

# KIC 004725681

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
004725681-01	OBS	0817.01	23.967927	138.285969	1205.4	4.135	22.3	25.0	0.52	3747	2.09	2.78
004725681-02	OBS	0817.02	8.295582	135.794579	856.4	1.283	15.3	19.0	0.52	3747	1.84	11.43

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
004725681-01	OBS	PC	1.00	0	0	0	0	NO_COMMENT
004725681-02	OBS	PC	0.99	0	0	0	0	NO_COMMENT

**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.

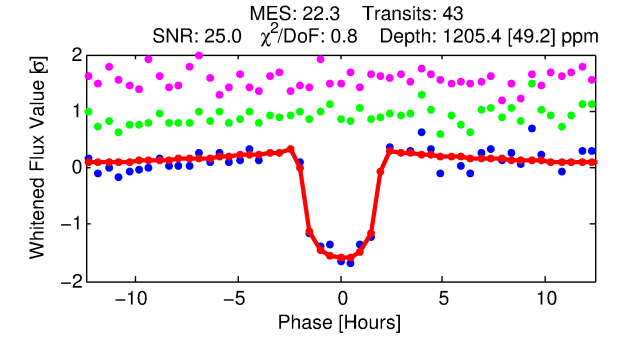
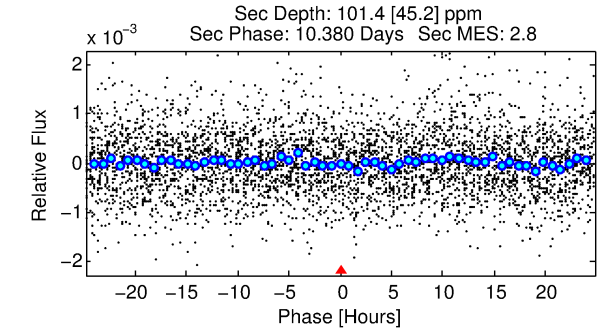
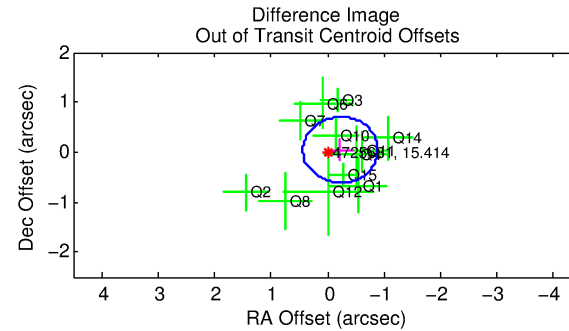
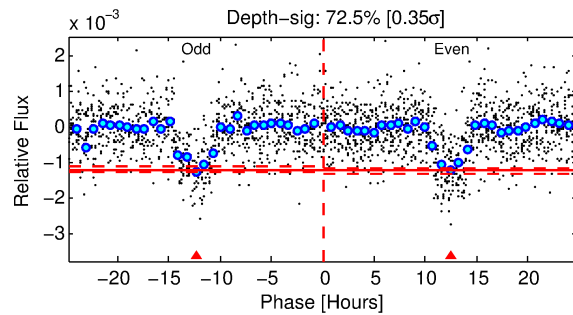
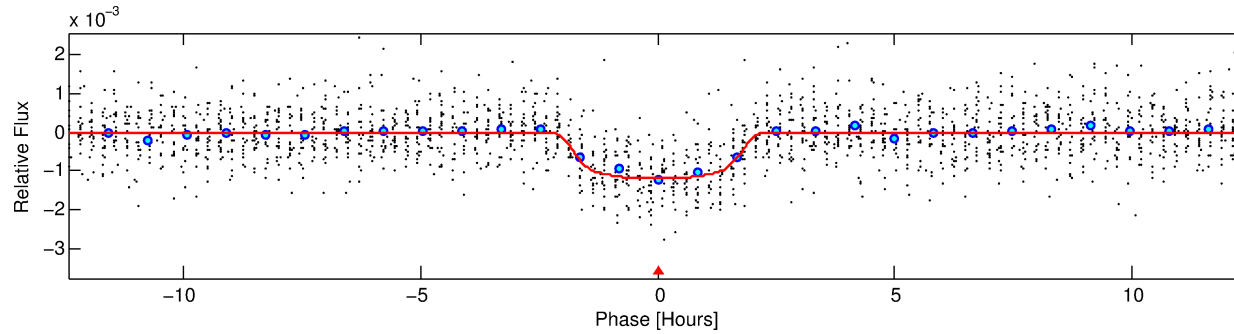
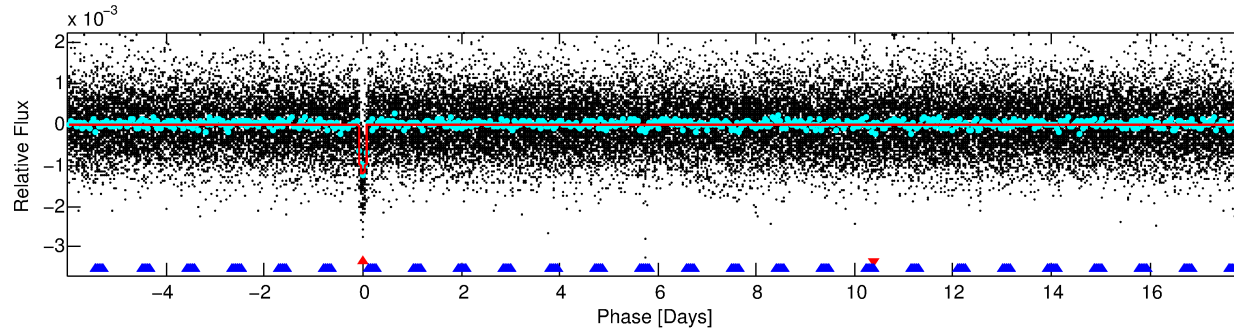
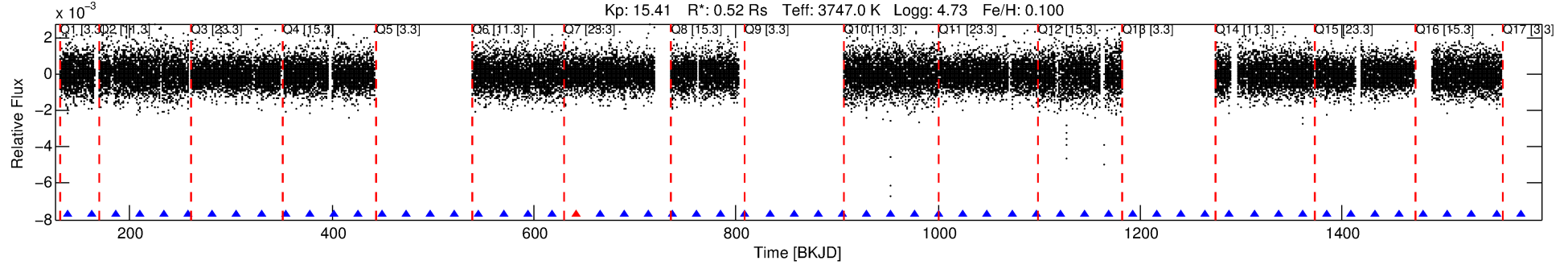
## Ephemeris Match Information For 004725681-01

No Significant Match Found

# DV One-Page Summary

KIC: 4725681 Candidate: 1 of 2 Period: 23.968 d  
KOI: K00817.01 Name: Kepler-236c Corr: 0.961

Kp: 15.41 R\*: 0.52 Rs Teff: 3747.0 K Logg: 4.73 Fe/H: 0.100



## DV Fit Results:

Period = 23.96793 [0.00009] d  
Epoch = 138.2860 [0.0030] BKJD  
Rp/R\* = 0.0365 [0.0034]  
a/R\* = 26.24 [9.51]  
b = 0.85 [0.12]  
Seff = 2.78 [0.34]  
Teq = 329 [10] K  
Rp = 2.09 [0.26] Re  
a = 0.1321 [0.0085] AU  
Ag = 223.03 [109.44] [2.03σ]  
Teffp = 1967 [242] K [6.77σ]

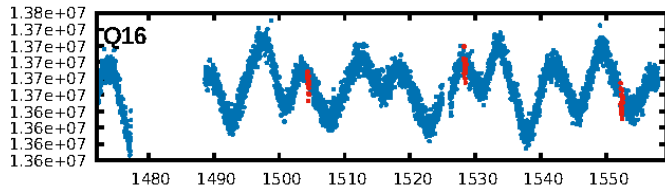
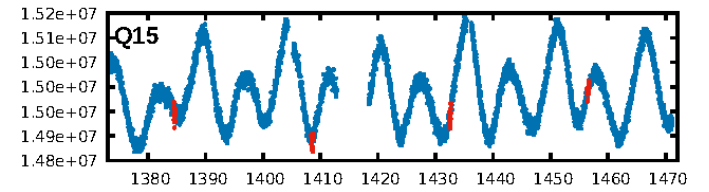
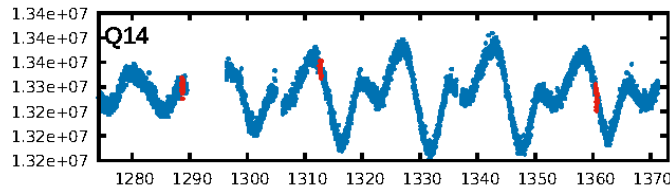
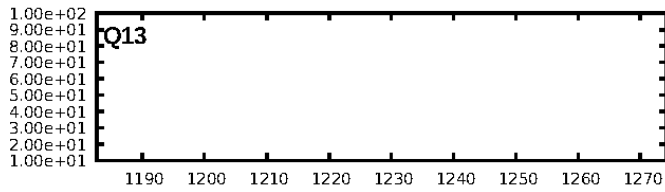
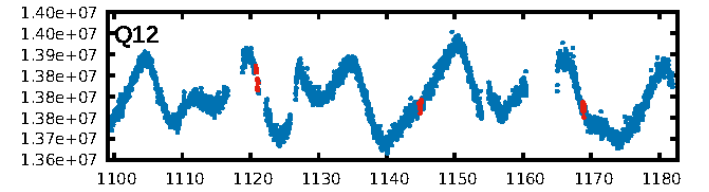
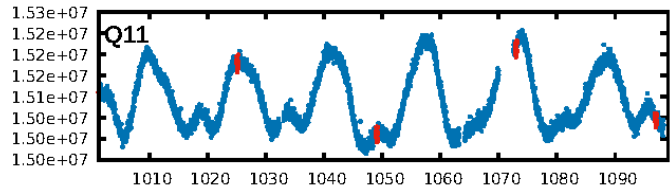
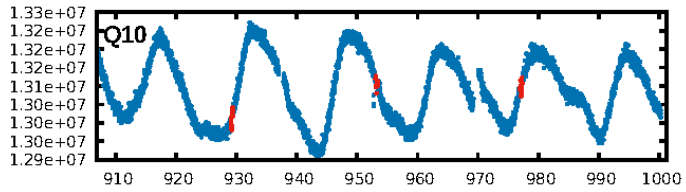
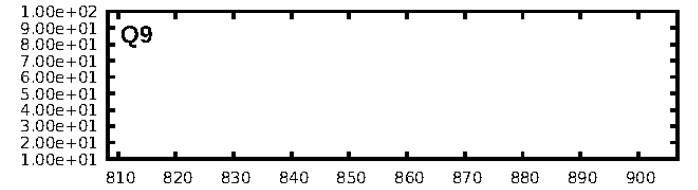
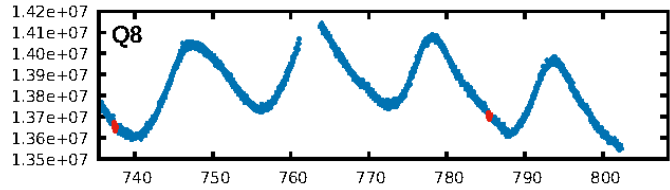
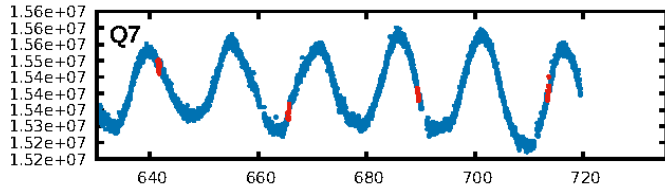
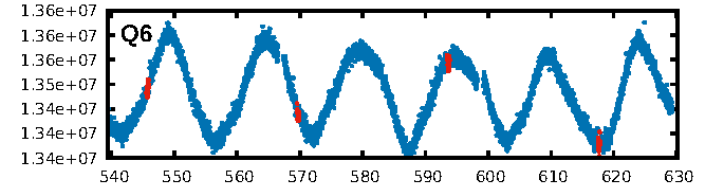
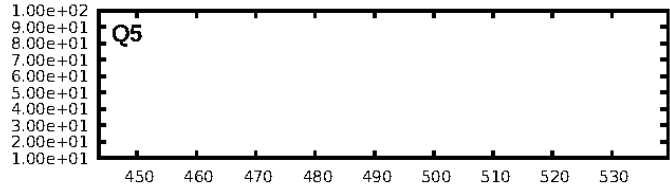
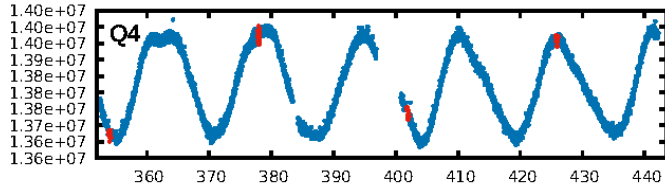
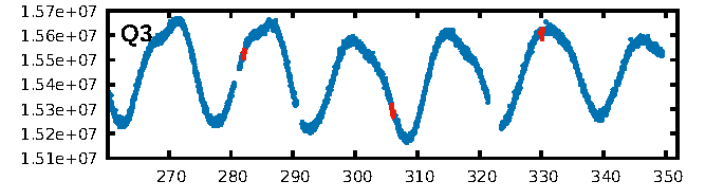
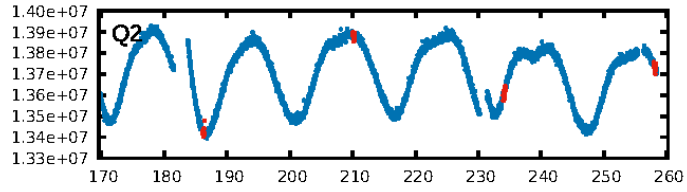
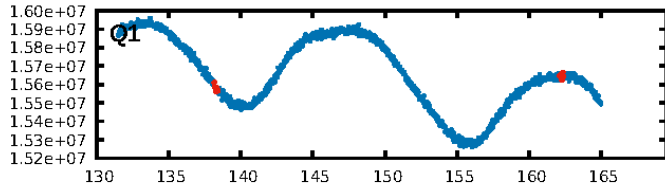
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [86.89σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 87.1%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 4.27e-110  
RollingBand-fgt: 0.98 [40/41]  
GhostDiagnostic-chr: 2.179  
Centroid-sig: 1.0%  
Centroid-so: 0.865 arcsec [1.57σ]  
OotOffset-rm: 0.230 arcsec [1.04σ]  
KicOffset-rm: 0.359 arcsec [1.51σ]  
OotOffset-st: 4/4/3/1 [12]  
KicOffset-st: 4/4/3/1 [12]  
DiffImageQuality-fgm: 0.92 [11/12]  
DiffImageOverlap-fno: 1.00 [13/13]

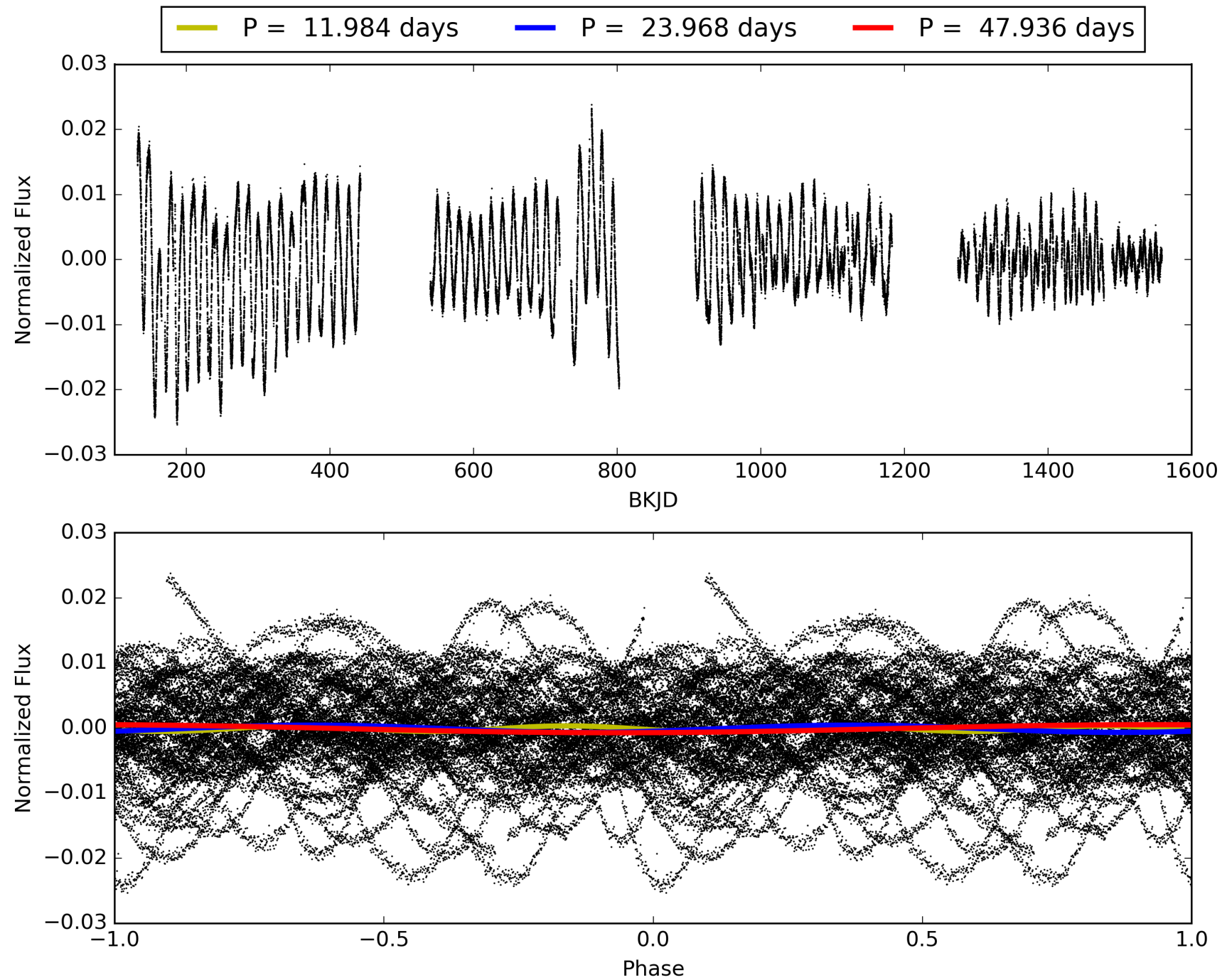
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 02:00:26 Z

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

## TCE 004725681-01, PDC Light Curves

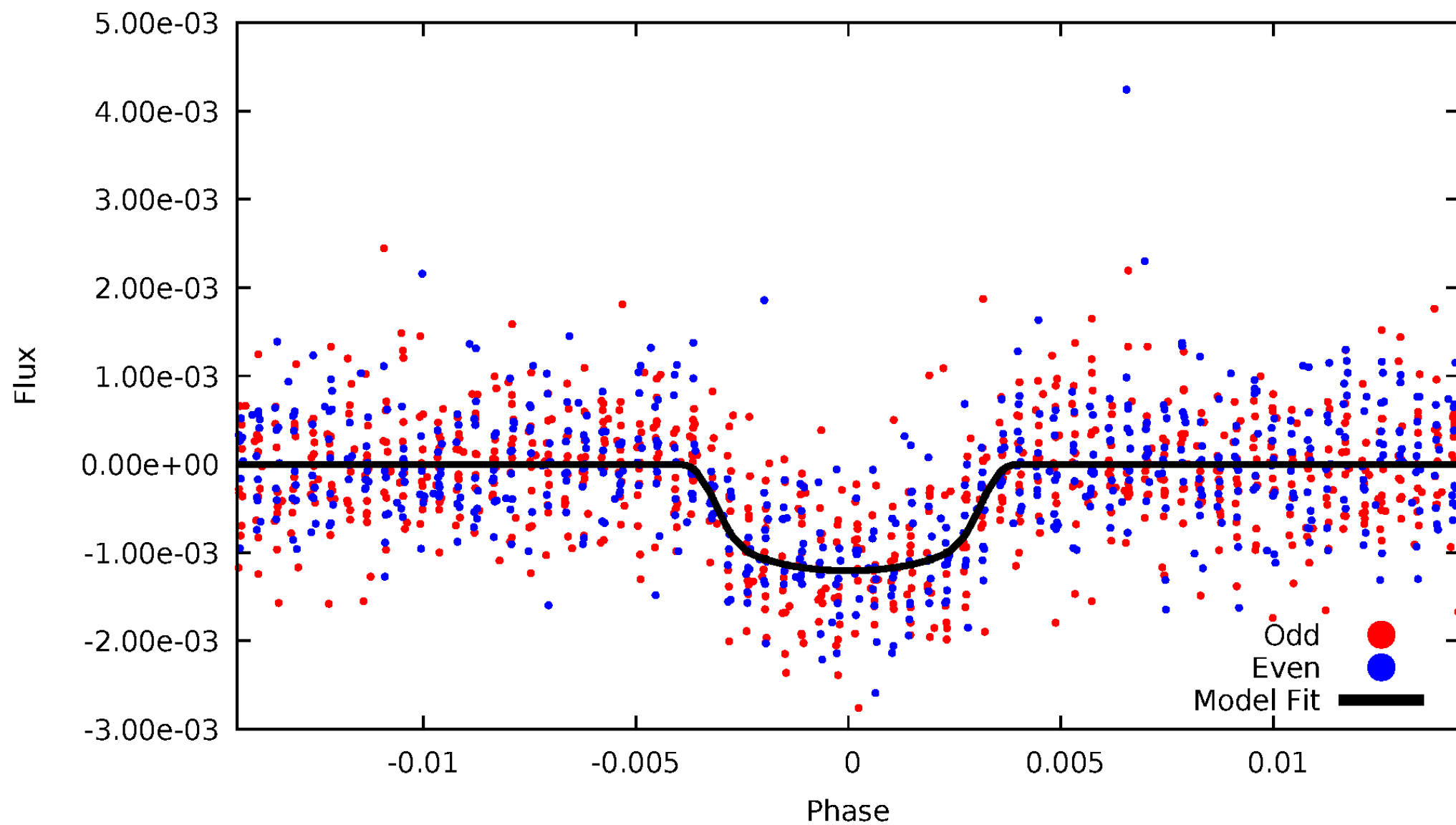


TCE 004725681-01



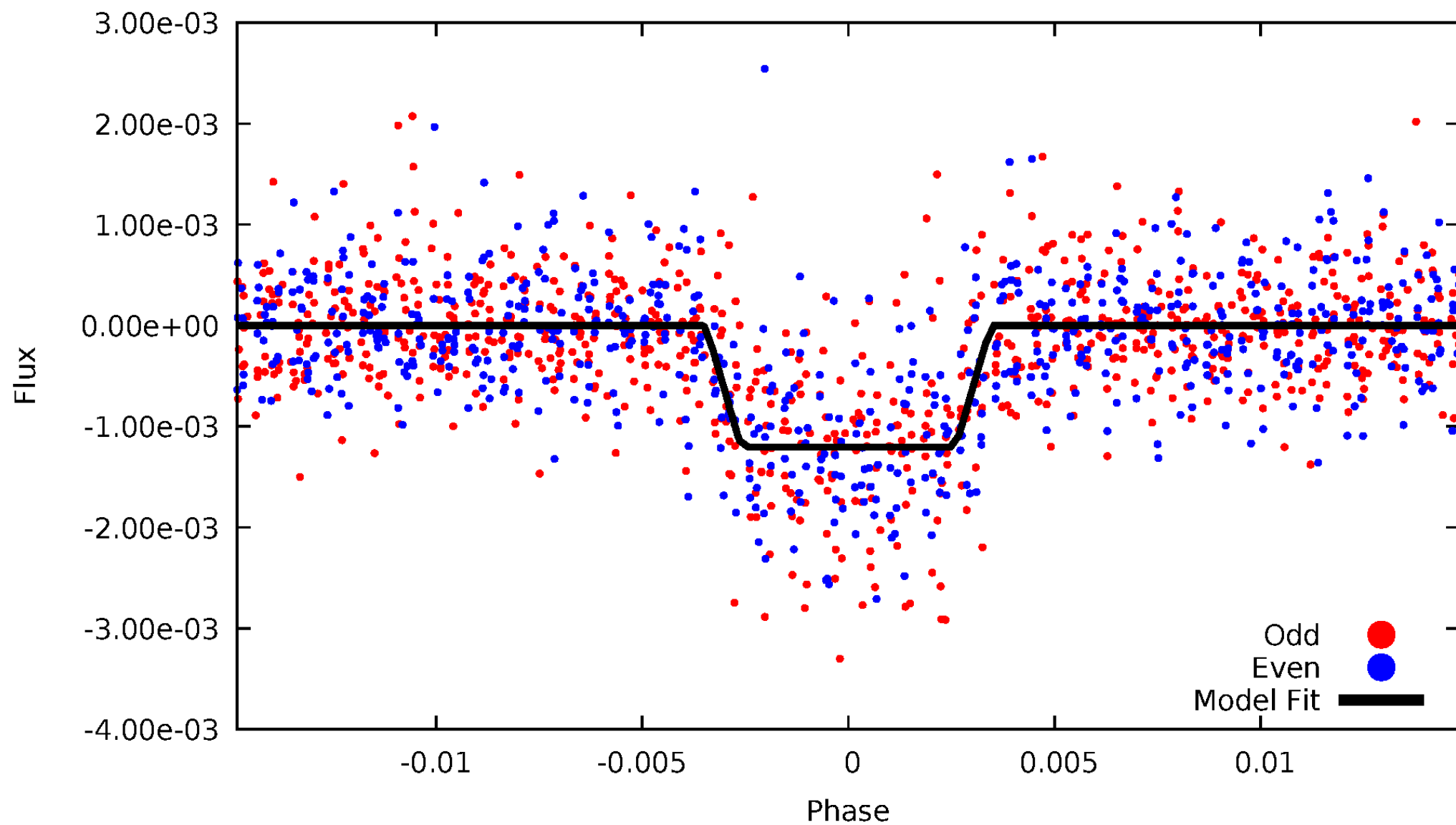
# DV Odd/Even

TCE 004725681-01



# ALT Odd/Even

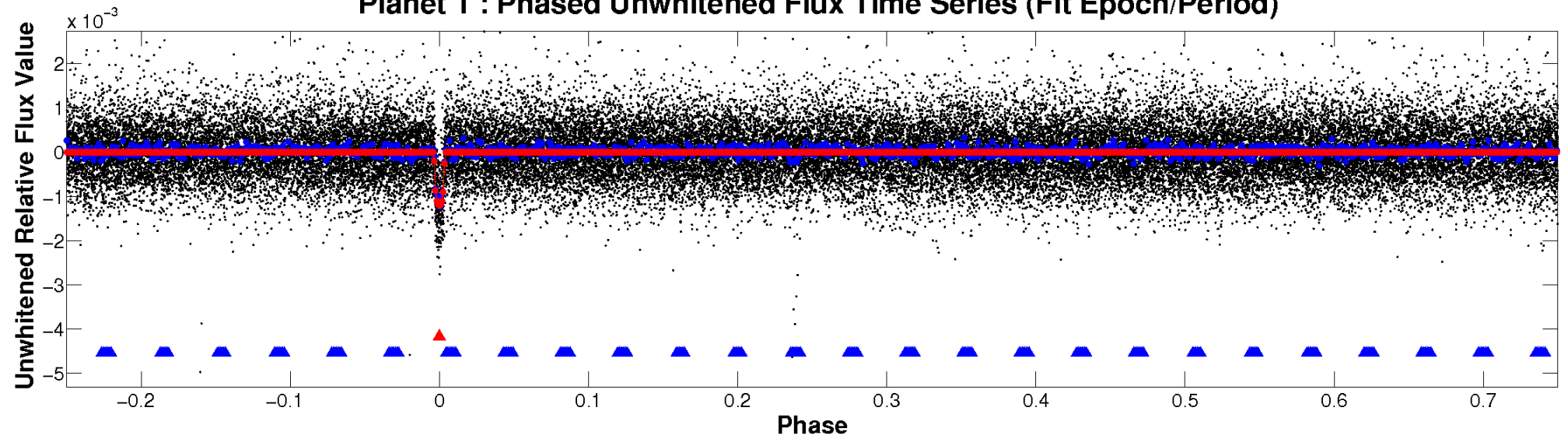
TCE 004725681-01



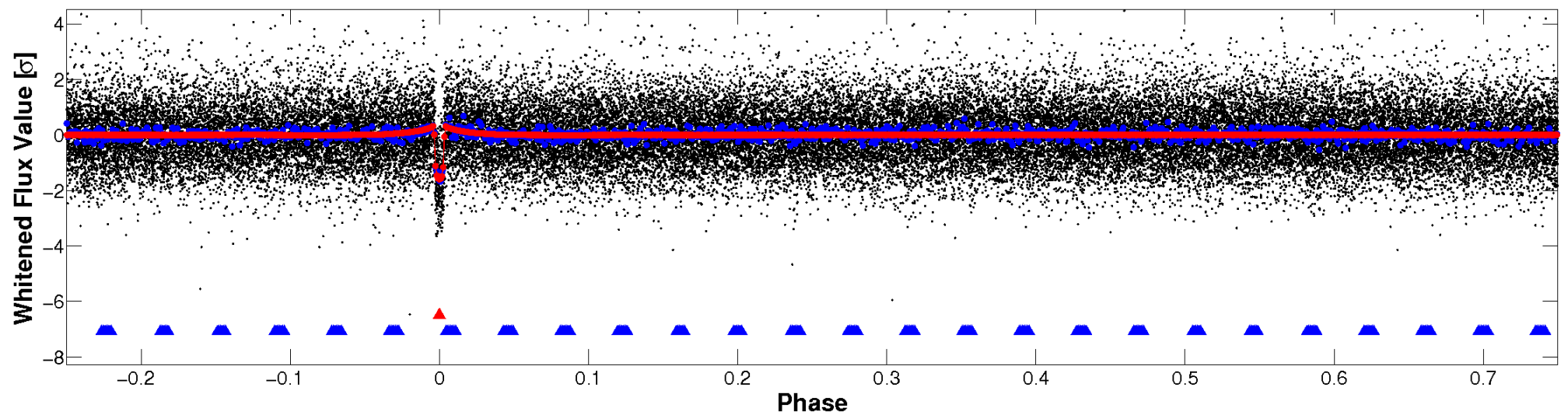


# Non-Whitened Vs. Whitened Light Curve

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

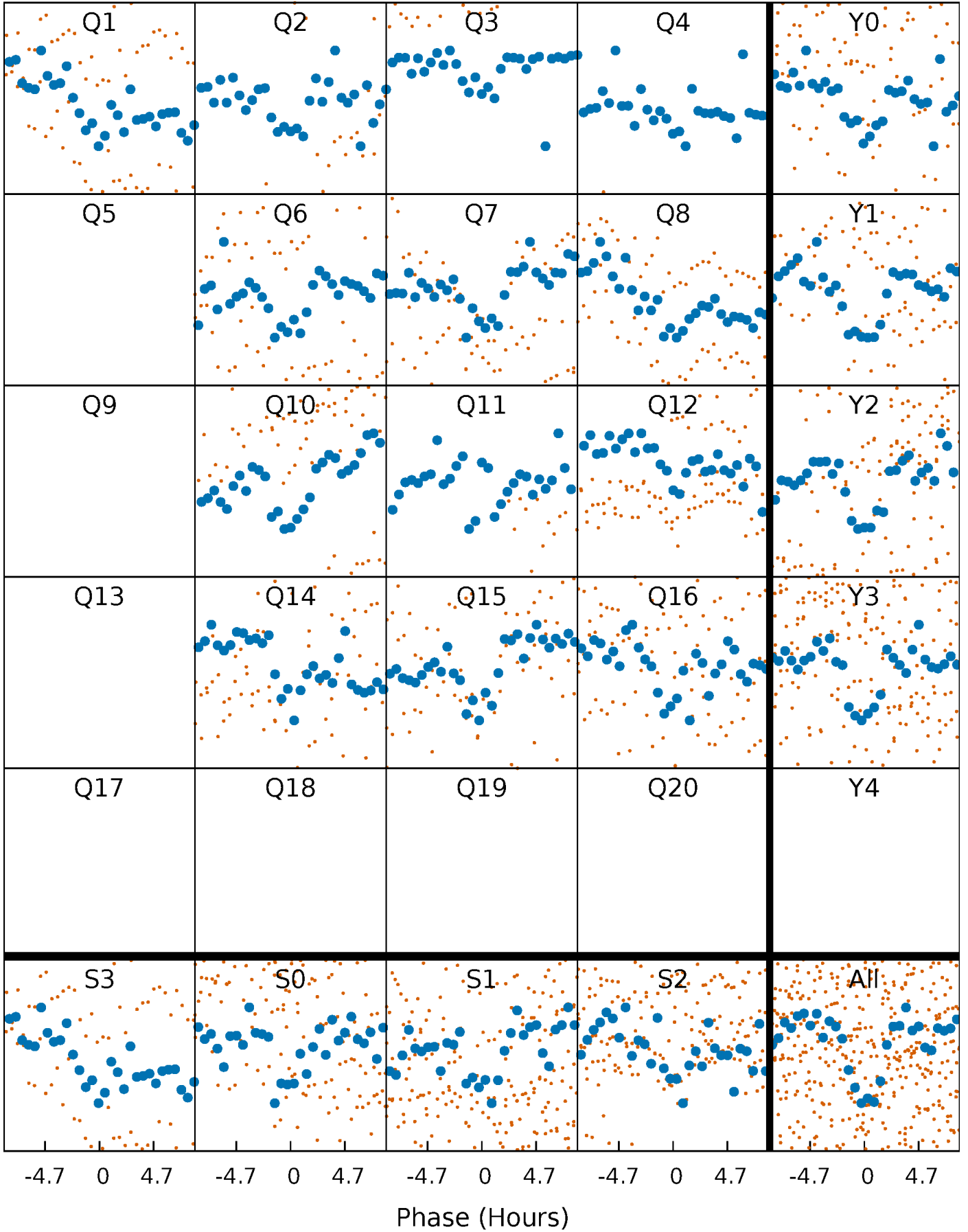


**Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



# PDC Quarter-Phased Transit Curves

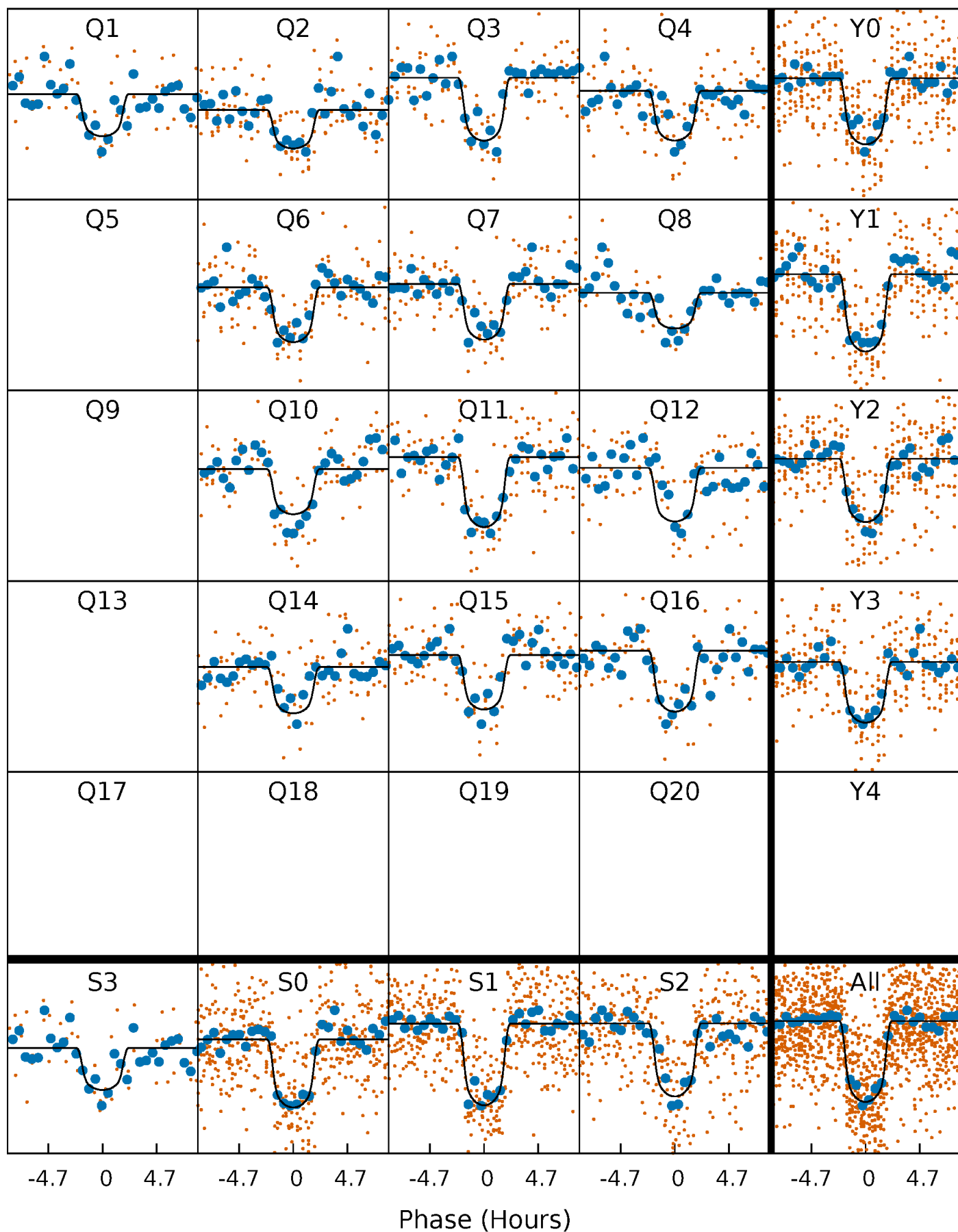
TCE 004725681-01 P= 23.967927 Days  $T_0=138.285969$  (BKJD)





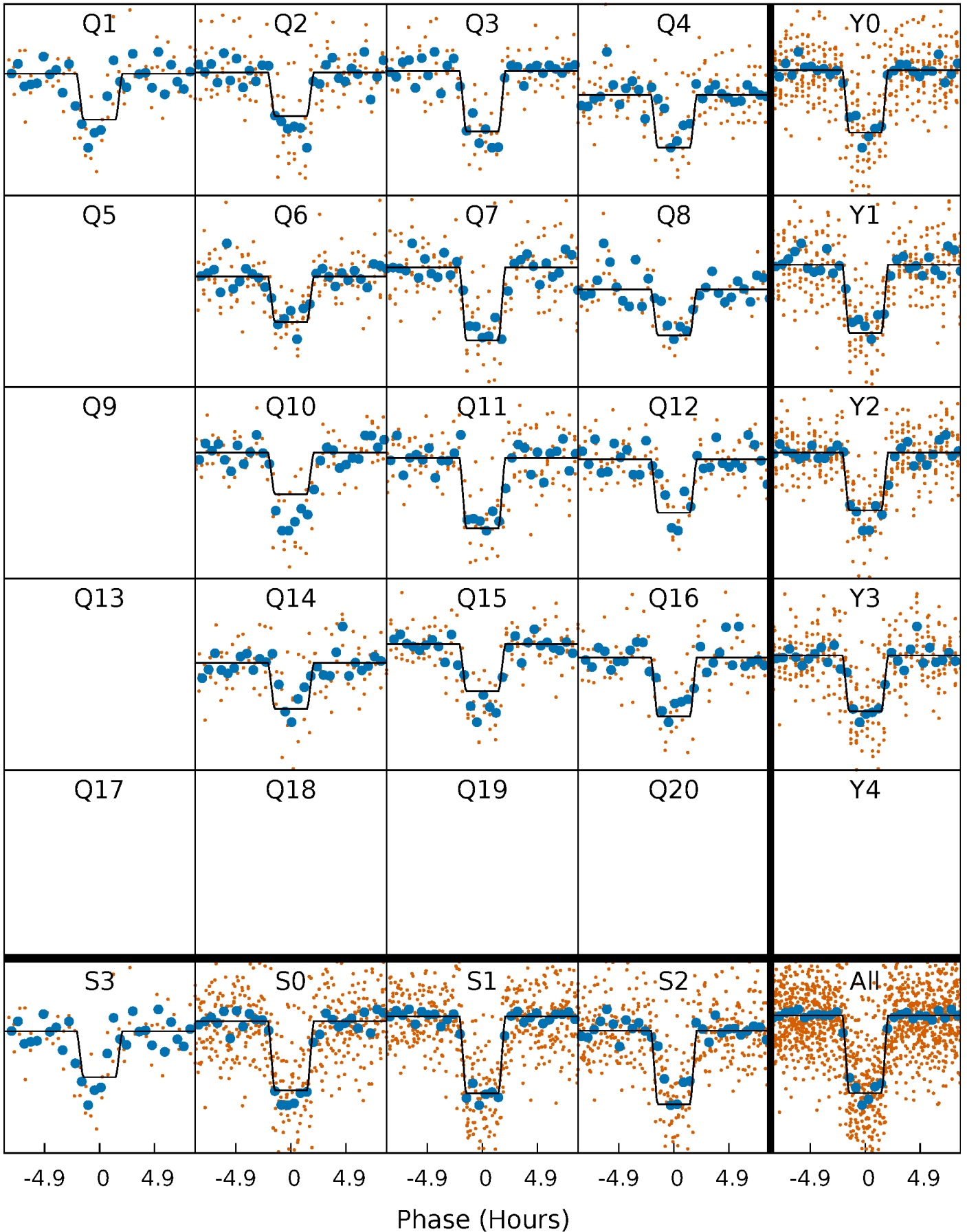
# DV Quarter-Phased Transit Curves

TCE 004725681-01 P= 23.967927 Days  $T_0=138.285969$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

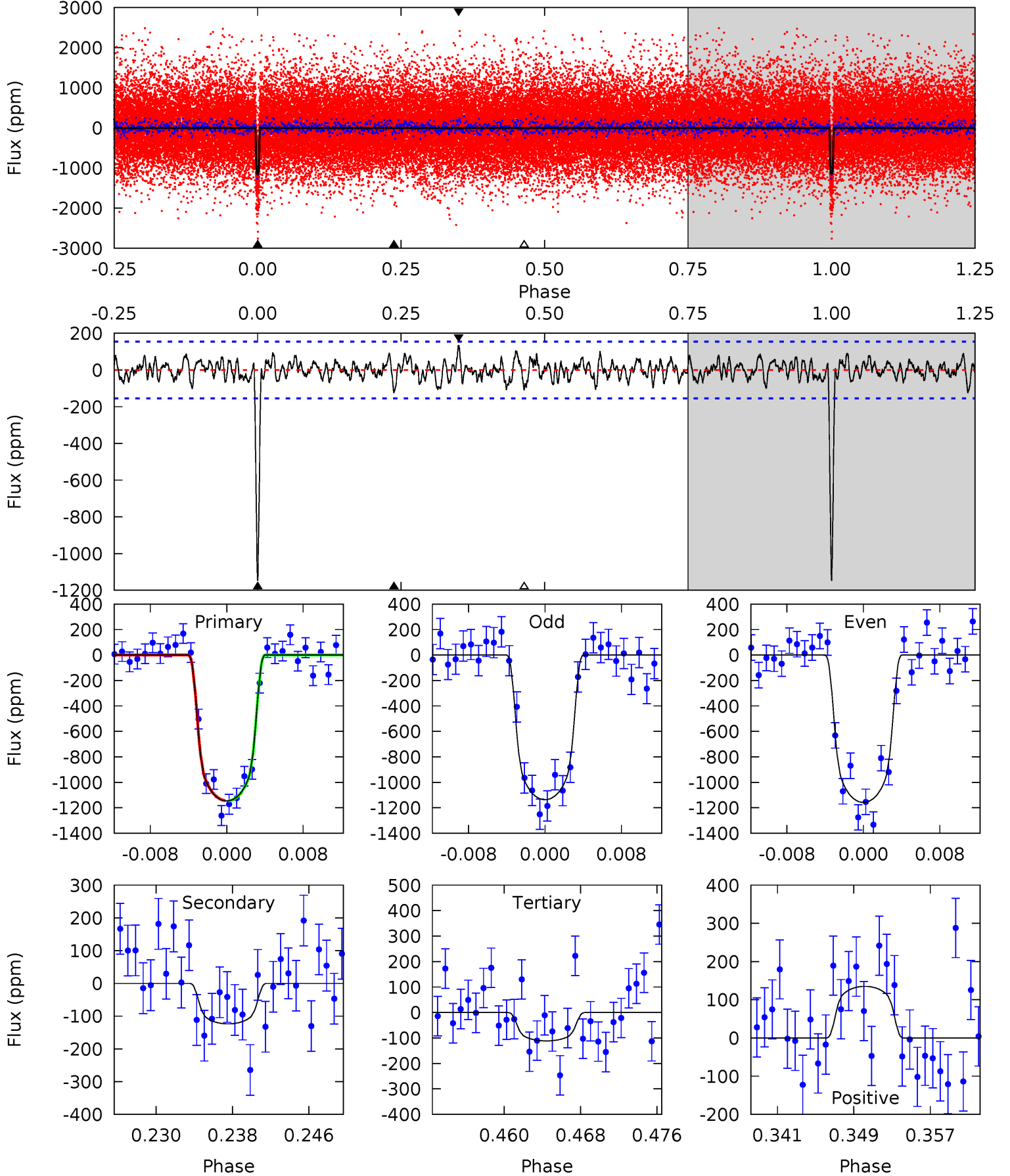
TCE 004725681-01 P= 23.967837 Days  $T_0=138.288034$  (BKJD)



# DV Model-Shift Uniqueness Test

004725681-01,  $P = 23.967927$  Days,  $E = 114.318042$  Days

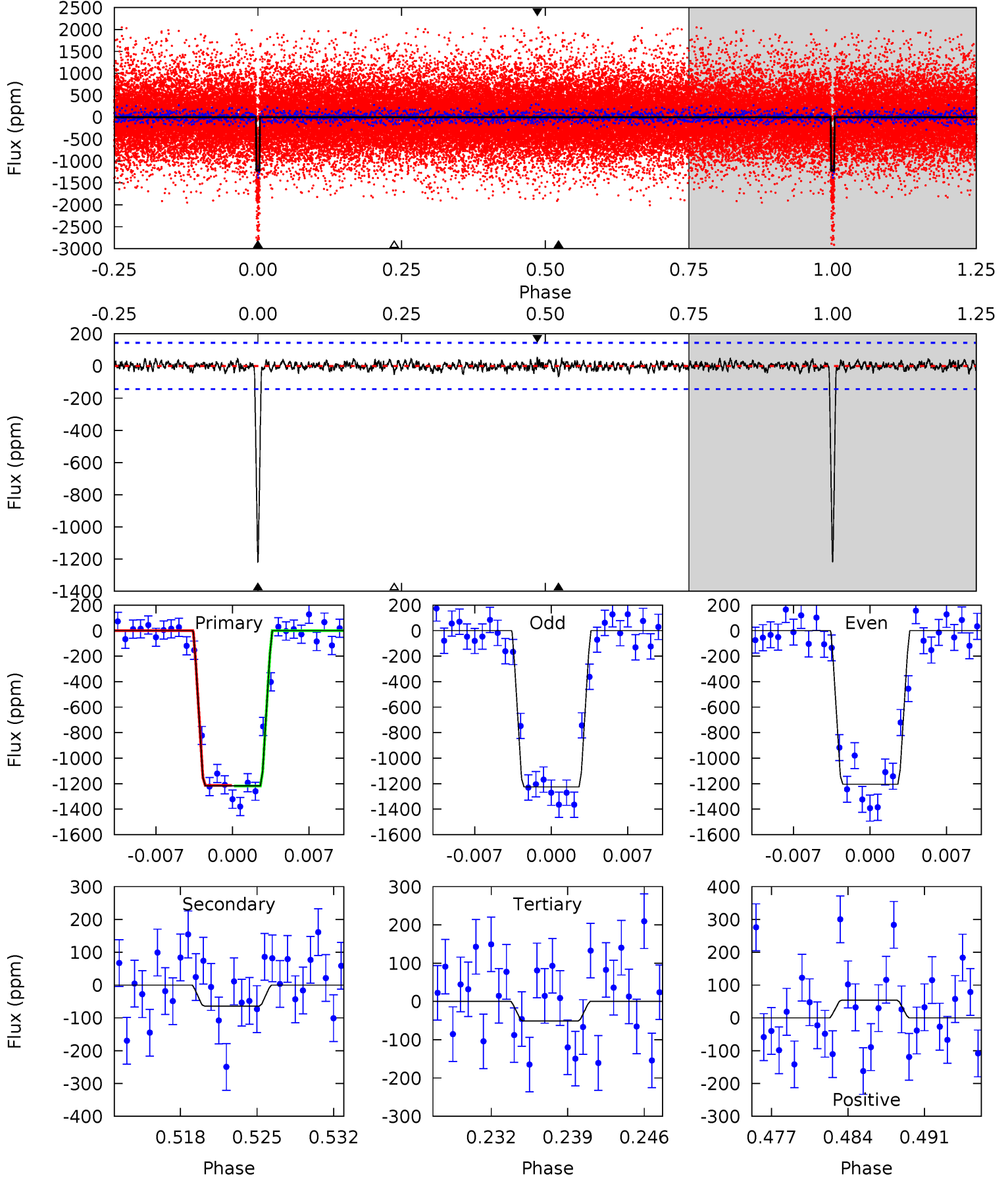
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
37.5	4.05	3.65	4.43	5.07	2.65	1.35	33.9	33.1	0.40	-0.38	0.34	0.98	0.11	0.06



# Alt Model-Shift Uniqueness Test

004725681-01,  $P = 23.967837$  Days,  $E = 114.320197$  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
43.1	2.27	1.81	1.92	5.10	2.71	0.61	41.3	41.2	0.46	0.35	0.38	1.03	0.04	0.09



### Stellar Parameters For KIC 004725681

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$3747^{+75}_{-83}$	$4.728^{+0.042}_{-0.025}$	$0.100^{+0.150}_{-0.150}$	$0.524^{+0.030}_{-0.044}$	$0.536^{+0.035}_{-0.039}$	$5.235^{+1.035}_{-0.594}$
	+2%/-2%	+1%/-1%	+150%/-150%	+6%/-8%	+7%/-7%	+20%/-11%
Source	SPE70	SPE60	SPE70	DSEP		

KIC = Kepler Input Catalog; PHO = Photometry; SPE = Spectroscopy; AST = Asteroseismology  
 TRA = Transits; DESP = Dartmouth Models; MULT = Multiple Models

### Secondary Eclipse Parameters for KIC 004725681-01 / KOI 0817.01

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-124 \pm 30$	$2.07^{+0.23}_{-0.20}$	$458^{+12}_{-12}$	$2640^{+119}_{-101}$	$273^{+97}_{-72}$
Alt.	$-64 \pm 28$	$1.96^{+0.22}_{-0.20}$	$457^{+12}_{-12}$	$2469^{+128}_{-162}$	$158^{+88}_{-68}$

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

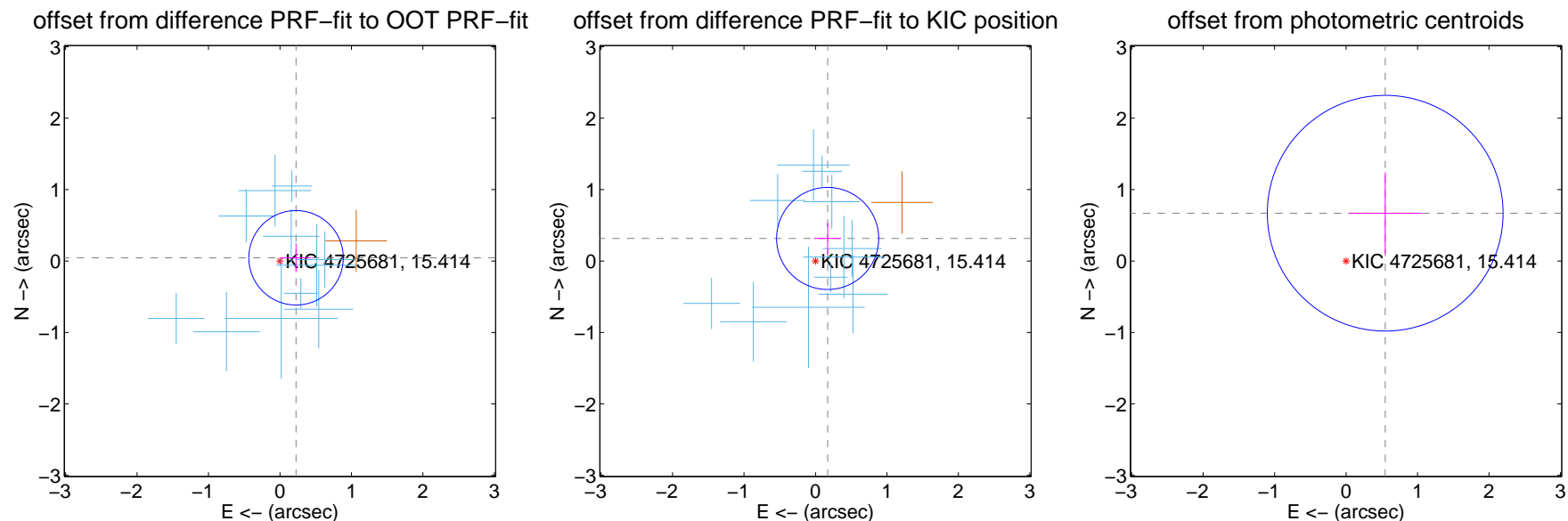
## DV Centroid Data

Supplemental centroid analysis for 004725681-01. Kepler magnitude: 15.41. Transit SNR 24.96

There are 11 quarters with good PRF difference image offsets

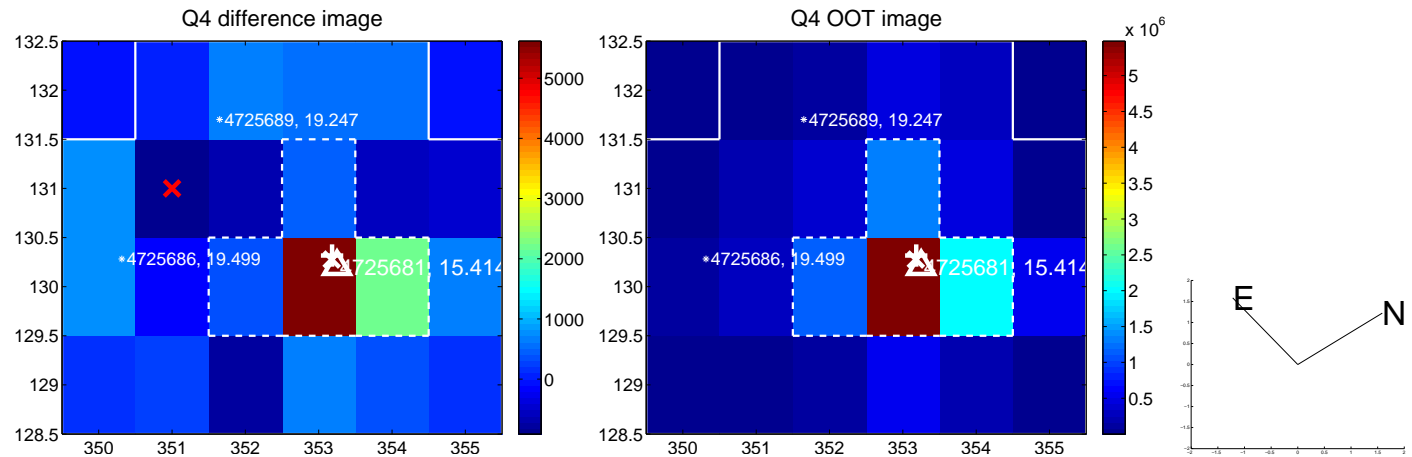
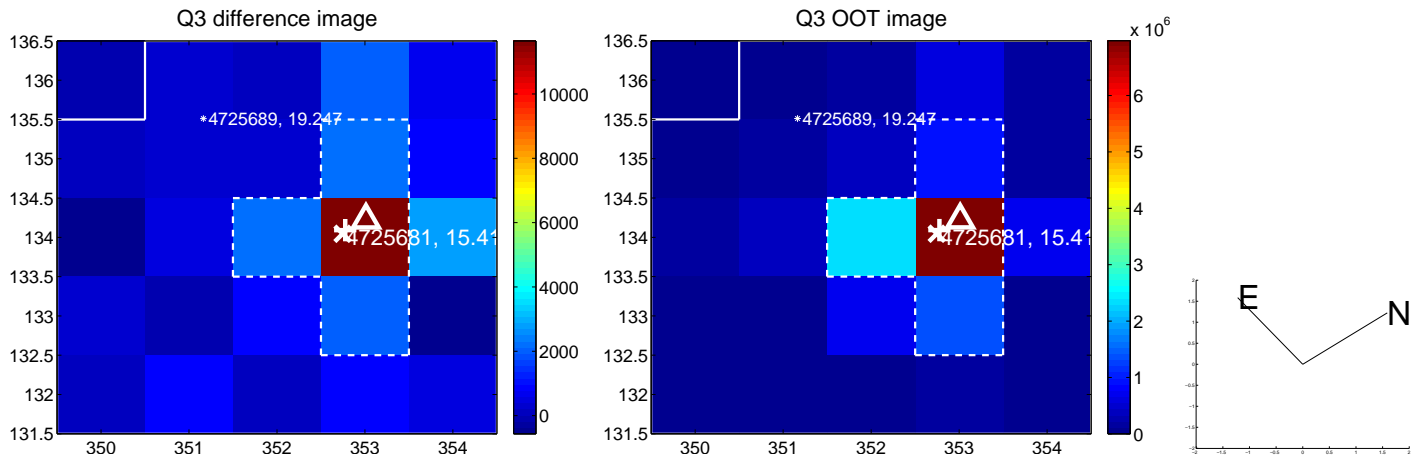
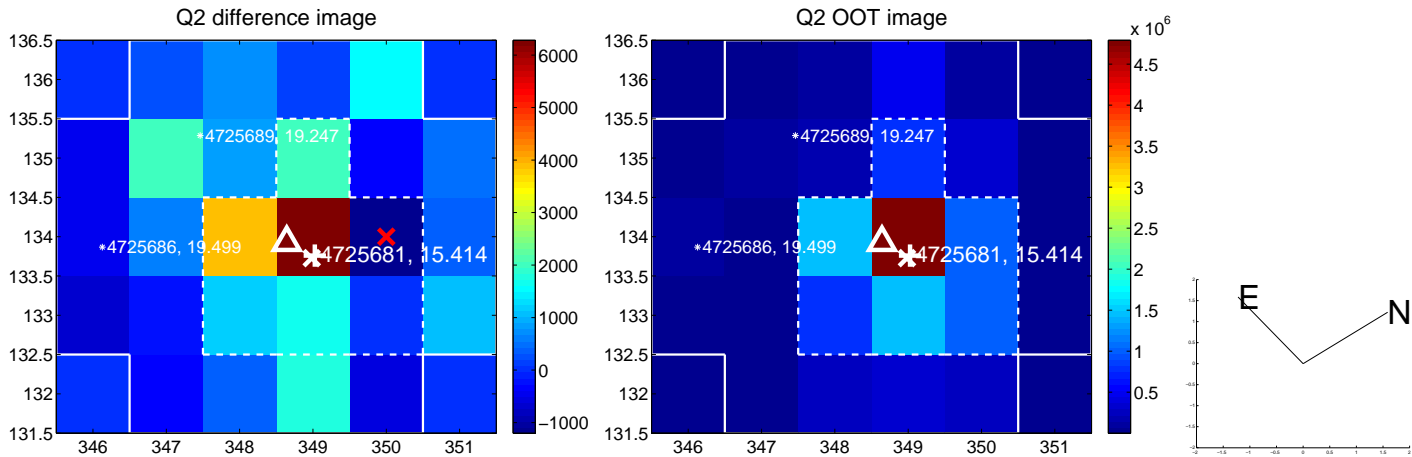
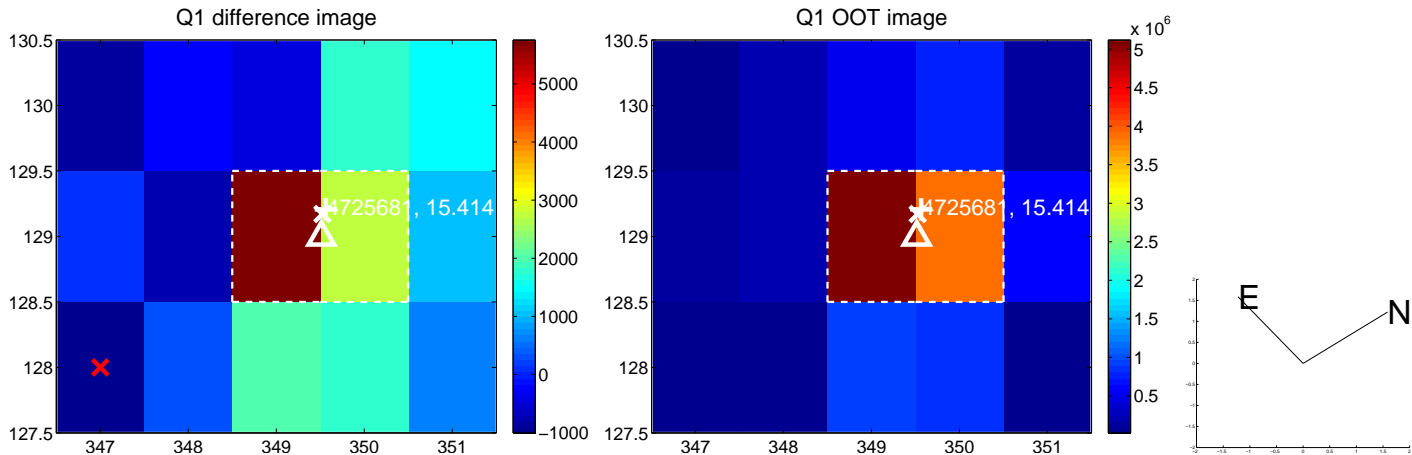
The direct PRF centroid is offset from the target star catalog position by about 0.24 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.230 \pm 0.220$	1.04	$-0.225 \pm 0.209$	$0.045 \pm 0.202$
PRF-fit source offset from KIC position	$0.359 \pm 0.238$	1.51	$-0.170 \pm 0.190$	$0.316 \pm 0.219$
photometric centroid source offset	$0.86 \pm 0.55$	1.57	$-0.55 \pm 0.52$	$0.67 \pm 0.57$



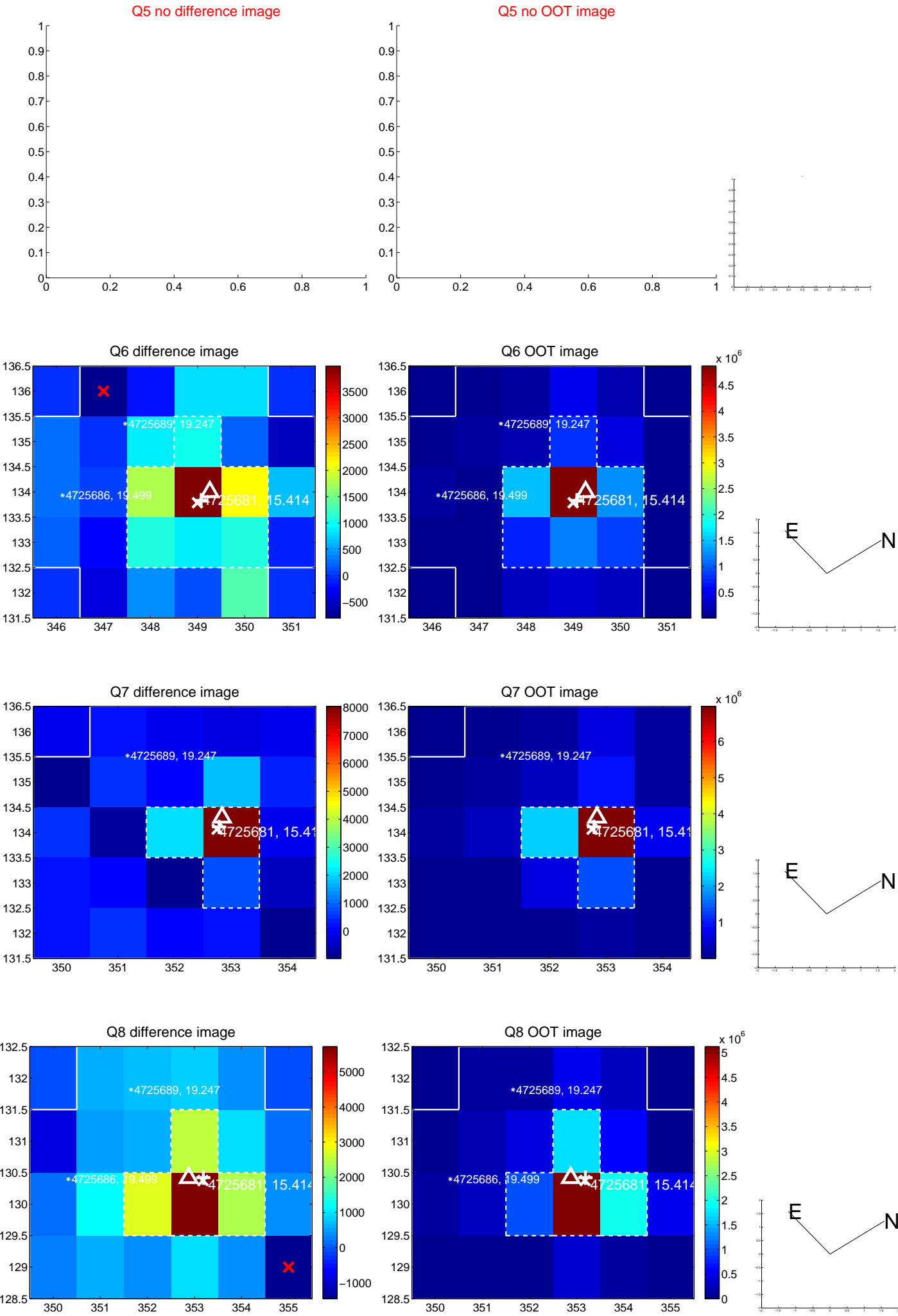
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets**; **Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

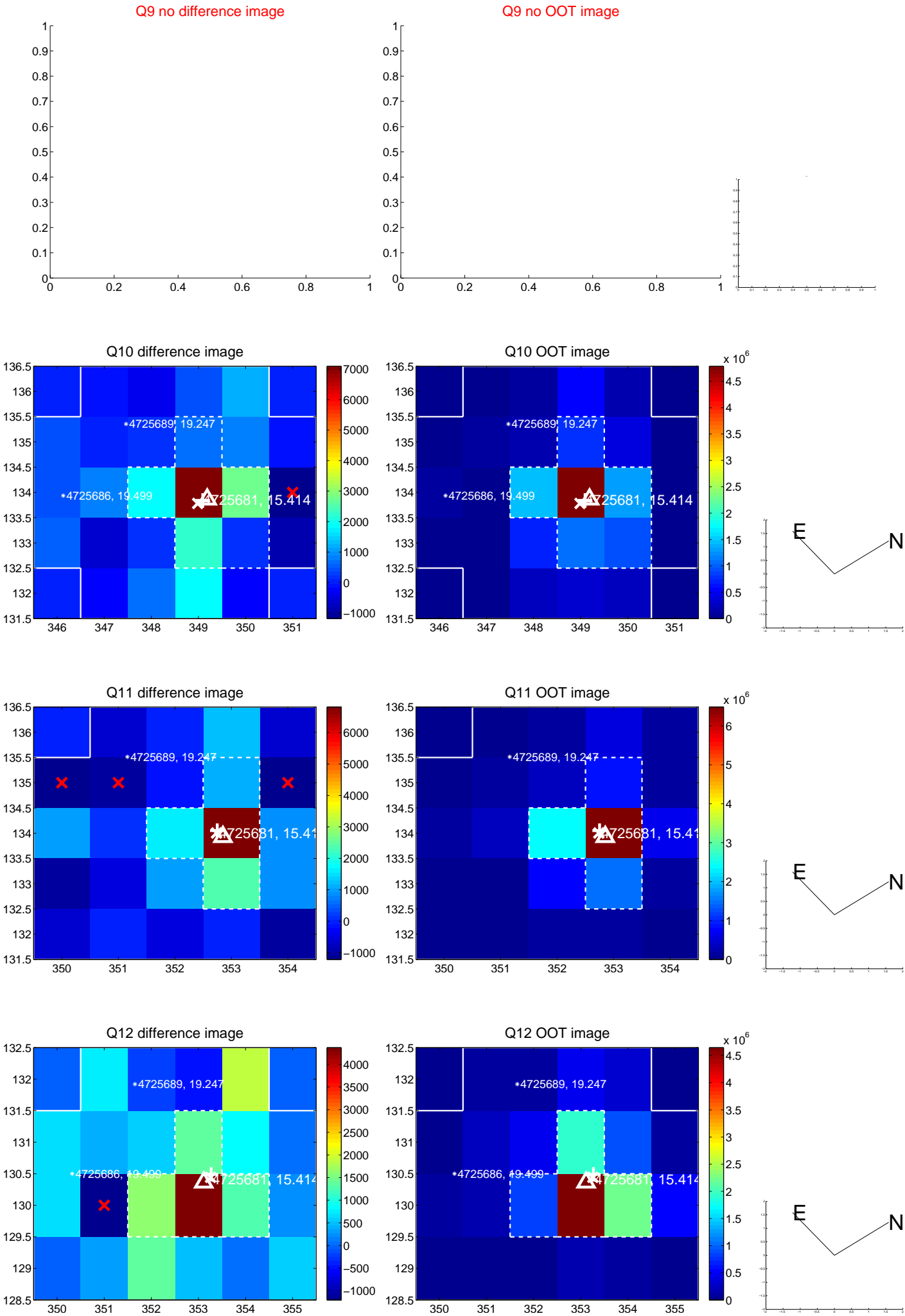




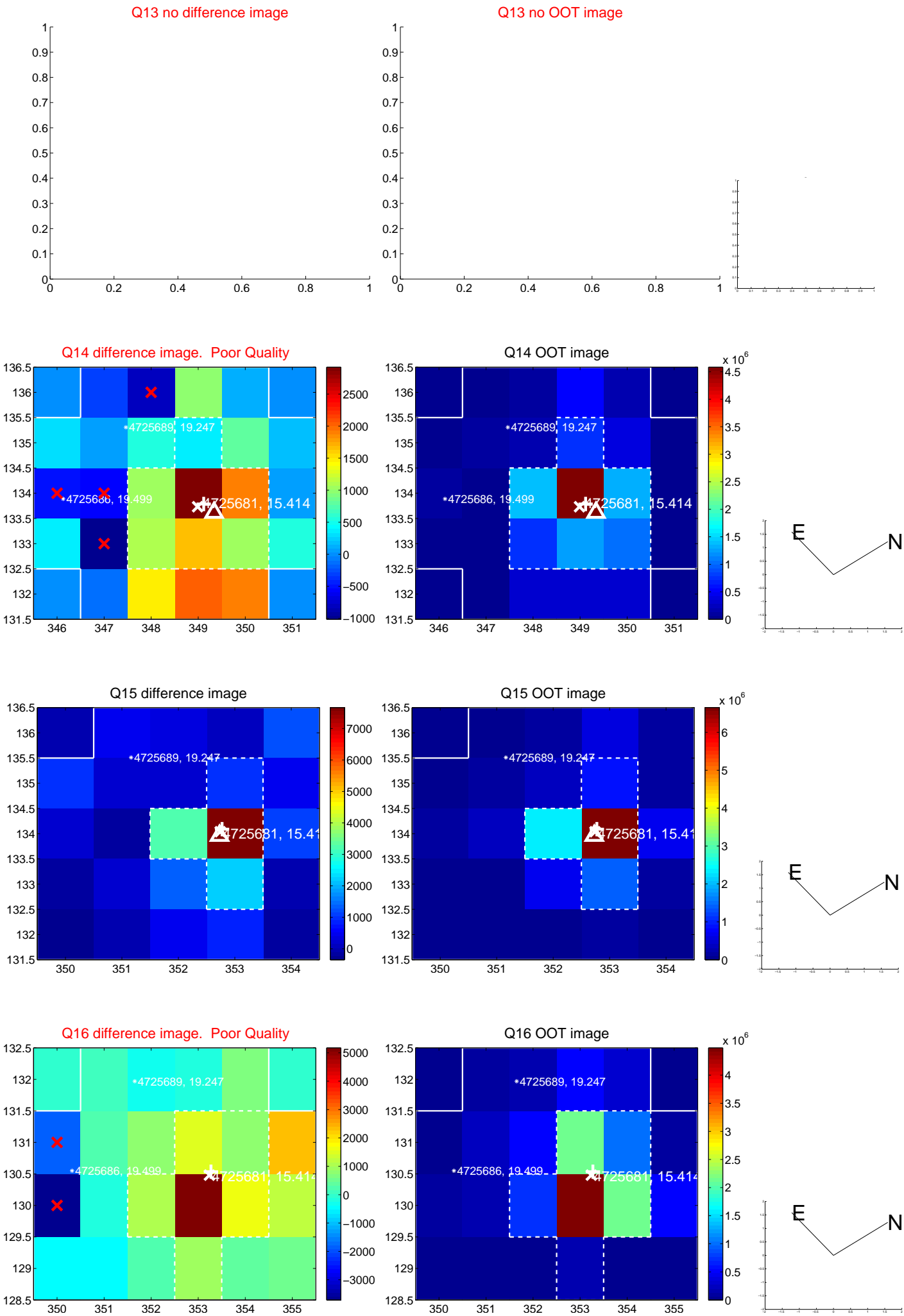
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



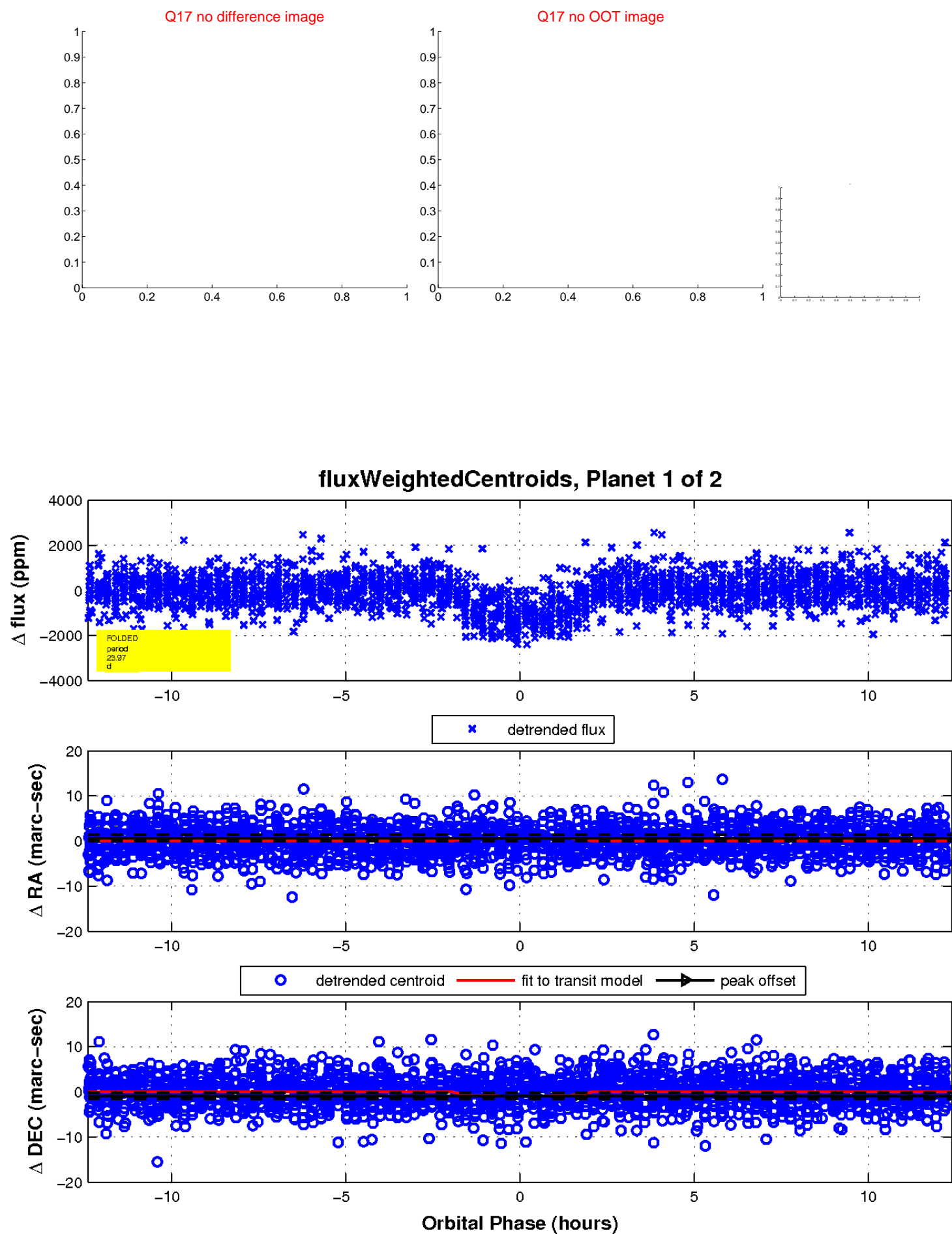
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

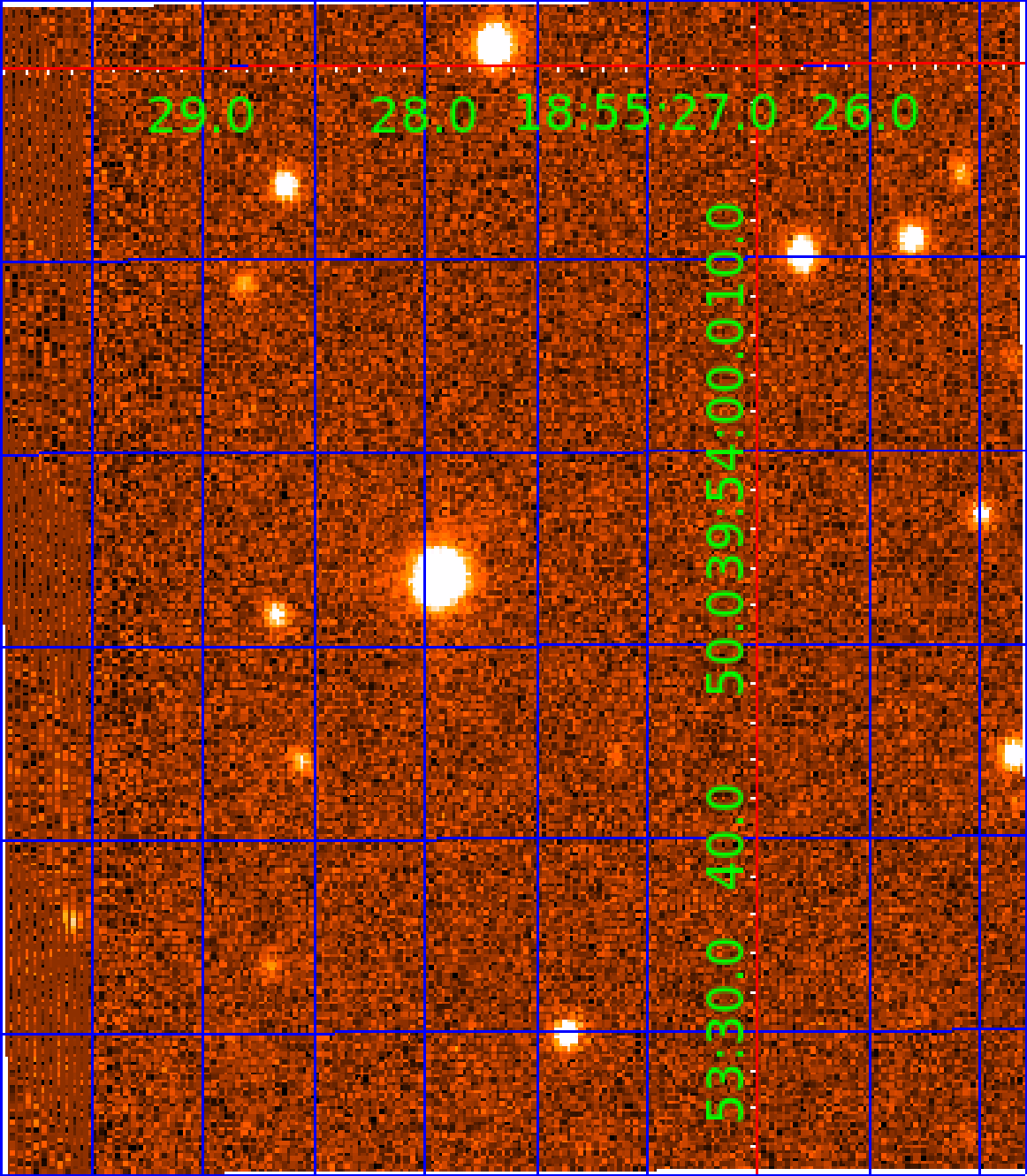


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 004725681

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
004725681-01	OBS	0817.01	23.967927	138.285969	1205.4	4.135	22.3	25.0	0.52	3747	2.09	2.78
004725681-02	OBS	0817.02	8.295582	135.794579	856.4	1.283	15.3	19.0	0.52	3747	1.84	11.43

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
004725681-01	OBS	PC	1.00	0	0	0	0	NO_COMMENT
004725681-02	OBS	PC	0.99	0	0	0	0	NO_COMMENT

**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.

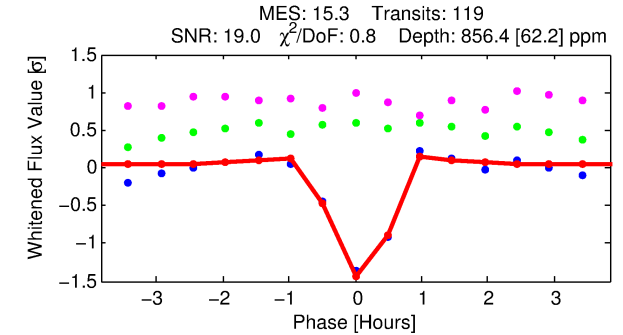
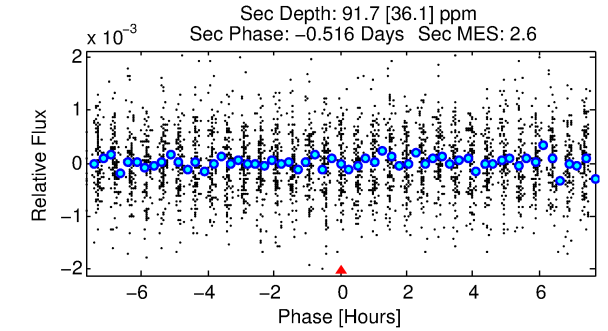
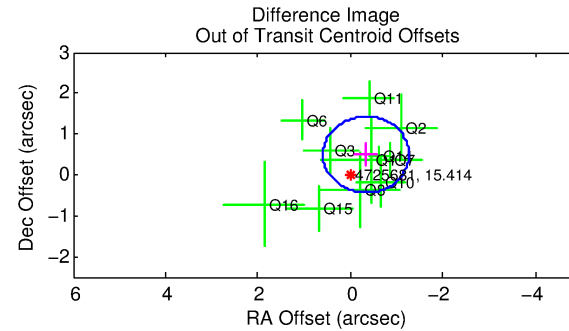
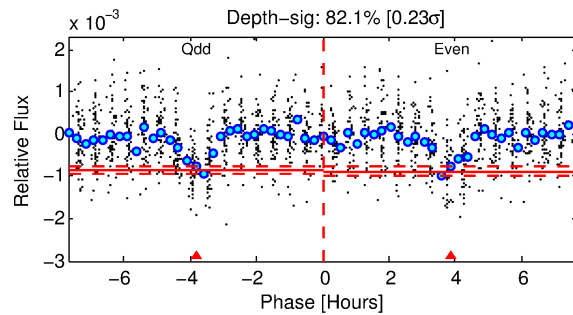
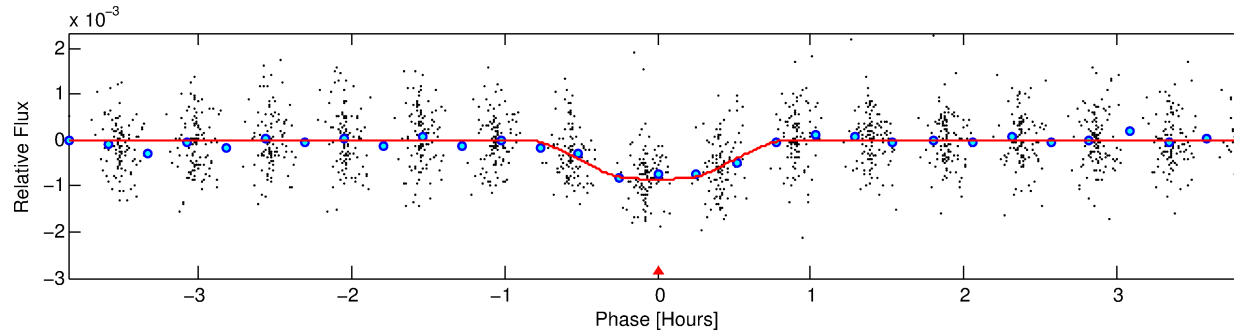
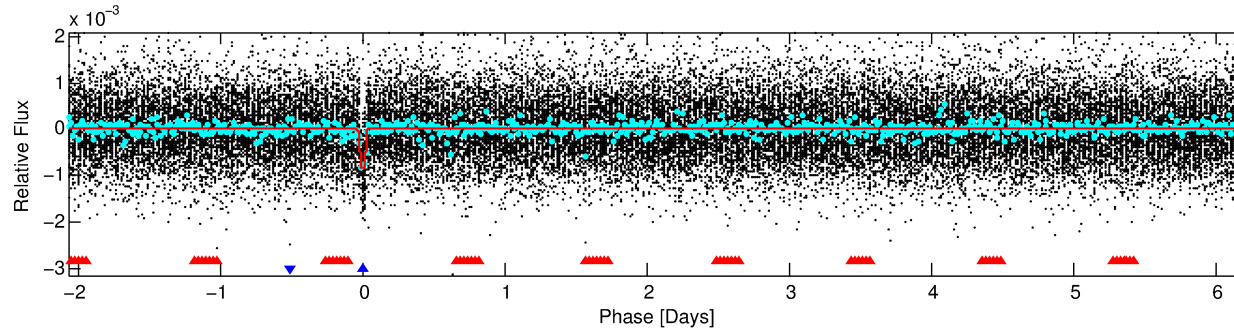
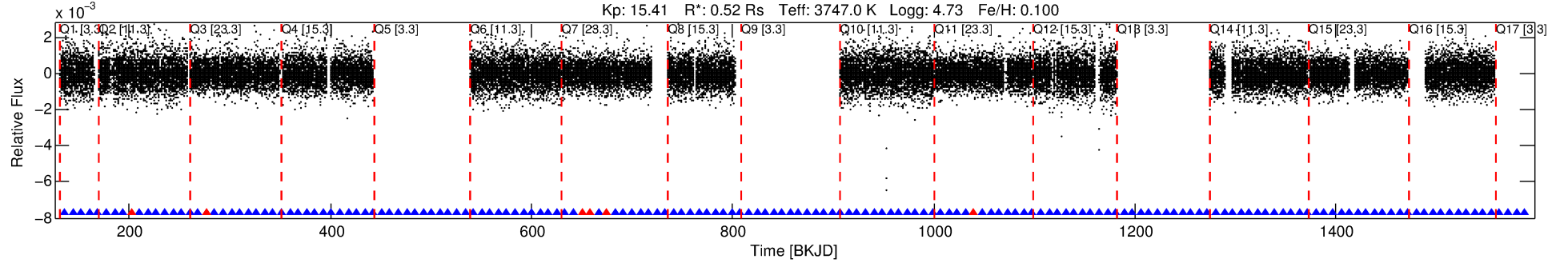
## Ephemeris Match Information For 004725681-02

No Significant Match Found

# DV One-Page Summary

KIC: 4725681 Candidate: 2 of 2 Period: 8.296 d  
KOI: K00817.02 Name: Kepler-236b Corr: 0.964

Kp: 15.41 R\*: 0.52 Rs Teff: 3747.0 K Logg: 4.73 Fe/H: 0.100



## DV Fit Results:

Period = 8.29558 [0.00002] d  
Epoch = 135.7946 [0.0015] BKJD  
Rp/R\* = 0.0322 [0.0151]  
a/R\* = 25.59 [49.63]  
b = 0.89 [0.45]  
Seff = 11.43 [1.41]  
Teq = 469 [14] K  
Rp = 1.84 [0.88] Re  
a = 0.0651 [0.0042] AU  
Ag = 63.23 [64.74] [0.96σ]  
Teffp = 2044 [523] K [3.01σ]

## DV Diagnostic Results:

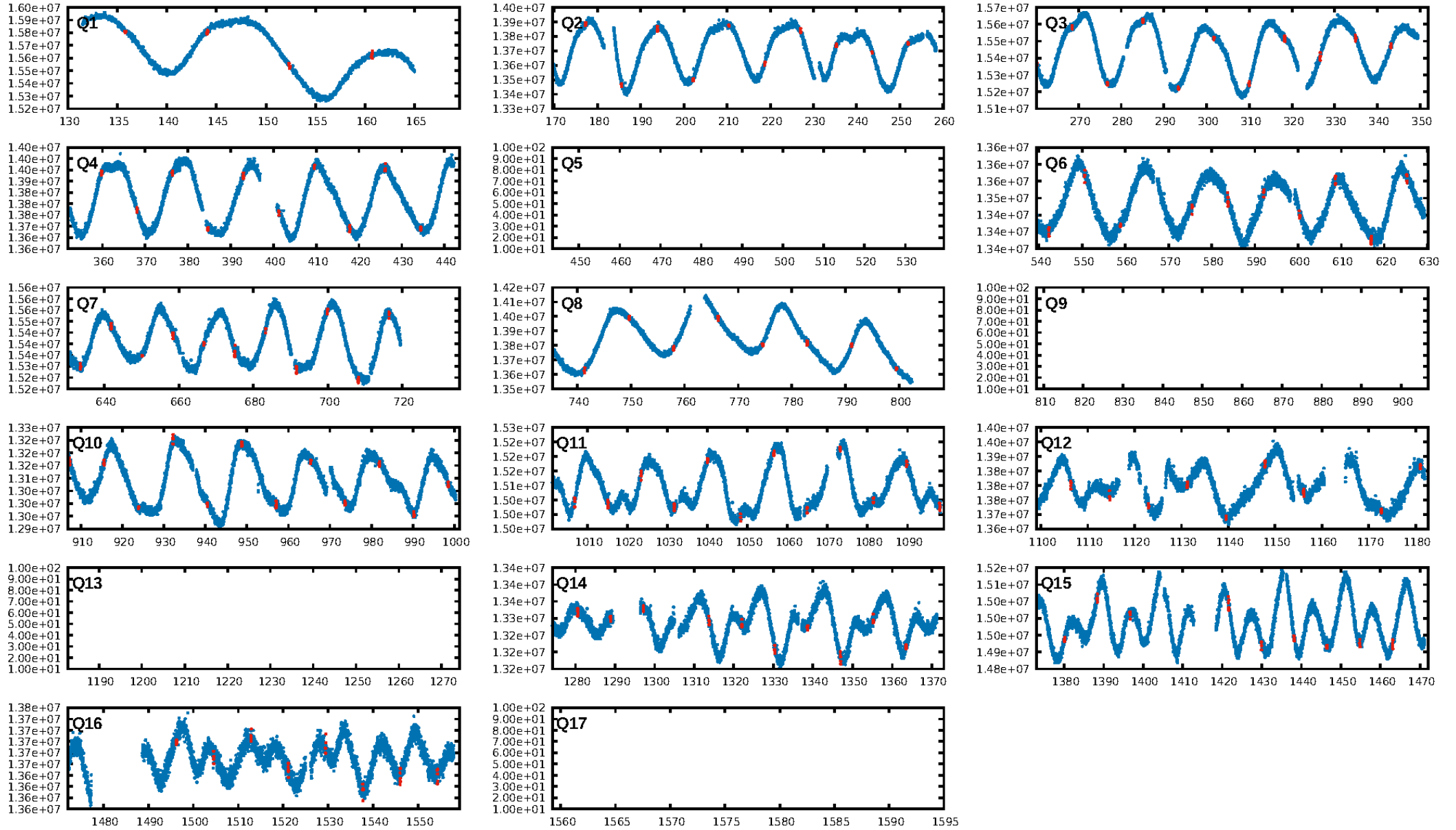
ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [86.89σ]  
ModelChiSquare2-sig: 98.1%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 1.22e-50  
RollingBand-fgt: 0.95 [109/115]  
GhostDiagnostic-chr: 7.802  
Centroid-sig: 2.9%  
Centroid-so: 1.073 arcsec [1.27σ]  
OotOffset-rm: 0.596 arcsec [1.92σ]  
KicOffset-rm: 0.936 arcsec [3.26σ]  
OotOffset-st: 4/4/2/1 [11]  
KicOffset-st: 4/4/2/1 [11]  
DiffImageQuality-fgm: 0.91 [10/11]  
DiffImageOverlap-fno: 1.00 [13/13]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 02:00:32 Z

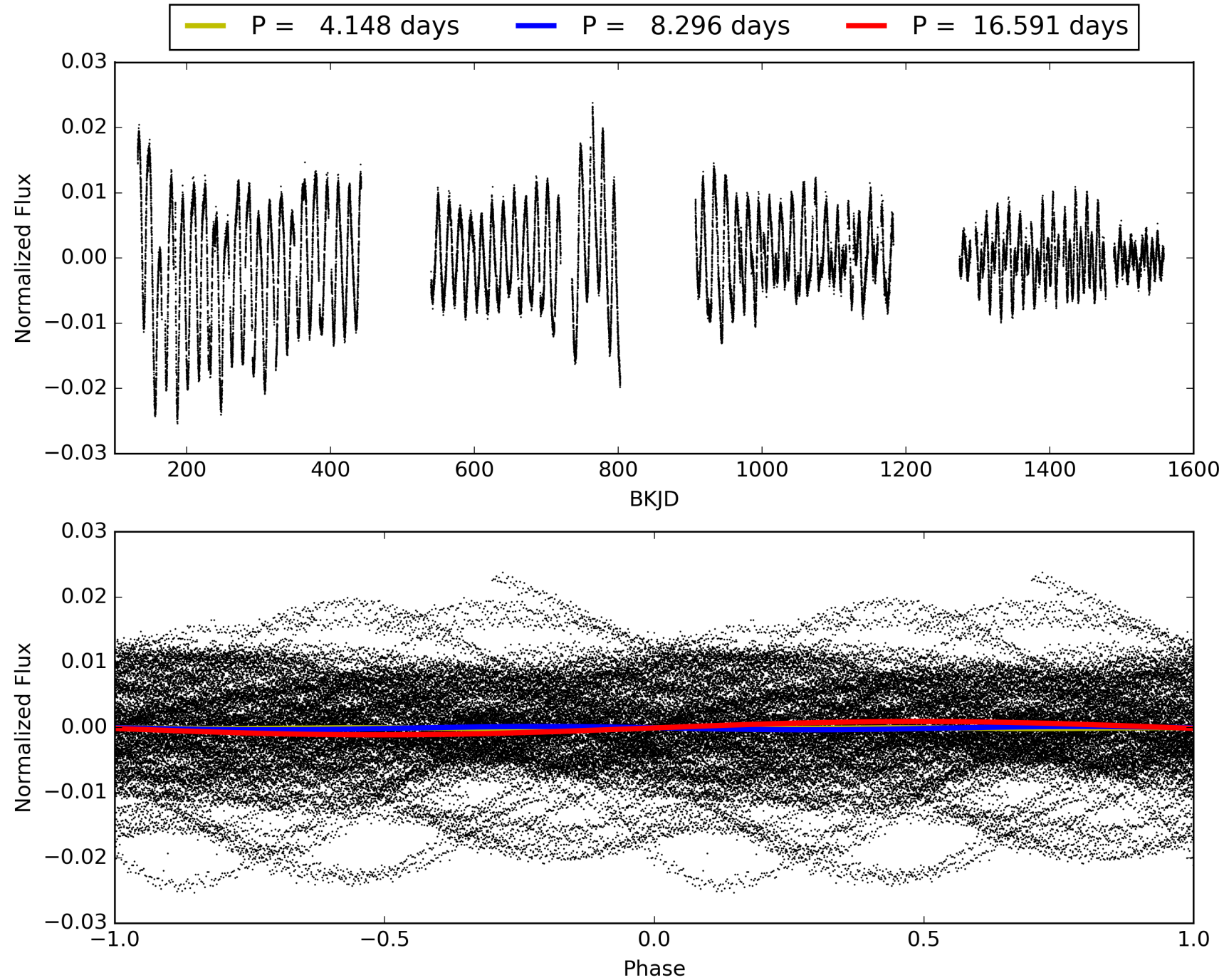
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center



# TCE 004725681-02, PDC Light Curves

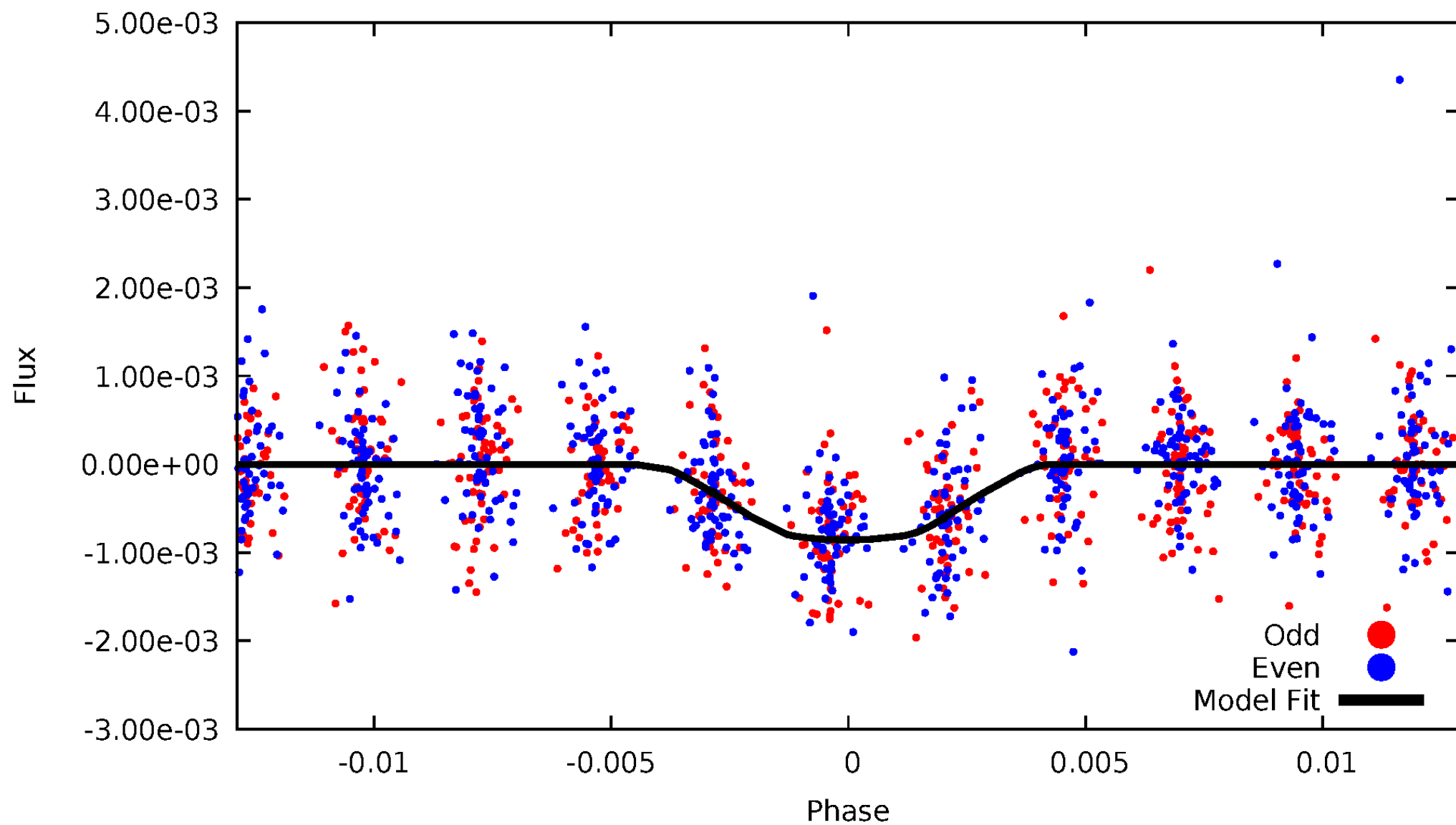


TCE 004725681-02



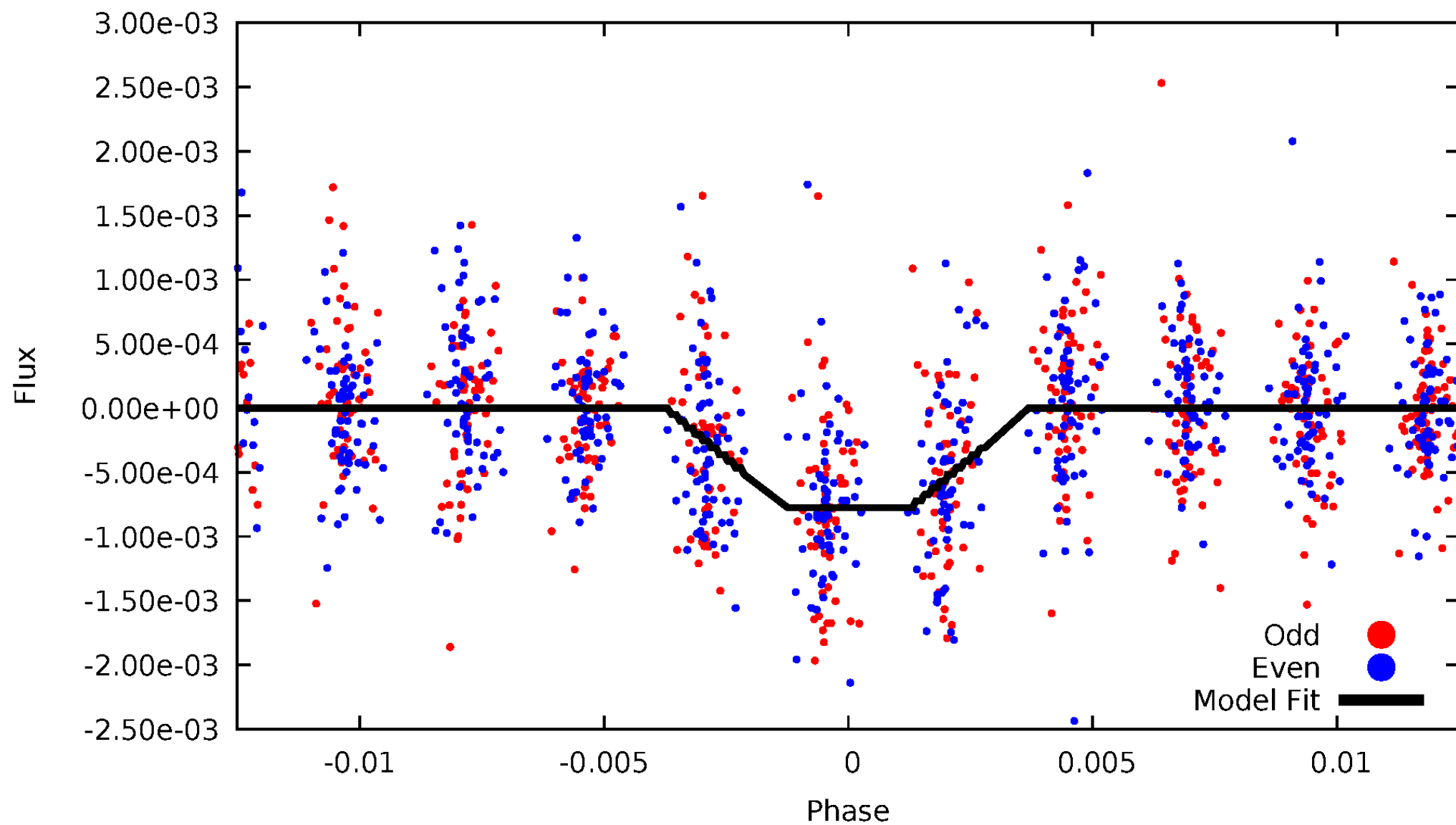
# DV Odd/Even

TCE 004725681-02



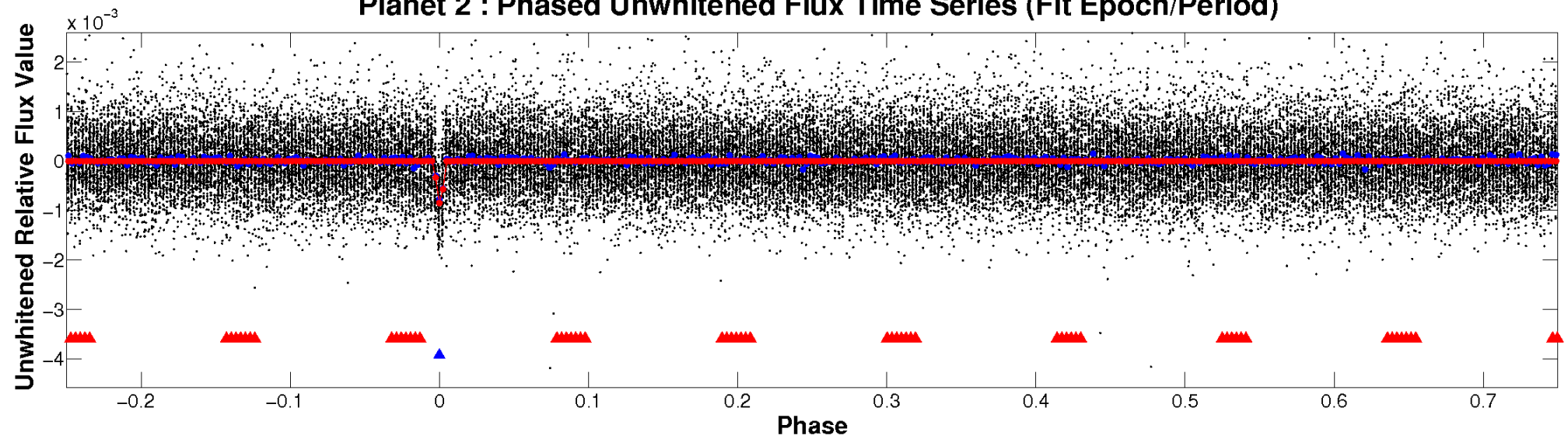
# ALT Odd/Even

TCE 004725681-02

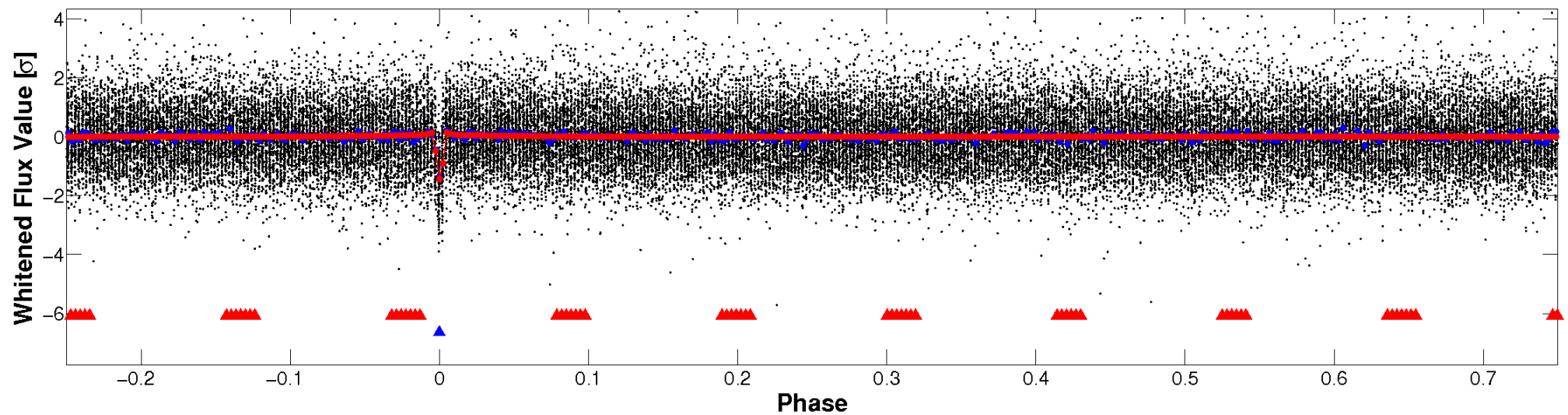


# Non-Whitened Vs. Whitened Light Curve

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

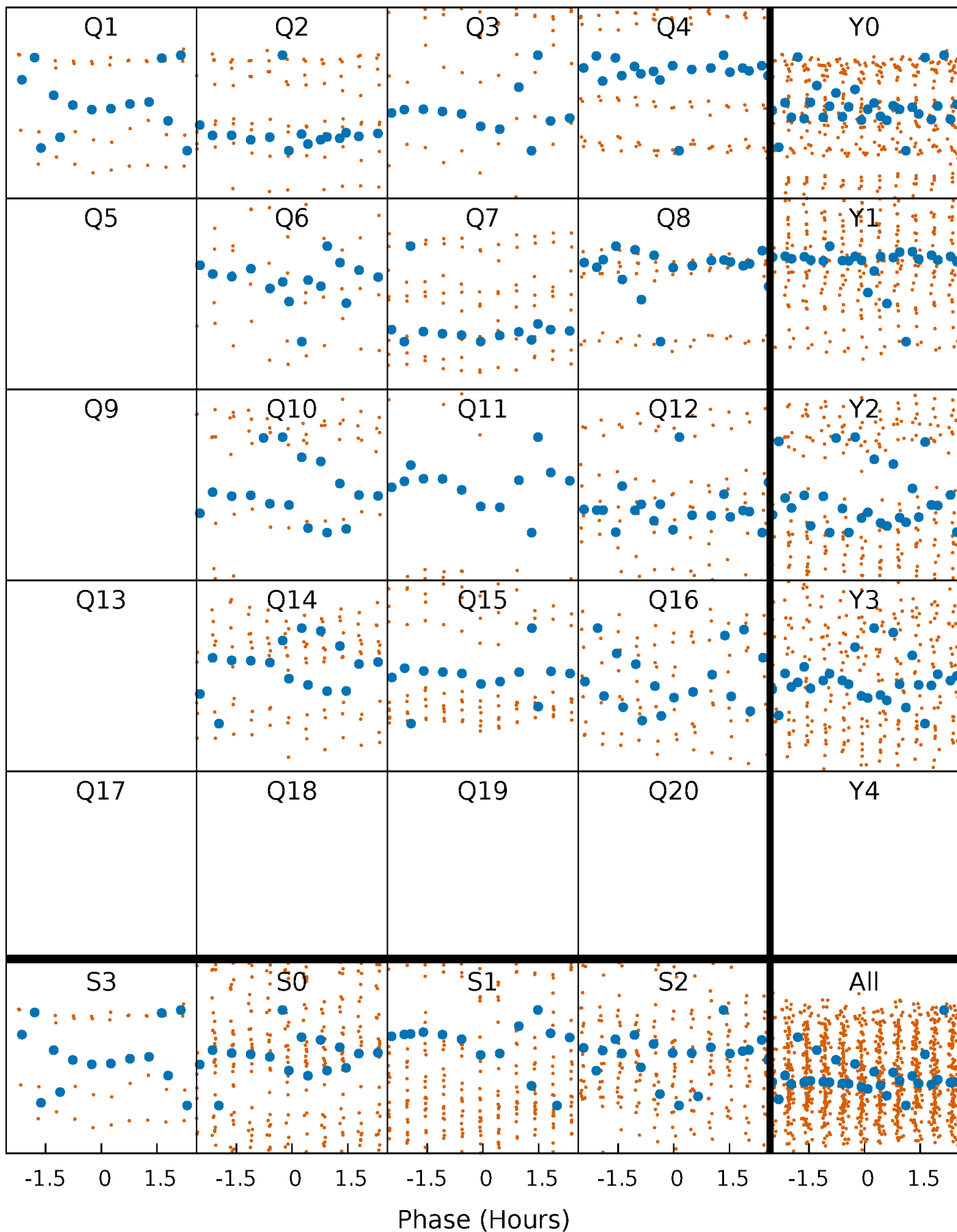


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



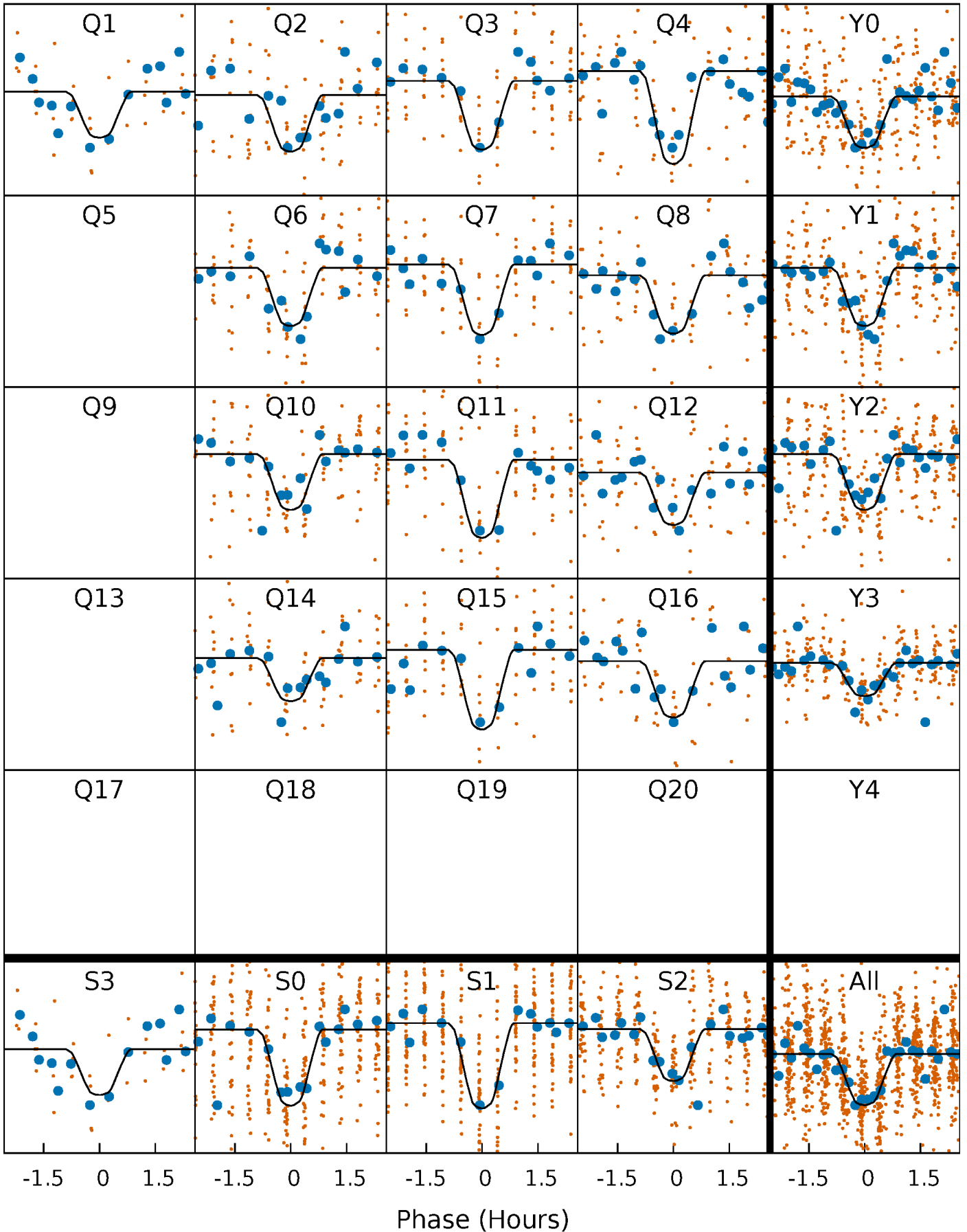
# PDC Quarter-Phased Transit Curves

TCE 004725681-02     $P = 8.295582$  Days     $T_0 = 135.794579$  (BKJD)



# DV Quarter-Phased Transit Curves

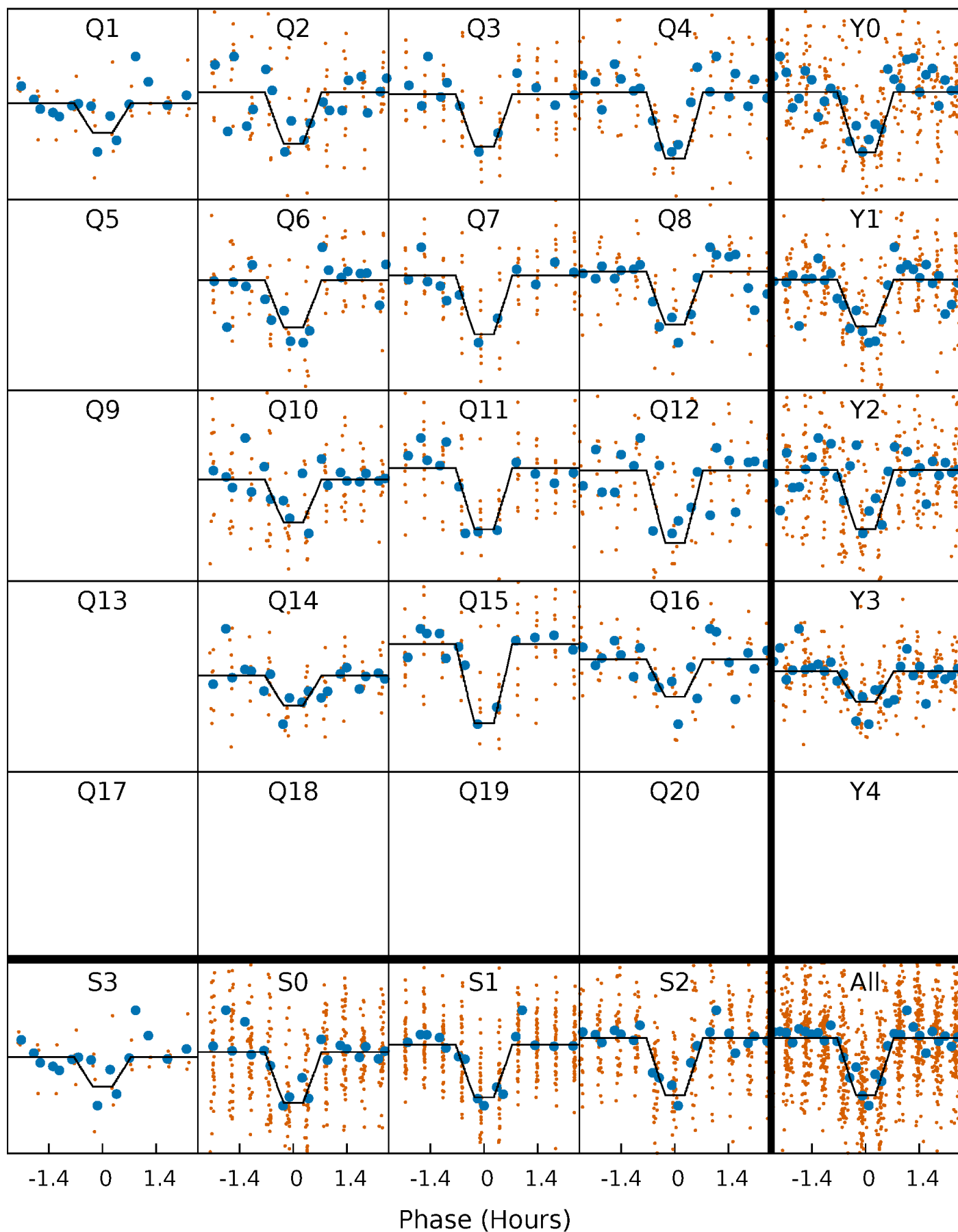
TCE 004725681-02   P= 8.295582 Days    $T_0=135.794579$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

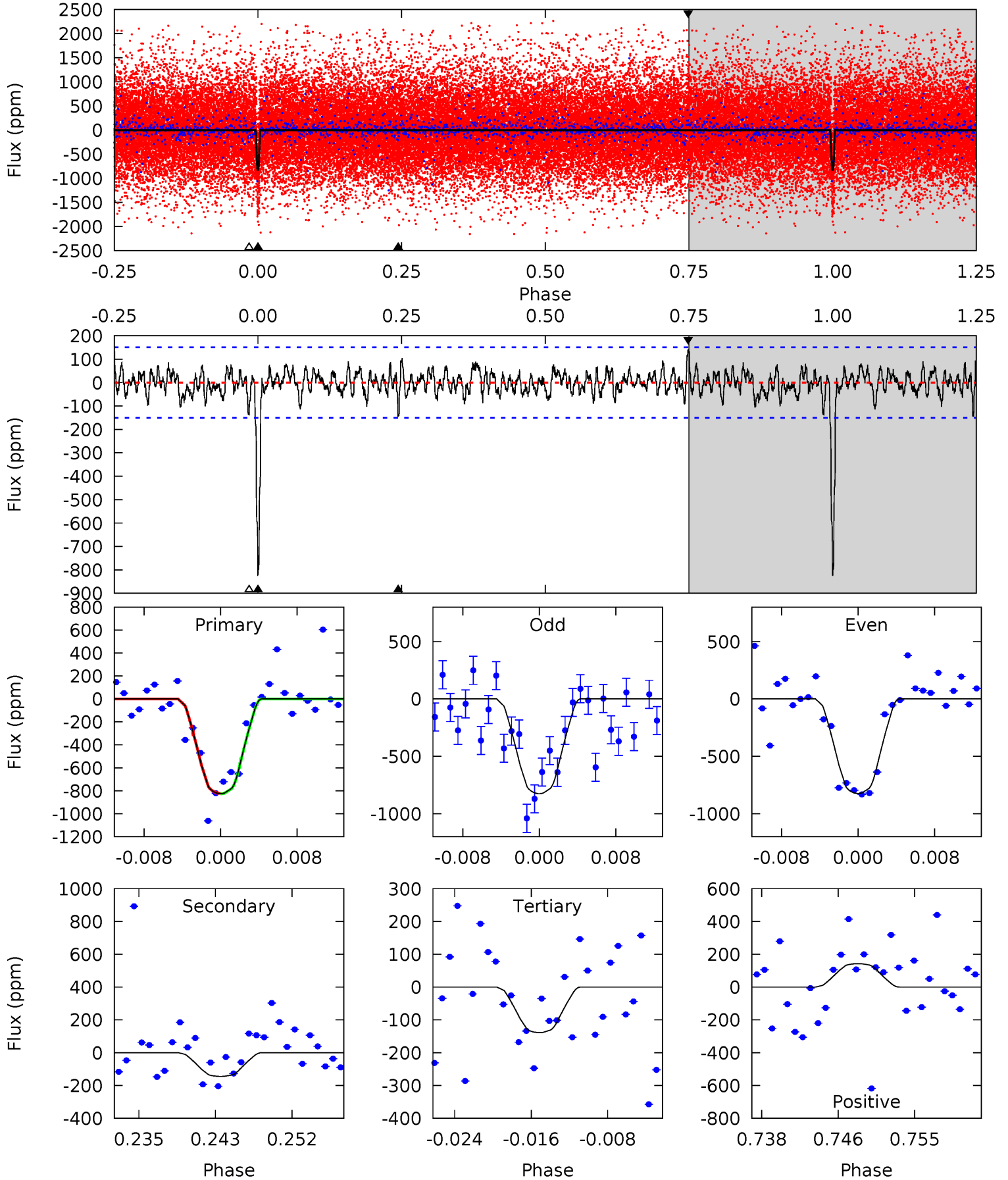
TCE 004725681-02   P= 8.295594 Days    $T_0=135.794089$  (BKJD)



# DV Model-Shift Uniqueness Test

004725681-02, P = 8.295582 Days, E = 127.498997 Days

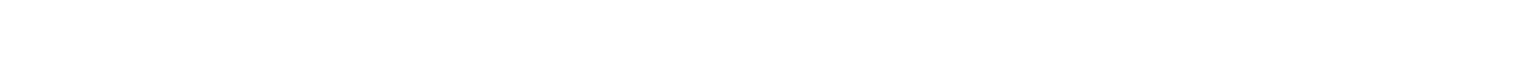
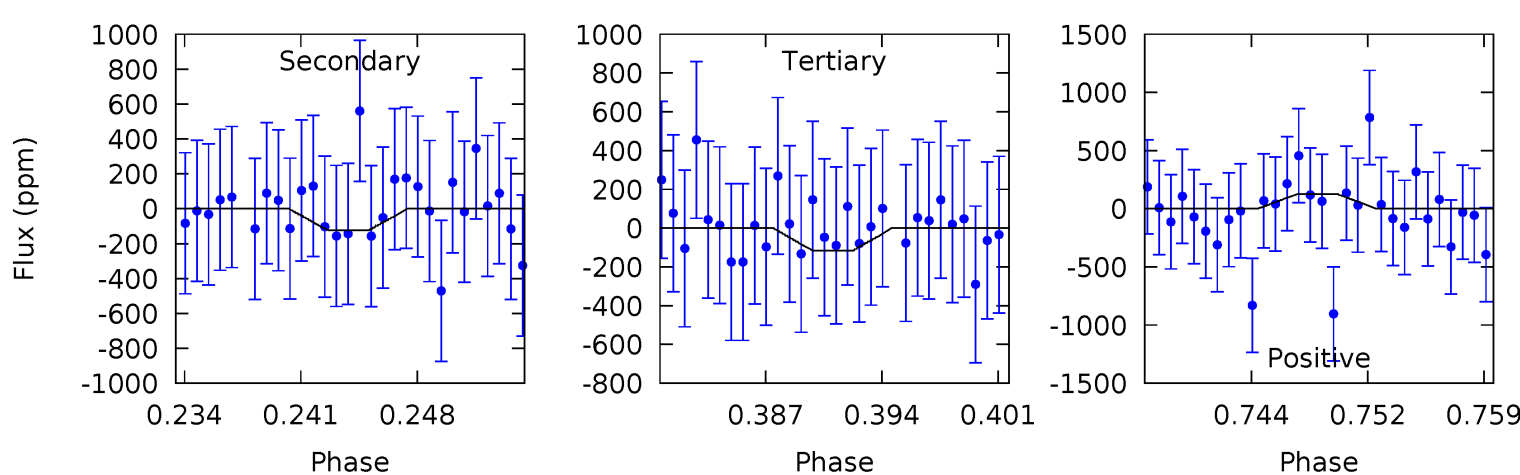
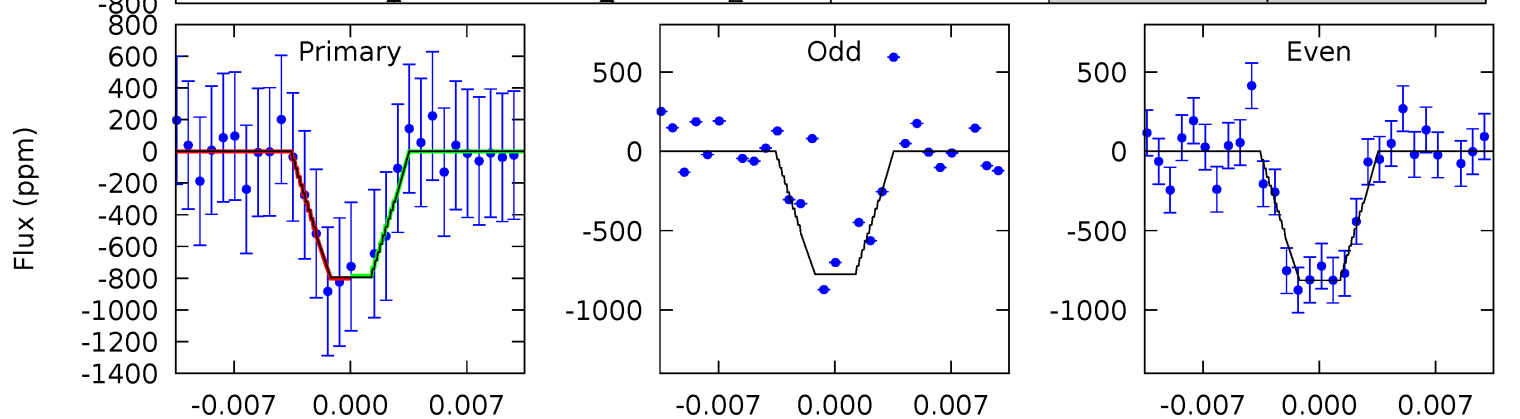
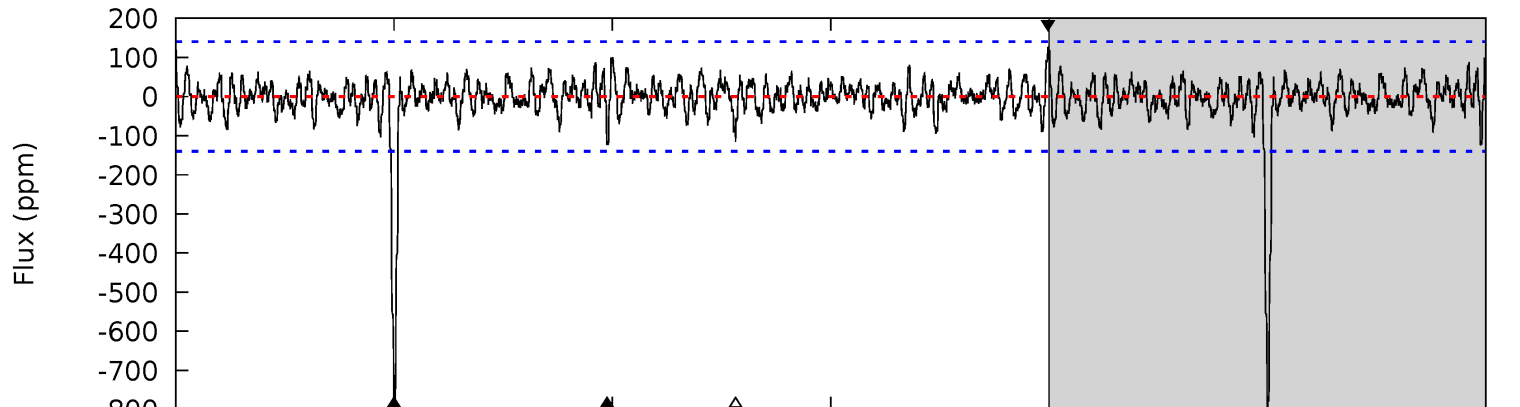
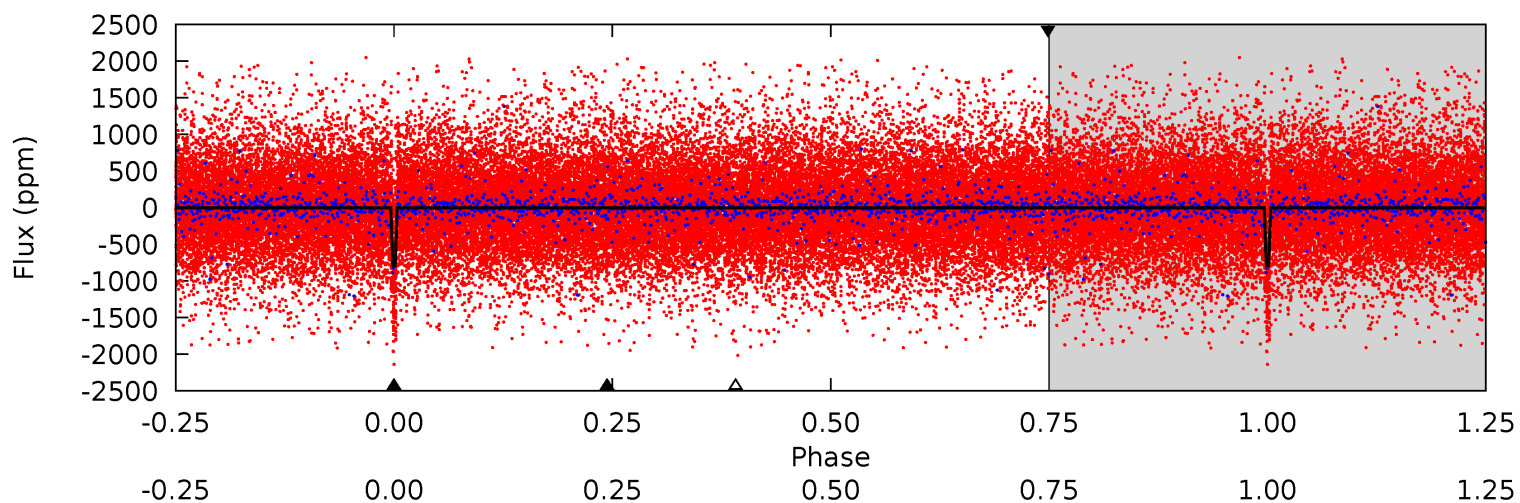
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
27.7	4.86	4.66	4.79	5.07	2.65	1.33	23.0	22.9	0.19	0.07	0.02	0.95	0.15	0.06



# Alt Model-Shift Uniqueness Test

004725681-02, P = 8.295594 Days, E = 127.498495 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
28.9	4.49	4.20	4.54	5.09	2.68	1.18	24.7	24.3	0.28	-0.05	0.72	0.99	0.14	0.27



### Stellar Parameters For KIC 004725681

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$3747^{+75}_{-83}$	$4.728^{+0.042}_{-0.025}$	$0.100^{+0.150}_{-0.150}$	$0.524^{+0.030}_{-0.044}$	$0.536^{+0.035}_{-0.039}$	$5.235^{+1.035}_{-0.594}$
	+2%/-2%	+1%/-1%	+150%/-150%	+6%/-8%	+7%/-7%	+20%/-11%
Source	SPE70	SPE60	SPE70	DSEP		

KIC = Kepler Input Catalog; PHO = Photometry; SPE = Spectroscopy; AST = Asteroseismology  
 TRA = Transits; DESP = Dartmouth Models; MULT = Multiple Models

### Secondary Eclipse Parameters for KIC 004725681-02 / KOI 0817.02

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-145 \pm 30$	$1.76^{+0.89}_{-0.74}$	$652^{+16}_{-18}$	$2801^{+510}_{-276}$	$106^{+231}_{-60}$
Alt.	$-124 \pm 28$	$1.67^{+0.79}_{-0.91}$	$652^{+15}_{-17}$	$2796^{+735}_{-296}$	$103^{+397}_{-60}$

$T_{max}$  = 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

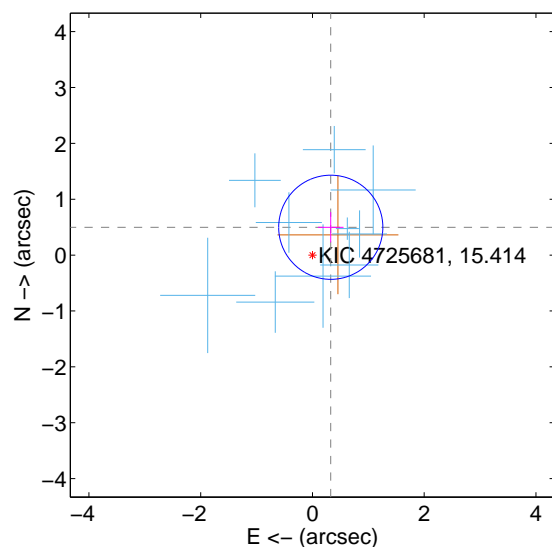
Supplemental centroid analysis for 004725681-02. Kepler magnitude: 15.41. Transit SNR 19.04

There are 10 quarters with good PRF difference image offsets

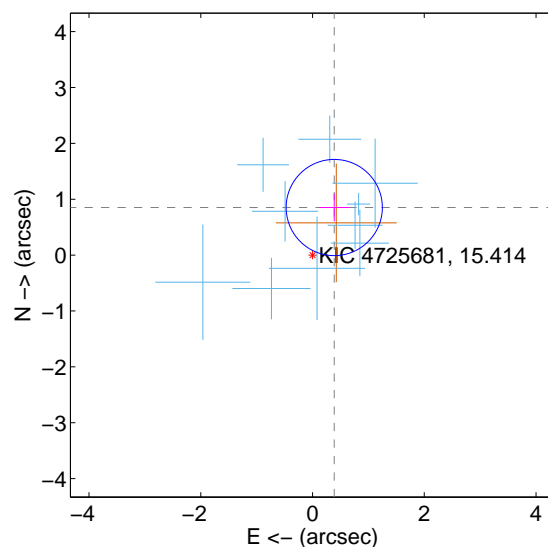
The direct PRF centroid is offset from the target star catalog position by about 0.25 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.596 \pm 0.311$	1.92	$-0.328 \pm 0.229$	$0.498 \pm 0.272$
PRF-fit source offset from KIC position	<b><math>0.936 \pm 0.287</math></b>	<b>3.26</b>	$-0.389 \pm 0.265$	$0.851 \pm 0.251$
photometric centroid source offset	$1.07 \pm 0.85$	1.27	$-0.13 \pm 0.76$	$1.06 \pm 0.85$

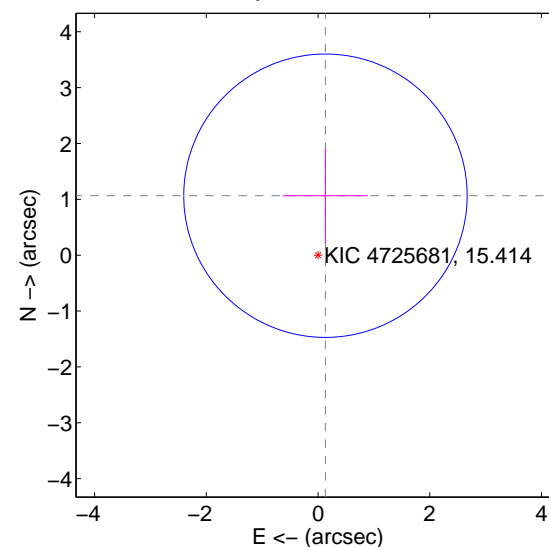
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

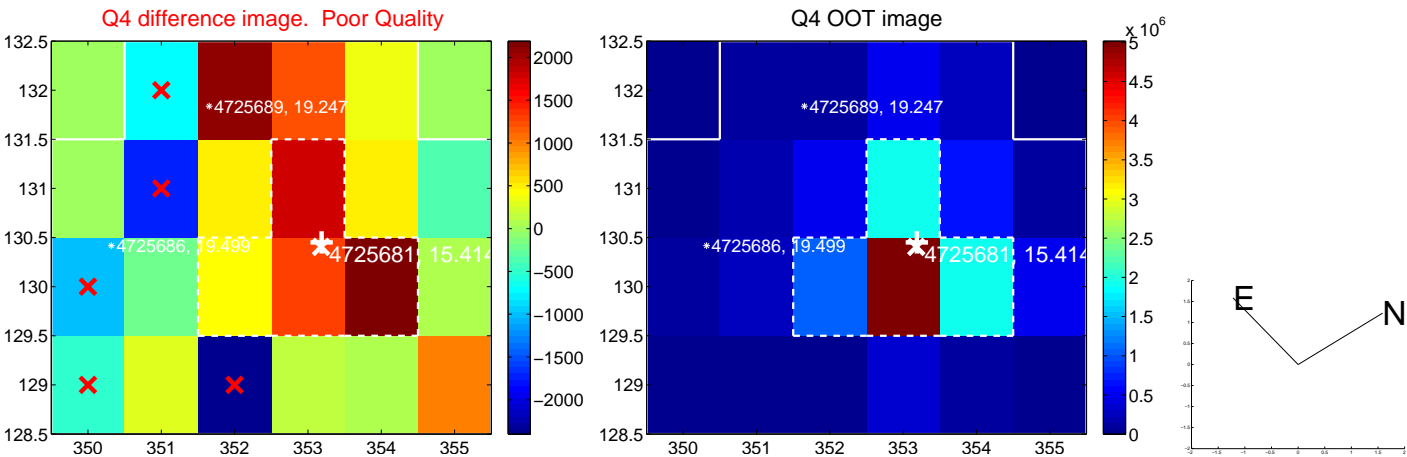
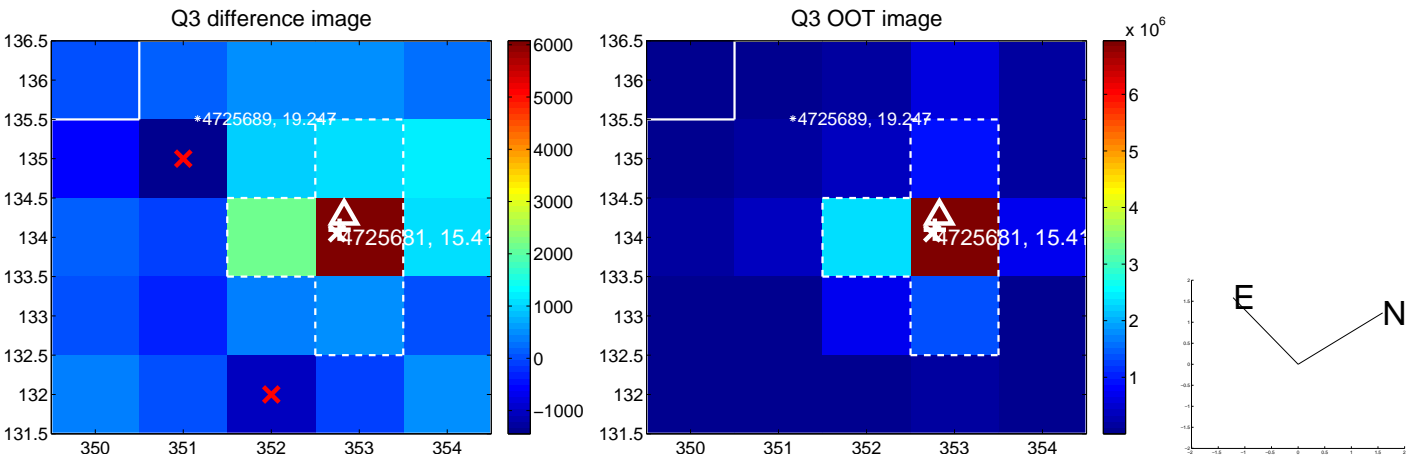
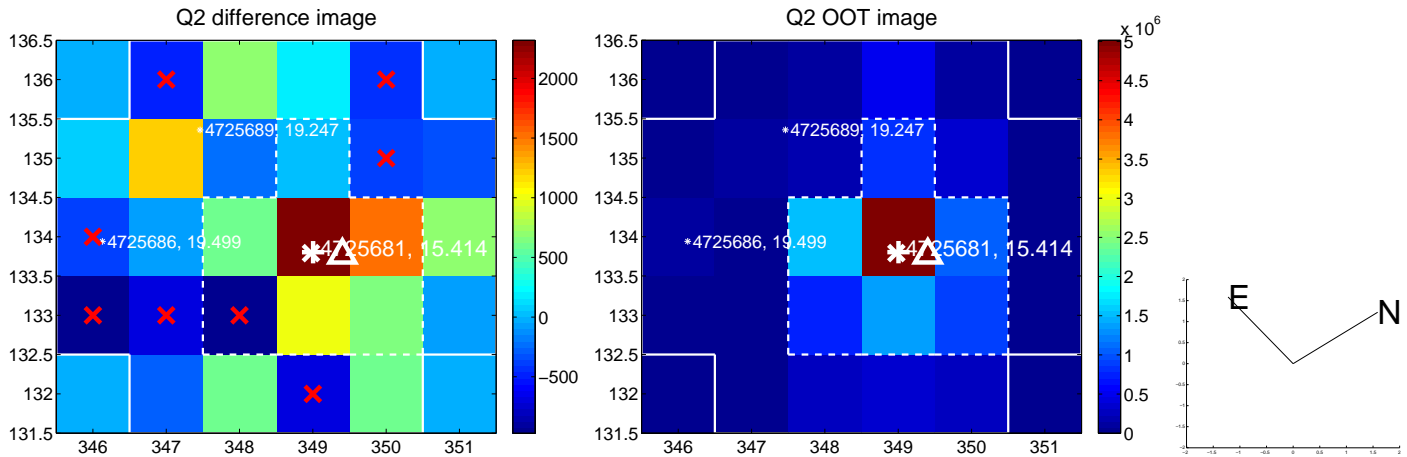
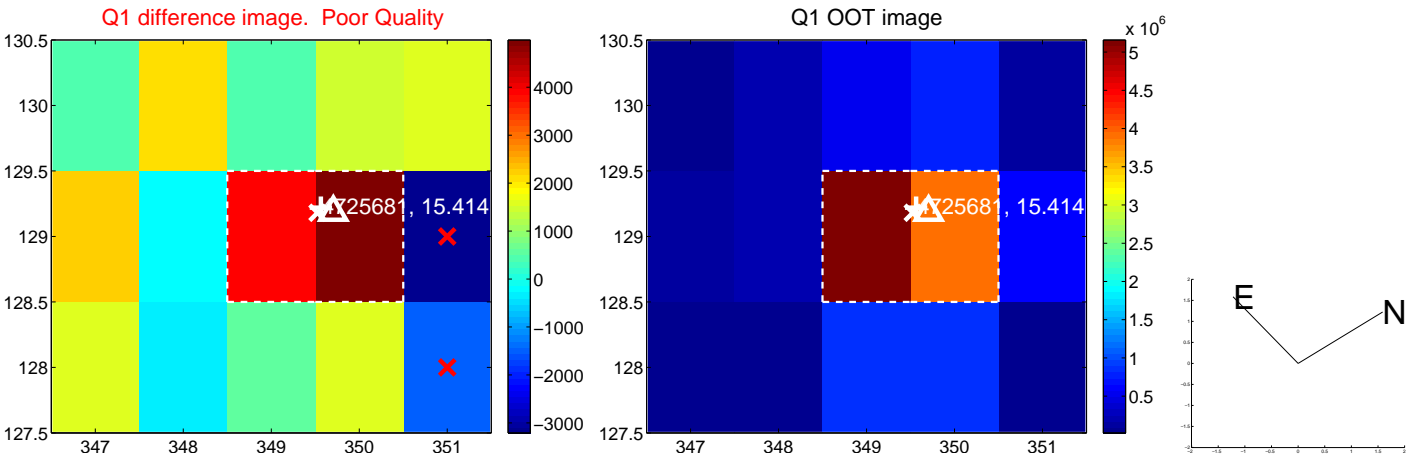


offset from photometric centroids

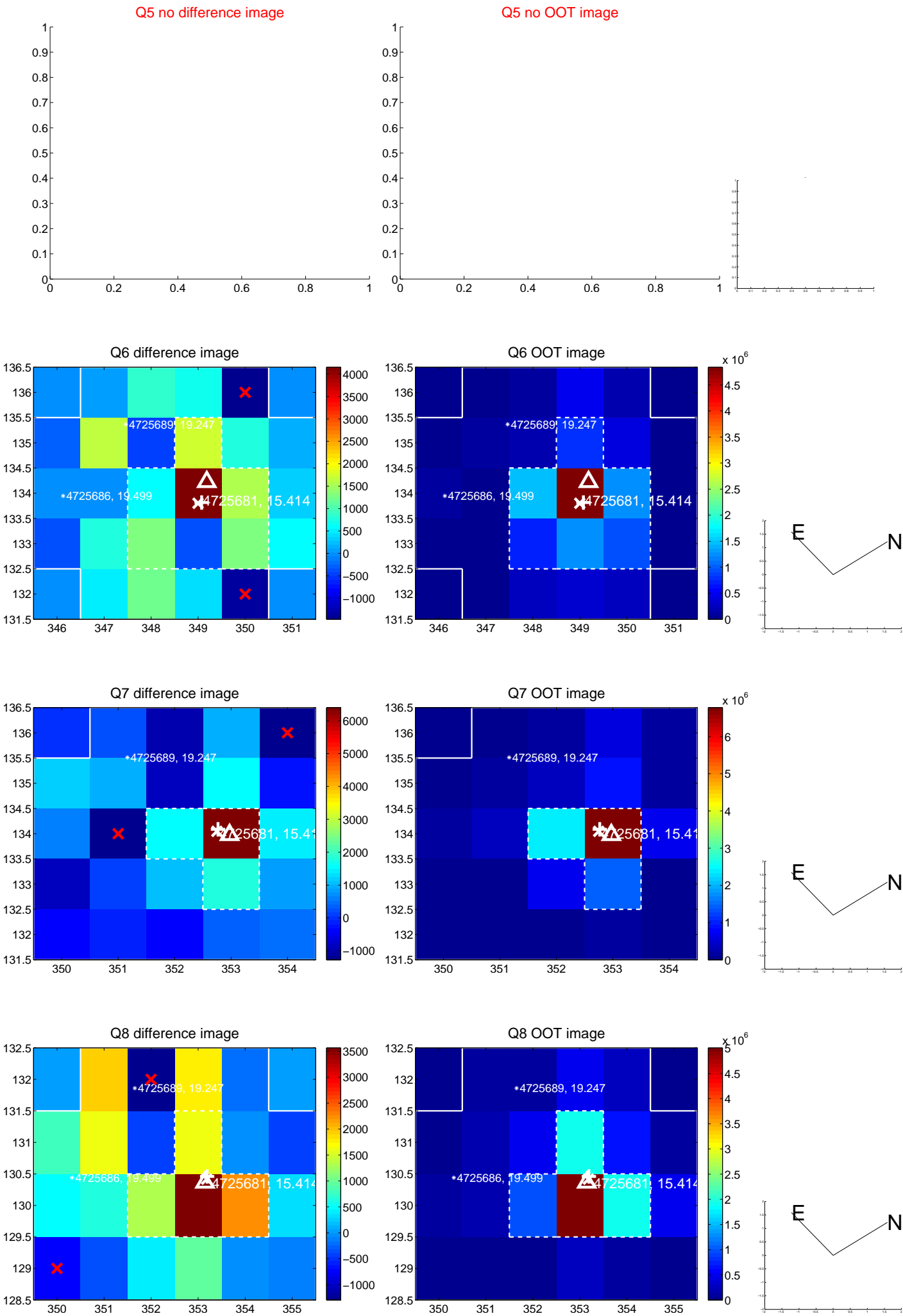


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

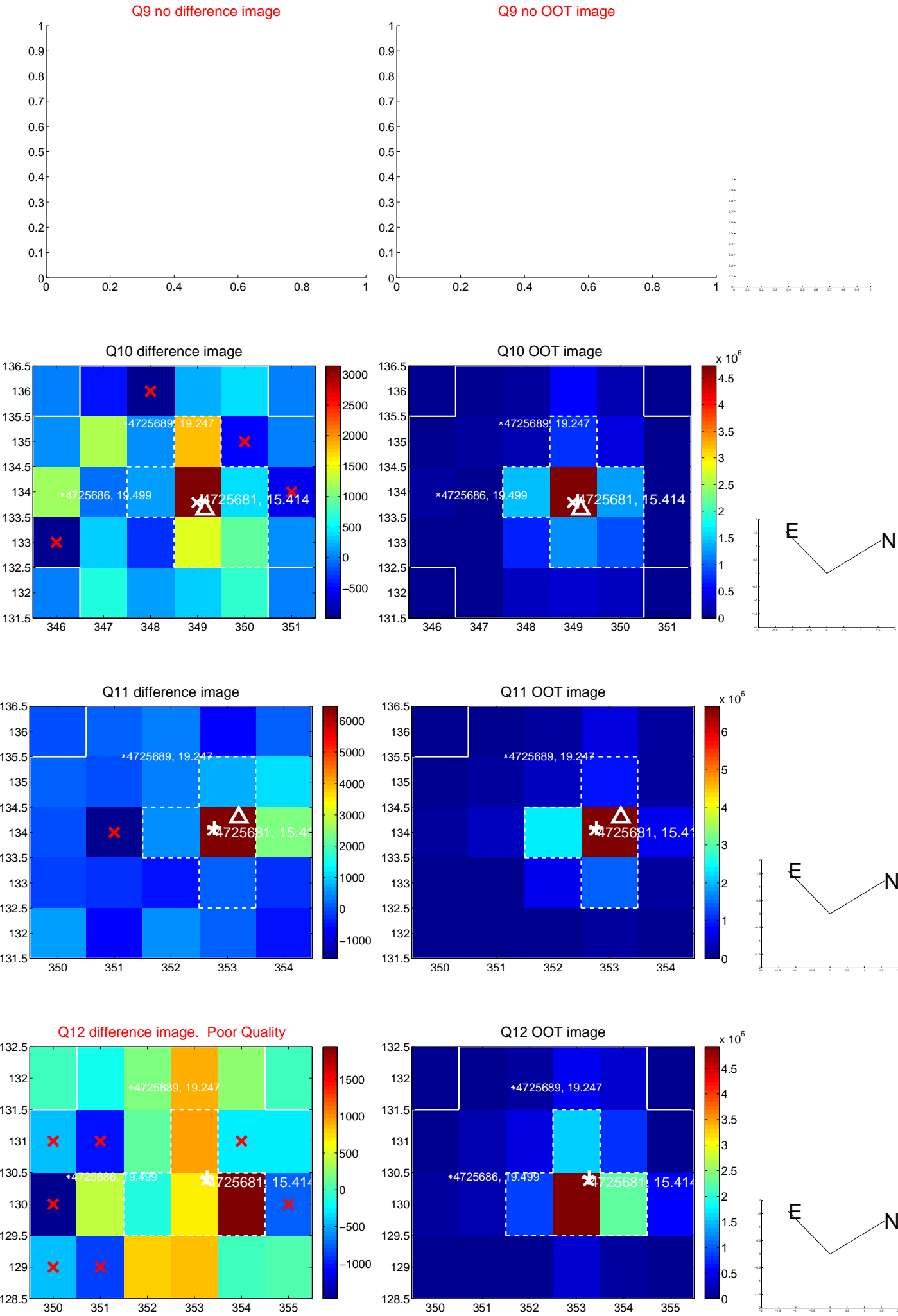


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

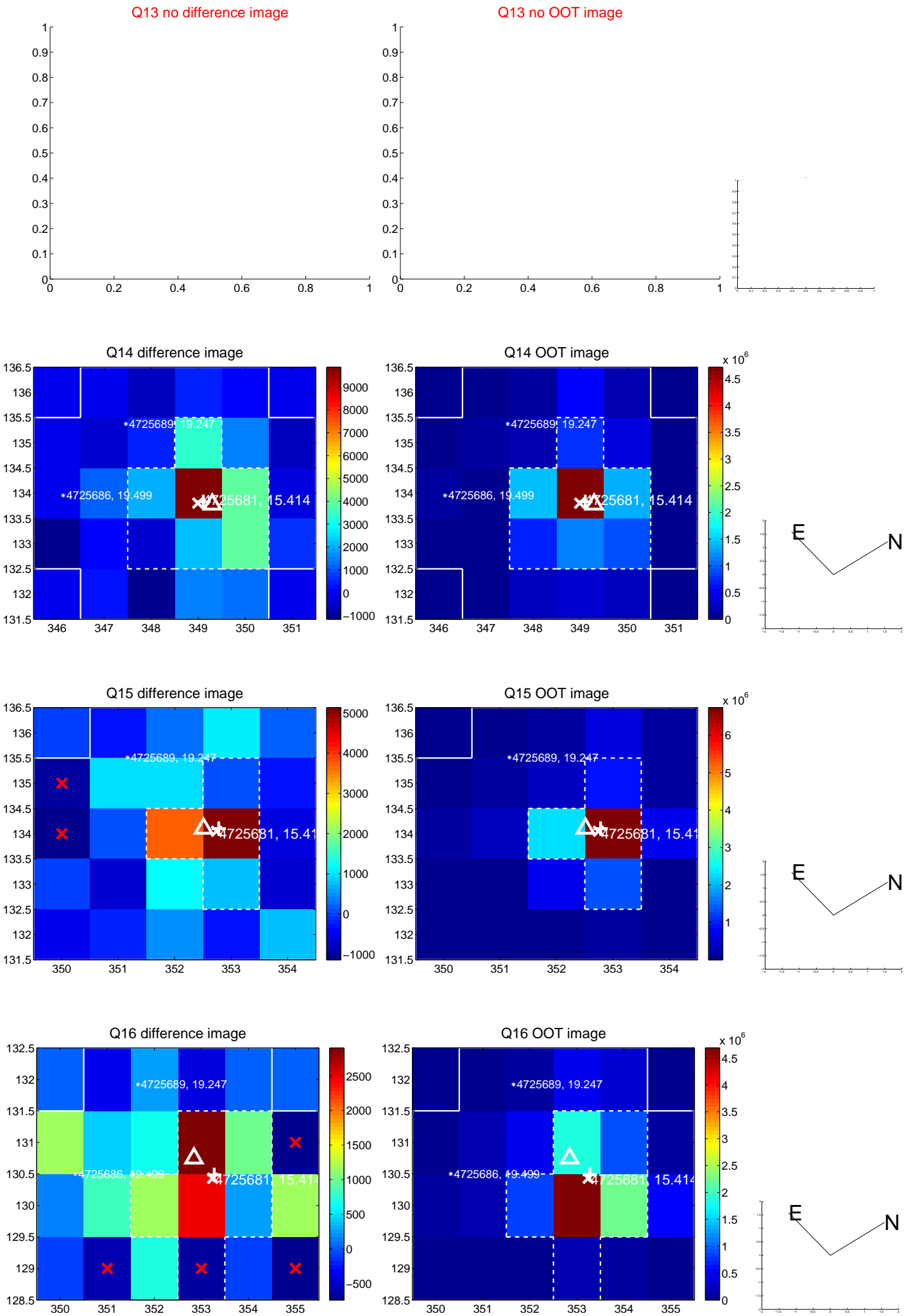




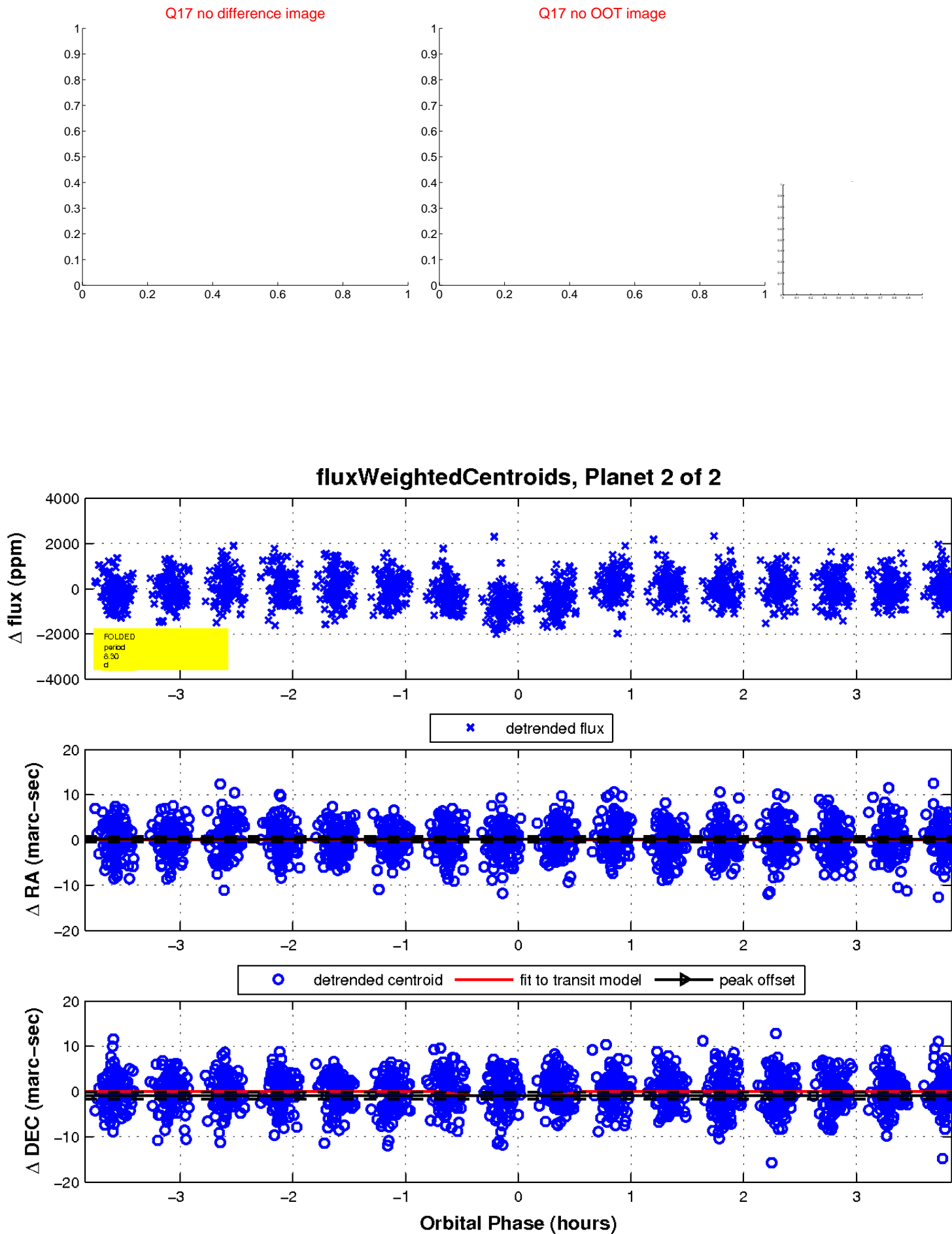
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



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



UKIRT Image

Declination

