

KIC 009973109

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})
009973109-01	OBS	2018.01	27.495601	133.287180	483.9	5.087	21.8	22.8	0.91	5657	2.30	28.70
009973109-02	OBS	2018.02	16.098919	131.873757	173.8	5.995	8.8	10.4	0.91	5657	1.50	58.59

Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009973109-01	OBS	PC	1.00	0	0	0	0	NO_COMMENT
009973109-02	OBS	PC	0.99	0	0	0	0	NO_COMMENT

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

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

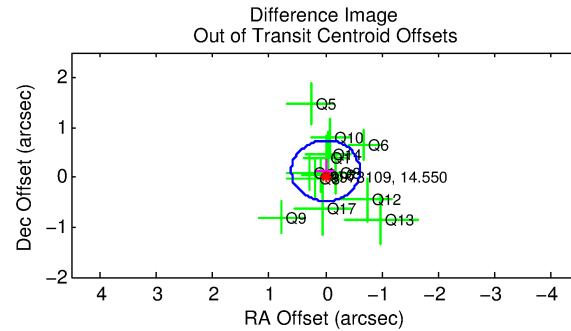
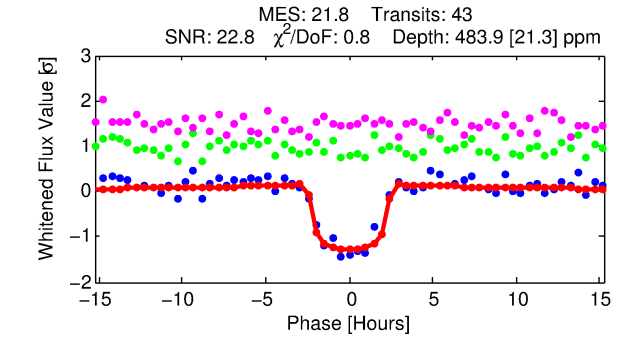
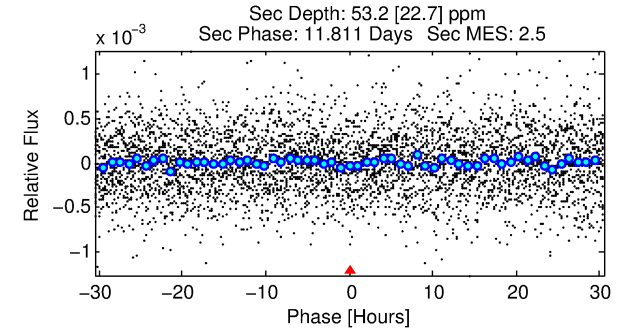
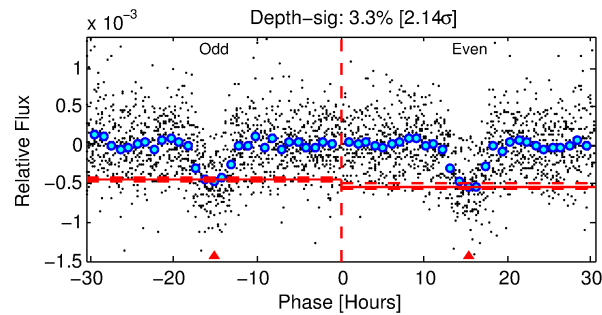
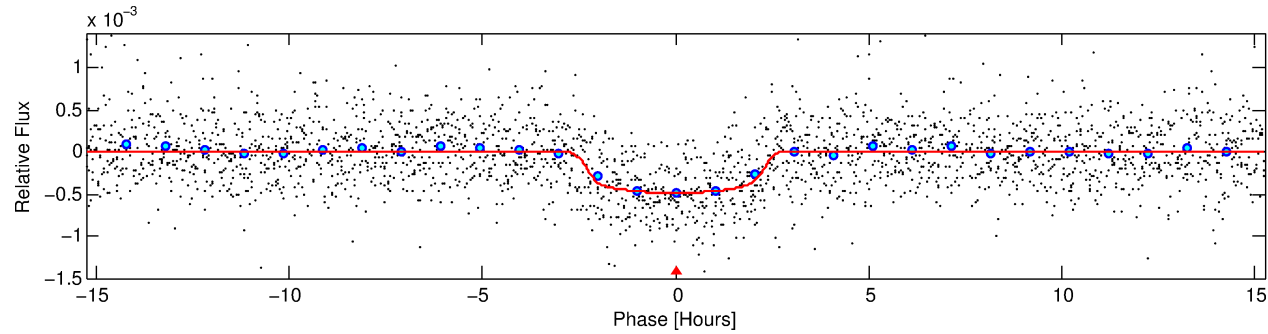
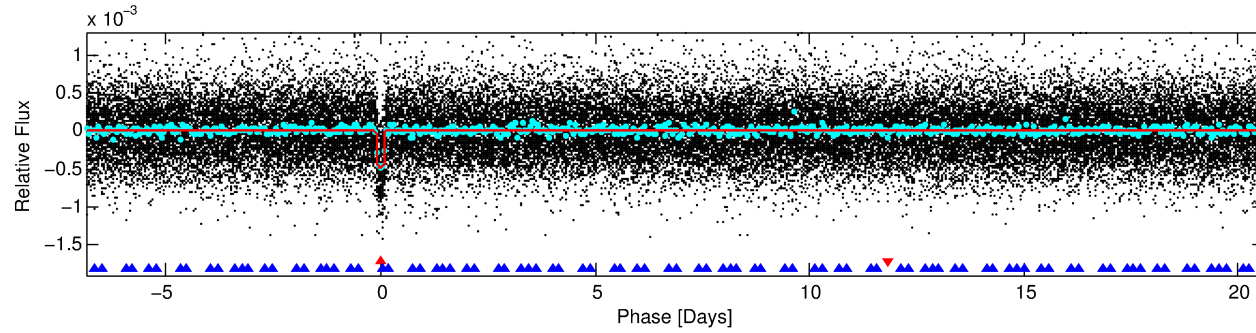
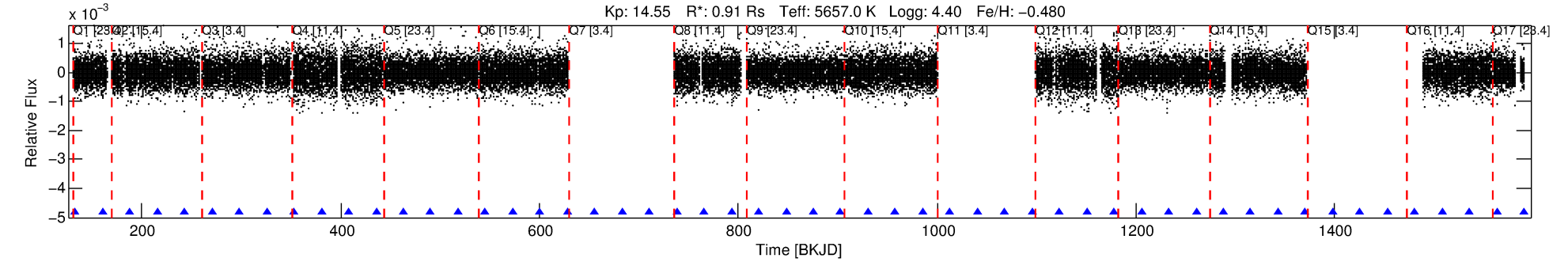
See http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col for comment definitions.

Ephemeris Match Information For 009973109-01

No Significant Match Found

DV One-Page Summary

KIC: 9973109 Candidate: 1 of 2 Period: 27.496 d
KOI: K02018.01 Corr: 0.976



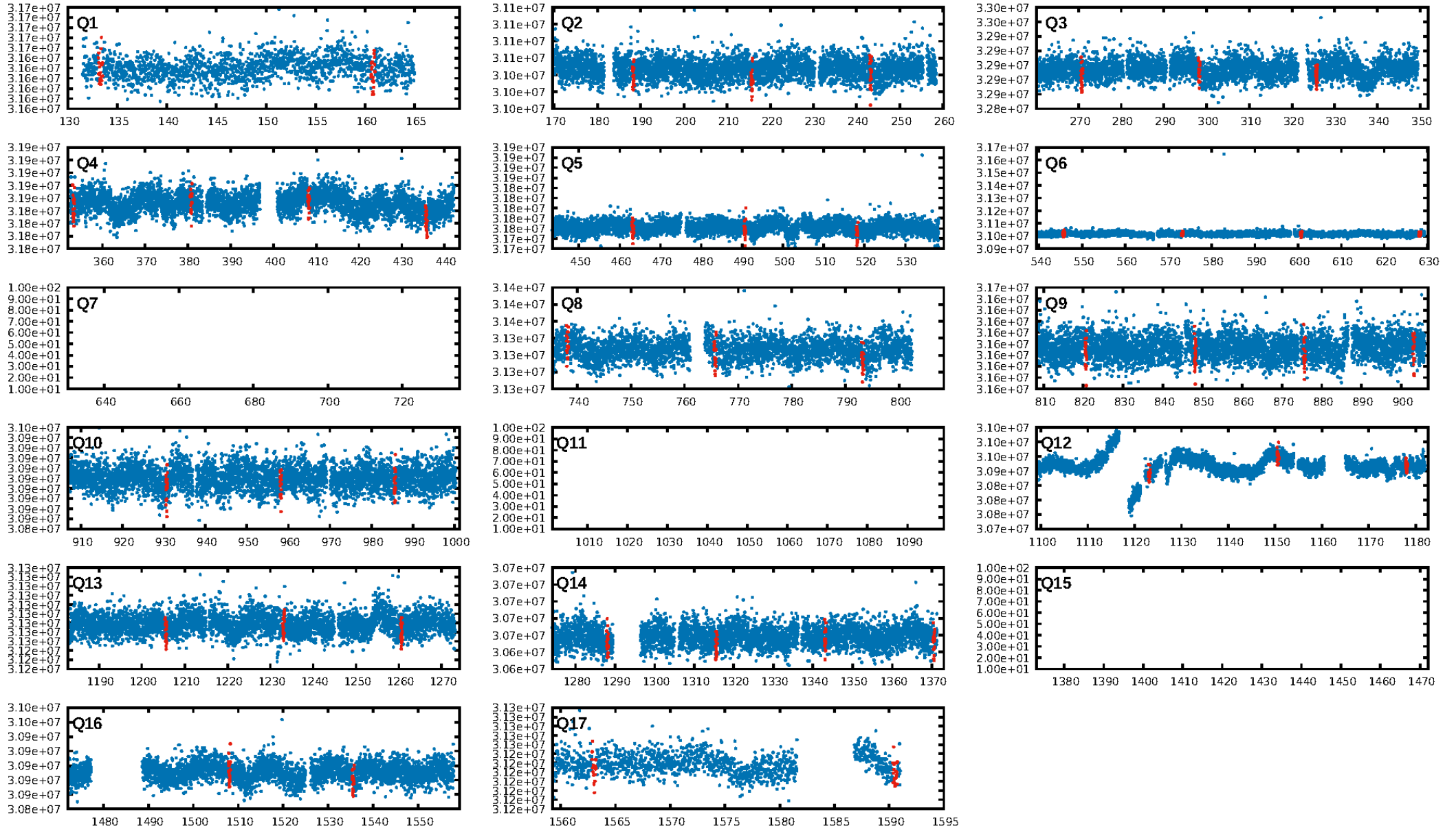
DV Fit Results:

Period = 27.49560 [0.00014] d
Epoch = 133.2872 [0.0041] BKJD
Rp/R* = 0.0231 [0.0031]
a/R* = 22.84 [13.97]
b = 0.86 [0.19]
Seff = 28.70 [11.08]
Teff = 590 [57] K
Rp = 2.30 [0.73] Re
a = 0.1629 [0.0403] AU
Ag = 146.91 [91.40] [1.60 σ]
Teffp = 3177 [410] K [6.25 σ]

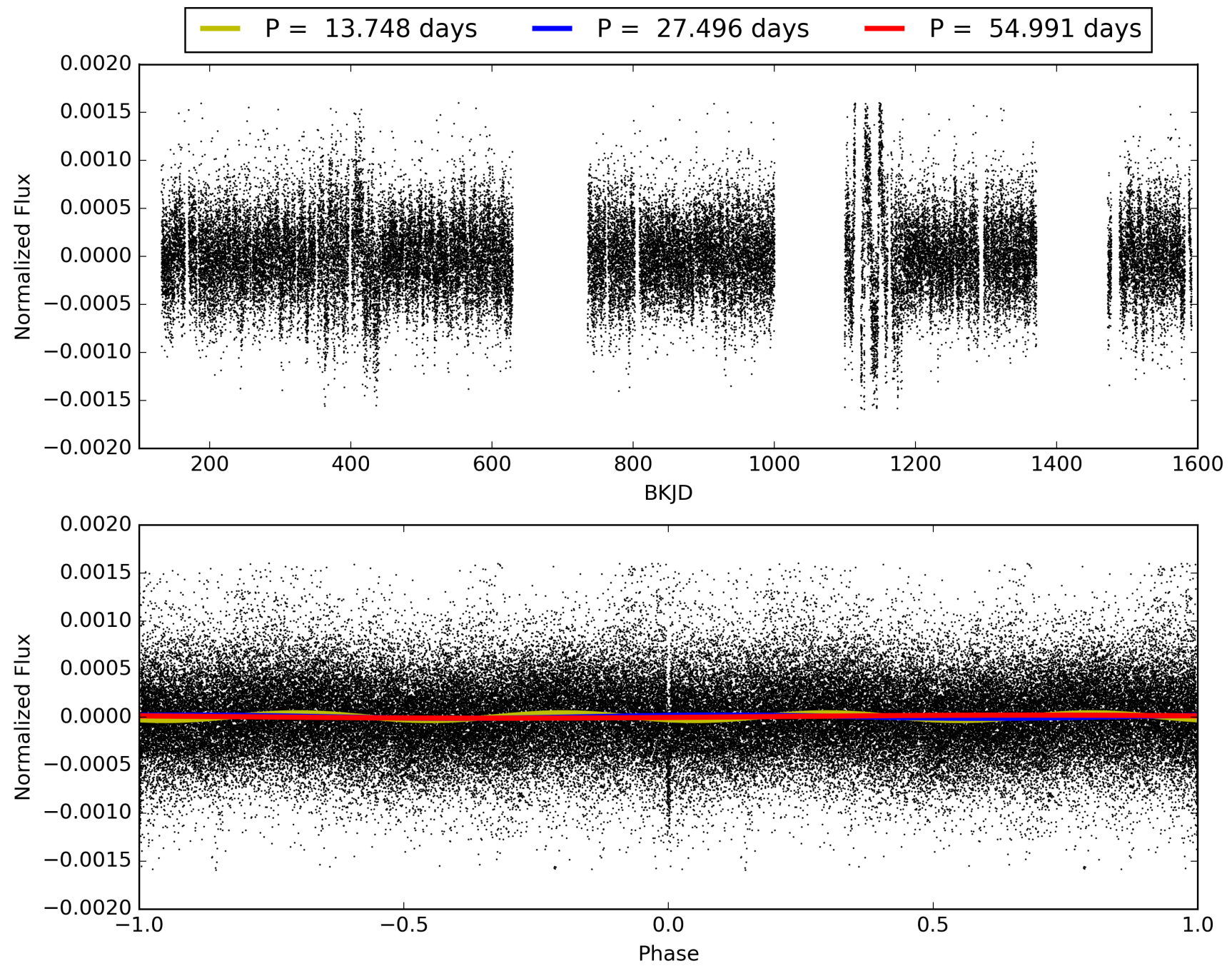
DV Diagnostic Results:

ShortPeriod-sig: 100.0% [34.79 σ]
LongPeriod-sig: N/A
ModelChiSquare2-sig: 91.2%
ModelChiSquareGof-sig: 100.0%
Bootstrap-pfa: 9.69e-106
RollingBand-fgt: 1.00 [39/39]
GhostDiagnostic-chr: 5.611
Centroid-sig: 0.8%
Centroid-so: 1.006 arcsec [1.75 σ]
OotOffset-rm: 0.128 arcsec [0.63 σ]
KicOffset-rm: 0.213 arcsec [1.05 σ]
OotOffset-st: 3/1/4/5 [13]
KicOffset-st: 3/1/4/5 [13]
DiffImageQuality-fgm: 1.00 [13/13]
DiffImageOverlap-fno: 1.00 [14/14]

TCE 009973109-01, PDC Light Curves

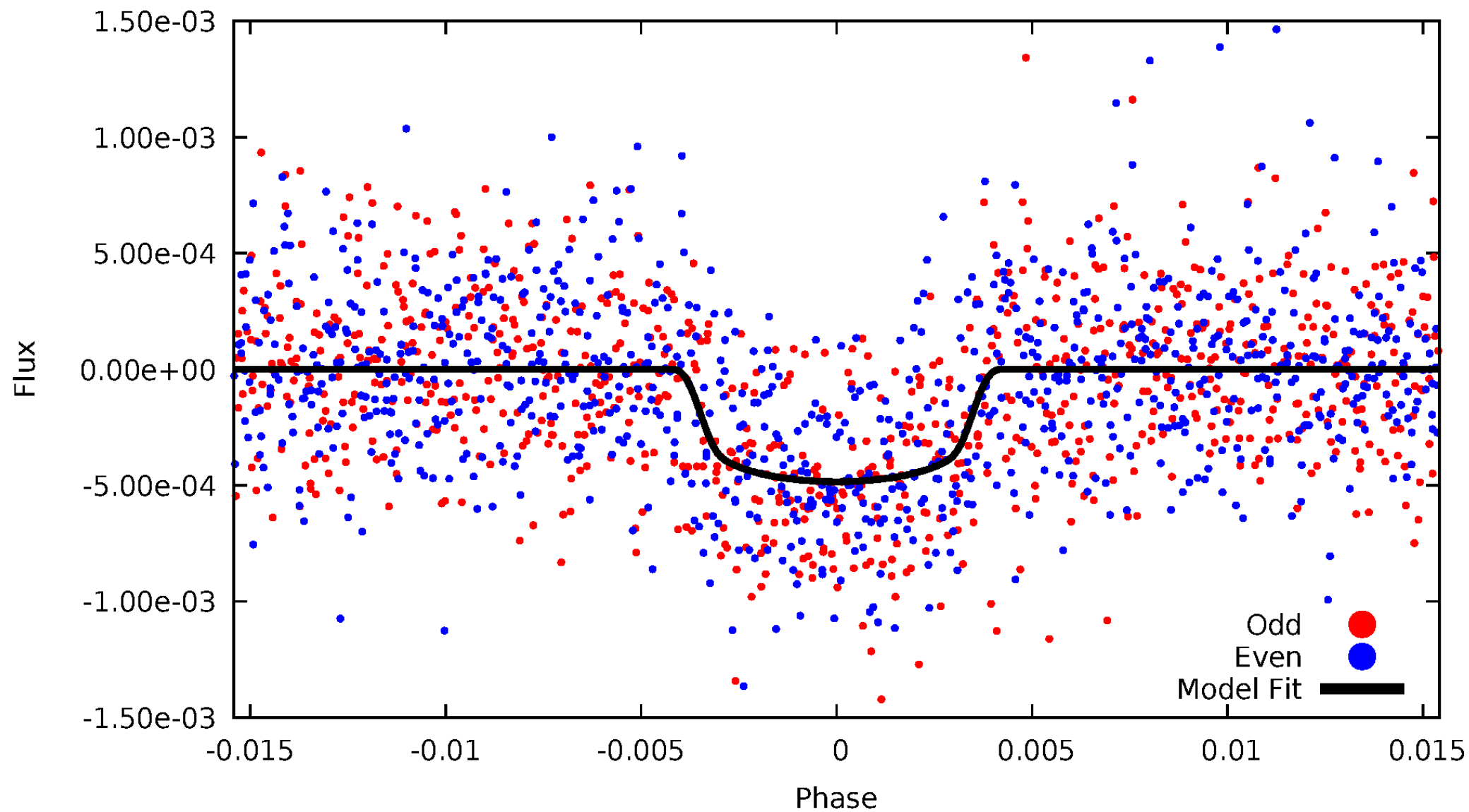


TCE 009973109-01



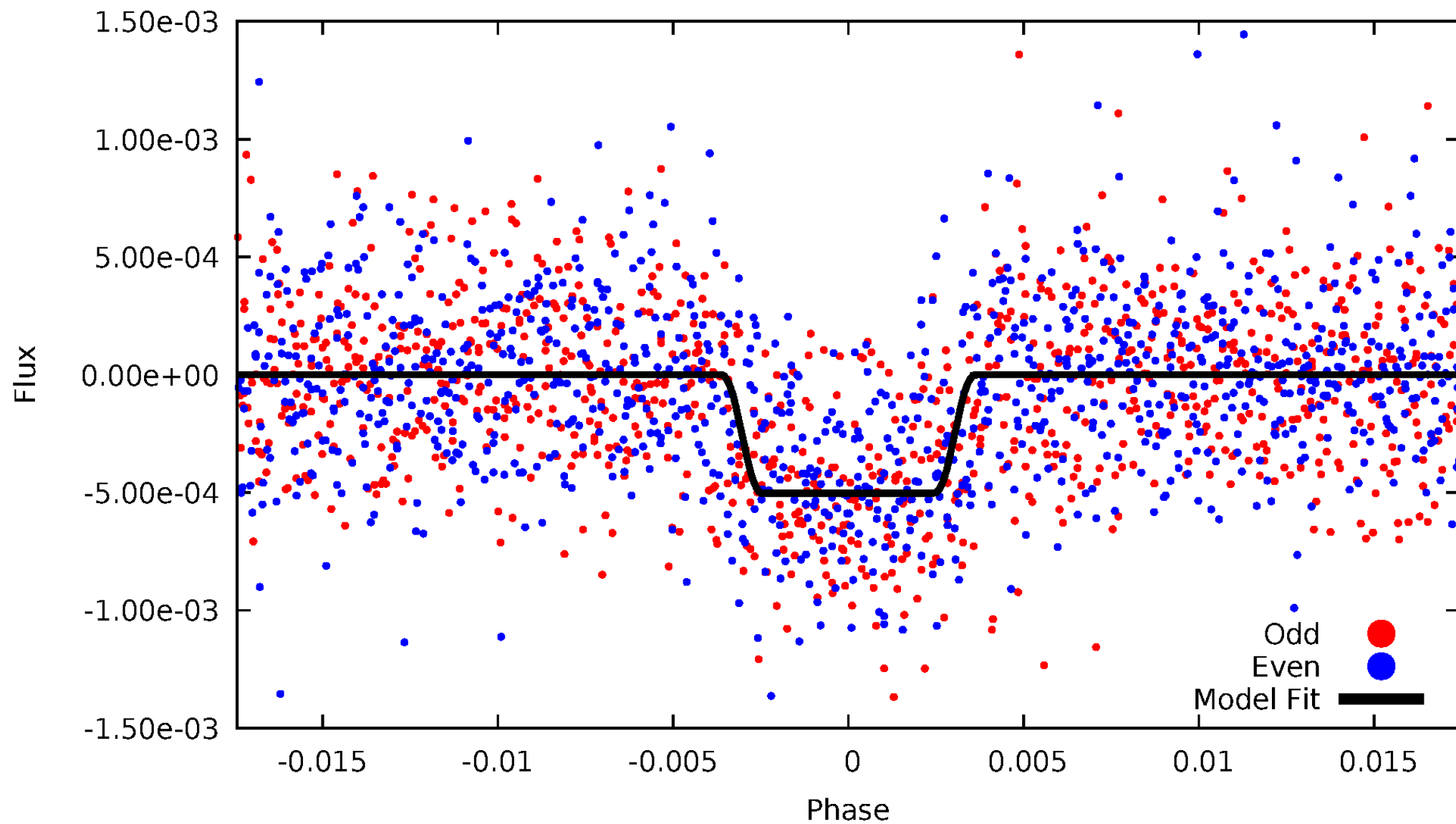
DV Odd/Even

TCE 009973109-01



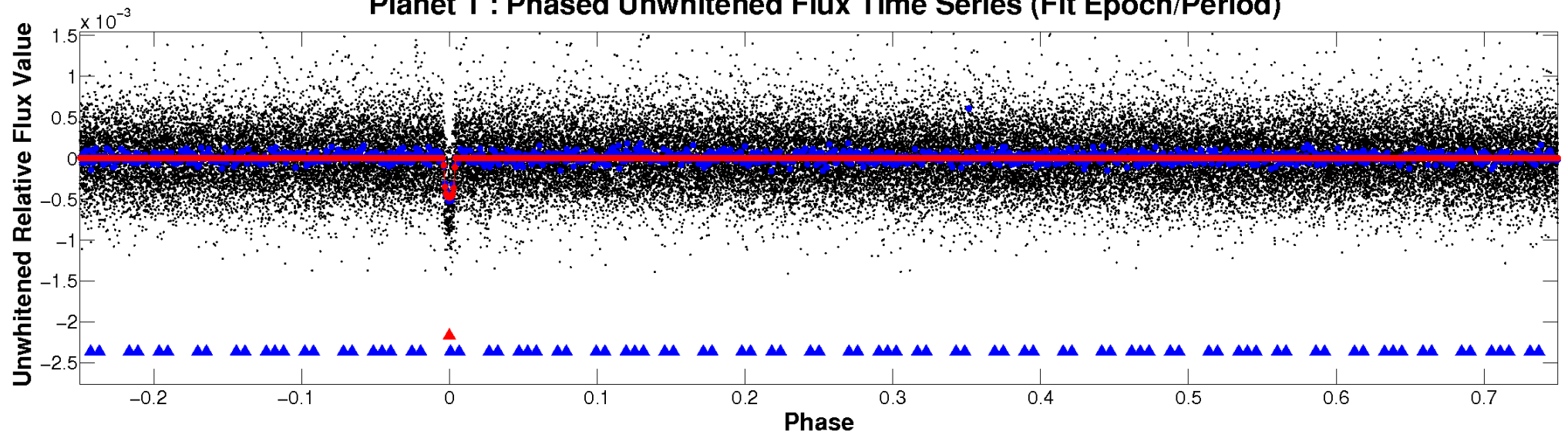
ALT Odd/Even

TCE 009973109-01

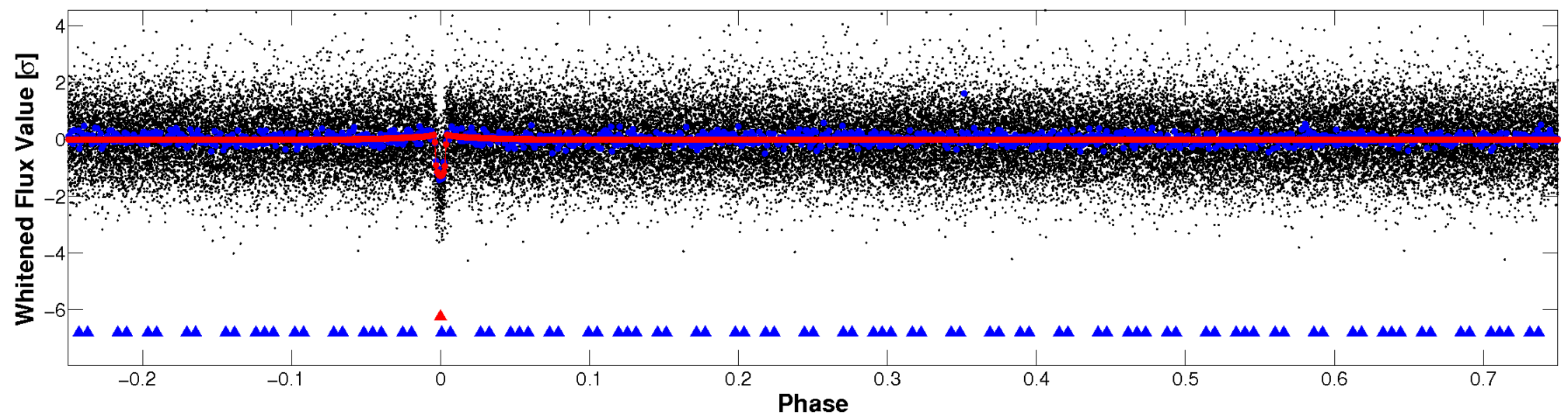


Non-Whitened Vs. Whitened Light Curve

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

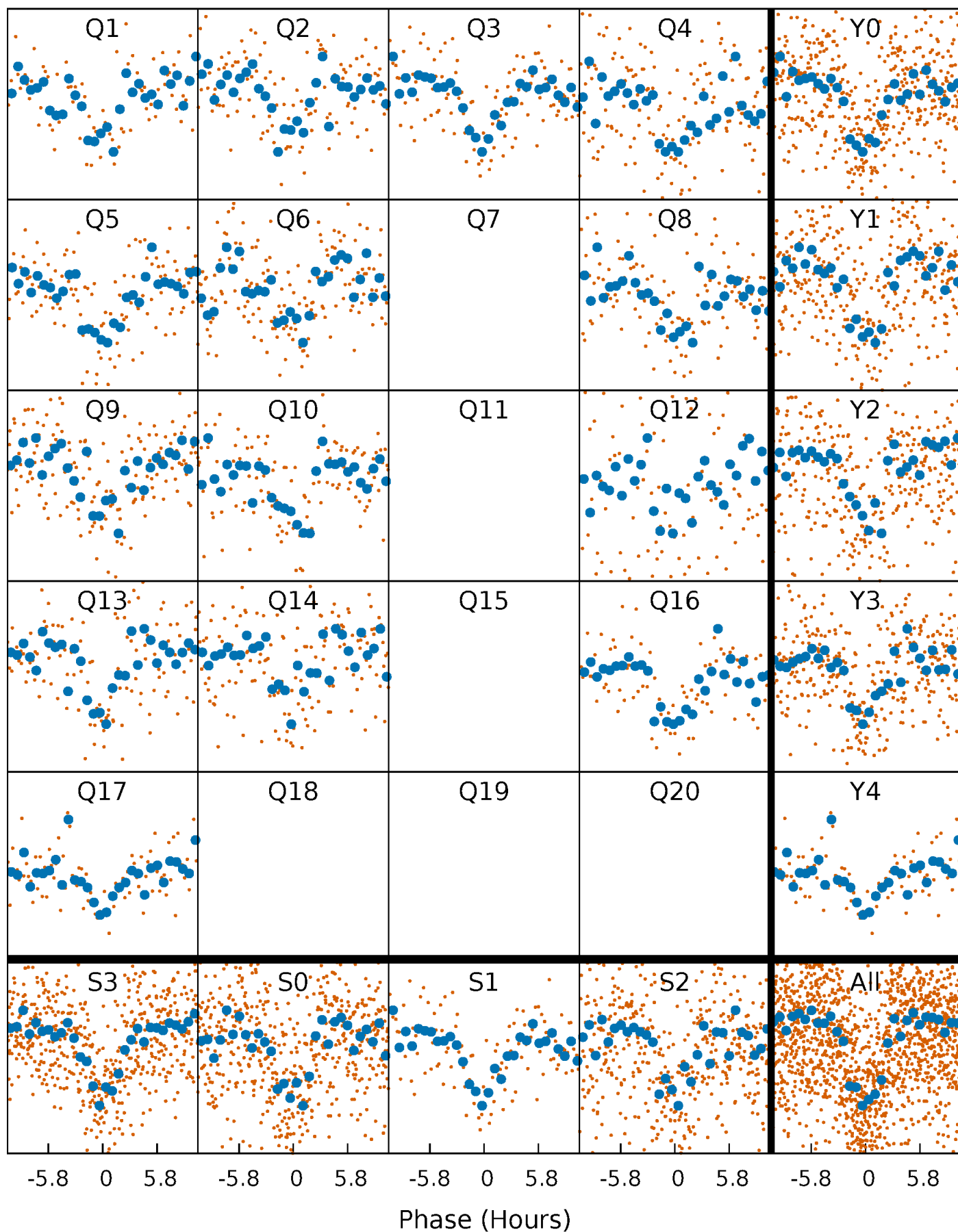


Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)



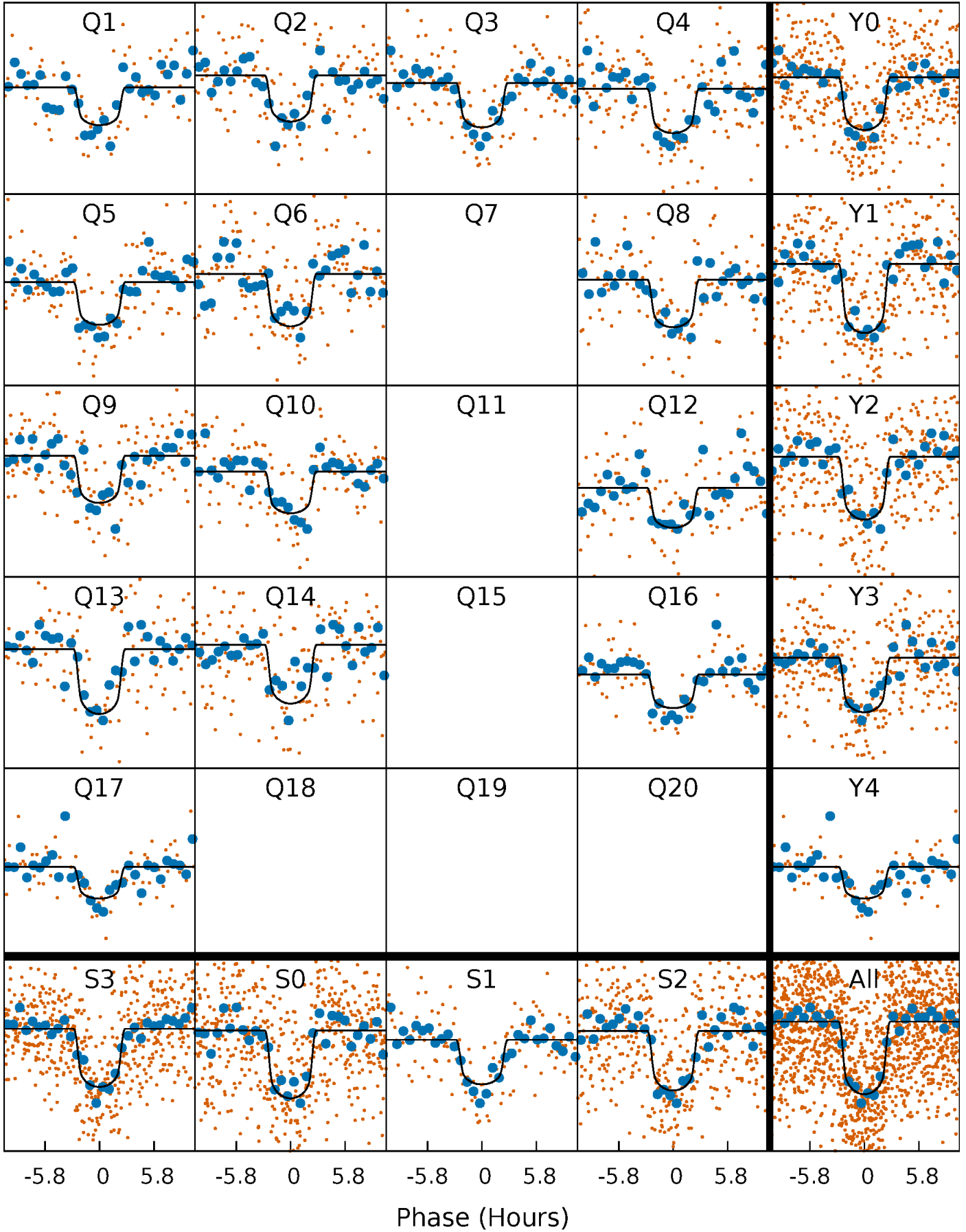
PDC Quarter-Phased Transit Curves

TCE 009973109-01 P= 27.495601 Days $T_0=133.287180$ (BKJD)



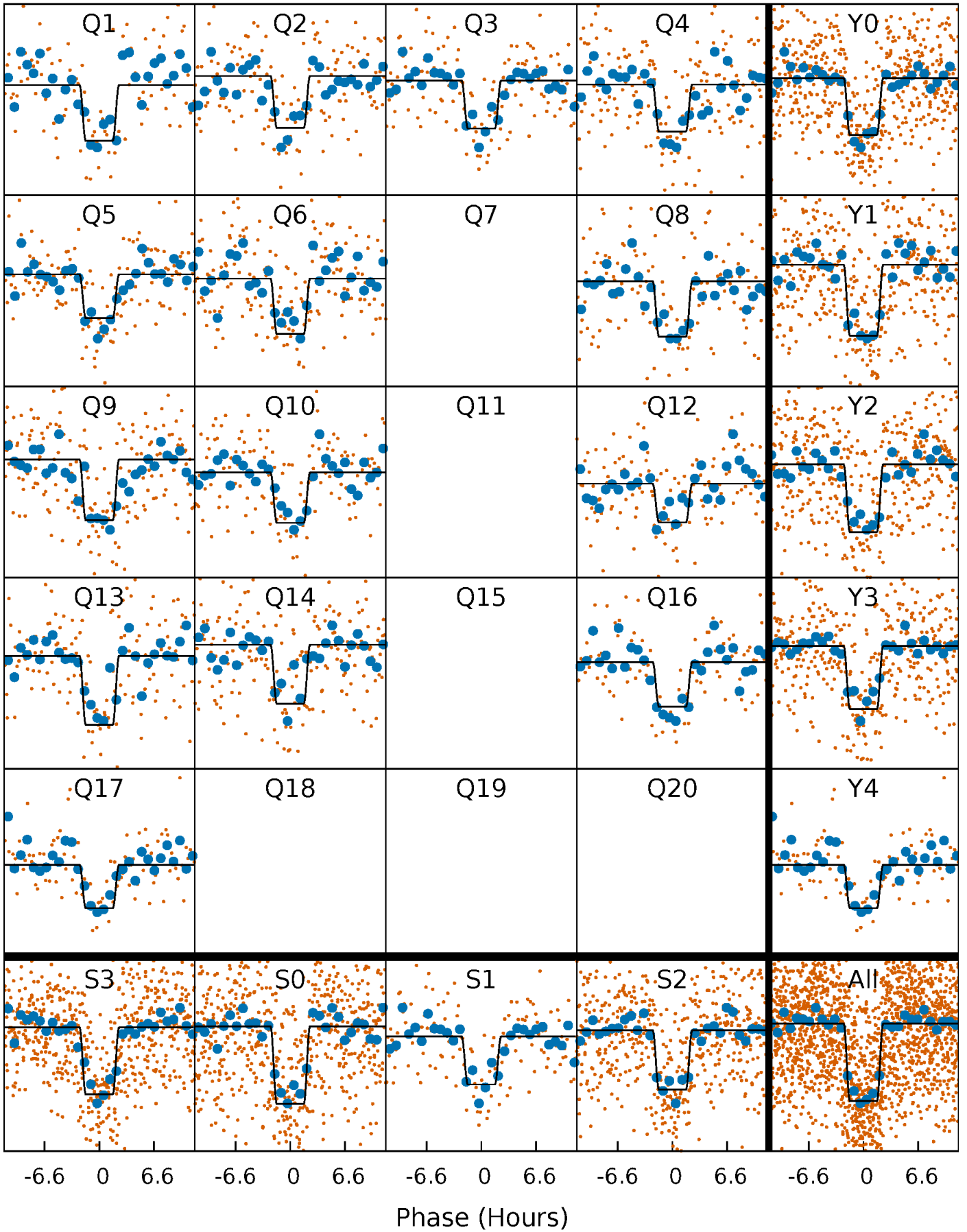
DV Quarter-Phased Transit Curves

TCE 009973109-01 P= 27.495601 Days $T_0=133.287180$ (BKJD)



Alt. Detrend Quarter-Phased Transit Curves

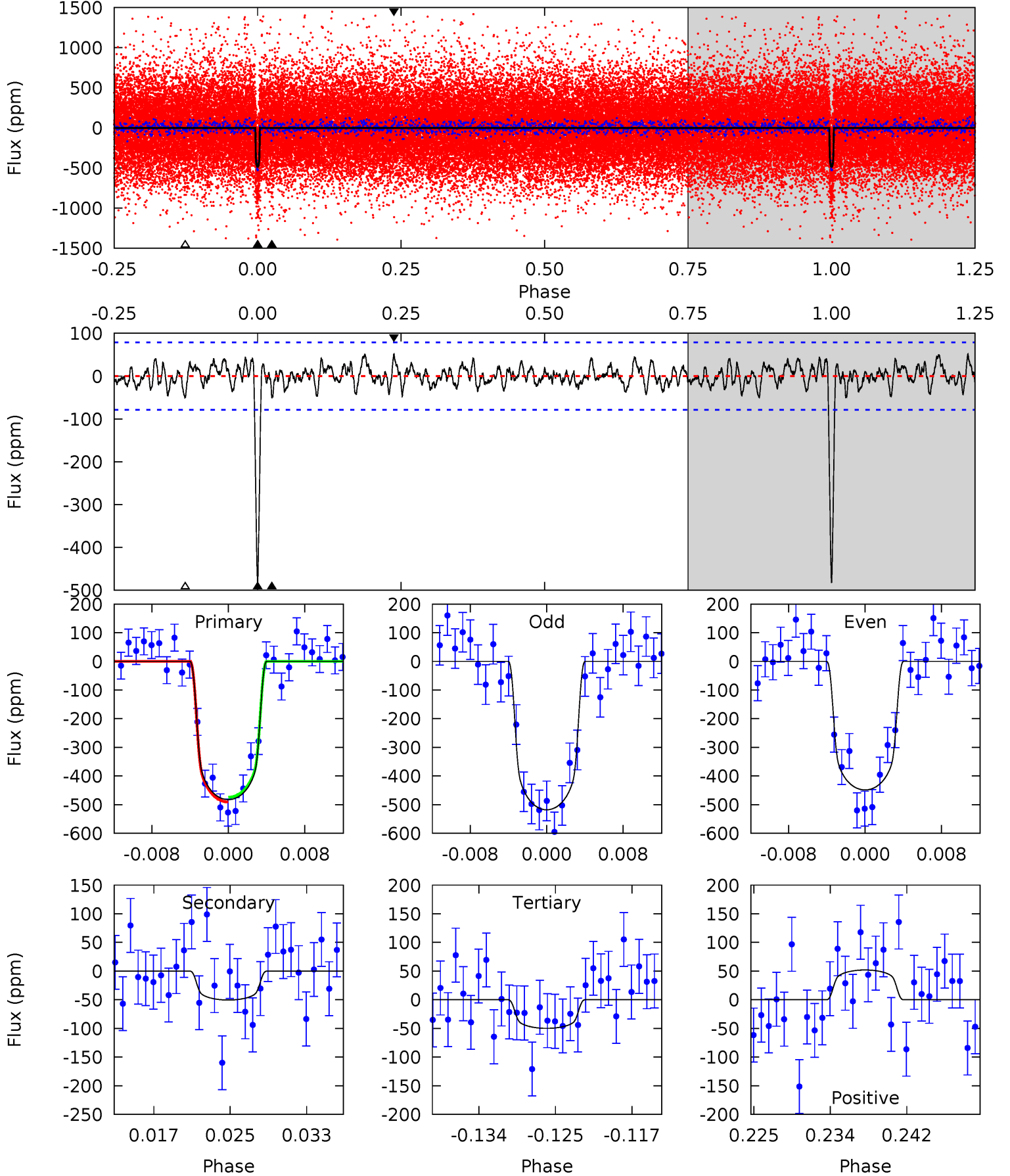
TCE 009973109-01 P= 27.495724 Days $T_0=133.281887$ (BKJD)



DV Model-Shift Uniqueness Test

009973109-01, $P = 27.495601$ Days, $E = 105.791579$ Days

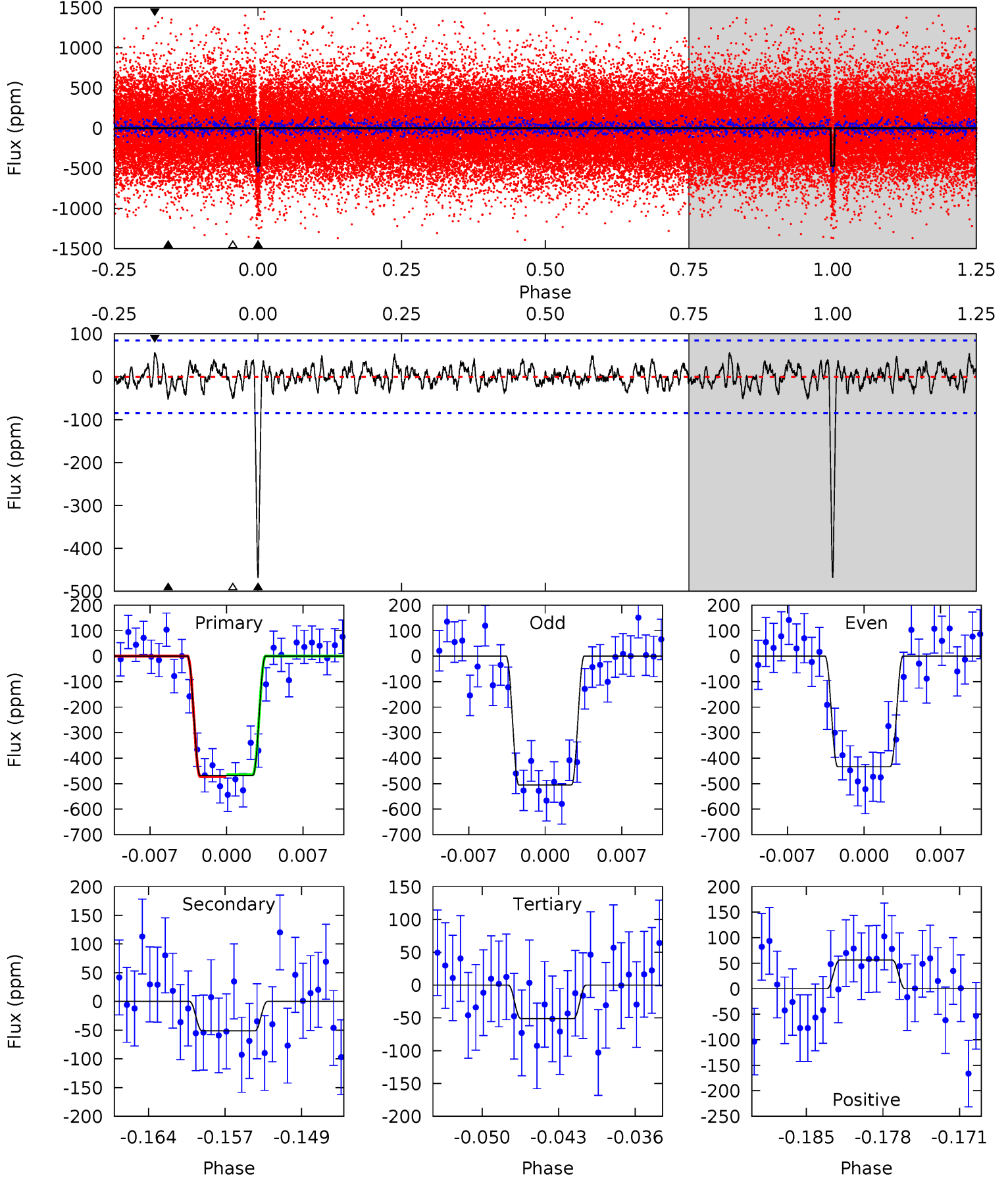
Pri	Sec	Ter	Pos	FA ₁	FA ₂	F _{Red}	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
31.0	3.25	3.21	3.34	5.06	2.64	1.20	27.8	27.7	0.04	-0.09	2.23	0.97	0.10	0.53



Alt Model-Shift Uniqueness Test

009973109-01, $P = 27.495724$ Days, $E = 105.786163$ Days

Pri	Sec	Ter	Pos	FA ₁	FA ₂	F _{Red}	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
28.1	3.08	3.07	3.38	5.09	2.69	1.08	25.1	24.7	0.01	-0.30	2.16	0.97	0.11	0.21



Stellar Parameters For KIC 009973109

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	5657^{+169}_{-169}	$4.401^{+0.167}_{-0.204}$	$-0.480^{+0.300}_{-0.300}$	$0.911^{+0.262}_{-0.161}$	$0.762^{+0.124}_{-0.044}$	$1.420^{+1.100}_{-0.711}$
	+3%/-3%	+4%/-5%	+62%/-62%	+29%/-18%	+16%/-6%	+77%/-50%
Source	PHO1	KIC0	KIC0	DSEP		

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

Secondary Eclipse Parameters for KIC 009973109-01 / KOI 2018.01

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	A_{obs}
DV	-50 ± 16	$2.34^{+0.51}_{-0.41}$	828^{+68}_{-55}	3577^{+264}_{-248}	134^{+84}_{-55}
Alt.	-51 ± 17	$2.28^{+0.55}_{-0.41}$	832^{+69}_{-54}	3619^{+273}_{-277}	141^{+95}_{-62}

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

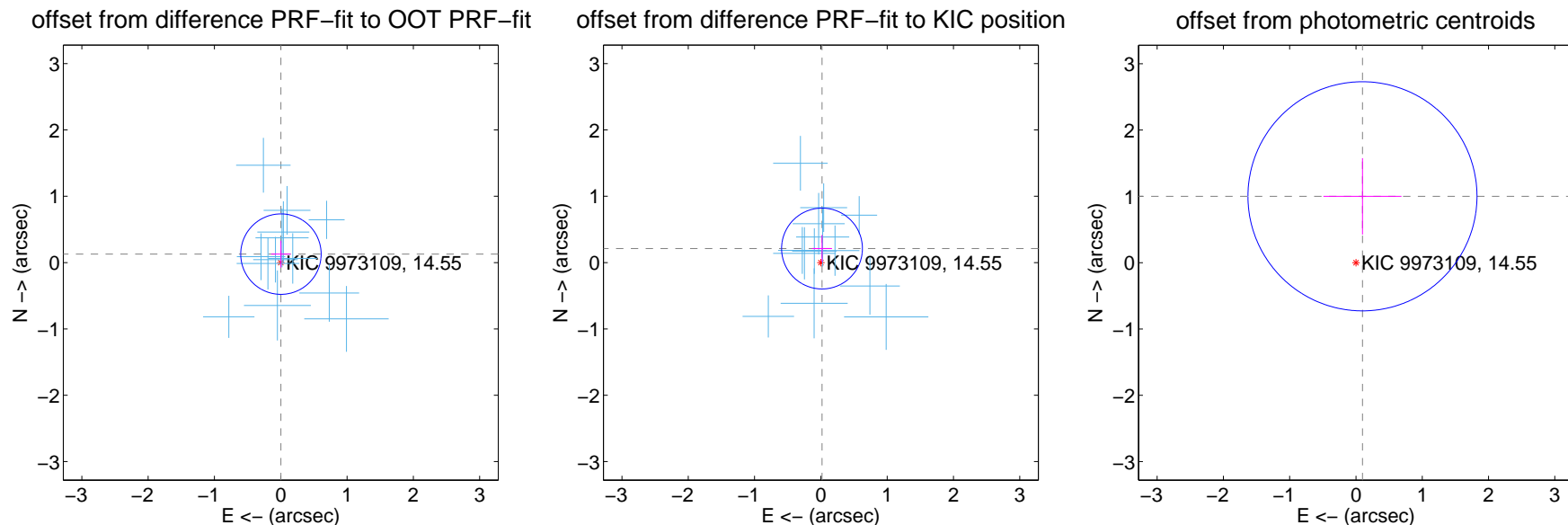
DV Centroid Data

Supplemental centroid analysis for 009973109-01. Kepler magnitude: 14.55. Transit SNR 22.84

There are 13 quarters with good PRF difference image offsets

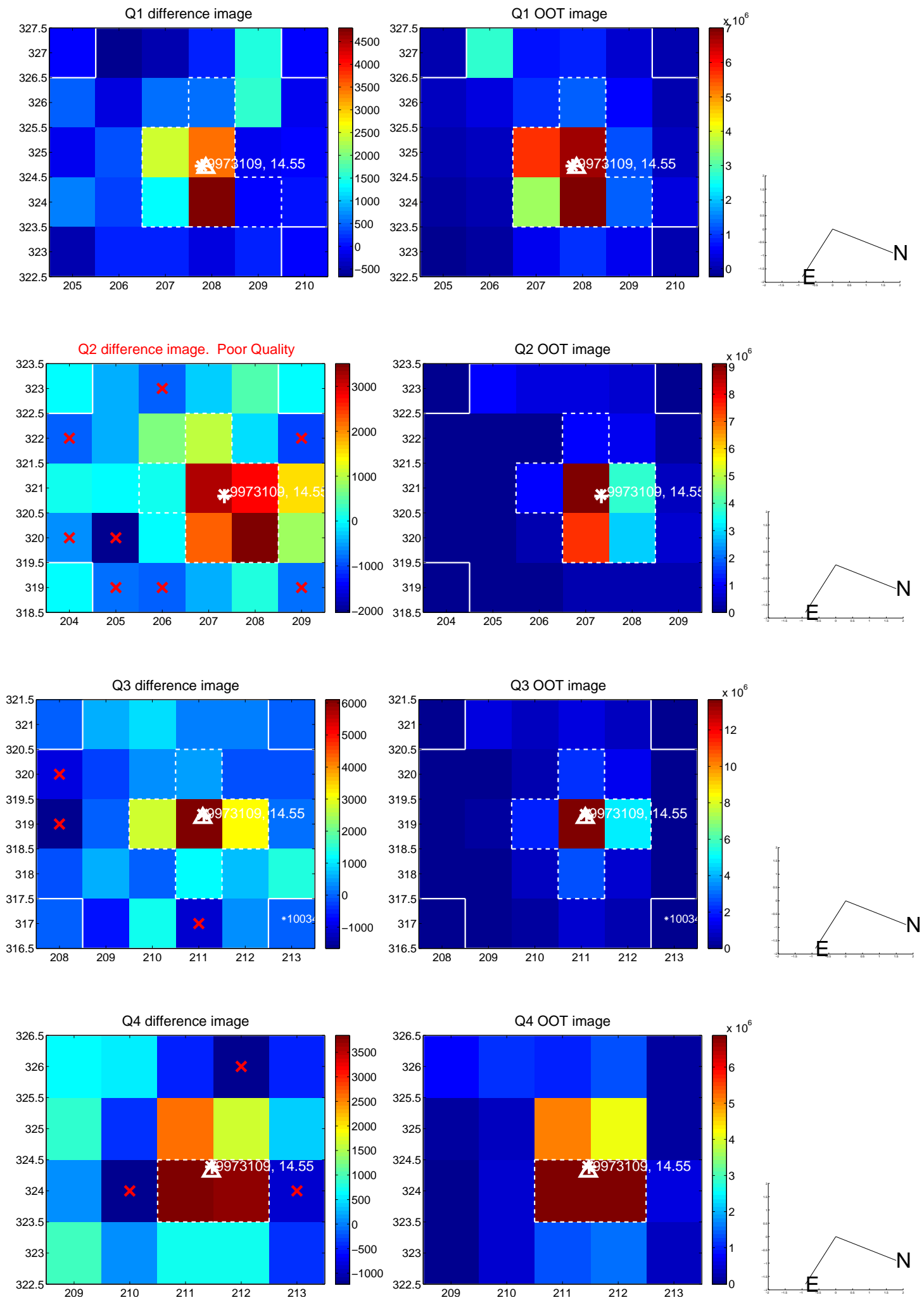
The direct PRF centroid is offset from the target star catalog position by about 0.06 arcsec

	Distance in arcsec	Distance / σ	Δ RA	Δ Dec
PRF-fit source offset from OOT	0.128 ± 0.202	0.63	-0.003 ± 0.147	0.128 ± 0.202
PRF-fit source offset from KIC position	0.213 ± 0.203	1.05	-0.017 ± 0.152	0.212 ± 0.203
photometric centroid source offset	1.01 ± 0.58	1.75	-0.10 ± 0.59	1.00 ± 0.58

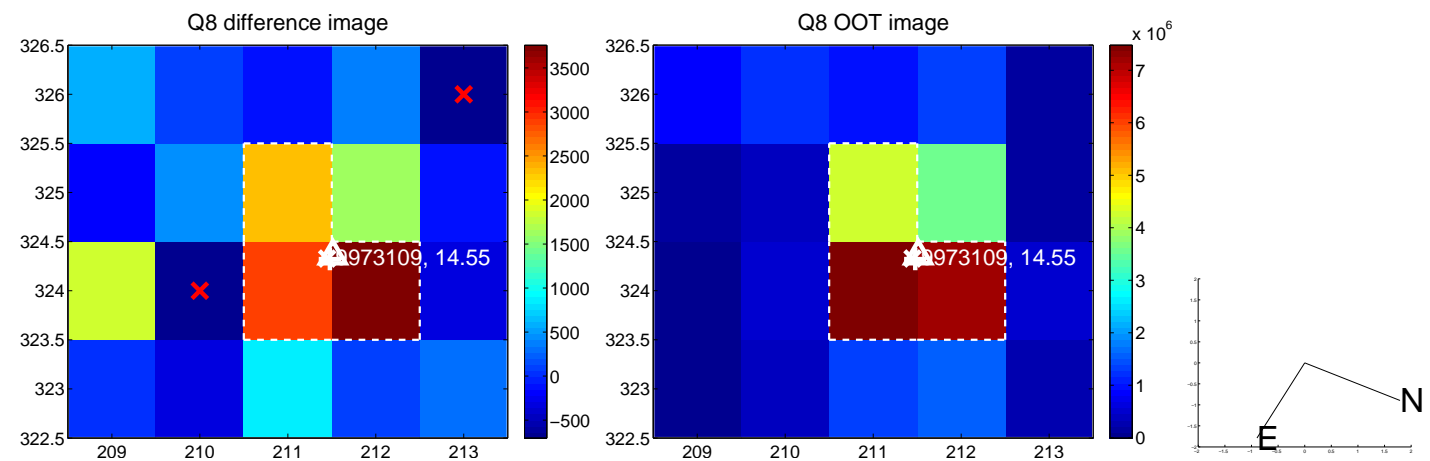
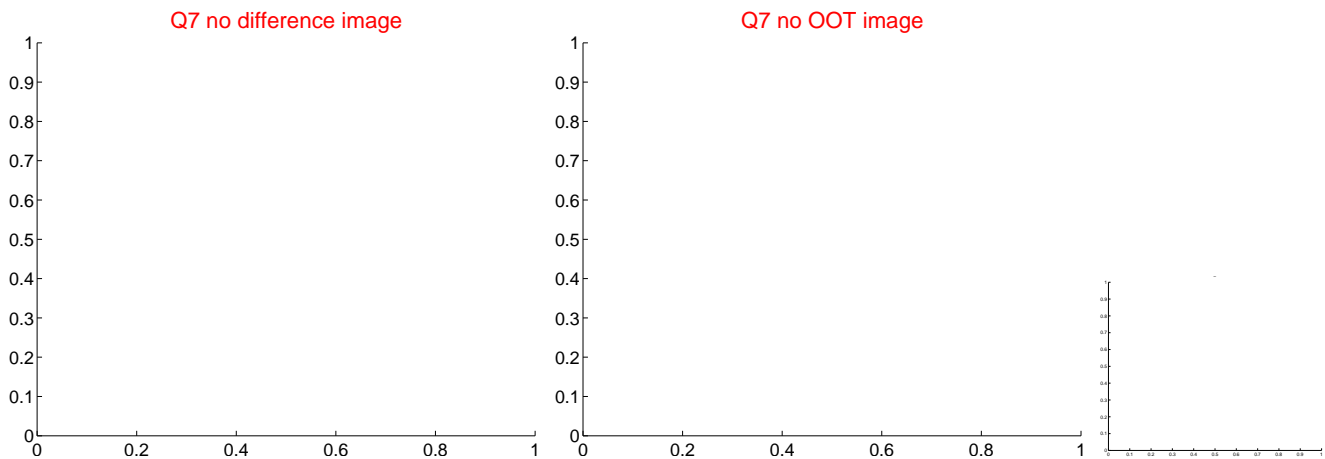
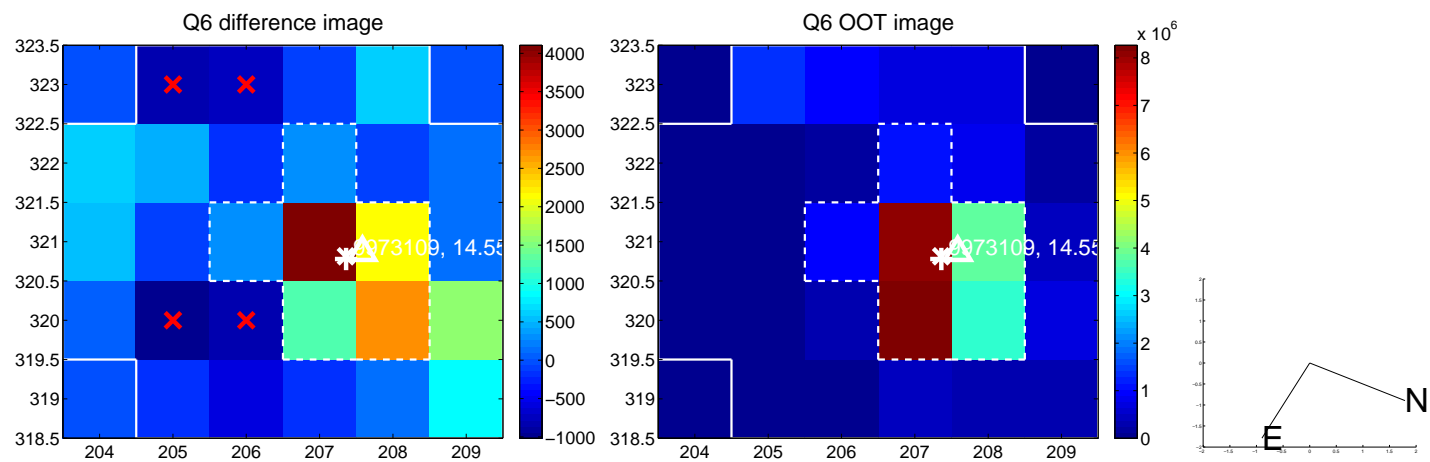
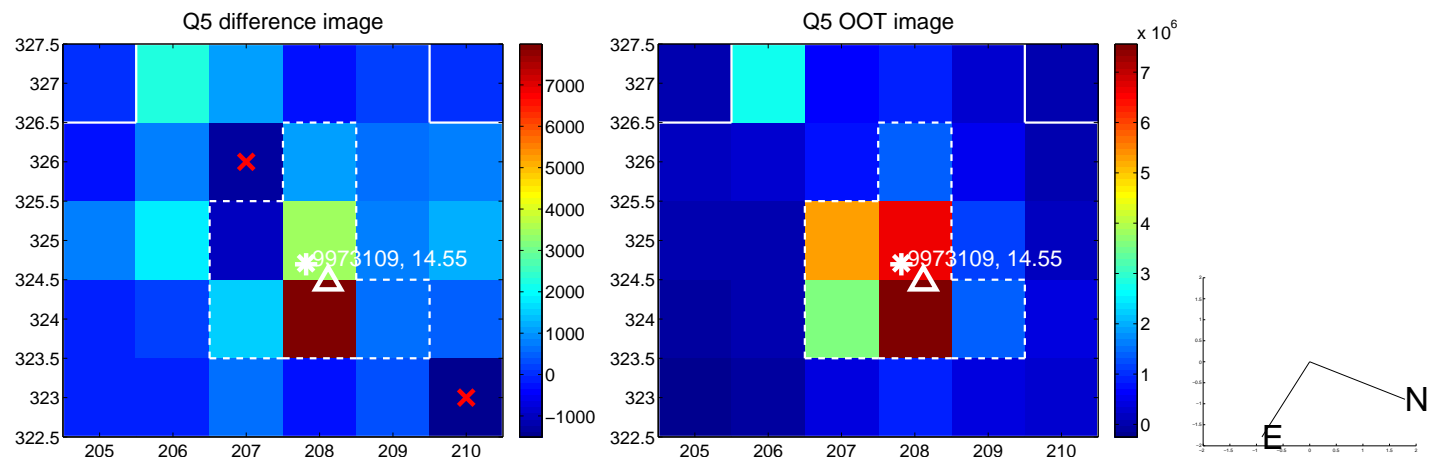


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets**; **Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- σ uncertainty. Blue circle: three-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

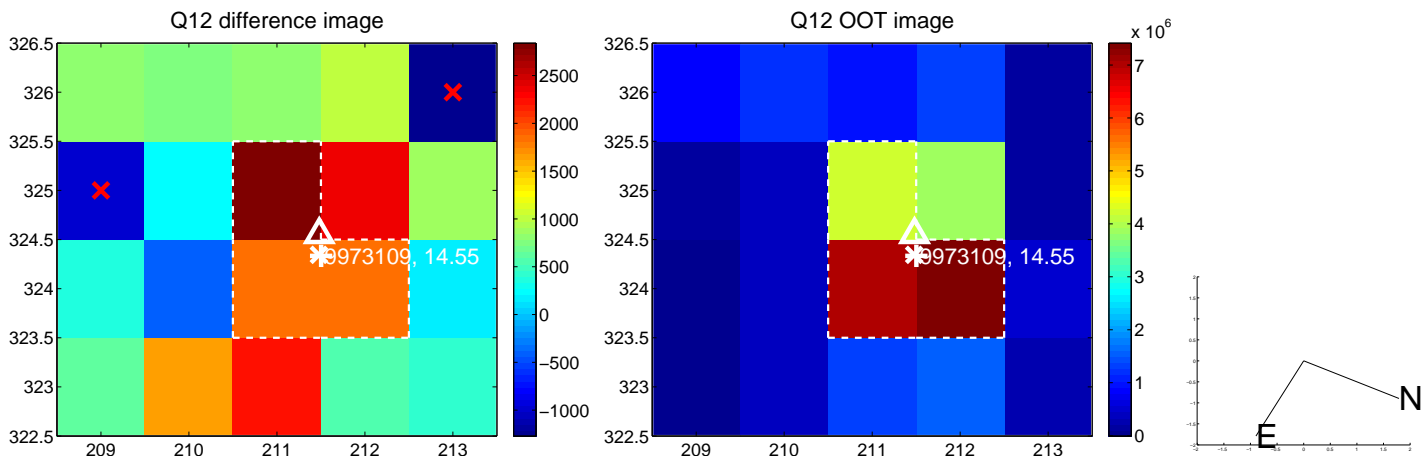
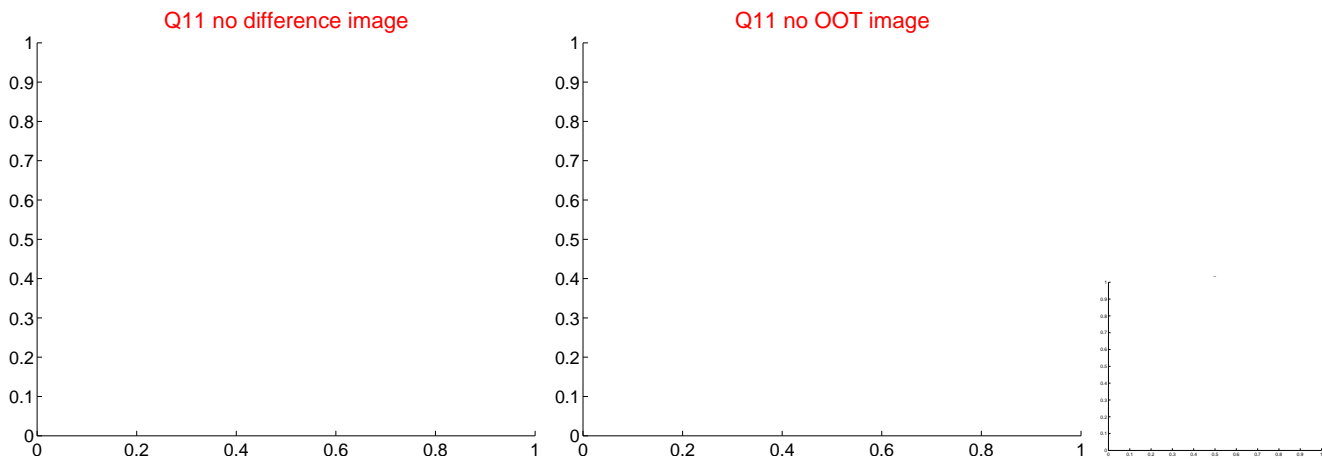
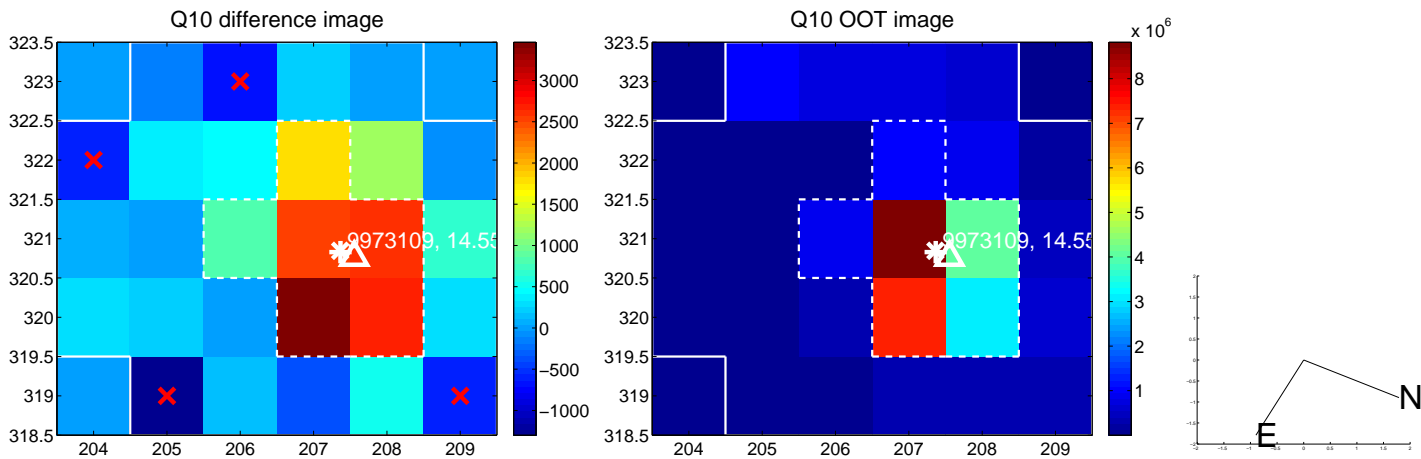
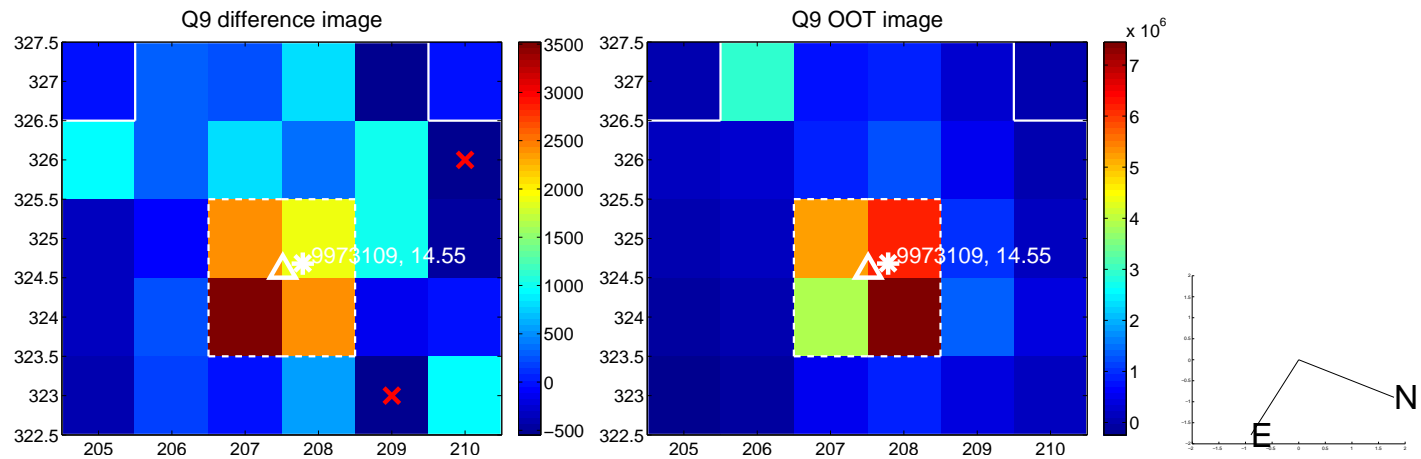
white \times : KIC target position; +: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



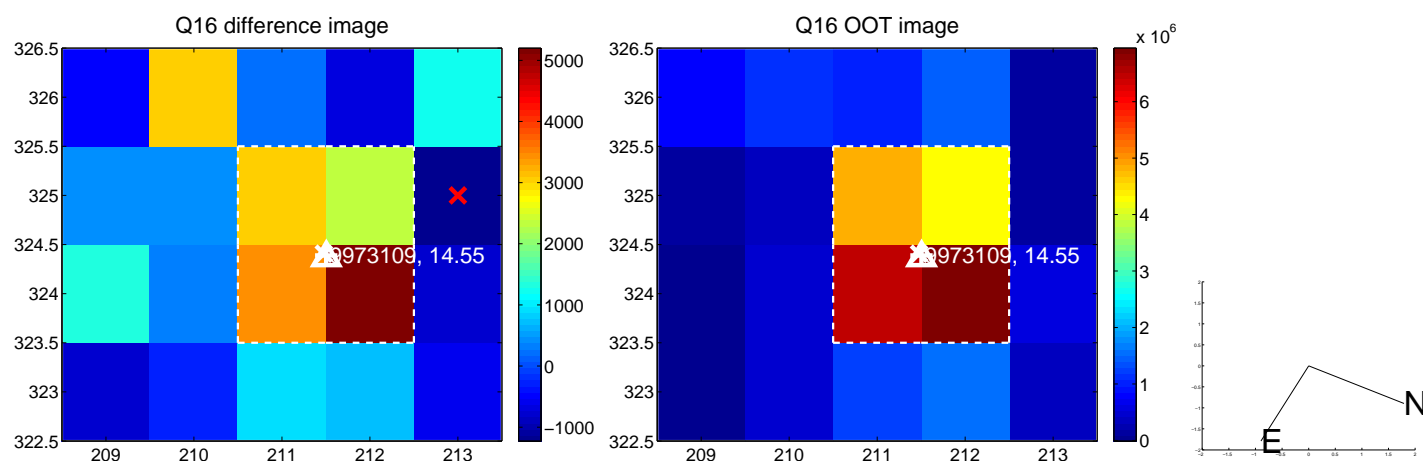
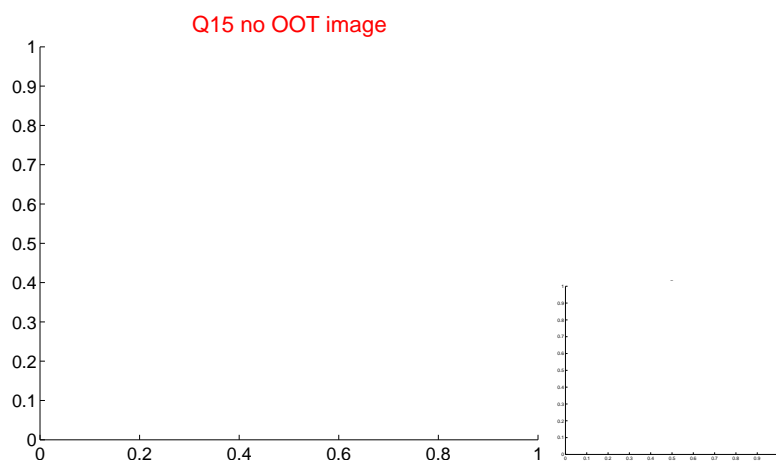
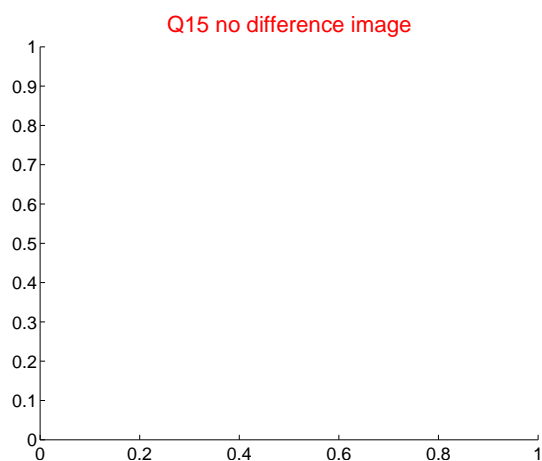
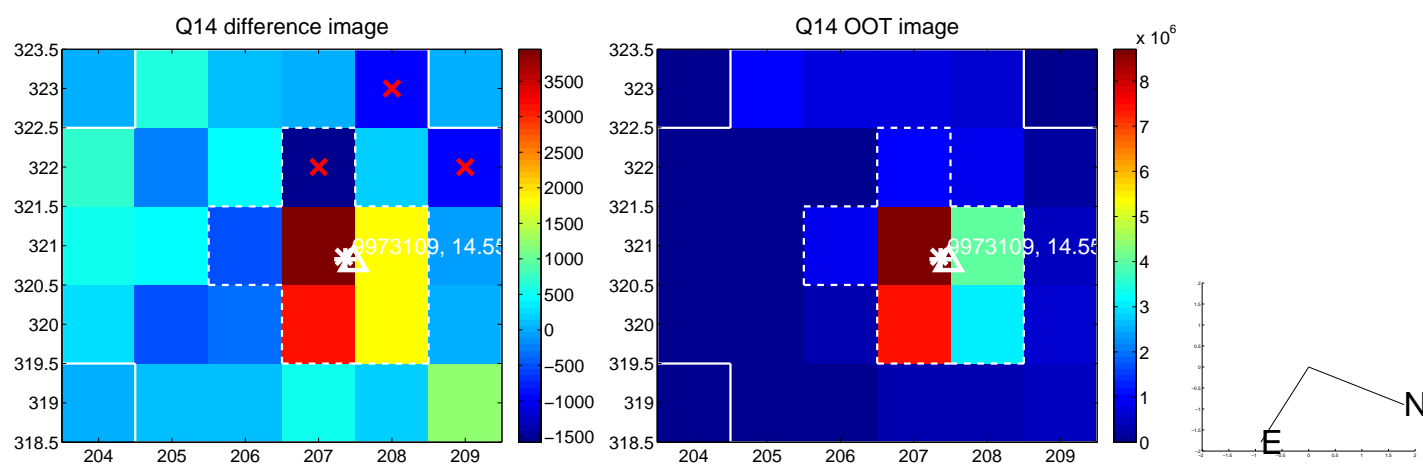
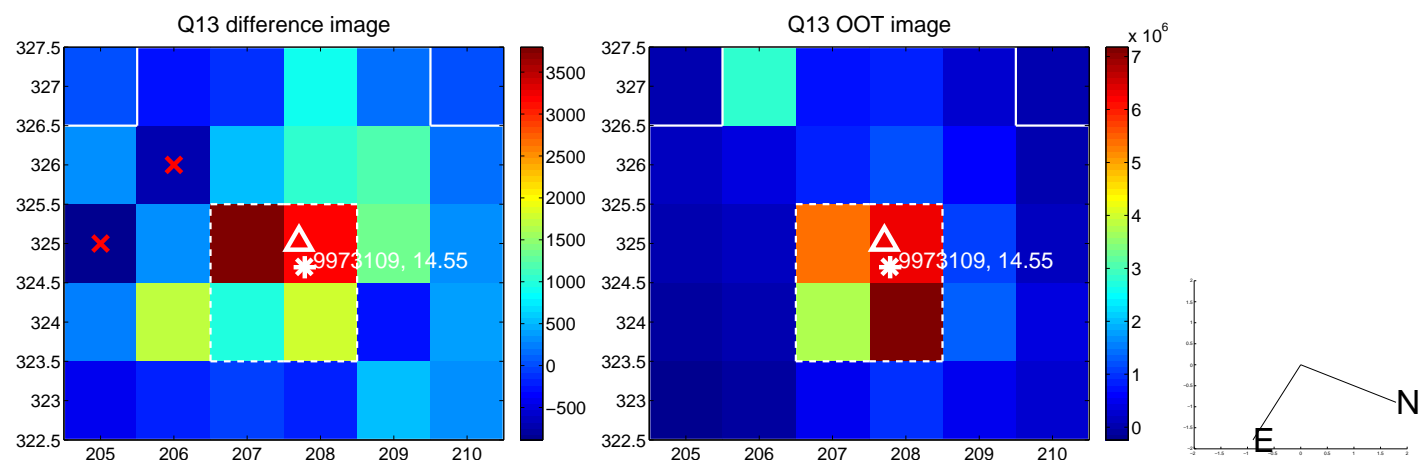
white \times : KIC target position; +: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



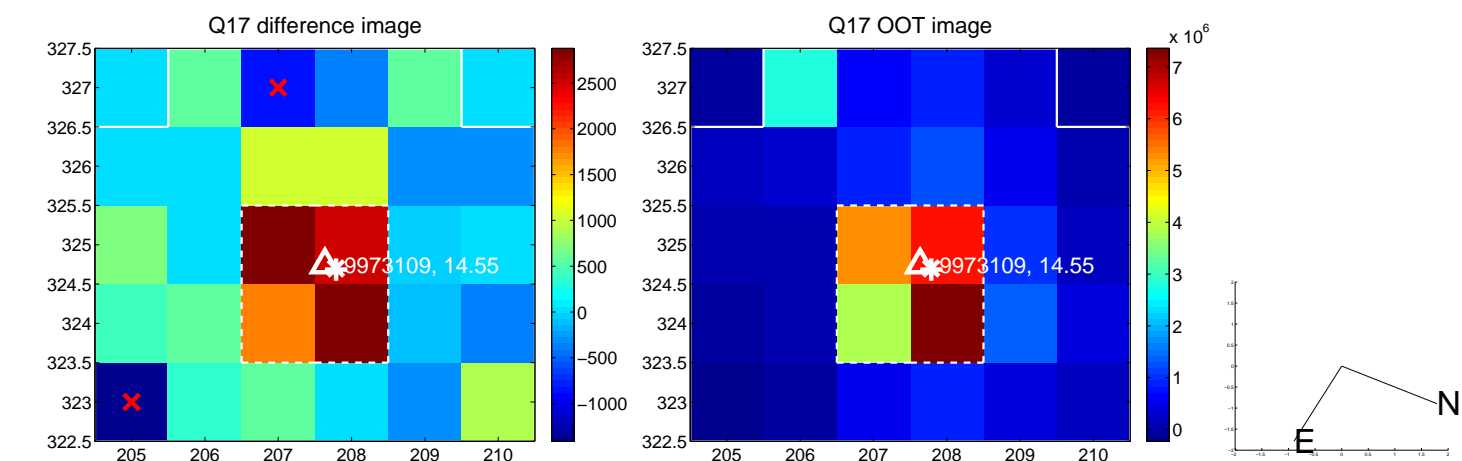
white \times : KIC target position; +: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



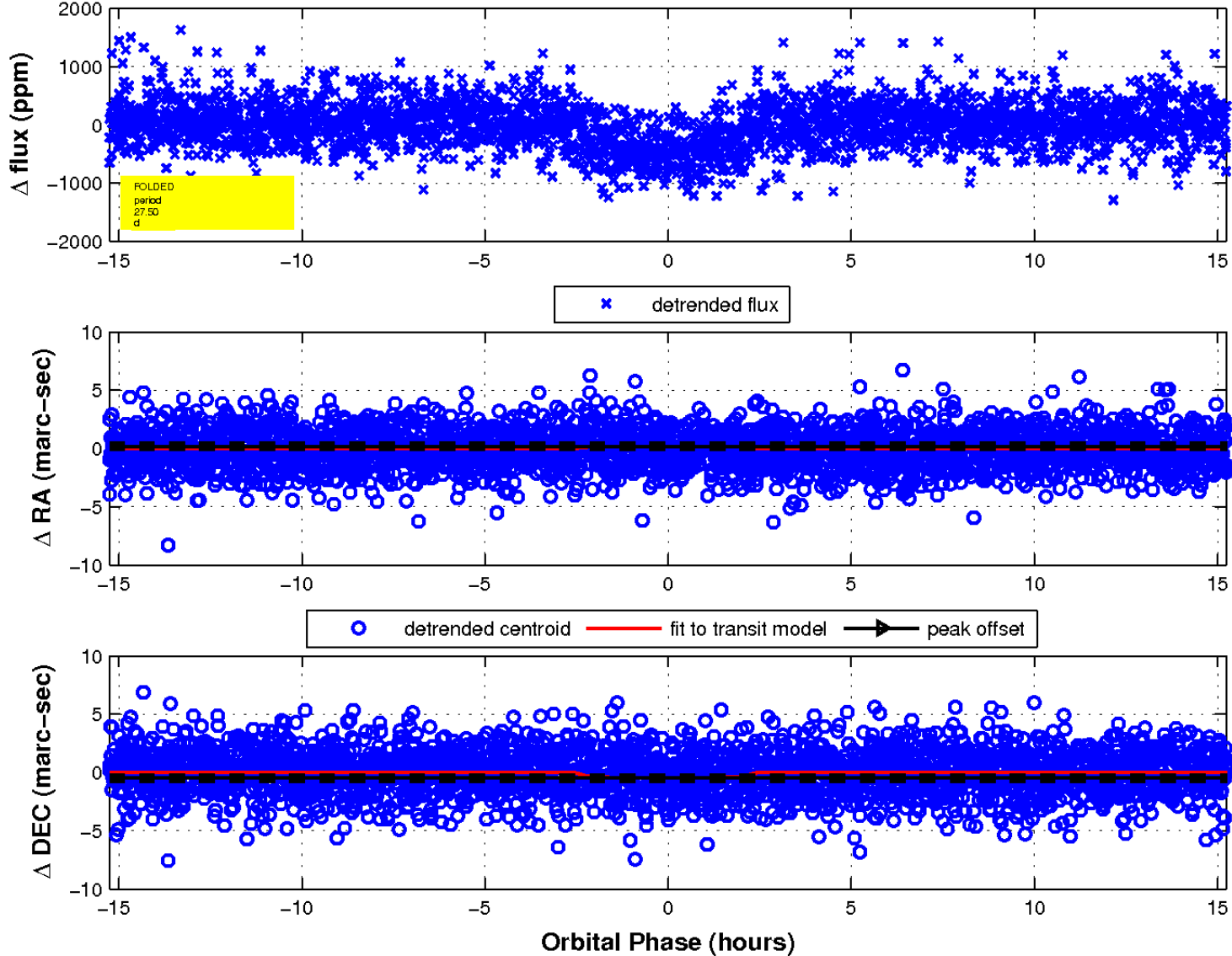
white \times : KIC target position; $+$: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



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

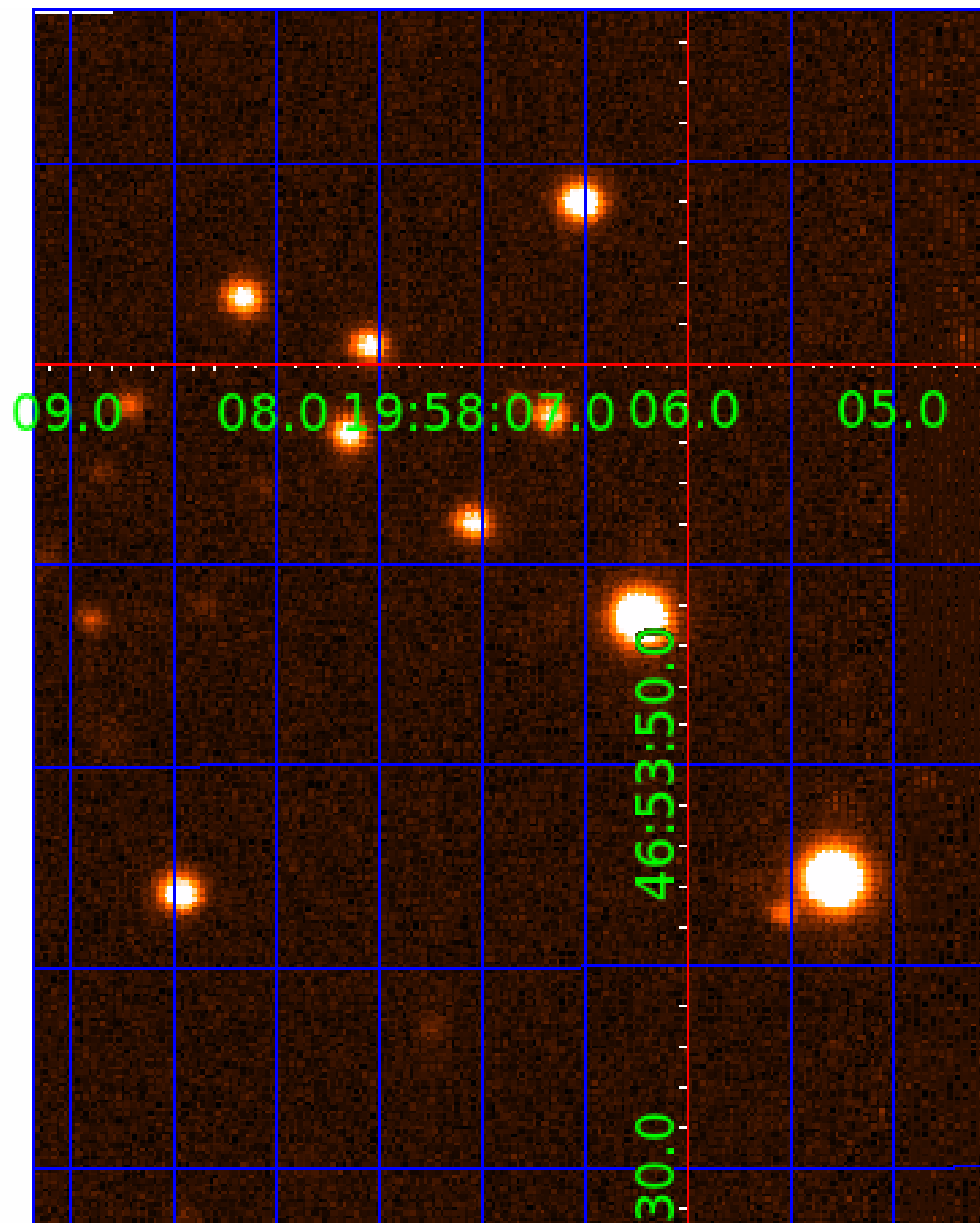


fluxWeightedCentroids, Planet 1 of 2



UKIRT Image

Declination



KIC 009973109

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})
009973109-01	OBS	2018.01	27.495601	133.287180	483.9	5.087	21.8	22.8	0.91	5657	2.30	28.70
009973109-02	OBS	2018.02	16.098919	131.873757	173.8	5.995	8.8	10.4	0.91	5657	1.50	58.59

Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009973109-01	OBS	PC	1.00	0	0	0	0	NO_COMMENT
009973109-02	OBS	PC	0.99	0	0	0	0	NO_COMMENT

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

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

See http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col for comment definitions.

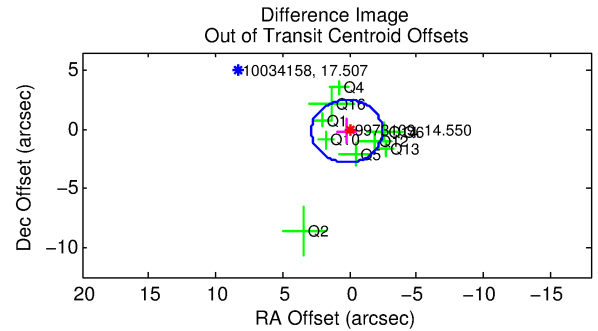
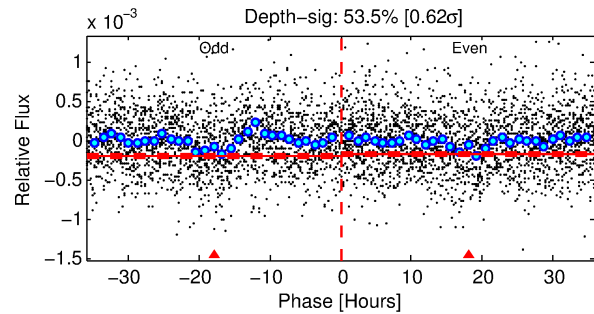
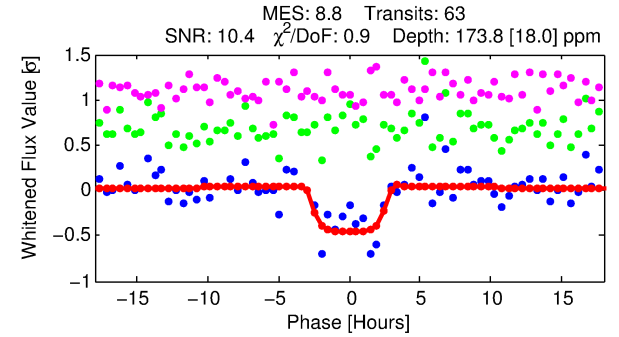
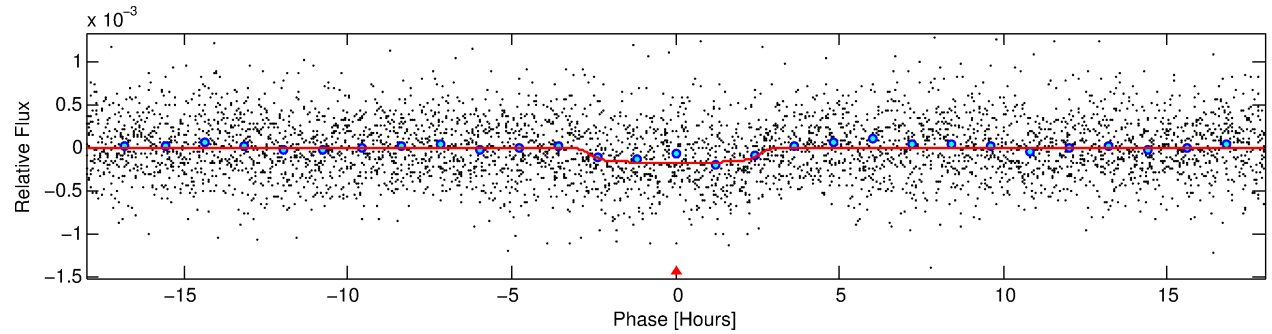
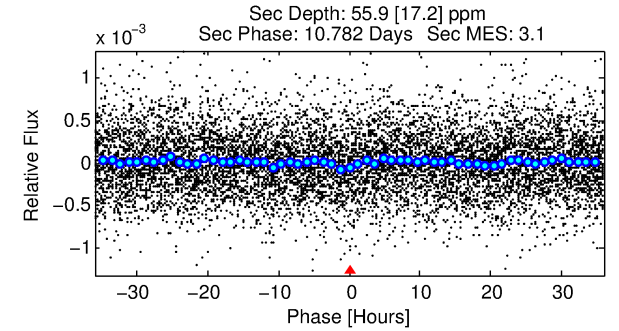
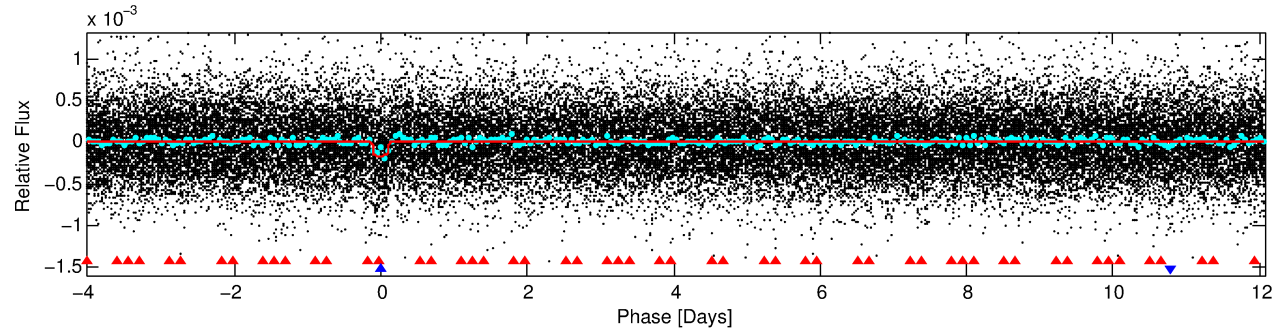
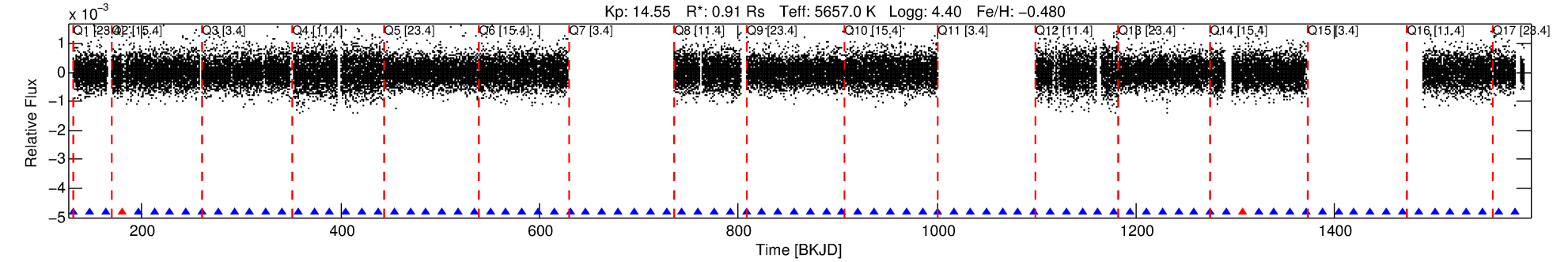
Ephemeris Match Information For 009973109-02

No Significant Match Found

DV One-Page Summary

KIC: 9973109 Candidate: 2 of 2 Period: 16.099 d

KOI: K02018.02 Corr: 0.966



DV Fit Results:

Period = 16.09892 [0.00021] d
Epoch = 131.8738 [0.0103] BKJD
Rp/R* = 0.0151 [0.0020]
a/R* = 7.66 [4.51]
b = 0.95 [0.07]
Seff = 58.59 [22.63]
Teff = 705 [68] K
Rp = 1.50 [0.48] Re
a = 0.1140 [0.0282] AU
Ag = 176.78 [96.72] [1.82σ]
Teffp = 3977 [420] K [7.68σ]

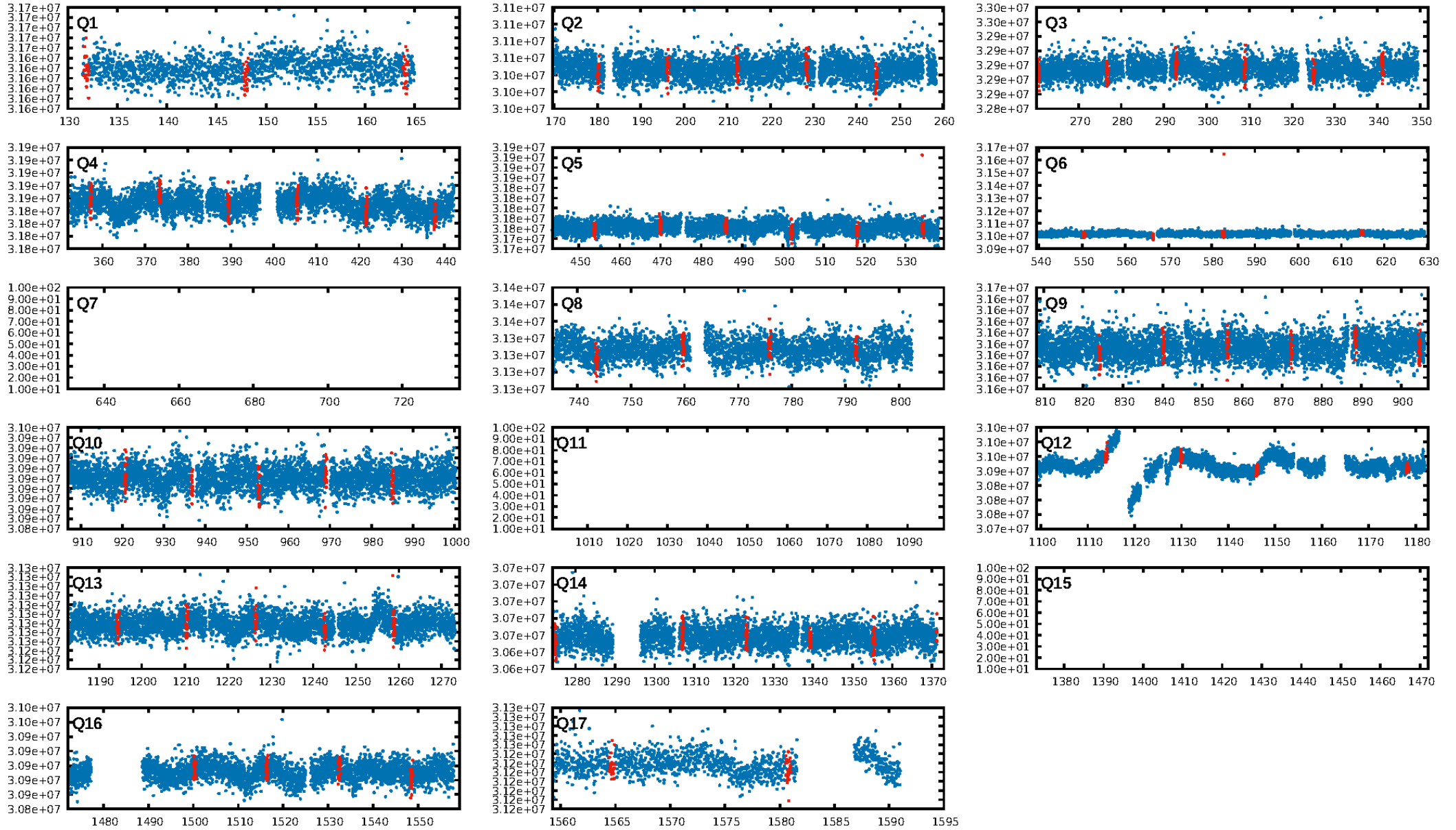
DV Diagnostic Results:

ShortPeriod-sig: N/A
LongPeriod-sig: 100.0% [34.79σ]
ModelChiSquare2-sig: 93.8%
ModelChiSquareGof-sig: 100.0%
Bootstrap-pfa: 4.36e-19
RollingBand-fgt: 0.97 [56/58]
GhostDiagnostic-chr: 4.254
Centroid-sig: 8.5%
Centroid-so: 1.917 arcsec [1.53σ]
OotOffset-rm: 0.279 arcsec [0.31σ]
KicOffset-rm: 0.266 arcsec [0.28σ]
OotOffset-st: 4/0/3/3 [10]
KicOffset-st: 4/0/3/3 [10]
DiffImageQuality-fgm: 0.50 [5/10]
DiffImageOverlap-fno: 1.00 [14/14]

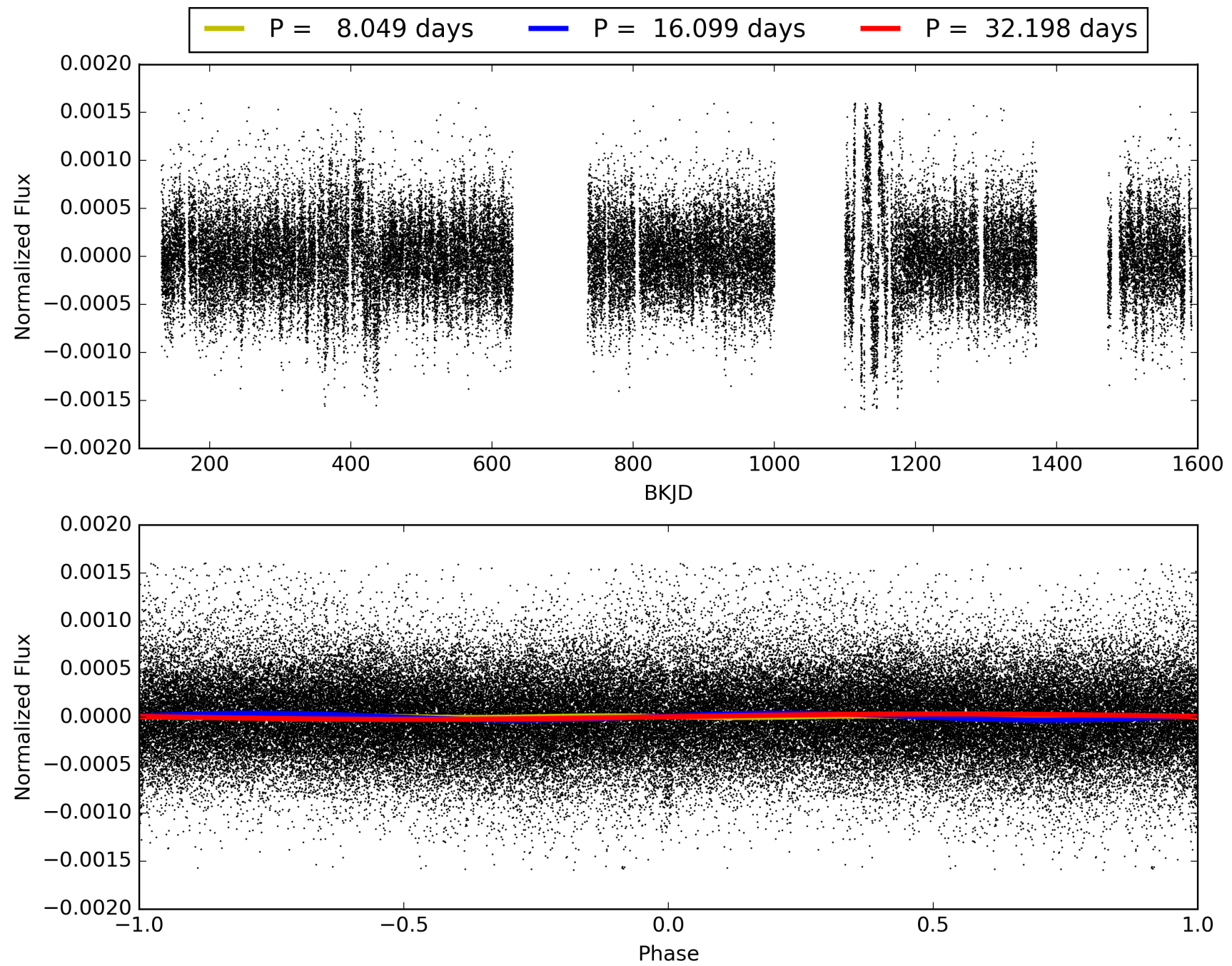
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 11:43:10 Z

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

TCE 009973109-02, PDC Light Curves

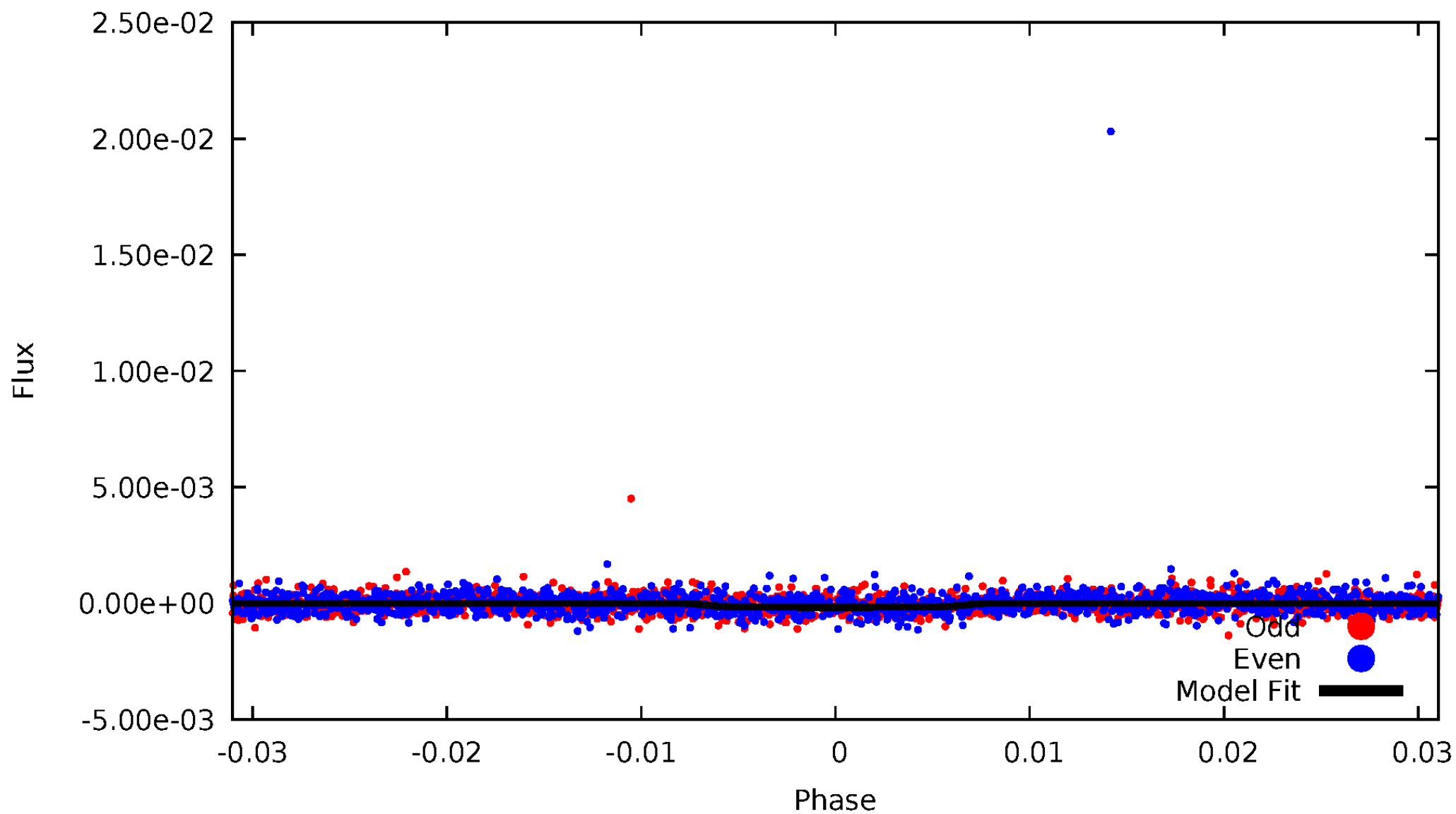


TCE 009973109-02



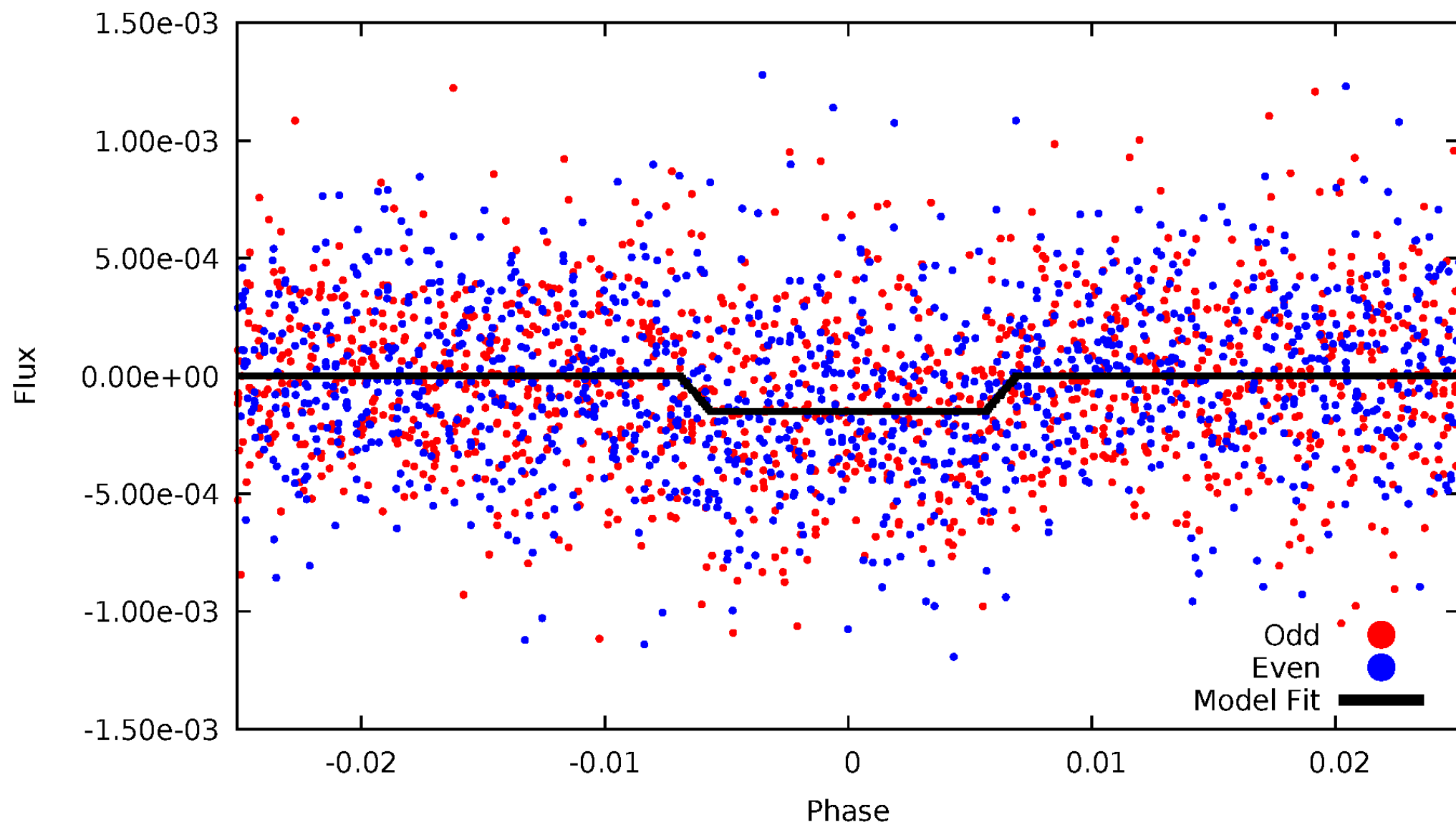
DV Odd/Even

TCE 009973109-02



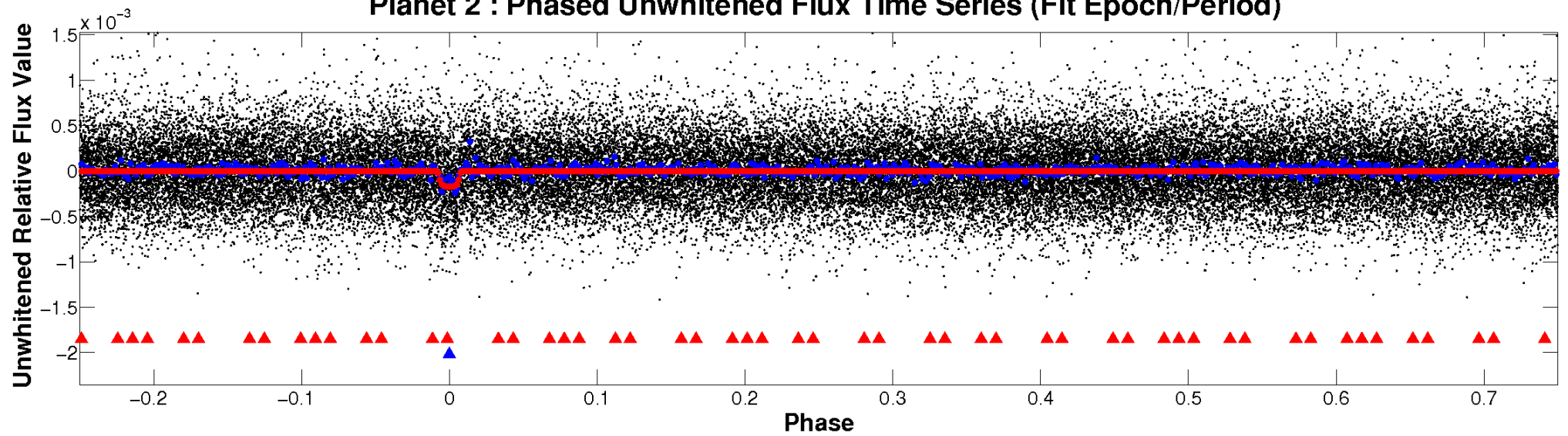
ALT Odd/Even

TCE 009973109-02

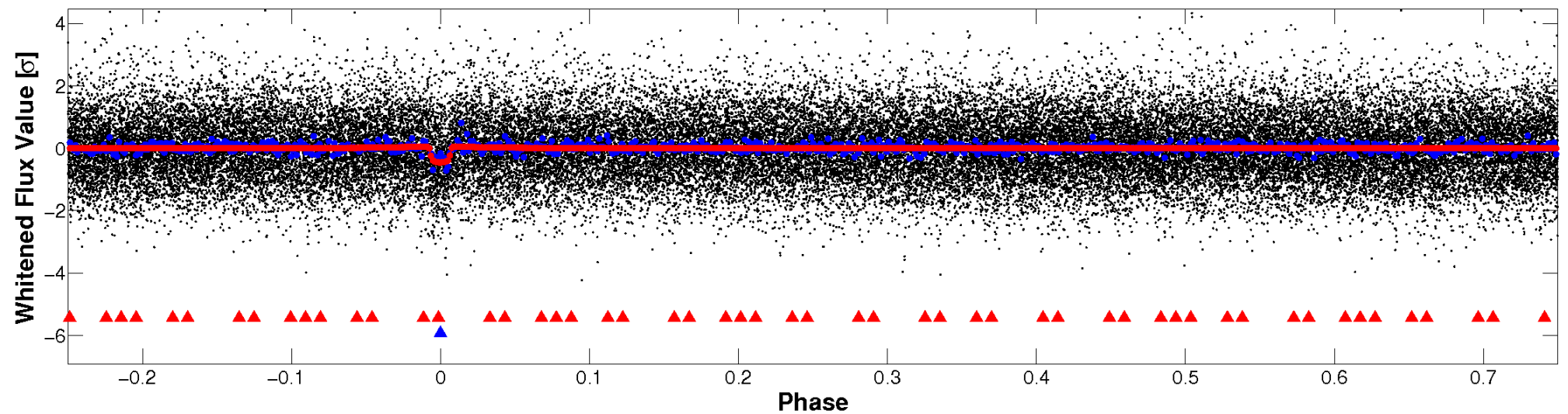


Non-Whitened Vs. Whitened Light Curve

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

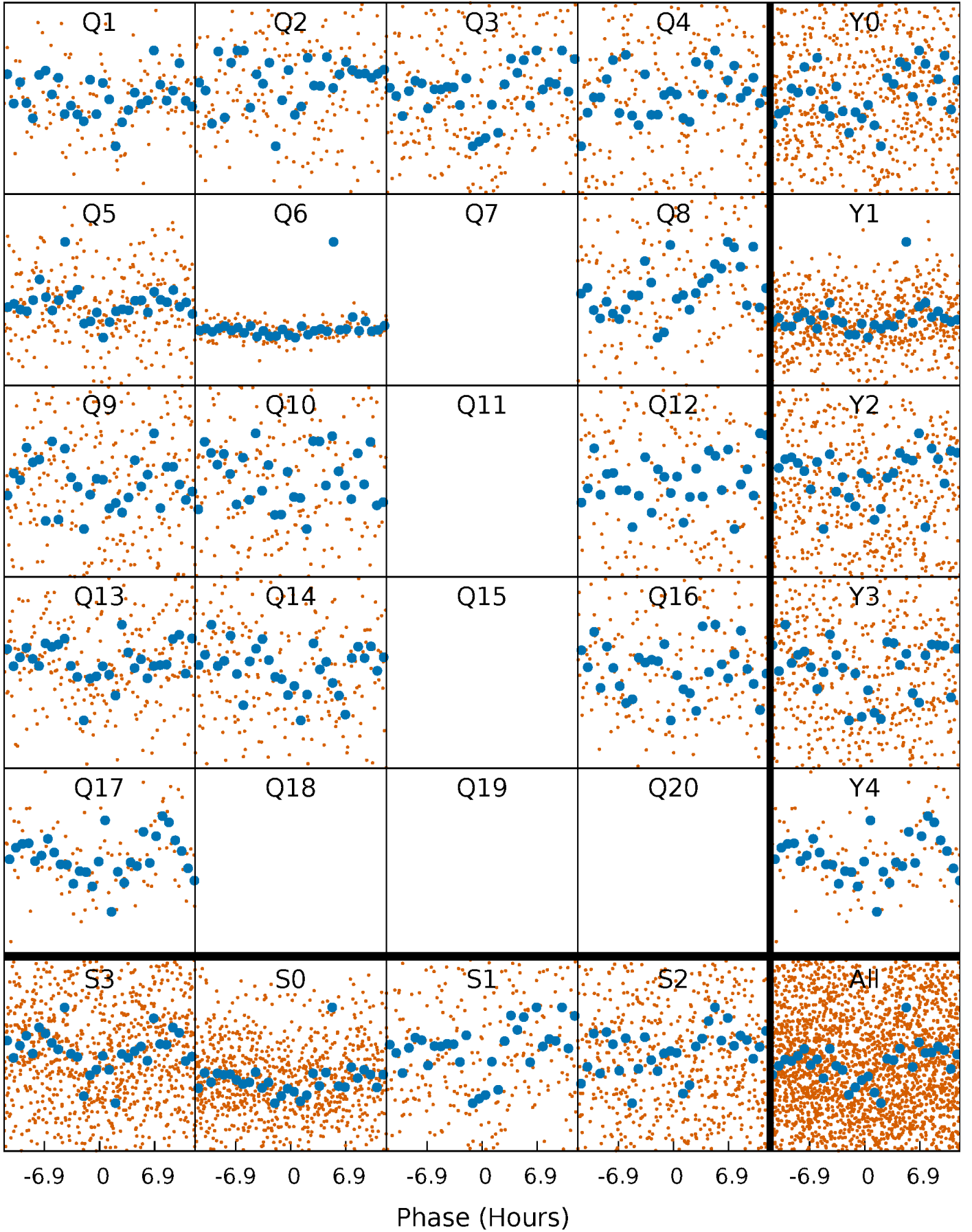


Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



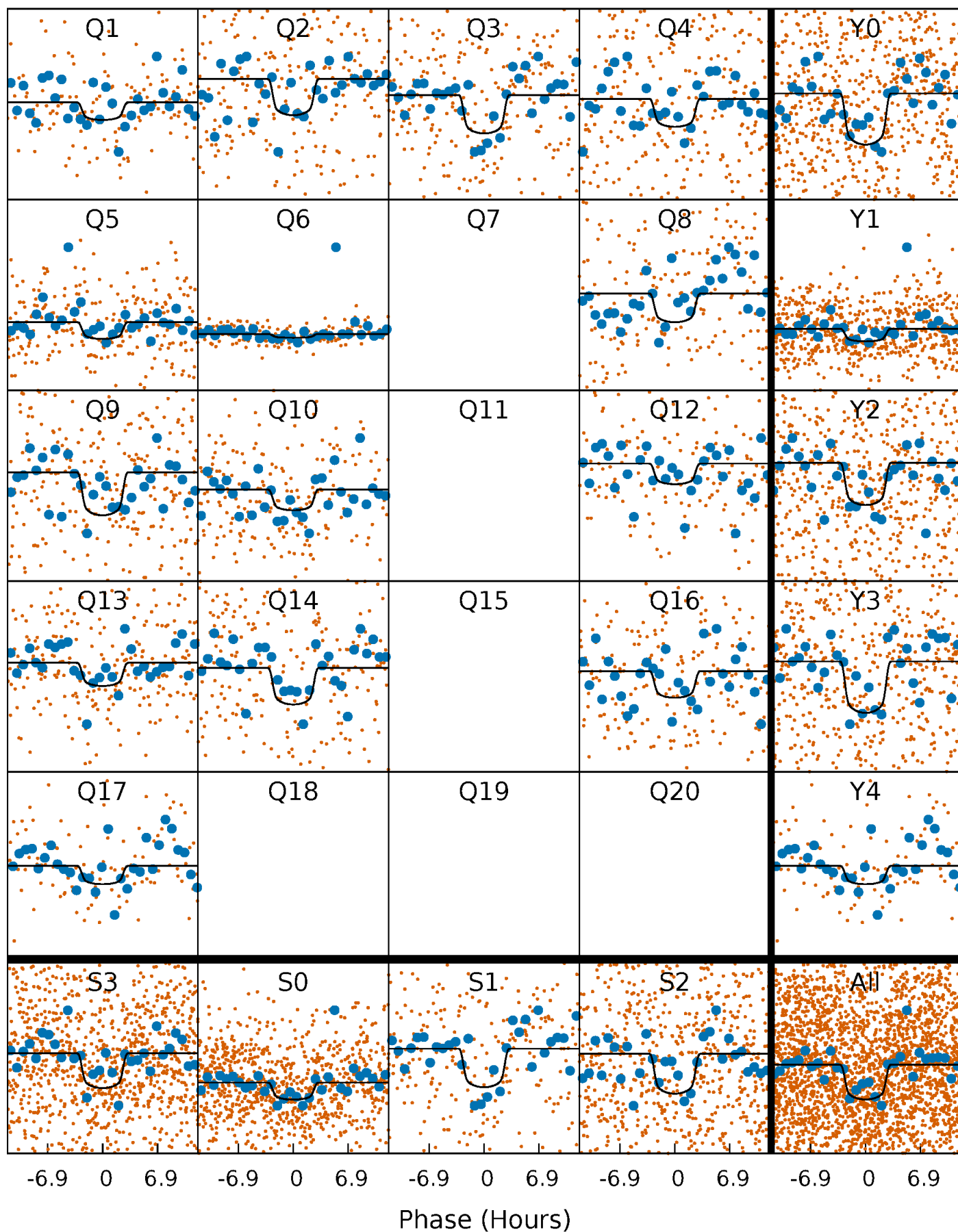
PDC Quarter-Phased Transit Curves

TCE 009973109-02 P= 16.098919 Days $T_0=131.873758$ (BKJD)



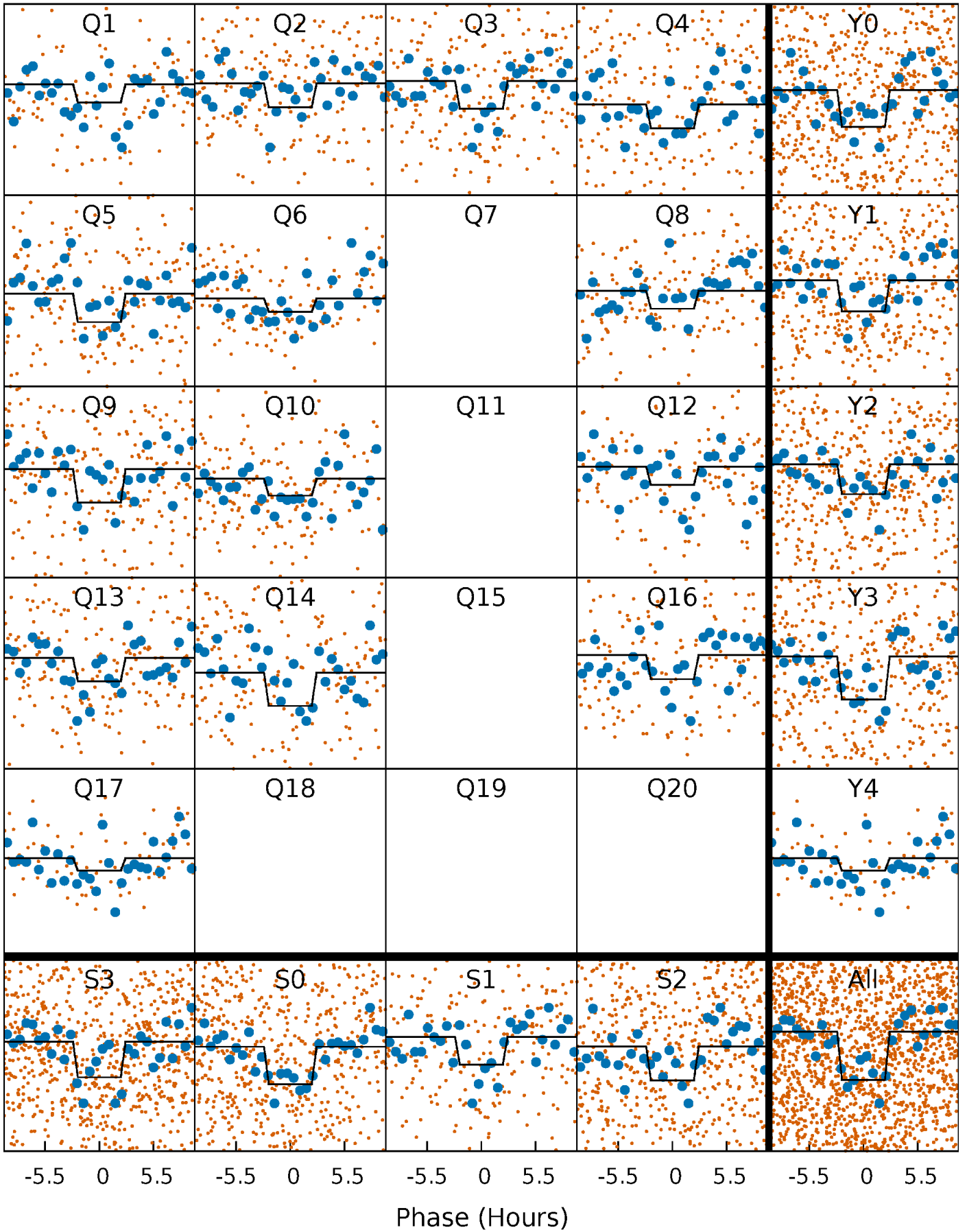
DV Quarter-Phased Transit Curves

TCE 009973109-02 P= 16.098919 Days $T_0=131.873758$ (BKJD)



Alt. Detrend Quarter-Phased Transit Curves

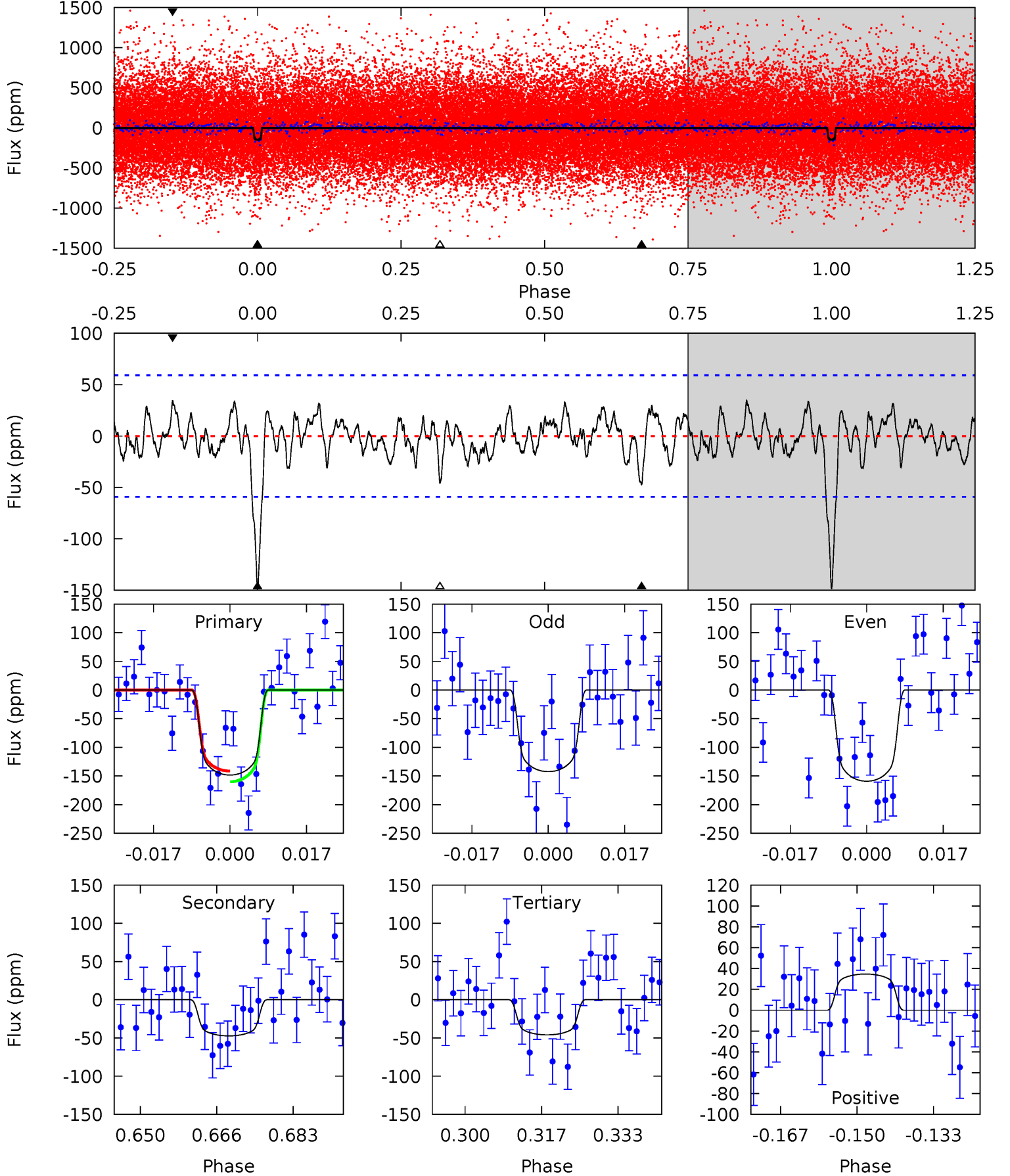
TCE 009973109-02 P= 16.098873 Days $T_0=131.876687$ (BKJD)



DV Model-Shift Uniqueness Test

009973109-02, P = 16.098919 Days, E = 115.774839 Days

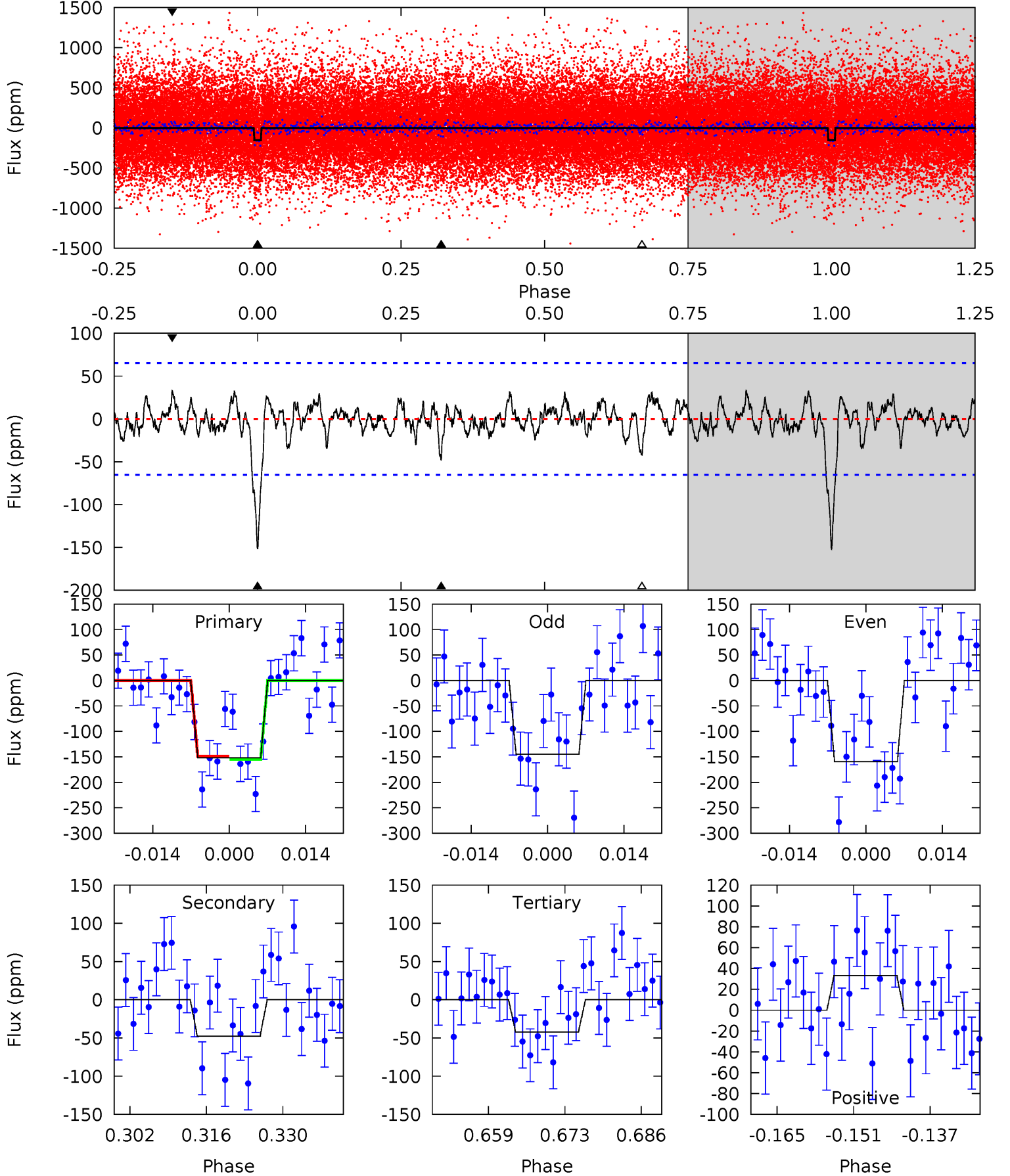
Pri	Sec	Ter	Pos	FA ₁	FA ₂	F _{Red}	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
12.3	3.93	3.82	2.88	4.93	2.39	1.21	8.52	9.46	0.12	1.05	0.70	0.92	0.19	0.78



Alt Model-Shift Uniqueness Test

009973109-02, P = 16.098873 Days, E = 115.777814 Days

Pri	Sec	Ter	Pos	FA ₁	FA ₂	F _{Red}	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
11.6	3.64	3.23	2.53	4.97	2.46	0.99	8.35	9.05	0.41	1.11	0.57	0.92	0.18	0.24



Stellar Parameters For KIC 009973109

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	R (R_{\odot})	$M(M_{\odot})$	p_{\star} ($\text{g}\cdot\text{cm}^{-3}$)
	5657^{+169}_{-169}	$4.401^{+0.167}_{-0.204}$	$-0.480^{+0.300}_{-0.300}$	$0.911^{+0.262}_{-0.161}$	$0.762^{+0.124}_{-0.044}$	$1.420^{+1.100}_{-0.711}$
	+3%/-3%	+4%/-5%	+62%/-62%	+29%/-18%	+16%/-6%	+77%/-50%
Source	PHO1	KIC0	KIC0	DSEP		

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

Secondary Eclipse Parameters for KIC 009973109-02 / KOI 2018.02

Detrend	Depth (ppm)	R_p (R_{\oplus})	T_{max} (K)	T_{obs} (K)	A_{obs}
DV	-47 ± 12	$1.53^{+0.33}_{-0.26}$	989^{+76}_{-64}	4094^{+303}_{-292}	144^{+82}_{-53}
Alt.	-48 ± 13	$1.24^{+0.30}_{-0.25}$	989^{+78}_{-66}	4426^{+387}_{-349}	222^{+143}_{-89}

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

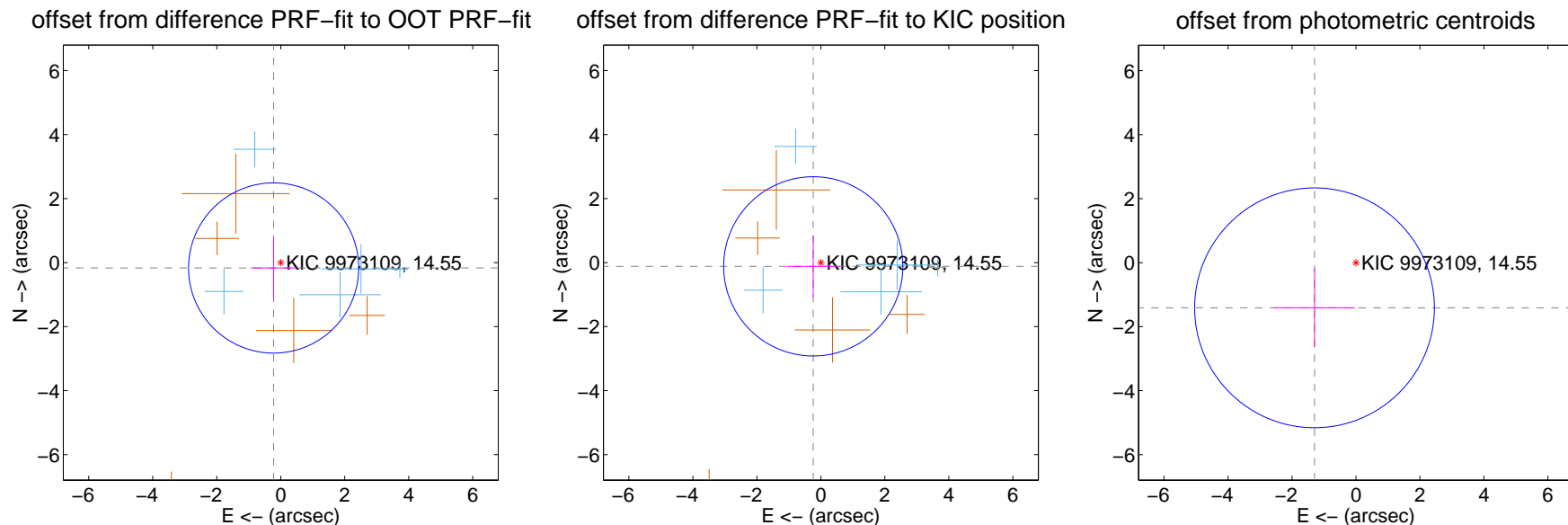
DV Centroid Data

Supplemental centroid analysis for 009973109-02. Kepler magnitude: 14.55. Transit SNR 10.37

There are 5 quarters with good PRF difference image offsets

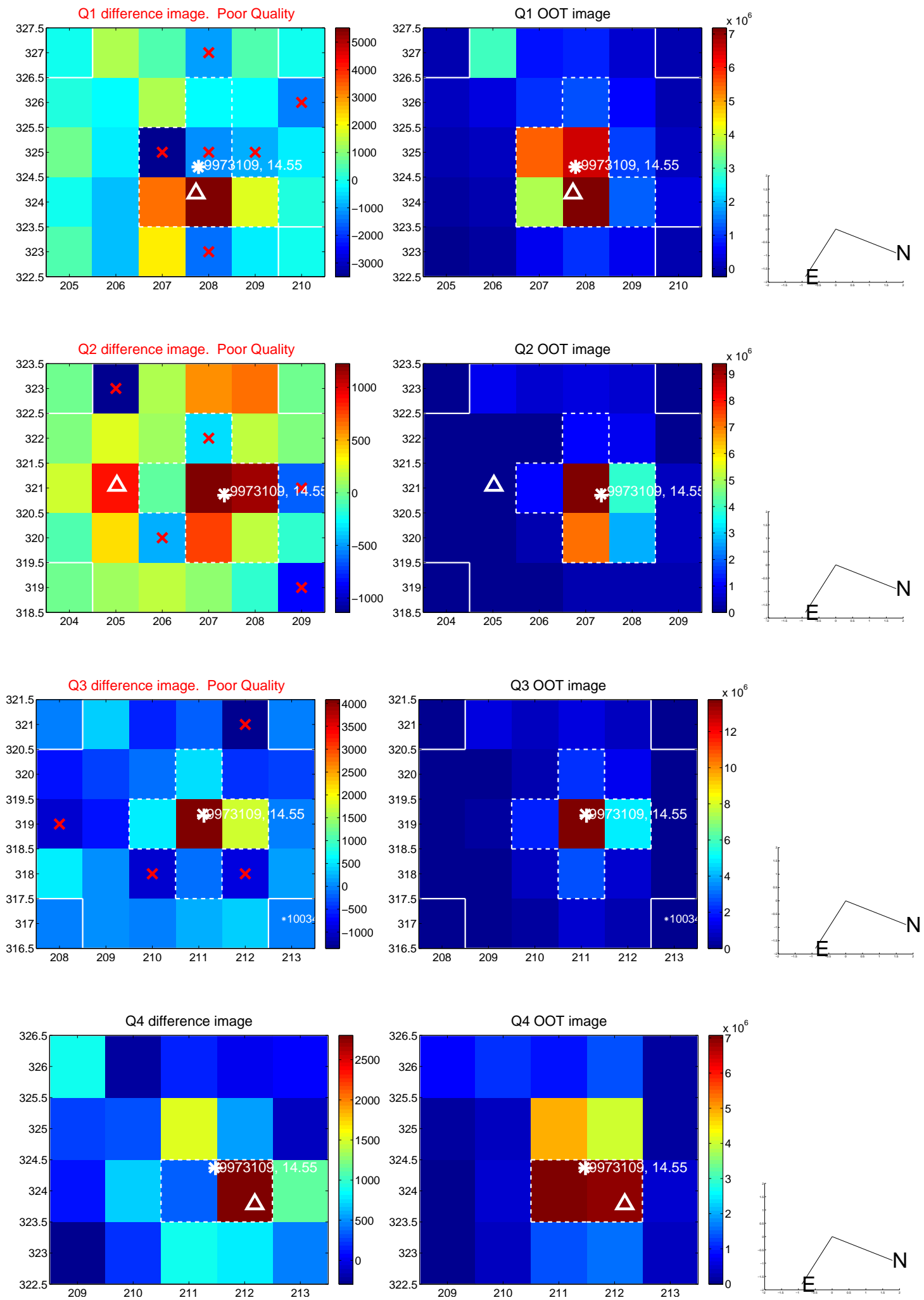
The direct PRF centroid is offset from the target star catalog position by about 0.12 arcsec

	Distance in arcsec	Distance / σ	Δ RA	Δ Dec
PRF-fit source offset from OOT	0.279 ± 0.886	0.31	0.222 ± 0.715	-0.169 ± 0.978
PRF-fit source offset from KIC position	0.266 ± 0.933	0.28	0.238 ± 0.819	-0.118 ± 0.969
photometric centroid source offset	1.92 ± 1.25	1.53	1.30 ± 1.27	-1.41 ± 1.23

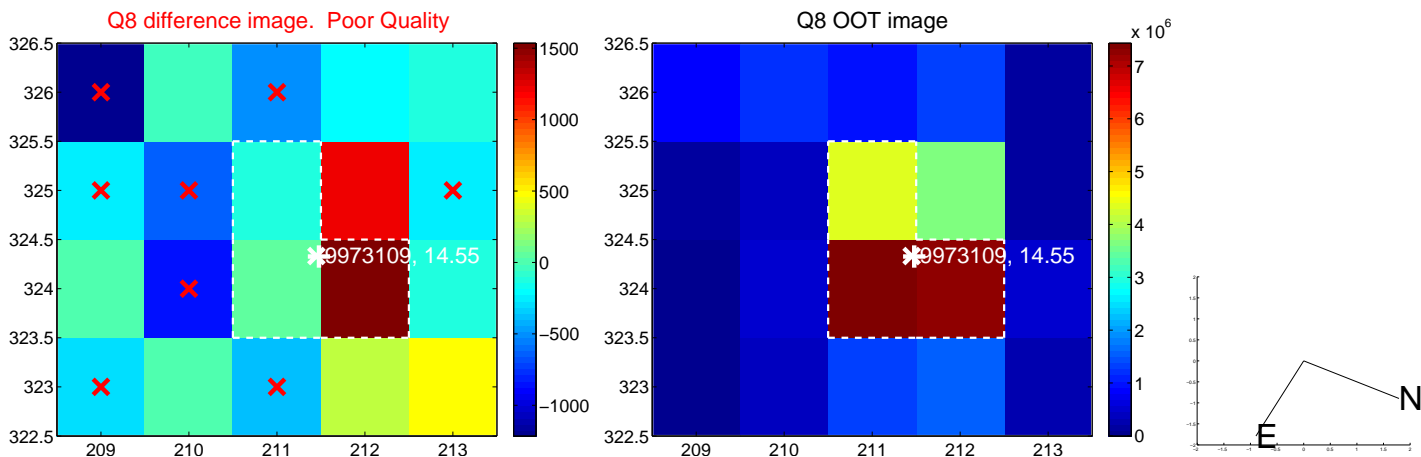
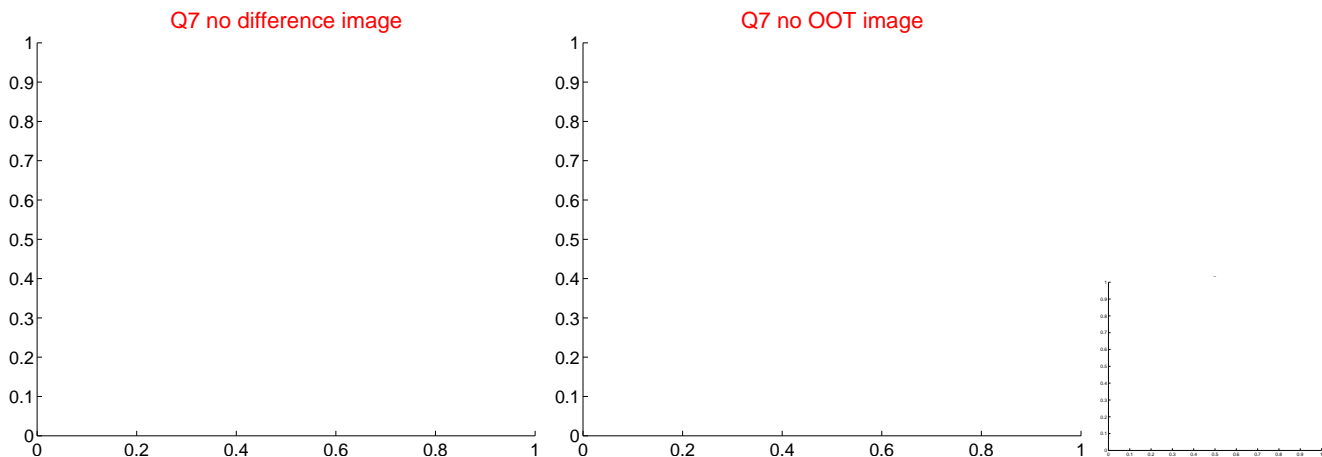
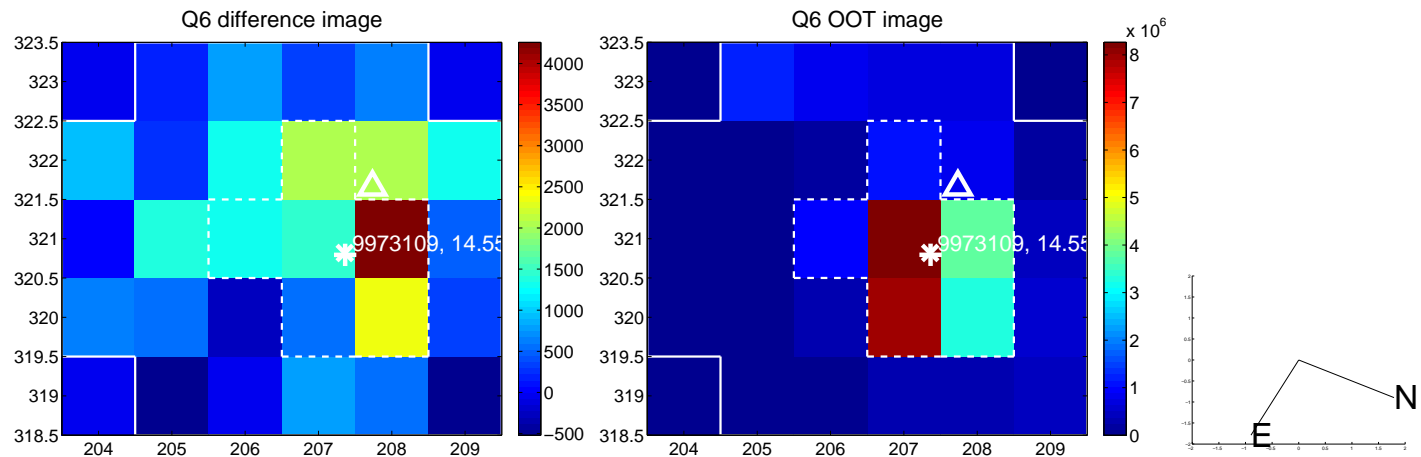
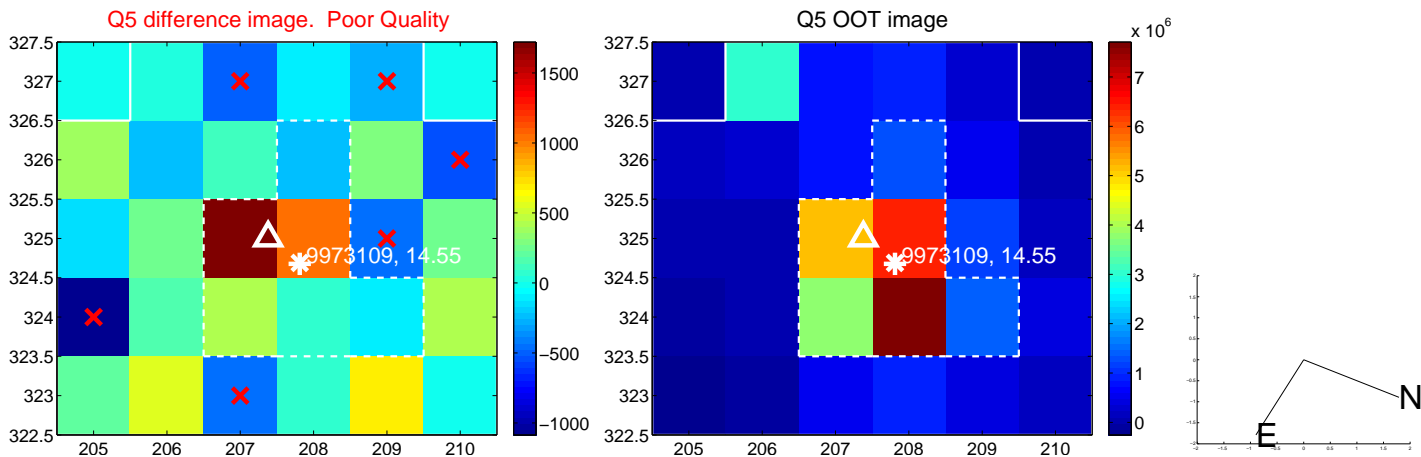


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- σ uncertainty. Blue circle: three-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

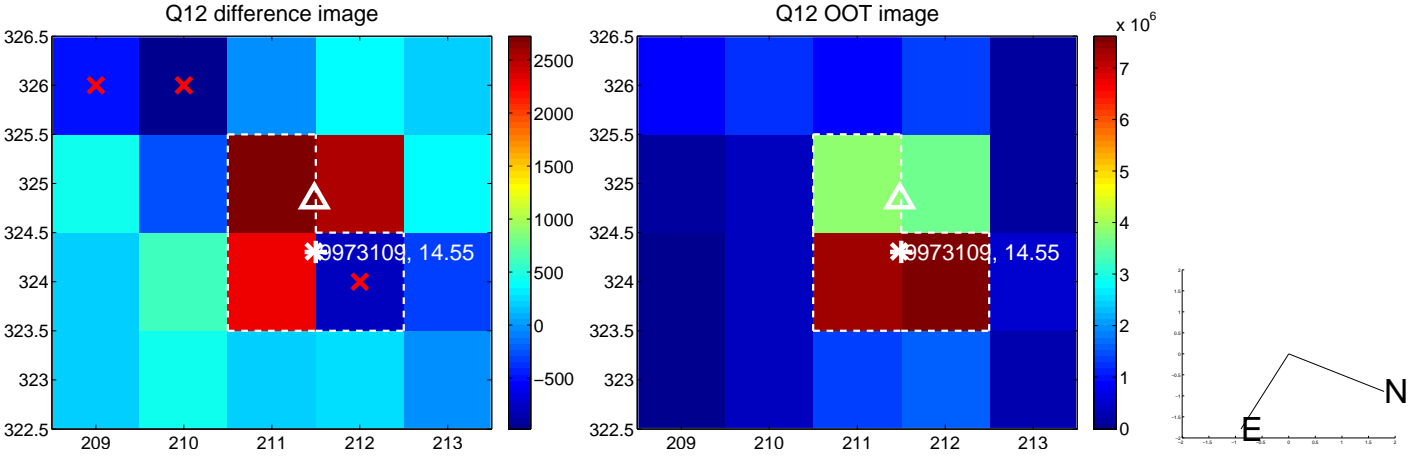
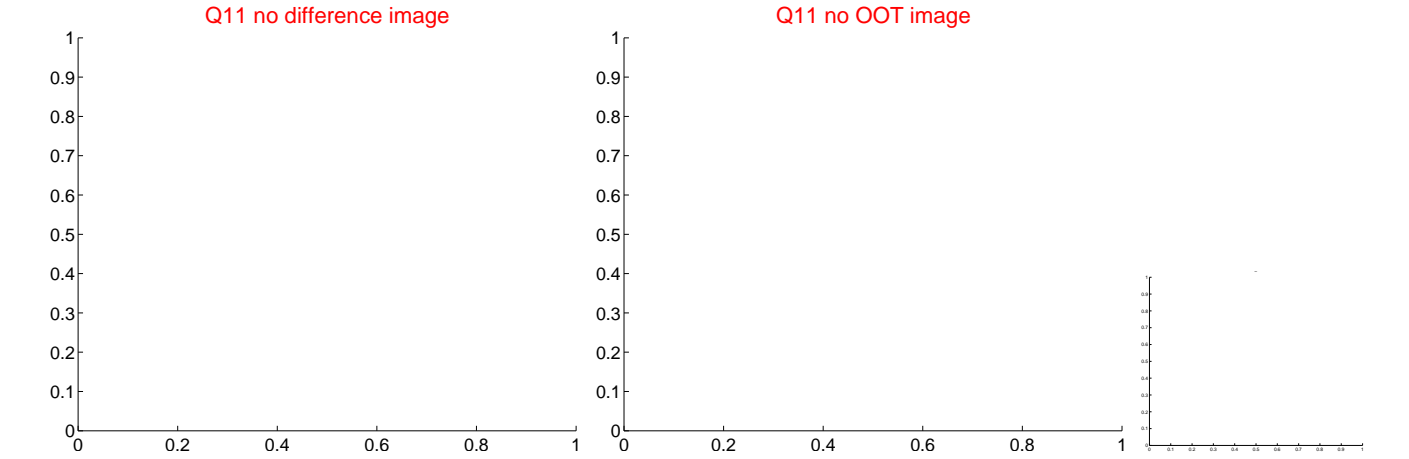
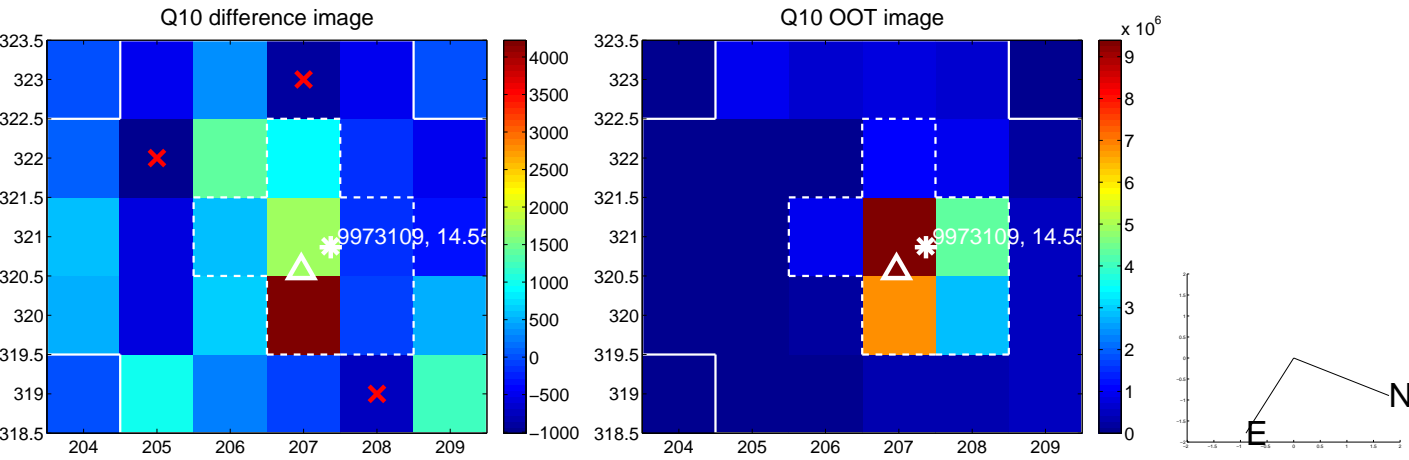
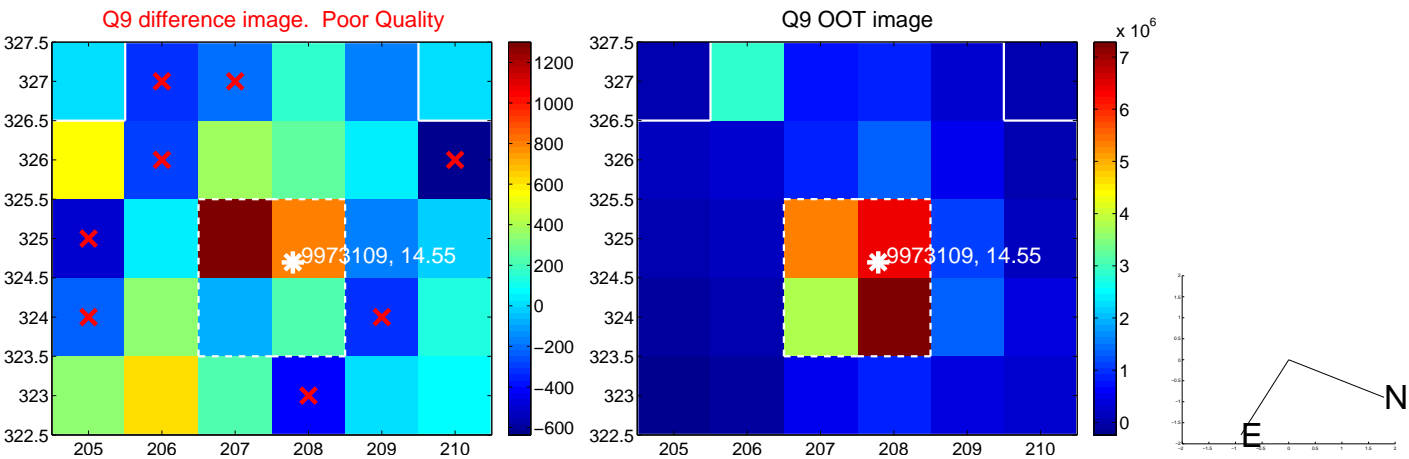
white \times : KIC target position; +: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



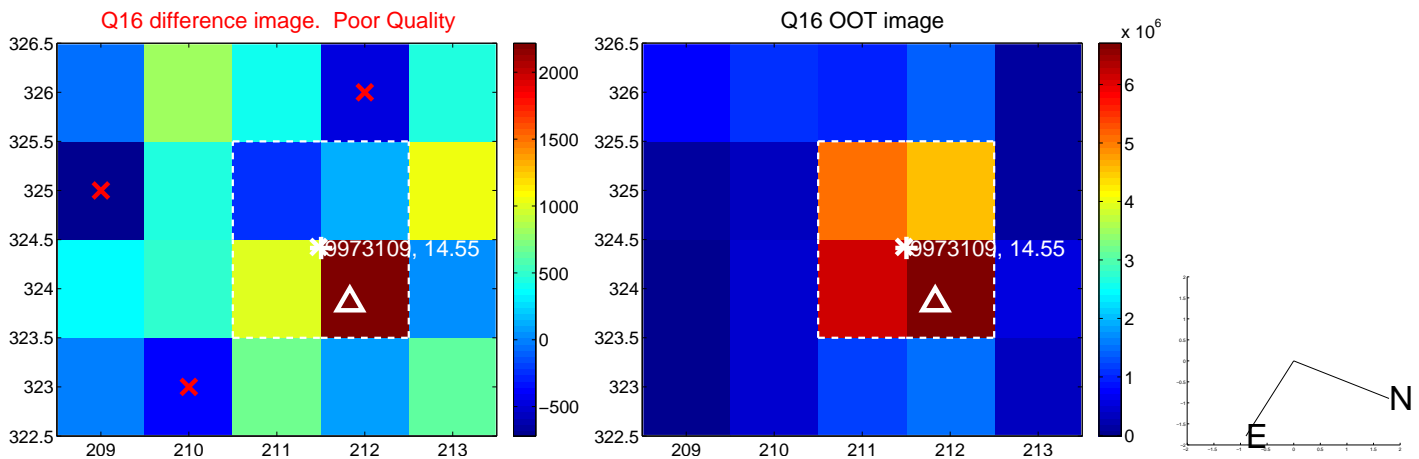
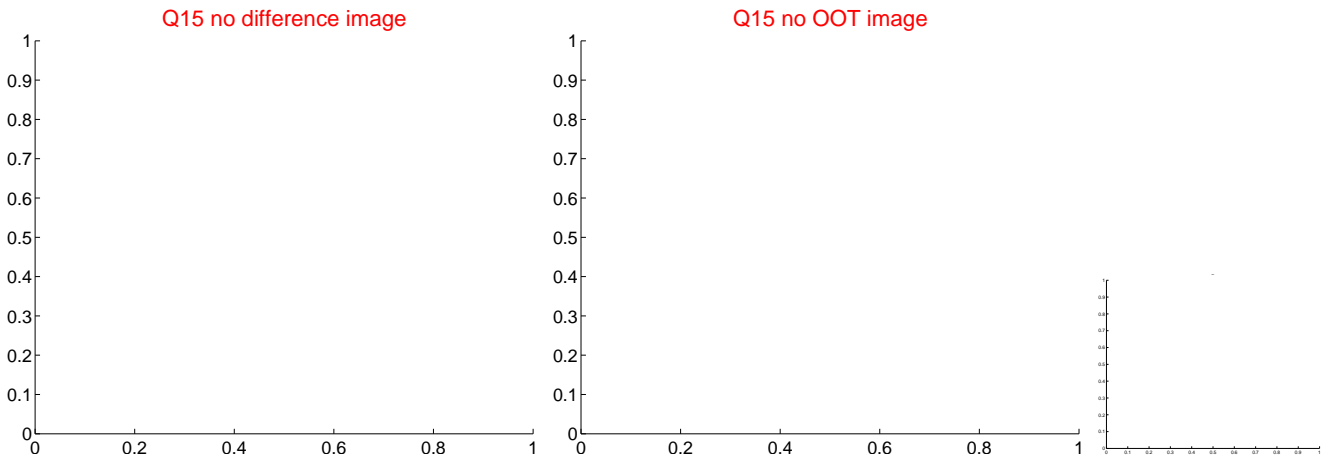
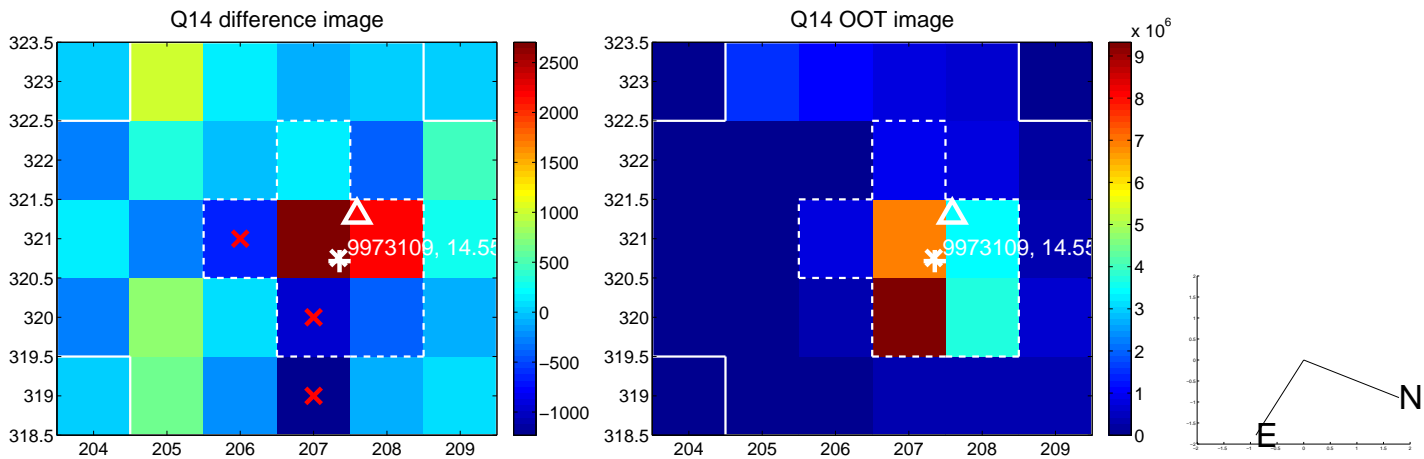
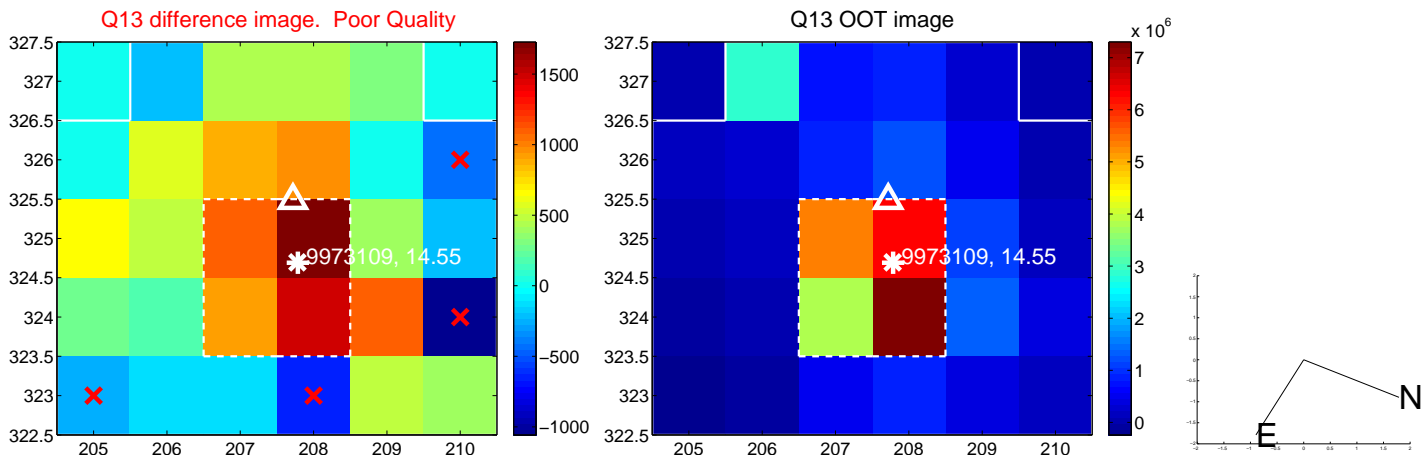
white \times : KIC target position; +: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



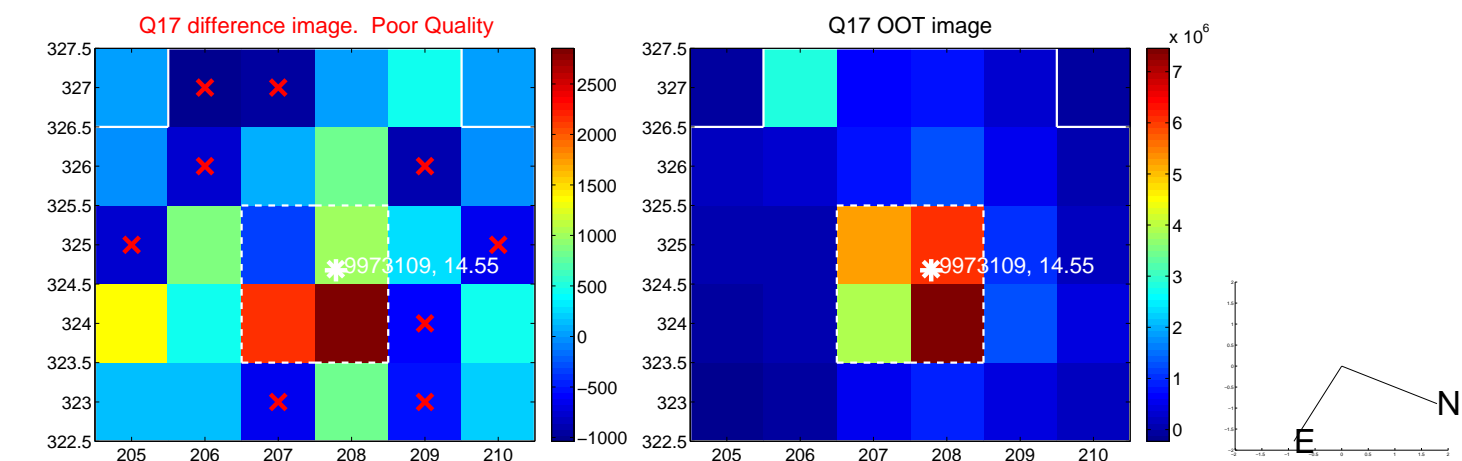
white \times : KIC target position; +: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



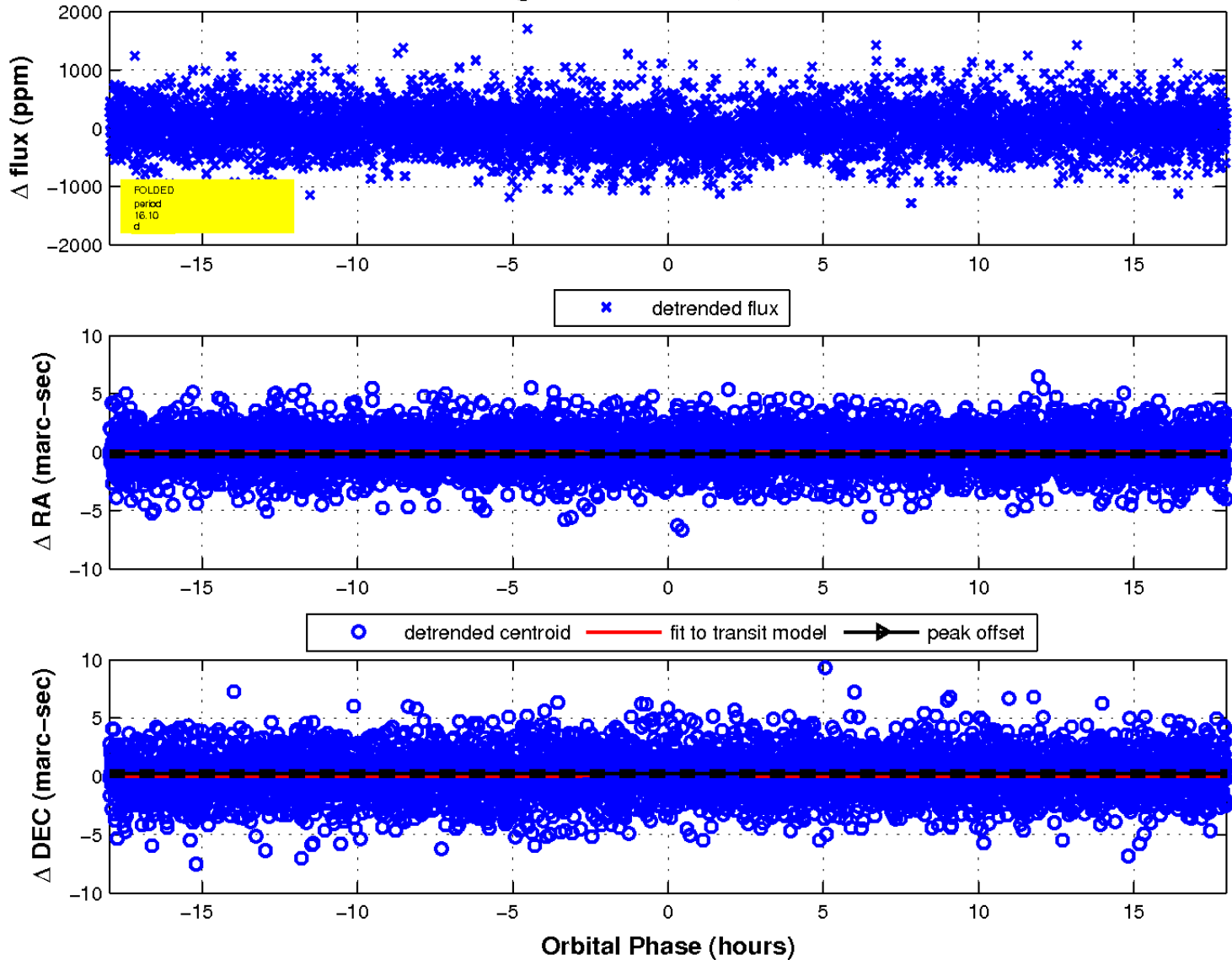
white \times : KIC target position; $+$: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



white ×: KIC target position; +: OOT centroid; △: difference centroid. red ✕: large negative pixel value.



fluxWeightedCentroids, Planet 2 of 2



UKIRT Image

Declination

