

# KIC 008415863

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
008415863-01	OBS	7037.01	27.533803	147.241010	48063.5	3.969	5528.6	5346.7	1.61	5925	52.02	86.14
008415863-02	OBS	No	27.533869	157.163954	678.4	3.217	76.0	74.7	1.61	5925	7.44	86.14

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
008415863-01	OBS	FP	0.00	0	1	0	0	MOD_SEC_DV—MOD_SEC_ALT—DEEP_V_SHAPED—HAS_SEC_TCE
008415863-02	OBS	FP	0.00	1	1	0	0	IS_SEC_TCE

**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.

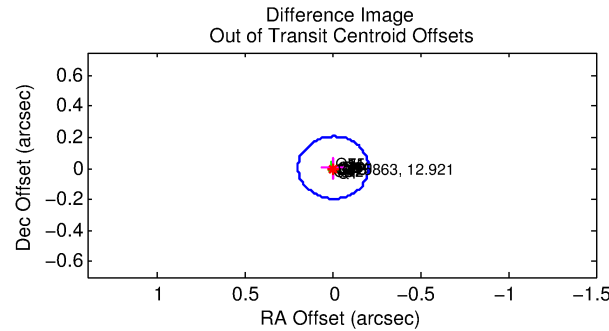
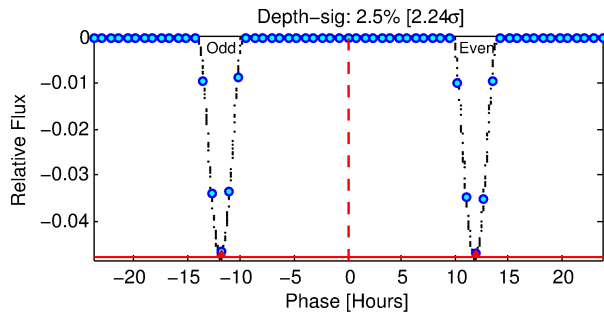
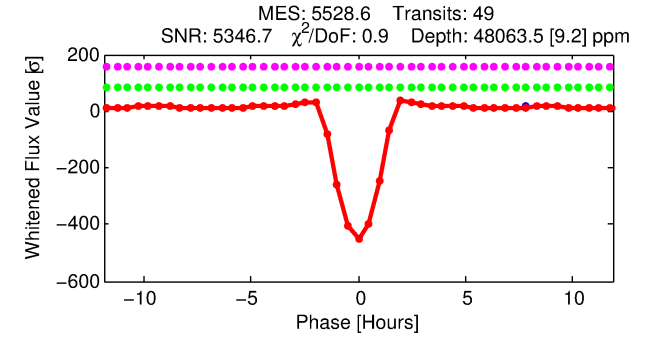
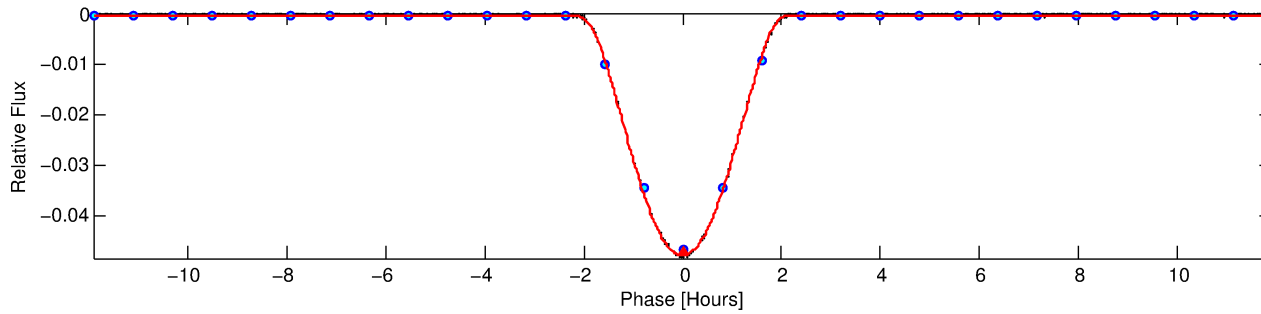
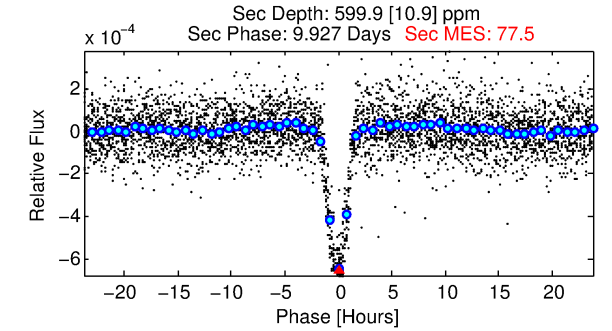
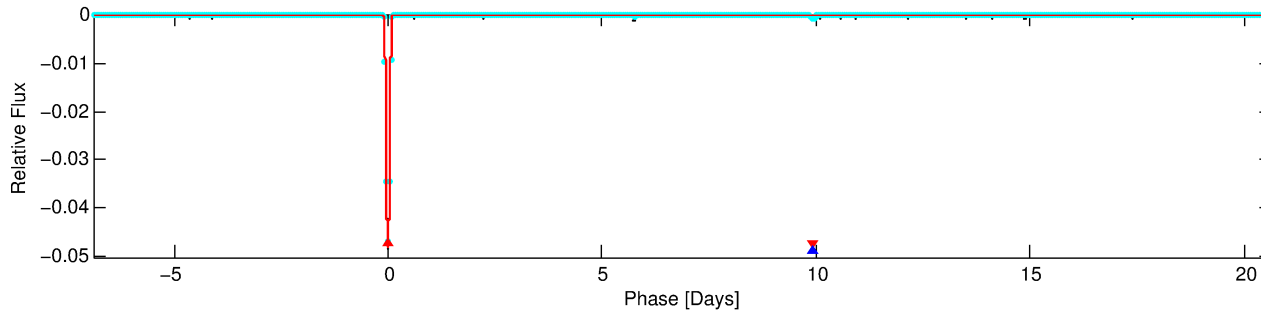
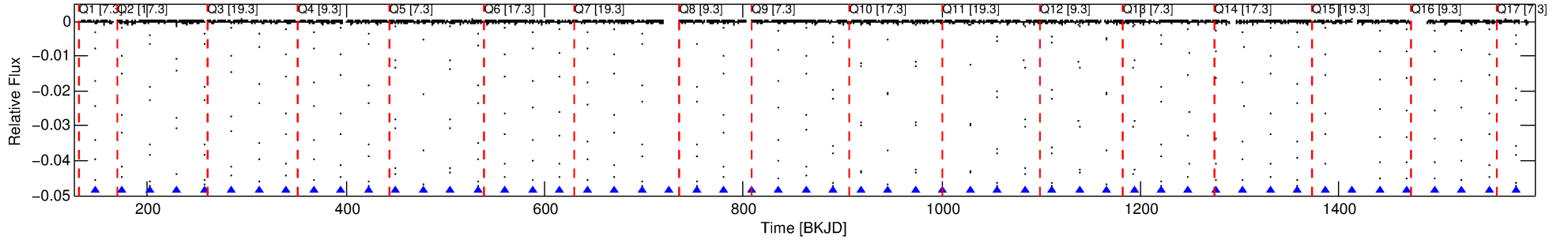
## Ephemeris Match Information For 008415863-01

No Significant Match Found

# DV One-Page Summary

KIC: 8415863 Candidate: 1 of 2 Period: 27.534 d  
KOI: K07037.01 Corr: 0.999

Kp: 12.92 R\*: 1.61 Rs Teff: 5925.0 K Logg: 4.05 Fe/H: -0.060



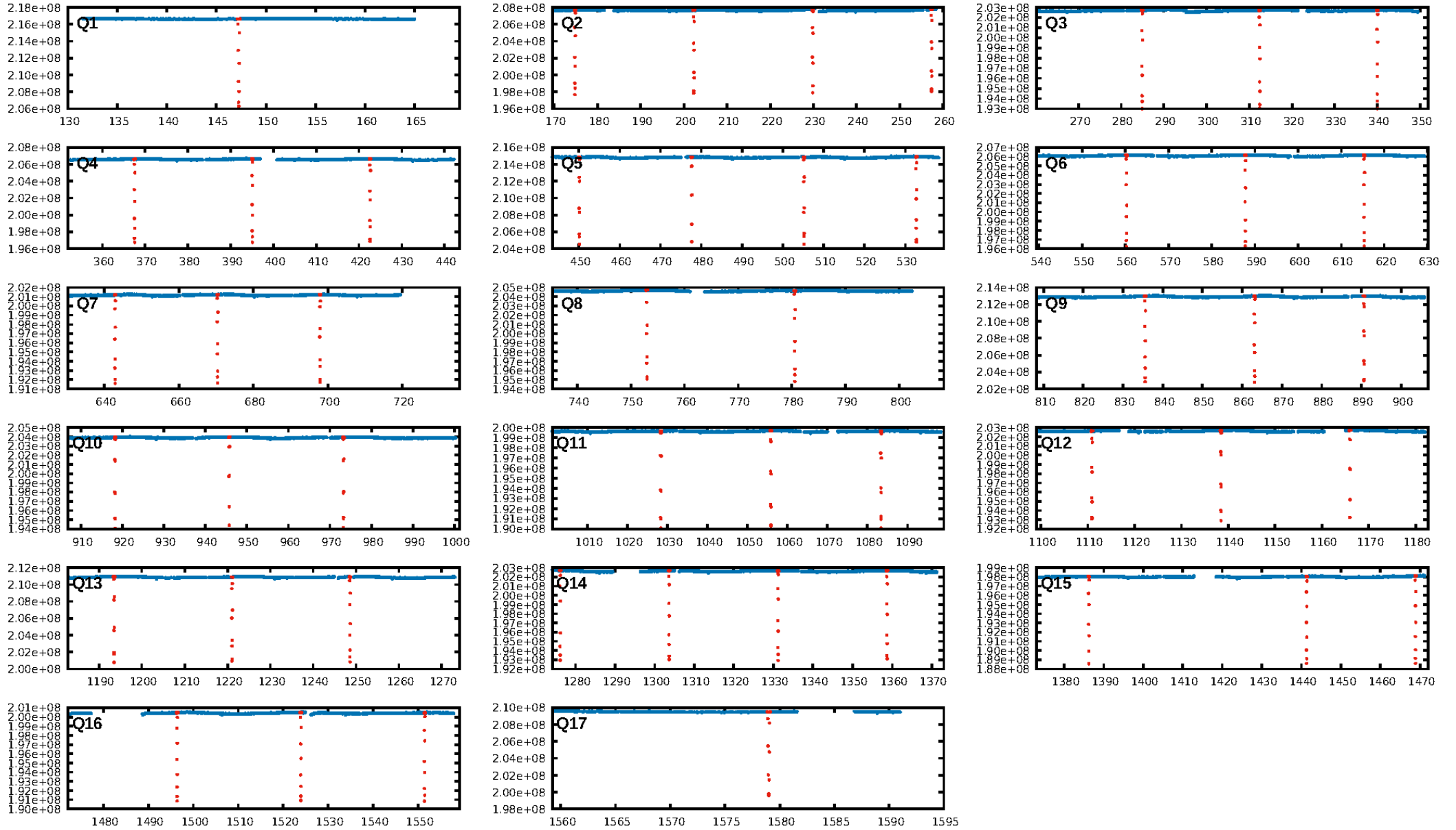
## DV Fit Results:

Period = 27.53380 [0.00000] d  
Epoch = 147.2410 [0.0000] BKJD  
Rp/R\* = 0.2959 [0.0022]  
a/R\* = 48.00 [0.03]  
b = 0.93 [0.00]  
Seff = 86.14 [52.37]  
Teff = 777 [118] K  
Rp = 52.02 [19.22] Re  
a = 0.1824 [0.0665] AU  
Ag = 4.06 [2.40] [1.27σ]  
Teffp = 1705 [62] K [6.97σ]

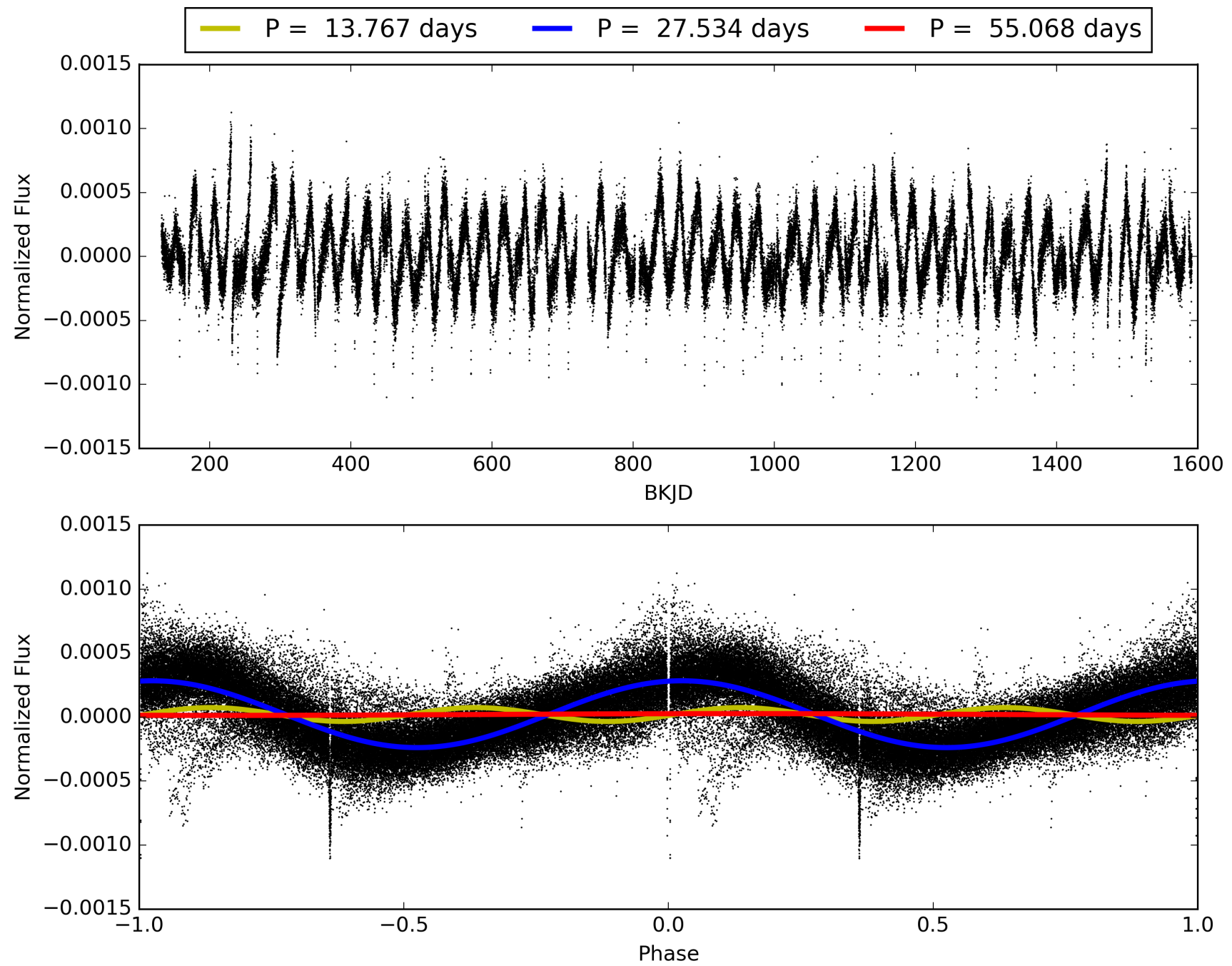
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 0.0% [0.00σ]  
ModelChiSquare2-sig: 0.0%  
ModelChiSquareGof-sig: 93.2%  
Bootstrap-pfa: 0.00e+00  
RollingBand-fgt: 1.00 [47/47]  
GhostDiagnostic-chr: 14.55  
Centroid-sig: 0.0%  
Centroid-so: 0.127 arcsec [70.18σ]  
OotOffset-rm: 0.007 arcsec [0.10σ]  
OotOffset-st: 4/4/4/5 [17]  
KicOffset-rm: 0.225 arcsec [3.21σ]  
KicOffset-st: 4/4/4/5 [17]  
DiffImageQuality-fgm: 1.00 [17/17]  
DiffImageOverlap-fno: 1.00 [17/17]

# TCE 008415863-01, PDC Light Curves

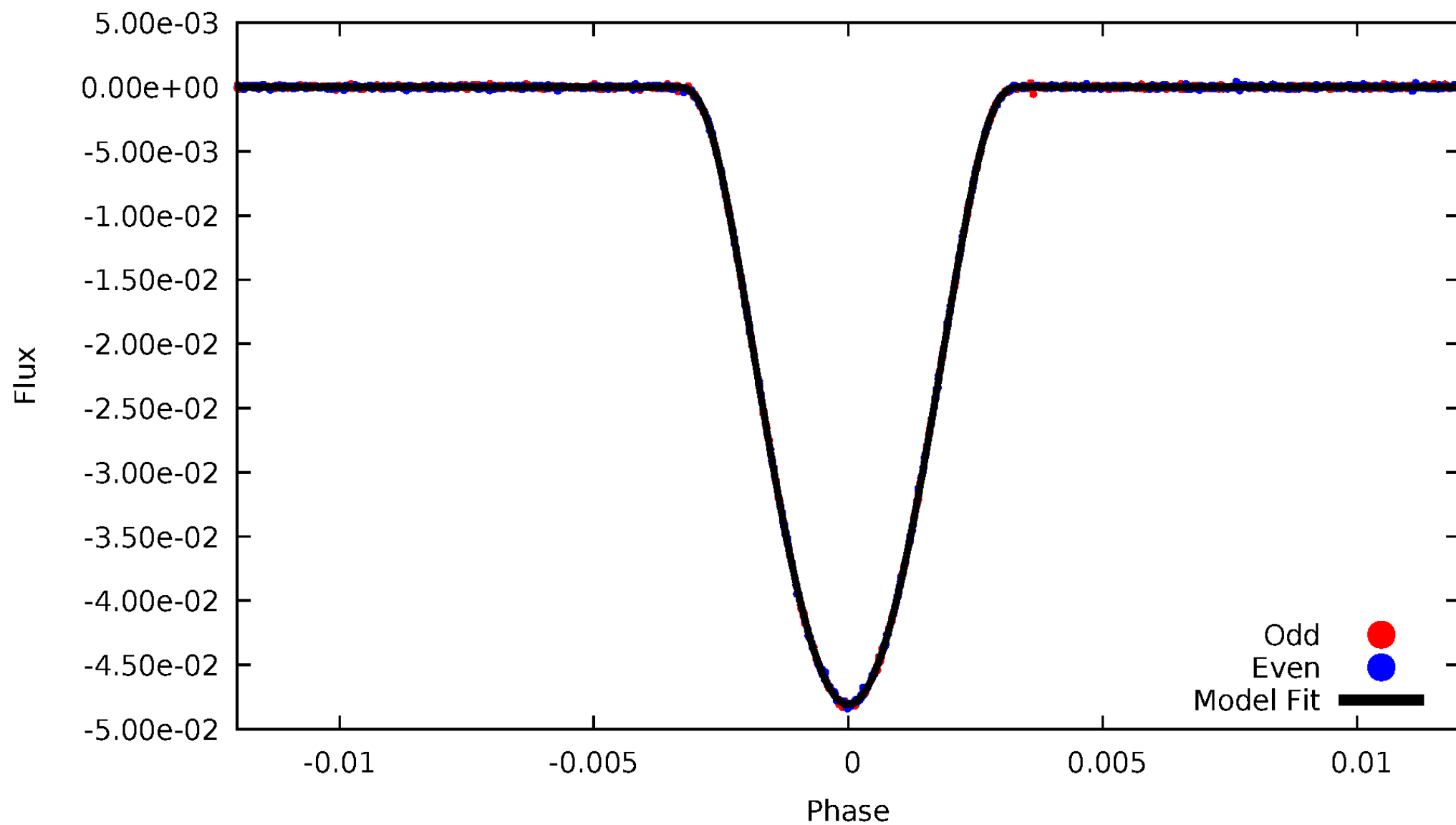


TCE 008415863-01



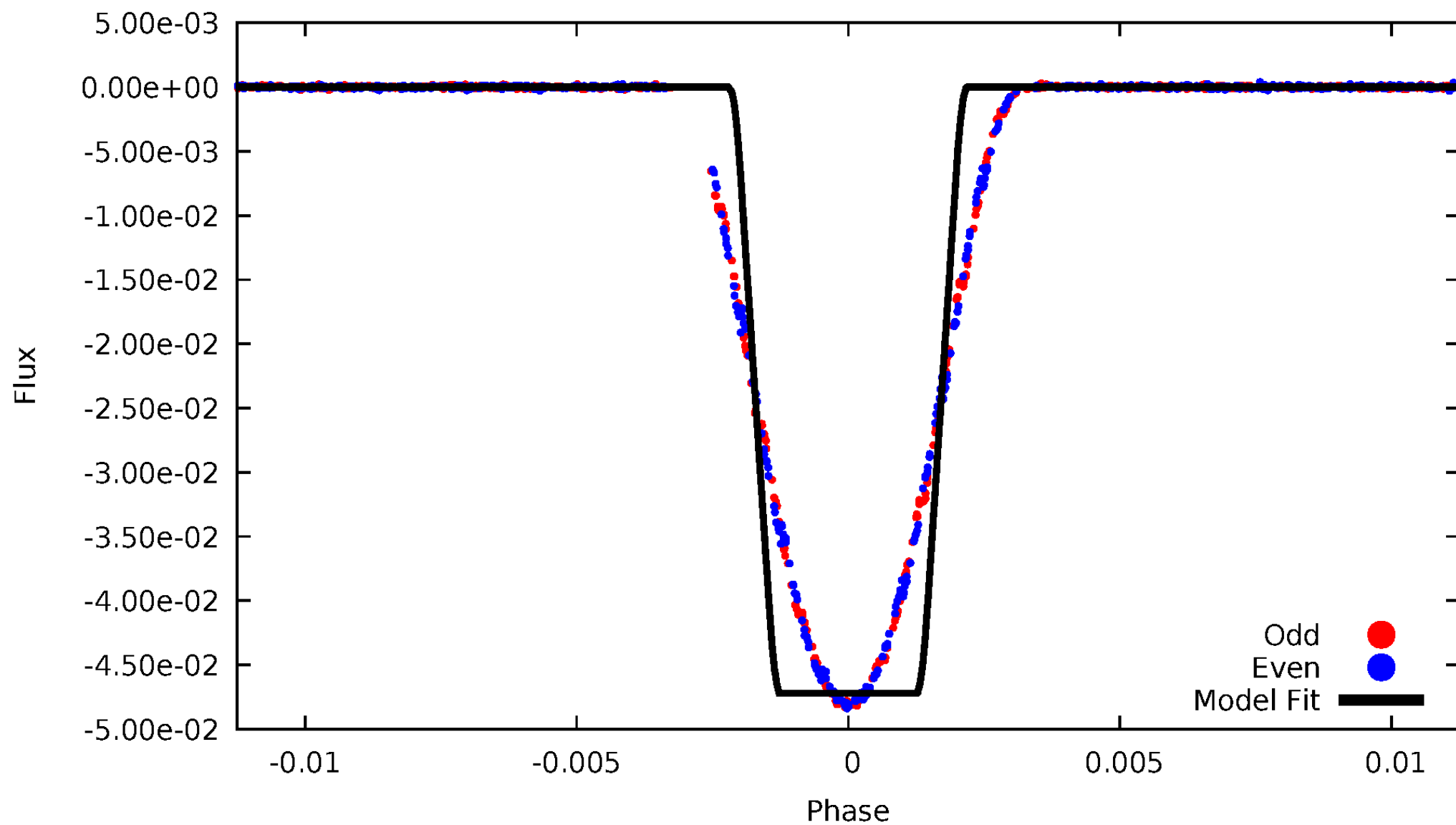
# DV Odd/Even

TCE 008415863-01



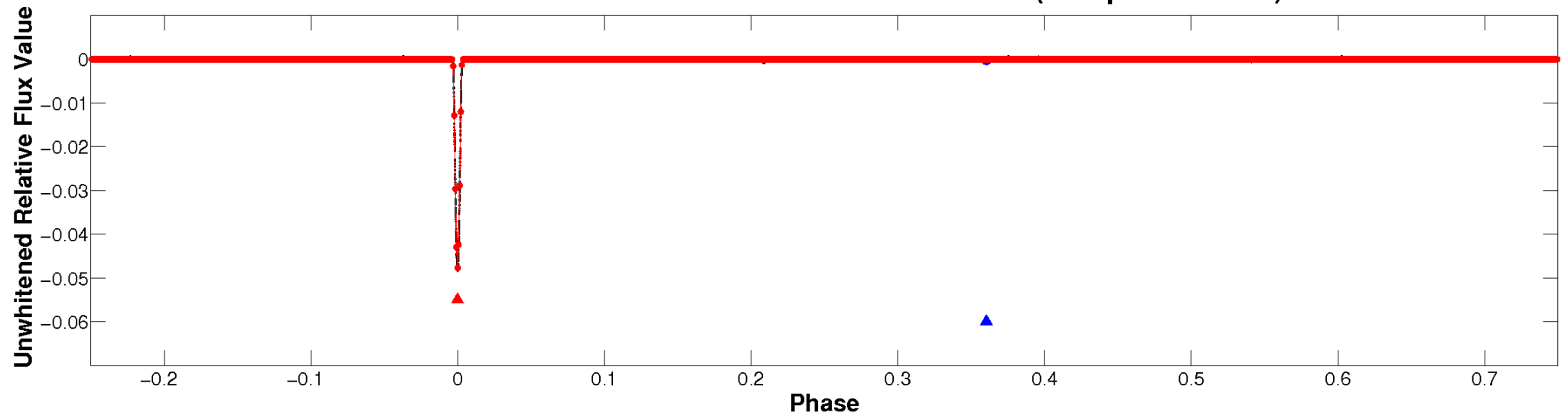
# ALT Odd/Even

TCE 008415863-01

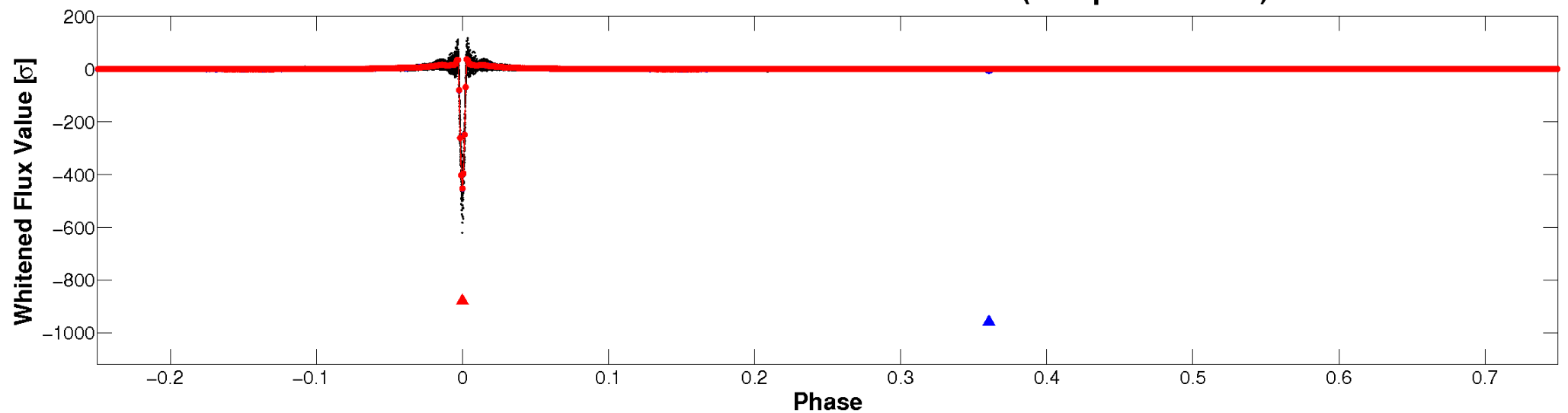


# Non-Whitened Vs. Whitened Light Curve

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

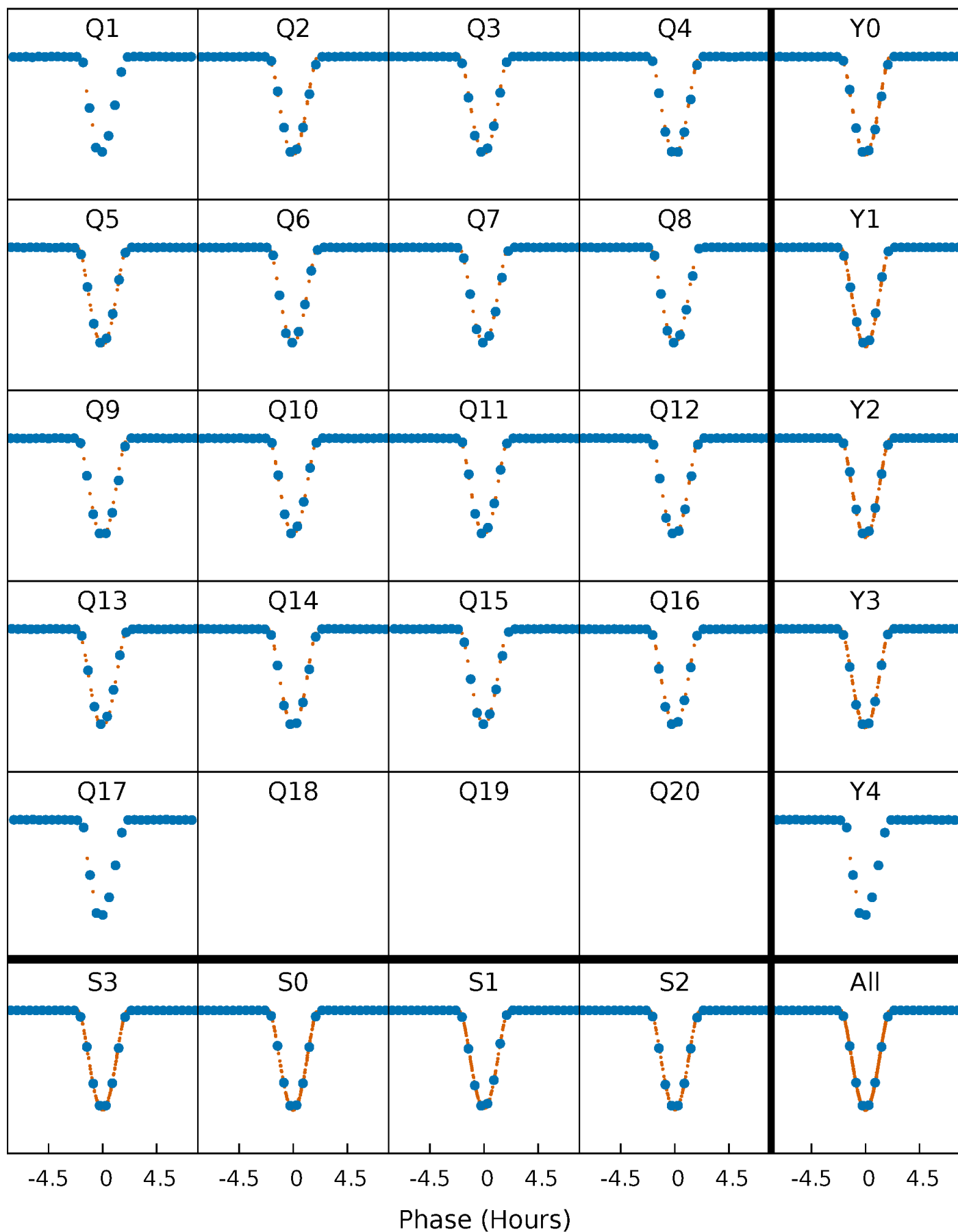


**Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



# PDC Quarter-Phased Transit Curves

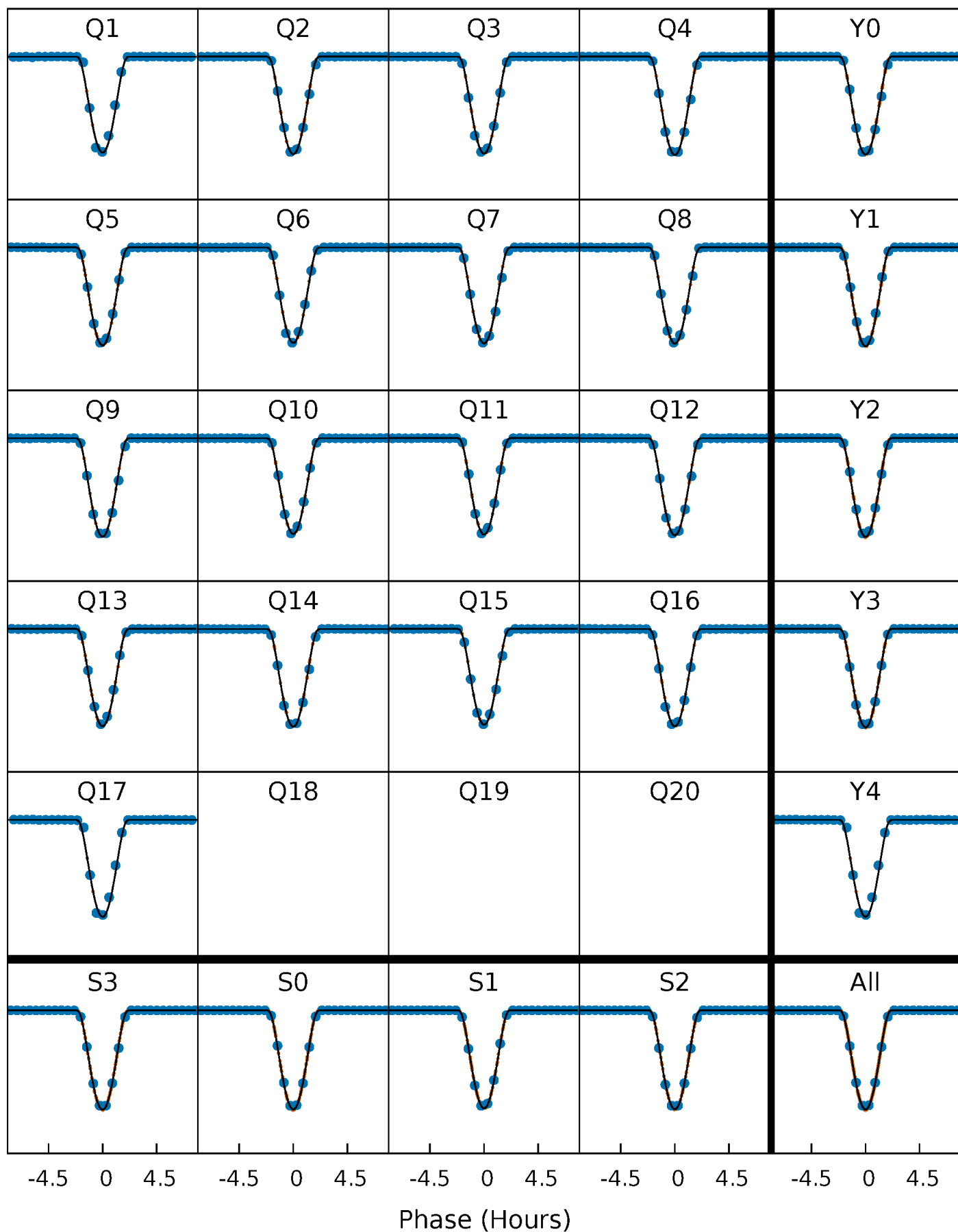
TCE 008415863-01 P= 27.533803 Days  $T_0=147.241010$  (BKJD)





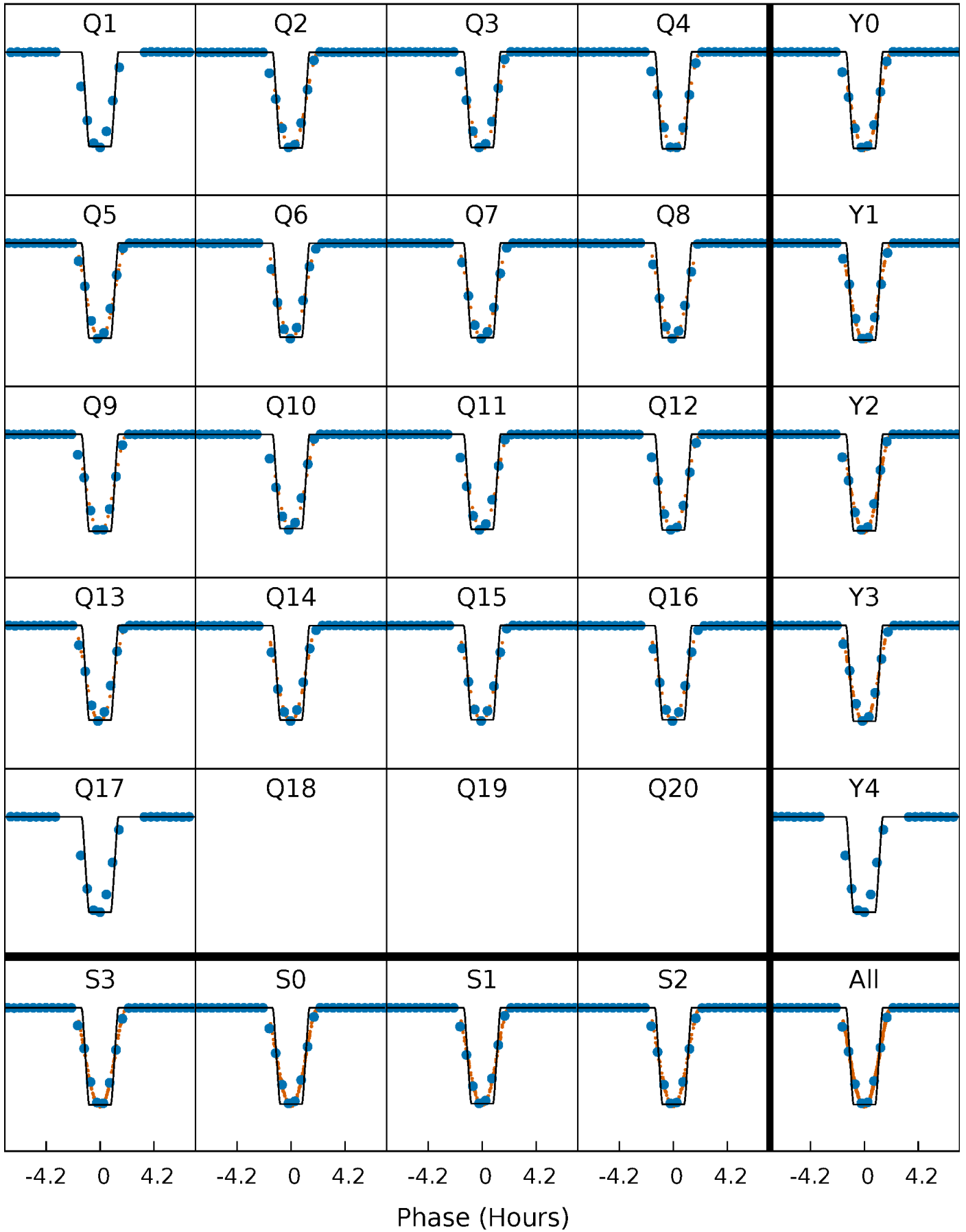
# DV Quarter-Phased Transit Curves

TCE 008415863-01 P= 27.533803 Days  $T_0=147.241010$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

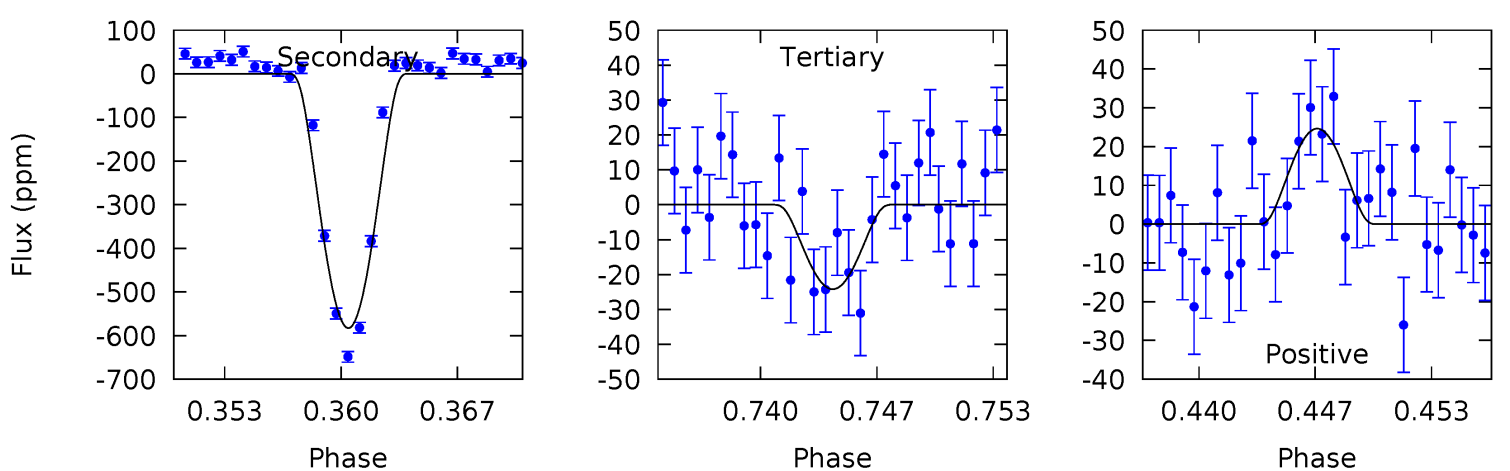
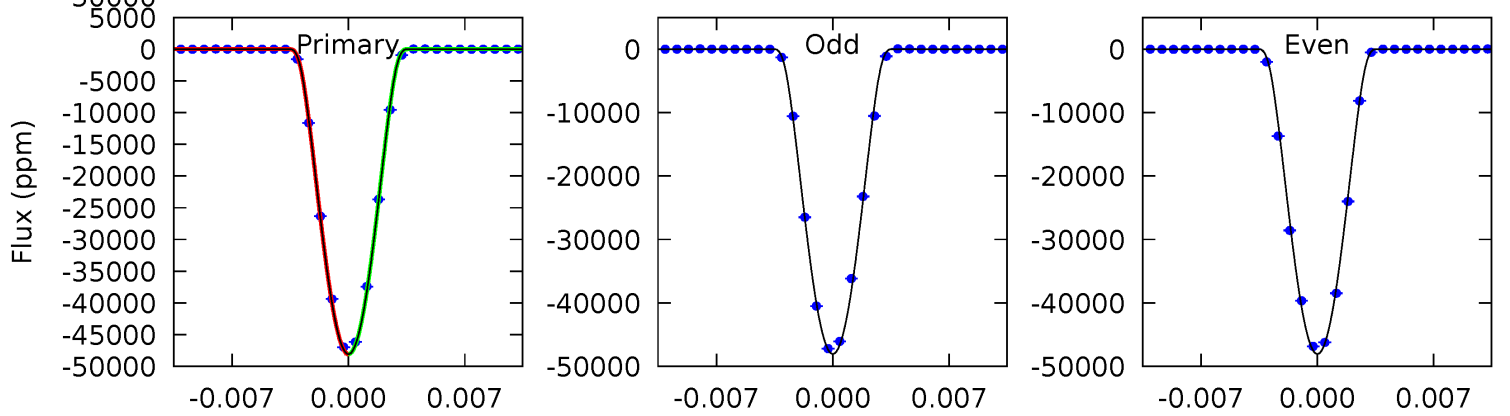
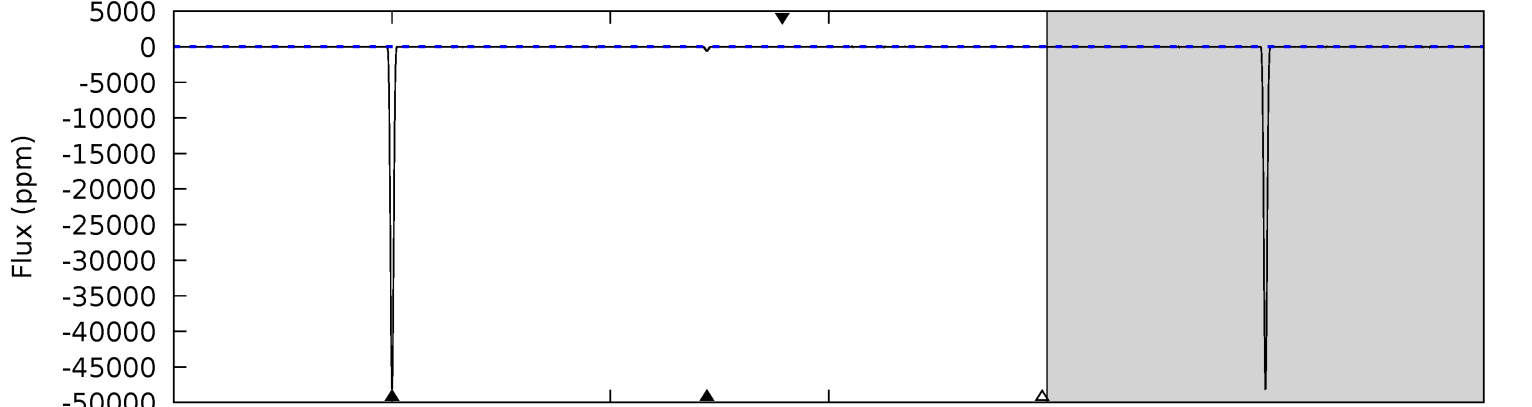
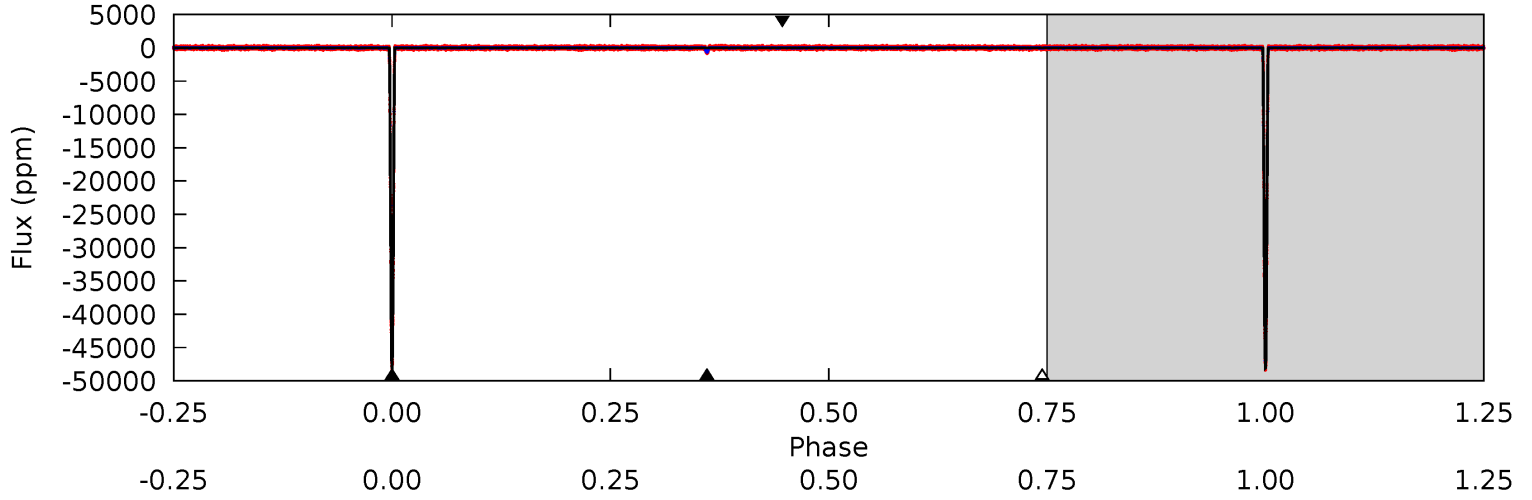
TCE 008415863-01 P= 27.533856 Days  $T_0=147.239679$  (BKJD)



# DV Model-Shift Uniqueness Test

008415863-01, P = 27.533803 Days, E = 119.707207 Days

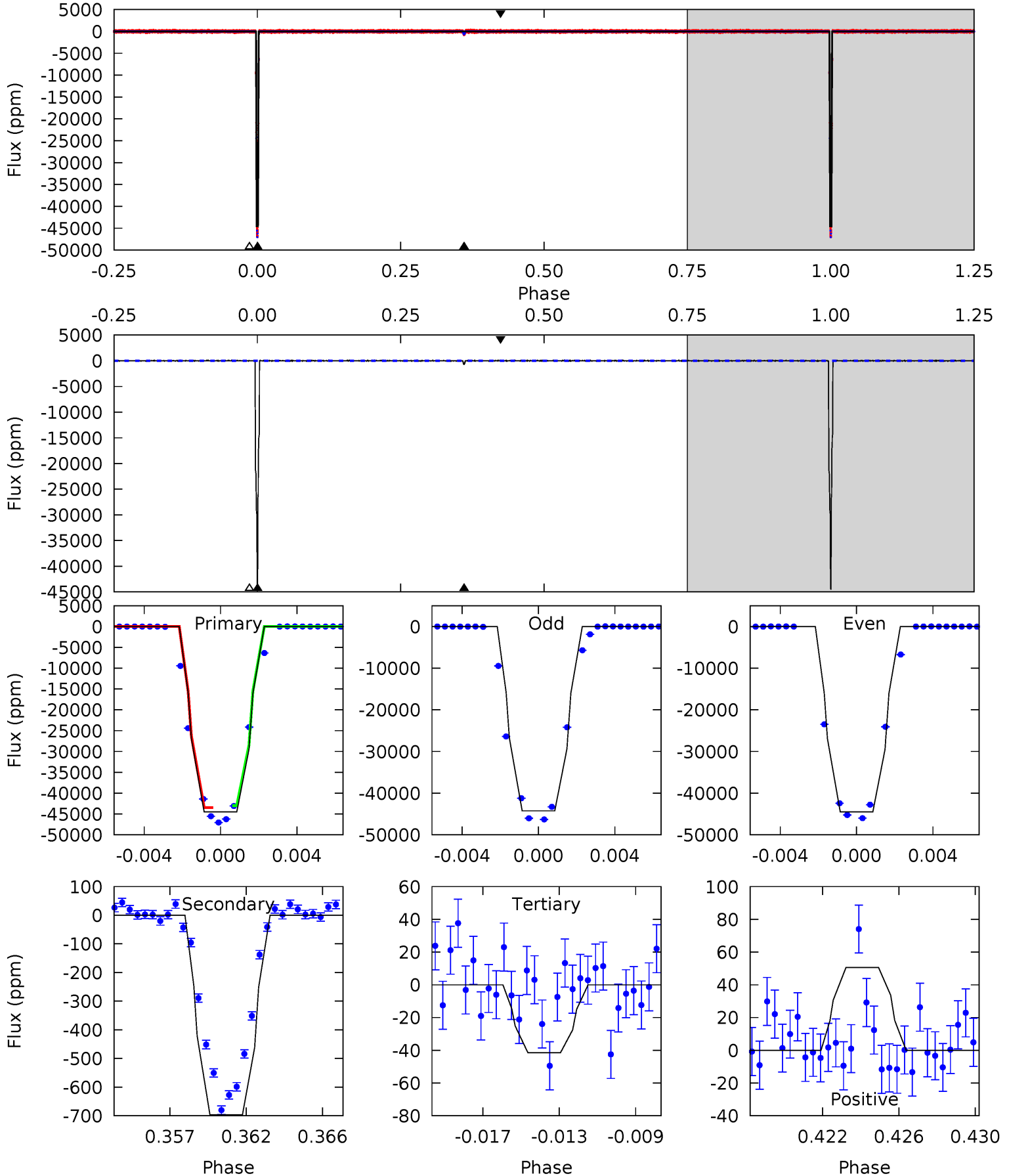
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
10953	132.8	5.52	5.61	5.10	2.71	2.05	10948	10948	127.3	127.2	0.12	1.00	0.00	0.17



# Alt Model-Shift Uniqueness Test

008415863-01, P = 27.533856 Days, E = 119.705823 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
4218	66.0	3.94	4.80	5.19	2.85	1.24	4214	4213	62.1	61.2	13.8	1.00	0.00	0



### Stellar Parameters For KIC 008415863

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5925^{+193}_{-211}$	$4.052^{+0.350}_{-0.150}$	$-0.060^{+0.300}_{-0.300}$	$1.611^{+0.396}_{-0.595}$	$1.066^{+0.163}_{-0.163}$	$0.359^{+0.889}_{-0.145}$
	+3%/-4%	+9%/-4%	+500%/-500%	+25%/-37%	+15%/-15%	+247%/-40%
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 008415863-01 / KOI 7037.01

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-583 \pm 4$	$51.56^{+7.13}_{-10.11}$	$1069^{+83}_{-103}$	$2513^{+41}_{-49}$	$4.100^{+1.952}_{-0.899}$
Alt.	$-697 \pm 11$	$37.78^{+5.31}_{-7.62}$	$1070^{+86}_{-109}$	$2796^{+51}_{-60}$	$9.043^{+4.749}_{-1.974}$

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

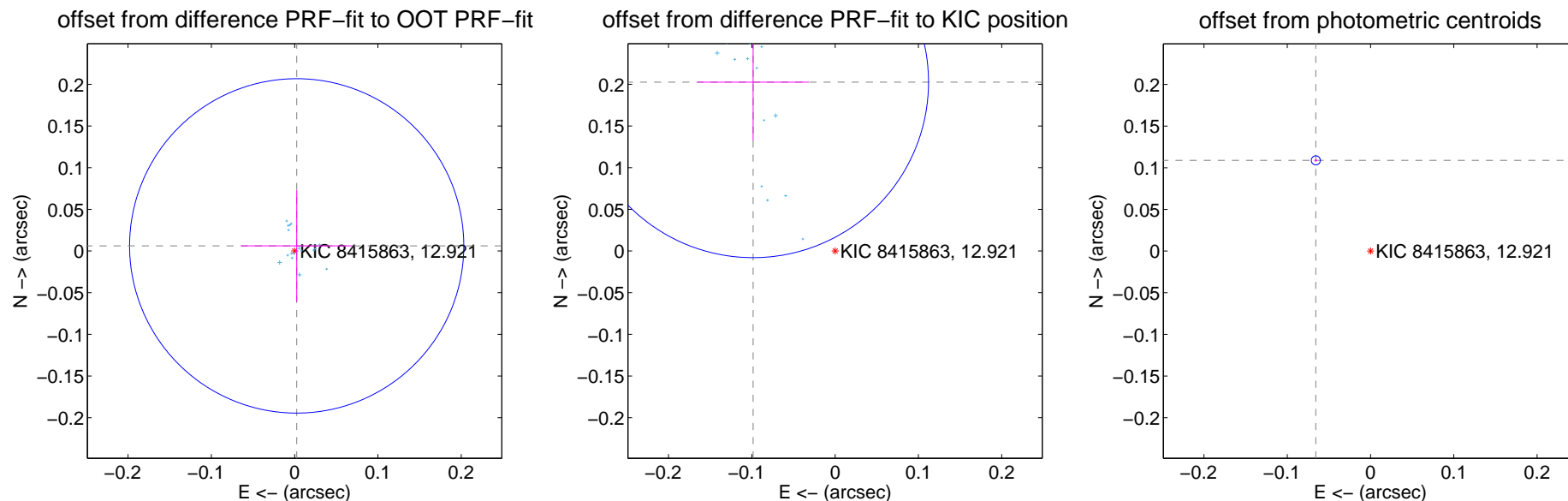
## DV Centroid Data

Supplemental centroid analysis for 008415863-01. Kepler magnitude: 12.92. Transit SNR 5346.70

There are 17 quarters with good PRF difference image offsets

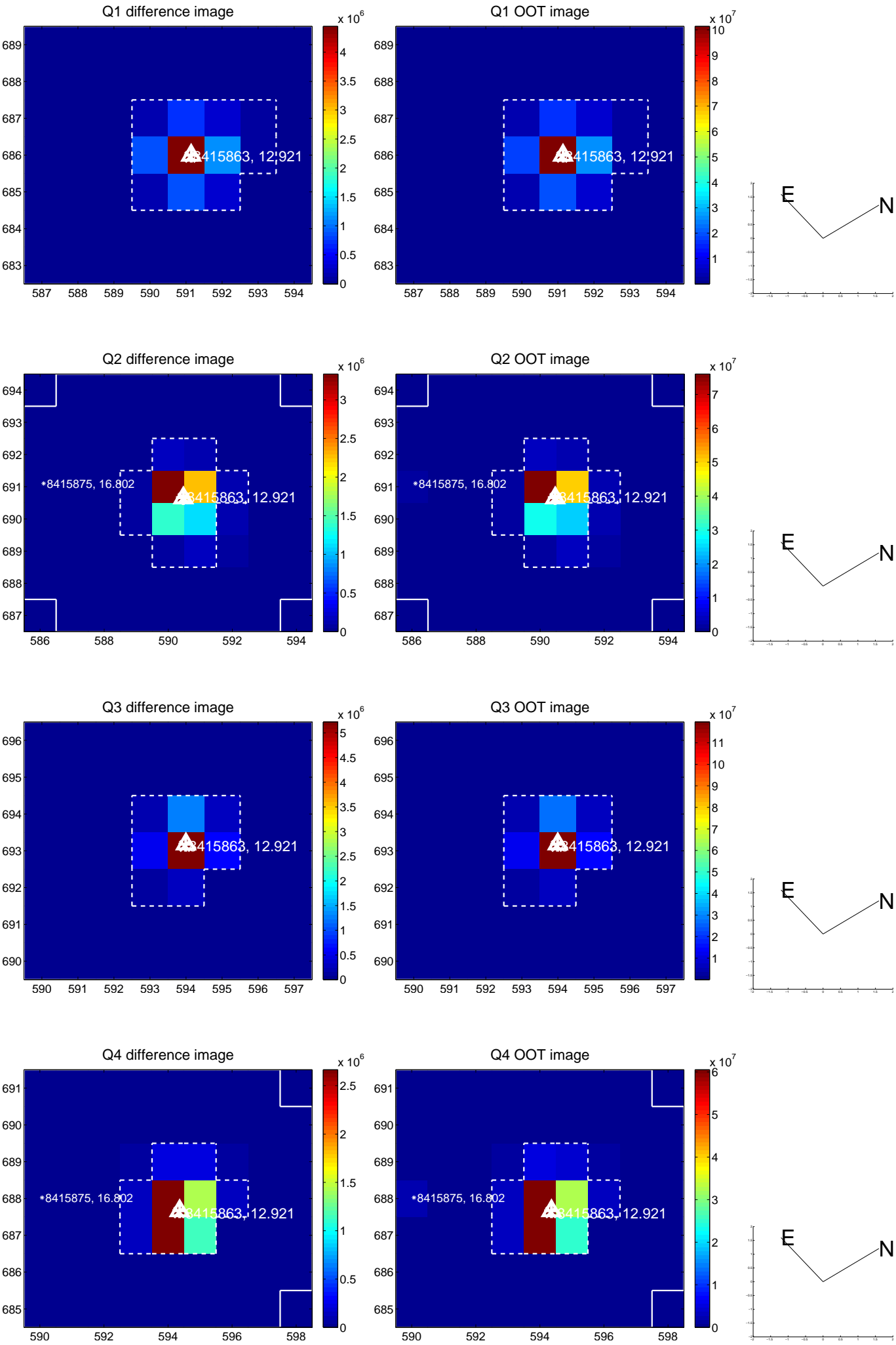
The direct PRF centroid is offset from the target star catalog position by about 0.28 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.007 \pm 0.067$	0.10	$-0.002 \pm 0.067$	$0.006 \pm 0.067$
PRF-fit source offset from KIC position	$0.225 \pm 0.070$	3.21	$0.099 \pm 0.067$	$0.203 \pm 0.070$
photometric centroid source offset	$0.13 \pm 0.00$	70.18	$0.07 \pm 0.00$	$0.11 \pm 0.00$

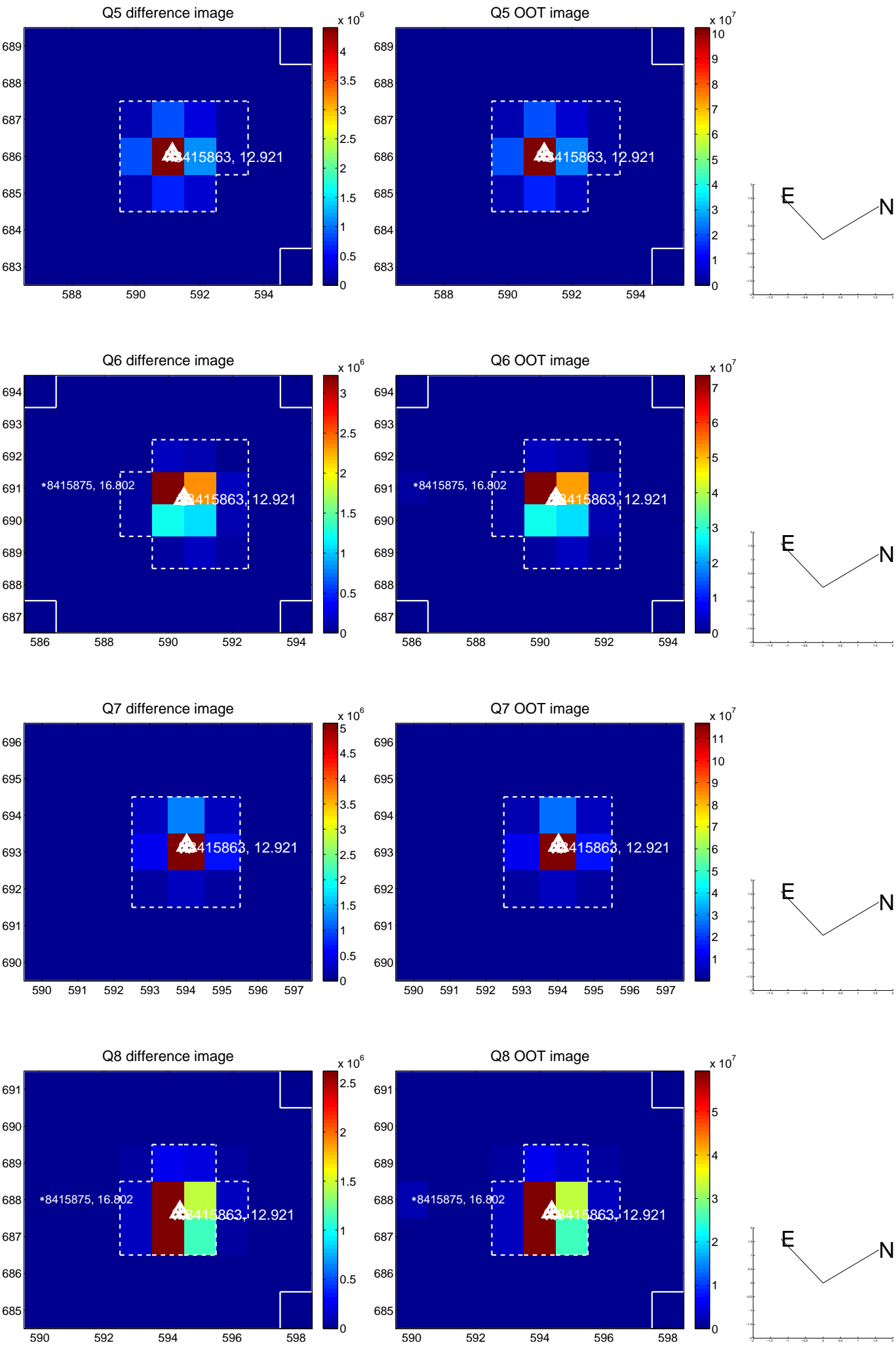


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

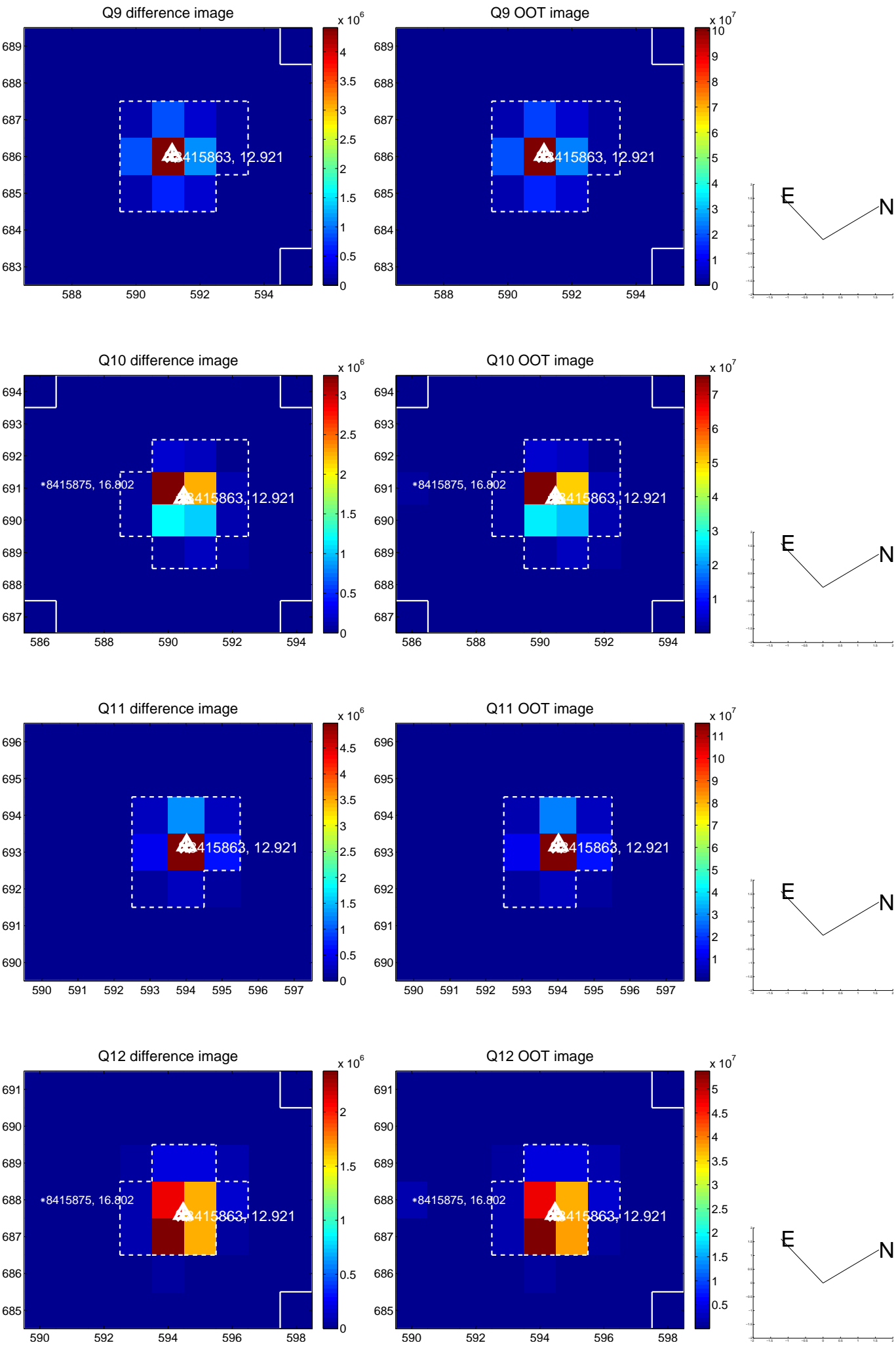


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

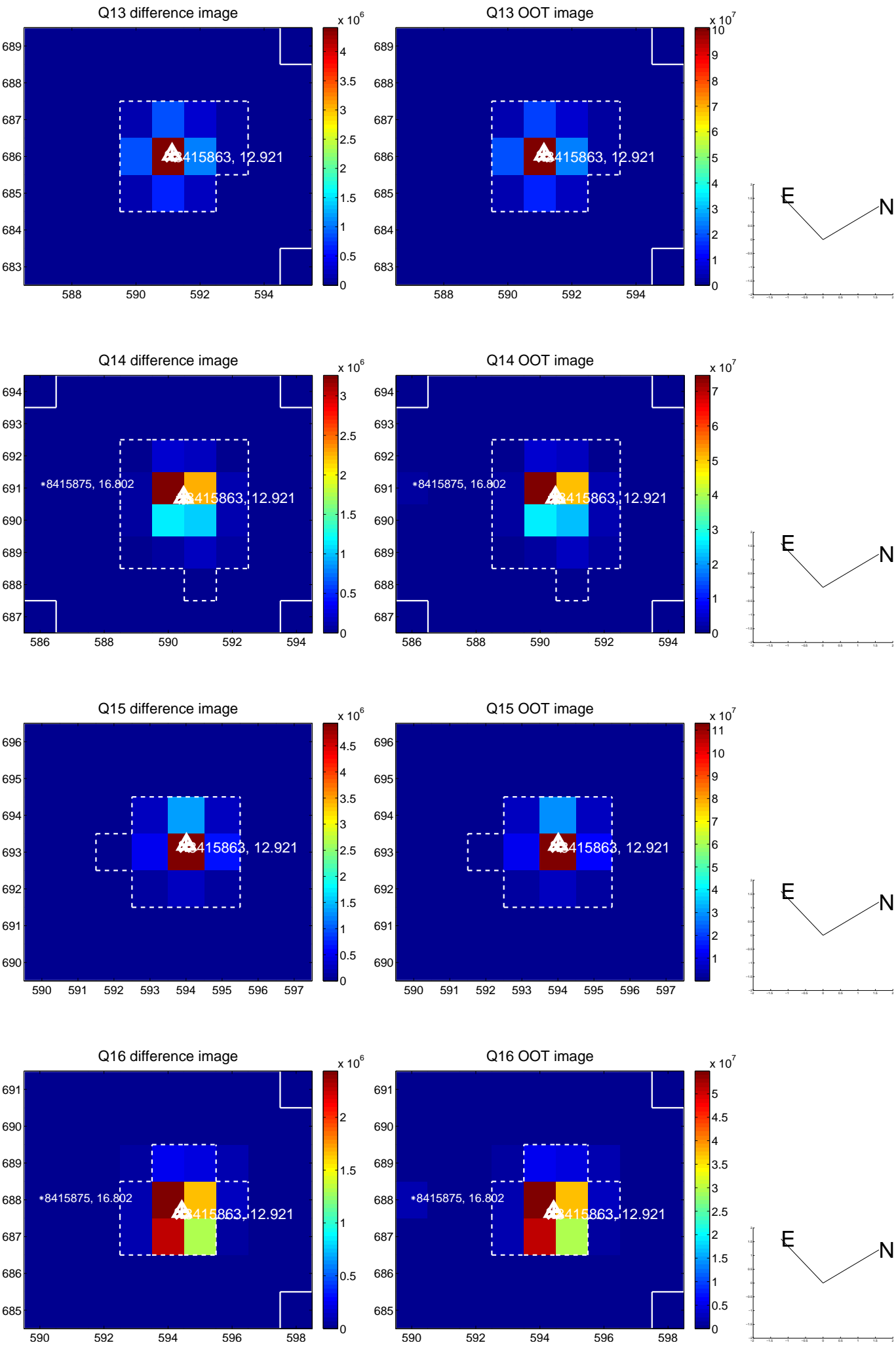




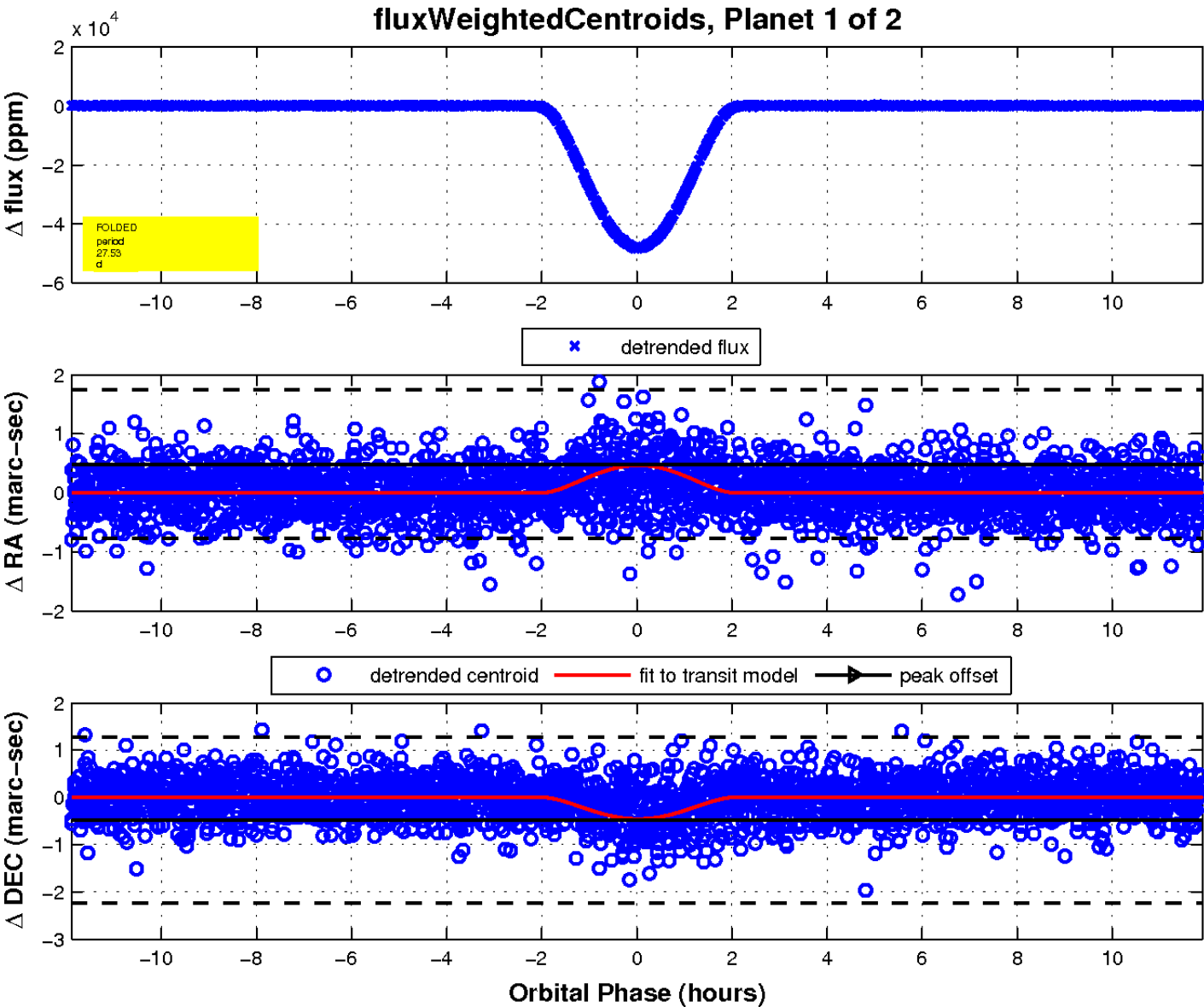
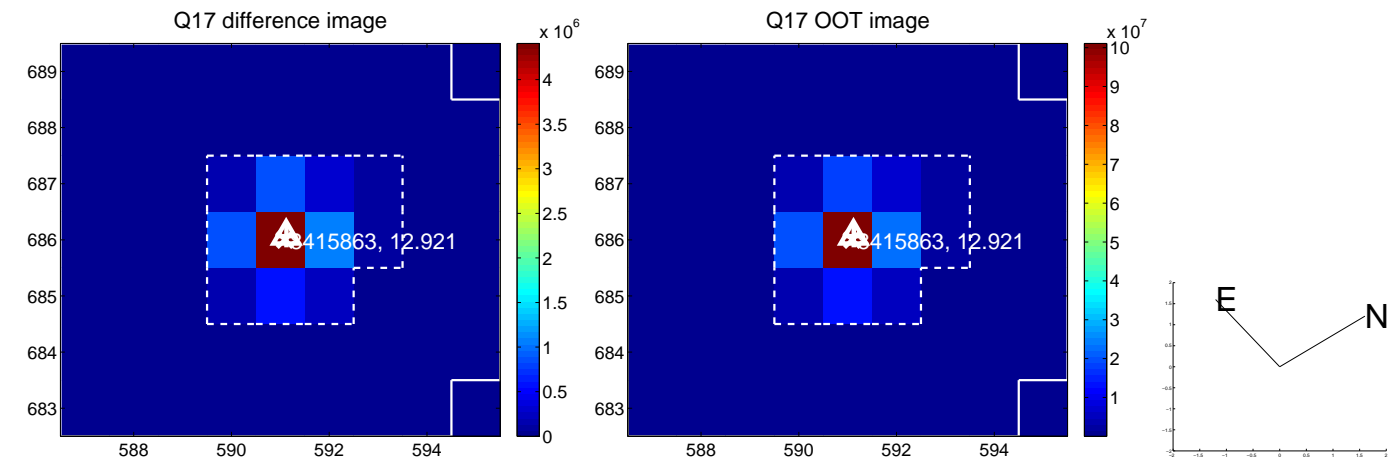
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

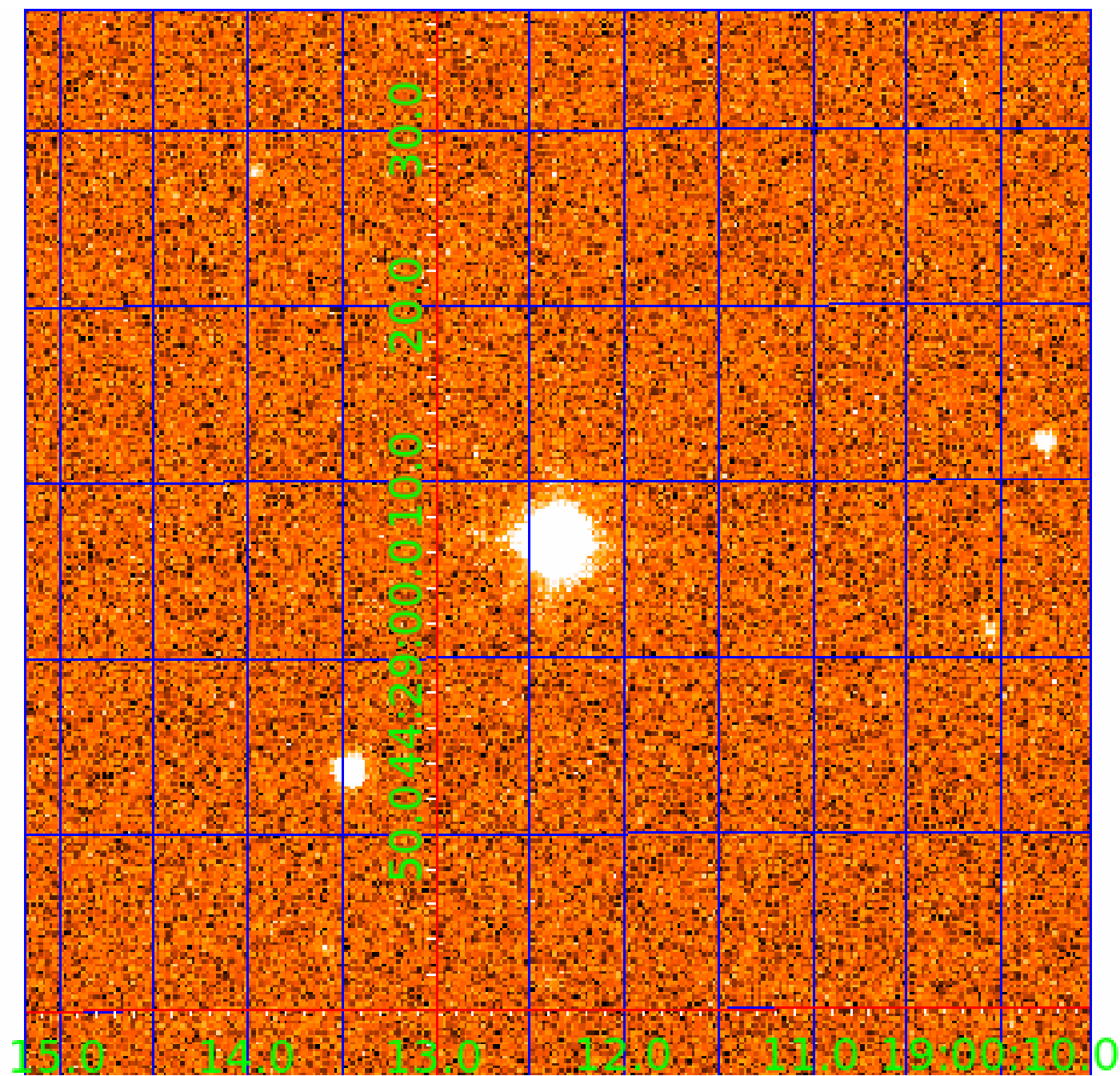


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 008415863

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
008415863-01	OBS	7037.01	27.533803	147.241010	48063.5	3.969	5528.6	5346.7	1.61	5925	52.02	86.14
008415863-02	OBS	No	27.533869	157.163954	678.4	3.217	76.0	74.7	1.61	5925	7.44	86.14

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
008415863-01	OBS	FP	0.00	0	1	0	0	MOD_SEC_DV—MOD_SEC_ALT—DEEP_V_SHAPED—HAS_SEC_TCE
008415863-02	OBS	FP	0.00	1	1	0	0	IS_SEC_TCE

**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 008415863-02

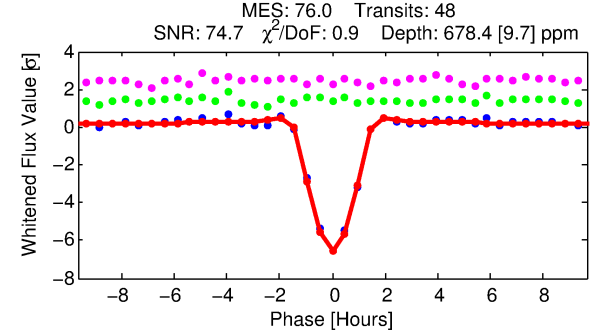
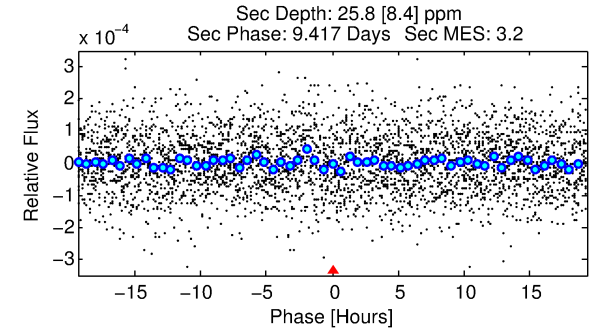
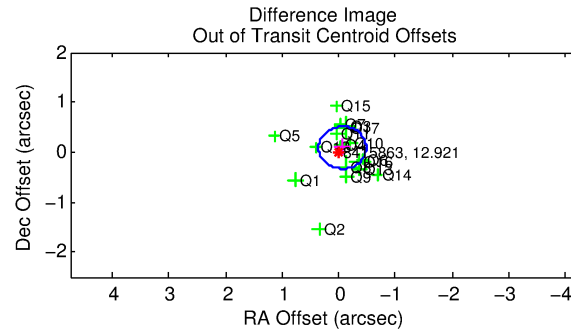
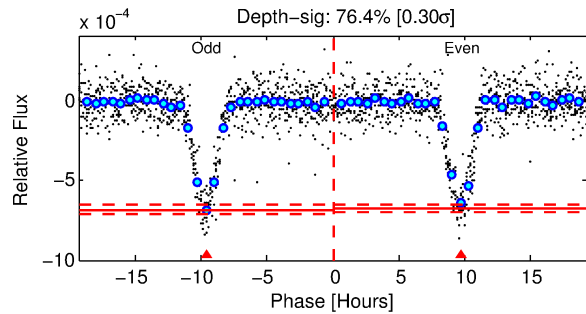
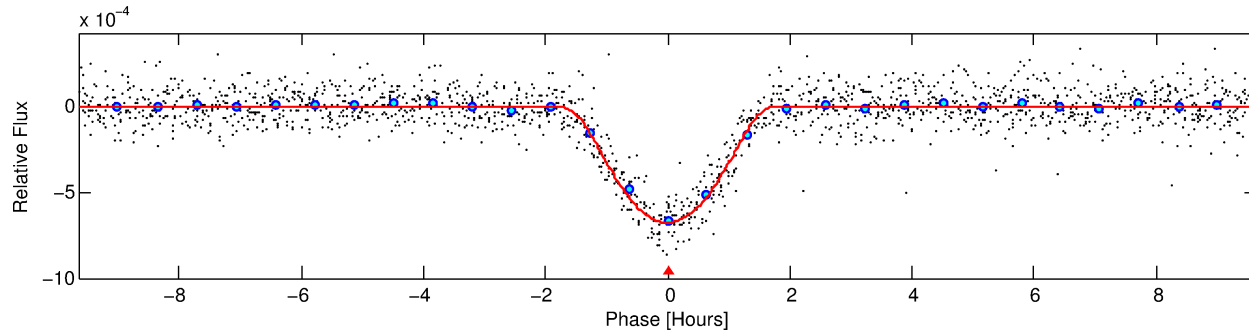
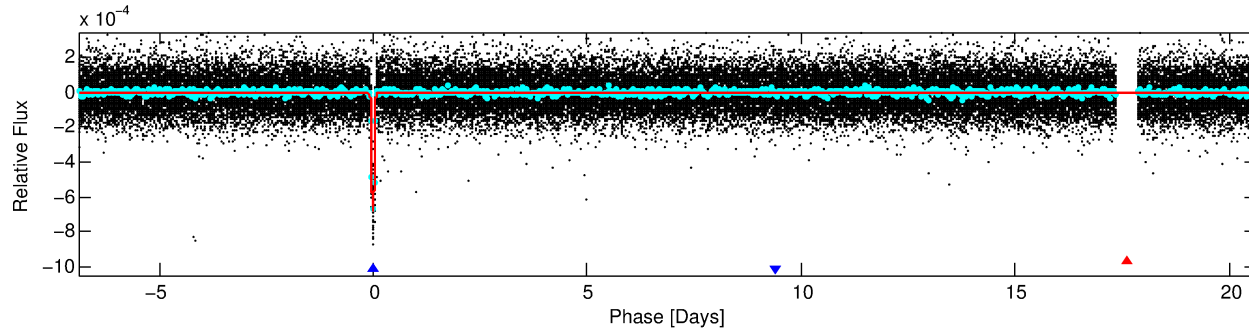
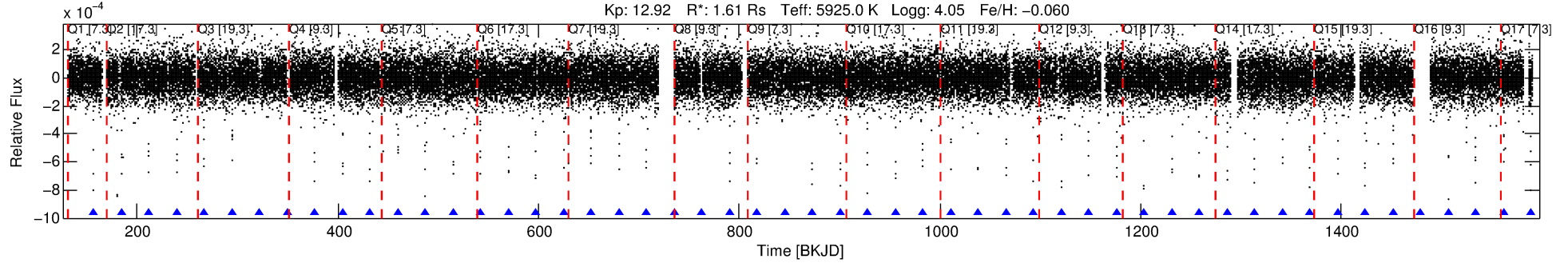
No Significant Match Found

# DV One-Page Summary

KIC: 8415863 Candidate: 2 of 2 Period: 27.534 d

KOI: K07037 Corr: No Ephemeris Match

Kp: 12.92 R\*: 1.61 Rs Teff: 5925.0 K Logg: 4.05 Fe/H: -0.060



## DV Fit Results:

Period = 27.53387 [0.00003] d  
Epoch = 157.1640 [0.0010] BKJD  
Rp/R\* = 0.0423 [0.0152]  
a/R\* = 20.77 [2.17]  
b = 0.99 [0.02]  
Seff = 86.14 [52.37]  
Teq = 777 [118] K  
Rp = 7.44 [3.83] Re  
a = 0.1824 [0.0665] AU  
Ag = 8.54 [8.40] [0.90σ]  
Teffp = 2053 [410] K [2.99σ]

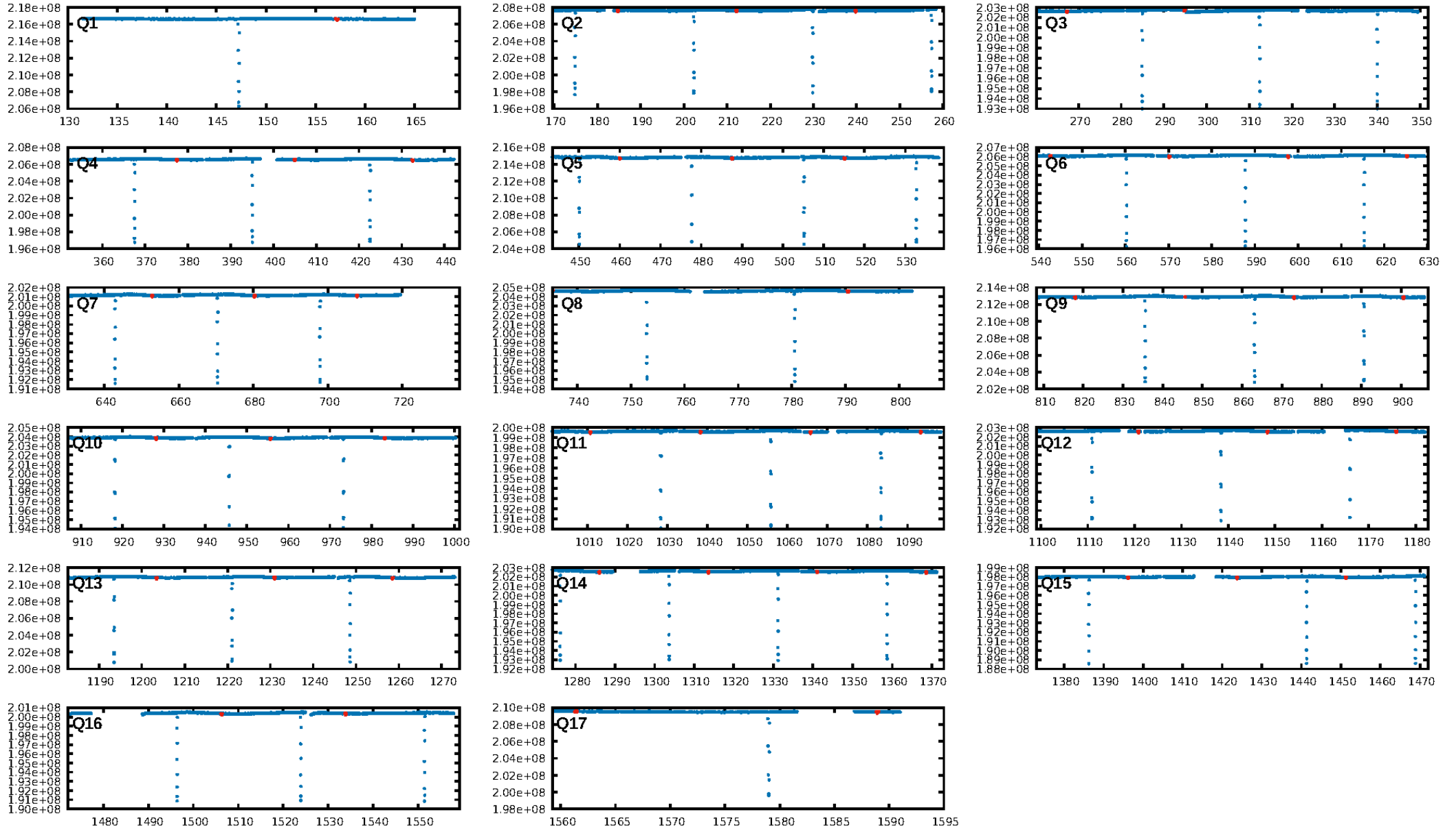
## DV Diagnostic Results:

ShortPeriod-sig: 0.0% [0.00σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 88.5%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 0.00e+00  
RollingBand-fgt: 1.00 [45/45]  
GhostDiagnostic-chr: 8.497  
Centroid-sig: 0.1%  
Centroid-so: 0.286 arcsec [2.09σ]  
OotOffset-rm: 0.110 arcsec [0.78σ]  
KicOffset-rm: 0.277 arcsec [1.73σ]  
OotOffset-st: 4/4/4/5 [17]  
KicOffset-st: 4/4/4/5 [17]  
DiffImageQuality-fgm: 1.00 [17/17]  
DiffImageOverlap-fno: 1.00 [17/17]

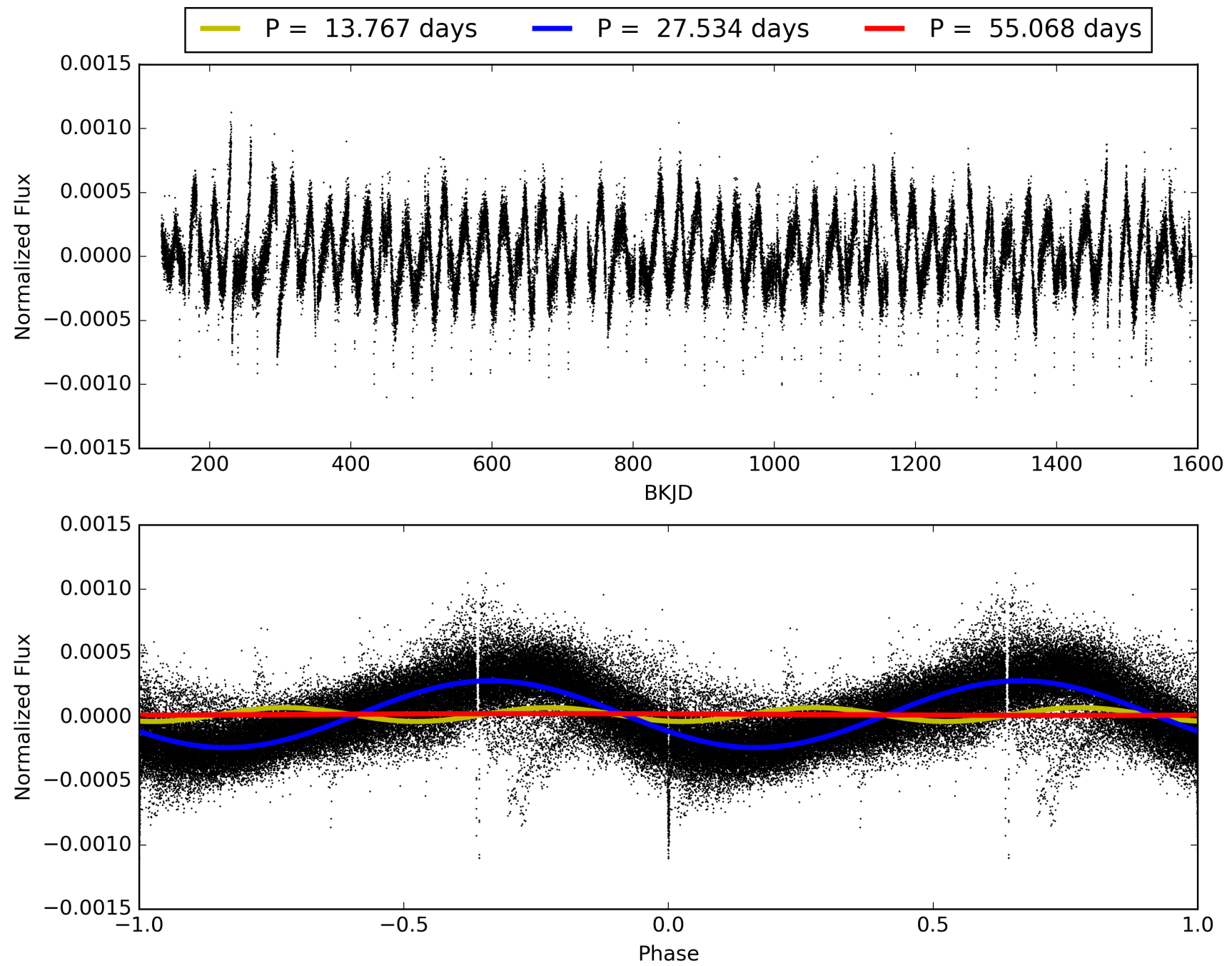
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 13:29:04 Z

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

# TCE 008415863-02, PDC Light Curves



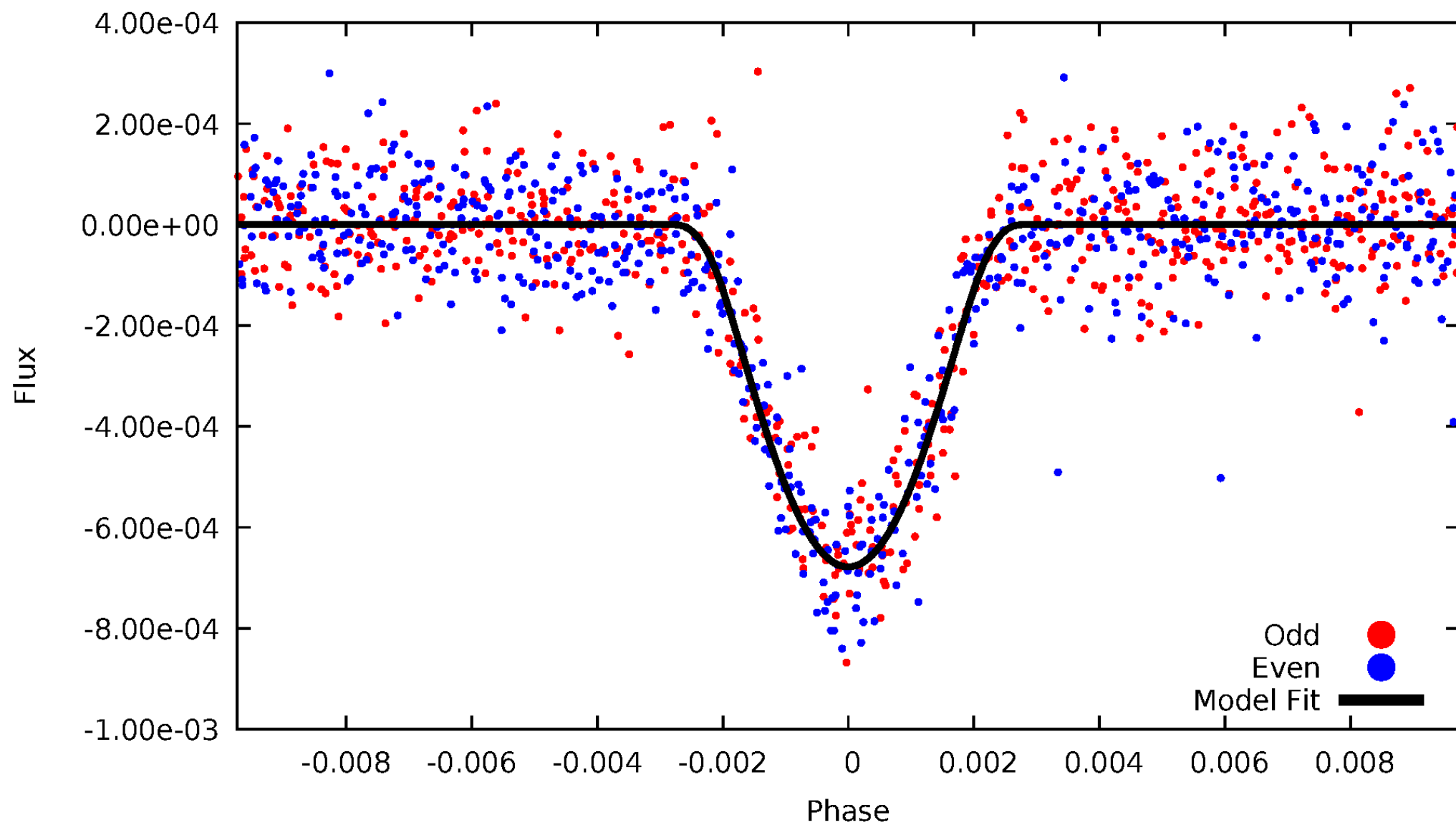
TCE 008415863-02





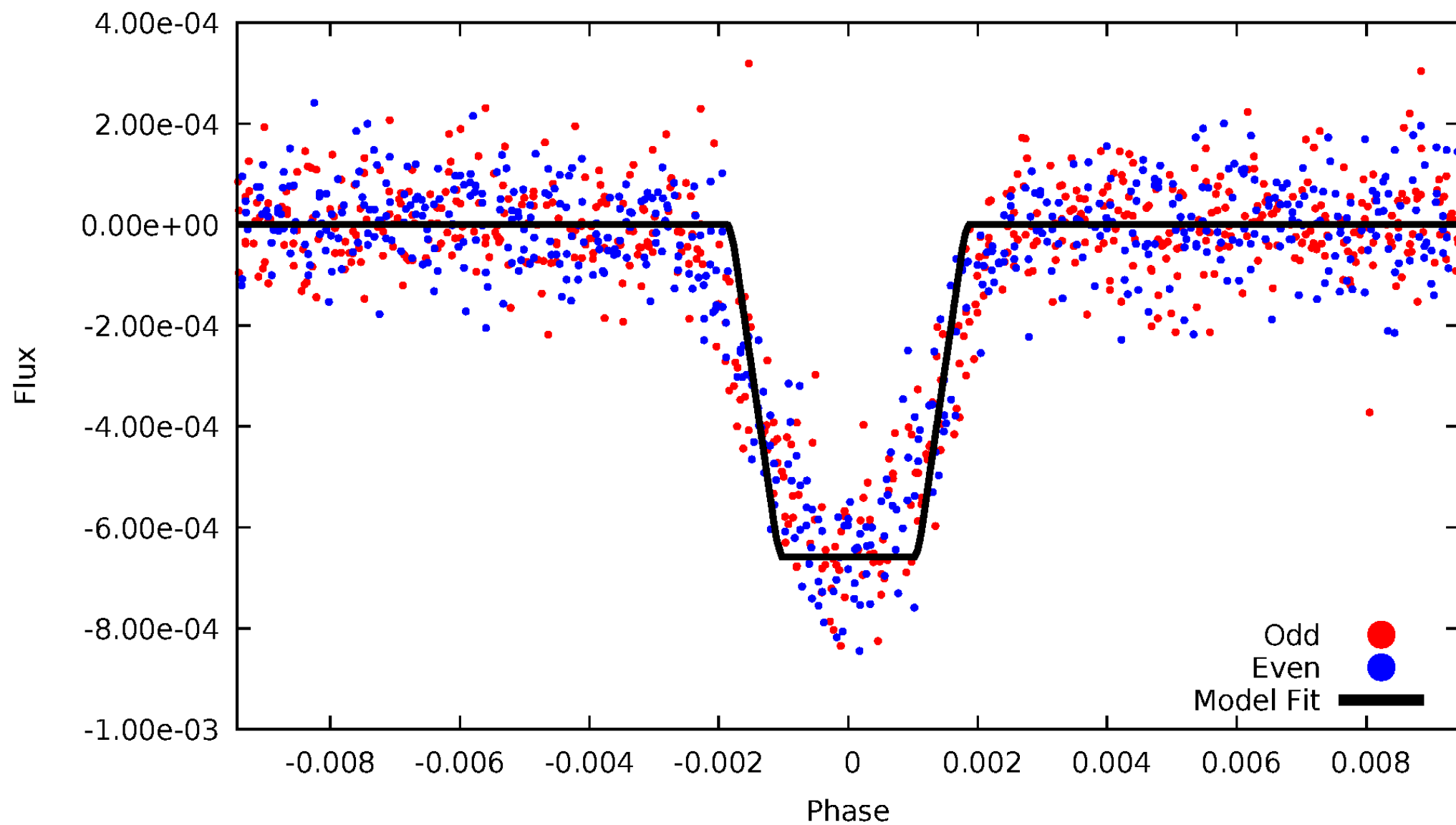
# DV Odd/Even

TCE 008415863-02



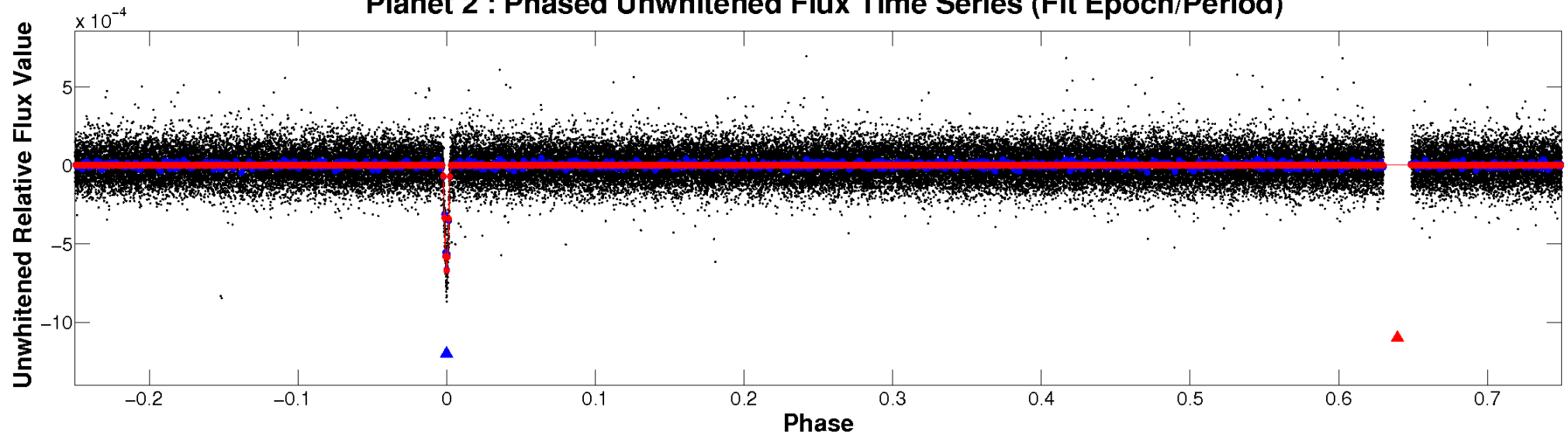
# ALT Odd/Even

TCE 008415863-02

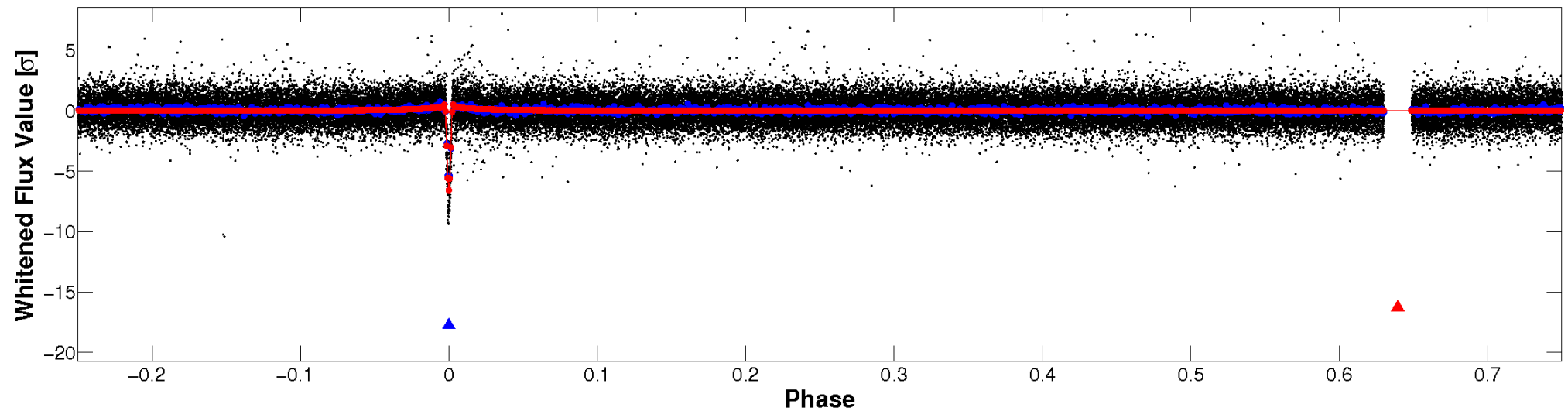


# Non-Whitened Vs. Whitened Light Curve

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

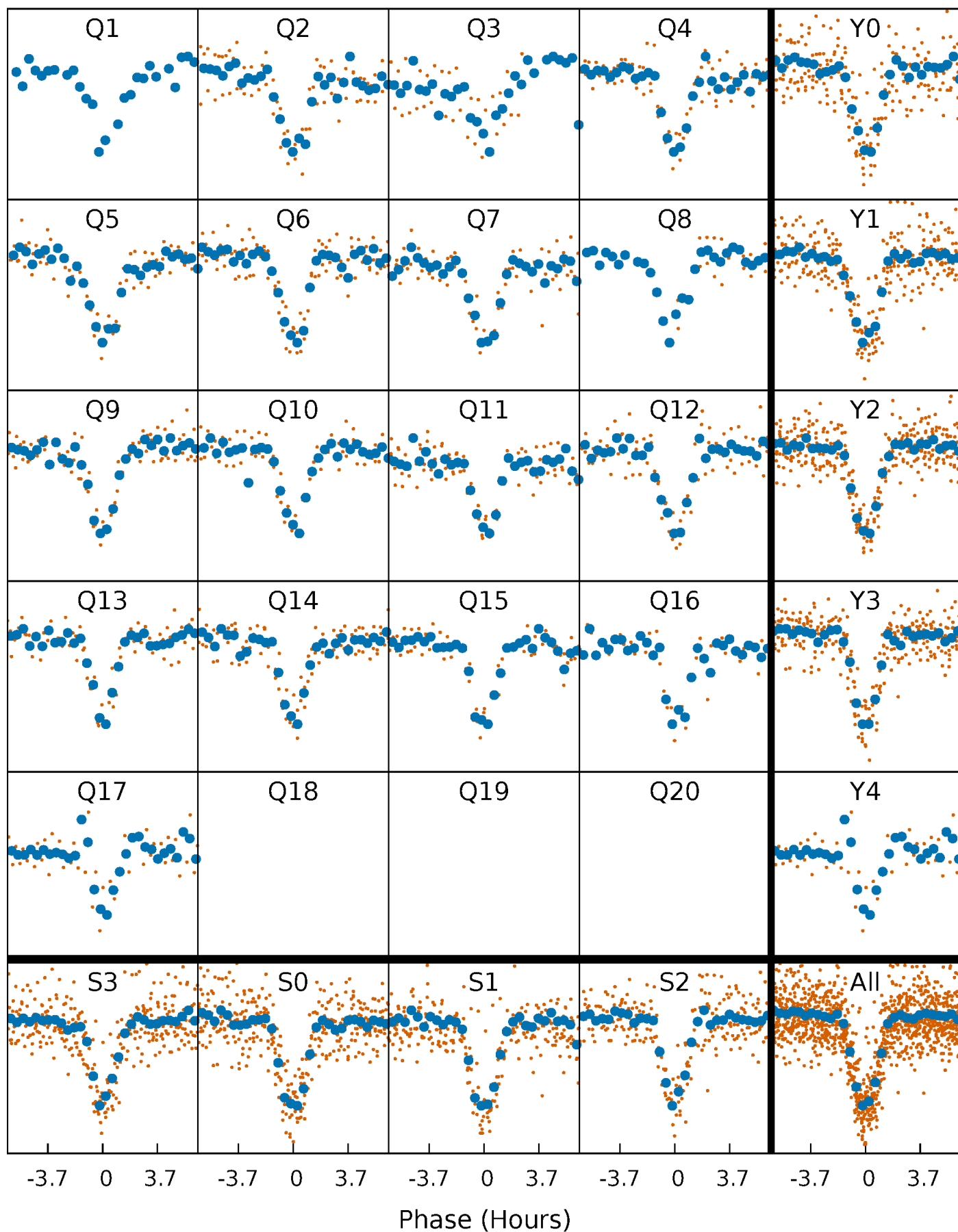


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



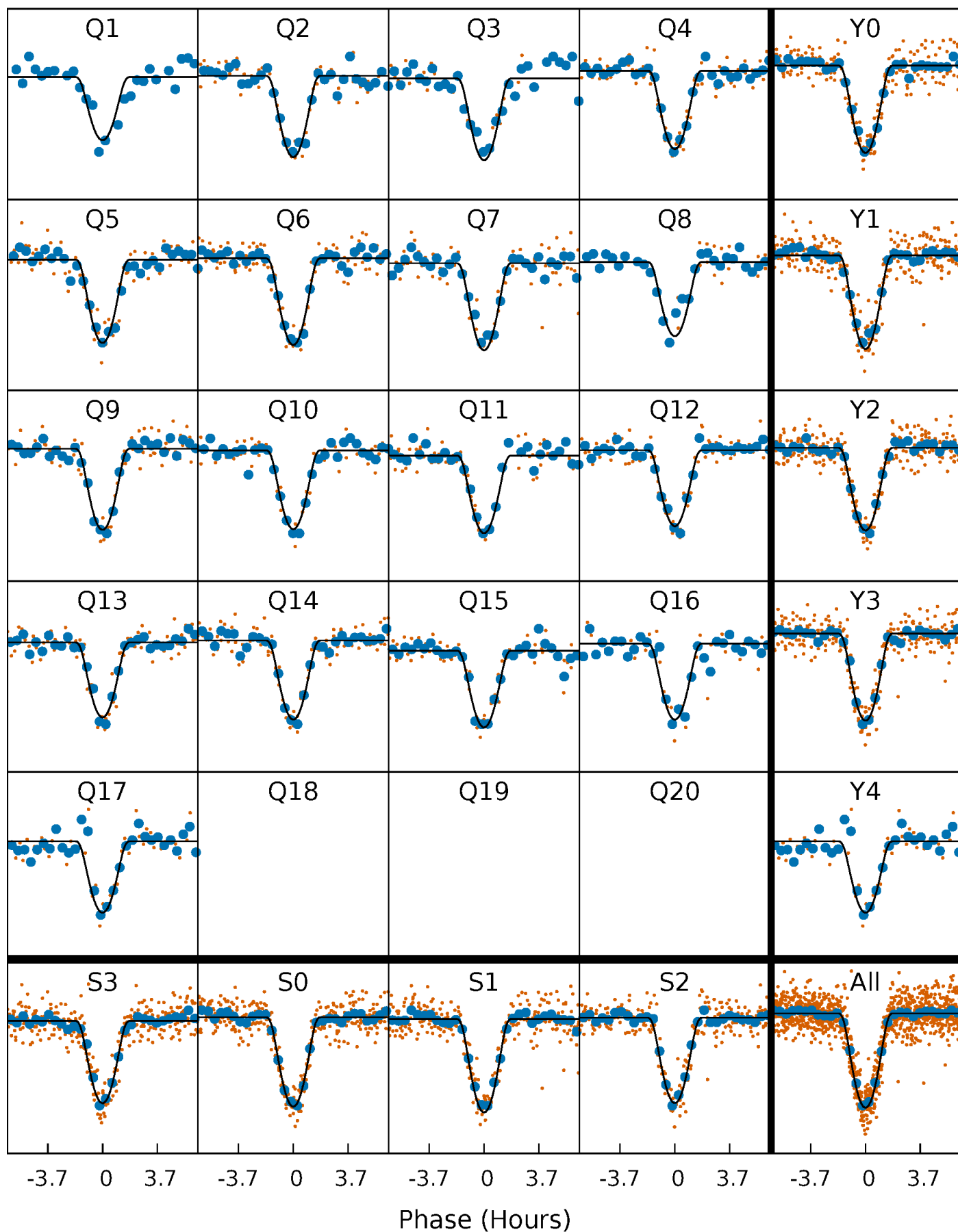
# PDC Quarter-Phased Transit Curves

TCE 008415863-02   P= 27.533869 Days    $T_0=157.163954$  (BKJD)



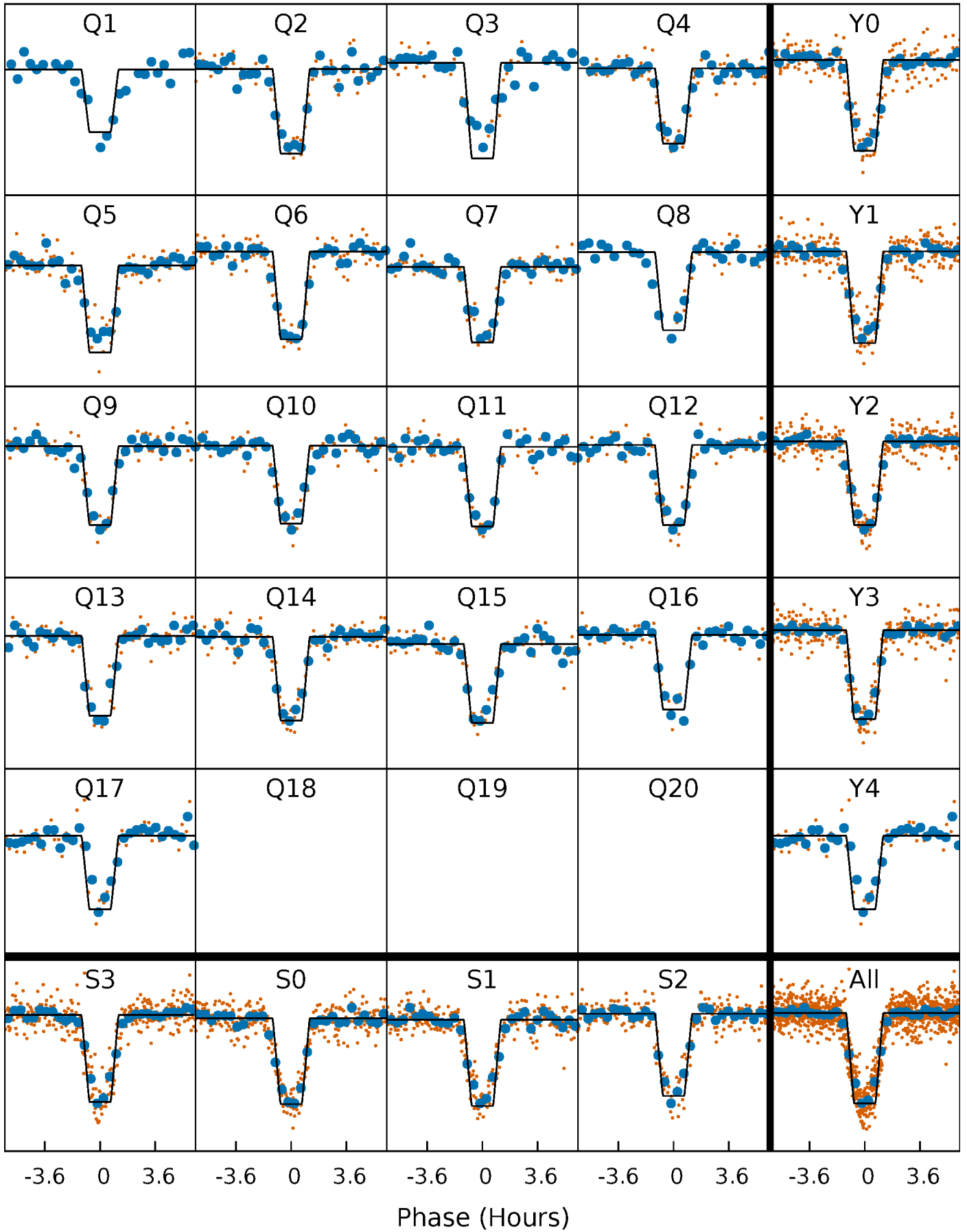
# DV Quarter-Phased Transit Curves

TCE 008415863-02 P= 27.533869 Days  $T_0=157.163954$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

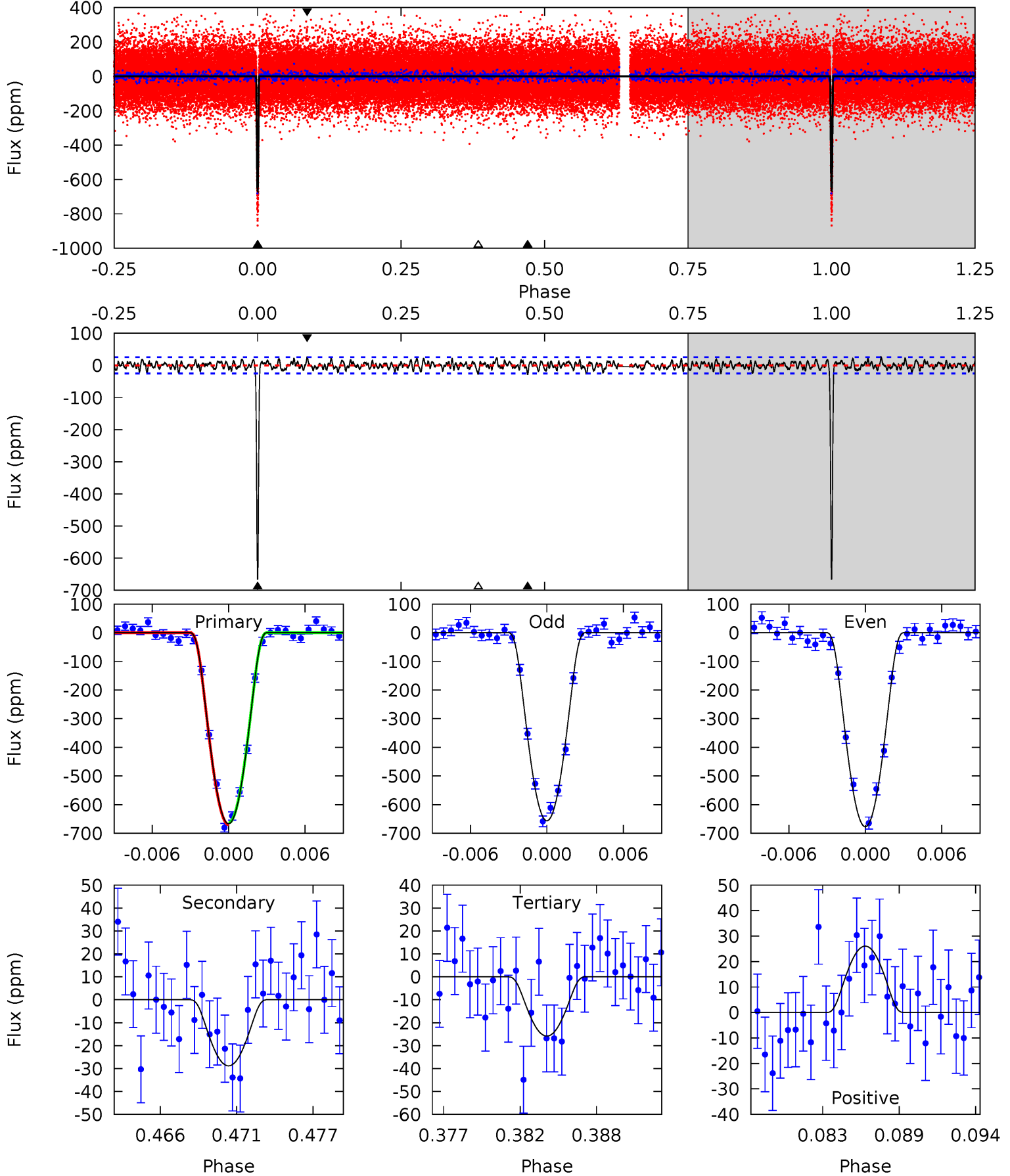
TCE 008415863-02 P= 27.533948 Days  $T_0=157.162632$  (BKJD)



# DV Model-Shift Uniqueness Test

008415863-02,  $P = 27.533869$  Days,  $E = 129.630085$  Days

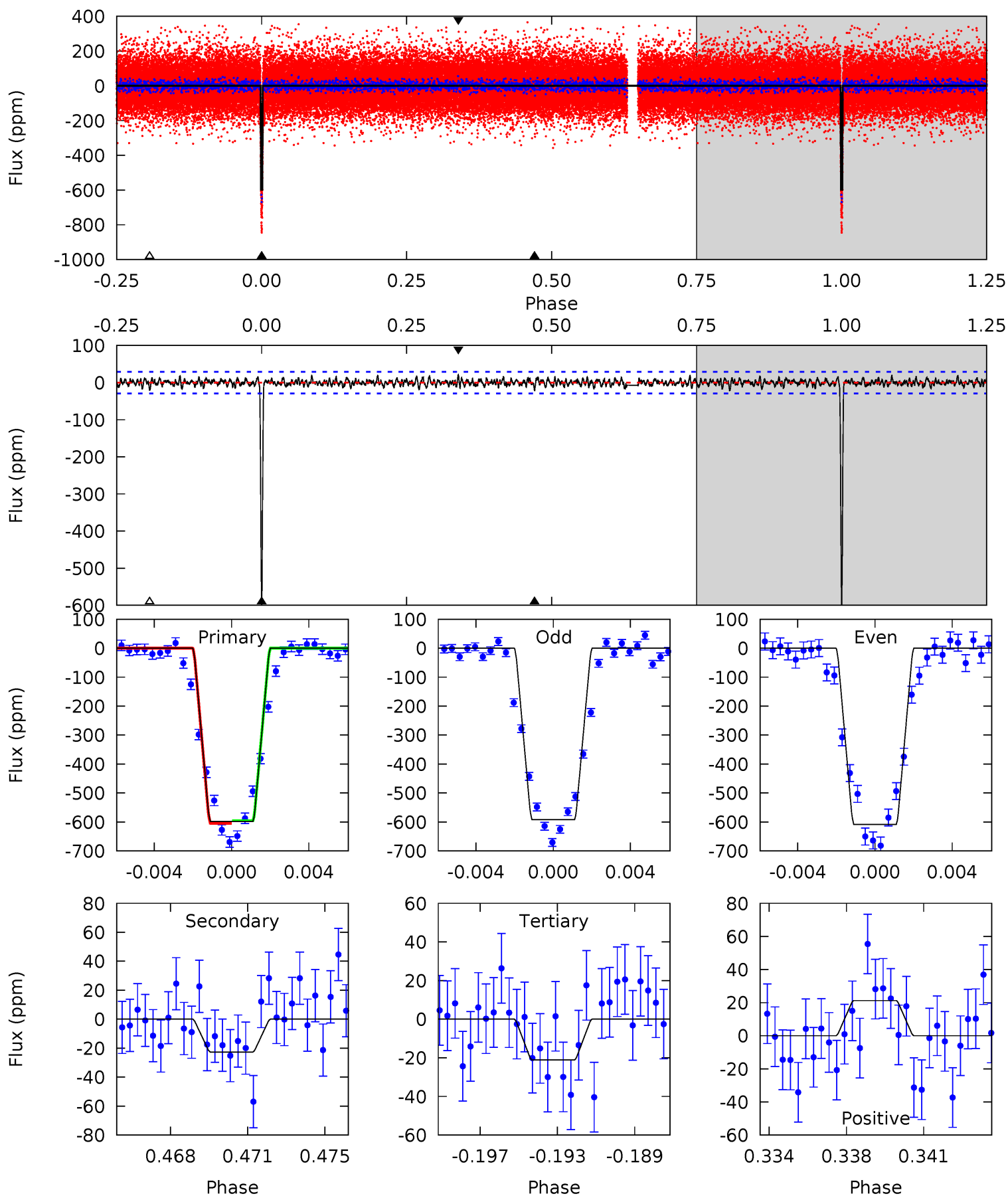
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
136.2	5.89	5.28	5.32	5.14	2.77	1.77	130.9	130.9	0.61	0.57	2.13	0.98	0.04	0.64



# Alt Model-Shift Uniqueness Test

008415863-02,  $P = 27.533948$  Days,  $E = 129.628684$  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
106.5	4.04	3.76	3.78	5.21	2.90	1.14	102.7	102.7	0.27	0.25	1.43	0.99	0.03	0.79





### Stellar Parameters For KIC 008415863

	$T_{\text{eff}} (K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5925^{+193}_{-211}$	$4.052^{+0.350}_{-0.150}$	$-0.060^{+0.300}_{-0.300}$	$1.611^{+0.396}_{-0.595}$	$1.066^{+0.163}_{-0.163}$	$0.359^{+0.889}_{-0.145}$
	+3%/-4%	+9%/-4%	+500%/-500%	+25%/-37%	+15%/-15%	+247%/-40%
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 008415863-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-29 \pm 5$	$7.08^{+3.11}_{-2.82}$	$1068^{+91}_{-98}$	$2830^{+438}_{-248}$	$11^{+19}_{-6}$
Alt.	$-23 \pm 6$	$4.35^{+2.71}_{-2.38}$	$1074^{+78}_{-114}$	$3105^{+895}_{-370}$	$21^{+85}_{-13}$

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

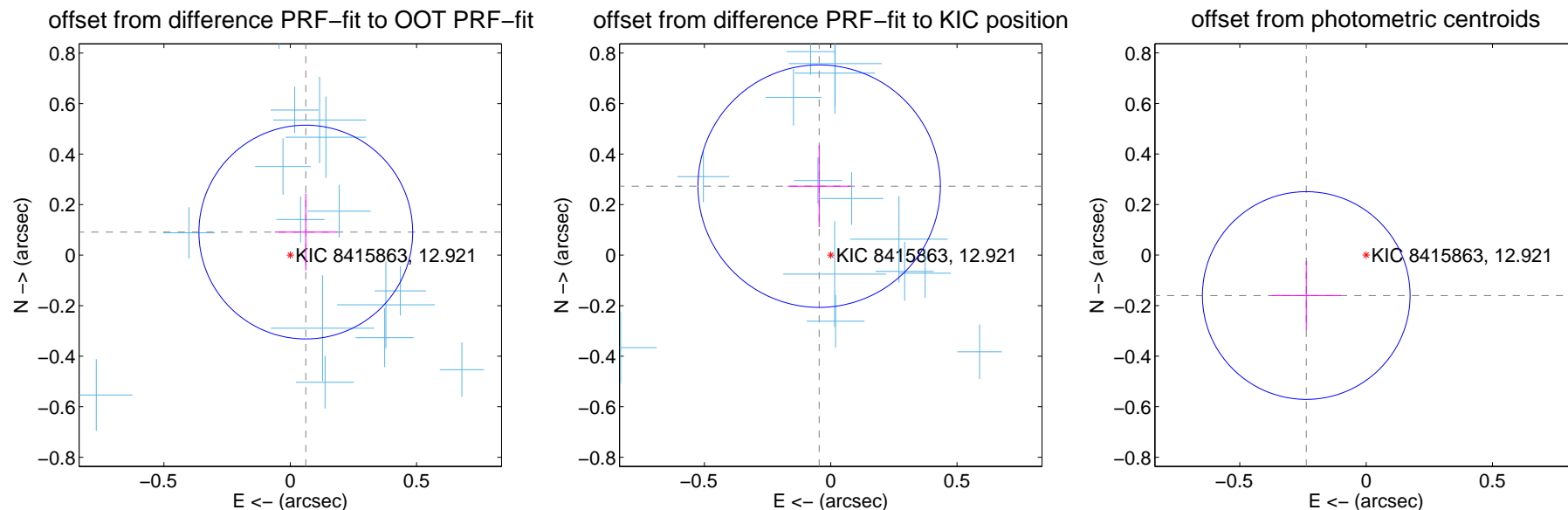
## DV Centroid Data

Supplemental centroid analysis for 008415863-02. Kepler magnitude: 12.92. Transit SNR 74.70

There are 17 quarters with good PRF difference image offsets

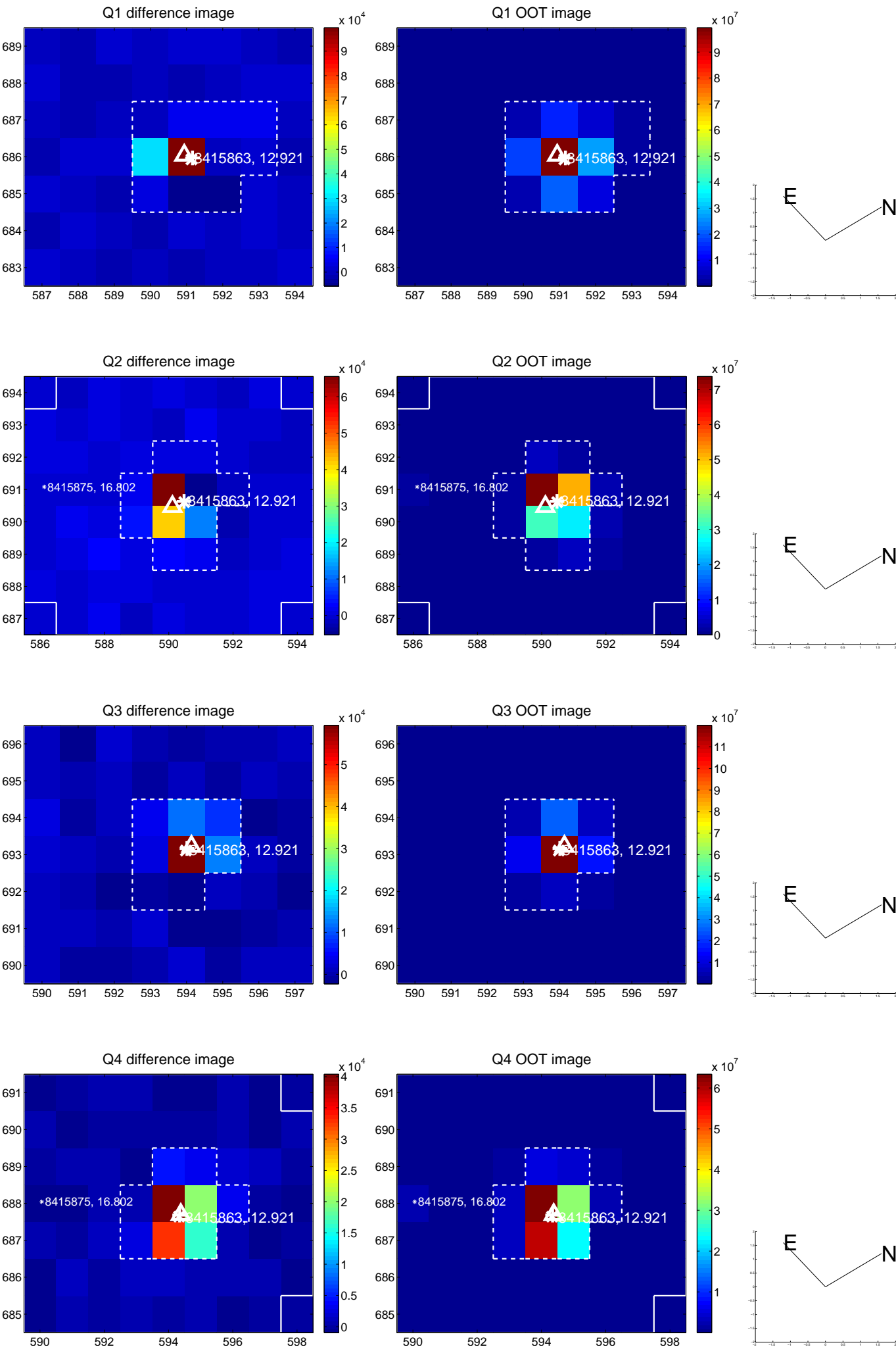
The direct PRF centroid is offset from the target star catalog position by about 0.28 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.110 \pm 0.141$	0.78	$-0.062 \pm 0.123$	$0.091 \pm 0.152$
PRF-fit source offset from KIC position	$0.277 \pm 0.160$	1.73	$0.046 \pm 0.124$	$0.273 \pm 0.161$
photometric centroid source offset	$0.29 \pm 0.14$	2.09	$0.24 \pm 0.14$	$-0.16 \pm 0.14$

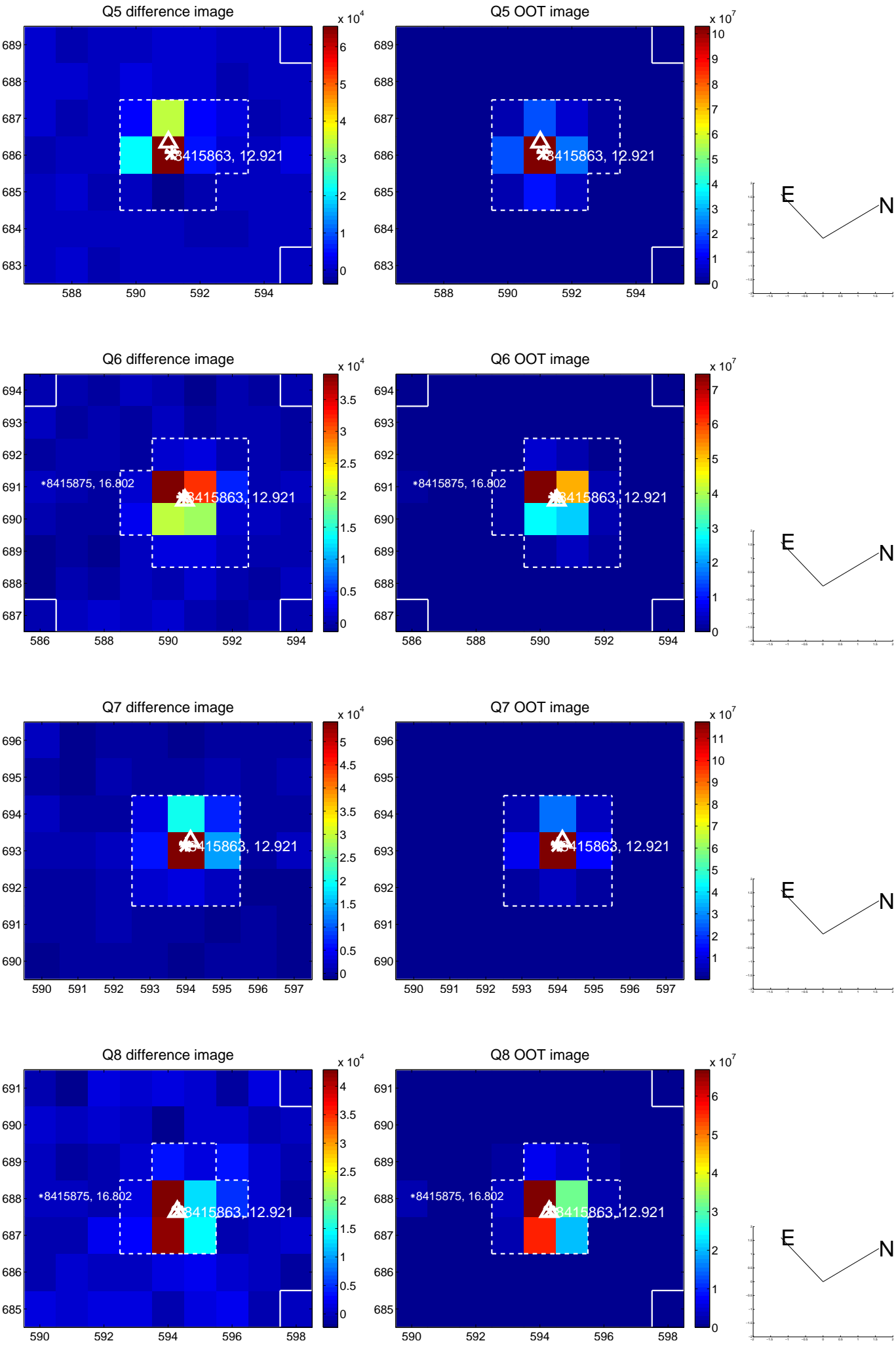


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

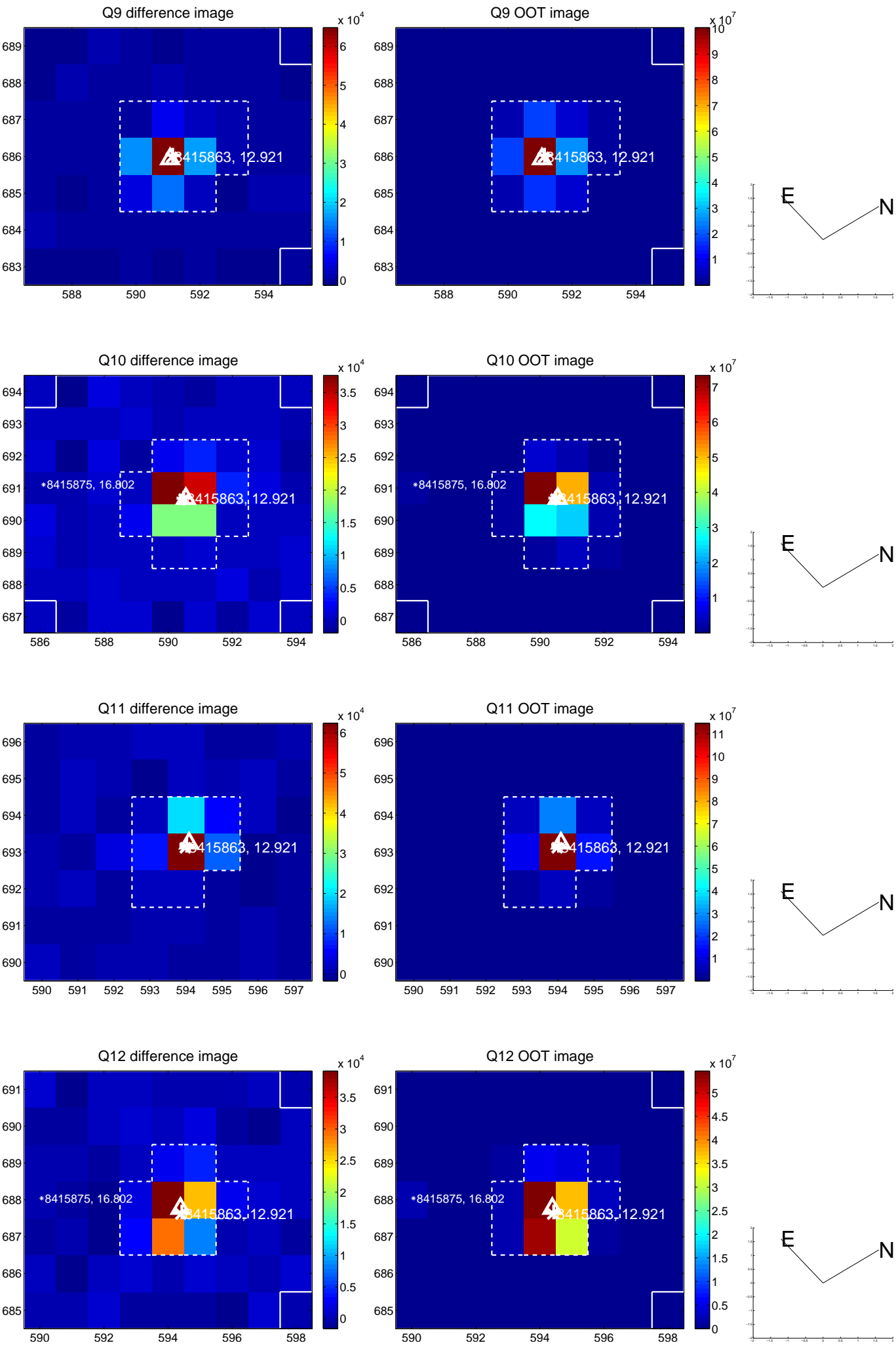
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



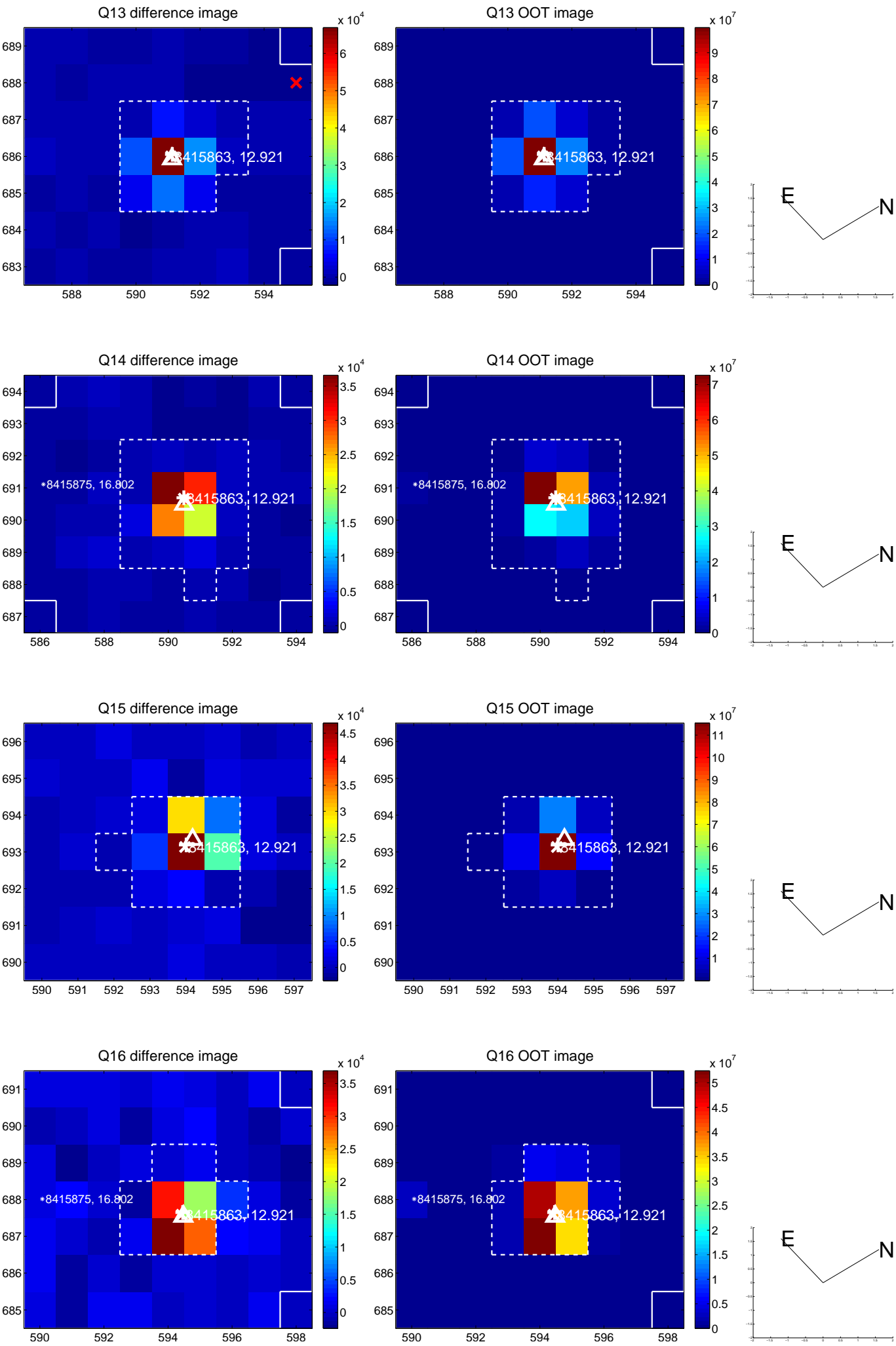
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



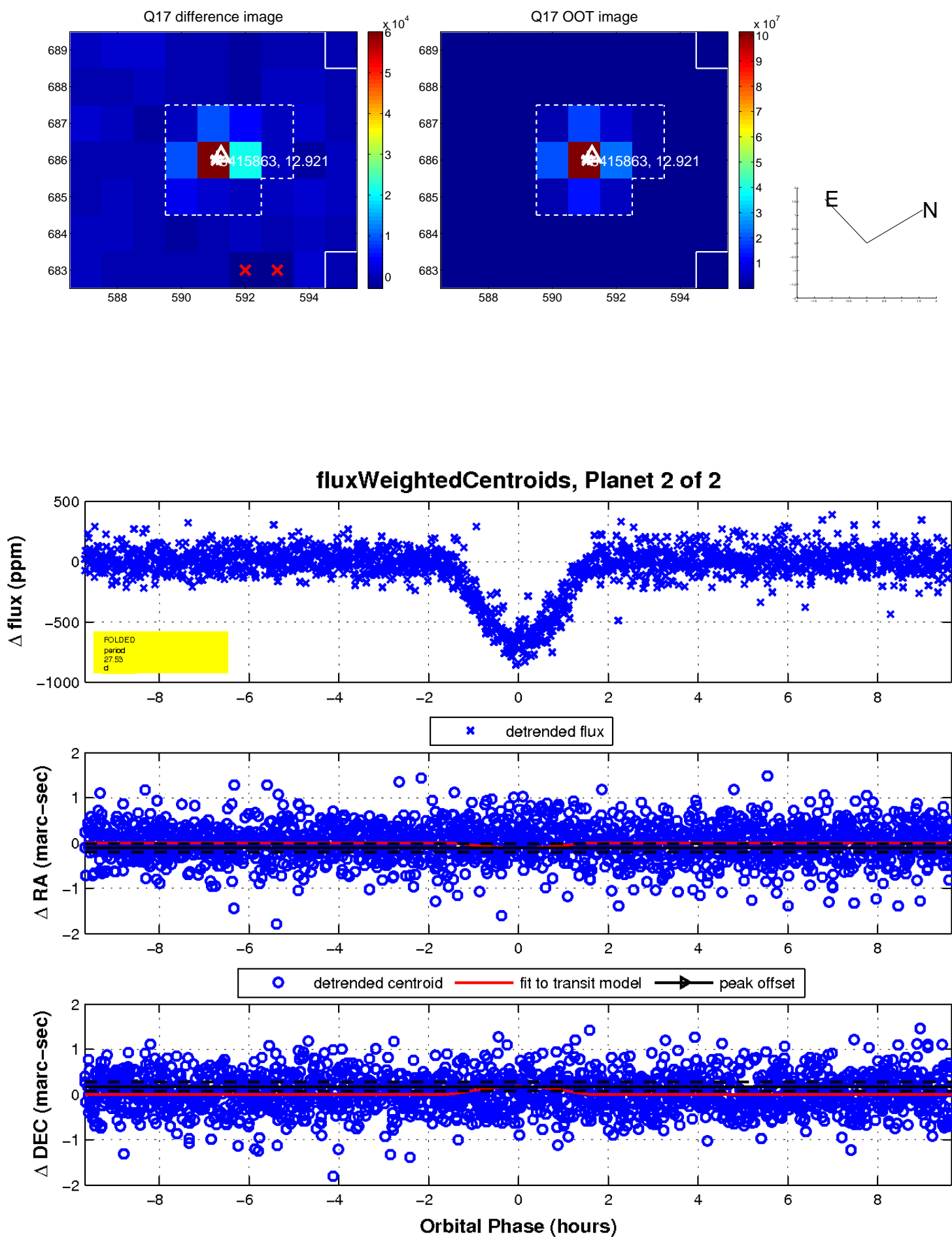
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UKIRT Image

Declination

