

# KIC 003231406

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
003231406-01	OBS	No	0.515318	131.727006	469.7	1.000	16.3	19.5	2.96	8005	6.67	133847.74
003231406-02	OBS	No	0.515321	131.979974	393.9	0.862	14.7	15.5	2.96	8005	6.35	133846.80
003231406-03	OBS	No	0.515490	131.882666	285.9	6.186	11.1	12.0	2.96	8005	5.04	133788.06

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
003231406-01	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—CENT_SATURATED
003231406-02	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—SAME_NTL_PERIOD—CENT_SATURATED
003231406-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE_ZUMA_TRACKER—LPP_DV—LPP_ALT—MOD_NONUNIQ_ALT—SAME_NTL_PERIOD—CENT_SATURATED

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

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

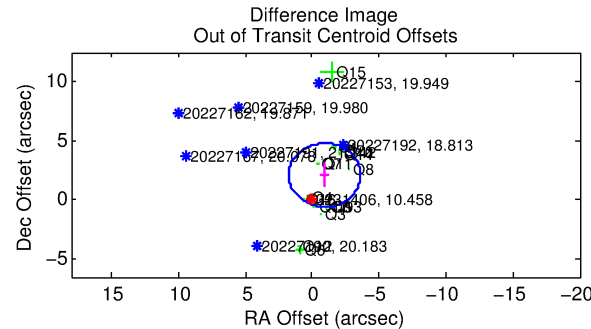
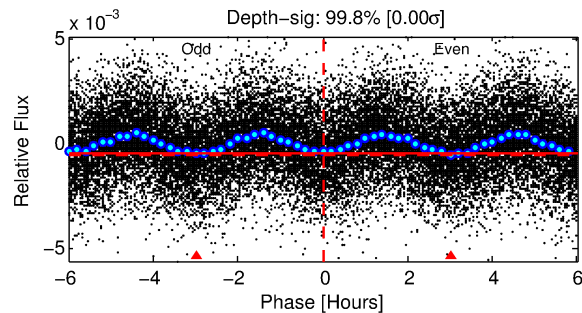
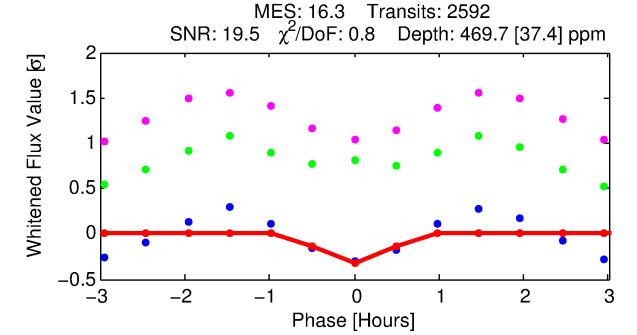
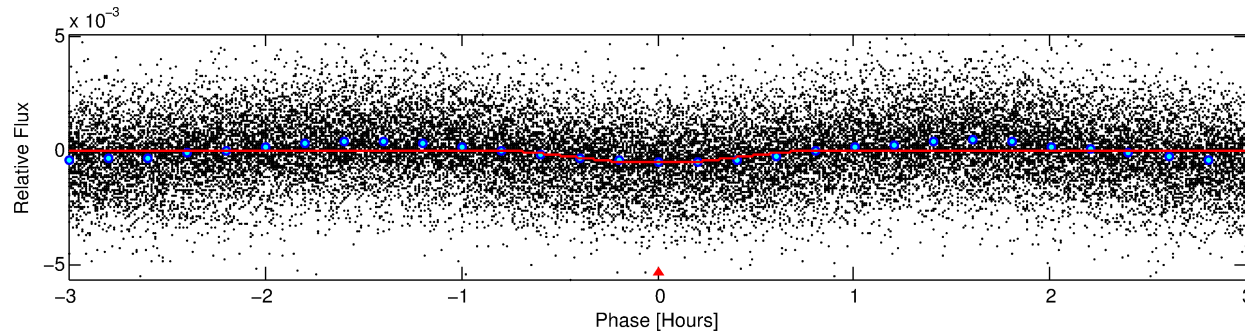
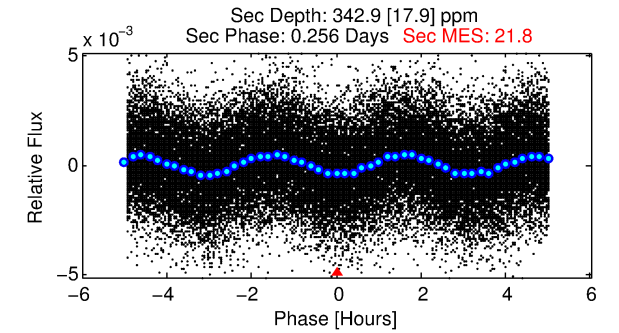
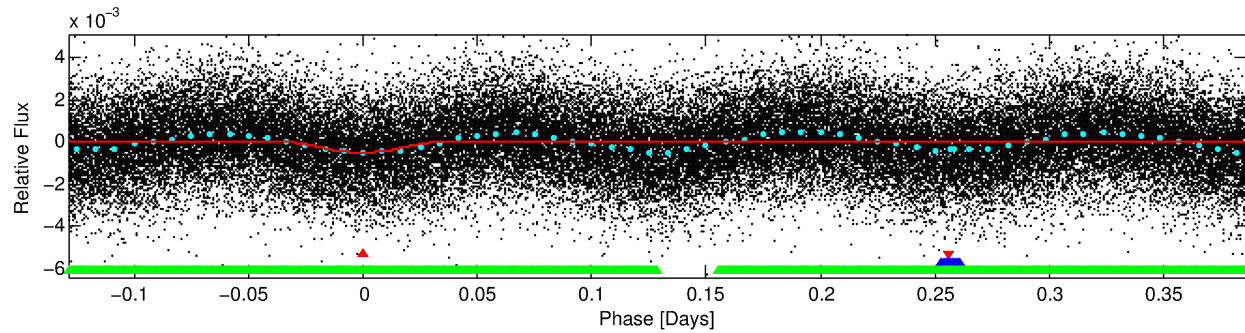
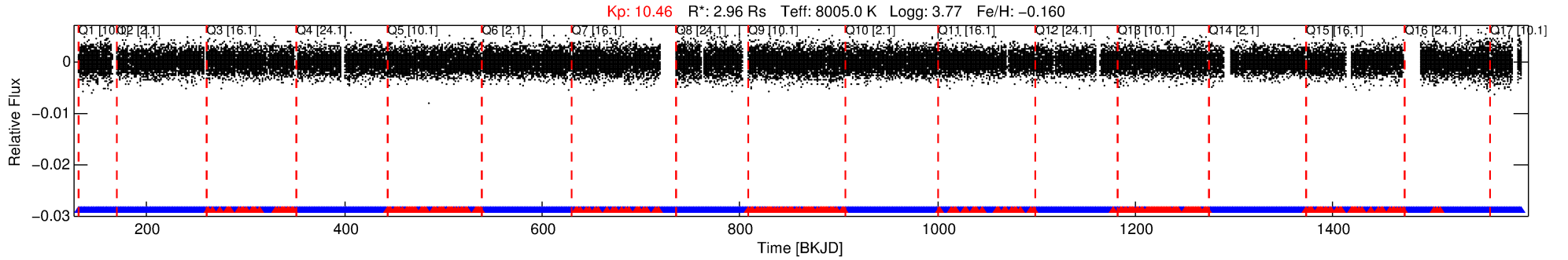
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 003231406-01

No Significant Match Found

# DV One-Page Summary

KIC: 3231406 Candidate: 1 of 3 Period: 0.515 d



## DV Fit Results:

Period = 0.51532 [0.00001] d  
Epoch = 131.7270 [0.0009] BKJD  
Rp/R\* = 0.0207 [0.0065]  
a/R\* = 3.58 [5.68]  
b = 0.50 [2.62]  
Seff = 133847.74 [92619.75]  
Teff = 4877 [844] K  
Rp = 6.67 [3.48] Re  
a = 0.0155 [0.0064] AU  
Ag = 1.02 [0.94] [0.02σ]  
Teffp = 7572 [1243] K [1.79σ]

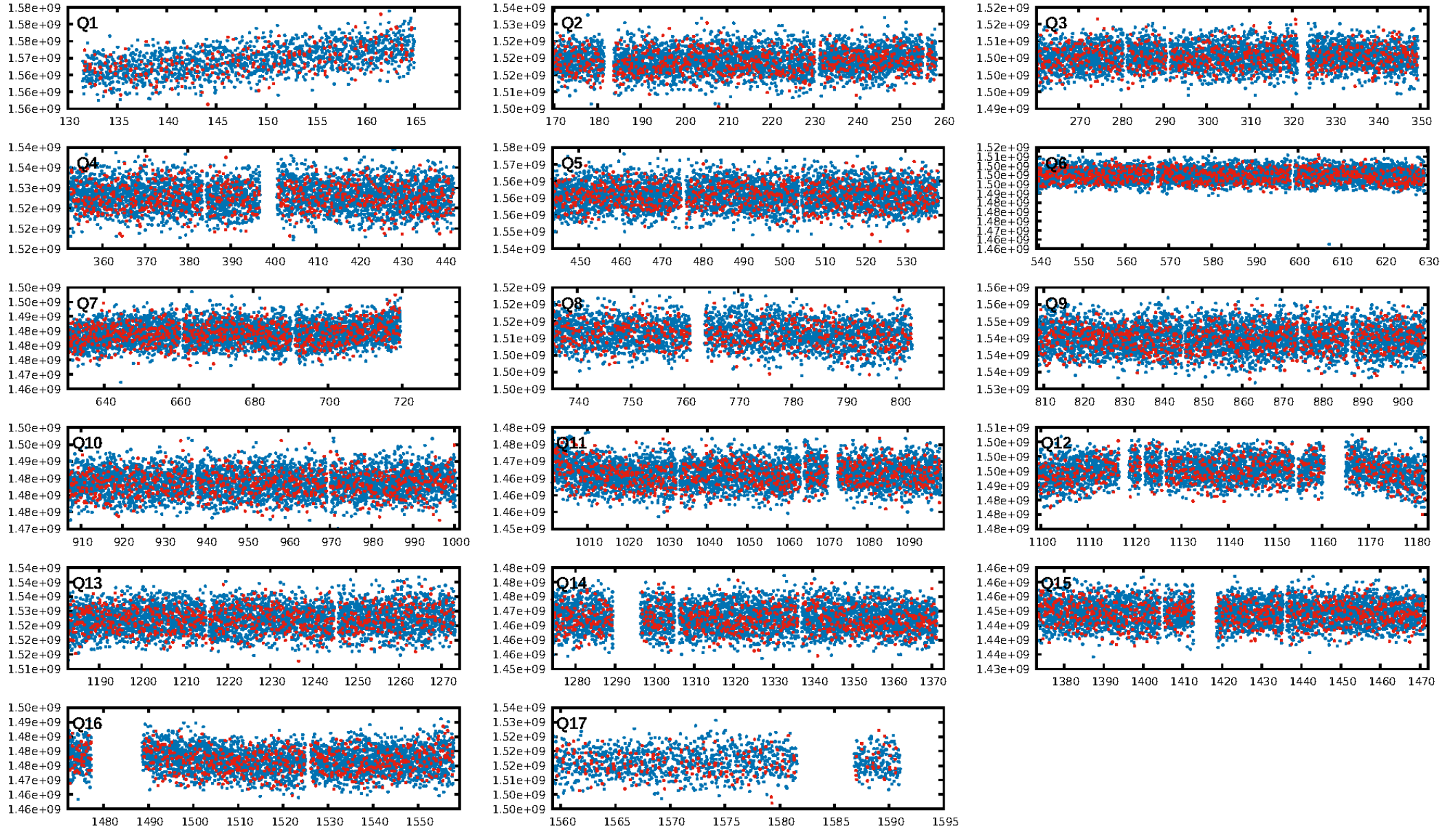
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 0.0% [0.00σ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: N/A  
RollingBand-fgt: 0.88 [2172/2476]  
GhostDiagnostic-chr: 1.404  
Centroid-sig: 55.9%  
Centroid-so: 0.266 arcsec [4.19σ]  
OotOffset-rm: 2.316 arcsec [2.59σ]  
KicOffset-rm: 2.106 arcsec [2.34σ]  
OotOffset-st: 4/4/4/5 [17]  
KicOffset-st: 4/4/4/5 [17]  
DiffImageQuality-fgm: 0.29 [5/17]  
DiffImageOverlap-fno: 0.00 [0/17]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 03-Feb-2016 09:31:25 Z

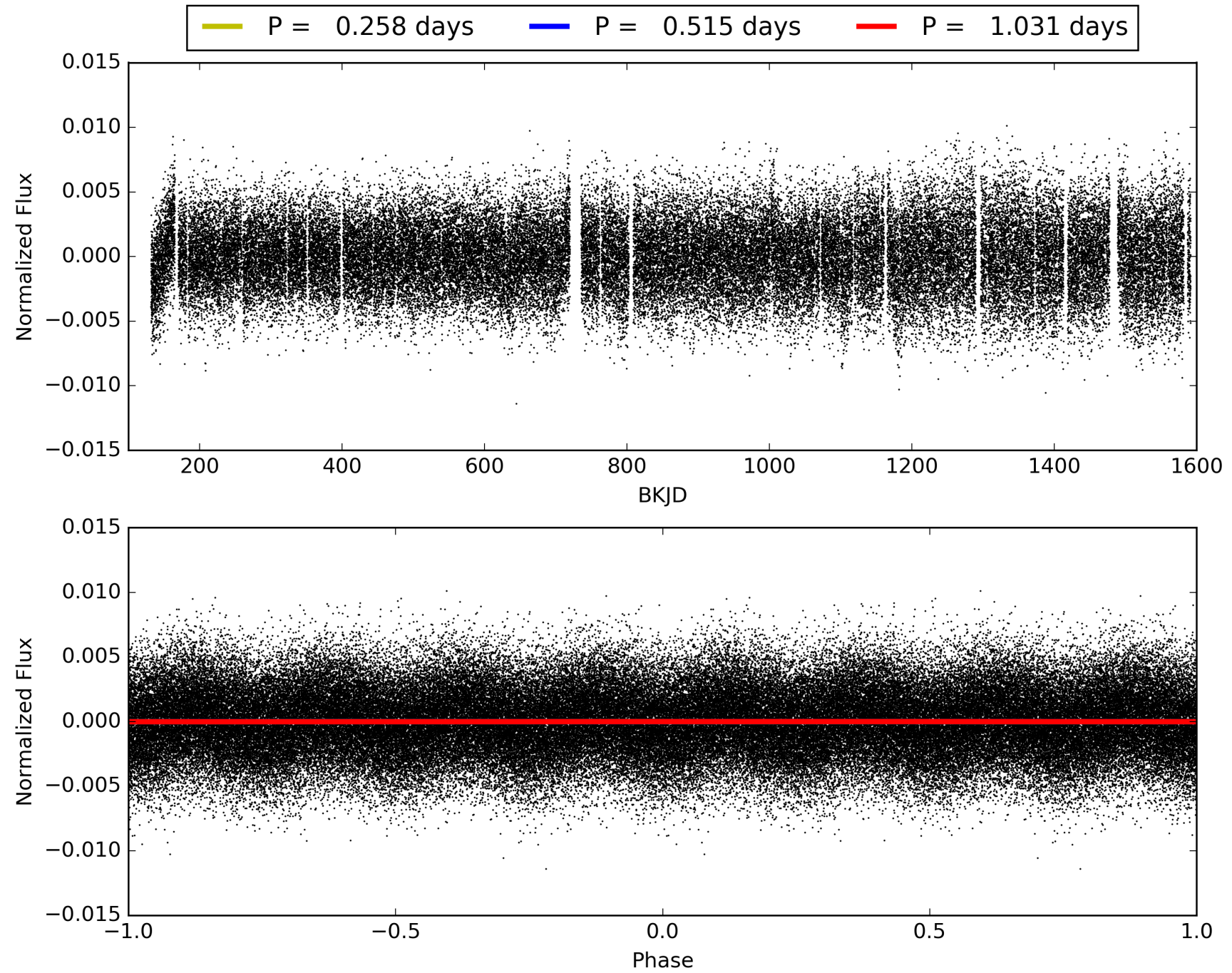
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 003231406-01, PDC Light Curves





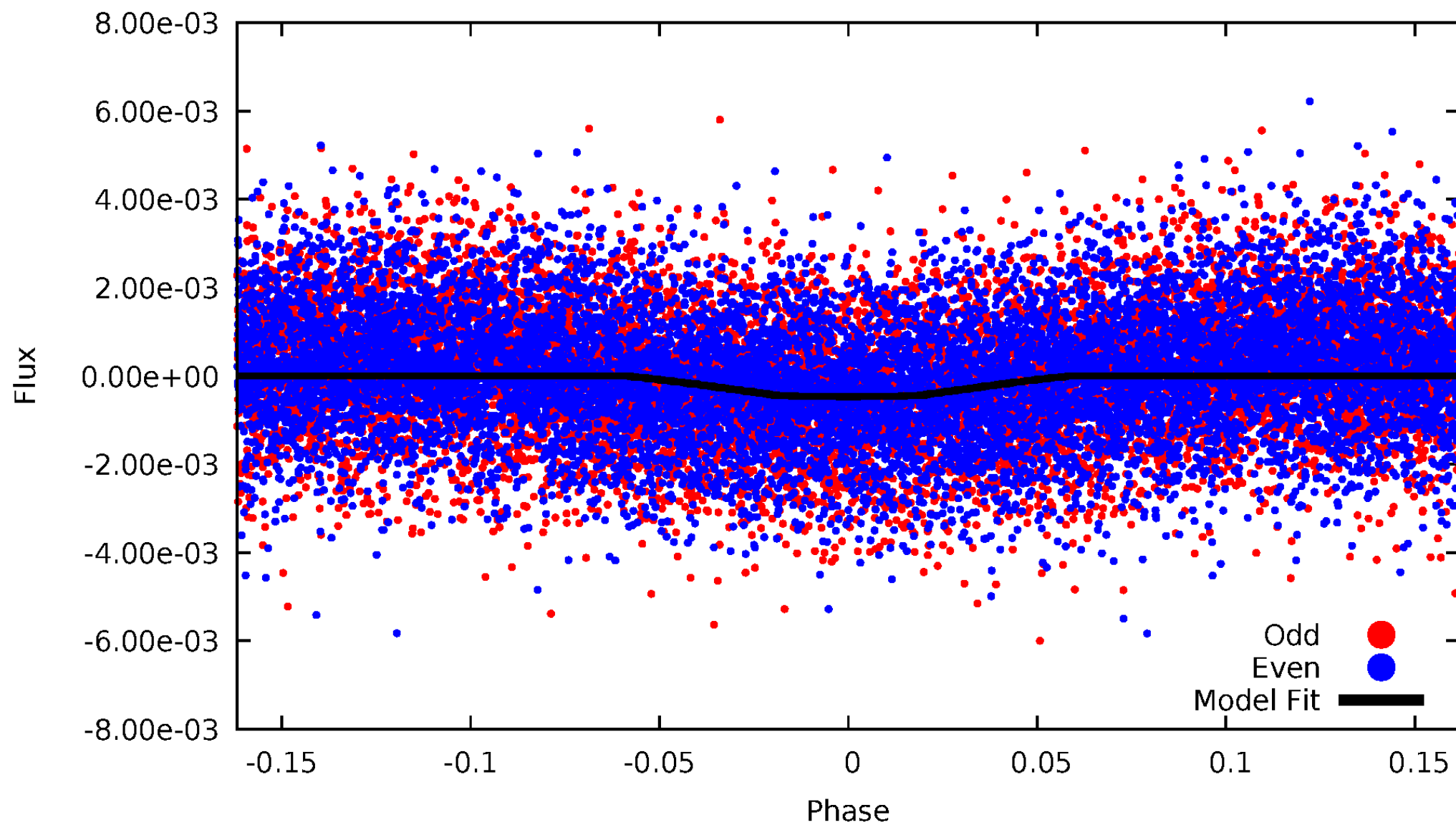
TCE 003231406-01





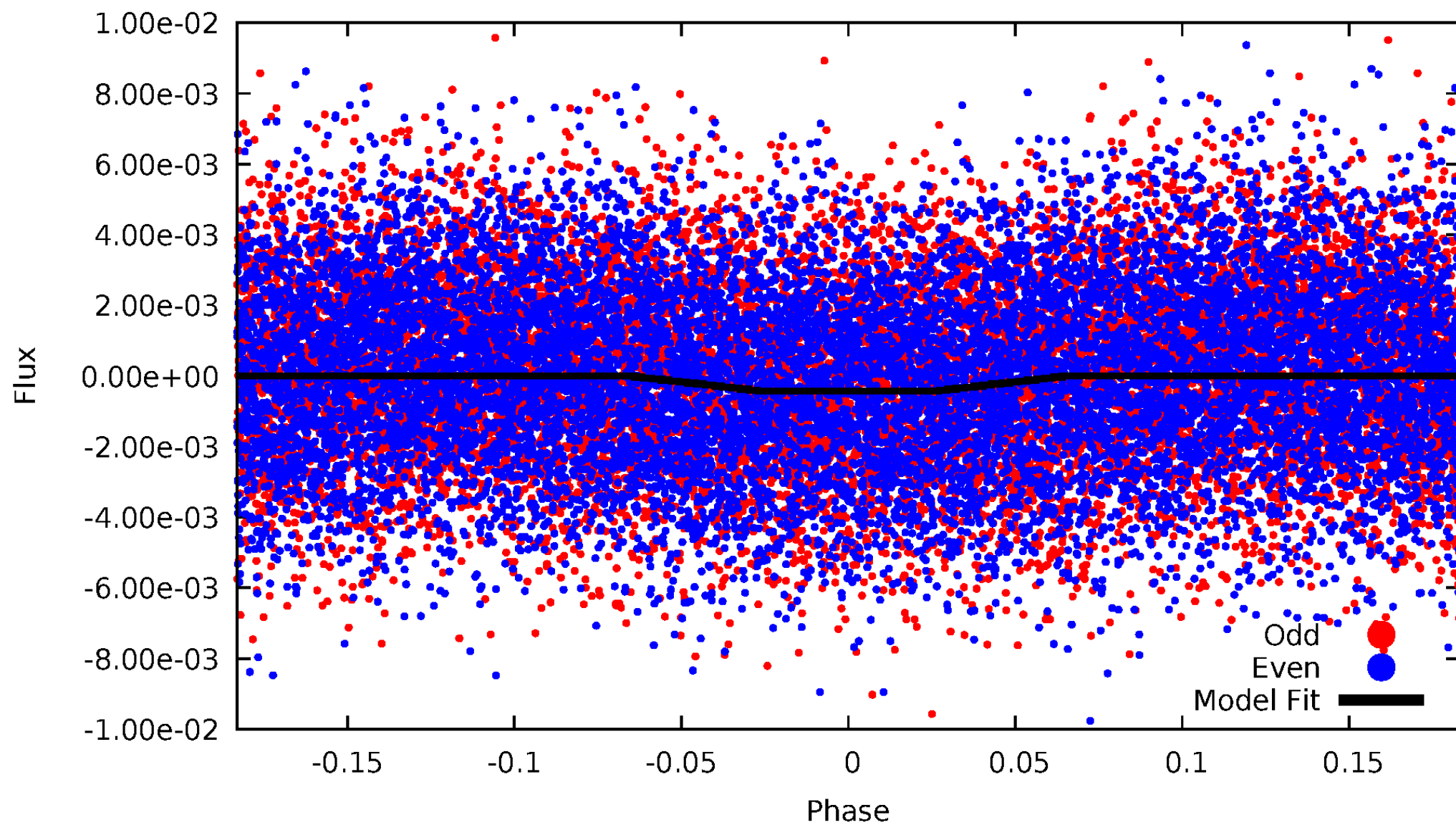
# DV Odd/Even

TCE 003231406-01



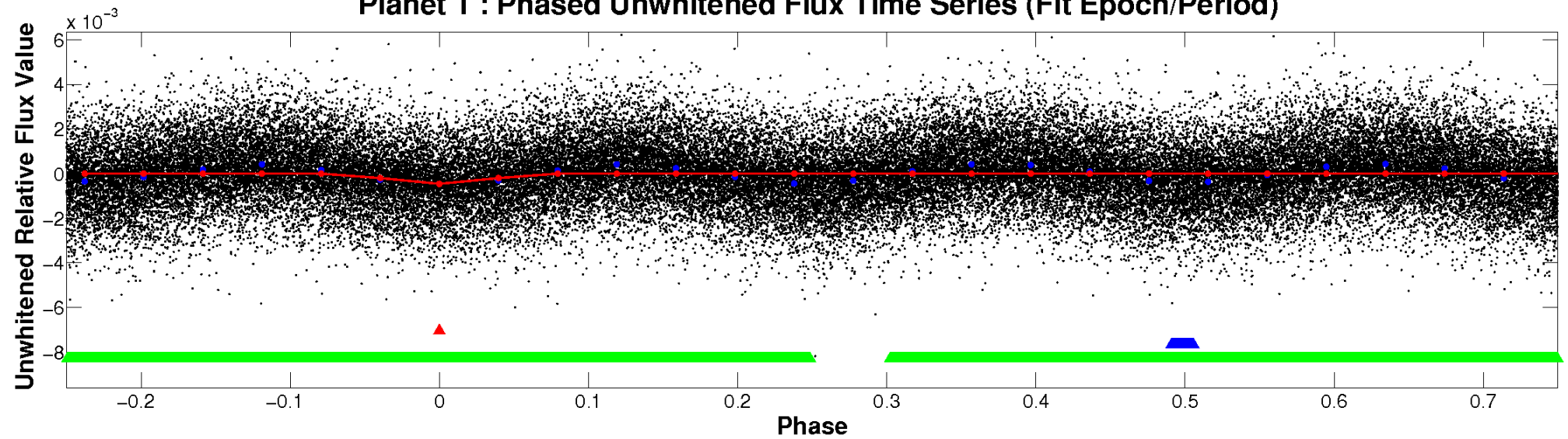
# ALT Odd/Even

TCE 003231406-01

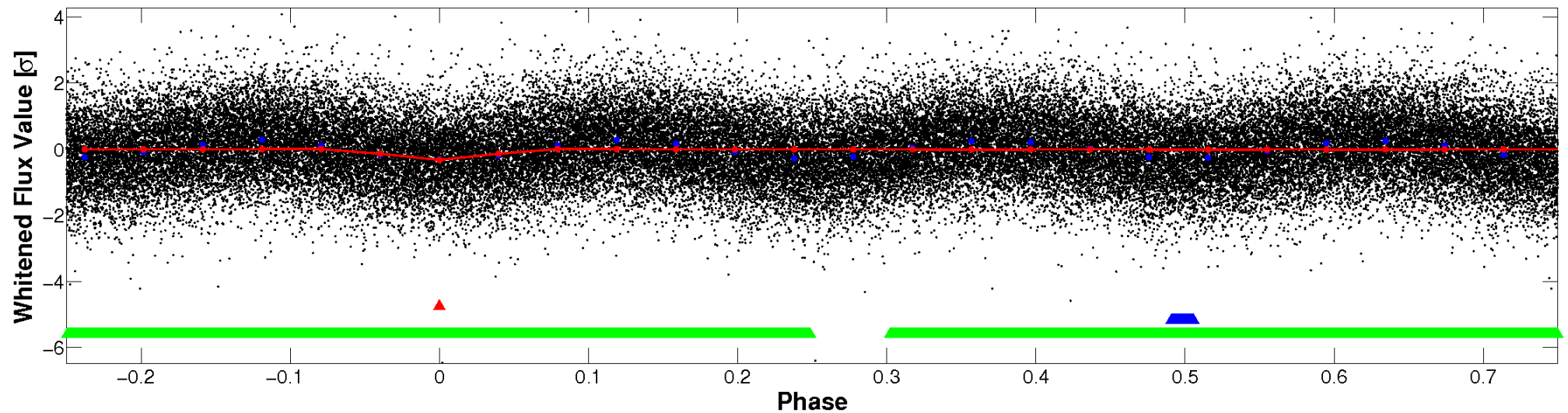


# Non-Whitened Vs. Whitened Light Curve

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



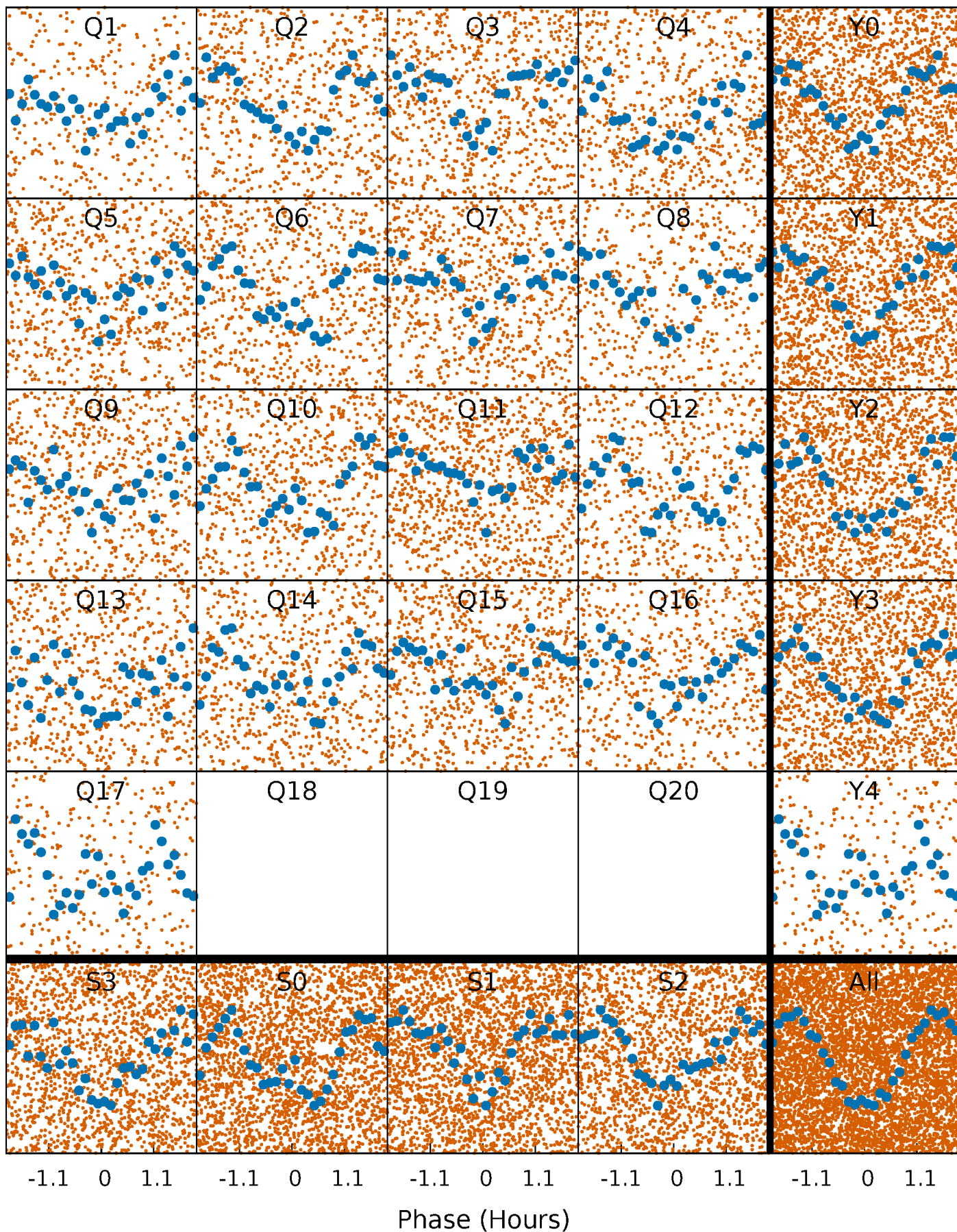
## Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)





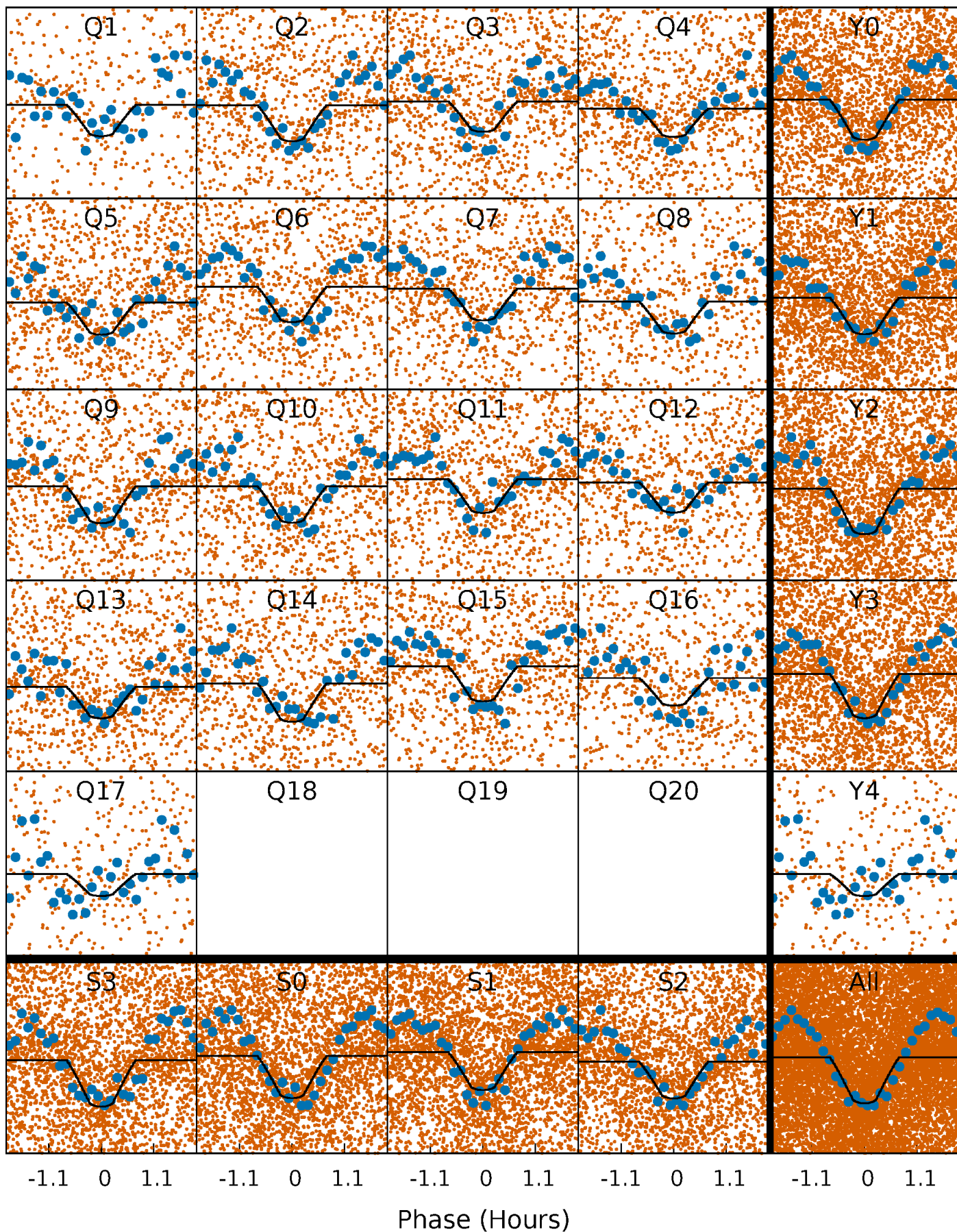
# PDC Quarter-Phased Transit Curves

TCE 003231406-01 P= 0.515318 Days  $T_0=131.727006$  (BKJD)



# DV Quarter-Phased Transit Curves

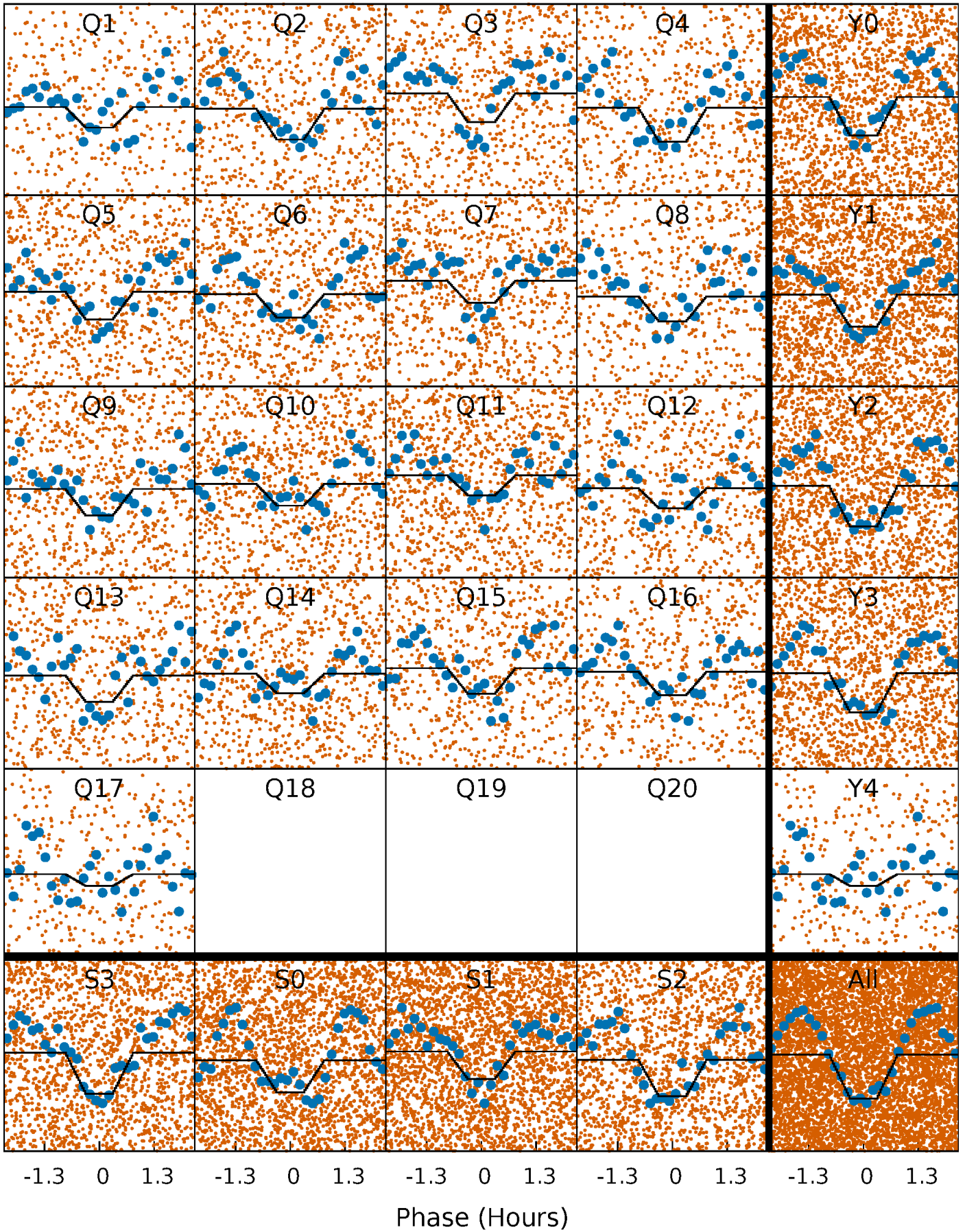
TCE 003231406-01 P= 0.515318 Days  $T_0=131.727006$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

TCE 003231406-01 P= 0.515318 Days  $T_0=131.726993$  (BKJD)

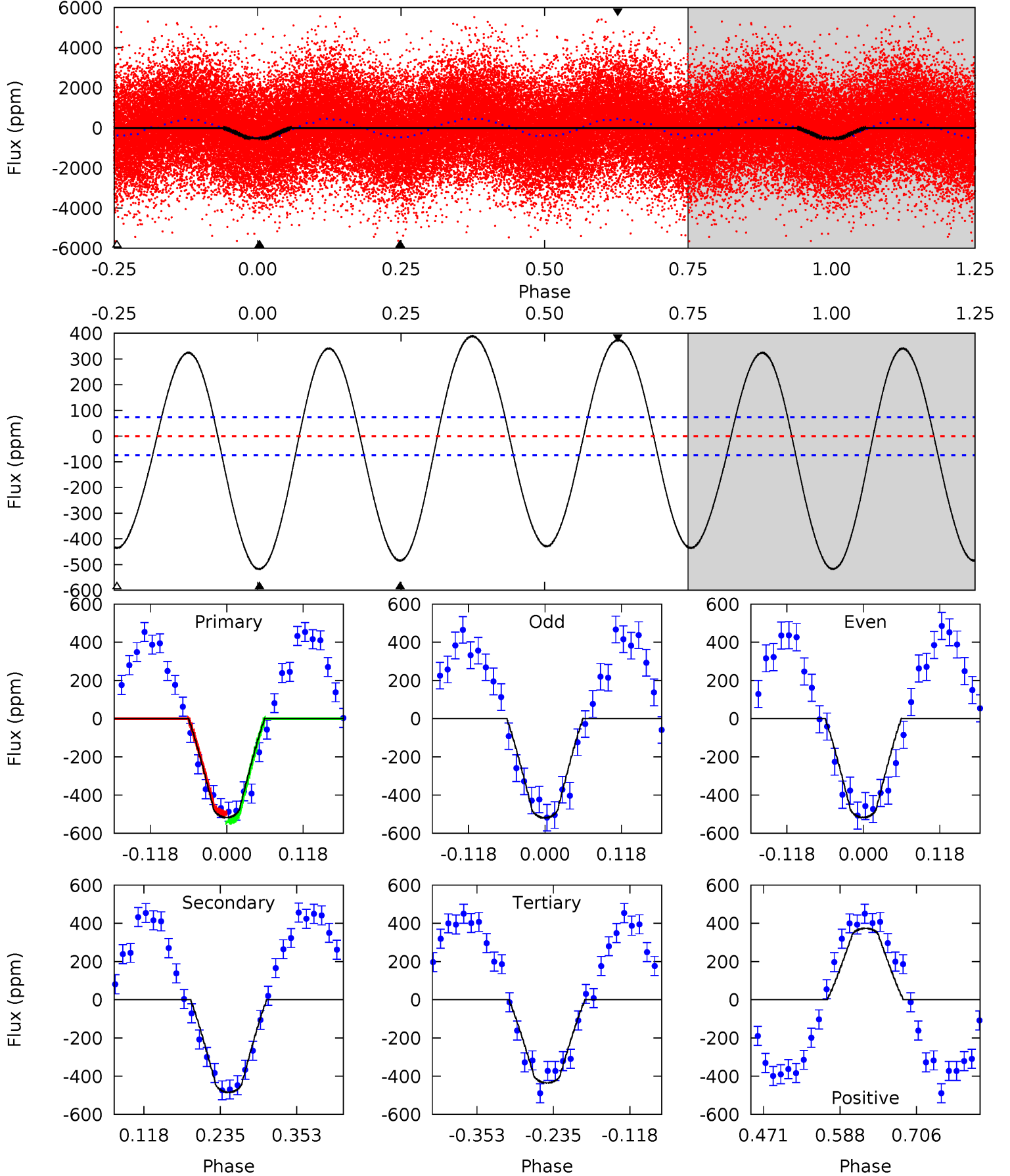




# DV Model-Shift Uniqueness Test

003231406-01, P = 0.515318 Days, E = 131.211688 Days

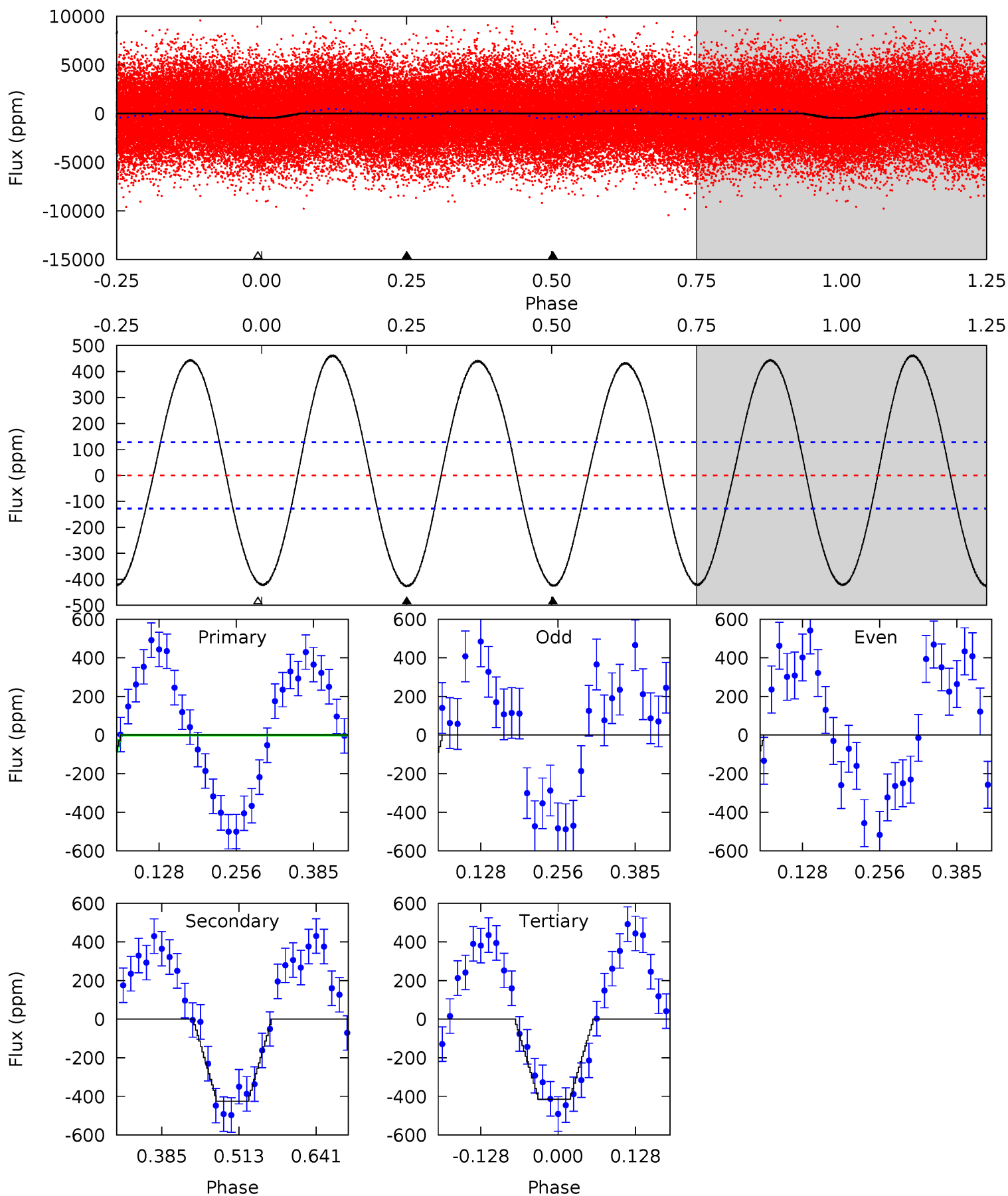
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
31.6	29.6	26.6	22.8	4.53	1.56	17.6	5.03	8.79	3.01	6.77	0.07	1.02	0.43	1.37



# Alt Model-Shift Uniqueness Test

003231406-01, P = 0.515318 Days, E = 131.211675 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
15.1	15.0	14.6	0	4.51	1.52	10.7	0.49	15.1	0.37	15.0	0.61	1.00	0.52	0.00



### Stellar Parameters For KIC 003231406

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$8005^{+222}_{-333}$	$3.768^{+0.399}_{-0.070}$	$-0.160^{+0.200}_{-0.350}$	$2.955^{+0.407}_{-1.222}$	$1.870^{+0.095}_{-0.379}$	$0.102^{+0.353}_{-0.030}$
	+3%/-4%	+11%/-2%	+125%/-219%	+14%/-41%	+5%/-20%	+346%/-30%
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 003231406-01 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	$-485 \pm 16$	$5.95^{+2.49}_{-2.18}$	$6565^{+468}_{-748}$	$7740^{+2457}_{-1483}$	$1.814^{+2.380}_{-0.919}$
Alt.	$-425 \pm 28$	$5.92^{+2.36}_{-2.19}$	$6556^{+451}_{-720}$	$7372^{+2674}_{-1363}$	$1.555^{+2.337}_{-0.745}$

$T_{\text{max}}$  = Theoretical Maximum Planetary Temperature  
 $T_{\text{obs}}$  = Observed Planetary Temperature (Assuming  $A=0.3$ )  
 $A_{\text{obs}}$  = Observed Albedo (Assuming  $T=0$ )

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



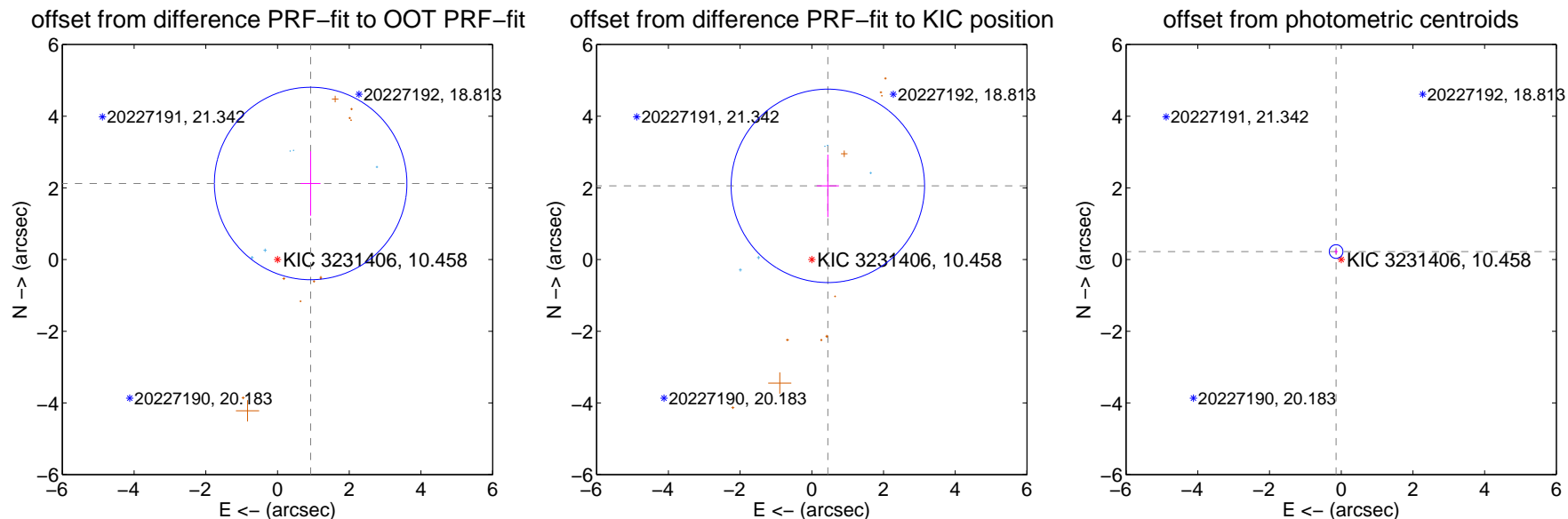
## DV Centroid Data

Supplemental centroid analysis for 003231406-01. **Kepler magnitude: 10.46.** Transit SNR 19.47

There are 5 quarters with good PRF difference image offsets

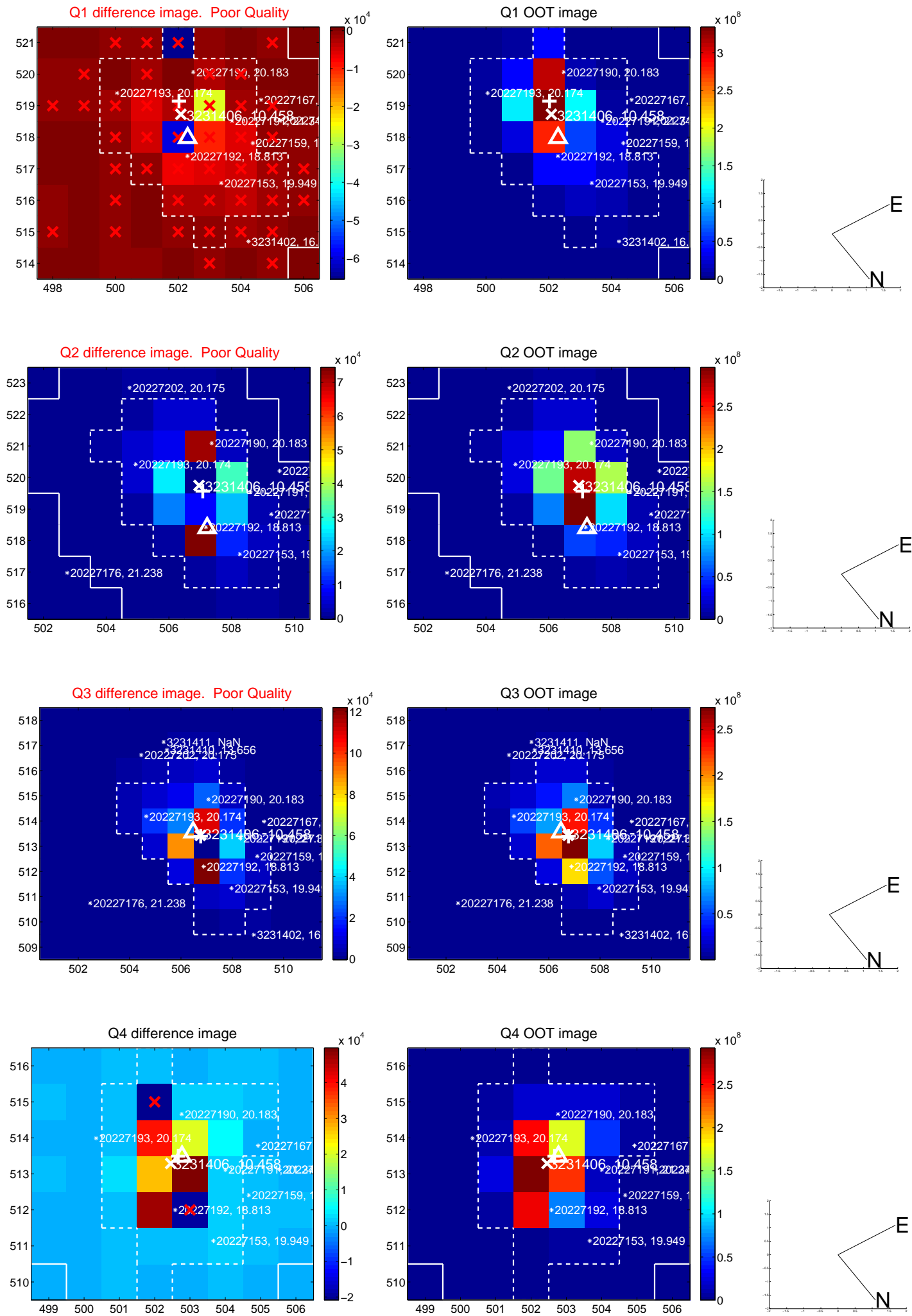
The direct PRF centroid is offset from the target star catalog position by about 1.91 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$2.316 \pm 0.895$	2.59	$-0.924 \pm 0.275$	$2.124 \pm 0.897$
PRF-fit source offset from KIC position	$2.106 \pm 0.900$	2.34	$-0.447 \pm 0.309$	$2.058 \pm 0.873$
photometric centroid source offset	<b><math>0.27 \pm 0.06</math></b>	<b>4.19</b>	$0.14 \pm 0.05$	$0.22 \pm 0.07$

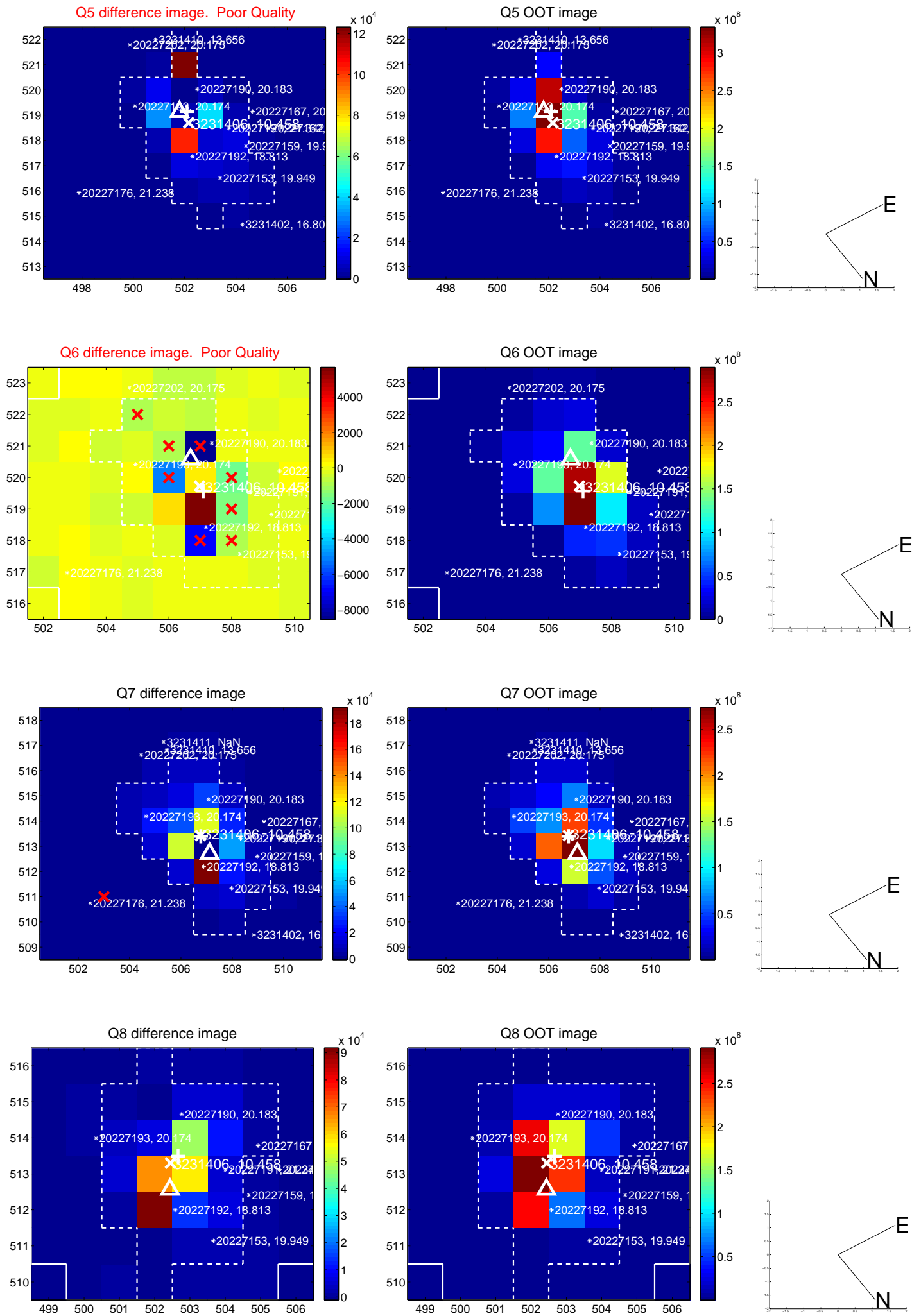


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

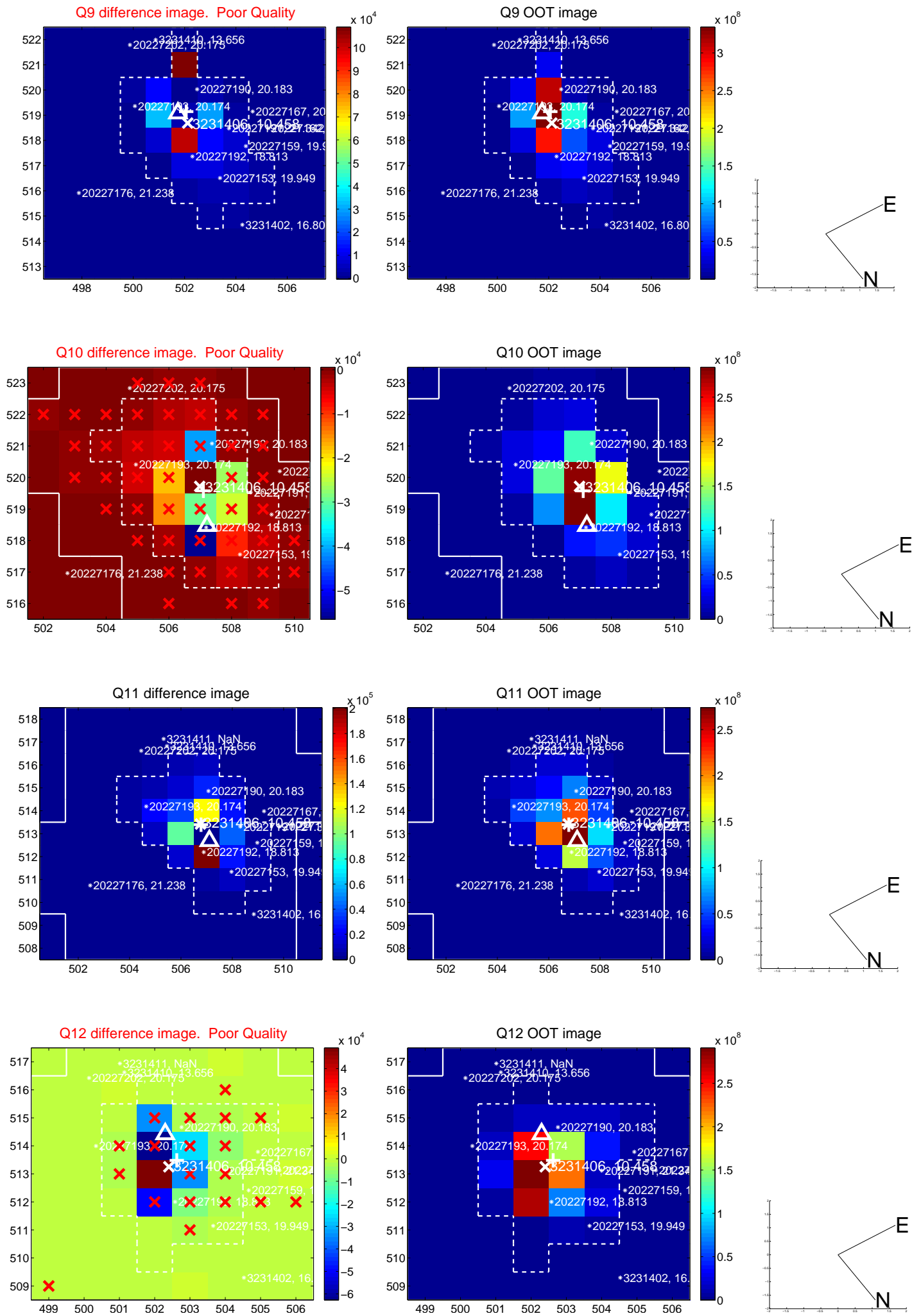


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

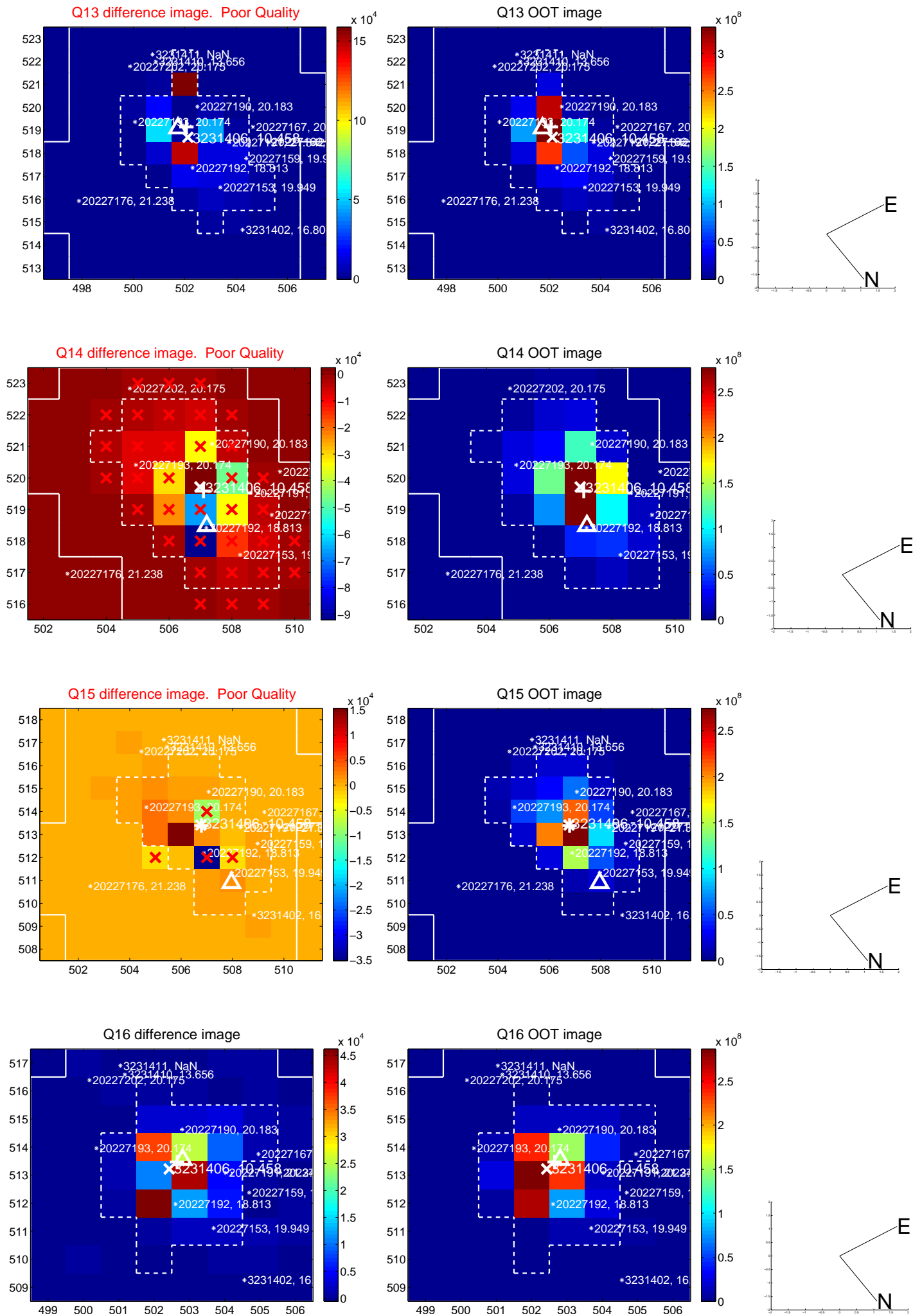




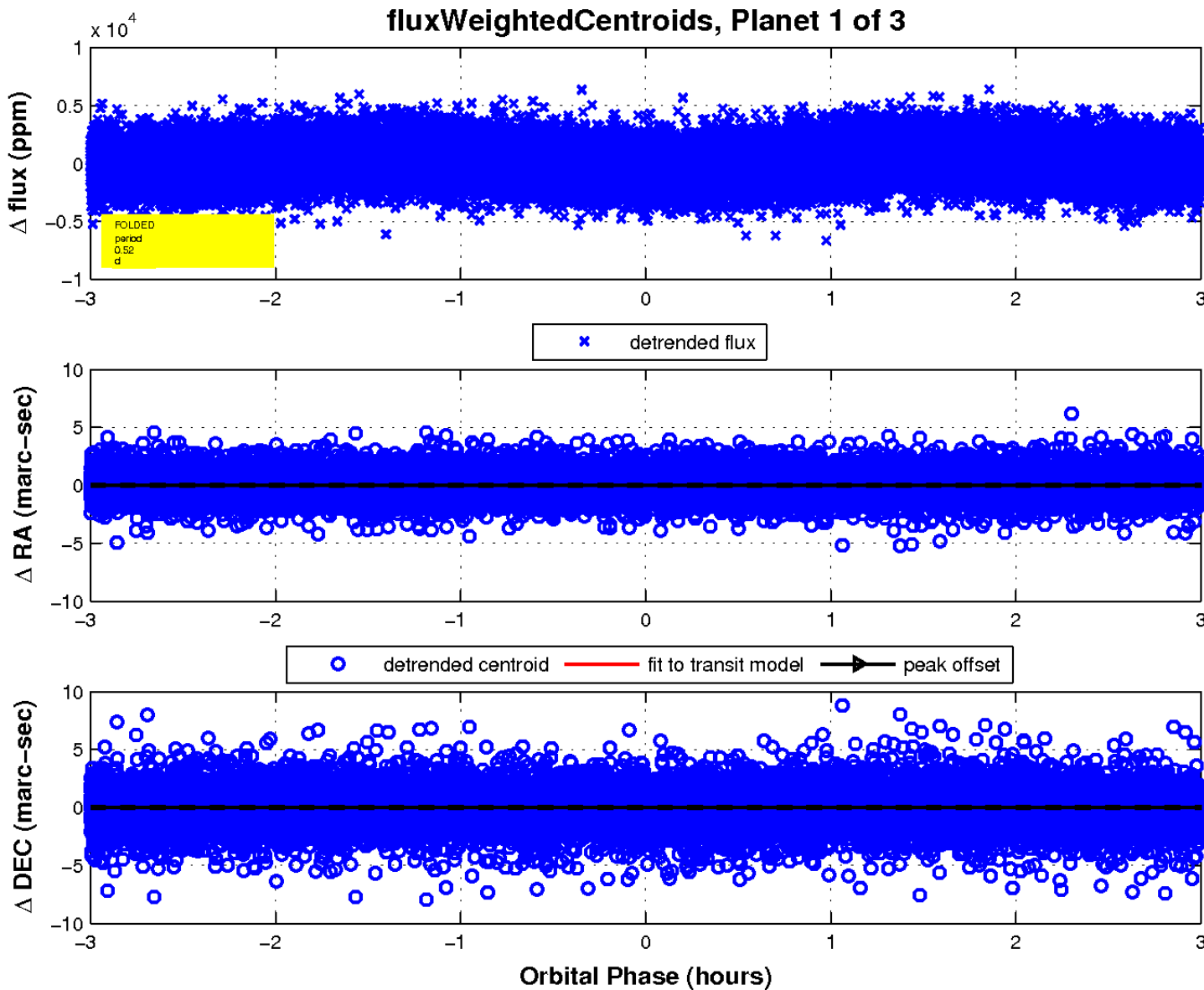
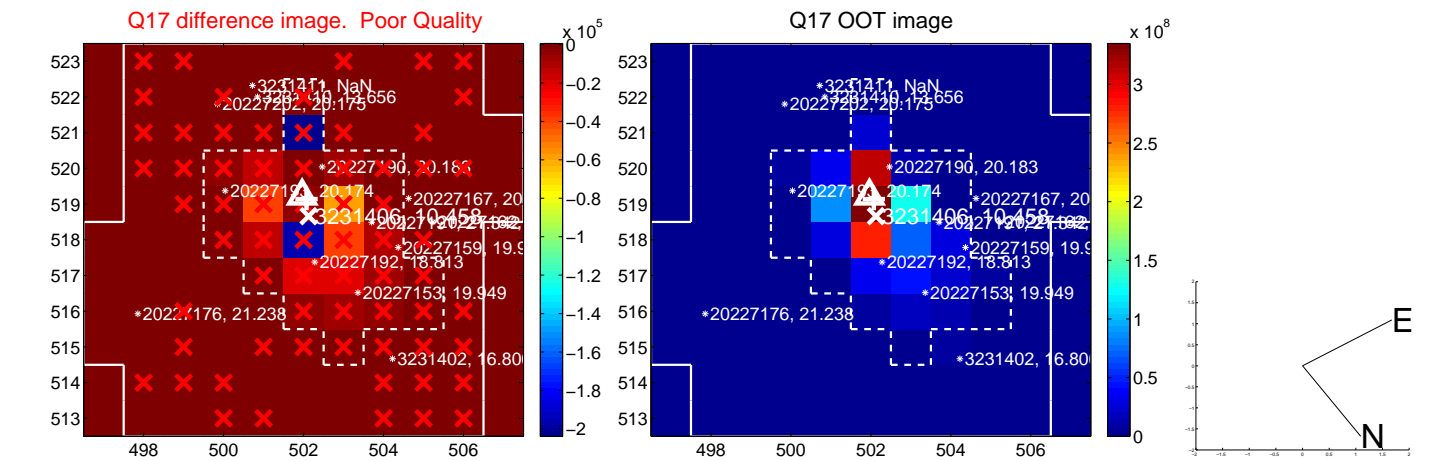
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



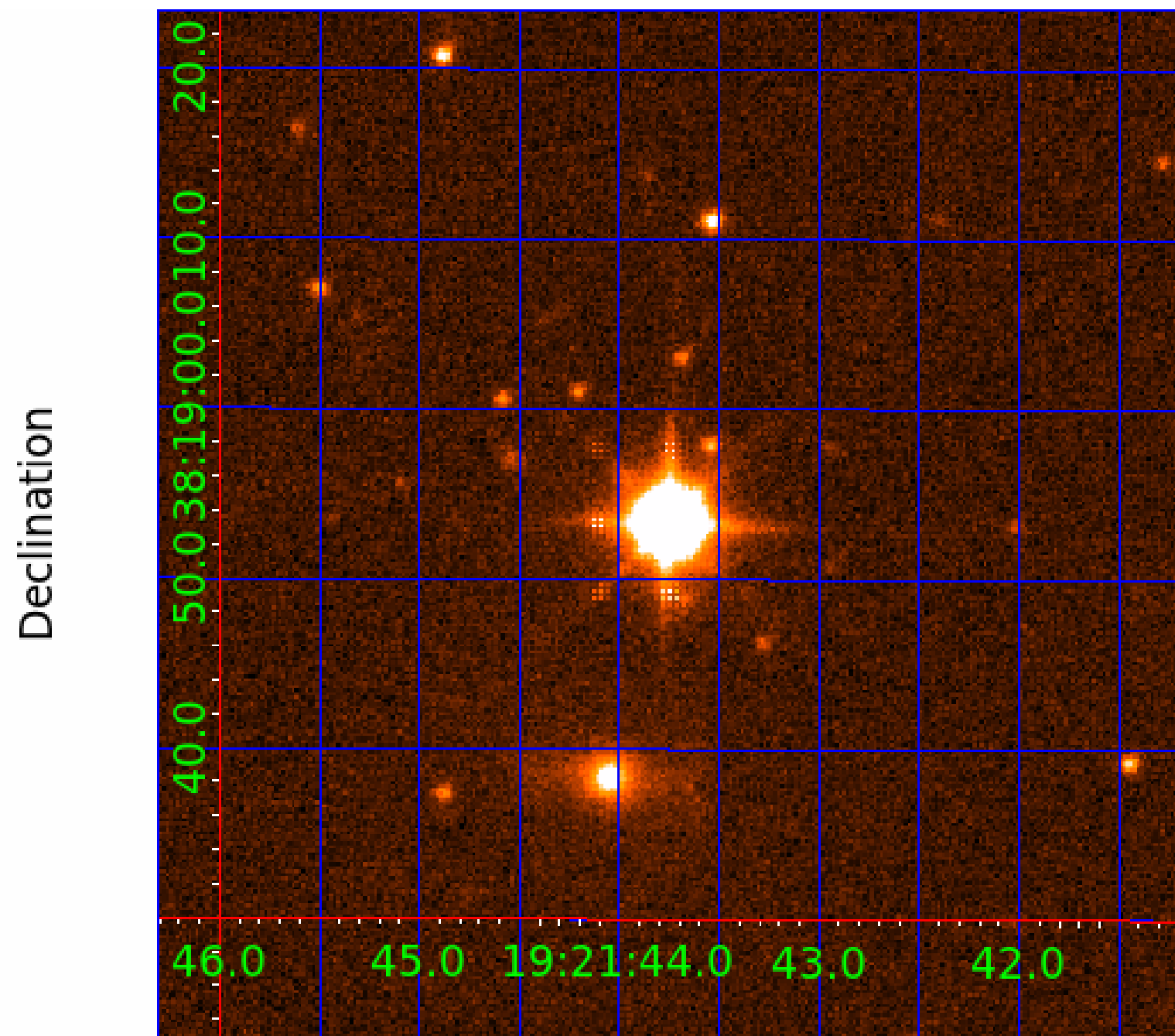
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



UKIRT Image



# KIC 003231406

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
003231406-01	OBS	No	0.515318	131.727006	469.7	1.000	16.3	19.5	2.96	8005	6.67	133847.74
003231406-02	OBS	No	0.515321	131.979974	393.9	0.862	14.7	15.5	2.96	8005	6.35	133846.80
003231406-03	OBS	No	0.515490	131.882666	285.9	6.186	11.1	12.0	2.96	8005	5.04	133788.06

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
003231406-01	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—CENT_SATURATED
003231406-02	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—SAME_NTL_PERIOD—CENT_SATURATED
003231406-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE_ZUMA_TRACKER—LPP_DV—LPP_ALT—MOD_NONUNIQ_ALT—SAME_NTL_PERIOD—CENT_SATURATED

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

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

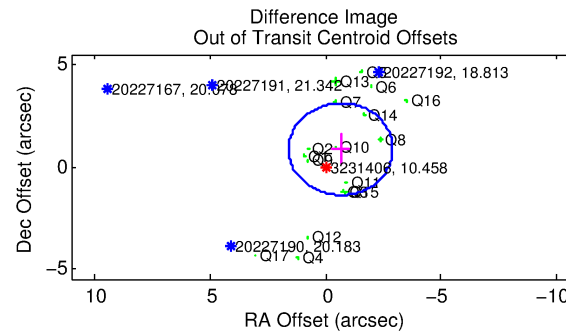
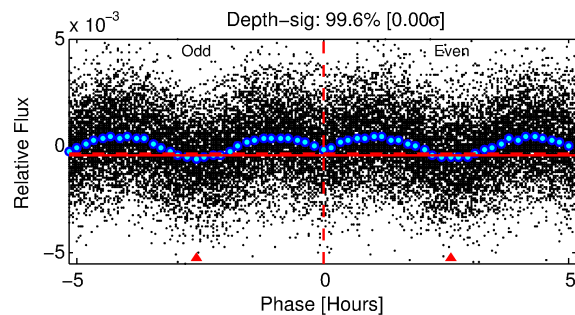
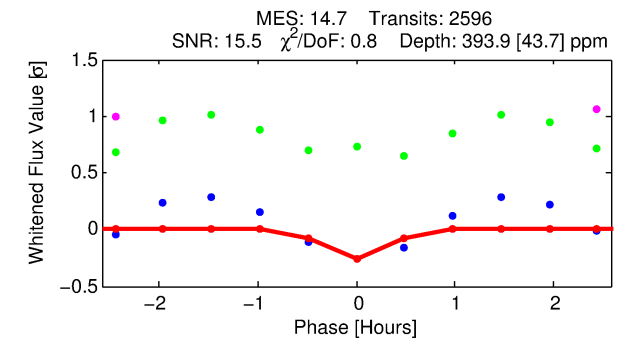
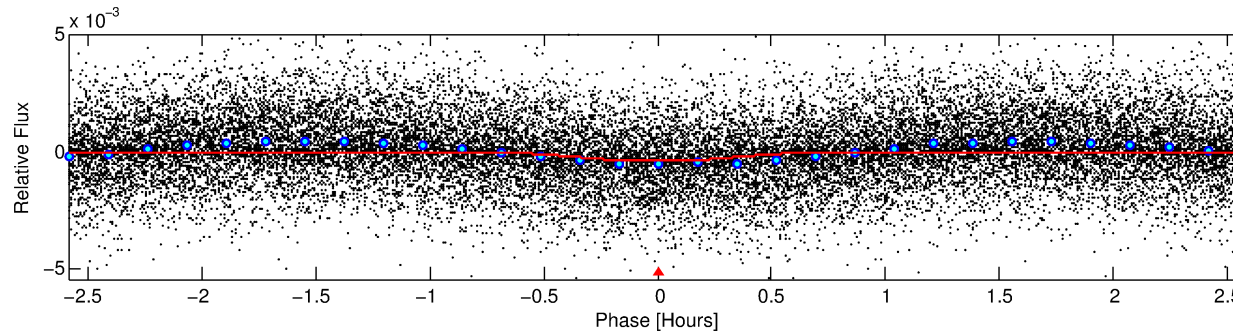
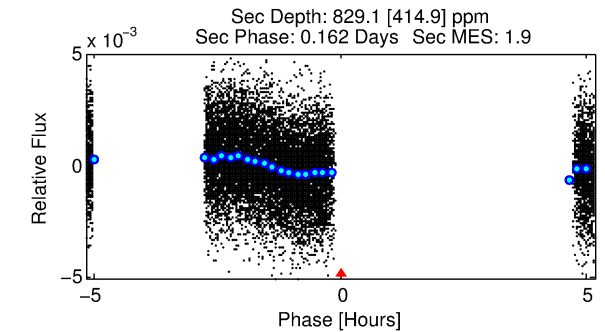
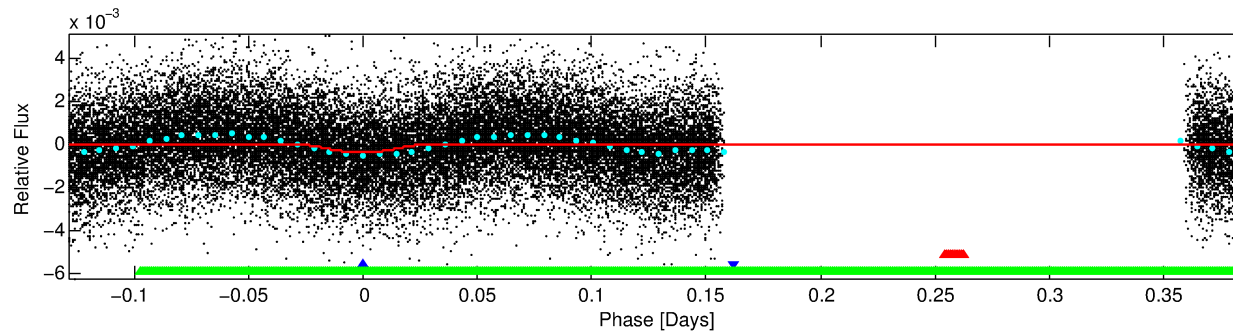
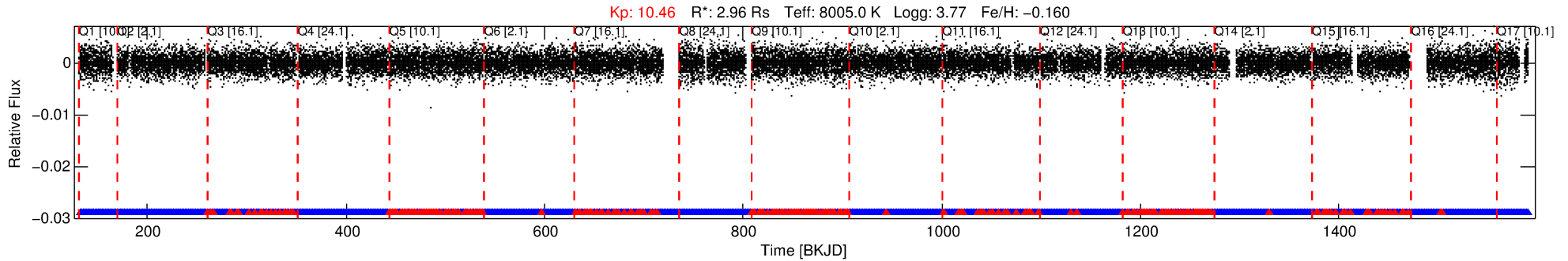
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 003231406-02

No Significant Match Found

# DV One-Page Summary

KIC: 3231406 Candidate: 2 of 3 Period: 0.515 d



## DV Fit Results:

Period = 0.51532 [0.00001] d  
Epoch = 131.9800 [0.0011] BKJD  
Rp/R\* = 0.0197 [0.0061]  
a/R\* = 3.50 [5.37]  
b = 0.70 [1.25]  
Seff = 133846.80 [92619.11]  
Teff = 4877 [844] K  
Rp = 6.35 [3.27] Re  
a = 0.0155 [0.0064] AU  
Ag = 2.72 [2.83] [0.61 $\sigma$ ]  
Teffp = 9682 [1962] K [2.25 $\sigma$ ]

## DV Diagnostic Results:

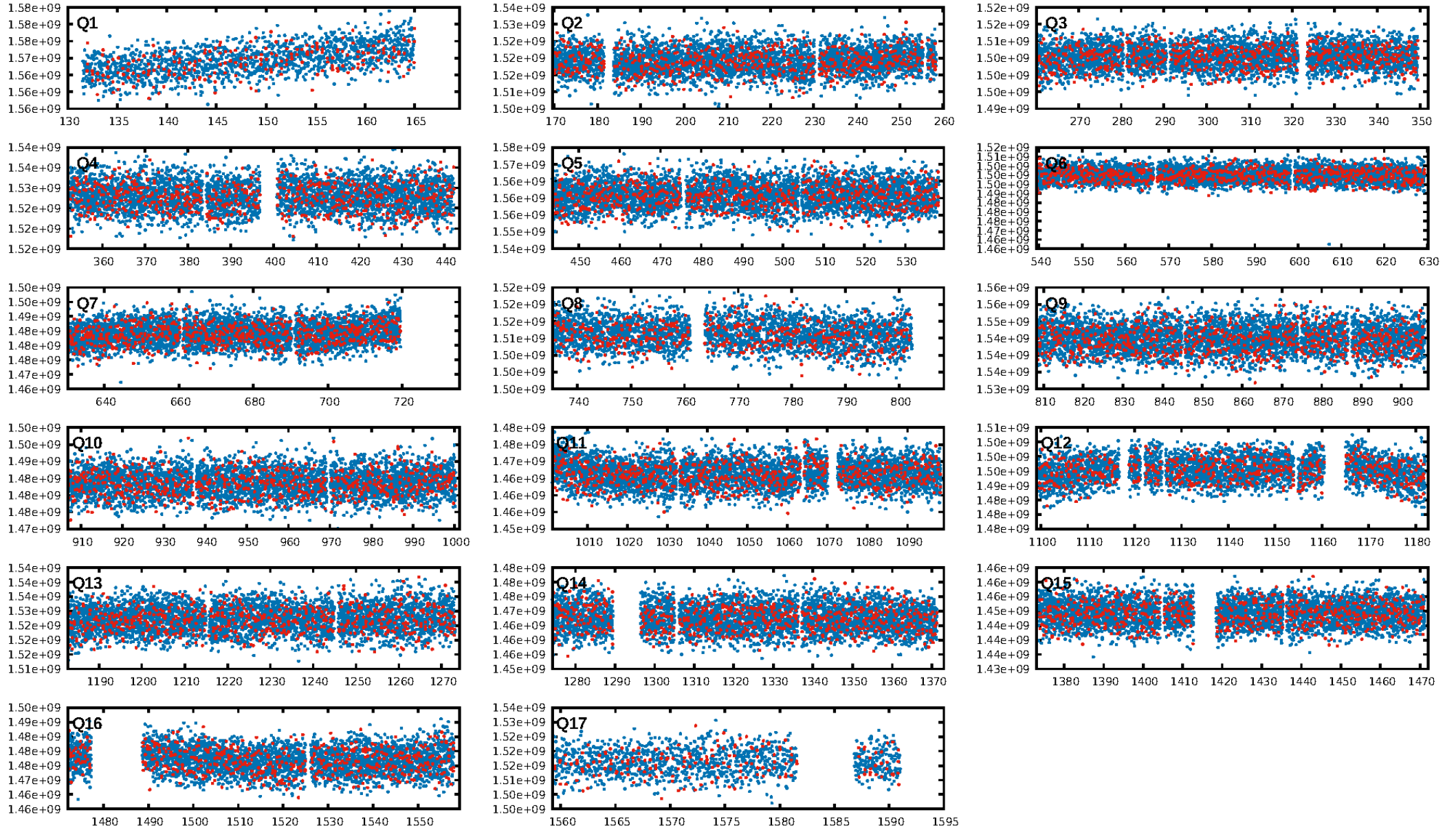
ShortPeriod-sig: 0.0% [0.00 $\sigma$ ]  
LongPeriod-sig: 0.1% [0.00 $\sigma$ ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: N/A  
RollingBand-fgt: 0.87 [2169/2479]  
GhostDiagnostic-chr: 1.916  
Centroid-sig: 13.8%  
Centroid-so: 0.331 arcsec [3.94 $\sigma$ ]  
OotOffset-rm: 1.074 arcsec [1.43 $\sigma$ ]  
KicOffset-rm: 1.349 arcsec [1.74 $\sigma$ ]  
OotOffset-st: 4/4/4/5 [17]  
KicOffset-st: 4/4/4/5 [17]  
DiffImageQuality-fgm: 0.24 [4/17]  
DiffImageOverlap-fno: 0.00 [0/17]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 03-Feb-2016 09:31:35 Z

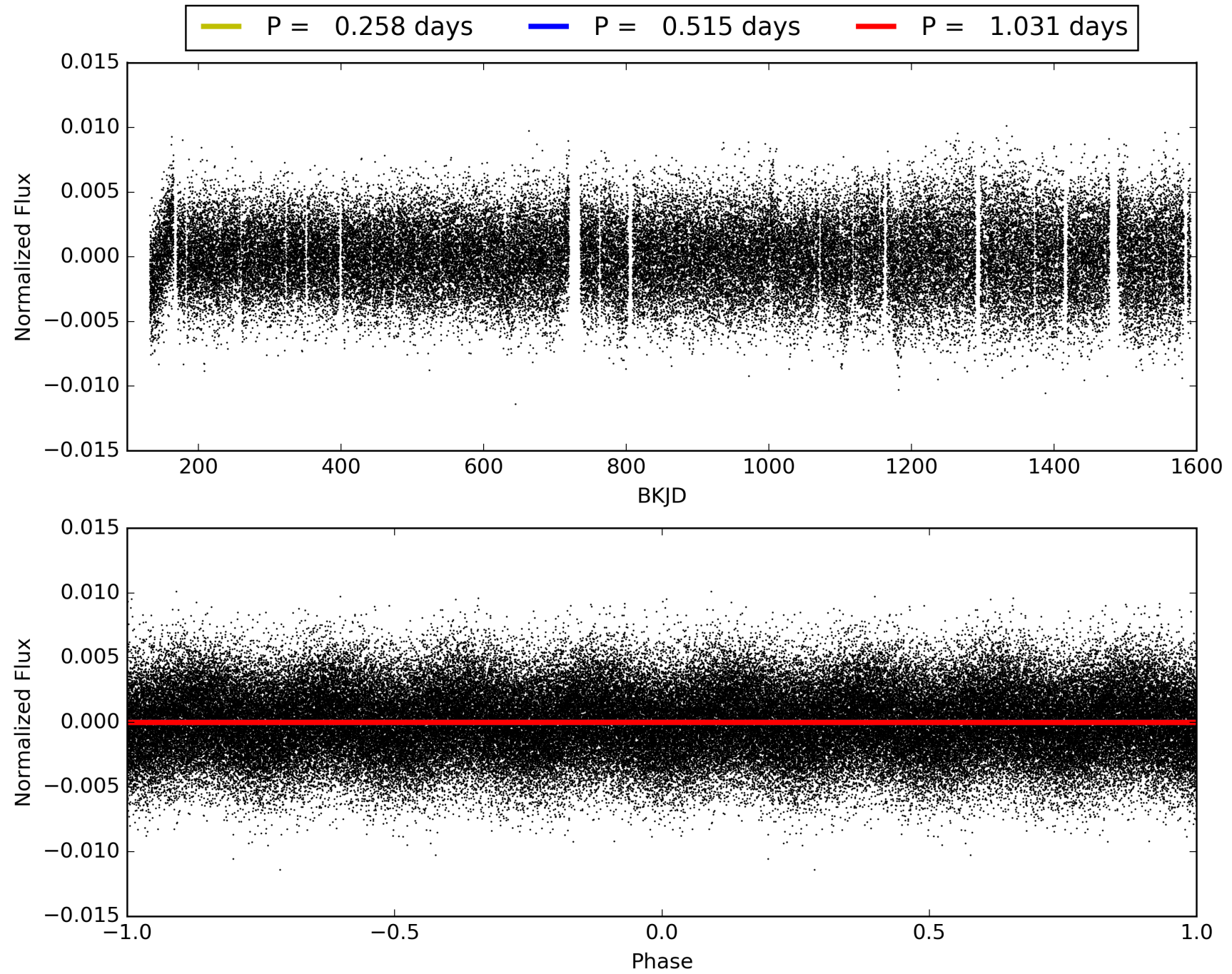
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center



# TCE 003231406-02, PDC Light Curves

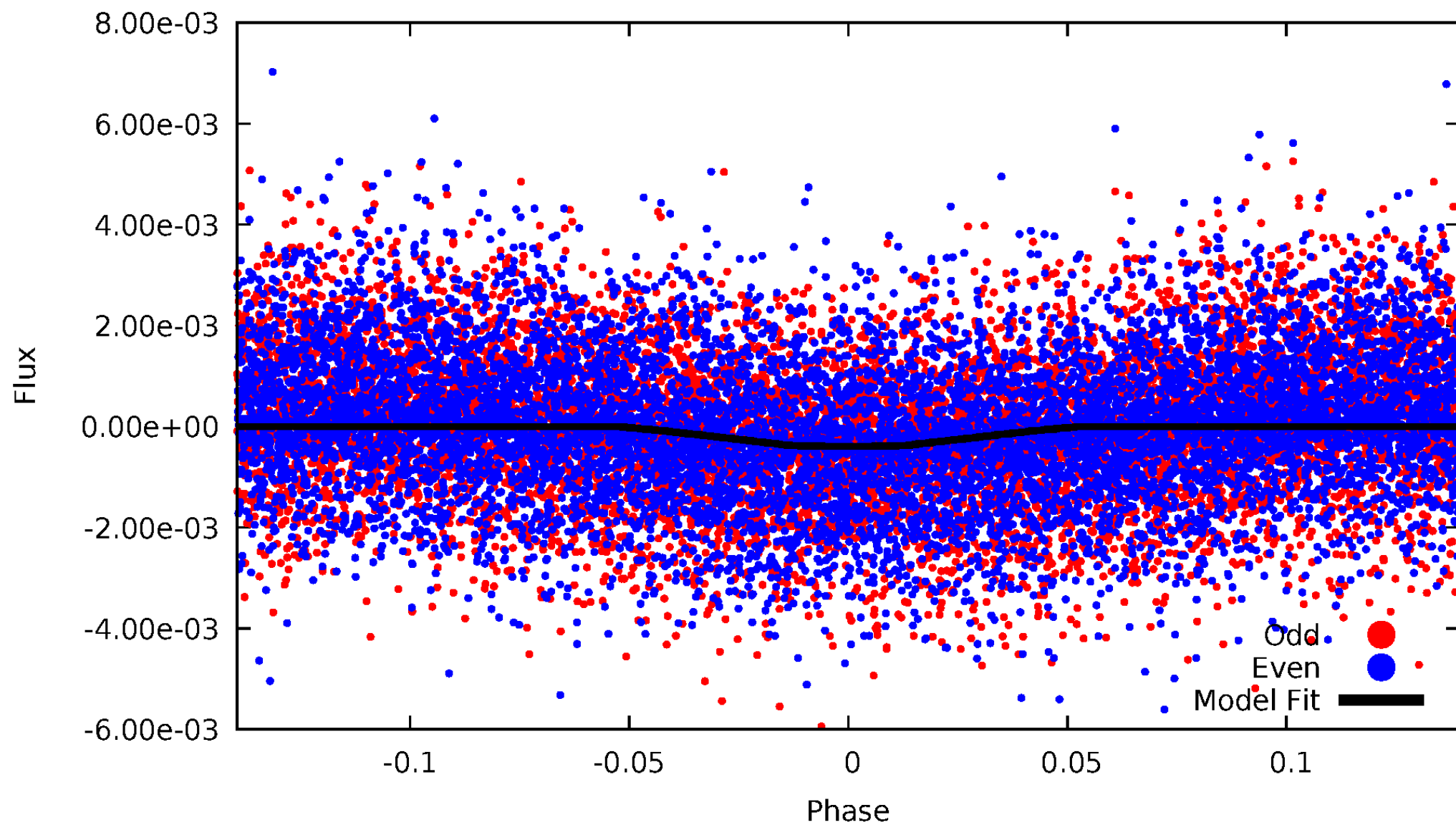


TCE 003231406-02



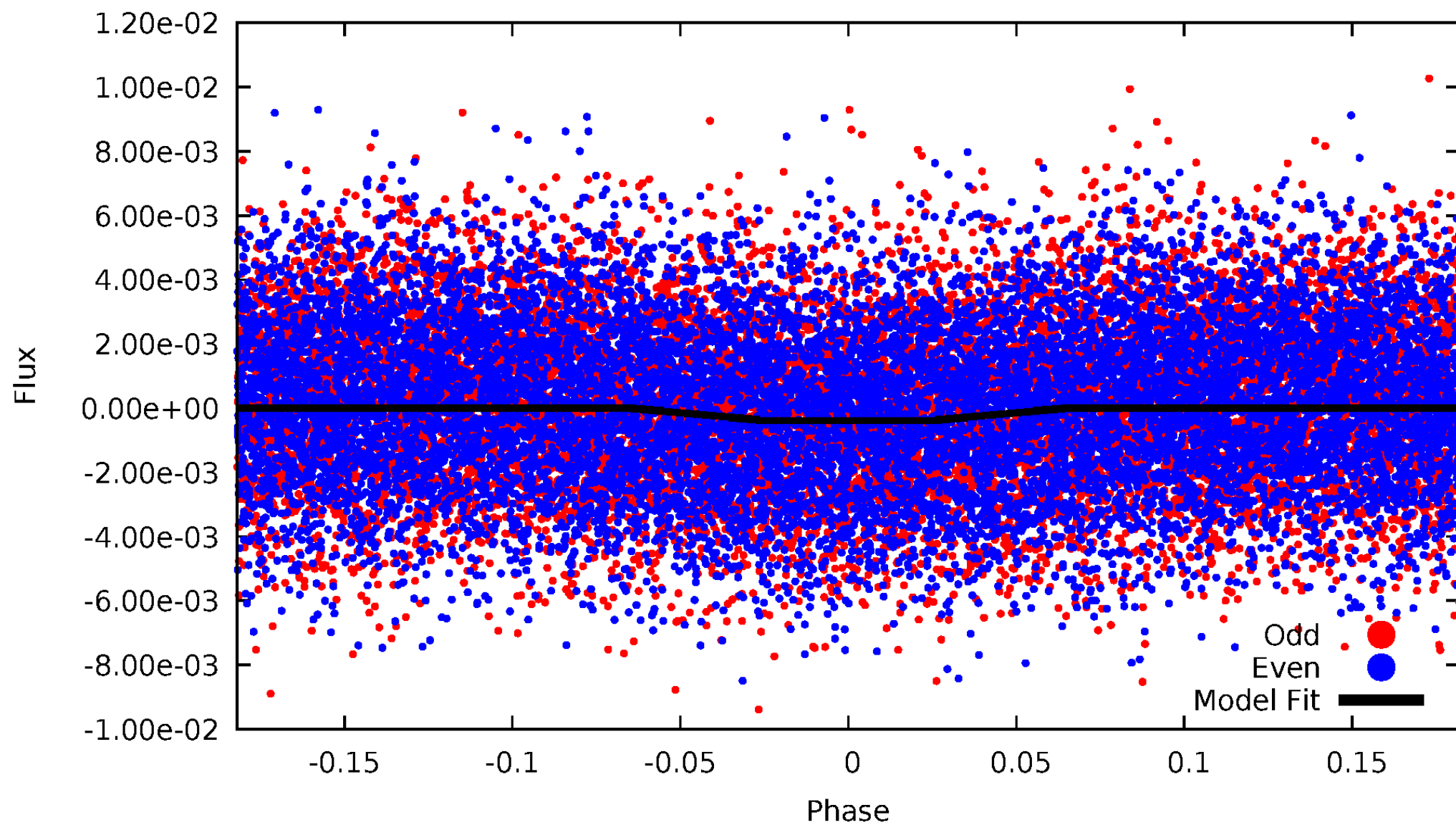
# DV Odd/Even

TCE 003231406-02



# ALT Odd/Even

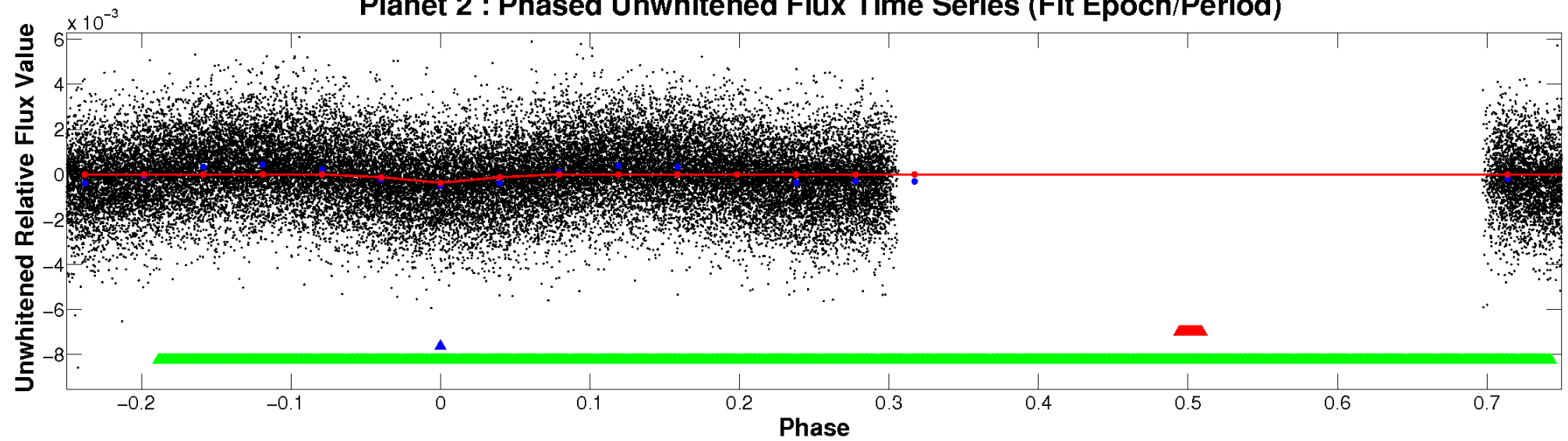
TCE 003231406-02



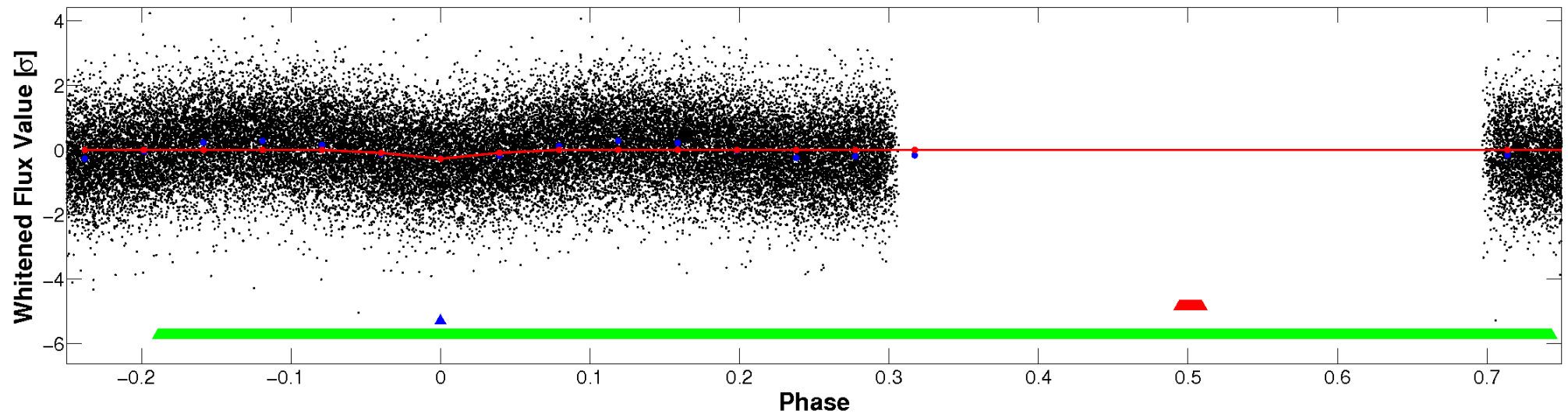


# Non-Whitened Vs. Whitened Light Curve

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

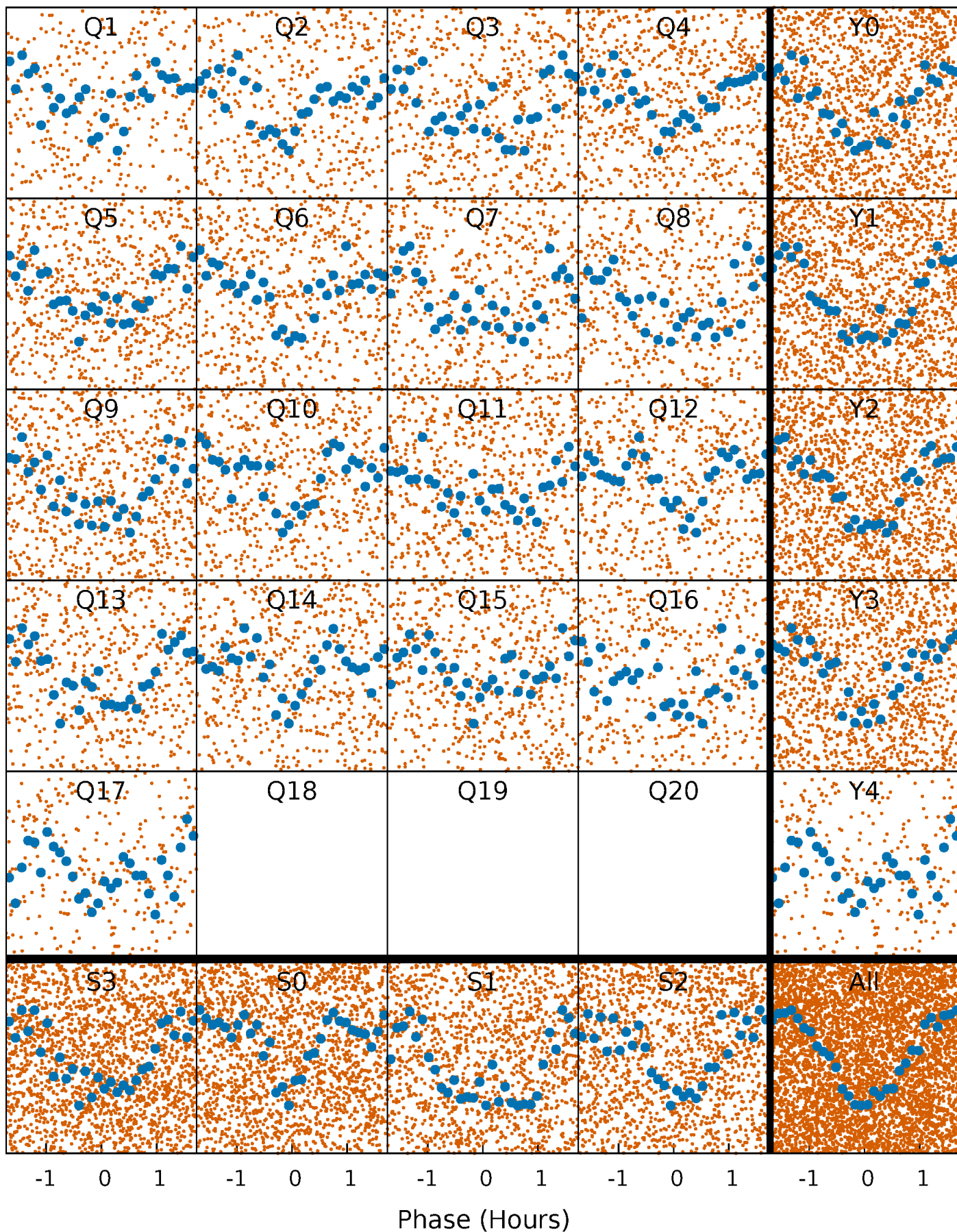


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



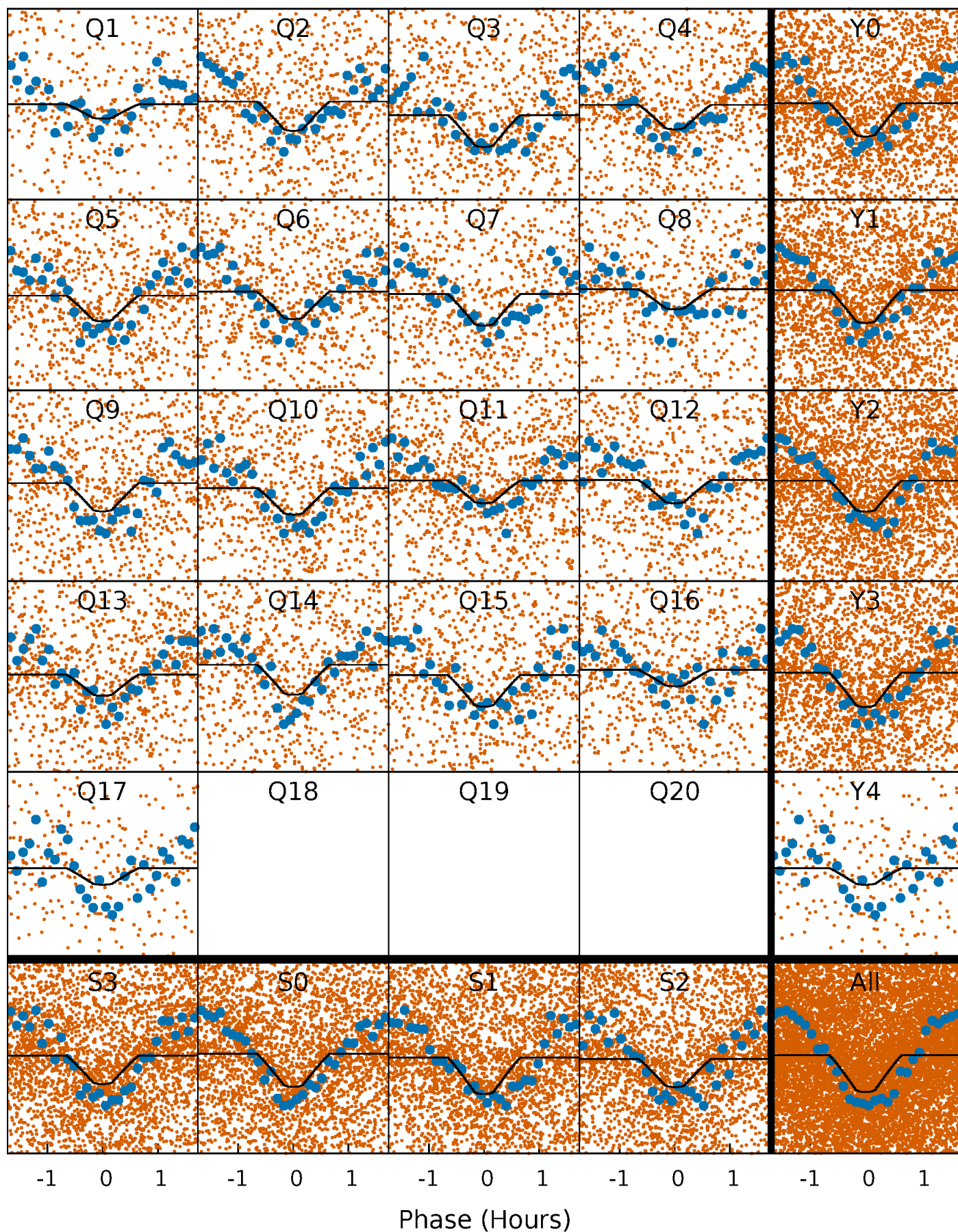
# PDC Quarter-Phased Transit Curves

TCE 003231406-02   P= 0.515321 Days    $T_0=131.979974$  (BKJD)



# DV Quarter-Phased Transit Curves

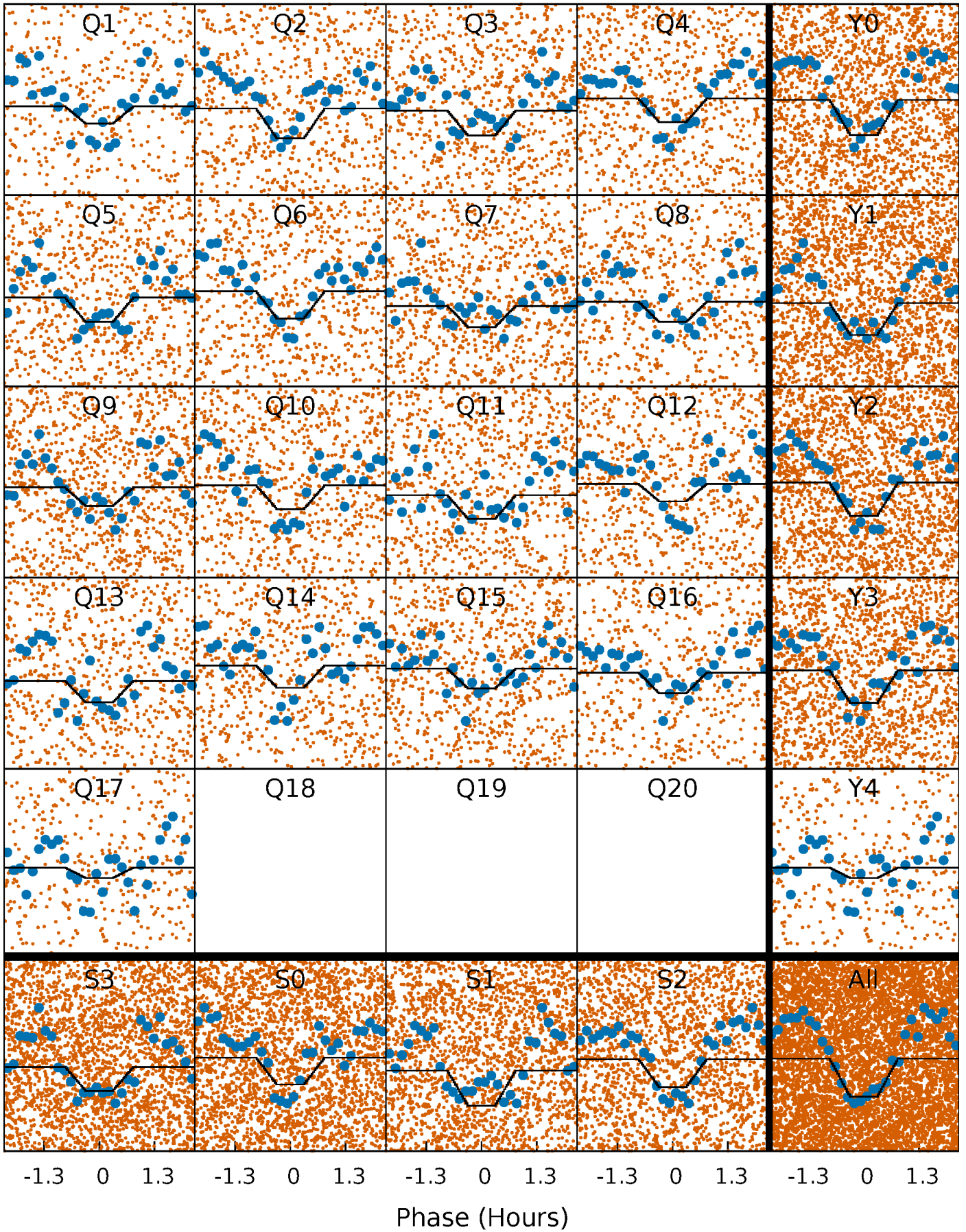
TCE 003231406-02   P= 0.515321 Days    $T_0=131.979974$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

TCE 003231406-02 P= 0.515322 Days  $T_0=131.979942$  (BKJD)

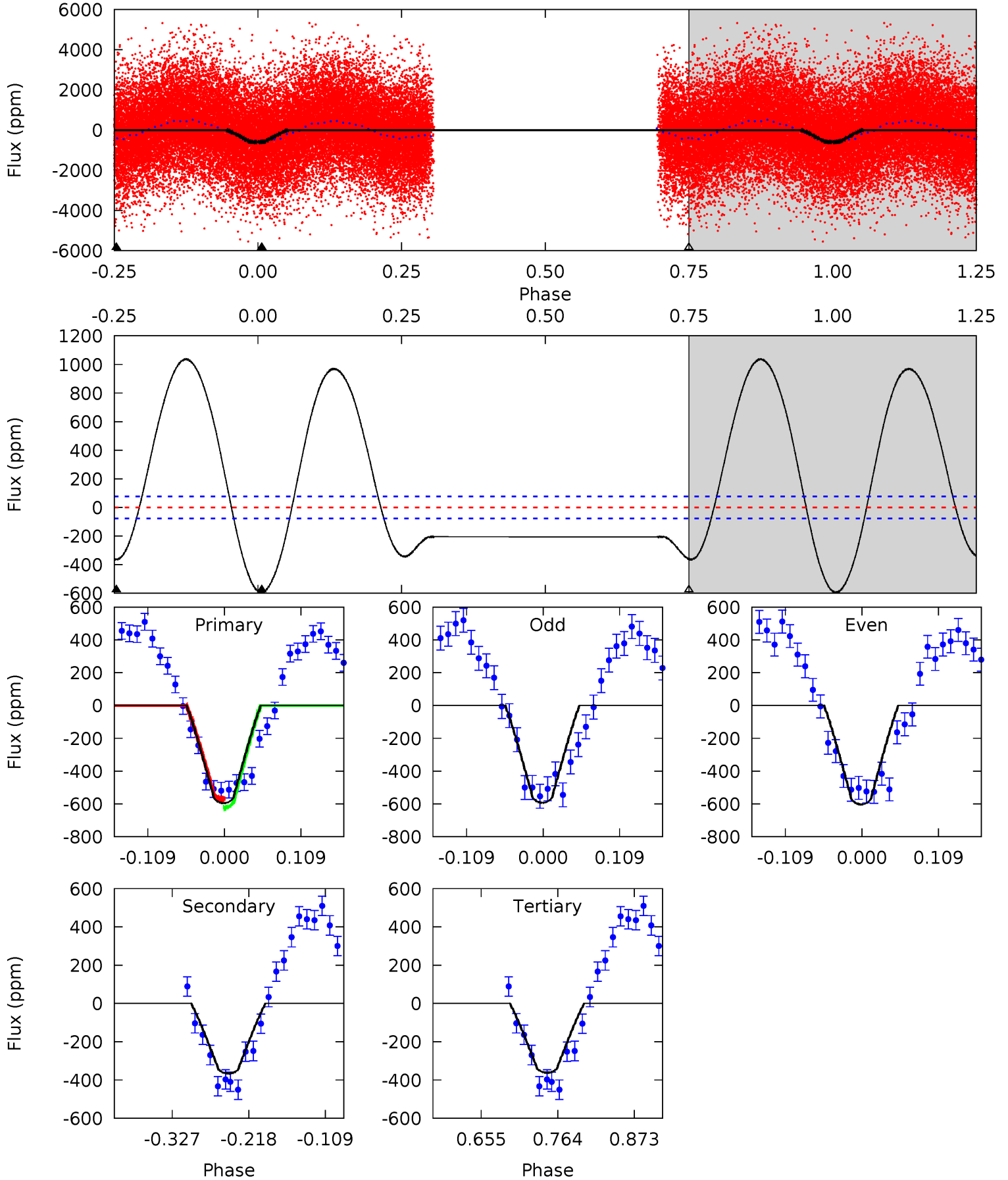




# DV Model-Shift Uniqueness Test

003231406-02, P = 0.515321 Days, E = 131.464653 Days

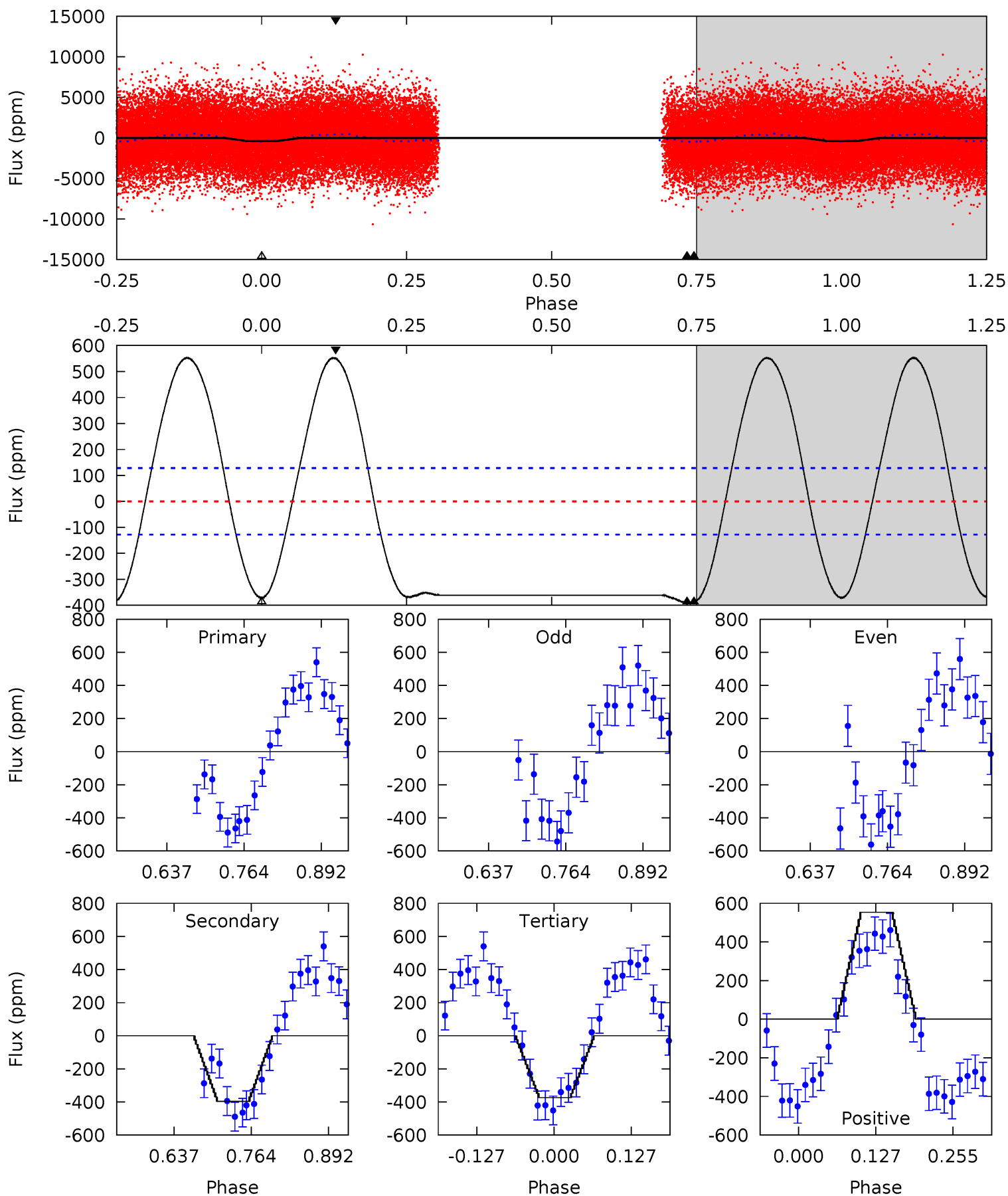
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
35.2	21.6	21.4	0	4.55	1.60	32.7	13.8	35.2	0.23	21.6	0.29	1.08	0.64	1.57



# Alt Model-Shift Uniqueness Test

003231406-02, P = 0.515322 Days, E = 131.464620 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
13.8	14.0	13.2	19.5	4.51	1.52	11.9	0.58	-5.76	0.80	-5.54	0.17	1.03	0.58	1.58



### Stellar Parameters For KIC 003231406

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$8005^{+222}_{-333}$	$3.768^{+0.399}_{-0.070}$	$-0.160^{+0.200}_{-0.350}$	$2.955^{+0.407}_{-1.222}$	$1.870^{+0.095}_{-0.379}$	$0.102^{+0.353}_{-0.030}$
	+3%/-4%	+11%/-2%	+125%/-219%	+14%/-41%	+5%/-20%	+346%/-30%
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 003231406-02 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-365 \pm 17$	$5.64^{+2.04}_{-2.03}$	$6547^{+483}_{-702}$	$7293^{+2329}_{-1327}$	$1.491^{+2.133}_{-0.692}$
Alt.	$-396 \pm 28$	$5.56^{+2.12}_{-1.83}$	$6549^{+453}_{-705}$	$7562^{+2528}_{-1399}$	$1.675^{+1.960}_{-0.816}$

$T_{max}$  = 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

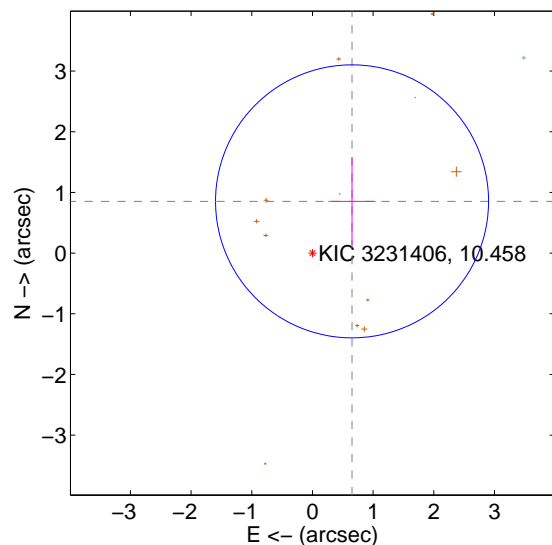
Supplemental centroid analysis for 003231406-02. **Kepler magnitude: 10.46.** Transit SNR 15.52

There are 4 quarters with good PRF difference image offsets

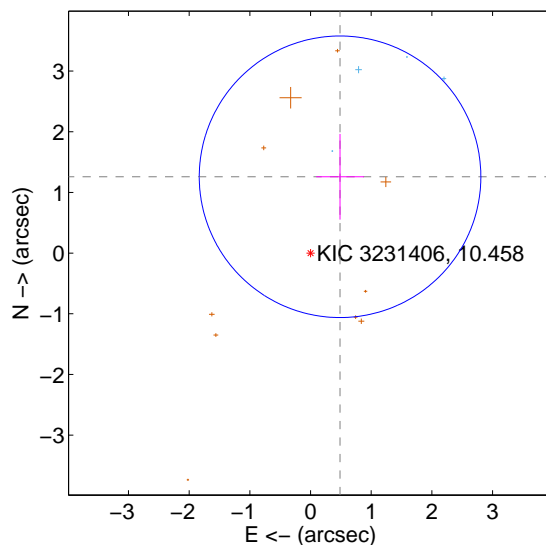
The direct PRF centroid is offset from the target star catalog position by about 1.91 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.074 \pm 0.750$	1.43	$-0.653 \pm 0.387$	$0.853 \pm 0.722$
PRF-fit source offset from KIC position	$1.349 \pm 0.773$	1.74	$-0.487 \pm 0.394$	$1.258 \pm 0.706$
photometric centroid source offset	<b><math>0.33 \pm 0.08</math></b>	<b>3.94</b>	$0.15 \pm 0.06$	$0.30 \pm 0.09$

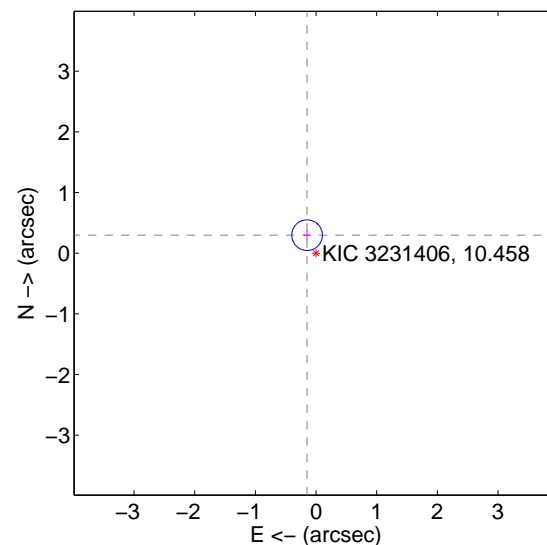
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position



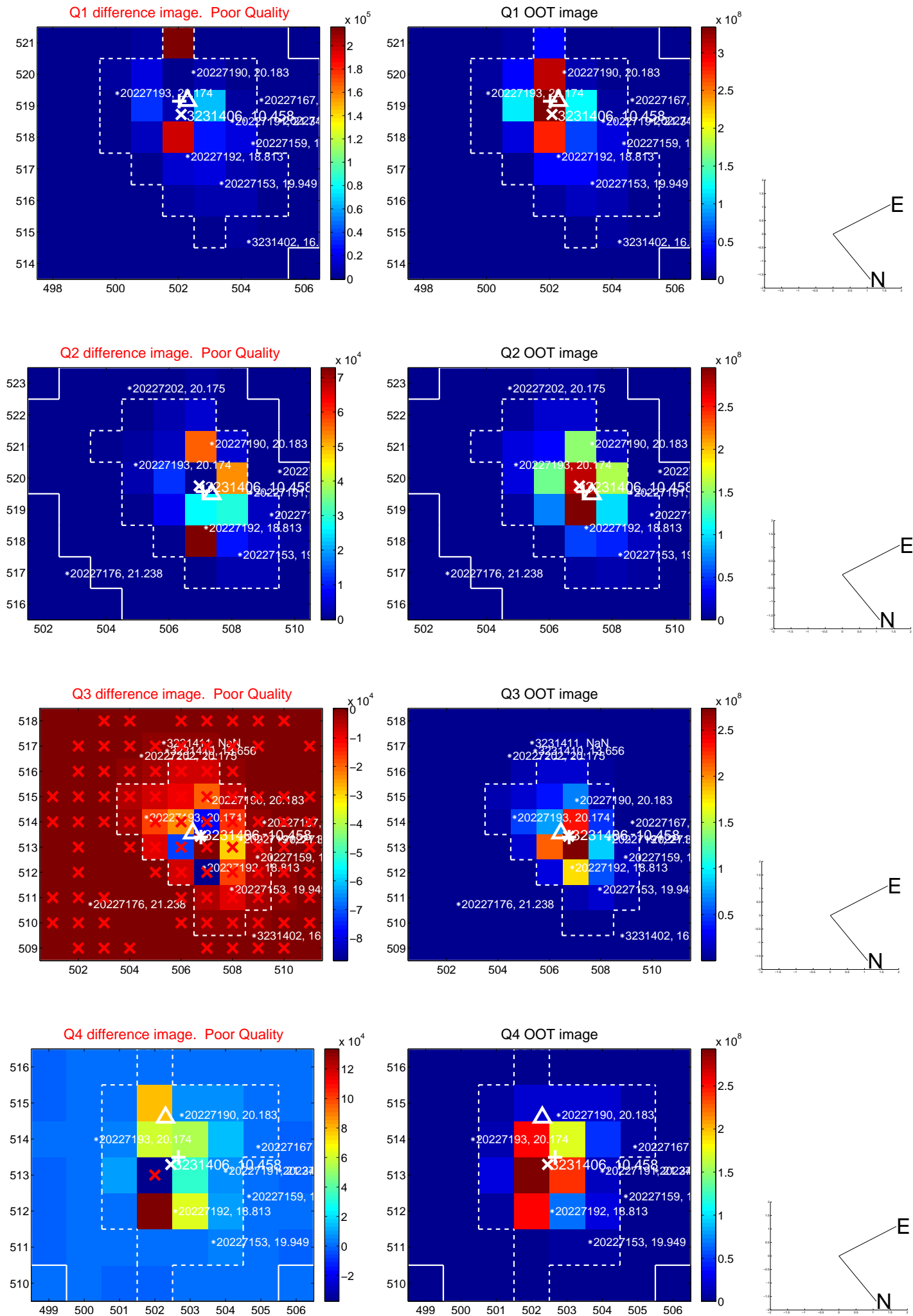
offset from photometric centroids



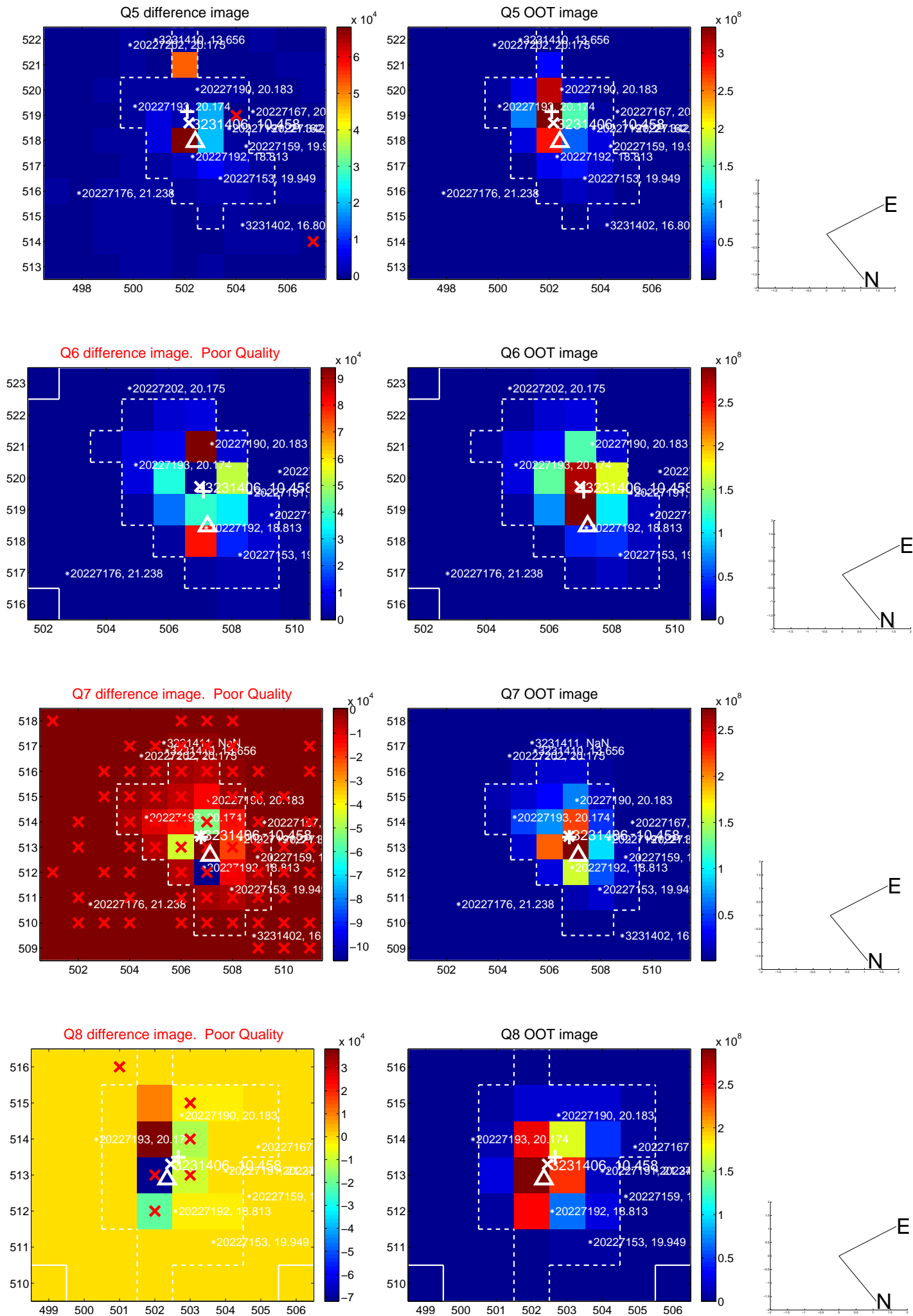
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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



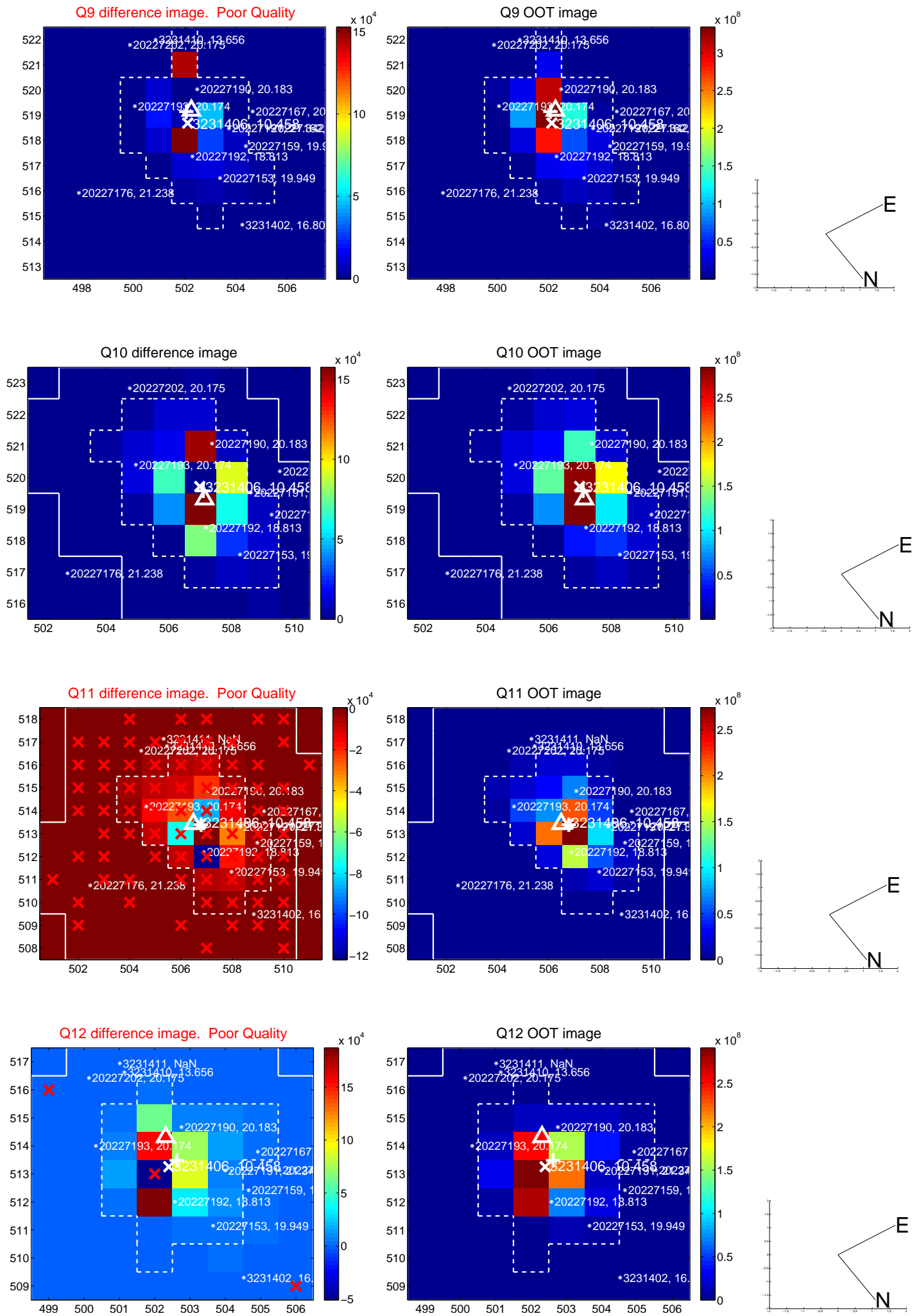
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



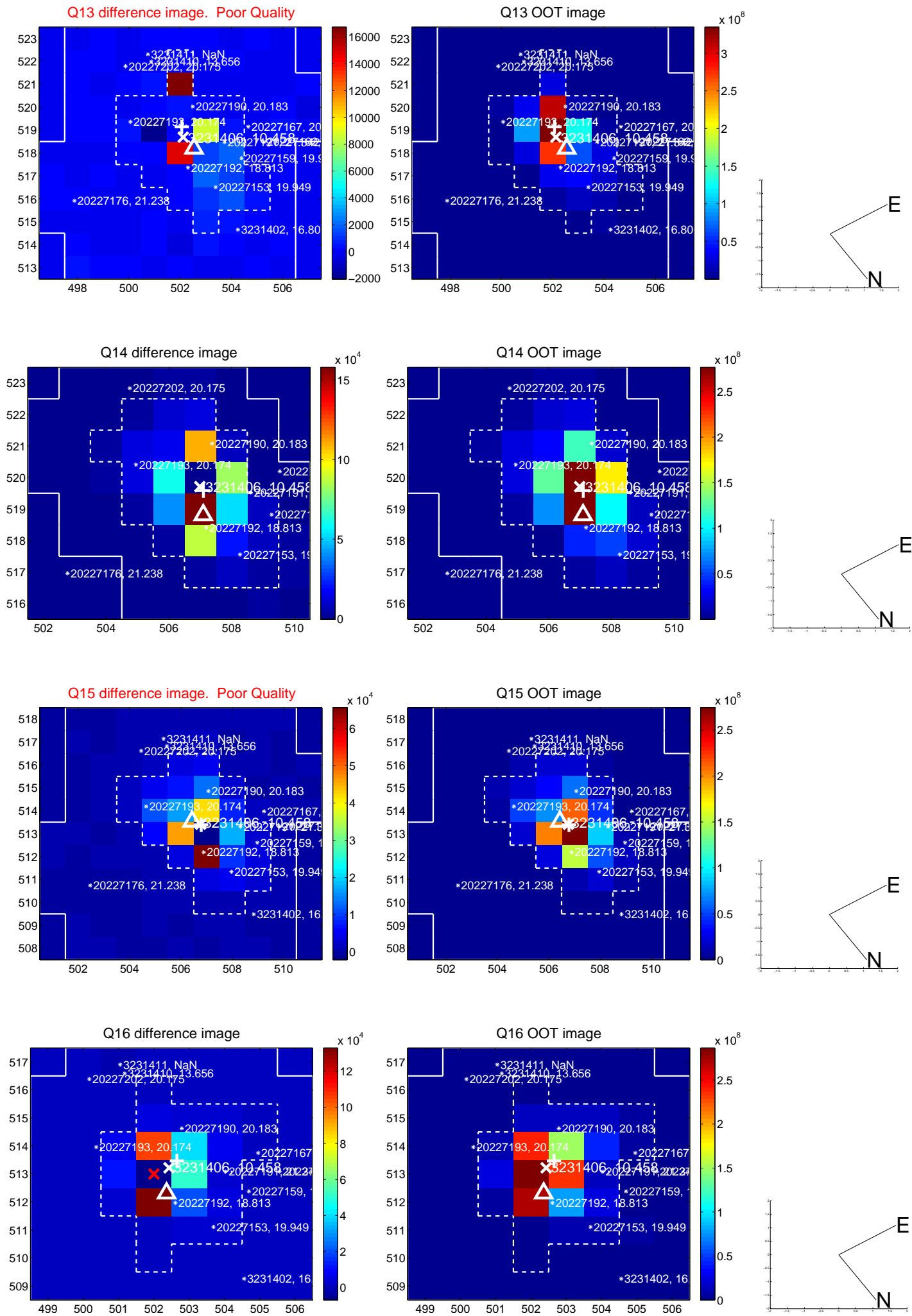
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

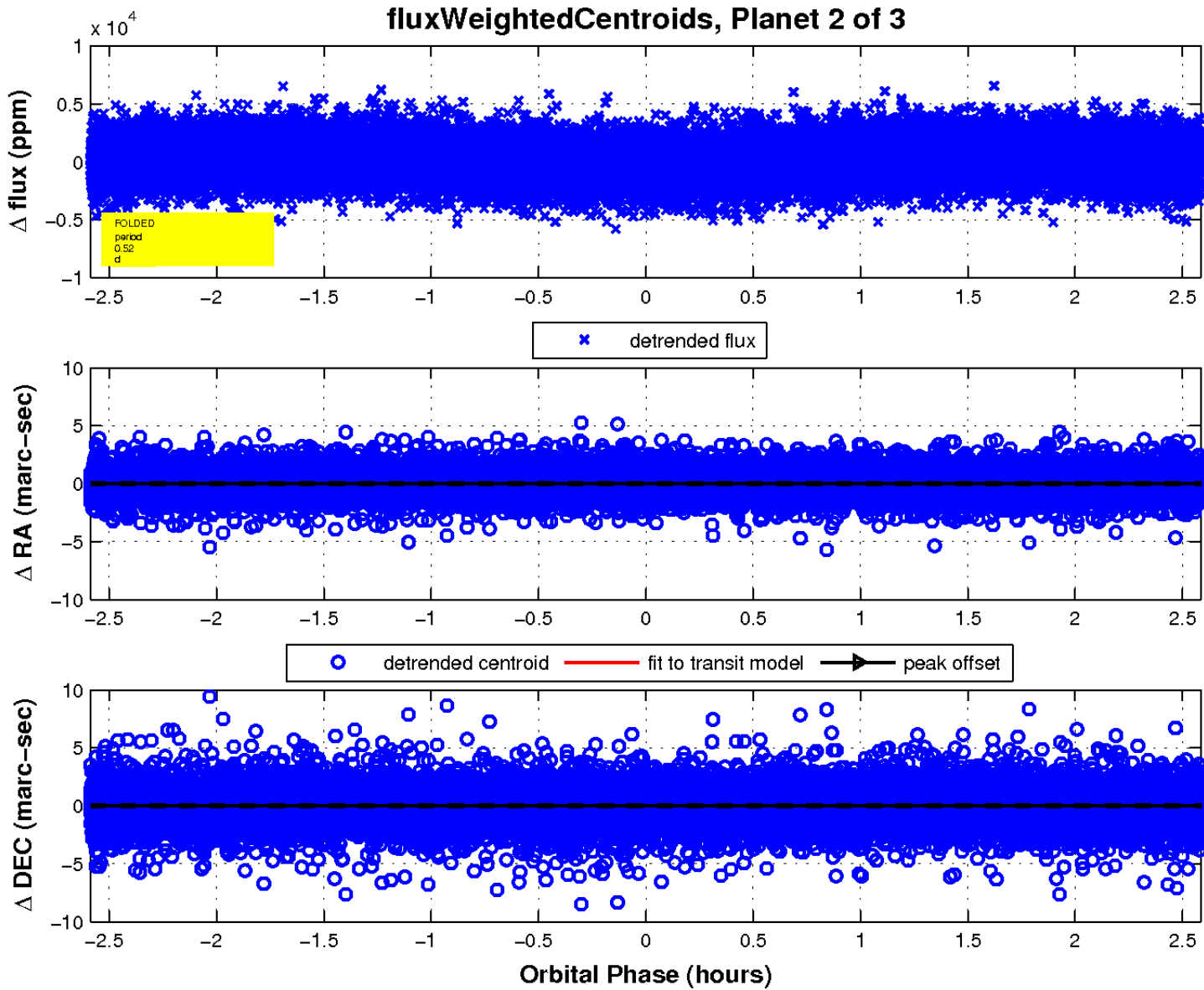
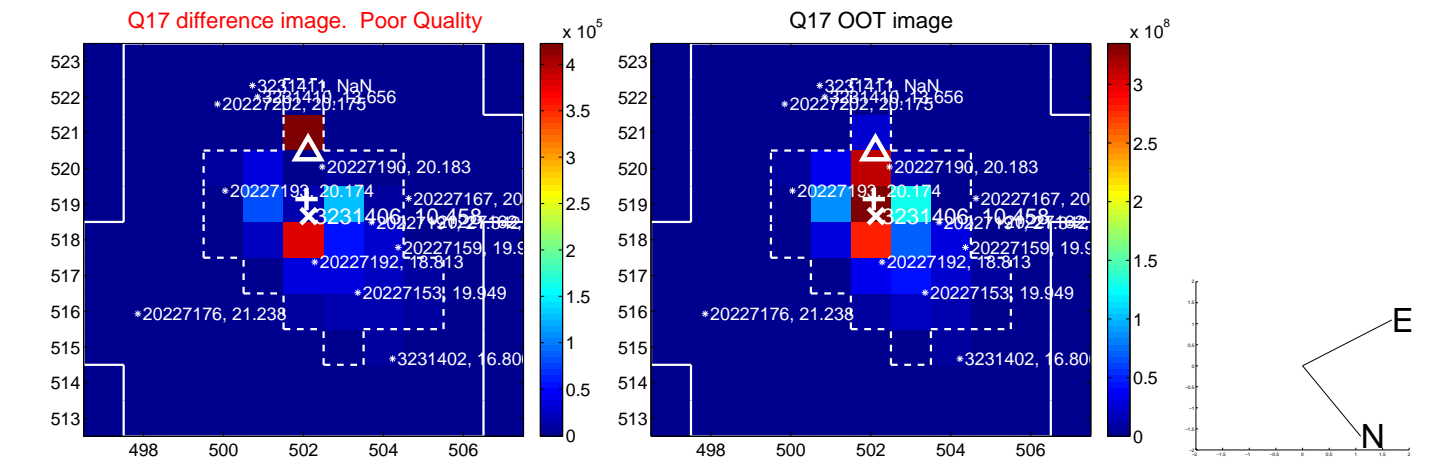


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

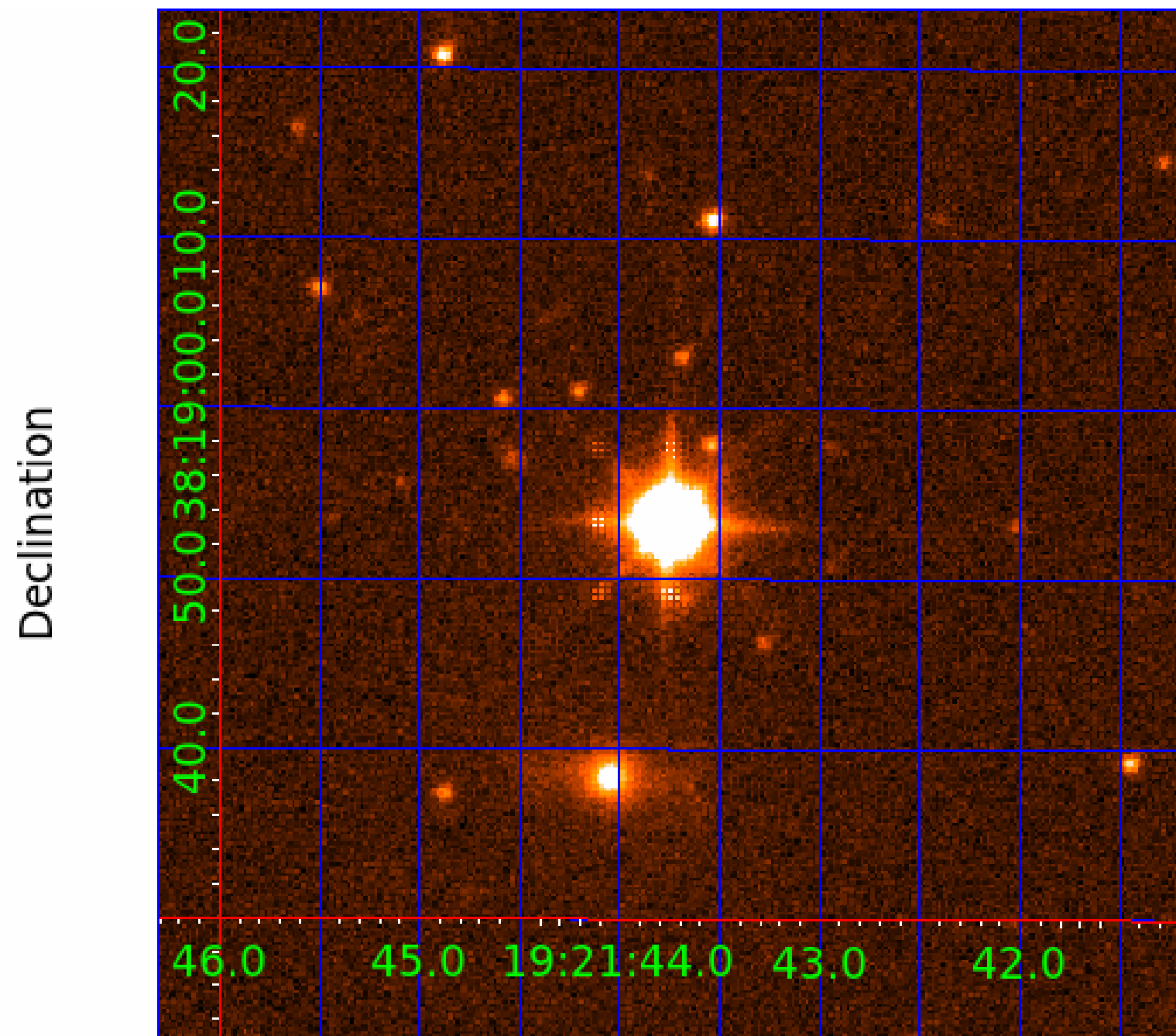




white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image



# KIC 003231406

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
003231406-01	OBS	No	0.515318	131.727006	469.7	1.000	16.3	19.5	2.96	8005	6.67	133847.74
003231406-02	OBS	No	0.515321	131.979974	393.9	0.862	14.7	15.5	2.96	8005	6.35	133846.80
003231406-03	OBS	No	0.515490	131.882666	285.9	6.186	11.1	12.0	2.96	8005	5.04	133788.06

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
003231406-01	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—CENT_SATURATED
003231406-02	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—SAME_NTL_PERIOD—CENT_SATURATED
003231406-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE_ZUMA_TRACKER—LPP_DV—LPP_ALT—MOD_NONUNIQ_ALT—SAME_NTL_PERIOD—CENT_SATURATED

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

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

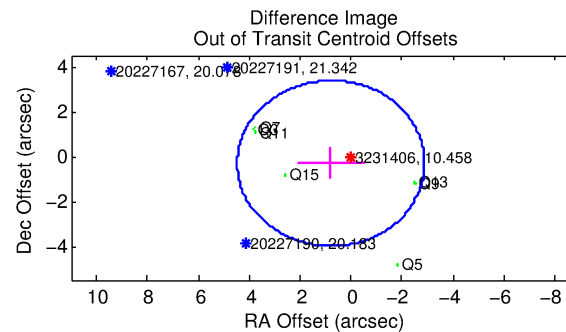
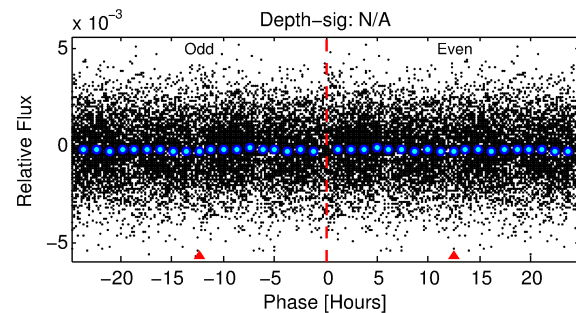
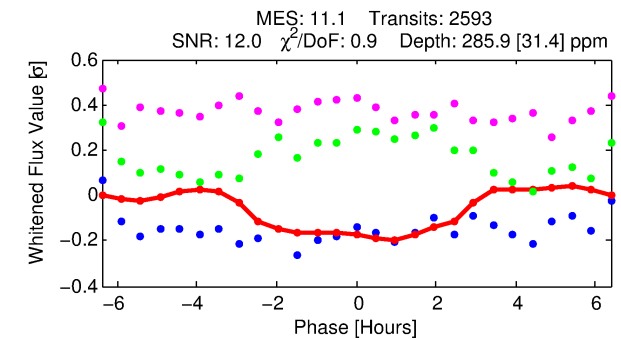
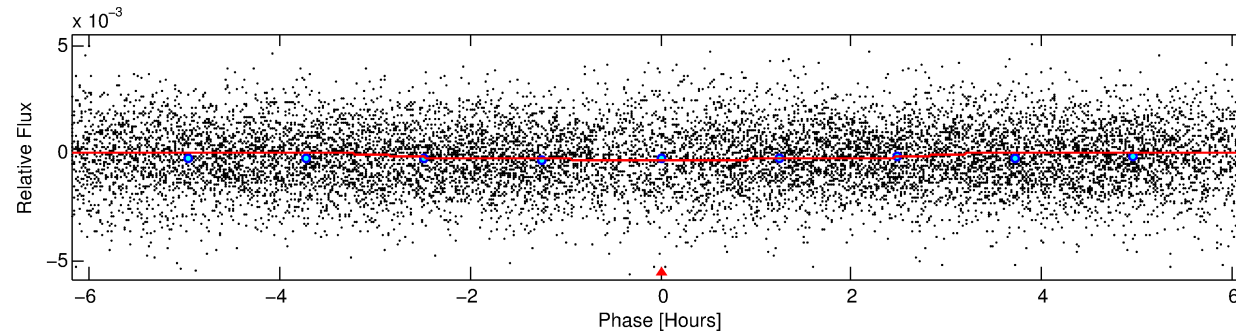
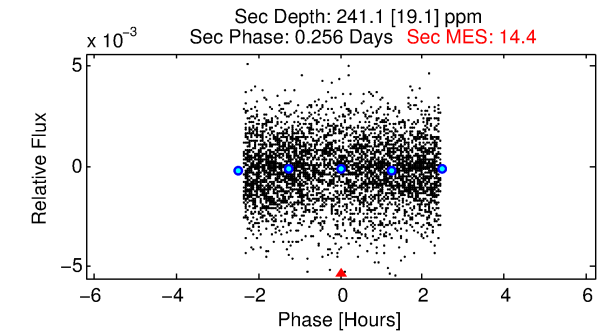
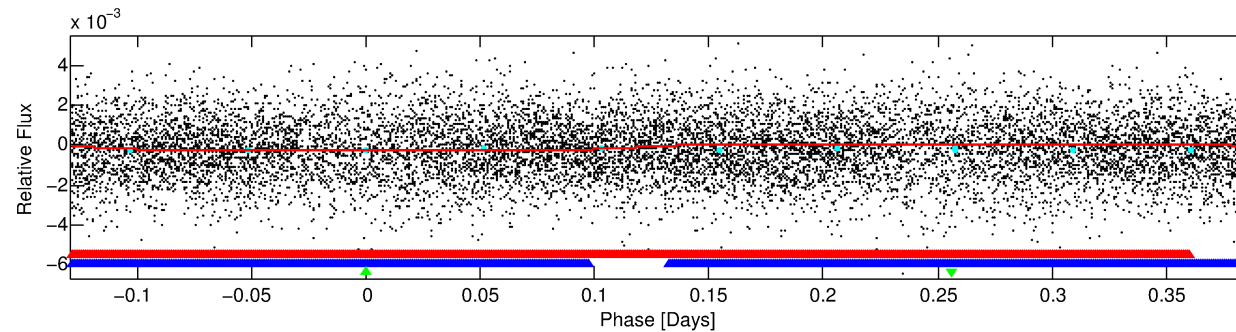
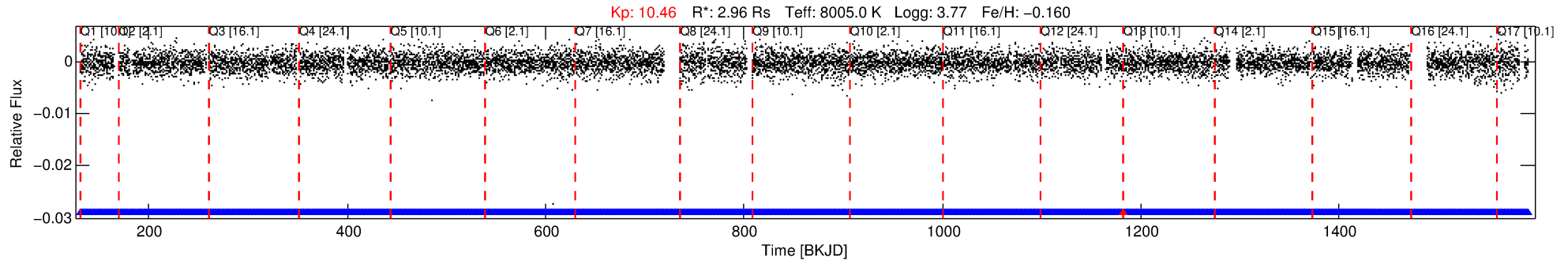
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 003231406-03

No Significant Match Found

# DV One-Page Summary

KIC: 3231406 Candidate: 3 of 3 Period: 0.515 d



## DV Fit Results:

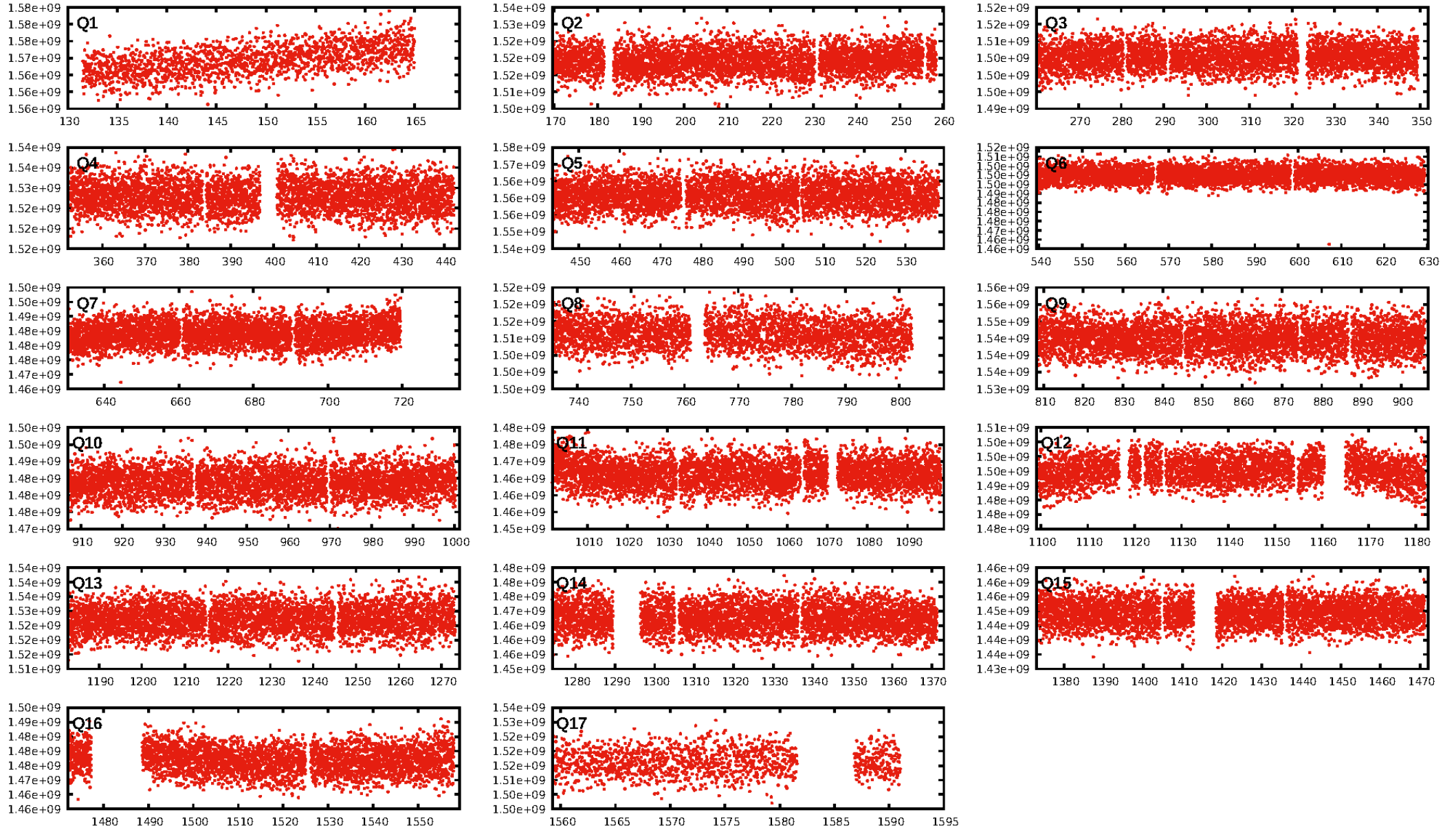
Period = 0.51549 [0.00001] d  
Epoch = 131.8827 [0.0058] BKJD  
Rp/R\* = 0.0156 [0.0067]  
a/R\* = 1.01 [0.02]  
b = 0.10 [23.79]  
Seff = 133788.06 [92578.46]  
Teff = 4877 [844] K  
Rp = 5.04 [2.99] Re  
a = 0.0155 [0.0064] AU  
Ag = 1.25 [1.37] [0.19σ]  
Teffp = 7980 [1740] K [1.60σ]

## DV Diagnostic Results:

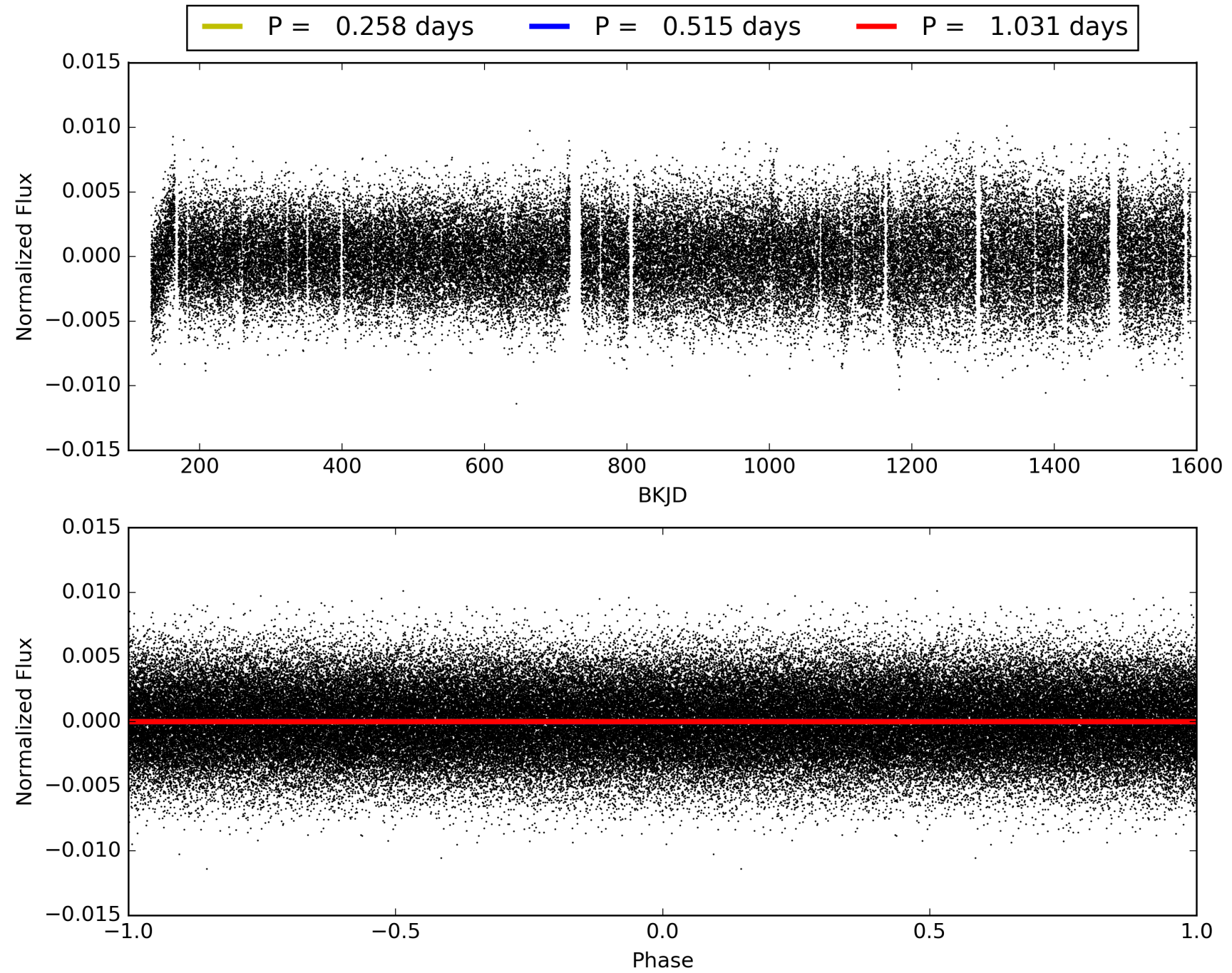
ShortPeriod-sig: 0.1% [0.00σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [2475/2476]  
GhostDiagnostic-chr: 1.371  
Centroid-sig: 1.7%  
Centroid-so: 0.309 arcsec [5.12σ]  
OotOffset-rm: 0.847 arcsec [0.69σ]  
KicOffset-rm: 2.299 arcsec [1.85σ]  
OotOffset-st: 0/4/0/3 [7]  
KicOffset-st: 0/4/0/3 [7]  
DiffImageQuality-fgm: 0.00 [0/7]  
DiffImageOverlap-fno: 0.00 [0/17]



# TCE 003231406-03, PDC Light Curves

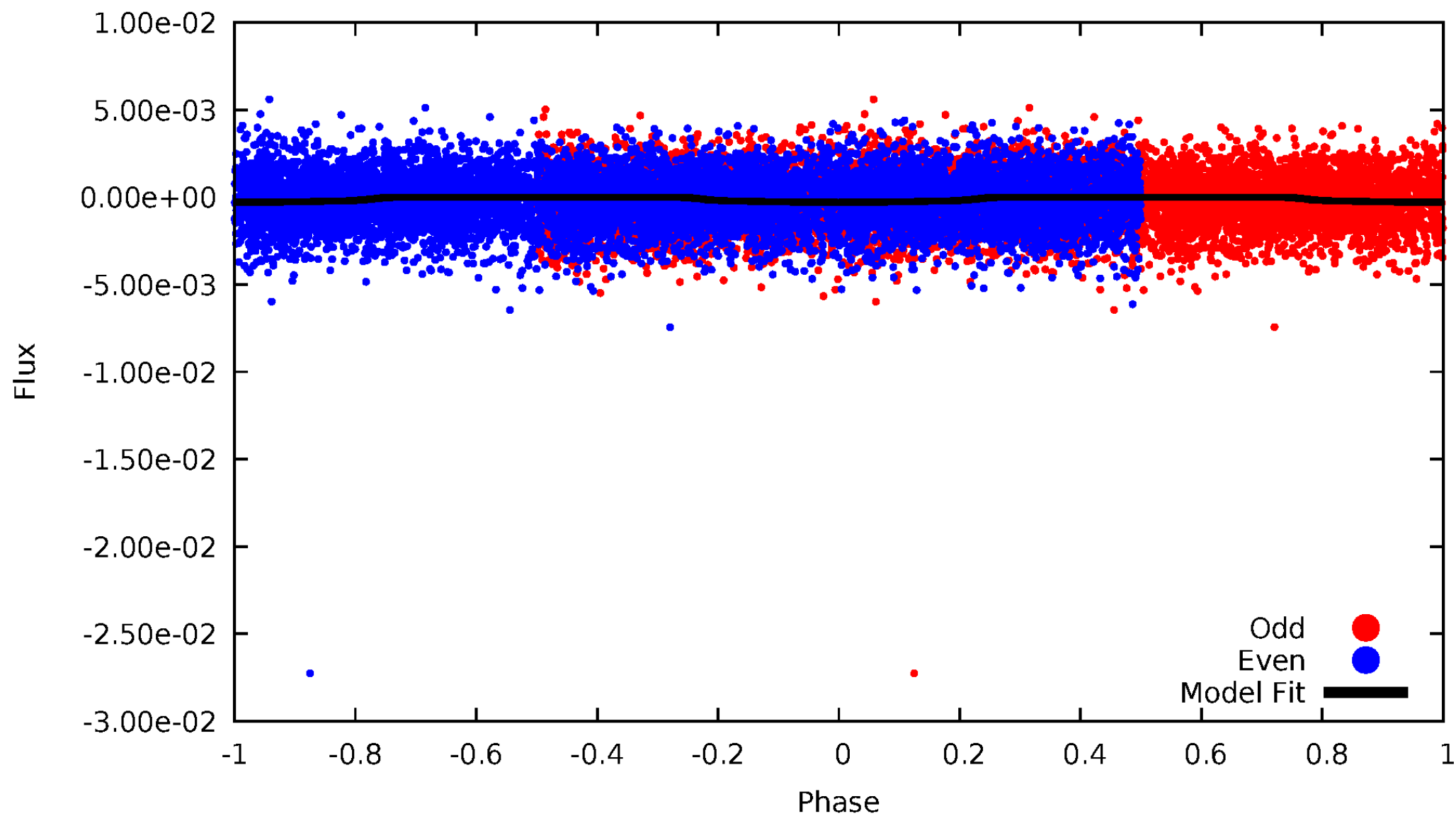


TCE 003231406-03



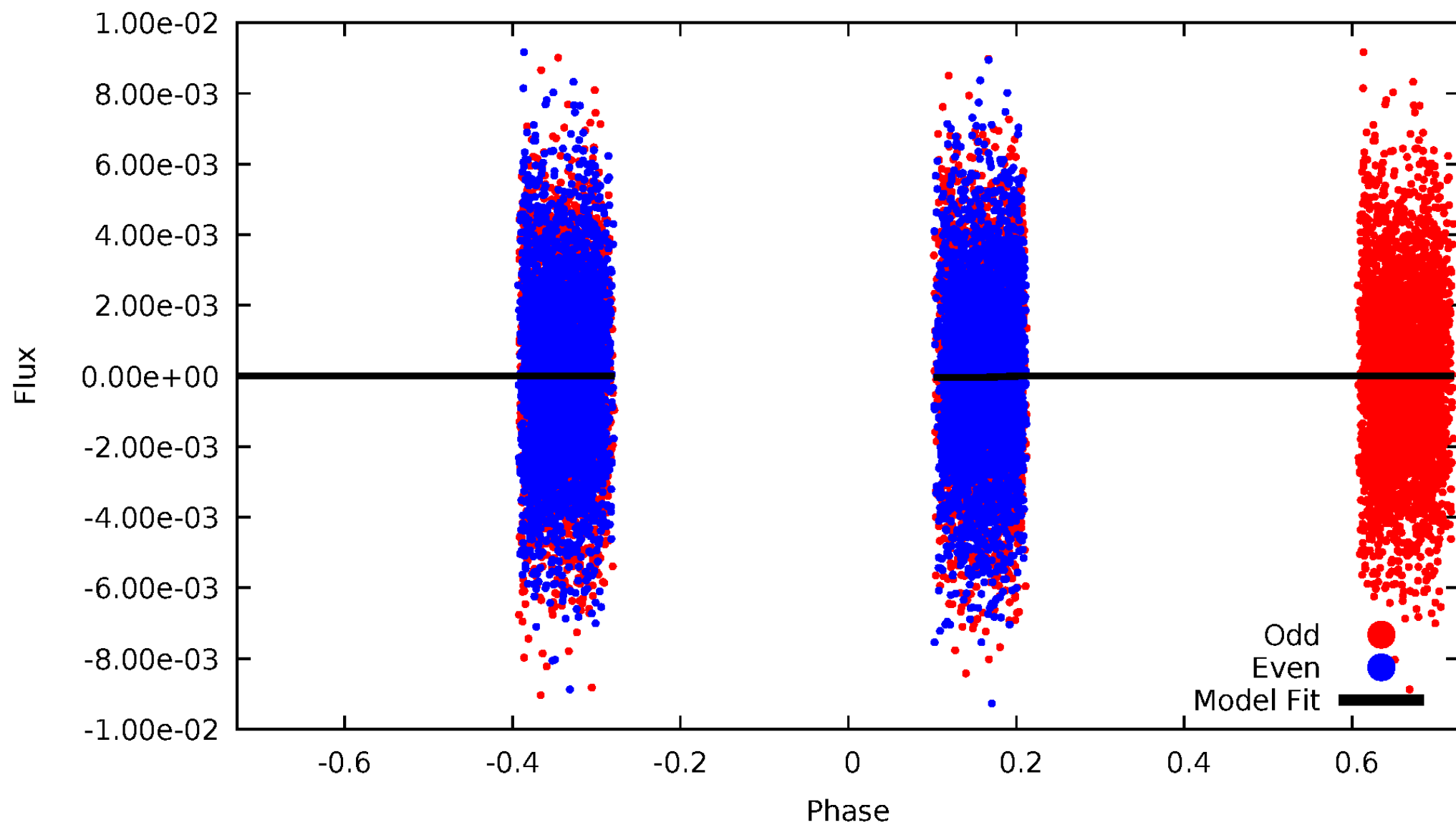
DV Odd/Even

TCE 003231406-03



# ALT Odd/Even

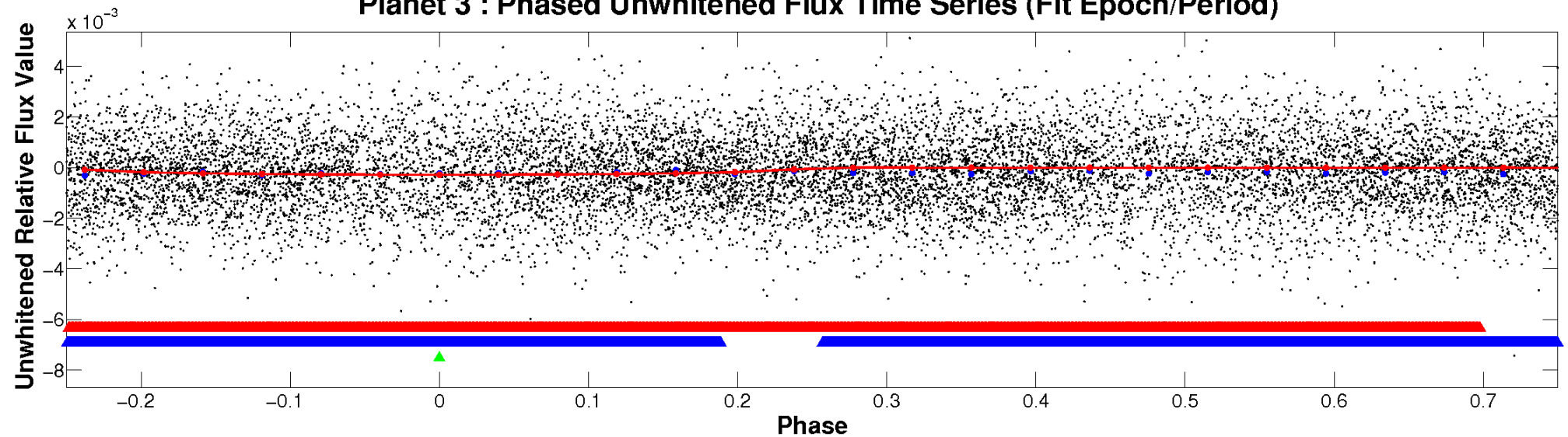
TCE 003231406-03



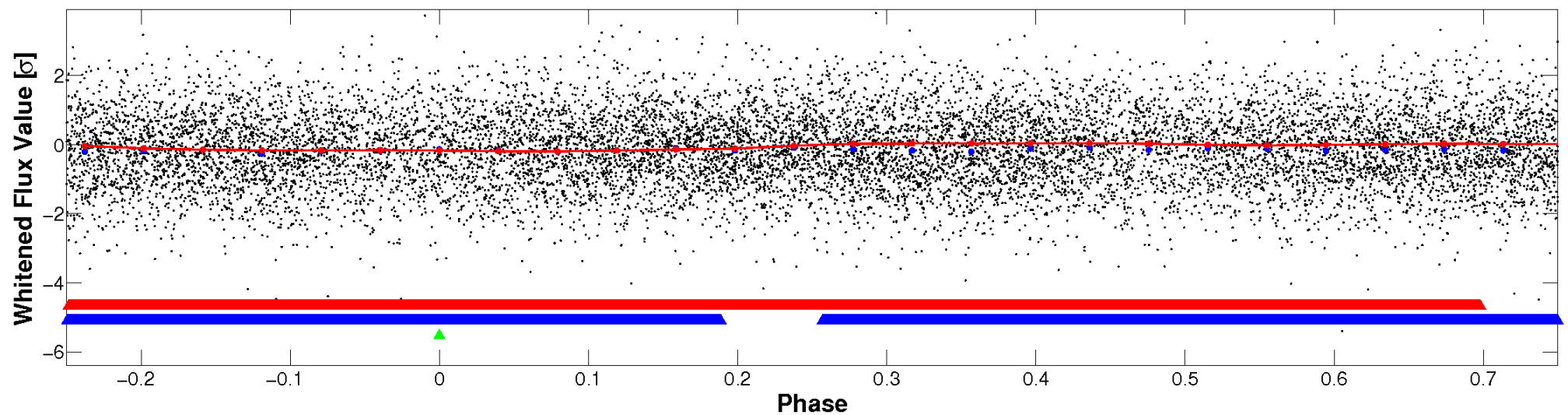


# Non-Whitened Vs. Whitened Light Curve

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

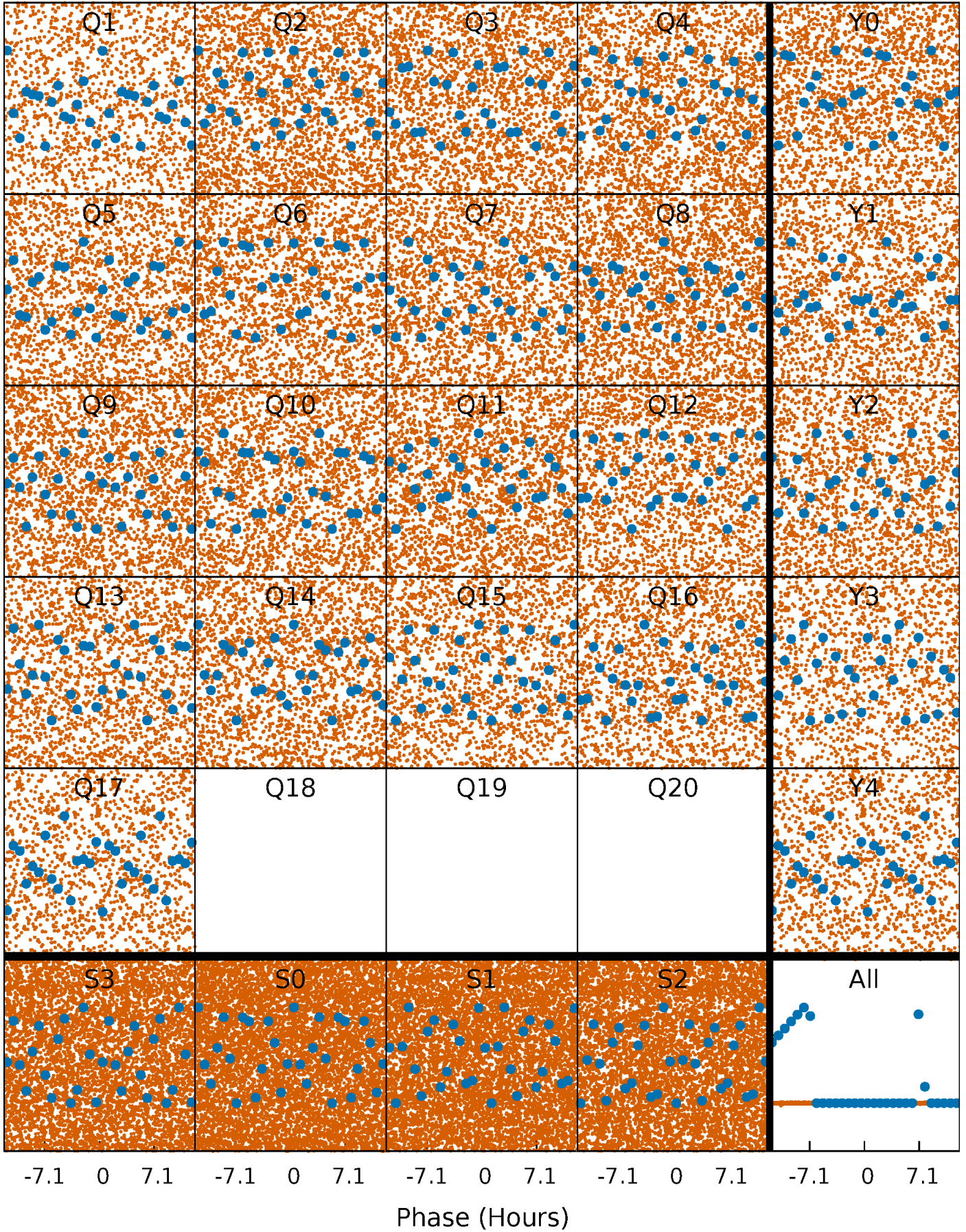


## Planet 3 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

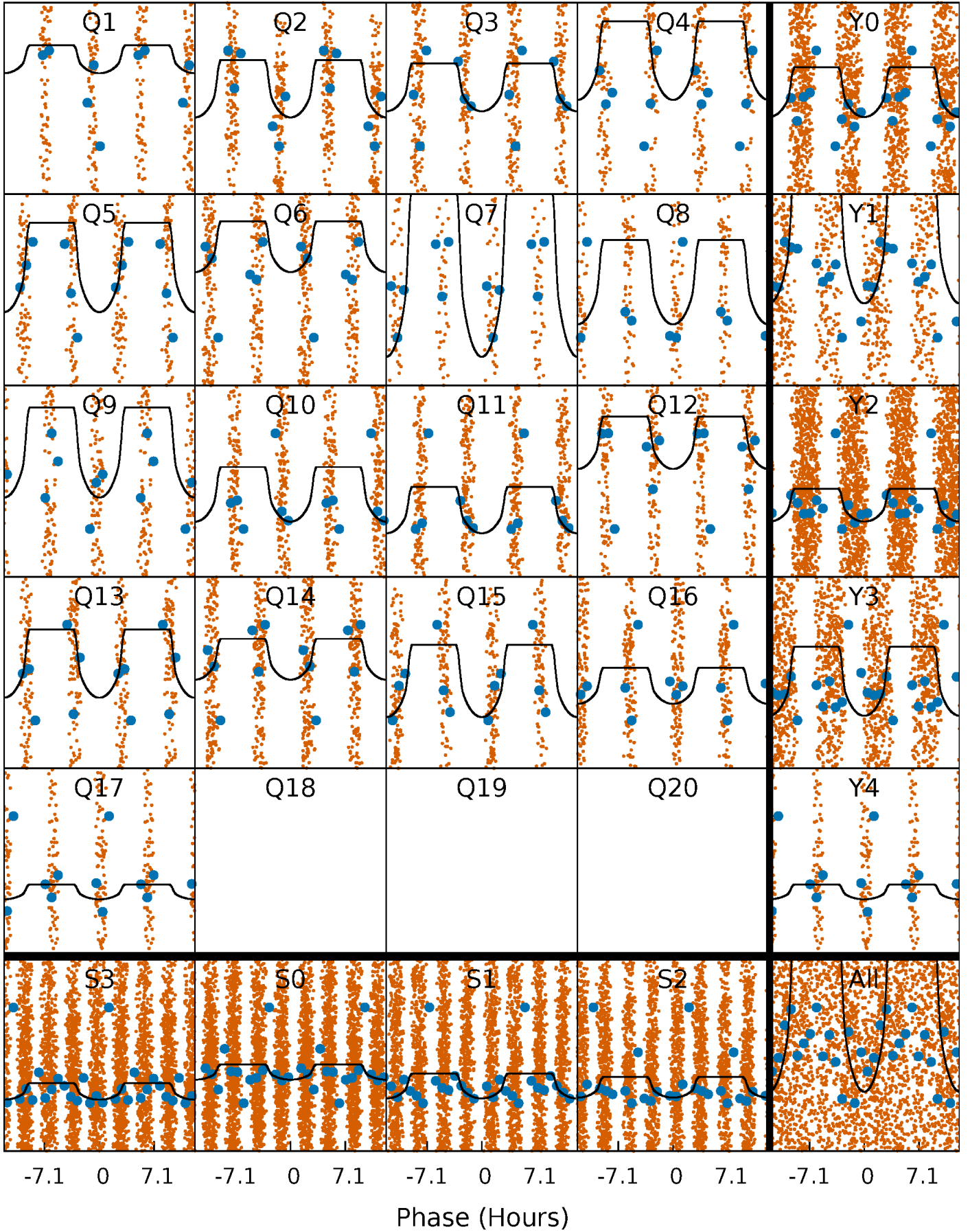
TCE 003231406-03 P= 0.515490 Days  $T_0=131.882666$  (BKJD)





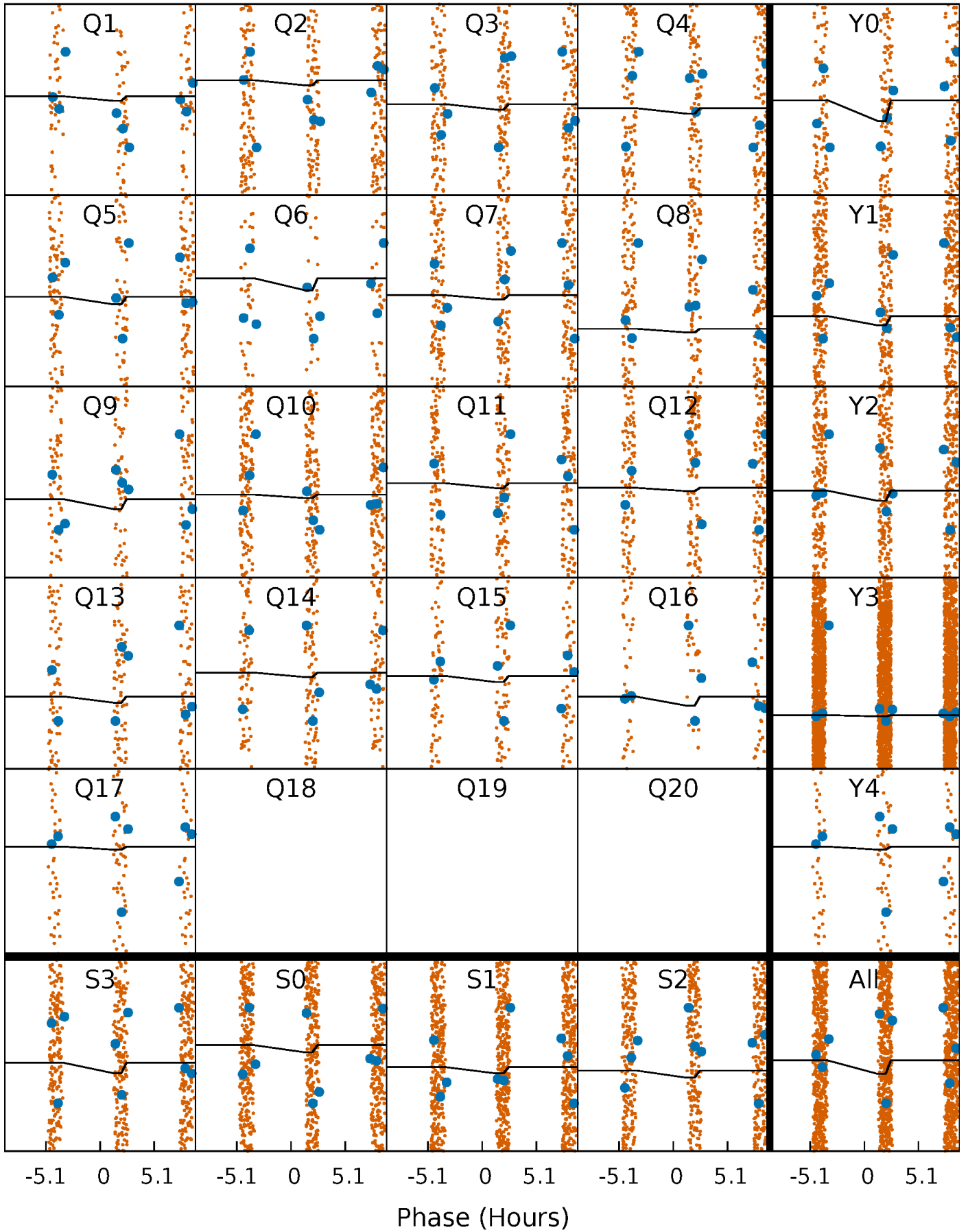
# DV Quarter-Phased Transit Curves

TCE 003231406-03   P= 0.515490 Days    $T_0=131.882666$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

TCE 003231406-03   P= 0.515322 Days    $T_0=131.766312$  (BKJD)

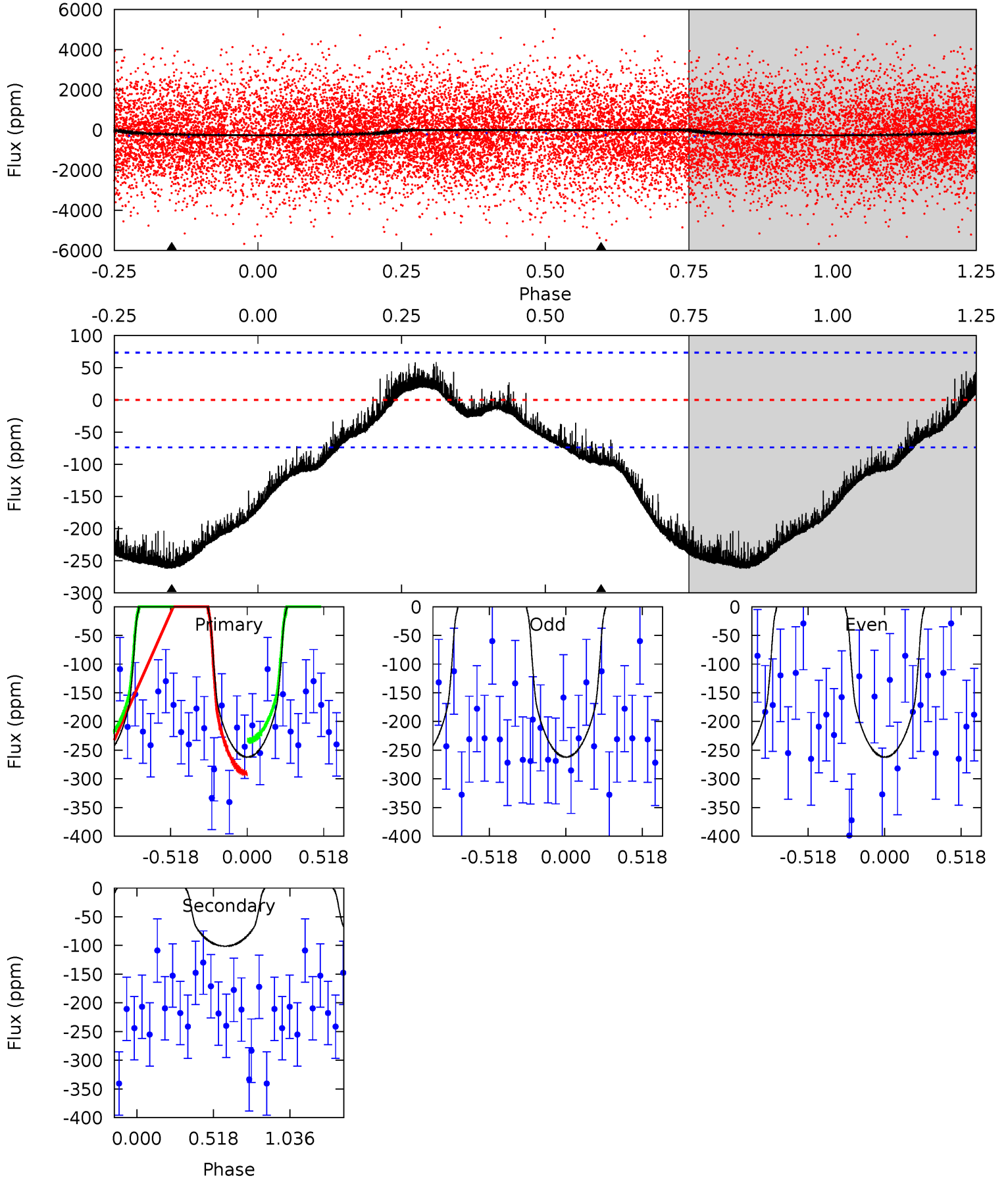




# DV Model-Shift Uniqueness Test

003231406-03, P = 0.515490 Days, E = 131.367176 Days

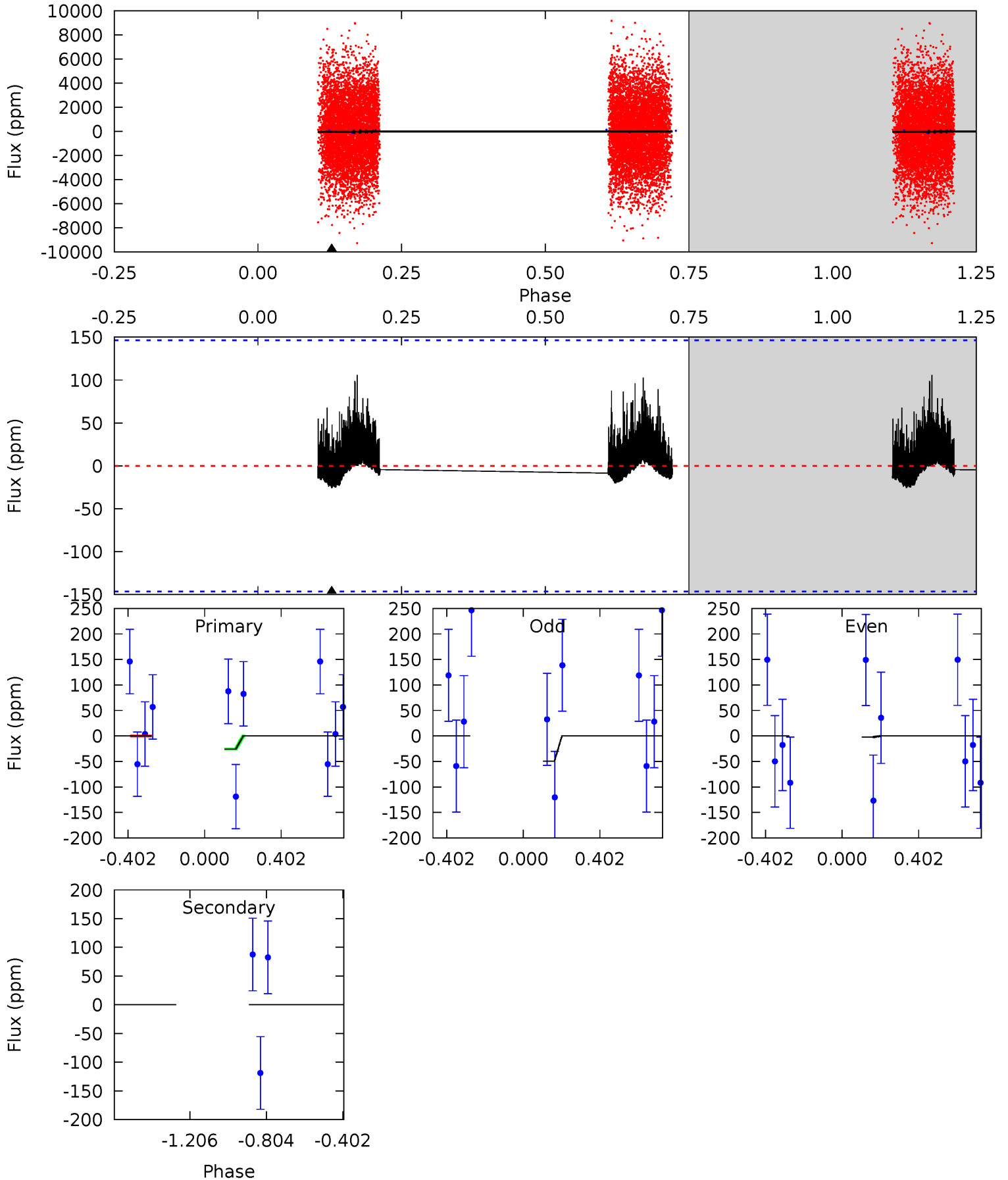
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
15.0	5.78	0	0	4.21	0.65	1.26	15.0	15.0	5.78	5.78	0.00	1.15	0.18	1.55



# Alt Model-Shift Uniqueness Test

003231406-03, P = 0.515322 Days, E = 131.250990 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
0.75	0	0	0	4.26	0.84	0.39	0.75	0.75	0	0	0.69	-7.19	0.80	0



### Stellar Parameters For KIC 003231406

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$8005^{+222}_{-333}$	$3.768^{+0.399}_{-0.070}$	$-0.160^{+0.200}_{-0.350}$	$2.955^{+0.407}_{-1.222}$	$1.870^{+0.095}_{-0.379}$	$0.102^{+0.353}_{-0.030}$
	+3%/-4%	+11%/-2%	+125%/-219%	+14%/-41%	+5%/-20%	+346%/-30%
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 003231406-03 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	$-101 \pm 18$	$4.56^{+2.17}_{-2.14}$	$6581^{+430}_{-707}$	$5272^{+2857}_{-8602}$	$0.624^{+1.477}_{-0.346}$
Alt.	$0 \pm 34$	$2.16^{+1.85}_{-1.33}$	$6530^{+457}_{-699}$	$-5387^{+12707}_{-3214}$	$-0.020^{+1.635}_{-1.735}$

$T_{\text{max}}$  = Theoretical Maximum Planetary Temperature  
 $T_{\text{obs}}$  = Observed Planetary Temperature (Assuming  $A=0.3$ )  
 $A_{\text{obs}}$  = Observed Albedo (Assuming  $T=0$ )

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

## DV Centroid Data

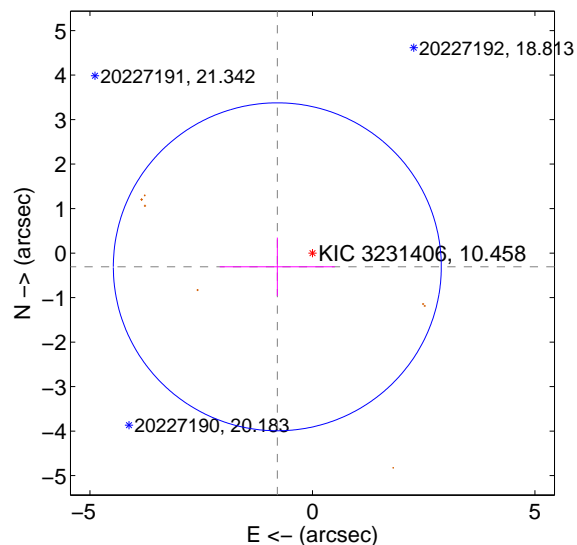
Supplemental centroid analysis for 003231406-03. **Kepler magnitude: 10.46.** Transit SNR 11.98

**There are 0 quarters with good PRF difference image offsets**

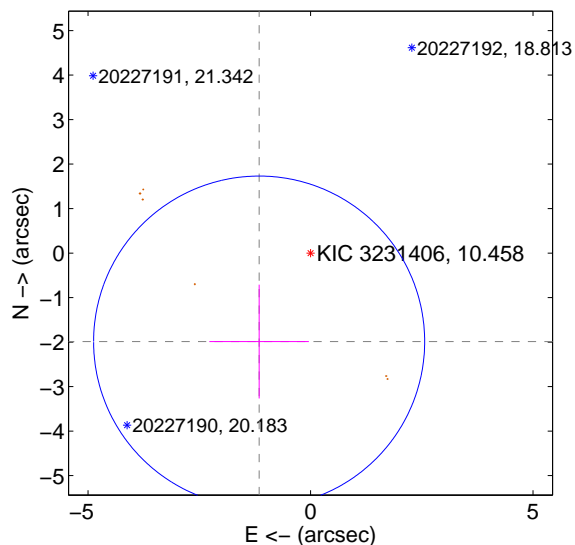
The direct PRF centroid is offset from the target star catalog position by about 0.13 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.847 \pm 1.228$	0.69	$0.789 \pm 1.293$	$-0.308 \pm 0.656$
PRF-fit source offset from KIC position	$2.299 \pm 1.240$	1.85	$1.155 \pm 1.118$	$-1.988 \pm 1.278$
photometric centroid source offset	$0.31 \pm 0.06$	<b>5.12</b>	$0.08 \pm 0.04$	$0.30 \pm 0.06$

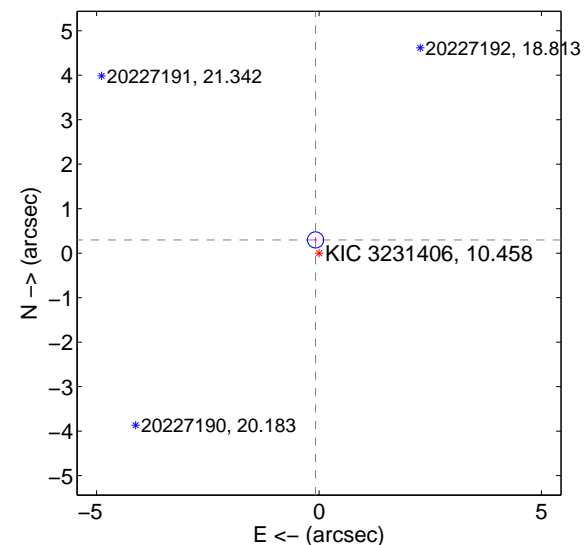
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

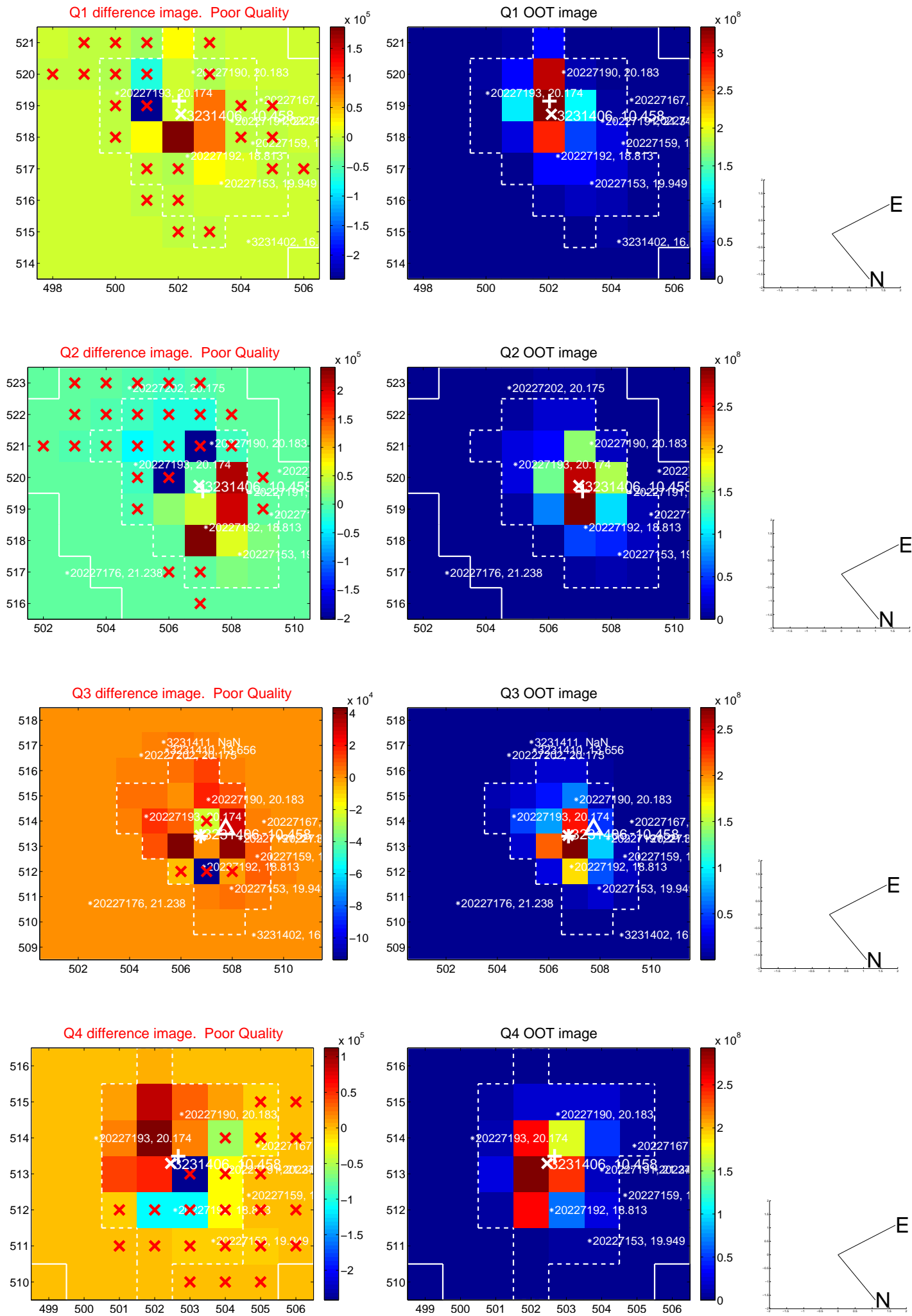


offset from photometric centroids



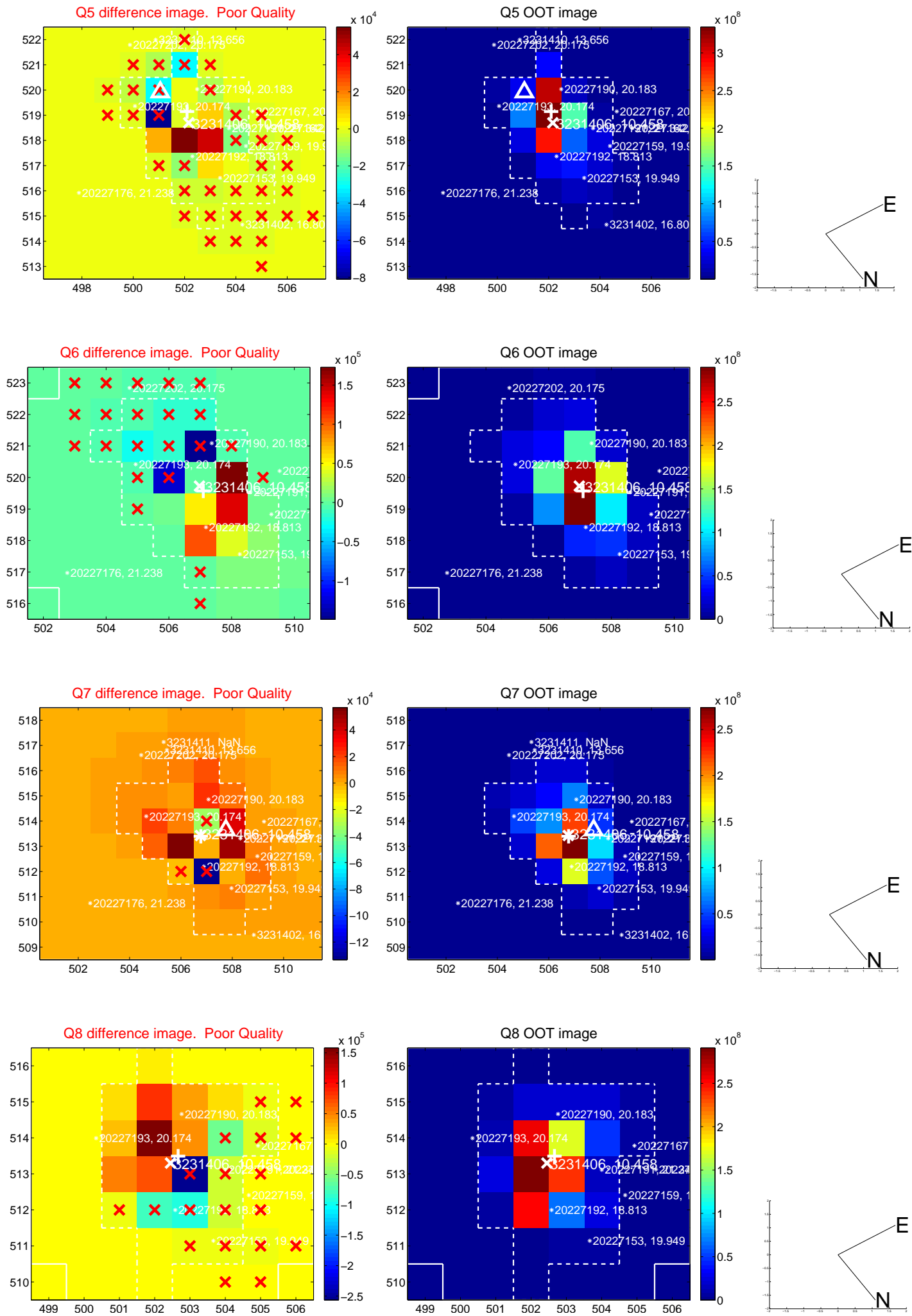
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

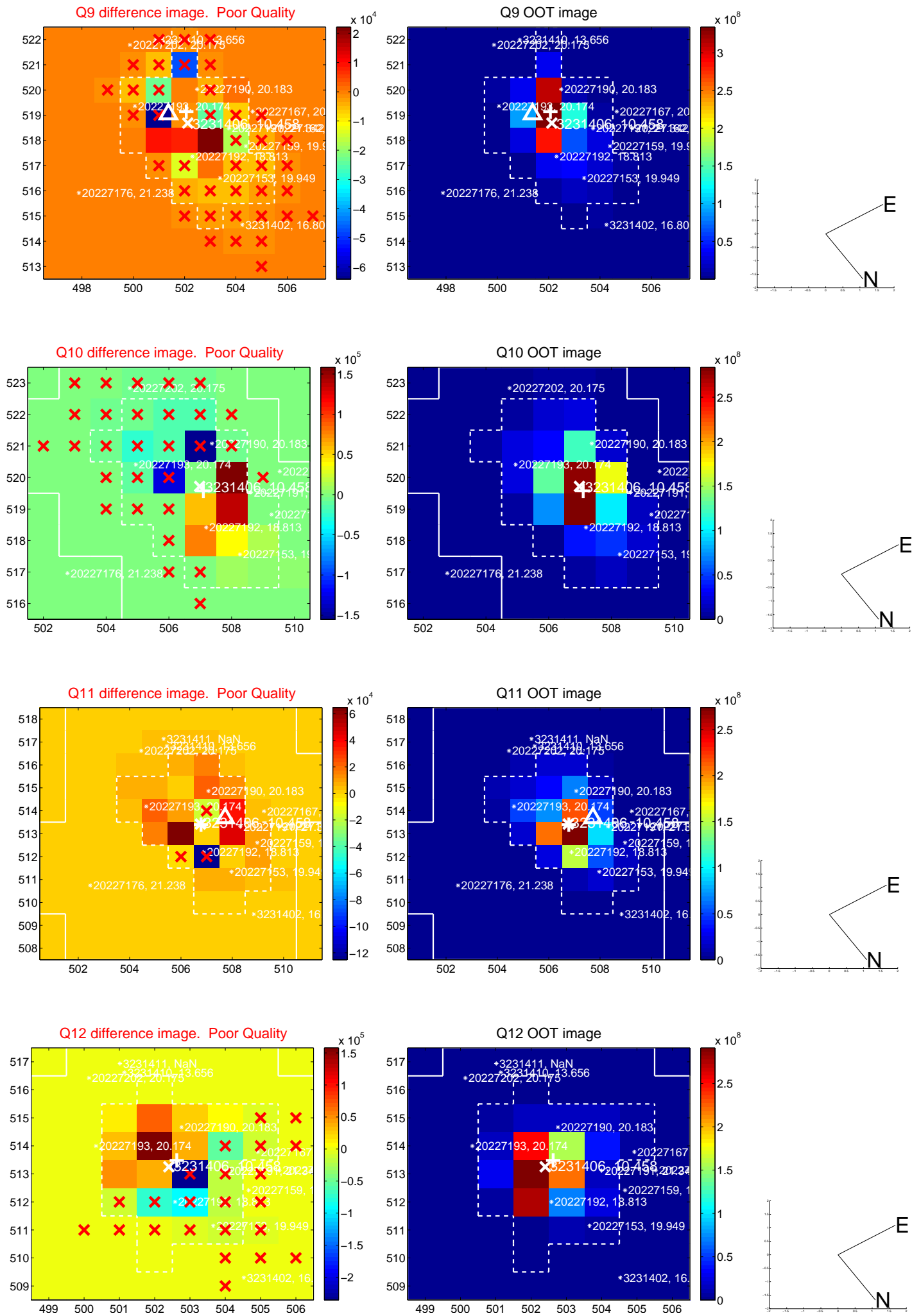




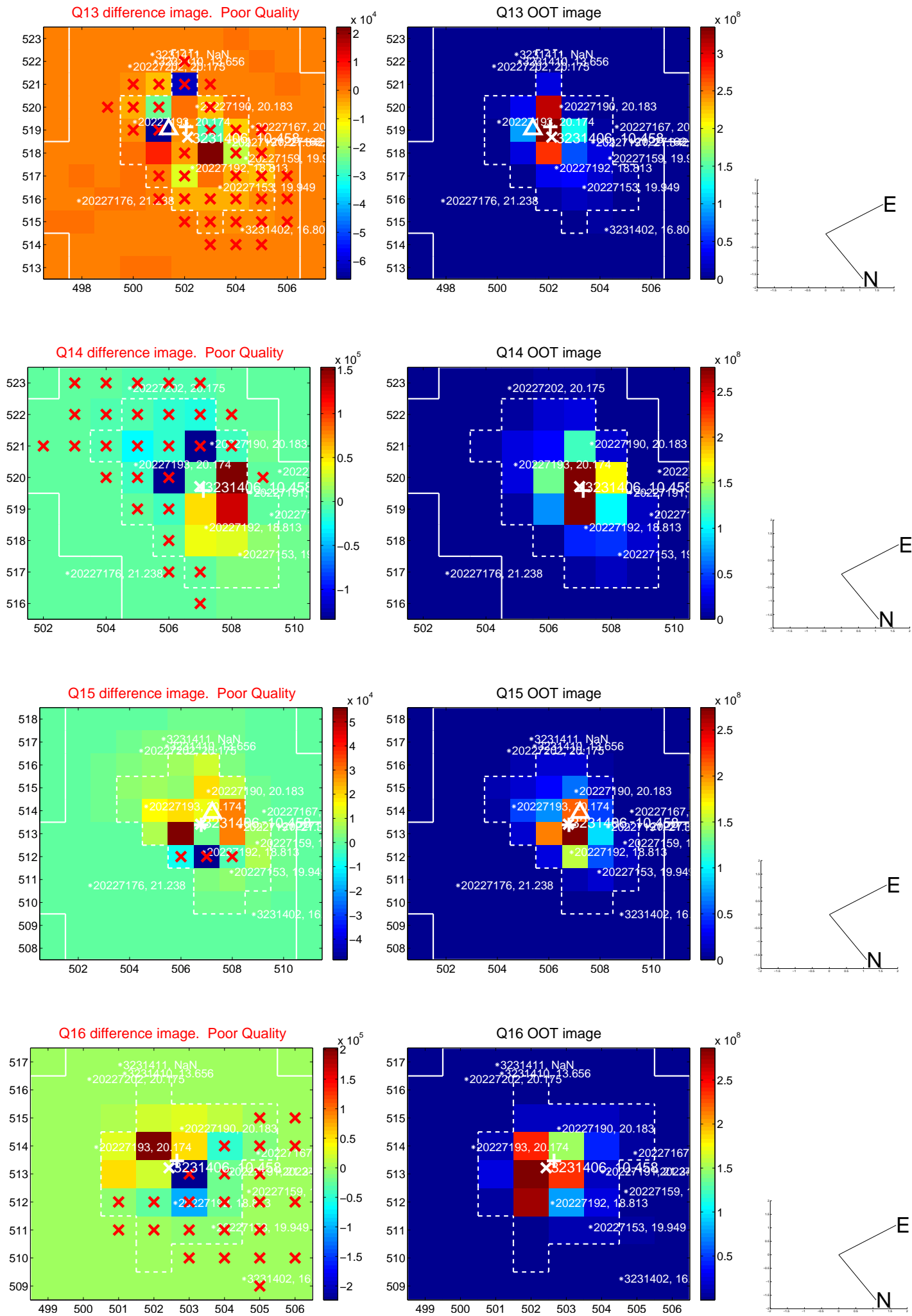
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



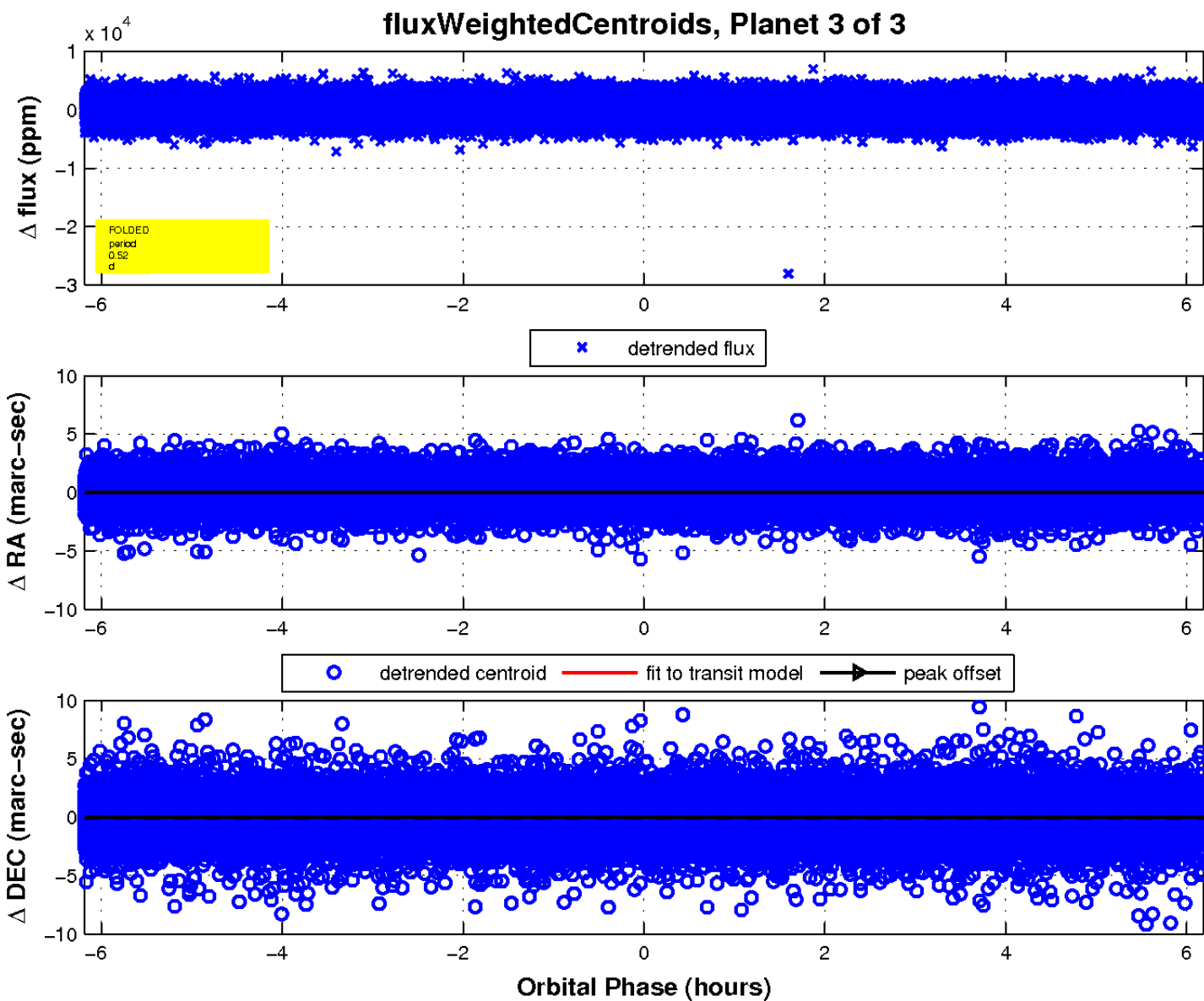
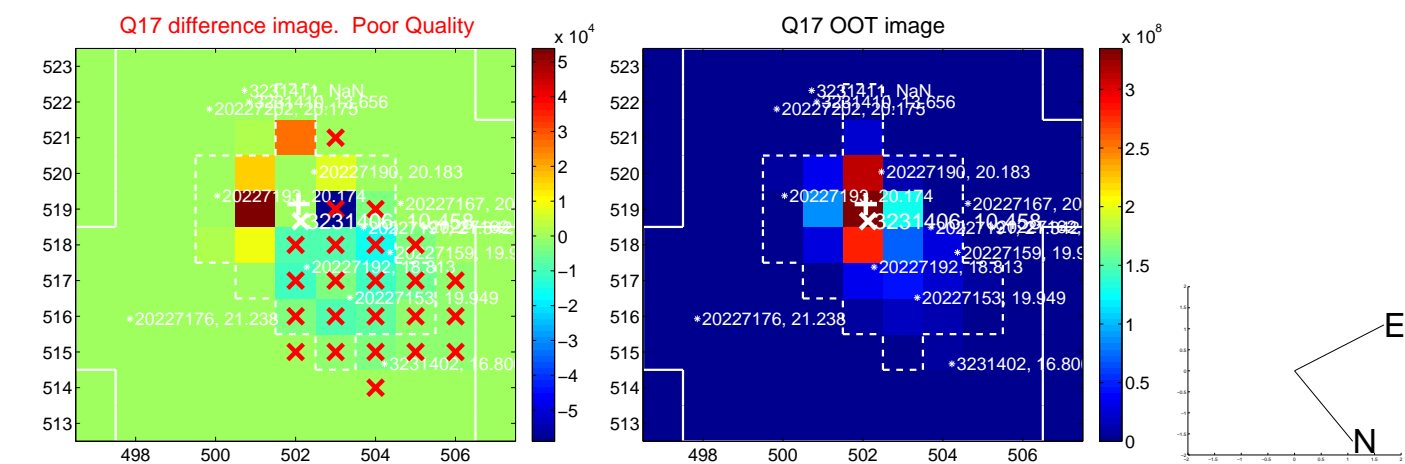
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

