

# KIC 009489524

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009489524-01	OBS	2029.01	16.332682	136.910308	308.9	2.533	24.7	28.6	0.77	5208	1.84	28.84
009489524-02	OBS	2029.02	10.055443	133.004205	136.6	2.888	17.2	18.0	0.77	5208	1.01	55.05
009489524-03	OBS	2029.03	6.887278	132.070333	77.5	2.400	11.2	11.8	0.77	5208	0.84	91.19
009489524-04	OBS	2029.04	4.788484	135.460708	69.7	2.211	9.9	11.9	0.77	5208	0.78	148.04

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009489524-01	OBS	PC	1.00	0	0	0	0	NO_COMMENT
009489524-02	OBS	PC	1.00	0	0	0	0	CENT_CROWDED
009489524-03	OBS	PC	1.00	0	0	0	0	NO_COMMENT
009489524-04	OBS	PC	0.86	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.

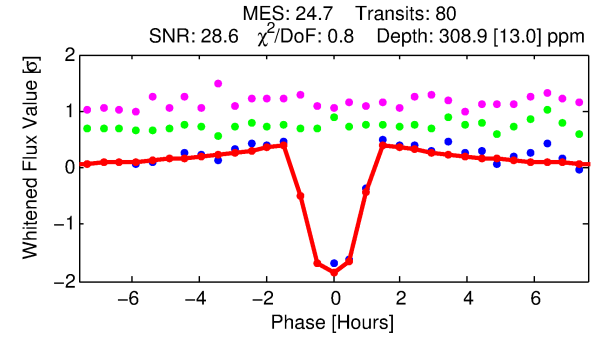
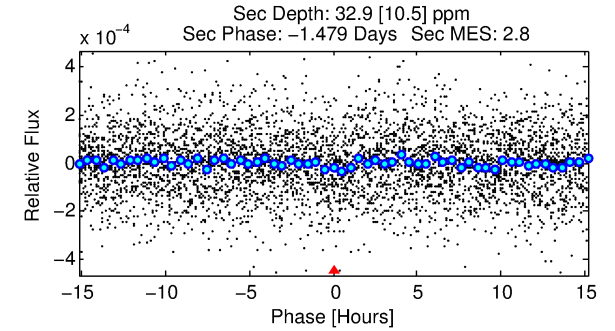
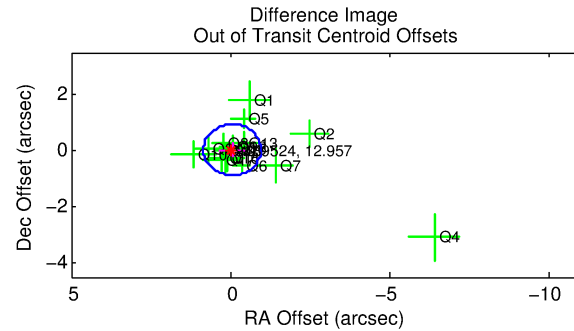
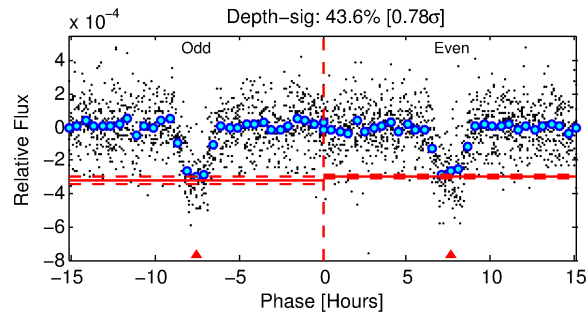
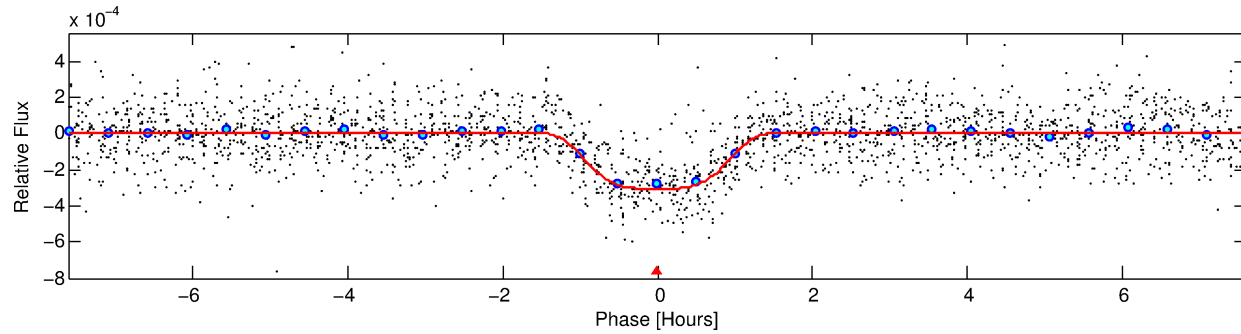
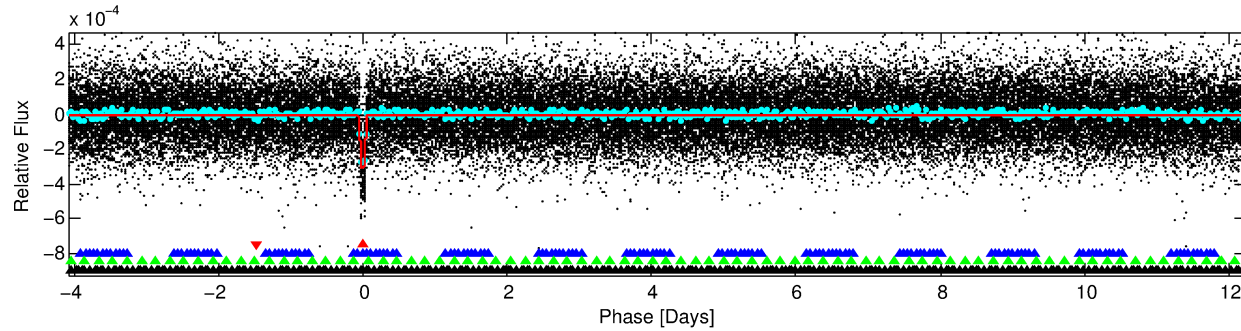
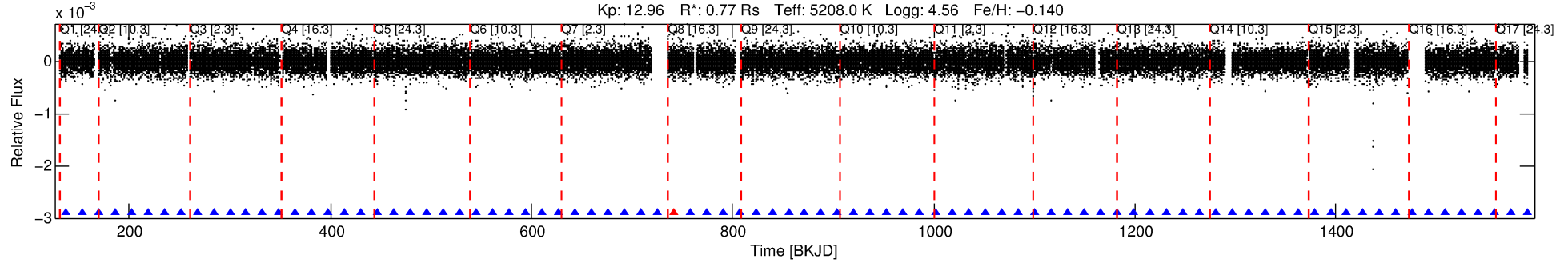
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 009489524-01

No Significant Match Found

# DV One-Page Summary

KIC: 9489524 Candidate: 1 of 4 Period: 16.333 d  
KOI: K02029.01 Name: Kepler-352c Corr: 0.900



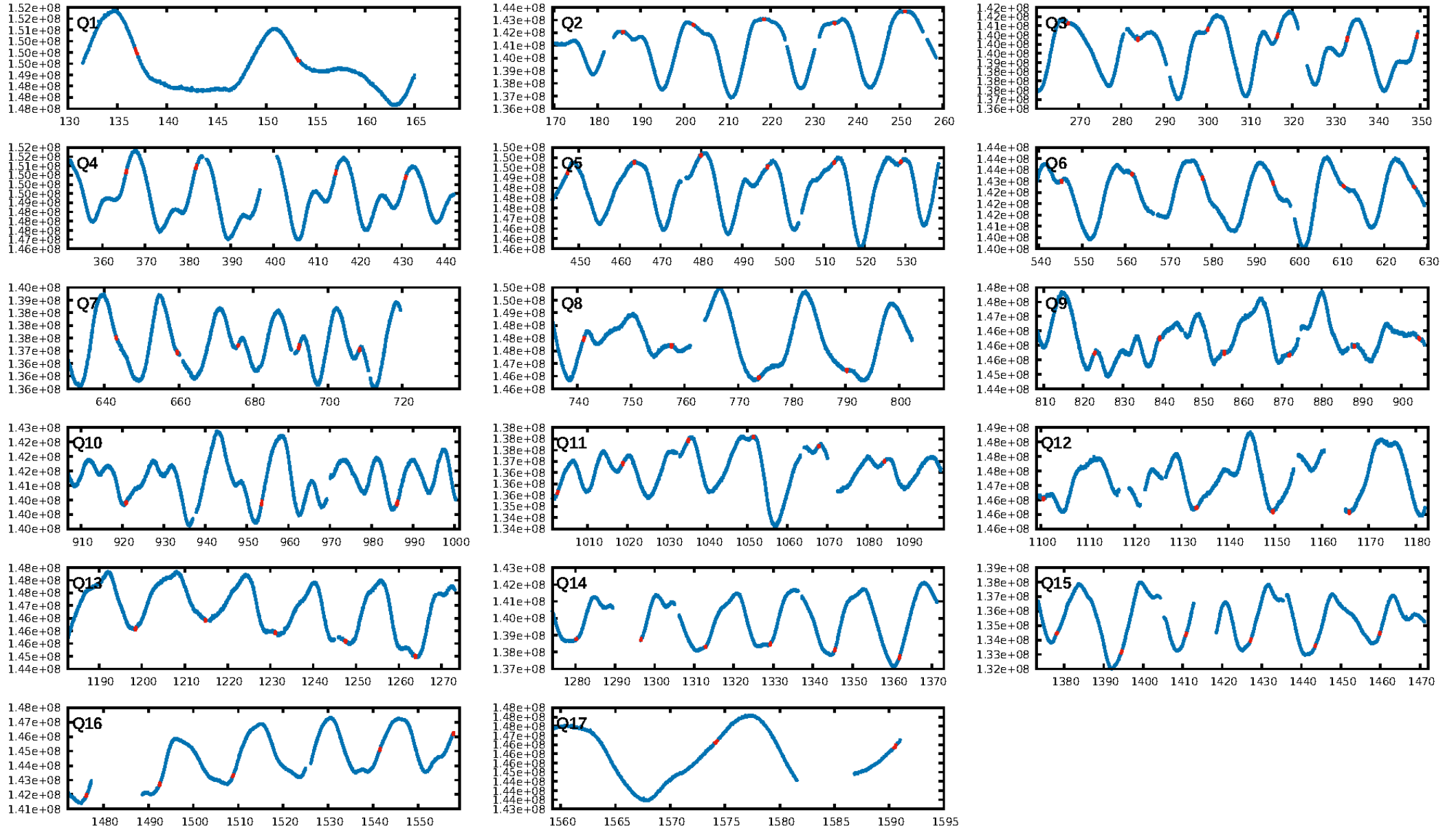
## DV Fit Results:

Period = 16.33268 [0.00004] d  
Epoch = 136.9103 [0.0019] BKJD  
Rp/R\* = 0.0219 [0.0008]  
a/R\* = 16.30 [1.90]  
b = 0.97 [0.01]  
Seff = 28.83 [3.52]  
Teq = 591 [18] K  
Rp = 1.84 [0.15] Re  
a = 0.1167 [0.0072] AU  
Ag = 72.52 [24.79] [2.88 $\sigma$ ]  
Teffp = 2666 [226] K [9.17 $\sigma$ ]

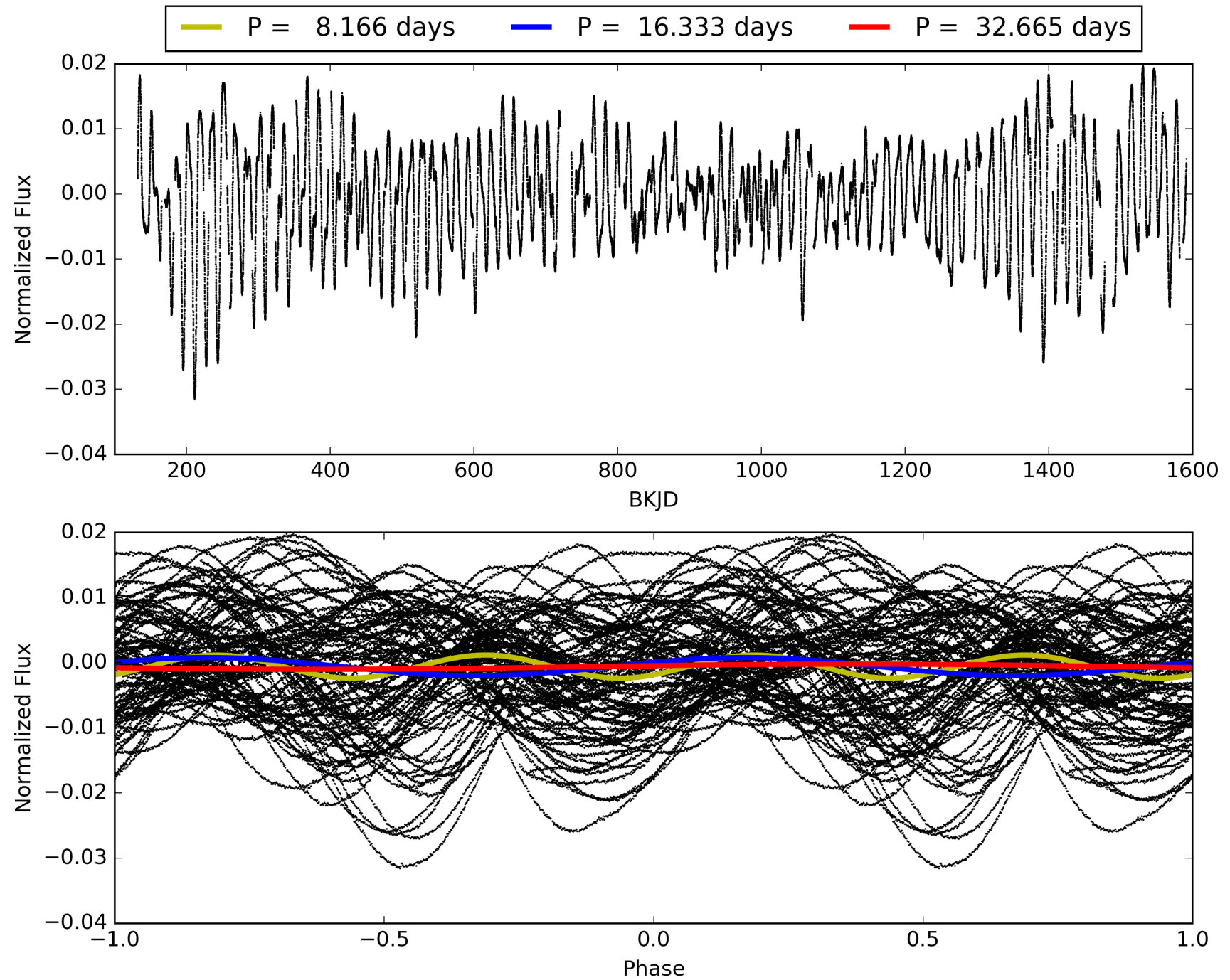
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [39.22 $\sigma$ ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 100.0%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 2.01e-128  
RollingBand-fgt: 0.99 [75/76]  
GhostDiagnostic-chr: 1.761  
Centroid-sig: N/A  
Centroid-so: 1.034 arcsec [2.21 $\sigma$ ]  
OotOffset-rm: 0.068 arcsec [0.23 $\sigma$ ]  
KicOffset-rm: 0.205 arcsec [0.86 $\sigma$ ]  
OotOffset-st: 4/4/4/5 [17]  
KicOffset-st: 4/4/4/5 [17]  
DiffImageQuality-fgm: 0.94 [16/17]  
DiffImageOverlap-fno: 1.00 [17/17]

# TCE 009489524-01, PDC Light Curves



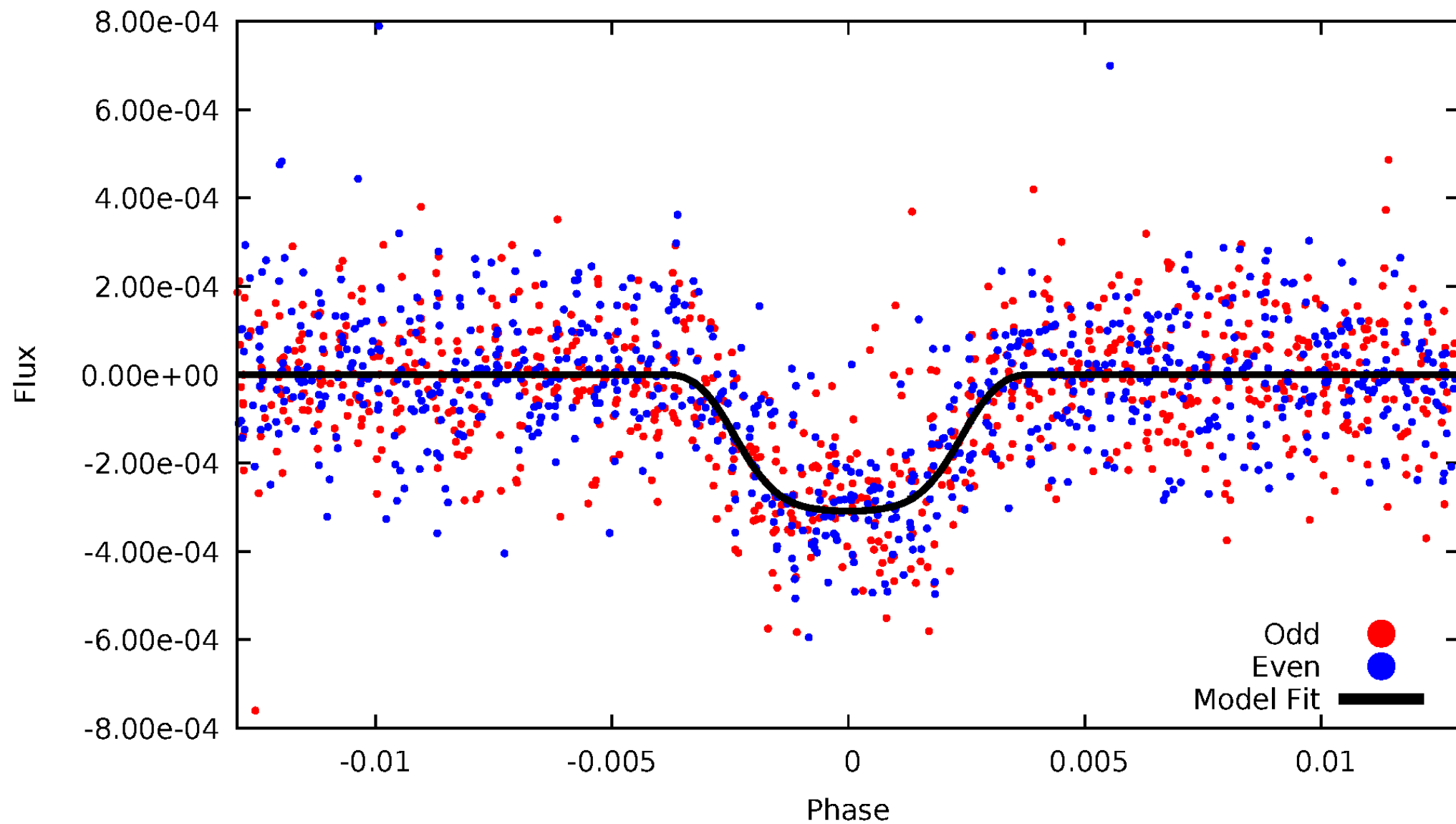
# TCE 009489524-01





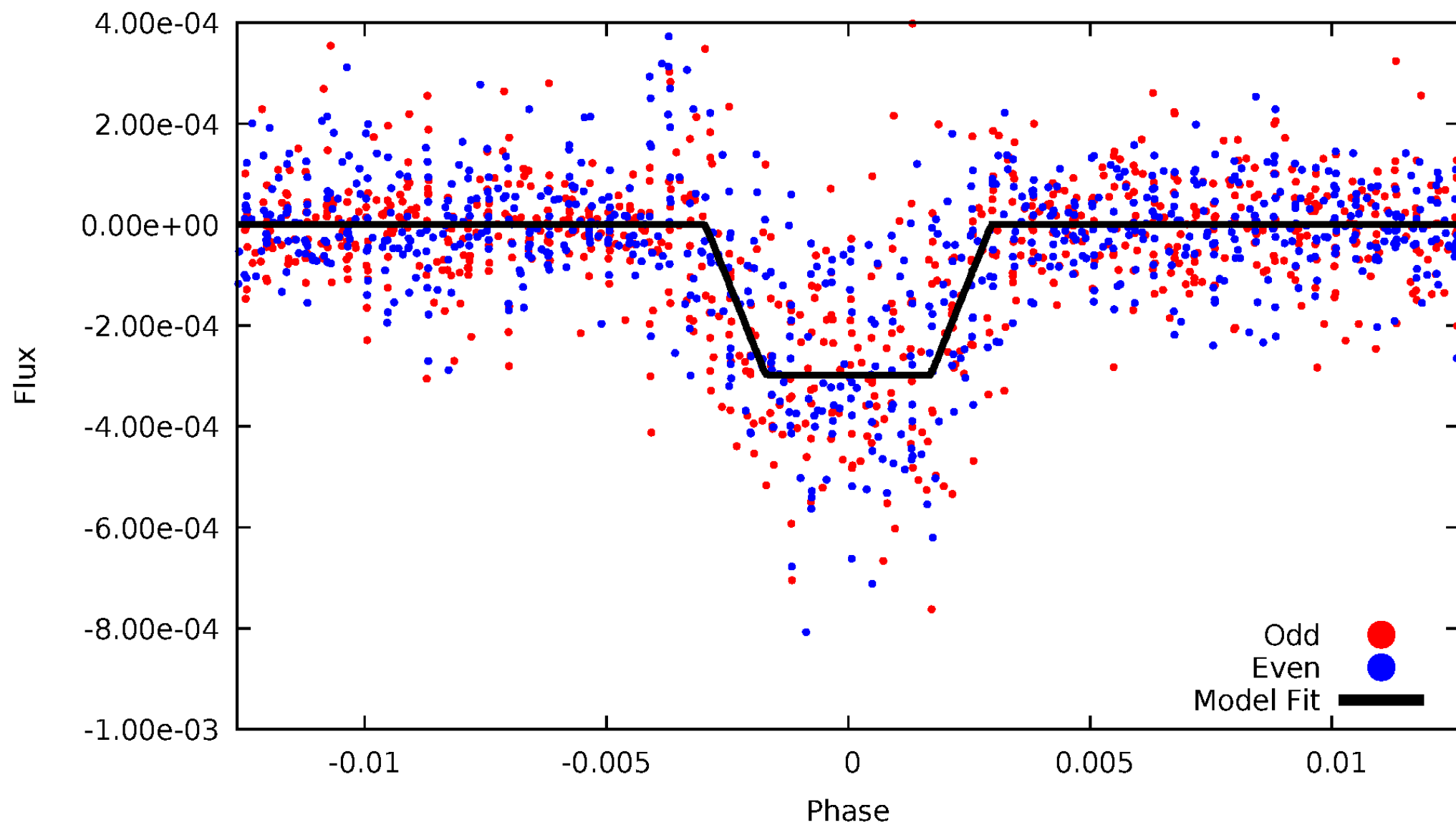
# DV Odd/Even

TCE 009489524-01



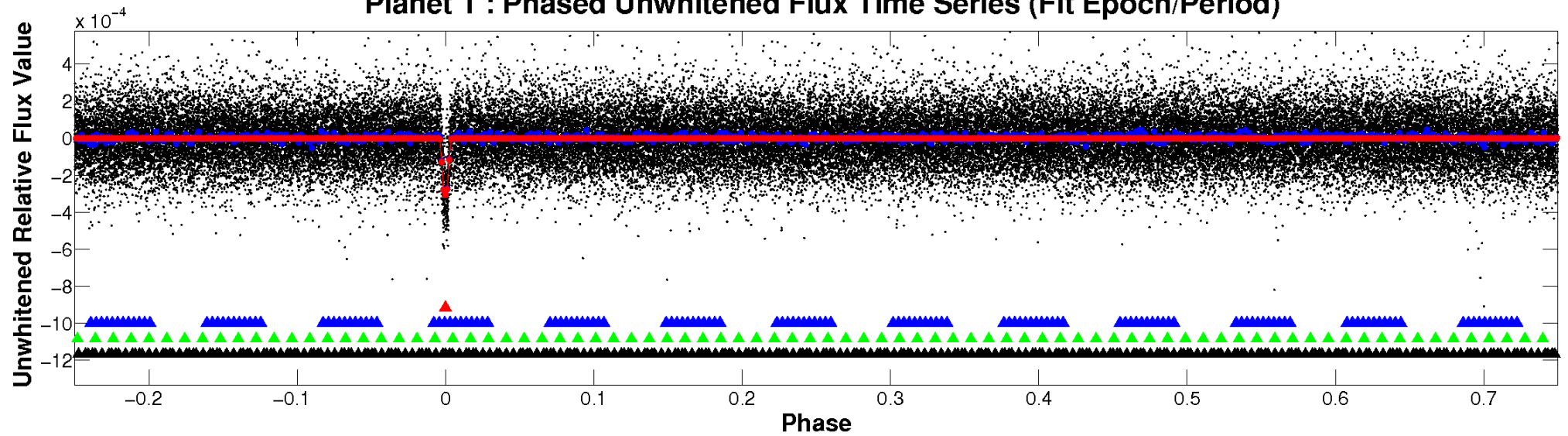
# ALT Odd/Even

TCE 009489524-01

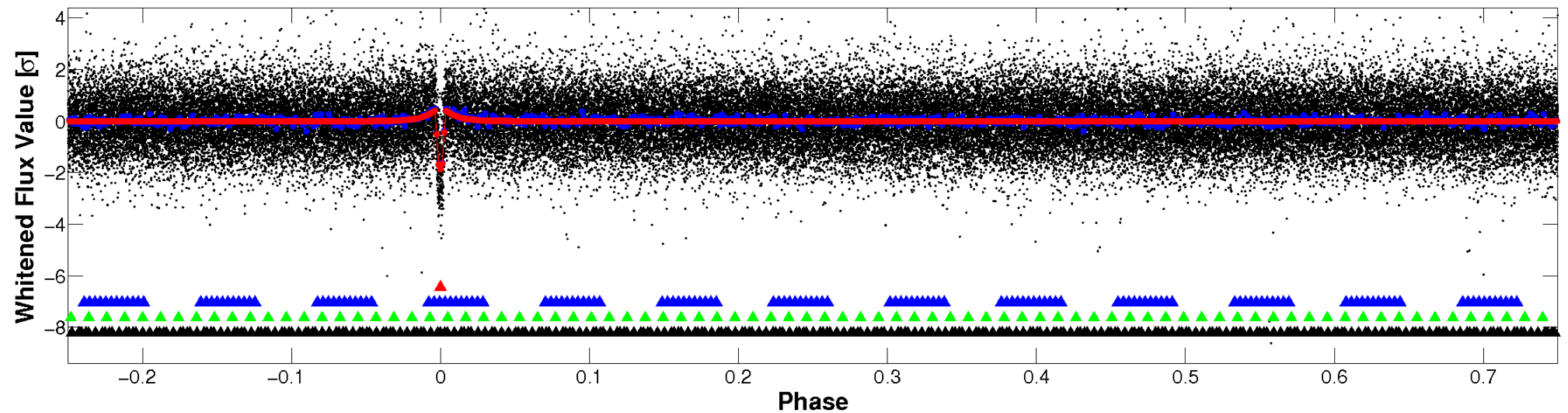


# Non-Whitened Vs. Whitened Light Curve

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

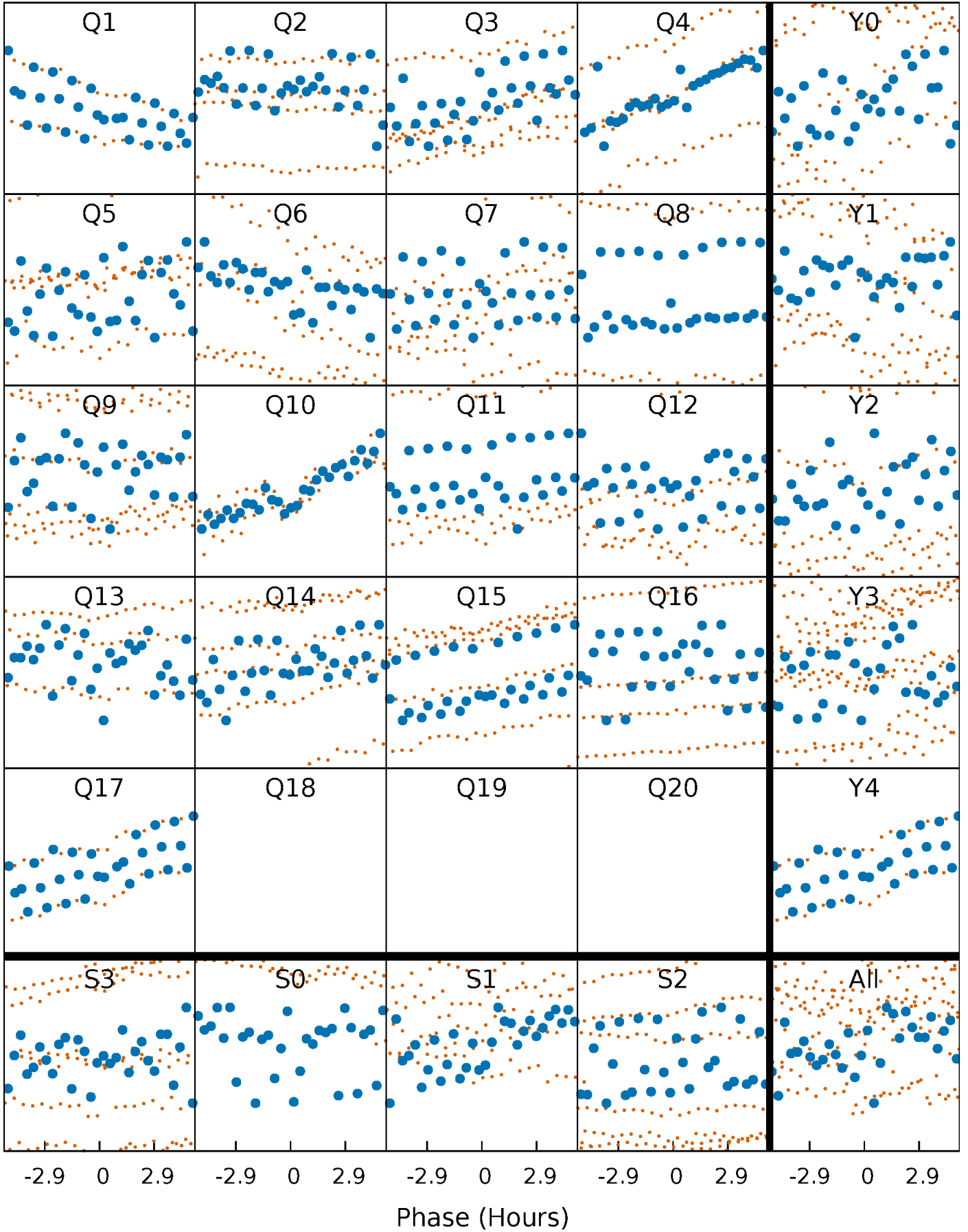


Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)



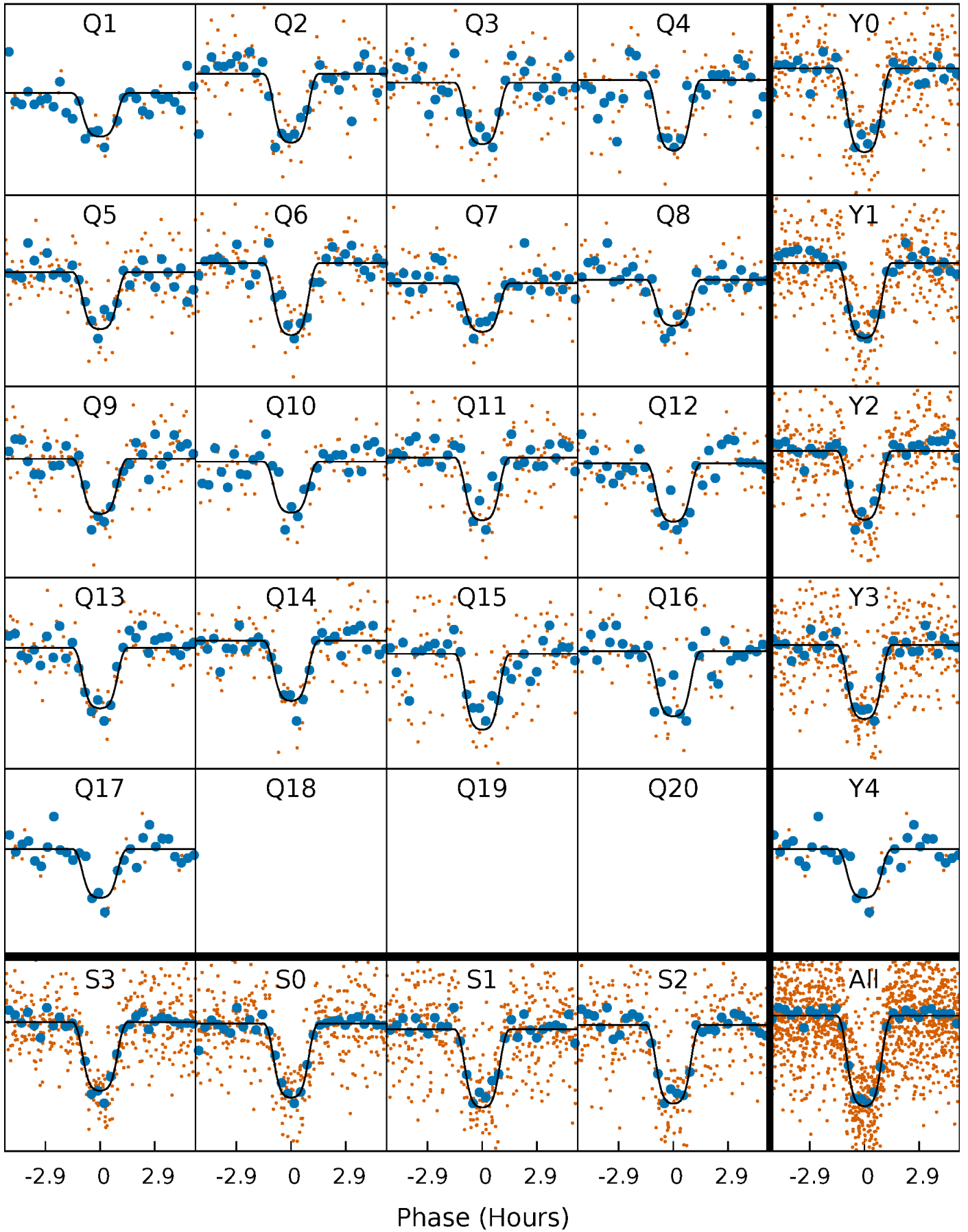
# PDC Quarter-Phased Transit Curves

TCE 009489524-01 P= 16.332682 Days  $T_0=136.910308$  (BKJD)



# DV Quarter-Phased Transit Curves

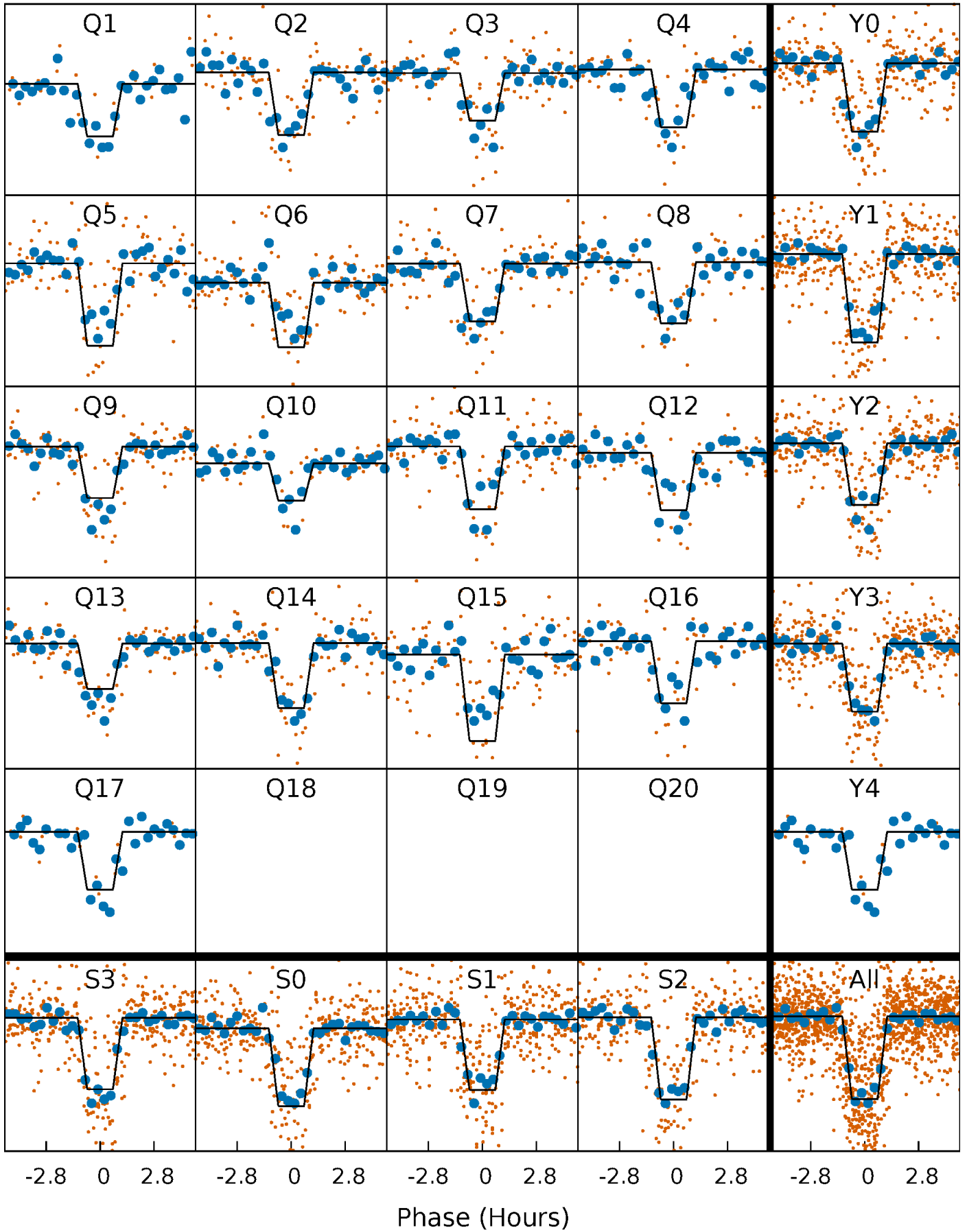
TCE 009489524-01 P= 16.332682 Days  $T_0=136.910308$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

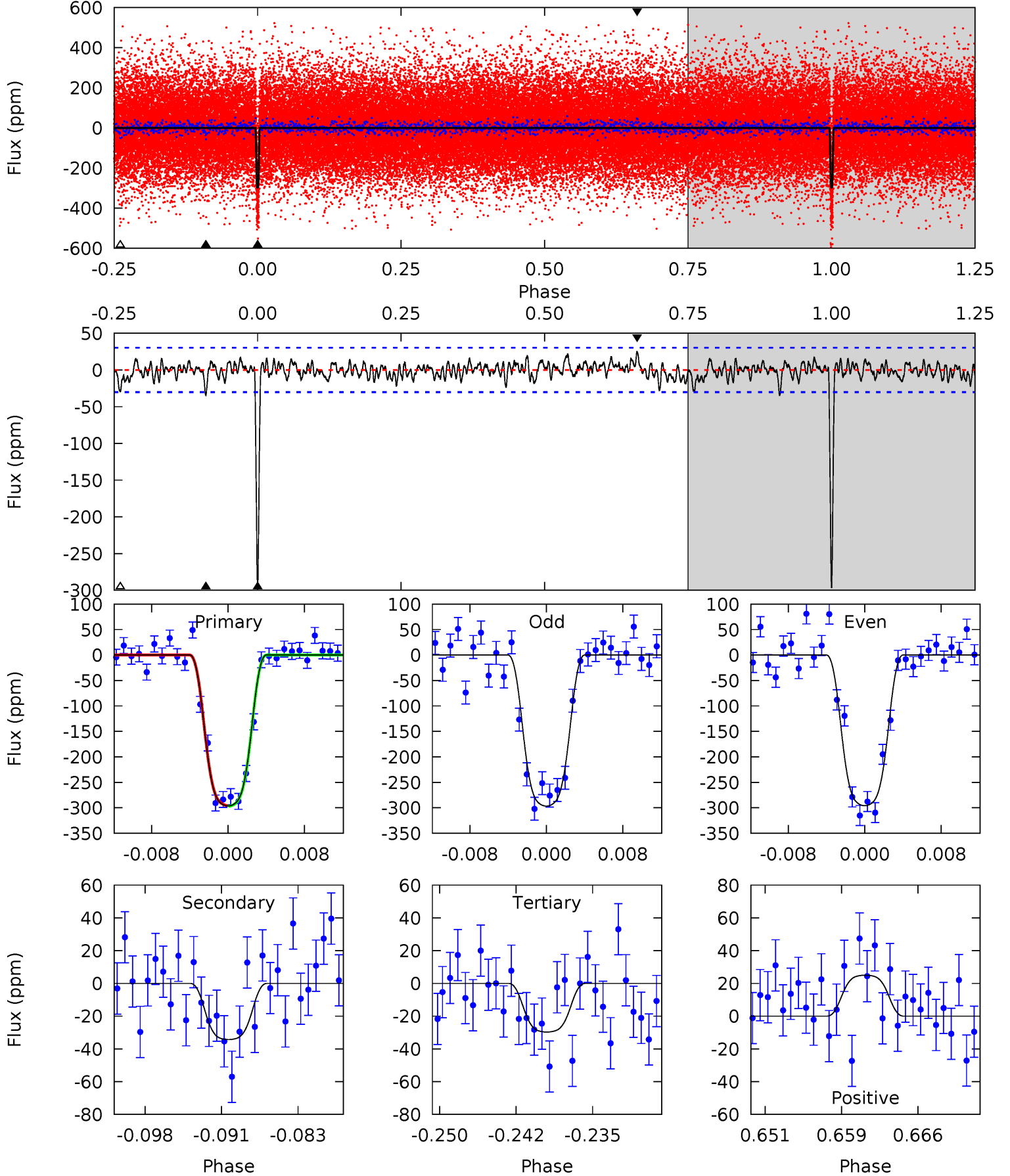
TCE 009489524-01 P= 16.332662 Days  $T_0=136.911742$  (BKJD)



# DV Model-Shift Uniqueness Test

009489524-01, P = 16.332682 Days, E = 120.577626 Days

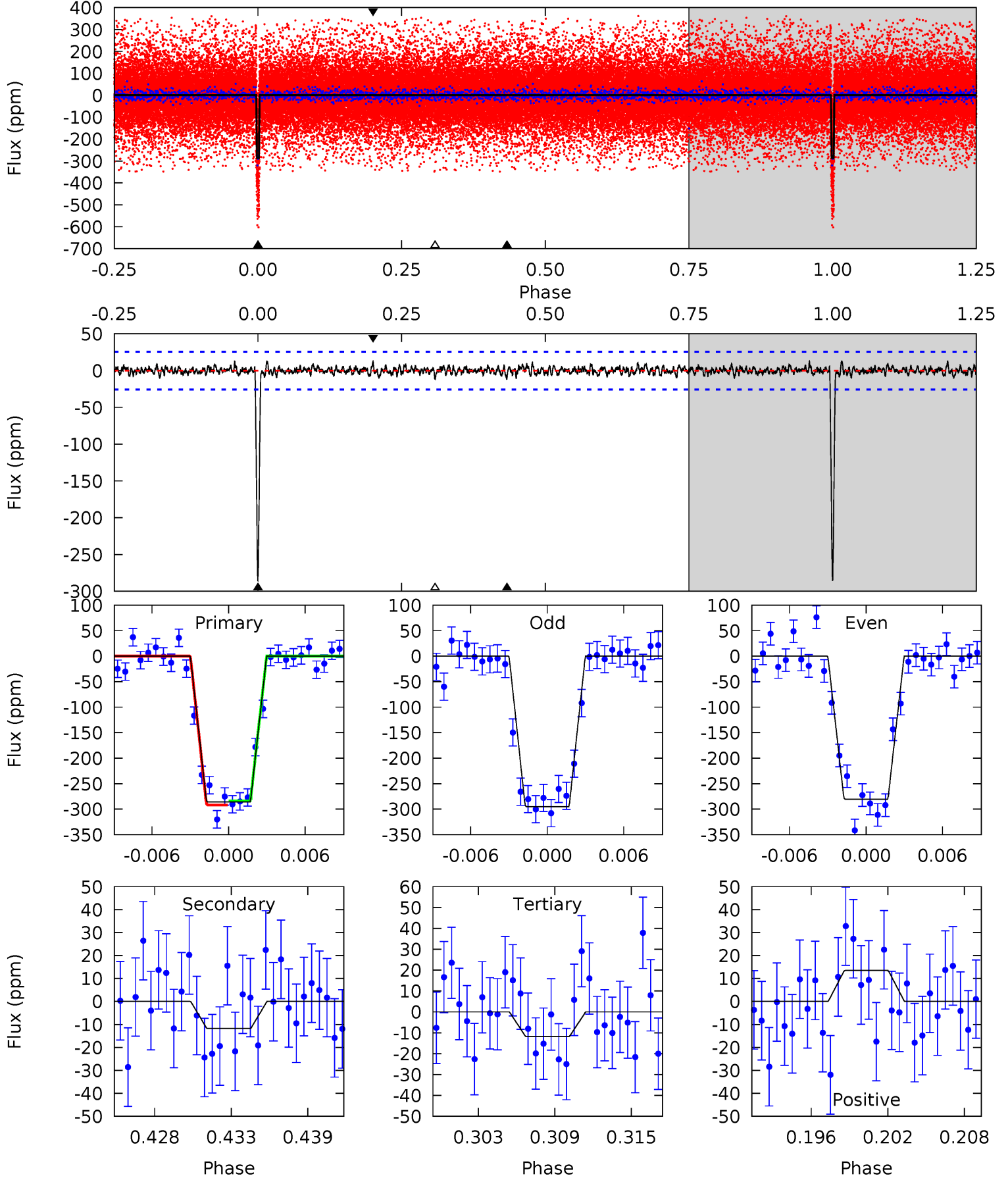
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
49.9	5.78	5.00	4.21	5.08	2.67	1.40	44.9	45.7	0.78	1.57	0.06	0.98	0.08	0.12



# Alt Model-Shift Uniqueness Test

009489524-01, P = 16.332662 Days, E = 120.579080 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
57.1	2.35	2.35	2.70	5.13	2.75	0.72	54.7	54.4	0.00	-0.34	1.44	1.04	0.05	0.82



### Stellar Parameters For KIC 009489524

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5208^{+103}_{-103}$	$4.563^{+0.036}_{-0.052}$	$-0.140^{+0.150}_{-0.150}$	$0.772^{+0.055}_{-0.041}$	$0.796^{+0.046}_{-0.046}$	$2.432^{+0.336}_{-0.397}$
	+2%/-2%	+1%/-1%	+107%/-107%	+7%/-5%	+6%/-6%	+14%/-16%
Source	SPE58	SPE58	SPE58	DSEP		

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

### Secondary Eclipse Parameters for KIC 009489524-01 / KOI 2029.01

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-34 \pm 6$	$1.86^{+0.09}_{-0.10}$	$828^{+22}_{-21}$	$3238^{+108}_{-102}$	$74^{+15}_{-13}$
Alt.	$-12 \pm 5$	$1.46^{+0.10}_{-0.09}$	$829^{+22}_{-21}$	$2960^{+172}_{-233}$	$39^{+19}_{-18}$

$T_{max}$  = Theoretical Maximum Planetary Temperature

$T_{obs}$  = Observed Planetary Temperature (Assuming A=0.3)

$A_{obs}$  = Observed Albedo (Assuming T=0)

If a secondary eclipse is present, the system is likely an EB if  $T_{obs} \gg T_{max}$  AND  $A_{obs} \gg 1.0$

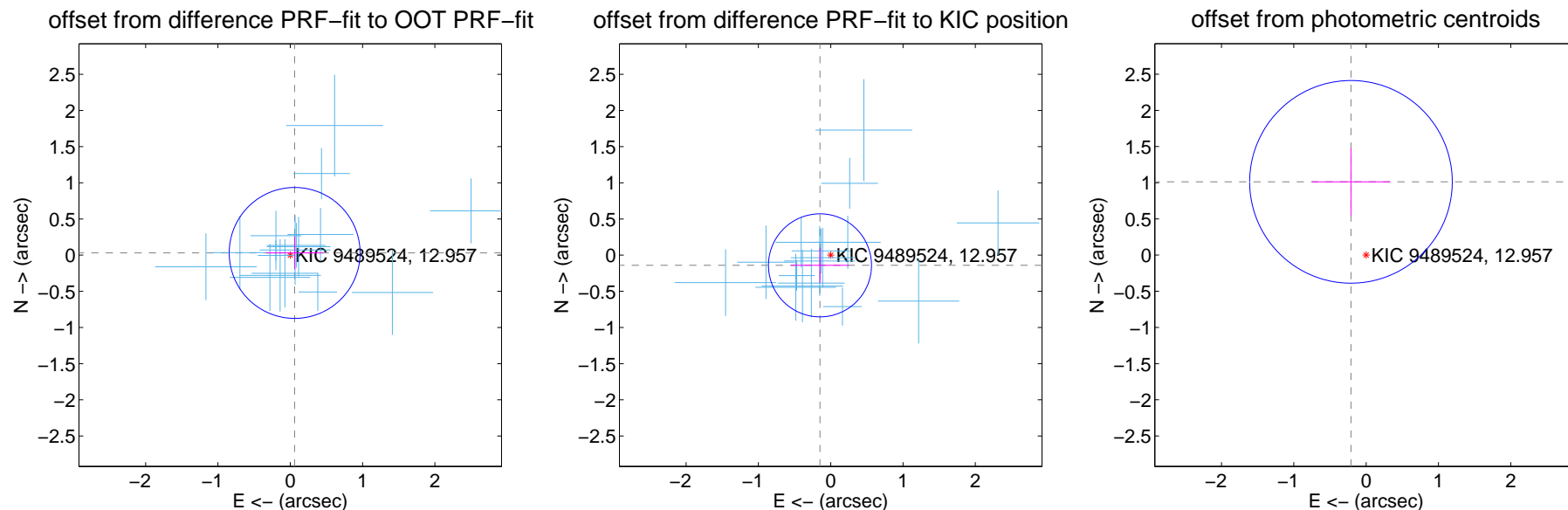
## DV Centroid Data

Supplemental centroid analysis for 009489524-01. Kepler magnitude: 12.96. Transit SNR 28.64

There are 16 quarters with good PRF difference image offsets

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

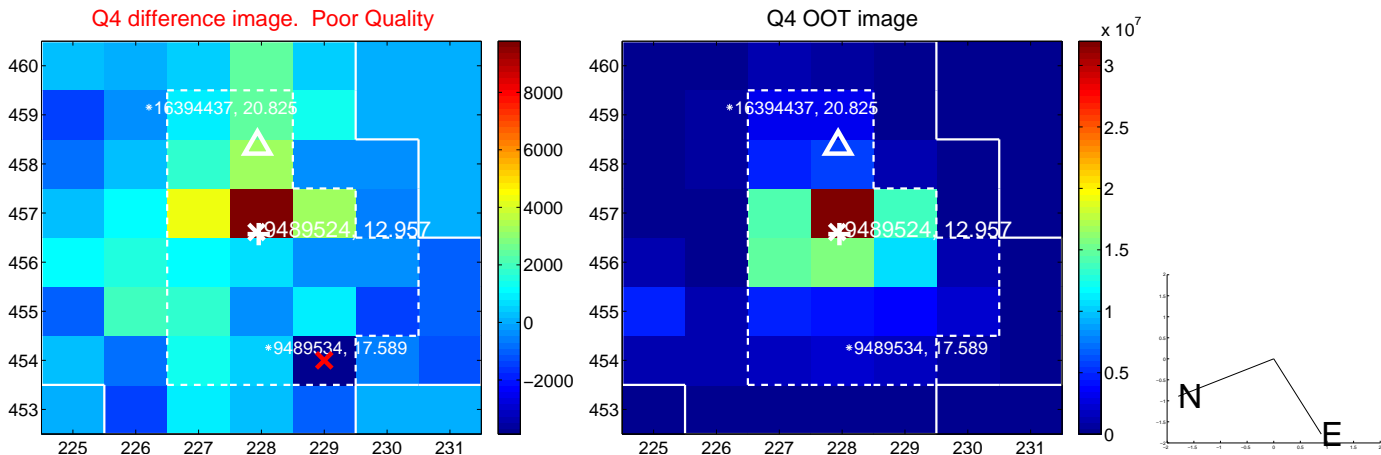
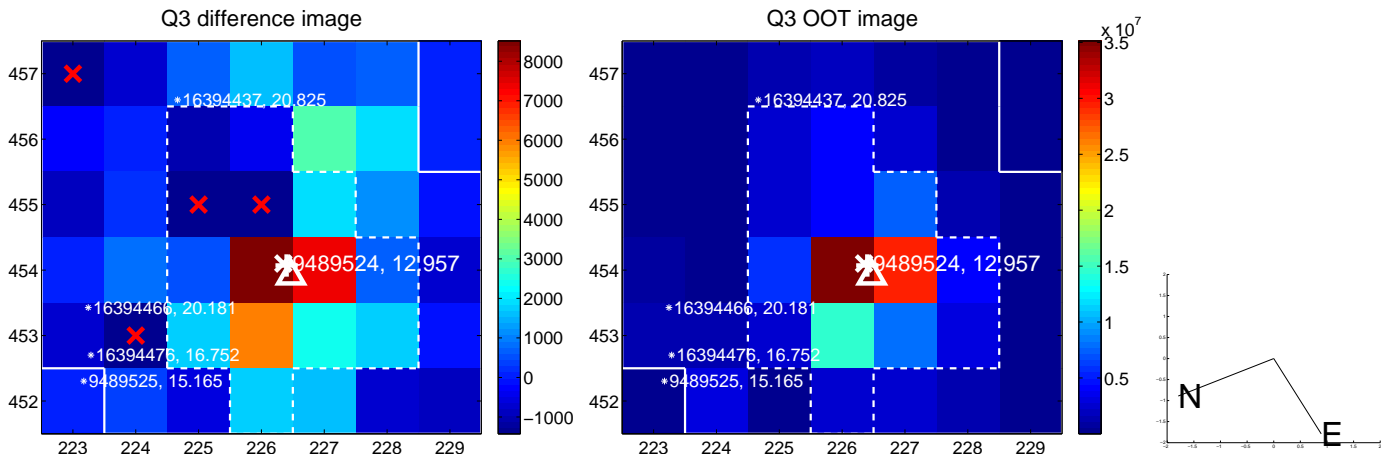
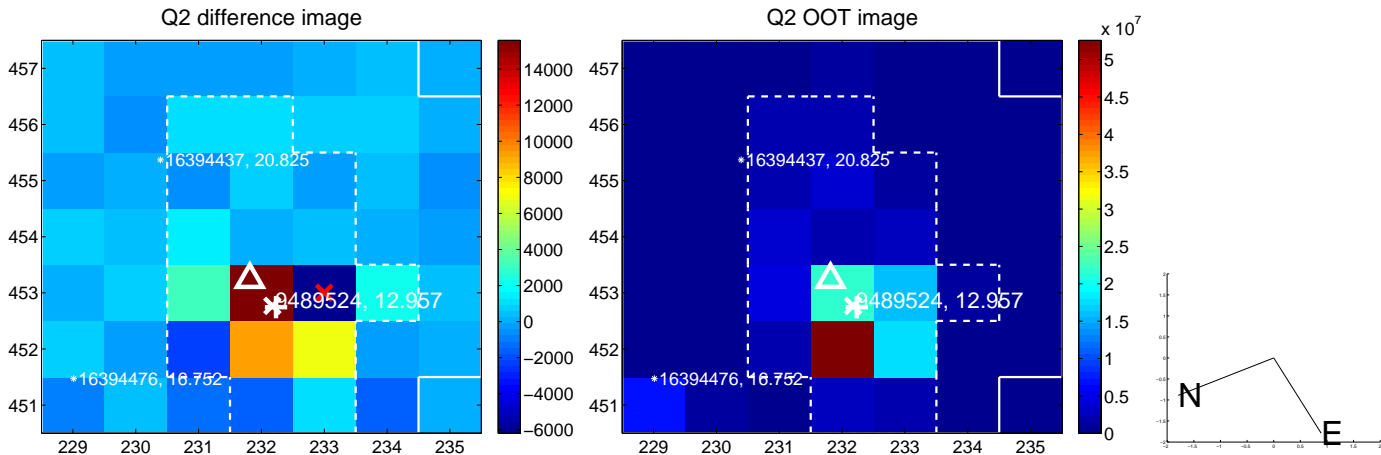
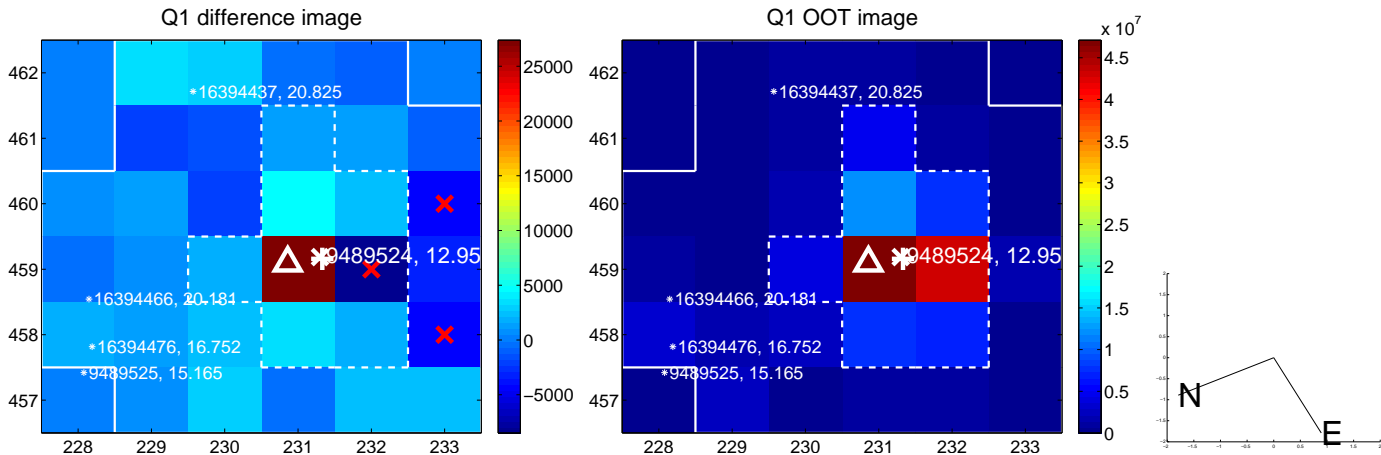
	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.068 \pm 0.302$	0.23	$-0.061 \pm 0.392$	$0.031 \pm 0.228$
PRF-fit source offset from KIC position	$0.205 \pm 0.237$	0.86	$0.149 \pm 0.401$	$-0.141 \pm 0.243$
photometric centroid source offset	$1.03 \pm 0.47$	2.21	$0.21 \pm 0.54$	$1.01 \pm 0.46$



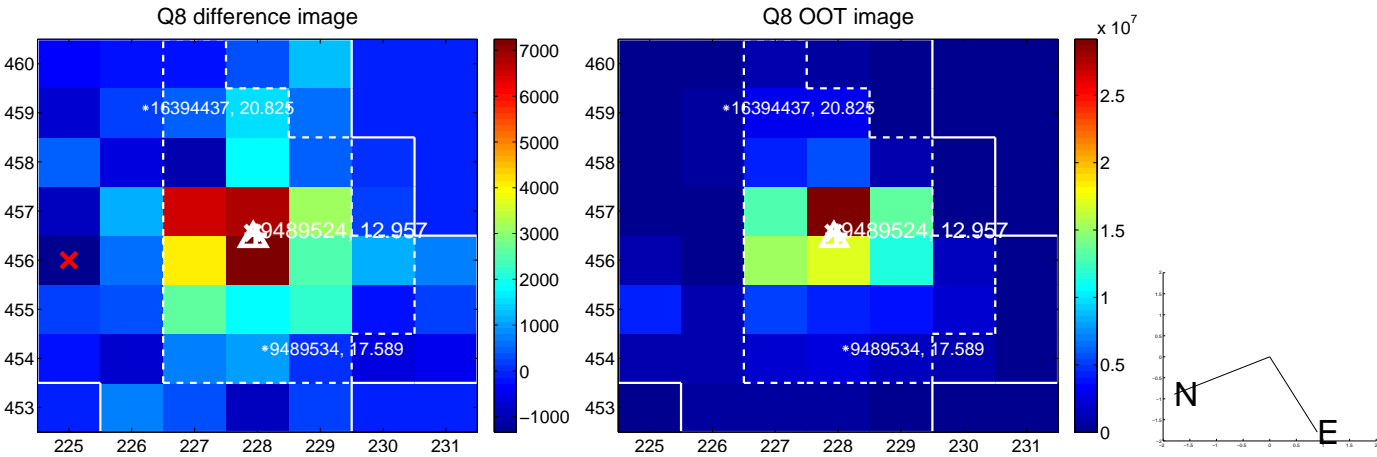
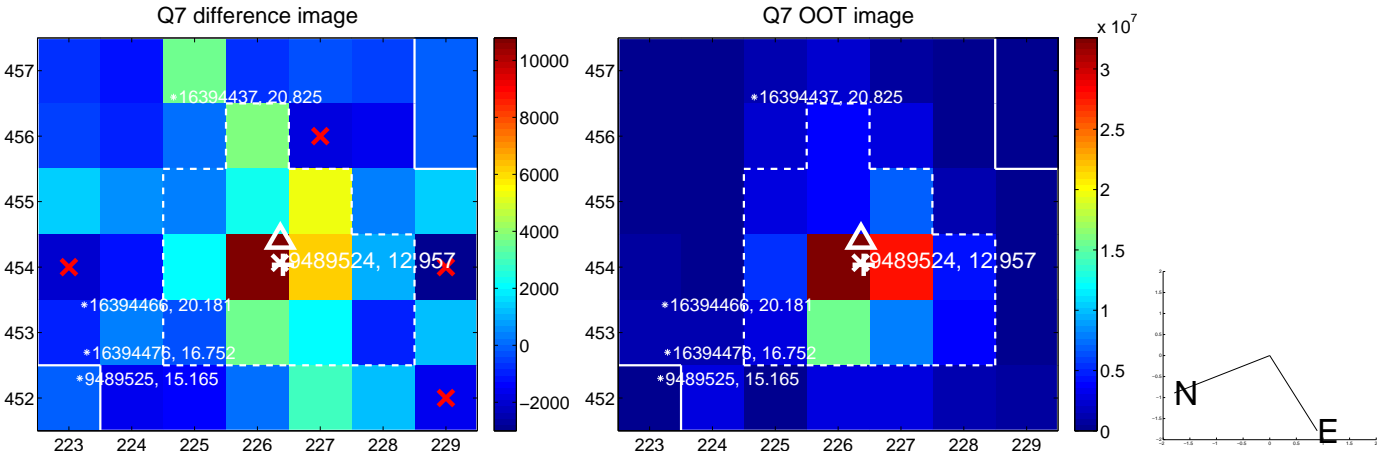
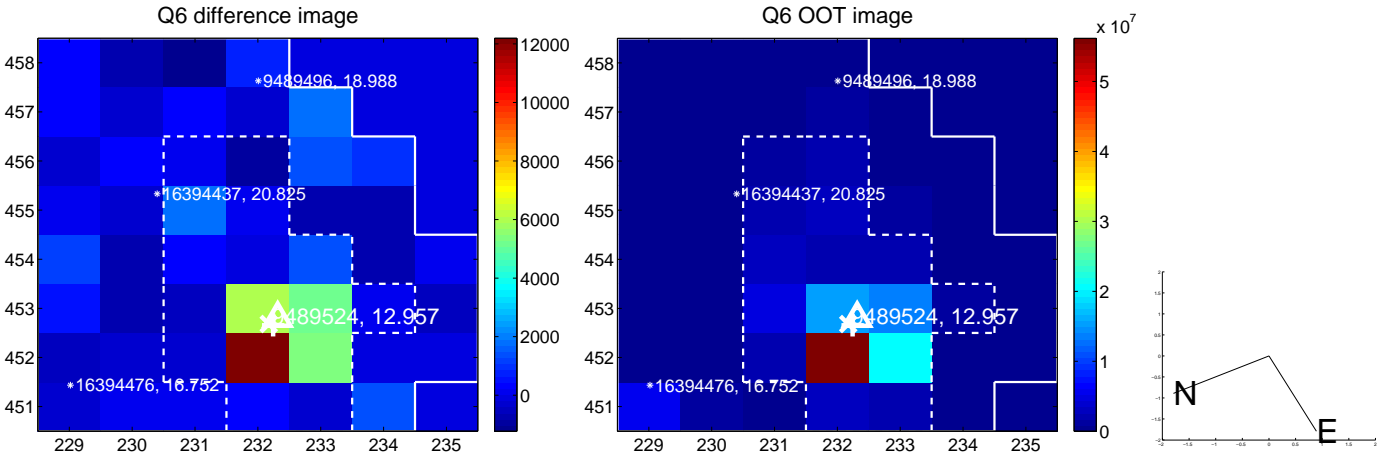
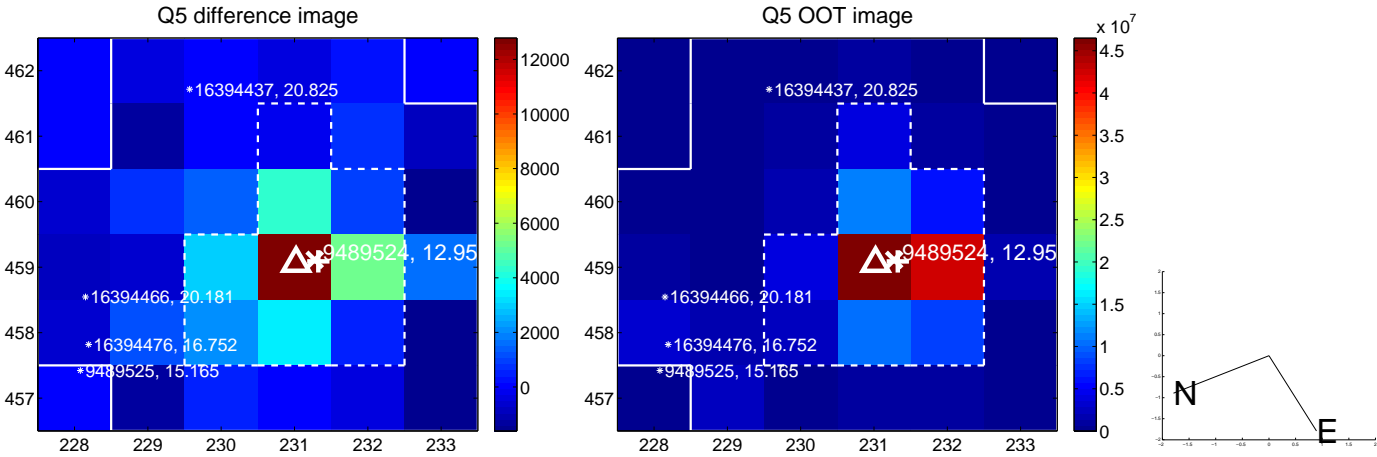
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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



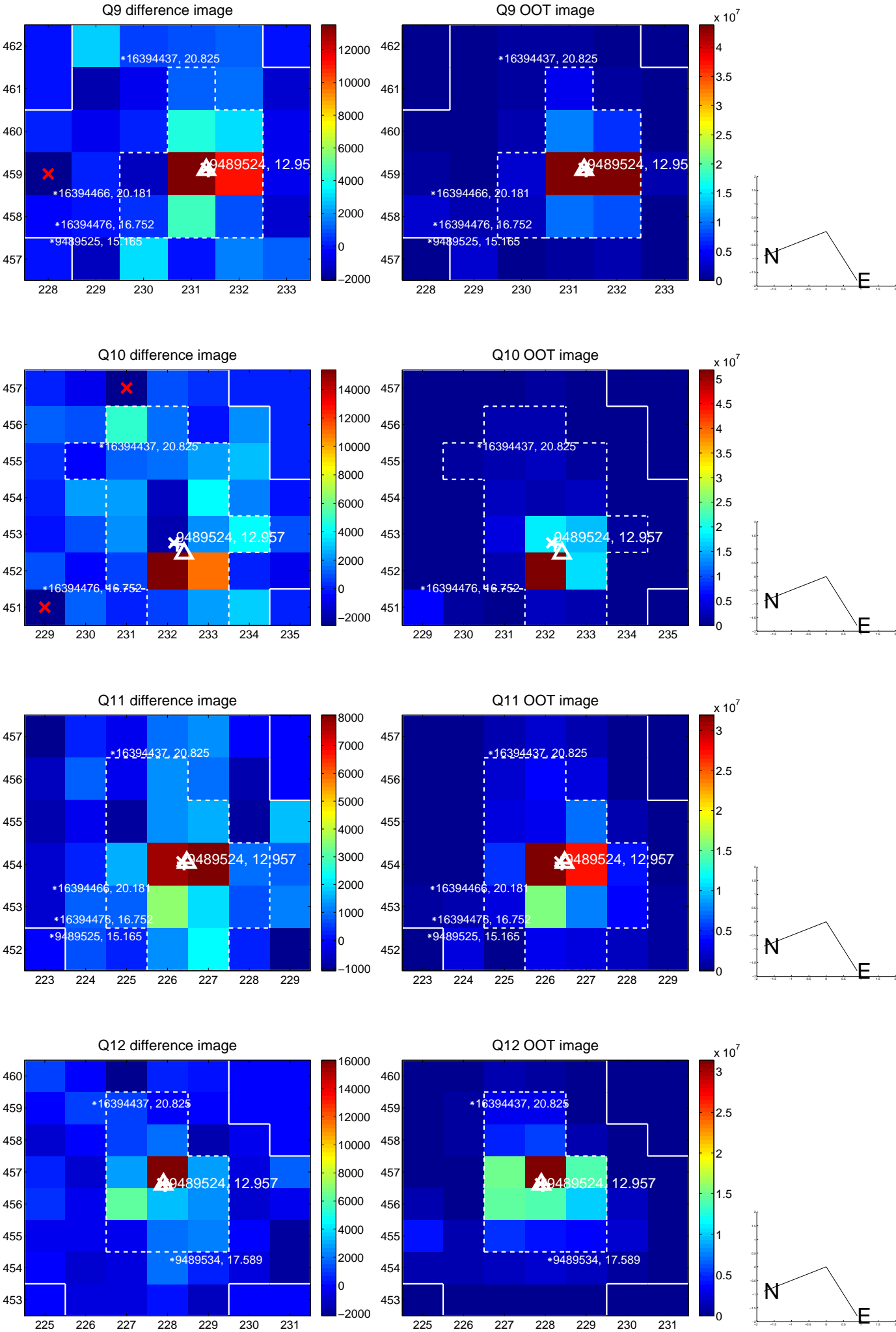
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



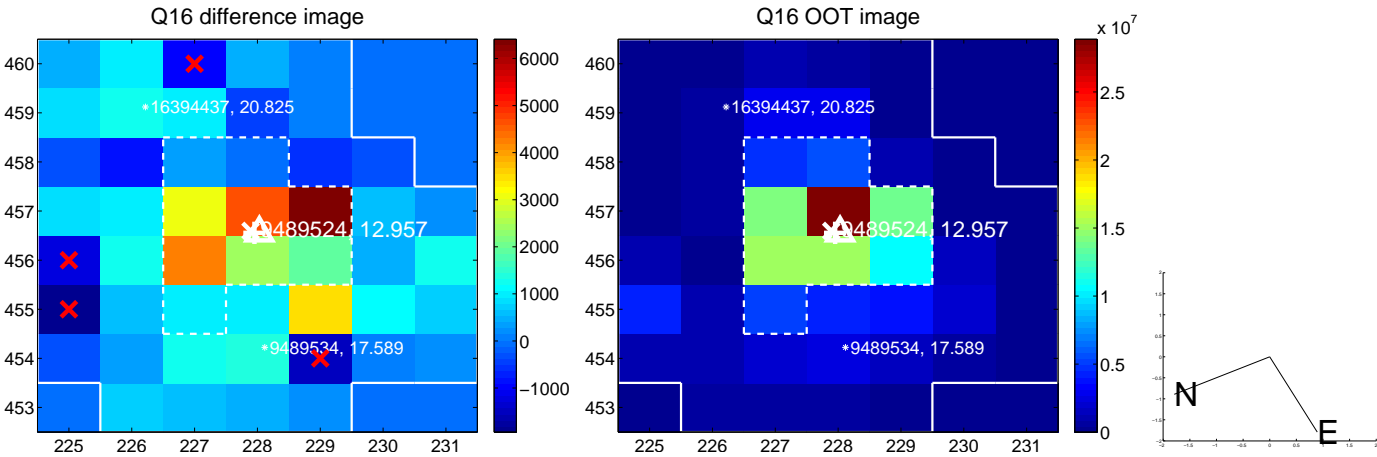
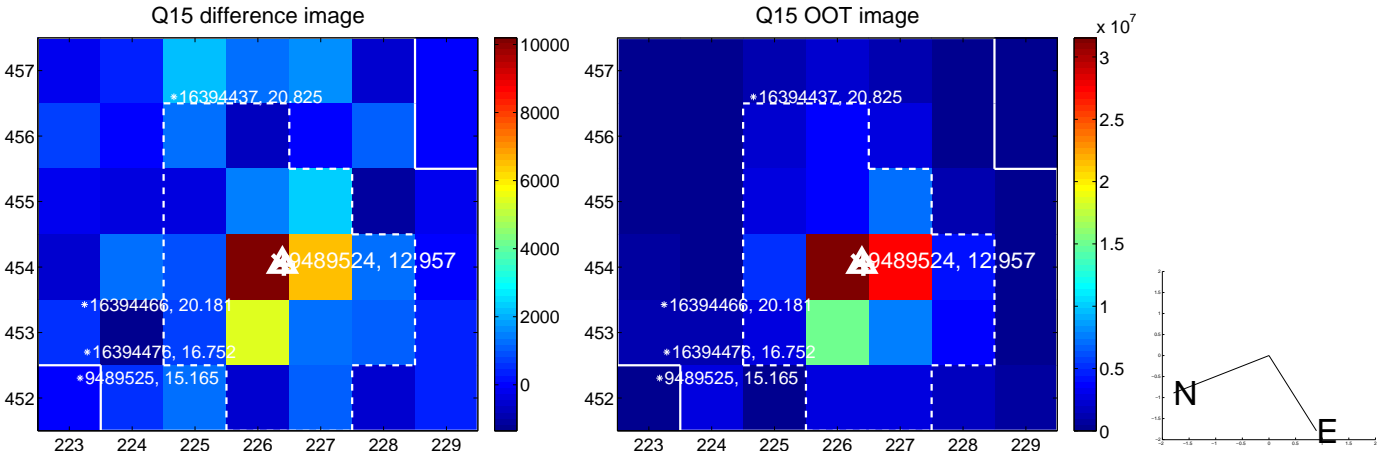
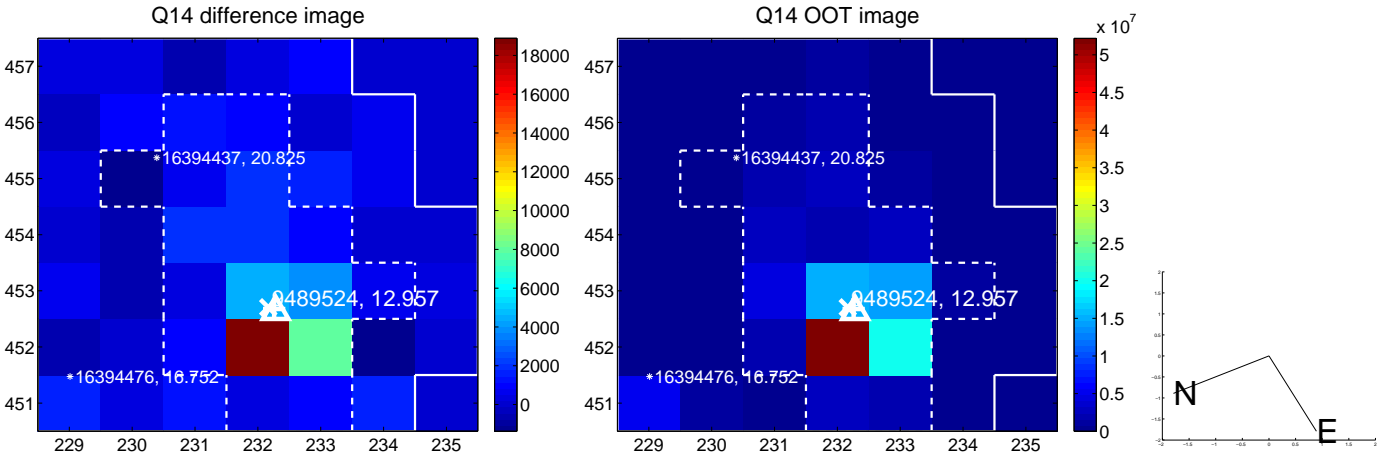
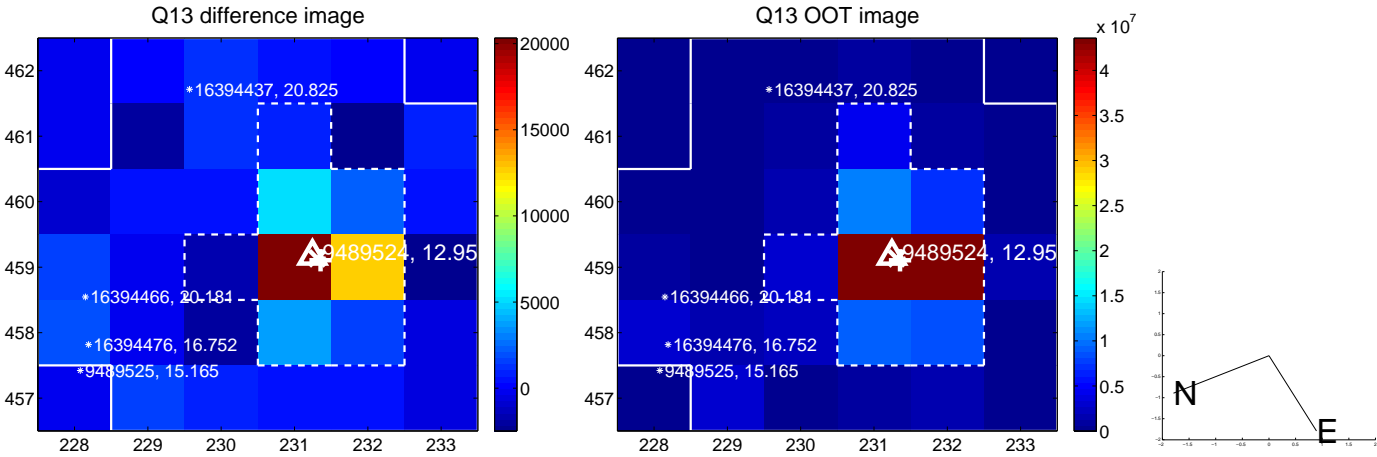
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



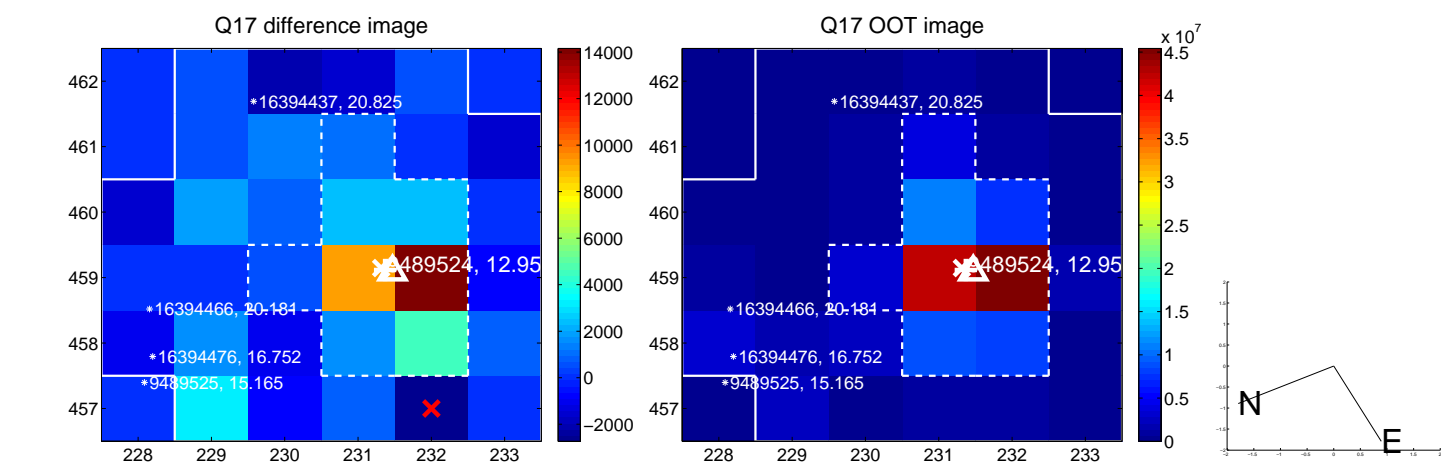
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



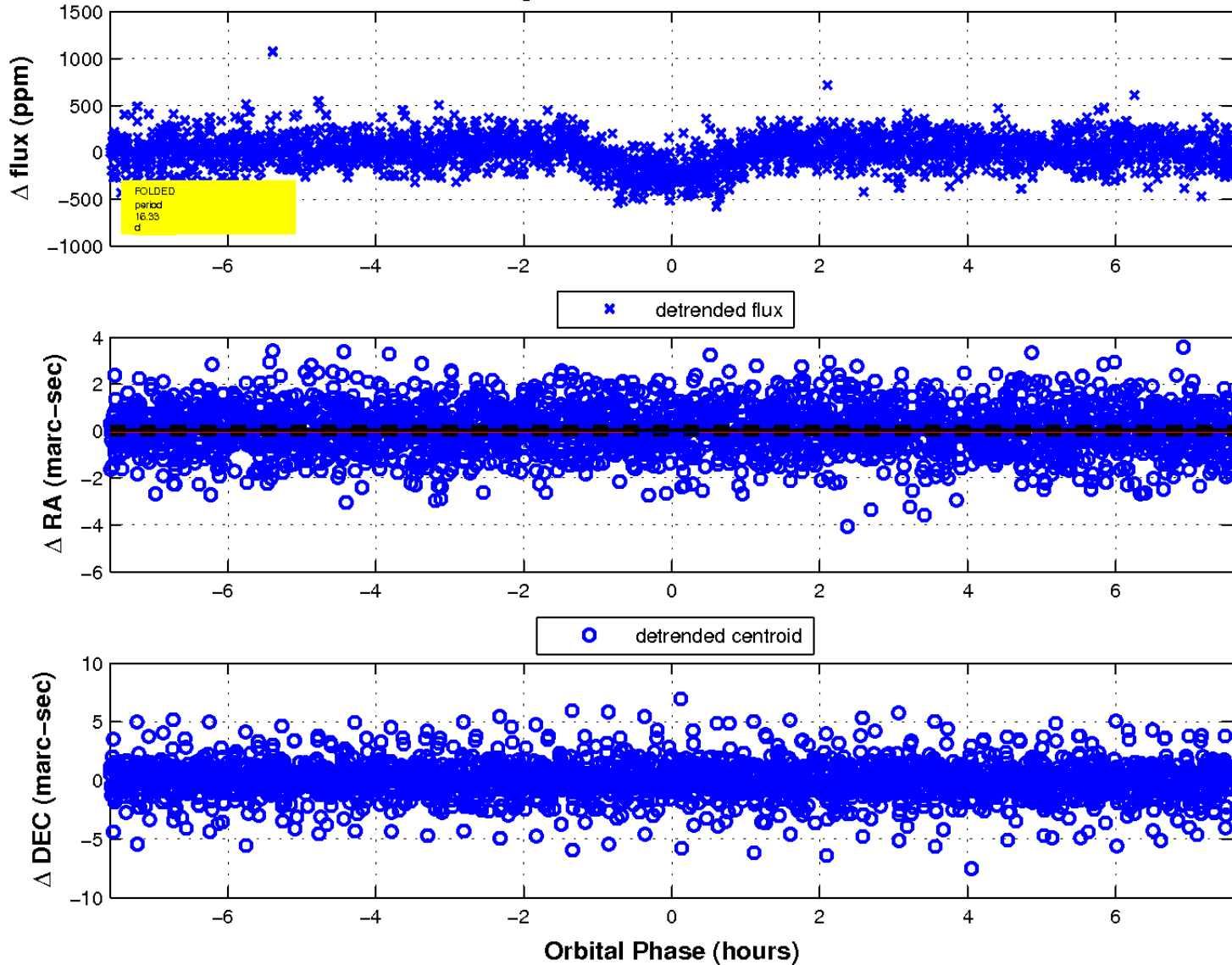
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

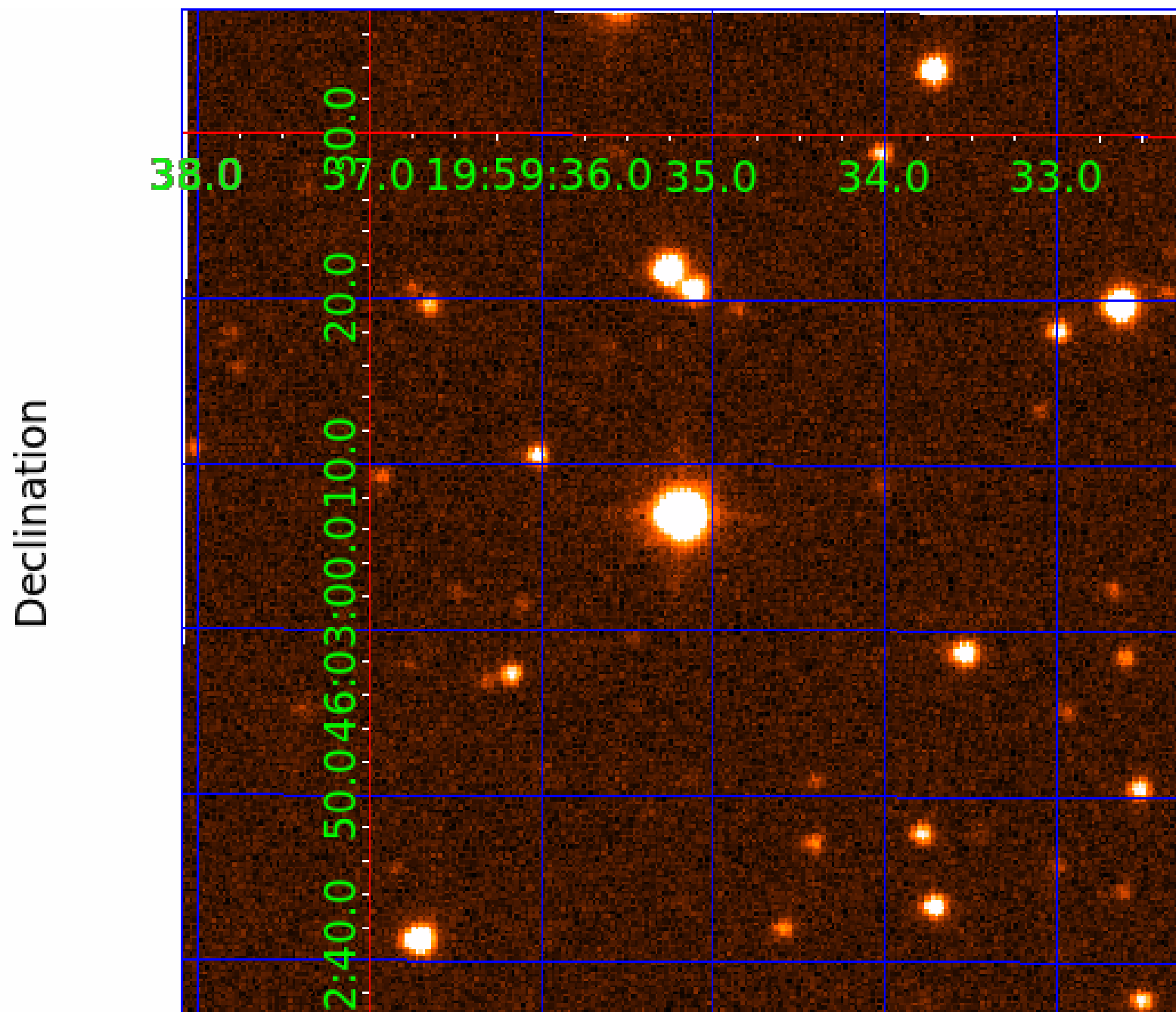


fluxWeightedCentroids, Planet 1 of 4





UKIRT Image



# KIC 009489524

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009489524-01	OBS	2029.01	16.332682	136.910308	308.9	2.533	24.7	28.6	0.77	5208	1.84	28.84
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009489524-04	OBS	2029.04	4.788484	135.460708	69.7	2.211	9.9	11.9	0.77	5208	0.78	148.04

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009489524-01	OBS	PC	1.00	0	0	0	0	NO_COMMENT
009489524-02	OBS	PC	1.00	0	0	0	0	CENT_CROWDED
009489524-03	OBS	PC	1.00	0	0	0	0	NO_COMMENT
009489524-04	OBS	PC	0.86	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.

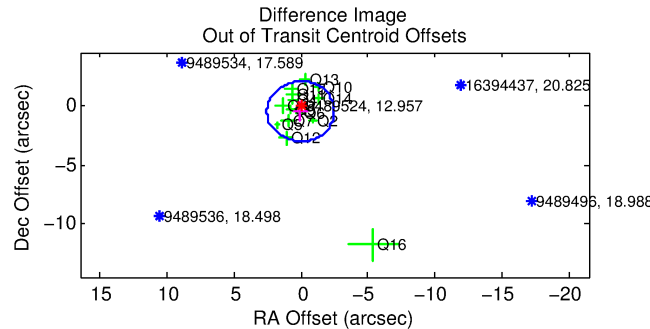
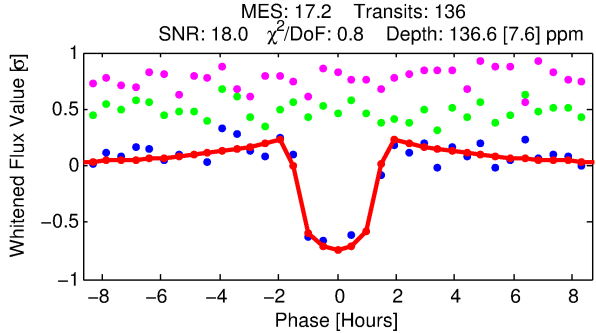
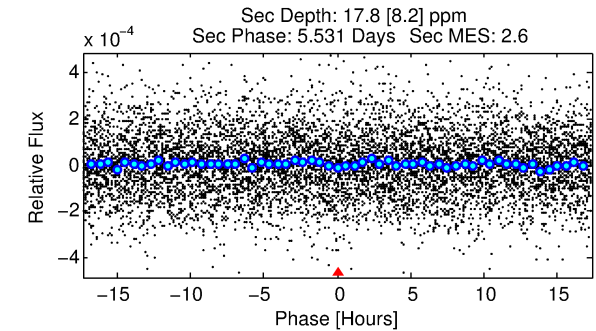
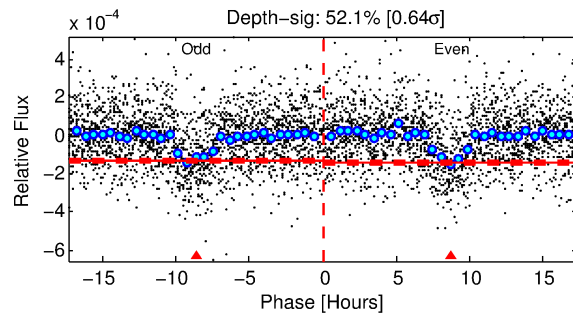
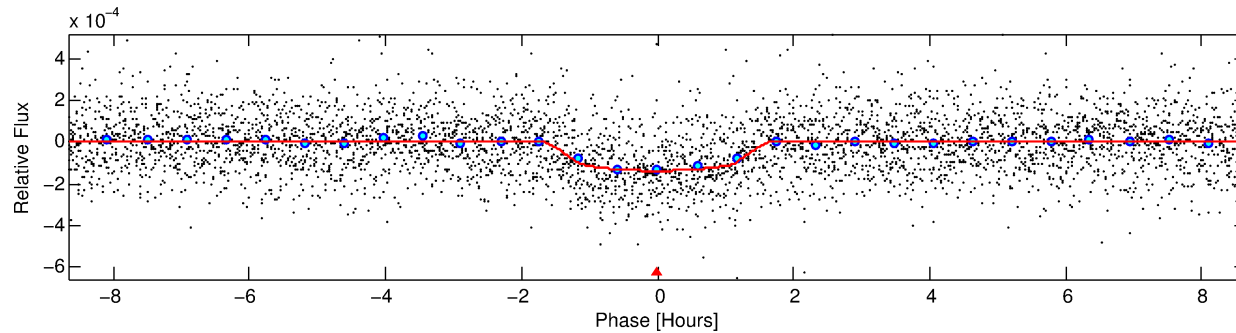
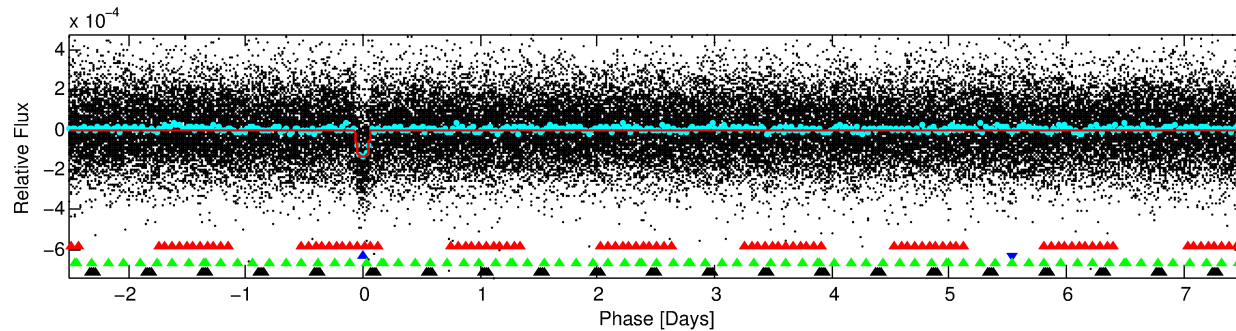
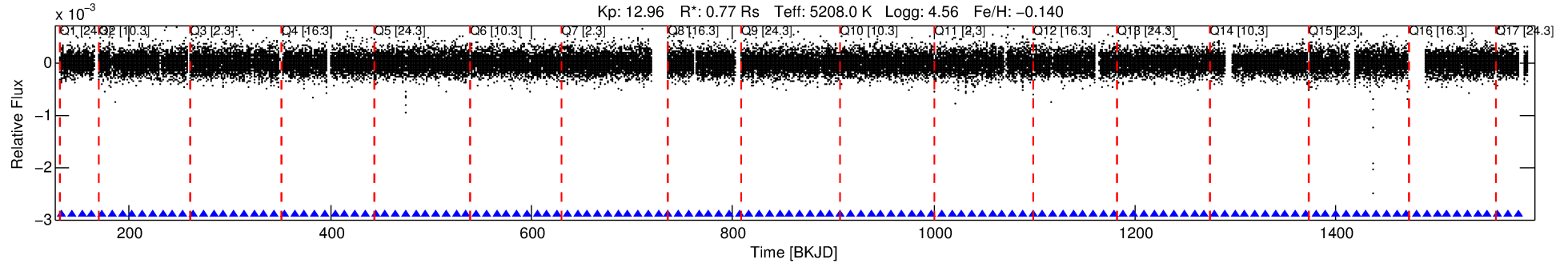
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 009489524-02

No Significant Match Found

# DV One-Page Summary

KIC: 9489524 Candidate: 2 of 4 Period: 10.055 d  
KOI: K02029.02 Name: Kepler-352b Corr: 0.980



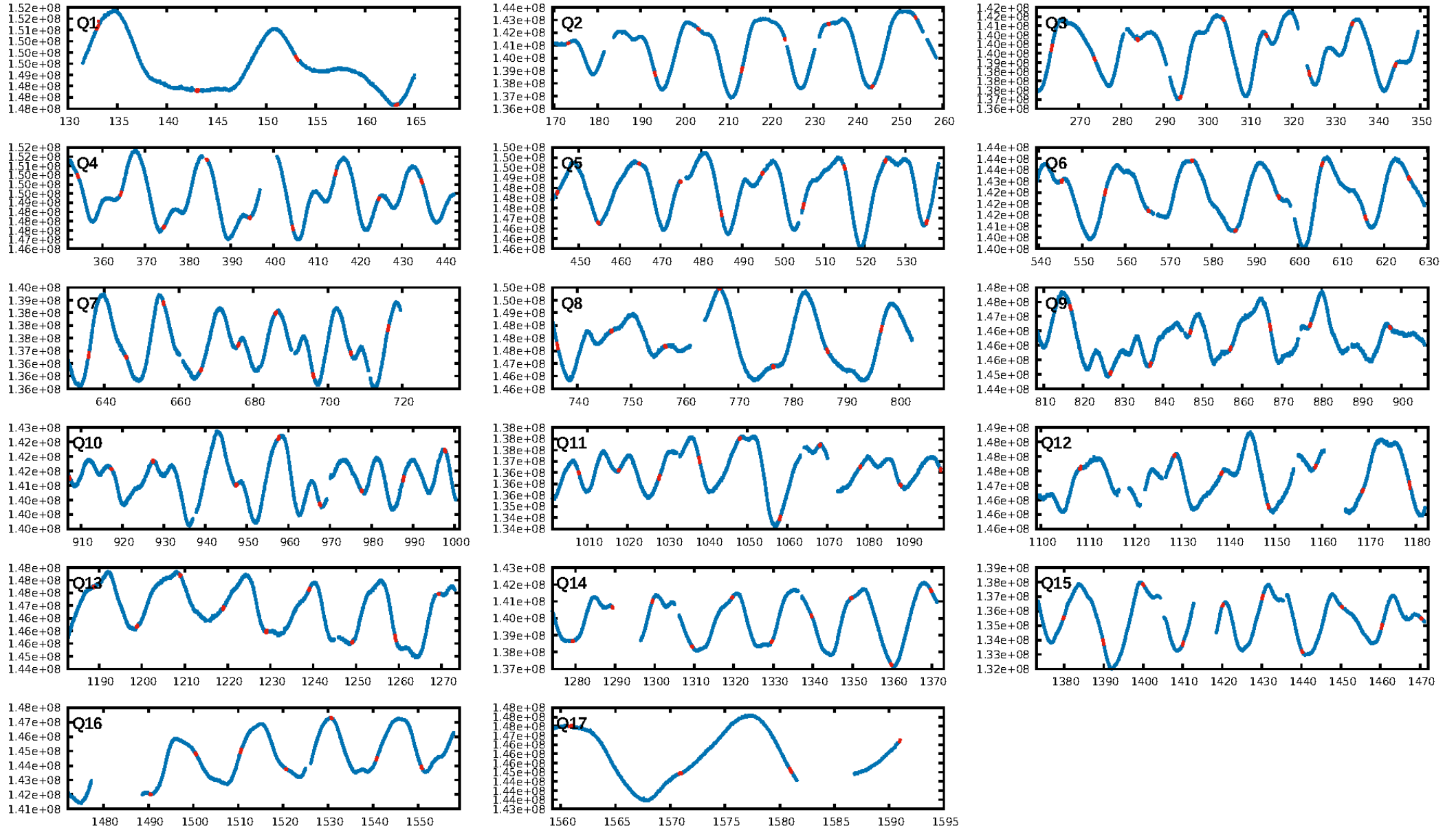
## DV Fit Results:

Period = 10.05544 [0.00004] d  
Epoch = 133.0042 [0.0029] BKJD  
Rp/R\* = 0.0120 [0.0049]  
a/R\* = 16.50 [26.22]  
b = 0.80 [0.73]  
Seff = 55.05 [6.72]  
Teq = 695 [21] K  
Rp = 1.01 [0.42] Re  
a = 0.0845 [0.0052] AU  
Ag = 68.92 [64.92] [1.05 $\sigma$ ]  
Teffp = 3094 [728] K [3.30 $\sigma$ ]

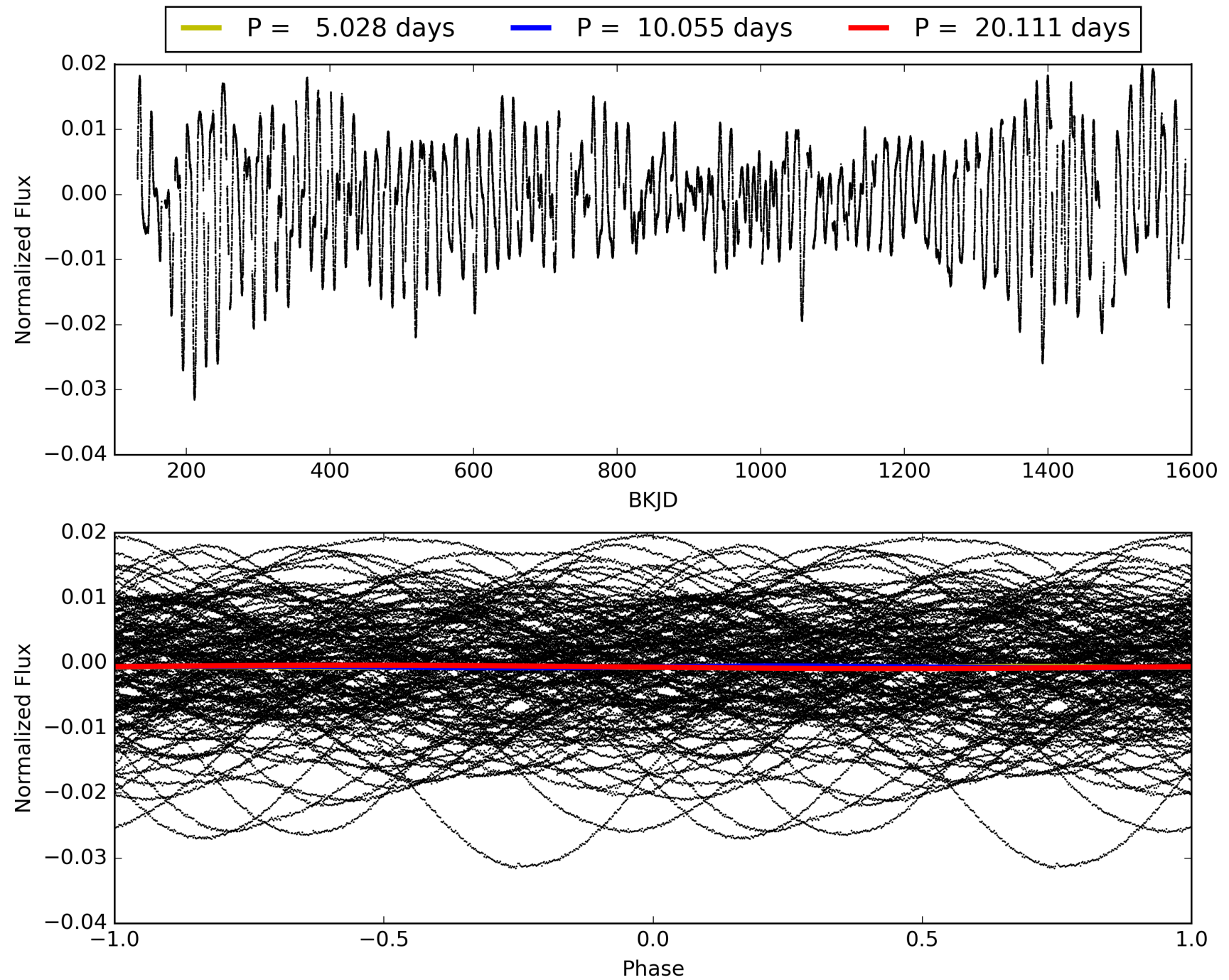
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [20.25 $\sigma$ ]  
LongPeriod-sig: 100.0% [39.22 $\sigma$ ]  
ModelChiSquare2-sig: 99.9%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 7.84e-63  
RollingBand-fgt: 1.00 [128/128]  
**GhostDiagnostic-chr: 0.3781**  
Centroid-sig: N/A  
Centroid-so: 1.262 arcsec [1.59 $\sigma$ ]  
OotOffset-rm: 0.491 arcsec [0.58 $\sigma$ ]  
KicOffset-rm: 0.698 arcsec [0.98 $\sigma$ ]  
OotOffset-st: 4/4/3/3 [14]  
KicOffset-st: 4/4/3/3 [14]  
DiffImageQuality-fgm: 0.93 [13/14]  
DiffImageOverlap-fno: 1.00 [17/17]

# TCE 009489524-02, PDC Light Curves



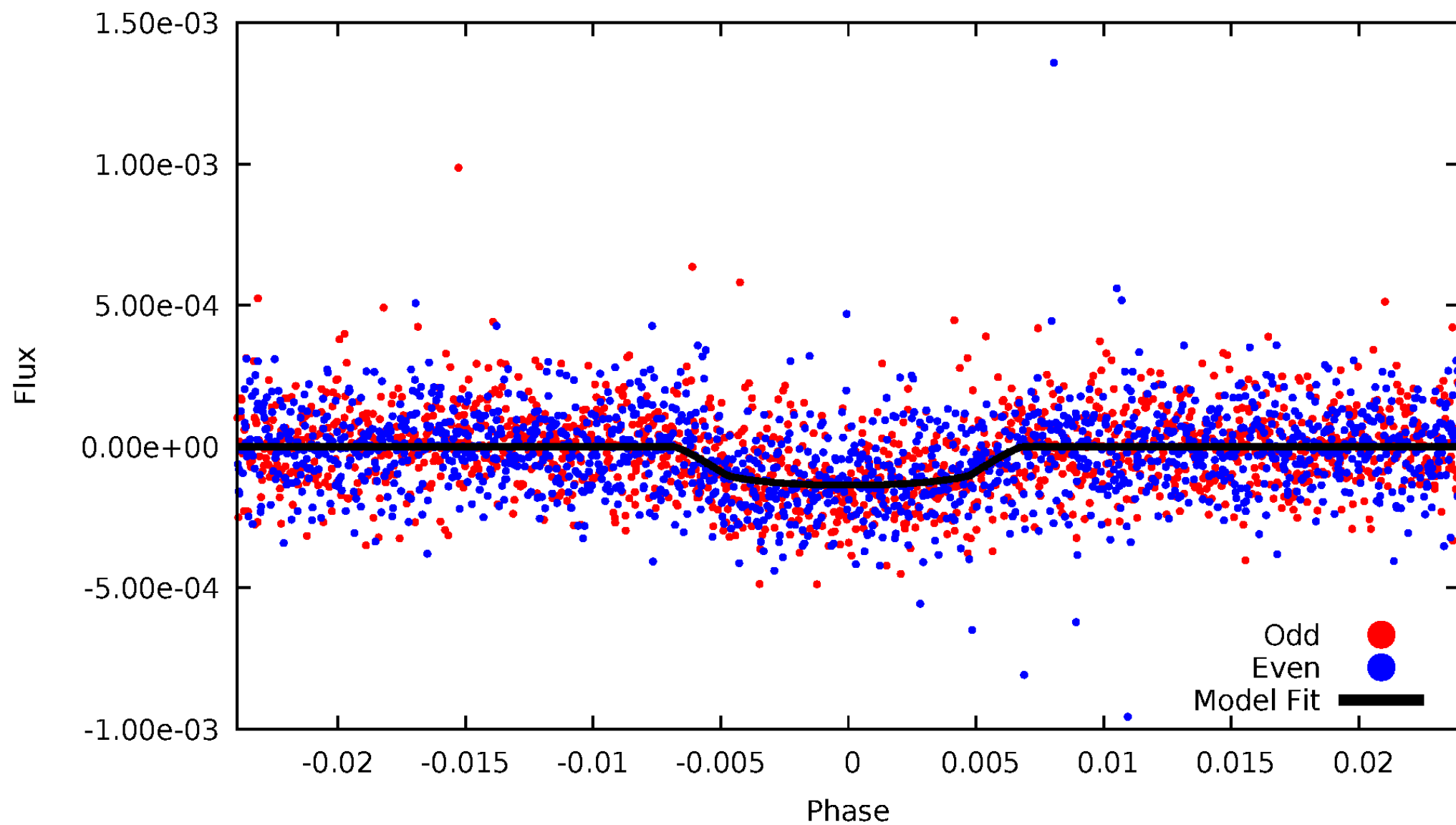
# TCE 009489524-02





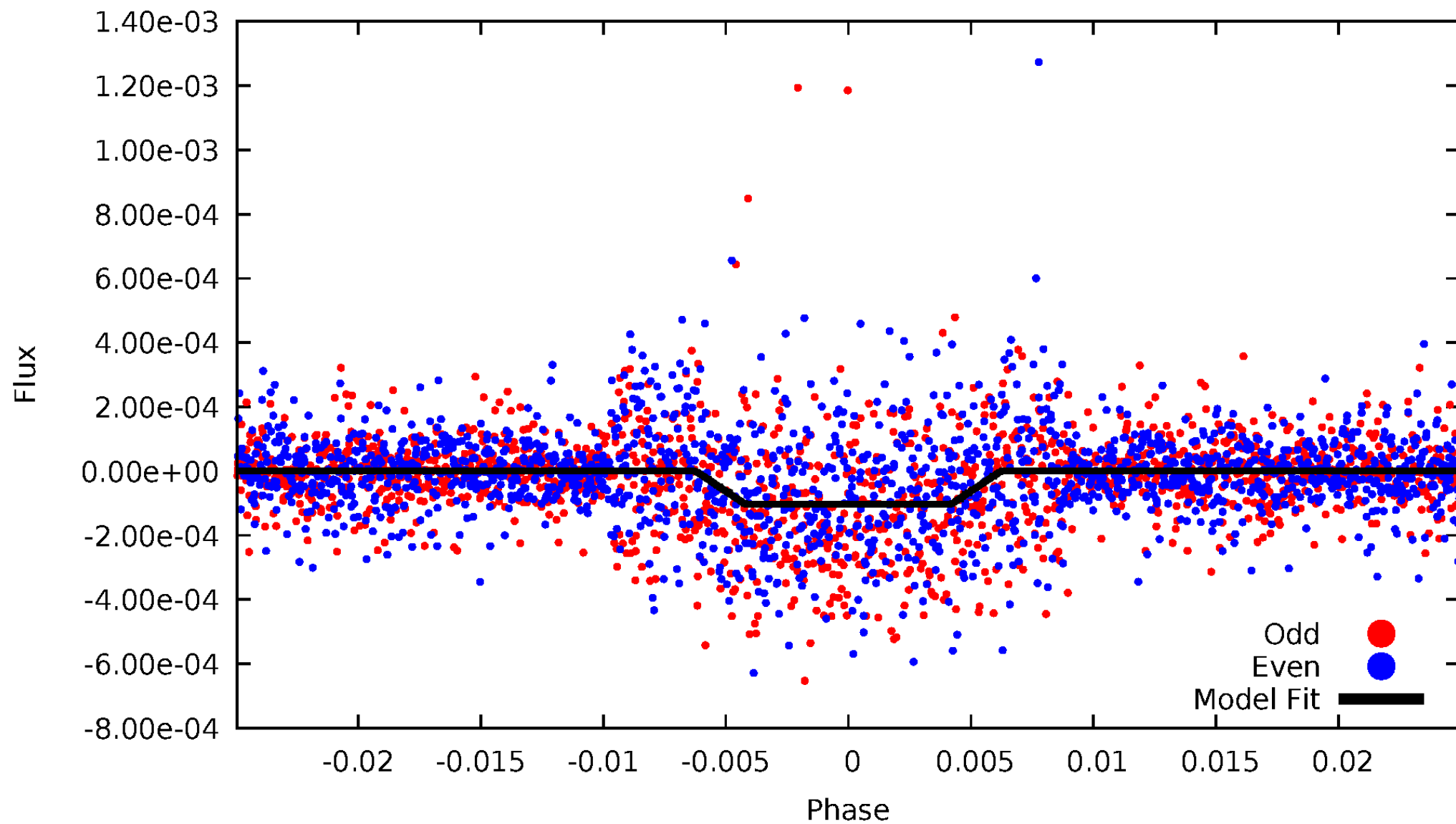
# DV Odd/Even

TCE 009489524-02



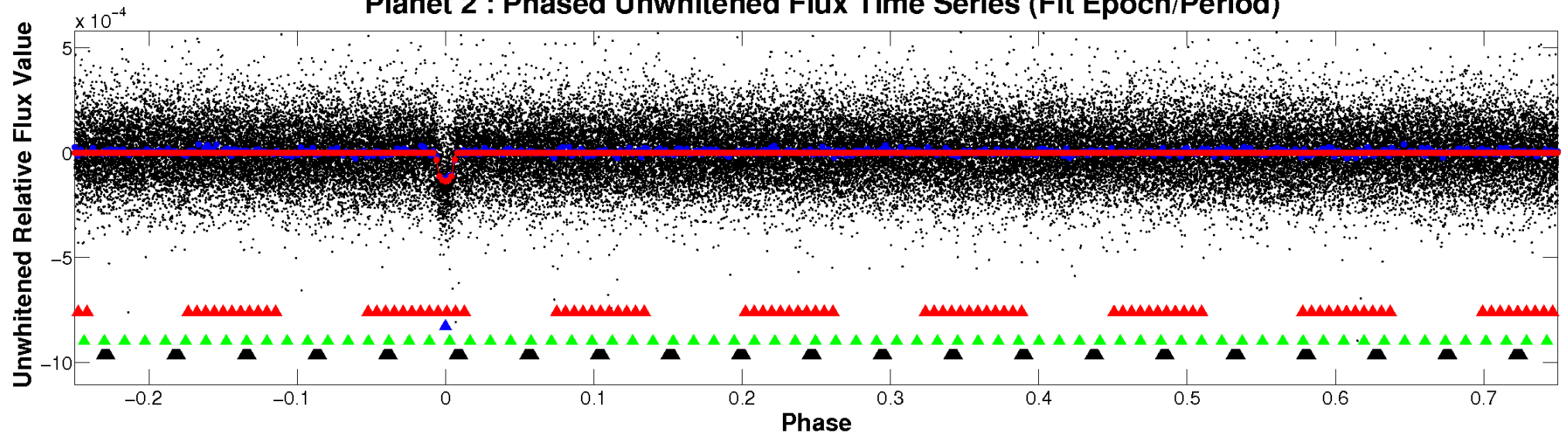
# ALT Odd/Even

TCE 009489524-02

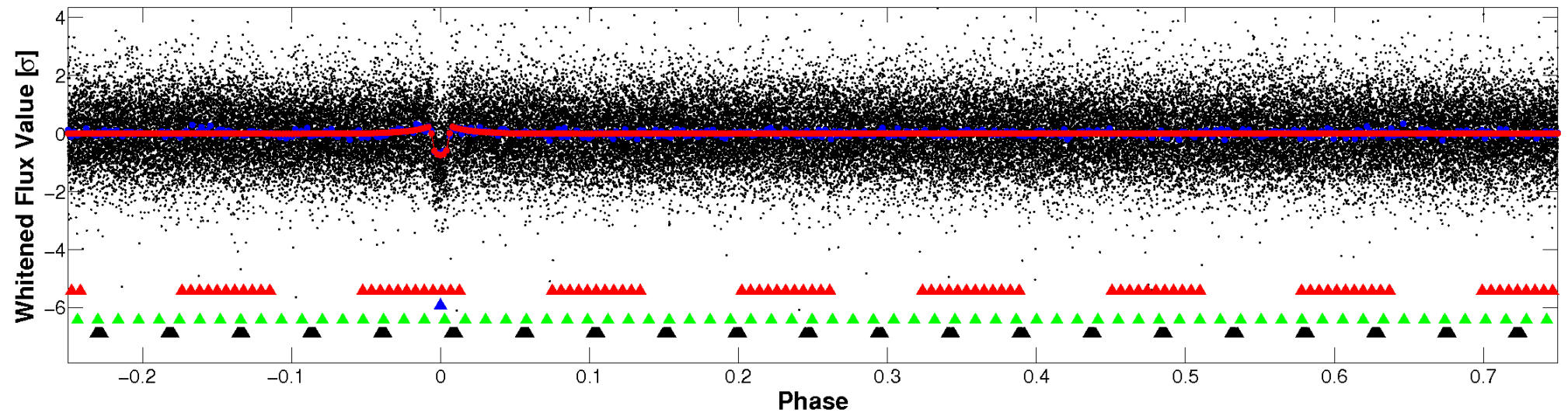


# Non-Whitened Vs. Whitened Light Curve

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

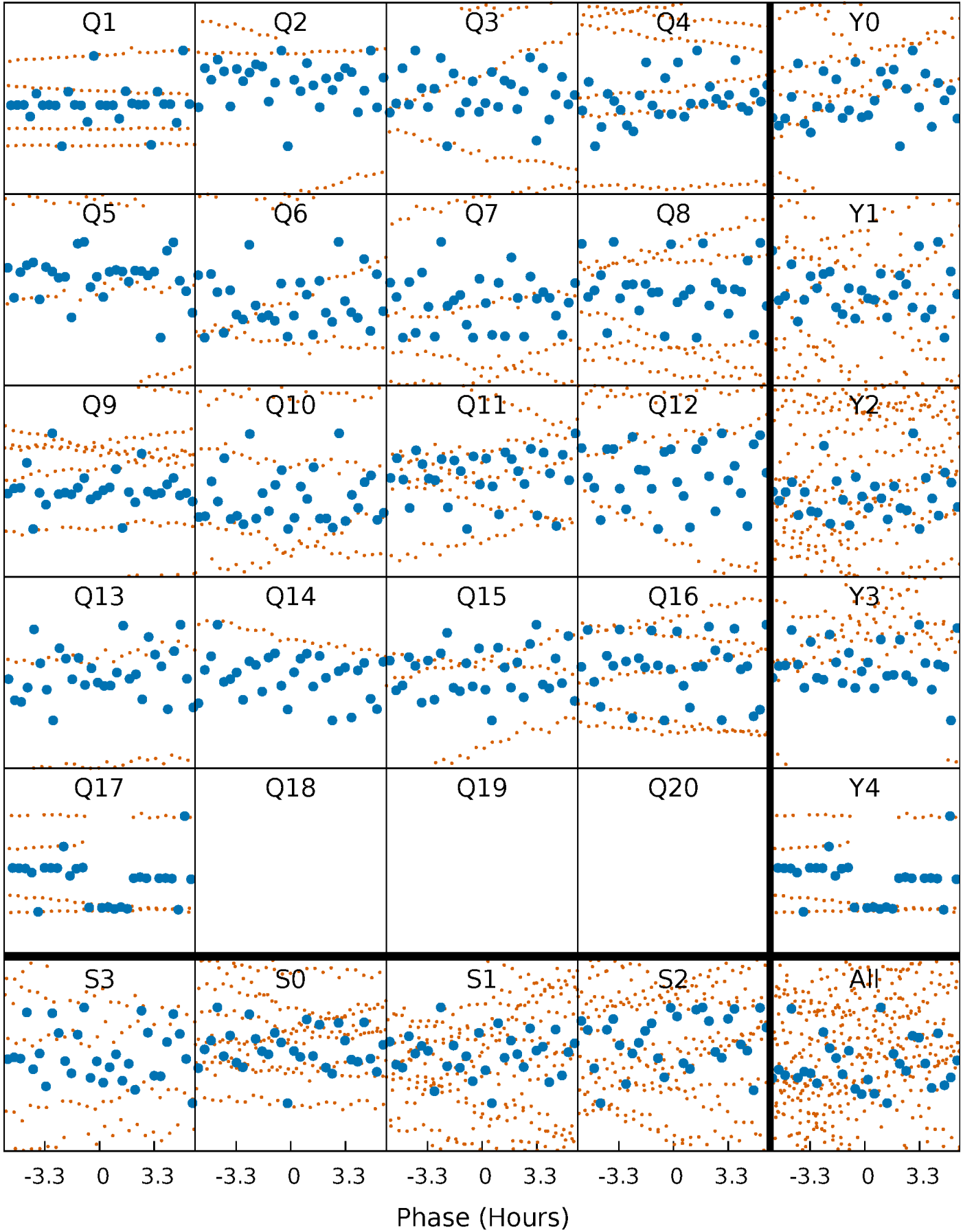


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



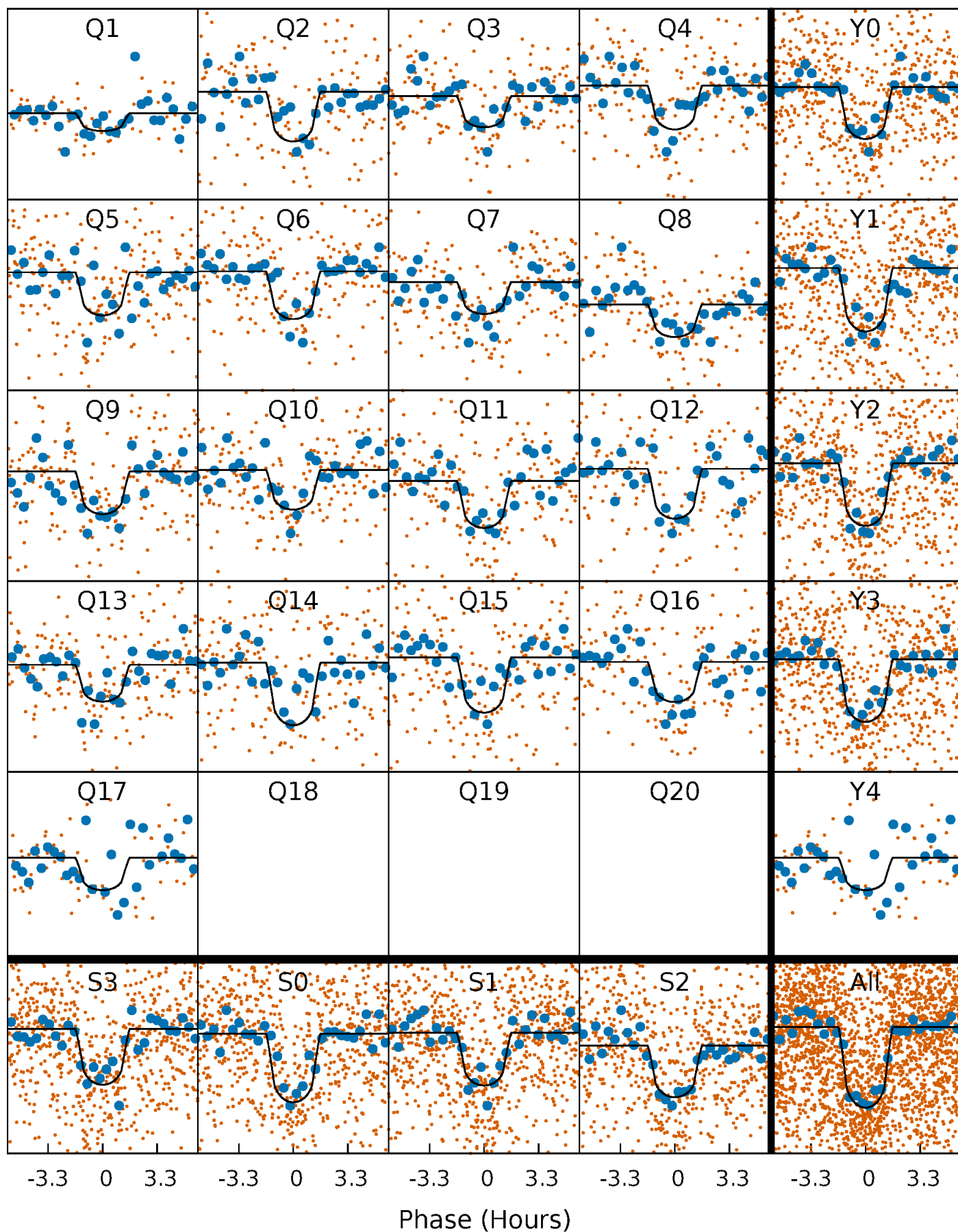
# PDC Quarter-Phased Transit Curves

TCE 009489524-02   P= 10.055443 Days    $T_0=133.004205$  (BKJD)



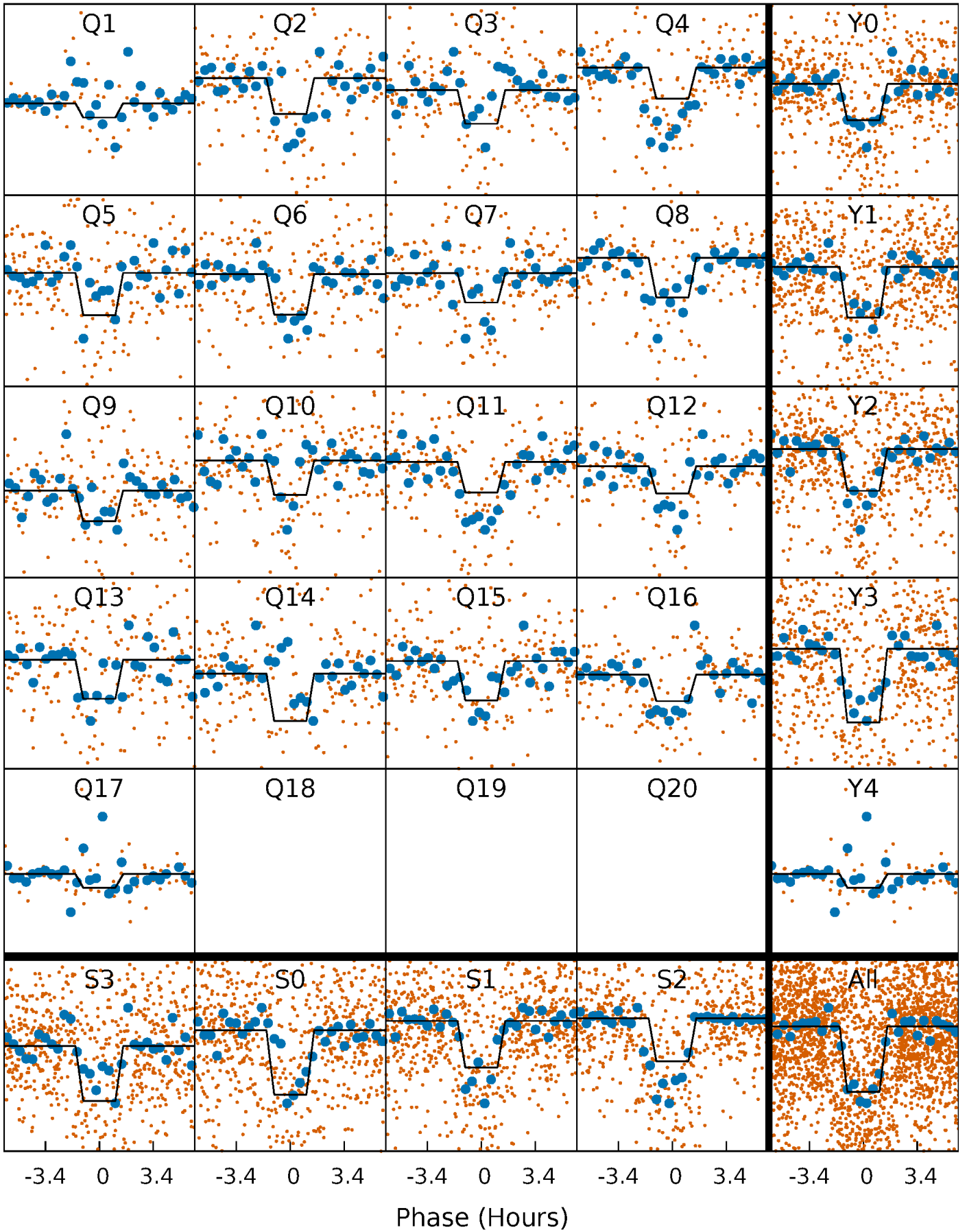
# DV Quarter-Phased Transit Curves

TCE 009489524-02 P= 10.055443 Days  $T_0=133.004205$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

TCE 009489524-02 P= 10.055448 Days  $T_0=133.006911$  (BKJD)

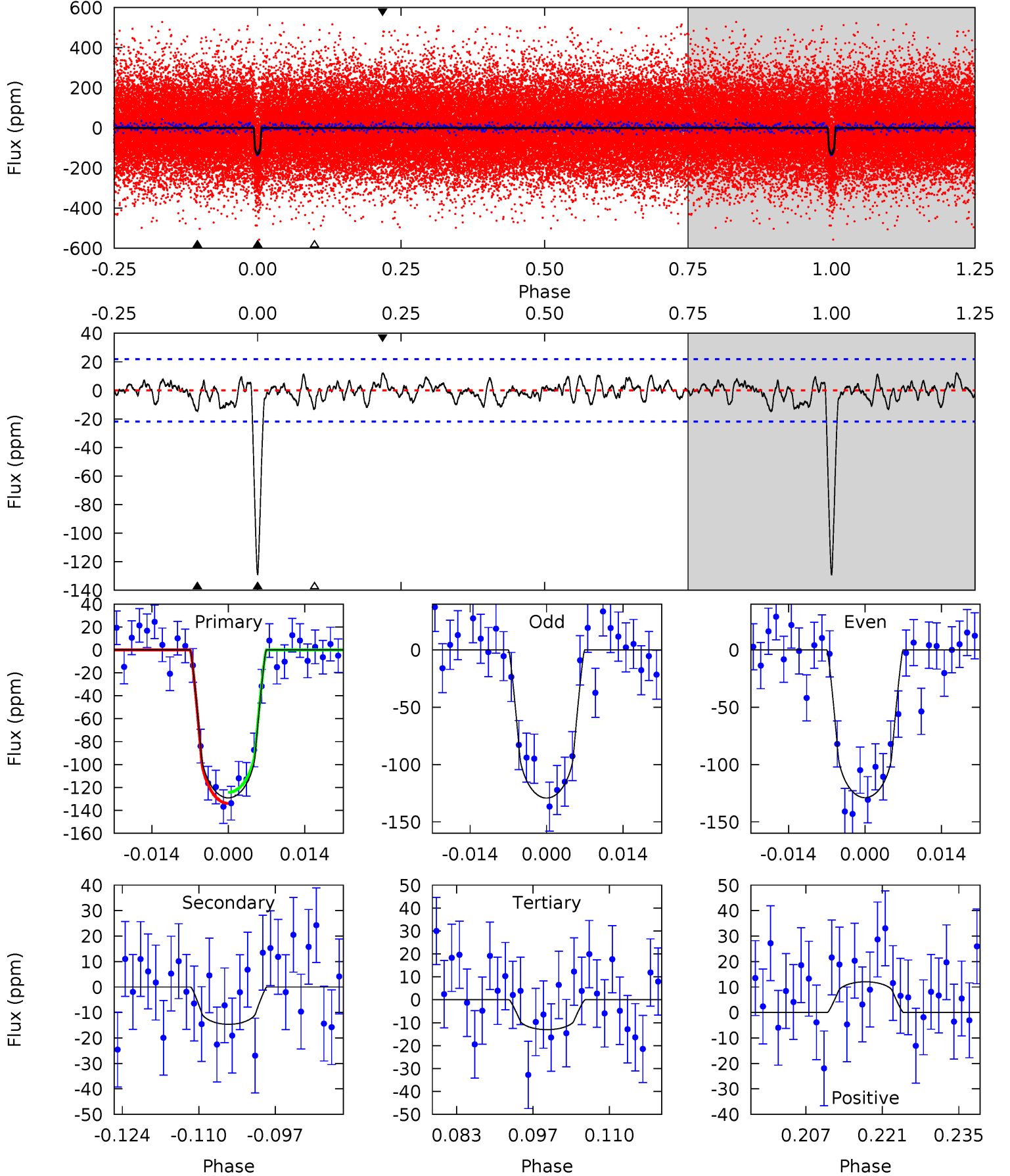




# DV Model-Shift Uniqueness Test

009489524-02,  $P = 10.055443$  Days,  $E = 122.948762$  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
29.3	3.33	2.96	2.74	4.96	2.46	1.13	26.4	26.6	0.36	0.59	0.04	0.96	0.09	1.09

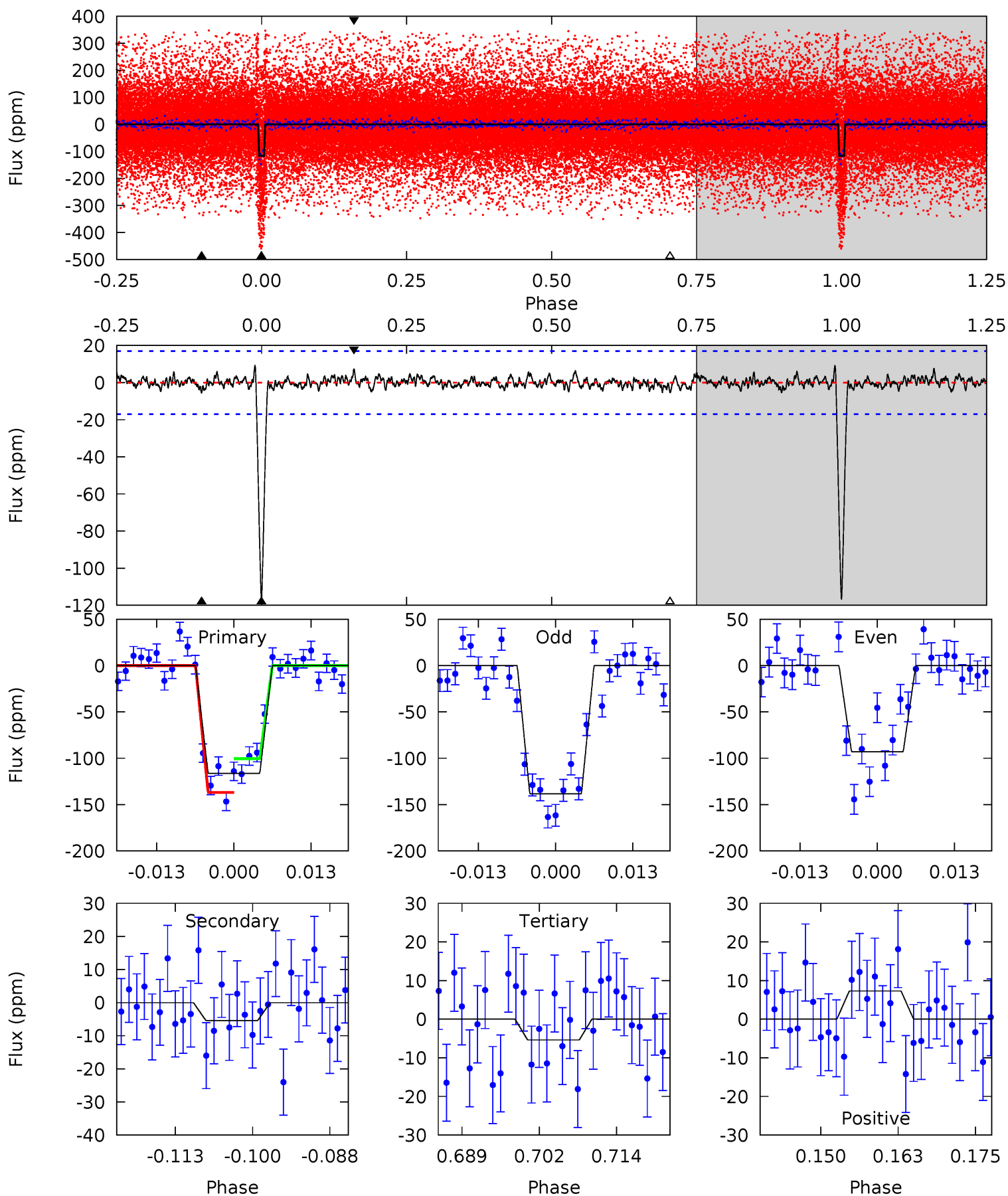




# Alt Model-Shift Uniqueness Test

009489524-02, P = 10.055448 Days, E = 122.951463 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
34.1	1.59	1.58	2.14	4.98	2.50	0.60	32.6	32.0	0.01	-0.55	6.67	0.90	0.07	5.36



### Stellar Parameters For KIC 009489524

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5208^{+103}_{-103}$	$4.563^{+0.036}_{-0.052}$	$-0.140^{+0.150}_{-0.150}$	$0.772^{+0.055}_{-0.041}$	$0.796^{+0.046}_{-0.046}$	$2.432^{+0.336}_{-0.397}$
	+2%/-2%	+1%/-1%	+107%/-107%	+7%/-5%	+6%/-6%	+14%/-16%
Source	SPE58	SPE58	SPE58	DSEP		

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

### Secondary Eclipse Parameters for KIC 009489524-02 / KOI 2029.02

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-15 \pm 4$	$0.98^{+0.45}_{-0.40}$	$973^{+25}_{-24}$	$3428^{+722}_{-418}$	$57^{+121}_{-32}$
Alt.	$-5 \pm 3$	$0.87^{+0.44}_{-0.40}$	$972^{+26}_{-24}$	$3042^{+709}_{-447}$	$25^{+74}_{-18}$

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

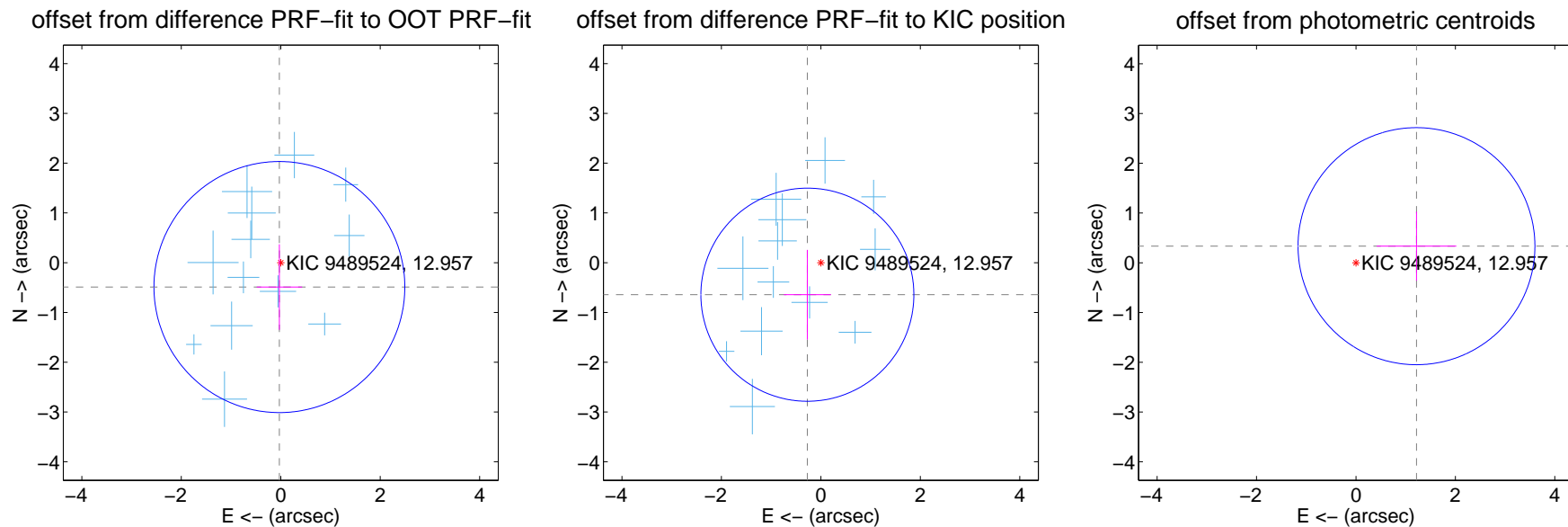
## DV Centroid Data

Supplemental centroid analysis for 009489524-02. Kepler magnitude: 12.96. Transit SNR 17.96

There are 13 quarters with good PRF difference image offsets

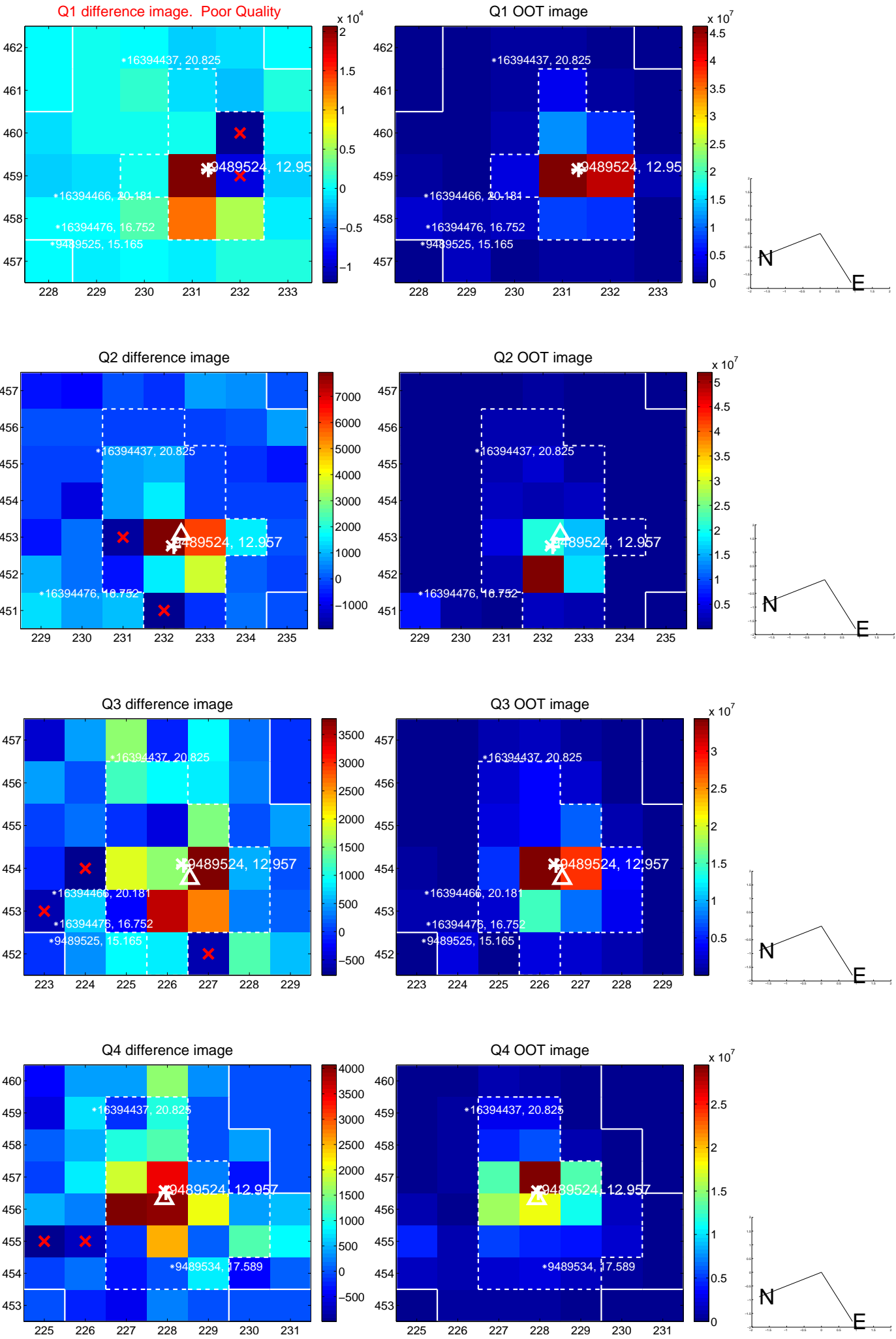
The direct PRF centroid is offset from the target star catalog position by about 0.27 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.491 \pm 0.841$	0.58	$0.028 \pm 0.456$	$-0.490 \pm 0.859$
PRF-fit source offset from KIC position	$0.698 \pm 0.714$	0.98	$0.271 \pm 0.474$	$-0.643 \pm 0.902$
photometric centroid source offset	$1.26 \pm 0.79$	1.59	$-1.22 \pm 0.80$	$0.33 \pm 0.69$



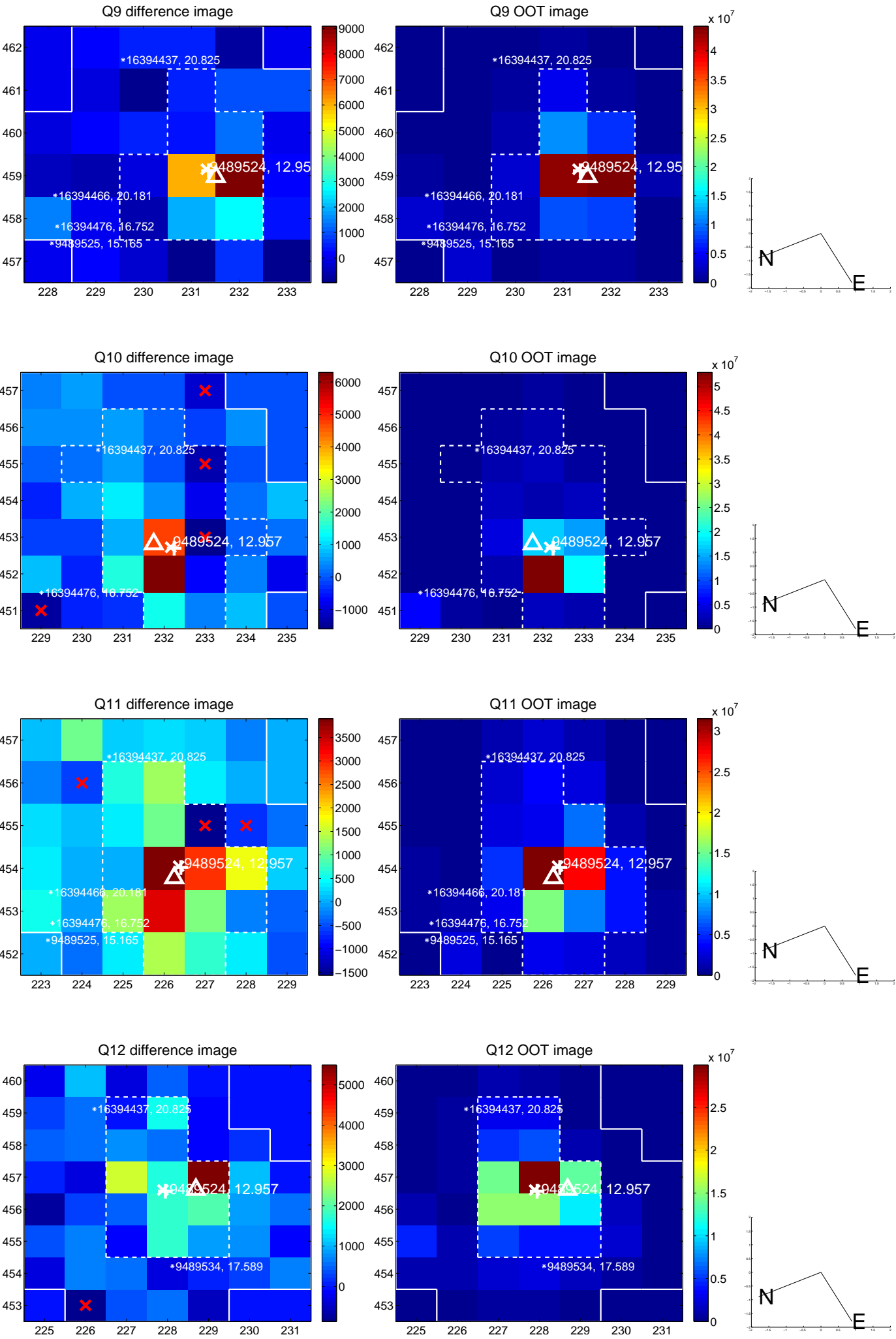
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

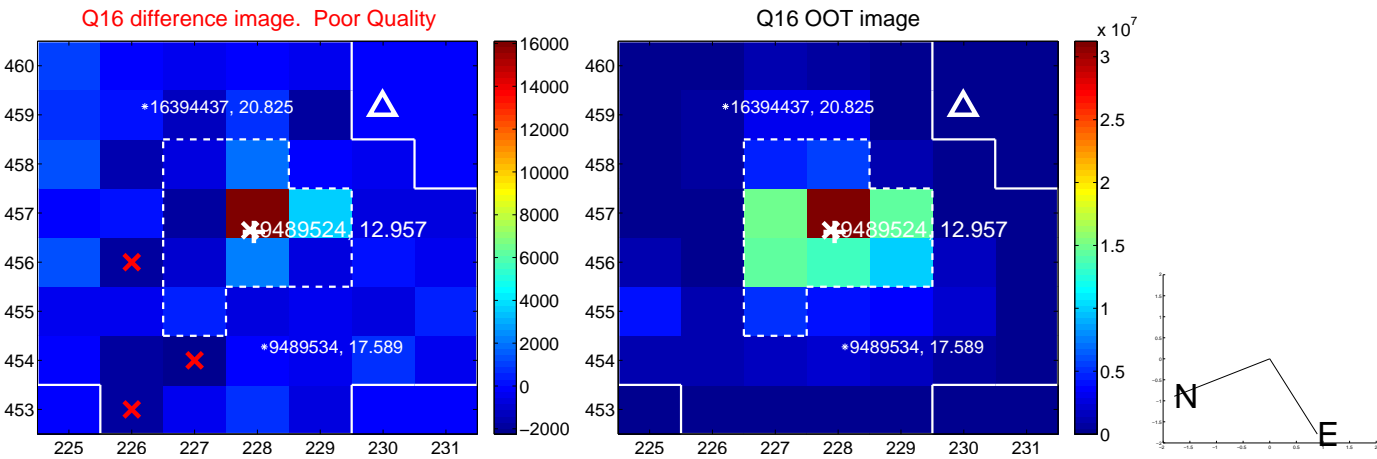
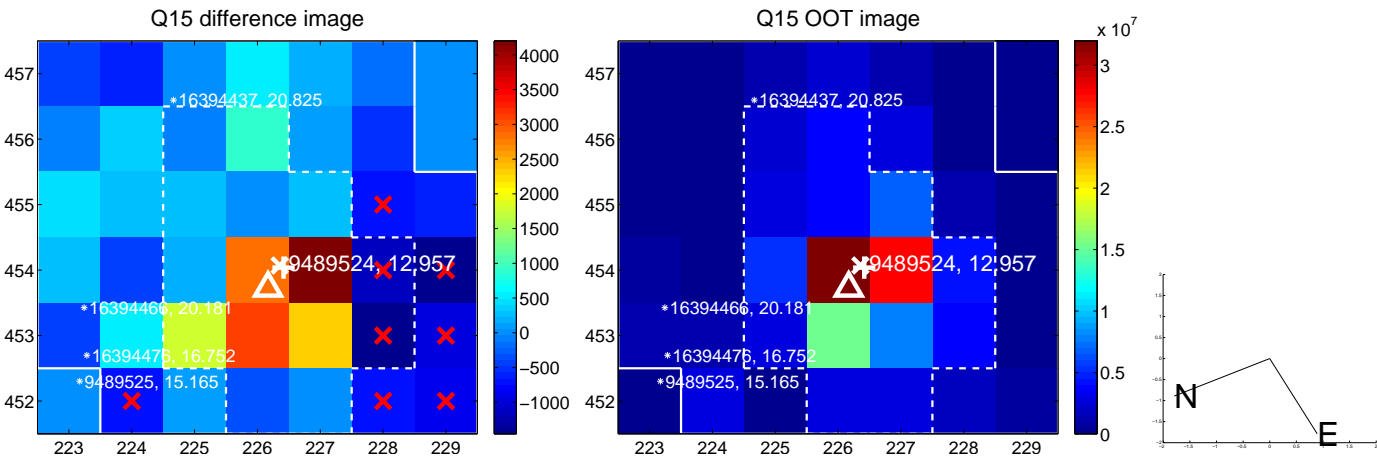
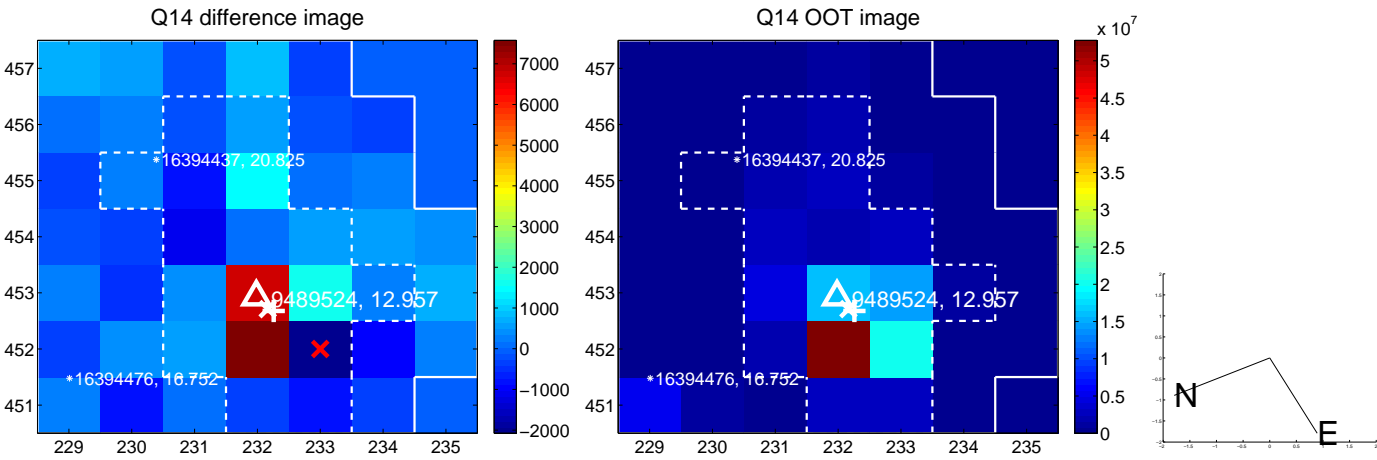
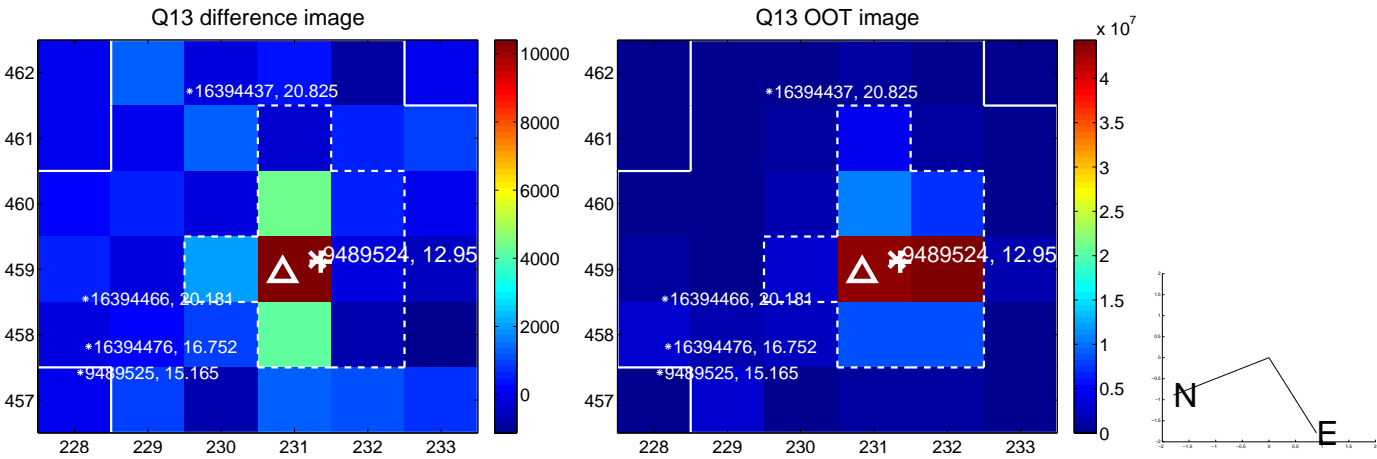




white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

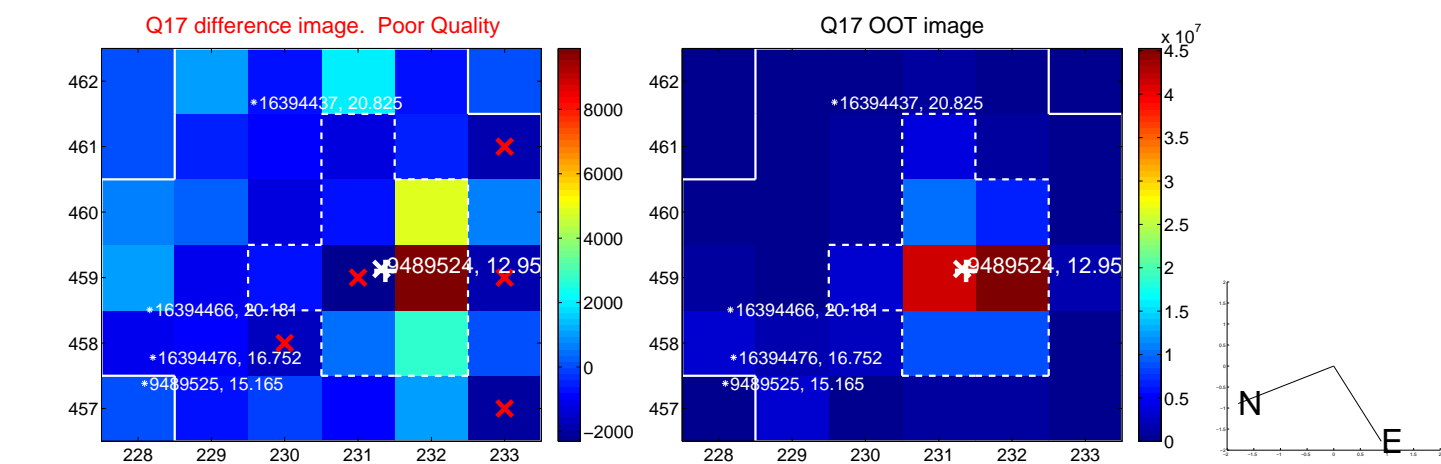


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

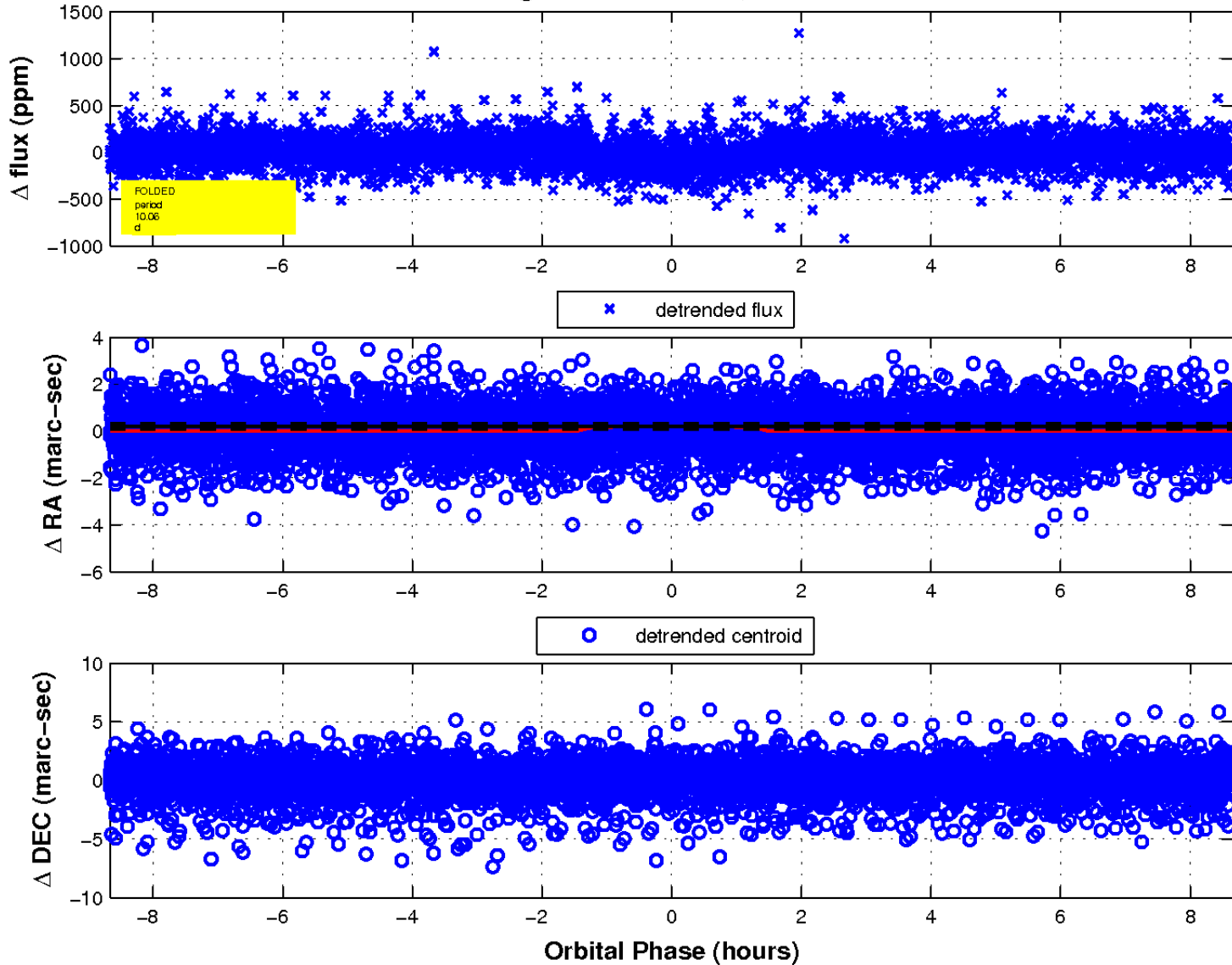




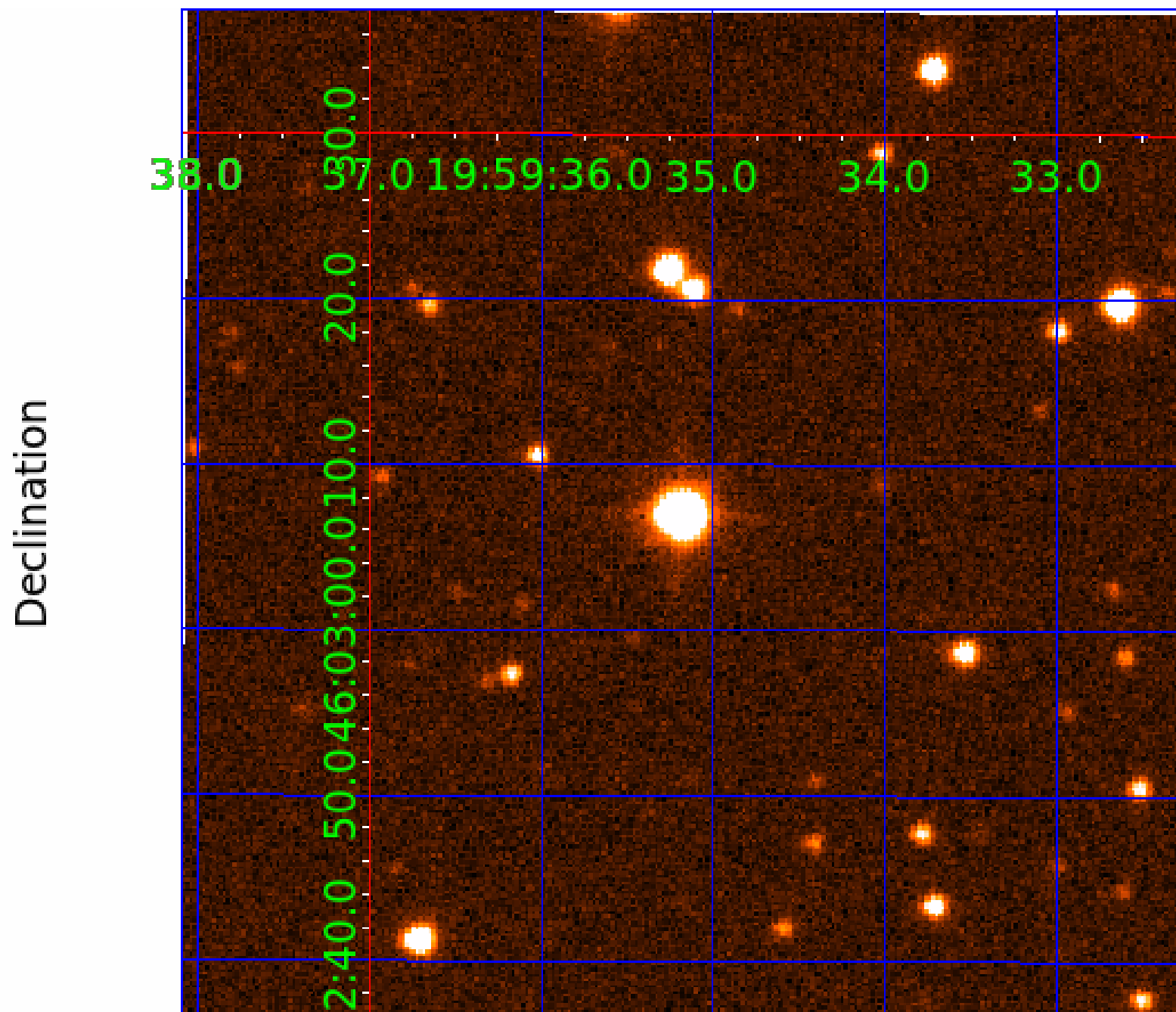
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



fluxWeightedCentroids, Planet 2 of 4



UKIRT Image



# KIC 009489524

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009489524-01	OBS	2029.01	16.332682	136.910308	308.9	2.533	24.7	28.6	0.77	5208	1.84	28.84
009489524-02	OBS	2029.02	10.055443	133.004205	136.6	2.888	17.2	18.0	0.77	5208	1.01	55.05
009489524-03	OBS	2029.03	6.887278	132.070333	77.5	2.400	11.2	11.8	0.77	5208	0.84	91.19
009489524-04	OBS	2029.04	4.788484	135.460708	69.7	2.211	9.9	11.9	0.77	5208	0.78	148.04

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009489524-01	OBS	PC	1.00	0	0	0	0	NO_COMMENT
009489524-02	OBS	PC	1.00	0	0	0	0	CENT_CROWDED
009489524-03	OBS	PC	1.00	0	0	0	0	NO_COMMENT
009489524-04	OBS	PC	0.86	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.

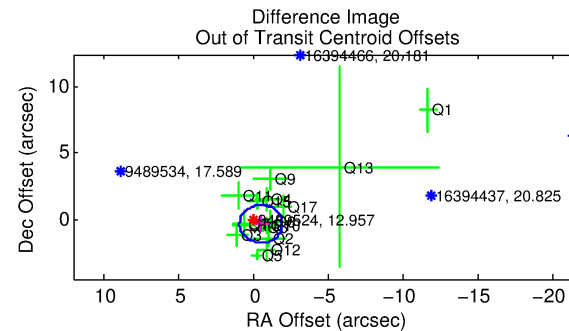
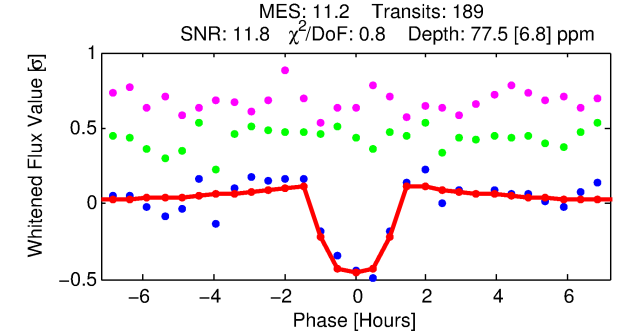
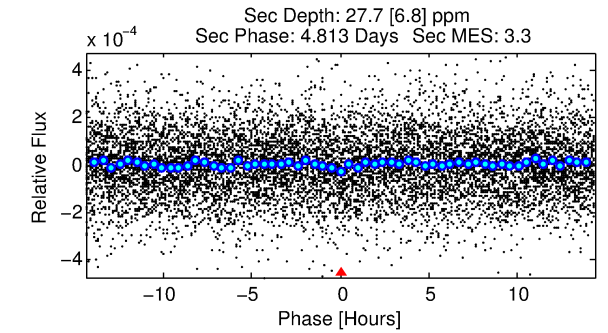
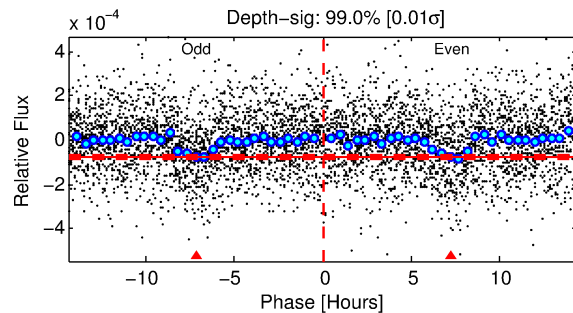
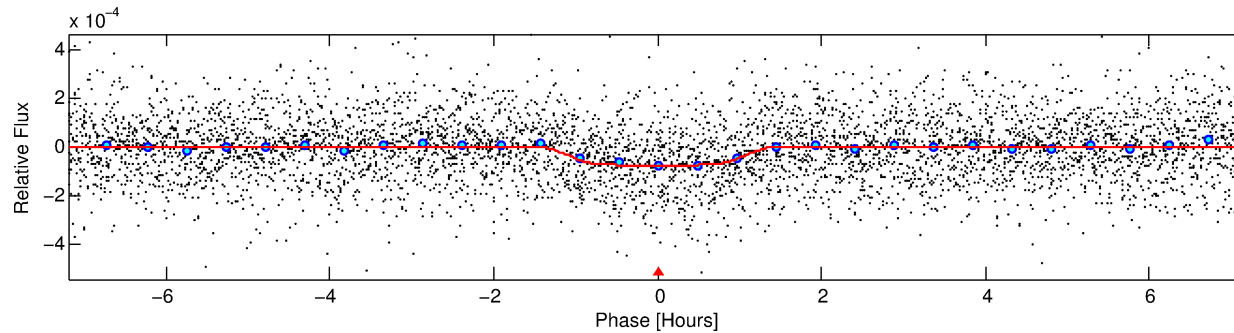
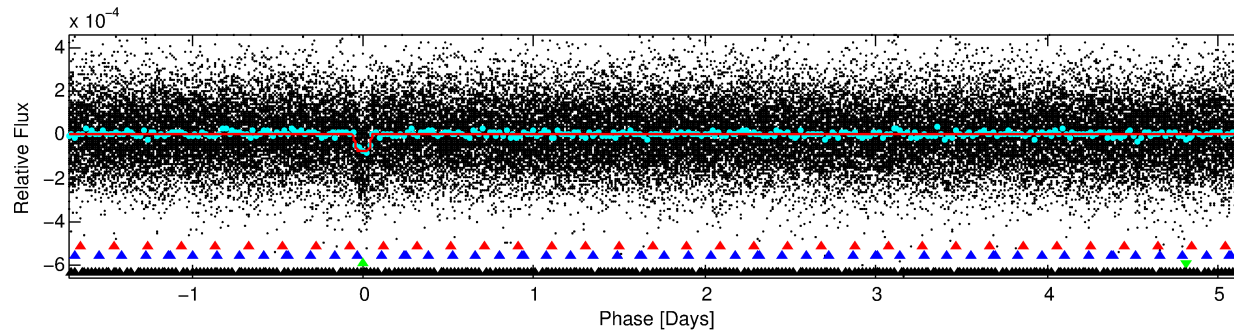
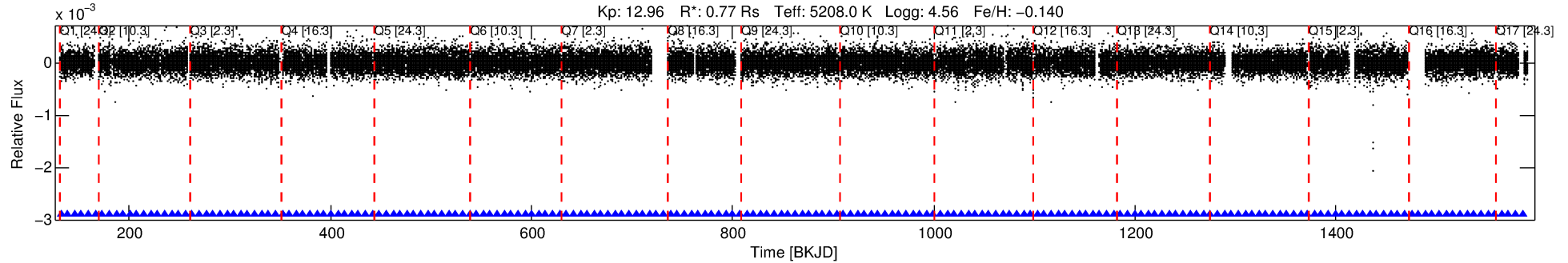
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 009489524-03

No Significant Match Found

# DV One-Page Summary

KIC: 9489524 Candidate: 3 of 4 Period: 6.887 d  
KOI: K02029.03 Corr: 0.988



## DV Fit Results:

Period = 6.88728 [0.00003] d  
Epoch = 132.0703 [0.0035] BKJD  
Rp/R\* = 0.0100 [0.0054]  
ModelChiSquare2-sig: 99.4%  
ModelChiSquareGof-sig: 100.0%  
b = 0.92 [0.39]  
Seff = 91.19 [11.13]  
Teq = 788 [24] K  
Rp = 0.85 [0.45] Re  
a = 0.0656 [0.0041] AU  
Ag = 91.82 [100.86] [0.90 $\sigma$ ]  
Teffp = 3771 [1035] K [2.88 $\sigma$ ]

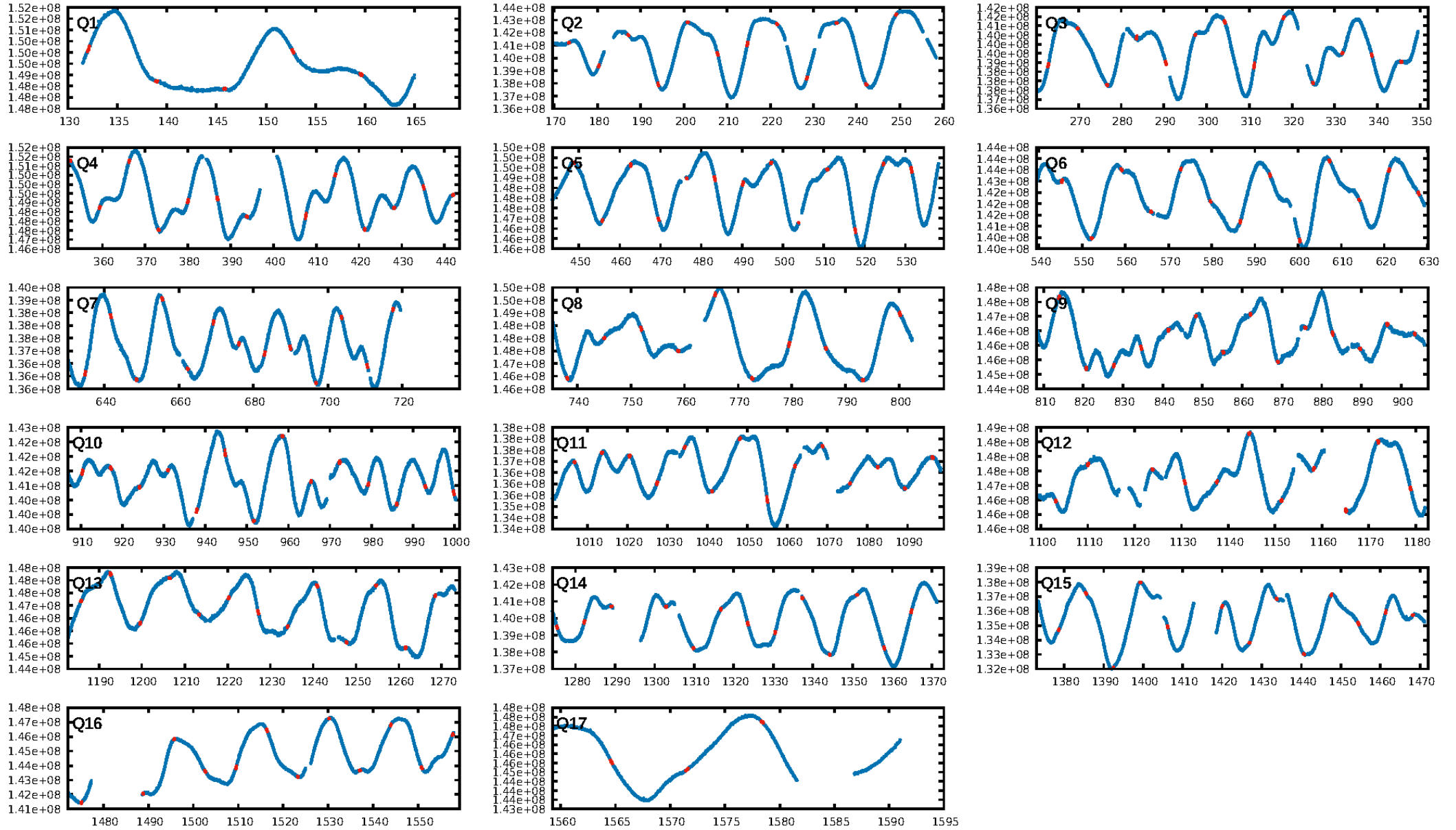
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [15.44 $\sigma$ ]  
LongPeriod-sig: 100.0% [20.25 $\sigma$ ]  
ModelChiSquare2-sig: 99.4%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 3.75e-28  
RollingBand-fgt: 1.00 [181/181]  
GhostDiagnostic-chr: -1.372  
Centroid-sig: N/A  
Centroid-so: 2.961 arcsec [2.59 $\sigma$ ]  
OotOffset-rm: 0.641 arcsec [1.34 $\sigma$ ]  
KicOffset-rm: 0.639 arcsec [1.28 $\sigma$ ]  
OotOffset-st: 4/4/3/5 [16]  
KicOffset-st: 4/4/3/5 [16]  
DiffImageQuality-fgm: 0.56 [9/16]  
DiffImageOverlap-fno: 1.00 [17/17]

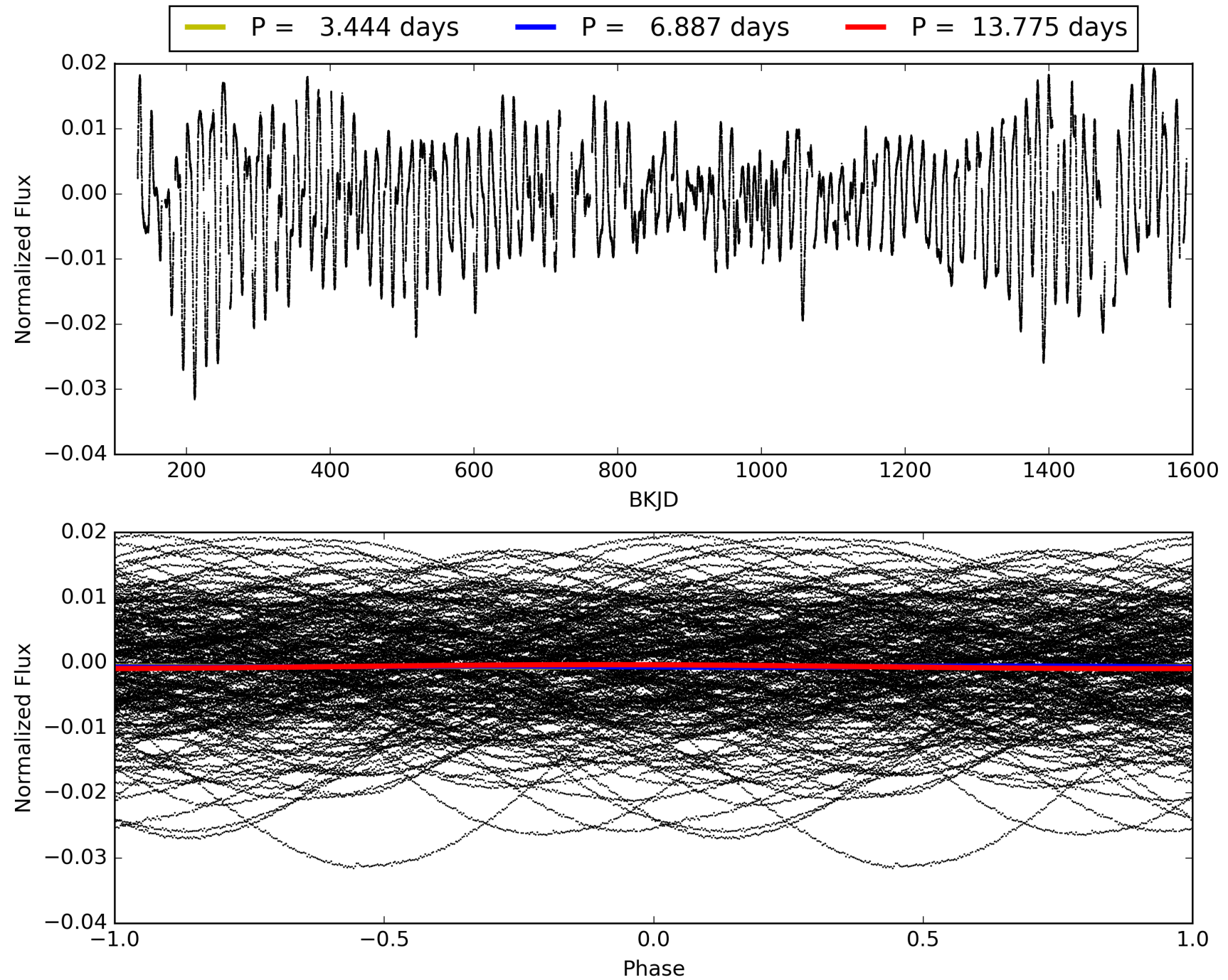
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 17:24:40 Z

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

# TCE 009489524-03, PDC Light Curves



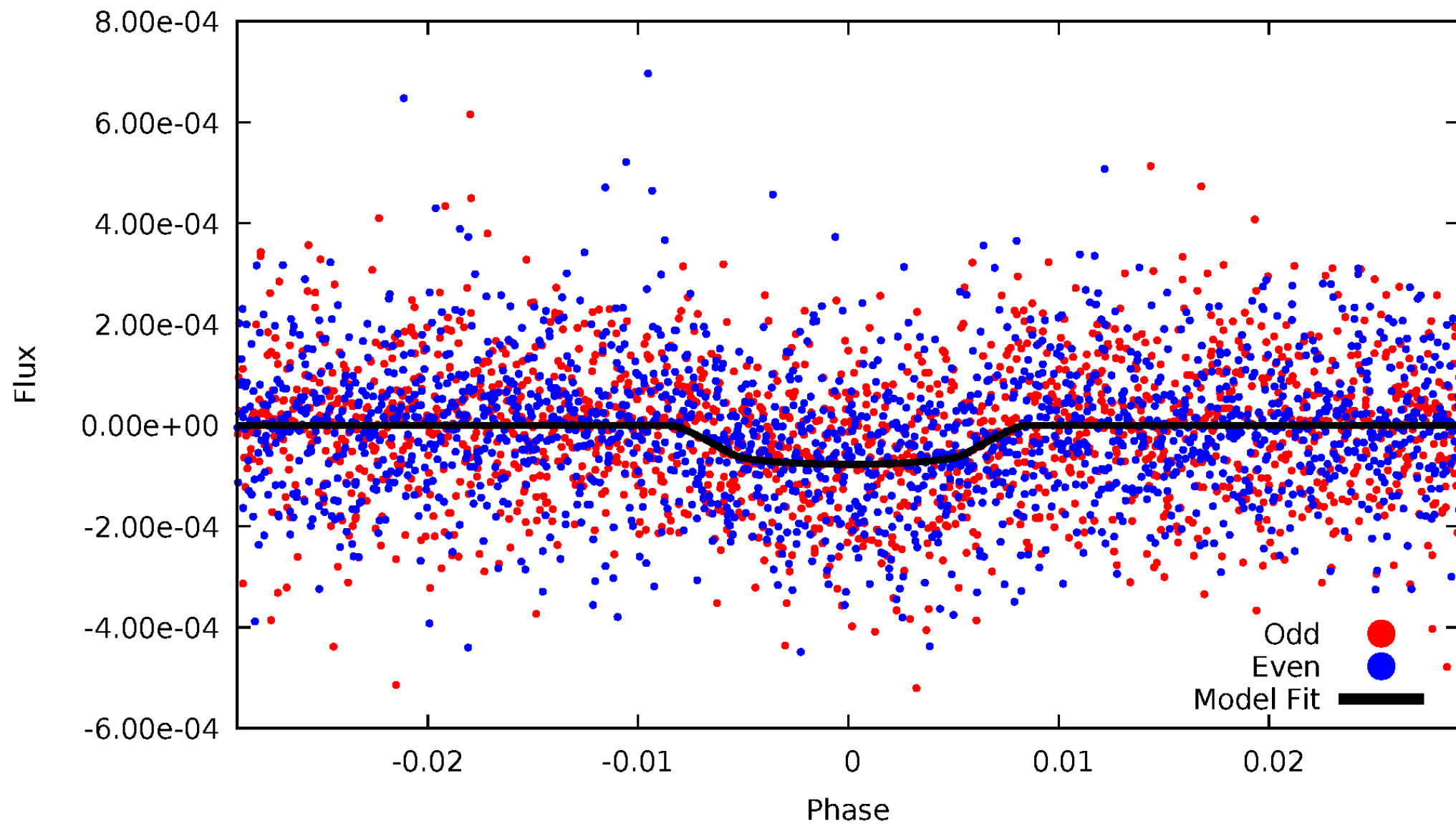
# TCE 009489524-03





# DV Odd/Even

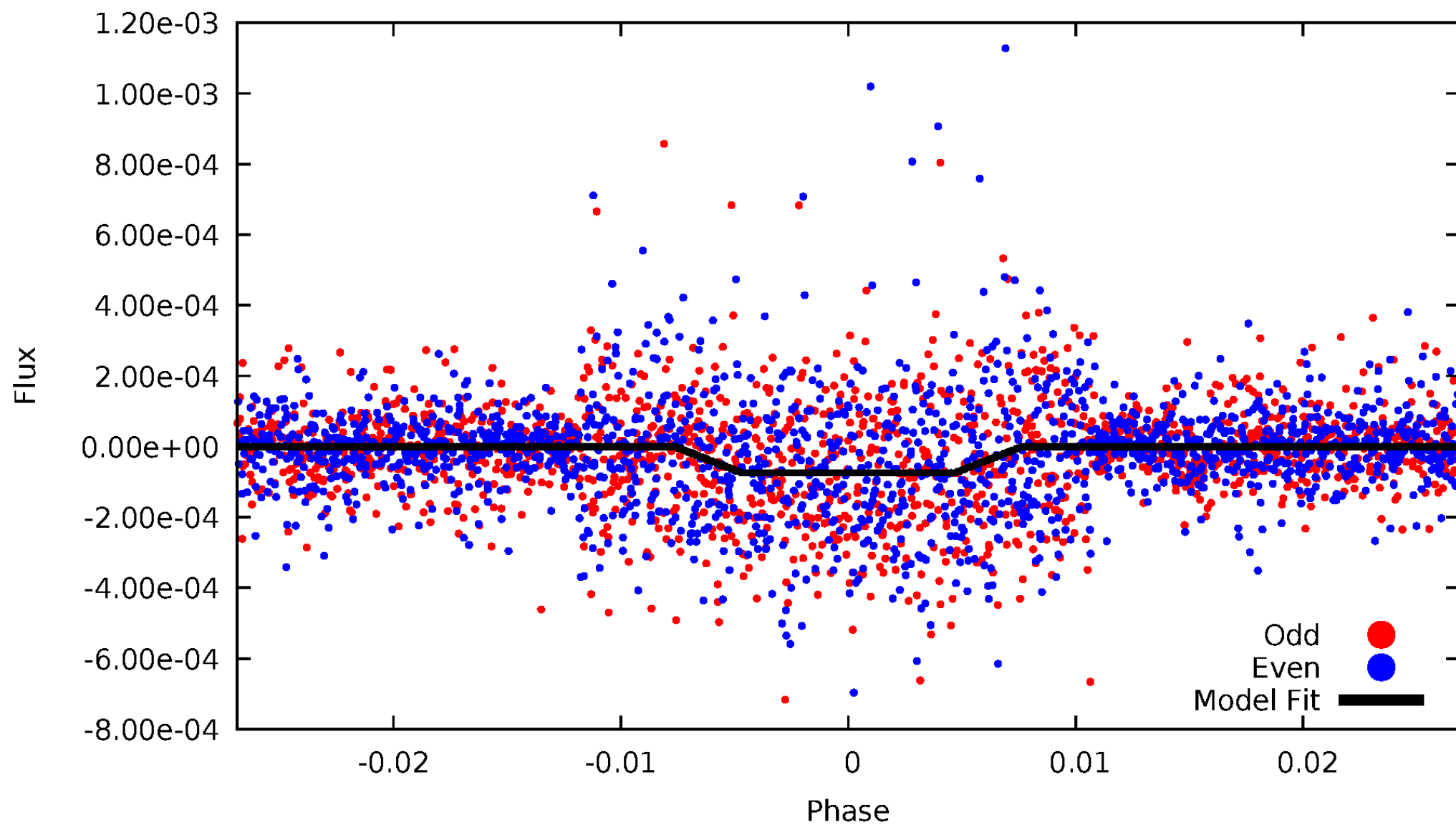
TCE 009489524-03



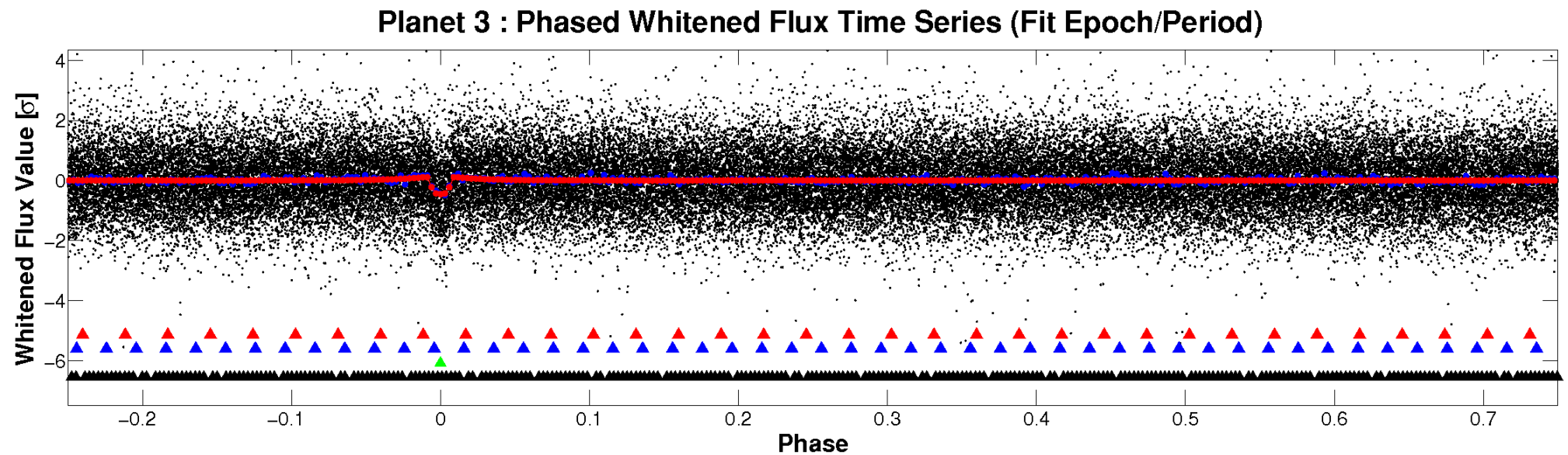
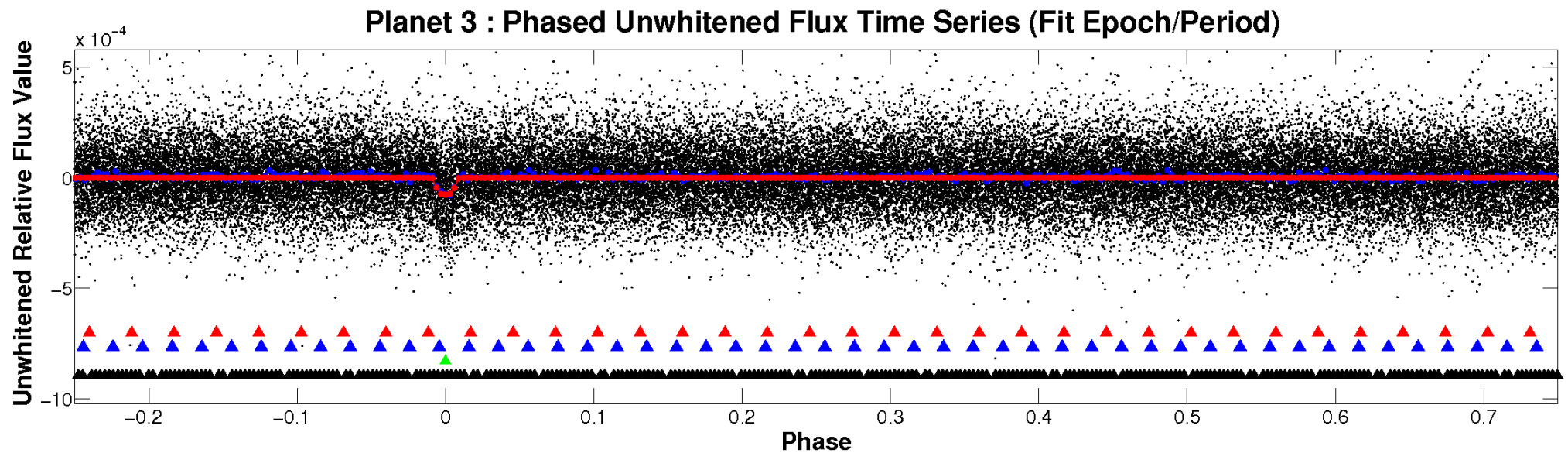


# ALT Odd/Even

TCE 009489524-03

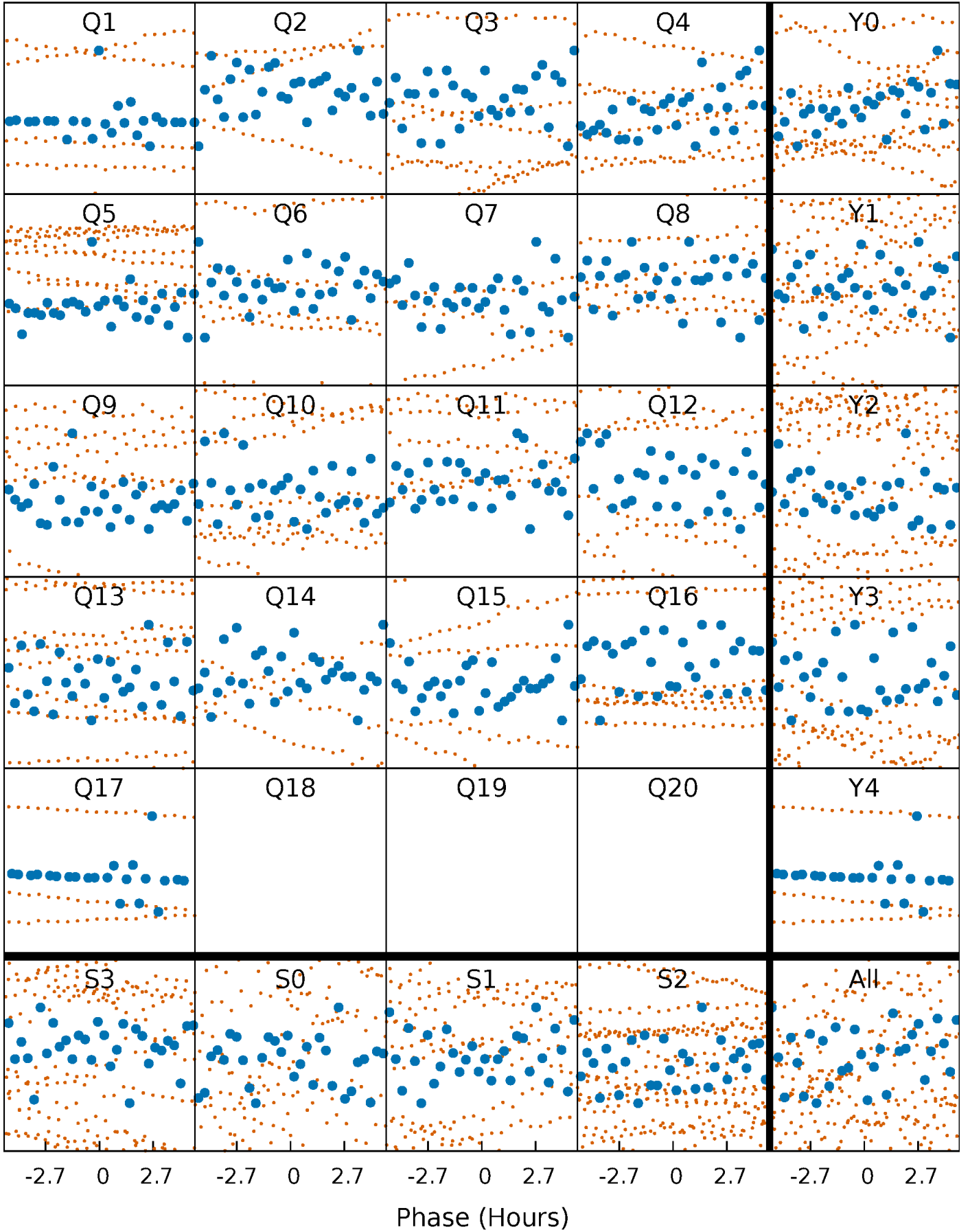


# Non-Whitened Vs. Whitened Light Curve



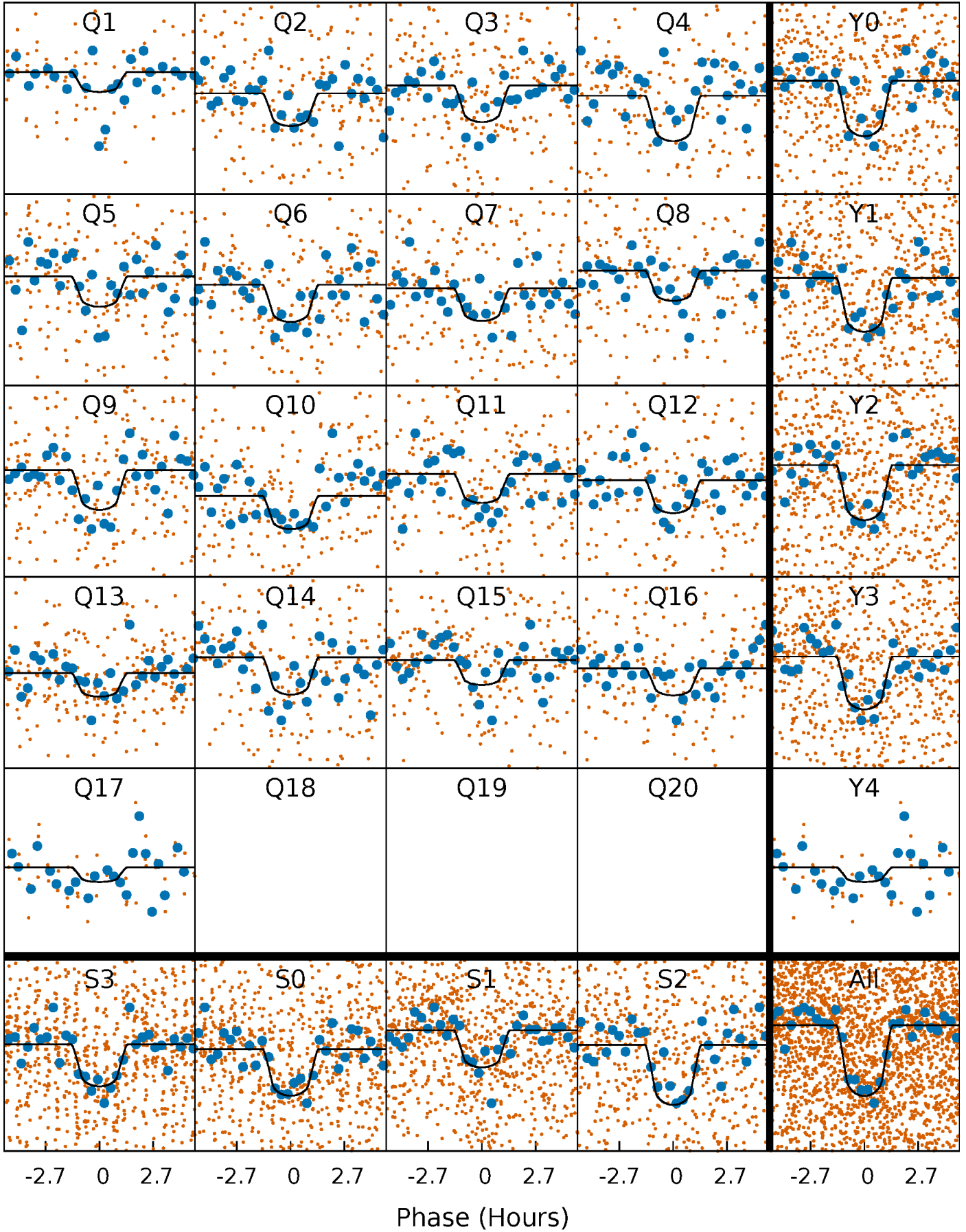
# PDC Quarter-Phased Transit Curves

TCE 009489524-03 P= 6.887278 Days  $T_0=132.070333$  (BKJD)



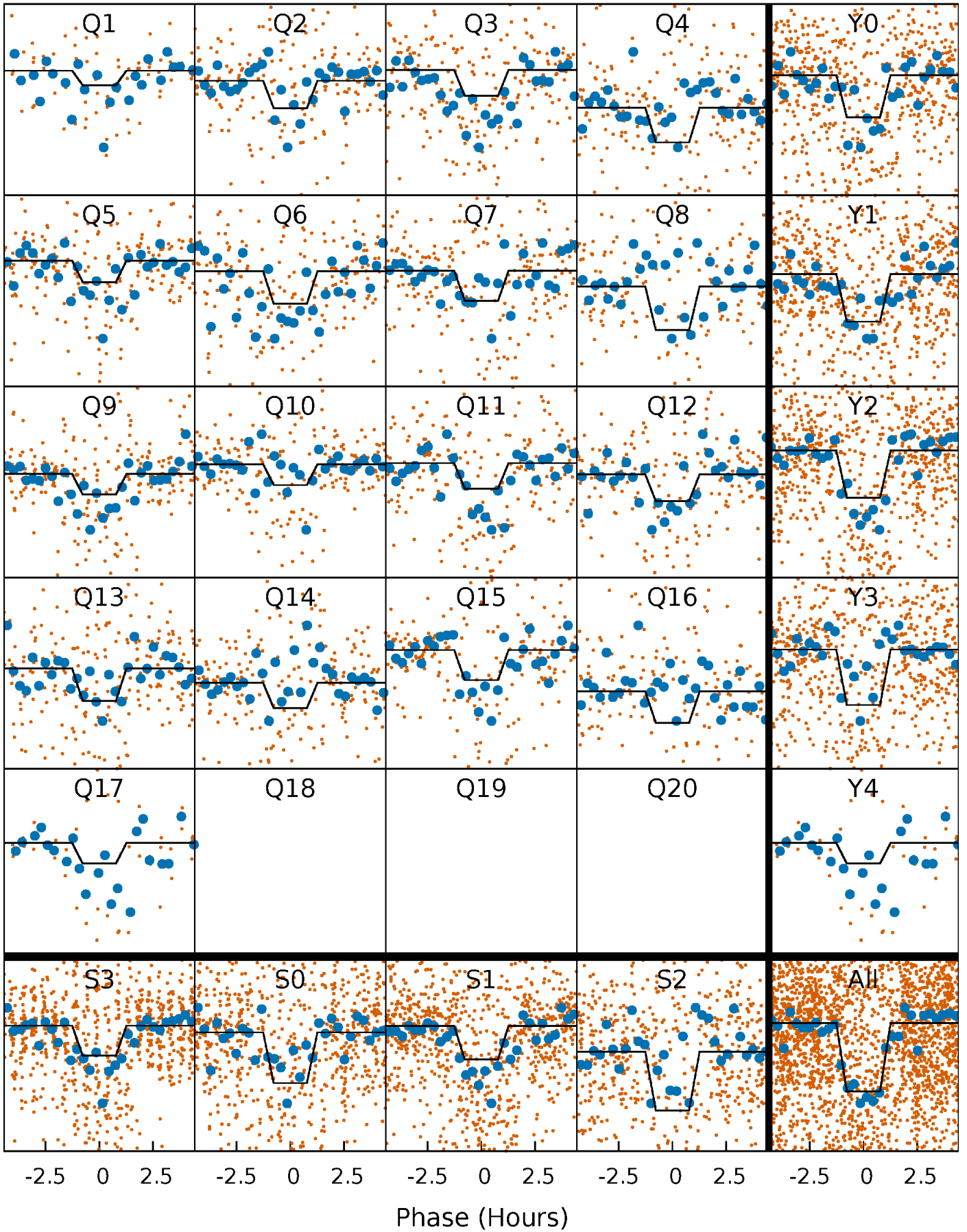
# DV Quarter-Phased Transit Curves

TCE 009489524-03 P= 6.887278 Days  $T_0=132.070333$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

TCE 009489524-03 P= 6.887288 Days  $T_0=132.066839$  (BKJD)

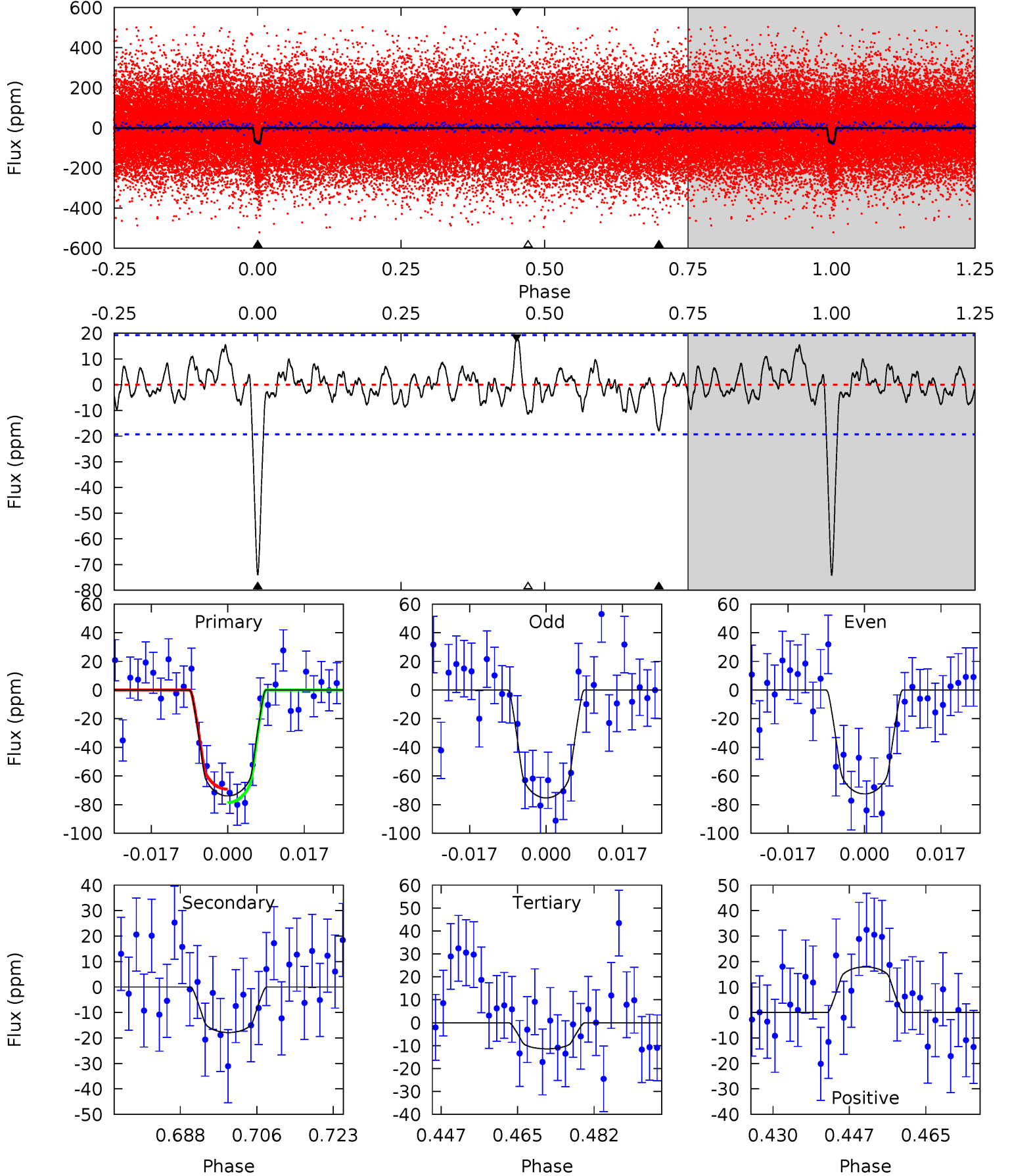




# DV Model-Shift Uniqueness Test

009489524-03, P = 6.887278 Days, E = 125.183055 Days

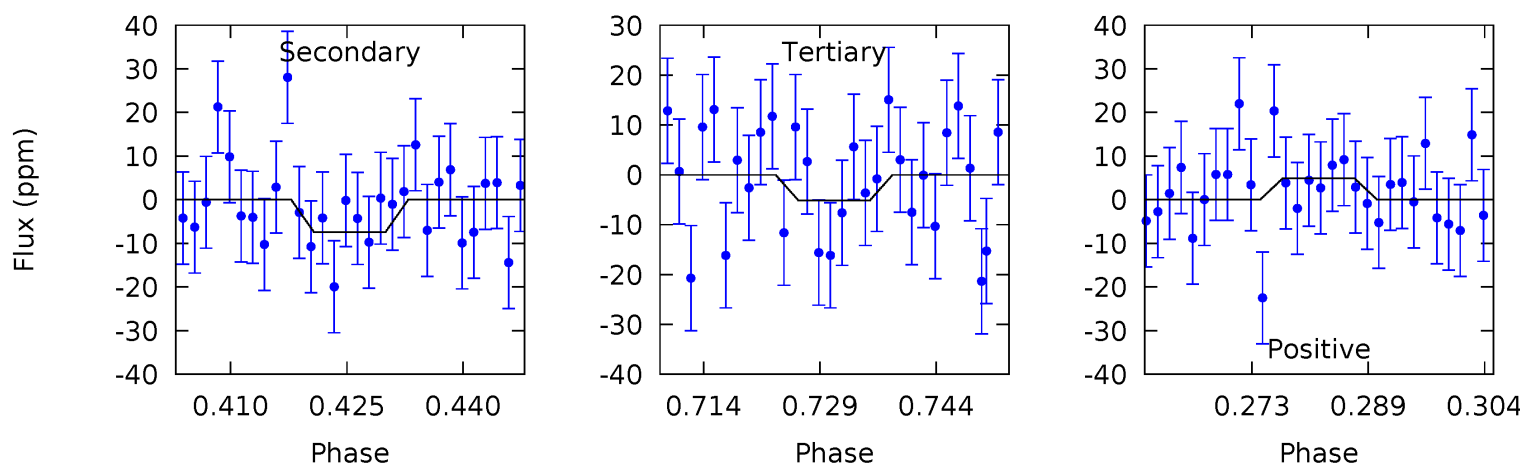
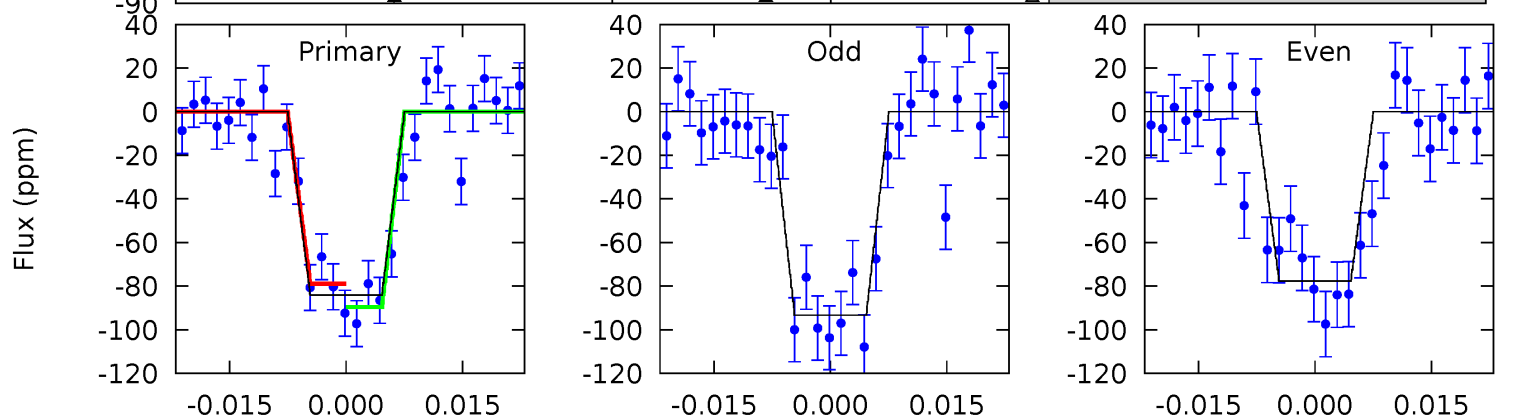
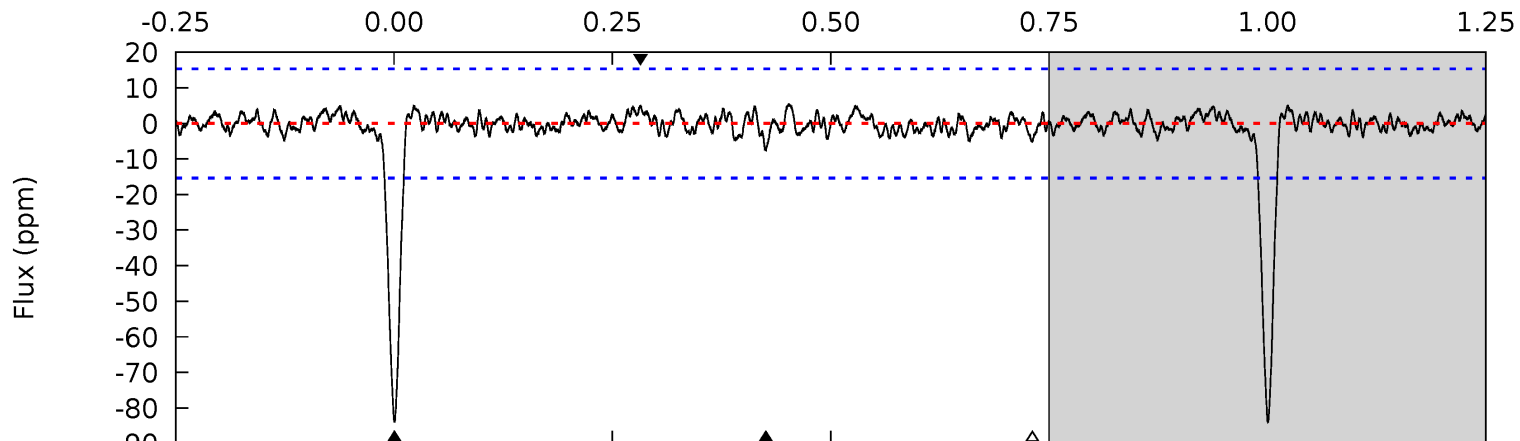
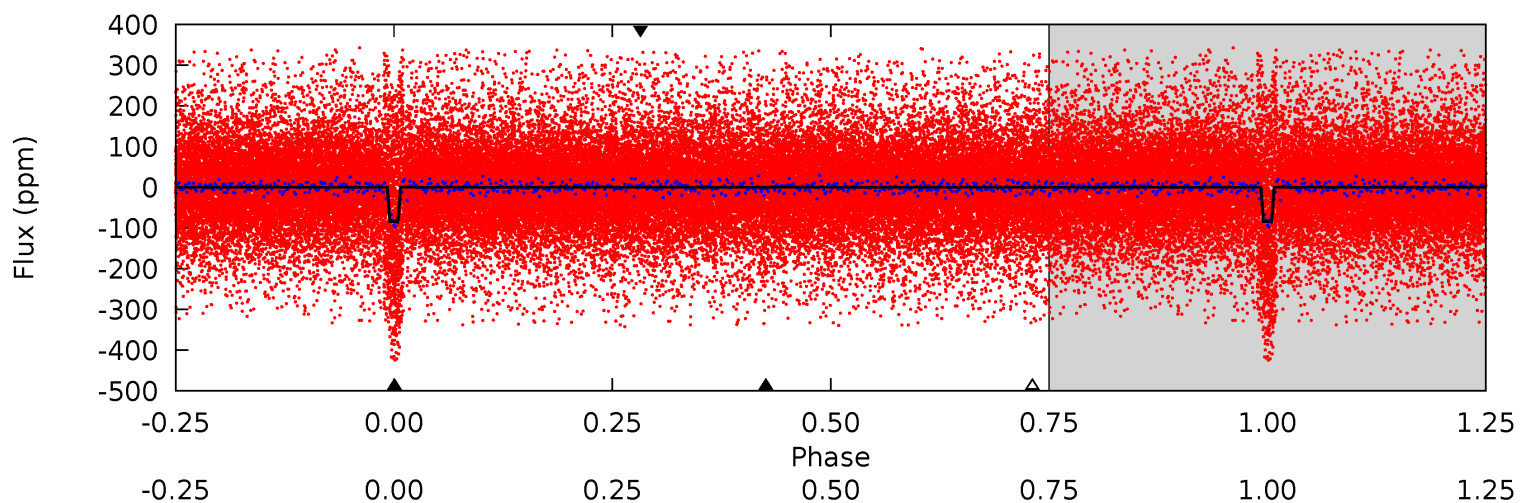
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
18.8	4.55	2.91	4.56	4.92	2.38	1.30	15.9	14.3	1.64	-0.01	0.36	1.05	0.19	1.19



# Alt Model-Shift Uniqueness Test

009489524-03, P = 6.887288 Days, E = 125.179551 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
27.1	2.38	1.65	1.59	4.95	2.43	0.68	25.4	25.5	0.74	0.80	2.53	0.86	0.06	1.72





### Stellar Parameters For KIC 009489524

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5208^{+103}_{-103}$	$4.563^{+0.036}_{-0.052}$	$-0.140^{+0.150}_{-0.150}$	$0.772^{+0.055}_{-0.041}$	$0.796^{+0.046}_{-0.046}$	$2.432^{+0.336}_{-0.397}$
	+2%/-2%	+1%/-1%	+107%/-107%	+7%/-5%	+6%/-6%	+14%/-16%
Source	SPE58	SPE58	SPE58	DSEP		

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

### Secondary Eclipse Parameters for KIC 009489524-03 / KOI 2029.03

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-18 \pm 4$	$0.88^{+0.45}_{-0.40}$	$1103^{+30}_{-26}$	$3706^{+917}_{-497}$	$57^{+133}_{-35}$
Alt.	$-7 \pm 3$	$0.77^{+0.44}_{-0.43}$	$1105^{+30}_{-26}$	$3322^{+1073}_{-448}$	$28^{+114}_{-17}$

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

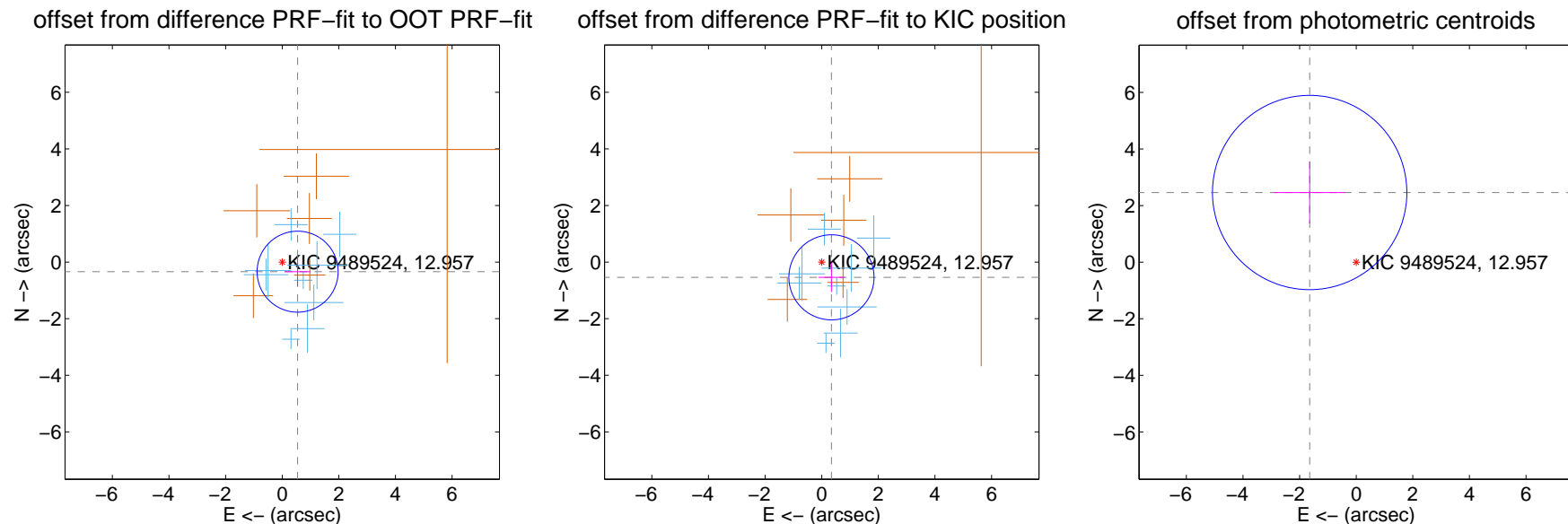
## DV Centroid Data

Supplemental centroid analysis for 009489524-03. Kepler magnitude: 12.96. Transit SNR 11.82

There are 9 quarters with good PRF difference image offsets

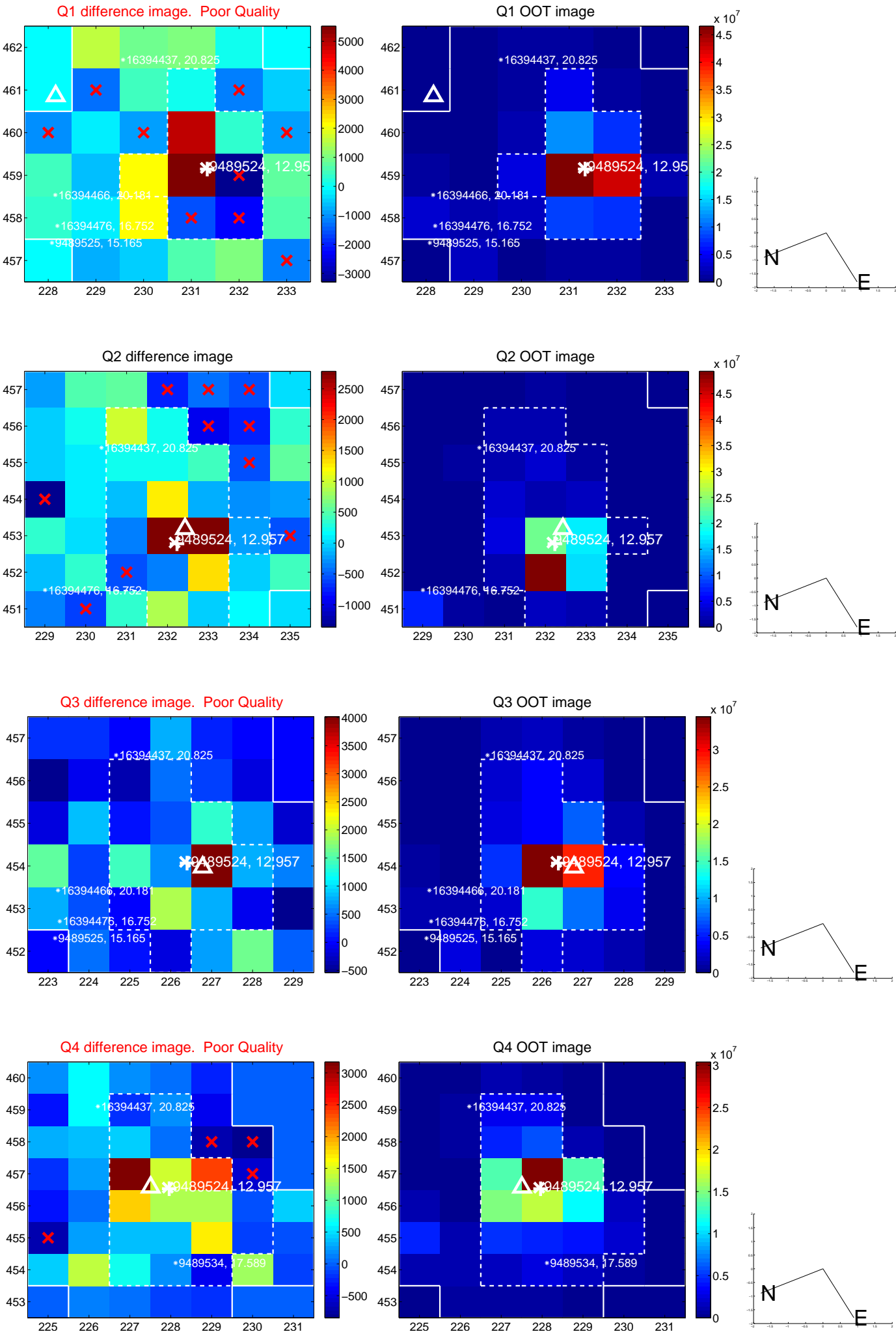
The direct PRF centroid is offset from the target star catalog position by about 0.24 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.641 \pm 0.477$	1.34	$-0.544 \pm 0.461$	$-0.339 \pm 0.517$
PRF-fit source offset from KIC position	$0.639 \pm 0.501$	1.28	$-0.344 \pm 0.461$	$-0.539 \pm 0.517$
photometric centroid source offset	$2.96 \pm 1.14$	2.59	$1.64 \pm 1.26$	$2.46 \pm 1.09$

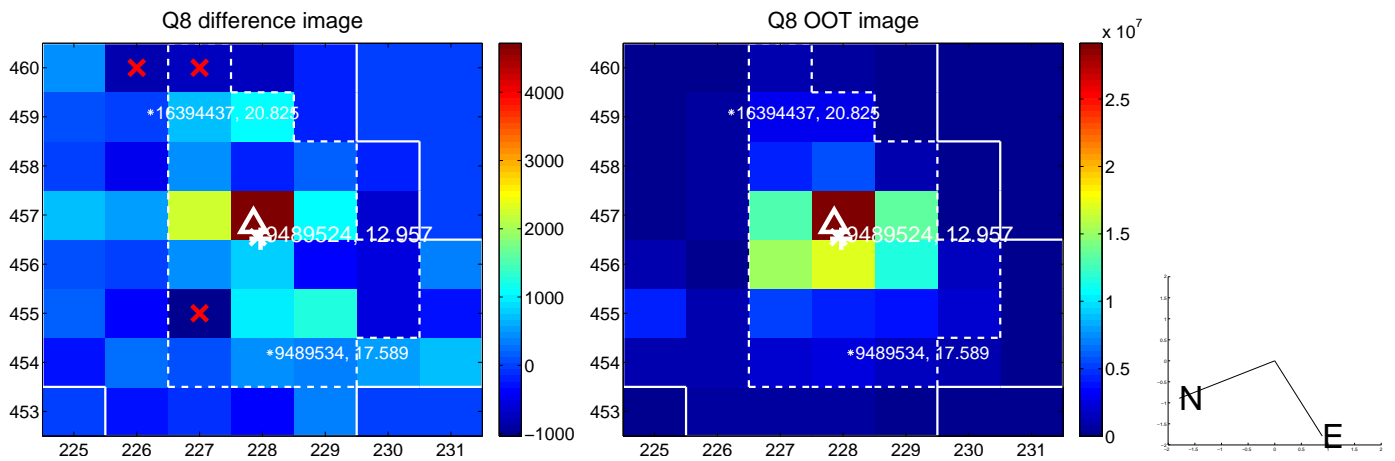
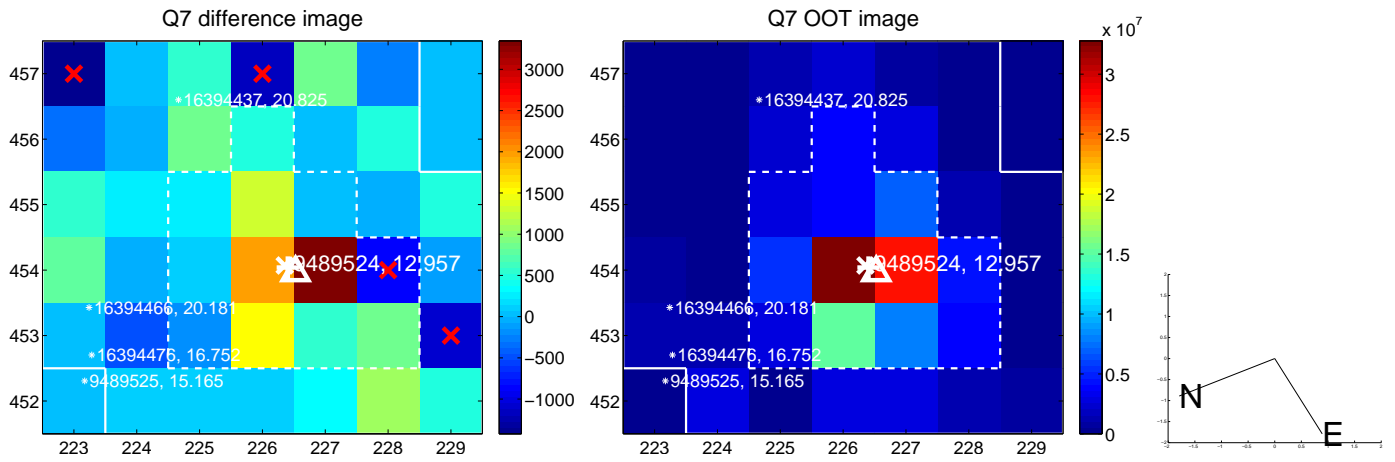
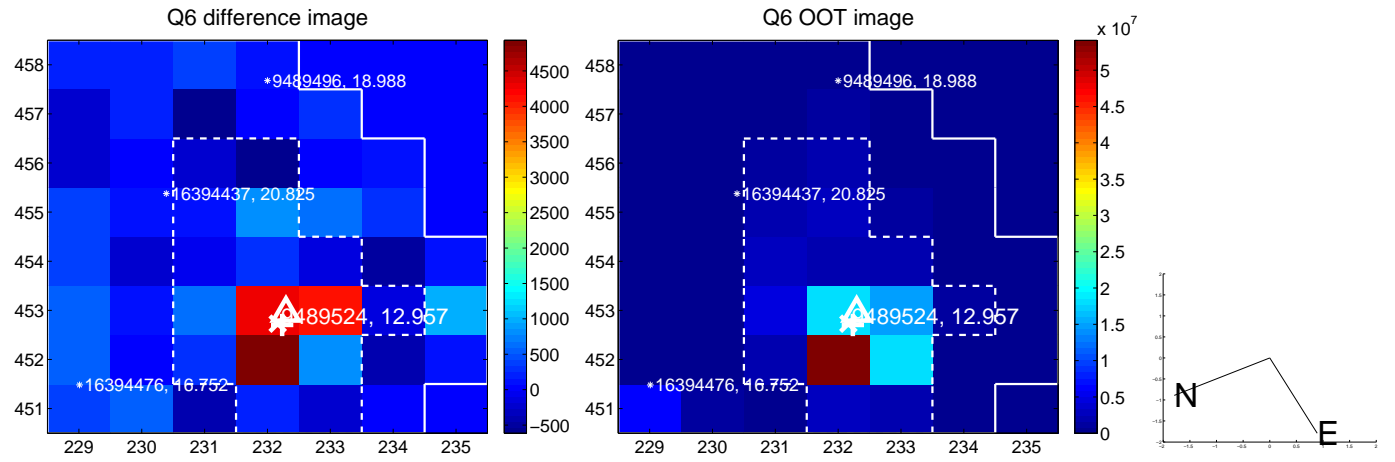
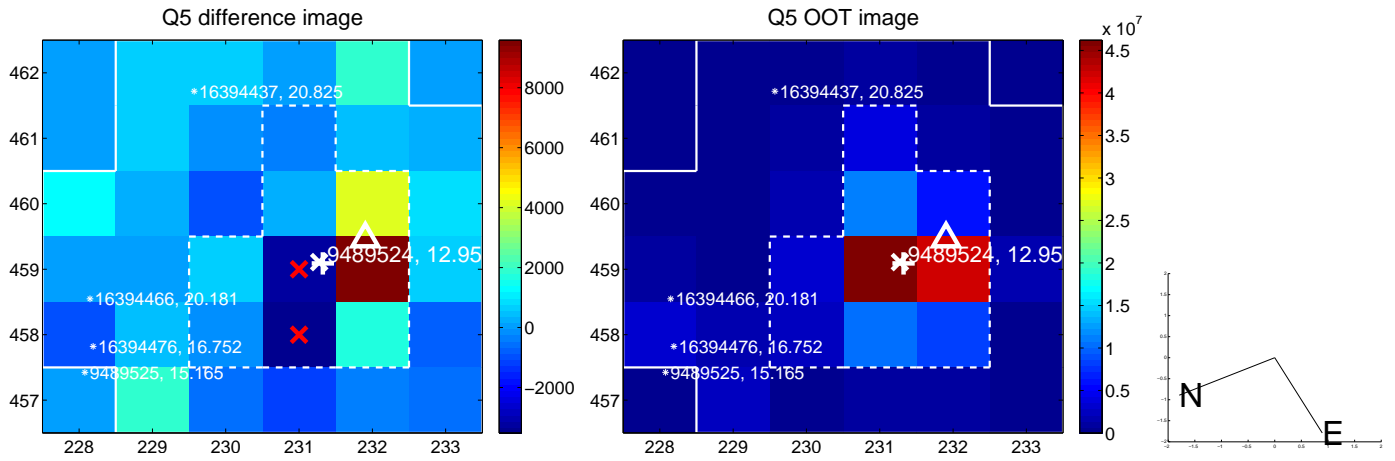


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

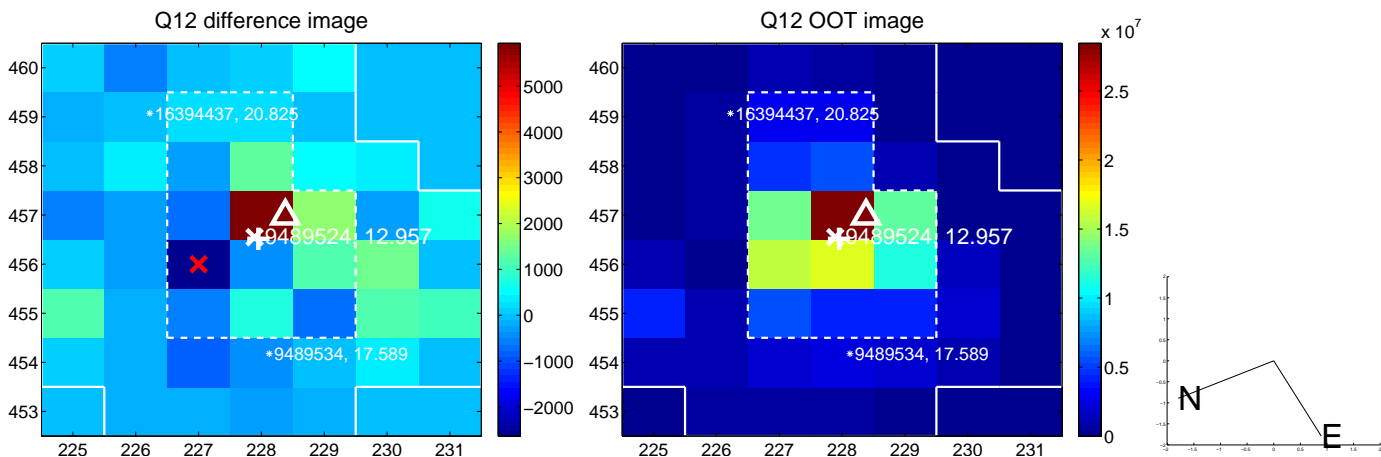
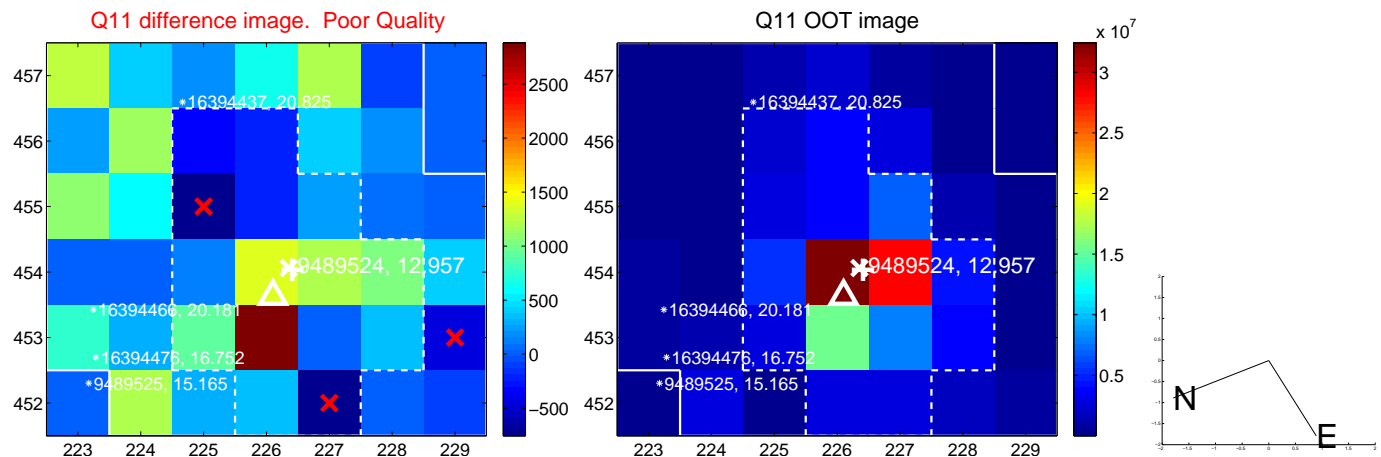
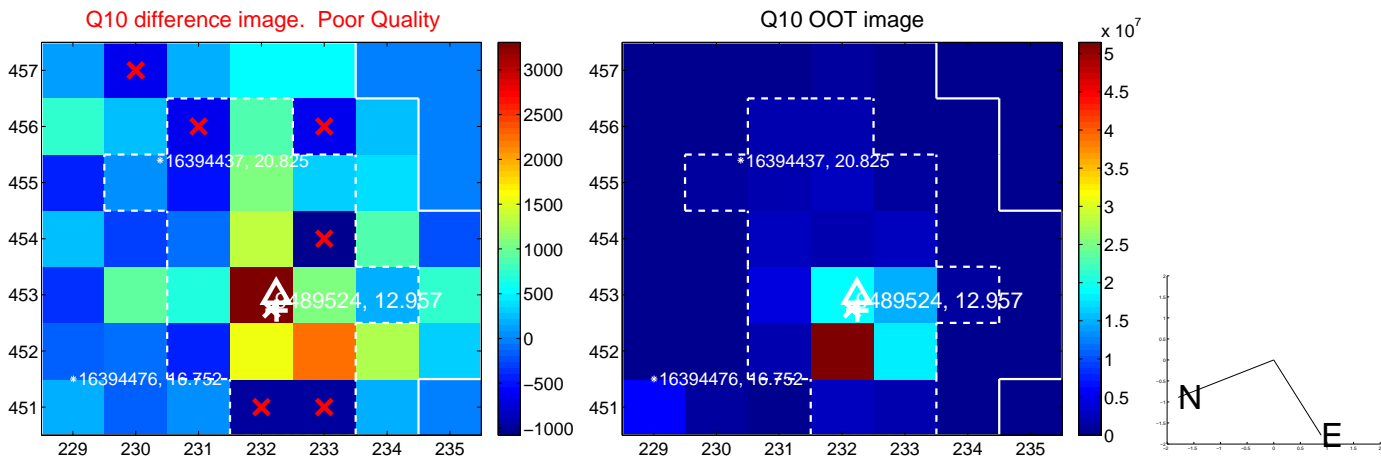
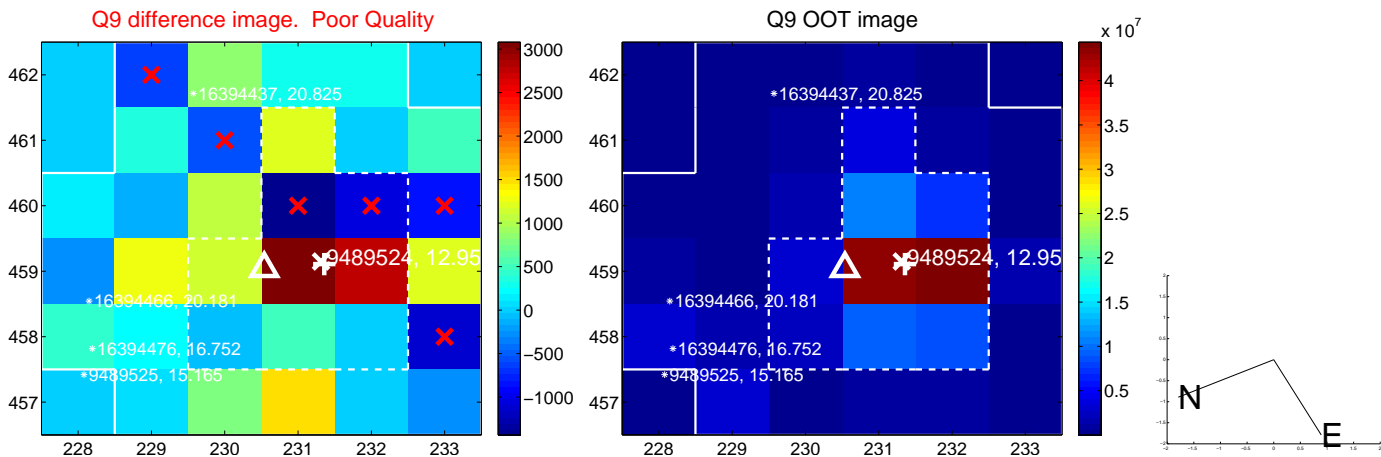
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



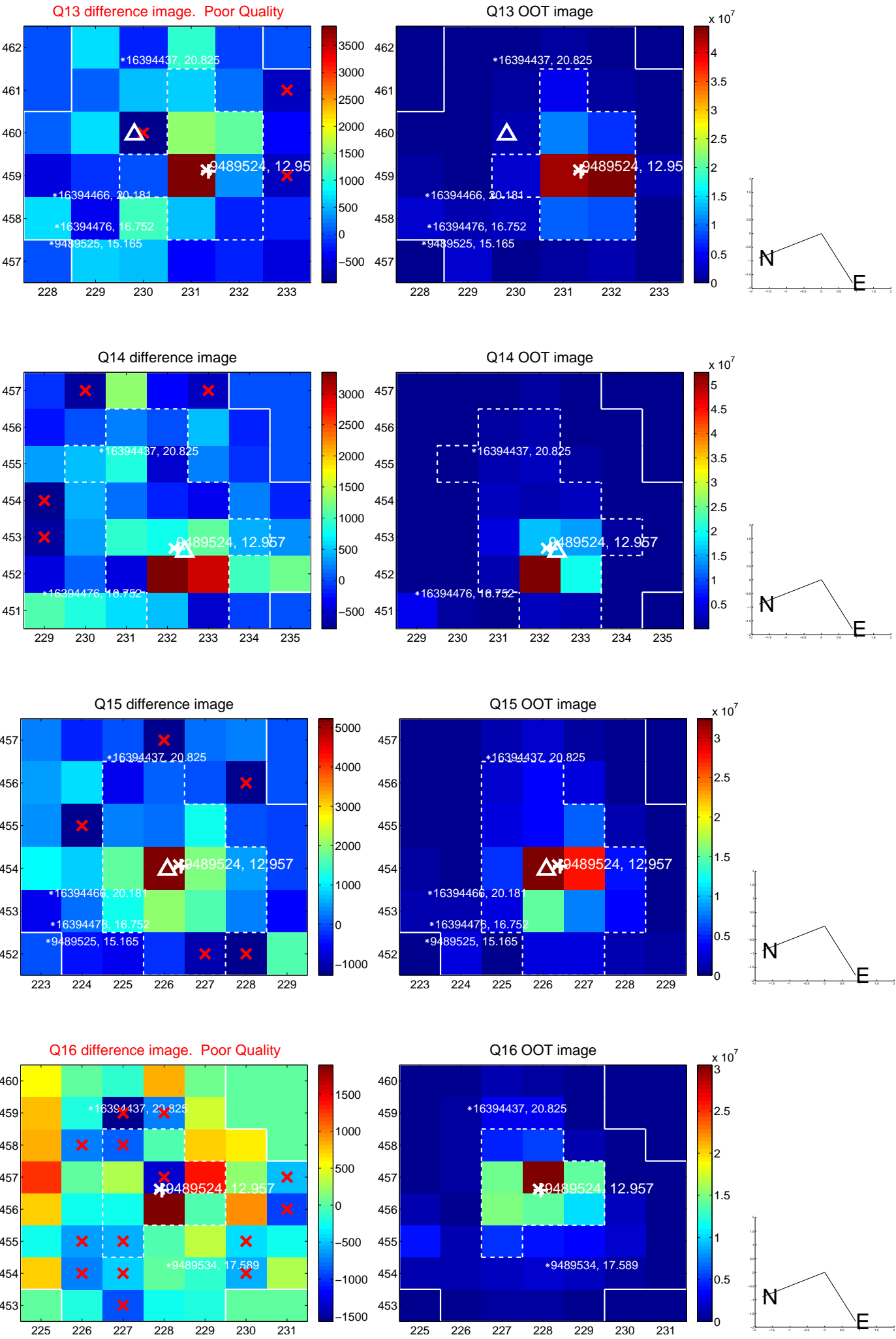
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



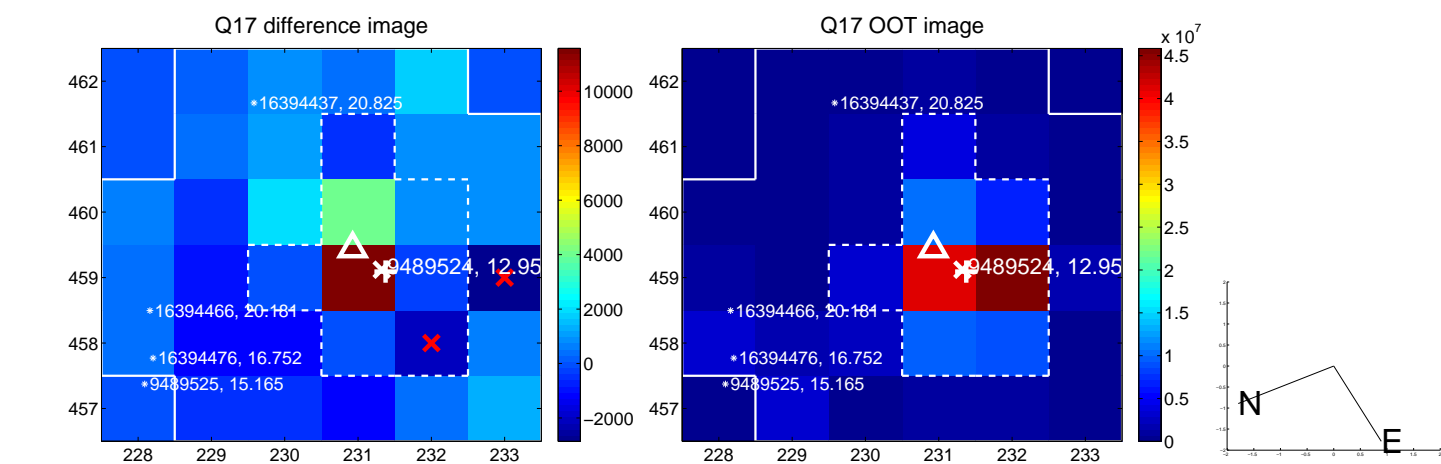
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



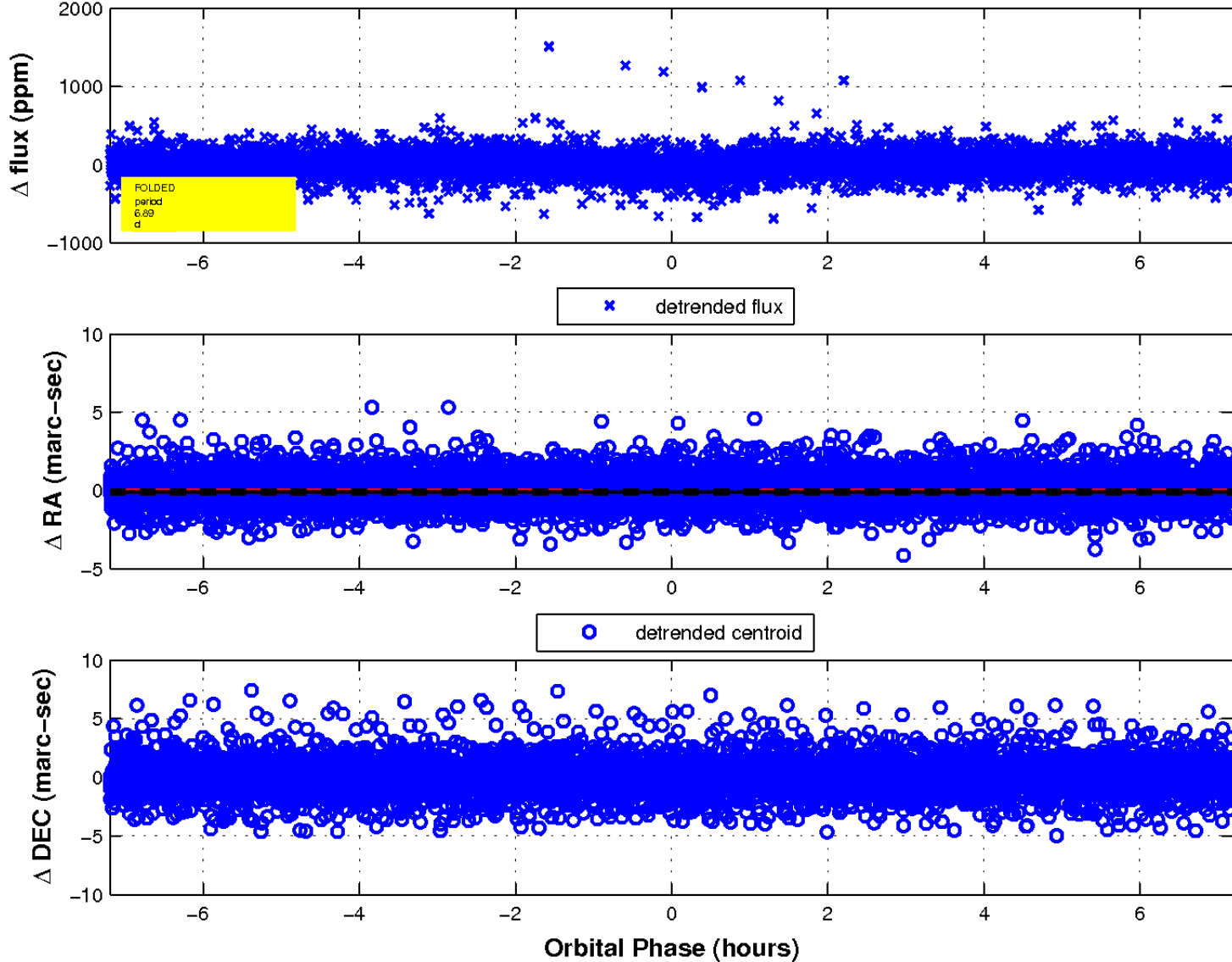
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

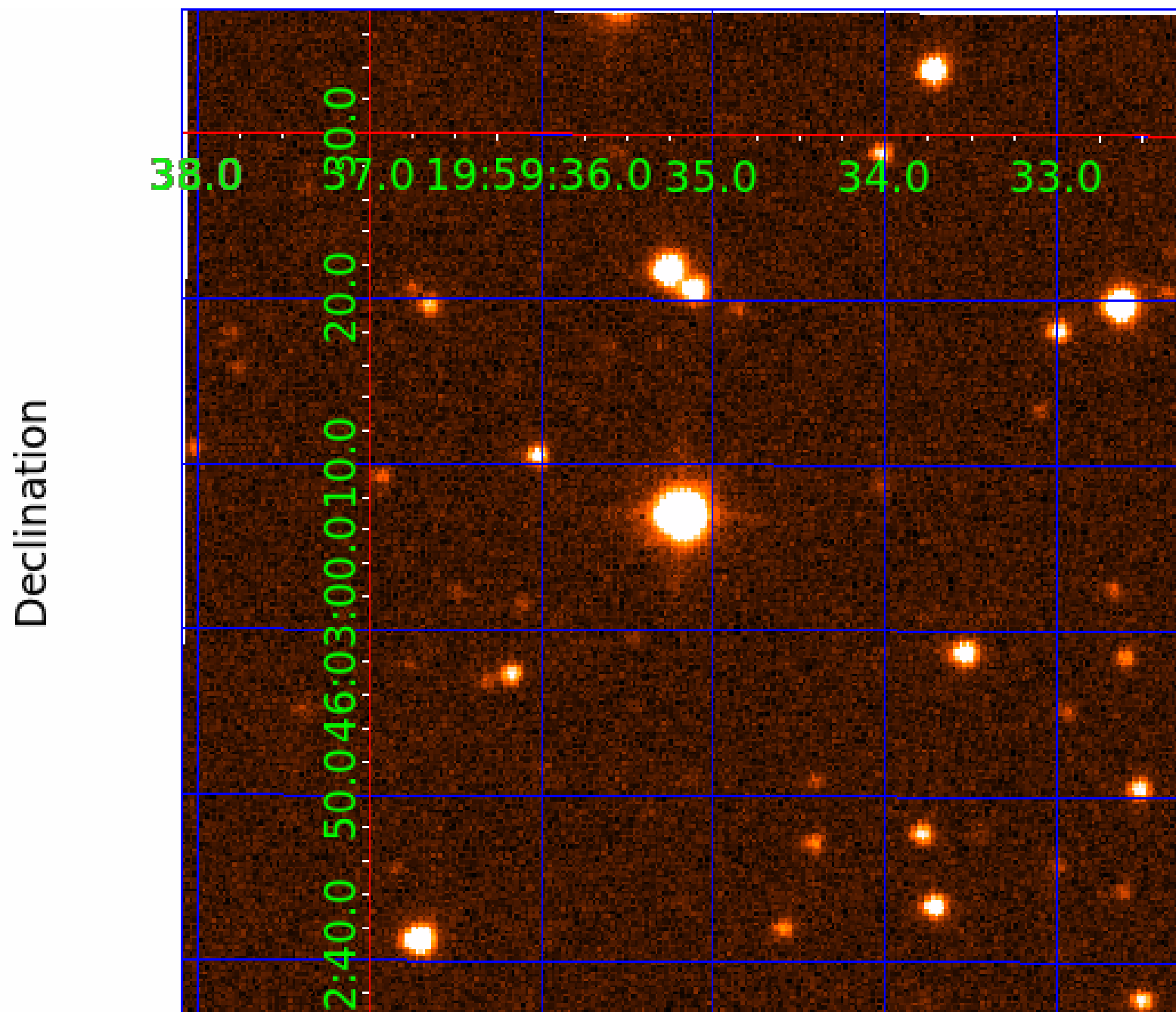


fluxWeightedCentroids, Planet 3 of 4





UKIRT Image



# KIC 009489524

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009489524-01	OBS	2029.01	16.332682	136.910308	308.9	2.533	24.7	28.6	0.77	5208	1.84	28.84
009489524-02	OBS	2029.02	10.055443	133.004205	136.6	2.888	17.2	18.0	0.77	5208	1.01	55.05
009489524-03	OBS	2029.03	6.887278	132.070333	77.5	2.400	11.2	11.8	0.77	5208	0.84	91.19
009489524-04	OBS	2029.04	4.788484	135.460708	69.7	2.211	9.9	11.9	0.77	5208	0.78	148.04

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009489524-01	OBS	PC	1.00	0	0	0	0	NO_COMMENT
009489524-02	OBS	PC	1.00	0	0	0	0	CENT_CROWDED
009489524-03	OBS	PC	1.00	0	0	0	0	NO_COMMENT
009489524-04	OBS	PC	0.86	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.

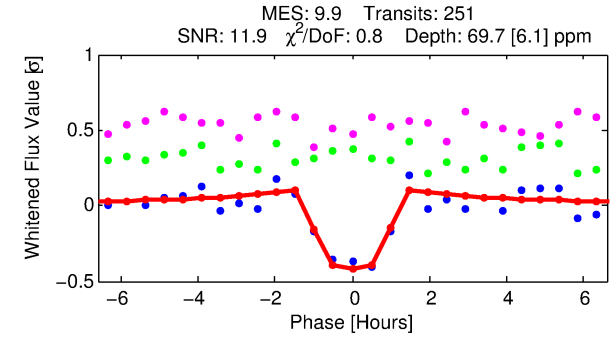
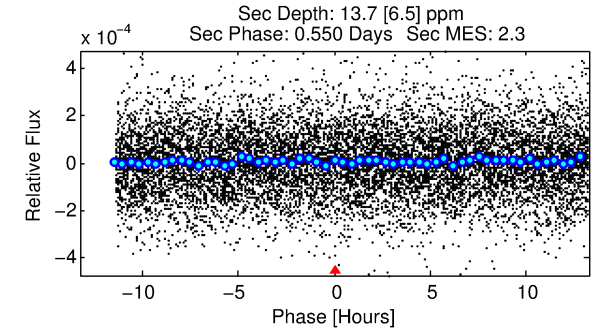
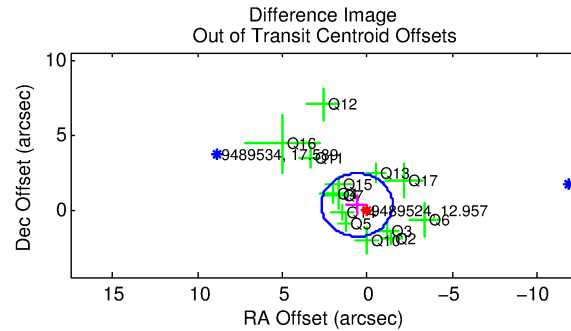
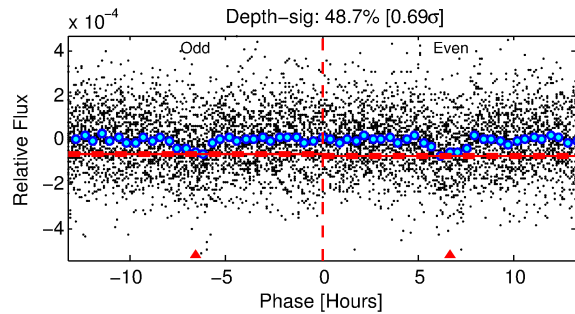
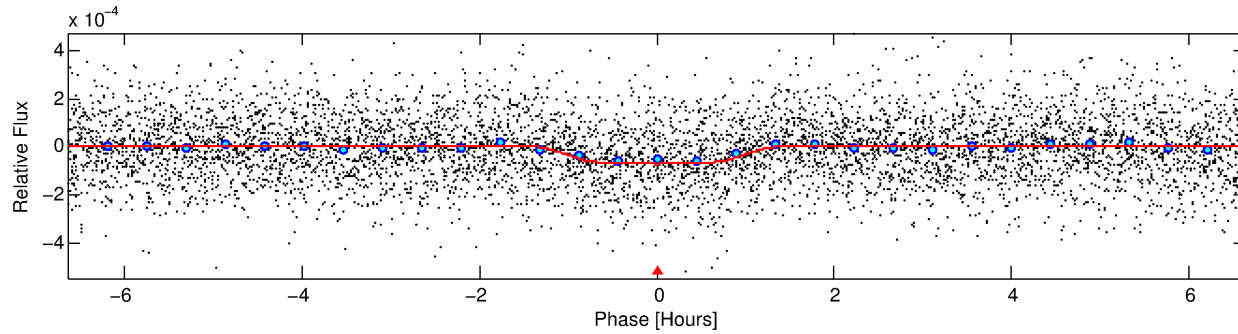
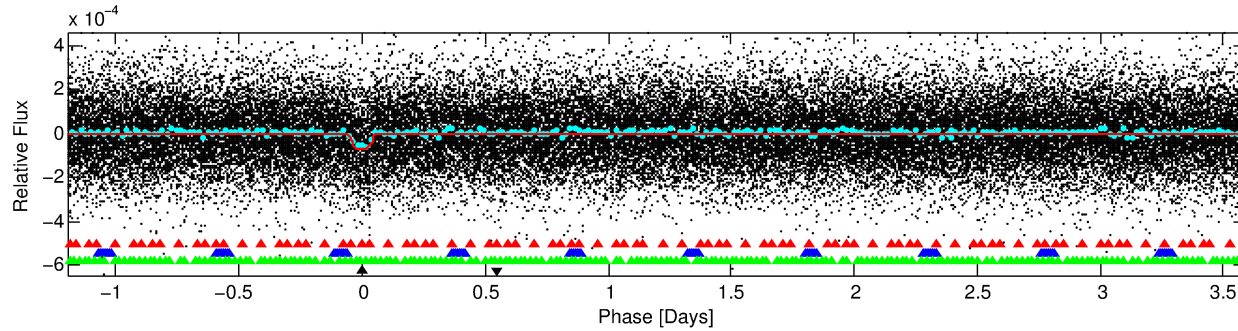
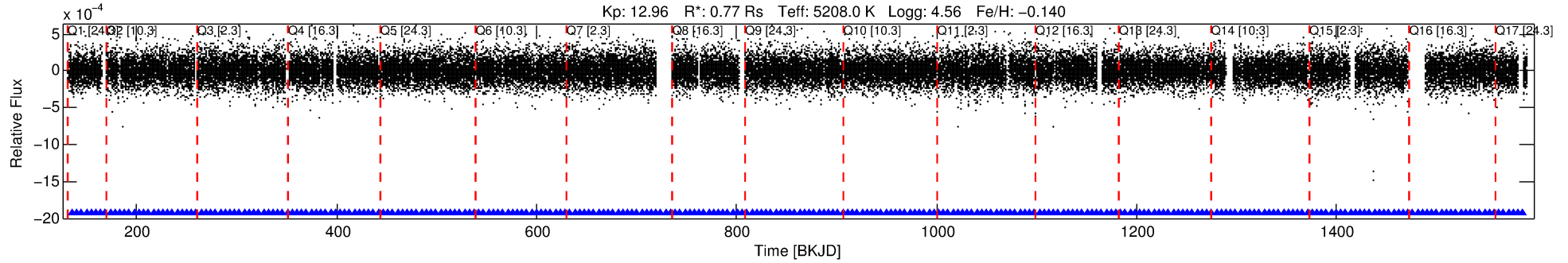
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 009489524-04

No Significant Match Found

# DV One-Page Summary

KIC: 9489524 Candidate: 4 of 4 Period: 4.788 d  
KOI: K02029.04 Corr: 0.976



## DV Fit Results:

Period = 4.78848 [0.00002] d  
Epoch = 135.4607 [0.0030] BKJD  
Rp/R\* = 0.0092 [0.0050]  
a/R\* = 7.63 [17.28]  
b = 0.90 [0.50]  
Self = 148.04 [18.06]  
Teq = 889 [27] K  
Rp = 0.78 [0.43] Re  
a = 0.0515 [0.0032] AU  
Ag = 33.03 [39.28] [0.82 $\sigma$ ]  
Teff = 3297 [979] K [2.46 $\sigma$ ]

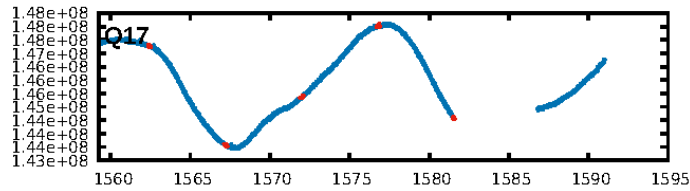
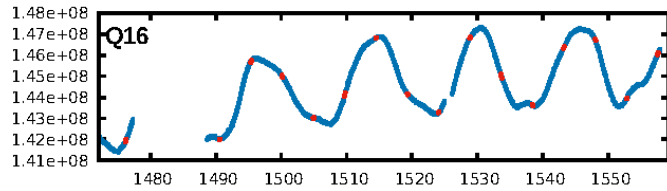
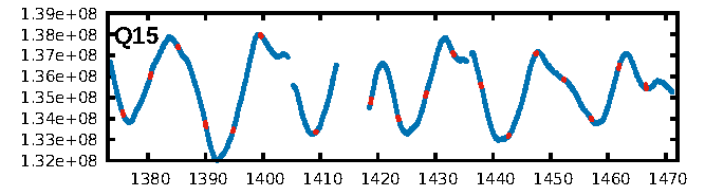
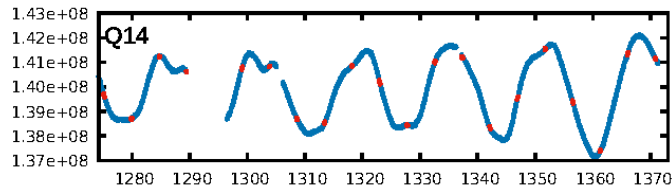
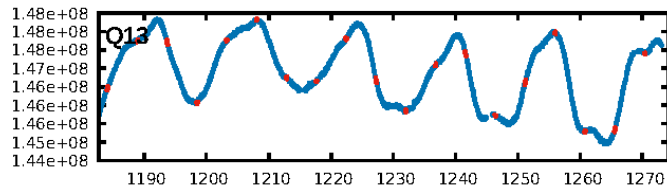
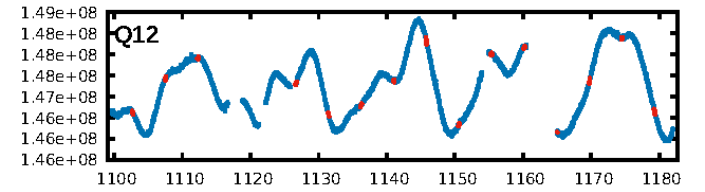
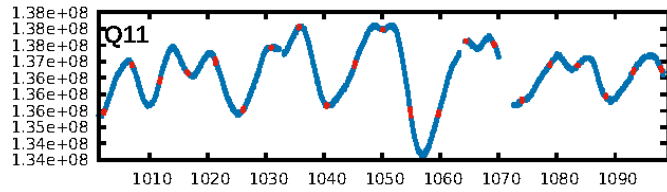
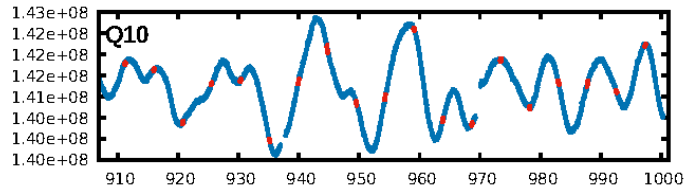
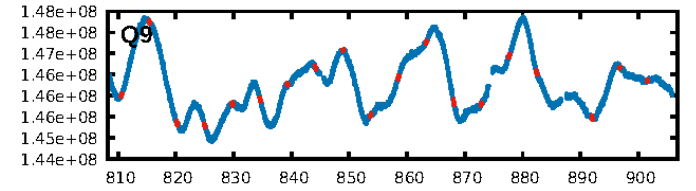
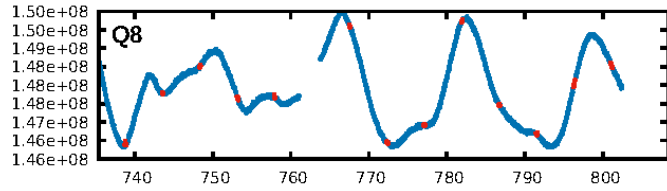
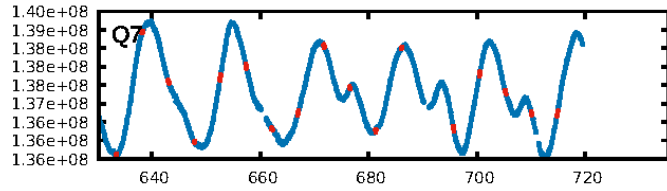
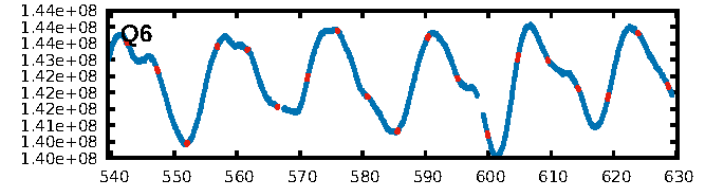
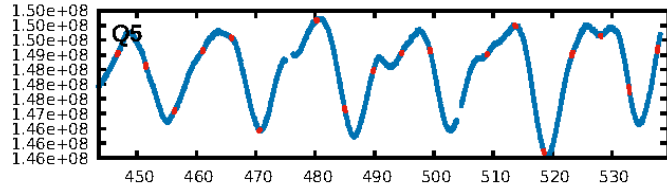
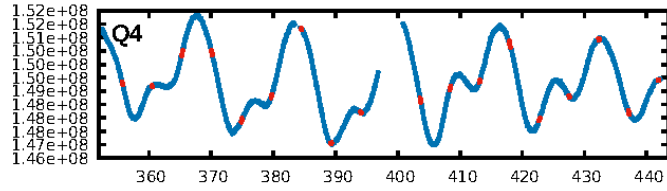
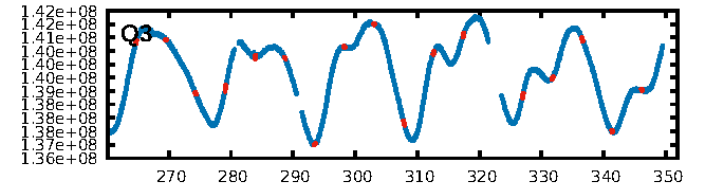
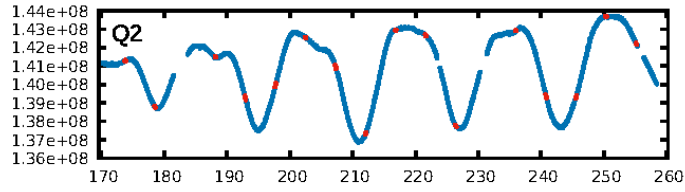
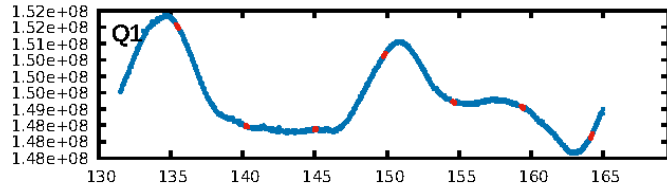
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [15.44 $\sigma$ ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: 8.86e-23  
RollingBand-fgt: 1.00 [239/239]  
GhostDiagnostic-chr: -2.991  
Centroid-sig: N/A  
Centroid-so: 1.559 arcsec [1.28 $\sigma$ ]  
OotOffset-rm: 0.671 arcsec [0.96 $\sigma$ ]  
KicOffset-rm: 0.806 arcsec [1.21 $\sigma$ ]  
OotOffset-st: 4/4/3/3 [14]  
KicOffset-st: 4/4/3/3 [14]  
DiffImageQuality-fgm: 0.57 [8/14]  
DiffImageOverlap-fno: 1.00 [17/17]

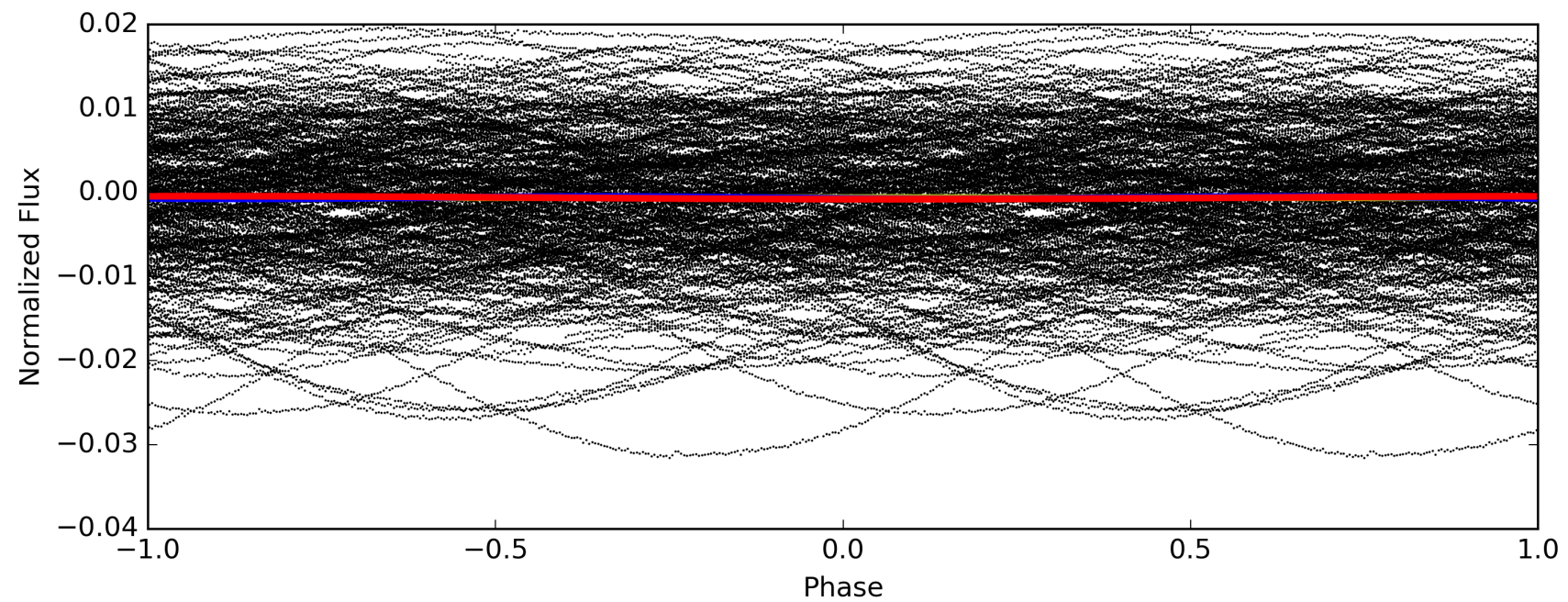
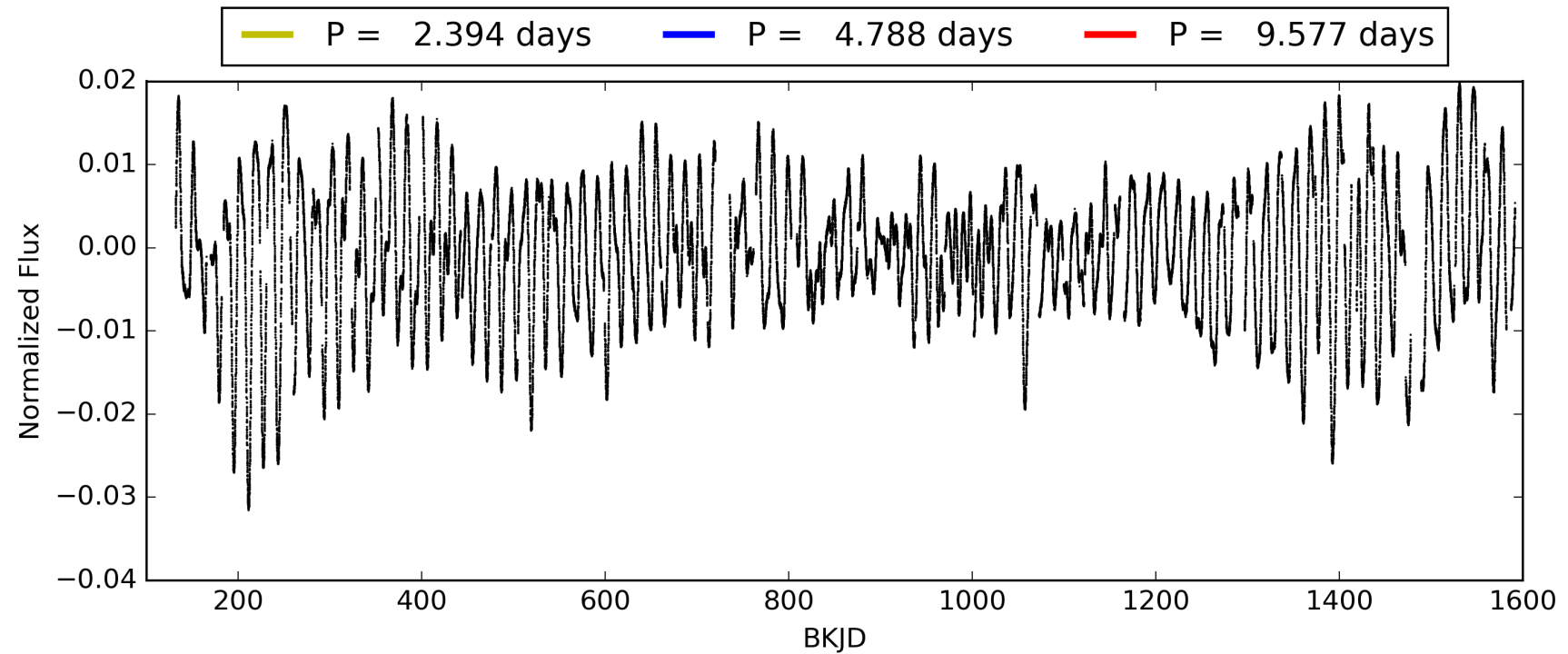
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 17:24:46 Z

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

# TCE 009489524-04, PDC Light Curves

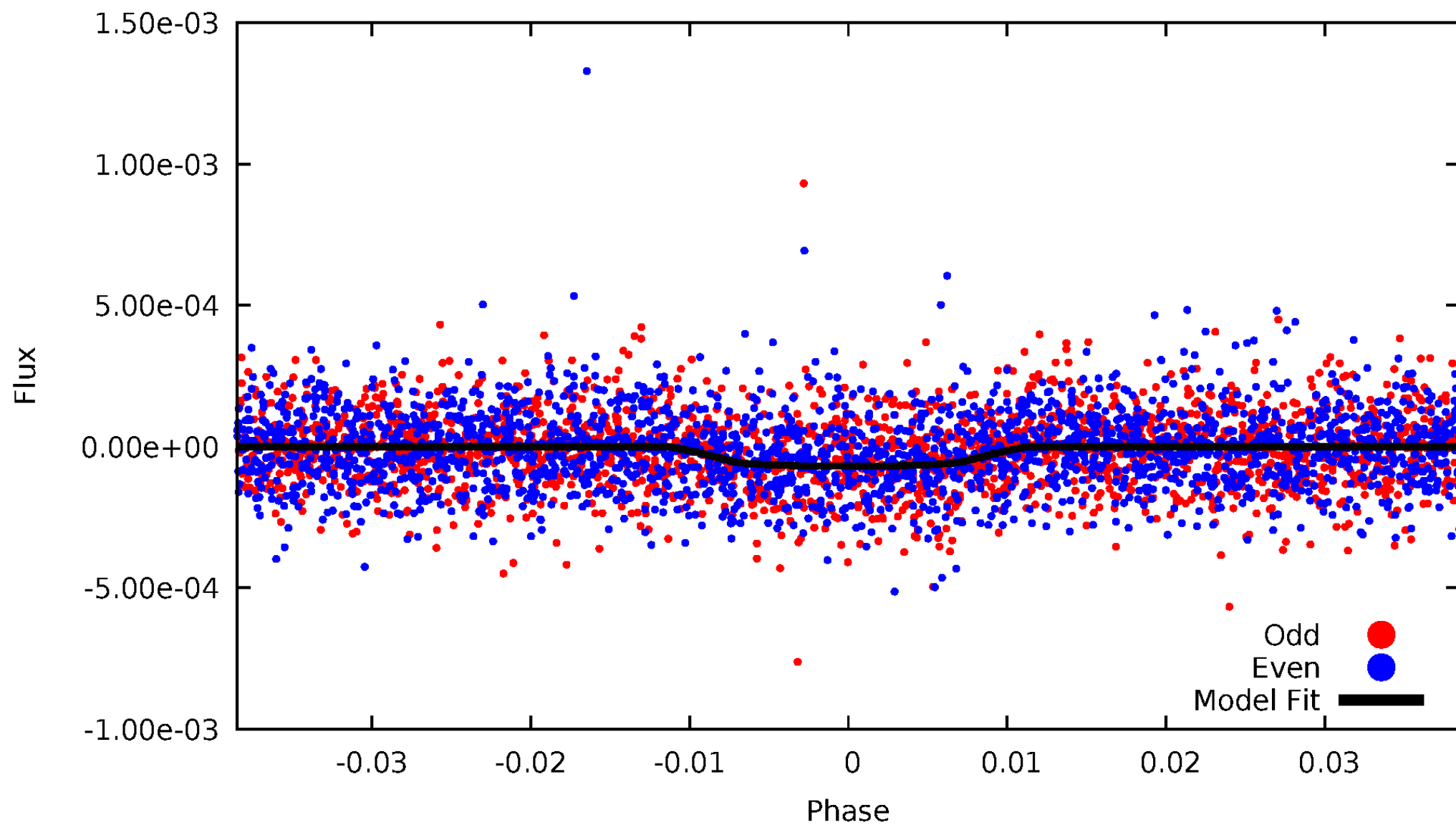


TCE 009489524-04



# DV Odd/Even

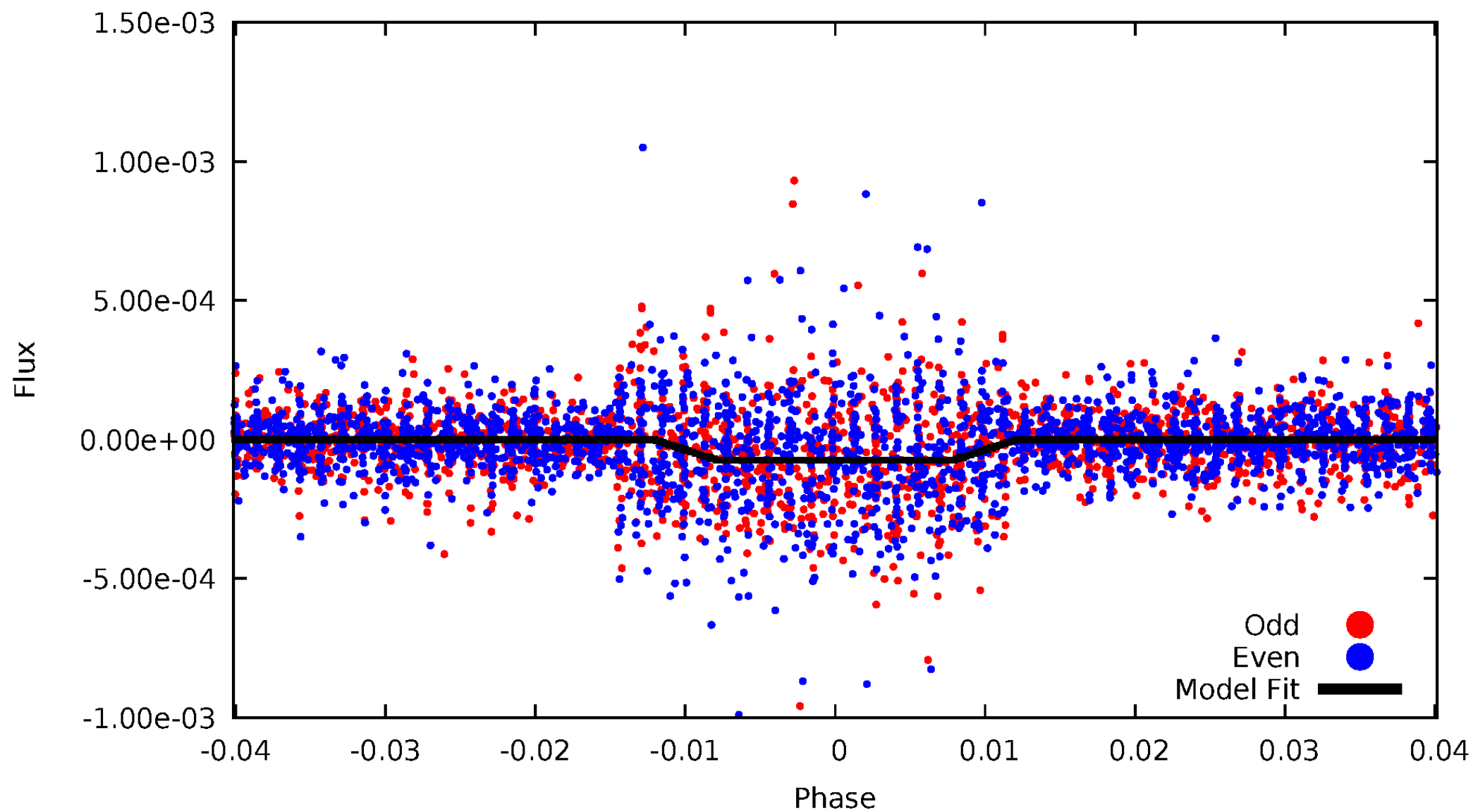
TCE 009489524-04





# ALT Odd/Even

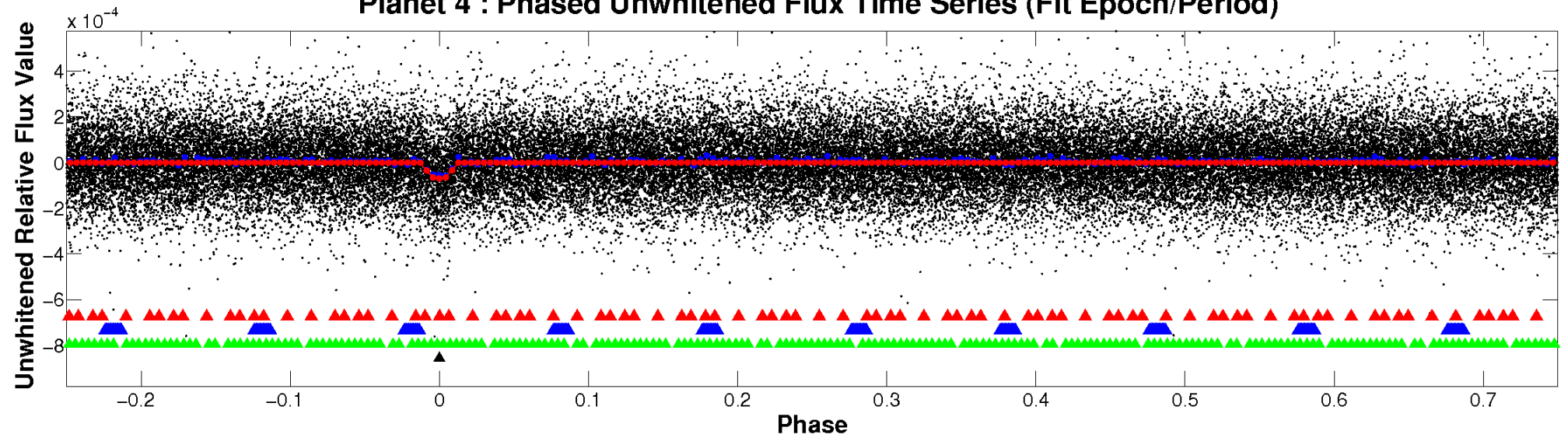
TCE 009489524-04



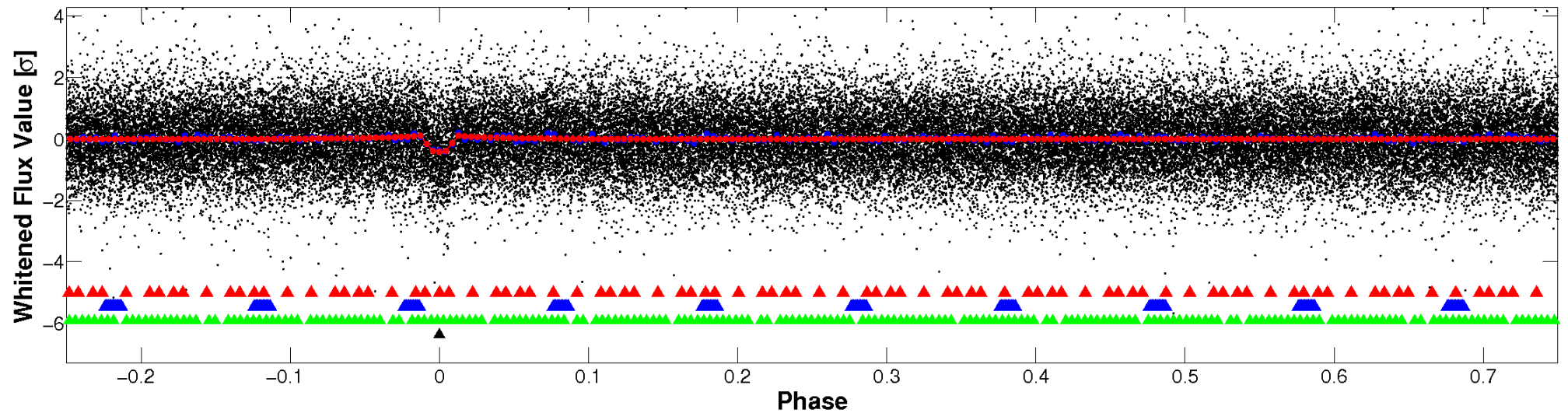


# Non-Whitened Vs. Whitened Light Curve

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

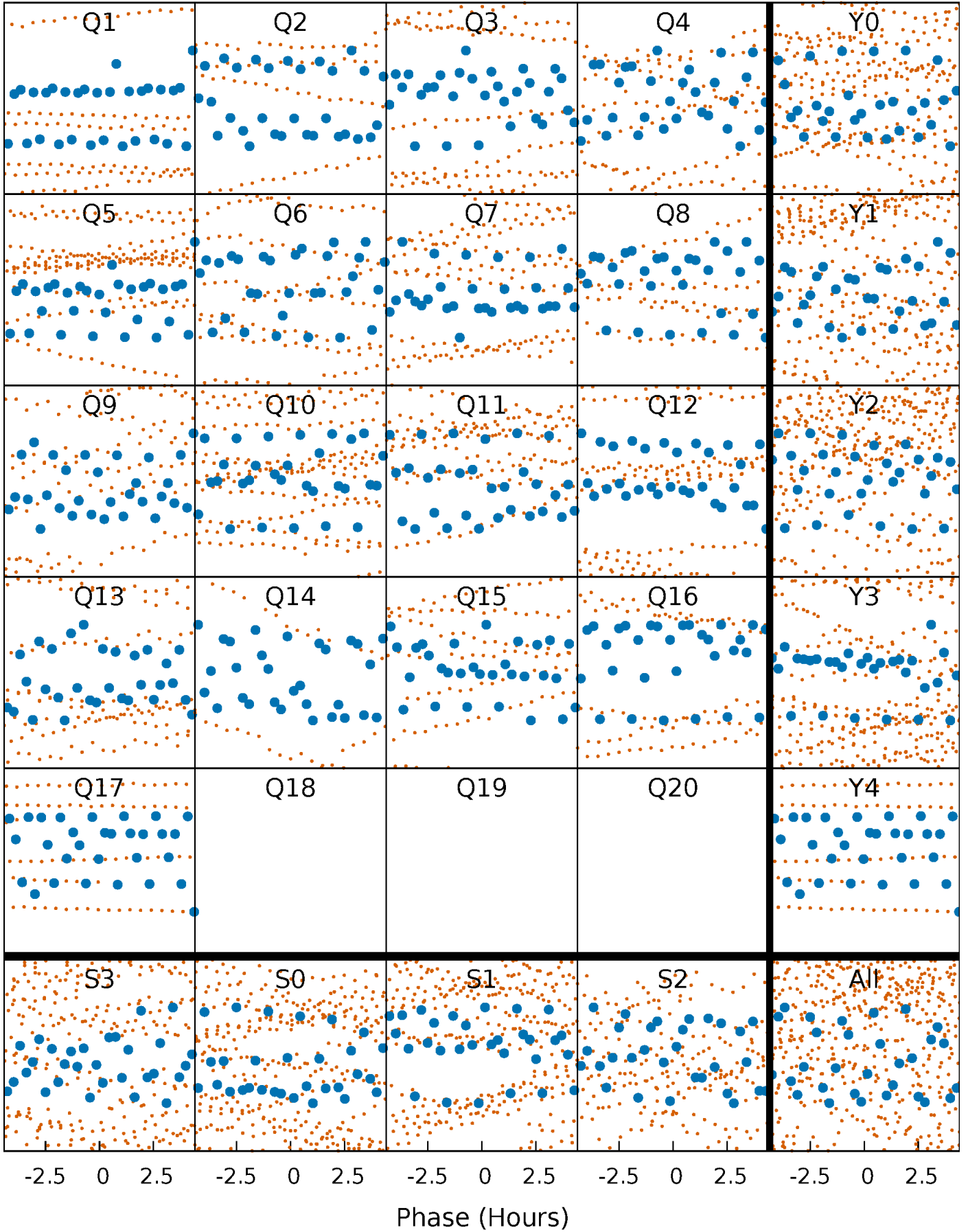


## Planet 4 : Phased Whitened Flux Time Series (Fit Epoch/Period)



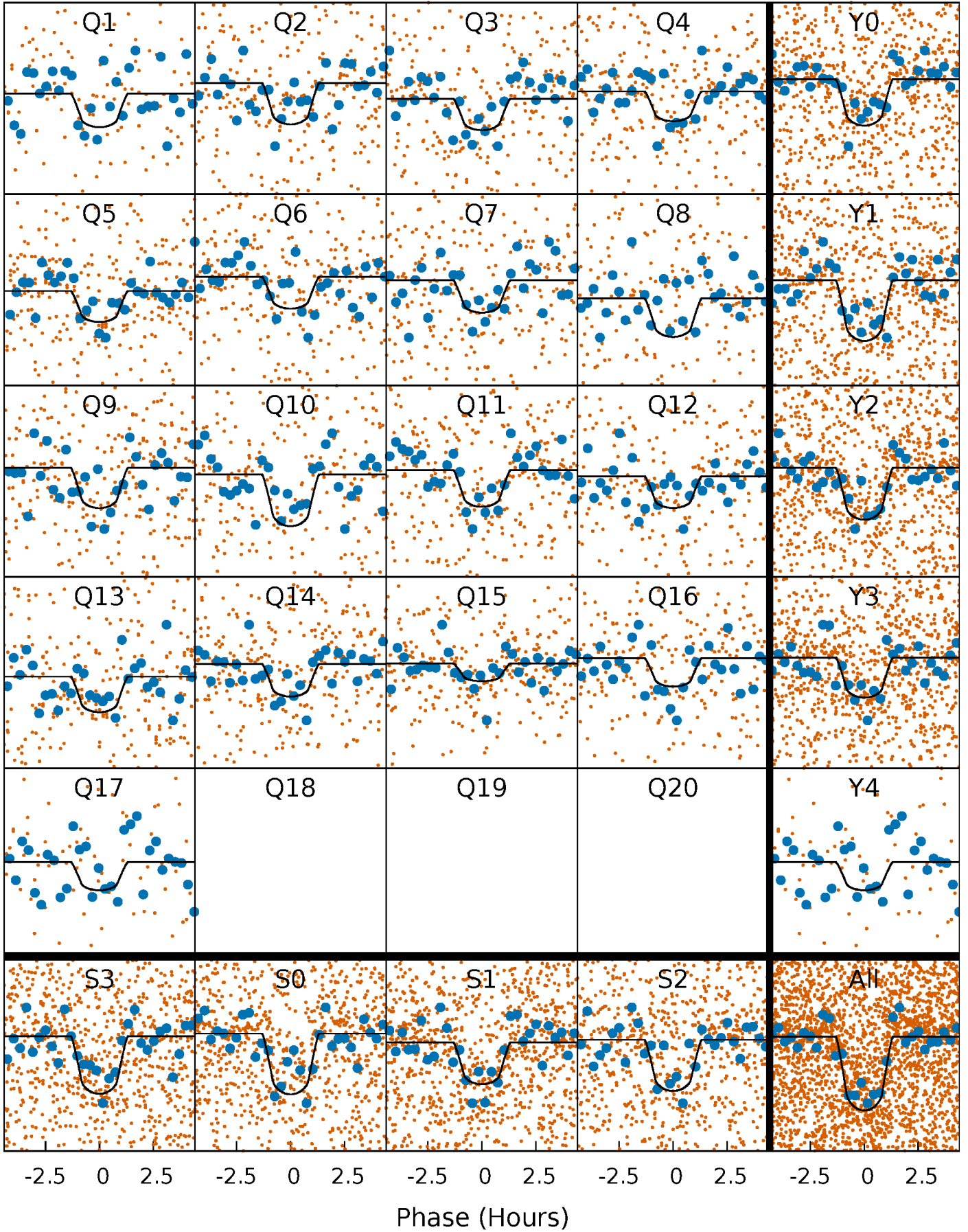
# PDC Quarter-Phased Transit Curves

TCE 009489524-04   P= 4.788484 Days    $T_0=135.460708$  (BKJD)



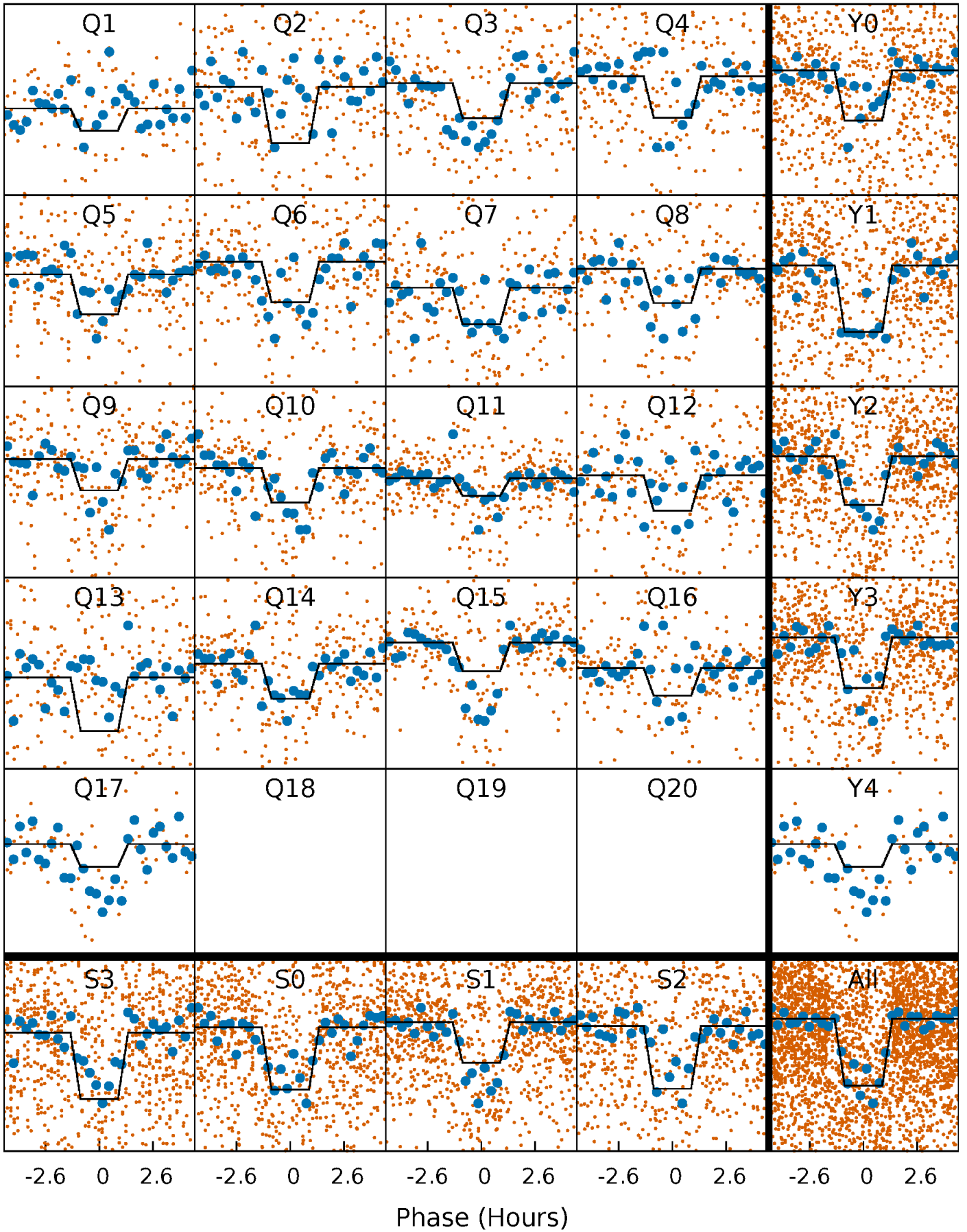
# DV Quarter-Phased Transit Curves

TCE 009489524-04     $P = 4.788484$  Days     $T_0 = 135.460708$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

TCE 009489524-04   P= 4.788451 Days    $T_0=135.462824$  (BKJD)

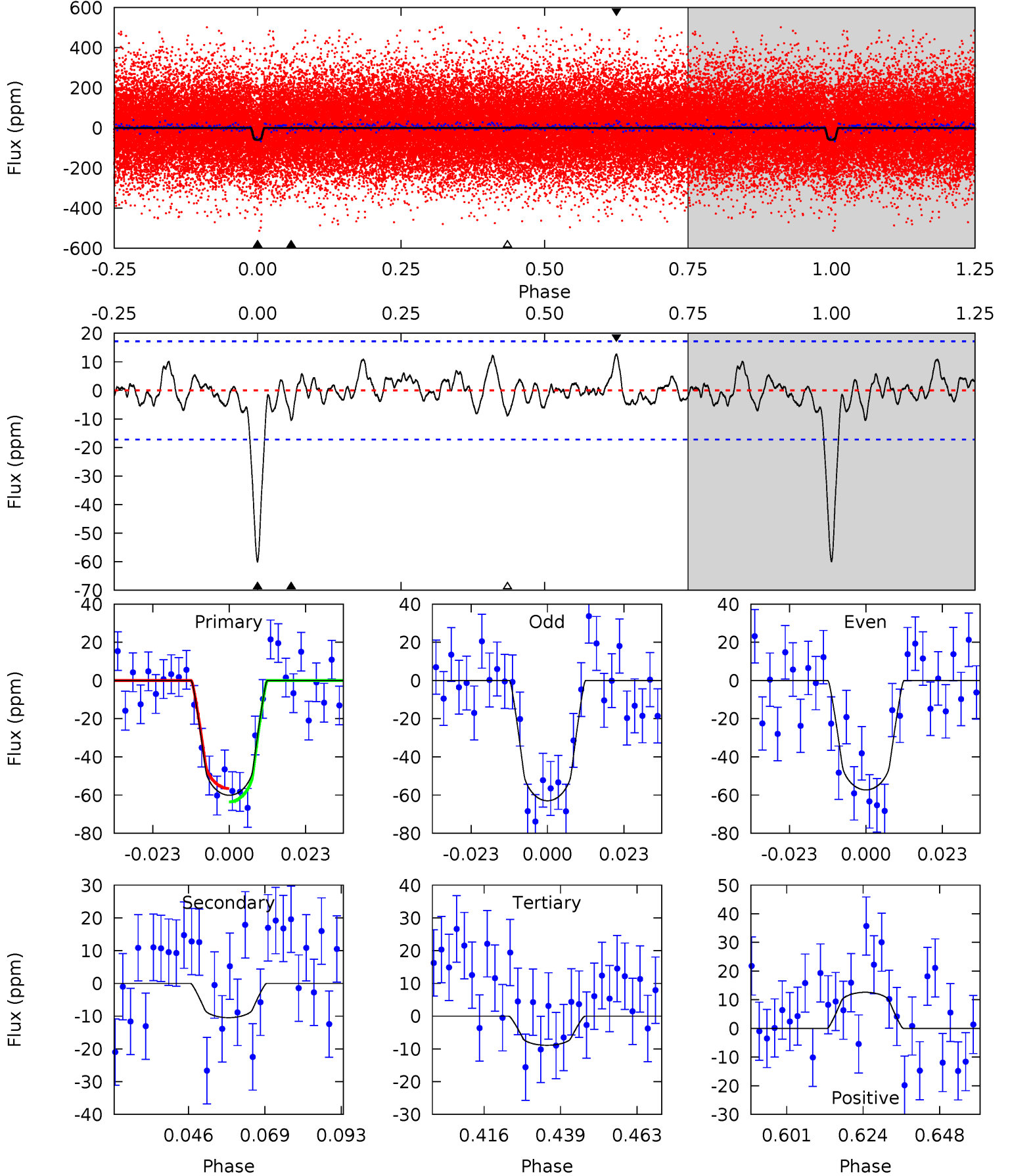




# DV Model-Shift Uniqueness Test

009489524-04, P = 4.788484 Days, E = 130.672224 Days

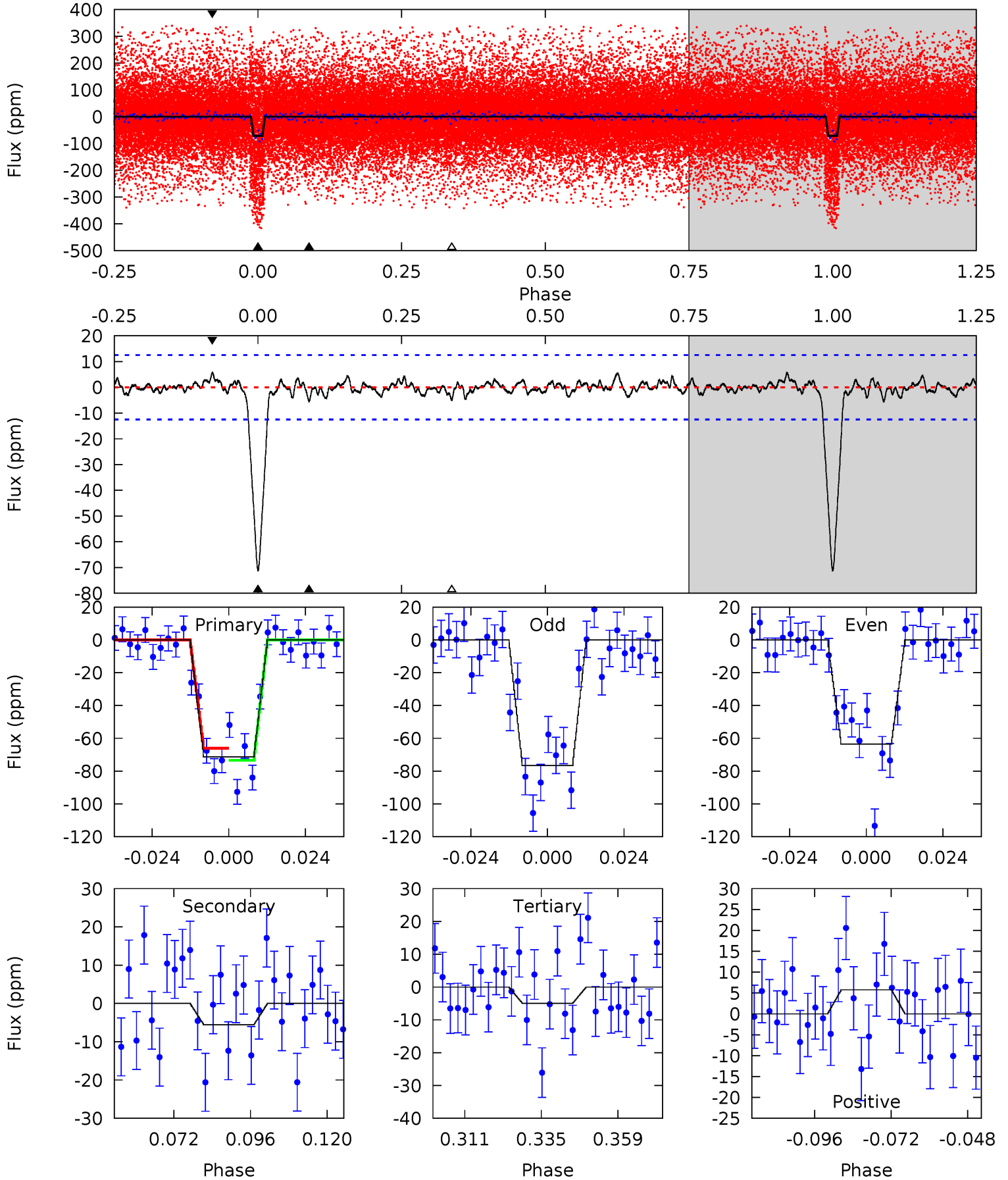
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
17.0	2.96	2.52	3.56	4.86	2.27	1.12	14.5	13.4	0.44	-0.60	0.81	1.09	0.17	0.98



# Alt Model-Shift Uniqueness Test

009489524-04, P = 4.788451 Days, E = 130.674373 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
27.6	2.15	1.92	2.23	4.86	2.26	0.69	25.7	25.4	0.23	-0.08	2.53	1.20	0.07	1.41



### Stellar Parameters For KIC 009489524

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5208^{+103}_{-103}$	$4.563^{+0.036}_{-0.052}$	$-0.140^{+0.150}_{-0.150}$	$0.772^{+0.055}_{-0.041}$	$0.796^{+0.046}_{-0.046}$	$2.432^{+0.336}_{-0.397}$
	+2%/-2%	+1%/-1%	+107%/-107%	+7%/-5%	+6%/-6%	+14%/-16%
Source	SPE58	SPE58	SPE58	DSEP		

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

### Secondary Eclipse Parameters for KIC 009489524-04 / KOI 2029.04

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-10 \pm 4$	$0.79^{+0.42}_{-0.41}$	$1246^{+32}_{-33}$	$3478^{+1028}_{-452}$	$23^{+79}_{-14}$
Alt.	$-6 \pm 3$	$0.74^{+0.43}_{-0.38}$	$1246^{+32}_{-30}$	$3172^{+1041}_{-446}$	$13^{+59}_{-8}$

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



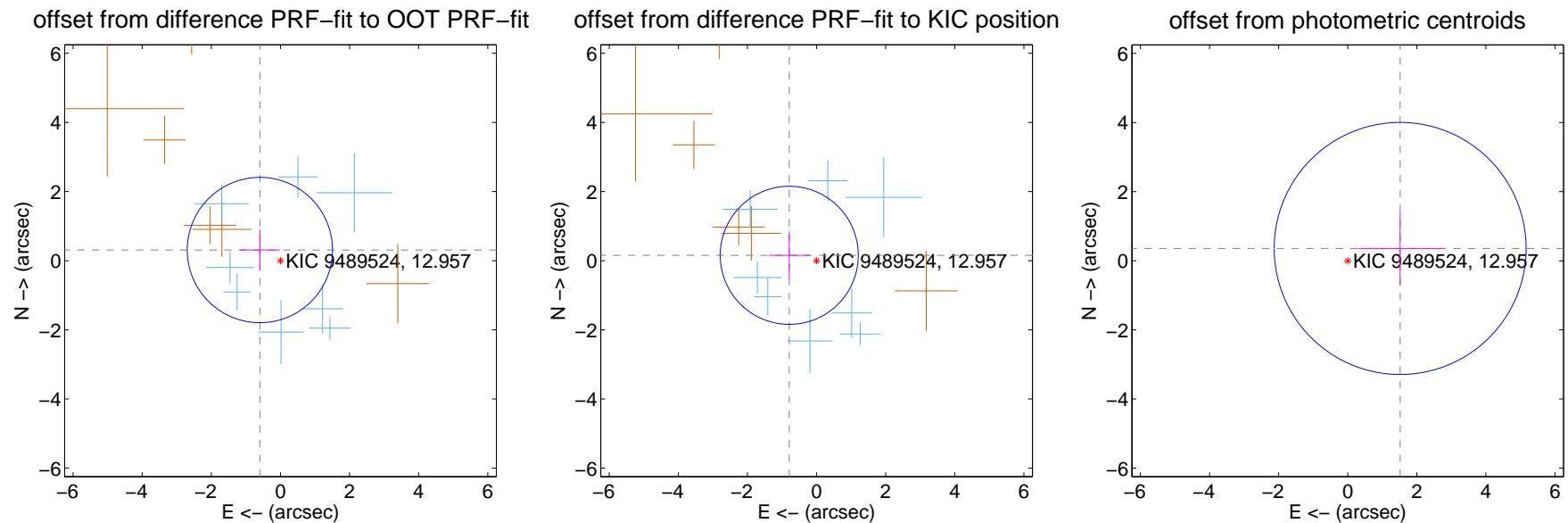
## DV Centroid Data

Supplemental centroid analysis for 009489524-04. Kepler magnitude: 12.96. Transit SNR 11.90

There are 8 quarters with good PRF difference image offsets

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

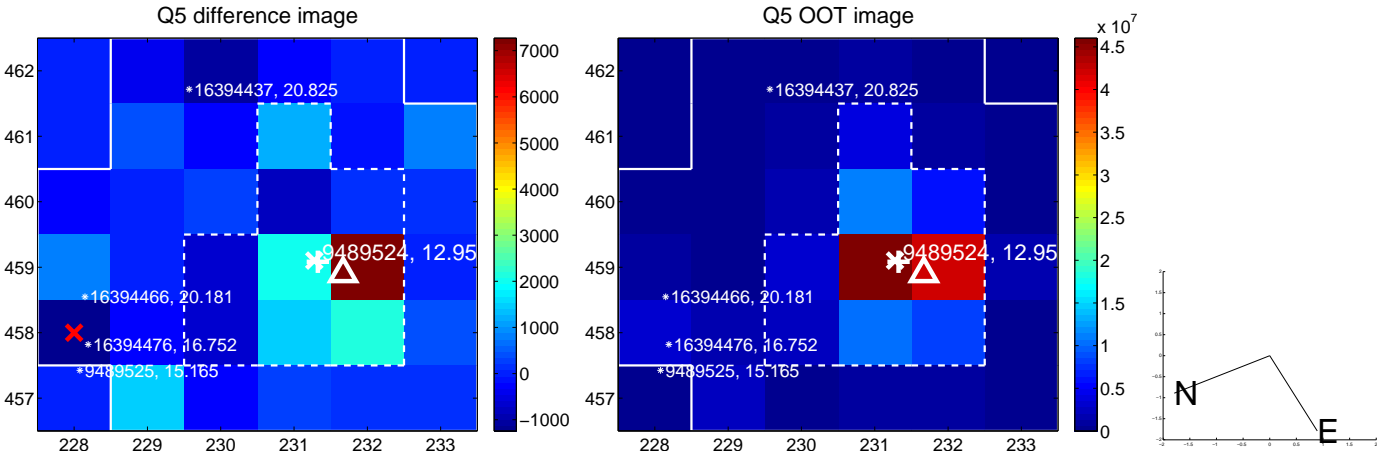
	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.671 \pm 0.701$	0.96	$0.596 \pm 0.583$	$0.308 \pm 0.585$
PRF-fit source offset from KIC position	$0.806 \pm 0.666$	1.21	$0.791 \pm 0.591$	$0.156 \pm 0.692$
photometric centroid source offset	$1.56 \pm 1.22$	1.28	$-1.52 \pm 1.22$	$0.36 \pm 1.06$



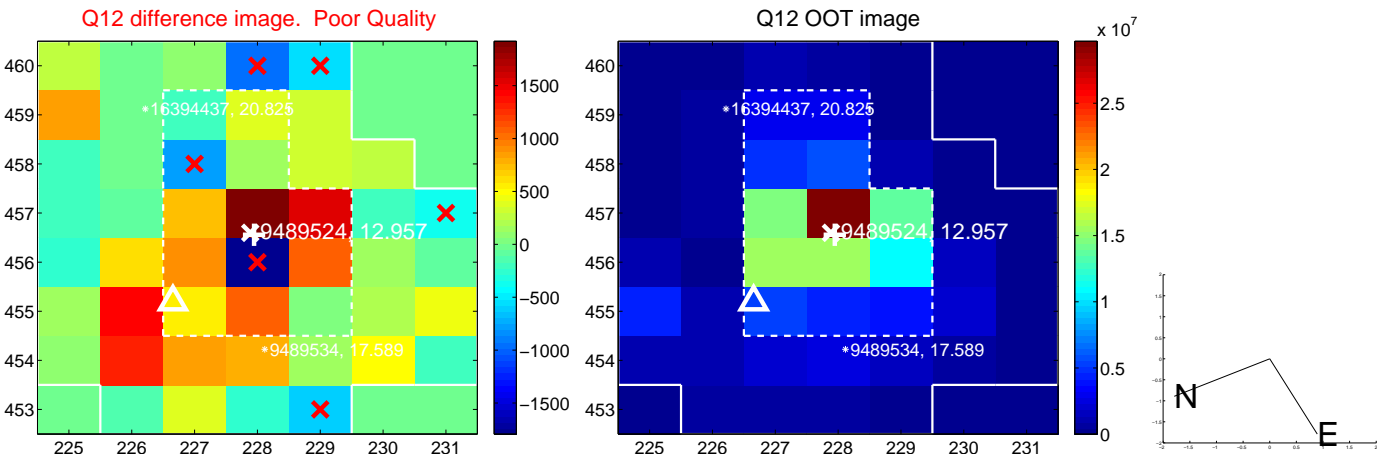
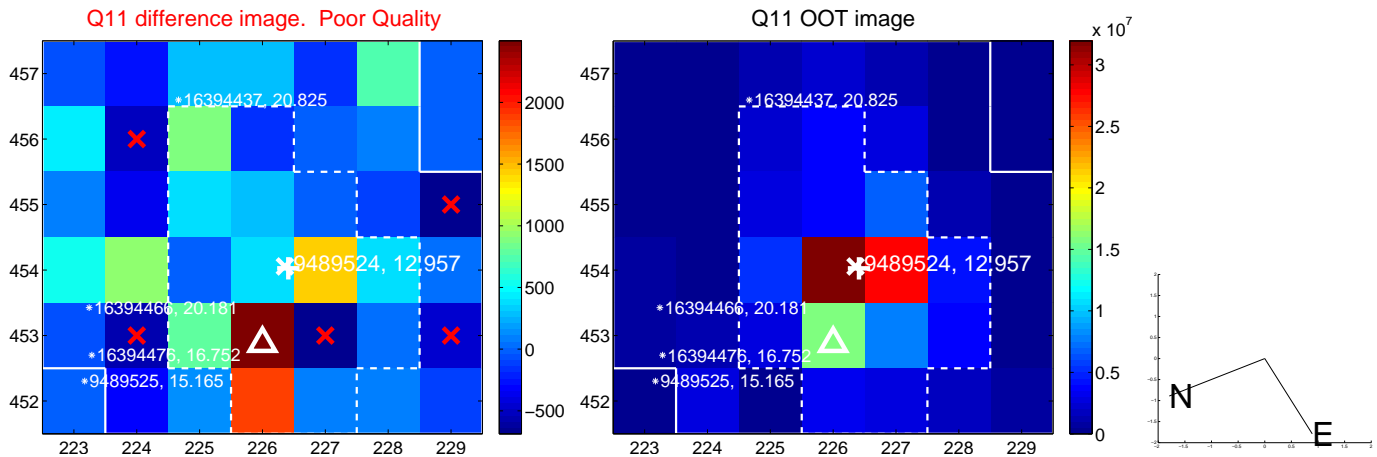
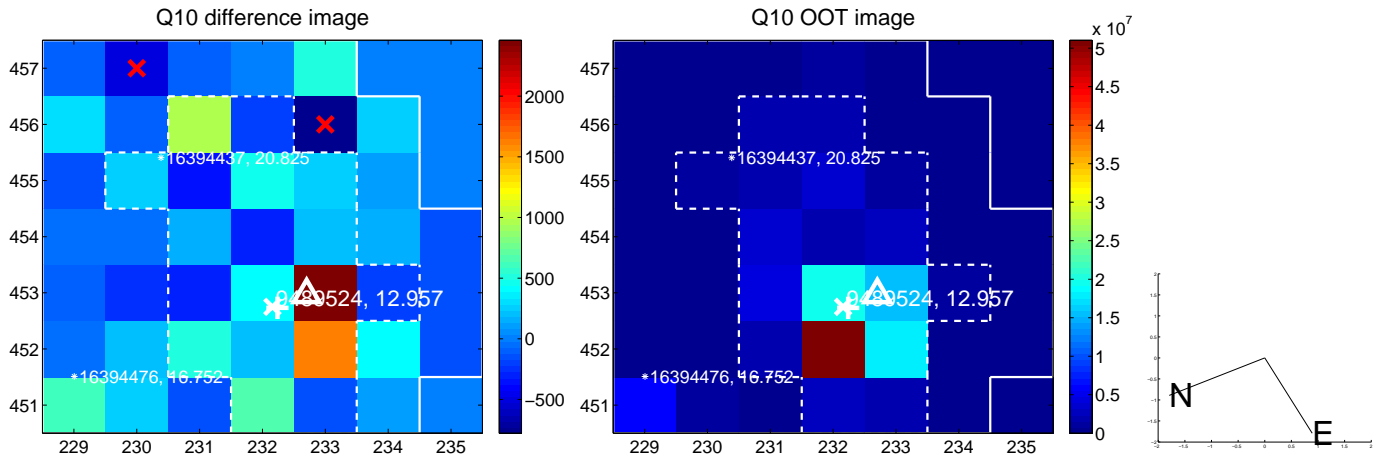
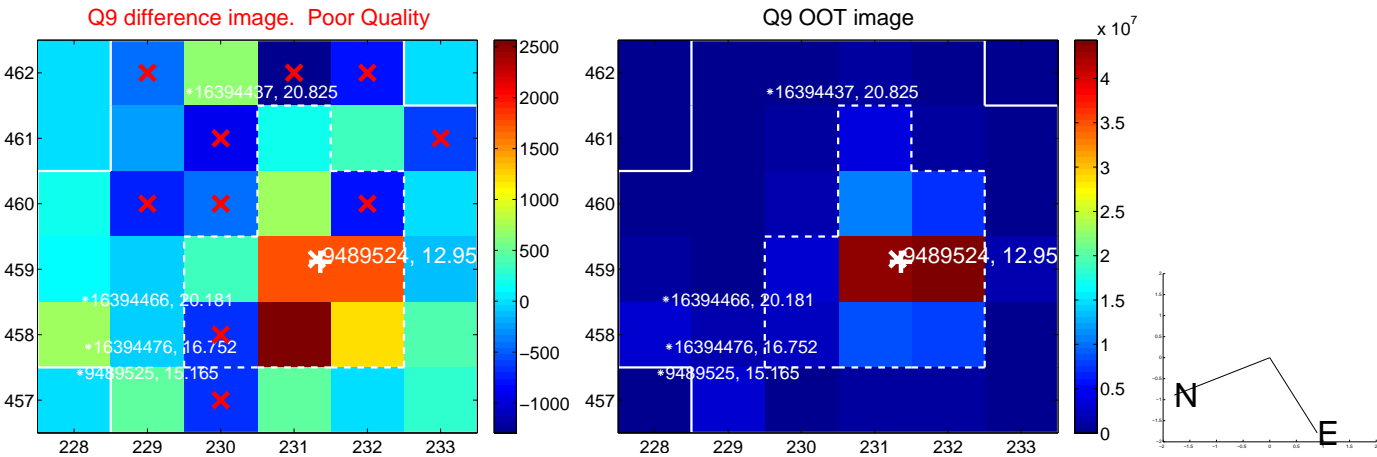
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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



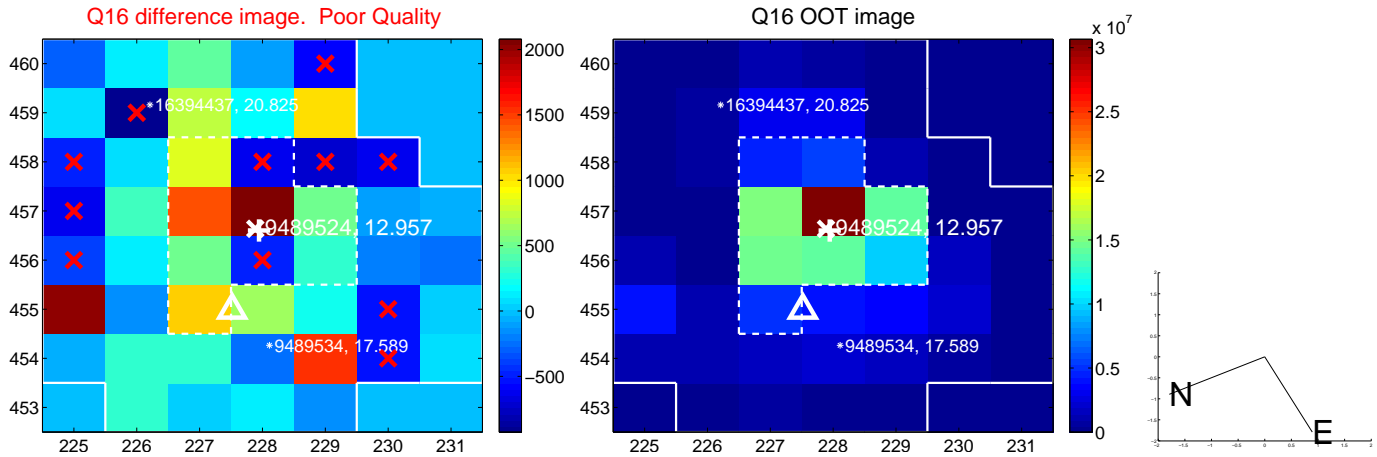
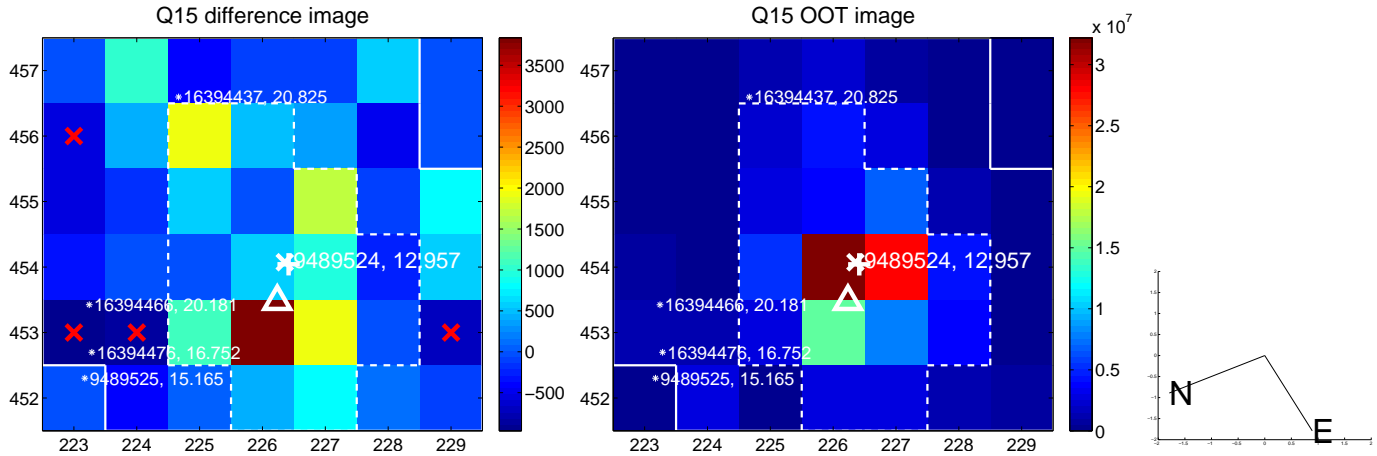
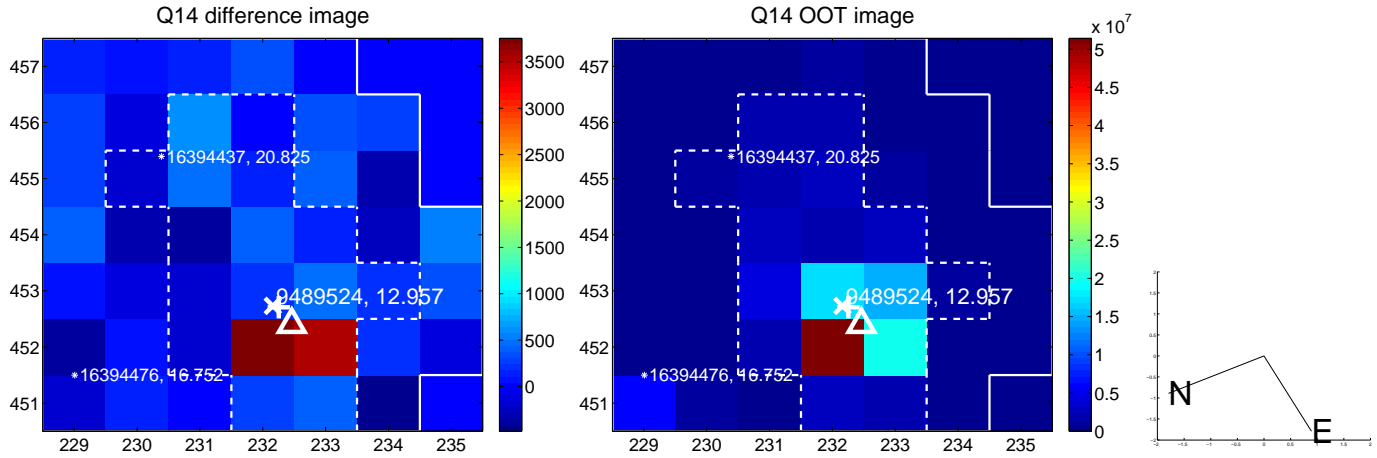
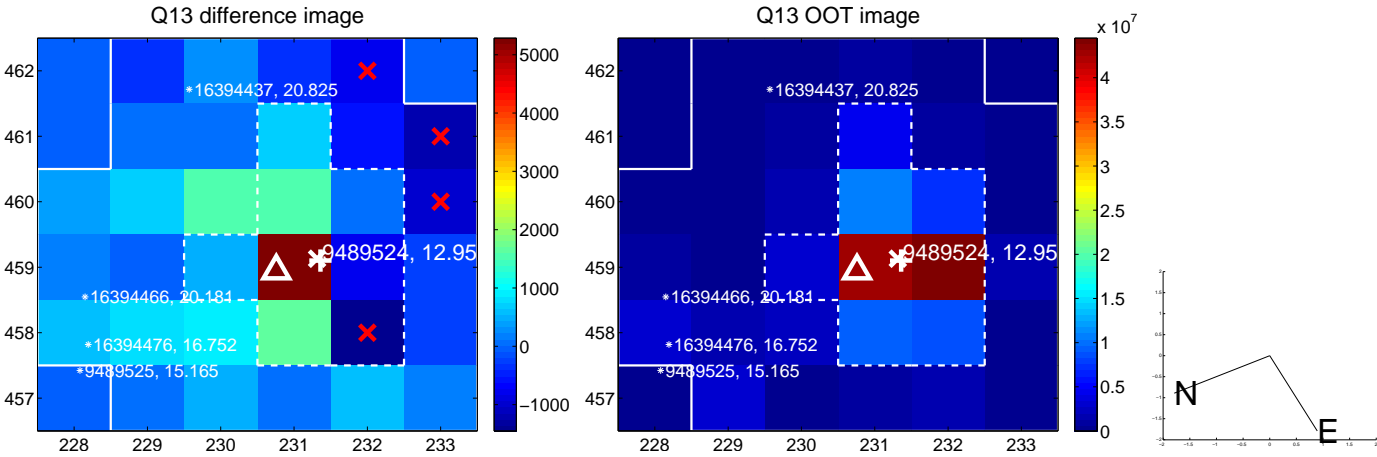
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



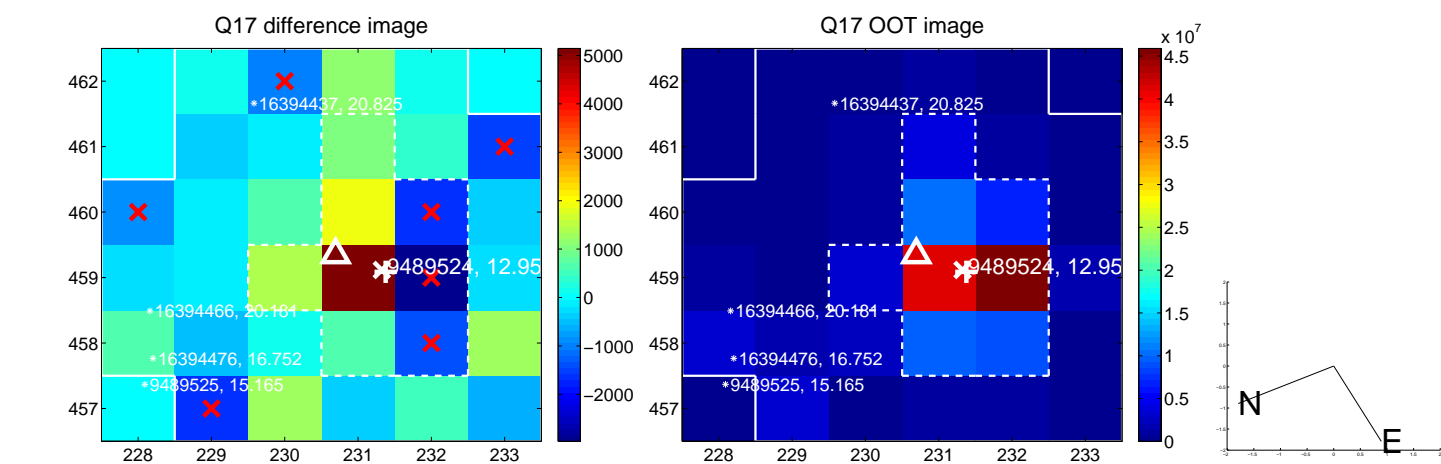
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



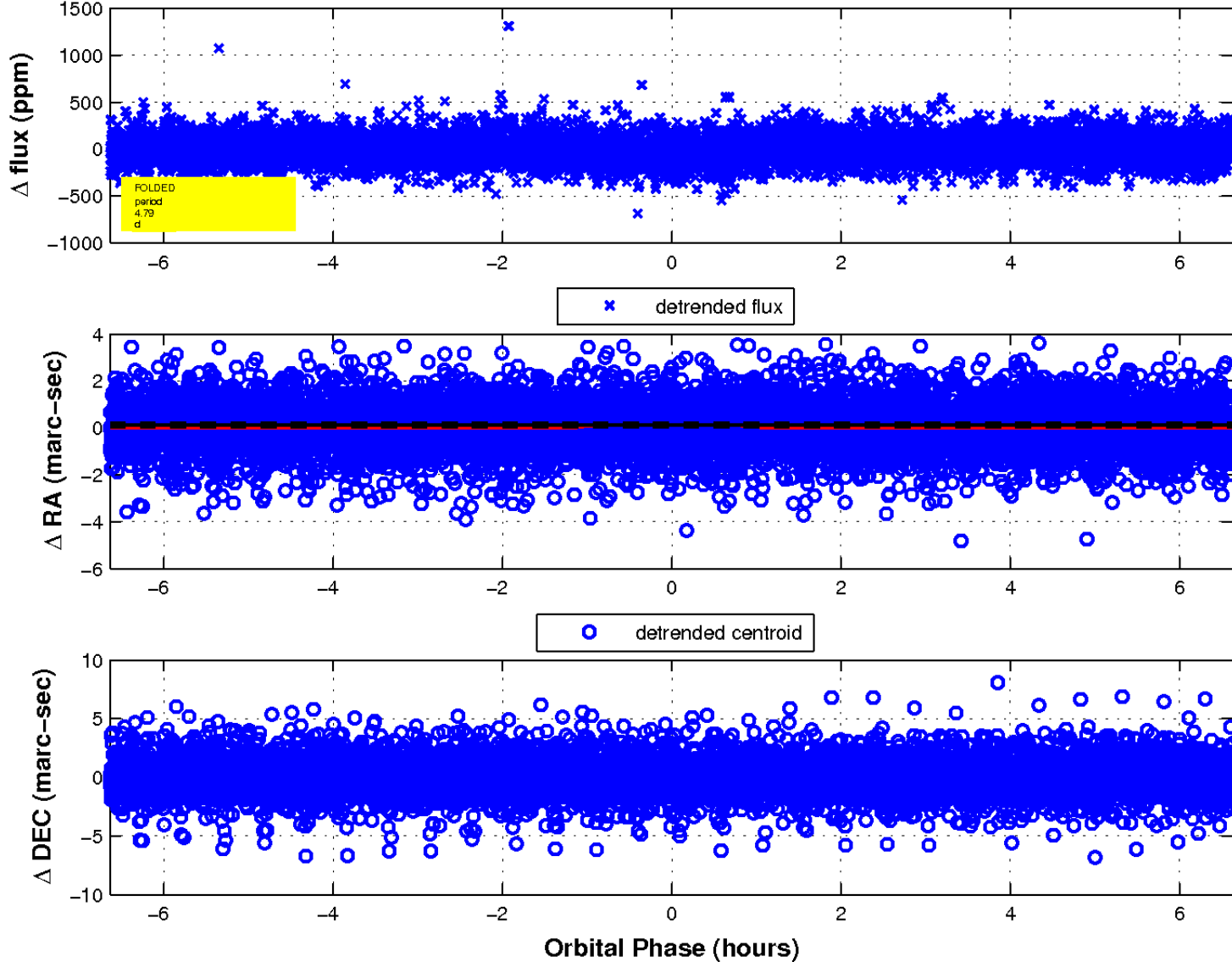
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



fluxWeightedCentroids, Planet 4 of 4



UKIRT Image

