

# KIC 007221584

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
007221584-01	OBS	No	1.106129	131.768362	17.4	4.630	11.8	9.3	3.14	6565	1.53	27393.97
007221584-02	OBS	No	1.177106	132.387392	27.5	4.481	9.9	10.1	3.14	6565	2.25	25214.03
007221584-03	OBS	No	49.343695	154.664203	167.9	8.114	8.5	8.7	3.14	6565	6.76	173.15
007221584-04	OBS	No	35.123241	152.772176	127.8	4.888	8.1	7.4	3.14	6565	4.04	272.44

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
007221584-01	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_ALT
007221584-02	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_DV
007221584-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT
007221584-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT

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

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

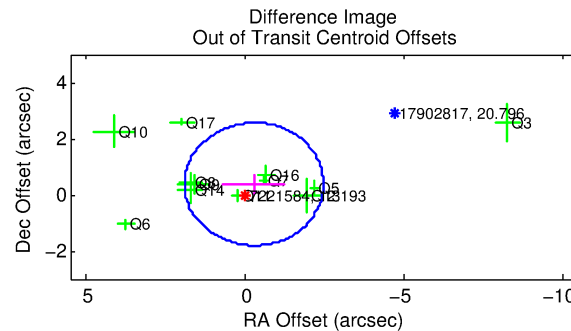
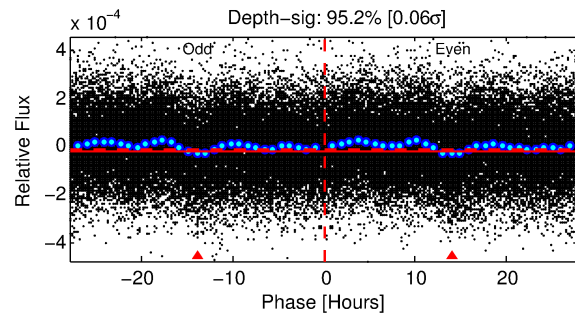
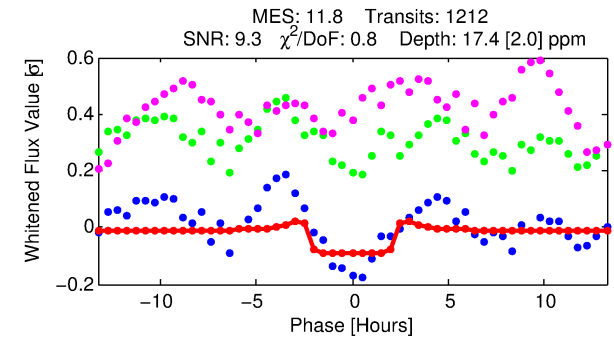
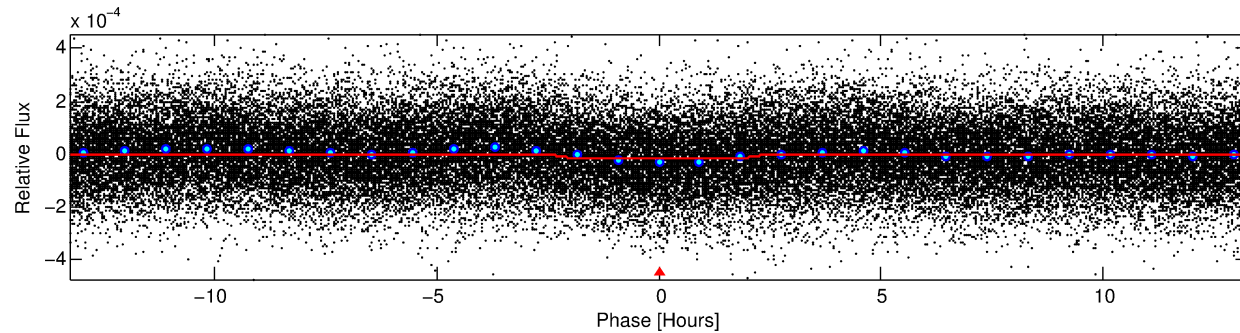
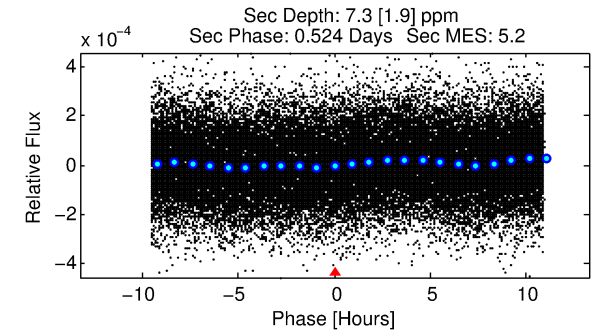
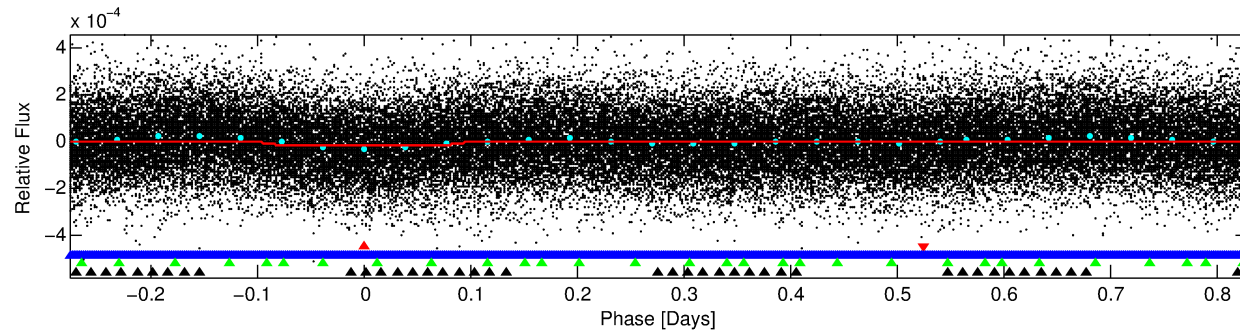
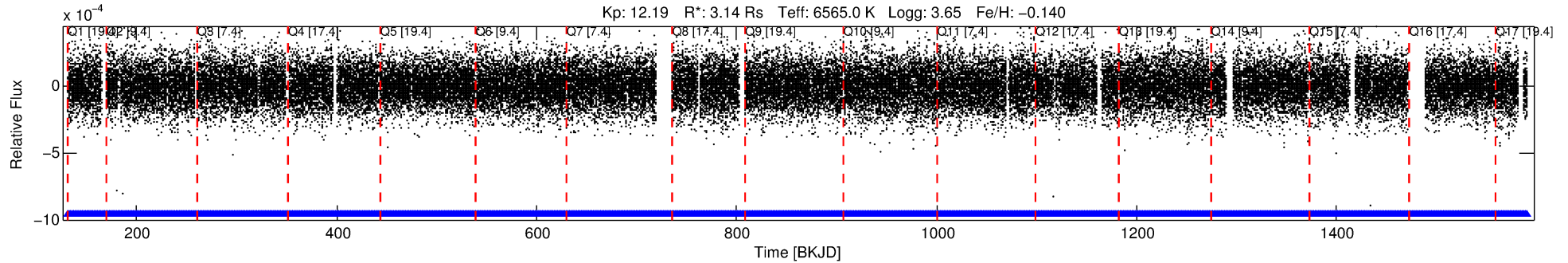
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 007221584-01

No Significant Match Found

# DV One-Page Summary

KIC: 7221584 Candidate: 1 of 4 Period: 1.106 d



## DV Fit Results:

Period = 1.10613 [0.00001] d  
Epoch = 131.7684 [0.0035] BKJD  
Rp/R\* = 0.0045 [0.0012]  
a/R\* = 1.24 [0.65]  
b = 0.90 [0.31]  
Seff = 27393.97 [16270.90]  
Teq = 3280 [487] K  
Rp = 1.53 [0.71] Re  
a = 0.0245 [0.0090] AU  
Ag = 1.03 [0.84] [0.03σ]  
Teffp = 5104 [752] K [2.03σ]

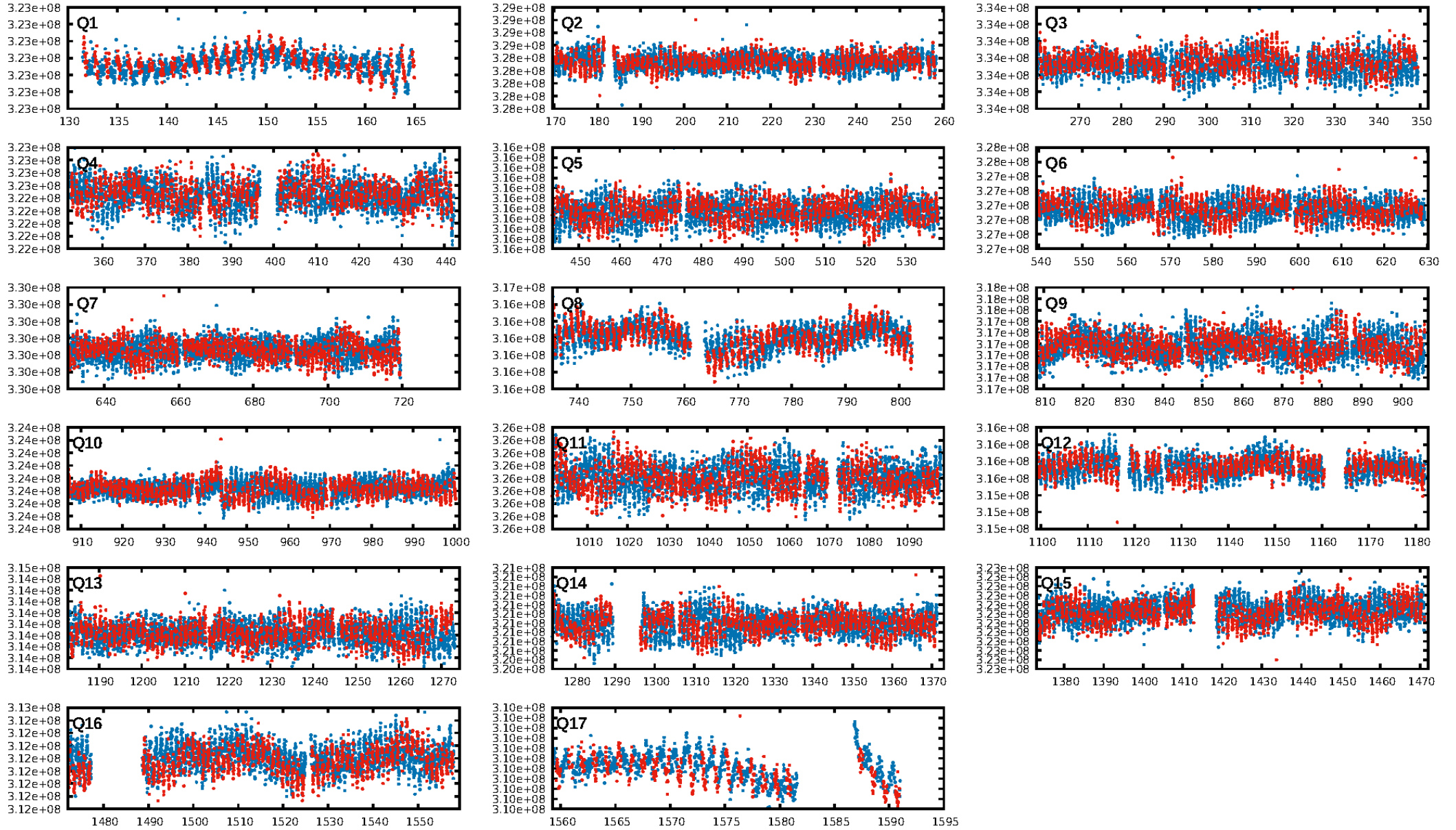
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 20.9% [0.26σ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGoF-sig: N/A  
Bootstrap-pfa: 3.74e-17  
RollingBand-fgt: 1.00 [1157/1157]  
GhostDiagnostic-chr: 3.133  
Centroid-sig: 21.1%  
Centroid-so: 0.479 arcsec [0.92σ]  
OotOffset-rm: 0.468 arcsec [0.64σ]  
KicOffset-rm: 0.433 arcsec [0.65σ]  
OotOffset-st: 3/3/2/4 [12]  
KicOffset-st: 3/3/2/4 [12]  
DiffImageQuality-fgm: 0.50 [6/12]  
DiffImageOverlap-fno: 1.00 [17/17]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 17:00:11 Z

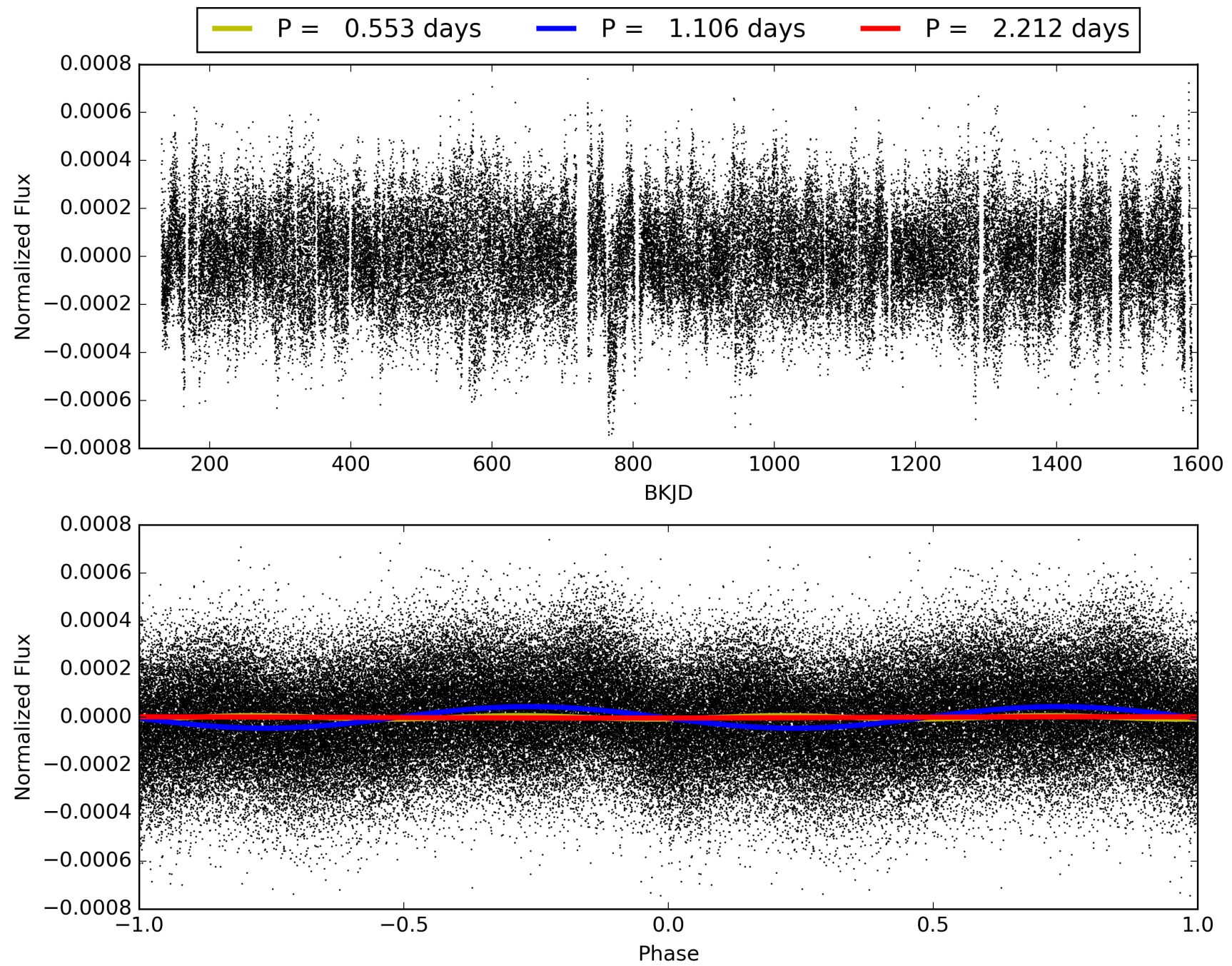
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 007221584-01, PDC Light Curves





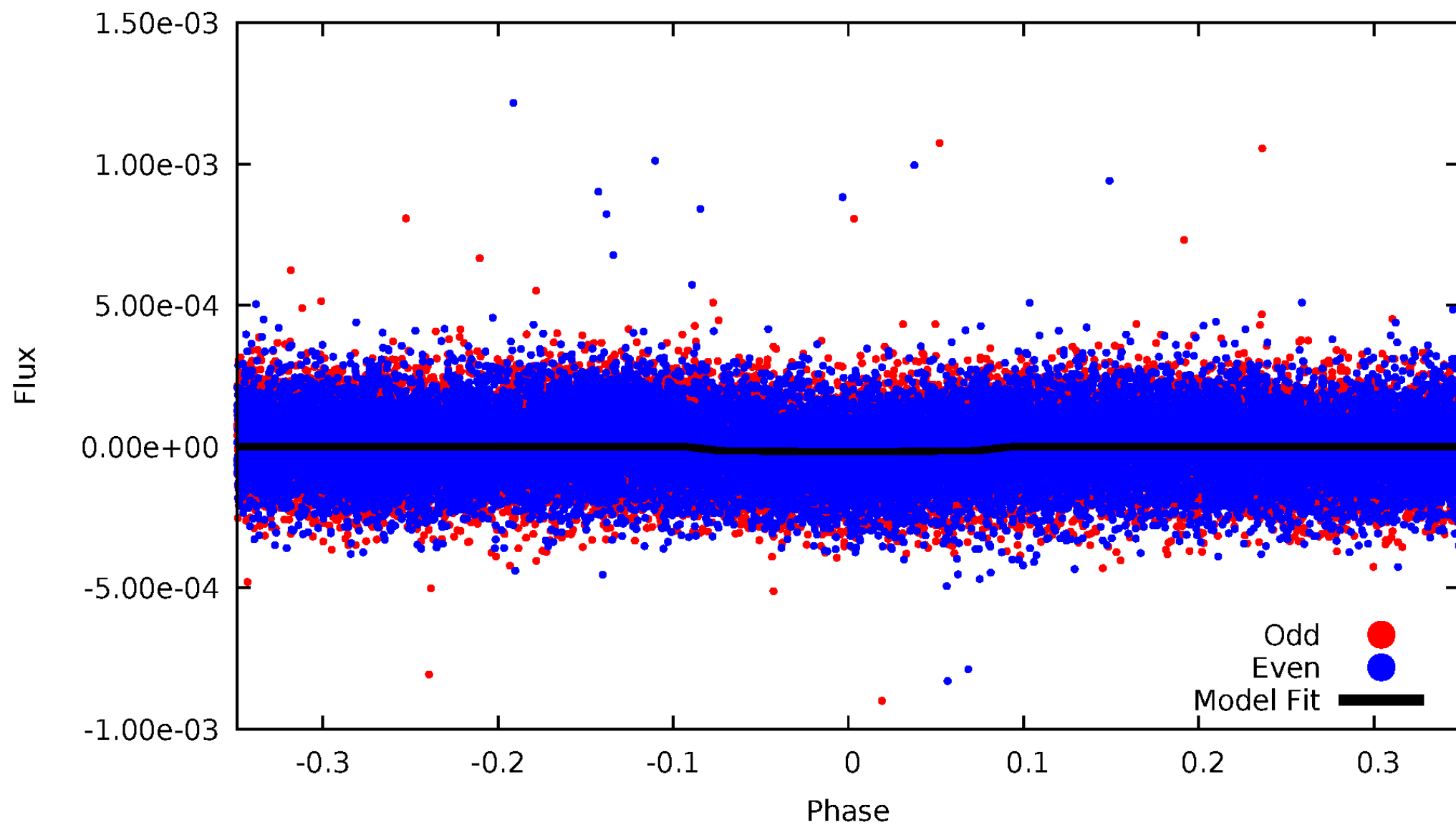
TCE 007221584-01





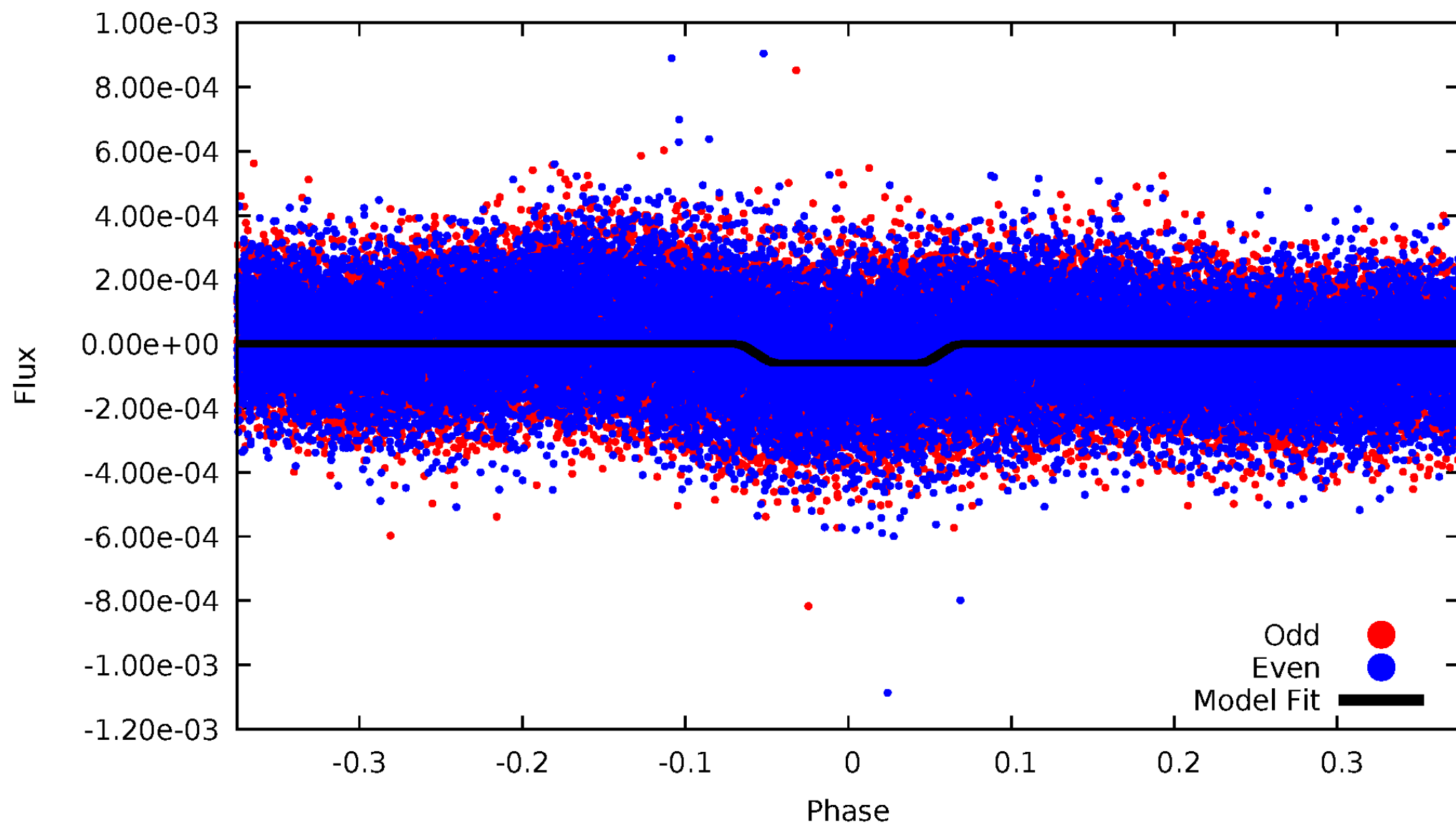
# DV Odd/Even

TCE 007221584-01



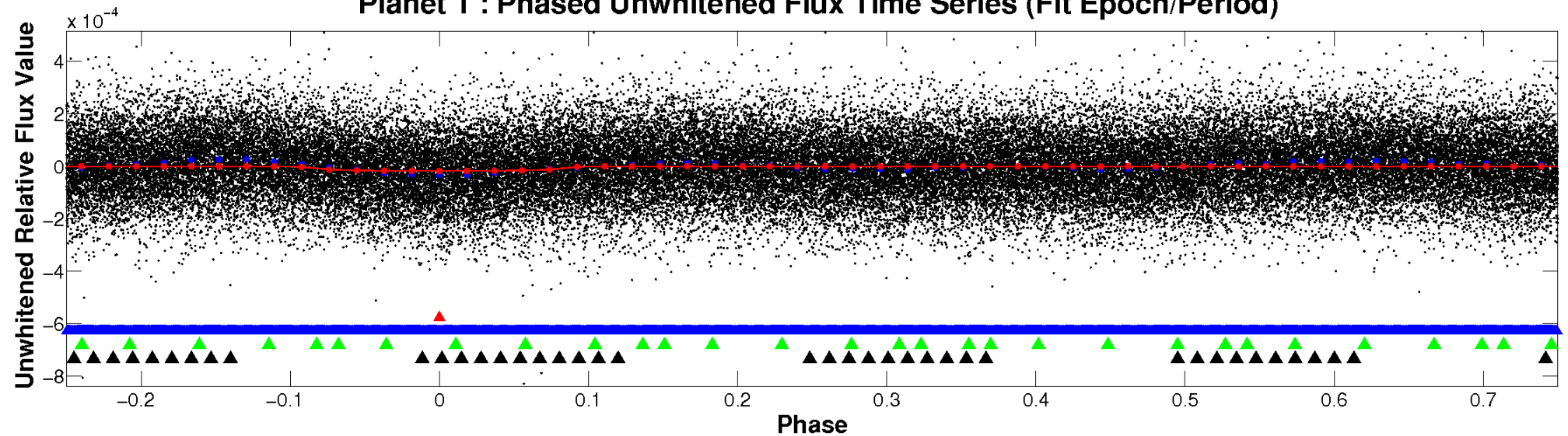
# ALT Odd/Even

TCE 007221584-01

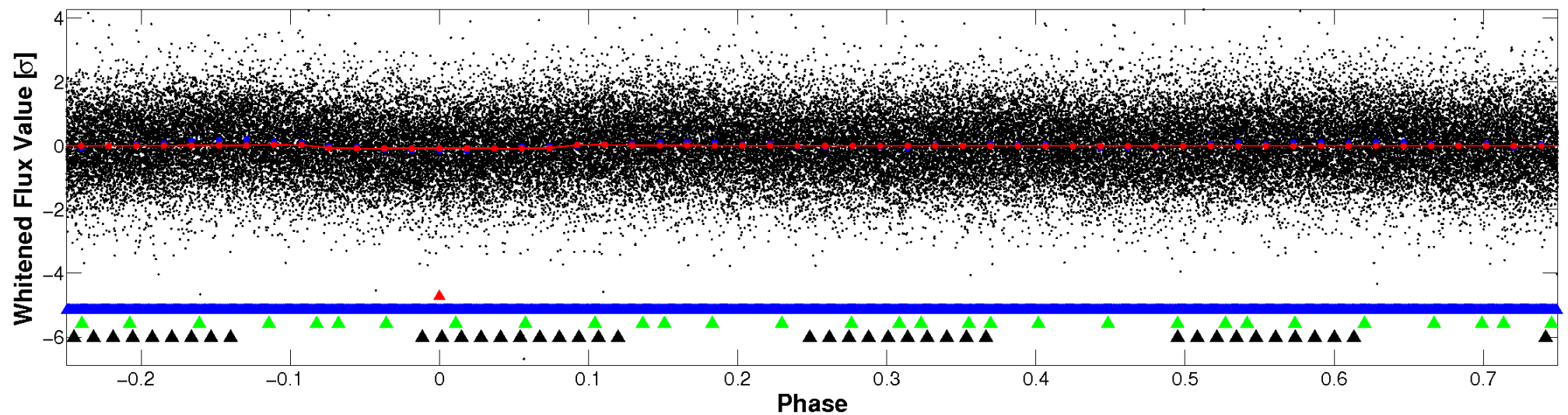


# Non-Whitened Vs. Whitened Light Curve

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



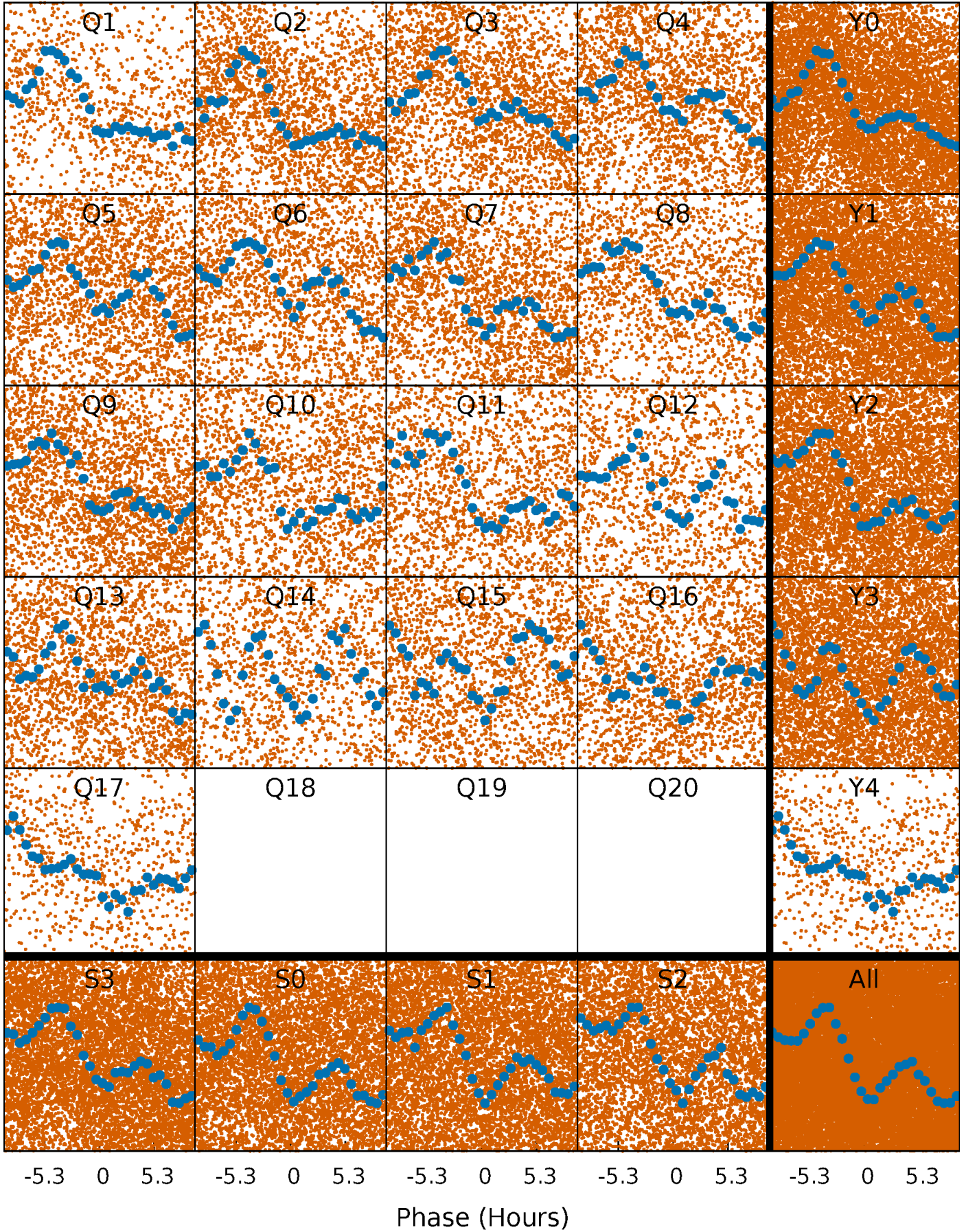
## Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)





# PDC Quarter-Phased Transit Curves

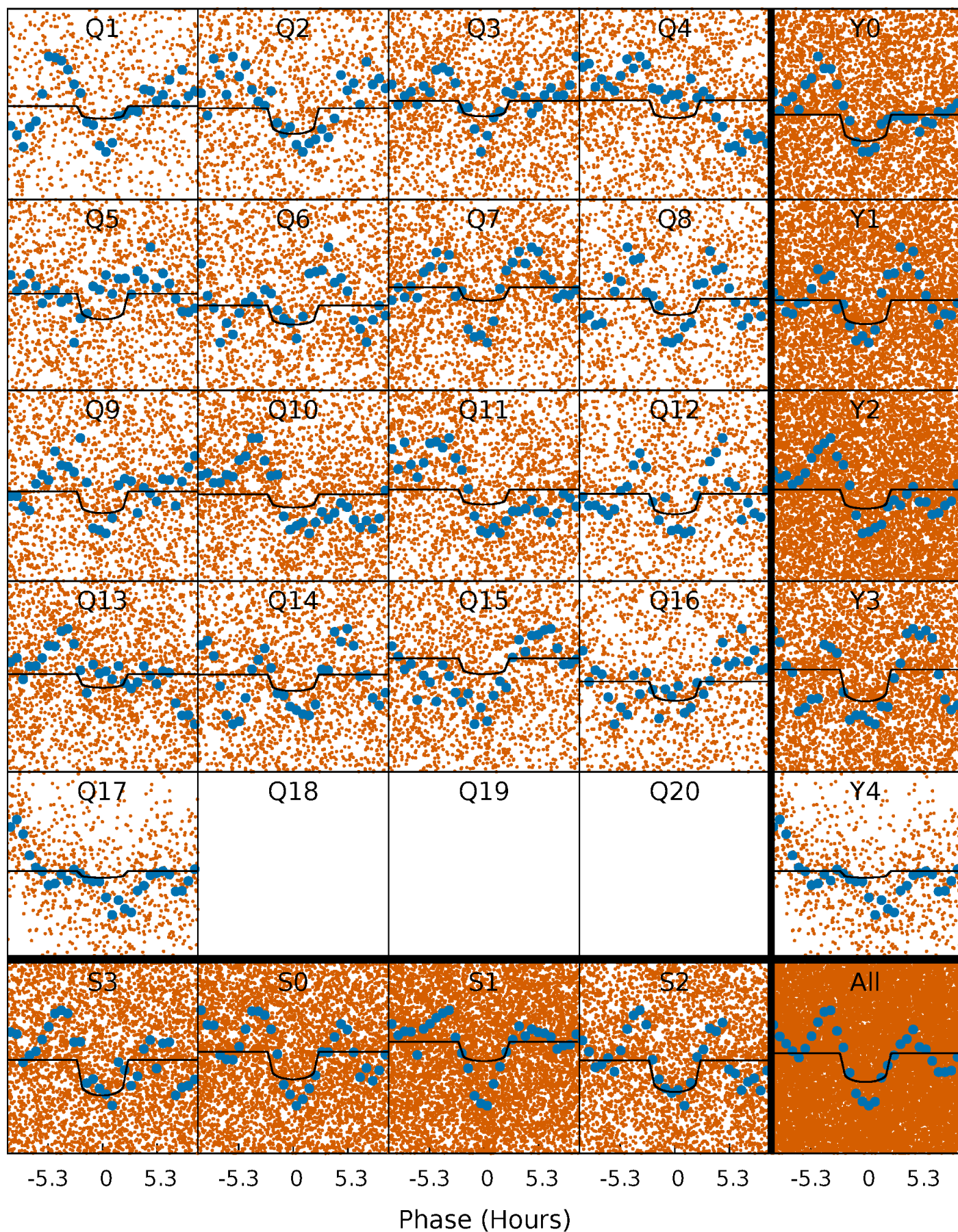
TCE 007221584-01 P= 1.106129 Days  $T_0=131.768362$  (BKJD)





# DV Quarter-Phased Transit Curves

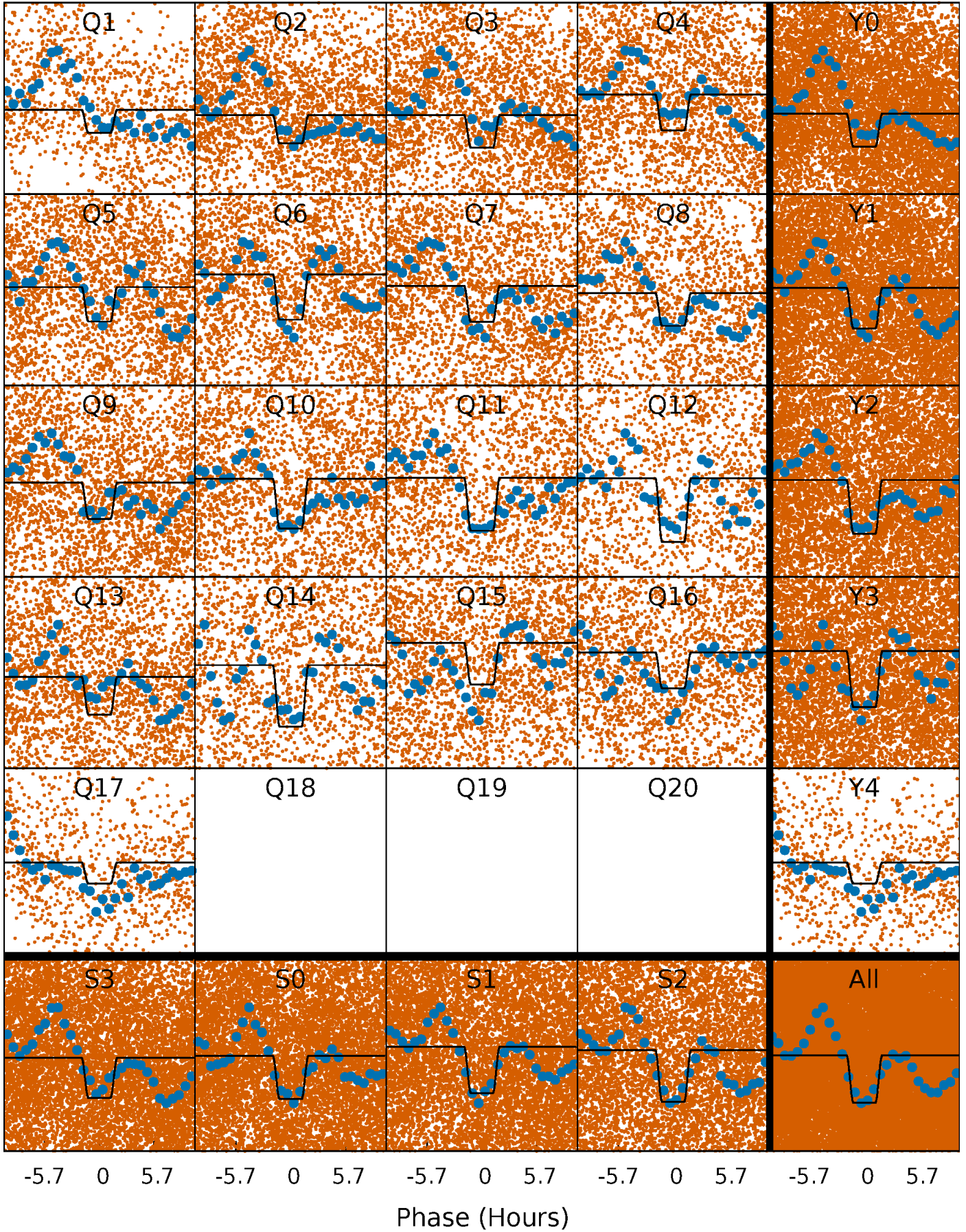
TCE 007221584-01 P= 1.106129 Days  $T_0=131.768362$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

TCE 007221584-01 P= 1.106173 Days  $T_0=131.765983$  (BKJD)

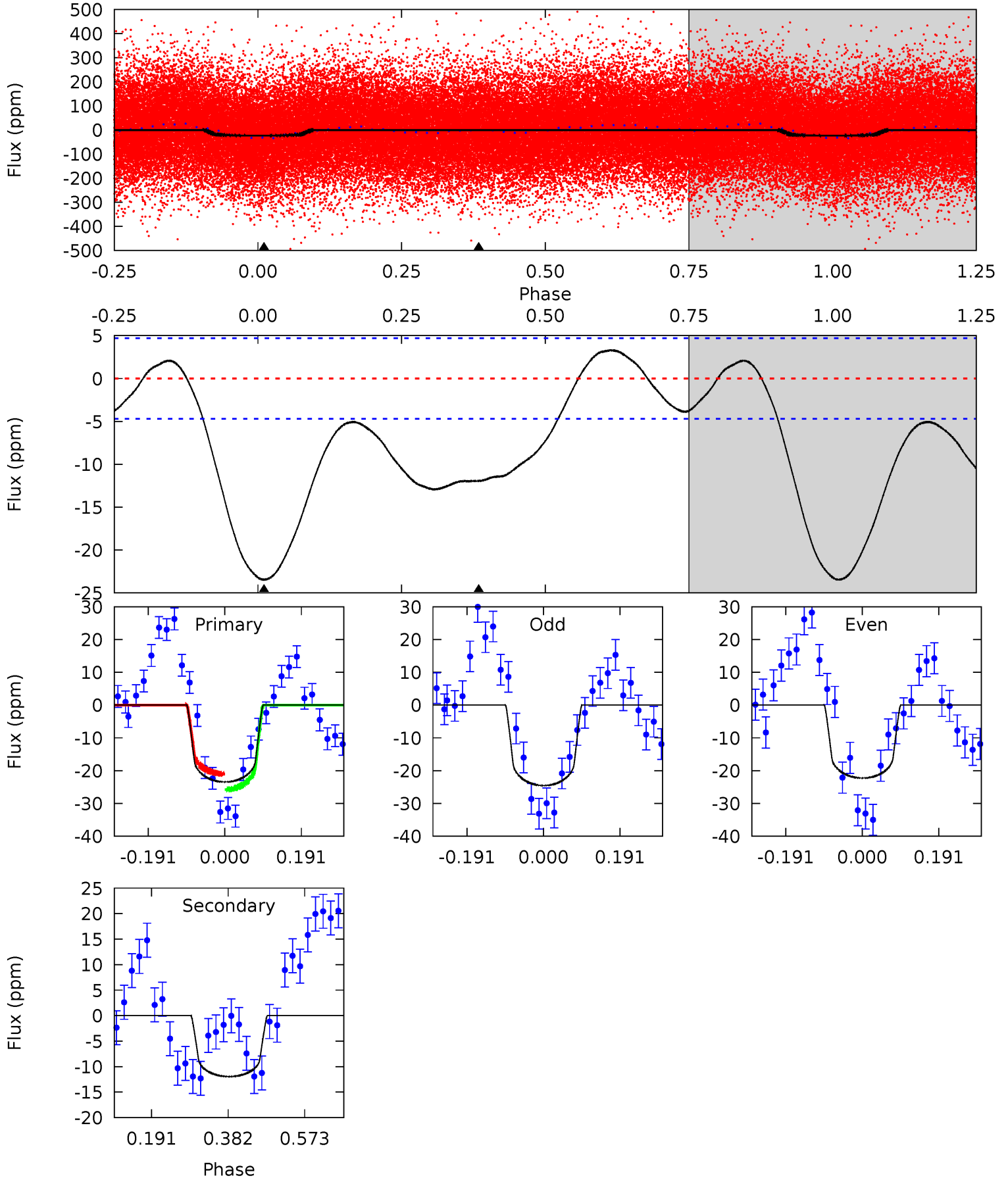




# DV Model-Shift Uniqueness Test

007221584-01, P = 1.106129 Days, E = 130.662233 Days

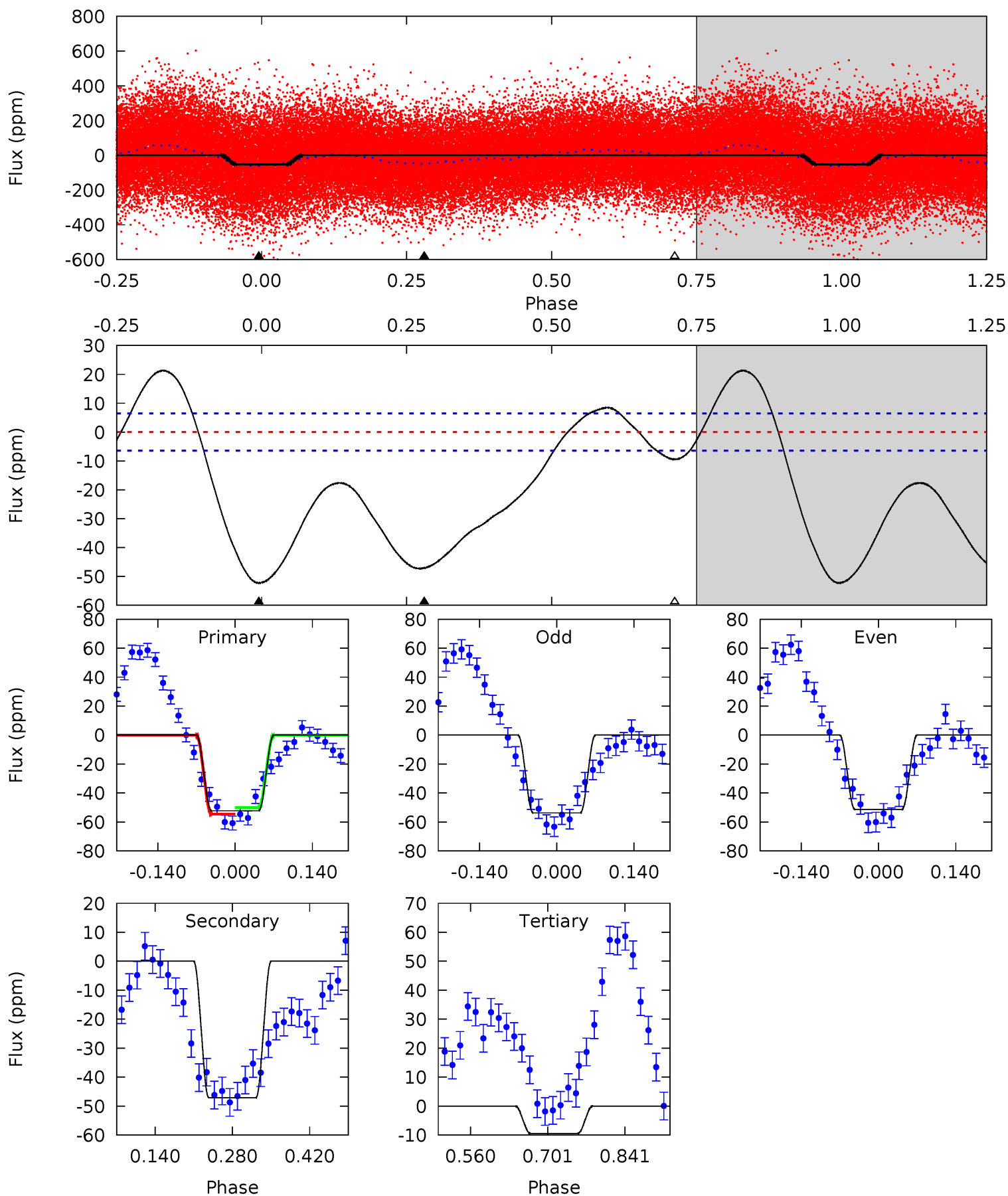
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
22.1	11.2	0	0	4.43	1.31	2.36	22.1	22.1	11.2	11.2	1.08	1.04	0.12	2.25



# Alt Model-Shift Uniqueness Test

007221584-01, P = 1.106173 Days, E = 130.659810 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
36.4	32.8	6.59	0	4.49	1.48	8.54	29.8	36.4	26.2	32.8	0.85	1.07	0.29	1.52



### Stellar Parameters For KIC 007221584

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$\rho_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6565^{+177}_{-197}$	$3.648^{+0.340}_{-0.060}$	$-0.140^{+0.300}_{-0.250}$	$3.143^{+0.404}_{-1.211}$	$1.601^{+0.215}_{-0.350}$	$0.073^{+0.171}_{-0.019}$
	+3%/-3%	+9%/-2%	+214%/-179%	+13%/-39%	+13%/-22%	+235%/-26%
Source	PHO1	FLK73	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 007221584-01 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-12 \pm 1$	$1.40^{+0.47}_{-0.46}$	$4458^{+259}_{-411}$	$5577^{+1045}_{-696}$	$2.031^{+2.297}_{-0.876}$
Alt.	$-47 \pm 1$	$2.43^{+0.55}_{-0.52}$	$4464^{+243}_{-425}$	$5988^{+587}_{-461}$	$2.572^{+1.652}_{-0.747}$

$T_{max}$  = 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

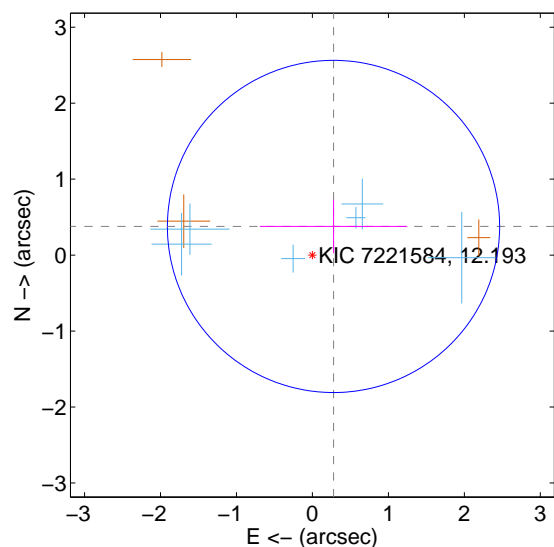
Supplemental centroid analysis for 007221584-01. Kepler magnitude: 12.19. Transit SNR 9.26

There are 6 quarters with good PRF difference image offsets

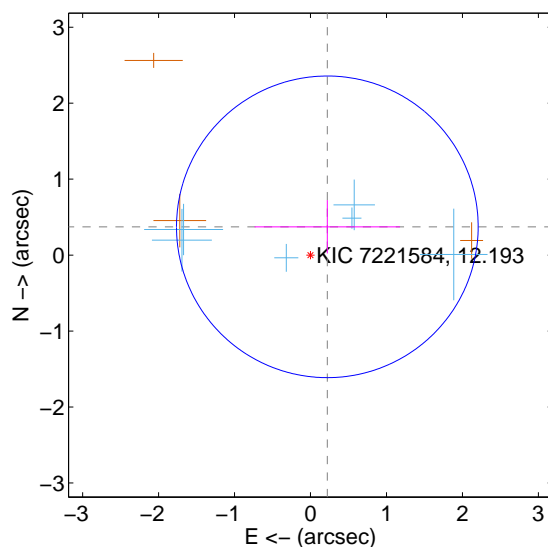
The direct PRF centroid is offset from the target star catalog position by about 0.08 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.468 \pm 0.729$	0.64	$-0.278 \pm 0.970$	$0.377 \pm 0.352$
PRF-fit source offset from KIC position	$0.433 \pm 0.662$	0.65	$-0.221 \pm 0.958$	$0.372 \pm 0.350$
photometric centroid source offset	$0.48 \pm 0.52$	0.92	$0.06 \pm 0.52$	$-0.47 \pm 0.52$

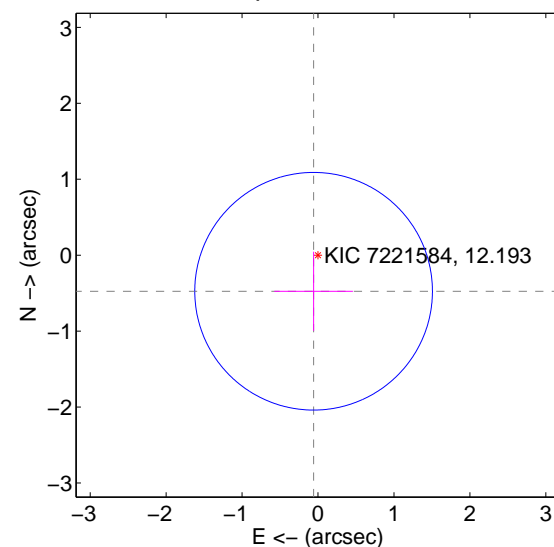
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

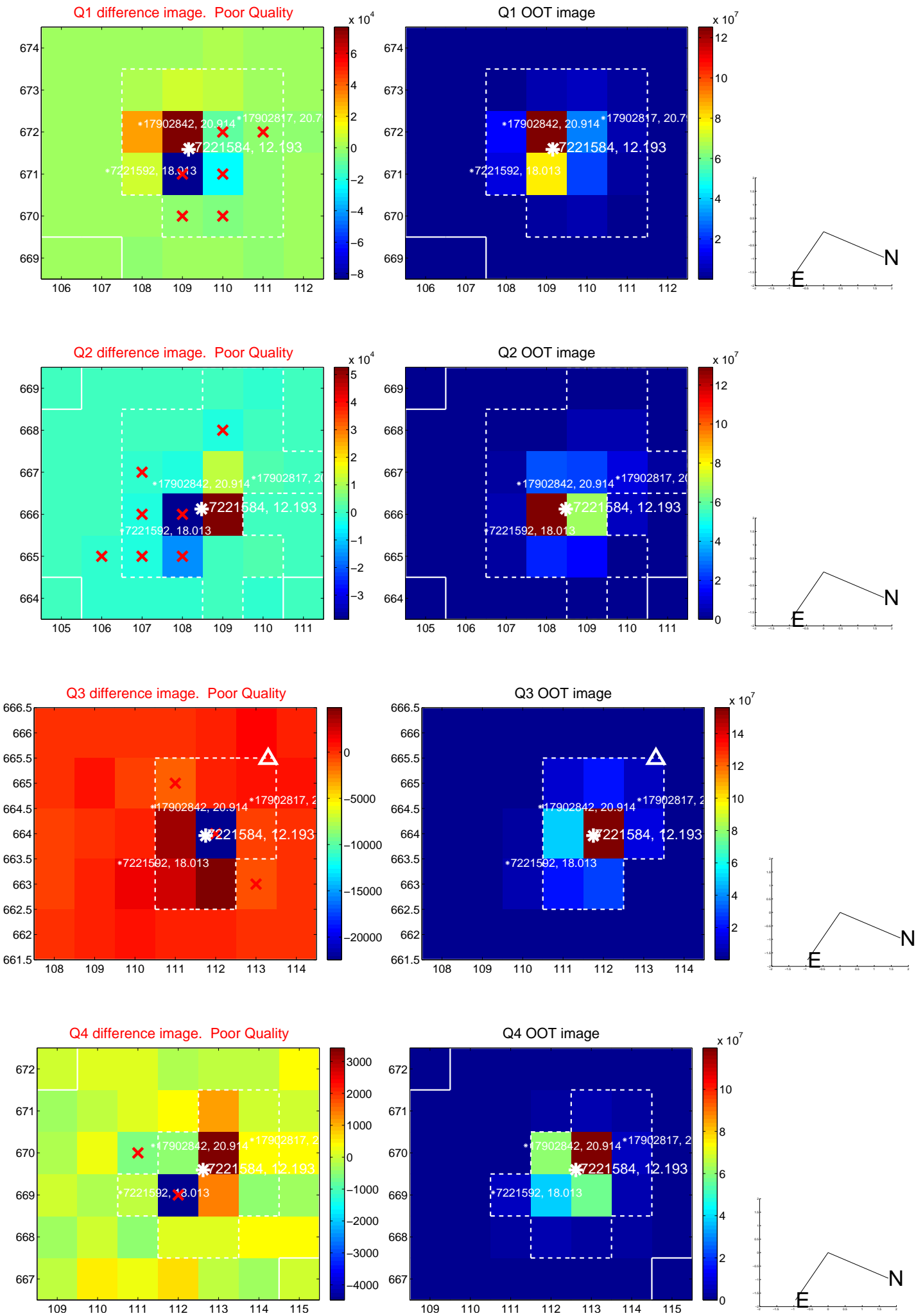


offset from photometric centroids

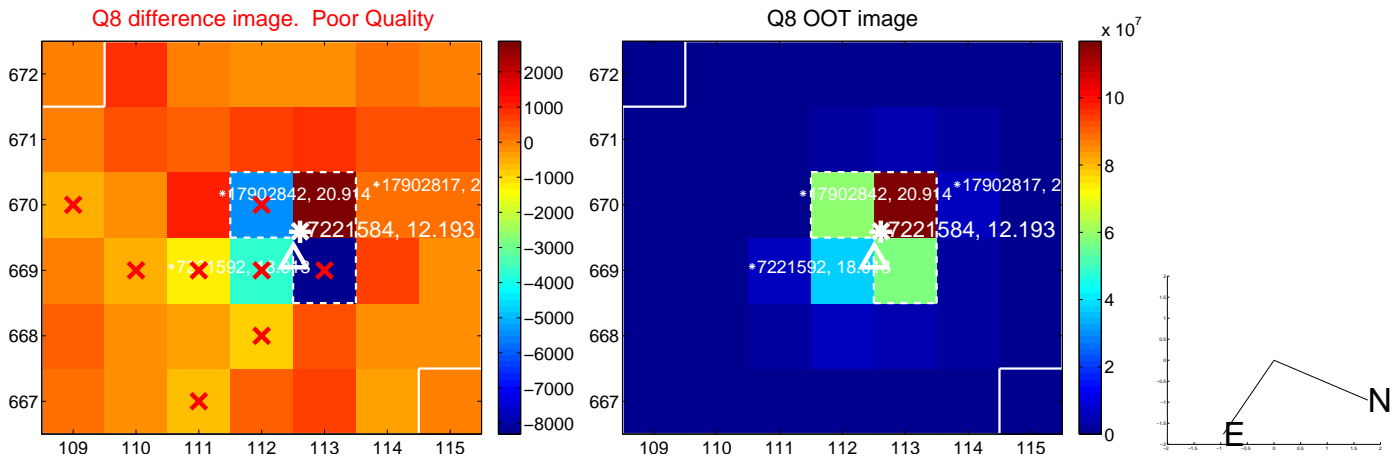
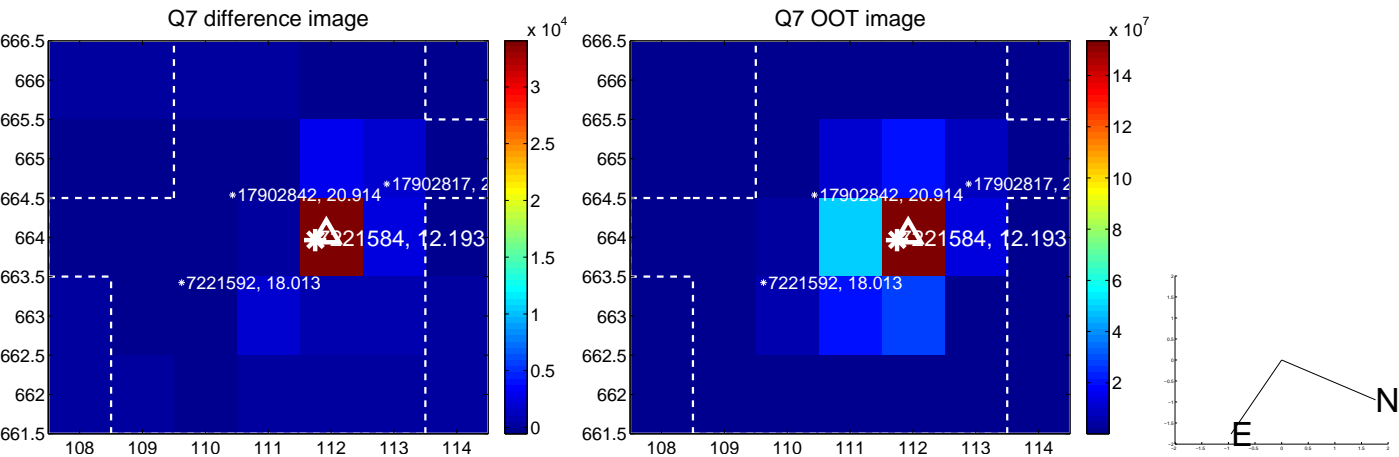
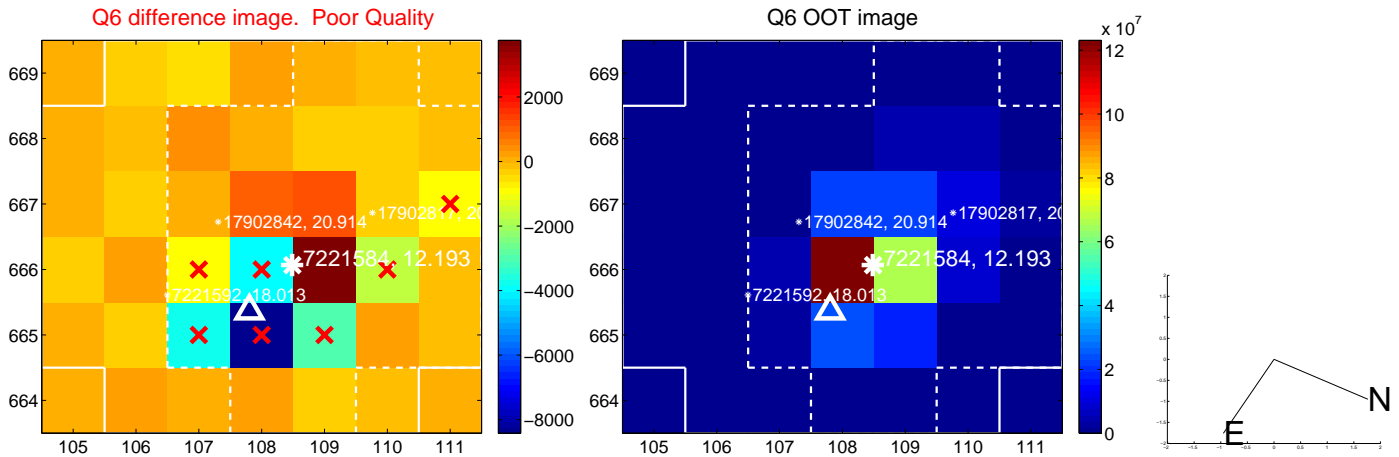
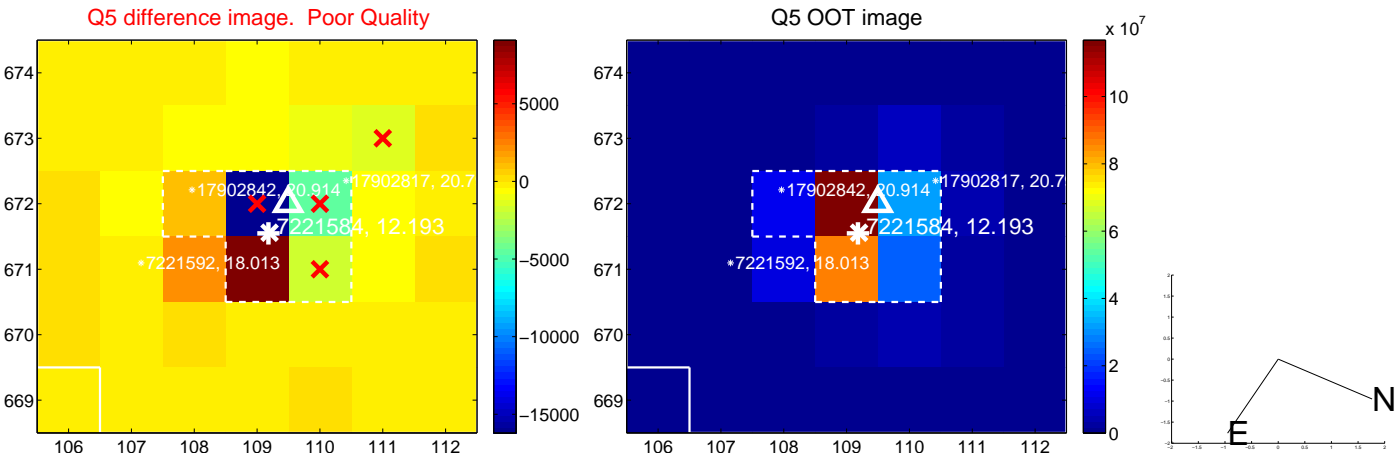


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

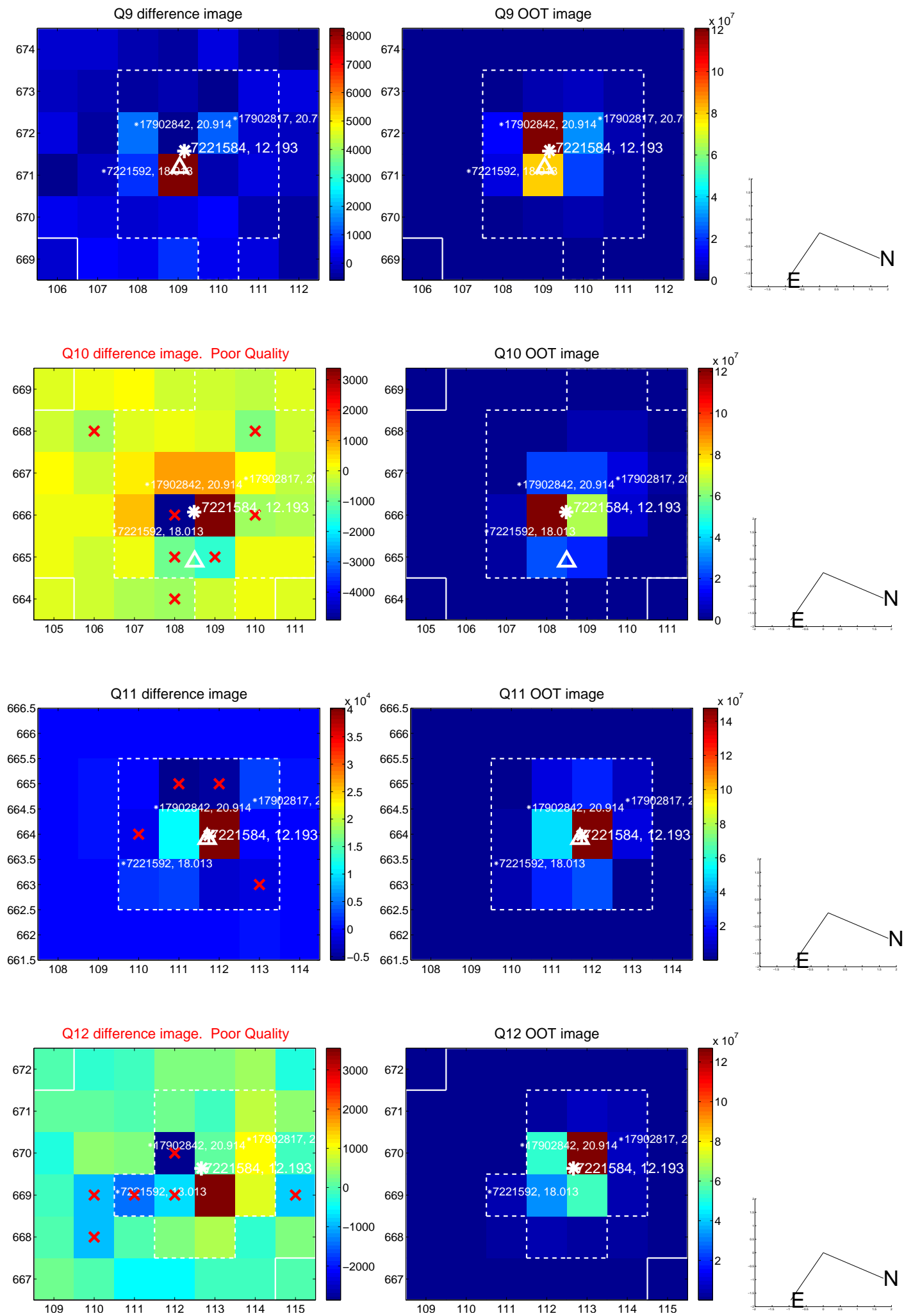


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

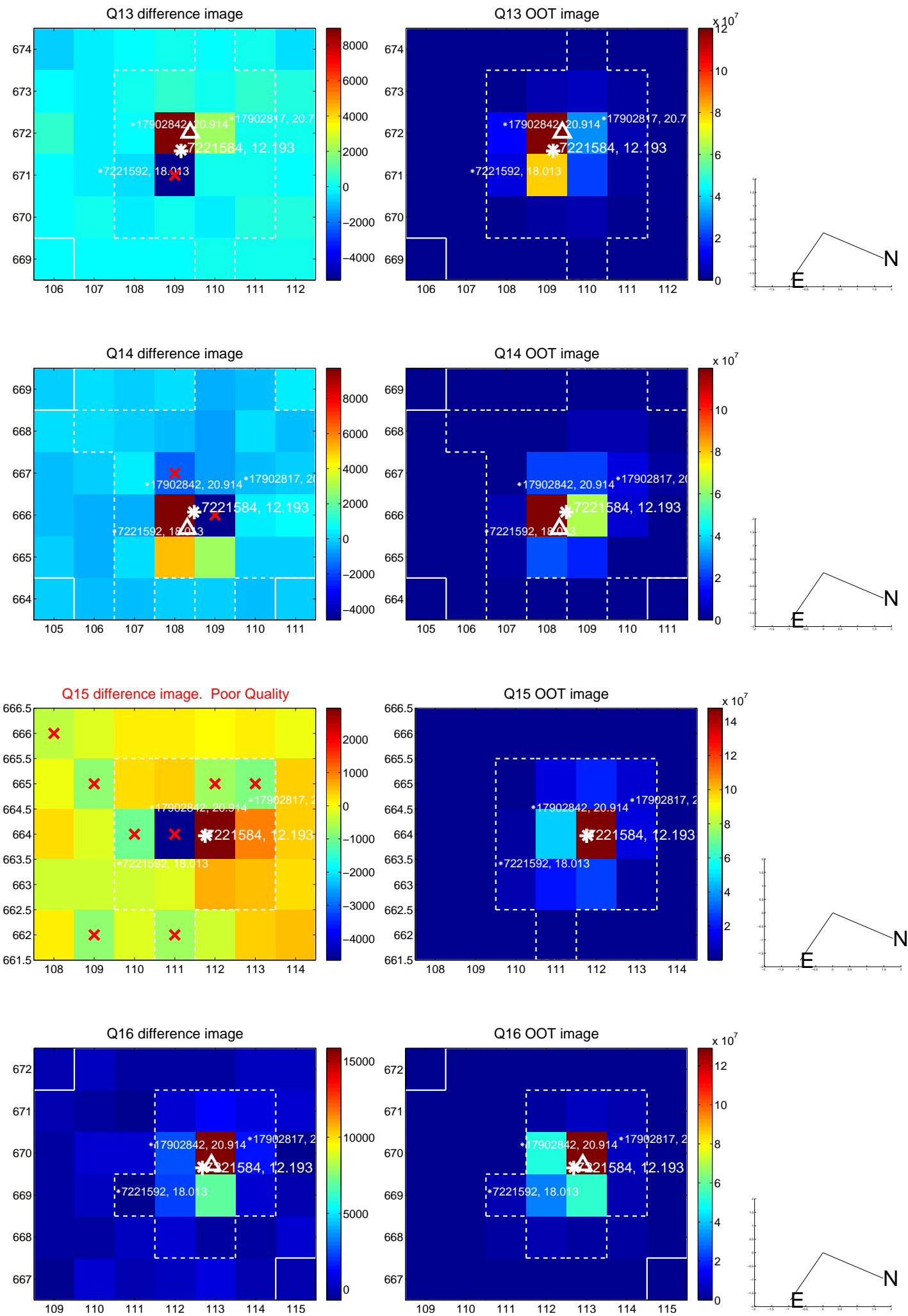




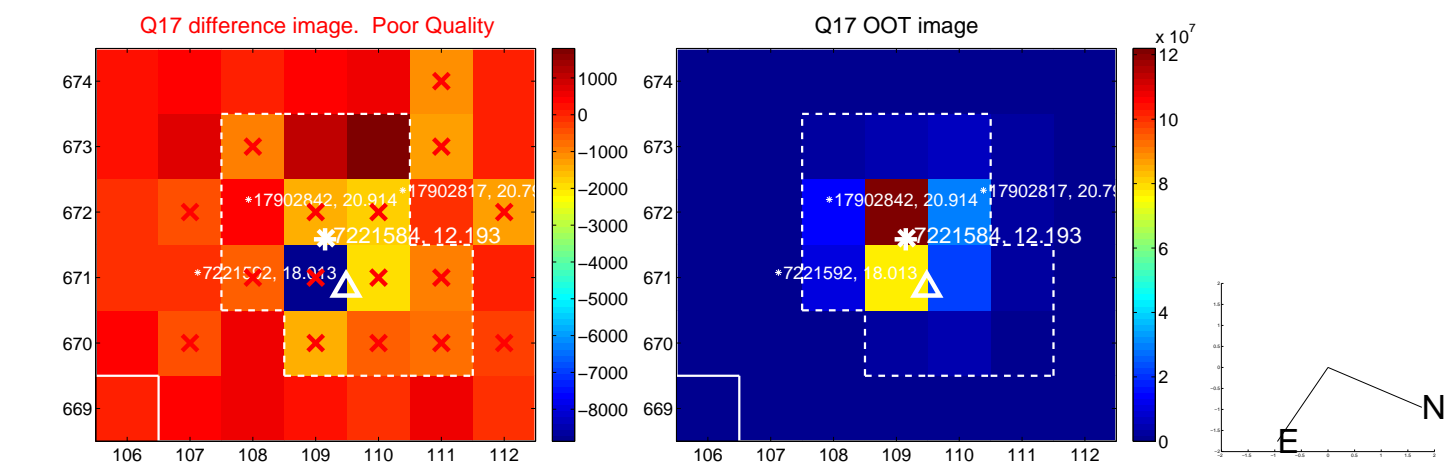
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



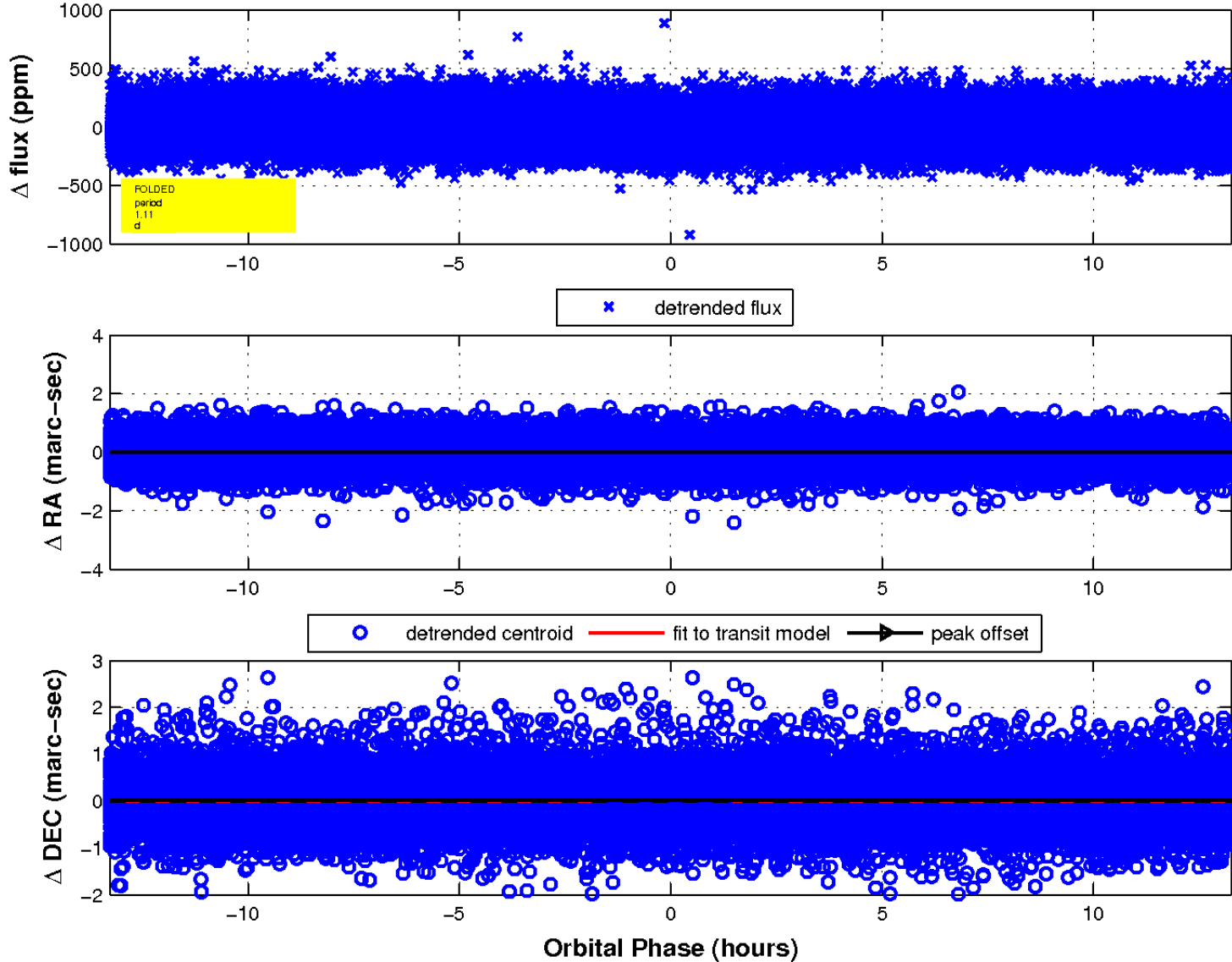
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



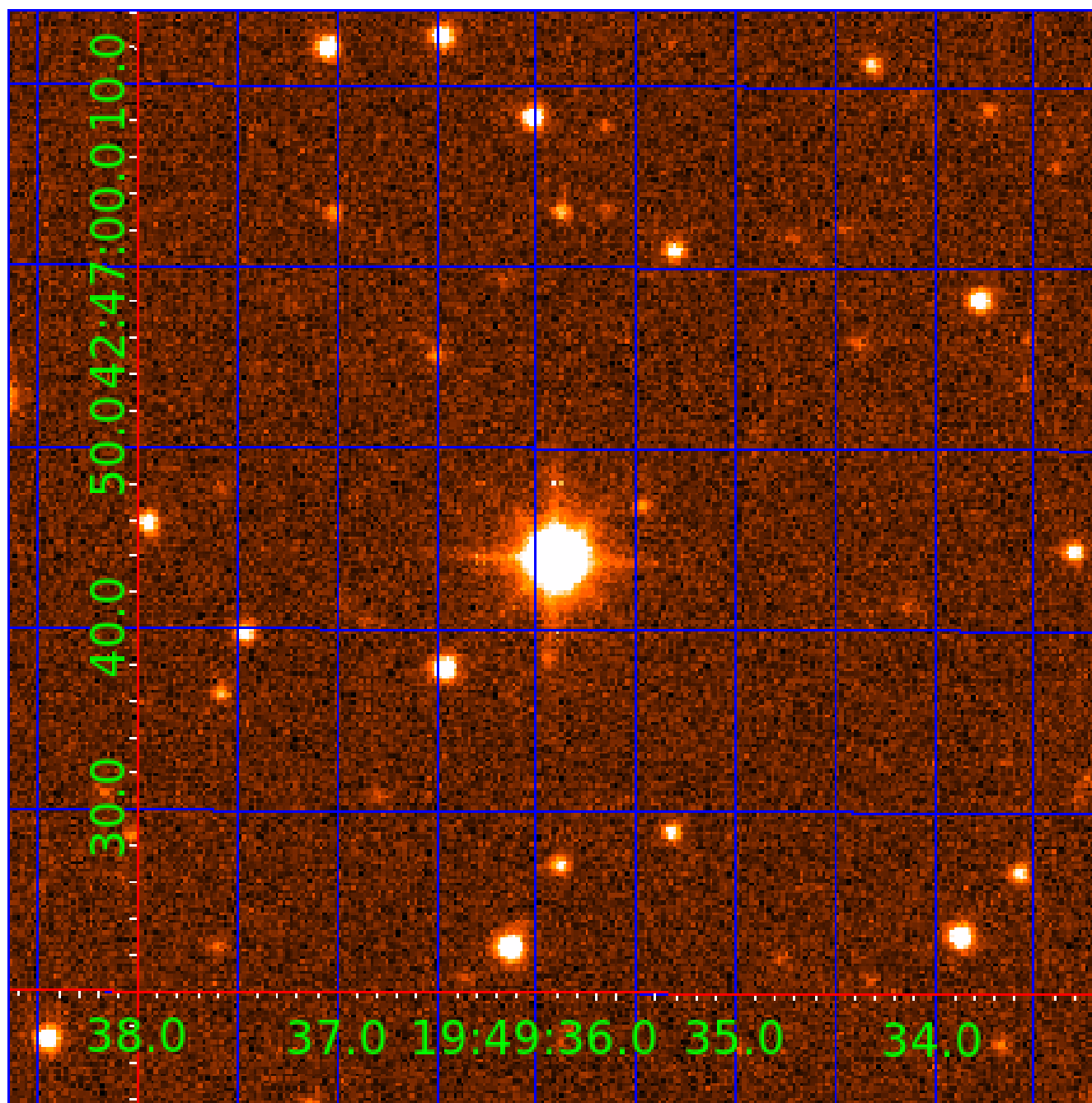
fluxWeightedCentroids, Planet 1 of 4





UKIRT Image

Declination



# KIC 007221584

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
007221584-01	OBS	No	1.106129	131.768362	17.4	4.630	11.8	9.3	3.14	6565	1.53	27393.97
007221584-02	OBS	No	1.177106	132.387392	27.5	4.481	9.9	10.1	3.14	6565	2.25	25214.03
007221584-03	OBS	No	49.343695	154.664203	167.9	8.114	8.5	8.7	3.14	6565	6.76	173.15
007221584-04	OBS	No	35.123241	152.772176	127.8	4.888	8.1	7.4	3.14	6565	4.04	272.44

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
007221584-01	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_ALT
007221584-02	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_DV
007221584-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT
007221584-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT

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

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

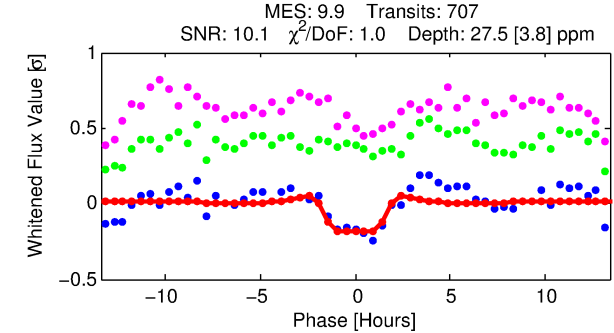
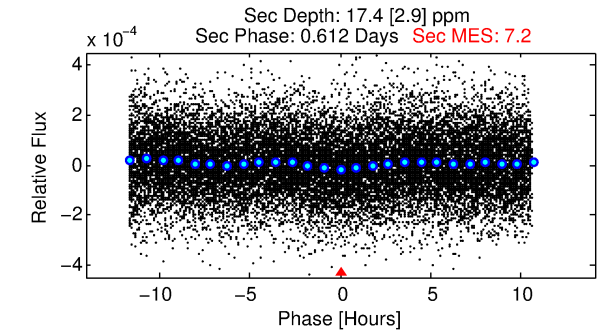
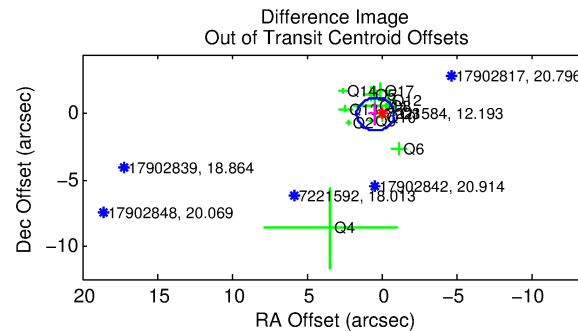
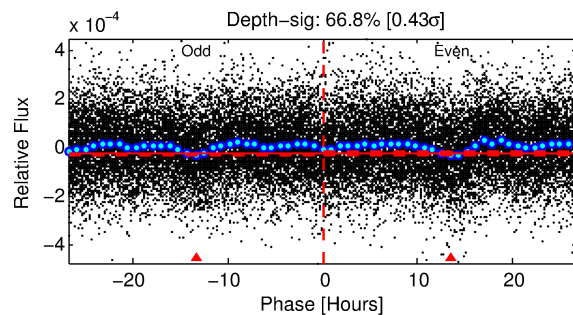
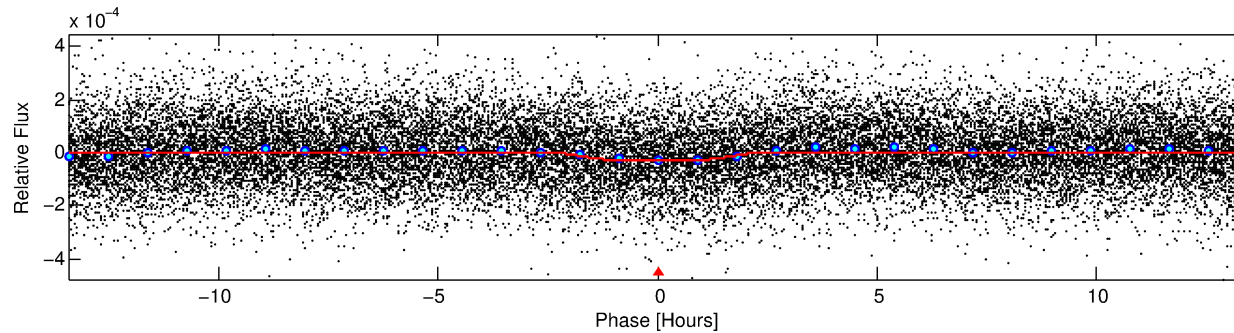
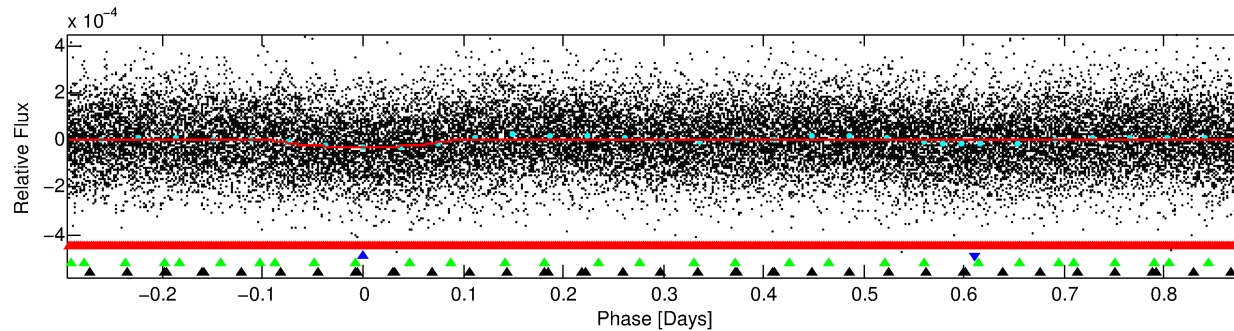
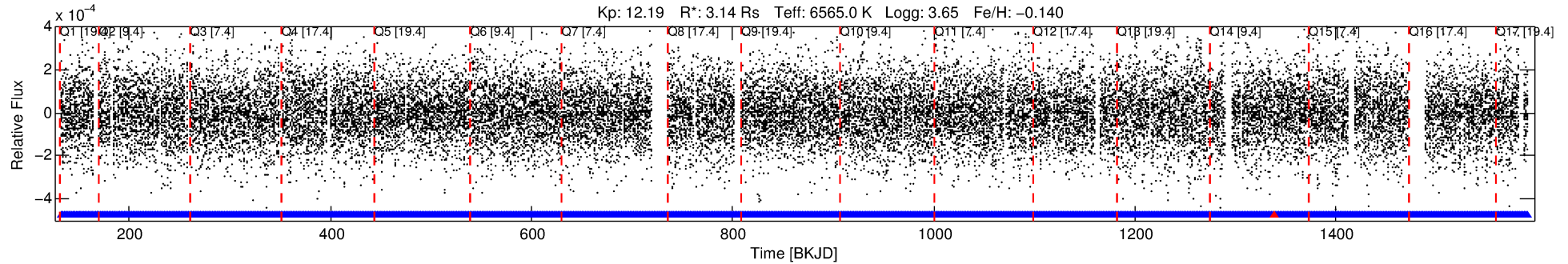
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 007221584-02

No Significant Match Found

# DV One-Page Summary

KIC: 7221584 Candidate: 2 of 4 Period: 1.177 d



## DV Fit Results:

Period = 1.17711 [0.00001] d  
Epoch = 132.3874 [0.0048] BKJD  
Rp/R\* = 0.0066 [0.0005]  
a/R\* = 1.07 [0.03]  
b = 0.99 [0.01]  
Seff = 25214.03 [14976.11]  
Teq = 3213 [477] K  
Rp = 2.25 [0.89] Re  
a = 0.0255 [0.0094] AU  
Ag = 1.23 [0.77] [0.29 $\sigma$ ]  
Teffp = 5227 [343] K [3.43 $\sigma$ ]

## DV Diagnostic Results:

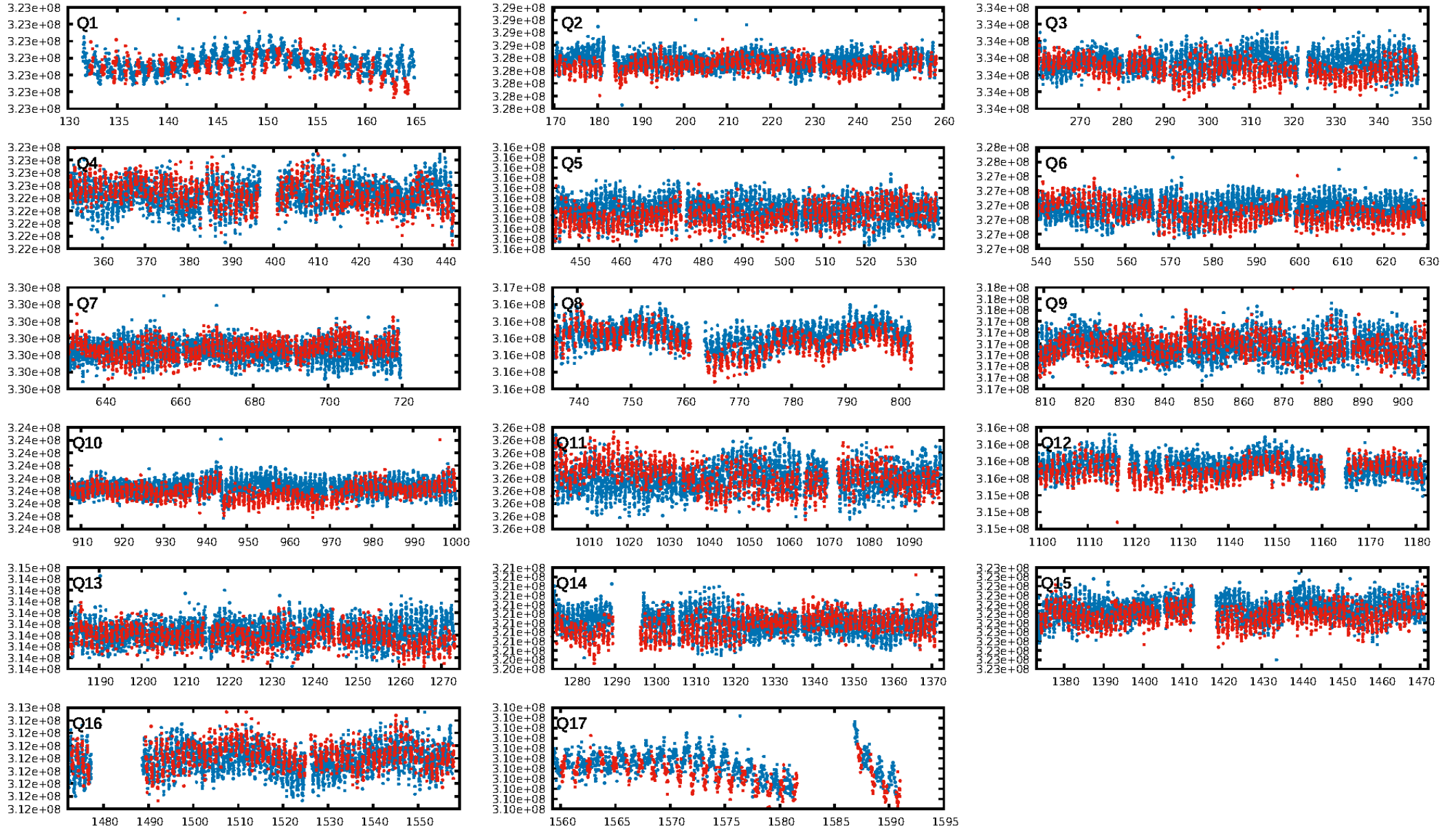
ShortPeriod-sig: 20.9% [0.26 $\sigma$ ]  
LongPeriod-sig: 100.0% [122.86 $\sigma$ ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: 1.04e-12  
RollingBand-fgt: 1.00 [677/678]  
GhostDiagnostic-chr: 3.899  
Centroid-sig: 2.7%  
Centroid-so: 0.835 arcsec [2.19 $\sigma$ ]  
OotOffset-rm: 0.409 arcsec [0.98 $\sigma$ ]  
OotOffset-st: 4/2/3/4 [13]  
KicOffset-rm: 0.464 arcsec [1.17 $\sigma$ ]  
KicOffset-st: 4/2/3/4 [13]  
DiffImageQuality-fgm: 0.77 [10/13]  
DiffImageOverlap-fno: 1.00 [17/17]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 17:00:23 Z

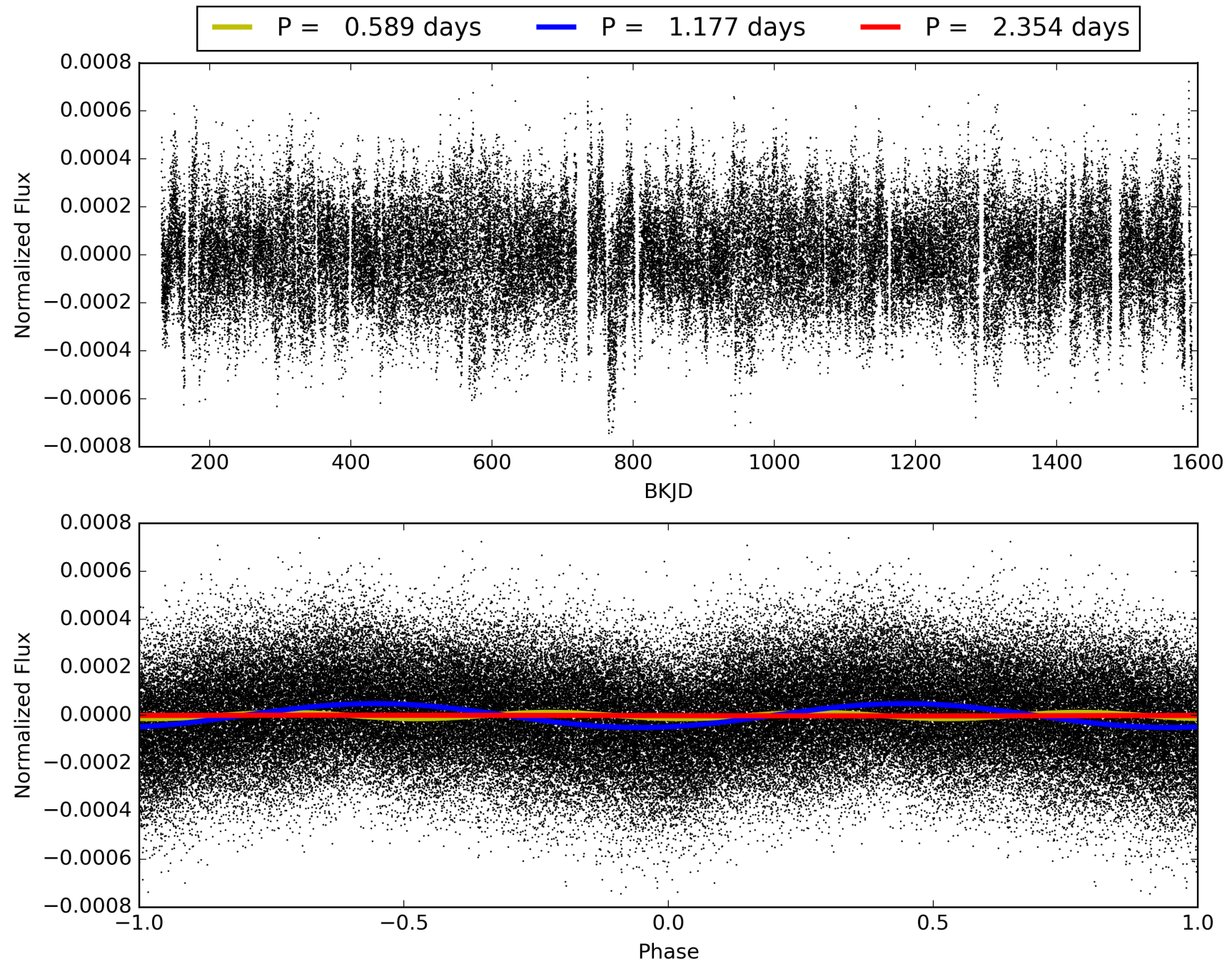
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center



# TCE 007221584-02, PDC Light Curves

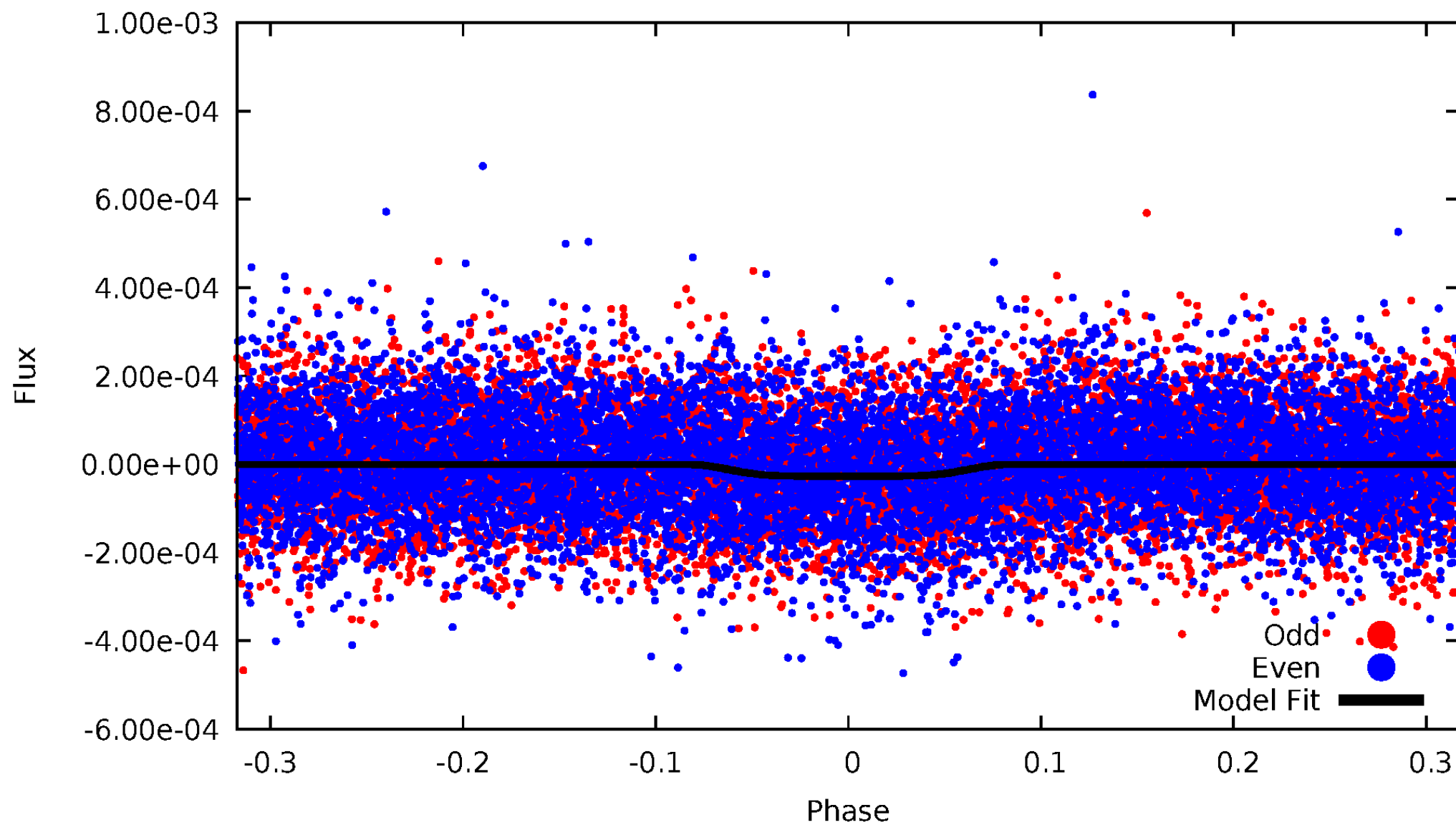


TCE 007221584-02



# DV Odd/Even

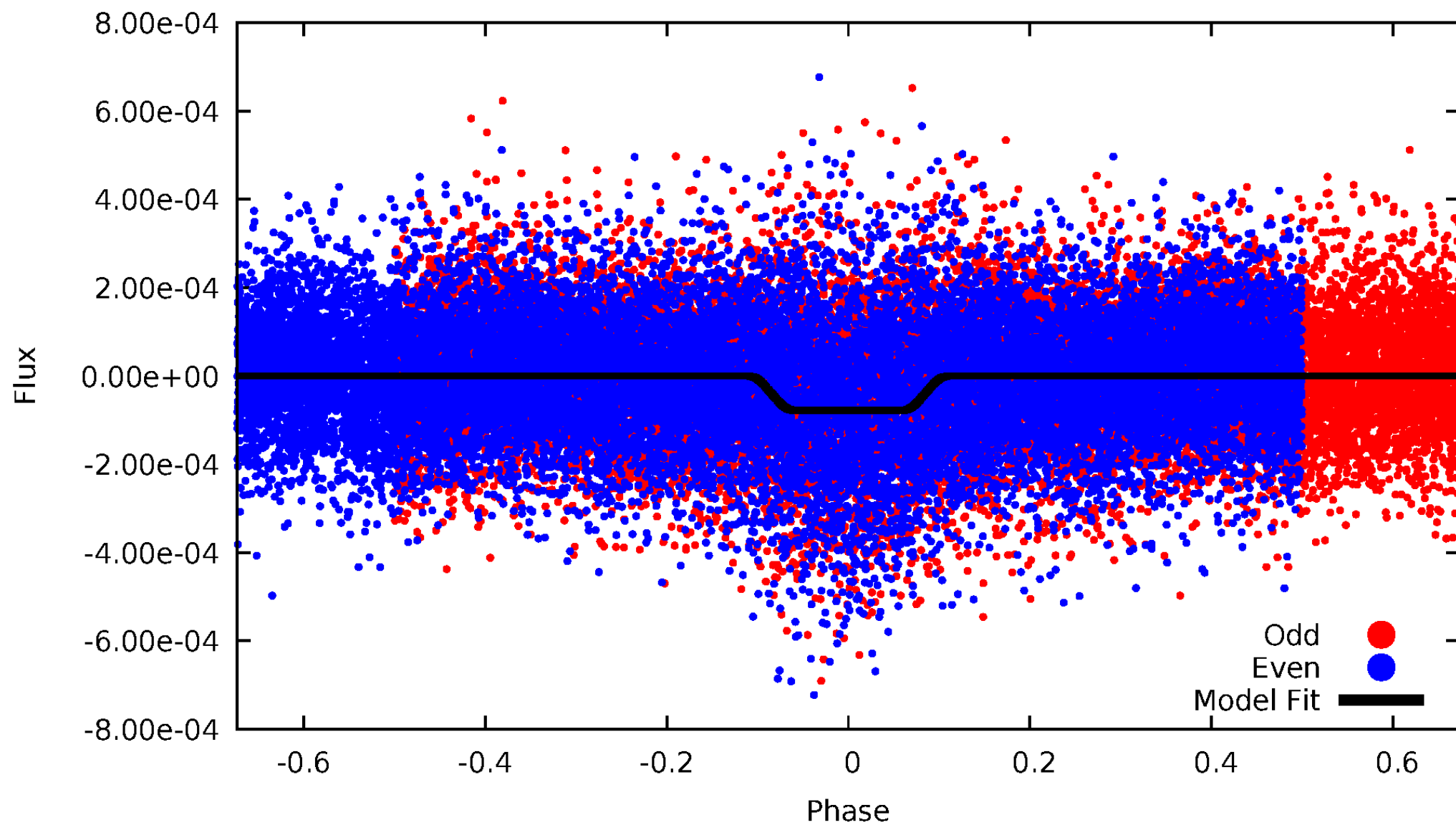
TCE 007221584-02





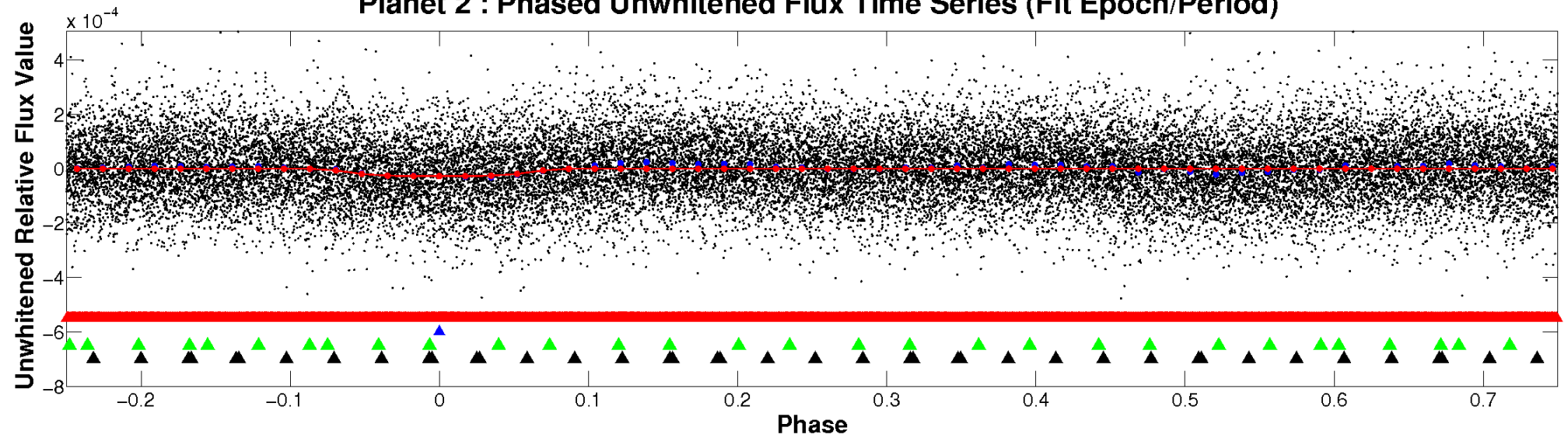
# ALT Odd/Even

TCE 007221584-02

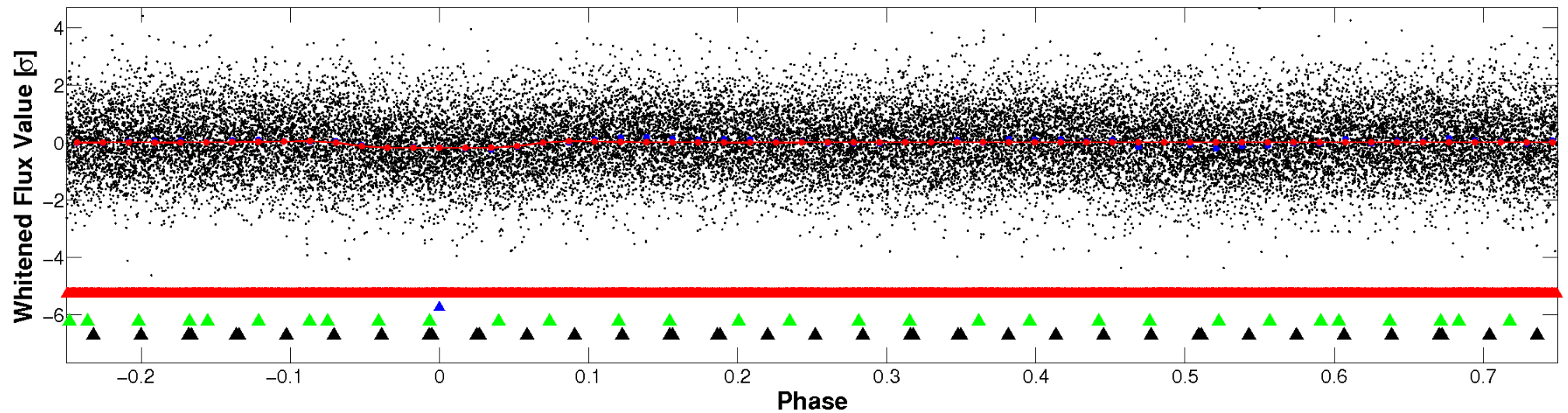


# Non-Whitened Vs. Whitened Light Curve

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

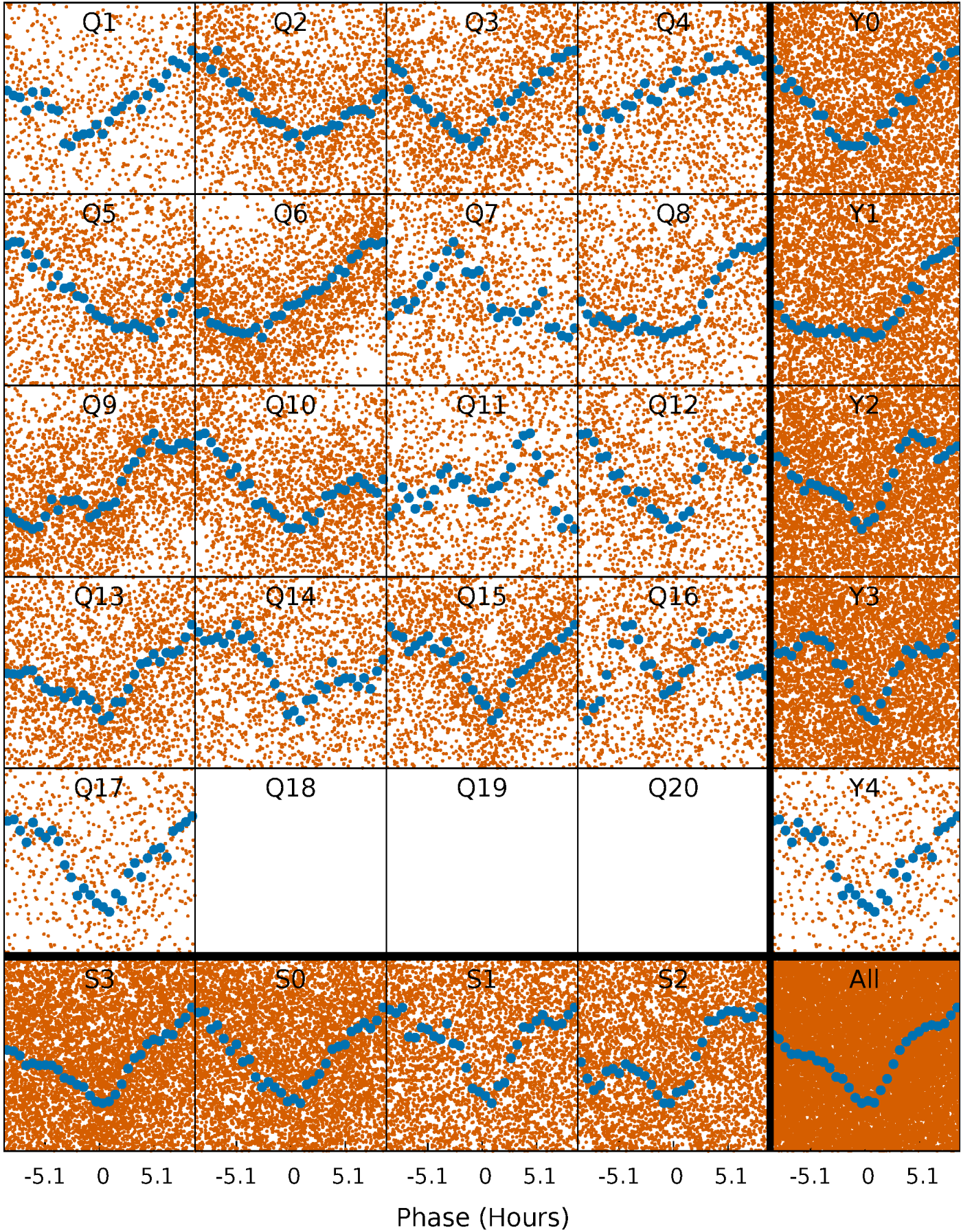


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

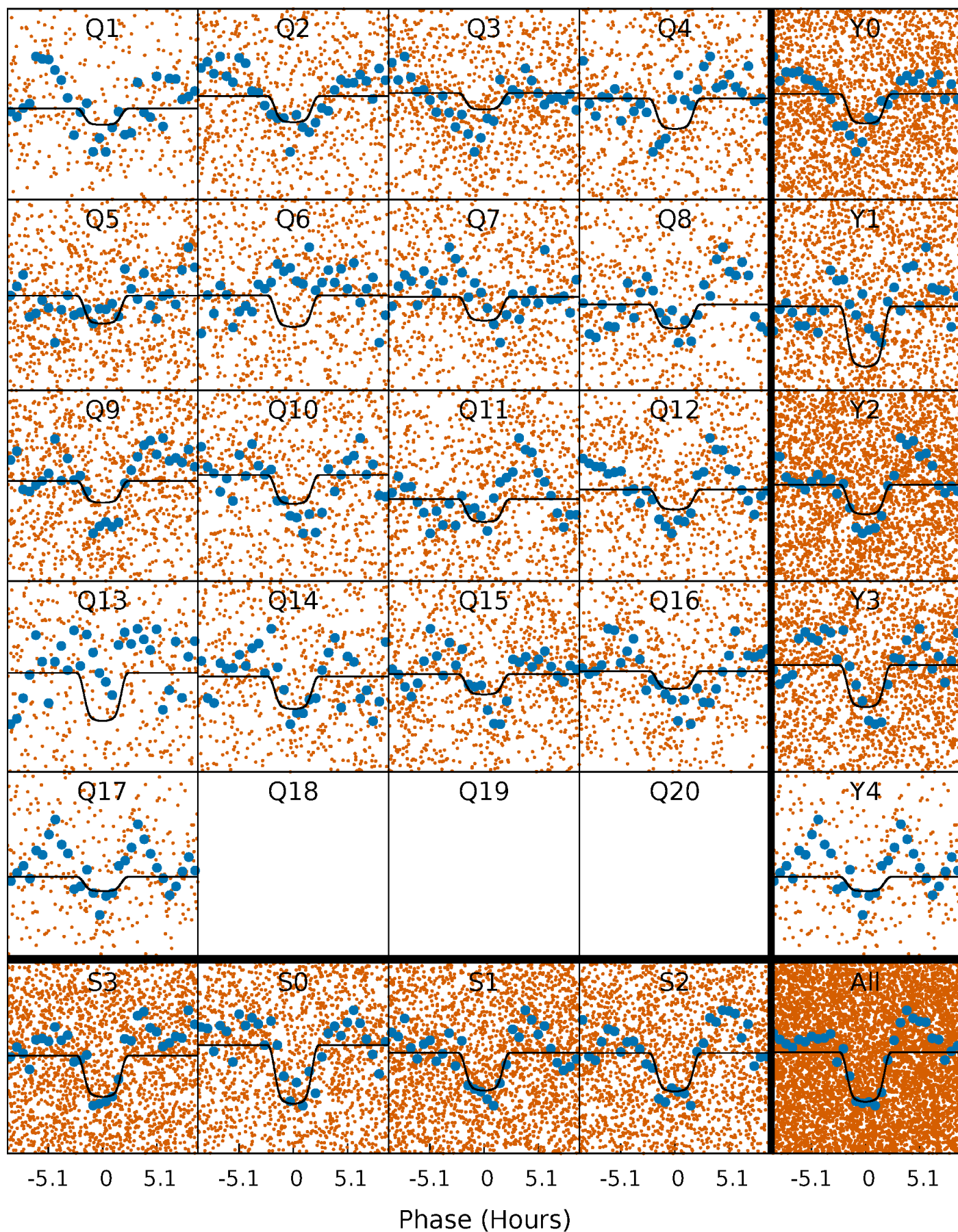
TCE 007221584-02   P= 1.177106 Days    $T_0=132.387392$  (BKJD)





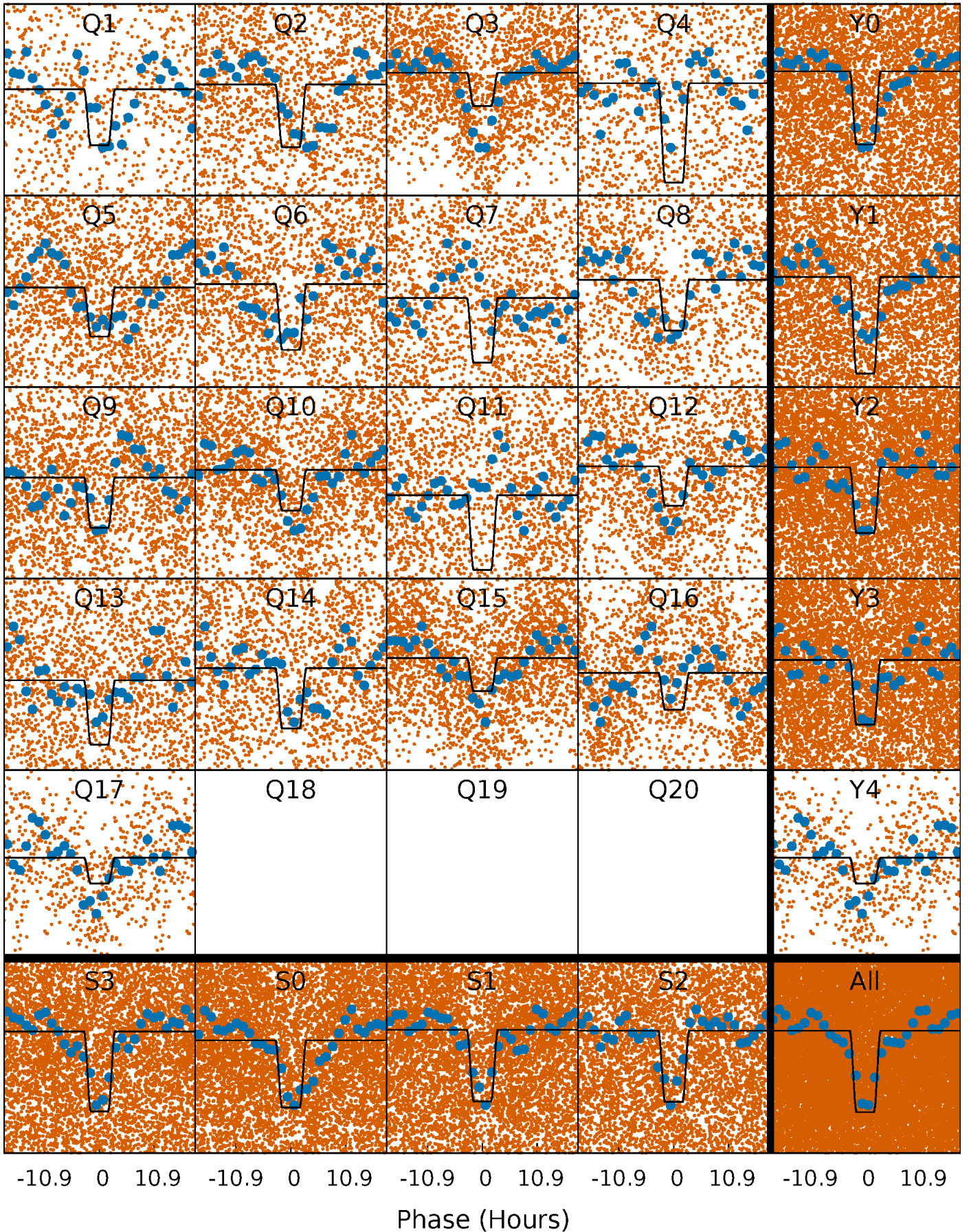
# DV Quarter-Phased Transit Curves

TCE 007221584-02 P= 1.177106 Days  $T_0=132.387392$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

TCE 007221584-02 P= 1.177167 Days  $T_0=132.342762$  (BKJD)

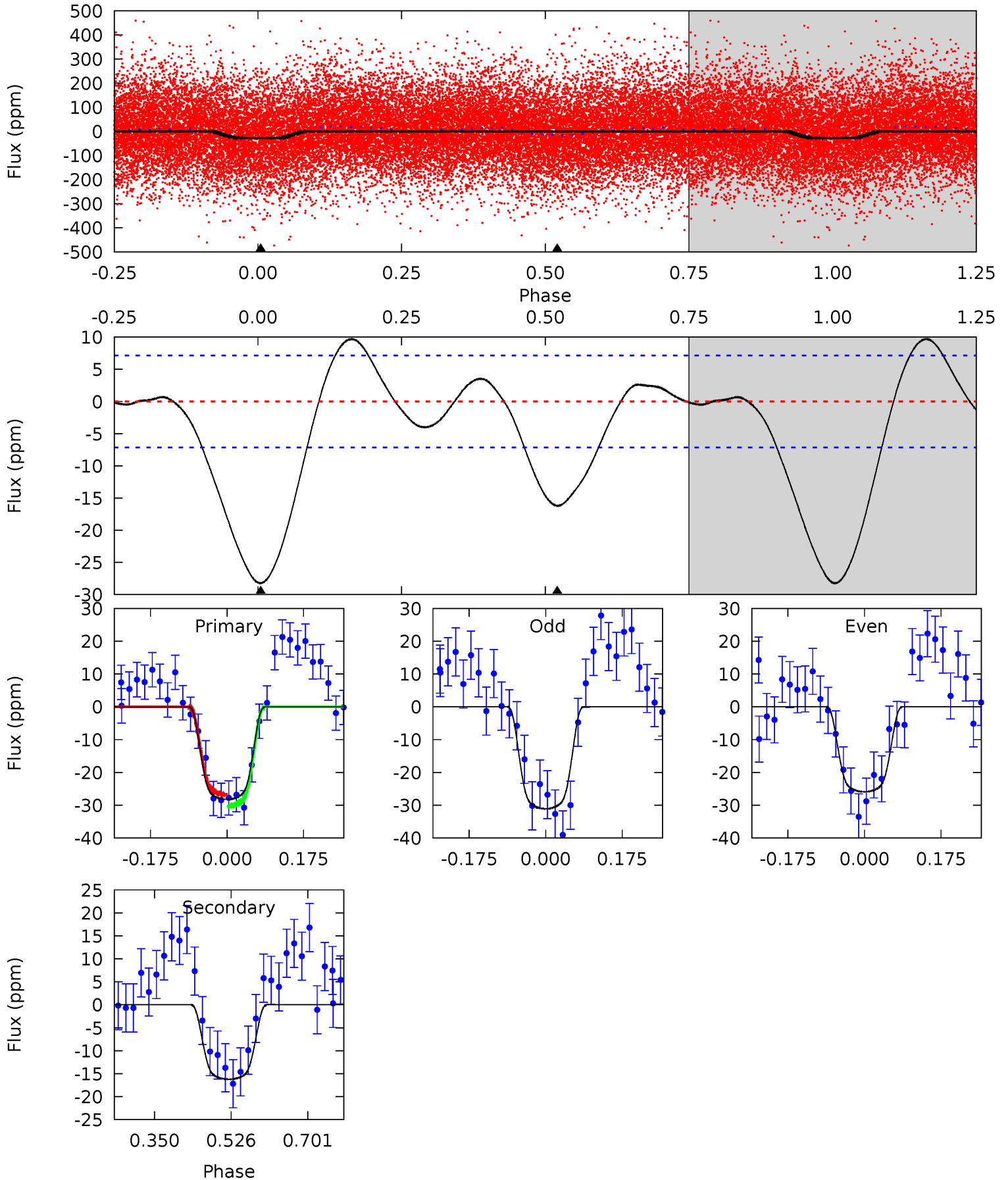




# DV Model-Shift Uniqueness Test

007221584-02, P = 1.177106 Days, E = 131.210286 Days

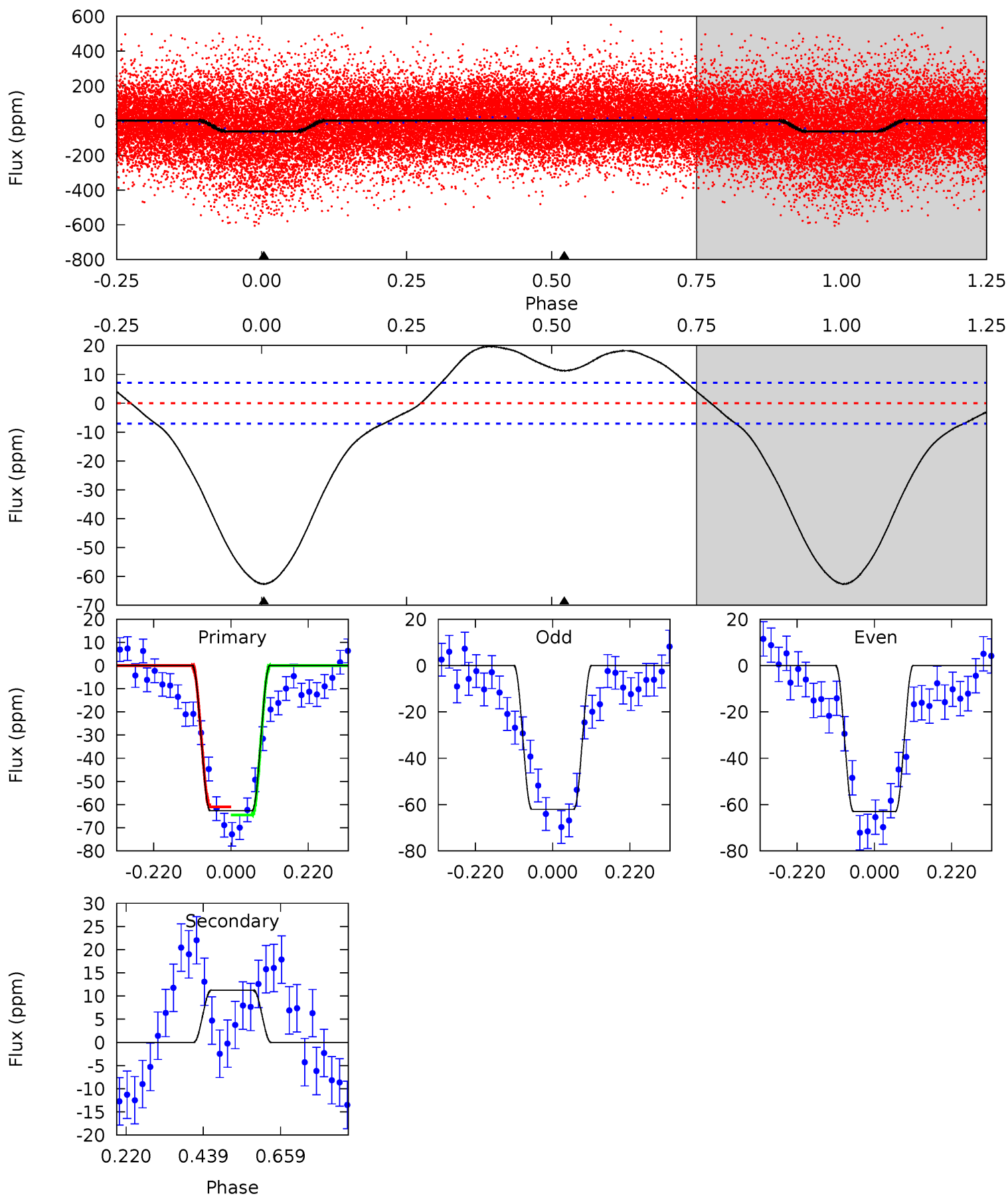
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
17.6	10.1	0	0	4.45	1.36	1.78	17.6	17.6	10.1	10.1	1.62	1.16	0.26	1.09



# Alt Model-Shift Uniqueness Test

007221584-02, P = 1.177167 Days, E = 131.165595 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
38.8	-6.98	0	0	4.40	1.23	1.96	38.8	38.8	-6.98	-6.98	0.30	1.09	0.24	1.08



### Stellar Parameters For KIC 007221584

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6565^{+177}_{-197}$	$3.648^{+0.340}_{-0.060}$	$-0.140^{+0.300}_{-0.250}$	$3.143^{+0.404}_{-1.211}$	$1.601^{+0.215}_{-0.350}$	$0.073^{+0.171}_{-0.019}$
	+3%/-3%	+9%/-2%	+214%/-179%	+13%/-39%	+13%/-22%	+235%/-26%
Source	PHO1	FLK73	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 007221584-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-16 \pm 2$	$2.15^{+0.31}_{-0.43}$	$4362^{+247}_{-431}$	$4913^{+271}_{-278}$	$1.307^{+0.663}_{-0.320}$
Alt.	$11 \pm 2$	$2.86^{+0.41}_{-0.58}$	$4360^{+242}_{-410}$	$-4684^{+174}_{-176}$	$-0.502^{+0.131}_{-0.244}$

$T_{max}$  = 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

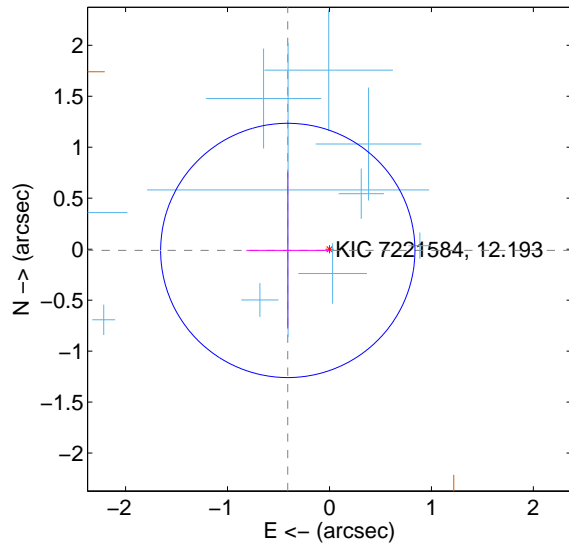
Supplemental centroid analysis for 007221584-02. Kepler magnitude: 12.19. Transit SNR 10.06

There are 10 quarters with good PRF difference image offsets

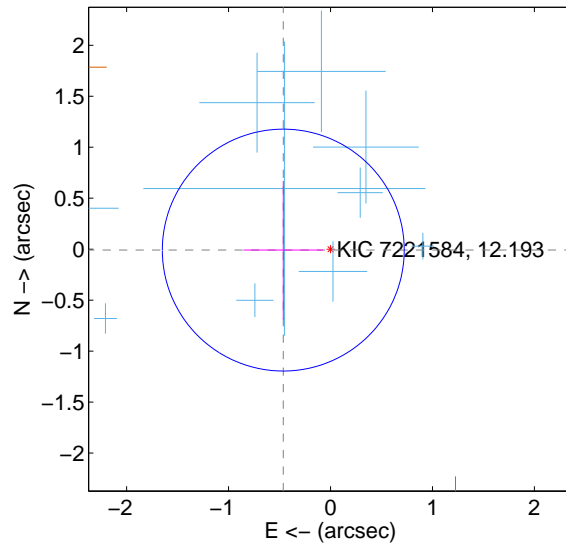
The direct PRF centroid is offset from the target star catalog position by about 0.08 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.409 \pm 0.416$	0.98	$0.409 \pm 0.406$	$-0.012 \pm 0.766$
PRF-fit source offset from KIC position	$0.464 \pm 0.395$	1.17	$0.463 \pm 0.391$	$-0.009 \pm 0.679$
photometric centroid source offset	$0.83 \pm 0.38$	2.19	$-0.82 \pm 0.38$	$-0.14 \pm 0.38$

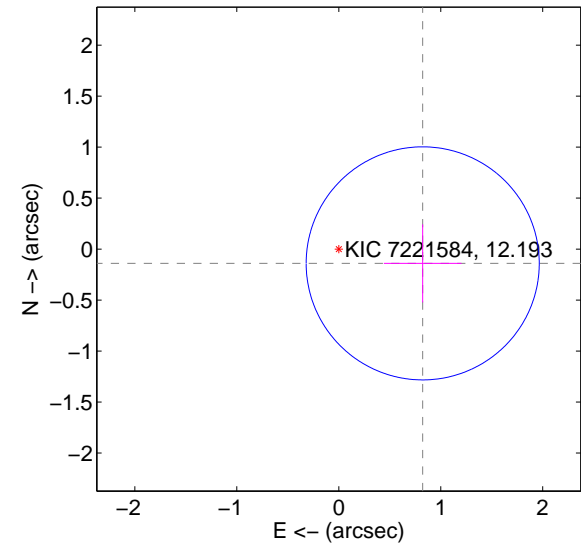
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

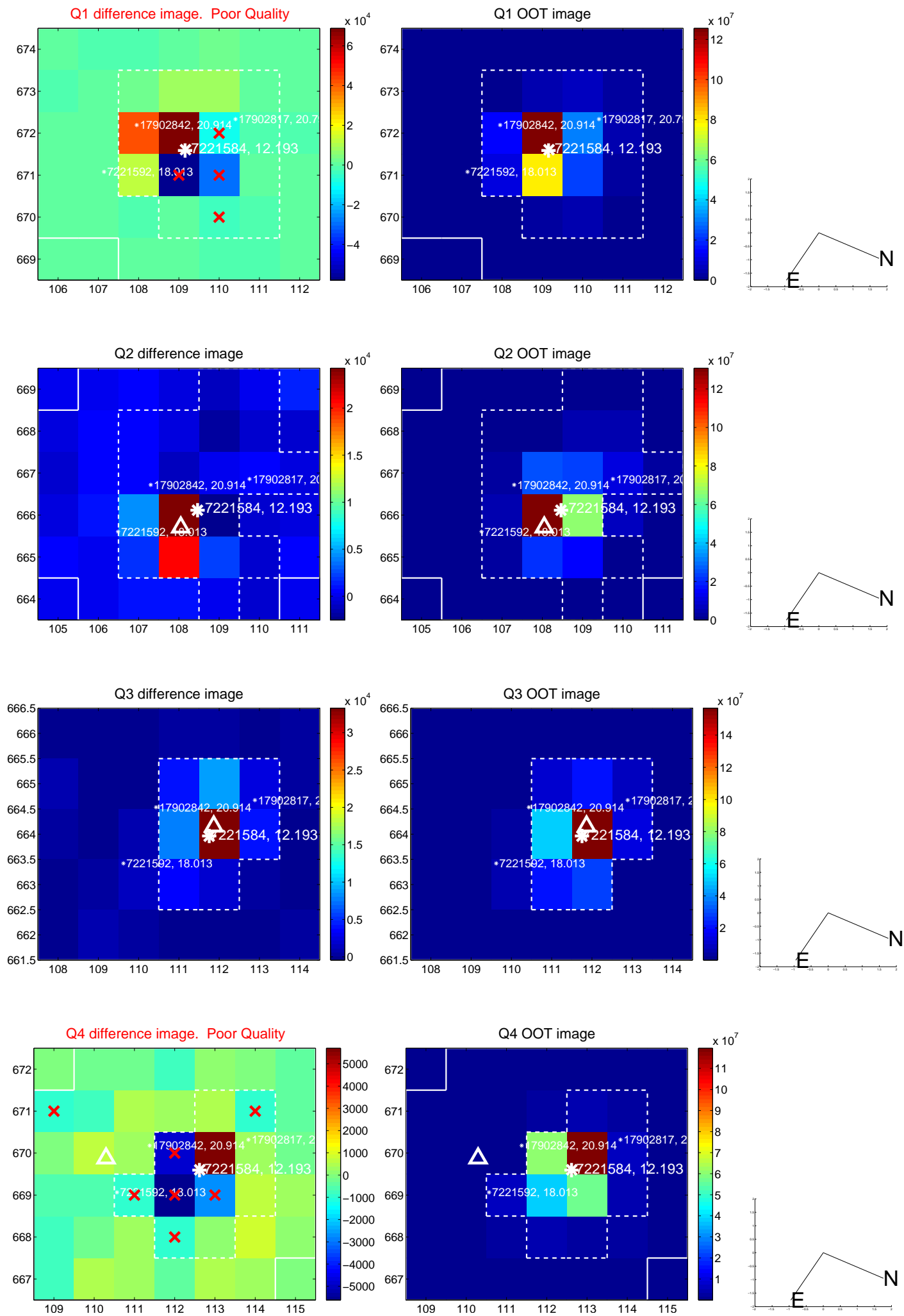


offset from photometric centroids



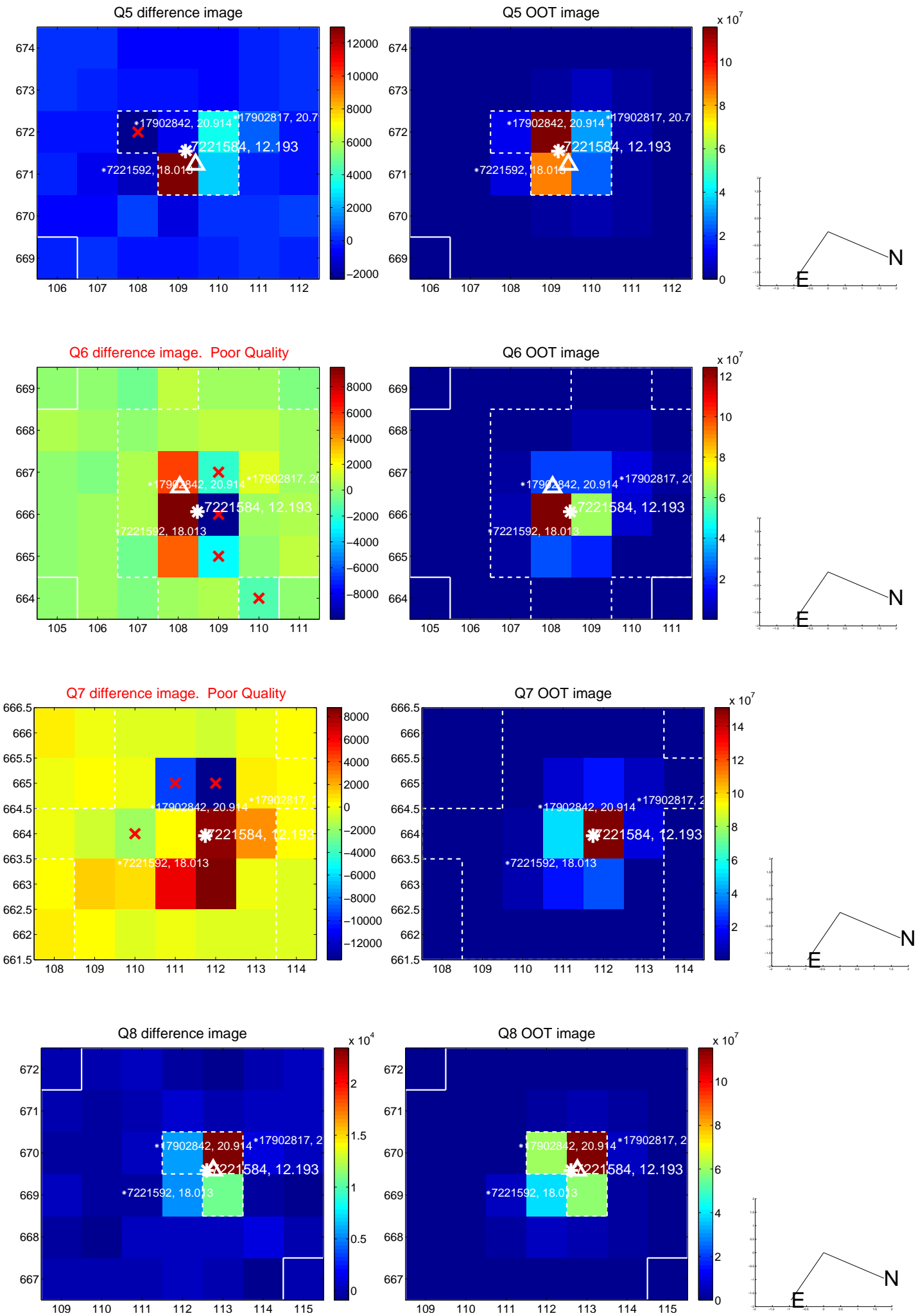
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

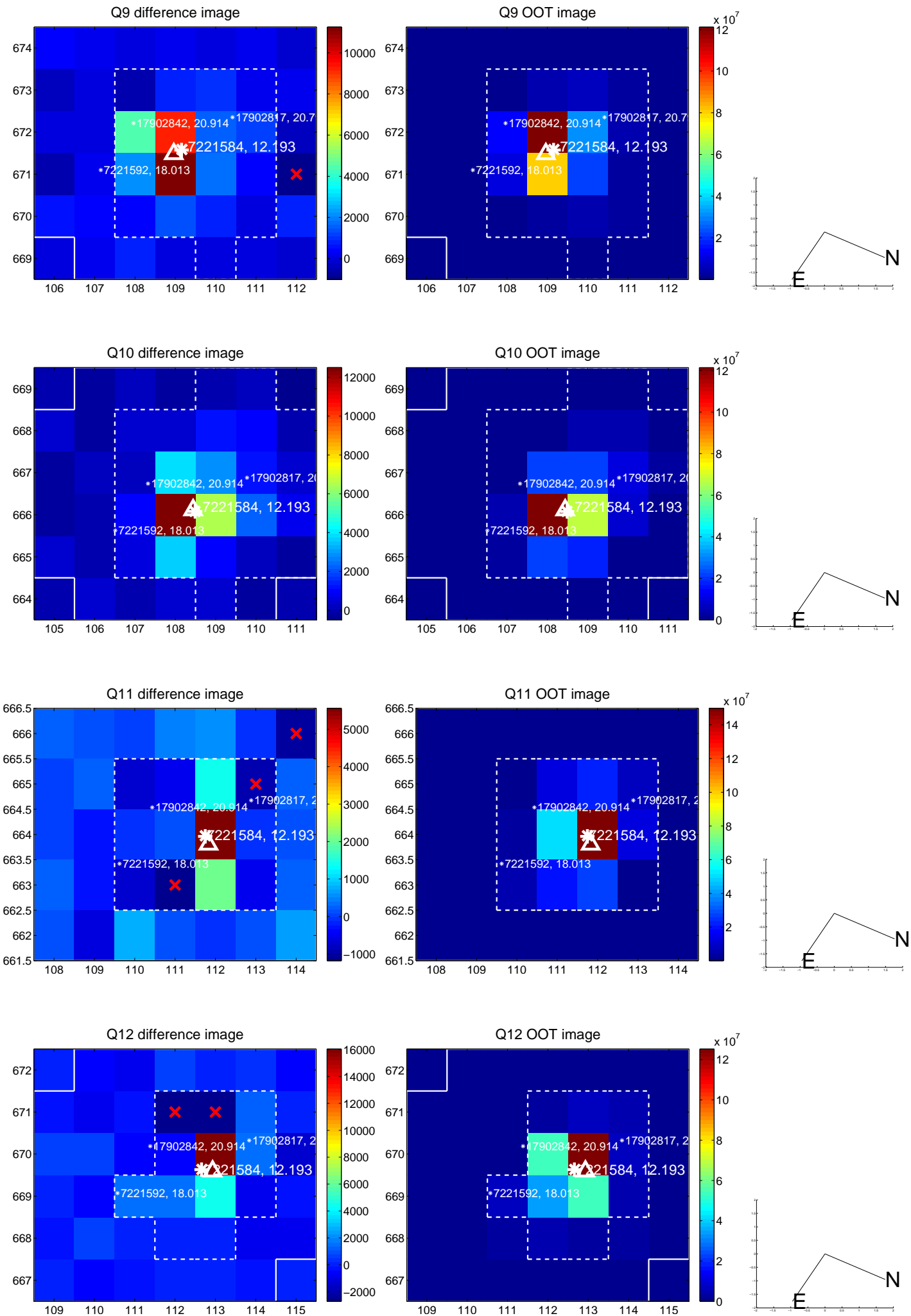




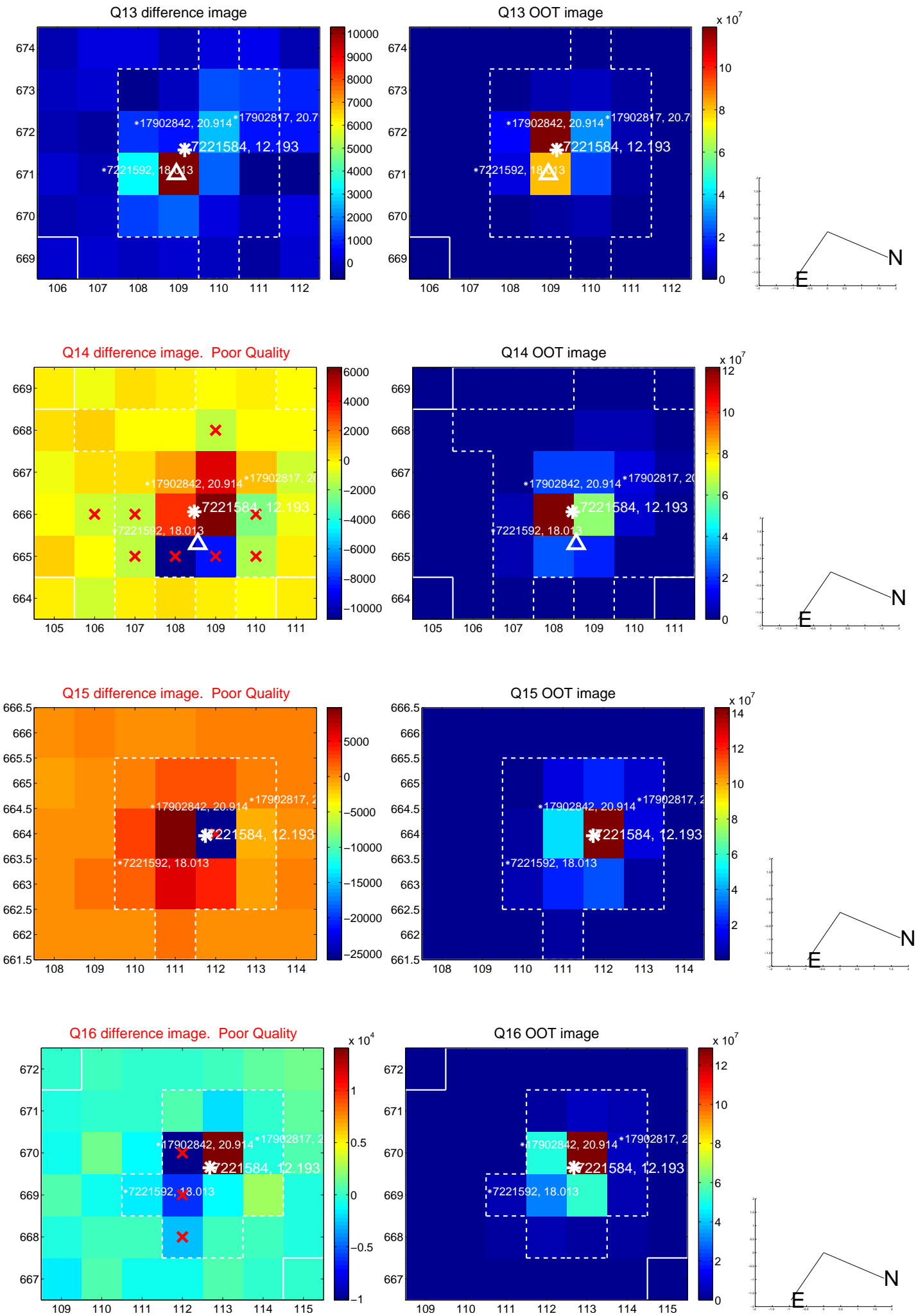
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



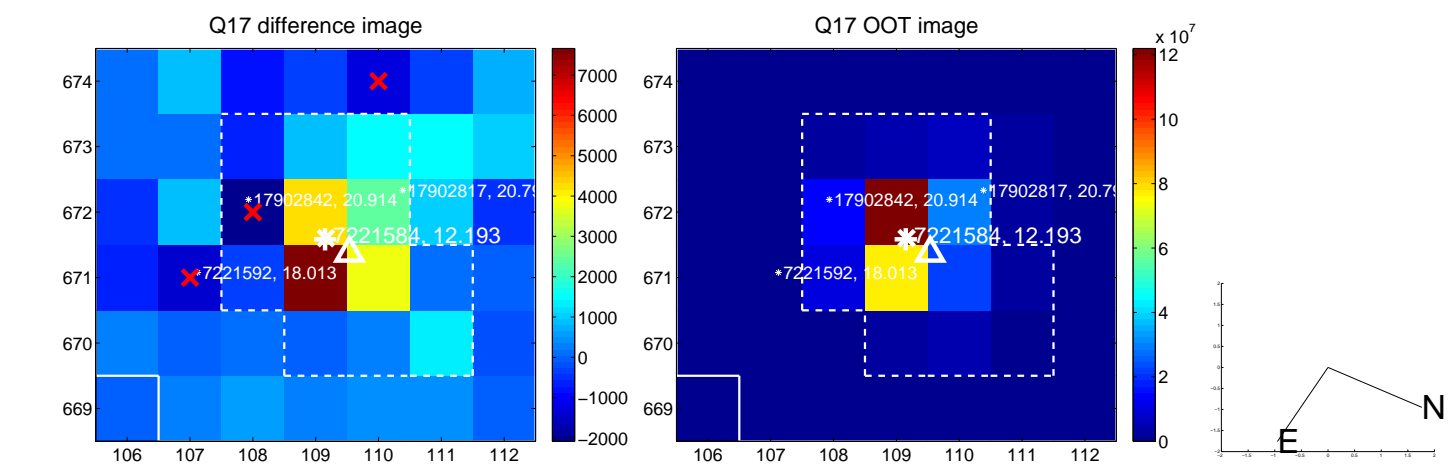
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



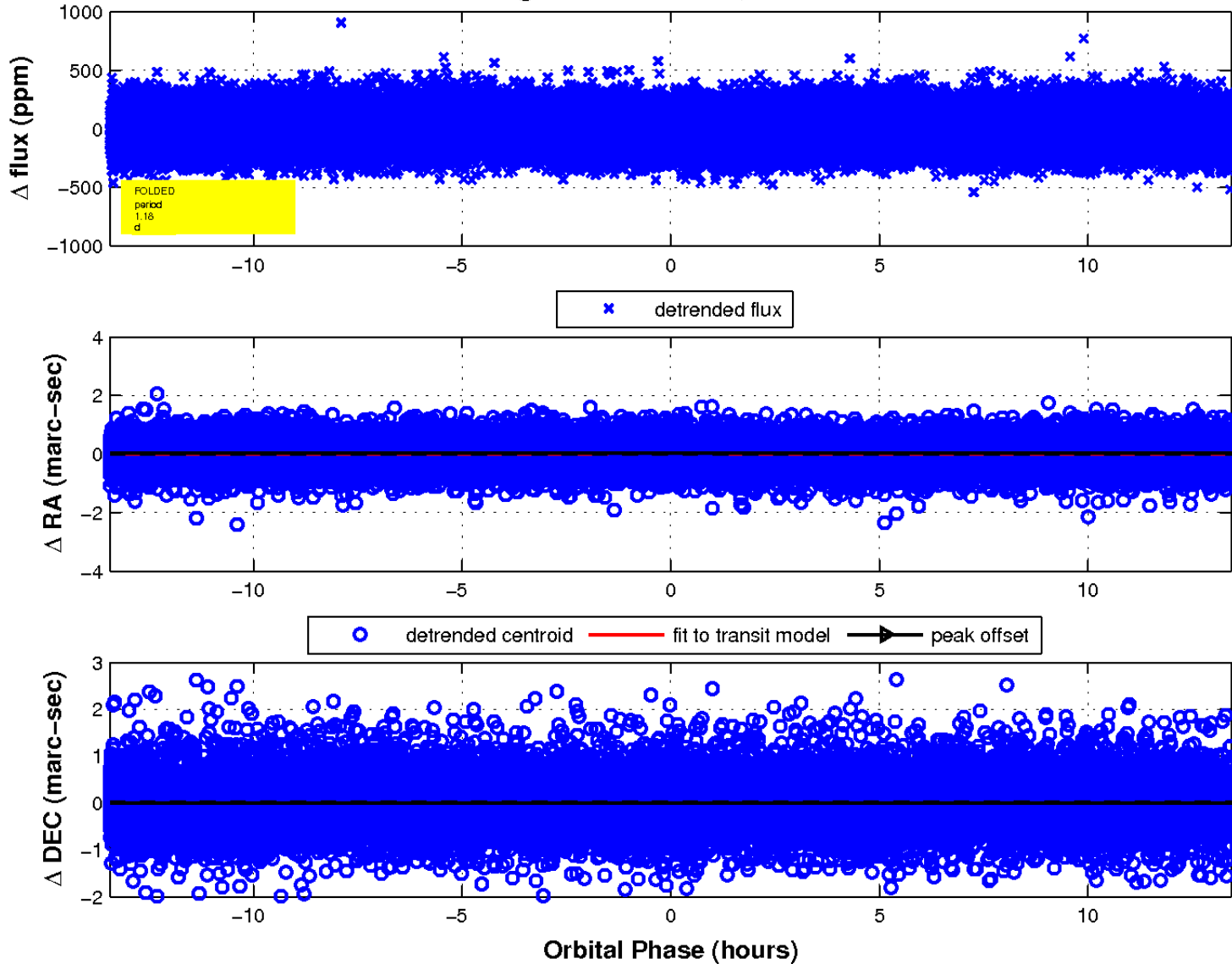
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

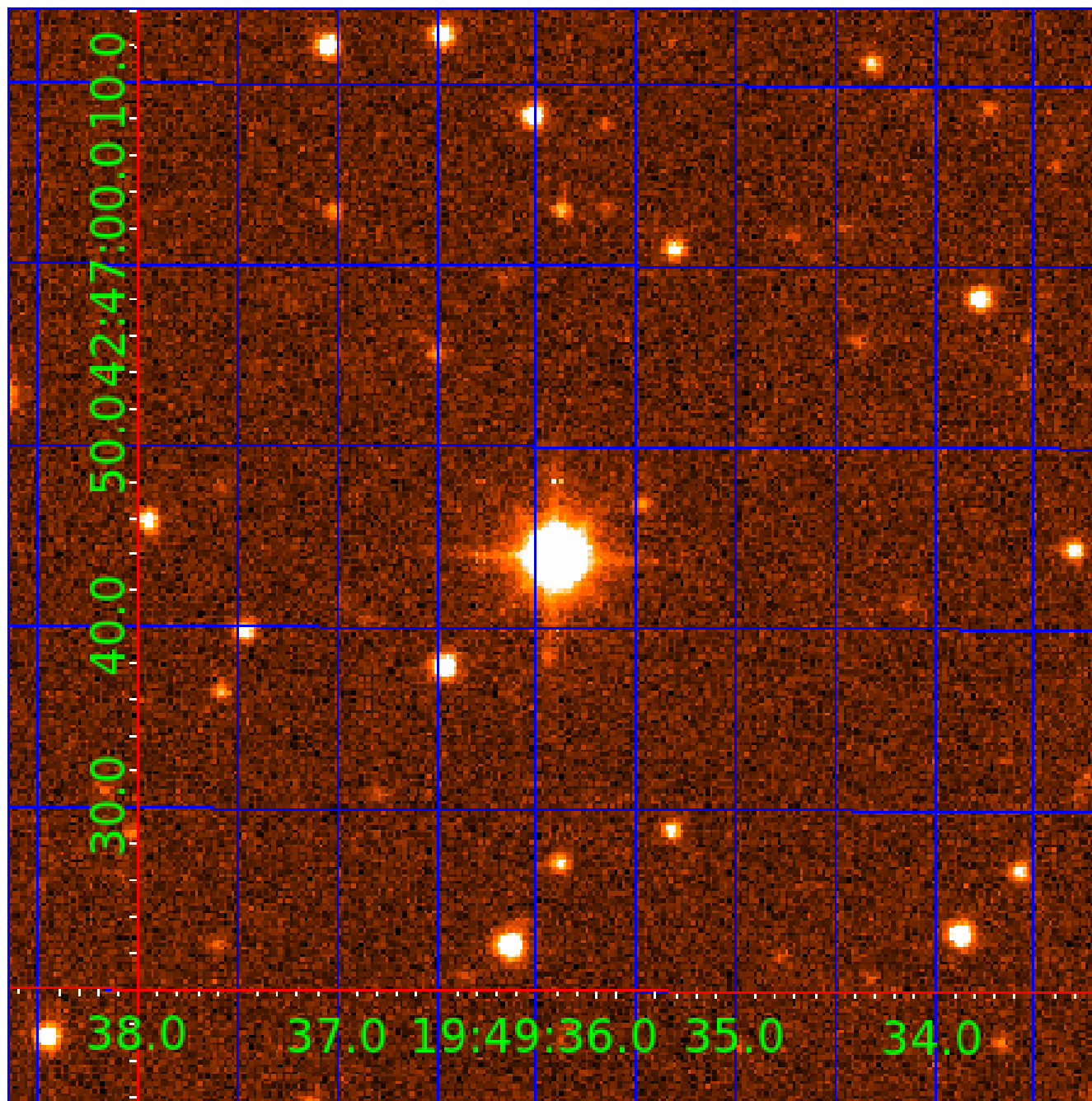


fluxWeightedCentroids, Planet 2 of 4



UKIRT Image

Declination





# KIC 007221584

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
007221584-01	OBS	No	1.106129	131.768362	17.4	4.630	11.8	9.3	3.14	6565	1.53	27393.97
007221584-02	OBS	No	1.177106	132.387392	27.5	4.481	9.9	10.1	3.14	6565	2.25	25214.03
007221584-03	OBS	No	49.343695	154.664203	167.9	8.114	8.5	8.7	3.14	6565	6.76	173.15
007221584-04	OBS	No	35.123241	152.772176	127.8	4.888	8.1	7.4	3.14	6565	4.04	272.44

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
007221584-01	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_ALT
007221584-02	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_DV
007221584-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT
007221584-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT

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

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

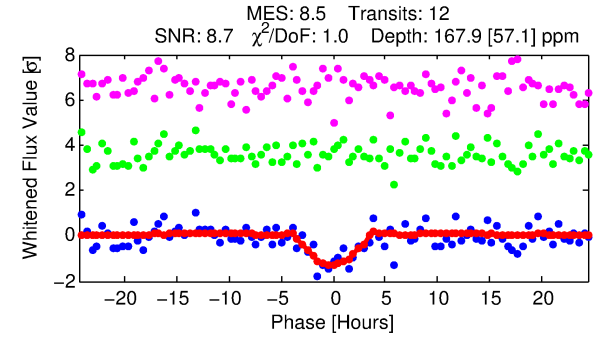
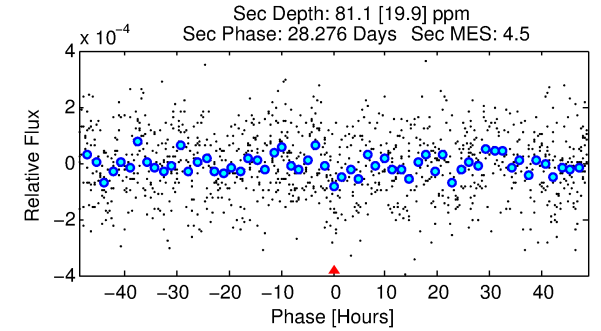
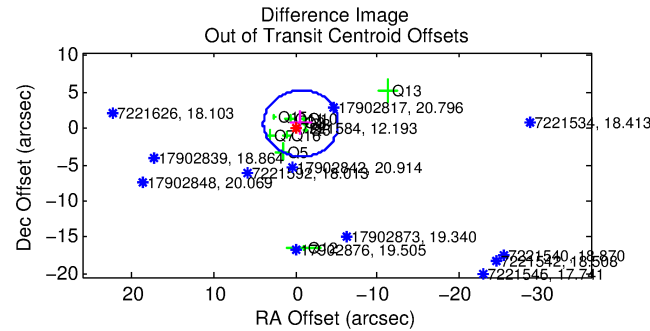
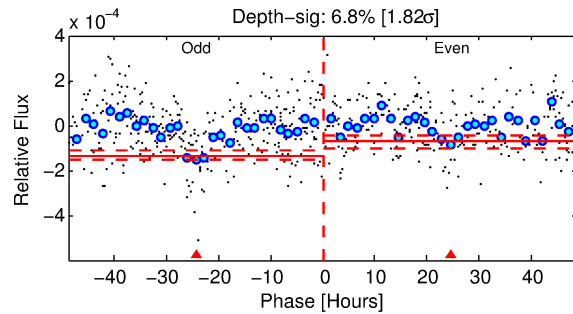
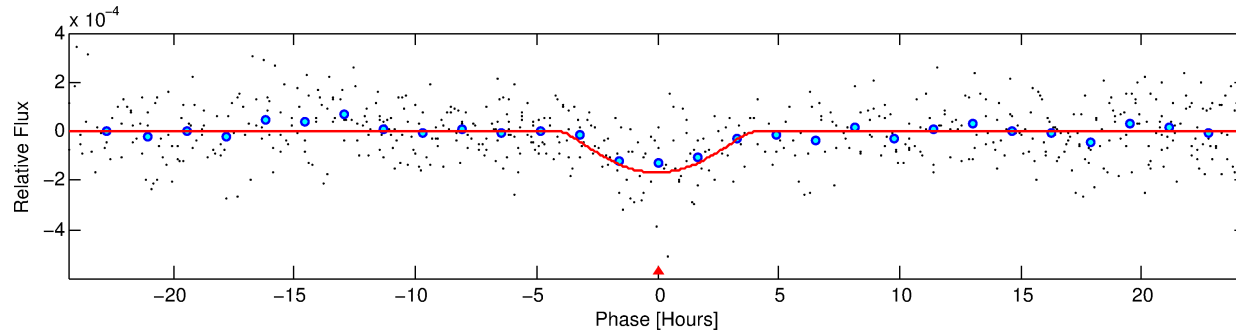
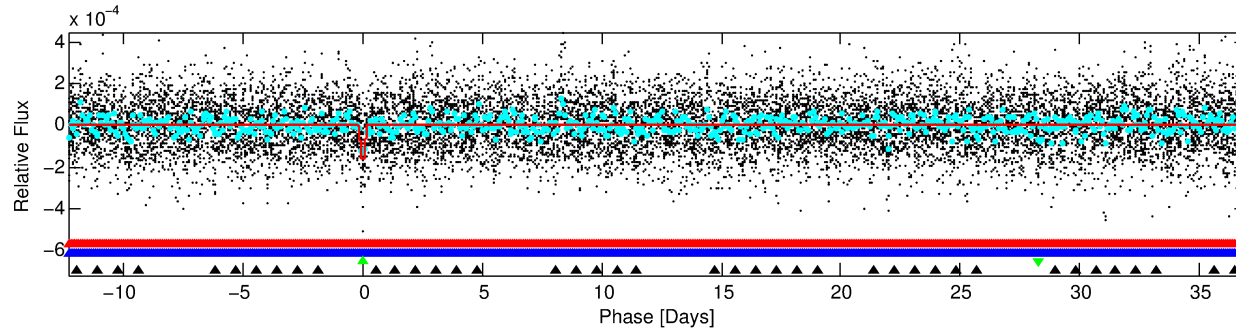
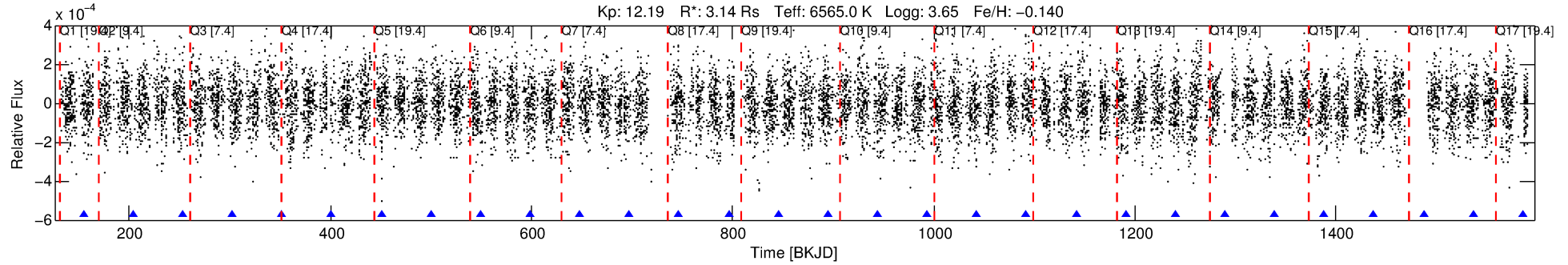
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 007221584-03

No Significant Match Found

# DV One-Page Summary

KIC: 7221584 Candidate: 3 of 4 Period: 49.344 d



## DV Fit Results:

Period = 49.34369 [0.00148] d  
Epoch = 154.6642 [0.0235] BKJD  
Rp/R\* = 0.0197 [0.0329]  
a/R\* = 10.67 [6.55]  
b = 0.99 [0.06]  
Seff = 173.15 [102.84]  
Teq = 925 [137] K  
Rp = 6.76 [11.60] Re  
a = 0.3081 [0.1128] AU  
Ag = 92.72 [315.42] [0.29σ]  
Teffp = 4438 [3721] K [0.94σ]

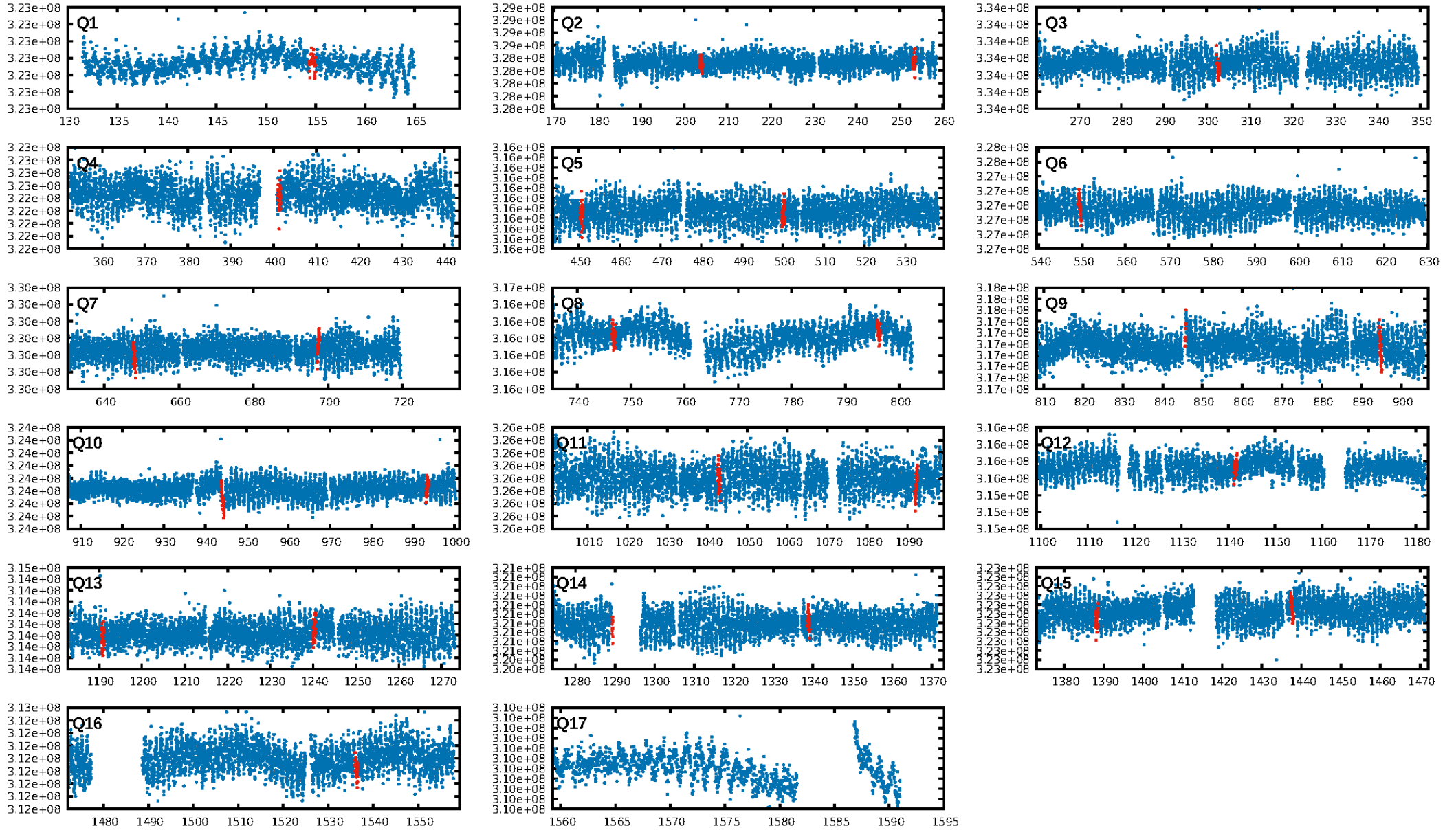
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [36.03σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 11.9%  
ModelChiSquareGof-sig: 100.0%  
**Bootstrap-pfa: 3.23e-09**  
RollingBand-fgt: 1.00 [12/12]  
GhostDiagnostic-chr: 3.715  
Centroid-sig: 13.0%  
Centroid-so: 0.681 arcsec [1.70σ]  
OotOffset-rm: 0.951 arcsec [0.63σ]  
OotOffset-st: 2/4/3/2 [11]  
KicOffset-rm: 0.927 arcsec [0.58σ]  
KicOffset-st: 2/4/3/2 [11]  
DiffImageQuality-fgm: 0.36 [4/11]  
DiffImageOverlap-fno: 0.00 [0/15]

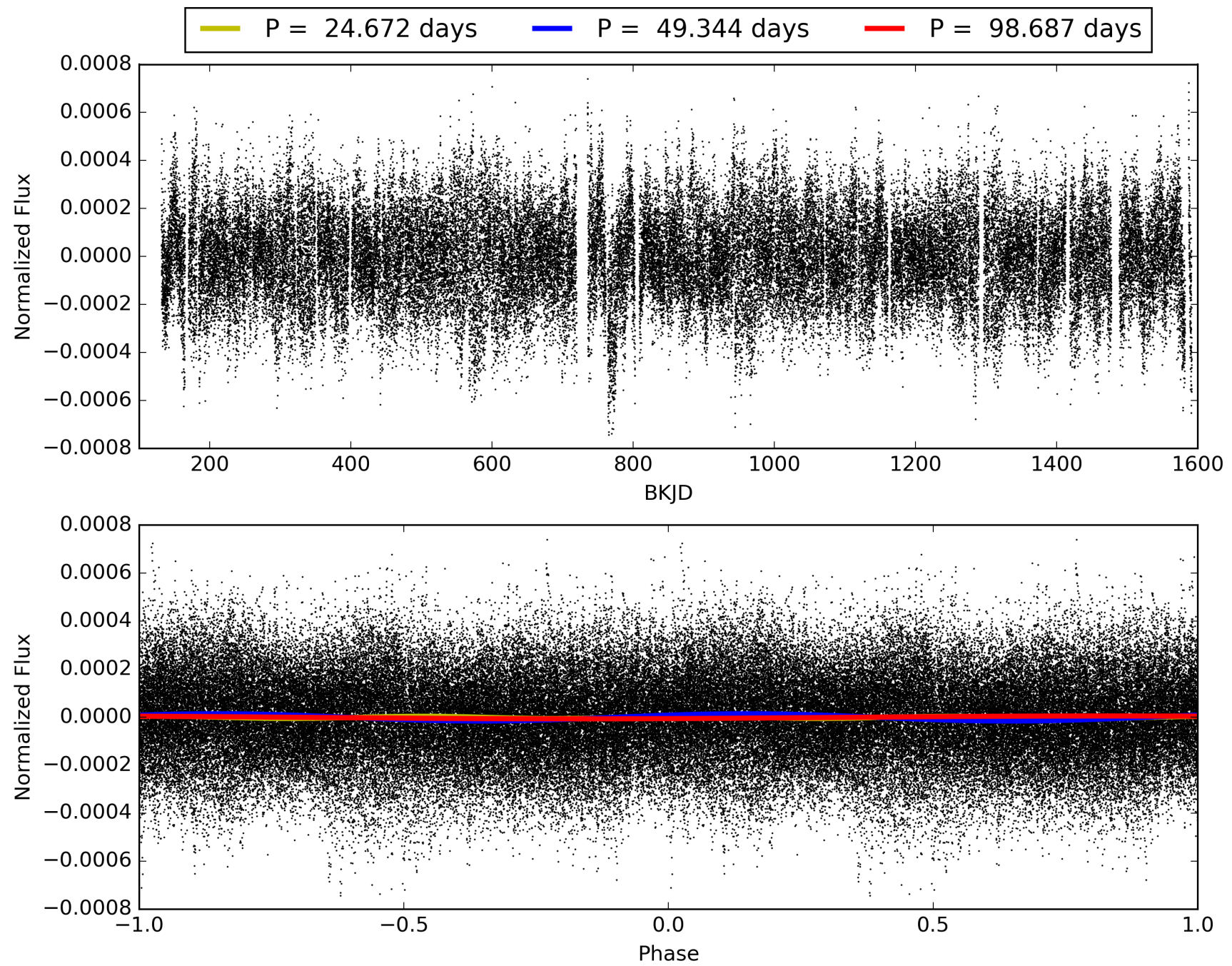
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 17:00:30 Z

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

# TCE 007221584-03, PDC Light Curves



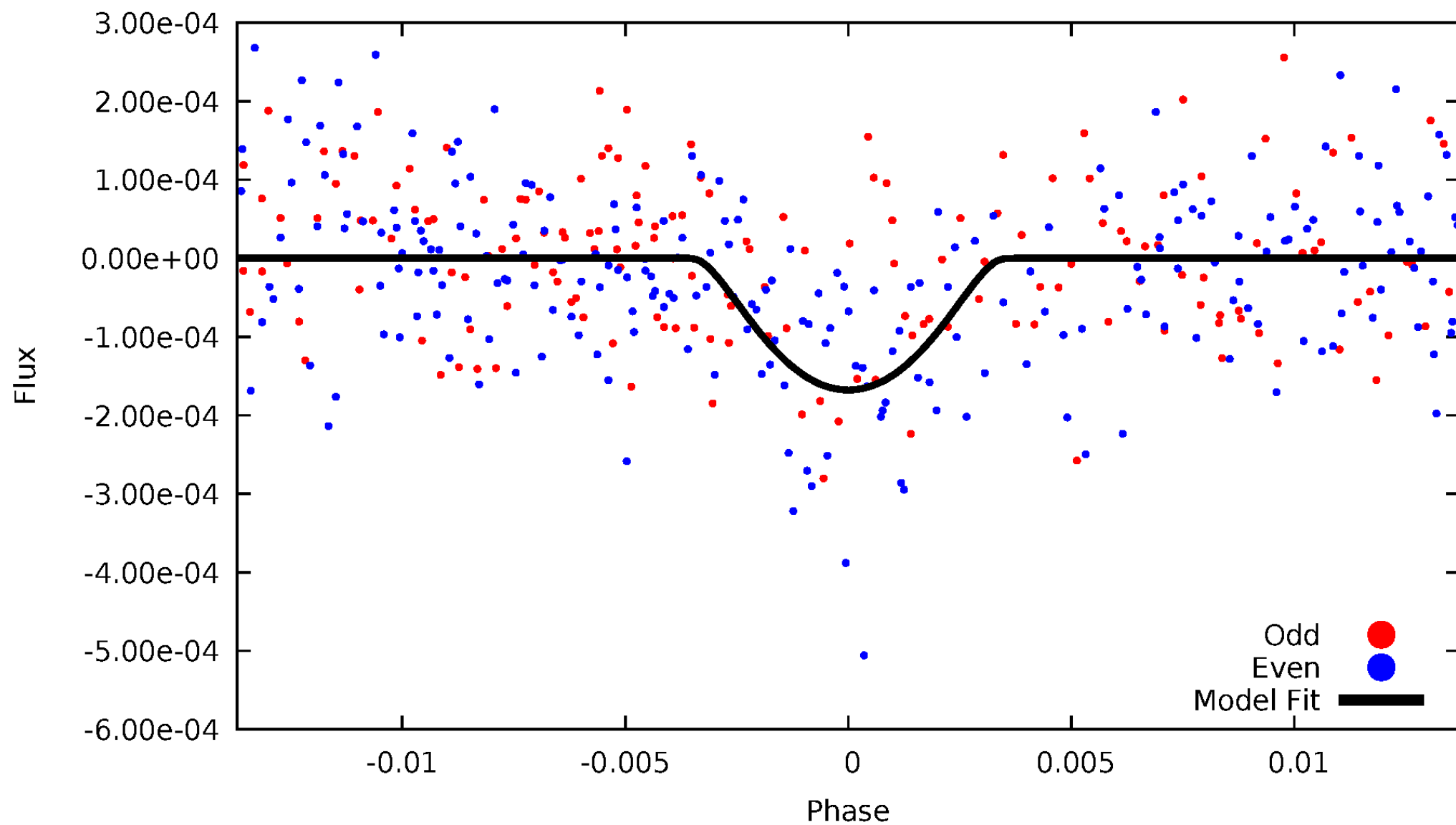
TCE 007221584-03





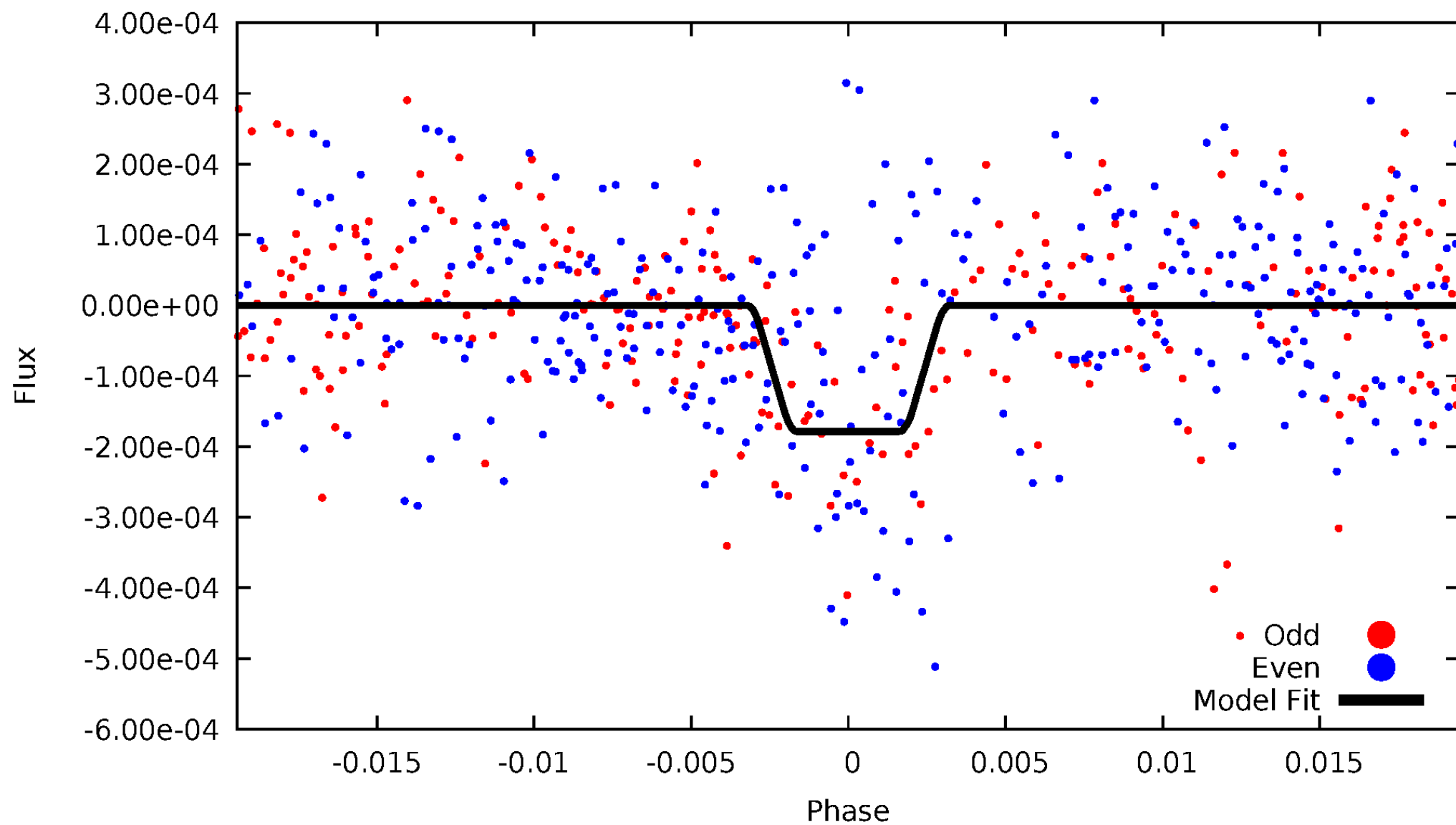
# DV Odd/Even

TCE 007221584-03

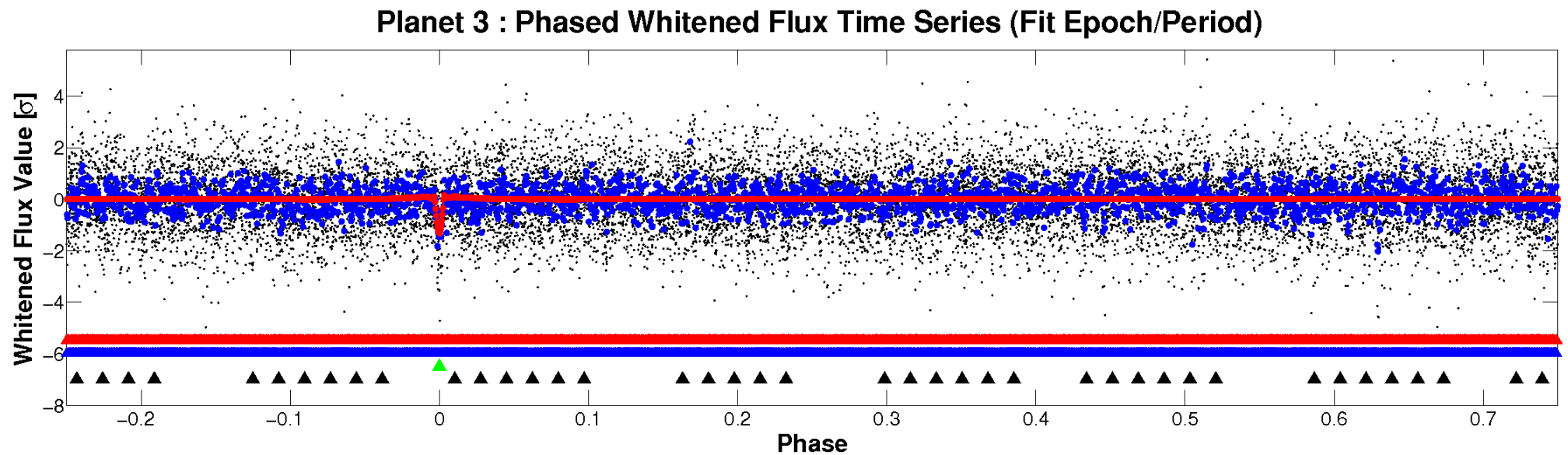
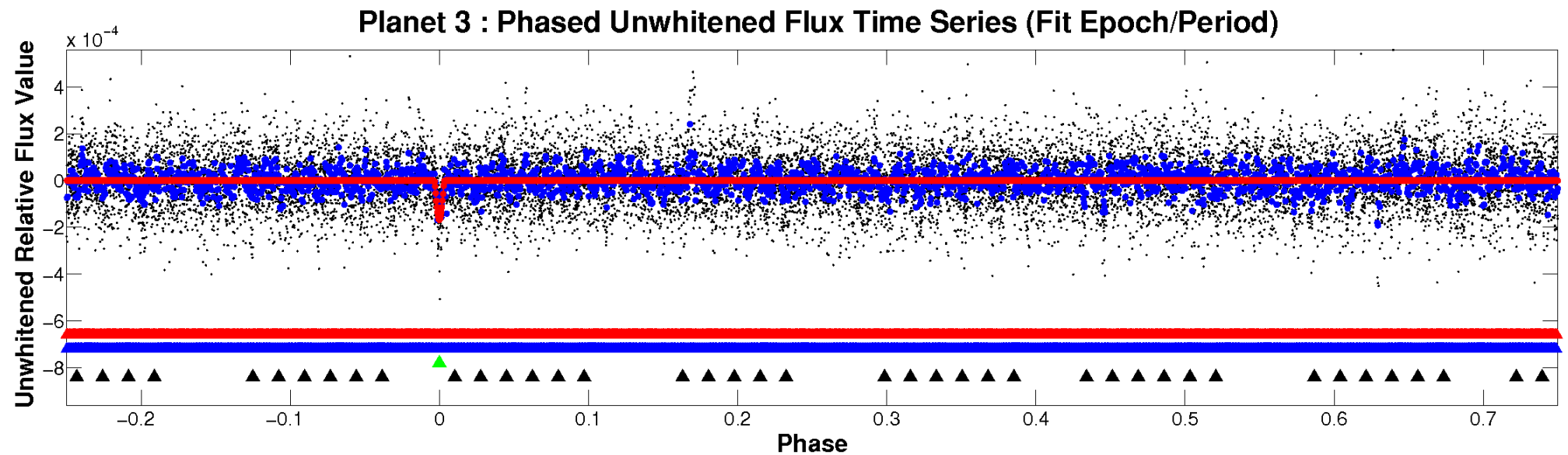


# ALT Odd/Even

TCE 007221584-03

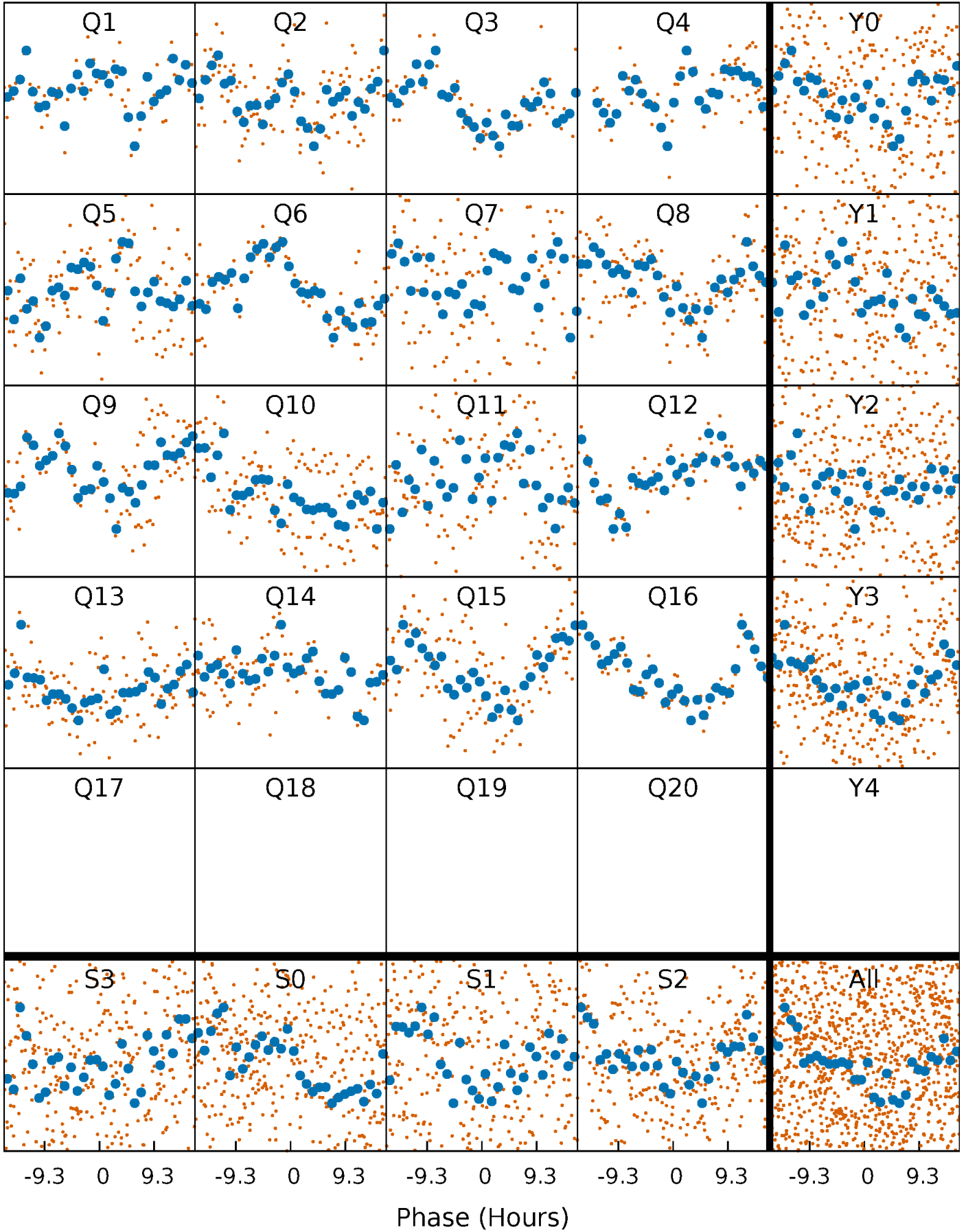


# Non-Whitened Vs. Whitened Light Curve



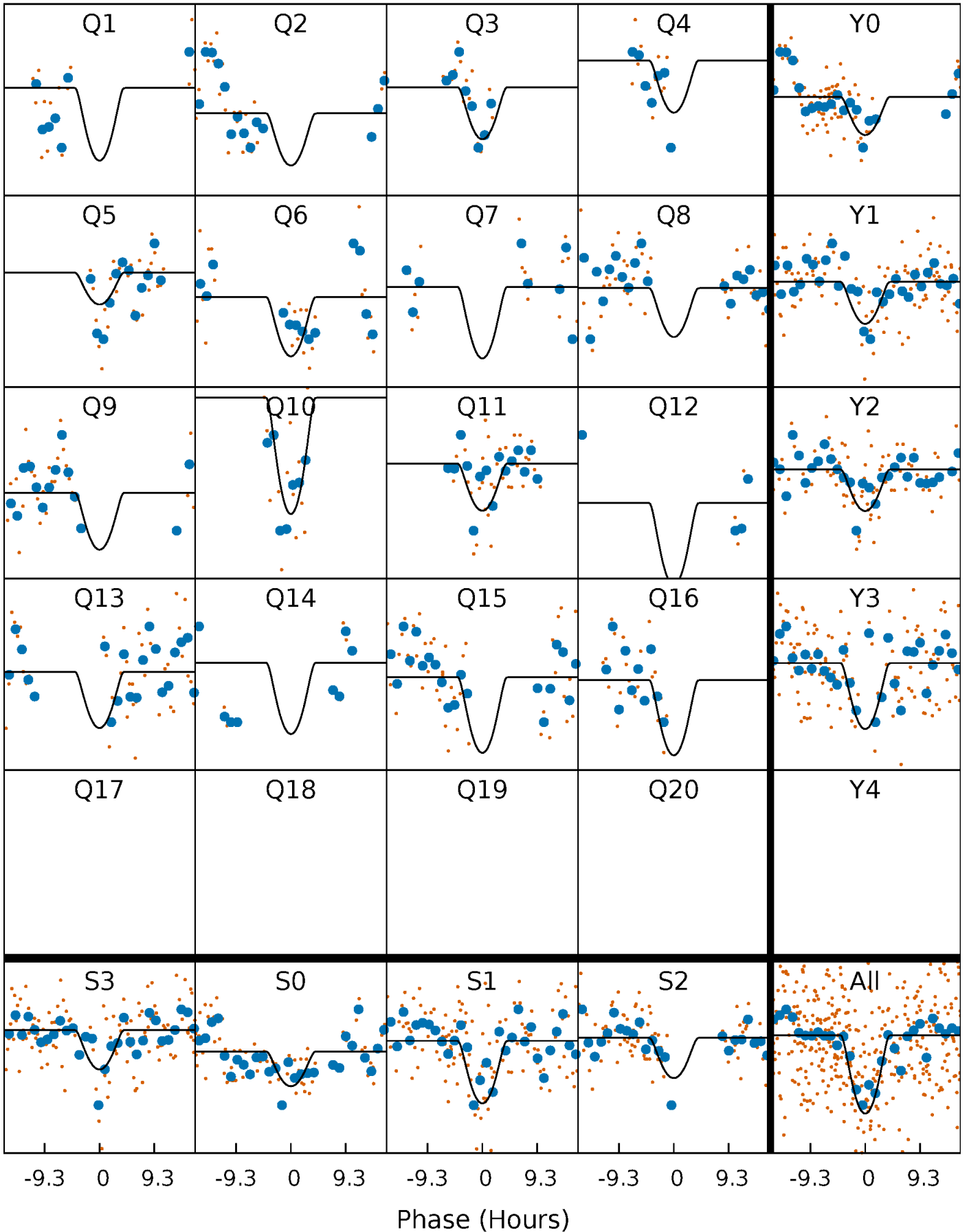
# PDC Quarter-Phased Transit Curves

TCE 007221584-03   P= 49.343695 Days    $T_0=154.664203$  (BKJD)



# DV Quarter-Phased Transit Curves

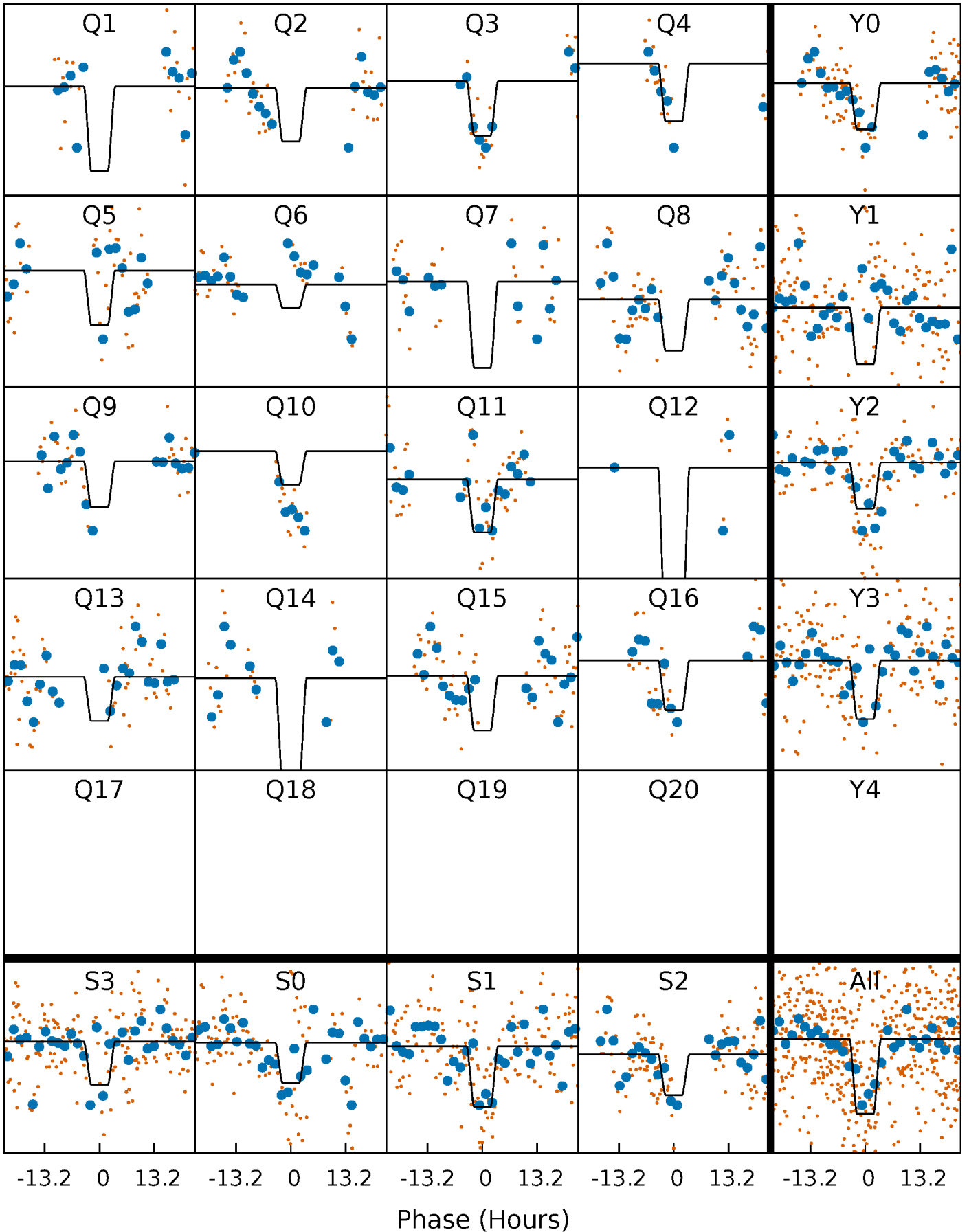
TCE 007221584-03     $P = 49.343695$  Days     $T_0 = 154.664203$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

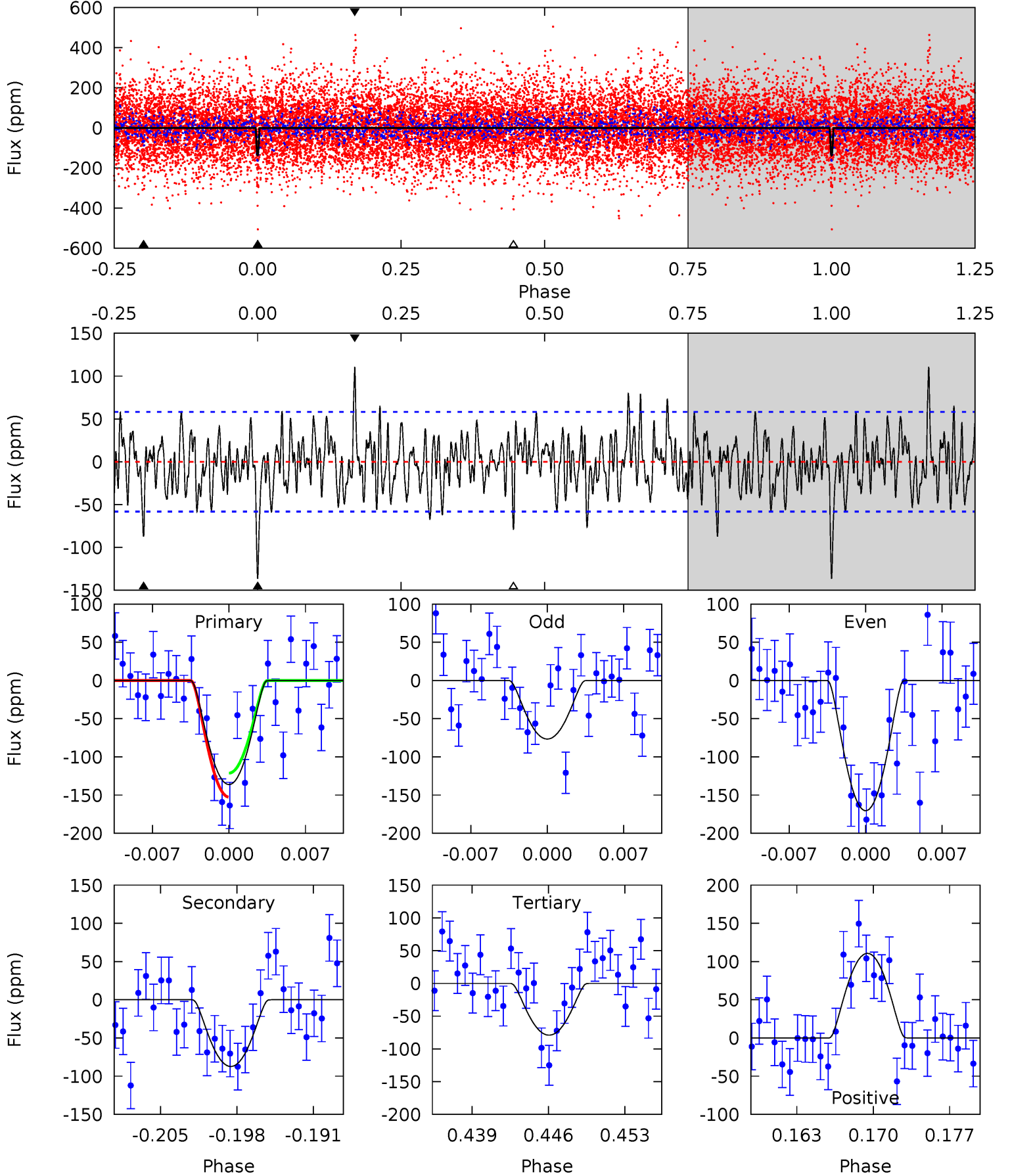
TCE 007221584-03 P= 49.342519 Days  $T_0=154.644006$  (BKJD)



# DV Model-Shift Uniqueness Test

007221584-03, P = 49.343695 Days, E = 105.320508 Days

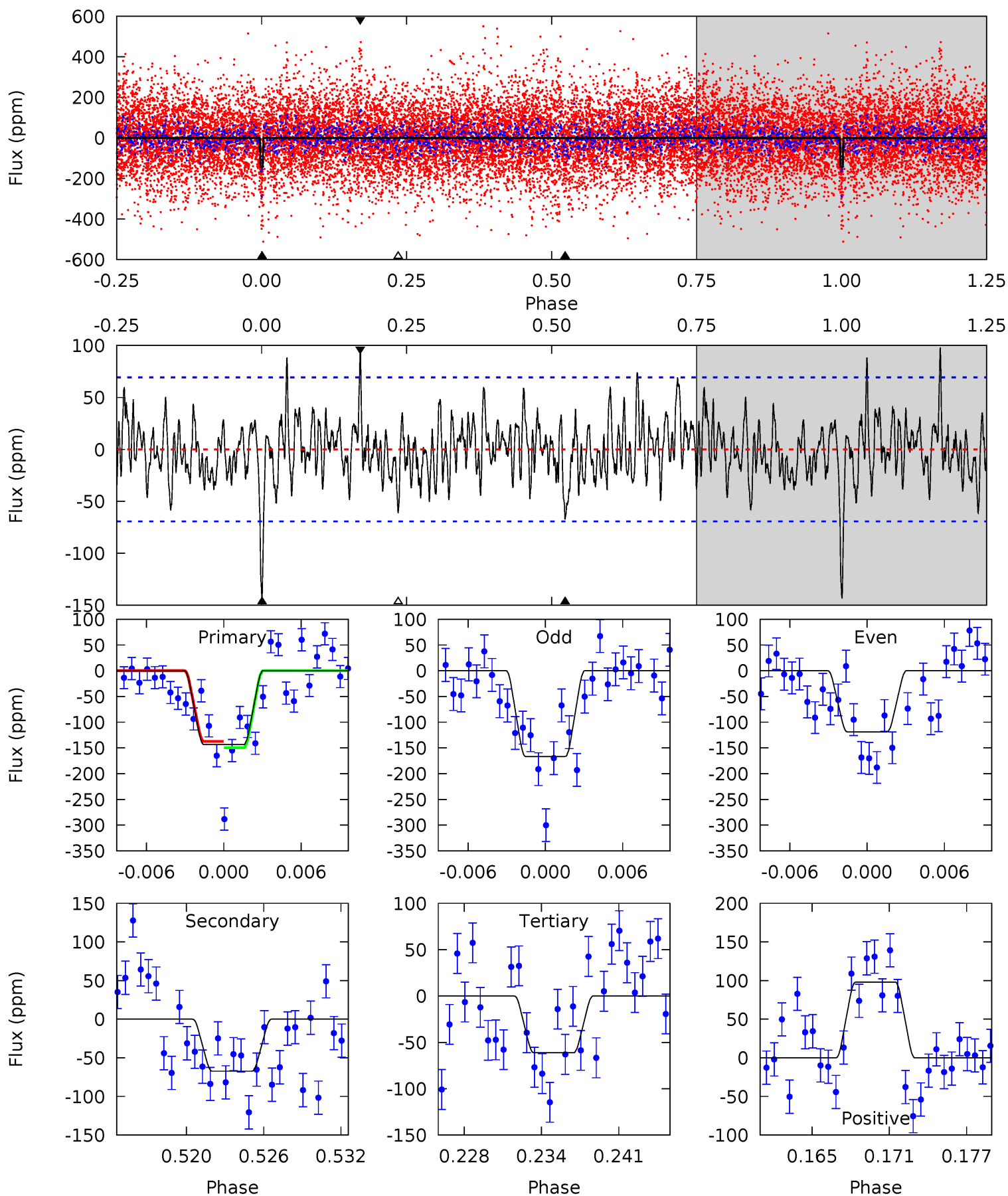
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
11.9	7.63	6.91	9.68	5.09	2.69	2.30	5.00	2.23	0.72	-2.05	4.05	1.19	0.45	1.37



# Alt Model-Shift Uniqueness Test

007221584-03, P = 49.342519 Days, E = 105.301487 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
10.6	4.97	4.51	7.23	5.11	2.73	1.74	6.07	3.35	0.45	-2.26	1.73	1.04	0.41	0.45



### Stellar Parameters For KIC 007221584

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6565^{+177}_{-197}$	$3.648^{+0.340}_{-0.060}$	$-0.140^{+0.300}_{-0.250}$	$3.143^{+0.404}_{-1.211}$	$1.601^{+0.215}_{-0.350}$	$0.073^{+0.171}_{-0.019}$
	+3%/-3%	+9%/-2%	+214%/-179%	+13%/-39%	+13%/-22%	+235%/-26%
Source	PHO1	FLK73	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 007221584-03 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-87 \pm 11$	$8.88^{+9.74}_{-6.07}$	$1247^{+70}_{-121}$	$4025^{+2607}_{-842}$	$57^{+538}_{-43}$
Alt.	$-67 \pm 14$	$8.82^{+9.46}_{-6.00}$	$1260^{+70}_{-113}$	$3882^{+2349}_{-789}$	$45^{+397}_{-35}$

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

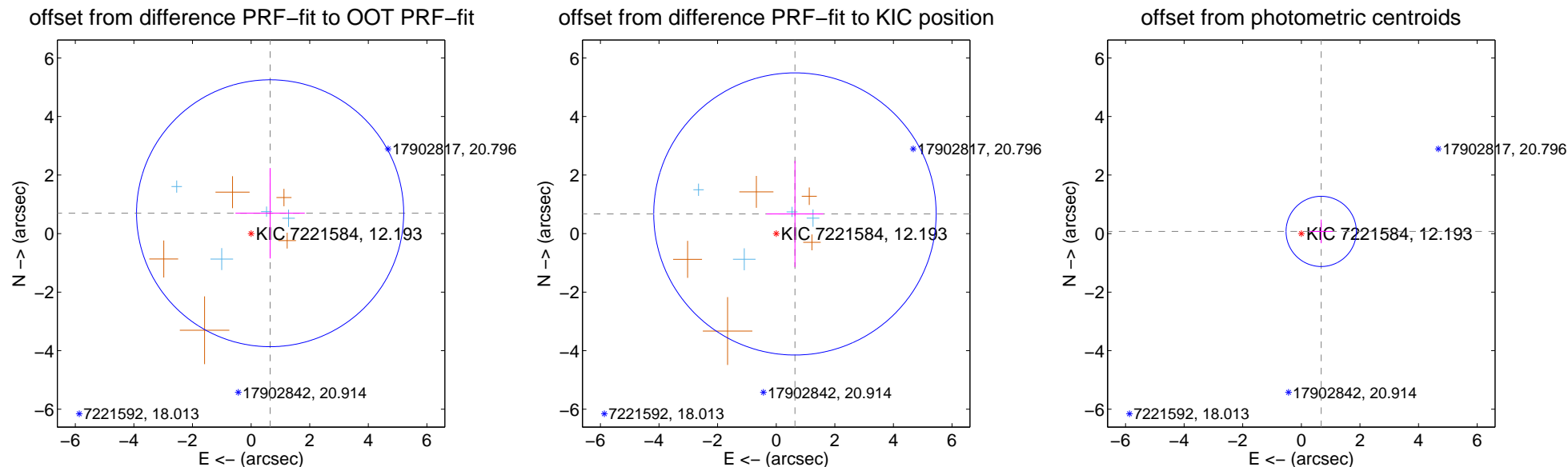
## DV Centroid Data

Supplemental centroid analysis for 007221584-03. Kepler magnitude: 12.19. Transit SNR 8.73

There are 4 quarters with good PRF difference image offsets

The direct PRF centroid is offset from the target star catalog position by about 0.09 arcsec

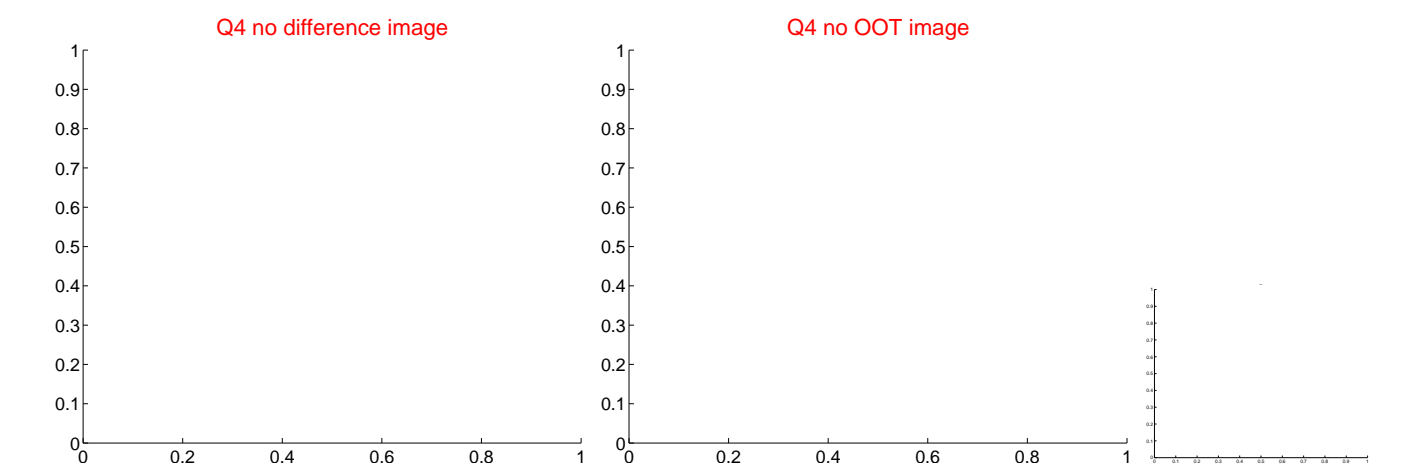
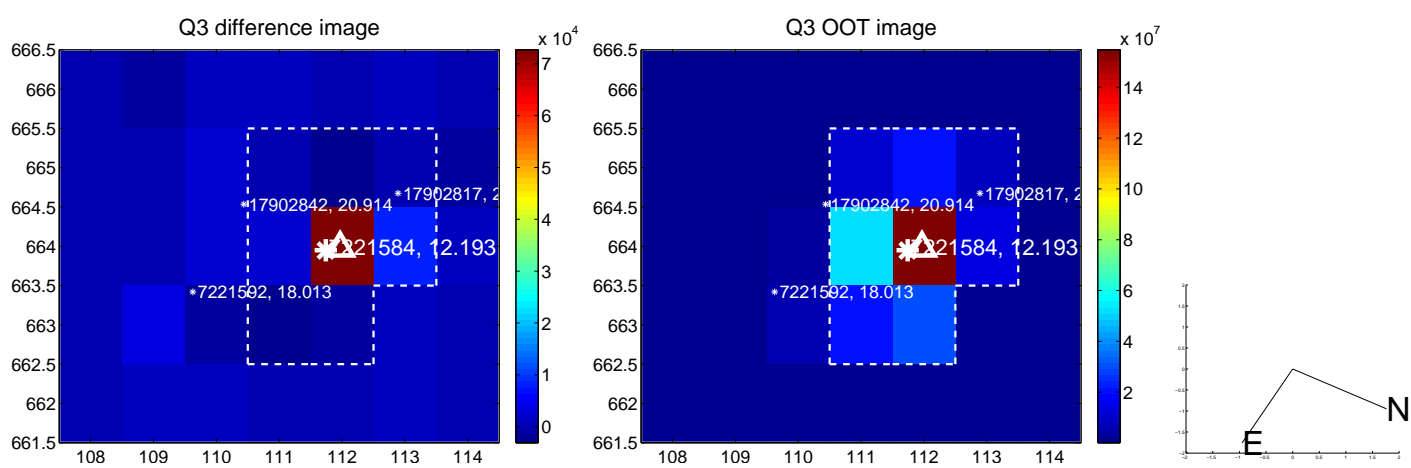
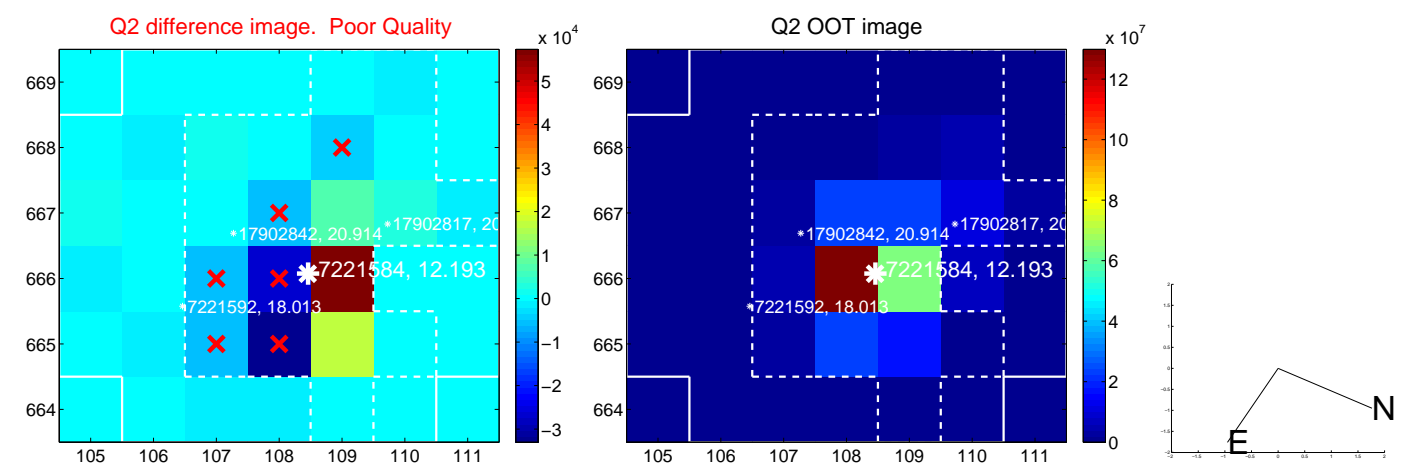
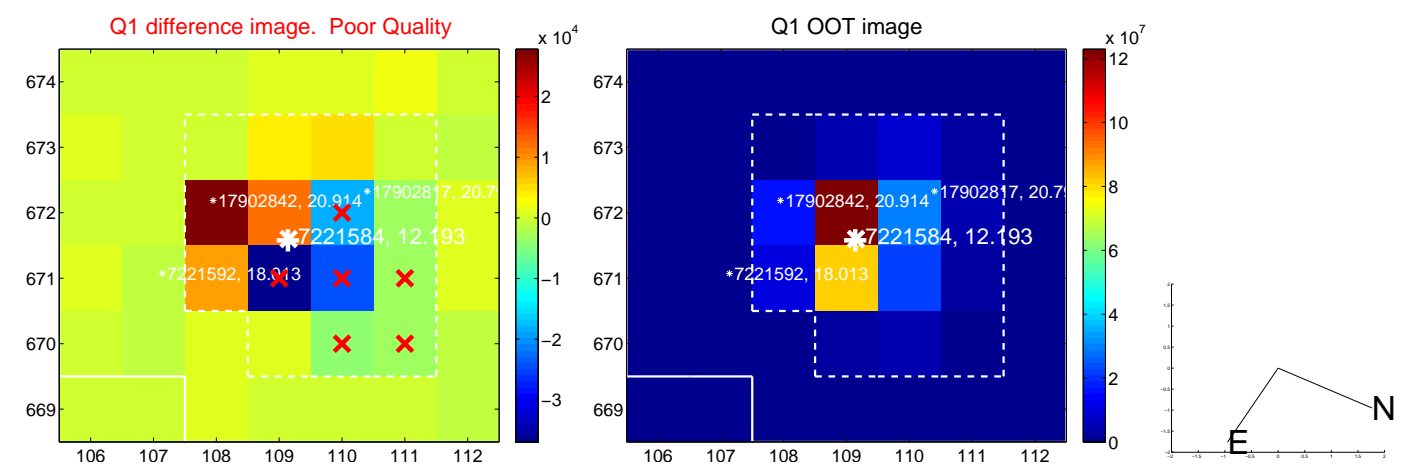
	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.951 \pm 1.520$	0.63	$-0.649 \pm 1.182$	$0.695 \pm 1.545$
PRF-fit source offset from KIC position	$0.927 \pm 1.607$	0.58	$-0.639 \pm 0.972$	$0.671 \pm 1.815$
photometric centroid source offset	$0.68 \pm 0.40$	1.70	$-0.68 \pm 0.40$	$0.07 \pm 0.40$



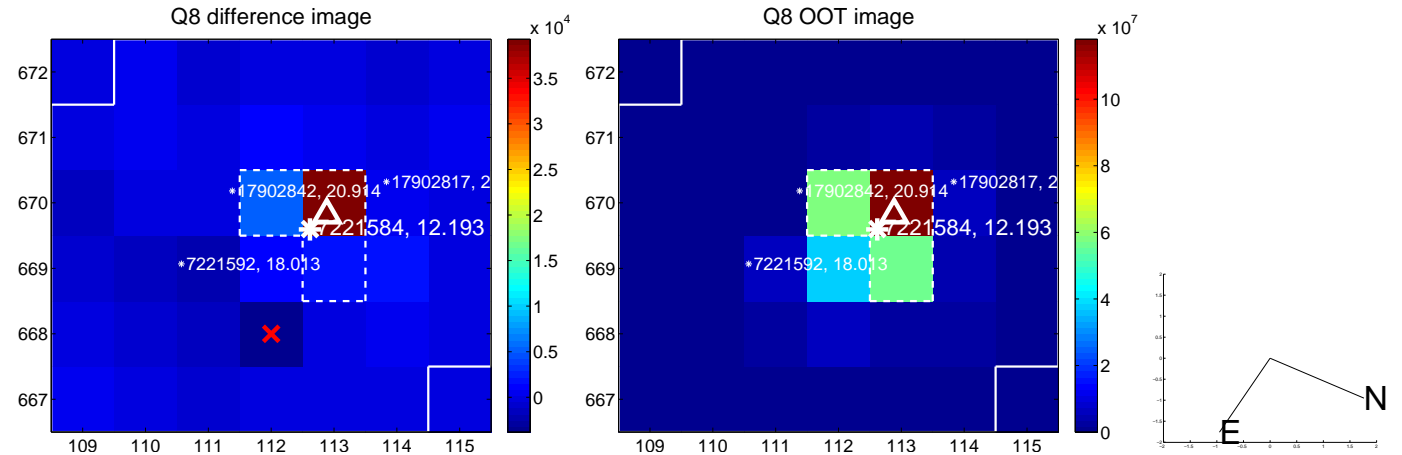
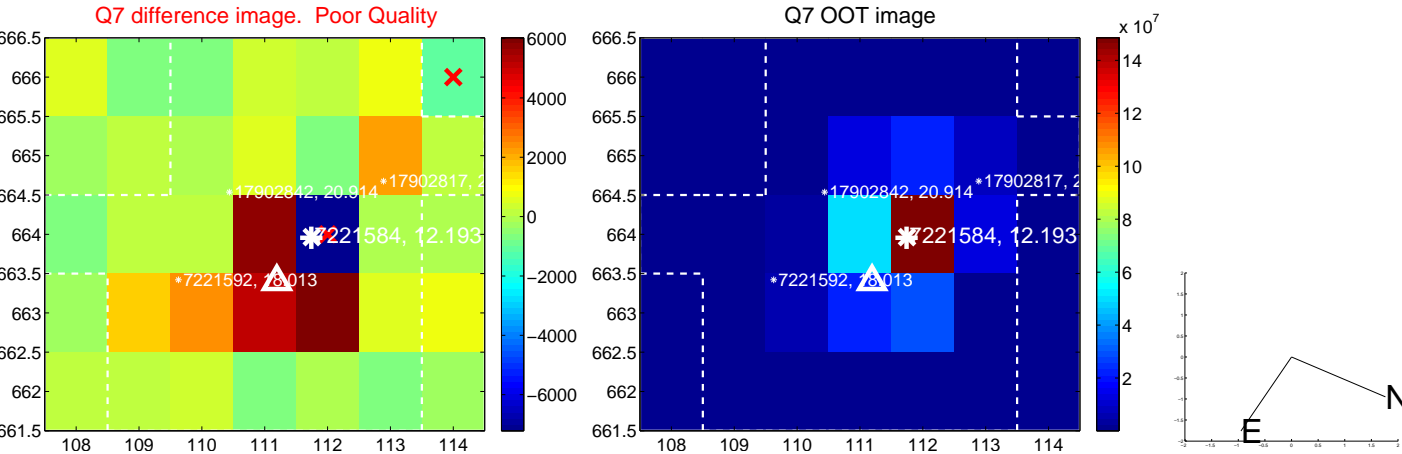
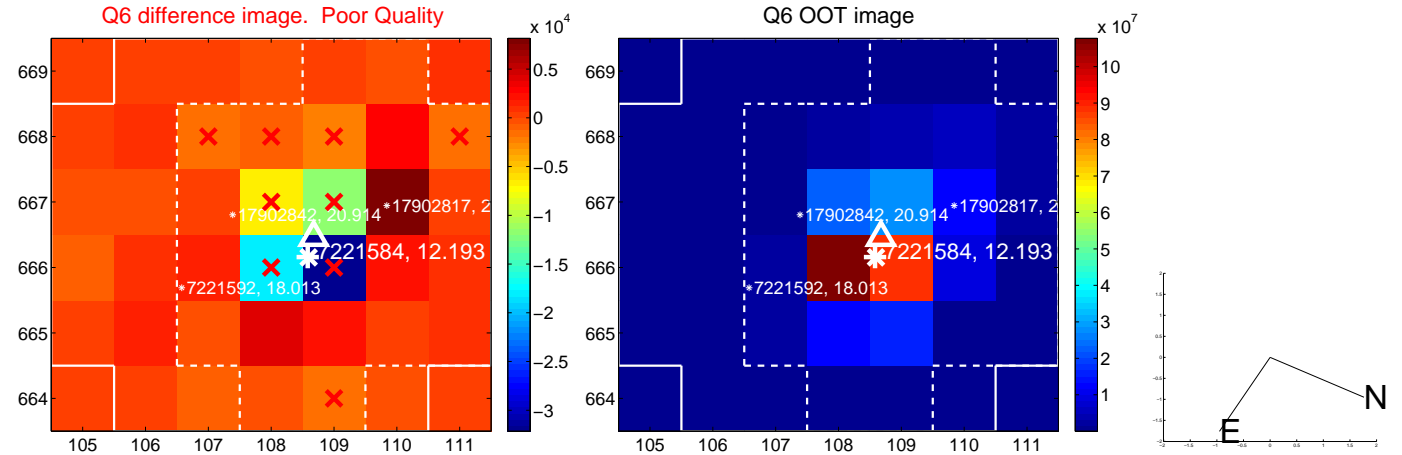
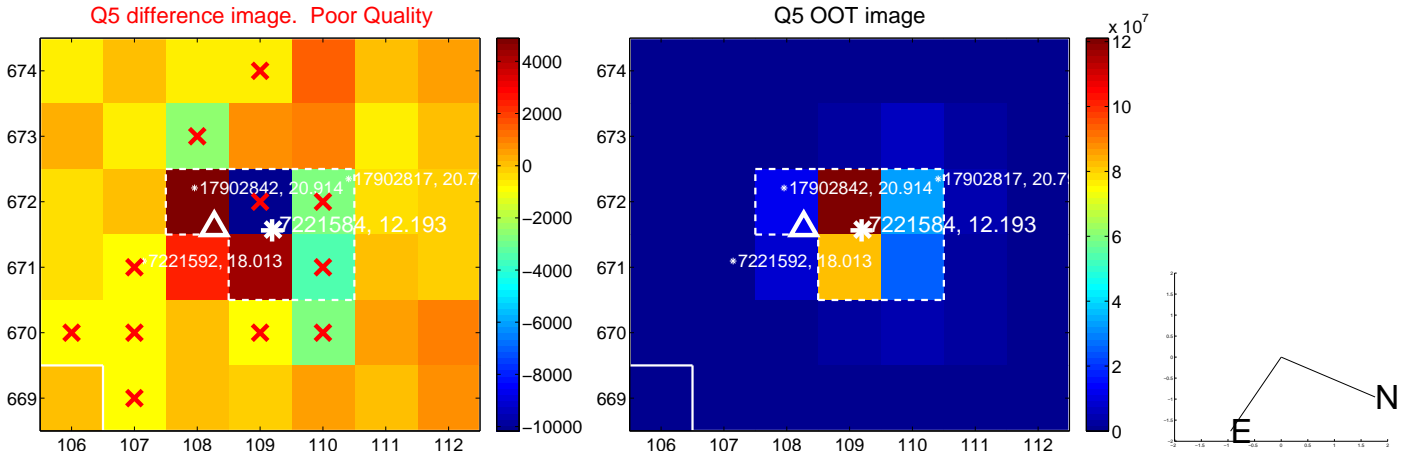
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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



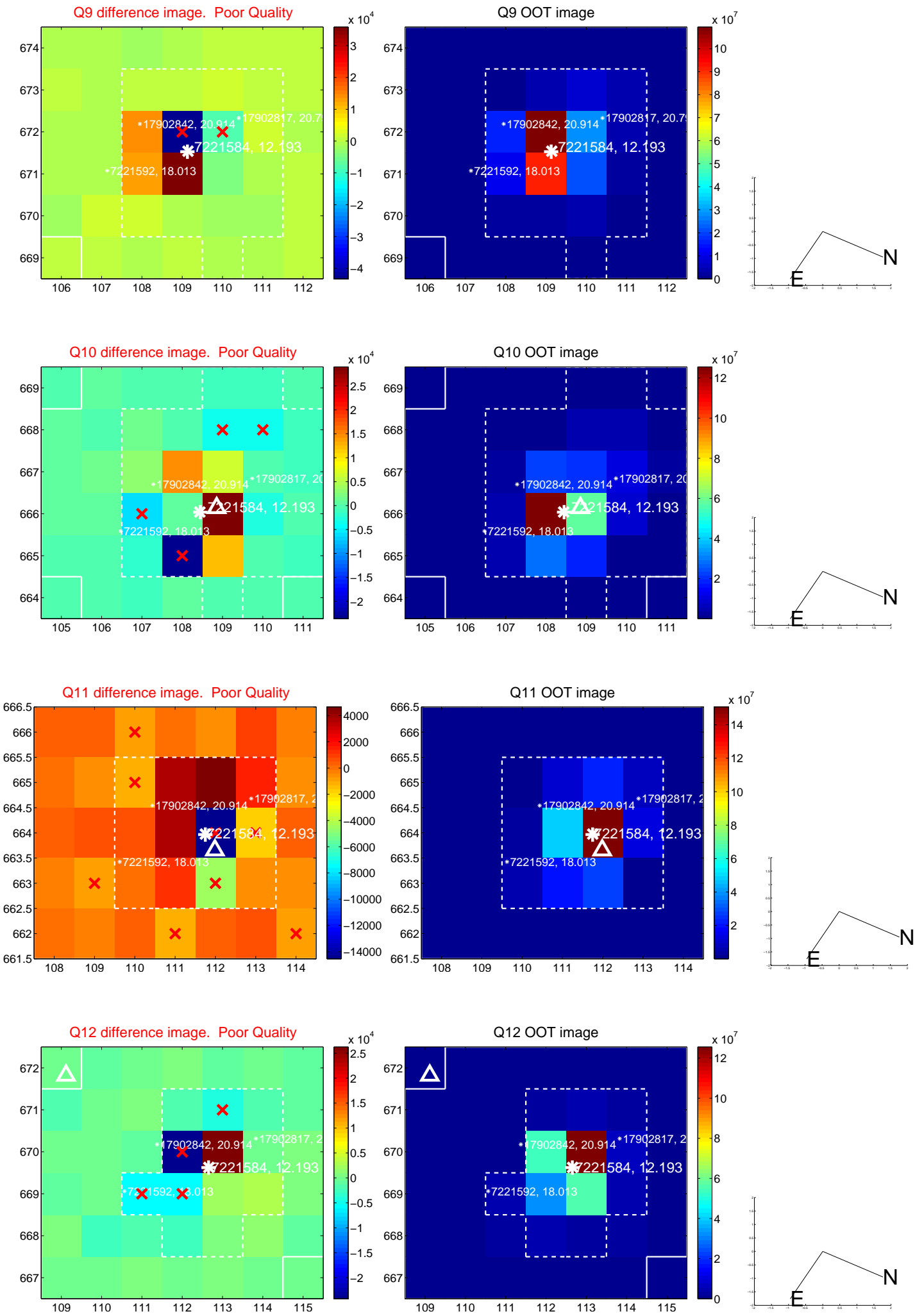
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



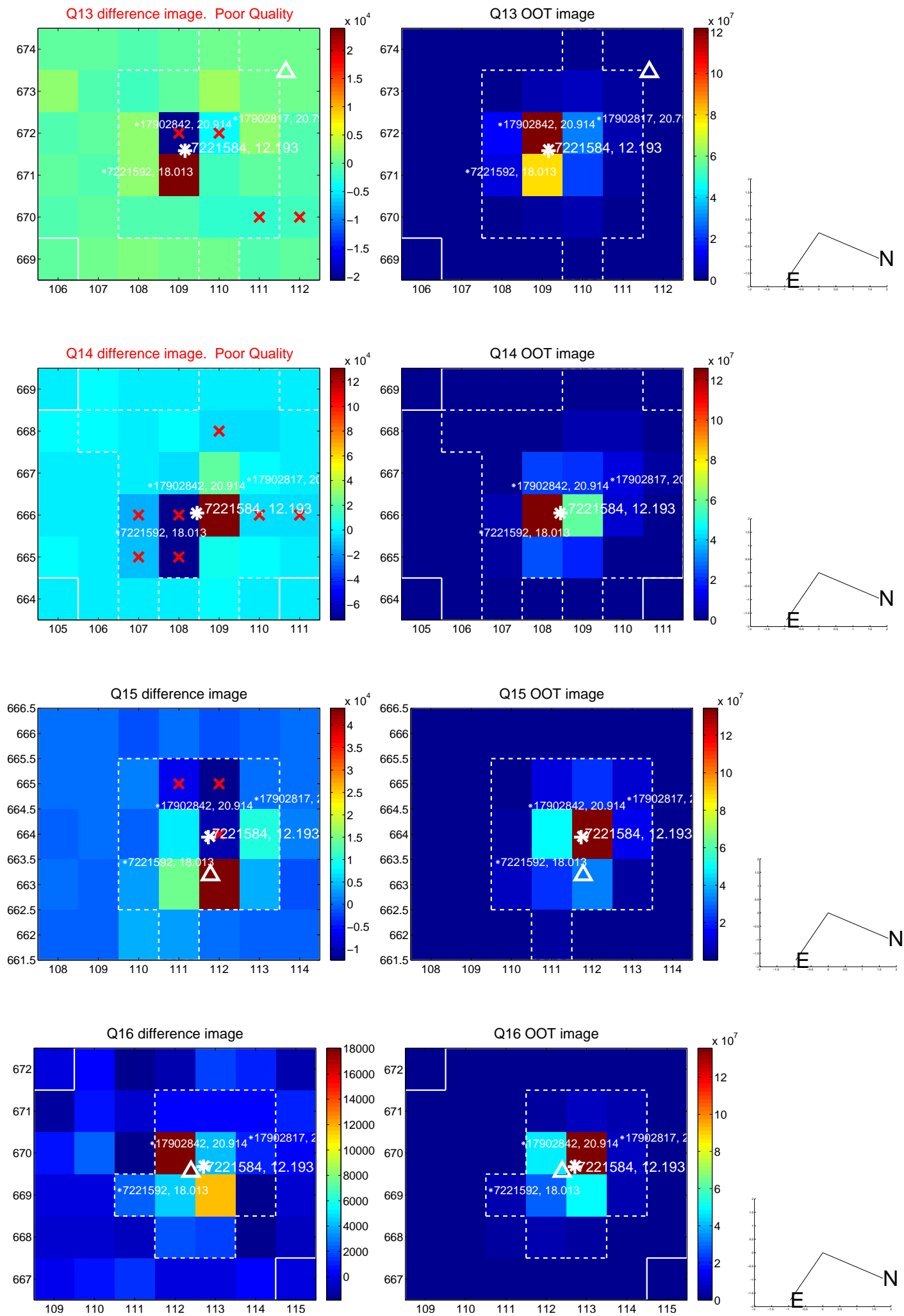
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



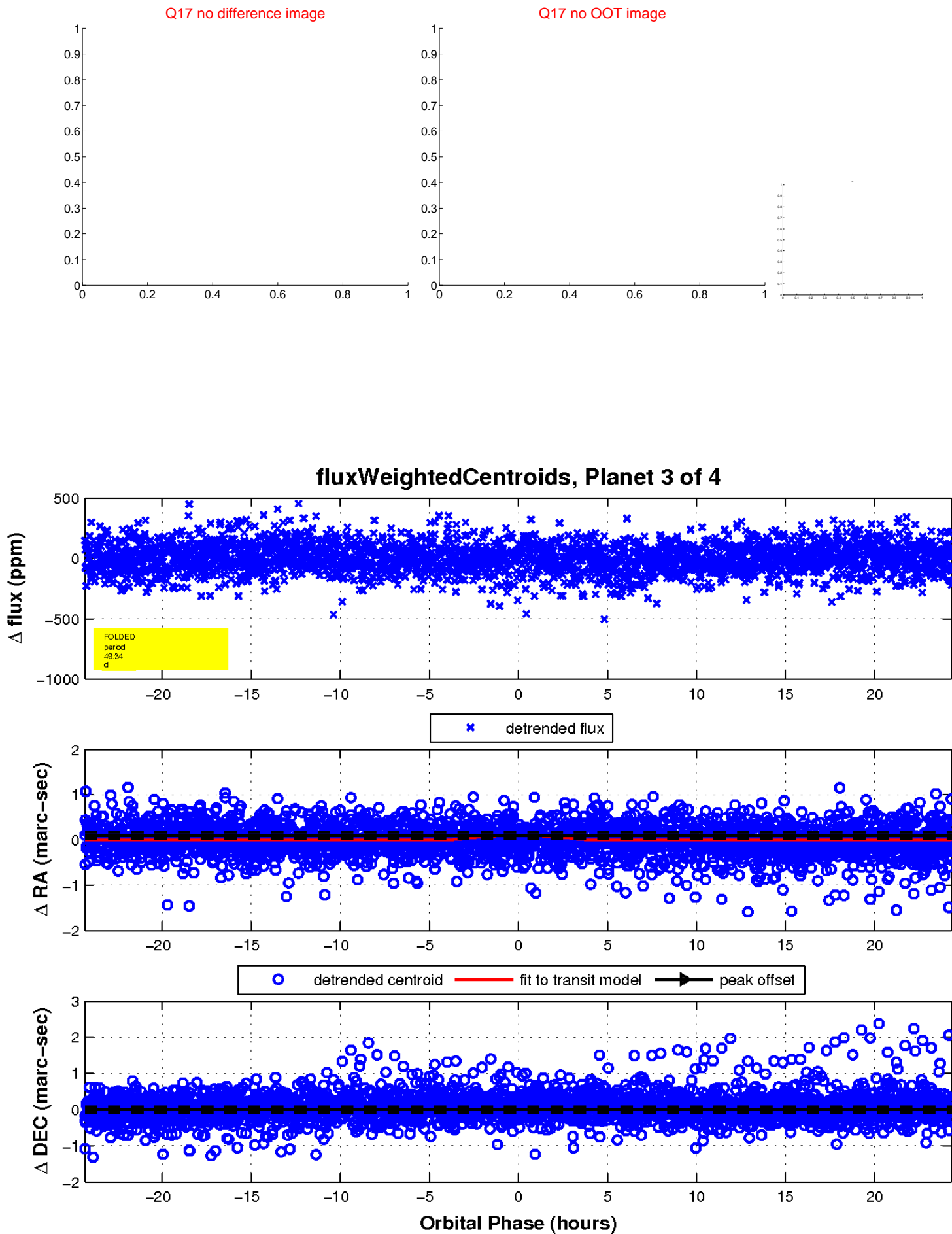
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



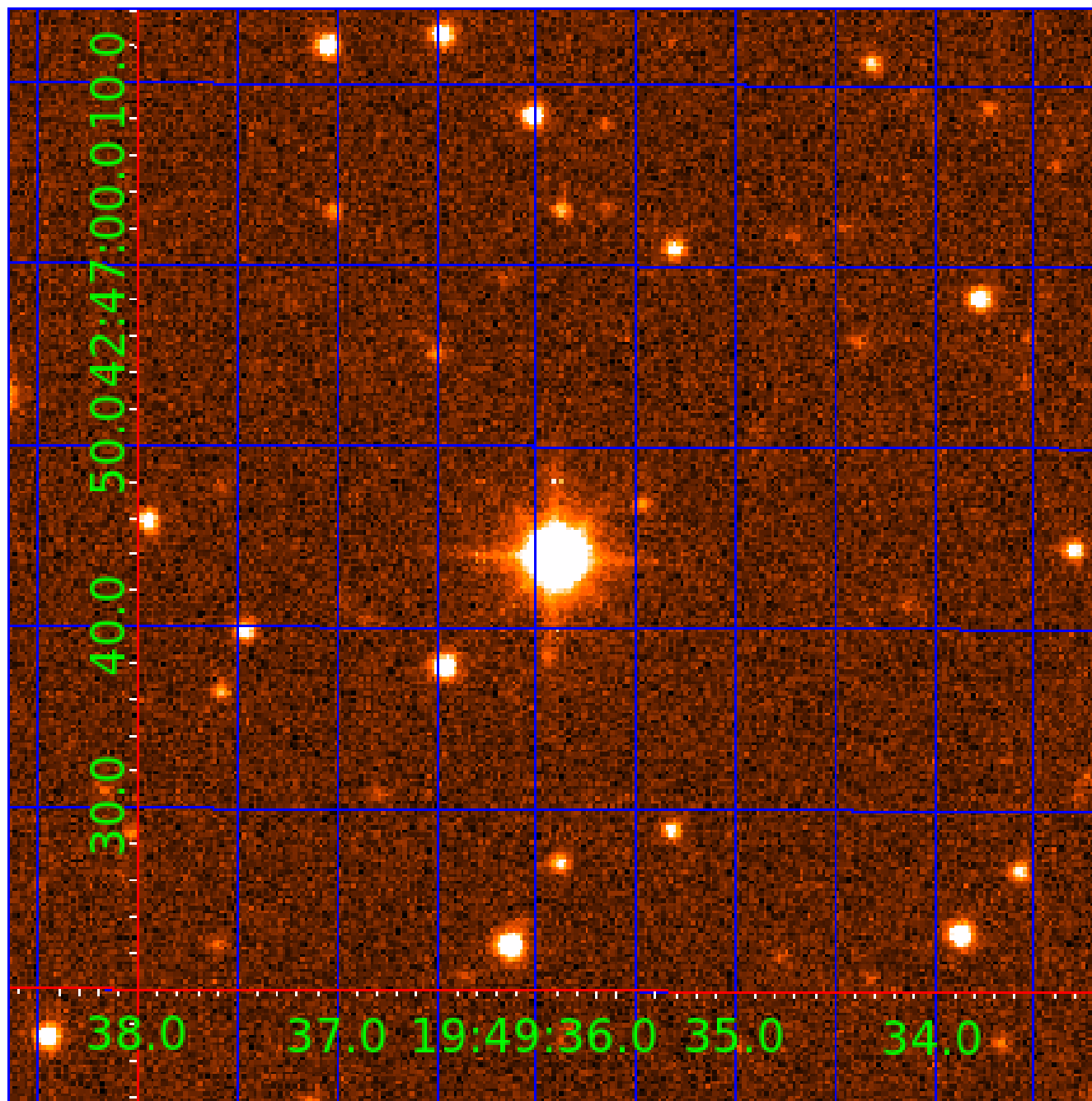
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





UKIRT Image

Declination



# KIC 007221584

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
007221584-01	OBS	No	1.106129	131.768362	17.4	4.630	11.8	9.3	3.14	6565	1.53	27393.97
007221584-02	OBS	No	1.177106	132.387392	27.5	4.481	9.9	10.1	3.14	6565	2.25	25214.03
007221584-03	OBS	No	49.343695	154.664203	167.9	8.114	8.5	8.7	3.14	6565	6.76	173.15
007221584-04	OBS	No	35.123241	152.772176	127.8	4.888	8.1	7.4	3.14	6565	4.04	272.44

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
007221584-01	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_ALT
007221584-02	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_DV
007221584-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT
007221584-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT

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

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

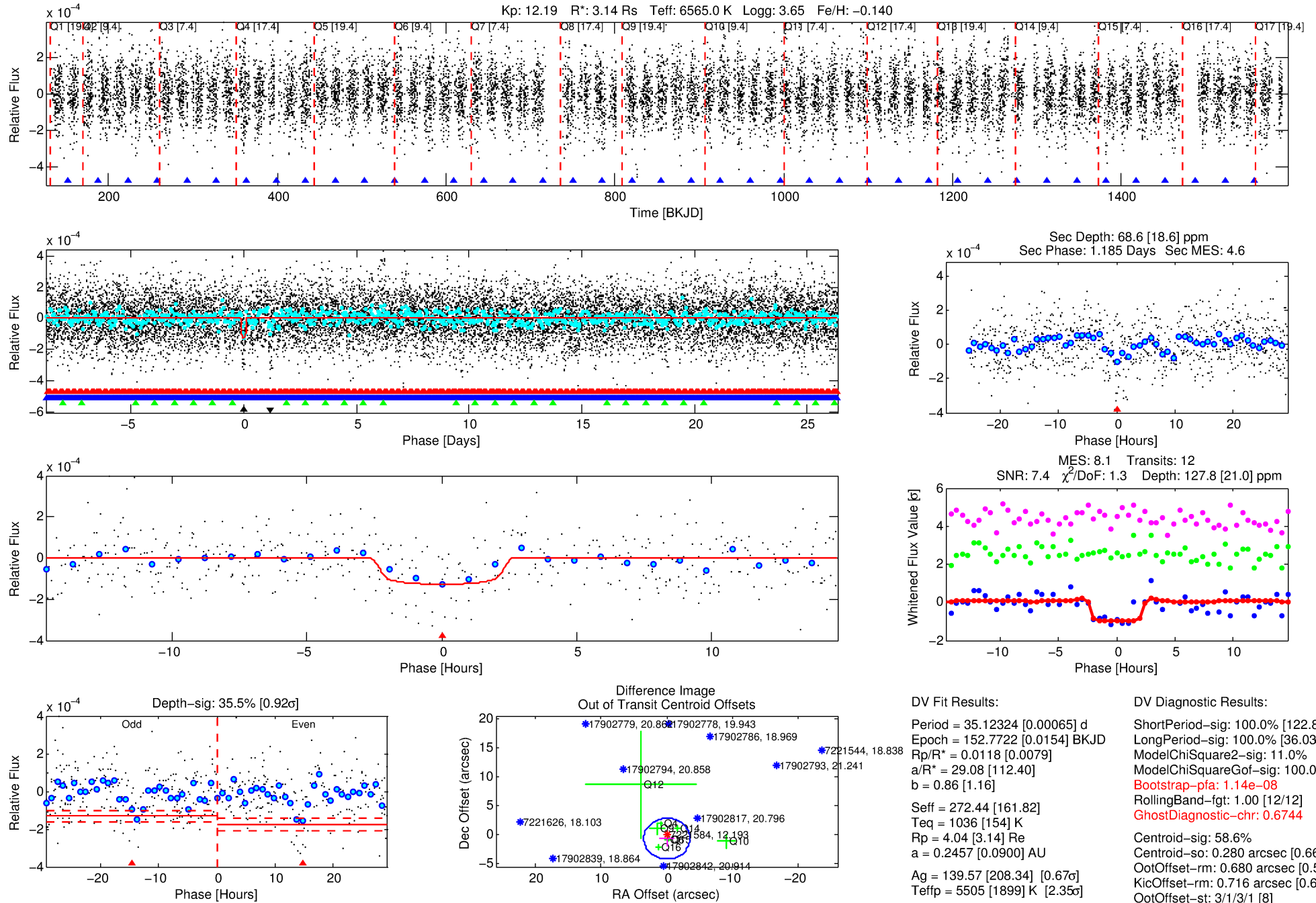
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 007221584-04

No Significant Match Found

# DV One-Page Summary

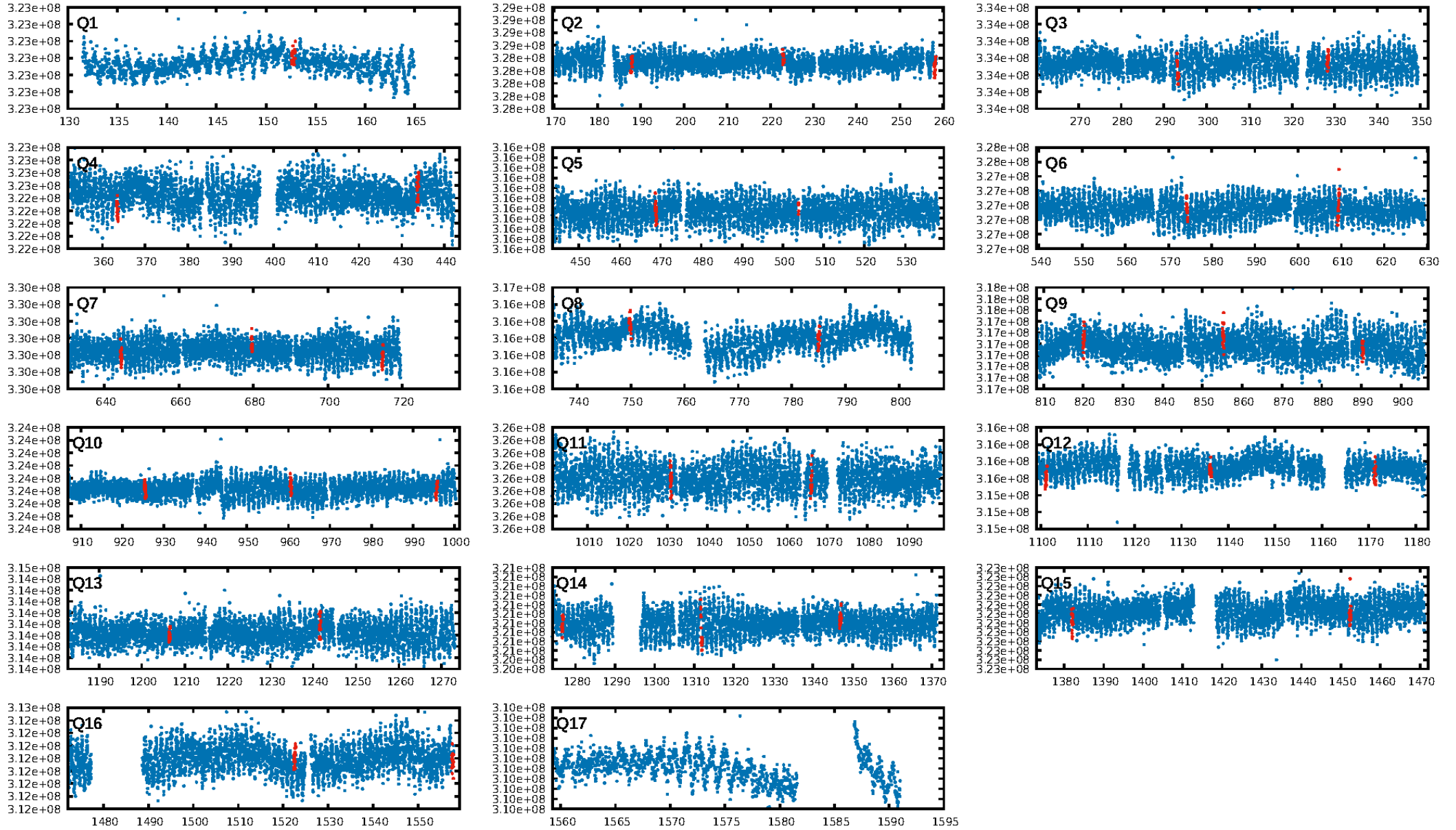
KIC: 7221584 Candidate: 4 of 4 Period: 35.123 d



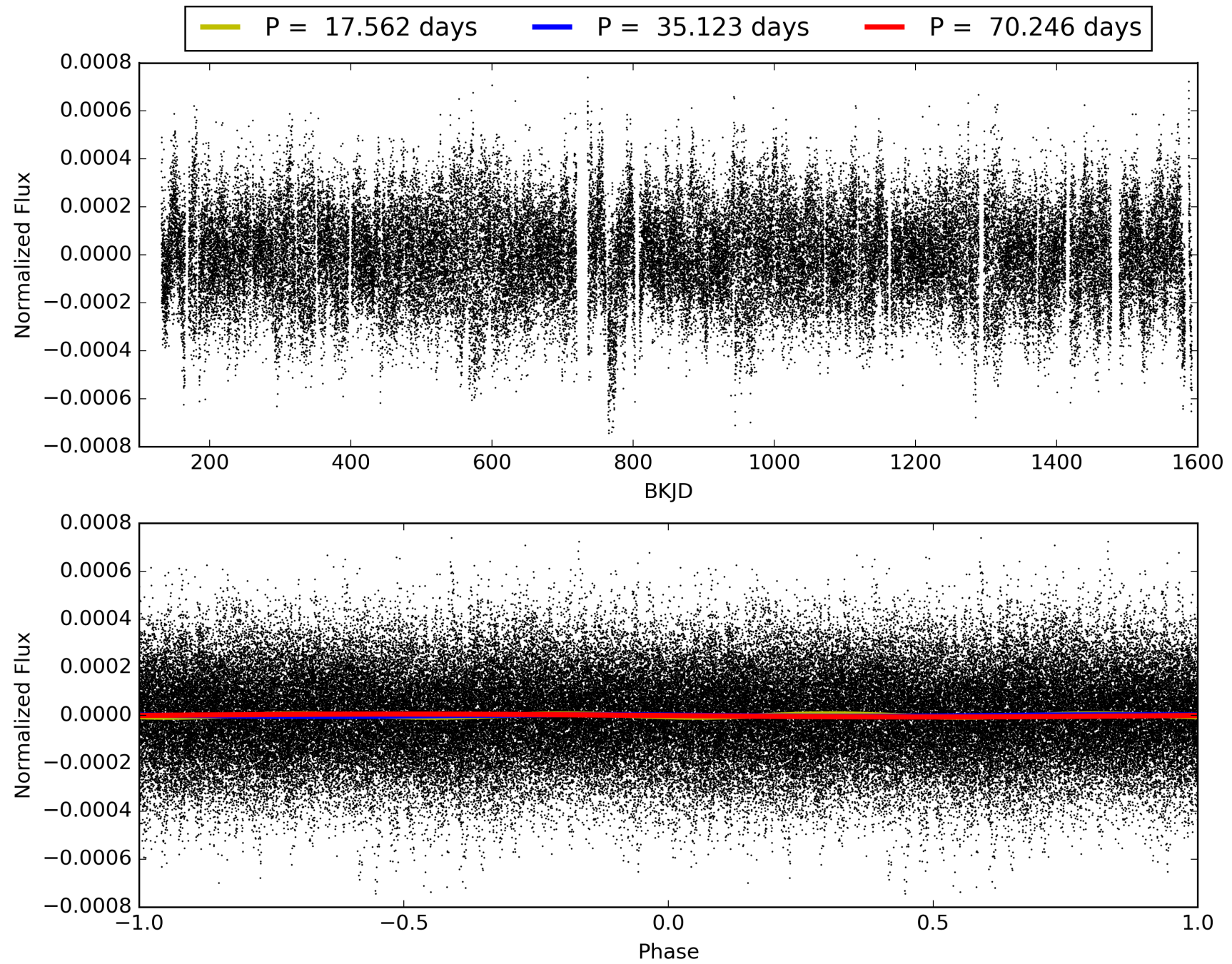
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 17:00:34 Z

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

# TCE 007221584-04, PDC Light Curves



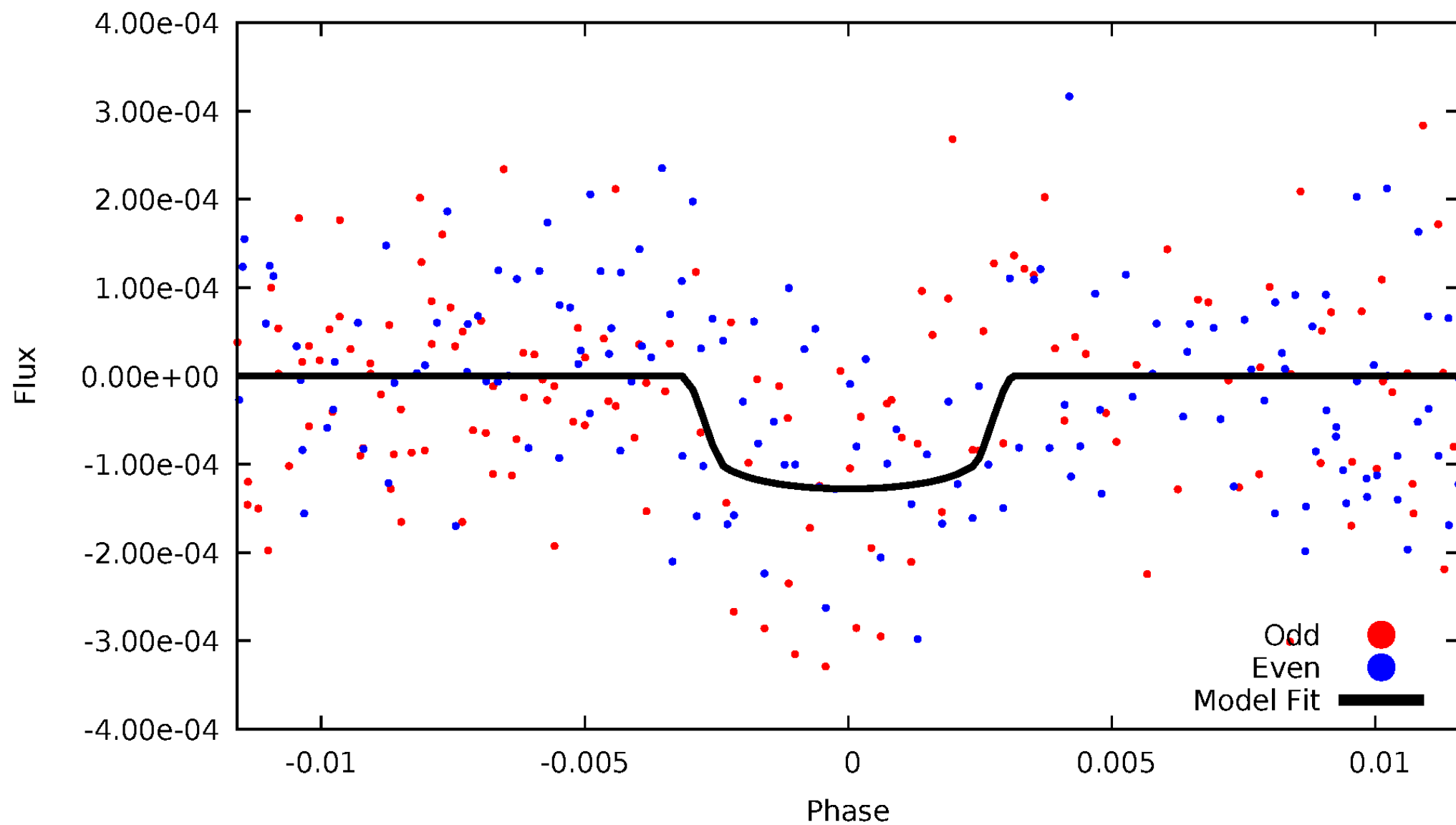
TCE 007221584-04





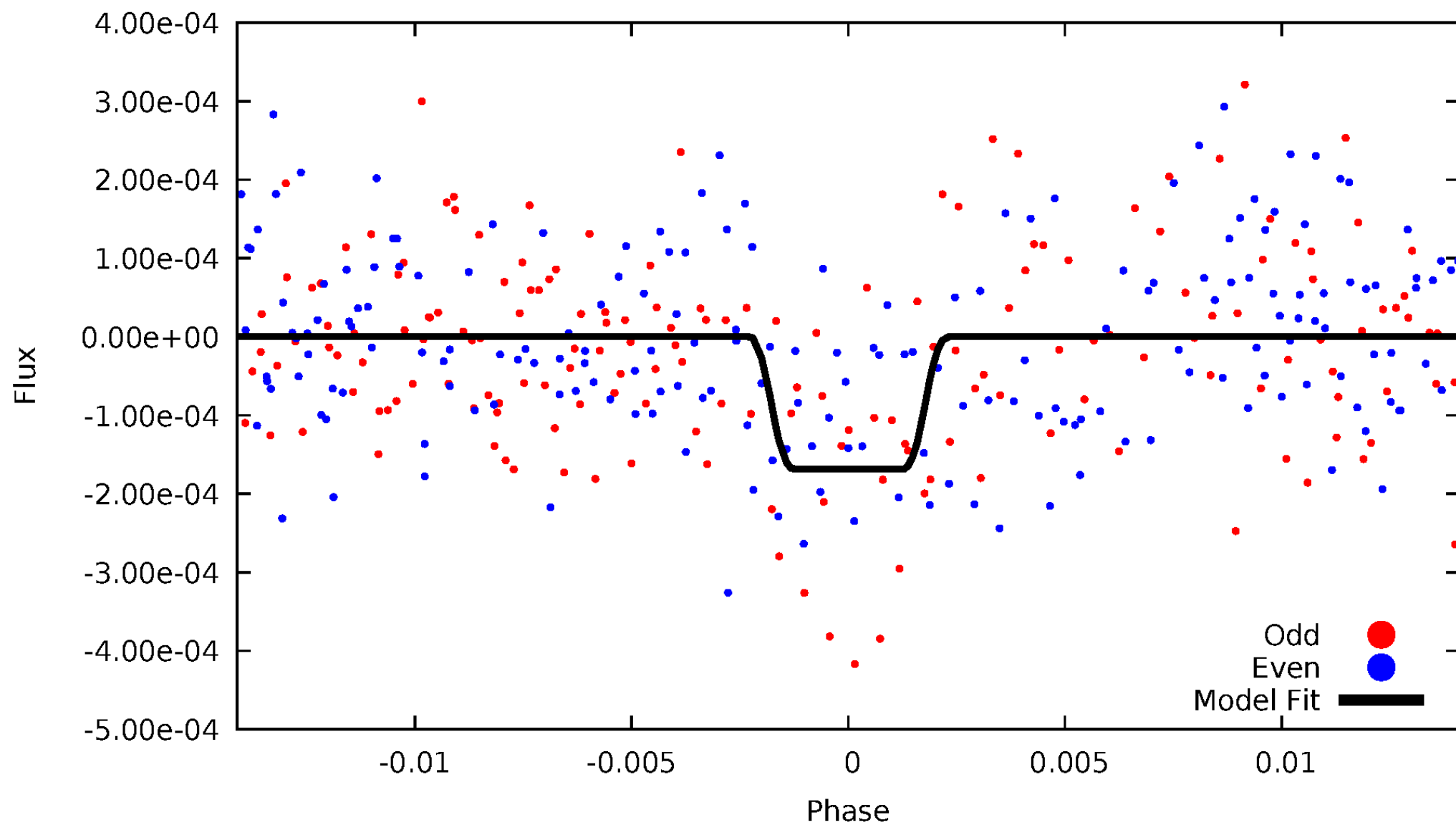
# DV Odd/Even

TCE 007221584-04



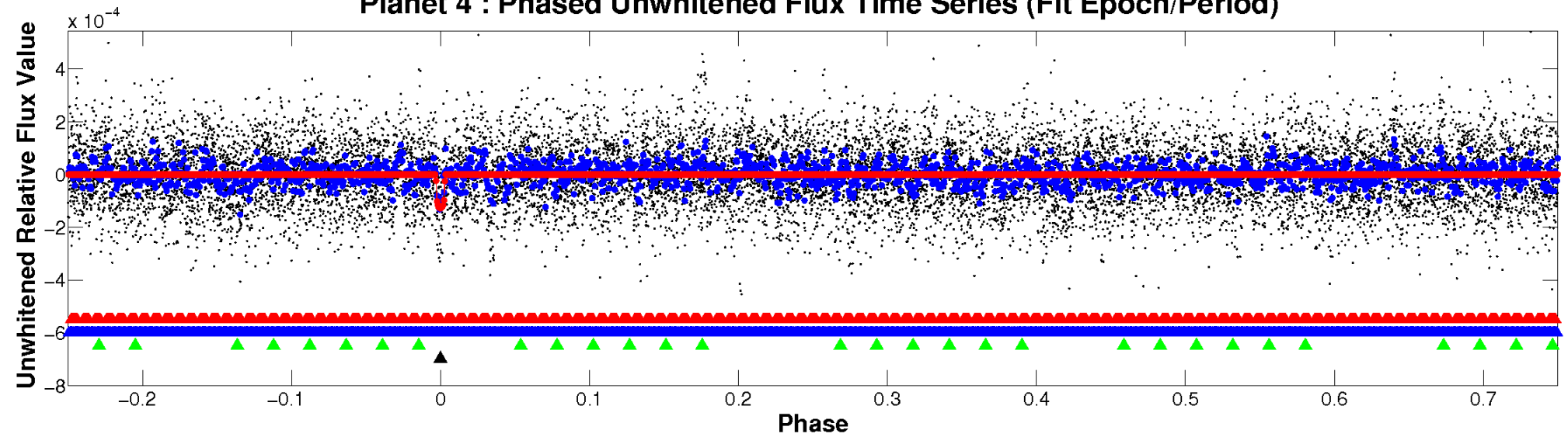
# ALT Odd/Even

TCE 007221584-04

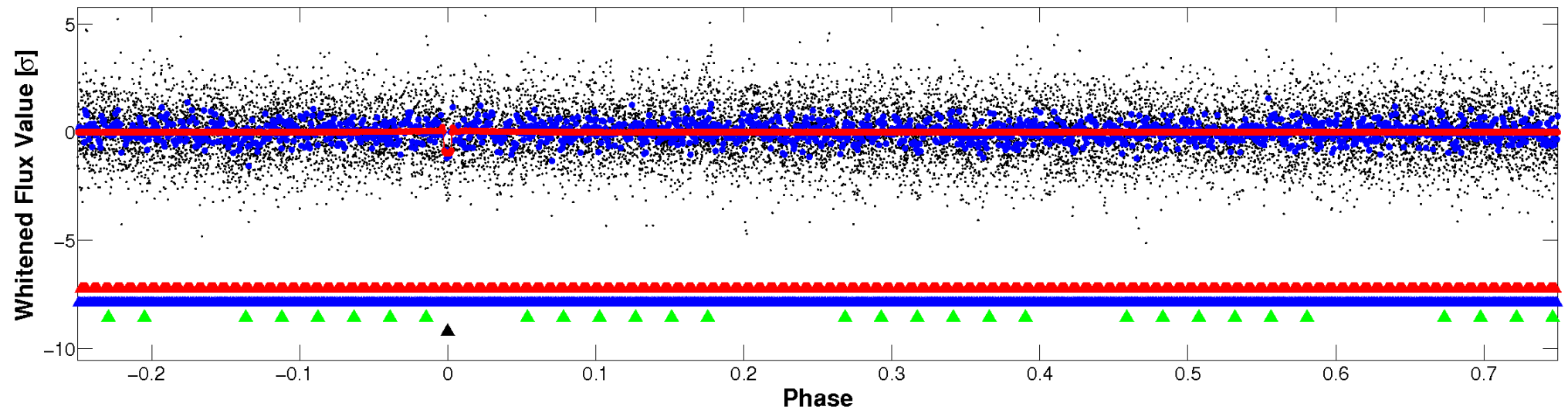


# Non-Whitened Vs. Whitened Light Curve

## Planet 4 : Phased Unwhitened Flux Time Series (Fit Epoch/Period)

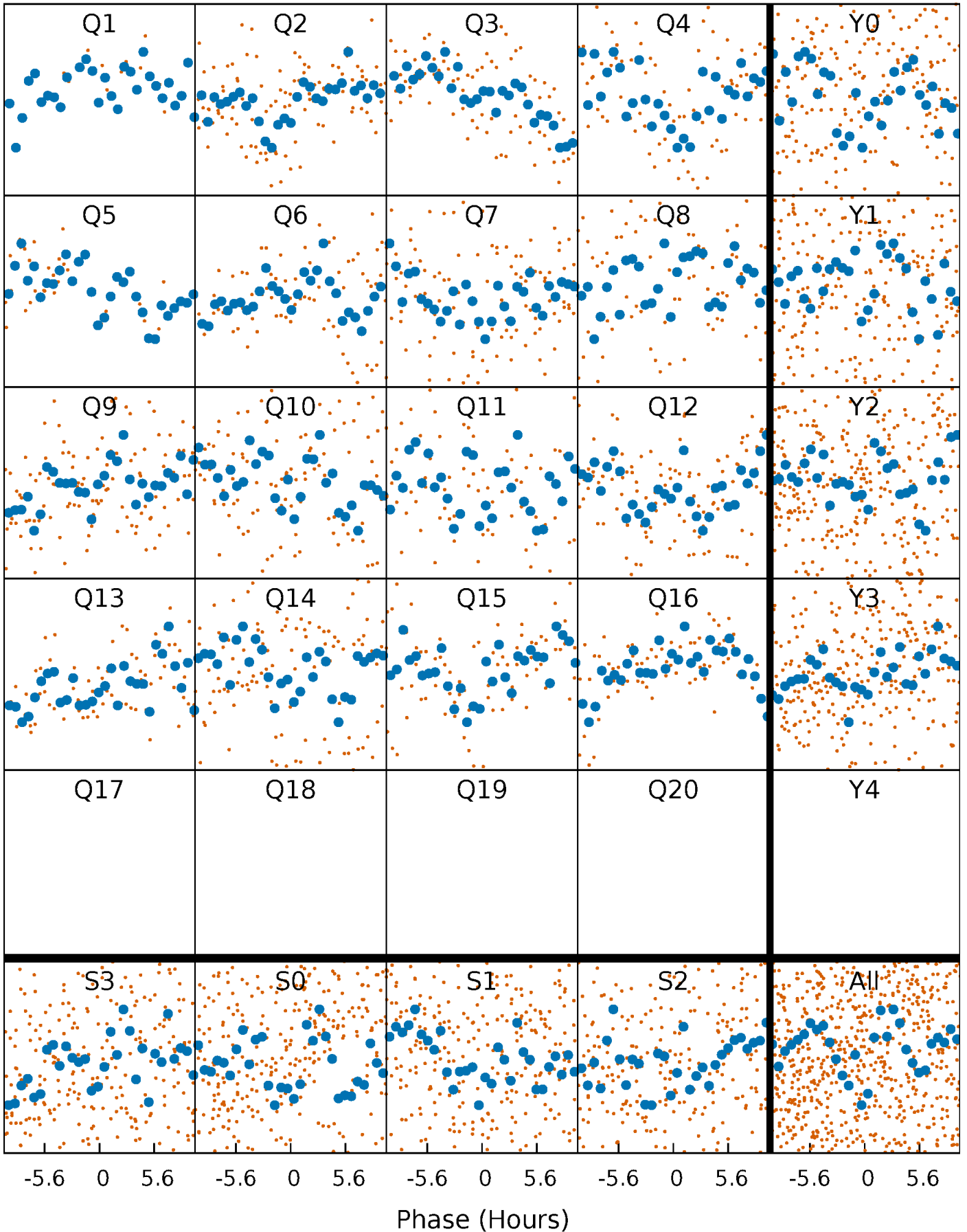


## Planet 4 : Phased Whitened Flux Time Series (Fit Epoch/Period)



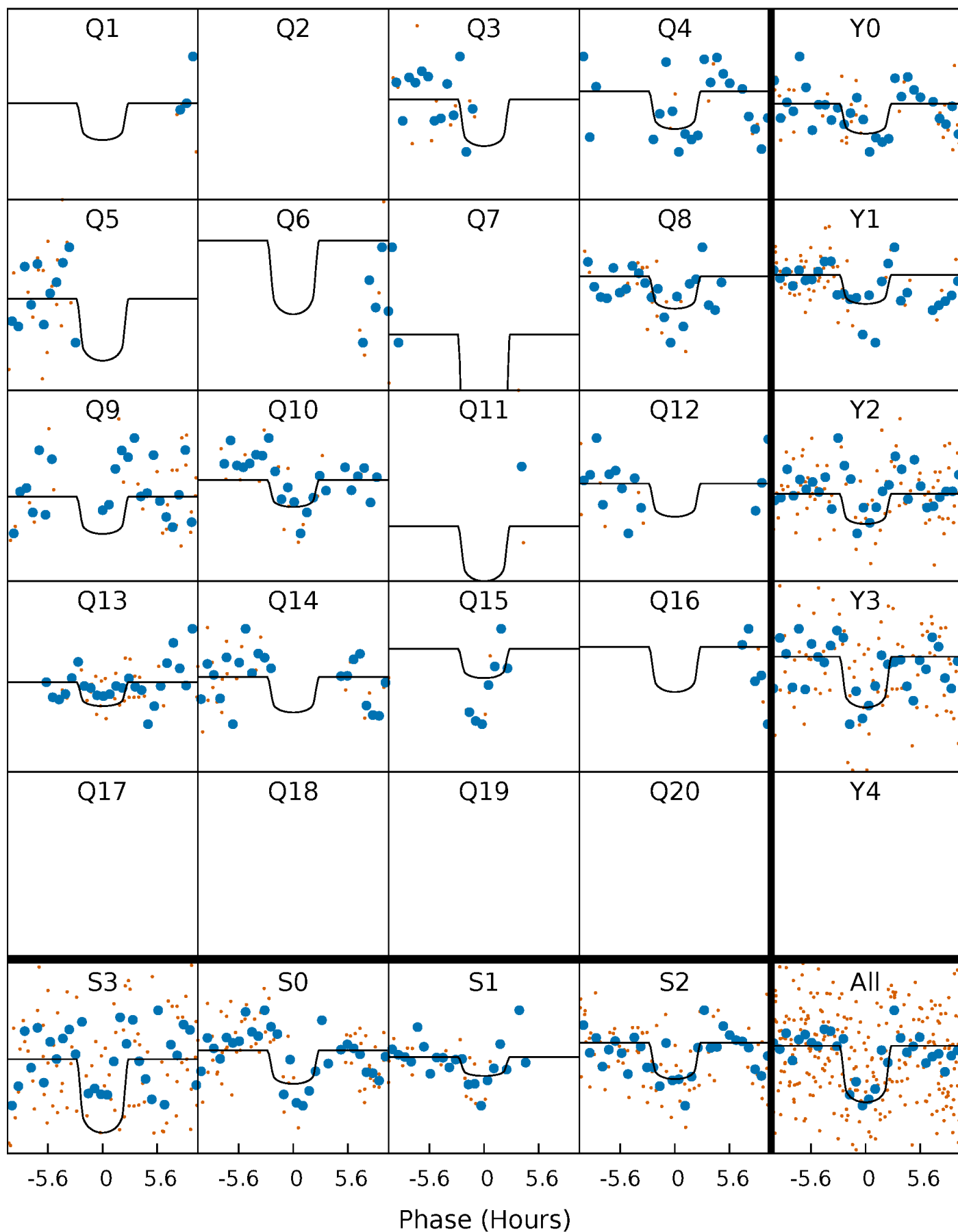
# PDC Quarter-Phased Transit Curves

TCE 007221584-04   P= 35.123241 Days    $T_0=152.772176$  (BKJD)



# DV Quarter-Phased Transit Curves

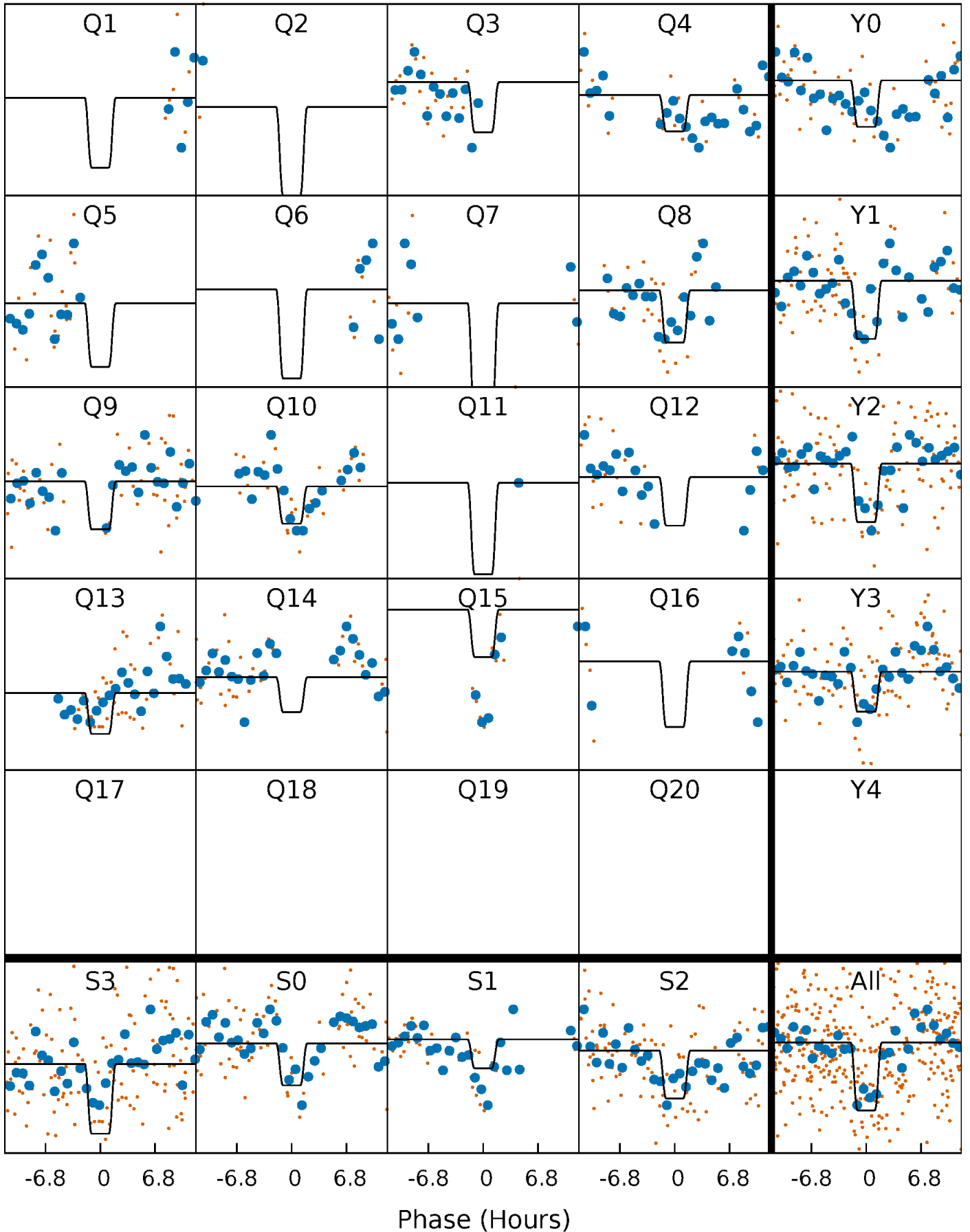
TCE 007221584-04 P= 35.123241 Days  $T_0=152.772176$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

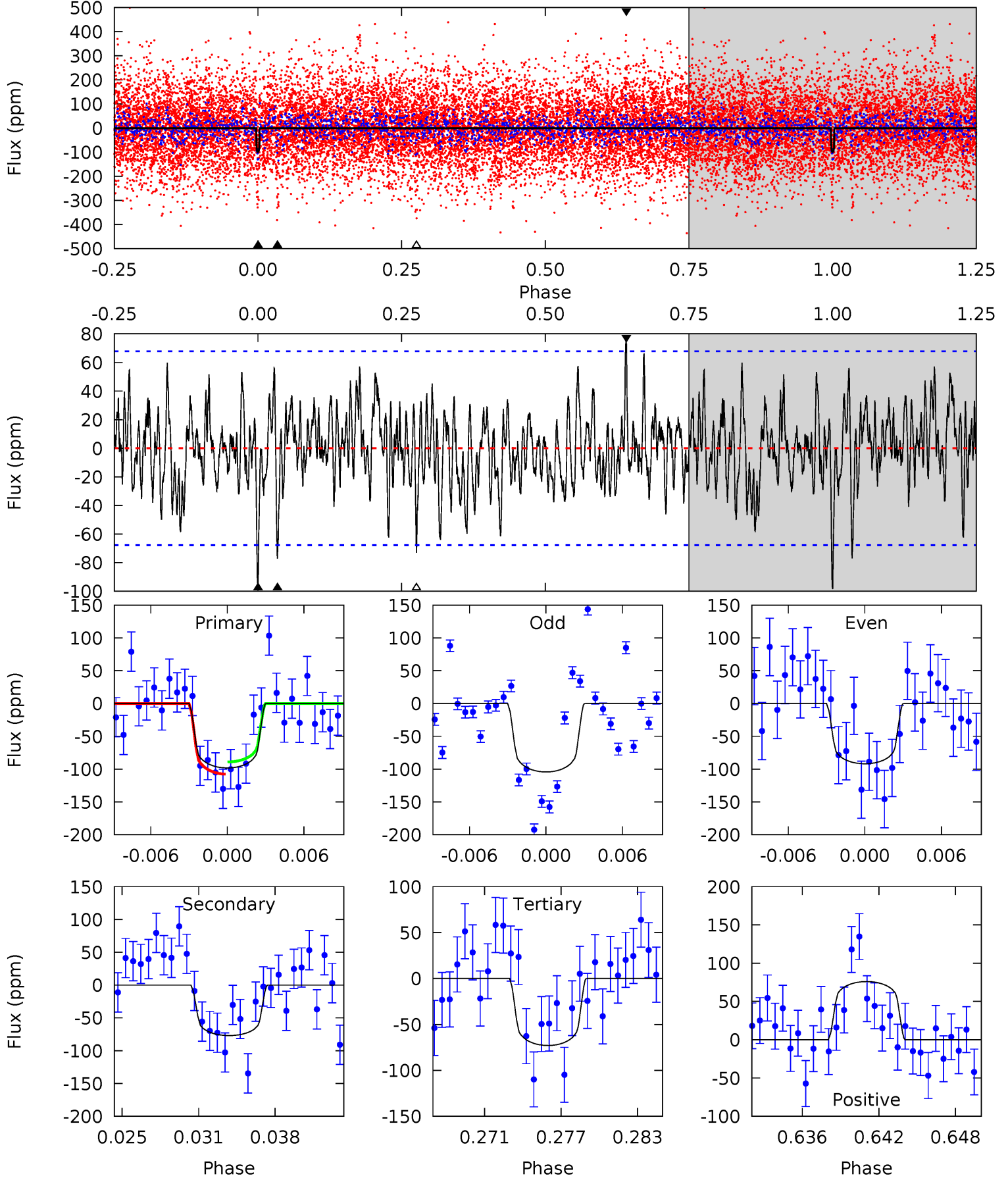
TCE 007221584-04 P= 35.123203 Days  $T_0=152.753175$  (BKJD)



# DV Model-Shift Uniqueness Test

007221584-04, P = 35.123241 Days, E = 117.648935 Days

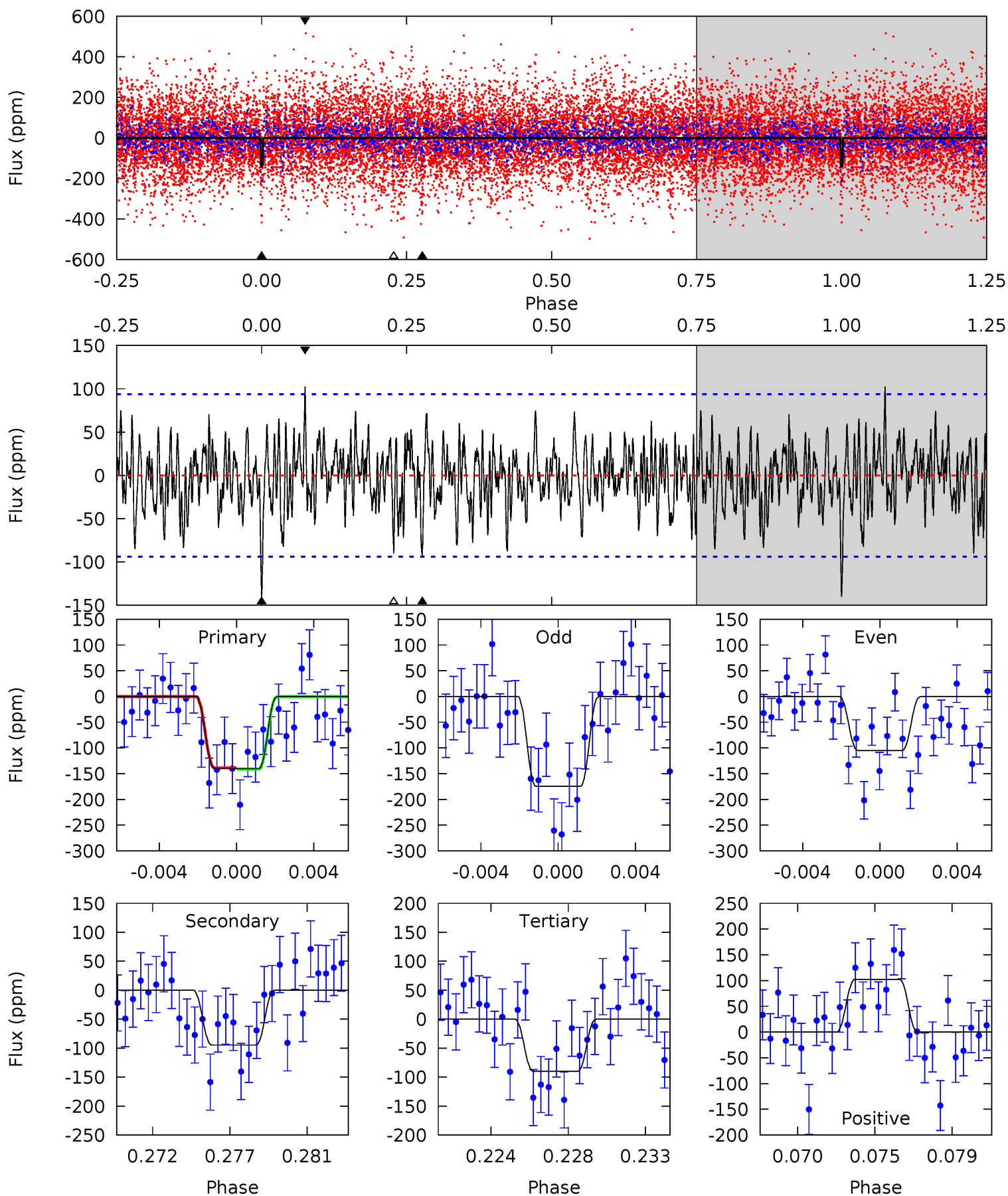
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
7.41	5.81	5.50	5.73	5.11	2.73	1.69	1.91	1.68	0.30	0.08	0.47	1.13	0.44	0.70



# Alt Model-Shift Uniqueness Test

007221584-04, P = 35.123203 Days, E = 117.629972 Days

Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
7.73	5.22	4.97	5.65	5.18	2.85	1.67	2.76	2.07	0.25	-0.43	1.92	1.20	0.42	0.07



### Stellar Parameters For KIC 007221584

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6565^{+177}_{-197}$	$3.648^{+0.340}_{-0.060}$	$-0.140^{+0.300}_{-0.250}$	$3.143^{+0.404}_{-1.211}$	$1.601^{+0.215}_{-0.350}$	$0.073^{+0.171}_{-0.019}$
	+3%/-3%	+9%/-2%	+214%/-179%	+13%/-39%	+13%/-22%	+235%/-26%
Source	PHO1	FLK73	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 007221584-04 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-77 \pm 13$	$3.99^{+2.63}_{-2.34}$	$1407^{+74}_{-139}$	$5467^{+2849}_{-995}$	$168^{+730}_{-108}$
Alt.	$-95 \pm 18$	$4.41^{+2.60}_{-2.58}$	$1409^{+74}_{-131}$	$5450^{+3387}_{-906}$	$158^{+908}_{-96}$

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

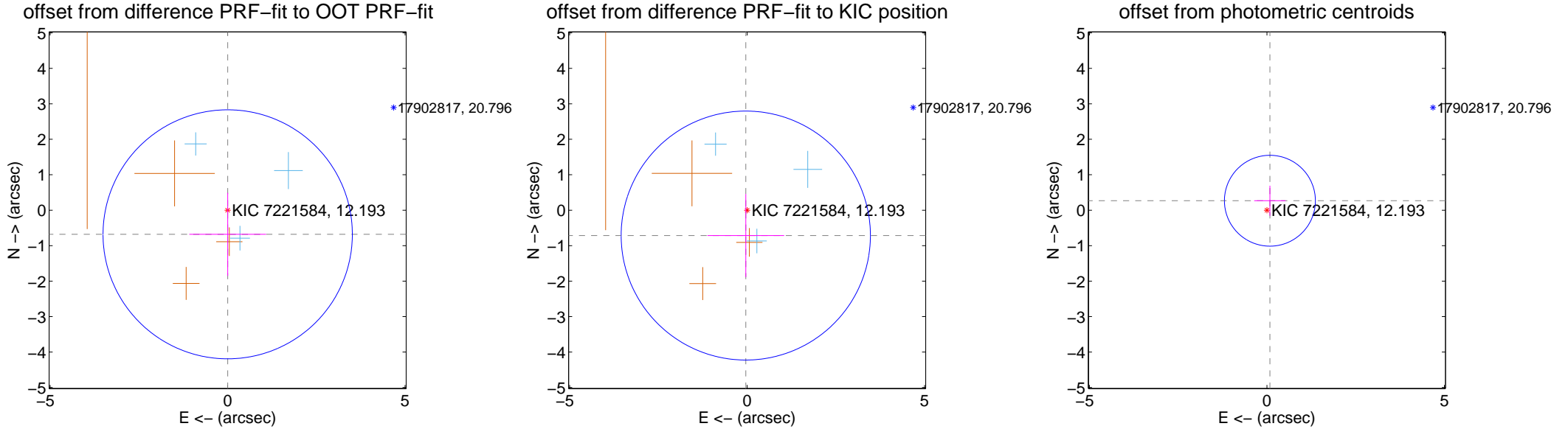
## DV Centroid Data

Supplemental centroid analysis for 007221584-04. Kepler magnitude: 12.19. Transit SNR 7.43

There are 3 quarters with good PRF difference image offsets

The direct PRF centroid is offset from the target star catalog position by about 0.08 arcsec

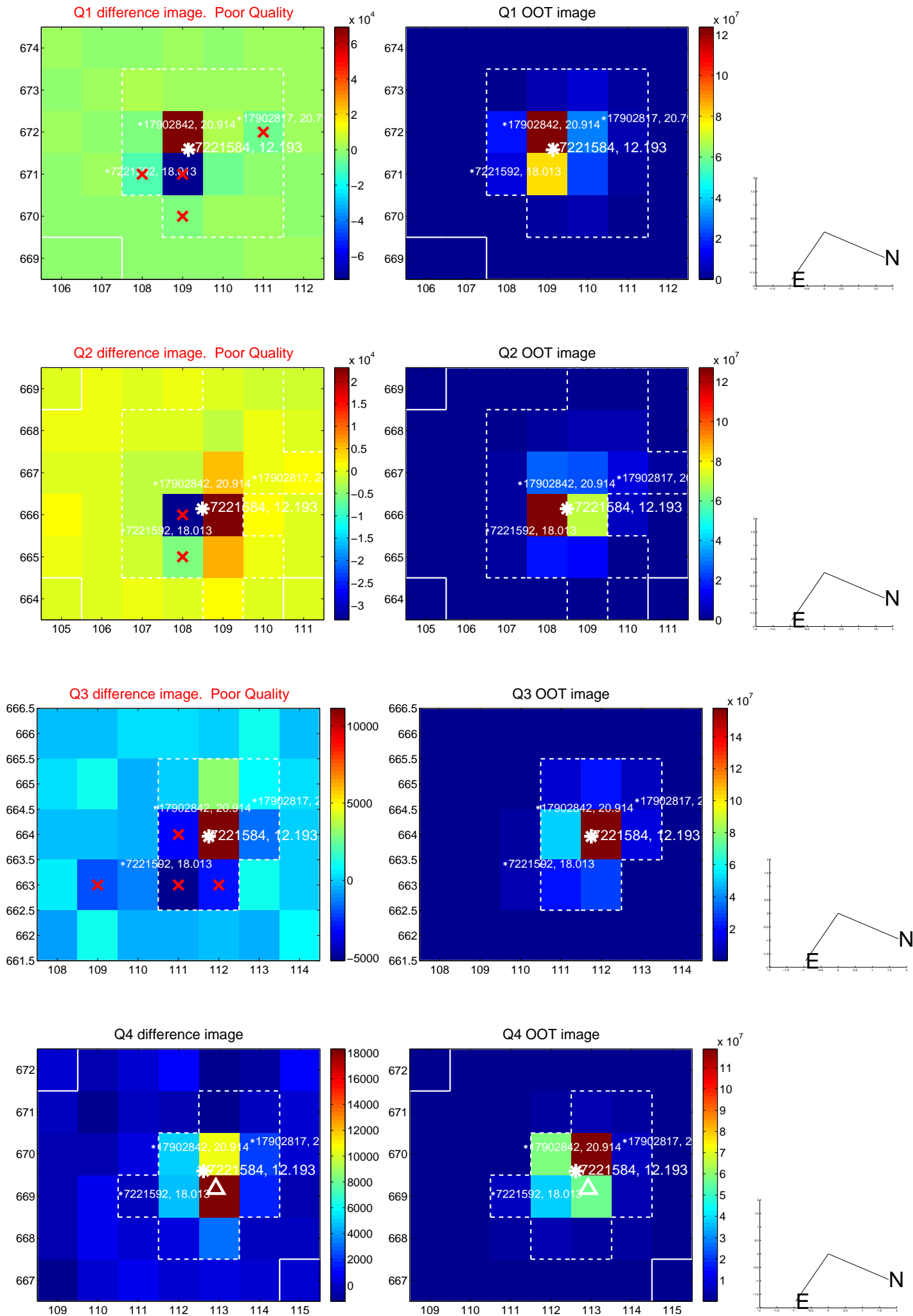
	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.680 \pm 1.170$	0.58	$-0.003 \pm 1.081$	$-0.680 \pm 1.170$
PRF-fit source offset from KIC position	$0.716 \pm 1.170$	0.61	$0.038 \pm 1.081$	$-0.715 \pm 1.170$
photometric centroid source offset	$0.28 \pm 0.43$	0.66	$-0.08 \pm 0.44$	$0.27 \pm 0.43$



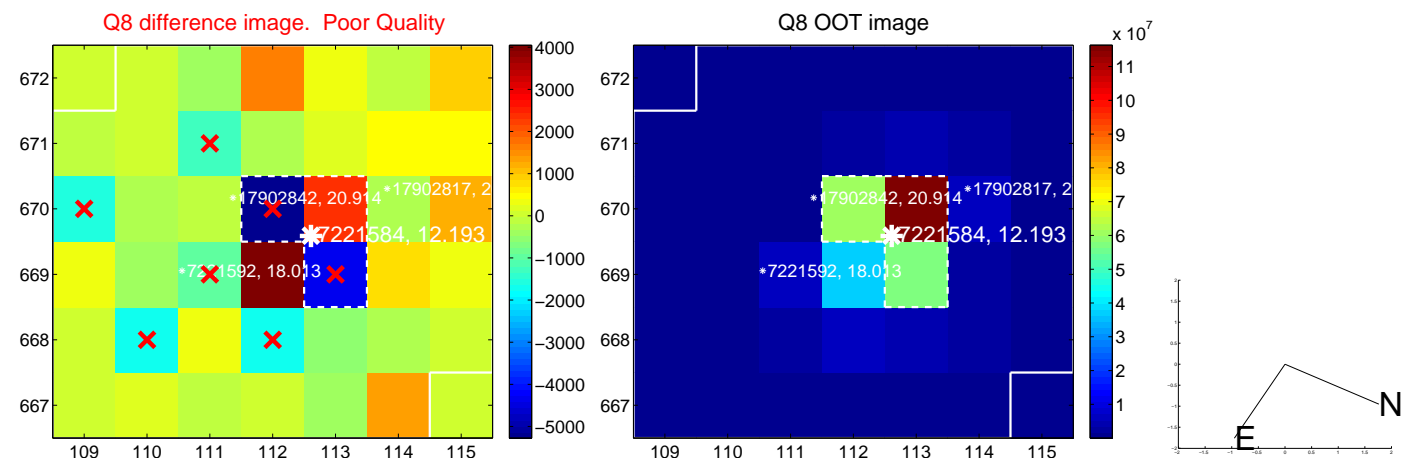
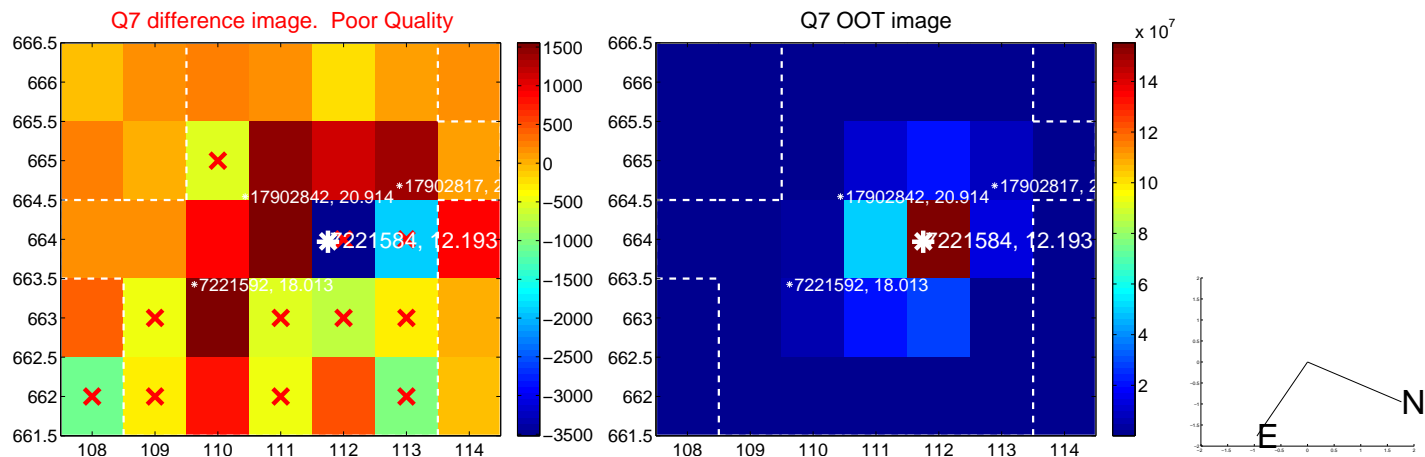
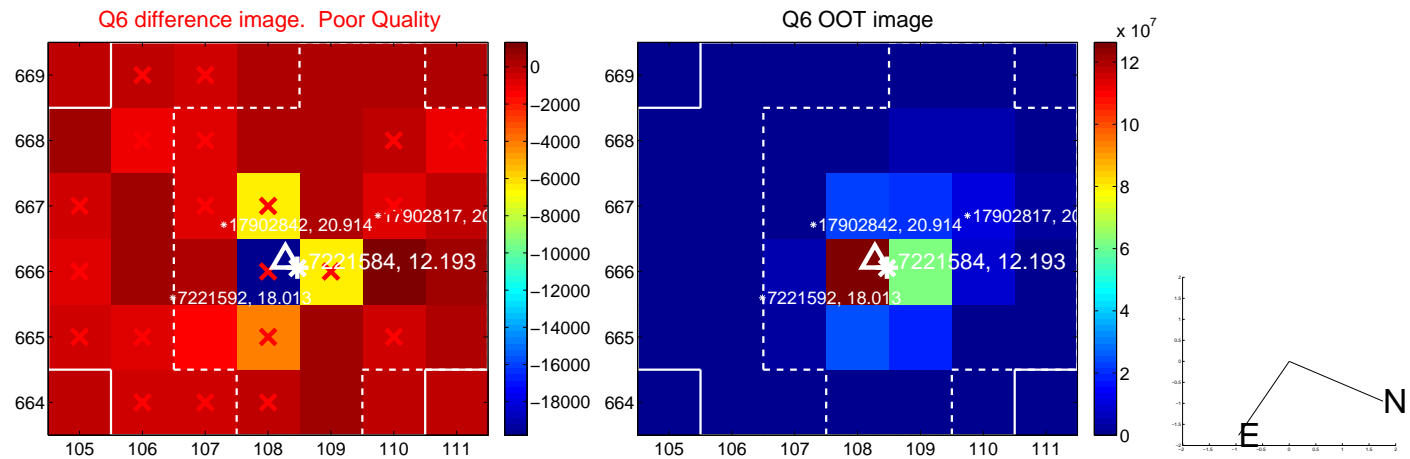
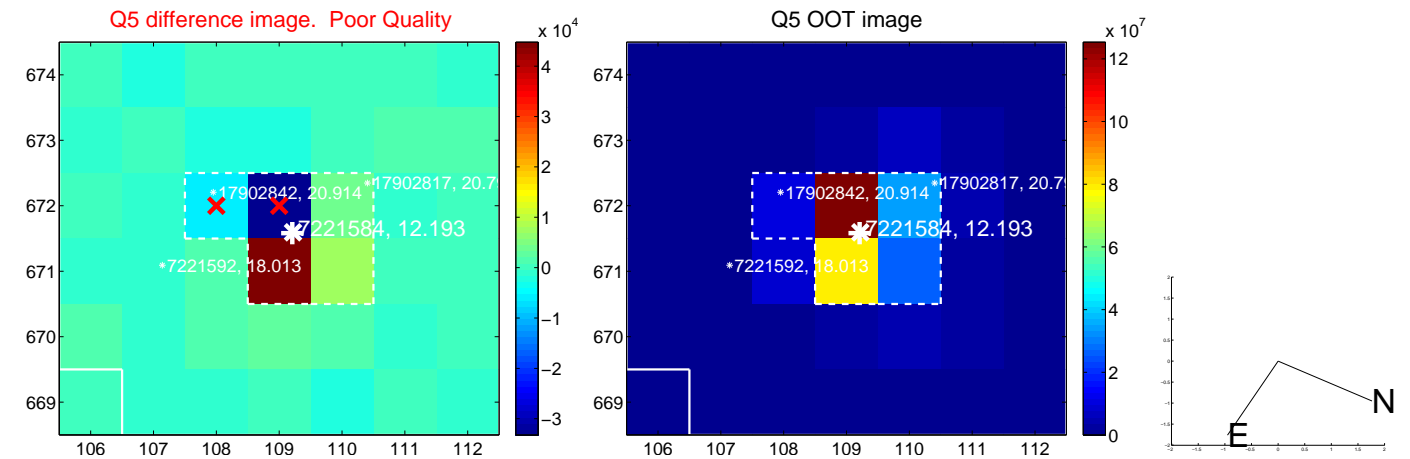
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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



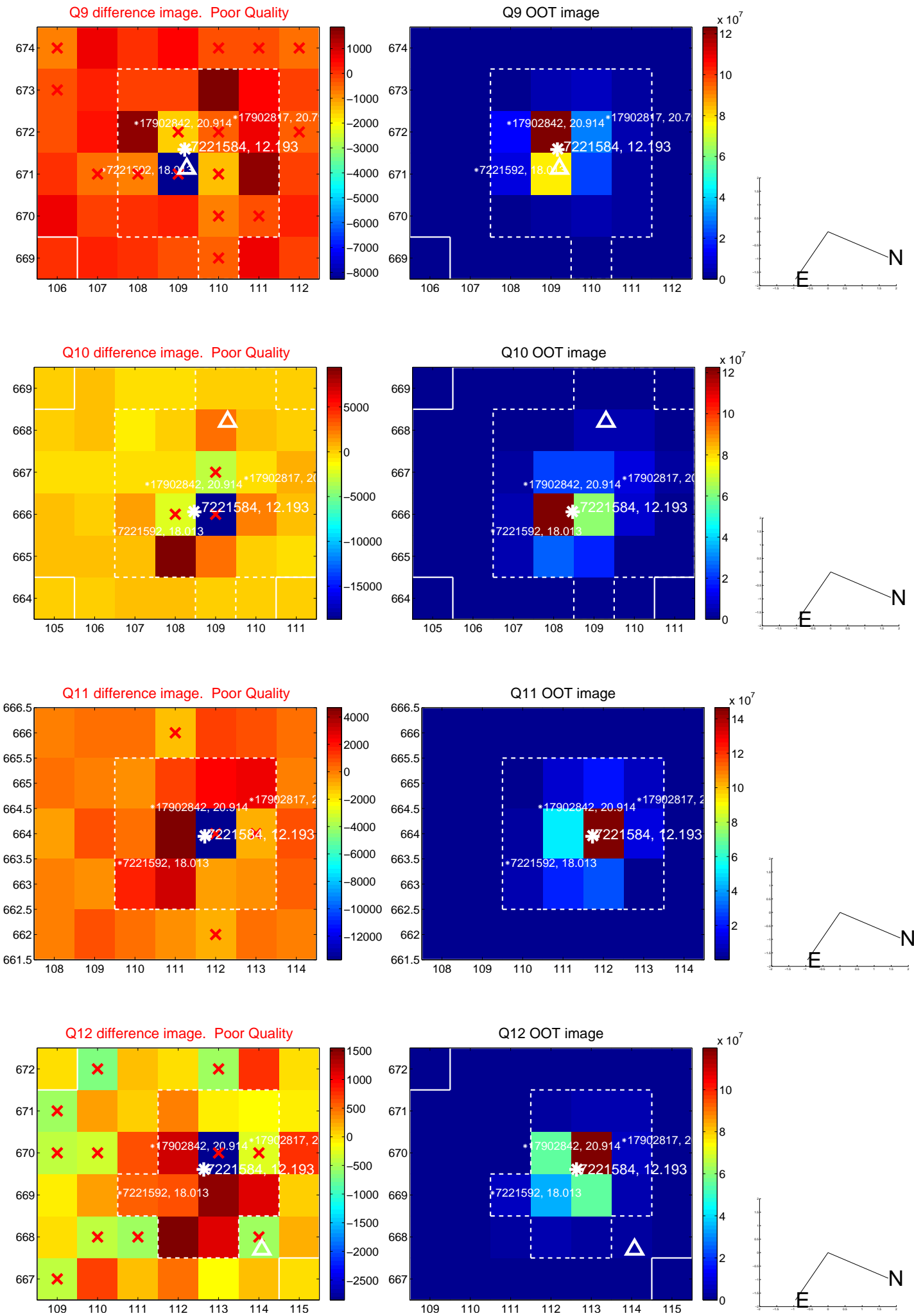
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



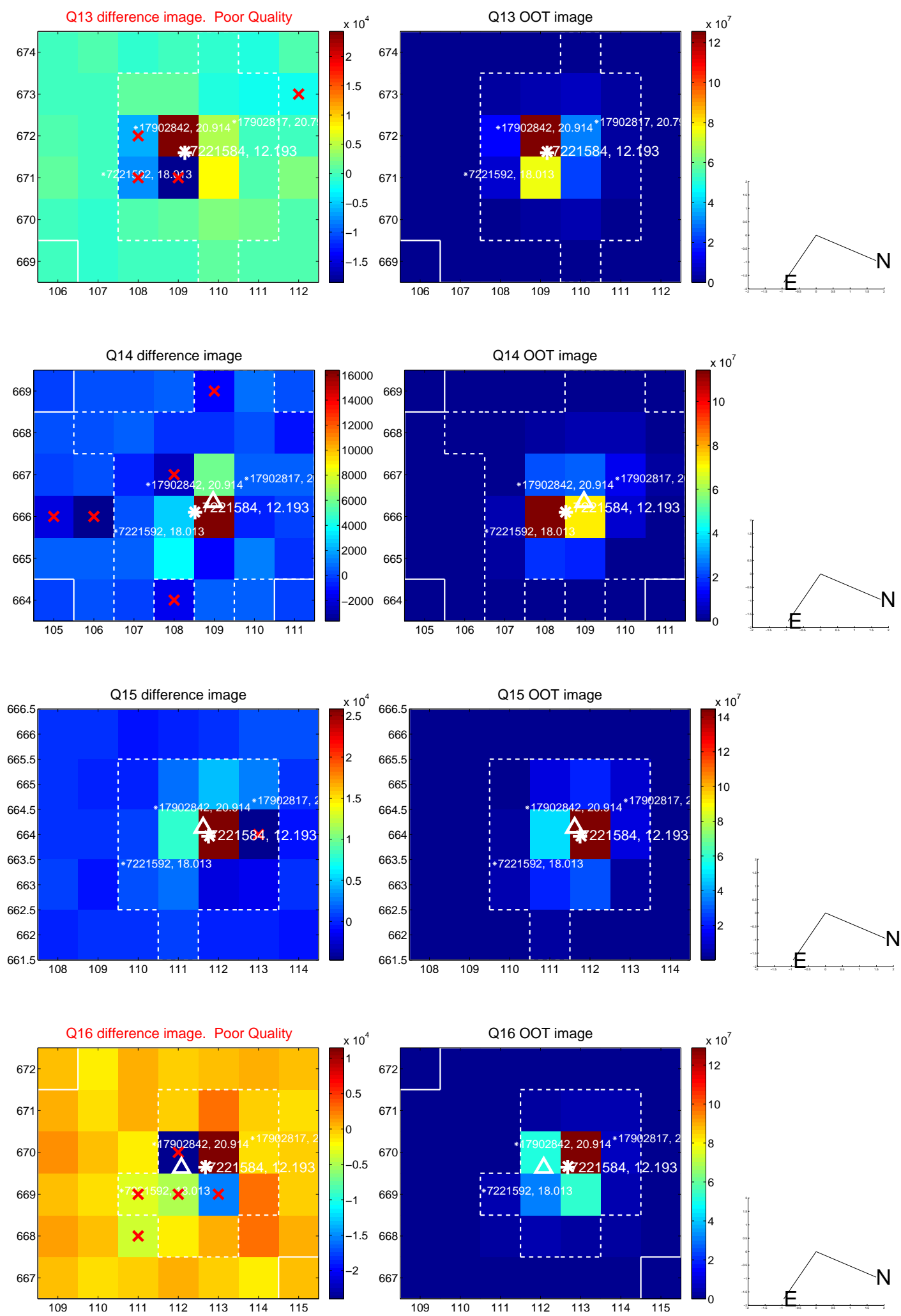
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



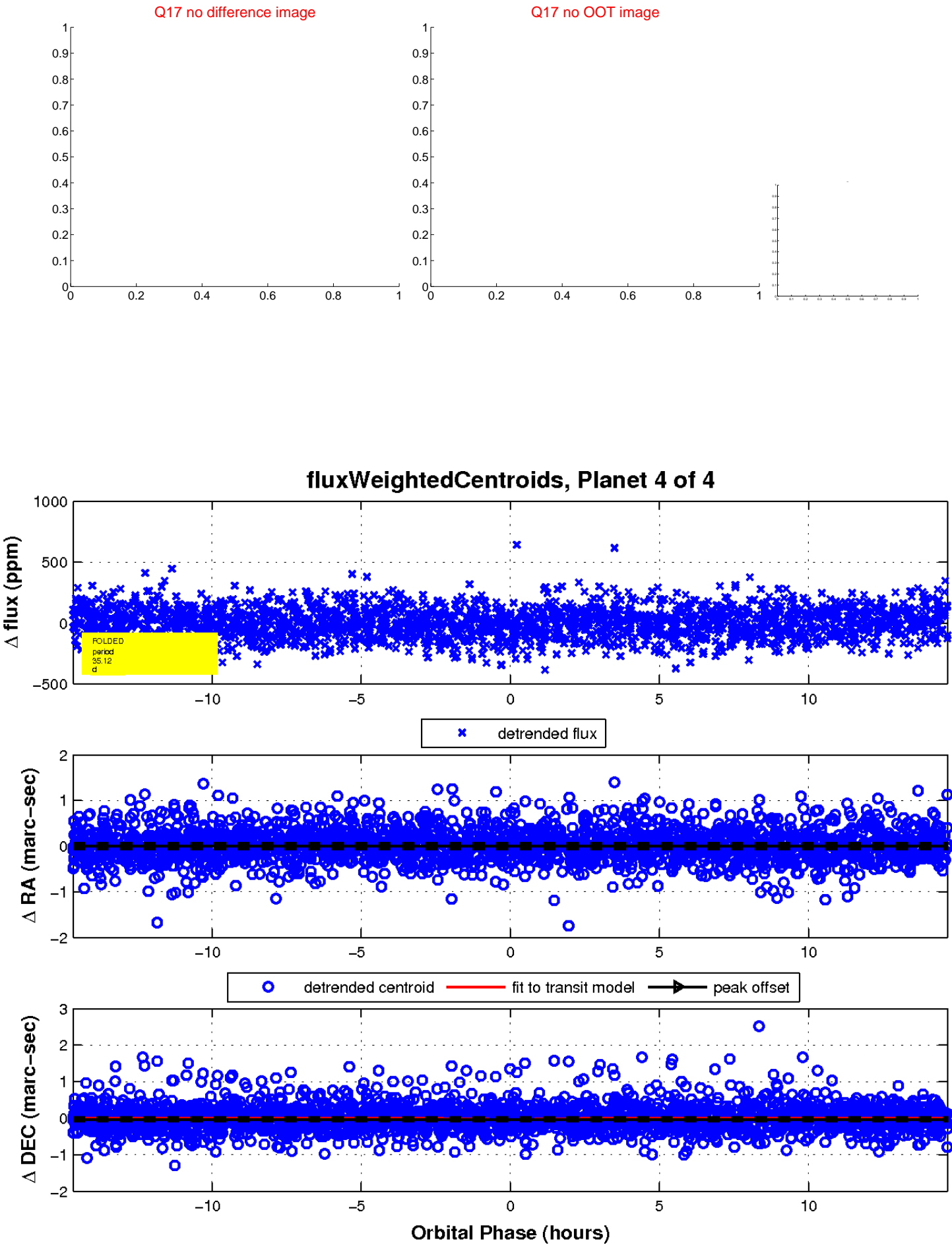
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

