

# KIC 003654515

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
003654515-01	OBS	No	2.442461	133.130290	35.3	7.864	7.8	8.0	4.32	6597	3.07	16903.04
003654515-02	OBS	No	70.632785	158.012085	222.4	6.376	7.3	7.2	4.32	6597	7.15	190.43

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
003654515-01	OBS	FP	0.00	1	0	0	0	LPP_DV
003654515-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_ALT

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

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

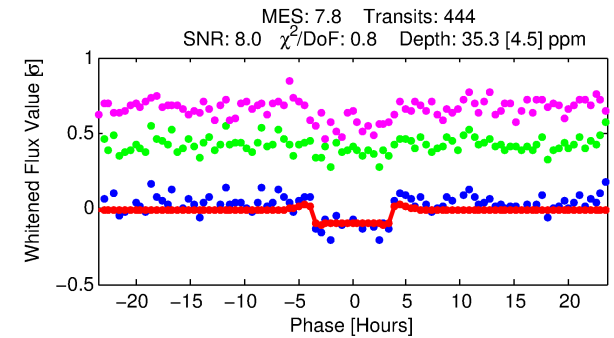
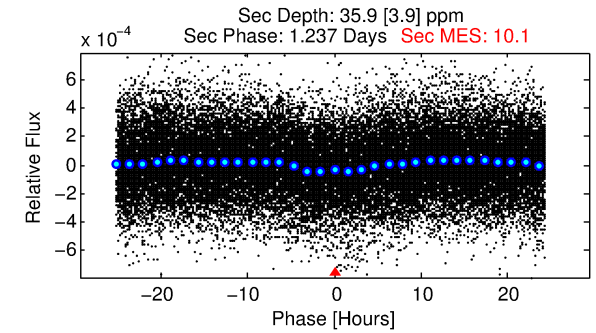
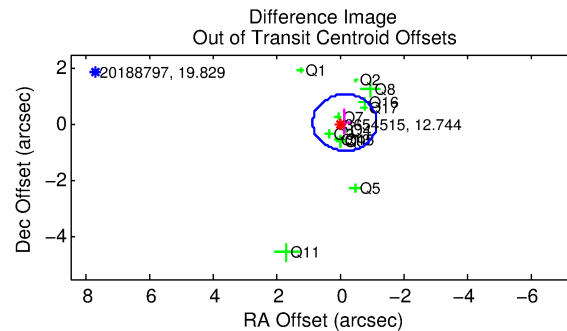
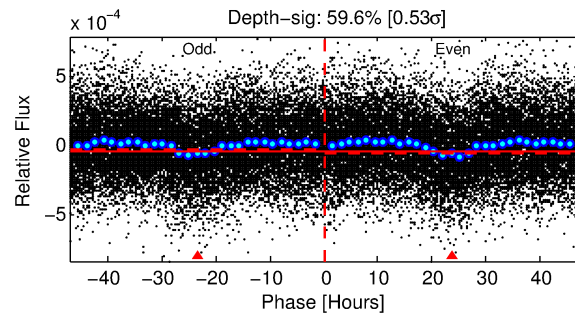
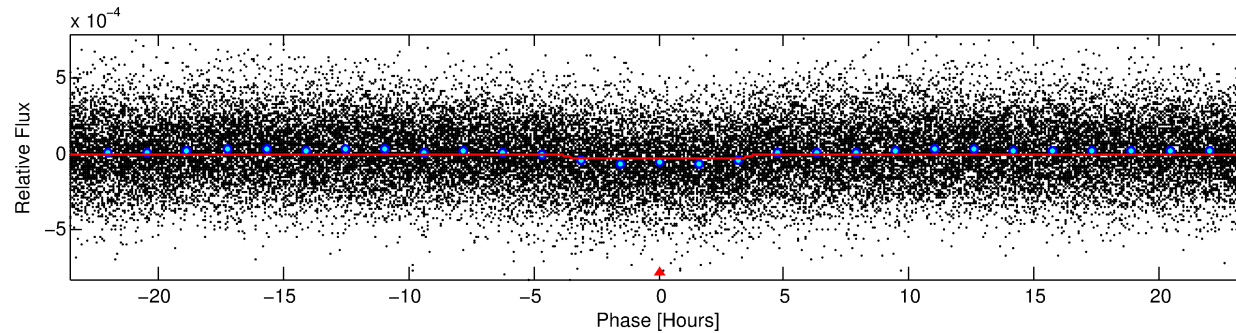
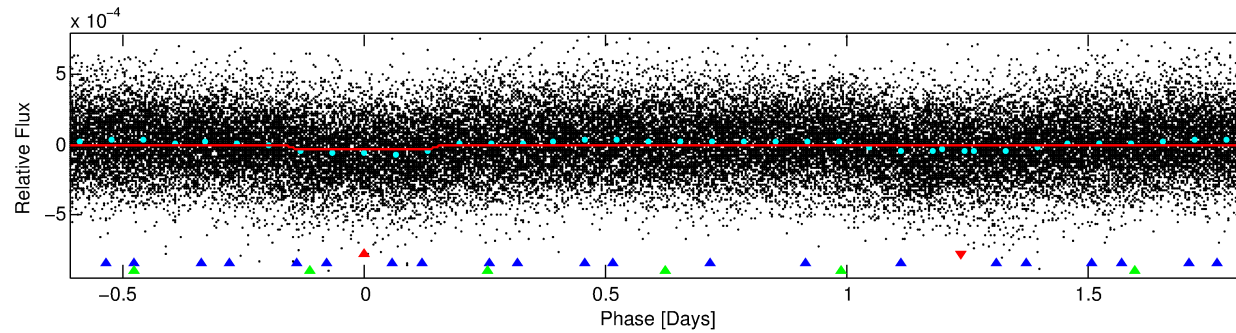
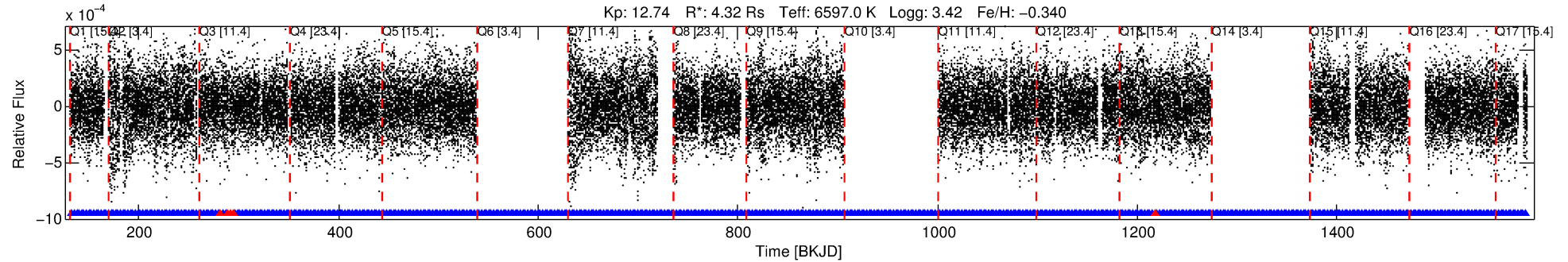
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 003654515-01

No Significant Match Found

# DV One-Page Summary

KIC: 3654515 Candidate: 1 of 3 Period: 2.442 d



## DV Fit Results:

Period = 2.44246 [0.00003] d  
Epoch = 133.1303 [0.0054] BKJD  
Rp/R\* = 0.0065 [0.0010]  
a/R\* = 1.33 [0.50]  
b = 0.93 [0.13]  
Seff = 16903.04 [11793.75]  
Teq = 2907 [507] K  
Rp = 3.07 [1.39] Re  
a = 0.0433 [0.0182] AU  
Ag = 3.93 [3.00] [0.98σ]  
Teffp = 6329 [559] K [4.53σ]

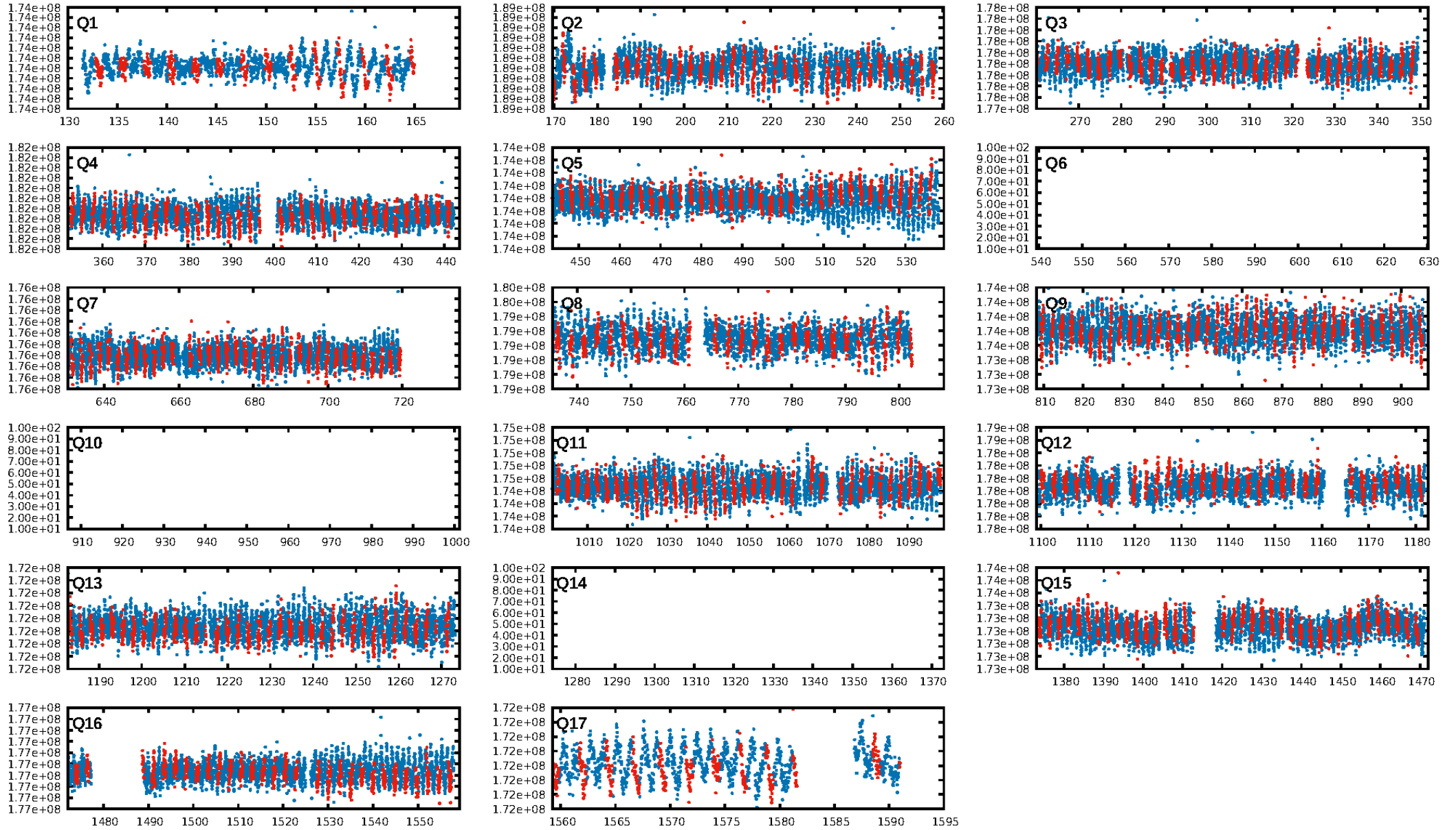
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [161.65σ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: 2.23e-09  
RollingBand-fgt: 0.99 [414/419]  
GhostDiagnostic-chr: 2.191  
Centroid-sig: 5.4%  
Centroid-so: 1.117 arcsec [1.66σ]  
OotOffset-rm: 0.151 arcsec [0.45σ]  
KicOffset-rm: 0.095 arcsec [0.34σ]  
OotOffset-st: 1/4/3/5 [13]  
KicOffset-st: 1/4/3/5 [13]  
DiffImageQuality-fgm: 0.69 [9/13]  
DiffImageOverlap-fno: 1.00 [14/14]

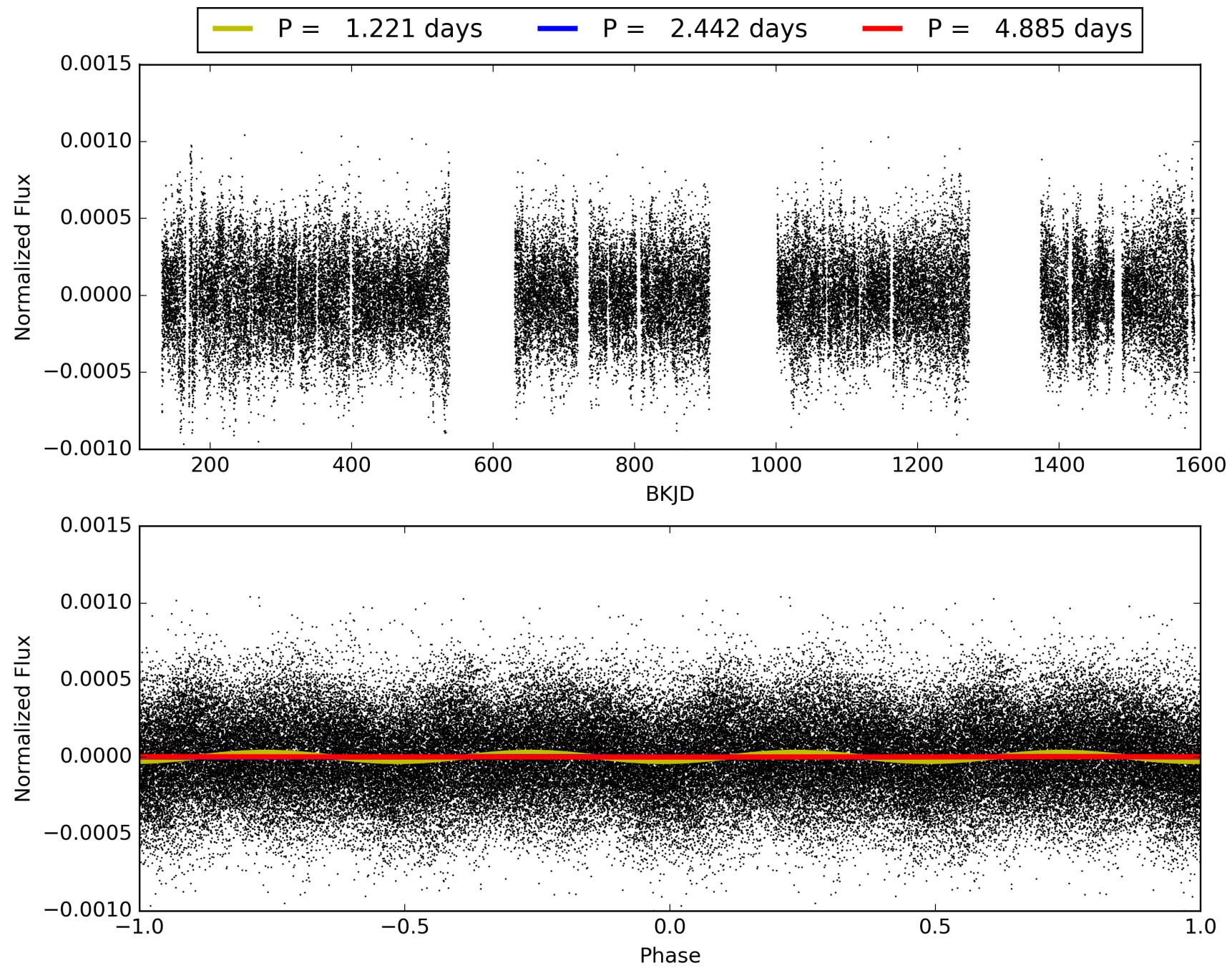
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 30-Jan-2016 23:42:48 Z

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

# TCE 003654515-01, PDC Light Curves



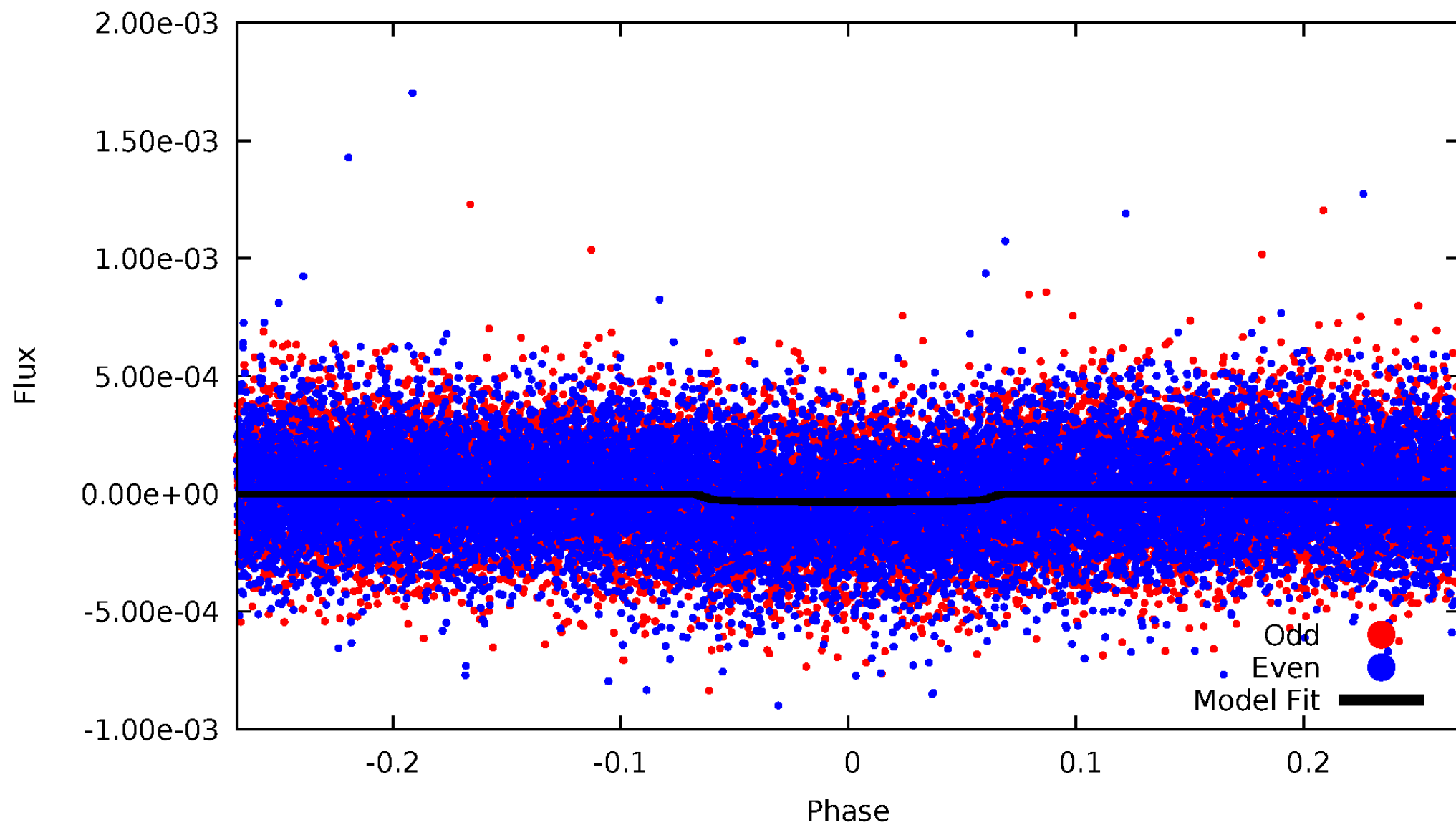
TCE 003654515-01





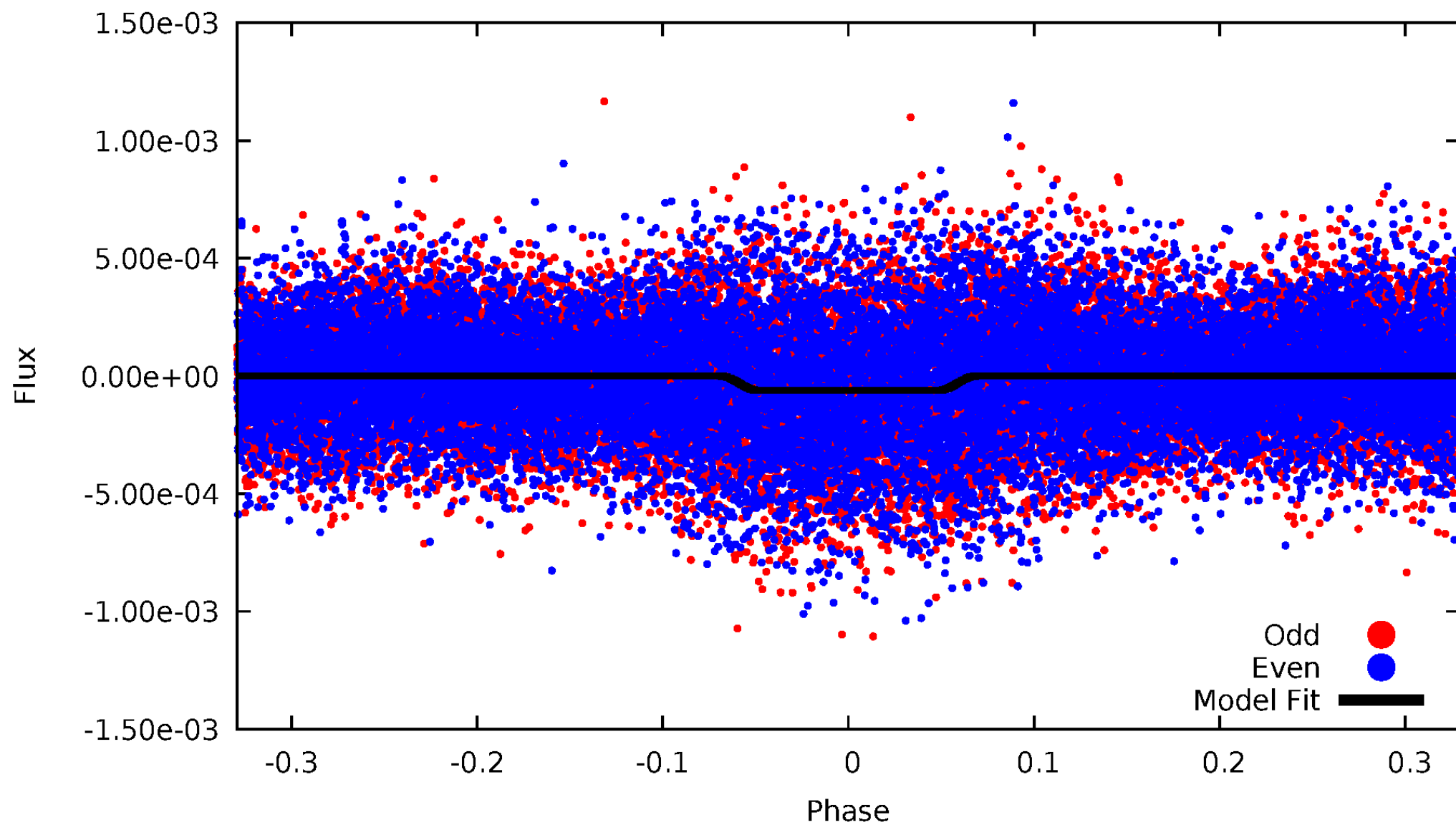
# DV Odd/Even

TCE 003654515-01

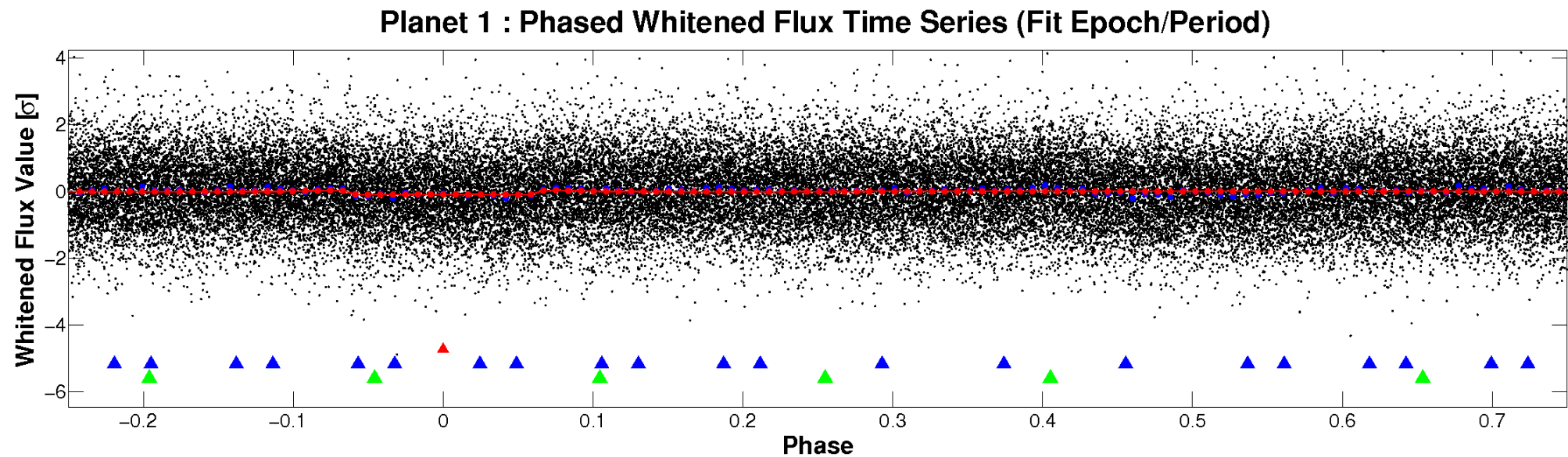
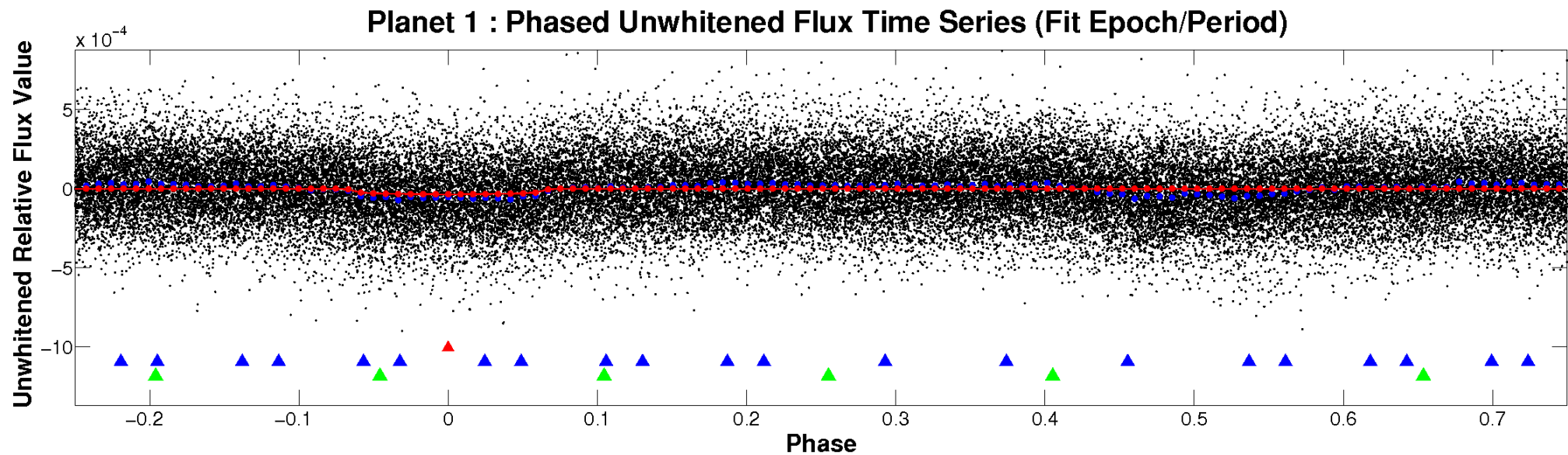


# ALT Odd/Even

TCE 003654515-01

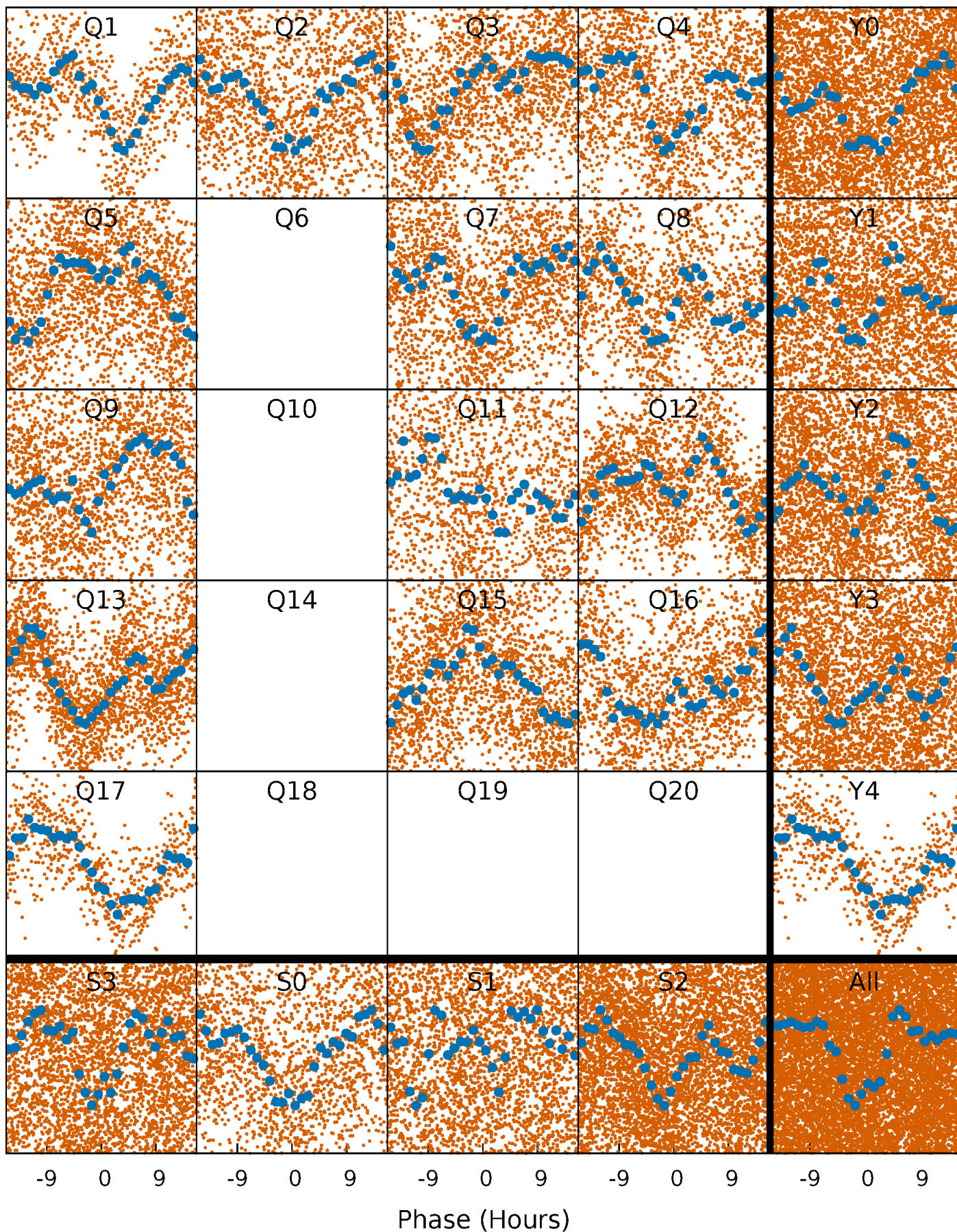


# Non-Whitened Vs. Whitened Light Curve



# PDC Quarter-Phased Transit Curves

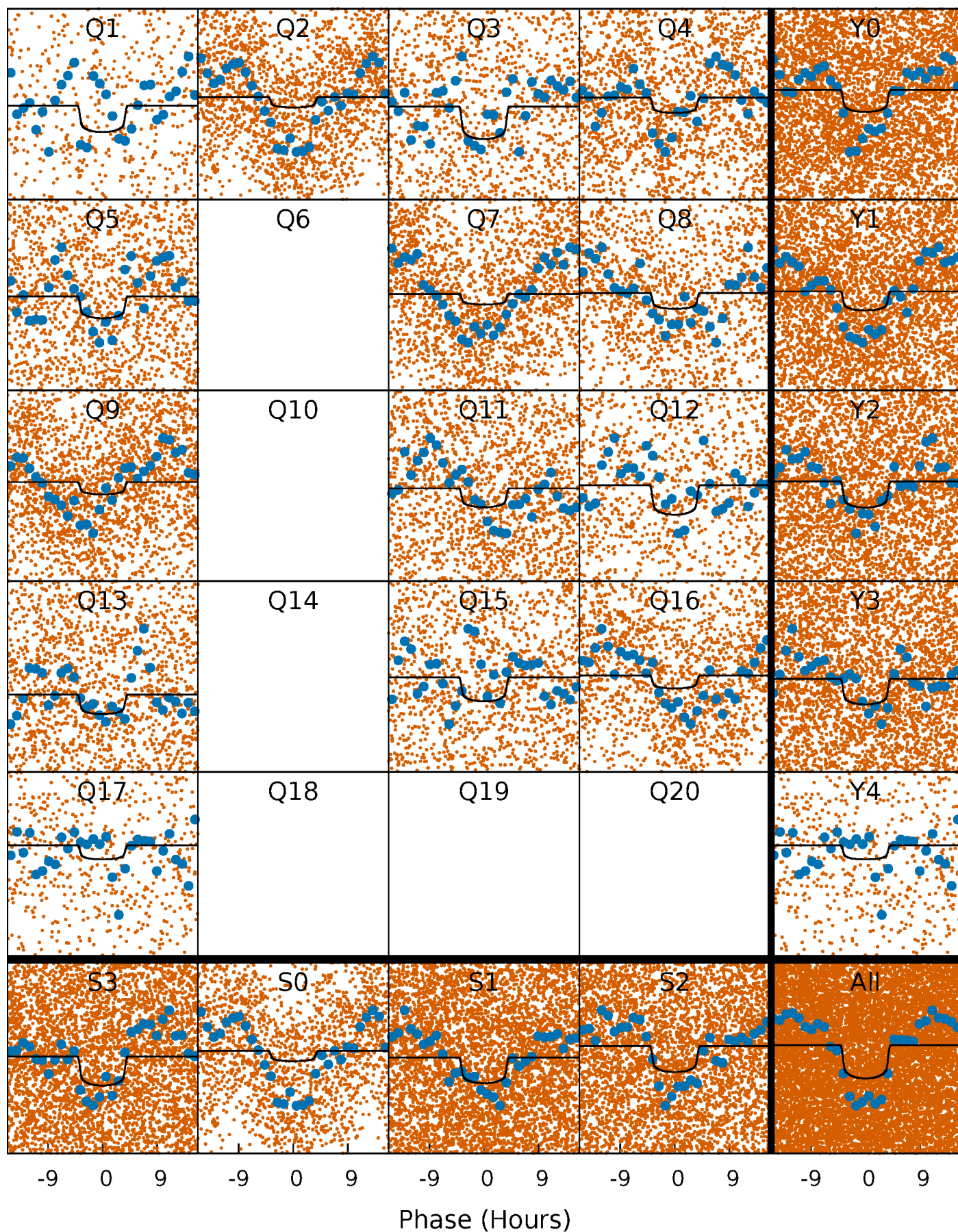
TCE 003654515-01 P= 2.442461 Days  $T_0=133.130290$  (BKJD)





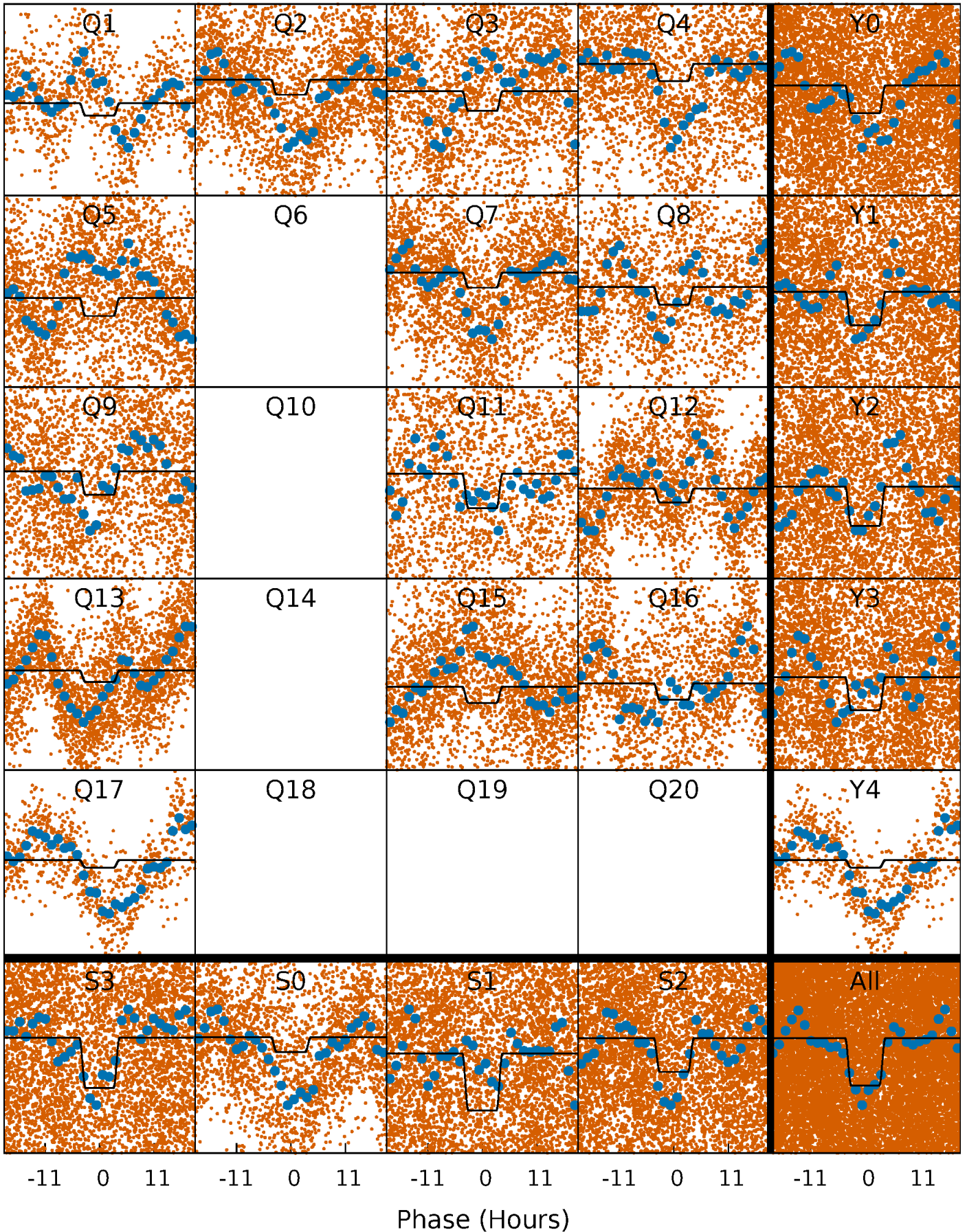
# DV Quarter-Phased Transit Curves

TCE 003654515-01 P= 2.442461 Days  $T_0=133.130290$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

TCE 003654515-01 P= 2.442671 Days  $T_0=133.050869$  (BKJD)

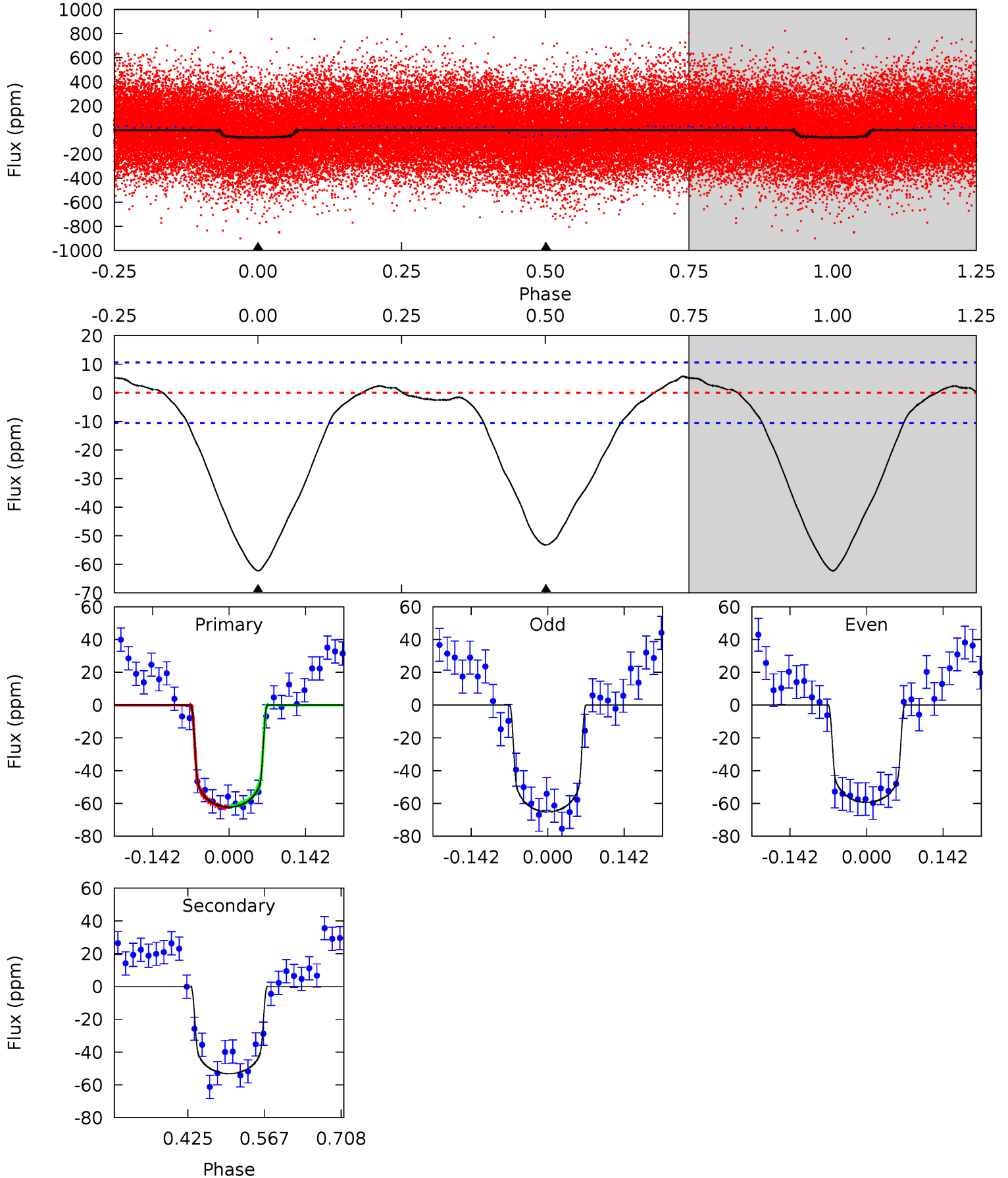




# DV Model-Shift Uniqueness Test

003654515-01, P = 2.442461 Days, E = 130.687829 Days

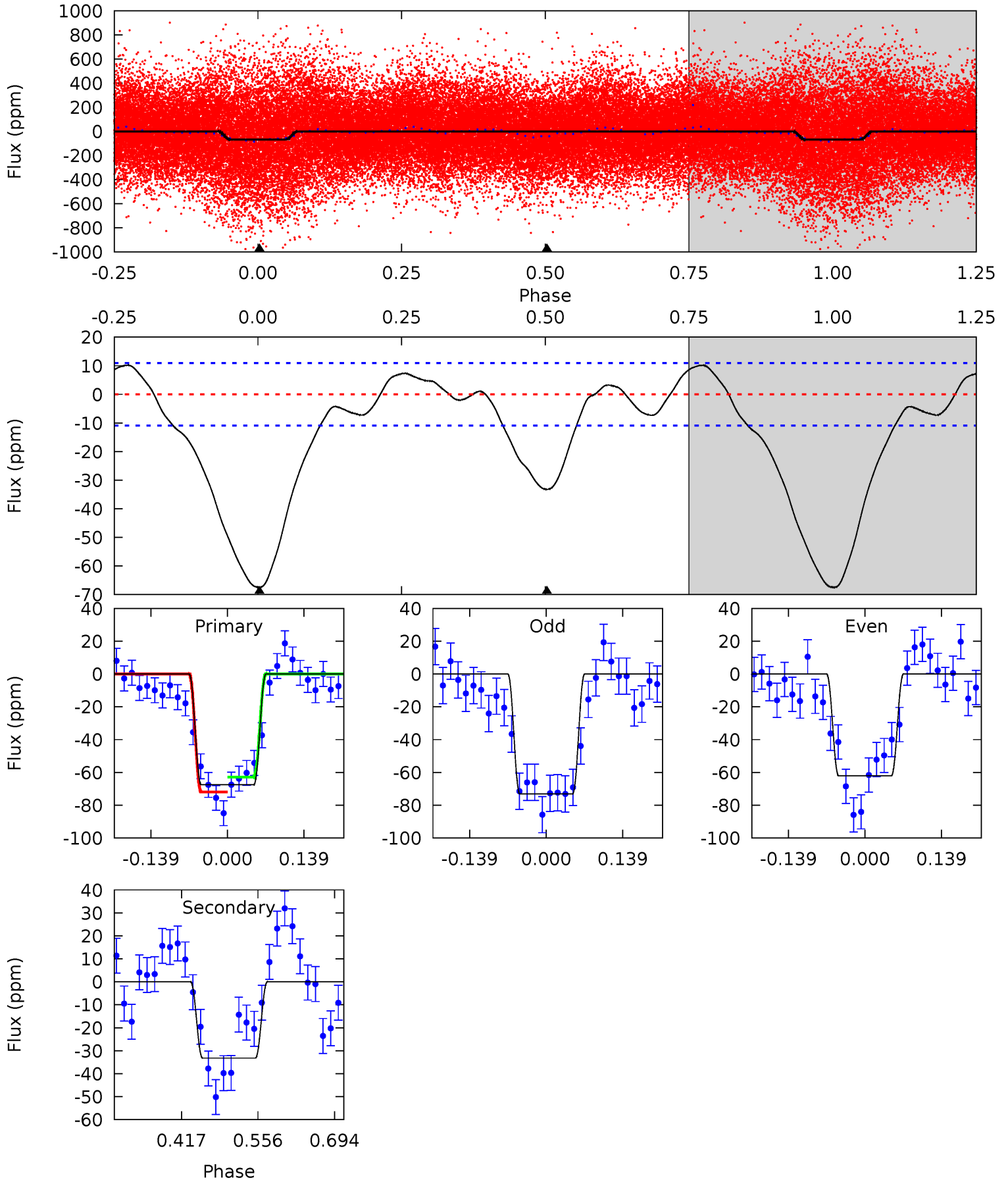
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
26.4	22.5	0	0	4.49	1.47	1.24	26.4	26.4	22.5	22.5	1.24	1.11	0.08	0.18



# Alt Model-Shift Uniqueness Test

003654515-01, P = 2.442671 Days, E = 130.608198 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
27.8	13.7	0	0	4.50	1.48	2.49	27.8	27.8	13.7	13.7	2.28	1.18	0.13	1.86





### Stellar Parameters For KIC 003654515

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6597^{+180}_{-200}$	$3.425^{+0.408}_{-0.072}$	$-0.340^{+0.400}_{-0.300}$	$4.317^{+0.610}_{-1.830}$	$1.810^{+0.152}_{-0.457}$	$0.032^{+0.112}_{-0.007}$
	+3%/-3%	+12%/-2%	+118%/-88%	+14%/-42%	+8%/-25%	+352%/-23%
Source	PHO1	FLK73	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 003654515-01 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-53 \pm 2$	$2.76^{+0.70}_{-0.75}$	$3926^{+259}_{-475}$	$6936^{+749}_{-574}$	$7.147^{+5.694}_{-2.529}$
Alt.	$-33 \pm 2$	$3.37^{+0.74}_{-0.82}$	$3940^{+238}_{-414}$	$5510^{+463}_{-375}$	$2.959^{+1.943}_{-0.940}$

$T_{max}$  = 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

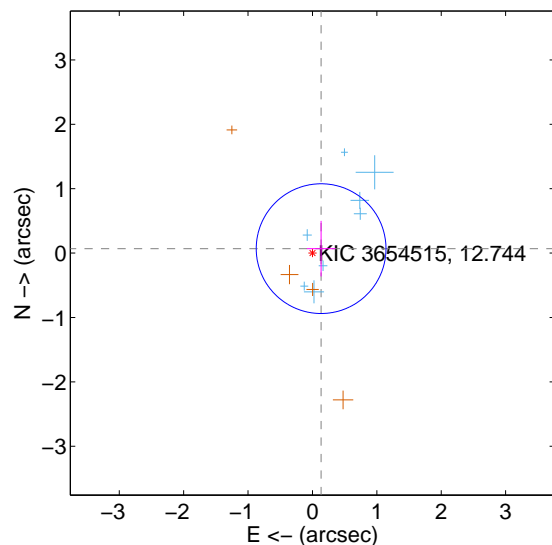
Supplemental centroid analysis for 003654515-01. Kepler magnitude: 12.74. Transit SNR 7.99

There are 9 quarters with good PRF difference image offsets

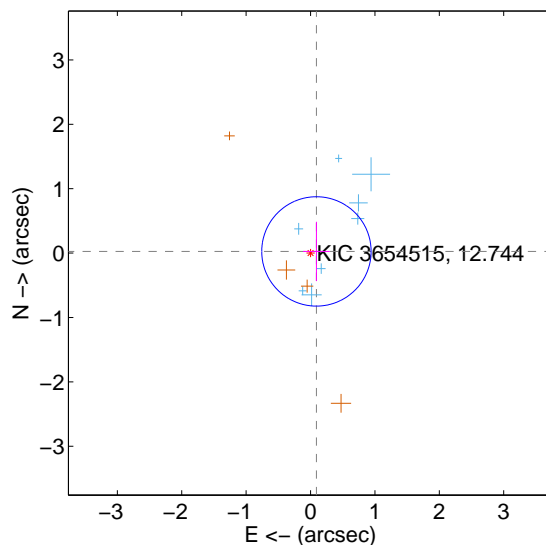
The direct PRF centroid is offset from the target star catalog position by about 0.08 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.151 \pm 0.336$	0.45	$-0.135 \pm 0.222$	$0.069 \pm 0.431$
PRF-fit source offset from KIC position	$0.095 \pm 0.283$	0.34	$-0.092 \pm 0.209$	$0.026 \pm 0.461$
photometric centroid source offset	$1.12 \pm 0.67$	1.66	$1.09 \pm 0.67$	$-0.24 \pm 0.76$

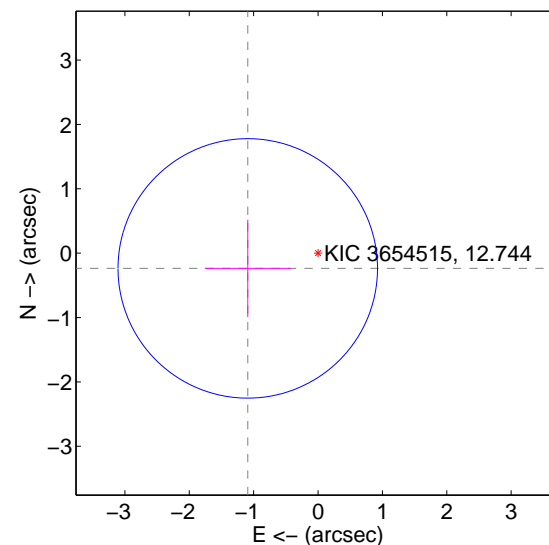
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

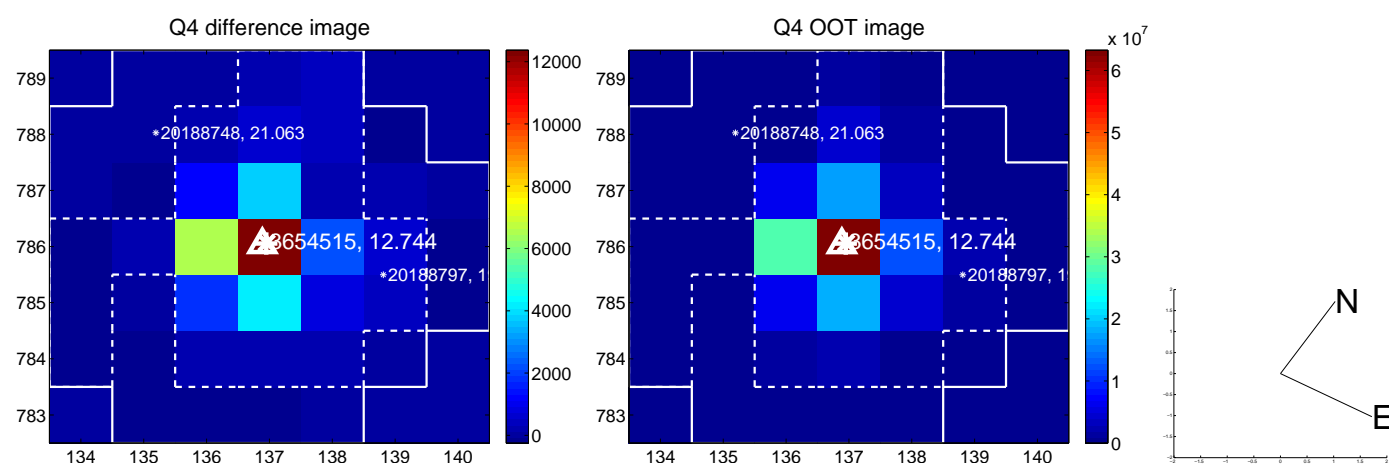
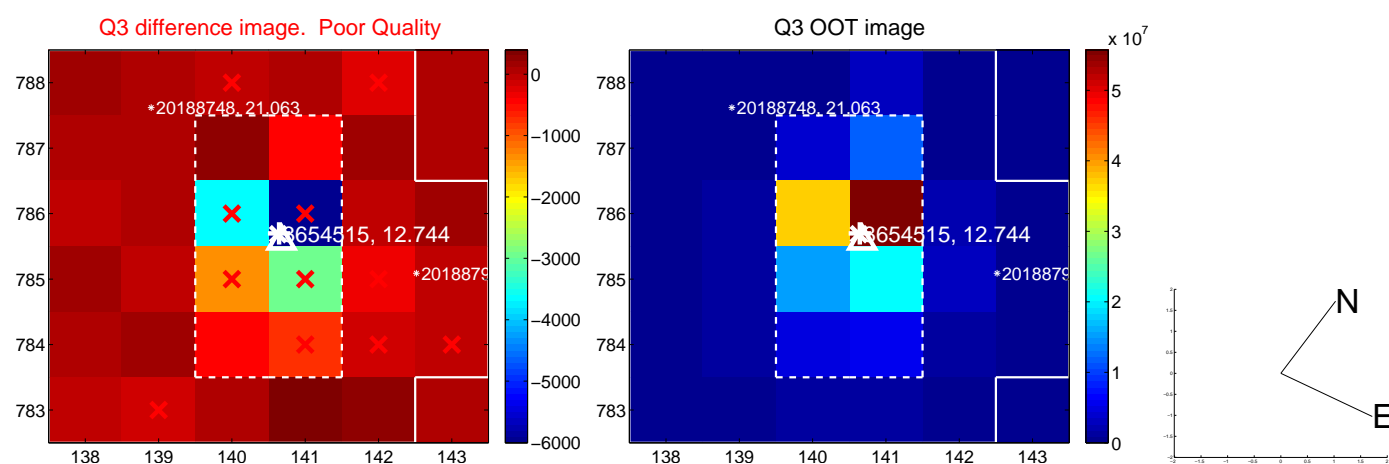
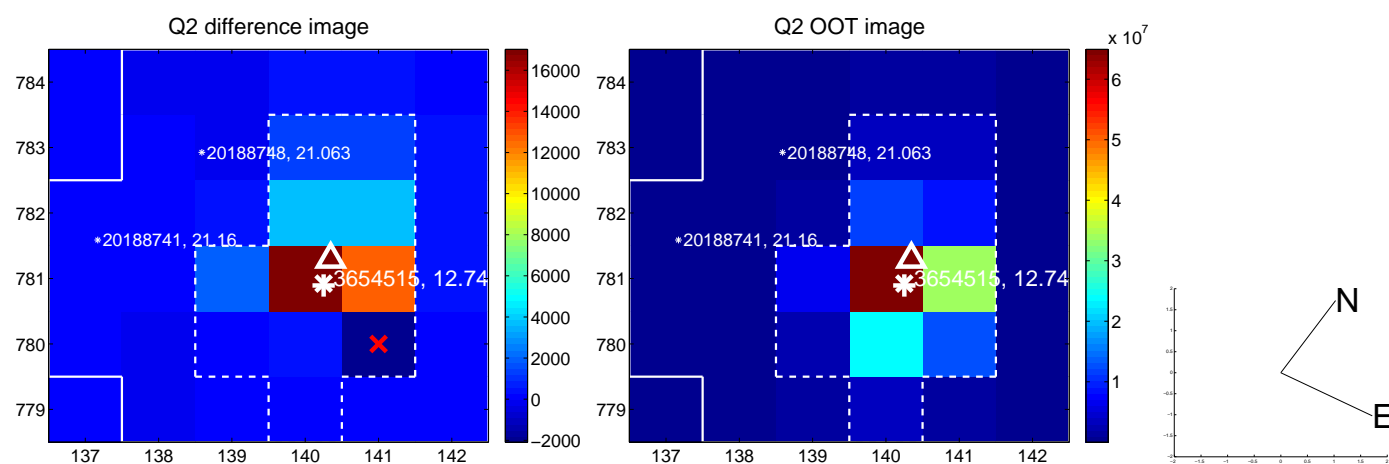
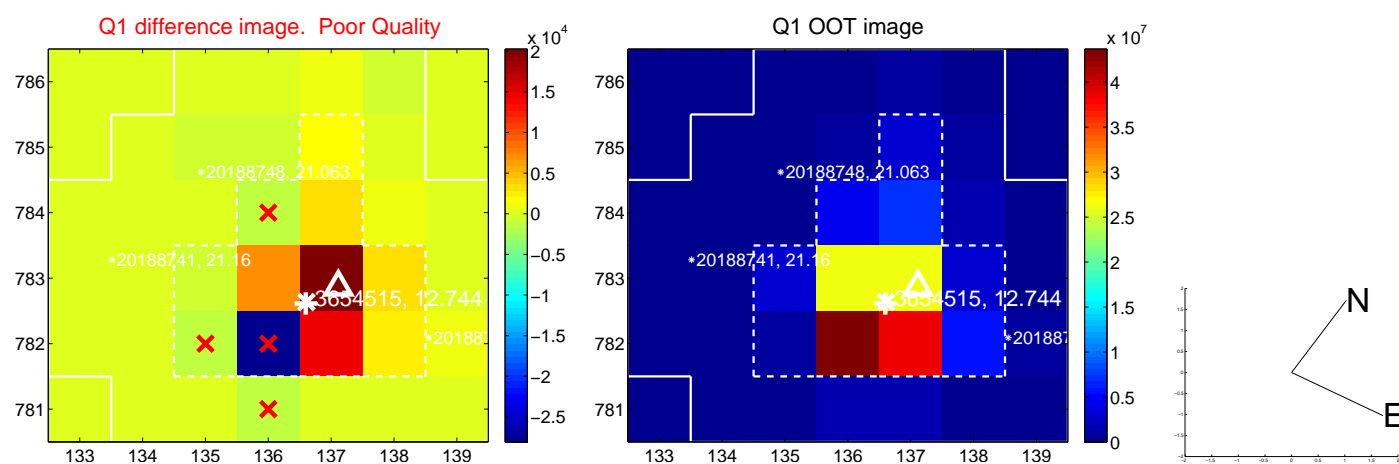


offset from photometric centroids

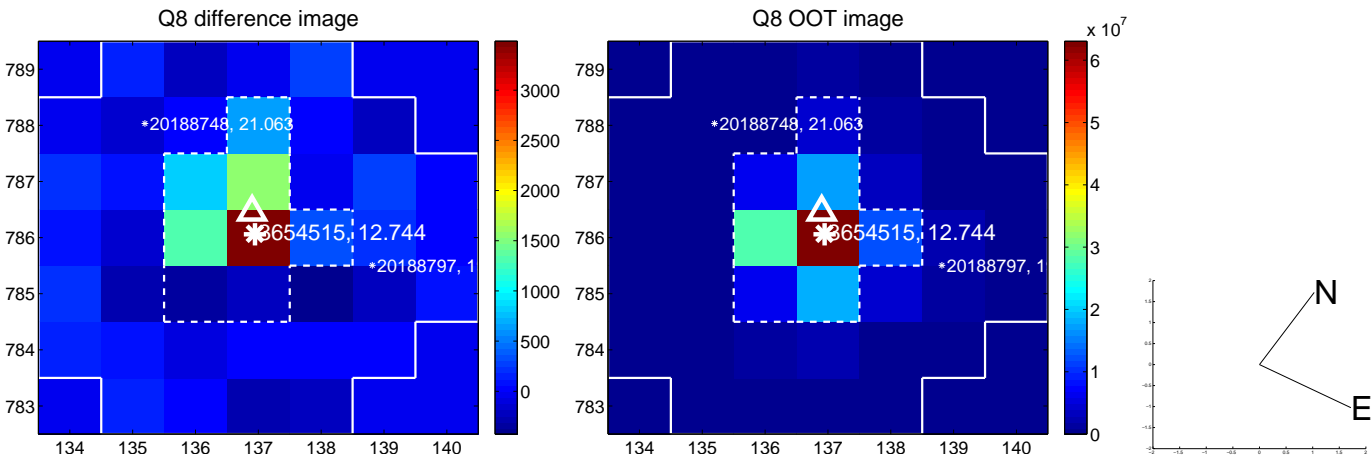
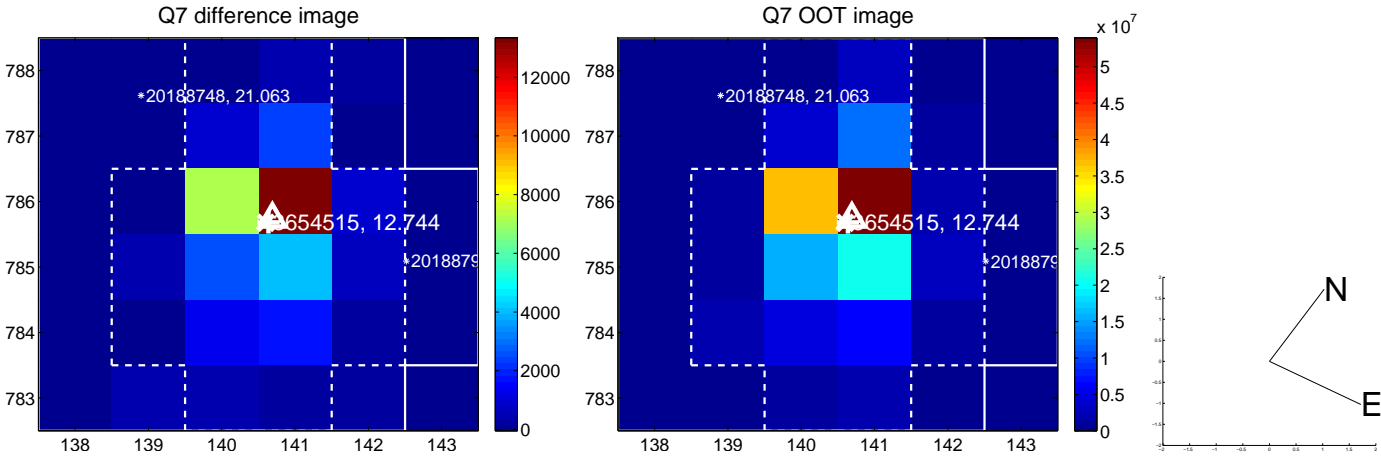
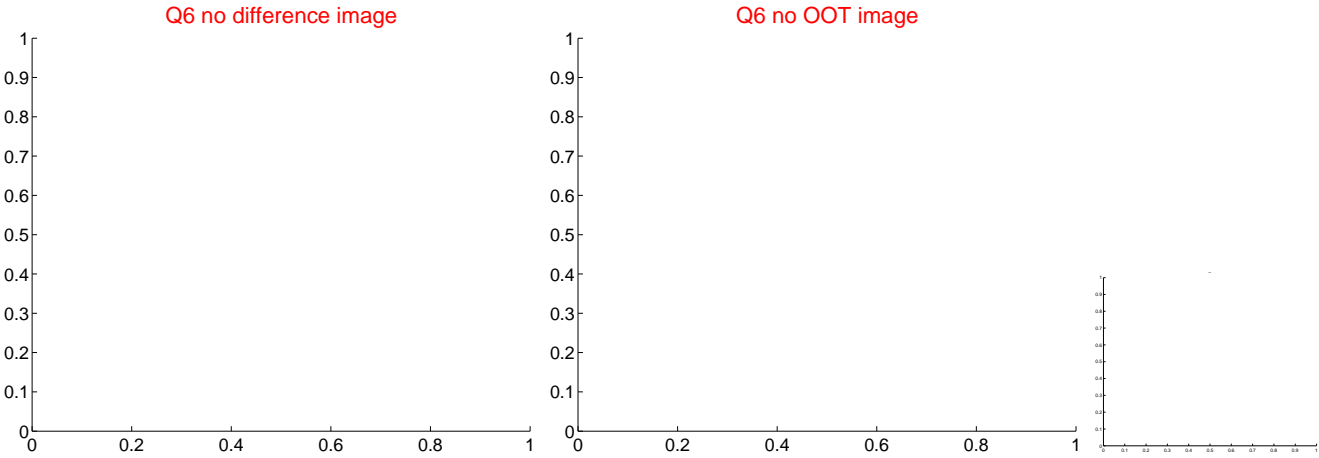
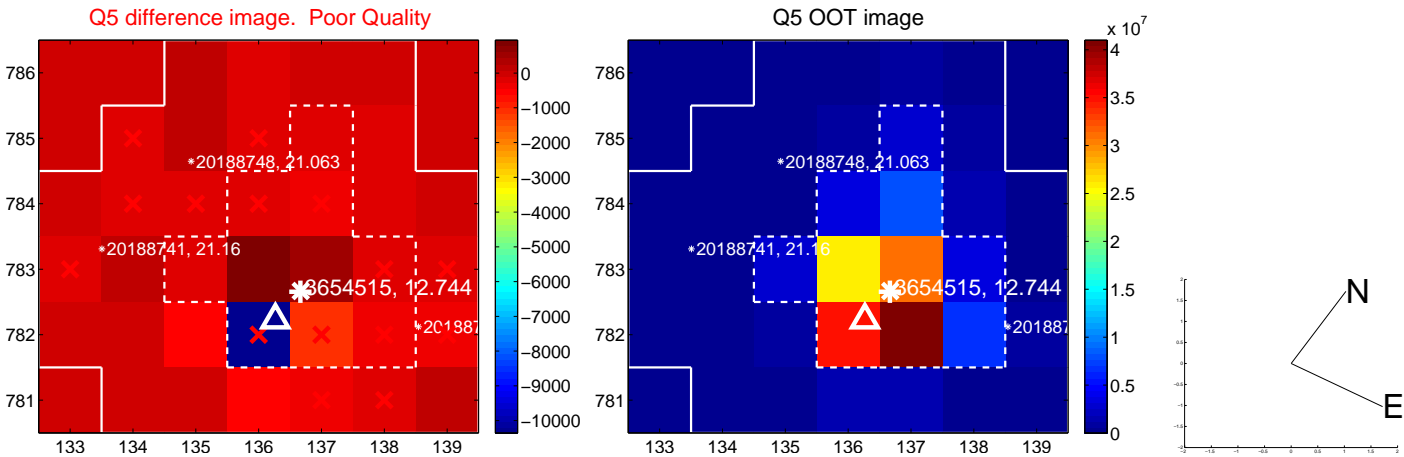


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

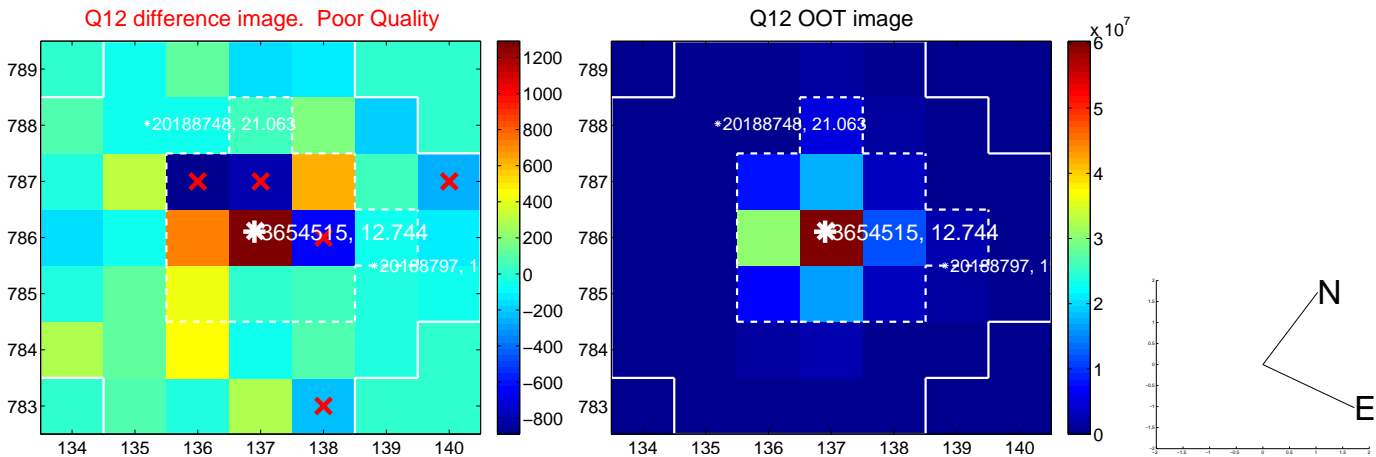
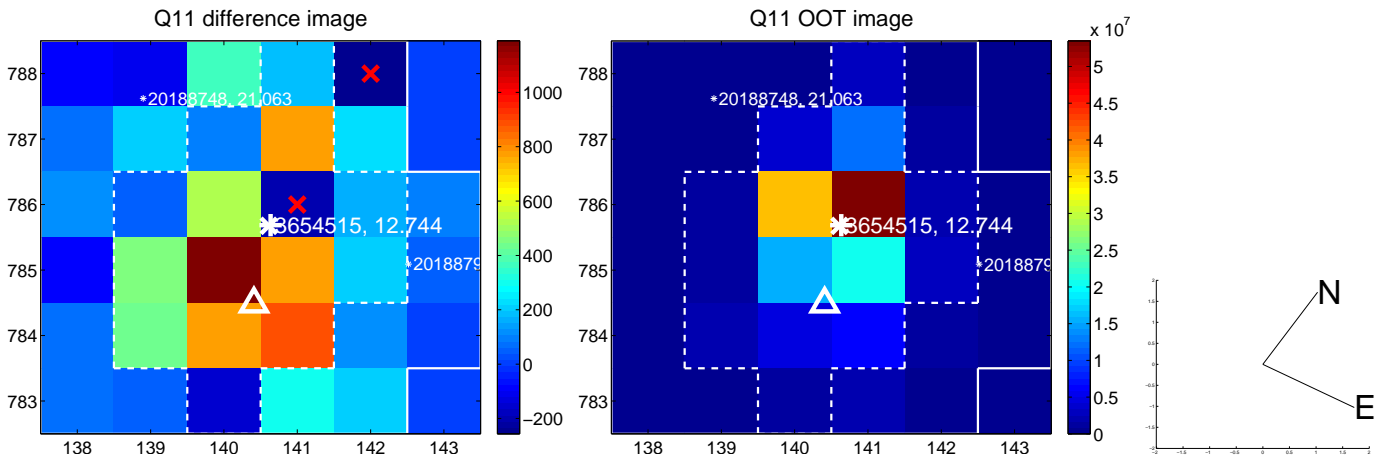
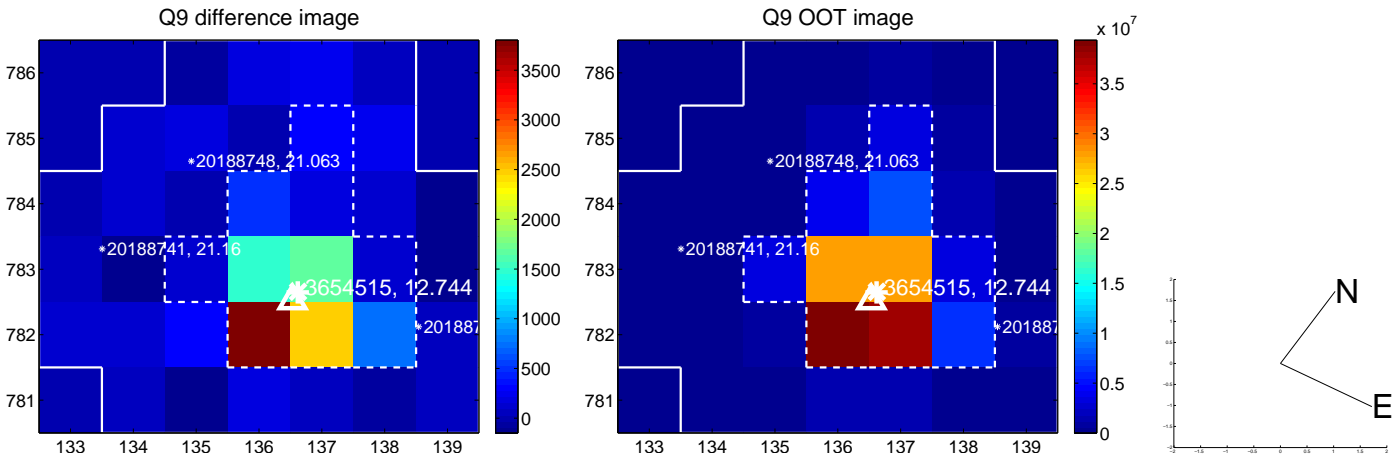


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

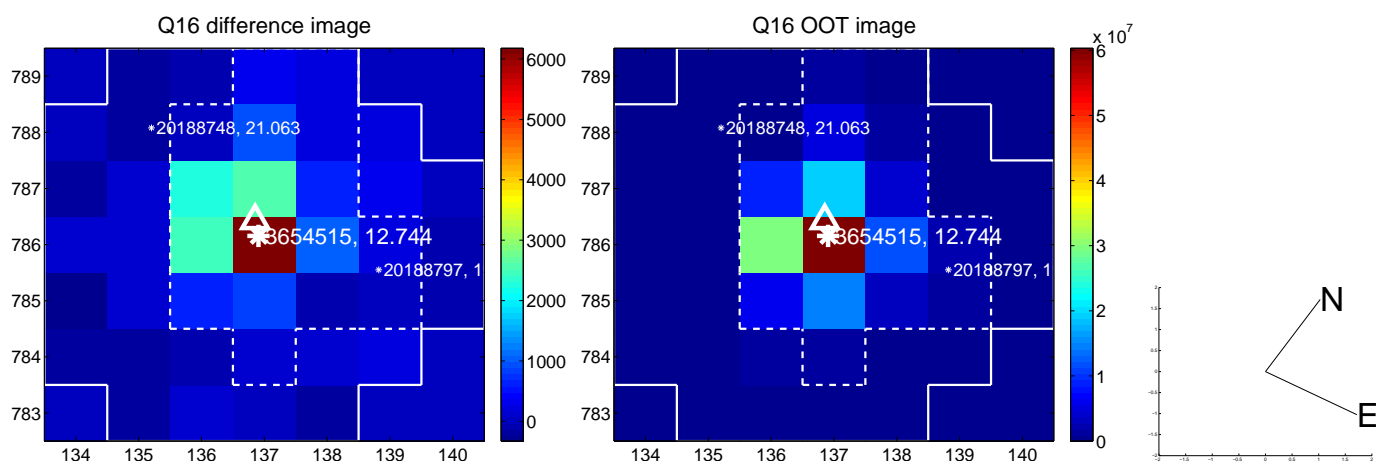
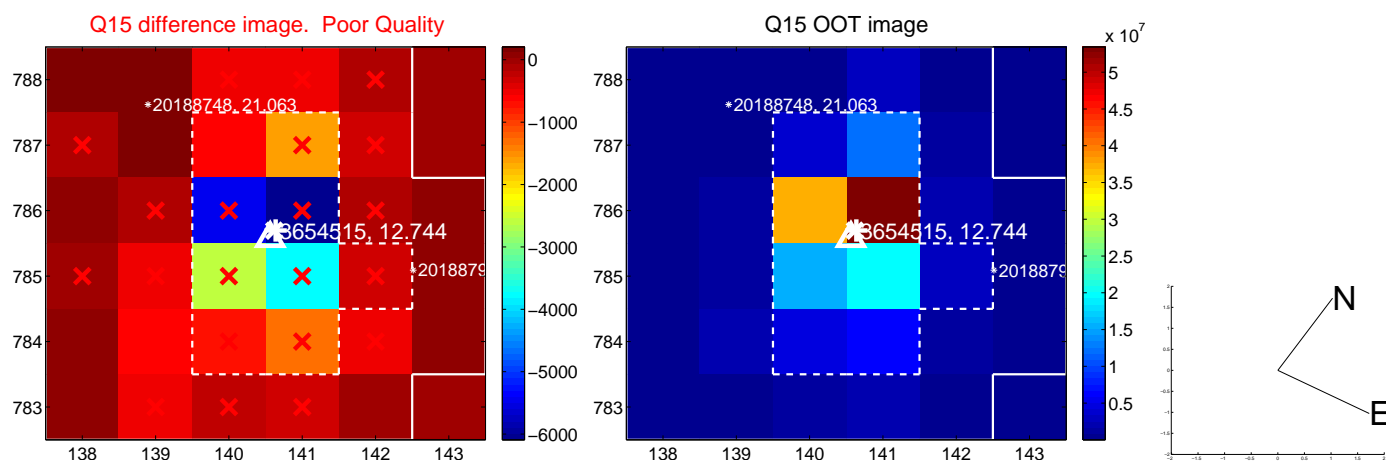
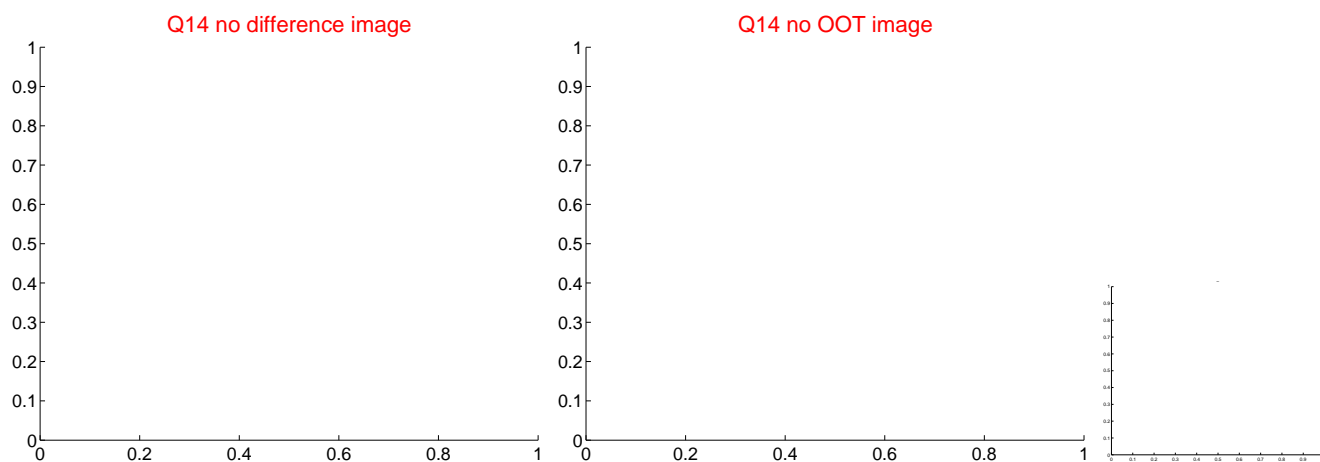
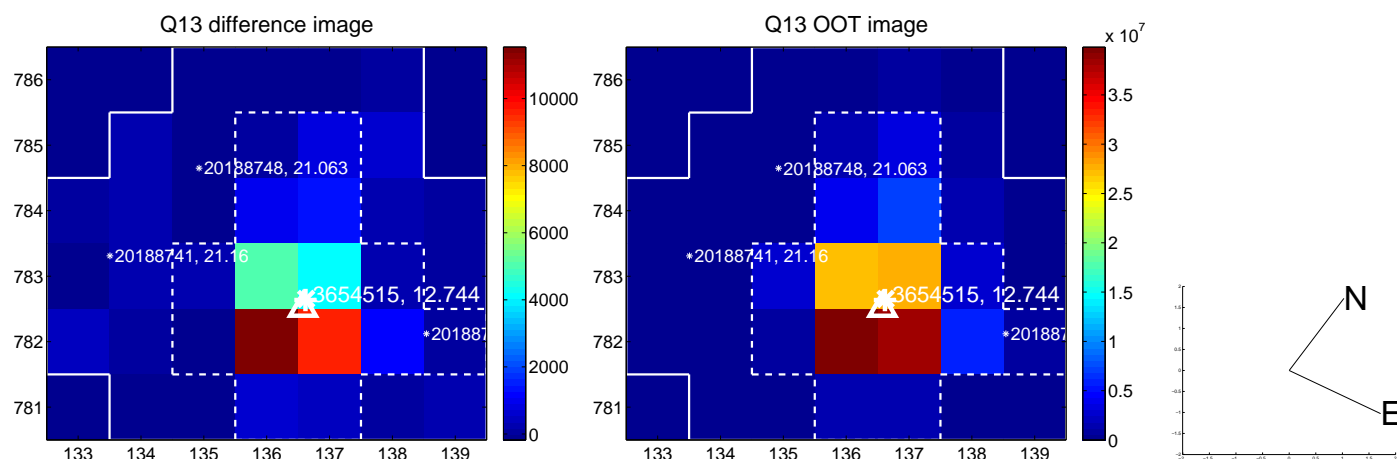




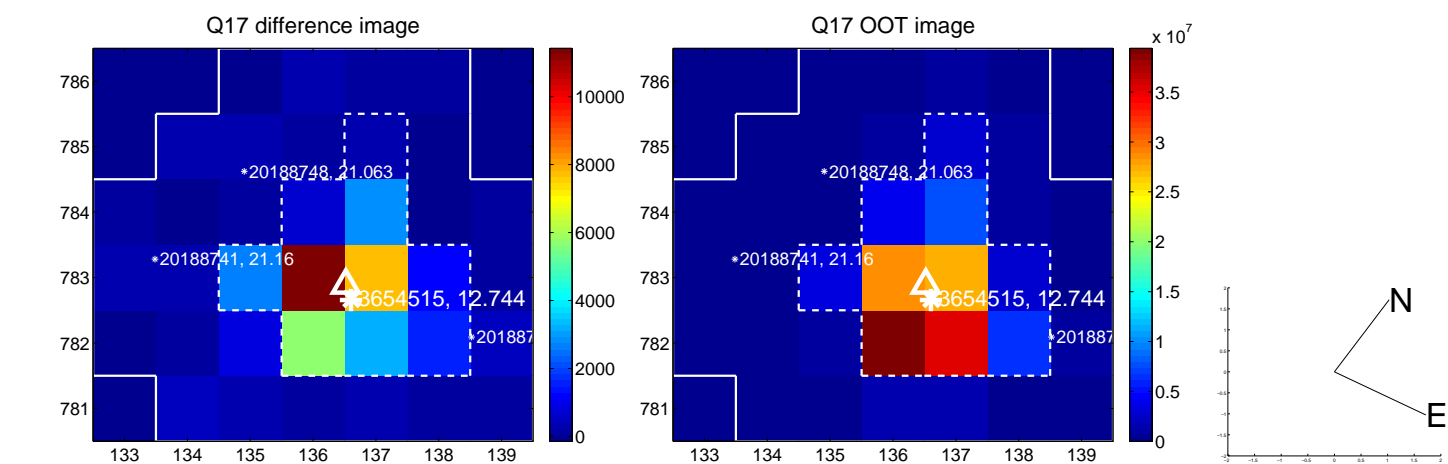
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



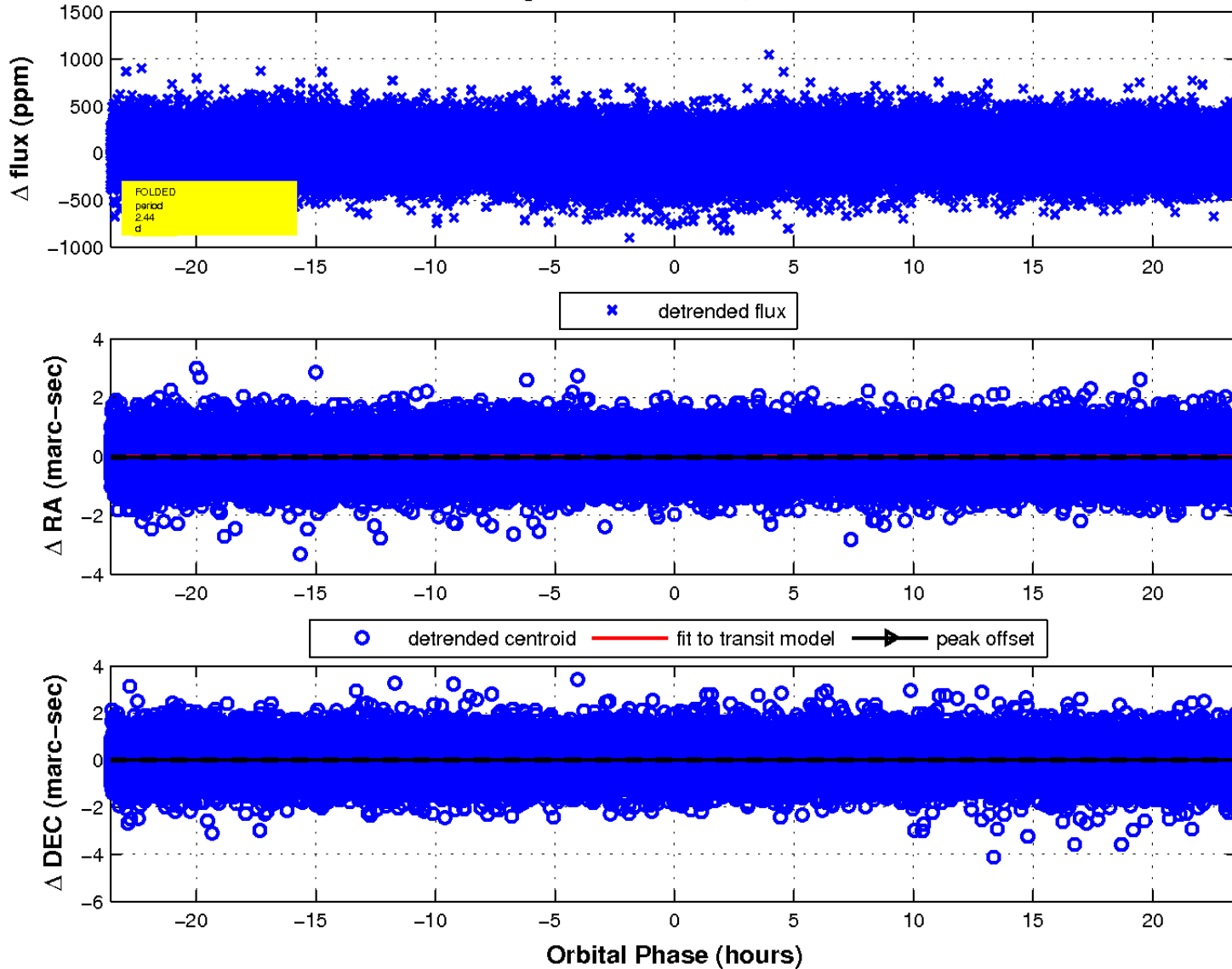
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



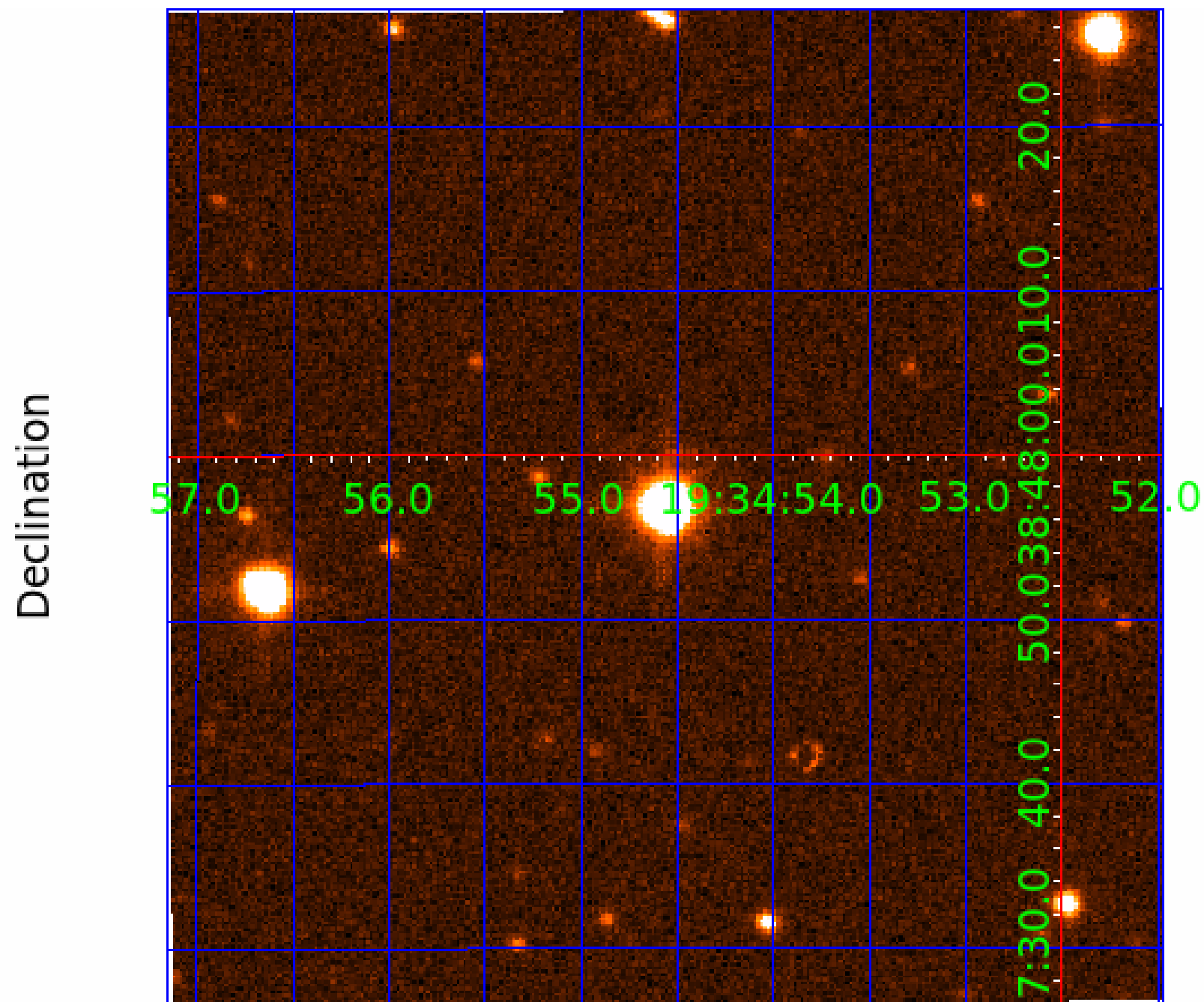
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



fluxWeightedCentroids, Planet 1 of 3



UKIRT Image





# KIC 003654515

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
003654515-01	OBS	No	2.442461	133.130290	35.3	7.864	7.8	8.0	4.32	6597	3.07	16903.04
003654515-02	OBS	No	70.632785	158.012085	222.4	6.376	7.3	7.2	4.32	6597	7.15	190.43

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
003654515-01	OBS	FP	0.00	1	0	0	0	LPP_DV
003654515-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_ALT

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

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

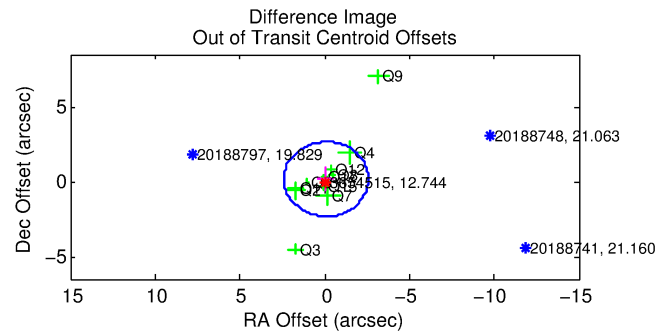
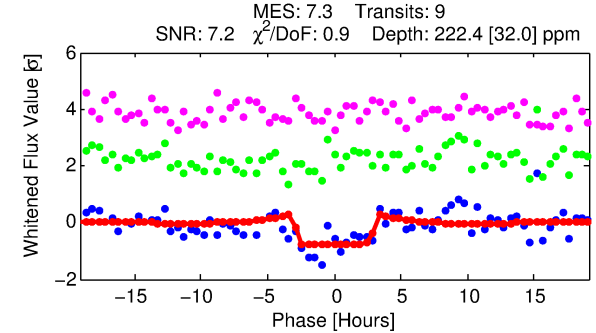
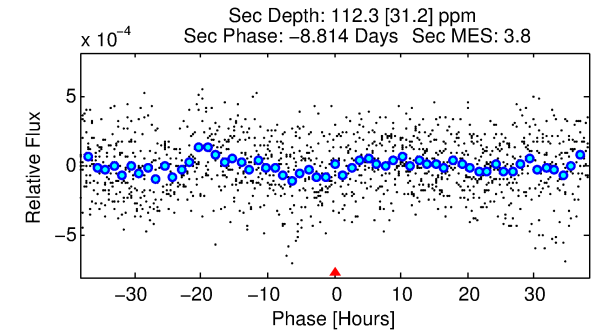
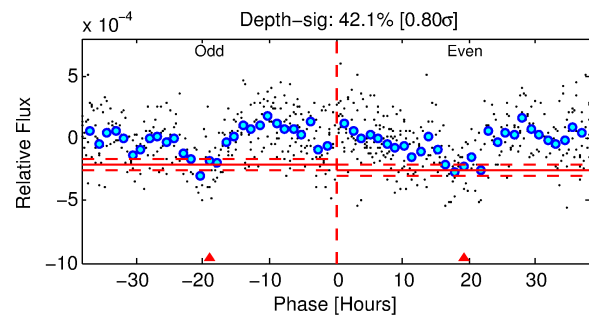
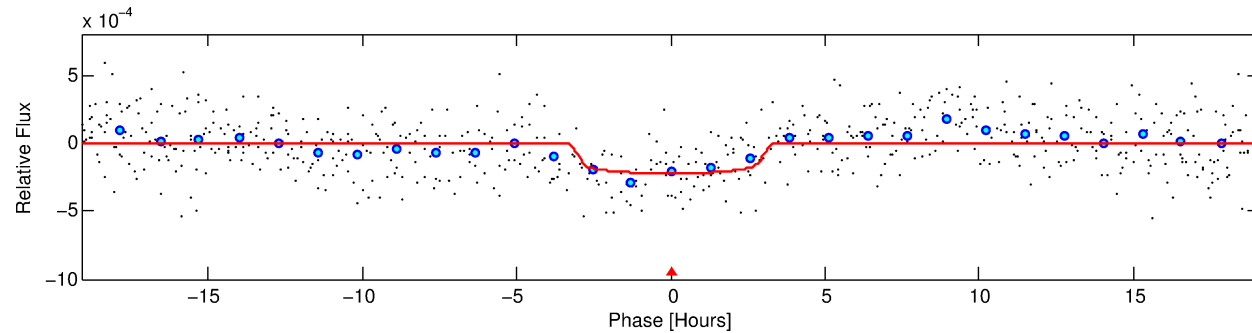
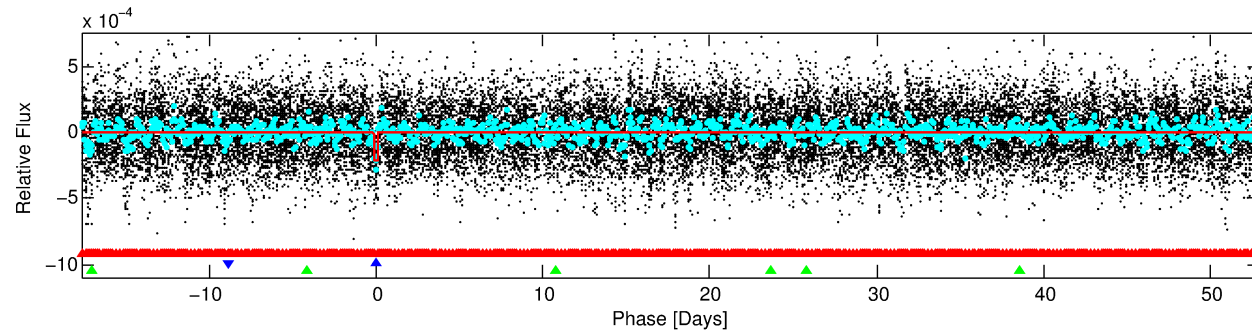
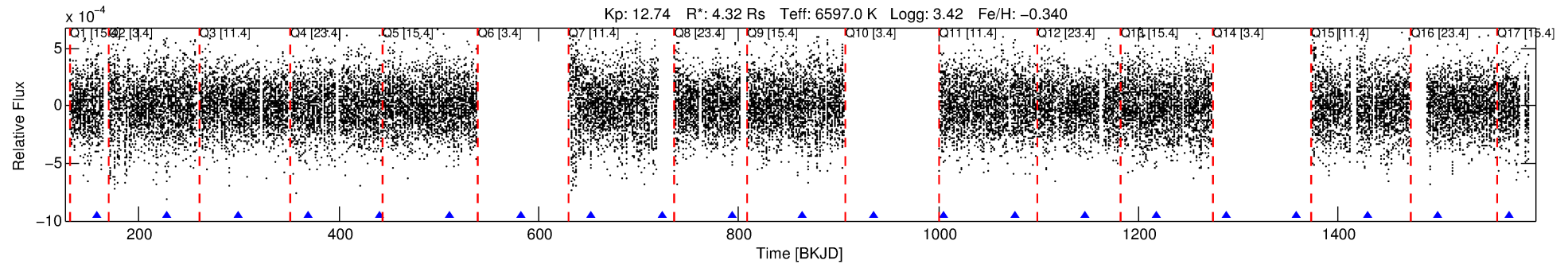
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 003654515-02

No Significant Match Found

# DV One-Page Summary

KIC: 3654515 Candidate: 2 of 3 Period: 70.633 d



## DV Fit Results:

Period = 70.63278 [0.00089] d  
Epoch = 158.0121 [0.0126] BKJD  
Rp/R\* = 0.0152 [0.0058]  
a/R\* = 51.30 [108.91]  
b = 0.81 [0.88]  
Seff = 190.43 [132.87]  
Teq = 947 [165] K  
Rp = 7.15 [4.08] Re  
a = 0.4075 [0.1719] AU  
Ag = 200.76 [213.72] [0.93 $\sigma$ ]  
Teffp = 5513 [1133] K [3.99 $\sigma$ ]

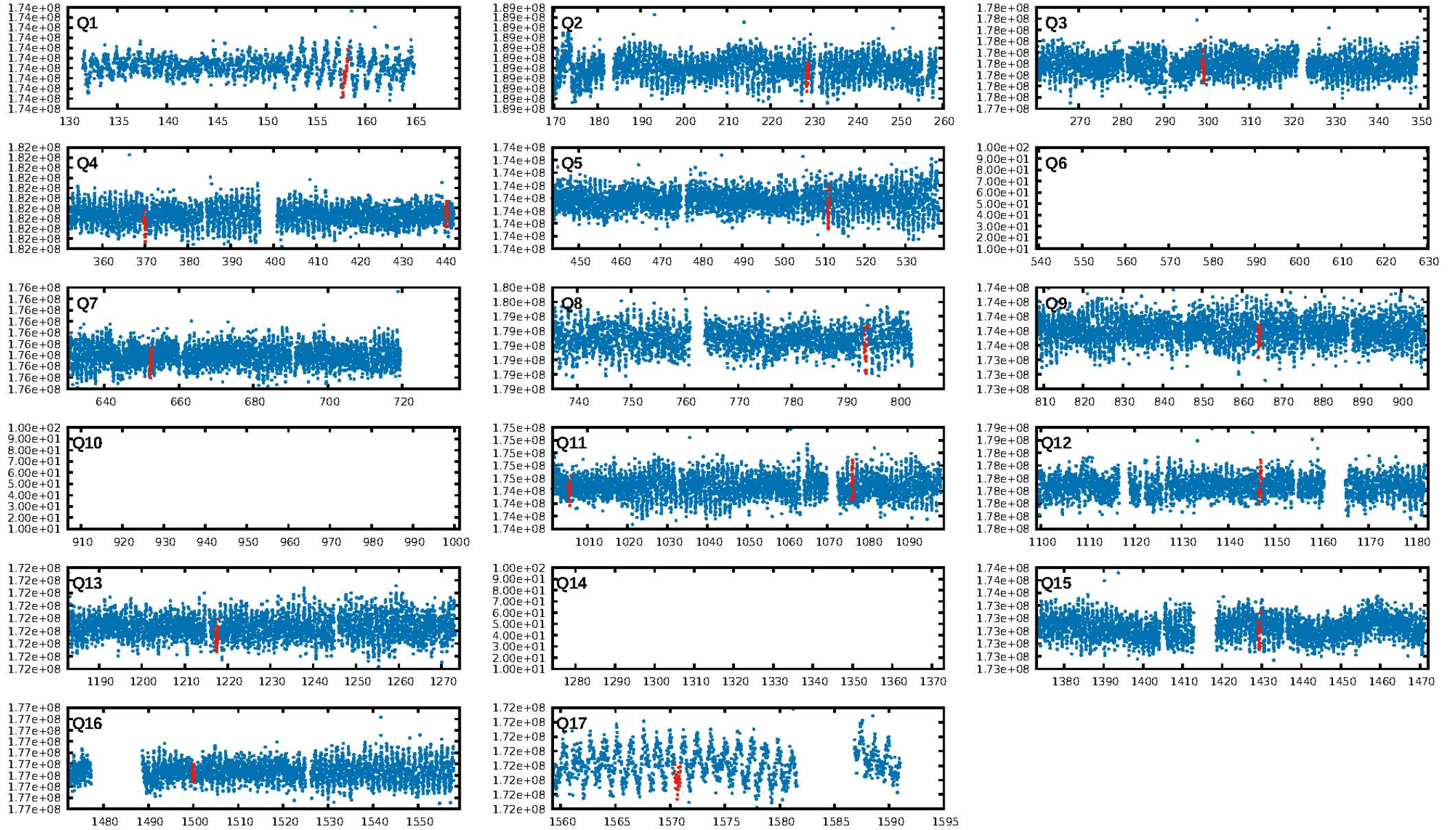
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [161.65 $\sigma$ ]  
LongPeriod-sig: 100.0% [556.87 $\sigma$ ]  
ModelChiSquare2-sig: 95.7%  
ModelChiSquareGof-sig: 100.0%  
**Bootstrap-pfa: 1.82e-09**  
RollingBand-fgt: 1.00 [7/7]  
GhostDiagnostic-chr: 1.75  
Centroid-sig: 74.5%  
Centroid-so: 0.220 arcsec [0.33 $\sigma$ ]  
OotOffset-rm: 0.186 arcsec [0.22 $\sigma$ ]  
KicOffset-rm: 0.143 arcsec [0.17 $\sigma$ ]  
OotOffset-st: 1/4/3/3 [11]  
KicOffset-st: 1/4/3/3 [11]  
DiffImageQuality-fgm: 0.55 [6/11]  
DiffImageOverlap-fno: 0.38 [5/13]

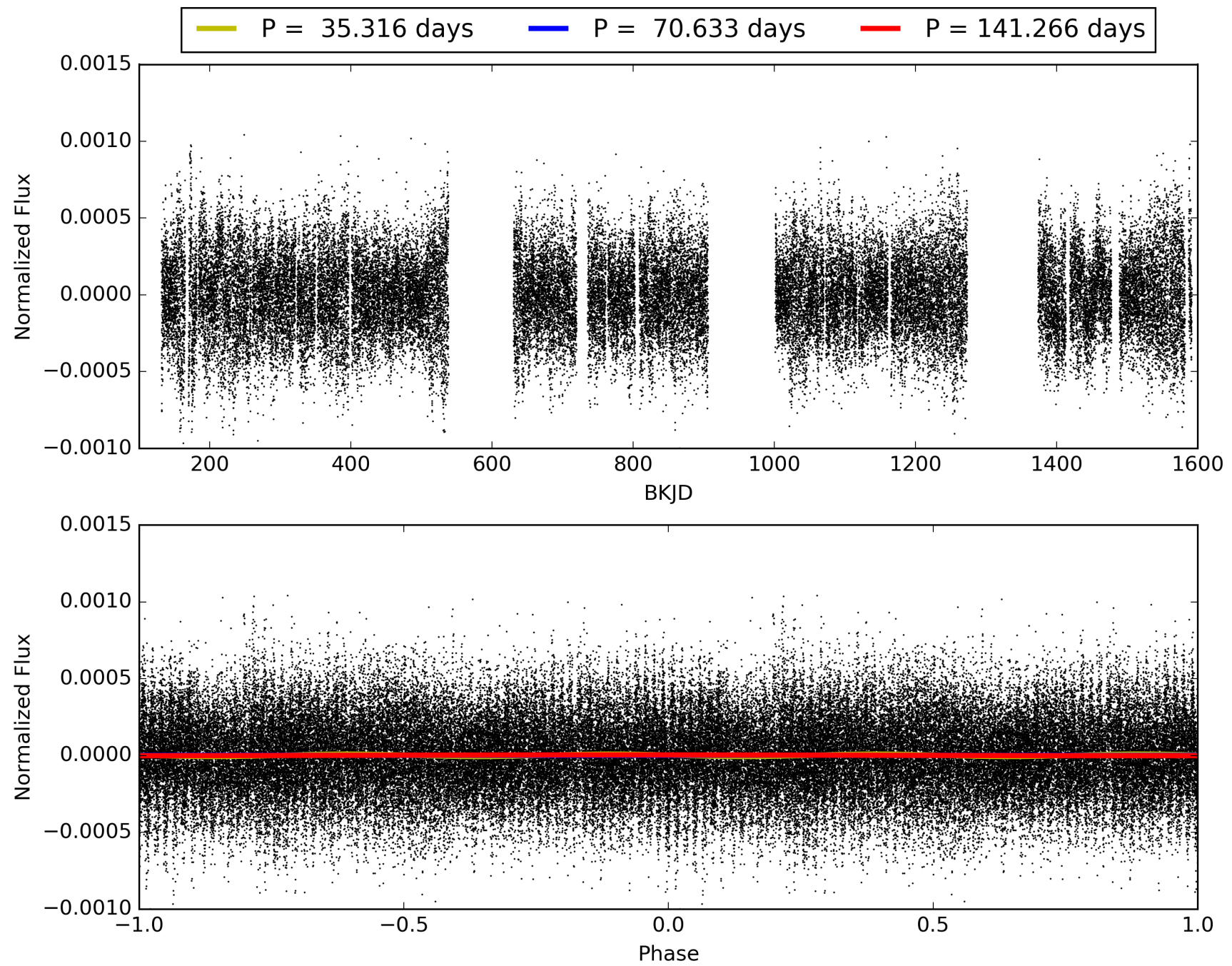
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 30-Jan-2016 23:42:57 Z

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

# TCE 003654515-02, PDC Light Curves

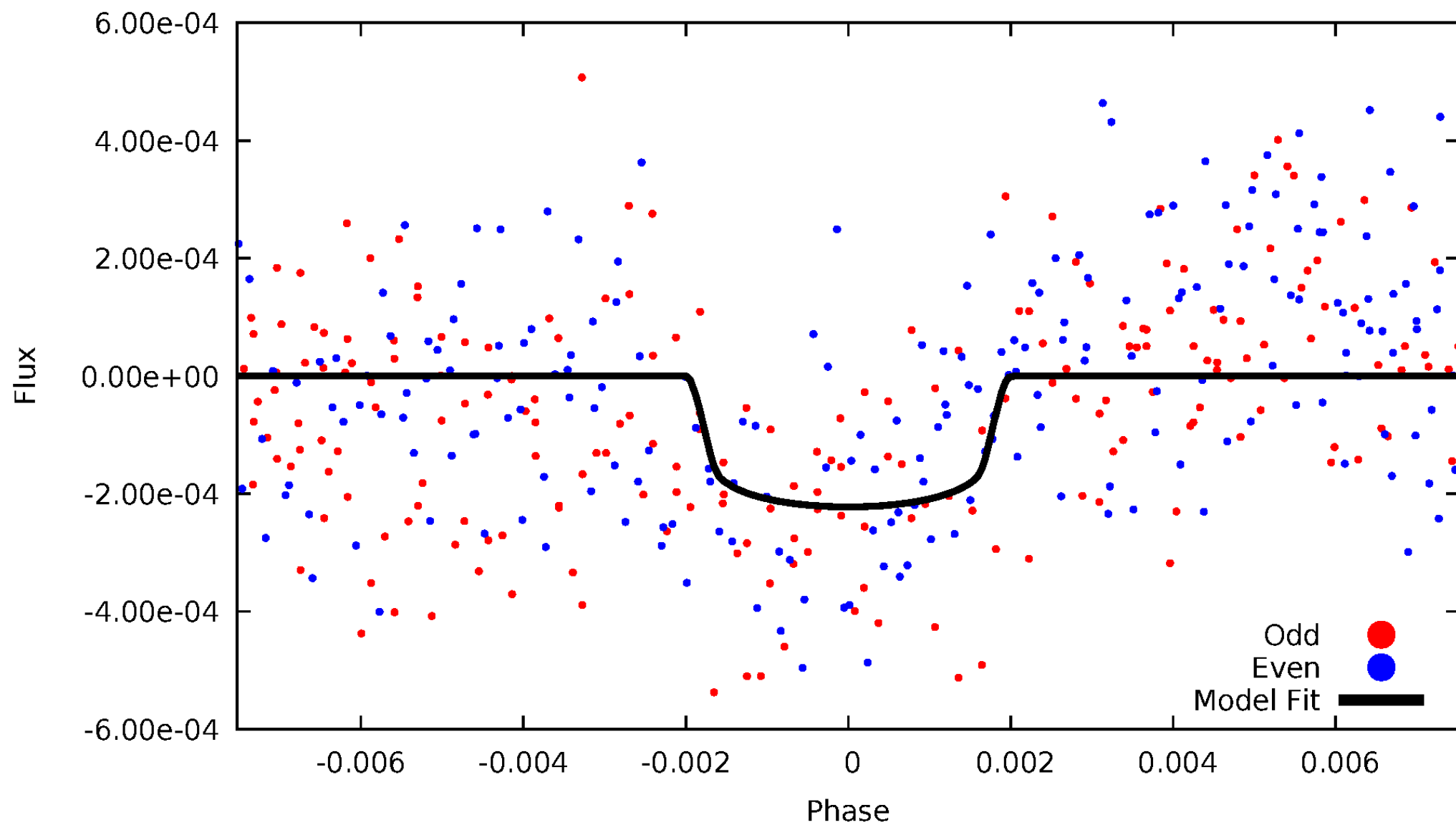


TCE 003654515-02



# DV Odd/Even

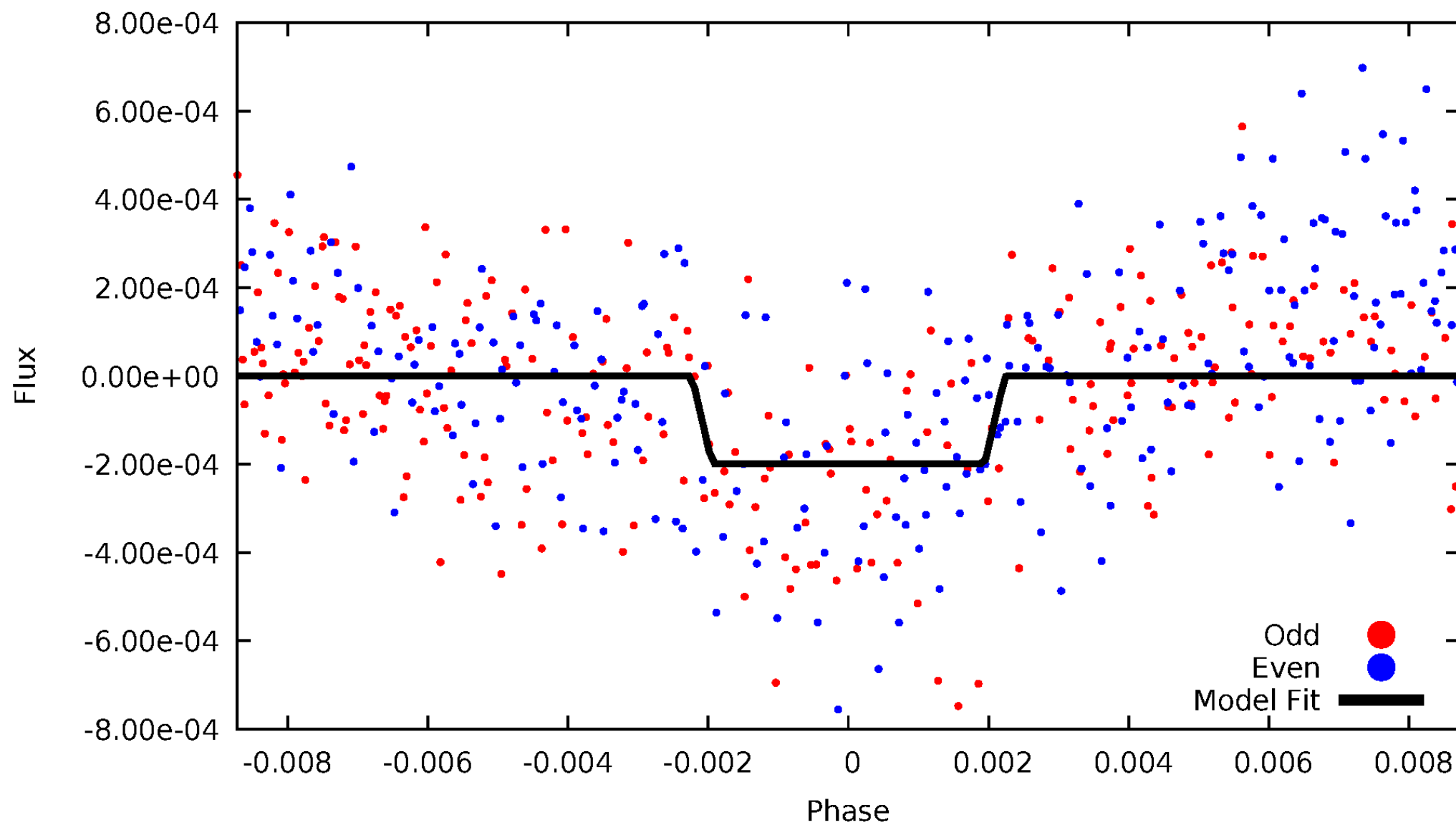
TCE 003654515-02





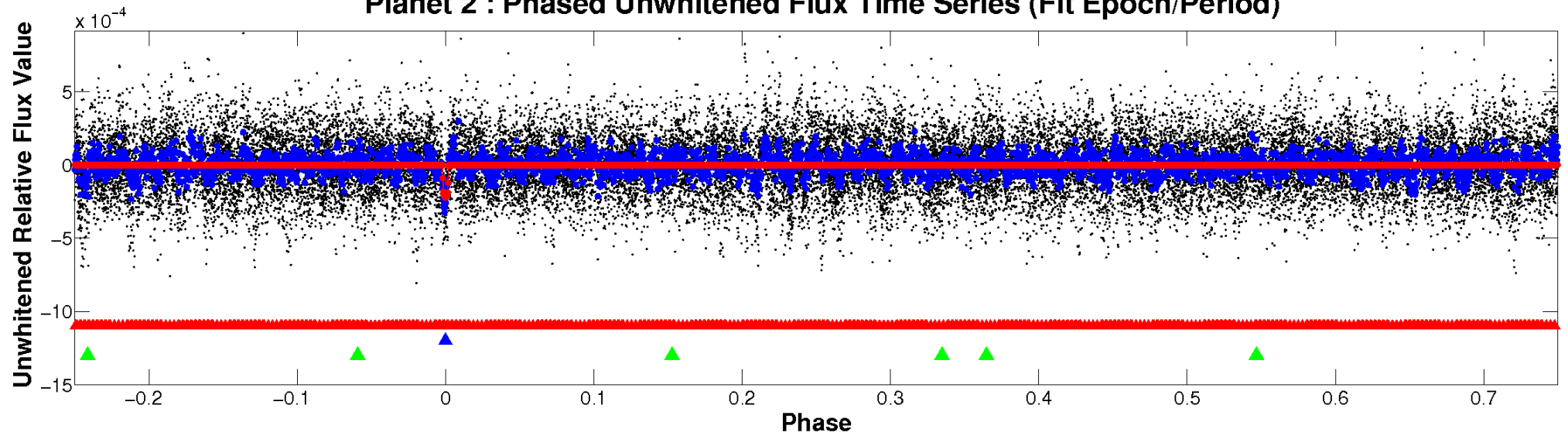
# ALT Odd/Even

TCE 003654515-02

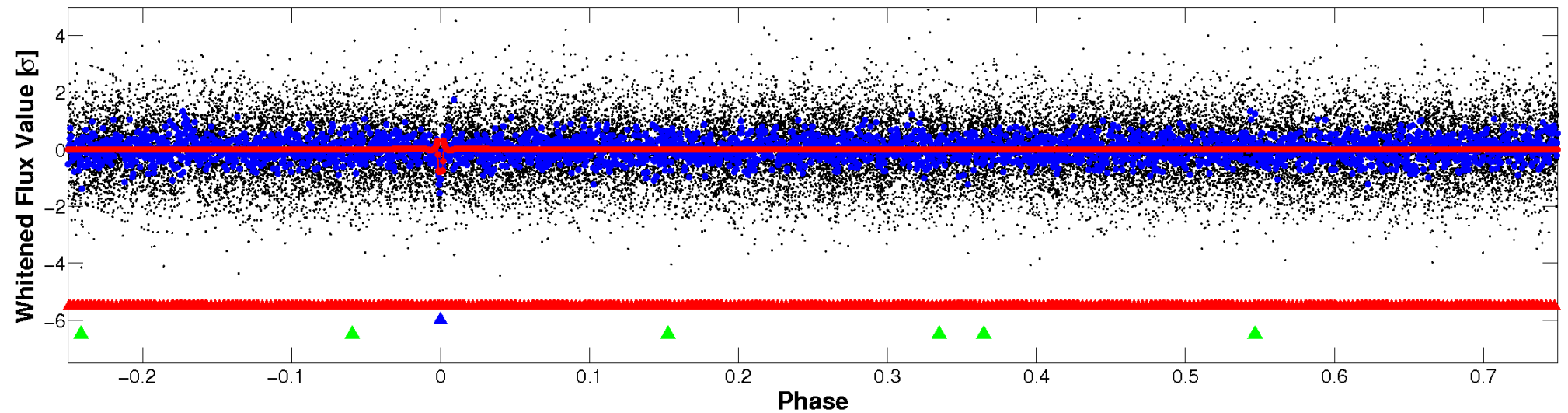


# Non-Whitened Vs. Whitened Light Curve

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

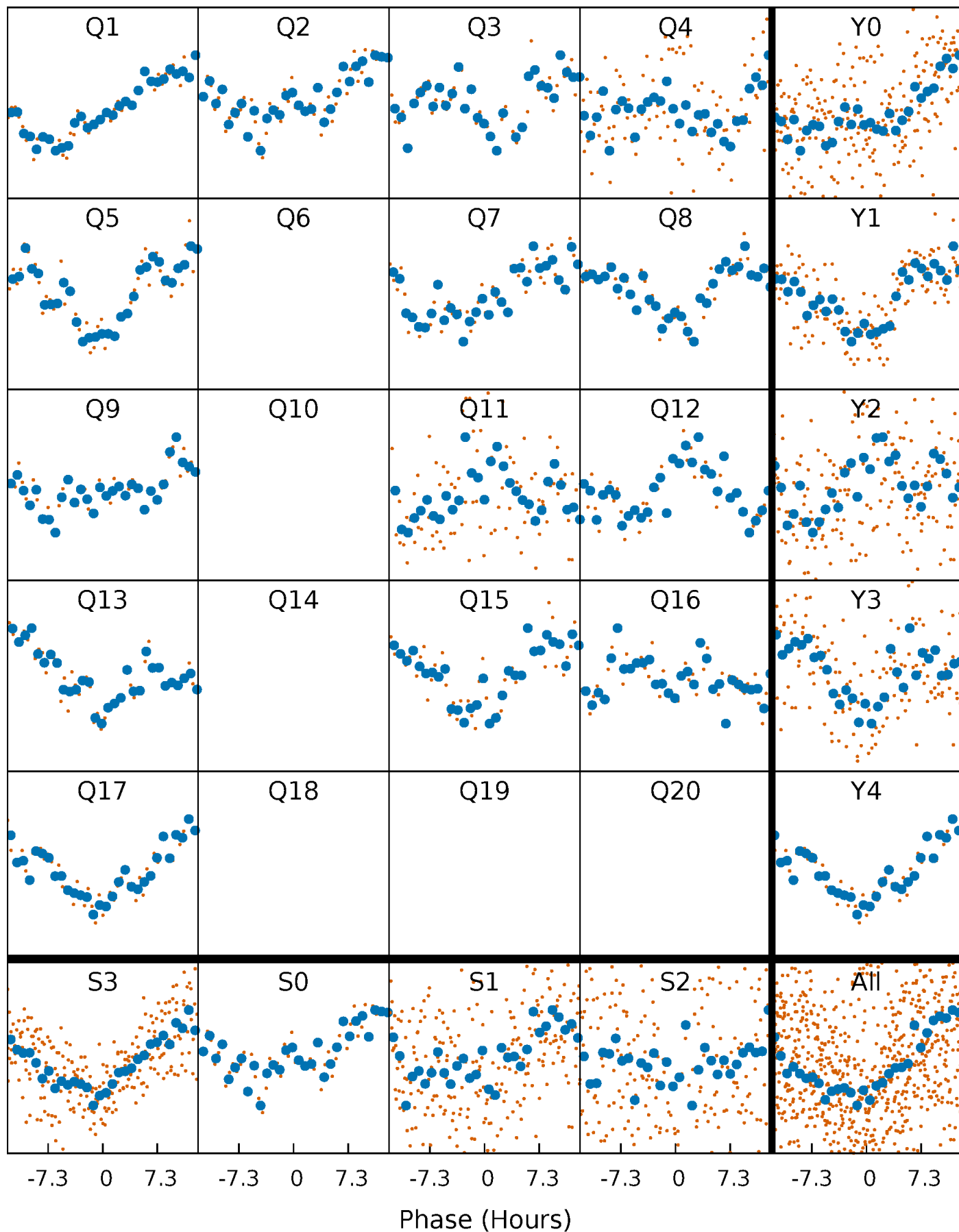


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



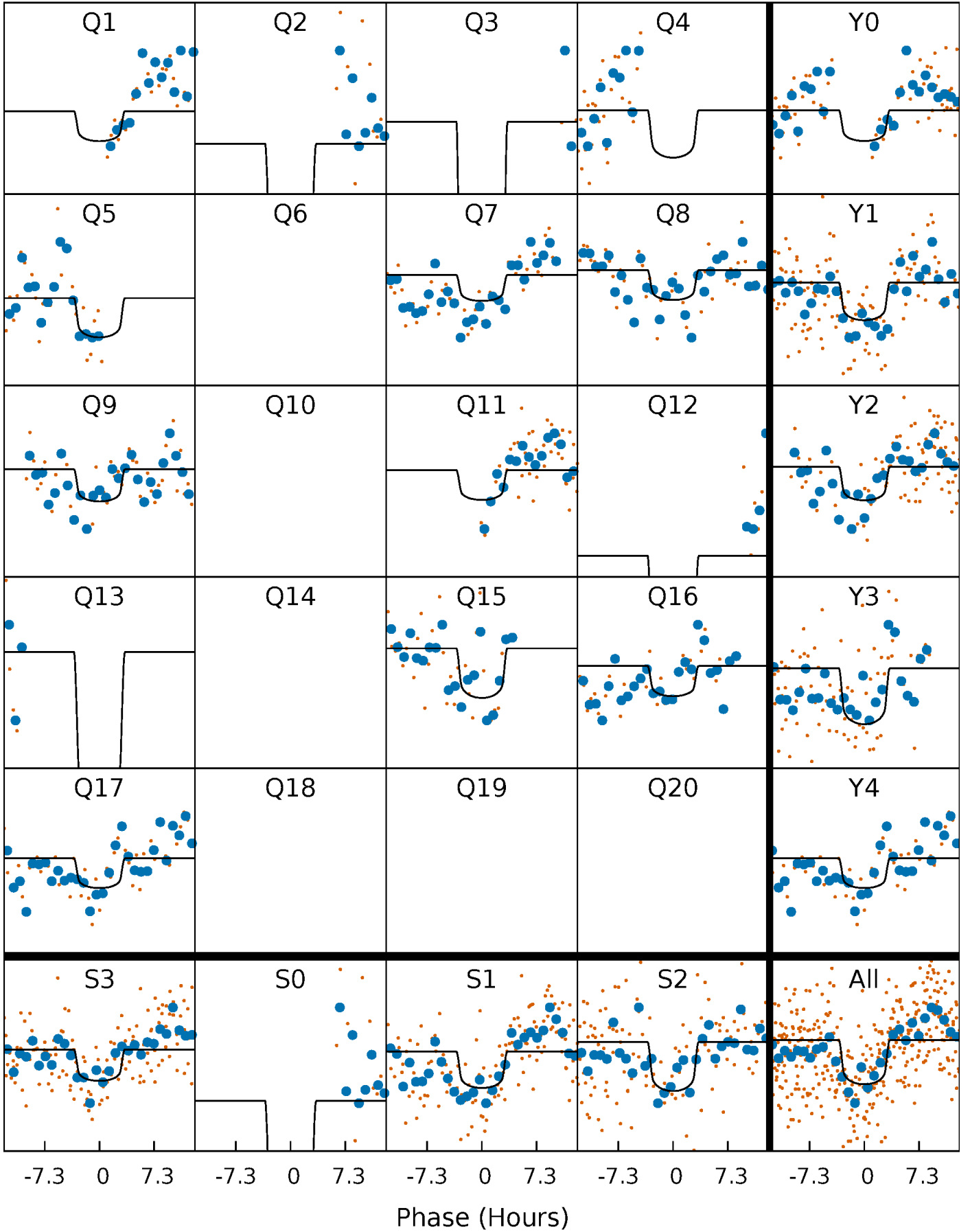
# PDC Quarter-Phased Transit Curves

TCE 003654515-02   P= 70.632785 Days    $T_0=158.012085$  (BKJD)



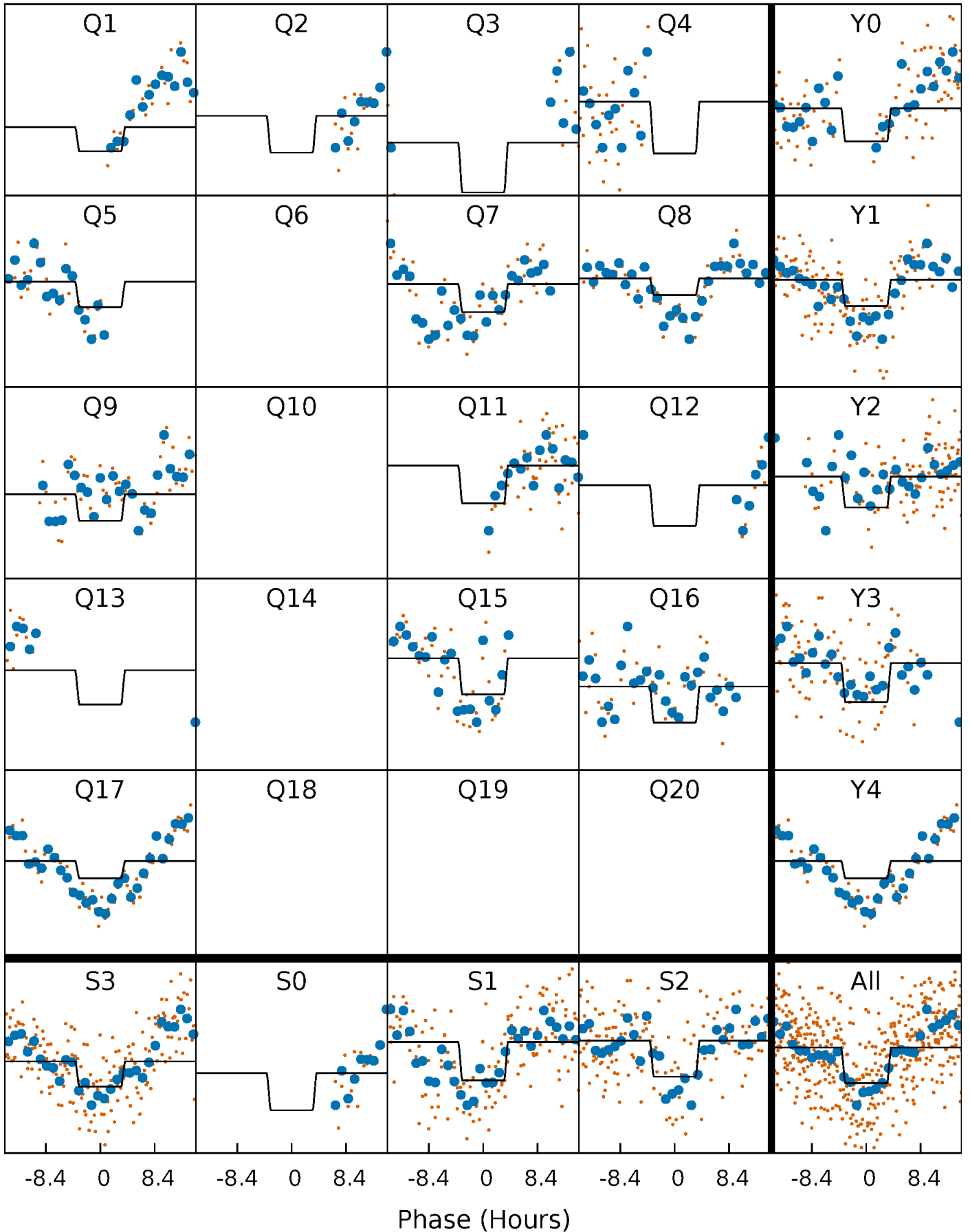
# DV Quarter-Phased Transit Curves

TCE 003654515-02   P= 70.632785 Days    $T_0=158.012085$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

TCE 003654515-02   P= 70.631476 Days    $T_0=158.008837$  (BKJD)

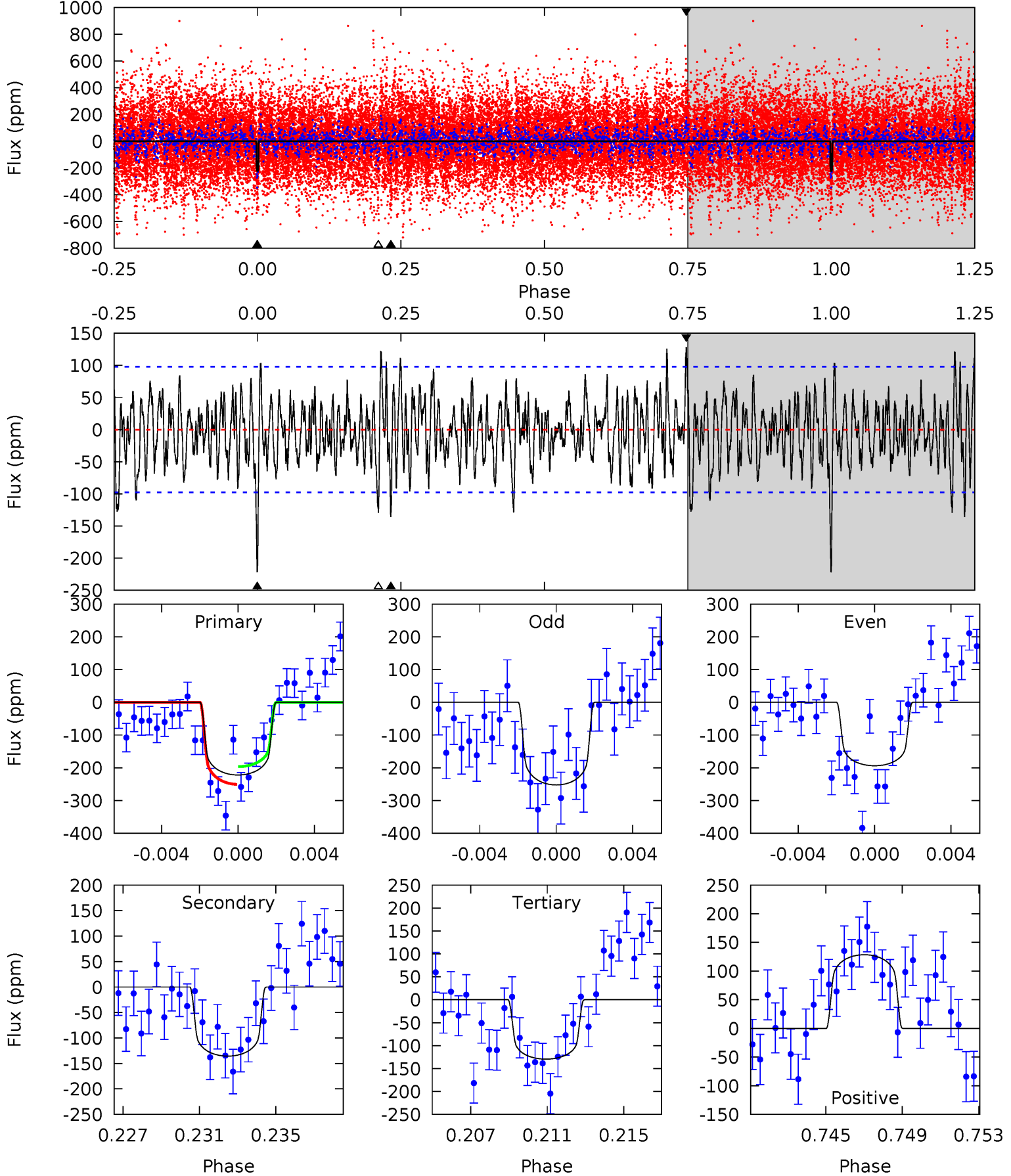




# DV Model-Shift Uniqueness Test

003654515-02, P = 70.632785 Days, E = 87.379300 Days

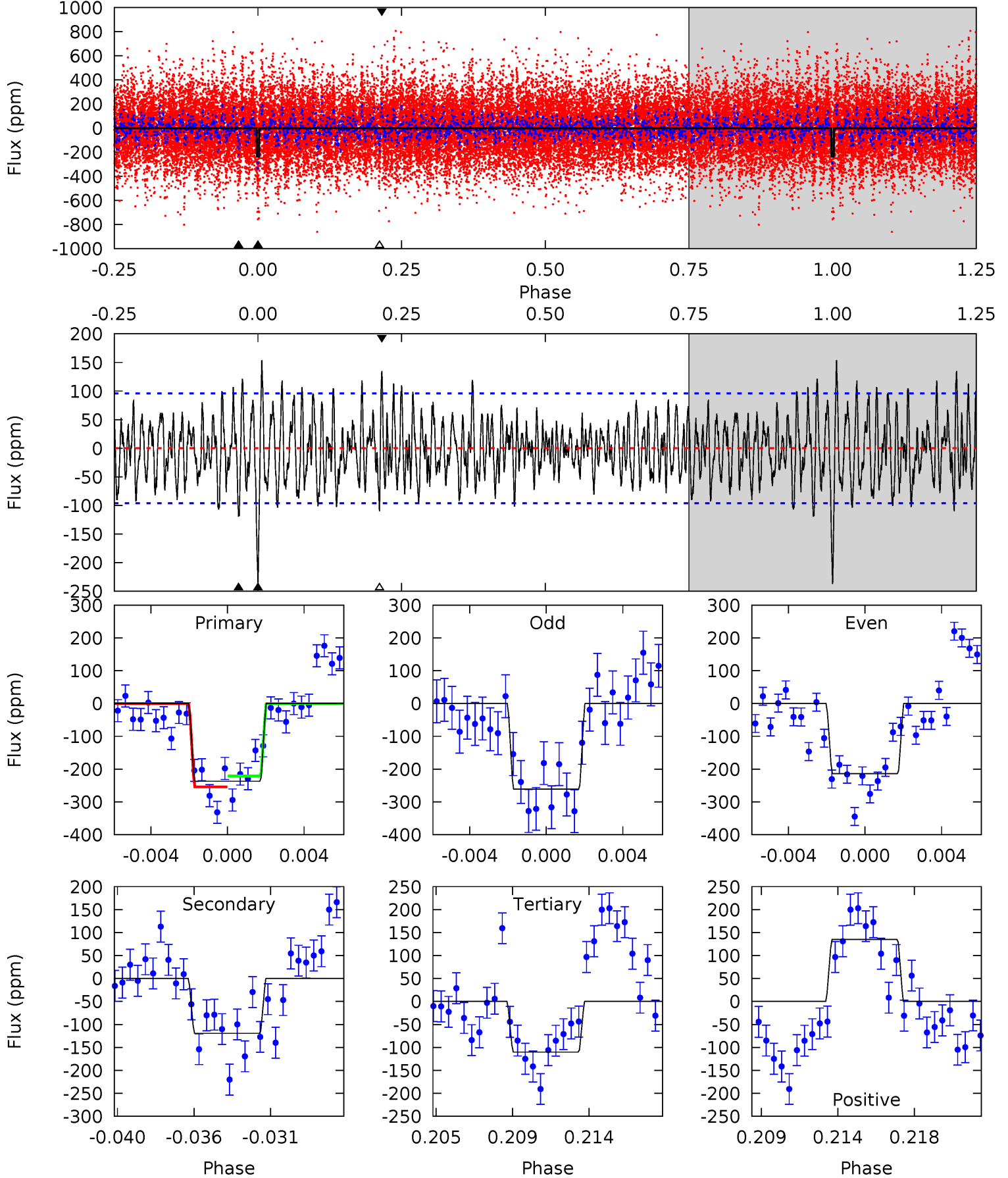
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
11.8	7.20	6.88	6.83	5.20	2.87	2.24	4.91	4.97	0.33	0.38	1.56	1.02	0.37	1.43



# Alt Model-Shift Uniqueness Test

003654515-02, P = 70.631476 Days, E = 87.377361 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
12.8	6.46	5.95	7.28	5.18	2.84	2.39	6.85	5.51	0.51	-0.83	1.29	1.04	0.39	0.89



### Stellar Parameters For KIC 003654515

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6597^{+180}_{-200}$	$3.425^{+0.408}_{-0.072}$	$-0.340^{+0.400}_{-0.300}$	$4.317^{+0.610}_{-1.830}$	$1.810^{+0.152}_{-0.457}$	$0.032^{+0.112}_{-0.007}$
	+3%/-3%	+12%/-2%	+118%/-88%	+14%/-42%	+8%/-25%	+352%/-23%
Source	PHO1	FLK73	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 003654515-02 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-136 \pm 19$	$6.26^{+2.86}_{-2.51}$	$1279^{+82}_{-157}$	$5805^{+1534}_{-832}$	$313^{+573}_{-170}$
Alt.	$-120 \pm 19$	$6.04^{+2.79}_{-2.50}$	$1279^{+87}_{-149}$	$5702^{+1609}_{-800}$	$290^{+532}_{-152}$

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

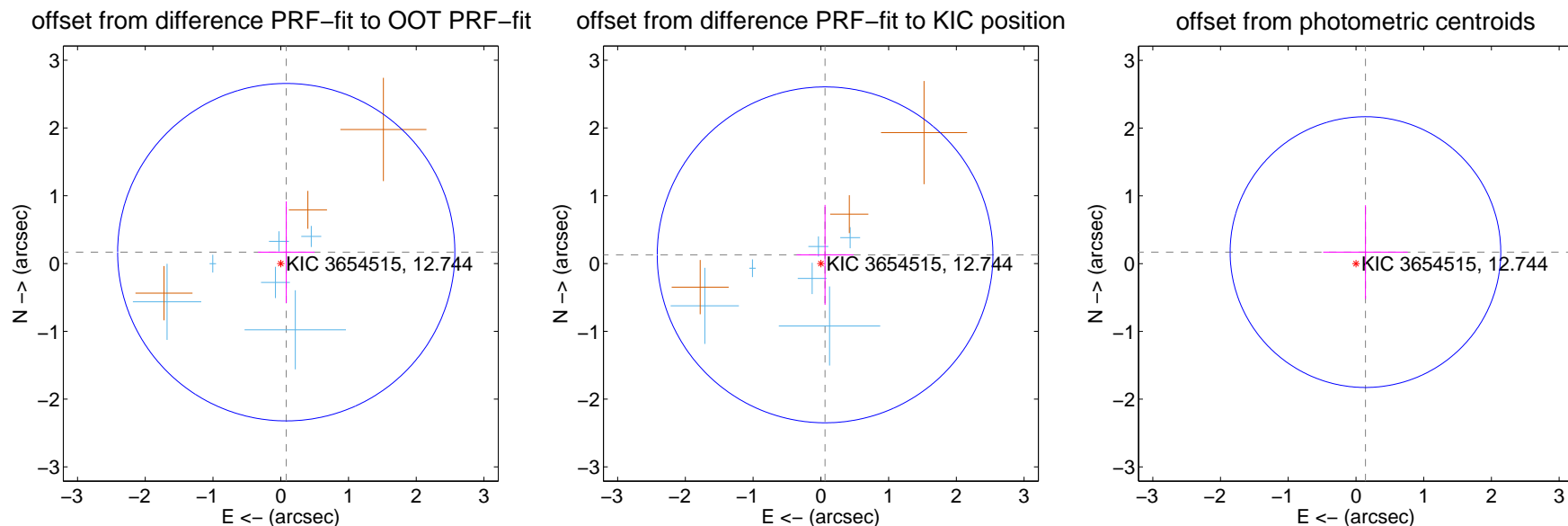
## DV Centroid Data

Supplemental centroid analysis for 003654515-02. Kepler magnitude: 12.74. Transit SNR 7.18

There are 6 quarters with good PRF difference image offsets

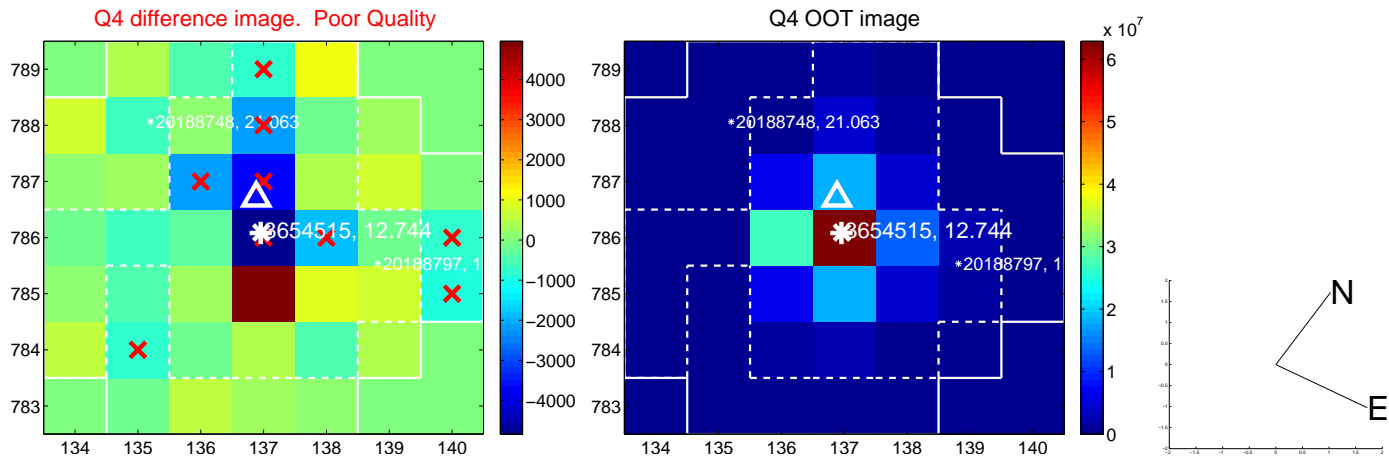
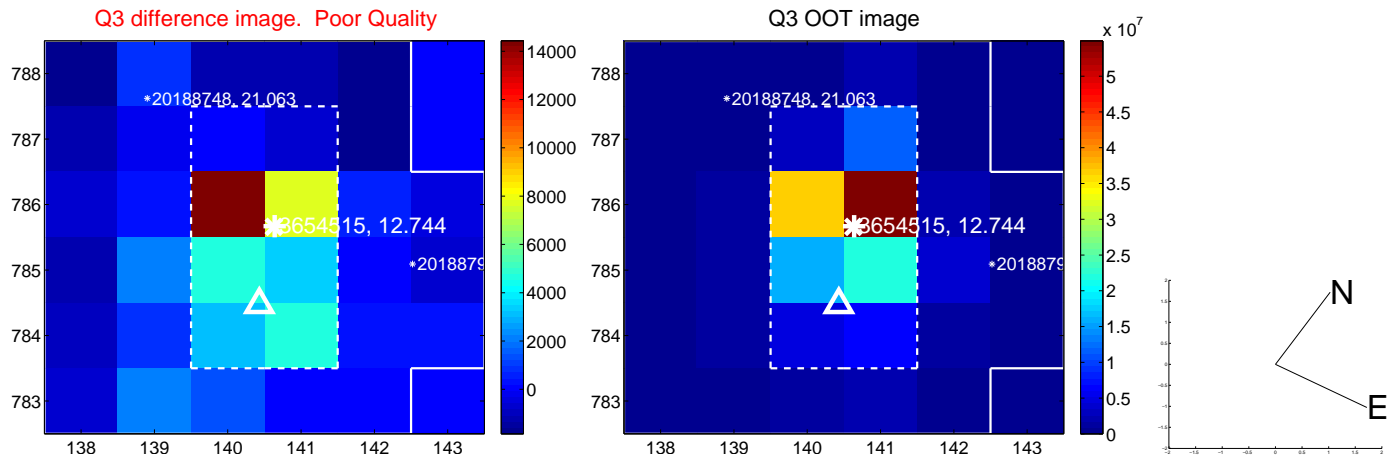
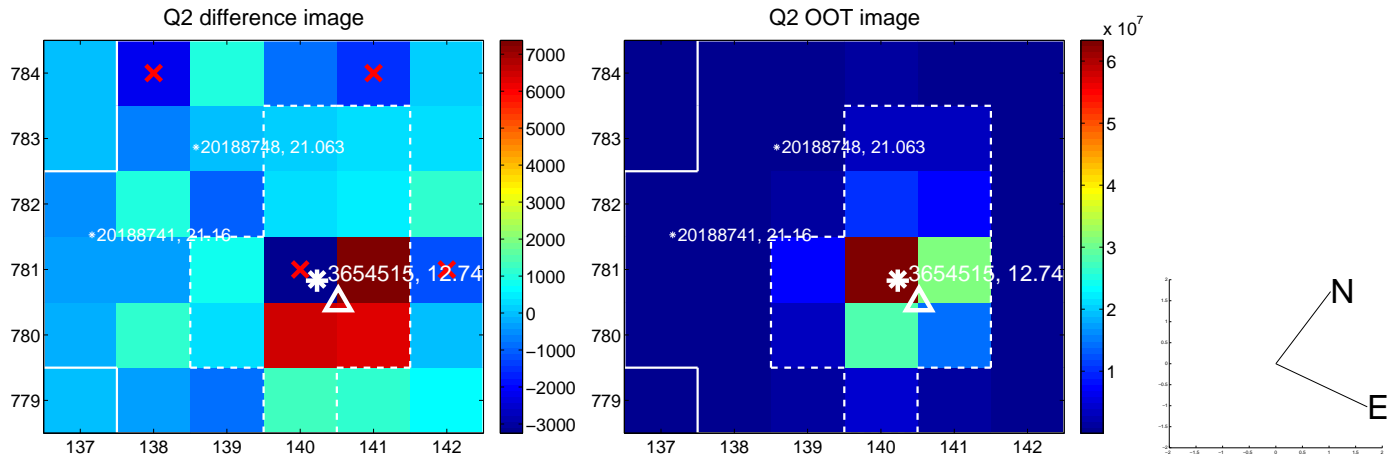
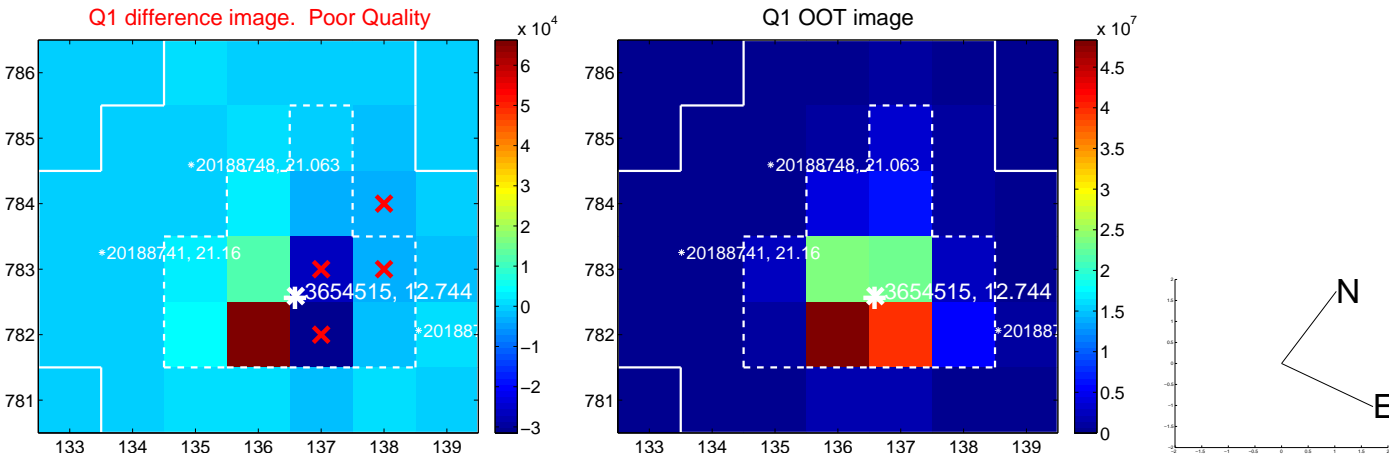
The direct PRF centroid is offset from the target star catalog position by about 0.08 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.186 \pm 0.830$	0.22	$-0.081 \pm 0.418$	$0.168 \pm 0.750$
PRF-fit source offset from KIC position	$0.143 \pm 0.826$	0.17	$-0.062 \pm 0.421$	$0.128 \pm 0.738$
photometric centroid source offset	$0.22 \pm 0.67$	0.33	$-0.14 \pm 0.62$	$0.17 \pm 0.69$



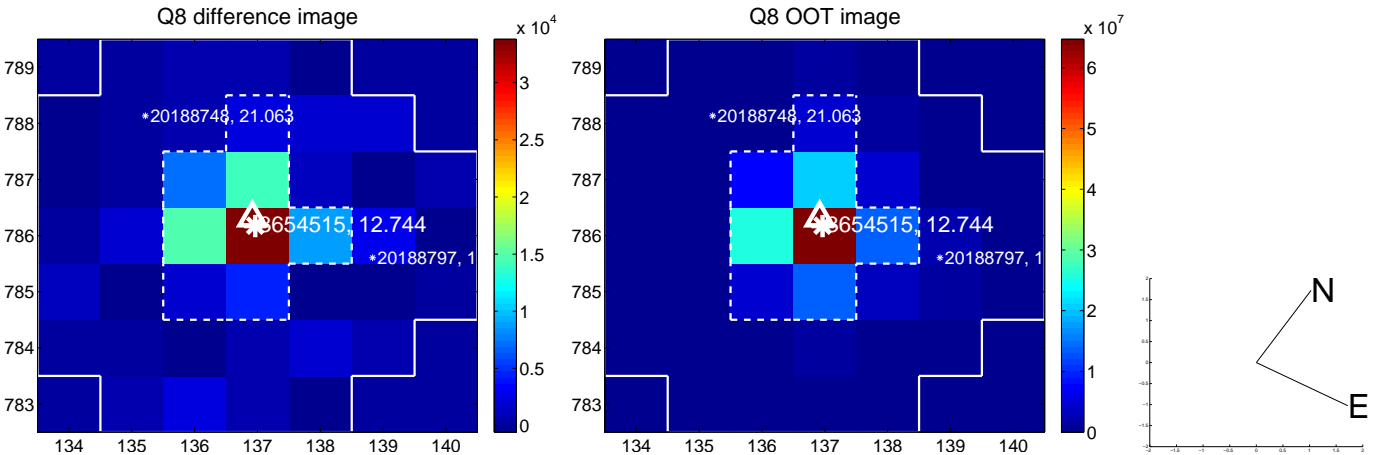
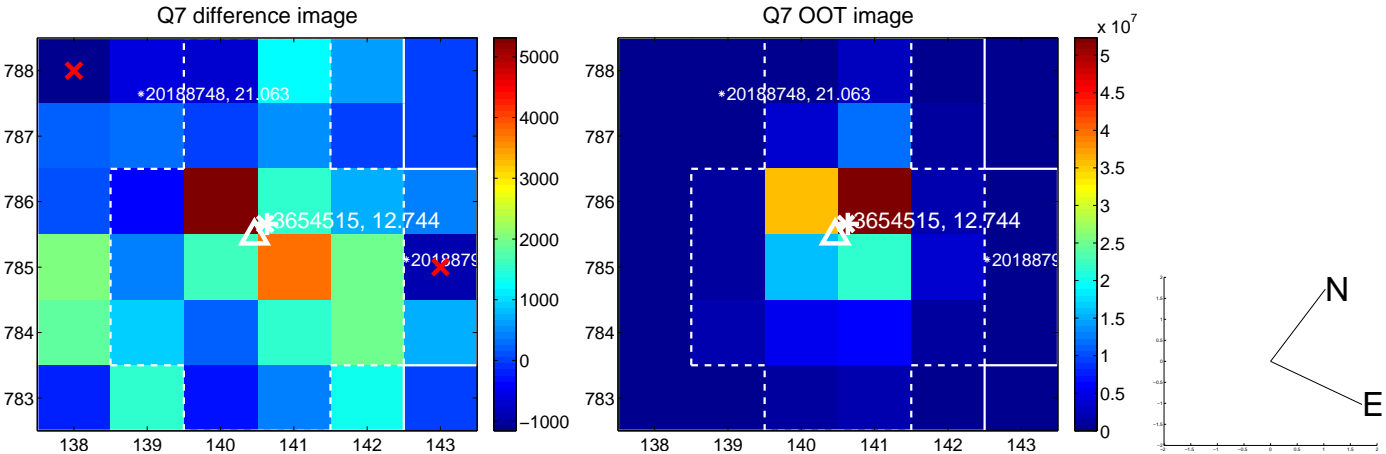
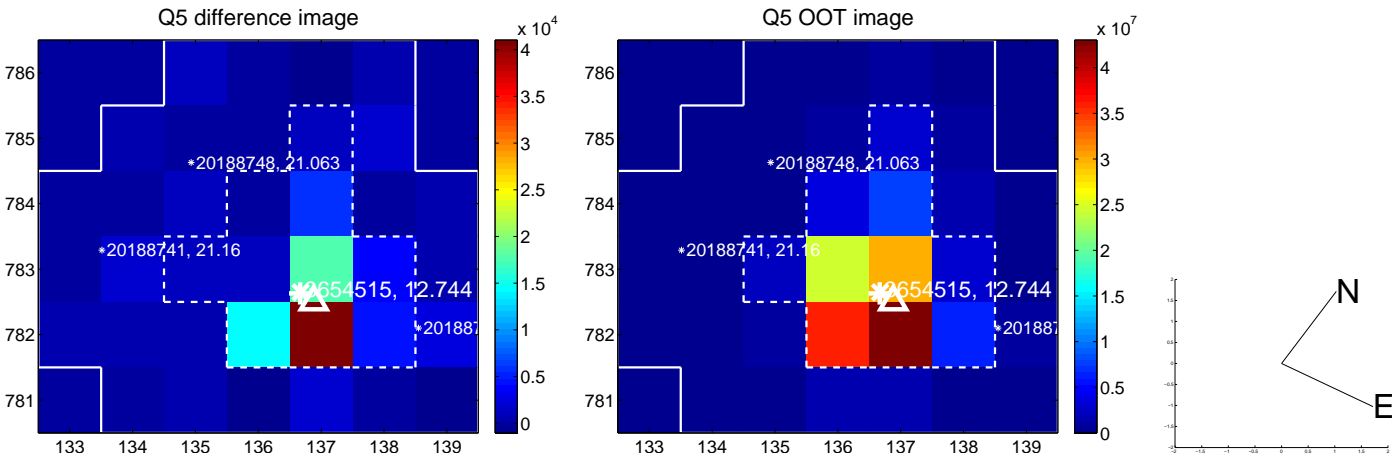
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

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

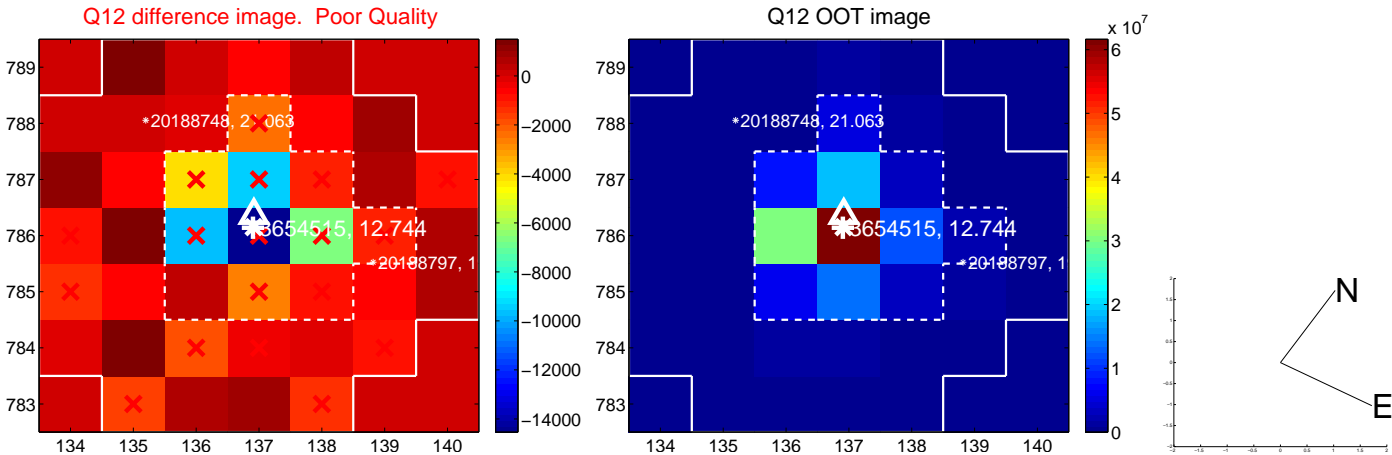
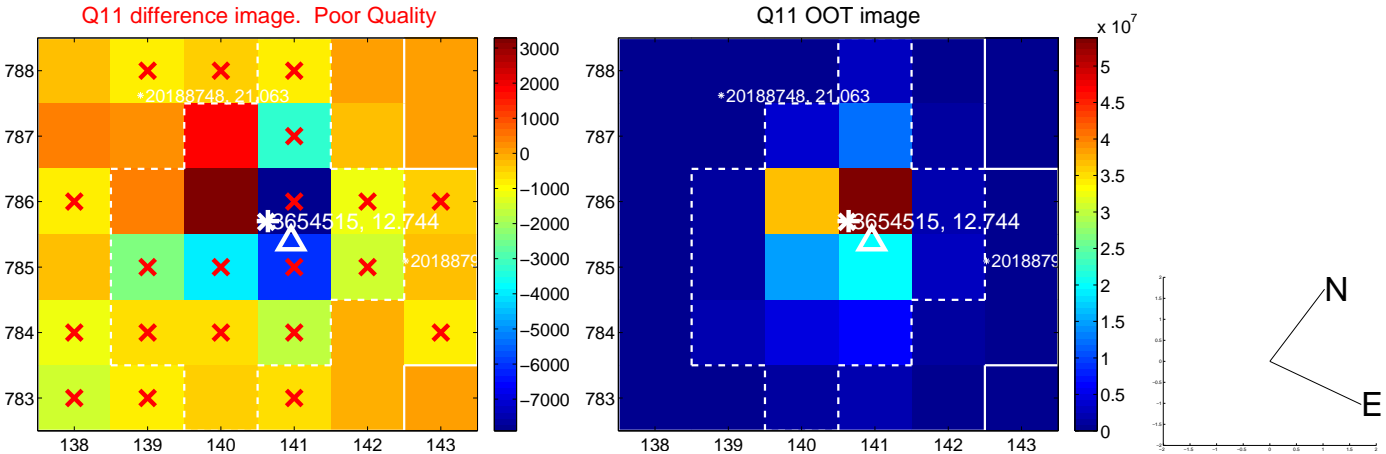
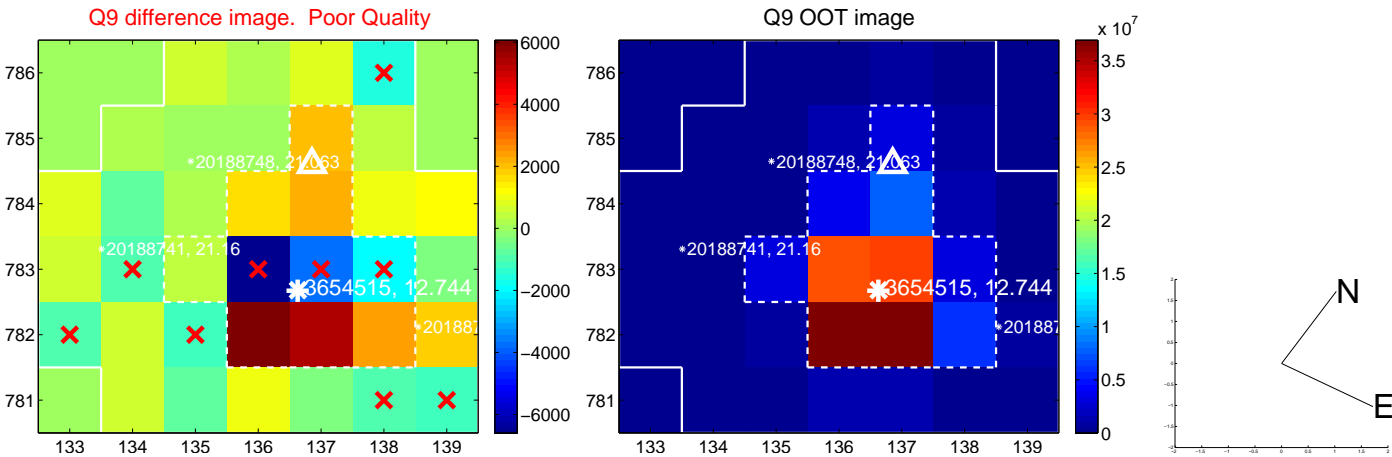




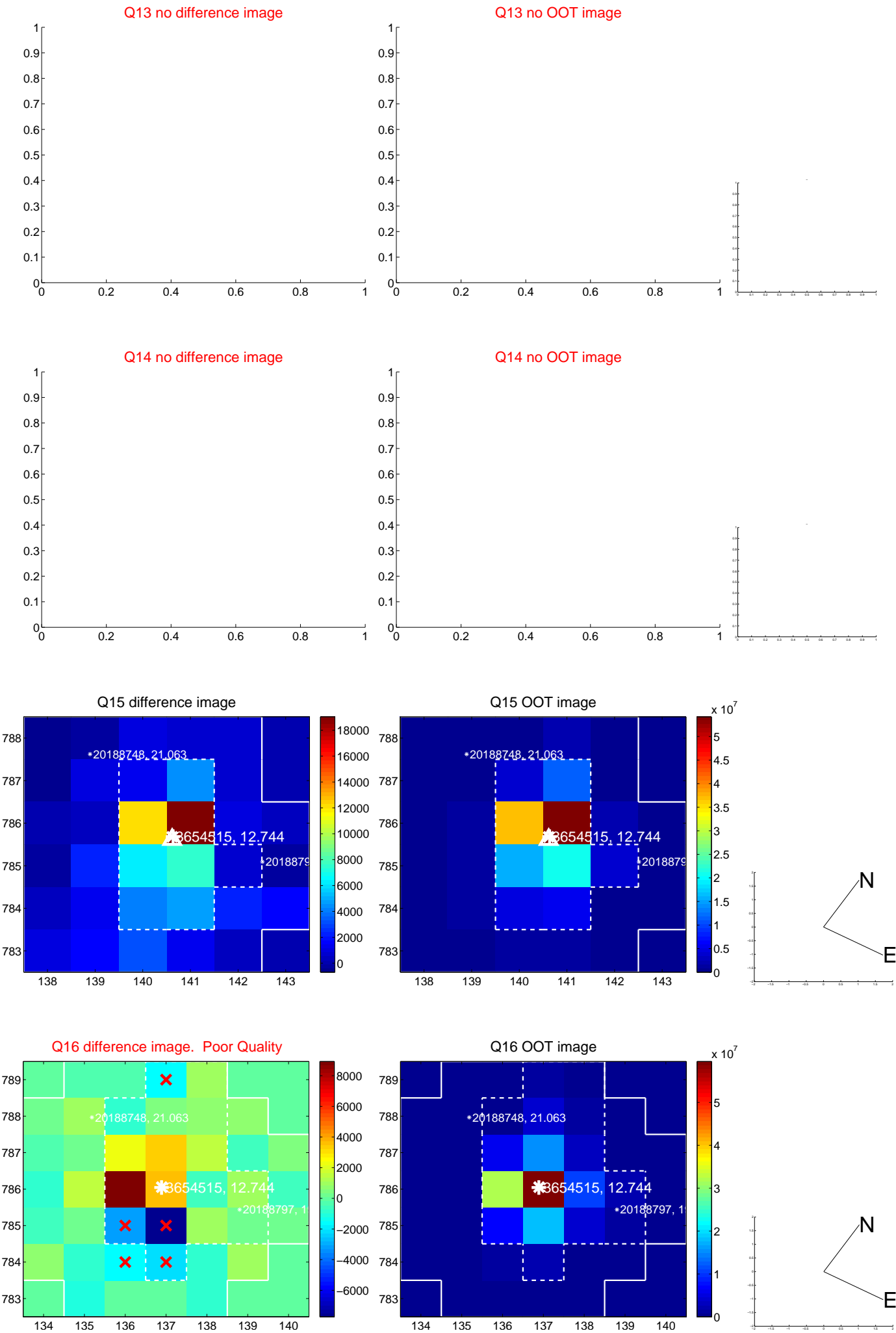
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



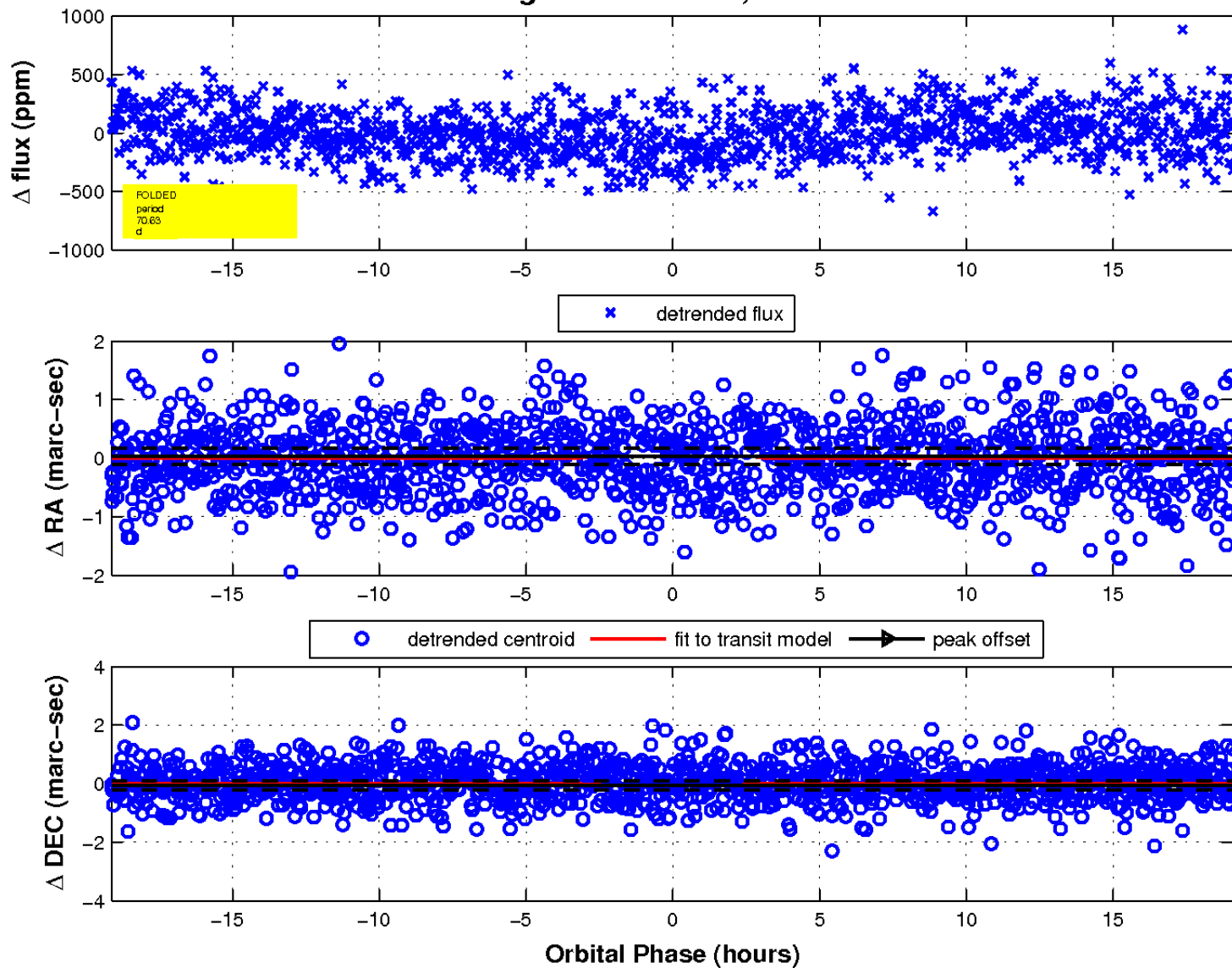
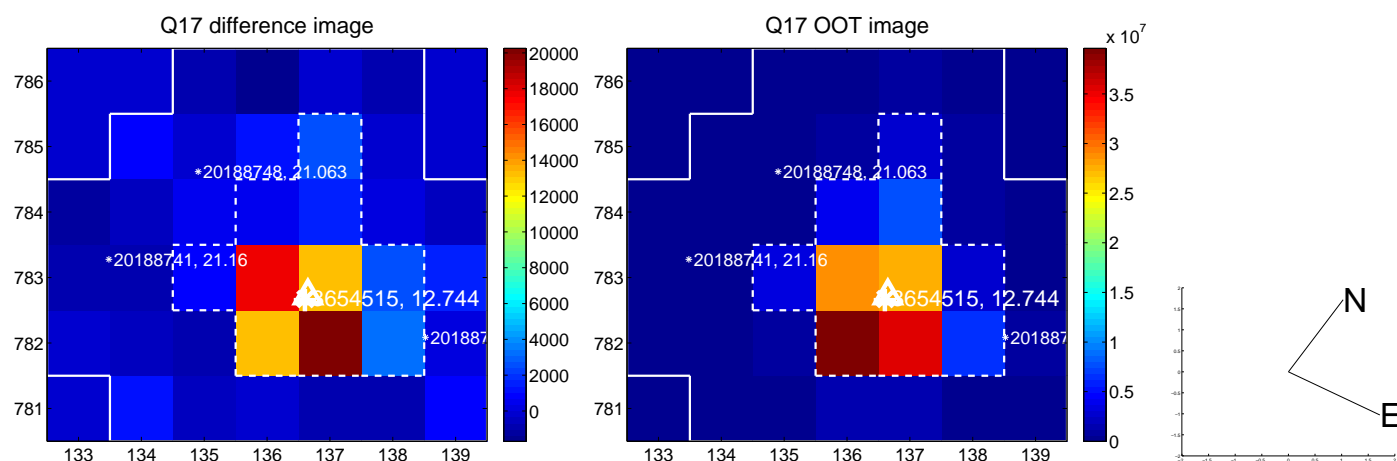
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



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



UKIRT Image

