

# KIC 009020160

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009020160-01	OBS	0582.01	5.945035	134.802634	791.9	2.723	58.7	64.1	0.87	5105	2.75	127.94
009020160-02	OBS	0582.02	17.738464	148.988758	622.7	3.115	27.0	29.0	0.87	5105	2.64	29.79
009020160-03	OBS	0582.03	9.939628	131.584771	301.1	3.144	18.7	19.8	0.87	5105	1.84	64.48

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009020160-01	OBS	PC	0.99	0	0	0	0	NO_COMMENT
009020160-02	OBS	PC	0.99	0	0	0	0	NO_COMMENT
009020160-03	OBS	PC	0.56	0	0	0	0	NO_COMMENT

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

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

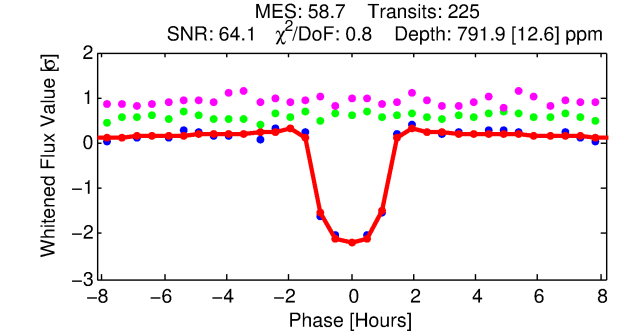
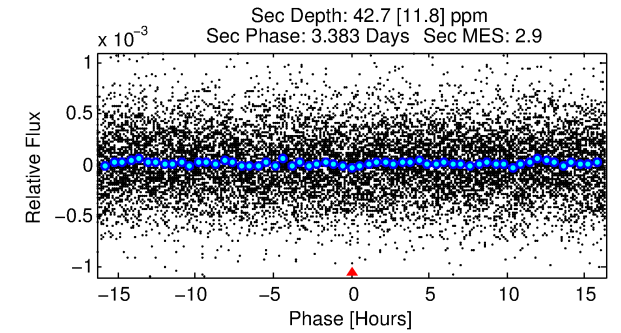
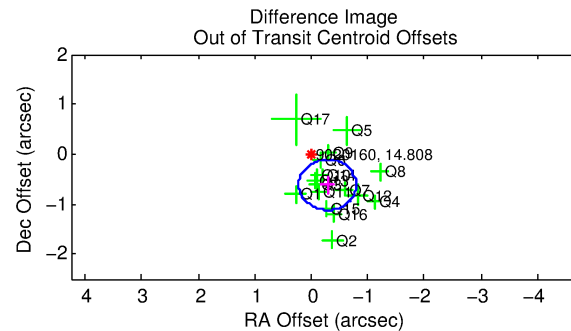
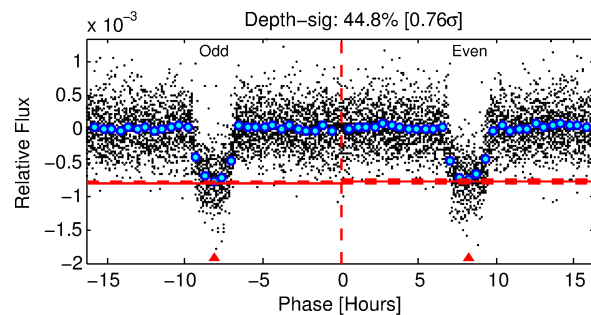
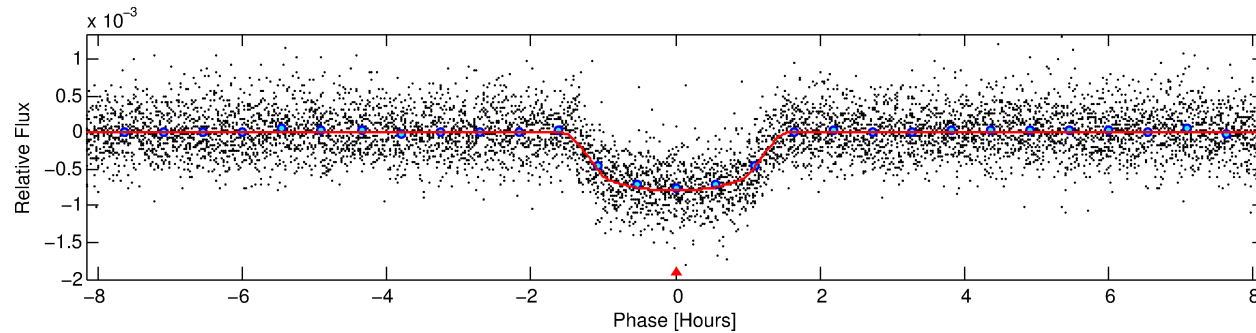
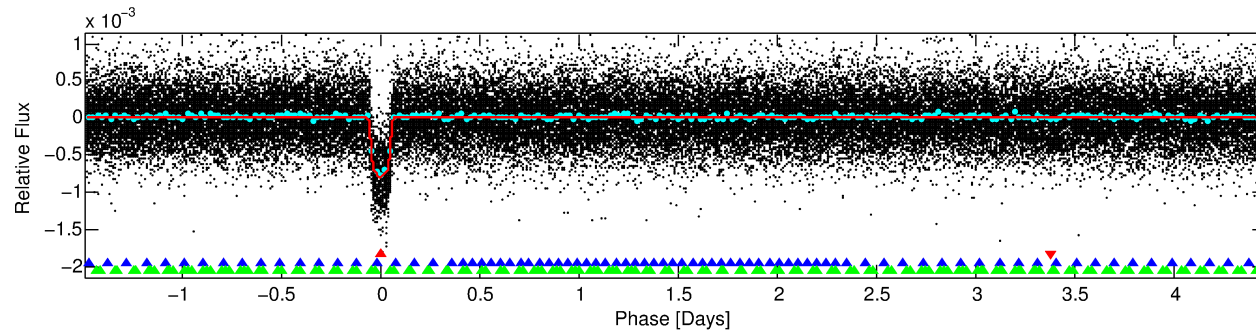
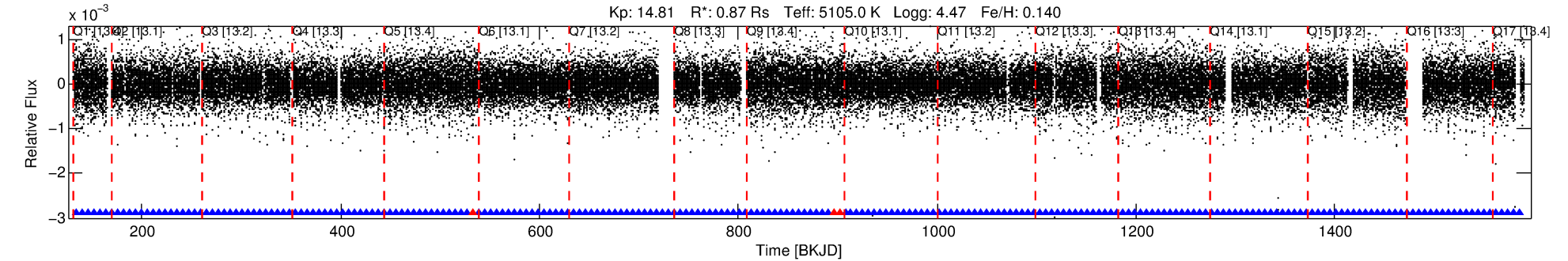
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 009020160-01

No Significant Match Found

# DV One-Page Summary

KIC: 9020160 Candidate: 1 of 3 Period: 5.945 d  
KOI: K00582.01 Corr: 0.972



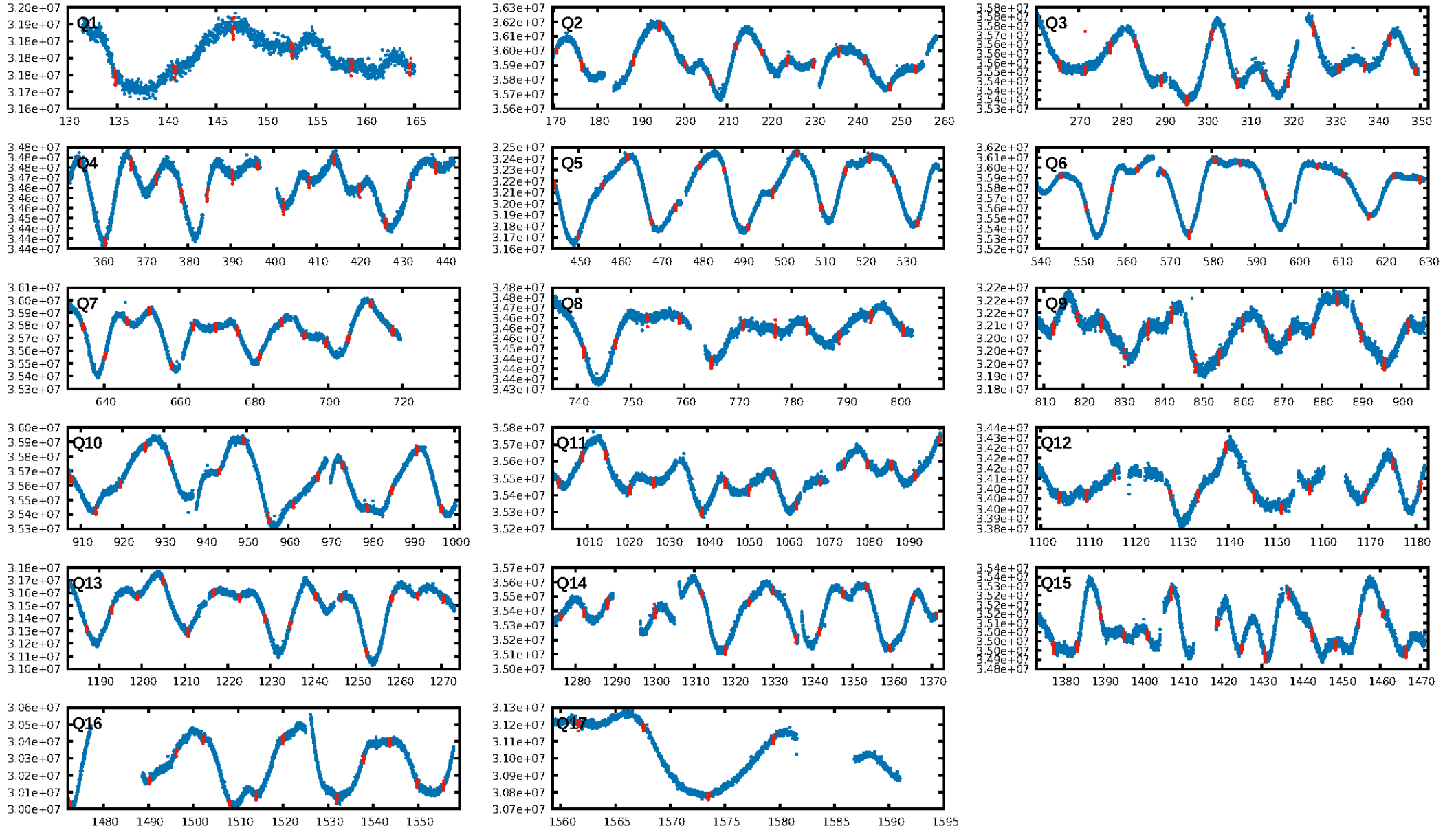
## DV Fit Results:

Period = 5.94503 [0.00001] d  
Epoch = 134.8026 [0.0007] BKJD  
Rp/R\* = 0.0290 [0.0038]  
a/R\* = 10.66 [5.09]  
b = 0.81 [0.21]  
Seff = 127.94 [20.96]  
Teff = 858 [35] K  
Rp = 2.75 [0.44] Re  
a = 0.0599 [0.0054] AU  
Ag = 11.11 [4.57] [2.21 $\sigma$ ]  
Teffp = 2421 [235] K [6.57 $\sigma$ ]

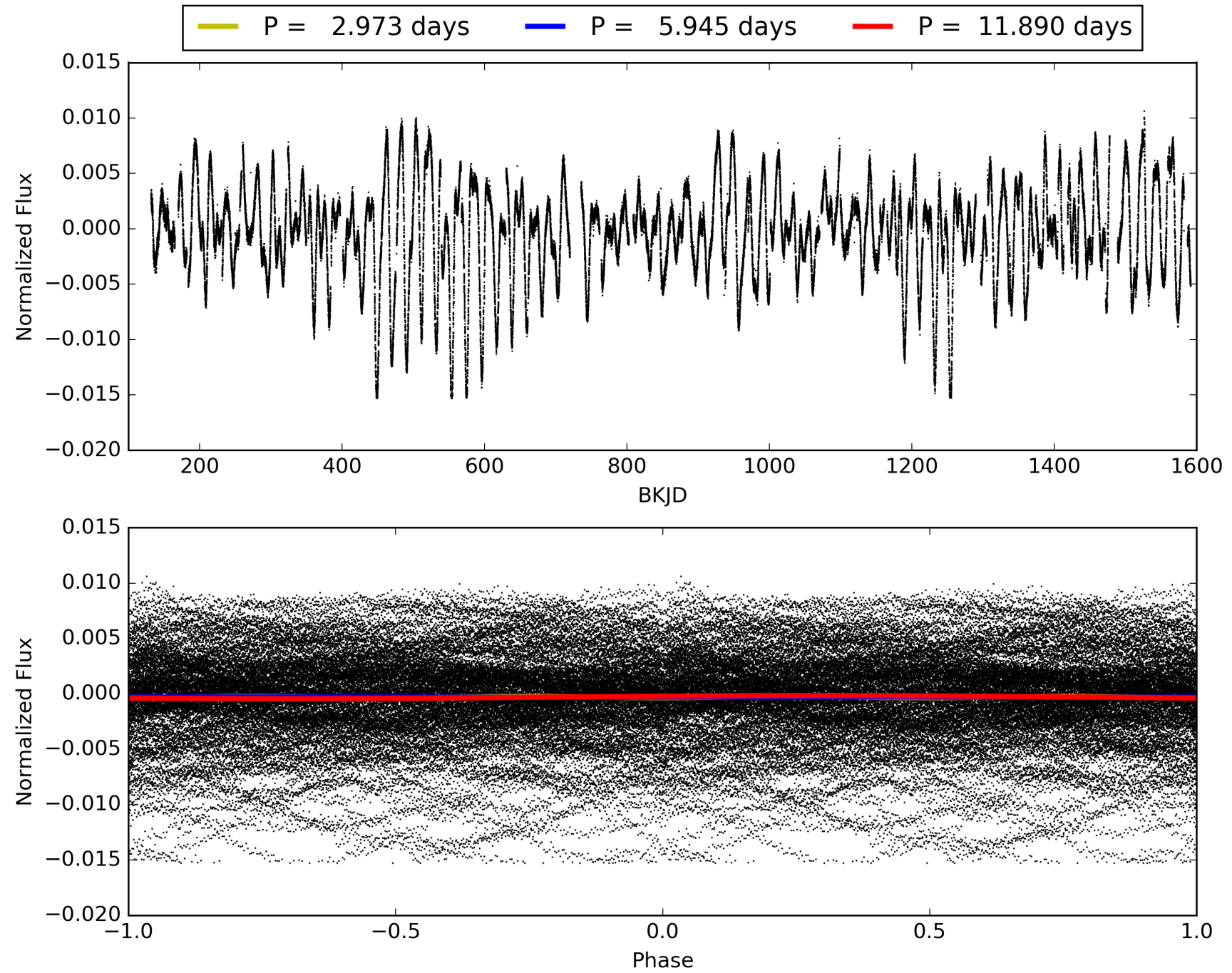
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [23.05 $\sigma$ ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: 0.00e+00  
RollingBand-fgt: 0.99 [212/215]  
GhostDiagnostic-chr: 2.578  
Centroid-sig: 0.0%  
Centroid-so: 0.228 arcsec [1.20 $\sigma$ ]  
OotOffset-rm: 0.673 arcsec [3.98 $\sigma$ ]  
KicOffset-rm: 0.288 arcsec [2.06 $\sigma$ ]  
OotOffset-st: 4/4/4/5 [17]  
KicOffset-st: 4/4/4/5 [17]  
DiffImageQuality-fgm: 1.00 [17/17]  
DiffImageOverlap-fno: 1.00 [17/17]

# TCE 009020160-01, PDC Light Curves

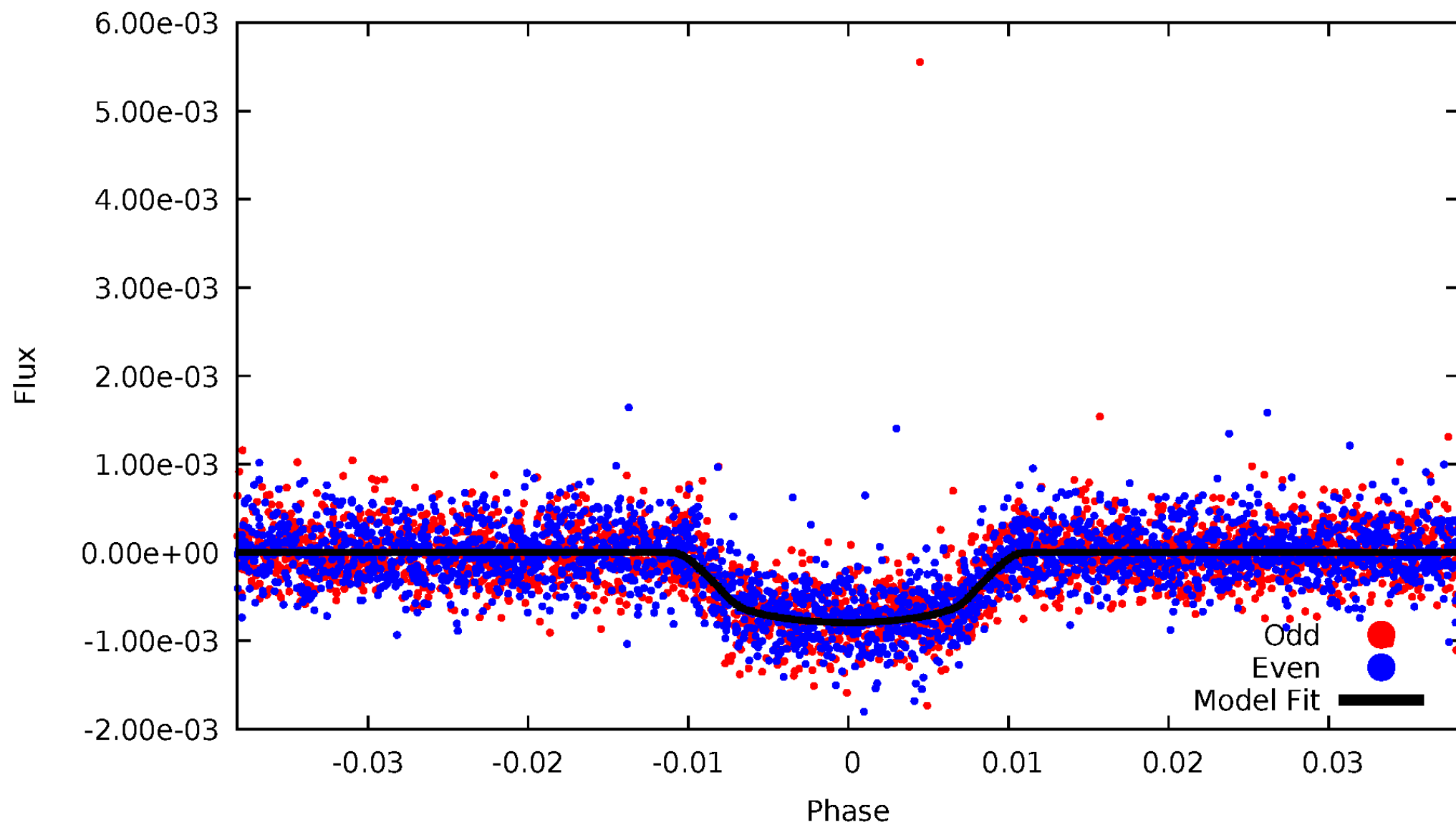


TCE 009020160-01



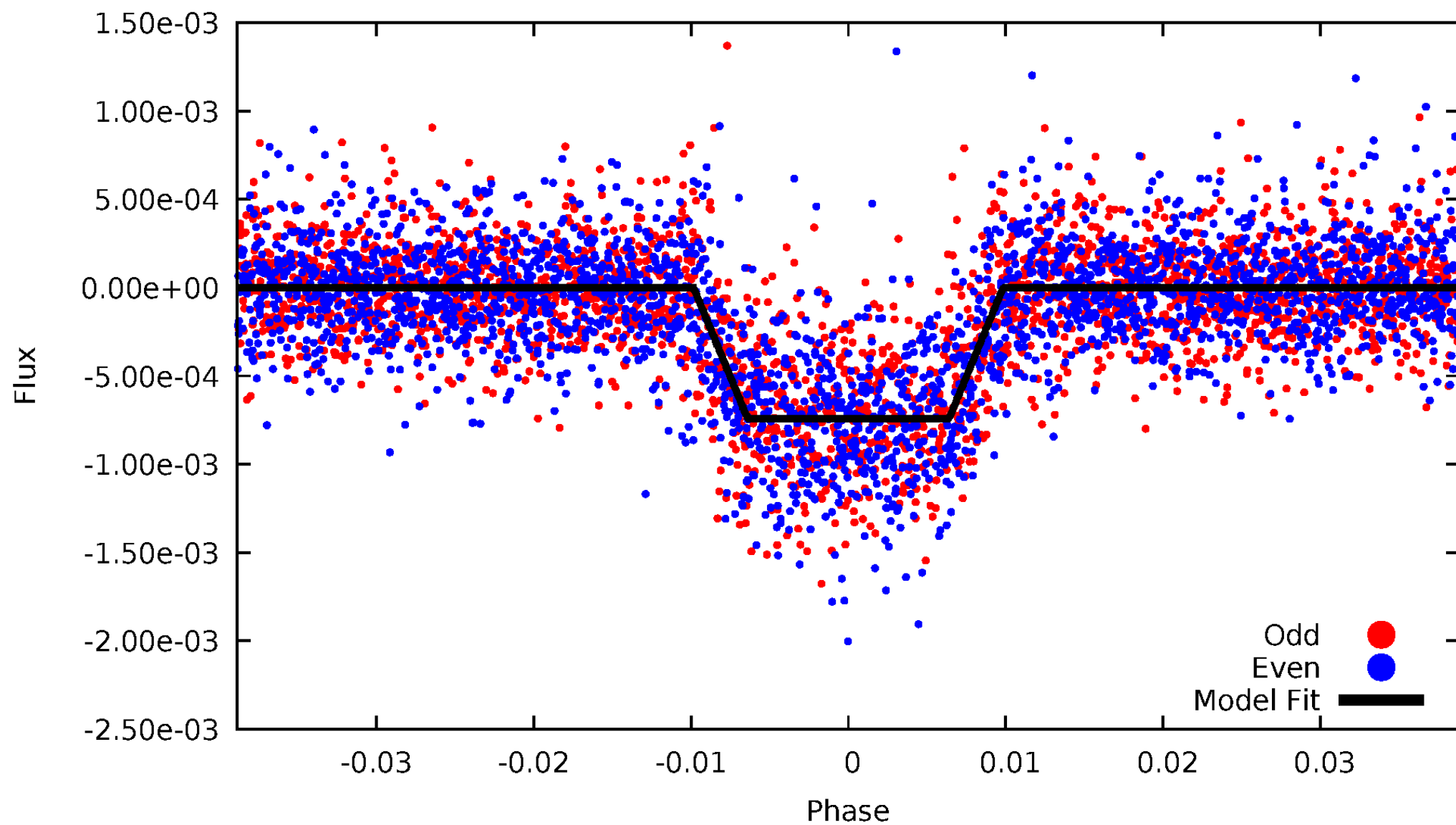
# DV Odd/Even

TCE 009020160-01



# ALT Odd/Even

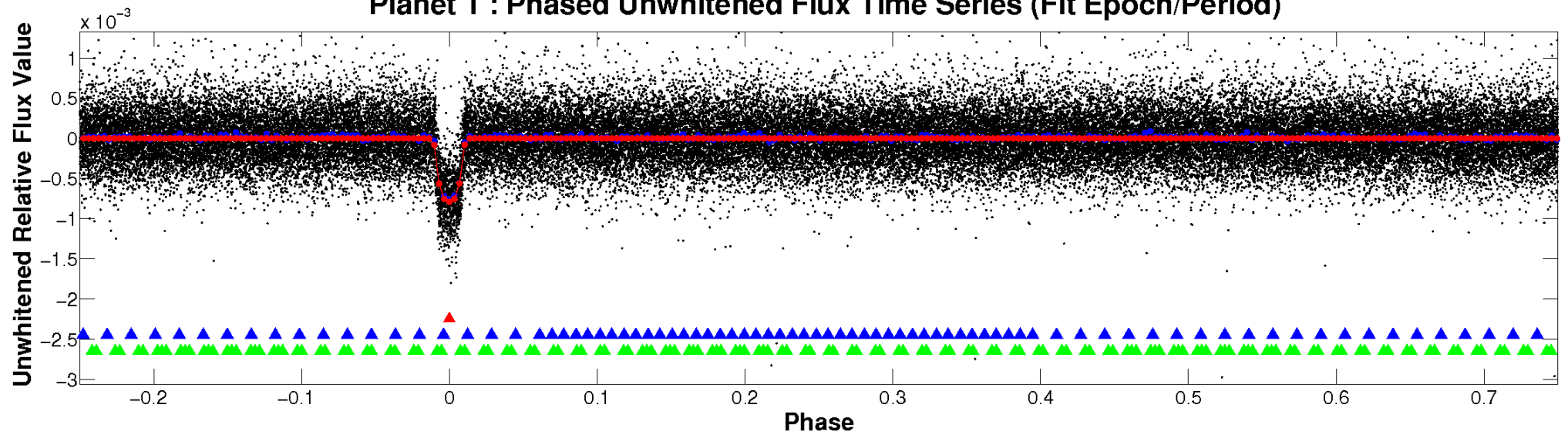
TCE 009020160-01



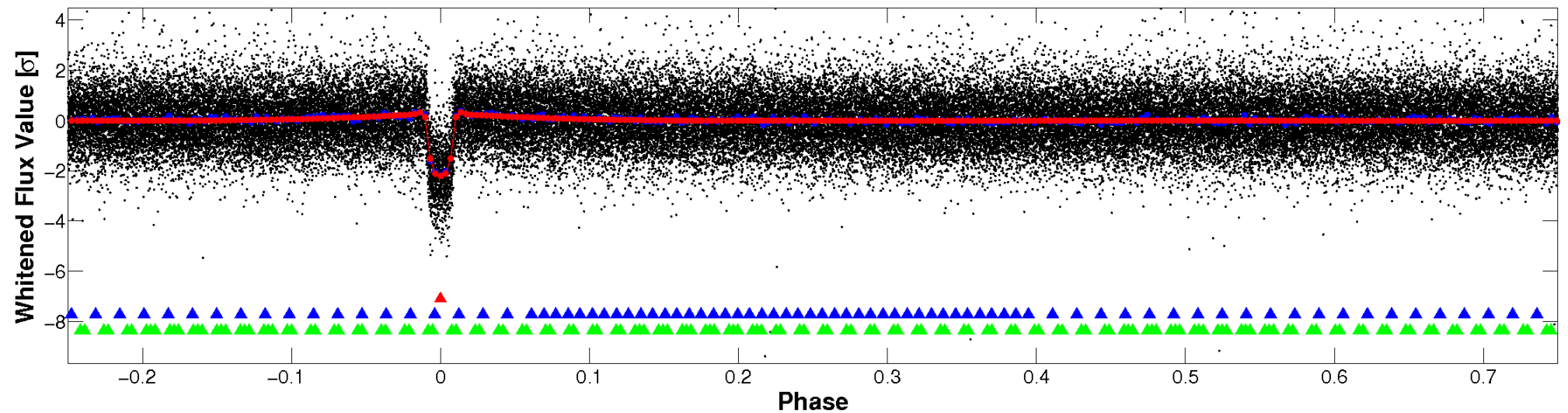


# Non-Whitened Vs. Whitened Light Curve

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

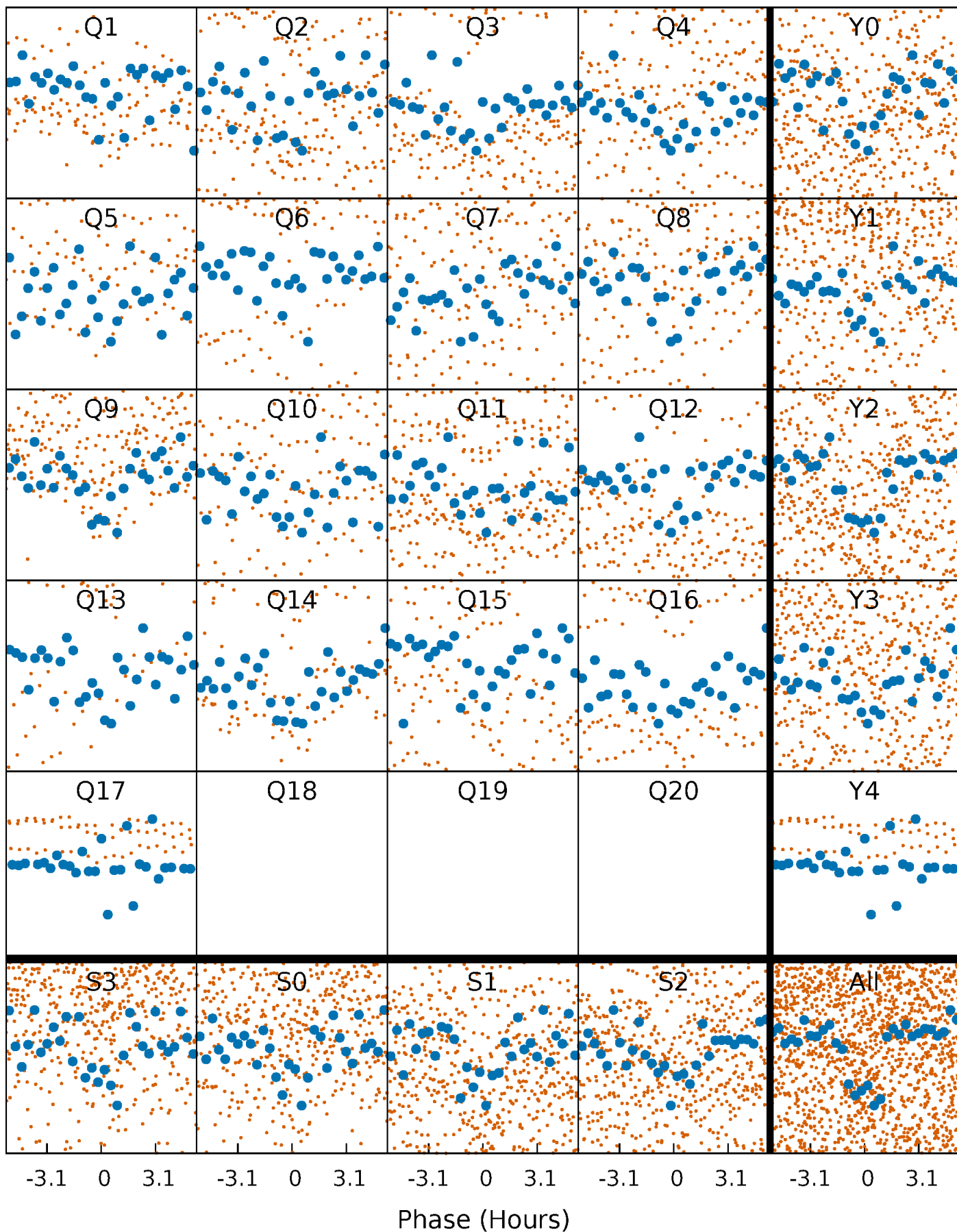


**Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



# PDC Quarter-Phased Transit Curves

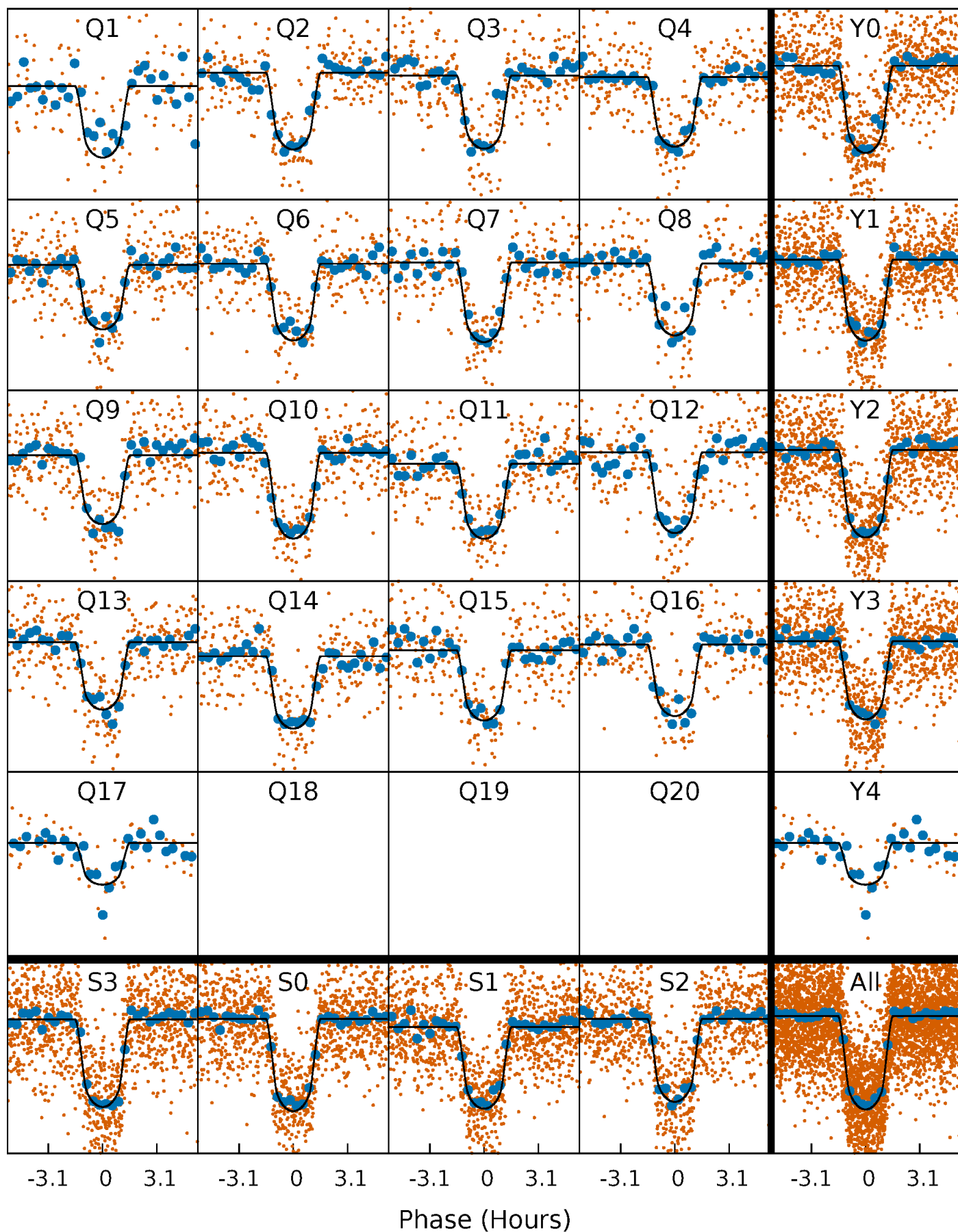
TCE 009020160-01 P= 5.945035 Days  $T_0=134.802634$  (BKJD)





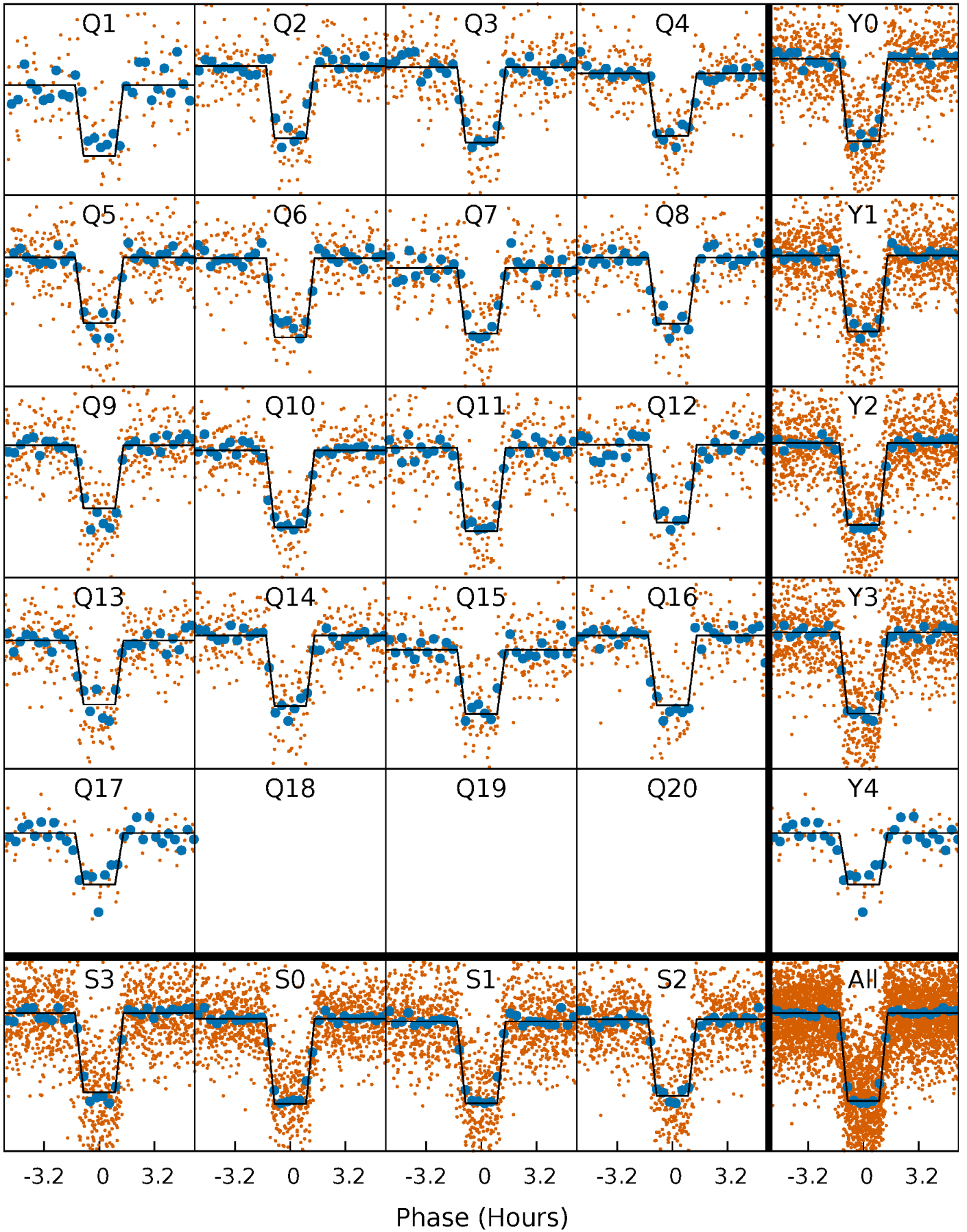
# DV Quarter-Phased Transit Curves

TCE 009020160-01 P= 5.945035 Days  $T_0=134.802634$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

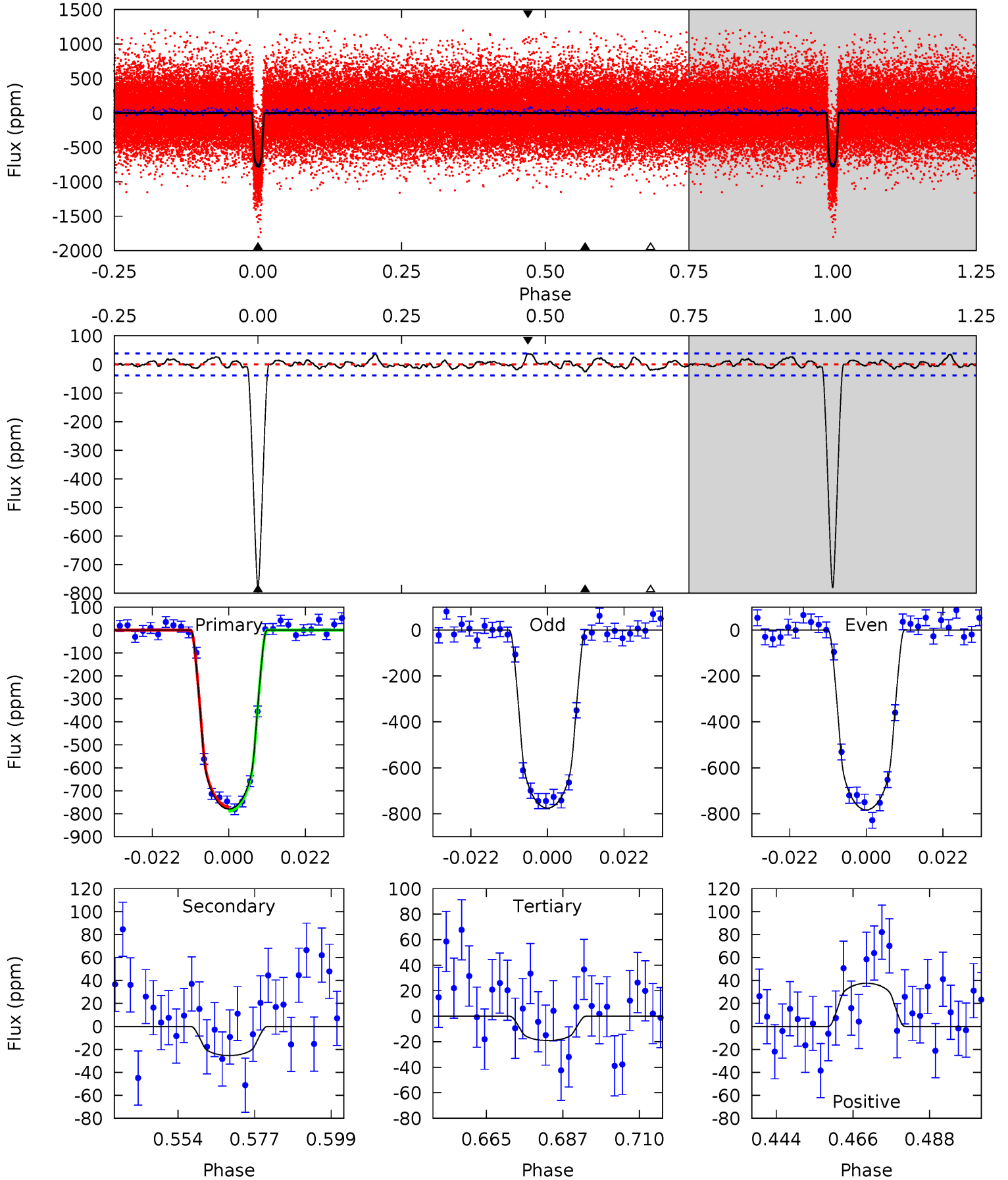
TCE 009020160-01 P= 5.945083 Days  $T_0=134.797046$  (BKJD)



# DV Model-Shift Uniqueness Test

009020160-01, P = 5.945035 Days, E = 128.857599 Days

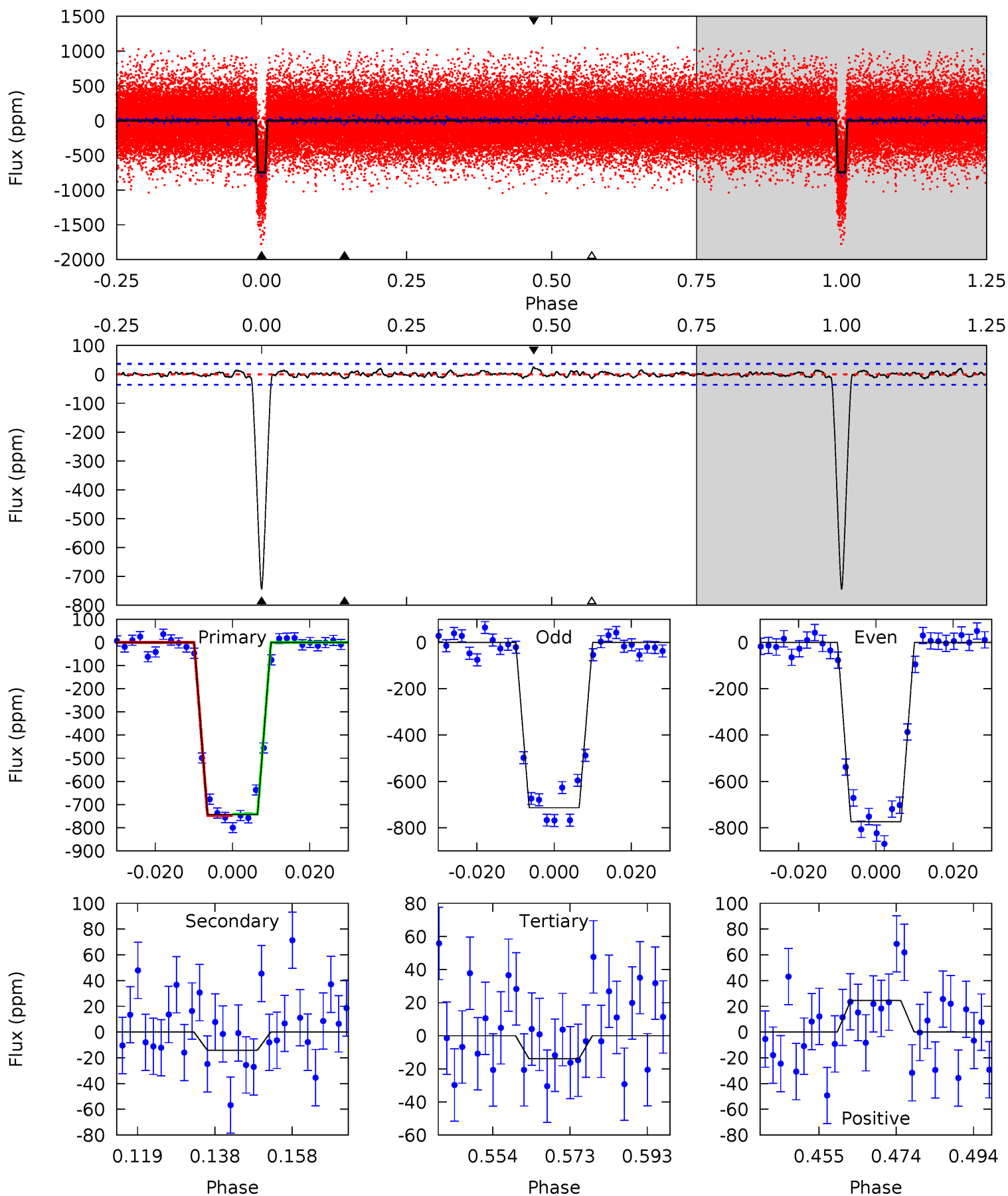
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
98.7	3.22	2.42	4.76	4.87	2.29	1.38	96.3	94.0	0.80	-1.54	0.49	0.99	0.05	1.16



# Alt Model-Shift Uniqueness Test

009020160-01, P = 5.945083 Days, E = 128.851963 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
100.7	1.91	1.87	3.32	4.89	2.33	0.85	98.8	97.4	0.03	-1.41	4.06	1.00	0.03	0.43



### Stellar Parameters For KIC 009020160

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5105^{+84}_{-76}$	$4.469^{+0.090}_{-0.030}$	$0.140^{+0.150}_{-0.150}$	$0.868^{+0.044}_{-0.076}$	$0.810^{+0.062}_{-0.026}$	$1.742^{+0.594}_{-0.193}$
	+2%/-1%	+2%/-1%	+107%/-107%	+5%/-9%	+8%/-3%	+34%/-11%
Source	SPE90	SPE90	SPE90	DSEP		

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

### Secondary Eclipse Parameters for KIC 009020160-01 / KOI 0582.01

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-25 \pm 8$	$2.74^{+0.37}_{-0.38}$	$1191^{+27}_{-35}$	$2807^{+157}_{-159}$	$6.666^{+3.258}_{-2.240}$
Alt.	$-14 \pm 7$	$2.55^{+0.37}_{-0.36}$	$1190^{+27}_{-33}$	$2637^{+190}_{-259}$	$4.261^{+2.795}_{-2.245}$

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



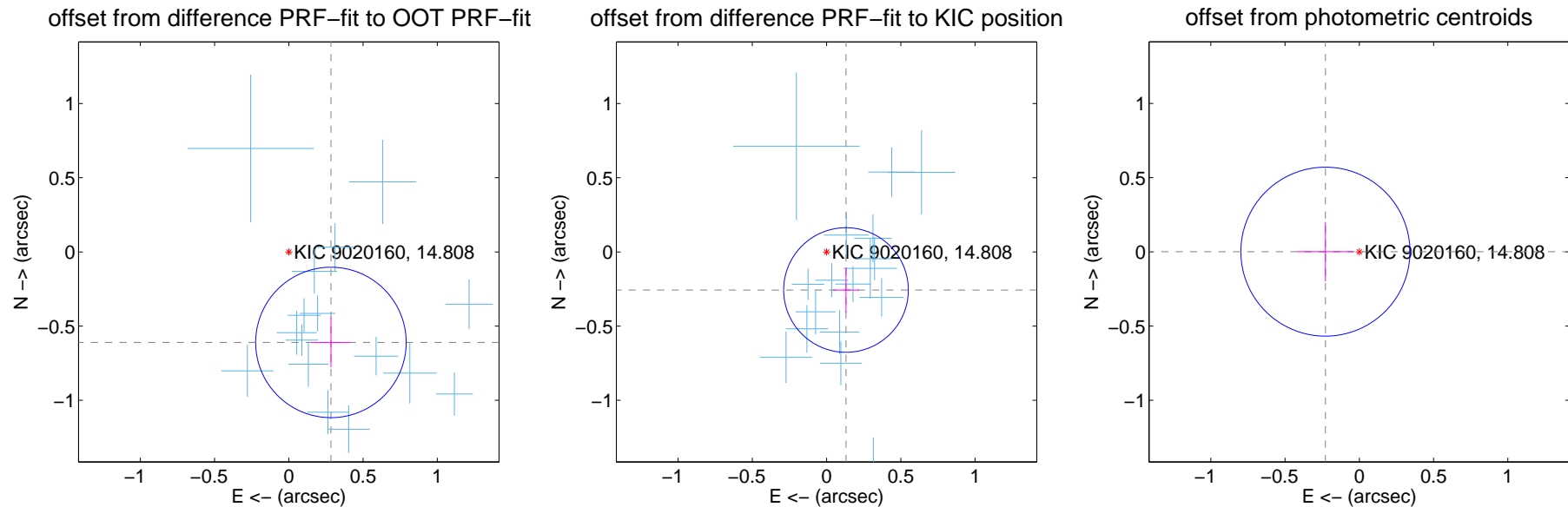
## DV Centroid Data

Supplemental centroid analysis for 009020160-01. Kepler magnitude: 14.81. Transit SNR 64.13

There are 17 quarters with good PRF difference image offsets

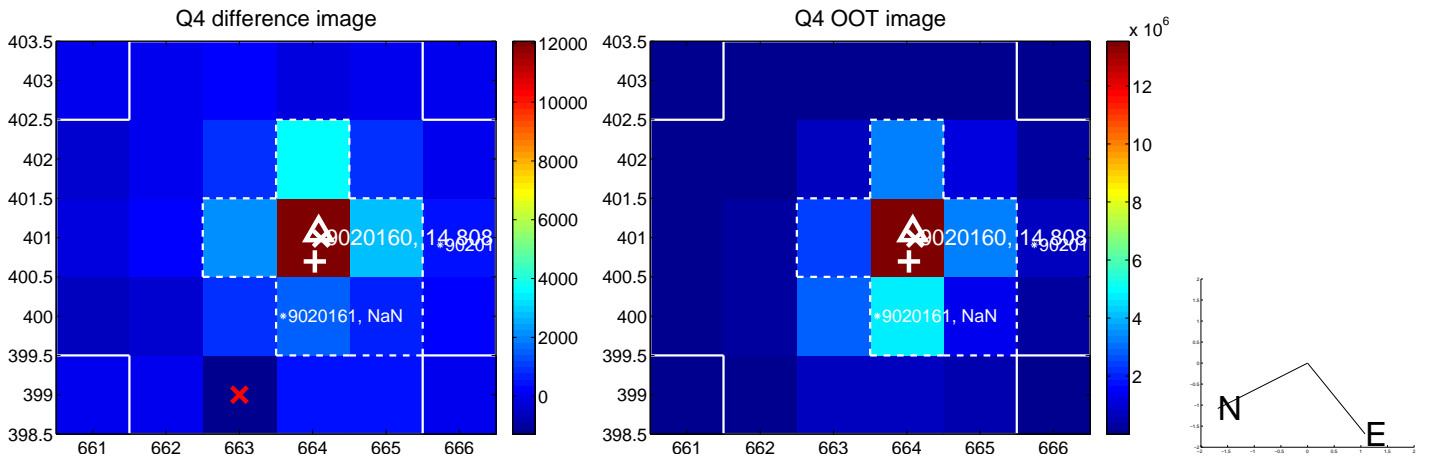
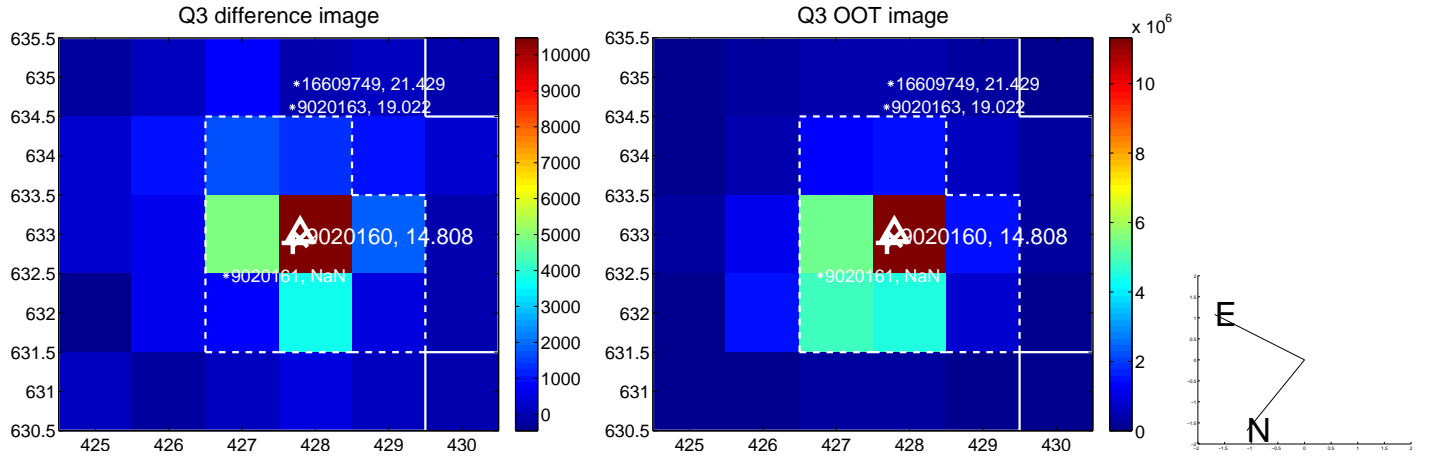
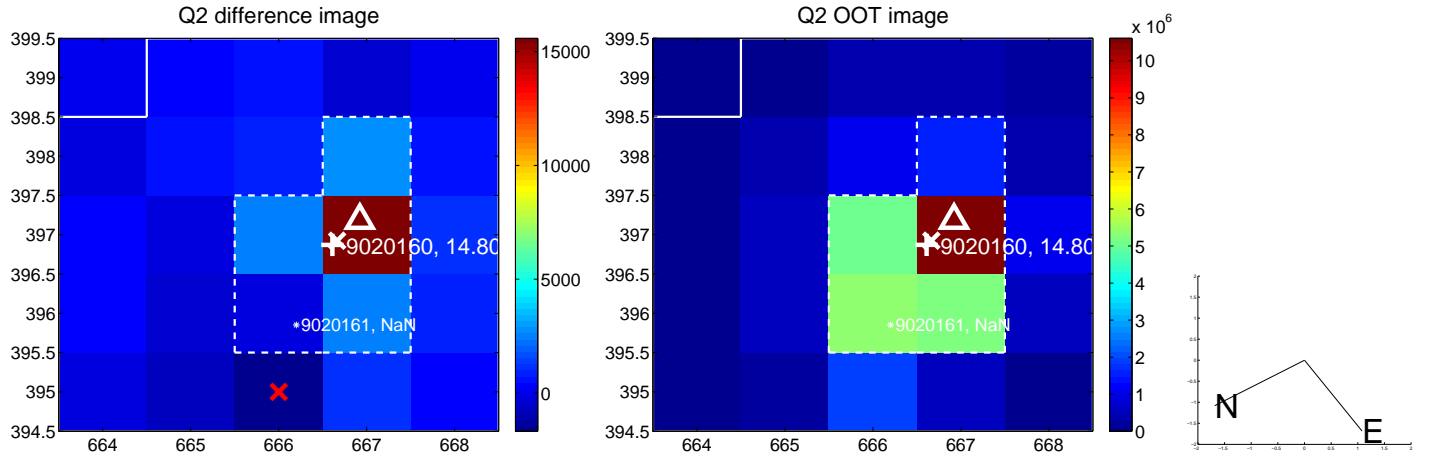
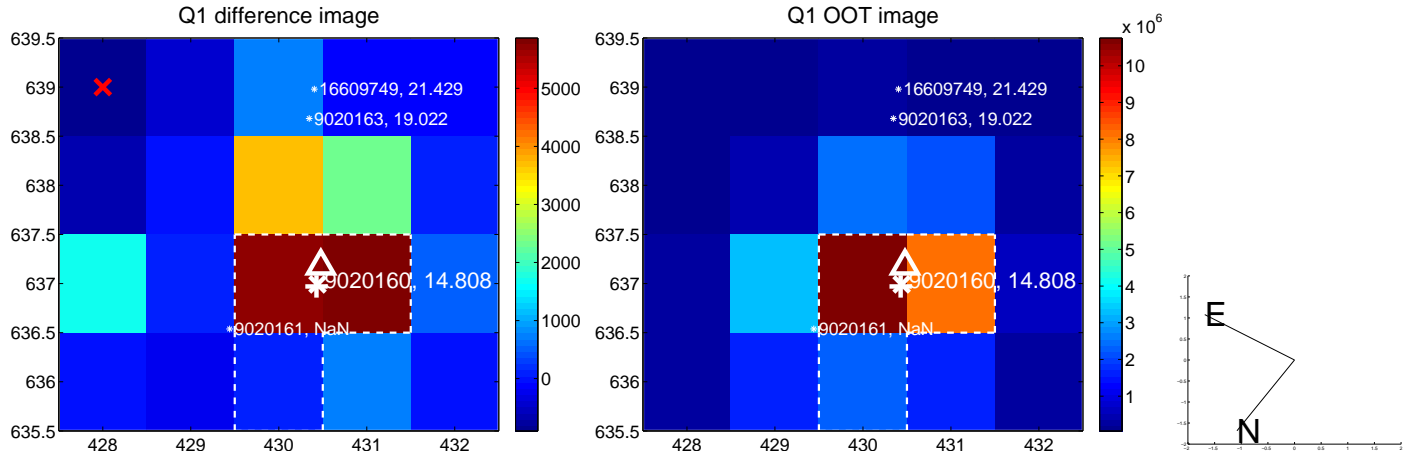
The direct PRF centroid is offset from the target star catalog position by about 0.06 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	<b><math>0.673 \pm 0.169</math></b>	<b>3.98</b>	$-0.284 \pm 0.130$	$-0.610 \pm 0.167$
PRF-fit source offset from KIC position	$0.288 \pm 0.140$	2.06	$-0.131 \pm 0.089$	$-0.257 \pm 0.153$
photometric centroid source offset	$0.23 \pm 0.19$	1.20	$0.23 \pm 0.19$	$0.00 \pm 0.20$

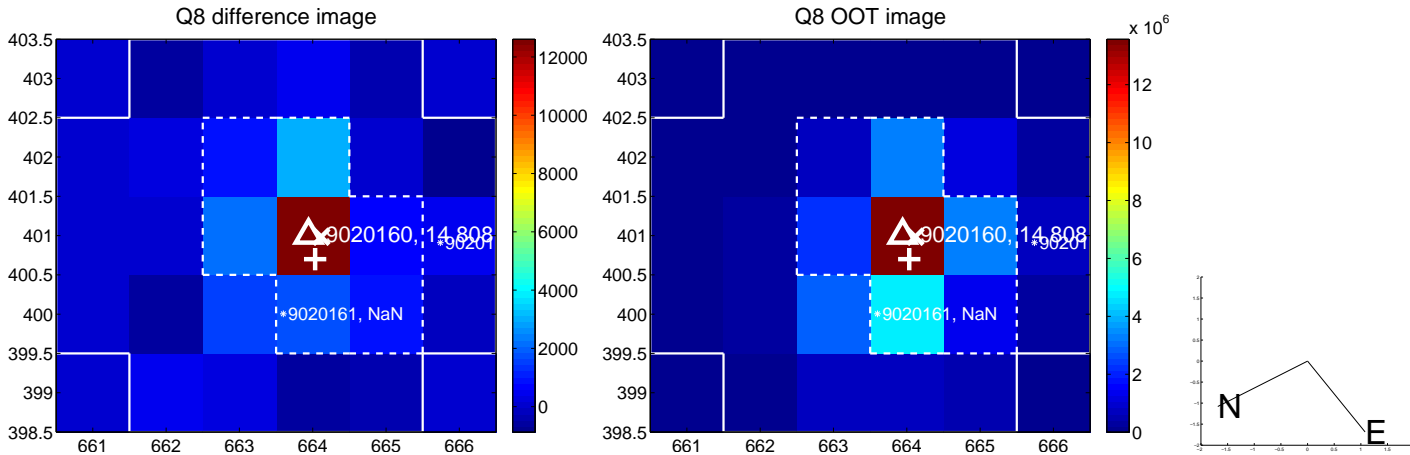
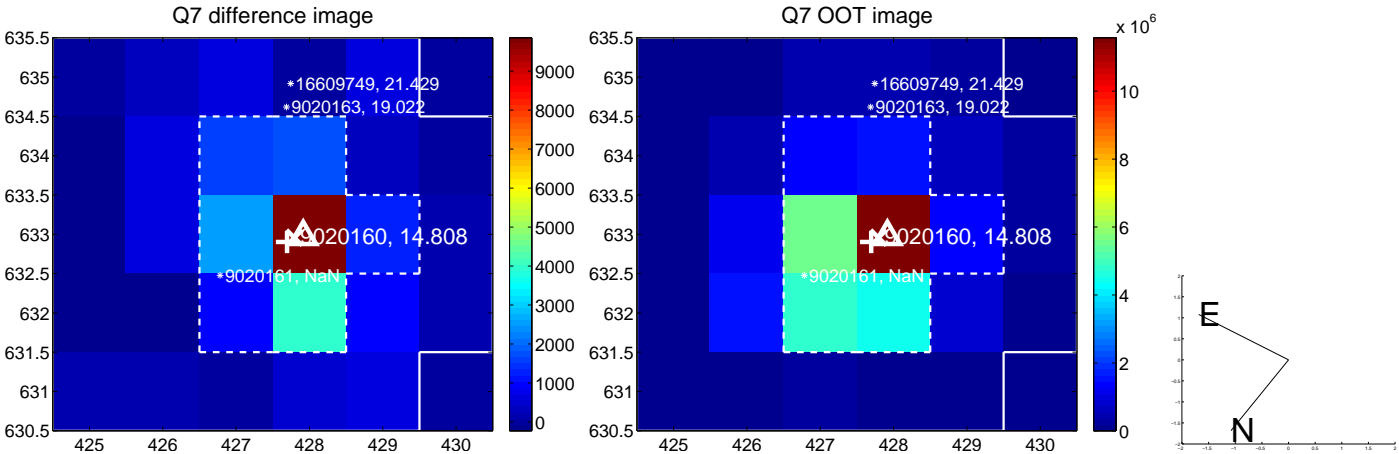
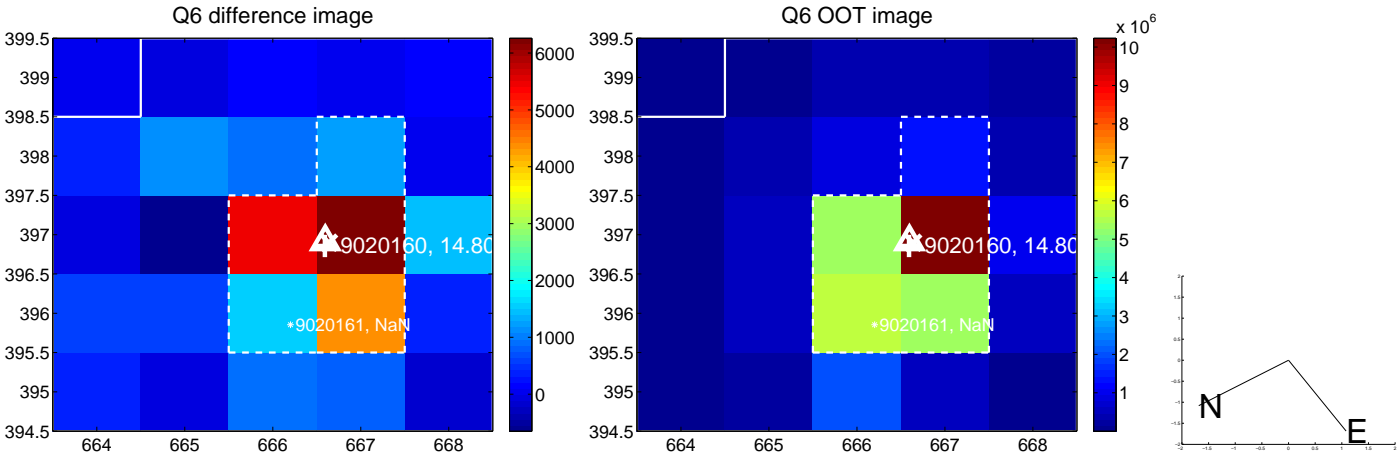
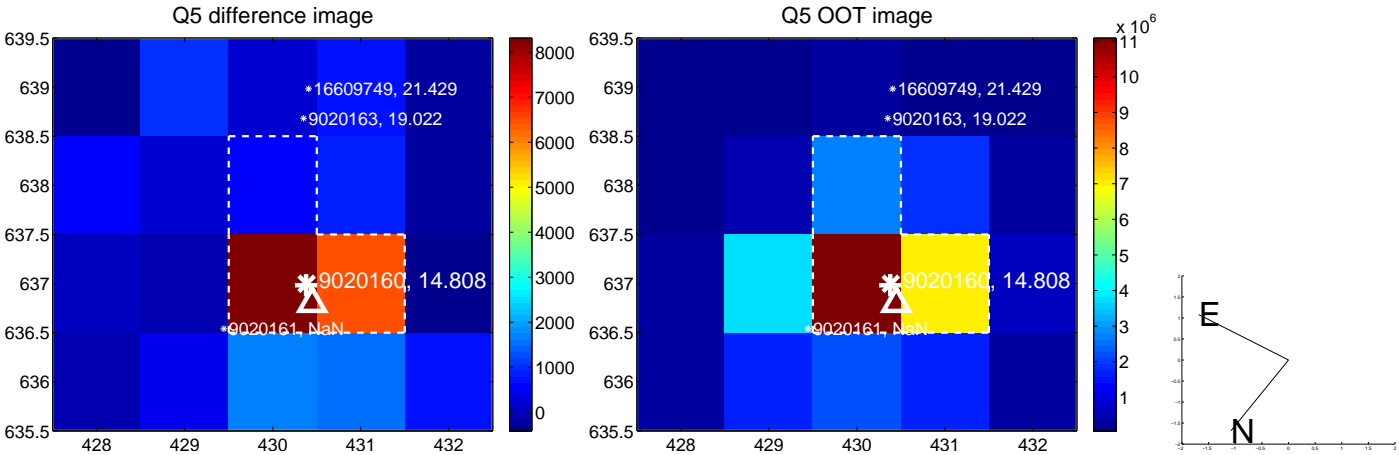


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets**; **Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

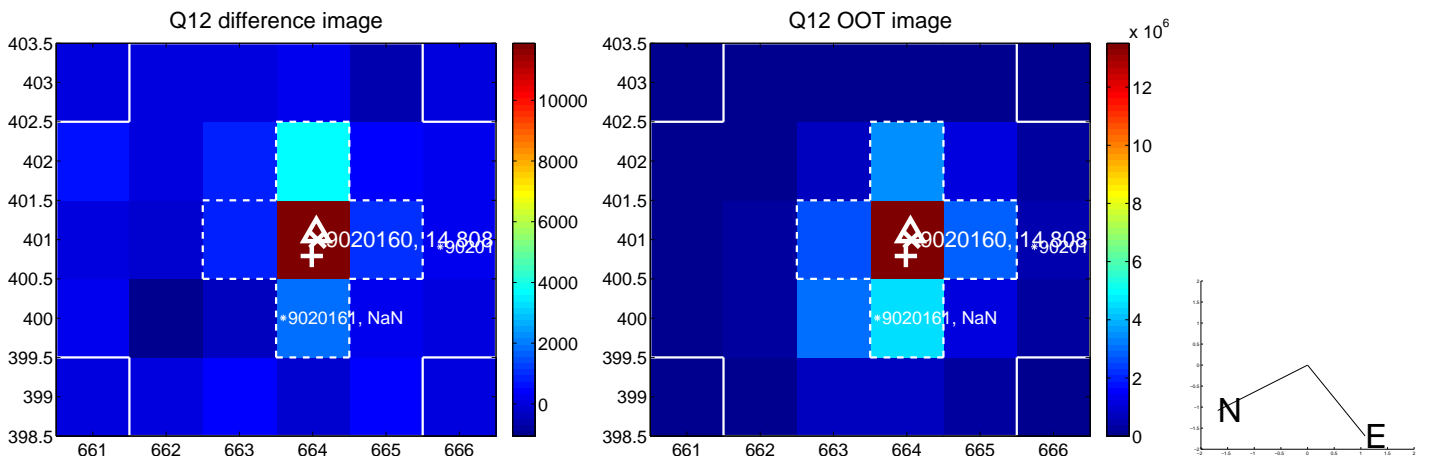
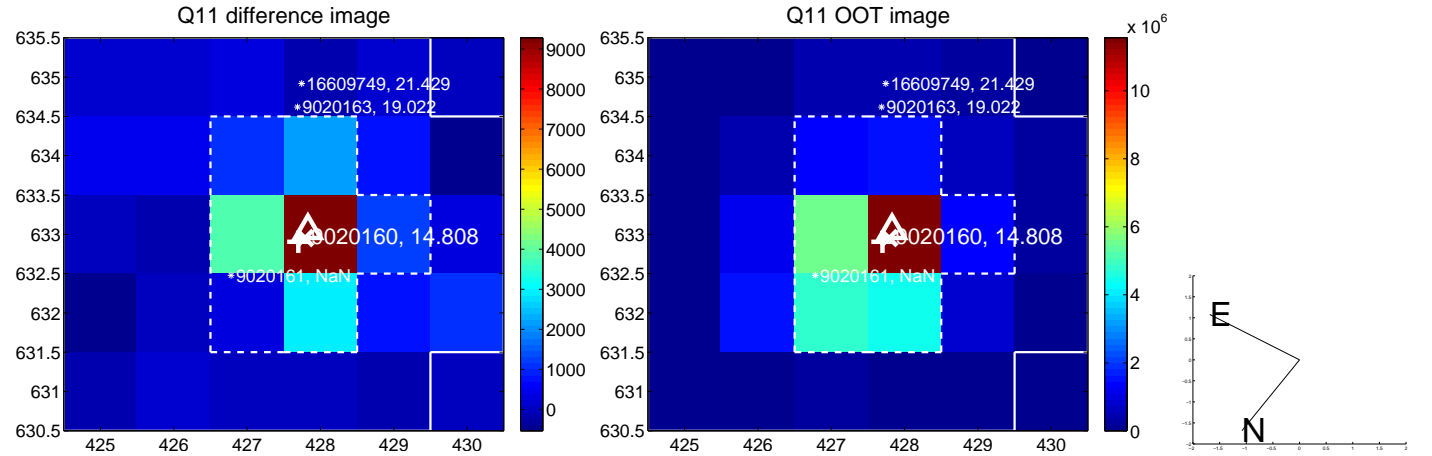
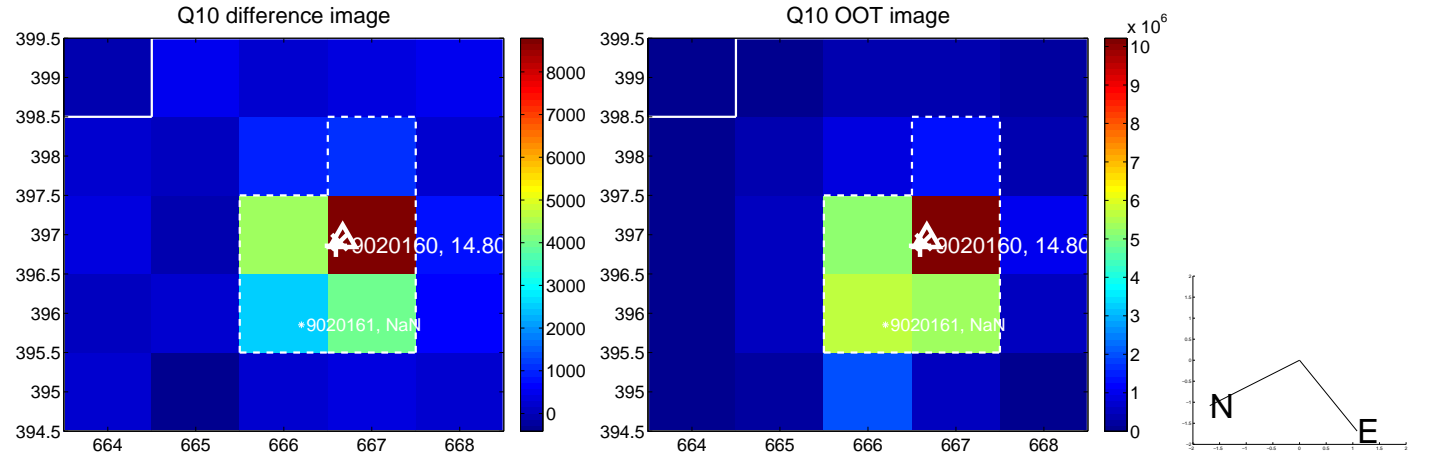
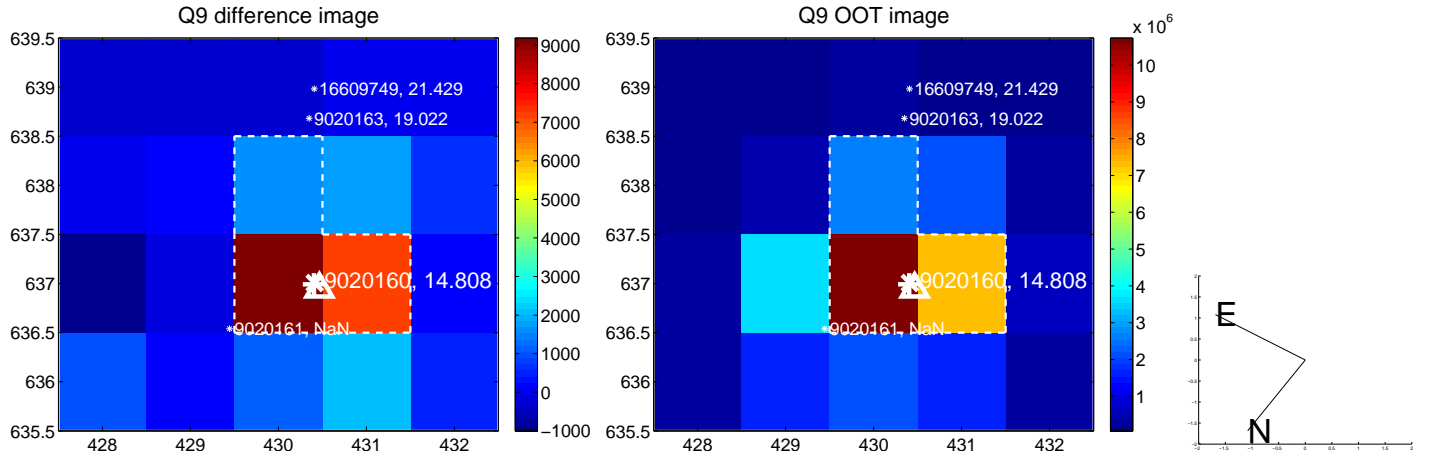
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



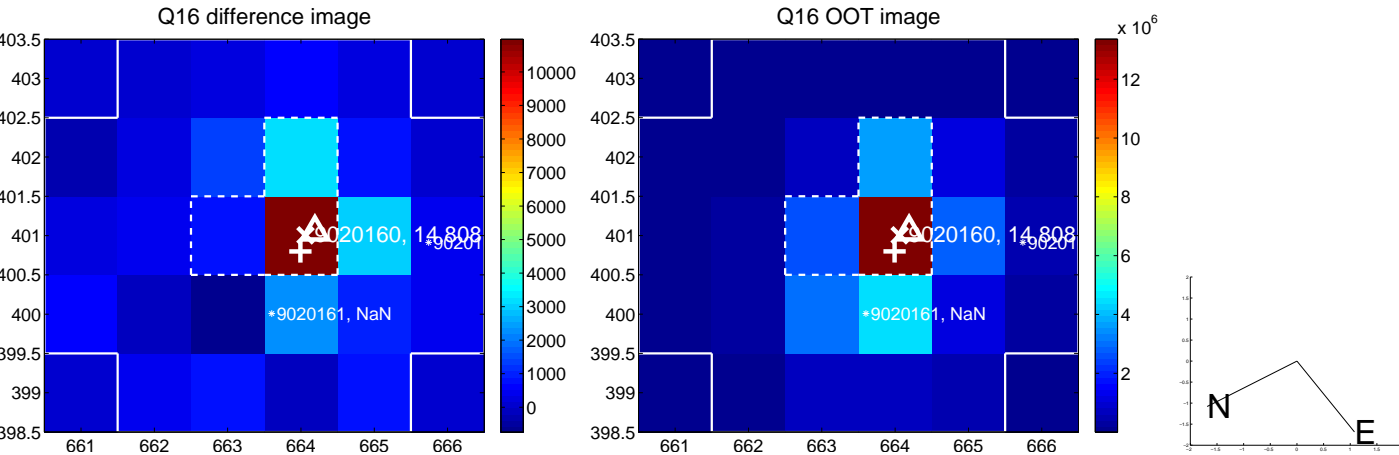
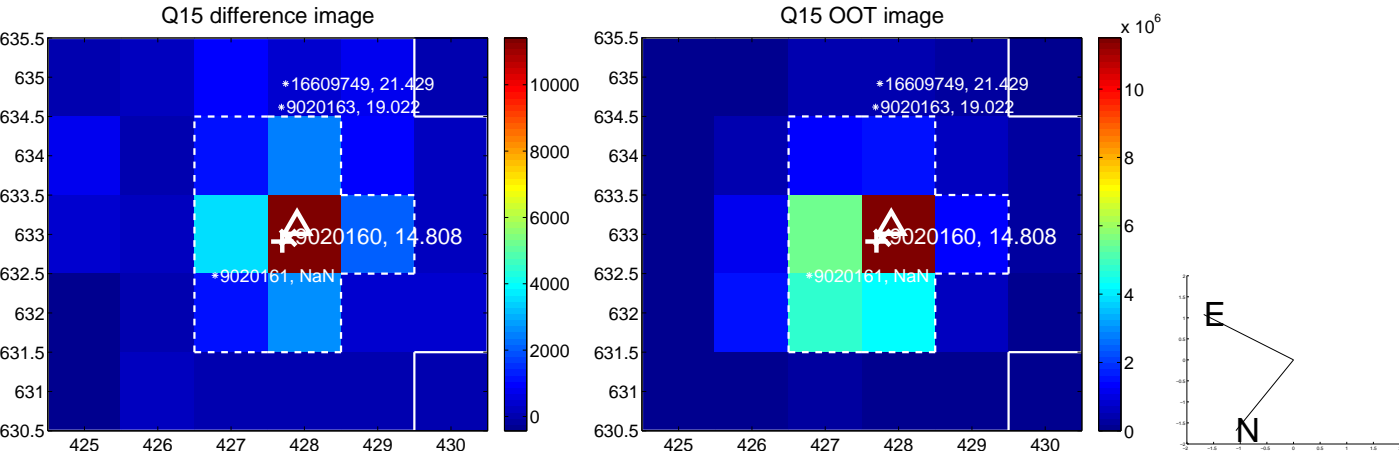
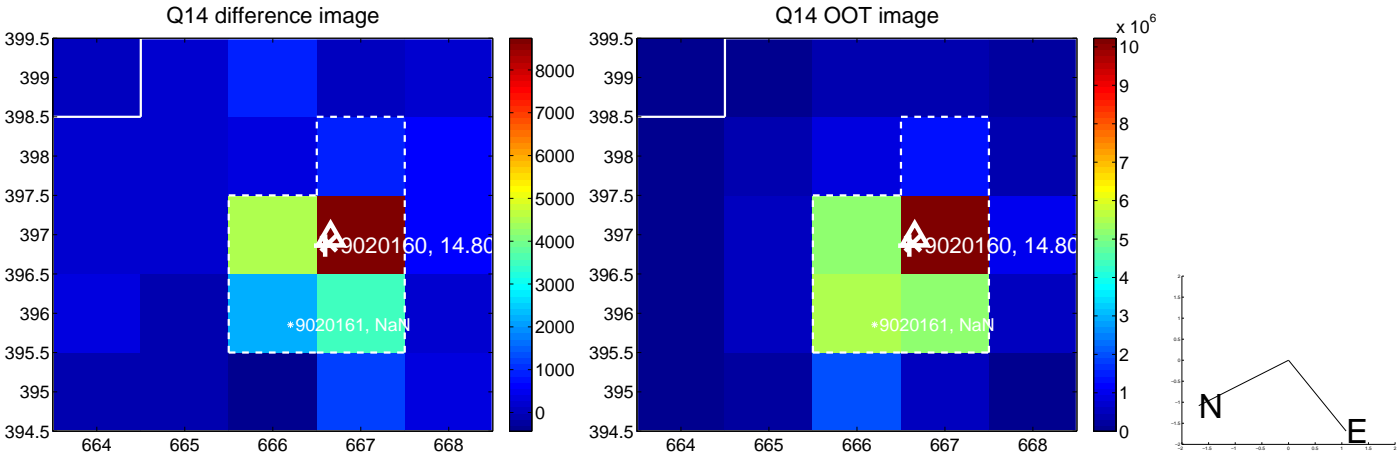
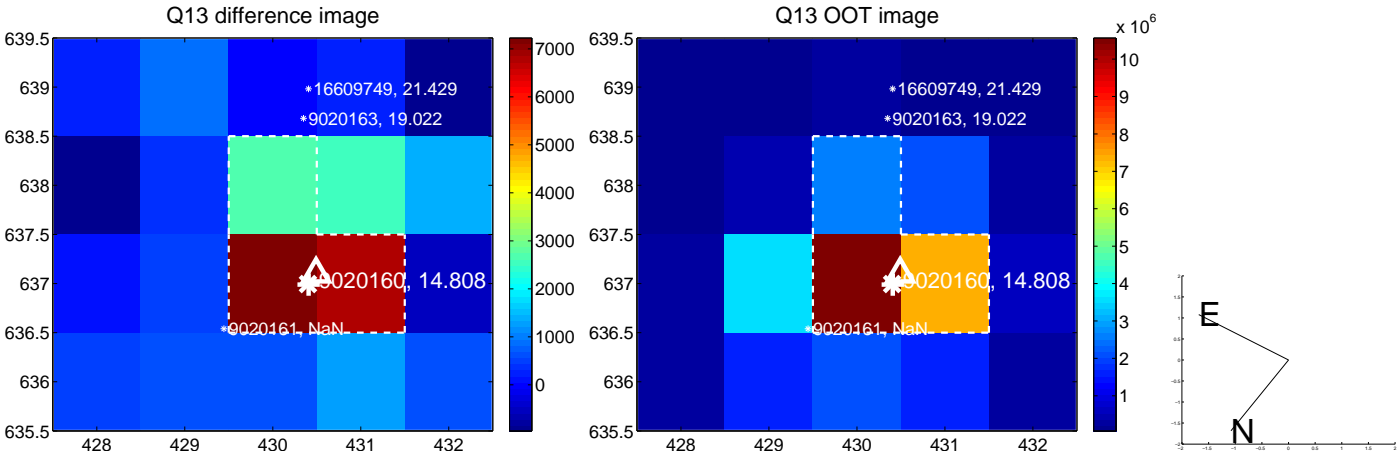
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white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

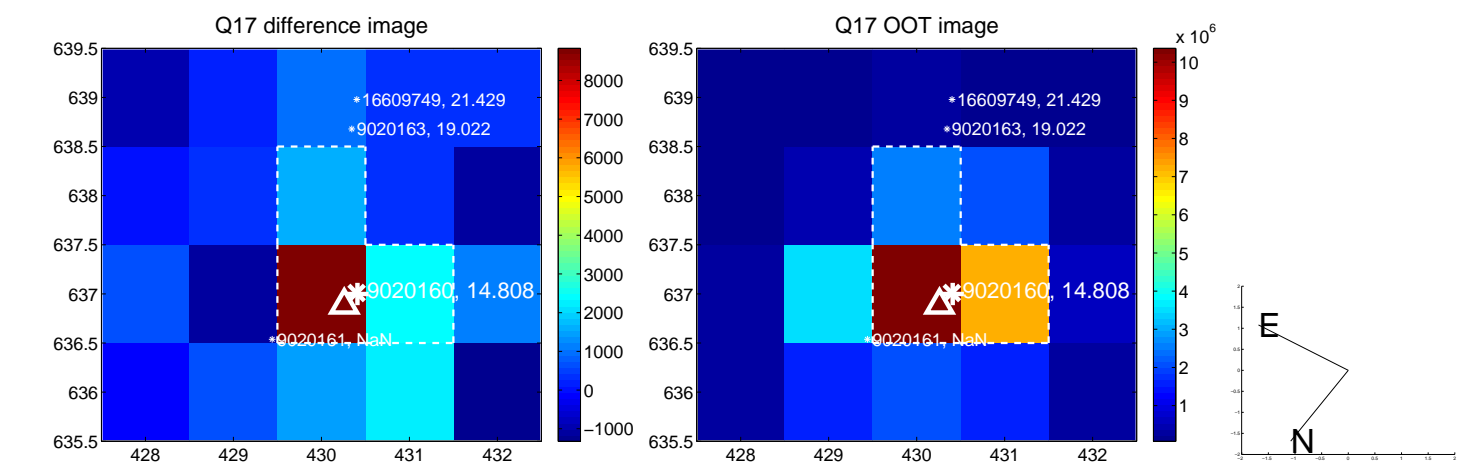


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

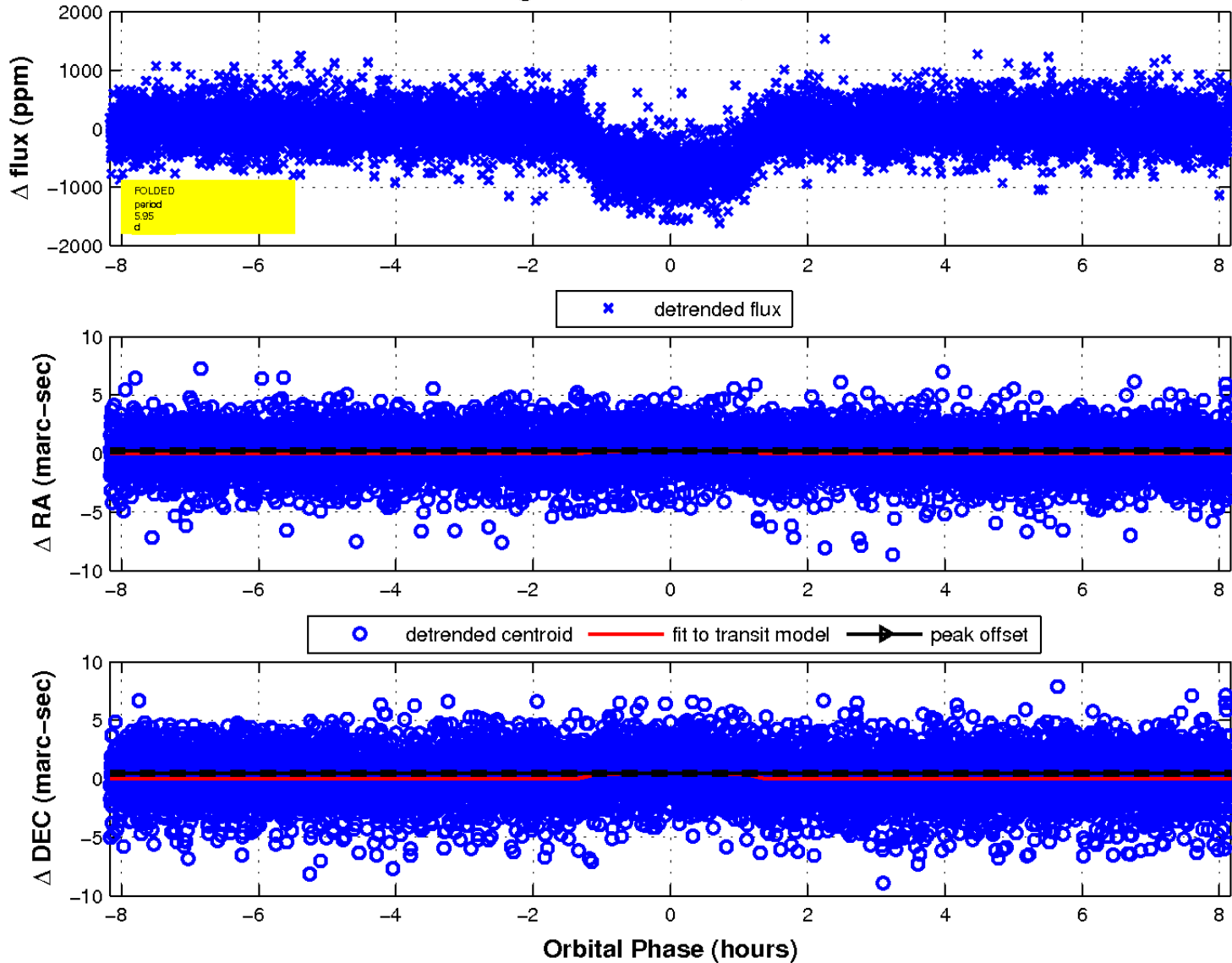




white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

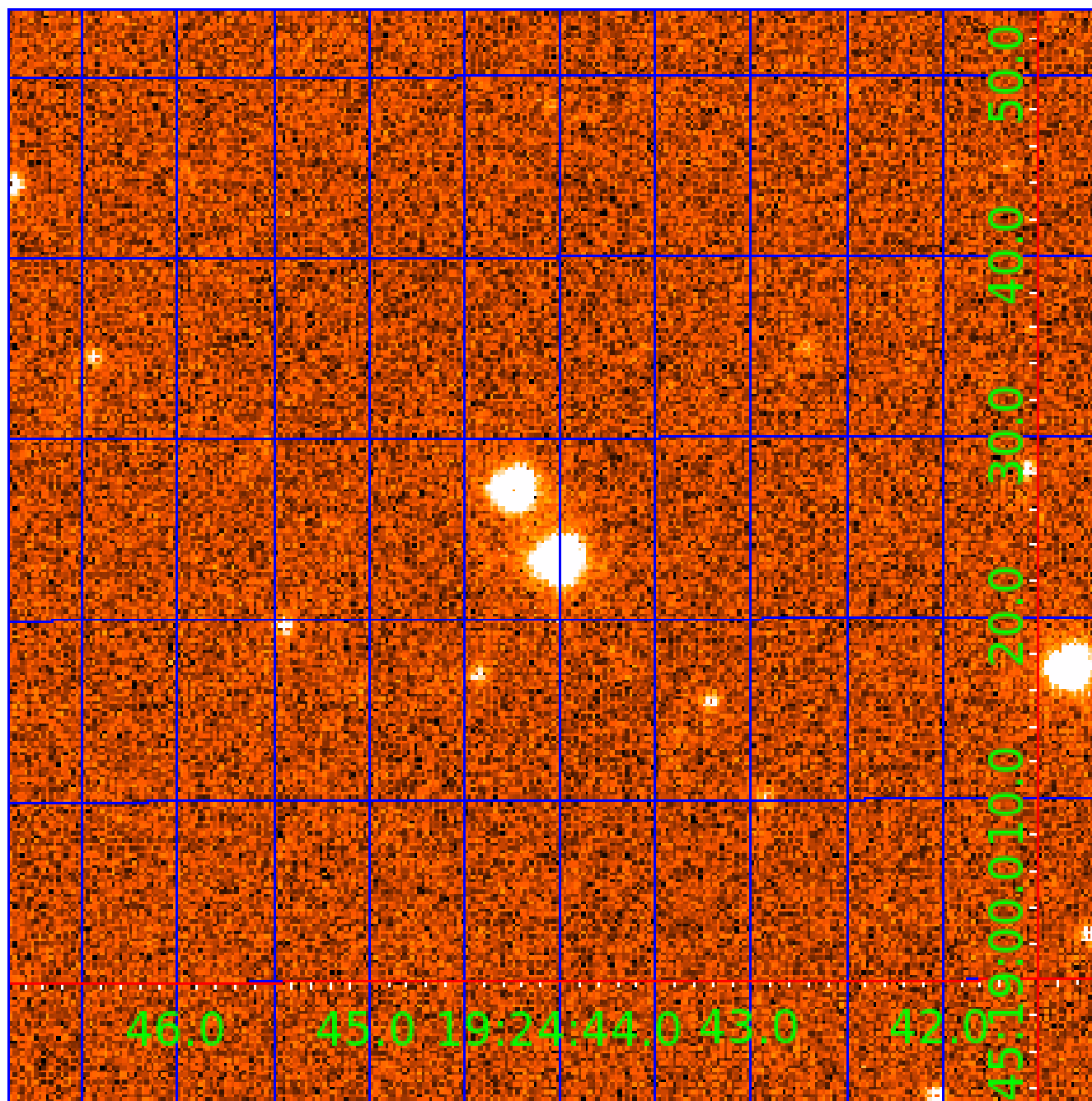


fluxWeightedCentroids, Planet 1 of 3



UKIRT Image

Declination



# KIC 009020160

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009020160-01	OBS	0582.01	5.945035	134.802634	791.9	2.723	58.7	64.1	0.87	5105	2.75	127.94
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009020160-03	OBS	0582.03	9.939628	131.584771	301.1	3.144	18.7	19.8	0.87	5105	1.84	64.48

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009020160-01	OBS	PC	0.99	0	0	0	0	NO_COMMENT
009020160-02	OBS	PC	0.99	0	0	0	0	NO_COMMENT
009020160-03	OBS	PC	0.56	0	0	0	0	NO_COMMENT

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

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

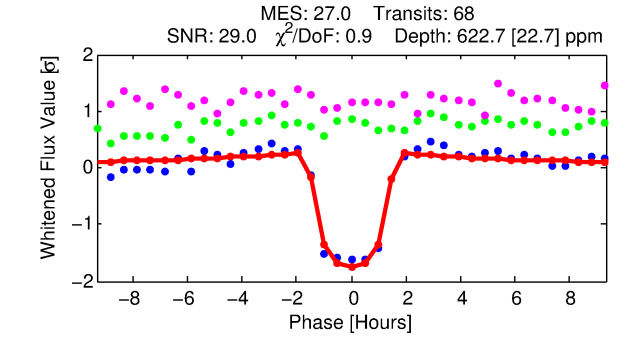
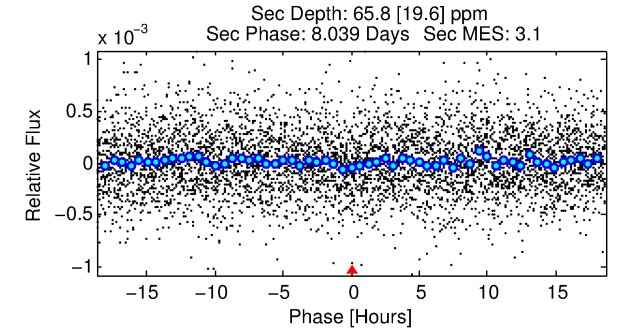
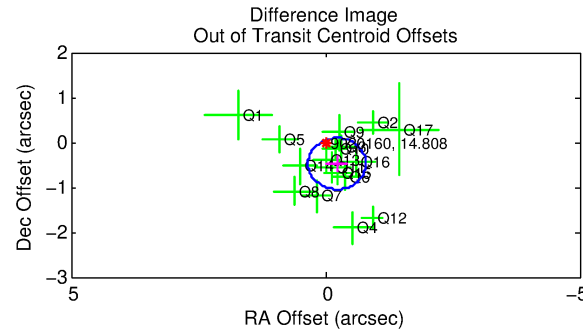
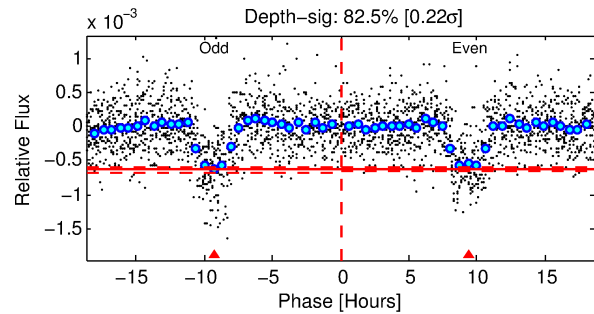
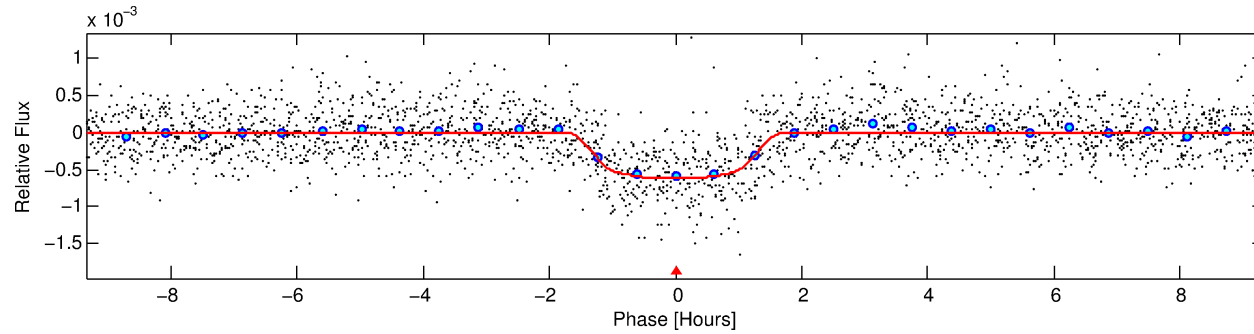
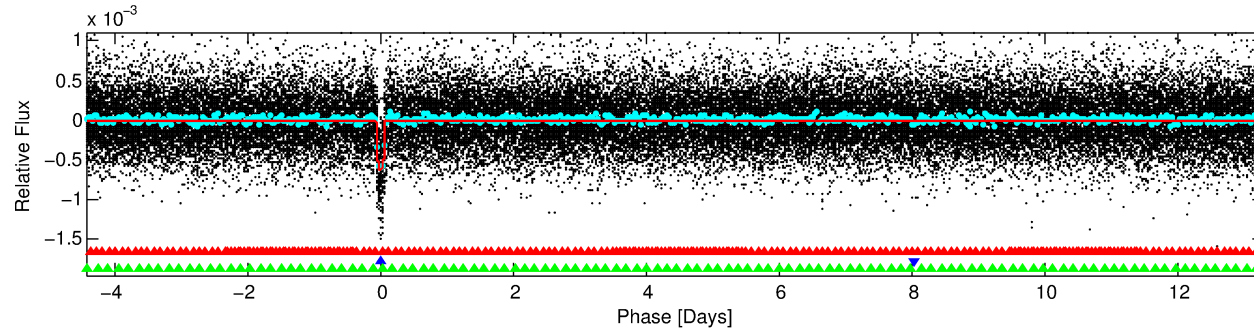
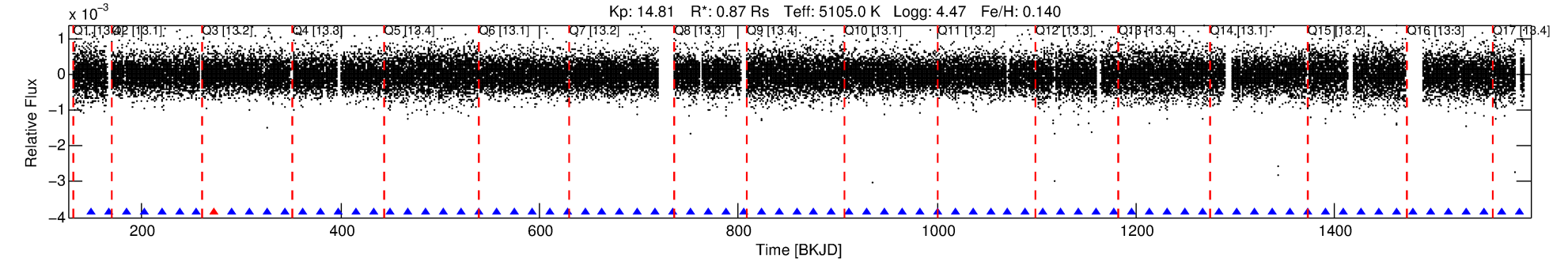
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 009020160-02

No Significant Match Found

# DV One-Page Summary

KIC: 9020160 Candidate: 2 of 3 Period: 17.738 d  
KOI: K00582.02 Name: Kepler-191c Corr: 0.970



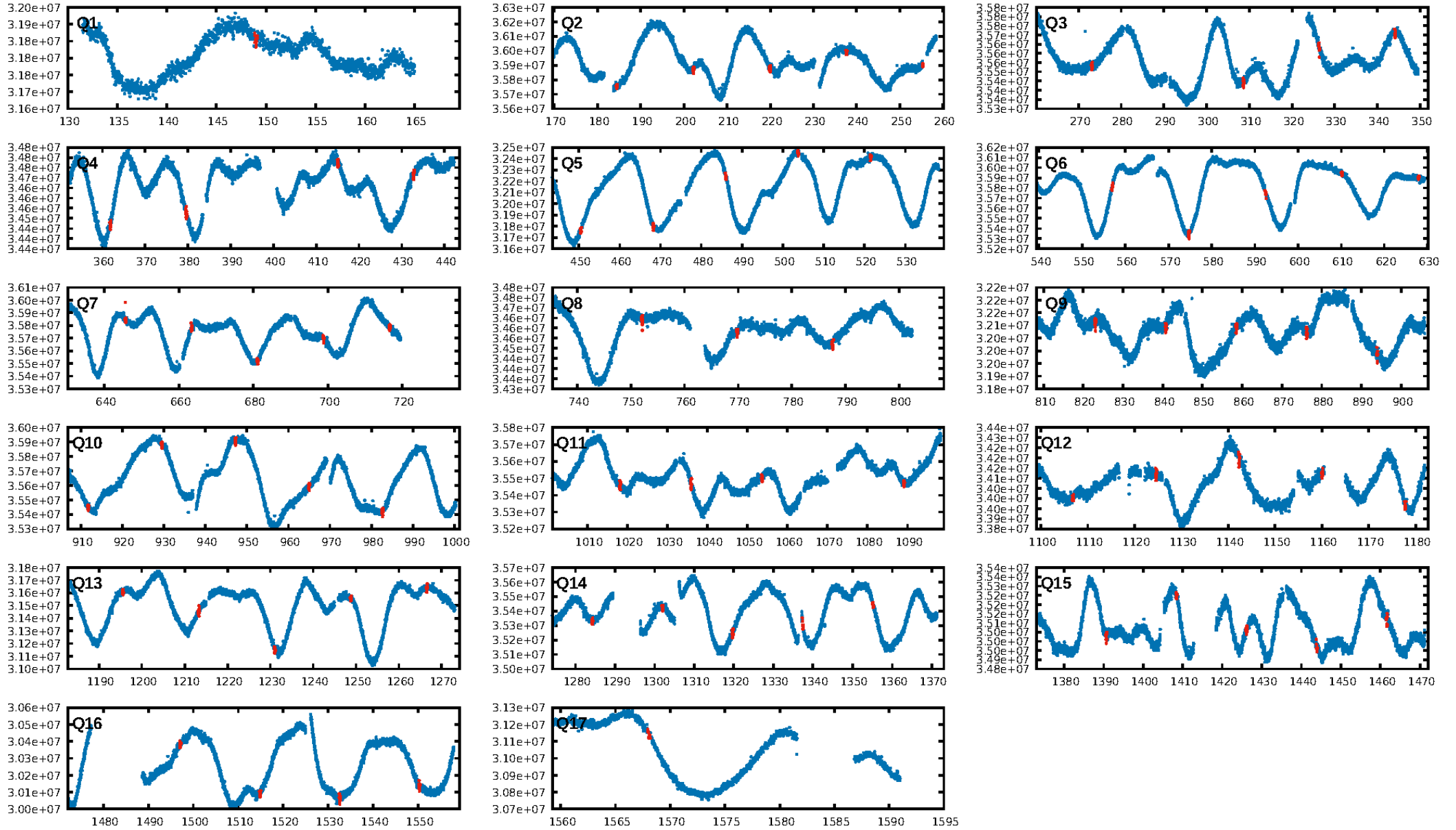
## DV Fit Results:

Period = 17.73846 [0.00005] d  
Epoch = 148.9888 [0.0023] BKJD  
Rp/R\* = 0.0279 [0.0030]  
a/R\* = 21.43 [8.69]  
b = 0.90 [0.09]  
Seff = 29.79 [4.88]  
Teff = 596 [24] K  
Rp = 2.64 [0.36] Re  
a = 0.1241 [0.0112] AU  
Ag = 79.77 [31.55] [2.50 $\sigma$ ]  
Teffp = 2752 [256] K [8.39 $\sigma$ ]

## DV Diagnostic Results:

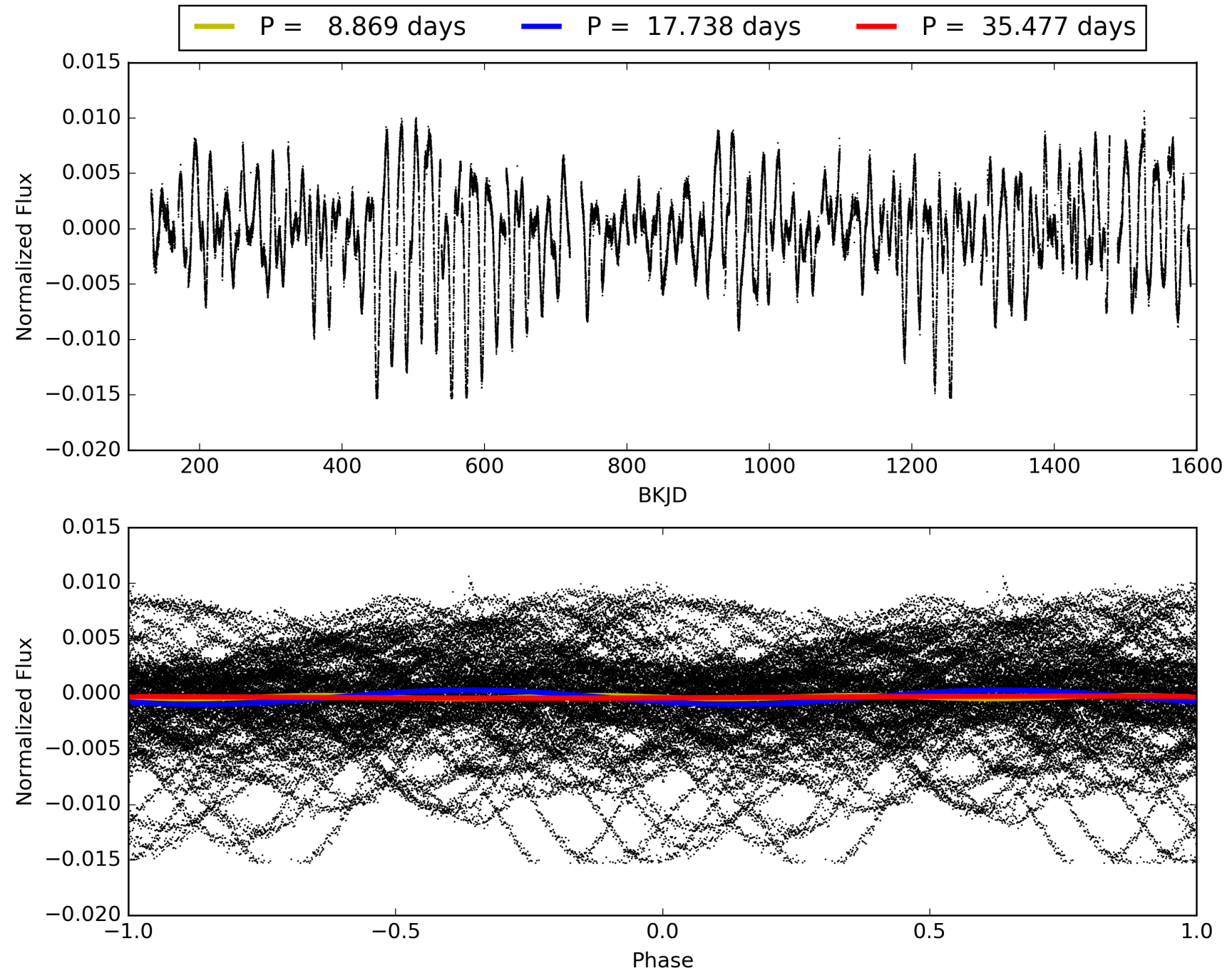
ShortPeriod-sig: 100.0% [42.29 $\sigma$ ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 57.9%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 3.68e-151  
RollingBand-fgt: 0.98 [65/66]  
GhostDiagnostic-chr: 2.445  
Centroid-sig: 0.0%  
Centroid-so: 0.644 arcsec [1.50 $\sigma$ ]  
OotOffset-rm: 0.527 arcsec [2.78 $\sigma$ ]  
KicOffset-rm: 0.150 arcsec [1.00 $\sigma$ ]  
OotOffset-st: 4/4/4/5 [17]  
KicOffset-st: 4/4/4/5 [17]  
DiffImageQuality-fgm: 1.00 [17/17]  
DiffImageOverlap-fno: 0.94 [16/17]

# TCE 009020160-02, PDC Light Curves



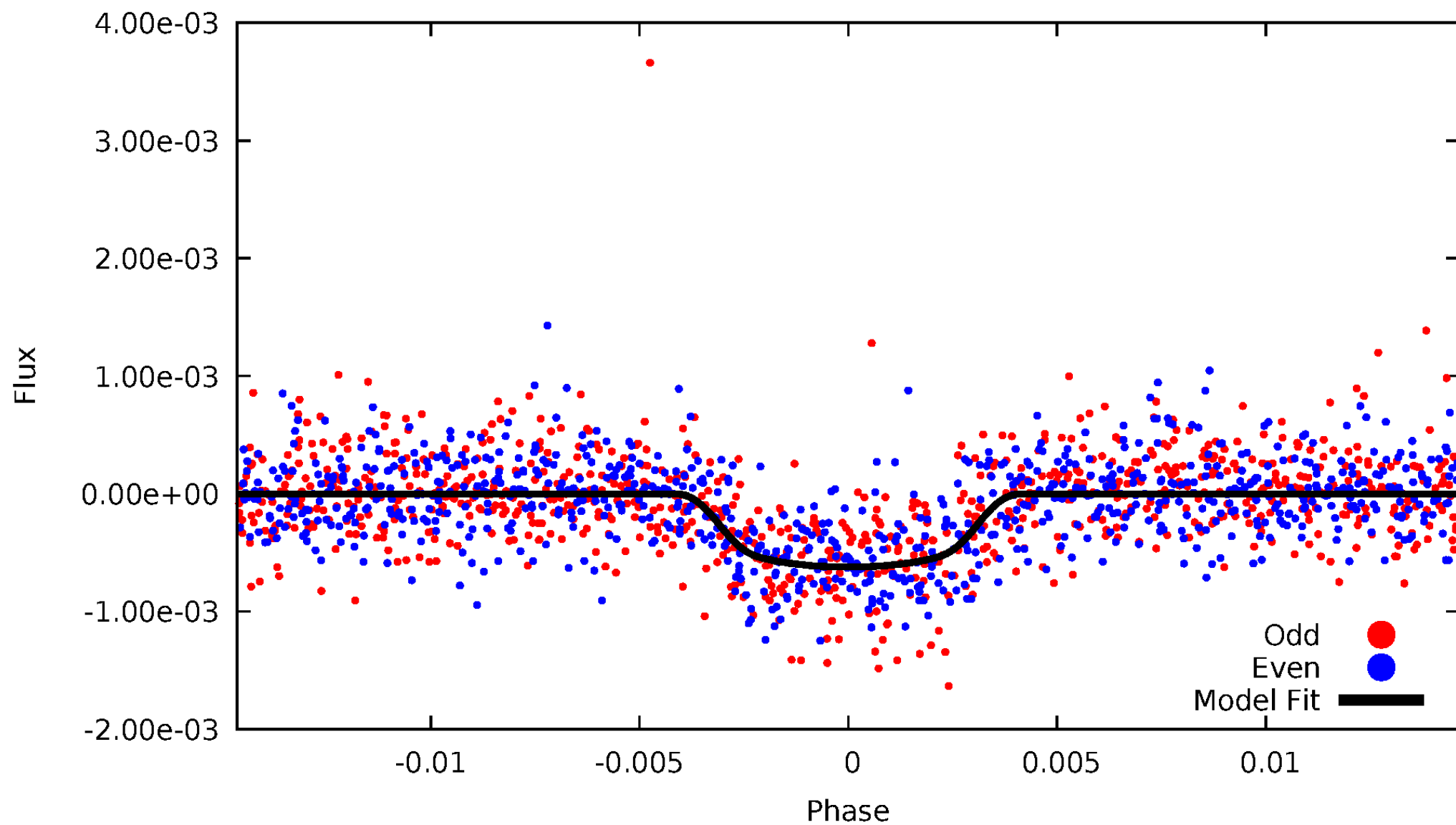


TCE 009020160-02



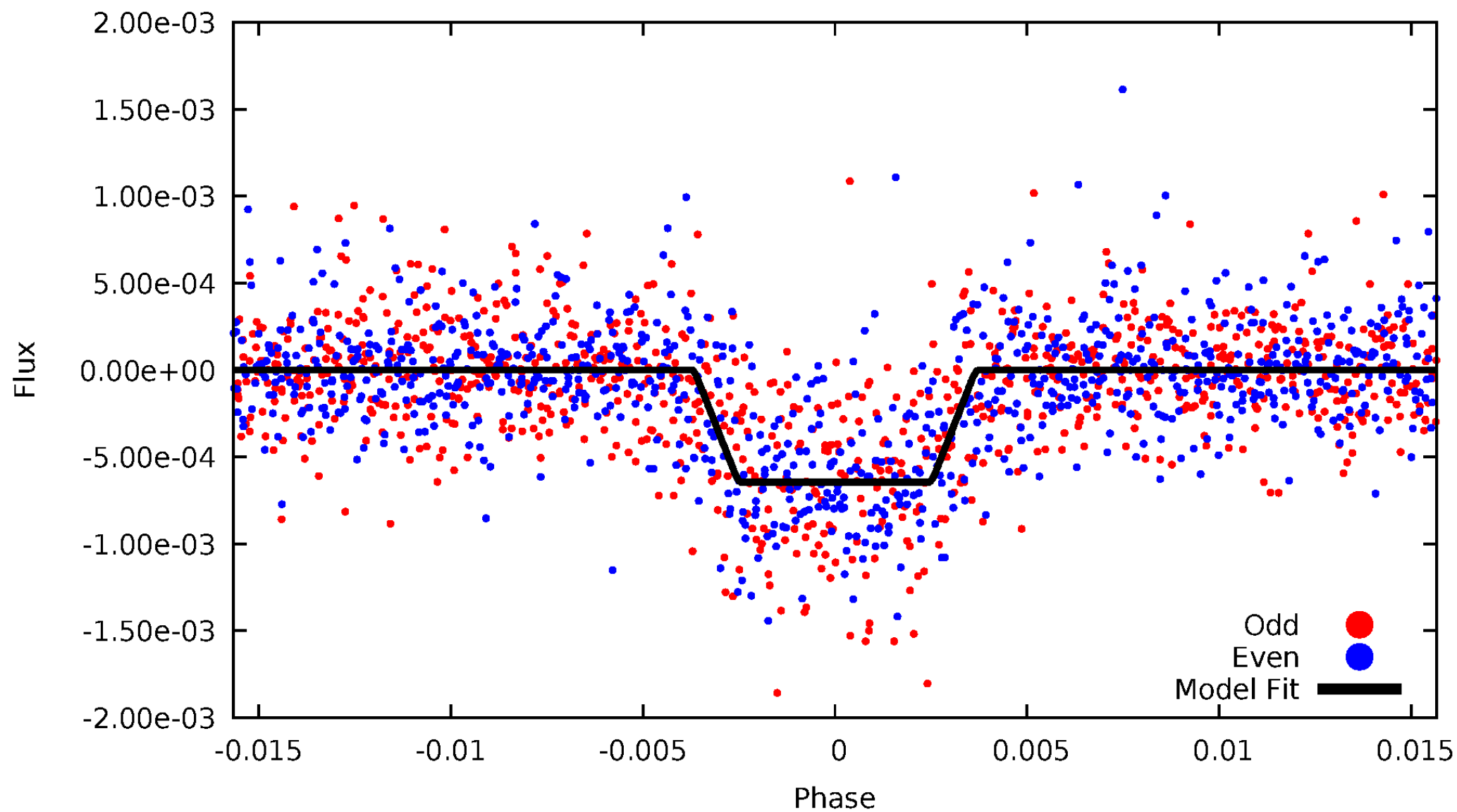
# DV Odd/Even

TCE 009020160-02



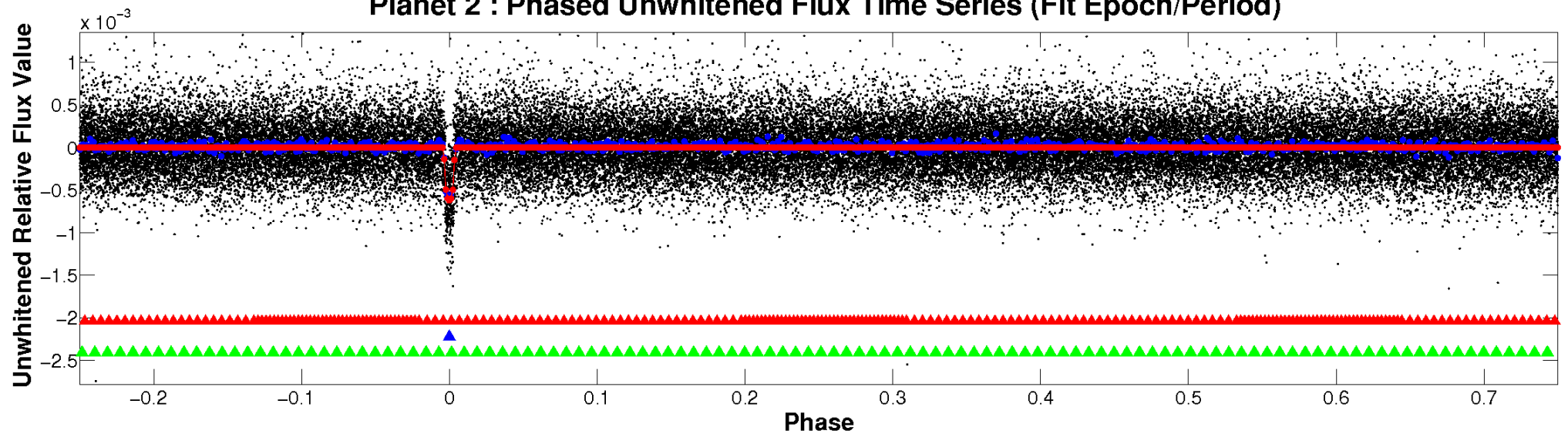
# ALT Odd/Even

TCE 009020160-02

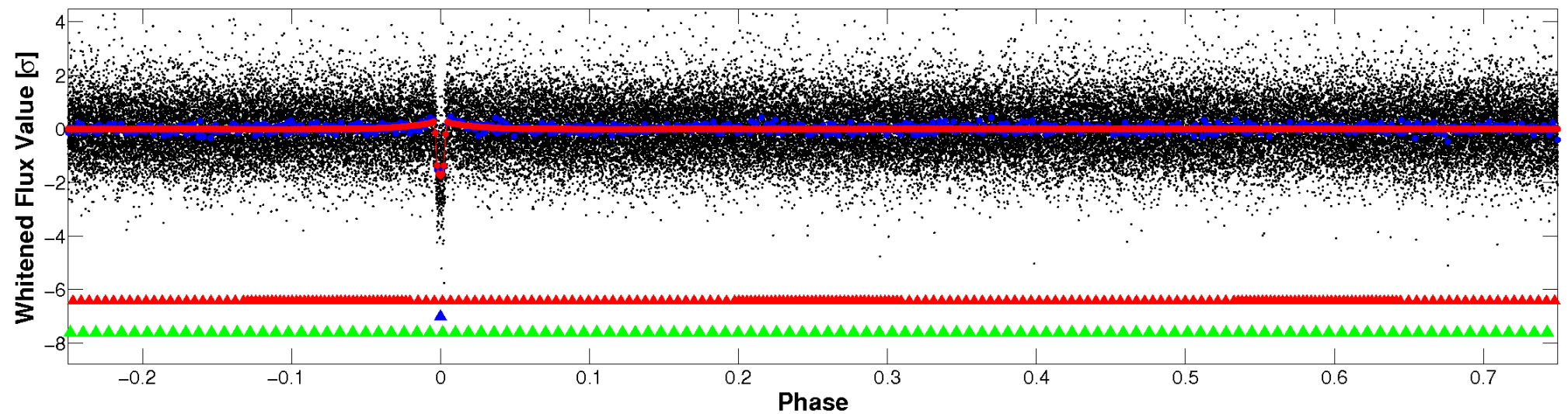


# Non-Whitened Vs. Whitened Light Curve

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

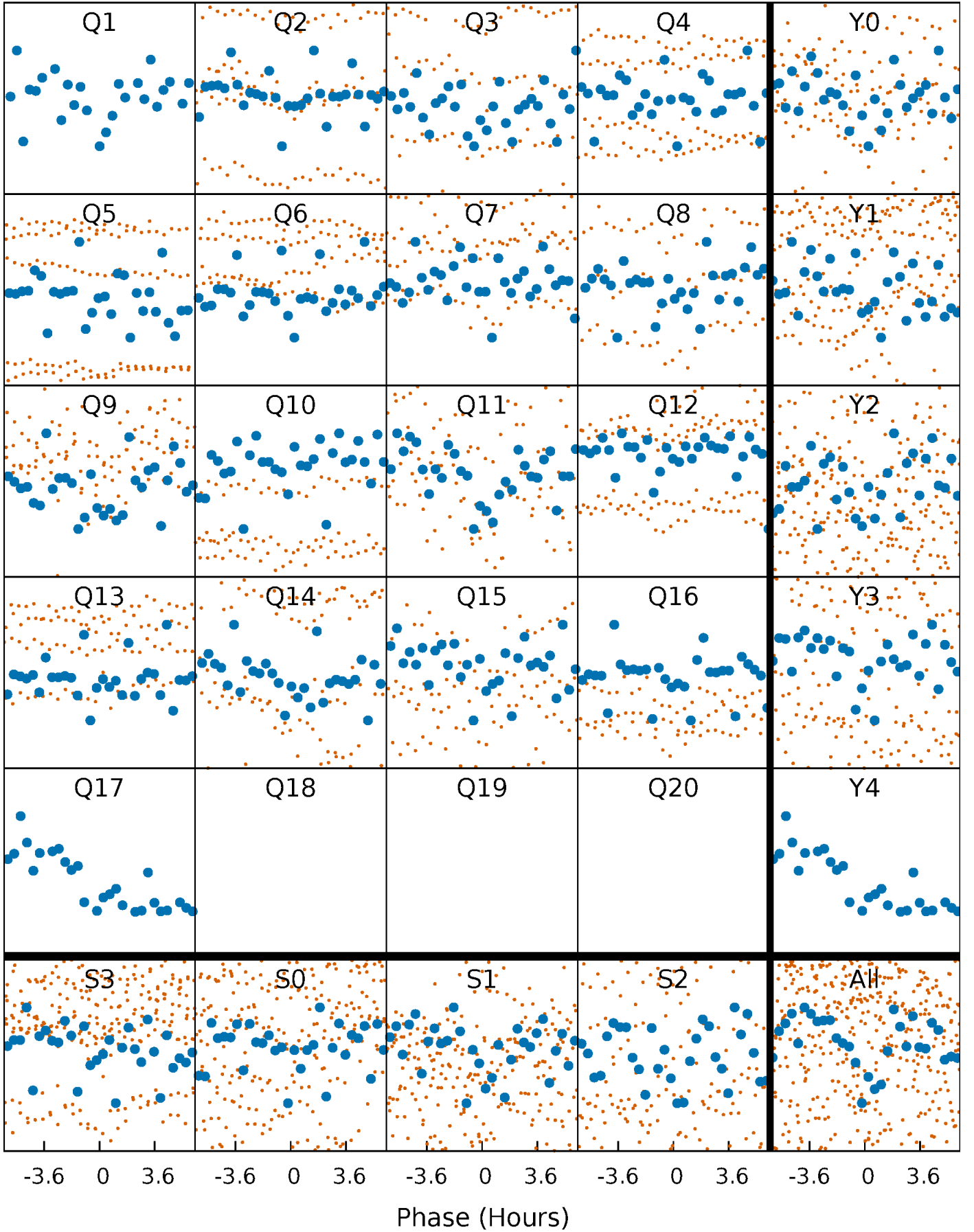


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



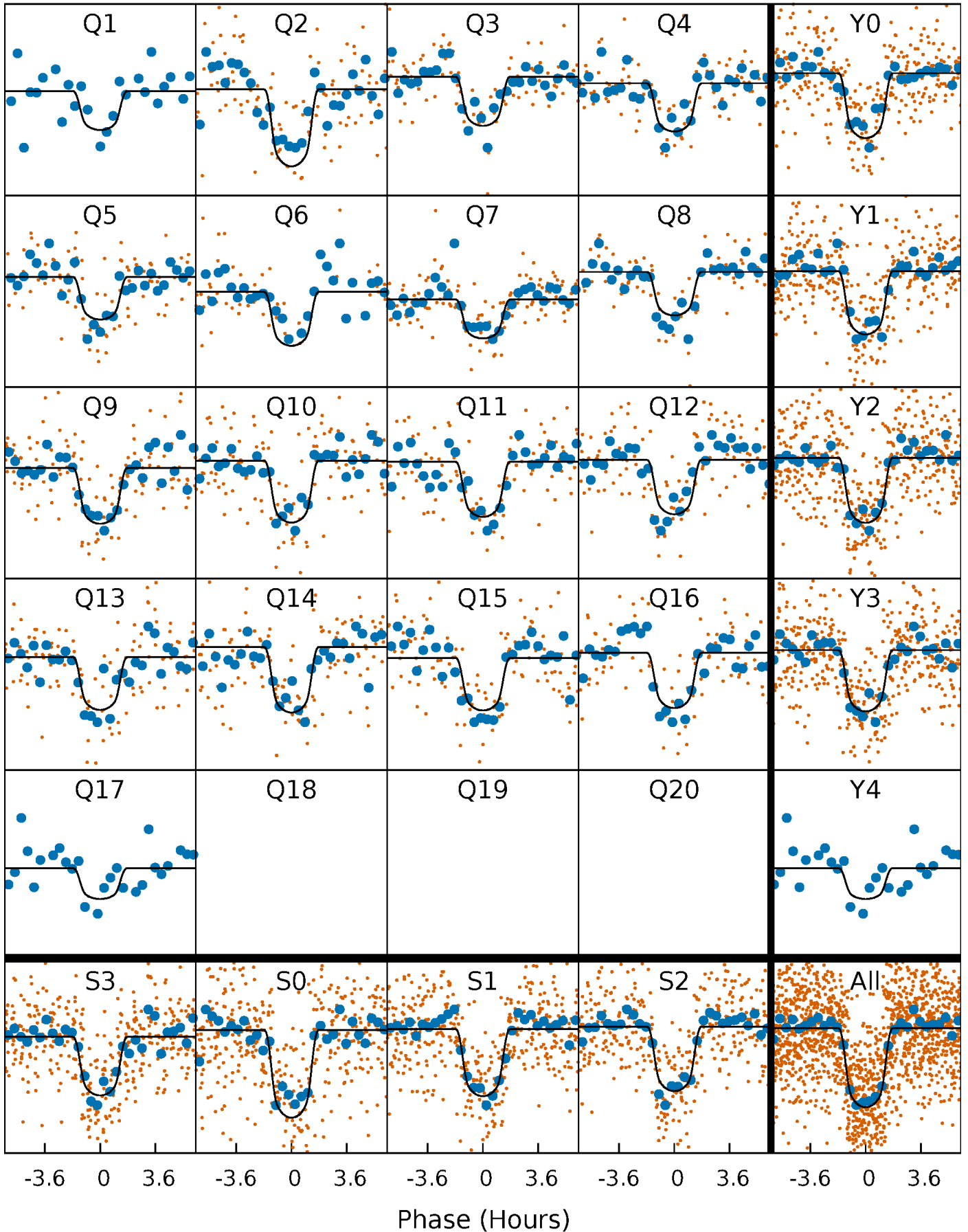
# PDC Quarter-Phased Transit Curves

TCE 009020160-02     $P = 17.738464$  Days     $T_0 = 148.988757$  (BKJD)



# DV Quarter-Phased Transit Curves

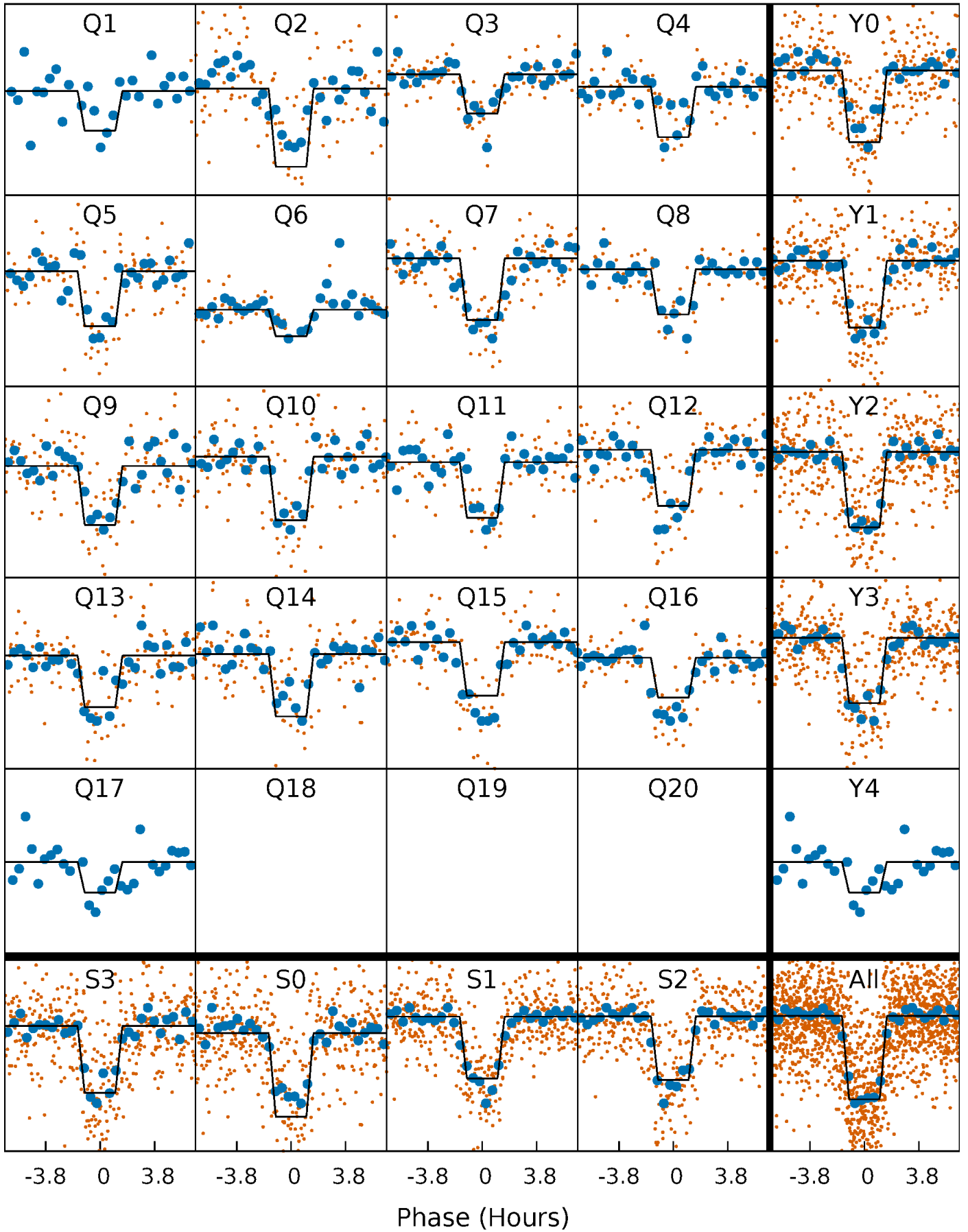
TCE 009020160-02 P= 17.738464 Days  $T_0=148.988757$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

TCE 009020160-02   P= 17.738584 Days    $T_0=148.984625$  (BKJD)

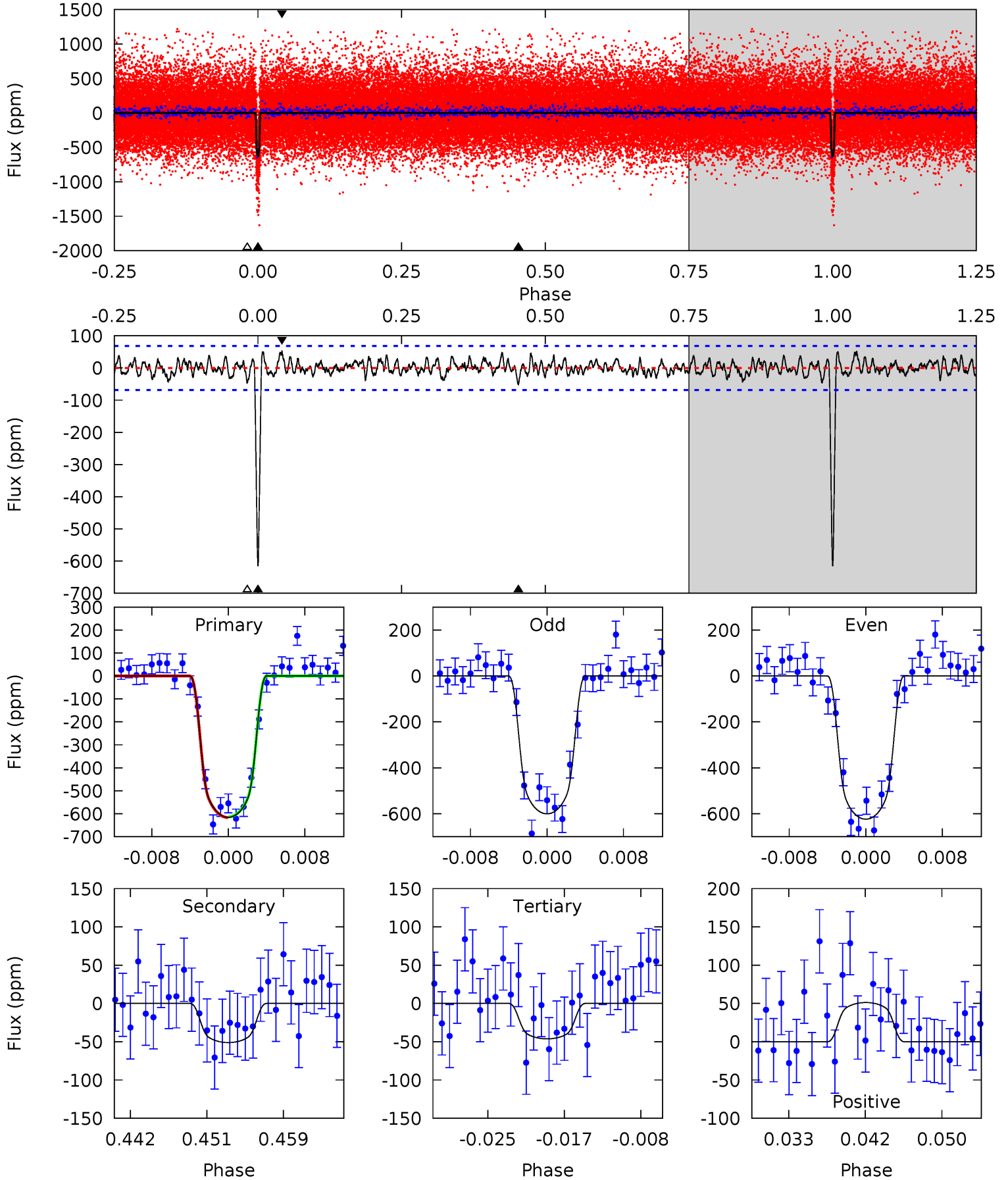




# DV Model-Shift Uniqueness Test

009020160-02, P = 17.738464 Days, E = 131.250293 Days

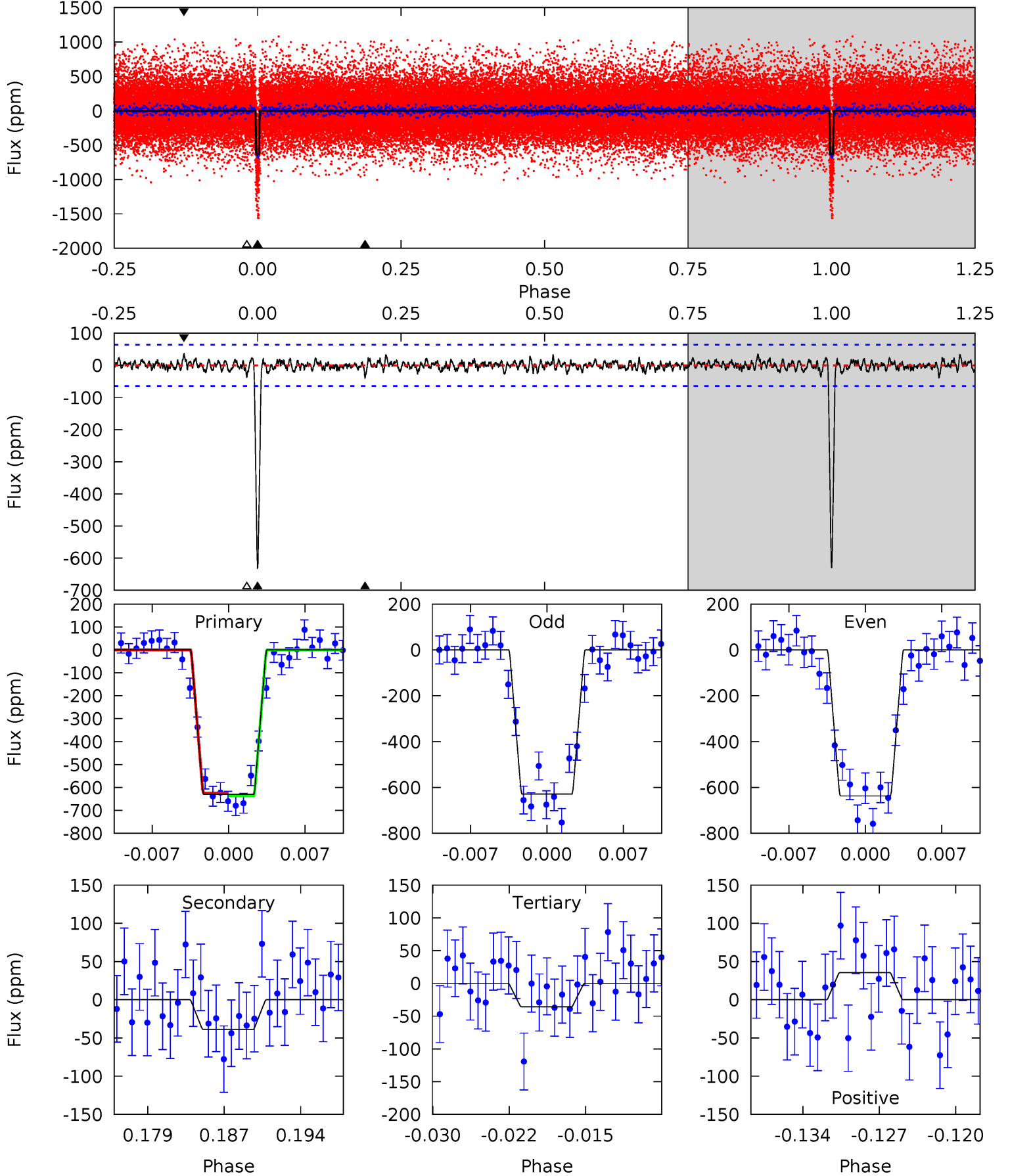
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
45.5	3.77	3.42	3.78	5.06	2.64	1.23	42.1	41.7	0.36	-0.01	0.87	1.01	0.08	0.11



# Alt Model-Shift Uniqueness Test

009020160-02, P = 17.738584 Days, E = 131.246041 Days

Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
49.7	3.07	2.83	2.81	5.08	2.68	0.80	46.9	46.9	0.24	0.26	0.33	1.06	0.05	0.45



### Stellar Parameters For KIC 009020160

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5105^{+84}_{-76}$	$4.469^{+0.090}_{-0.030}$	$0.140^{+0.150}_{-0.150}$	$0.868^{+0.044}_{-0.076}$	$0.810^{+0.062}_{-0.026}$	$1.742^{+0.594}_{-0.193}$
	+2%/-1%	+2%/-1%	+107%/-107%	+5%/-9%	+8%/-3%	+34%/-11%
Source	SPE90	SPE90	SPE90	DSEP		

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

### Secondary Eclipse Parameters for KIC 009020160-02 / KOI 0582.02

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-51 \pm 14$	$2.62^{+0.31}_{-0.31}$	$827^{+18}_{-23}$	$3152^{+153}_{-170}$	$63^{+26}_{-21}$
Alt.	$-39 \pm 13$	$2.39^{+0.29}_{-0.29}$	$826^{+19}_{-22}$	$3118^{+171}_{-189}$	$58^{+26}_{-20}$

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

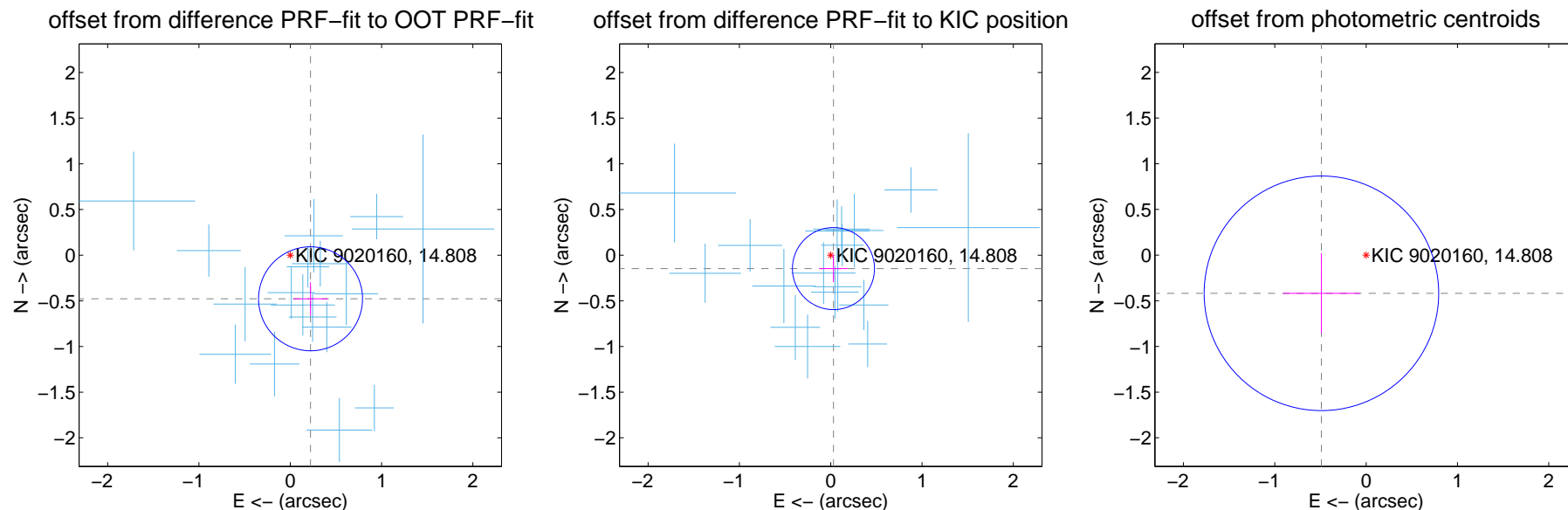
## DV Centroid Data

Supplemental centroid analysis for 009020160-02. Kepler magnitude: 14.81. Transit SNR 29.00

There are 17 quarters with good PRF difference image offsets

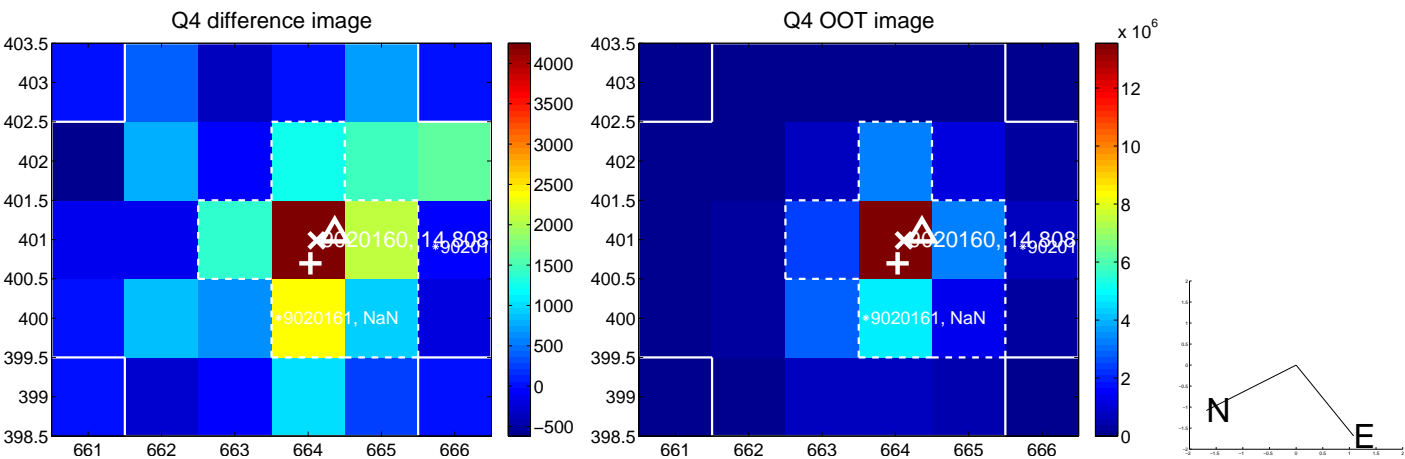
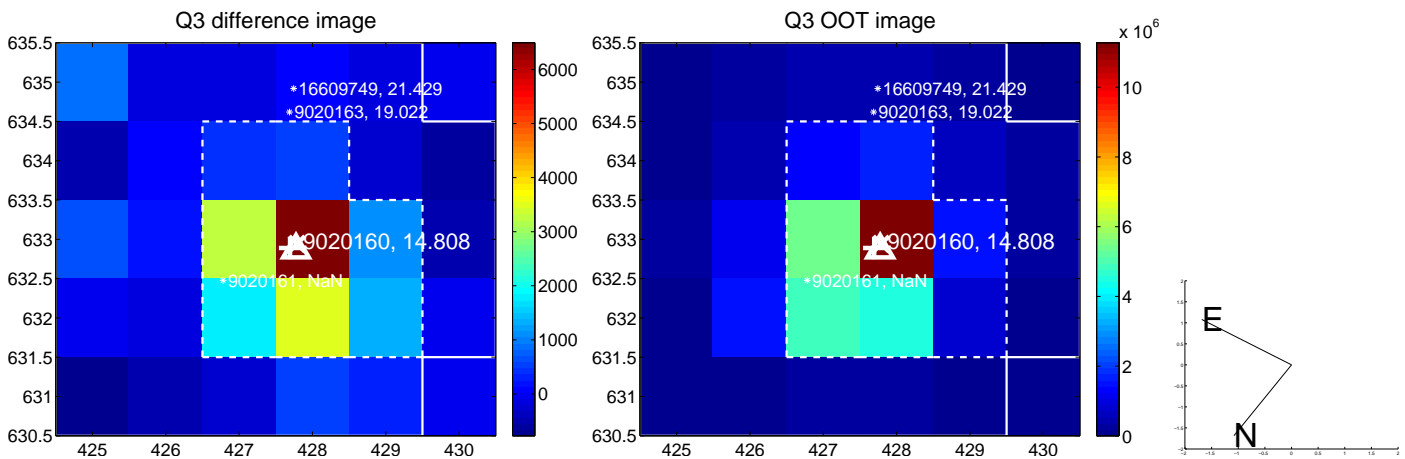
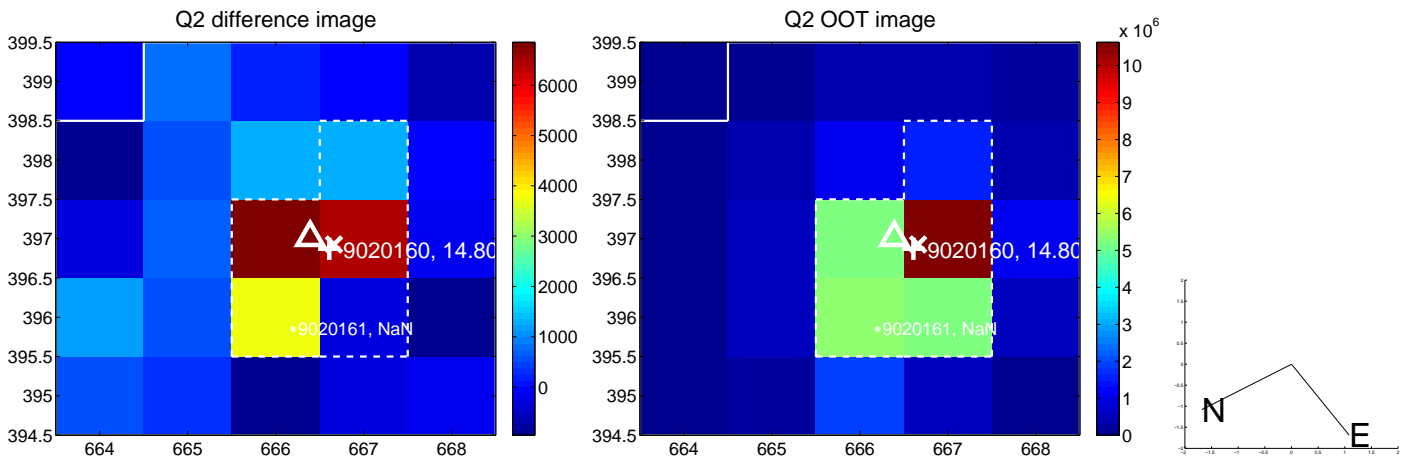
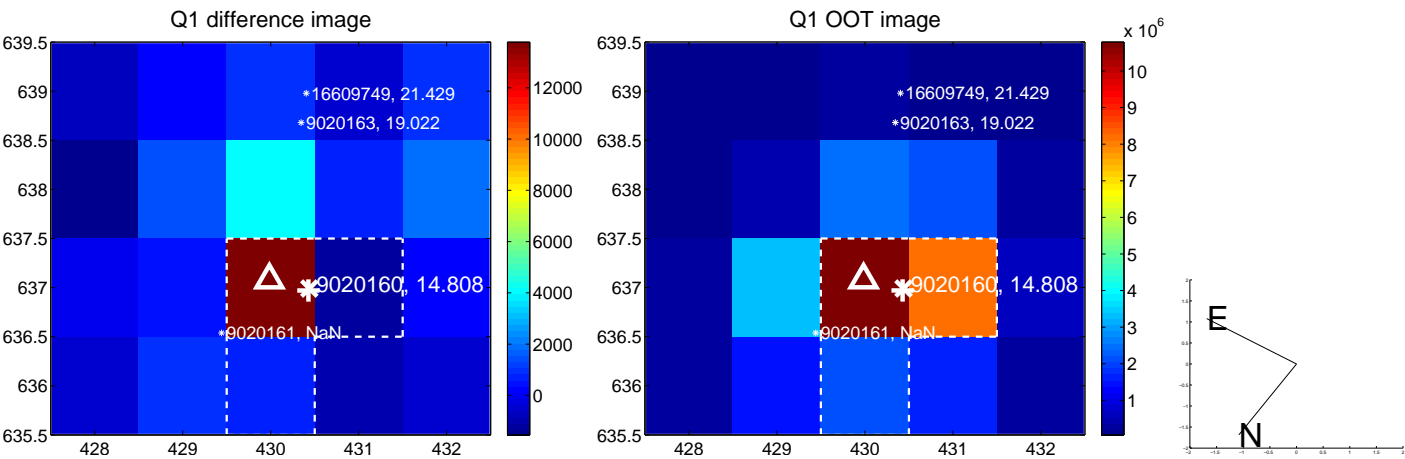
The direct PRF centroid is offset from the target star catalog position by about 0.06 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.527 \pm 0.190$	2.78	$-0.222 \pm 0.188$	$-0.478 \pm 0.181$
PRF-fit source offset from KIC position	$0.150 \pm 0.150$	1.00	$-0.030 \pm 0.154$	$-0.147 \pm 0.150$
photometric centroid source offset	$0.64 \pm 0.43$	1.50	$0.49 \pm 0.42$	$-0.42 \pm 0.44$

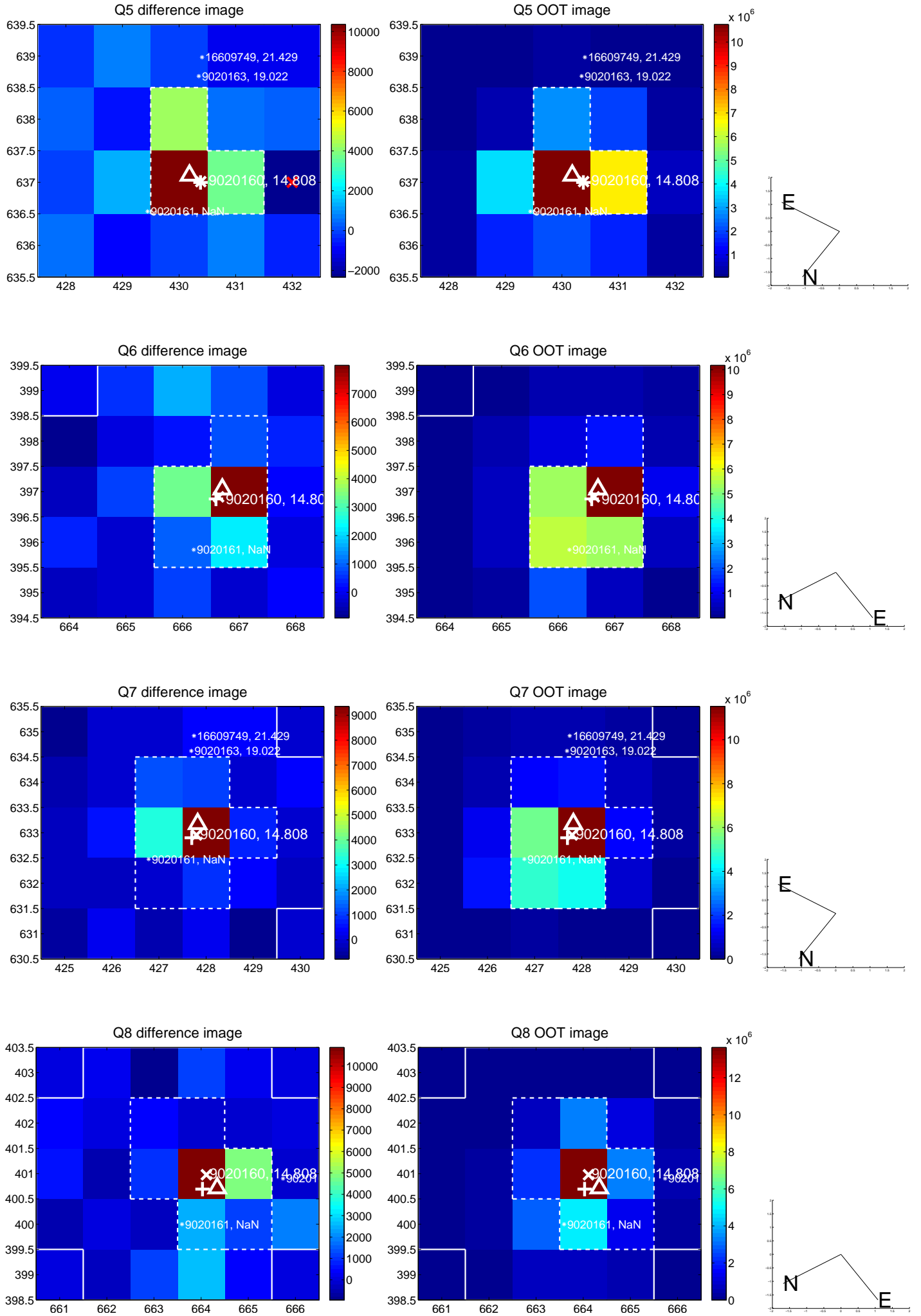


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

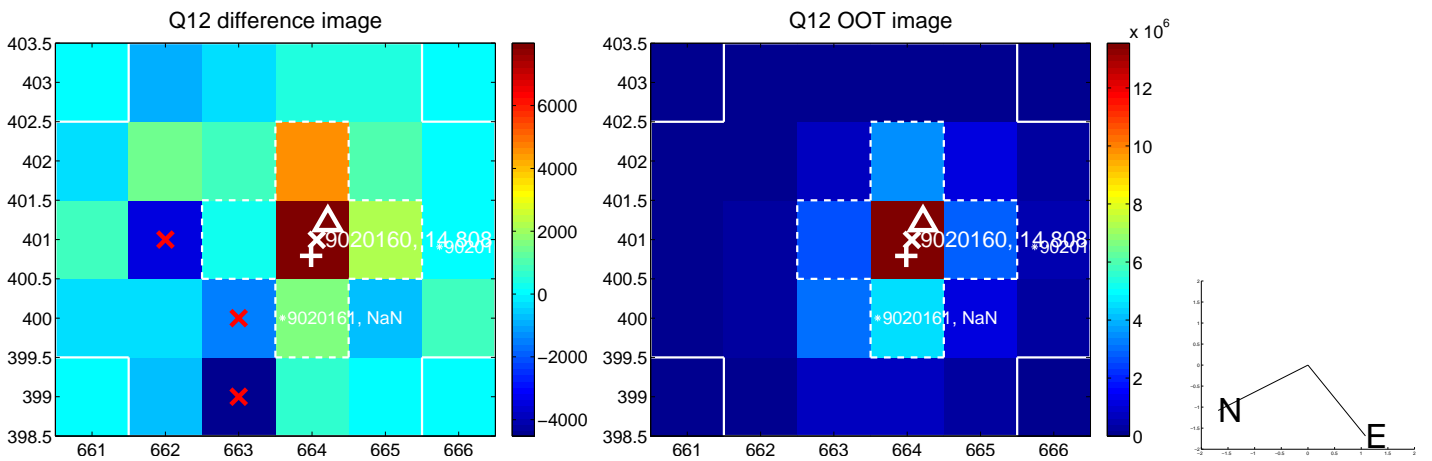
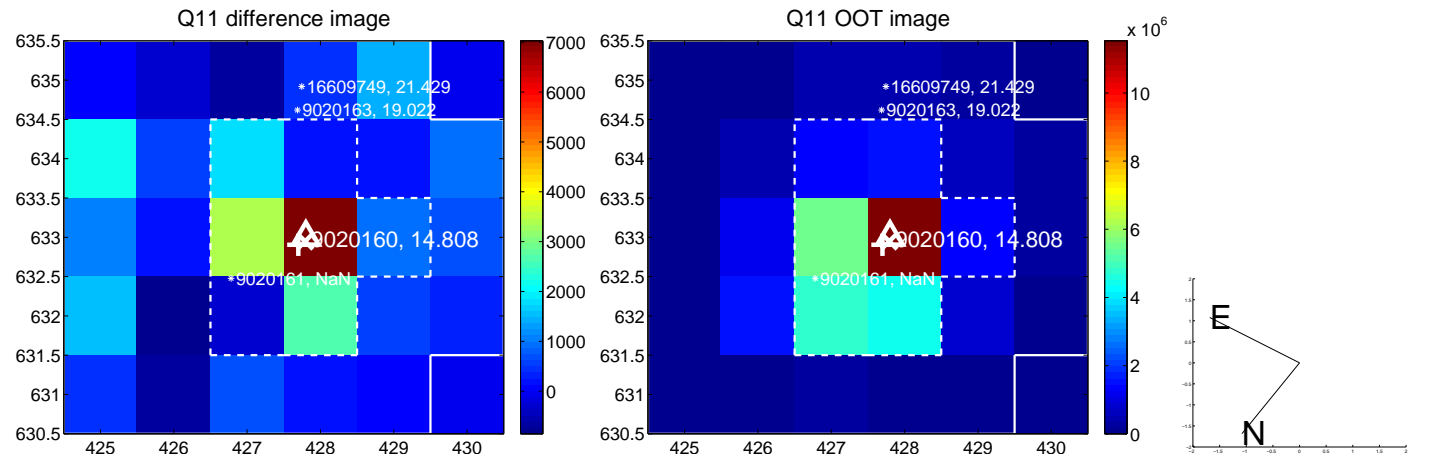
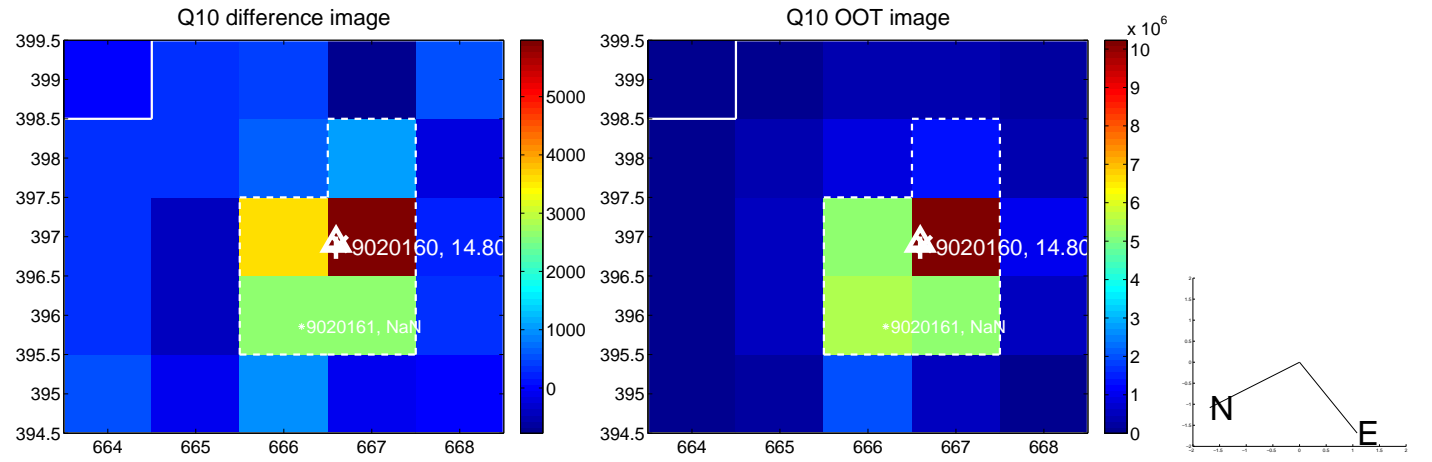
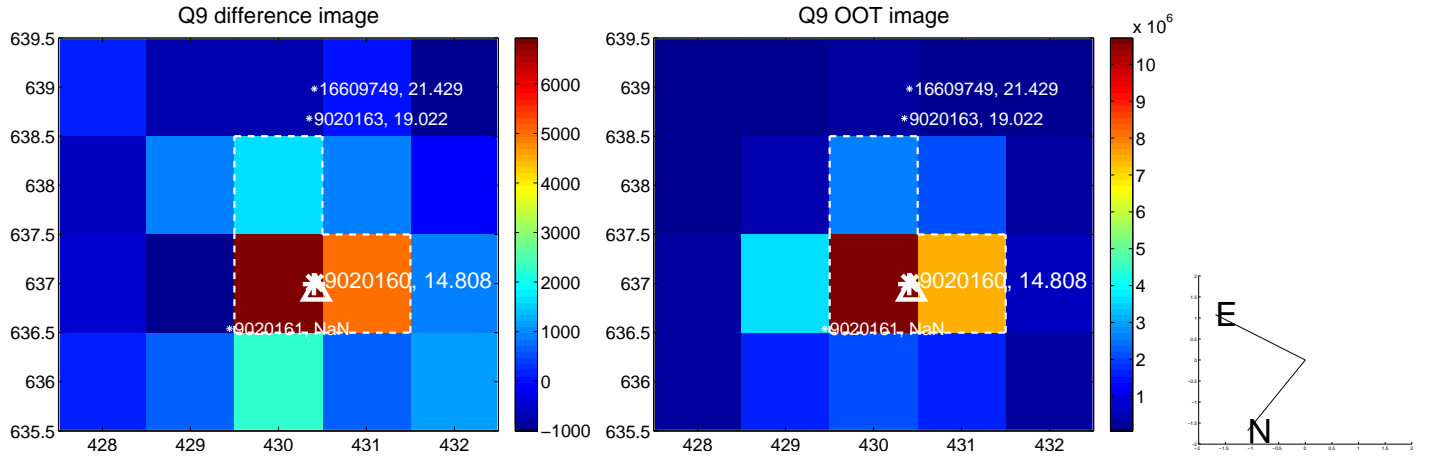
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

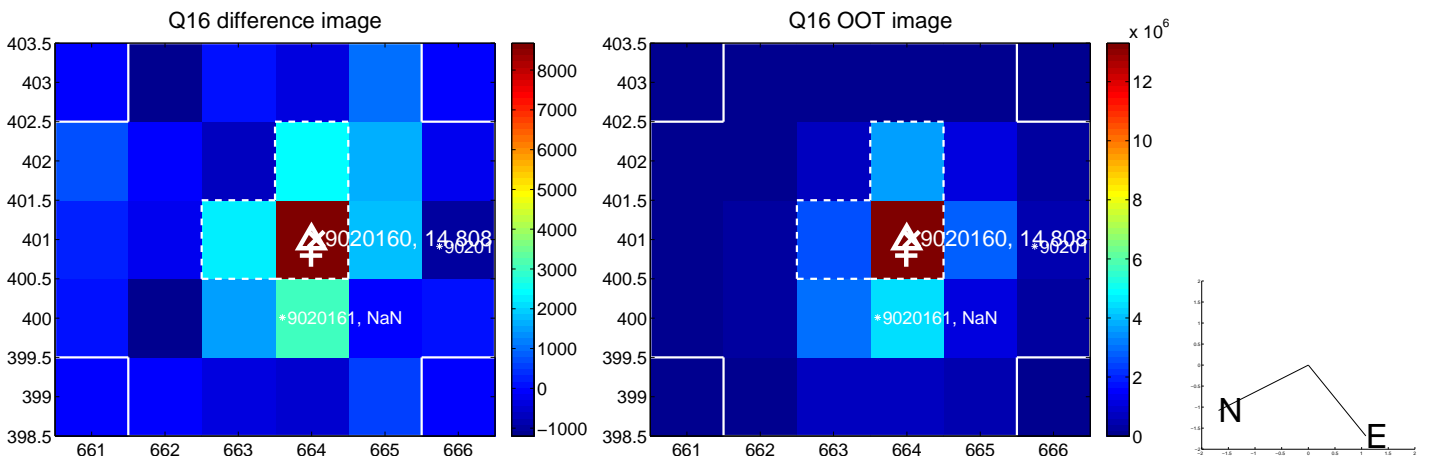
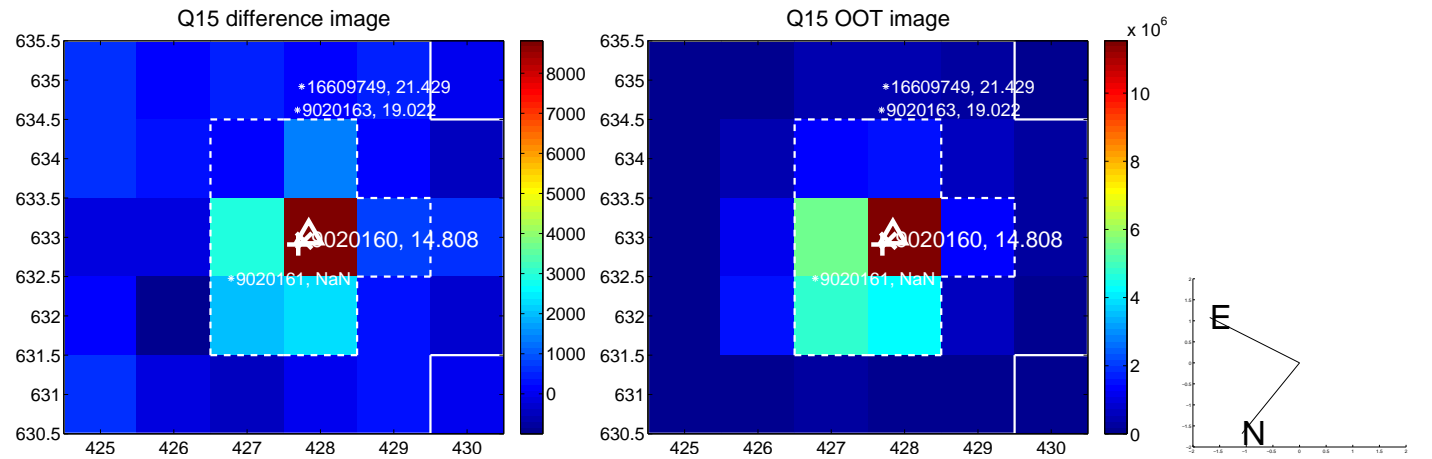
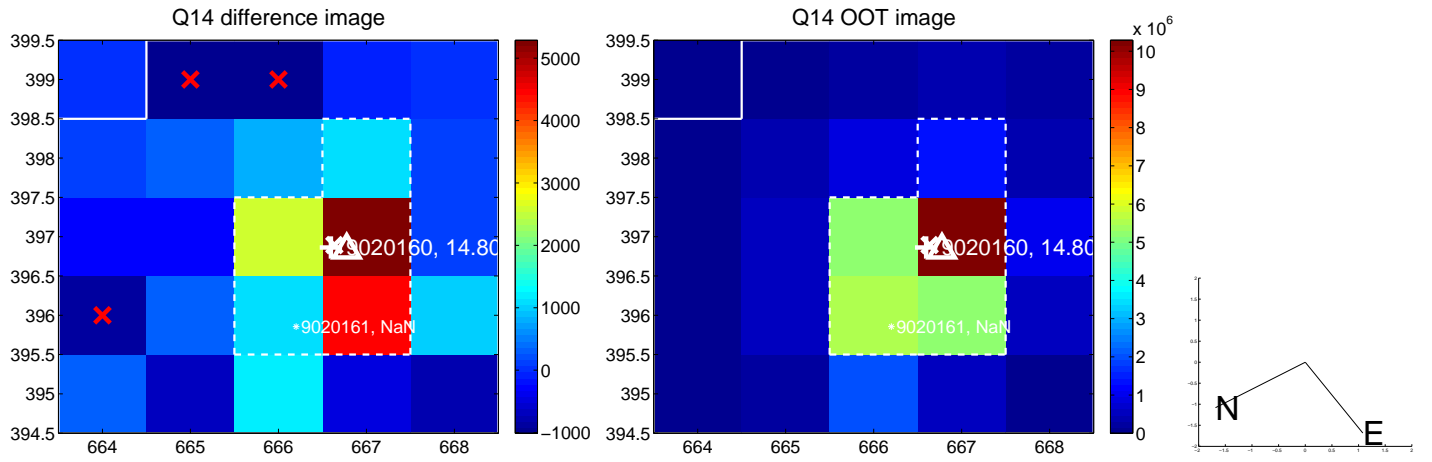
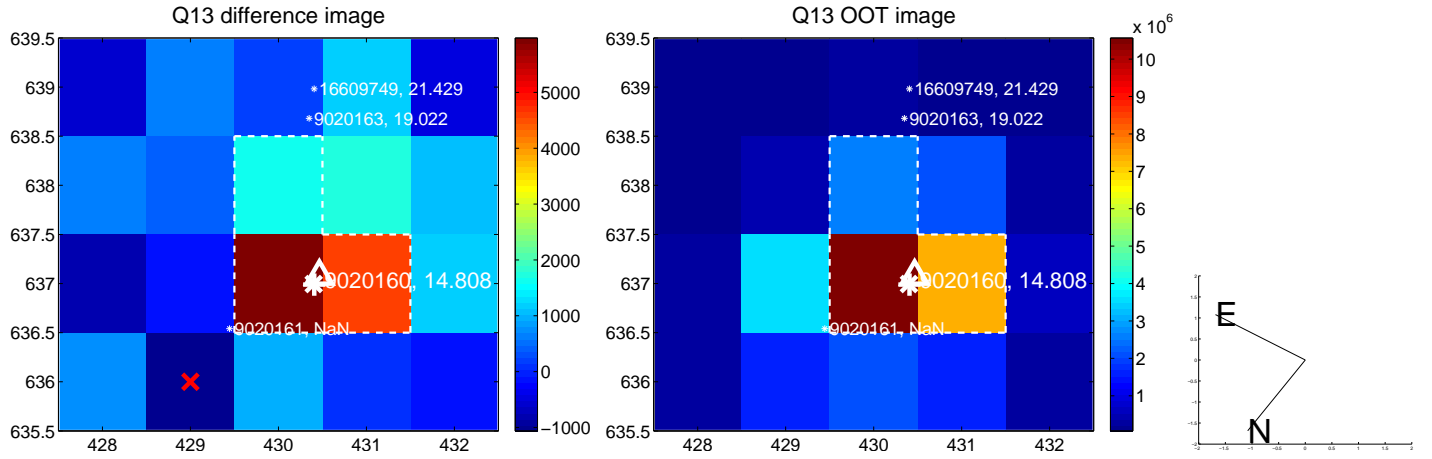


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

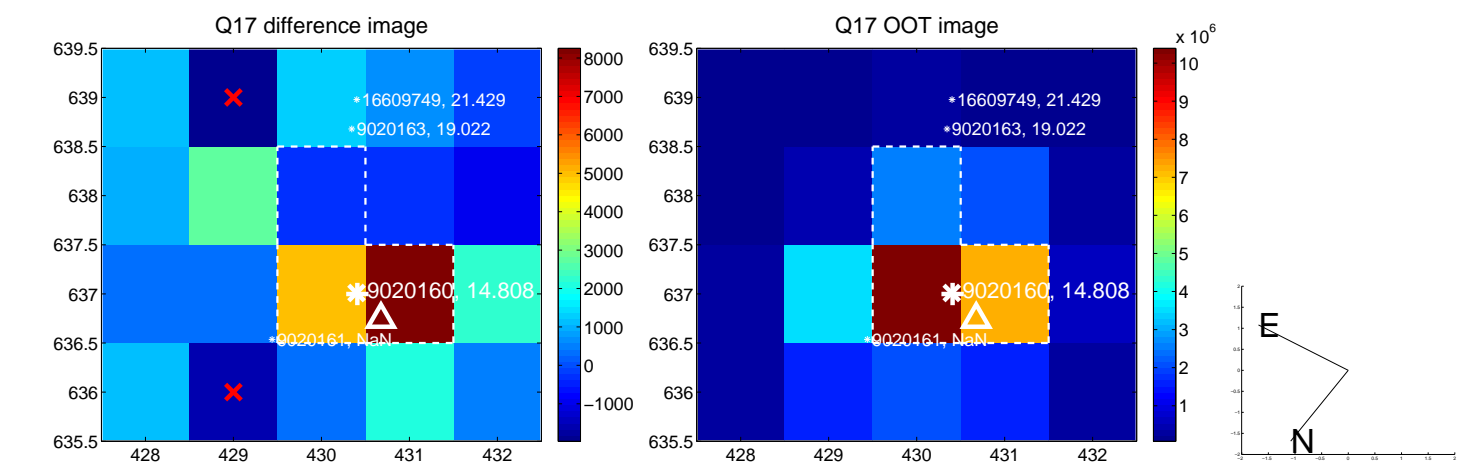




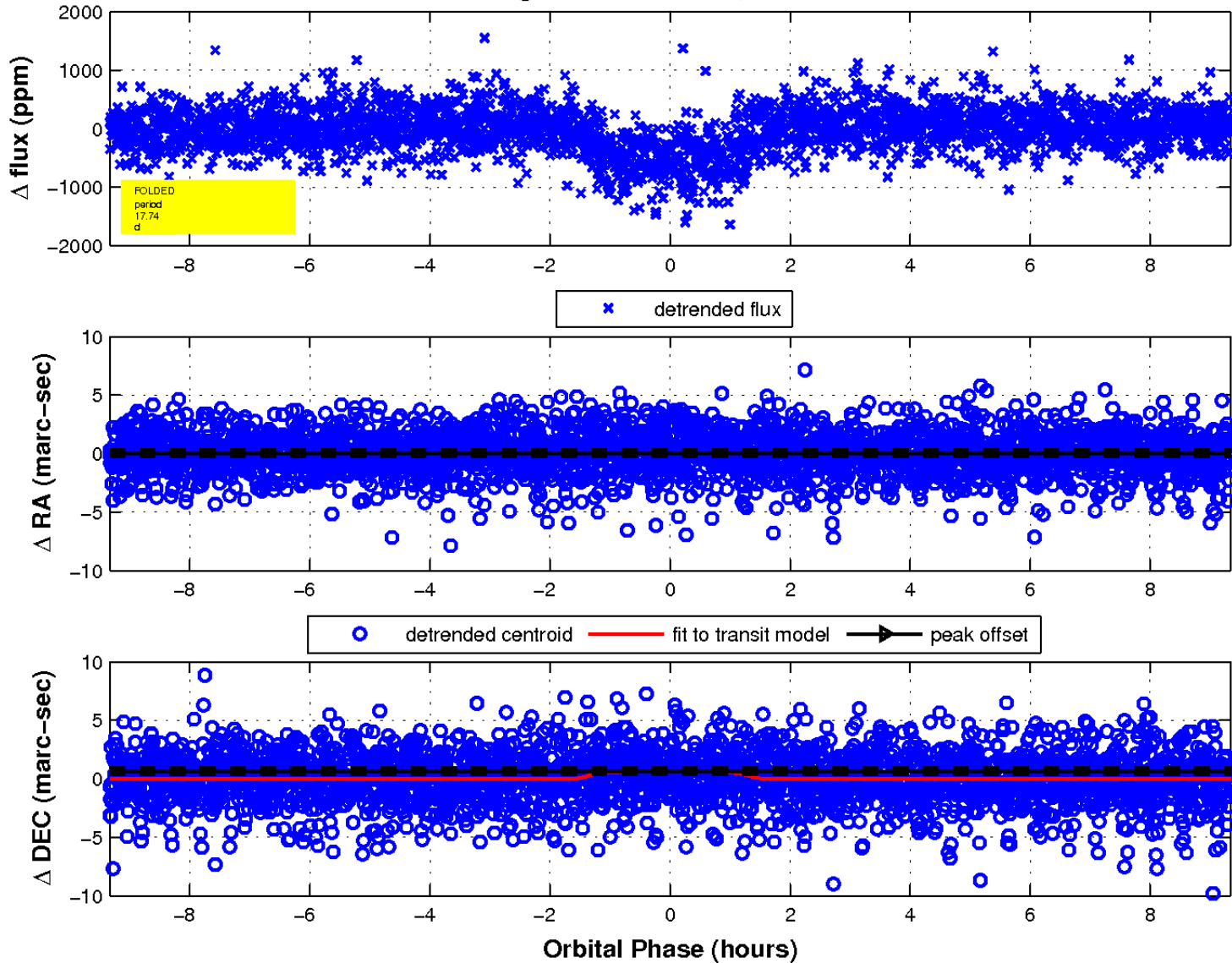
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



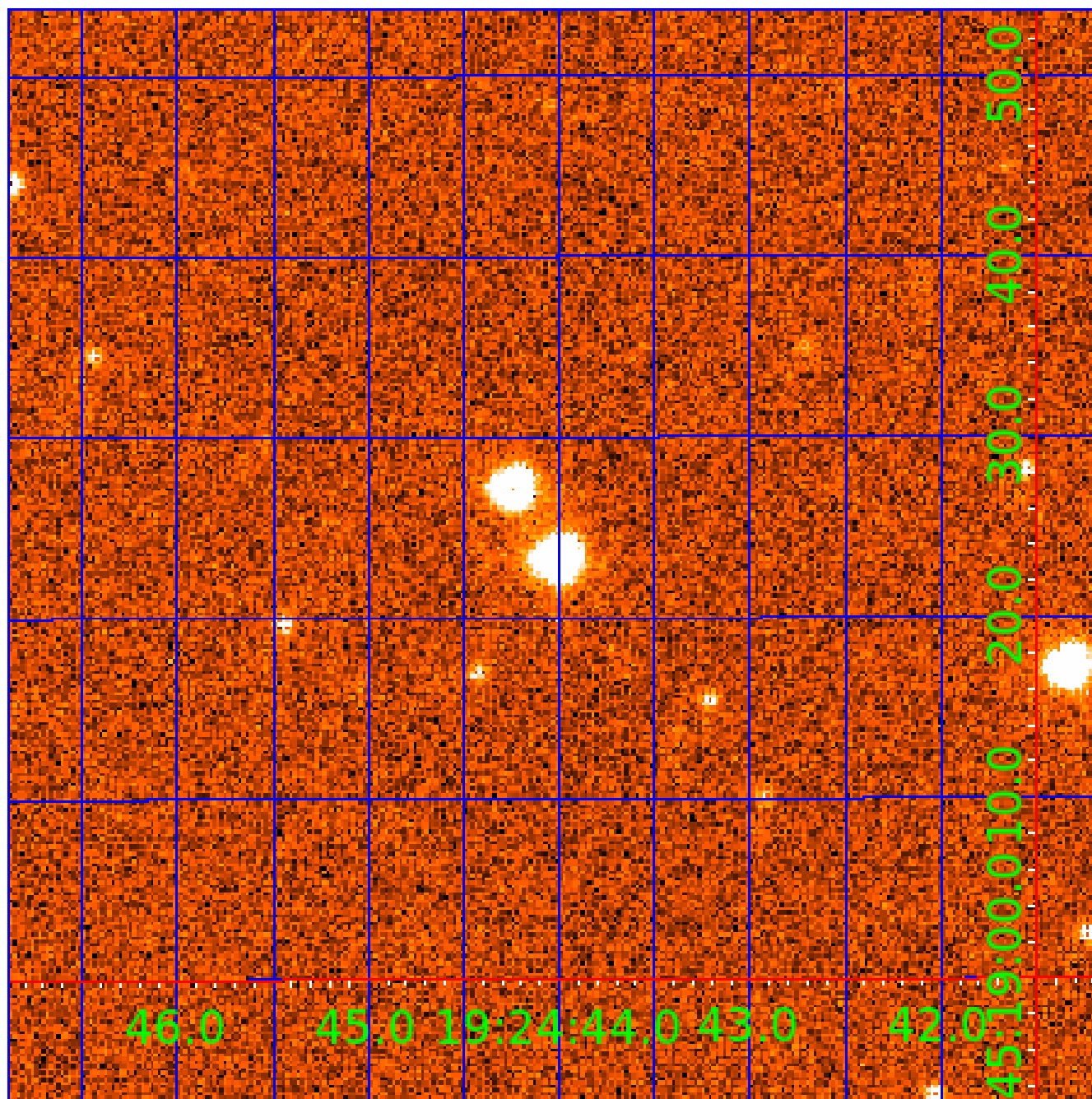
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



fluxWeightedCentroids, Planet 2 of 3



UKIRT Image



# KIC 009020160

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009020160-01	OBS	0582.01	5.945035	134.802634	791.9	2.723	58.7	64.1	0.87	5105	2.75	127.94
009020160-02	OBS	0582.02	17.738464	148.988758	622.7	3.115	27.0	29.0	0.87	5105	2.64	29.79
009020160-03	OBS	0582.03	9.939628	131.584771	301.1	3.144	18.7	19.8	0.87	5105	1.84	64.48

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009020160-01	OBS	PC	0.99	0	0	0	0	NO_COMMENT
009020160-02	OBS	PC	0.99	0	0	0	0	NO_COMMENT
009020160-03	OBS	PC	0.56	0	0	0	0	NO_COMMENT

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

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

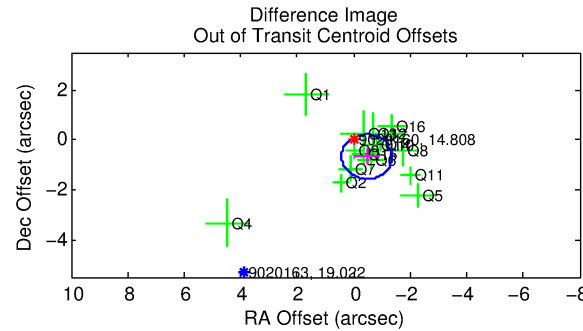
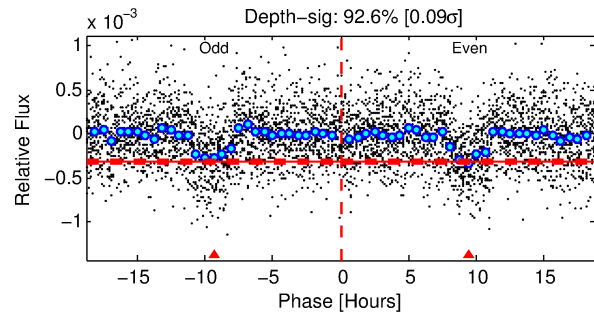
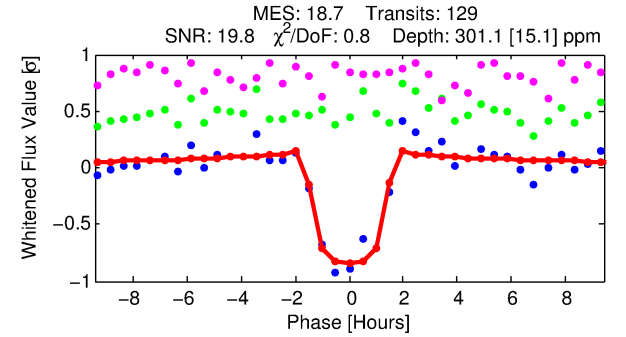
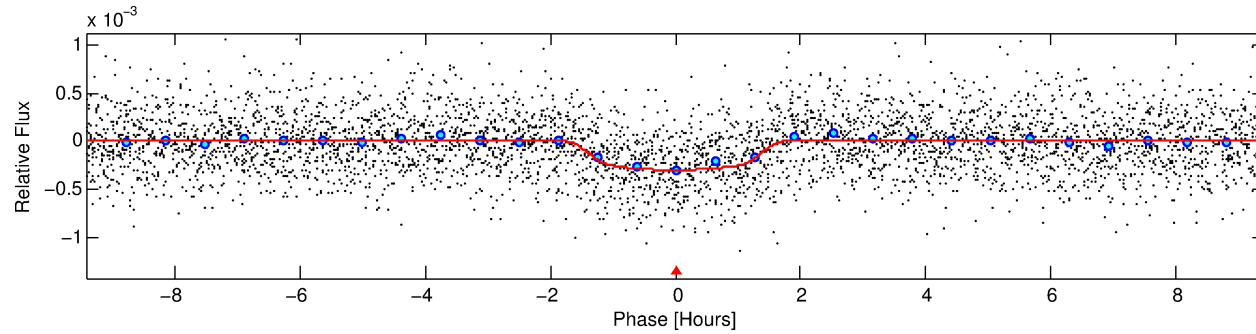
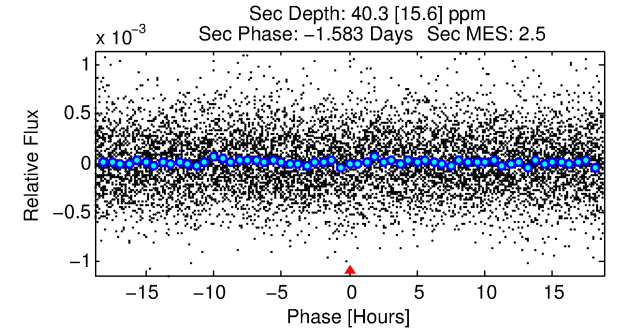
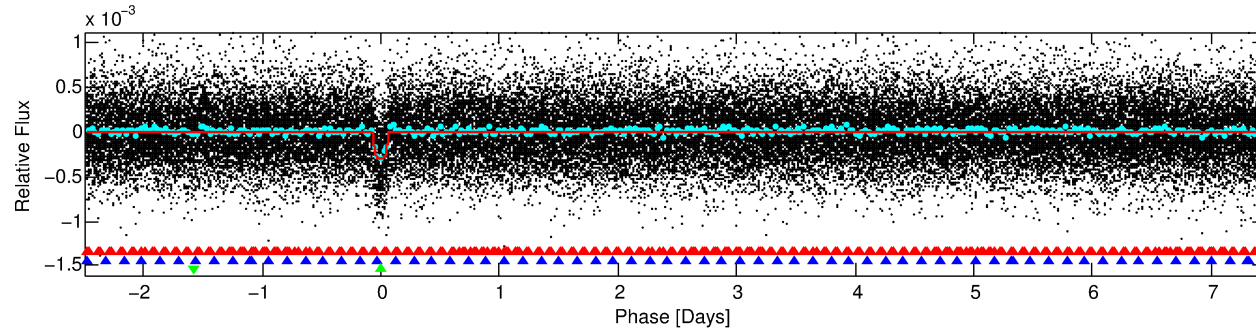
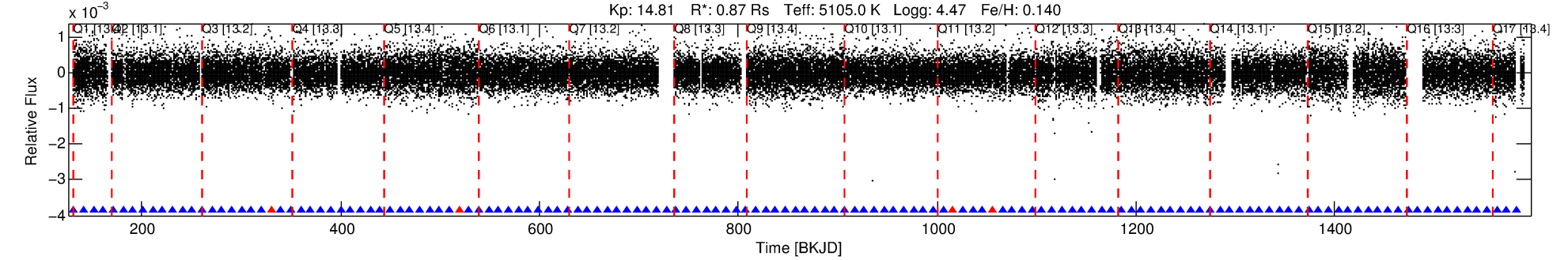
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 009020160-03

No Significant Match Found

# DV One-Page Summary

KIC: 9020160 Candidate: 3 of 3 Period: 9.940 d  
KOI: K00582.03 Name: Kepler-191b Corr: 0.971



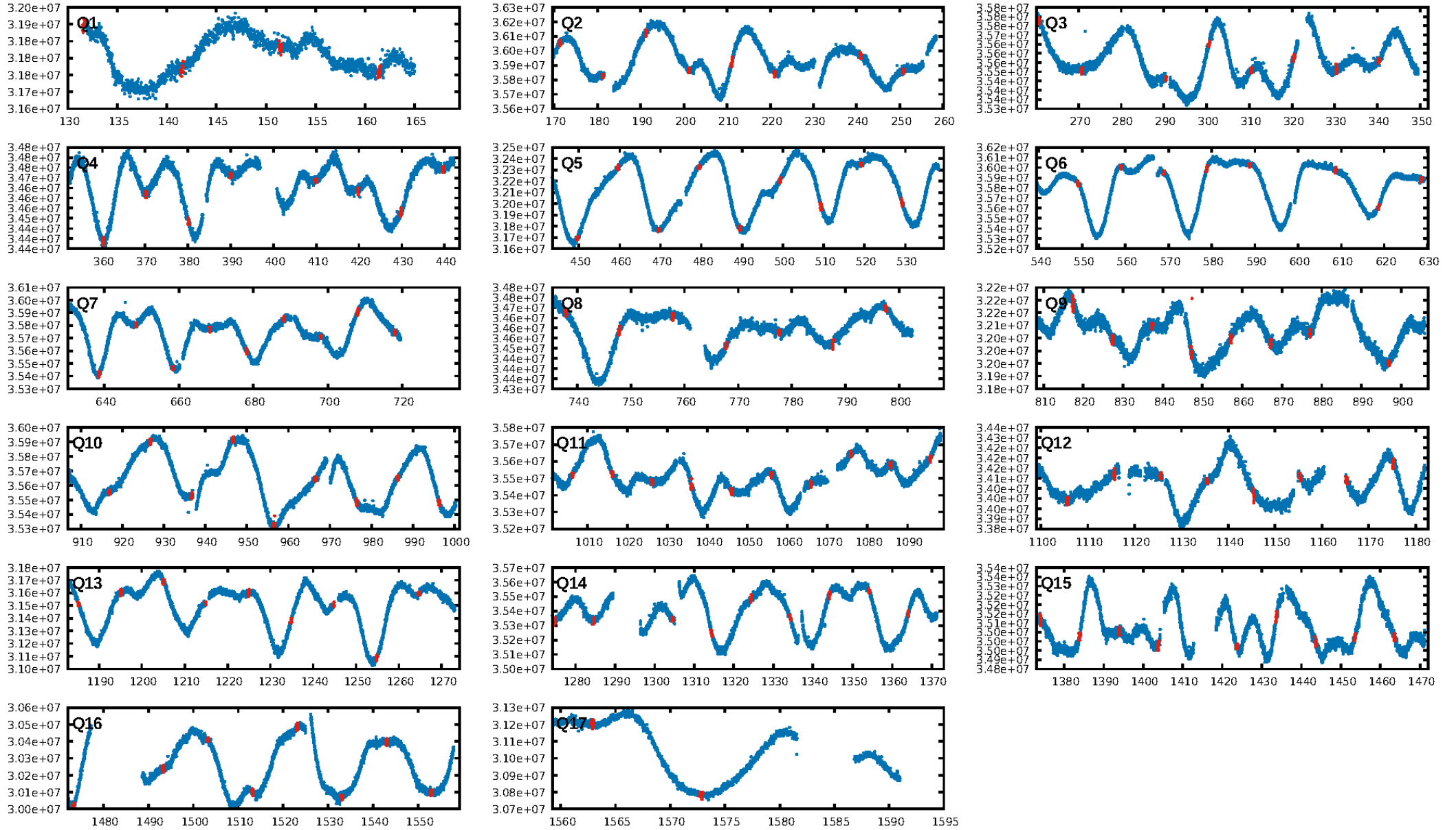
## DV Fit Results:

Period = 9.93963 [0.00004] d  
Epoch = 131.5848 [0.0030] BKJD  
Rp/R\* = 0.0194 [0.0043]  
a/R\* = 11.45 [10.00]  
b = 0.90 [0.18]  
Seff = 64.48 [10.56]  
Teff = 723 [30] K  
Rp = 1.84 [0.44] Re  
a = 0.0843 [0.0076] AU  
Ag = 46.65 [28.24] [1.62 $\sigma$ ]  
Teffp = 2920 [431] K [5.09 $\sigma$ ]

## DV Diagnostic Results:

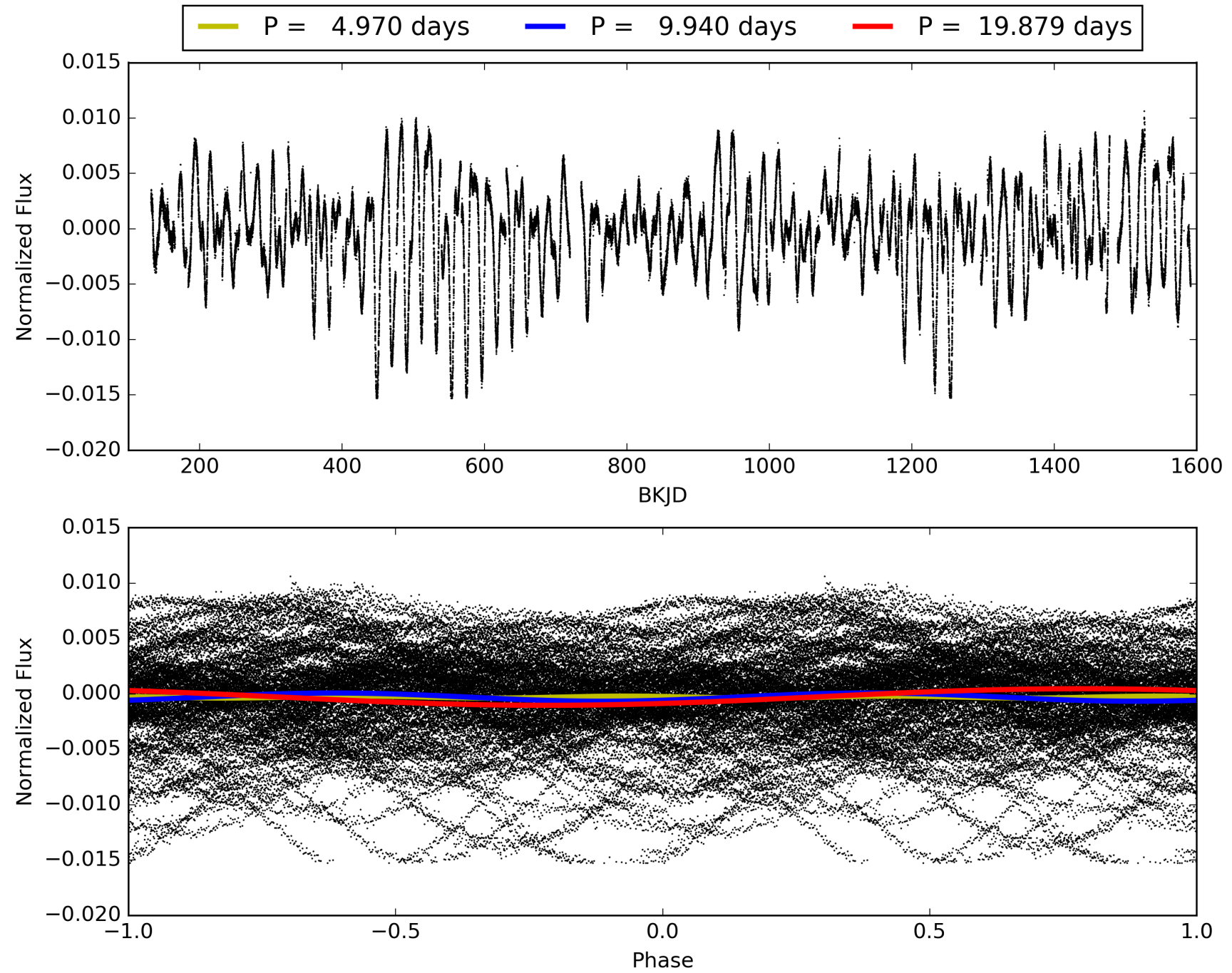
ShortPeriod-sig: 100.0% [23.05 $\sigma$ ]  
LongPeriod-sig: 100.0% [42.29 $\sigma$ ]  
ModelChiSquare2-sig: 100.0%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 1.53e-74  
RollingBand-fgt: 0.97 [119/123]  
GhostDiagnostic-chr: 4.857  
Centroid-sig: 0.3%  
Centroid-so: 0.544 arcsec [0.86 $\sigma$ ]  
OotOffset-rm: 0.819 arcsec [2.77 $\sigma$ ]  
KicOffset-rm: 0.545 arcsec [1.53 $\sigma$ ]  
OotOffset-st: 4/3/4/4 [15]  
KicOffset-st: 4/3/4/4 [15]  
DiffImageQuality-fgm: 0.80 [12/15]  
DiffImageOverlap-fno: 1.00 [17/17]

# TCE 009020160-03, PDC Light Curves





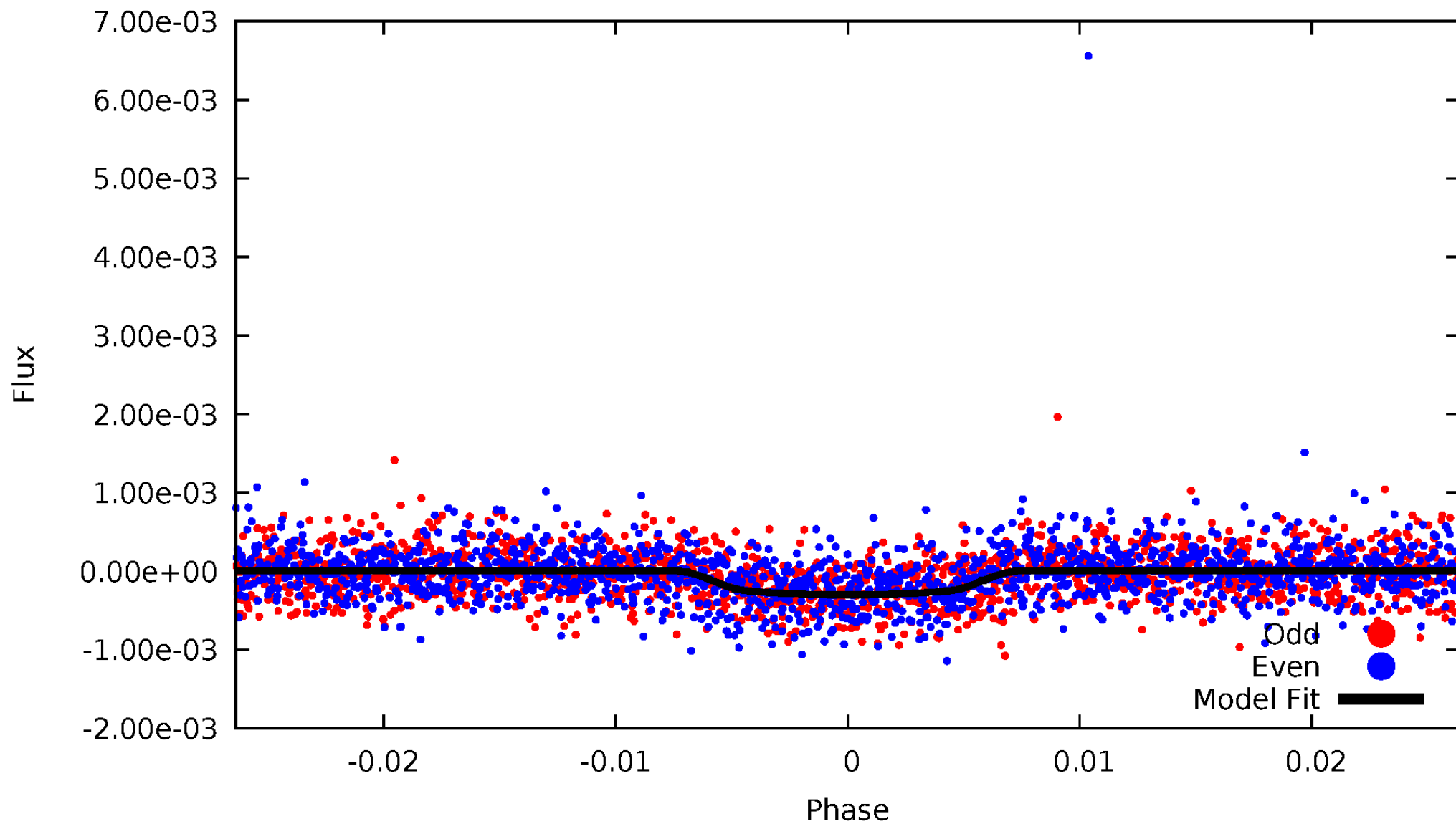
TCE 009020160-03





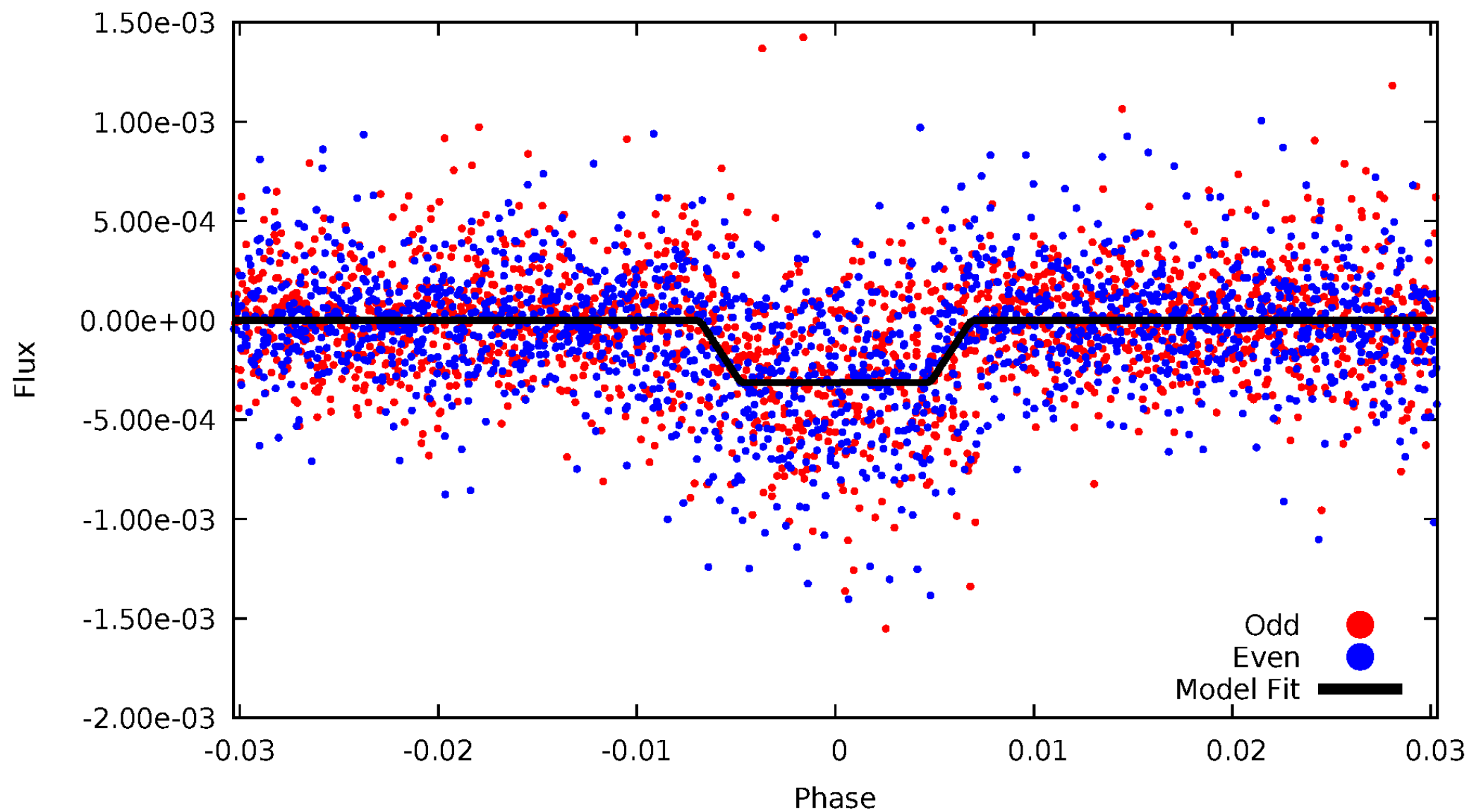
# DV Odd/Even

TCE 009020160-03

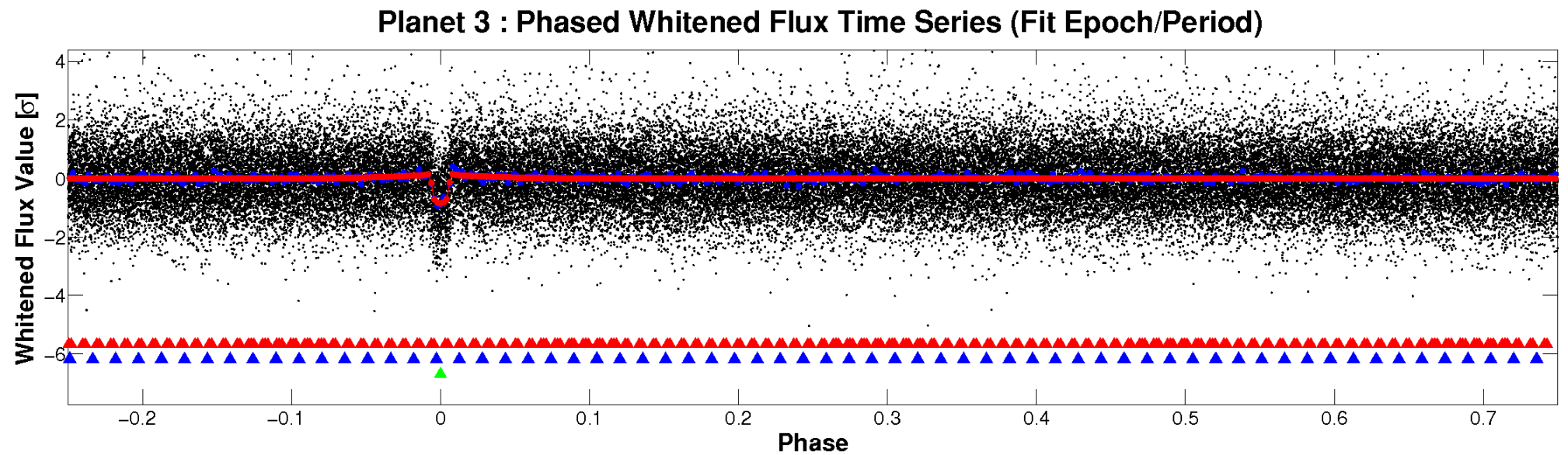
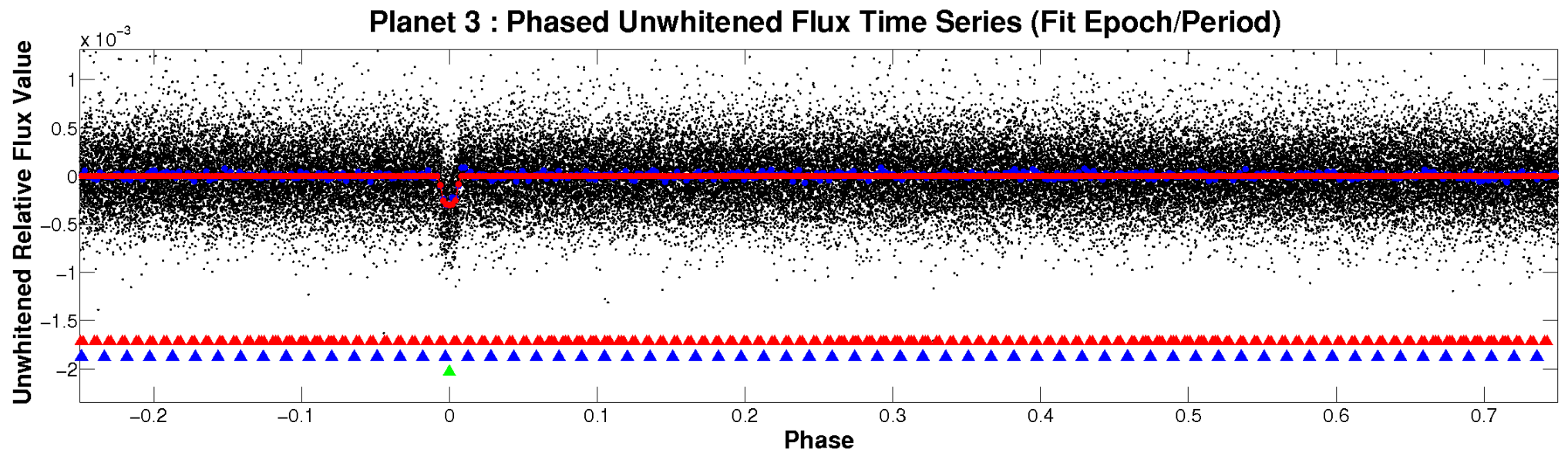


# ALT Odd/Even

TCE 009020160-03

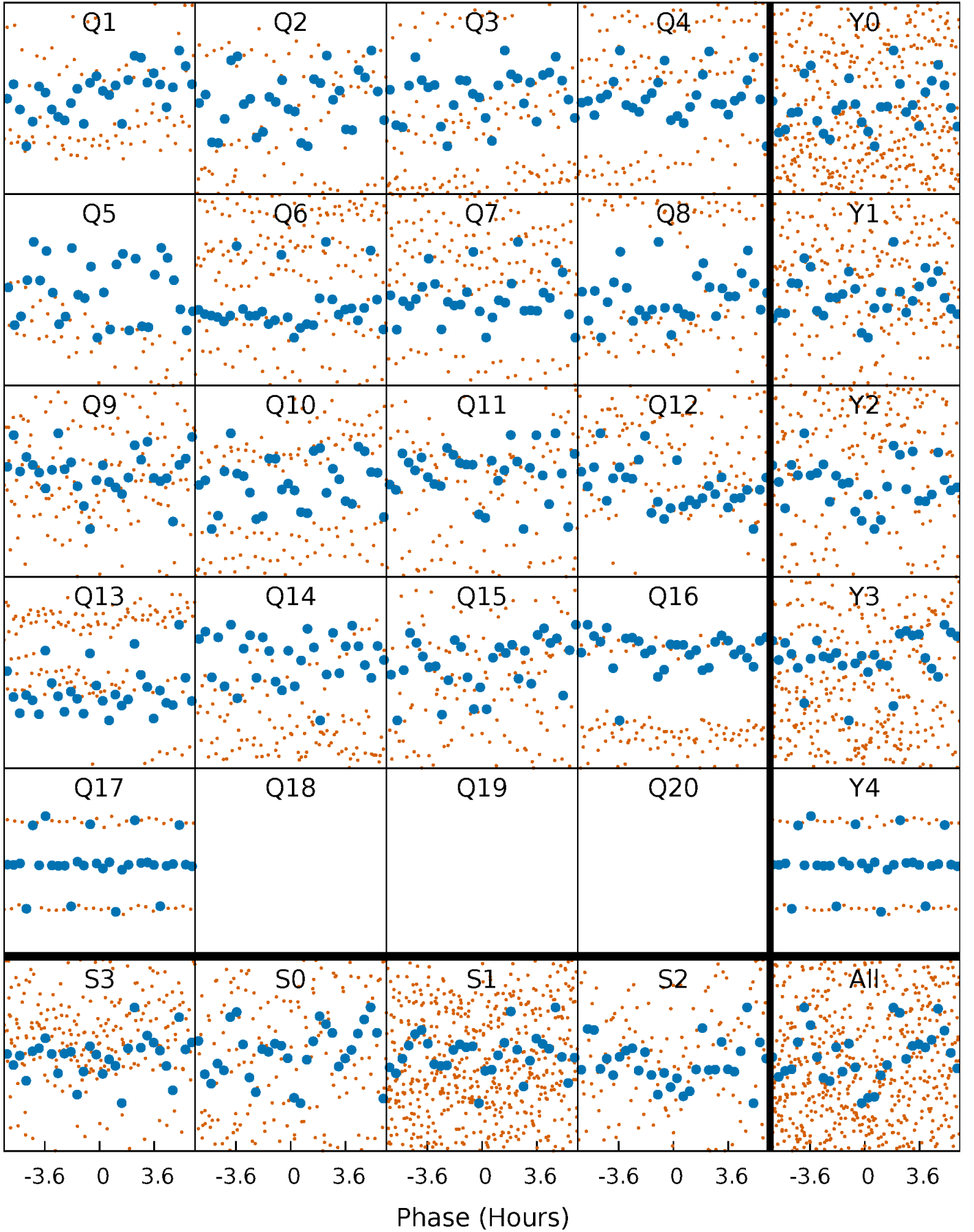


# Non-Whitened Vs. Whitened Light Curve



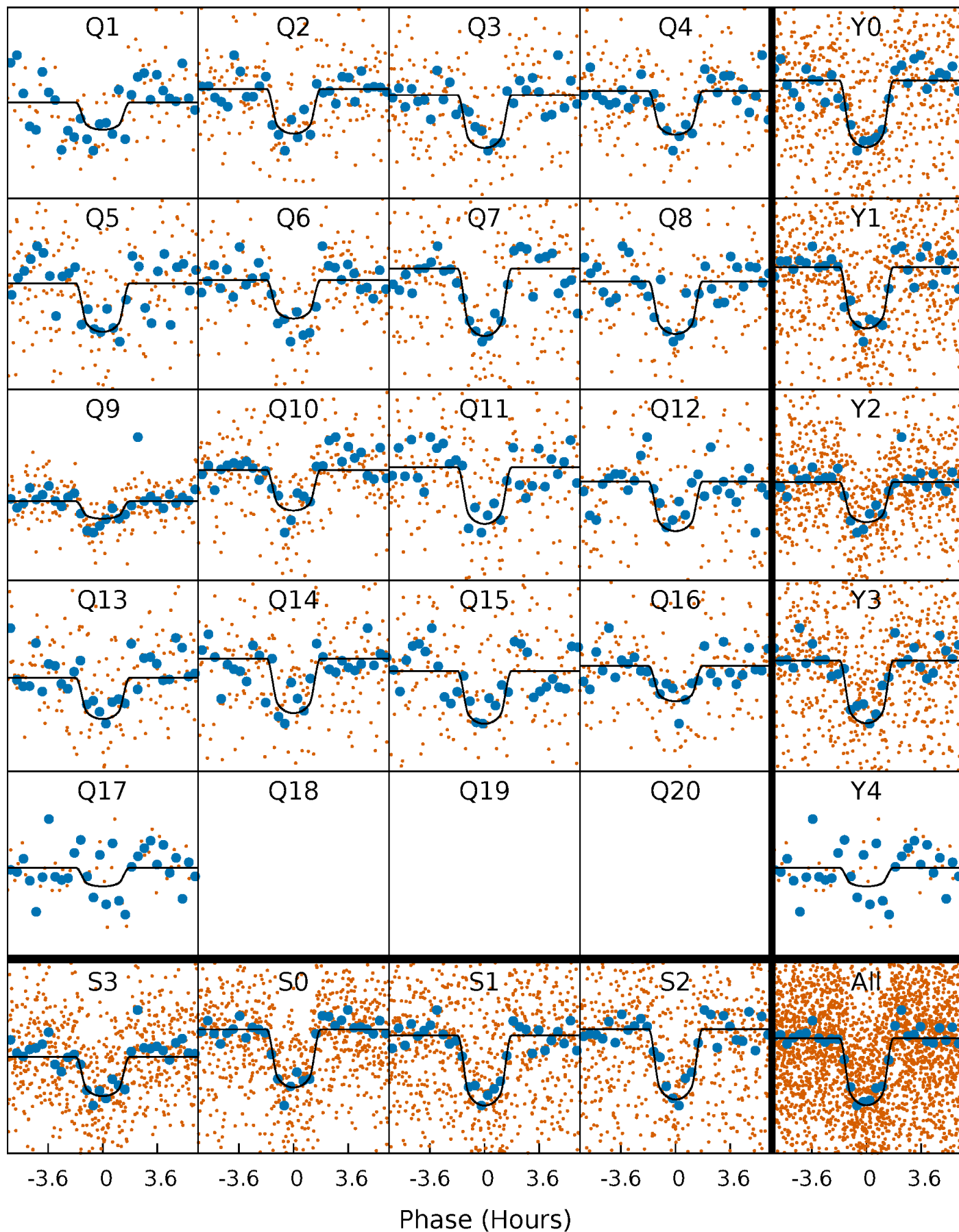
# PDC Quarter-Phased Transit Curves

TCE 009020160-03   P= 9.939628 Days    $T_0=131.584771$  (BKJD)



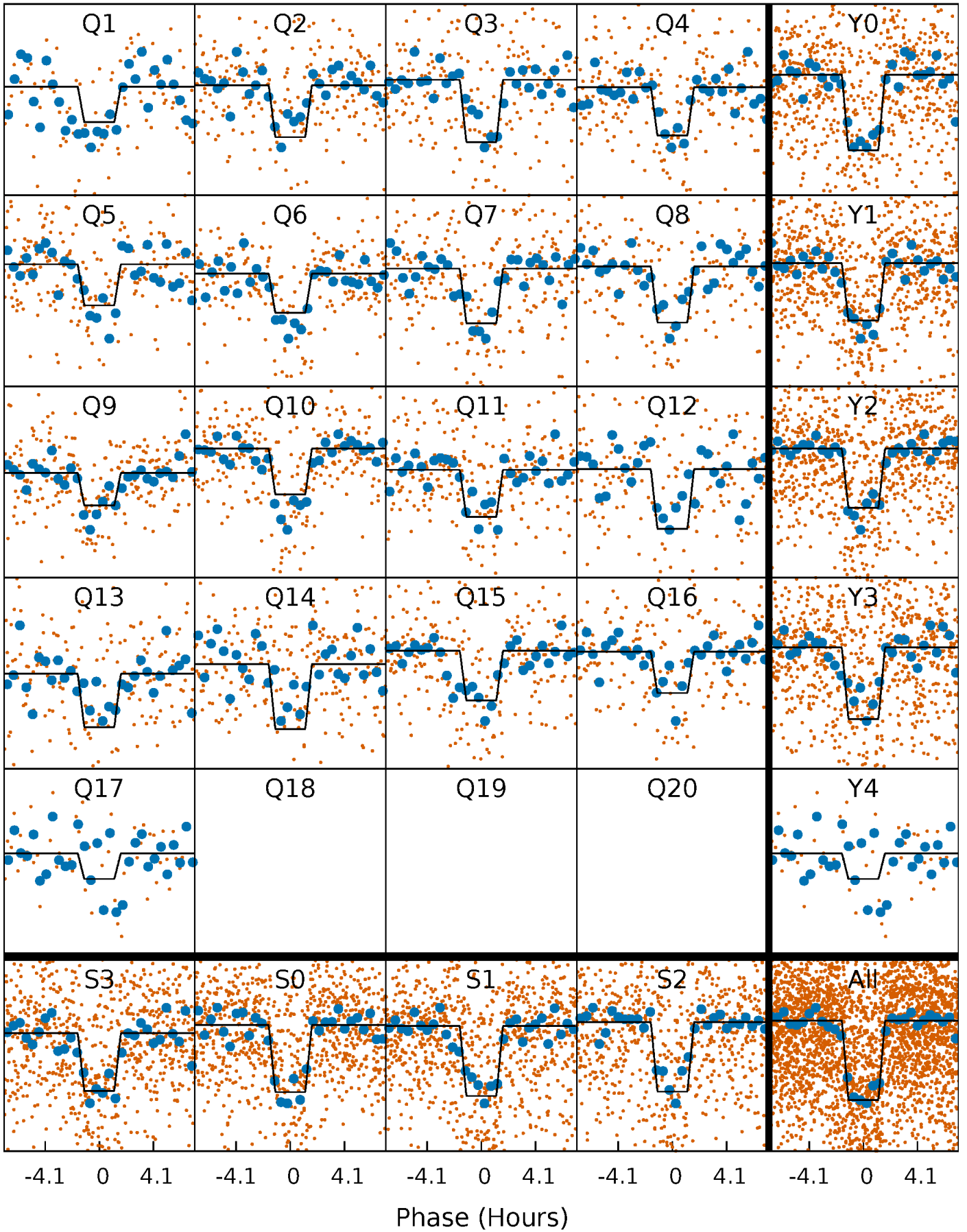
# DV Quarter-Phased Transit Curves

TCE 009020160-03 P= 9.939628 Days  $T_0=131.584771$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

TCE 009020160-03 P= 9.939573 Days  $T_0=131.588415$  (BKJD)

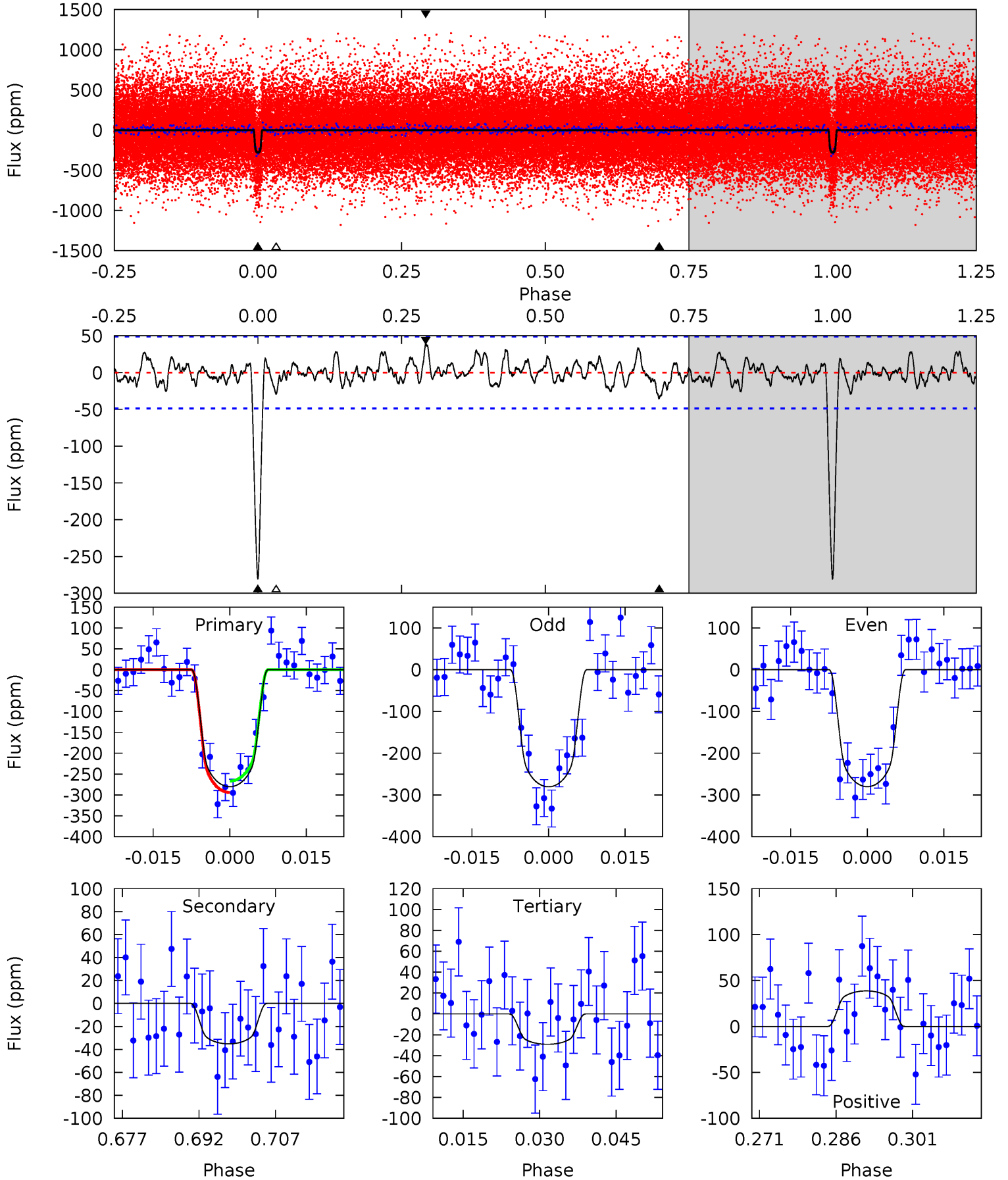




# DV Model-Shift Uniqueness Test

009020160-03, P = 9.939628 Days, E = 121.645143 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
28.3	3.56	2.95	3.91	4.95	2.43	1.23	25.4	24.4	0.61	-0.35	0.02	0.97	0.12	1.38

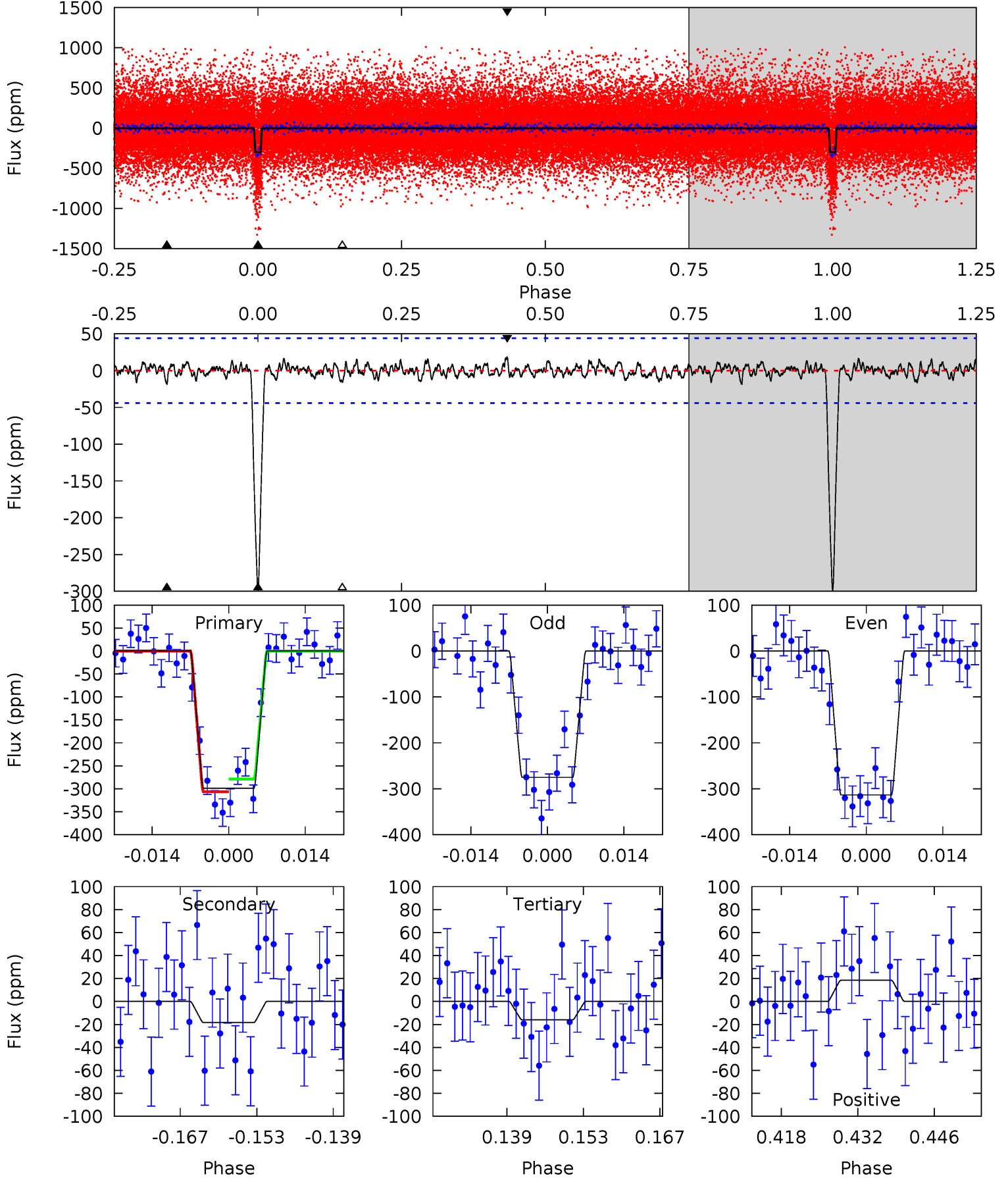




# Alt Model-Shift Uniqueness Test

009020160-03, P = 9.939573 Days, E = 121.648842 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
33.5	2.05	1.80	2.07	4.96	2.46	0.70	31.7	31.5	0.26	-0.01	2.14	1.05	0.06	1.55



### Stellar Parameters For KIC 009020160

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5105^{+84}_{-76}$	$4.469^{+0.090}_{-0.030}$	$0.140^{+0.150}_{-0.150}$	$0.868^{+0.044}_{-0.076}$	$0.810^{+0.062}_{-0.026}$	$1.742^{+0.594}_{-0.193}$
	+2%/-1%	+2%/-1%	+107%/-107%	+5%/-9%	+8%/-3%	+34%/-11%
Source	SPE90	SPE90	SPE90	DSEP		

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

### Secondary Eclipse Parameters for KIC 009020160-03 / KOI 0582.03

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-35 \pm 10$	$1.85^{+0.40}_{-0.45}$	$1002^{+24}_{-28}$	$3316^{+330}_{-252}$	$42^{+33}_{-18}$
Alt.	$-18 \pm 9$	$1.65^{+0.41}_{-0.41}$	$1004^{+24}_{-28}$	$3083^{+371}_{-333}$	$26^{+28}_{-15}$

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

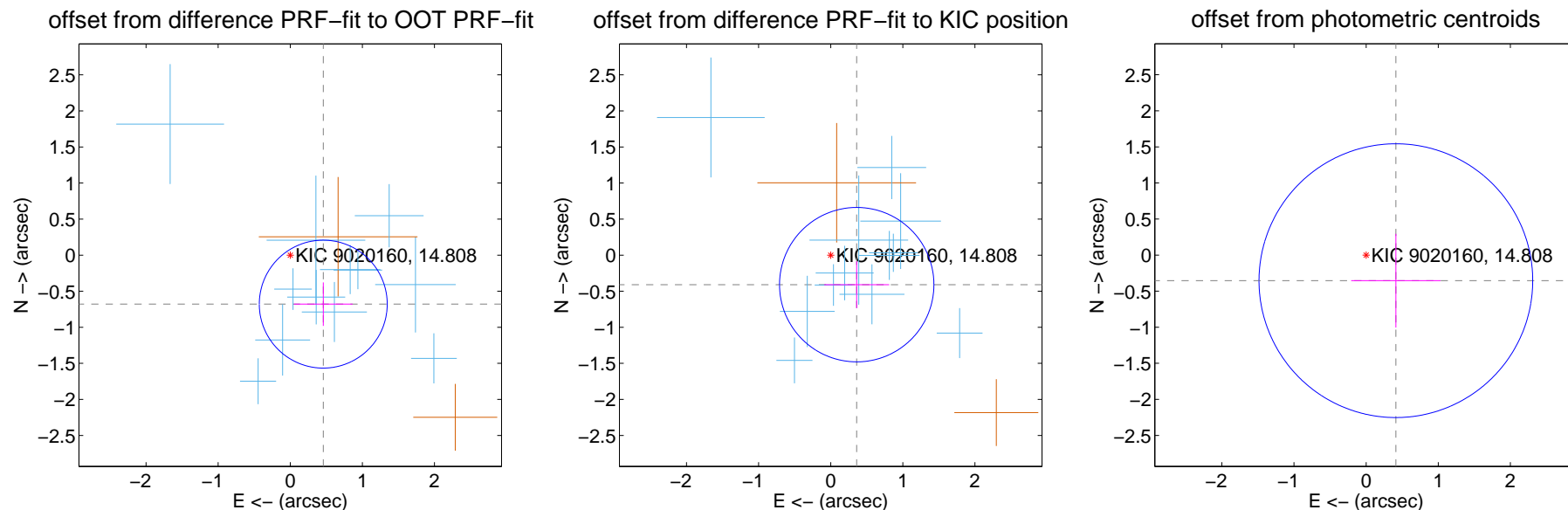
## DV Centroid Data

Supplemental centroid analysis for 009020160-03. Kepler magnitude: 14.81. Transit SNR 19.83

There are 12 quarters with good PRF difference image offsets

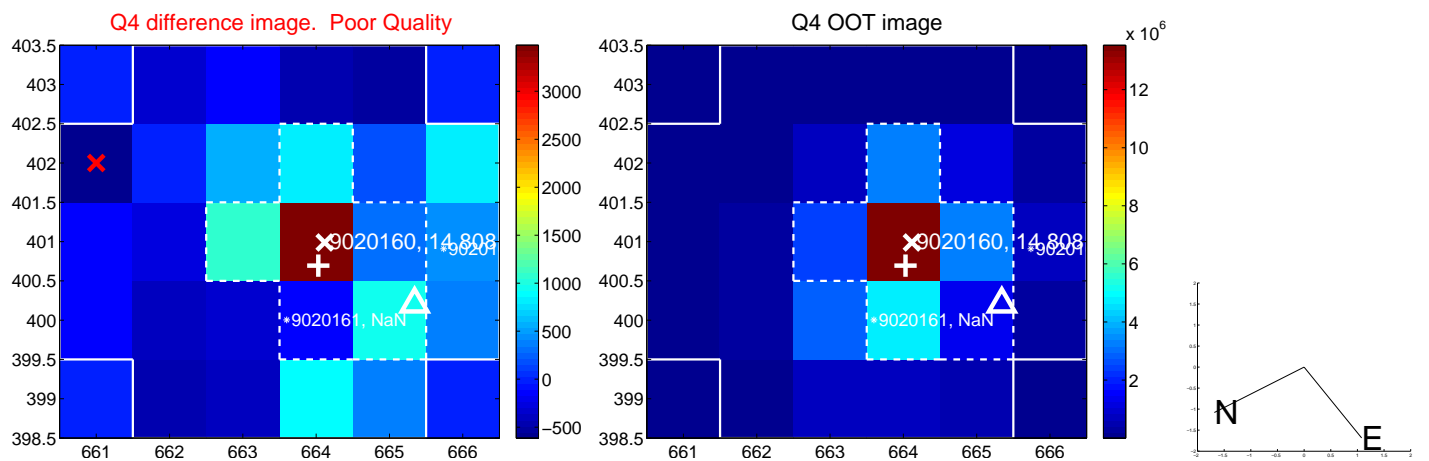
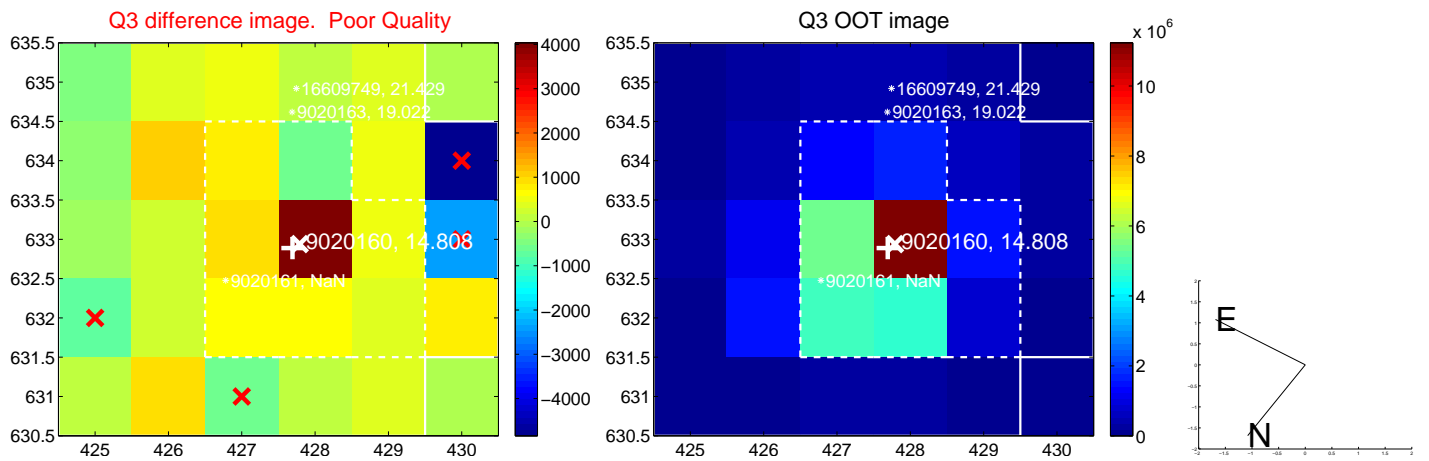
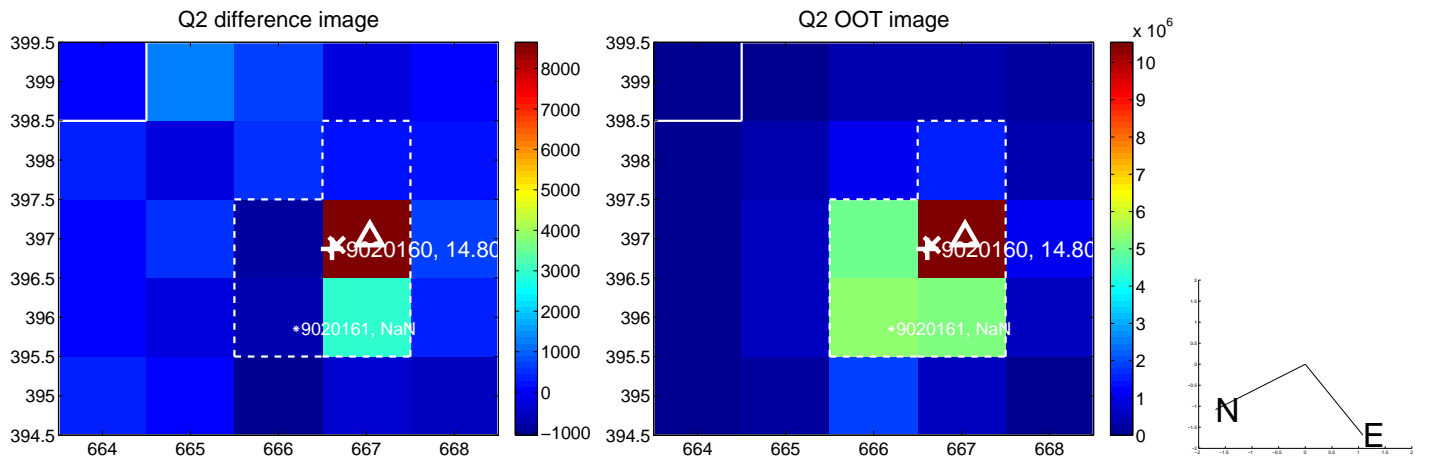
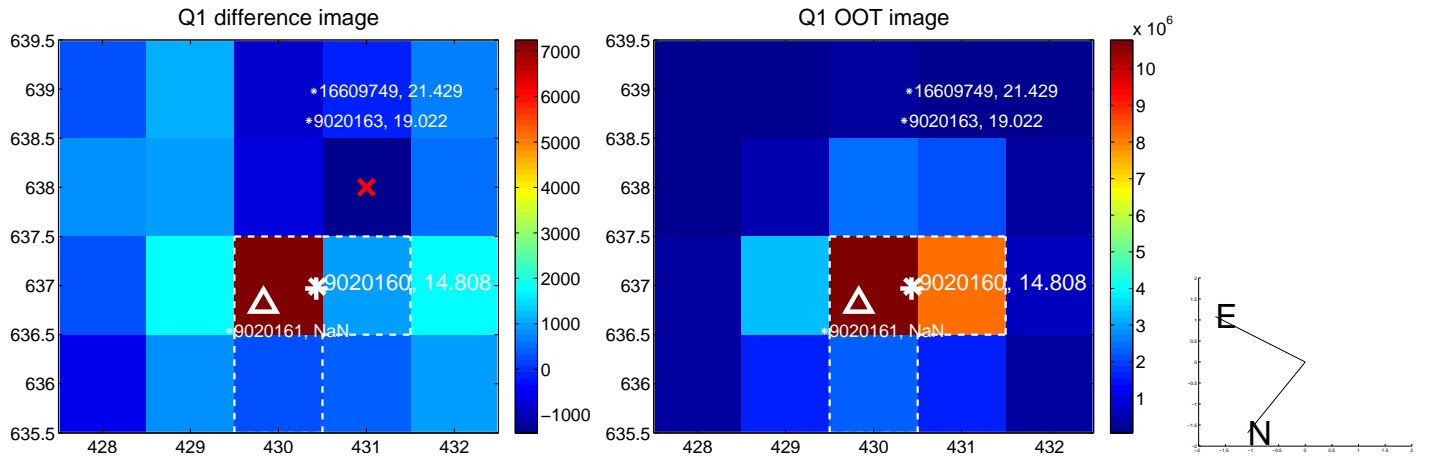
The direct PRF centroid is offset from the target star catalog position by about 0.85 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.819 \pm 0.296$	2.77	$-0.458 \pm 0.407$	$-0.679 \pm 0.301$
PRF-fit source offset from KIC position	$0.545 \pm 0.357$	1.53	$-0.360 \pm 0.450$	$-0.409 \pm 0.326$
photometric centroid source offset	$0.54 \pm 0.63$	0.86	$-0.41 \pm 0.62$	$-0.35 \pm 0.65$

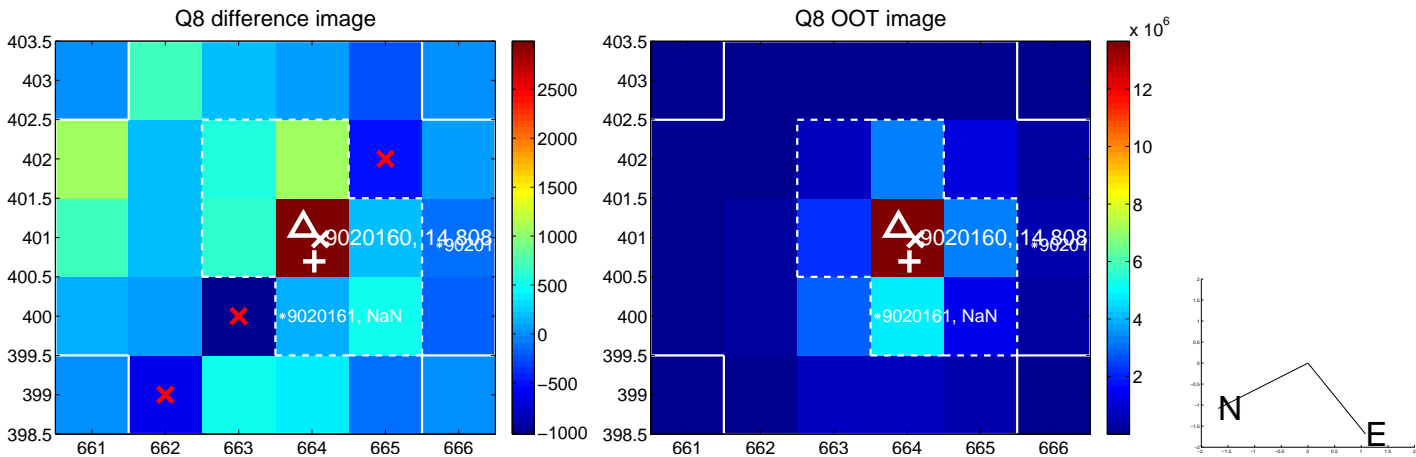
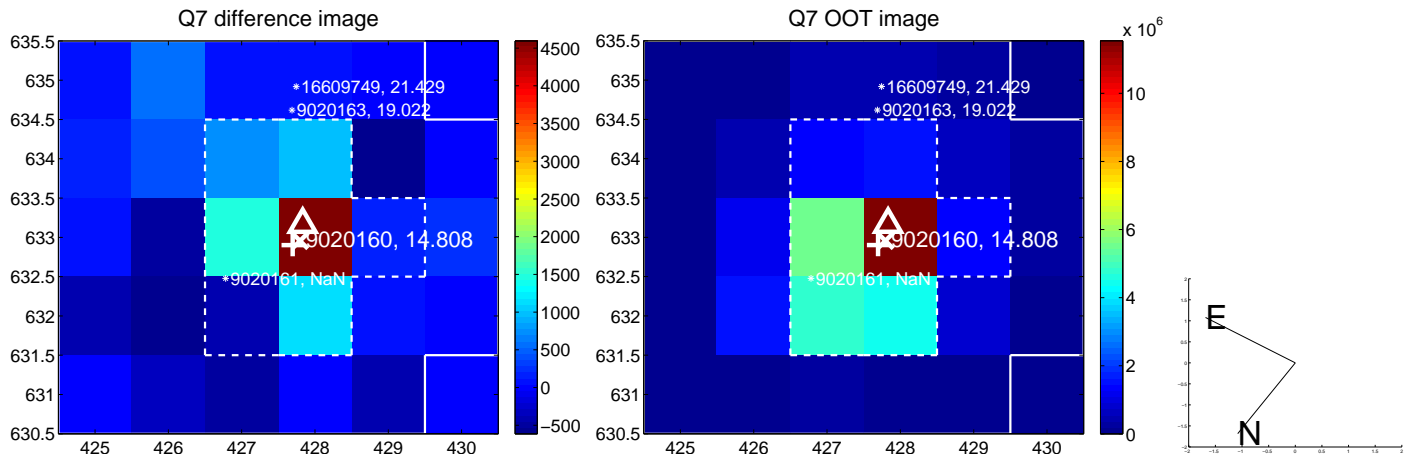
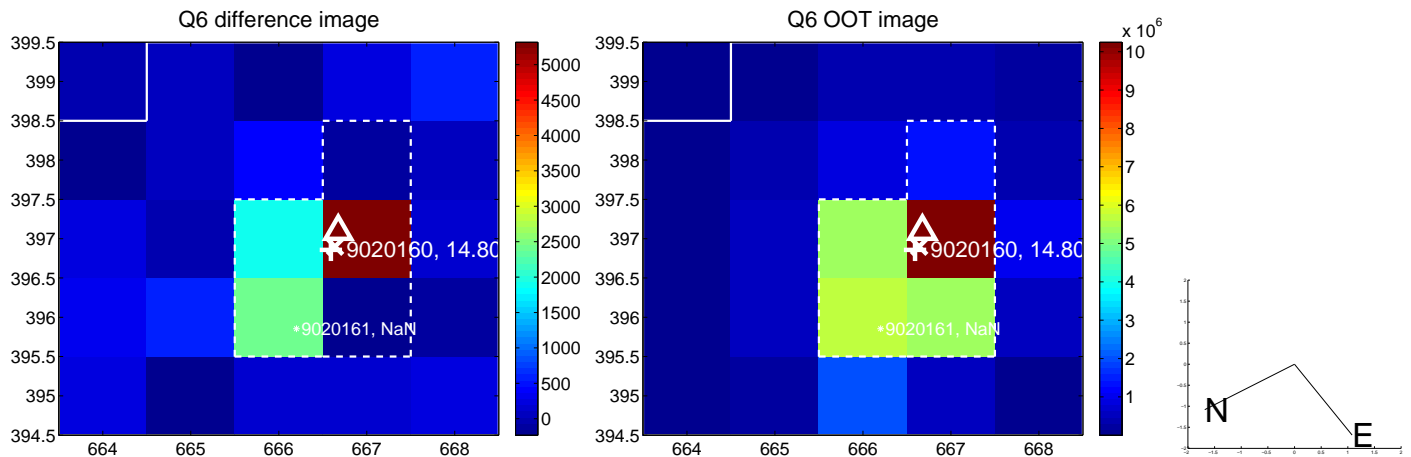
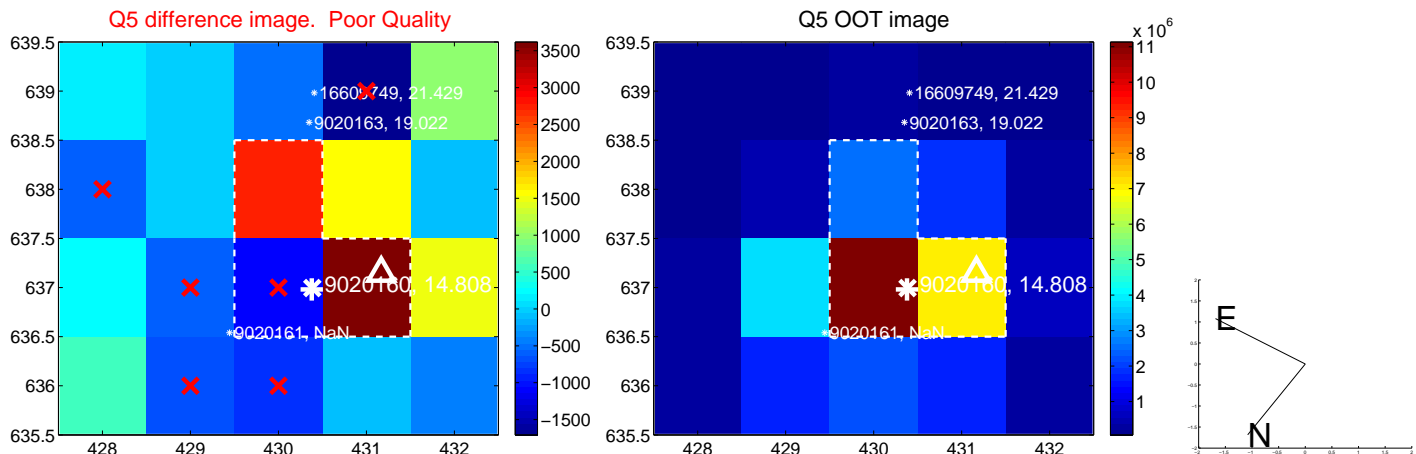


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

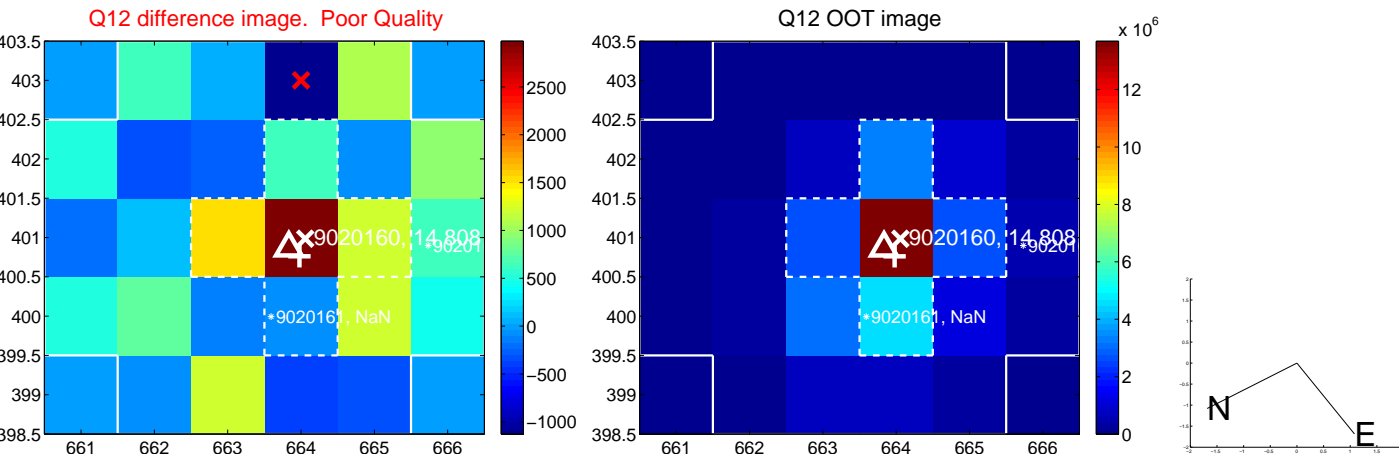
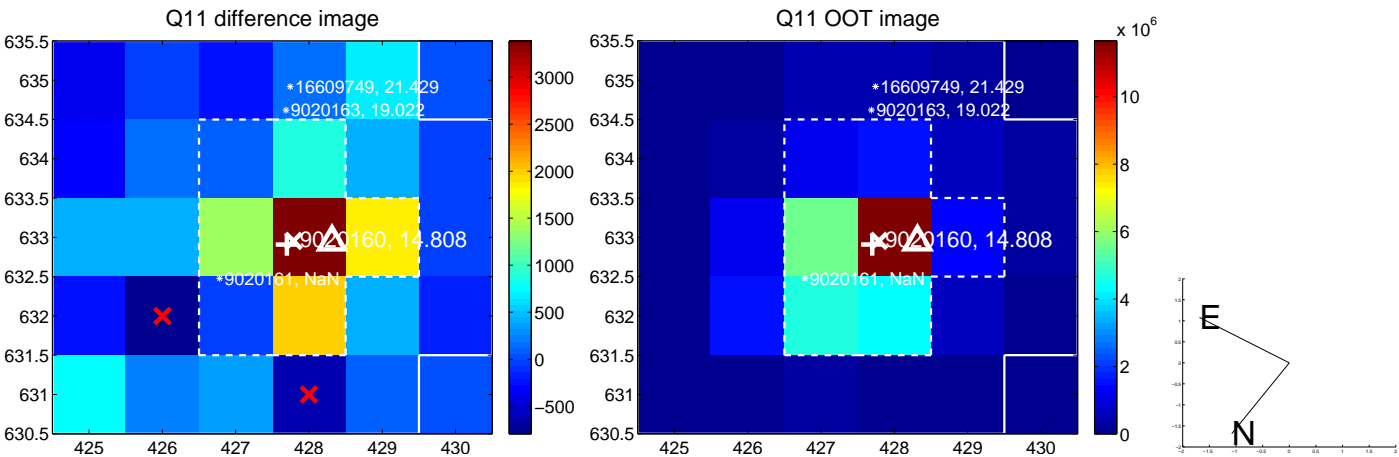
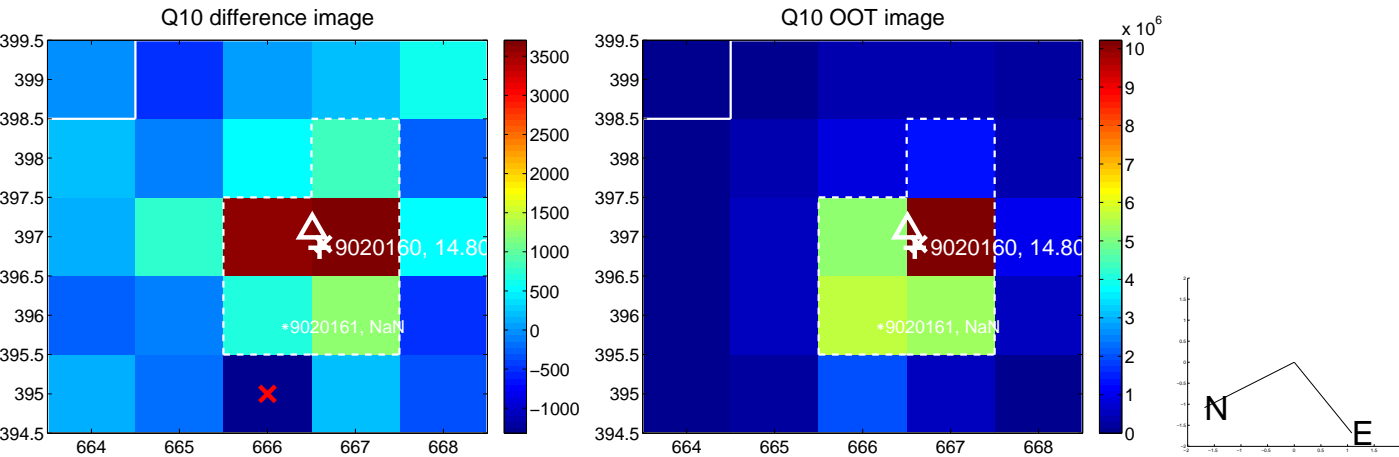
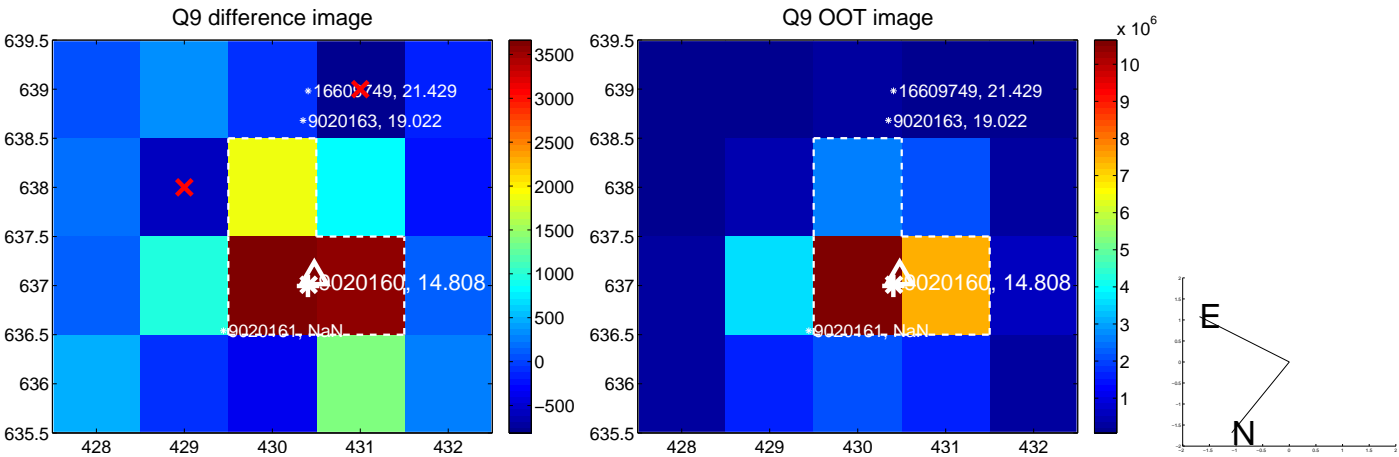
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



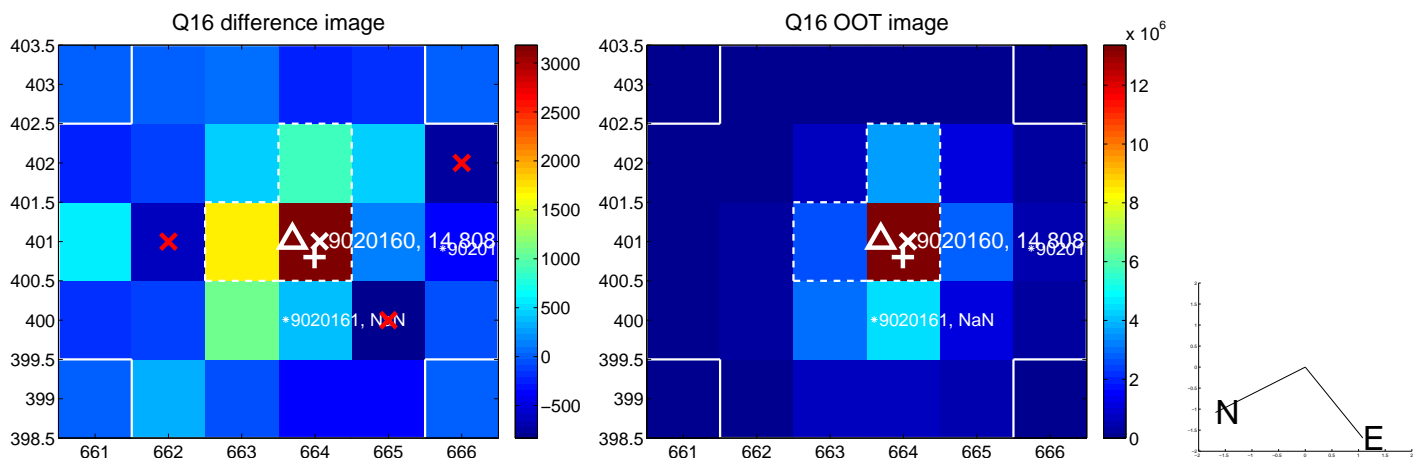
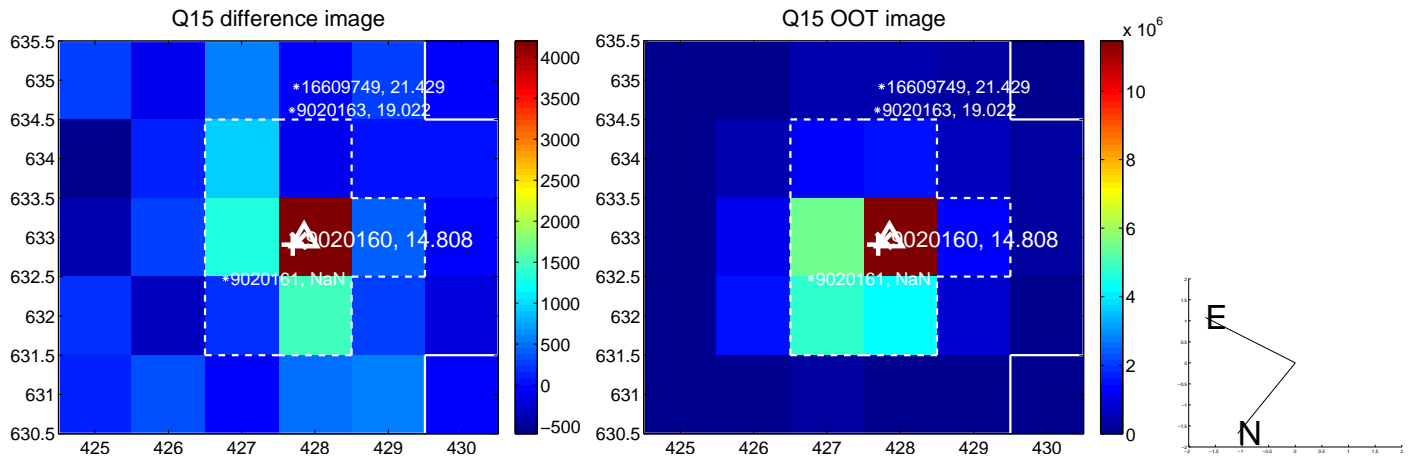
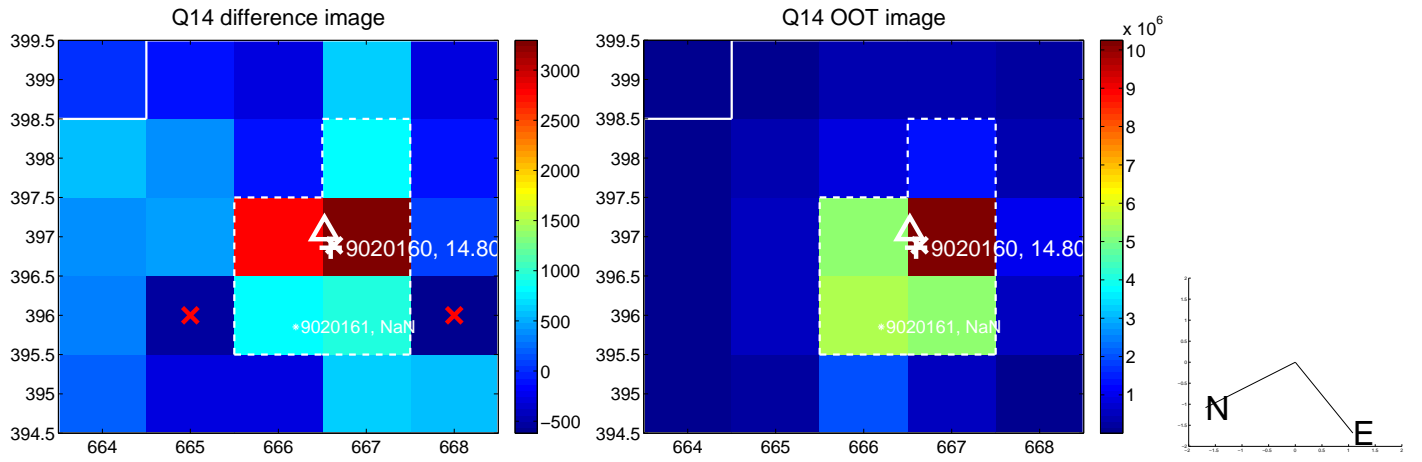
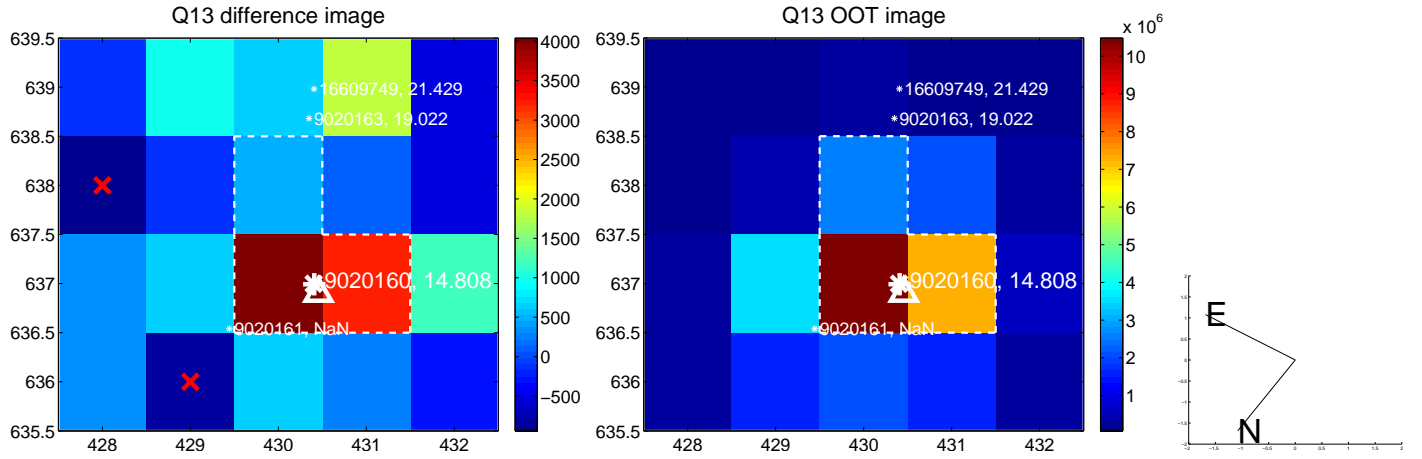
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

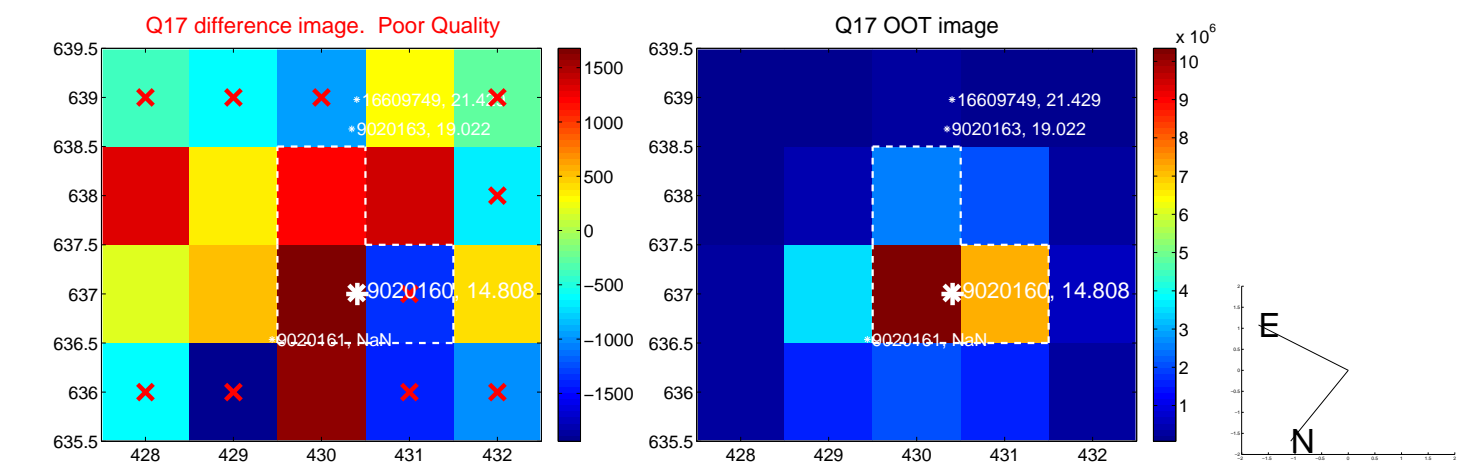


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

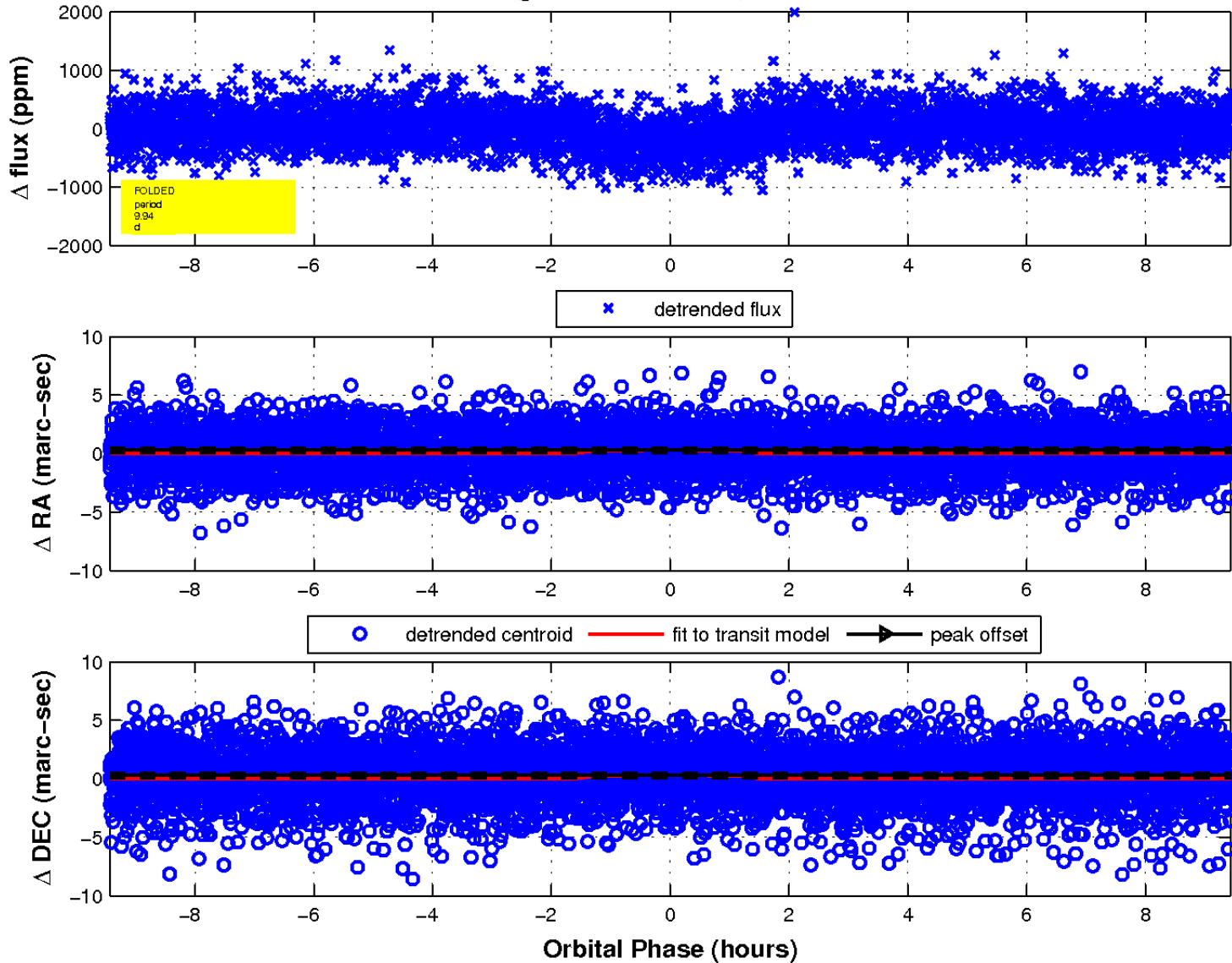




white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



### fluxWeightedCentroids, Planet 3 of 3



UKIRT Image

