

KIC 005391416

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})
005391416-01	OBS	No	1.226221	132.685893	61.2	7.518	8.7	6.7	3.15	8281	2.57	51570.14
005391416-02	OBS	No	48.072188	162.788985	1380.7	2.993	9.6	10.8	3.15	8281	12.28	387.23
005391416-03	OBS	No	19.812693	148.943625	1476.5	1.475	10.1	11.4	3.15	8281	13.50	1262.50
005391416-04	OBS	No	108.685941	159.455659	2621.7	1.734	10.2	10.1	3.15	8281	16.41	130.49

Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
005391416-01	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—CENT_SATURATED
005391416-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
005391416-03	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
005391416-04	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED

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

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

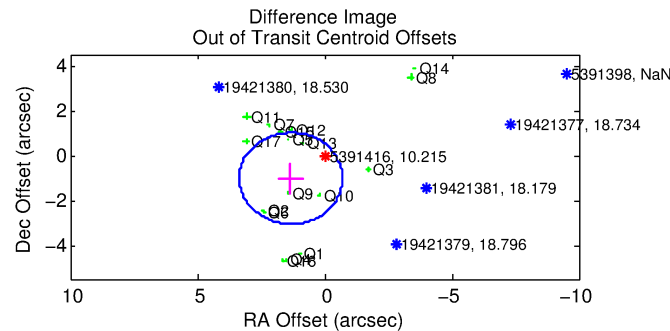
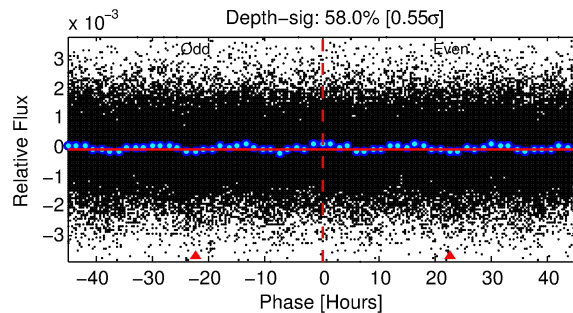
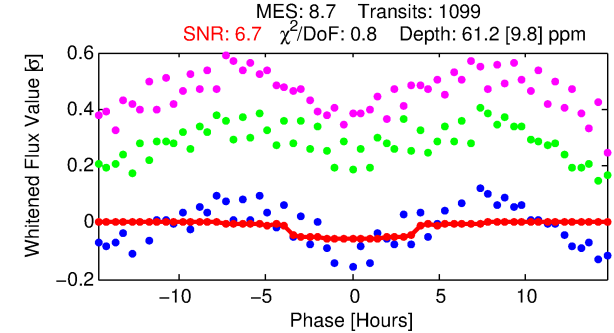
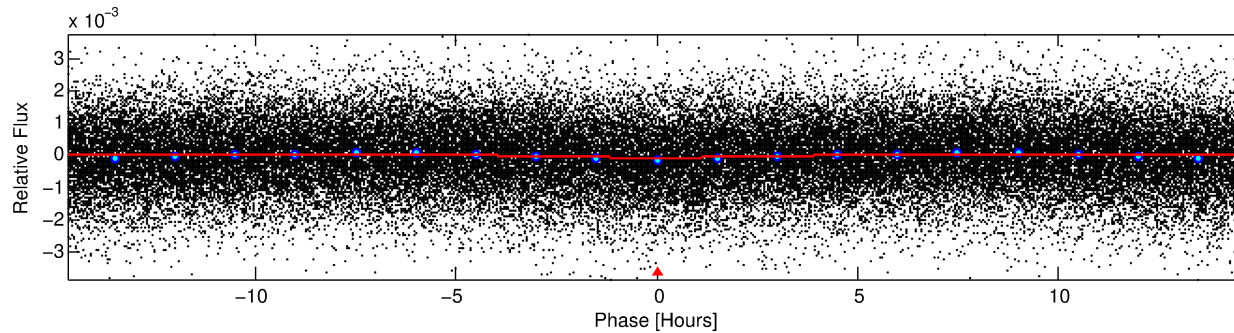
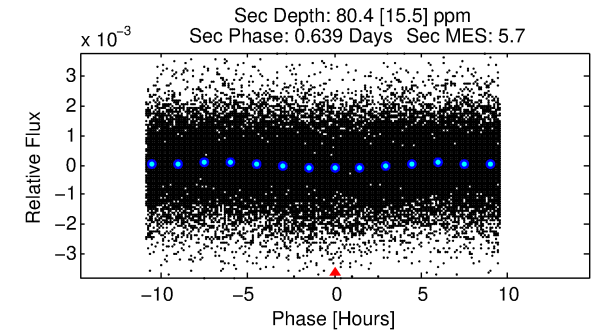
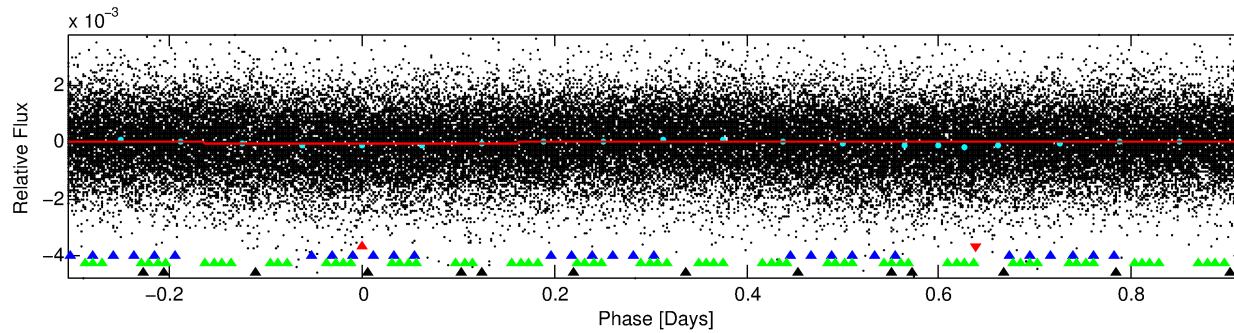
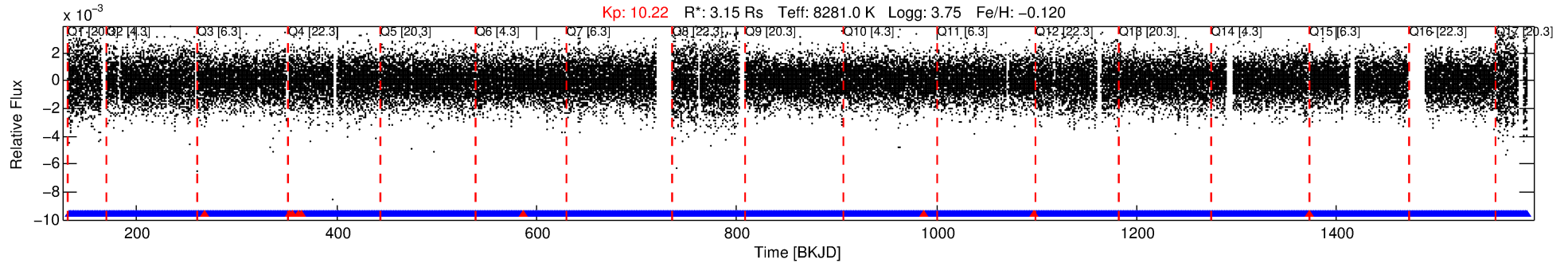
See http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col for comment definitions.

Ephemeris Match Information For 005391416-01

No Significant Match Found

DV One-Page Summary

KIC: 5391416 Candidate: 1 of 4 Period: 1.226 d



DV Fit Results:

Period = 1.22622 [0.00003] d
Epoch = 132.6859 [0.0094] BKJD
 $R_p/R^* = 0.0075$ [0.0093]
 $a/R^* = 1.30$ [3.84]
 $b = 0.54$ [9.48]
 $S_{\text{eff}} = 51570.14$ [37283.98]
 $T_{\text{eq}} = 3843$ [695] K
 $R_p = 2.57$ [3.40] R_e
 $a = 0.0284$ [0.0125] AU
 $A_g = 5.44$ [14.08] [0.32σ]
 $T_{\text{eff}} = 9072$ [5664] K [0.92σ]

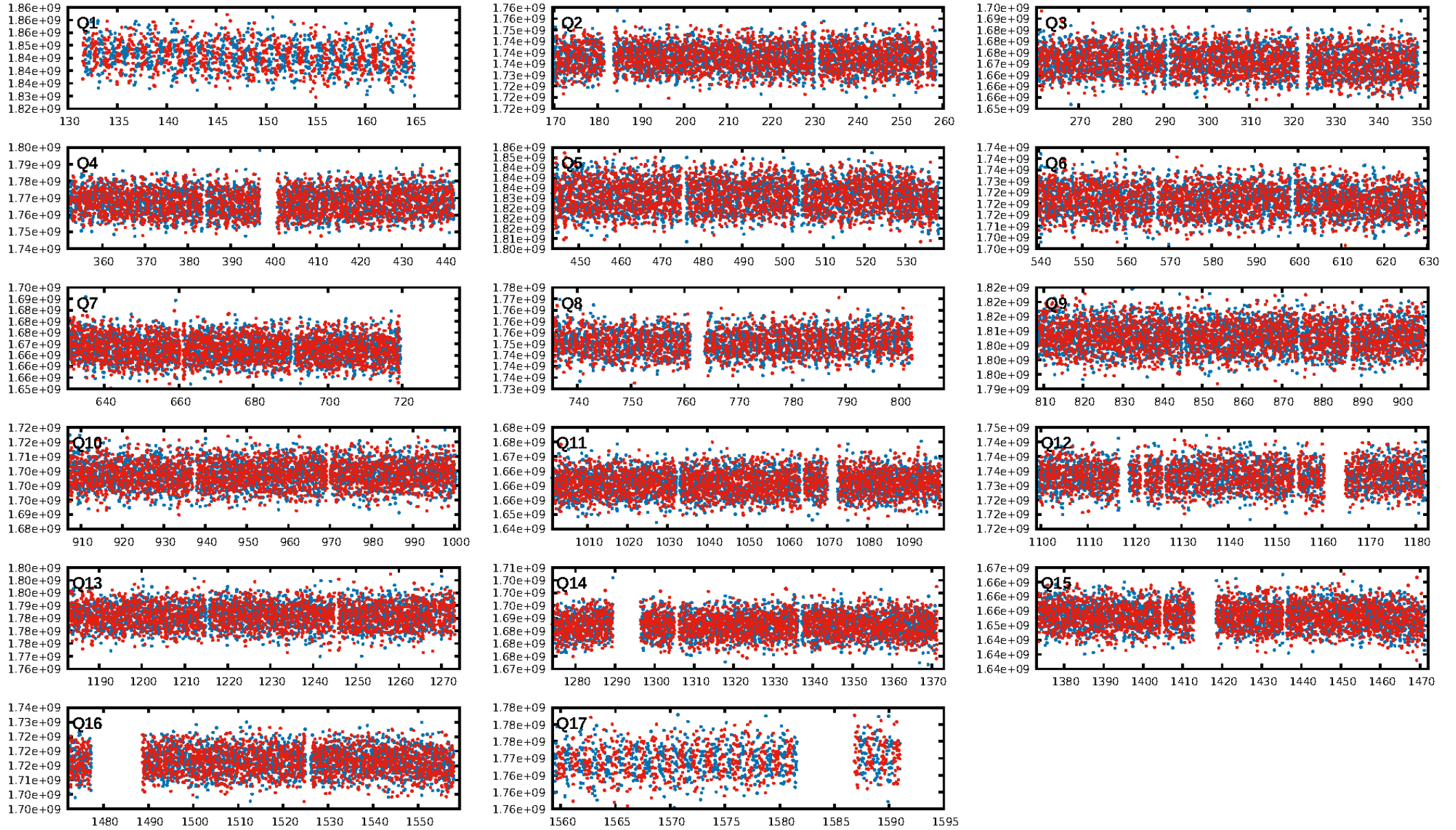
DV Diagnostic Results:

ShortPeriod-sig: N/A
LongPeriod-sig: 100.0% [58.23σ]
ModelChiSquare2-sig: N/A
ModelChiSquareGof-sig: N/A
Bootstrap-pfa: 2.10e-07
RollingBand-fgt: 0.99 [1040/1049]
GhostDiagnostic-chr: N/A
Centroid-sig: 95.8%
Centroid-so: 0.305 arcsec [1.09σ]
OotOffset-rm: 1.680 arcsec [2.48σ]
OotOffset-st: 4/4/4/5 [17]
KicOffset-rm: 2.273 arcsec [3.53σ]
KicOffset-st: 4/4/4/5 [17]
DiffImageQuality-fgm: 0.41 [7/17]
DiffImageOverlap-fno: 1.00 [17/17]

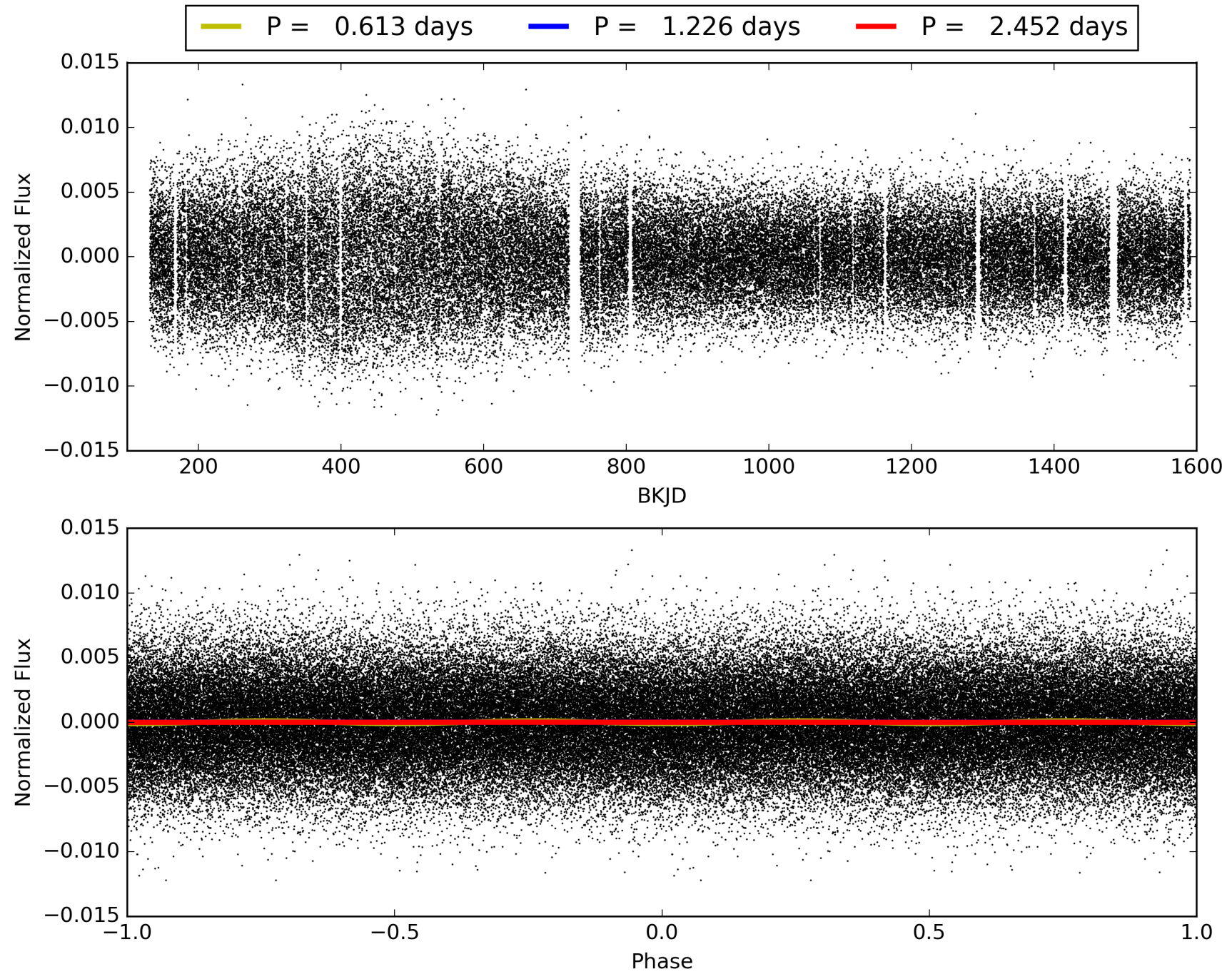
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This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

TCE 005391416-01, PDC Light Curves

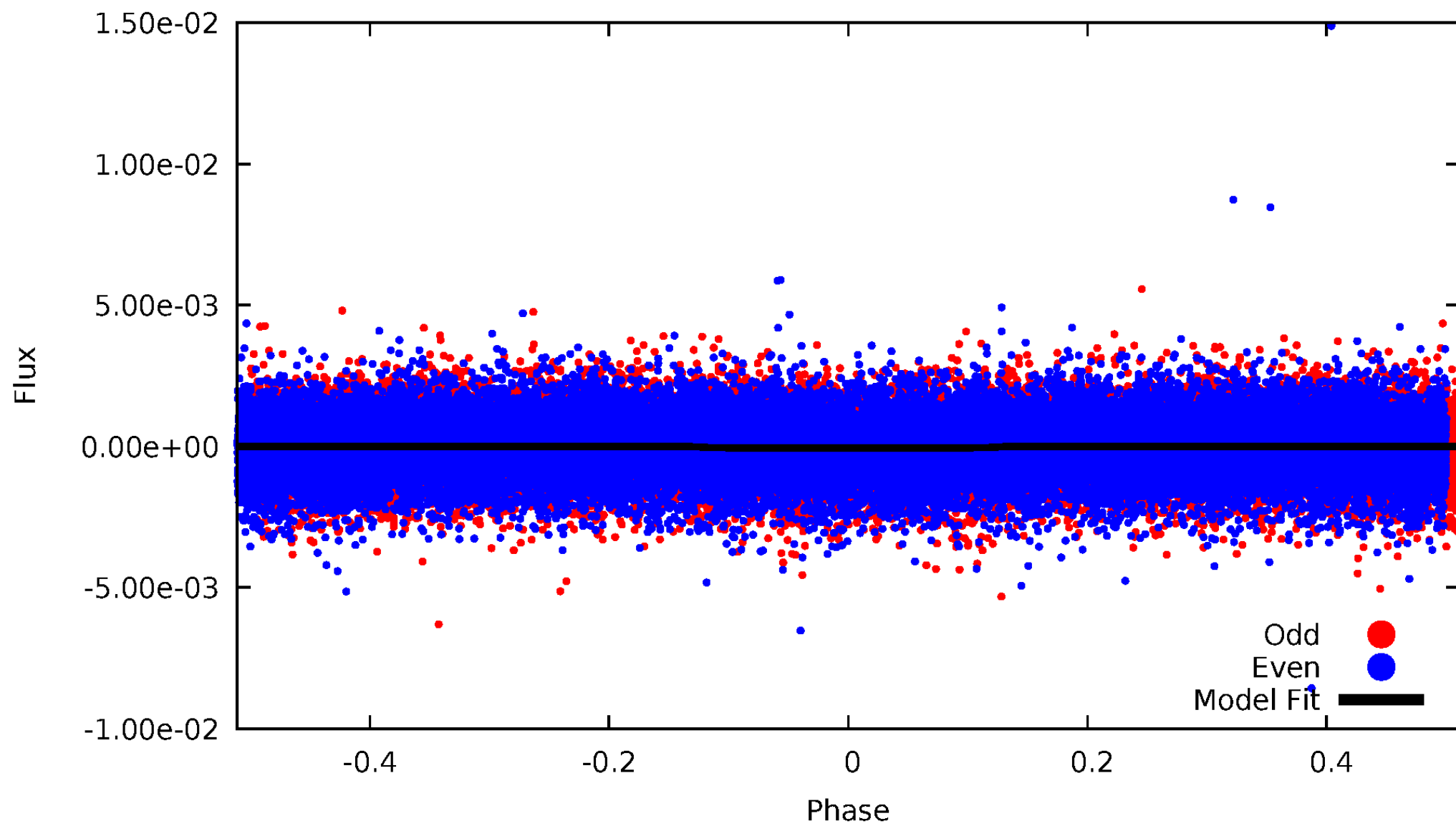


TCE 005391416-01



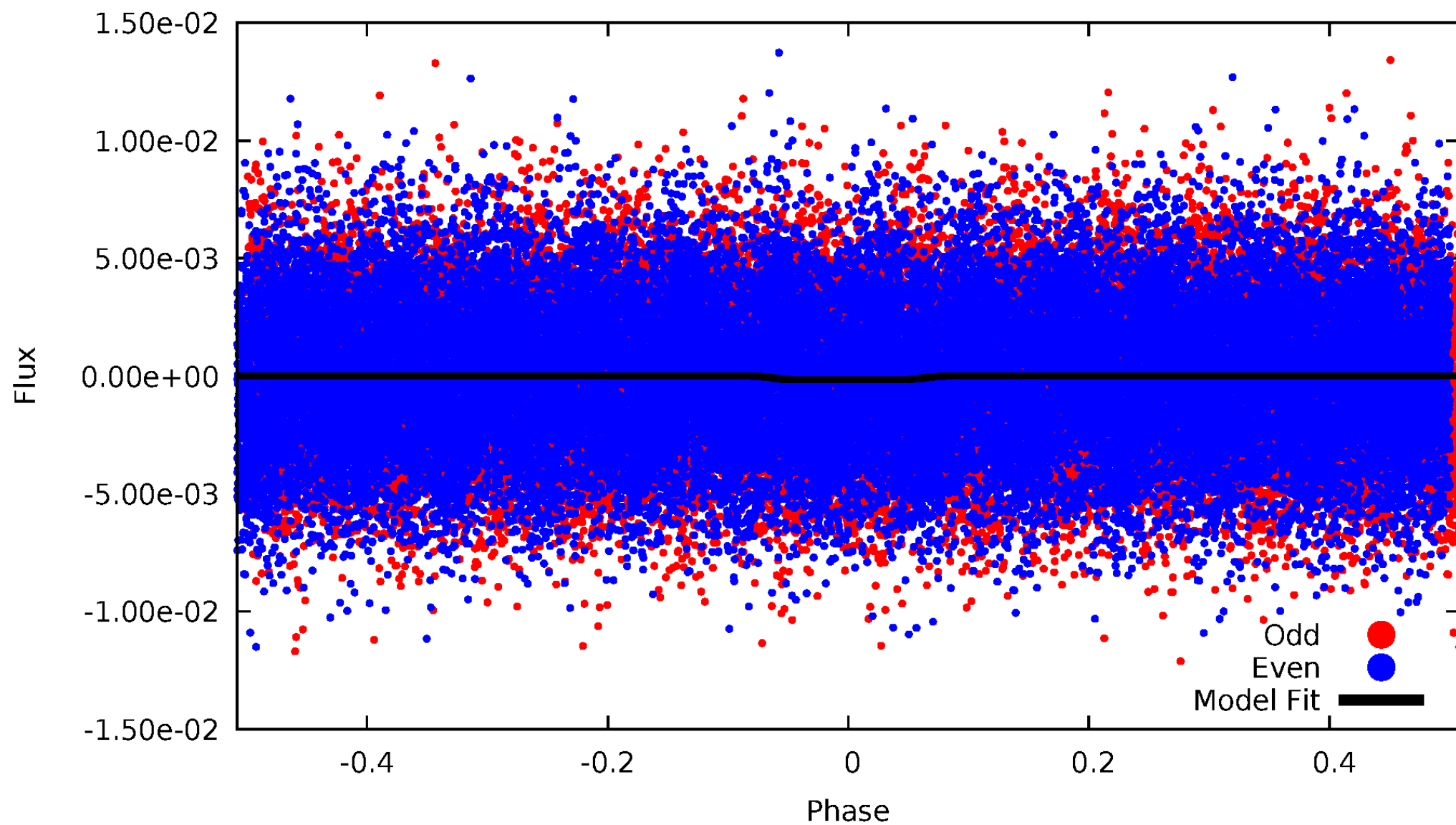
DV Odd/Even

TCE 005391416-01

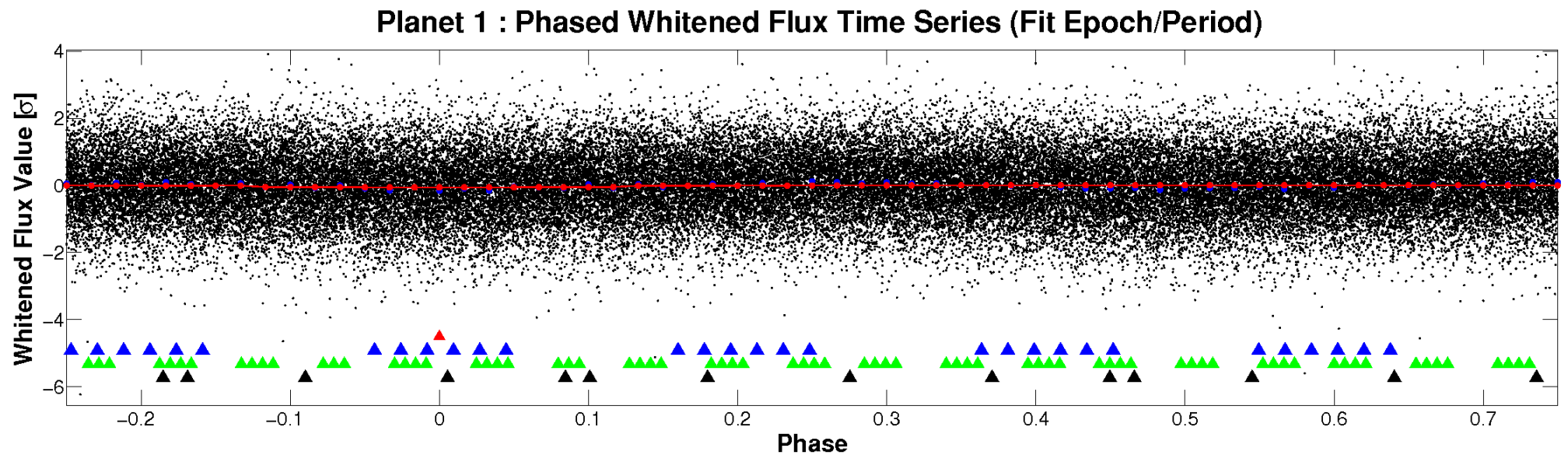
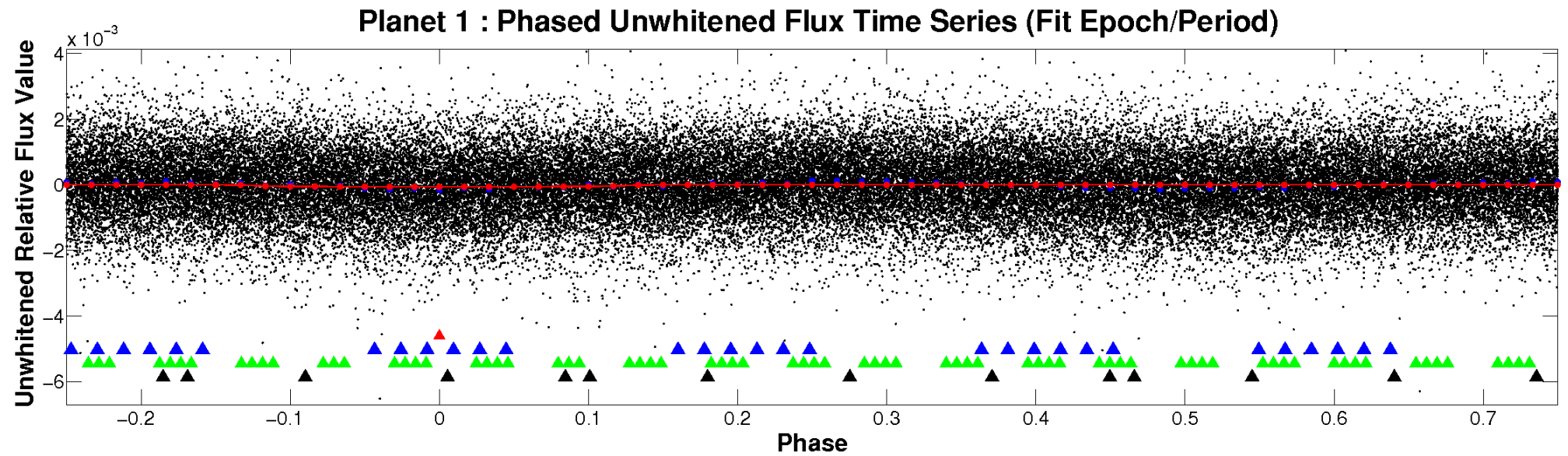


ALT Odd/Even

TCE 005391416-01

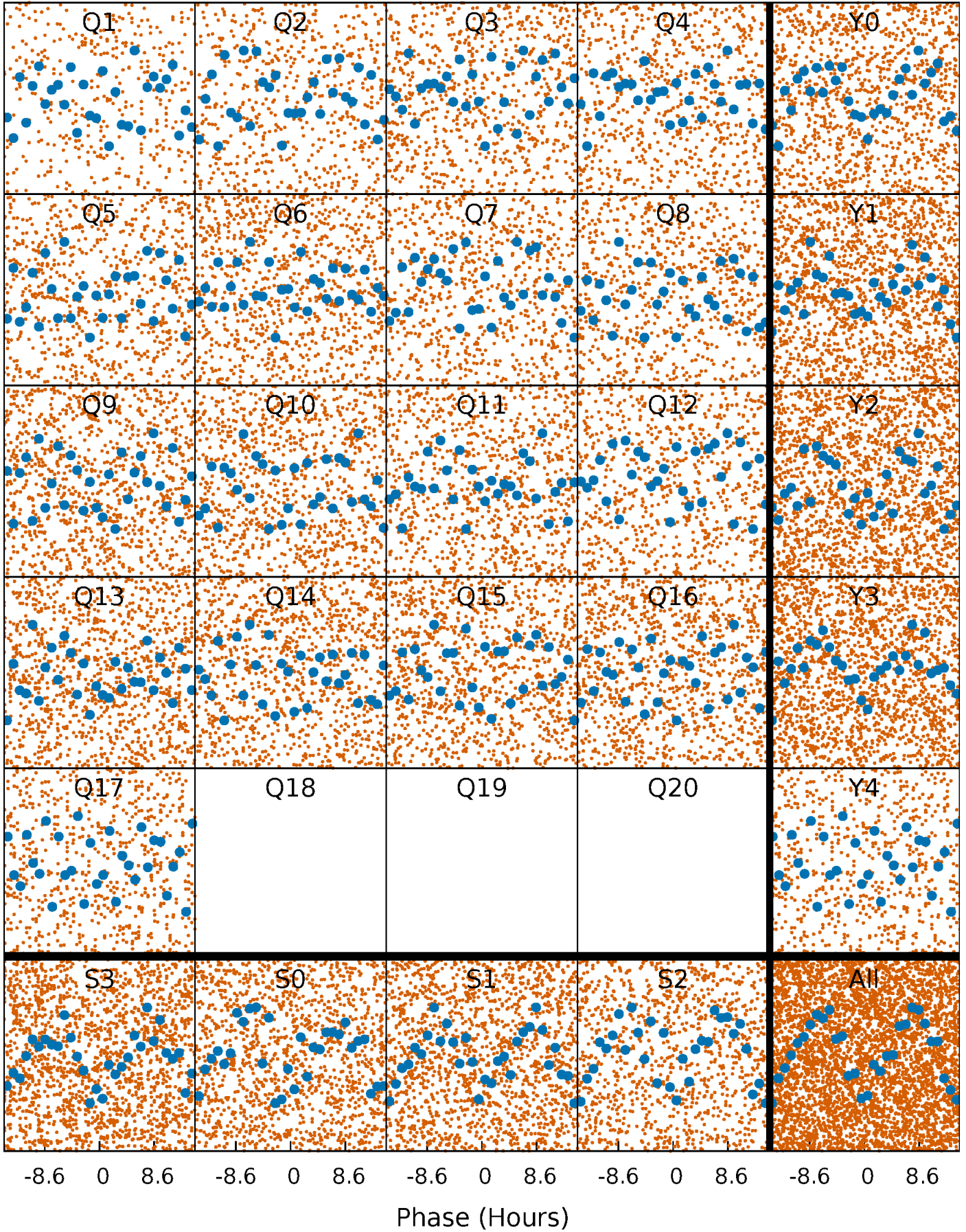


Non-Whitened Vs. Whitened Light Curve



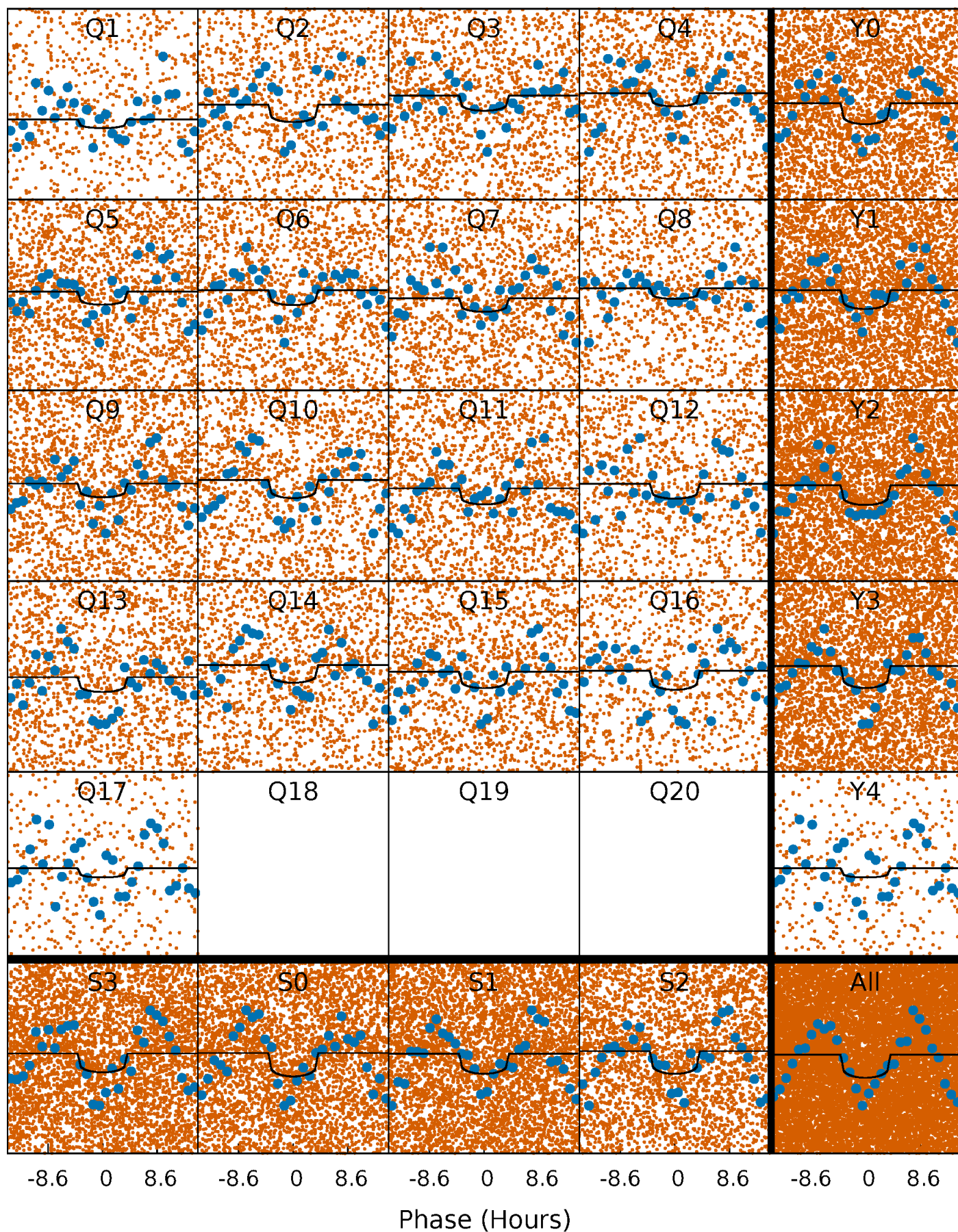
PDC Quarter-Phased Transit Curves

TCE 005391416-01 P= 1.226221 Days $T_0=132.685893$ (BKJD)



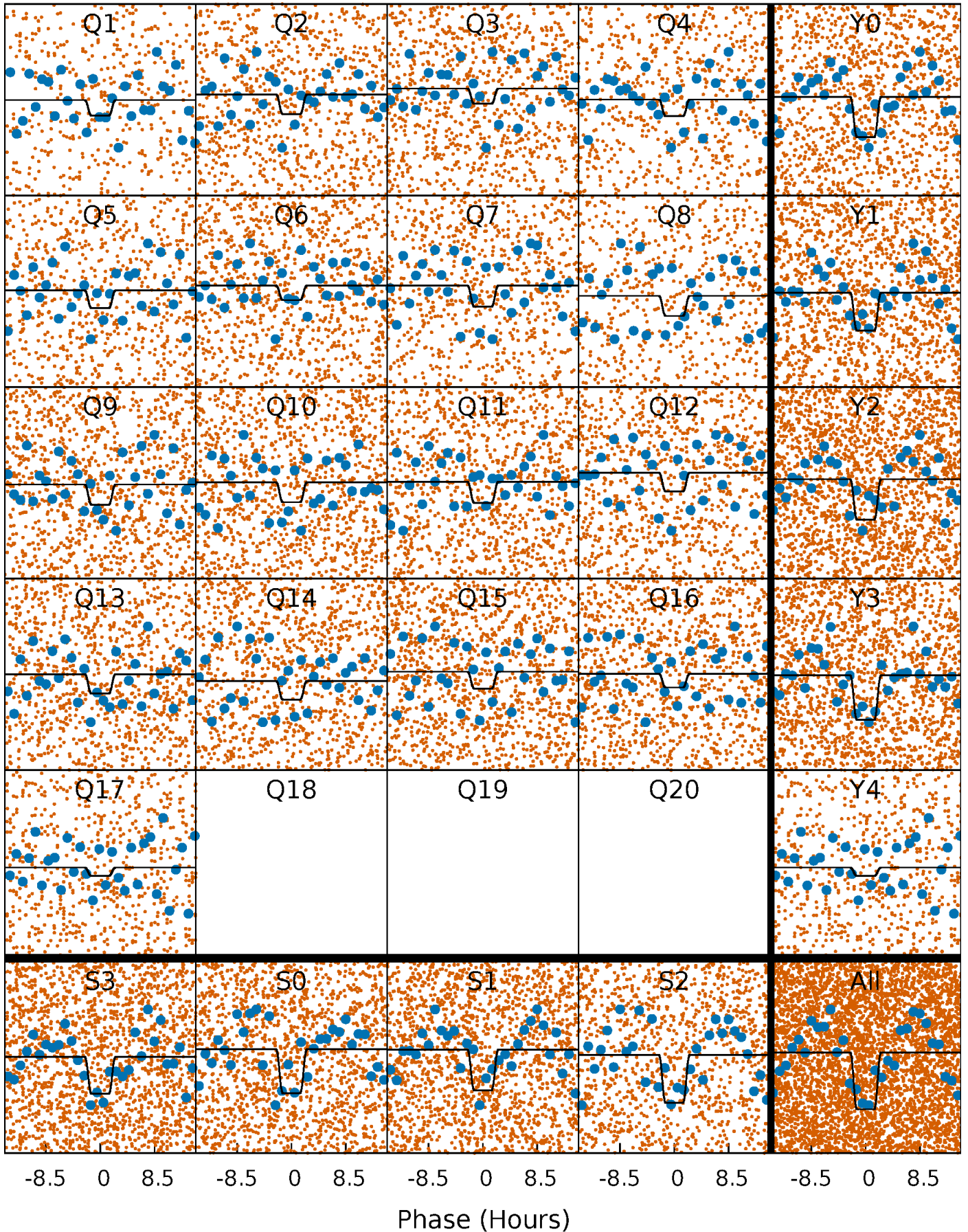
DV Quarter-Phased Transit Curves

TCE 005391416-01 P= 1.226221 Days $T_0=132.685893$ (BKJD)



Alt. Detrend Quarter-Phased Transit Curves

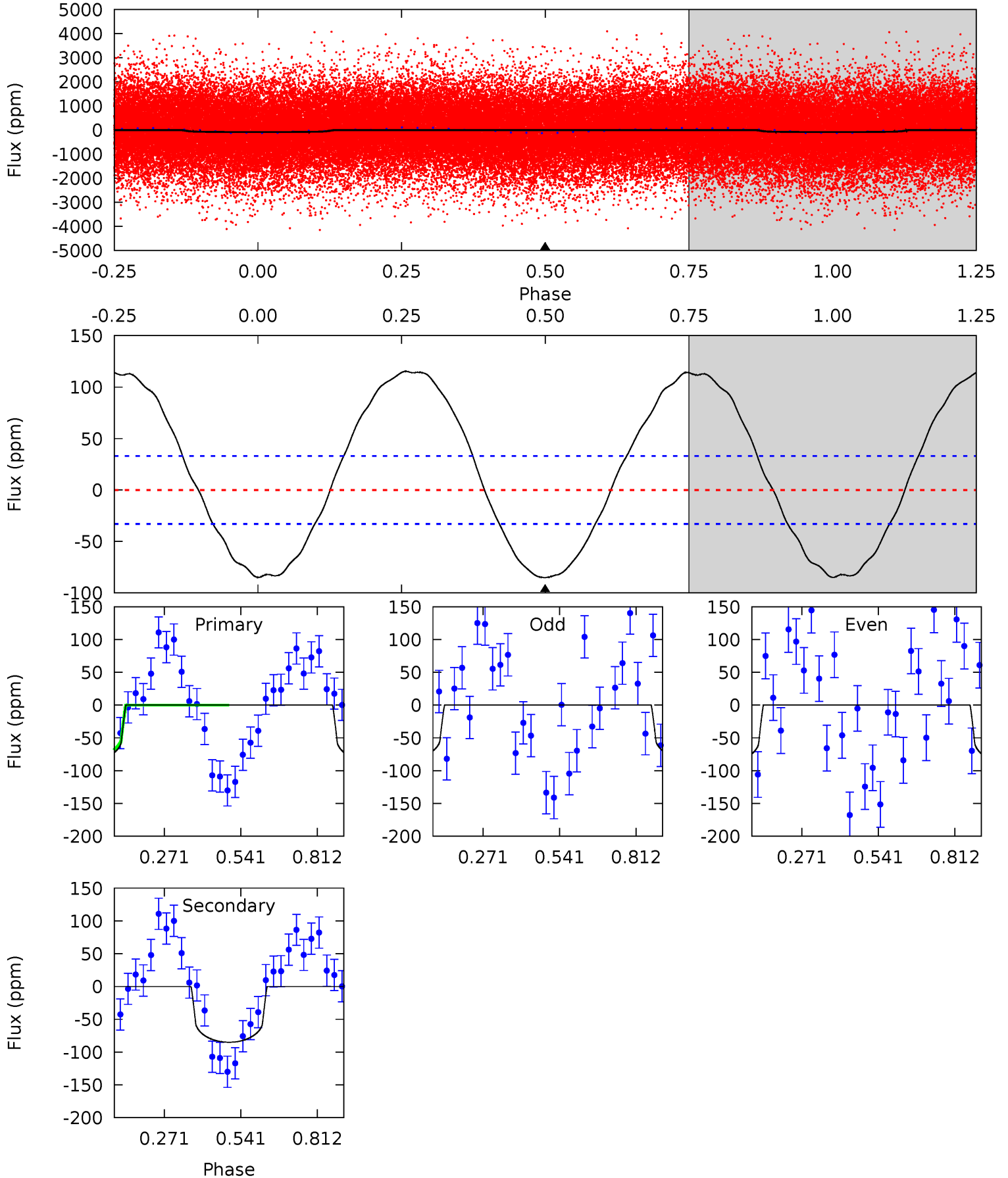
TCE 005391416-01 P= 1.226225 Days $T_0=132.686848$ (BKJD)



DV Model-Shift Uniqueness Test

005391416-01, P = 1.226221 Days, E = 131.459672 Days

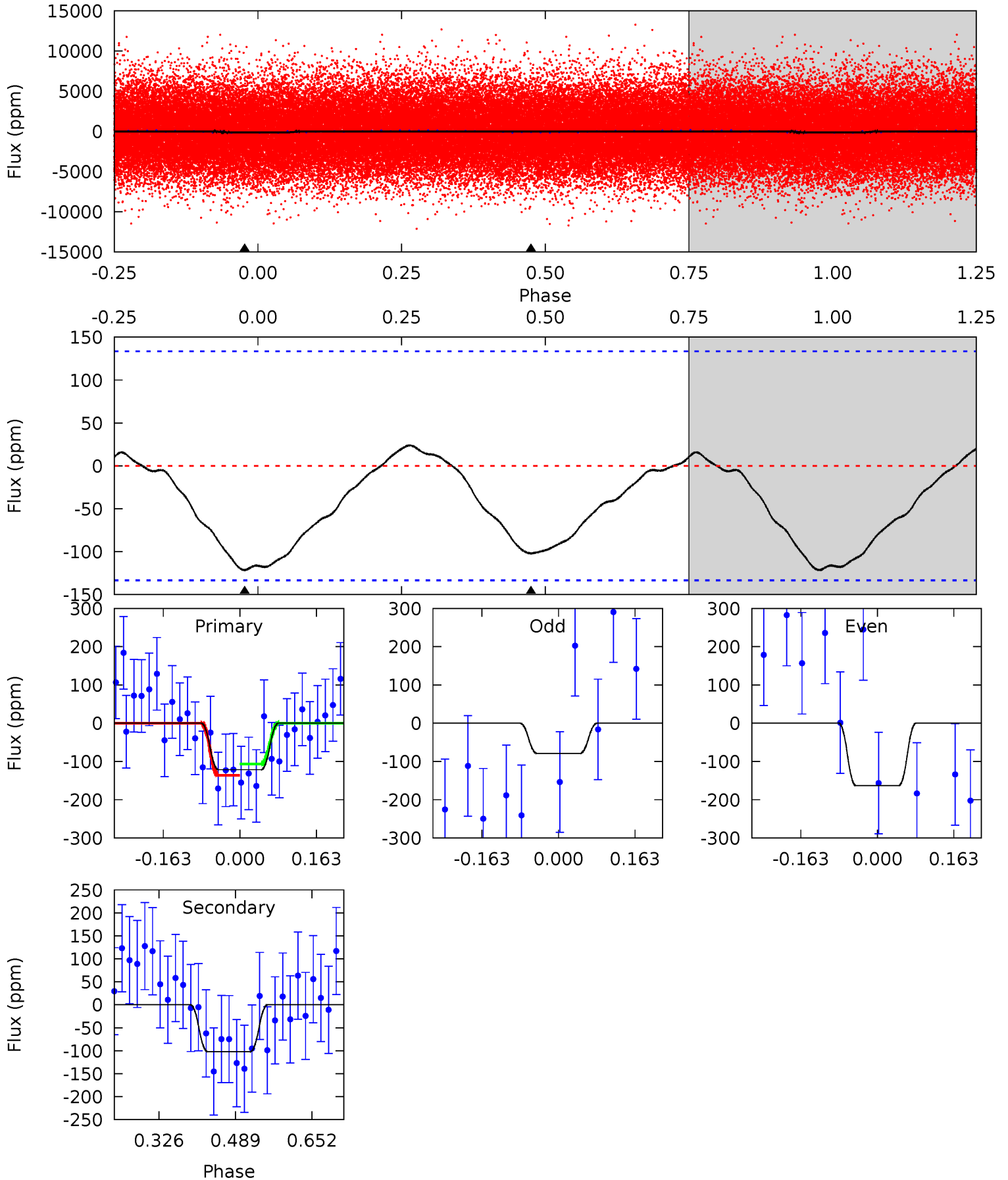
Pri	Sec	Ter	Pos	FA ₁	FA ₂	F _{Red}	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
11.2	11.2	0	0	4.35	1.10	9.01	11.2	11.2	11.2	11.2	0.36	1.13	0.58	0.61



Alt Model-Shift Uniqueness Test

005391416-01, P = 1.226225 Days, E = 131.460623 Days

Pri	Sec	Ter	Pos	FA ₁	FA ₂	F _{Red}	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
4.06	3.41	0	0	4.46	1.40	0.54	4.06	4.06	3.41	3.41	1.40	0.88	0.16	0.50



Stellar Parameters For KIC 005391416

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	R (R_{\odot})	$M(M_{\odot})$	p_{\star} ($\text{g}\cdot\text{cm}^{-3}$)
	8281^{+200}_{-343}	$3.752^{+0.413}_{-0.110}$	$-0.120^{+0.250}_{-0.350}$	$3.147^{+0.777}_{-1.442}$	$2.039^{+0.329}_{-0.493}$	$0.092^{+0.361}_{-0.039}$
	+2%/-4%	+11%/-3%	+208%/-292%	+25%/-46%	+16%/-24%	+392%/-42%
Source	KIC0	KIC0	KIC0	DSEP		

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

Secondary Eclipse Parameters for KIC 005391416-01 / KOI

Detrend	Depth (ppm)	R_p (R_{\oplus})	T_{max} (K)	T_{obs} (K)	A_{obs}
DV	-85 ± 8	$3.15^{+2.75}_{-2.06}$	5207^{+376}_{-542}	7468^{+10635}_{-2139}	$3.856^{+29.662}_{-2.756}$
Alt.	-102 ± 30	$4.08^{+3.08}_{-2.49}$	5150^{+433}_{-579}	6745^{+6360}_{-1889}	$2.628^{+14.819}_{-1.780}$

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 $A_{obs} \gg 1.0$

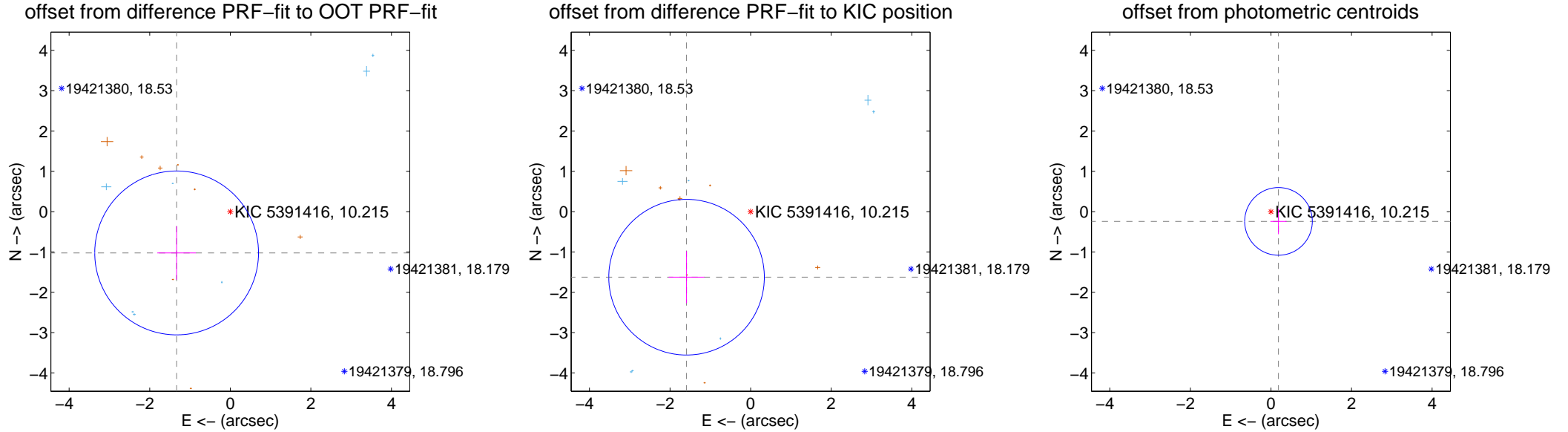
DV Centroid Data

Supplemental centroid analysis for 005391416-01. **Kepler magnitude: 10.21.** Transit SNR 6.73

There are 7 quarters with good PRF difference image offsets

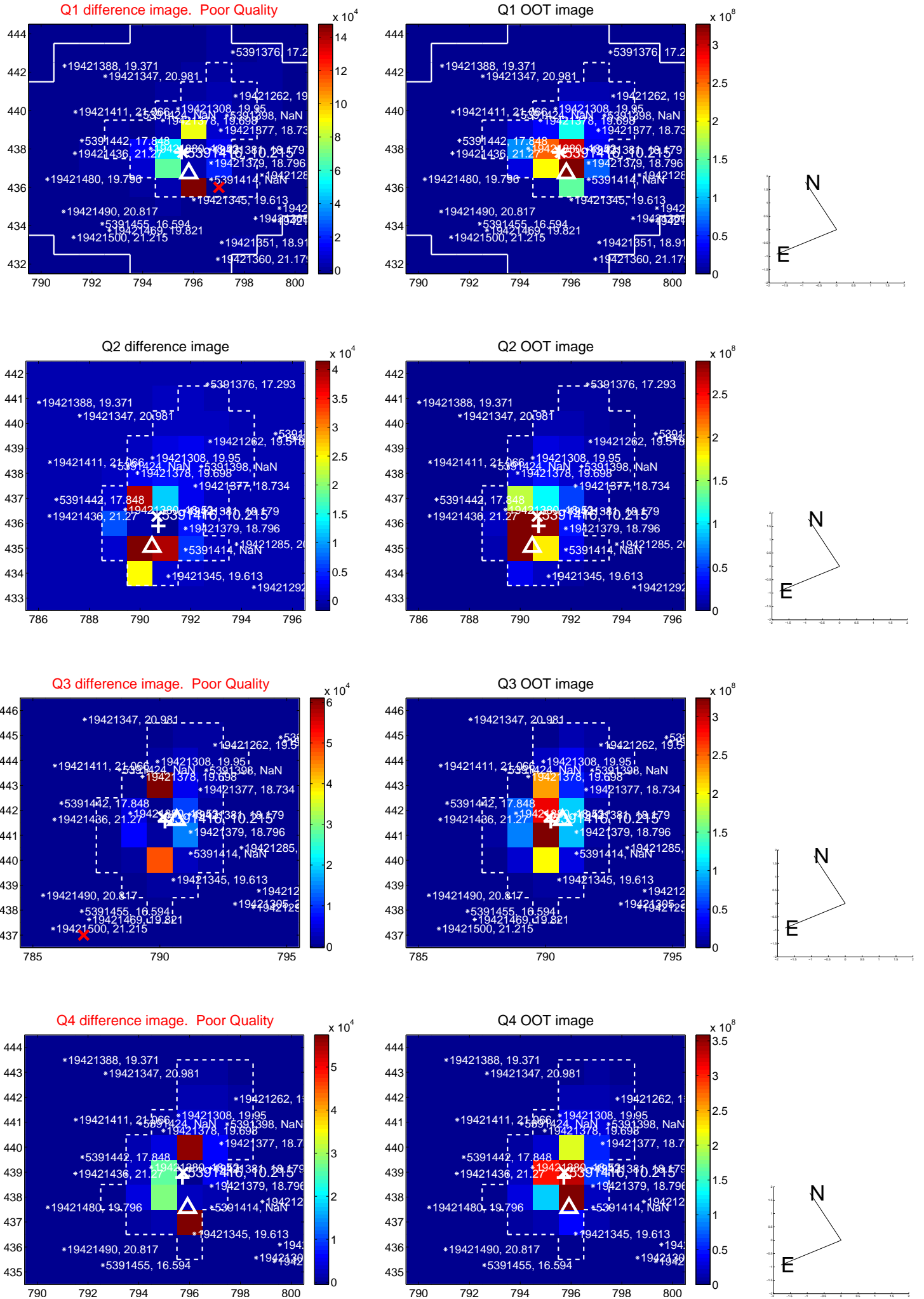
The direct PRF centroid is offset from the target star catalog position by about 0.17 arcsec

	Distance in arcsec	Distance / σ	Δ RA	Δ Dec
PRF-fit source offset from OOT	1.680 ± 0.677	2.48	1.332 ± 0.480	-1.023 ± 0.665
PRF-fit source offset from KIC position	2.273 ± 0.643	3.53	1.590 ± 0.442	-1.625 ± 0.643
photometric centroid source offset	0.31 ± 0.28	1.09	-0.19 ± 0.20	-0.24 ± 0.32

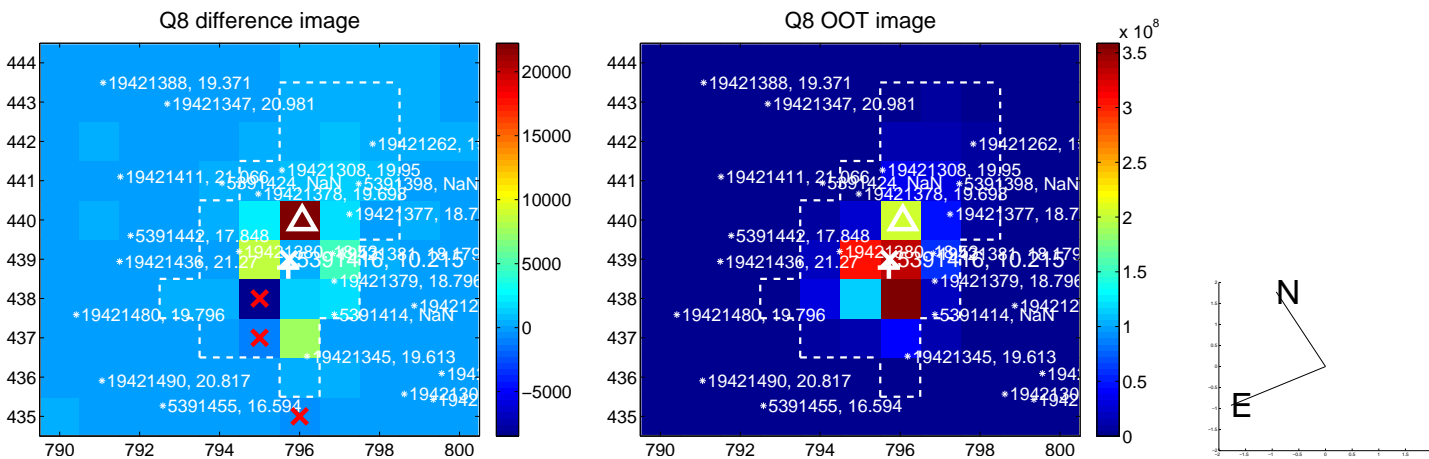
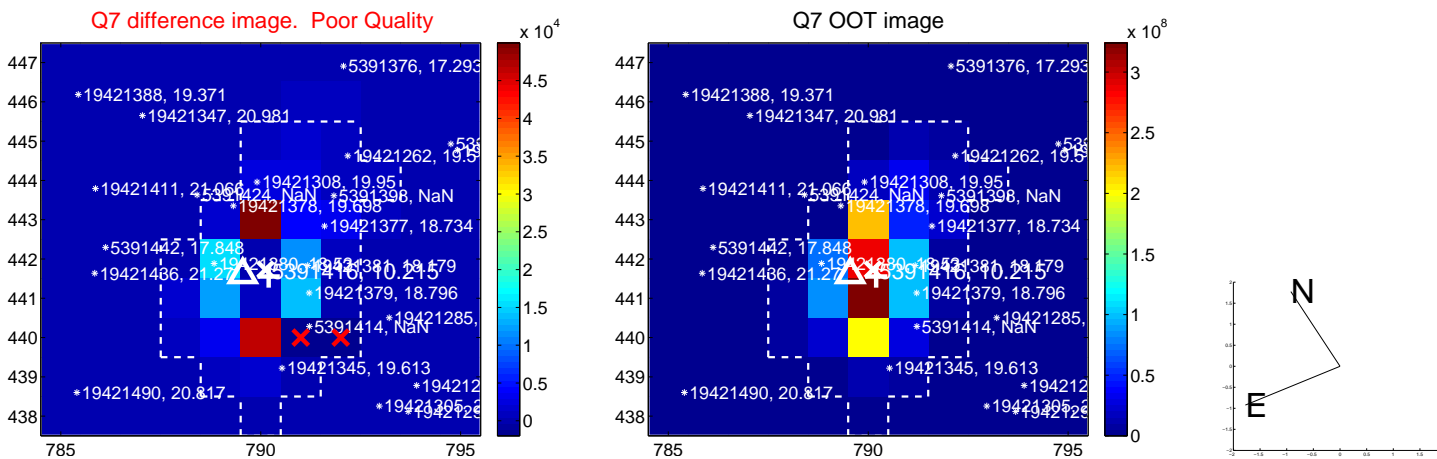
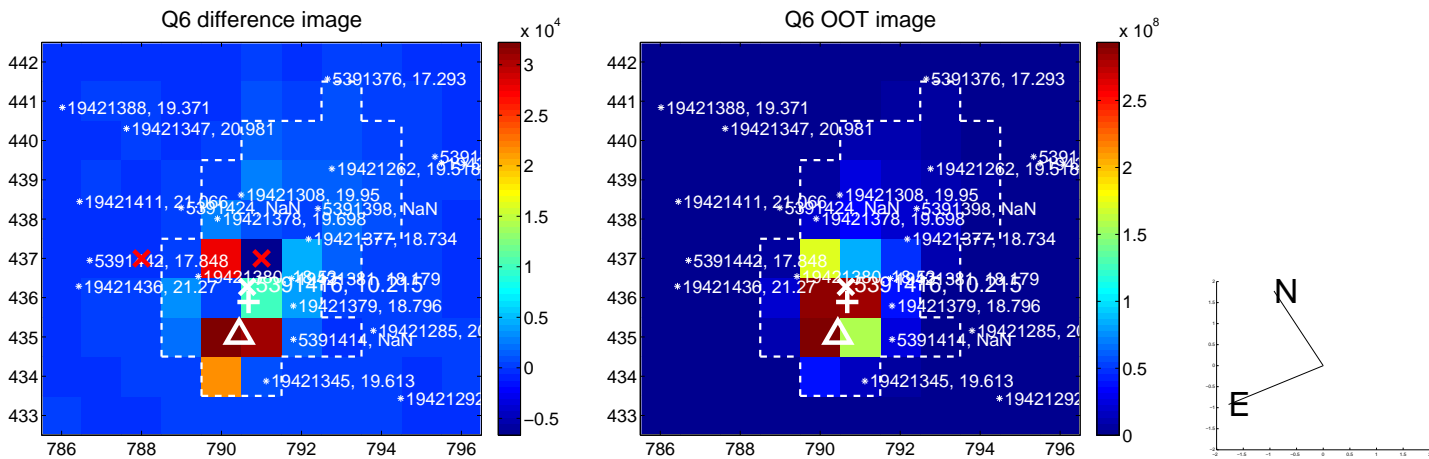
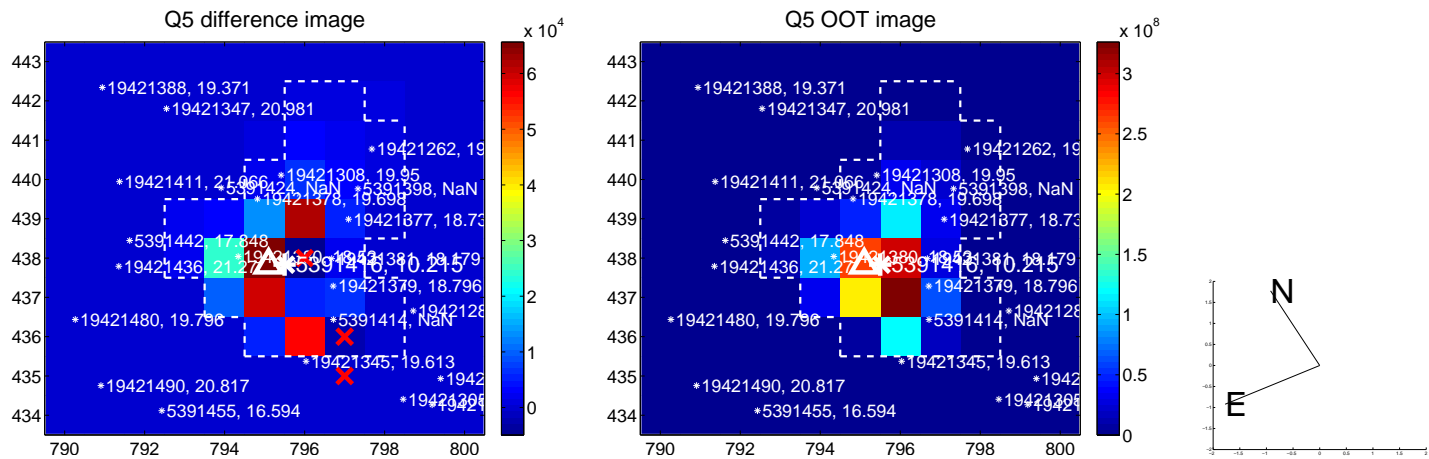


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- σ uncertainty. Blue circle: three- σ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

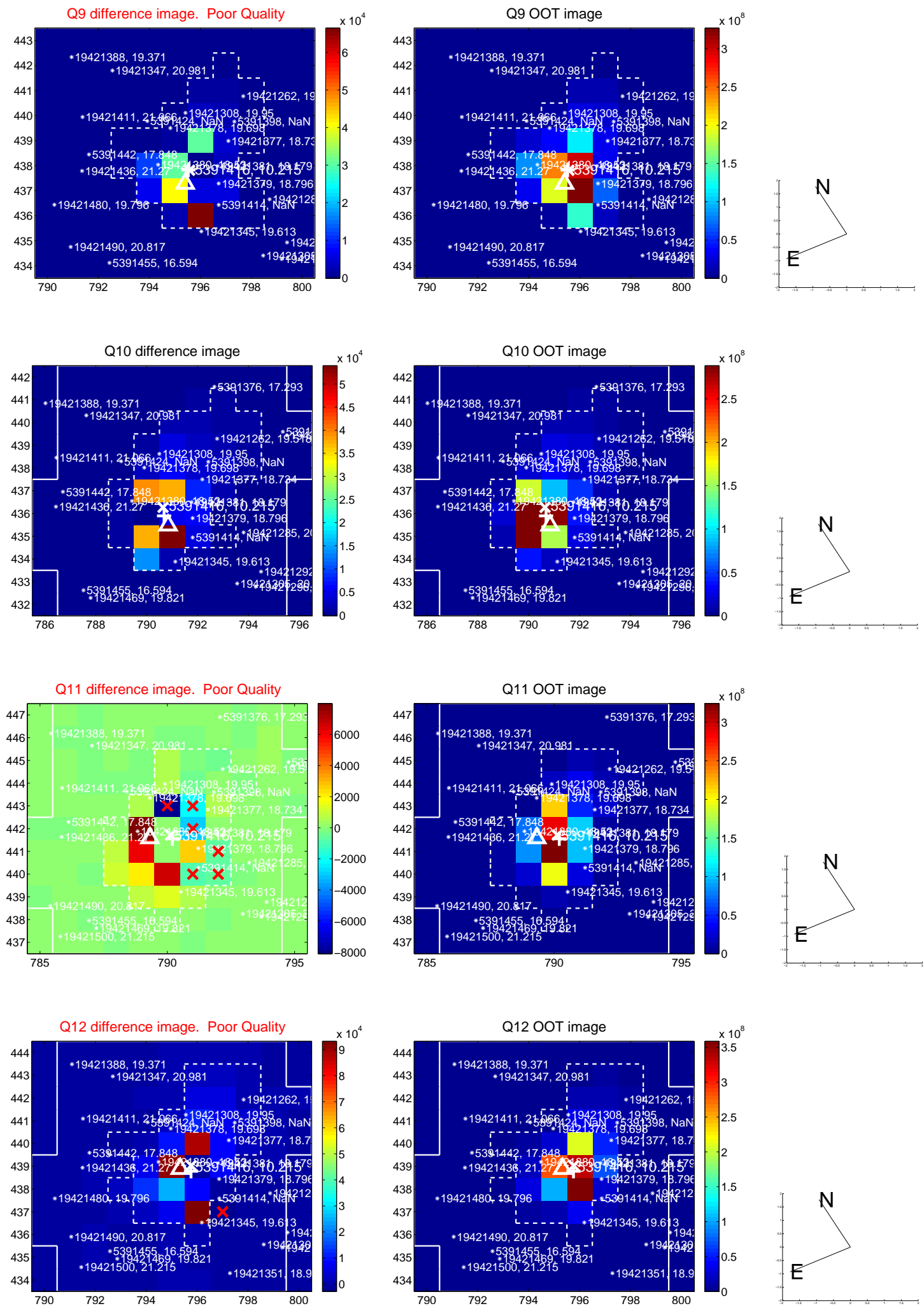
white \times : KIC target position; +: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



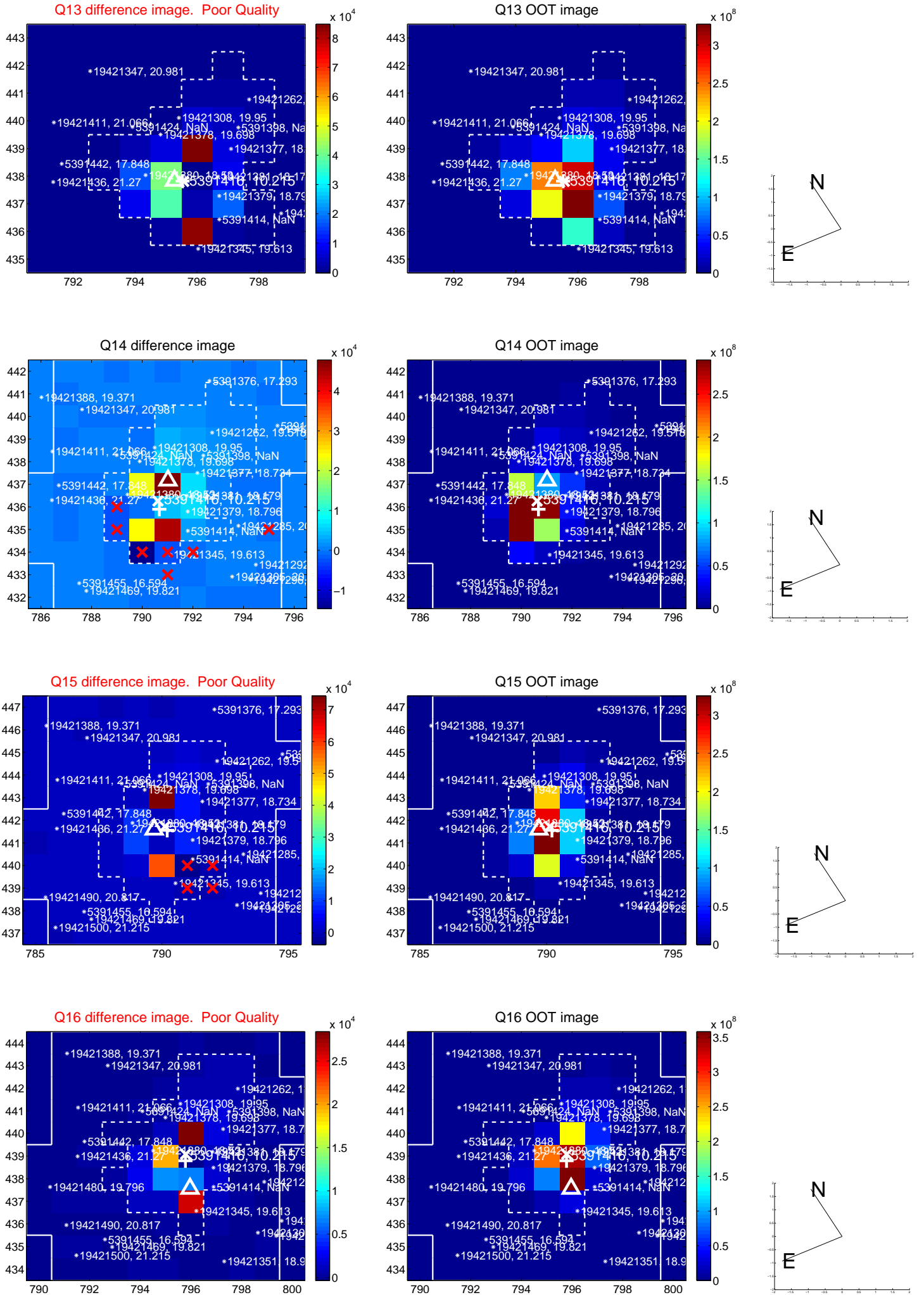
white \times : KIC target position; $+$: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



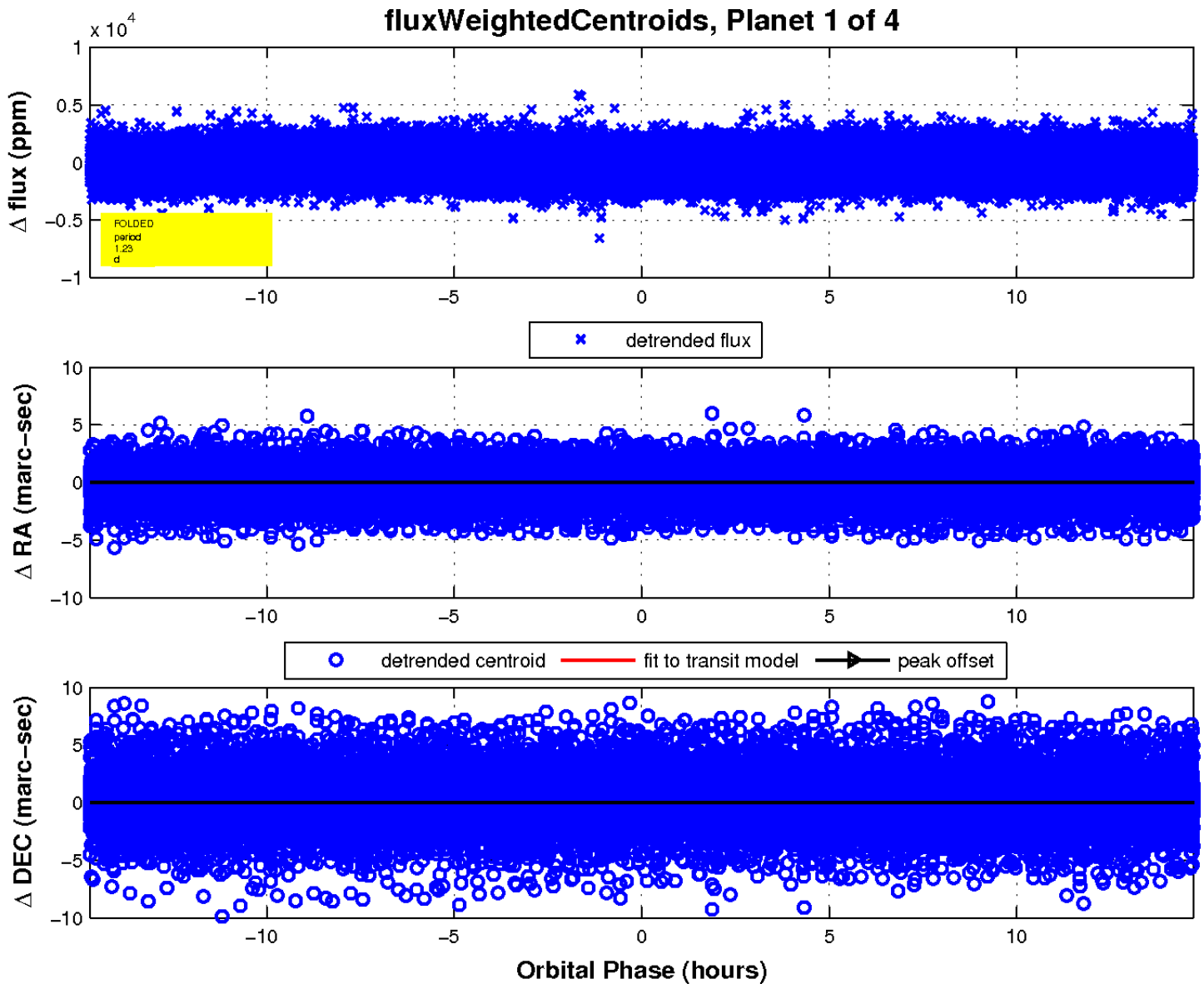
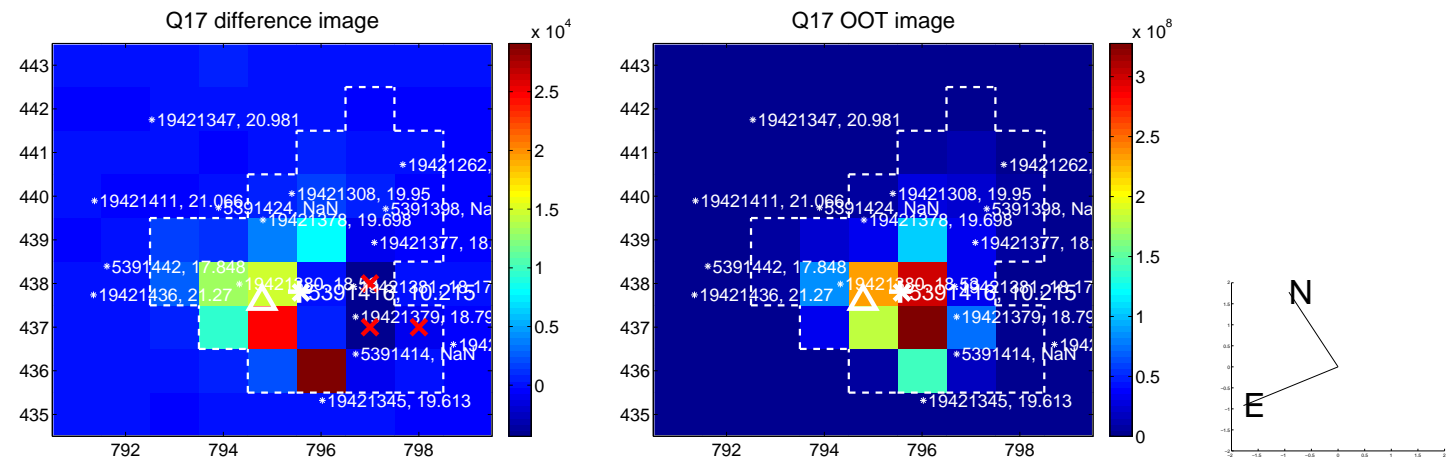
white \times : KIC target position; +: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



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

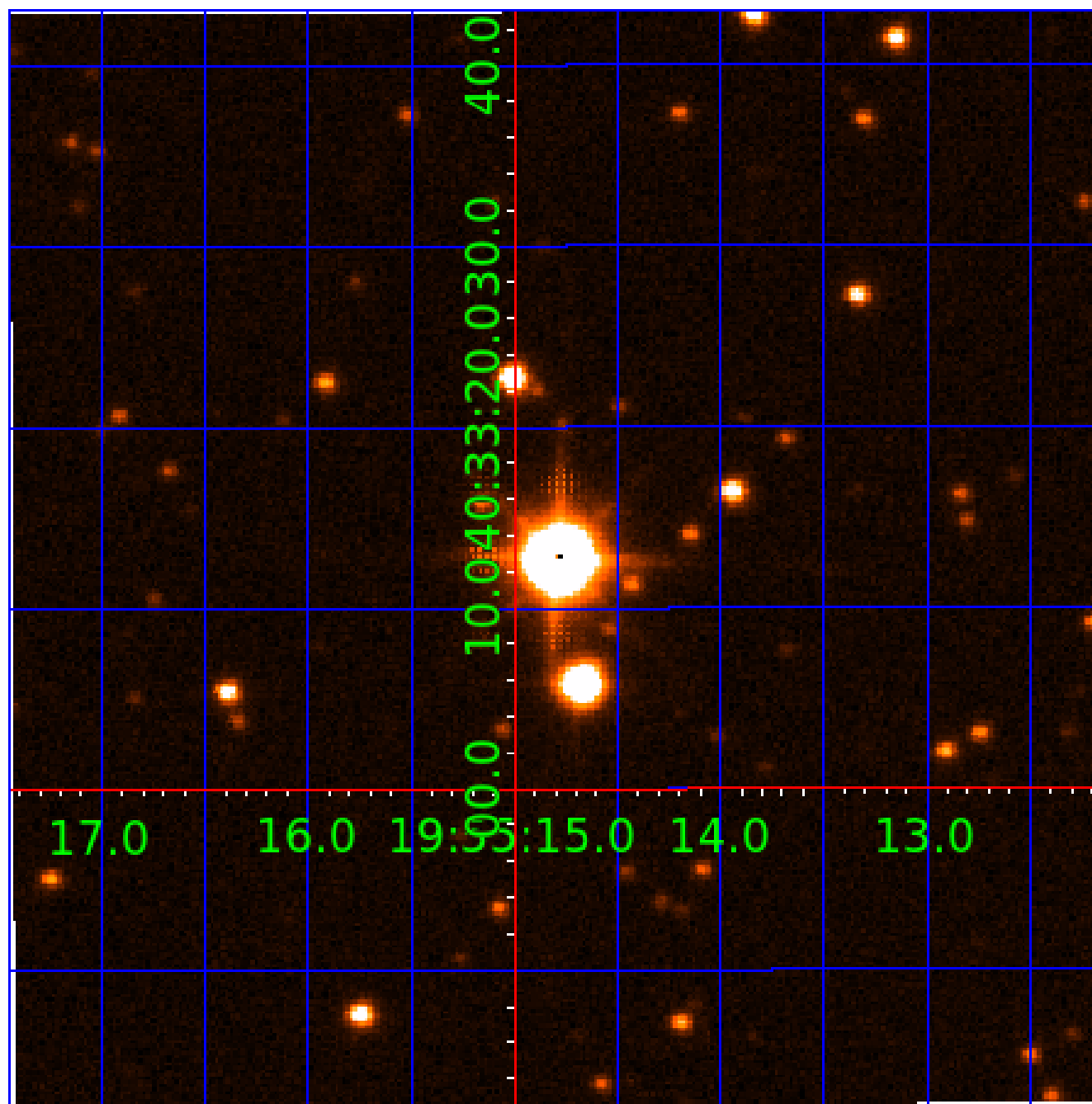


white \times : KIC target position; $+$: OOT centroid; Δ : difference centroid. red \times : large negative pixel value.



UKIRT Image

Declination



KIC 005391416

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})
005391416-01	OBS	No	1.226221	132.685893	61.2	7.518	8.7	6.7	3.15	8281	2.57	51570.14
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005391416-03	OBS	No	19.812693	148.943625	1476.5	1.475	10.1	11.4	3.15	8281	13.50	1262.50
005391416-04	OBS	No	108.685941	159.455659	2621.7	1.734	10.2	10.1	3.15	8281	16.41	130.49

Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
005391416-01	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—CENT_SATURATED
005391416-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
005391416-03	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
005391416-04	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED

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

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

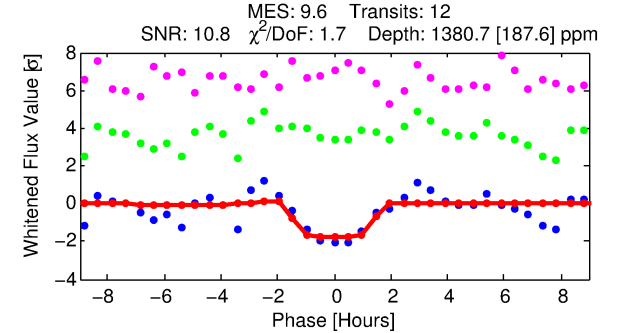
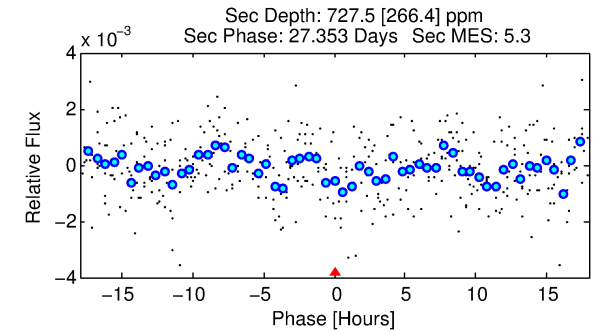
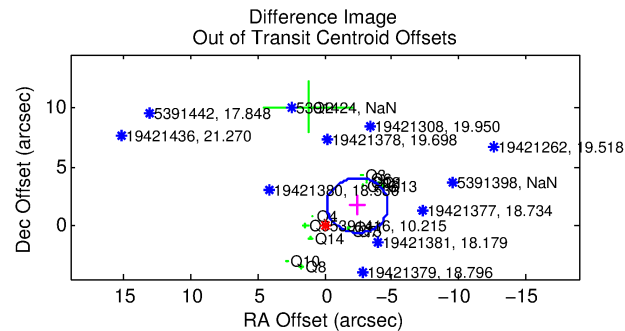
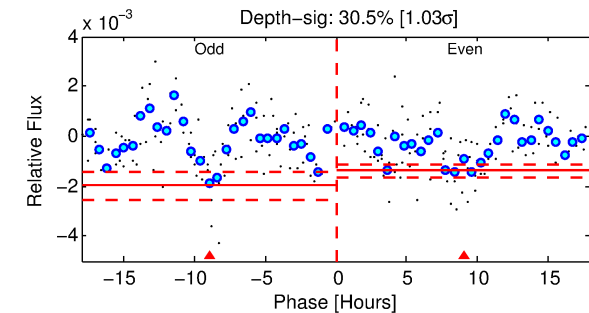
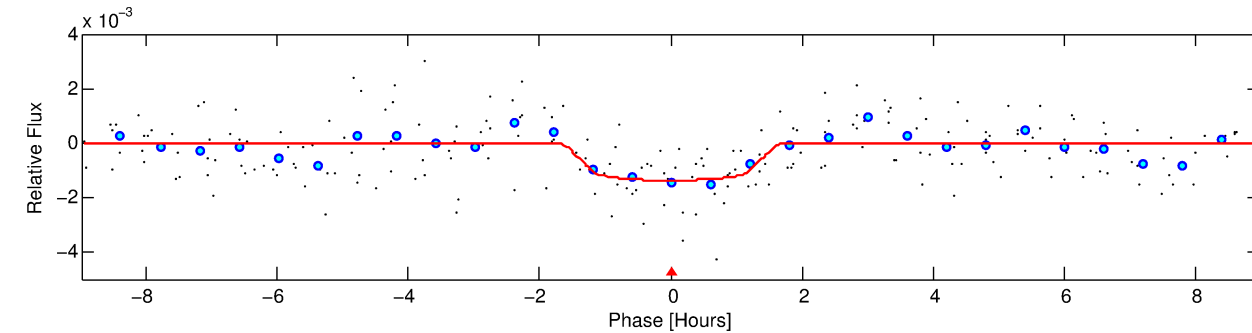
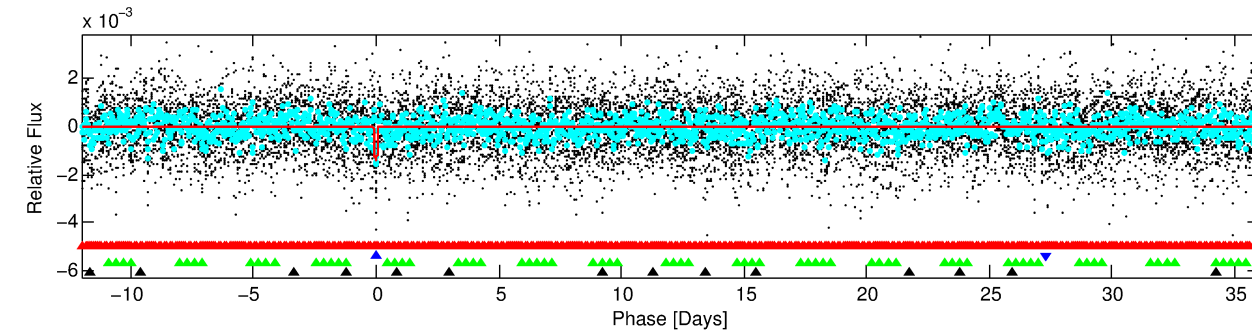
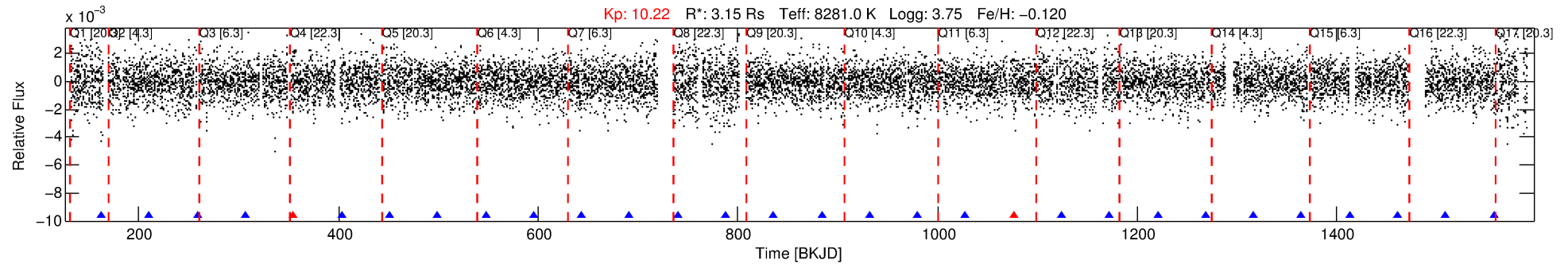
See http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col for comment definitions.

Ephemeris Match Information For 005391416-02

No Significant Match Found

DV One-Page Summary

KIC: 5391416 Candidate: 2 of 4 Period: 48.072 d



DV Fit Results:

Period = 48.07219 [0.00051] d
Epoch = 162.7890 [0.0088] BKJD
Rp/R* = 0.0357 [0.0481]
a/R* = 104.55 [803.15]
b = 0.59 [8.62]
Seff = 387.23 [279.96]
Teff = 1131 [204] K
Rp = 12.28 [17.45] Re
a = 0.3283 [0.1445] AU
Ag = 286.15 [803.02] [0.36 σ]
Teffp = 7193 [4894] K [1.24 σ]

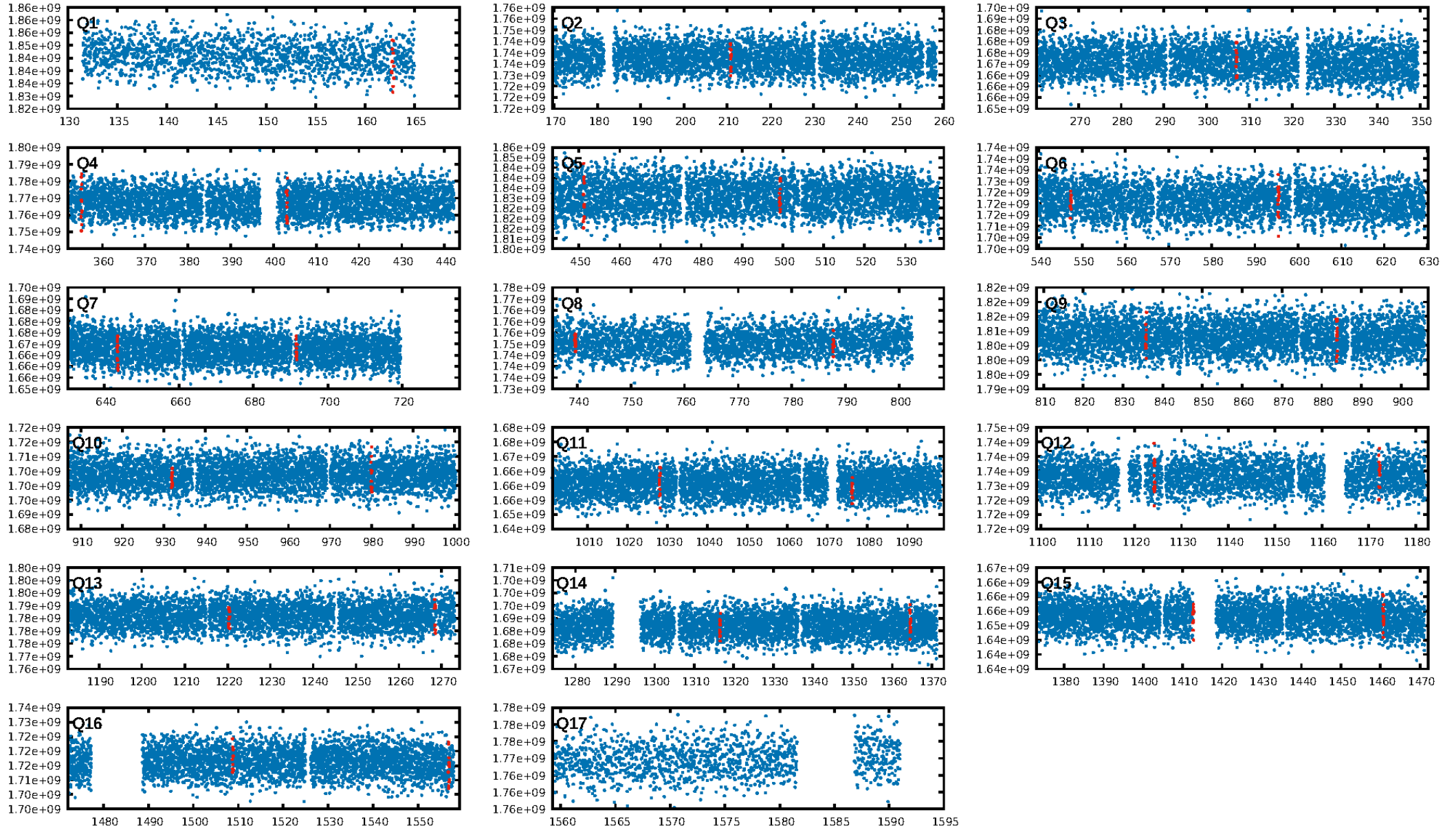
DV Diagnostic Results:

ShortPeriod-sig: 100.0% [203.25 σ]
LongPeriod-sig: 100.0% [420.54 σ]
ModelChiSquare2-sig: 38.0%
ModelChiSquareGof-sig: 99.9%
Bootstrap-pfa: 1.16e-08
RollingBand-fgt: 0.82 [9/11]
GhostDiagnostic-chr: N/A
Centroid-sig: 38.8%
Centroid-so: 0.410 arcsec [3.50 σ]
OotOffset-rm: 2.996 arcsec [3.91 σ]
KicOffset-rm: 2.000 arcsec [3.25 σ]
OotOffset-st: 4/4/4/3 [15]
KicOffset-st: 4/4/4/3 [15]
DiffImageQuality-fgm: 0.00 [0/15]
DiffImageOverlap-fno: 0.44 [7/16]

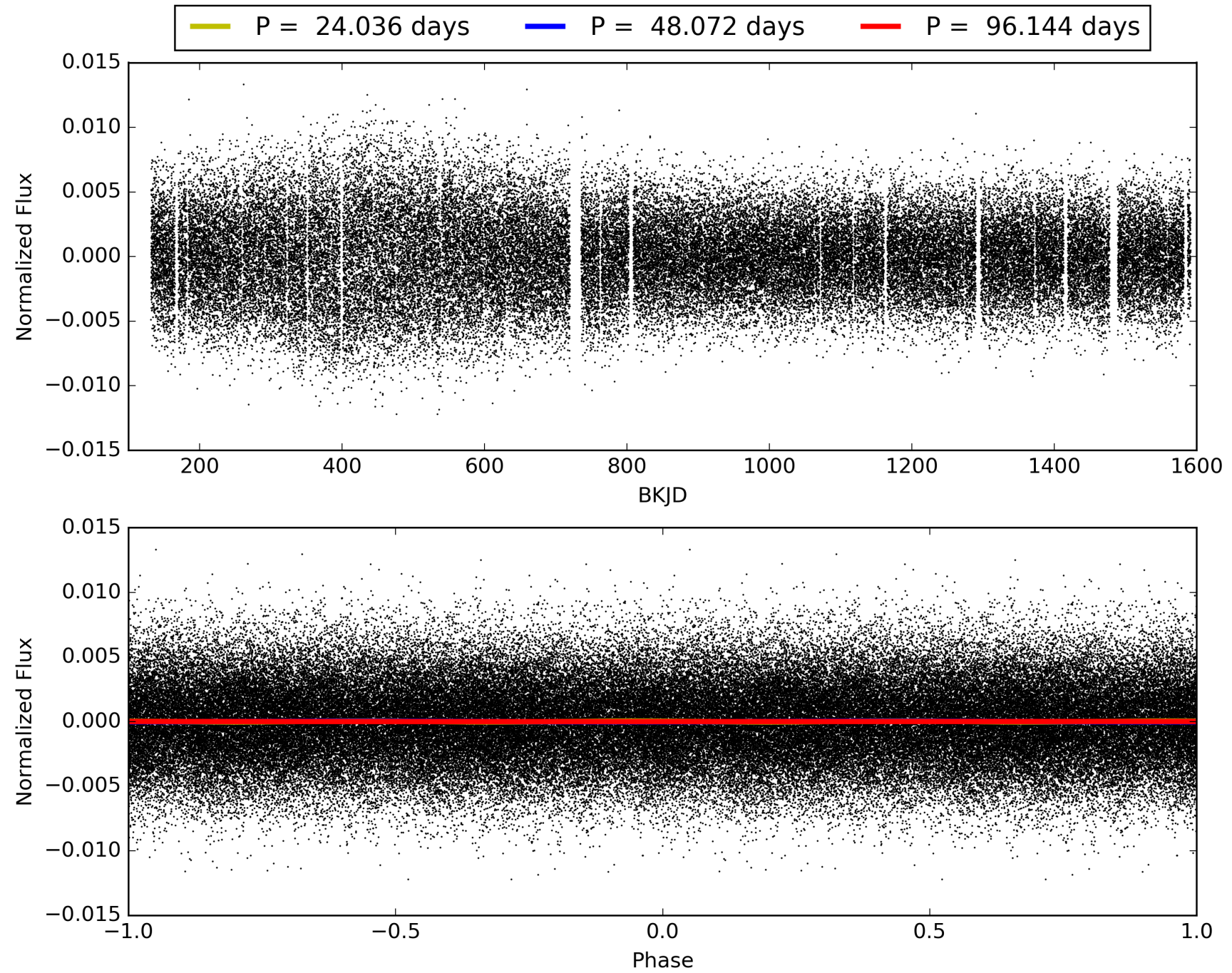
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This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

TCE 005391416-02, PDC Light Curves

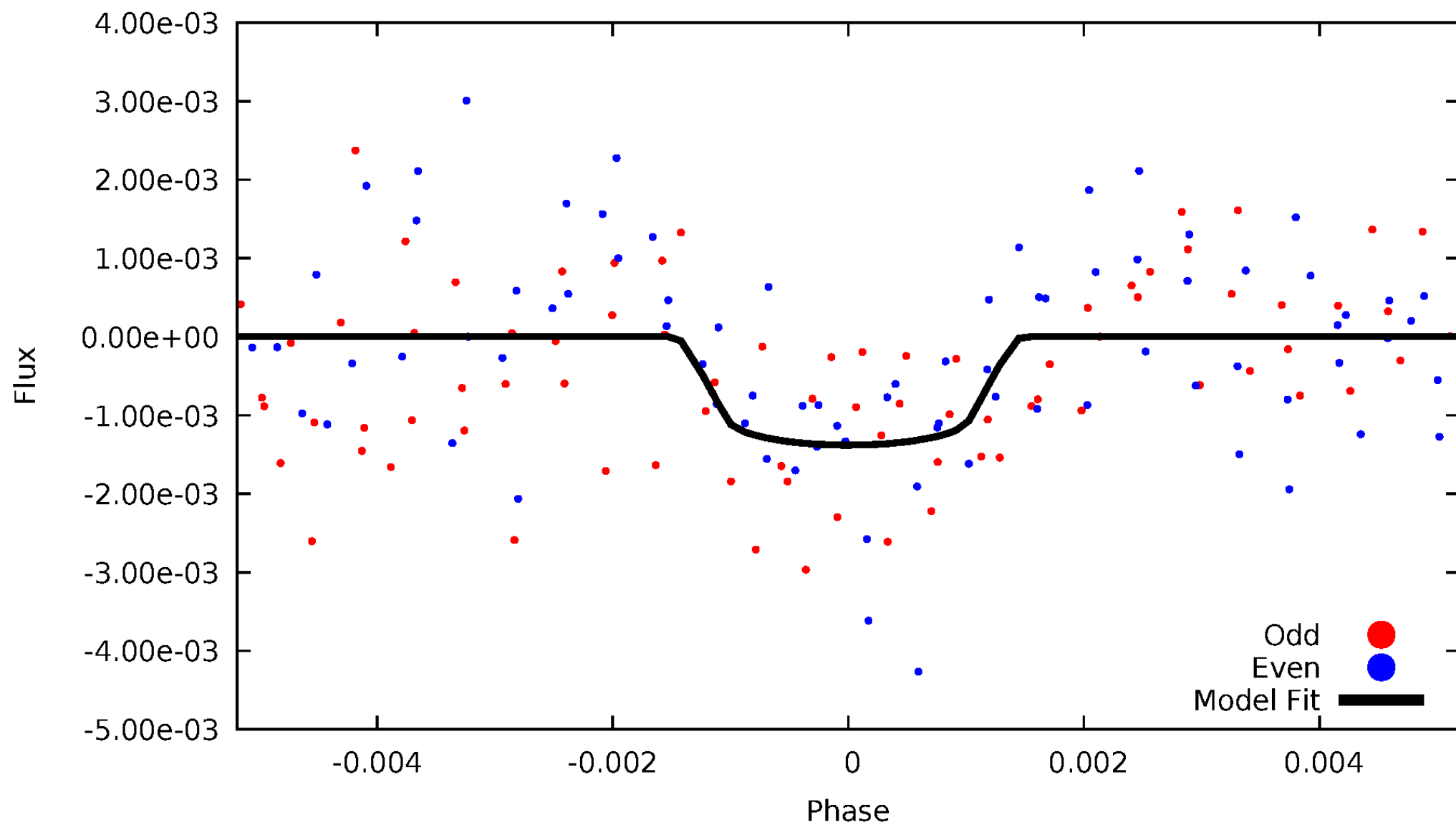


TCE 005391416-02



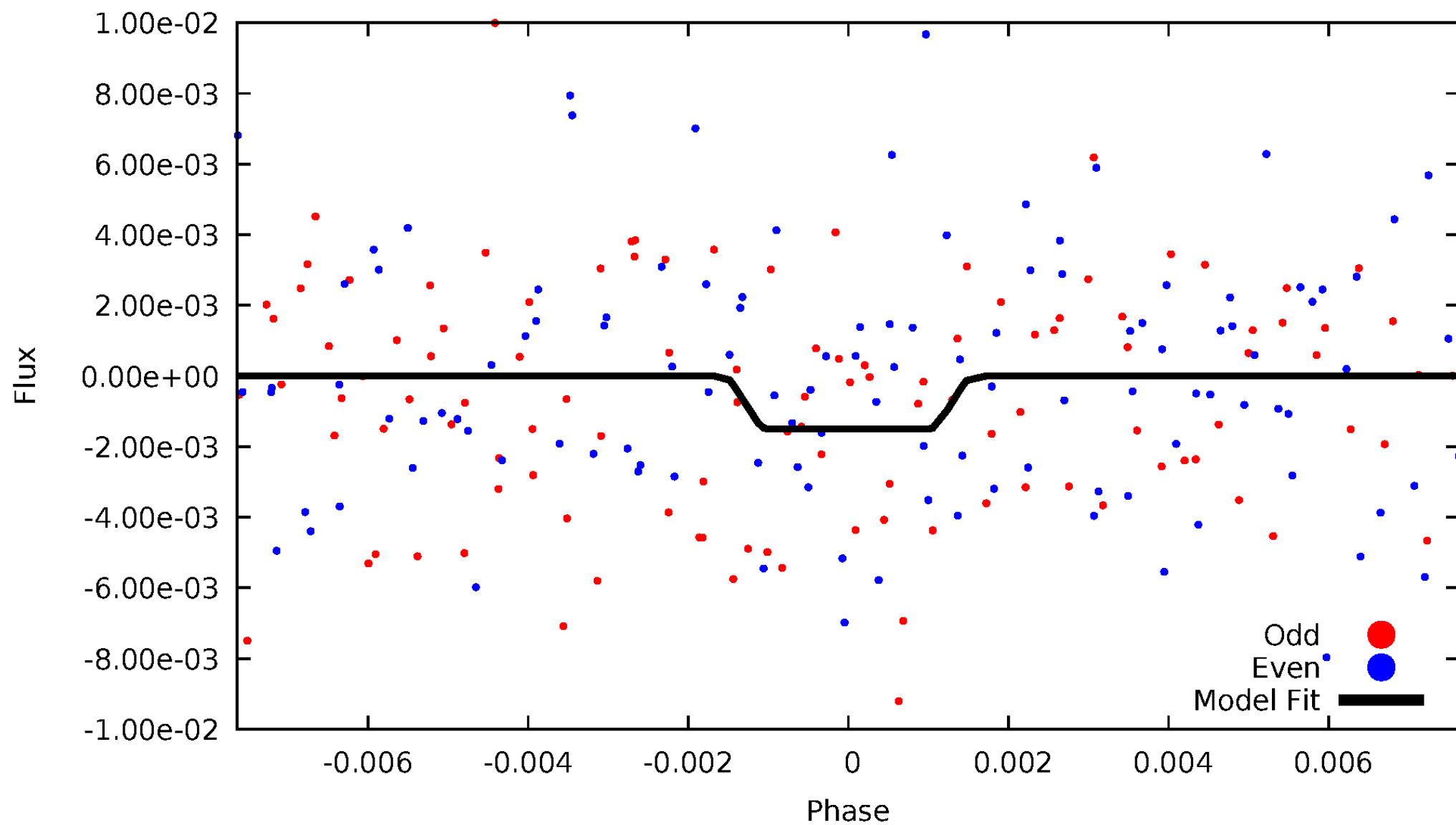
DV Odd/Even

TCE 005391416-02



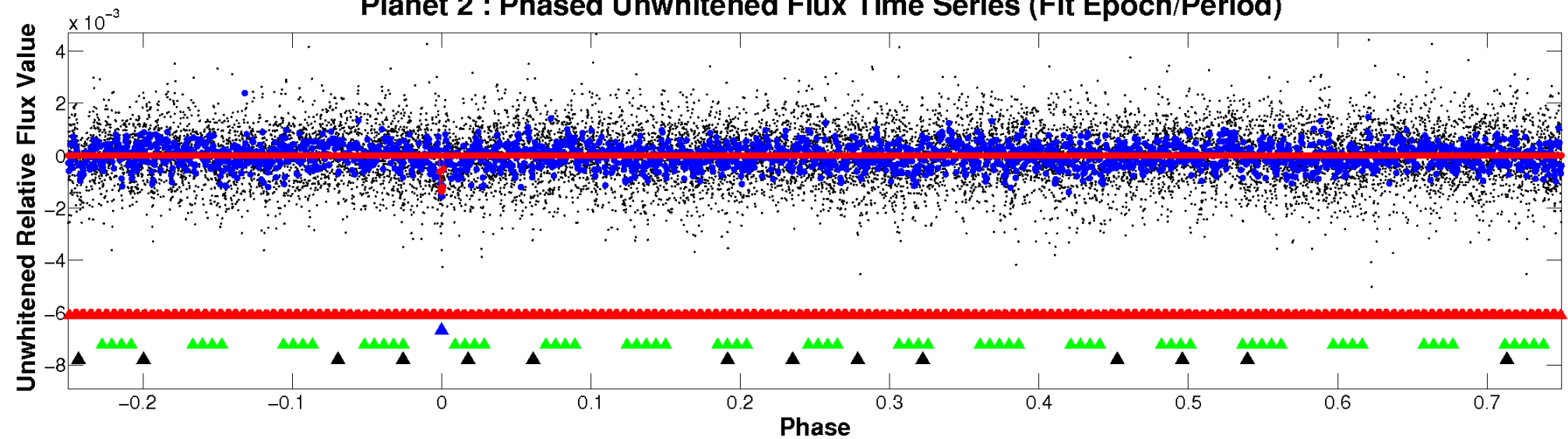
ALT Odd/Even

TCE 005391416-02

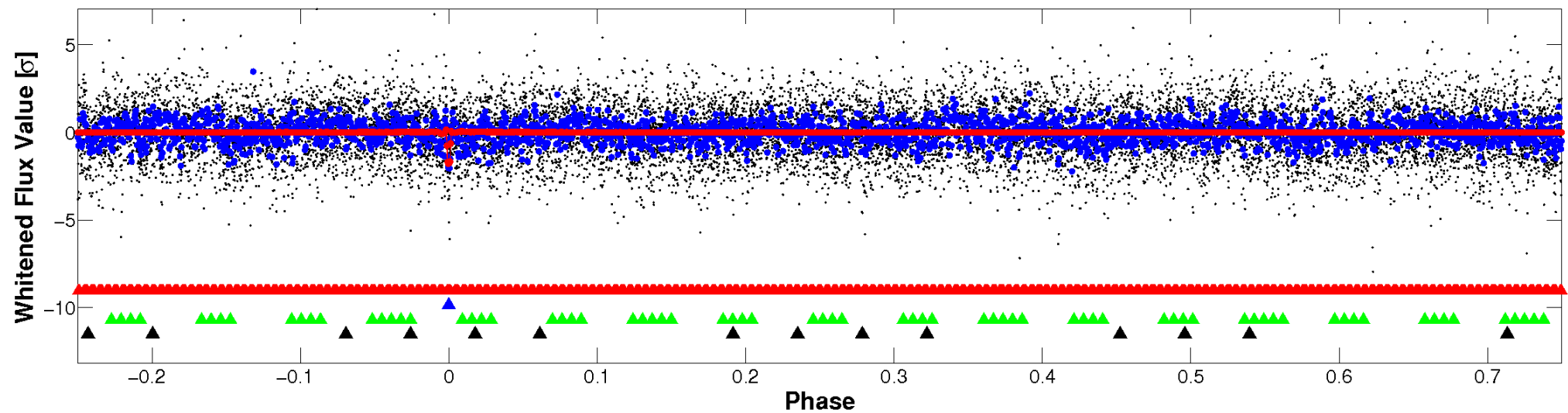


Non-Whitened Vs. Whitened Light Curve

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

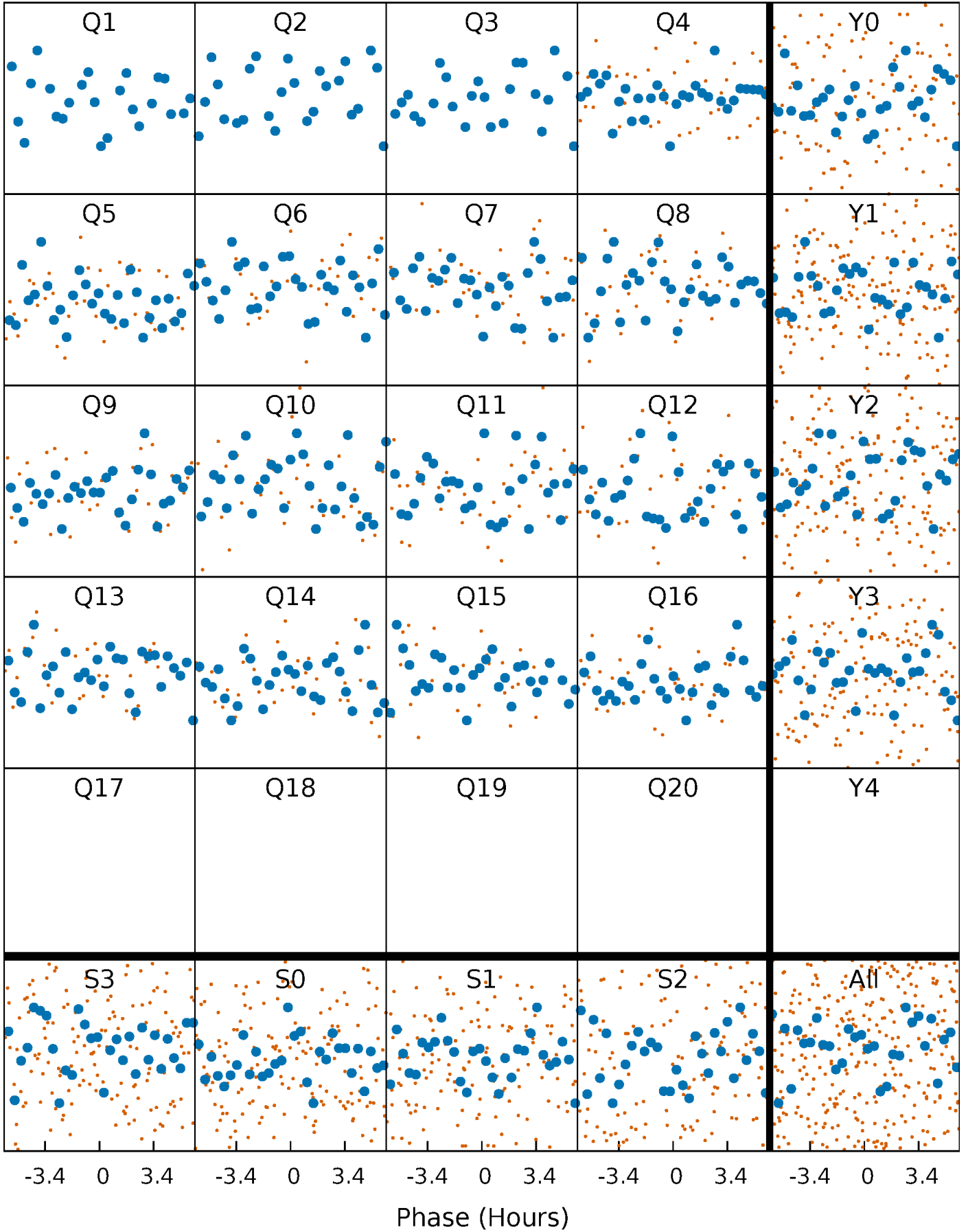


Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



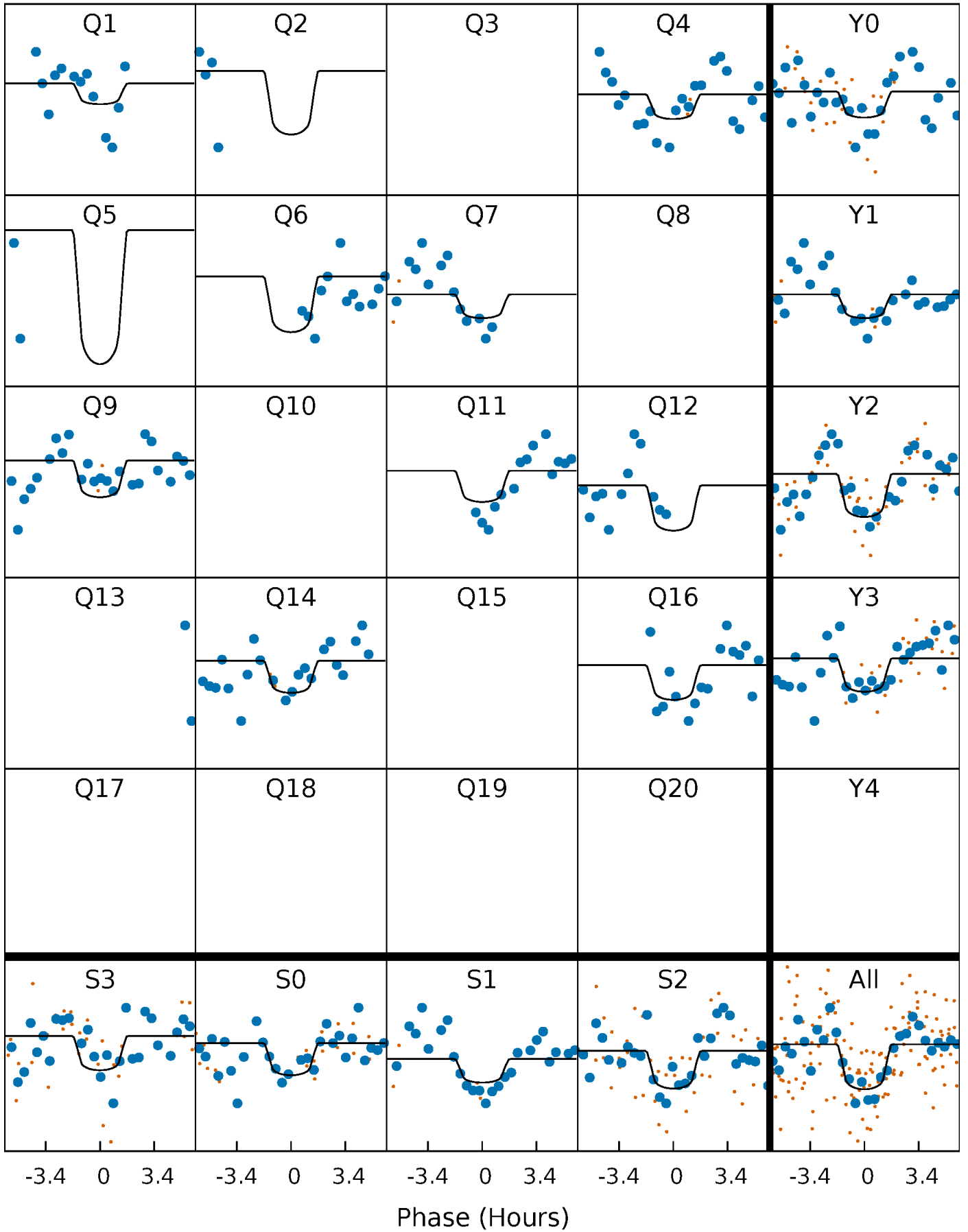
PDC Quarter-Phased Transit Curves

TCE 005391416-02 P= 48.072188 Days $T_0=162.788985$ (BKJD)



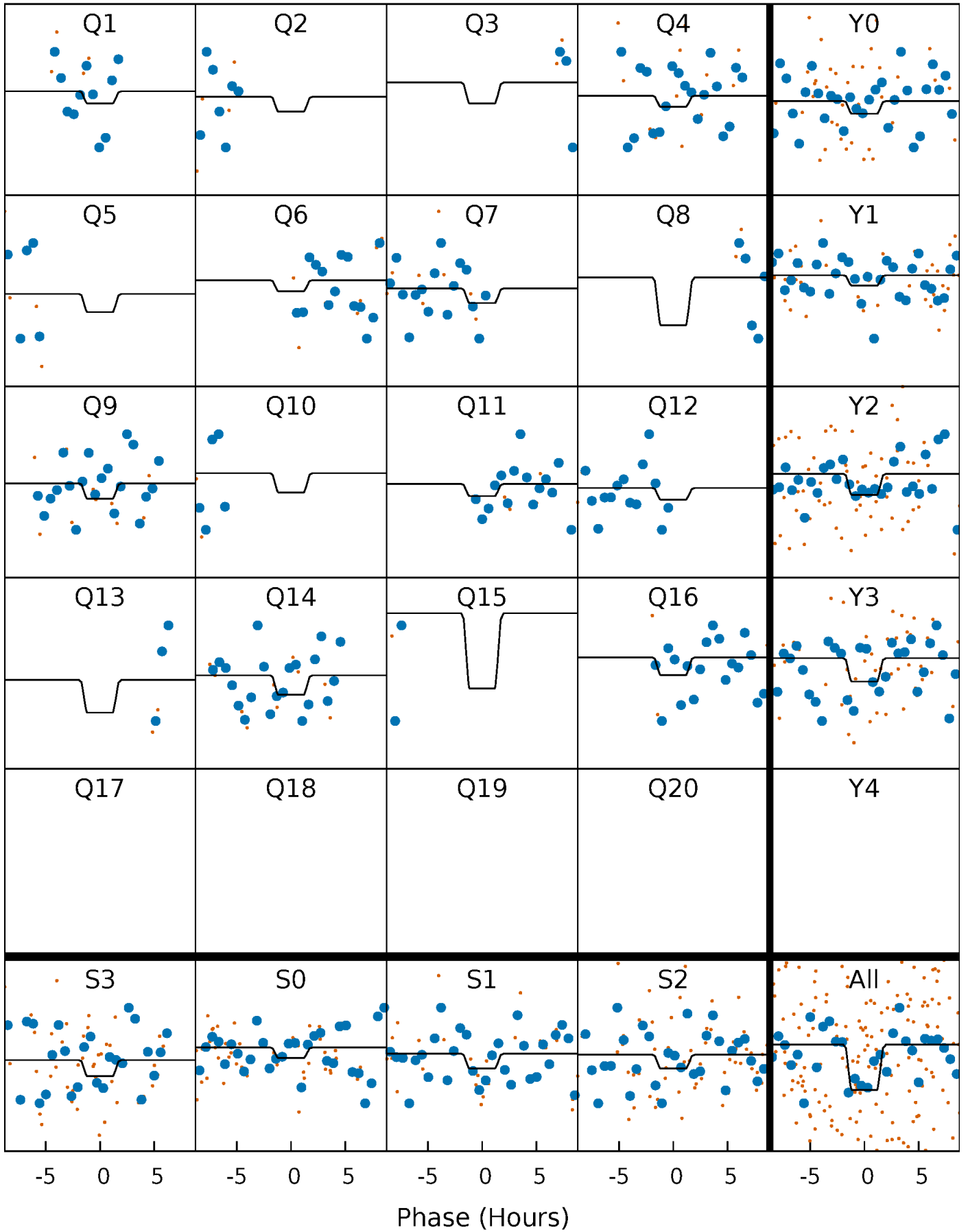
DV Quarter-Phased Transit Curves

TCE 005391416-02 P= 48.072188 Days $T_0=162.788985$ (BKJD)



Alt. Detrend Quarter-Phased Transit Curves

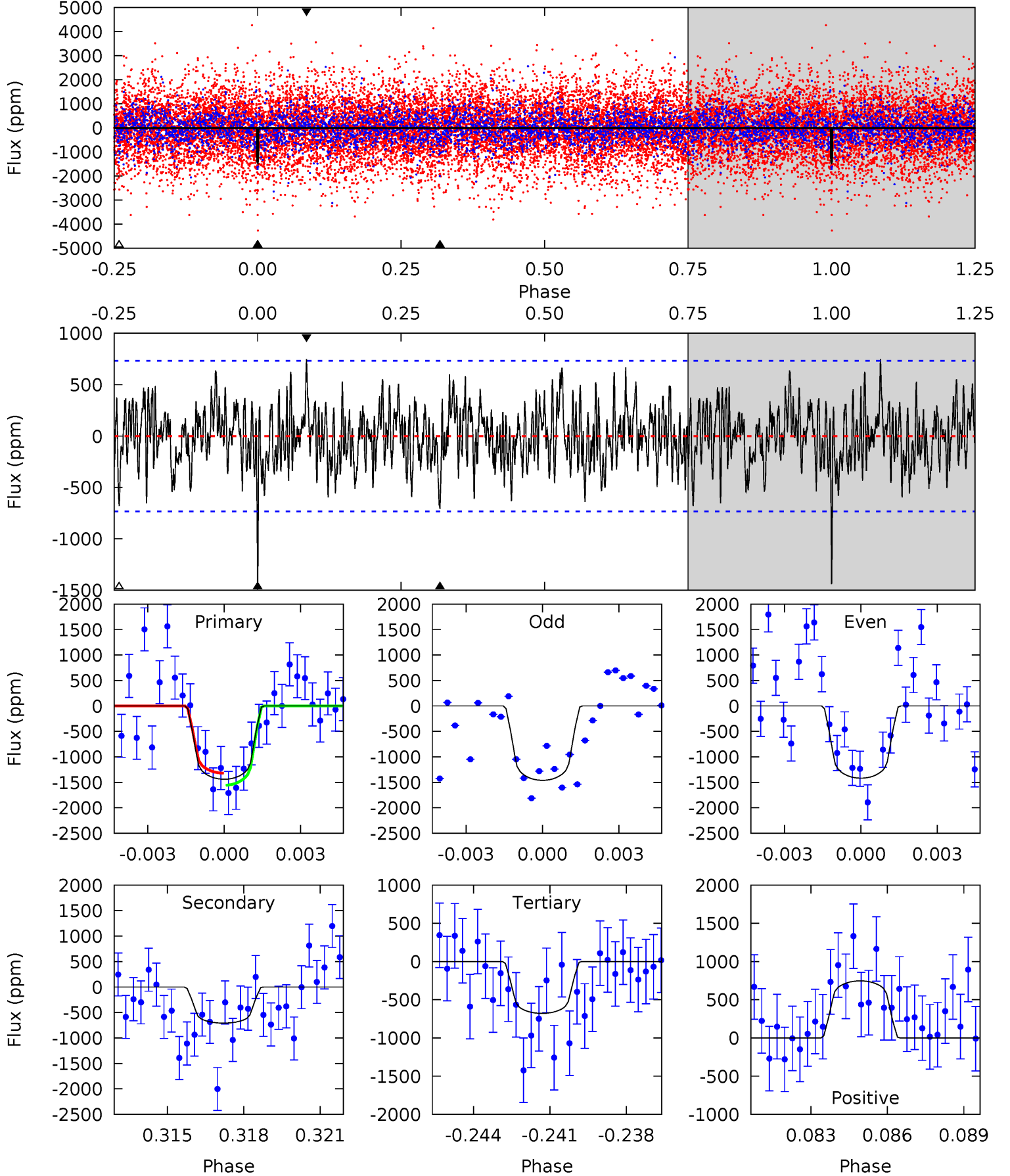
TCE 005391416-02 P= 48.072253 Days $T_0=162.799530$ (BKJD)



DV Model-Shift Uniqueness Test

005391416-02, $P = 48.072188$ Days, $E = 114.716797$ Days

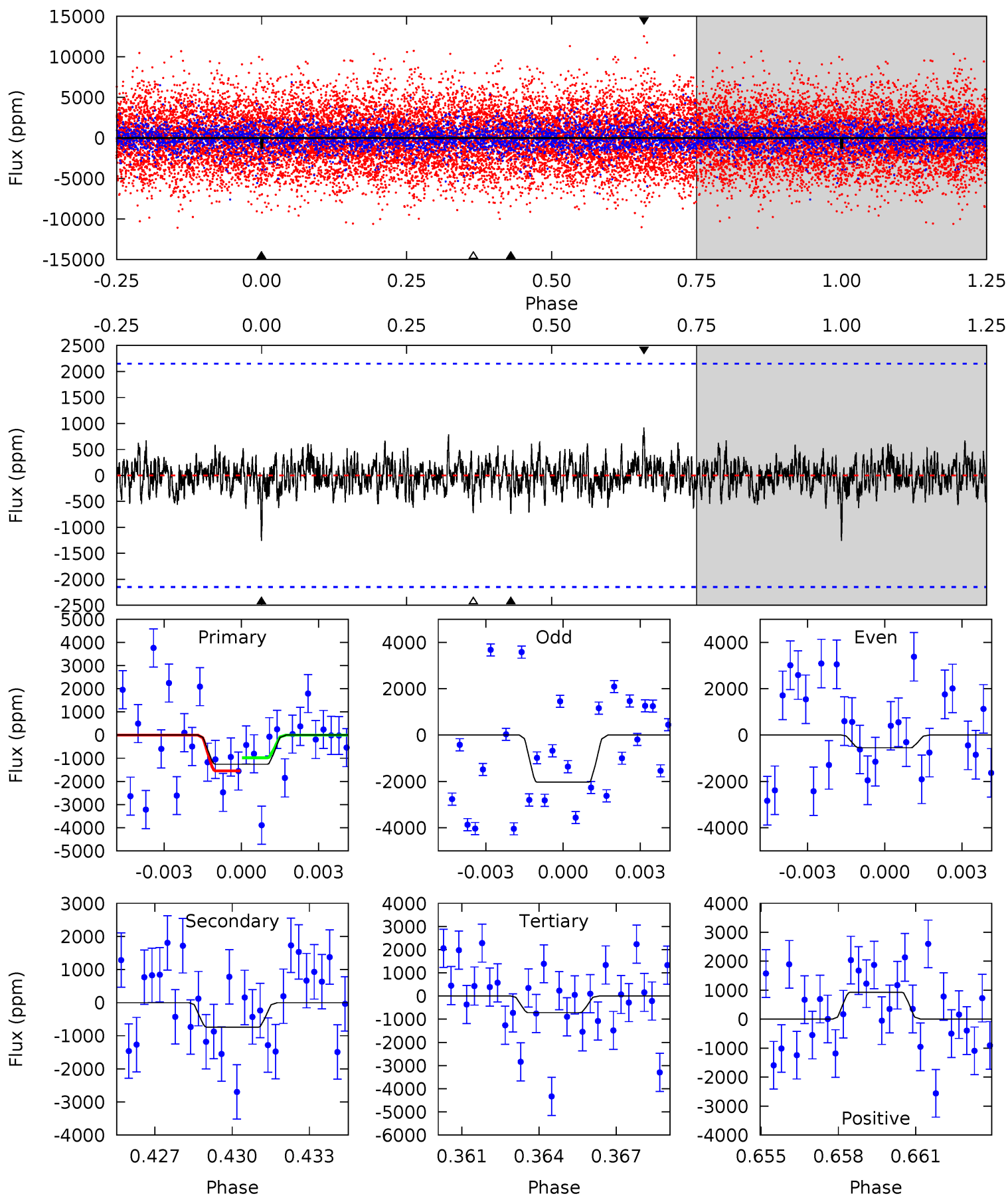
Pri	Sec	Ter	Pos	FA ₁	FA ₂	F _{Red}	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
10.3	5.08	4.87	5.36	5.25	2.97	1.76	5.46	4.97	0.21	-0.28	0.15	1.13	0.34	0.85



Alt Model-Shift Uniqueness Test

005391416-02, $P = 48.072253$ Days, $E = 114.727277$ Days

Pri	Sec	Ter	Pos	FA ₁	FA ₂	F _{Red}	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
3.08	1.81	1.75	2.26	5.25	2.97	0.57	1.33	0.82	0.06	-0.45	1.82	0.47	0.42	0.68



Stellar Parameters For KIC 005391416

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	R (R_{\odot})	$M(M_{\odot})$	p_{\star} ($\text{g}\cdot\text{cm}^{-3}$)
	8281^{+200}_{-343}	$3.752^{+0.413}_{-0.110}$	$-0.120^{+0.250}_{-0.350}$	$3.147^{+0.777}_{-1.442}$	$2.039^{+0.329}_{-0.493}$	$0.092^{+0.361}_{-0.039}$
	+2%/-4%	+11%/-3%	+208%/-292%	+25%/-46%	+16%/-24%	+392%/-42%
Source	KIC0	KIC0	KIC0	DSEP		

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

Secondary Eclipse Parameters for KIC 005391416-02 / KOI

Detrend	Depth (ppm)	R_p (R_{\oplus})	T_{max} (K)	T_{obs} (K)	A_{obs}
DV	-708 ± 139	$15.57^{+15.33}_{-10.55}$	1527^{+115}_{-173}	5679^{+5907}_{-1269}	166^{+1537}_{-125}
Alt.	-738 ± 409	$16.72^{+14.88}_{-10.93}$	1525^{+121}_{-164}	5527^{+3998}_{-1423}	140^{+946}_{-110}

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

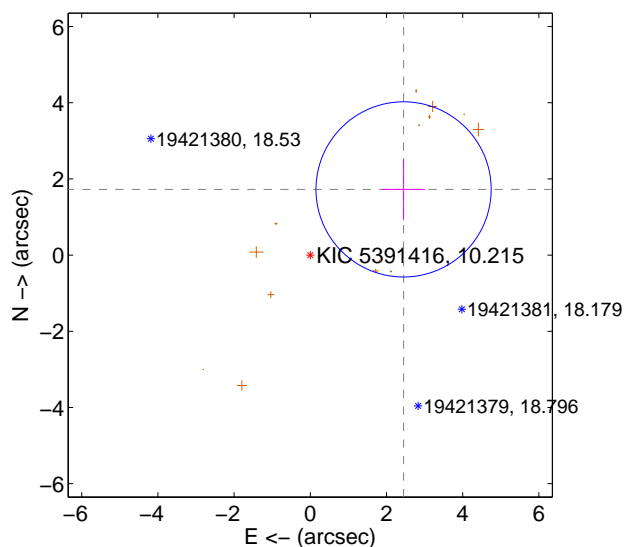
Supplemental centroid analysis for 005391416-02. **Kepler magnitude: 10.21.** Transit SNR 10.80

There are 0 quarters with good PRF difference image offsets

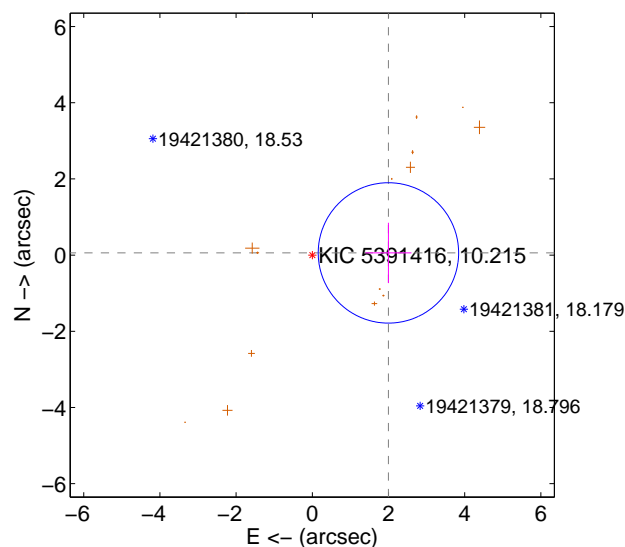
The direct PRF centroid is offset from the target star catalog position by about 1.60 arcsec

	Distance in arcsec	Distance / σ	Δ RA	Δ Dec
PRF-fit source offset from OOT	2.996 ± 0.767	3.91	-2.449 ± 0.564	1.725 ± 0.813
PRF-fit source offset from KIC position	2.000 ± 0.614	3.25	-1.999 ± 0.605	0.057 ± 0.792
photometric centroid source offset	0.41 ± 0.12	3.50	-0.17 ± 0.08	-0.38 ± 0.12

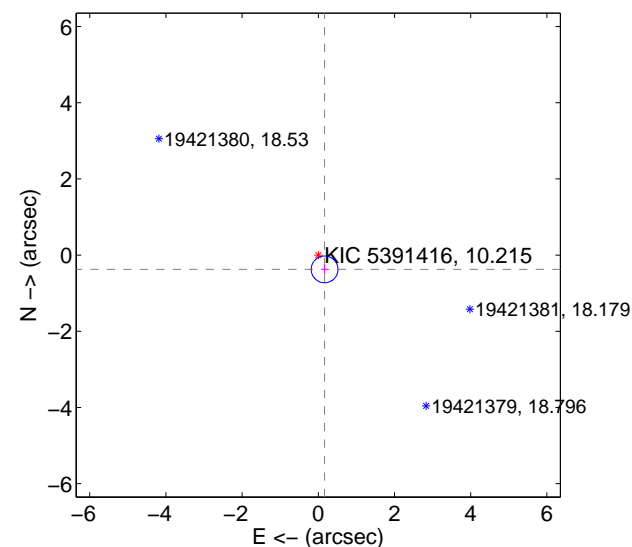
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

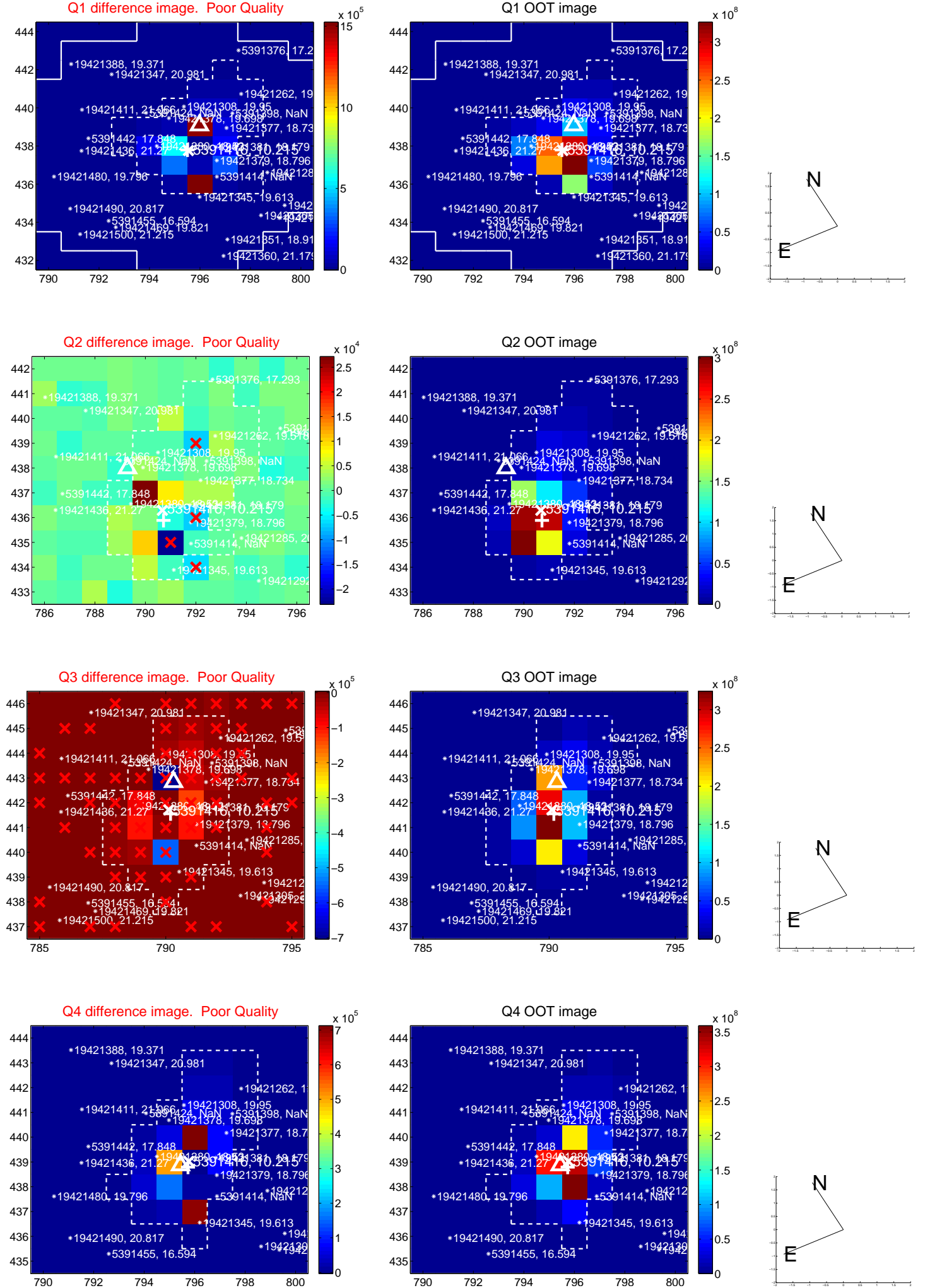


offset from photometric centroids

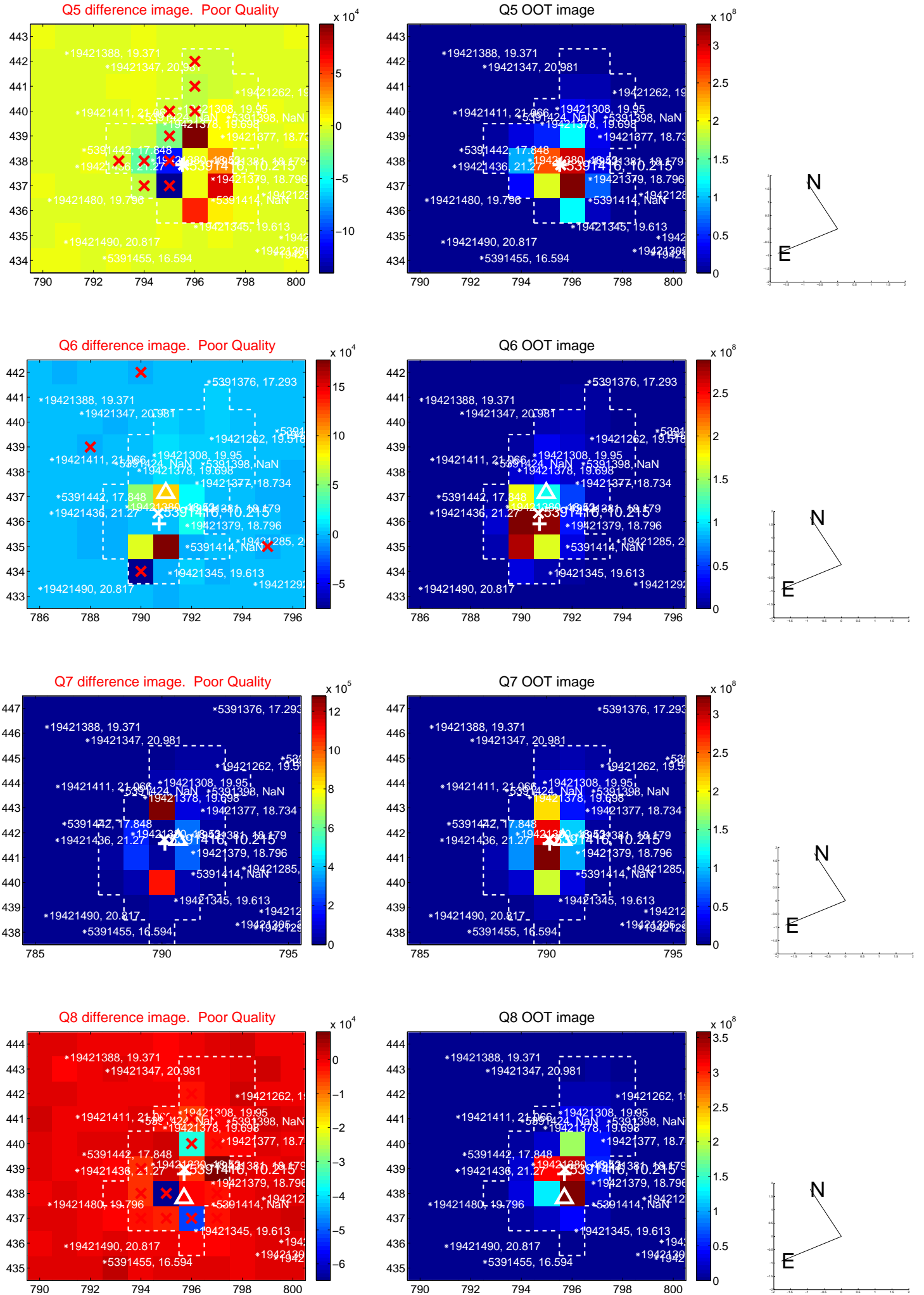


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- σ uncertainty. Blue circle: three-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

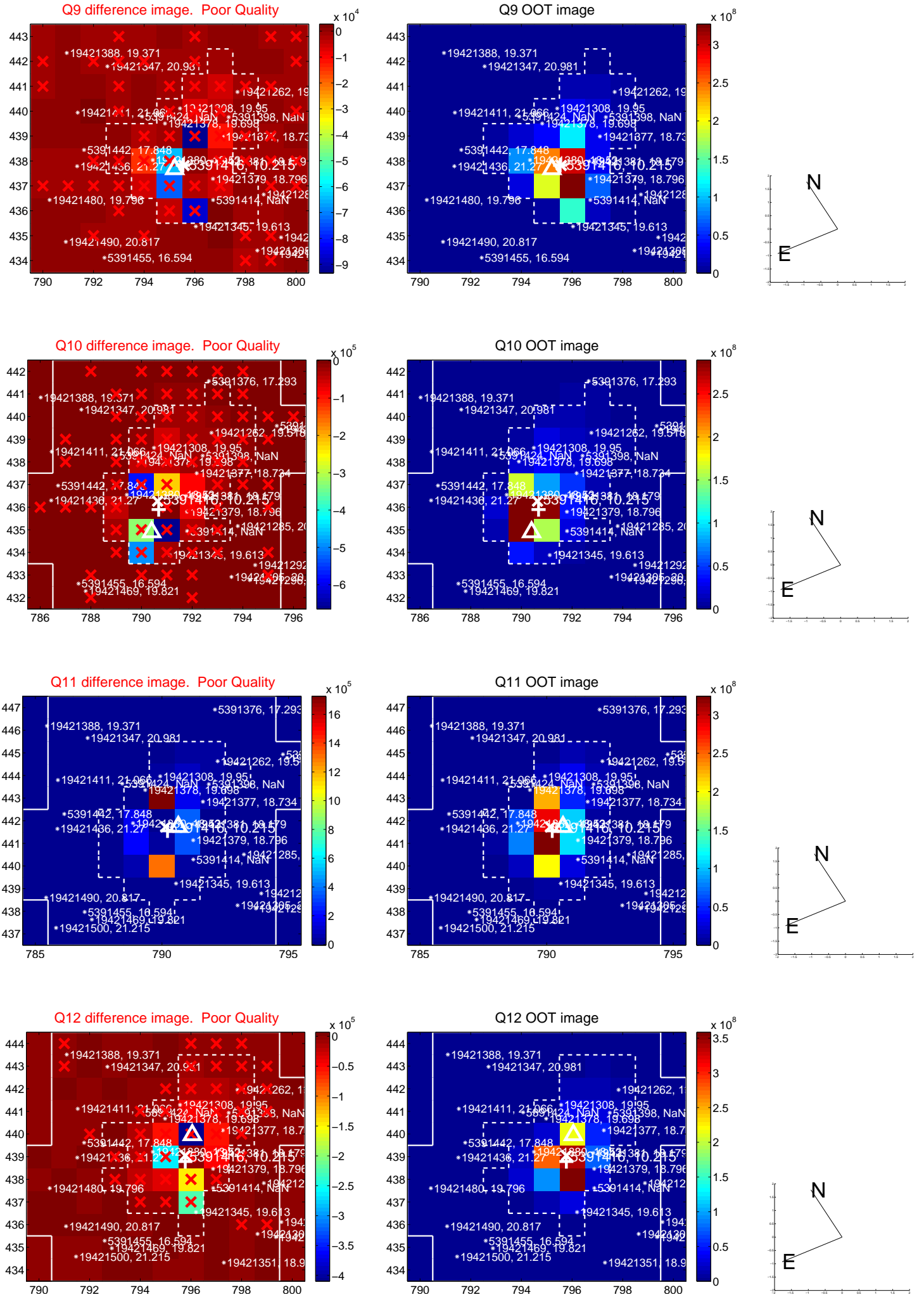
white \times : KIC target position; +: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



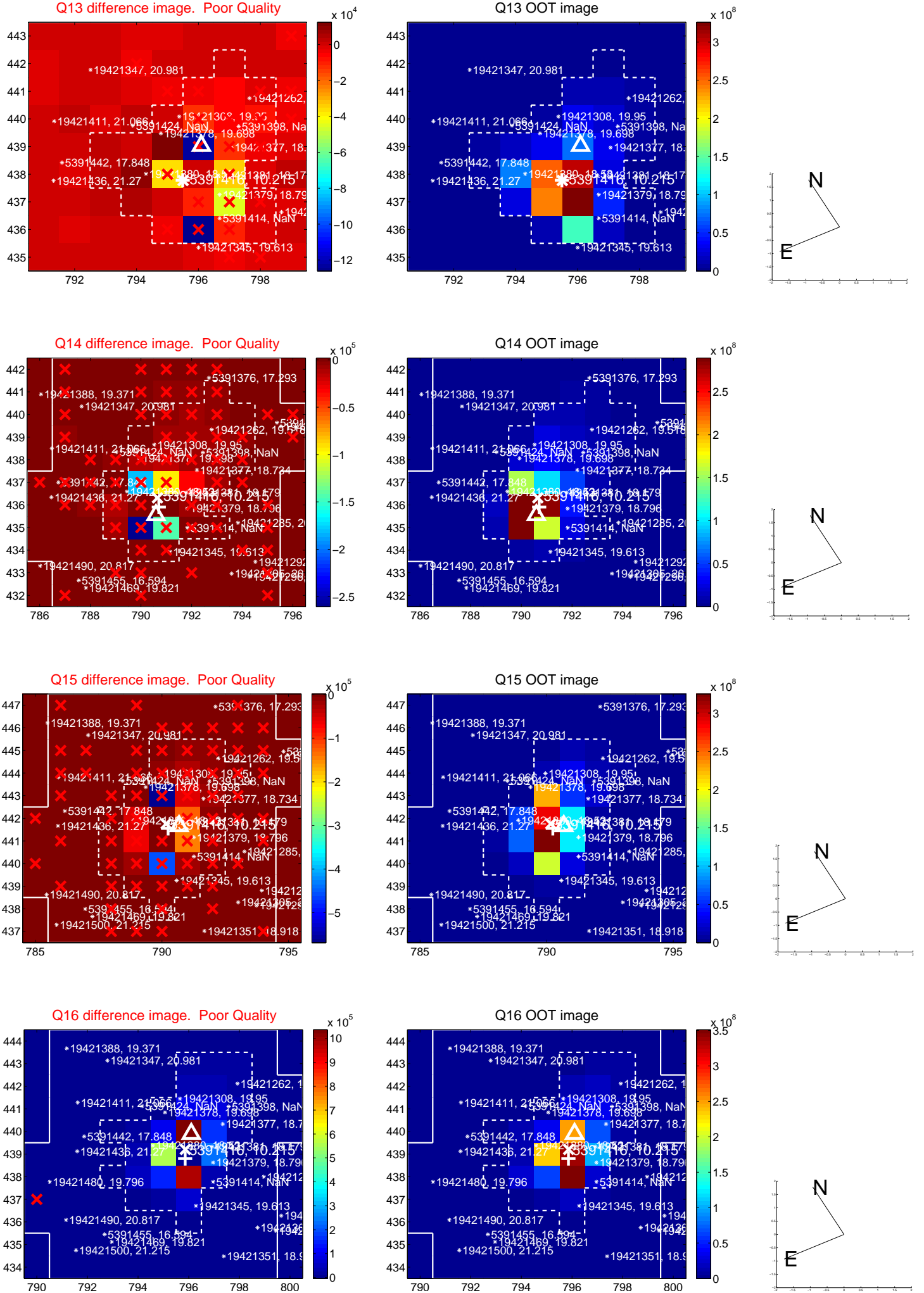
white \times : KIC target position; +: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



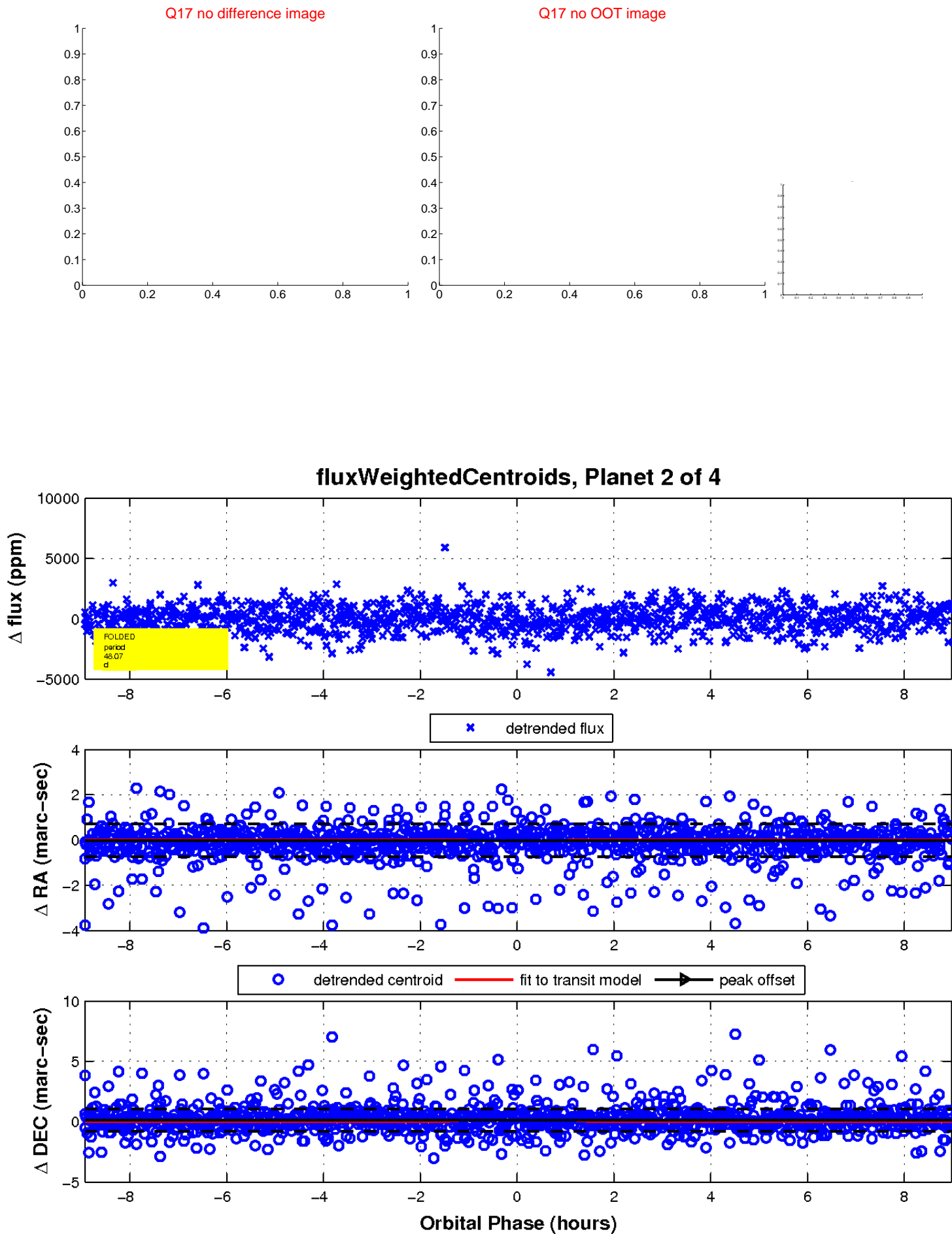
white \times : KIC target position; +: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



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

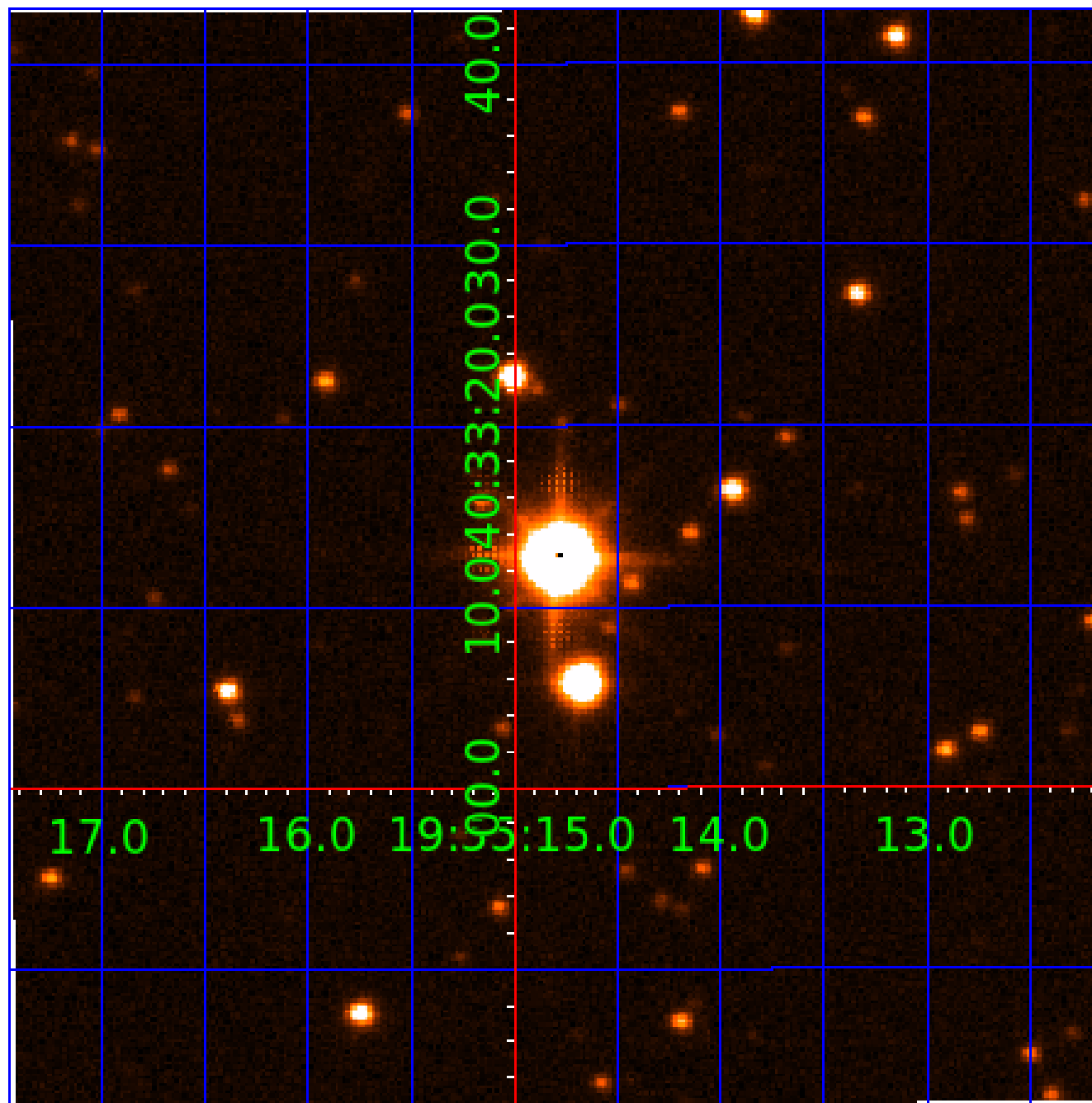


white \times : KIC target position; $+$: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



UKIRT Image

Declination



KIC 005391416

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})
005391416-01	OBS	No	1.226221	132.685893	61.2	7.518	8.7	6.7	3.15	8281	2.57	51570.14
005391416-02	OBS	No	48.072188	162.788985	1380.7	2.993	9.6	10.8	3.15	8281	12.28	387.23
005391416-03	OBS	No	19.812693	148.943625	1476.5	1.475	10.1	11.4	3.15	8281	13.50	1262.50
005391416-04	OBS	No	108.685941	159.455659	2621.7	1.734	10.2	10.1	3.15	8281	16.41	130.49

Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
005391416-01	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—CENT_SATURATED
005391416-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
005391416-03	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
005391416-04	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED

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

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

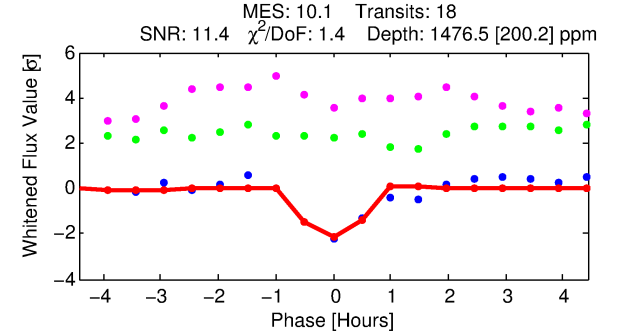
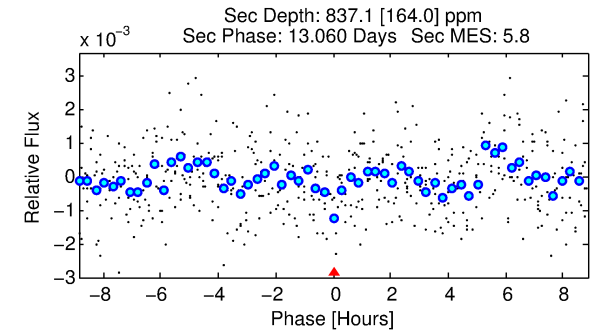
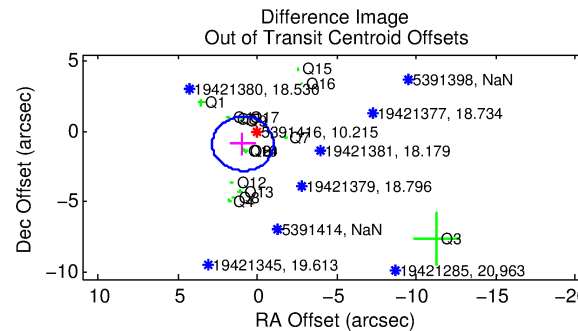
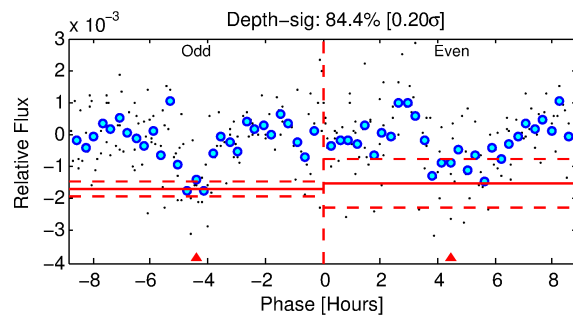
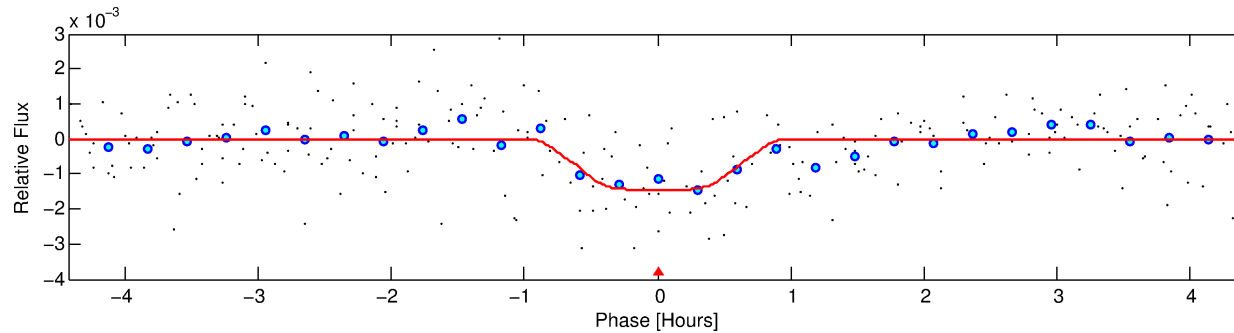
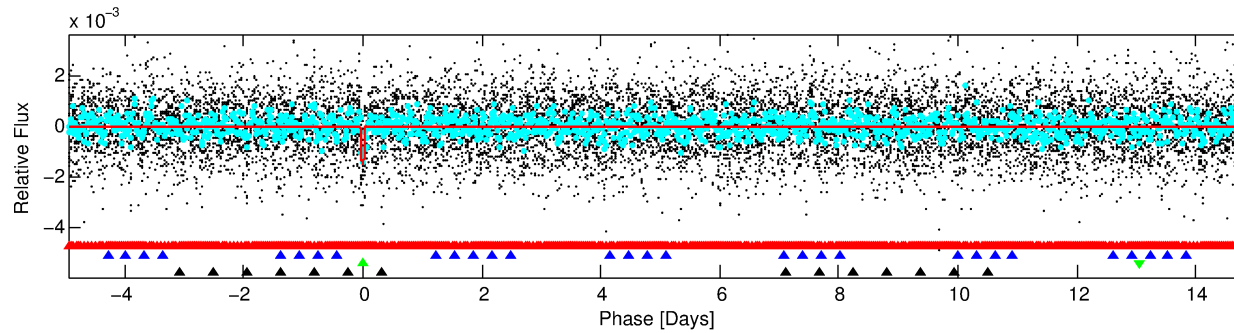
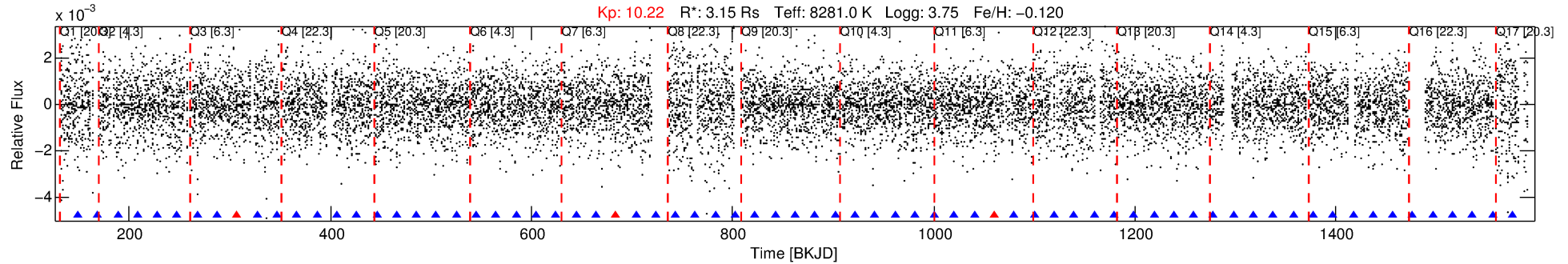
See http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col for comment definitions.

Ephemeris Match Information For 005391416-03

No Significant Match Found

DV One-Page Summary

KIC: 5391416 Candidate: 3 of 4 Period: 19.813 d



DV Fit Results:

Period = 19.81269 [0.00012] d
Epoch = 148.9436 [0.0050] BKJD
Rp/R* = 0.0393 [0.0250]
a/R* = 65.76 [238.52]
b = 0.82 [1.49]
Seff = 1262.50 [912.76]
Teq = 1520 [275] K
Rp = 13.50 [10.59] Re
a = 0.1818 [0.0800] AU
Ag = 83.54 [122.68] [0.67 σ]
Teffp = 7105 [2308] K [2.40 σ]

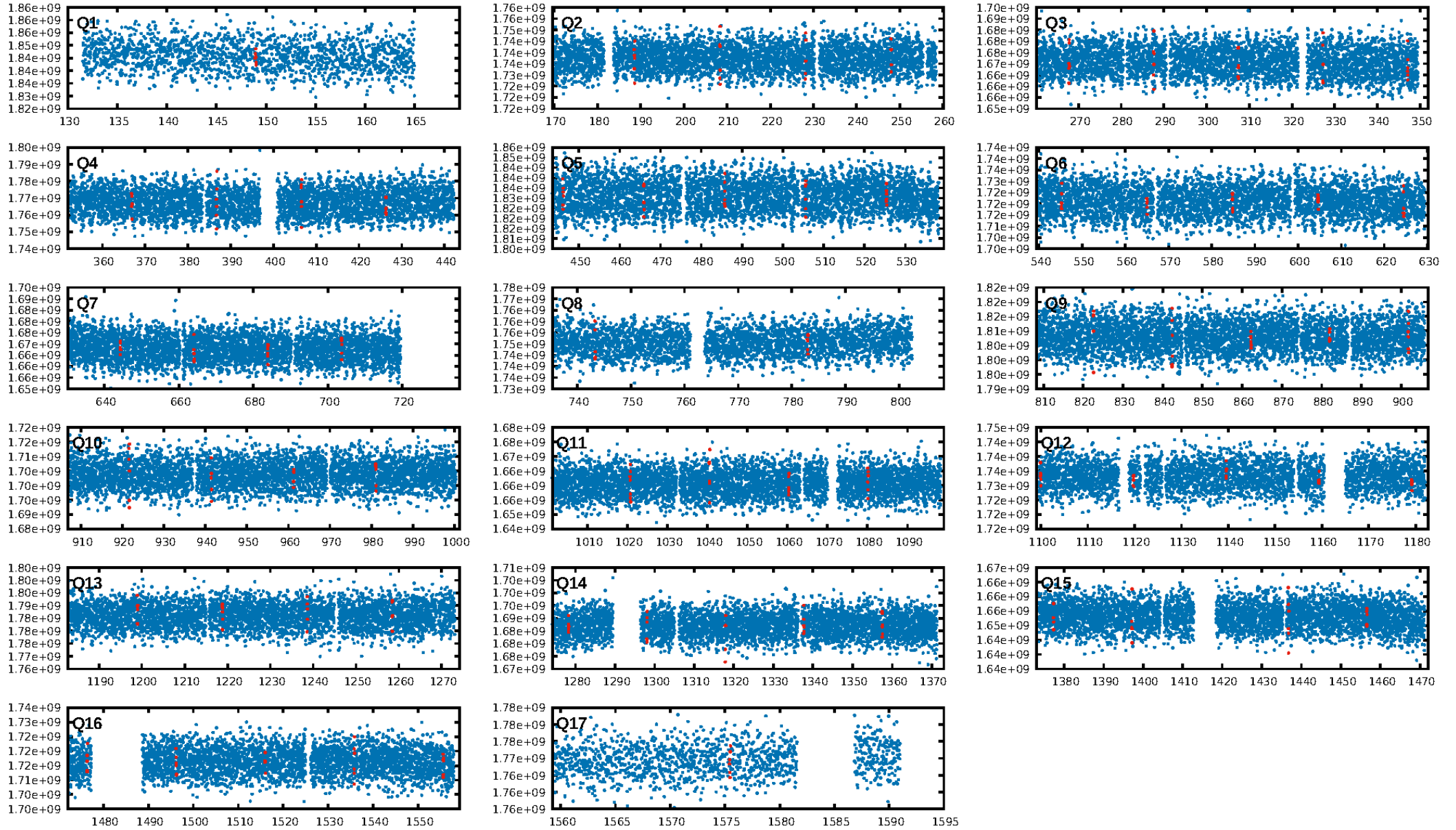
DV Diagnostic Results:

ShortPeriod-sig: 100.0% [58.23 σ]
LongPeriod-sig: 100.0% [203.25 σ]
ModelChiSquare2-sig: 32.2%
ModelChiSquareGof-sig: 94.4%
Bootstrap-pfa: 5.67e-10
RollingBand-fgt: 0.82 [14/17]
GhostDiagnostic-chr: N/A
Centroid-sig: 2.1%
Centroid-so: 0.350 arcsec [4.24 σ]
OotOffset-rm: 1.239 arcsec [1.93 σ]
KicOffset-rm: 2.624 arcsec [3.70 σ]
OotOffset-st: 4/4/4/5 [17]
KicOffset-st: 4/4/4/5 [17]
DiffImageQuality-fgm: 0.35 [6/17]
DiffImageOverlap-fno: 0.88 [15/17]

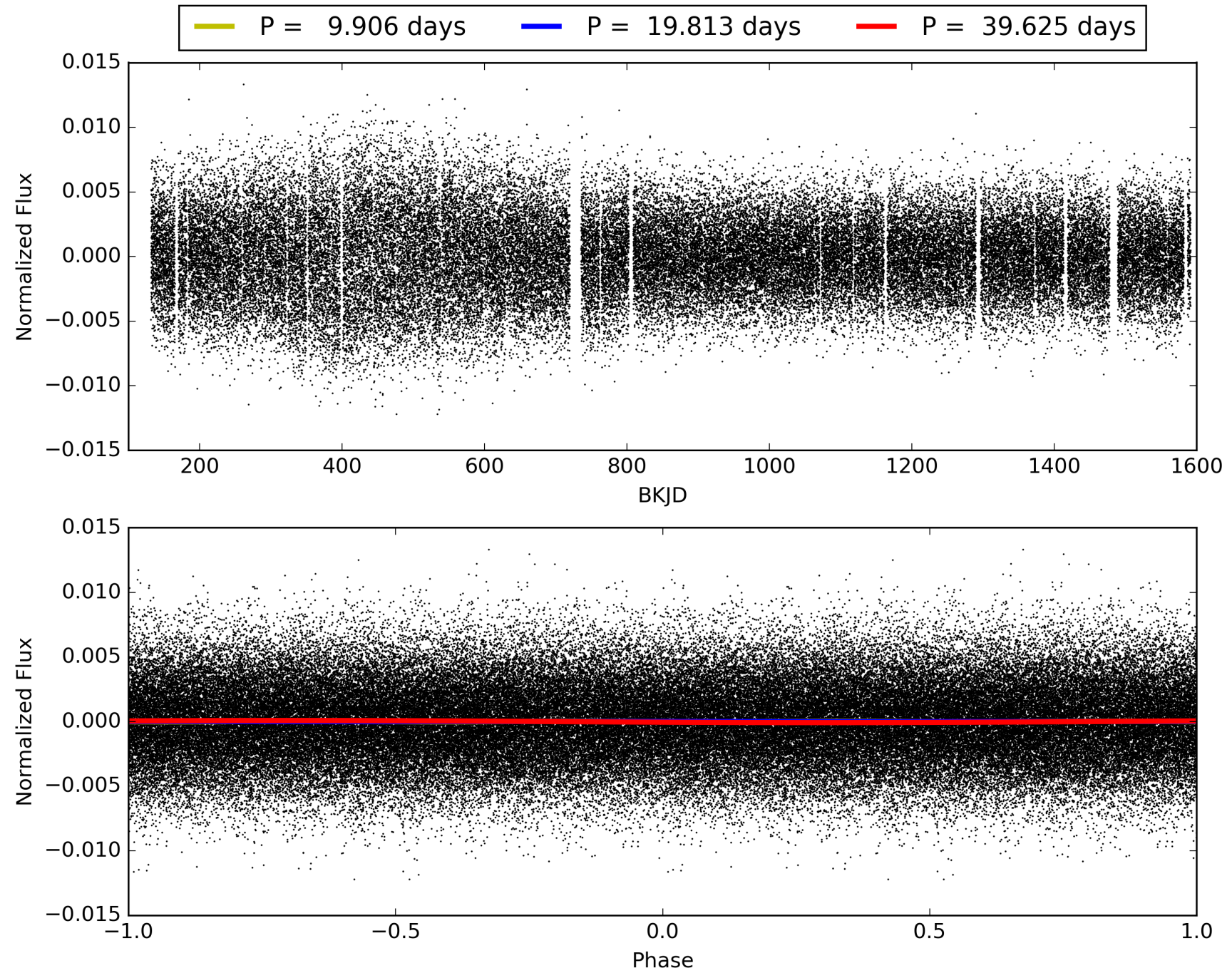
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 30-Jan-2016 16:11:20 Z

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

TCE 005391416-03, PDC Light Curves

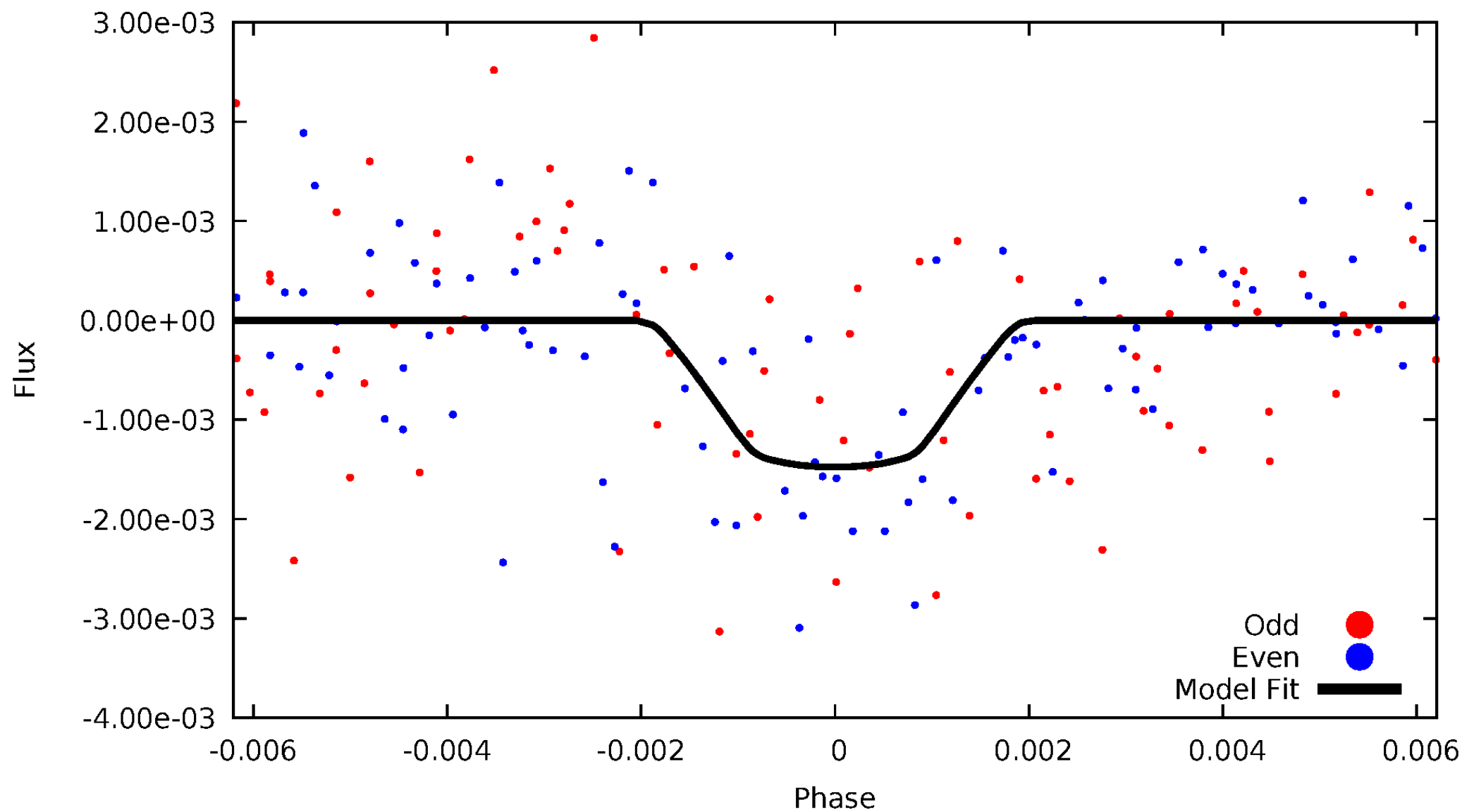


TCE 005391416-03



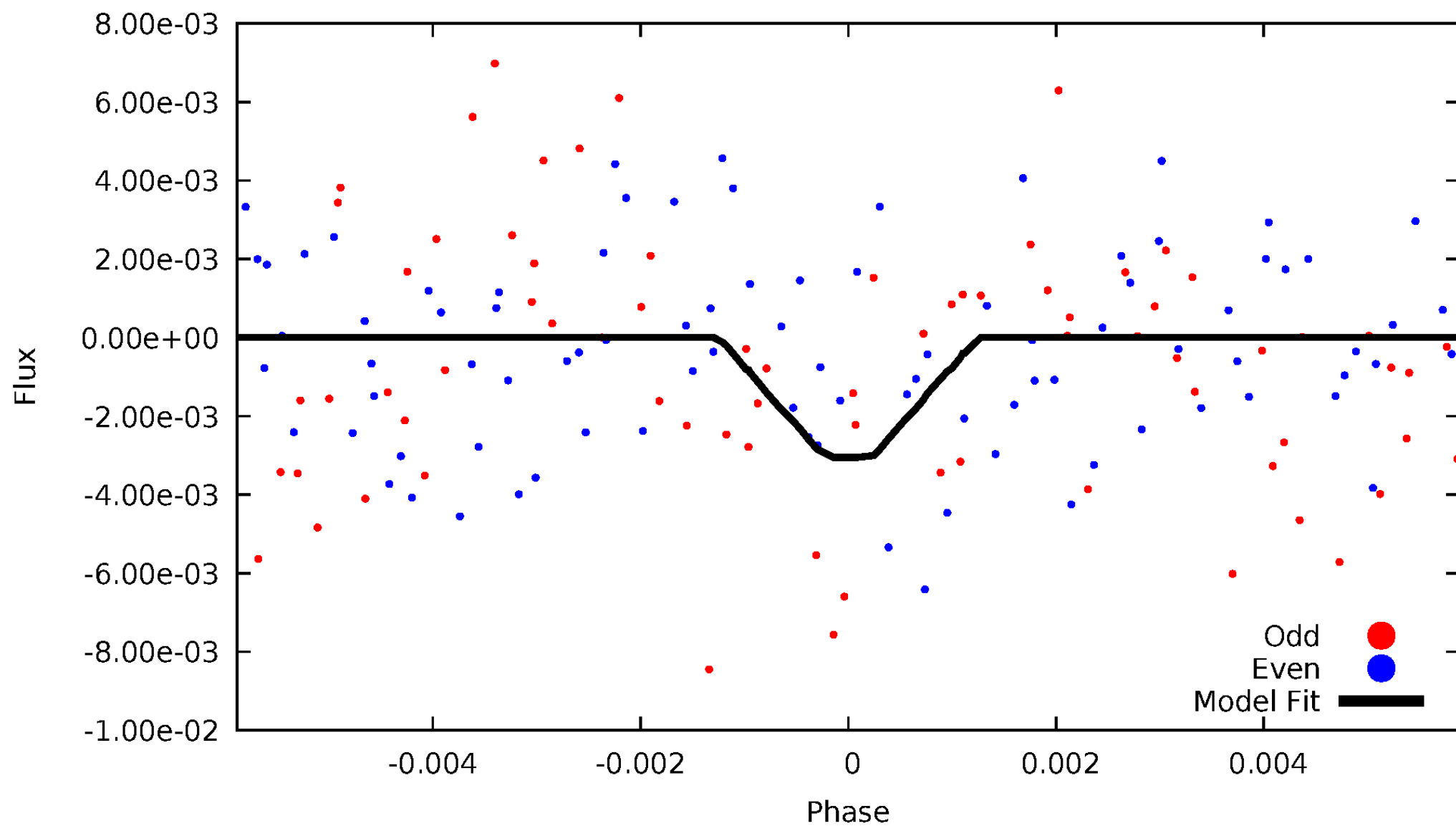
DV Odd/Even

TCE 005391416-03



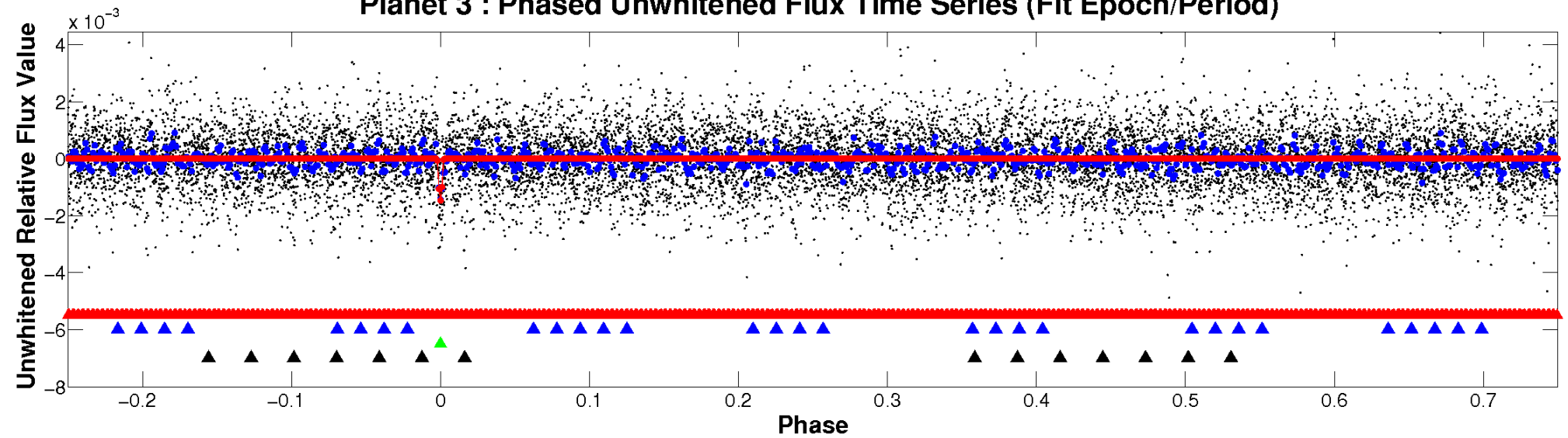
ALT Odd/Even

TCE 005391416-03

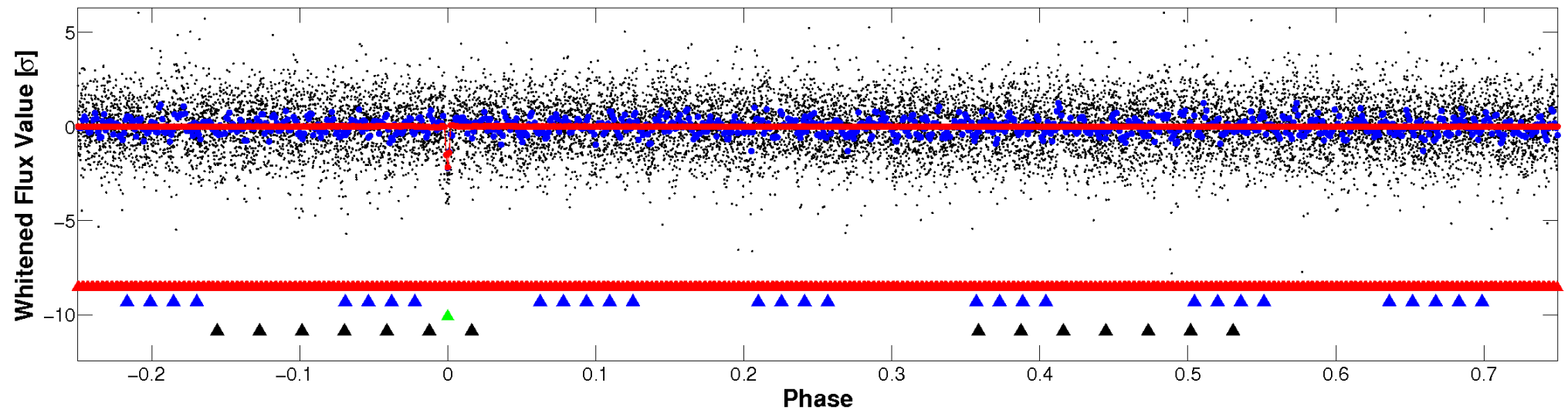


Non-Whitened Vs. Whitened Light Curve

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

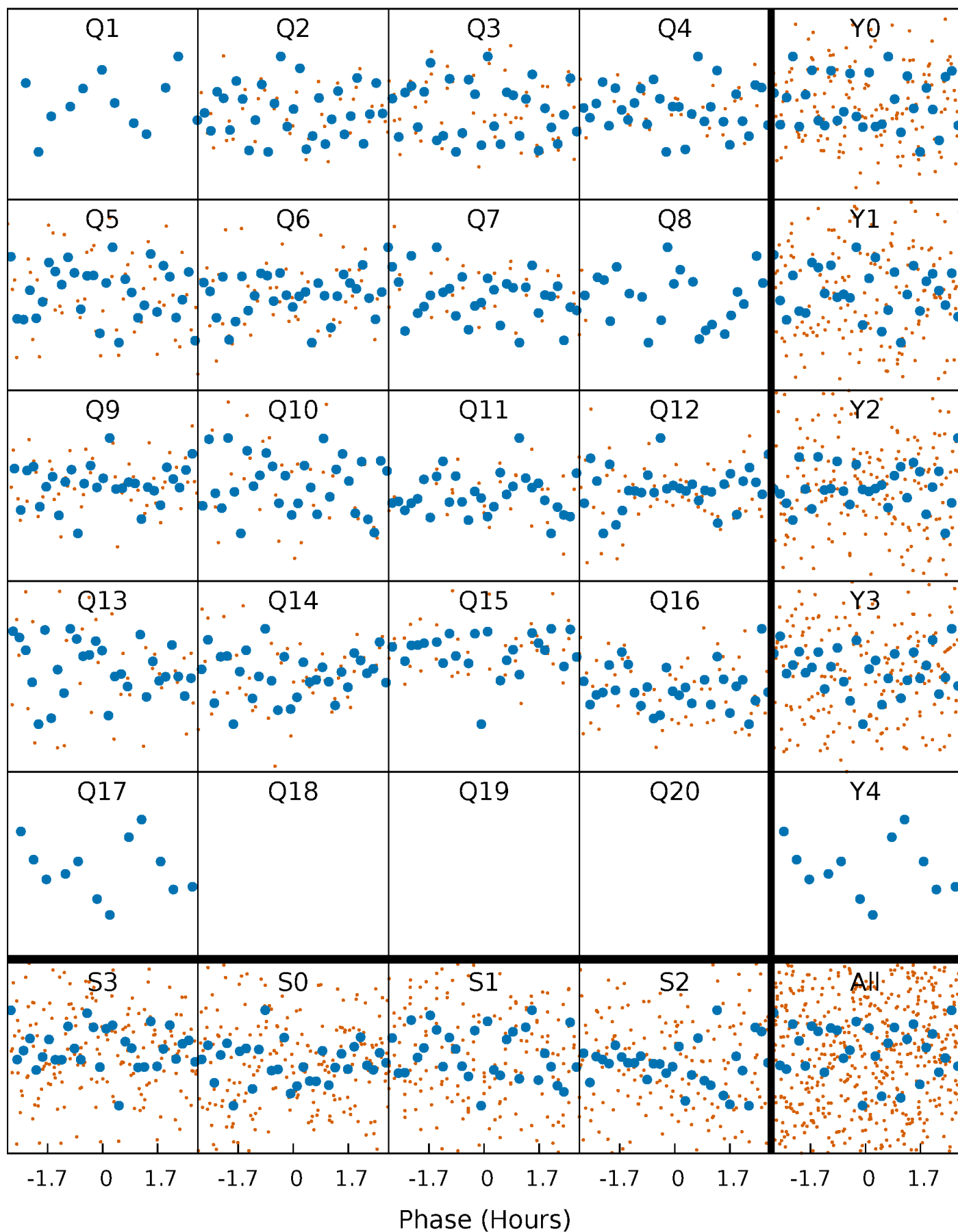


Planet 3 : Phased Whitened Flux Time Series (Fit Epoch/Period)



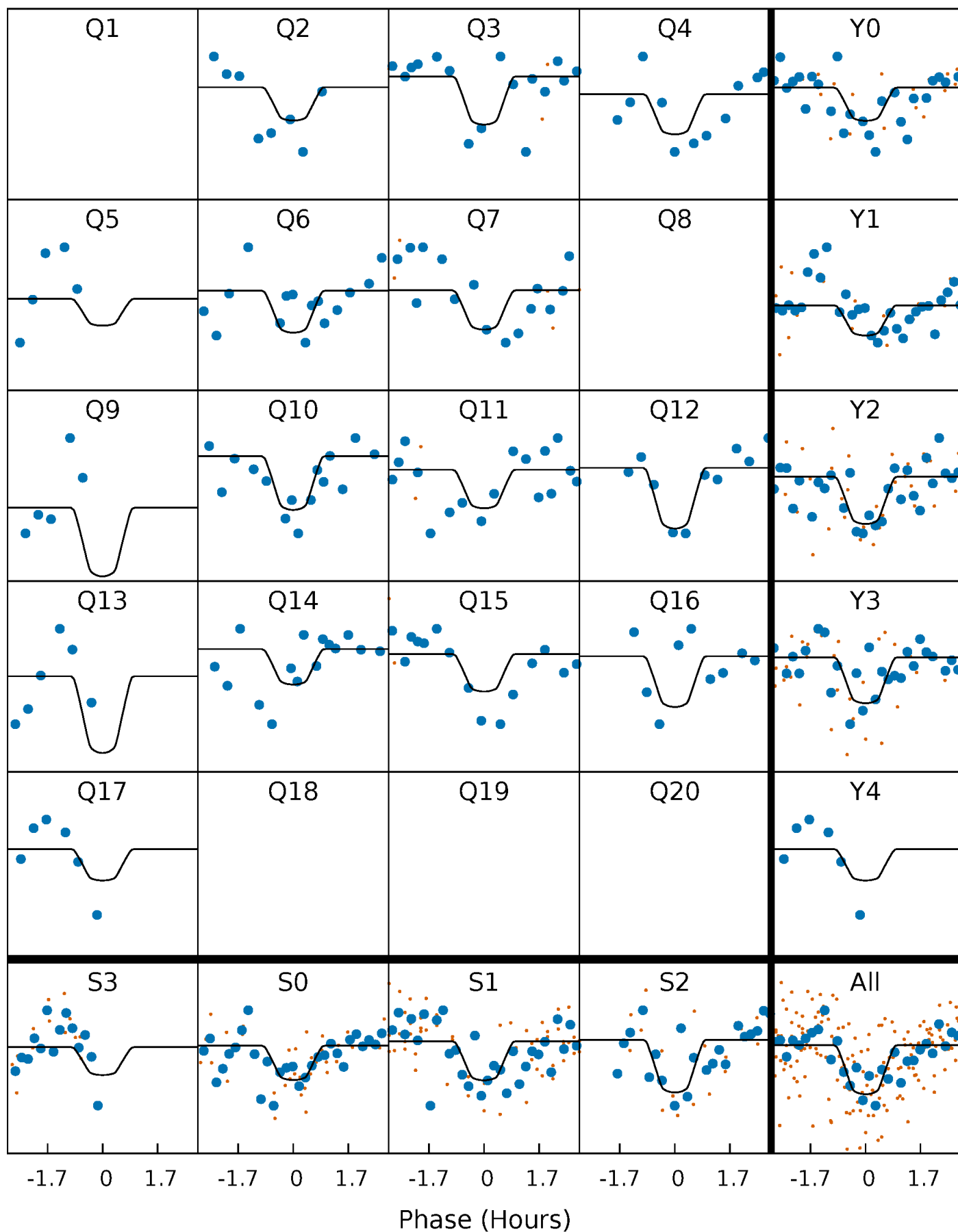
PDC Quarter-Phased Transit Curves

TCE 005391416-03 P= 19.812693 Days $T_0=148.943625$ (BKJD)



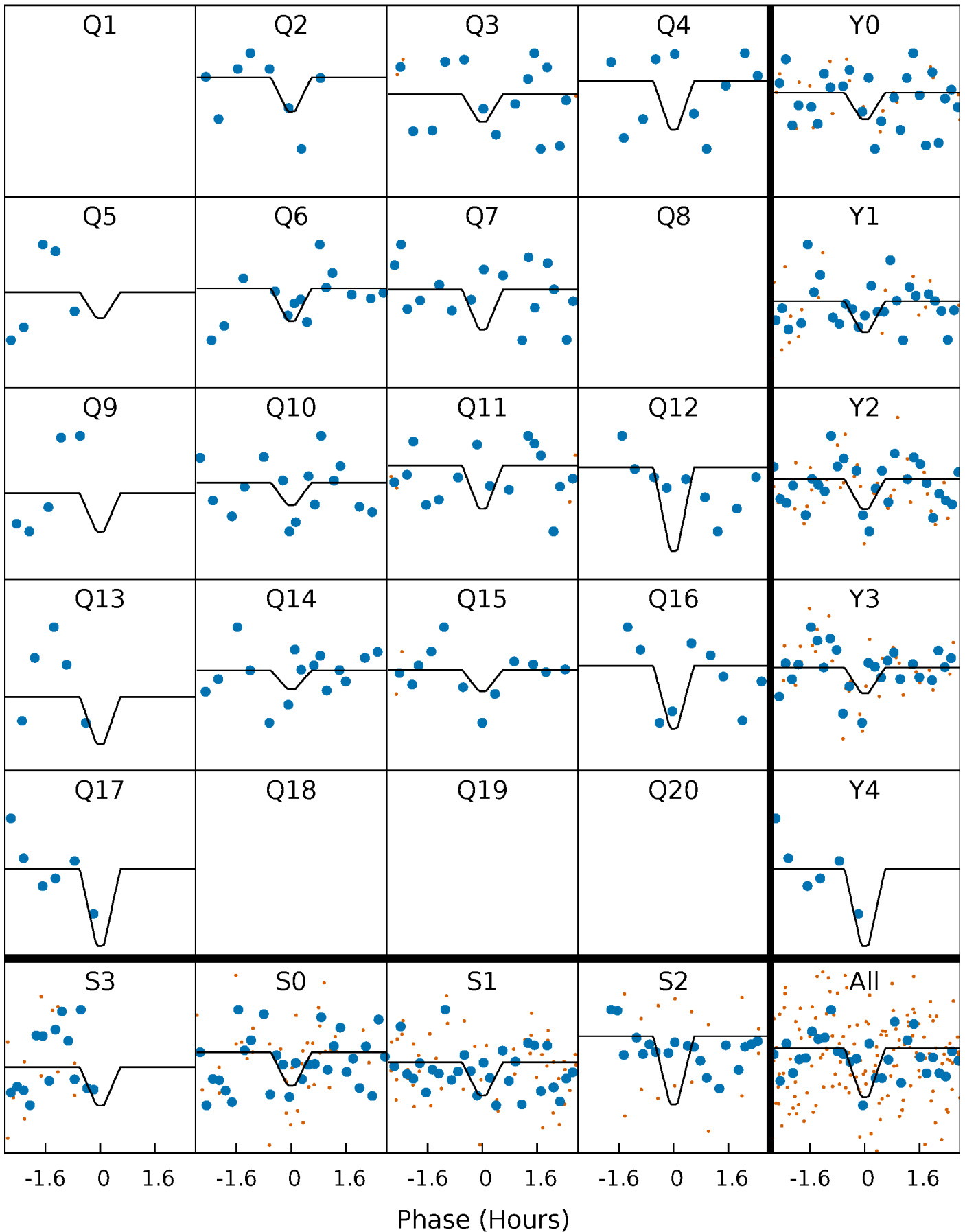
DV Quarter-Phased Transit Curves

TCE 005391416-03 P= 19.812693 Days $T_0=148.943625$ (BKJD)



Alt. Detrend Quarter-Phased Transit Curves

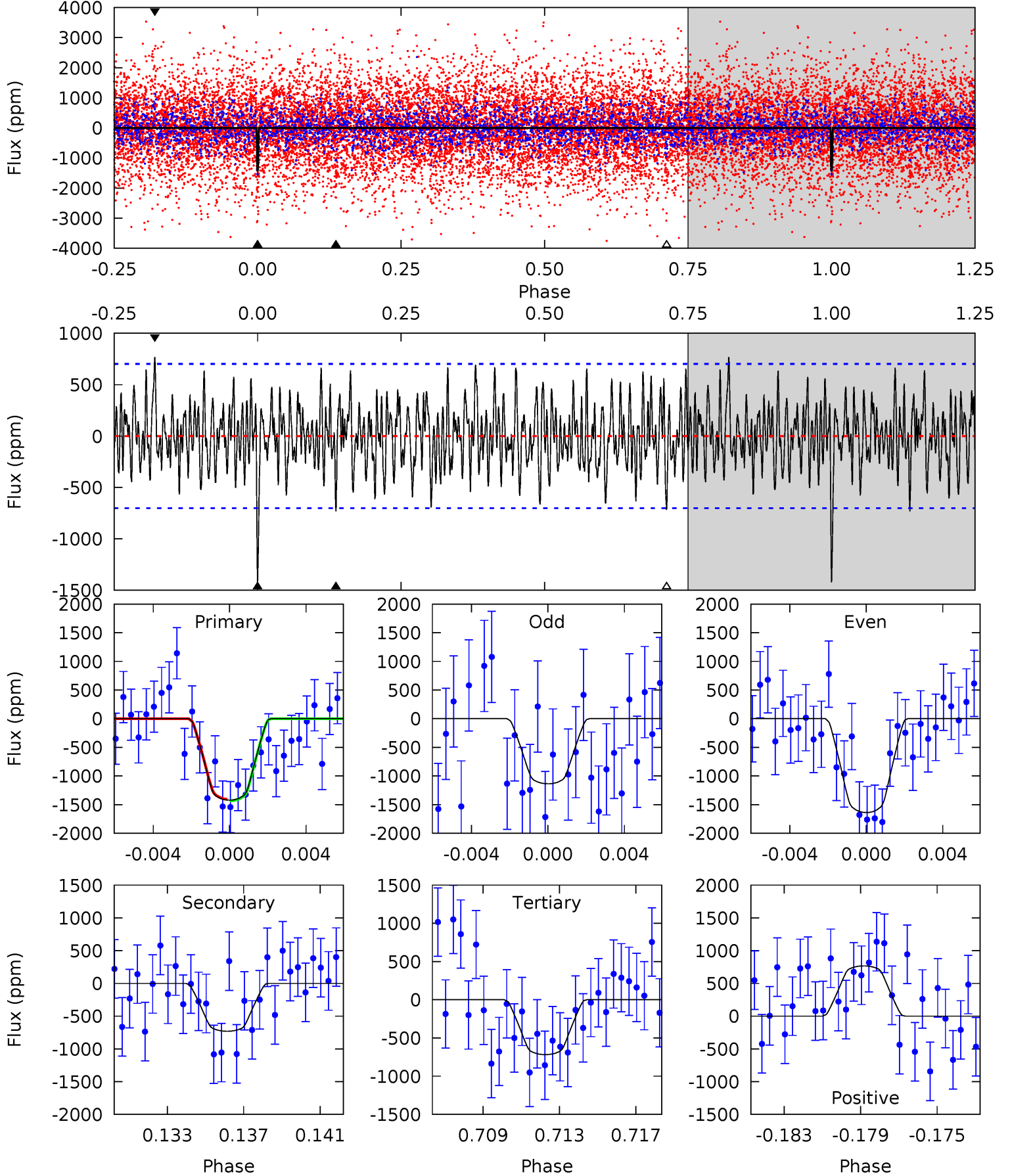
TCE 005391416-03 P= 19.812715 Days $T_0=148.945292$ (BKJD)



DV Model-Shift Uniqueness Test

005391416-03, P = 19.812693 Days, E = 129.130932 Days

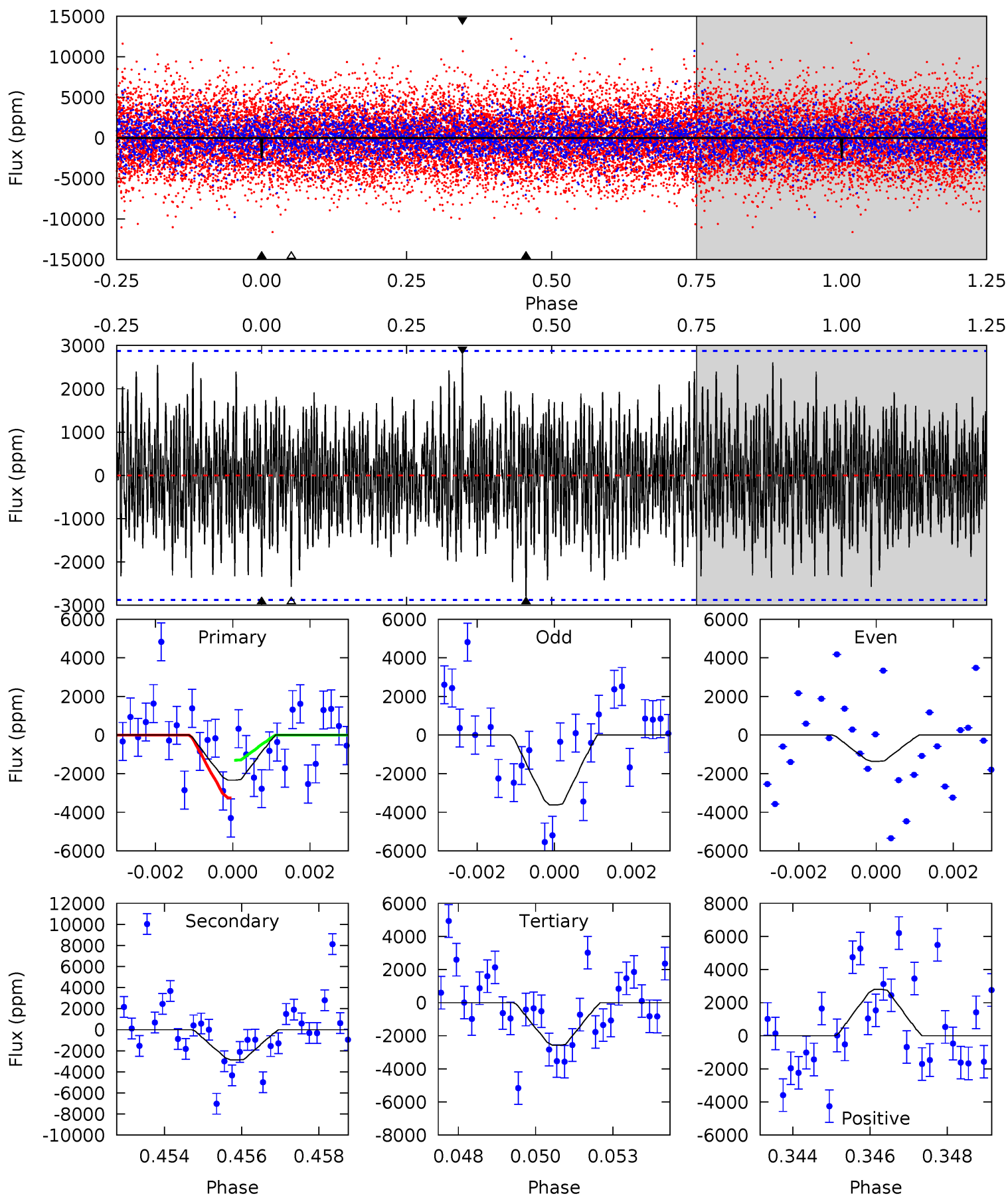
Pri	Sec	Ter	Pos	FA ₁	FA ₂	F _{Red}	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
10.6	5.42	5.33	5.69	5.21	2.89	1.96	5.22	4.86	0.10	-0.27	1.86	1.03	0.35	0.09



Alt Model-Shift Uniqueness Test

005391416-03, P = 19.812715 Days, E = 129.132577 Days

Pri	Sec	Ter	Pos	FA ₁	FA ₂	F _{Red}	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
4.31	5.30	4.74	5.16	5.30	3.05	1.73	-0.43	-0.85	0.56	0.14	2.08	1.04	0.49	1.80



Stellar Parameters For KIC 005391416

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	R (R_{\odot})	$M(M_{\odot})$	p_{\star} ($\text{g}\cdot\text{cm}^{-3}$)
	8281^{+200}_{-343}	$3.752^{+0.413}_{-0.110}$	$-0.120^{+0.250}_{-0.350}$	$3.147^{+0.777}_{-1.442}$	$2.039^{+0.329}_{-0.493}$	$0.092^{+0.361}_{-0.039}$
	+2%/-4%	+11%/-3%	+208%/-292%	+25%/-46%	+16%/-24%	+392%/-42%
Source	KIC0	KIC0	KIC0	DSEP		

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

Secondary Eclipse Parameters for KIC 005391416-03 / KOI

Detrend	Depth (ppm)	R_p (R_{\oplus})	T_{max} (K)	T_{obs} (K)	A_{obs}
DV	-731 ± 135	$13.05^{+8.84}_{-7.20}$	2046^{+158}_{-237}	6425^{+4065}_{-1318}	78^{+296}_{-50}
Alt.	-2873 ± 542	$17.32^{+8.60}_{-8.17}$	2045^{+165}_{-235}	8090^{+3873}_{-1669}	175^{+422}_{-99}

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 $A_{obs} \gg 1.0$

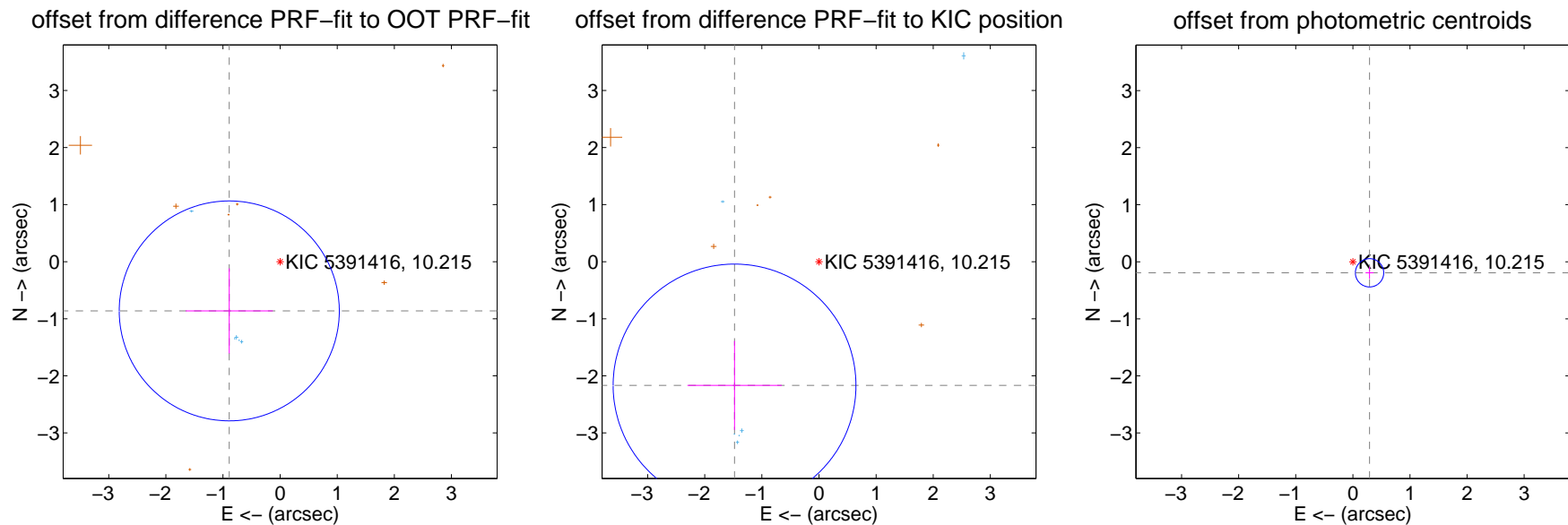
DV Centroid Data

Supplemental centroid analysis for 005391416-03. **Kepler magnitude: 10.21.** Transit SNR 11.43

There are 6 quarters with good PRF difference image offsets

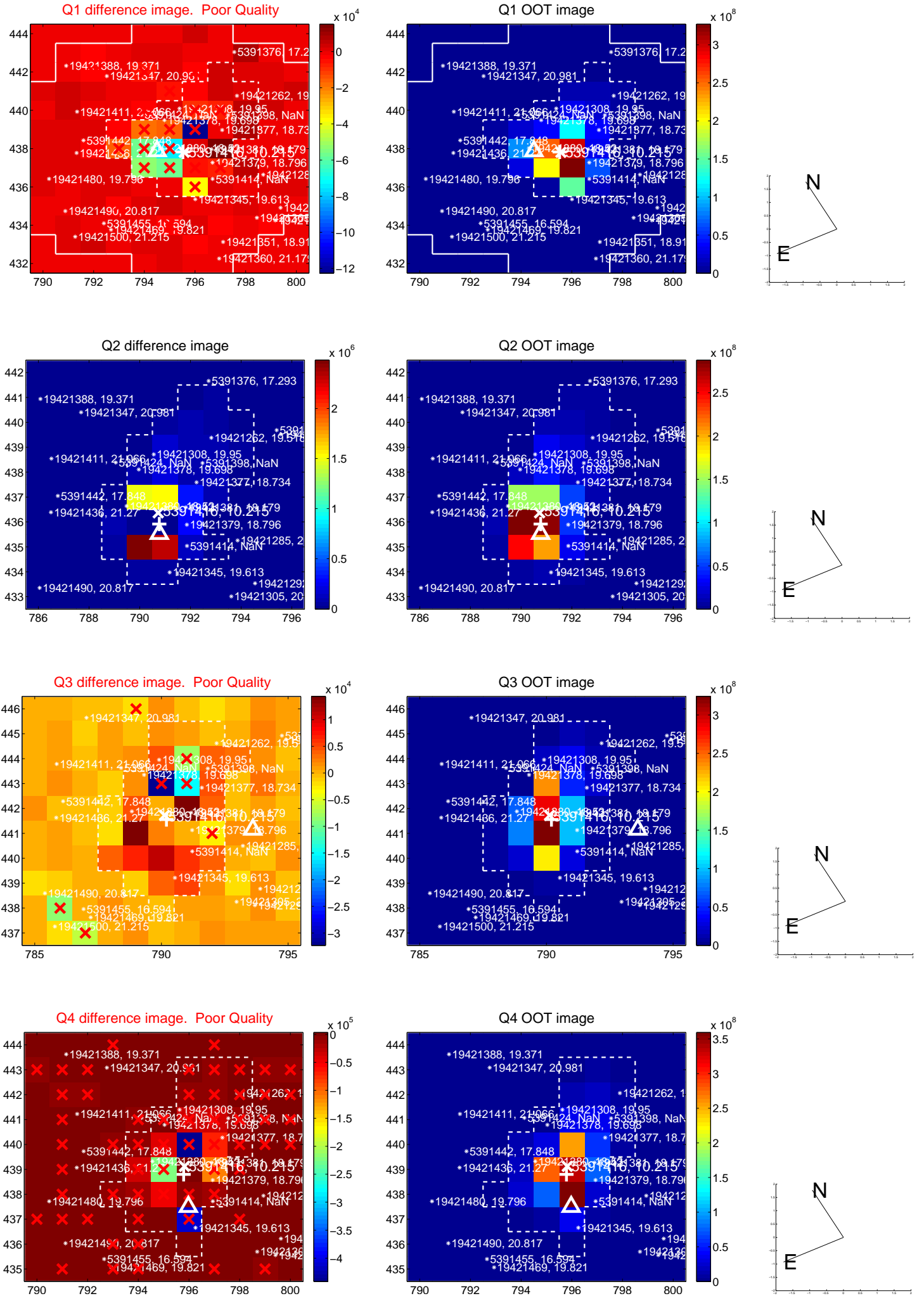
The direct PRF centroid is offset from the target star catalog position by about 0.16 arcsec

	Distance in arcsec	Distance / σ	Δ RA	Δ Dec
PRF-fit source offset from OOT	1.239 ± 0.642	1.93	0.890 ± 0.763	-0.862 ± 0.744
PRF-fit source offset from KIC position	2.624 ± 0.708	3.70	1.478 ± 0.826	-2.167 ± 0.780
photometric centroid source offset	0.35 ± 0.08	4.24	-0.29 ± 0.07	-0.19 ± 0.11

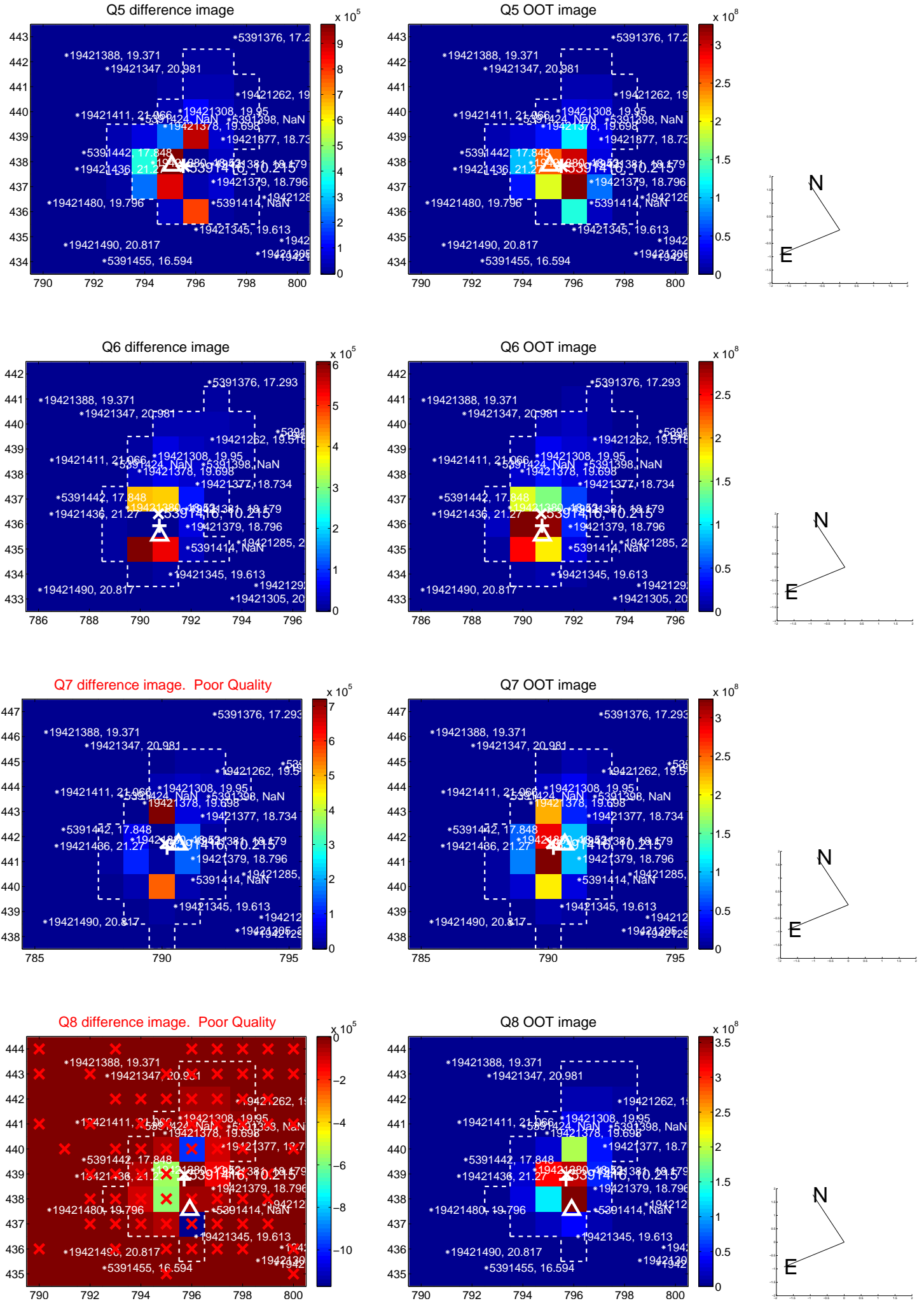


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- σ uncertainty. Blue circle: three-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

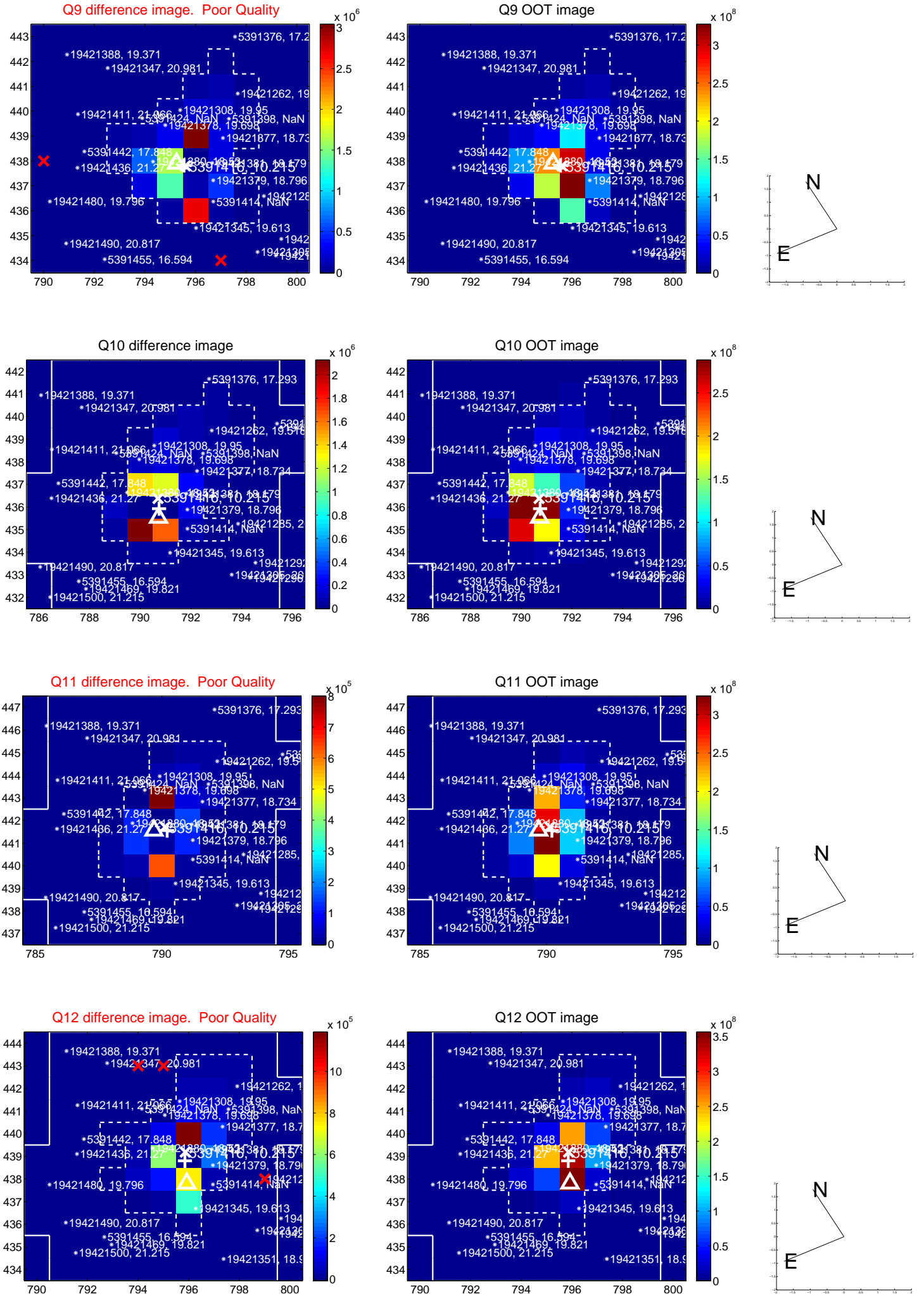
white \times : KIC target position; +: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



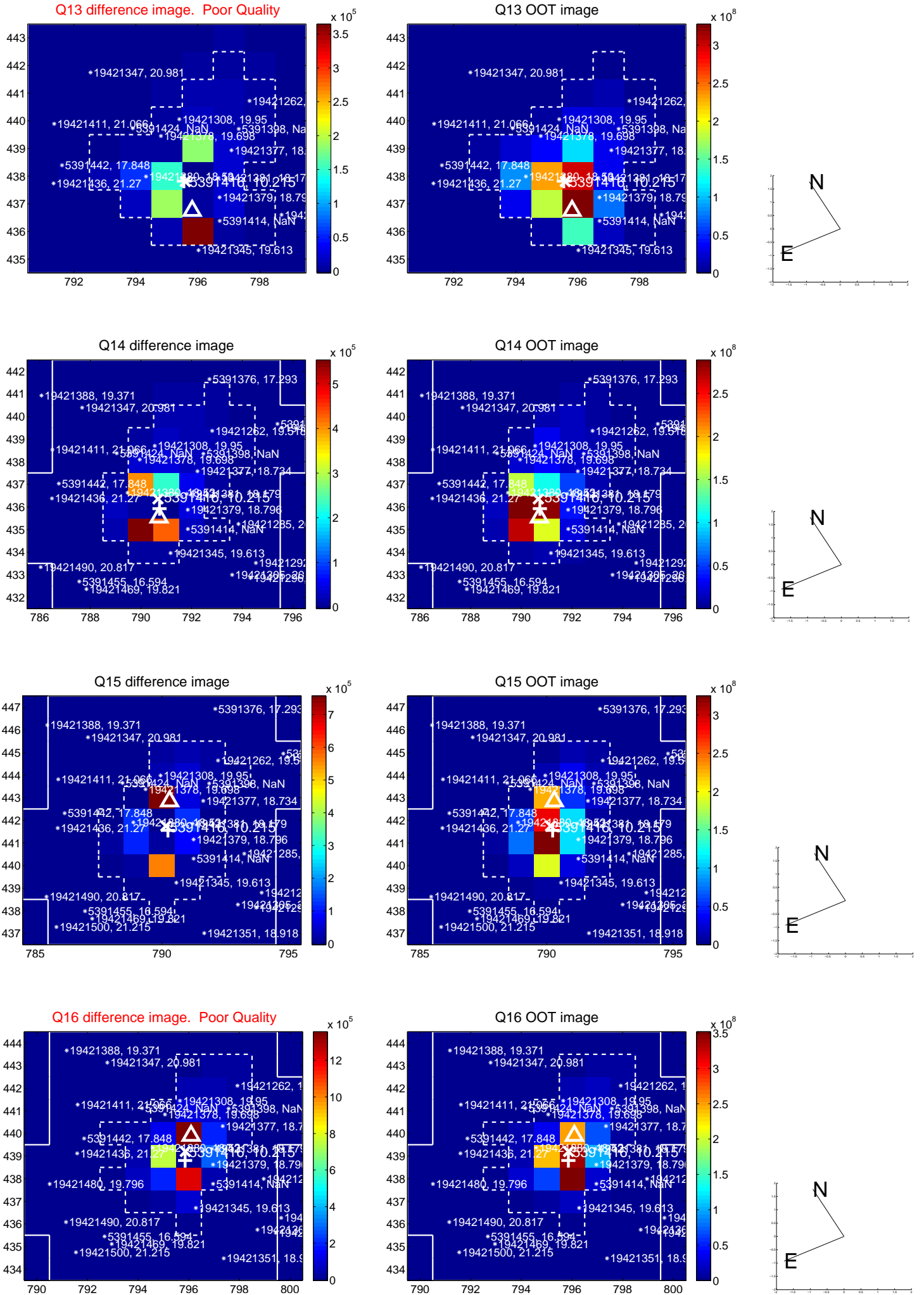
white \times : KIC target position; +: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



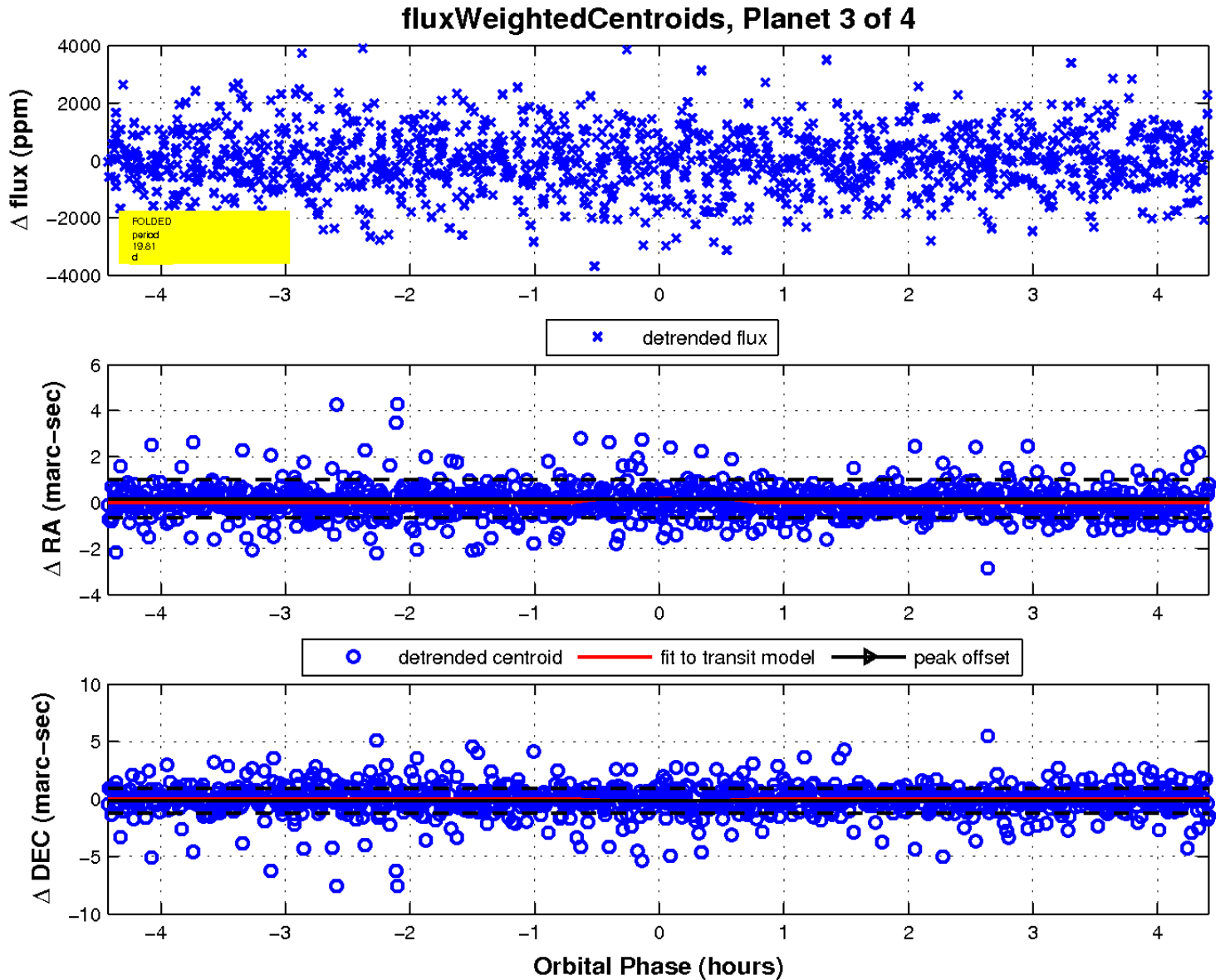
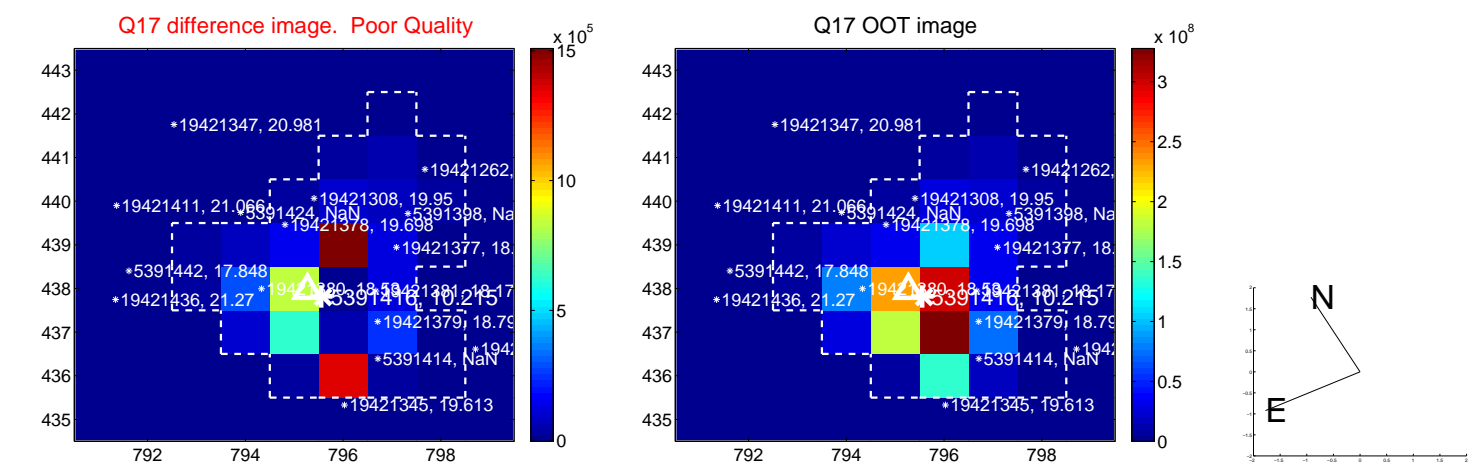
white \times : KIC target position; $+$: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



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

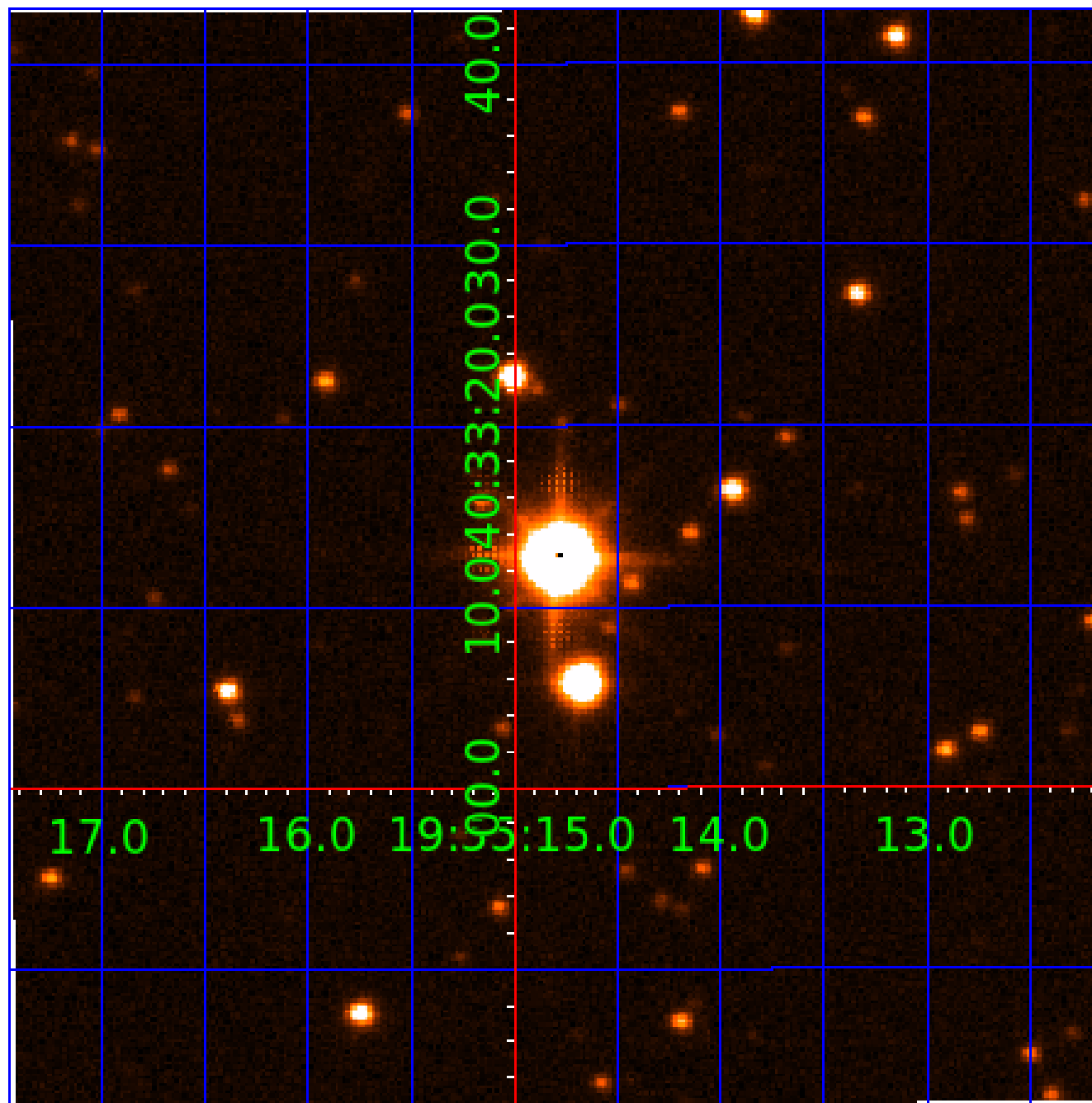


white \times : KIC target position; $+$: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



UKIRT Image

Declination



KIC 005391416

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})
005391416-01	OBS	No	1.226221	132.685893	61.2	7.518	8.7	6.7	3.15	8281	2.57	51570.14
005391416-02	OBS	No	48.072188	162.788985	1380.7	2.993	9.6	10.8	3.15	8281	12.28	387.23
005391416-03	OBS	No	19.812693	148.943625	1476.5	1.475	10.1	11.4	3.15	8281	13.50	1262.50
005391416-04	OBS	No	108.685941	159.455659	2621.7	1.734	10.2	10.1	3.15	8281	16.41	130.49

Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
005391416-01	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—CENT_SATURATED
005391416-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
005391416-03	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
005391416-04	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED

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

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

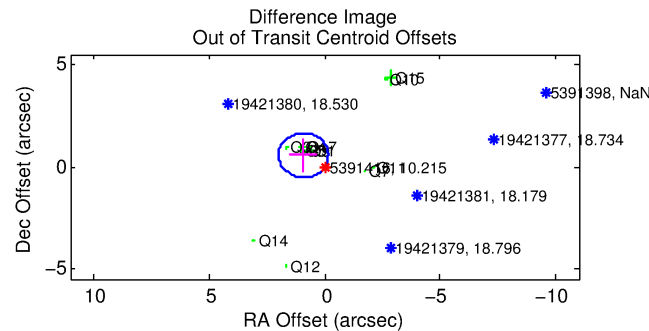
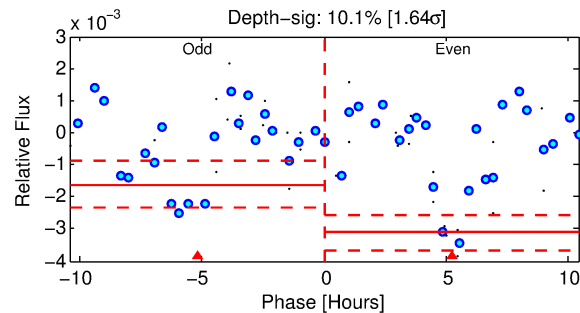
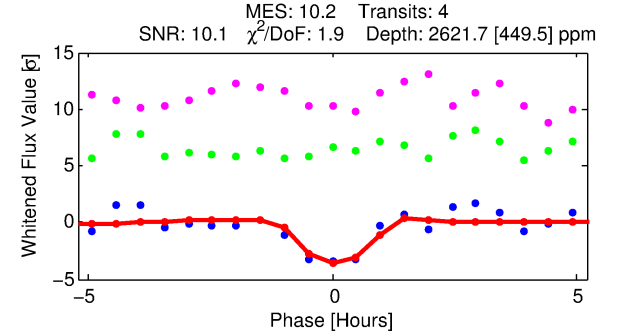
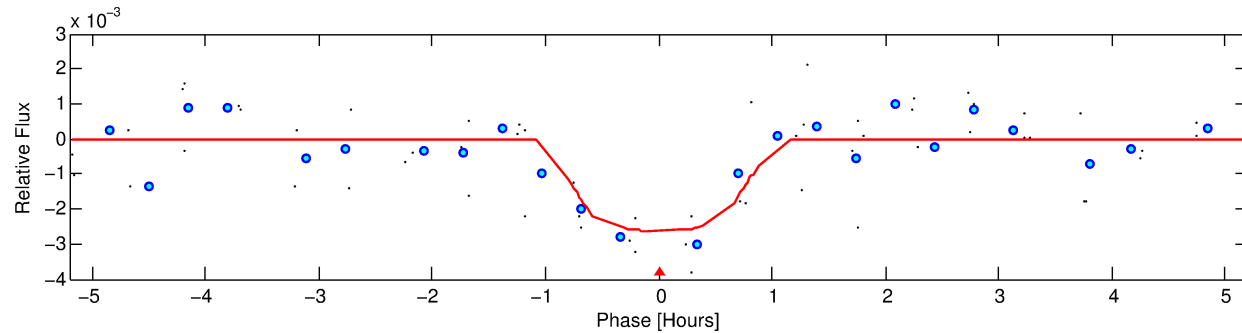
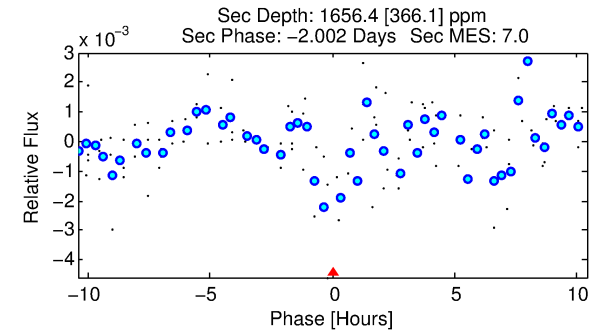
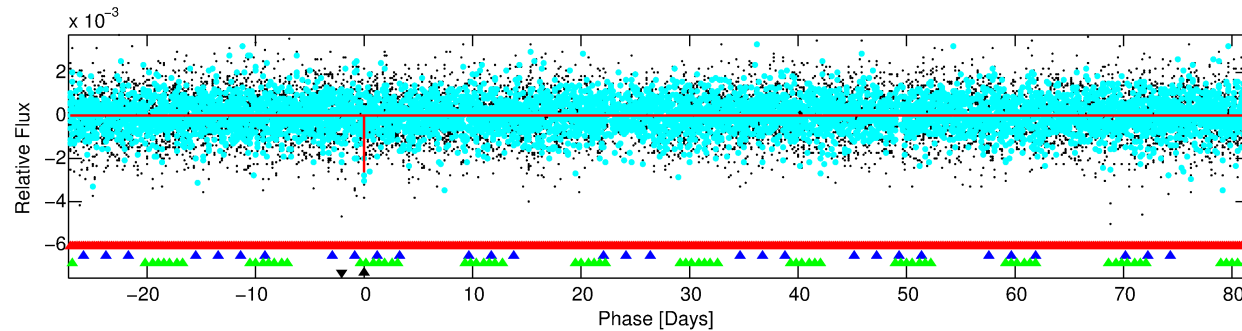
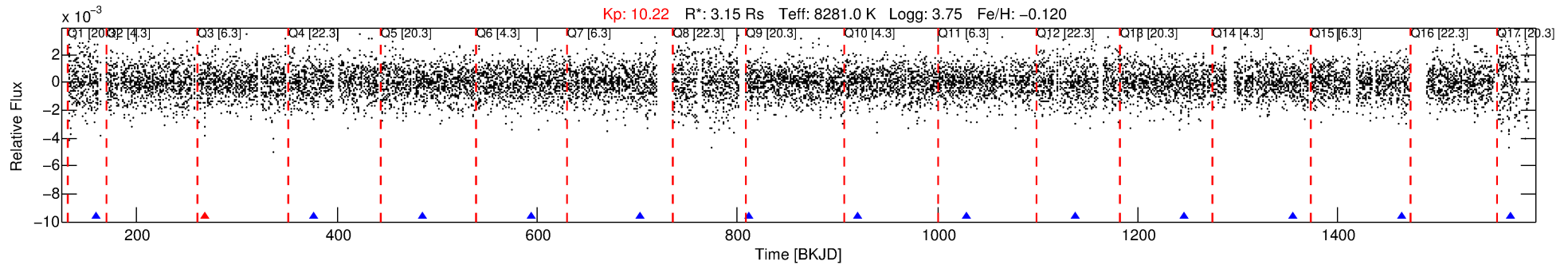
See http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col for comment definitions.

Ephemeris Match Information For 005391416-04

No Significant Match Found

DV One-Page Summary

KIC: 5391416 Candidate: 4 of 4 Period: 108.686 d



DV Fit Results:

Period = 108.68594 [0.00084] d
Epoch = 159.4557 [0.0118] BKJD
Rp/R* = 0.0478 [0.2860]
a/R* = 492.93 [16735.18]
b = 0.20 [168.63]
Seff = 130.49 [94.34]
Teq = 862 [156] K
Rp = 16.41 [98.51] Re
a = 0.5655 [0.2489] AU
Ag = 1082.21 [12980.81] [0.08σ]
Teffp = 7643 [22881] K [0.30σ]

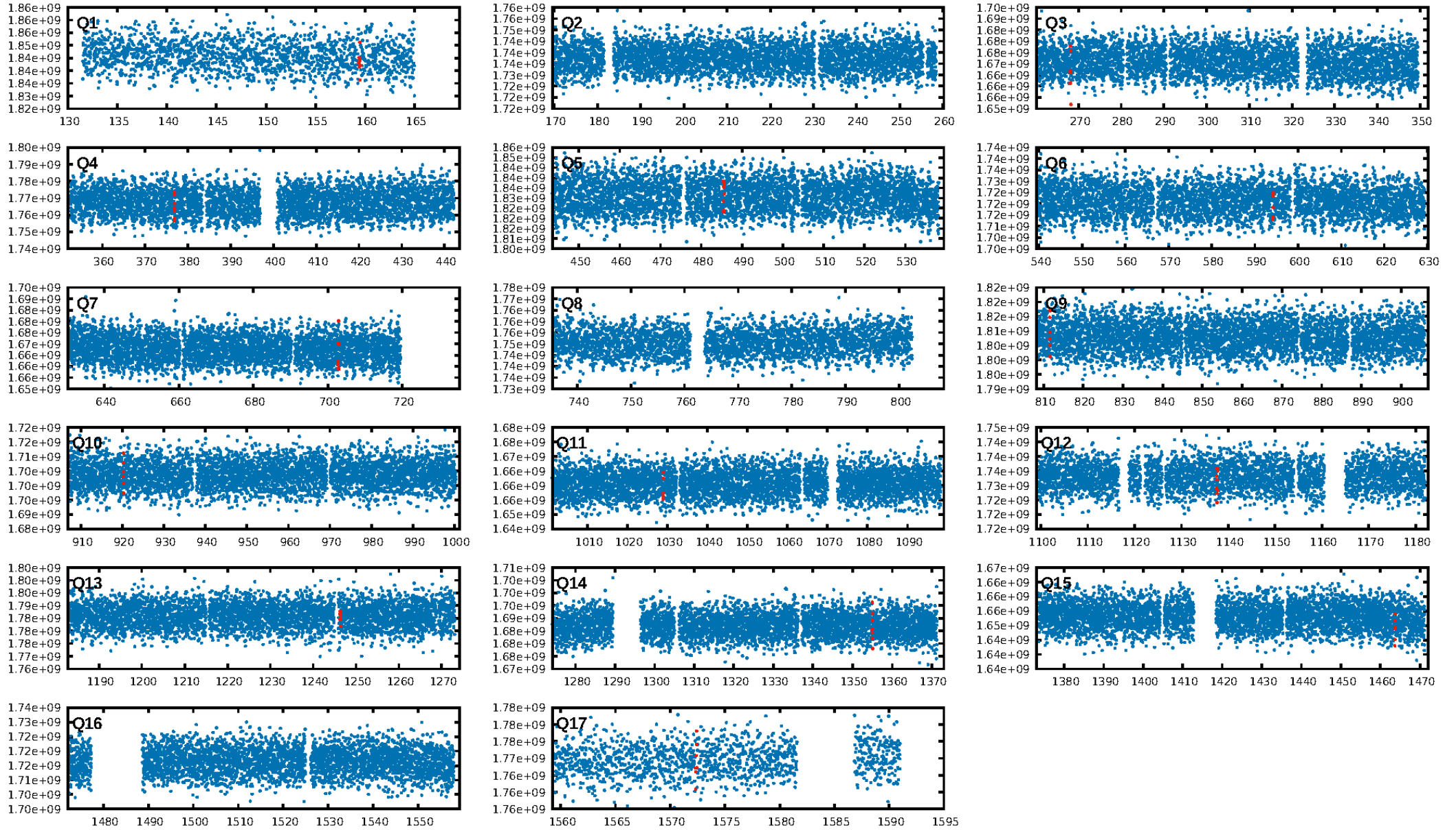
DV Diagnostic Results:

ShortPeriod-sig: 100.0% [420.54σ]
LongPeriod-sig: N/A
ModelChiSquare2-sig: 3.3%
ModelChiSquareGof-sig: 89.5%
Bootstrap-pfa: 2.37e-09
RollingBand-fgt: 0.75 [3/4]
GhostDiagnostic-chr: N/A
Centroid-sig: 2.0%
Centroid-so: 0.368 arcsec [3.95σ]
OotOffset-rm: 1.075 arcsec [2.98σ]
OotOffset-st: 2/4/2/4 [12]
KicOffset-rm: 1.312 arcsec [3.22σ]
KicOffset-st: 2/4/2/4 [12]
DiffImageQuality-fgm: 0.08 [1/12]
DiffImageOverlap-fno: 0.38 [5/13]

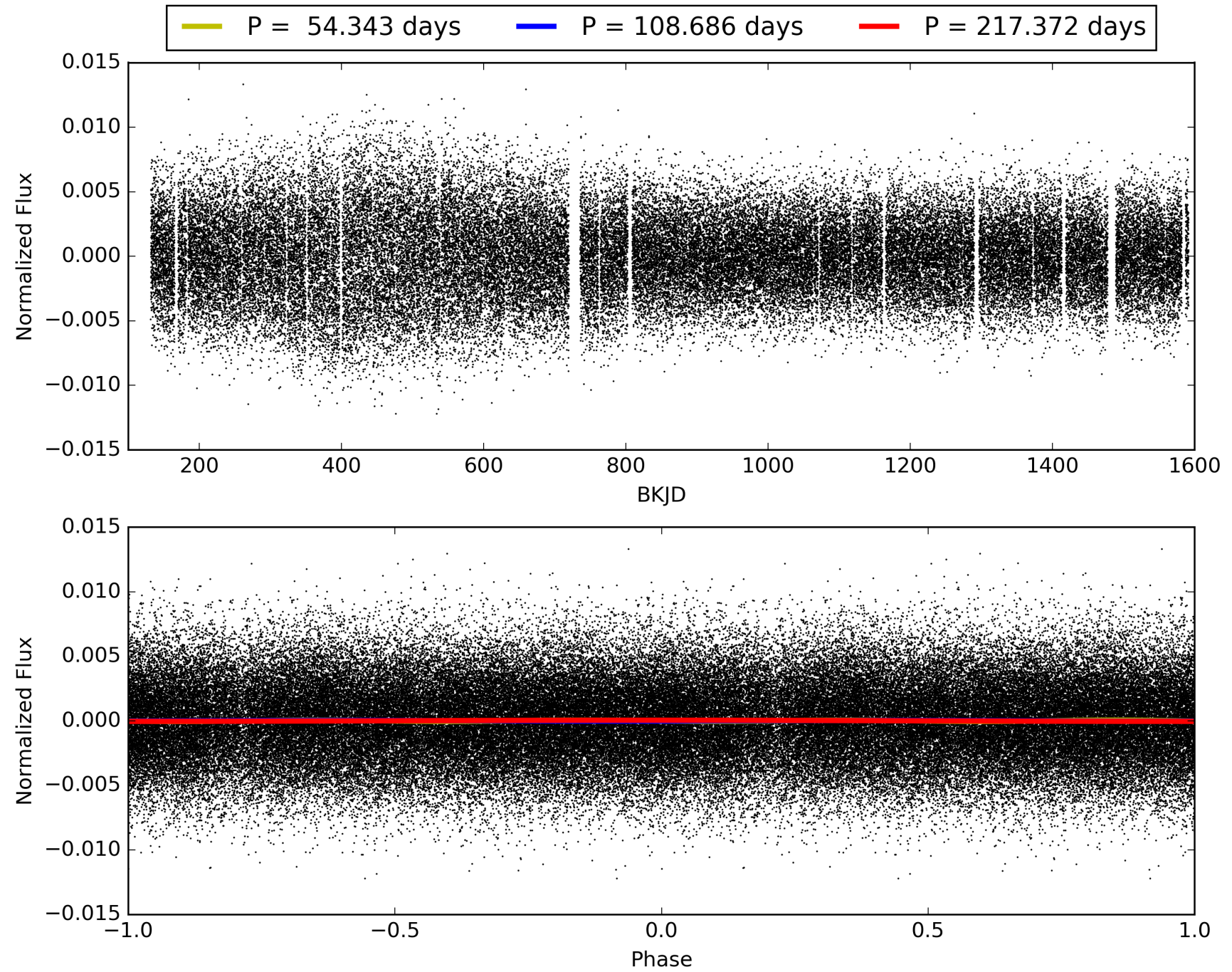
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 30-Jan-2016 16:11:25 Z

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

TCE 005391416-04, PDC Light Curves

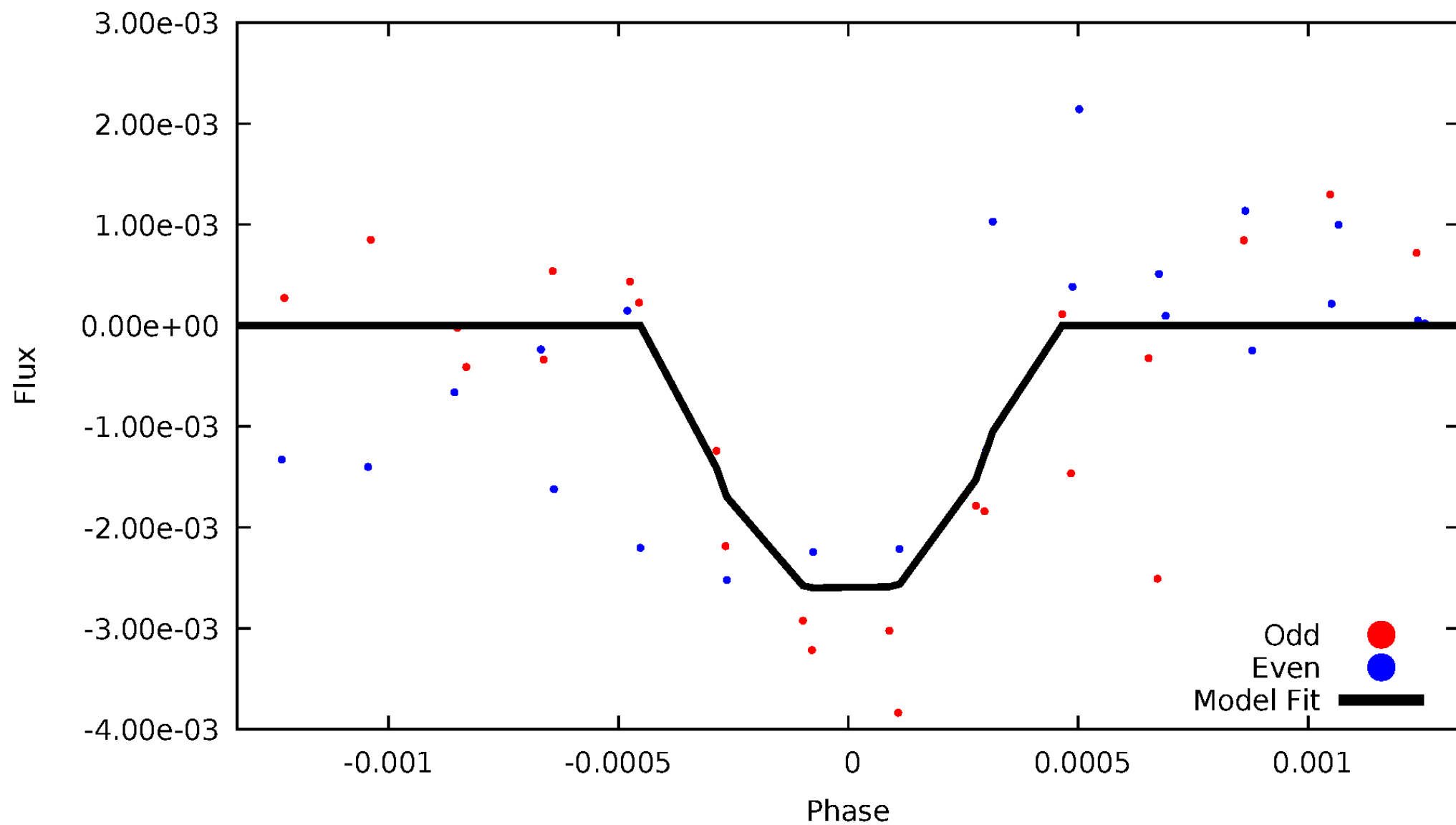


TCE 005391416-04



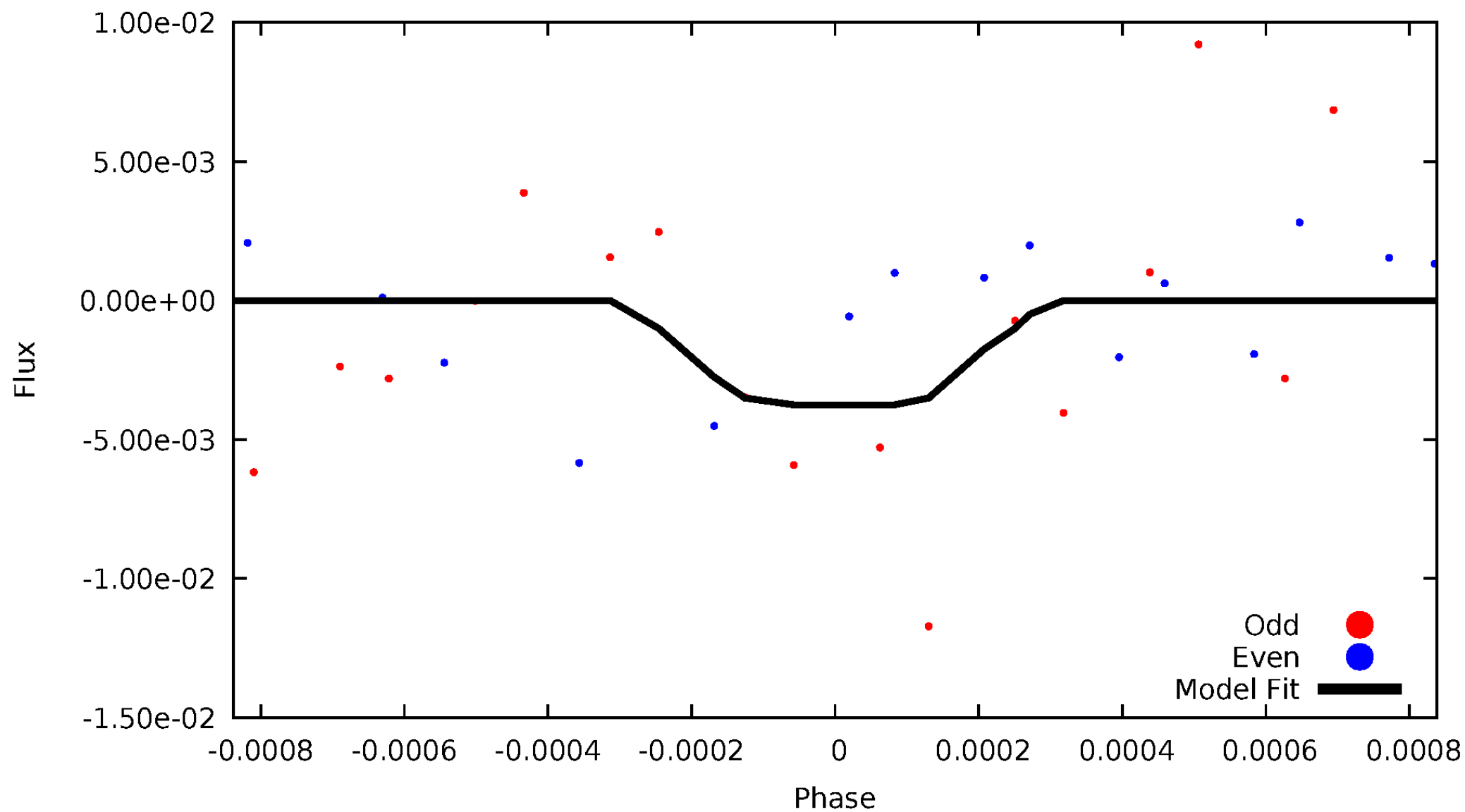
DV Odd/Even

TCE 005391416-04



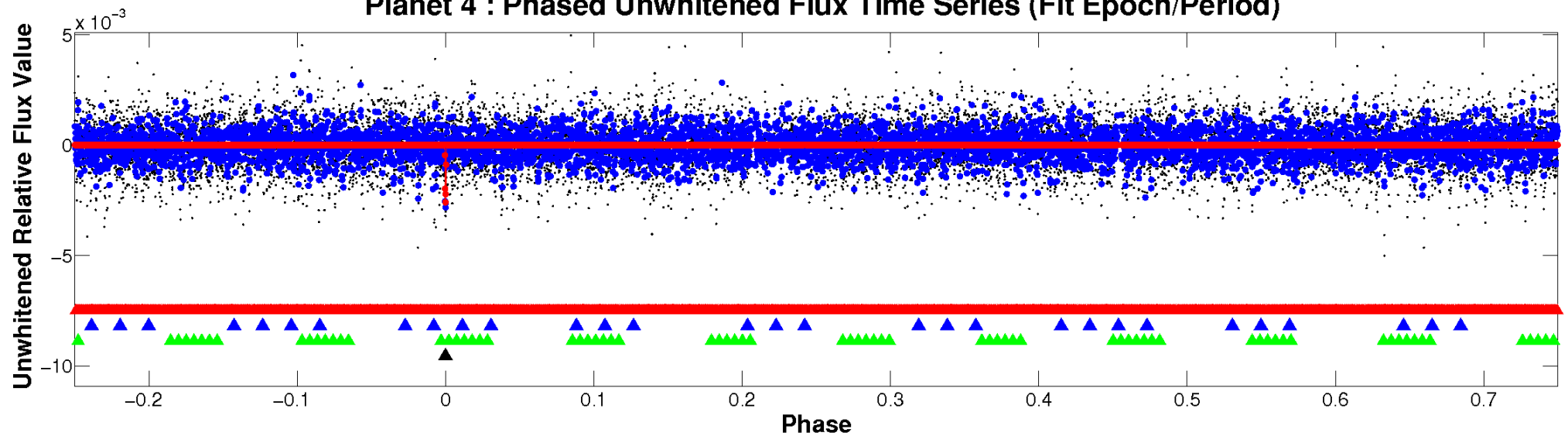
ALT Odd/Even

TCE 005391416-04

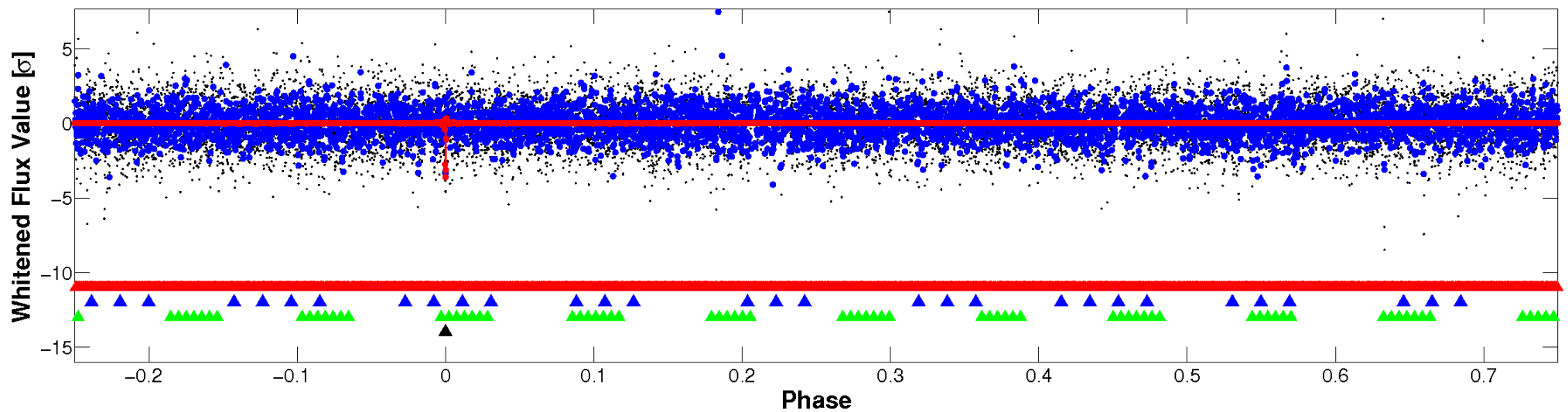


Non-Whitened Vs. Whitened Light Curve

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

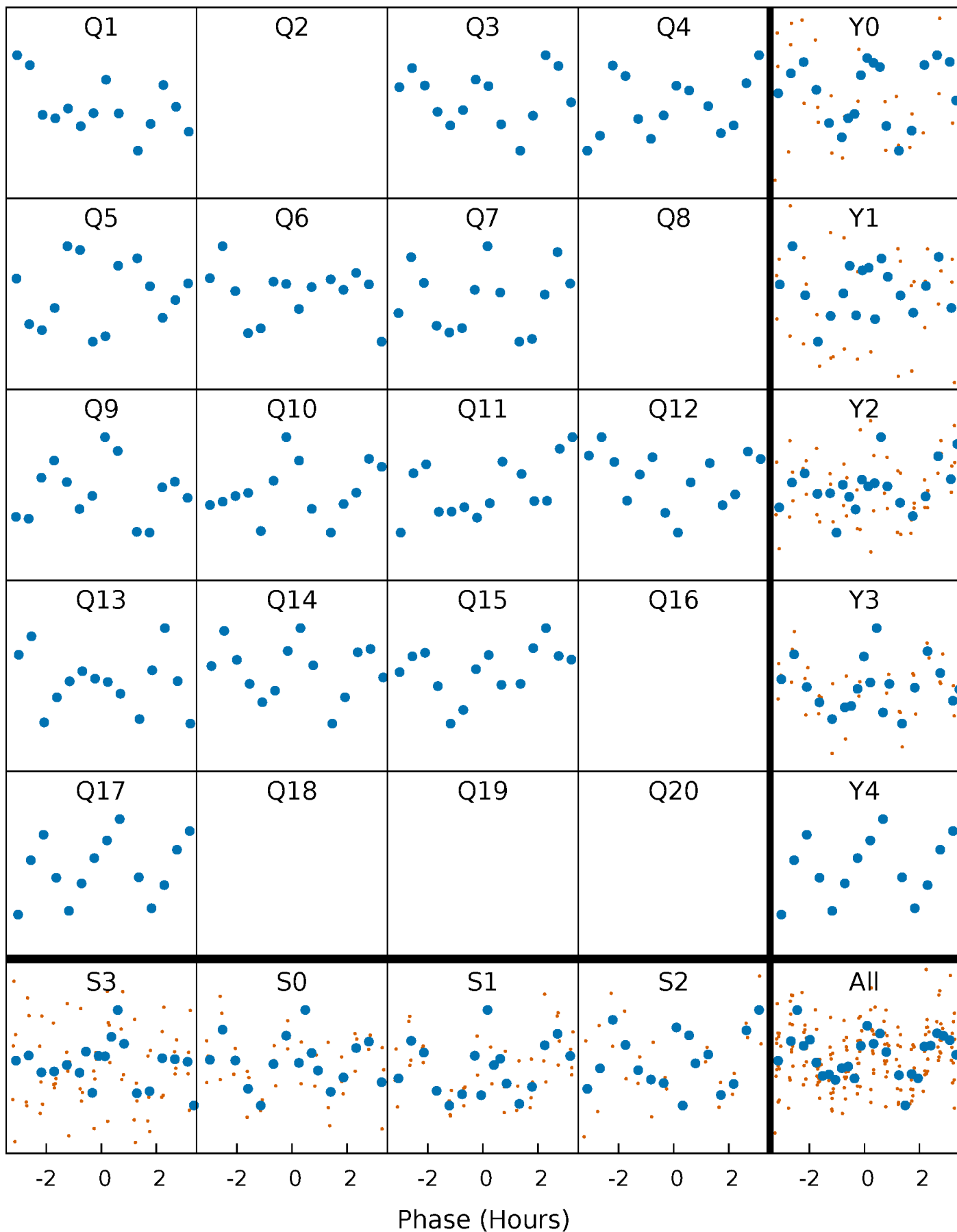


Planet 4 : Phased Whitened Flux Time Series (Fit Epoch/Period)



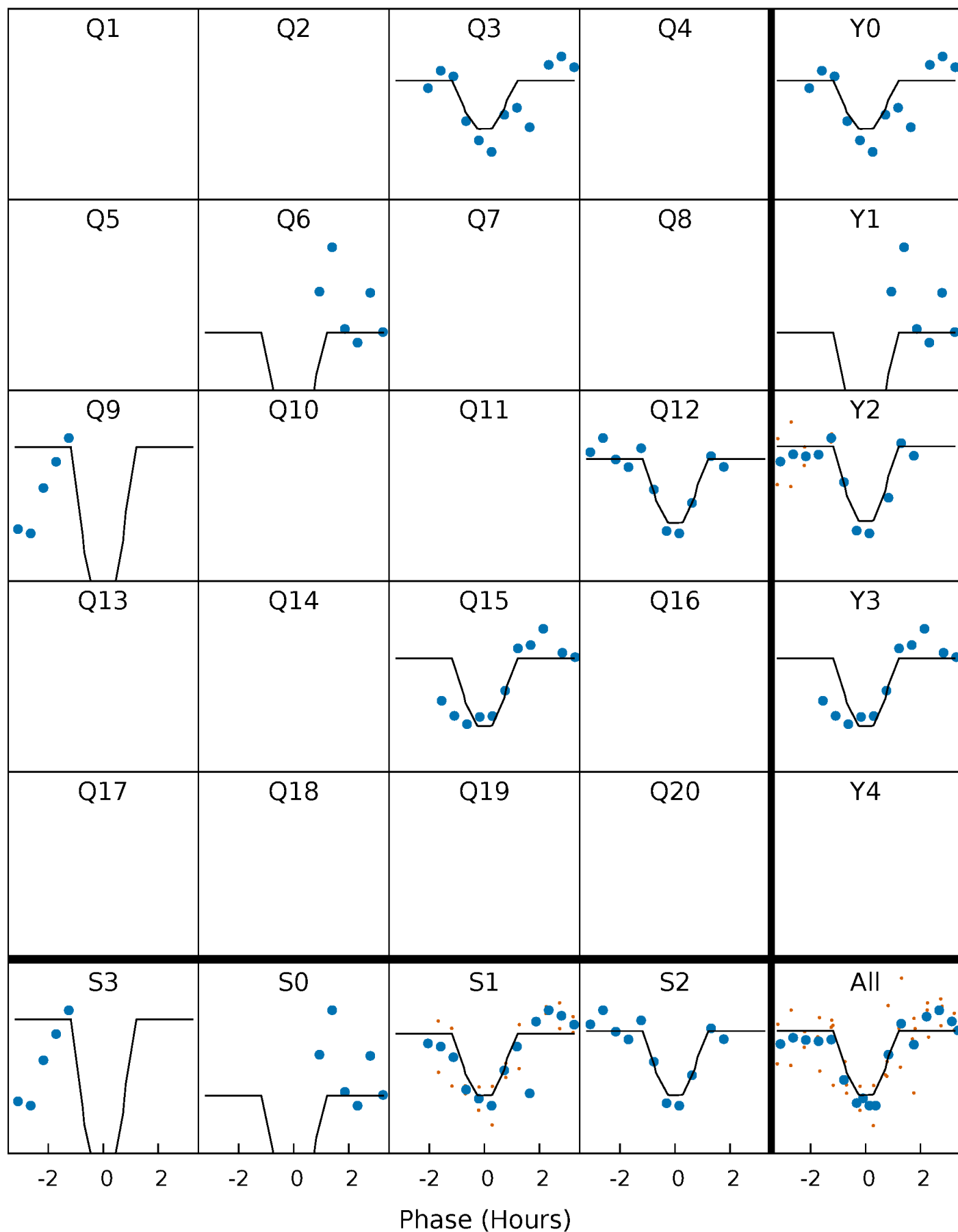
PDC Quarter-Phased Transit Curves

TCE 005391416-04 P=108.685941 Days $T_0=159.455659$ (BKJD)



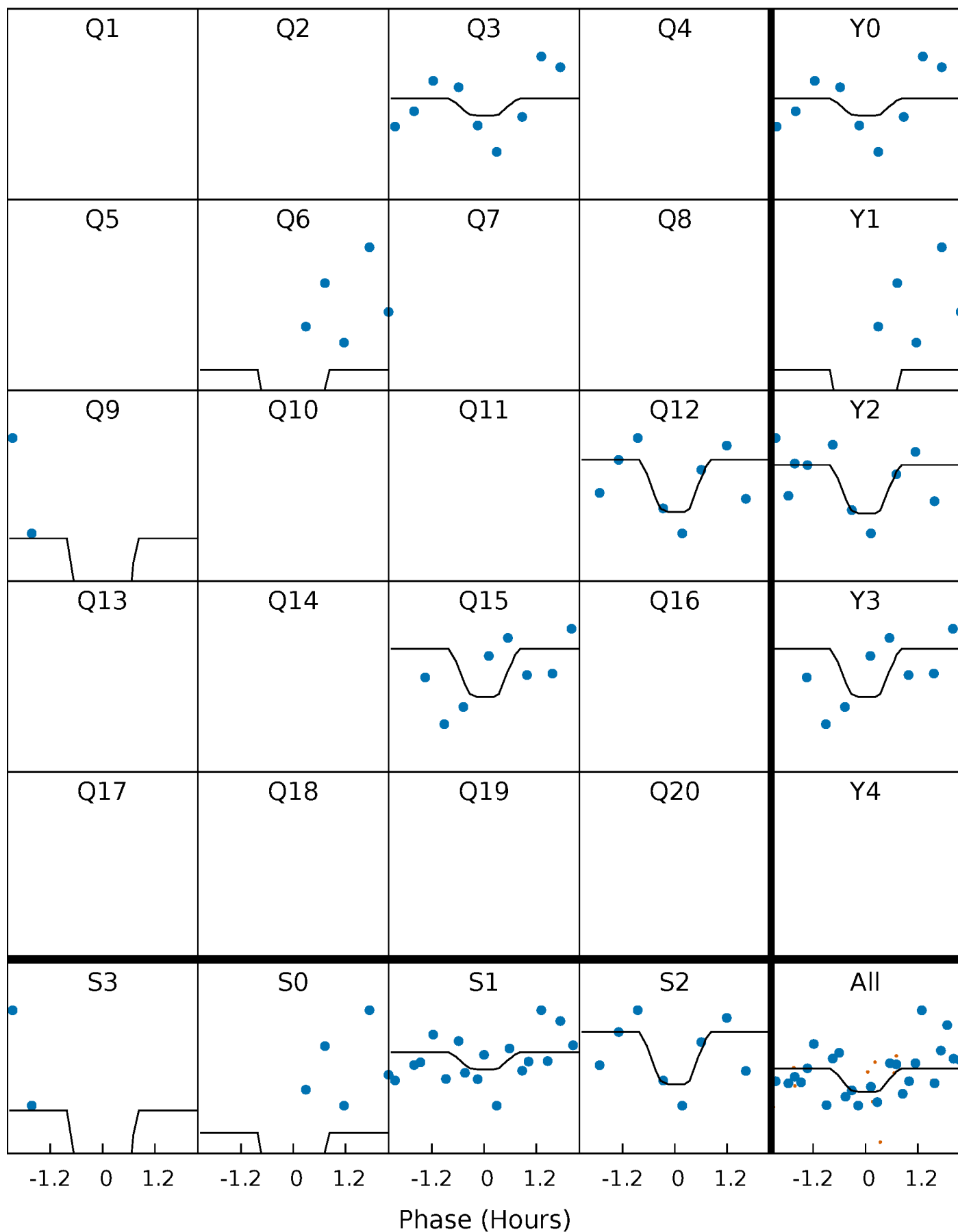
DV Quarter-Phased Transit Curves

TCE 005391416-04 P=108.685941 Days $T_0=159.455659$ (BKJD)



Alt. Detrend Quarter-Phased Transit Curves

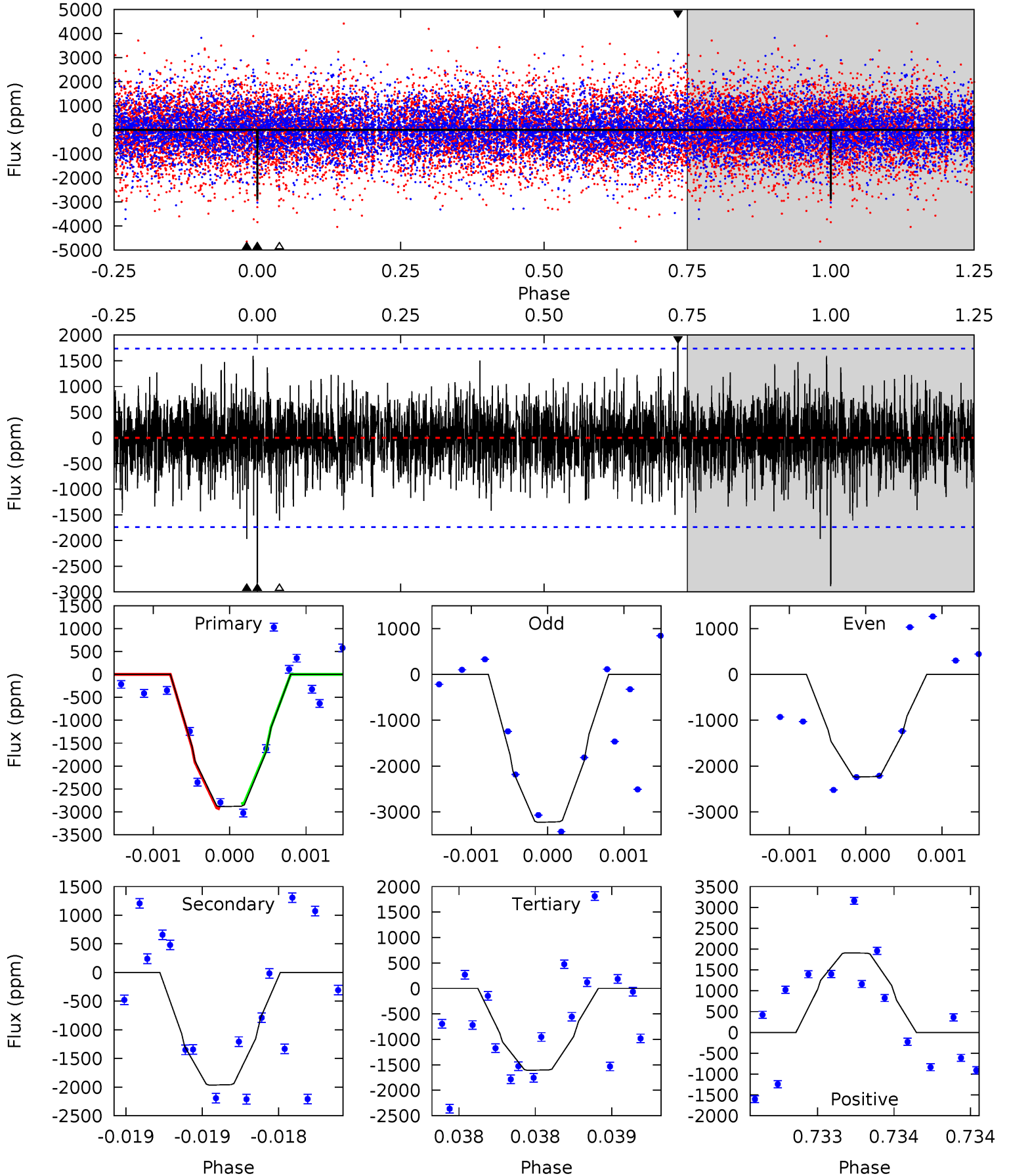
TCE 005391416-04 P=108.681492 Days $T_0=159.498606$ (BKJD)



DV Model-Shift Uniqueness Test

005391416-04, P = 108.685941 Days, E = 50.769718 Days

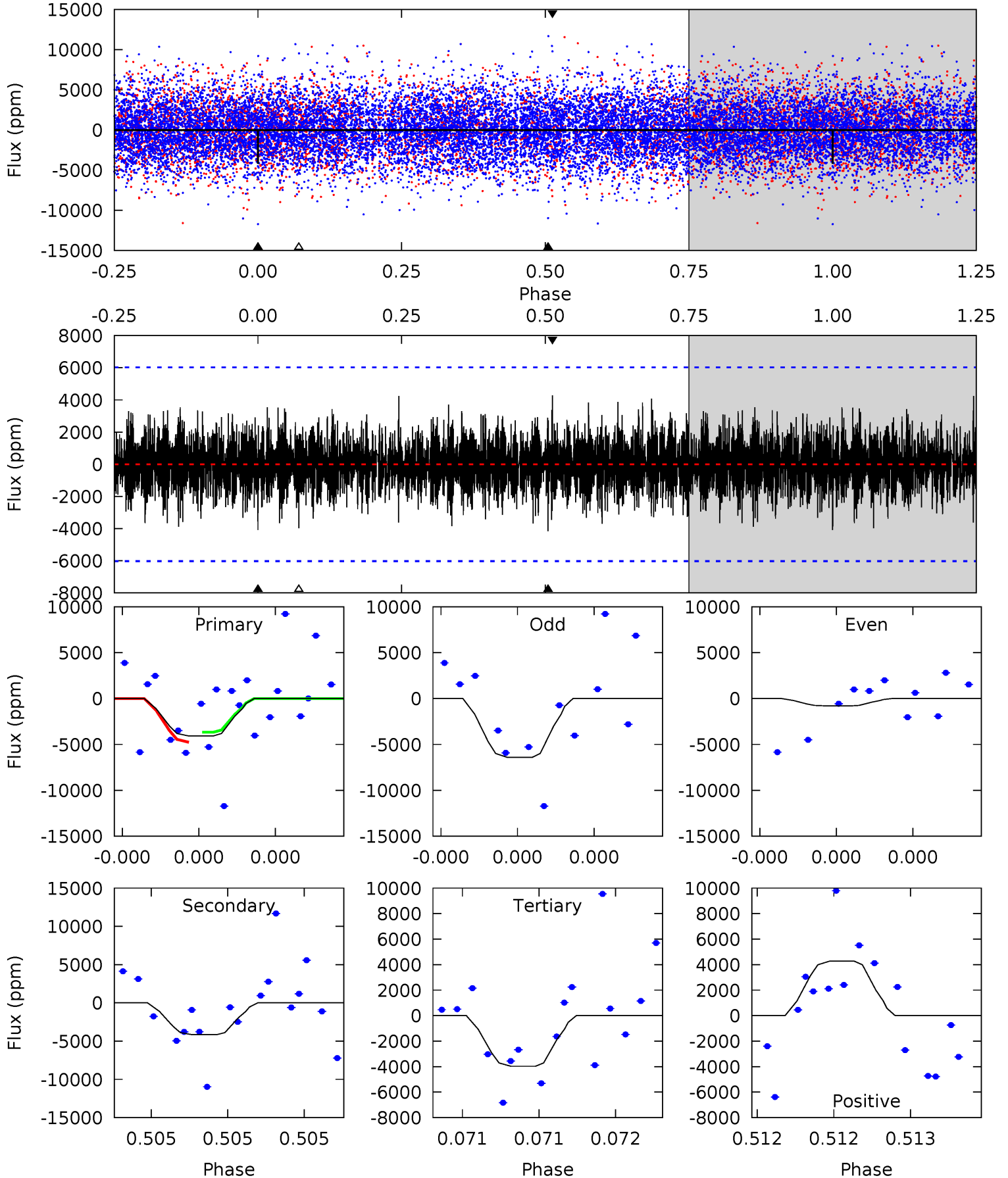
Pri	Sec	Ter	Pos	FA ₁	FA ₂	F _{Red}	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
9.22	6.27	5.13	6.10	5.55	3.44	1.40	4.09	3.12	1.14	0.18	1.55	1.03	0.40	0.17



Alt Model-Shift Uniqueness Test

005391416-04, P = 108.681492 Days, E = 50.817114 Days

Pri	Sec	Ter	Pos	FA ₁	FA ₂	F _{Red}	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
3.79	3.86	3.69	3.97	5.60	3.52	1.14	0.10	-0.18	0.17	-0.11	2.52	1.05	0.51	0.44



Stellar Parameters For KIC 005391416

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	R (R_{\odot})	$M(M_{\odot})$	p_{\star} ($\text{g}\cdot\text{cm}^{-3}$)
	8281^{+200}_{-343}	$3.752^{+0.413}_{-0.110}$	$-0.120^{+0.250}_{-0.350}$	$3.147^{+0.777}_{-1.442}$	$2.039^{+0.329}_{-0.493}$	$0.092^{+0.361}_{-0.039}$
	+2%/-4%	+11%/-3%	+208%/-292%	+25%/-46%	+16%/-24%	+392%/-42%
Source	KIC0	KIC0	KIC0	DSEP		

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

Secondary Eclipse Parameters for KIC 005391416-04 / KOI

Detrend	Depth (ppm)	R_p (R_{\oplus})	T_{max} (K)	T_{obs} (K)	A_{obs}
DV	-1965 ± 313	$59.95^{+77.44}_{-40.72}$	1158^{+95}_{-140}	4078^{+2356}_{-907}	95^{+821}_{-76}
Alt.	-4160 ± 1077	$65.86^{+72.47}_{-46.41}$	1166^{+87}_{-147}	4553^{+3576}_{-1001}	164^{+1520}_{-125}

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 $A_{obs} \gg 1.0$

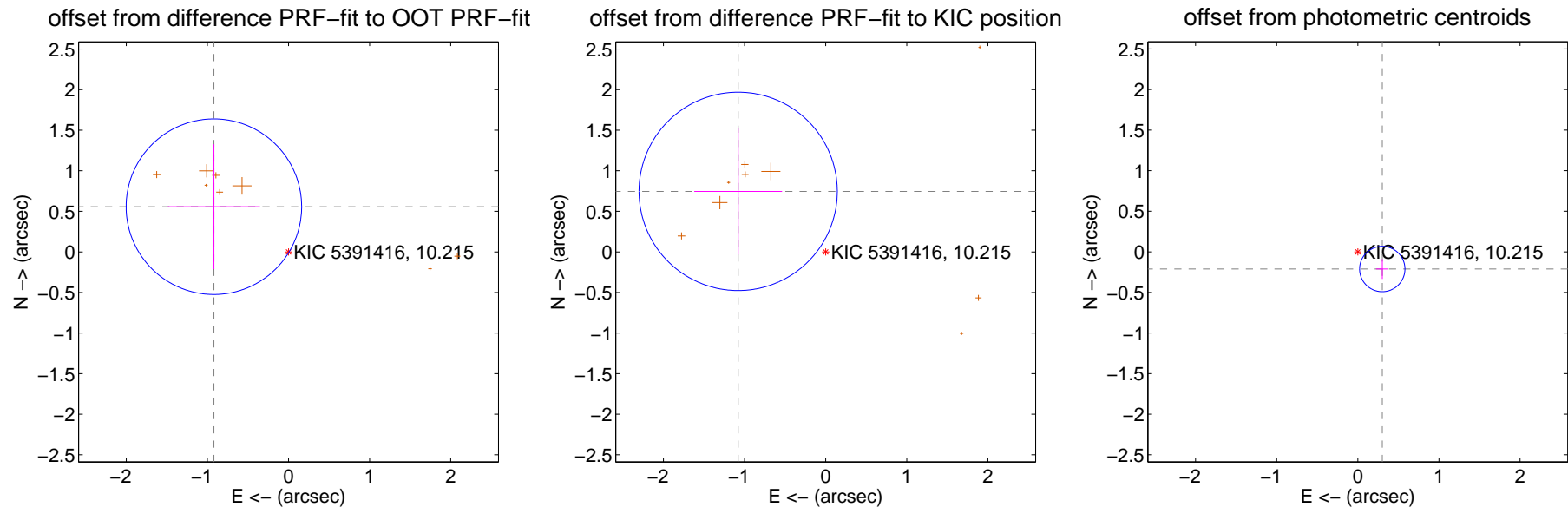
DV Centroid Data

Supplemental centroid analysis for 005391416-04. **Kepler magnitude: 10.21.** Transit SNR 10.06

There are 1 quarters with good PRF difference image offsets

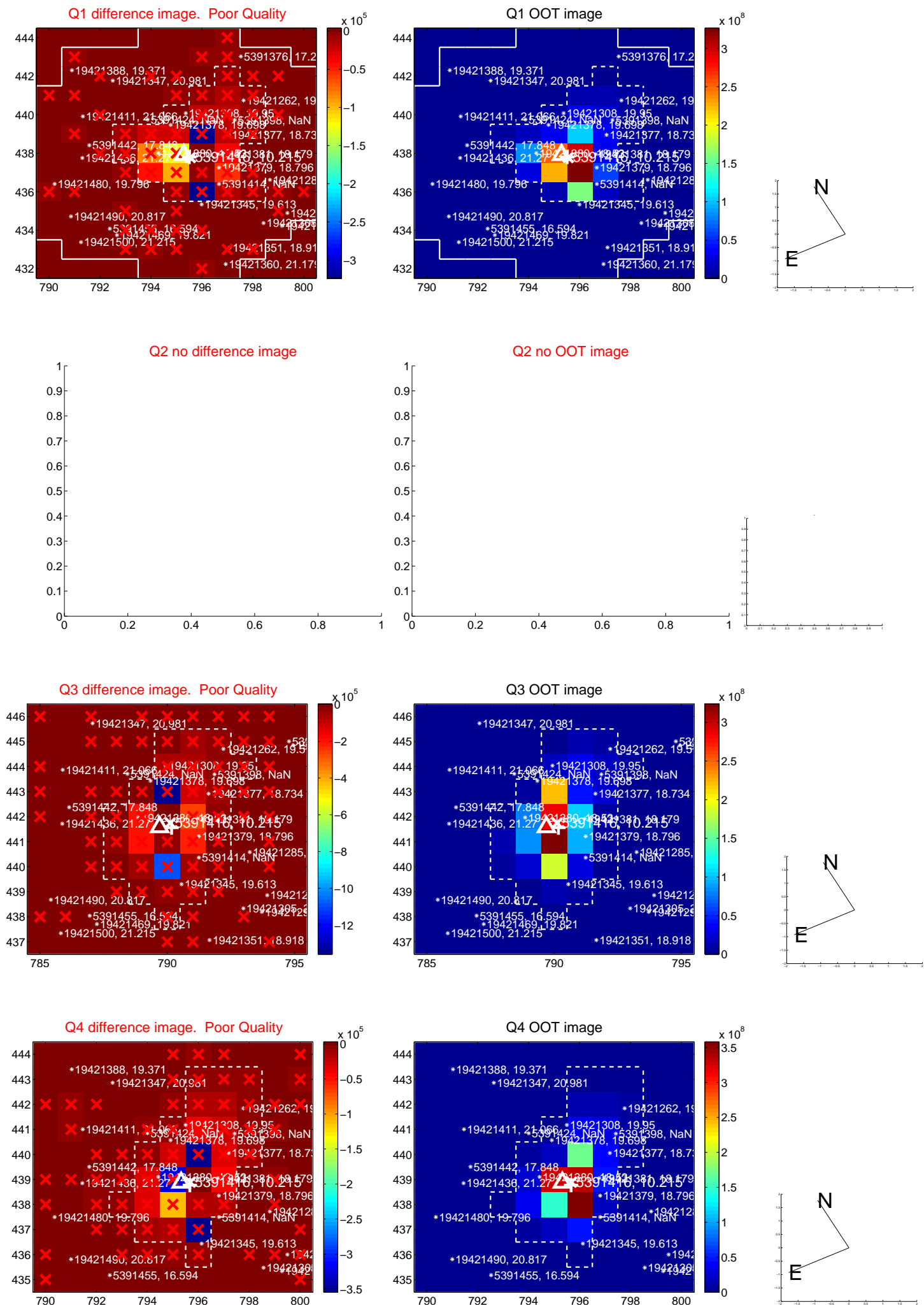
The direct PRF centroid is offset from the target star catalog position by about 0.17 arcsec

	Distance in arcsec	Distance / σ	Δ RA	Δ Dec
PRF-fit source offset from OOT	1.075 ± 0.361	2.98	0.920 ± 0.567	0.557 ± 0.769
PRF-fit source offset from KIC position	1.312 ± 0.407	3.22	1.079 ± 0.541	0.746 ± 0.778
photometric centroid source offset	0.37 ± 0.09	3.95	-0.30 ± 0.08	-0.21 ± 0.12

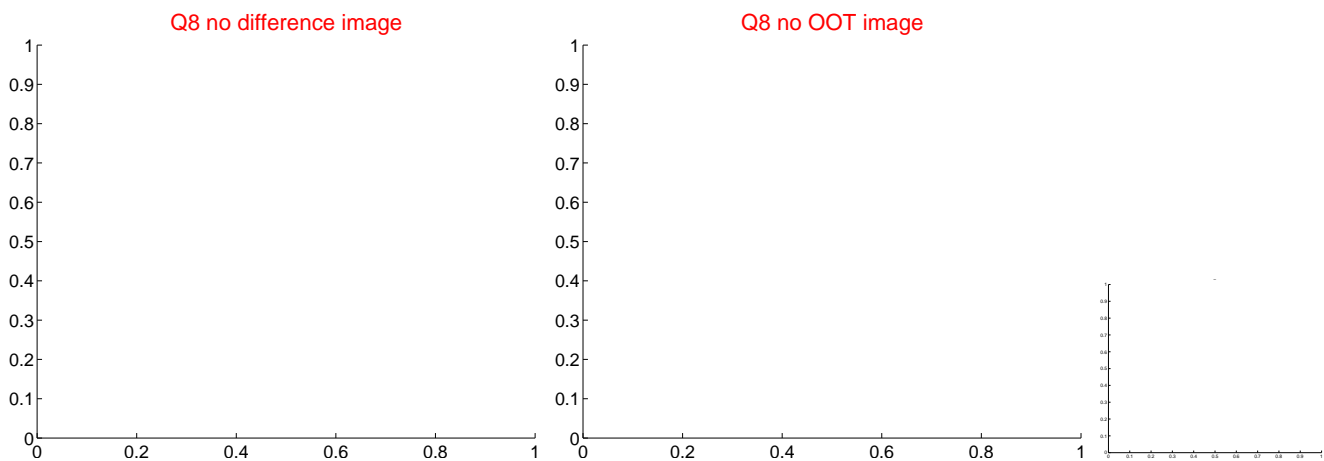
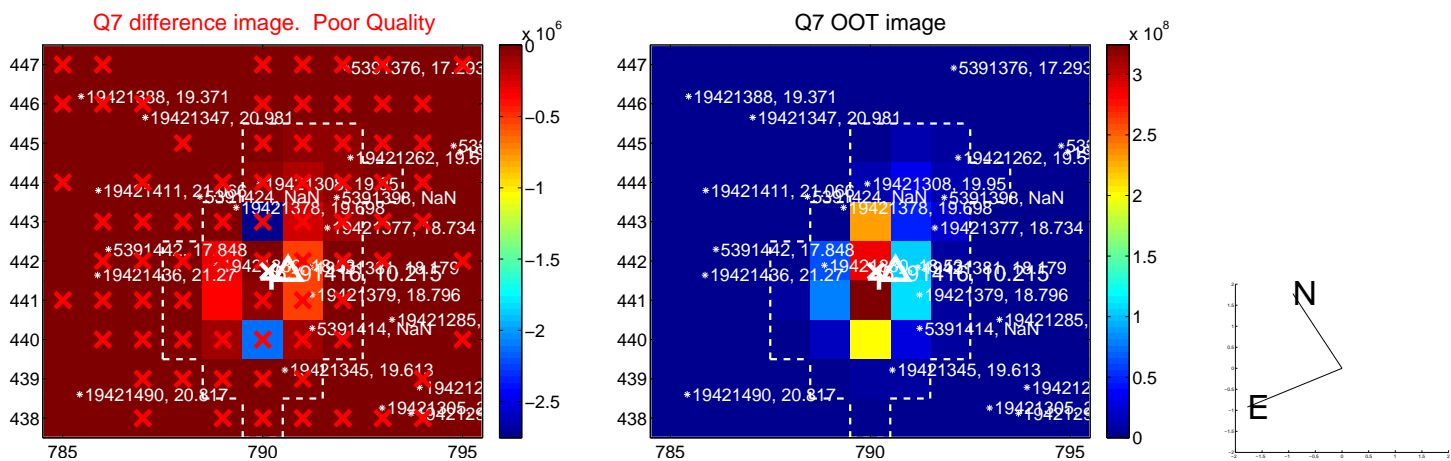
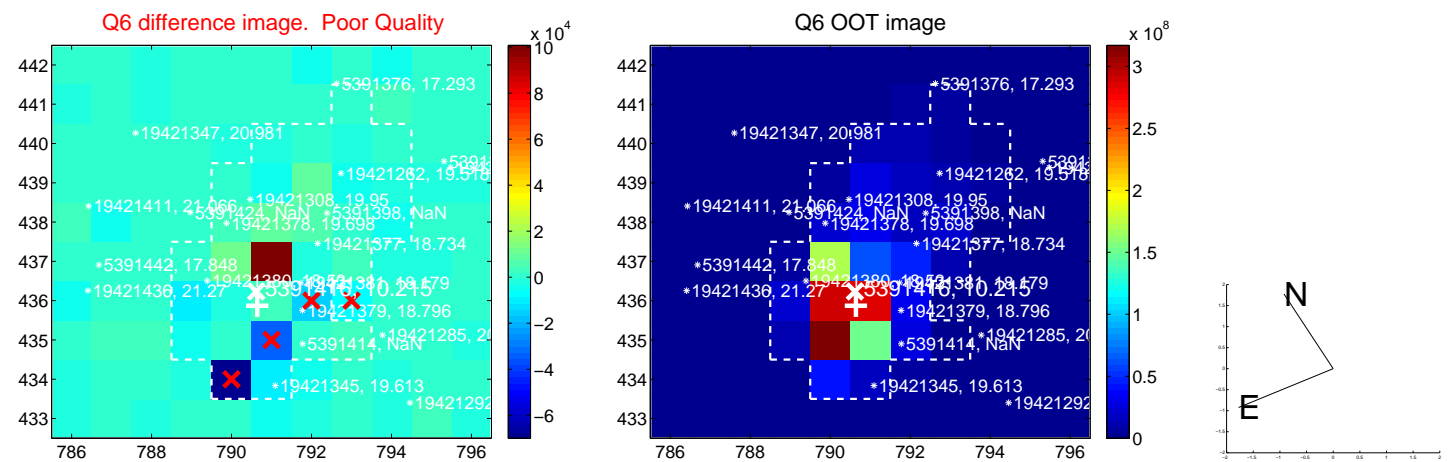
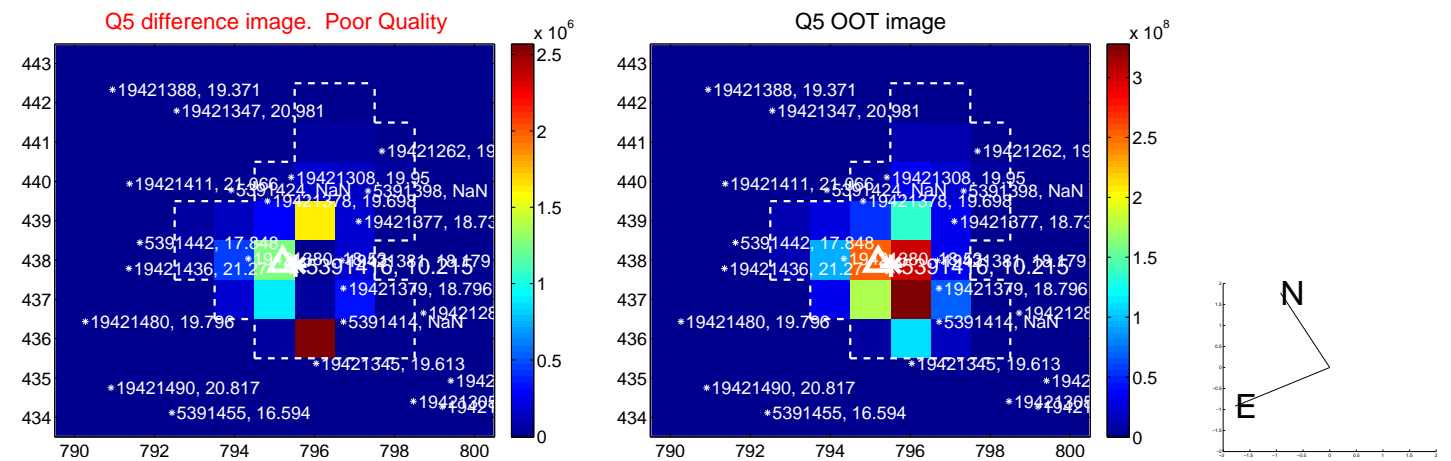


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- σ uncertainty. Blue circle: three-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

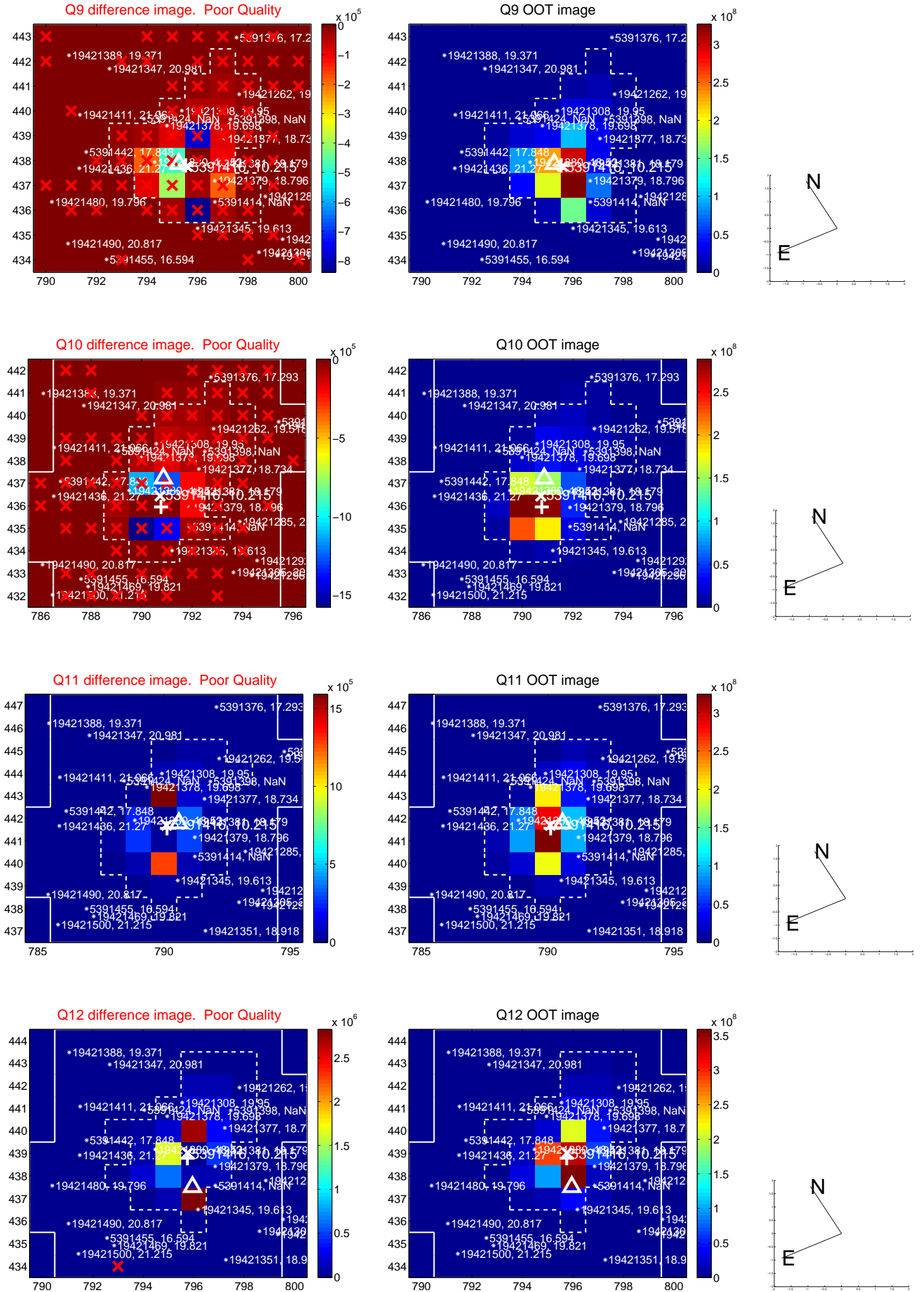
white \times : KIC target position; $+$: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



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

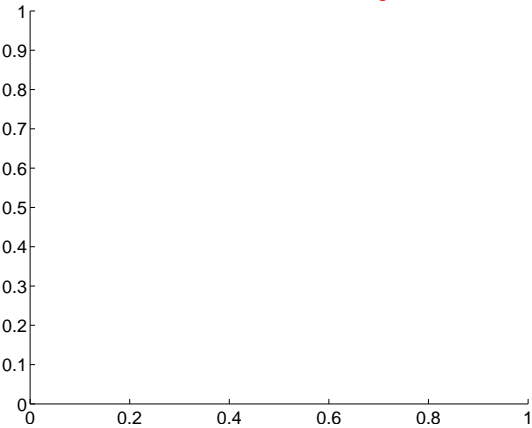


white \times : KIC target position; +: OOT centroid; \triangle : difference centroid. red \times : large negative pixel value.



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

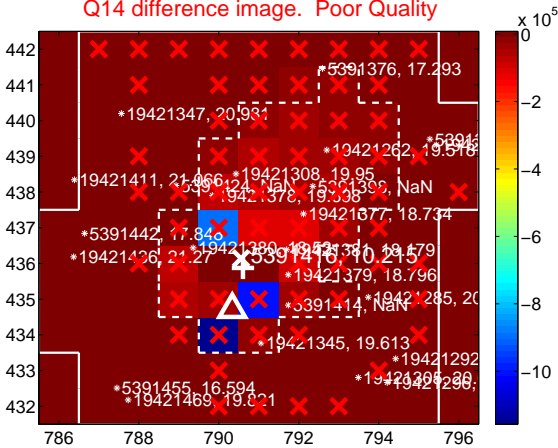
Q13 no difference image



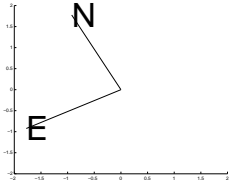
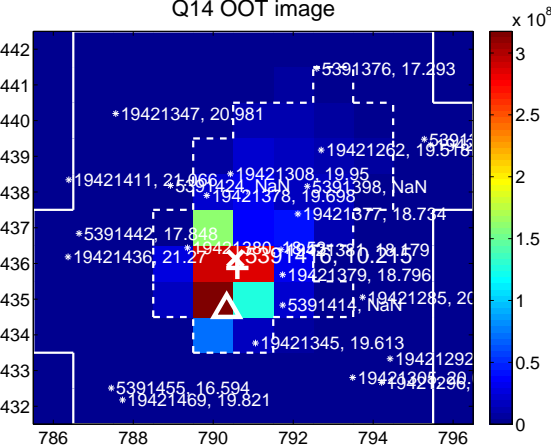
Q13 no OOT image



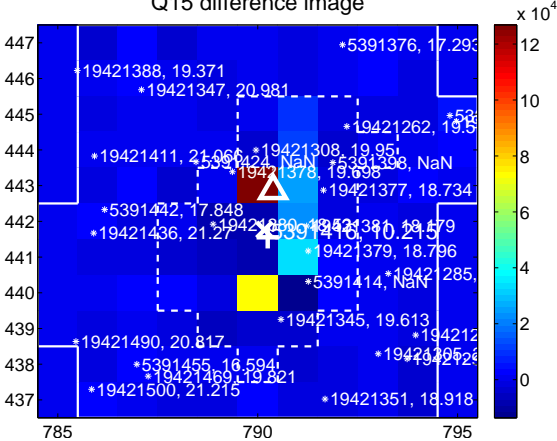
Q14 difference image. Poor Quality



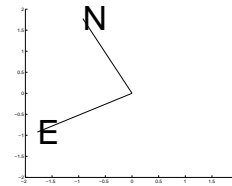
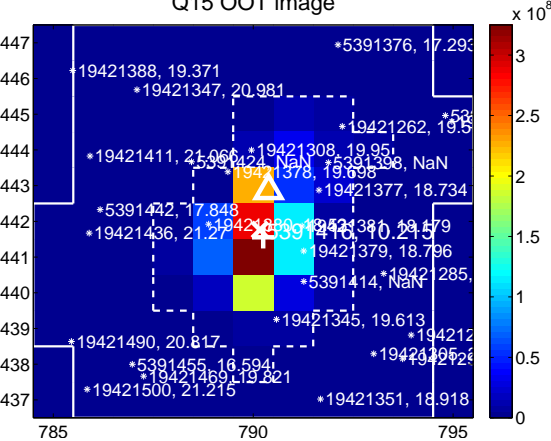
Q14 OOT image



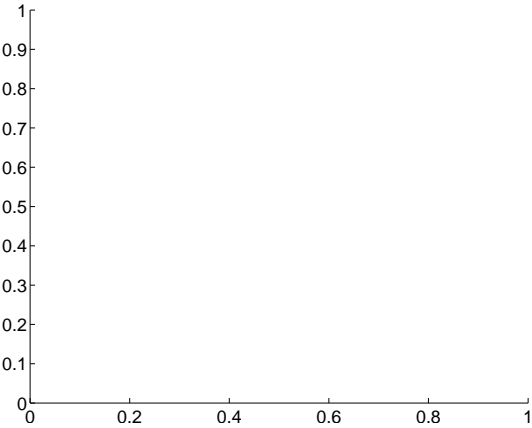
Q15 difference image



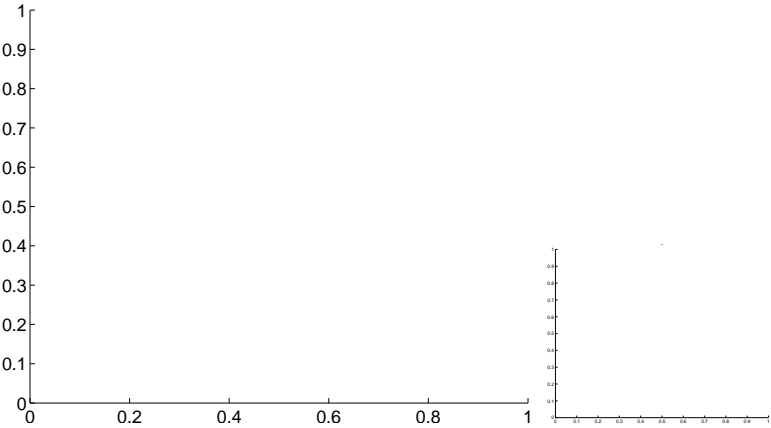
Q15 OOT image



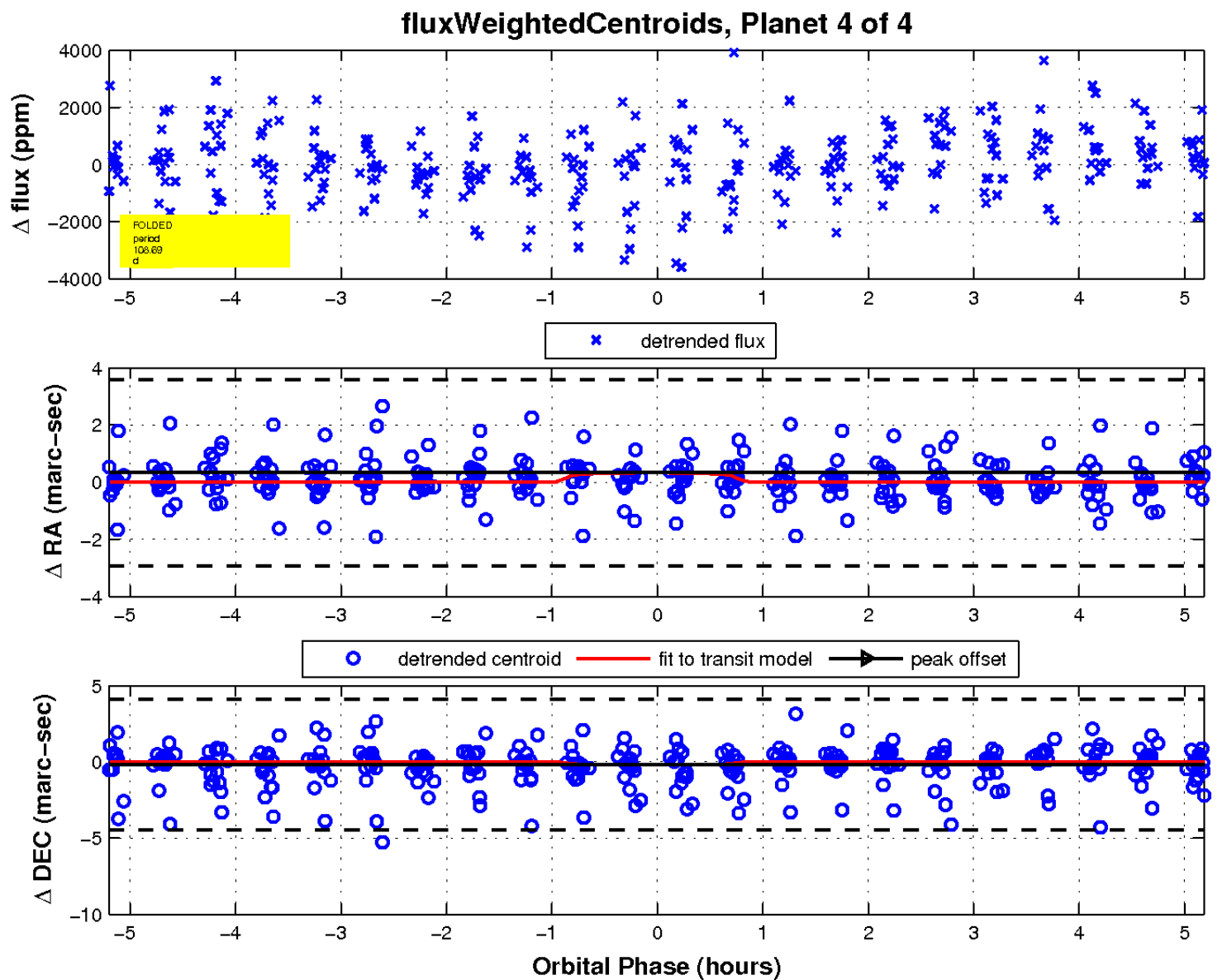
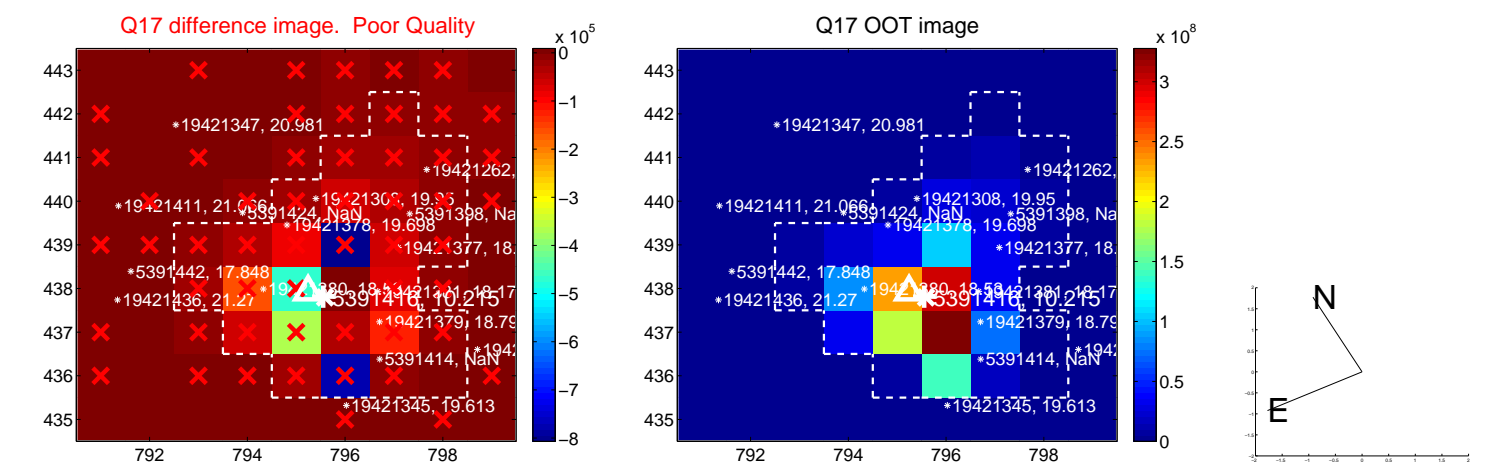
Q16 no difference image



Q16 no OOT image



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



UKIRT Image

Declination

