

# KIC 004831616

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
004831616-01	OBS	No	2.091076	132.809029	92.0	3.877	10.6	11.9	4.66	11287	5.13	134409.62
004831616-02	OBS	No	2.091254	133.005095	53.8	18.928	7.9	9.1	4.66	11287	3.52	134394.28

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
004831616-01	OBS	FP	0.00	1	0	0	0	SWEET_NTL—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
004831616-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE_ZUMA—LPP_DV—MOD_NONUNIQ_DV—SAME_NTL_PERIOD—CENT_KIC_POS

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

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

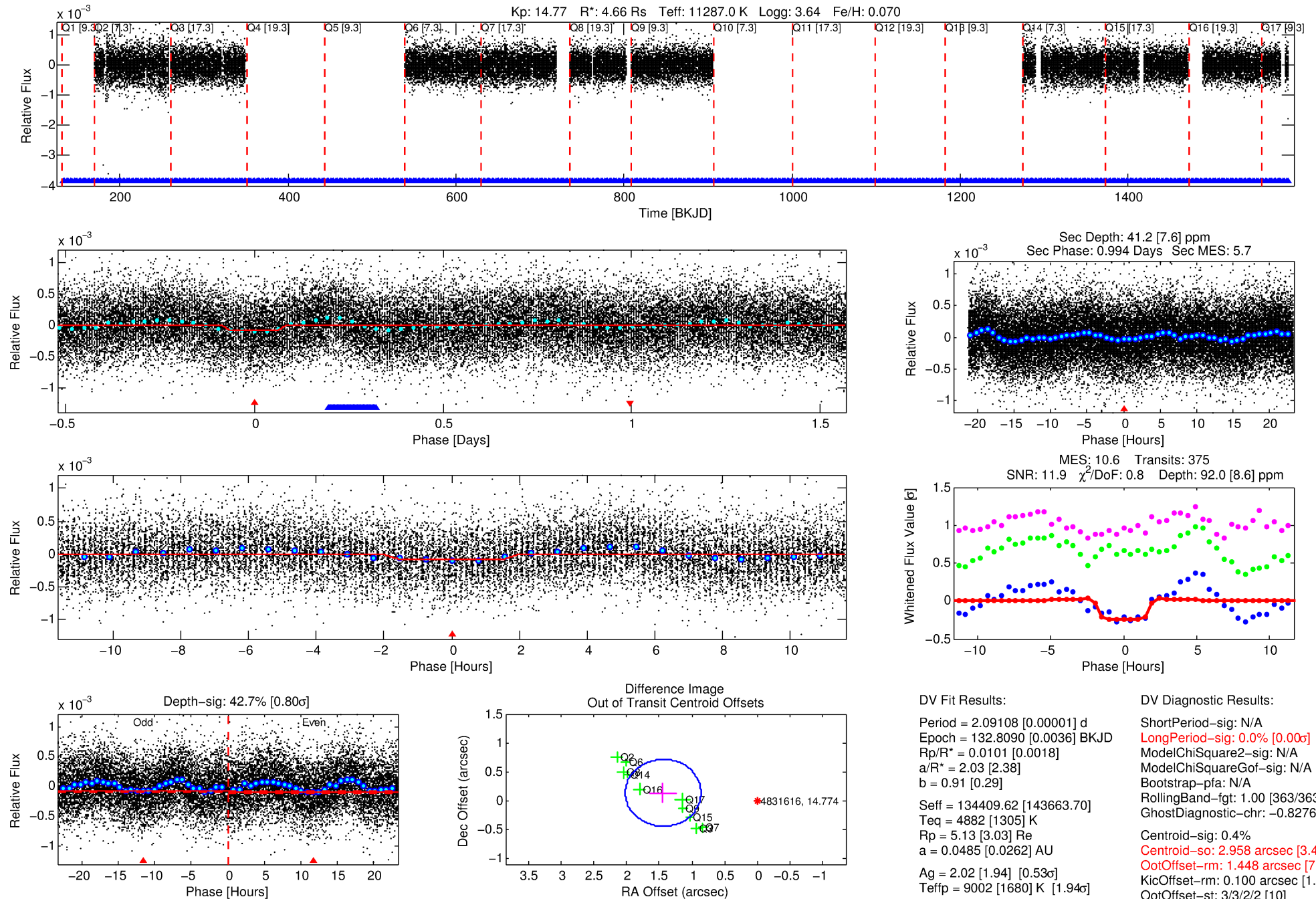
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 004831616-01

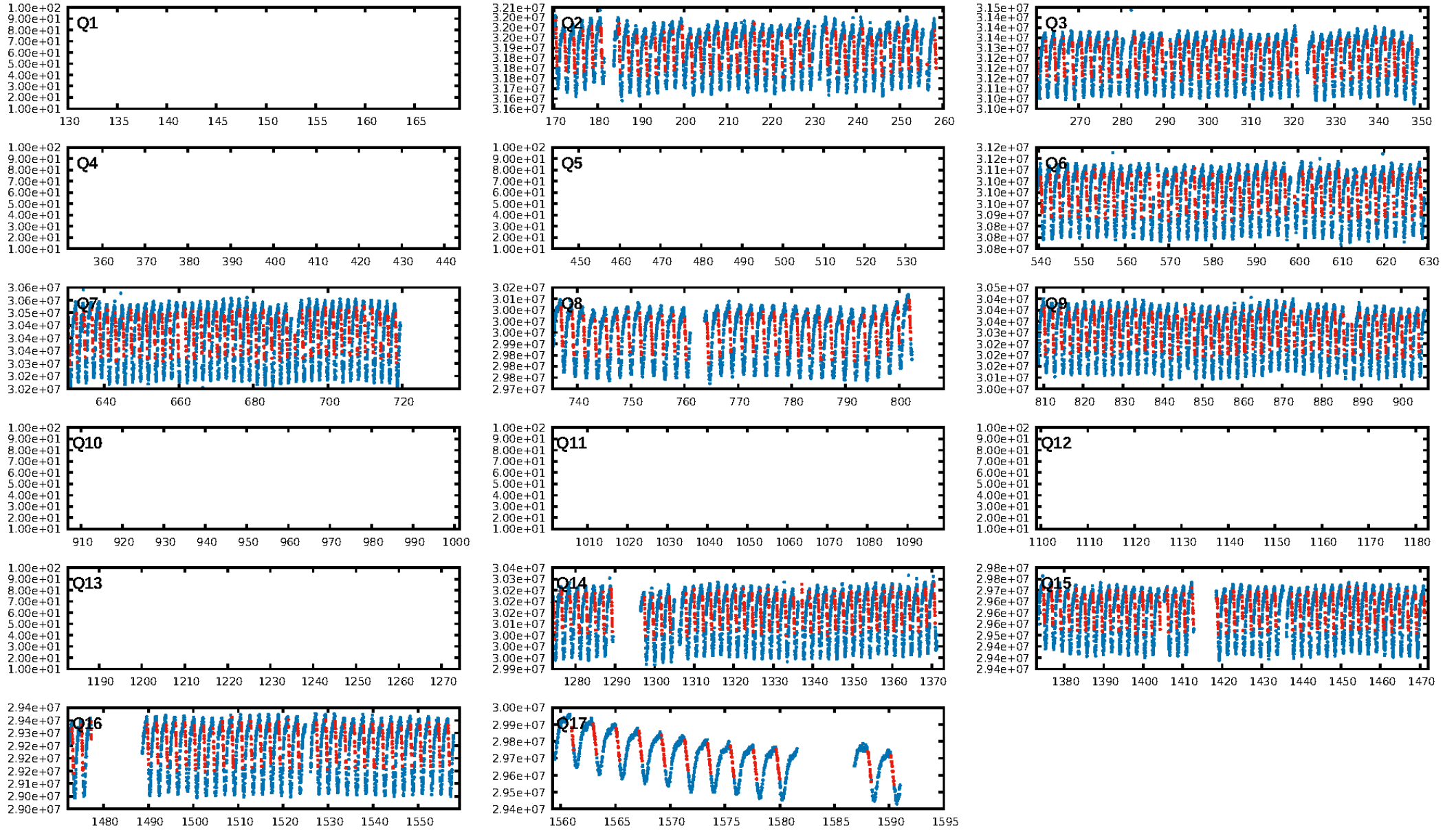
No Significant Match Found

# DV One-Page Summary

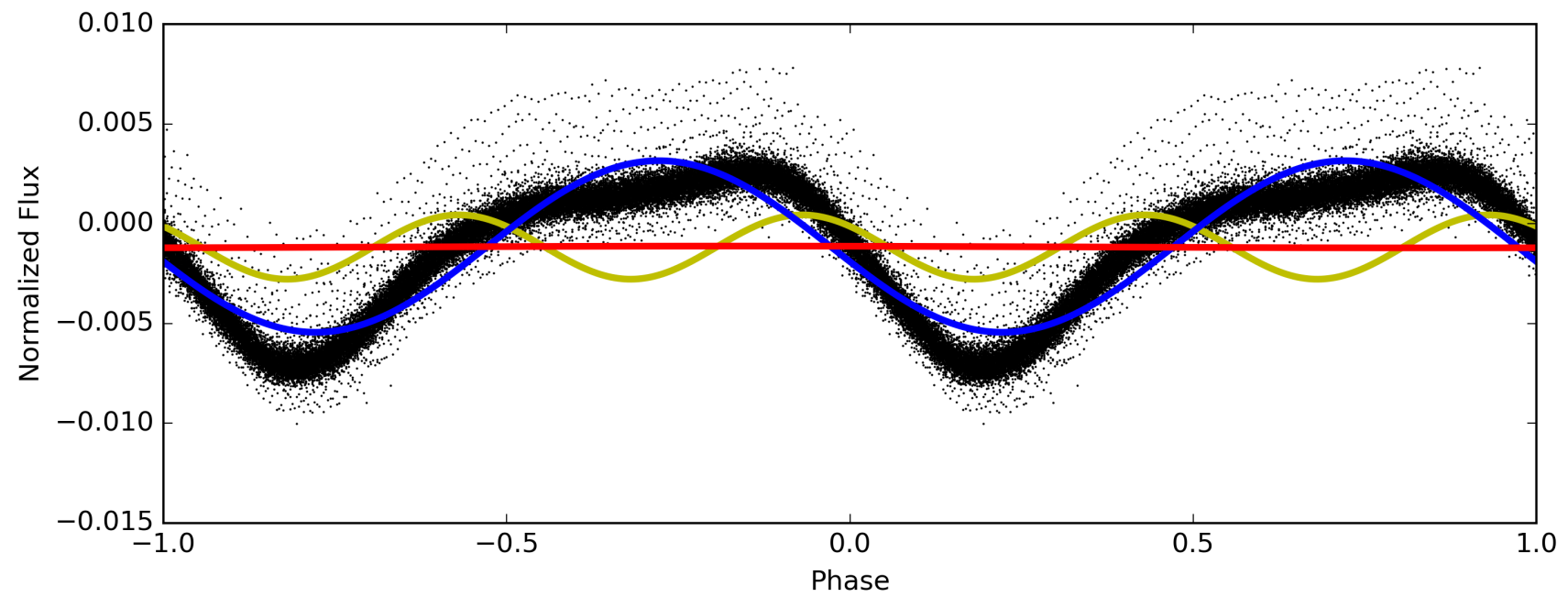
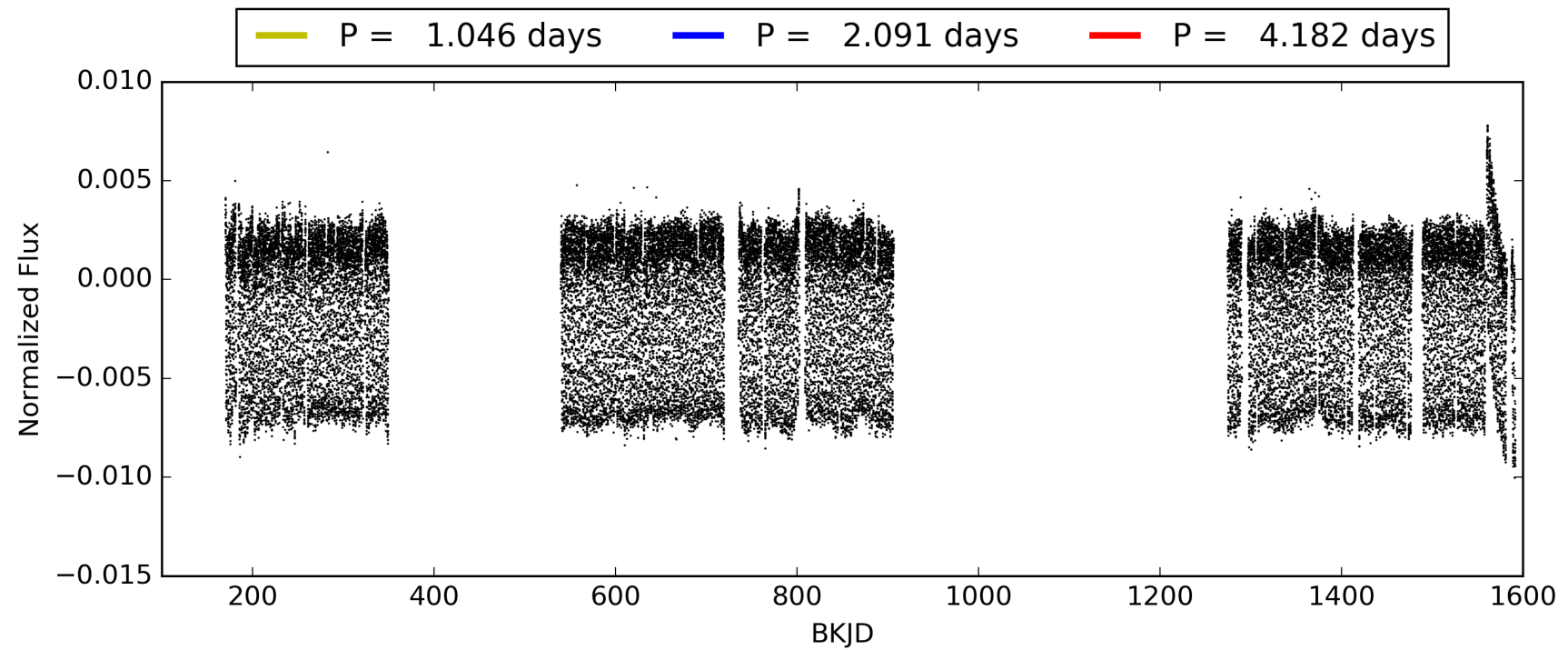
KIC: 4831616 Candidate: 1 of 2 Period: 2.091 d



# TCE 004831616-01, PDC Light Curves

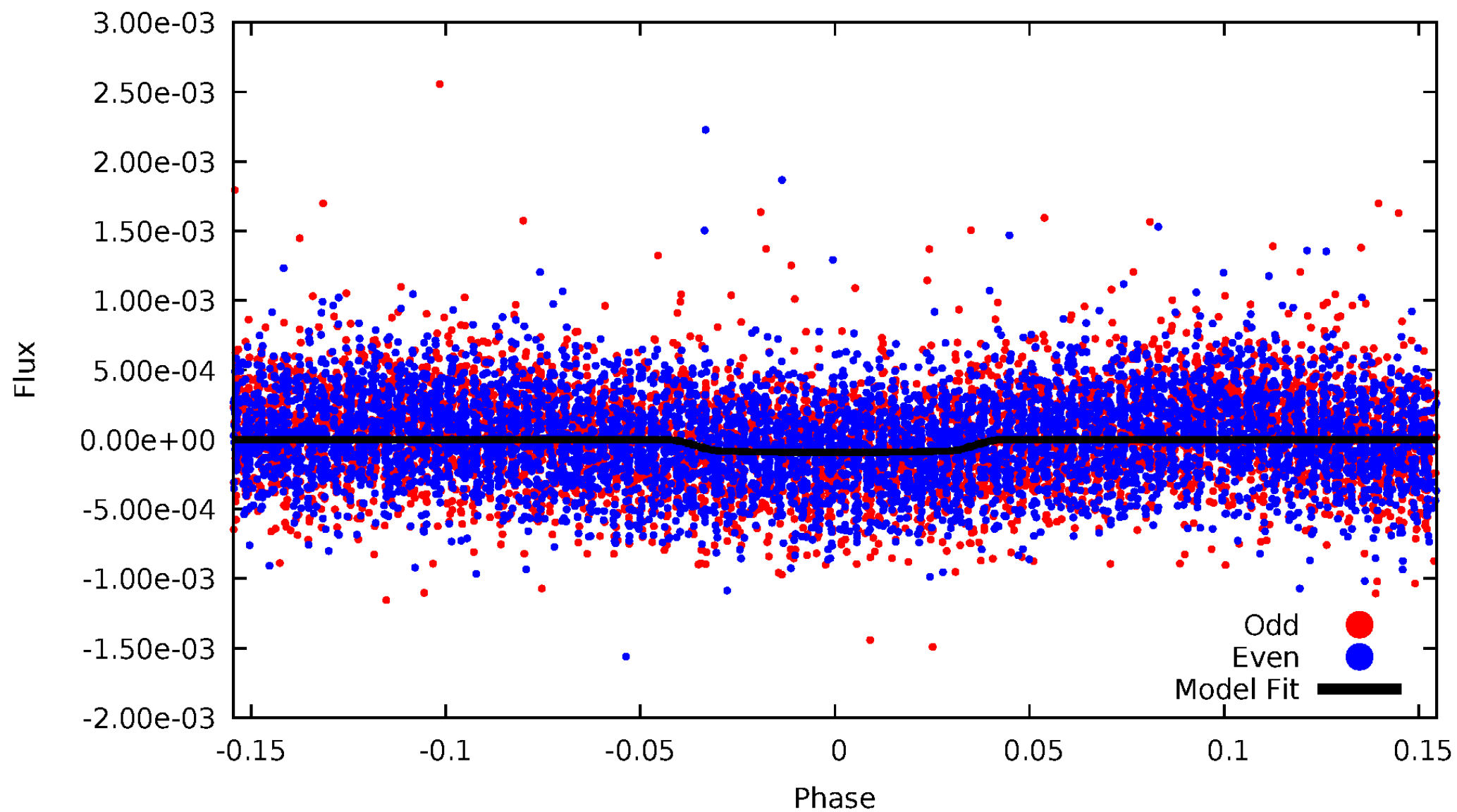


TCE 004831616-01



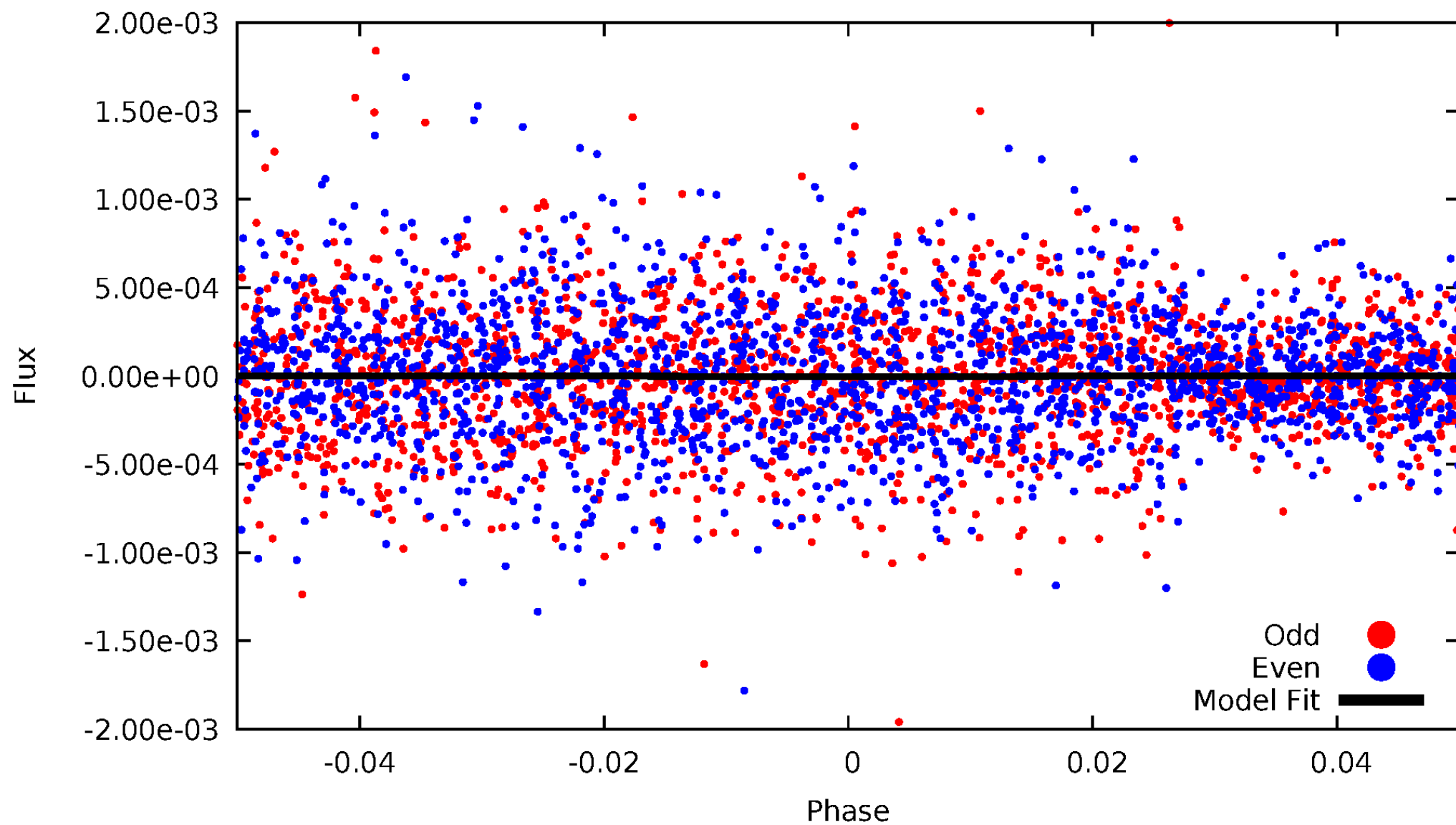
# DV Odd/Even

TCE 004831616-01



# ALT Odd/Even

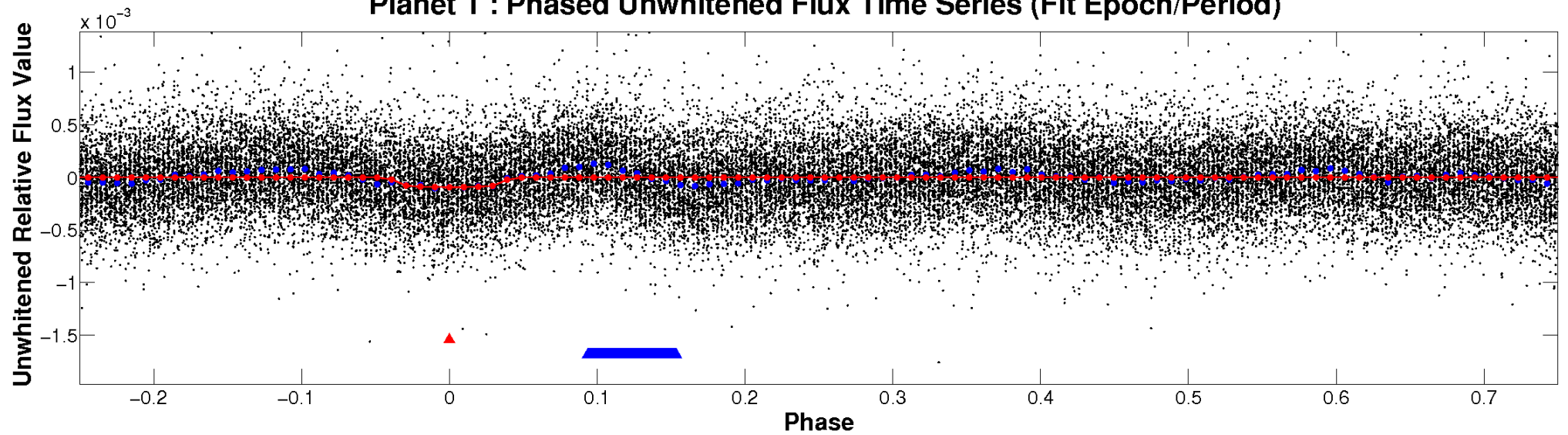
TCE 004831616-01



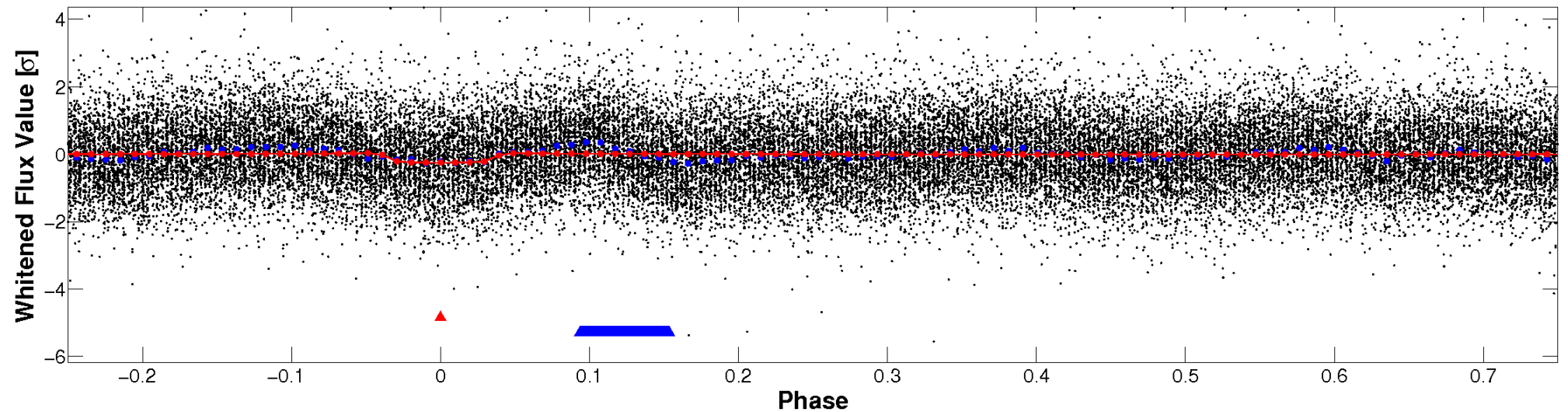


# Non-Whitened Vs. Whitened Light Curve

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

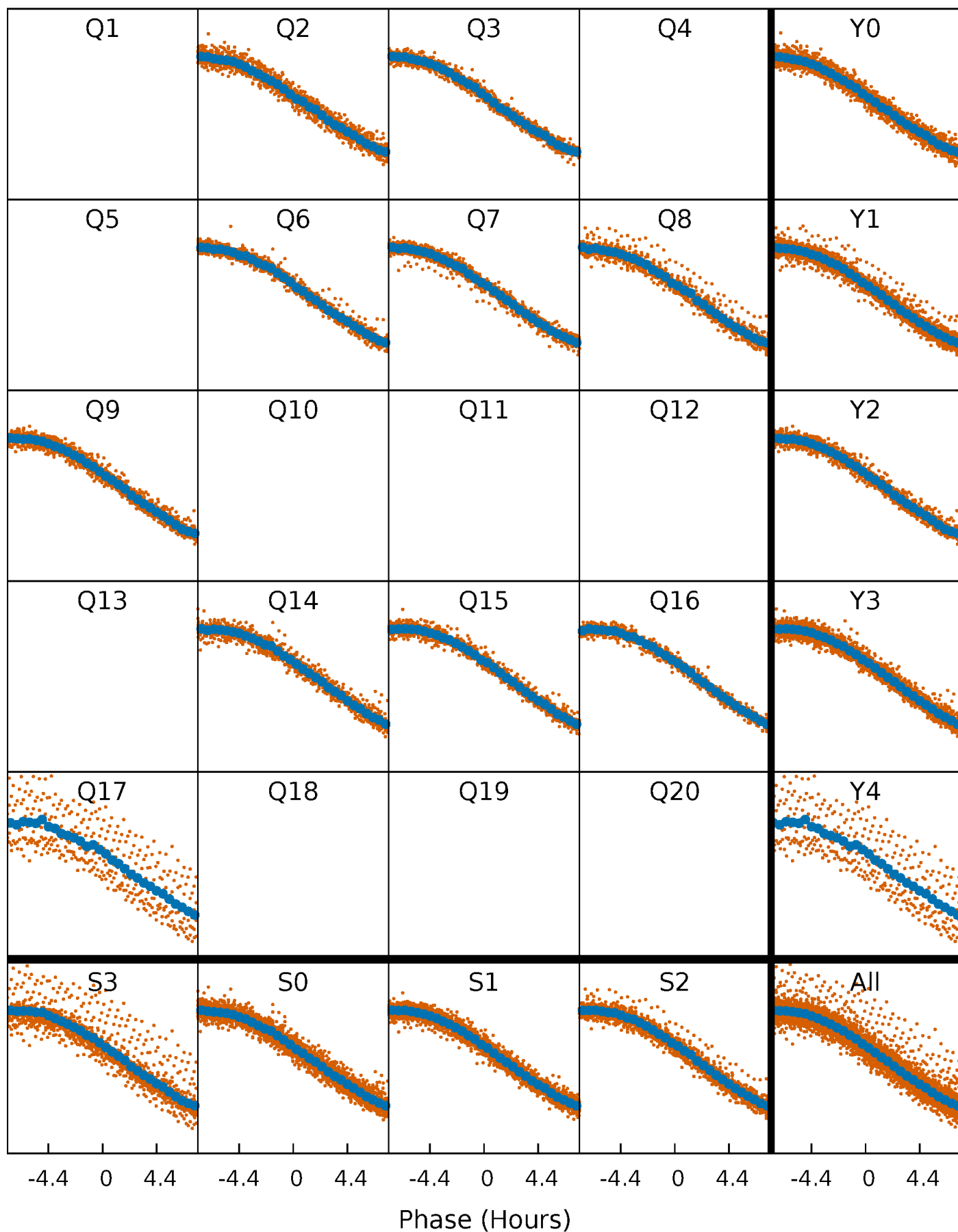


**Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



# PDC Quarter-Phased Transit Curves

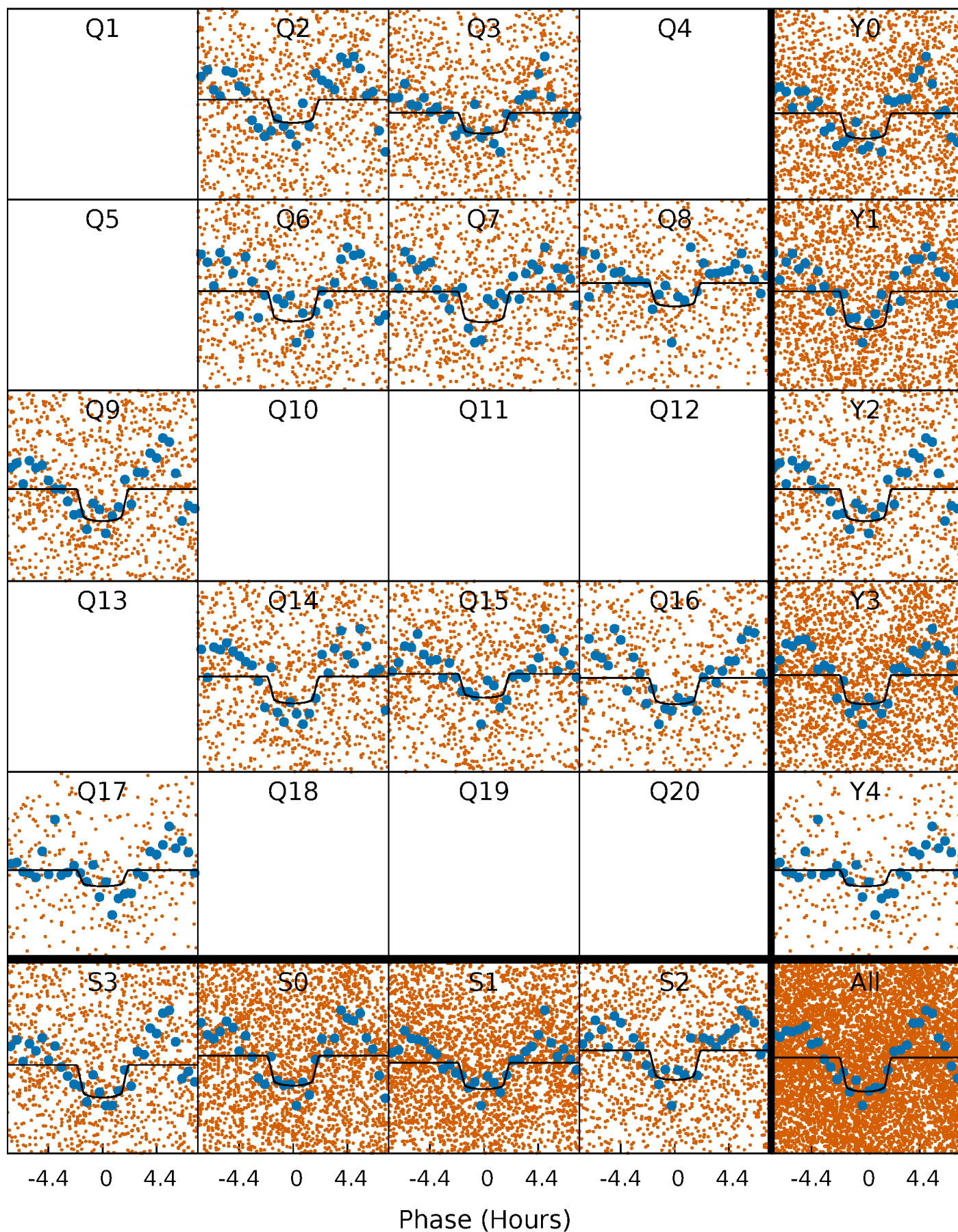
TCE 004831616-01 P= 2.091076 Days  $T_0=132.809029$  (BKJD)





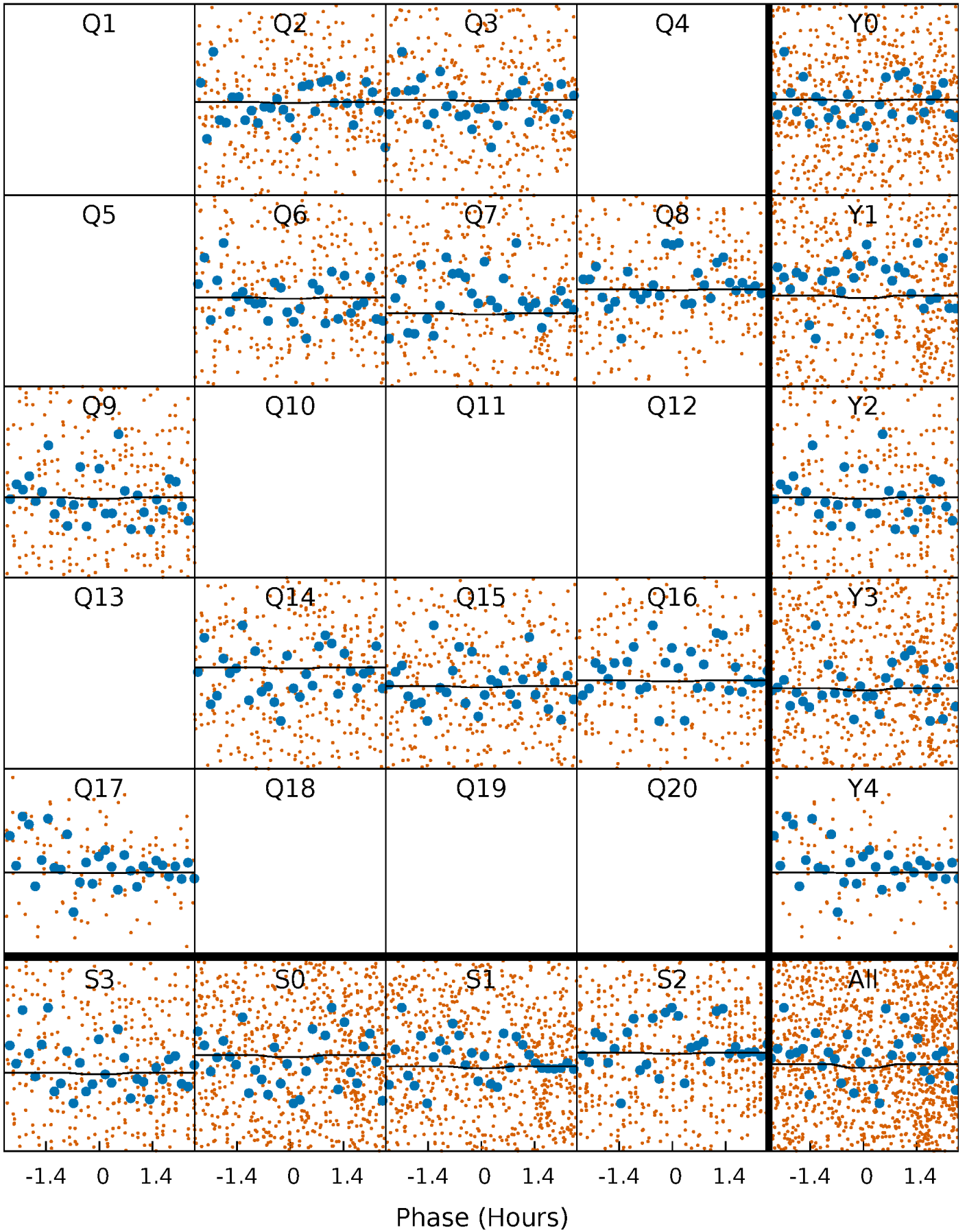
# DV Quarter-Phased Transit Curves

TCE 004831616-01 P= 2.091076 Days  $T_0=132.809029$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

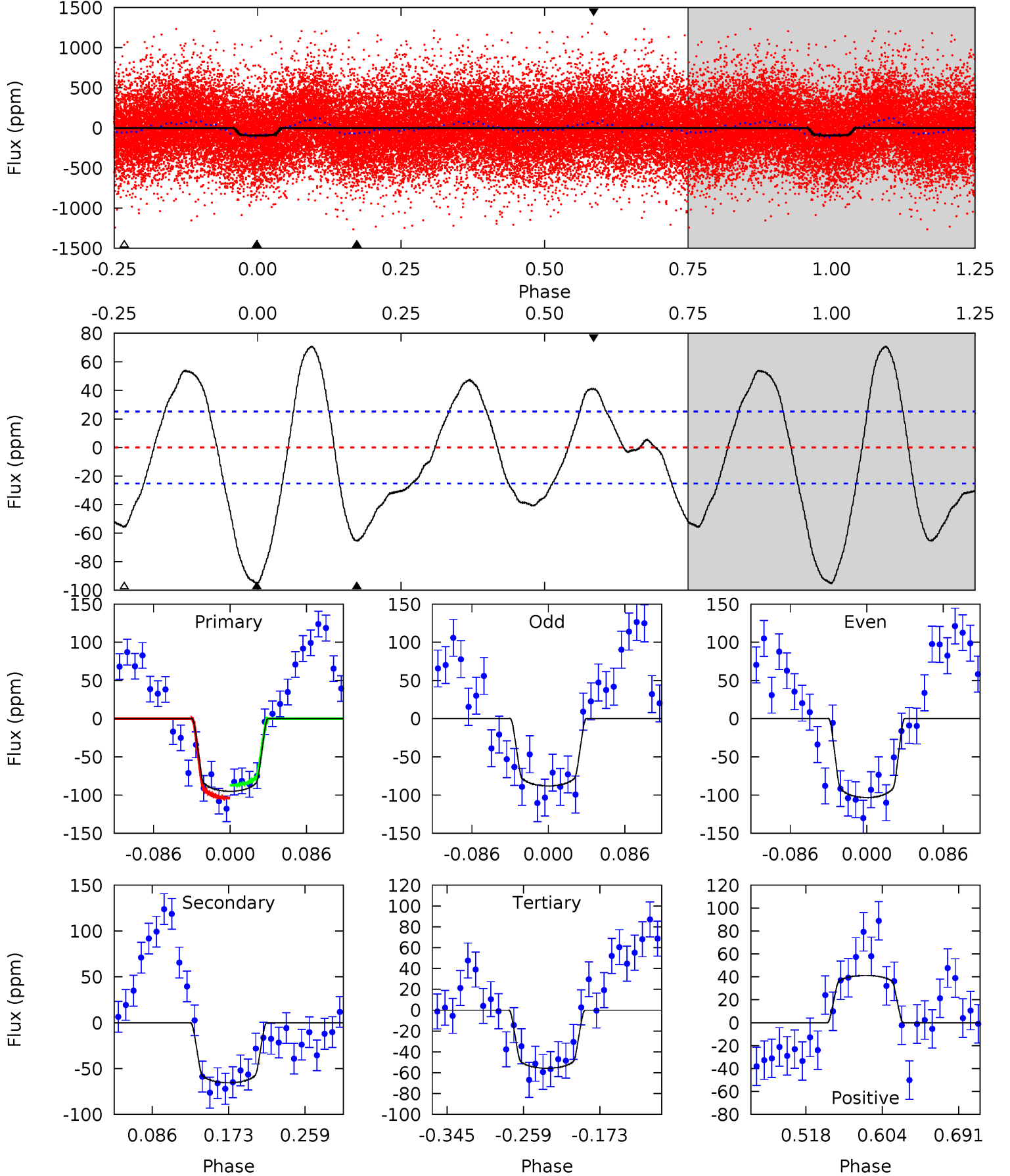
TCE 004831616-01 P= 2.091097 Days  $T_0=132.851825$  (BKJD)



# DV Model-Shift Uniqueness Test

004831616-01, P = 2.091076 Days, E = 132.809029 Days

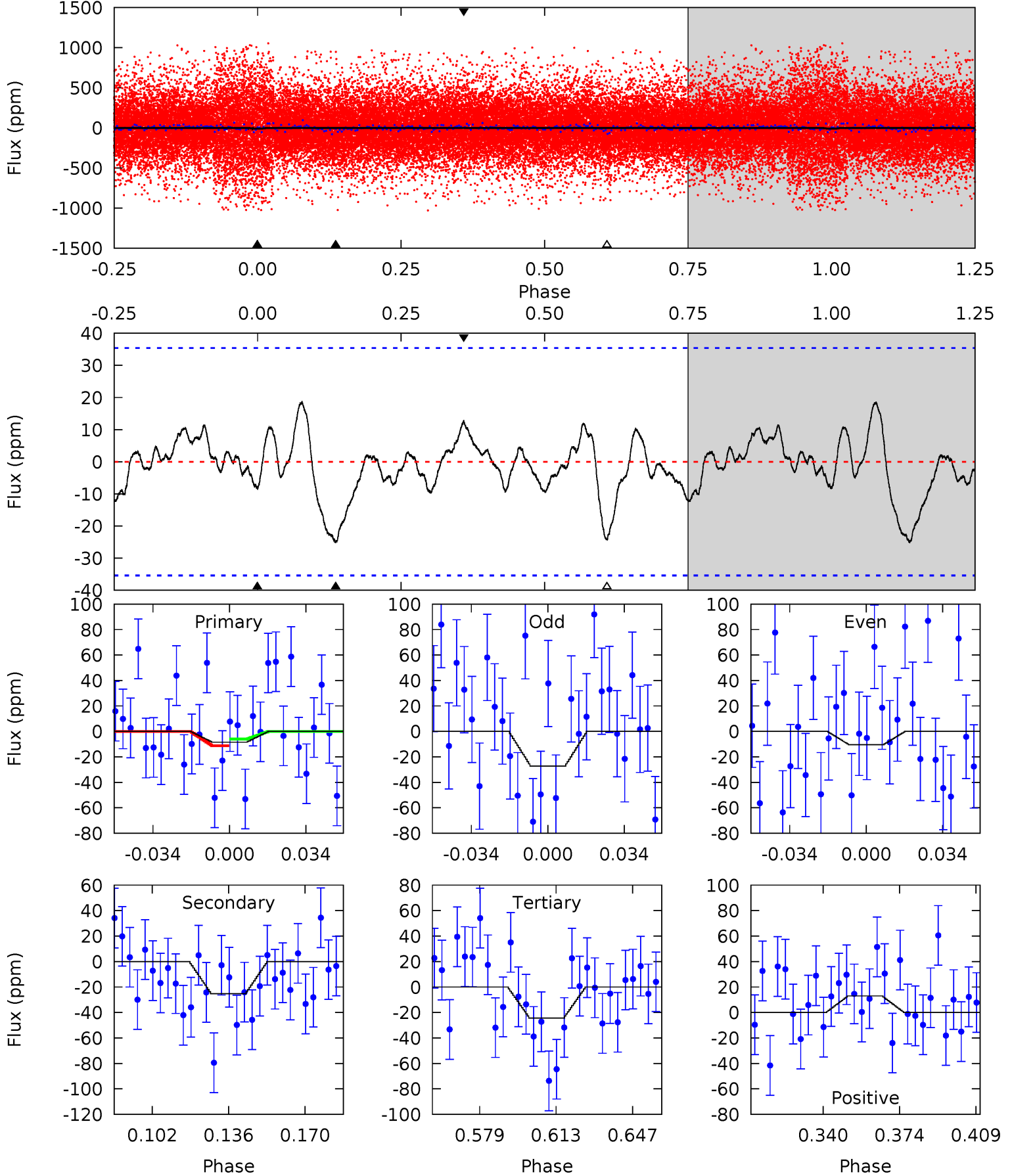
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
17.3	11.9	10.2	7.51	4.60	1.72	5.70	7.17	9.81	1.77	4.42	1.39	0.97	0.43	1.52



# Alt Model-Shift Uniqueness Test

004831616-01, P = 2.091097 Days, E = 132.851825 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
1.15	3.41	3.29	1.75	4.79	2.12	0.94	-2.14	-0.61	0.13	1.66	1.13	1.04	0.43	0.36



### Stellar Parameters For KIC 004831616

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$11287^{+587}_{-1762}$	$3.642^{+0.510}_{-0.090}$	$0.070^{+0.150}_{-0.600}$	$4.662^{+0.461}_{-2.613}$	$3.471^{+0.069}_{-1.265}$	$0.048^{+0.302}_{-0.015}$
	+5%/-16%	+14%/-2%	+214%/-857%	+10%/-56%	+2%/-36%	+626%/-31%
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 004831616-01 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-65 \pm 5$	$4.59^{+1.20}_{-1.50}$	$6355^{+803}_{-1167}$	$9087^{+1902}_{-1398}$	$3.883^{+4.172}_{-1.453}$
Alt.	$-25 \pm 7$	$1.07^{+0.88}_{-0.67}$	$6364^{+822}_{-1128}$	$20919^{+67547}_{-9749}$	$25^{+169}_{-18}$

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

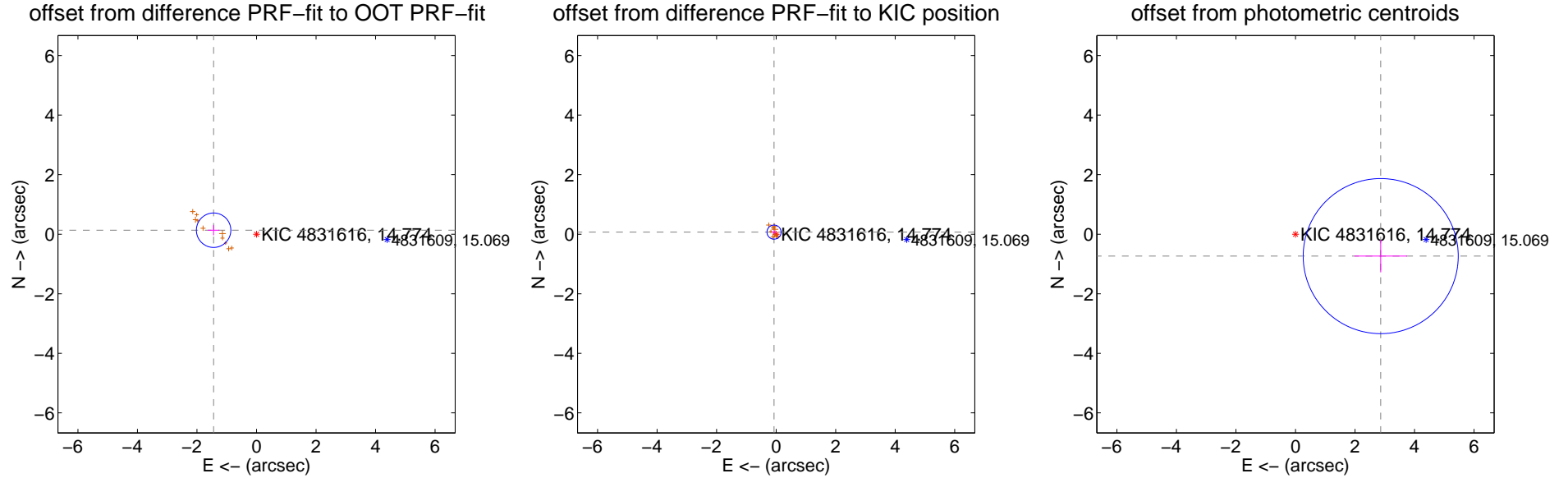
## DV Centroid Data

Supplemental centroid analysis for 004831616-01. Kepler magnitude: 14.77. Transit SNR 11.91

There are 0 quarters with good PRF difference image offsets

The direct PRF centroid is offset from the target star catalog position by about 1.11 arcsec

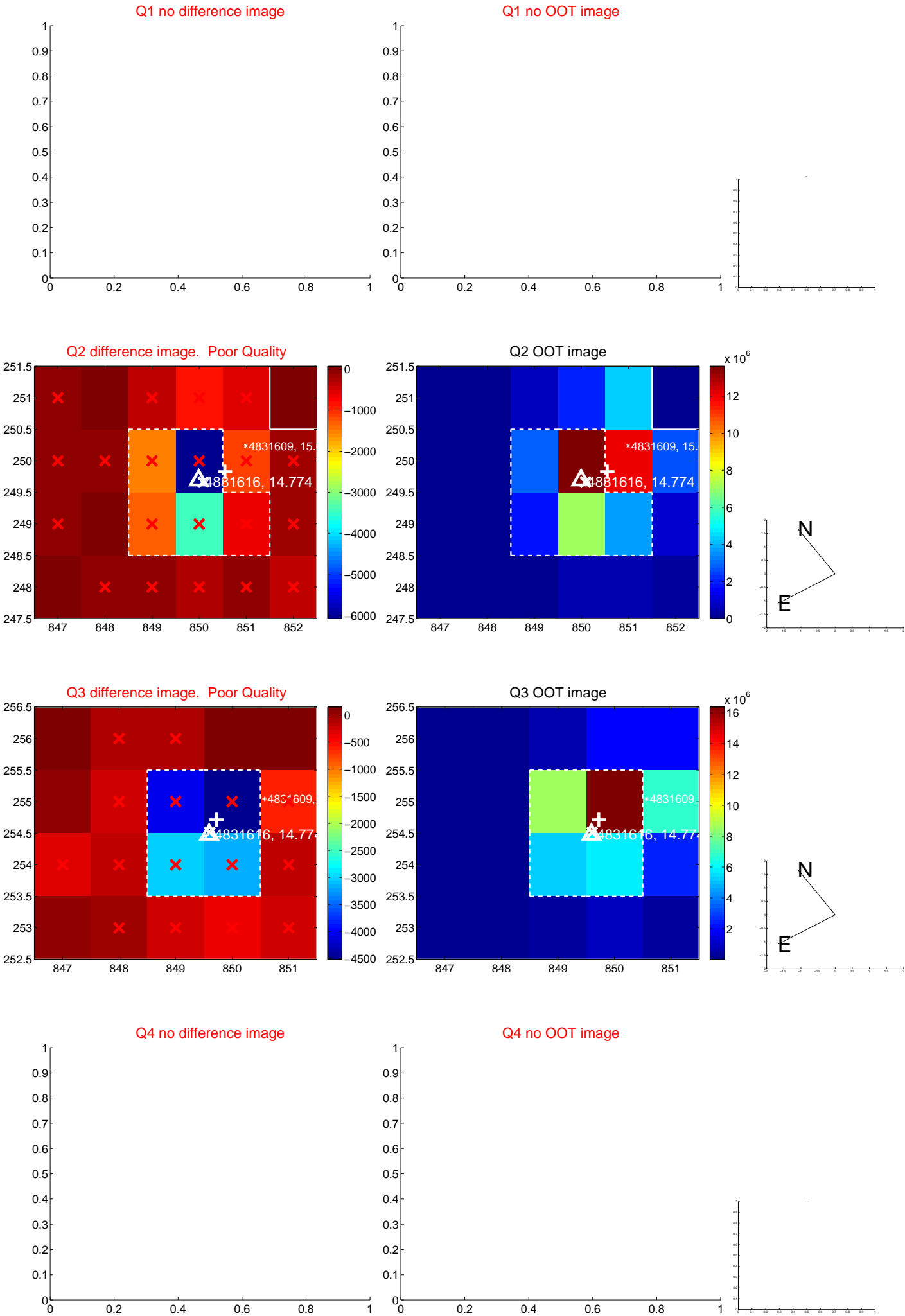
	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.448 \pm 0.193$	7.51	$1.442 \pm 0.193$	$0.135 \pm 0.171$
PRF-fit source offset from KIC position	$0.100 \pm 0.079$	1.26	$0.071 \pm 0.071$	$0.070 \pm 0.081$
photometric centroid source offset	$2.96 \pm 0.87$	3.41	$-2.86 \pm 0.89$	$-0.74 \pm 0.54$



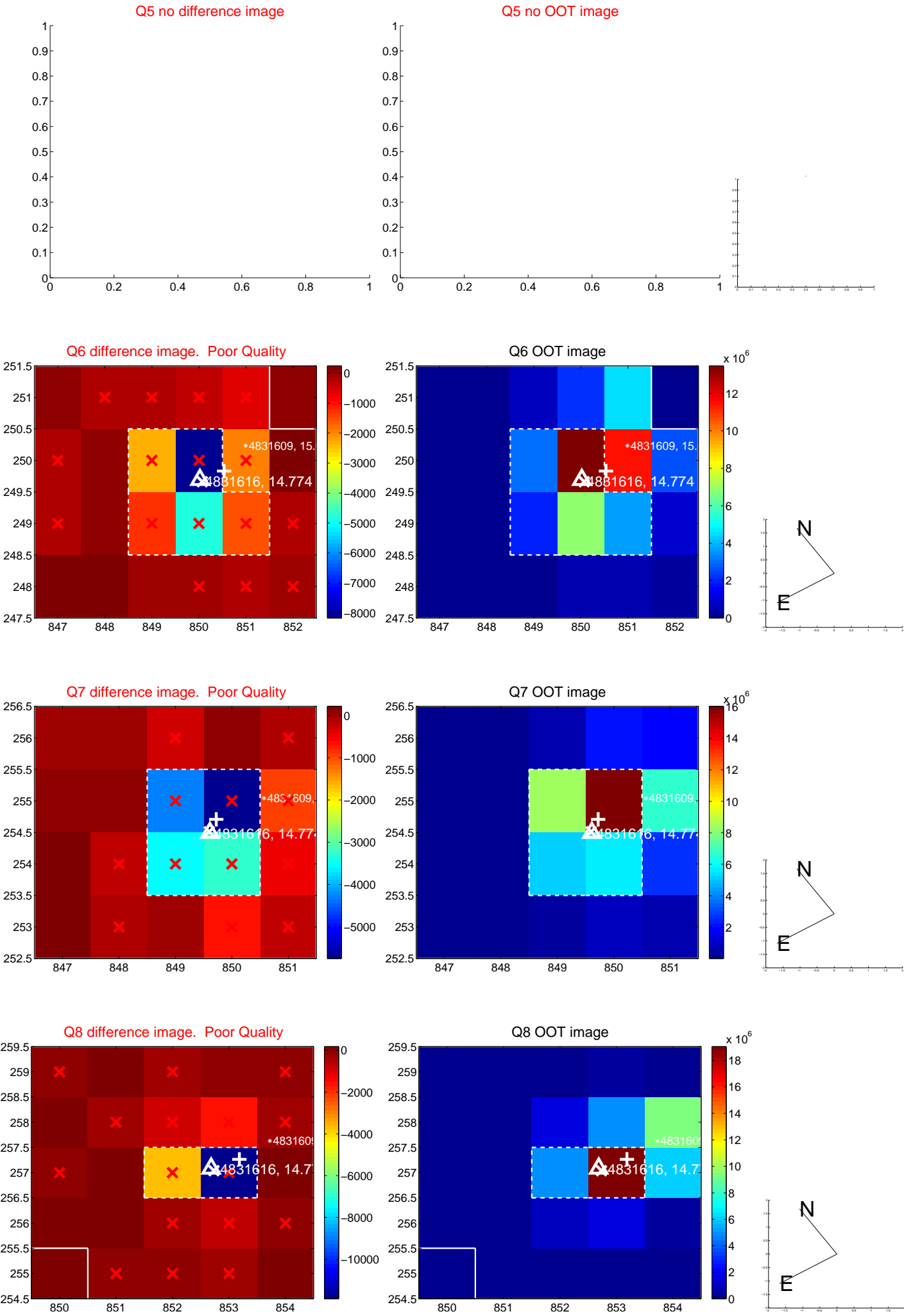
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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



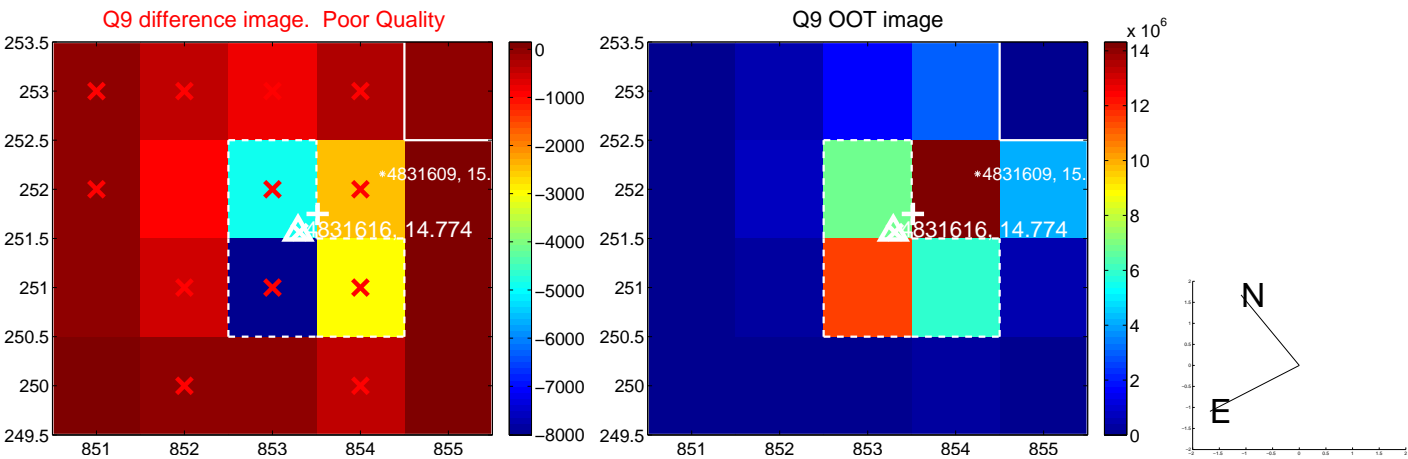
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



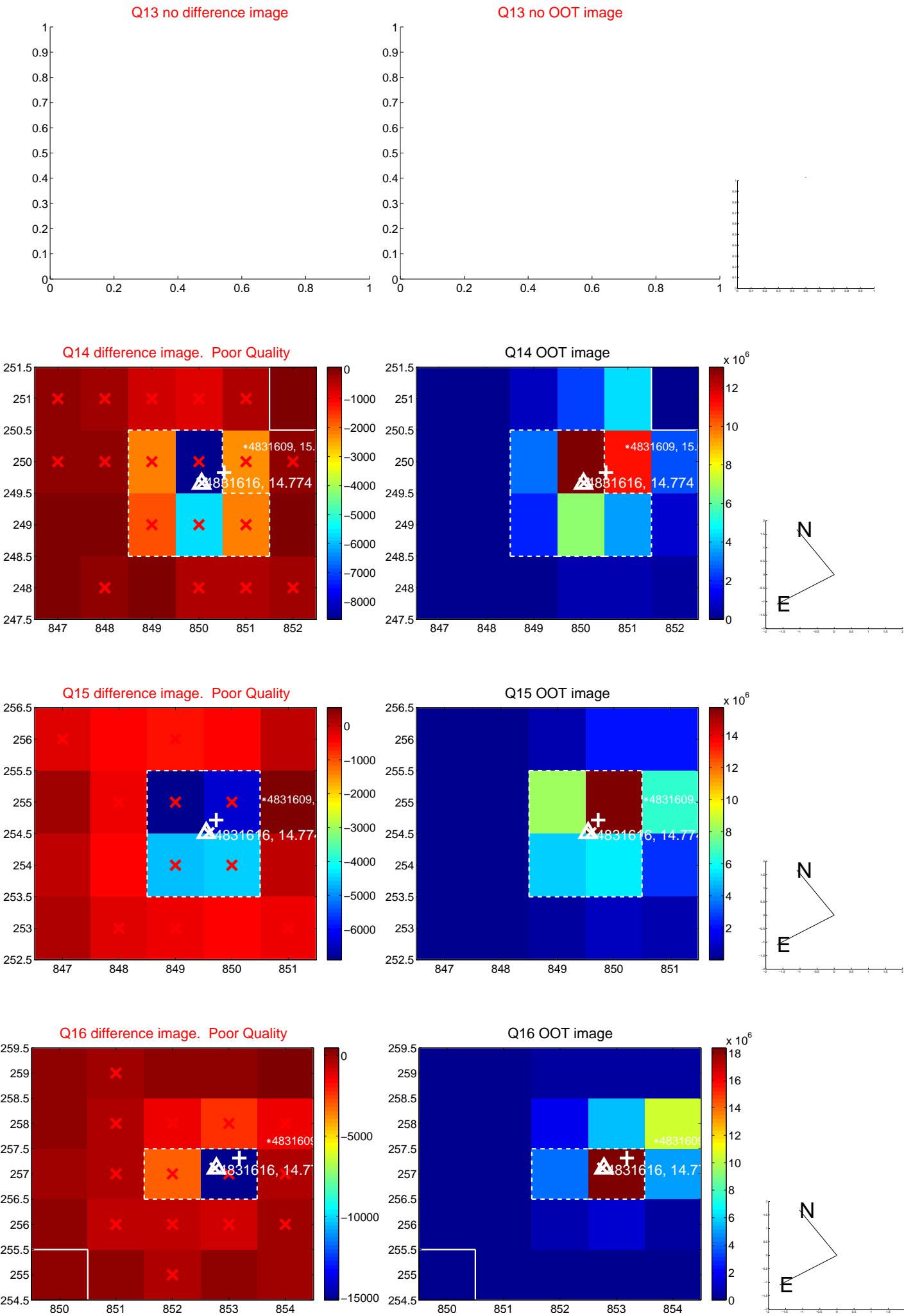
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



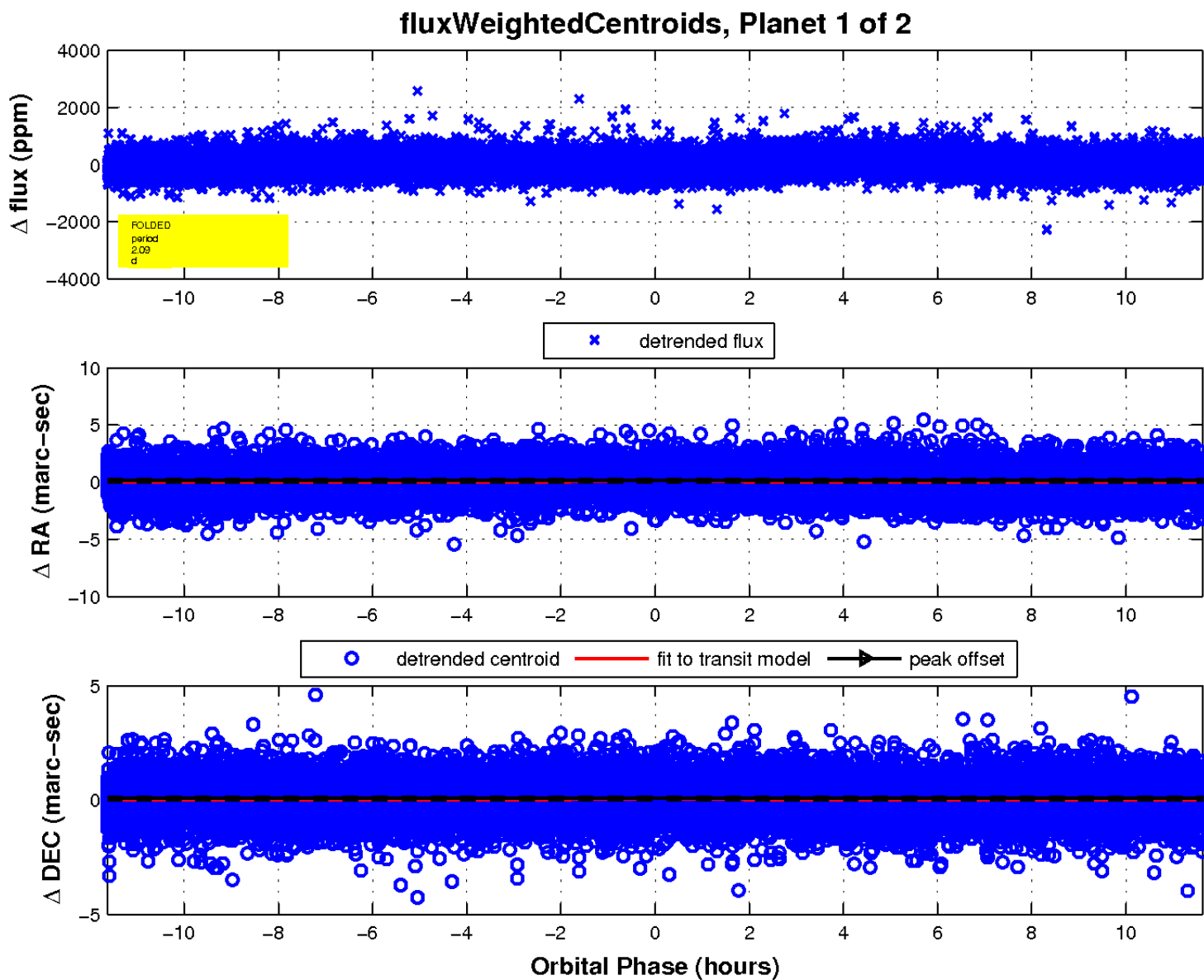
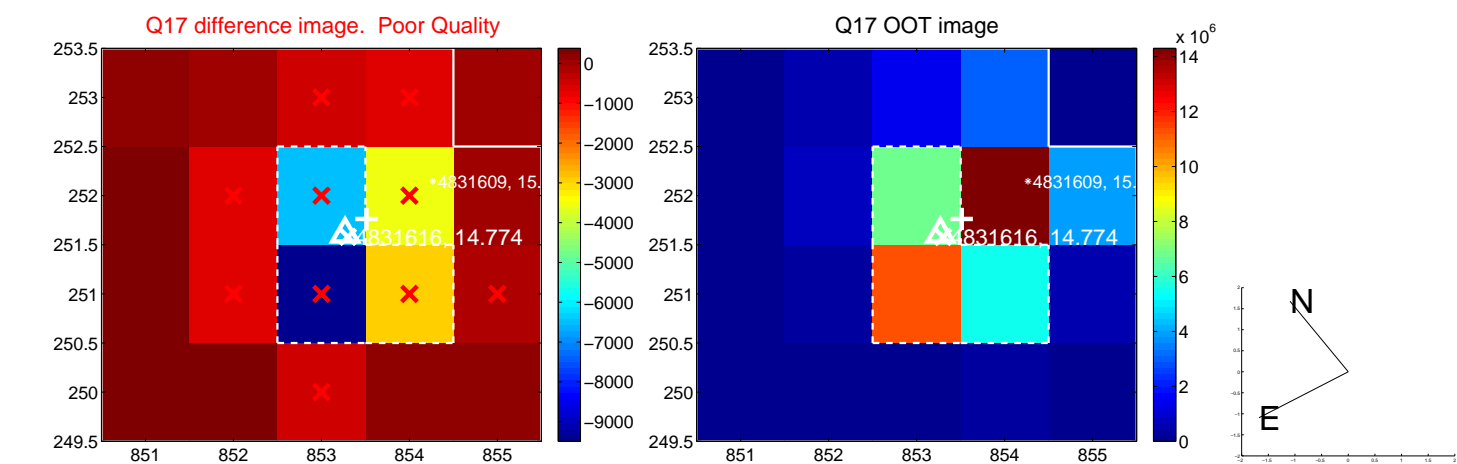
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

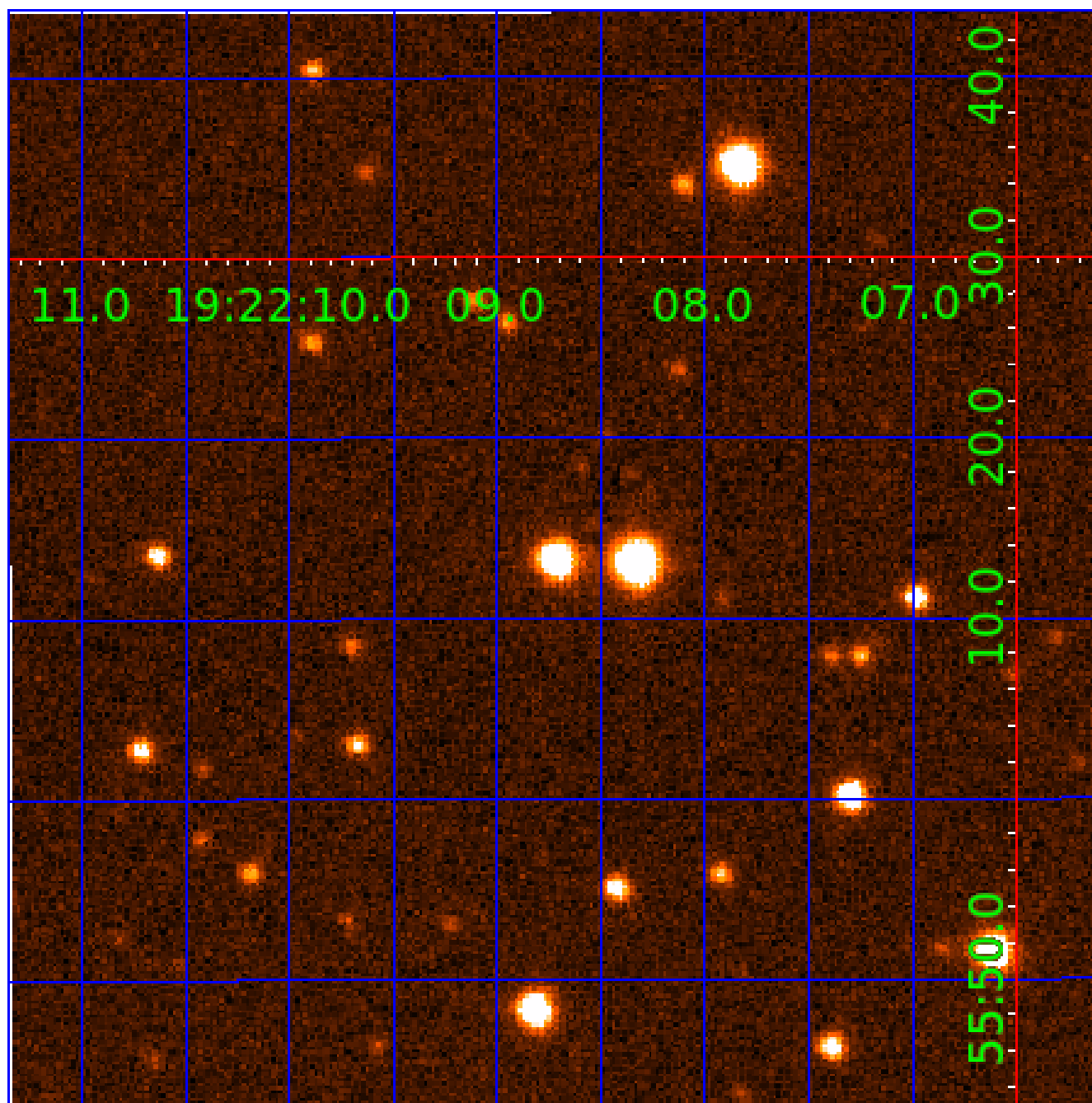


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination





# KIC 004831616

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
004831616-01	OBS	No	2.091076	132.809029	92.0	3.877	10.6	11.9	4.66	11287	5.13	134409.62
004831616-02	OBS	No	2.091254	133.005095	53.8	18.928	7.9	9.1	4.66	11287	3.52	134394.28

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
004831616-01	OBS	FP	0.00	1	0	0	0	SWEET_NTL—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
004831616-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE_ZUMA—LPP_DV—MOD_NONUNIQ_DV—SAME_NTL_PERIOD—CENT_KIC_POS

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

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

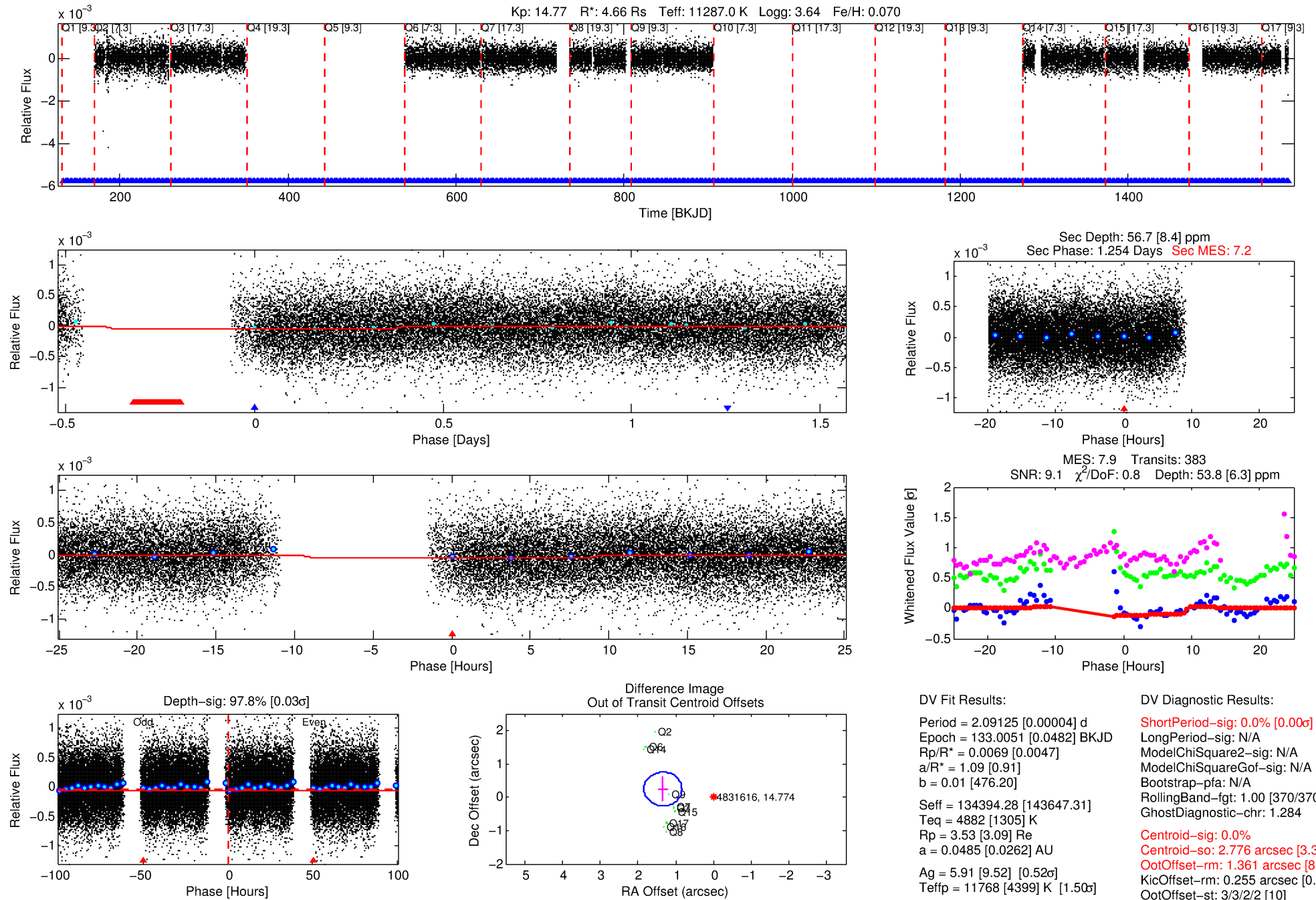
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 004831616-02

No Significant Match Found

# DV One-Page Summary

KIC: 4831616 Candidate: 2 of 2 Period: 2.091 d



## DV Fit Results:

Period = 2.09125 [0.00004] d  
Epoch = 133.0051 [0.0482] BKJD  
Rp/R\* = 0.0069 [0.0047]  
a/R\* = 1.09 [0.91]  
b = 0.01 [476.20]  
Seff = 134394.28 [143647.31]  
Teff = 4882 [1305] K  
Rp = 3.53 [3.09] Re  
a = 0.0485 [0.0262] AU  
Ag = 5.91 [9.52] [0.52 $\sigma$ ]  
Teffp = 11768 [4399] K [1.50 $\sigma$ ]

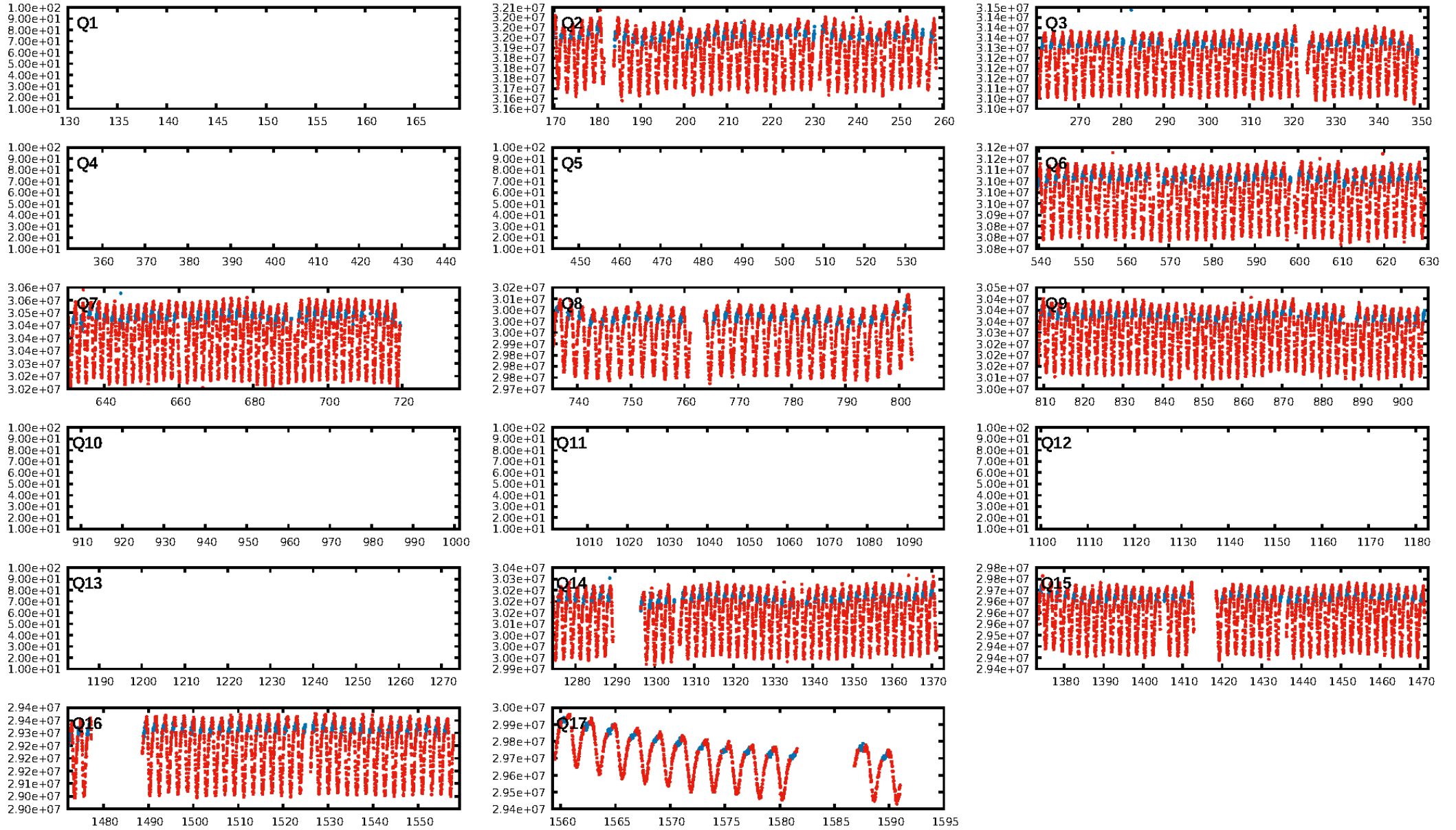
## DV Diagnostic Results:

ShortPeriod-sig: 0.0% [0.00 $\sigma$ ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [370/370]  
GhostDiagnostic-chr: 1.284  
Centroid-sig: 0.0%  
Centroid-so: 2.776 arcsec [3.30 $\sigma$ ]  
OotOffset-rm: 1.361 arcsec [8.06 $\sigma$ ]  
KicOffset-rm: 0.255 arcsec [0.81 $\sigma$ ]  
OotOffset-st: 3/3/2/2 [10]  
KicOffset-st: 3/3/2/2 [10]  
DiffImageQuality-fgm: 1.00 [10/10]  
DiffImageOverlap-fno: 0.00 [0/10]

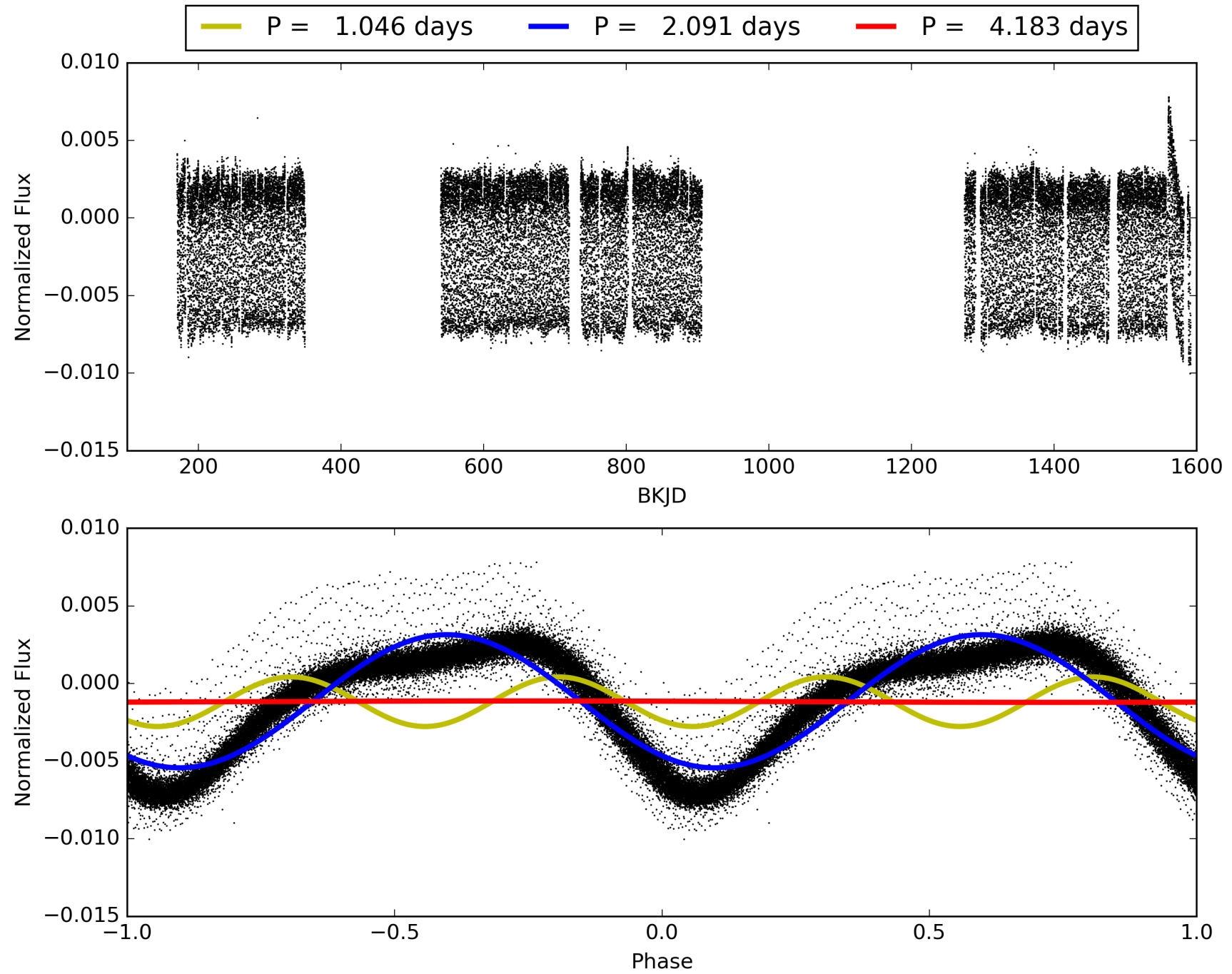
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 11:19:56 Z

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

# TCE 004831616-02, PDC Light Curves

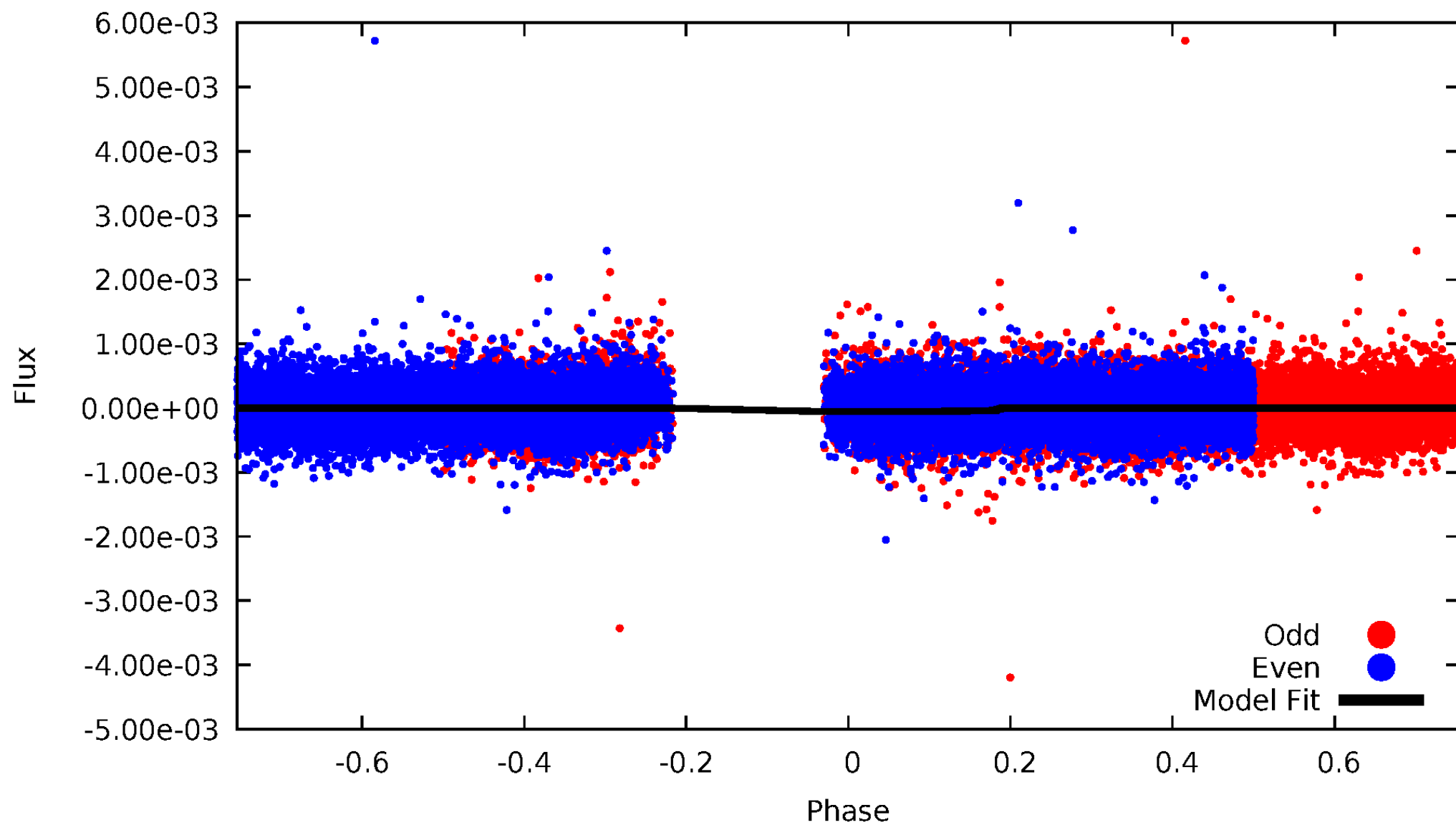


TCE 004831616-02



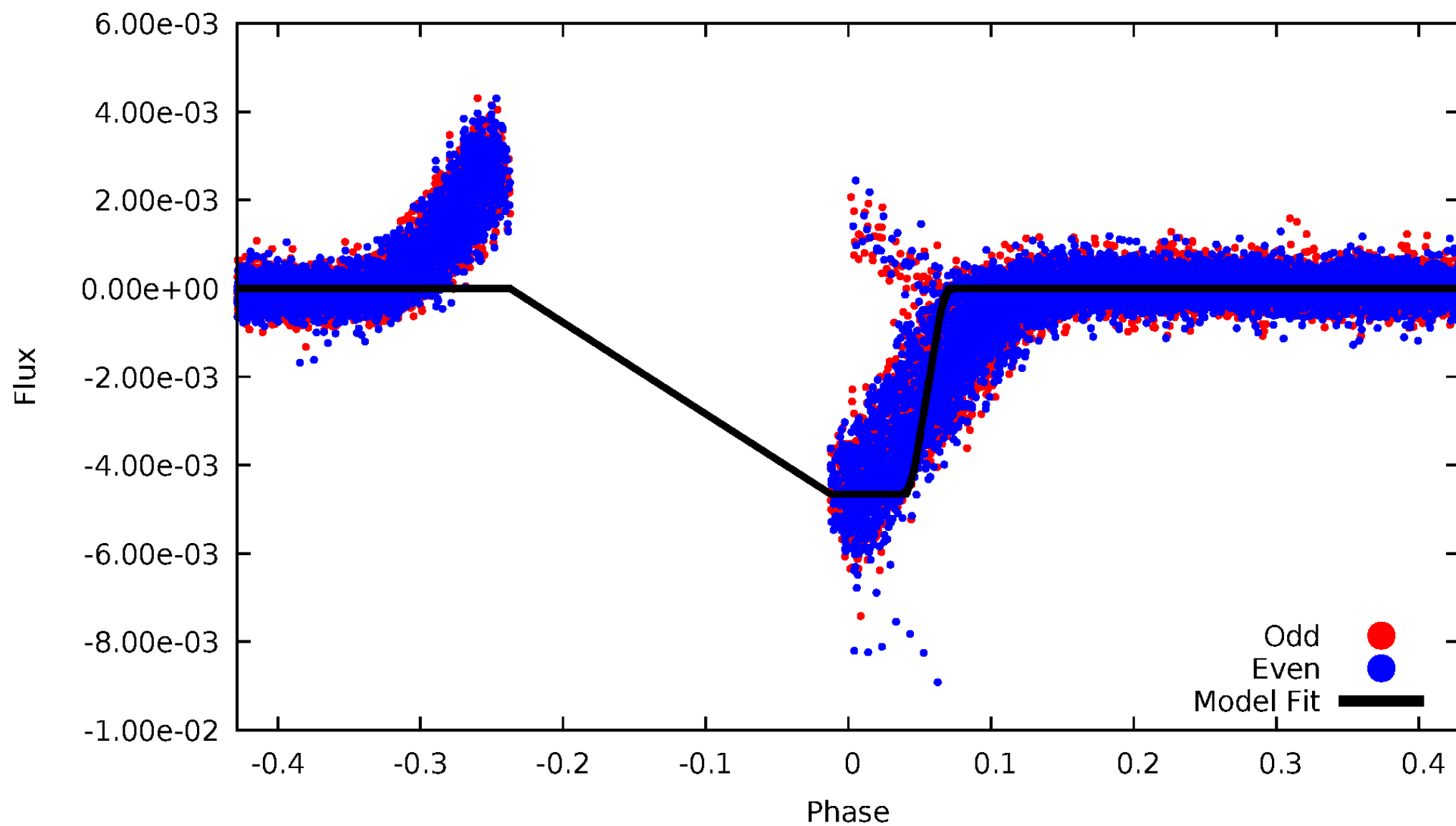
# DV Odd/Even

TCE 004831616-02



# ALT Odd/Even

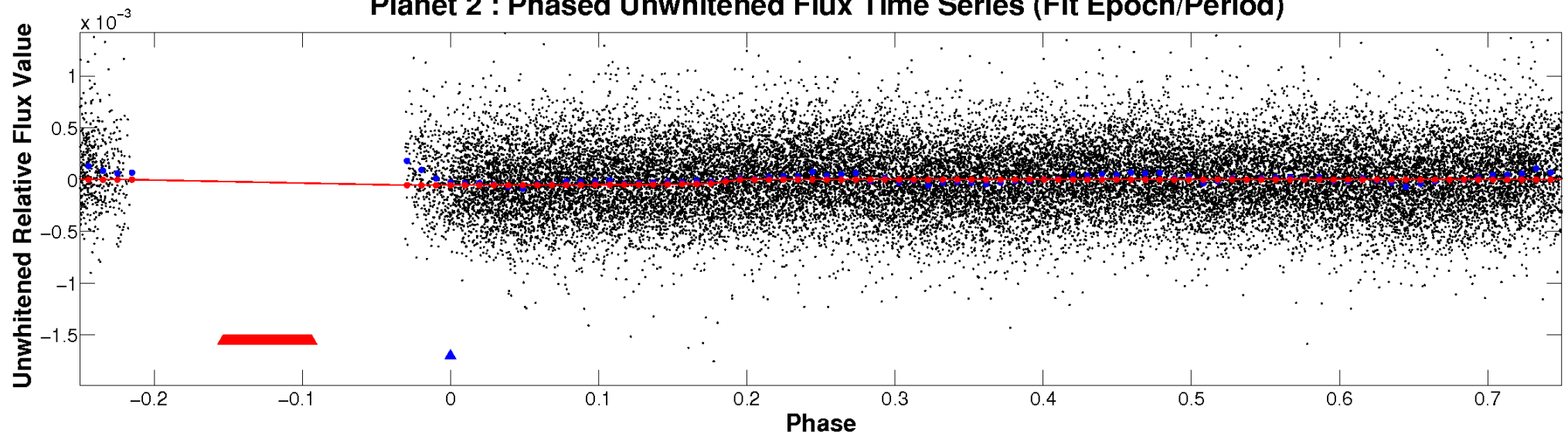
TCE 004831616-02



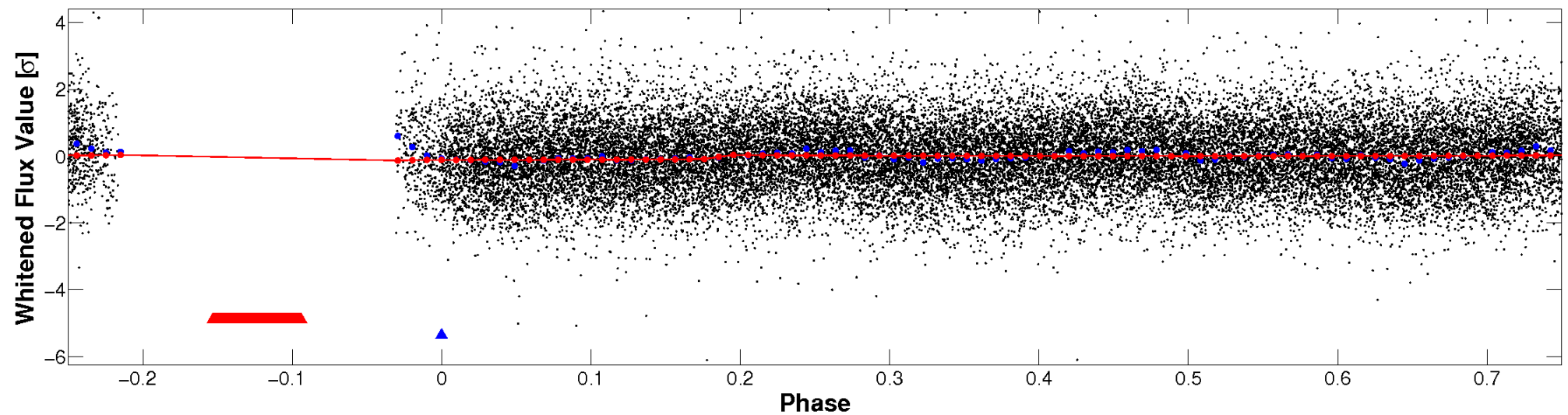


# Non-Whitened Vs. Whitened Light Curve

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

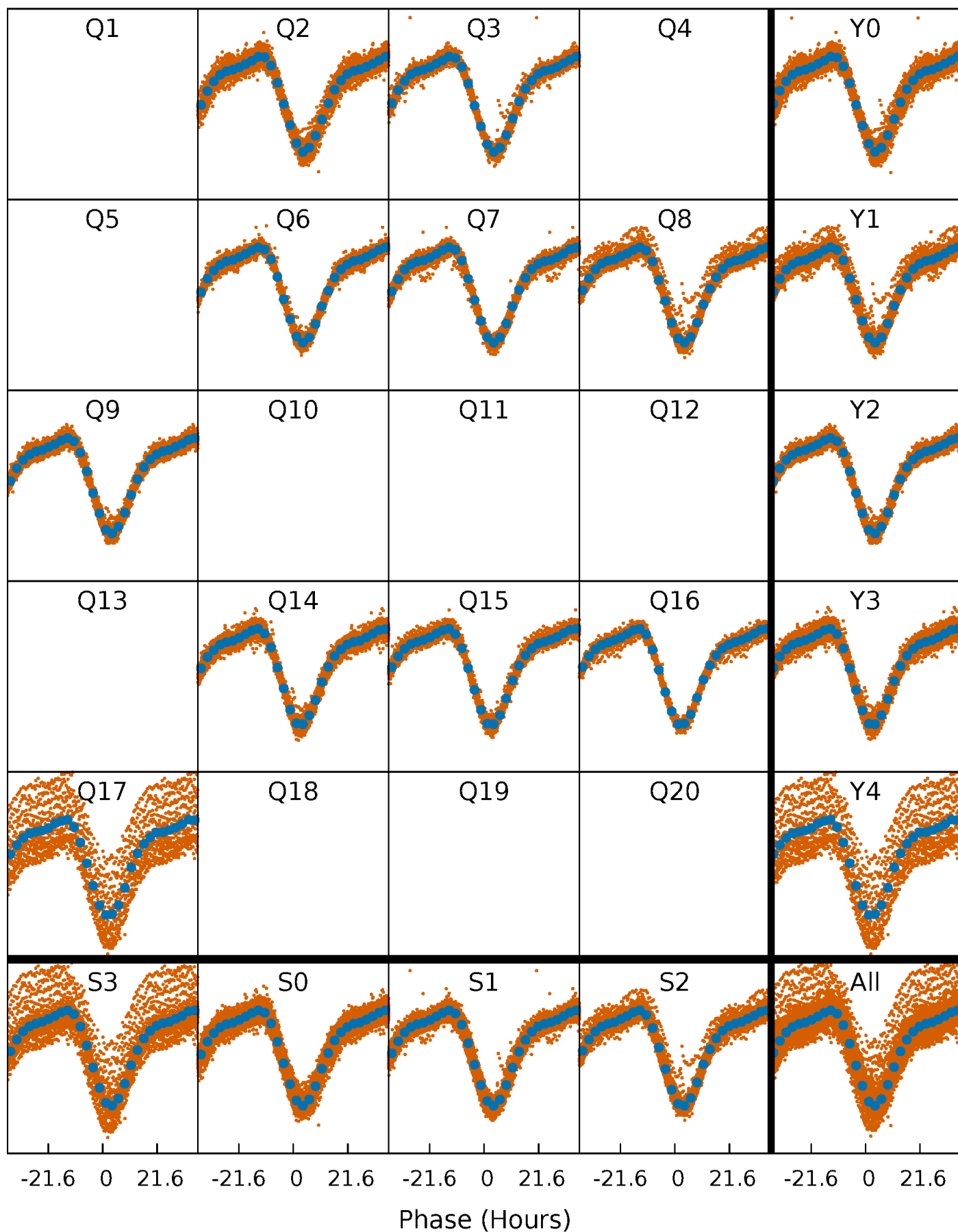


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



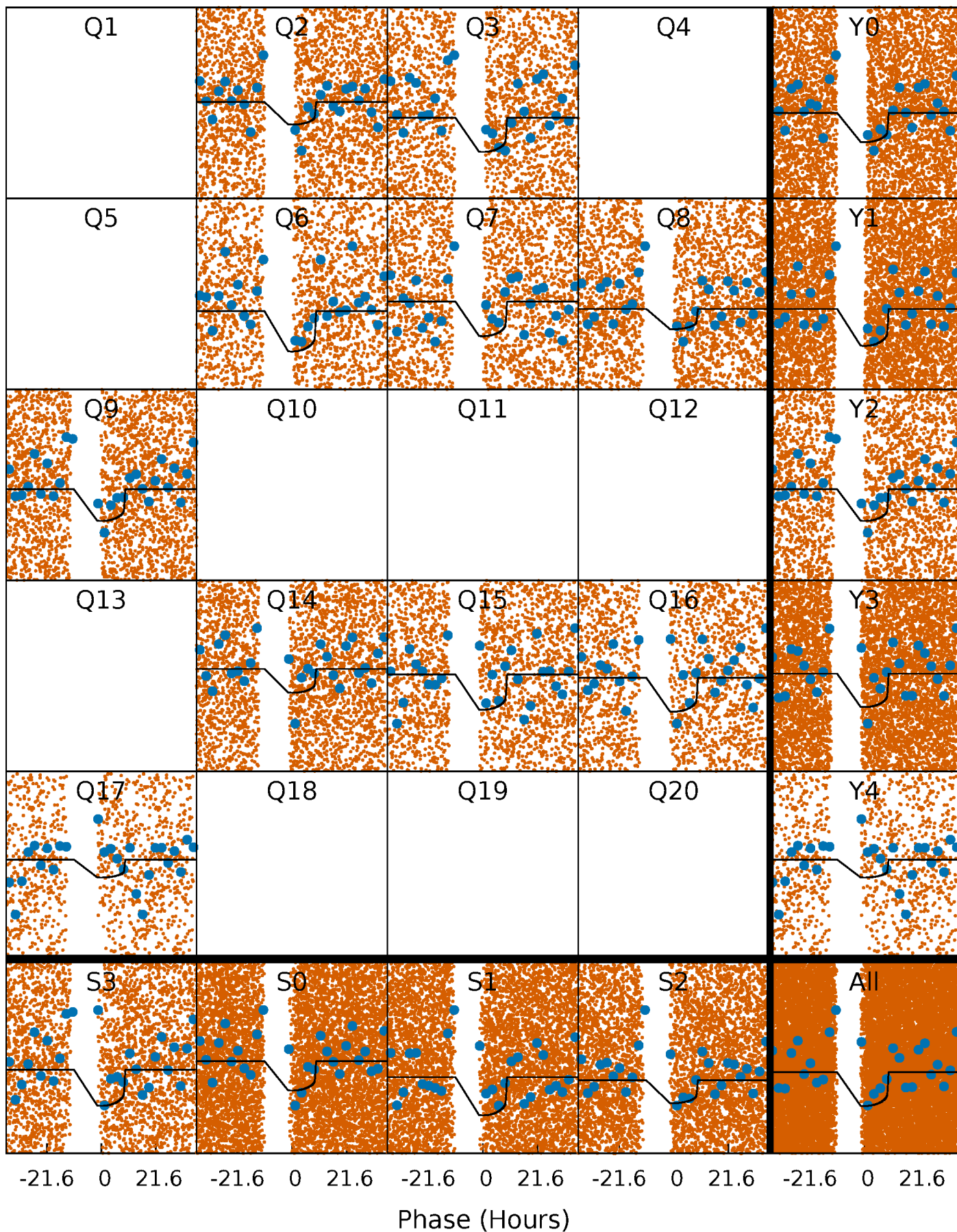
# PDC Quarter-Phased Transit Curves

TCE 004831616-02 P= 2.091254 Days  $T_0=133.005095$  (BKJD)



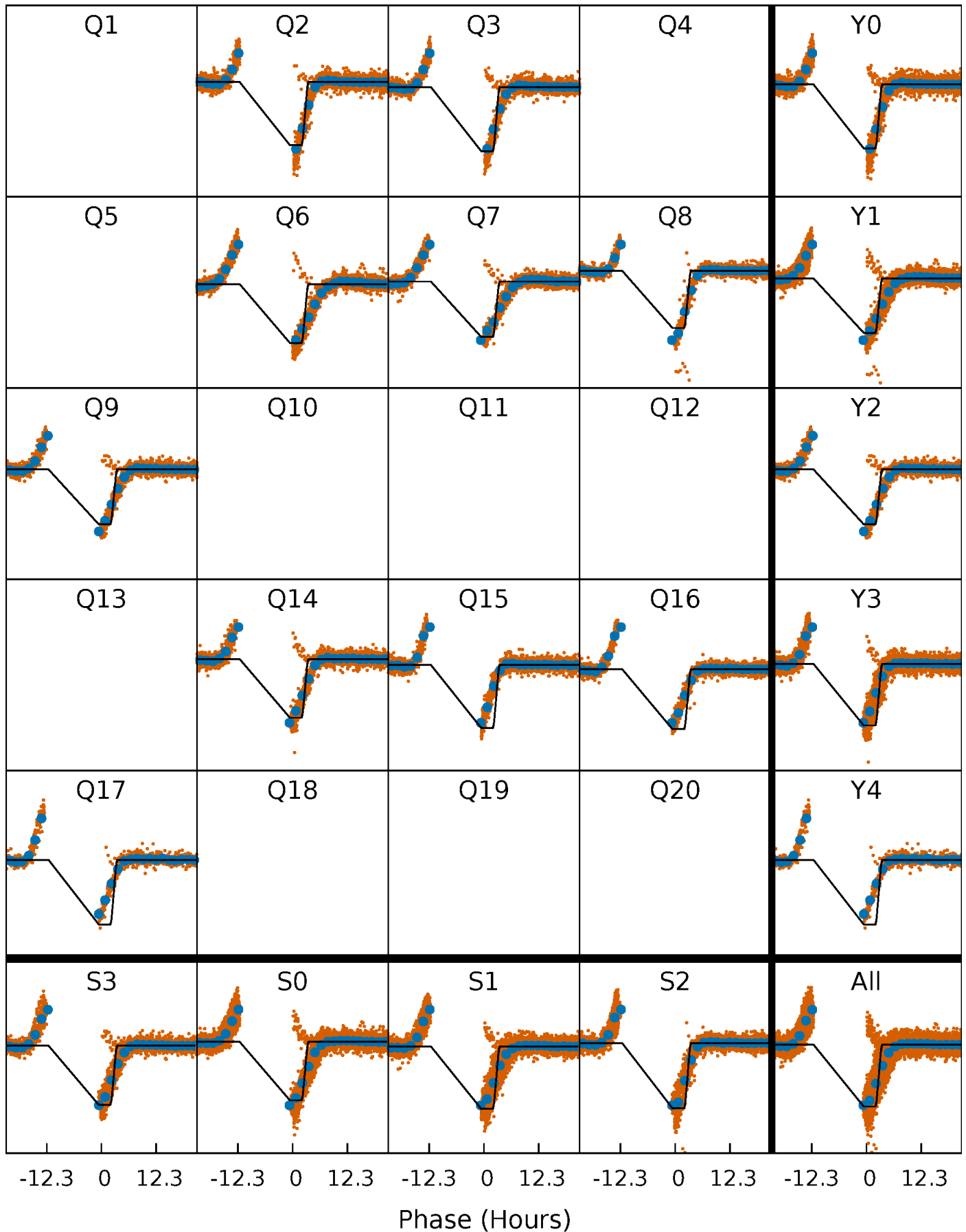
# DV Quarter-Phased Transit Curves

TCE 004831616-02 P= 2.091254 Days  $T_0=133.005095$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

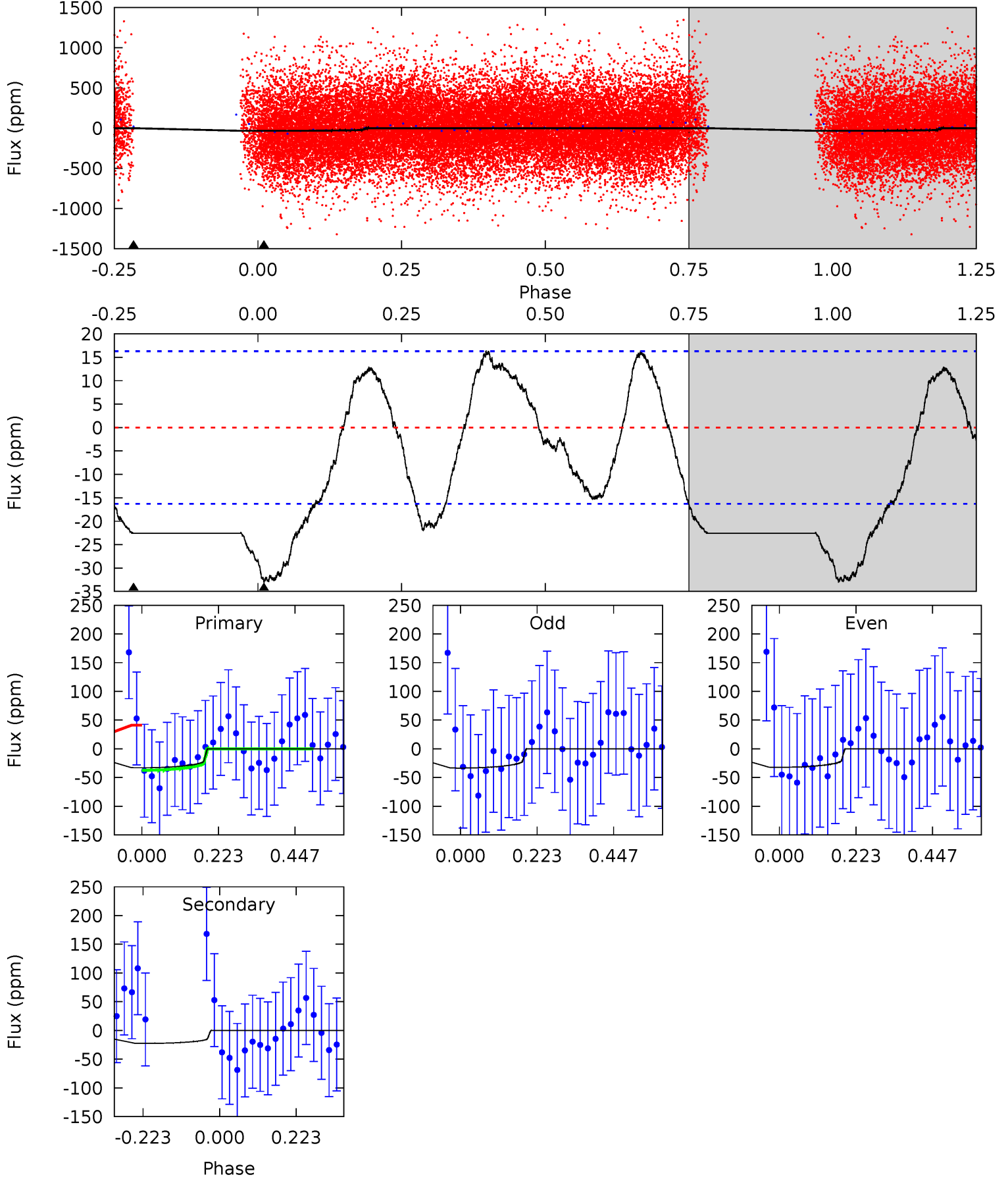
TCE 004831616-02     $P = 2.091134$  Days     $T_0 = 133.050523$  (BKJD)



# DV Model-Shift Uniqueness Test

004831616-02, P = 2.091254 Days, E = 133.005095 Days

Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
8.92	6.09	0	0	4.39	1.22	2.71	8.92	8.92	6.09	6.09	0.18	1.00	0.33	0.22

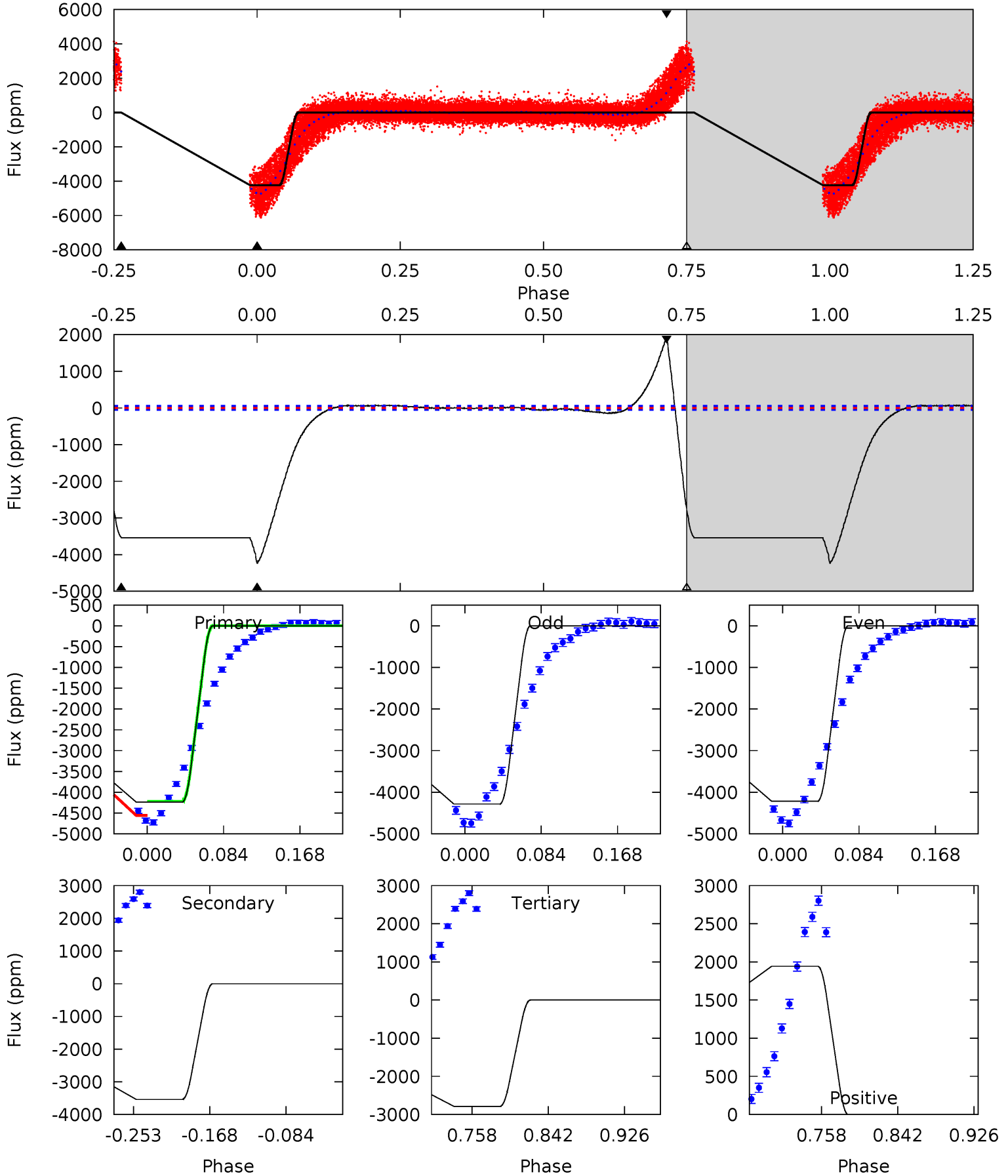




# Alt Model-Shift Uniqueness Test

004831616-02, P = 2.091134 Days, E = 133.050523 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
356.8	298.1	234.8	163.7	4.60	1.73	37.9	122.1	193.1	63.4	134.4	2.87	0.92	0.31	3.13





### Stellar Parameters For KIC 004831616

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$\rho_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$11287^{+587}_{-1762}$	$3.642^{+0.510}_{-0.090}$	$0.070^{+0.150}_{-0.600}$	$4.662^{+0.461}_{-2.613}$	$3.471^{+0.069}_{-1.265}$	$0.048^{+0.302}_{-0.015}$
	+5%/-16%	+14%/-2%	+214%/-857%	+10%/-56%	+2%/-36%	+626%/-31%
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 004831616-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	-23±4	$3.18^{+2.26}_{-1.78}$	$6402^{+776}_{-1135}$	$7745^{+7124}_{-2173}$	$2.789^{+10.703}_{-1.837}$
Alt.	-3539±12	$32.80^{+4.75}_{-9.07}$	$6413^{+761}_{-1122}$	$9730^{+943}_{-1246}$	$4.202^{+2.808}_{-0.985}$

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

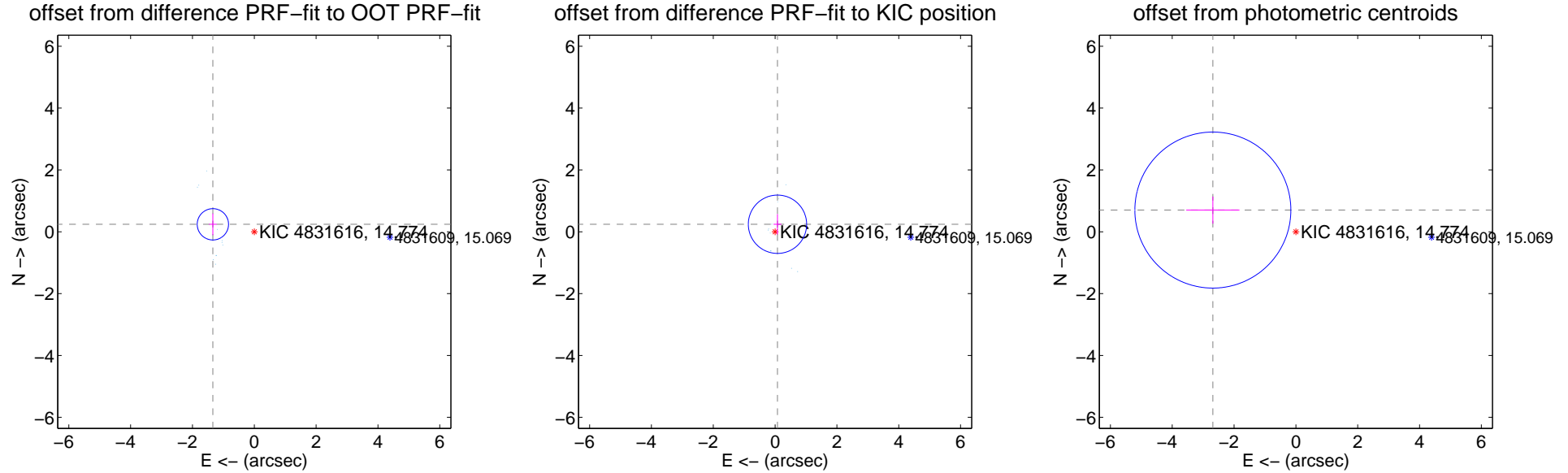
## DV Centroid Data

Supplemental centroid analysis for 004831616-02. Kepler magnitude: 14.77. Transit SNR 9.13

There are 10 quarters with good PRF difference image offsets

The direct PRF centroid is offset from the target star catalog position by about 1.10 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.361 \pm 0.169$	8.06	$1.340 \pm 0.123$	$0.241 \pm 0.350$
PRF-fit source offset from KIC position	$0.255 \pm 0.314$	0.81	$-0.077 \pm 0.126$	$0.243 \pm 0.327$
photometric centroid source offset	$2.78 \pm 0.84$	3.30	$2.69 \pm 0.86$	$0.70 \pm 0.44$



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.

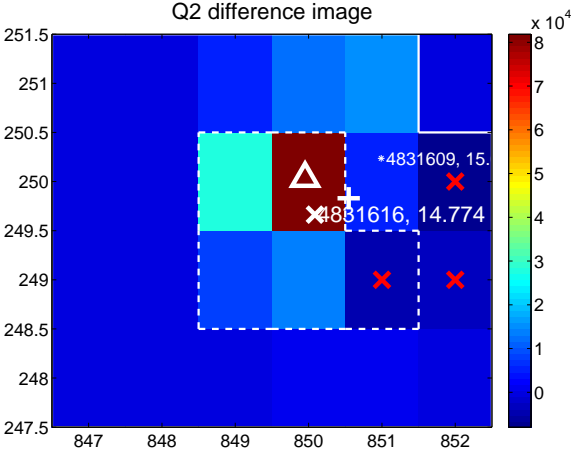
Q1 no difference image



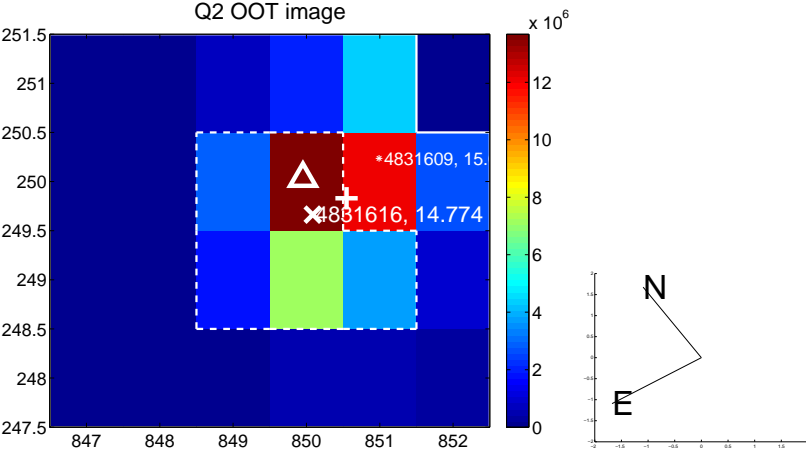
Q1 no OOT image



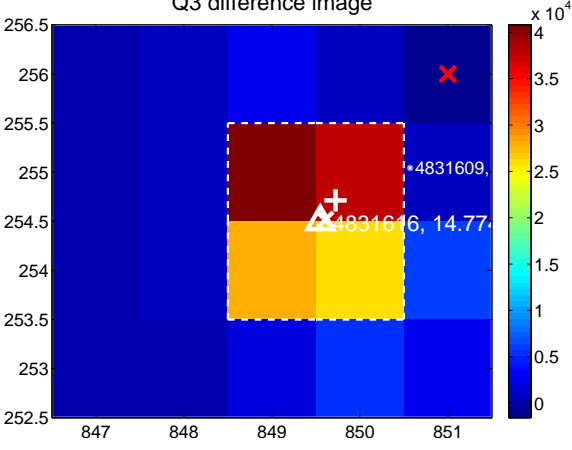
Q2 difference image



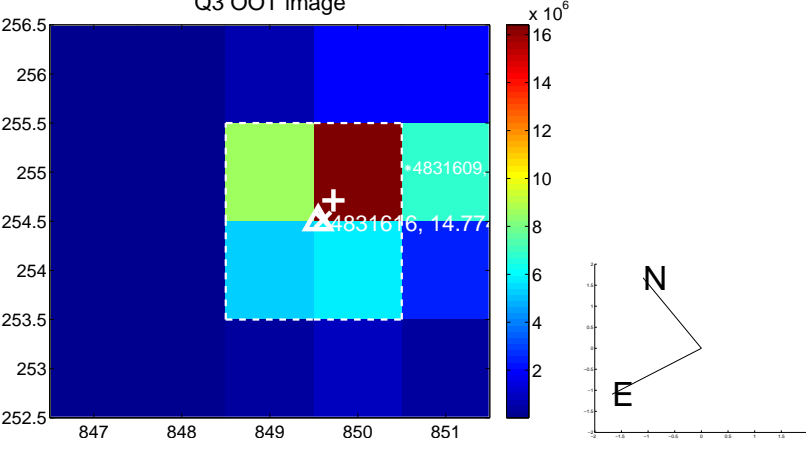
Q2 OOT image



Q3 difference image



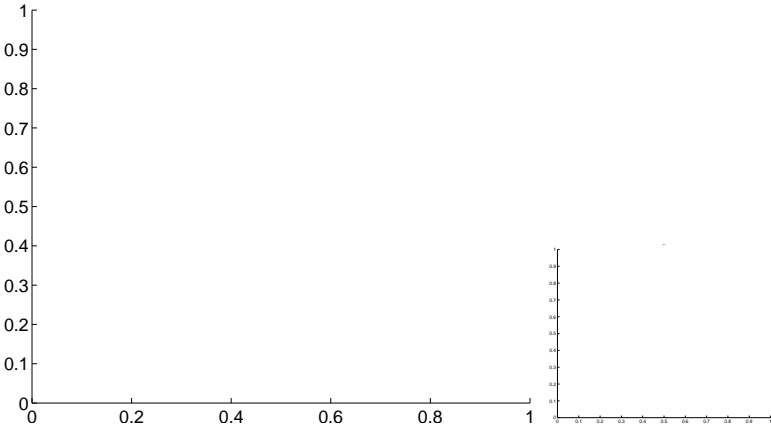
Q3 OOT image



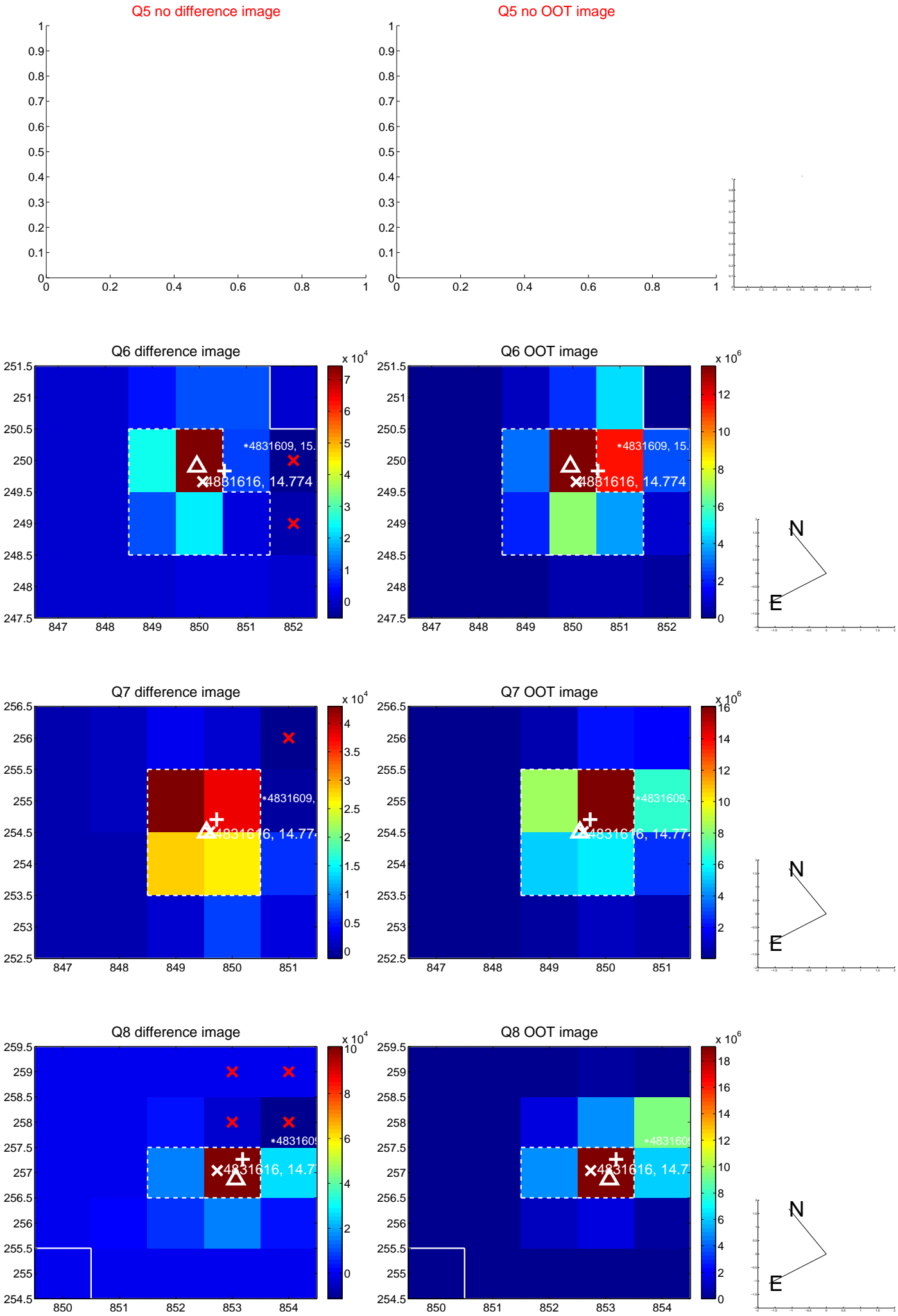
Q4 no difference image



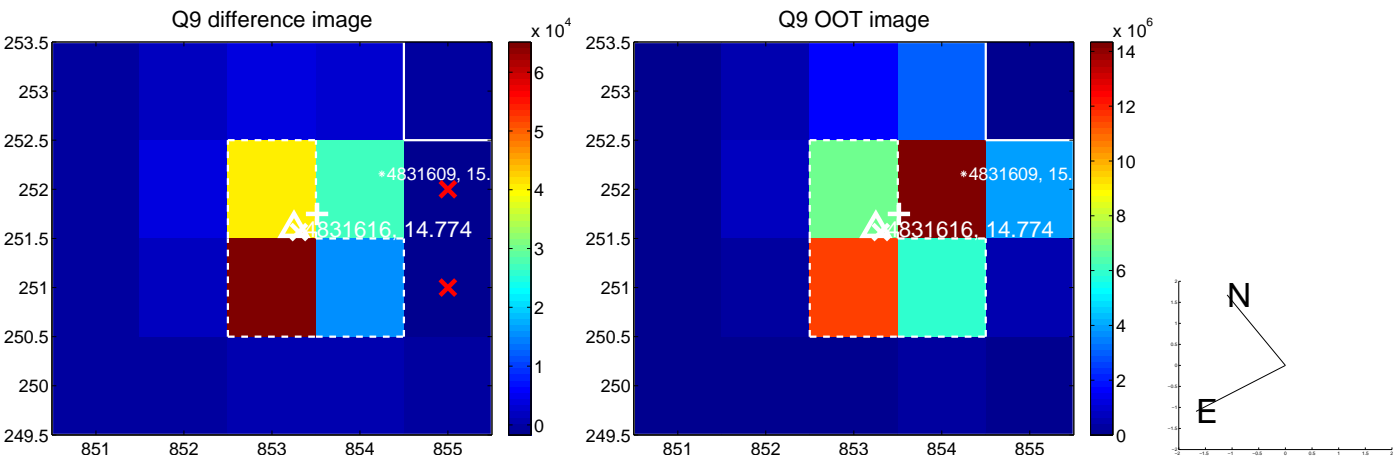
Q4 no OOT image



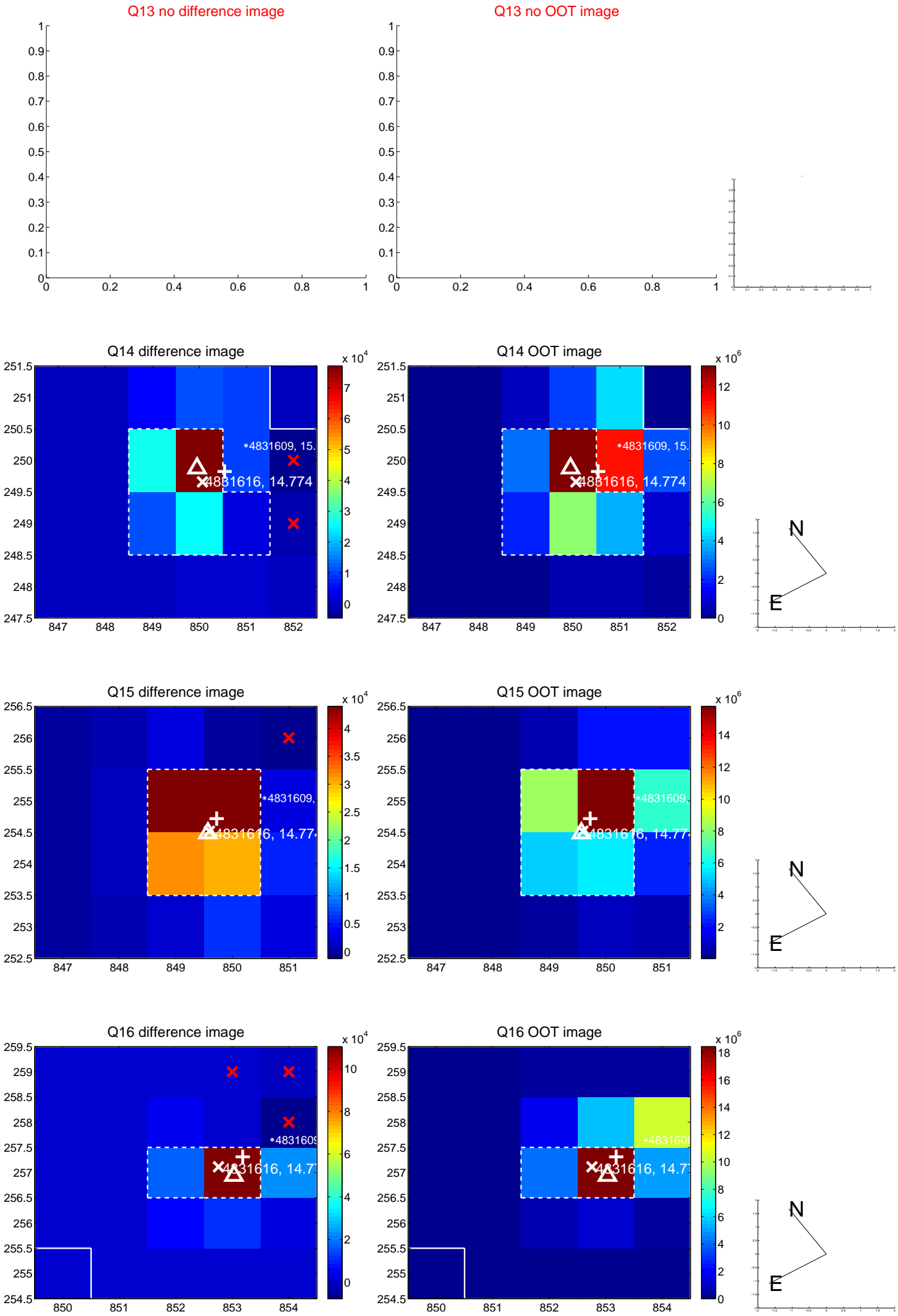
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



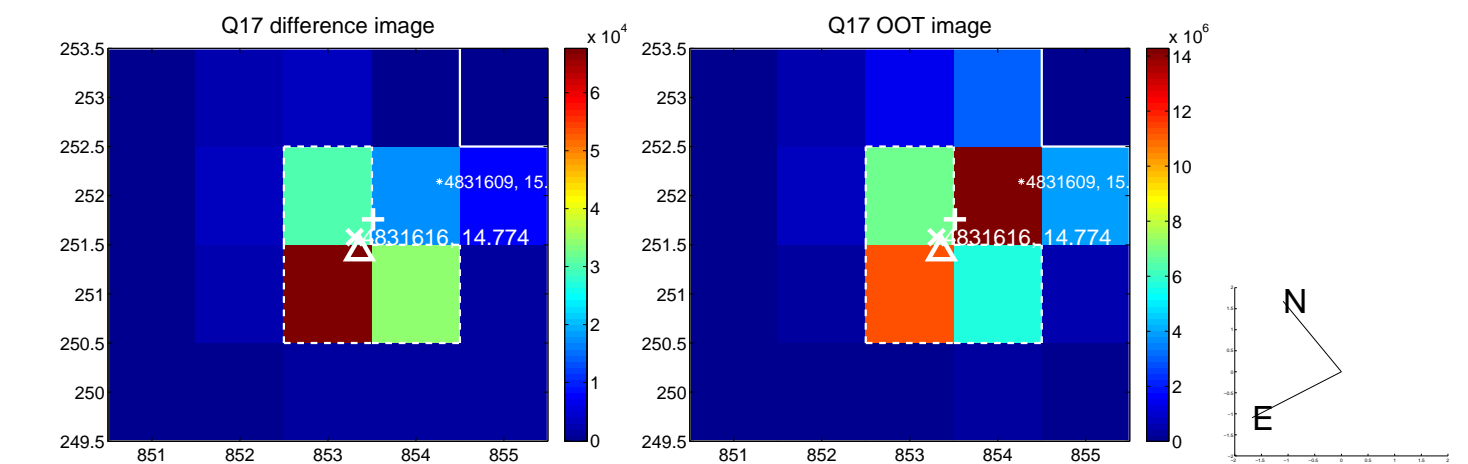
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



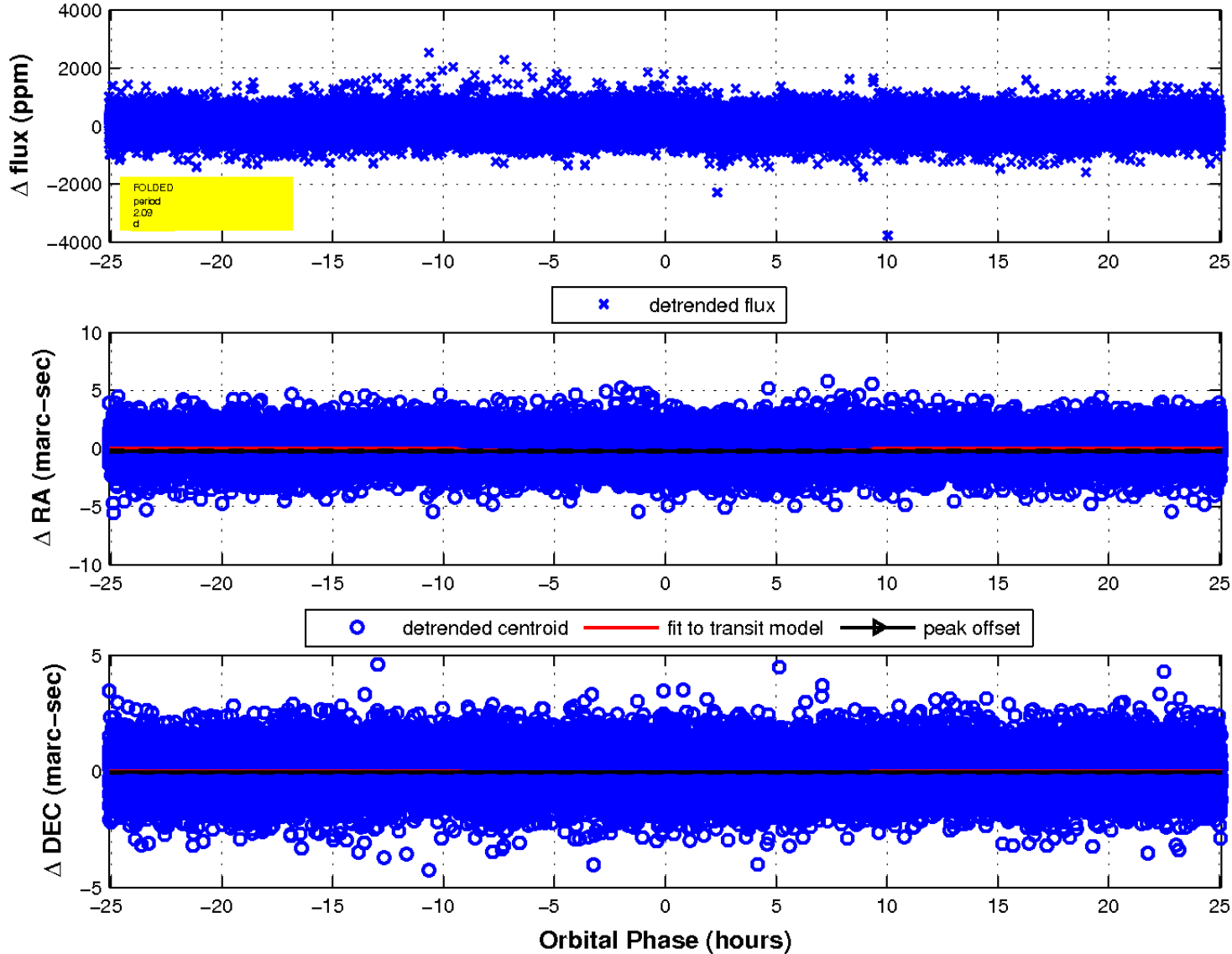
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



fluxWeightedCentroids, Planet 2 of 2



UKIRT Image

Declination

