

# KIC 012470709

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
012470709-01	OBS	No	1.024308	132.226752	76.8	2.204	11.6	7.8	1.66	7421	1.66	14024.15
012470709-02	OBS	No	0.512177	131.942841	102.5	1.409	10.7	9.9	1.66	7421	1.95	35336.58
012470709-03	OBS	No	3.350104	132.813703	175.9	8.260	7.9	7.3	1.66	7421	2.36	2888.73

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
012470709-01	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT
012470709-02	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—SAME_NTL_PERIOD
012470709-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_ZUMA—TRANS_GAPPED—LPP_DV—LPP_ALT

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

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

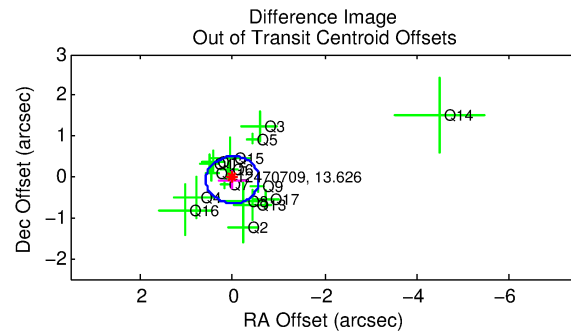
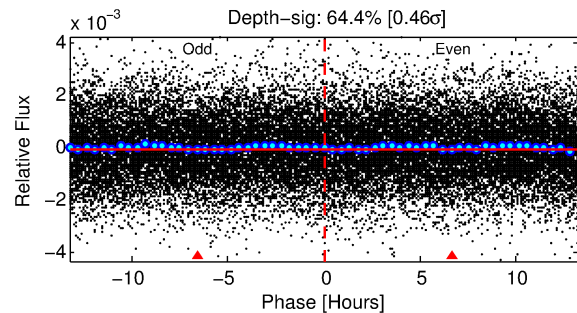
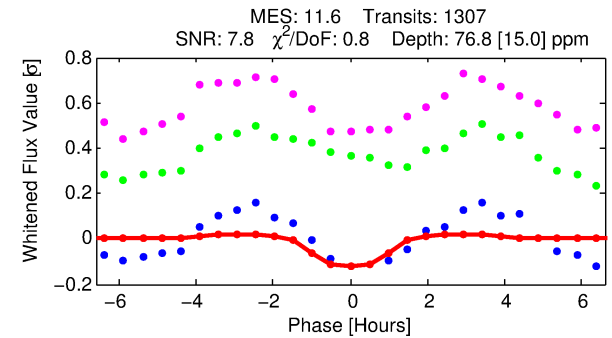
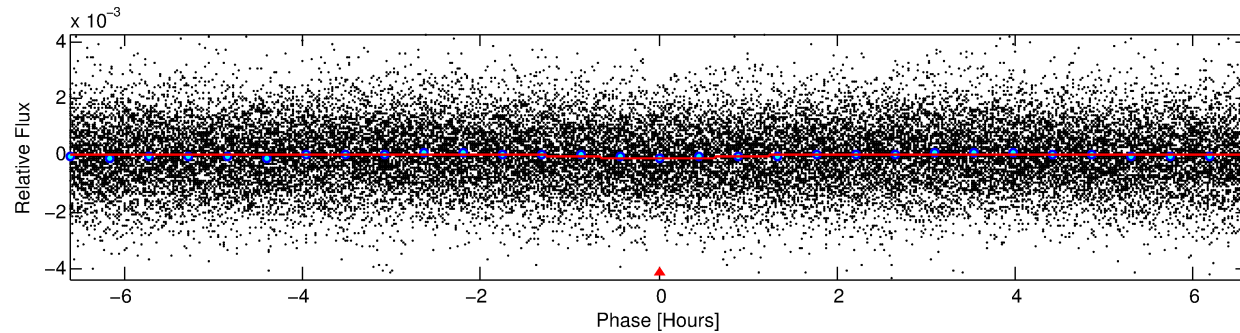
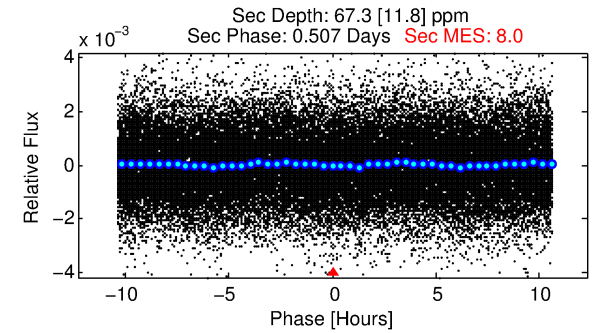
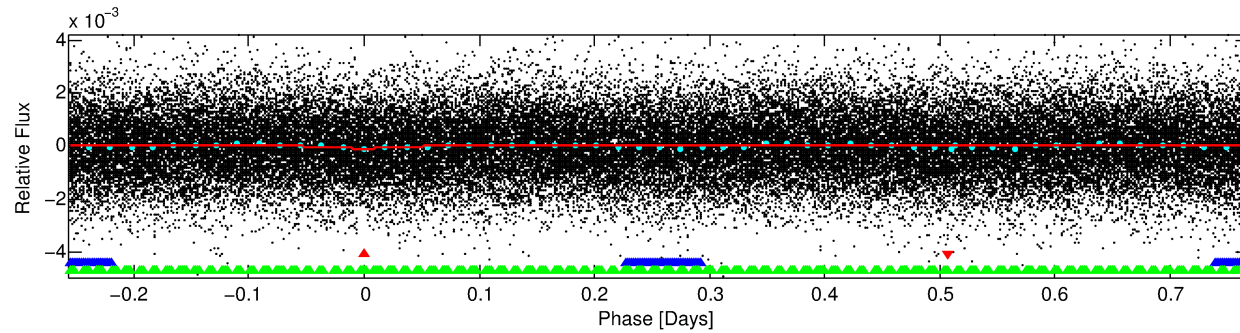
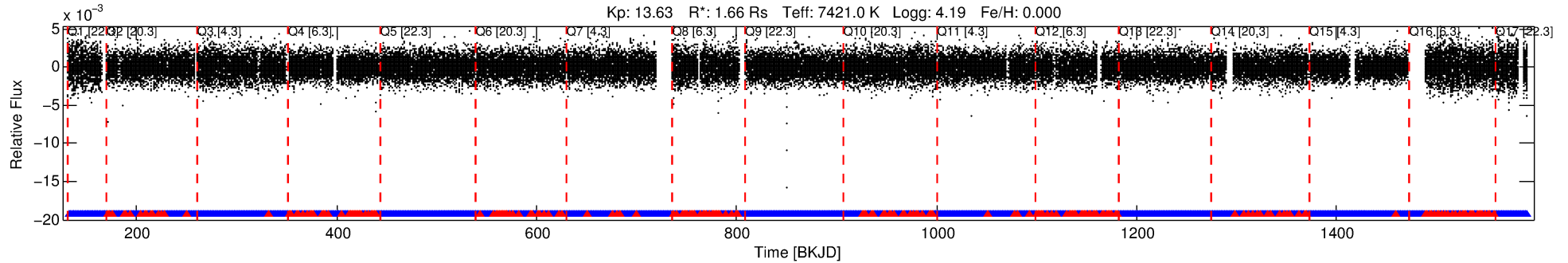
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 012470709-01

No Significant Match Found

# DV One-Page Summary

KIC: 12470709 Candidate: 1 of 3 Period: 1.024 d



## DV Fit Results:

Period = 1.02431 [0.00001] d  
Epoch = 132.2268 [0.0050] BKJD  
Rp/R\* = 0.0092 [0.0077]  
a/R\* = 1.97 [7.89]  
b = 0.88 [1.37]  
Seff = 14024.15 [6047.29]  
Teff = 2775 [299] K  
Rp = 1.66 [1.49] Re  
a = 0.0231 [0.0063] AU  
Ag = 7.12 [12.24] [0.50σ]  
Teffp = 7008 [2950] K [1.43σ]

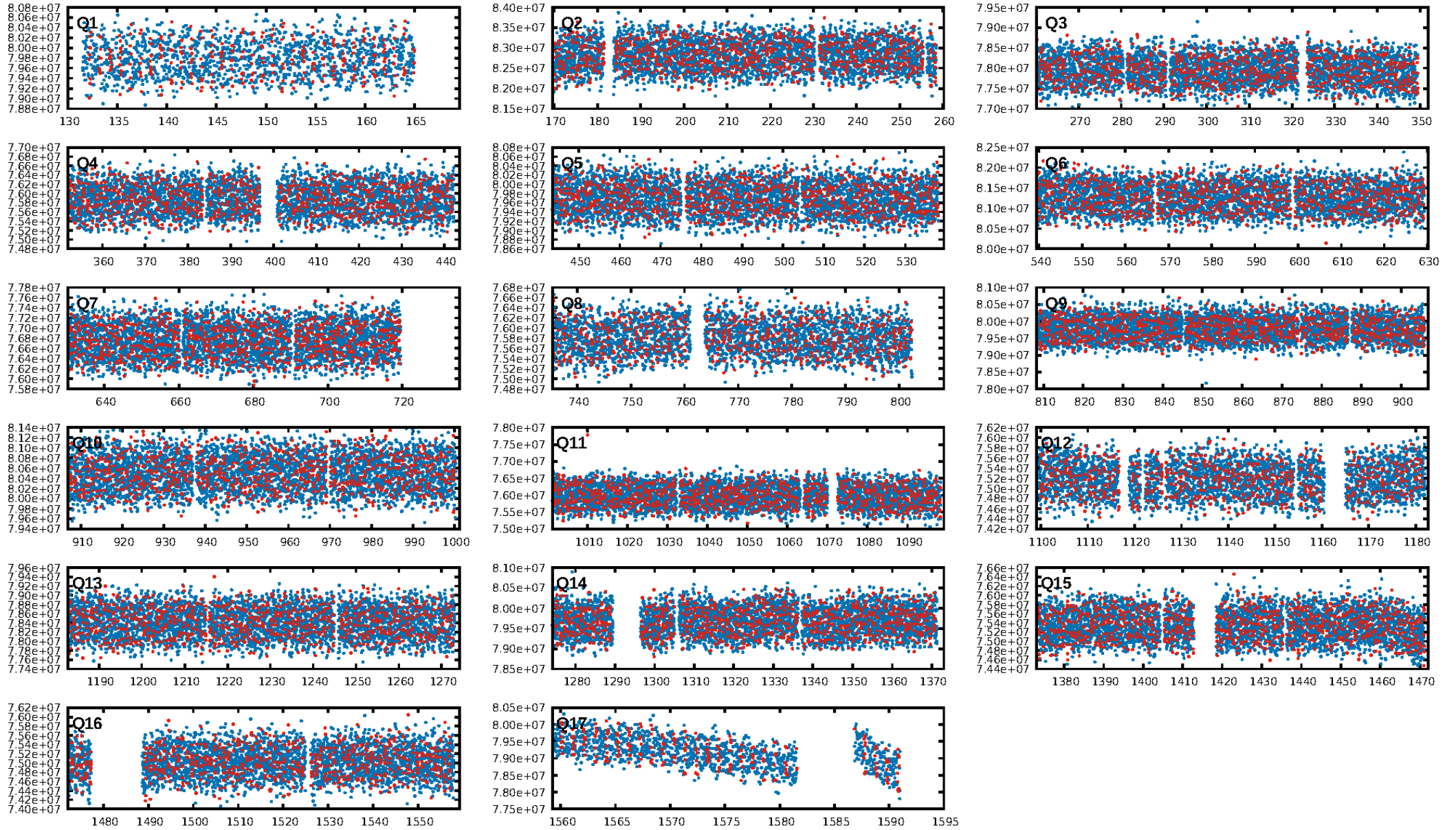
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [4.70σ]  
LongPeriod-sig: 100.0% [6.53σ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: 5.01e-42  
RollingBand-fgt: 0.83 [1031/1248]  
GhostDiagnostic-chr: 3.179  
Centroid-sig: 78.5%  
Centroid-so: 0.824 arcsec [1.36σ]  
OotOffset-rm: 0.075 arcsec [0.39σ]  
KicOffset-rm: 0.044 arcsec [0.19σ]  
OotOffset-st: 3/4/4/5 [16]  
KicOffset-st: 3/4/4/5 [16]  
DiffImageQuality-fgm: 0.81 [13/16]  
DiffImageOverlap-fno: 0.00 [0/17]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 29-Jan-2016 22:02:07 Z

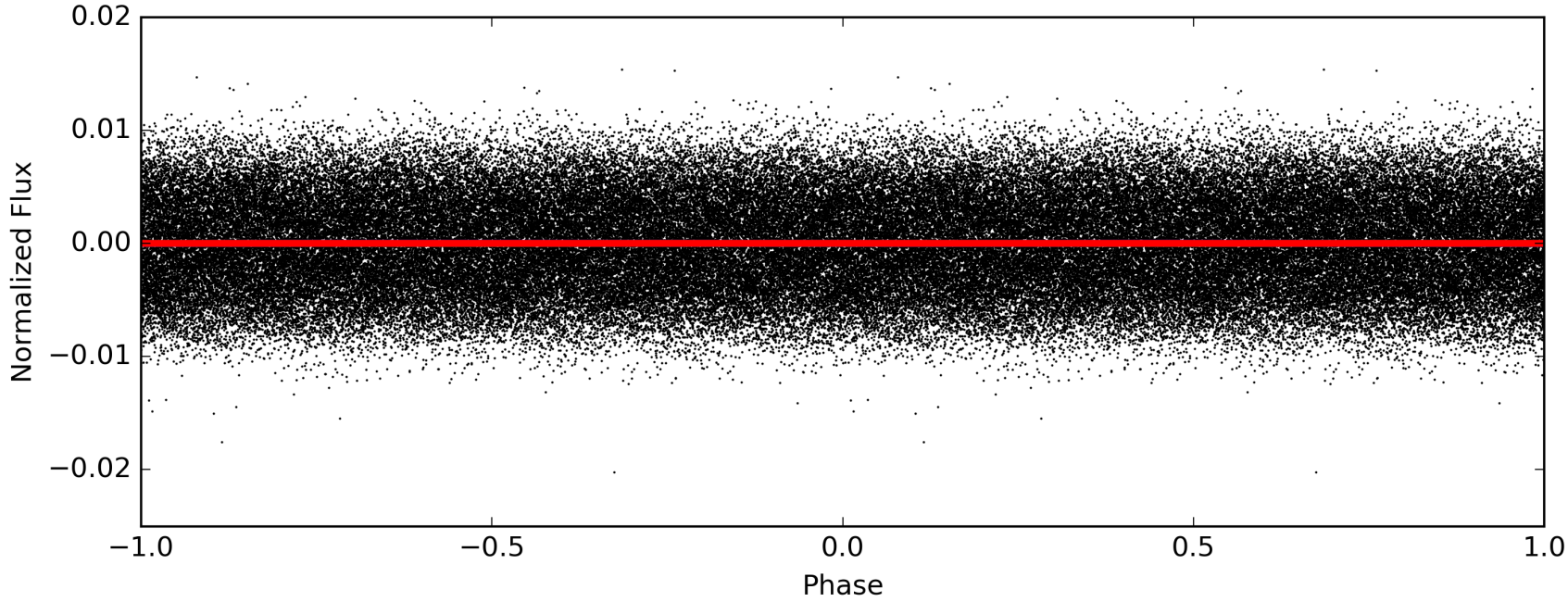
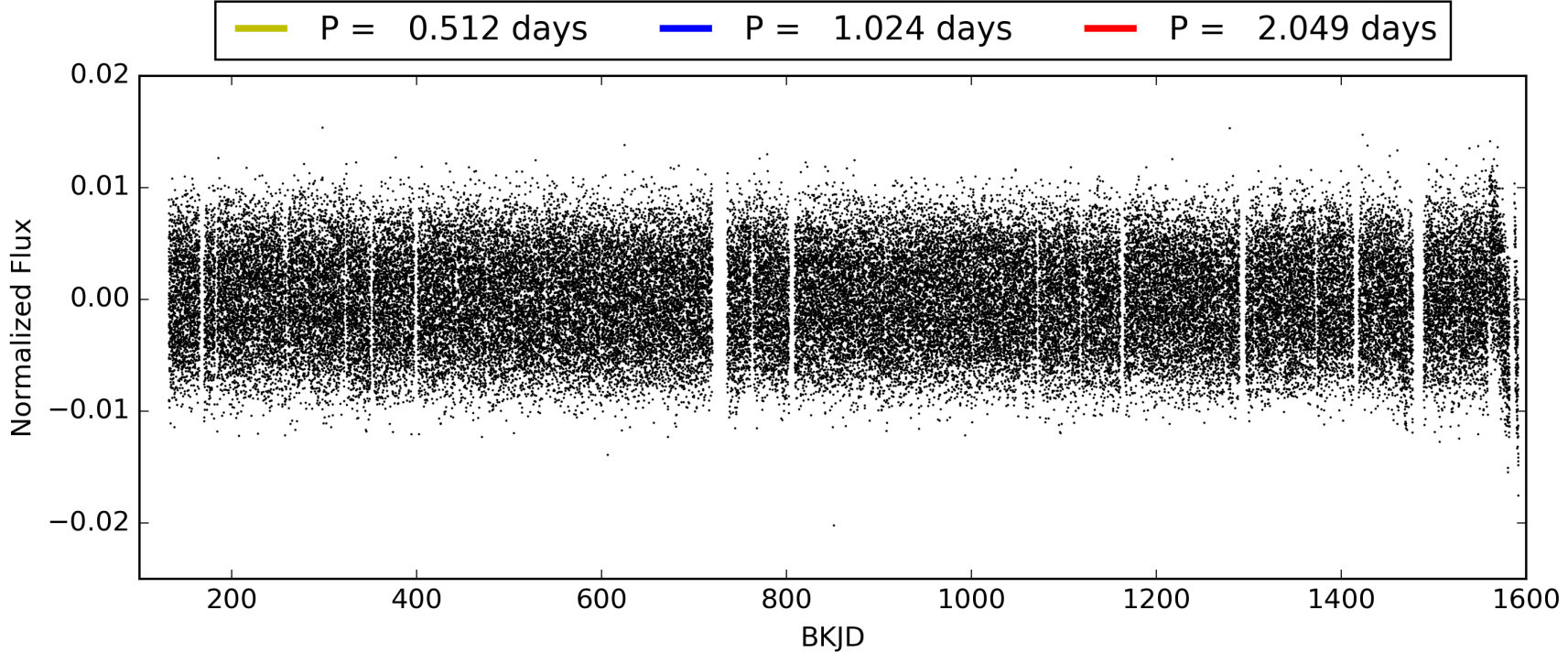
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 012470709-01, PDC Light Curves





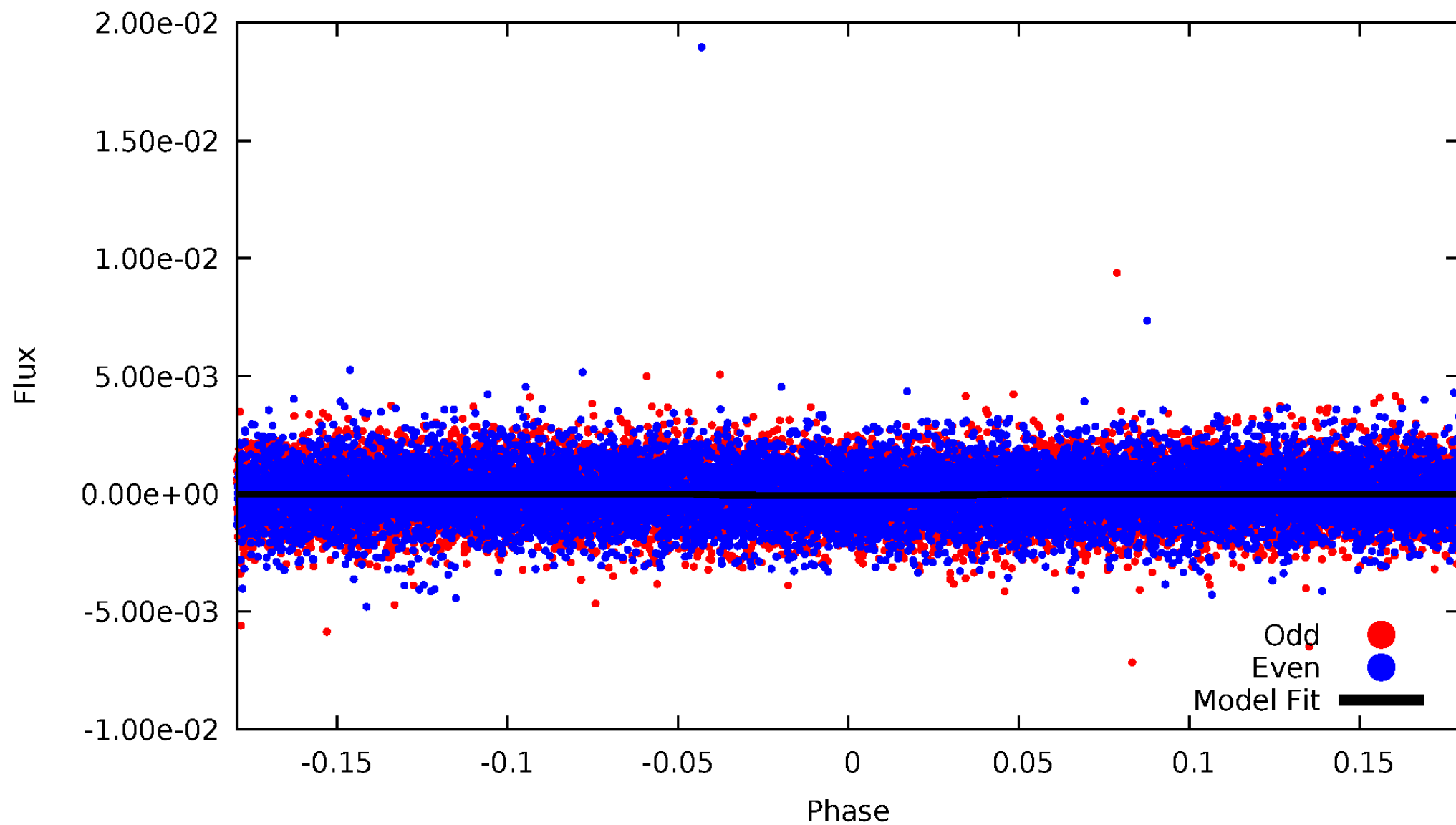
TCE 012470709-01





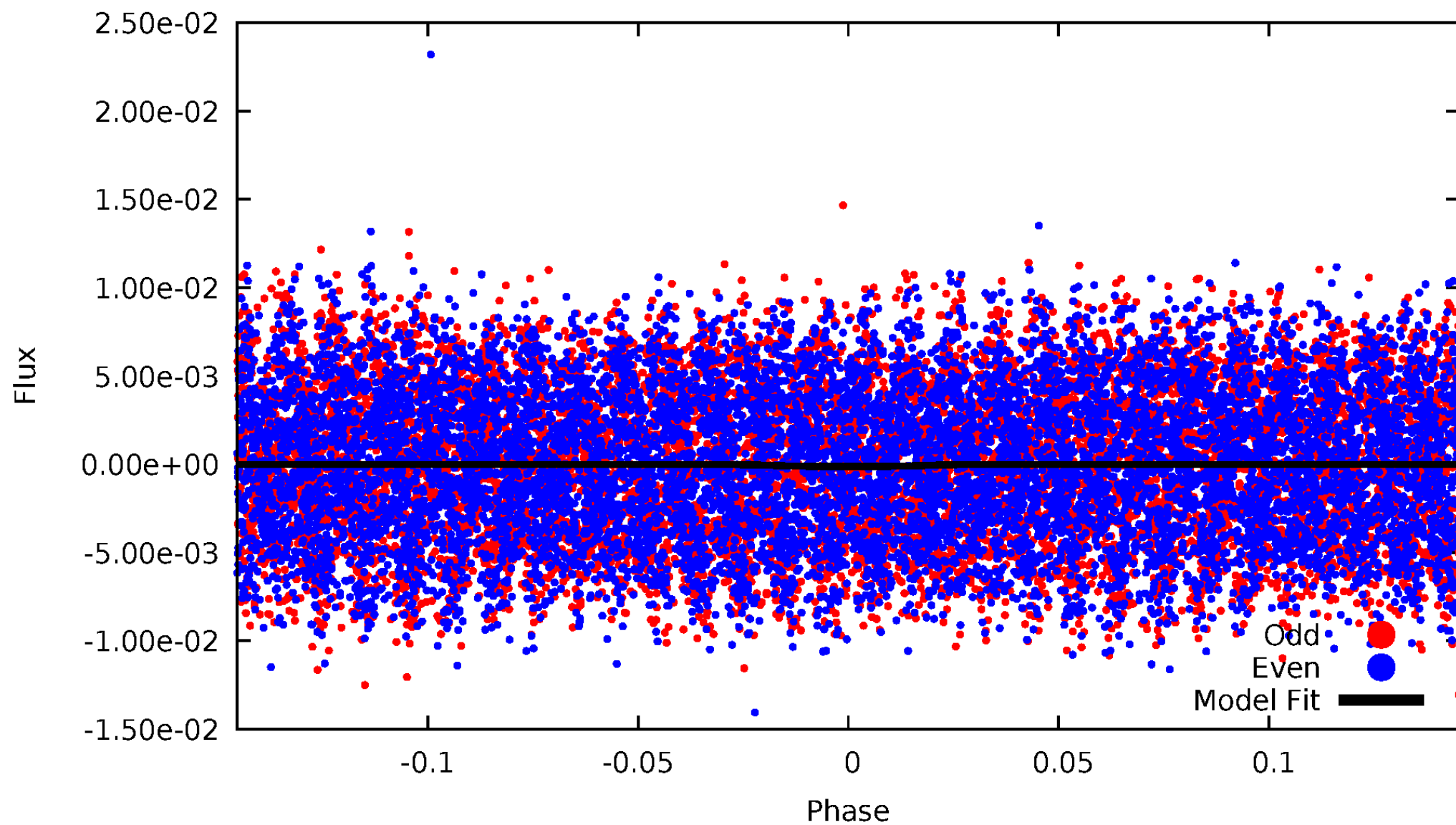
# DV Odd/Even

TCE 012470709-01



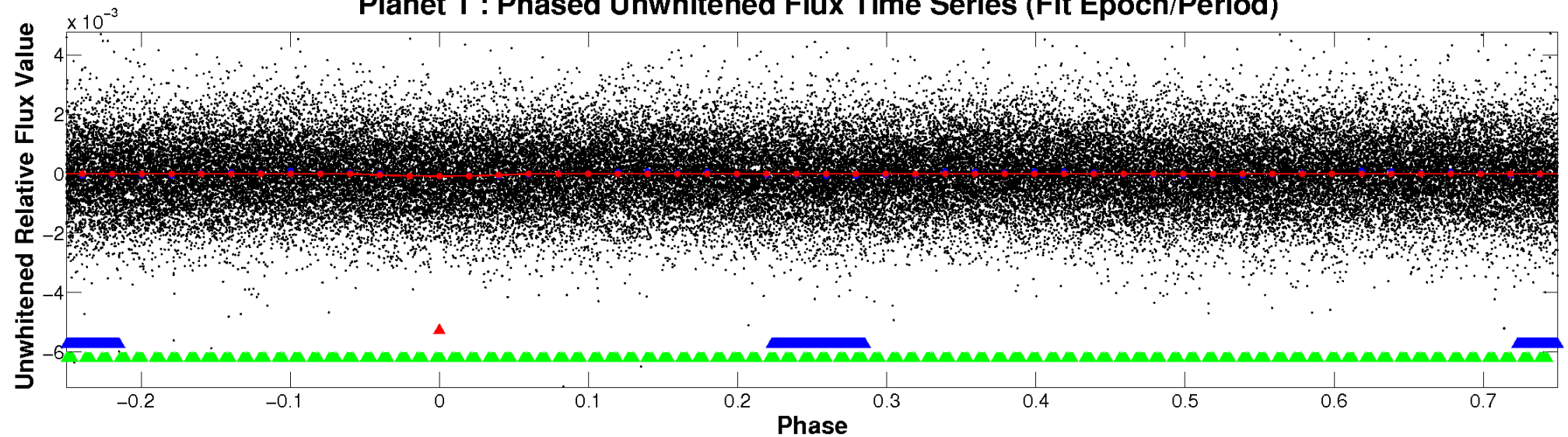
# ALT Odd/Even

TCE 012470709-01

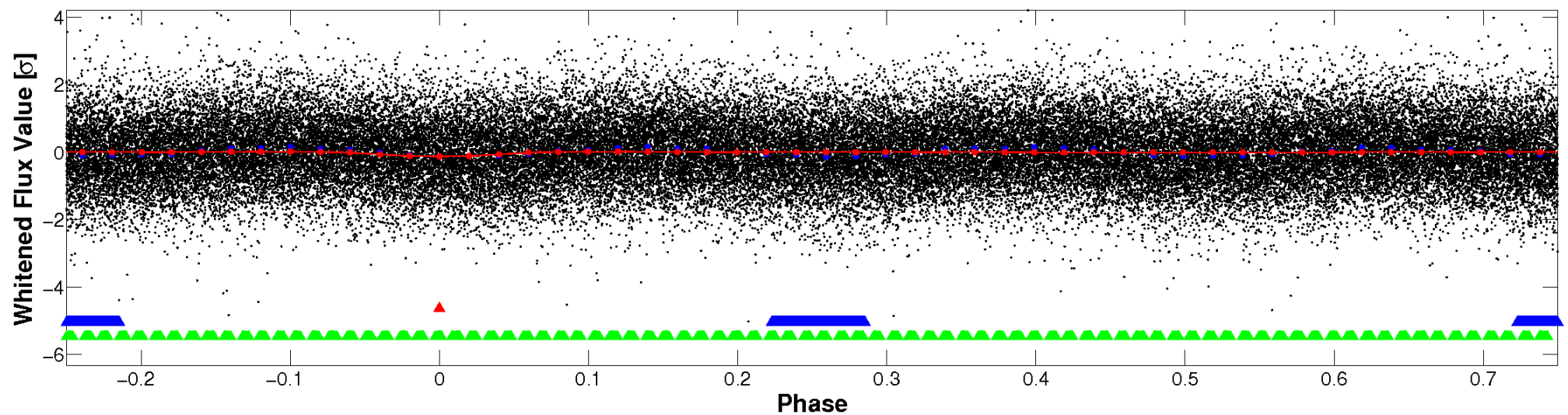


# Non-Whitened Vs. Whitened Light Curve

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



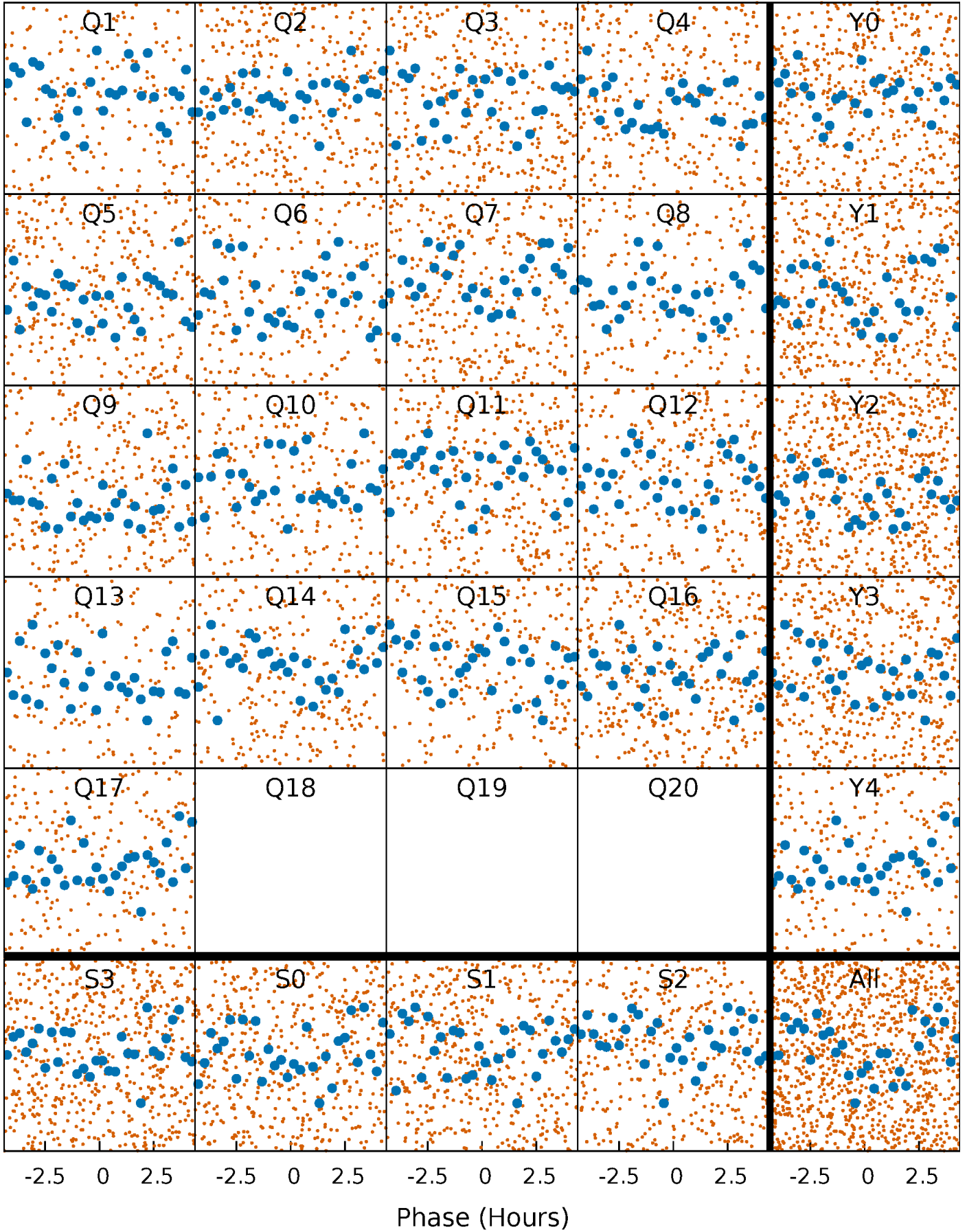
Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)





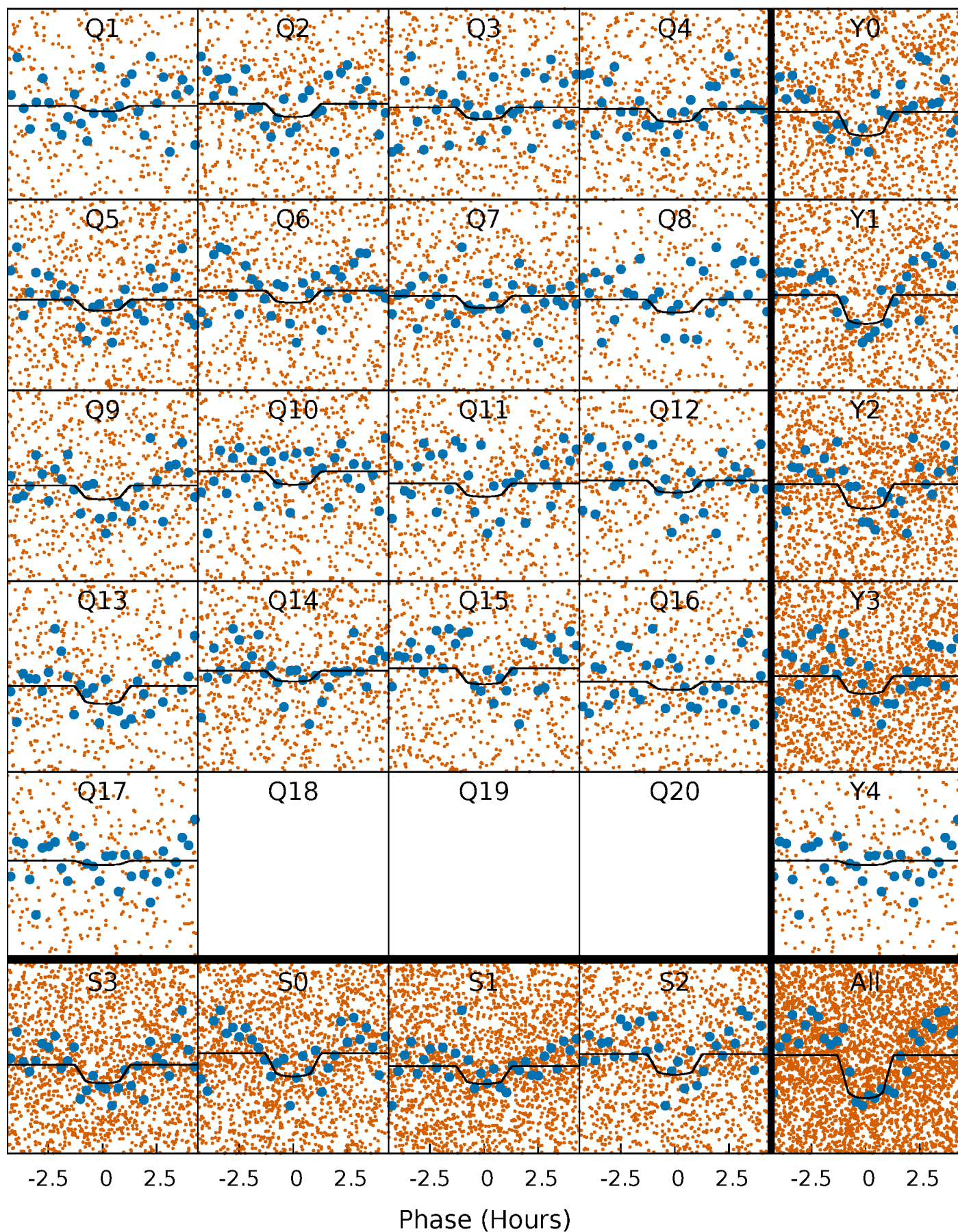
# PDC Quarter-Phased Transit Curves

TCE 012470709-01 P= 1.024308 Days  $T_0=132.226752$  (BKJD)



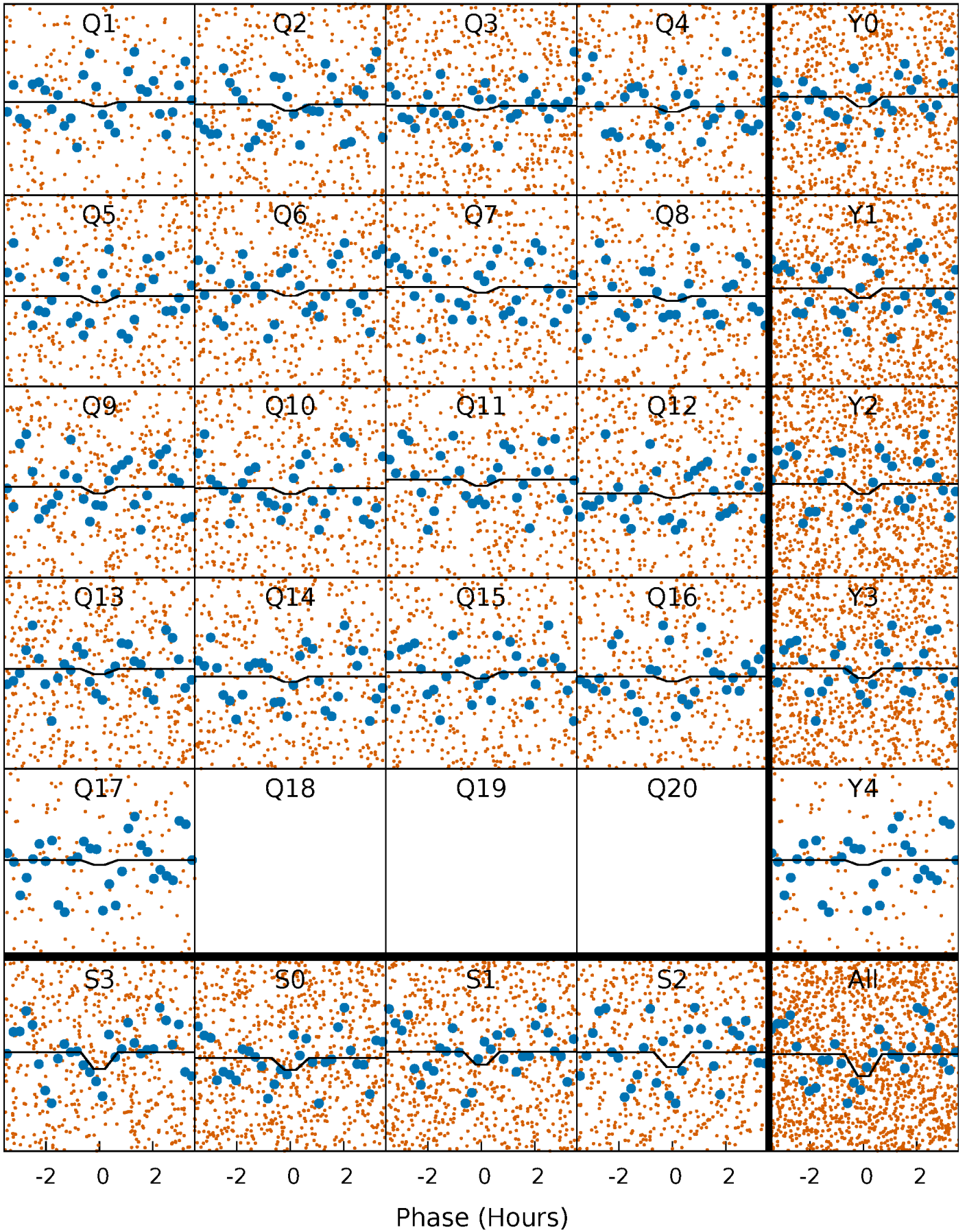
# DV Quarter-Phased Transit Curves

TCE 012470709-01 P= 1.024308 Days  $T_0=132.226752$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

TCE 012470709-01 P= 1.024369 Days  $T_0=132.232678$  (BKJD)

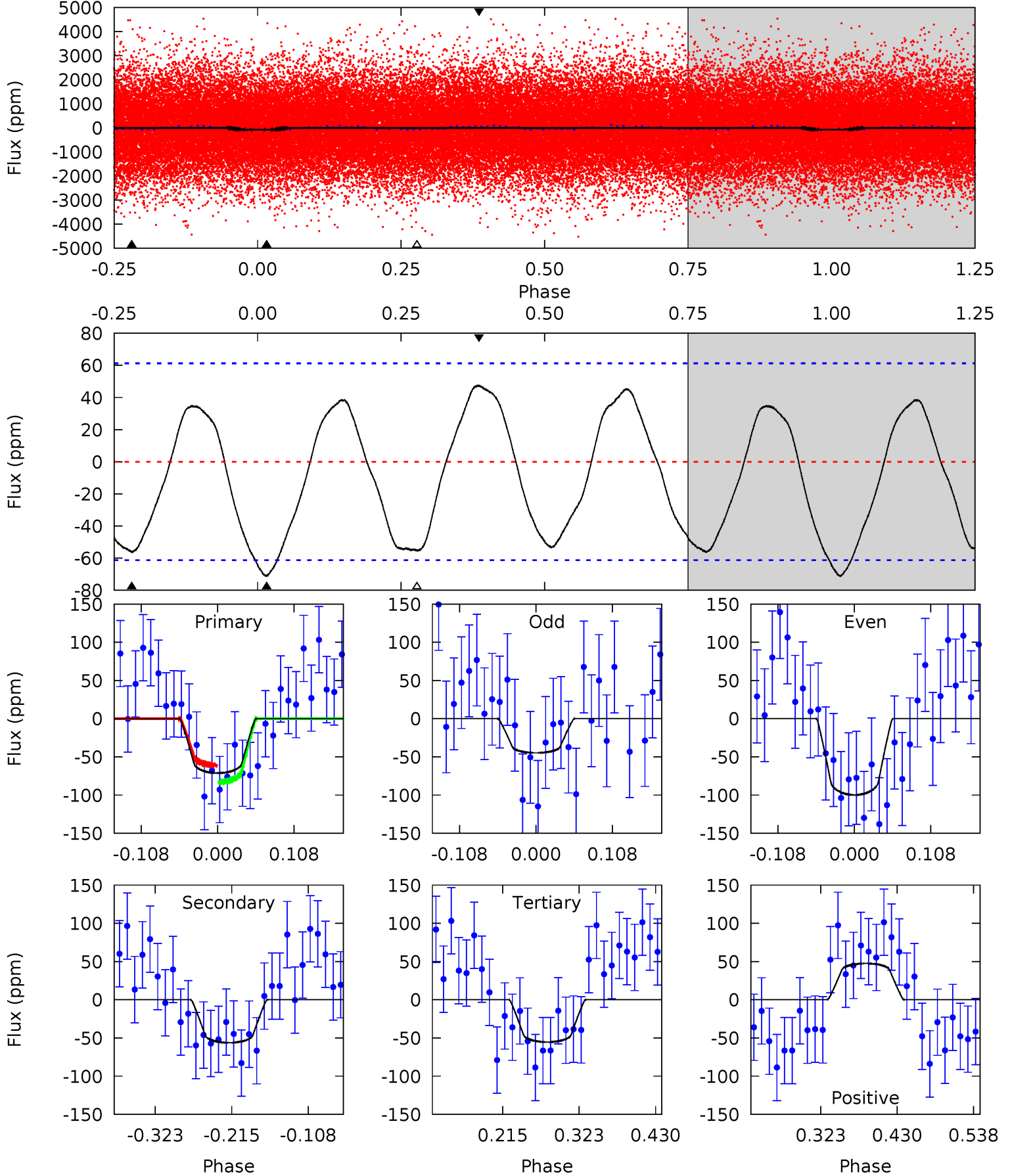




# DV Model-Shift Uniqueness Test

012470709-01, P = 1.024308 Days, E = 131.202444 Days

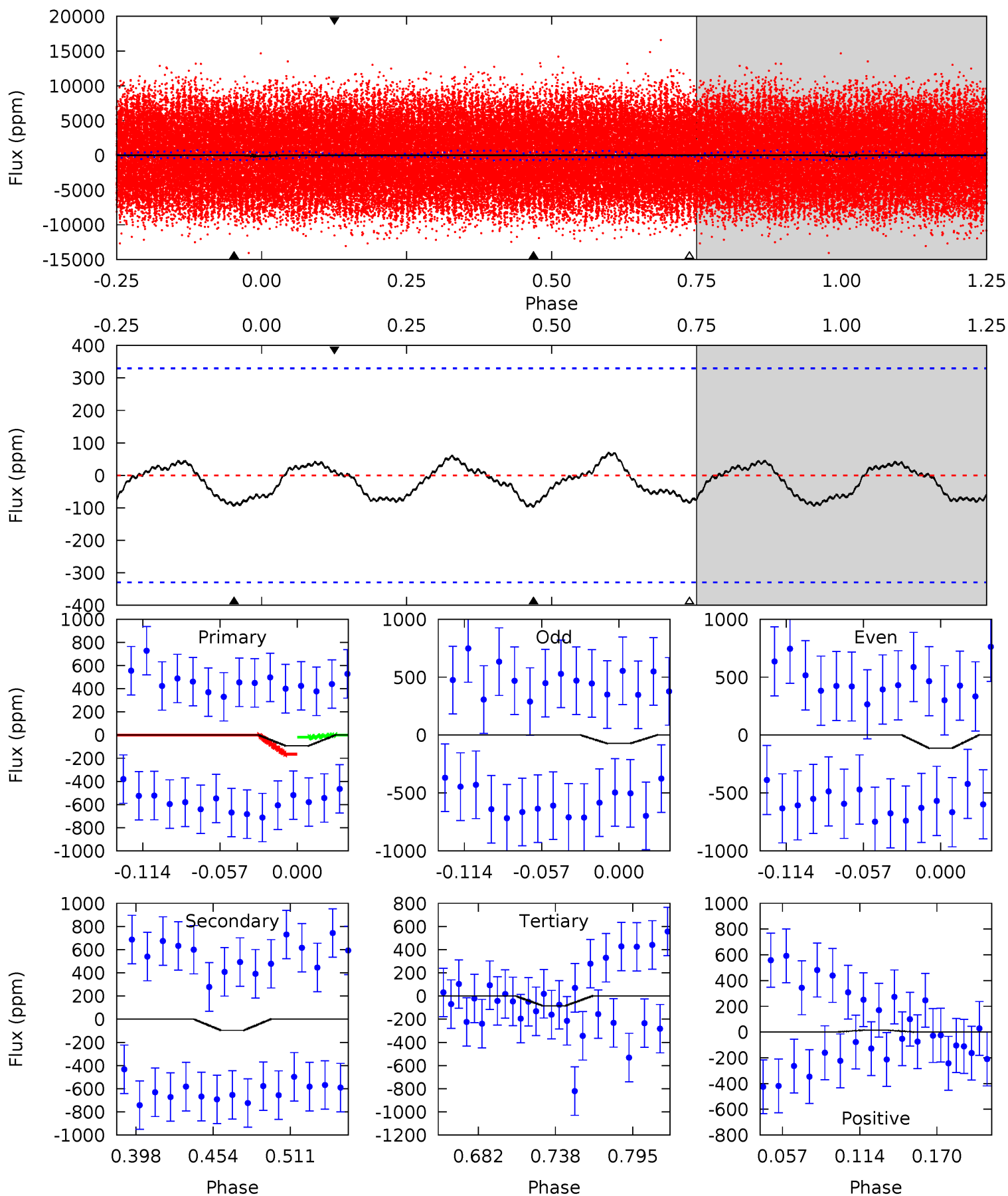
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
5.28	4.17	4.11	3.53	4.55	1.61	2.58	1.17	1.76	0.06	0.65	2.05	0.90	0.40	0.81



# Alt Model-Shift Uniqueness Test

012470709-01, P = 1.024369 Days, E = 131.208309 Days

Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
1.32	1.37	1.20	0.21	4.68	1.90	0.58	0.12	1.11	0.17	1.16	0.29	-0.84	0.42	1.04



### Stellar Parameters For KIC 012470709

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$7421^{+207}_{-337}$	$4.192^{+0.090}_{-0.210}$	$0.000^{+0.200}_{-0.350}$	$1.656^{+0.550}_{-0.254}$	$1.556^{+0.222}_{-0.222}$	$0.482^{+0.244}_{-0.259}$
	+3%/-5%	+2%/-5%	+inf%/-inf%	+33%/-15%	+14%/-14%	+51%/-54%
Source	KIC0	KIC0	KIC0	DSEP		

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

### Secondary Eclipse Parameters for KIC 012470709-01 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-56 \pm 13$	$2.01^{+1.39}_{-1.23}$	$3927^{+301}_{-243}$	$6002^{+4802}_{-1473}$	$4.071^{+20.733}_{-2.775}$
Alt.	$-96 \pm 70$	$2.19^{+1.56}_{-1.29}$	$3919^{+287}_{-245}$	$6322^{+5321}_{-1983}$	$5.236^{+28.495}_{-4.129}$

$T_{max}$  = 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

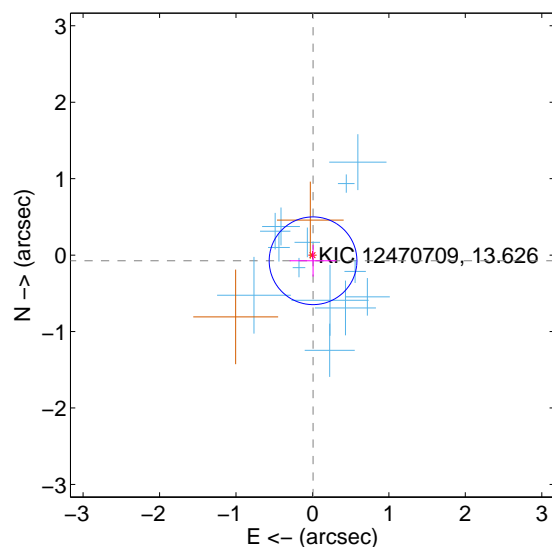
Supplemental centroid analysis for 012470709-01. Kepler magnitude: 13.63. Transit SNR 7.80

There are 13 quarters with good PRF difference image offsets

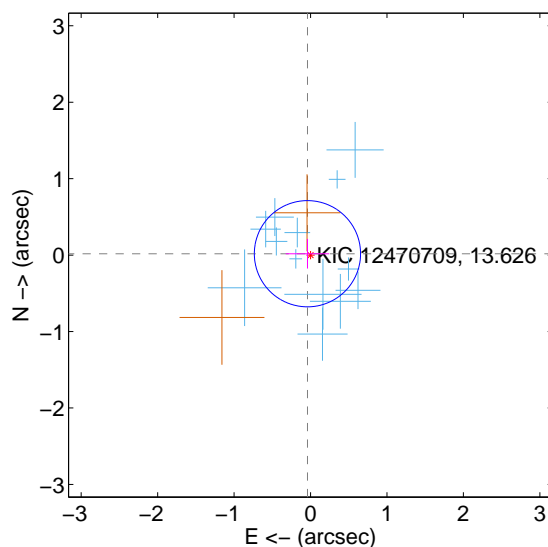
The direct PRF centroid is offset from the target star catalog position by about 0.13 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.075 \pm 0.191$	0.39	$-0.008 \pm 0.305$	$-0.074 \pm 0.206$
PRF-fit source offset from KIC position	$0.044 \pm 0.232$	0.19	$0.040 \pm 0.285$	$0.018 \pm 0.194$
photometric centroid source offset	$0.82 \pm 0.60$	1.36	$0.54 \pm 0.56$	$0.62 \pm 0.64$

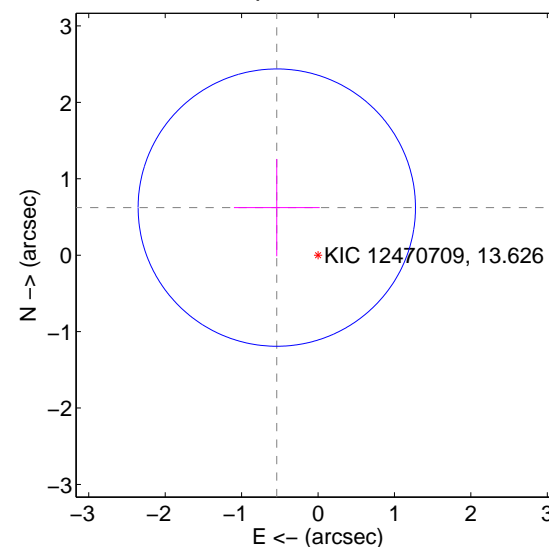
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

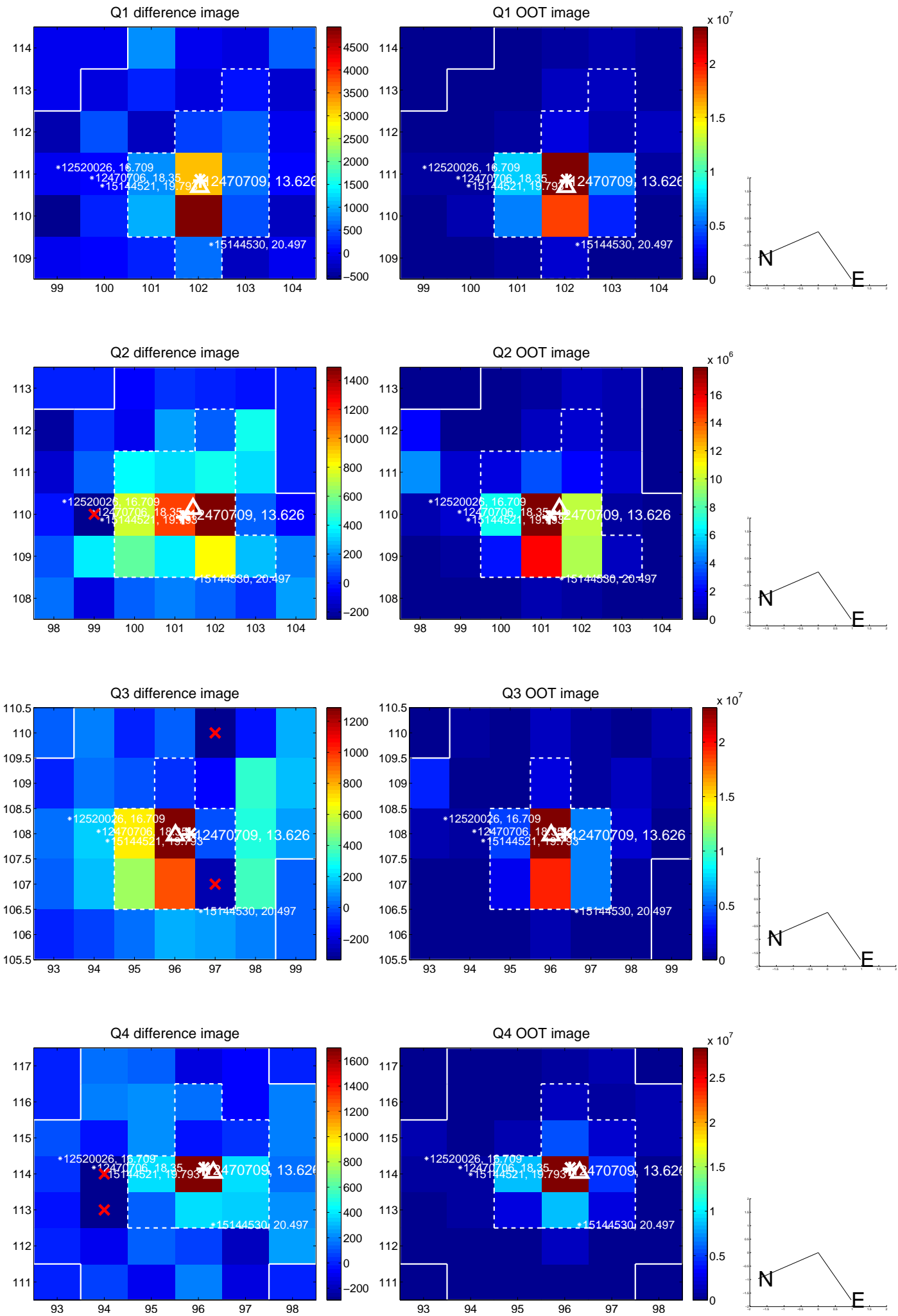


offset from photometric centroids

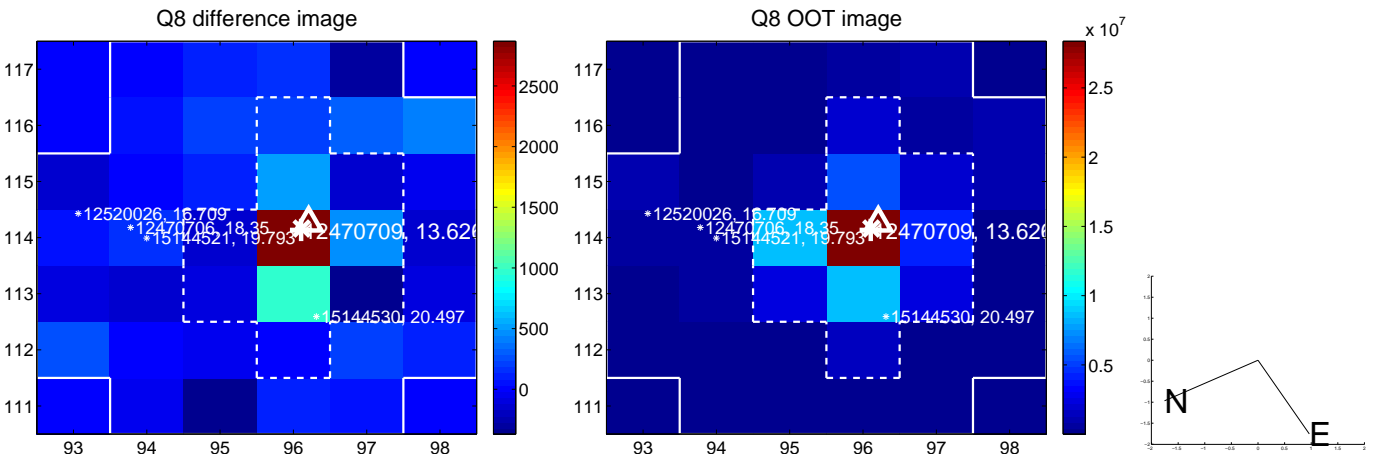
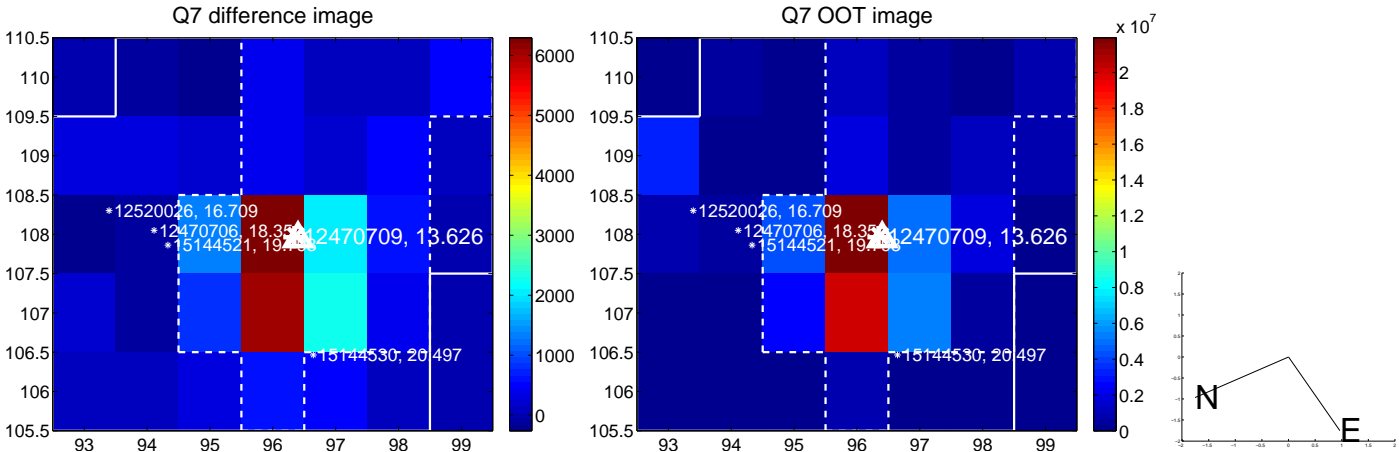
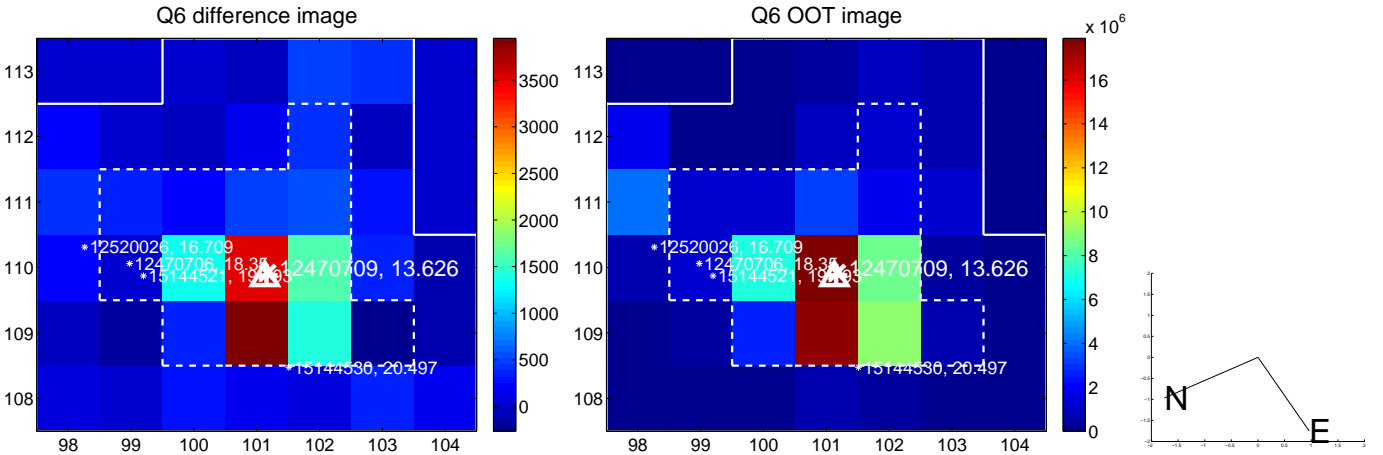
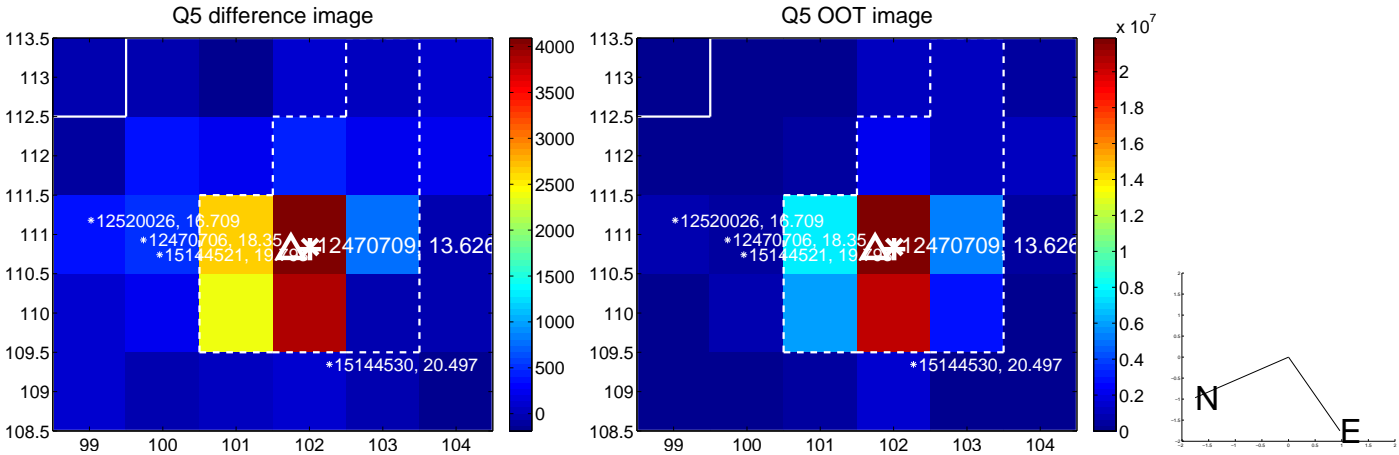


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

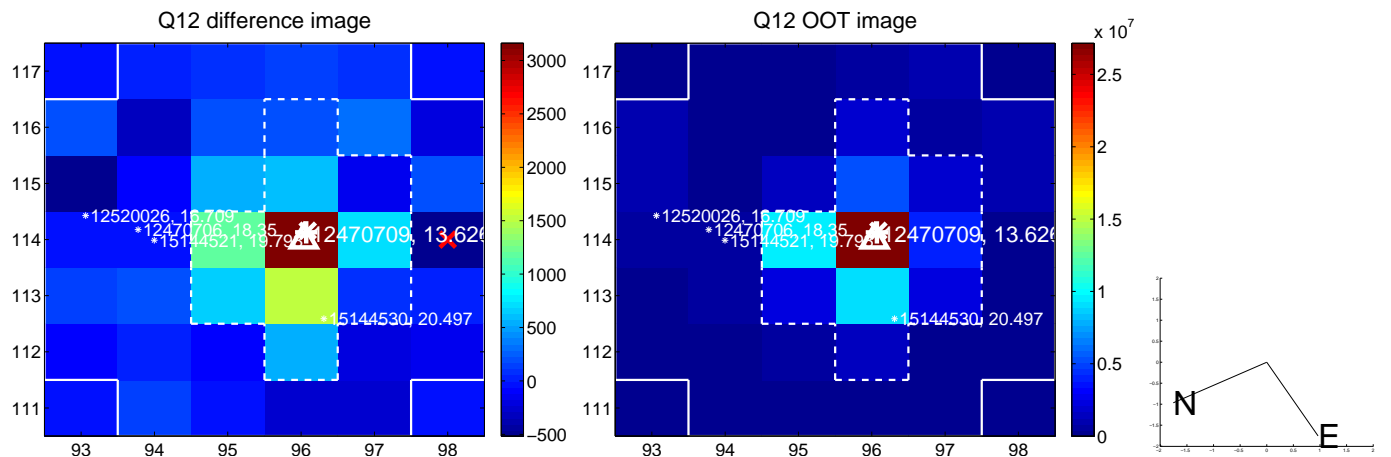
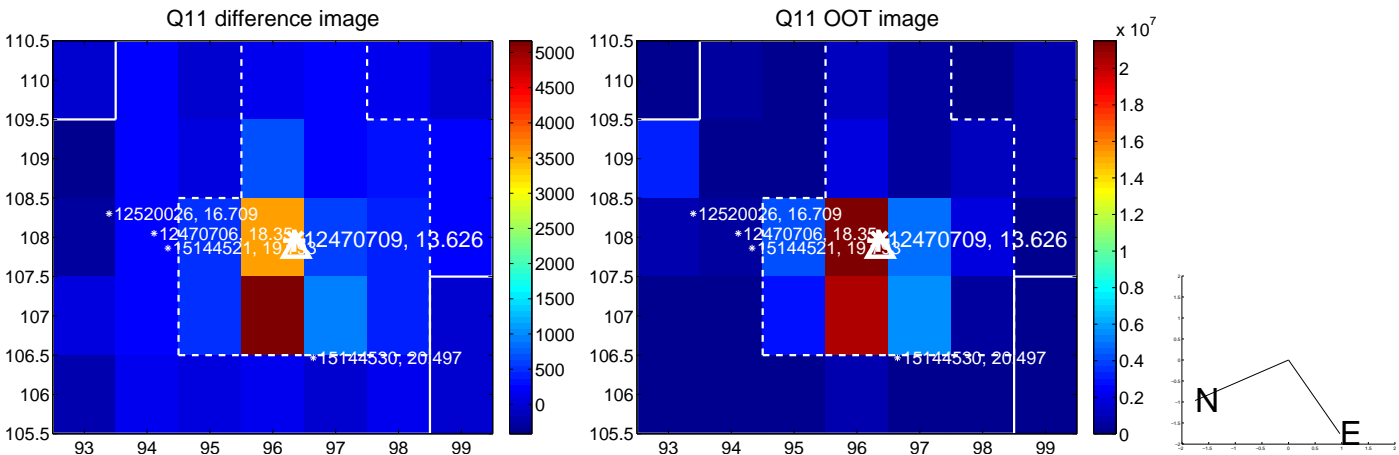
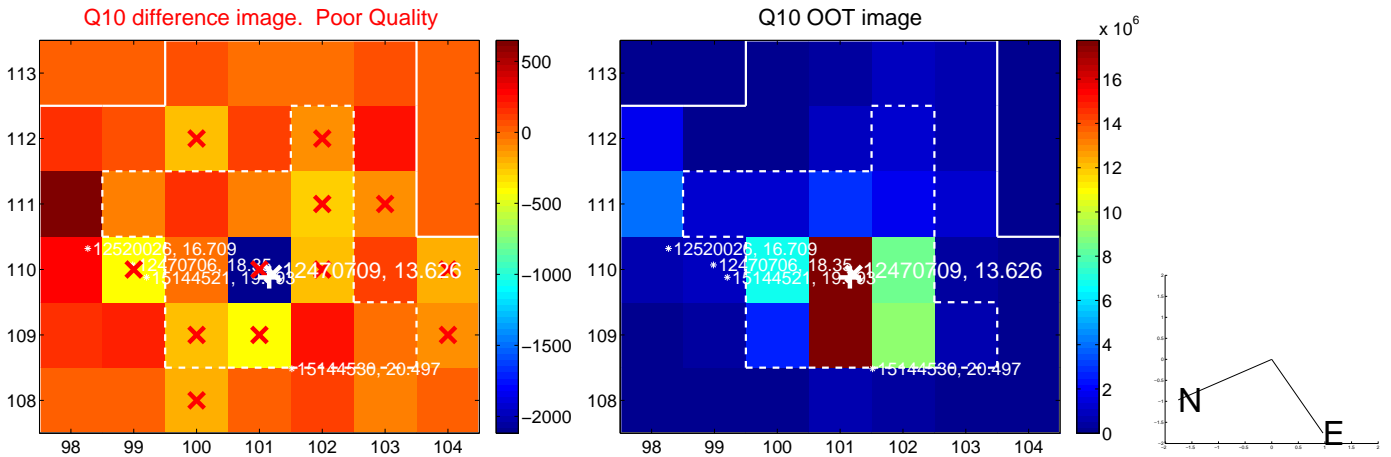
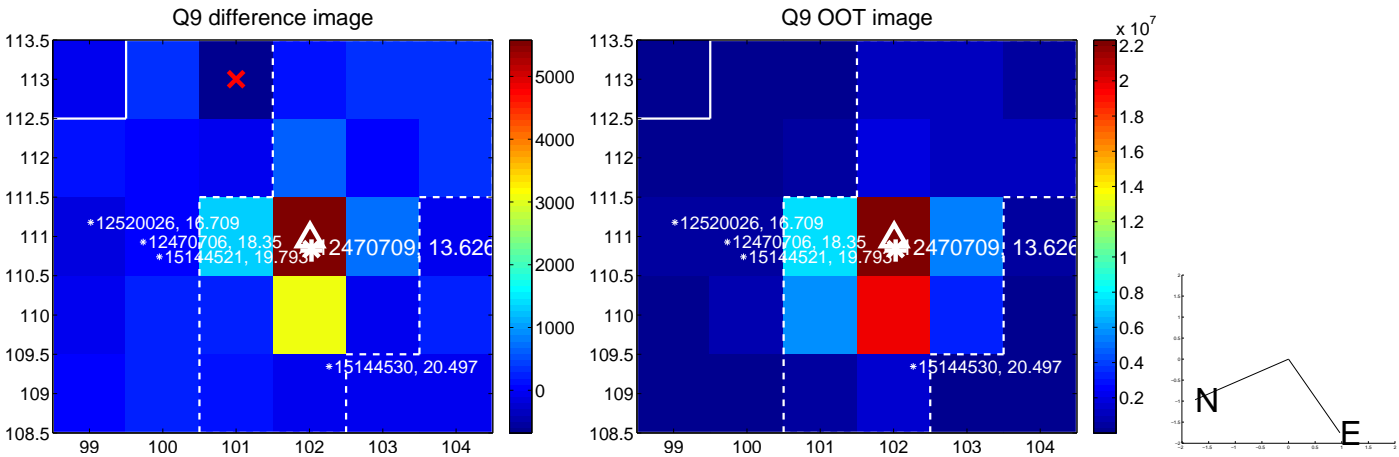


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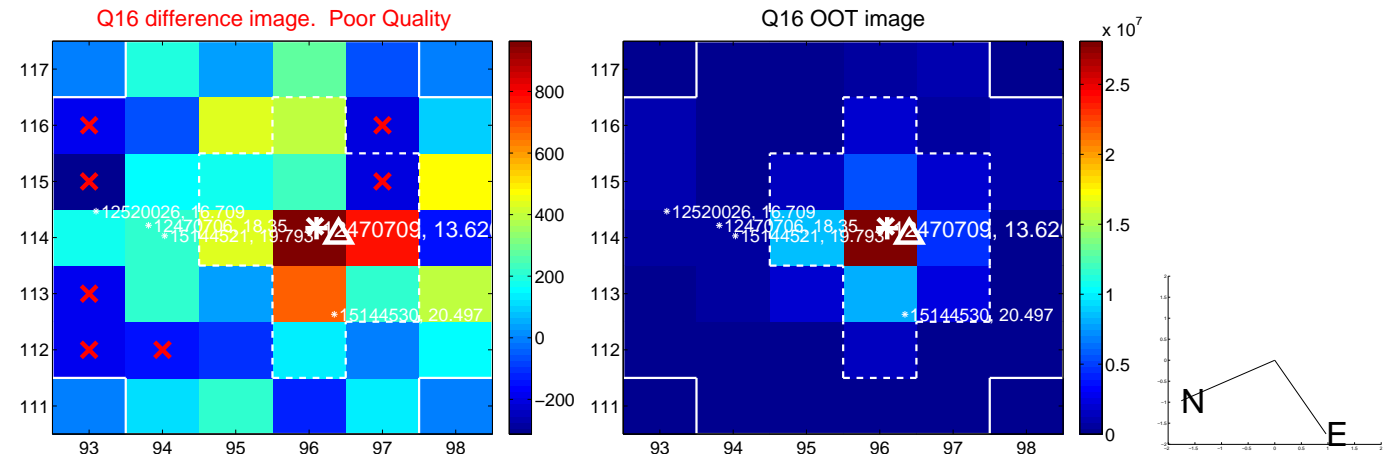
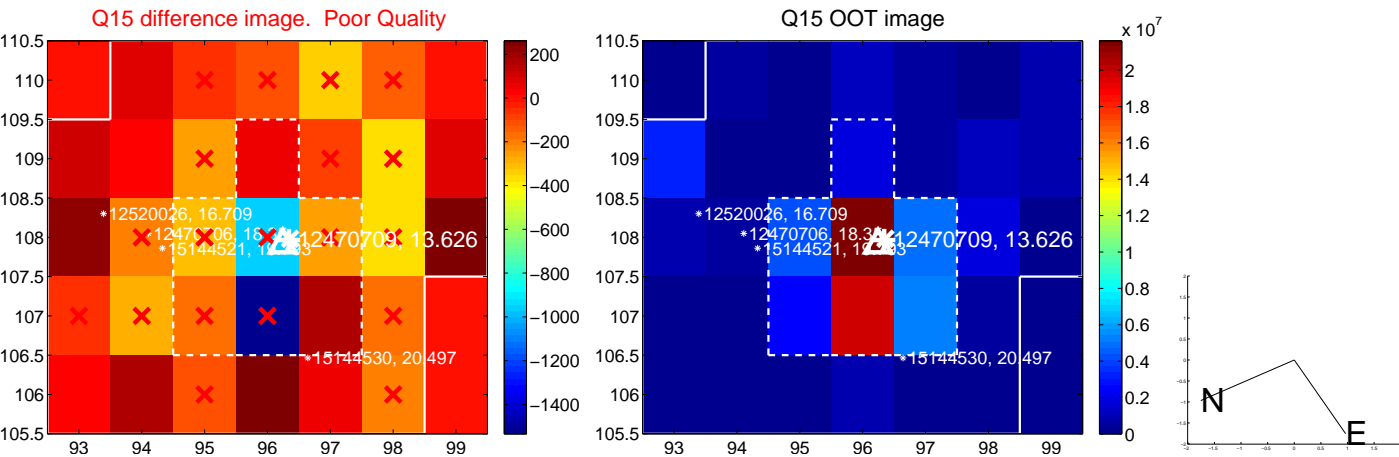
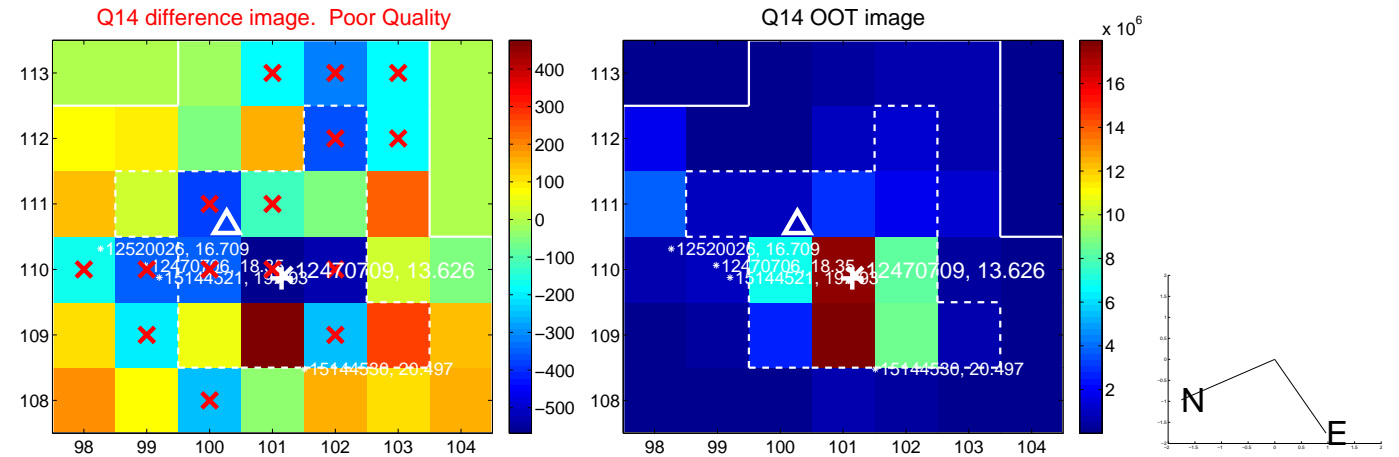
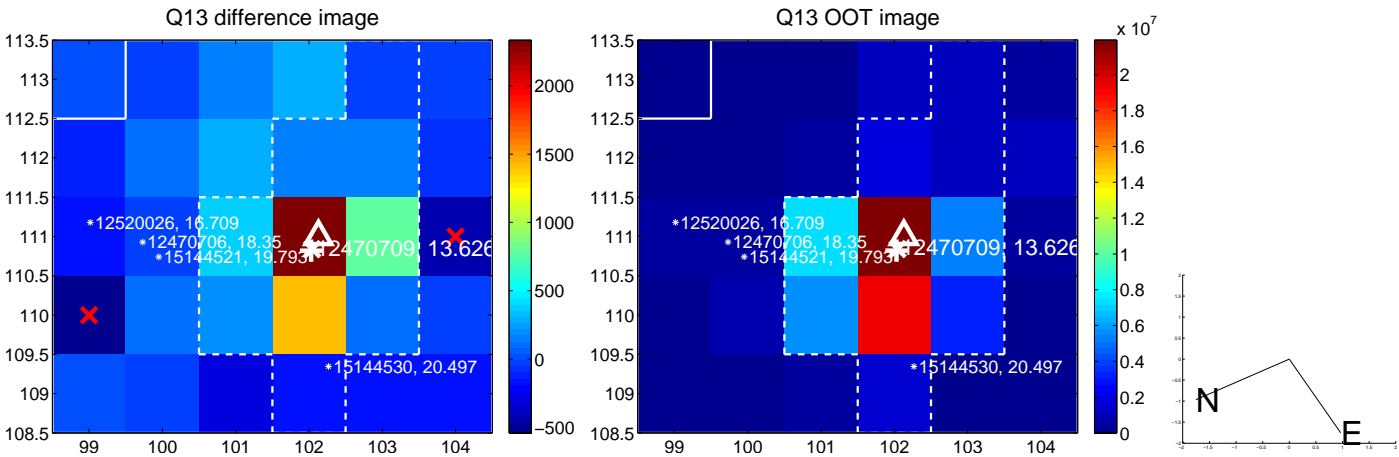




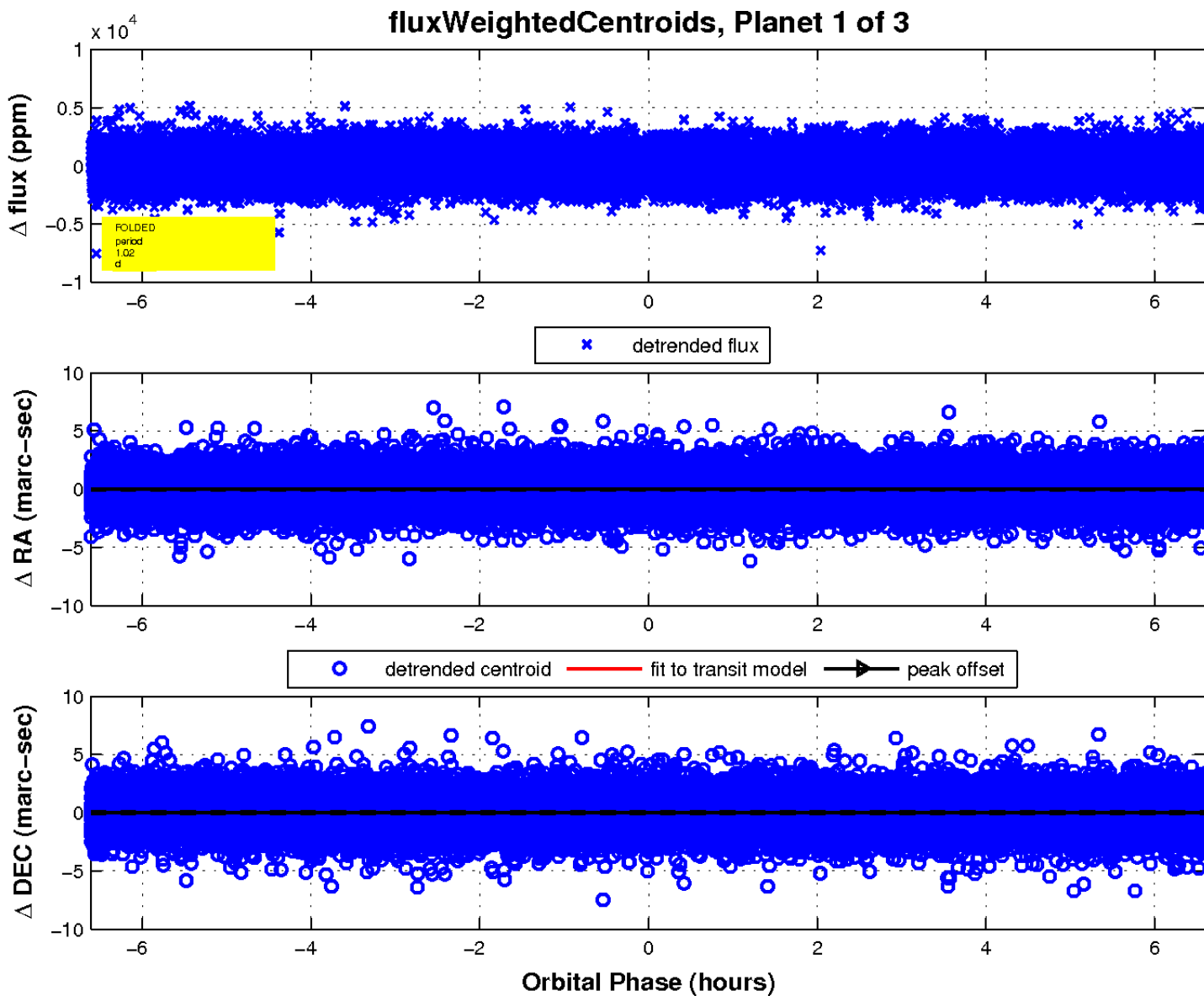
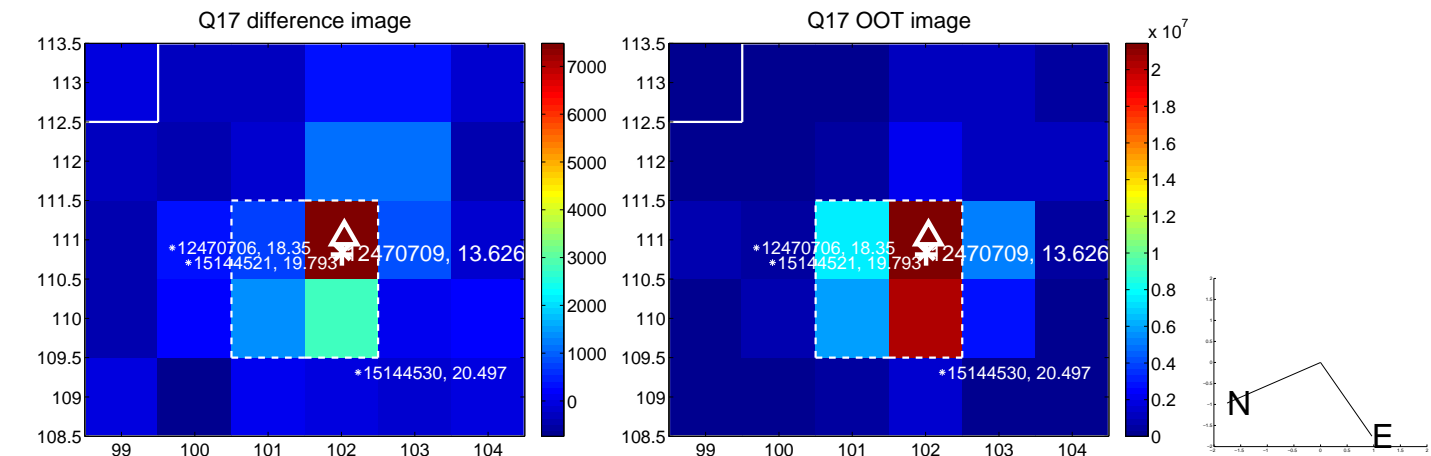
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

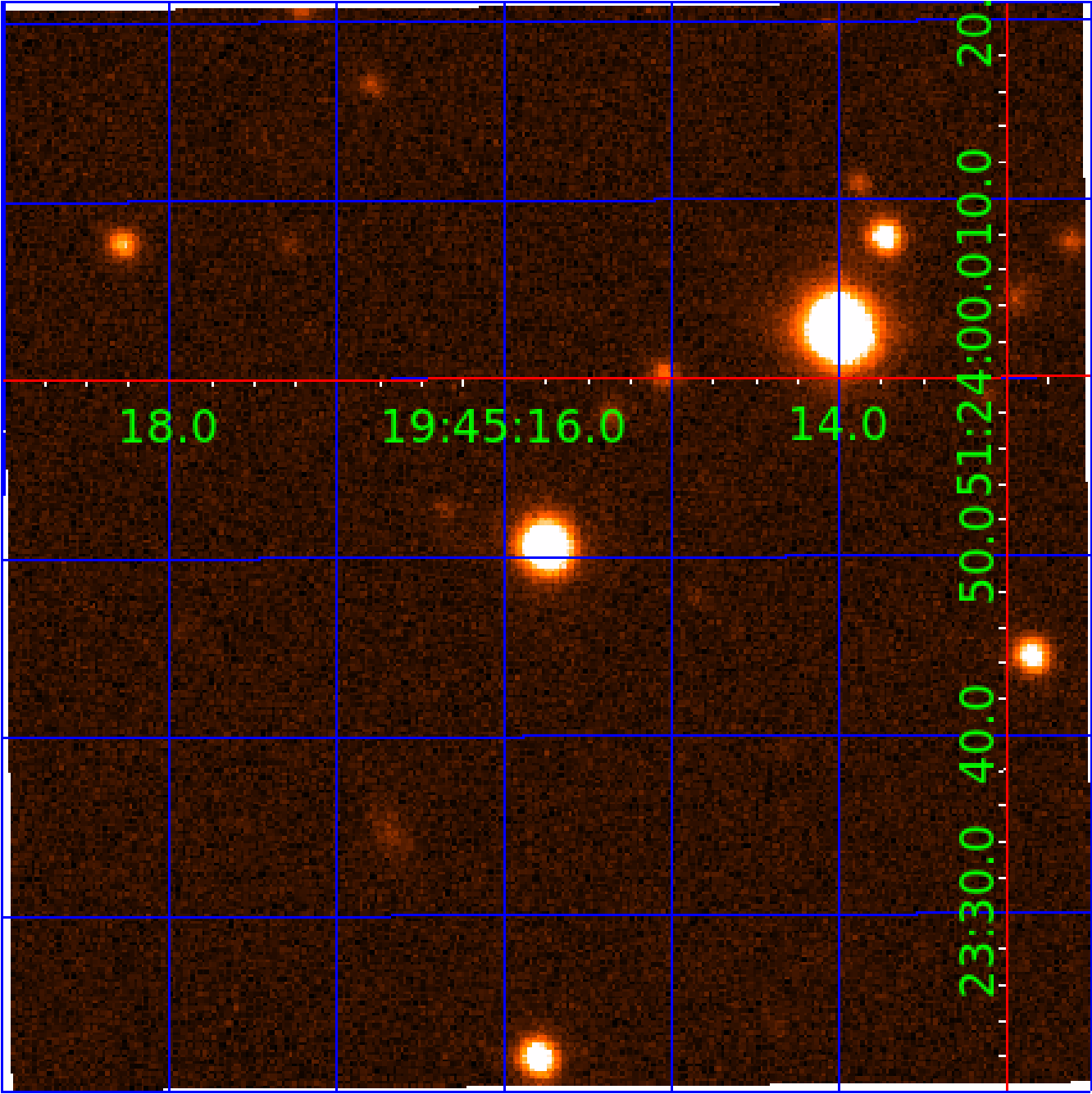


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination





# KIC 012470709

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
012470709-01	OBS	No	1.024308	132.226752	76.8	2.204	11.6	7.8	1.66	7421	1.66	14024.15
012470709-02	OBS	No	0.512177	131.942841	102.5	1.409	10.7	9.9	1.66	7421	1.95	35336.58
012470709-03	OBS	No	3.350104	132.813703	175.9	8.260	7.9	7.3	1.66	7421	2.36	2888.73

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
012470709-01	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT
012470709-02	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—SAME_NTL_PERIOD
012470709-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_ZUMA—TRANS_GAPPED—LPP_DV—LPP_ALT

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

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

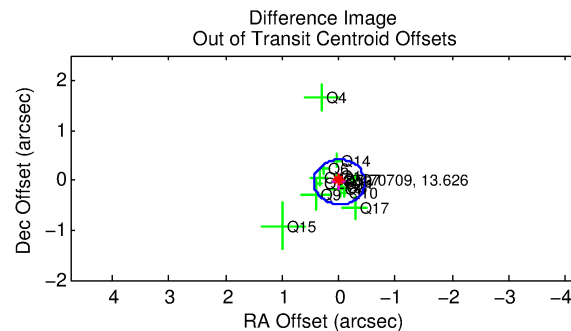
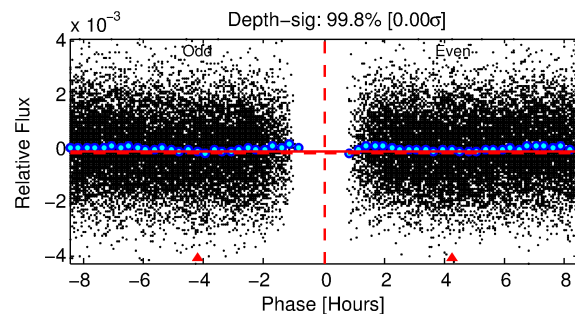
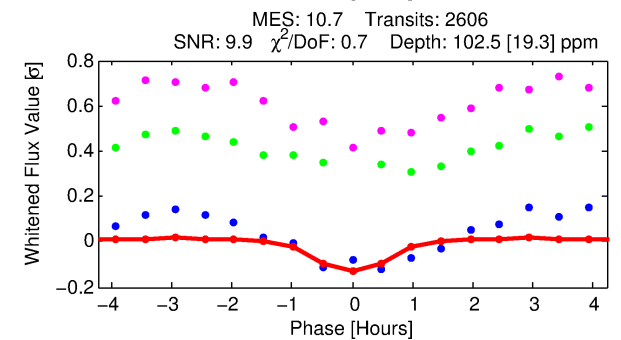
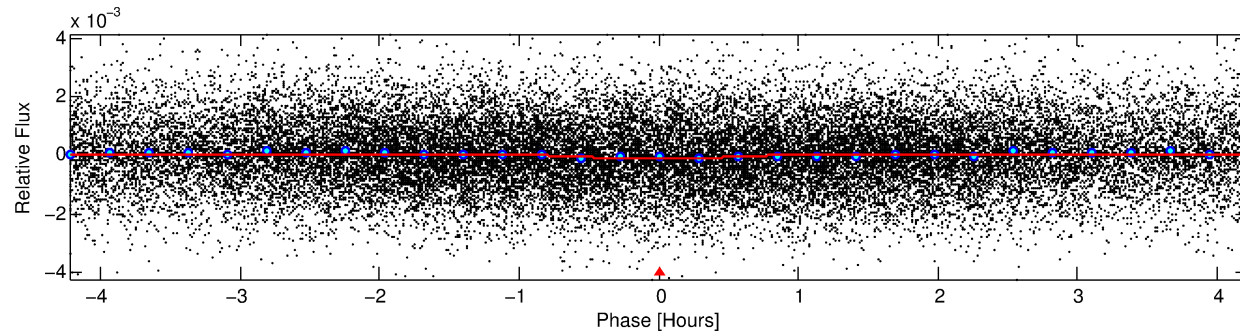
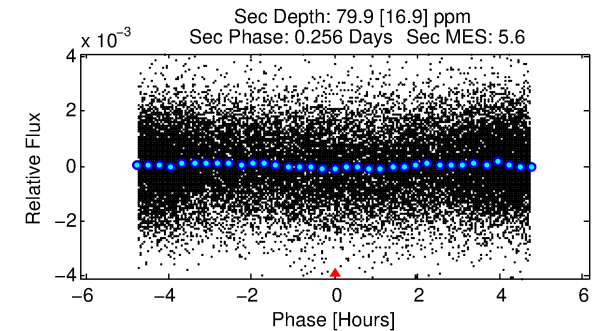
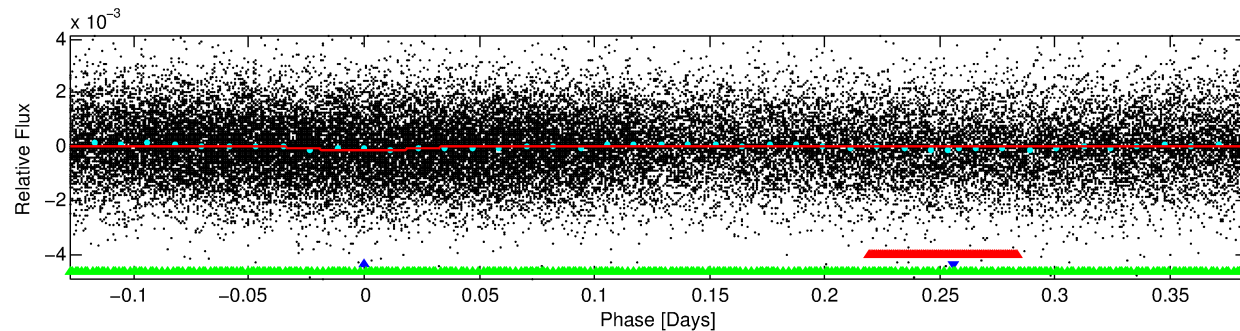
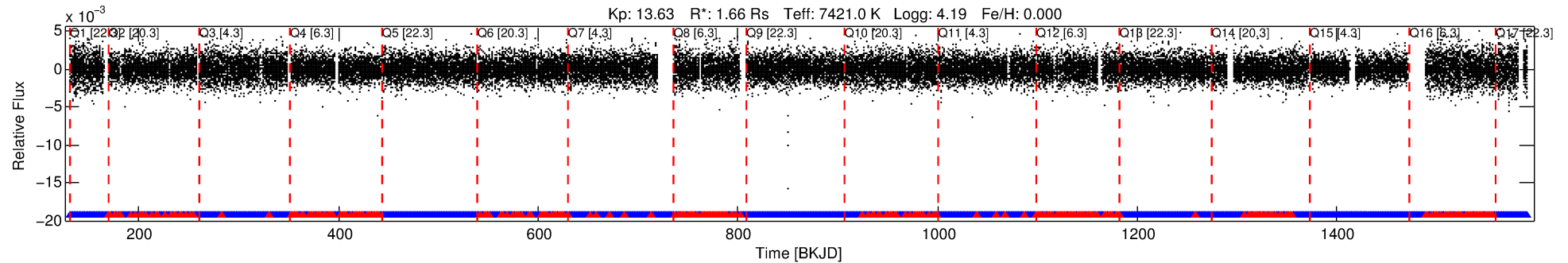
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 012470709-02

No Significant Match Found

# DV One-Page Summary

KIC: 12470709 Candidate: 2 of 3 Period: 0.512 d



## DV Fit Results:

Period = 0.51218 [0.00001] d  
Epoch = 131.9428 [0.0027] BKJD  
Rp/R\* = 0.0108 [0.0076]  
a/R\* = 1.59 [4.38]  
b = 0.90 [0.98]  
Seff = 35336.58 [15237.33]  
Teq = 3496 [377] K  
Rp = 1.95 [1.51] Re  
a = 0.0145 [0.0040] AU  
Ag = 2.45 [3.61] [0.40σ]  
Teffp = 6763 [2420] K [1.33σ]

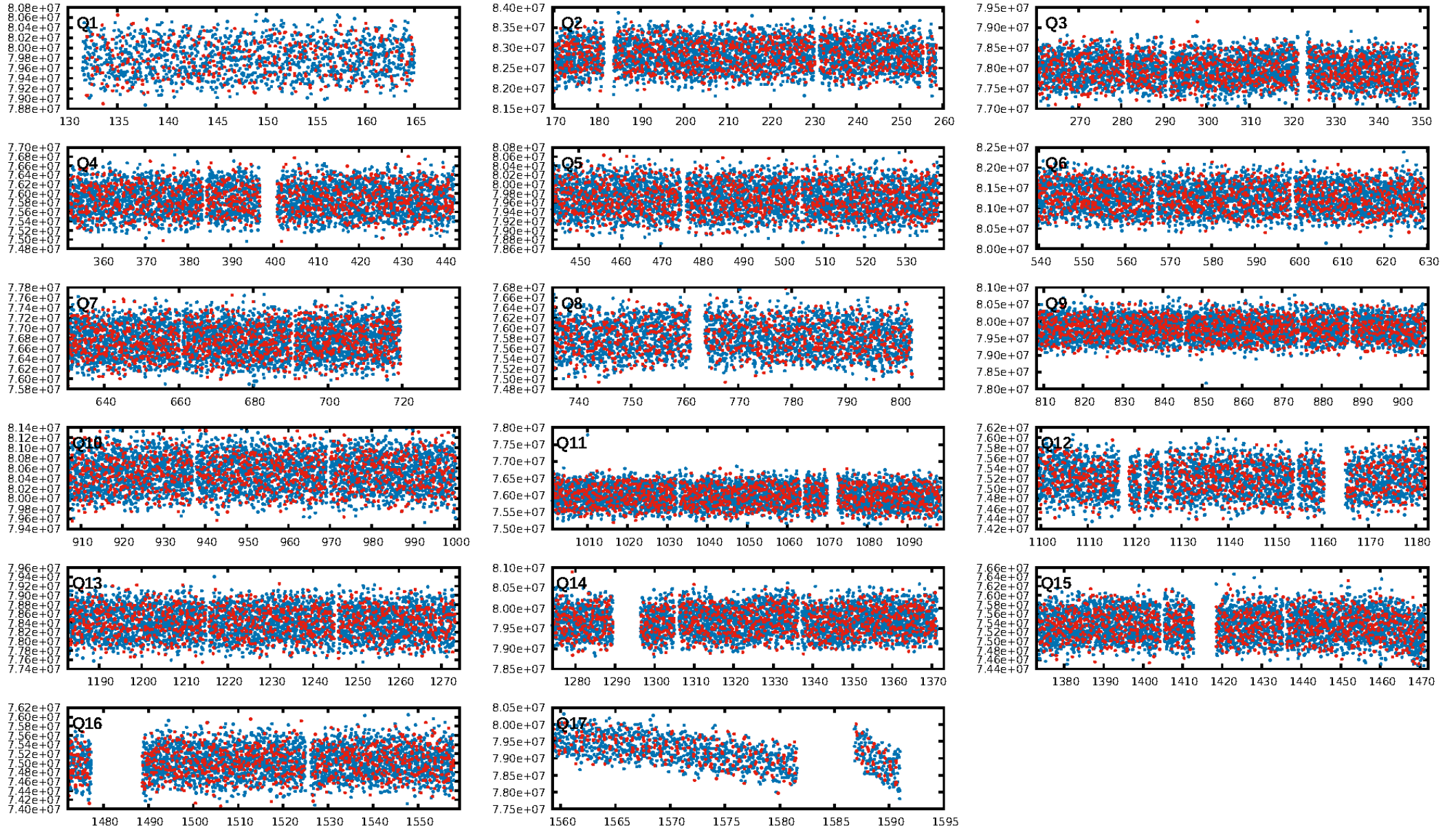
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [4.70σ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: 6.47e-41  
RollingBand-fgt: 0.86 [2146/2490]  
GhostDiagnostic-chr: 1.271  
Centroid-sig: 25.9%  
Centroid-so: 0.492 arcsec [1.15σ]  
OotOffset-rm: 0.040 arcsec [0.27σ]  
OotOffset-st: 4/4/3/5 [16]  
KicOffset-rm: 0.078 arcsec [0.61σ]  
KicOffset-st: 4/4/3/5 [16]  
DiffImageQuality-fgm: 0.75 [12/16]  
DiffImageOverlap-fno: 0.82 [14/17]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 29-Jan-2016 22:02:18 Z

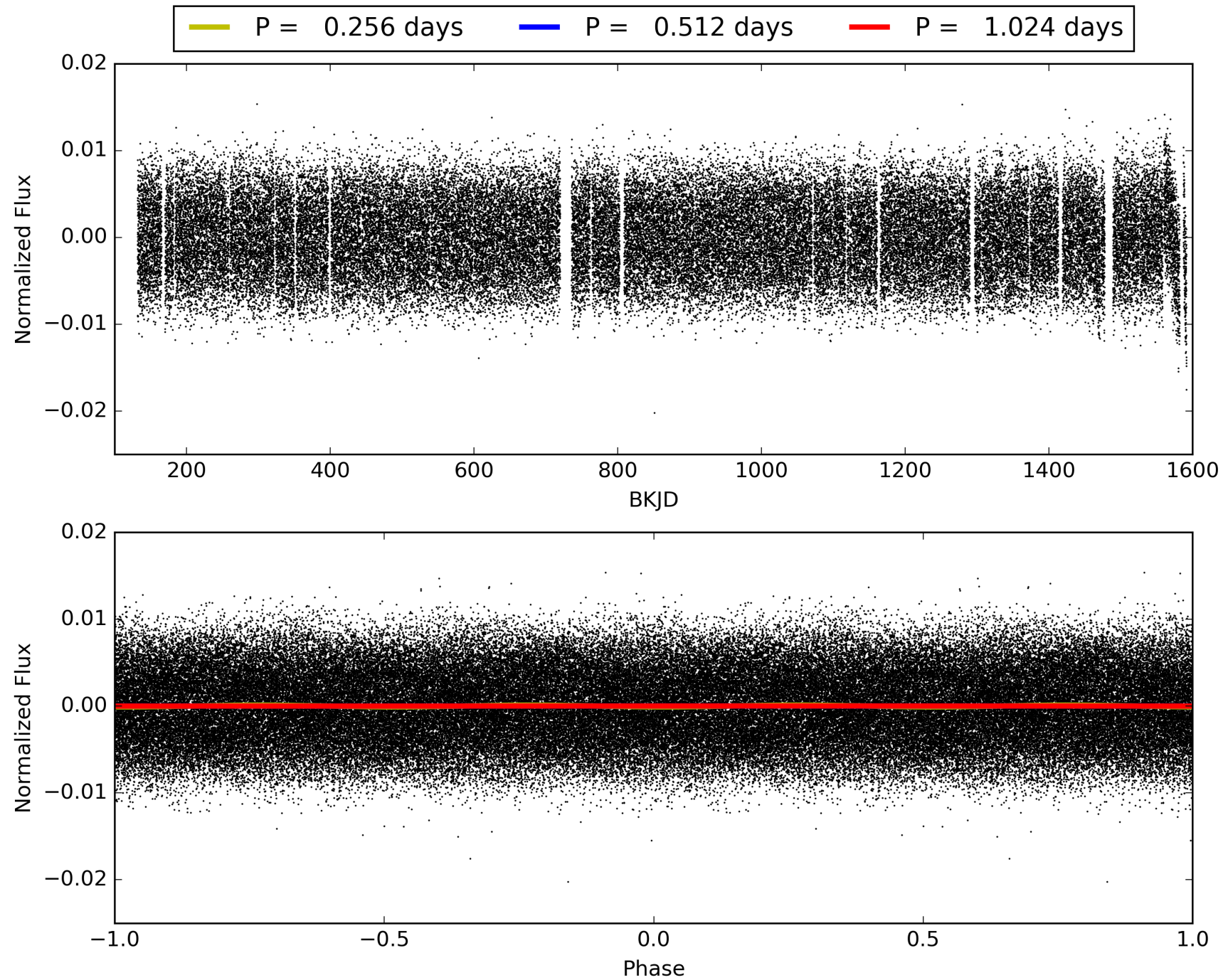
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 012470709-02, PDC Light Curves





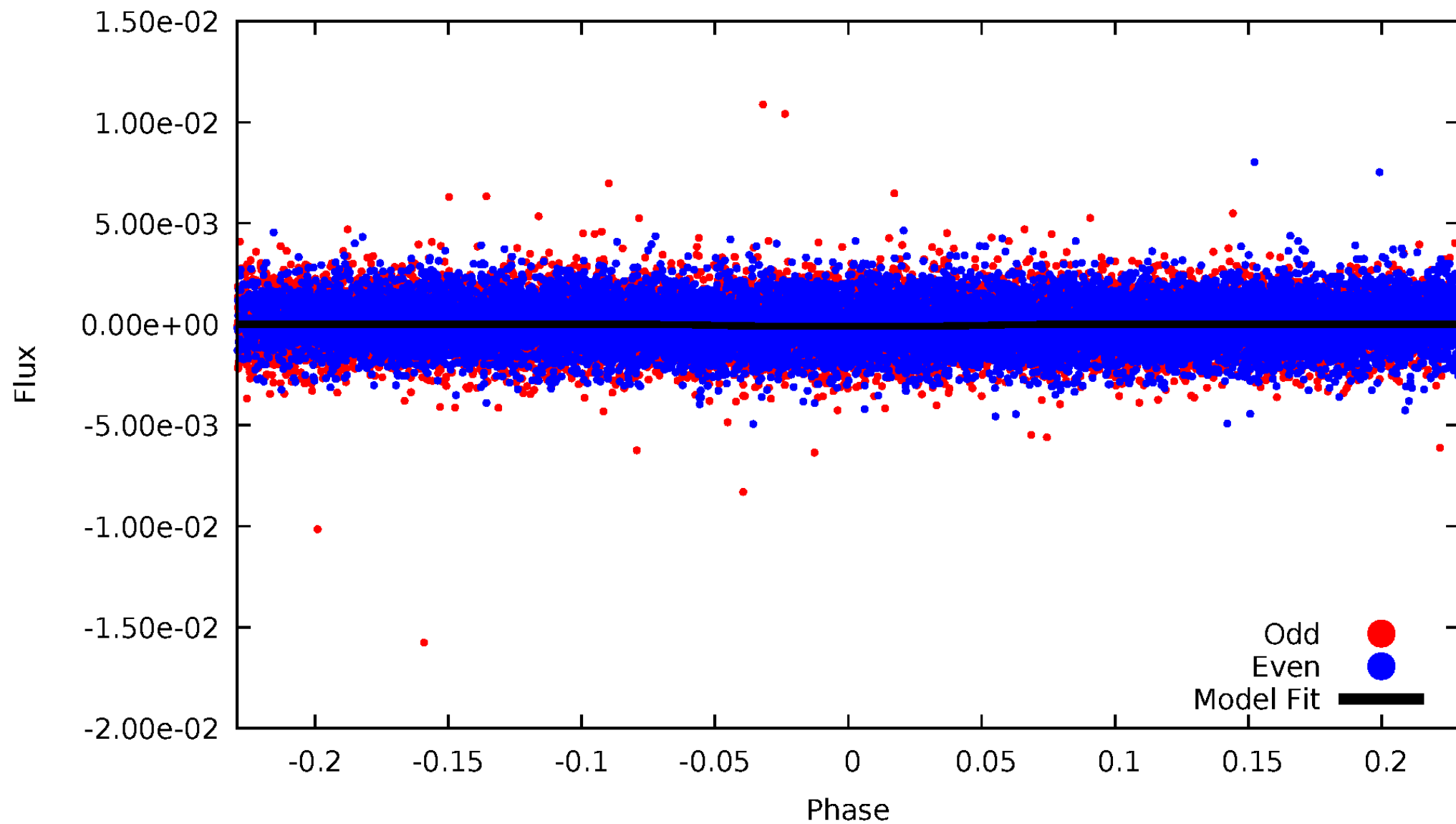
TCE 012470709-02





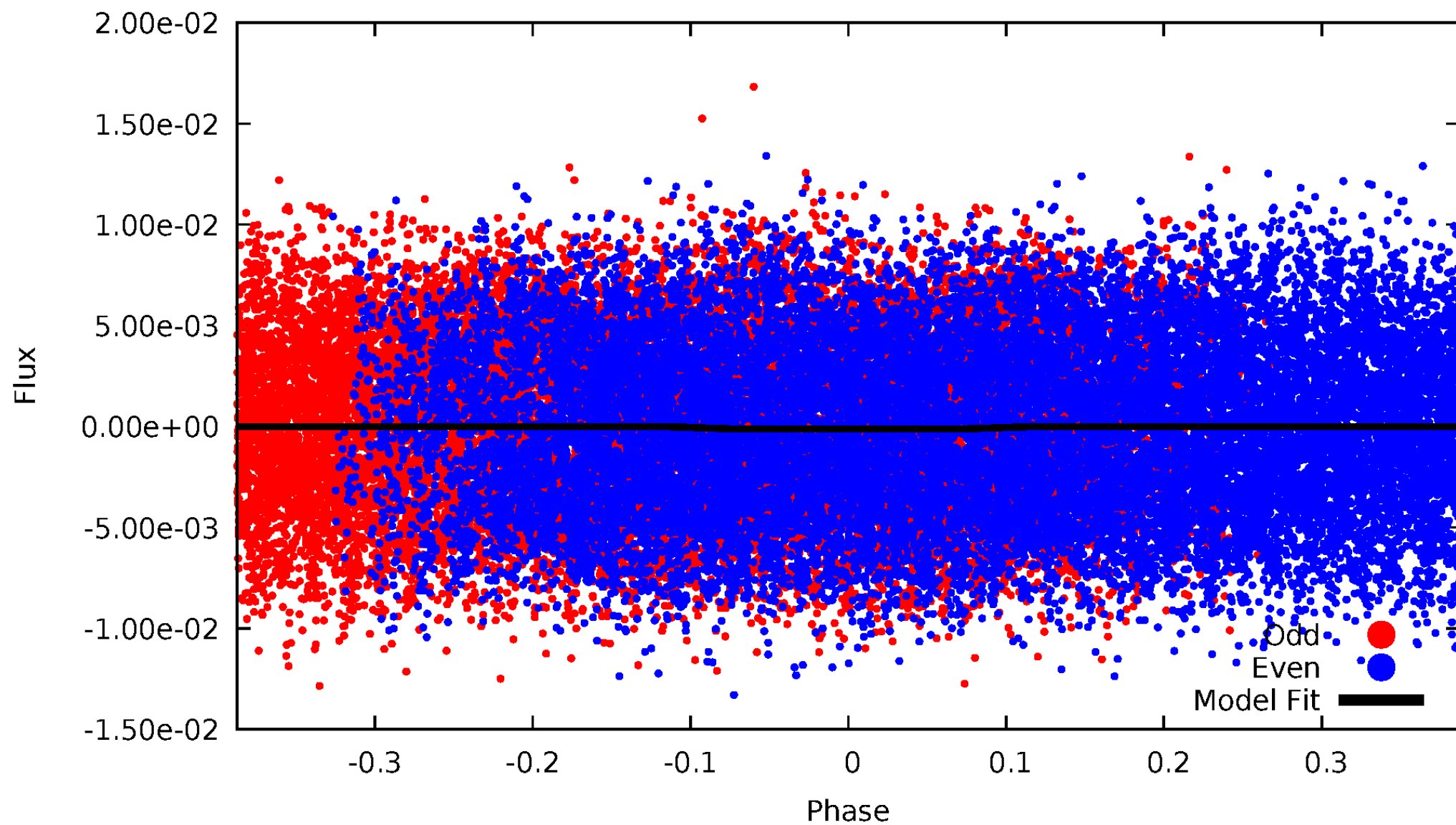
# DV Odd/Even

TCE 012470709-02



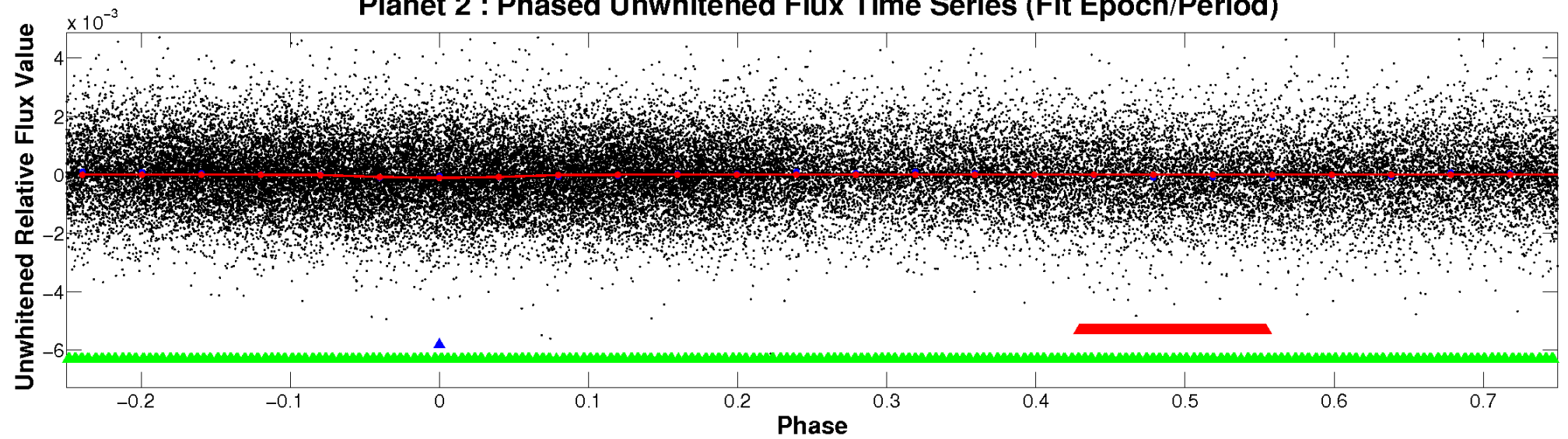
# ALT Odd/Even

TCE 012470709-02

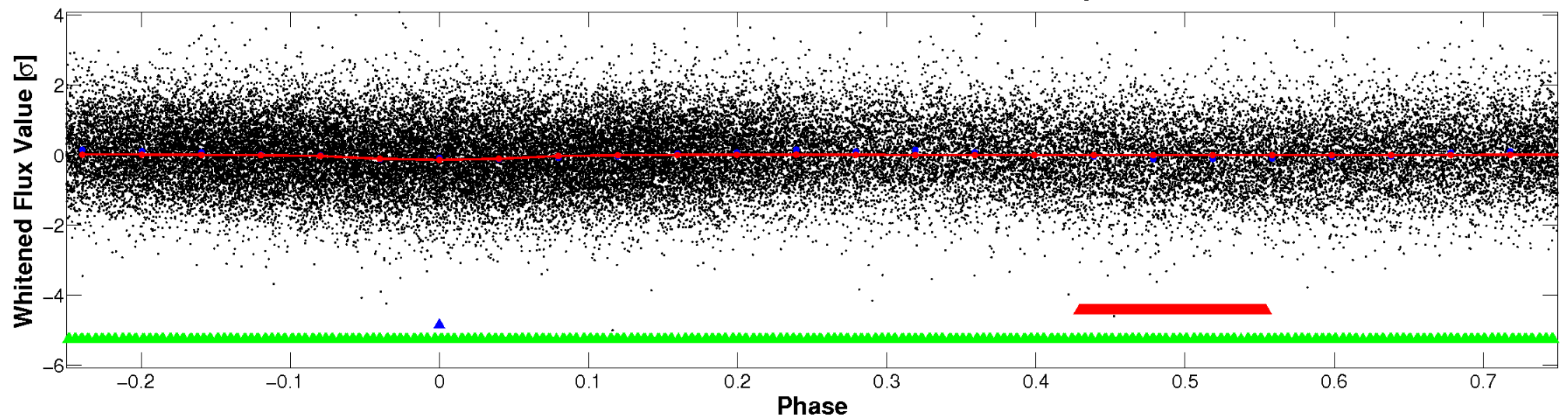


# Non-Whitened Vs. Whitened Light Curve

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

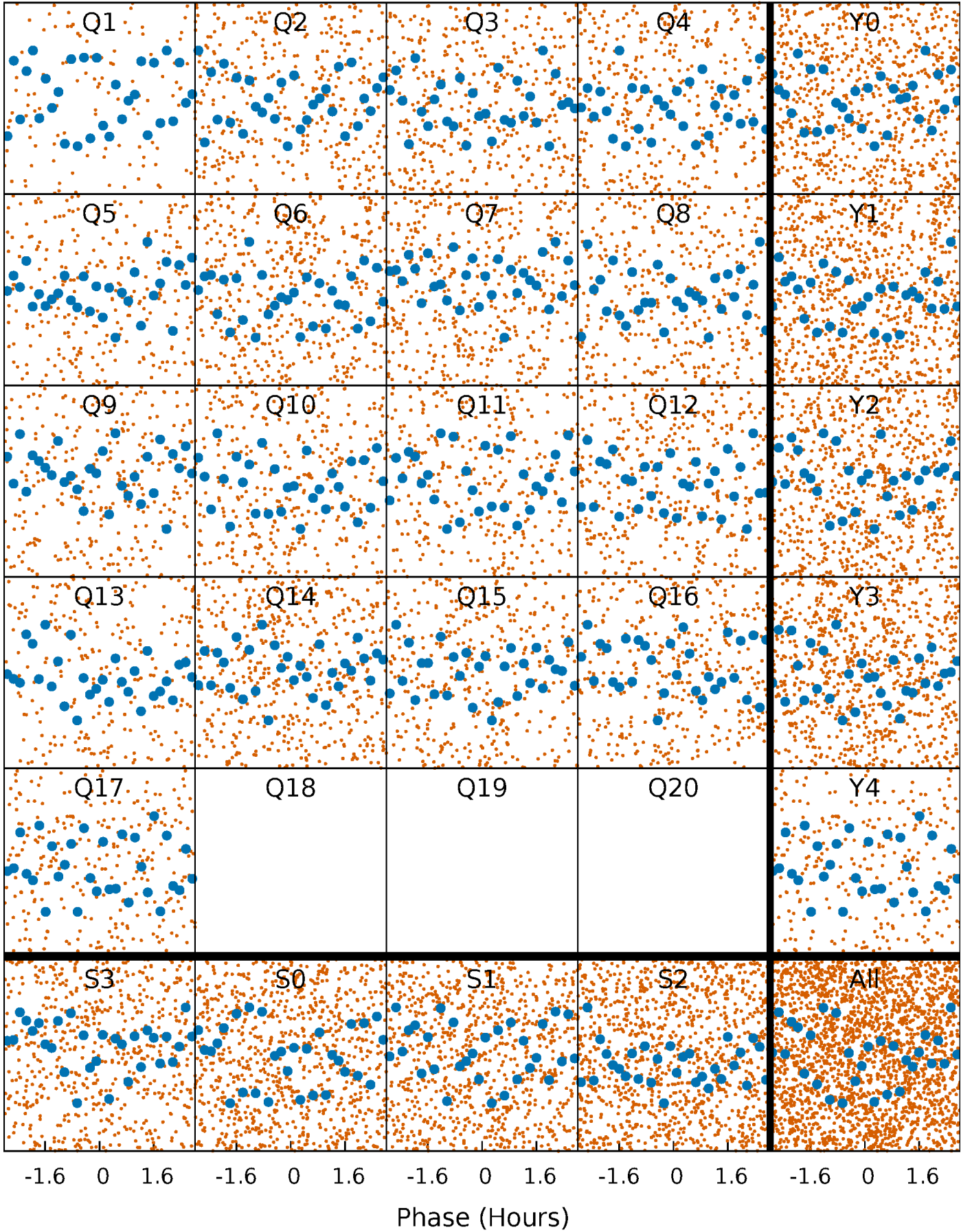


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

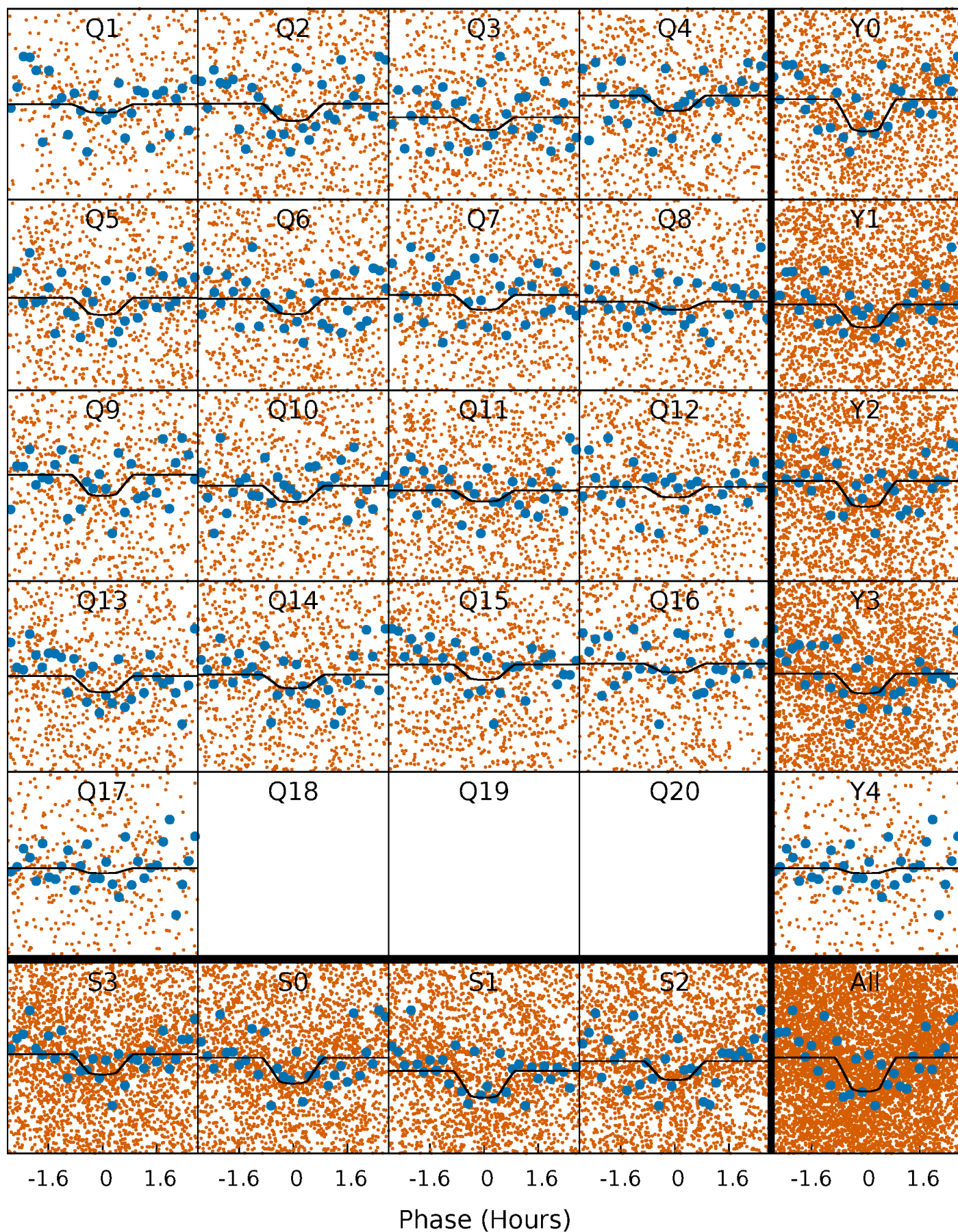
TCE 012470709-02   P= 0.512177 Days    $T_0=131.942841$  (BKJD)





# DV Quarter-Phased Transit Curves

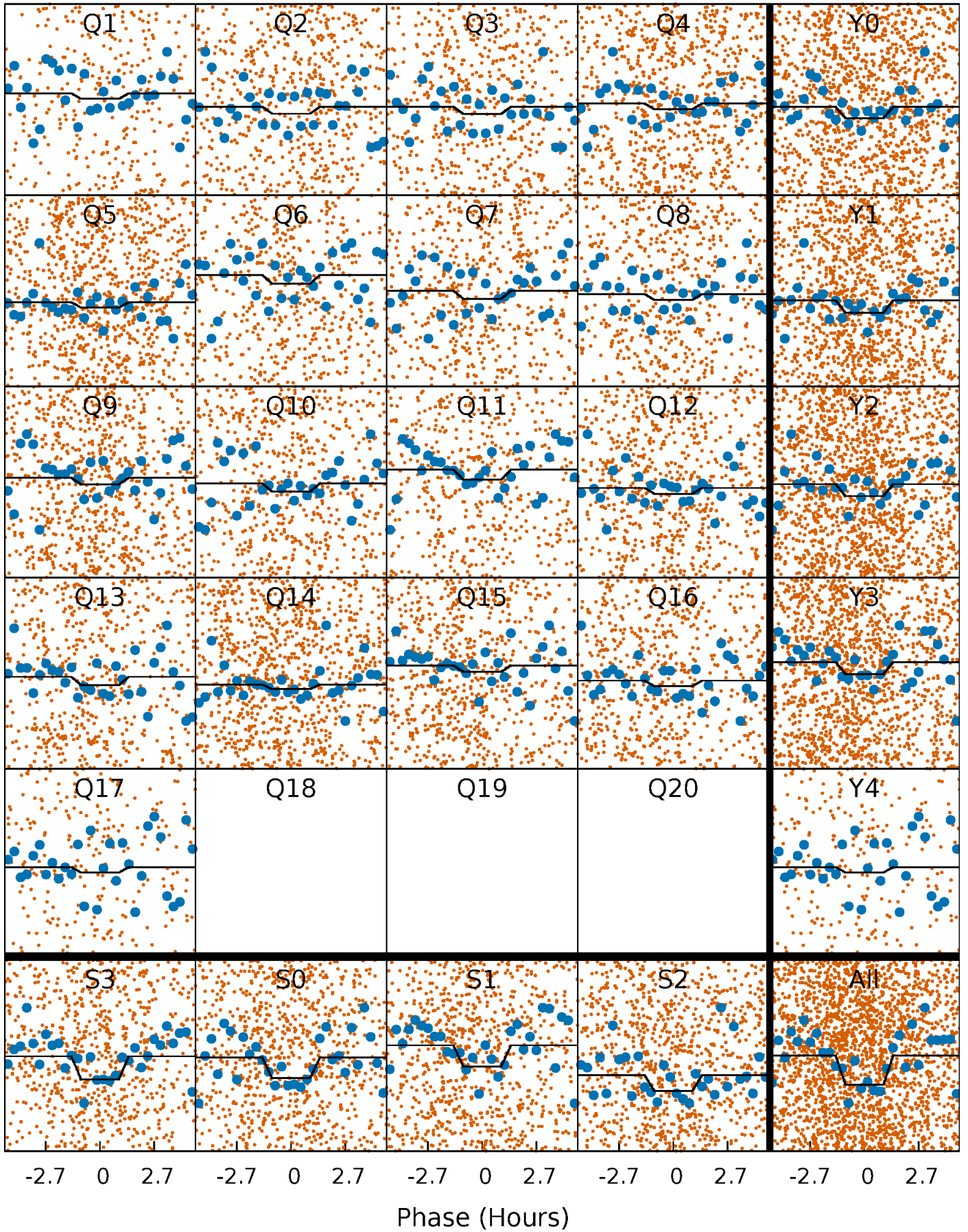
TCE 012470709-02 P= 0.512177 Days  $T_0=131.942841$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

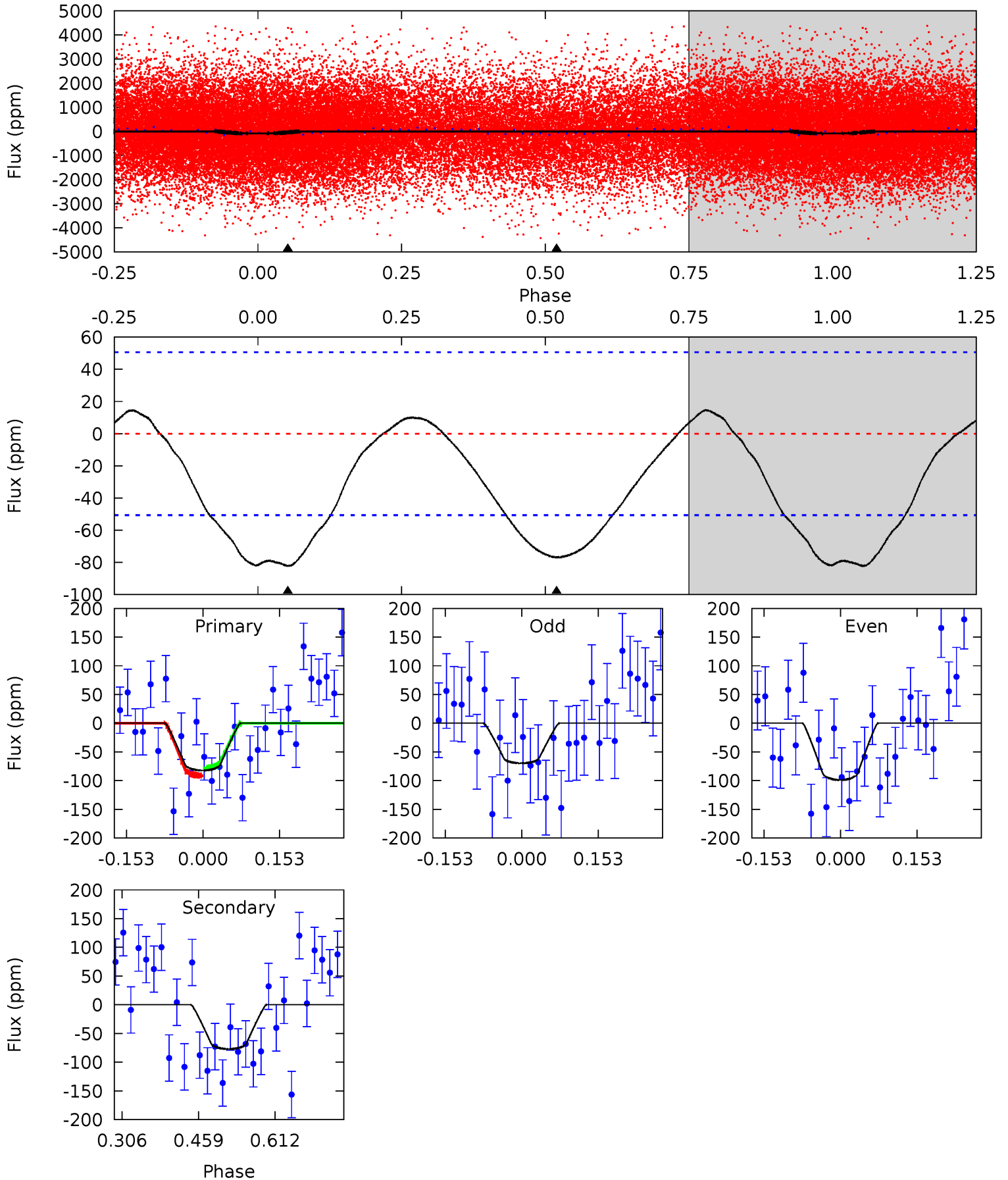
TCE 012470709-02 P= 0.512186 Days  $T_0=131.941324$  (BKJD)



# DV Model-Shift Uniqueness Test

012470709-02, P = 0.512177 Days, E = 131.430664 Days

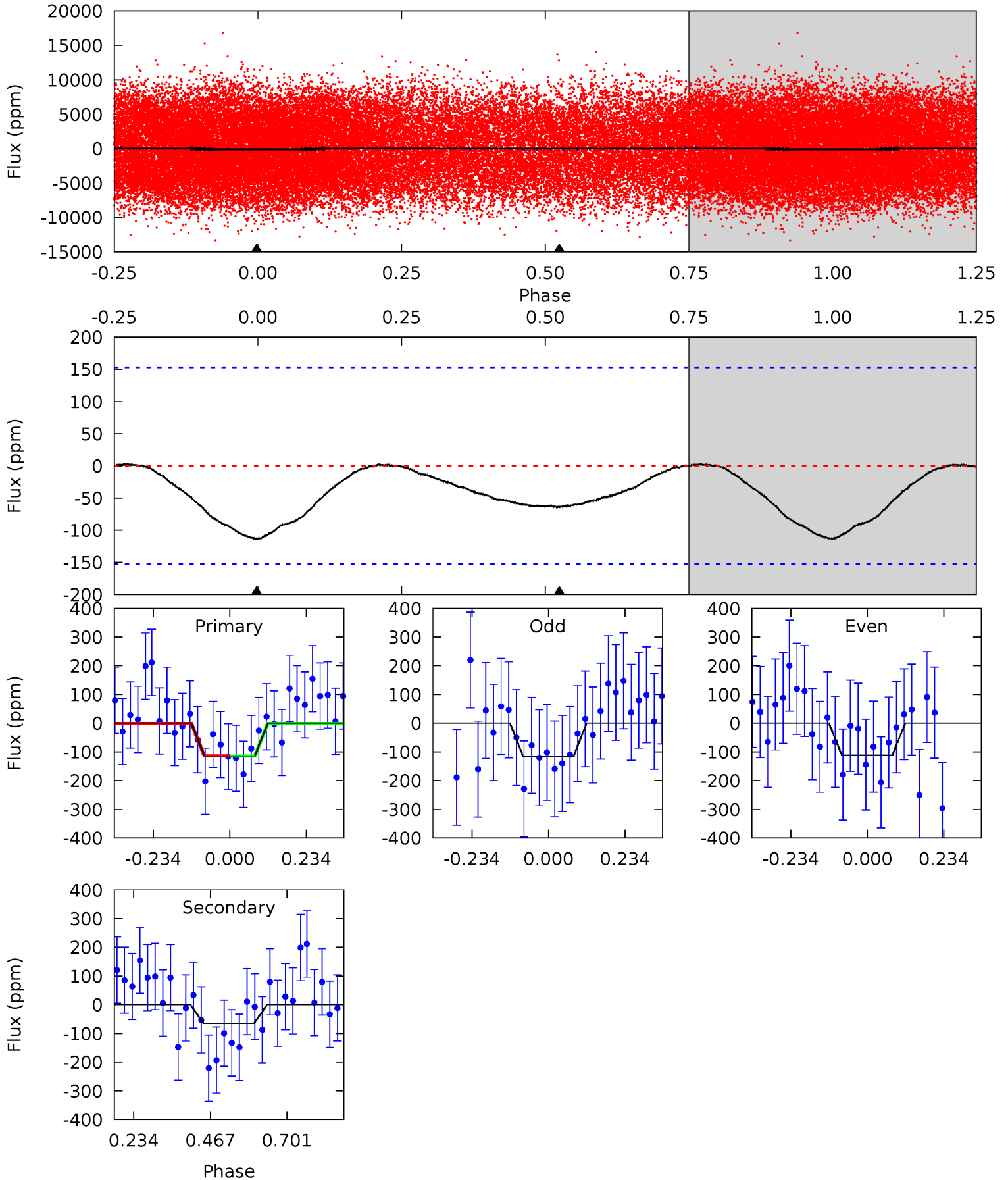
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
7.28	6.81	0	0	4.47	1.43	1.18	7.28	7.28	6.81	6.81	1.31	0.79	0.15	0.59



# Alt Model-Shift Uniqueness Test

012470709-02, P = 0.512186 Days, E = 131.429138 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
3.27	1.87	0	0	4.38	1.19	0.17	3.27	3.27	1.87	1.87	0.06	1.10	0.03	0.02



### Stellar Parameters For KIC 012470709

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$7421^{+207}_{-337}$	$4.192^{+0.090}_{-0.210}$	$0.000^{+0.200}_{-0.350}$	$1.656^{+0.550}_{-0.254}$	$1.556^{+0.222}_{-0.222}$	$0.482^{+0.244}_{-0.259}$
	+3%/-5%	+2%/-5%	+inf%/-inf%	+33%/-15%	+14%/-14%	+51%/-54%
Source	KIC0	KIC0	KIC0	DSEP		

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

### Secondary Eclipse Parameters for KIC 012470709-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-77 \pm 11$	$2.14^{+1.54}_{-1.17}$	$4937^{+396}_{-292}$	$6079^{+4158}_{-1635}$	$1.889^{+7.755}_{-1.231}$
Alt.	$-65 \pm 35$	$2.16^{+1.33}_{-1.25}$	$4958^{+370}_{-288}$	$5661^{+4611}_{-1894}$	$1.425^{+7.922}_{-0.979}$

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

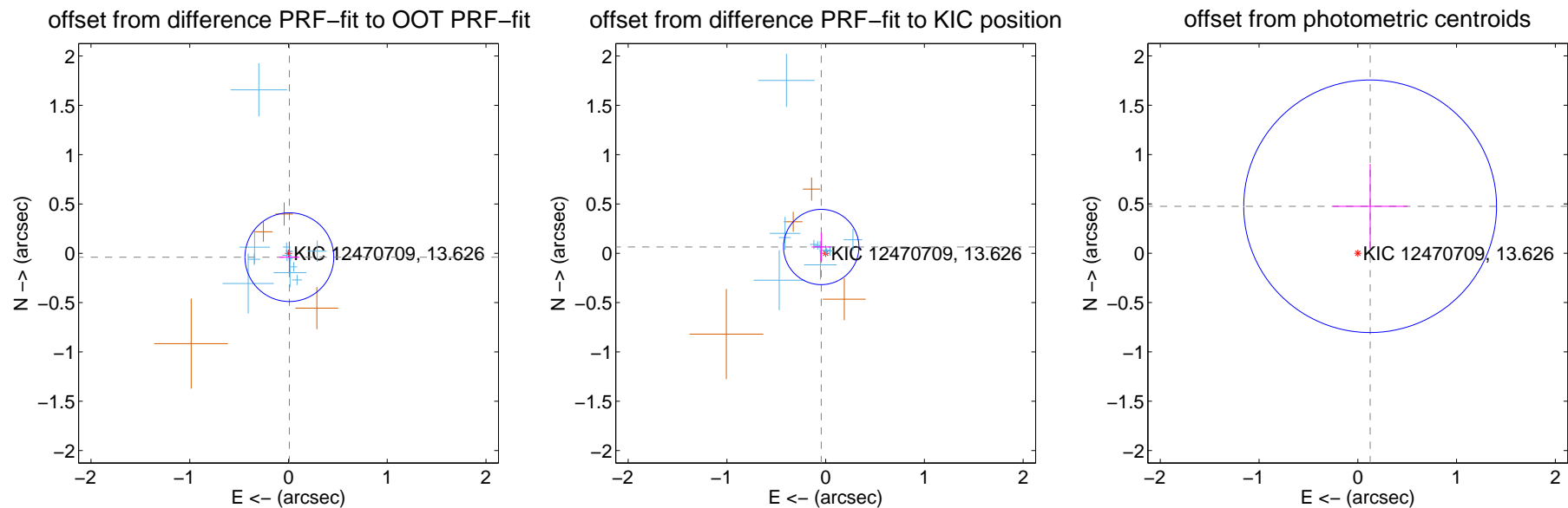
## DV Centroid Data

Supplemental centroid analysis for 012470709-02. Kepler magnitude: 13.63. Transit SNR 9.92

There are 12 quarters with good PRF difference image offsets

The direct PRF centroid is offset from the target star catalog position by about 0.13 arcsec

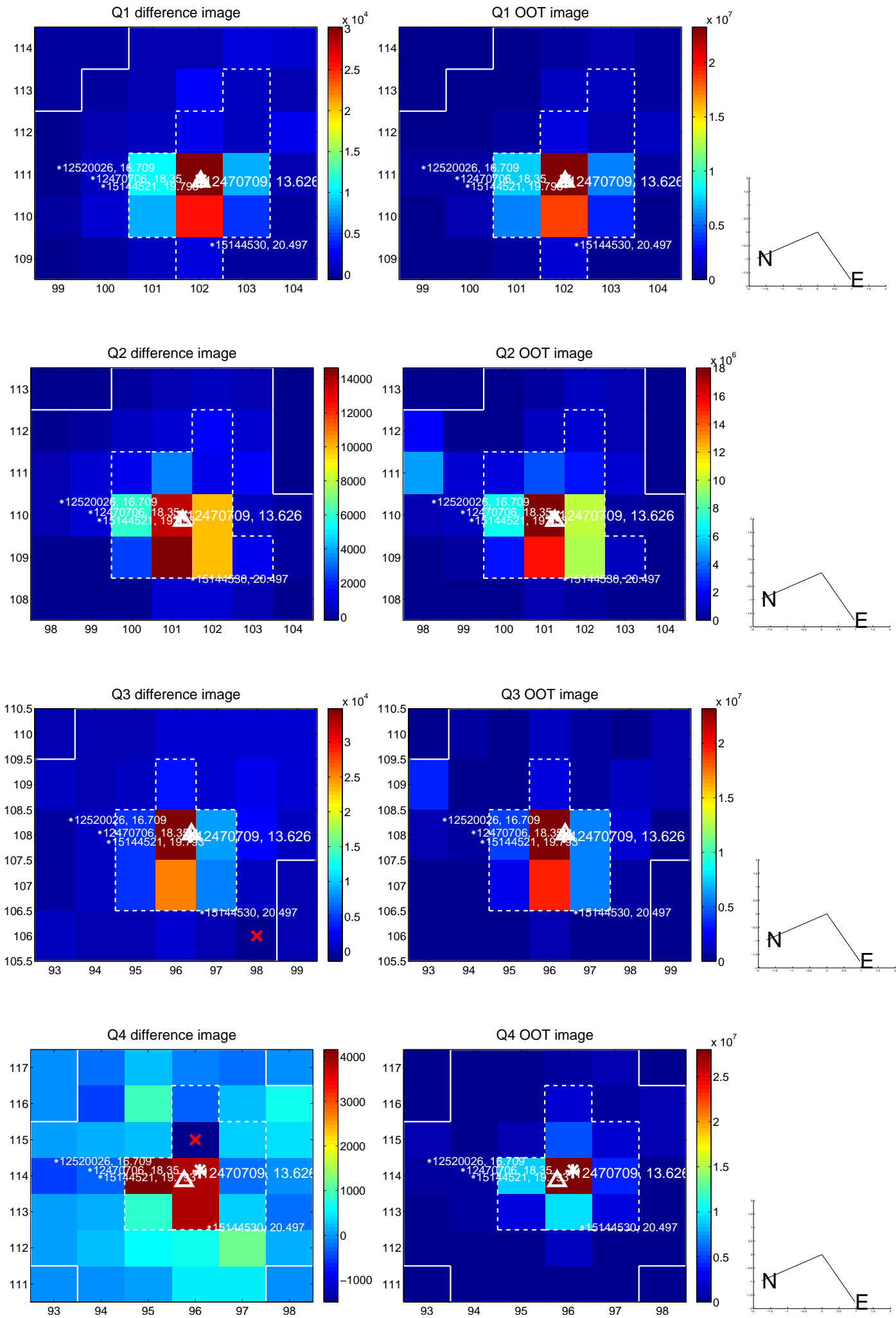
	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.040 \pm 0.150$	0.27	$-0.009 \pm 0.101$	$-0.039 \pm 0.154$
PRF-fit source offset from KIC position	$0.078 \pm 0.127$	0.61	$0.045 \pm 0.098$	$0.064 \pm 0.144$
photometric centroid source offset	$0.49 \pm 0.43$	1.15	$-0.12 \pm 0.38$	$0.48 \pm 0.43$



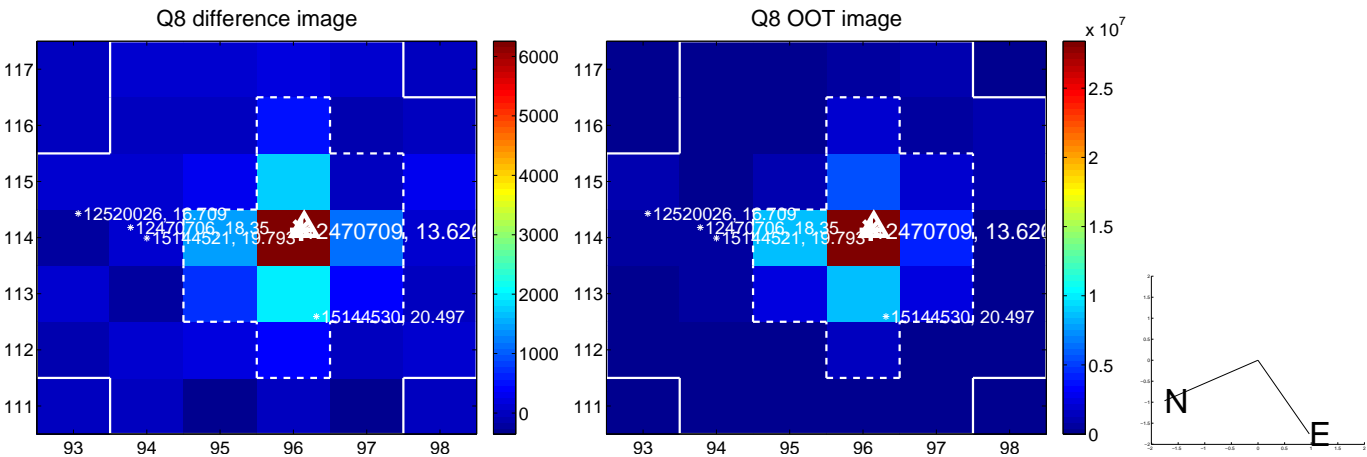
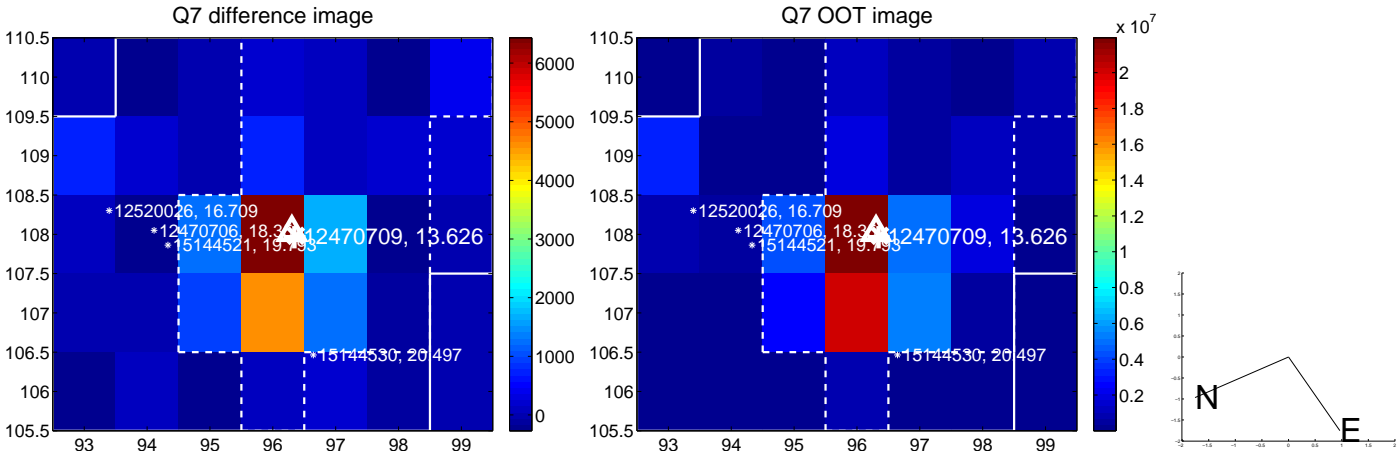
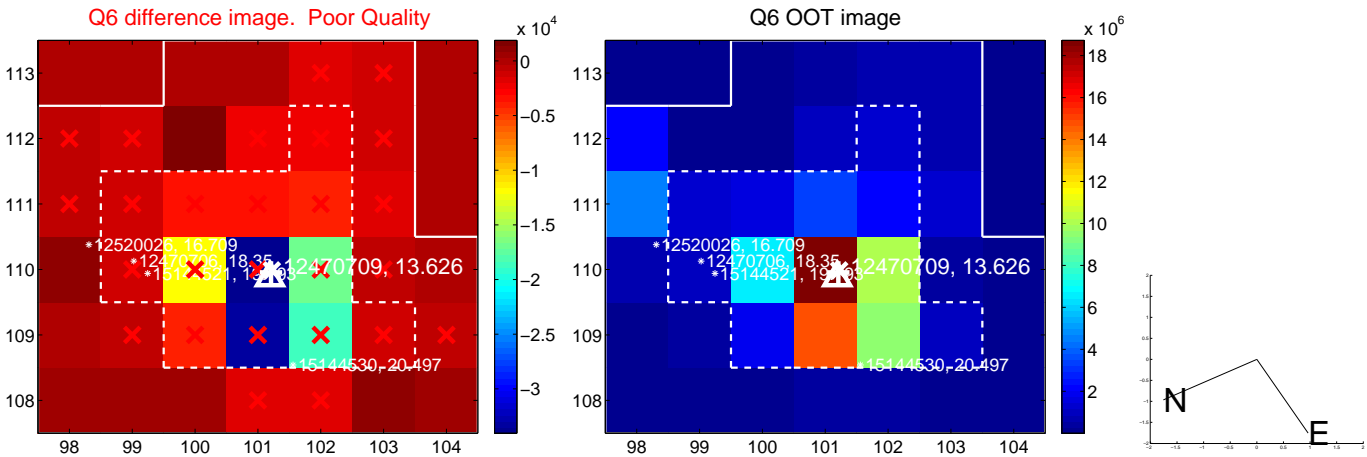
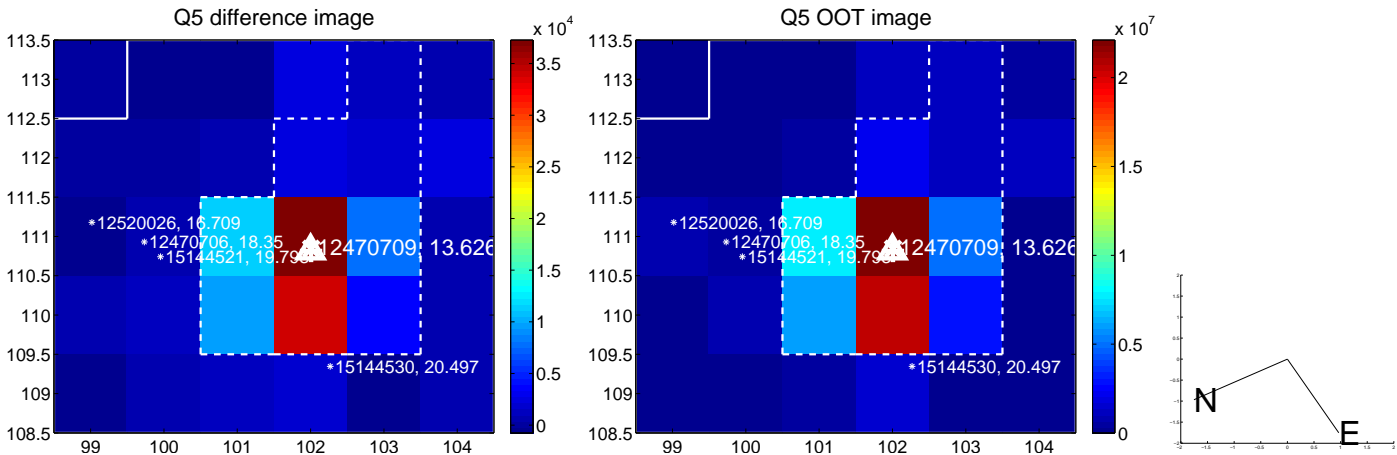
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets**; **Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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



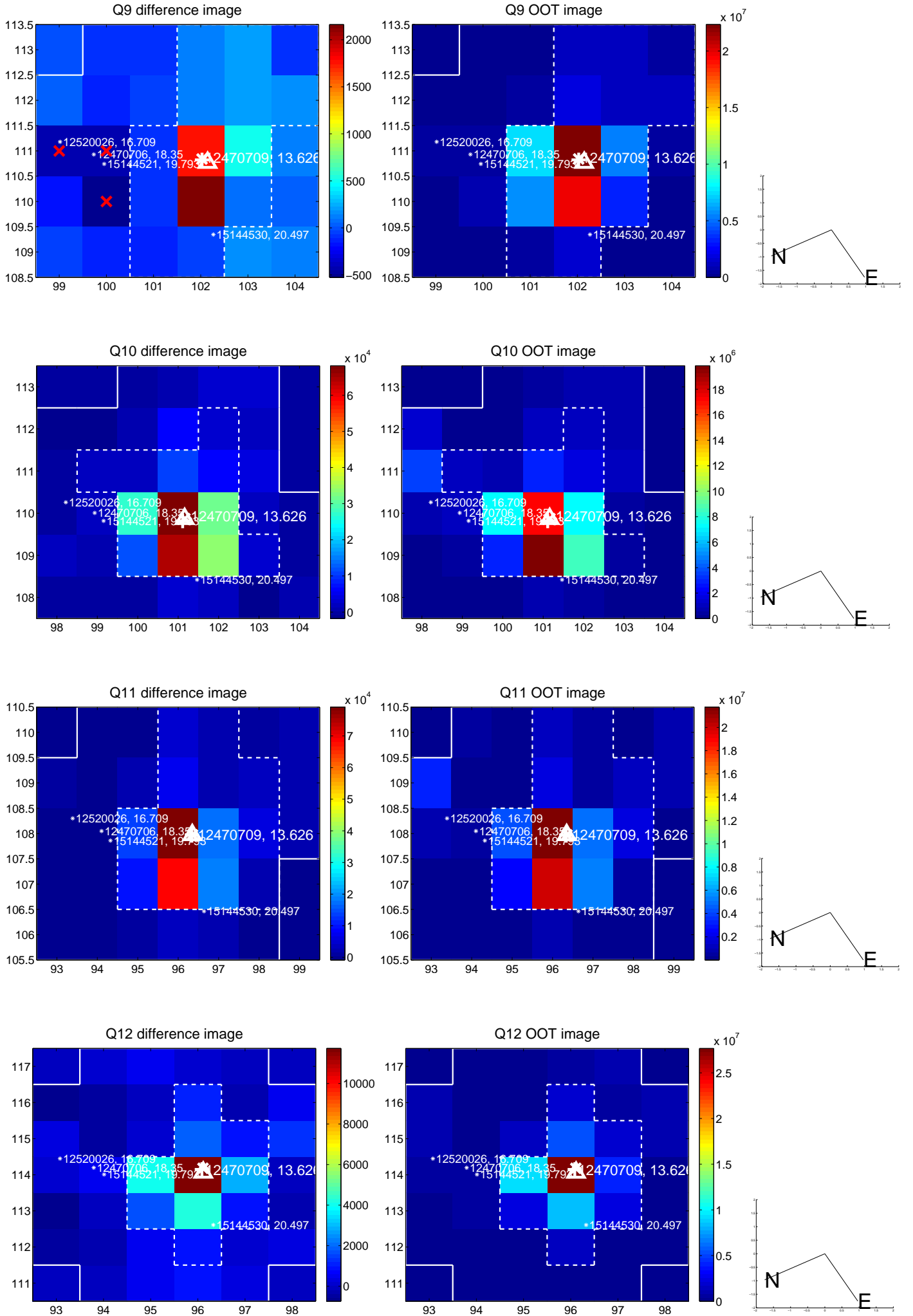
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



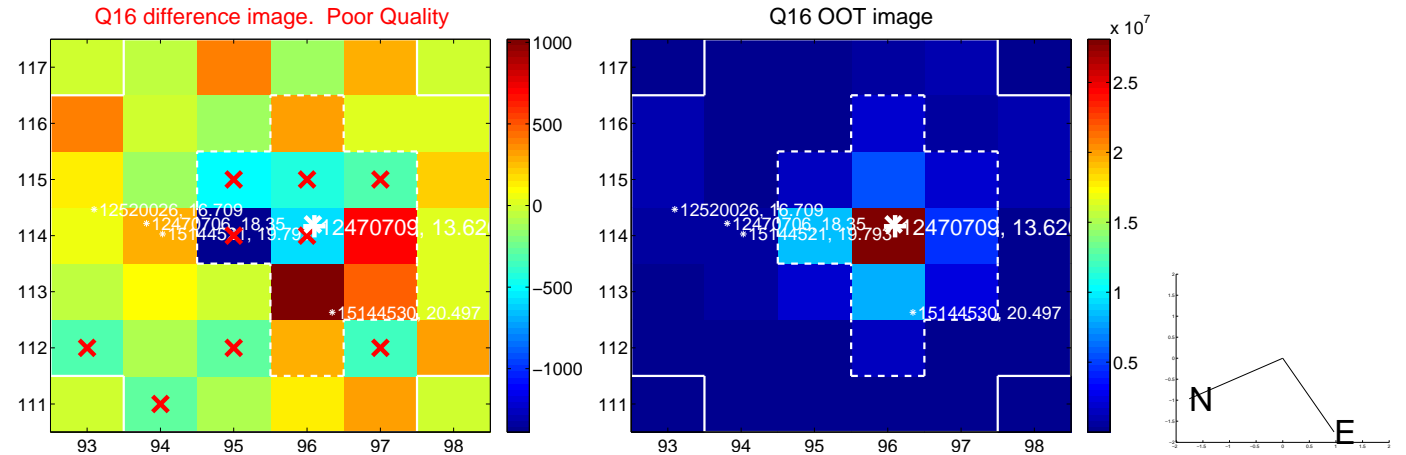
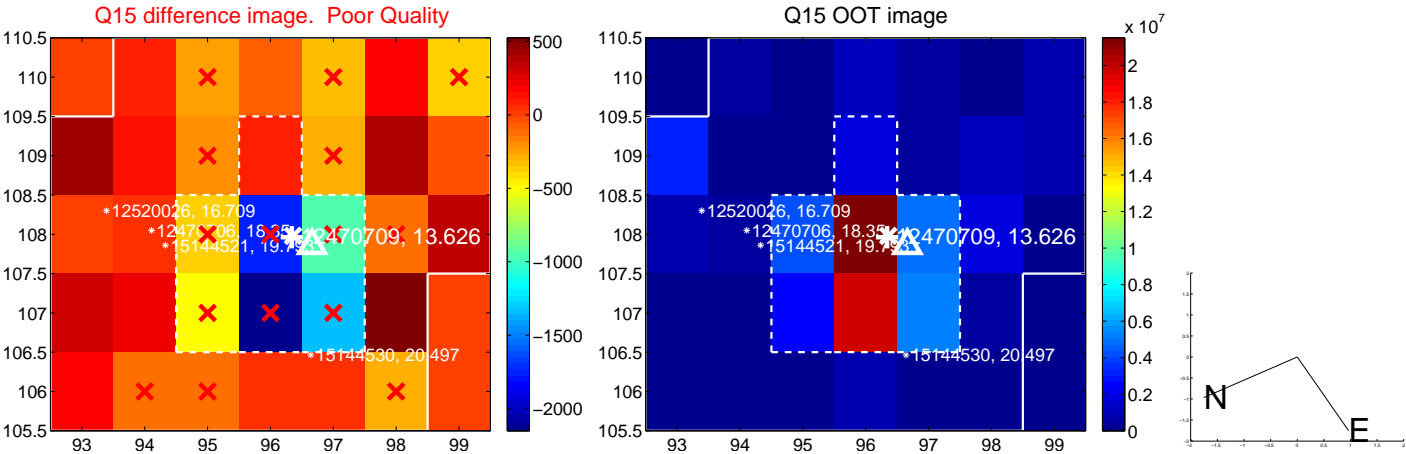
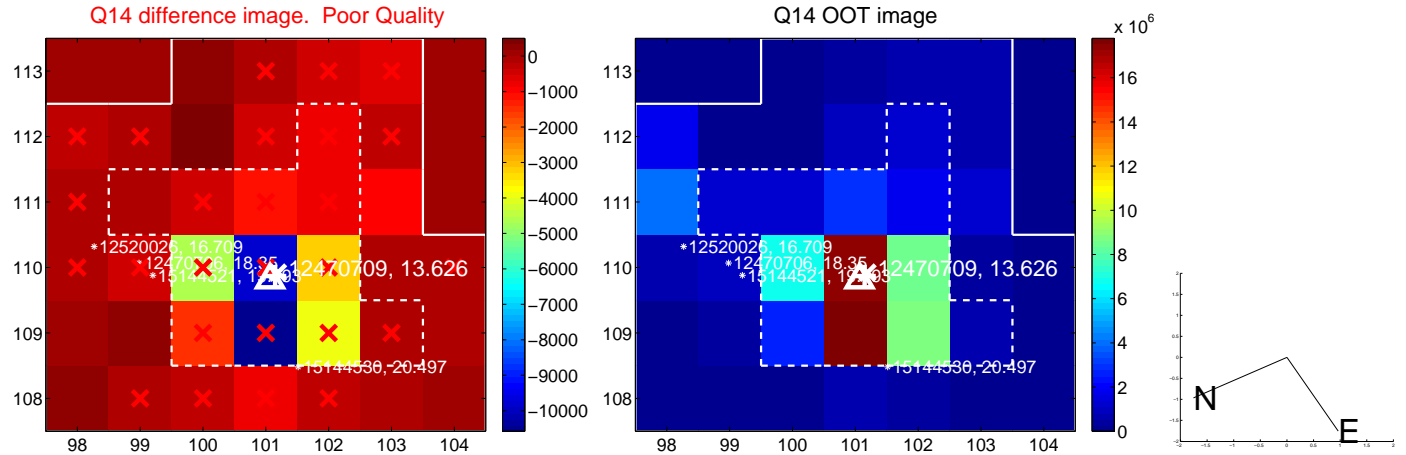
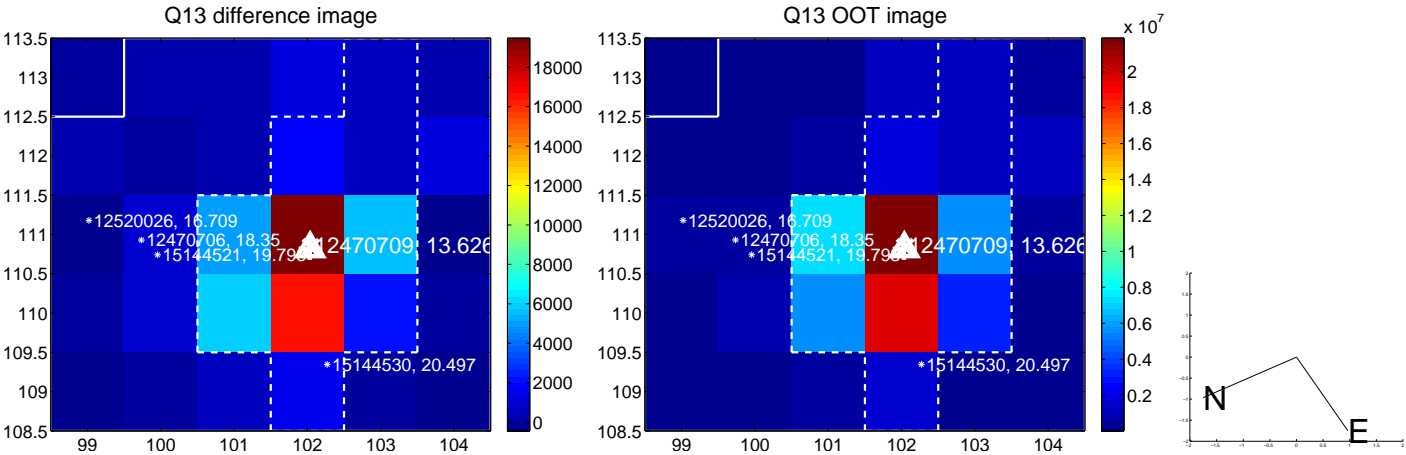
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



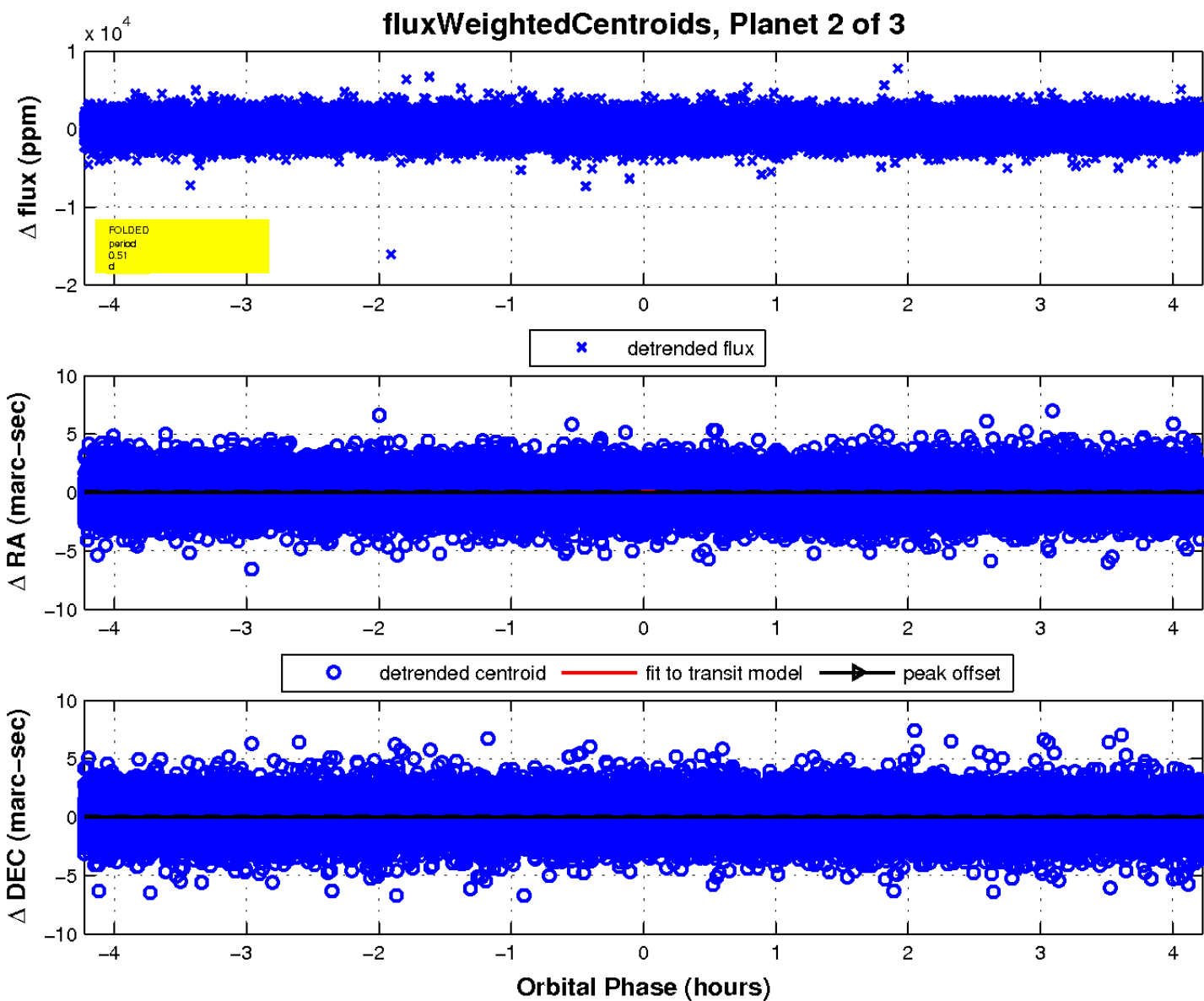
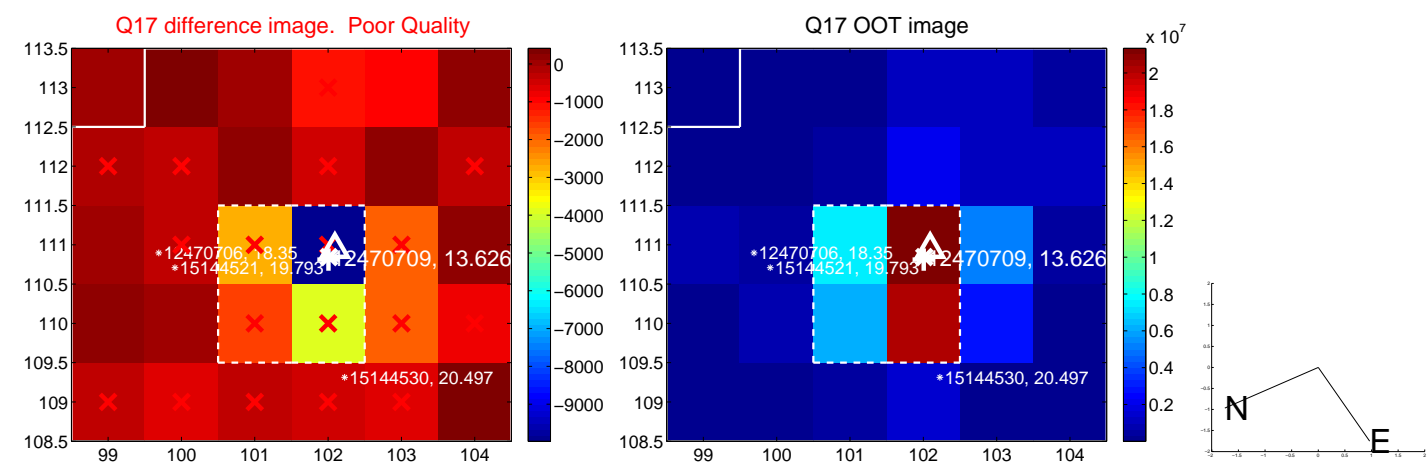
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



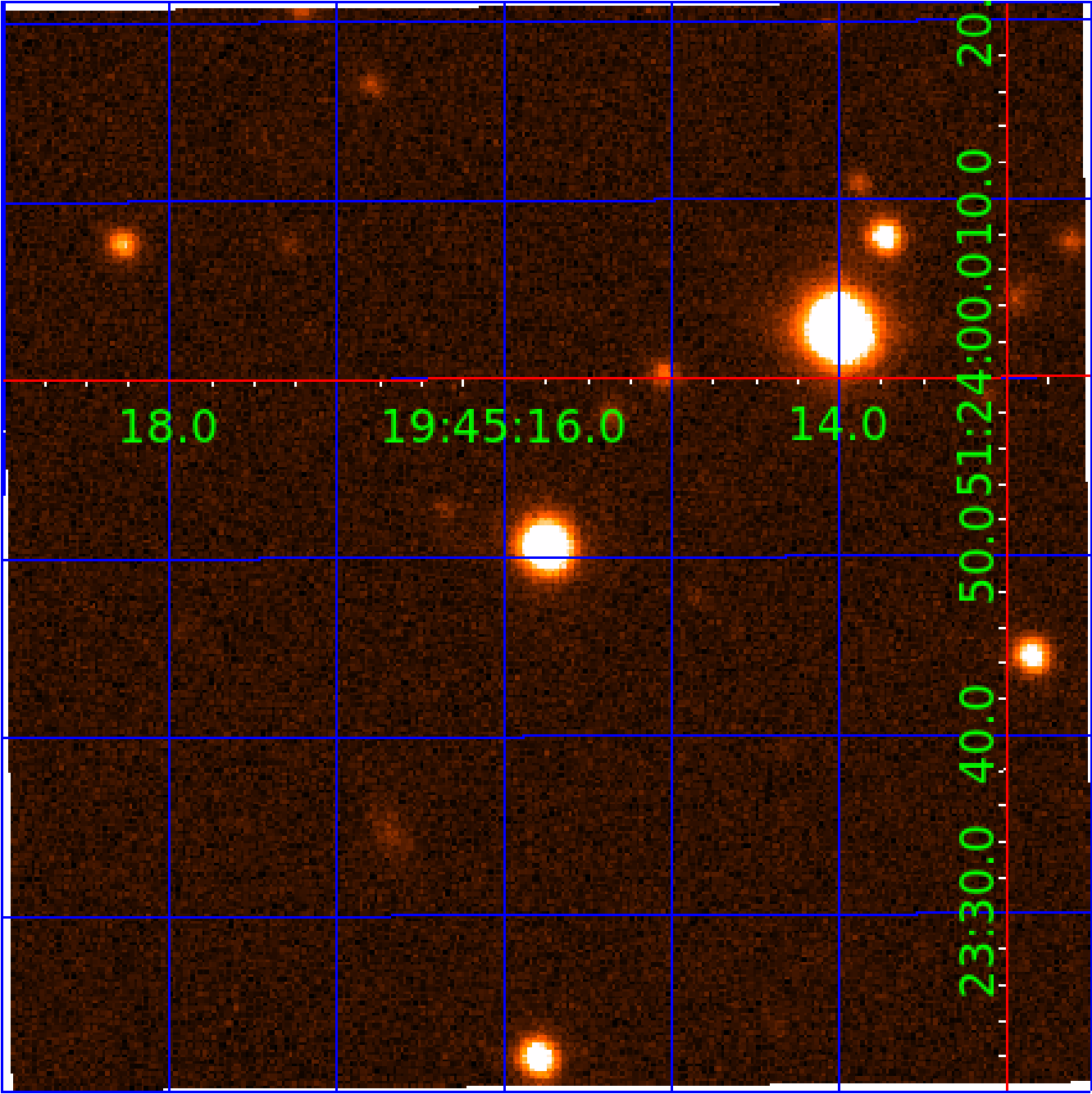
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





UKIRT Image

Declination



# KIC 012470709

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
012470709-01	OBS	No	1.024308	132.226752	76.8	2.204	11.6	7.8	1.66	7421	1.66	14024.15
012470709-02	OBS	No	0.512177	131.942841	102.5	1.409	10.7	9.9	1.66	7421	1.95	35336.58
012470709-03	OBS	No	3.350104	132.813703	175.9	8.260	7.9	7.3	1.66	7421	2.36	2888.73

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
012470709-01	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT
012470709-02	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—SAME_NTL_PERIOD
012470709-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_ZUMA—TRANS_GAPPED—LPP_DV—LPP_ALT

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

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

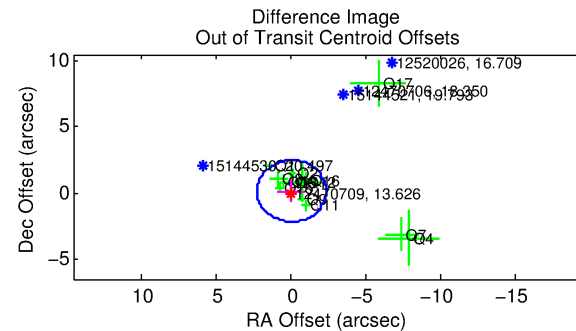
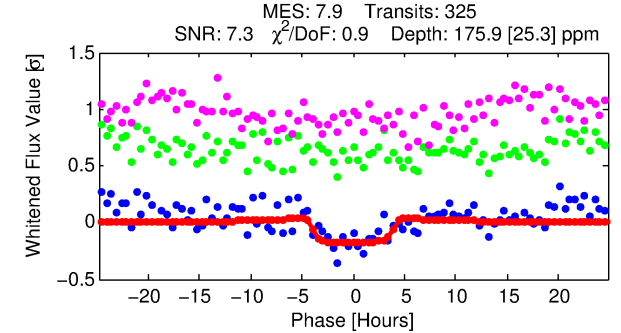
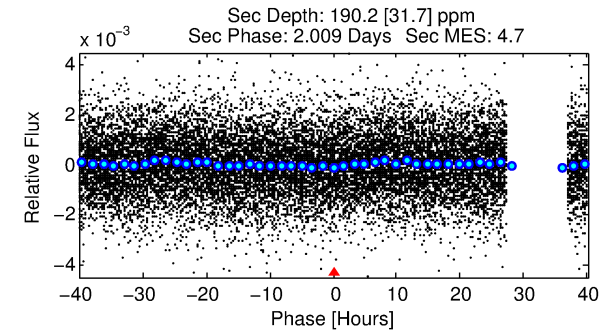
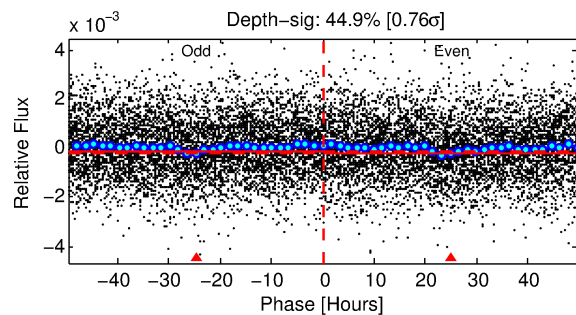
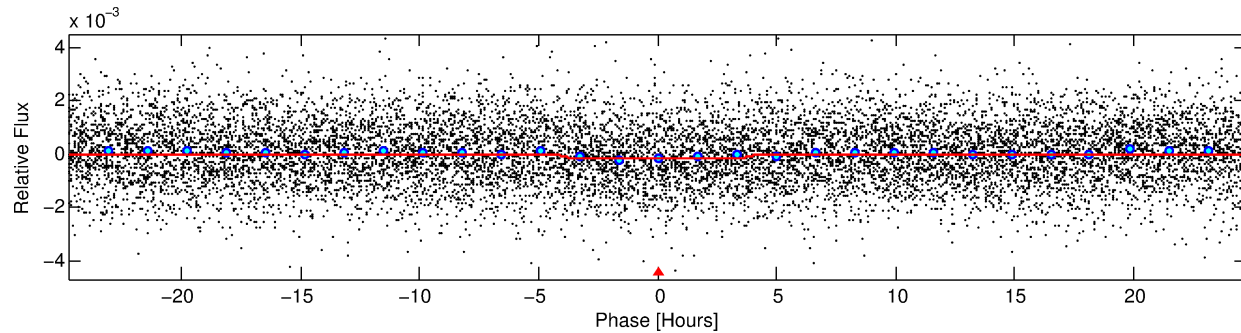
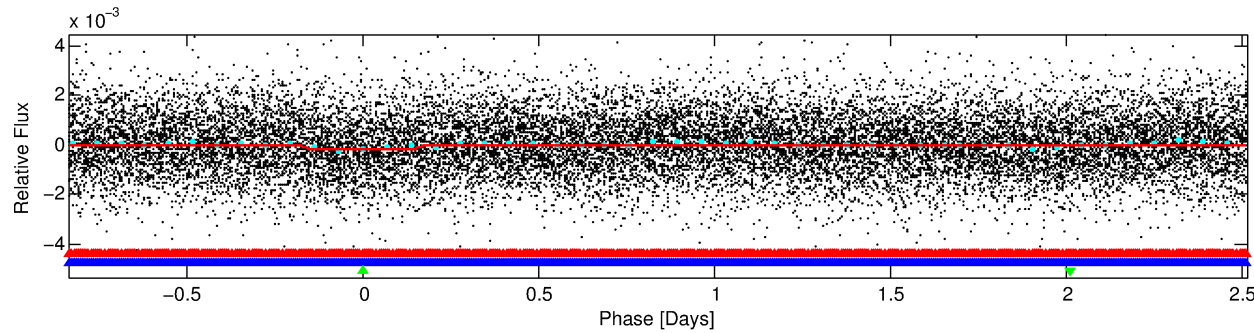
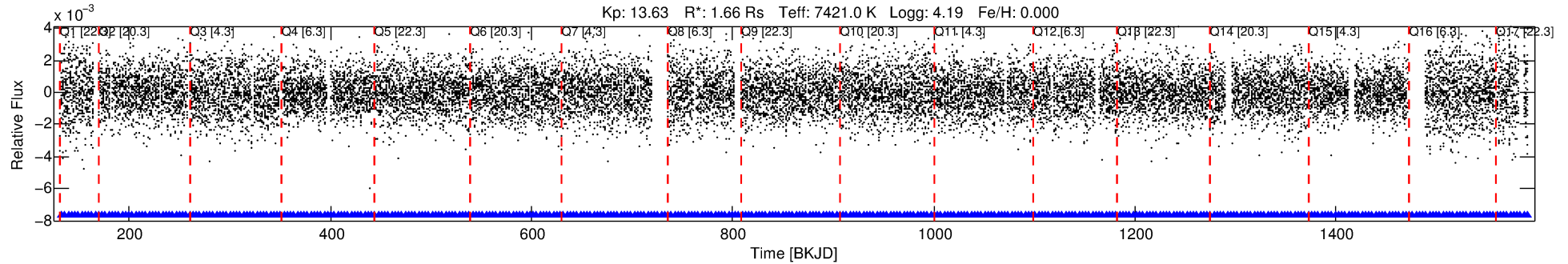
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 012470709-03

No Significant Match Found

# DV One-Page Summary

KIC: 12470709 Candidate: 3 of 3 Period: 3.350 d



## DV Fit Results:

Period = 3.35010 [0.00007] d  
Epoch = 132.8137 [0.0146] BKJD  
Rp/R\* = 0.0130 [0.0113]  
a/R\* = 2.40 [10.79]  
b = 0.71 [3.89]  
Seff = 2888.73 [1245.64]  
Teq = 1869 [202] K  
Rp = 2.36 [2.18] Re  
a = 0.0508 [0.0139] AU  
Ag = 48.59 [86.56] [0.55 $\sigma$ ]  
Teffp = 7631 [3334] K [1.73 $\sigma$ ]

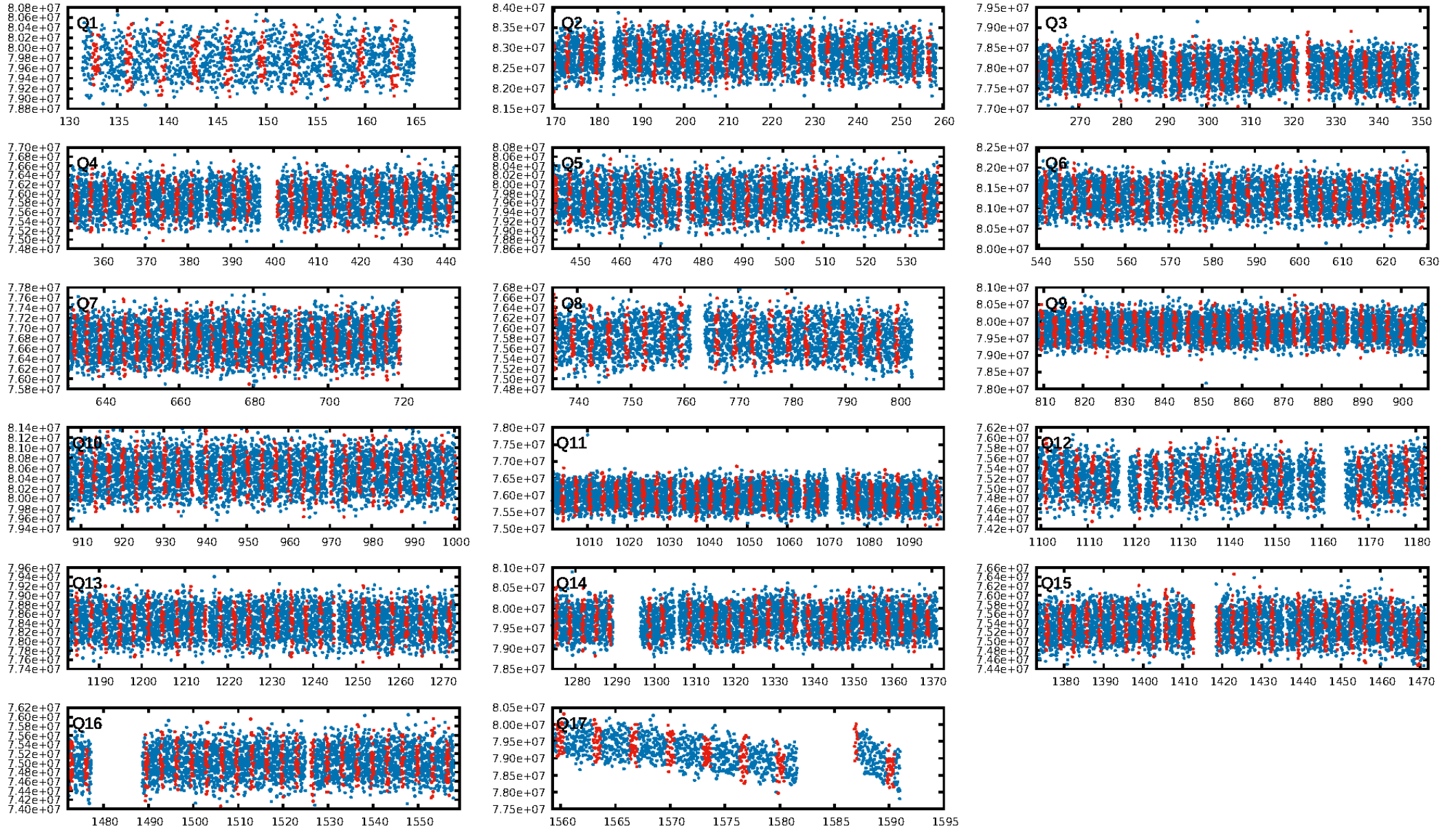
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [6.53 $\sigma$ ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: 6.39e-16  
RollingBand-fgt: 1.00 [308/308]  
GhostDiagnostic-chr: 9.969  
Centroid-sig: 0.1%  
Centroid-so: 0.525 arcsec [2.11 $\sigma$ ]  
OotOffset-rm: 0.176 arcsec [0.23 $\sigma$ ]  
KicOffset-rm: 0.255 arcsec [0.37 $\sigma$ ]  
OotOffset-st: 2/3/4/4 [13]  
KicOffset-st: 2/3/4/4 [13]  
DiffImageQuality-fgm: 0.23 [3/13]  
DiffImageOverlap-fno: 0.00 [0/17]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 29-Jan-2016 22:02:28 Z

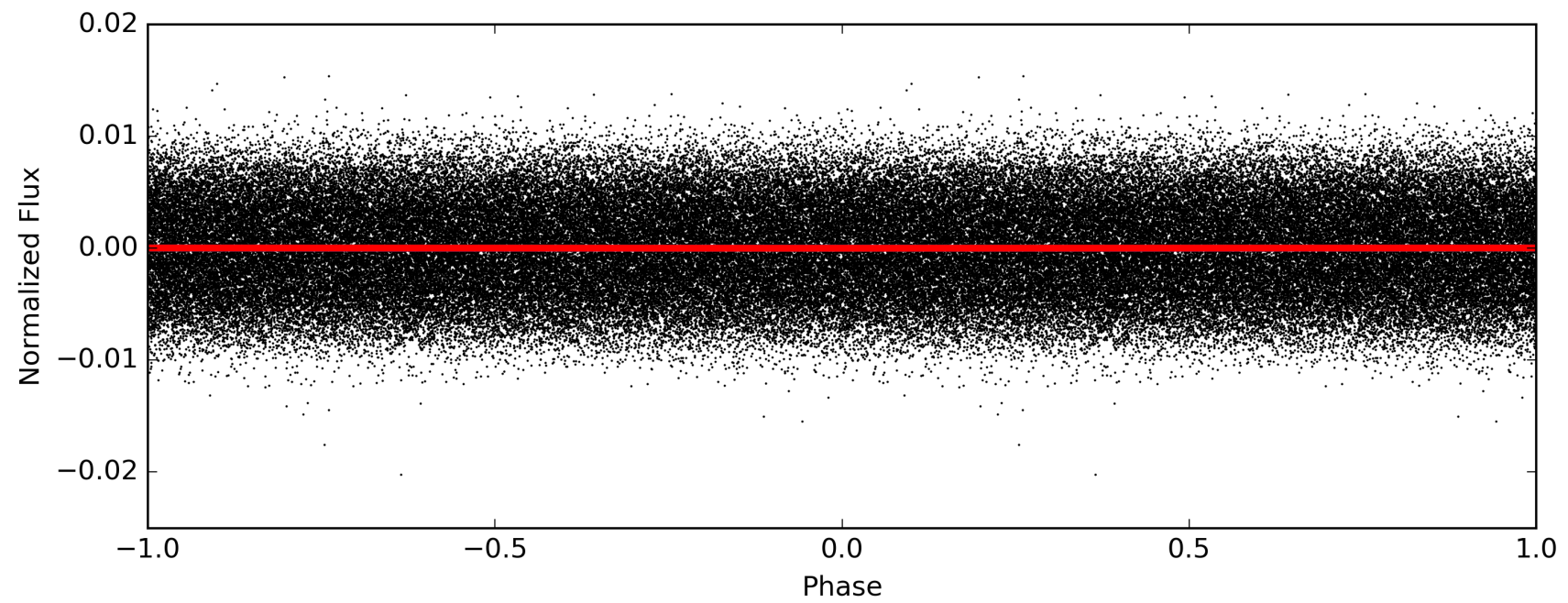
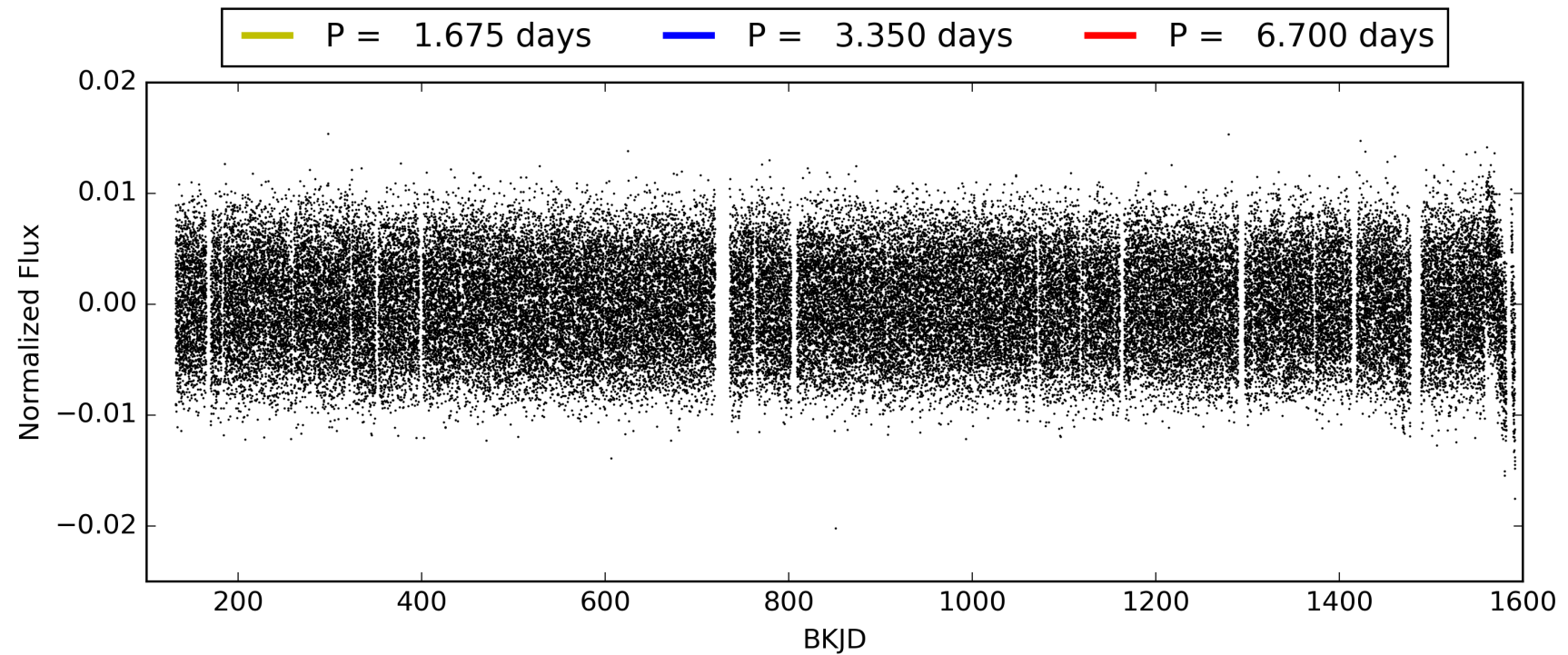
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 012470709-03, PDC Light Curves





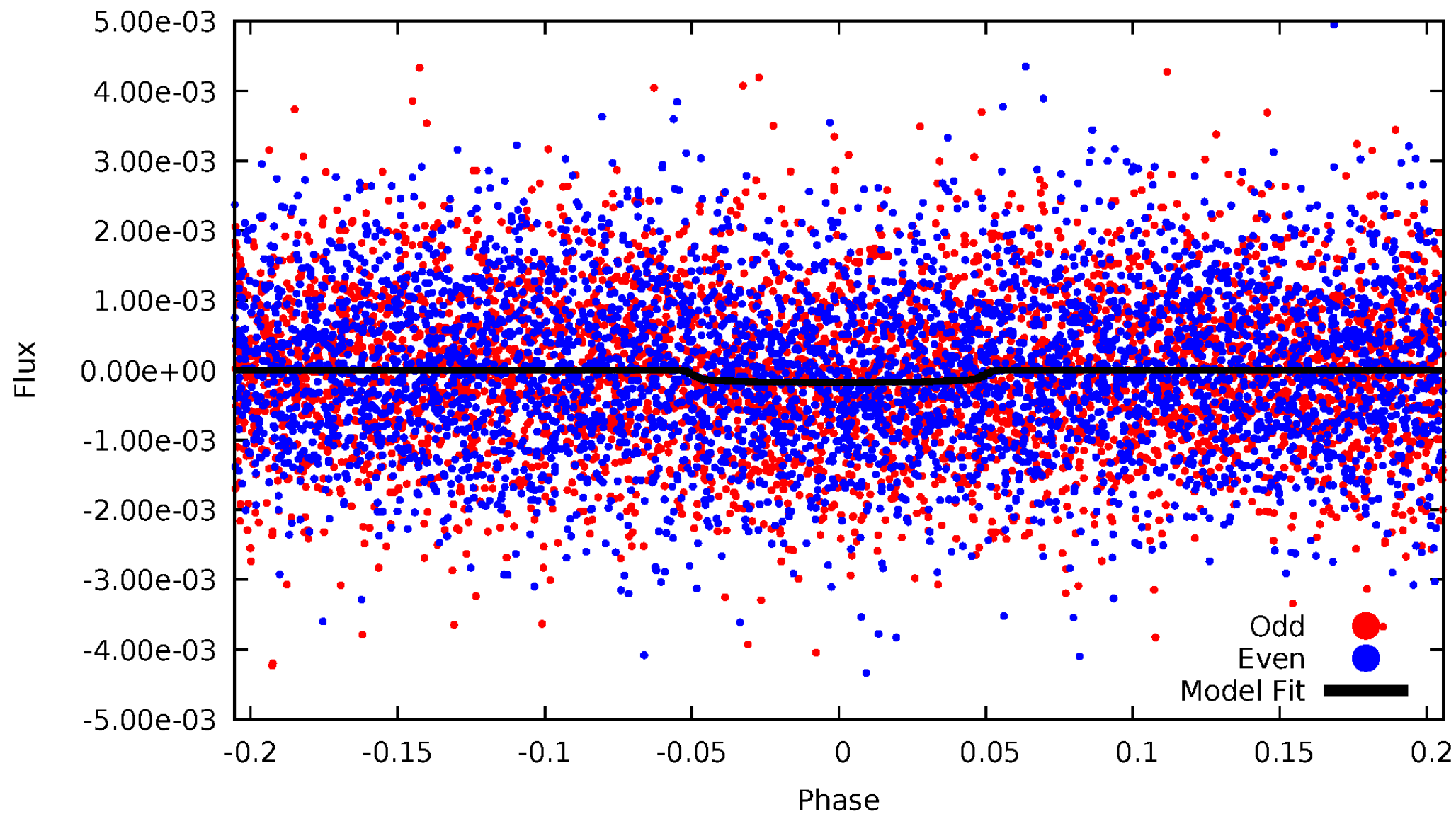
TCE 012470709-03





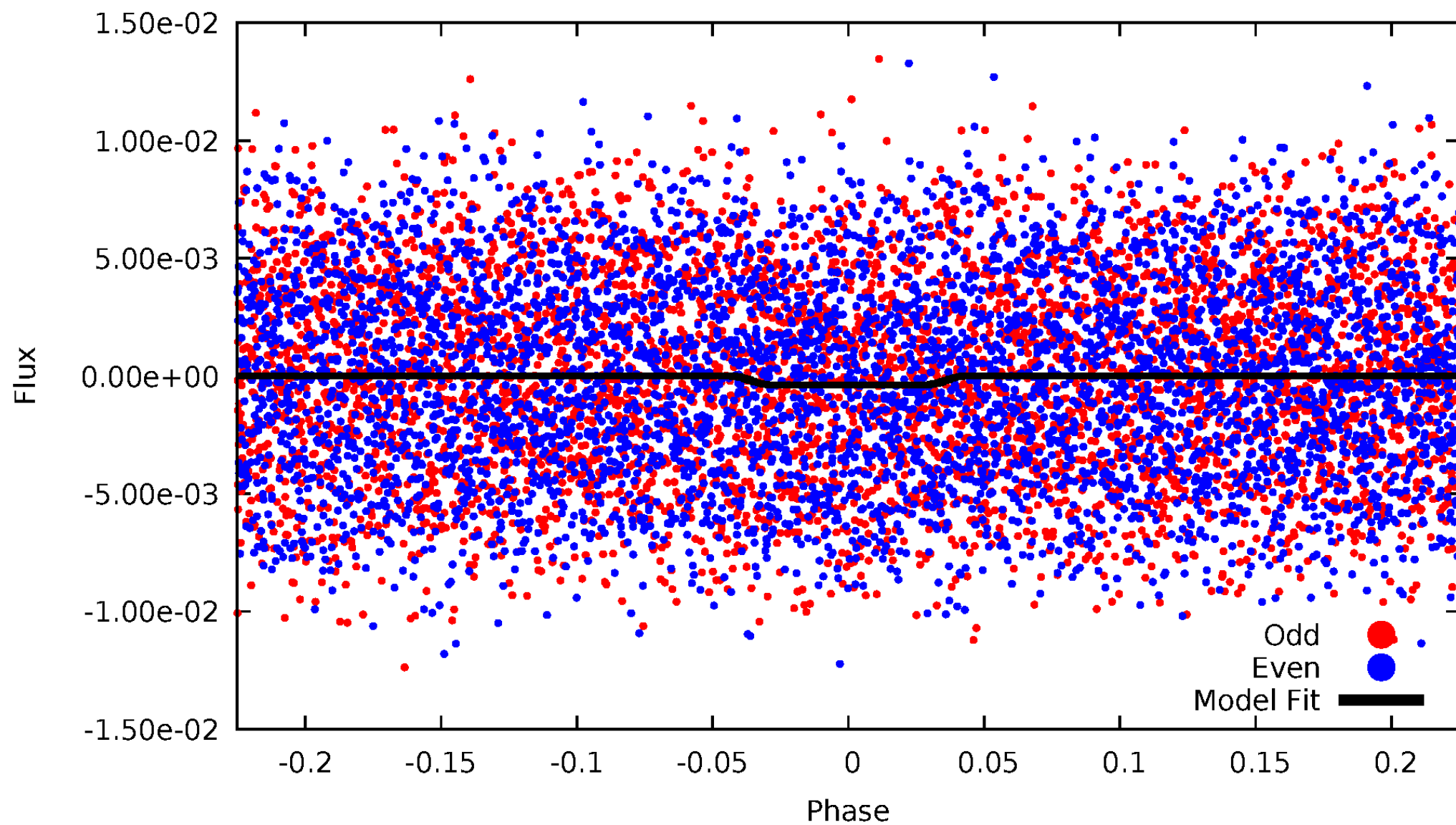
# DV Odd/Even

TCE 012470709-03



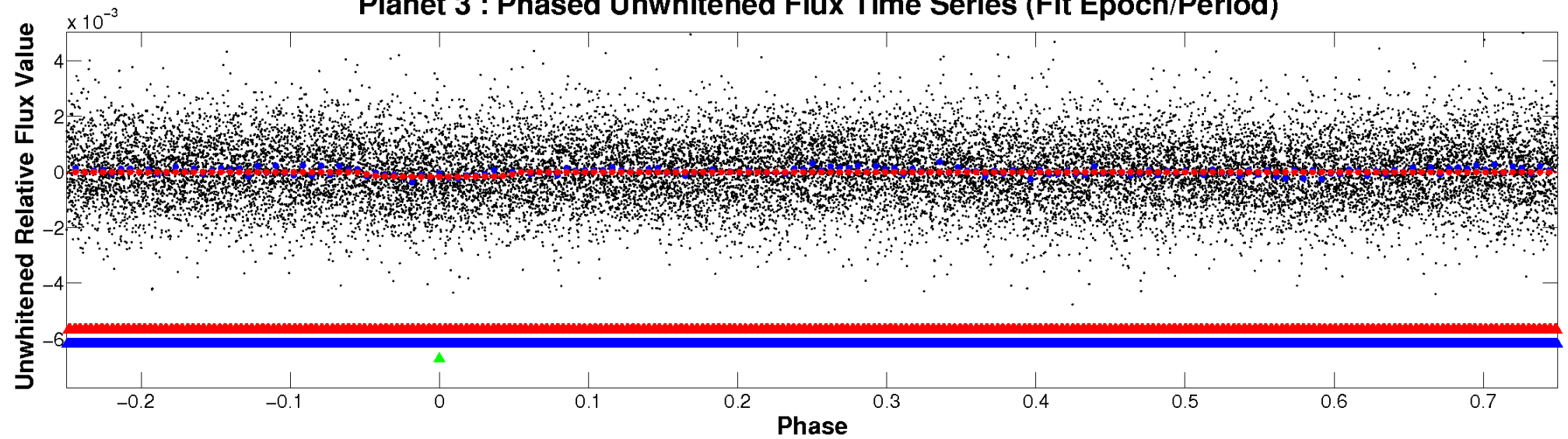
# ALT Odd/Even

TCE 012470709-03

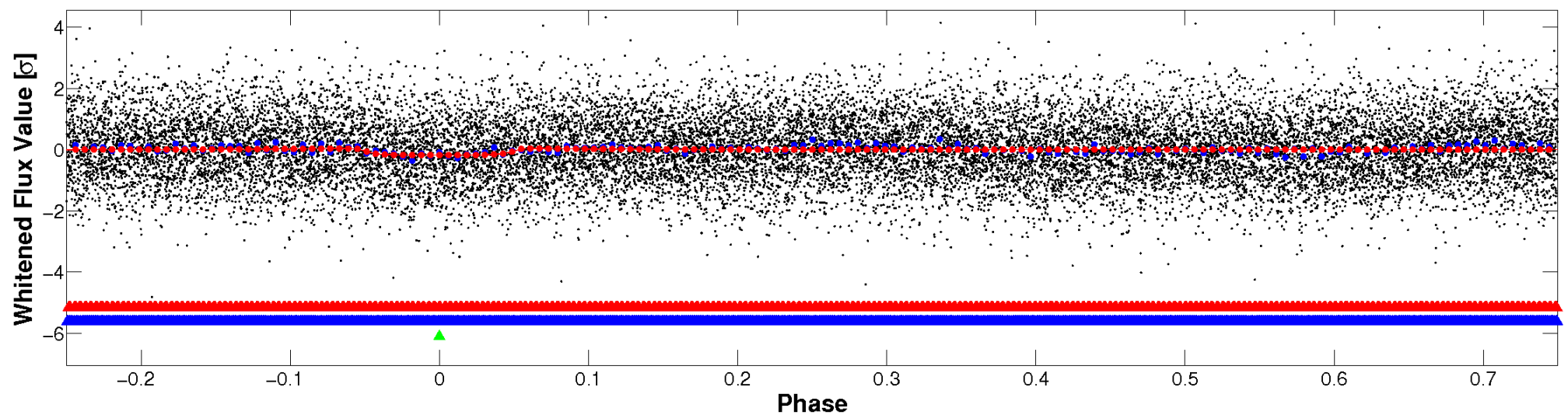


# Non-Whitened Vs. Whitened Light Curve

## Planet 3 : Phased Unwhitened Flux Time Series (Fit Epoch/Period)

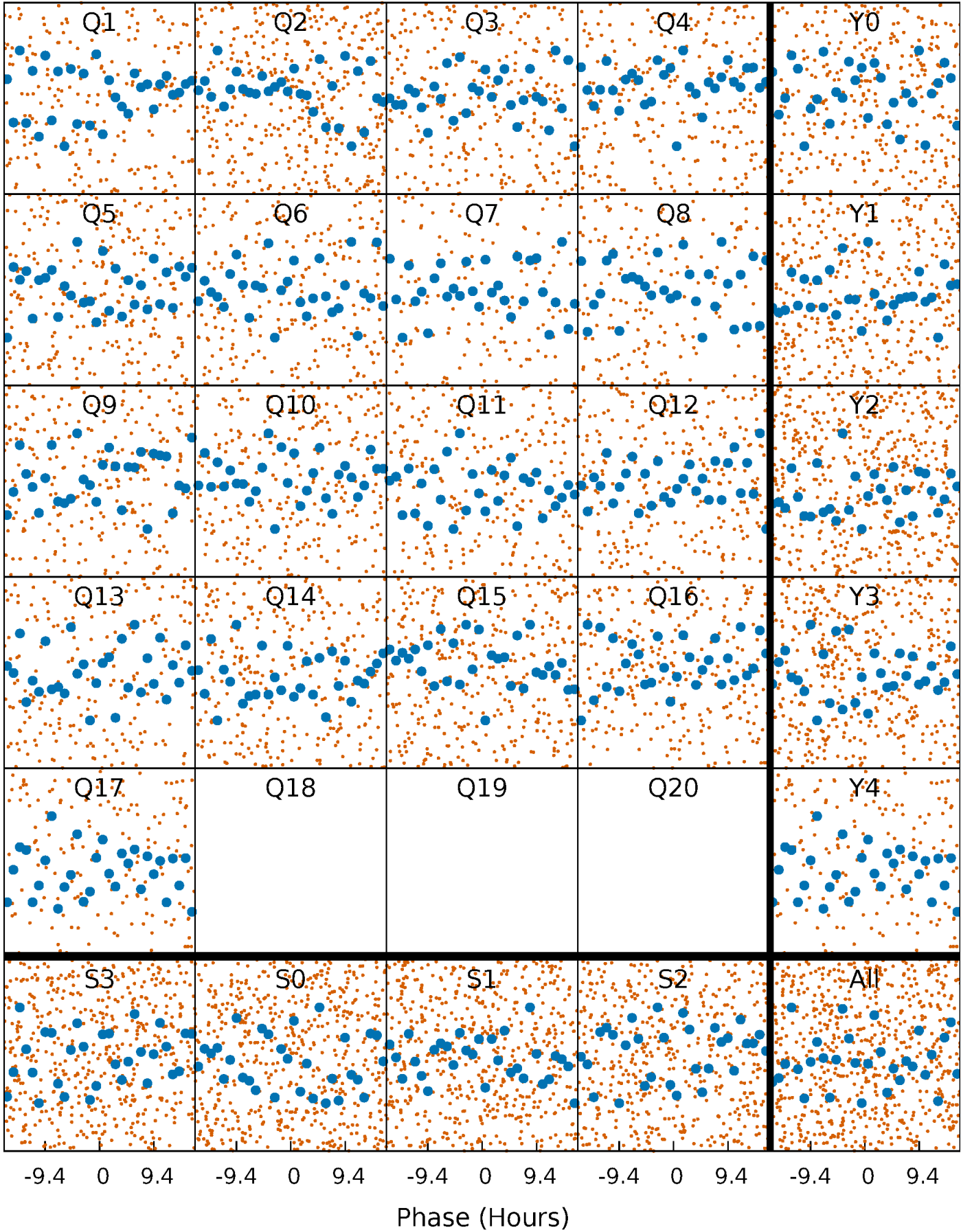


## Planet 3 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

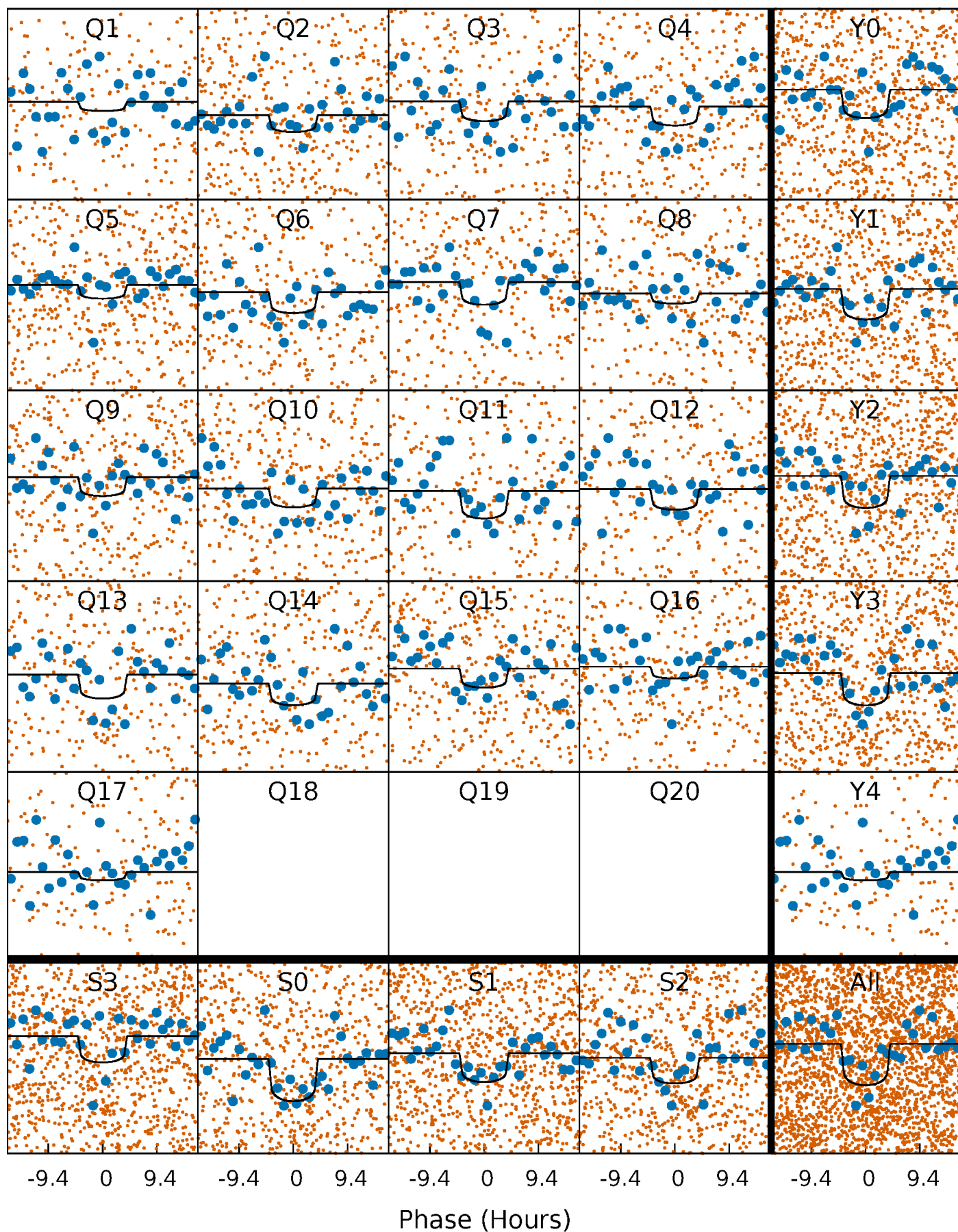
TCE 012470709-03    P= 3.350104 Days     $T_0=132.813703$  (BKJD)





# DV Quarter-Phased Transit Curves

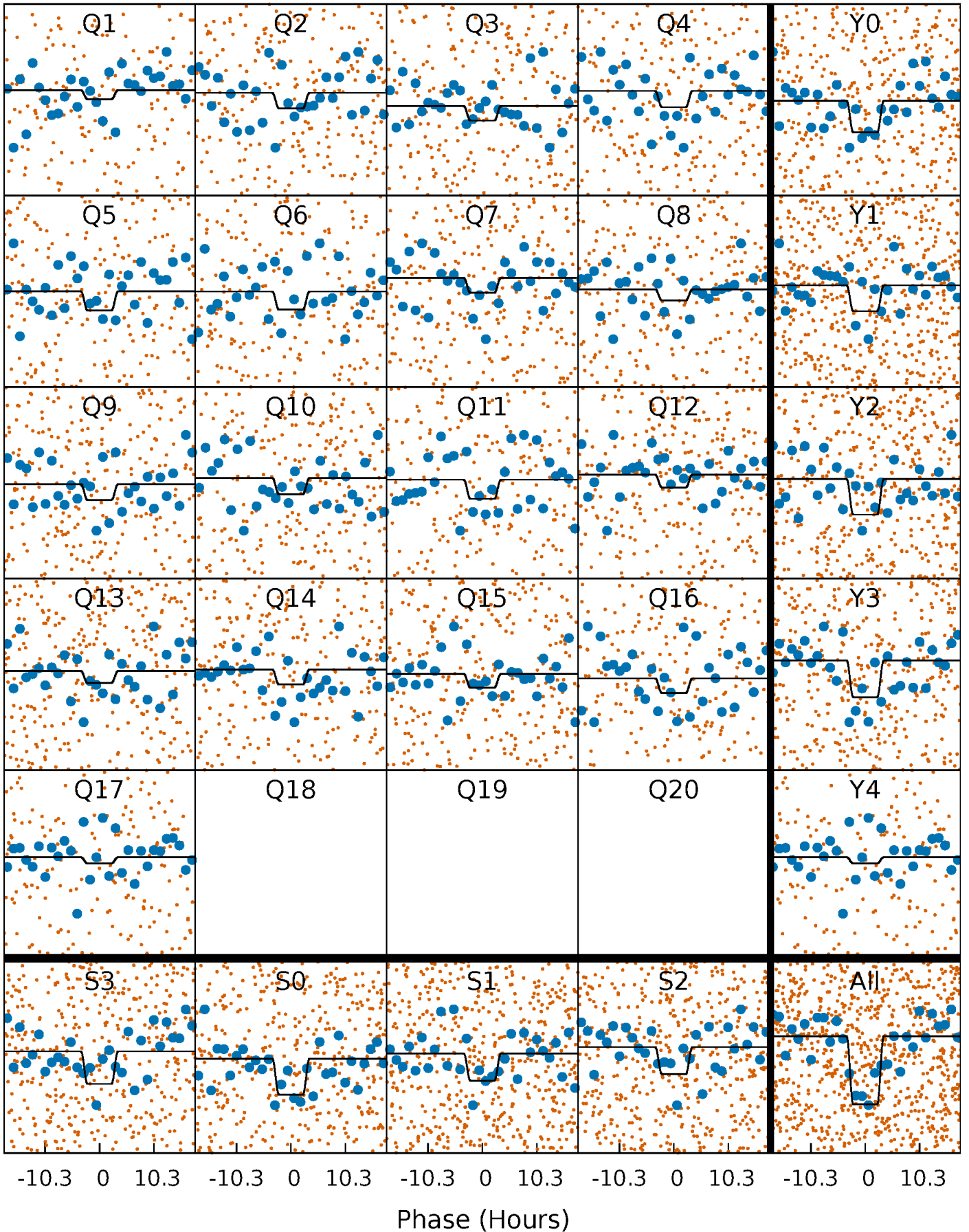
TCE 012470709-03 P= 3.350104 Days  $T_0=132.813703$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

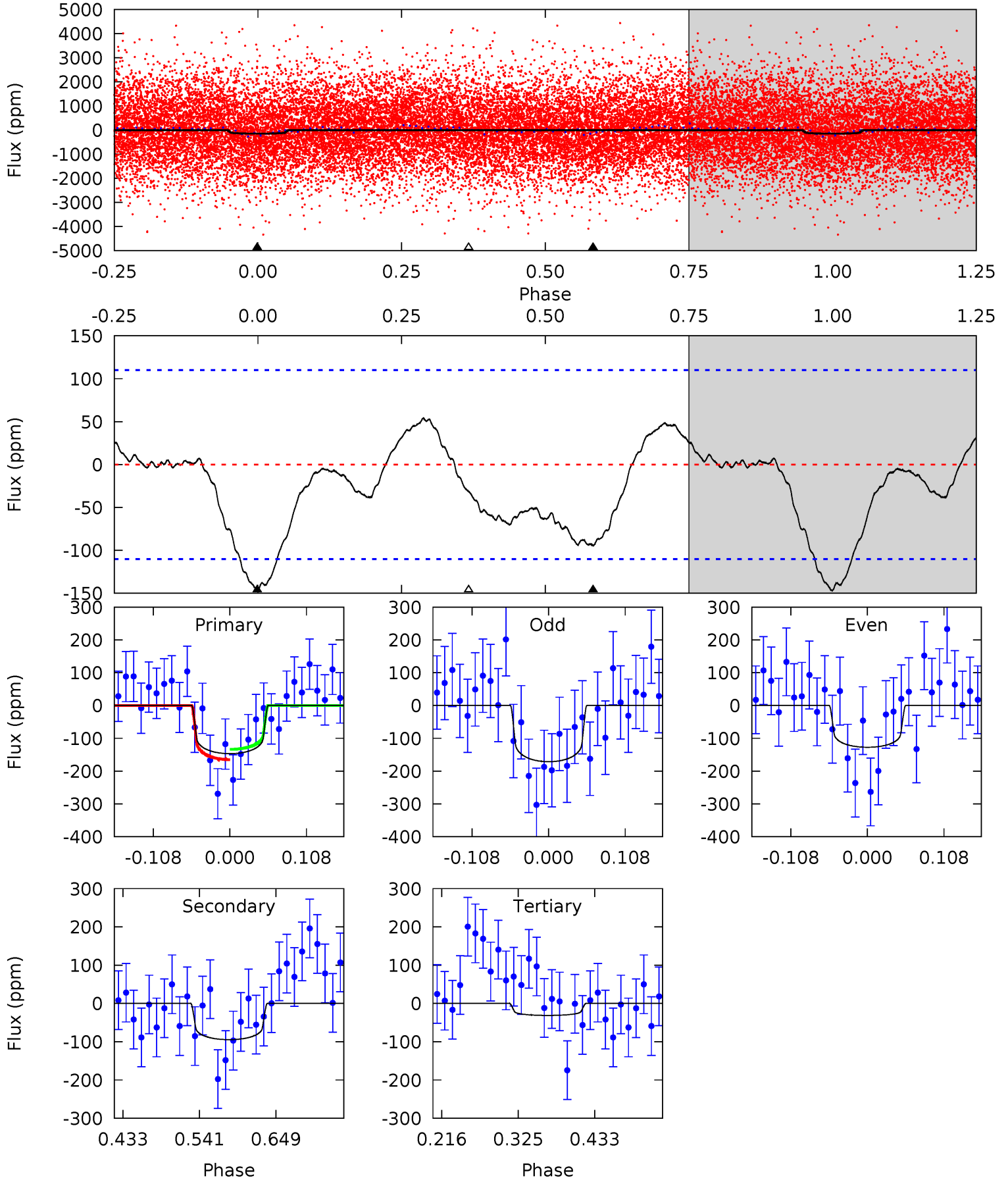
TCE 012470709-03     $P = 3.350200$  Days     $T_0 = 132.778633$  (BKJD)



# DV Model-Shift Uniqueness Test

012470709-03, P = 3.350104 Days, E = 129.463599 Days

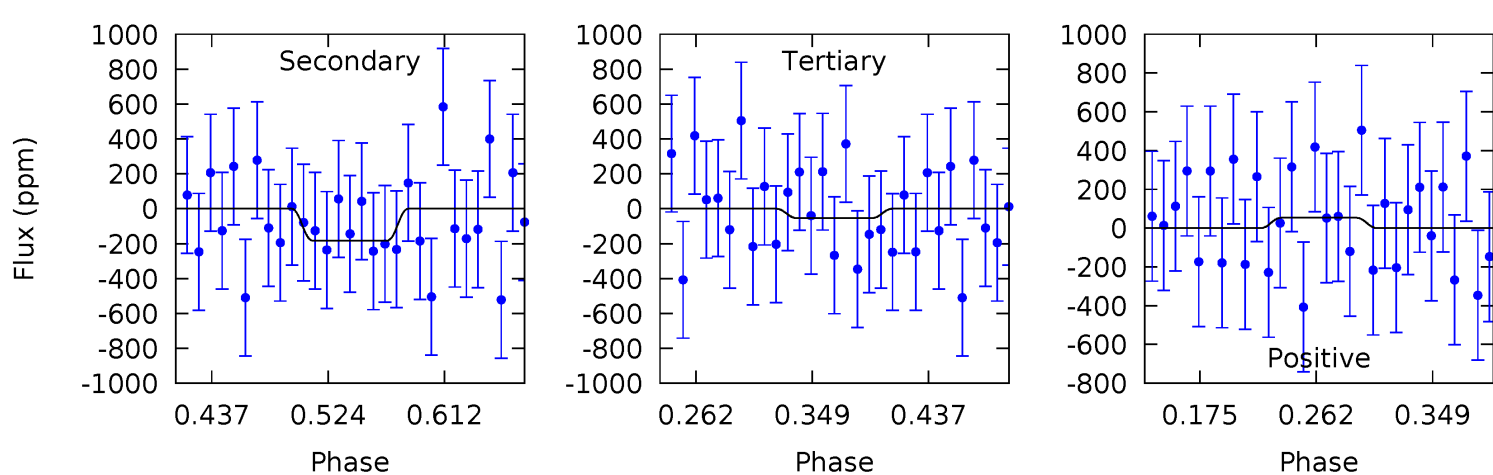
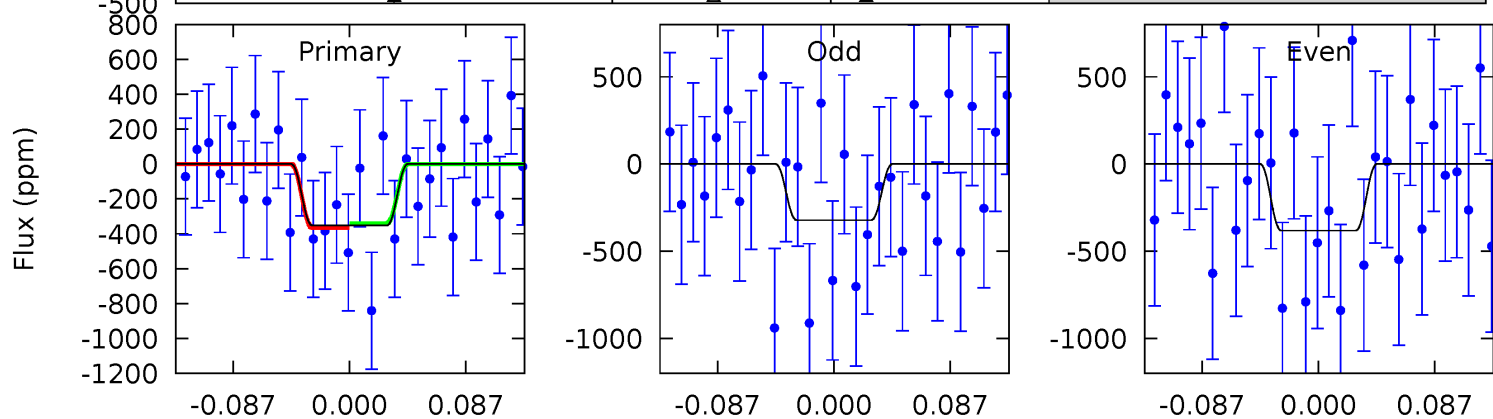
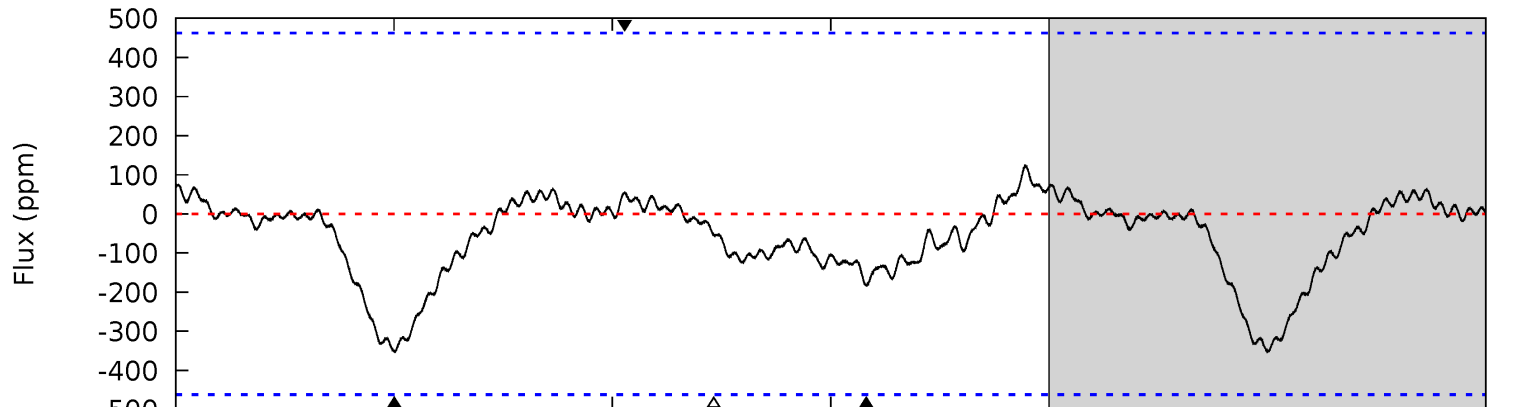
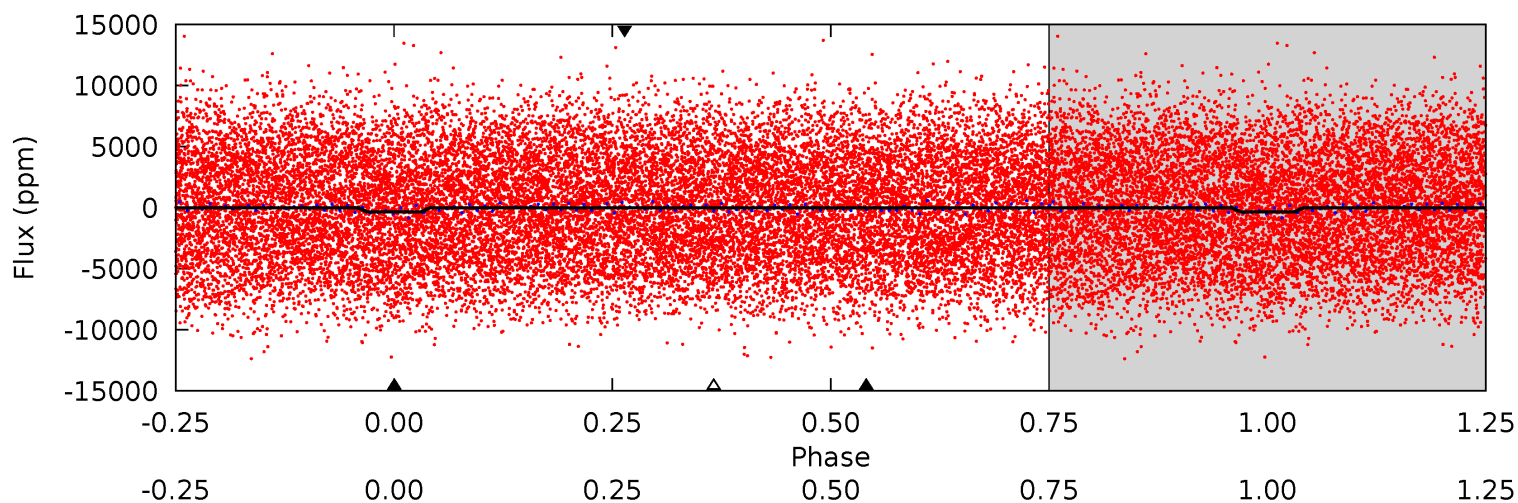
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
6.07	3.91	1.29	0	4.55	1.61	1.43	4.77	6.07	2.61	3.91	0.91	0.74	0.27	0.66



# Alt Model-Shift Uniqueness Test

012470709-03, P = 3.350200 Days, E = 129.428433 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
3.50	1.81	0.54	0.53	4.59	1.71	0.50	2.97	2.97	1.28	1.28	0.30	0.27	0.26	0.13



### Stellar Parameters For KIC 012470709

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$7421^{+207}_{-337}$	$4.192^{+0.090}_{-0.210}$	$0.000^{+0.200}_{-0.350}$	$1.656^{+0.550}_{-0.254}$	$1.556^{+0.222}_{-0.222}$	$0.482^{+0.244}_{-0.259}$
	+3%/-5%	+2%/-5%	+inf%/-inf%	+33%/-15%	+14%/-14%	+51%/-54%
Source	KIC0	KIC0	KIC0	DSEP		

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

### Secondary Eclipse Parameters for KIC 012470709-03 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-95 \pm 24$	$2.81^{+2.12}_{-1.67}$	$2656^{+214}_{-157}$	$5869^{+4537}_{-1332}$	$16^{+87}_{-11}$
Alt.	$-182 \pm 101$	$3.78^{+2.08}_{-1.94}$	$2649^{+202}_{-167}$	$5776^{+3188}_{-1375}$	$17^{+58}_{-12}$

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

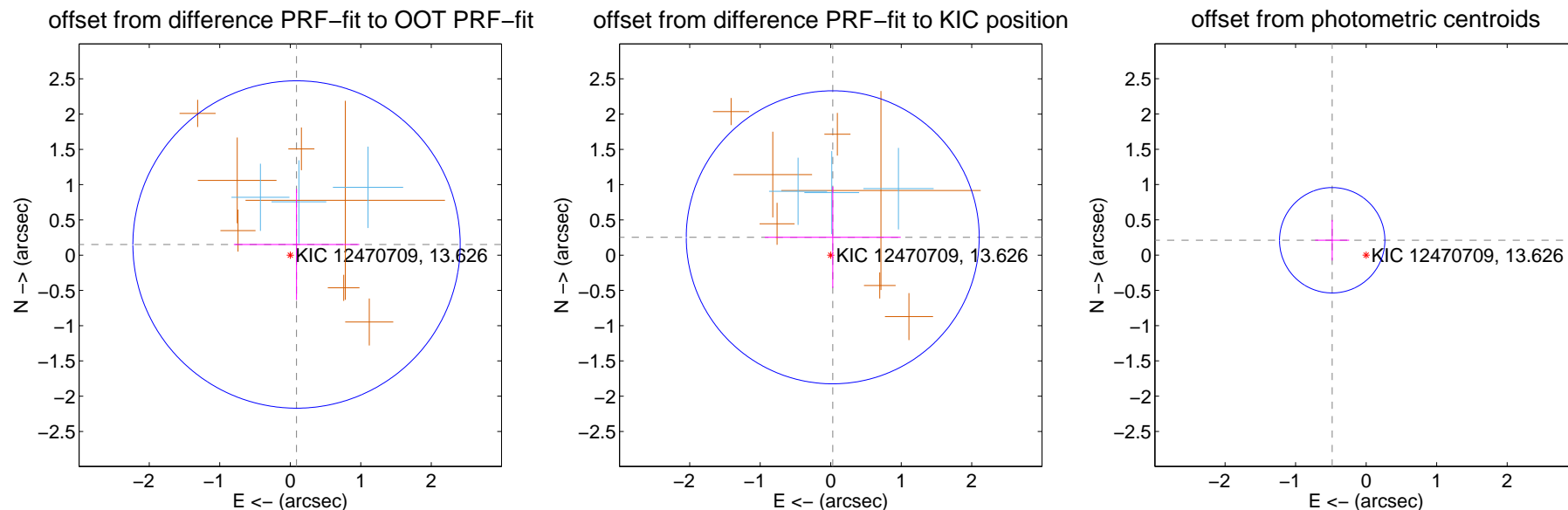
## DV Centroid Data

Supplemental centroid analysis for 012470709-03. Kepler magnitude: 13.63. Transit SNR 7.31

There are 3 quarters with good PRF difference image offsets

The direct PRF centroid is offset from the target star catalog position by about 0.13 arcsec

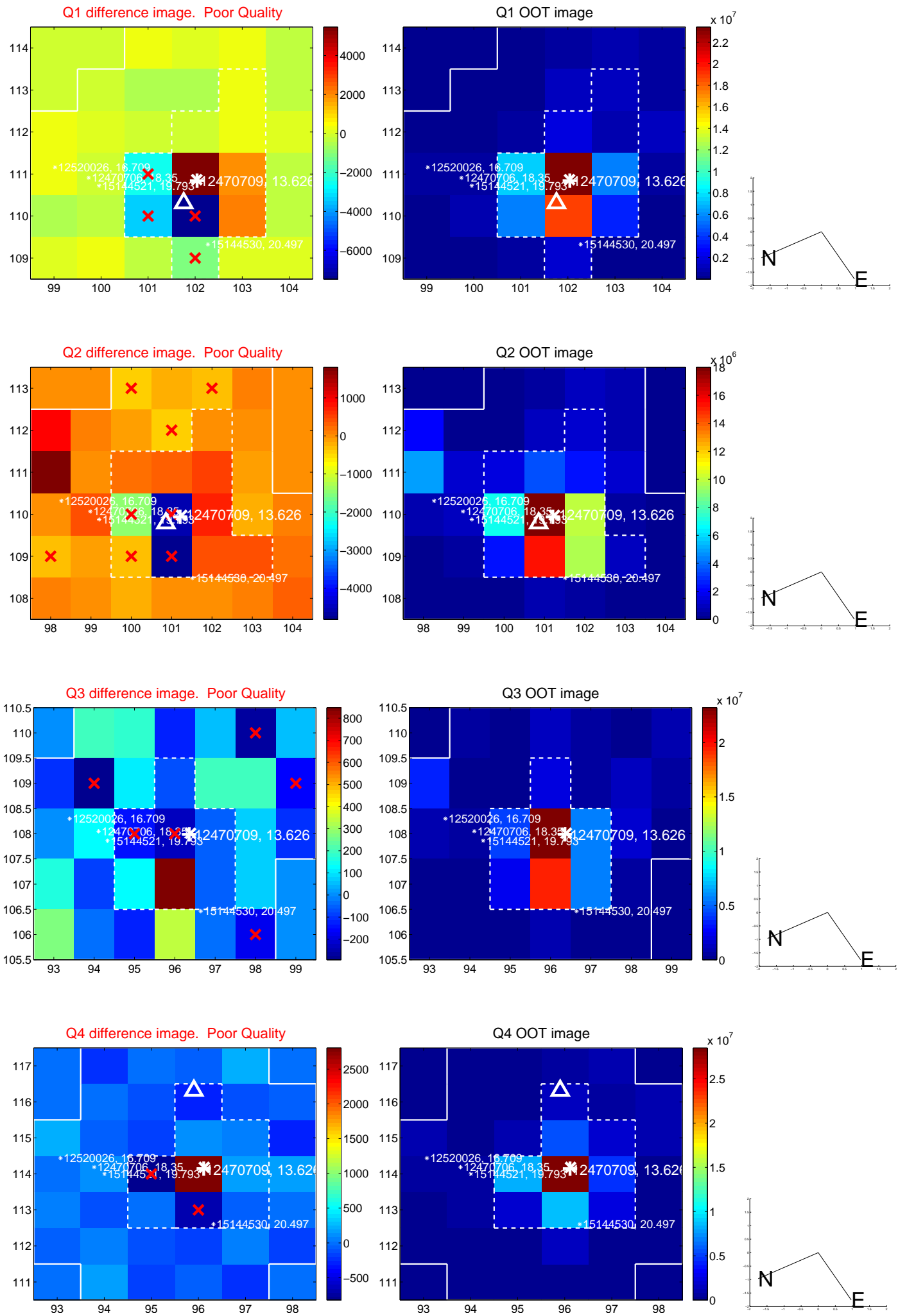
	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.176 \pm 0.774$	0.23	$-0.089 \pm 0.890$	$0.151 \pm 0.787$
PRF-fit source offset from KIC position	$0.255 \pm 0.693$	0.37	$-0.029 \pm 0.964$	$0.253 \pm 0.718$
photometric centroid source offset	$0.53 \pm 0.25$	2.11	$0.48 \pm 0.24$	$0.21 \pm 0.29$



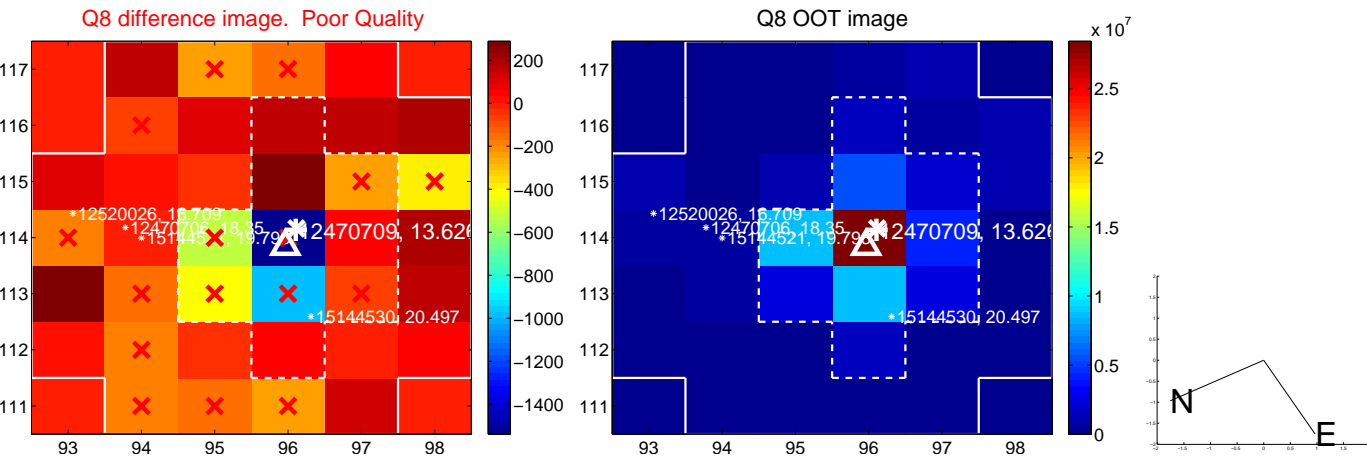
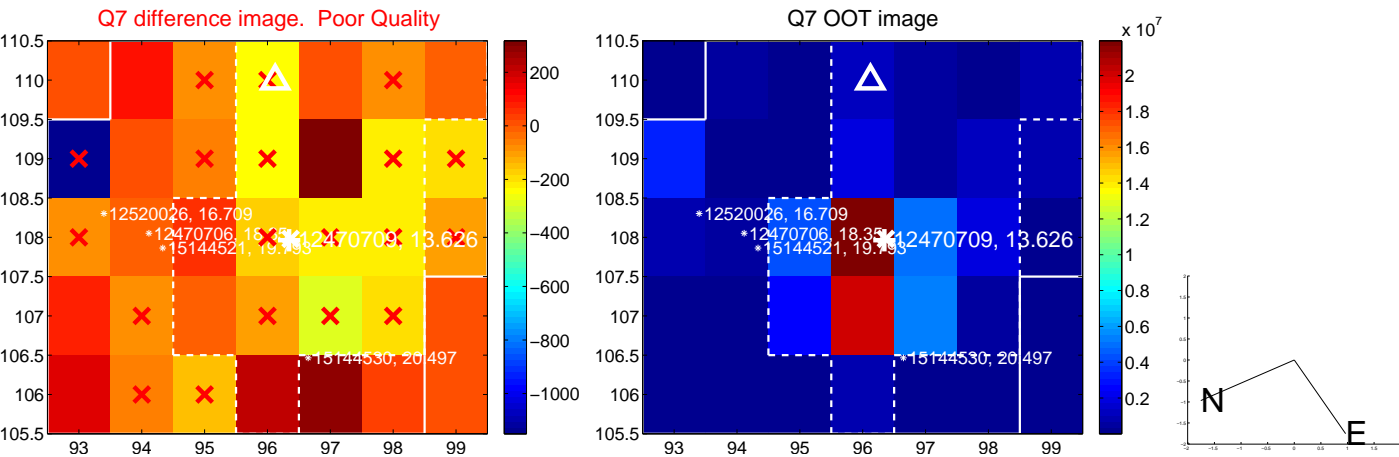
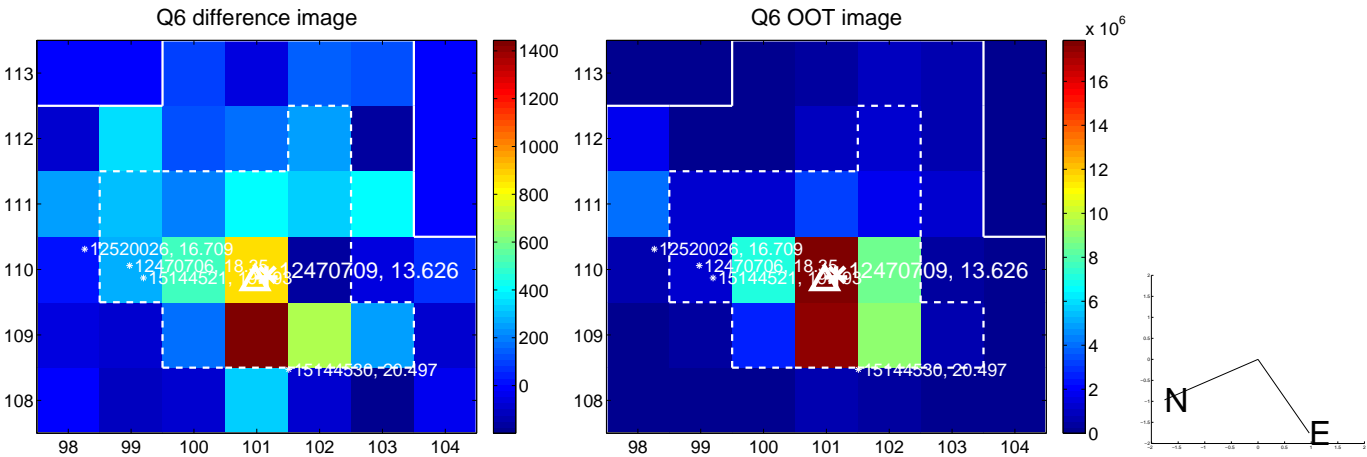
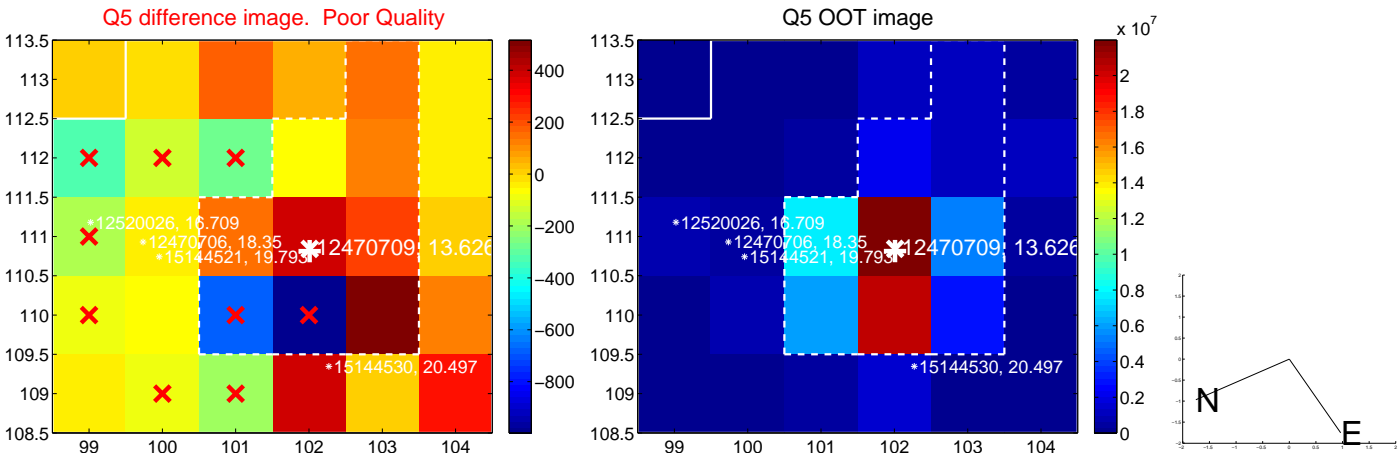
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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



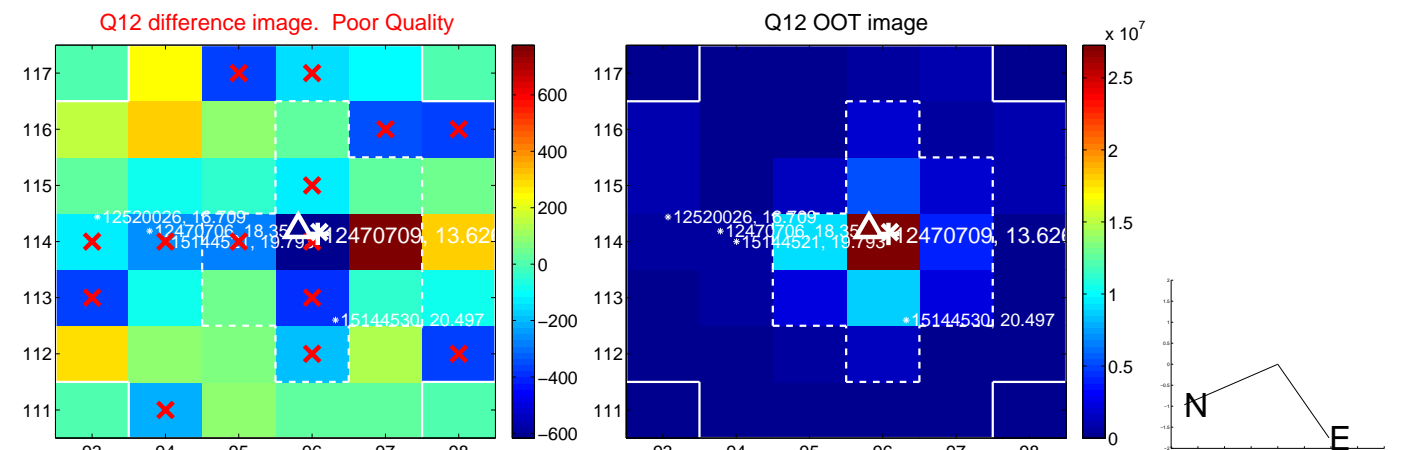
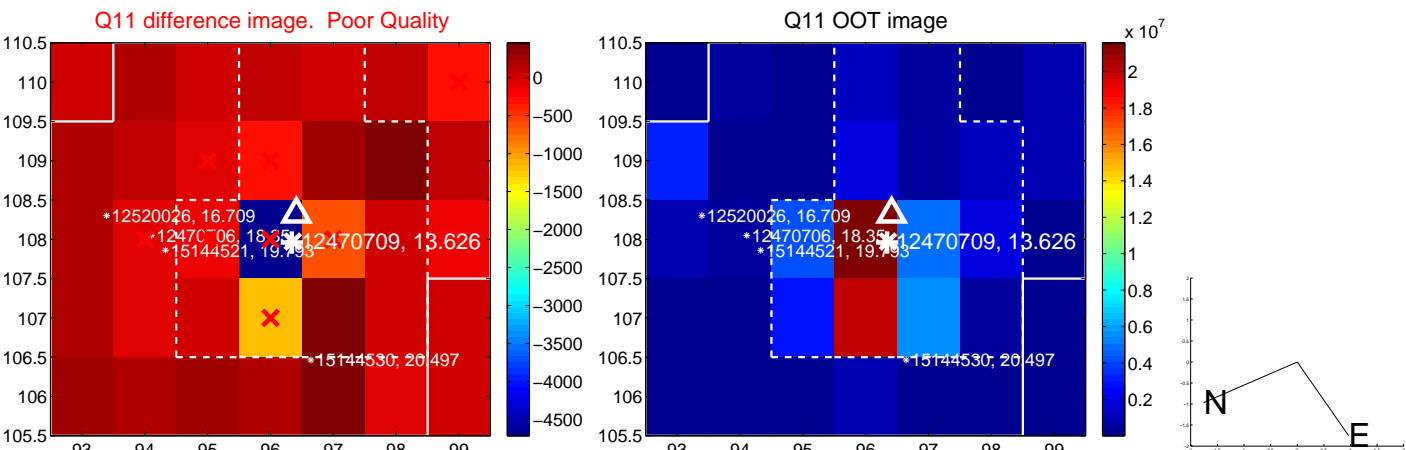
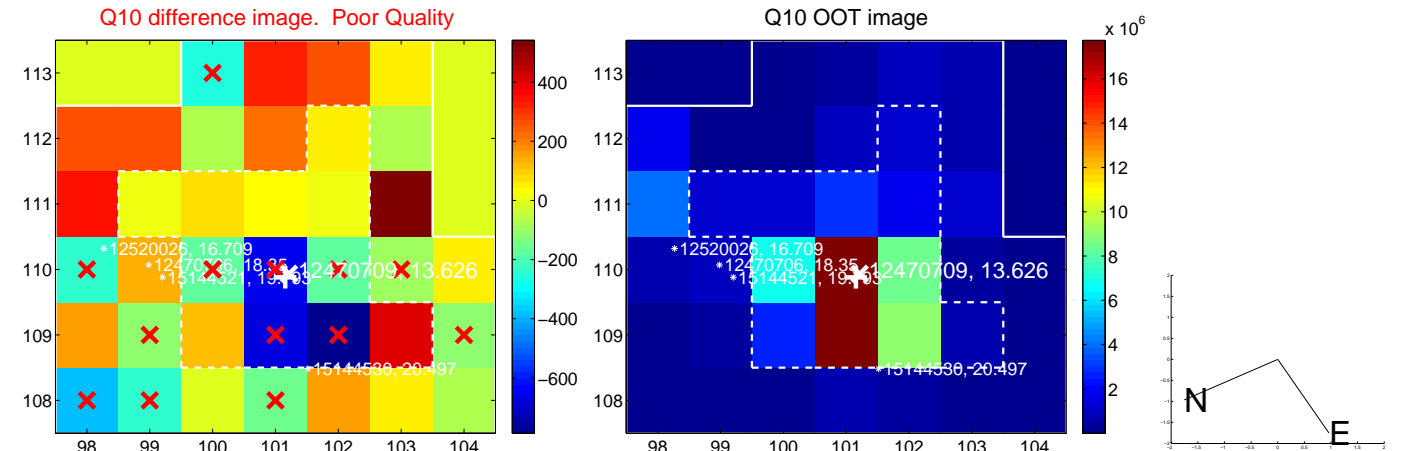
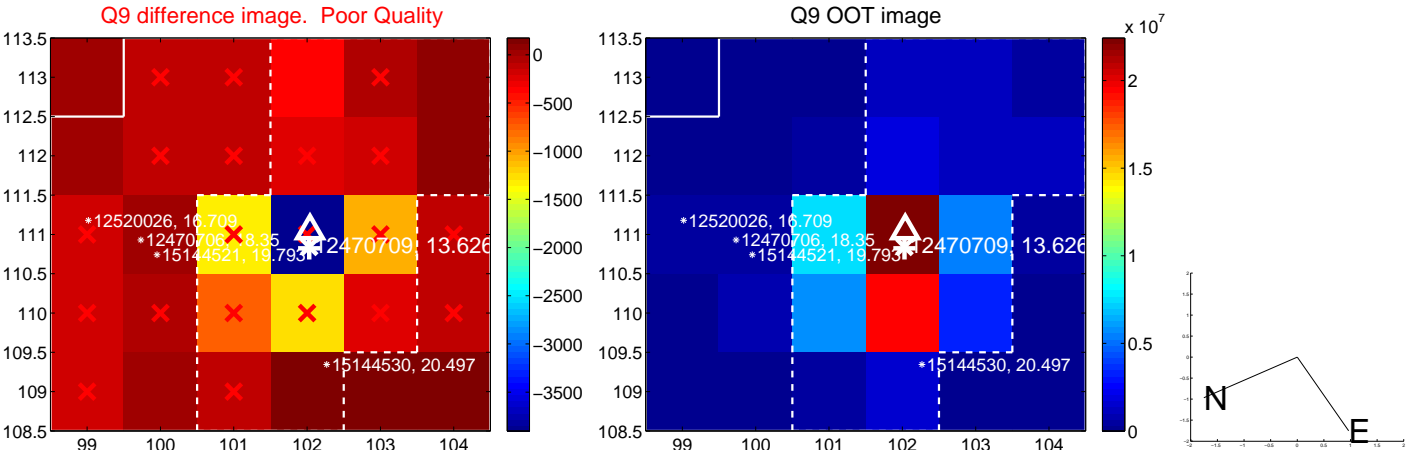
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



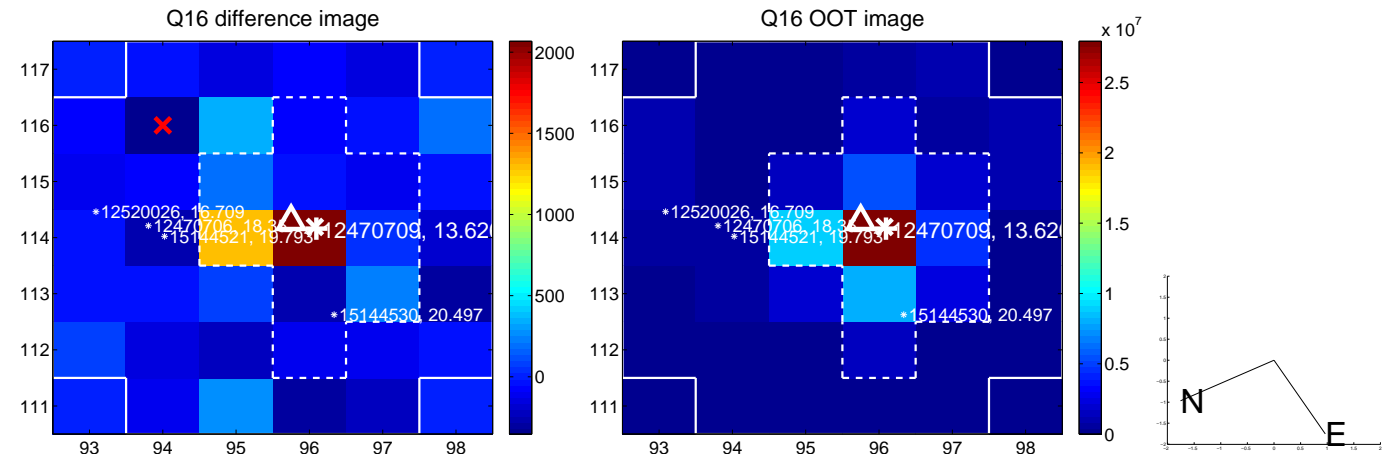
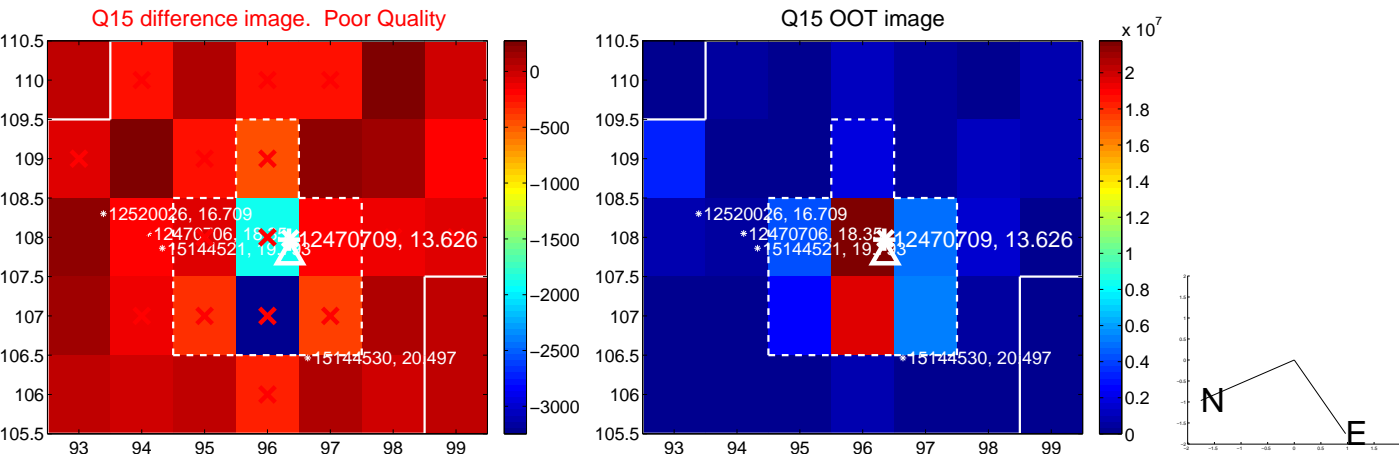
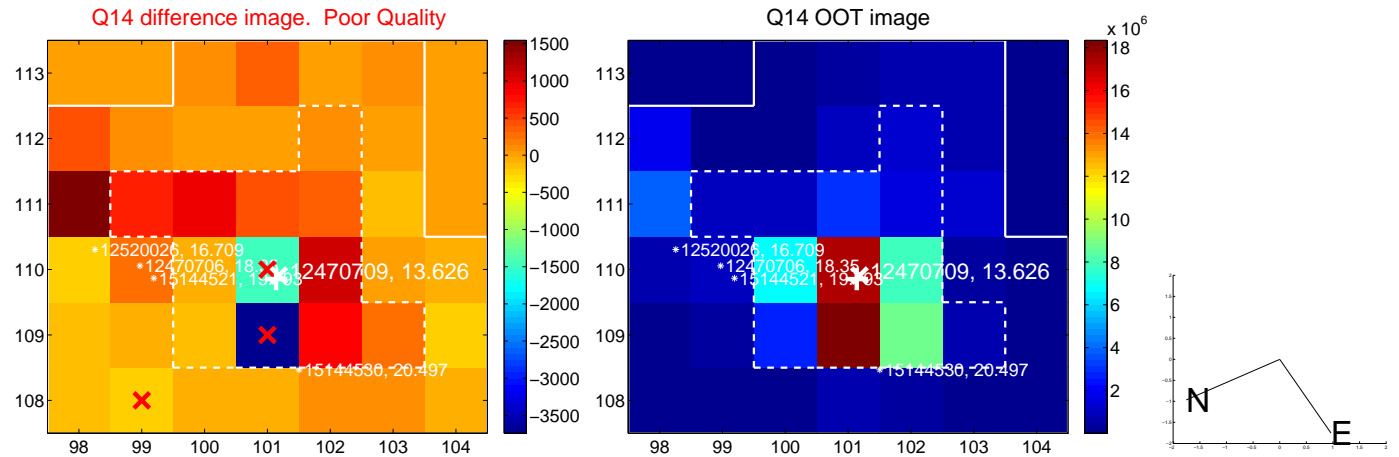
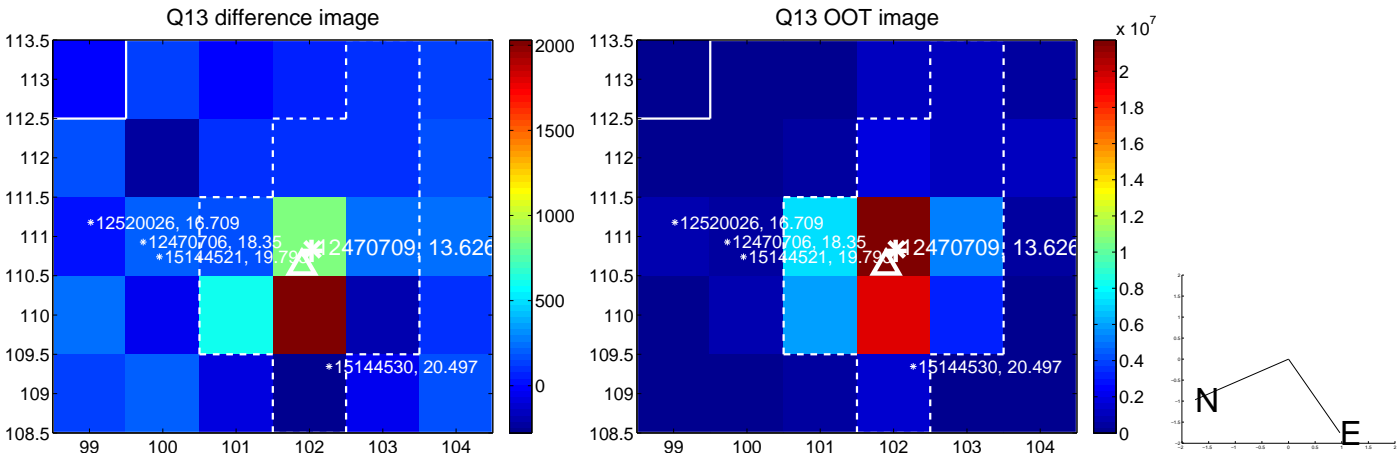
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



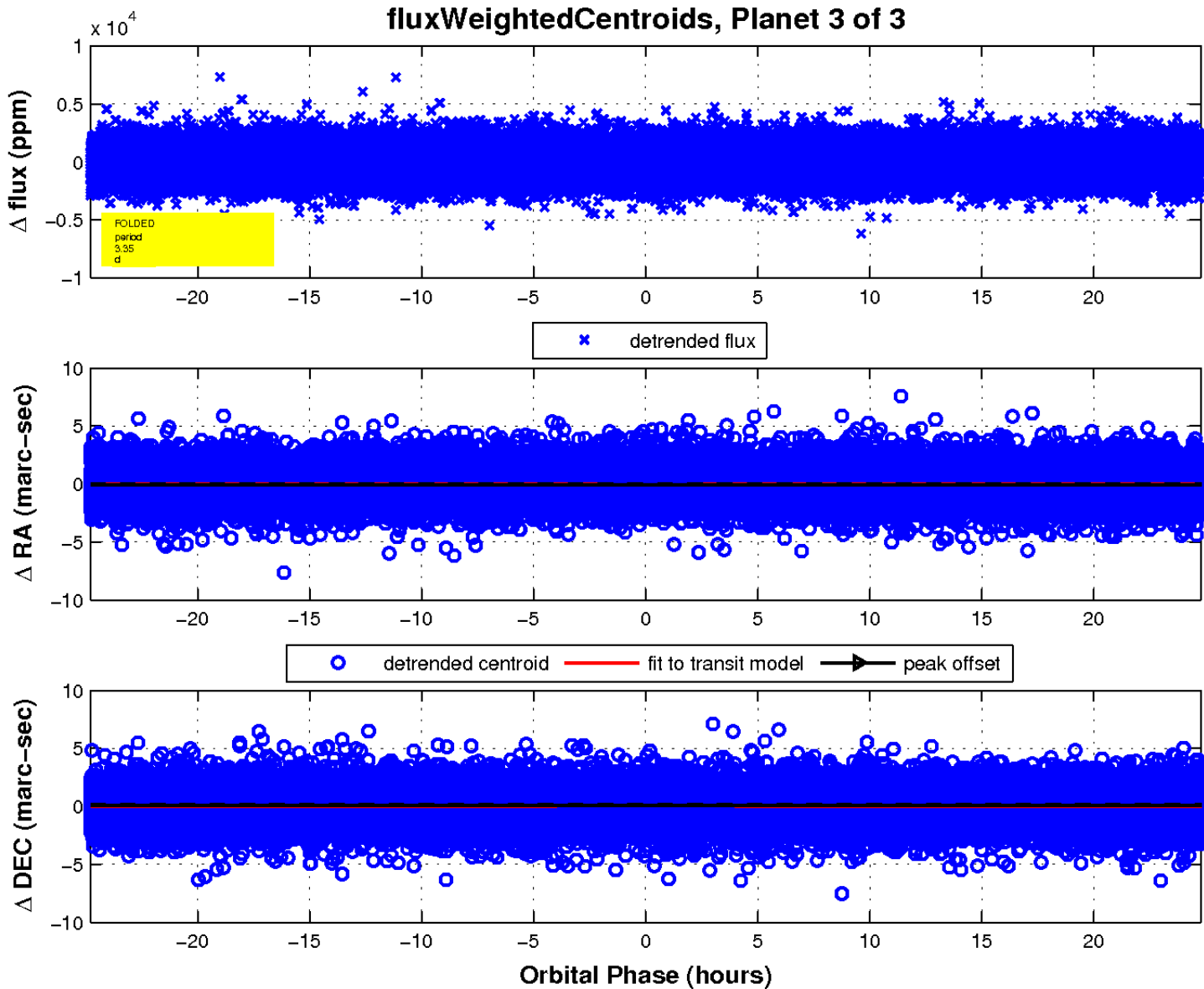
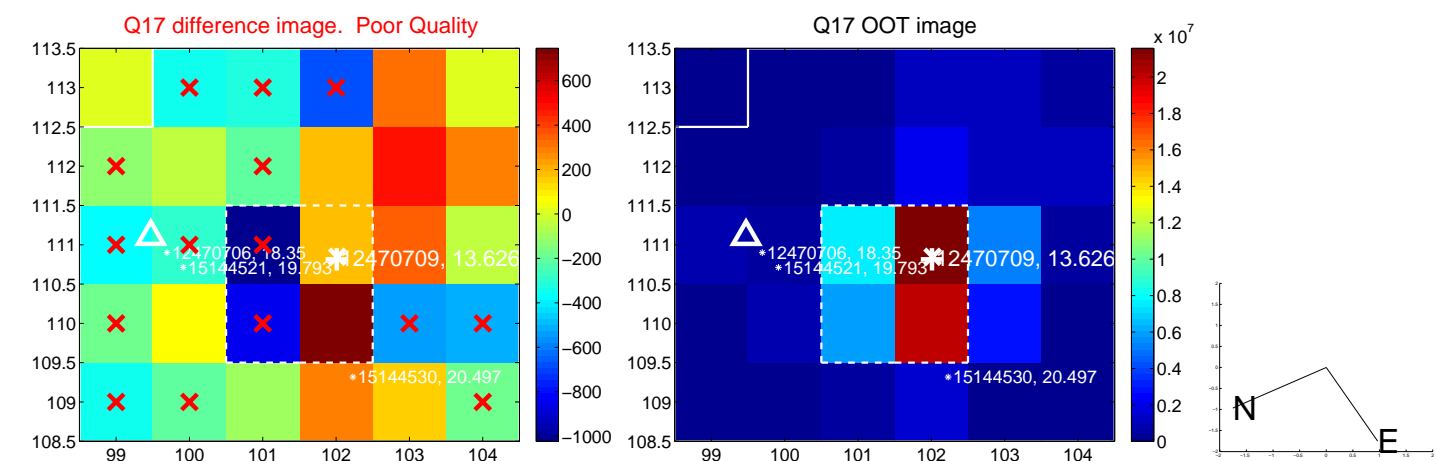
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

