

# KIC 005709103

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
005709103-01	OBS	7736.01	0.664732	131.629798	17.7	1.602	8.0	9.2	1.12	6143	0.55	7133.95
005709103-02	OBS	No	0.664721	131.966326	7.9	1.811	7.9	4.3	1.12	6143	0.34	7134.11
005709103-03	OBS	No	134.647320	145.004757	245.1	1.925	10.0	5.7	1.12	6143	1.94	6.00
005709103-04	OBS	No	197.644083	204.933496	299.4	3.093	9.4	5.6	1.12	6143	2.19	3.60

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
005709103-01	OBS	FP	0.00	0	1	1	0	HAS_SEC_TCE—CENT_RESOLVED_OFFSET
005709103-02	OBS	FP	0.00	1	1	1	0	IS_SEC_TCE—CENT_RESOLVED_OFFSET
005709103-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT
005709103-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL—TRANS_GAPPED—ALL_TRANS_CHASES—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS

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

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

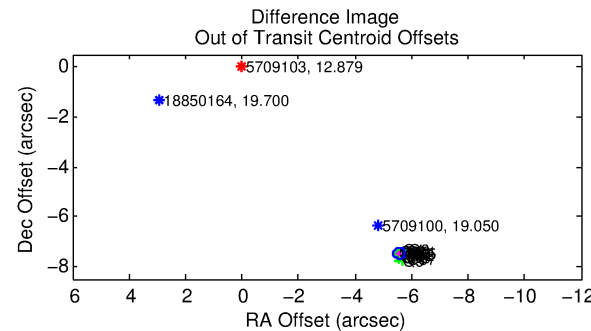
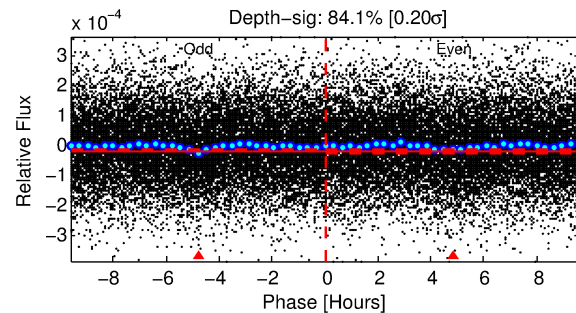
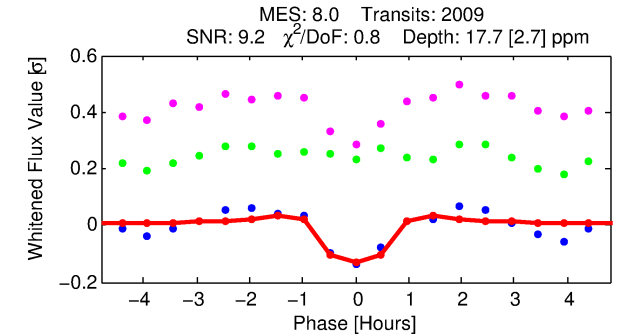
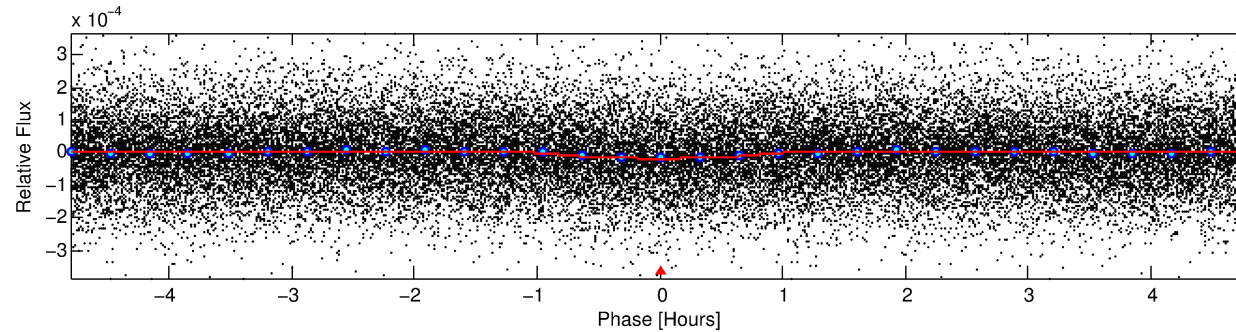
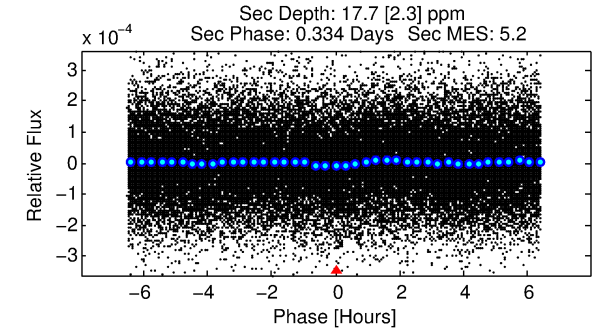
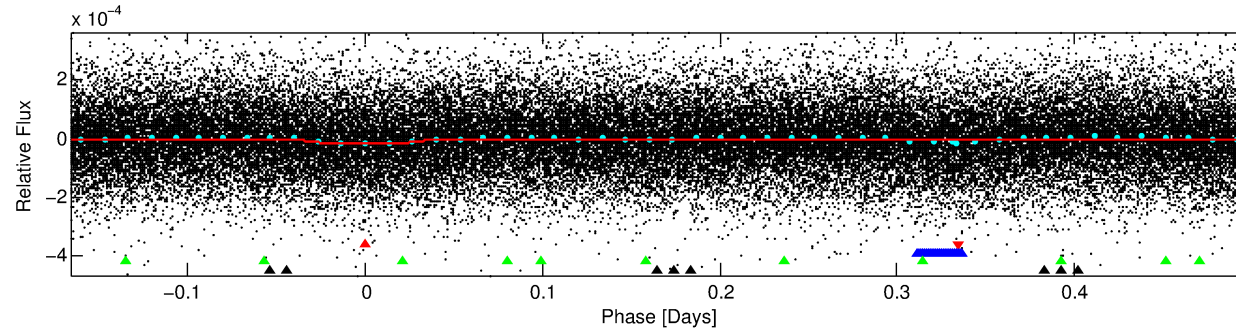
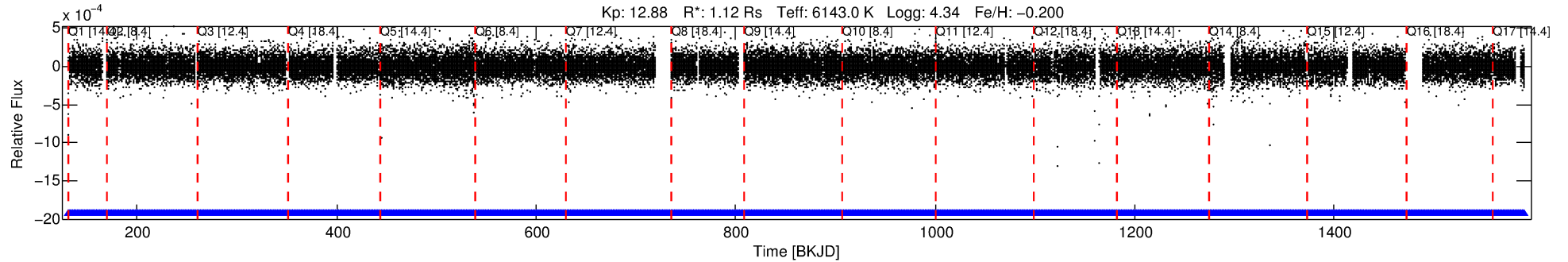
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 005709103-01

No Significant Match Found

# DV One-Page Summary

KIC: 5709103 Candidate: 1 of 4 Period: 0.665 d



## DV Fit Results:

Period = 0.66473 [0.00001] d  
Epoch = 131.6298 [0.0021] BKJD  
Rp/R\* = 0.0045 [0.0009]  
a/R\* = 1.70 [1.16]  
b = 0.90 [0.23]  
Seff = 7133.95 [1608.48]  
Teq = 2343 [132] K  
Rp = 0.55 [0.15] Re  
a = 0.0149 [0.0022] AU  
Ag = 7.09 [3.45] [1.76σ]  
Teff = 5913 [650] K [5.38σ]

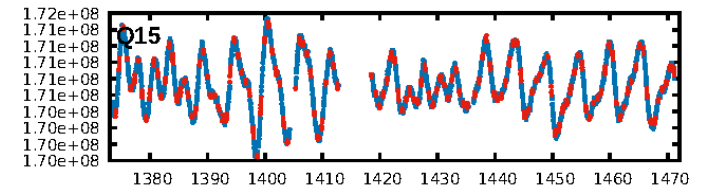
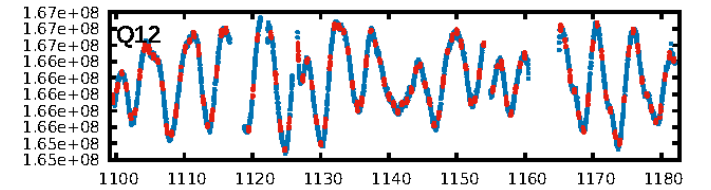
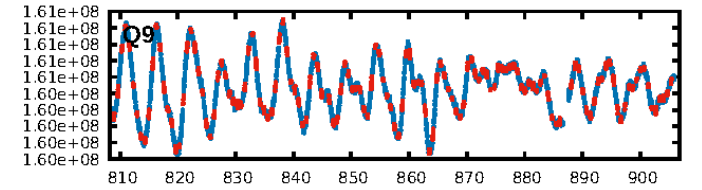
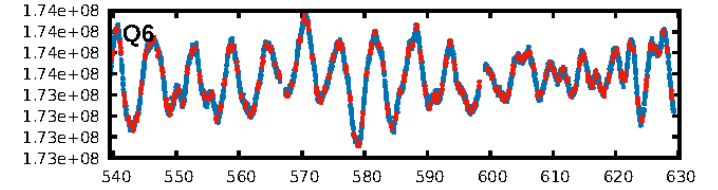
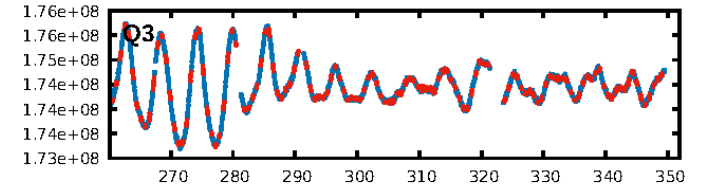
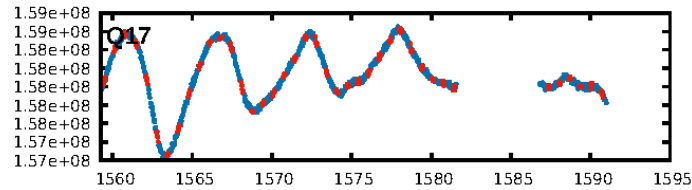
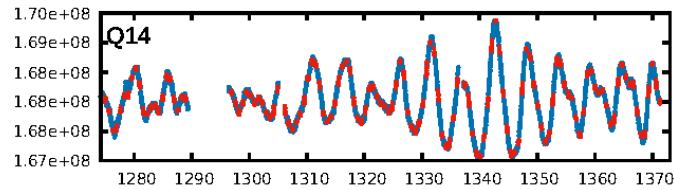
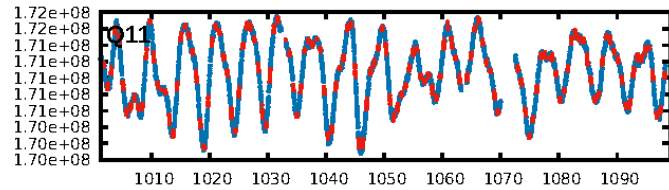
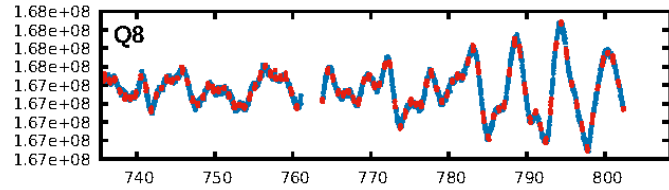
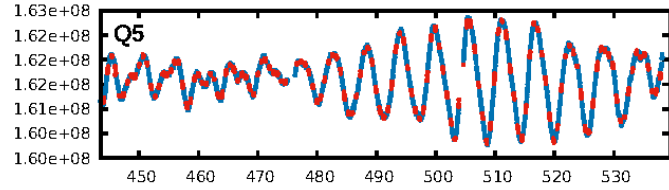
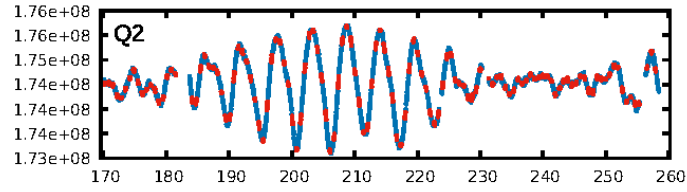
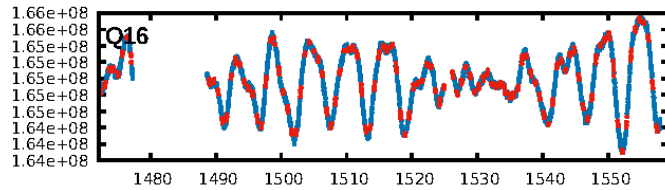
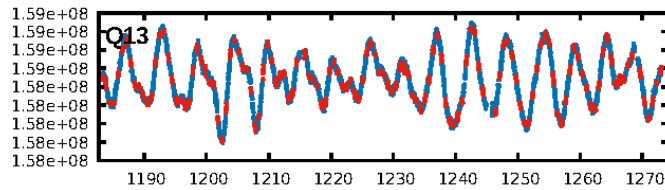
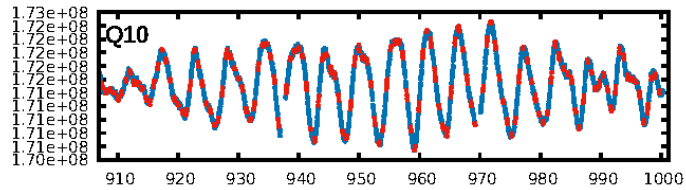
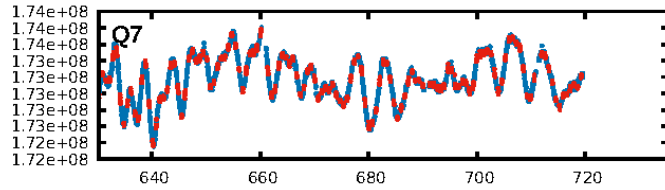
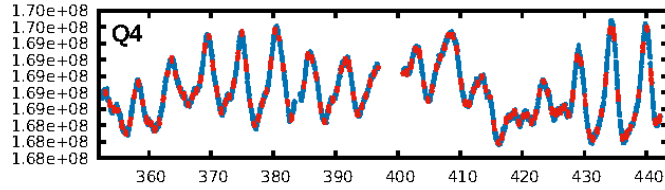
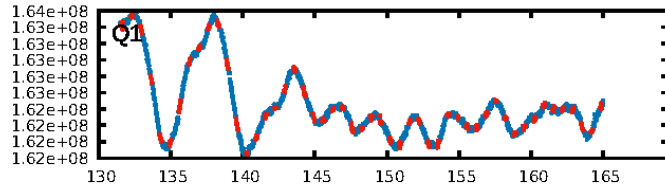
## DV Diagnostic Results:

ShortPeriod-sig: 0.0% [0.00σ]  
LongPeriod-sig: 100.0% [1284.21σ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGoF-sig: N/A  
Bootstrap-pfa: 1.67e-13  
RollingBand-fgt: 1.00 [1918/1918]  
GhostDiagnostic-chr: -0.6649  
Centroid-sig: 4.2%  
Centroid-so: 1.732 arcsec [1.70σ]  
OotOffset-rm: 9.309 arcsec [128.92σ]  
KicOffset-rm: 9.292 arcsec [124.54σ]  
OotOffset-st: 4/4/4/5 [17]  
KicOffset-st: 4/4/4/5 [17]  
DiffImageQuality-fgm: 1.00 [17/17]  
DiffImageOverlap-fno: 1.00 [17/17]

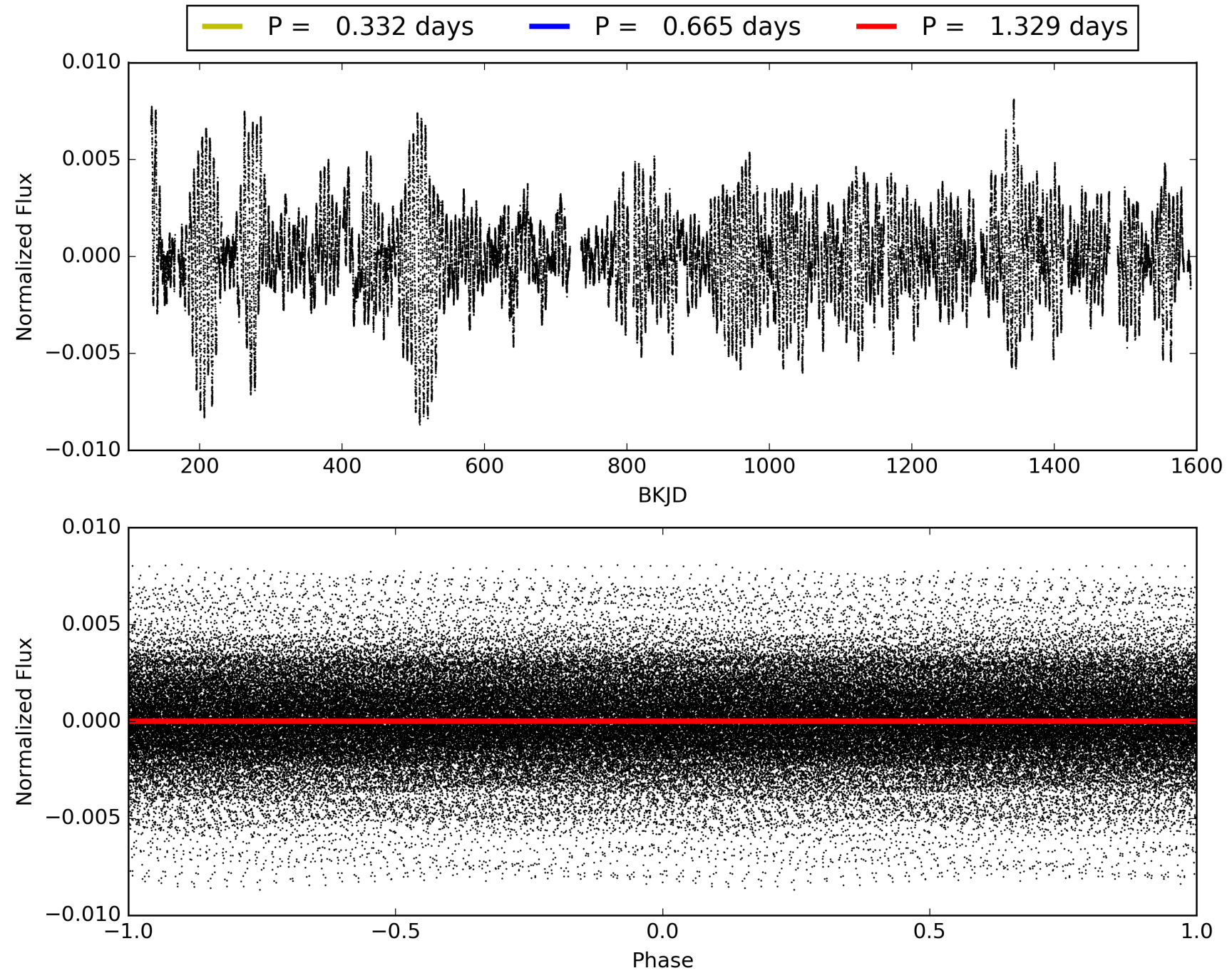
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 13:46:37 Z

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

# TCE 005709103-01, PDC Light Curves



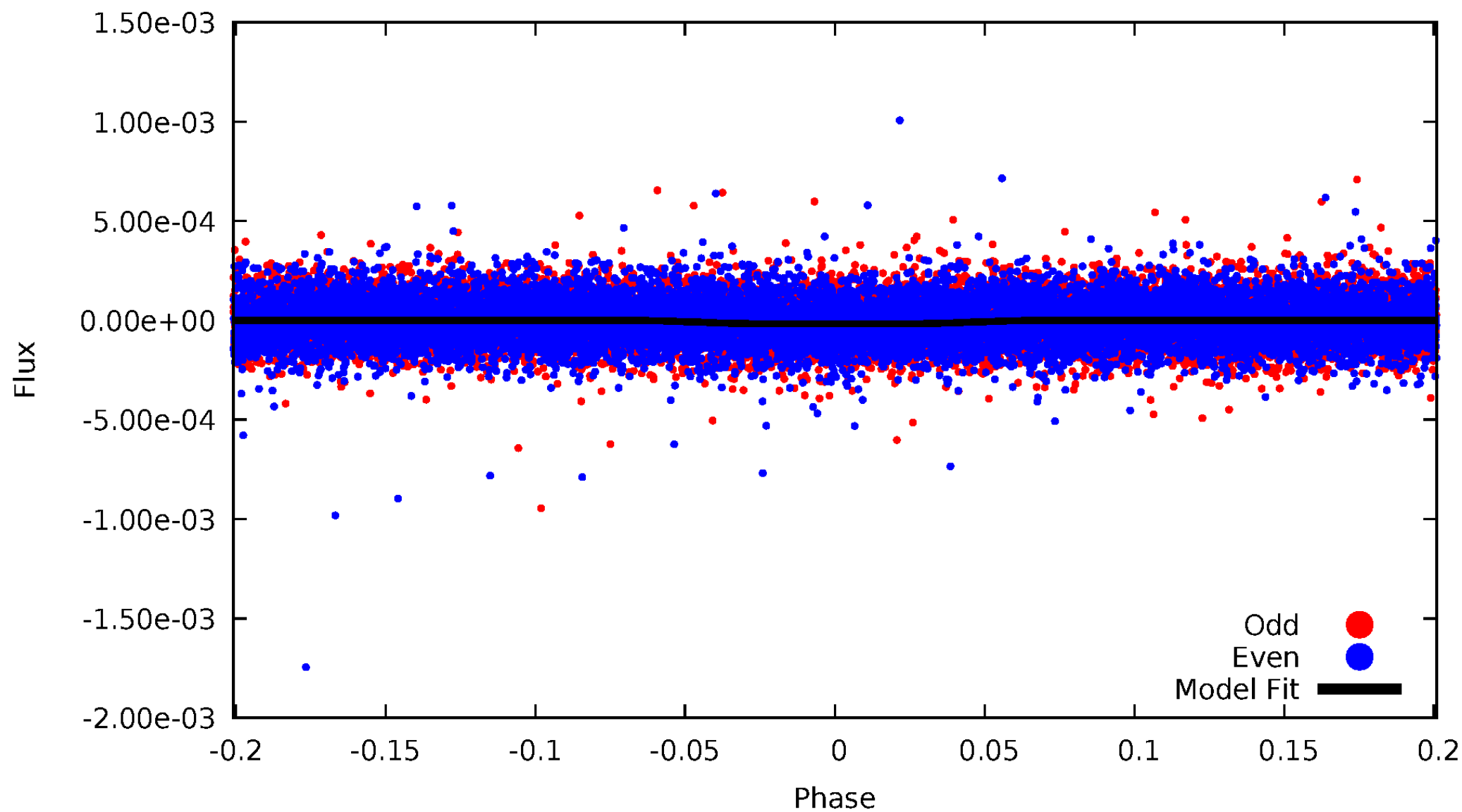
TCE 005709103-01





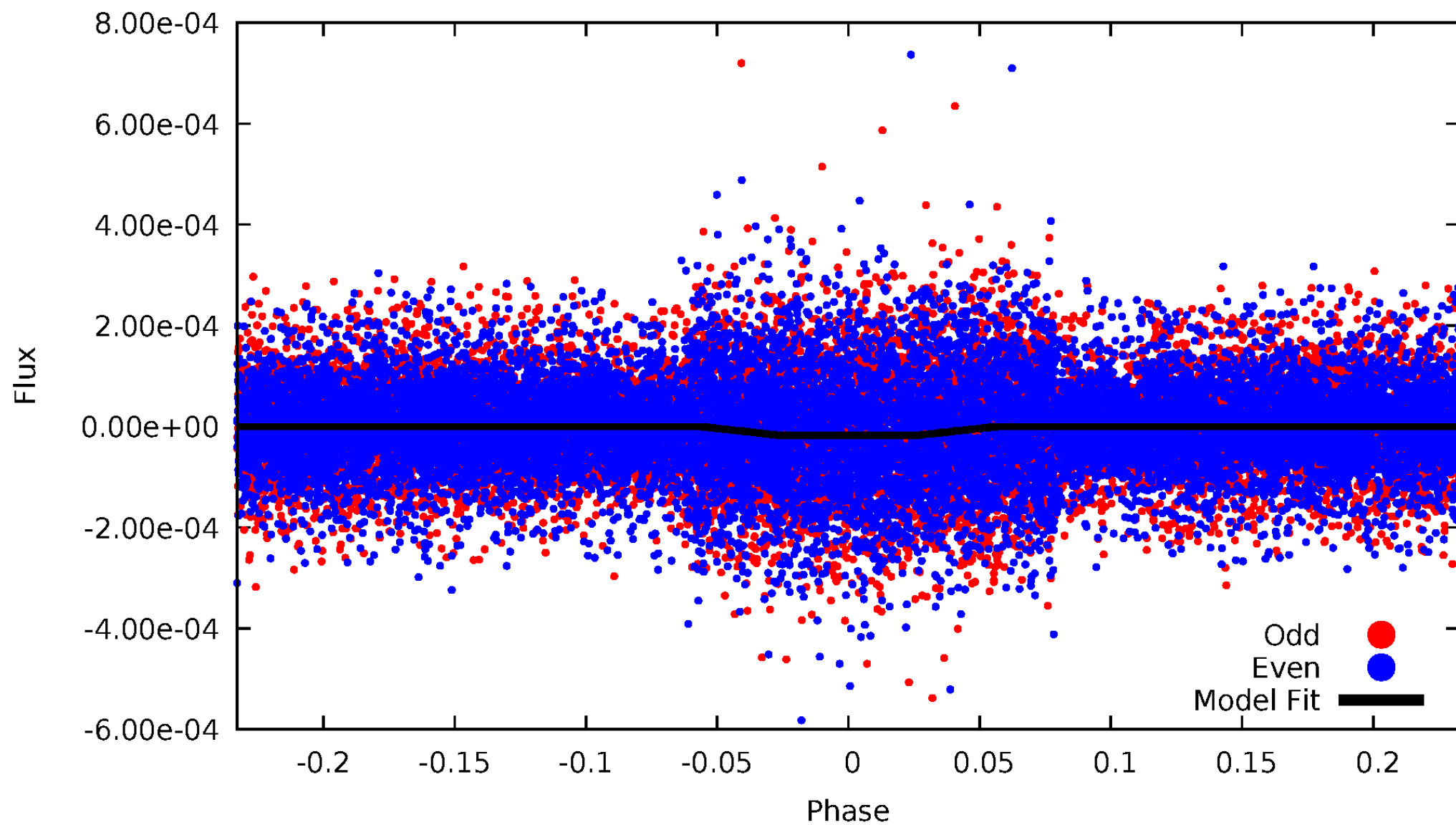
# DV Odd/Even

TCE 005709103-01



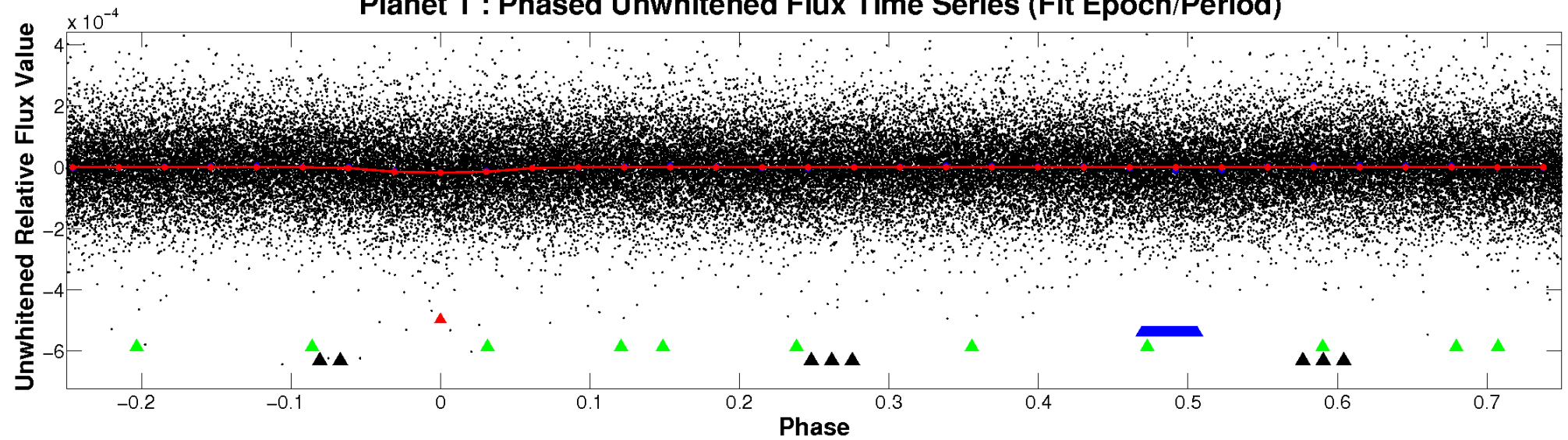
# ALT Odd/Even

TCE 005709103-01

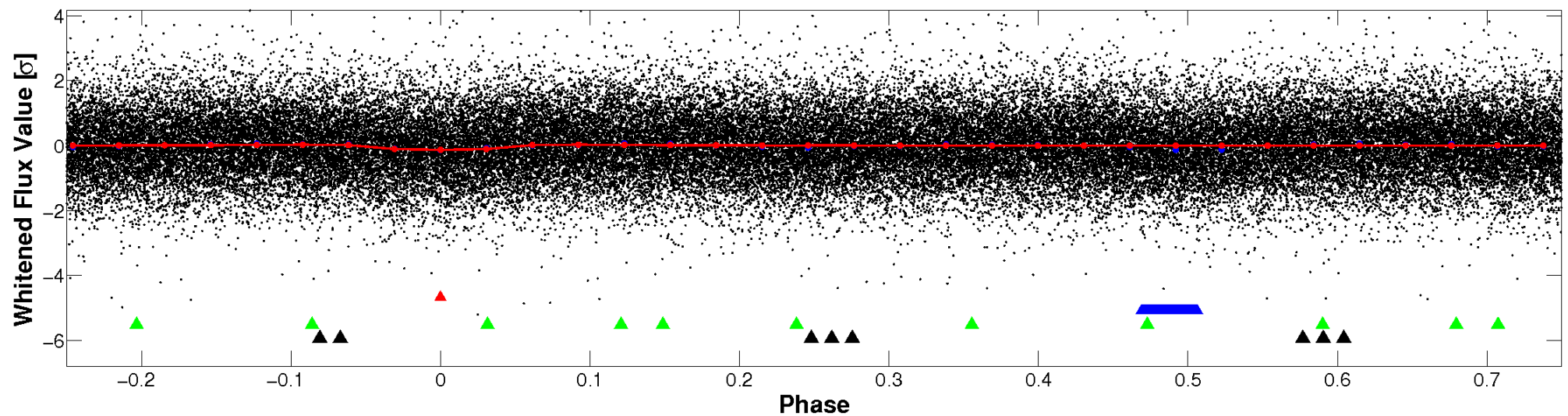


# Non-Whitened Vs. Whitened Light Curve

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

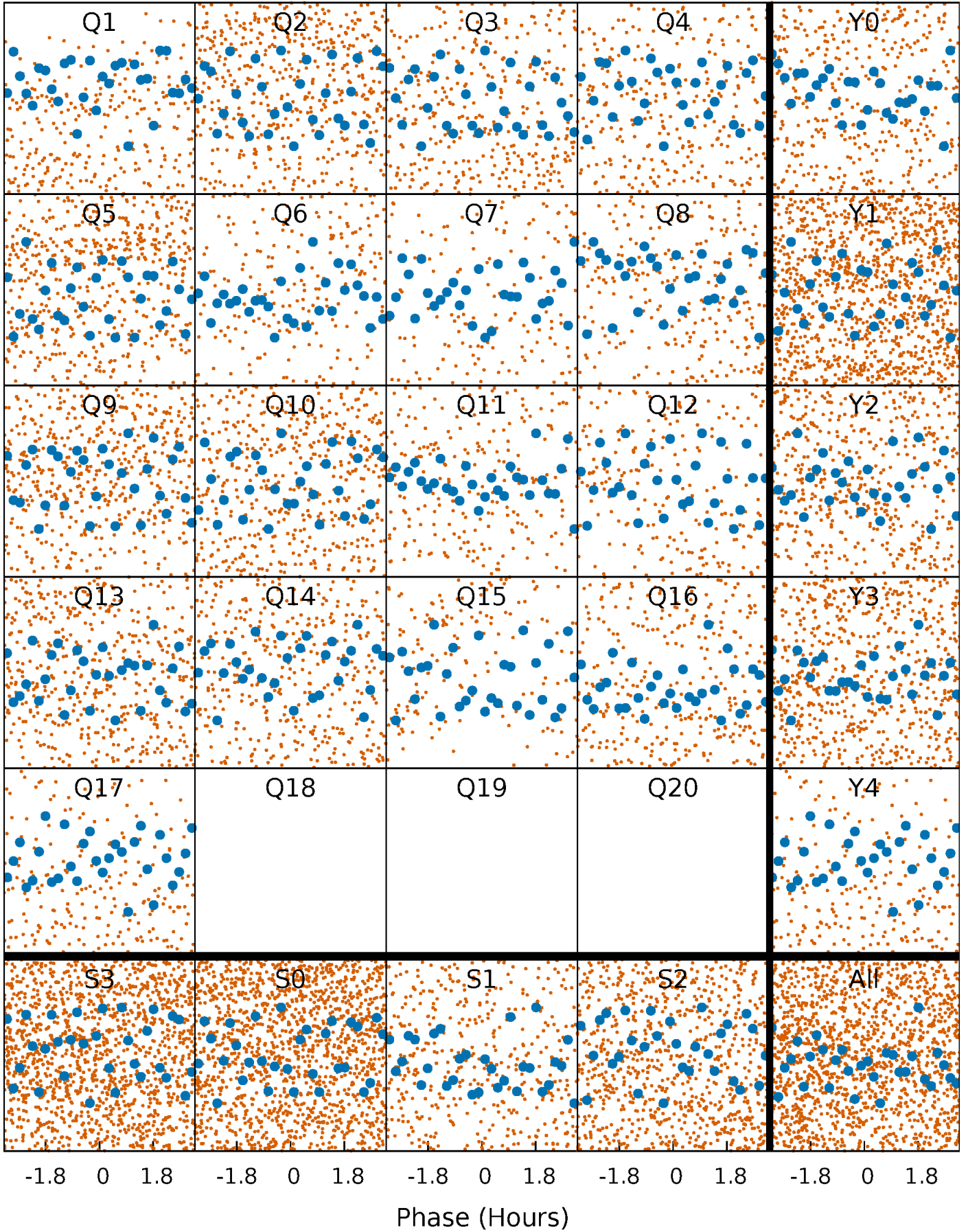


**Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



# PDC Quarter-Phased Transit Curves

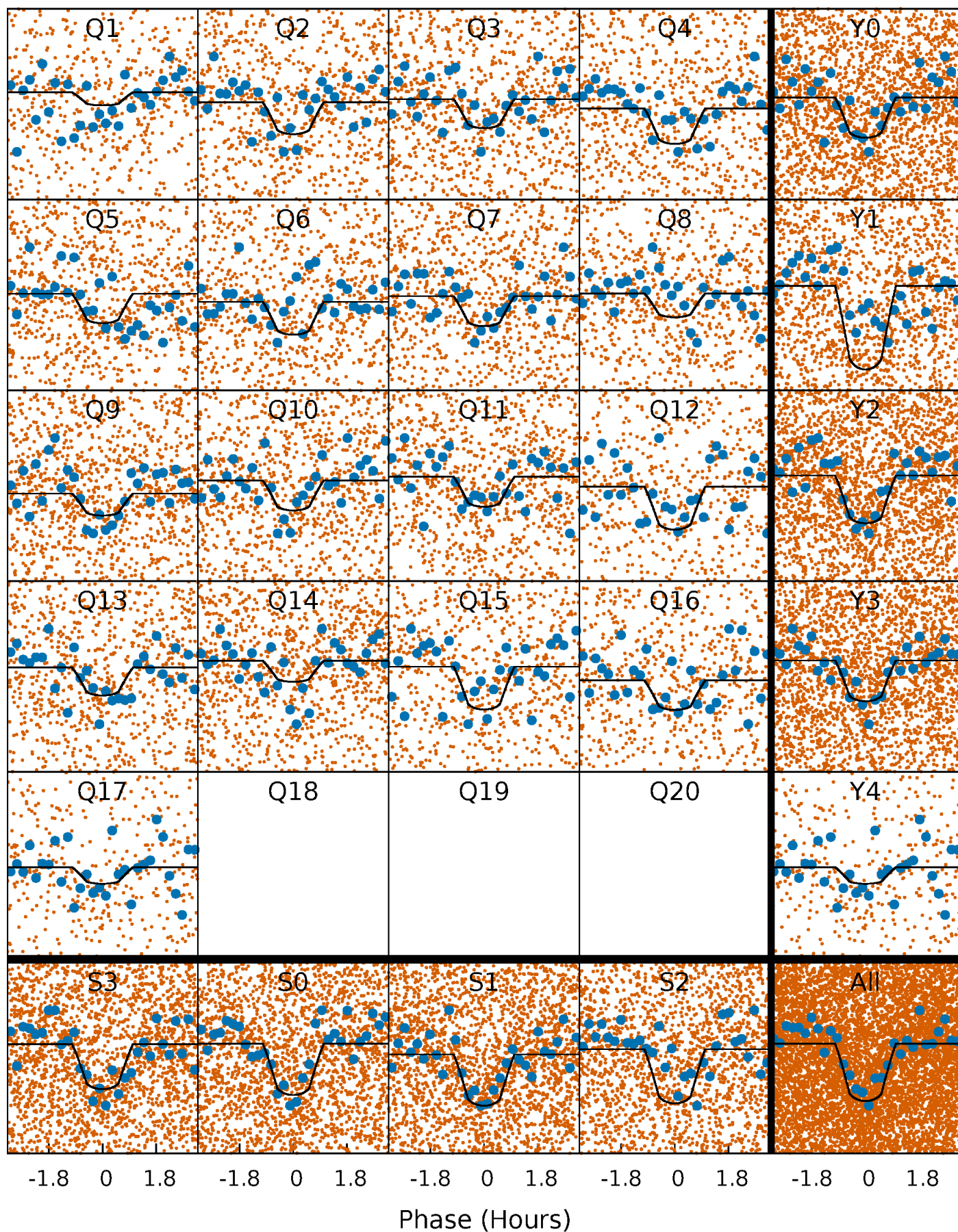
TCE 005709103-01    P= 0.664732 Days     $T_0=131.629798$  (BKJD)





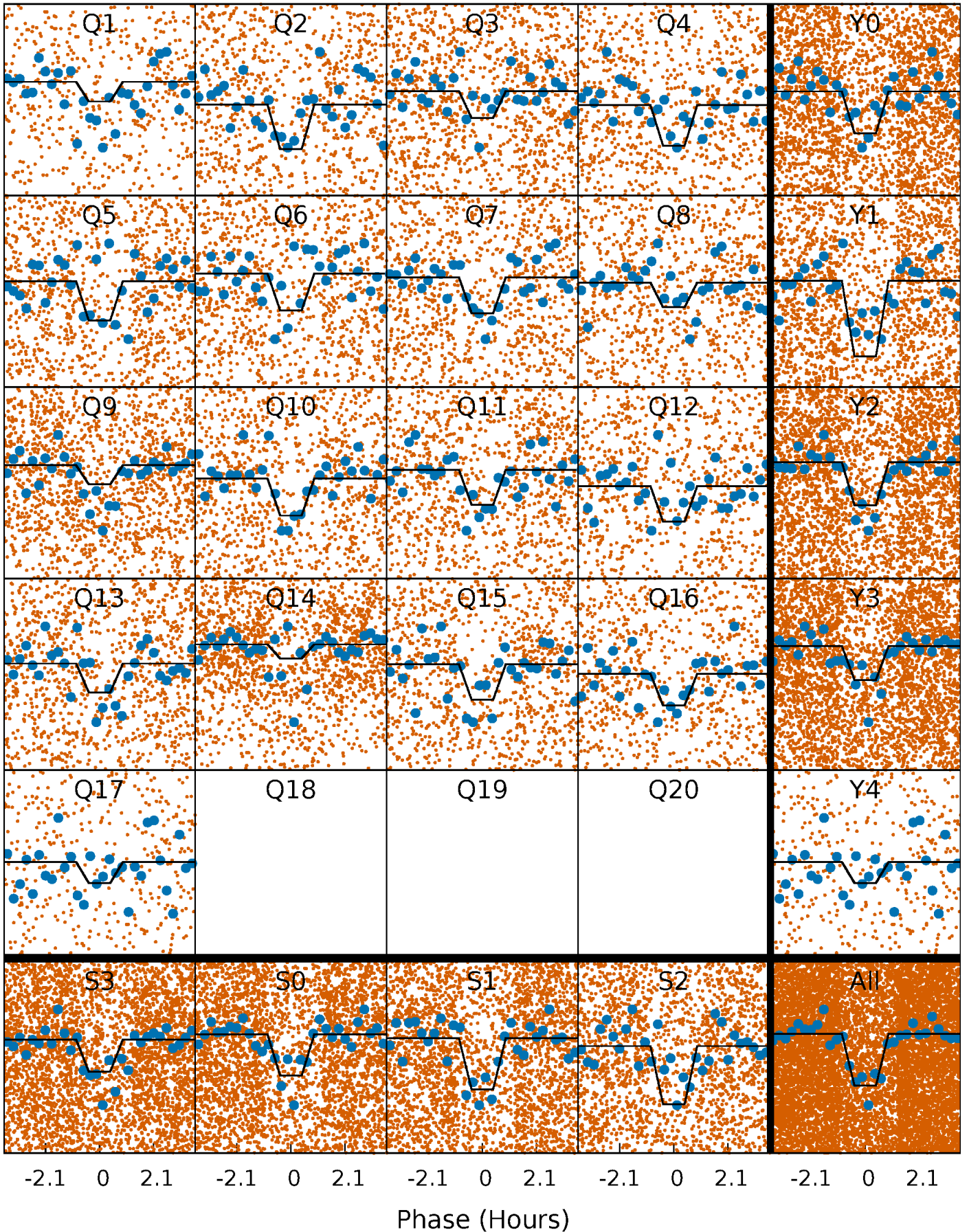
# DV Quarter-Phased Transit Curves

TCE 005709103-01 P= 0.664732 Days  $T_0=131.629798$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

TCE 005709103-01 P= 0.664730 Days  $T_0=131.629626$  (BKJD)

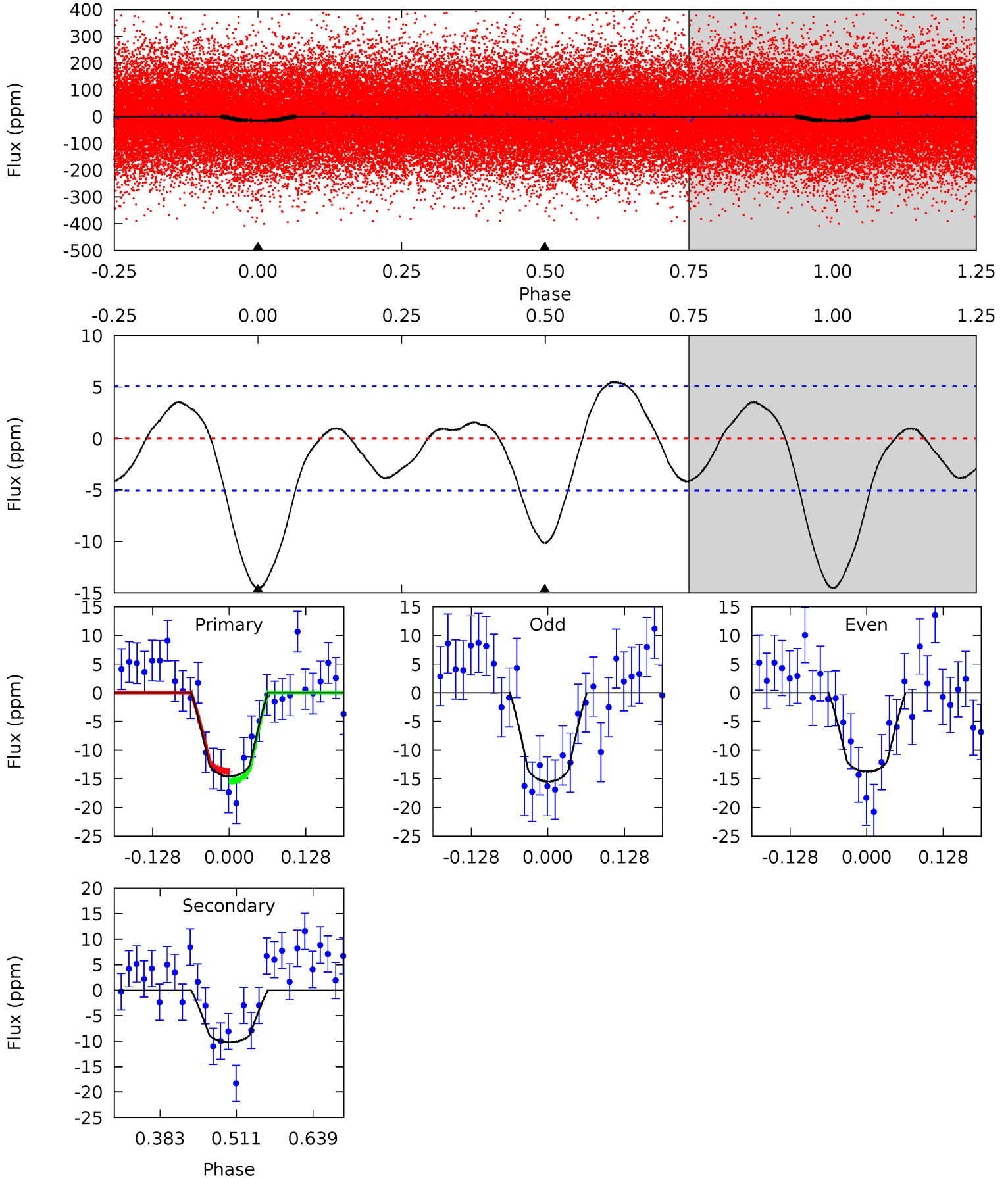




# DV Model-Shift Uniqueness Test

005709103-01, P = 0.664732 Days, E = 130.965066 Days

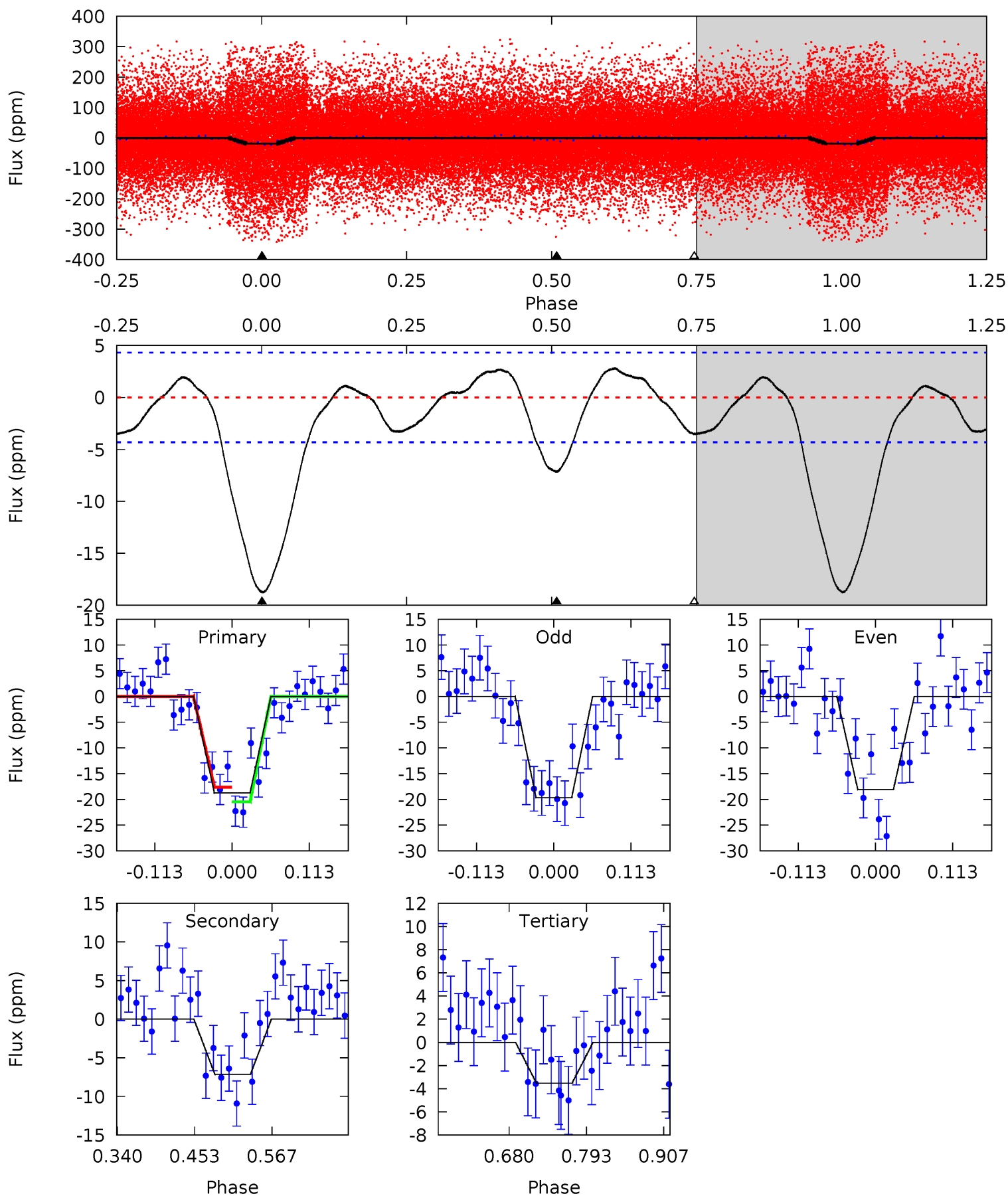
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
13.0	9.07	0	0	4.51	1.52	2.33	13.0	13.0	9.07	9.07	0.77	0.96	0.27	0.77



# Alt Model-Shift Uniqueness Test

005709103-01, P = 0.664730 Days, E = 130.964896 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
19.7	7.52	3.70	0	4.54	1.58	1.92	16.0	19.7	3.81	7.52	0.83	1.01	0.13	1.48





### Stellar Parameters For KIC 005709103

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6143^{+83}_{-92}$	$4.344^{+0.110}_{-0.121}$	$-0.200^{+0.150}_{-0.150}$	$1.116^{+0.189}_{-0.126}$	$1.001^{+0.073}_{-0.059}$	$1.015^{+0.421}_{-0.349}$
	+1%/-1%	+3%/-3%	+75%/-75%	+17%/-11%	+7%/-6%	+41%/-34%
Source	SPE68	SPE68	SPE68	DSEP		

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

### Secondary Eclipse Parameters for KIC 005709103-01 / KOI 7736.01

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-10 \pm 1$	$0.55^{+0.14}_{-0.12}$	$3269^{+143}_{-120}$	$5104^{+671}_{-411}$	$4.145^{+2.939}_{-1.477}$
Alt.	$-7 \pm 1$	$0.51^{+0.13}_{-0.12}$	$3275^{+146}_{-134}$	$4914^{+648}_{-482}$	$3.406^{+2.418}_{-1.311}$

$T_{max}$  = 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

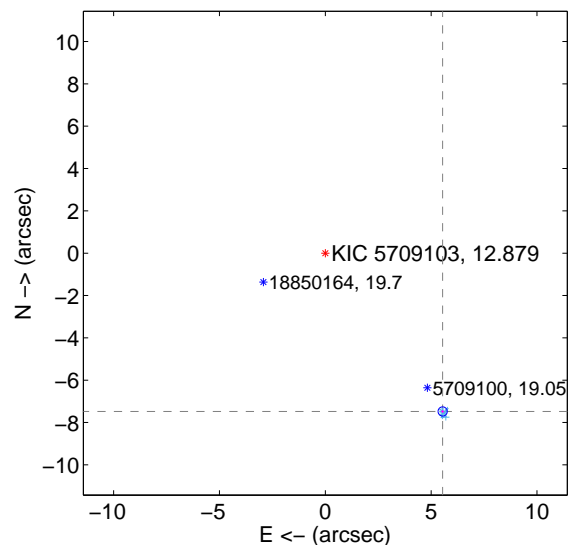
Supplemental centroid analysis for 005709103-01. Kepler magnitude: 12.88. Transit SNR 9.19

There are 17 quarters with good PRF difference image offsets

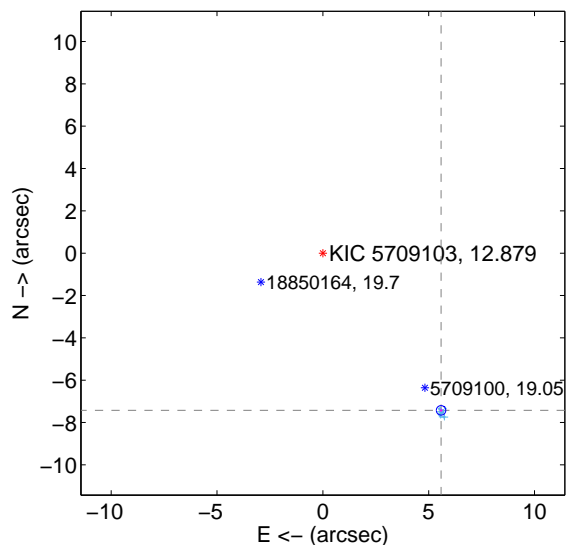
The direct PRF centroid is offset from the target star catalog position by about 0.05 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$9.309 \pm 0.072$	$128.92$	$-5.544 \pm 0.070$	$-7.478 \pm 0.073$
PRF-fit source offset from KIC position	$9.292 \pm 0.075$	$124.54$	$-5.585 \pm 0.070$	$-7.426 \pm 0.076$
photometric centroid source offset	$1.73 \pm 1.02$	1.70	$1.66 \pm 1.02$	$-0.51 \pm 1.01$

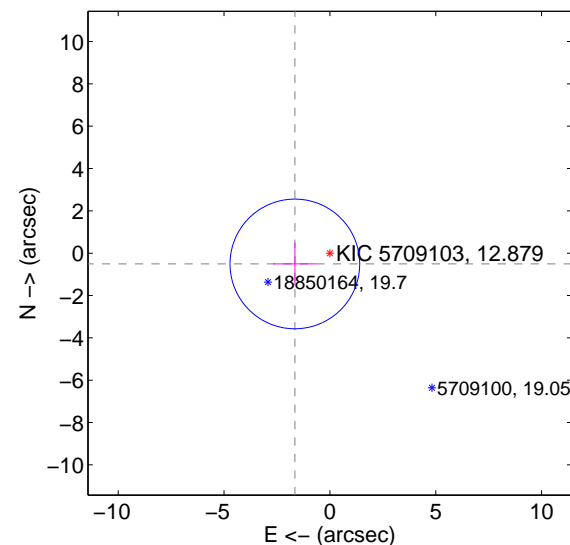
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

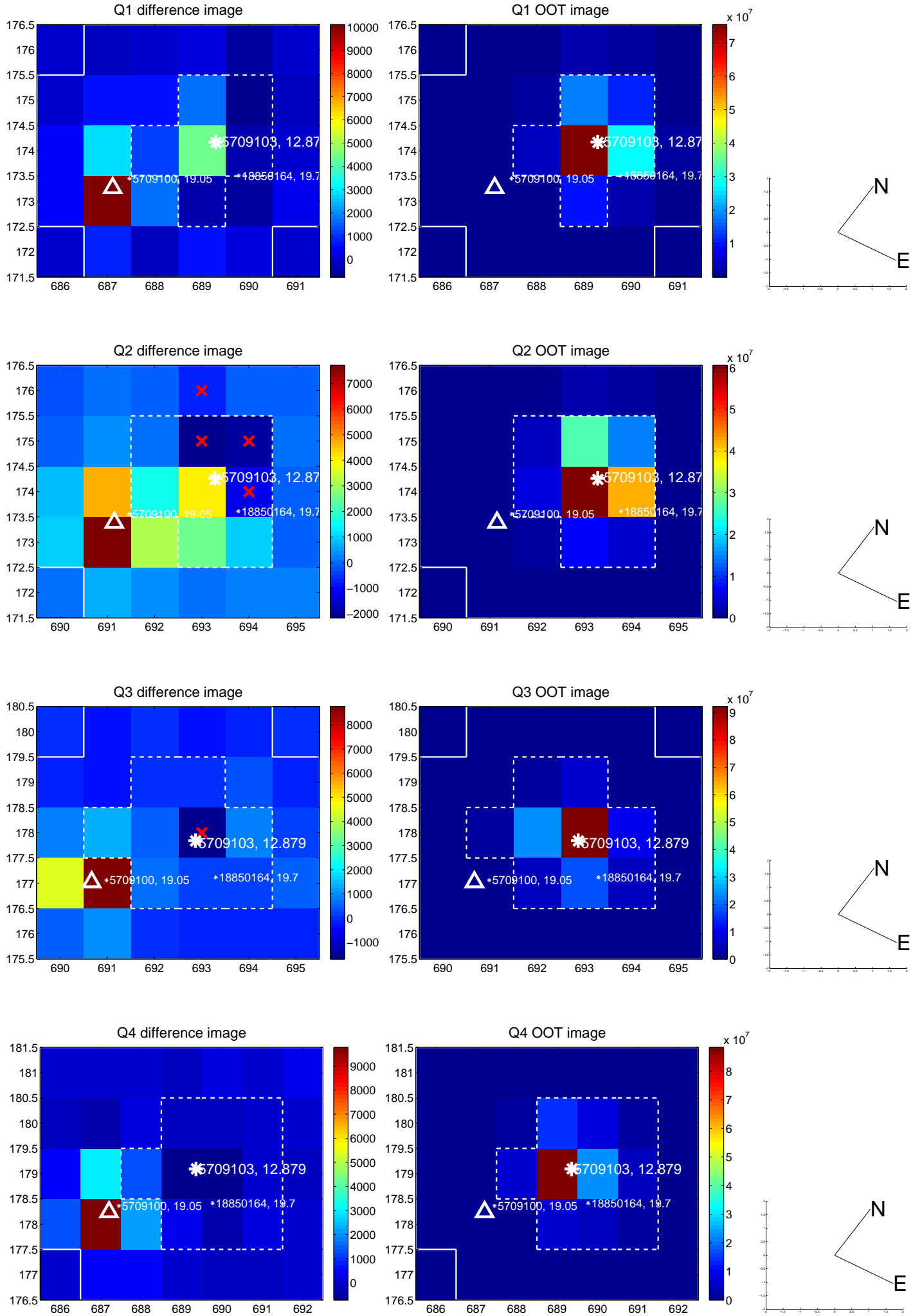


offset from photometric centroids

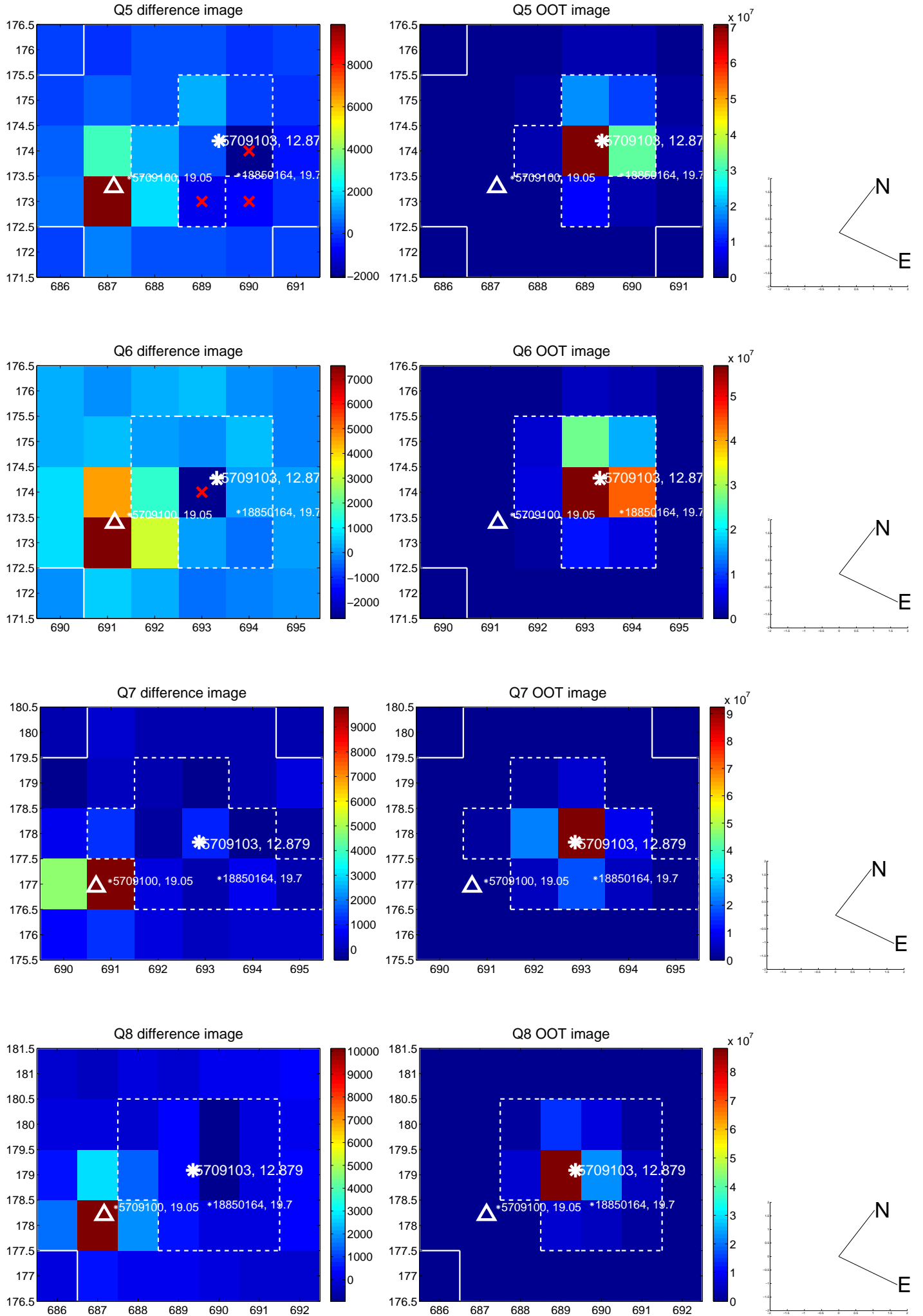


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

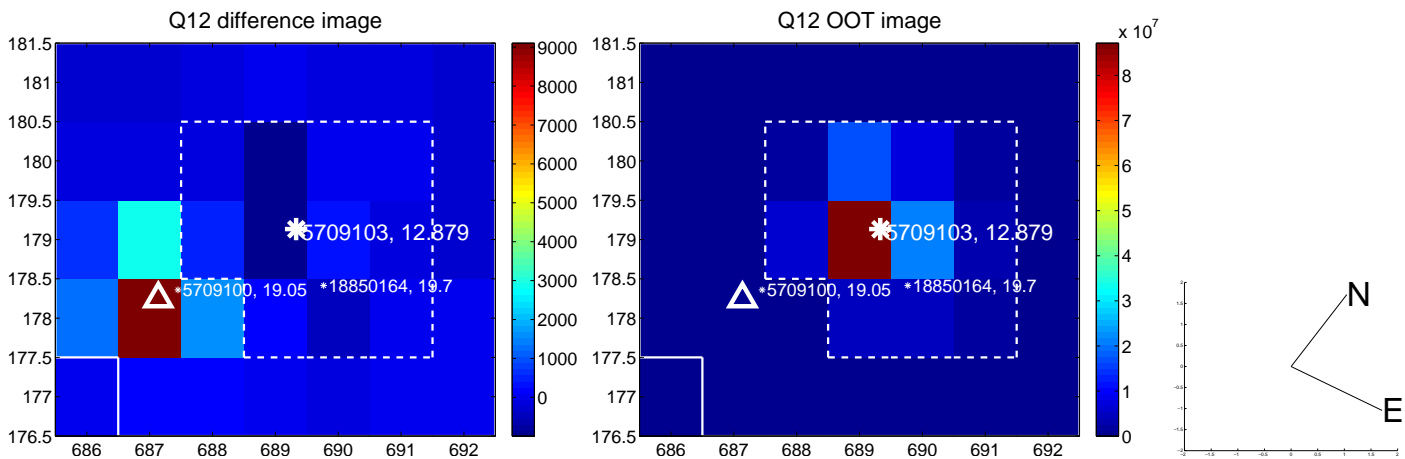
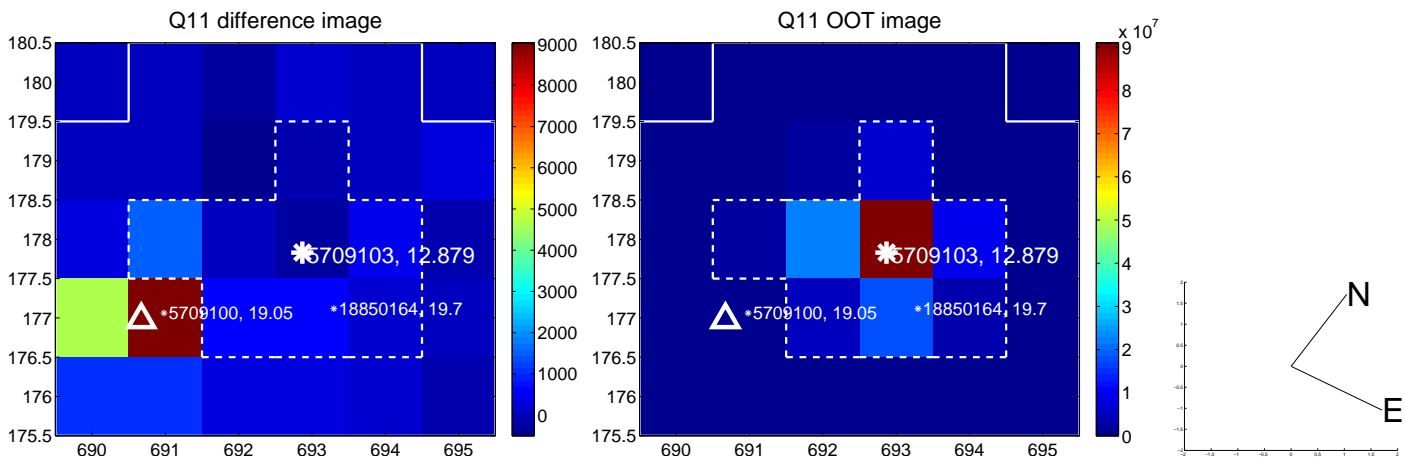
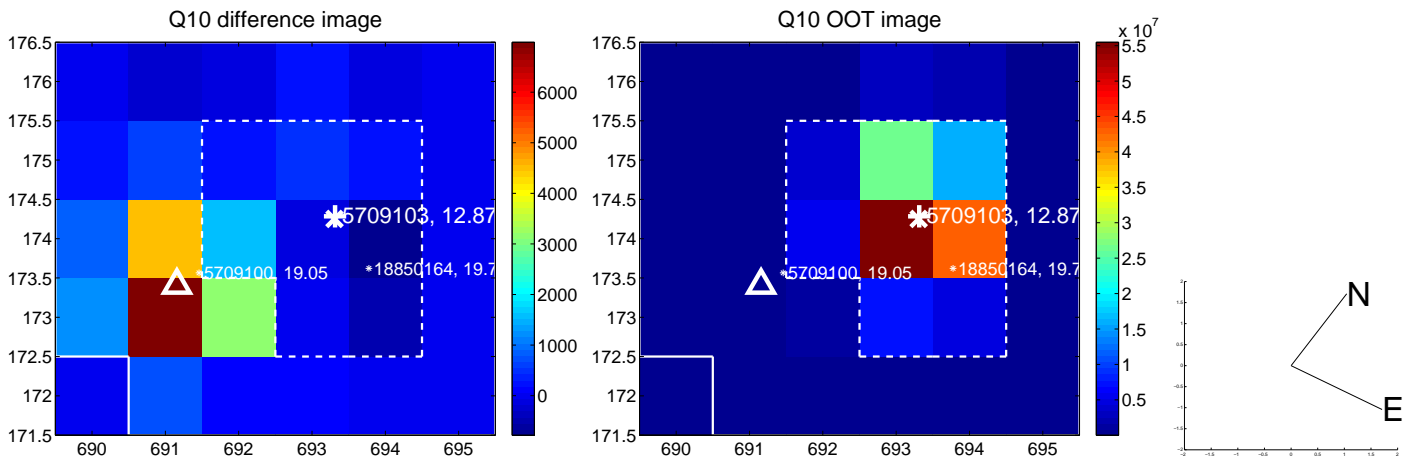
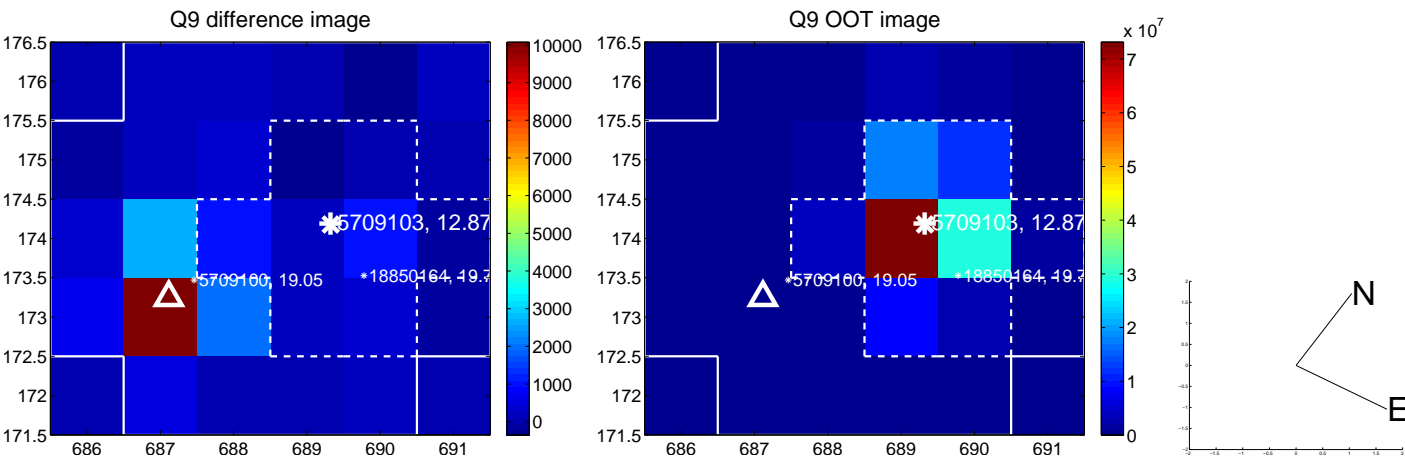


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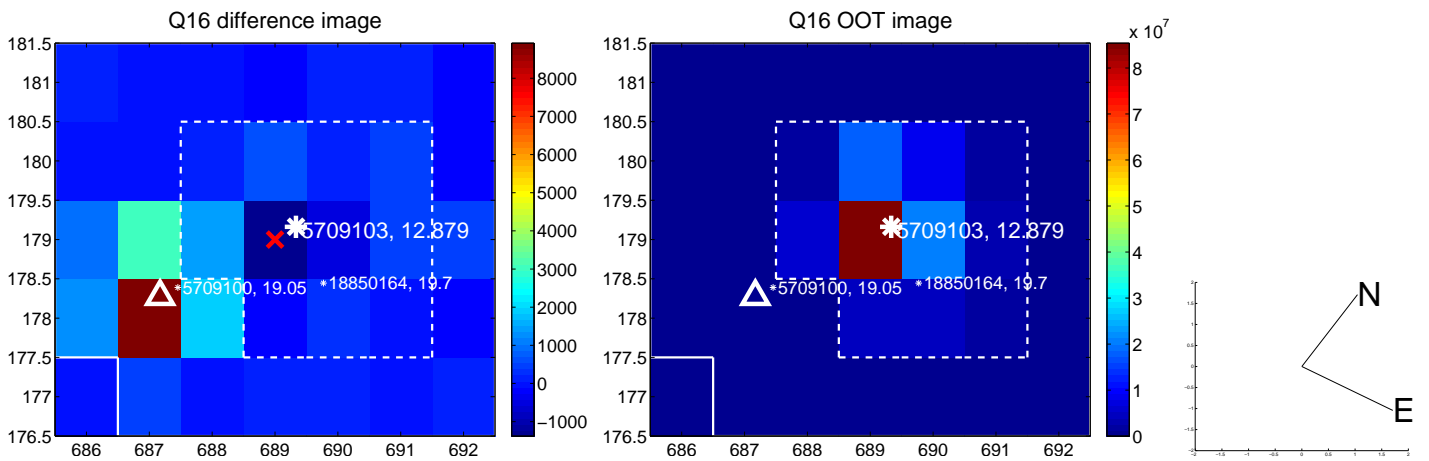
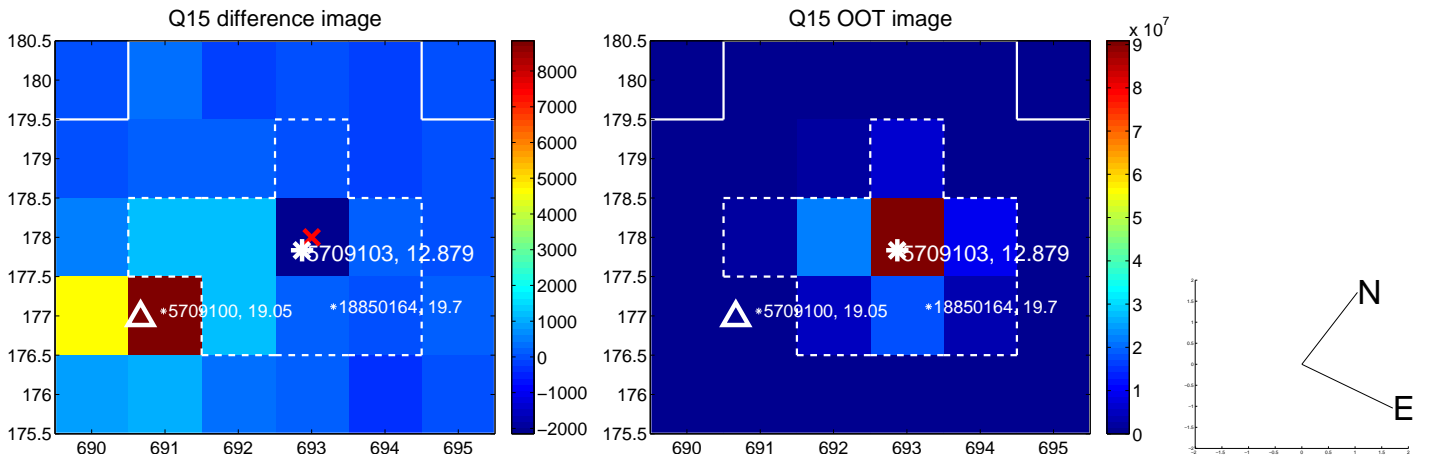
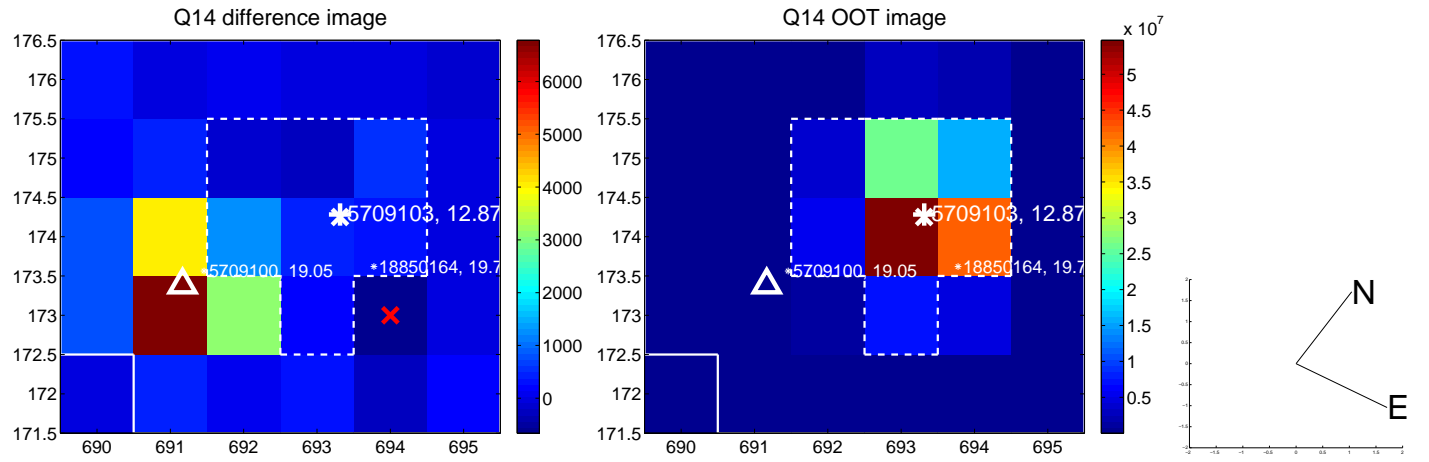
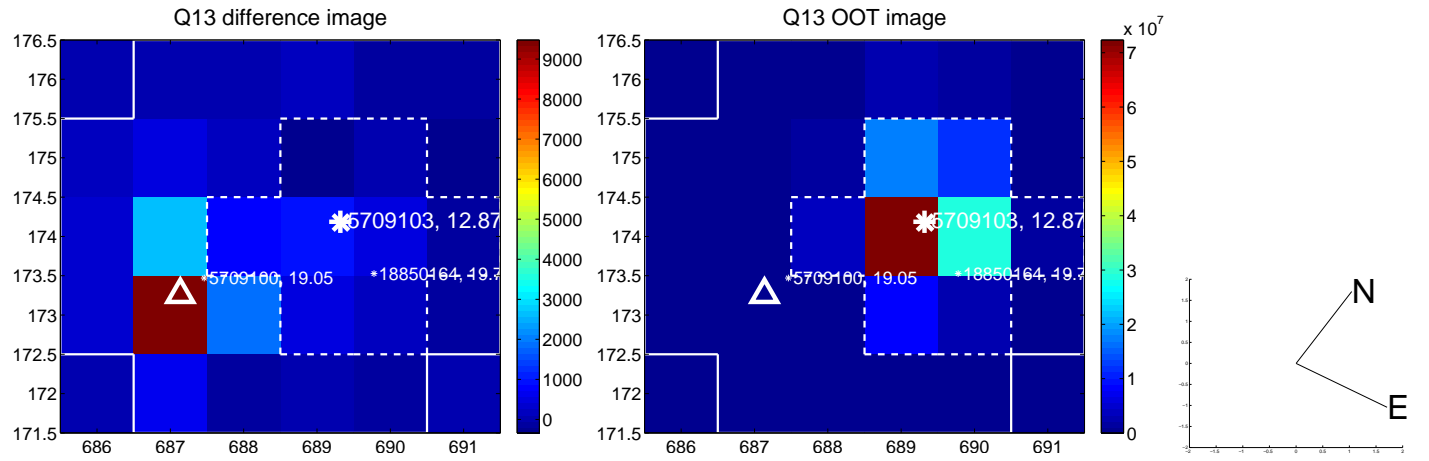




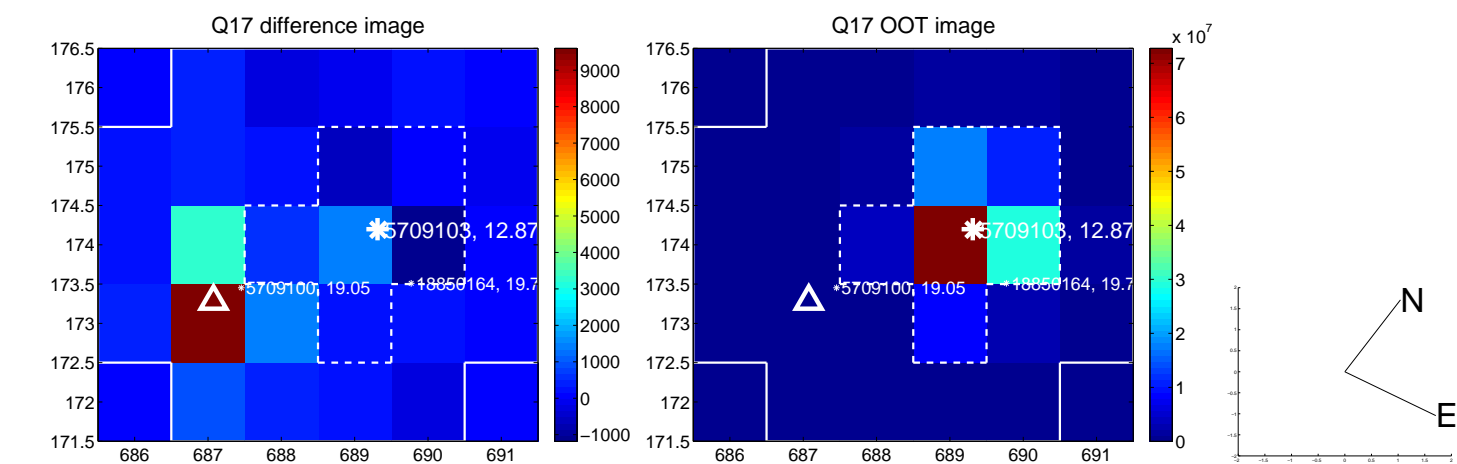
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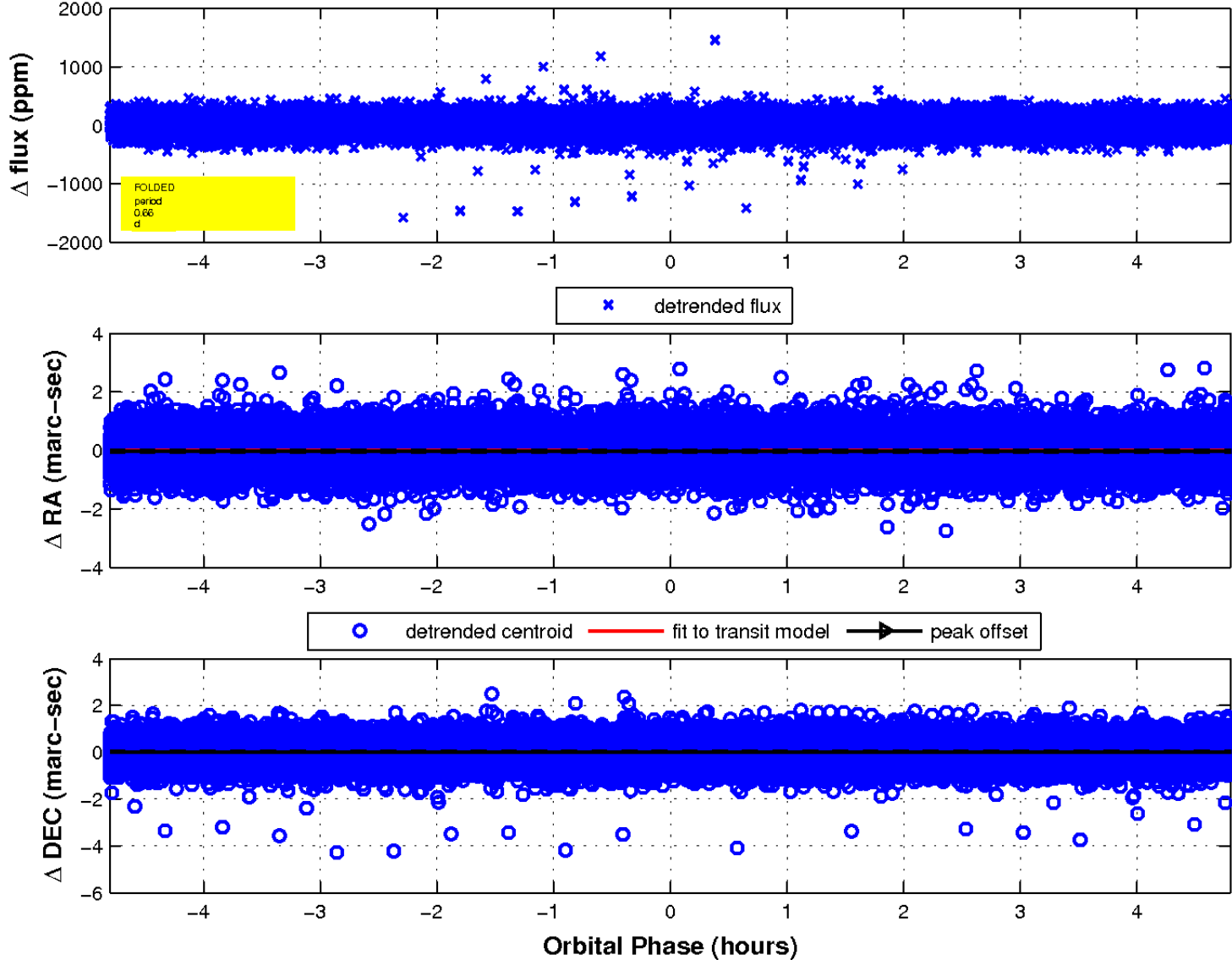
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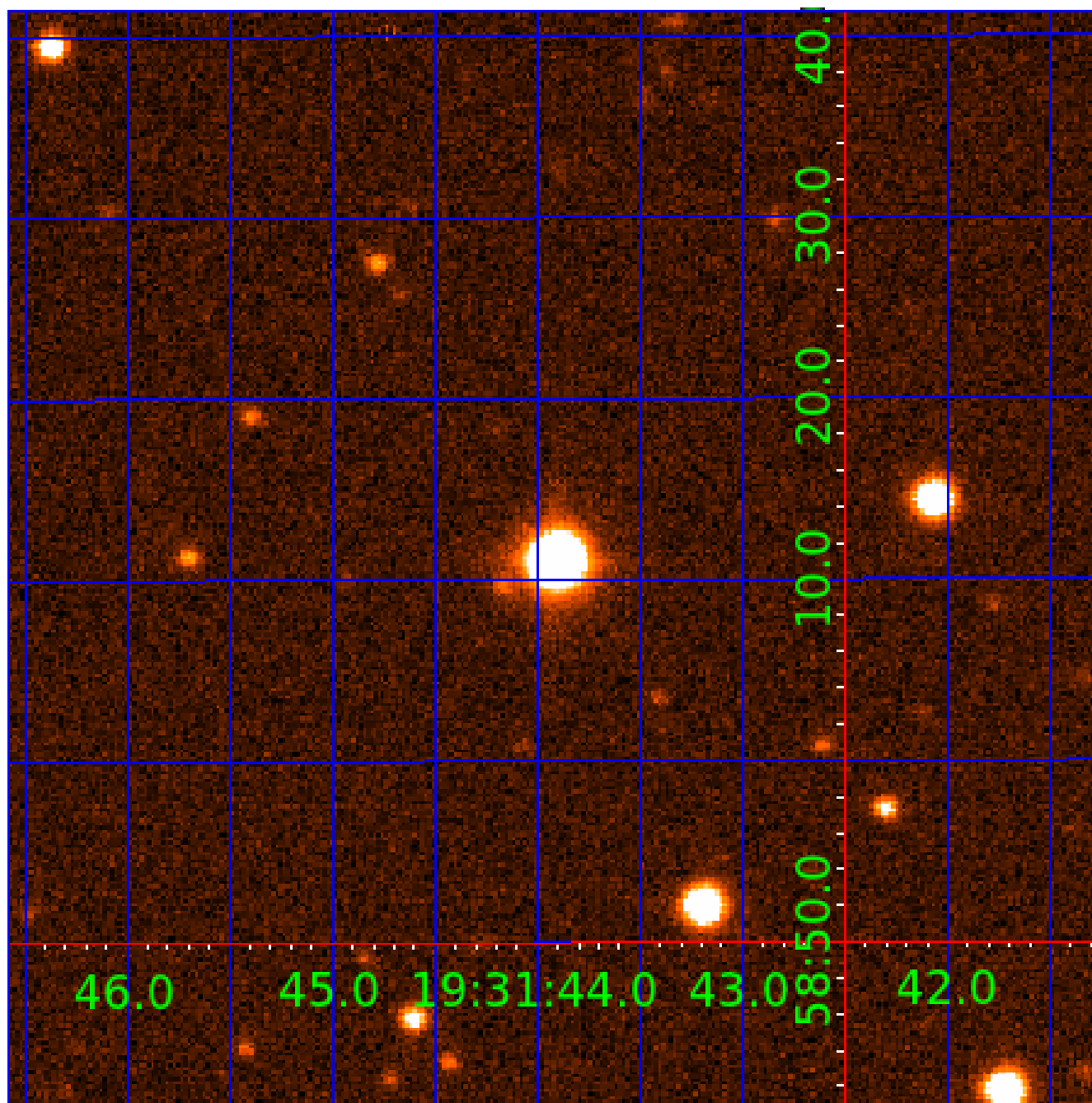


fluxWeightedCentroids, Planet 1 of 4



UKIRT Image

Declination





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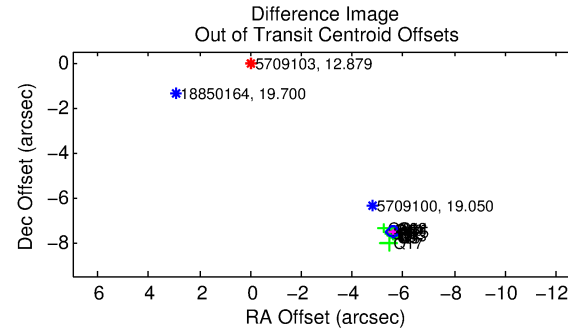
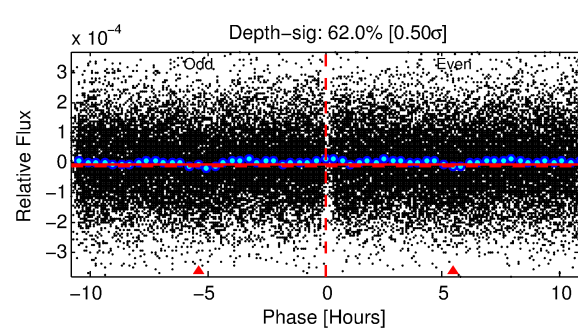
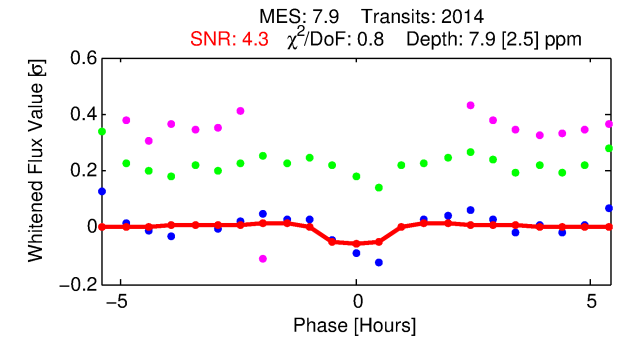
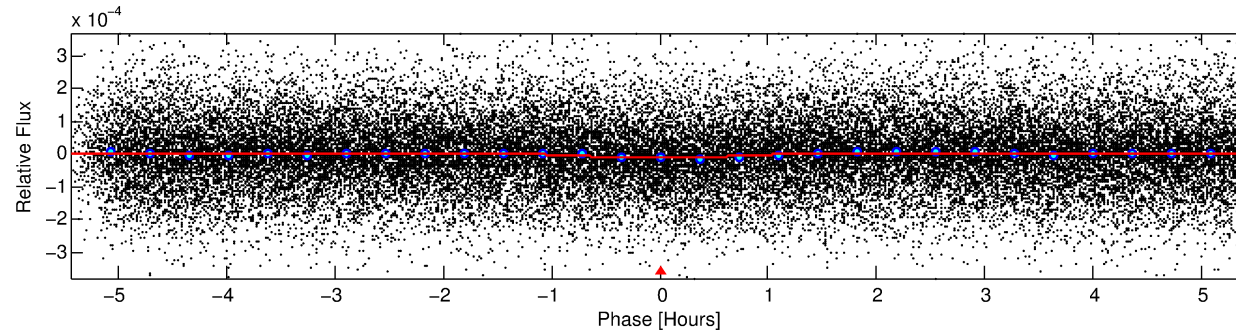
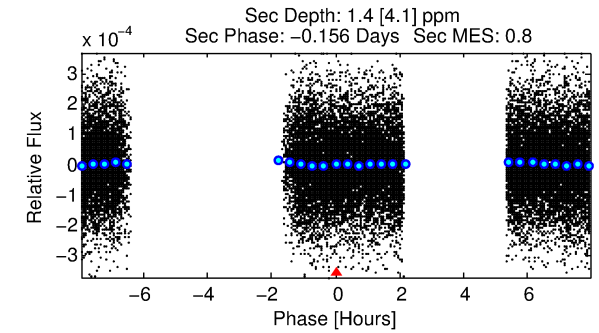
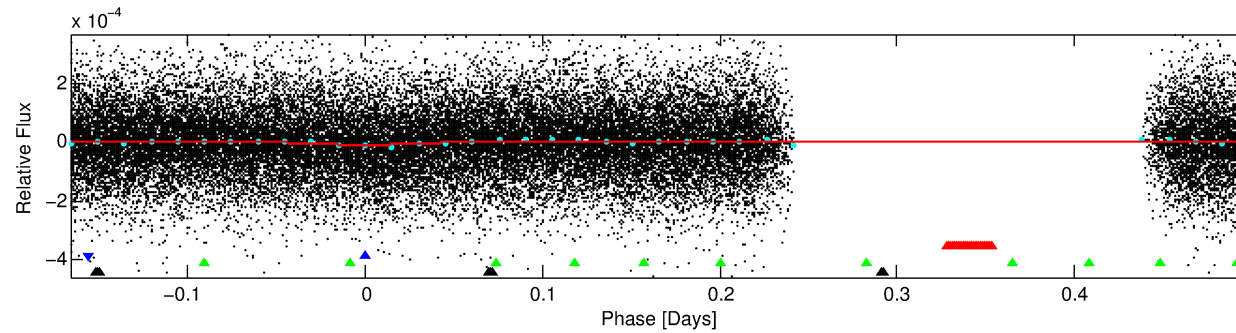
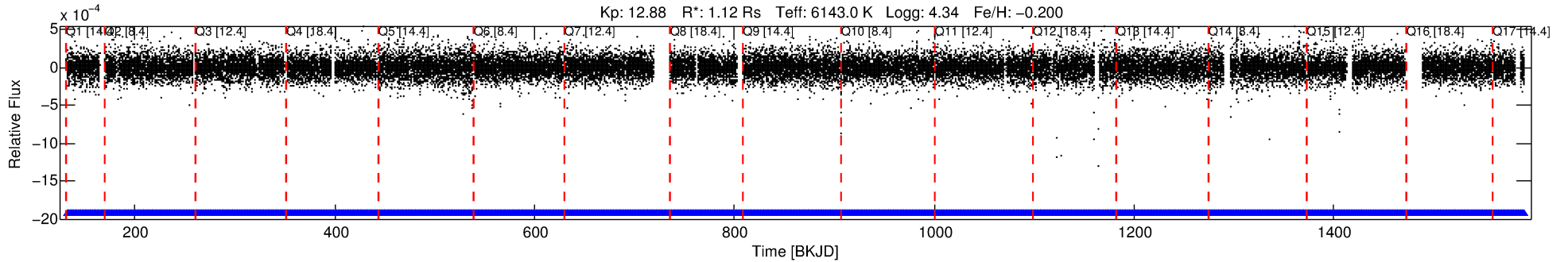
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 005709103-02

No Significant Match Found

# DV One-Page Summary

KIC: 5709103 Candidate: 2 of 4 Period: 0.665 d



## DV Fit Results:

Period = 0.66472 [0.00002] d  
Epoch = 131.9663 [0.0048] BKJD  
Rp/R\* = 0.0028 [0.0008]  
a/R\* = 2.11 [1.94]  
b = 0.72 [0.78]  
Seff = 7134.11 [1608.51]  
Teq = 2343 [132] K  
Rp = 0.34 [0.11] Re  
a = 0.0149 [0.0022] AU  
Ag = 1.47 [4.52] [0.10σ]  
Teff = 3991 [3061] K [0.54σ]

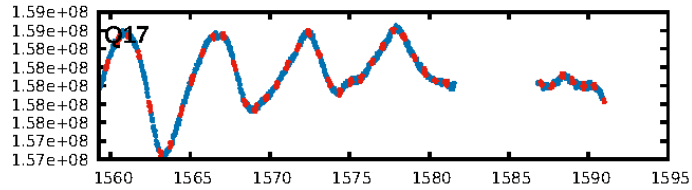
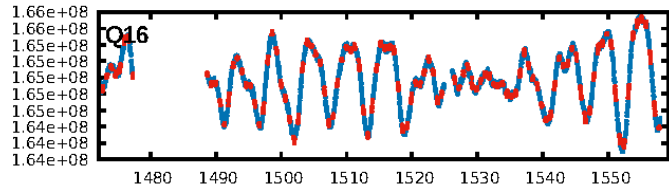
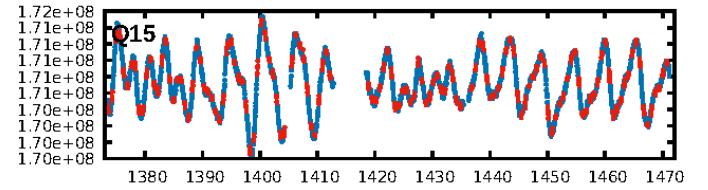
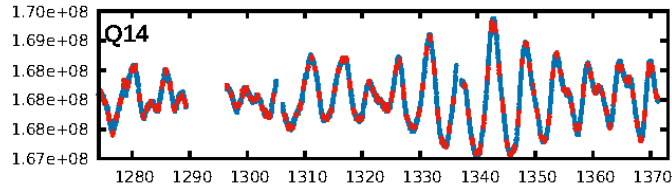
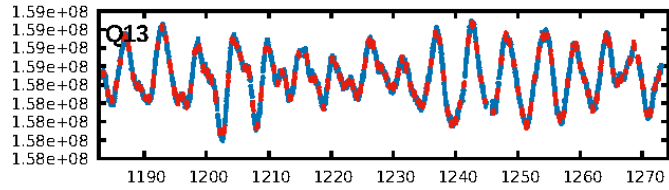
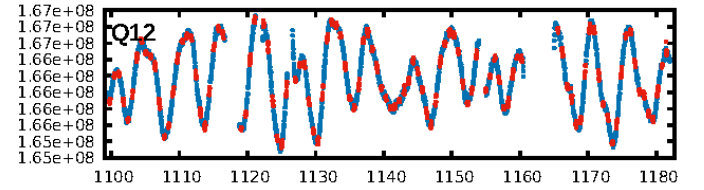
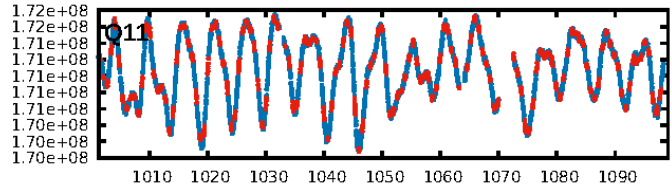
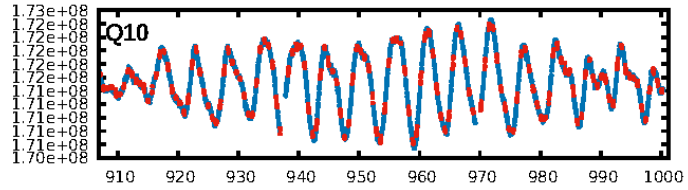
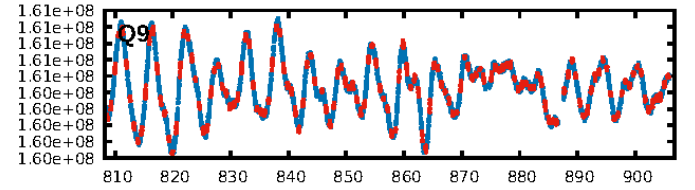
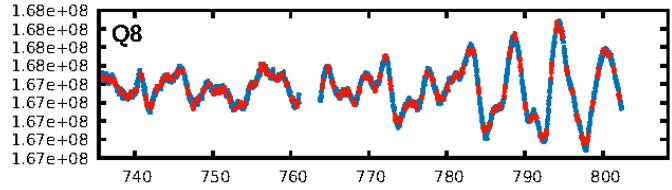
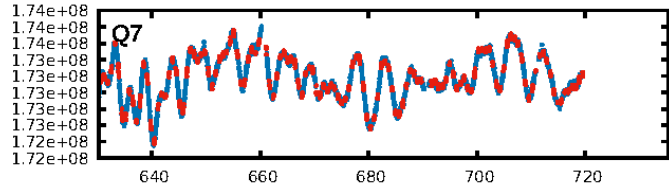
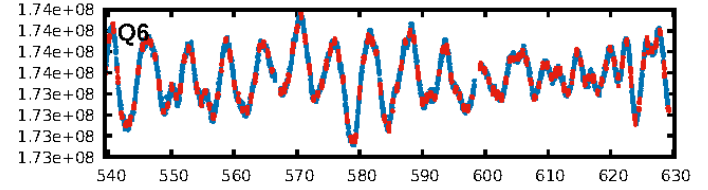
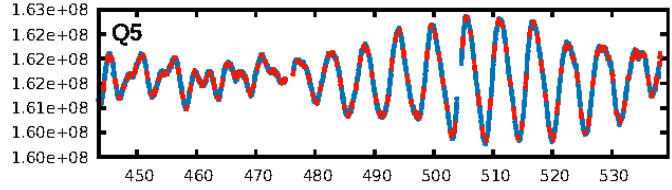
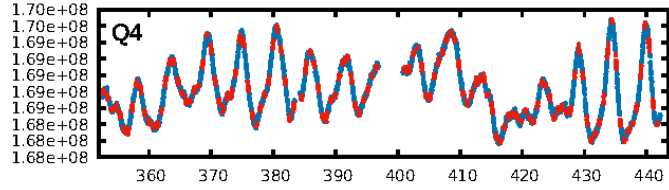
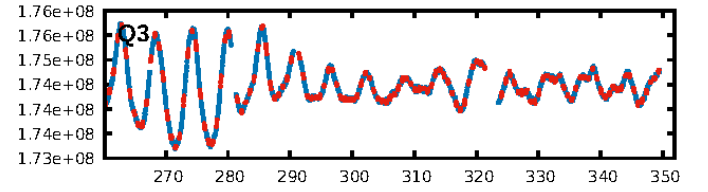
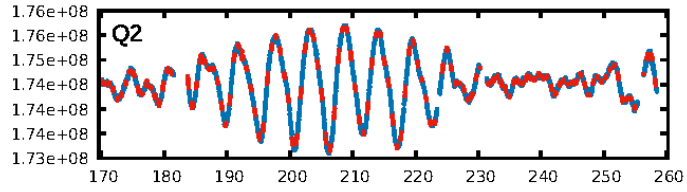
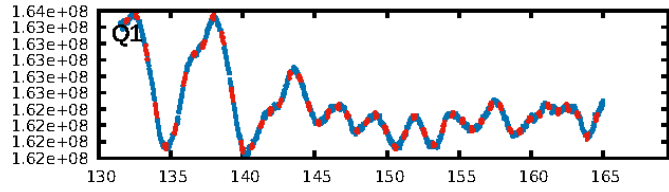
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 0.0% [0.00σ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: 4.33e-13  
RollingBand-fgt: 1.00 [1924/1924]  
GhostDiagnostic-chr: -1.866  
Centroid-sig: 43.0%  
Centroid-so: 1.920 arcsec [0.90σ]  
OotOffset-rm: 9.363 arcsec [119.97σ]  
KicOffset-rm: 9.363 arcsec [114.25σ]  
OotOffset-st: 4/4/4/5 [17]  
KicOffset-st: 4/4/4/5 [17]  
DiffImageQuality-fgm: 1.00 [17/17]  
DiffImageOverlap-fno: 1.00 [17/17]

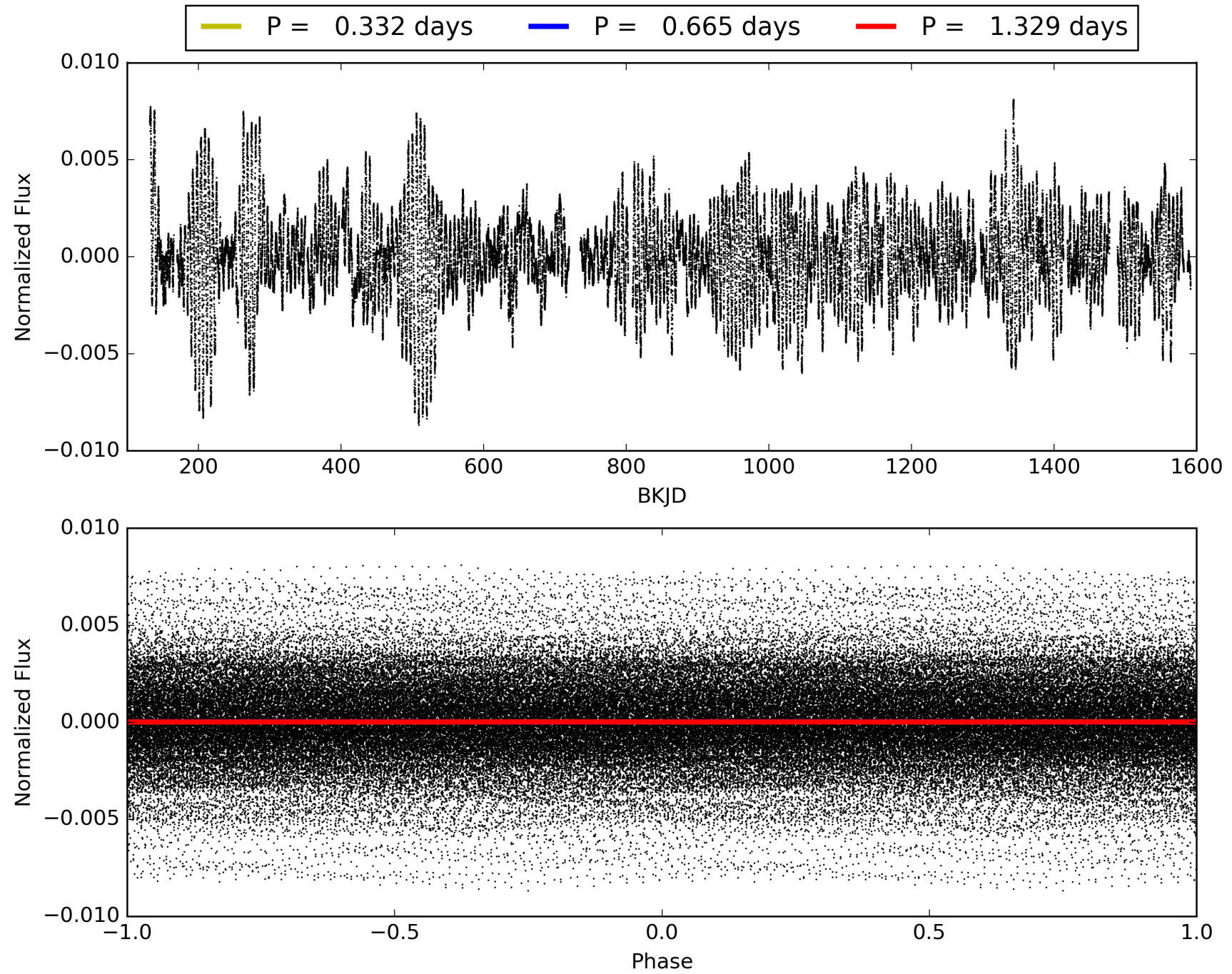
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 13:46:48 Z

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

## TCE 005709103-02, PDC Light Curves

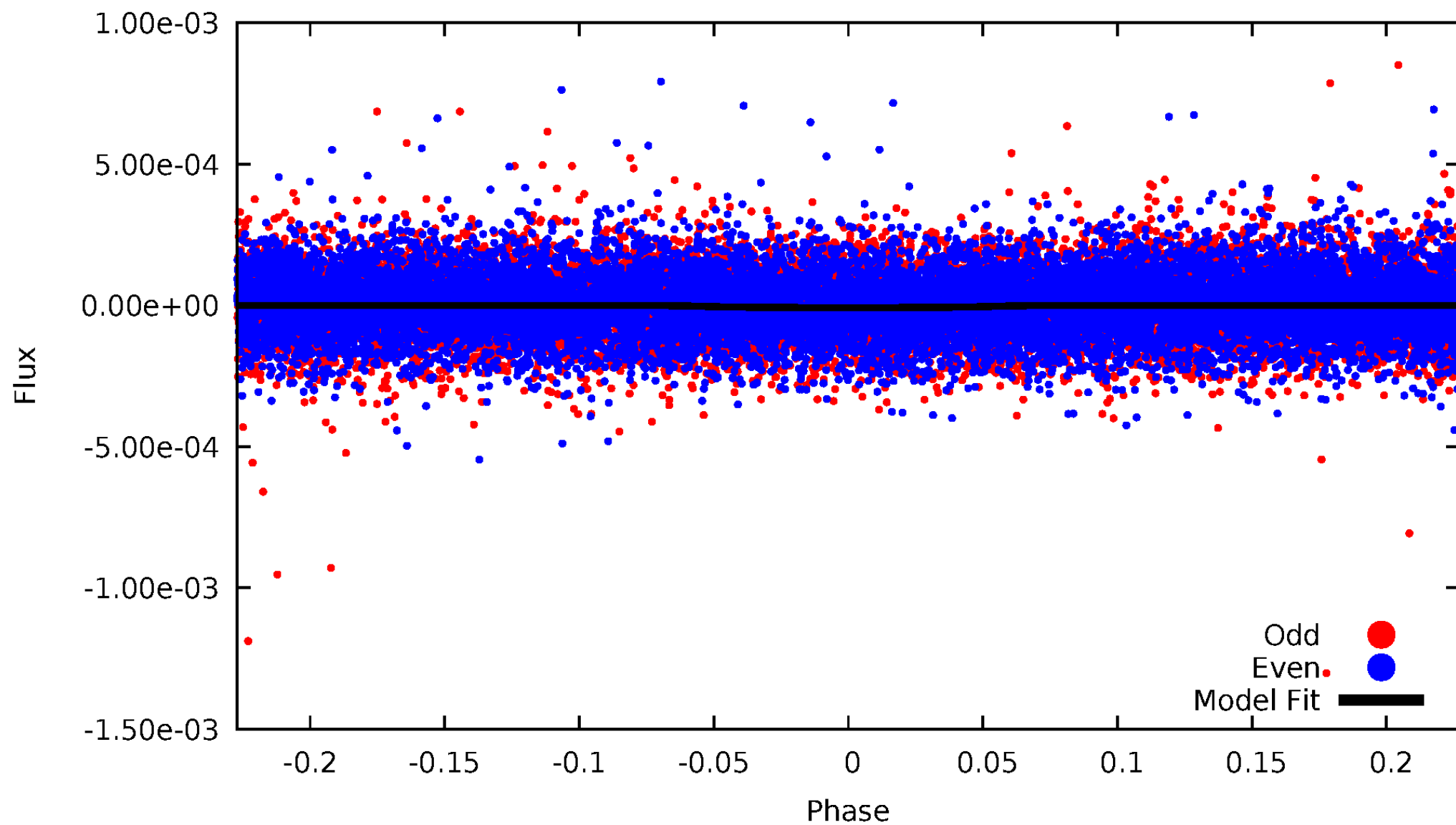


TCE 005709103-02



# DV Odd/Even

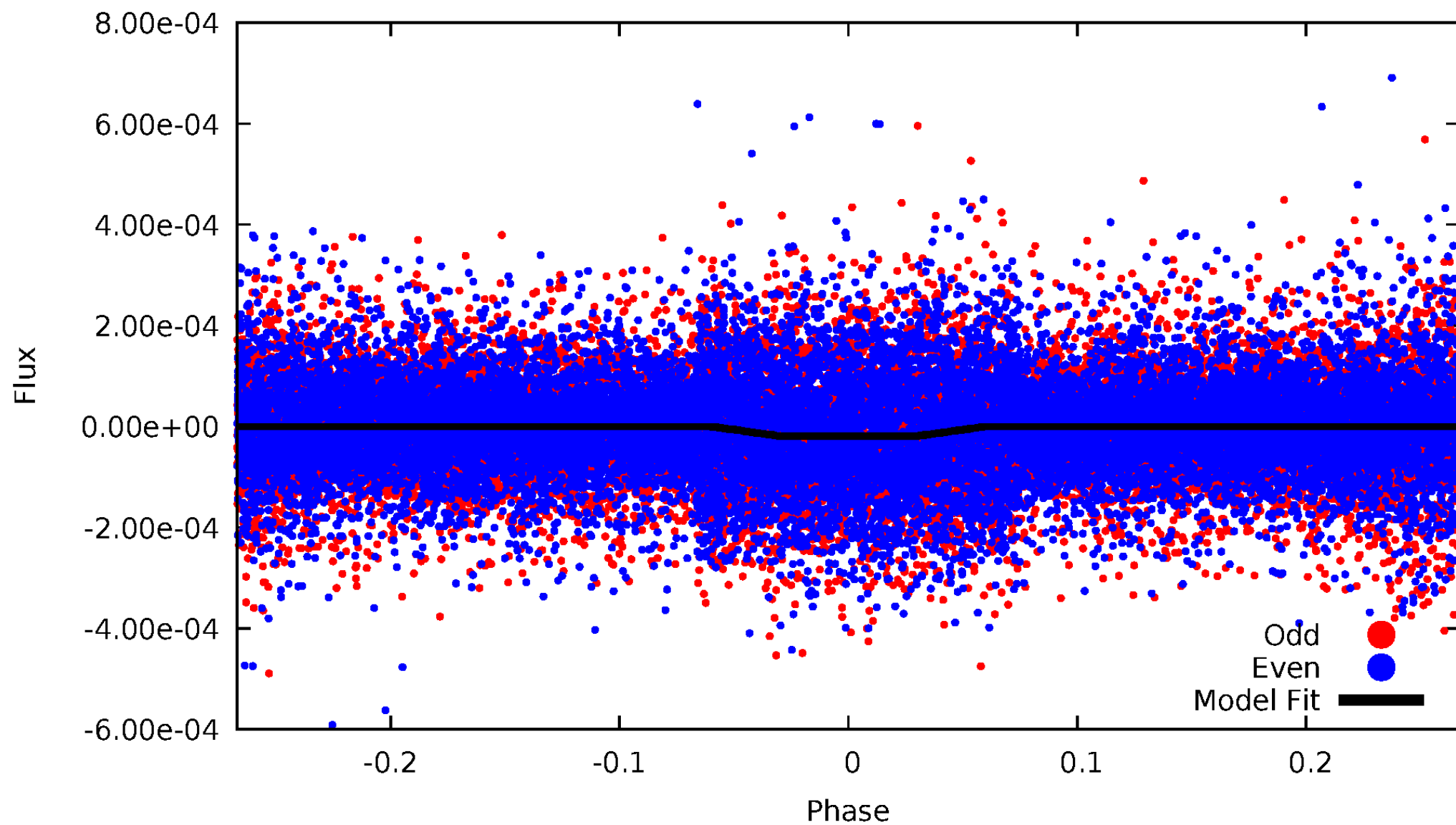
TCE 005709103-02





# ALT Odd/Even

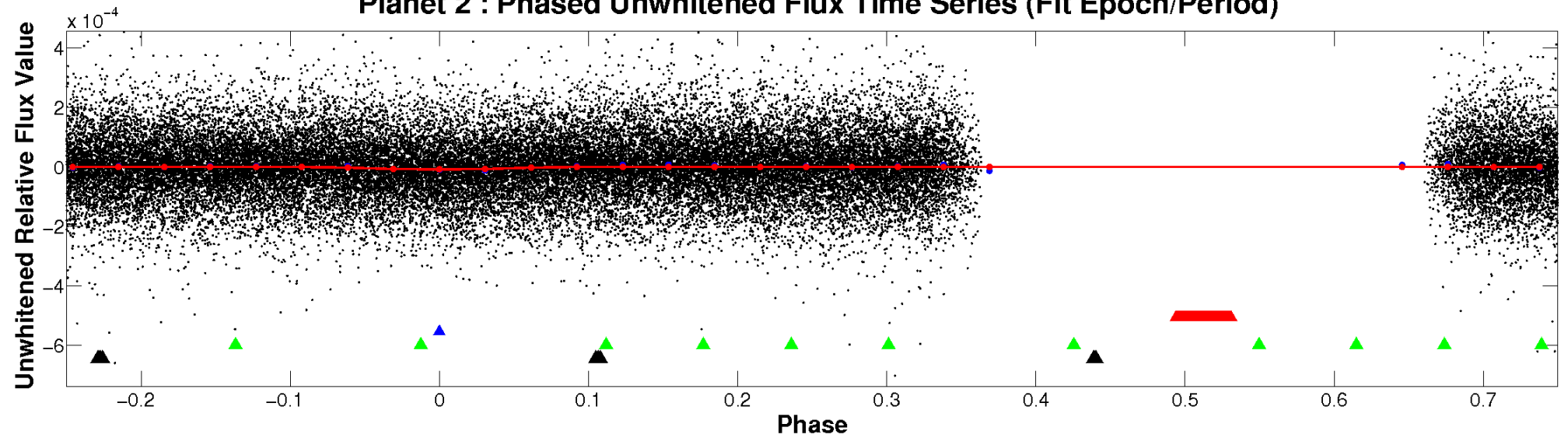
TCE 005709103-02



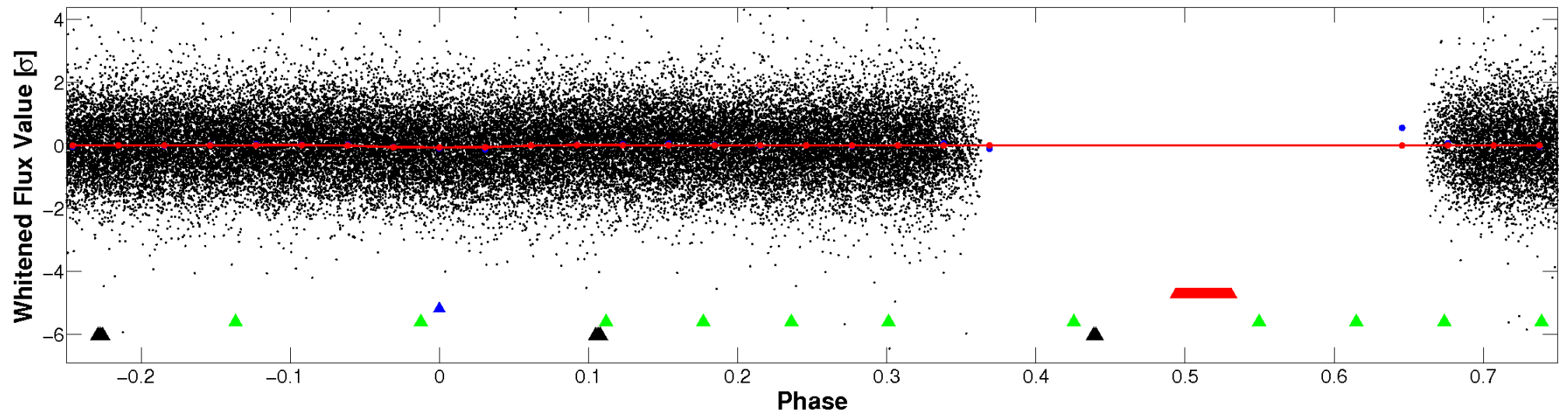


# Non-Whitened Vs. Whitened Light Curve

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

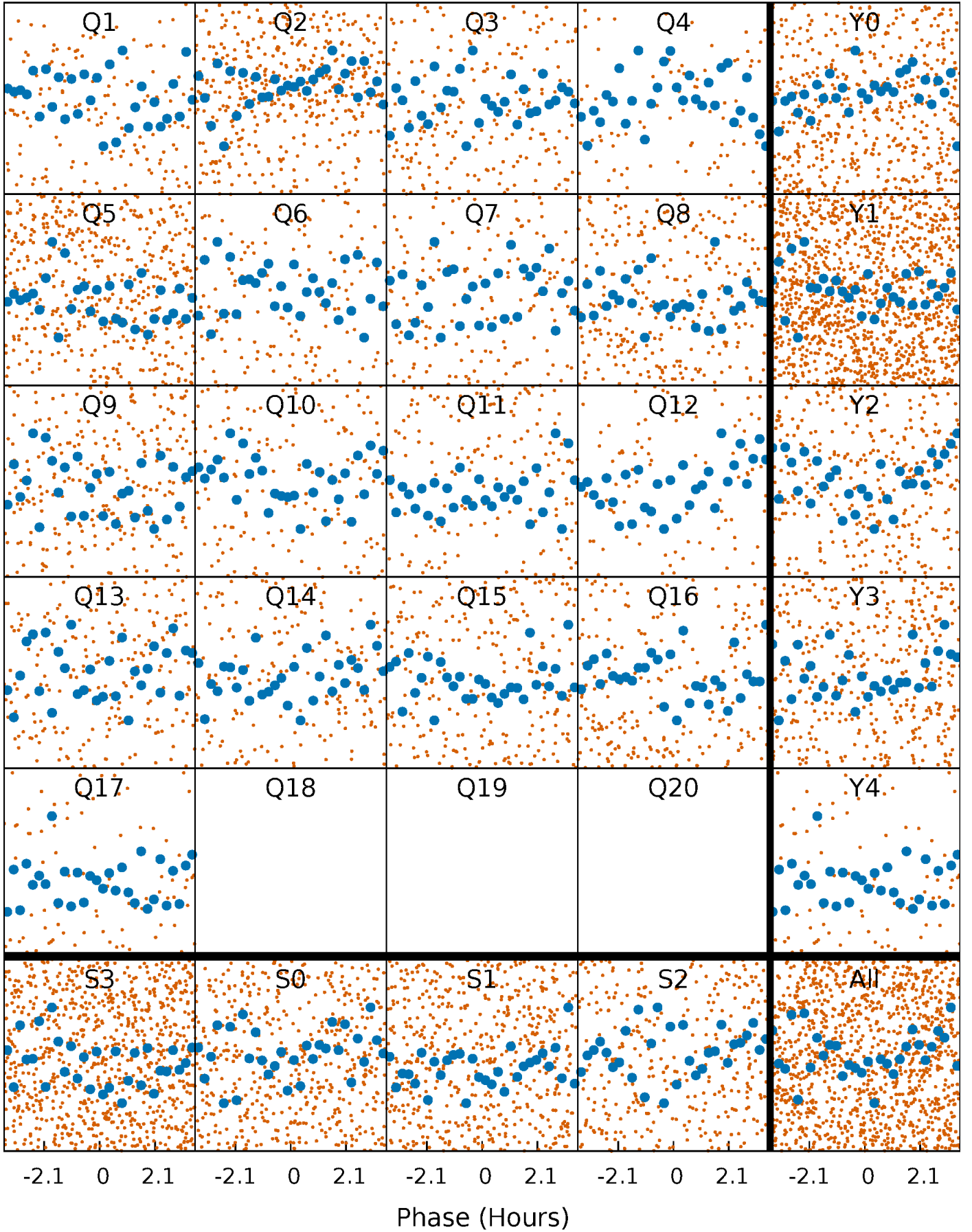


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



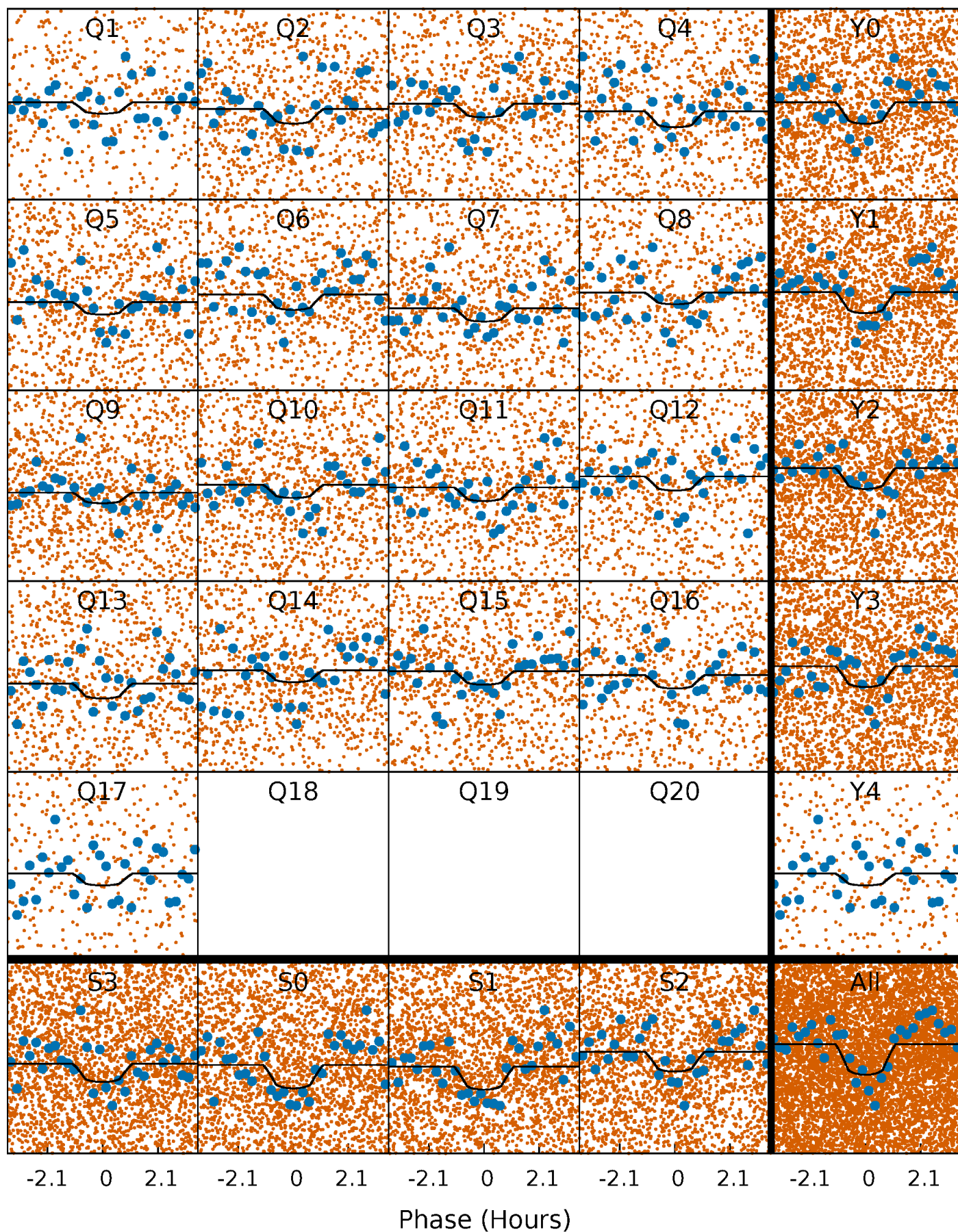
# PDC Quarter-Phased Transit Curves

TCE 005709103-02    P= 0.664721 Days     $T_0=131.966326$  (BKJD)



# DV Quarter-Phased Transit Curves

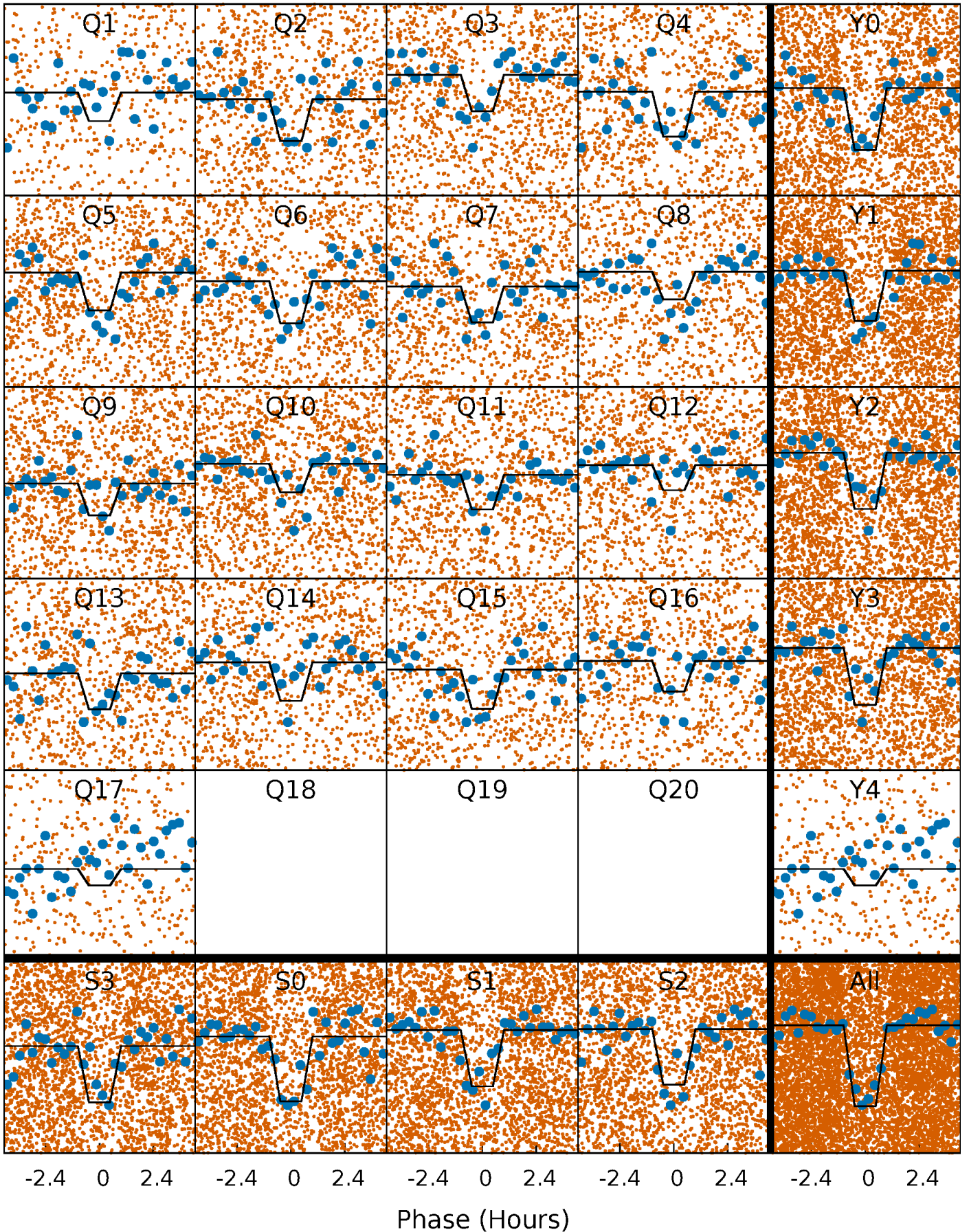
TCE 005709103-02   P= 0.664721 Days    $T_0=131.966326$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

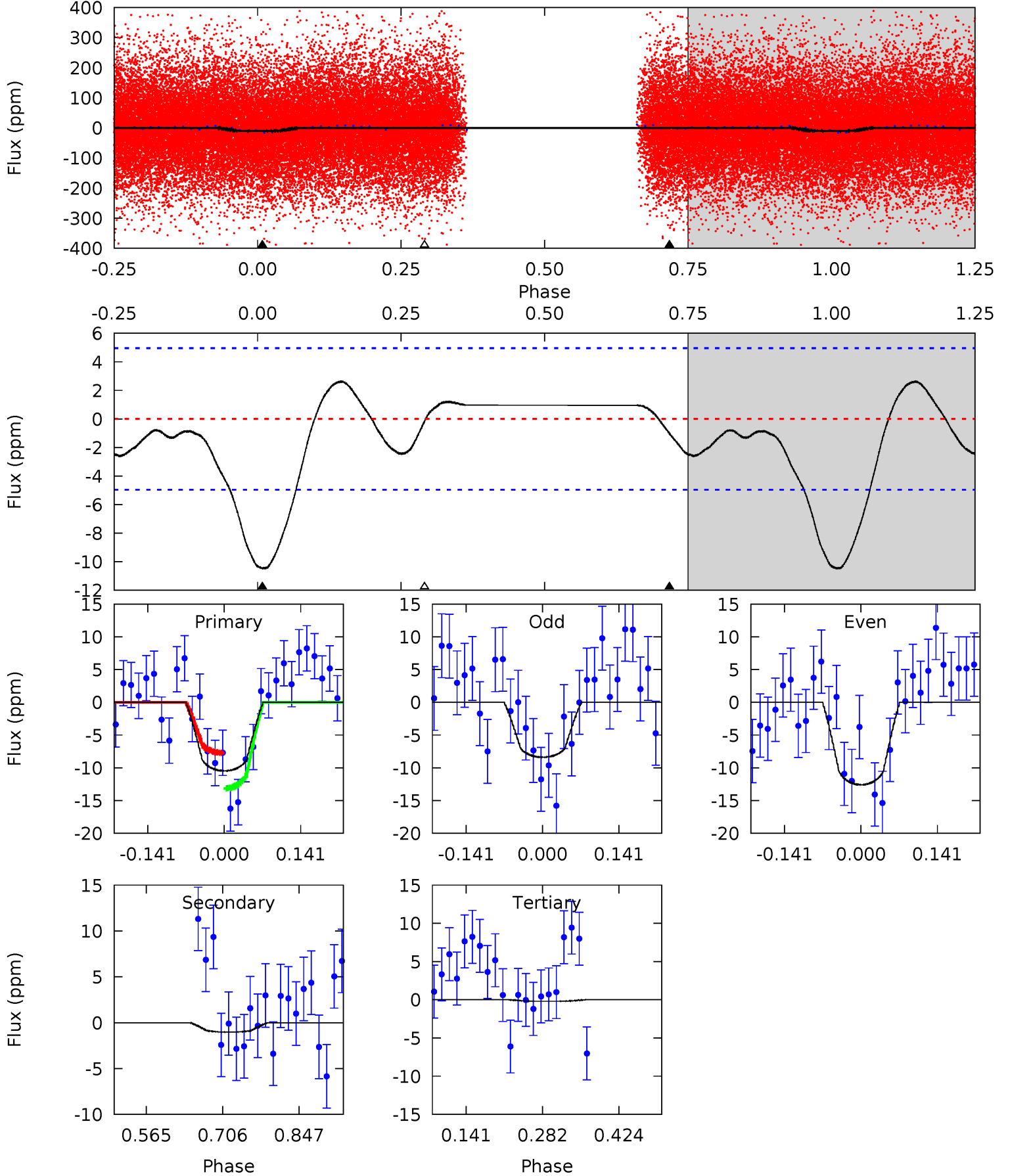
TCE 005709103-02 P= 0.664736 Days  $T_0=131.959332$  (BKJD)



# DV Model-Shift Uniqueness Test

005709103-02, P = 0.664721 Days, E = 131.301605 Days

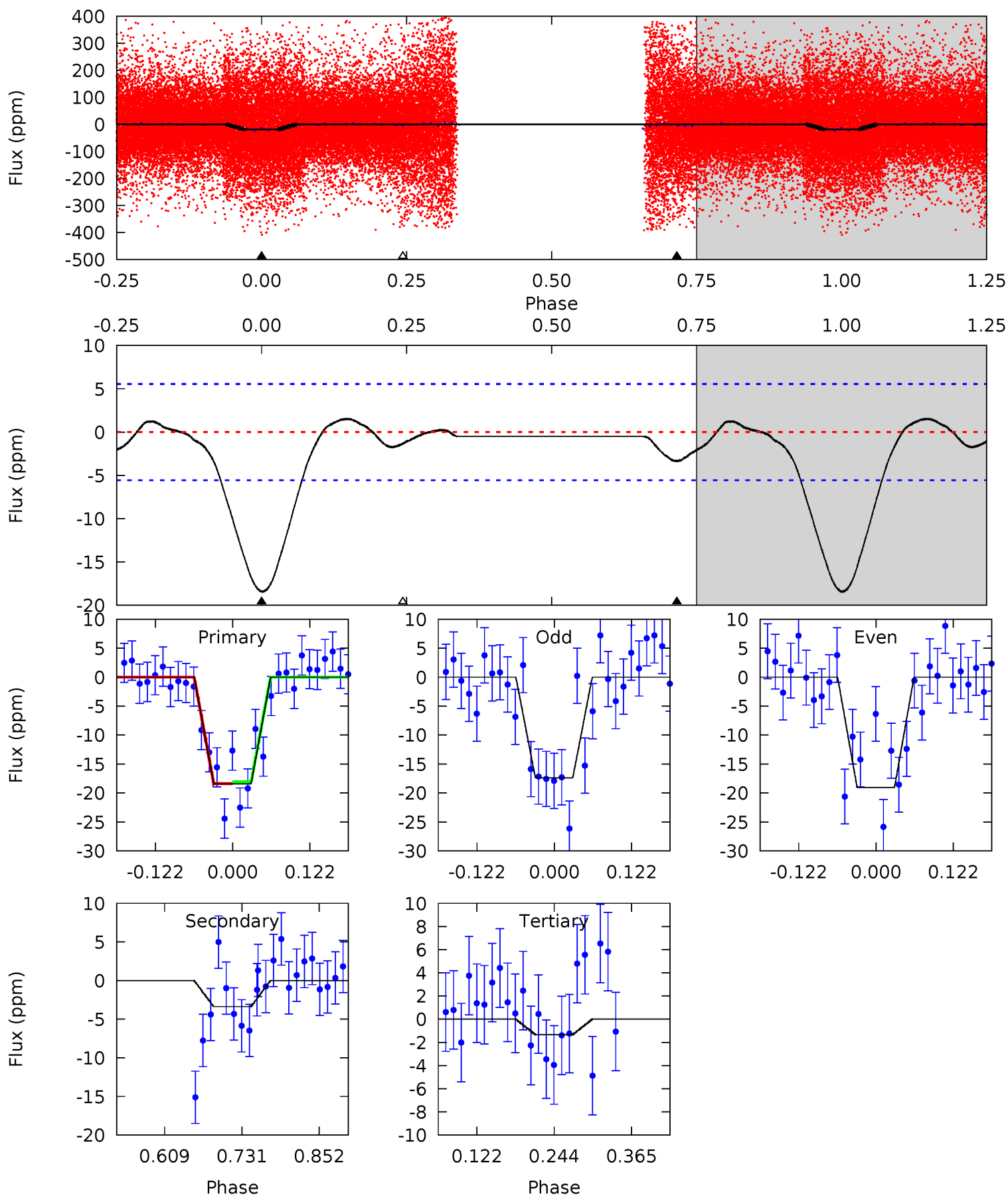
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
9.49	0.93	0.18	0	4.49	1.47	1.36	9.31	9.49	0.75	0.93	1.92	1.04	0.20	2.51



# Alt Model-Shift Uniqueness Test

005709103-02, P = 0.664736 Days, E = 131.294596 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
15.0	2.74	1.09	0	4.52	1.55	0.76	13.9	15.0	1.66	2.74	0.68	0.99	0.08	0.14



### Stellar Parameters For KIC 005709103

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6143^{+83}_{-92}$	$4.344^{+0.110}_{-0.121}$	$-0.200^{+0.150}_{-0.150}$	$1.116^{+0.189}_{-0.126}$	$1.001^{+0.073}_{-0.059}$	$1.015^{+0.421}_{-0.349}$
	+1%/-1%	+3%/-3%	+75%/-75%	+17%/-11%	+7%/-6%	+41%/-34%
Source	SPE68	SPE68	SPE68	DSEP		

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

### Secondary Eclipse Parameters for KIC 005709103-02 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-1 \pm 1$	$0.34^{+0.10}_{-0.09}$	$3270^{+142}_{-131}$	$3678^{+962}_{-7073}$	$0.934^{+1.786}_{-1.015}$
Alt.	$-3 \pm 1$	$0.54^{+0.11}_{-0.11}$	$3277^{+150}_{-131}$	$4045^{+473}_{-508}$	$1.456^{+0.985}_{-0.665}$

$T_{max}$  = 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

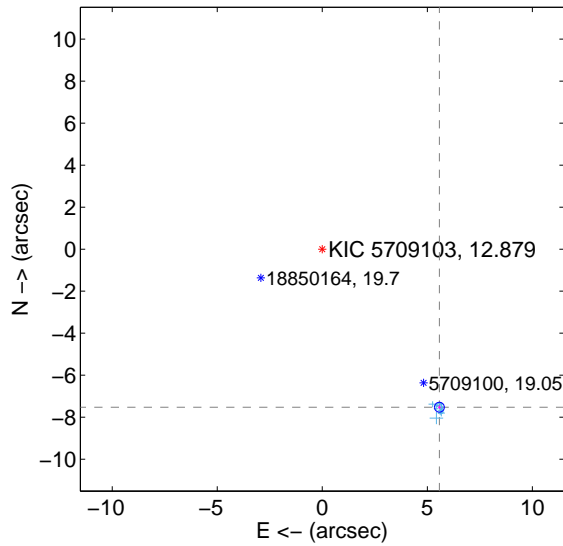
Supplemental centroid analysis for 005709103-02. Kepler magnitude: 12.88. Transit SNR 4.33

There are 17 quarters with good PRF difference image offsets

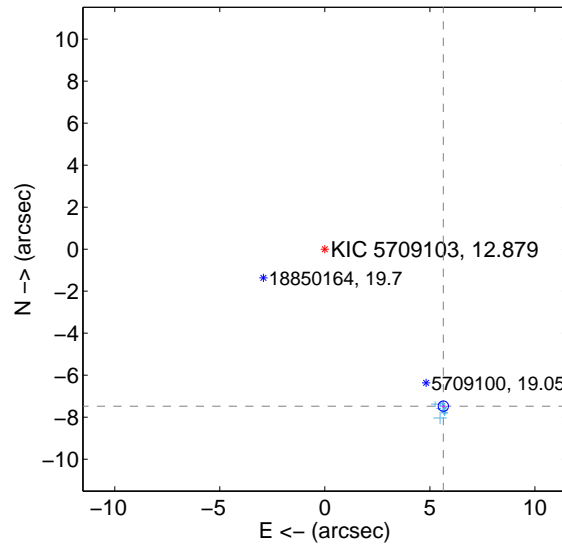
The direct PRF centroid is offset from the target star catalog position by about 0.05 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$9.363 \pm 0.078$	119.97	$-5.574 \pm 0.074$	$-7.523 \pm 0.079$
PRF-fit source offset from KIC position	$9.363 \pm 0.082$	114.25	$-5.641 \pm 0.074$	$-7.473 \pm 0.081$
photometric centroid source offset	$1.92 \pm 2.13$	0.90	$-1.78 \pm 2.14$	$0.71 \pm 2.11$

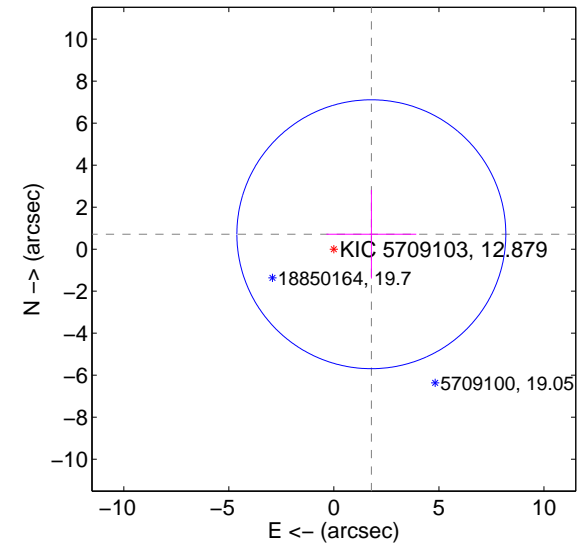
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

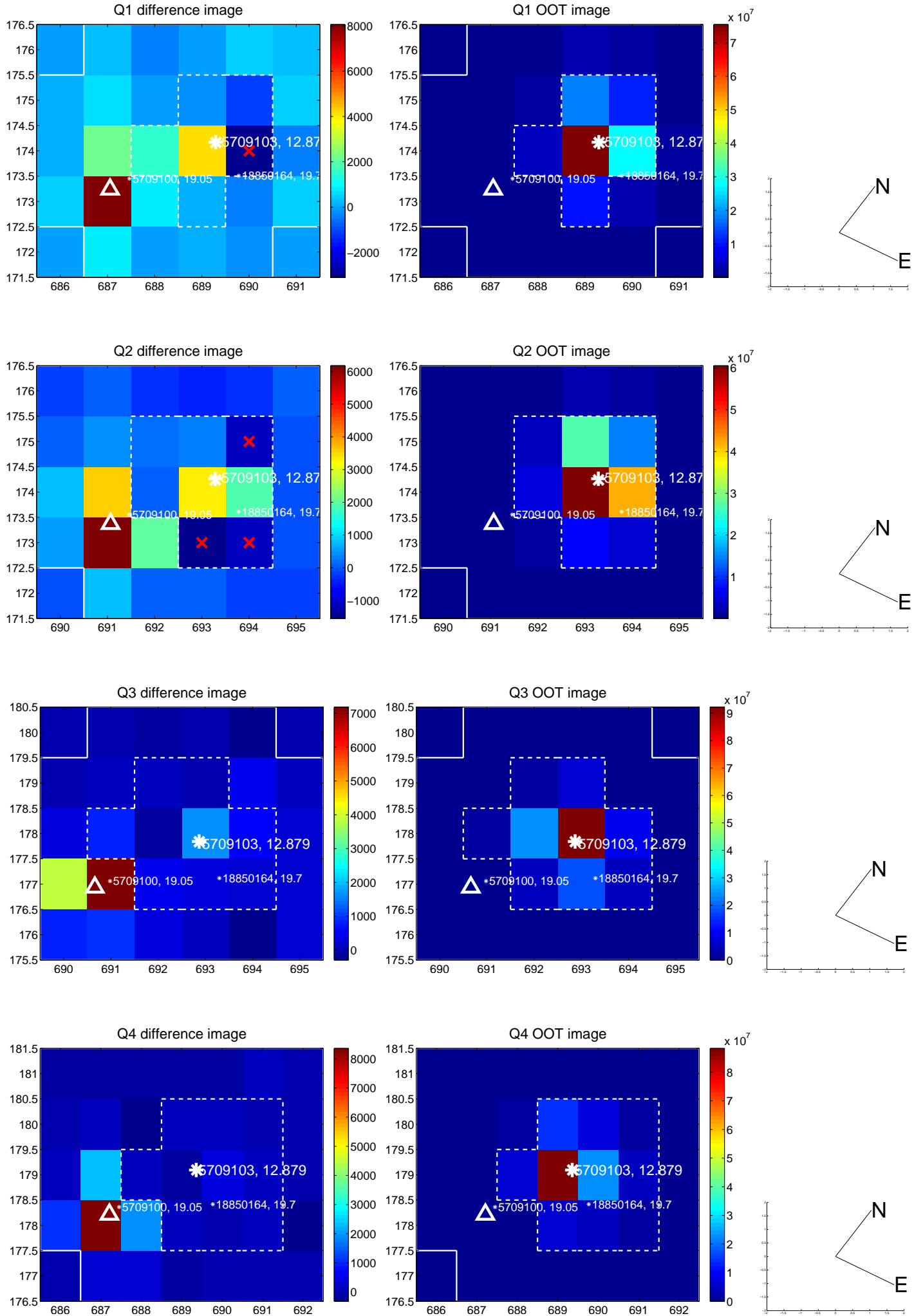


offset from photometric centroids

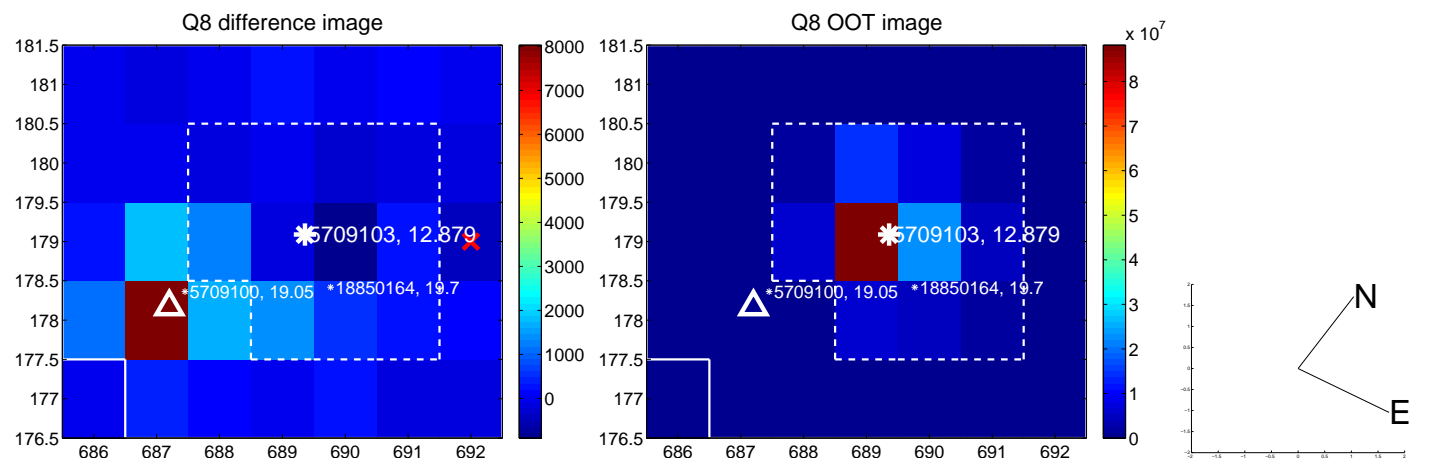
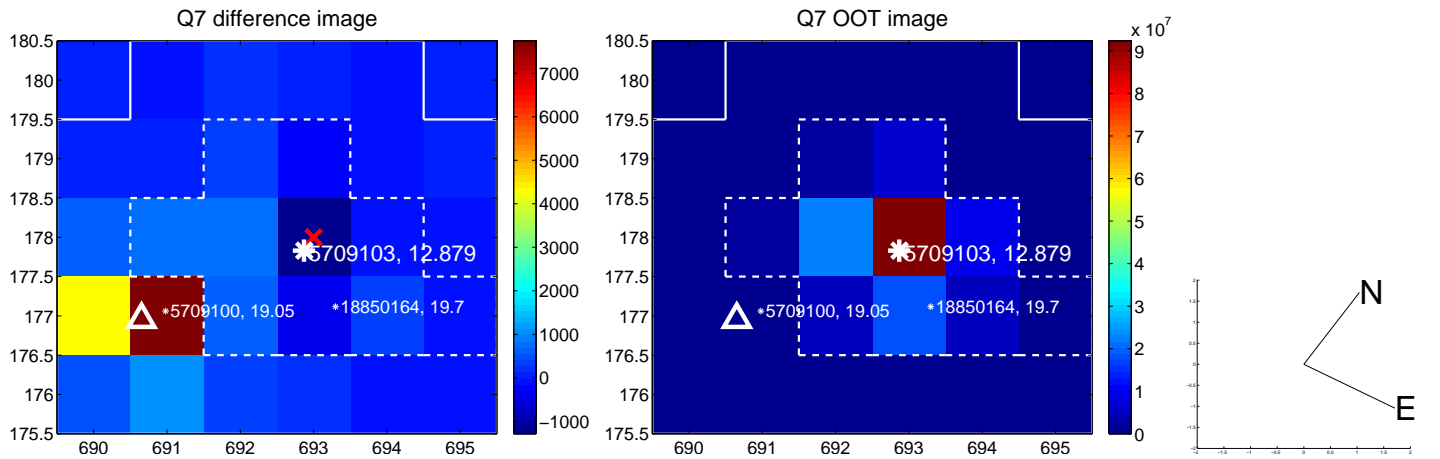
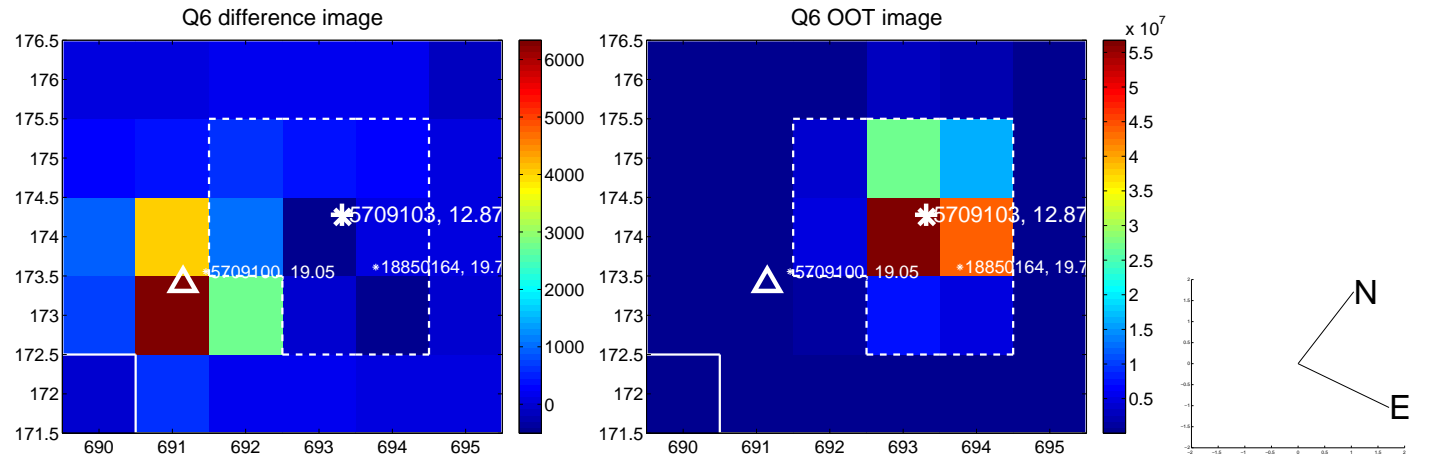
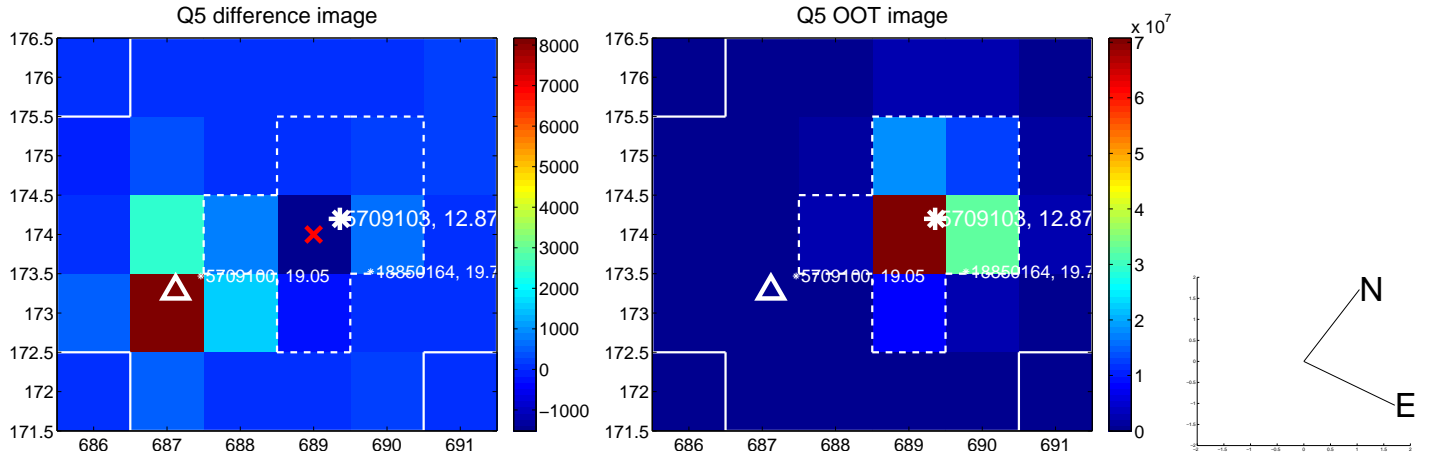


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three- $\sigma$ . Red \*: target star. Blue \*: Other stars. Text next to a star gives its KIC ID and kepmag. KIC IDs > 15,000,000 are from the UKIRT catalog.

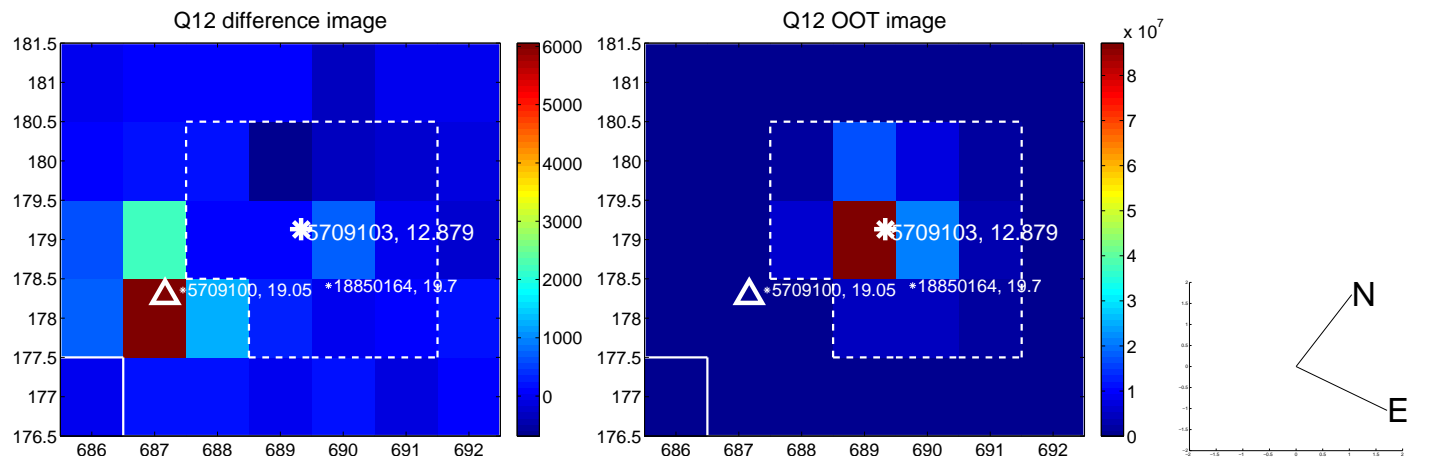
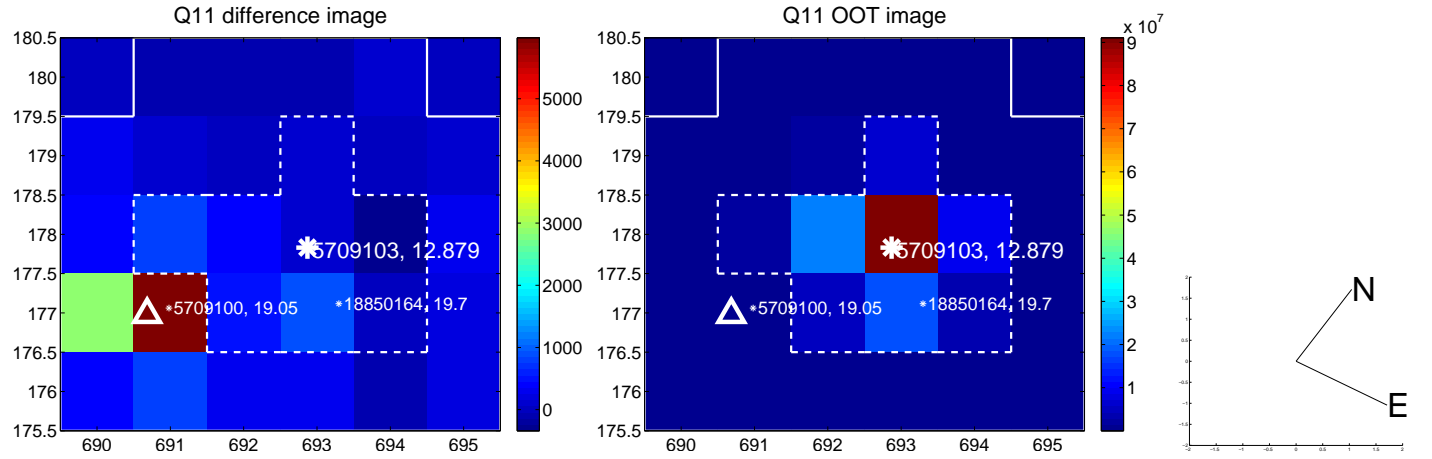
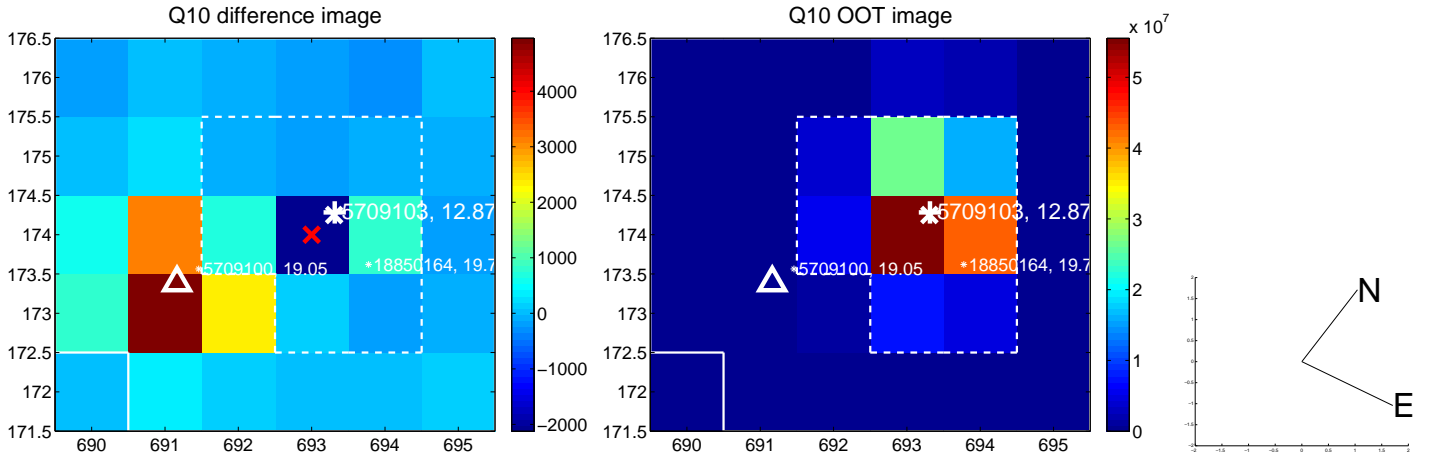
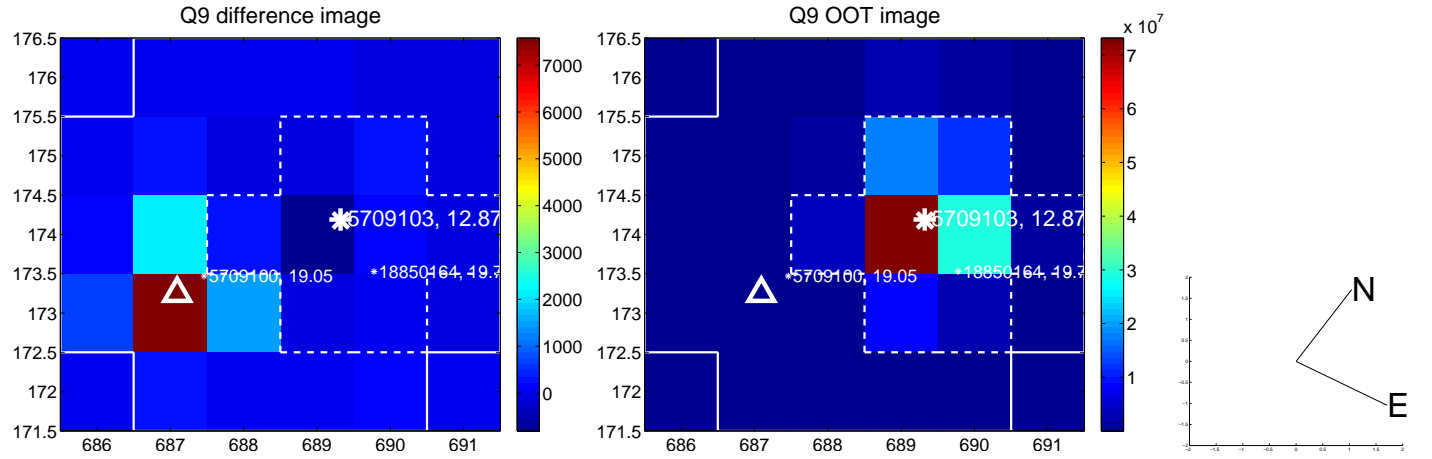
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



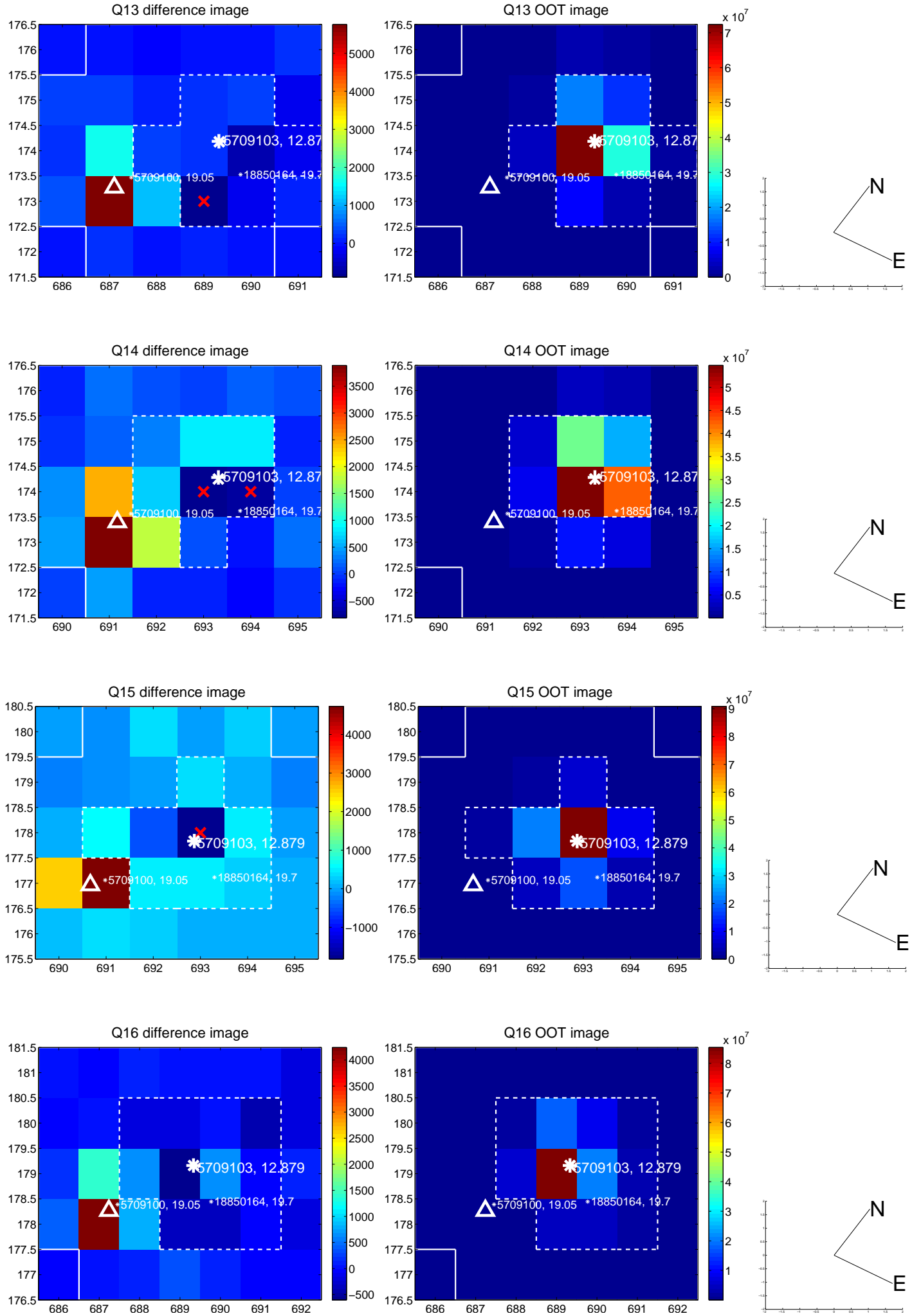
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

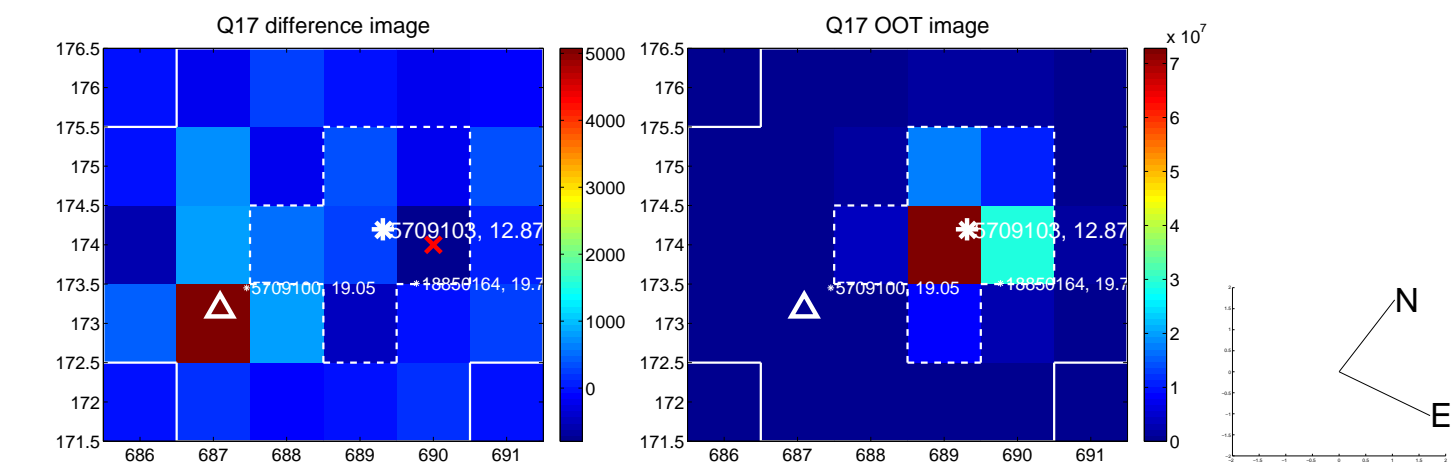


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

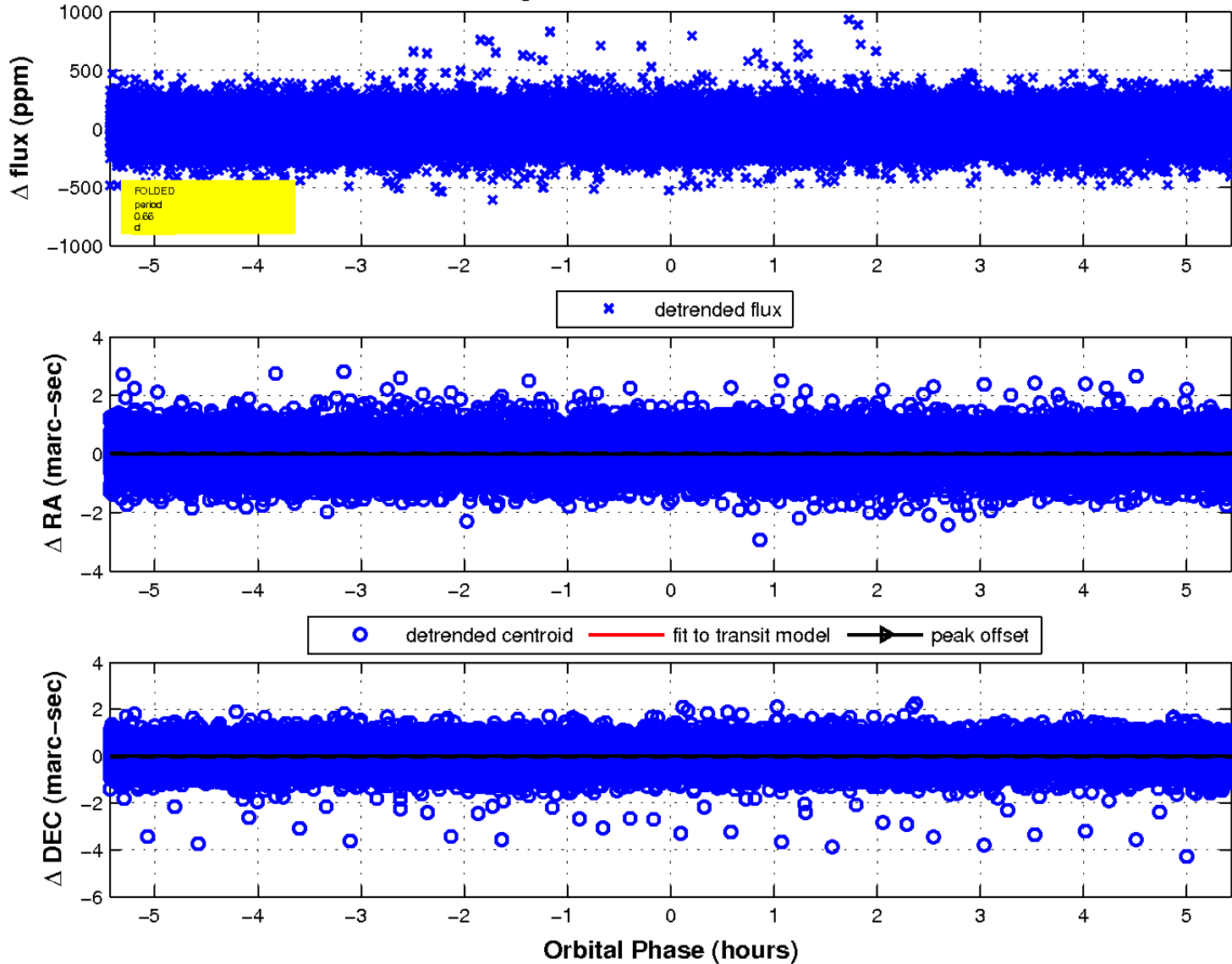




white  $\times$ : KIC target position; +: OOT centroid;  $\Delta$ : difference centroid. red  $\times$ : large negative pixel value.

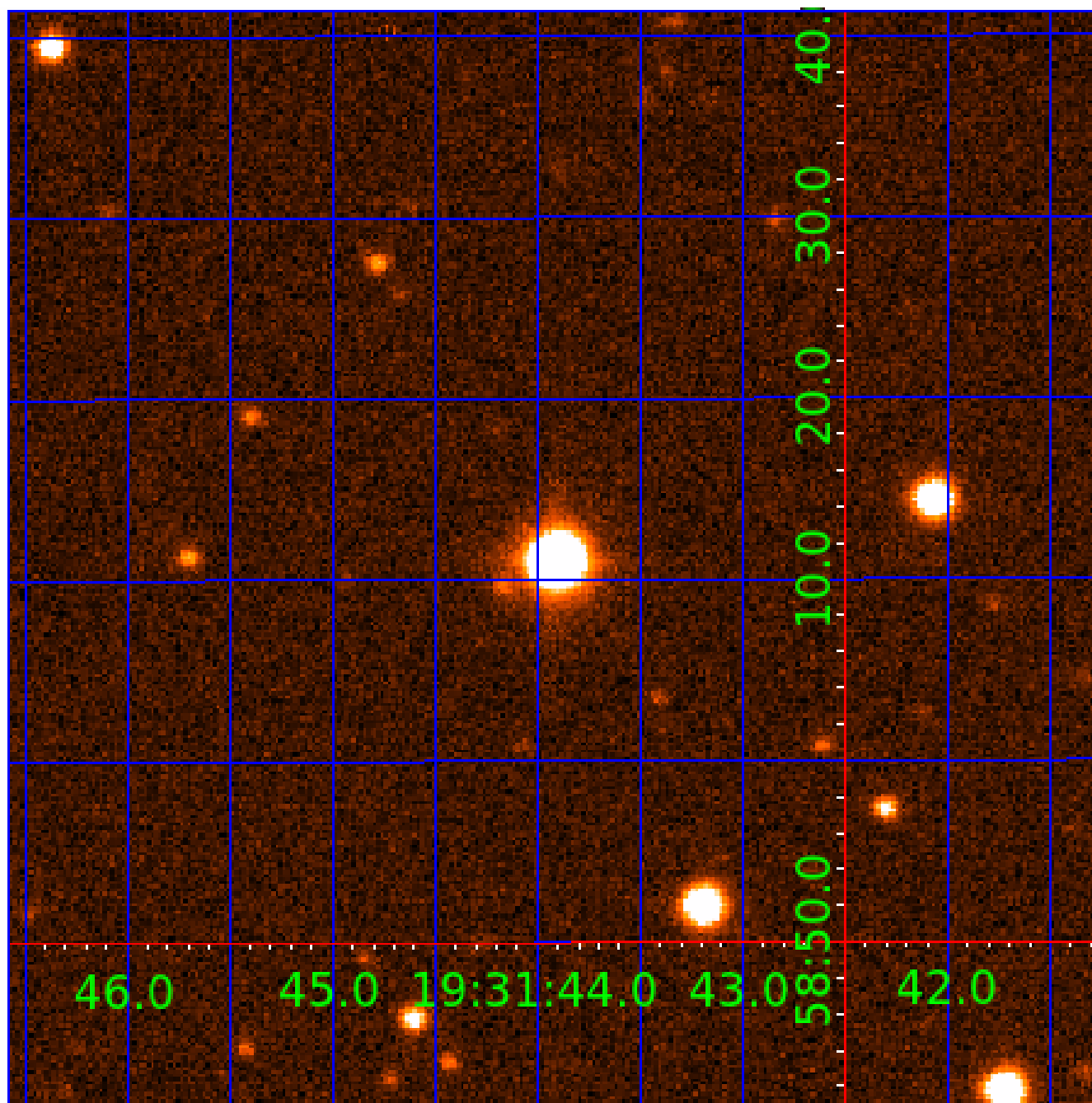


fluxWeightedCentroids, Planet 2 of 4



UKIRT Image

Declination



# KIC 005709103

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
005709103-01	OBS	7736.01	0.664732	131.629798	17.7	1.602	8.0	9.2	1.12	6143	0.55	7133.95
005709103-02	OBS	No	0.664721	131.966326	7.9	1.811	7.9	4.3	1.12	6143	0.34	7134.11
005709103-03	OBS	No	134.647320	145.004757	245.1	1.925	10.0	5.7	1.12	6143	1.94	6.00
005709103-04	OBS	No	197.644083	204.933496	299.4	3.093	9.4	5.6	1.12	6143	2.19	3.60

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
005709103-01	OBS	FP	0.00	0	1	1	0	HAS_SEC_TCE—CENT_RESOLVED_OFFSET
005709103-02	OBS	FP	0.00	1	1	1	0	IS_SEC_TCE—CENT_RESOLVED_OFFSET
005709103-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT
005709103-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL—TRANS_GAPPED—ALL_TRANS_CHASES—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS

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

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

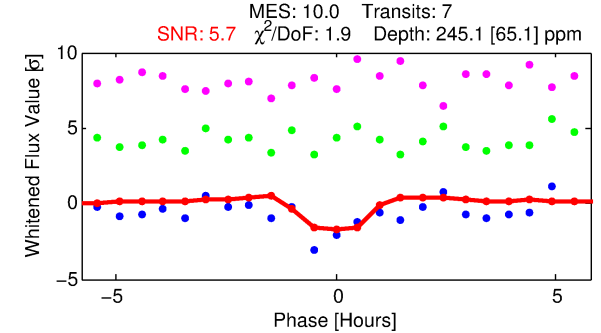
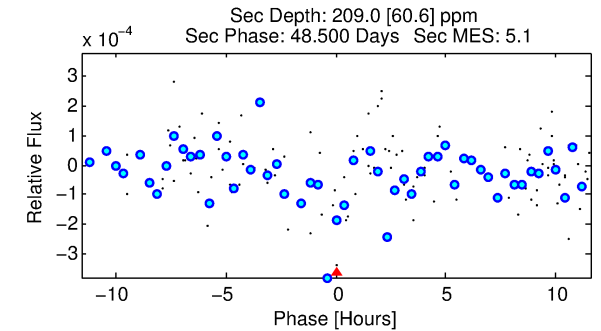
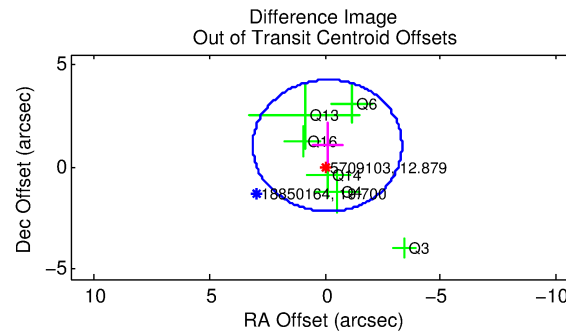
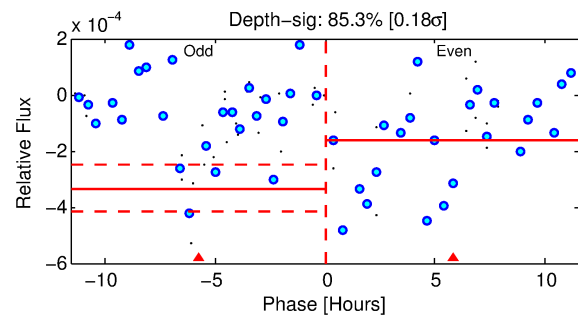
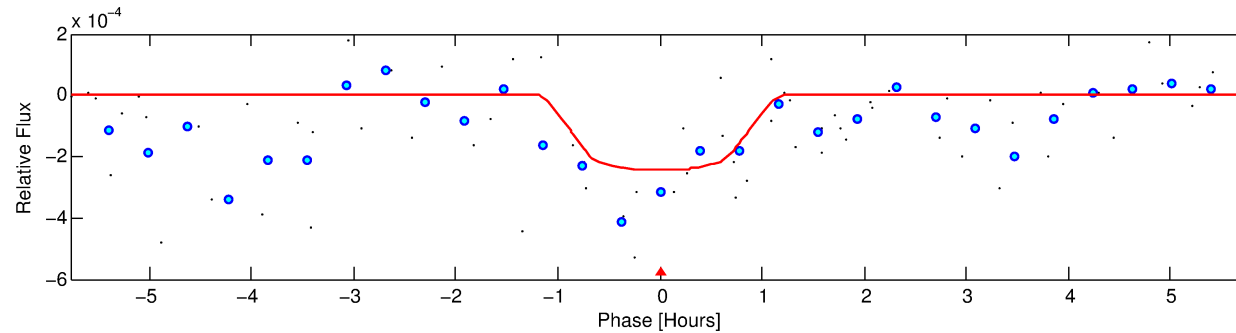
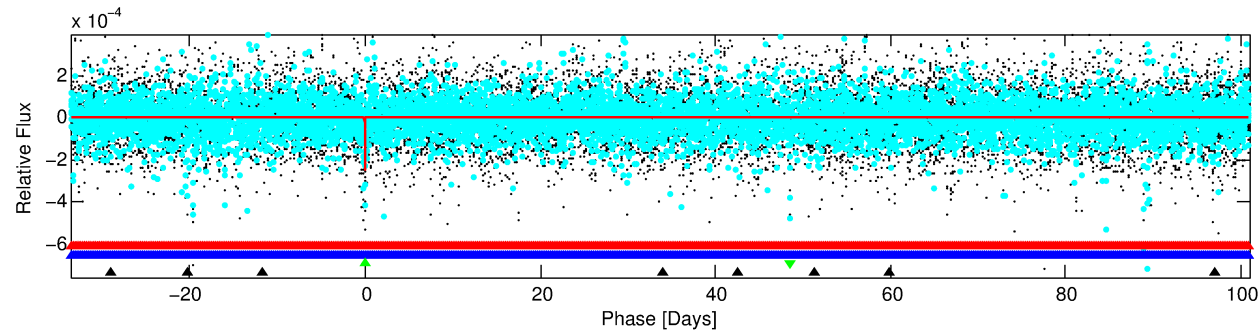
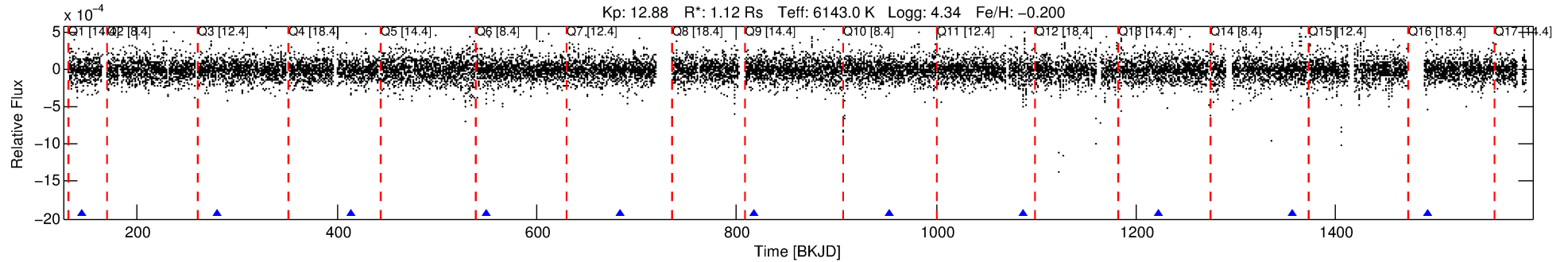
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 005709103-03

No Significant Match Found

# DV One-Page Summary

KIC: 5709103 Candidate: 3 of 4 Period: 134.647 d



## DV Fit Results:

Period = 134.64732 [0.00117] d  
Epoch = 145.0048 [0.0078] BKJD  
Rp/R\* = 0.0159 [0.0290]  
a/R\* = 334.78 [3111.71]  
b = 0.80 [4.25]  
Seff = 6.00 [1.35]  
Teq = 399 [22] K  
Rp = 1.94 [3.54] Re  
a = 0.5148 [0.0753] AU  
Ag = 8124.44 [29753.86] [0.27 $\sigma$ ]  
Teffp = 5857 [5354] K [1.02 $\sigma$ ]

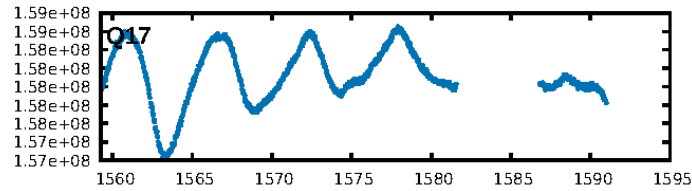
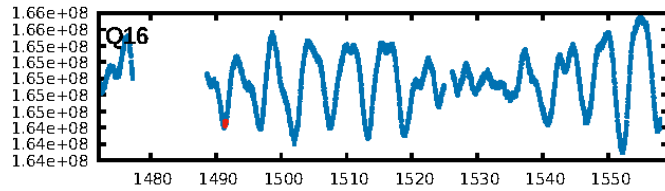
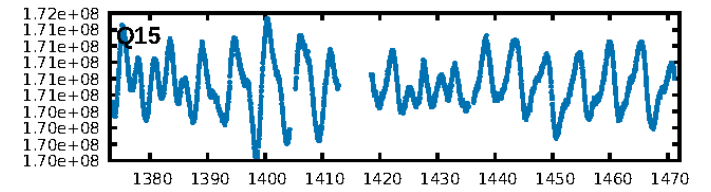
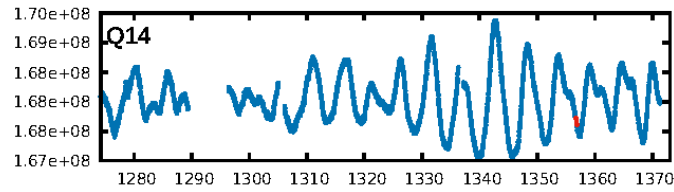
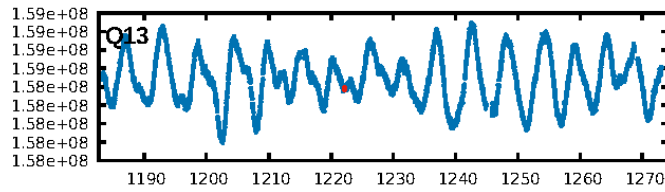
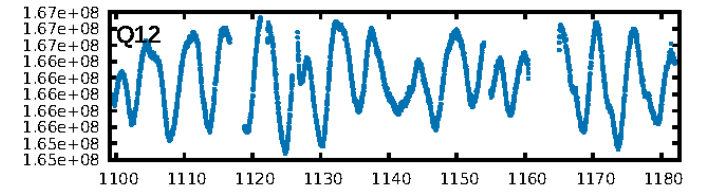
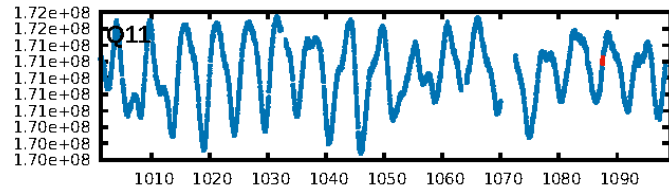
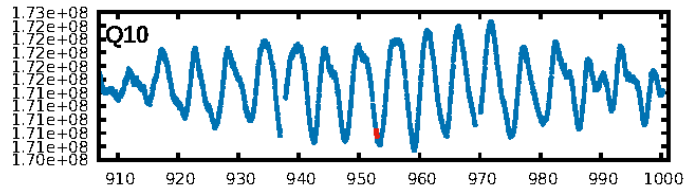
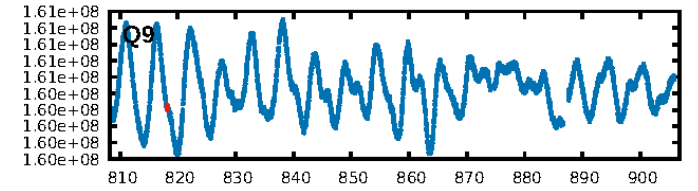
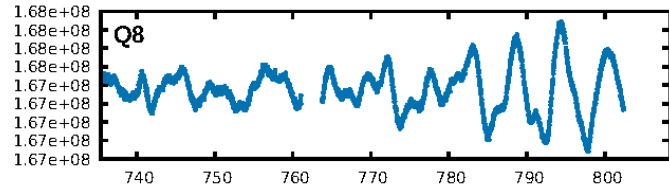
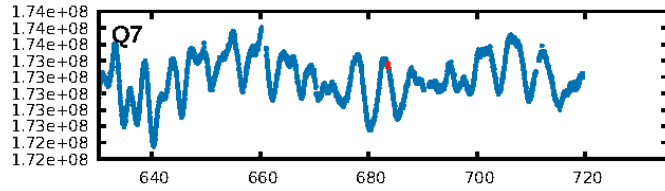
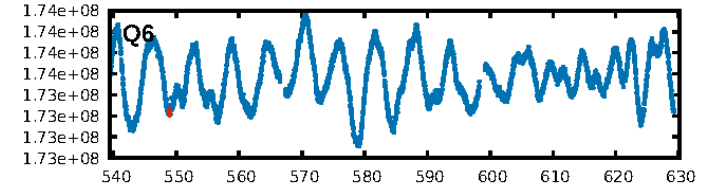
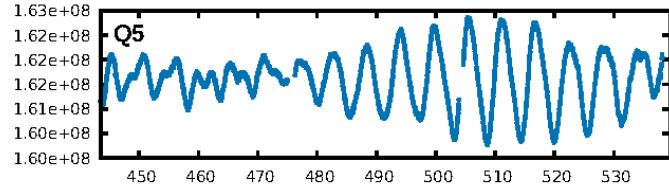
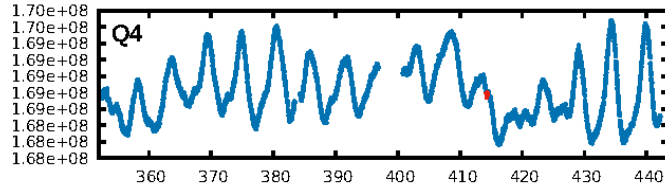
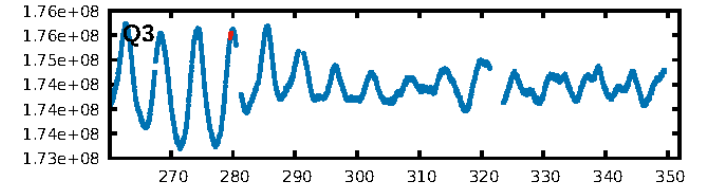
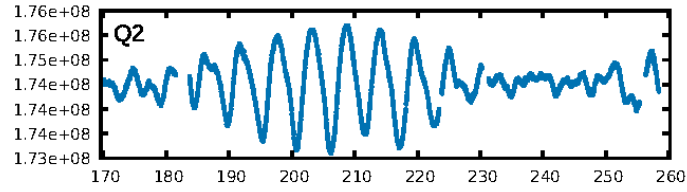
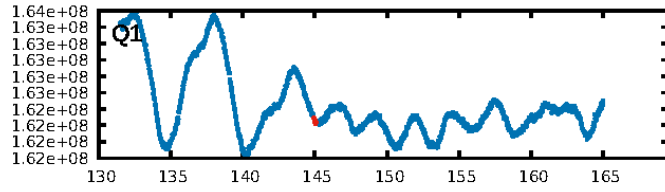
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [1284.21 $\sigma$ ]  
LongPeriod-sig: 100.0% [415.02 $\sigma$ ]  
ModelChiSquare2-sig: 10.7%  
ModelChiSquareGof-sig: 97.7%  
Bootstrap-pfa: 2.31e-13  
RollingBand-fgt: 1.00 [6/6]  
**GhostDiagnostic-chr: 3.557**  
Centroid-sig: 2.7%  
Centroid-so: 1.598 arcsec [1.78 $\sigma$ ]  
OotOffset-rm: 1.037 arcsec [0.97 $\sigma$ ]  
OotOffset-st: 2/1/2/1 [6]  
KicOffset-rm: 1.059 arcsec [1.11 $\sigma$ ]  
KicOffset-st: 2/1/2/1 [6]  
DiffImageQuality-fgm: 0.33 [2/6]  
DiffImageOverlap-fno: 0.00 [0/11]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 13:46:57 Z

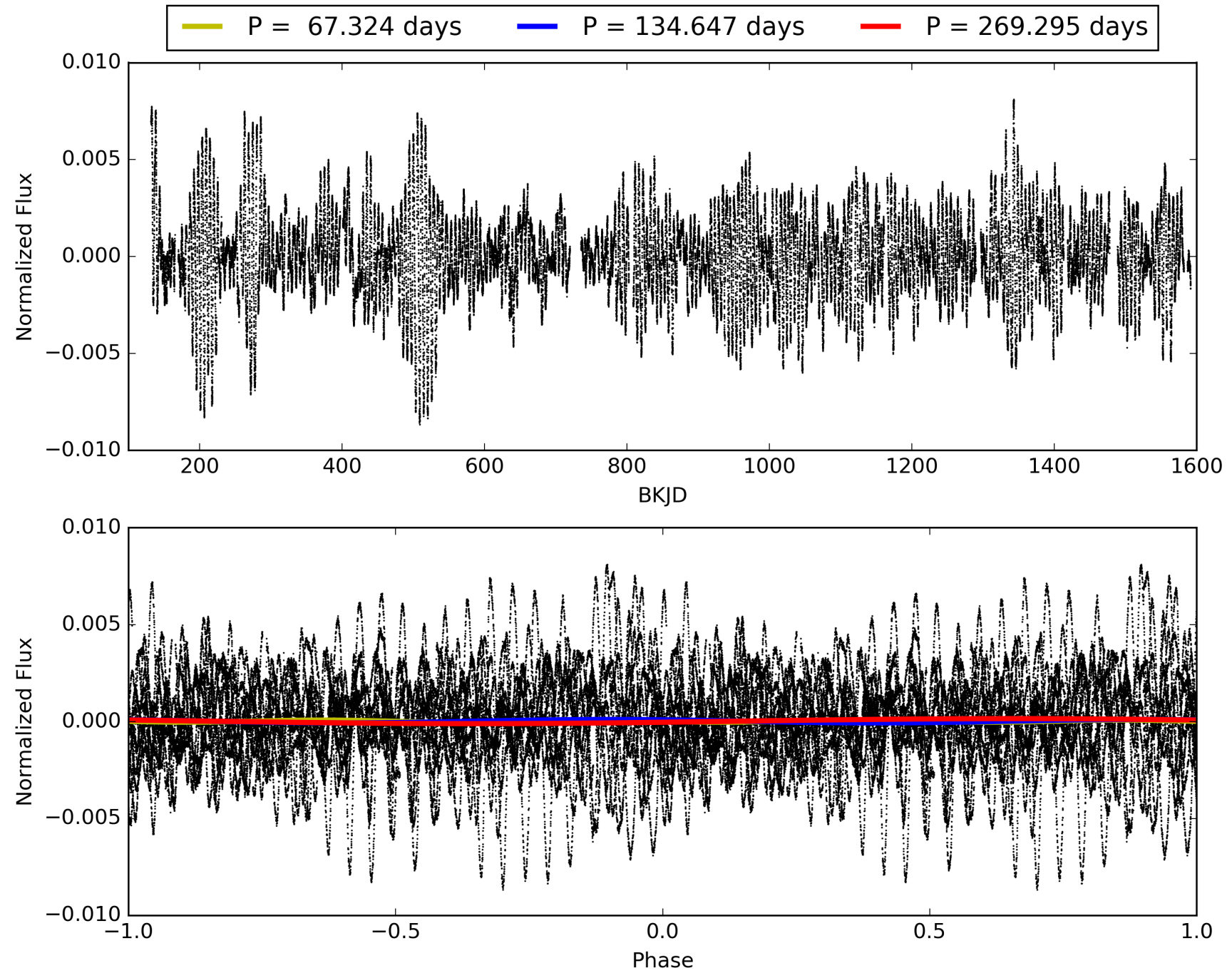
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 005709103-03, PDC Light Curves



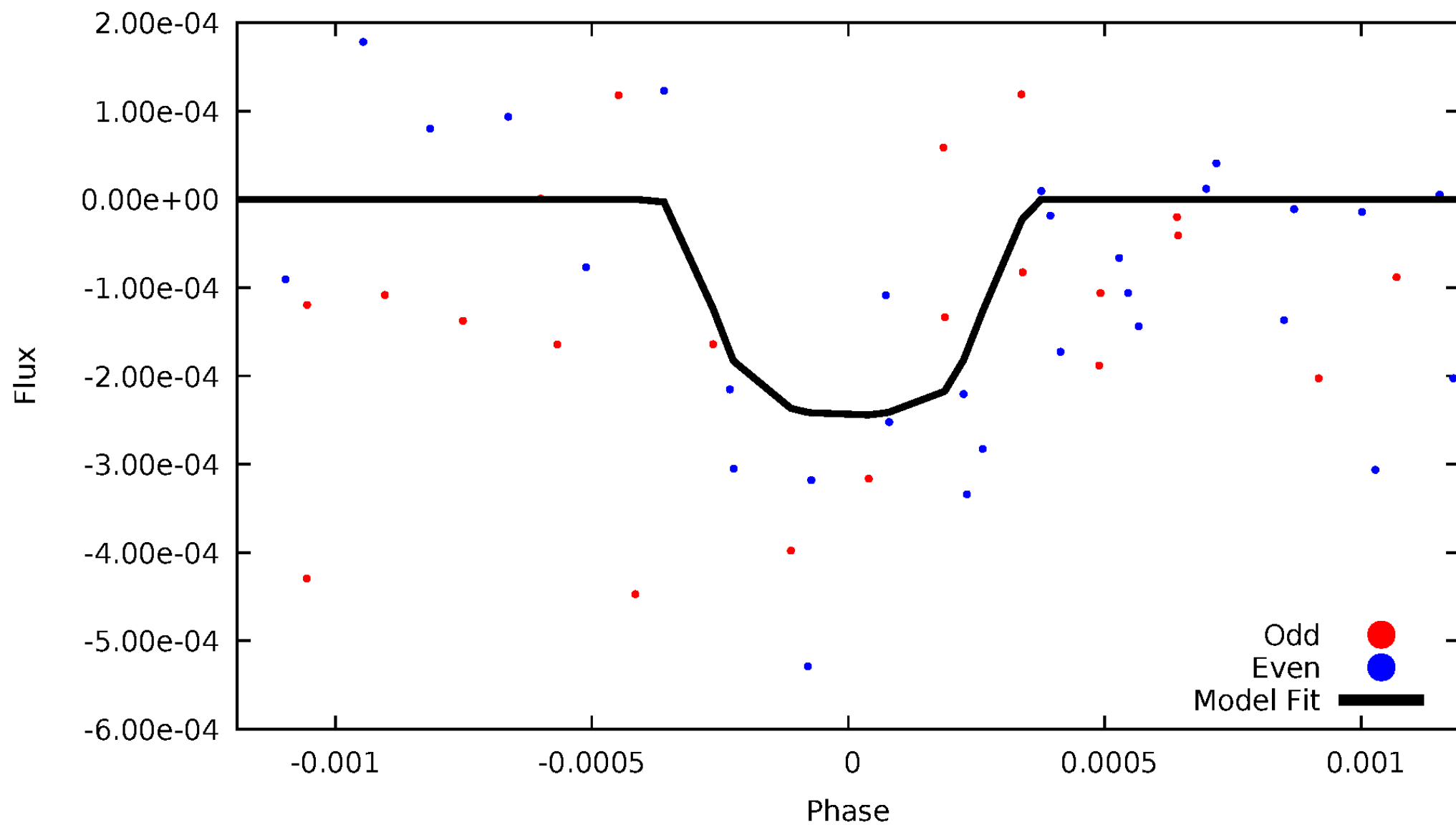


TCE 005709103-03



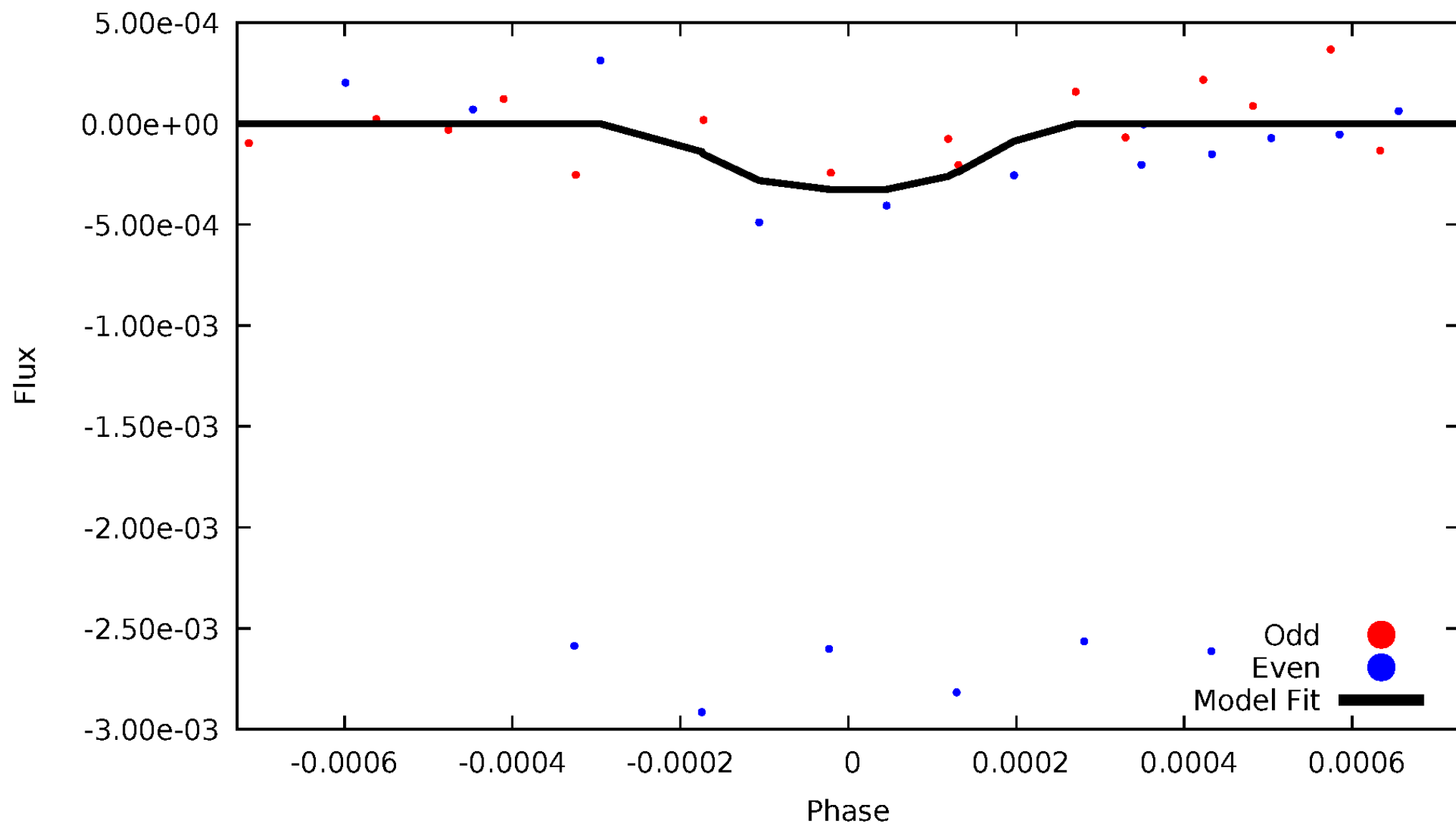
# DV Odd/Even

TCE 005709103-03



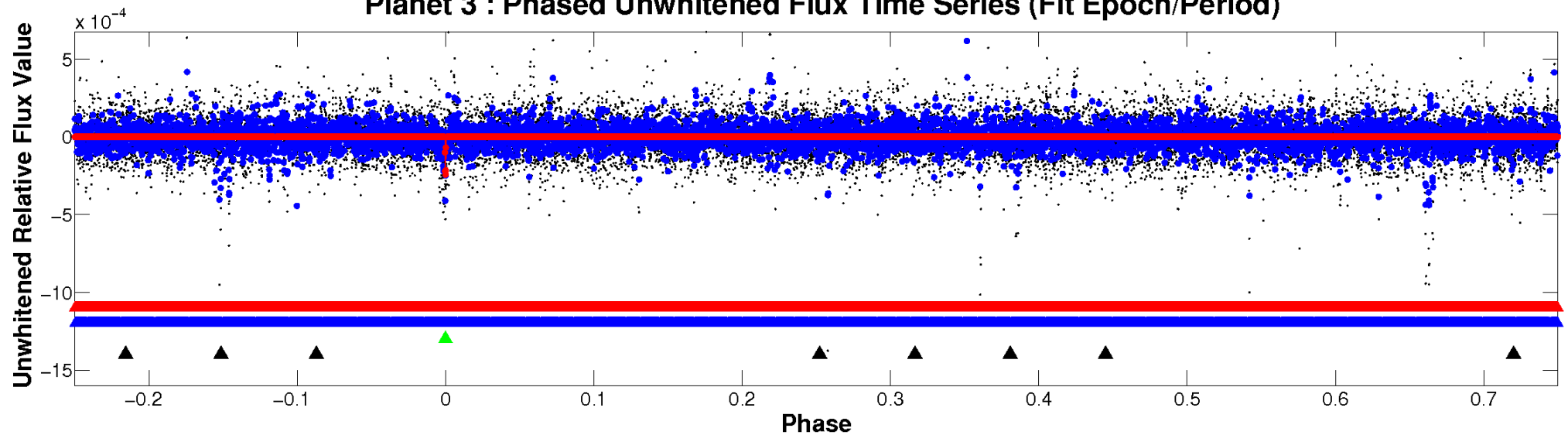
# ALT Odd/Even

TCE 005709103-03

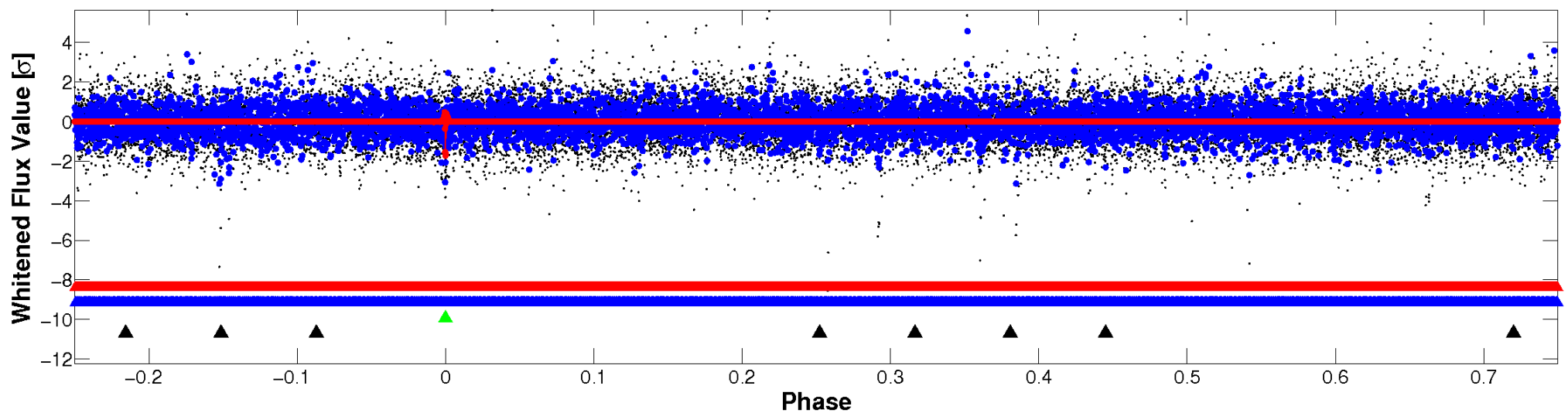


# Non-Whitened Vs. Whitened Light Curve

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

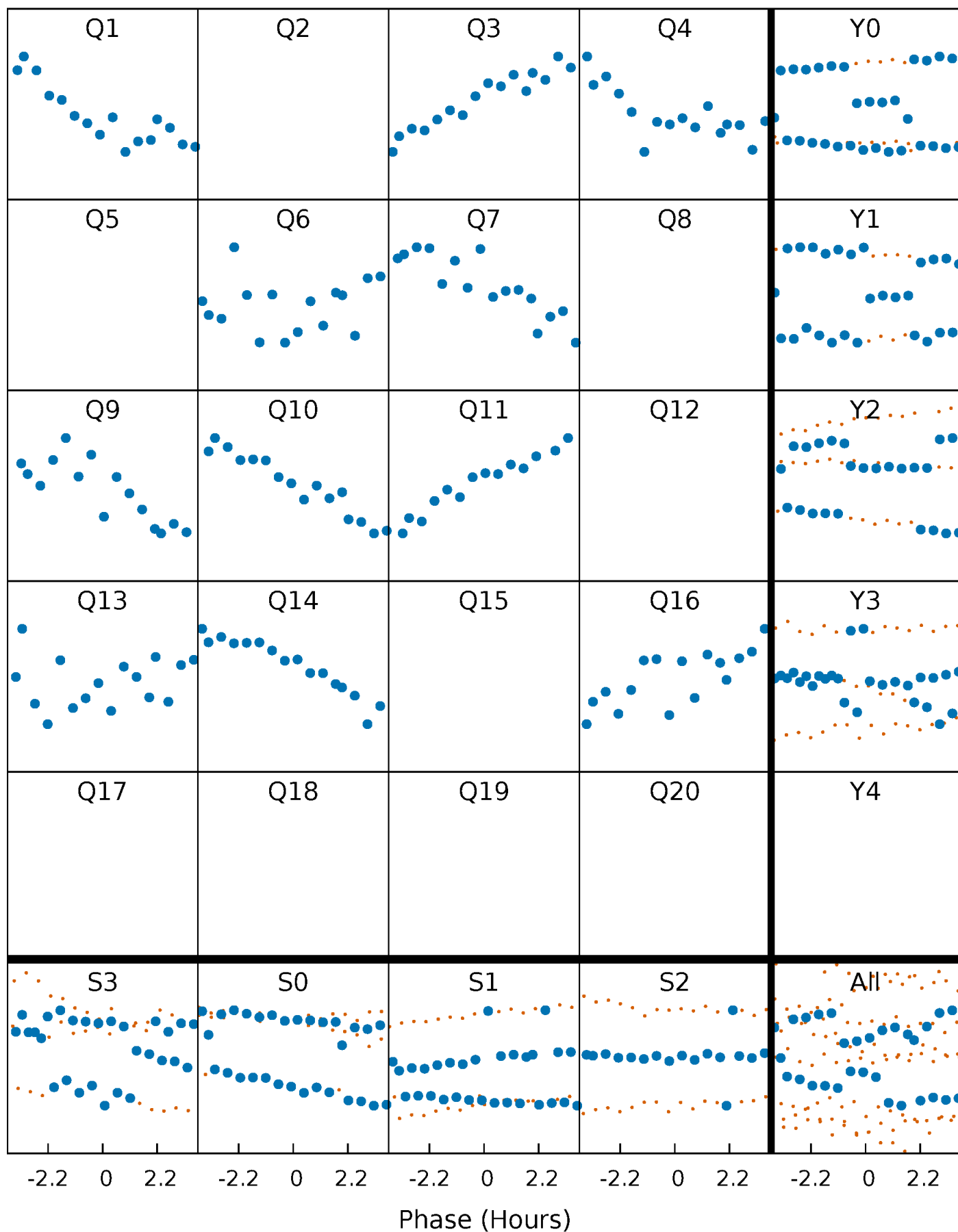


Planet 3 : Phased Whitened Flux Time Series (Fit Epoch/Period)



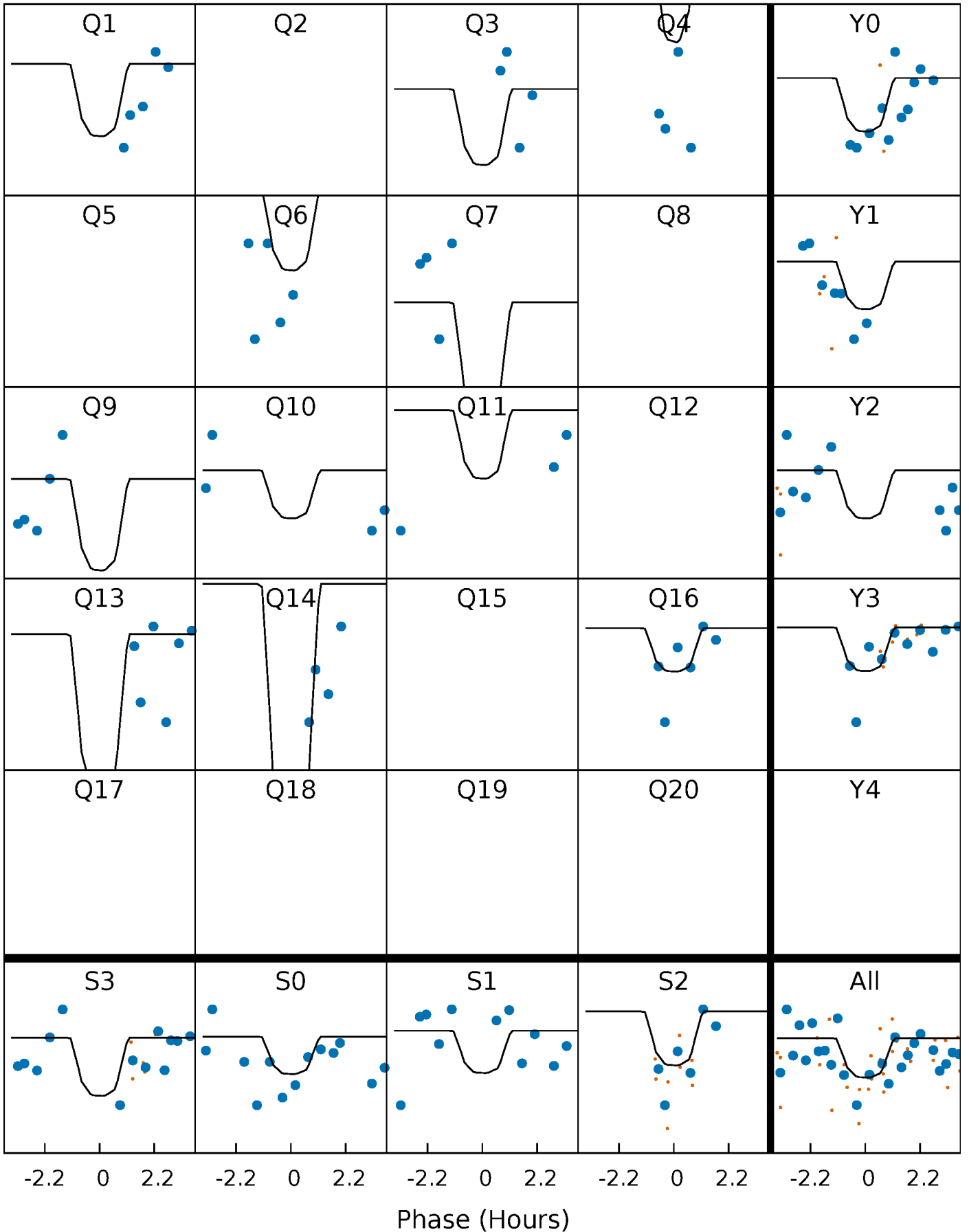
# PDC Quarter-Phased Transit Curves

TCE 005709103-03 P=134.647320 Days  $T_0=145.004757$  (BKJD)



# DV Quarter-Phased Transit Curves

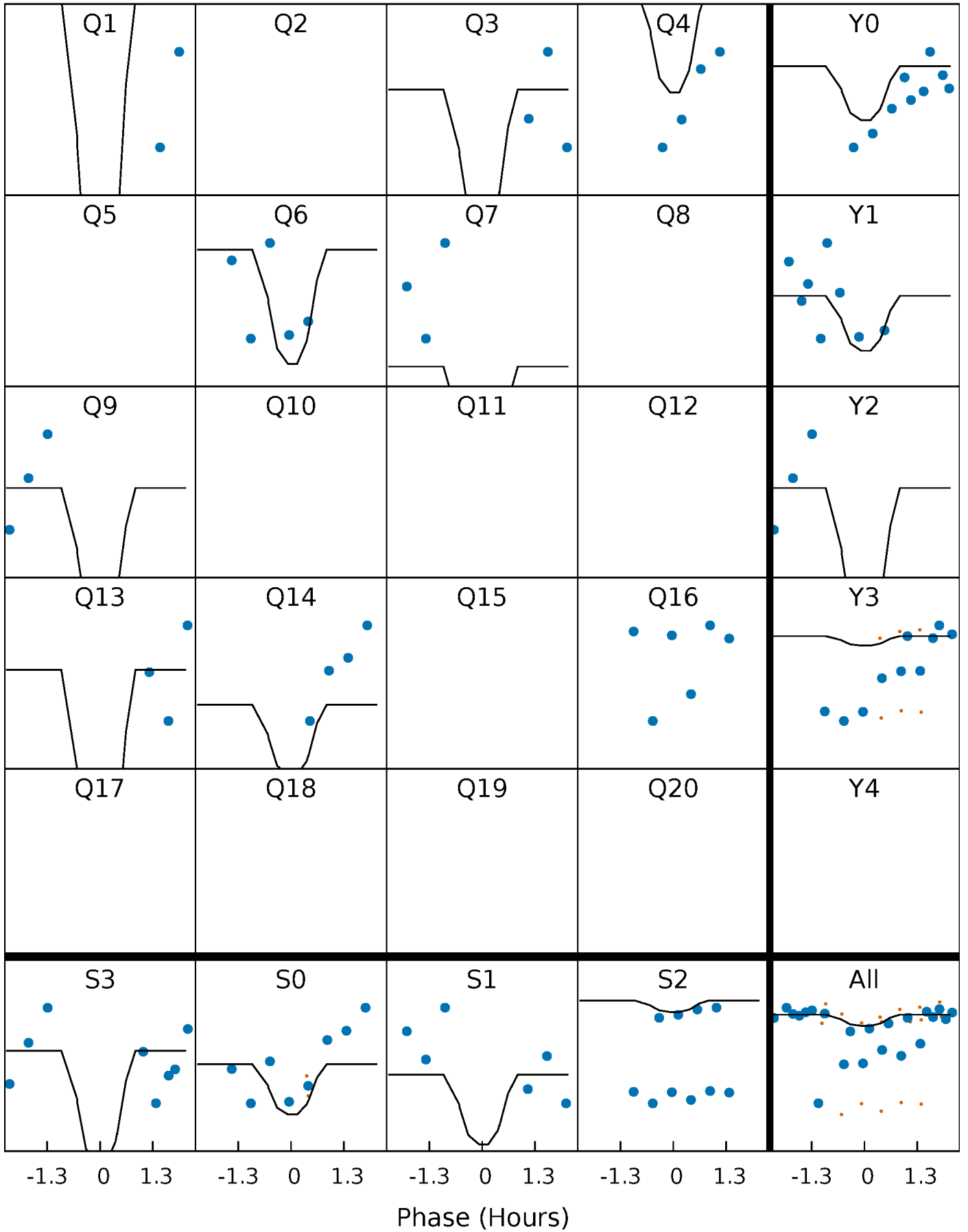
TCE 005709103-03 P=134.647320 Days  $T_0=145.004757$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

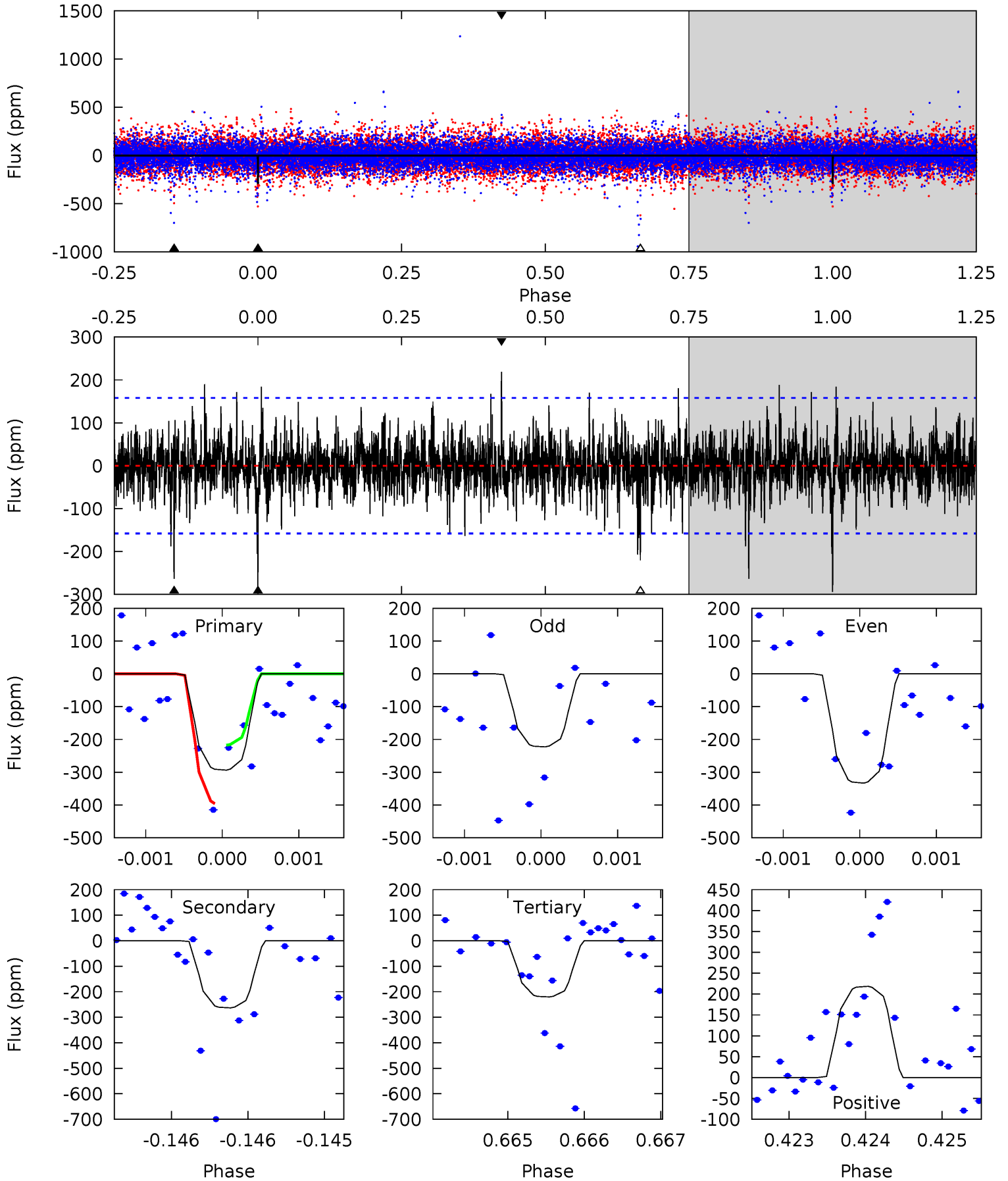
TCE 005709103-03 P=134.650910 Days  $T_0=144.981732$  (BKJD)



# DV Model-Shift Uniqueness Test

005709103-03, P = 134.647320 Days, E = 10.357437 Days

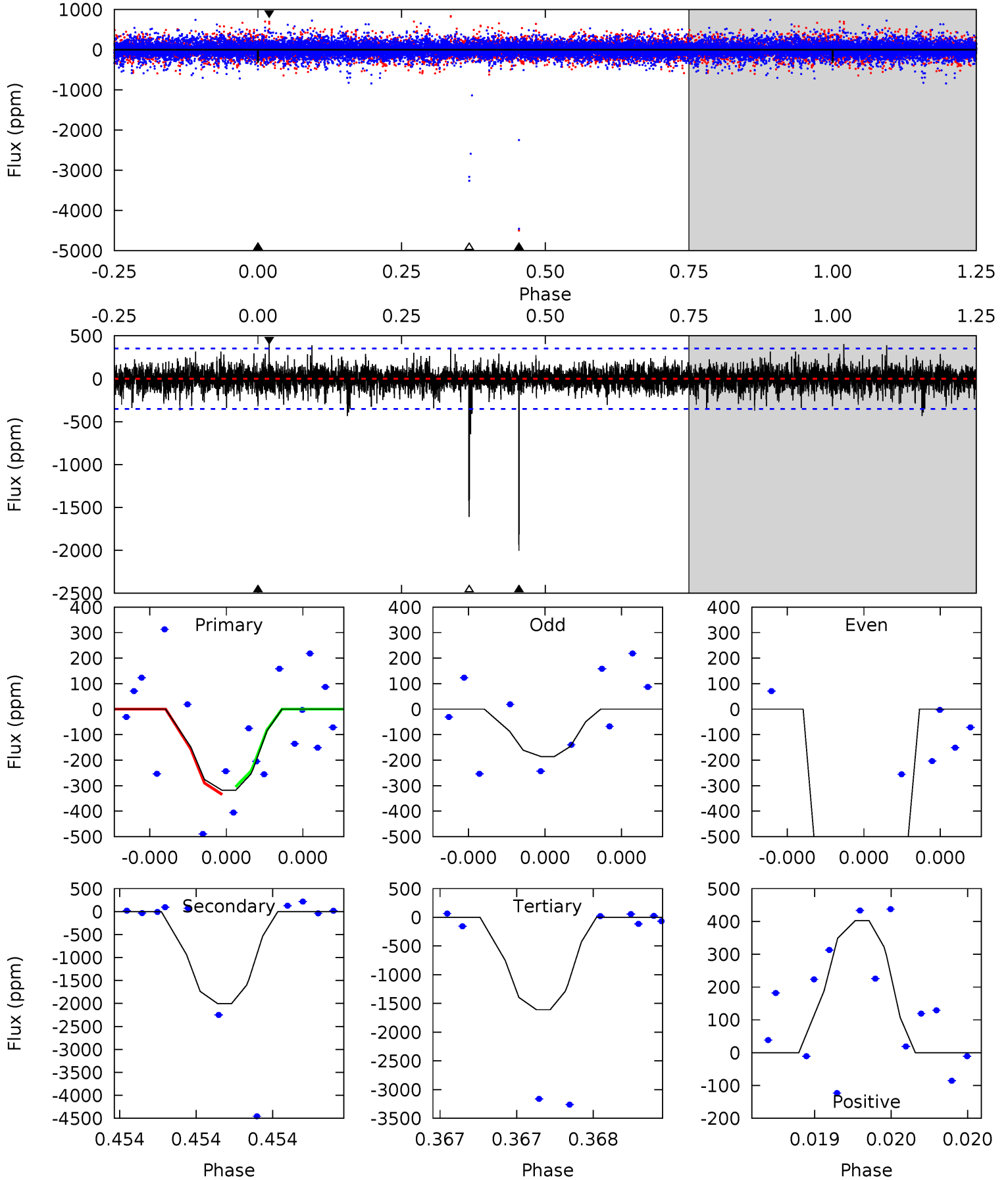
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
10.2	9.18	7.68	7.62	5.51	3.38	1.56	2.56	2.62	1.50	1.56	1.91	0.69	0.43	3.01



# Alt Model-Shift Uniqueness Test

005709103-03, P = 134.650910 Days, E = 10.330822 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
5.09	32.0	25.7	6.44	5.62	3.56	1.40	-20.7	-1.35	6.31	25.6	7.45	2.81	0.17	0.24



### Stellar Parameters For KIC 005709103

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6143^{+83}_{-92}$	$4.344^{+0.110}_{-0.121}$	$-0.200^{+0.150}_{-0.150}$	$1.116^{+0.189}_{-0.126}$	$1.001^{+0.073}_{-0.059}$	$1.015^{+0.421}_{-0.349}$
	+1%/-1%	+3%/-3%	+75%/-75%	+17%/-11%	+7%/-6%	+41%/-34%
Source	SPE68	SPE68	SPE68	DSEP		

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

### Secondary Eclipse Parameters for KIC 005709103-03 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-263 \pm 29$	$3.44^{+2.82}_{-2.29}$	$557^{+26}_{-21}$	$4824^{+3585}_{-1002}$	$3358^{+26687}_{-2404}$
Alt.	$-2005 \pm 63$	$3.62^{+2.99}_{-2.36}$	$557^{+25}_{-21}$	$7737^{+10990}_{-2159}$	$22685^{+163833}_{-16188}$

$T_{max}$  = 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

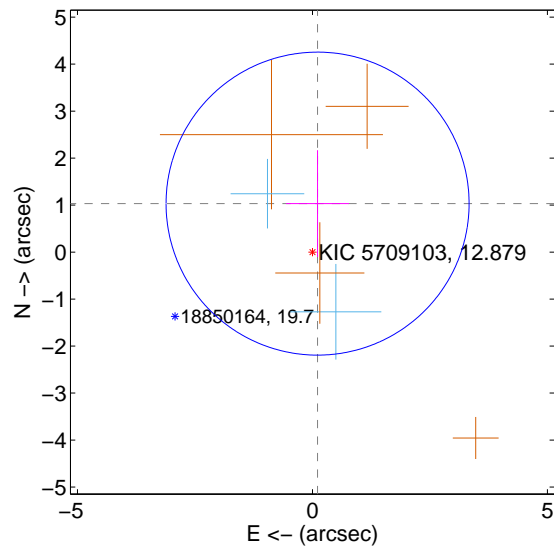
Supplemental centroid analysis for 005709103-03. Kepler magnitude: 12.88. Transit SNR 5.73

There are 2 quarters with good PRF difference image offsets

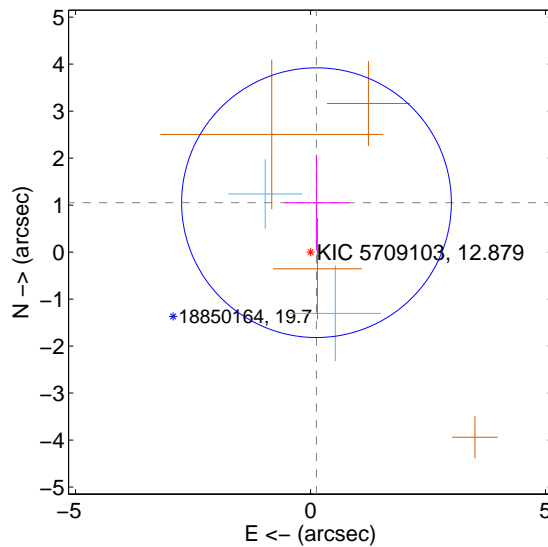
The direct PRF centroid is offset from the target star catalog position by about 0.01 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.037 \pm 1.075$	0.97	$-0.109 \pm 0.667$	$1.032 \pm 1.136$
PRF-fit source offset from KIC position	$1.059 \pm 0.957$	1.11	$-0.127 \pm 0.678$	$1.052 \pm 1.019$
photometric centroid source offset	$1.60 \pm 0.90$	1.78	$1.30 \pm 0.90$	$-0.93 \pm 0.90$

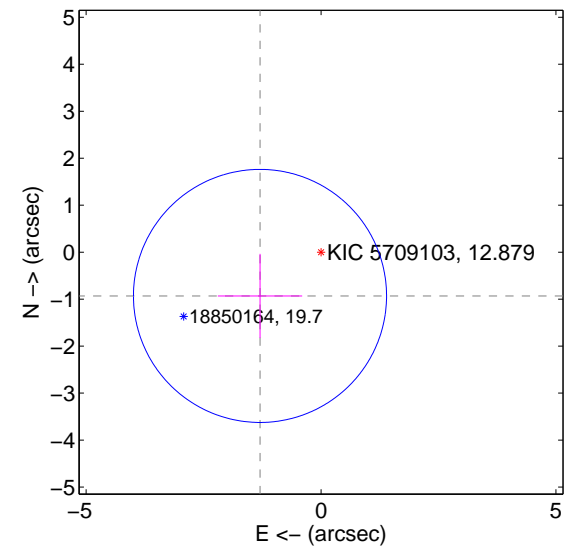
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

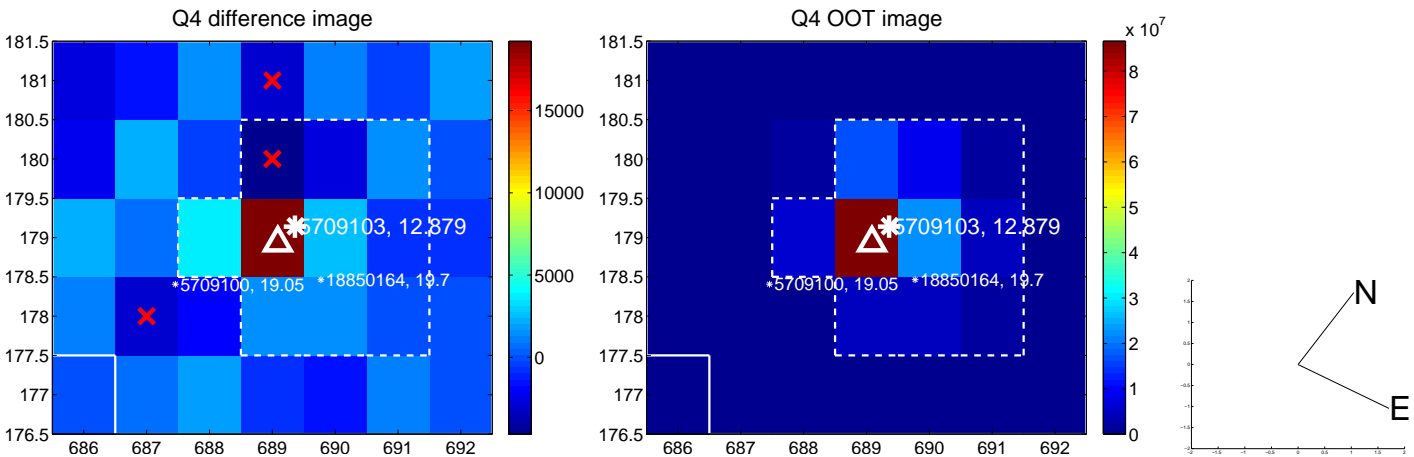
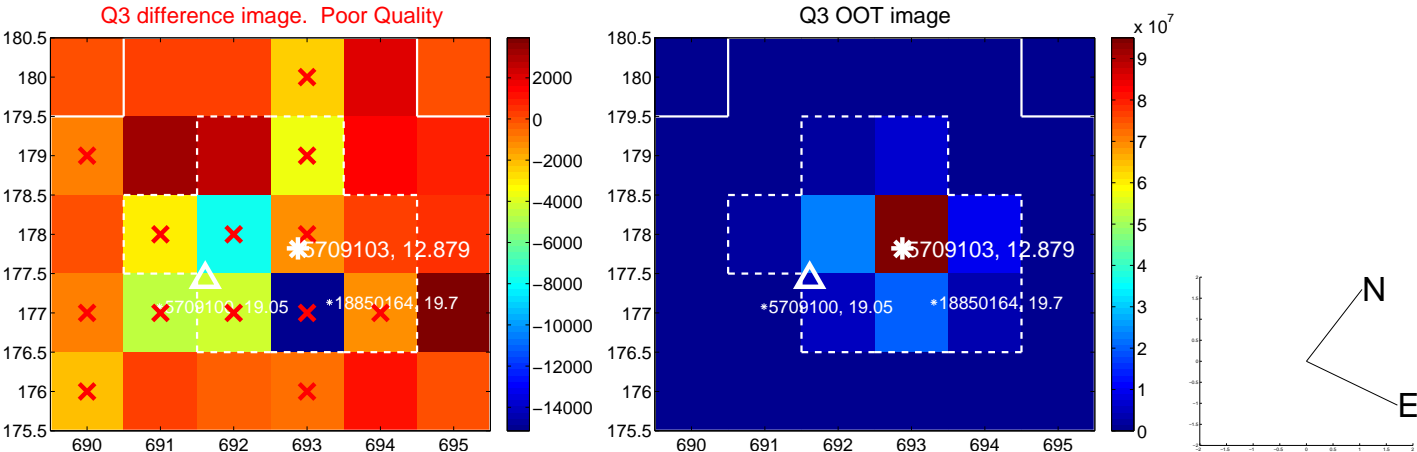
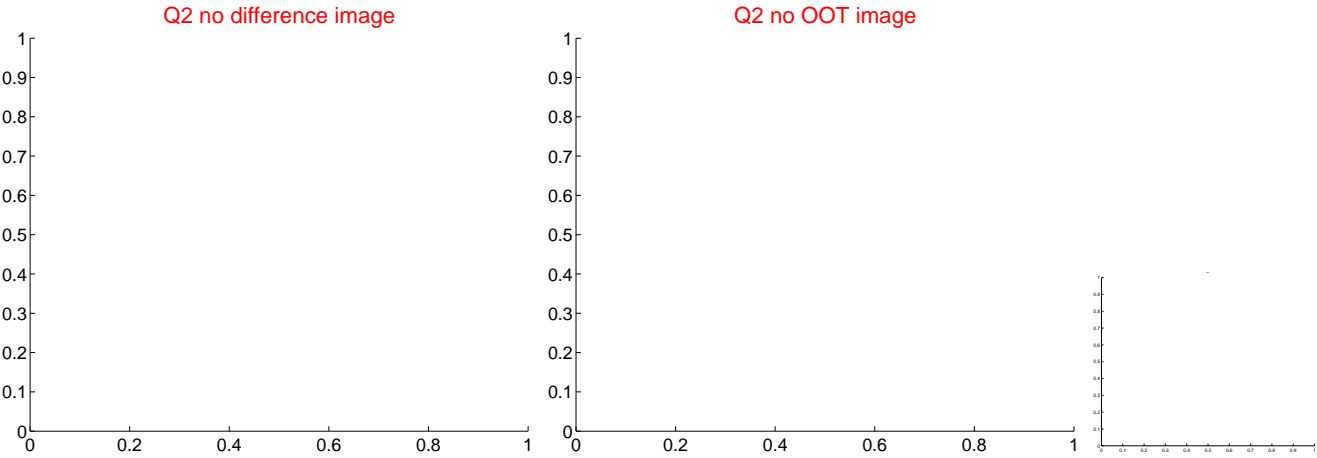
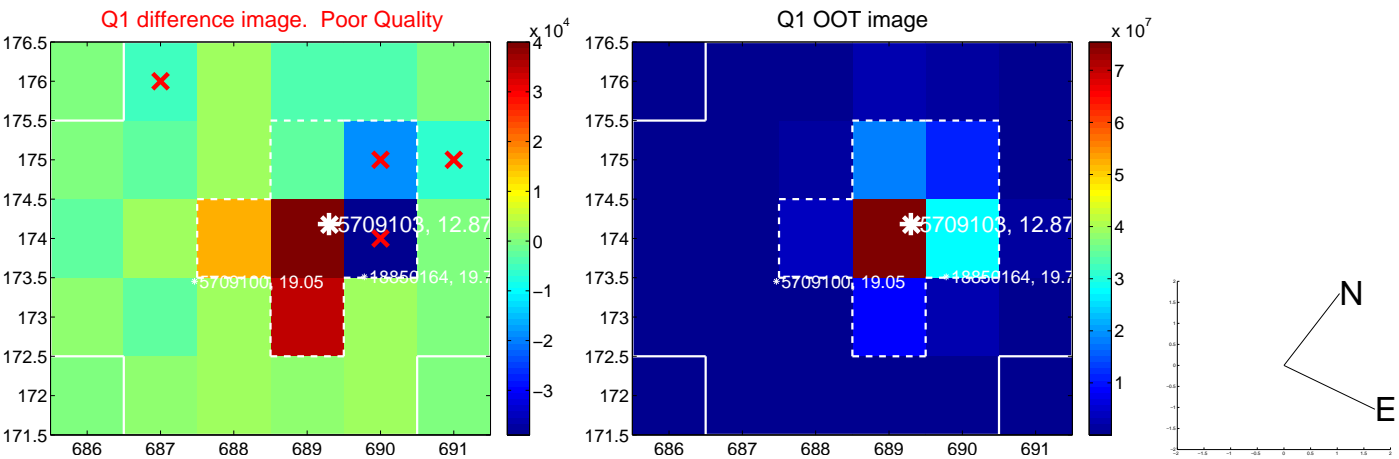


offset from photometric centroids



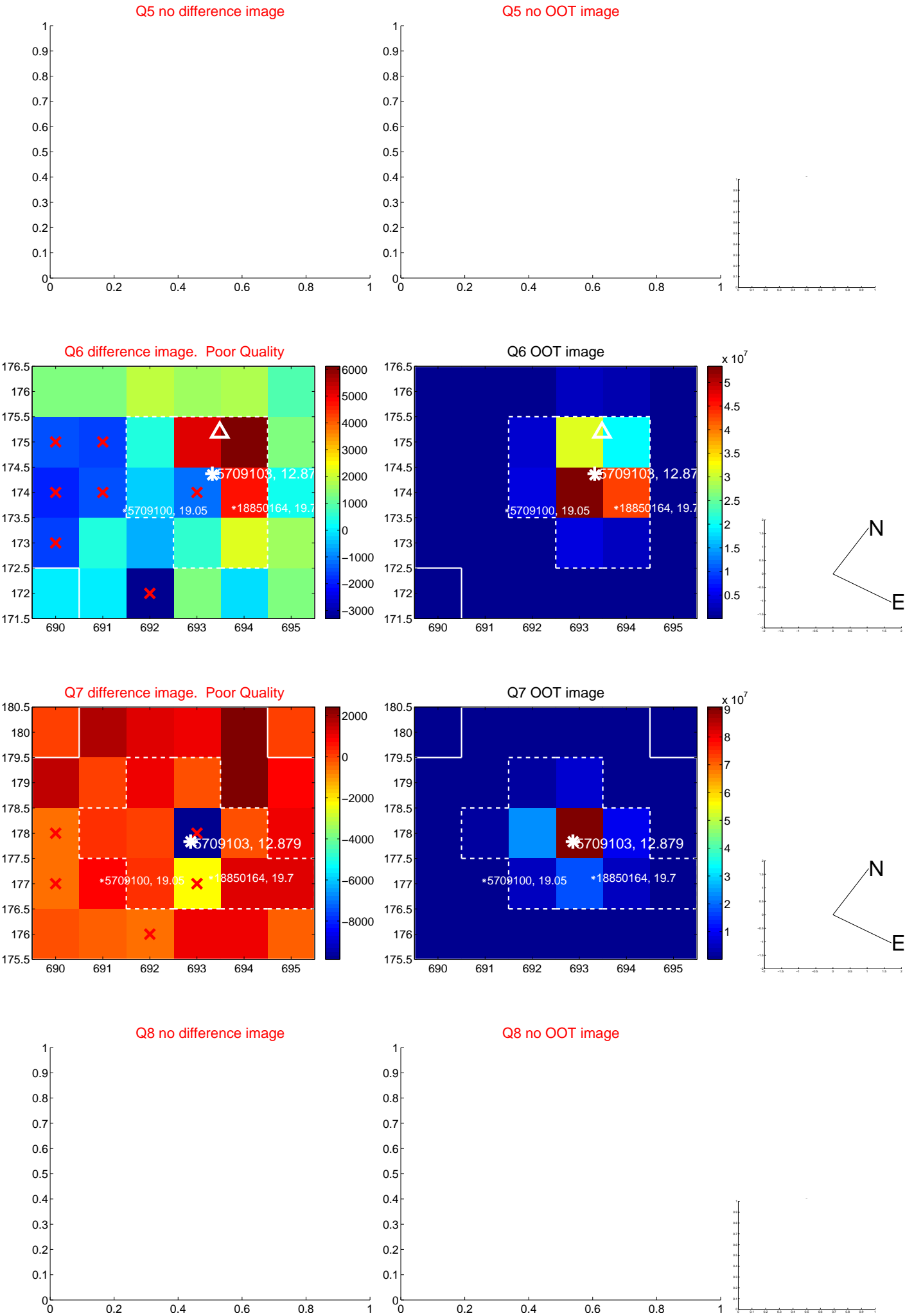
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three- $\sigma$ . Red \*: target star. Blue \*: Other stars. Text next to a star gives its KIC ID and kepmag. KIC IDs > 15,000,000 are from the UKIRT catalog.

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

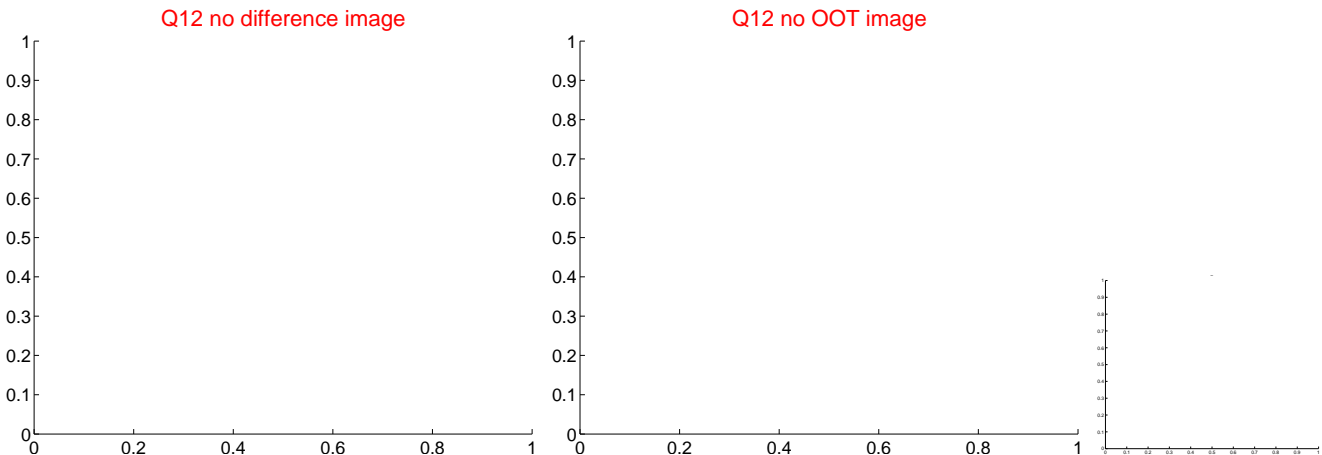
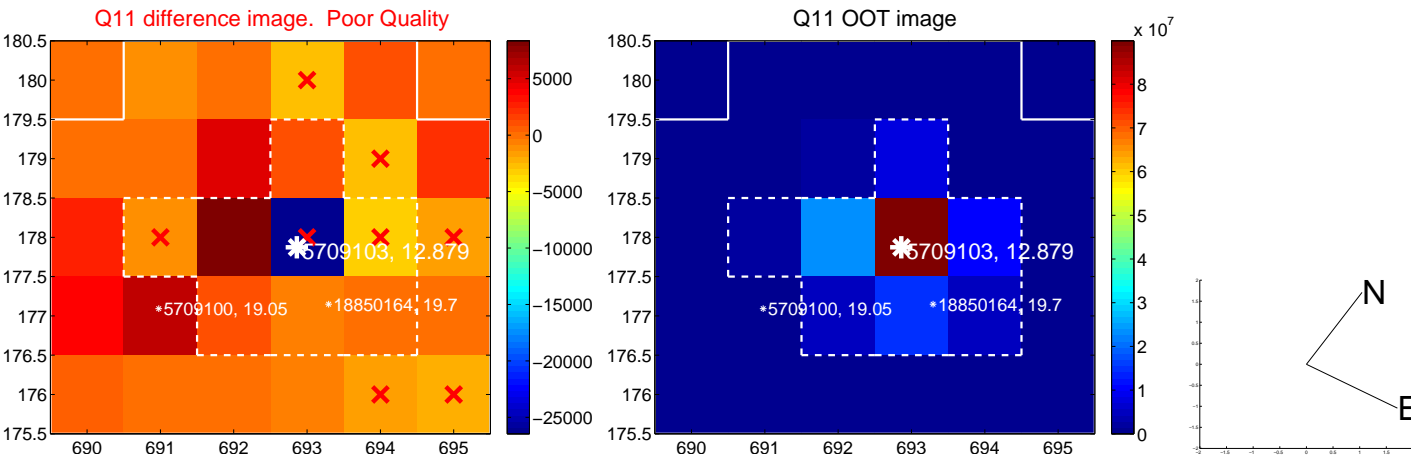
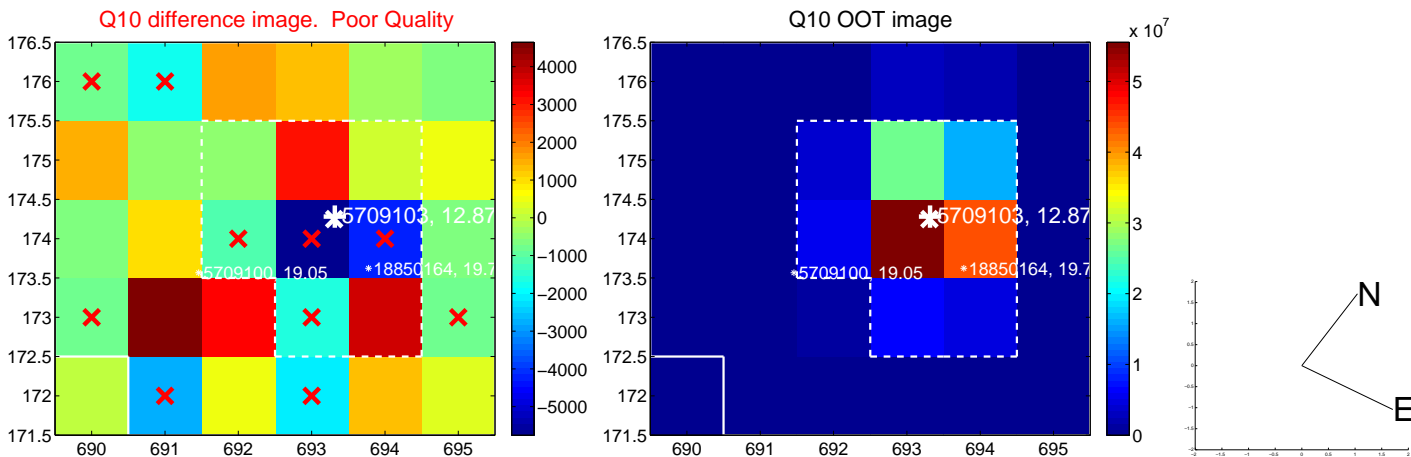
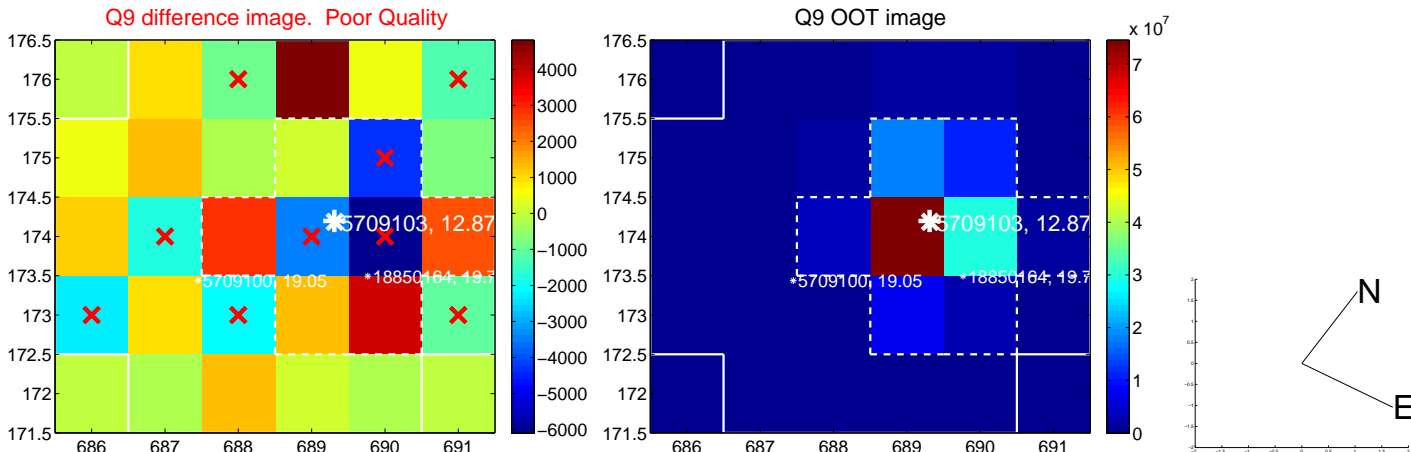




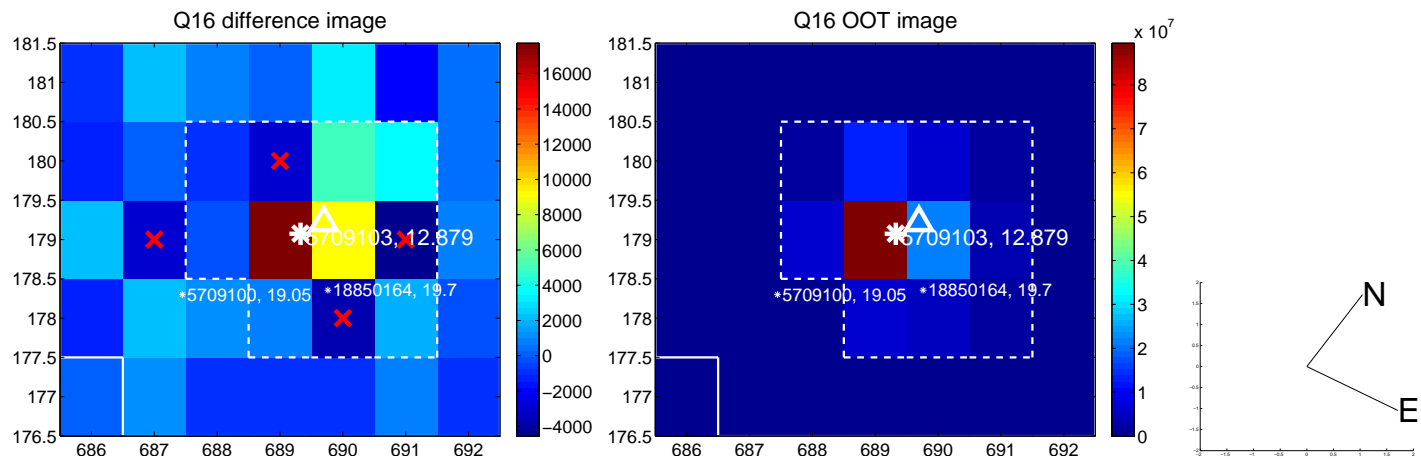
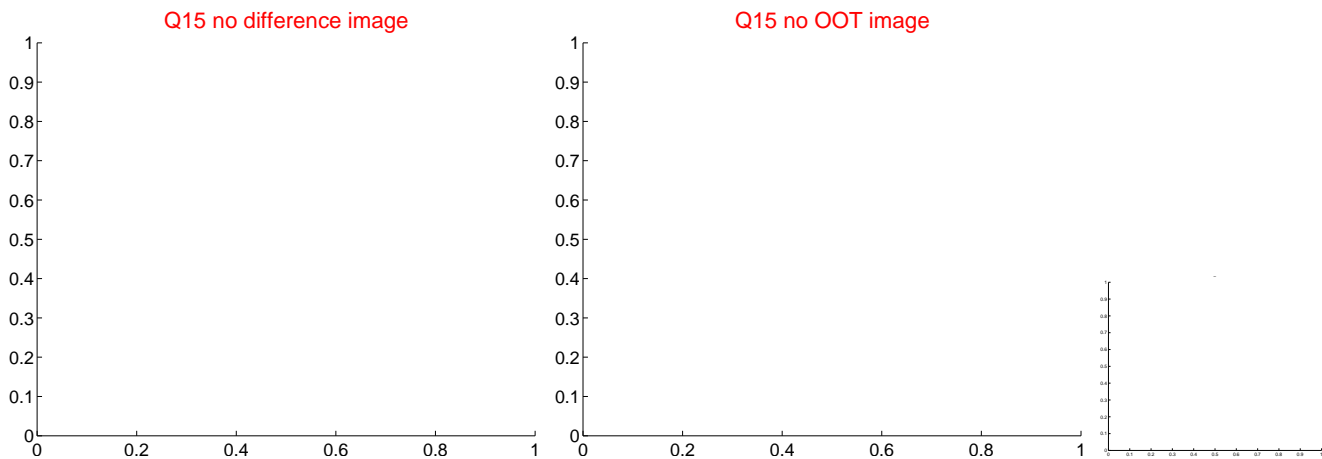
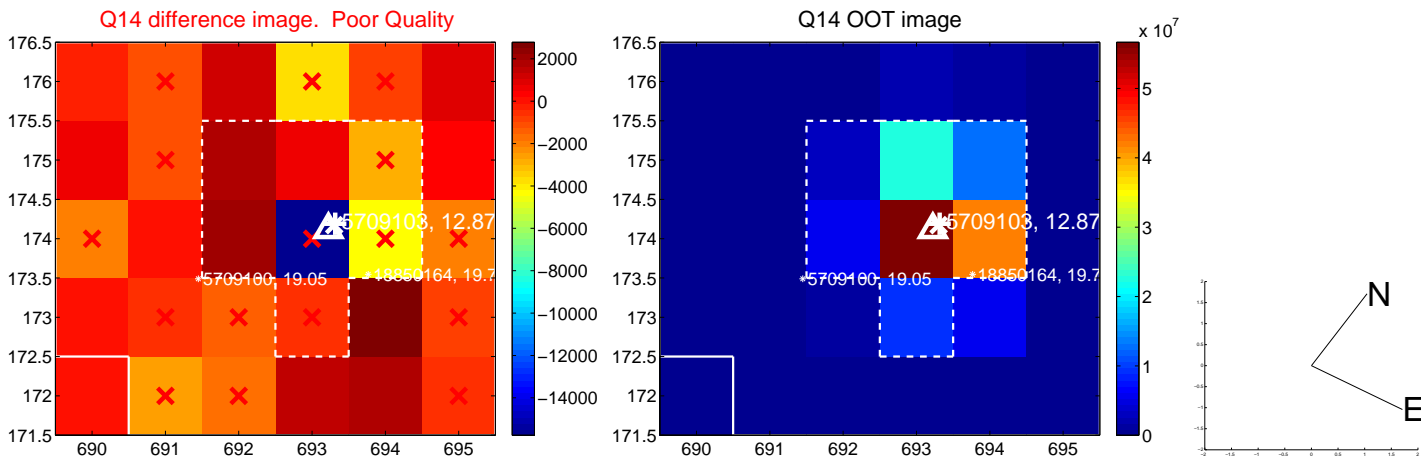
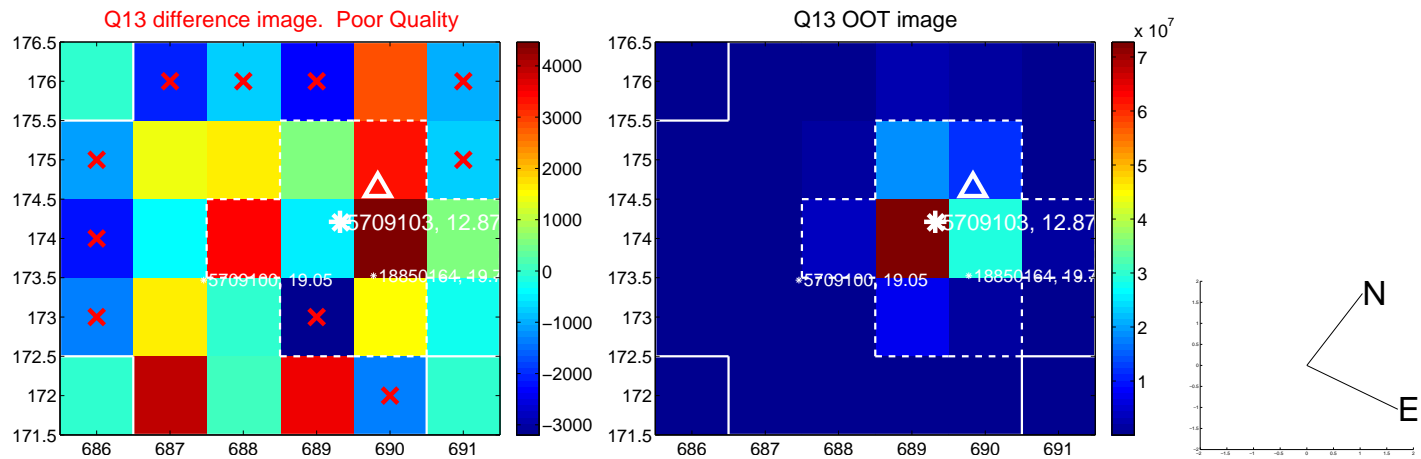
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



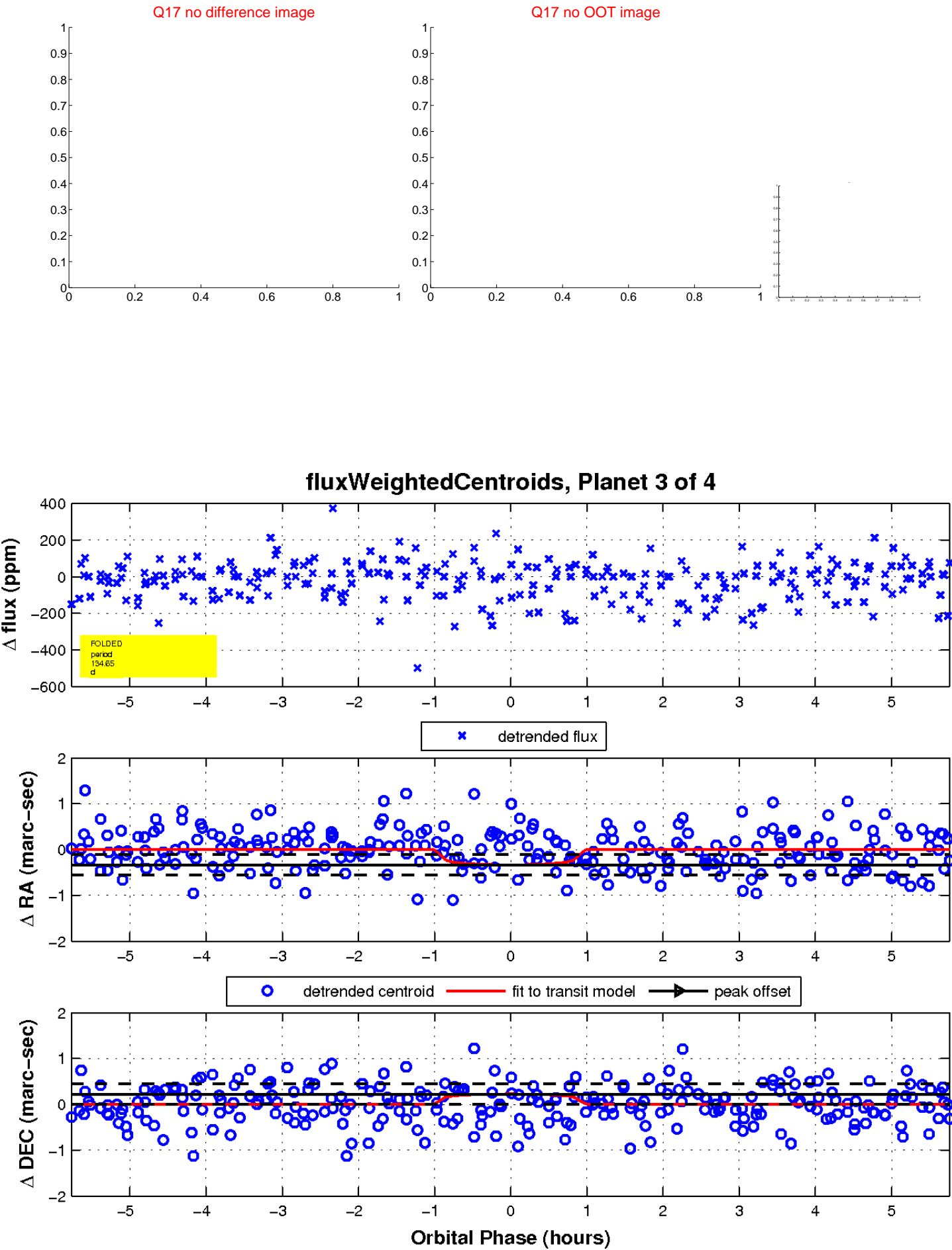
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

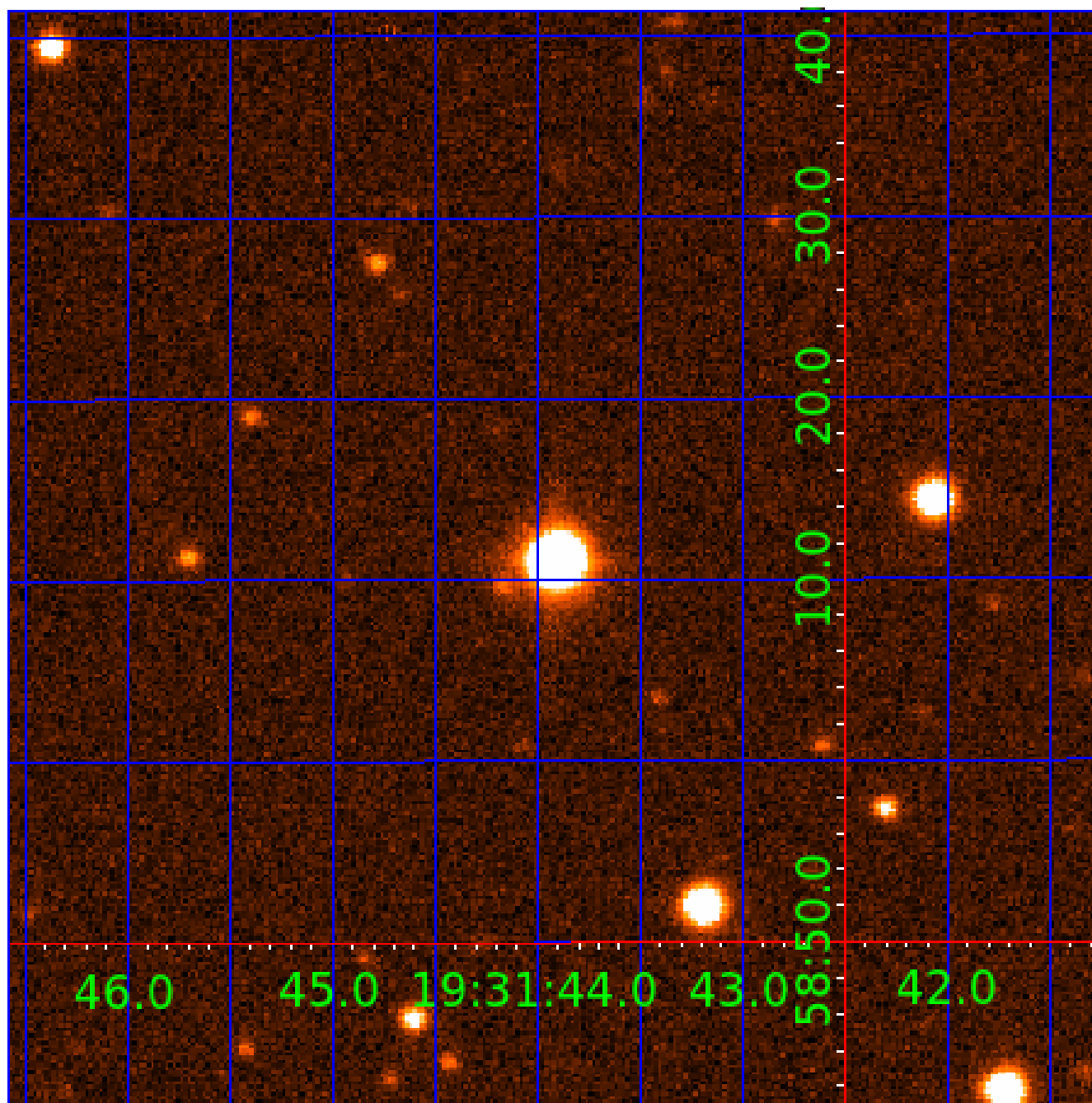


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 005709103

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
005709103-01	OBS	7736.01	0.664732	131.629798	17.7	1.602	8.0	9.2	1.12	6143	0.55	7133.95
005709103-02	OBS	No	0.664721	131.966326	7.9	1.811	7.9	4.3	1.12	6143	0.34	7134.11
005709103-03	OBS	No	134.647320	145.004757	245.1	1.925	10.0	5.7	1.12	6143	1.94	6.00
005709103-04	OBS	No	197.644083	204.933496	299.4	3.093	9.4	5.6	1.12	6143	2.19	3.60

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
005709103-01	OBS	FP	0.00	0	1	1	0	HAS_SEC_TCE—CENT_RESOLVED_OFFSET
005709103-02	OBS	FP	0.00	1	1	1	0	IS_SEC_TCE—CENT_RESOLVED_OFFSET
005709103-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT
005709103-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL—TRANS_GAPPED—ALL_TRANS_CHASES—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS

**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.

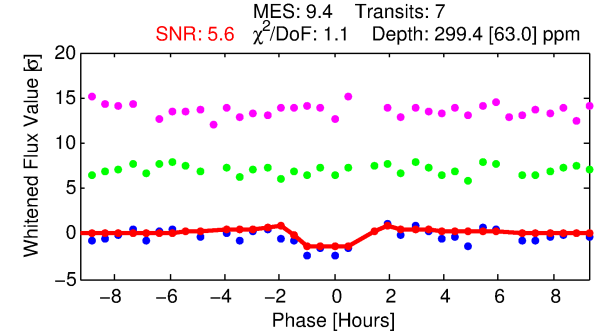
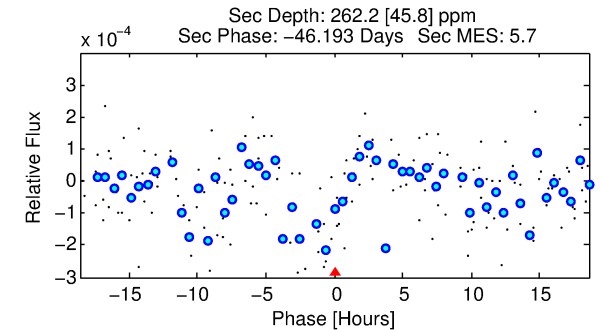
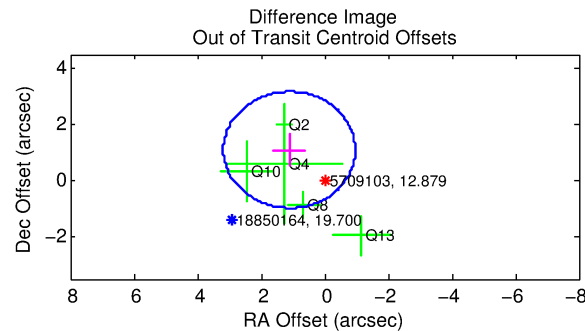
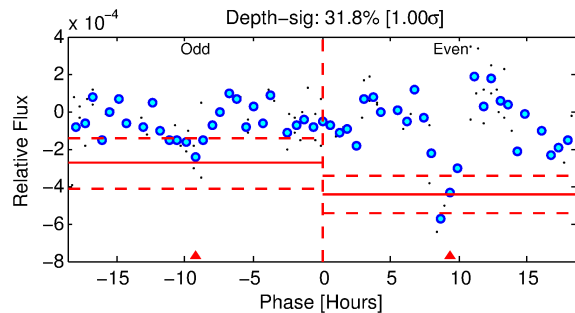
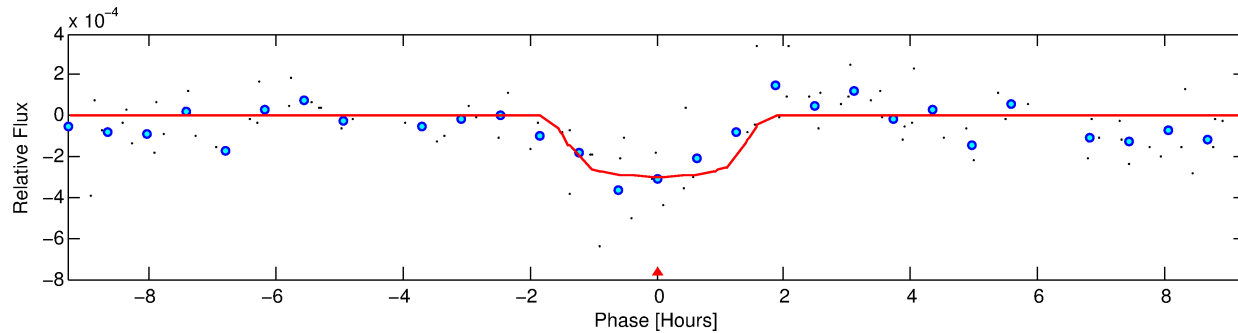
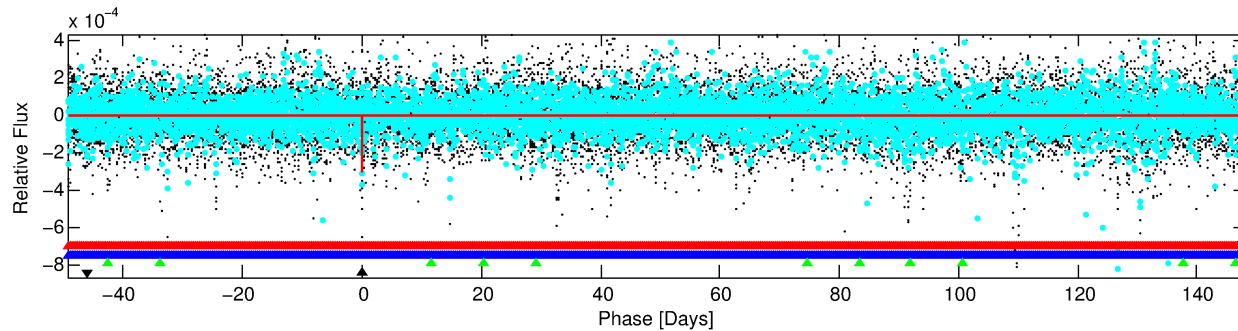
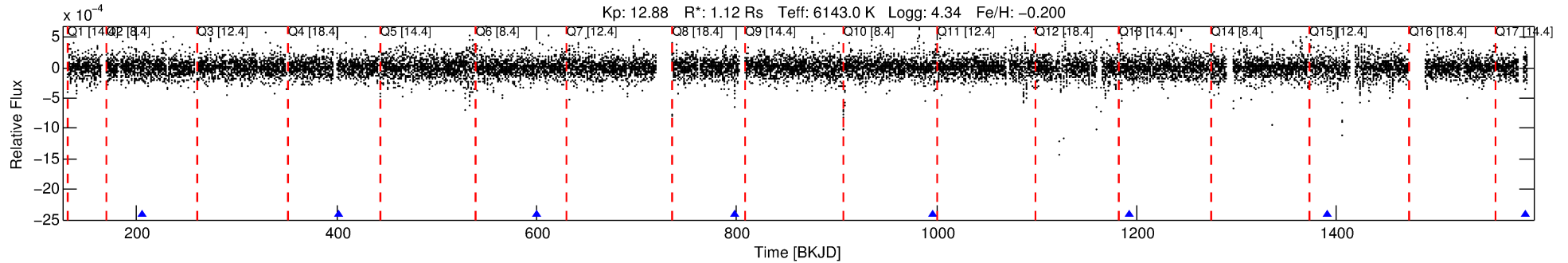
## Ephemeris Match Information For 005709103-04

No Significant Match Found



# DV One-Page Summary

KIC: 5709103 Candidate: 4 of 4 Period: 197.644 d



## DV Fit Results:

Period = 197.64408 [0.00248] d  
Epoch = 204.9335 [0.0085] BKJD  
Rp/R\* = 0.0180 [0.0498]  
a/R\* = 274.28 [3969.34]  
b = 0.85 [4.81]  
Seff = 3.59 [0.81]  
Teq = 351 [20] K  
Rp = 2.19 [6.07] Re  
a = 0.6649 [0.0972] AU  
Ag = 13289.28 [73661.54] [0.18 $\sigma$ ]  
Teffp = 5829 [8071] K [0.68 $\sigma$ ]

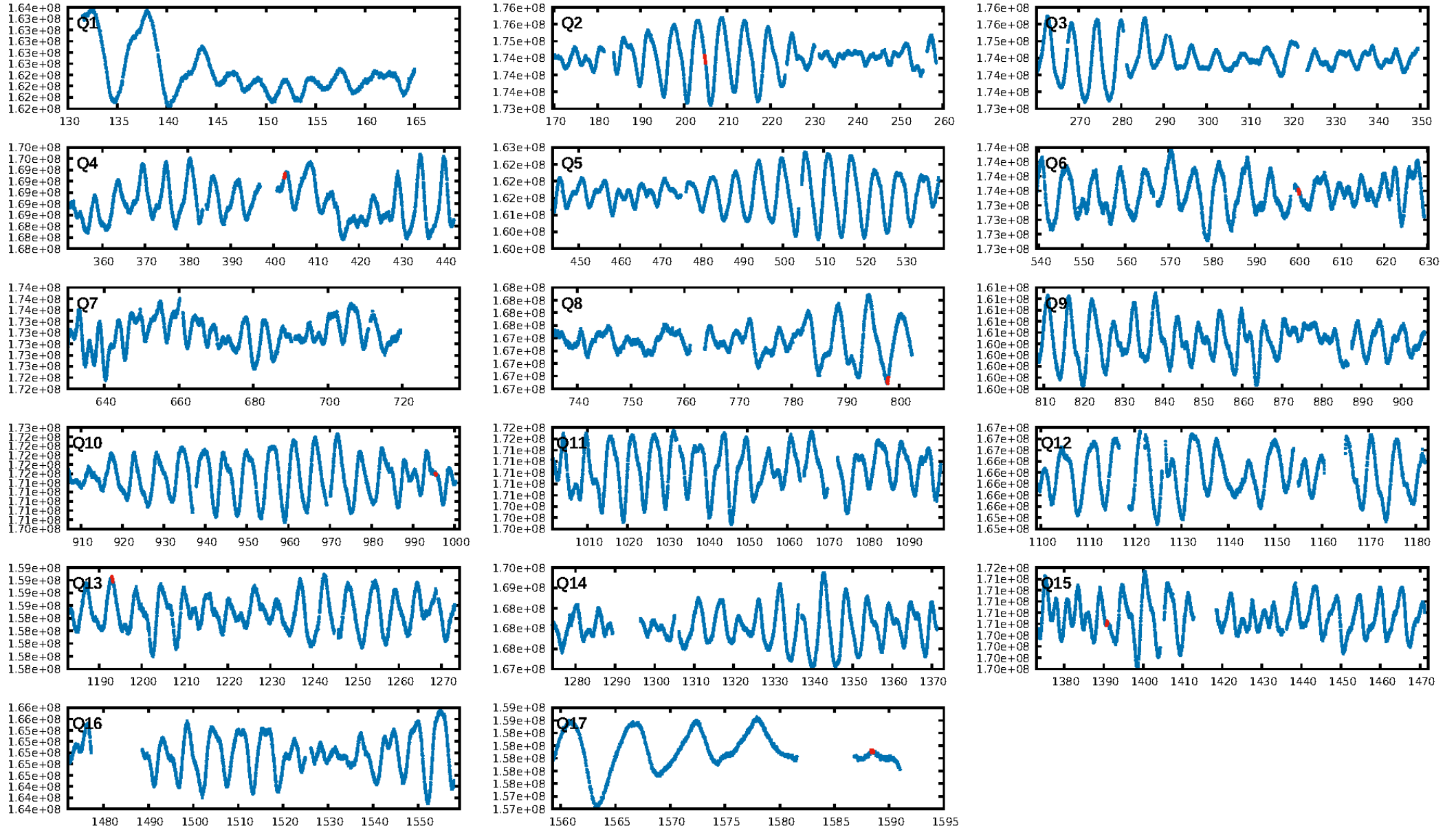
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [415.02 $\sigma$ ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 24.2%  
ModelChiSquareGof-sig: 100.0%  
**Bootstrap-pfa: 2.09e-11**  
RollingBand-fgt: 1.00 [6/6]  
**GhostDiagnostic-chr: 0.9068**  
Centroid-sig: 13.4%  
Centroid-so: 1.088 arcsec [1.58 $\sigma$ ]  
OotOffset-rm: 1.565 arcsec [2.26 $\sigma$ ]  
OotOffset-st: 2/0/2/1 [5]  
KicOffset-rm: 1.570 arcsec [1.84 $\sigma$ ]  
KicOffset-st: 2/0/2/1 [5]  
DiffImageQuality-fgm: 0.20 [1/5]  
DiffImageOverlap-fno: 0.00 [0/7]

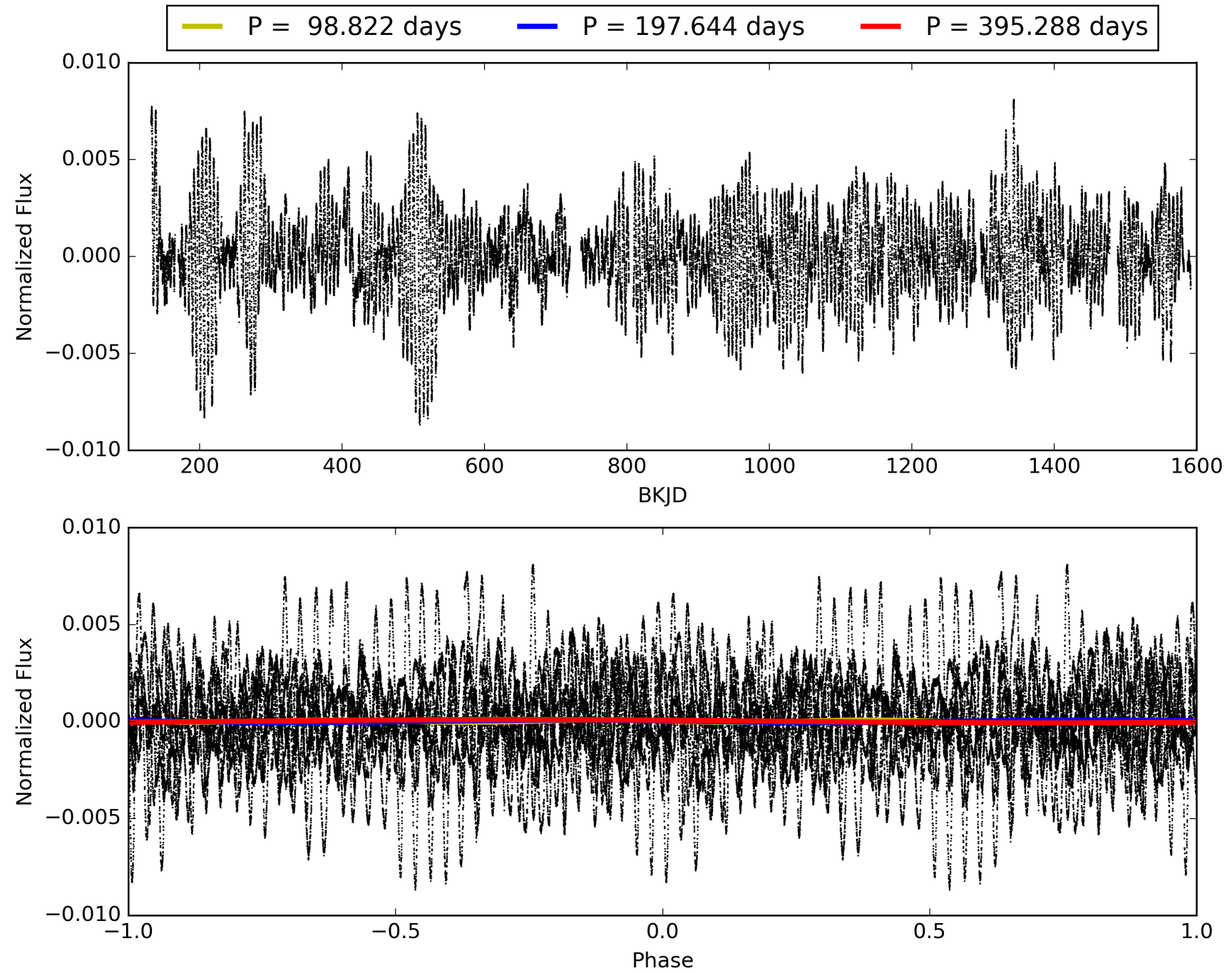
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 13:47:04 Z

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

# TCE 005709103-04, PDC Light Curves

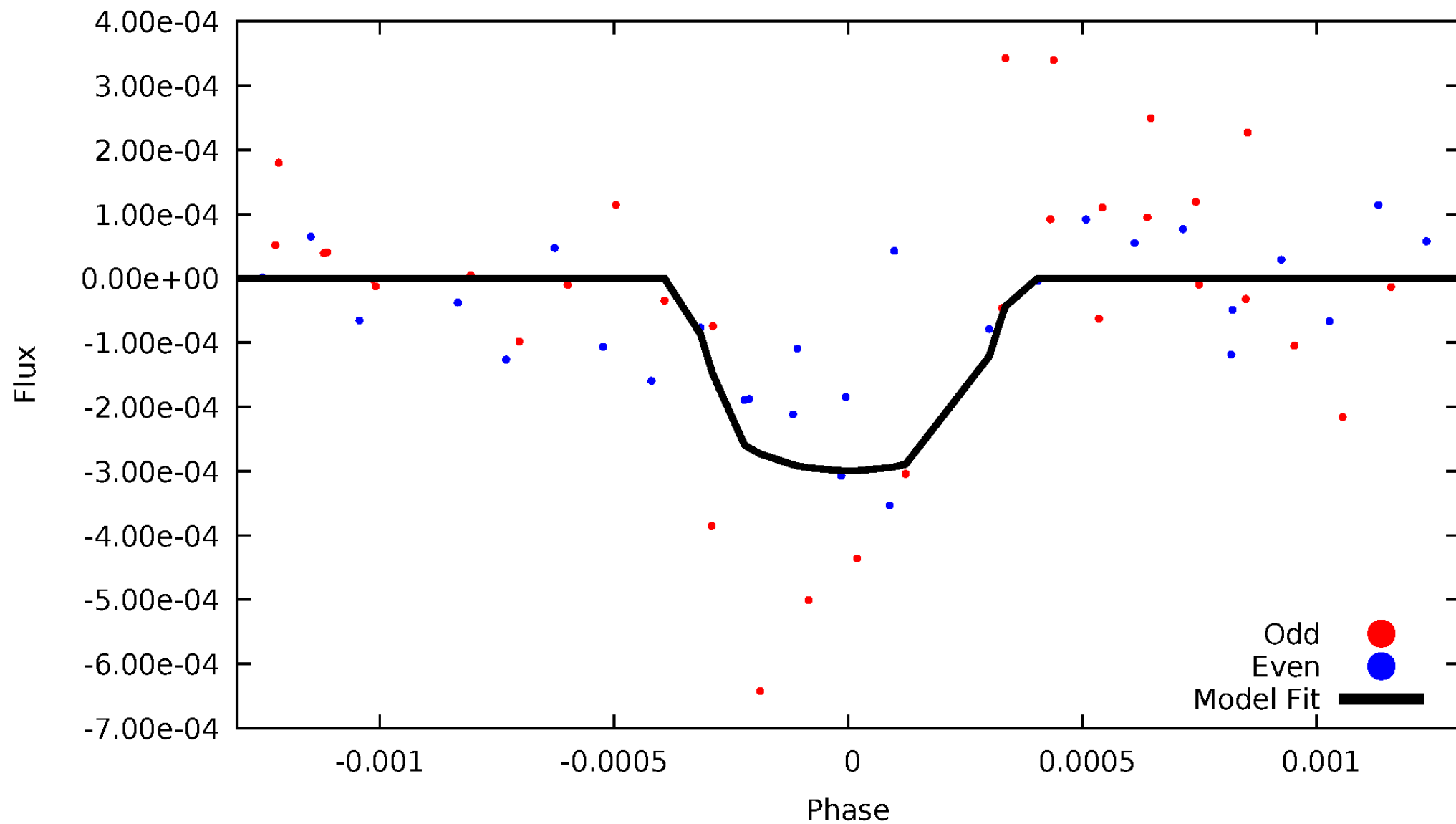


# TCE 005709103-04



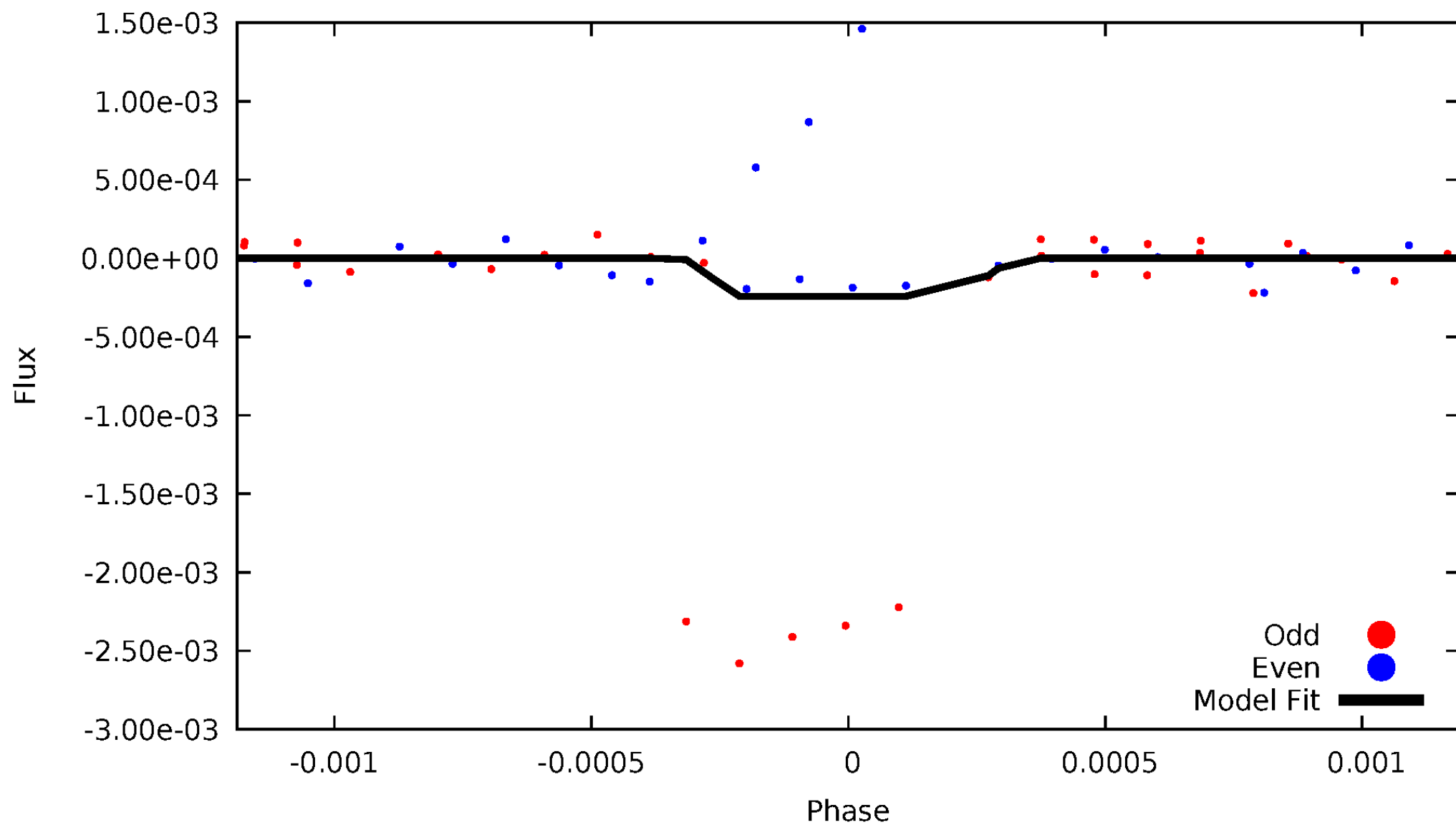
# DV Odd/Even

TCE 005709103-04



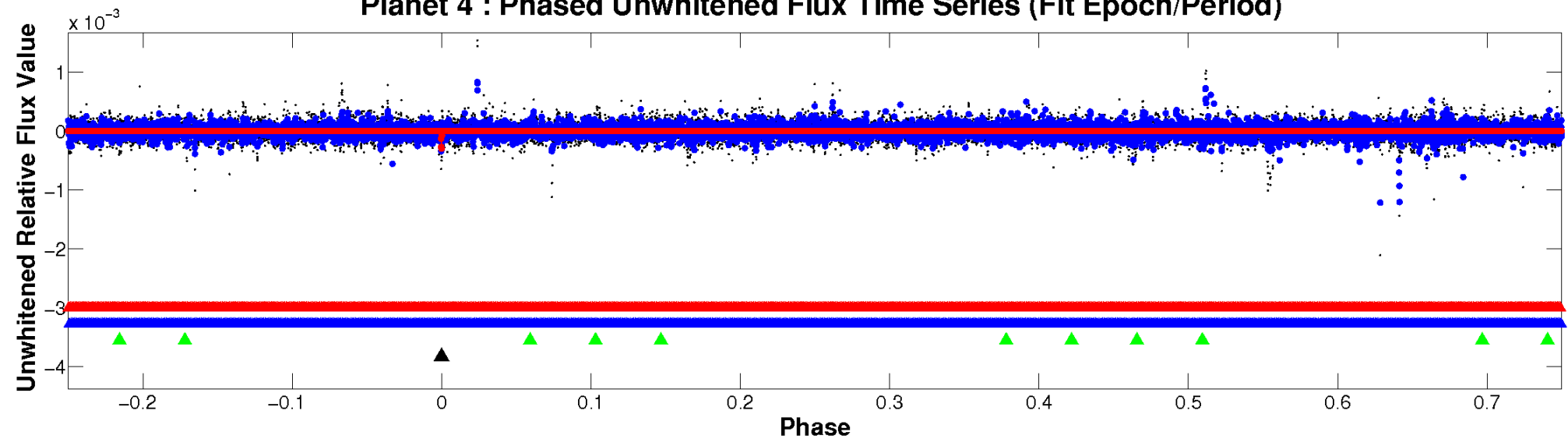
# ALT Odd/Even

TCE 005709103-04

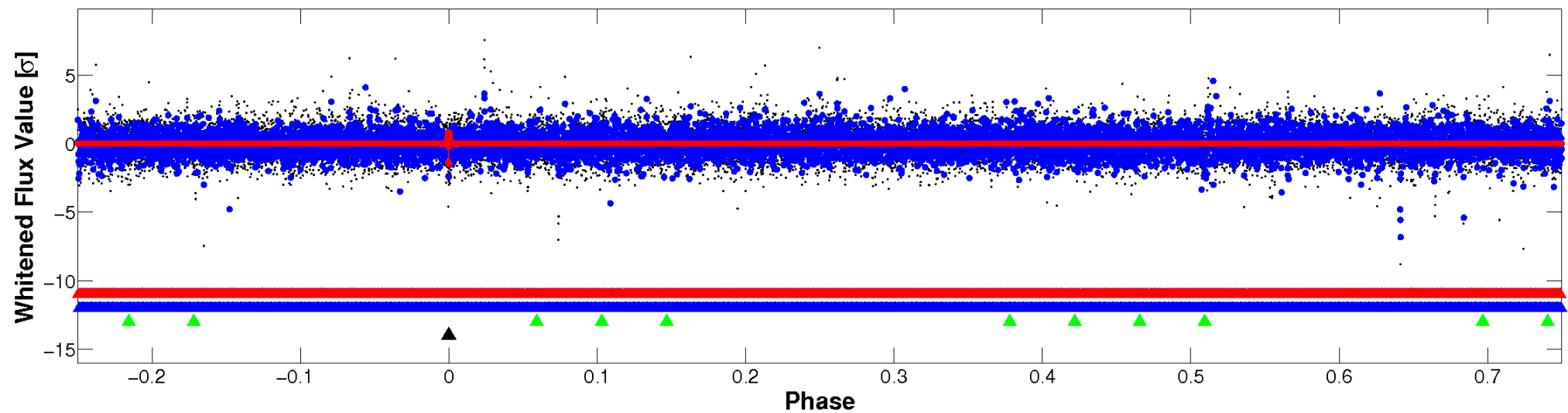


# Non-Whitened Vs. Whitened Light Curve

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



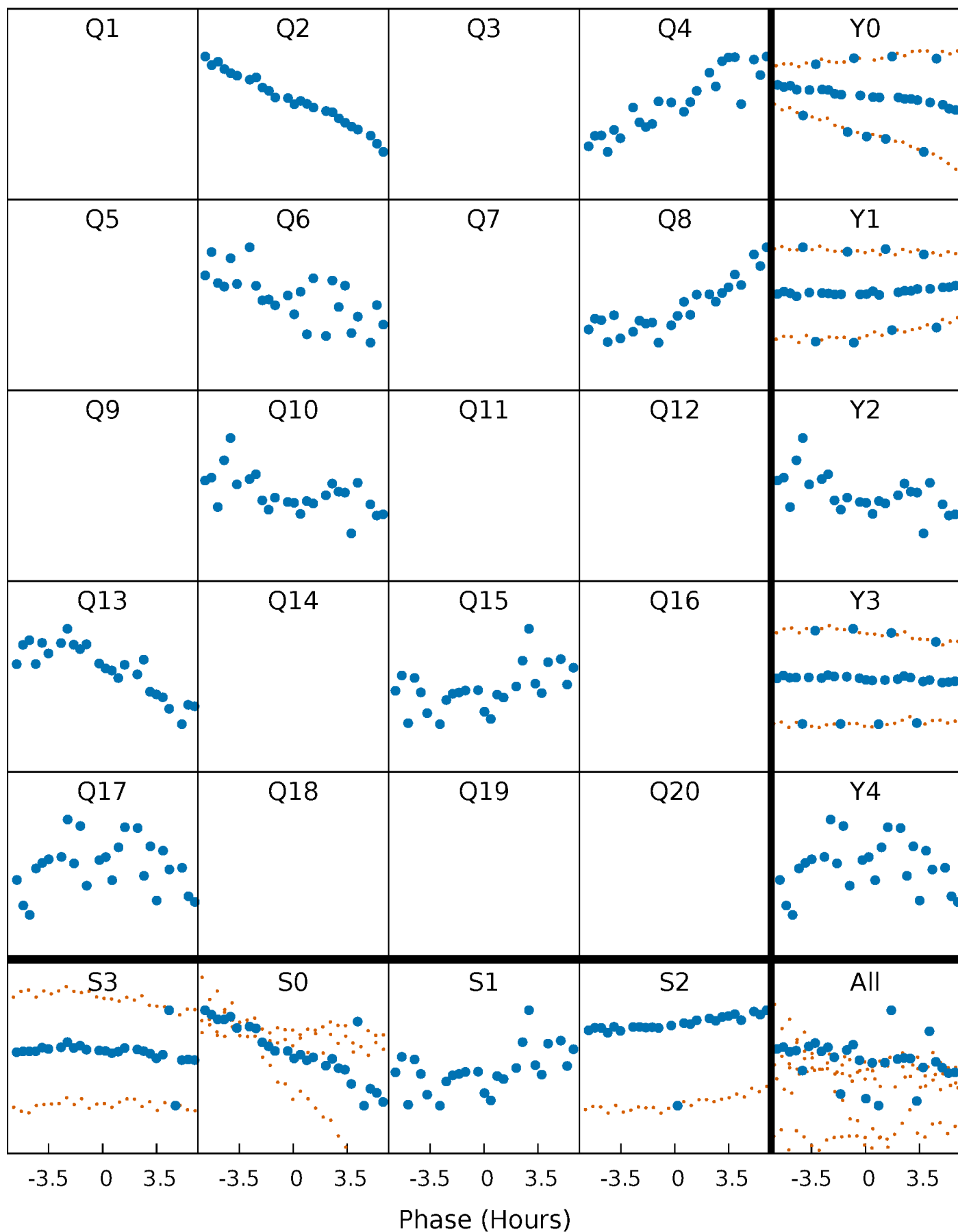
## Planet 4 : Phased Whitened Flux Time Series (Fit Epoch/Period)





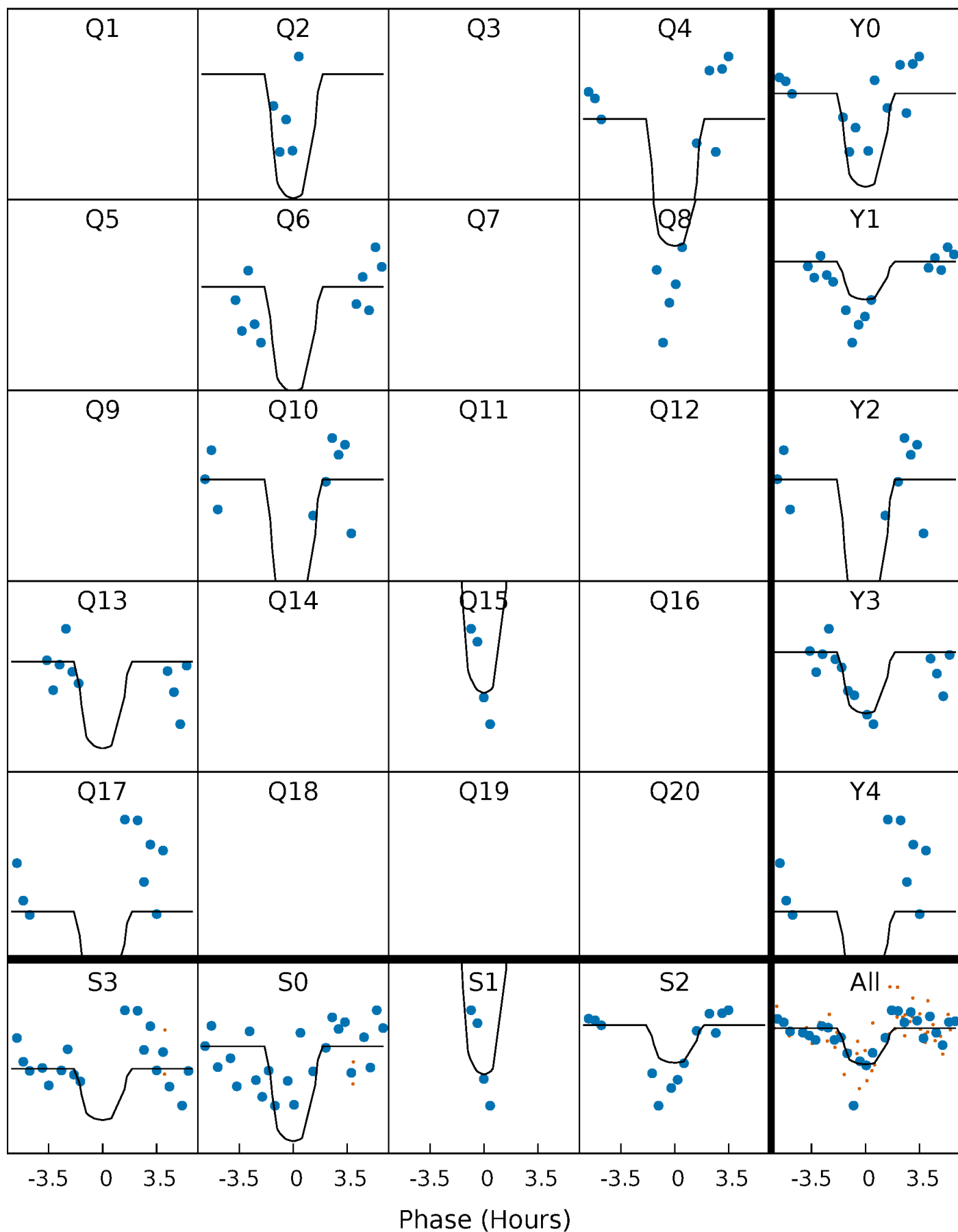
# PDC Quarter-Phased Transit Curves

TCE 005709103-04   P=197.644083 Days    $T_0=204.933496$  (BKJD)



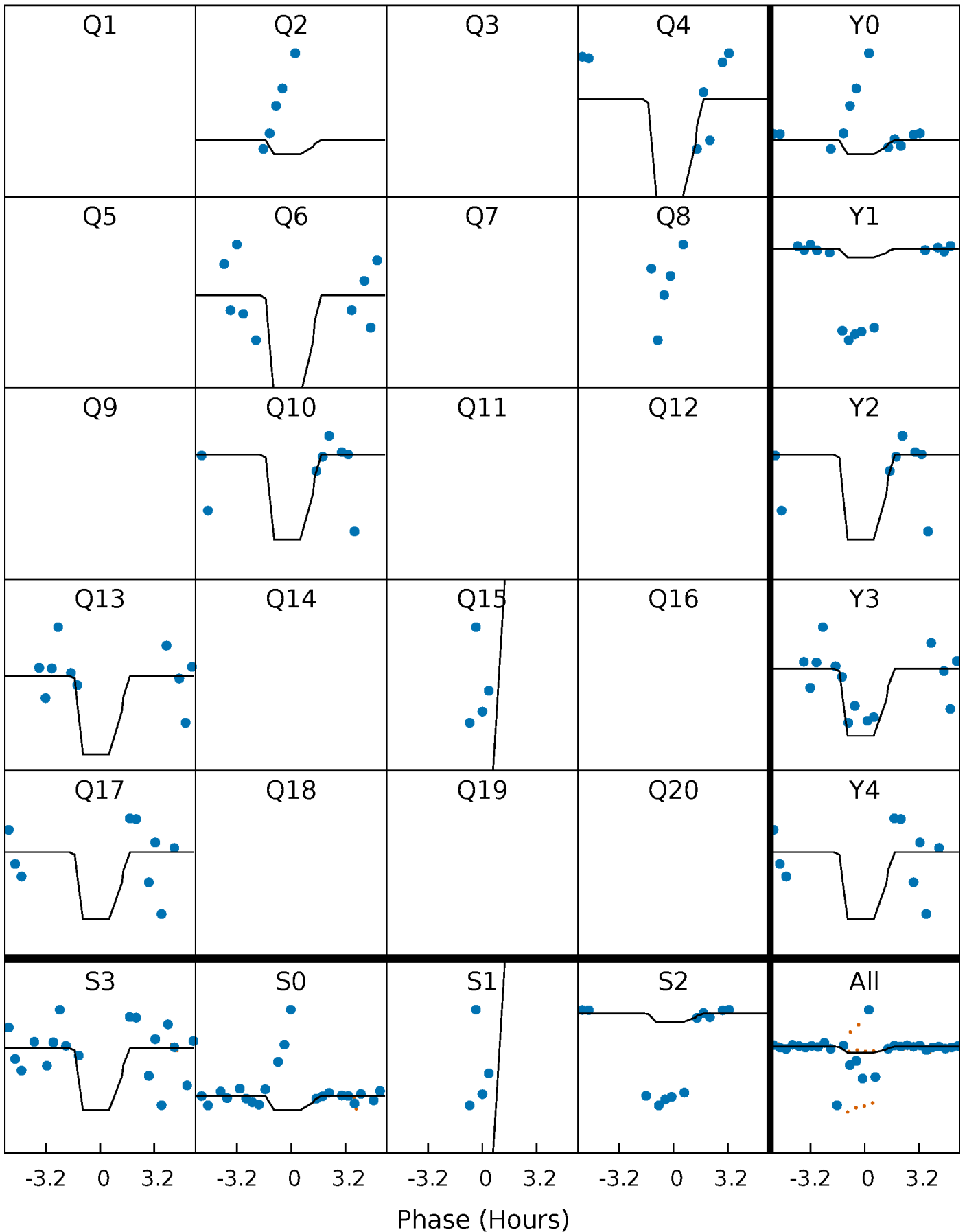
# DV Quarter-Phased Transit Curves

TCE 005709103-04 P=197.644083 Days  $T_0=204.933496$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

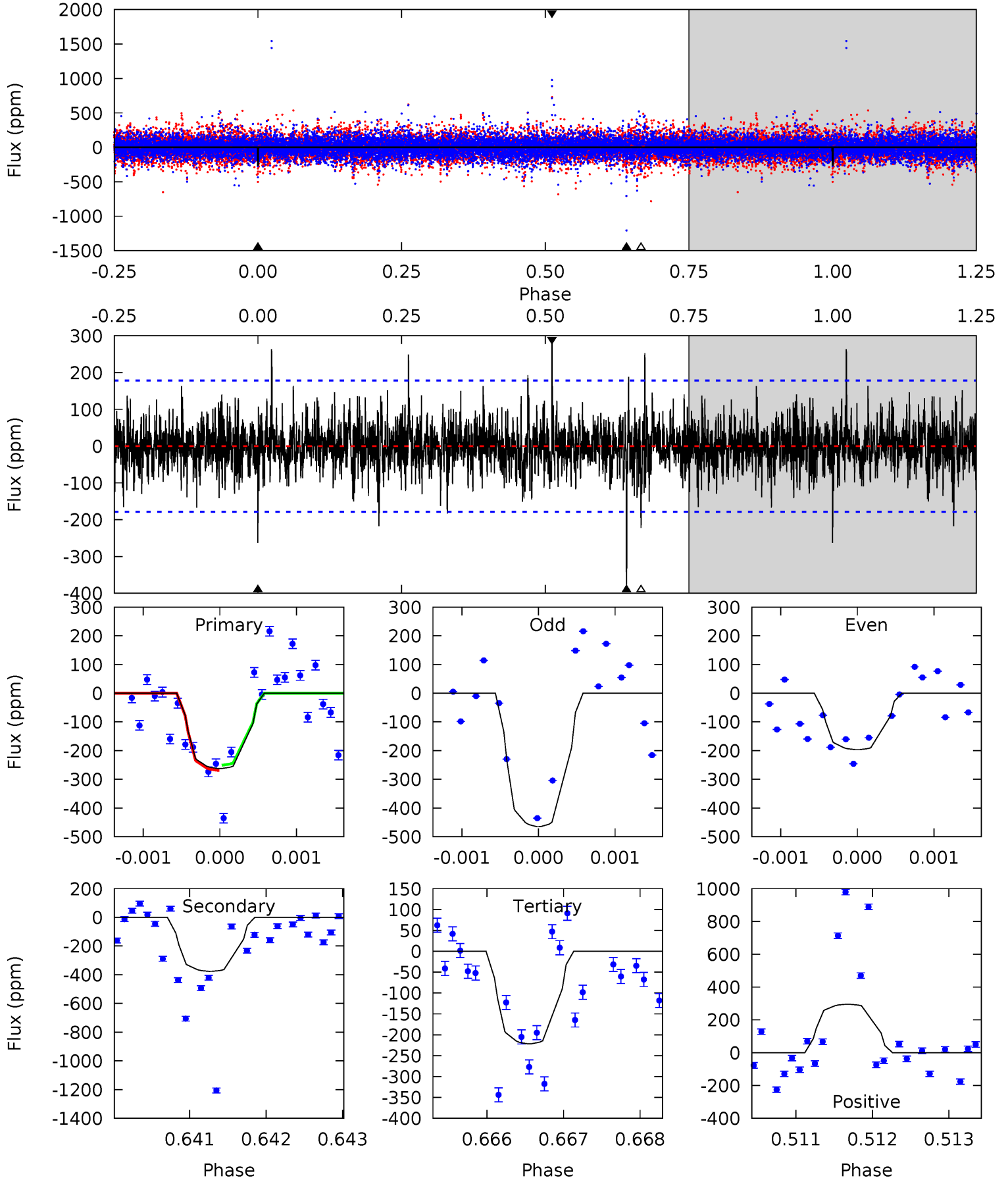
TCE 005709103-04 P=197.640949 Days  $T_0=204.947636$  (BKJD)



# DV Model-Shift Uniqueness Test

005709103-04, P = 197.644083 Days, E = 7.289413 Days

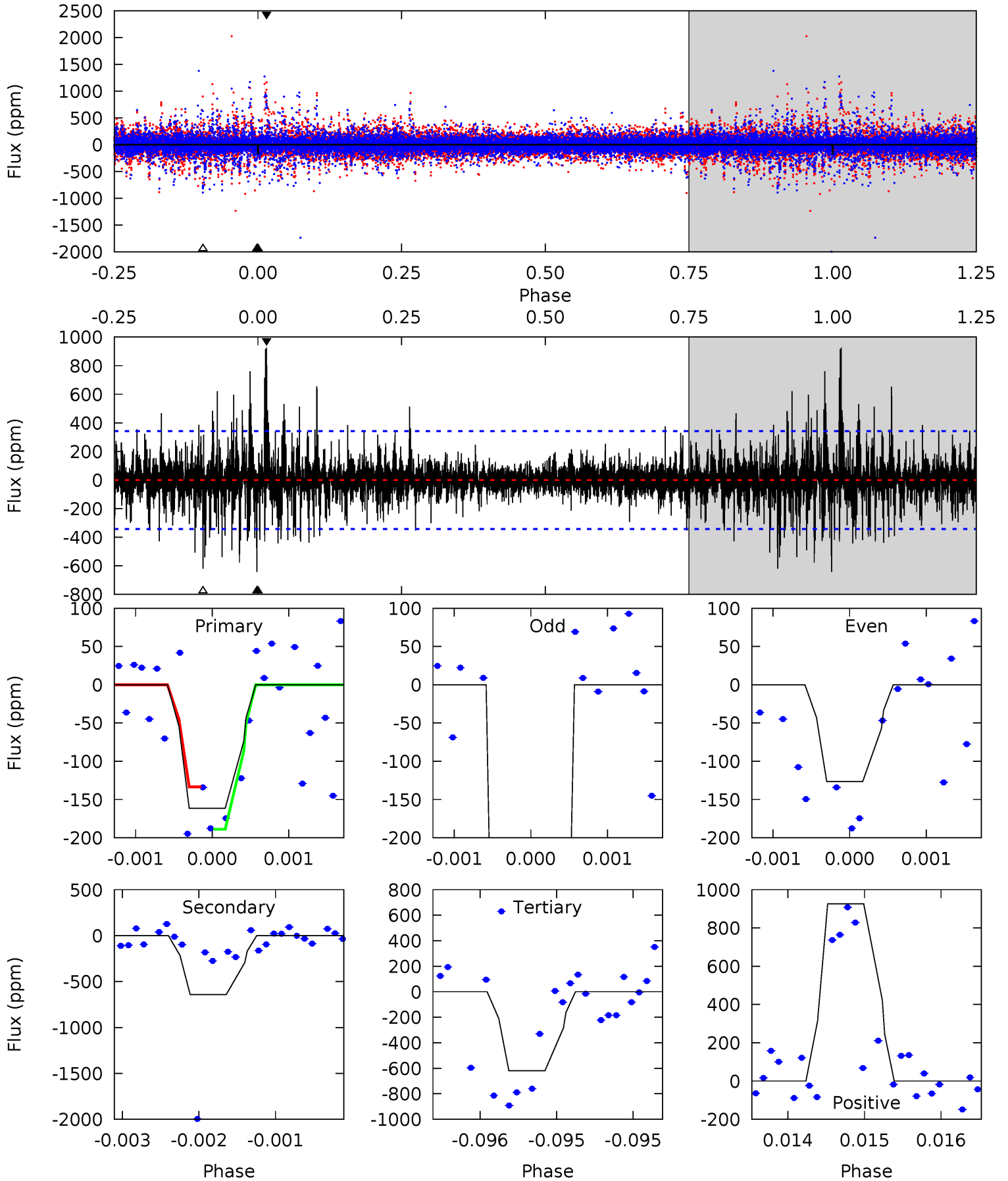
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
8.11	11.6	6.85	9.13	5.52	3.39	1.54	1.26	-1.01	4.78	2.51	4.12	1.07	0.44	0.28



# Alt Model-Shift Uniqueness Test

005709103-04, P = 197.640949 Days, E = 7.306687 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
2.60	10.4	10.00	14.9	5.53	3.41	1.60	-7.39	-12.3	0.36	-4.59	13.7	3.16	0.59	0



### Stellar Parameters For KIC 005709103

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6143^{+83}_{-92}$	$4.344^{+0.110}_{-0.121}$	$-0.200^{+0.150}_{-0.150}$	$1.116^{+0.189}_{-0.126}$	$1.001^{+0.073}_{-0.059}$	$1.015^{+0.421}_{-0.349}$
	+1%/-1%	+3%/-3%	+75%/-75%	+17%/-11%	+7%/-6%	+41%/-34%
Source	SPE68	SPE68	SPE68	DSEP		

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

### Secondary Eclipse Parameters for KIC 005709103-04 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-376 \pm 32$	$4.92^{+4.70}_{-3.34}$	$489^{+24}_{-19}$	$4421^{+3208}_{-897}$	$3632^{+32700}_{-2678}$
Alt.	$-642 \pm 62$	$4.72^{+4.79}_{-3.13}$	$490^{+21}_{-18}$	$5062^{+3970}_{-1200}$	$7054^{+55217}_{-5309}$

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



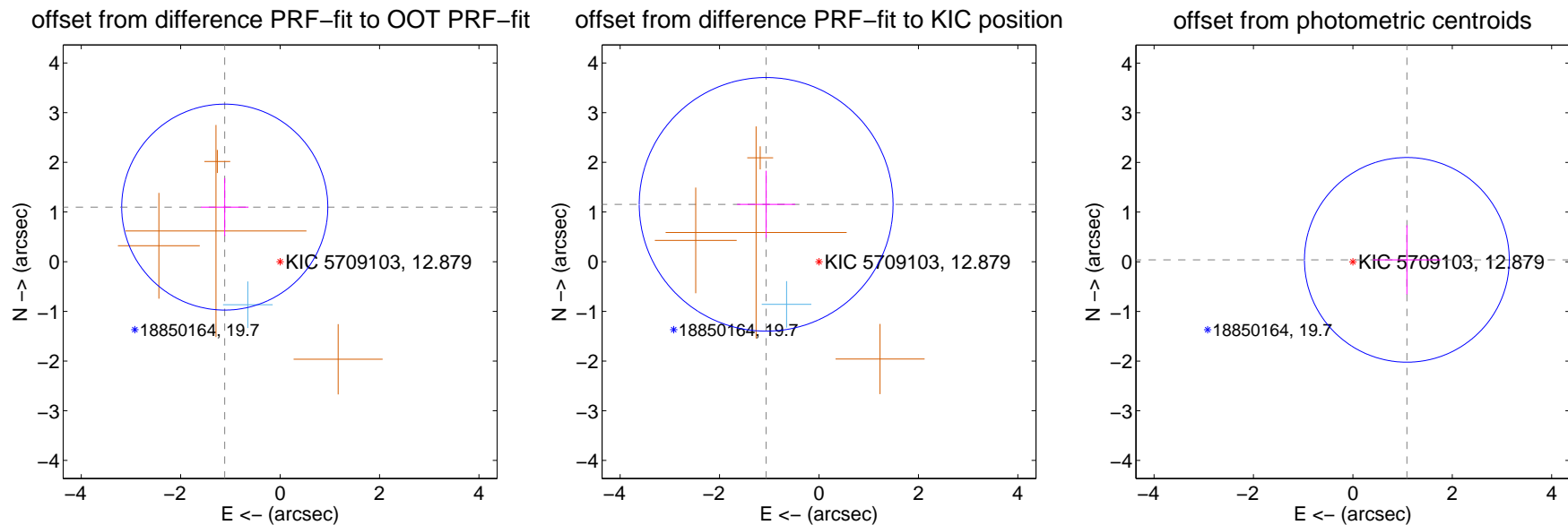
## DV Centroid Data

Supplemental centroid analysis for 005709103-04. Kepler magnitude: 12.88. Transit SNR 5.55

There are 1 quarters with good PRF difference image offsets

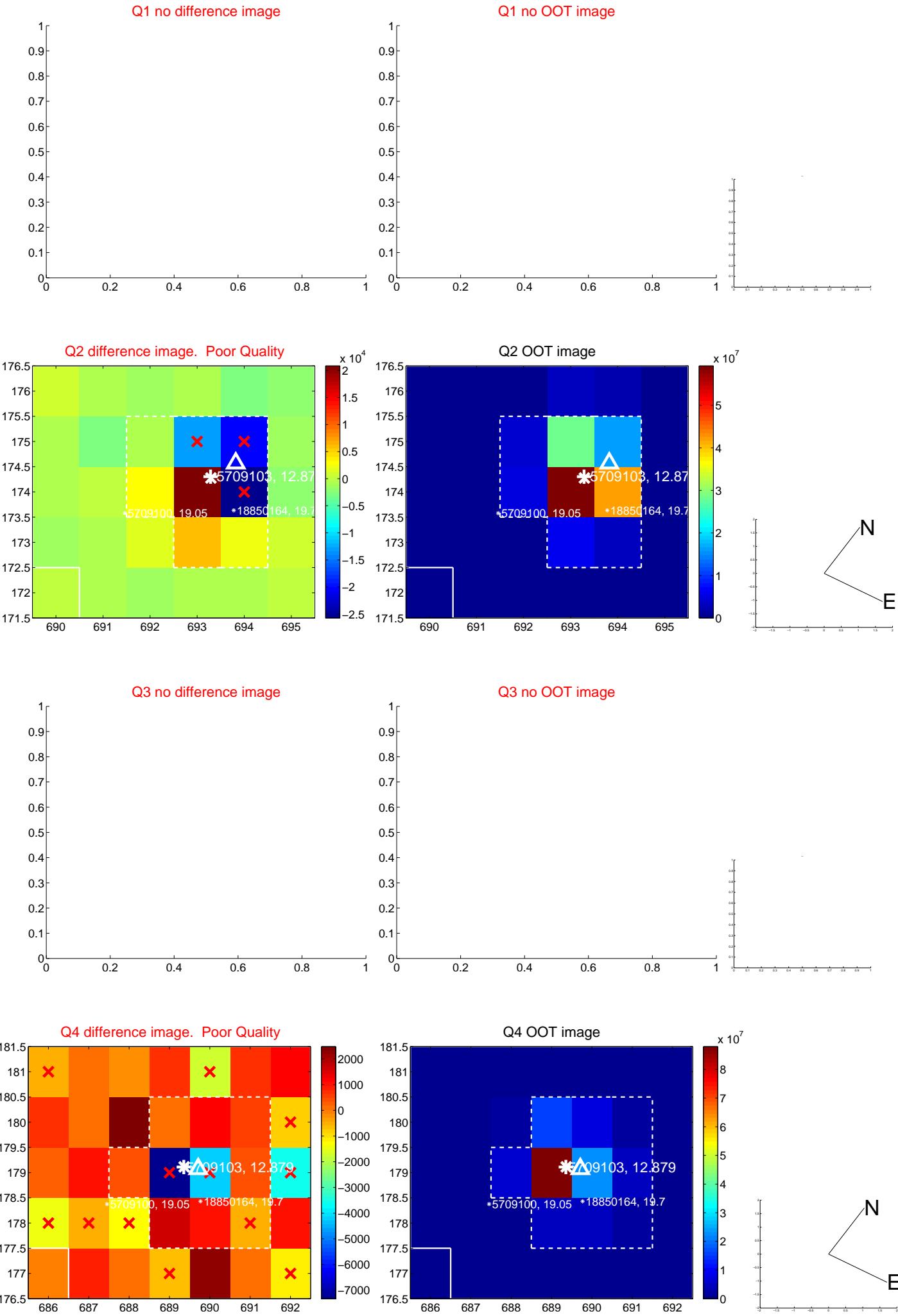
The direct PRF centroid is offset from the target star catalog position by about 0.06 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.565 \pm 0.691$	2.26	$1.114 \pm 0.479$	$1.099 \pm 0.584$
PRF-fit source offset from KIC position	$1.570 \pm 0.851$	1.84	$1.063 \pm 0.585$	$1.155 \pm 0.677$
photometric centroid source offset	$1.09 \pm 0.69$	1.58	$-1.09 \pm 0.69$	$0.04 \pm 0.69$



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.

Q5 no difference image



Q5 no OOT image



Q6 no difference image



Q6 no OOT image



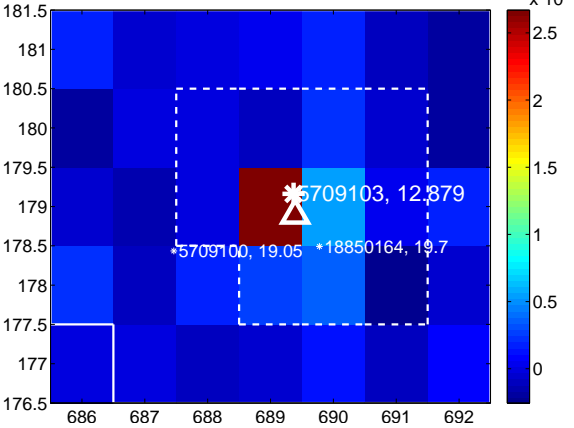
Q7 no difference image



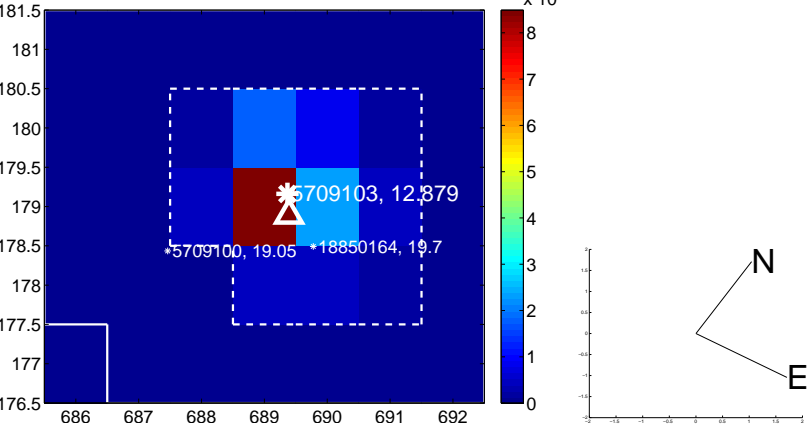
Q7 no OOT image



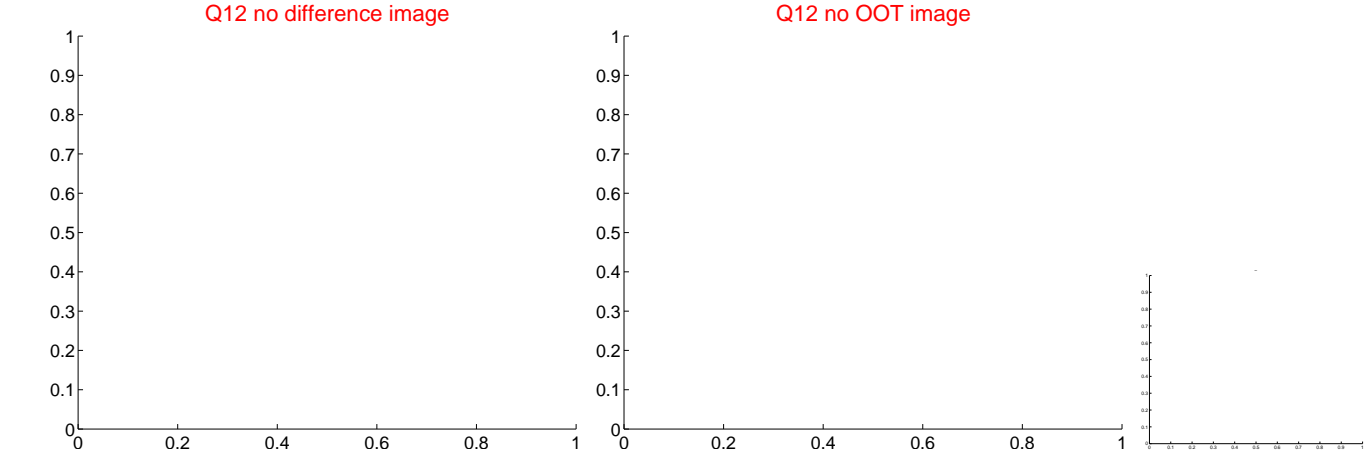
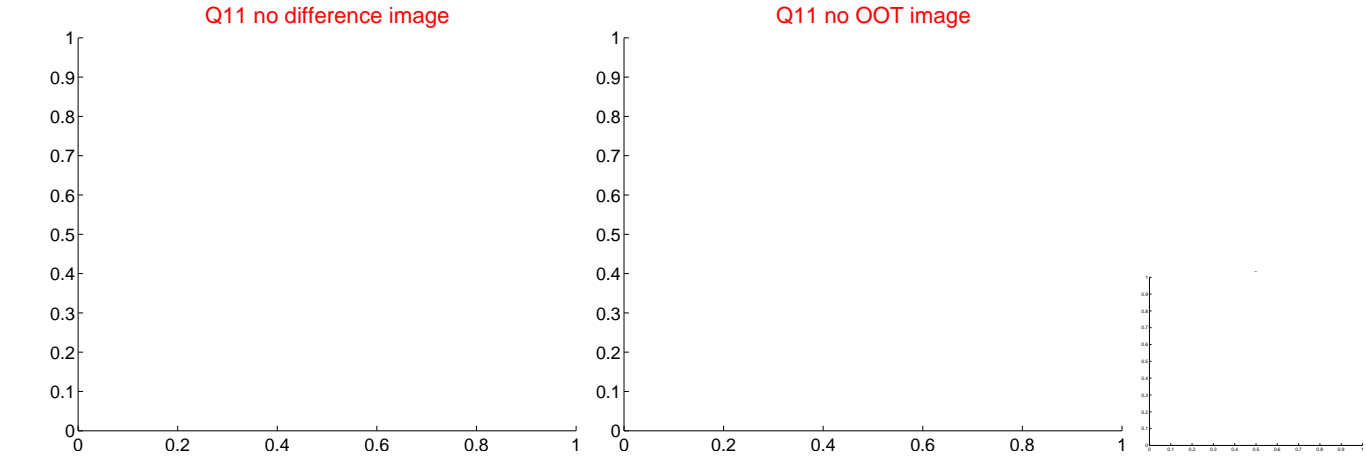
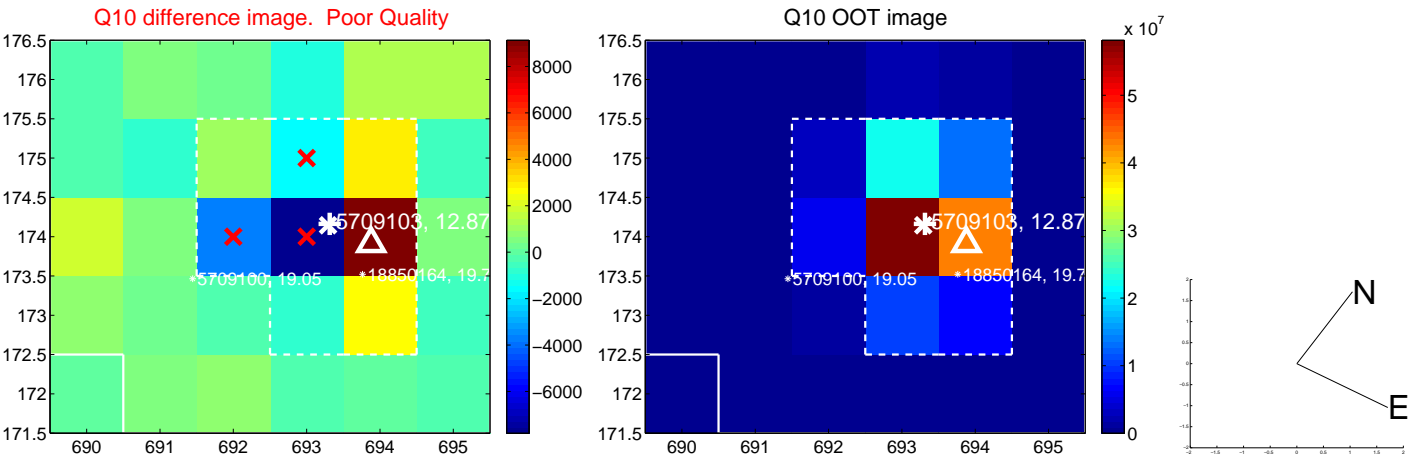
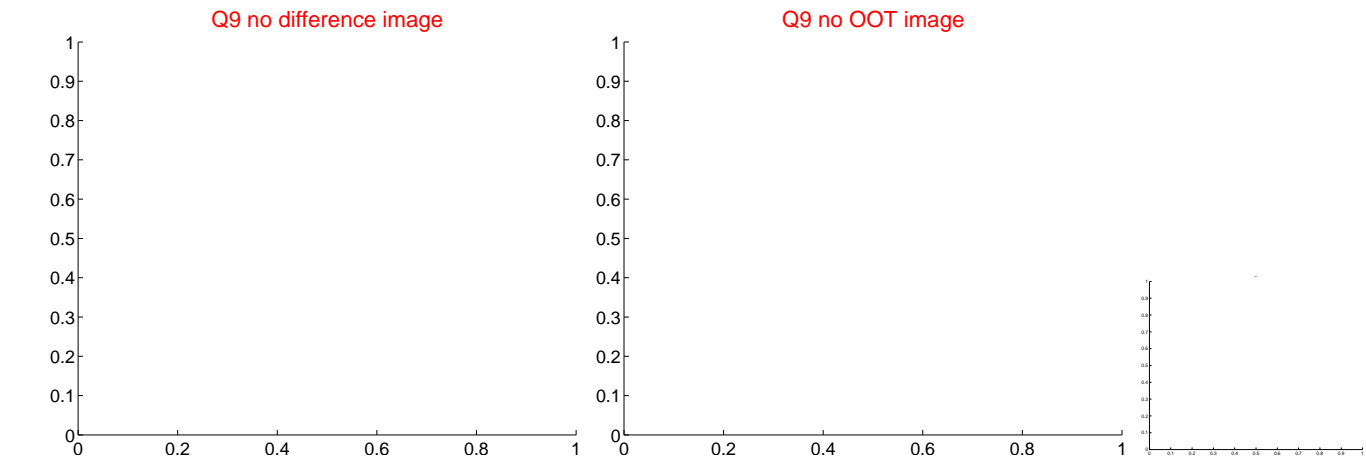
Q8 difference image



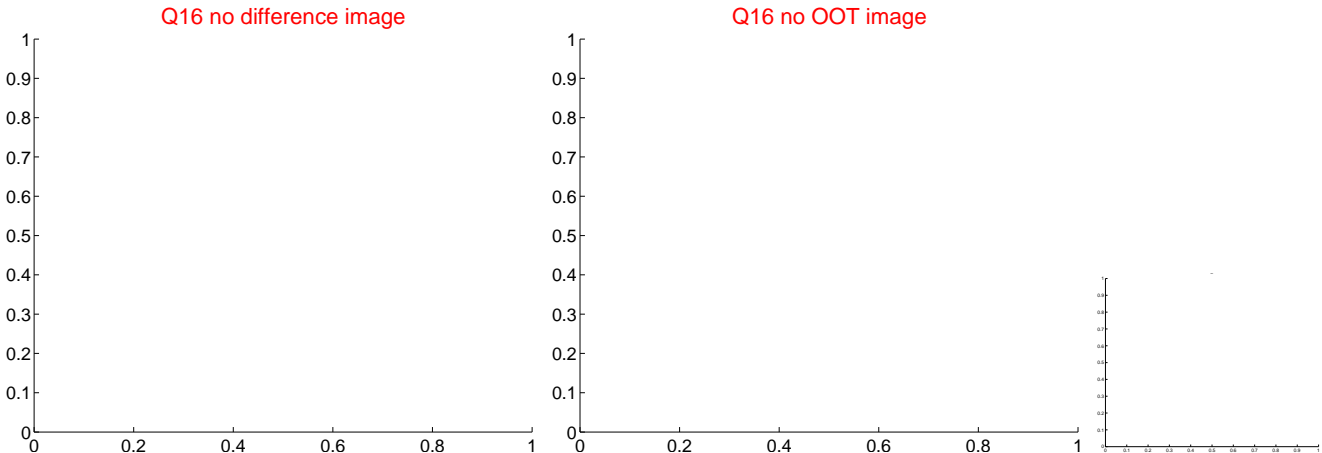
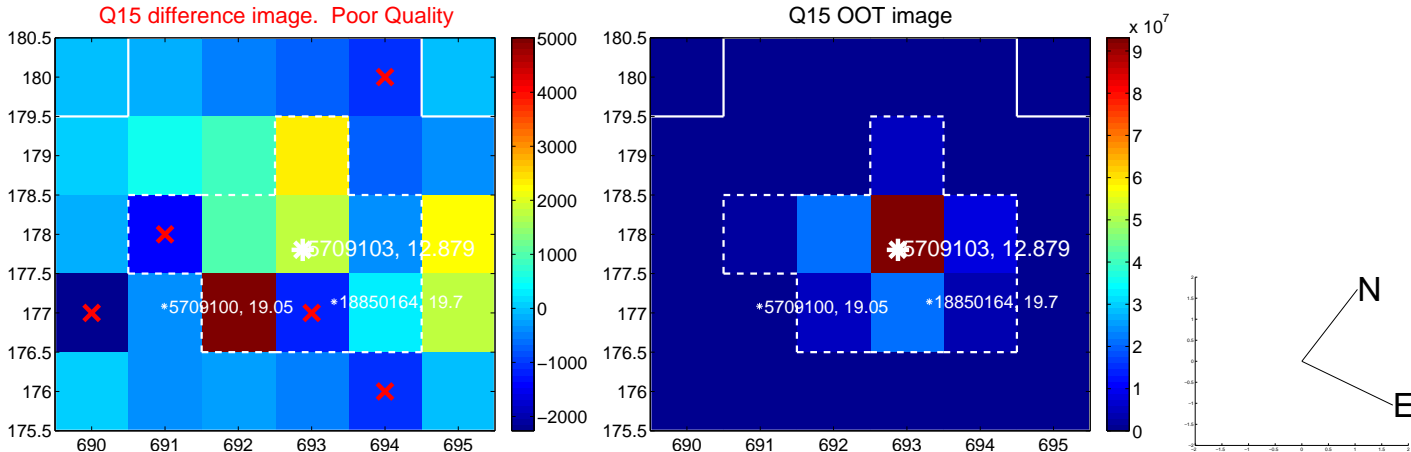
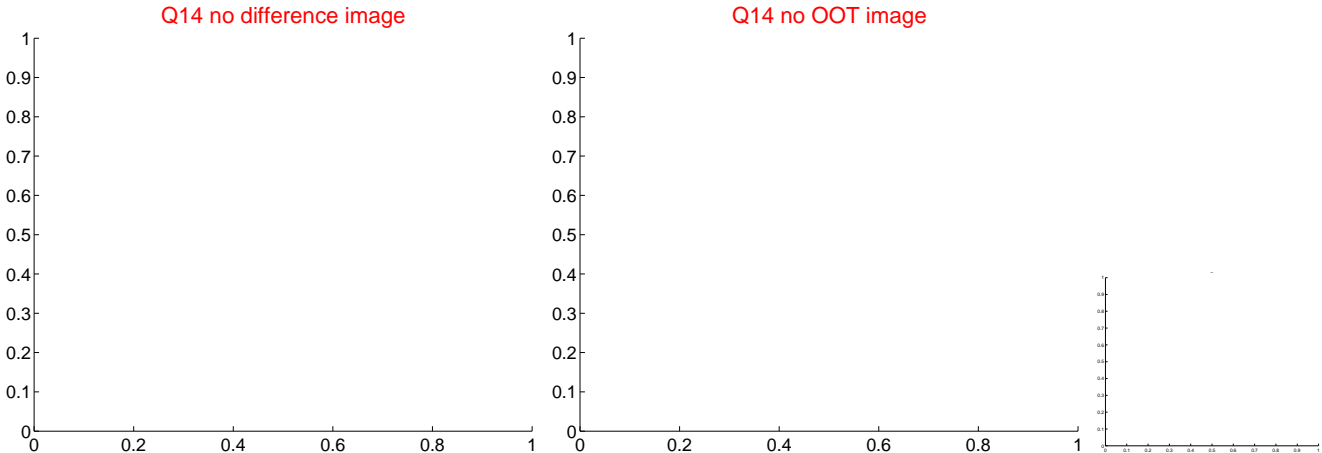
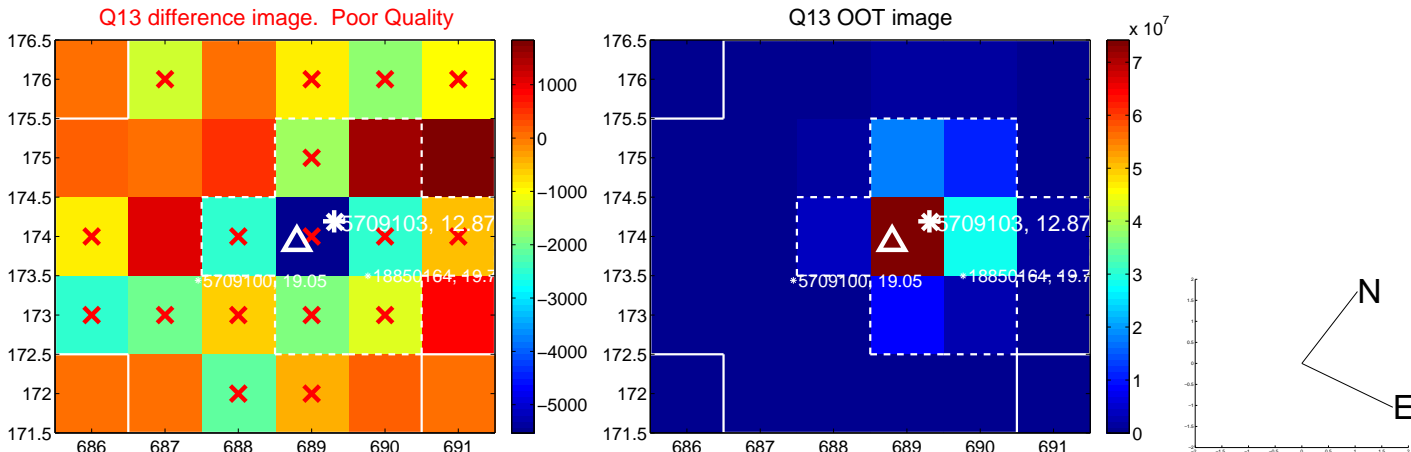
Q8 OOT image



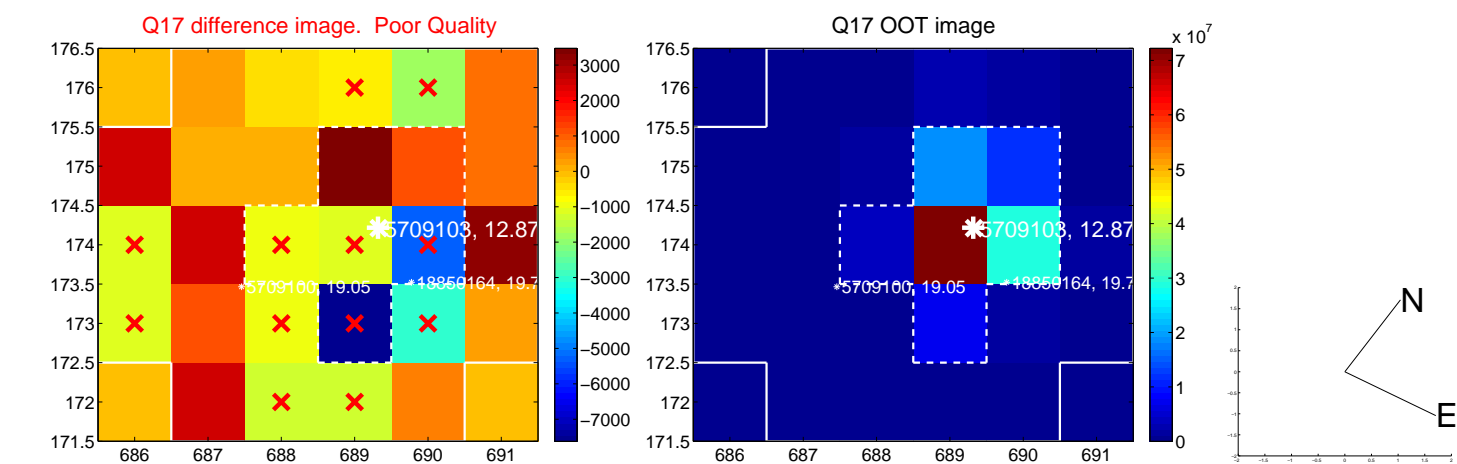
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



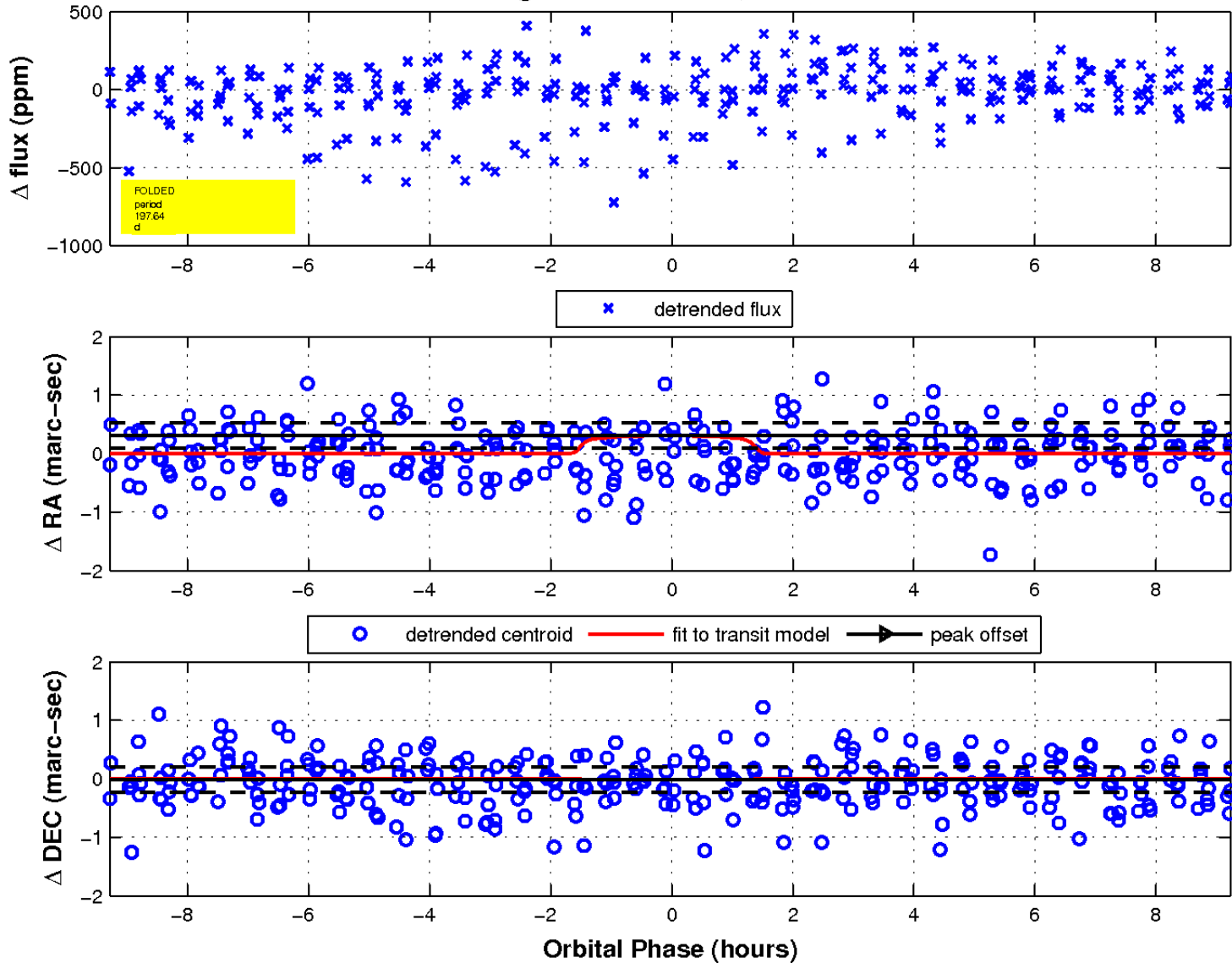
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value



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



### fluxWeightedCentroids, Planet 4 of 4



UKIRT Image

Declination

