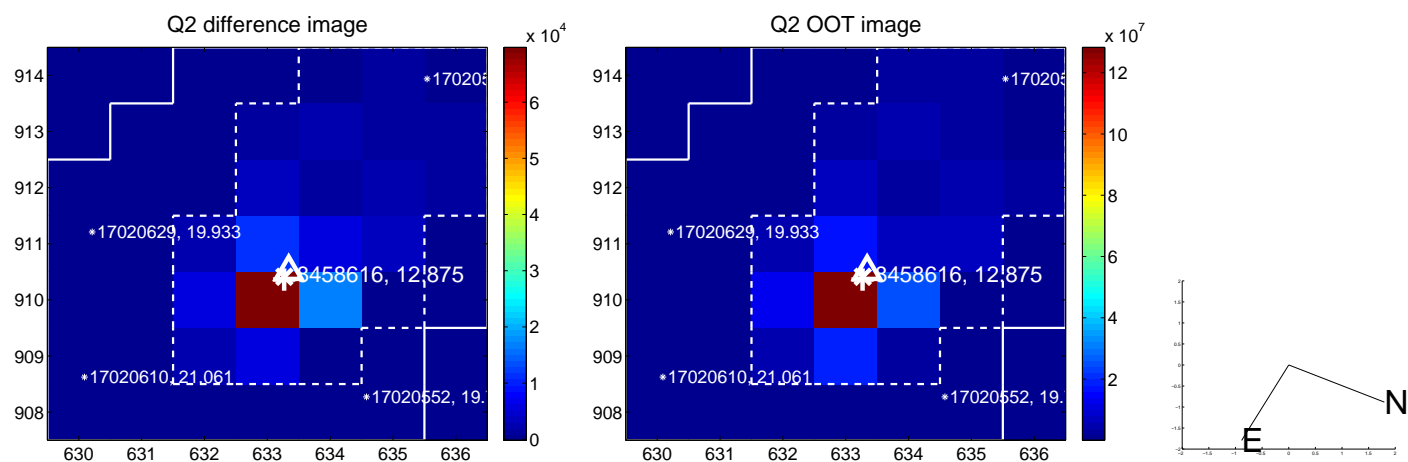
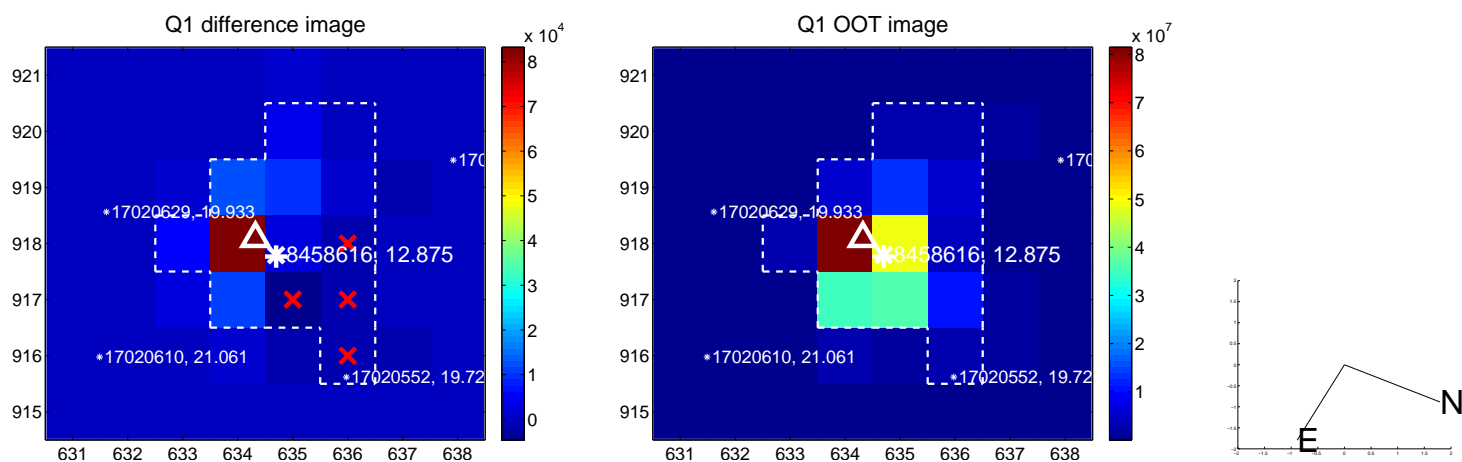
The direct PRF centroid is offset from the target star catalog position by about 0.11 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.143 \pm 0.132$	1.08	$-0.142 \pm 0.132$	$-0.010 \pm 0.177$
PRF-fit source offset from KIC position	$0.165 \pm 0.137$	1.20	$-0.153 \pm 0.138$	$0.062 \pm 0.161$
photometric centroid source offset	$0.90 \pm 0.48$	1.87	$-0.36 \pm 0.60$	$0.83 \pm 0.46$

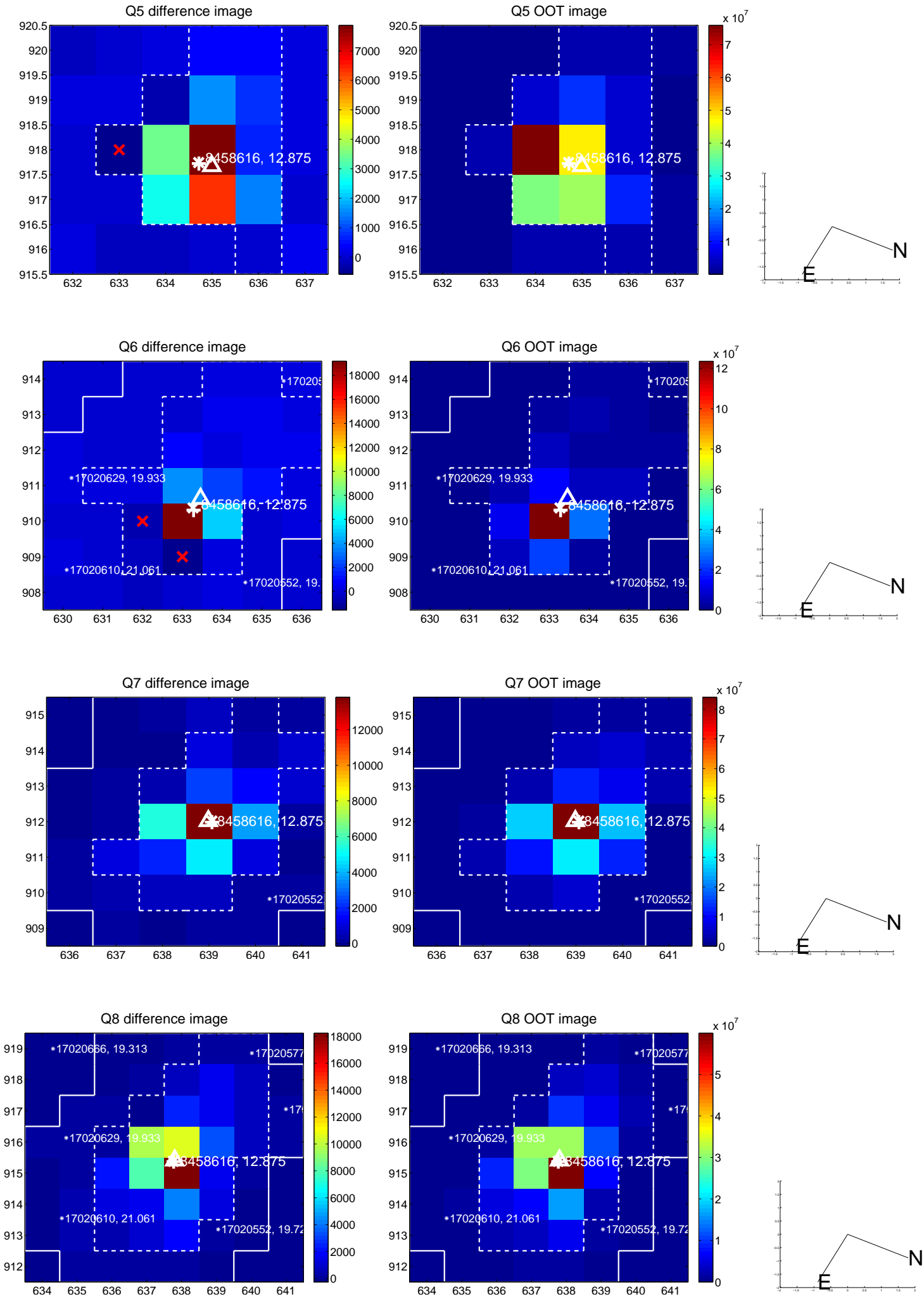


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

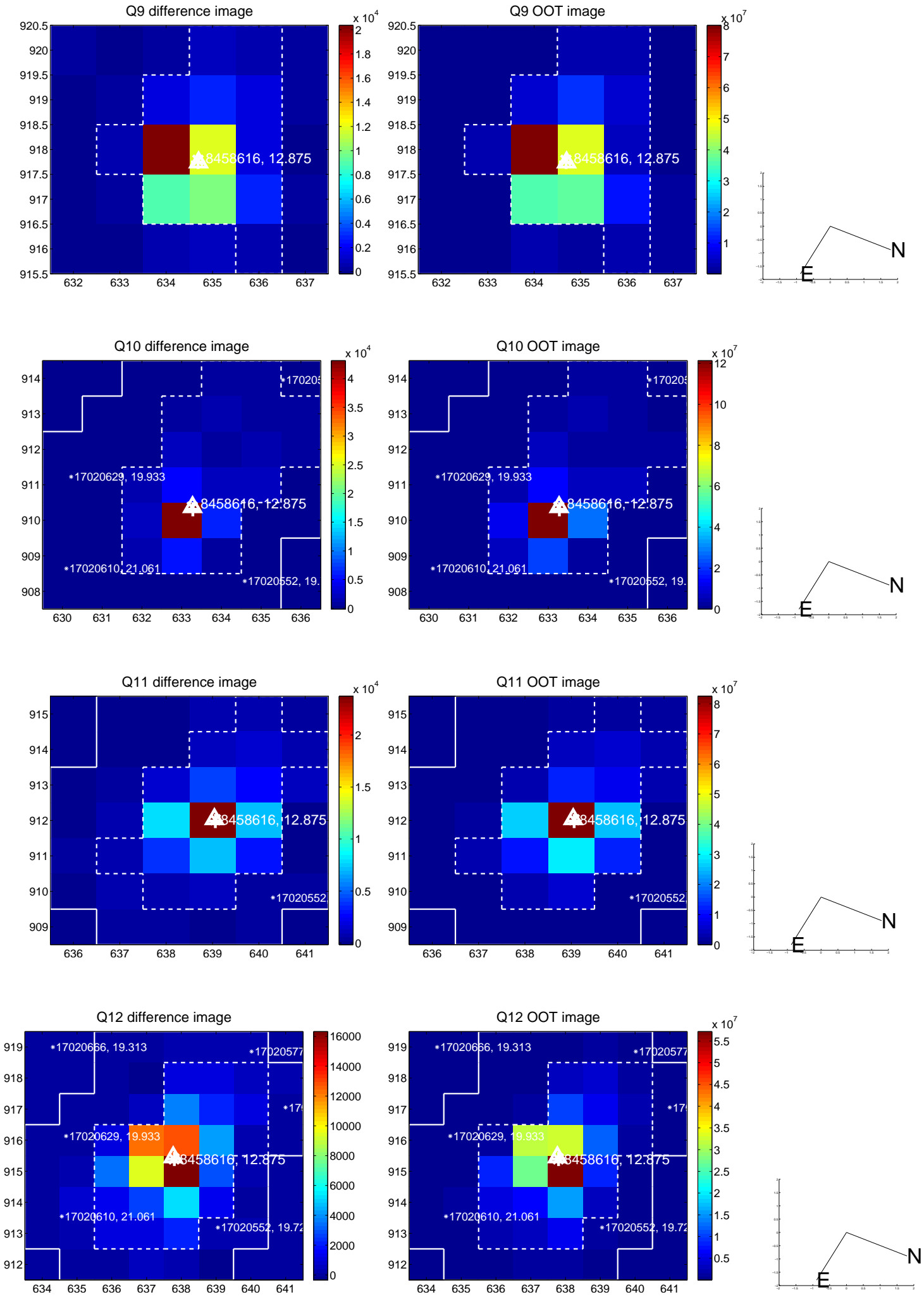
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



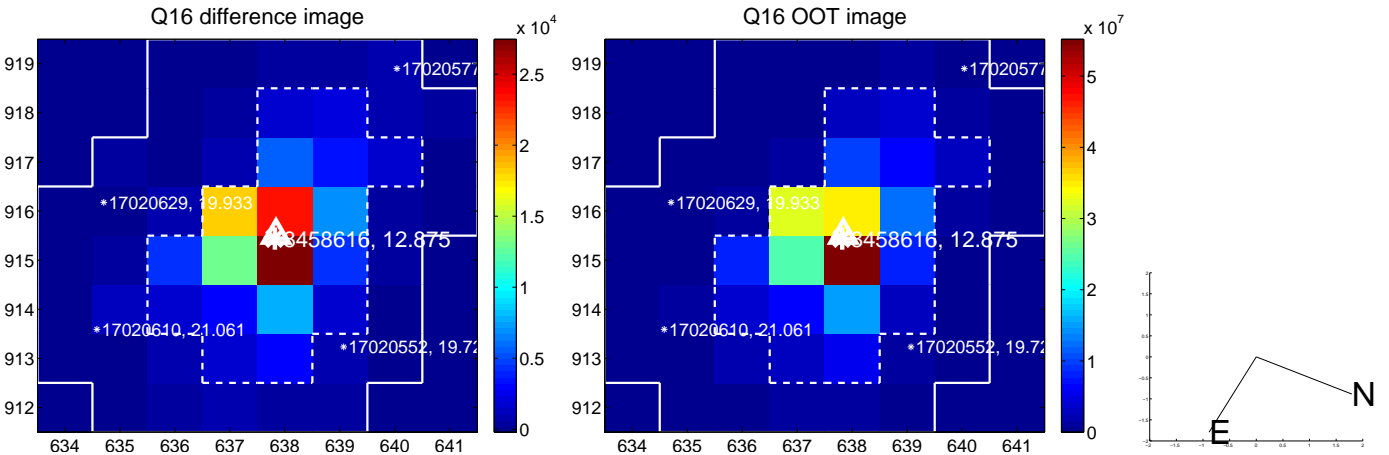
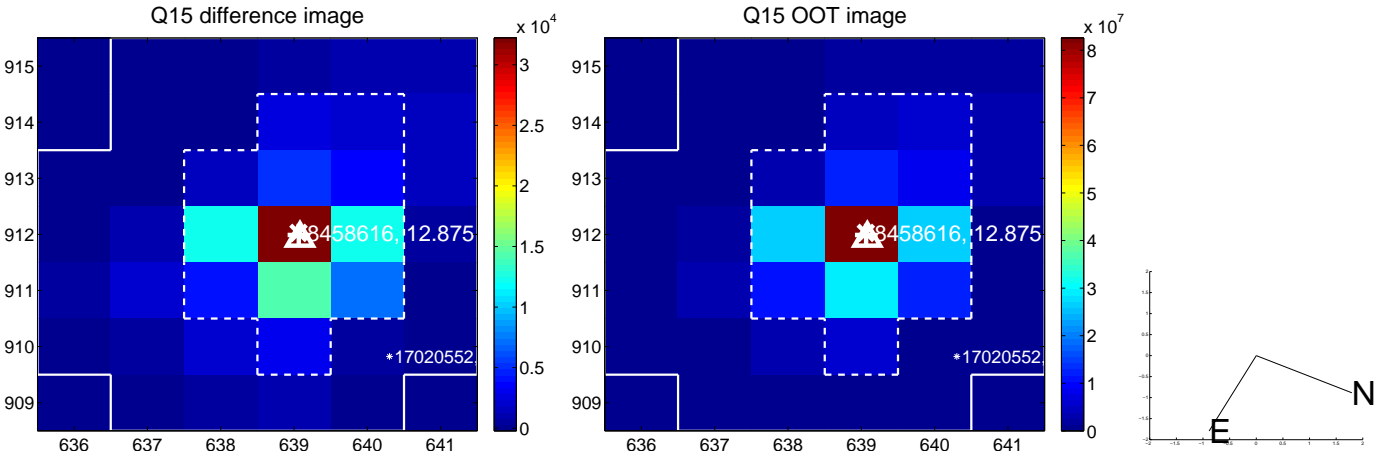
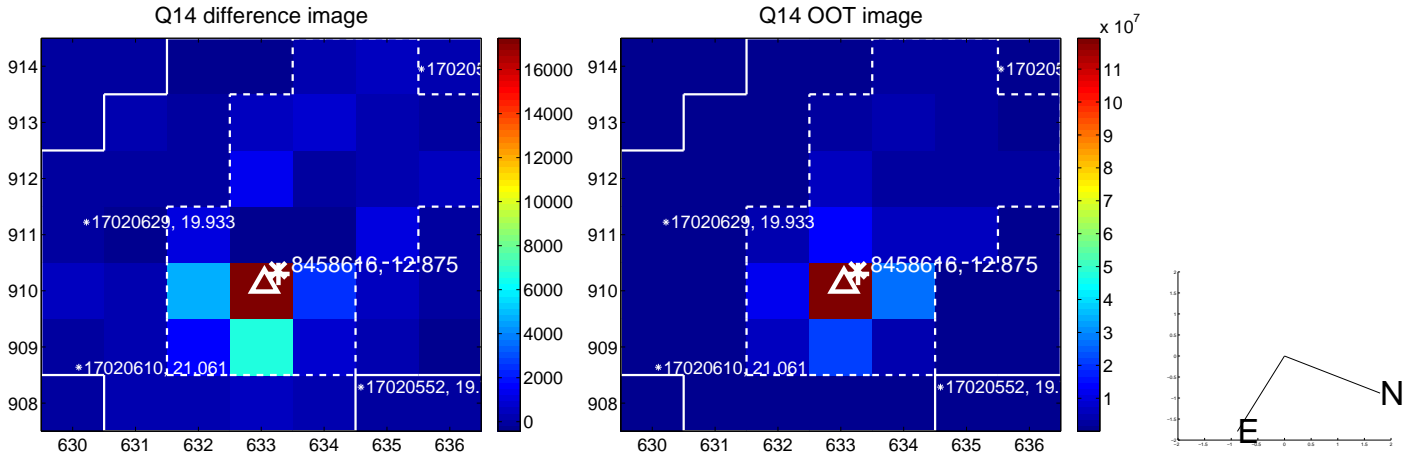
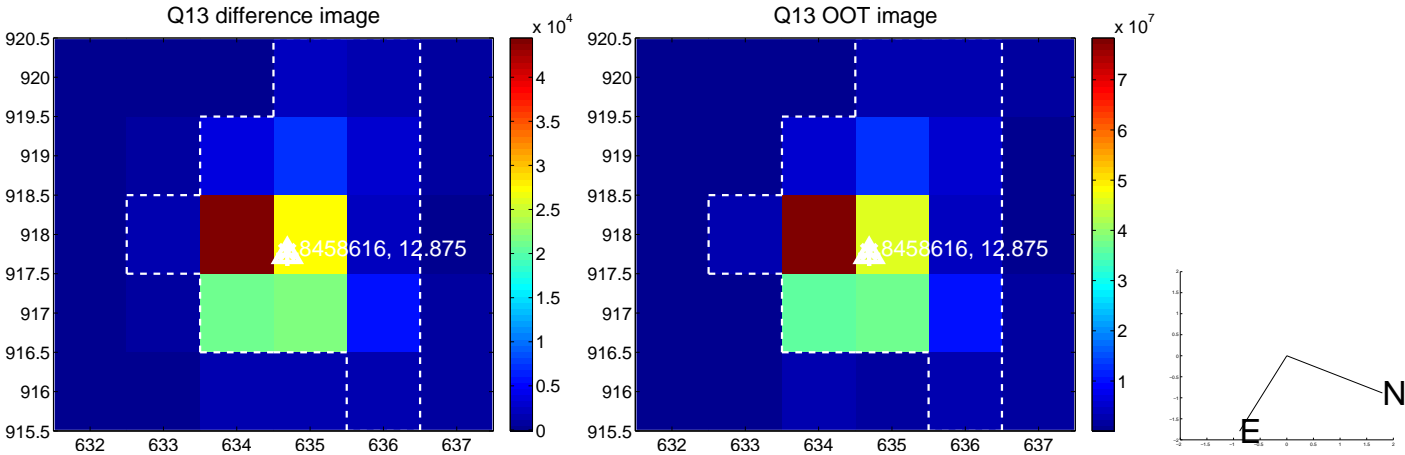
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



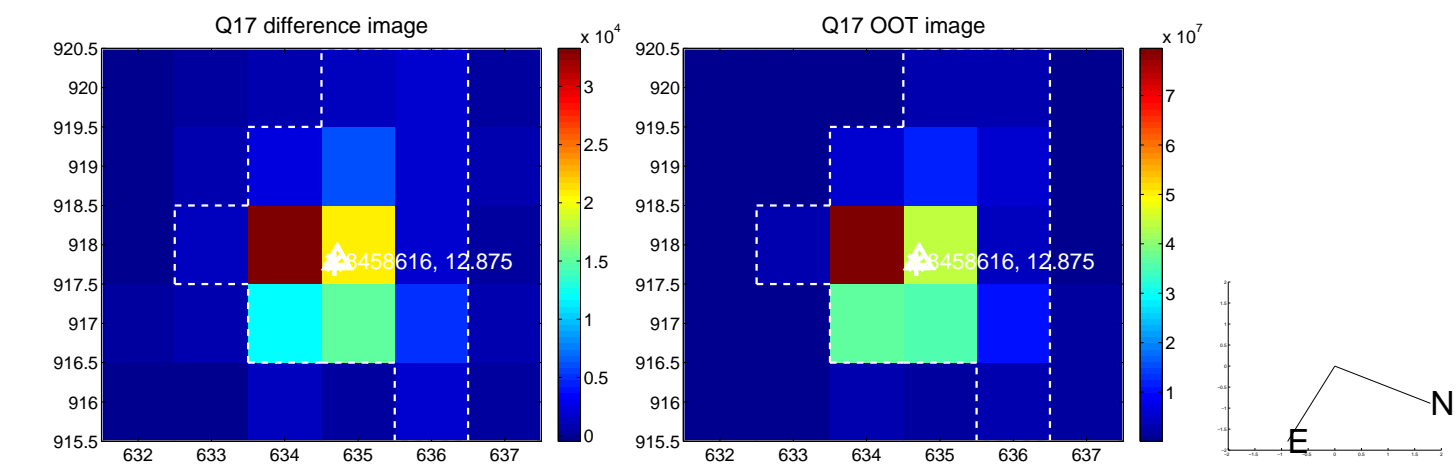
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



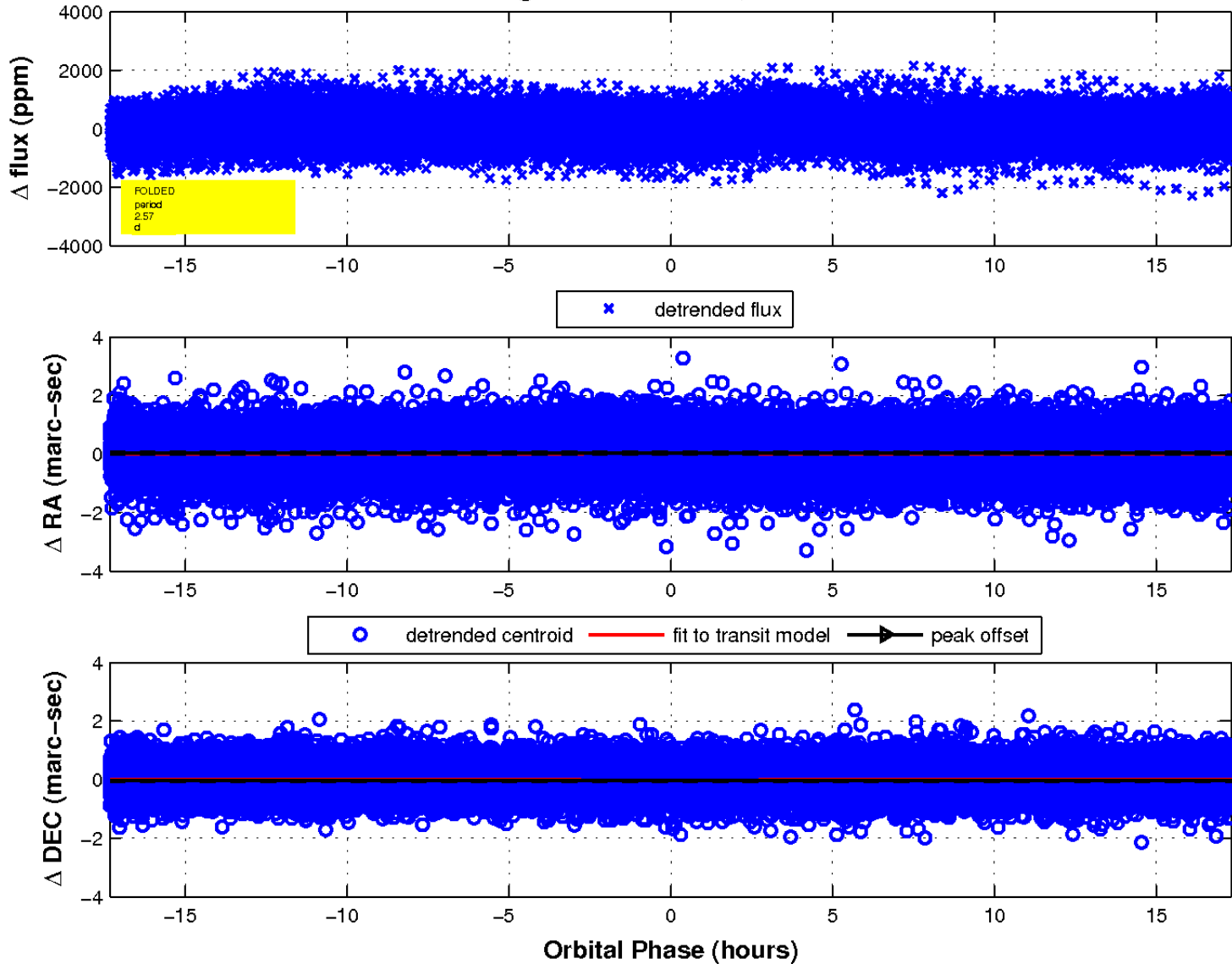
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



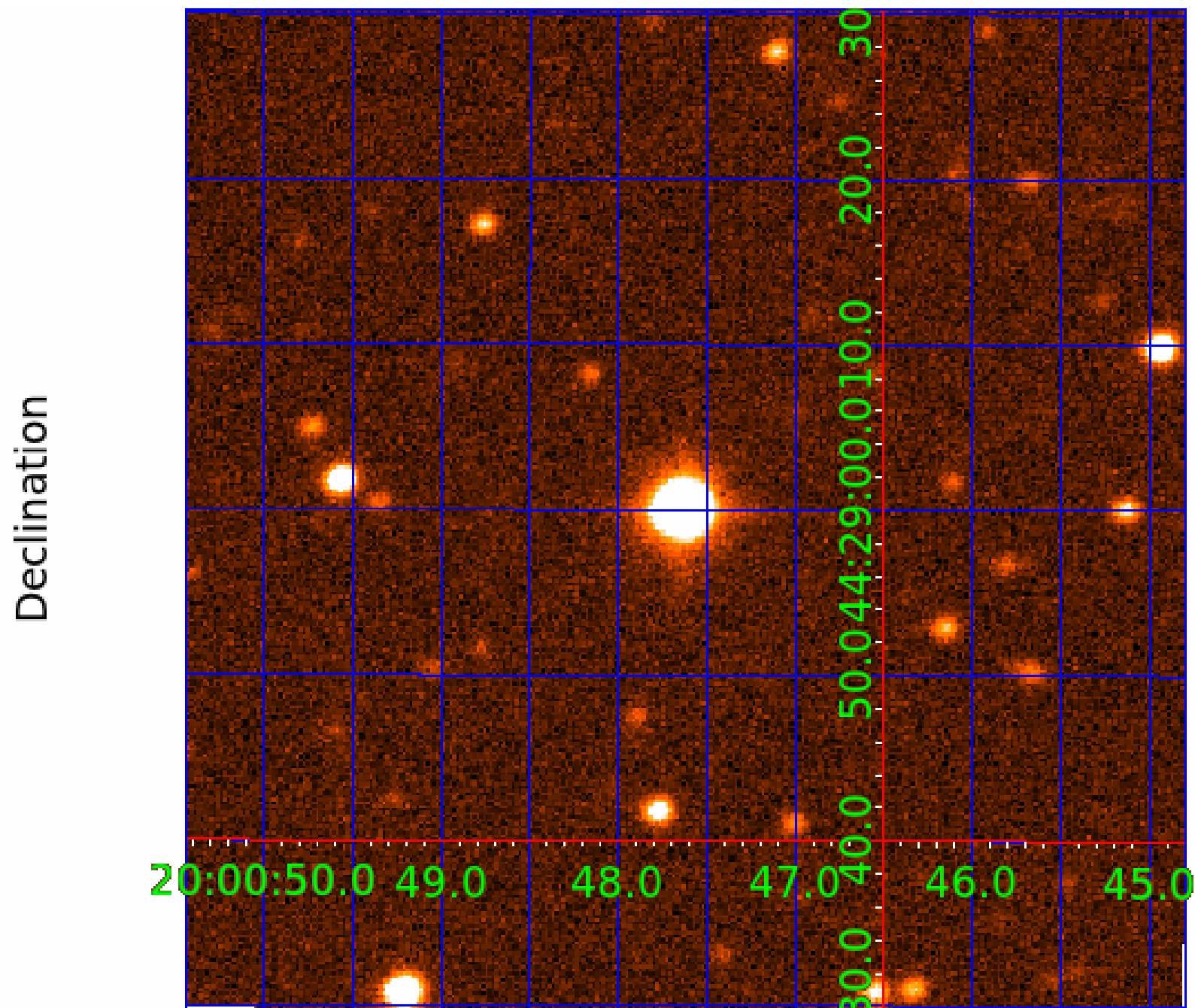
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



fluxWeightedCentroids, Planet 1 of 2



UKIRT Image



# KIC 008458616

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
008458616-01	OBS	No	2.569852	133.990424	44.2	5.775	8.3	6.4	1.58	6997	1.22	3225.17
008458616-02	OBS	No	1.284796	132.020153	13.5	10.262	8.6	2.6	1.58	6997	0.61	8128.01

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
008458616-01	OBS	FP	0.00	1	0	0	0	LPP_DV—MOD_NONUNIQ_DV
008458616-02	OBS	FP	0.00	1	0	0	0	SWEET_NTL—LPP_DV—MOD_NONUNIQ_DV—SAME_NTL_PERIOD

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

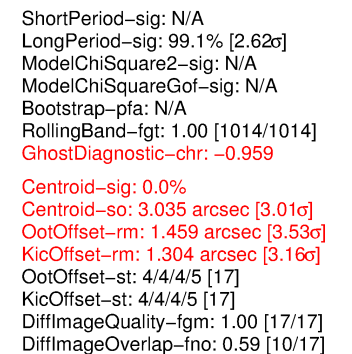
N = Not Transit-Like. S = Stellar Eclipse. C = Centroid Offset. E = Ephemeris Match.

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.

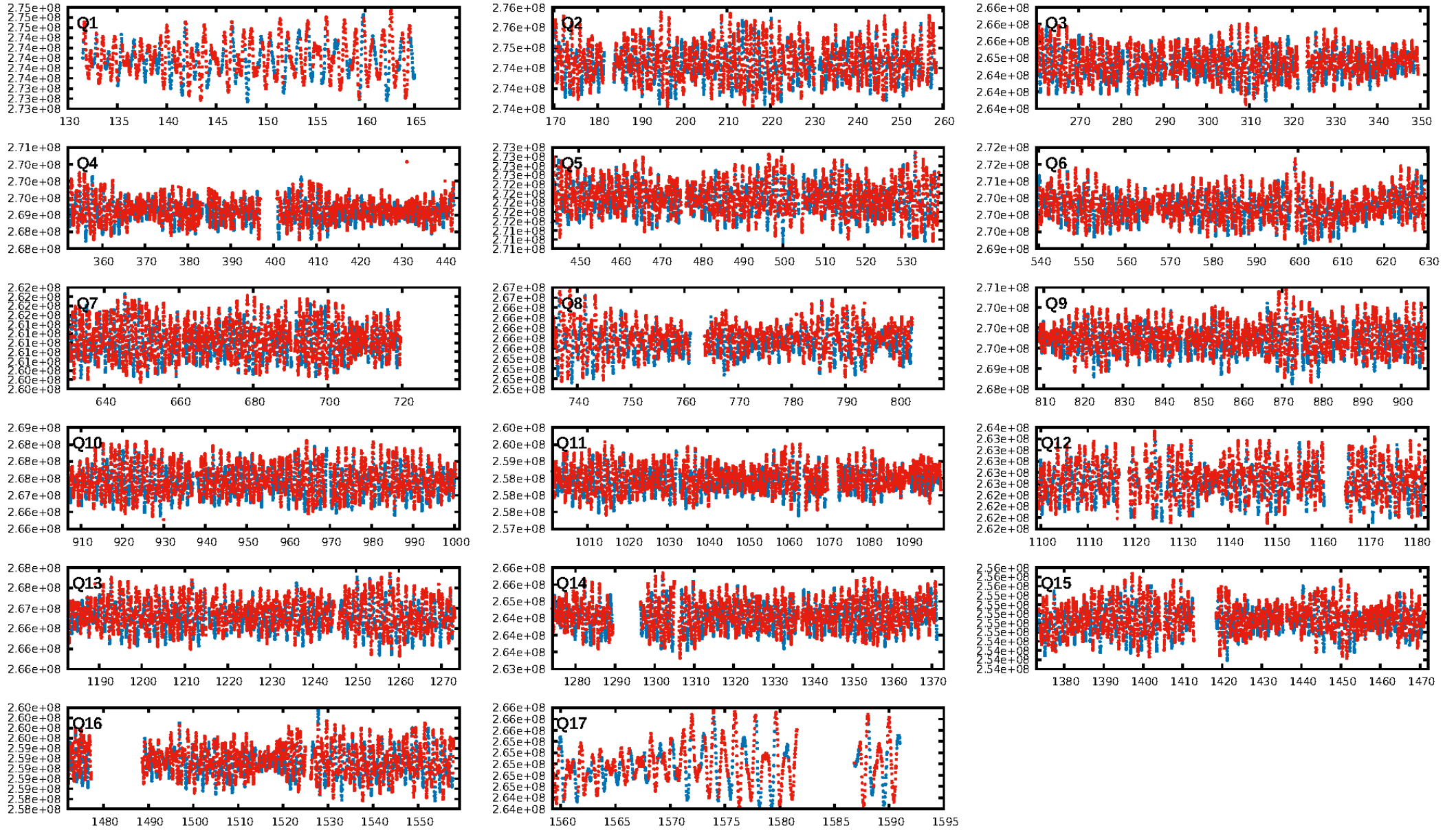
## Ephemeris Match Information For 008458616-02

No Significant Match Found

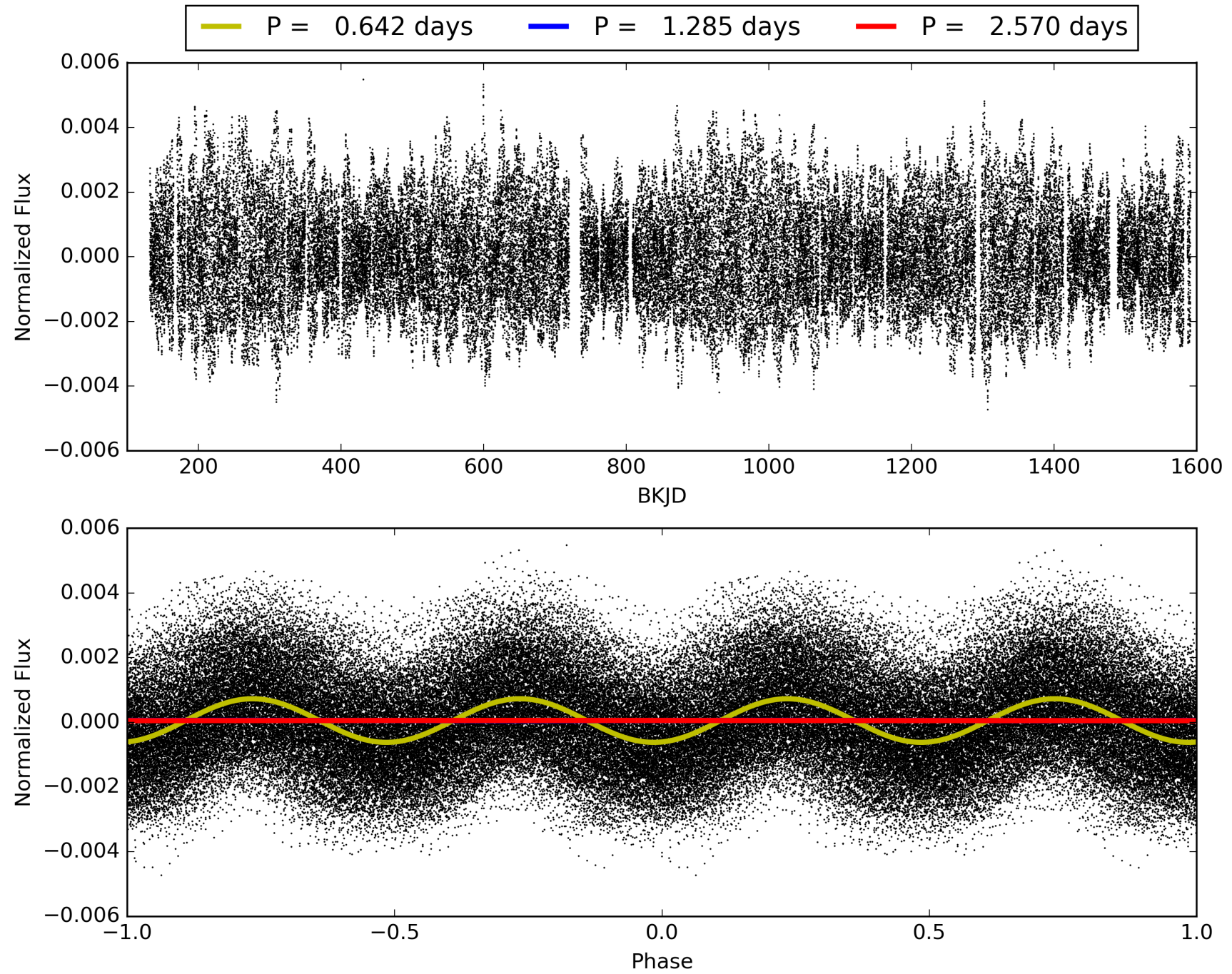
## KIC: 8458616    Candidate: 2 of 2    Period: 1.285 d



# TCE 008458616-02, PDC Light Curves

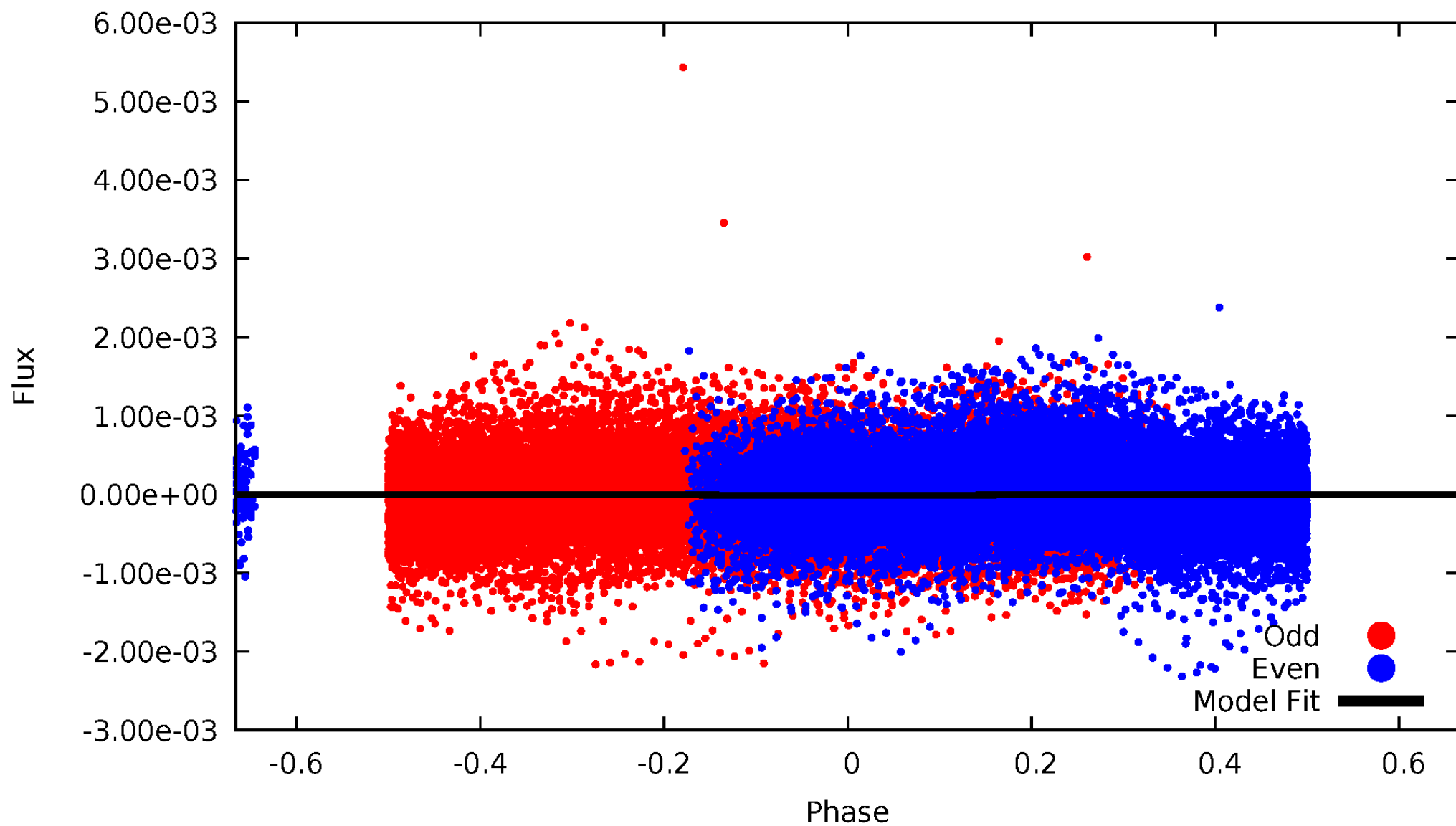


TCE 008458616-02



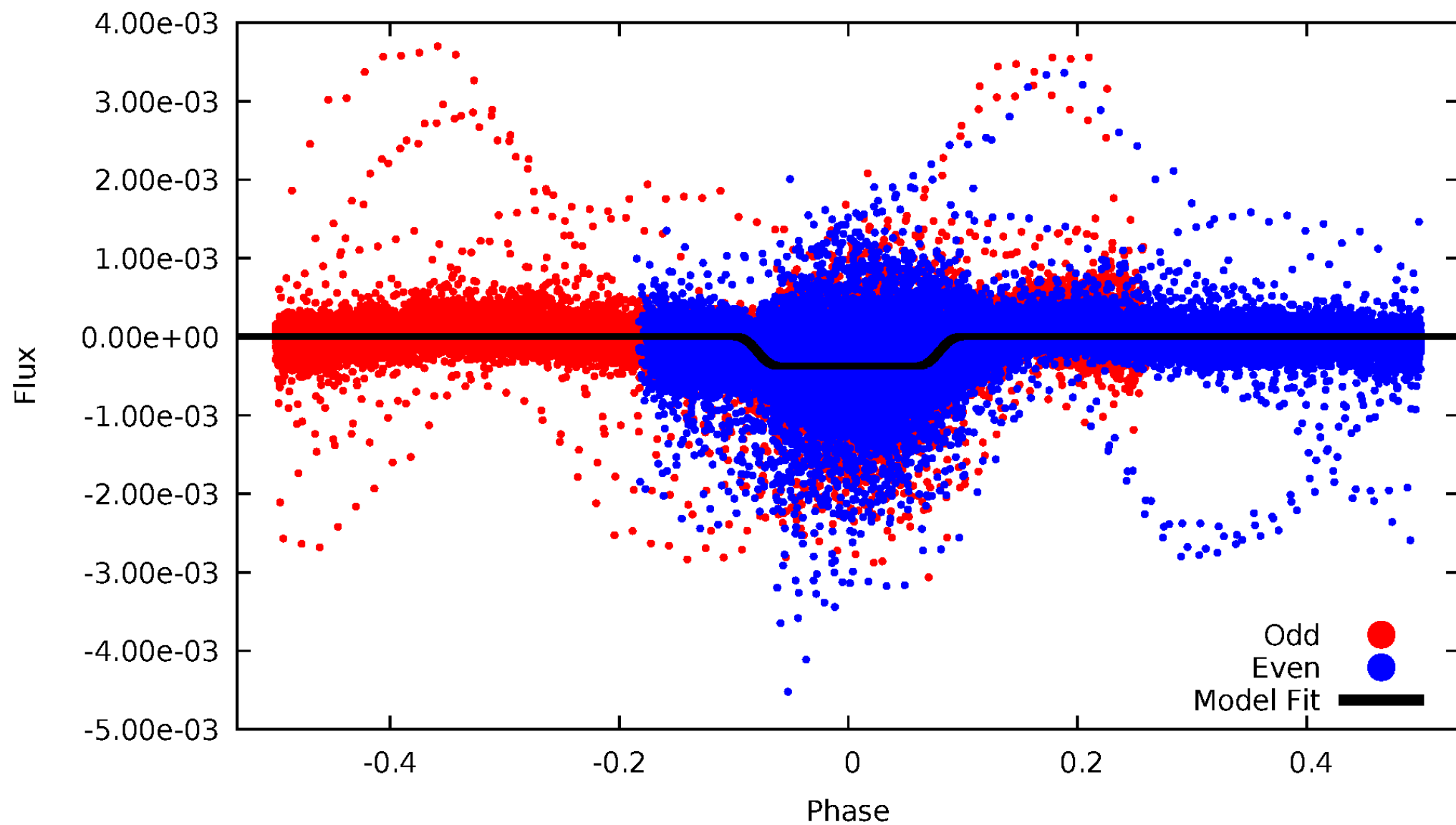
# DV Odd/Even

TCE 008458616-02



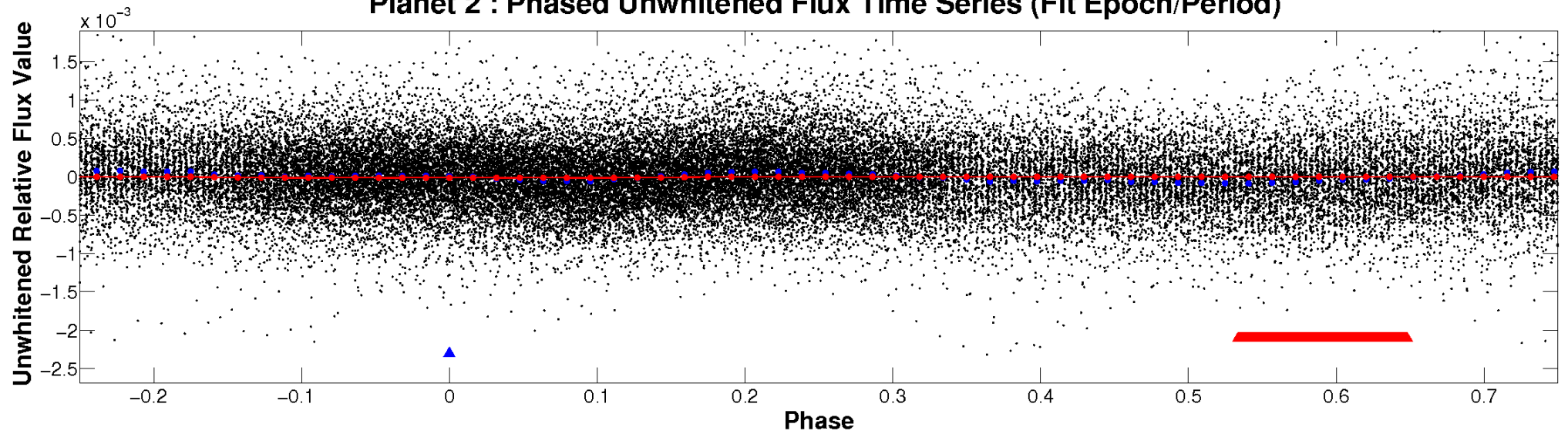
# ALT Odd/Even

TCE 008458616-02

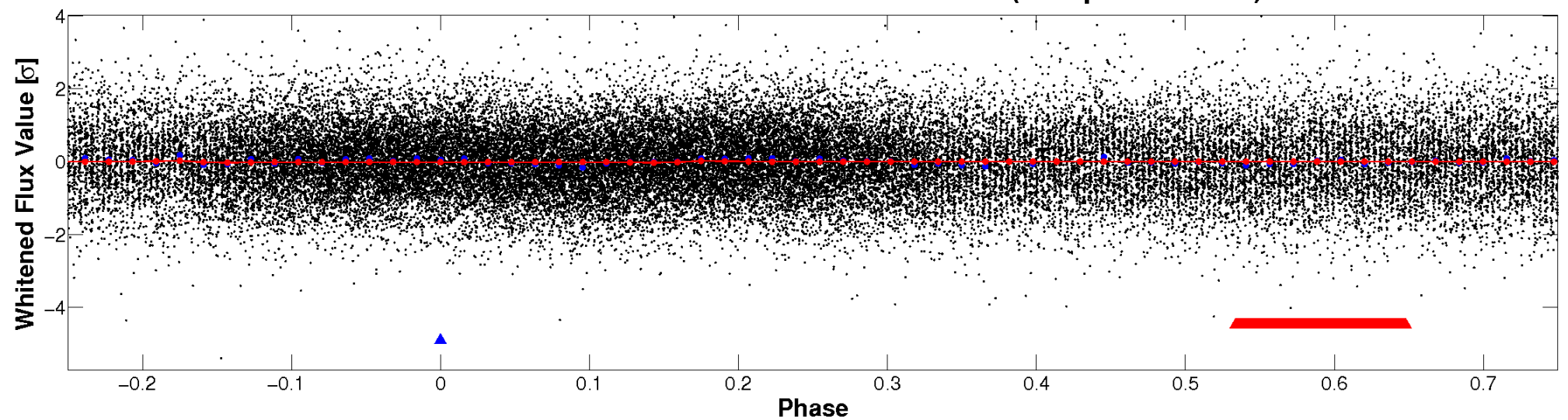


# Non-Whitened Vs. Whitened Light Curve

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

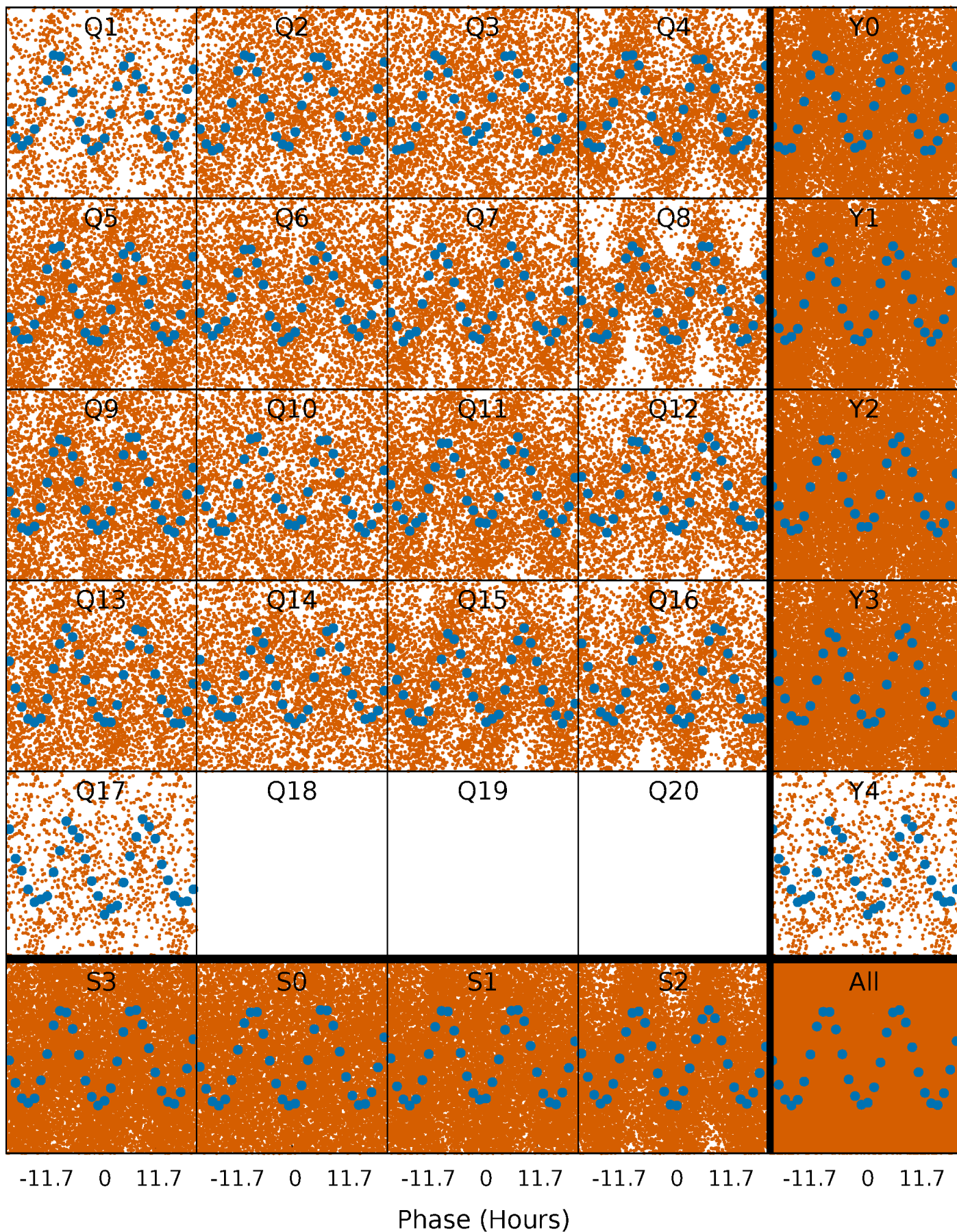


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



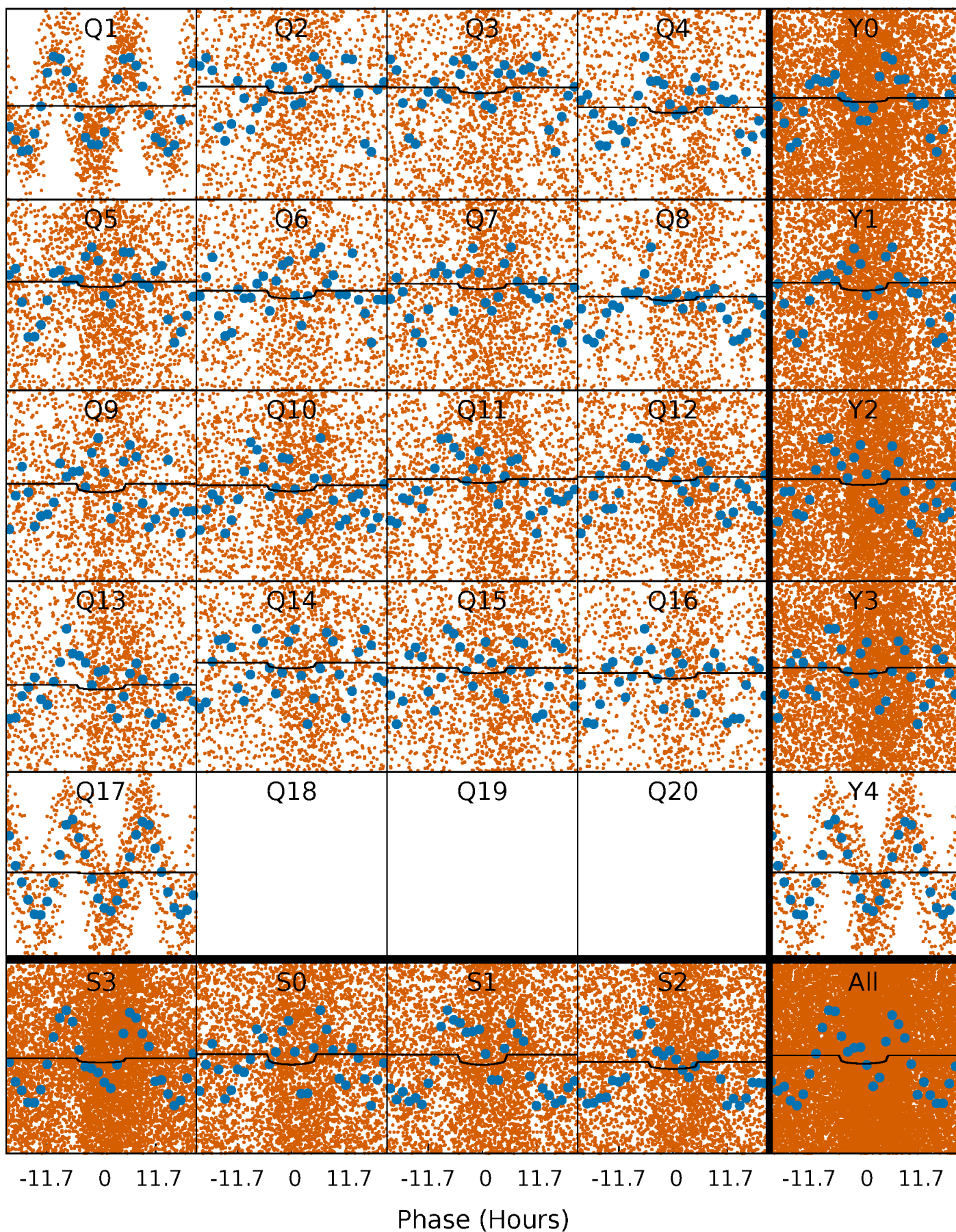
# PDC Quarter-Phased Transit Curves

TCE 008458616-02 P= 1.284796 Days  $T_0=132.020153$  (BKJD)



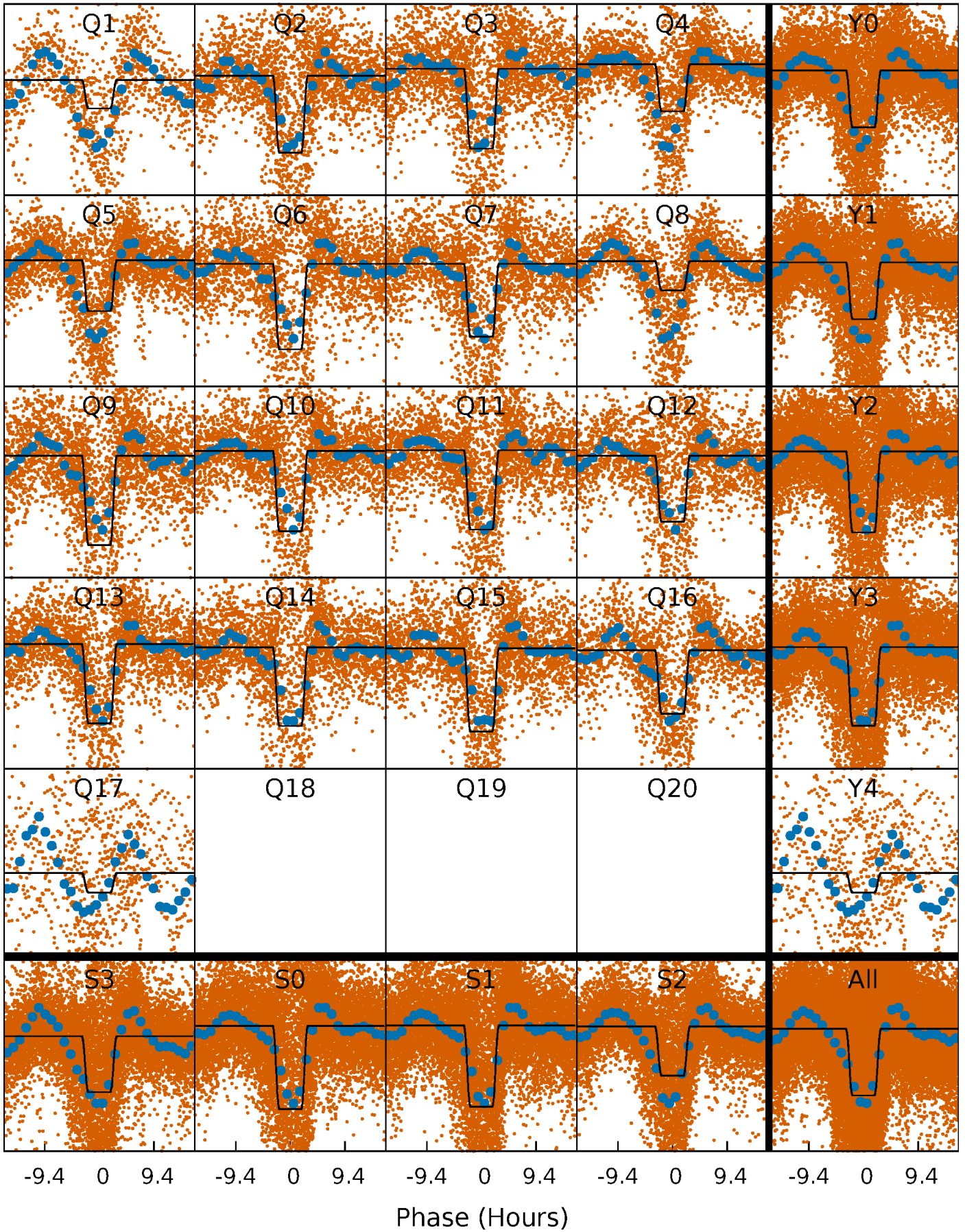
# DV Quarter-Phased Transit Curves

TCE 008458616-02   P= 1.284796 Days    $T_0=132.020153$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

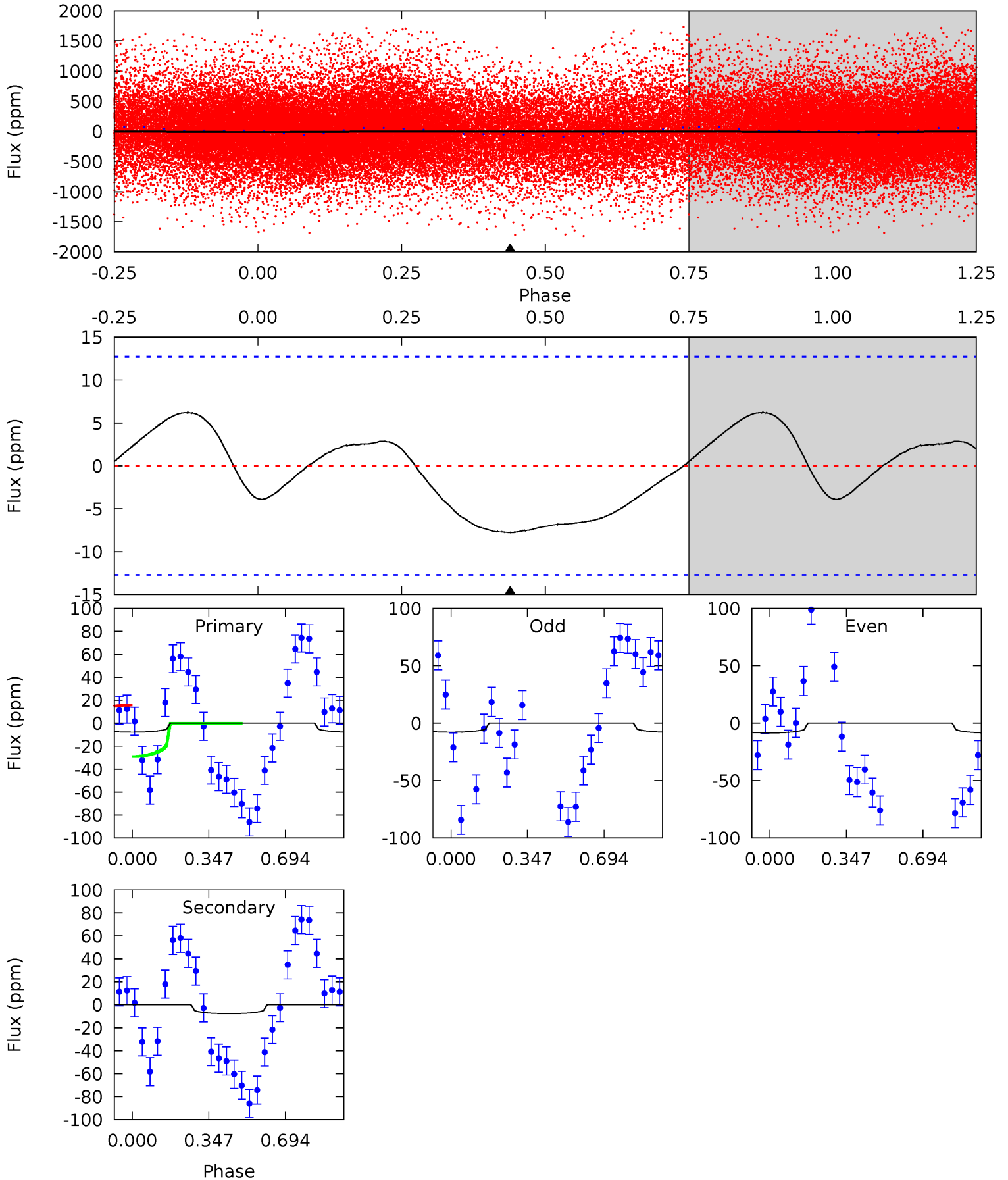
TCE 008458616-02   P= 1.284954 Days    $T_0=131.998326$  (BKJD)



# DV Model-Shift Uniqueness Test

008458616-02, P = 1.284796 Days, E = 130.735357 Days

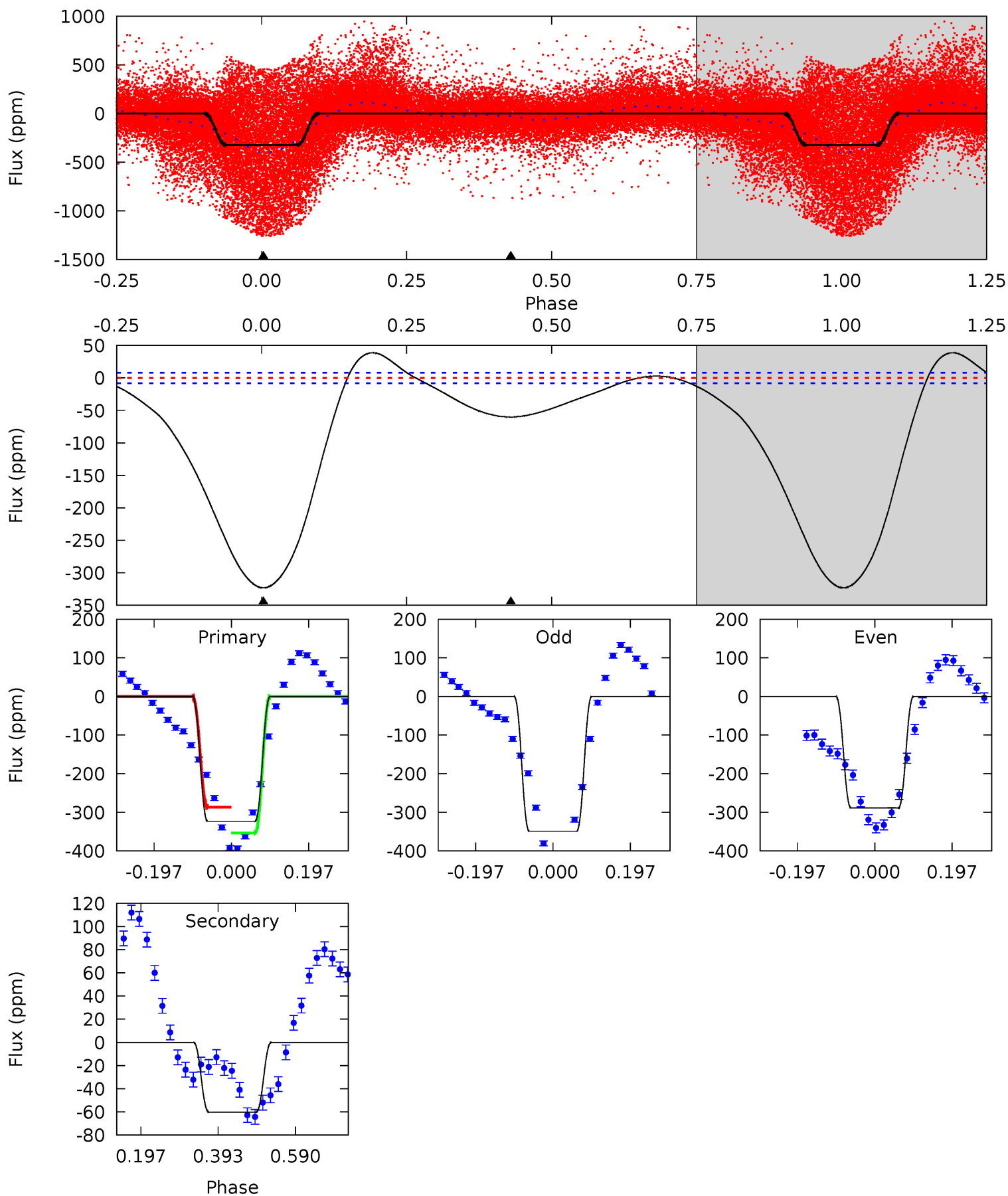
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
2.63	2.63	0	0	4.30	0.94	1.22	2.63	2.63	2.63	2.63	0.12	0.72	0.44	2.11



# Alt Model-Shift Uniqueness Test

008458616-02, P = 1.284954 Days, E = 130.713372 Days

Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
178.5	33.2	0	0	4.42	1.29	11.6	178.5	178.5	33.2	33.2	15.7	1.07	0.11	18.4



### Stellar Parameters For KIC 008458616

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6997^{+225}_{-310}$	$4.176^{+0.136}_{-0.187}$	$-0.200^{+0.250}_{-0.350}$	$1.577^{+0.496}_{-0.330}$	$1.369^{+0.195}_{-0.239}$	$0.491^{+0.381}_{-0.249}$
	+3%/-4%	+3%/-4%	+125%/-175%	+31%/-21%	+14%/-17%	+78%/-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 008458616-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-8 \pm 3$	$0.76^{+0.63}_{-0.48}$	$3404^{+276}_{-236}$	$5370^{+4440}_{-1334}$	$4.799^{+29.019}_{-3.489}$
Alt.	$-60 \pm 2$	$3.34^{+0.84}_{-0.77}$	$3383^{+273}_{-242}$	$4412^{+499}_{-396}$	$1.977^{+1.197}_{-0.721}$

$T_{\text{max}}$  = 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

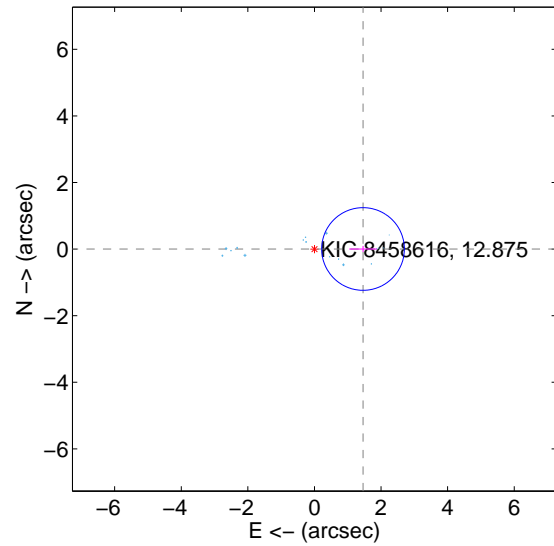
Supplemental centroid analysis for 008458616-02. Kepler magnitude: 12.88. Transit SNR 2.63

There are 17 quarters with good PRF difference image offsets

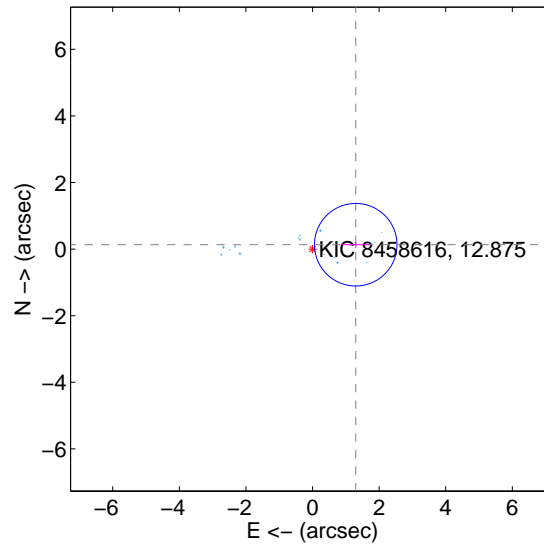
The direct PRF centroid is offset from the target star catalog position by about 0.11 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.459 \pm 0.414$	<b>3.53</b>	$-1.459 \pm 0.414$	$0.003 \pm 0.091$
PRF-fit source offset from KIC position	$1.304 \pm 0.413$	<b>3.16</b>	$-1.298 \pm 0.414$	$0.132 \pm 0.098$
photometric centroid source offset	$3.04 \pm 1.01$	<b>3.01</b>	$-2.46 \pm 1.09$	$1.78 \pm 0.82$

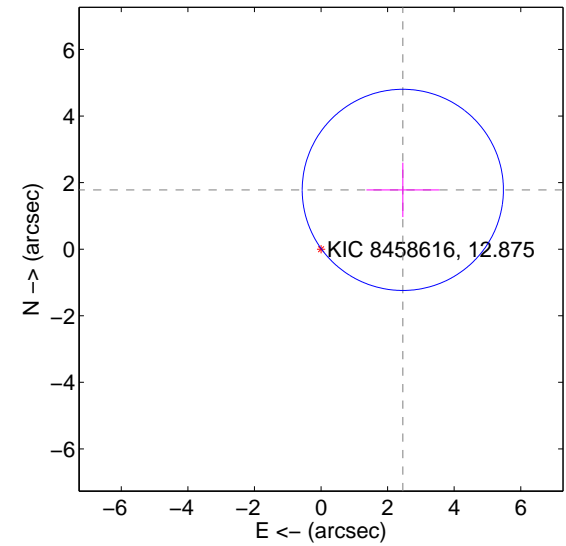
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position



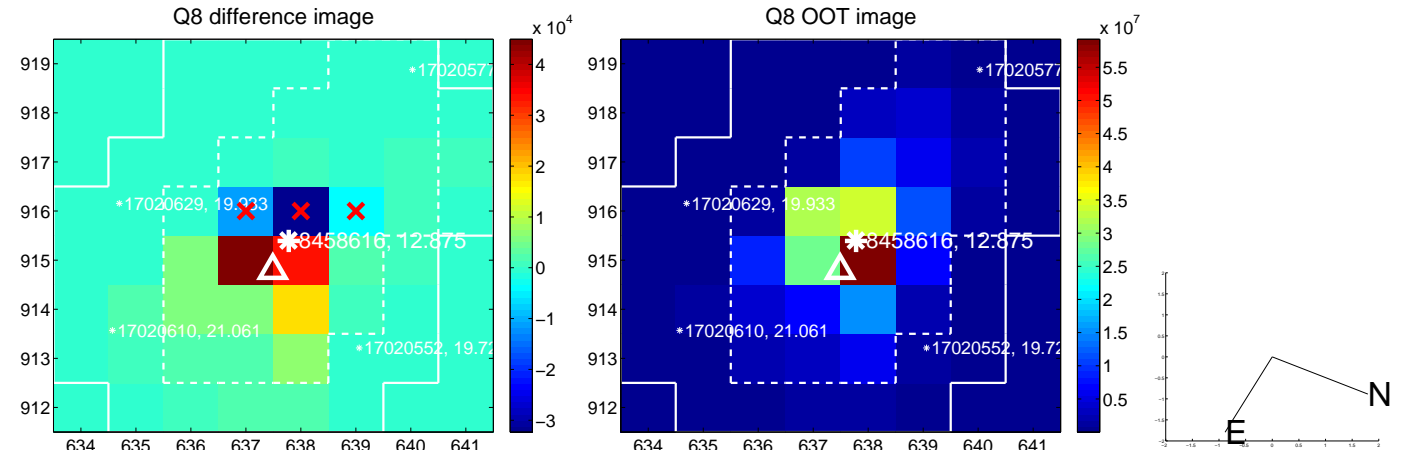
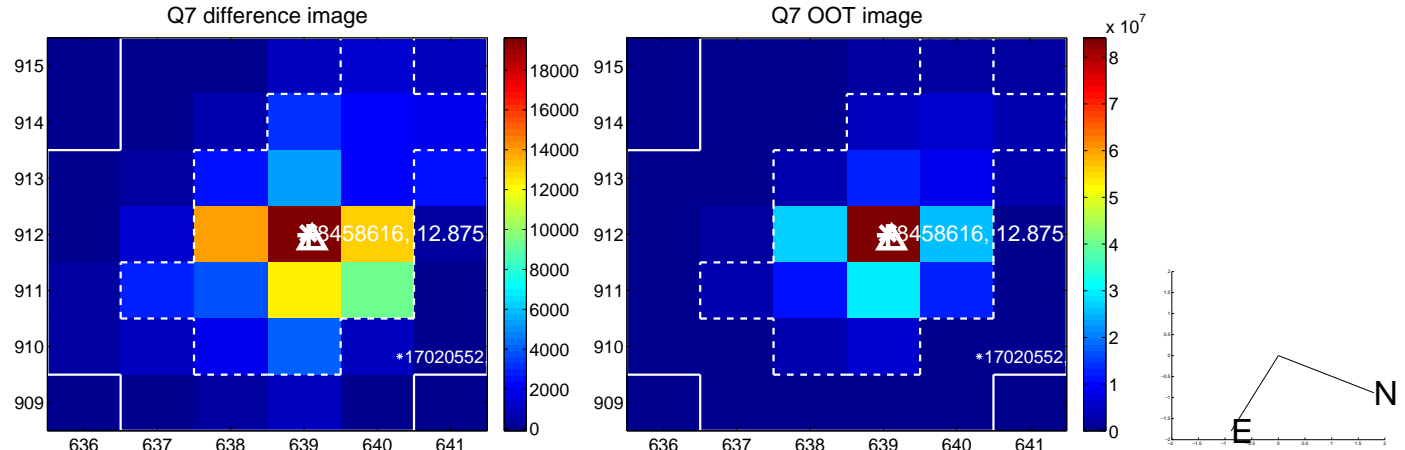
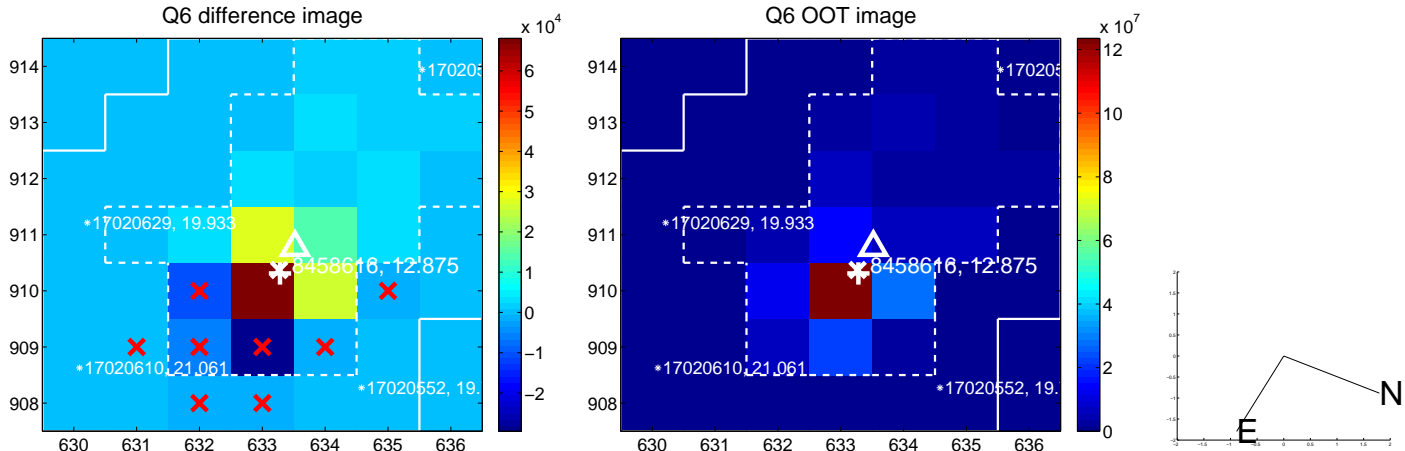
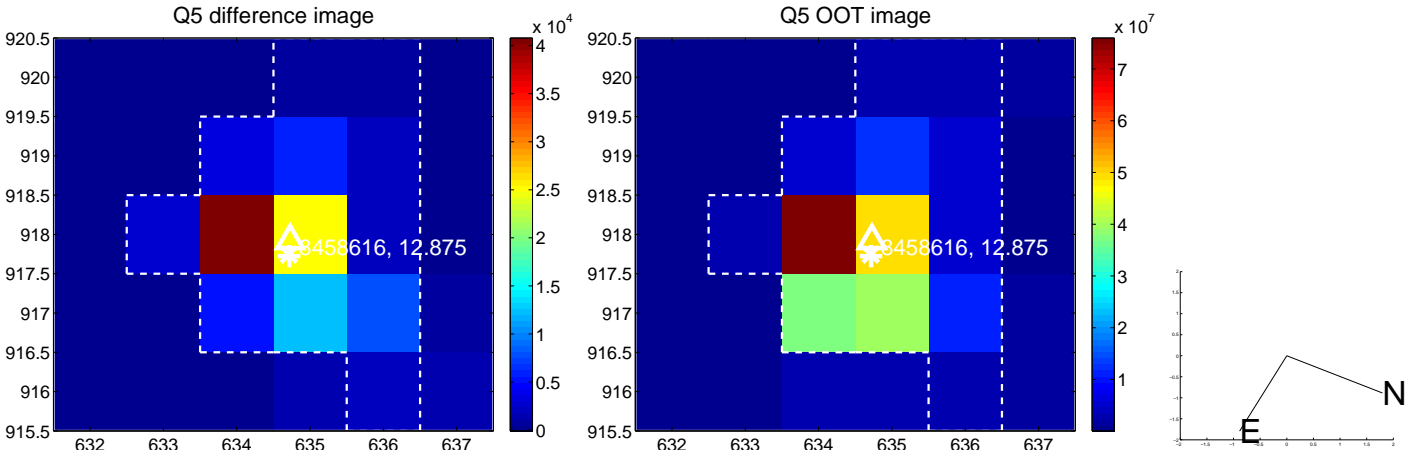
offset from photometric centroids



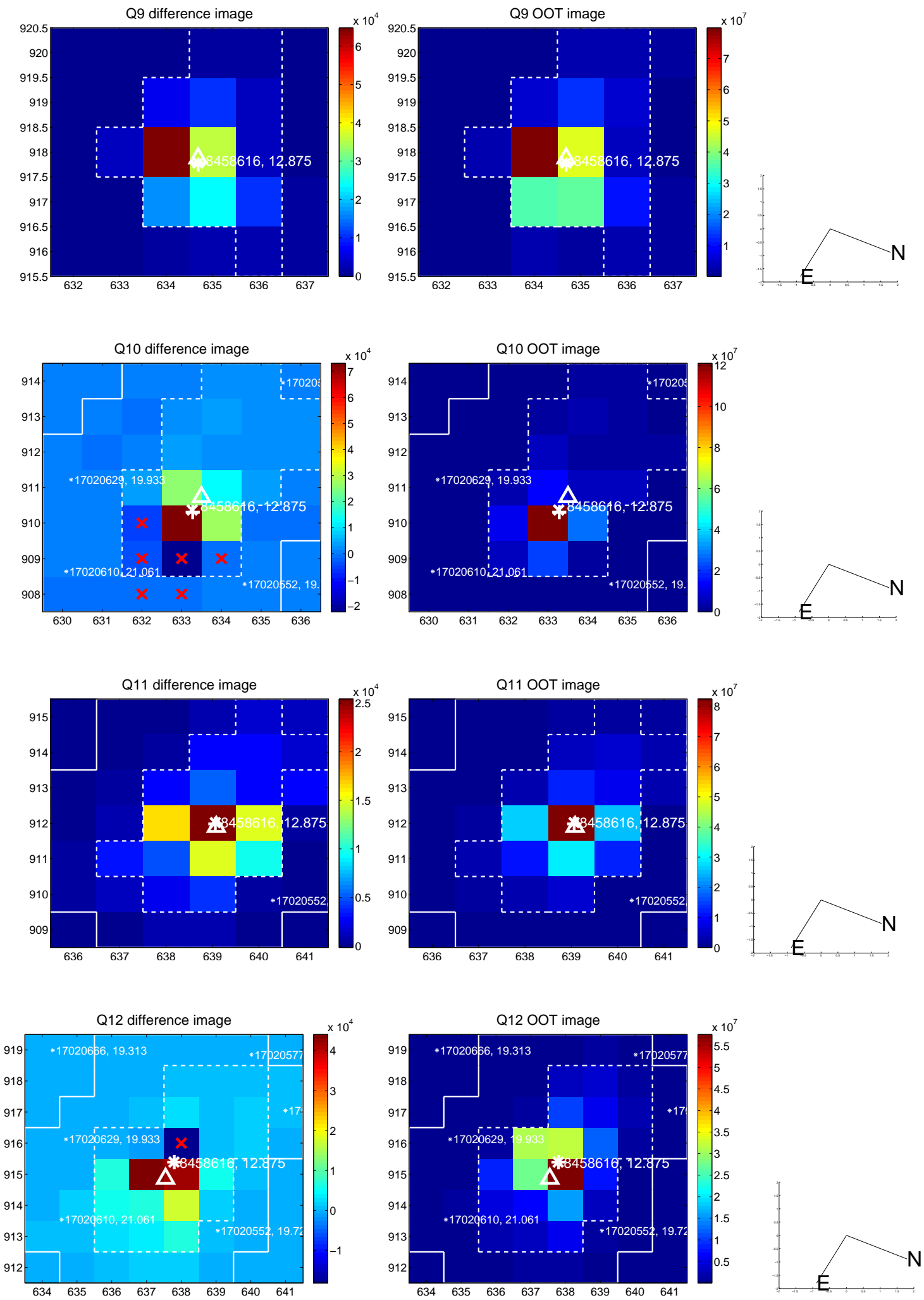
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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



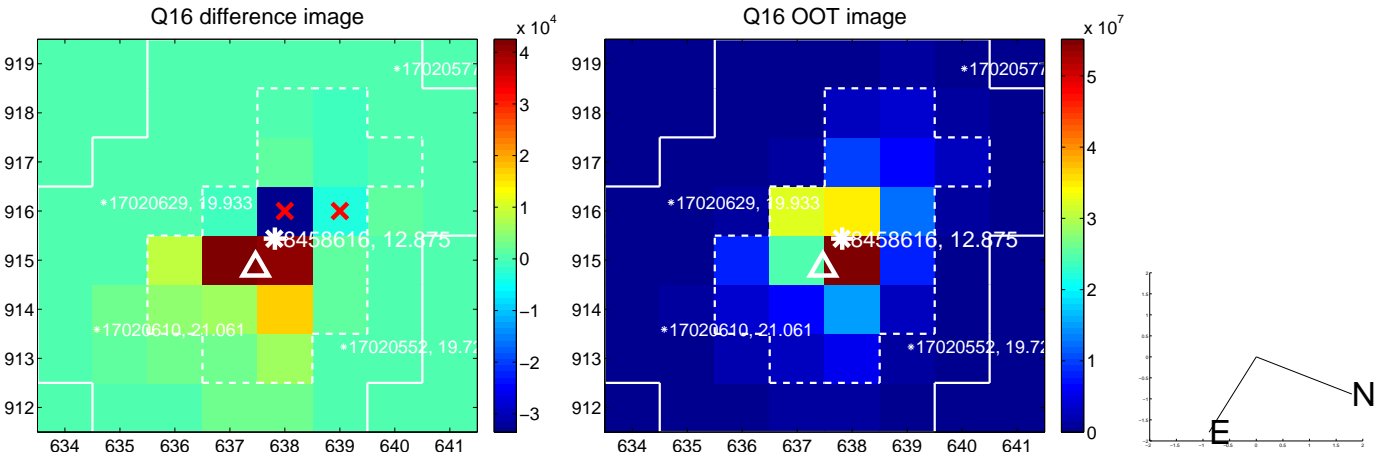
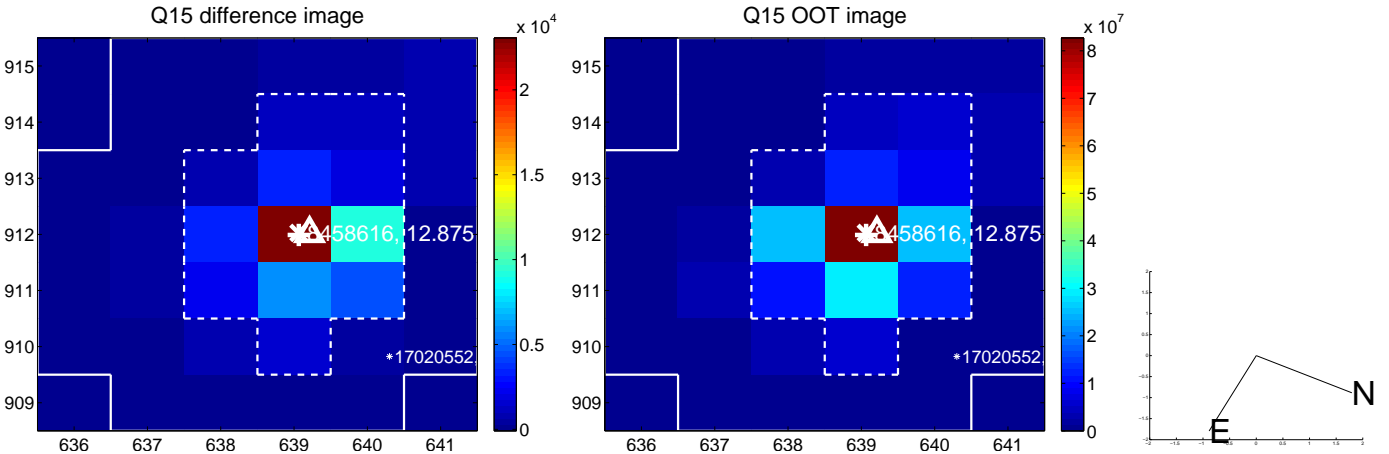
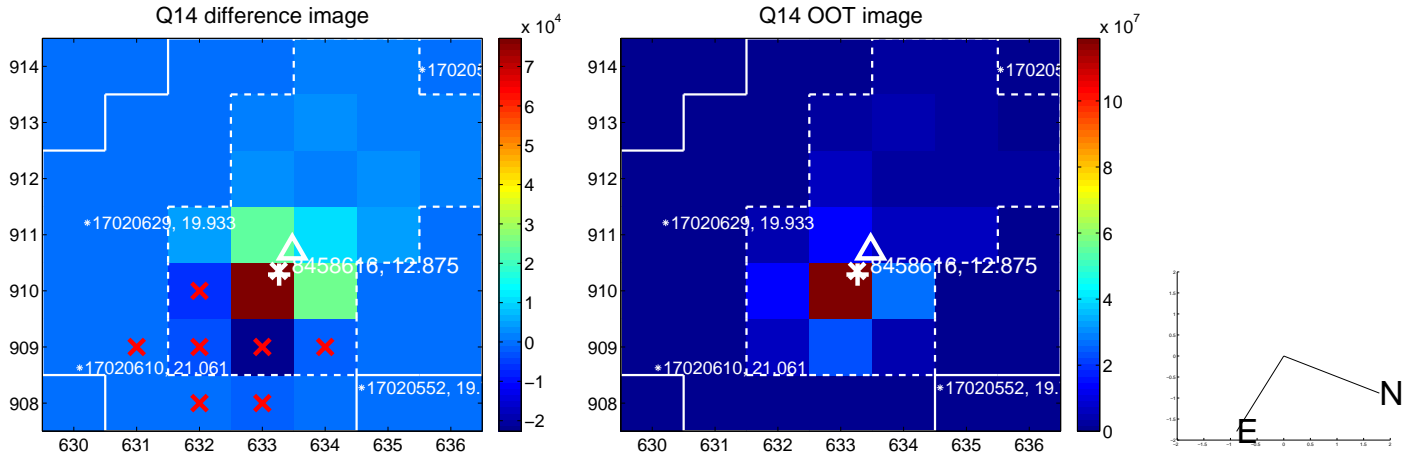
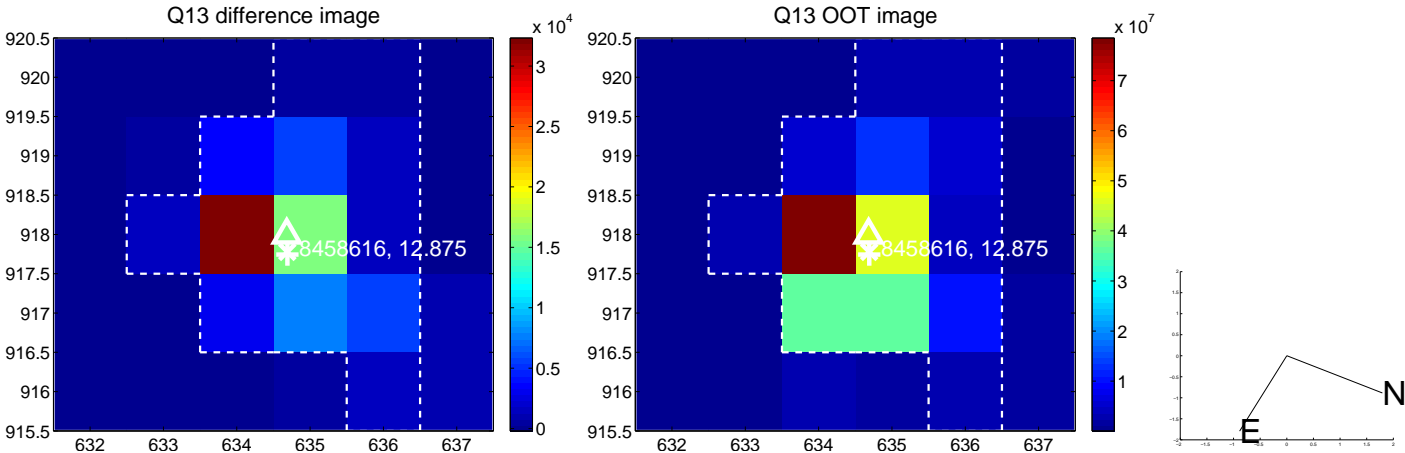
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



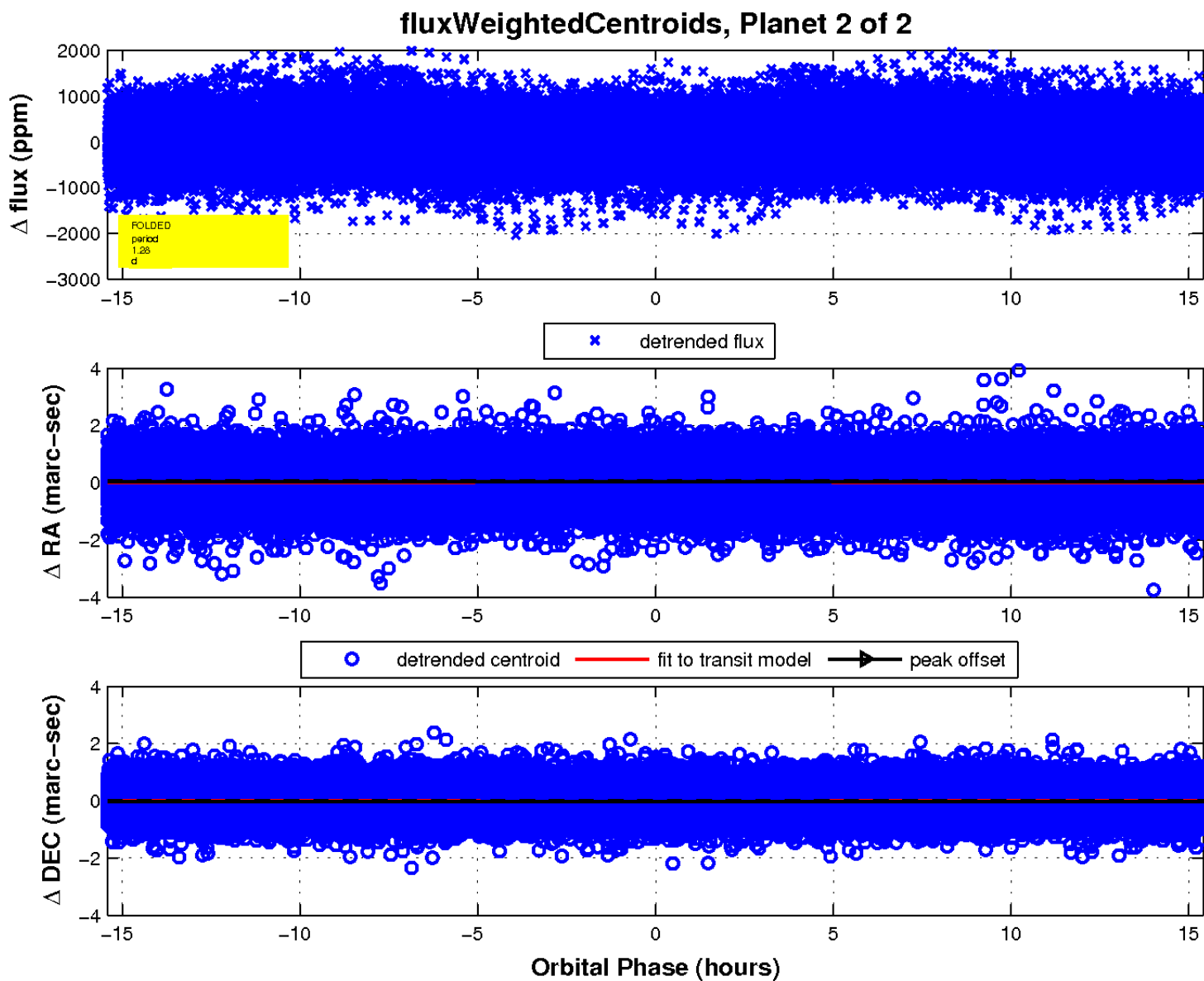
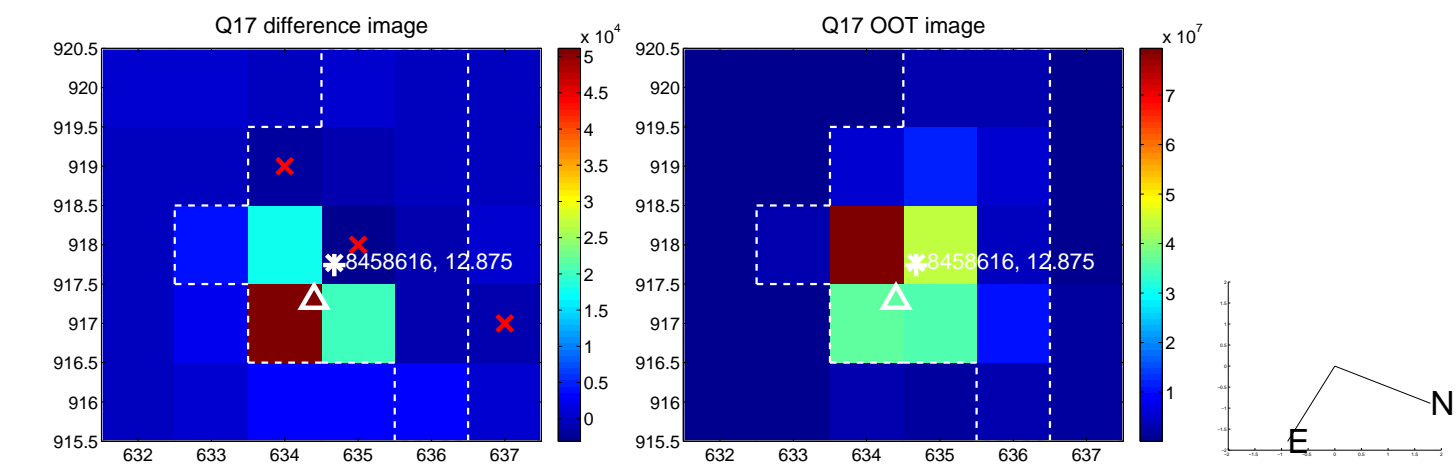
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



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



UKIRT Image

