

# KIC 010989859

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
010989859-01	OBS	No	1.032262	131.862720	14.6	6.908	8.1	7.1	1.28	7291	0.49	9120.32
010989859-02	OBS	No	27.797714	145.835134	231.8	2.094	11.2	11.5	1.28	7291	3.06	112.99
010989859-03	OBS	No	31.943139	158.167322	296.6	2.043	10.5	11.7	1.28	7291	2.57	93.88
010989859-04	OBS	No	20.545399	145.462444	122.0	2.279	8.7	5.7	1.28	7291	1.66	169.09
010989859-05	OBS	No	24.191498	148.647136	134.3	2.949	8.0	6.8	1.28	7291	1.72	135.99
010989859-06	OBS	No	47.767277	156.662618	384.1	1.137	8.9	8.6	1.28	7291	2.71	54.90
010989859-07	OBS	No	40.707094	170.263259	214.2	2.535	8.8	8.4	1.28	7291	2.09	67.95
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010989859-09	OBS	No	52.174965	160.628549	285.1	0.641	8.9	4.4	1.28	7291	2.23	48.80

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
010989859-01	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT
010989859-02	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT
010989859-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT
010989859-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT
010989859-05	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—HALO_GHOST
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010989859-08	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—CENT_FEW_DIFFS
010989859-09	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_TRACKER—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS

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

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

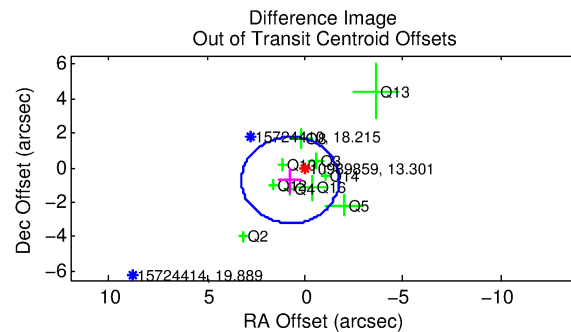
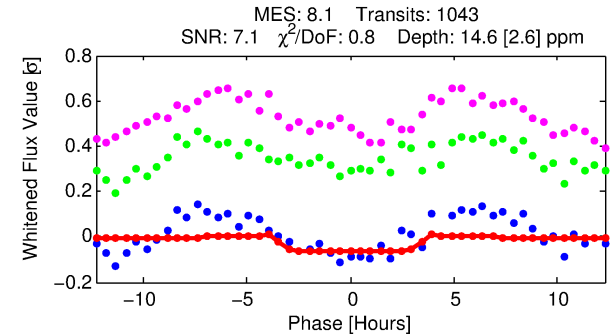
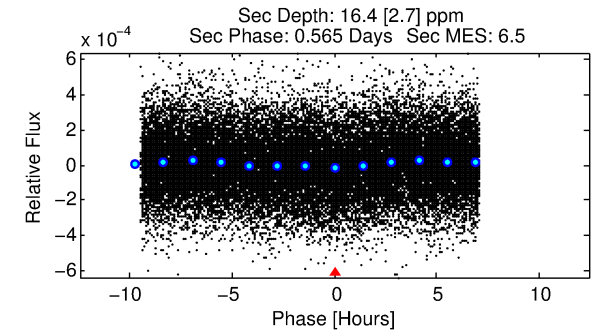
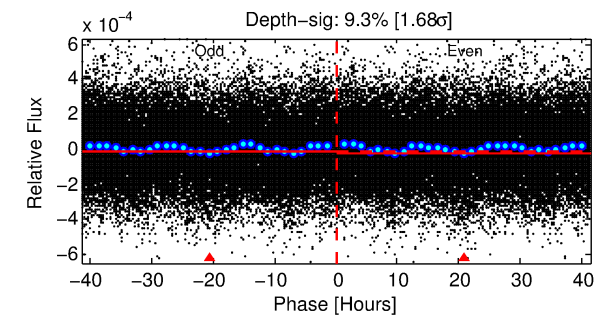
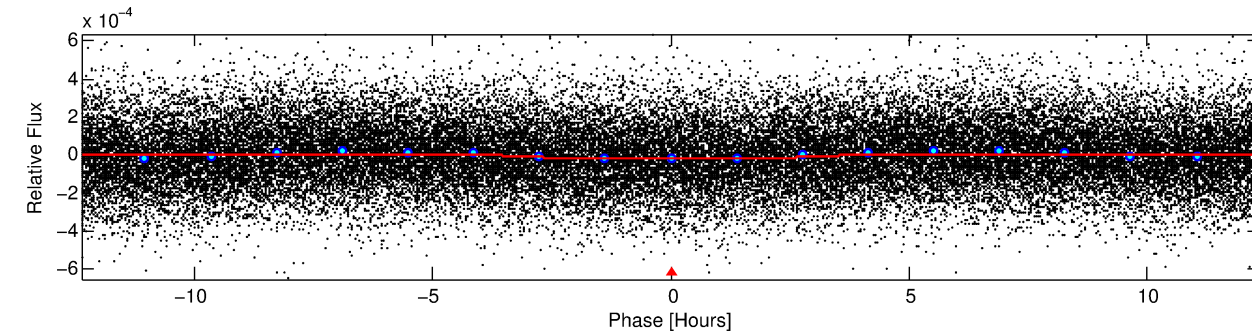
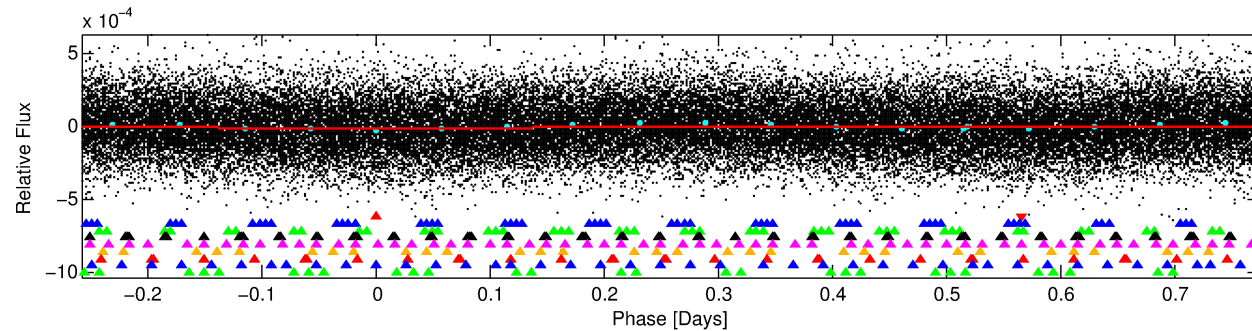
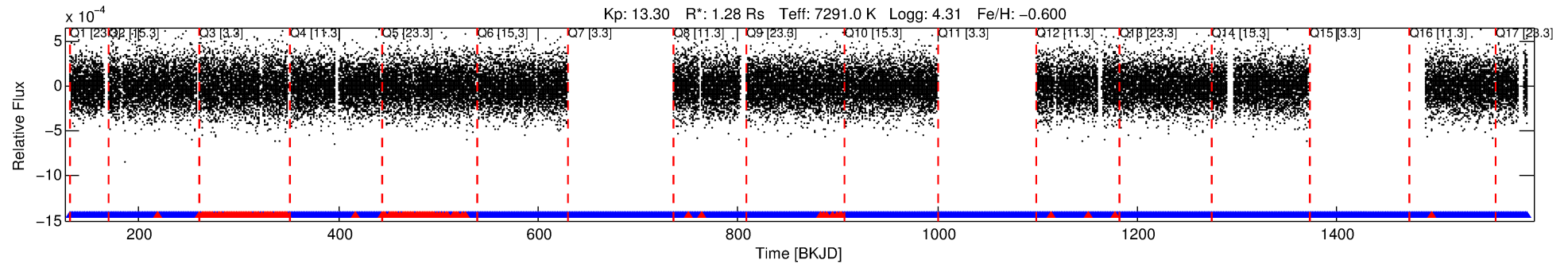
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 010989859-01

No Significant Match Found

# DV One-Page Summary

KIC: 10989859 Candidate: 1 of 9 Period: 1.032 d



## DV Fit Results:

Period = 1.03226 [0.00002] d  
Epoch = 131.8627 [0.0077] BKJD  
Rp/R\* = 0.0035 [0.0046]  
a/R\* = 1.31 [4.18]  
b = 0.02 [402.59]  
Seff = 9120.31 [3434.31]  
Teq = 2492 [235] K  
Rp = 0.49 [0.66] Re  
a = 0.0213 [0.0052] AU  
Ag = 16.74 [43.96] [0.36 $\sigma$ ]  
Teffp = 7793 [5081] K [1.04 $\sigma$ ]

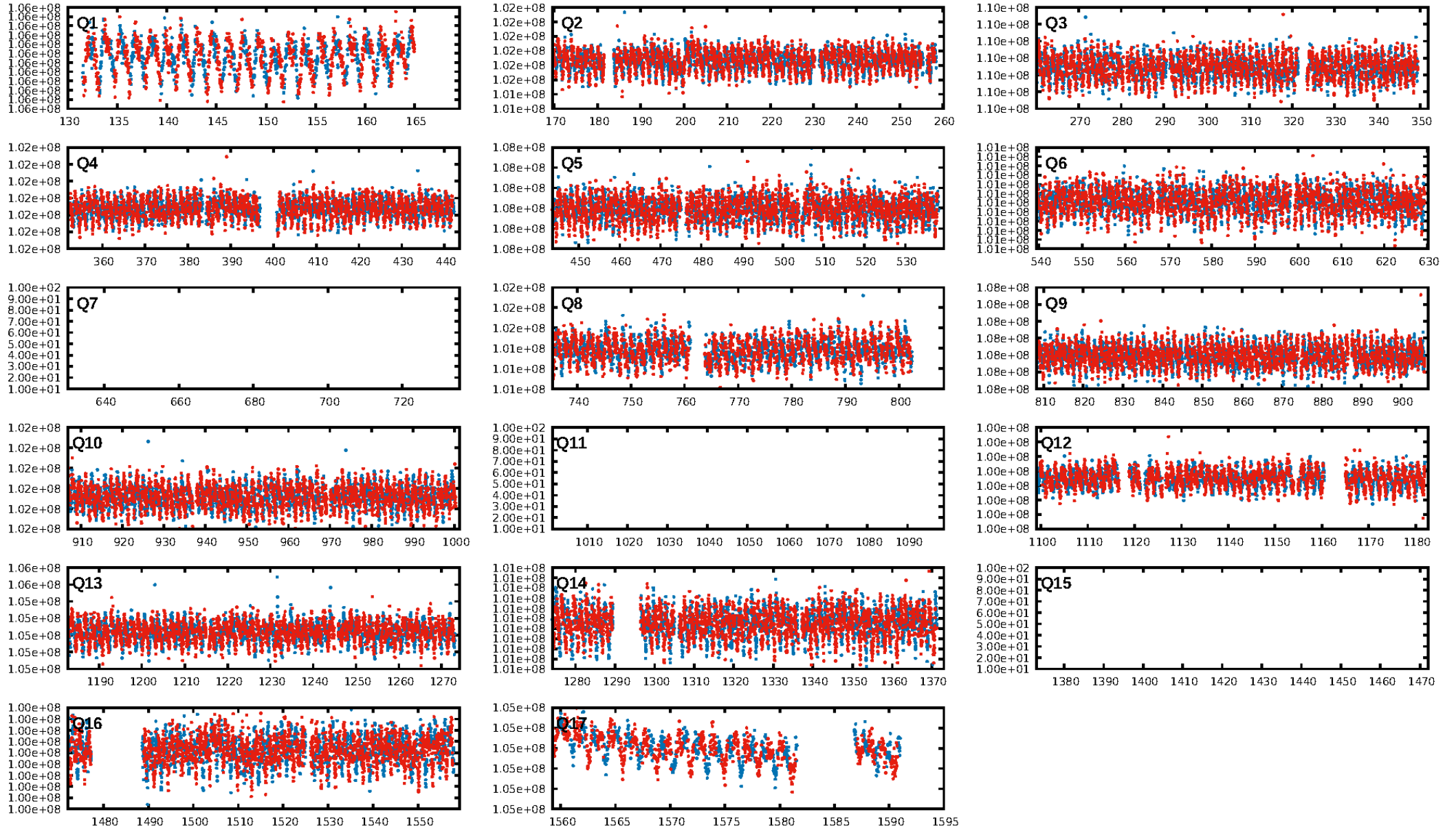
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [64.38 $\sigma$ ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
**Bootstrap-pfa: 2.51e-10**  
RollingBand-fgt: 0.86 [850/984]  
GhostDiagnostic-chr: 4.092  
Centroid-sig: 53.4%  
Centroid-so: 1.068 arcsec [0.79 $\sigma$ ]  
OotOffset-rm: 1.045 arcsec [1.26 $\sigma$ ]  
OotOffset-st: 3/1/4/2 [10]  
KicOffset-rm: 1.188 arcsec [1.38 $\sigma$ ]  
KicOffset-st: 3/1/4/2 [10]  
DiffImageQuality-fgm: 0.80 [8/10]  
DiffImageOverlap-fno: 1.00 [14/14]

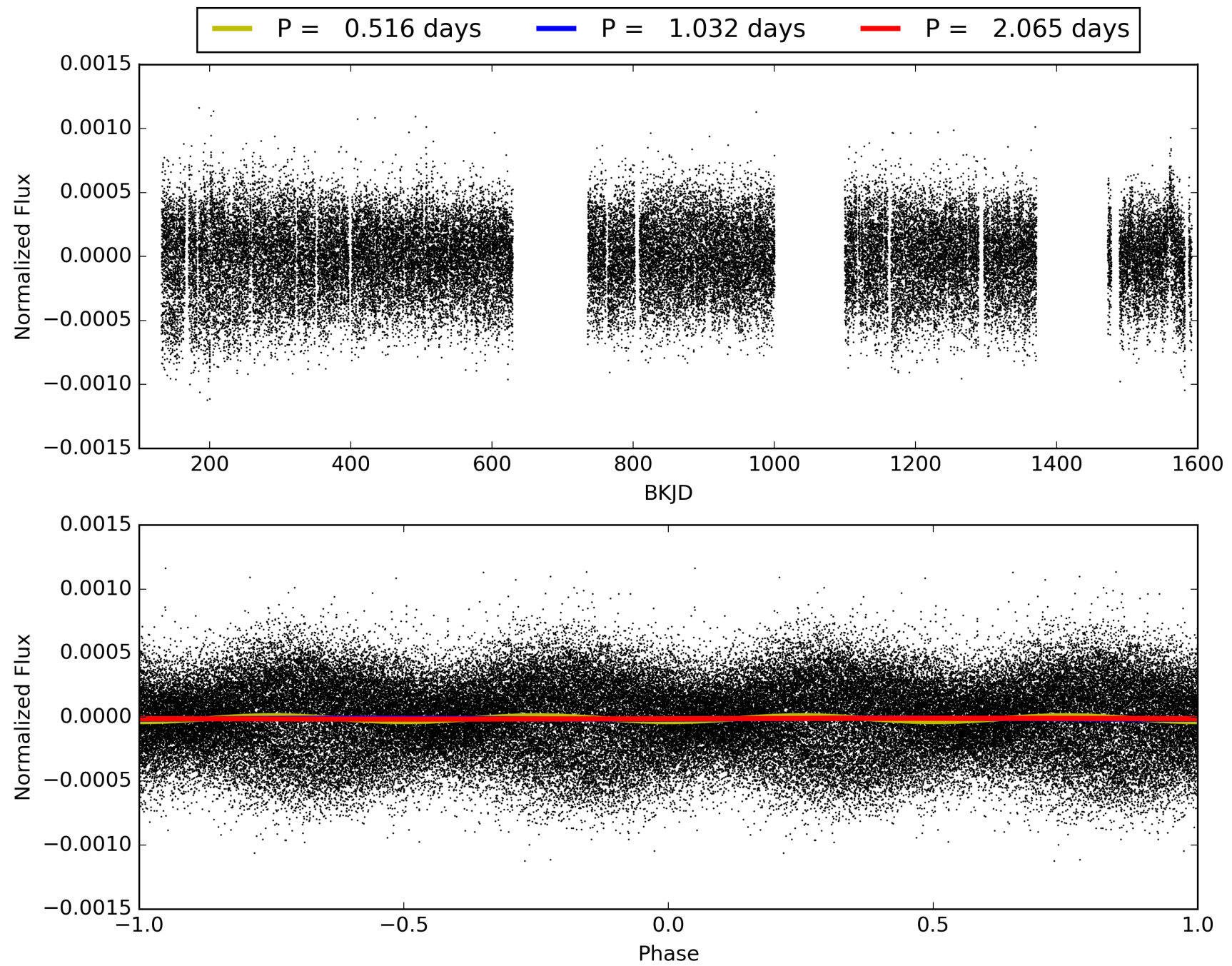
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 09:38:02 Z

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

# TCE 010989859-01, PDC Light Curves



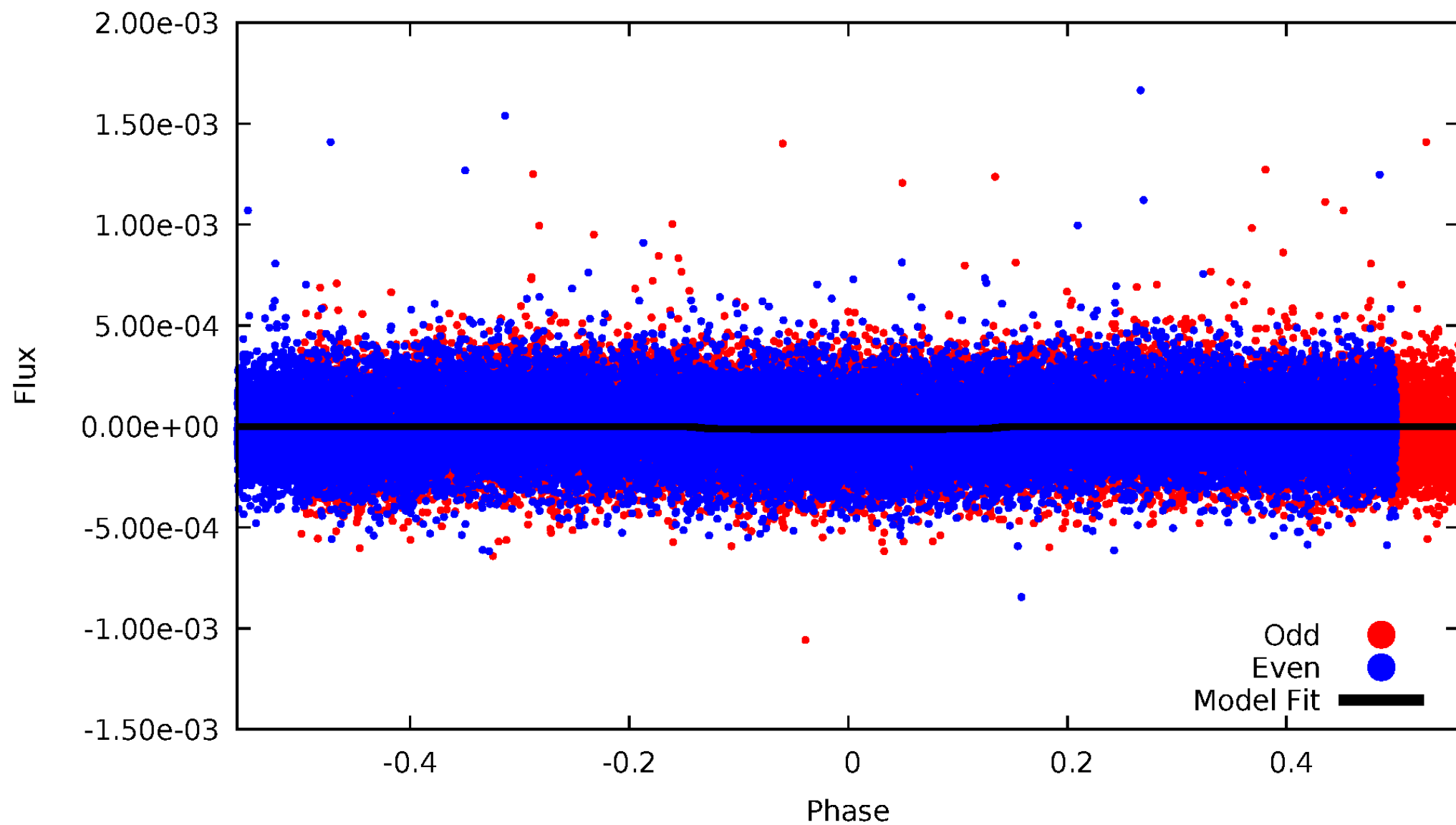
TCE 010989859-01





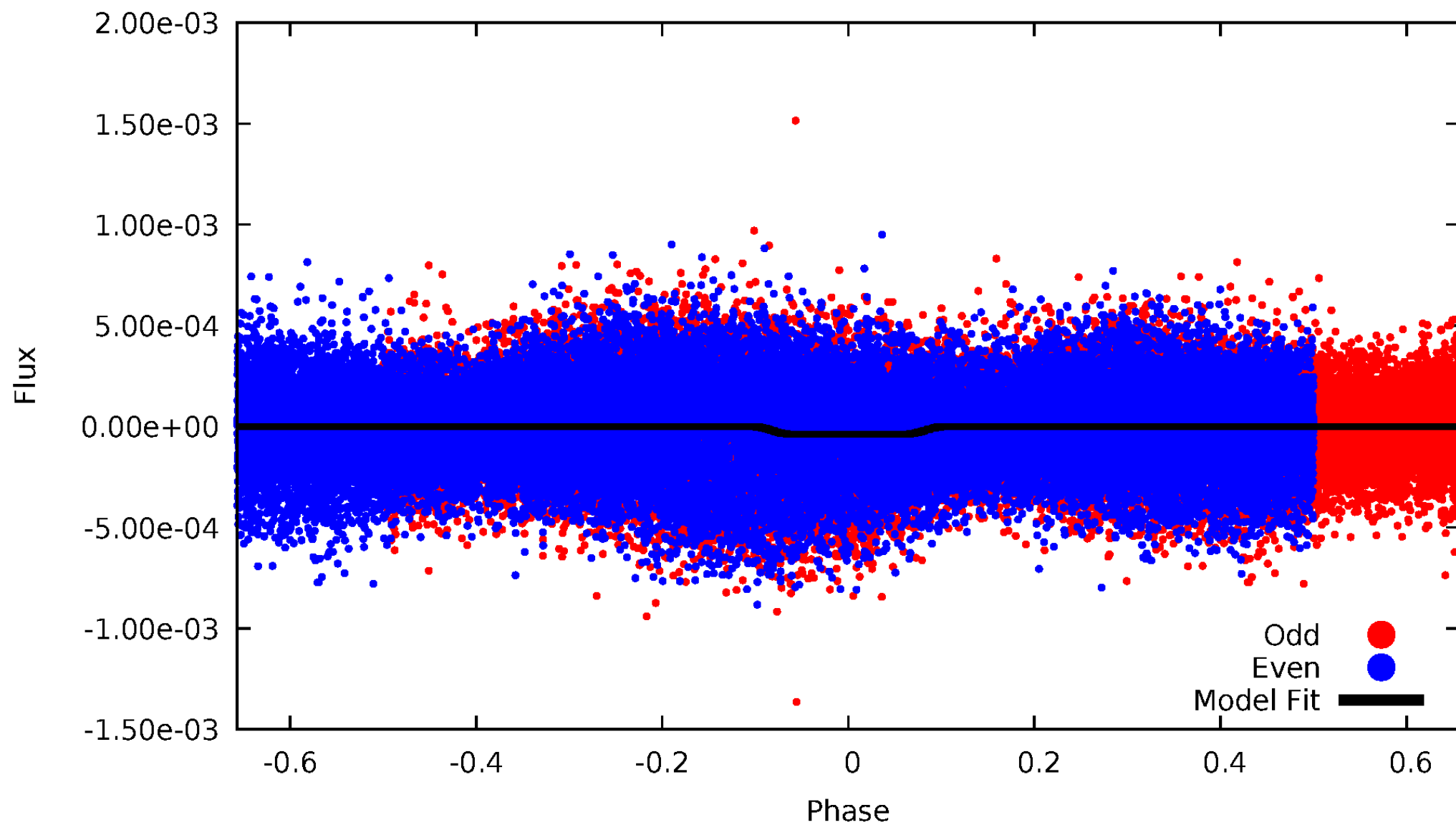
# DV Odd/Even

TCE 010989859-01



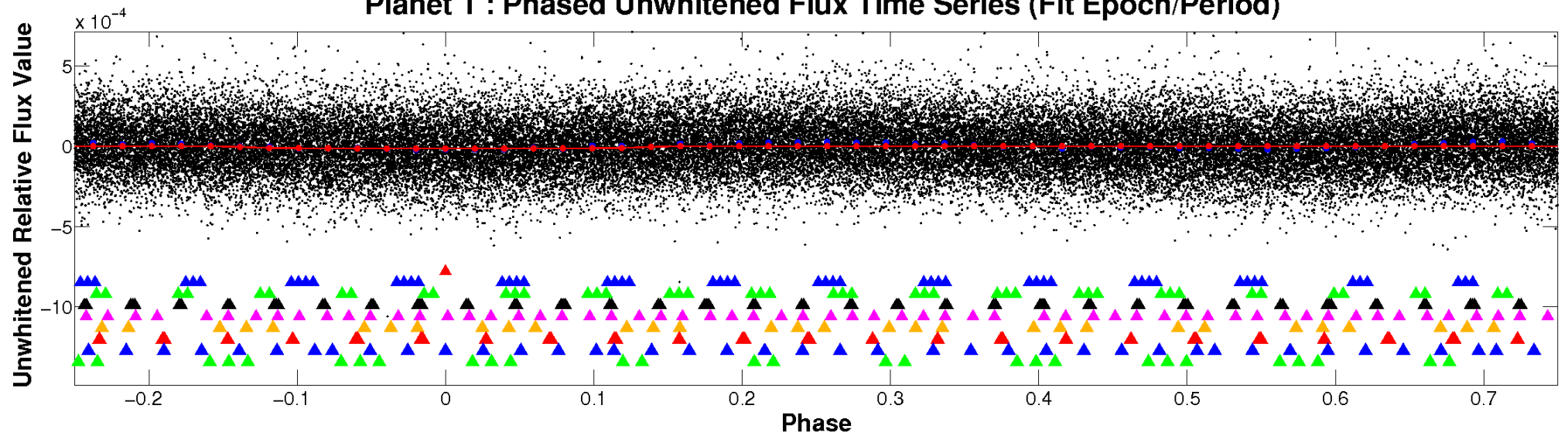
# ALT Odd/Even

TCE 010989859-01

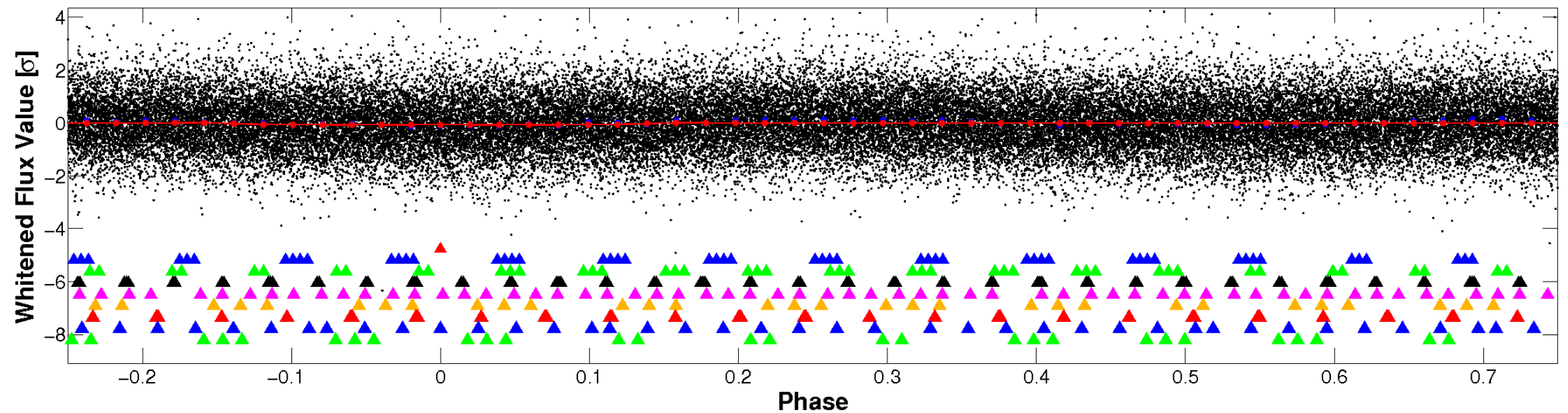


# Non-Whitened Vs. Whitened Light Curve

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

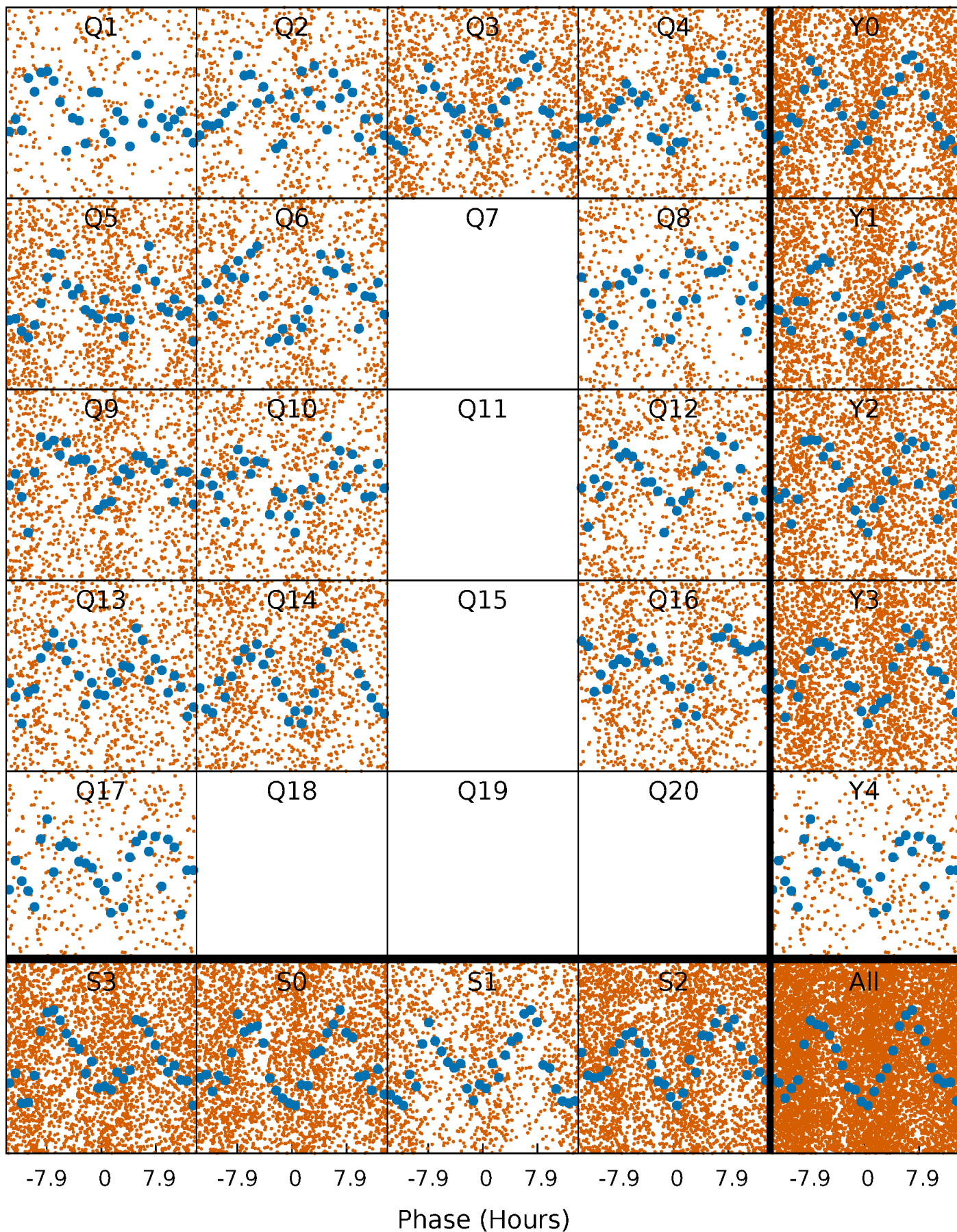


## Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

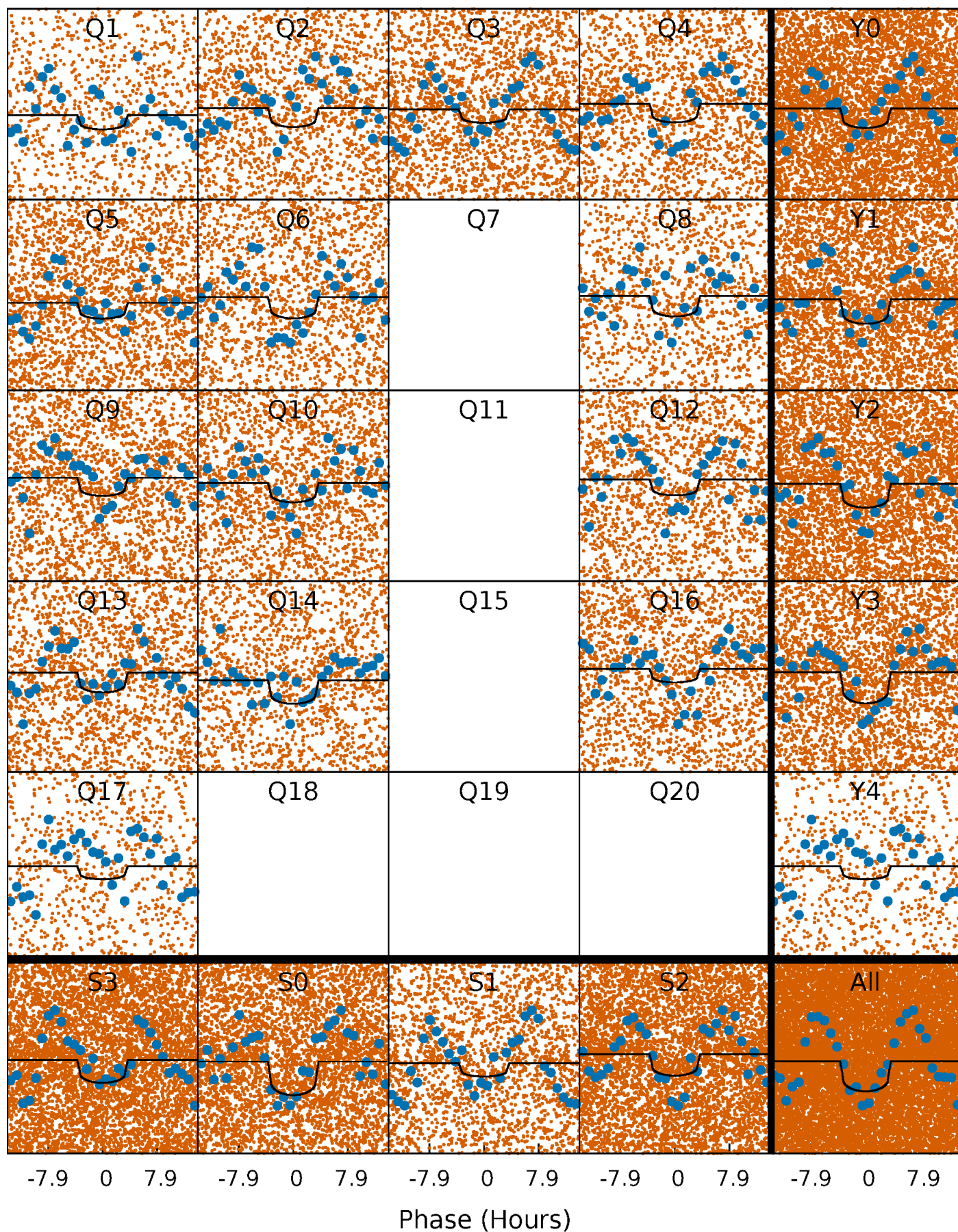
TCE 010989859-01 P= 1.032262 Days  $T_0=131.862720$  (BKJD)





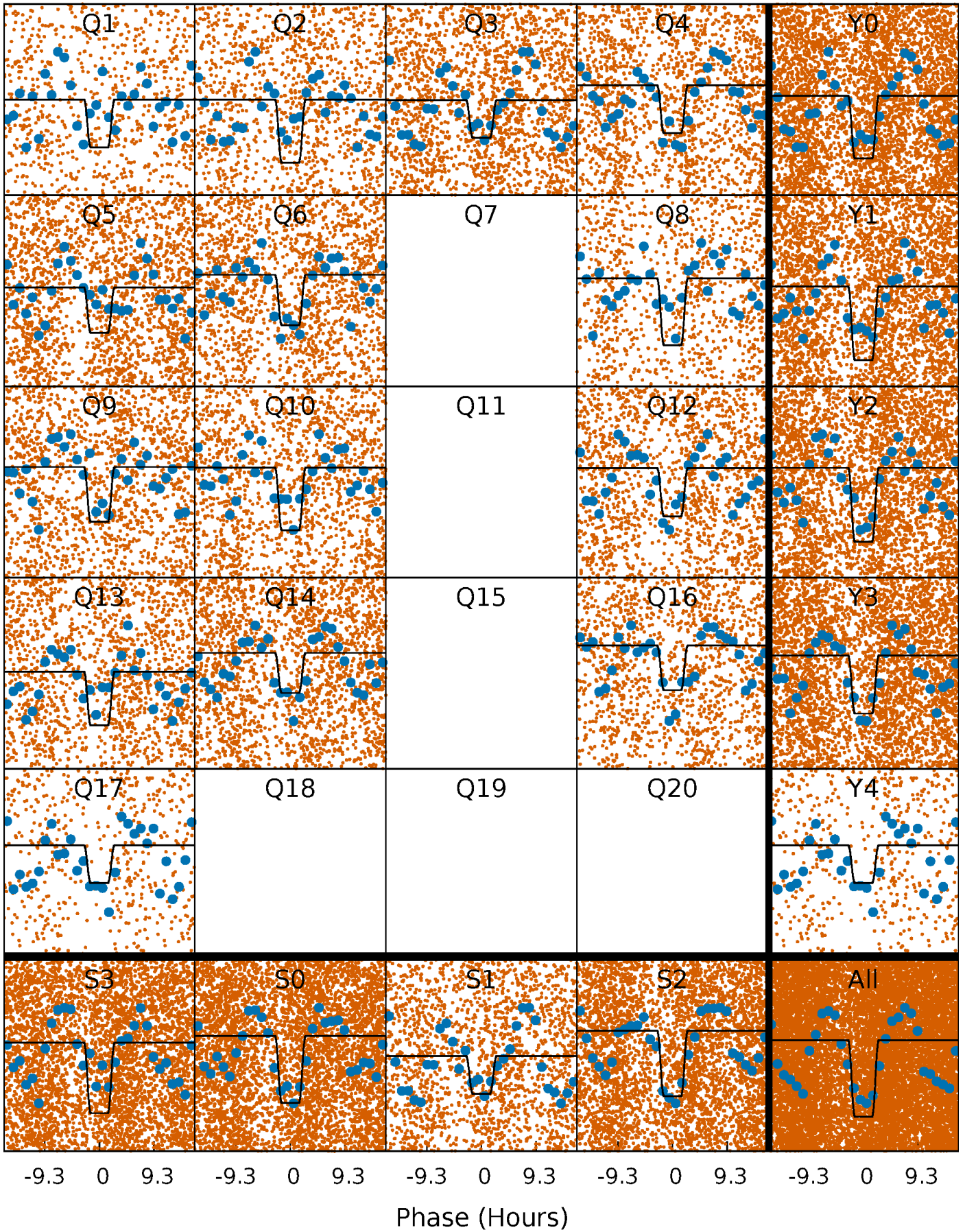
# DV Quarter-Phased Transit Curves

TCE 010989859-01 P= 1.032262 Days  $T_0=131.862720$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

TCE 010989859-01 P= 1.032340 Days  $T_0=131.801649$  (BKJD)

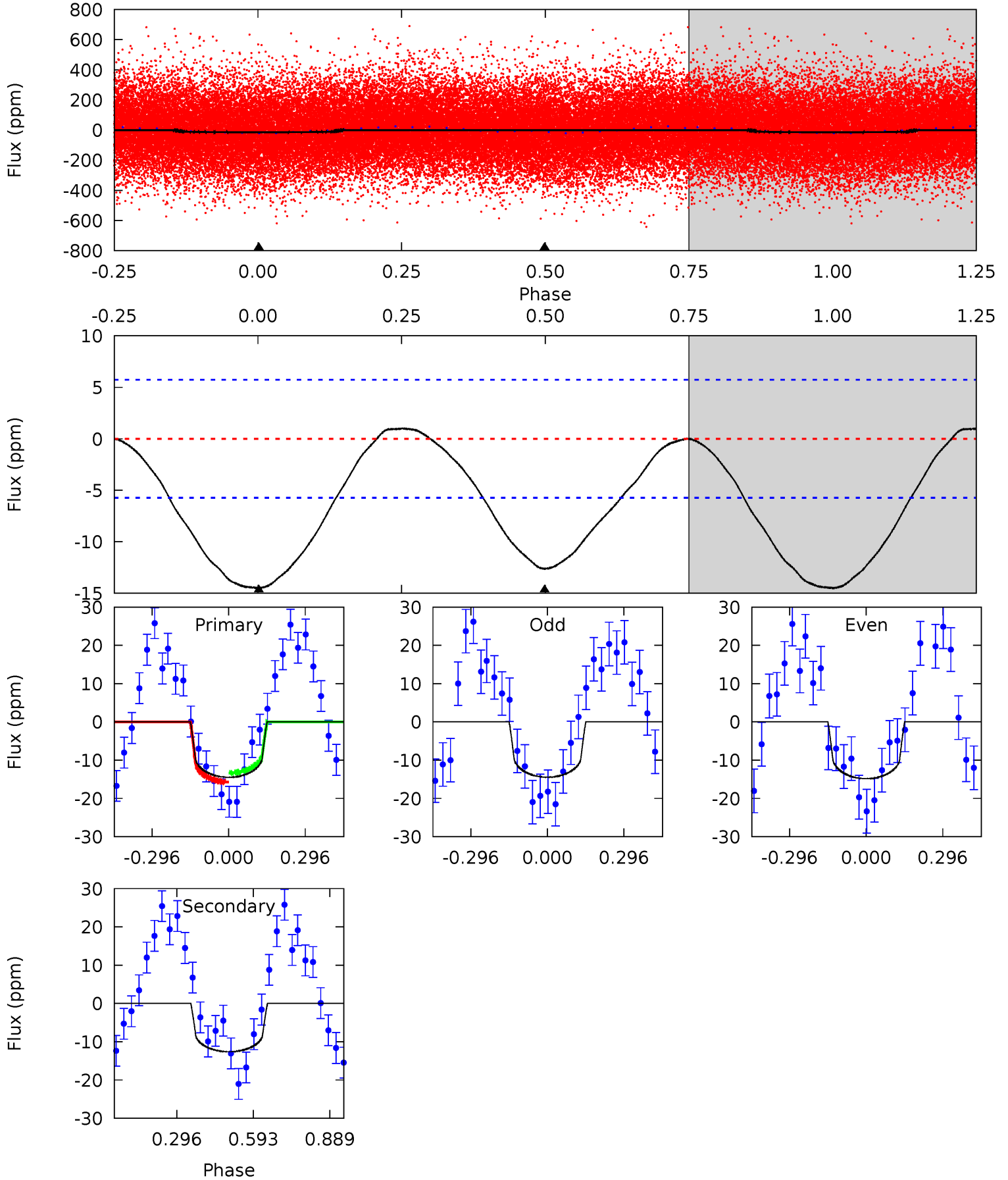




# DV Model-Shift Uniqueness Test

010989859-01, P = 1.032262 Days, E = 130.830458 Days

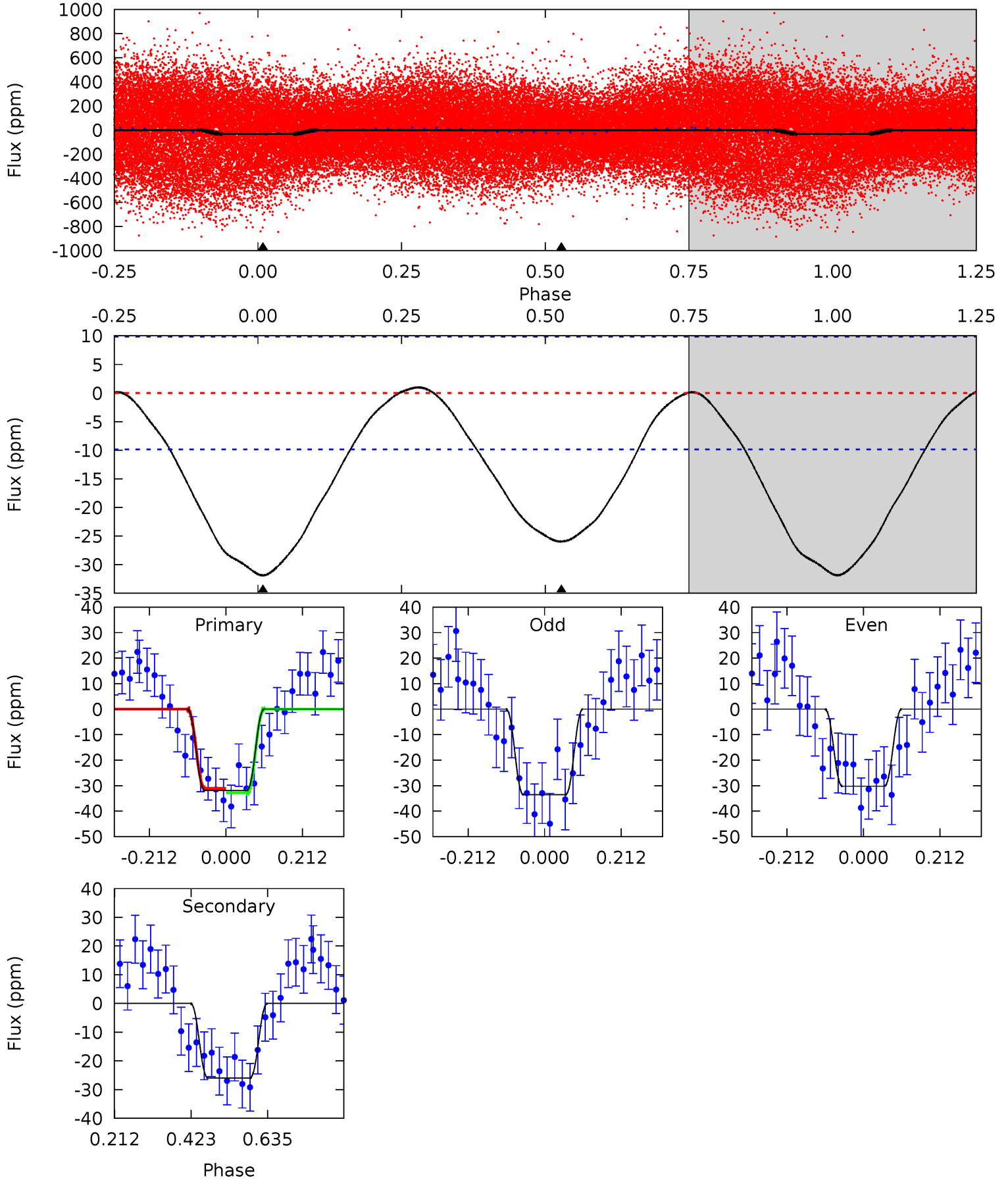
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
11.0	9.53	0	0	4.33	1.04	0.45	11.0	11.0	9.53	9.53	0.14	1.36	0.06	0.90



# Alt Model-Shift Uniqueness Test

010989859-01, P = 1.032340 Days, E = 130.769309 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
14.3	11.6	0	0	4.40	1.25	0.41	14.3	14.3	11.6	11.6	0.75	-1.76	0.03	0.38





### Stellar Parameters For KIC 010989859

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$\rho_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$7291^{+207}_{-285}$	$4.307^{+0.084}_{-0.182}$	$-0.600^{+0.250}_{-0.300}$	$1.278^{+0.380}_{-0.163}$	$1.208^{+0.166}_{-0.136}$	$0.815^{+0.355}_{-0.399}$
	+3%/-4%	+2%/-4%	+42%/-50%	+30%/-13%	+14%/-11%	+44%/-49%
Source	PHO1	KIC0	KIC0	DSEP		

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

### Secondary Eclipse Parameters for KIC 010989859-01 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-13 \pm 1$	$0.70^{+0.57}_{-0.46}$	$3524^{+226}_{-193}$	$6052^{+5833}_{-1498}$	$6.193^{+41.526}_{-4.319}$
Alt.	$-26 \pm 2$	$0.97^{+0.65}_{-0.55}$	$3513^{+232}_{-198}$	$6166^{+4255}_{-1326}$	$6.874^{+28.684}_{-4.346}$

$T_{\text{max}}$  = 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

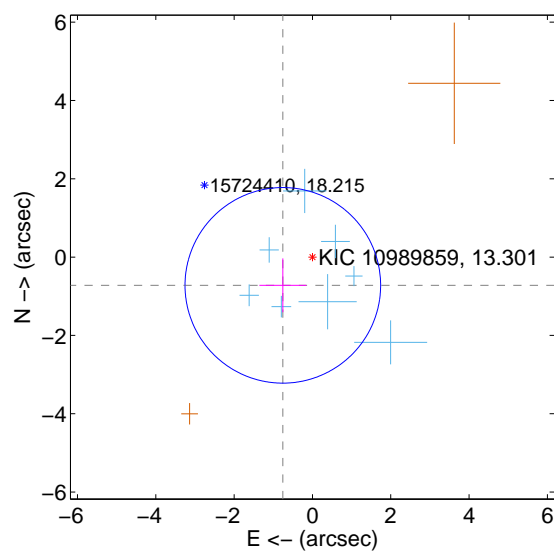
Supplemental centroid analysis for 010989859-01. Kepler magnitude: 13.30. Transit SNR 7.13

There are 8 quarters with good PRF difference image offsets

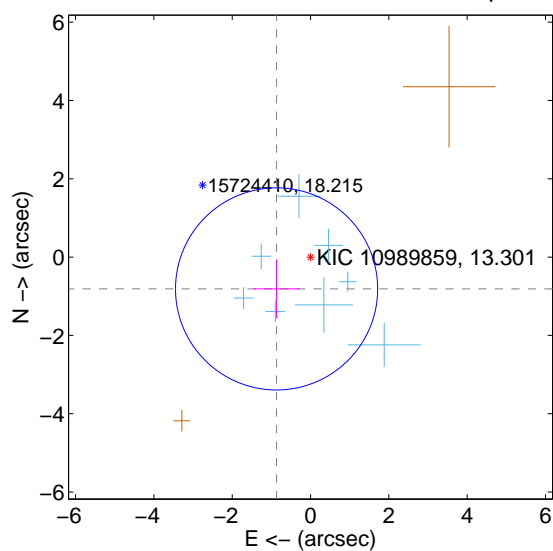
The direct PRF centroid is offset from the target star catalog position by about 0.10 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.045 \pm 0.833$	1.26	$0.757 \pm 0.600$	$-0.721 \pm 0.688$
PRF-fit source offset from KIC position	$1.188 \pm 0.860$	1.38	$0.867 \pm 0.592$	$-0.812 \pm 0.754$
photometric centroid source offset	$1.07 \pm 1.36$	0.79	$-1.06 \pm 1.36$	$-0.09 \pm 1.38$

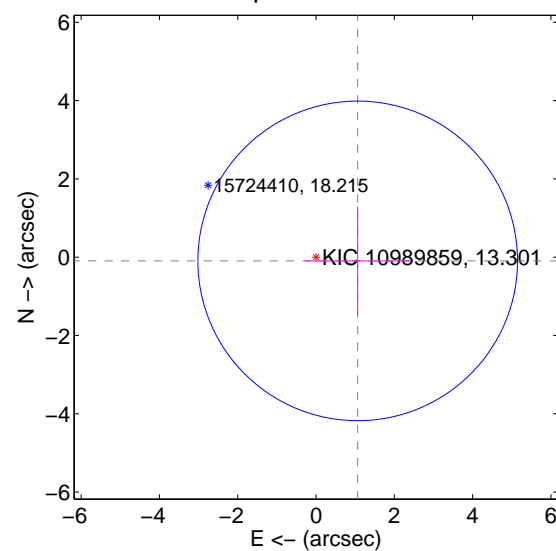
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

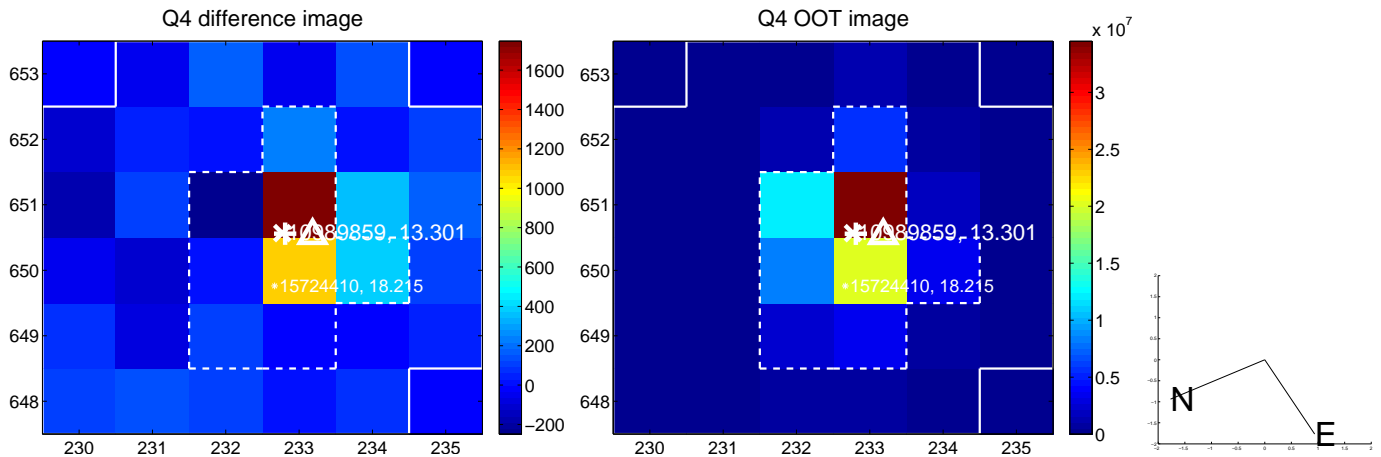
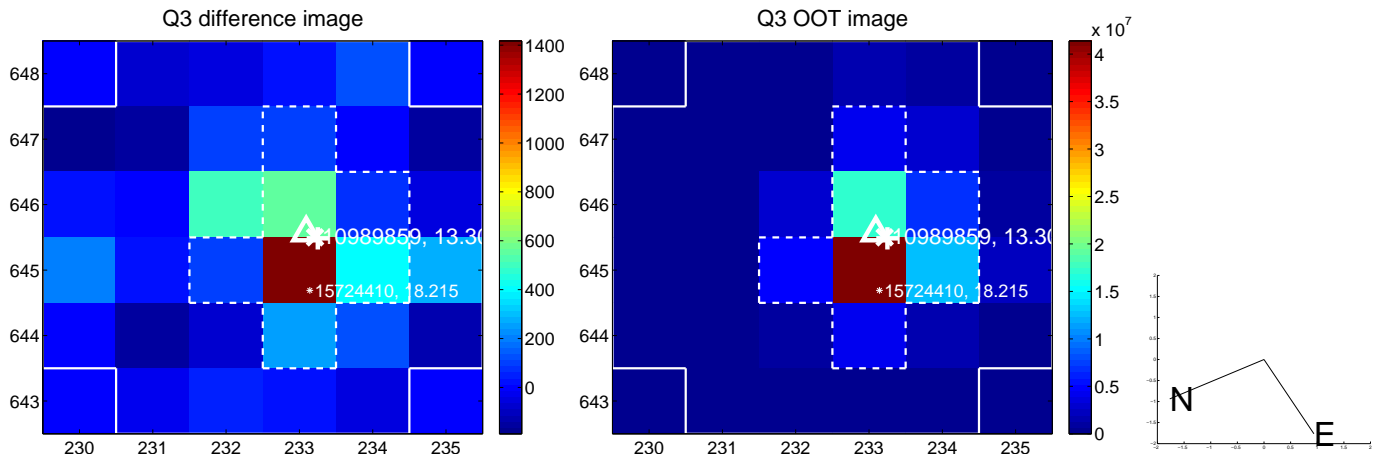
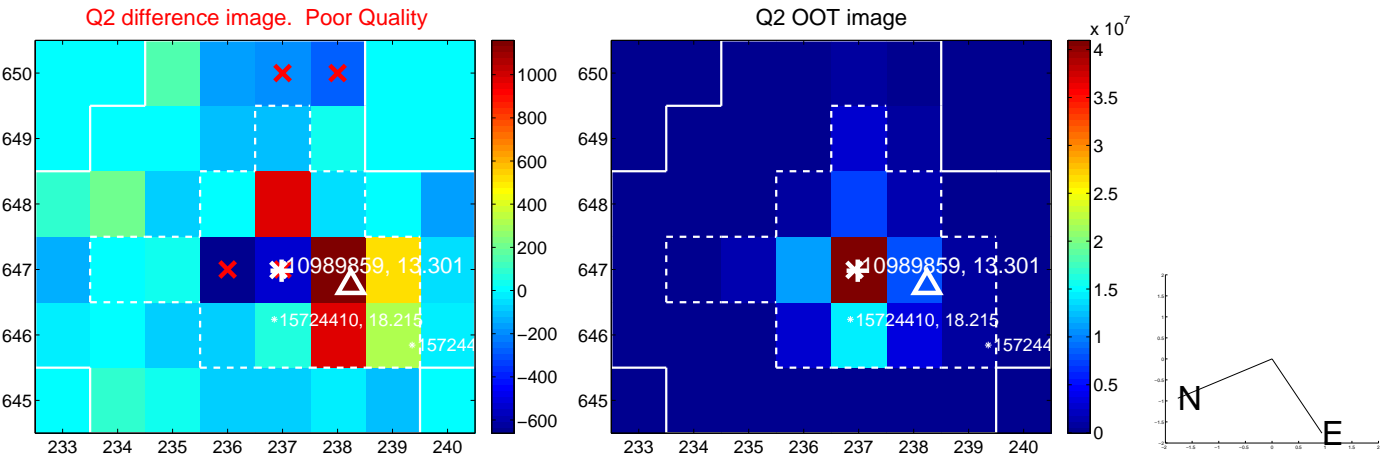
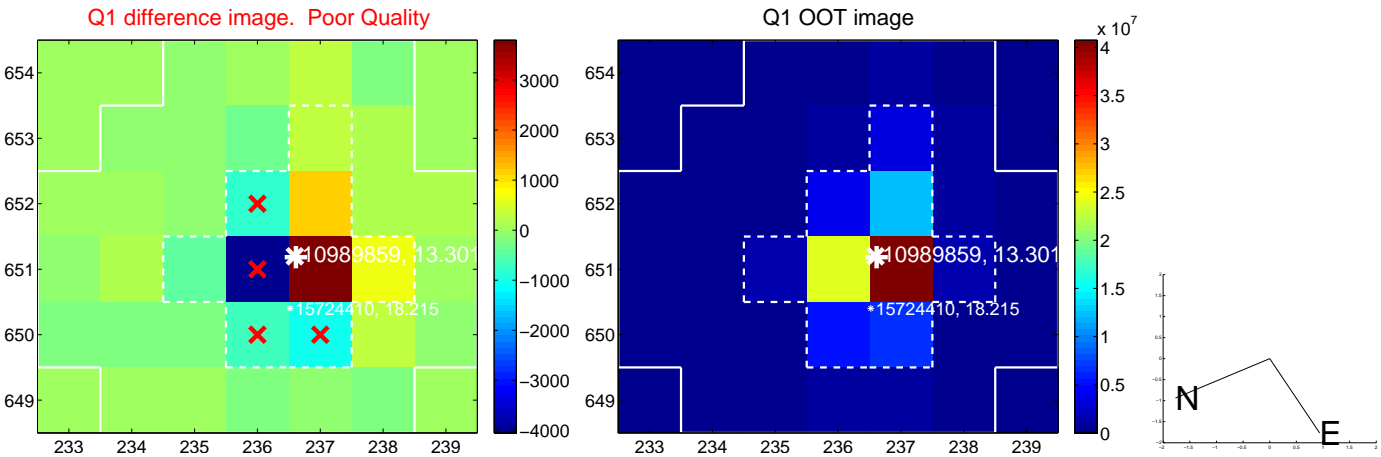


offset from photometric centroids

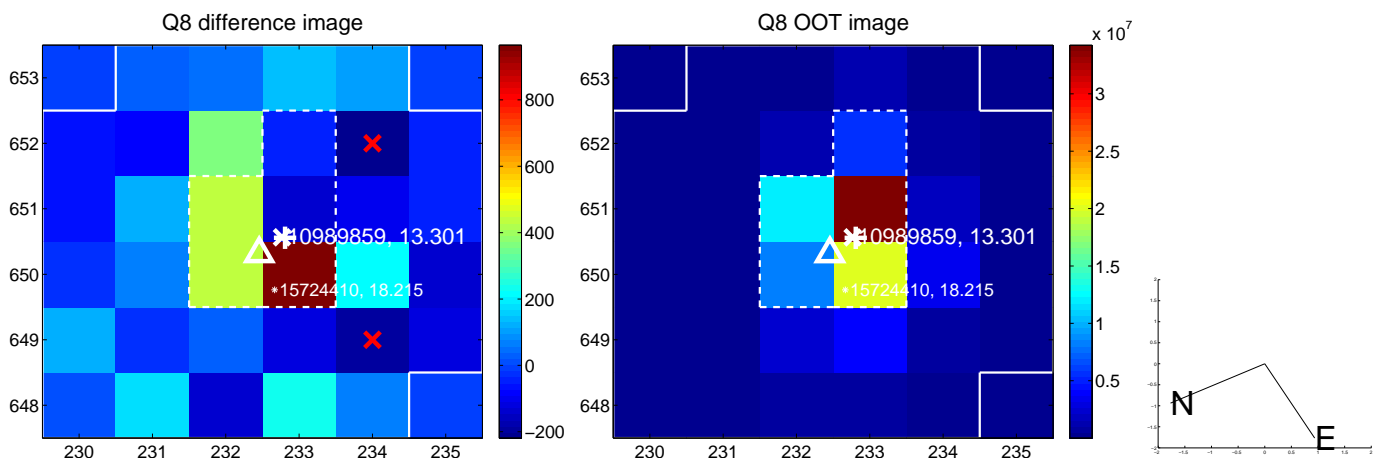
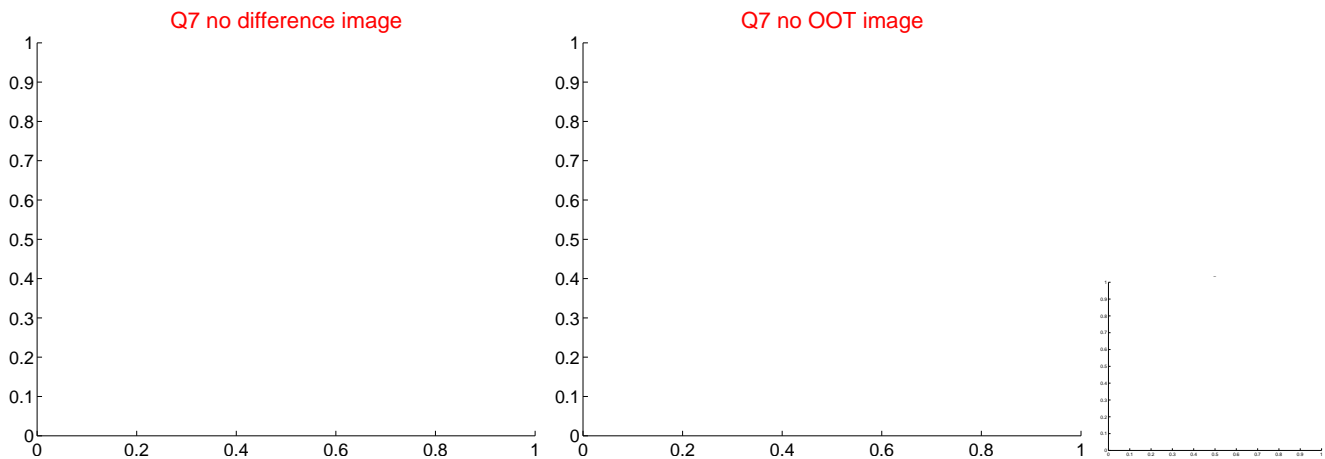
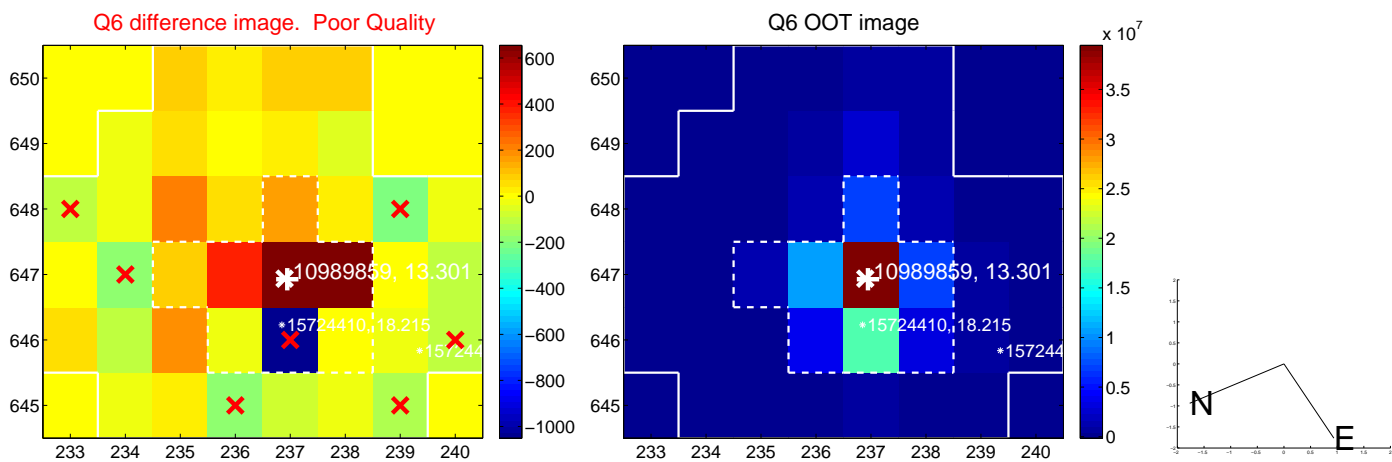
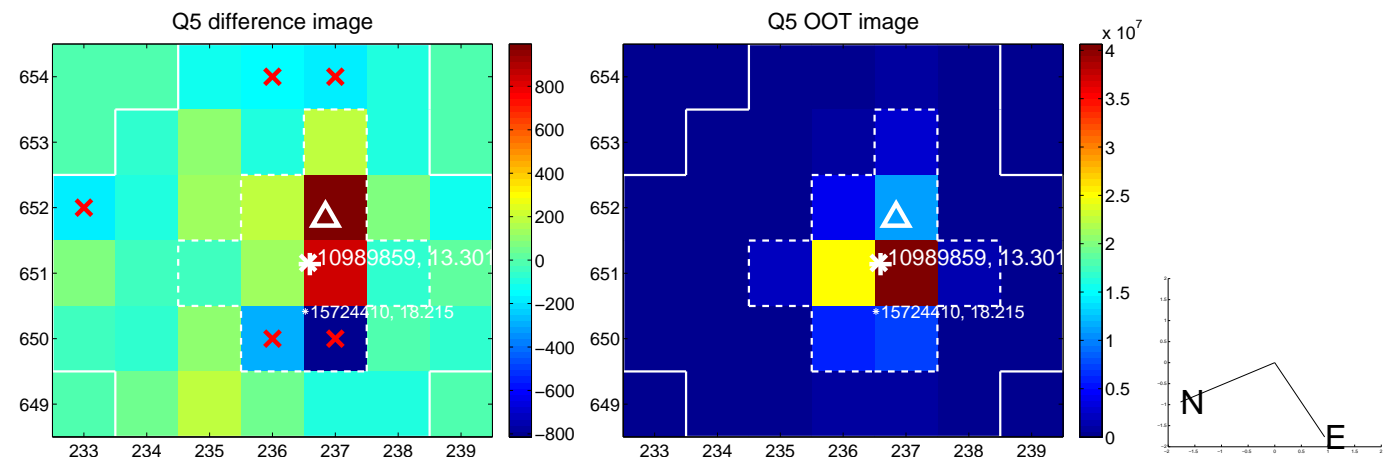


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

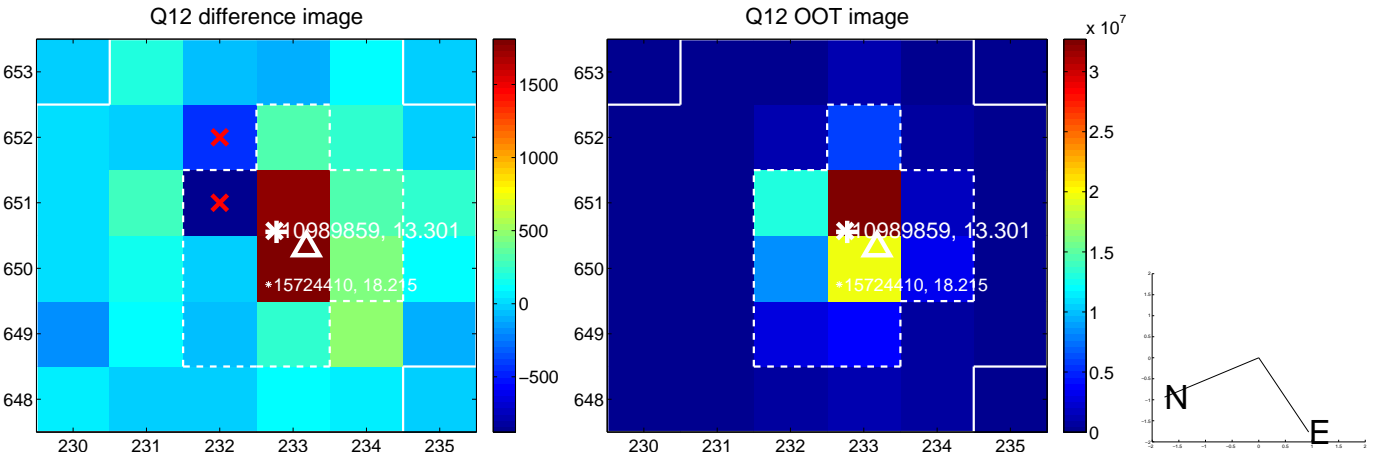
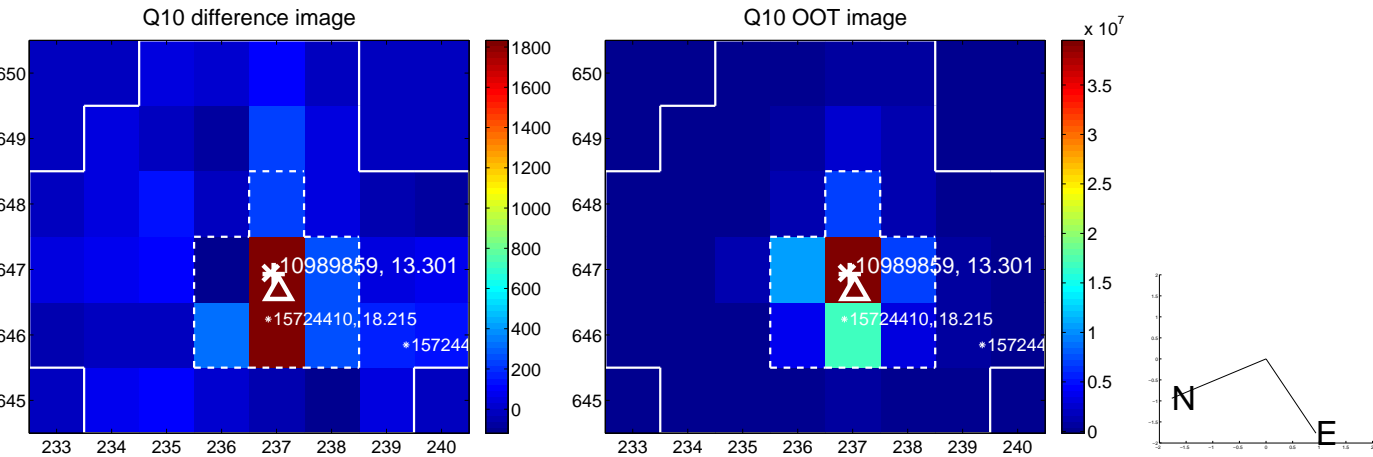
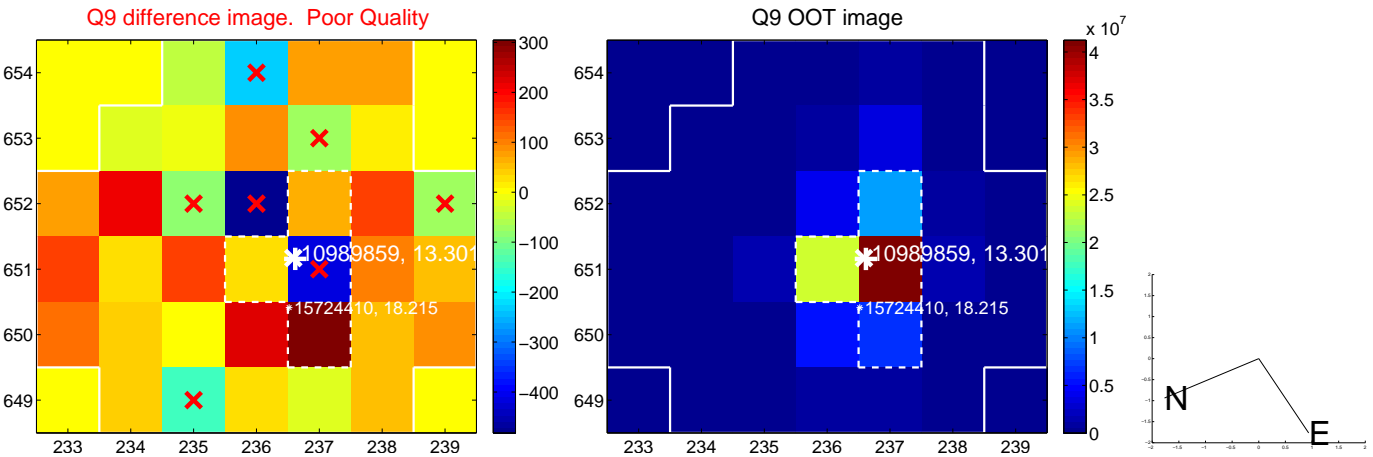


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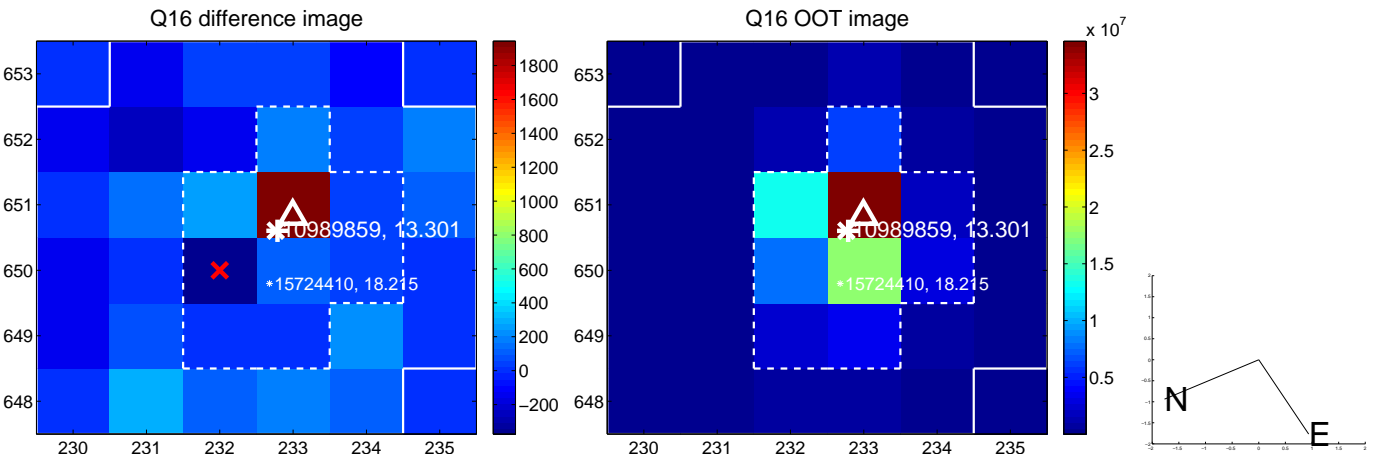
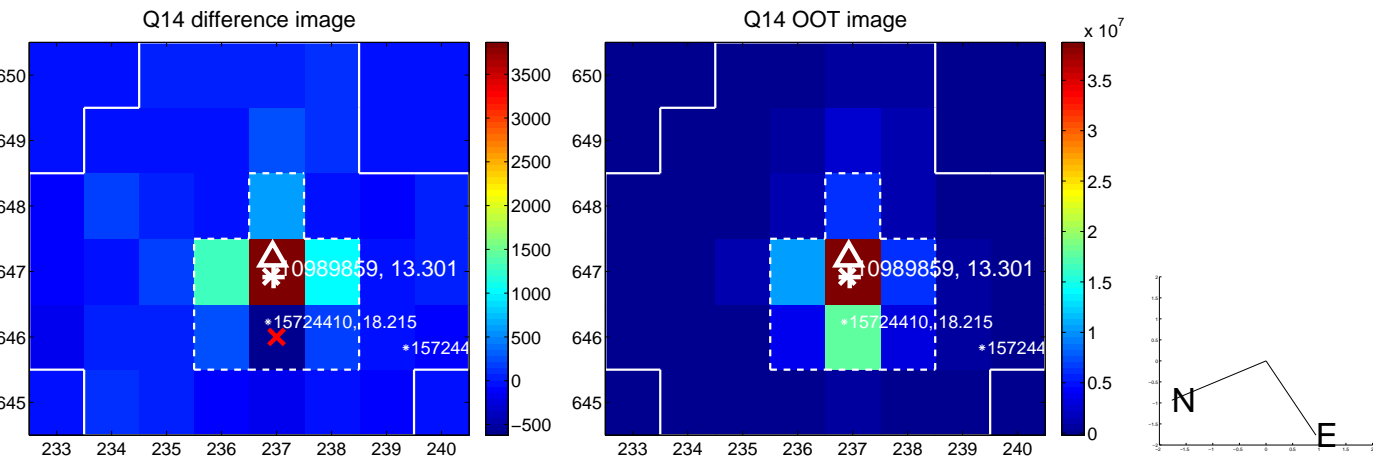
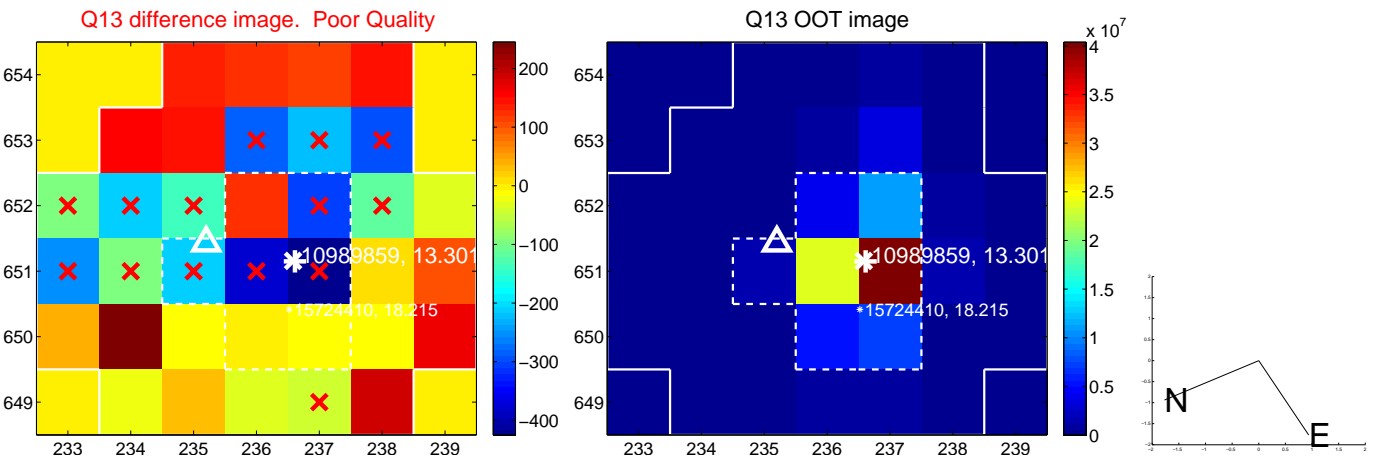




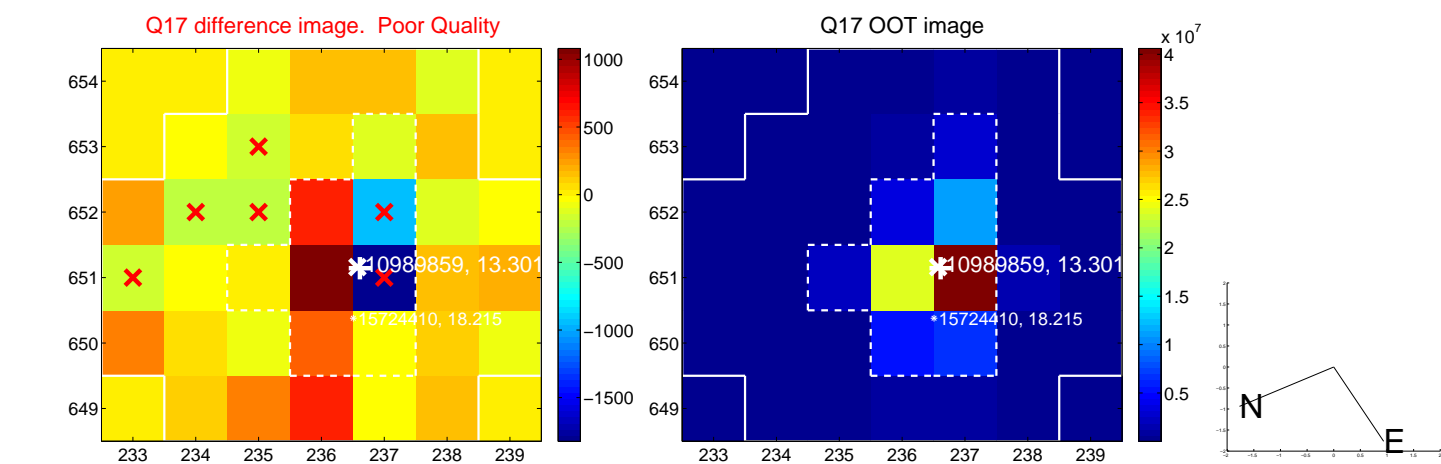
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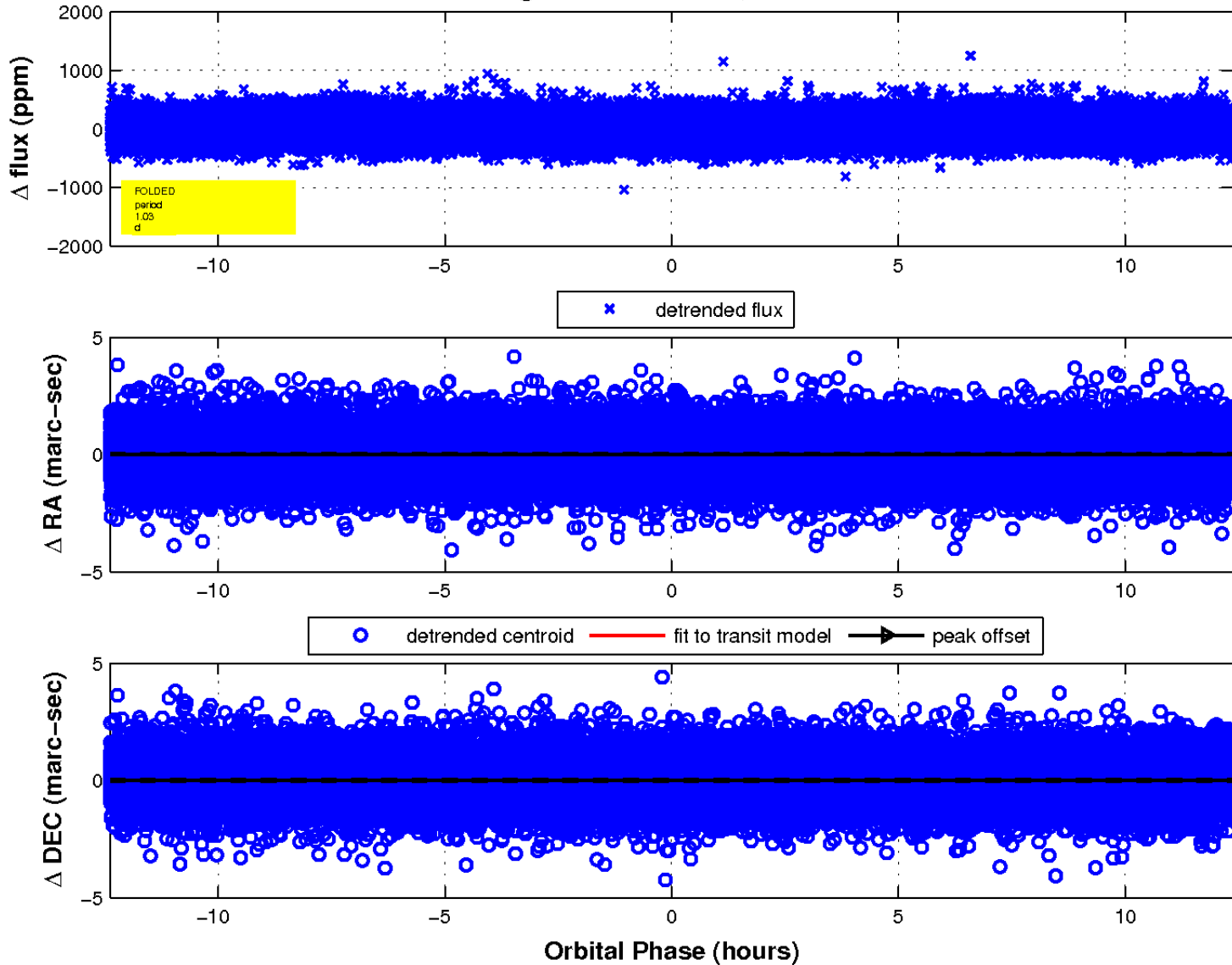
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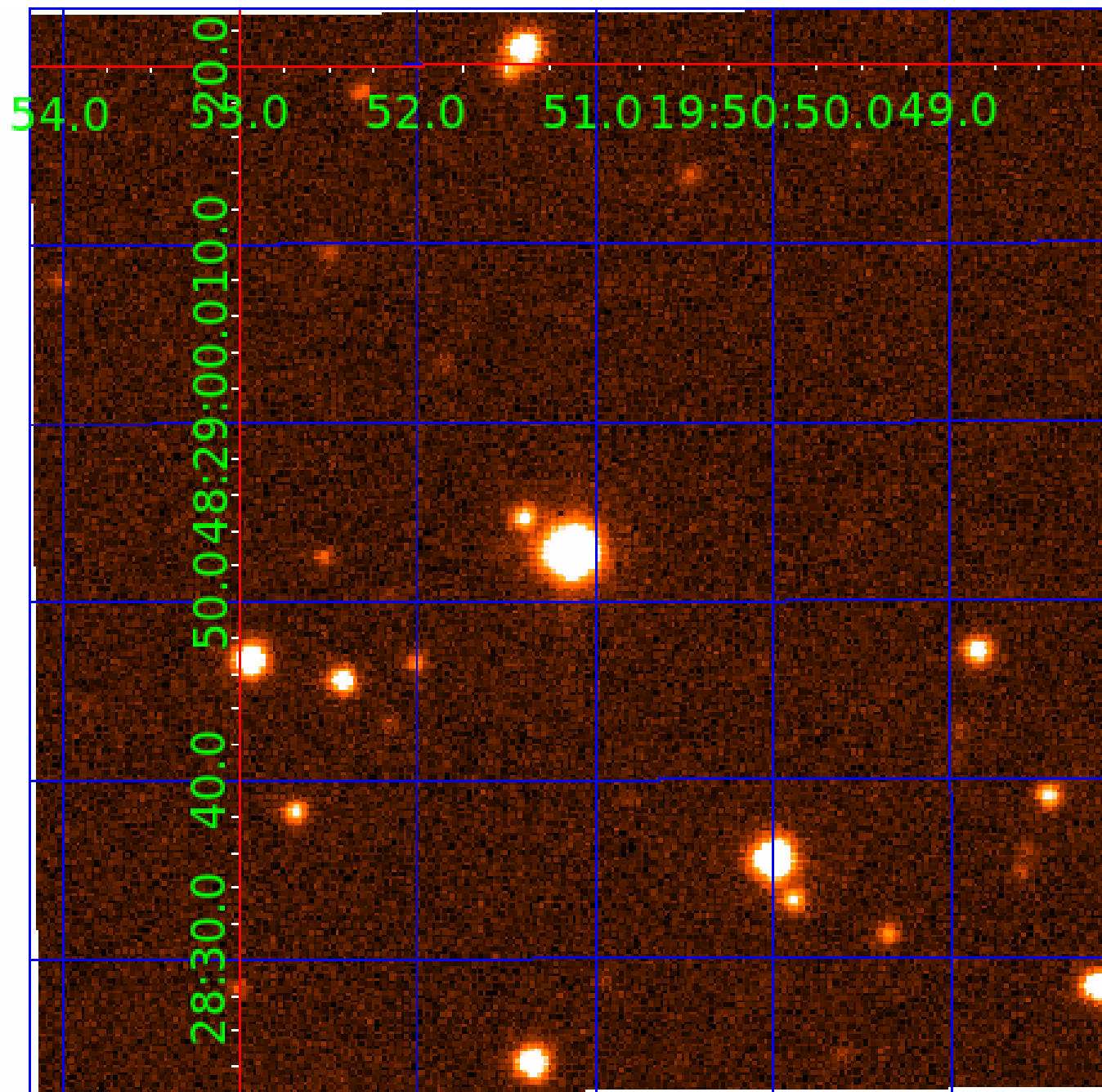


fluxWeightedCentroids, Planet 1 of 9



UKIRT Image

Declination





# KIC 010989859

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

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

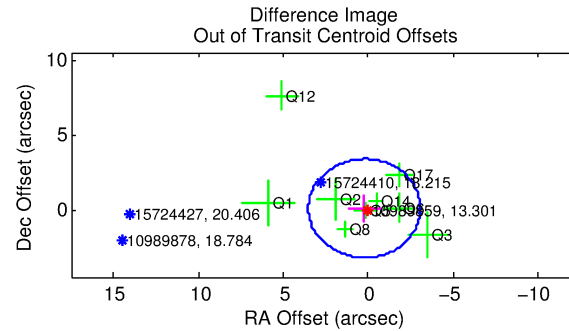
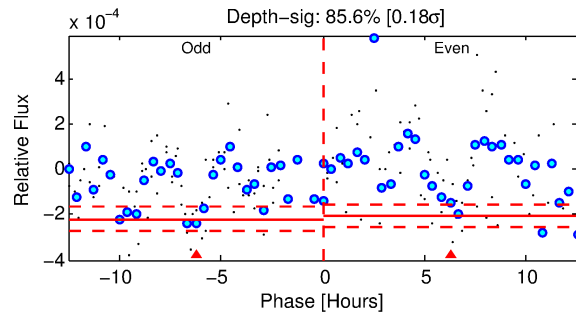
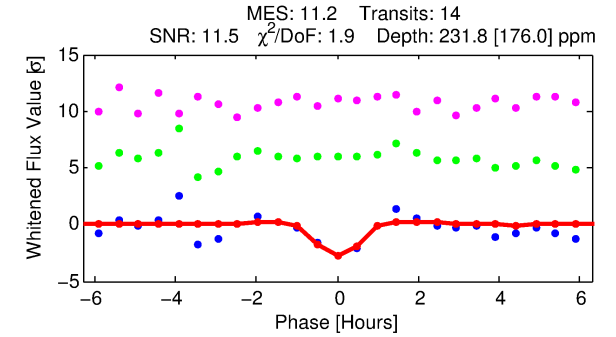
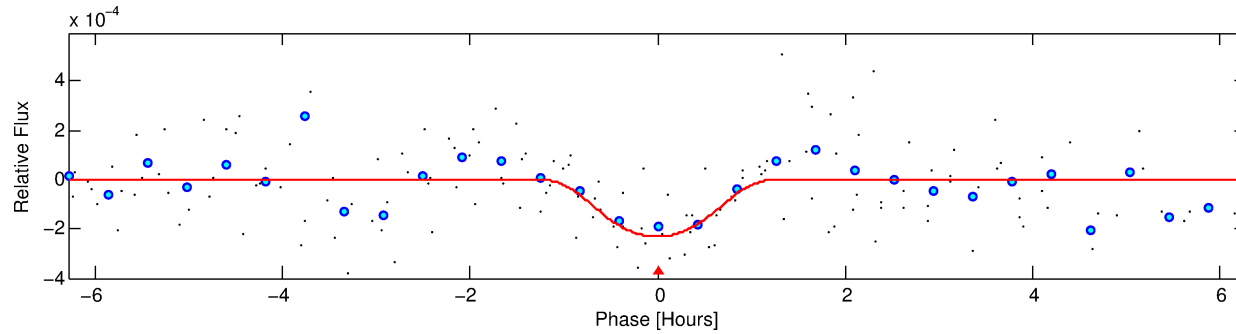
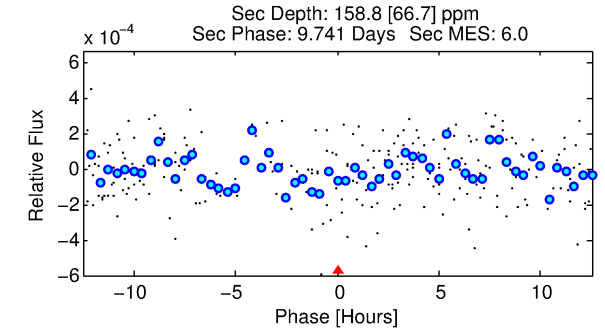
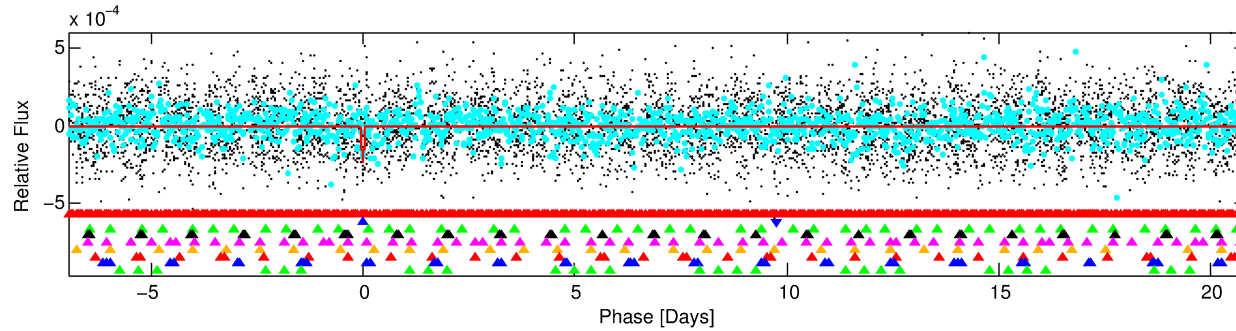
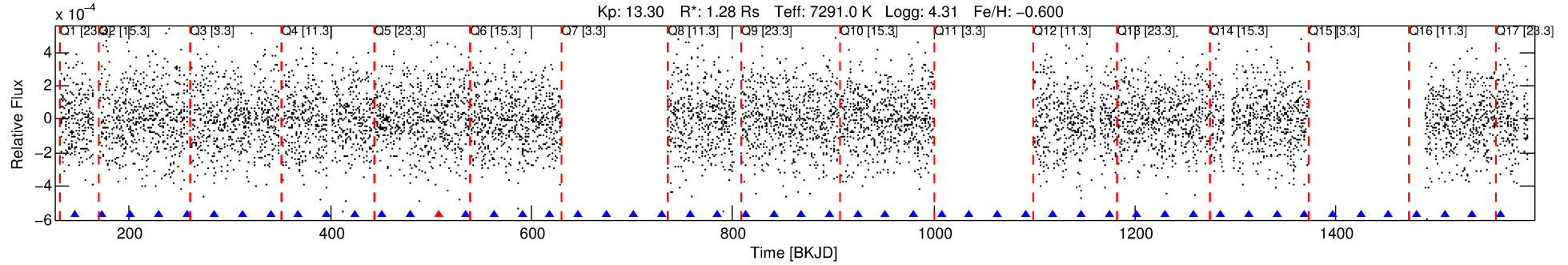
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 010989859-02

No Significant Match Found

# DV One-Page Summary

KIC: 10989859 Candidate: 2 of 9 Period: 27.798 d



## DV Fit Results:

Period = 27.79771 [0.00027] d  
Epoch = 145.8351 [0.0082] BKJD  
Rp/R\* = 0.0219 [0.0807]  
a/R\* = 25.28 [38.98]  
b = 0.99 [0.16]  
Seff = 112.99 [42.55]  
Teq = 831 [78] K  
Rp = 3.05 [11.29] Re  
a = 0.1913 [0.0464] AU  
Ag = 342.73 [2531.88] [0.13σ]  
Teffp = 5531 [10205] K [0.46σ]

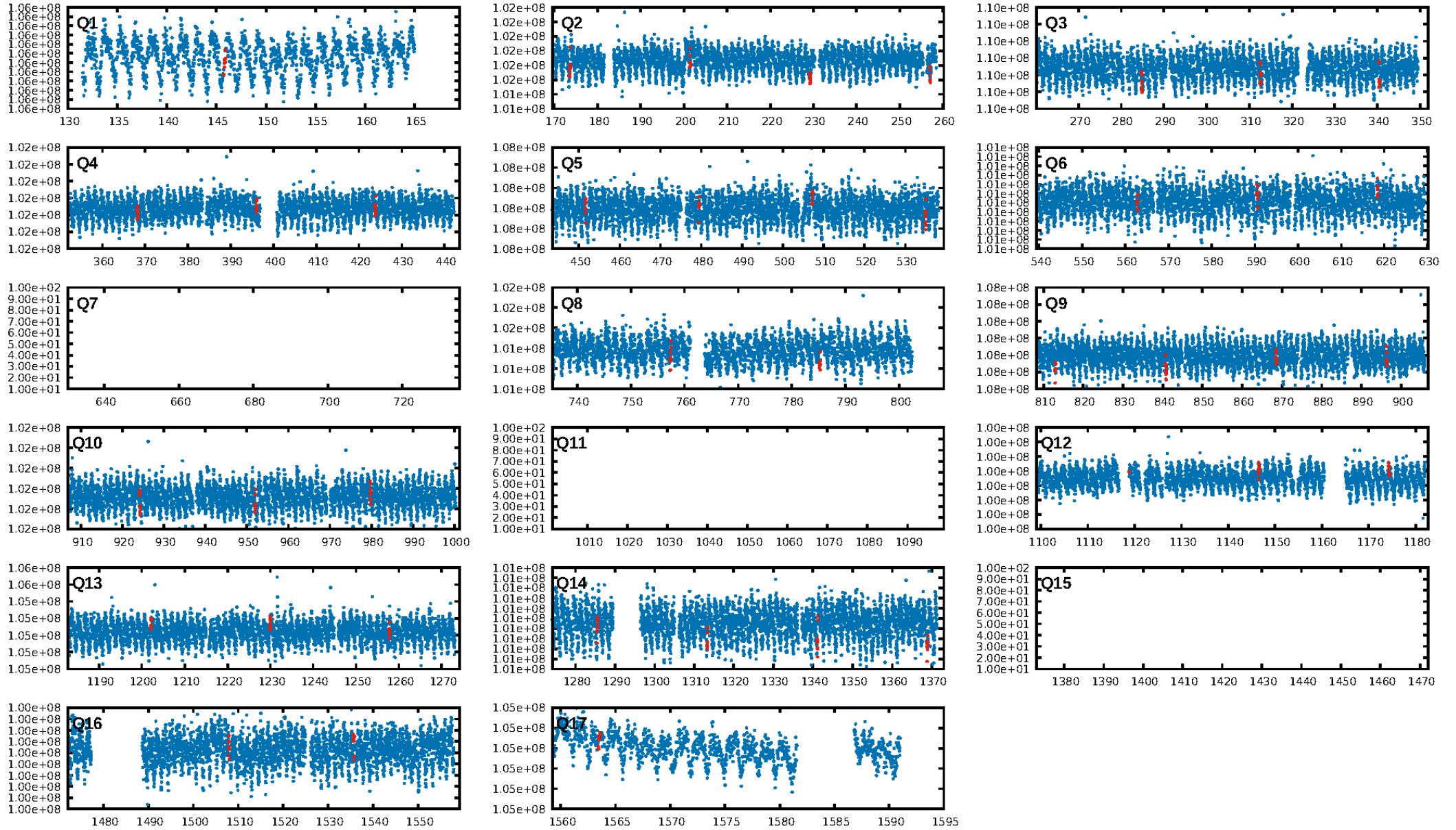
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [23.93σ]  
LongPeriod-sig: 100.0% [34.01σ]  
ModelChiSquare2-sig: 44.0%  
ModelChiSquareGof-sig: 100.0%  
**Bootstrap-pfa: 4.43e-12**  
RollingBand-fgt: 0.92 [12/13]  
GhostDiagnostic-chr: -0.3909  
Centroid-sig: 38.7%  
Centroid-so: 1.293 arcsec [1.35σ]  
OotOffset-rm: 0.228 arcsec [0.21σ]  
OotOffset-st: 3/1/2/3 [9]  
KicOffset-rm: 0.321 arcsec [0.35σ]  
KicOffset-st: 3/1/2/3 [9]  
DiffImageQuality-fgm: 0.56 [5/9]  
DiffImageOverlap-fno: 0.43 [6/14]

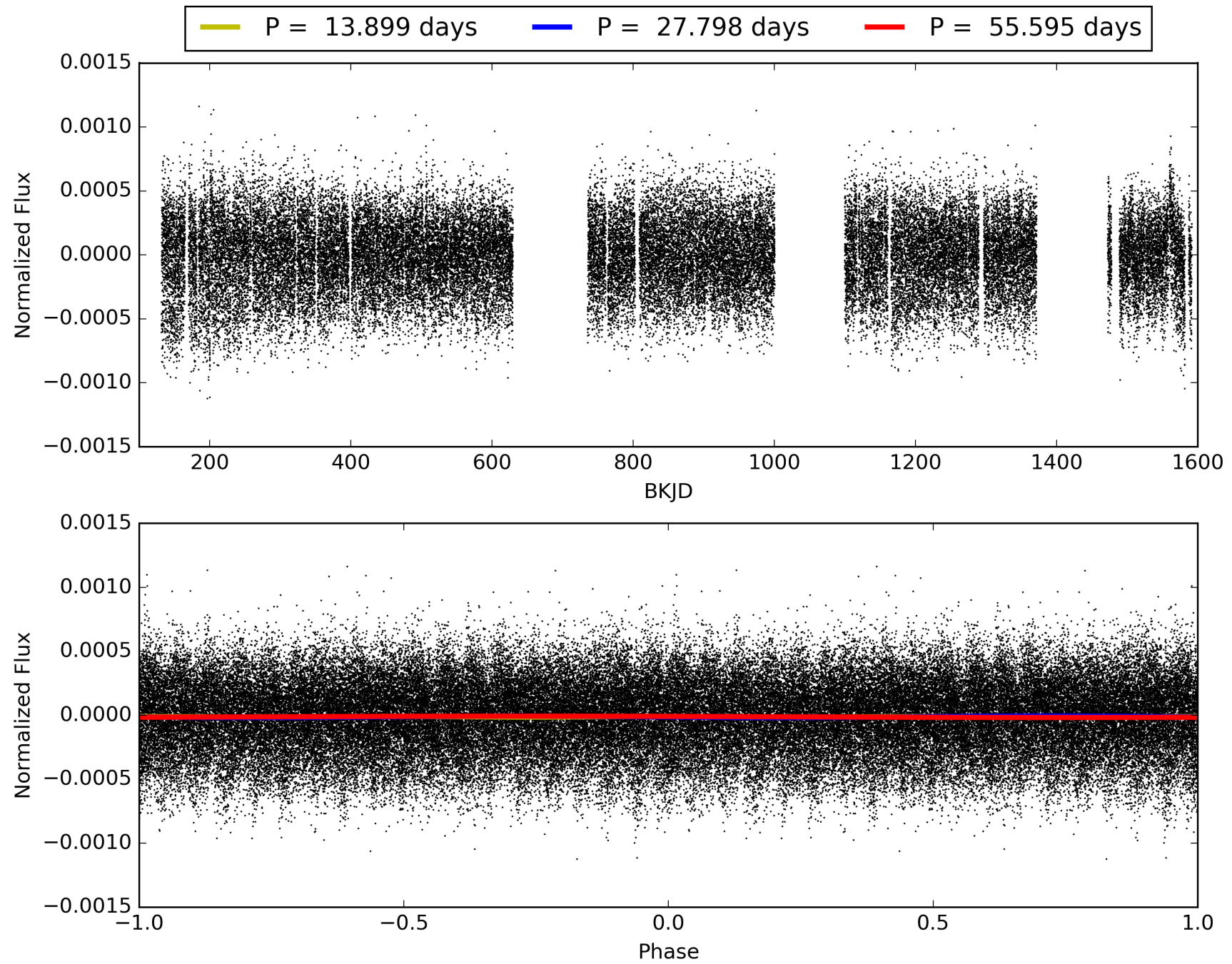
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 09:38:12 Z

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

# TCE 010989859-02, PDC Light Curves

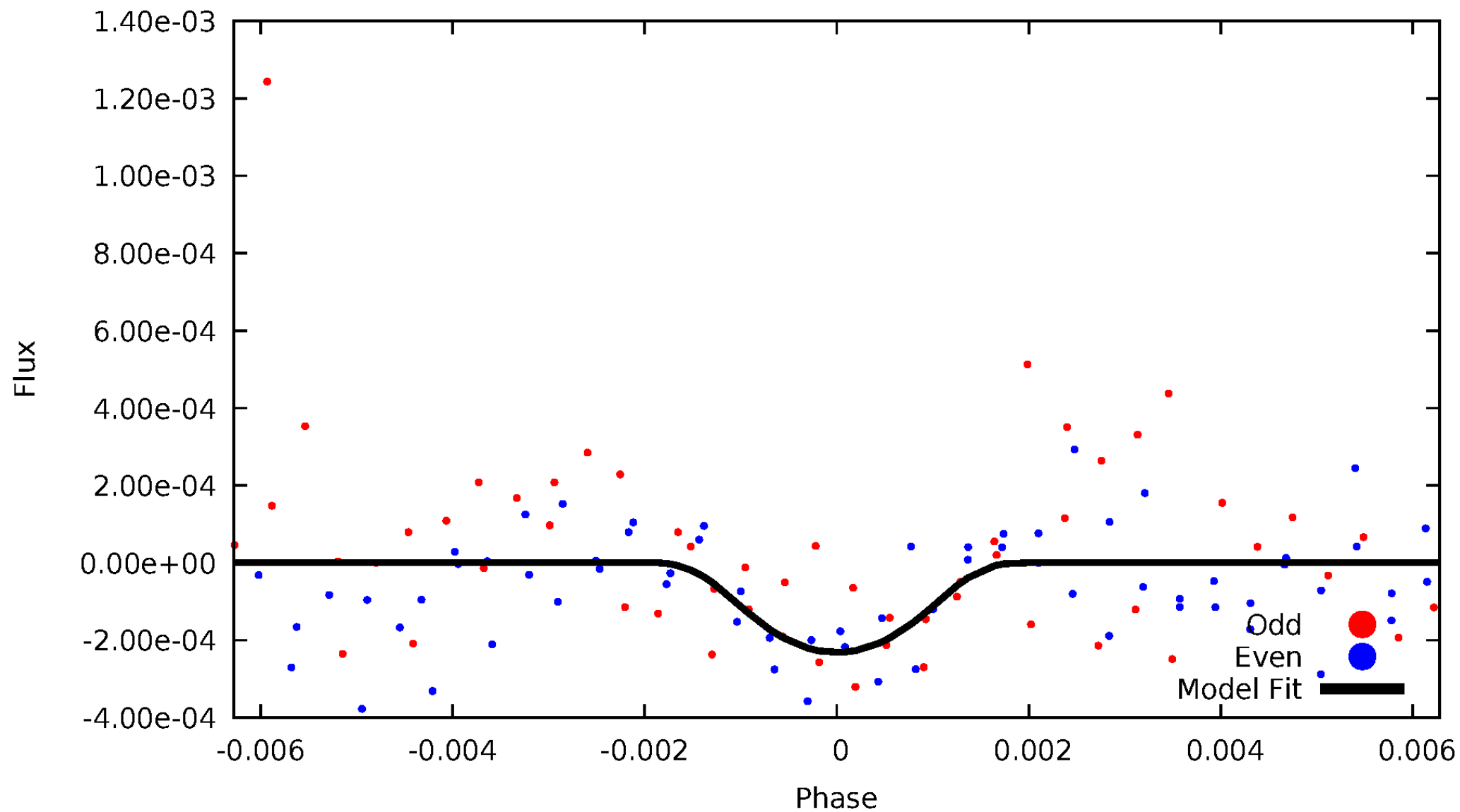


TCE 010989859-02



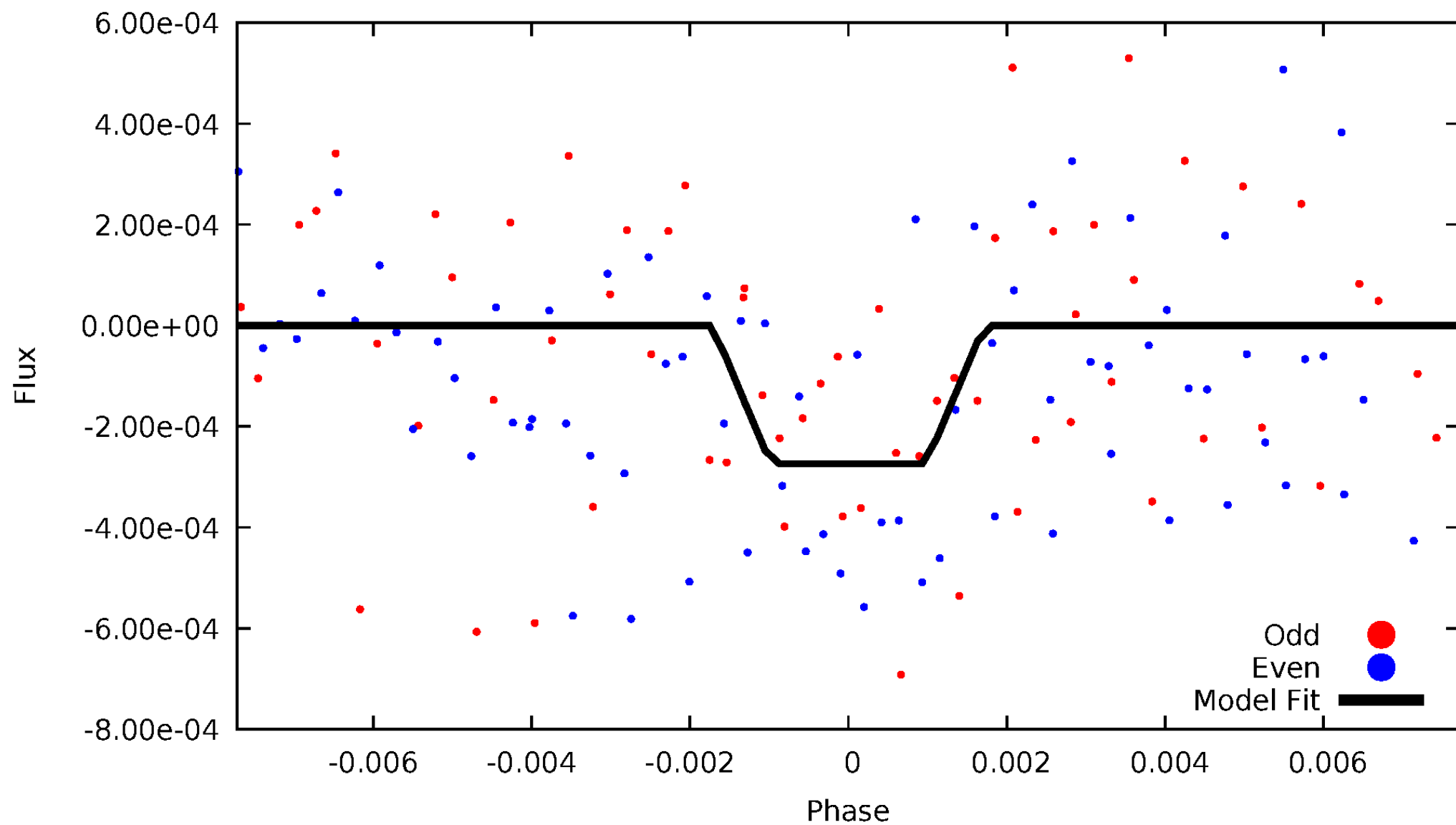
# DV Odd/Even

TCE 010989859-02



# ALT Odd/Even

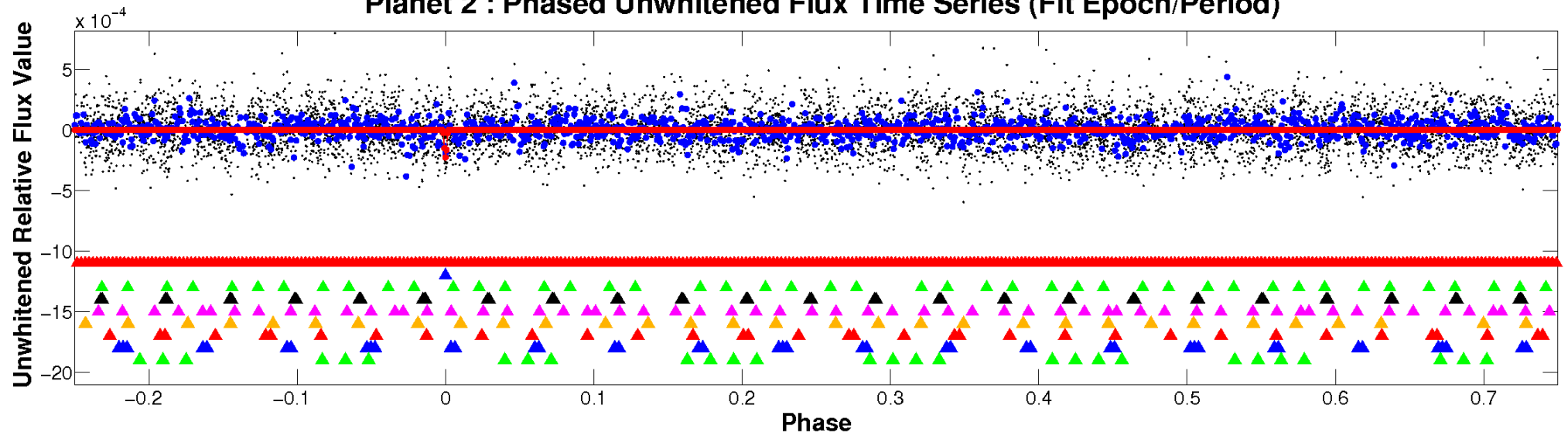
TCE 010989859-02



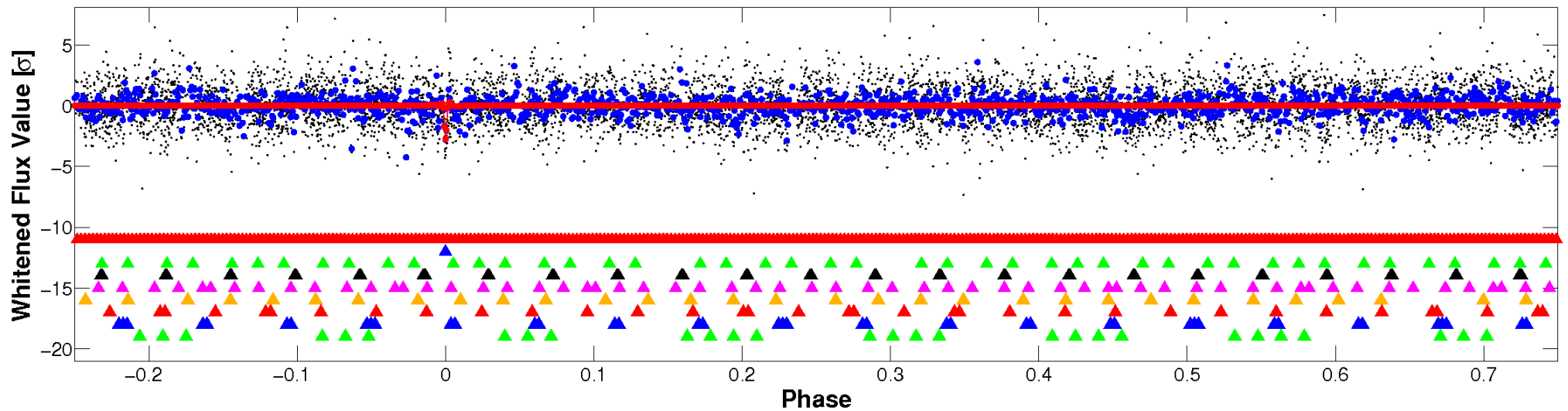


# Non-Whitened Vs. Whitened Light Curve

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

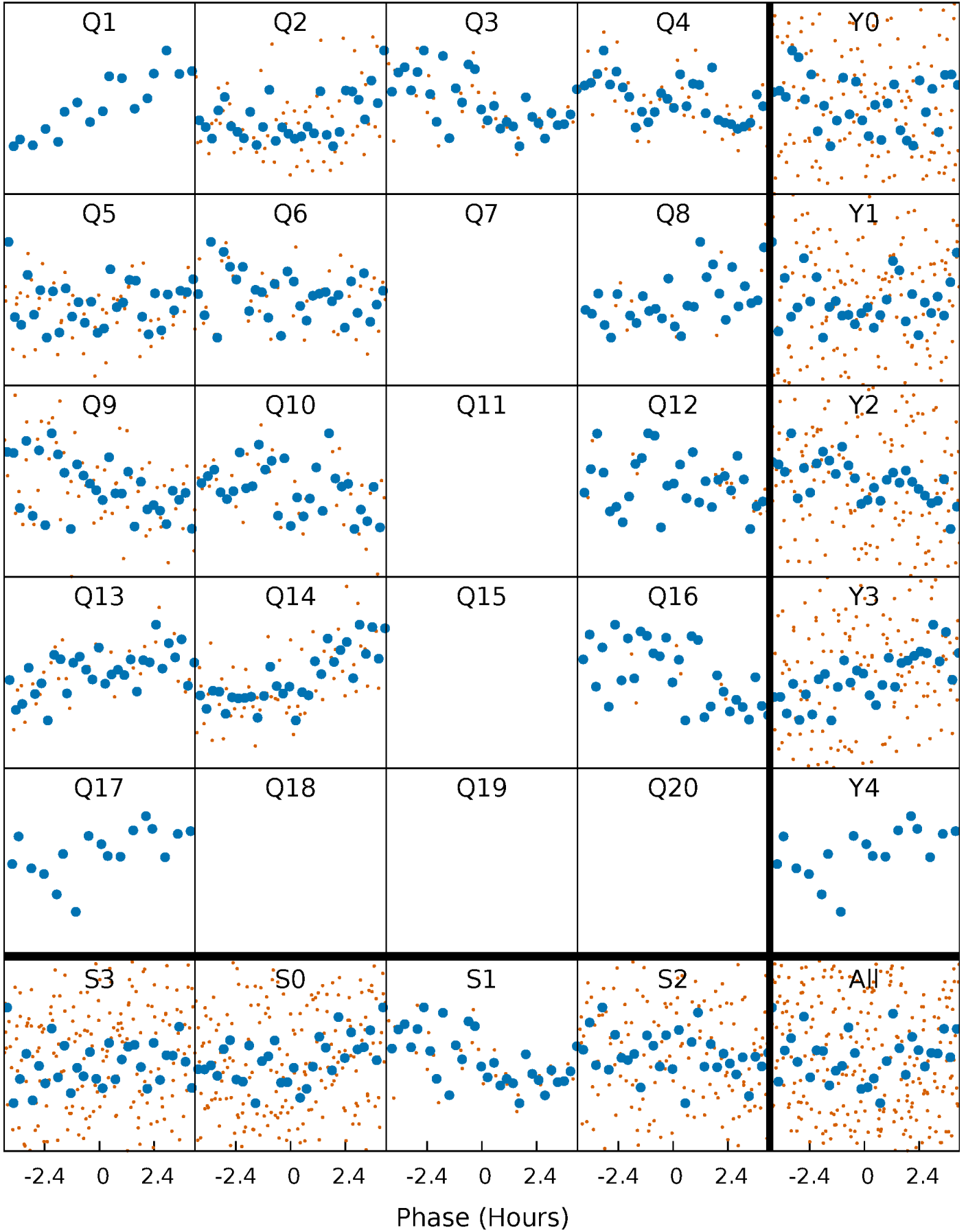


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



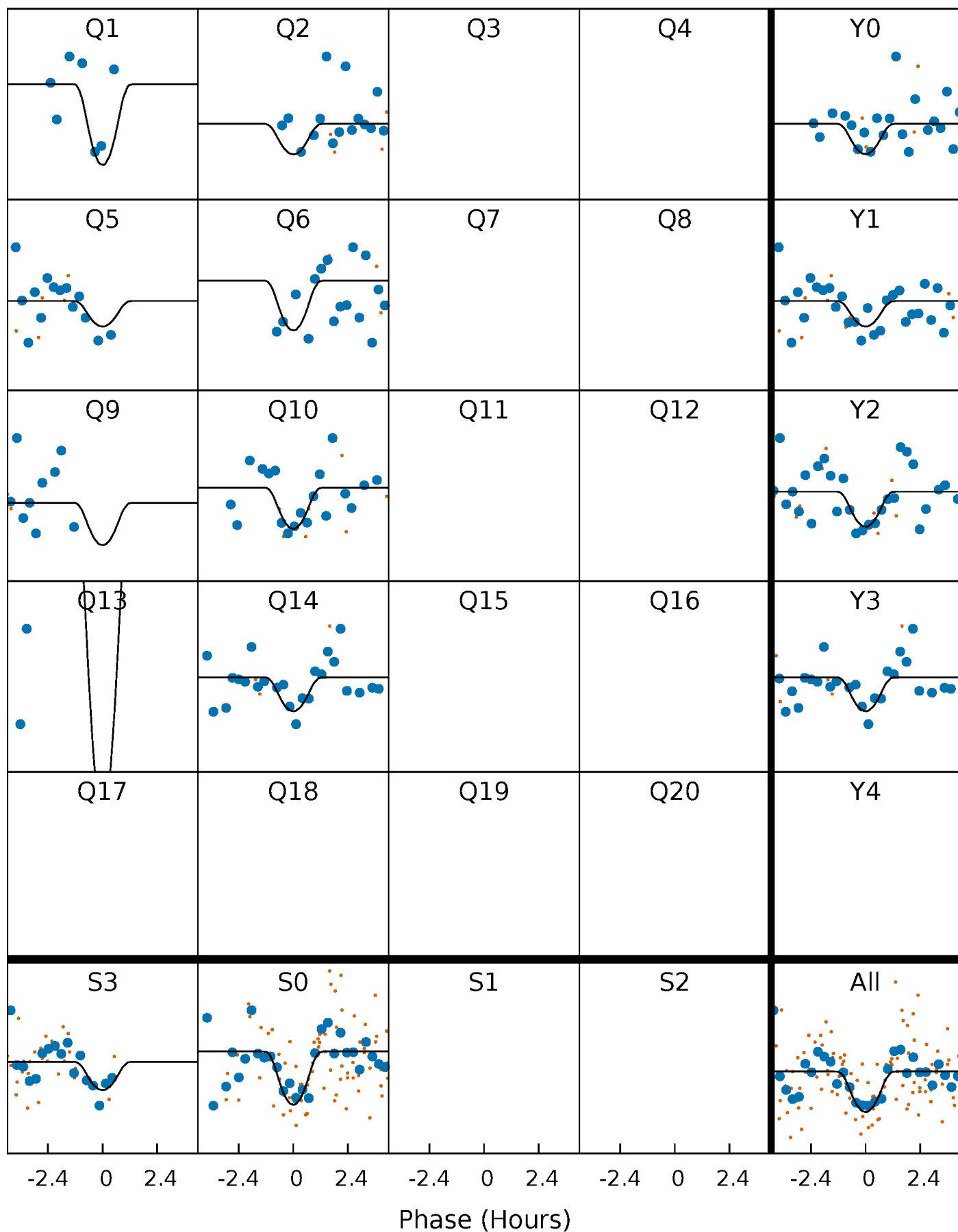
# PDC Quarter-Phased Transit Curves

TCE 010989859-02     $P = 27.797714$  Days     $T_0 = 145.835134$  (BKJD)



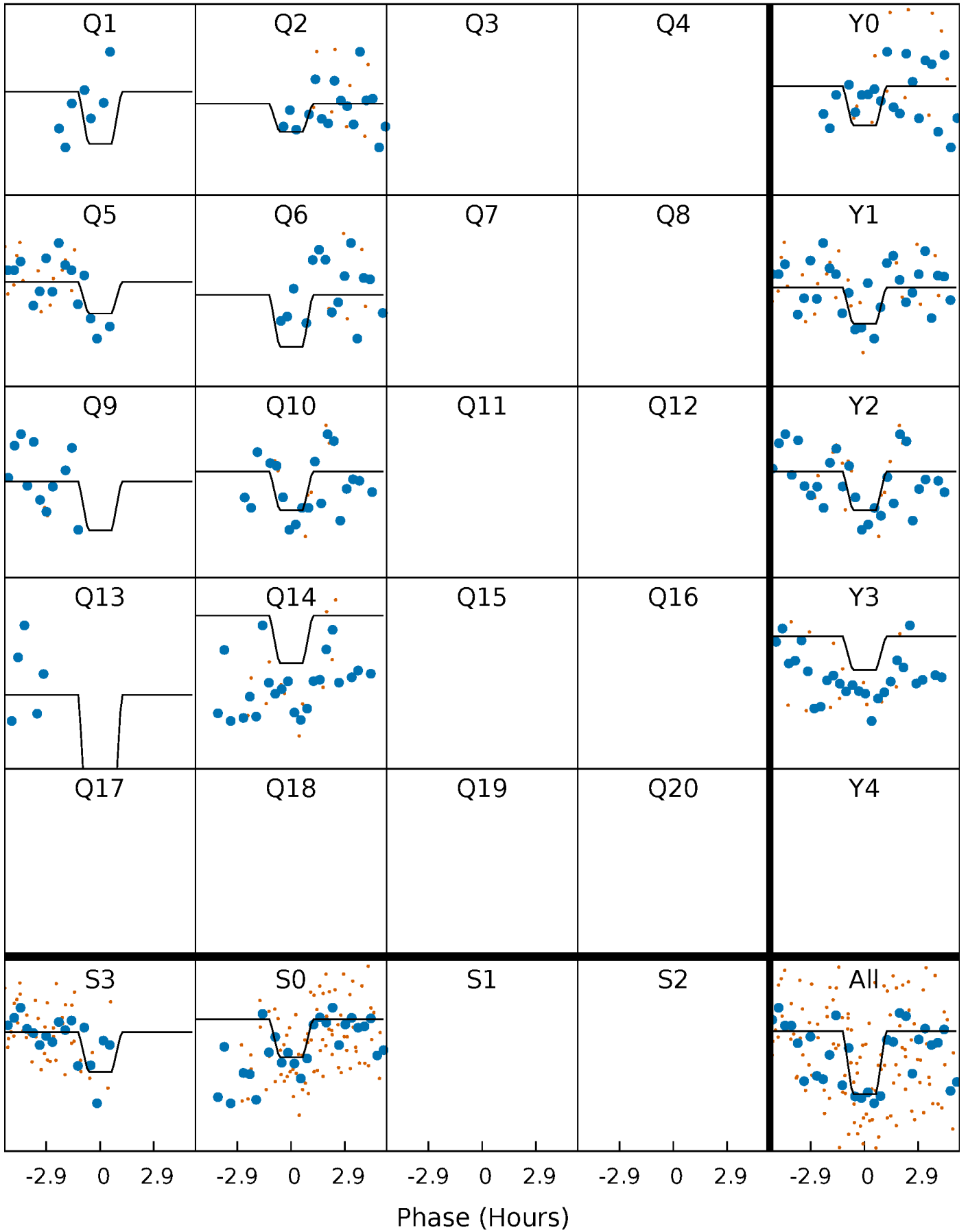
# DV Quarter-Phased Transit Curves

TCE 010989859-02     $P = 27.797714$  Days     $T_0 = 145.835134$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

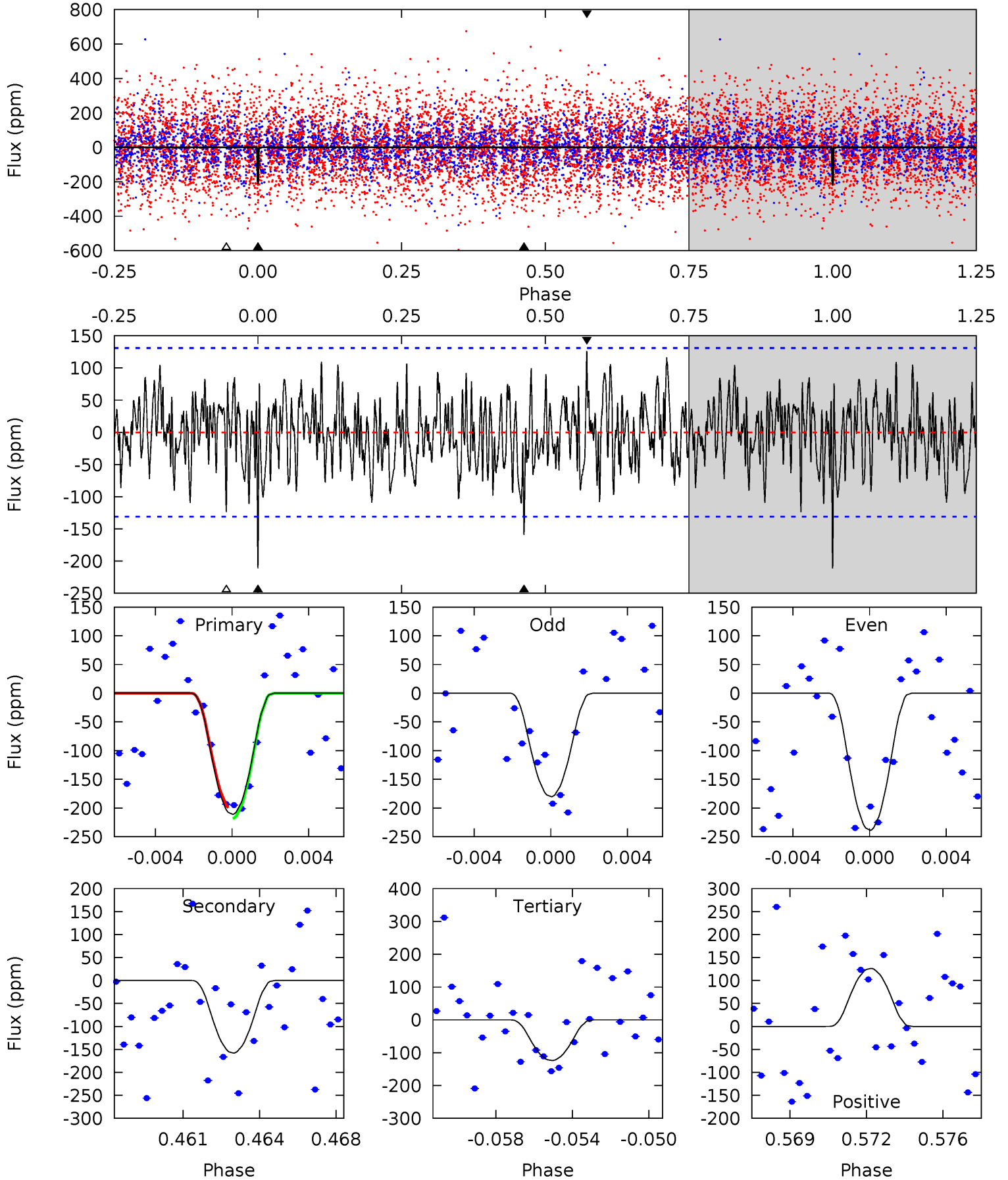
TCE 010989859-02     $P = 27.797459$  Days     $T_0 = 145.833049$  (BKJD)



# DV Model-Shift Uniqueness Test

010989859-02, P = 27.797714 Days, E = 118.037420 Days

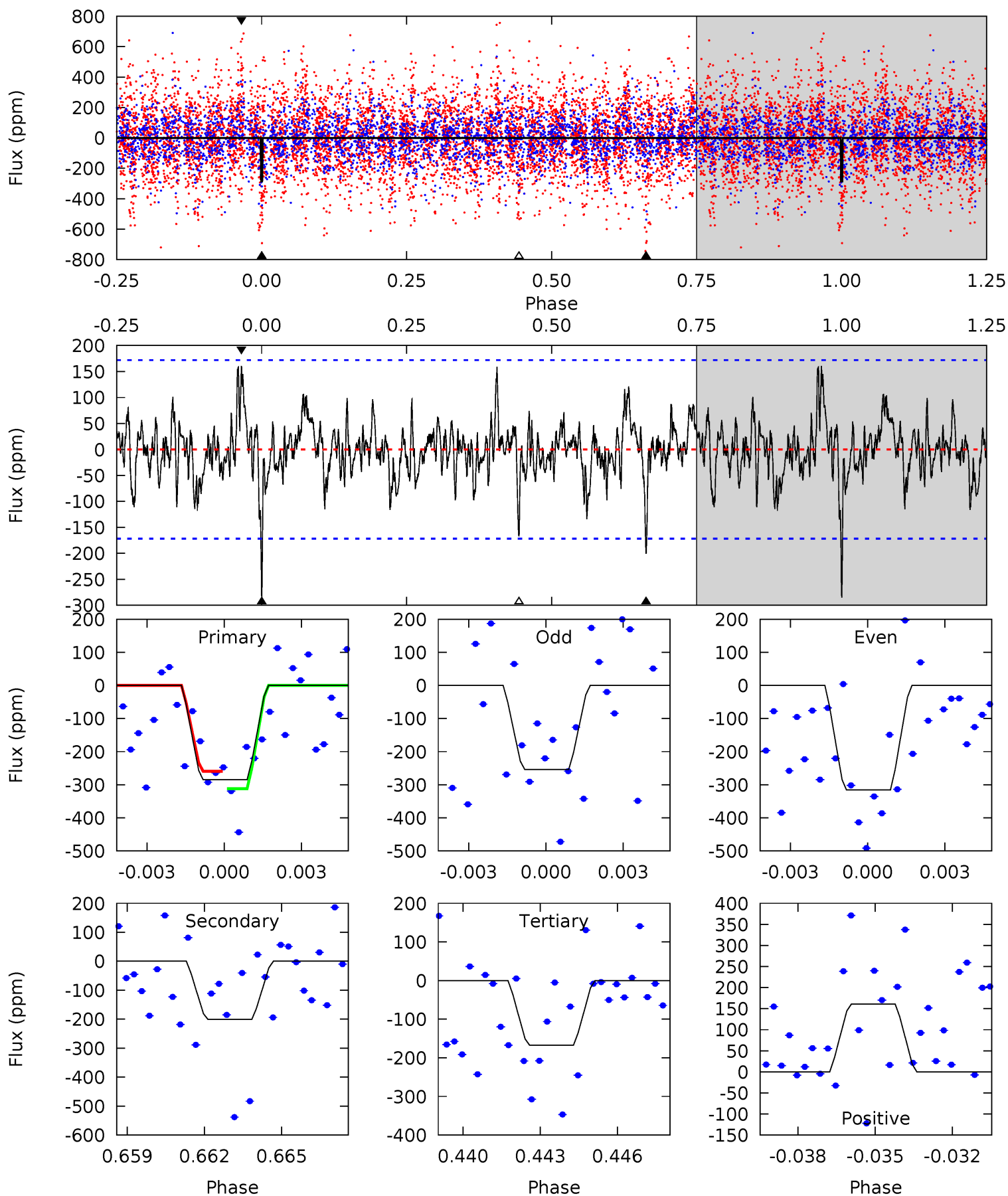
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
8.41	6.30	4.94	5.03	5.22	2.91	1.73	3.48	3.38	1.36	1.27	1.17	0.98	0.37	0.38



# Alt Model-Shift Uniqueness Test

010989859-02, P = 27.797459 Days, E = 118.035590 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
8.69	6.12	5.11	4.90	5.24	2.95	1.40	3.58	3.79	1.01	1.22	0.94	1.01	0.36	0.81





### Stellar Parameters For KIC 010989859

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$7291^{+207}_{-285}$	$4.307^{+0.084}_{-0.182}$	$-0.600^{+0.250}_{-0.300}$	$1.278^{+0.380}_{-0.163}$	$1.208^{+0.166}_{-0.136}$	$0.815^{+0.355}_{-0.399}$
	+3%/-4%	+2%/-4%	+42%/-50%	+30%/-13%	+14%/-11%	+44%/-49%
Source	PHO1	KIC0	KIC0	DSEP		

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

### Secondary Eclipse Parameters for KIC 010989859-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-158 \pm 25$	$8.83^{+10.81}_{-6.01}$	$1168^{+82}_{-58}$	$3680^{+2026}_{-813}$	$41^{+337}_{-33}$
Alt.	$-201 \pm 33$	$8.75^{+8.64}_{-6.17}$	$1173^{+80}_{-69}$	$3826^{+2553}_{-752}$	$51^{+569}_{-39}$

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

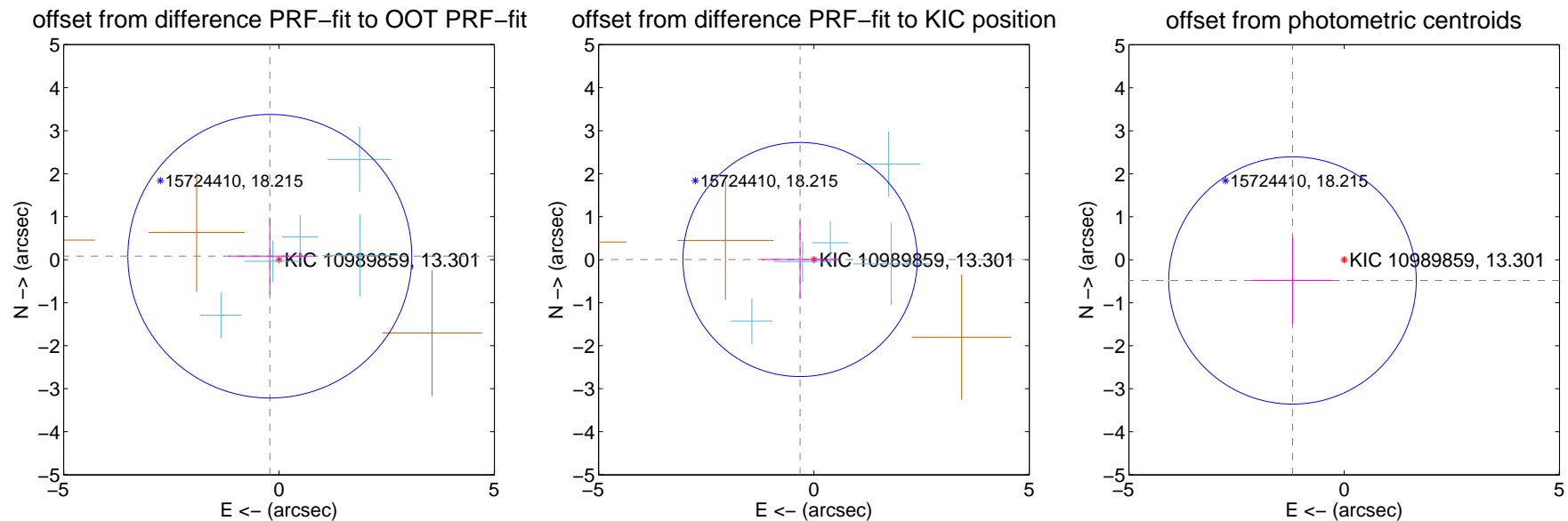
## DV Centroid Data

Supplemental centroid analysis for 010989859-02. Kepler magnitude: 13.30. Transit SNR 11.50

There are 5 quarters with good PRF difference image offsets

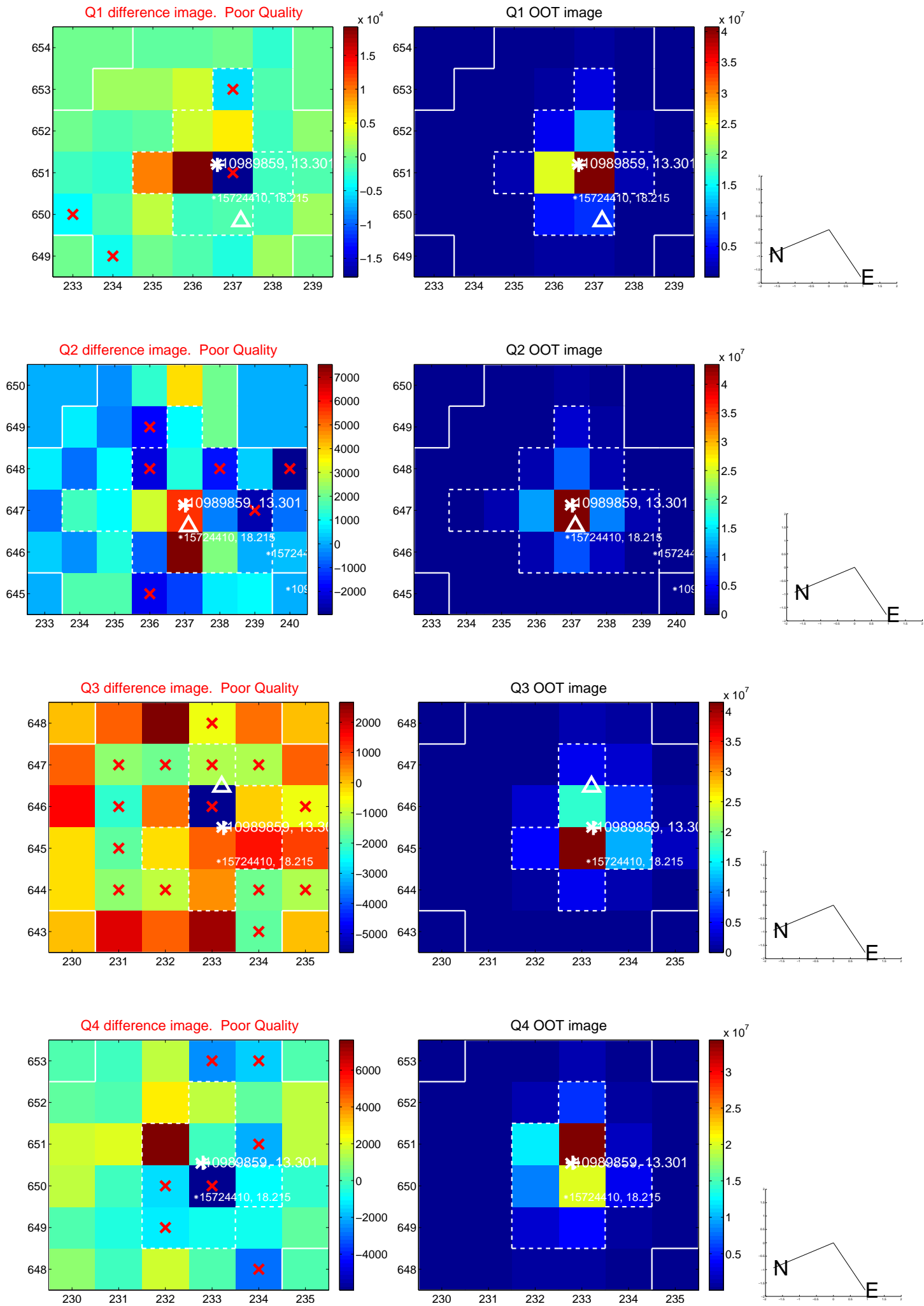
The direct PRF centroid is offset from the target star catalog position by about 0.17 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.228 \pm 1.099$	0.21	$0.213 \pm 0.963$	$0.081 \pm 0.895$
PRF-fit source offset from KIC position	$0.321 \pm 0.907$	0.35	$0.321 \pm 0.902$	$0.004 \pm 0.904$
photometric centroid source offset	$1.29 \pm 0.96$	1.35	$1.20 \pm 0.95$	$-0.48 \pm 1.01$

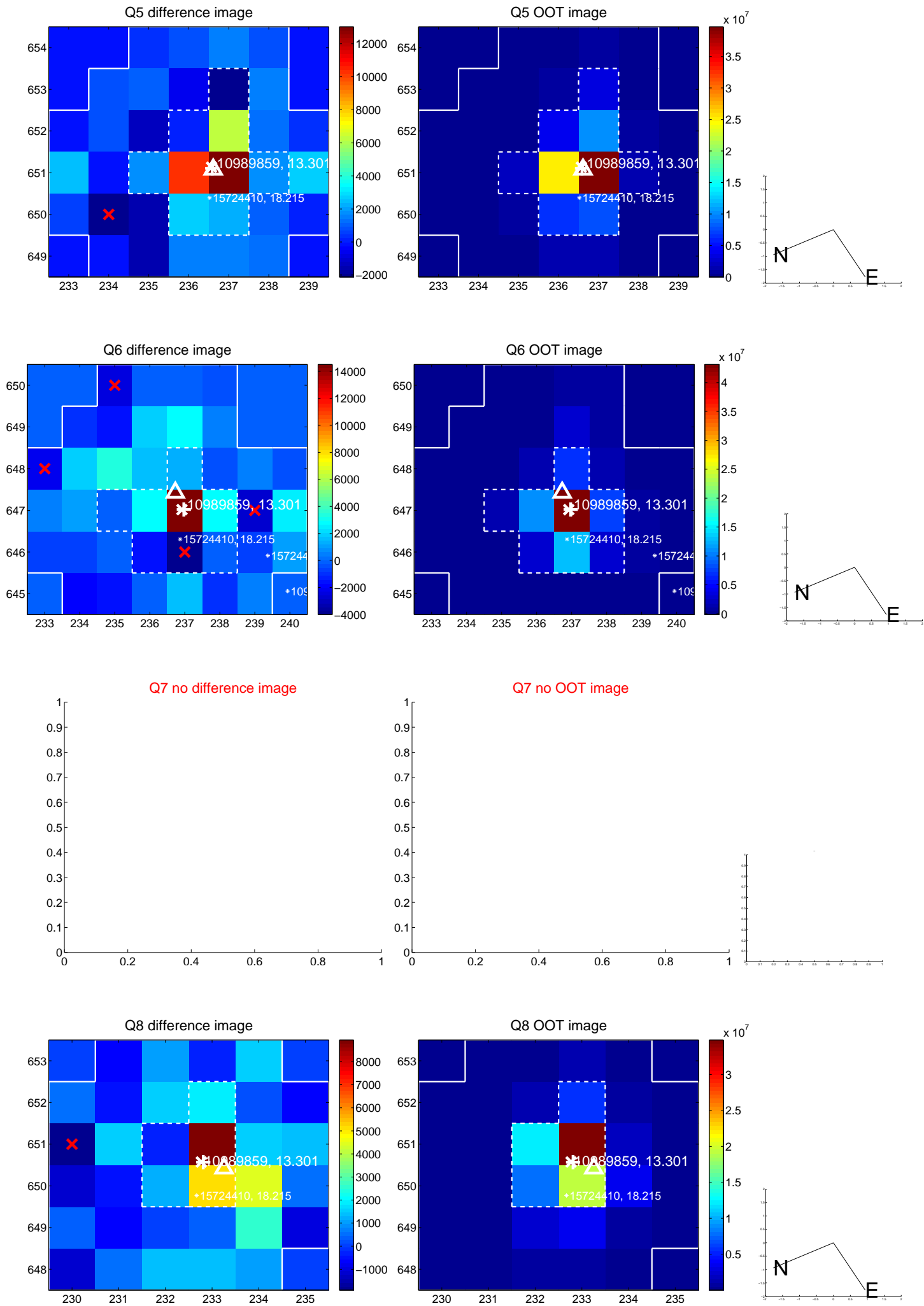


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

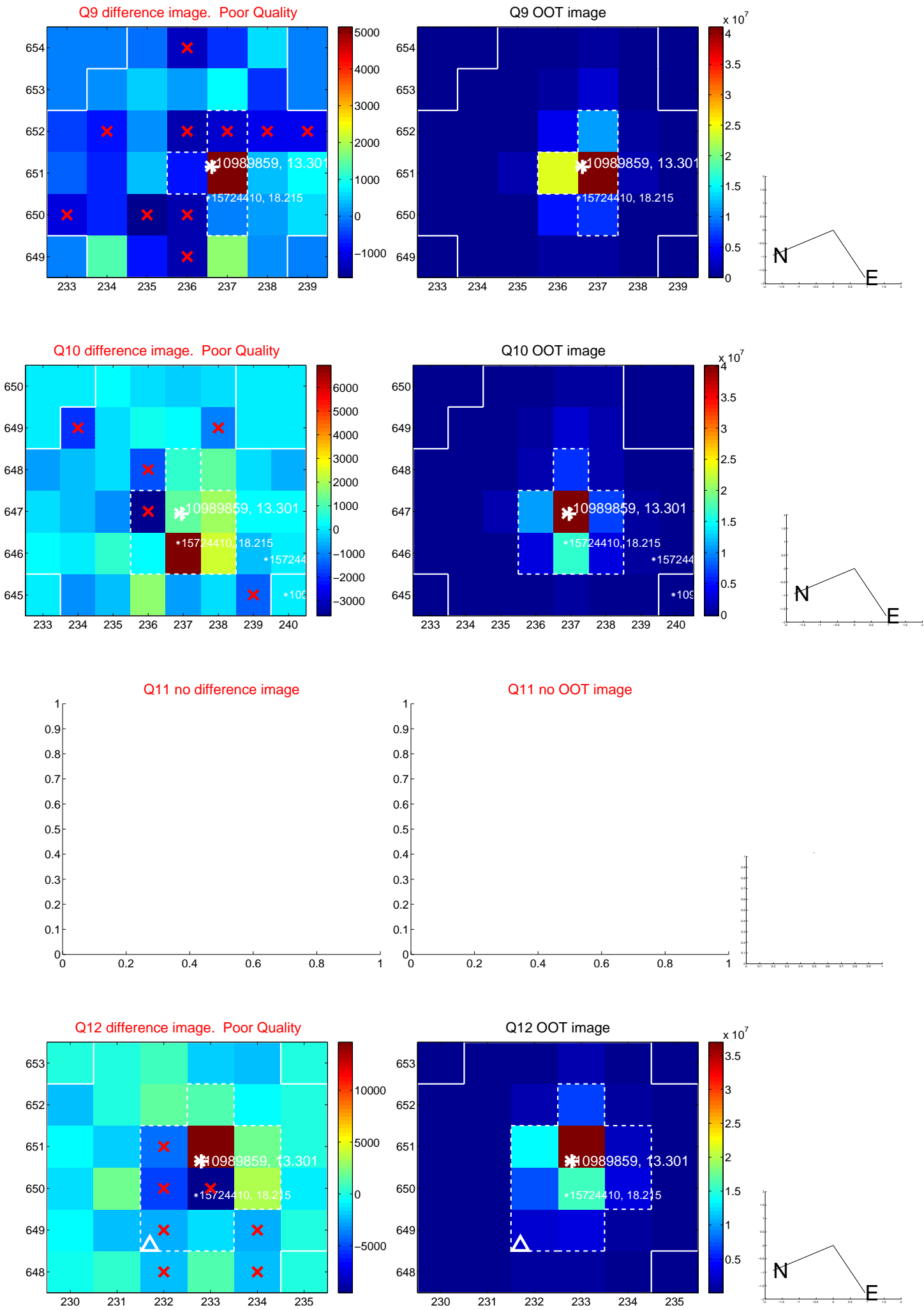
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



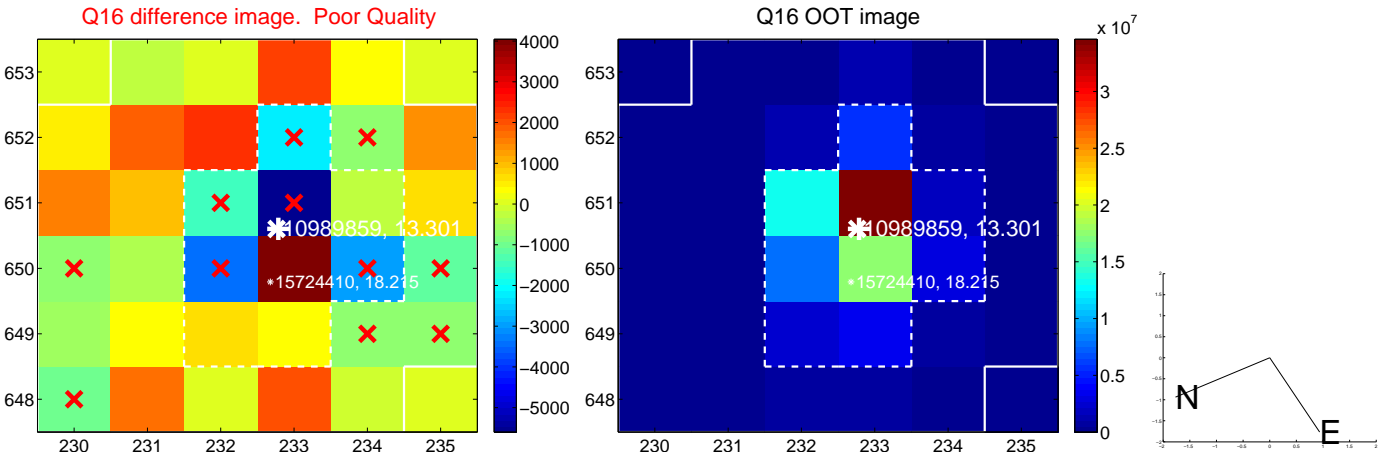
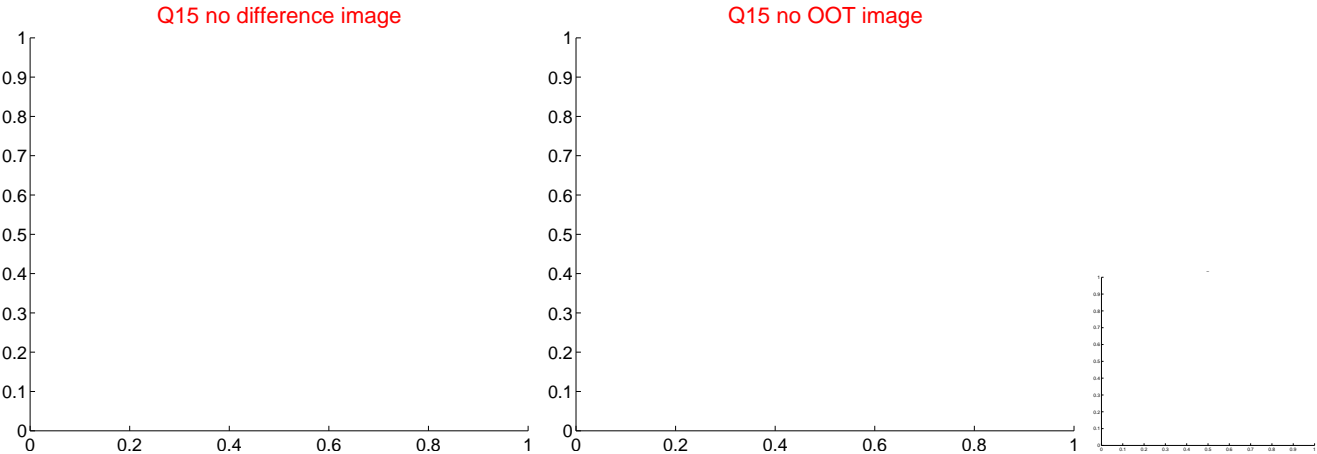
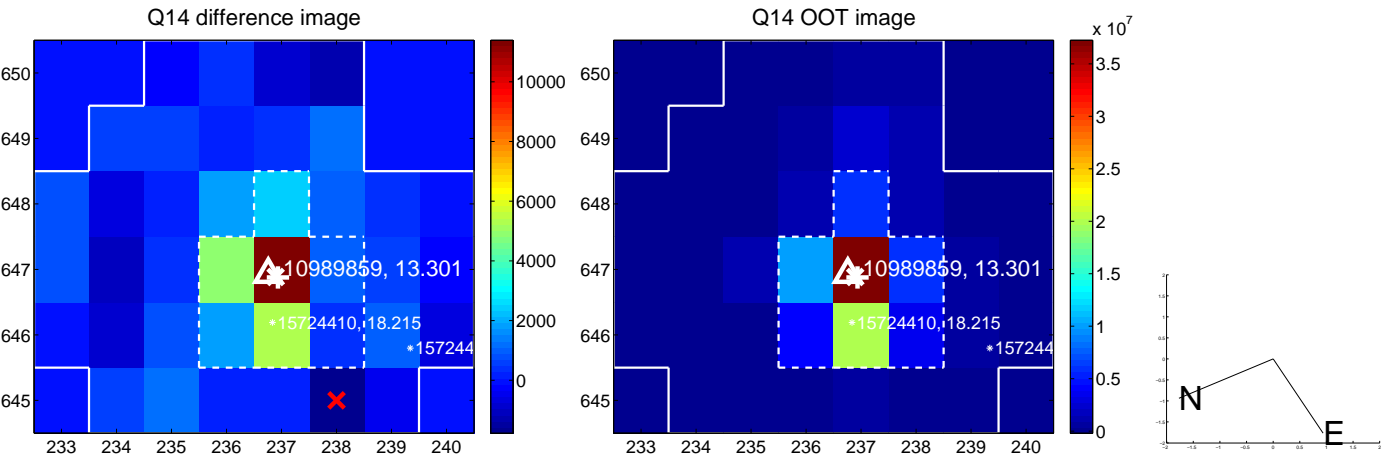
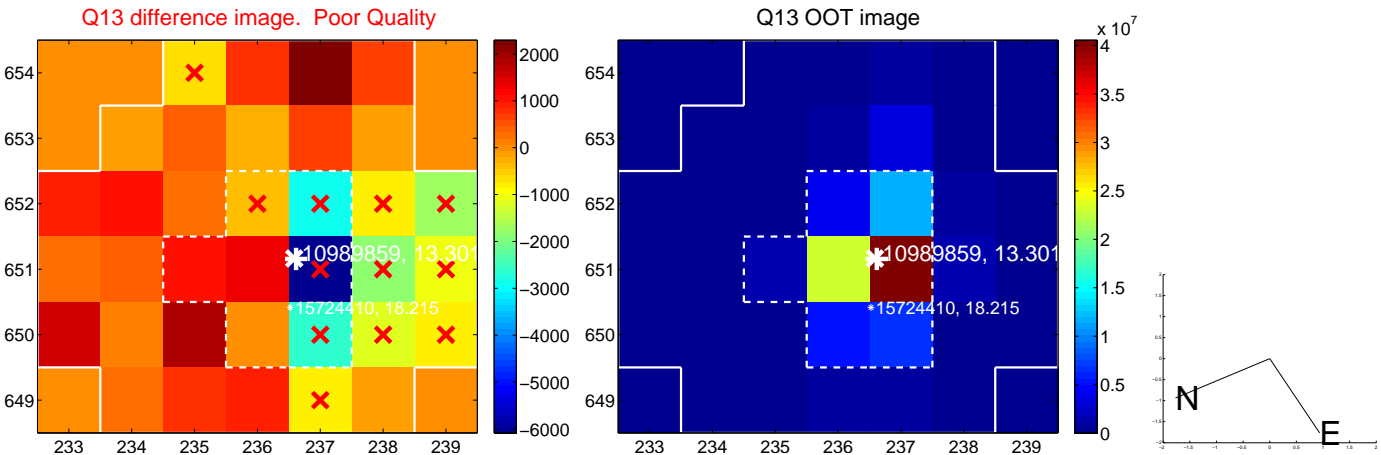
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

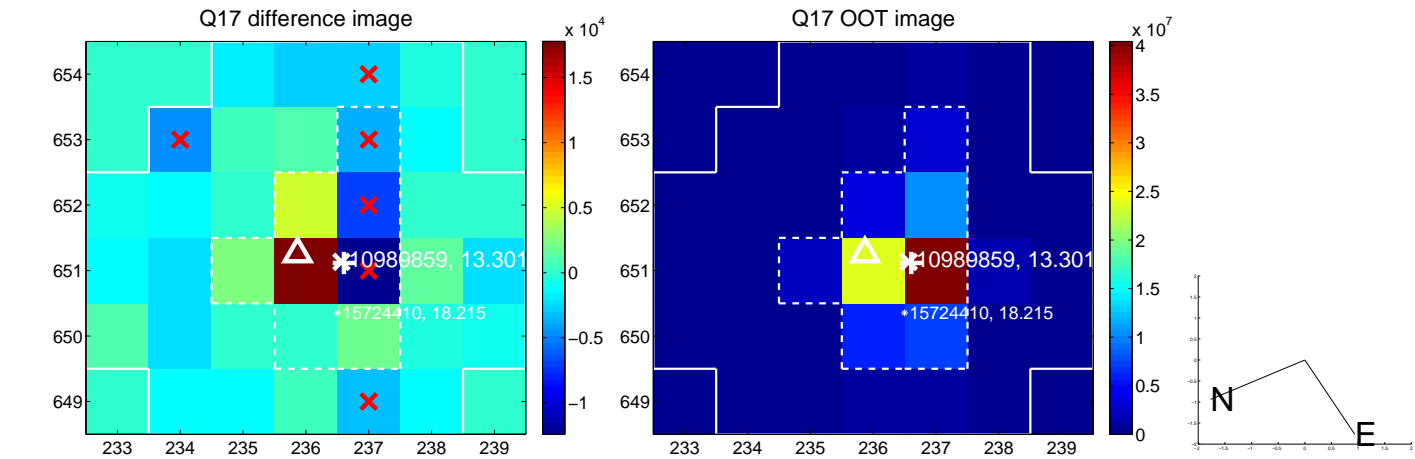


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

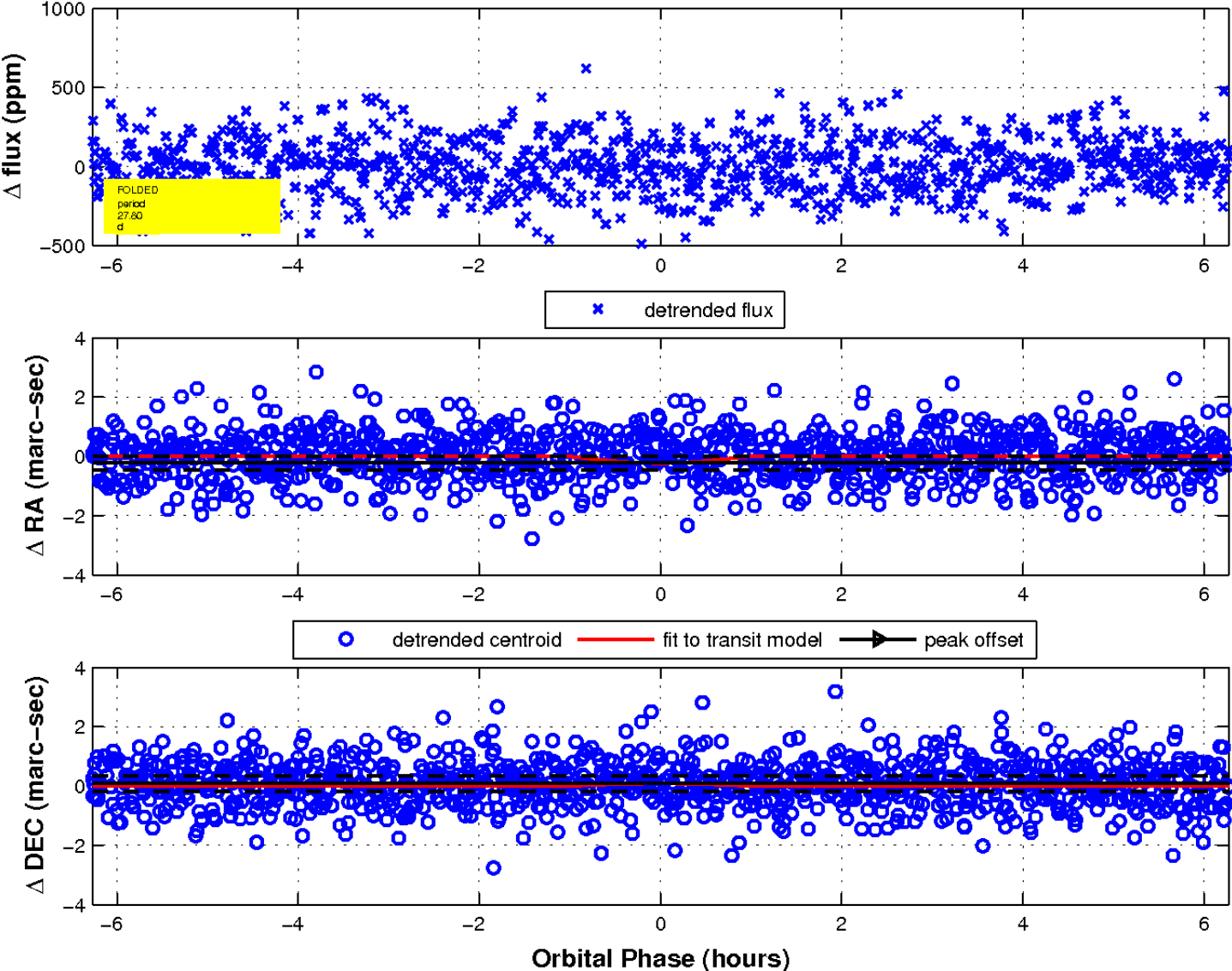




white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

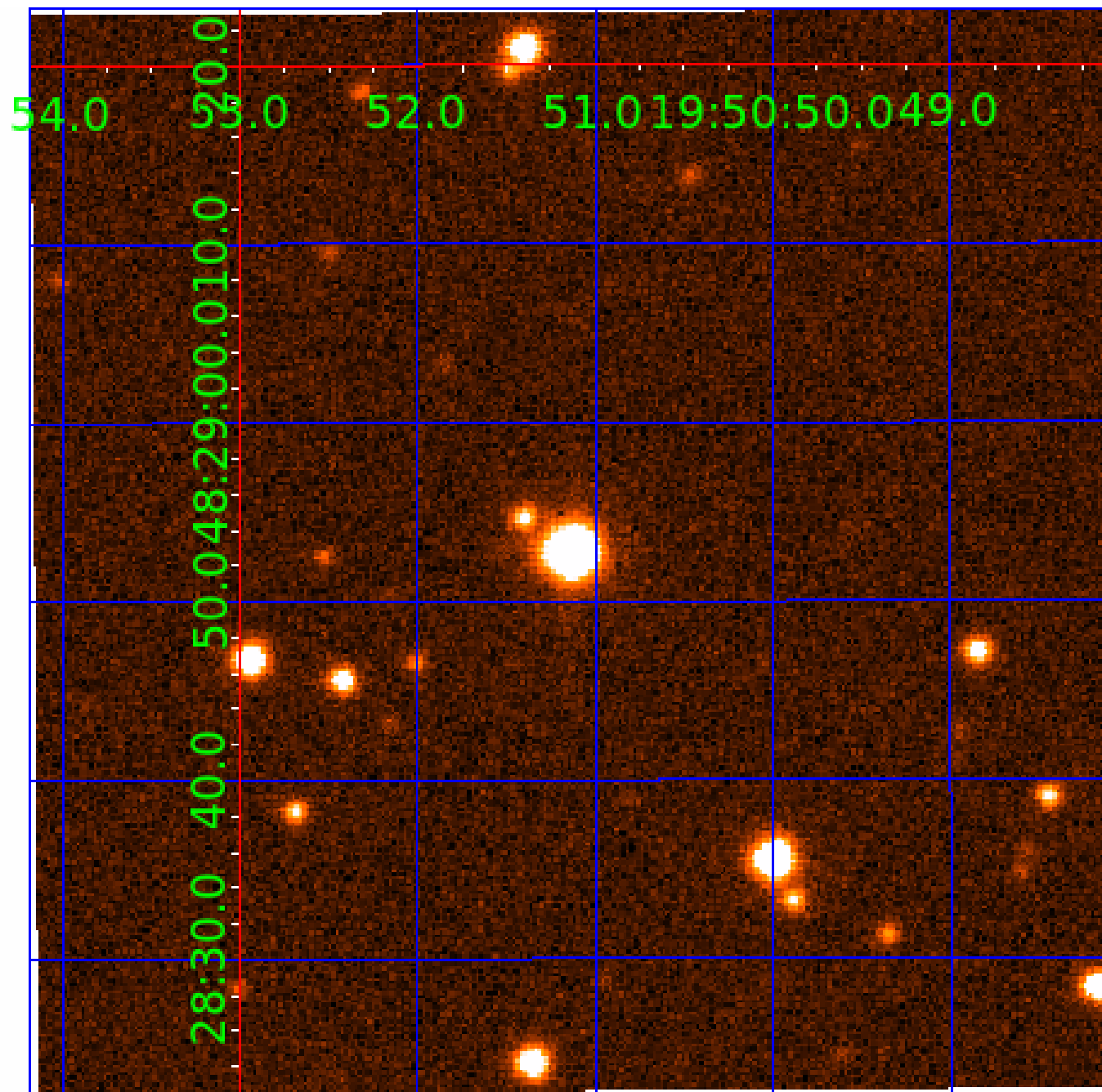


fluxWeightedCentroids, Planet 2 of 9



UKIRT Image

Declination



# KIC 010989859

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
010989859-01	OBS	No	1.032262	131.862720	14.6	6.908	8.1	7.1	1.28	7291	0.49	9120.32
010989859-02	OBS	No	27.797714	145.835134	231.8	2.094	11.2	11.5	1.28	7291	3.06	112.99
010989859-03	OBS	No	31.943139	158.167322	296.6	2.043	10.5	11.7	1.28	7291	2.57	93.88
010989859-04	OBS	No	20.545399	145.462444	122.0	2.279	8.7	5.7	1.28	7291	1.66	169.09
010989859-05	OBS	No	24.191498	148.647136	134.3	2.949	8.0	6.8	1.28	7291	1.72	135.99
010989859-06	OBS	No	47.767277	156.662618	384.1	1.137	8.9	8.6	1.28	7291	2.71	54.90
010989859-07	OBS	No	40.707094	170.263259	214.2	2.535	8.8	8.4	1.28	7291	2.09	67.95
010989859-08	OBS	No	35.515074	164.594190	363.2	1.016	8.8	9.6	1.28	7291	2.63	81.50
010989859-09	OBS	No	52.174965	160.628549	285.1	0.641	8.9	4.4	1.28	7291	2.23	48.80

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
010989859-01	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT
010989859-02	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT
010989859-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT
010989859-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT
010989859-05	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—HALO_GHOST
010989859-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_DV—CENT_UNCERTAIN
010989859-07	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
010989859-08	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—CENT_FEW_DIFFS
010989859-09	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_TRACKER—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS

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

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

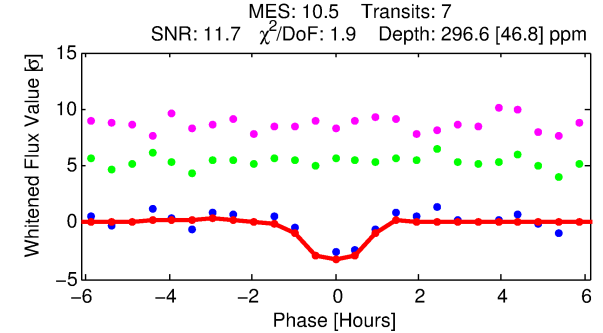
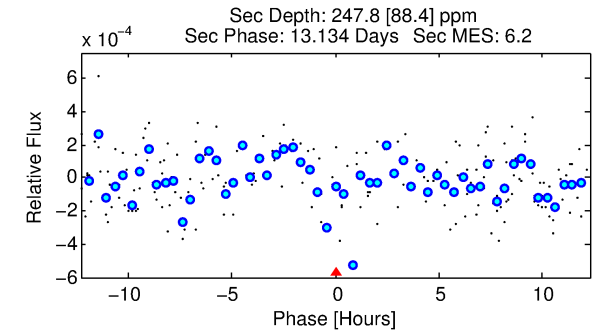
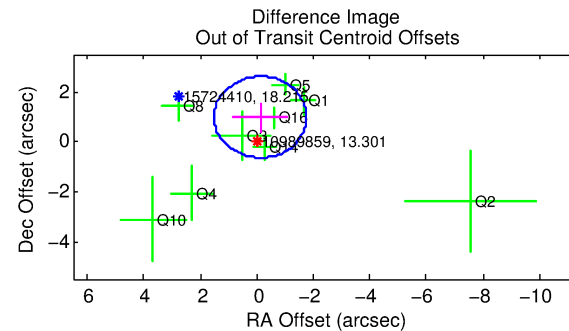
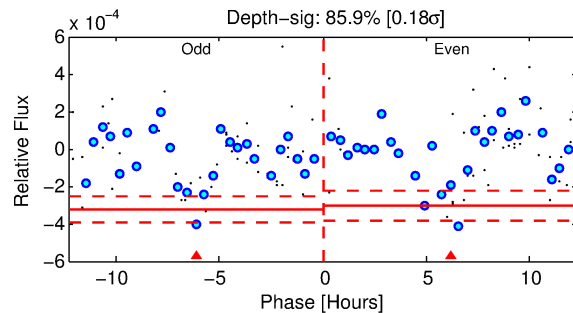
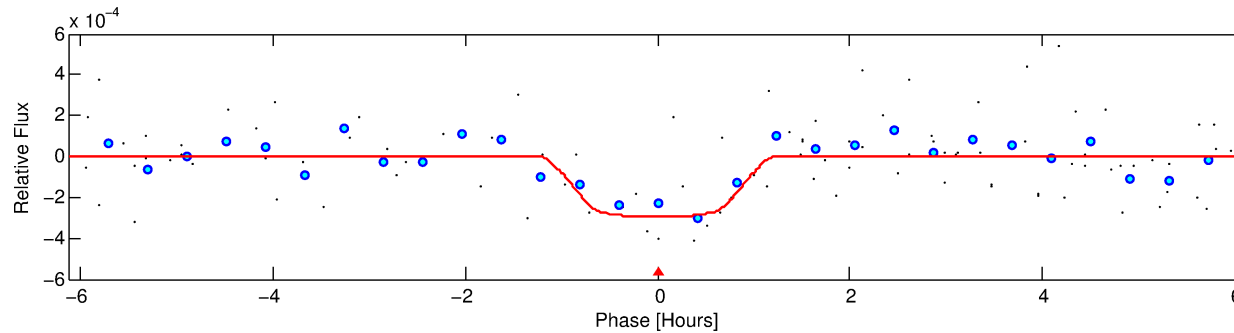
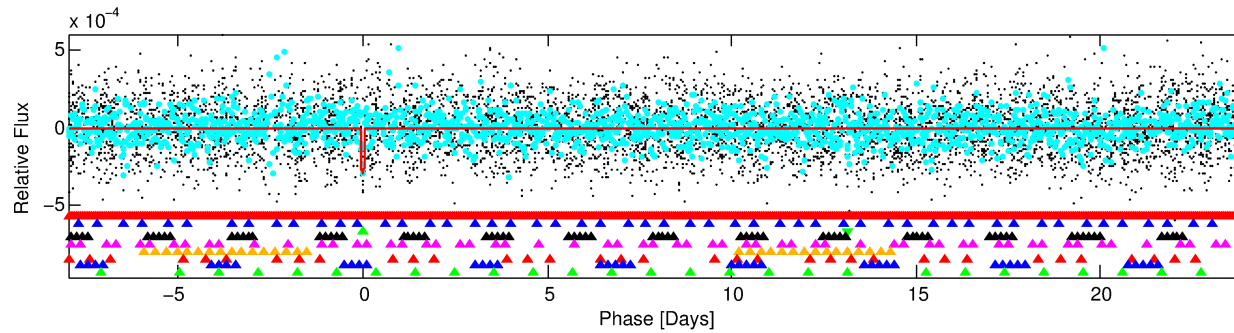
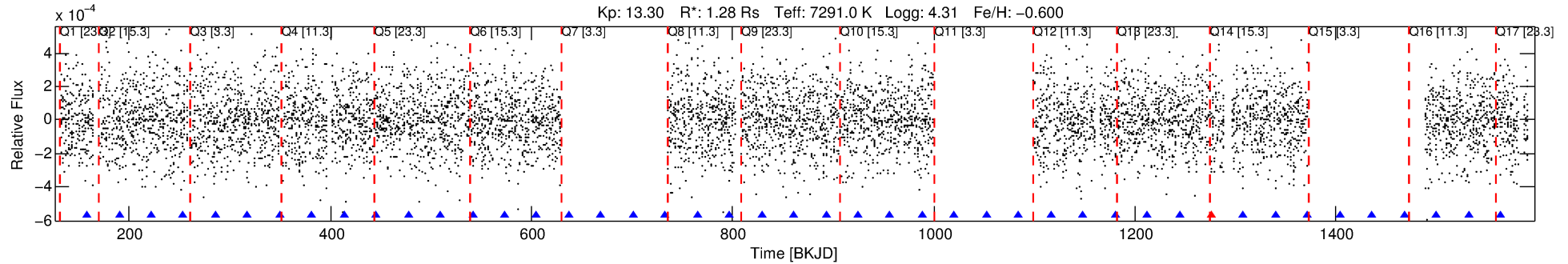
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 010989859-03

No Significant Match Found

# DV One-Page Summary

KIC: 10989859 Candidate: 3 of 9 Period: 31.943 d



## DV Fit Results:

Period = 31.94314 [0.00025] d  
Epoch = 158.1673 [0.0076] BKJD  
Rp/R\* = 0.0184 [0.0087]  
a/R\* = 55.02 [159.43]  
b = 0.91 [0.56]  
Seff = 93.88 [35.35]  
Teq = 794 [75] K  
Rp = 2.57 [1.44] Re  
a = 0.2099 [0.0509] AU  
Ag = 908.80 [970.61] [0.94 $\sigma$ ]  
Teffp = 6738 [1724] K [3.44 $\sigma$ ]

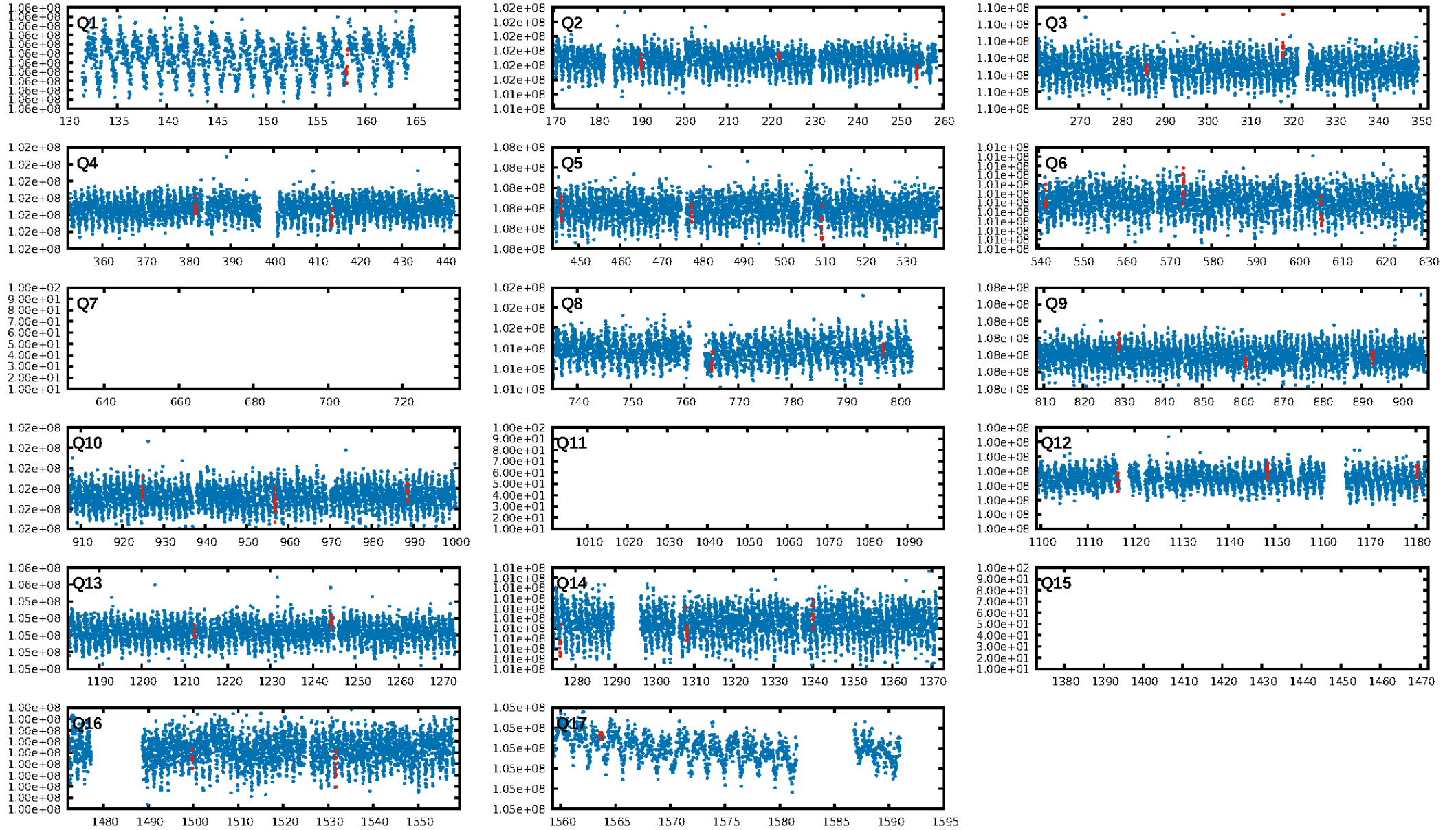
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [34.01 $\sigma$ ]  
LongPeriod-sig: 100.0% [37.57 $\sigma$ ]  
ModelChiSquare2-sig: 3.0%  
ModelChiSquareGof-sig: 98.4%  
**Bootstrap-pfa: 8.15e-11**  
RollingBand-fgt: 0.83 [5/6]  
**GhostDiagnostic-chr: 0.4941**  
Centroid-sig: 40.6%  
Centroid-so: 0.356 arcsec [0.51 $\sigma$ ]  
OotOffset-rm: 0.993 arcsec [1.83 $\sigma$ ]  
OotOffset-st: 3/1/3/2 [9]  
KicOffset-rm: 0.892 arcsec [1.29 $\sigma$ ]  
KicOffset-st: 3/1/3/2 [9]  
DiffImageQuality-fgm: 0.44 [4/9]  
DiffImageOverlap-fno: 0.29 [4/14]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 09:38:16 Z

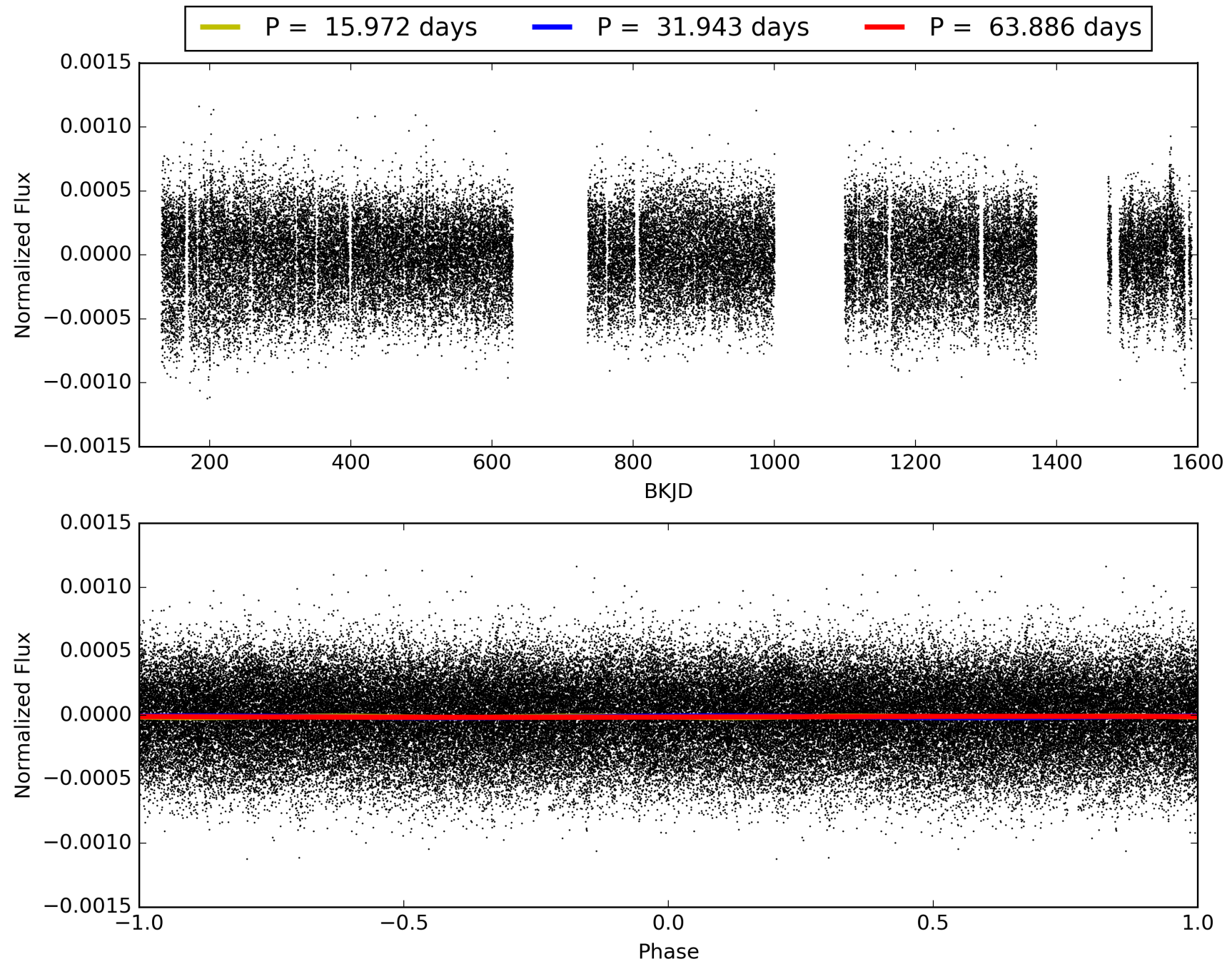
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 010989859-03, PDC Light Curves



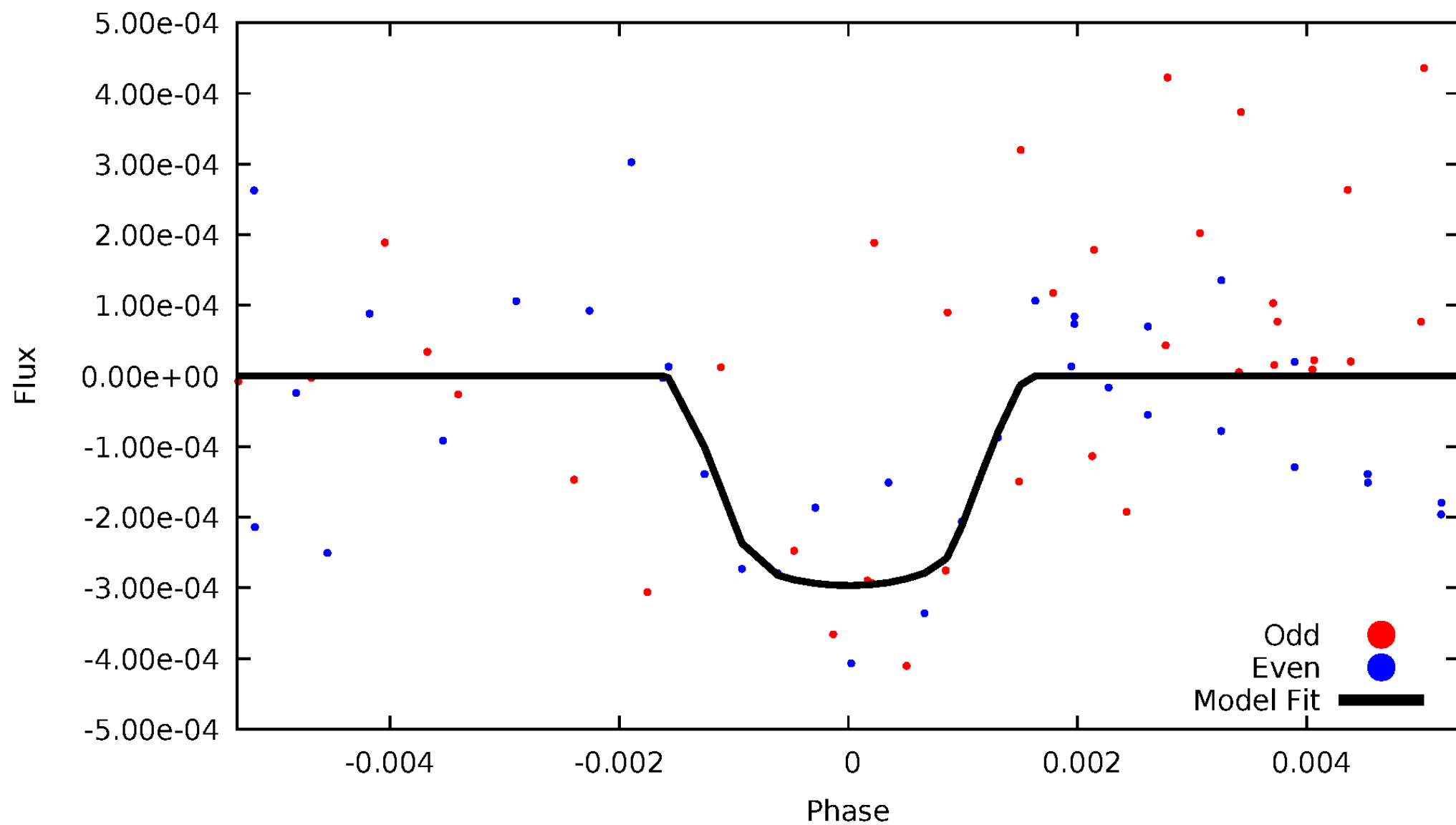


TCE 010989859-03



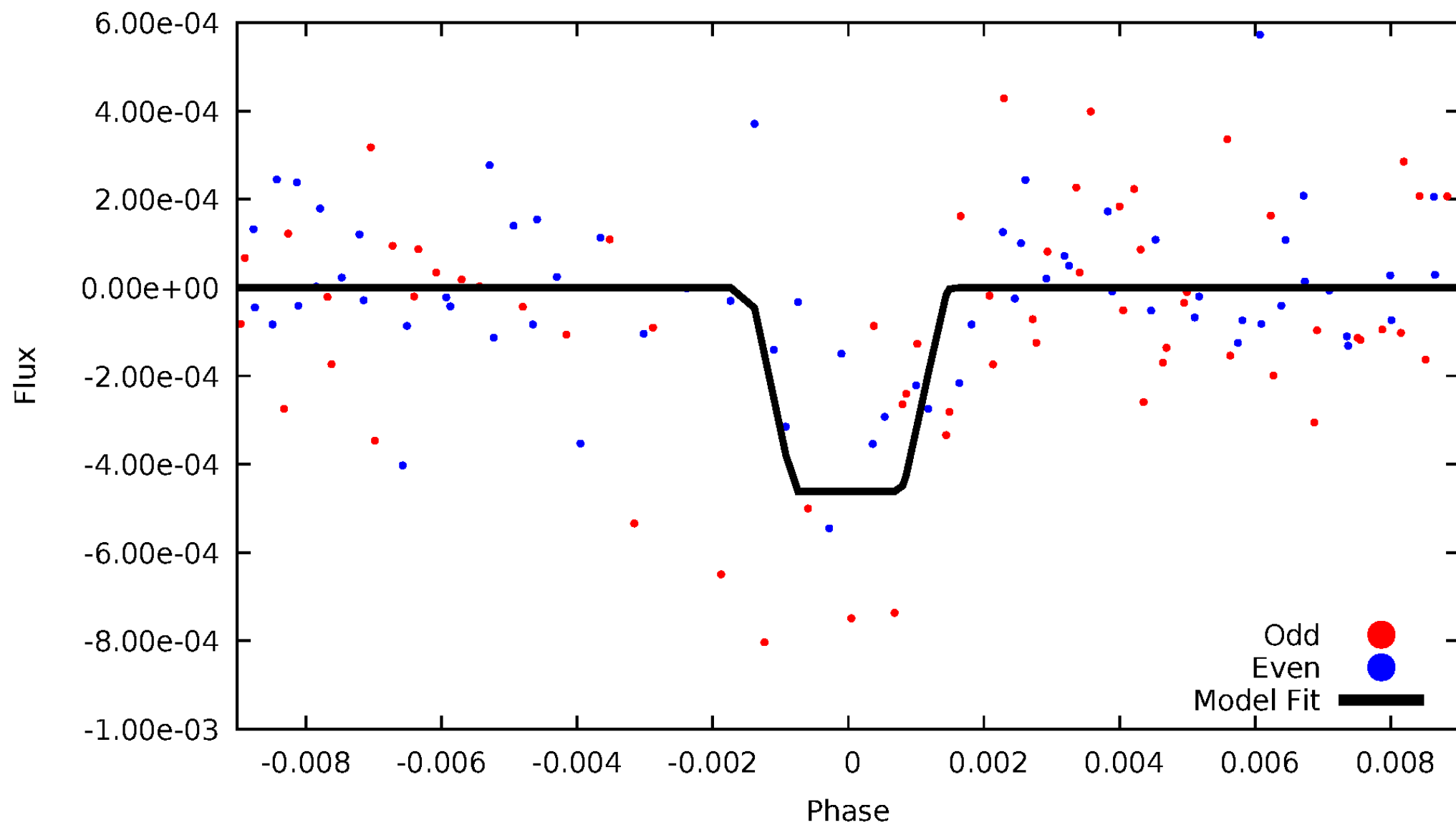
# DV Odd/Even

TCE 010989859-03



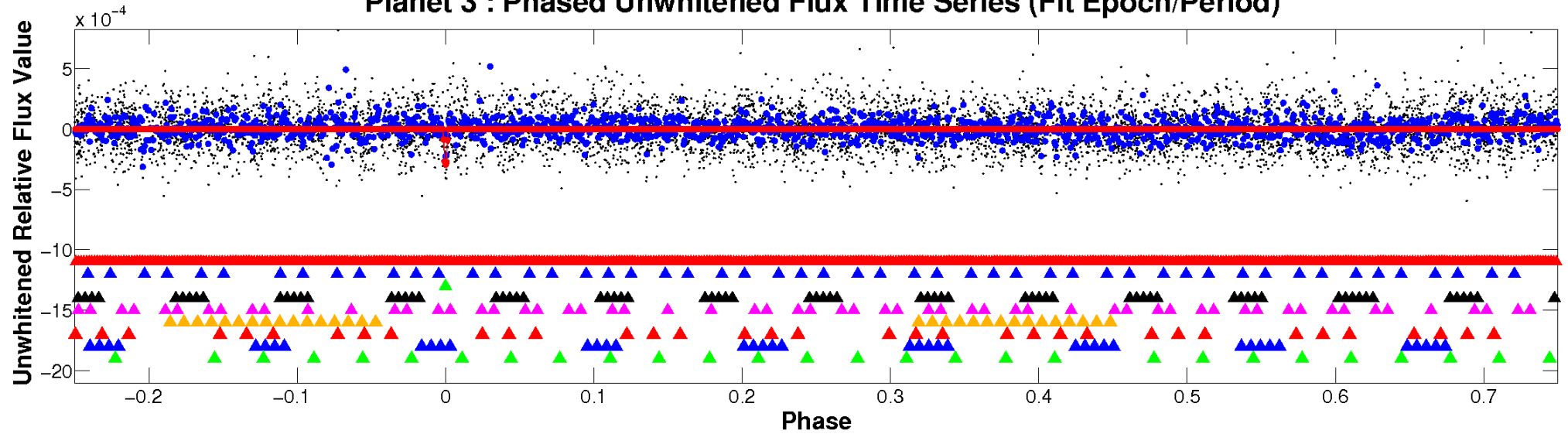
# ALT Odd/Even

TCE 010989859-03

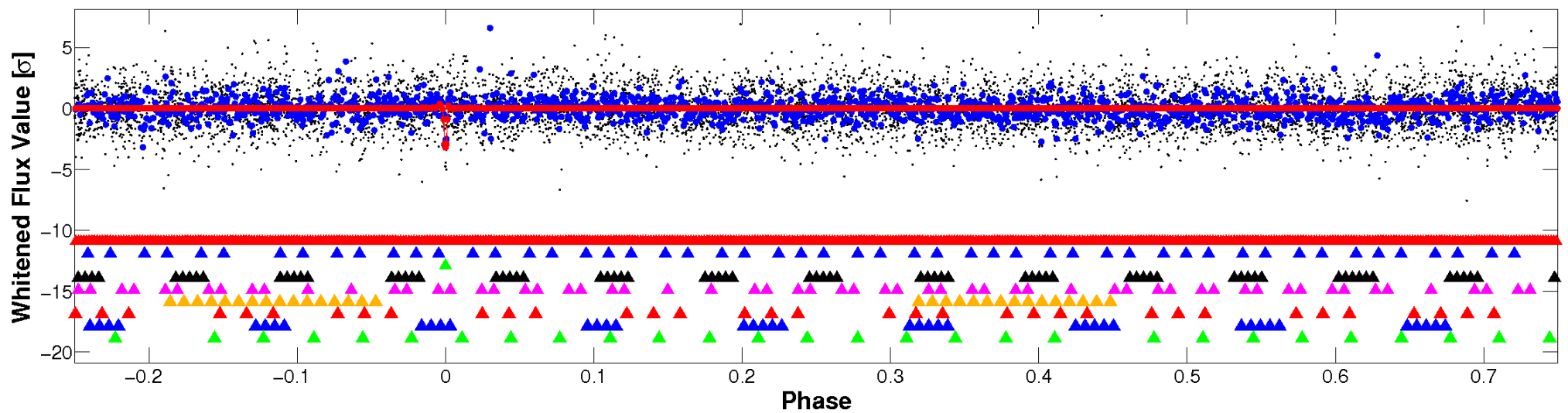


# Non-Whitened Vs. Whitened Light Curve

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

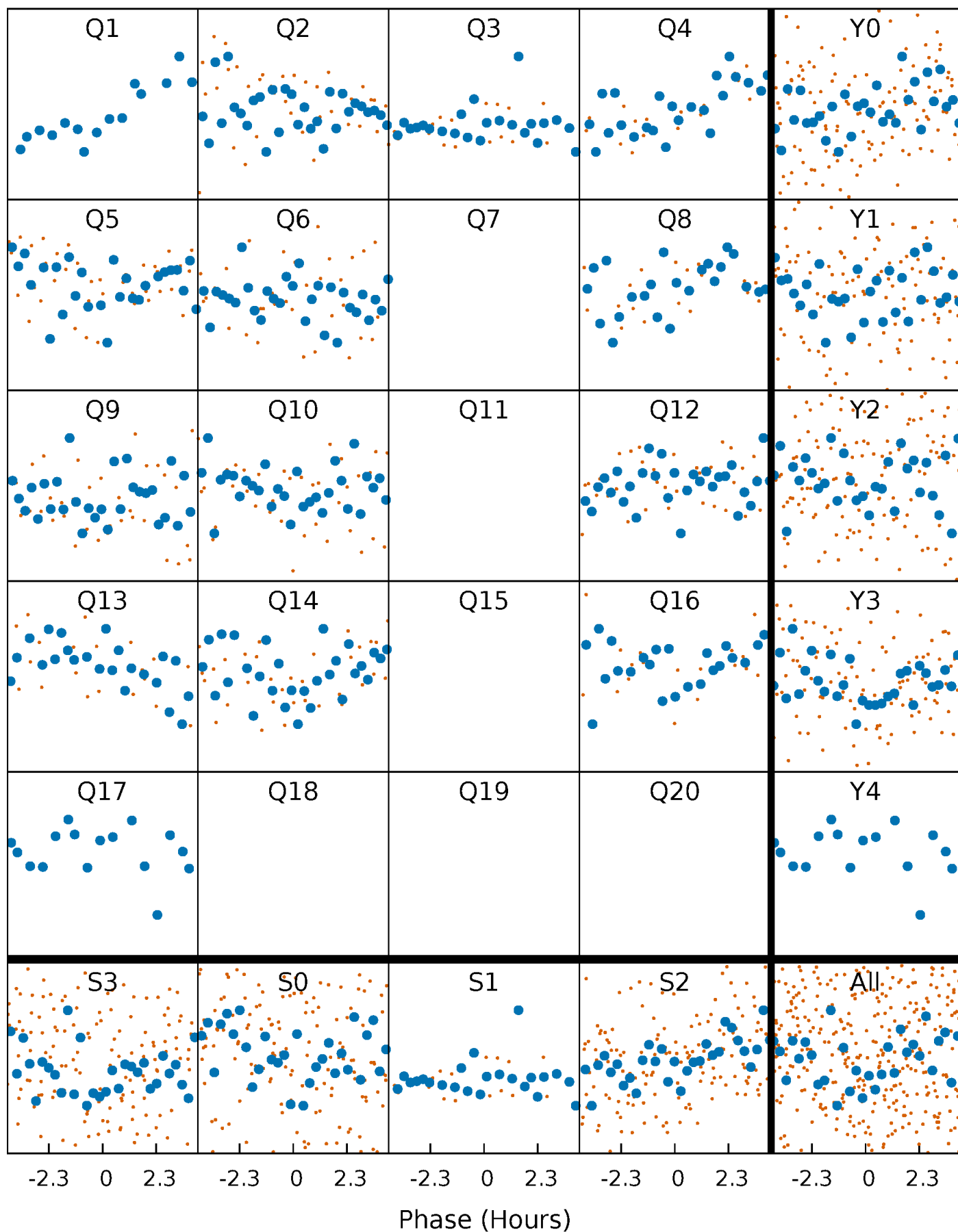


Planet 3 : Phased Whitened Flux Time Series (Fit Epoch/Period)



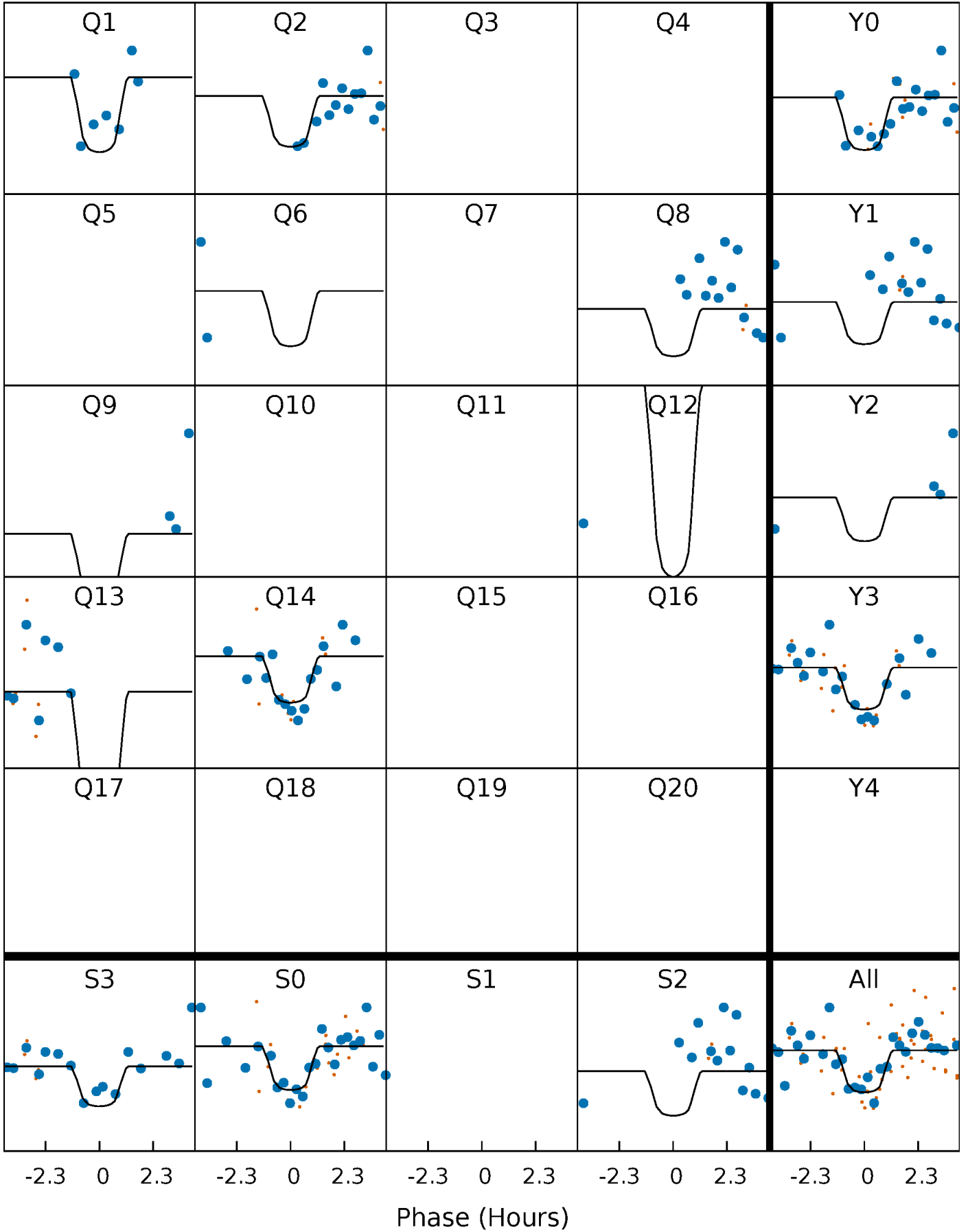
# PDC Quarter-Phased Transit Curves

TCE 010989859-03 P= 31.943139 Days  $T_0=158.167322$  (BKJD)



# DV Quarter-Phased Transit Curves

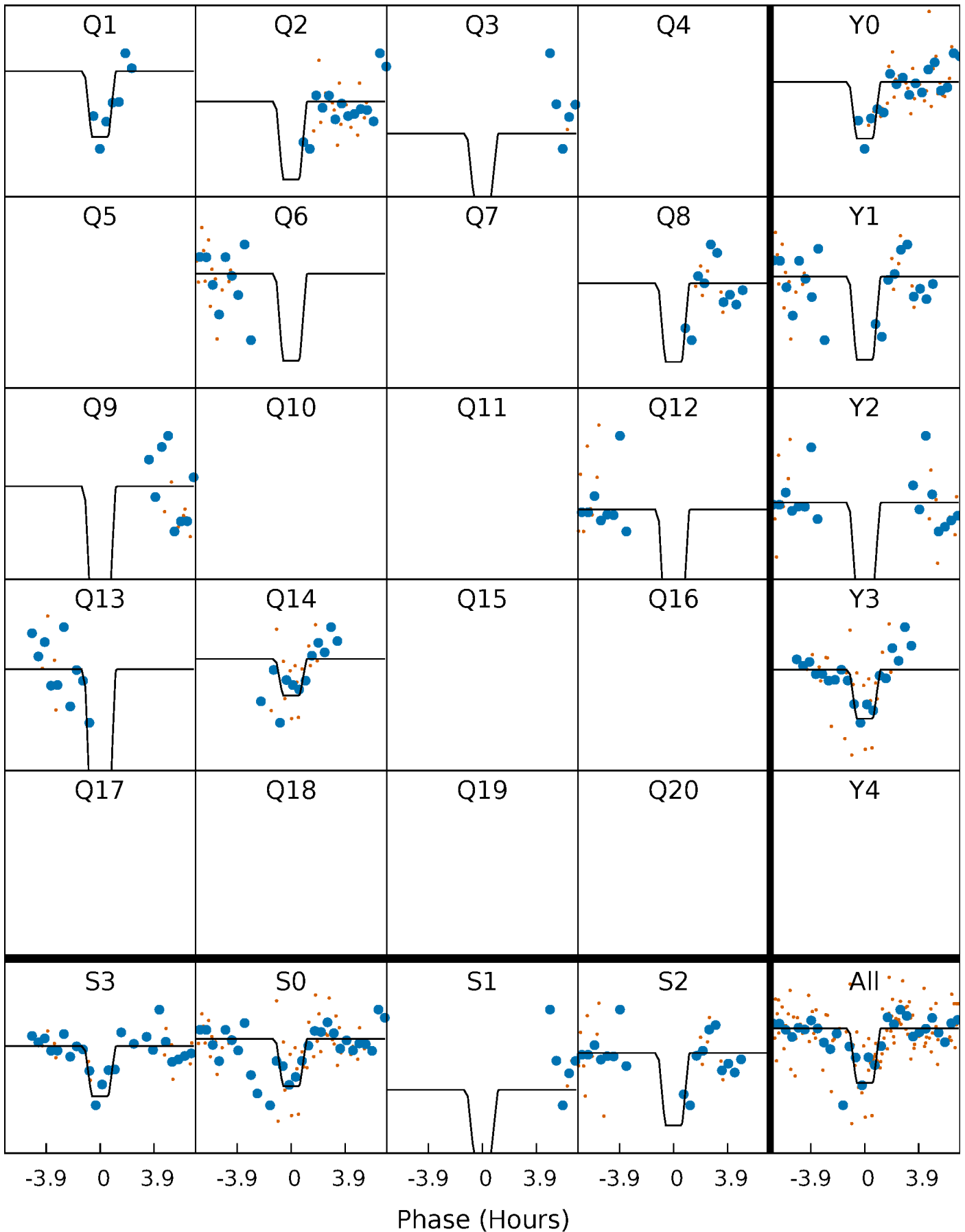
TCE 010989859-03 P= 31.943139 Days  $T_0=158.167322$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

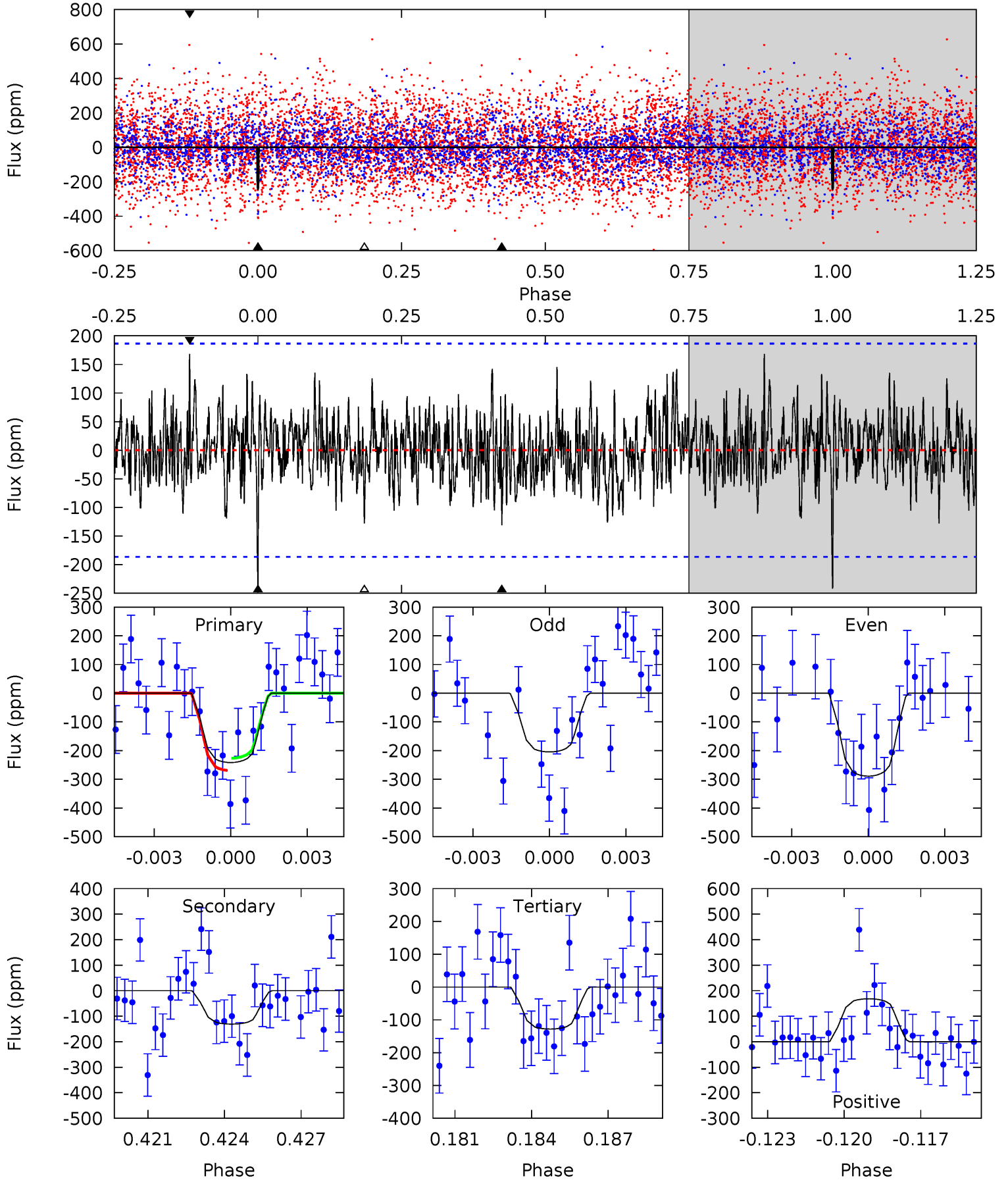
TCE 010989859-03 P= 31.943259 Days  $T_0=158.146655$  (BKJD)



# DV Model-Shift Uniqueness Test

010989859-03, P = 31.943139 Days, E = 126.224183 Days

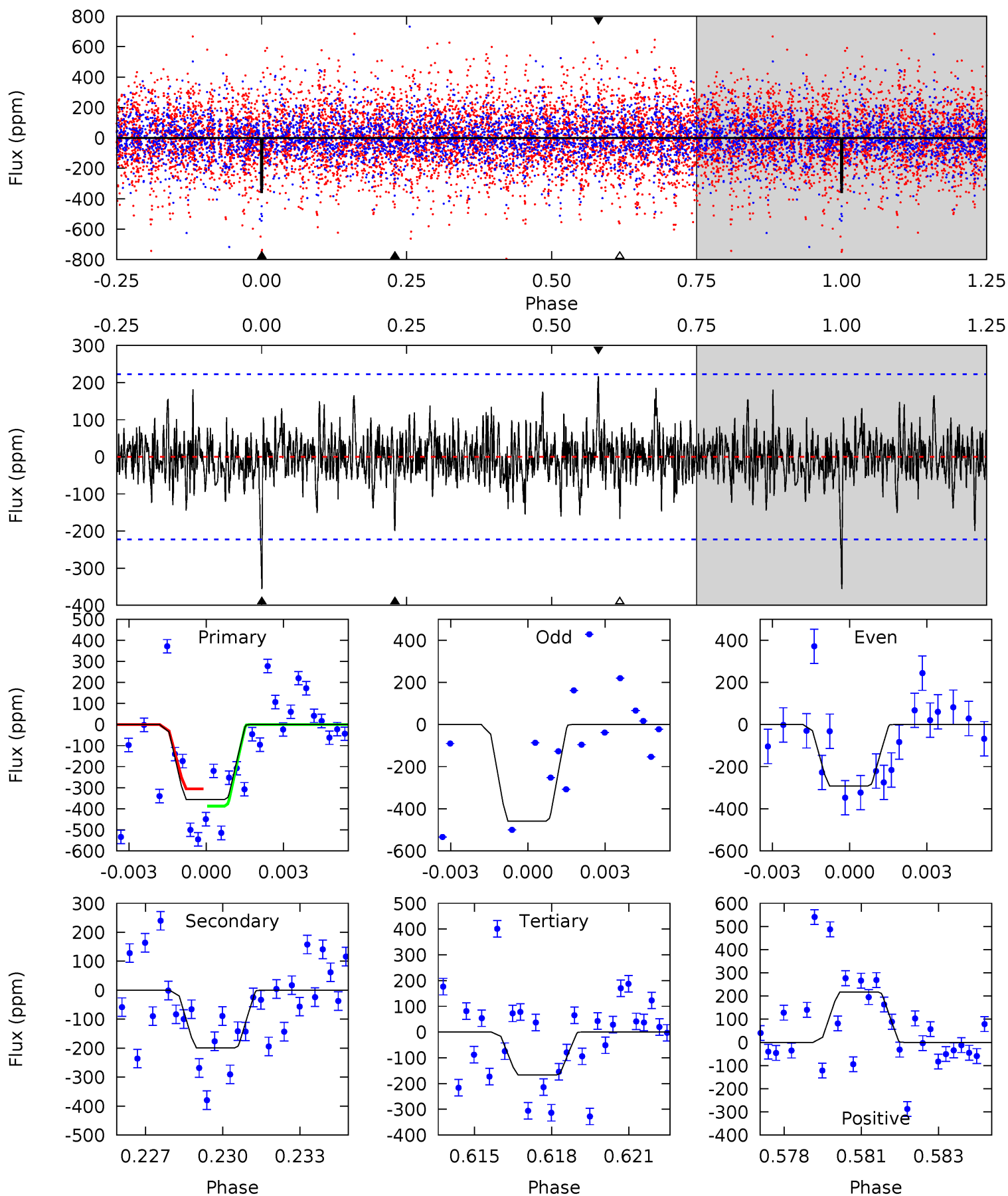
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
6.81	3.69	3.61	4.75	5.25	2.96	1.31	3.20	2.06	0.08	-1.06	1.22	0.83	0.41	0.57



# Alt Model-Shift Uniqueness Test

010989859-03, P = 31.943259 Days, E = 126.203396 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
8.42	4.71	3.94	5.14	5.26	2.98	1.20	4.48	3.27	0.77	-0.43	2.03	1.21	0.38	0.91



### Stellar Parameters For KIC 010989859

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$7291^{+207}_{-285}$	$4.307^{+0.084}_{-0.182}$	$-0.600^{+0.250}_{-0.300}$	$1.278^{+0.380}_{-0.163}$	$1.208^{+0.166}_{-0.136}$	$0.815^{+0.355}_{-0.399}$
	+3%/-4%	+2%/-4%	+42%/-50%	+30%/-13%	+14%/-11%	+44%/-49%
Source	PHO1	KIC0	KIC0	DSEP		

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

### Secondary Eclipse Parameters for KIC 010989859-03 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-131 \pm 35$	$2.72^{+1.35}_{-1.28}$	$1117^{+85}_{-61}$	$5563^{+2274}_{-851}$	$431^{+1182}_{-258}$
Alt.	$-199 \pm 42$	$3.10^{+1.38}_{-1.30}$	$1119^{+72}_{-65}$	$5808^{+2043}_{-900}$	$511^{+901}_{-276}$

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

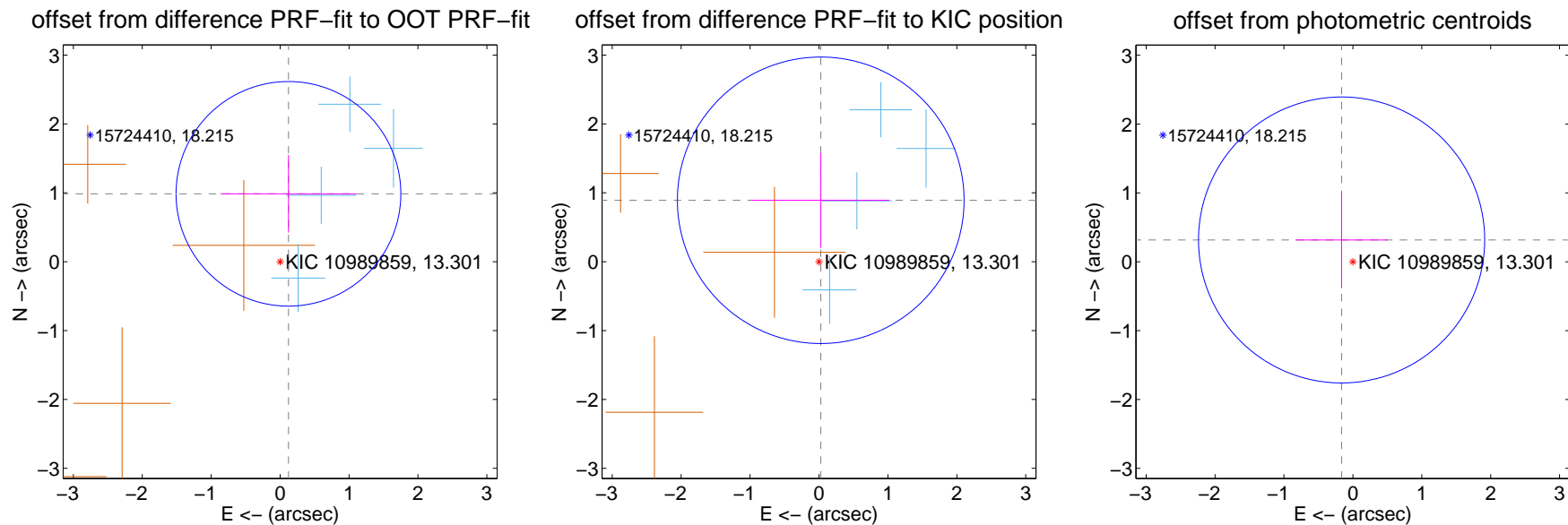
## DV Centroid Data

Supplemental centroid analysis for 010989859-03. Kepler magnitude: 13.30. Transit SNR 11.69

There are 4 quarters with good PRF difference image offsets

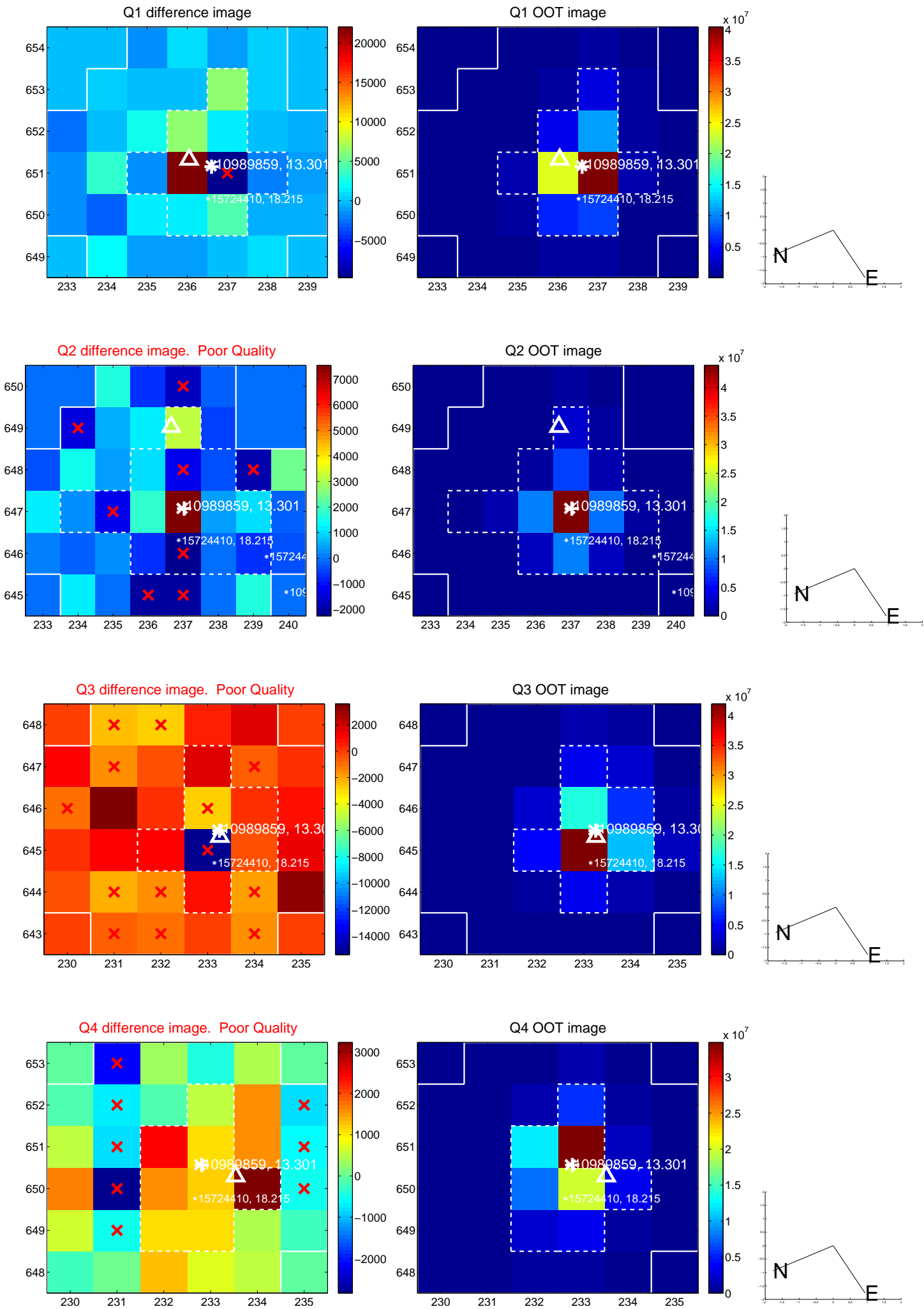
The direct PRF centroid is offset from the target star catalog position by about 0.09 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.993 \pm 0.544$	1.83	$-0.121 \pm 0.986$	$0.985 \pm 0.563$
PRF-fit source offset from KIC position	$0.892 \pm 0.693$	1.29	$-0.025 \pm 0.996$	$0.892 \pm 0.690$
photometric centroid source offset	$0.36 \pm 0.69$	0.51	$0.16 \pm 0.67$	$0.32 \pm 0.70$



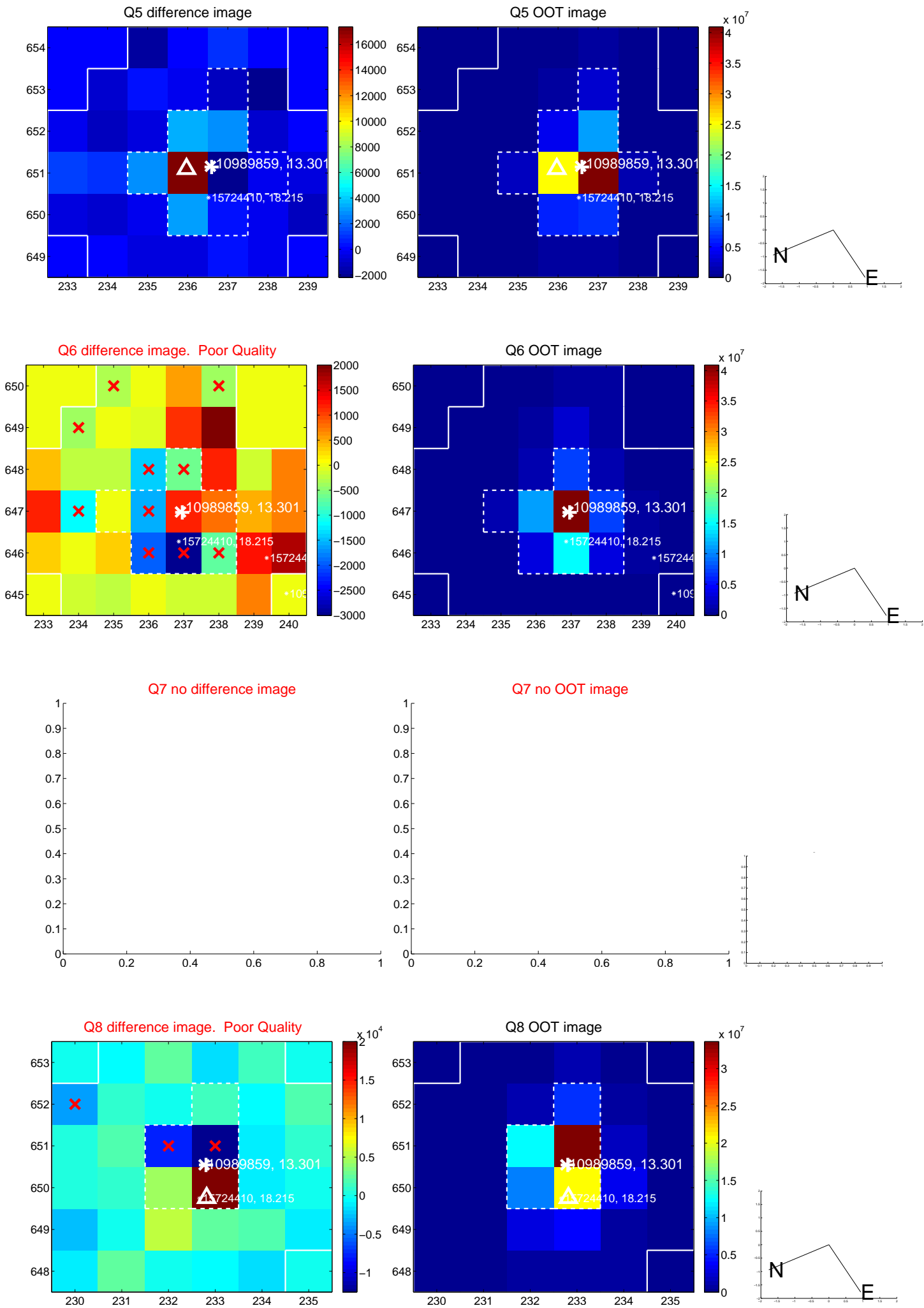
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

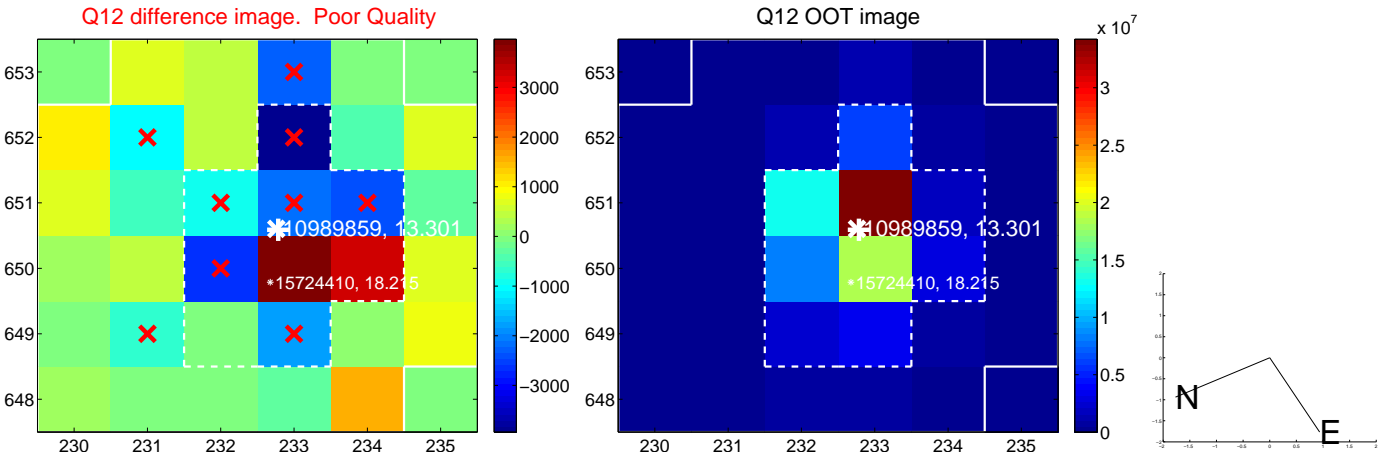
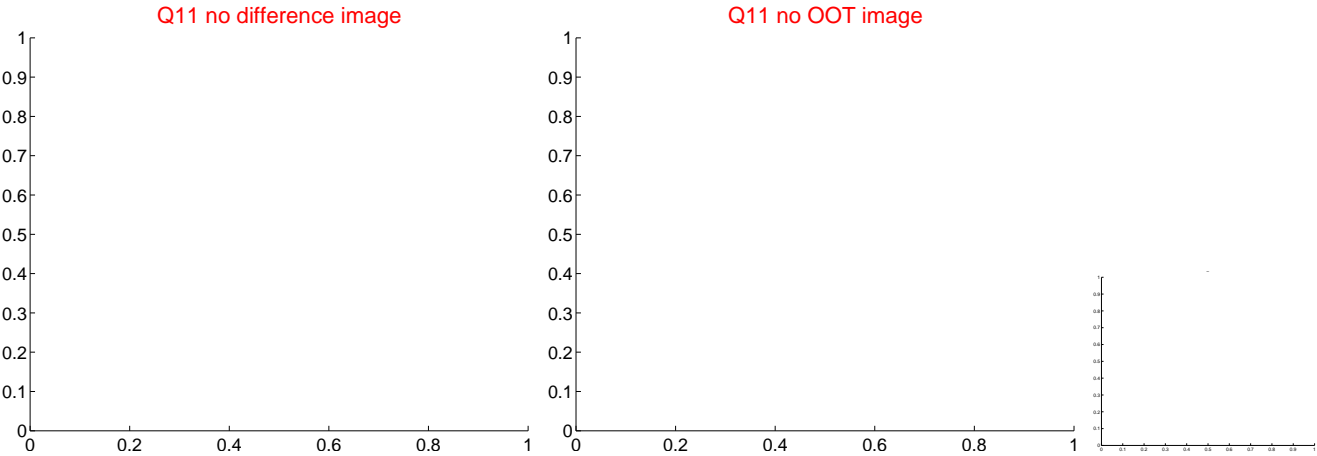
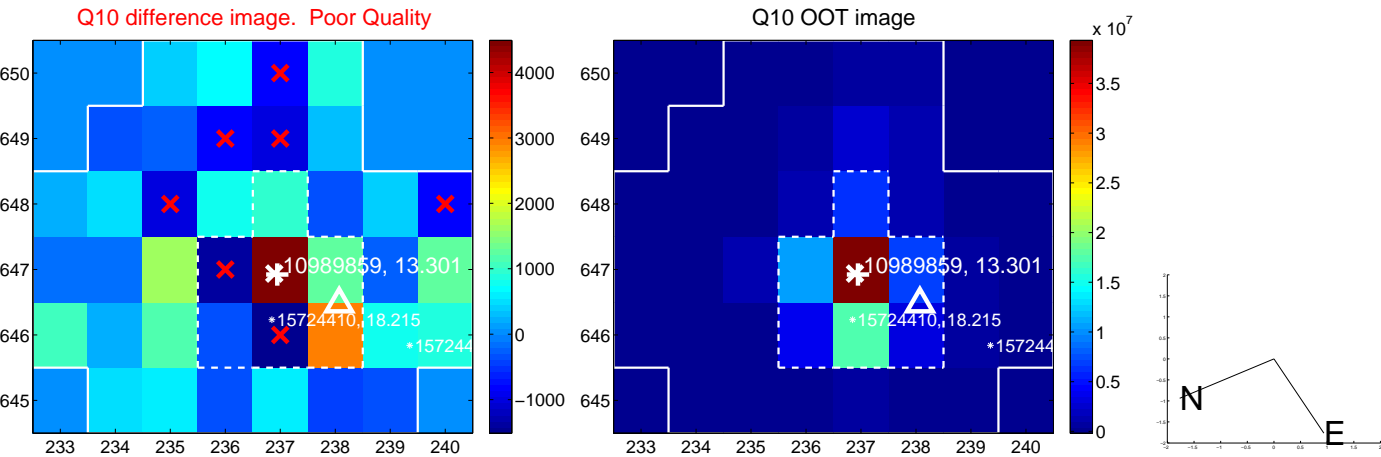
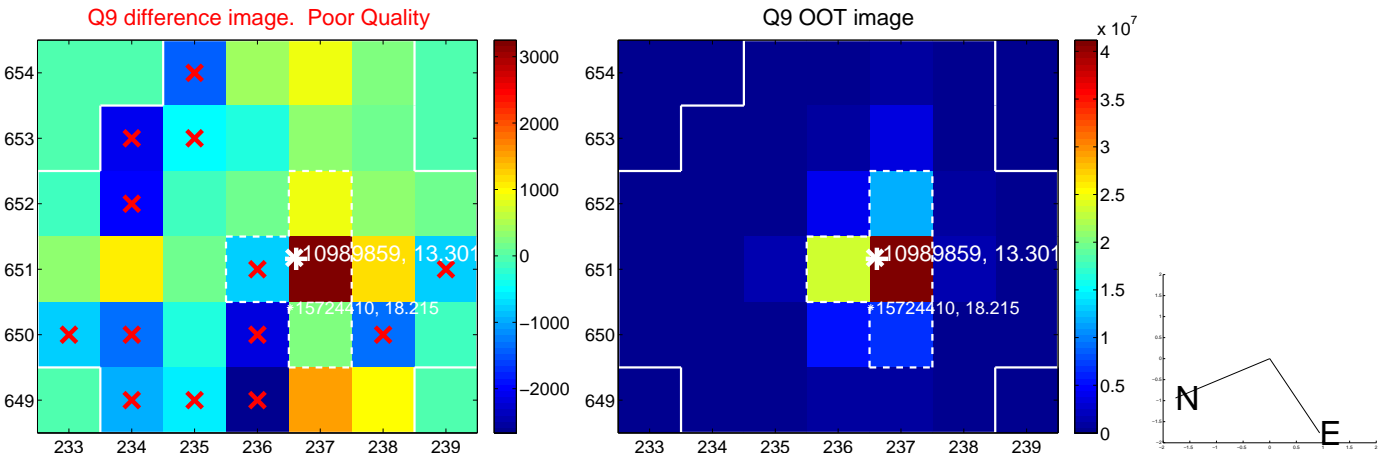




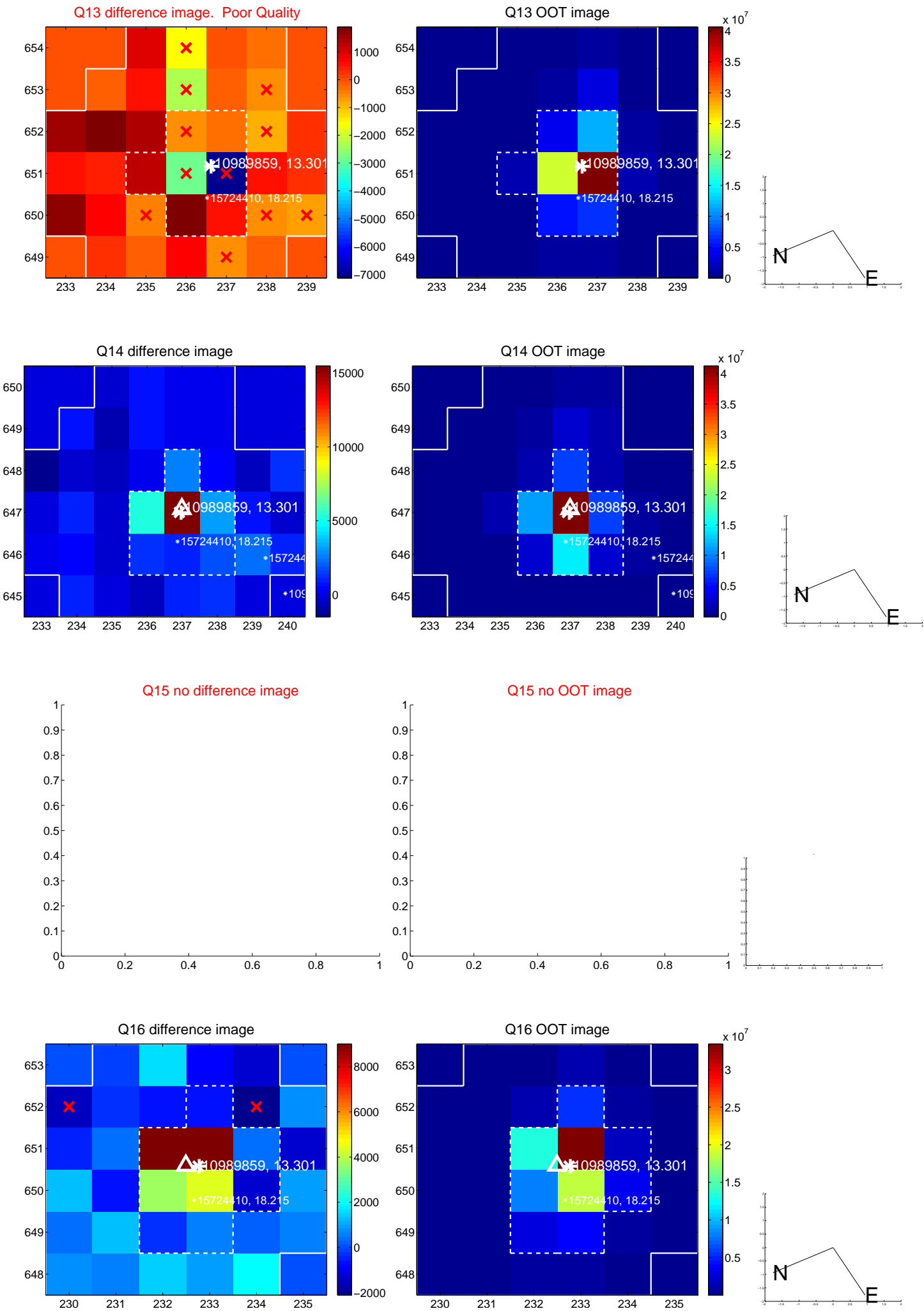
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



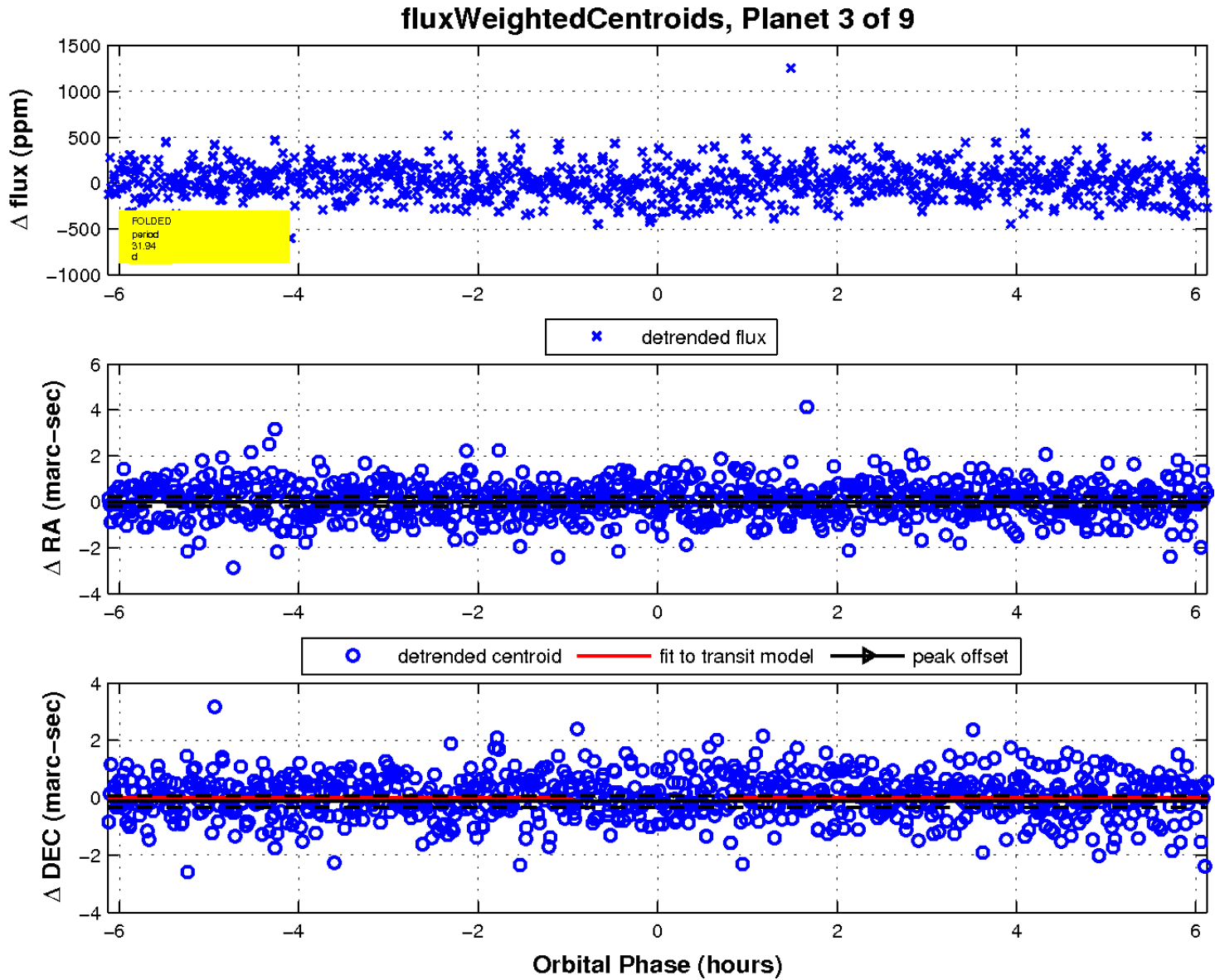
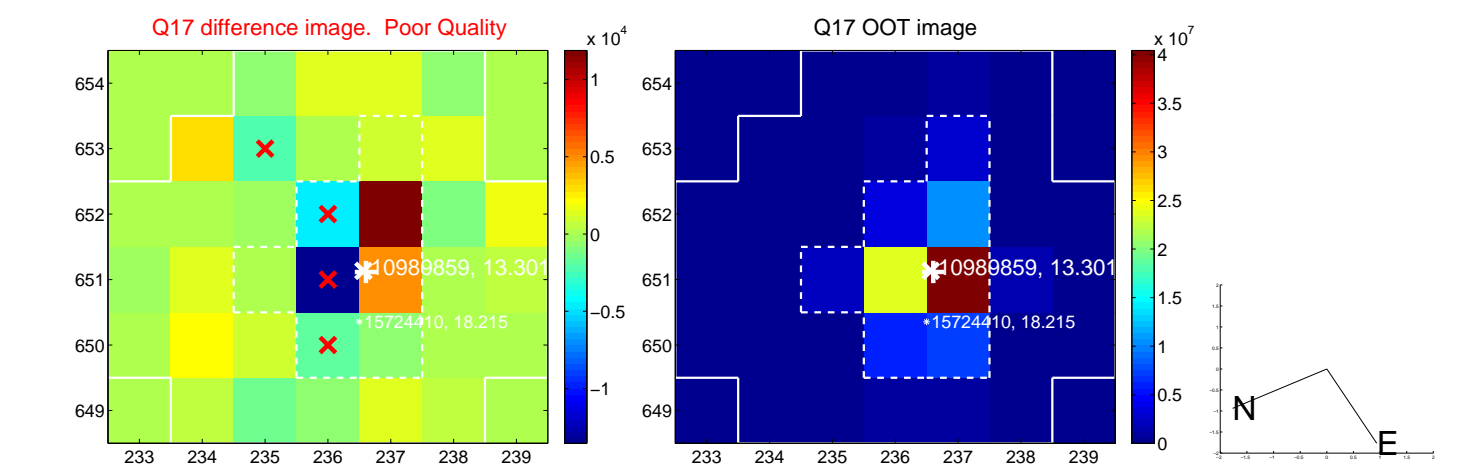
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

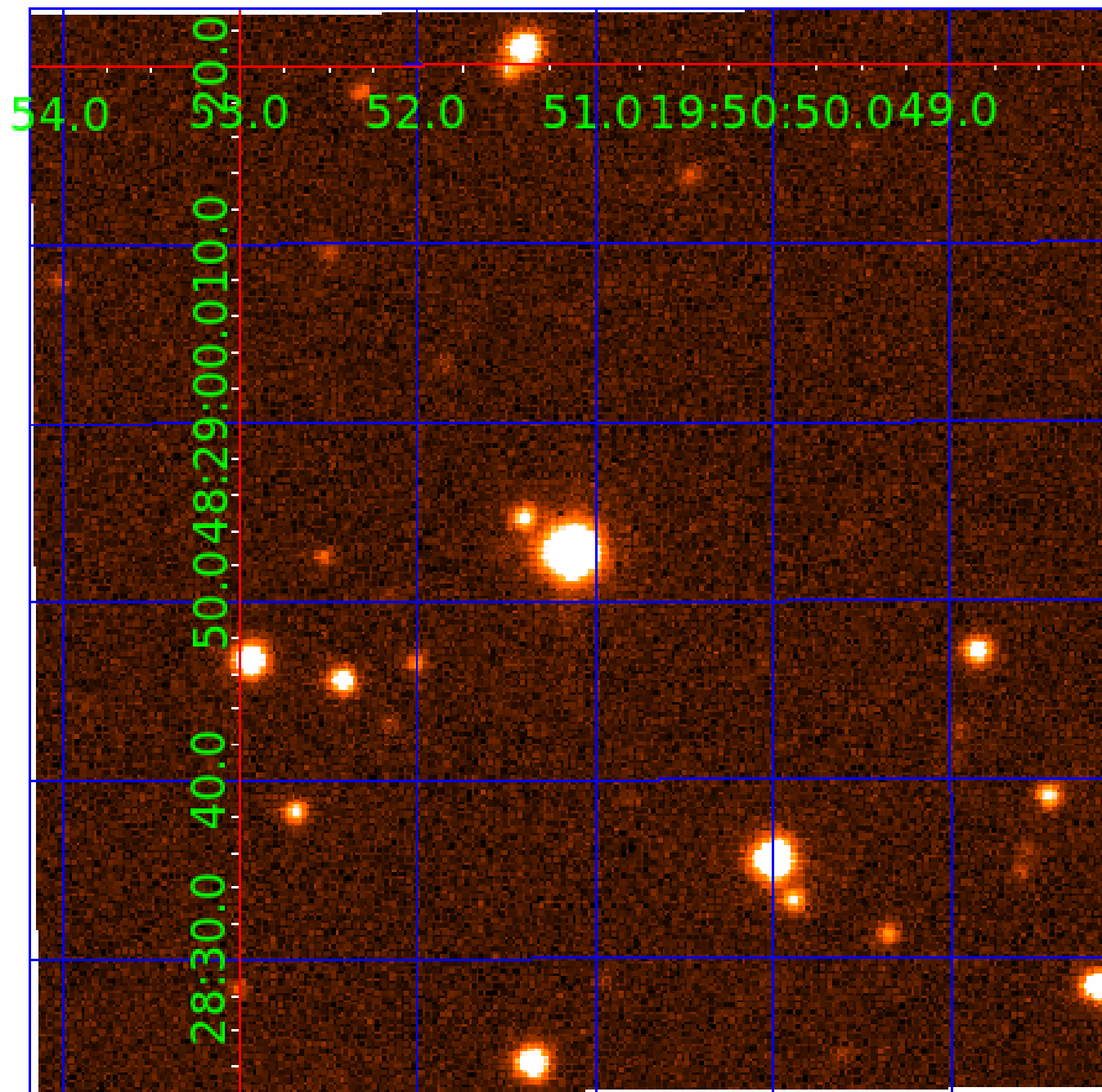


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 010989859

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
010989859-01	OBS	No	1.032262	131.862720	14.6	6.908	8.1	7.1	1.28	7291	0.49	9120.32
010989859-02	OBS	No	27.797714	145.835134	231.8	2.094	11.2	11.5	1.28	7291	3.06	112.99
010989859-03	OBS	No	31.943139	158.167322	296.6	2.043	10.5	11.7	1.28	7291	2.57	93.88
010989859-04	OBS	No	20.545399	145.462444	122.0	2.279	8.7	5.7	1.28	7291	1.66	169.09
010989859-05	OBS	No	24.191498	148.647136	134.3	2.949	8.0	6.8	1.28	7291	1.72	135.99
010989859-06	OBS	No	47.767277	156.662618	384.1	1.137	8.9	8.6	1.28	7291	2.71	54.90
010989859-07	OBS	No	40.707094	170.263259	214.2	2.535	8.8	8.4	1.28	7291	2.09	67.95
010989859-08	OBS	No	35.515074	164.594190	363.2	1.016	8.8	9.6	1.28	7291	2.63	81.50
010989859-09	OBS	No	52.174965	160.628549	285.1	0.641	8.9	4.4	1.28	7291	2.23	48.80

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
010989859-01	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT
010989859-02	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT
010989859-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT
010989859-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT
010989859-05	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—HALO_GHOST
010989859-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_DV—CENT_UNCERTAIN
010989859-07	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
010989859-08	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—CENT_FEW_DIFFS
010989859-09	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_TRACKER—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS

**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.

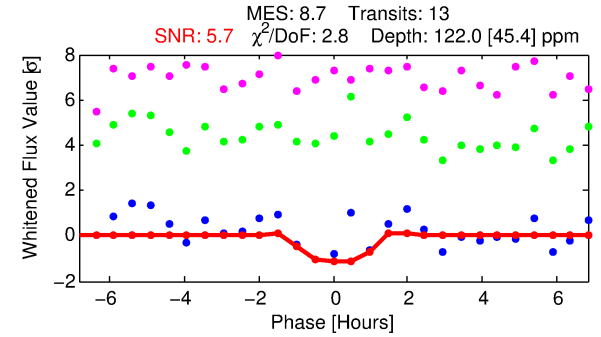
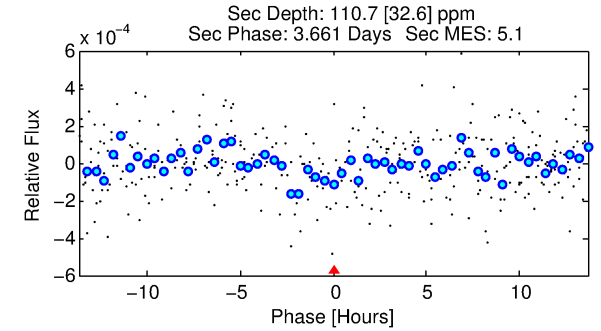
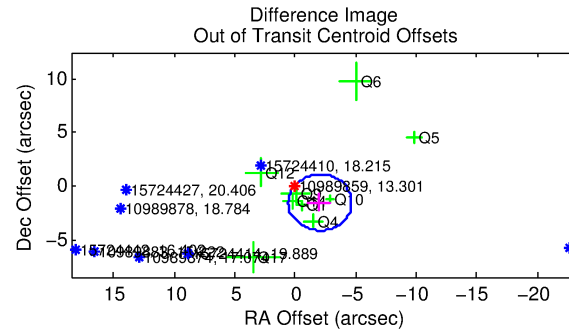
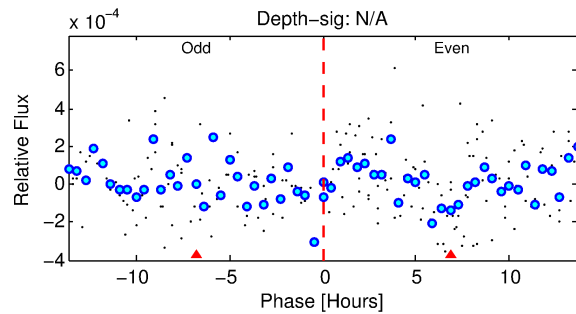
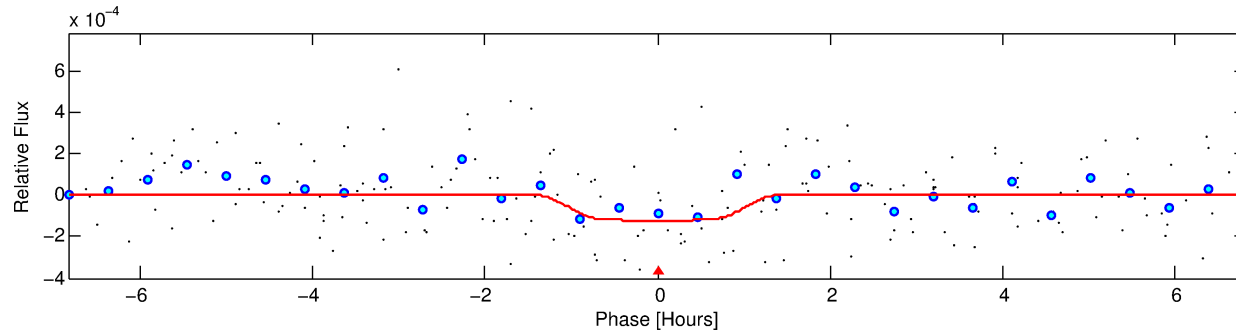
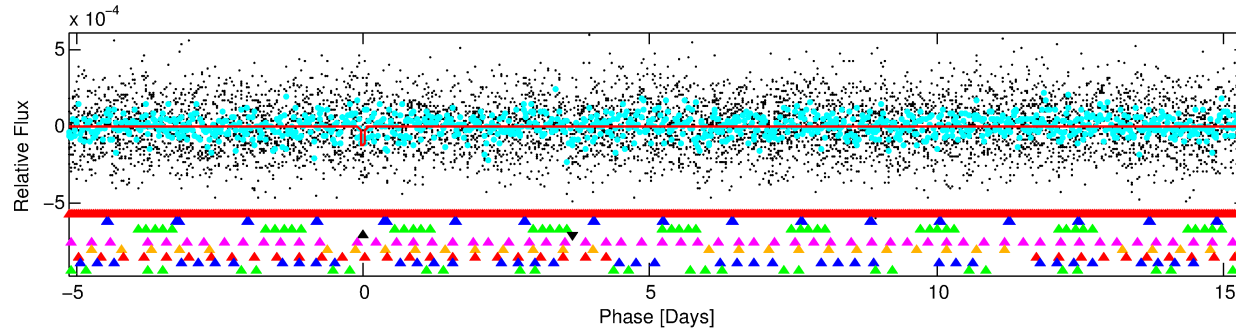
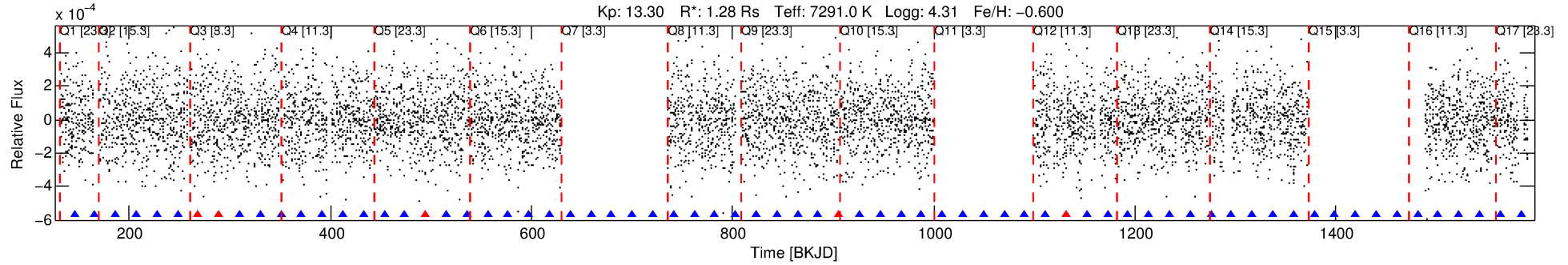
Ephemeris Match Information For 010989859-04

No Significant Match Found



# DV One-Page Summary

KIC: 10989859 Candidate: 4 of 9 Period: 20.545 d



## DV Fit Results:

Period = 20.54540 [0.00039] d  
Epoch = 145.4624 [0.0166] BKJD  
Rp/R\* = 0.0119 [0.0160]  
a/R\* = 29.10 [245.81]  
b = 0.92 [1.43]  
Seff = 169.09 [63.67]  
Teq = 920 [87] K  
Rp = 1.66 [2.29] Re  
a = 0.1564 [0.0379] AU  
Ag = 538.10 [1466.43] [0.37σ]  
Teffp = 6847 [4636] K [1.28σ]

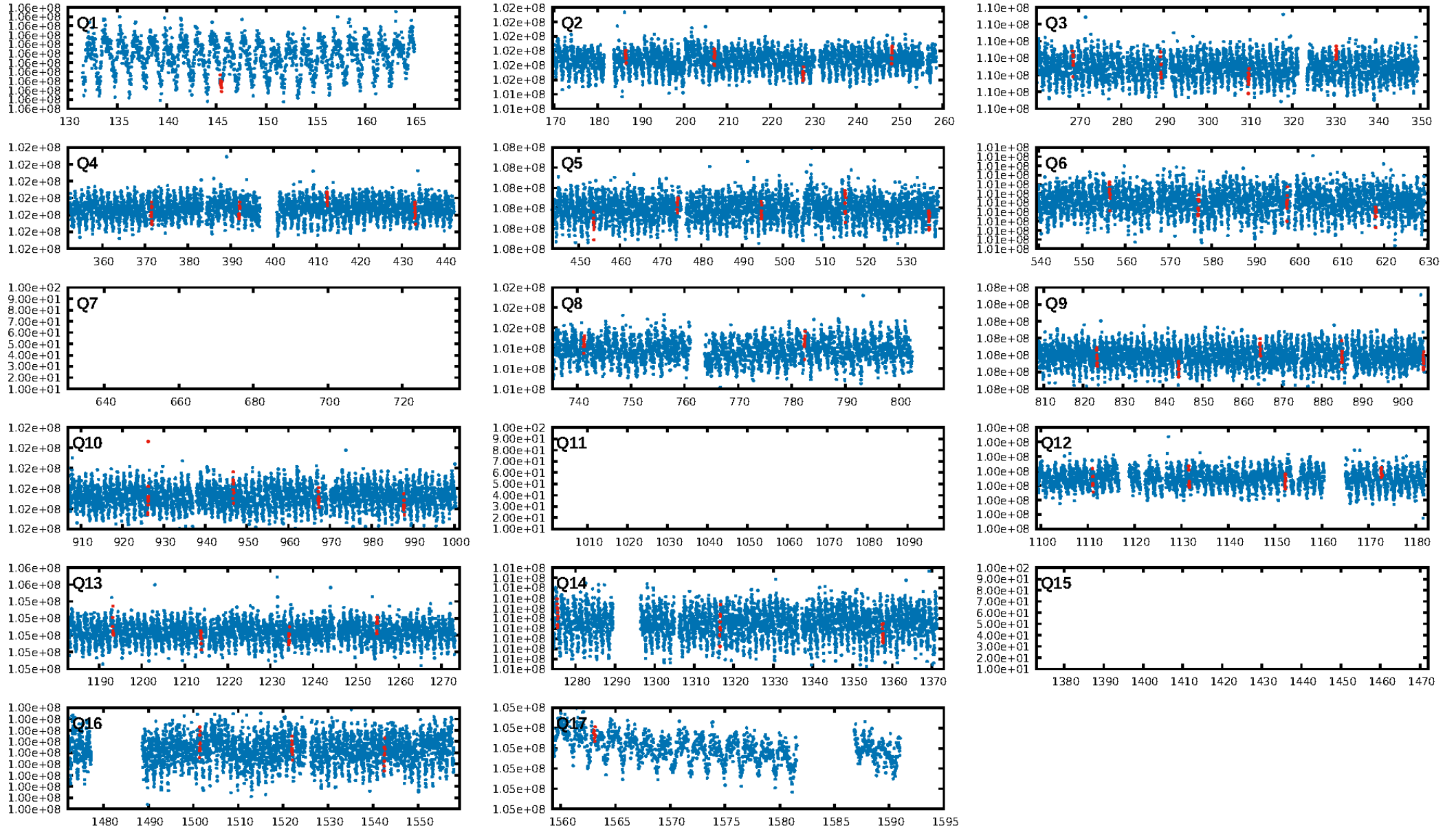
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [64.38σ]  
LongPeriod-sig: 100.0% [23.48σ]  
ModelChiSquare2-sig: 0.0%  
ModelChiSquareGof-sig: 3.1%  
Bootstrap-pfa: 1.52e-08  
RollingBand-fgt: 0.58 [7/12]  
GhostDiagnostic-chr: -3.228  
Centroid-sig: 0.0%  
Centroid-so: 2.908 arcsec [2.15σ]  
OotOffset-rm: 2.545 arcsec [2.91σ]  
KicOffset-rm: 2.567 arcsec [2.96σ]  
OotOffset-st: 3/0/2/4 [9]  
KicOffset-st: 3/0/2/4 [9]  
DiffImageQuality-fgm: 0.33 [3/9]  
DiffImageOverlap-fno: 0.43 [6/14]

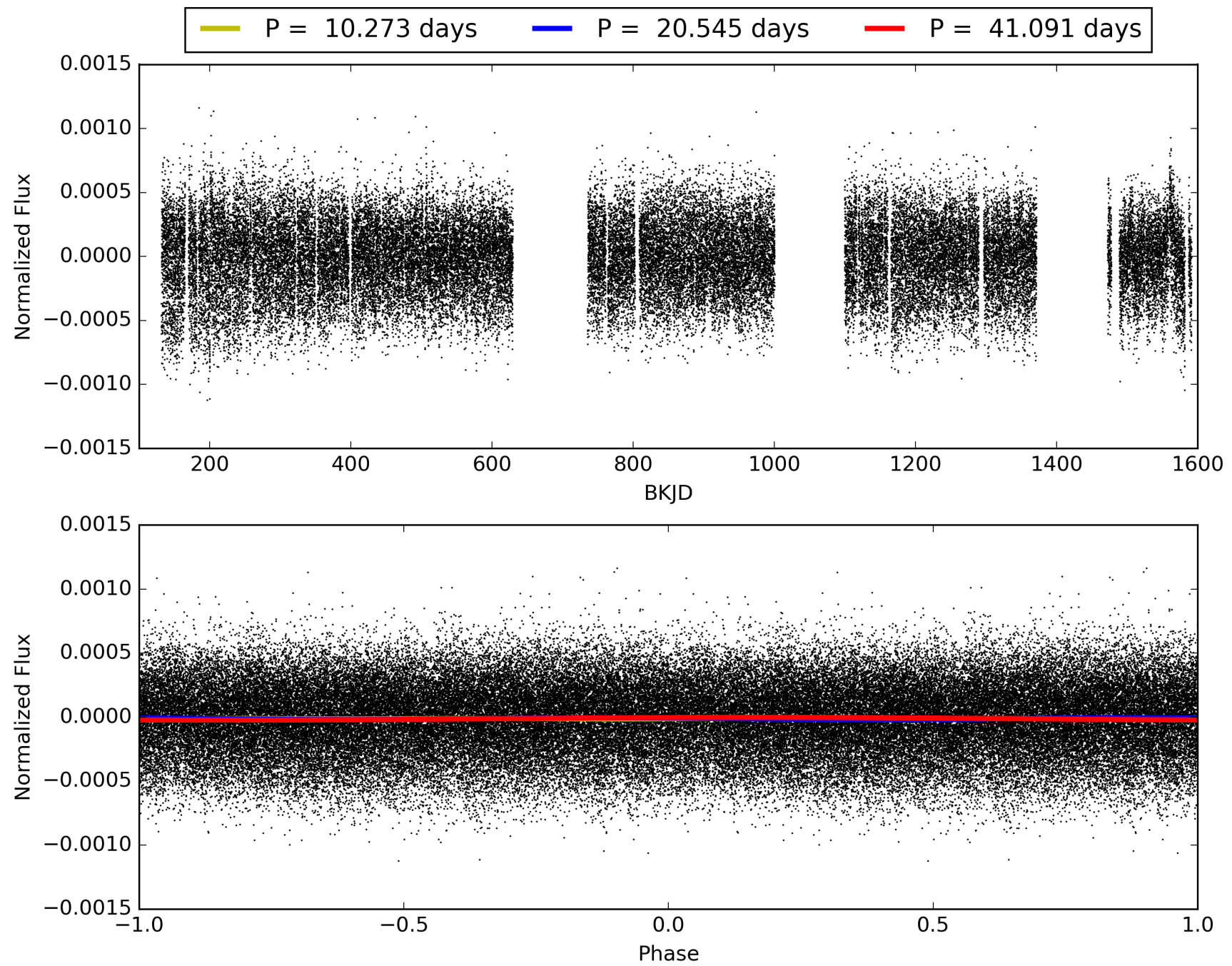
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 09:38:19 Z

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

# TCE 010989859-04, PDC Light Curves

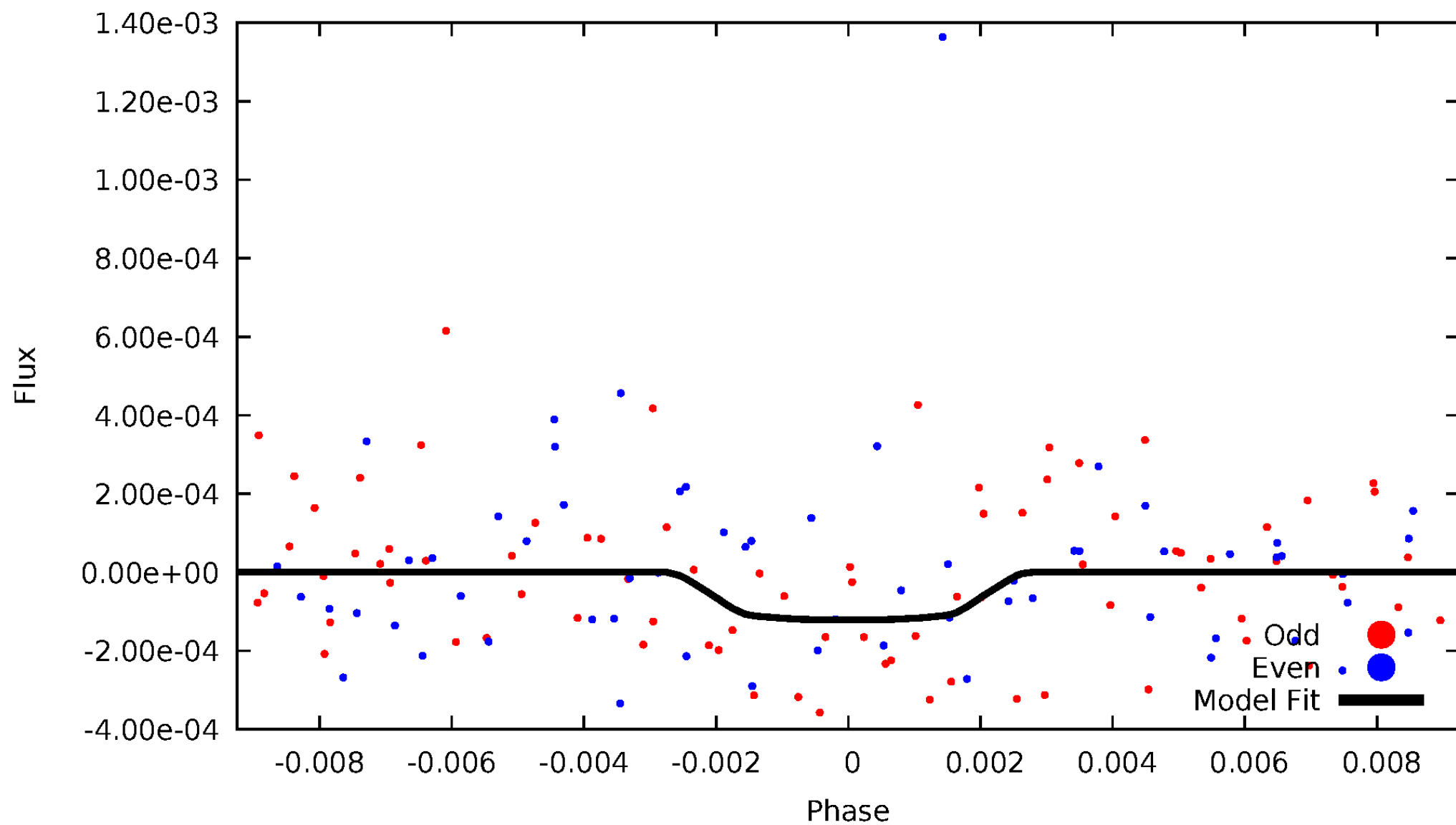


TCE 010989859-04



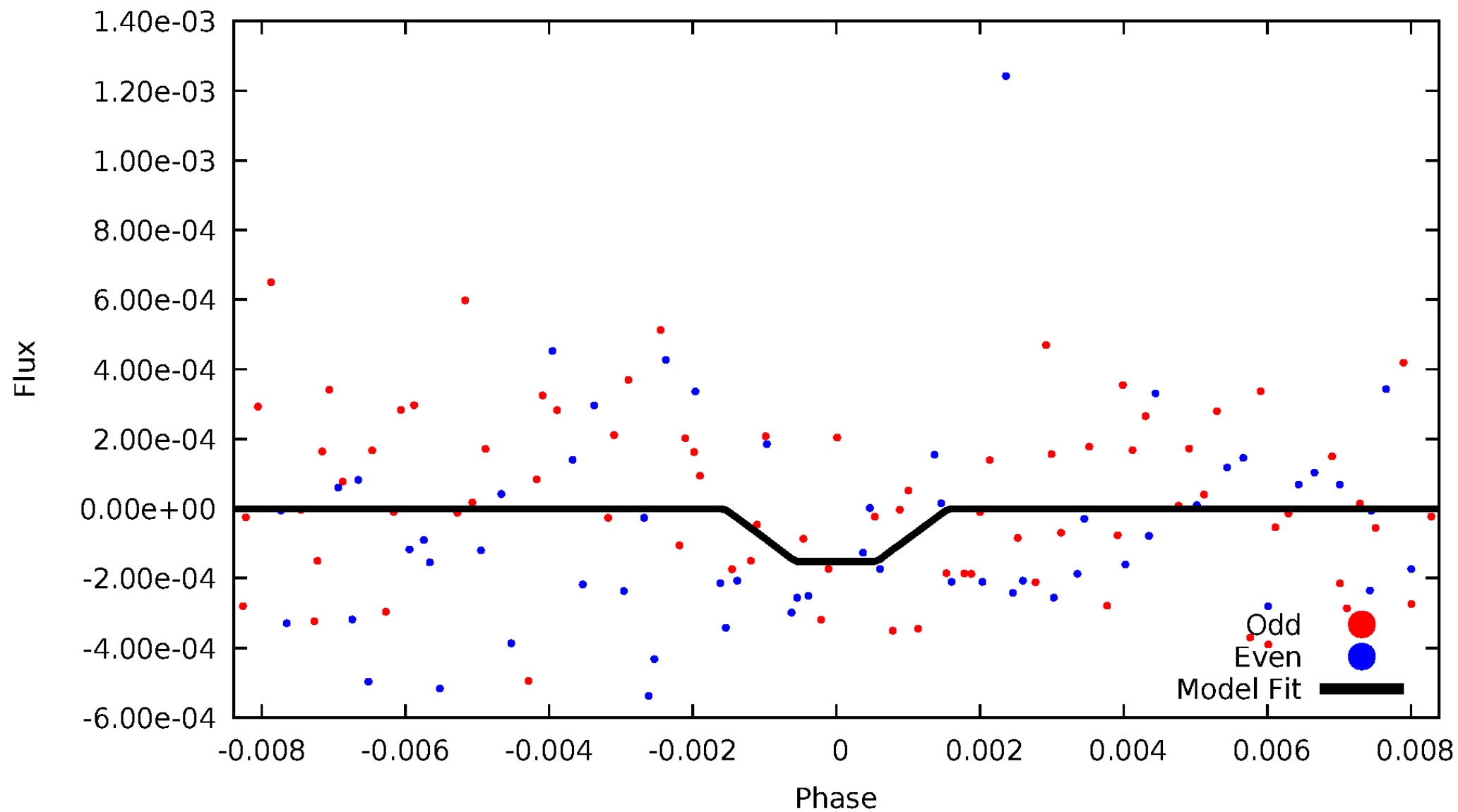
# DV Odd/Even

TCE 010989859-04



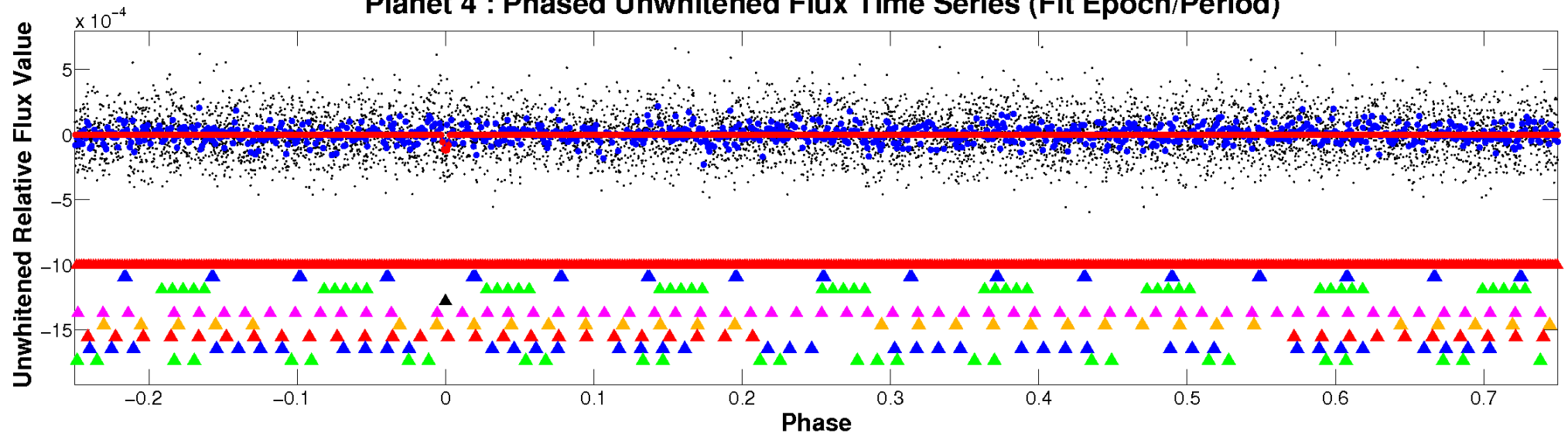
# ALT Odd/Even

TCE 010989859-04

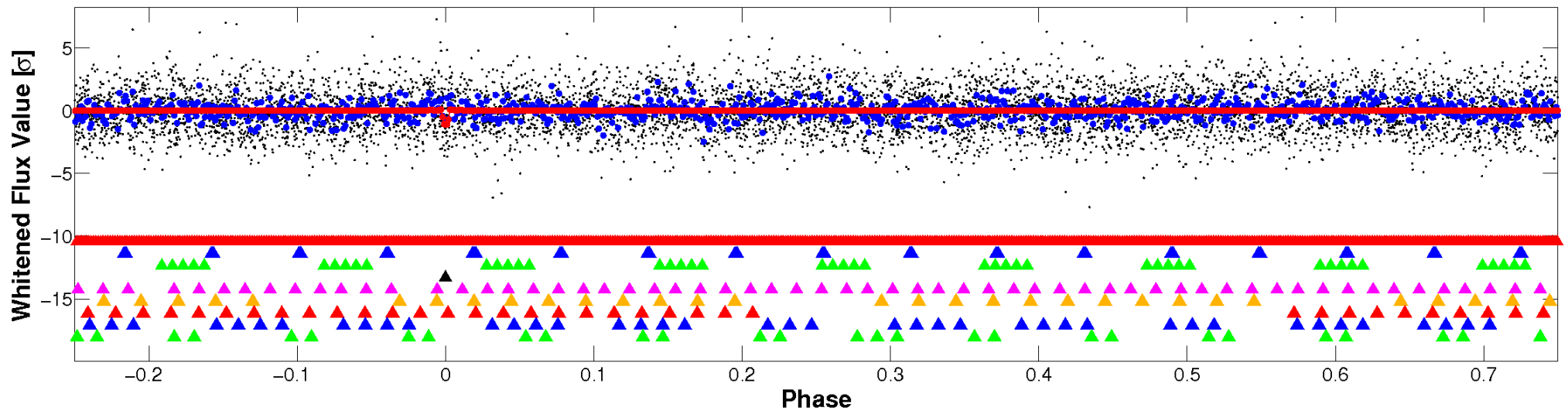


# Non-Whitened Vs. Whitened Light Curve

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



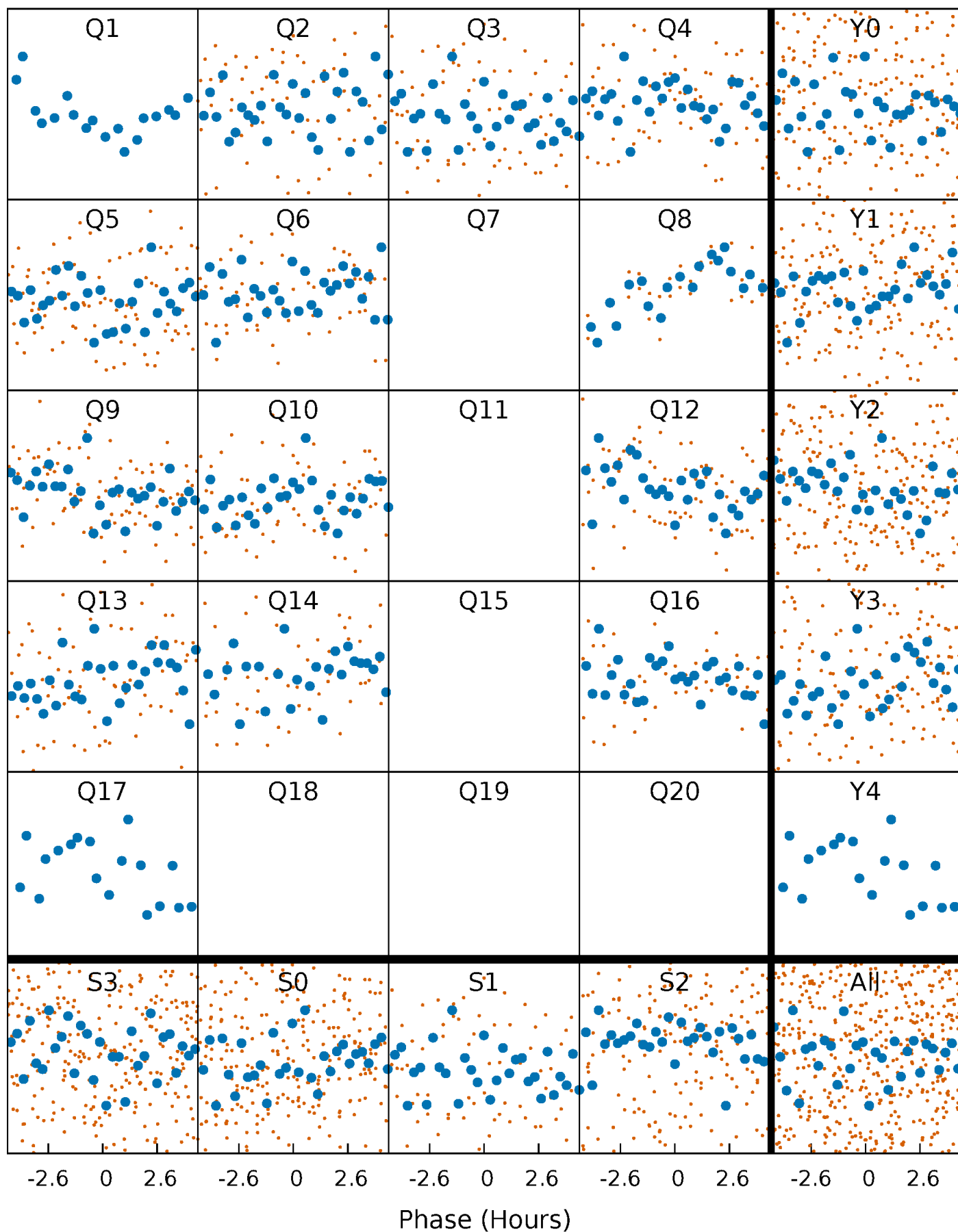
## Planet 4 : Phased Whitened Flux Time Series (Fit Epoch/Period)





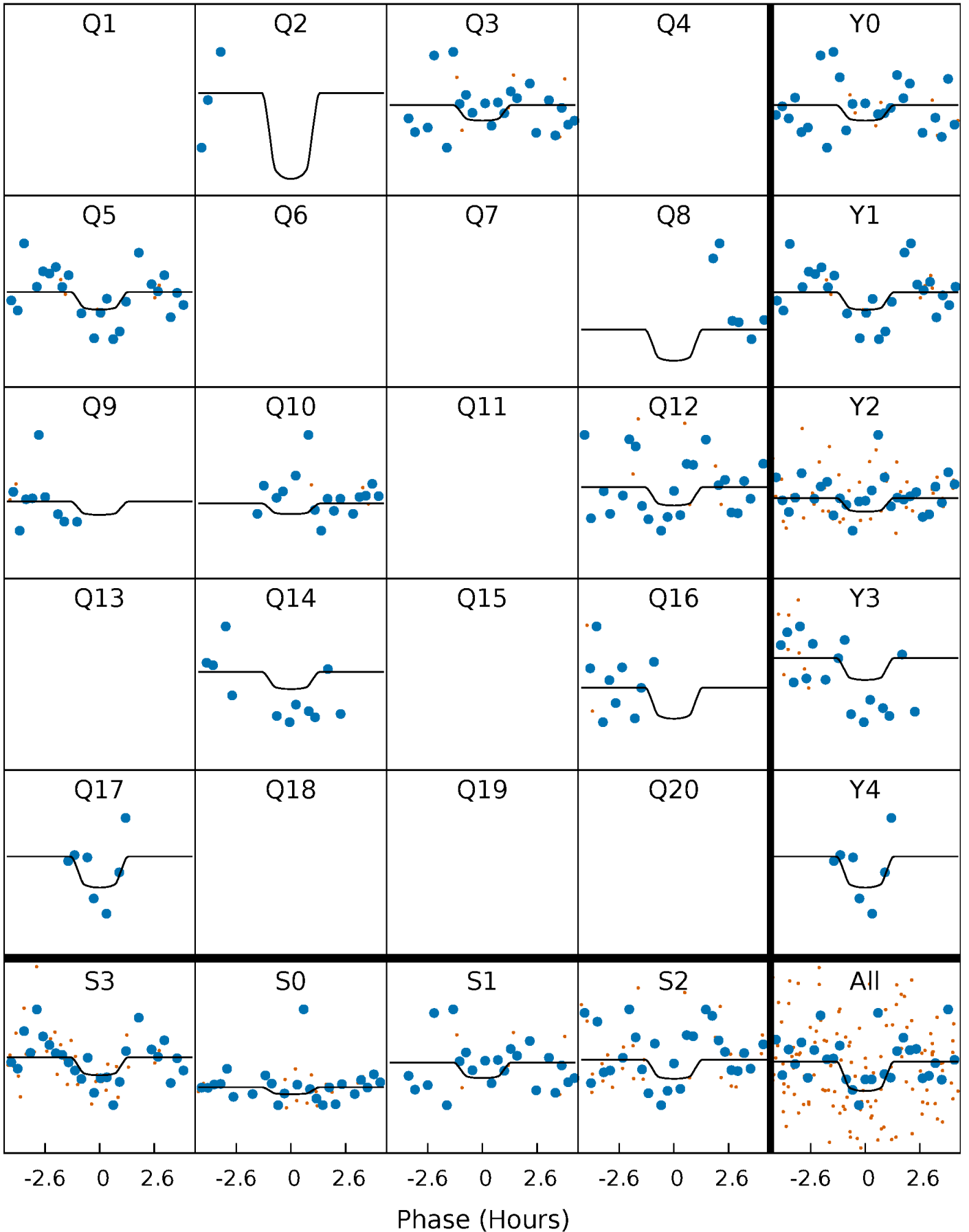
# PDC Quarter-Phased Transit Curves

TCE 010989859-04 P= 20.545399 Days  $T_0=145.462444$  (BKJD)



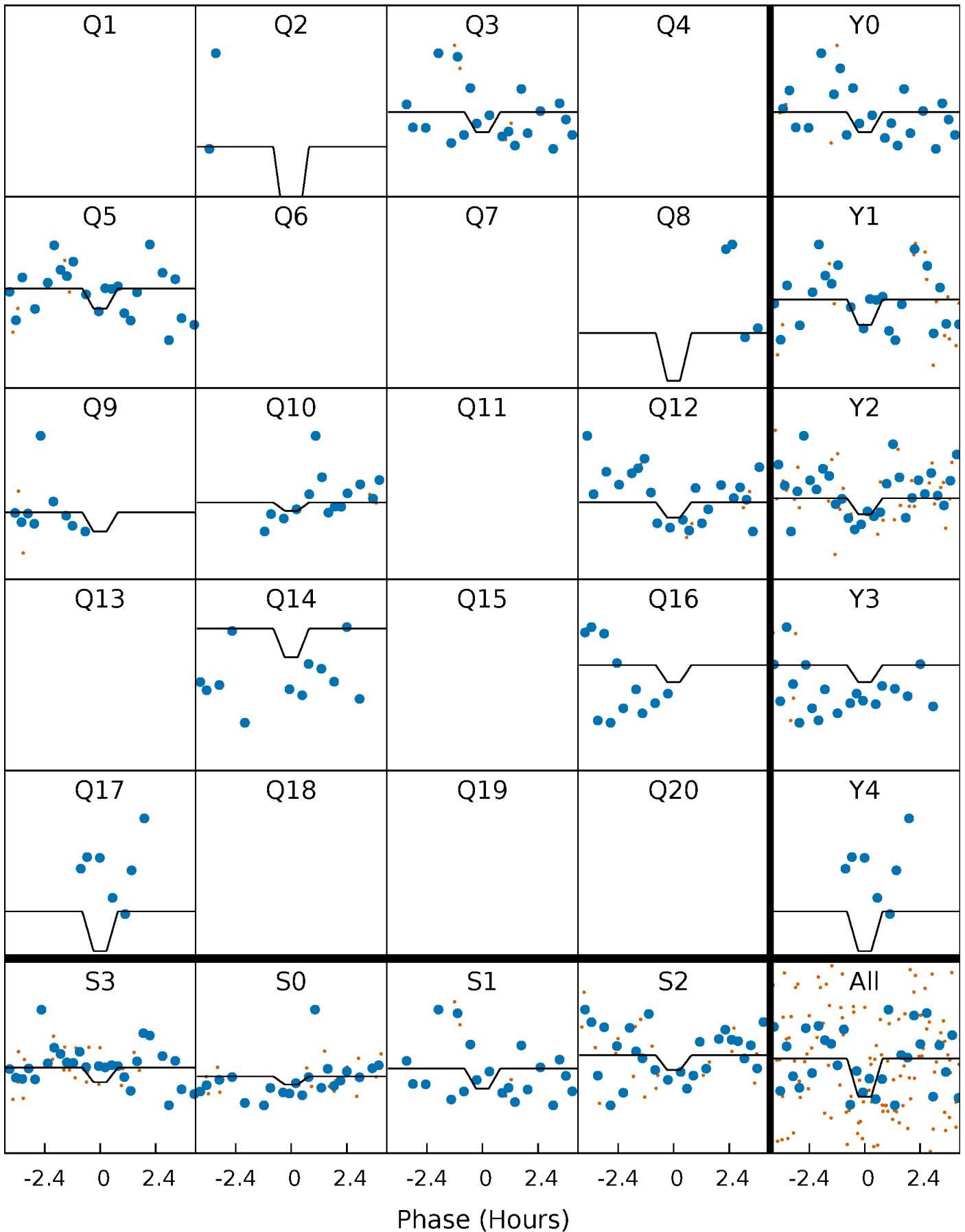
# DV Quarter-Phased Transit Curves

TCE 010989859-04     $P = 20.545399$  Days     $T_0 = 145.462444$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

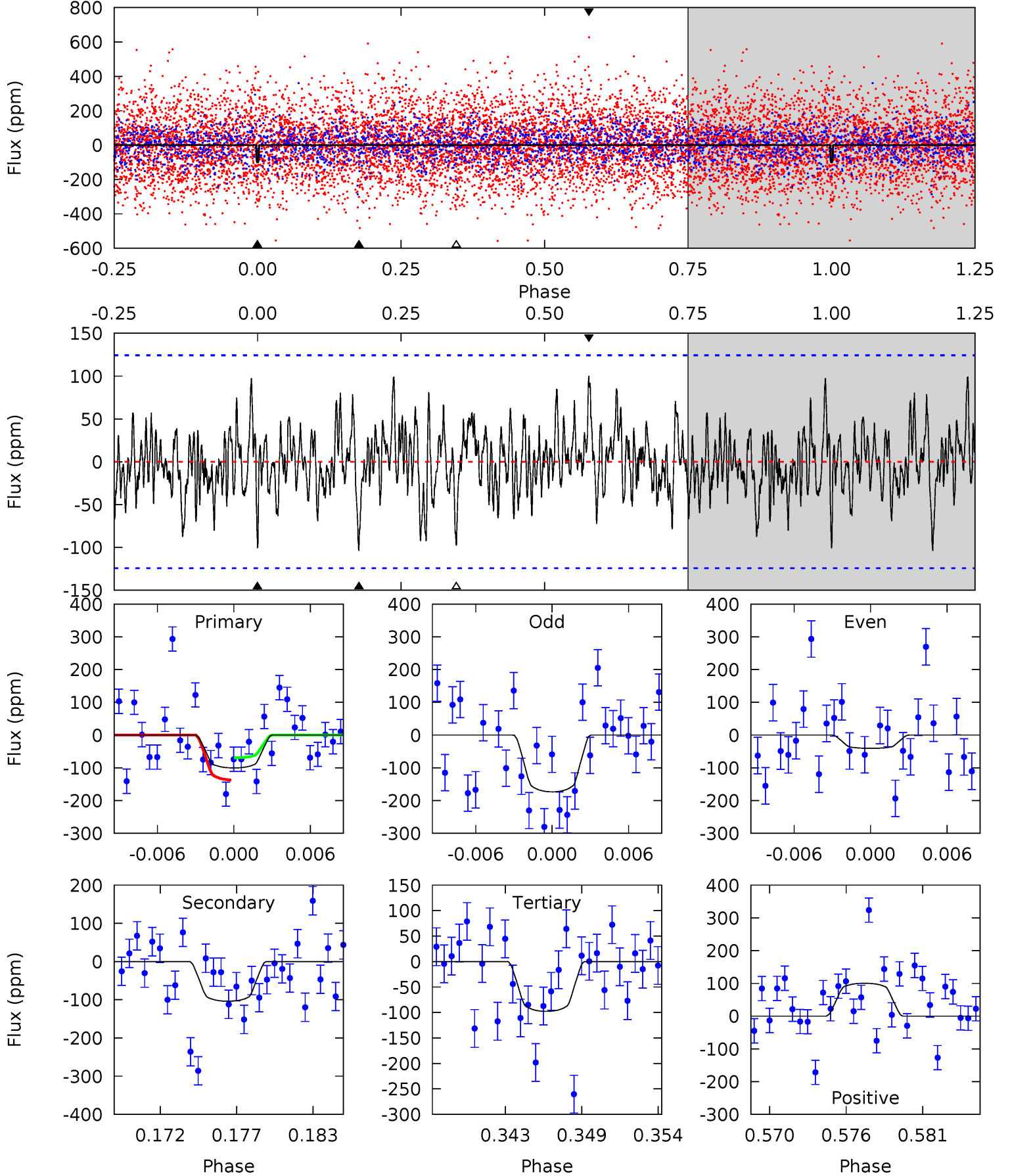
TCE 010989859-04 P= 20.545120 Days  $T_0=145.453882$  (BKJD)



# DV Model-Shift Uniqueness Test

010989859-04, P = 20.545399 Days, E = 124.917045 Days

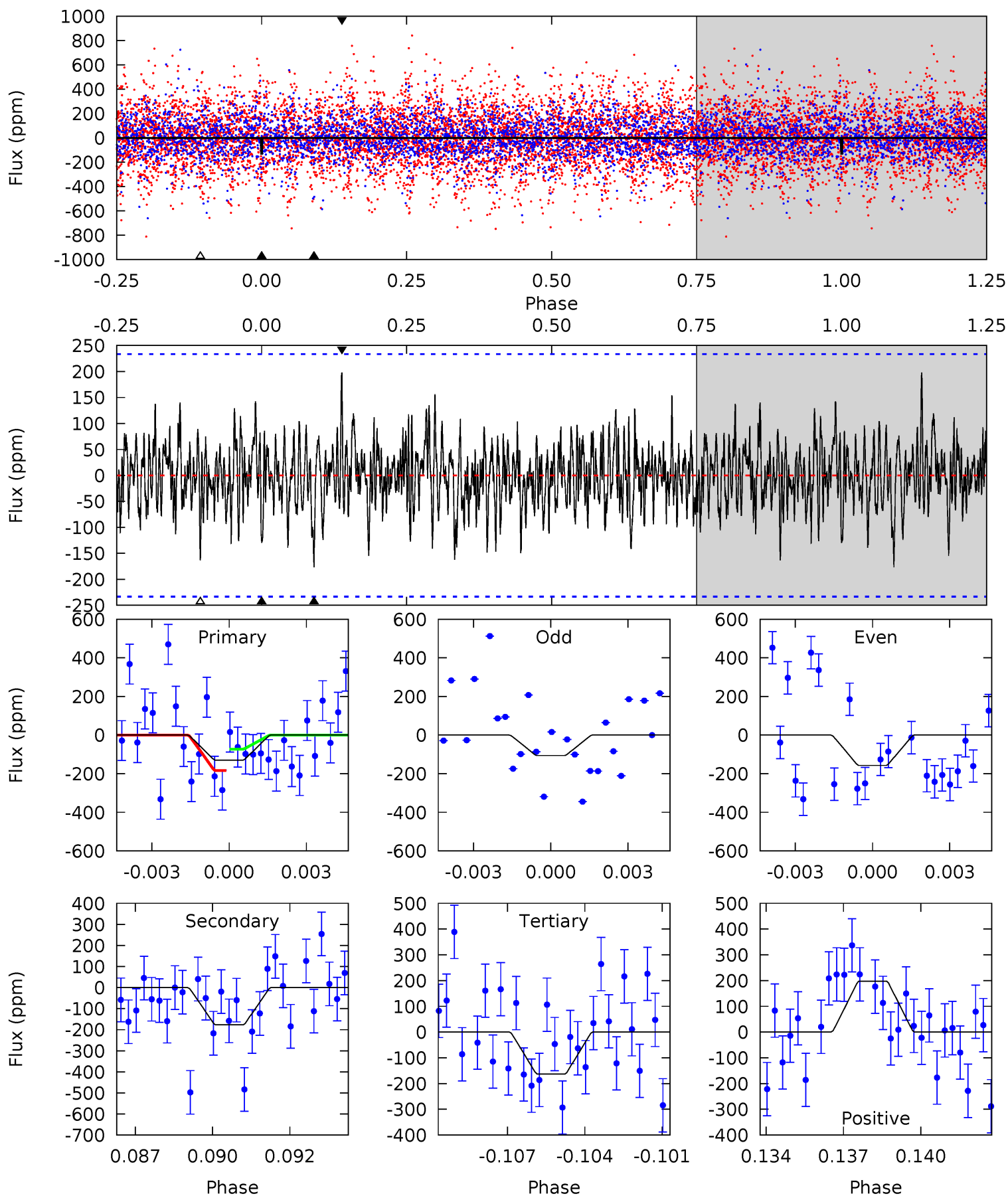
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
4.15	4.30	4.05	4.15	5.14	2.77	1.34	0.11	-0.00	0.25	0.14	2.69	0.29	0.49	1.40



# Alt Model-Shift Uniqueness Test

010989859-04, P = 20.545120 Days, E = 124.908762 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
2.92	3.98	3.68	4.45	5.25	2.97	1.19	-0.75	-1.53	0.31	-0.47	0.57	0.82	0.53	1.26



### Stellar Parameters For KIC 010989859

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$7291^{+207}_{-285}$	$4.307^{+0.084}_{-0.182}$	$-0.600^{+0.250}_{-0.300}$	$1.278^{+0.380}_{-0.163}$	$1.208^{+0.166}_{-0.136}$	$0.815^{+0.355}_{-0.399}$
	+3%/-4%	+2%/-4%	+42%/-50%	+30%/-13%	+14%/-11%	+44%/-49%
Source	PHO1	KIC0	KIC0	DSEP		

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

### Secondary Eclipse Parameters for KIC 010989859-04 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-104 \pm 24$	$2.42^{+1.98}_{-1.65}$	$1292^{+97}_{-68}$	$5603^{+5310}_{-1285}$	$238^{+1957}_{-169}$
Alt.	$-177 \pm 44$	$2.39^{+2.24}_{-1.53}$	$1300^{+80}_{-68}$	$6330^{+6576}_{-1633}$	$382^{+2935}_{-278}$

$T_{\text{max}}$  = 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

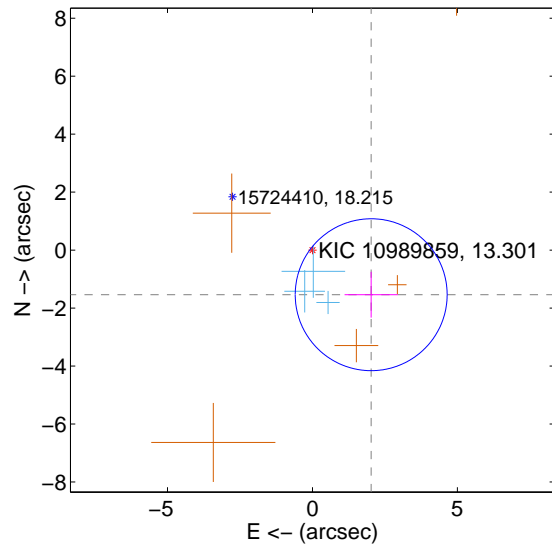
Supplemental centroid analysis for 010989859-04. Kepler magnitude: 13.30. Transit SNR 5.73

There are 3 quarters with good PRF difference image offsets

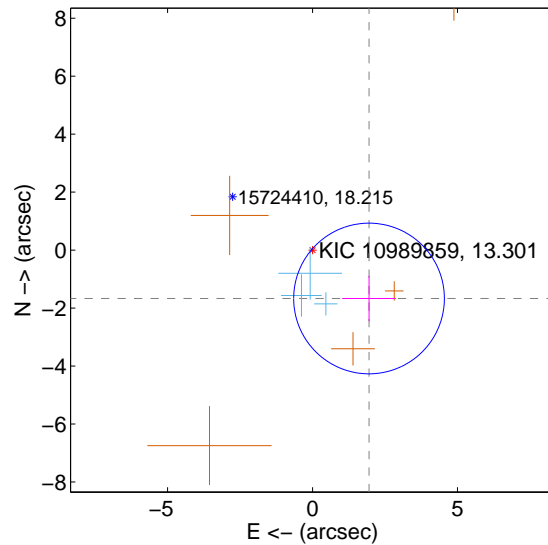
The direct PRF centroid is offset from the target star catalog position by about 0.17 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$2.545 \pm 0.873$	2.91	$-2.027 \pm 0.918$	$-1.540 \pm 0.790$
PRF-fit source offset from KIC position	$2.567 \pm 0.866$	2.96	$-1.949 \pm 0.924$	$-1.670 \pm 0.781$
photometric centroid source offset	$2.91 \pm 1.35$	2.15	$-0.59 \pm 1.26$	$2.85 \pm 1.35$

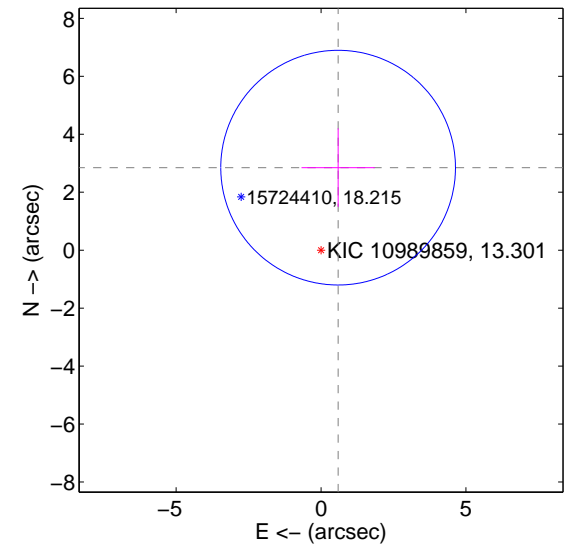
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position



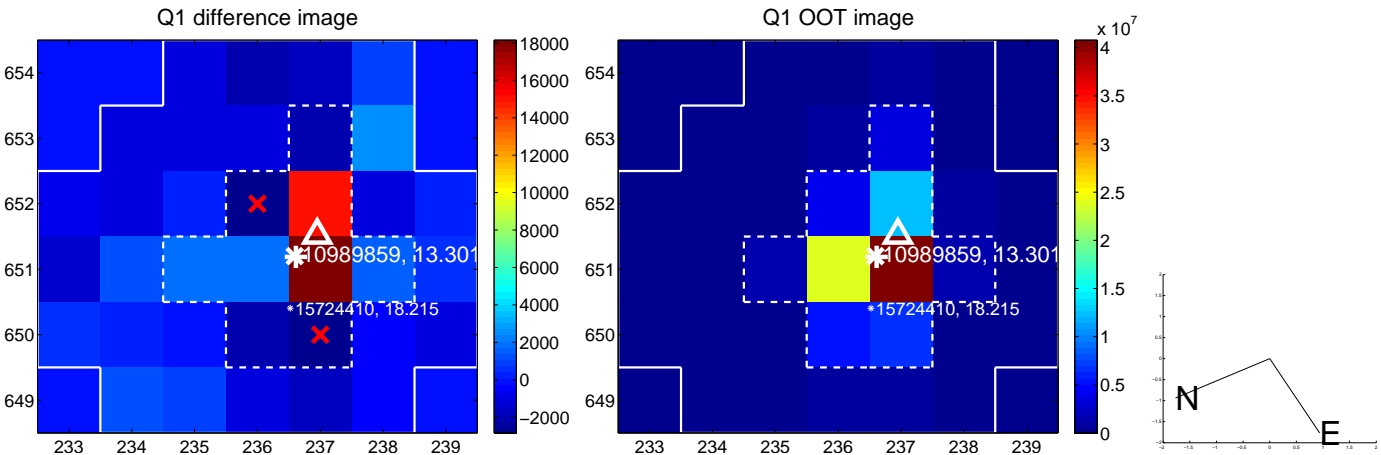
offset from photometric centroids



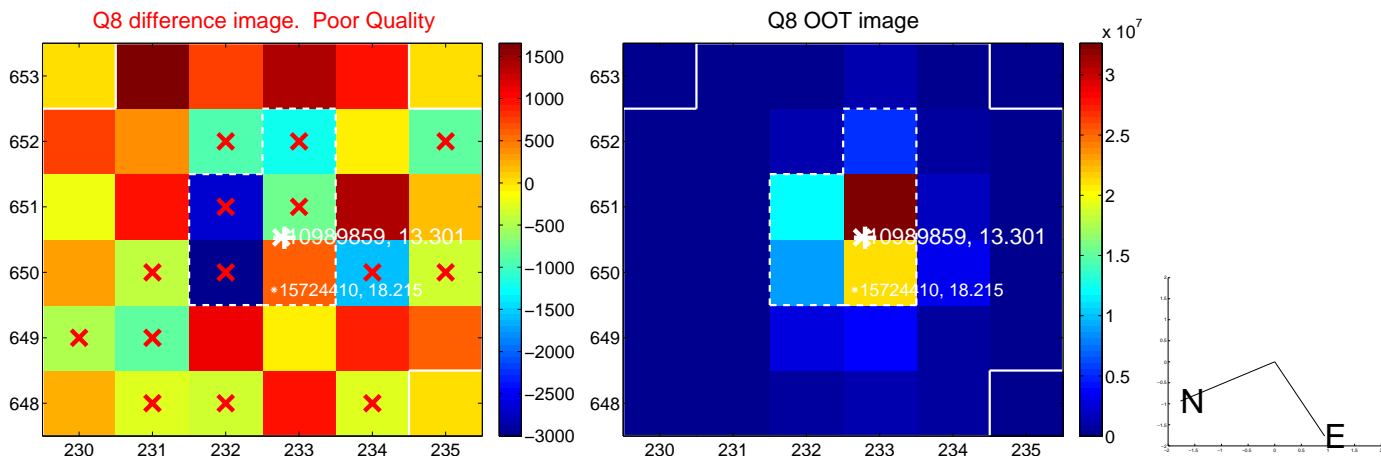
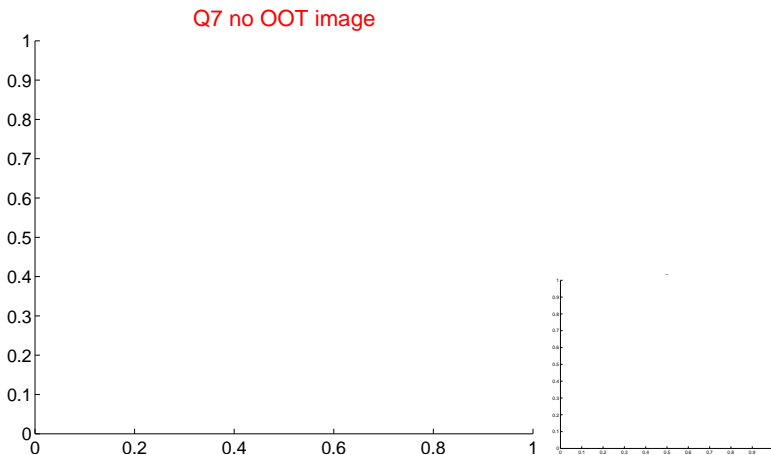
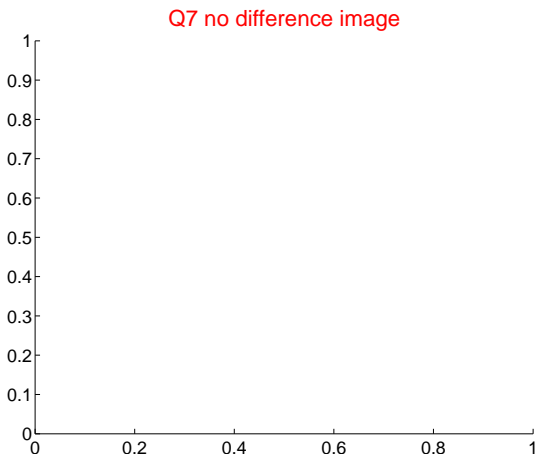
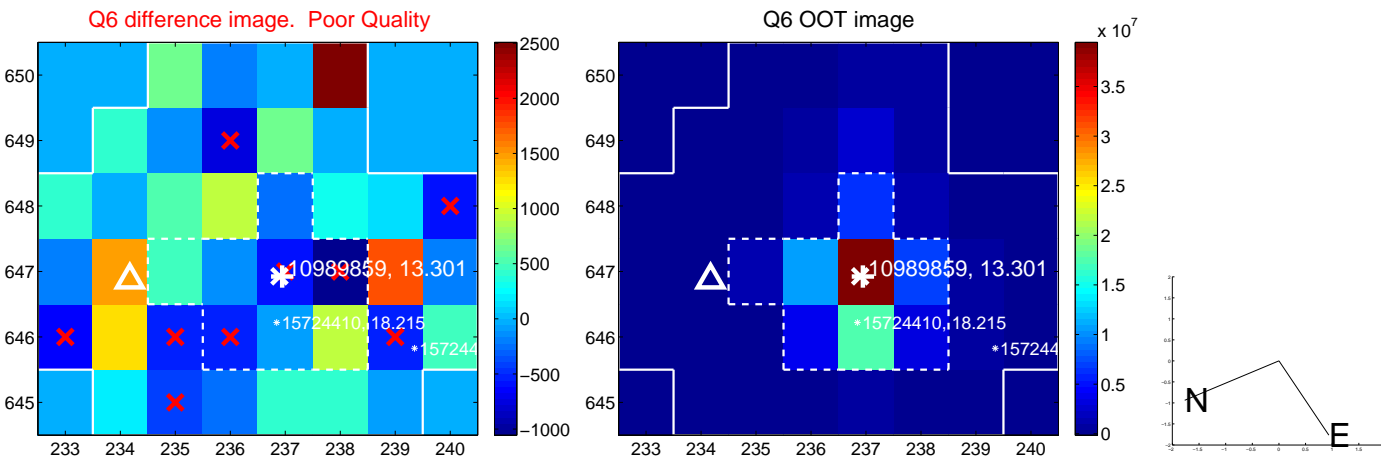
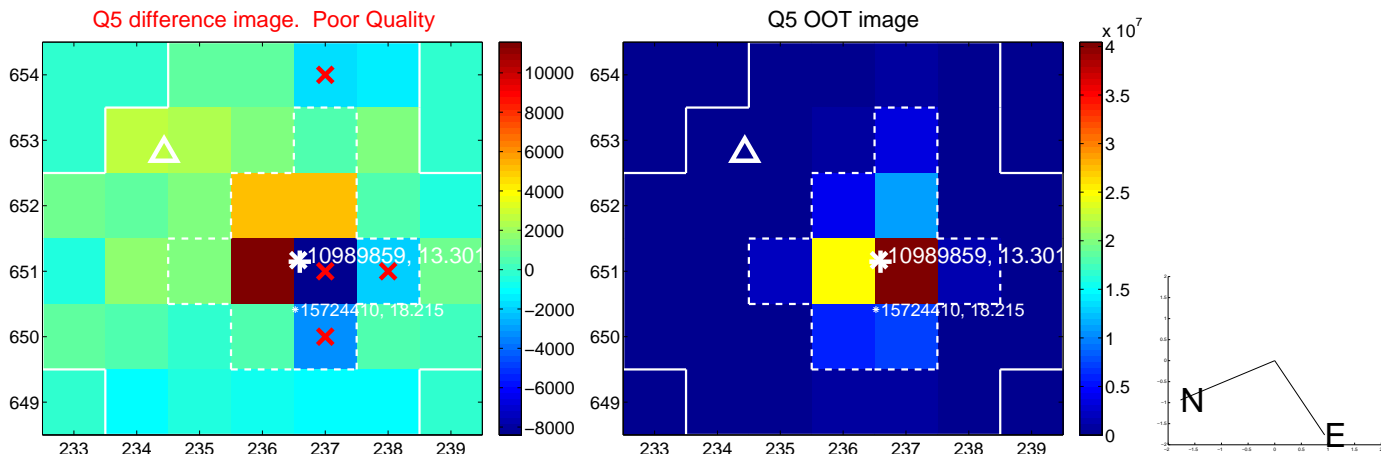
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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



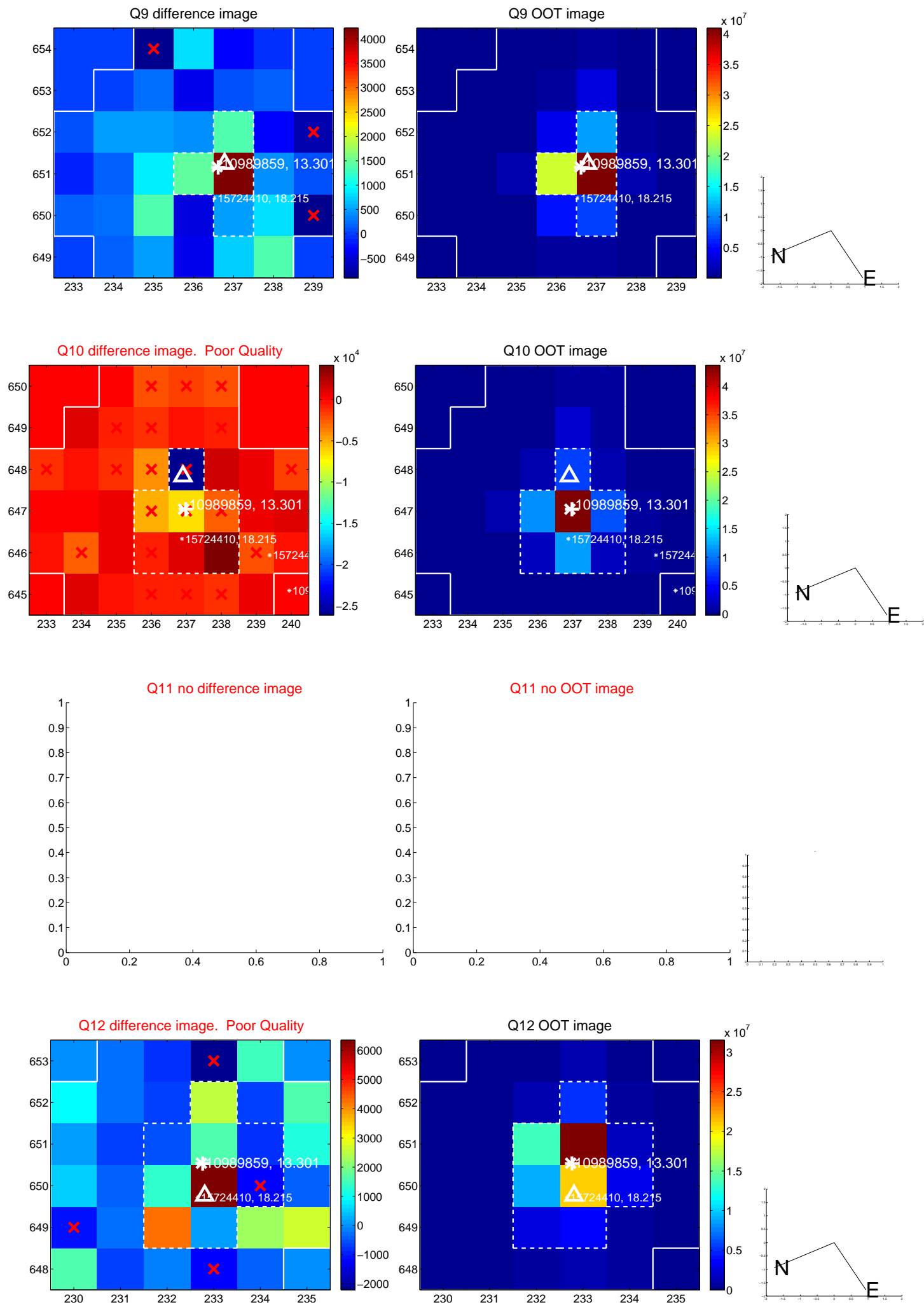
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



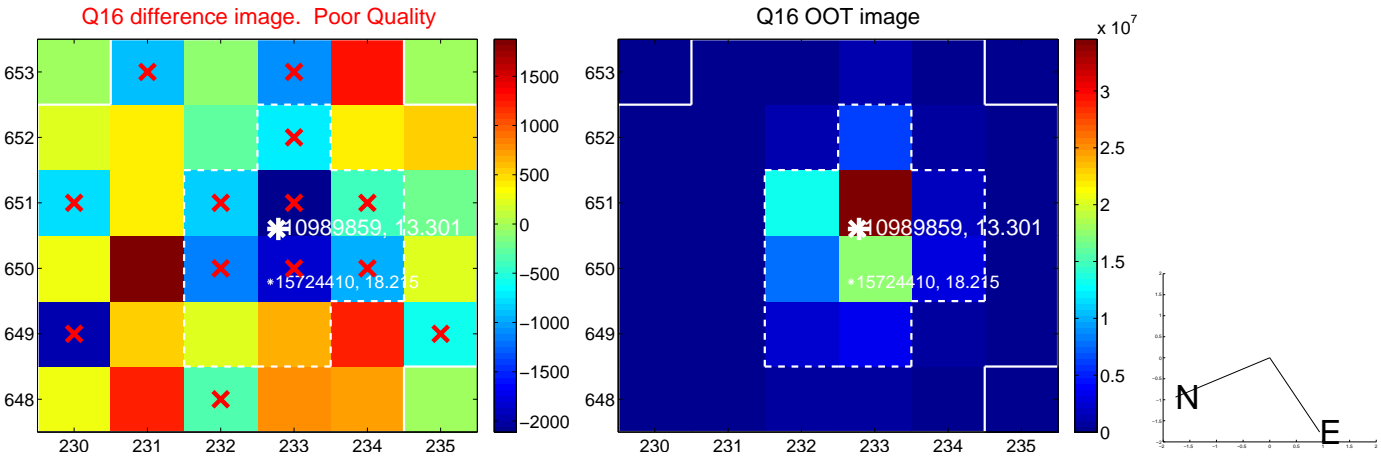
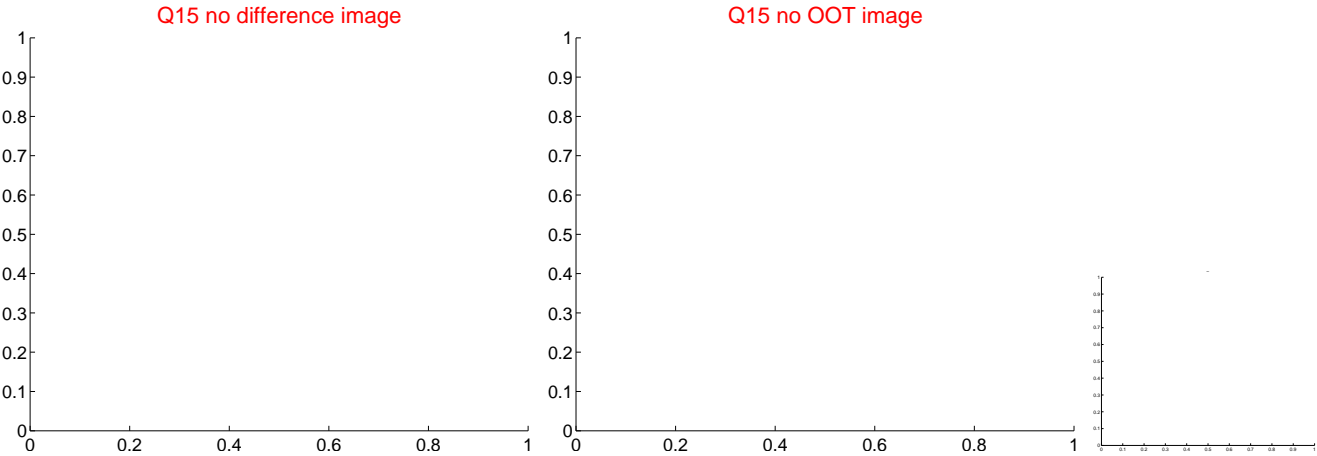
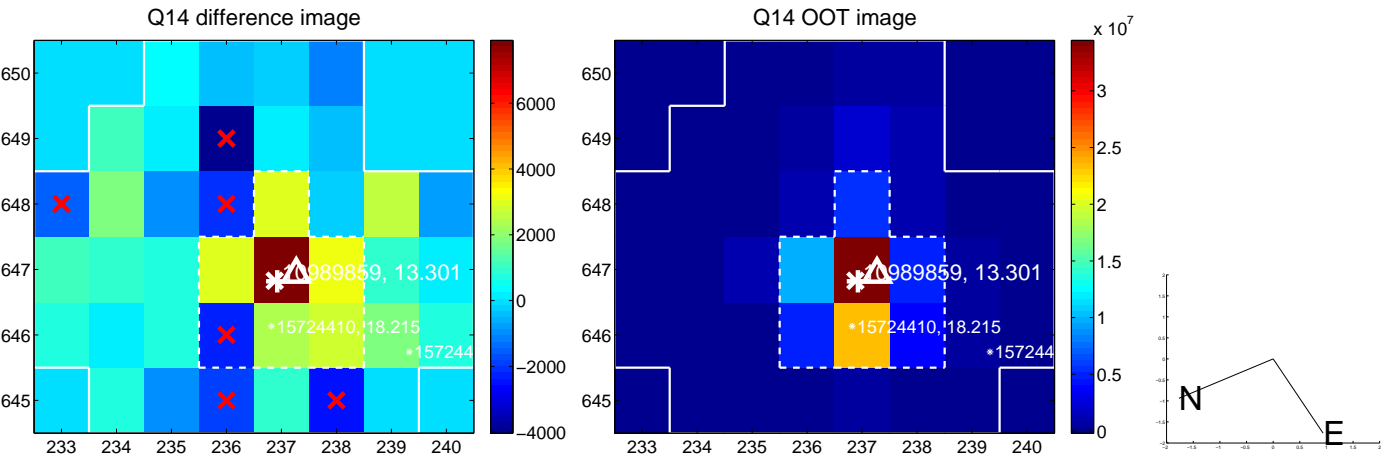
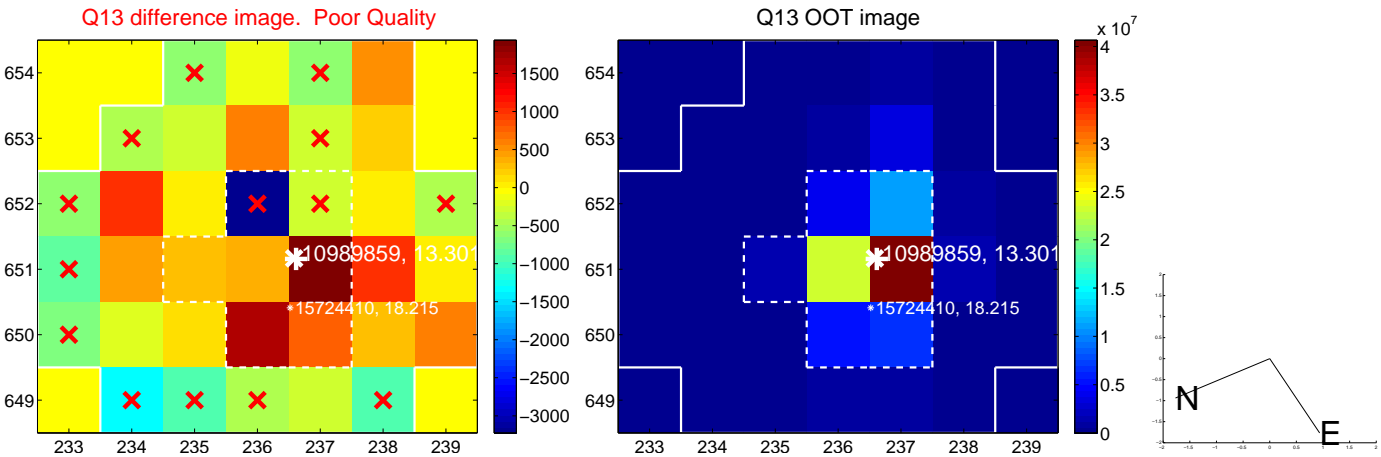
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



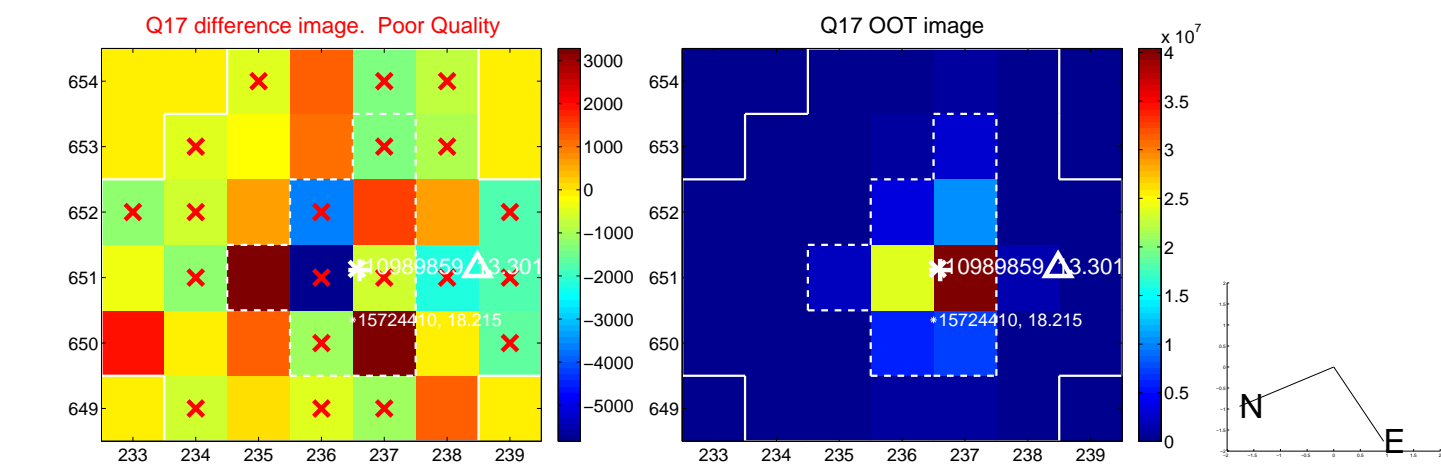
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



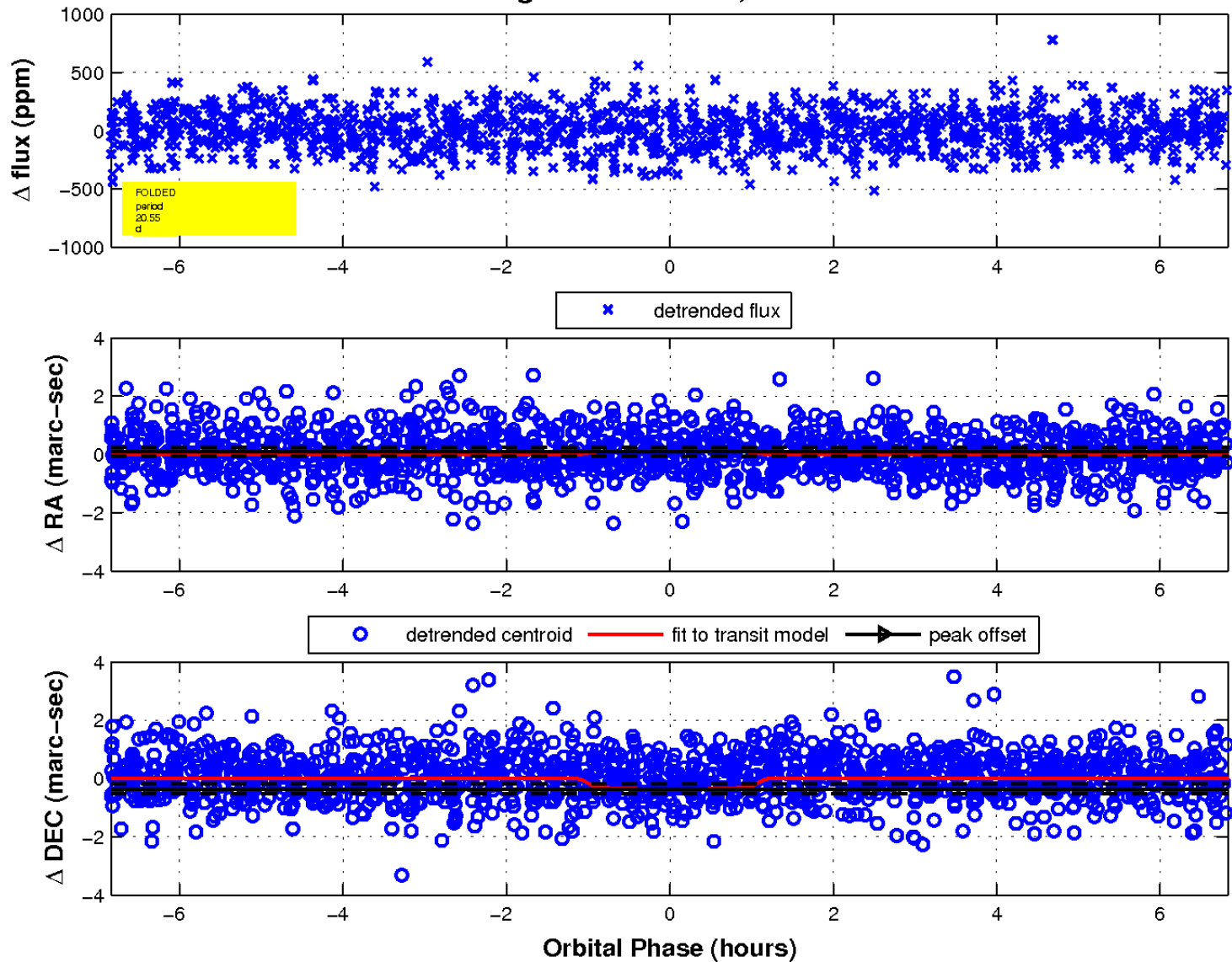
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

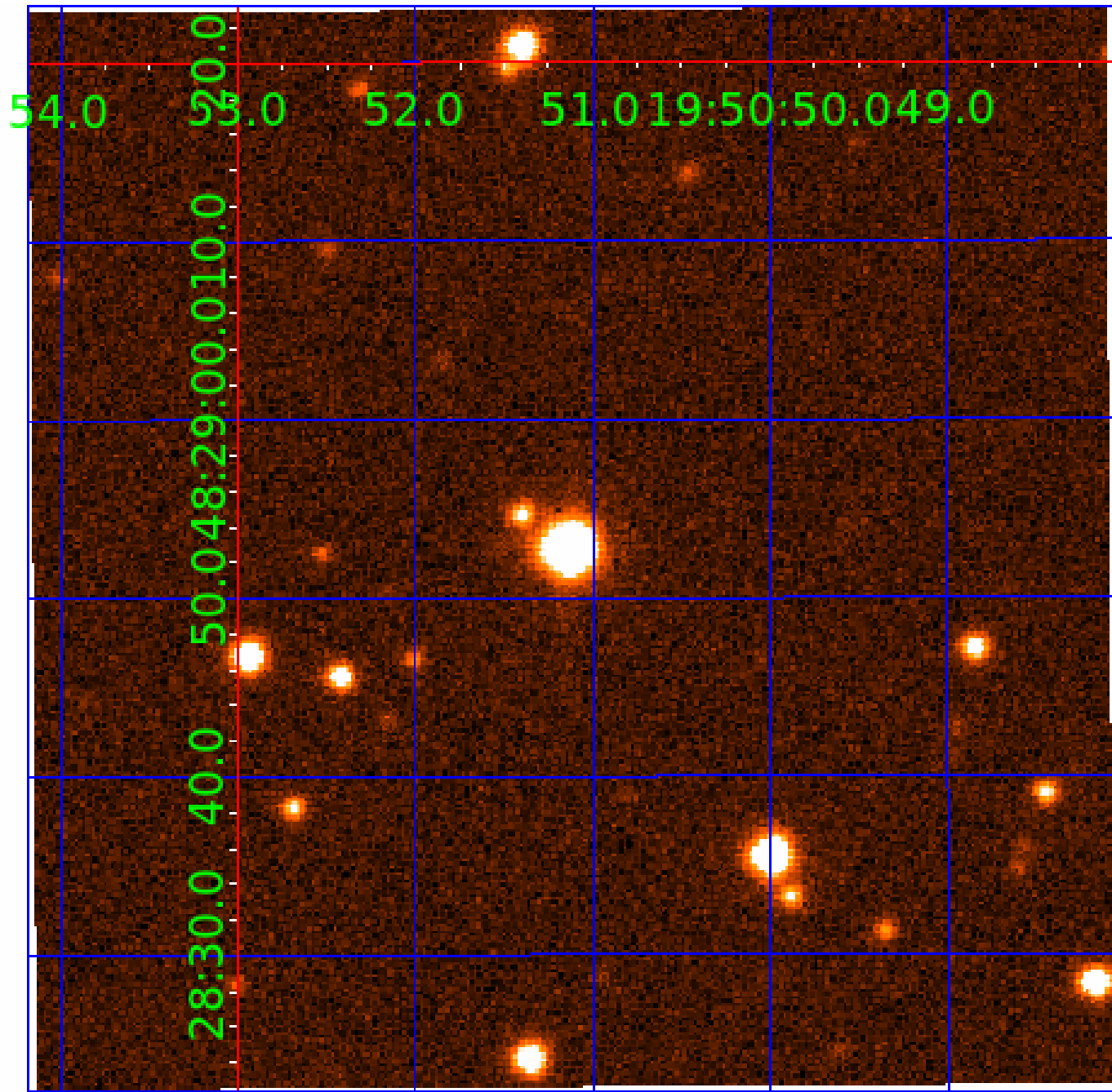


fluxWeightedCentroids, Planet 4 of 9



UKIRT Image

Declination



# KIC 010989859

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
010989859-01	OBS	No	1.032262	131.862720	14.6	6.908	8.1	7.1	1.28	7291	0.49	9120.32
010989859-02	OBS	No	27.797714	145.835134	231.8	2.094	11.2	11.5	1.28	7291	3.06	112.99
010989859-03	OBS	No	31.943139	158.167322	296.6	2.043	10.5	11.7	1.28	7291	2.57	93.88
010989859-04	OBS	No	20.545399	145.462444	122.0	2.279	8.7	5.7	1.28	7291	1.66	169.09
010989859-05	OBS	No	24.191498	148.647136	134.3	2.949	8.0	6.8	1.28	7291	1.72	135.99
010989859-06	OBS	No	47.767277	156.662618	384.1	1.137	8.9	8.6	1.28	7291	2.71	54.90
010989859-07	OBS	No	40.707094	170.263259	214.2	2.535	8.8	8.4	1.28	7291	2.09	67.95
010989859-08	OBS	No	35.515074	164.594190	363.2	1.016	8.8	9.6	1.28	7291	2.63	81.50
010989859-09	OBS	No	52.174965	160.628549	285.1	0.641	8.9	4.4	1.28	7291	2.23	48.80

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
010989859-01	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT
010989859-02	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT
010989859-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT
010989859-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT
010989859-05	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—HALO_GHOST
010989859-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_DV—CENT_UNCERTAIN
010989859-07	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
010989859-08	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—CENT_FEW_DIFFS
010989859-09	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_TRACKER—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS

**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.

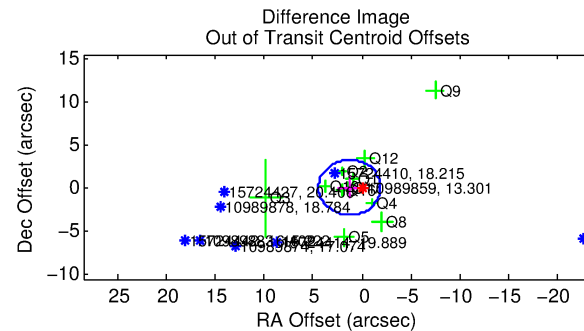
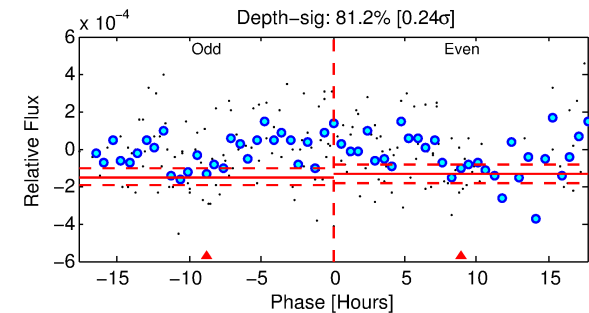
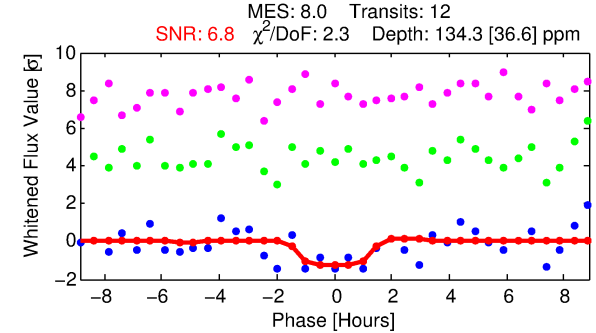
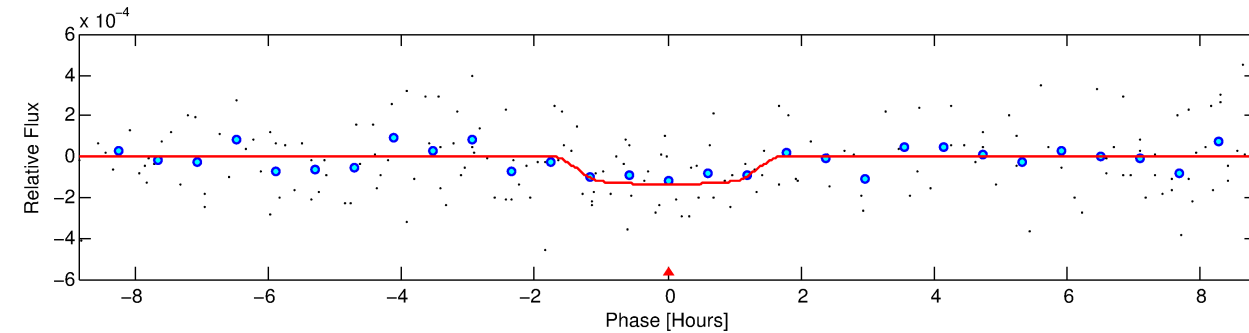
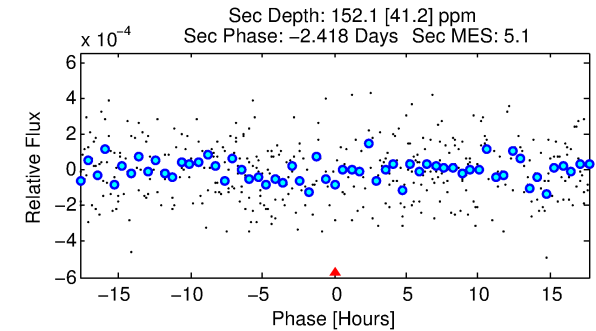
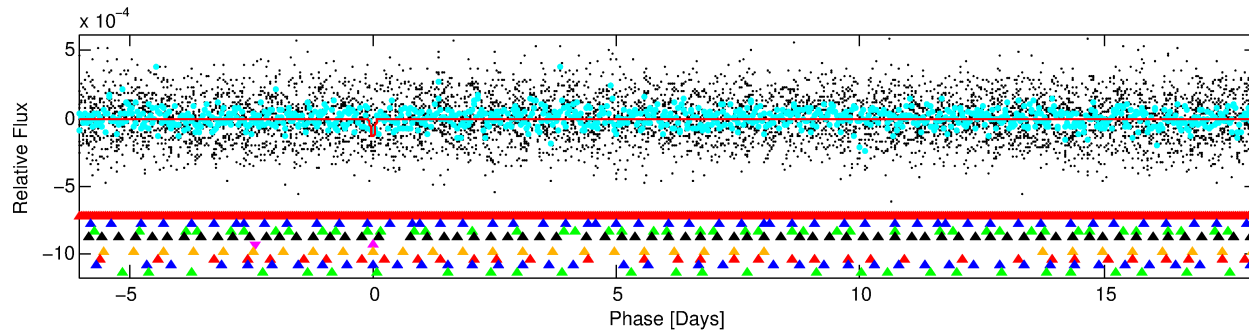
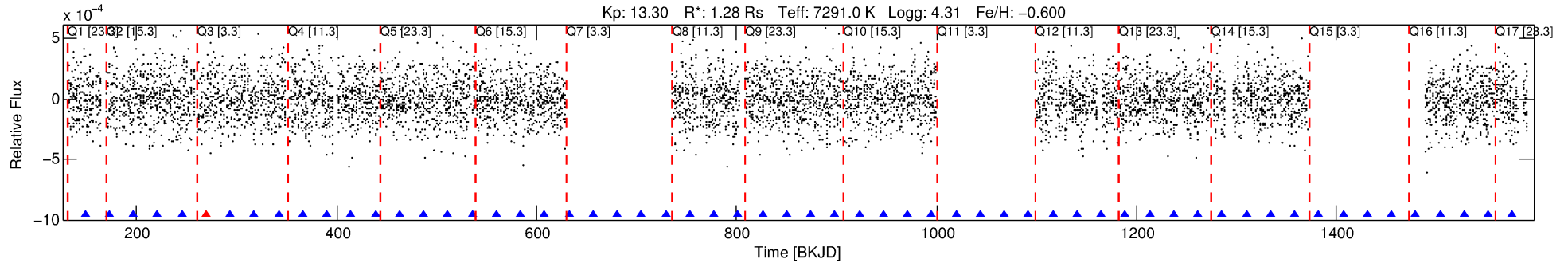
Ephemeris Match Information For 010989859-05

No Significant Match Found



# DV One-Page Summary

KIC: 10989859 Candidate: 5 of 9 Period: 24.191 d



## DV Fit Results:

Period = 24.19150 [0.00051] d  
Epoch = 148.6471 [0.0173] BKJD  
Rp/R\* = 0.0123 [0.0116]  
a/R\* = 29.14 [170.18]  
b = 0.90 [1.26]  
Seff = 135.99 [51.21]  
Teq = 871 [82] K  
Rp = 1.72 [1.69] Re  
a = 0.1744 [0.0423] AU  
Ag = 864.42 [1667.56] [0.52σ]  
Teffp = 7300 [3476] K [1.85σ]

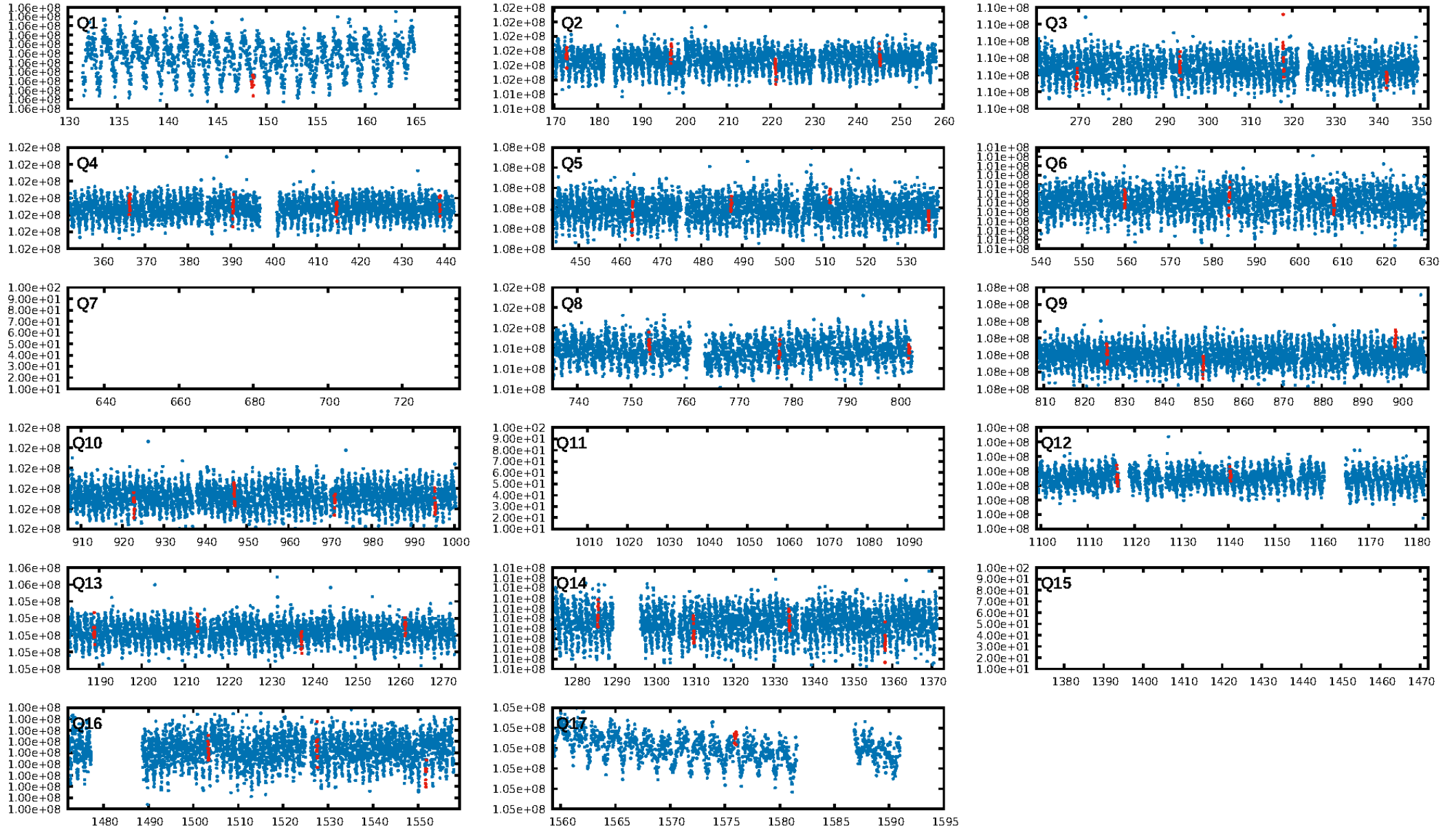
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [23.48σ]  
LongPeriod-sig: 100.0% [23.93σ]  
ModelChiSquare2-sig: 2.3%  
ModelChiSquareGof-sig: 92.5%  
Bootstrap-pfa: 4.21e-08  
RollingBand-fgt: 0.92 [11/12]  
GhostDiagnostic-chr: -0.1952  
Centroid-sig: 9.1%  
Centroid-so: 1.832 arcsec [1.67σ]  
OotOffset-rm: 1.296 arcsec [1.22σ]  
KicOffset-rm: 1.392 arcsec [1.19σ]  
OotOffset-st: 2/1/4/4 [11]  
KicOffset-st: 2/1/4/4 [11]  
DiffImageQuality-fgm: 0.36 [4/11]  
DiffImageOverlap-fno: 0.29 [4/14]

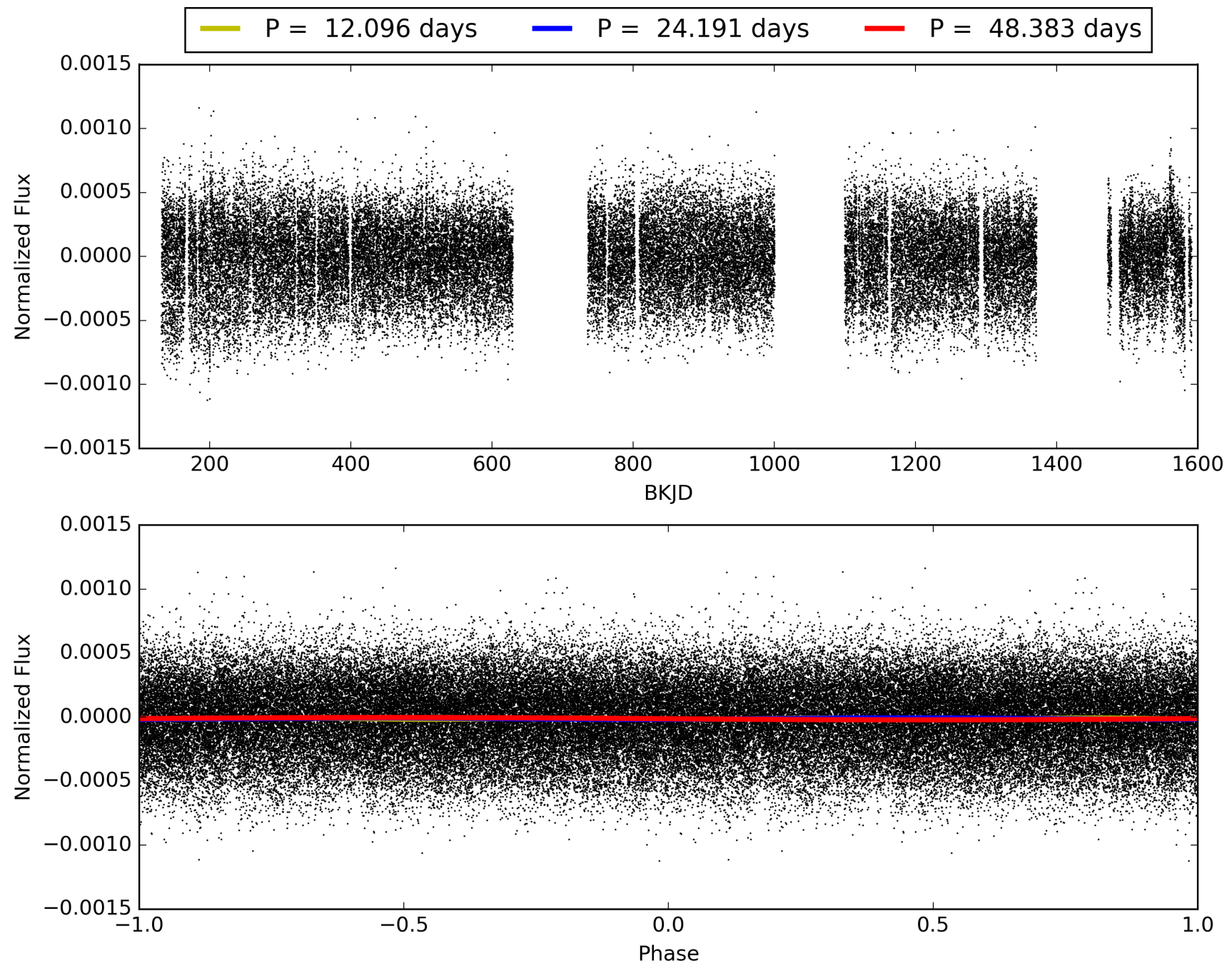
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 09:38:22 Z

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

# TCE 010989859-05, PDC Light Curves

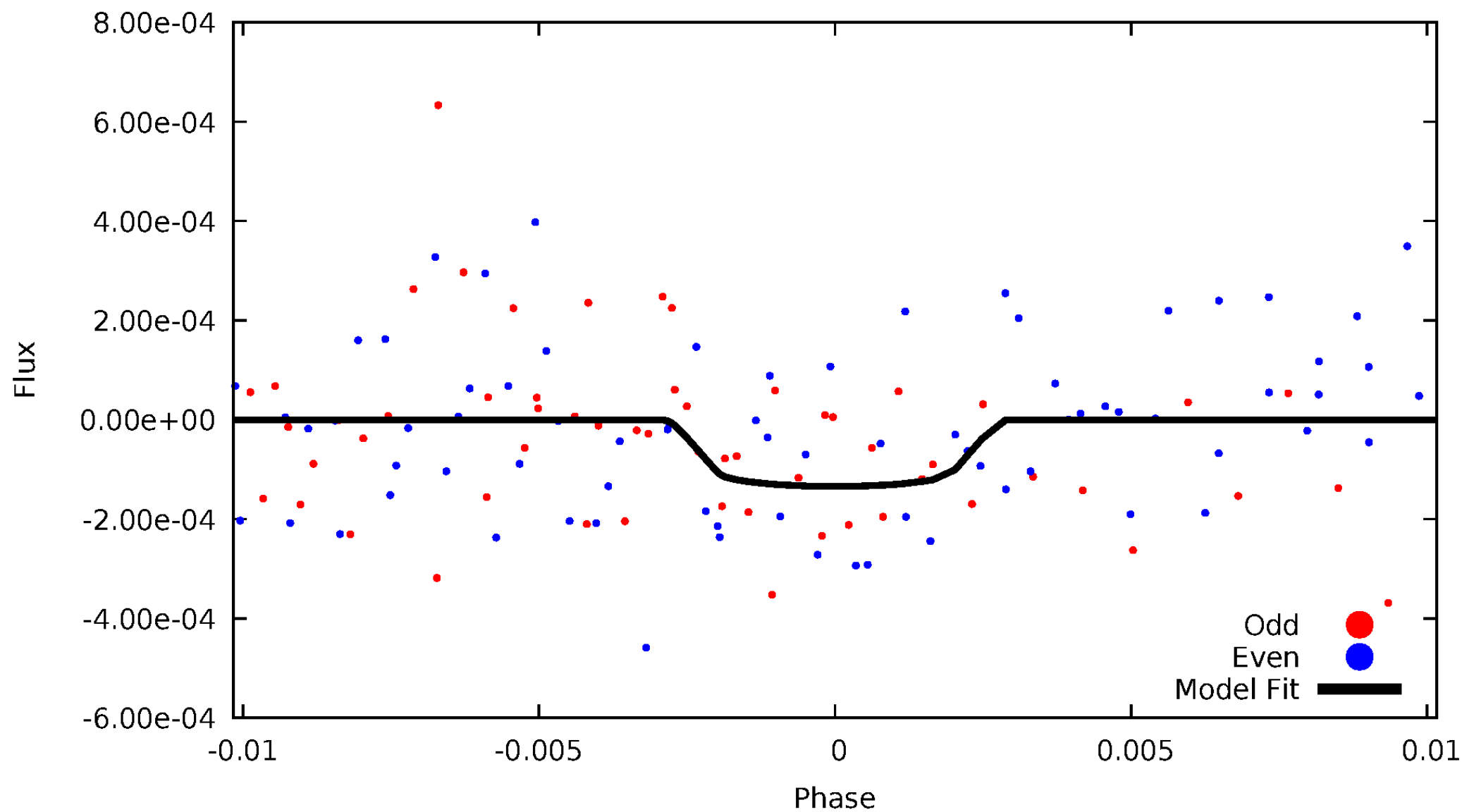


TCE 010989859-05



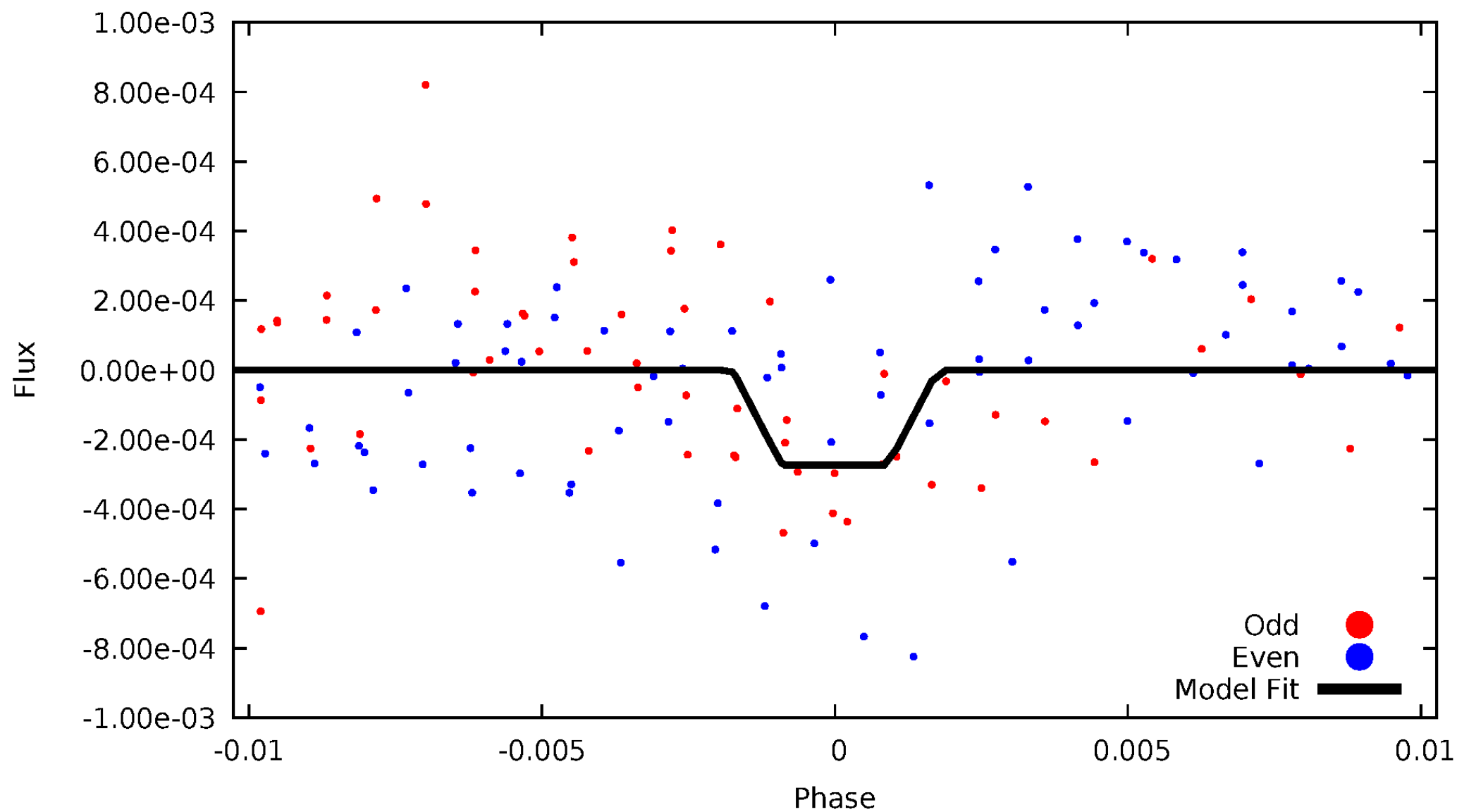
# DV Odd/Even

TCE 010989859-05



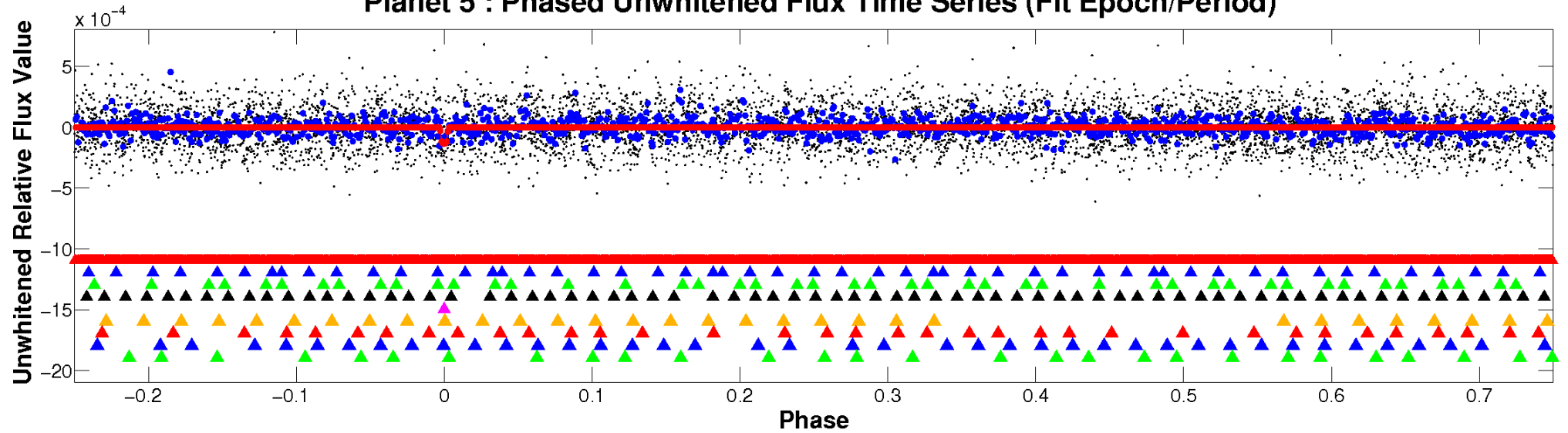
# ALT Odd/Even

TCE 010989859-05

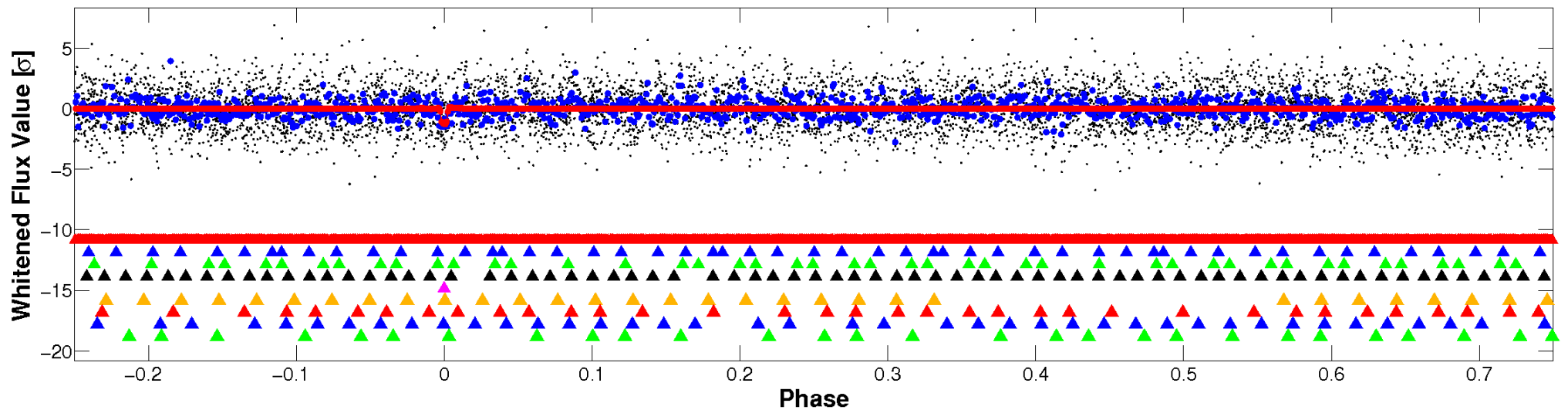


# Non-Whitened Vs. Whitened Light Curve

Planet 5 : Phased Unwhitened Flux Time Series (Fit Epoch/Period)



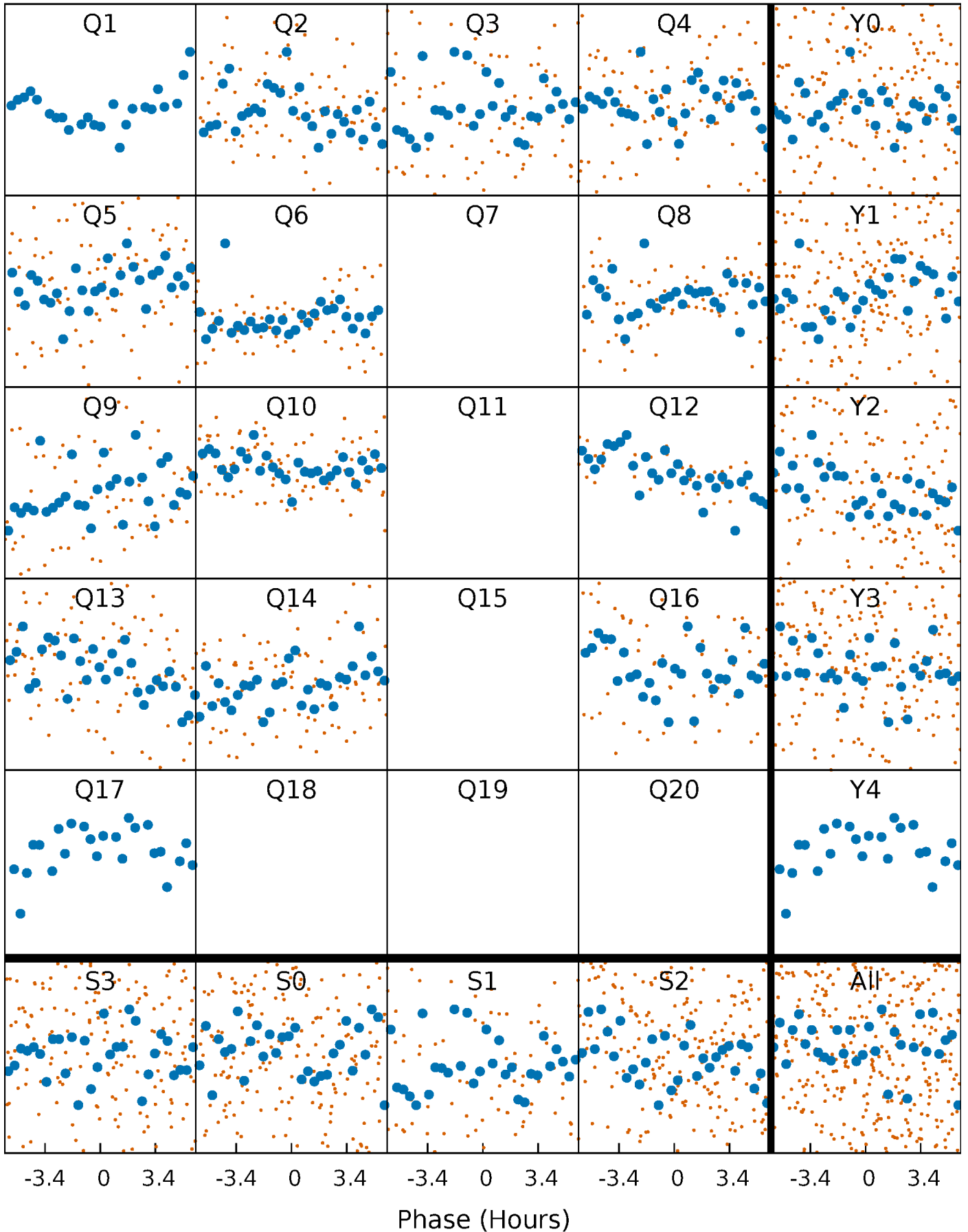
Planet 5 : Phased Whitened Flux Time Series (Fit Epoch/Period)





# PDC Quarter-Phased Transit Curves

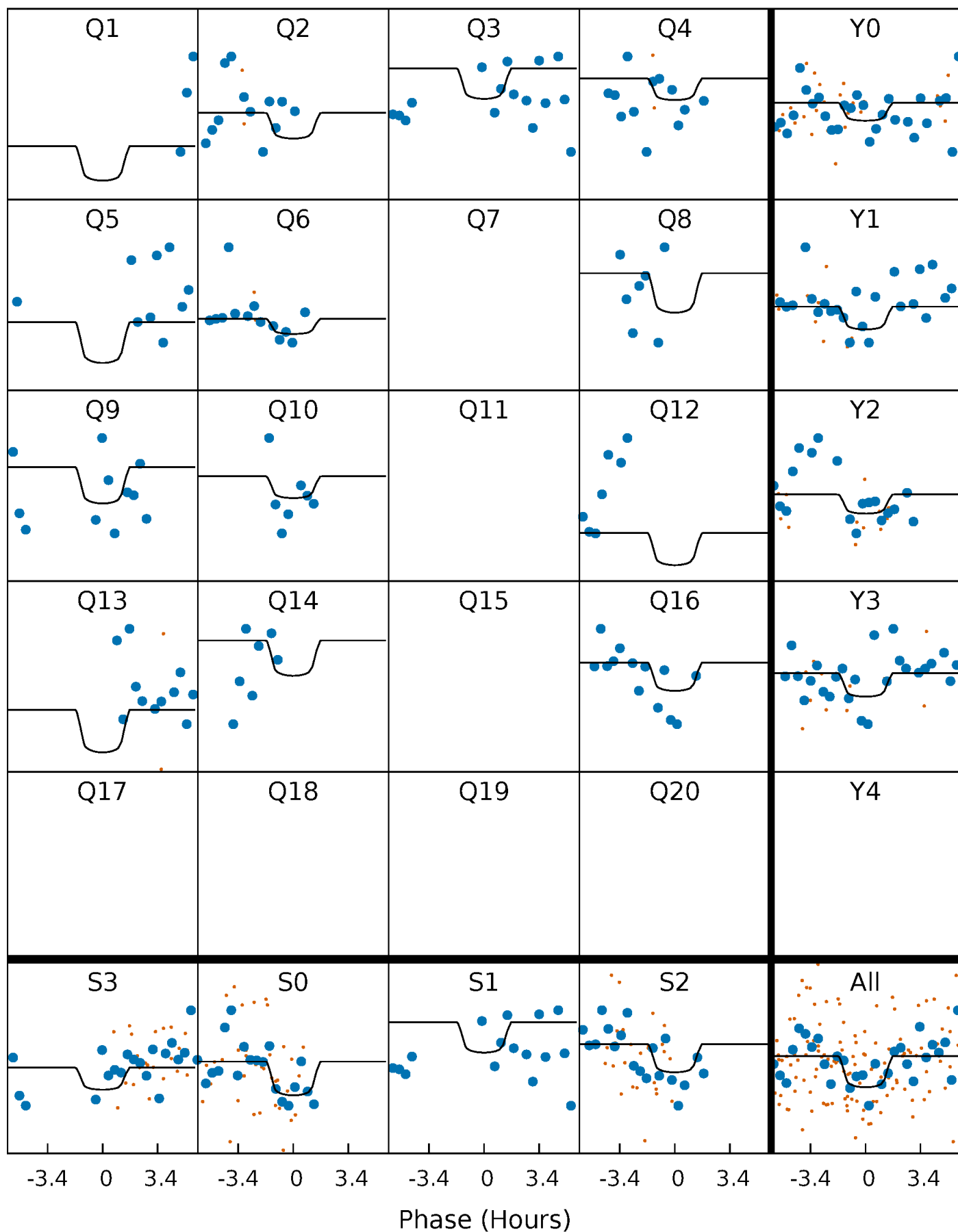
TCE 010989859-05   P= 24.191498 Days    $T_0=148.647136$  (BKJD)





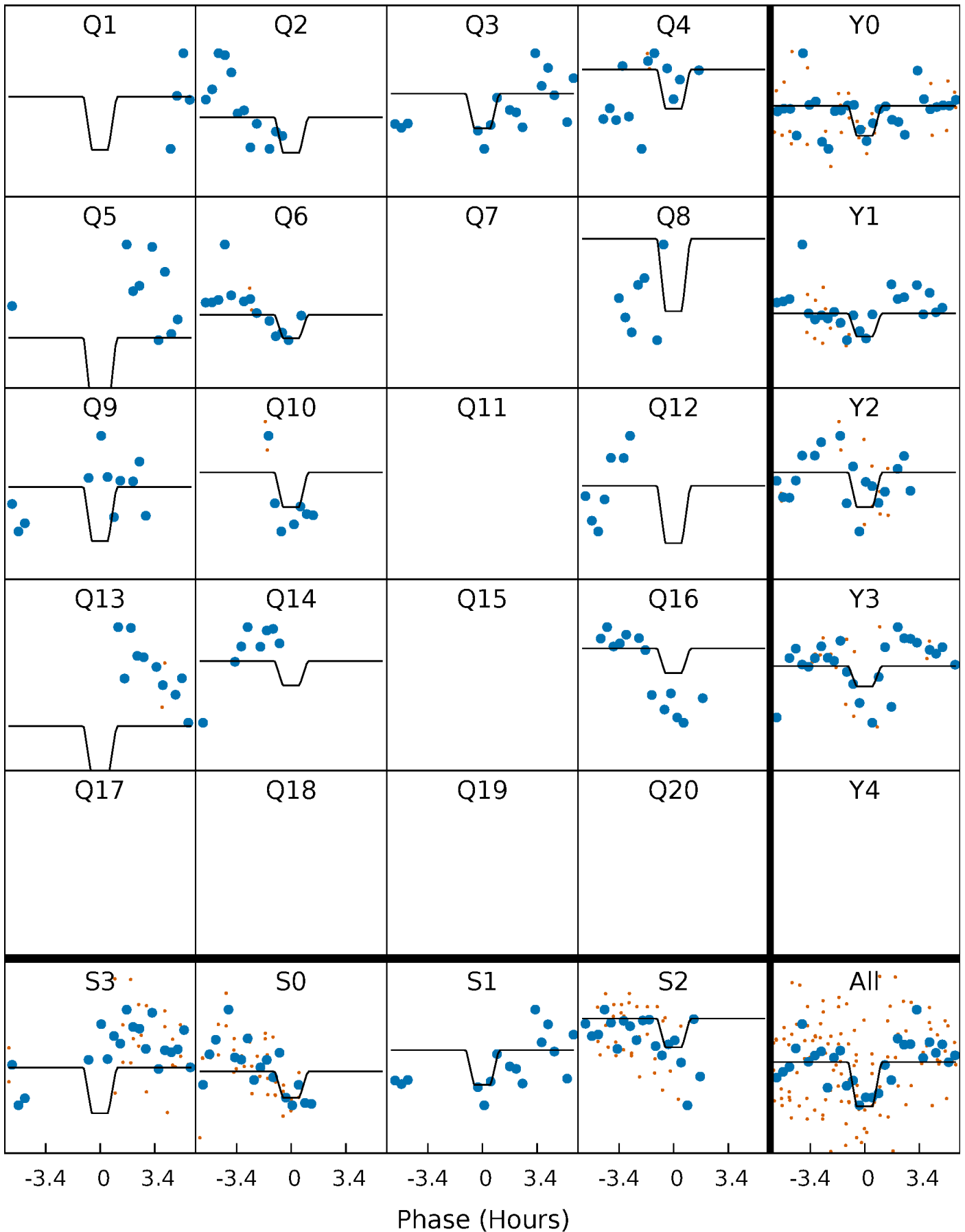
# DV Quarter-Phased Transit Curves

TCE 010989859-05     $P = 24.191498$  Days     $T_0 = 148.647136$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

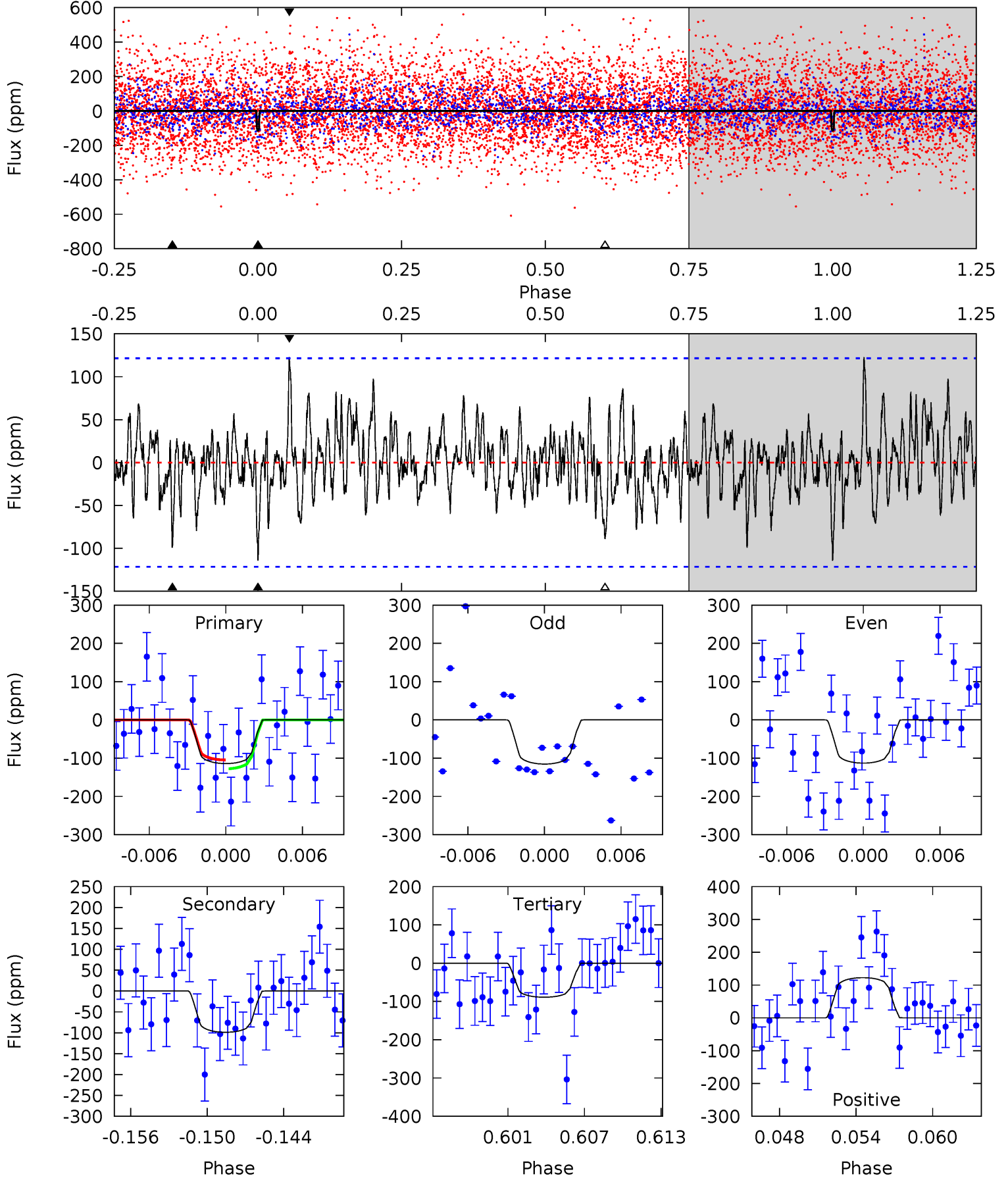
TCE 010989859-05     $P = 24.190865$  Days     $T_0 = 148.664864$  (BKJD)



# DV Model-Shift Uniqueness Test

010989859-05, P = 24.191498 Days, E = 124.455638 Days

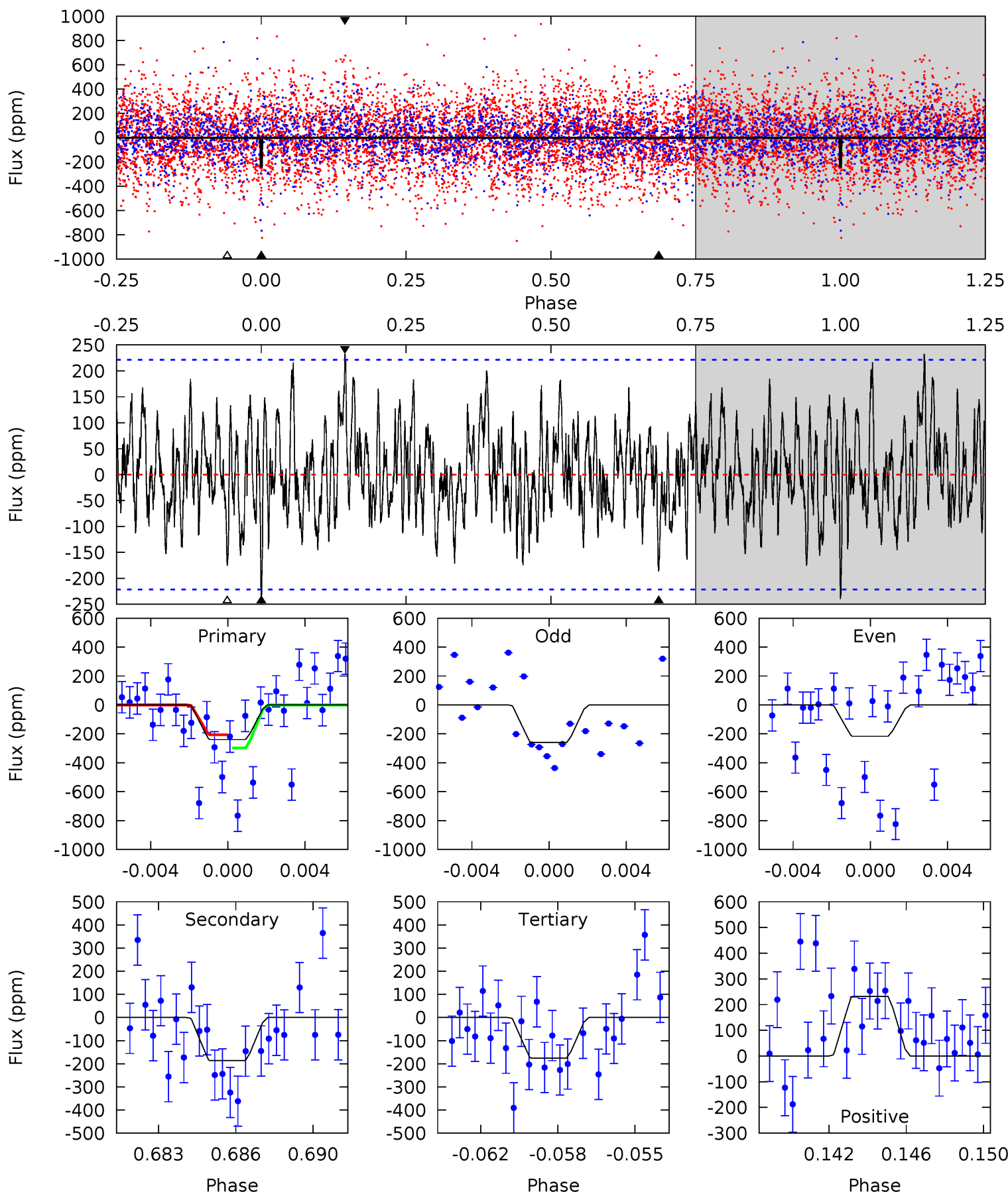
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
4.81	4.17	3.75	5.17	5.12	2.75	1.34	1.06	-0.35	0.42	-1.00	0.05	0.93	0.52	0.48



# Alt Model-Shift Uniqueness Test

010989859-05, P = 24.190865 Days, E = 124.473999 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
5.64	4.39	4.14	5.47	5.22	2.91	1.64	1.51	0.17	0.26	-1.08	0.50	1.49	0.49	1.06



### Stellar Parameters For KIC 010989859

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$7291^{+207}_{-285}$	$4.307^{+0.084}_{-0.182}$	$-0.600^{+0.250}_{-0.300}$	$1.278^{+0.380}_{-0.163}$	$1.208^{+0.166}_{-0.136}$	$0.815^{+0.355}_{-0.399}$
	+3%/-4%	+2%/-4%	+42%/-50%	+30%/-13%	+14%/-11%	+44%/-49%
Source	PHO1	KIC0	KIC0	DSEP		

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

### Secondary Eclipse Parameters for KIC 010989859-05 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-99 \pm 24$	$2.12^{+1.55}_{-1.31}$	$1226^{+90}_{-69}$	$5883^{+4531}_{-1252}$	$359^{+2105}_{-243}$
Alt.	$-186 \pm 42$	$2.49^{+1.63}_{-1.43}$	$1228^{+80}_{-65}$	$6360^{+4193}_{-1370}$	$494^{+2094}_{-323}$

$T_{\text{max}}$  = 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

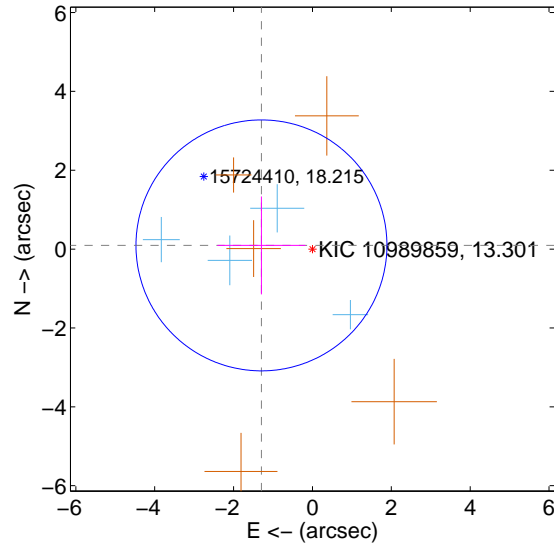
Supplemental centroid analysis for 010989859-05. Kepler magnitude: 13.30. Transit SNR 6.82

There are 4 quarters with good PRF difference image offsets

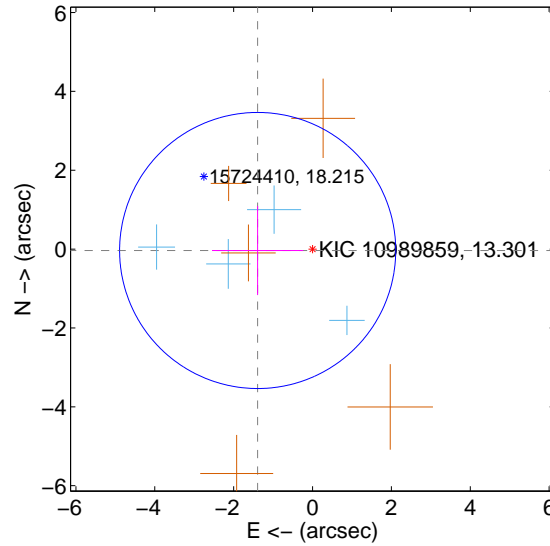
The direct PRF centroid is offset from the target star catalog position by about 0.17 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.296 \pm 1.061$	1.22	$1.293 \pm 1.115$	$0.094 \pm 1.241$
PRF-fit source offset from KIC position	$1.392 \pm 1.167$	1.19	$1.391 \pm 1.156$	$-0.035 \pm 1.130$
photometric centroid source offset	$1.83 \pm 1.09$	1.67	$1.44 \pm 1.07$	$-1.14 \pm 1.13$

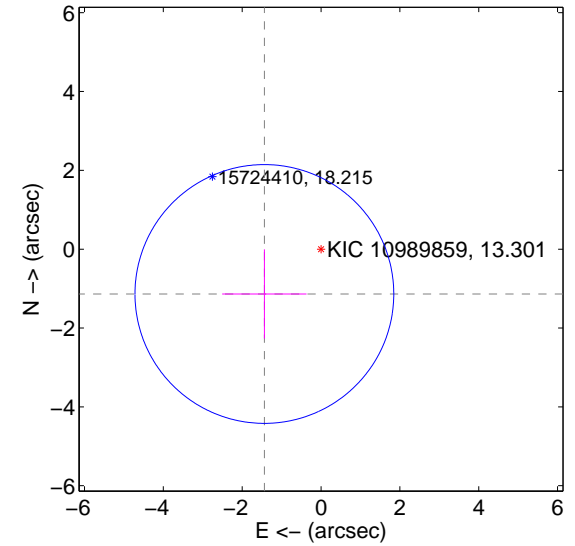
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

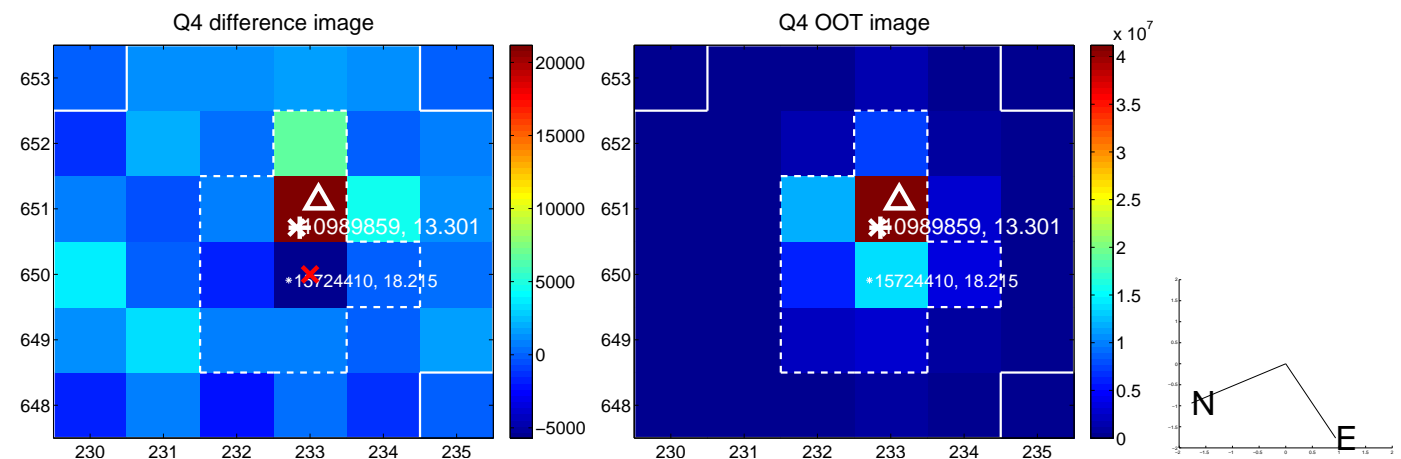
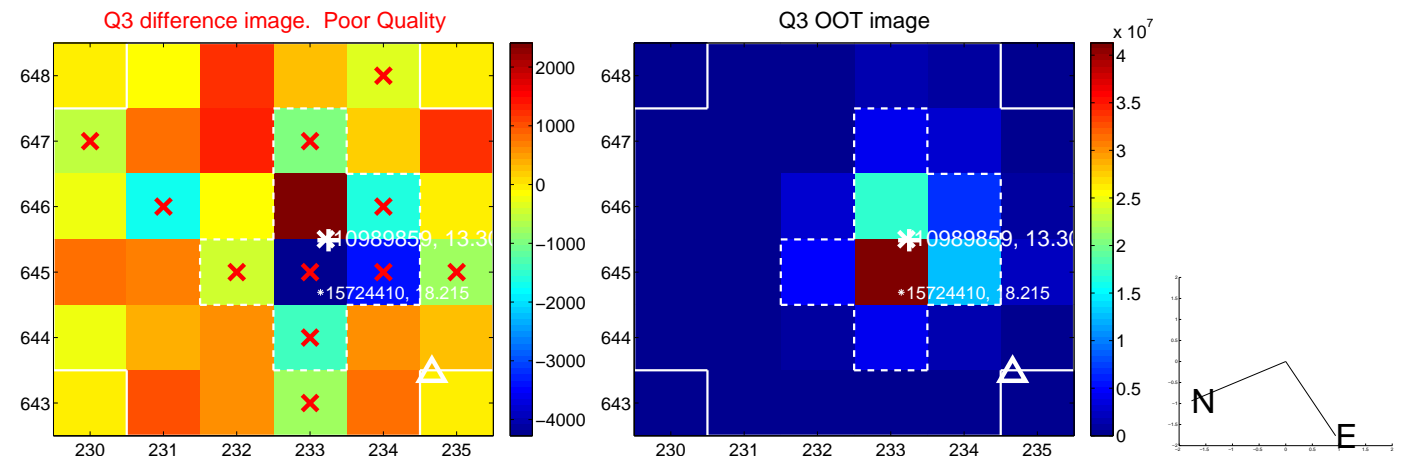
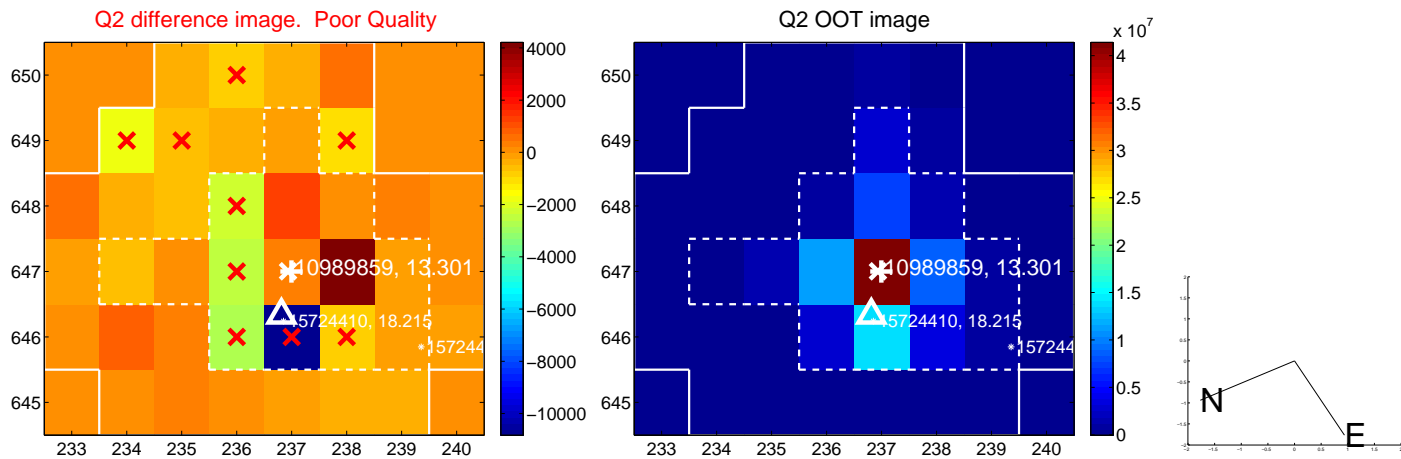
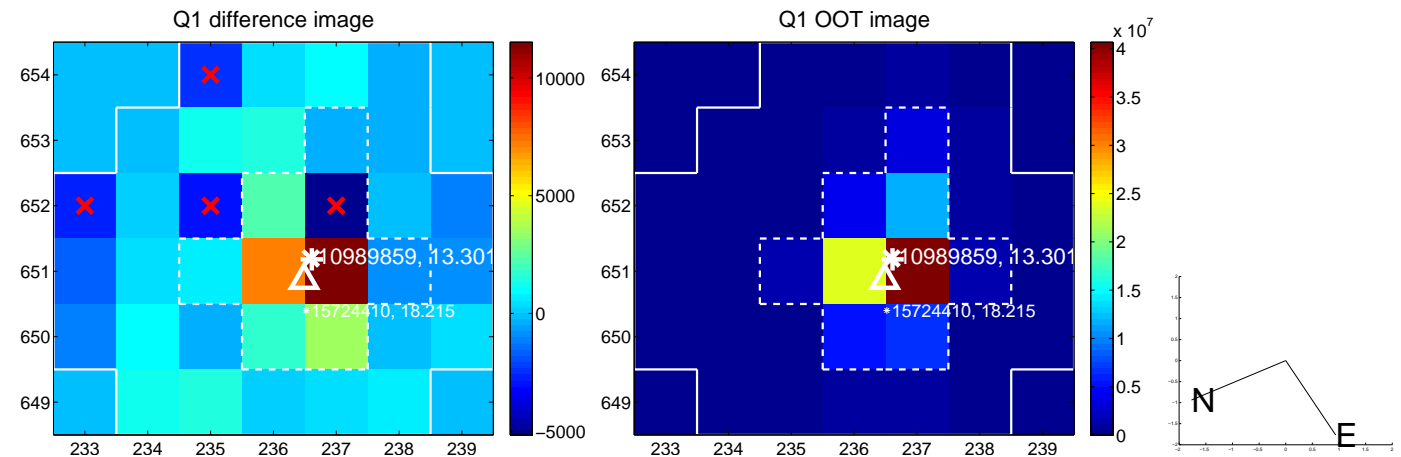


offset from photometric centroids



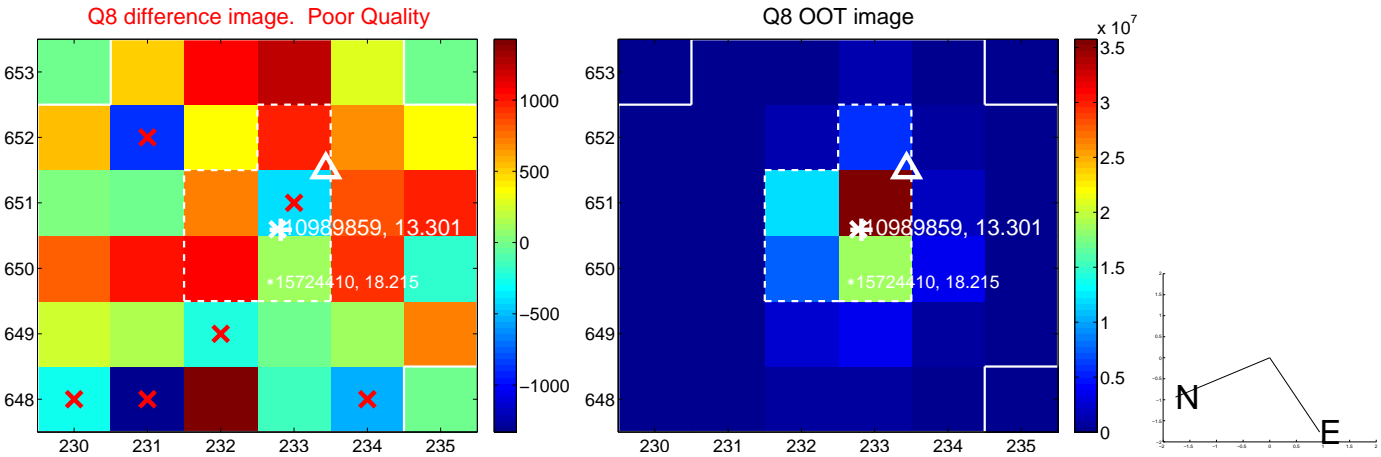
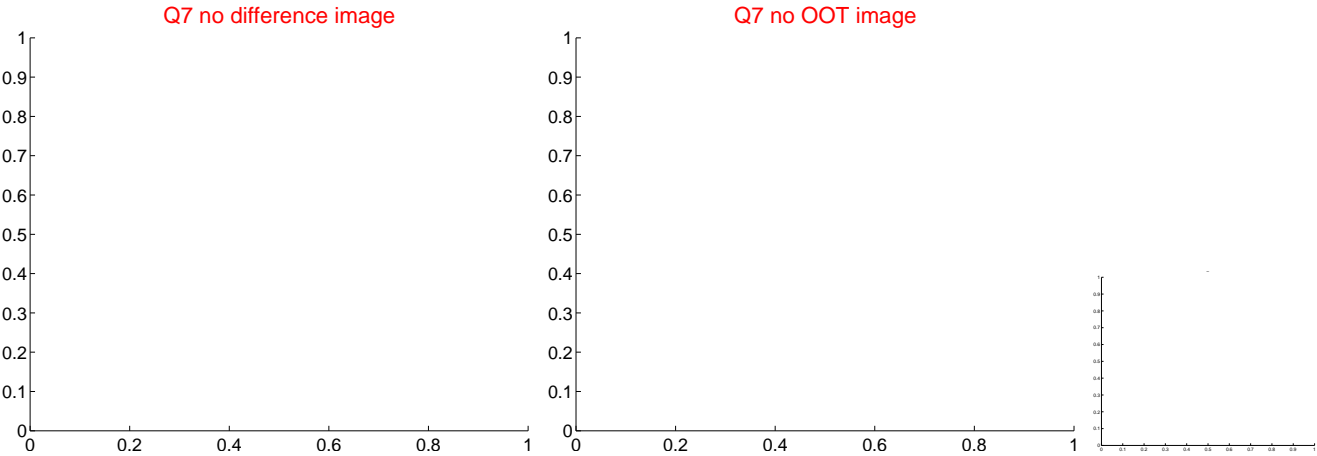
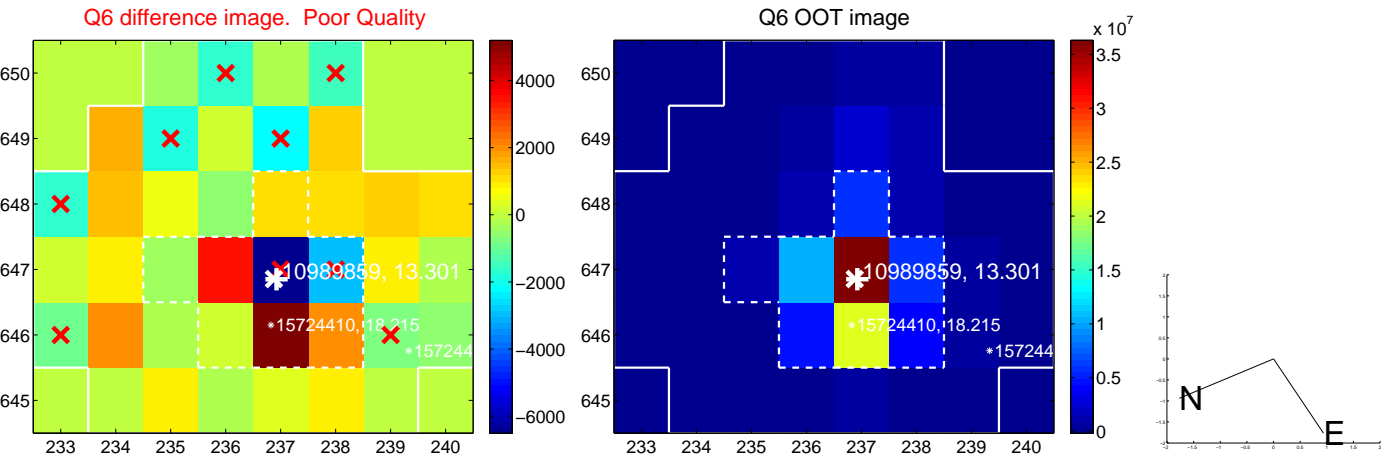
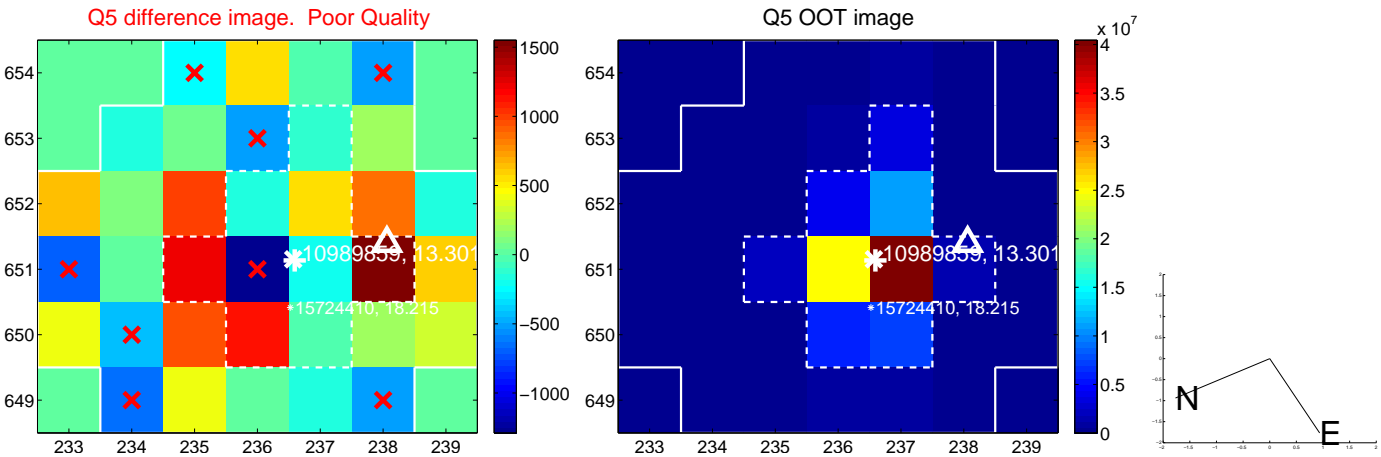
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

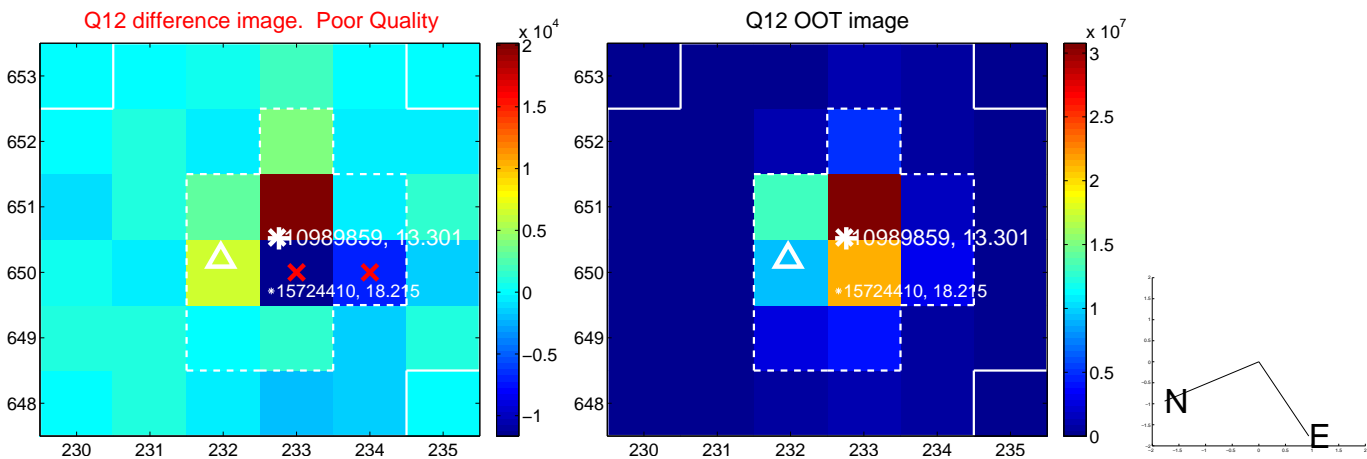
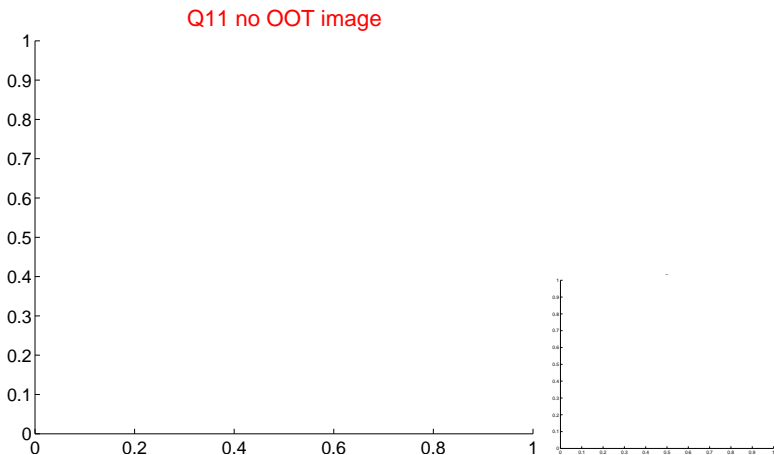
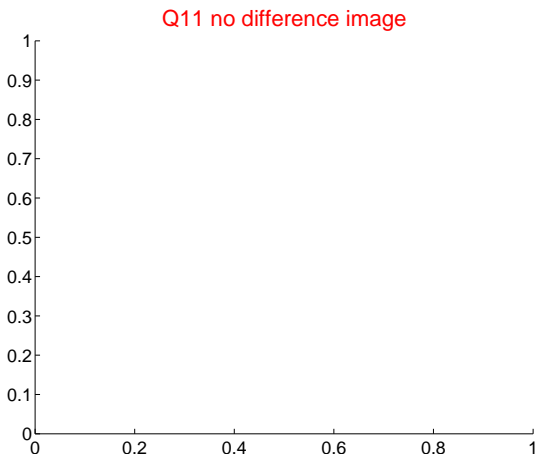
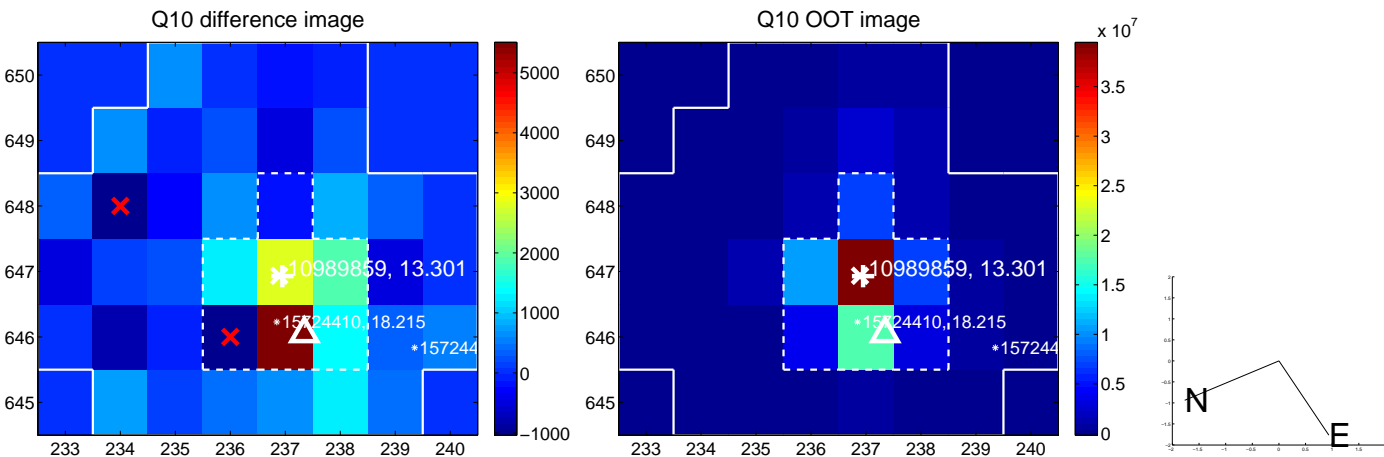
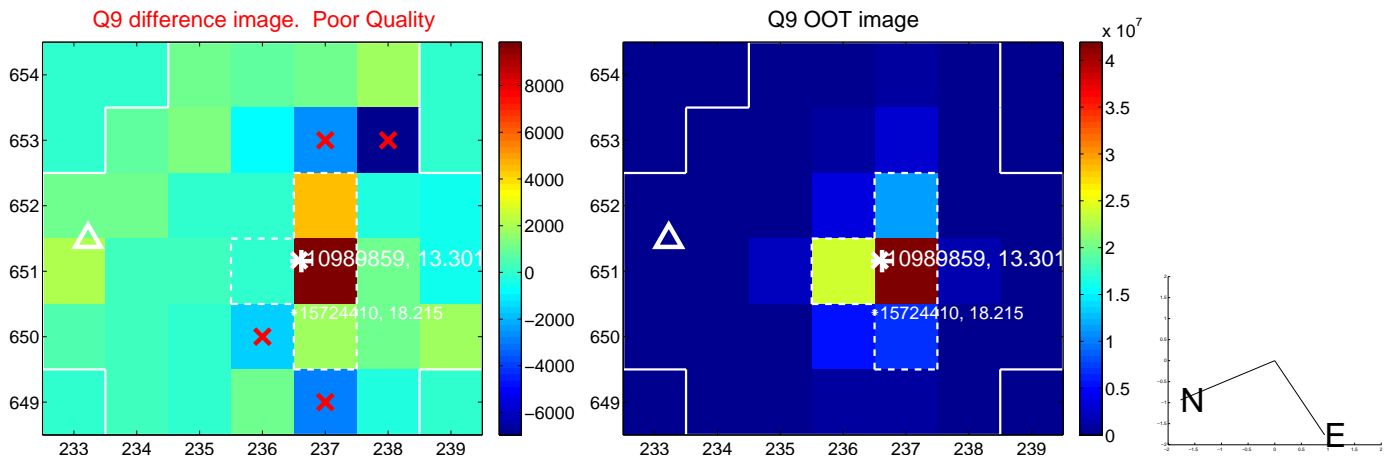




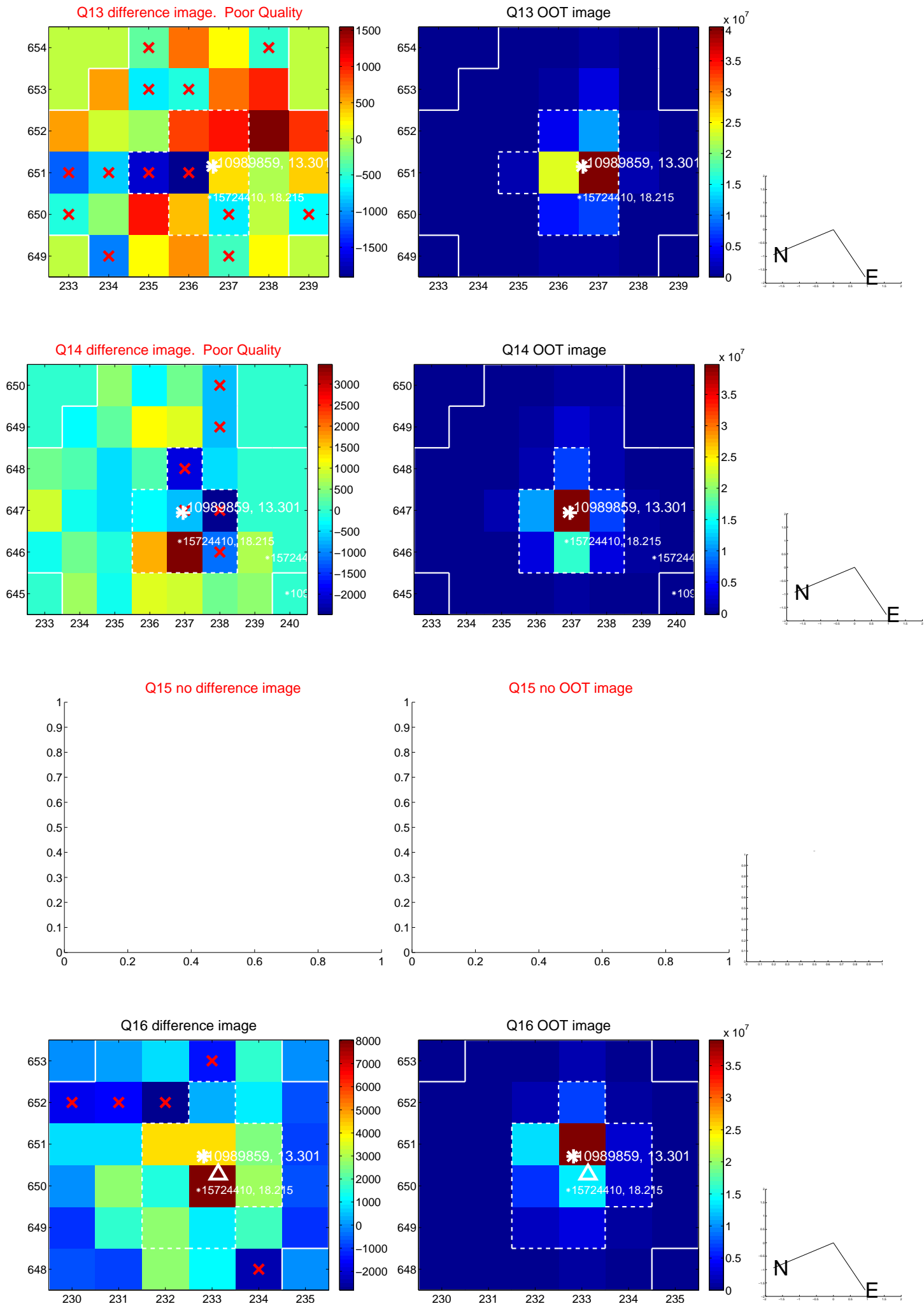
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



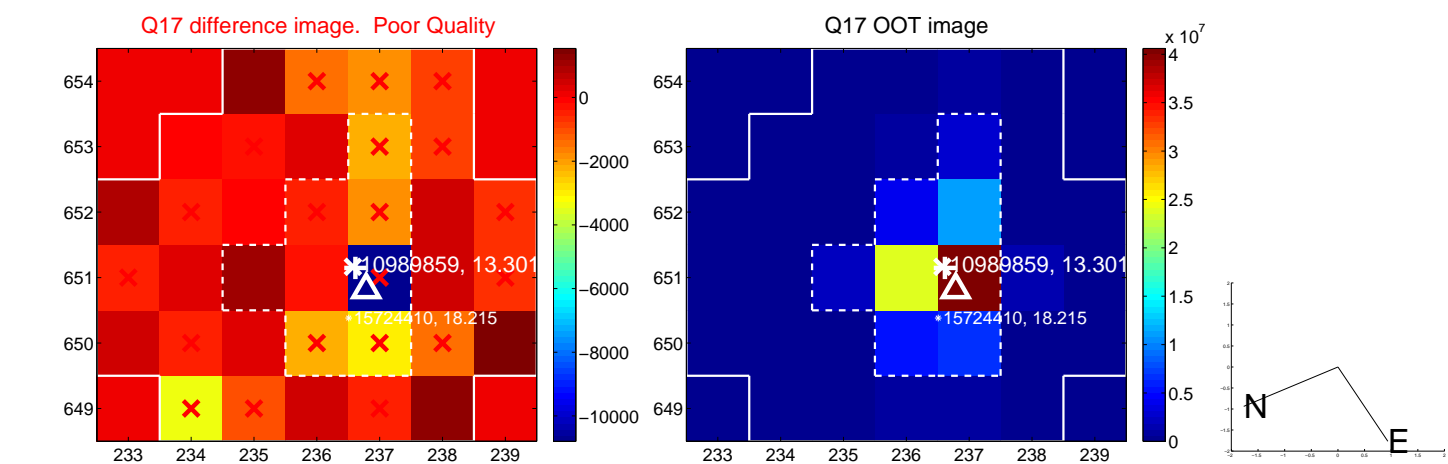
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



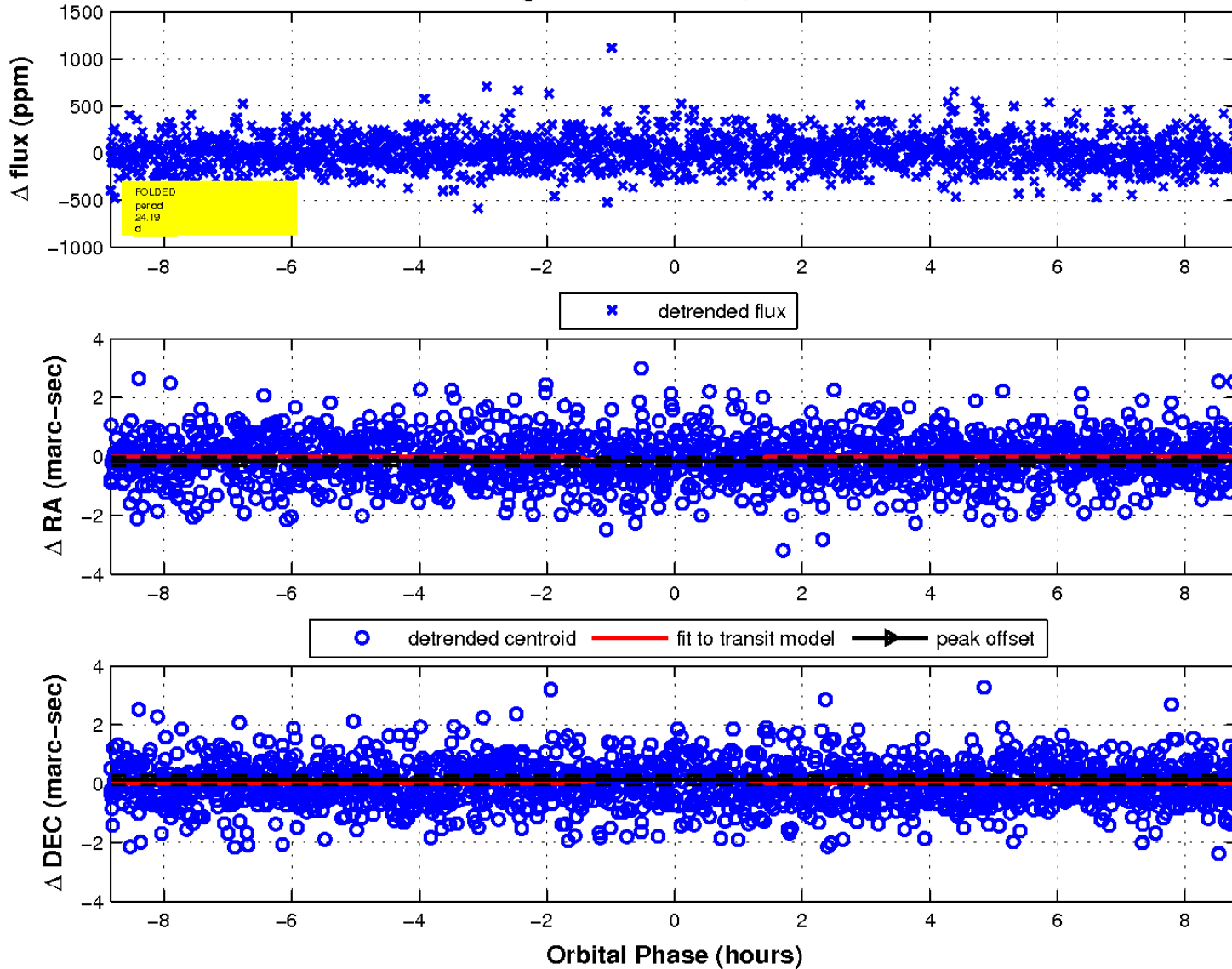
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

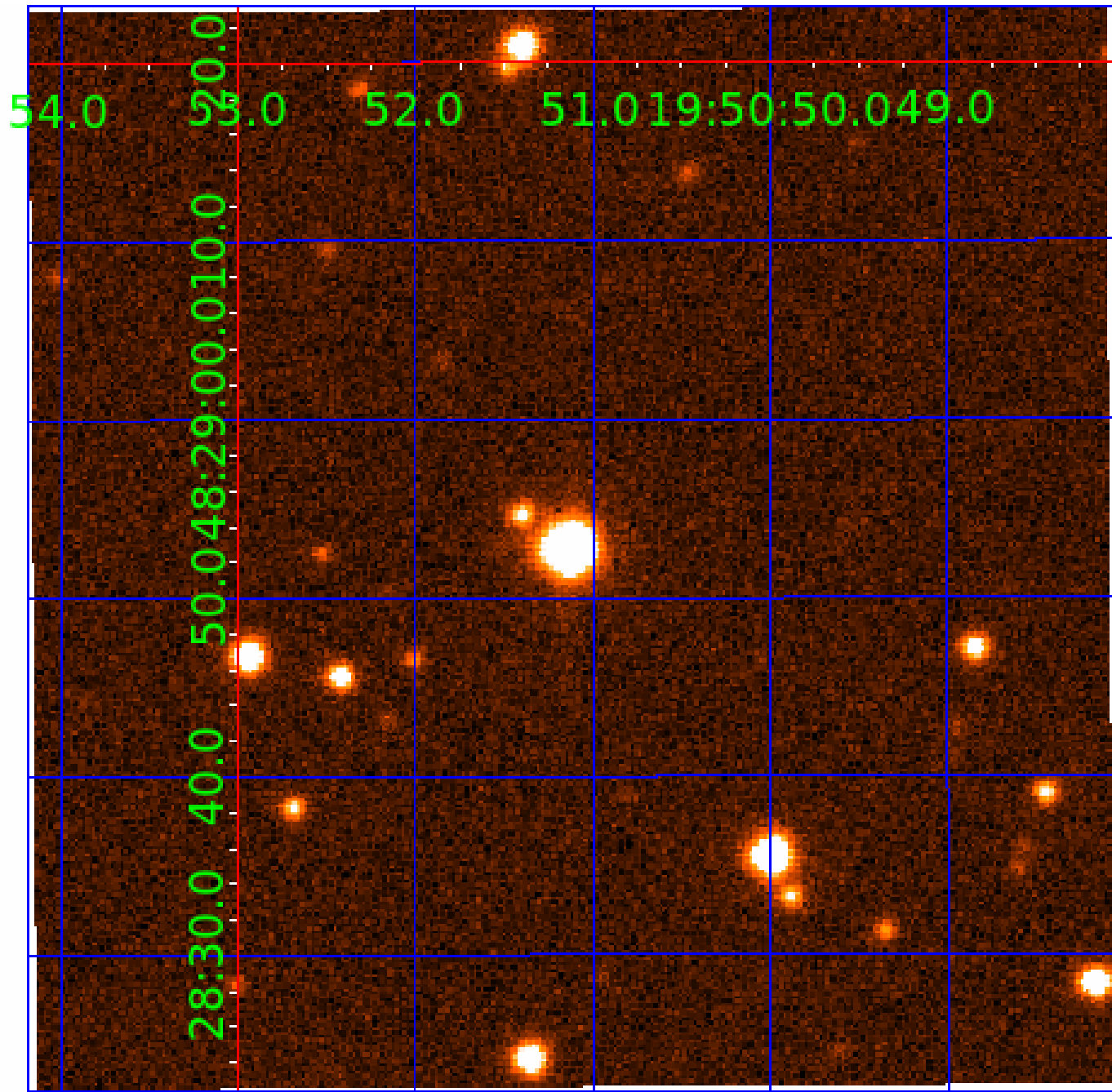


fluxWeightedCentroids, Planet 5 of 9



UKIRT Image

Declination



# KIC 010989859

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
010989859-01	OBS	No	1.032262	131.862720	14.6	6.908	8.1	7.1	1.28	7291	0.49	9120.32
010989859-02	OBS	No	27.797714	145.835134	231.8	2.094	11.2	11.5	1.28	7291	3.06	112.99
010989859-03	OBS	No	31.943139	158.167322	296.6	2.043	10.5	11.7	1.28	7291	2.57	93.88
010989859-04	OBS	No	20.545399	145.462444	122.0	2.279	8.7	5.7	1.28	7291	1.66	169.09
010989859-05	OBS	No	24.191498	148.647136	134.3	2.949	8.0	6.8	1.28	7291	1.72	135.99
010989859-06	OBS	No	47.767277	156.662618	384.1	1.137	8.9	8.6	1.28	7291	2.71	54.90
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010989859-09	OBS	No	52.174965	160.628549	285.1	0.641	8.9	4.4	1.28	7291	2.23	48.80

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
010989859-01	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT
010989859-02	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT
010989859-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT
010989859-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT
010989859-05	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—HALO_GHOST
010989859-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_DV—CENT_UNCERTAIN
010989859-07	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
010989859-08	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—CENT_FEW_DIFFS
010989859-09	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_TRACKER—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS

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

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

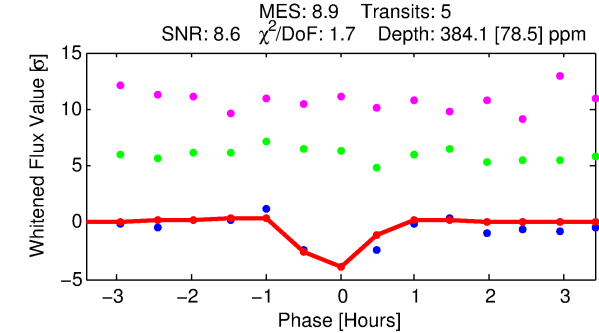
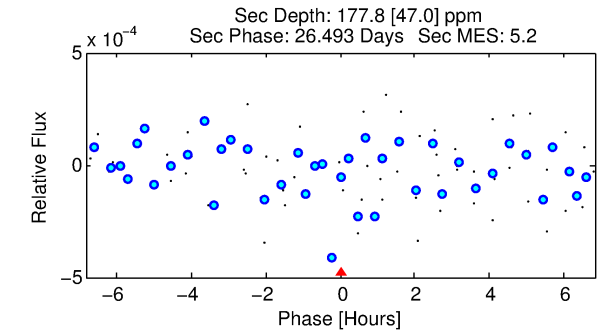
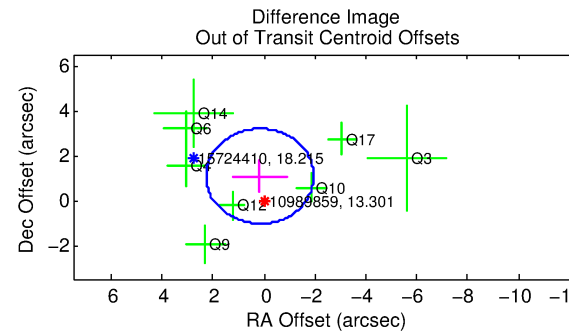
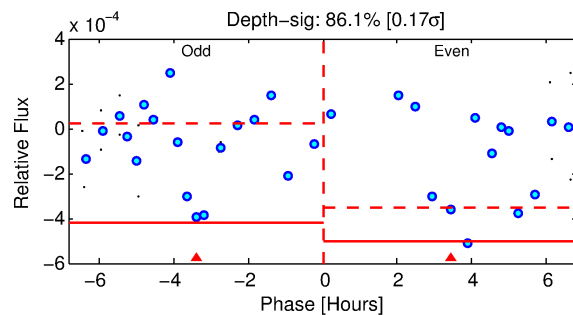
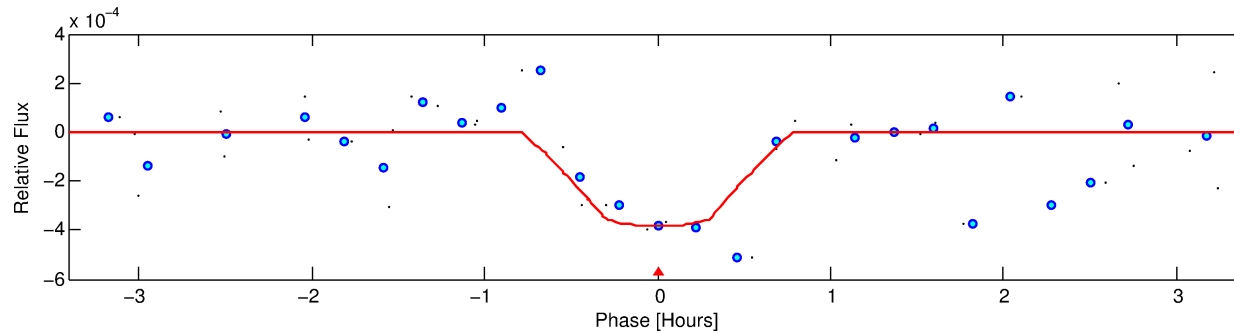
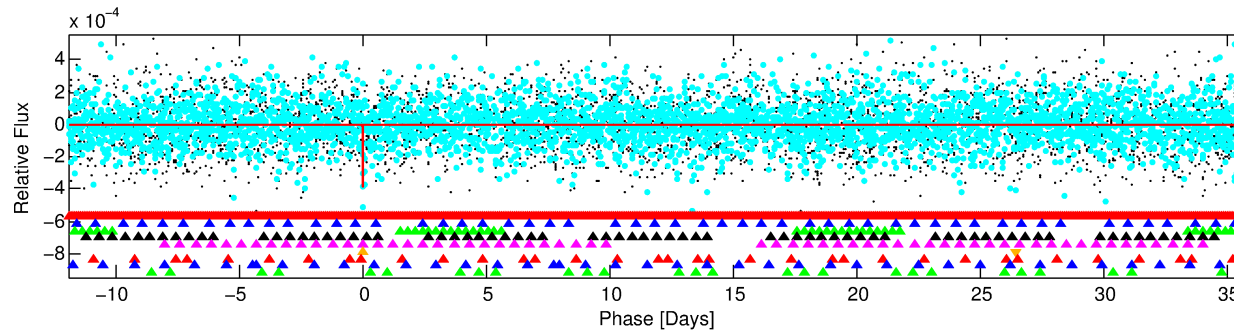
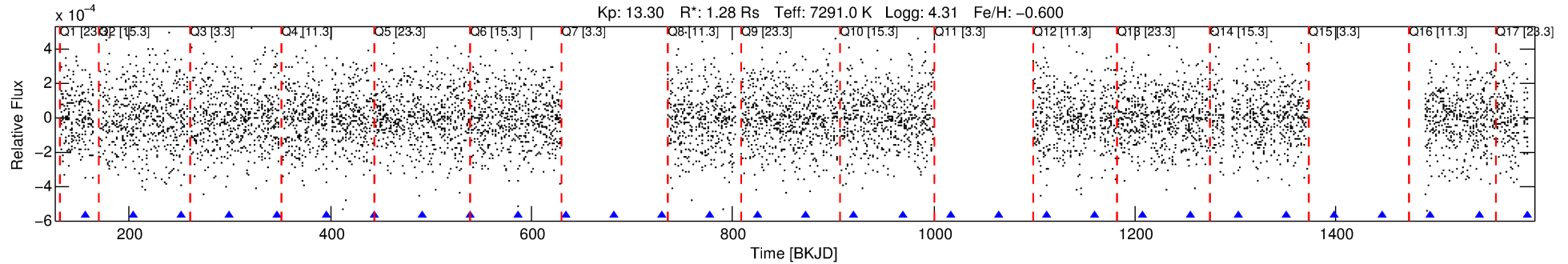
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 010989859-06

No Significant Match Found

# DV One-Page Summary

KIC: 10989859 Candidate: 6 of 9 Period: 47.767 d



## DV Fit Results:

Period = 47.76728 [0.00056] d  
Epoch = 156.6626 [0.0064] BKJD  
Rp/R\* = 0.0194 [0.0172]  
a/R\* = 233.75 [1285.12]  
b = 0.71 [3.78]  
Seff = 54.90 [20.67]  
Teq = 694 [65] K  
Rp = 2.71 [2.54] Re  
a = 0.2745 [0.0666] AU  
Ag = 1005.34 [1838.35] [0.55 $\sigma$ ]  
Teffp = 6043 [2724] K [1.96 $\sigma$ ]

## DV Diagnostic Results:

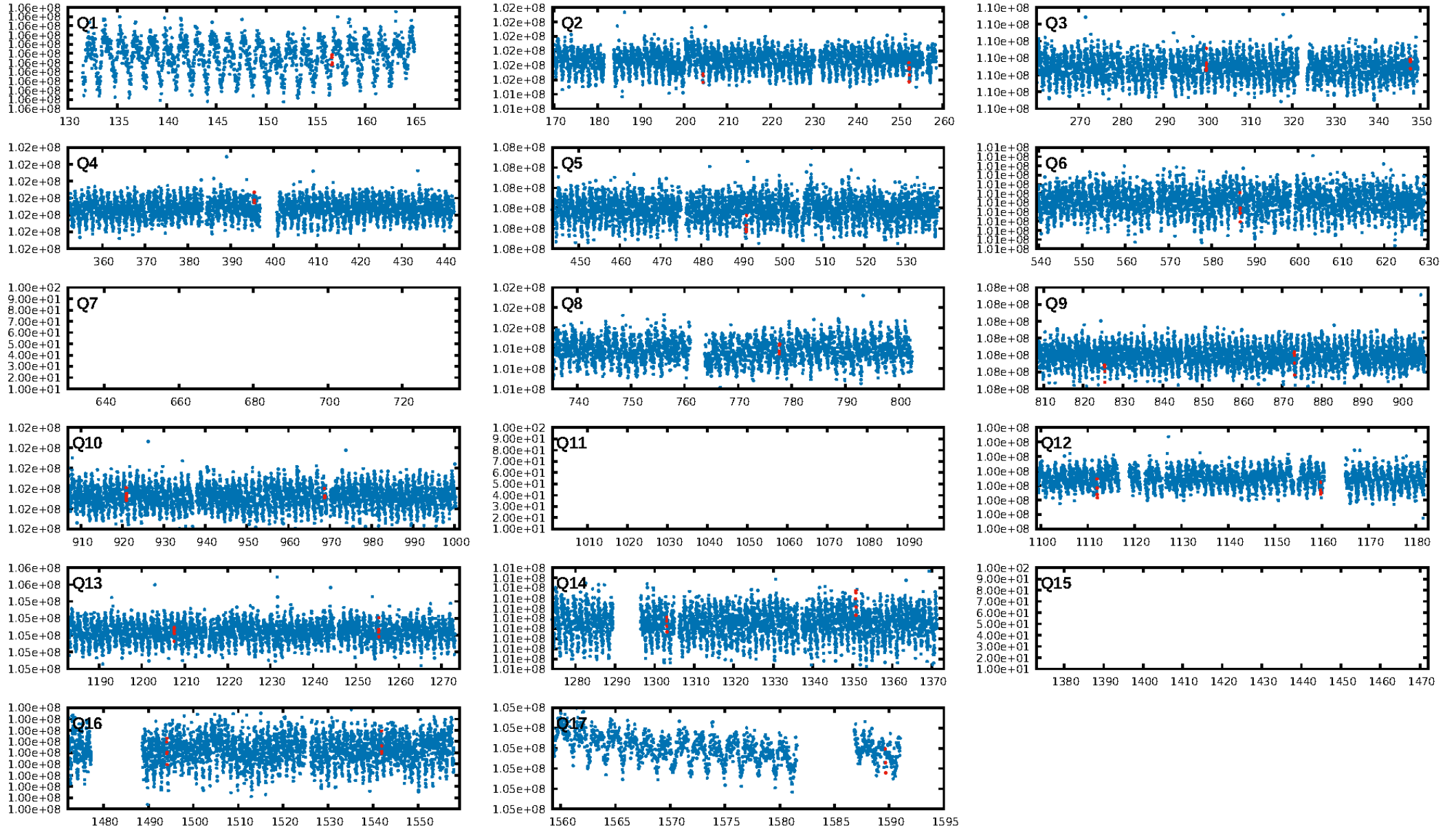
ShortPeriod-sig: 100.0% [60.99 $\sigma$ ]  
LongPeriod-sig: 100.0% [81.04 $\sigma$ ]  
ModelChiSquare2-sig: 94.0%  
ModelChiSquareGof-sig: 99.8%  
**Bootstrap-pfa: 2.79e-08**  
RollingBand-fgt: 1.00 [5/5]  
**GhostDiagnostic-chr: -27.76**  
Centroid-sig: 18.1%  
Centroid-so: 1.213 arcsec [1.42 $\sigma$ ]  
OotOffset-rm: 1.086 arcsec [1.54 $\sigma$ ]  
KicOffset-rm: 0.972 arcsec [1.34 $\sigma$ ]  
OotOffset-st: 3/1/2/2 [8]  
KicOffset-st: 3/1/2/2 [8]  
DiffImageQuality-fgm: 0.25 [2/8]  
DiffImageOverlap-fno: 0.43 [6/14]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 09:38:26 Z

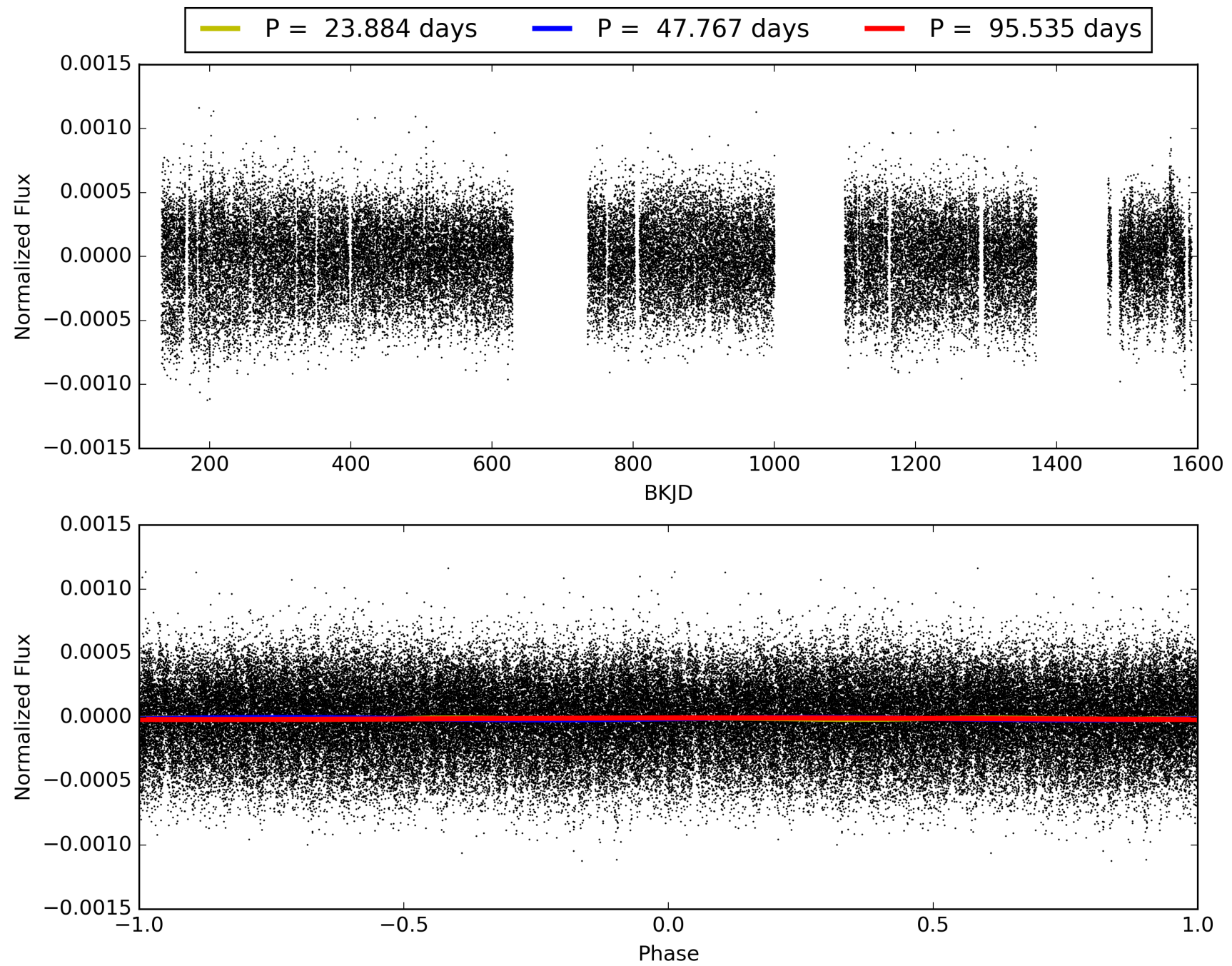
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center



# TCE 010989859-06, PDC Light Curves

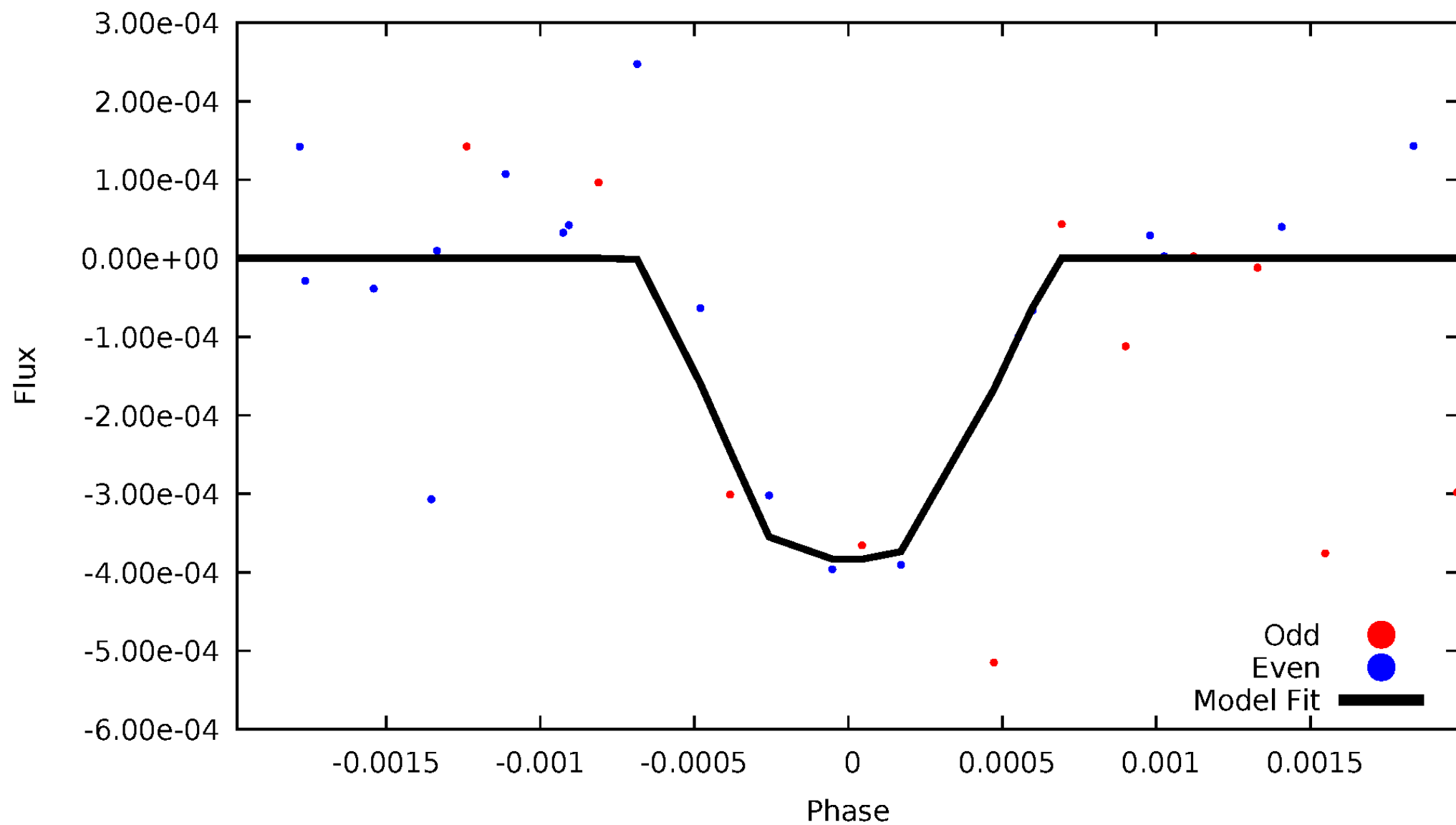


TCE 010989859-06



# DV Odd/Even

TCE 010989859-06



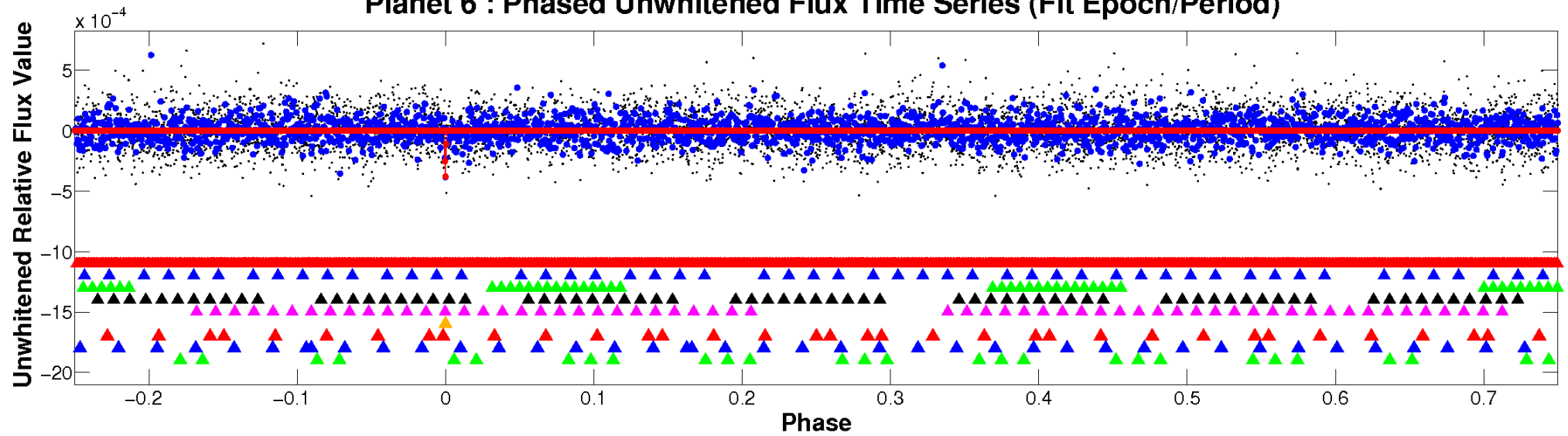


ALT Odd/Even

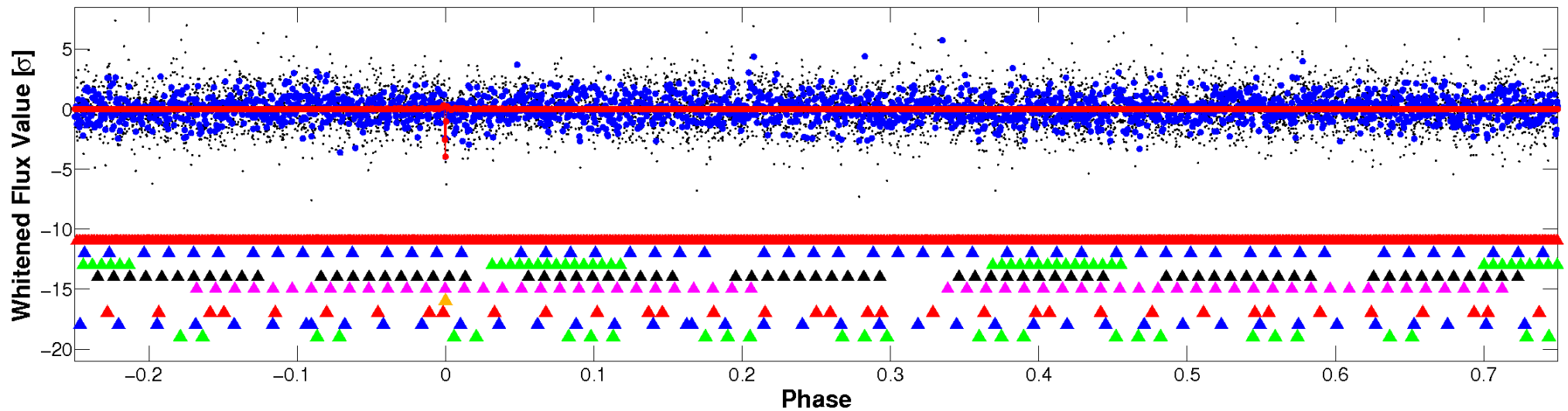
This plot does not exist for this TCE.

# Non-Whitened Vs. Whitened Light Curve

## Planet 6 : Phased Unwhitened Flux Time Series (Fit Epoch/Period)

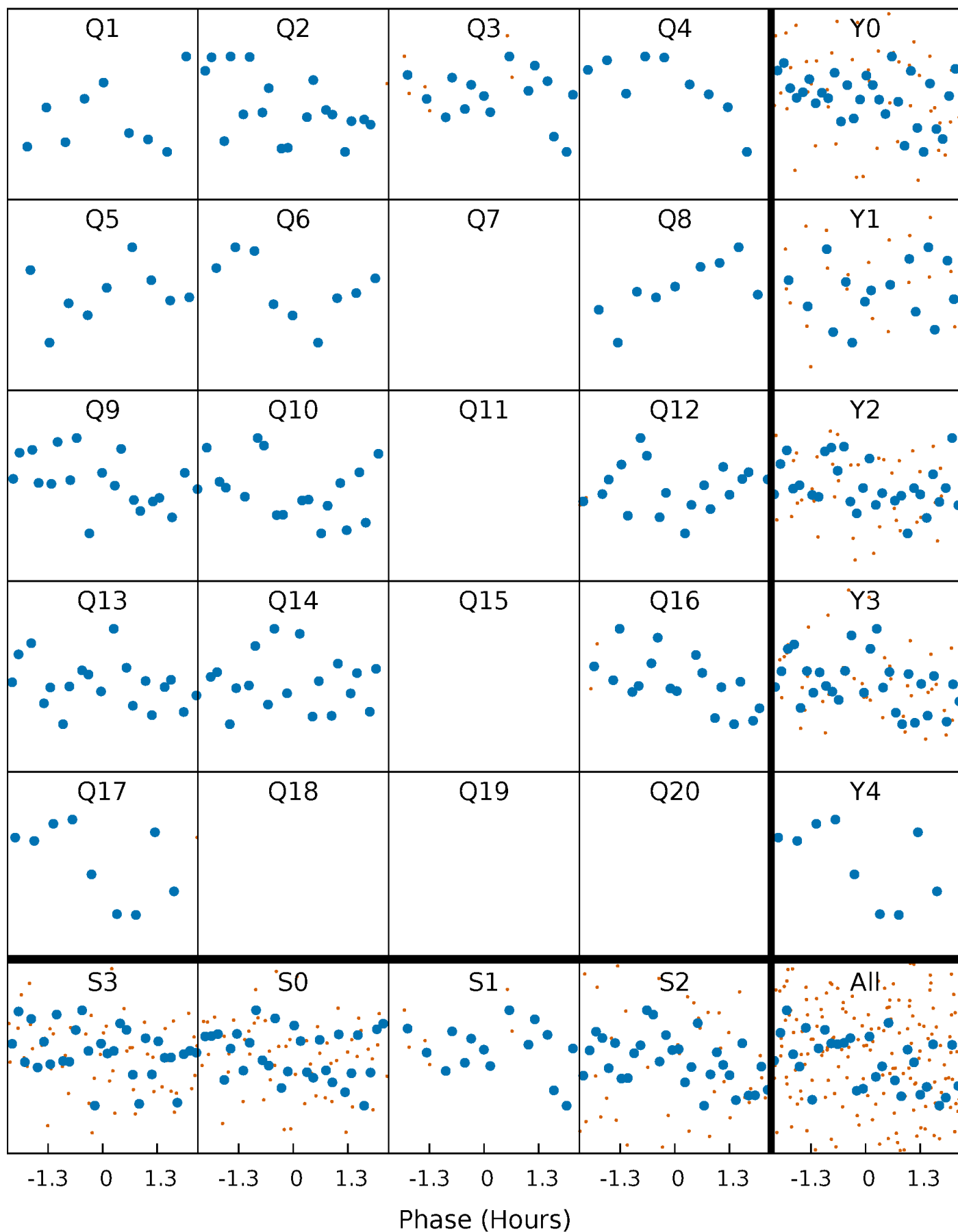


## Planet 6 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

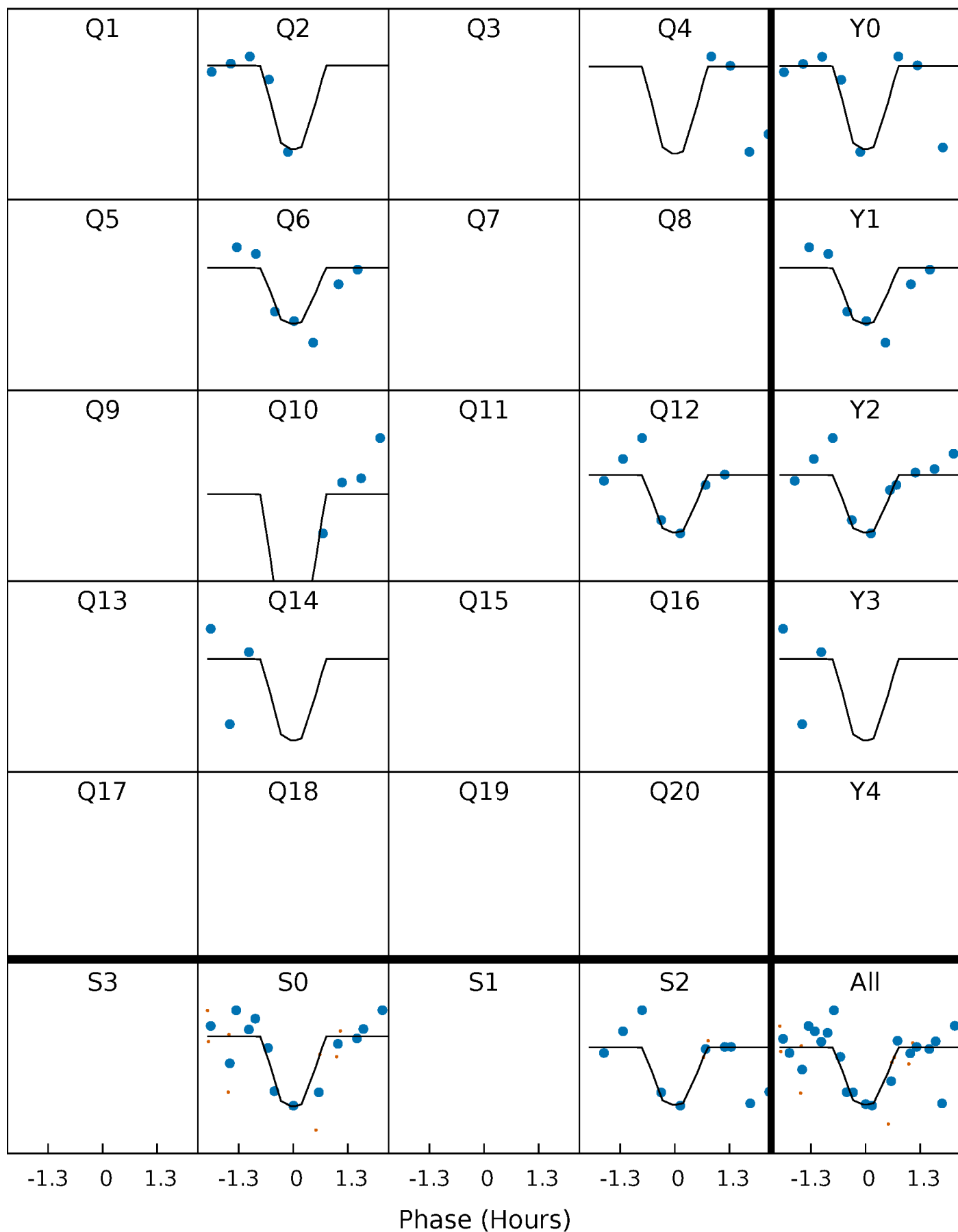
TCE 010989859-06 P= 47.767277 Days  $T_0=156.662618$  (BKJD)





# DV Quarter-Phased Transit Curves

TCE 010989859-06 P= 47.767277 Days  $T_0=156.662618$  (BKJD)

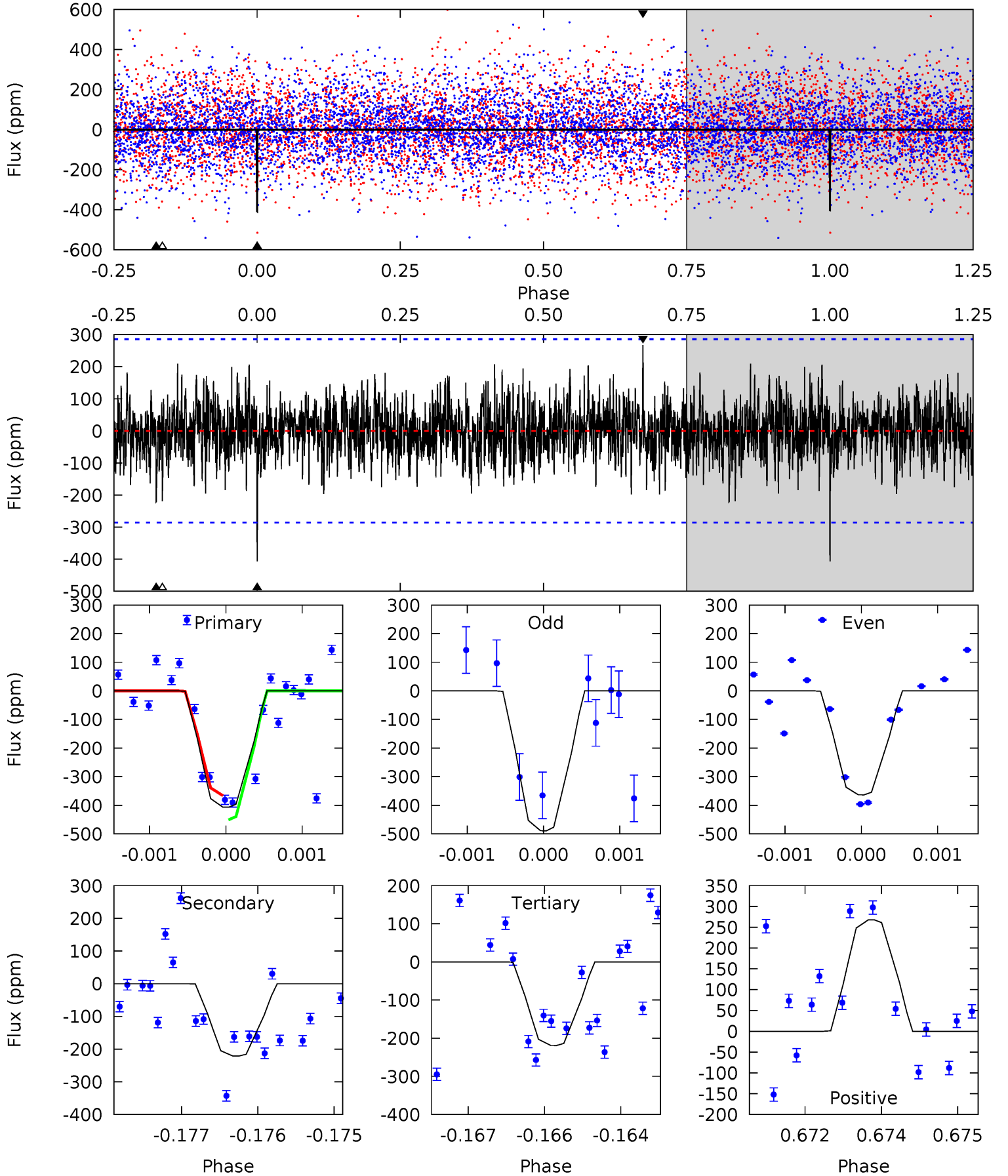


This plot does not exist for this TCE.

# DV Model-Shift Uniqueness Test

010989859-06,  $P = 47.767277$  Days,  $E = 108.895341$  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
7.69	4.18	4.14	5.06	5.41	3.22	1.25	3.55	2.63	0.04	-0.88	1.15	1.11	0.40	0.81



## Alt Model-Shift Uniqueness Test

This plot does not exist for this TCE.

### Stellar Parameters For KIC 010989859

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$7291^{+207}_{-285}$	$4.307^{+0.084}_{-0.182}$	$-0.600^{+0.250}_{-0.300}$	$1.278^{+0.380}_{-0.163}$	$1.208^{+0.166}_{-0.136}$	$0.815^{+0.355}_{-0.399}$
	+3%/-4%	+2%/-4%	+42%/-50%	+30%/-13%	+14%/-11%	+44%/-49%
Source	PHO1	KIC0	KIC0	DSEP		

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

### Secondary Eclipse Parameters for KIC 010989859-06 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-221 \pm 53$	$3.24^{+2.49}_{-1.92}$	$981^{+75}_{-57}$	$5831^{+4272}_{-1284}$	$866^{+4609}_{-601}$
Alt.	N/A	N/A	N/A	N/A	N/A

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

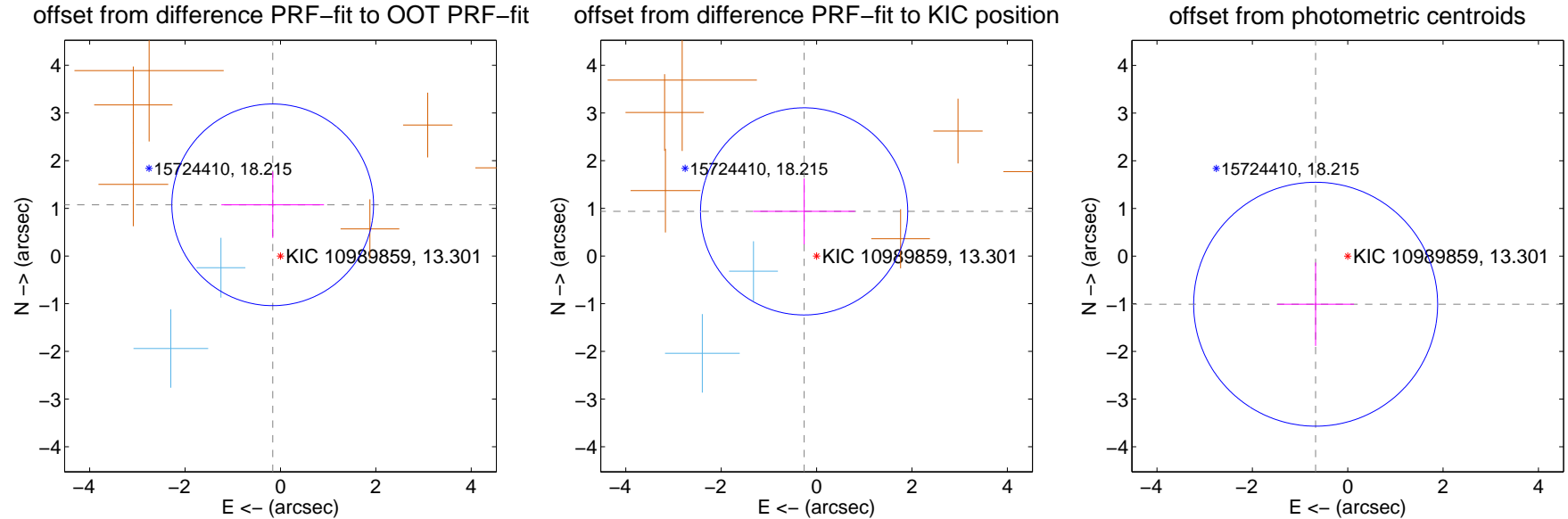
## DV Centroid Data

Supplemental centroid analysis for 010989859-06. Kepler magnitude: 13.30. Transit SNR 8.56

There are 2 quarters with good PRF difference image offsets

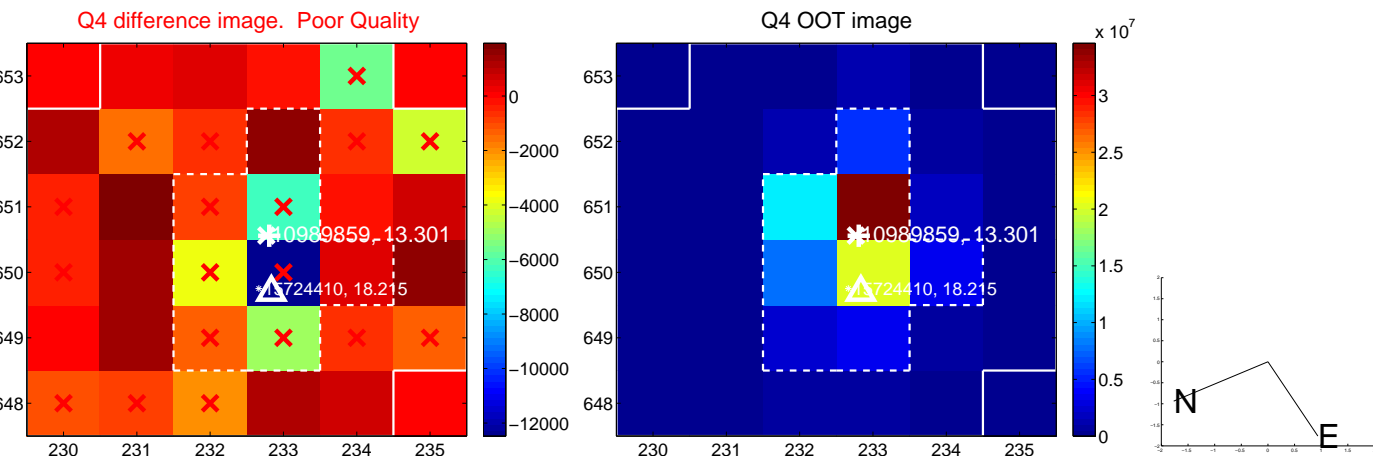
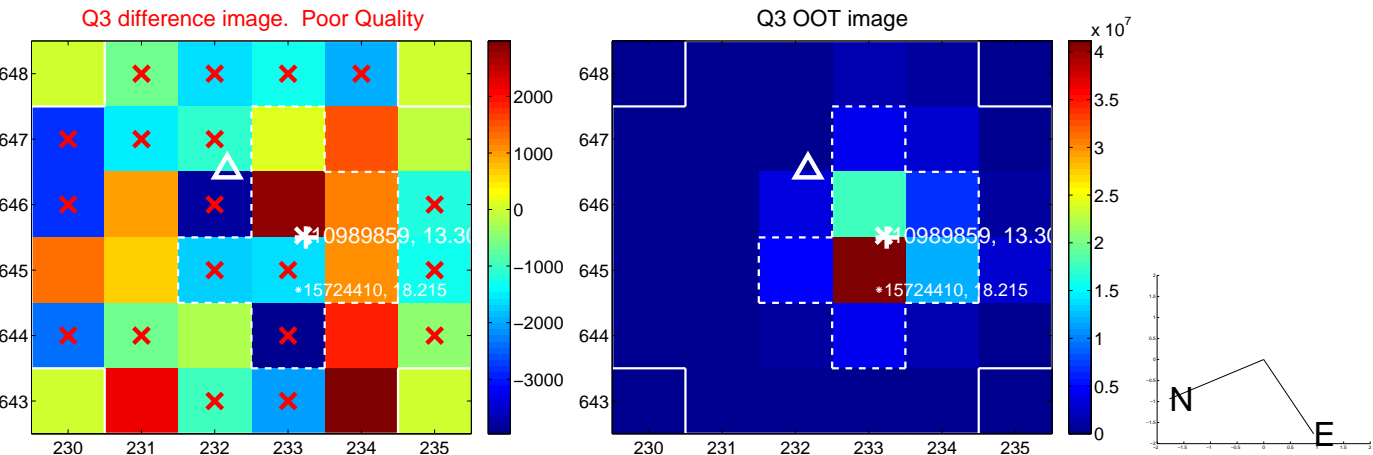
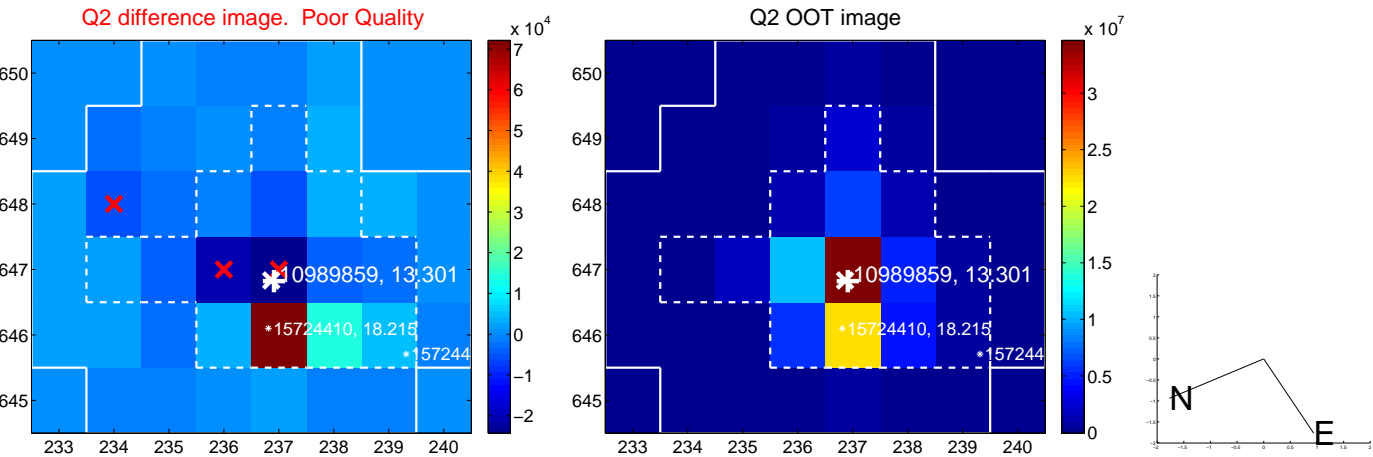
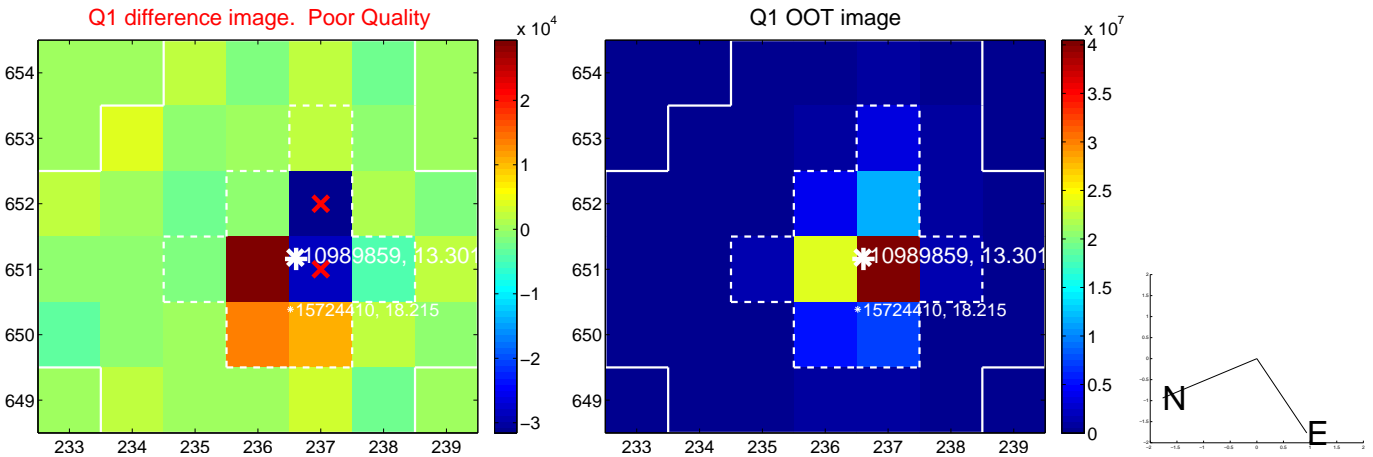
The direct PRF centroid is offset from the target star catalog position by about 0.18 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.086 \pm 0.705$	1.54	$0.162 \pm 1.076$	$1.073 \pm 0.694$
PRF-fit source offset from KIC position	$0.972 \pm 0.724$	1.34	$0.261 \pm 1.068$	$0.936 \pm 0.690$
photometric centroid source offset	$1.21 \pm 0.85$	1.42	$0.67 \pm 0.80$	$-1.01 \pm 0.87$

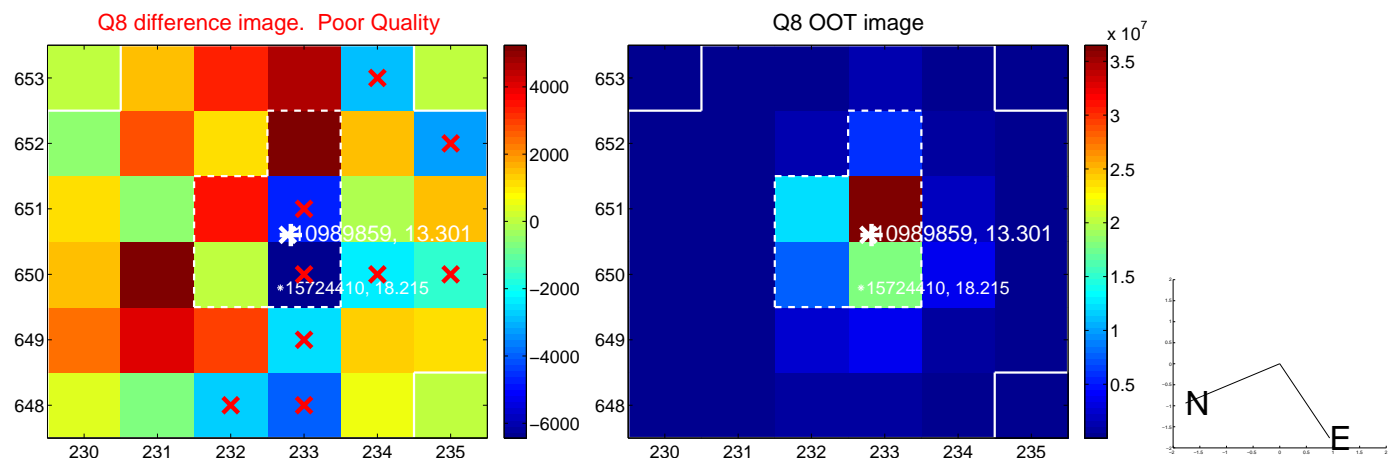
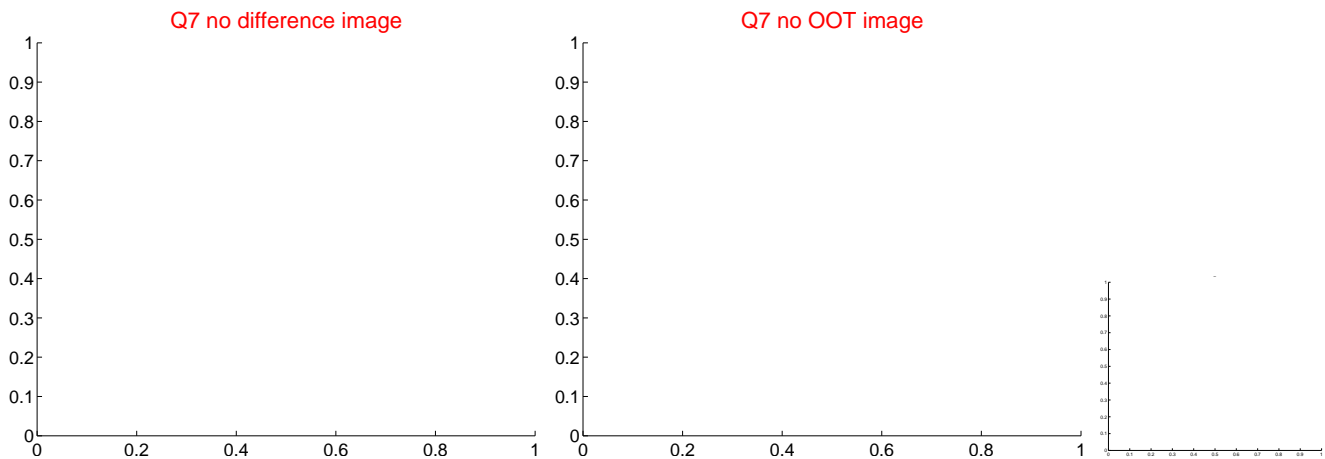
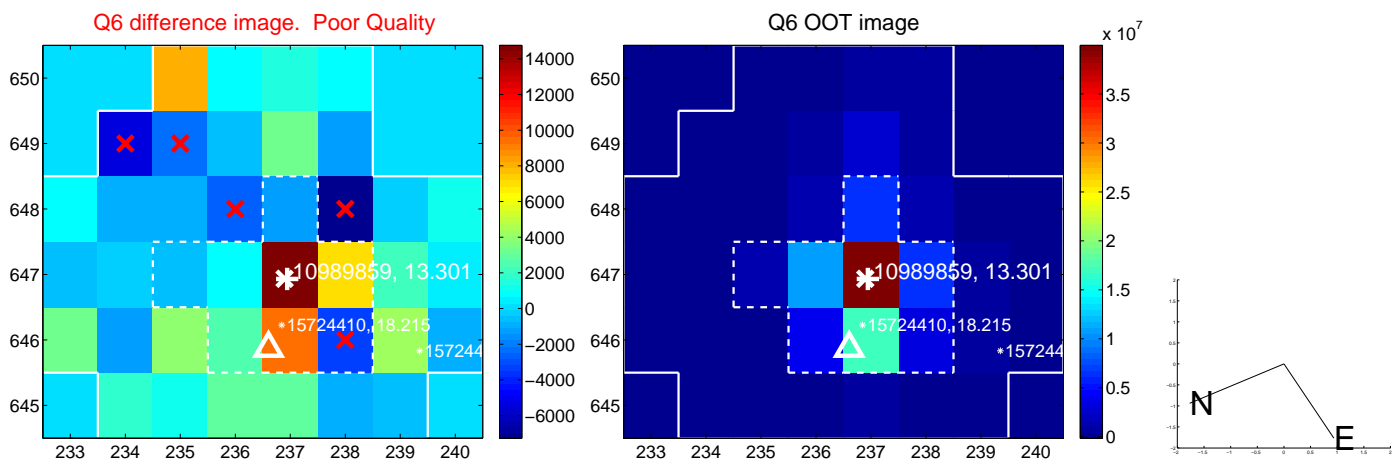
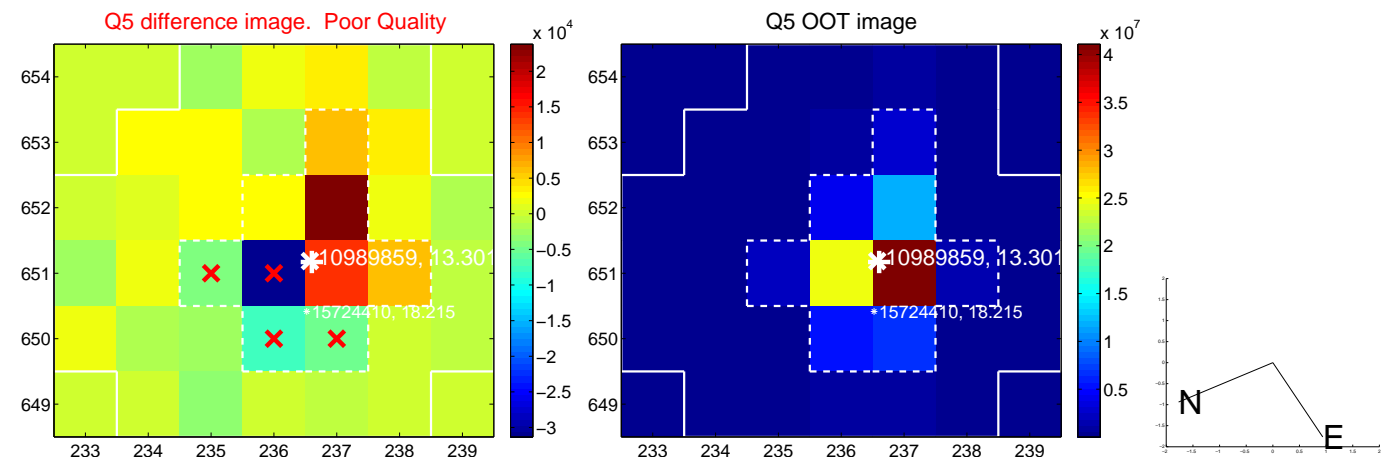


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

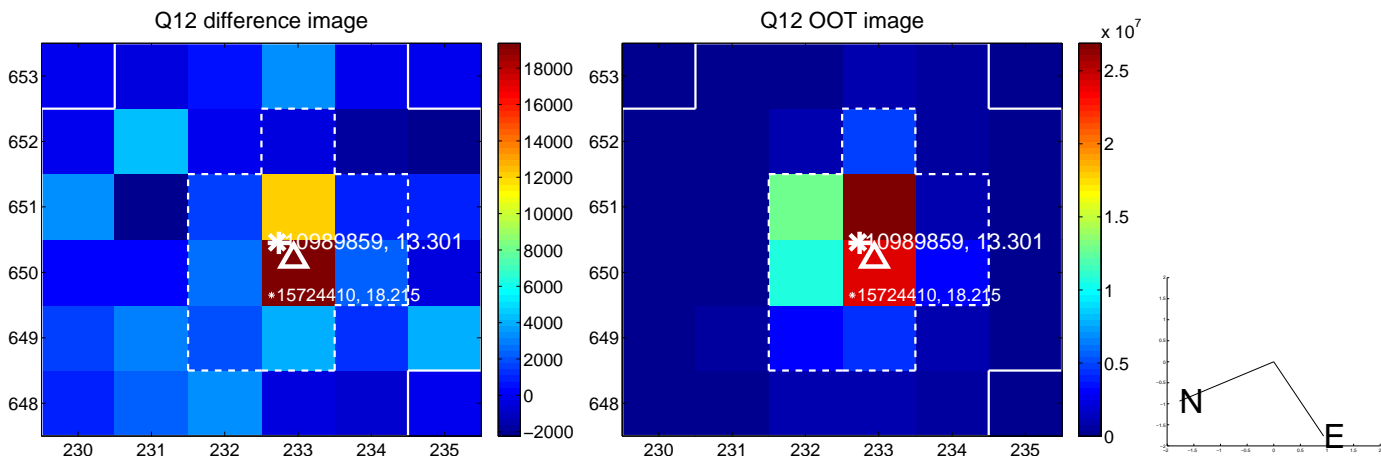
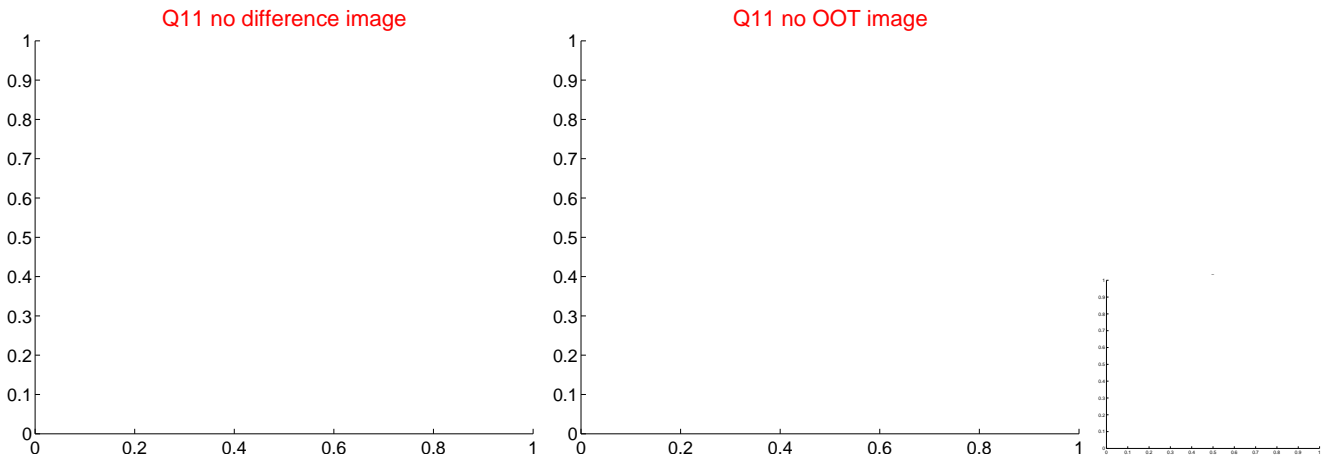
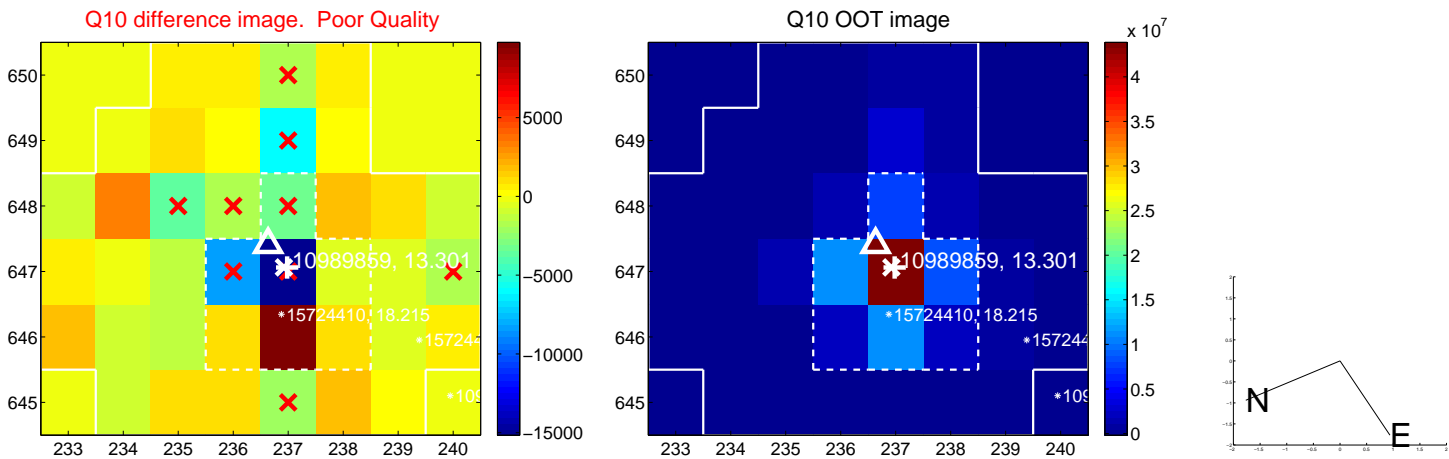
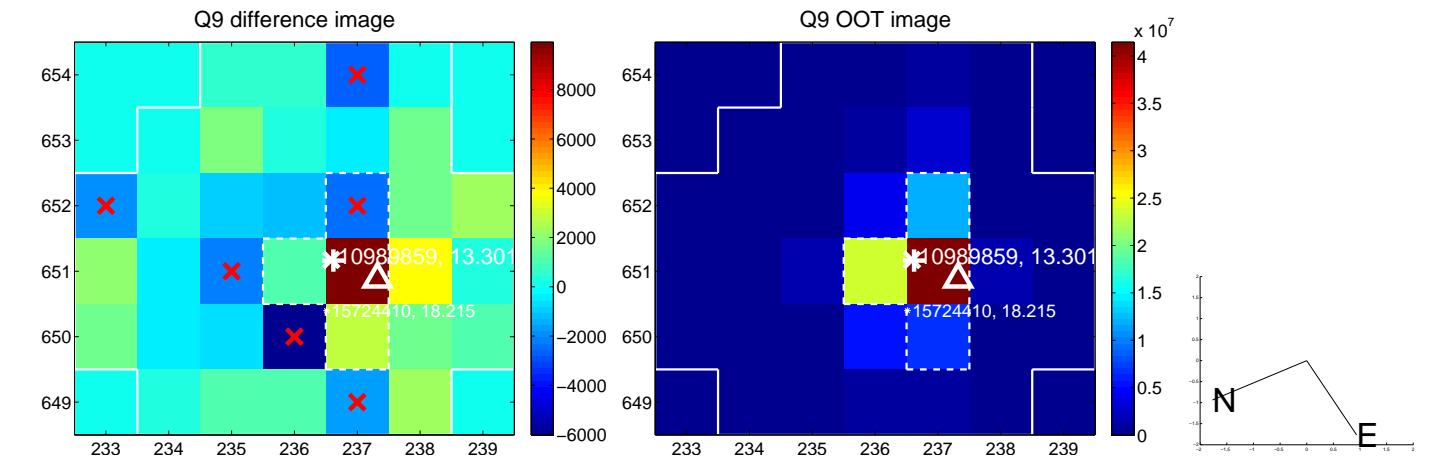


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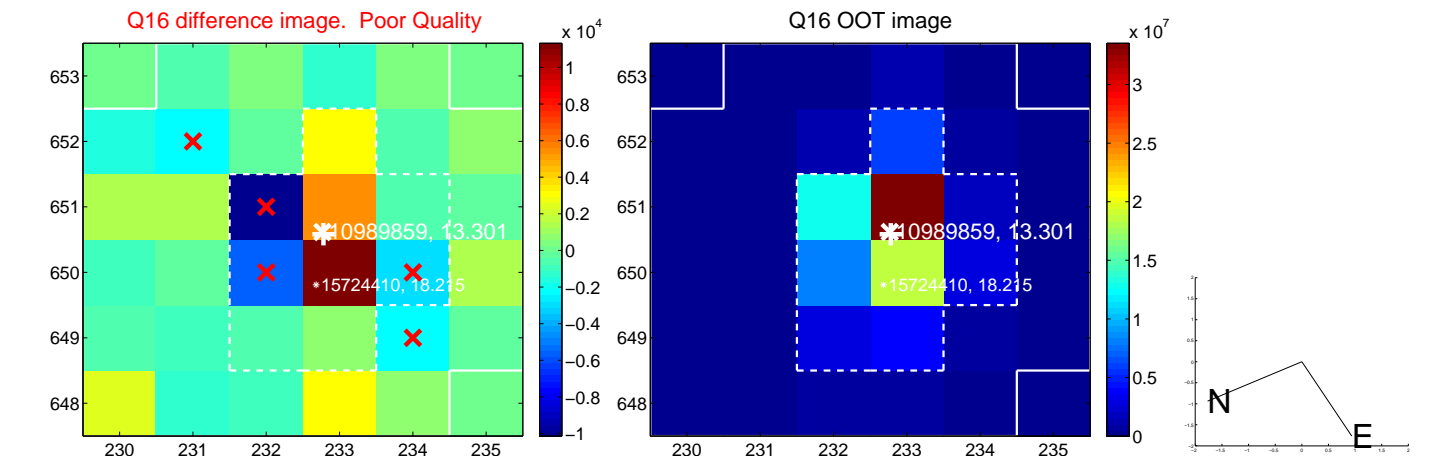
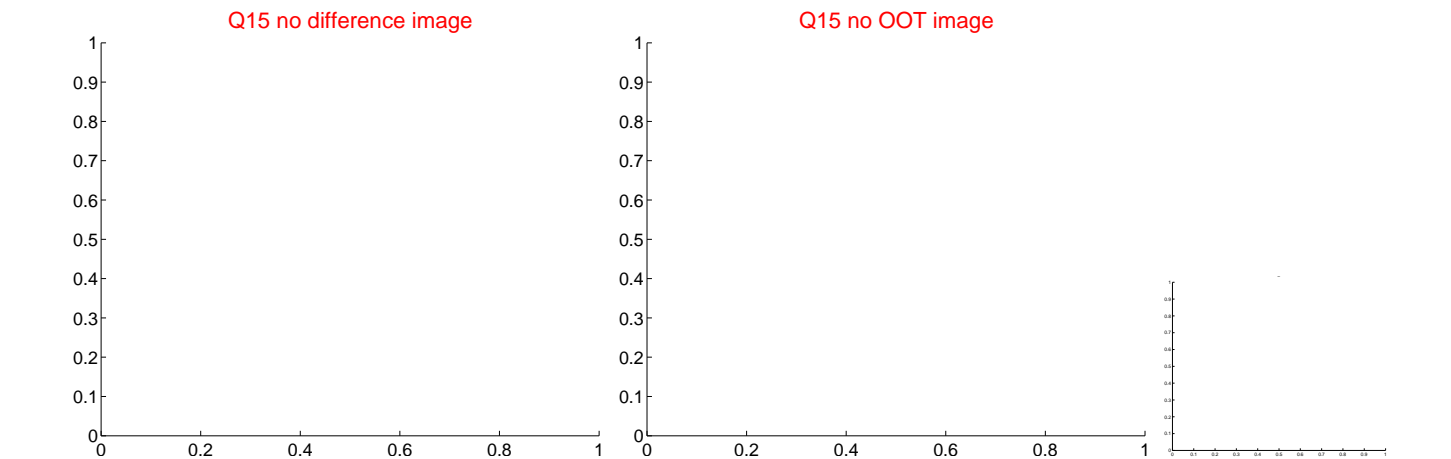
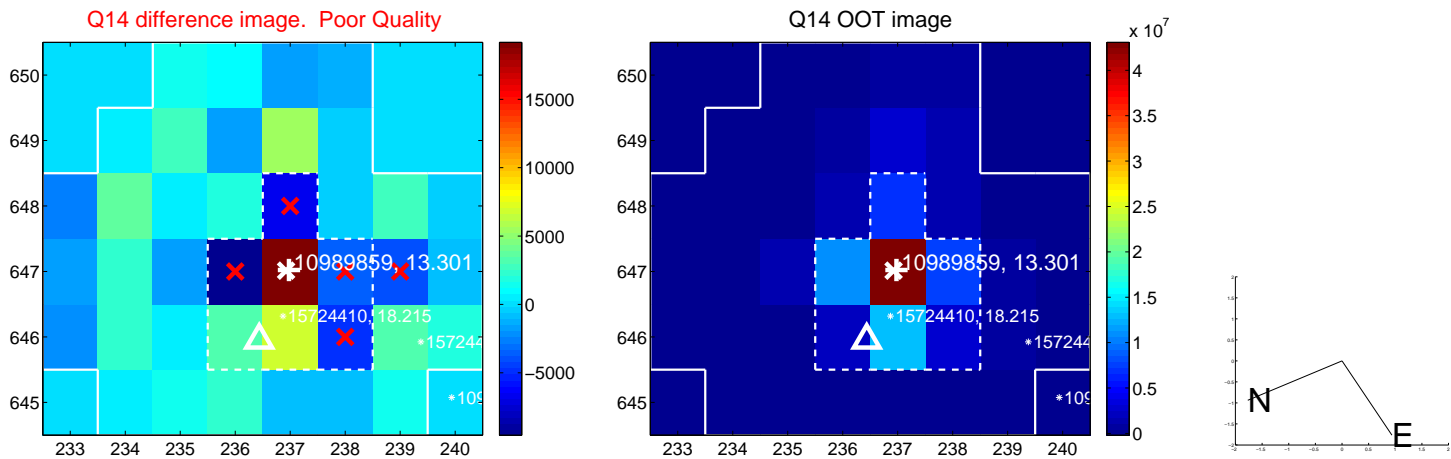
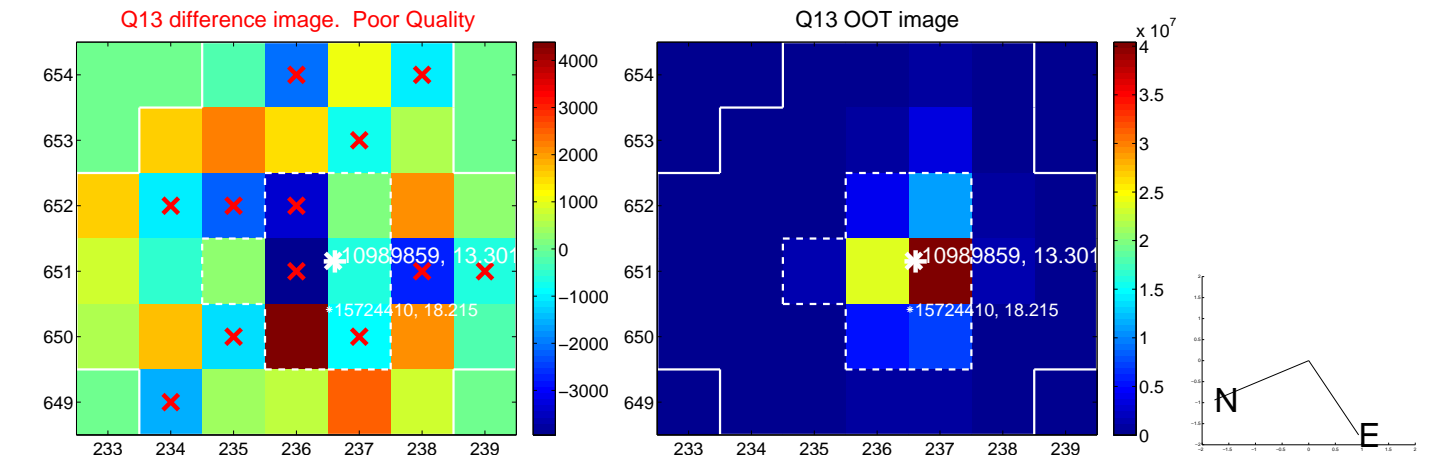




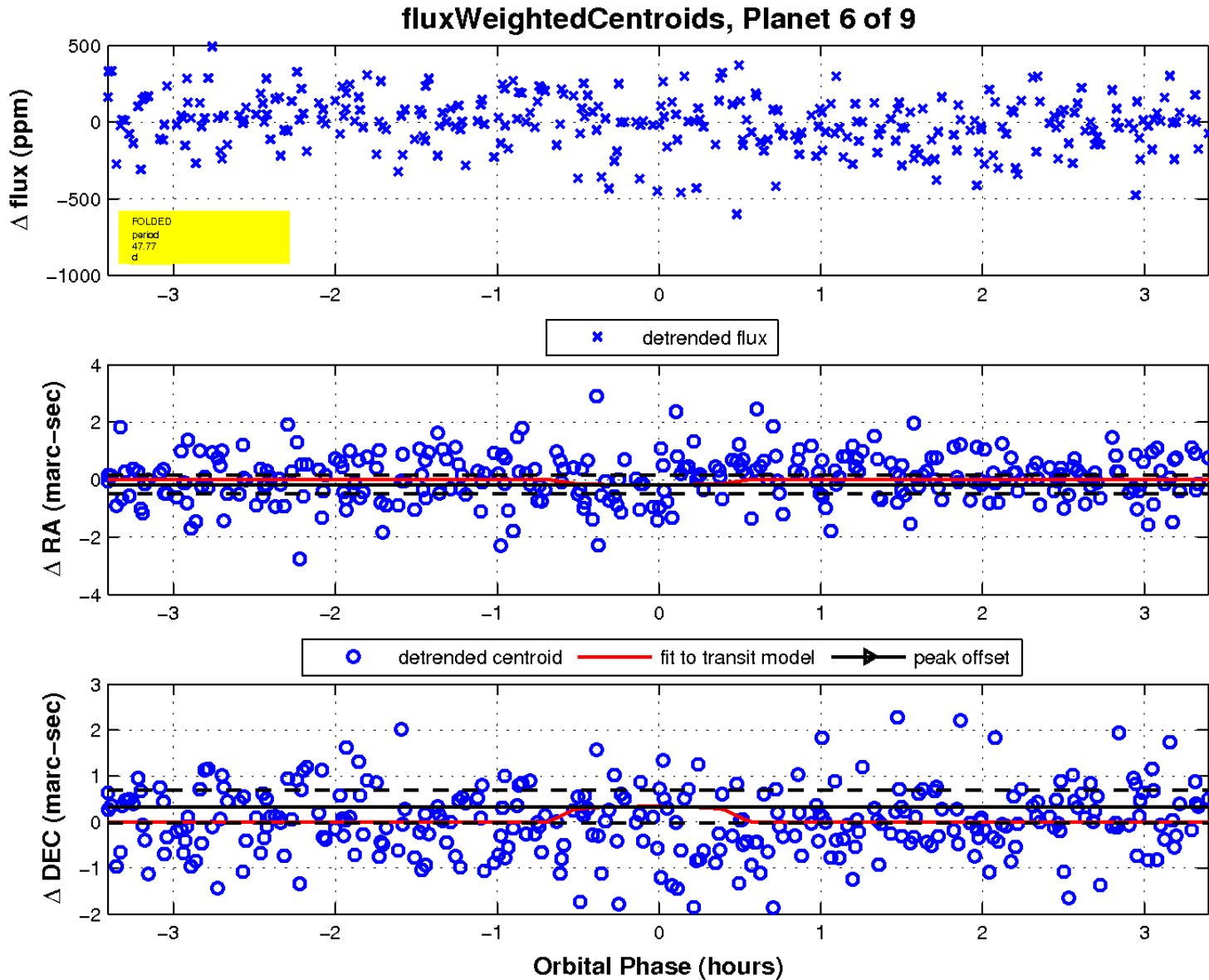
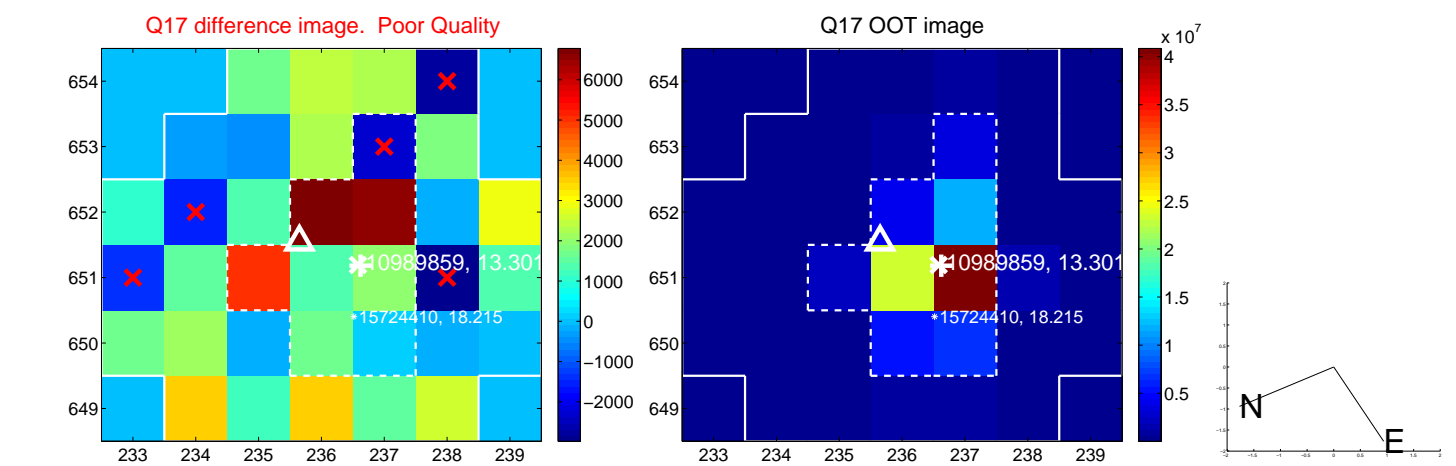
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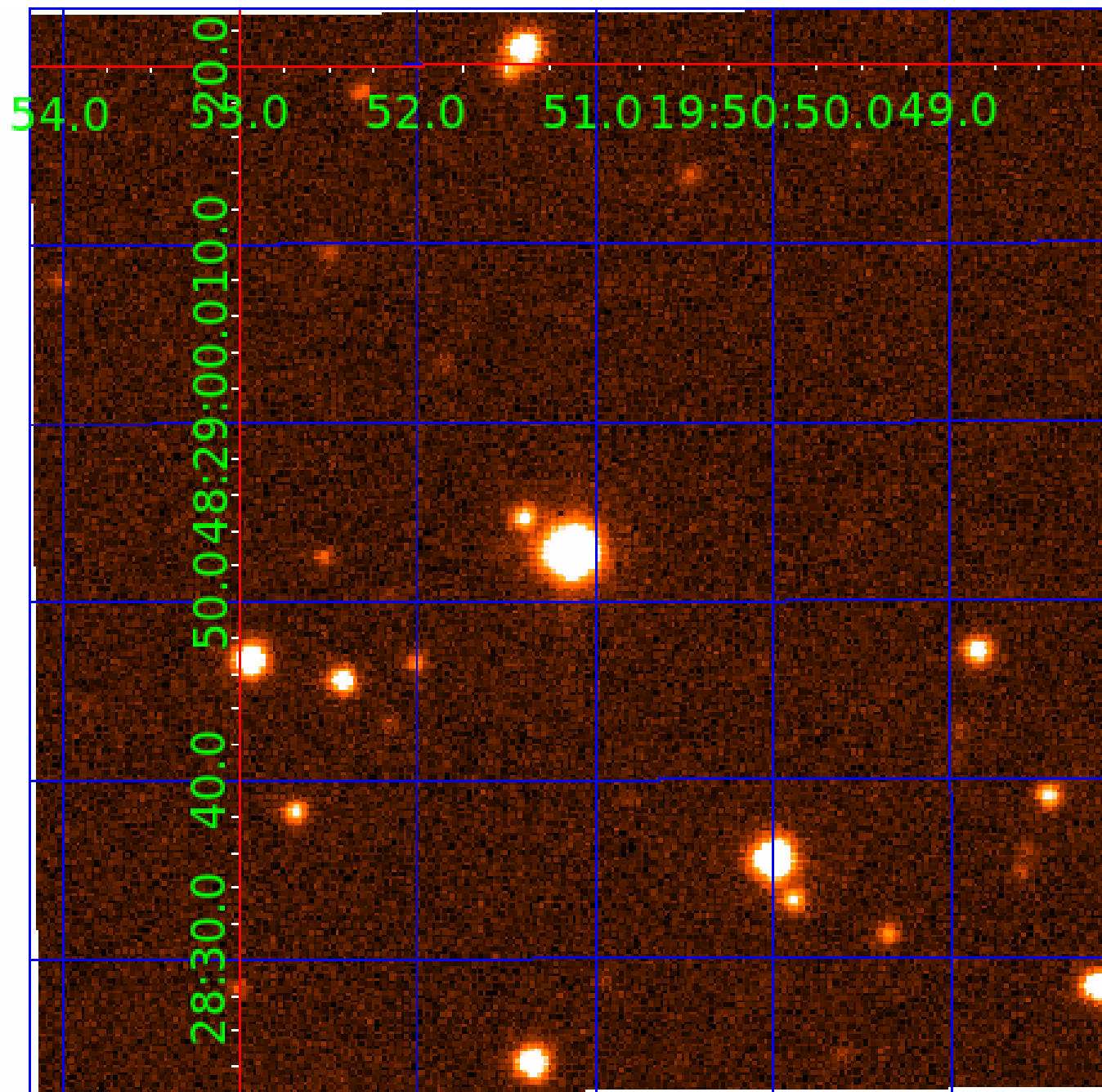


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UKIRT Image

Declination



# KIC 010989859

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010989859-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT
010989859-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT
010989859-05	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—HALO_GHOST
010989859-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_DV—CENT_UNCERTAIN
010989859-07	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
010989859-08	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—CENT_FEW_DIFFS
010989859-09	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_TRACKER—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS

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

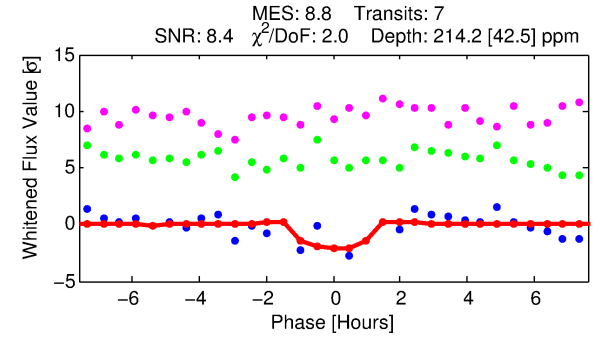
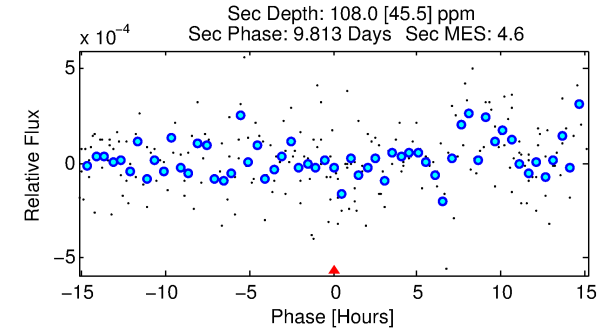
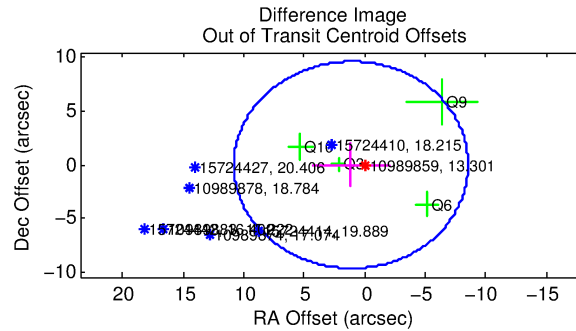
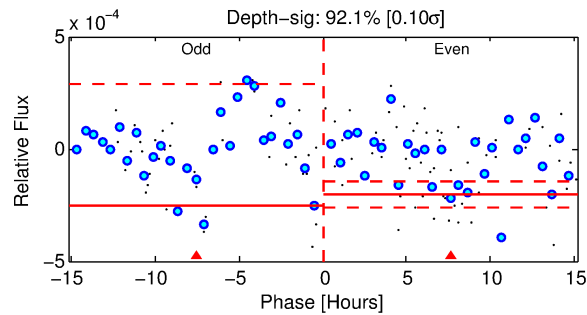
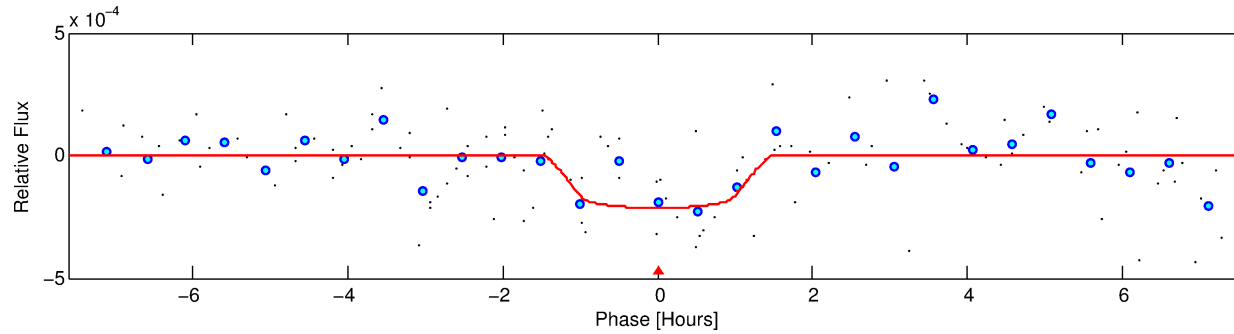
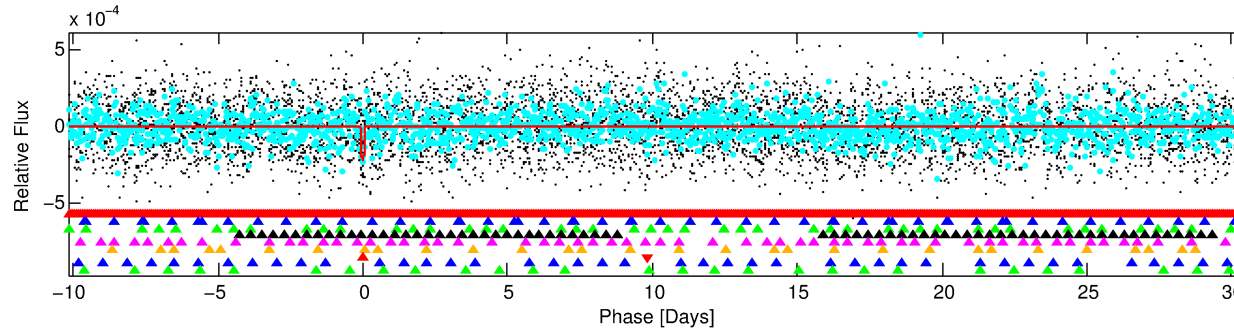
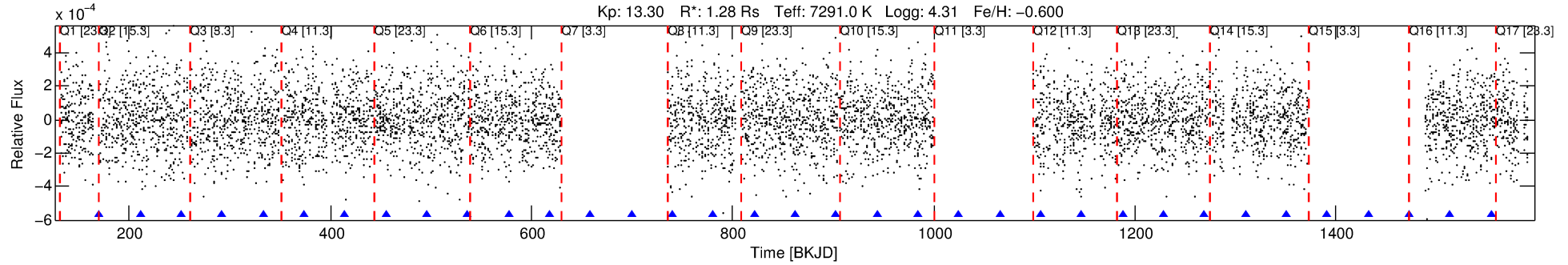
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 010989859-07

No Significant Match Found

# DV One-Page Summary

KIC: 10989859 Candidate: 7 of 9 Period: 40.707 d



## DV Fit Results:

Period = 40.70709 [0.00050] d  
Epoch = 170.2633 [0.0111] BKJD  
Rp/R\* = 0.0150 [0.0143]  
a/R\* = 71.58 [420.02]  
b = 0.83 [2.20]  
Seff = 67.95 [25.59]  
Teq = 732 [69] K  
Rp = 2.09 [2.08] Re  
a = 0.2467 [0.0598] AU  
Ag = 830.13 [1643.67] [0.50 $\sigma$ ]  
Teffp = 6076 [2972] K [1.80 $\sigma$ ]

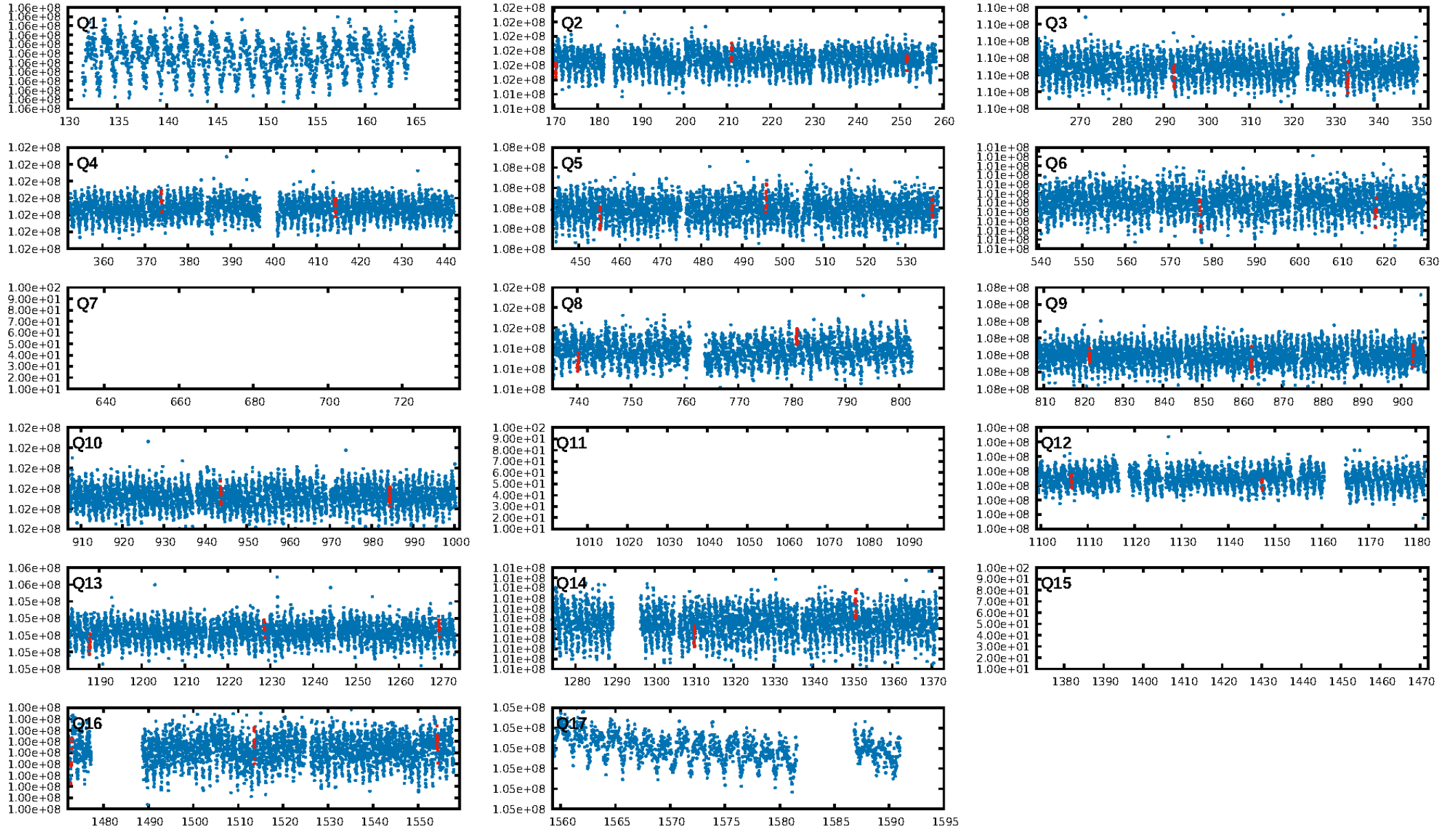
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [45.63 $\sigma$ ]  
LongPeriod-sig: 100.0% [60.99 $\sigma$ ]  
ModelChiSquare2-sig: 11.8%  
ModelChiSquareGof-sig: 53.4%  
**Bootstrap-pfa: 1.13e-08**  
RollingBand-fgt: 1.00 [7/7]  
GhostDiagnostic-chr: -2.218  
Centroid-sig: 12.2%  
Centroid-so: 0.914 arcsec [0.94 $\sigma$ ]  
OotOffset-rm: 1.128 arcsec [0.35 $\sigma$ ]  
OotOffset-st: 2/1/0/1 [4]  
KicOffset-rm: 1.253 arcsec [0.42 $\sigma$ ]  
KicOffset-st: 2/1/0/1 [4]  
DiffImageQuality-fgm: 0.25 [1/4]  
DiffImageOverlap-fno: 0.27 [3/11]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 09:38:29 Z

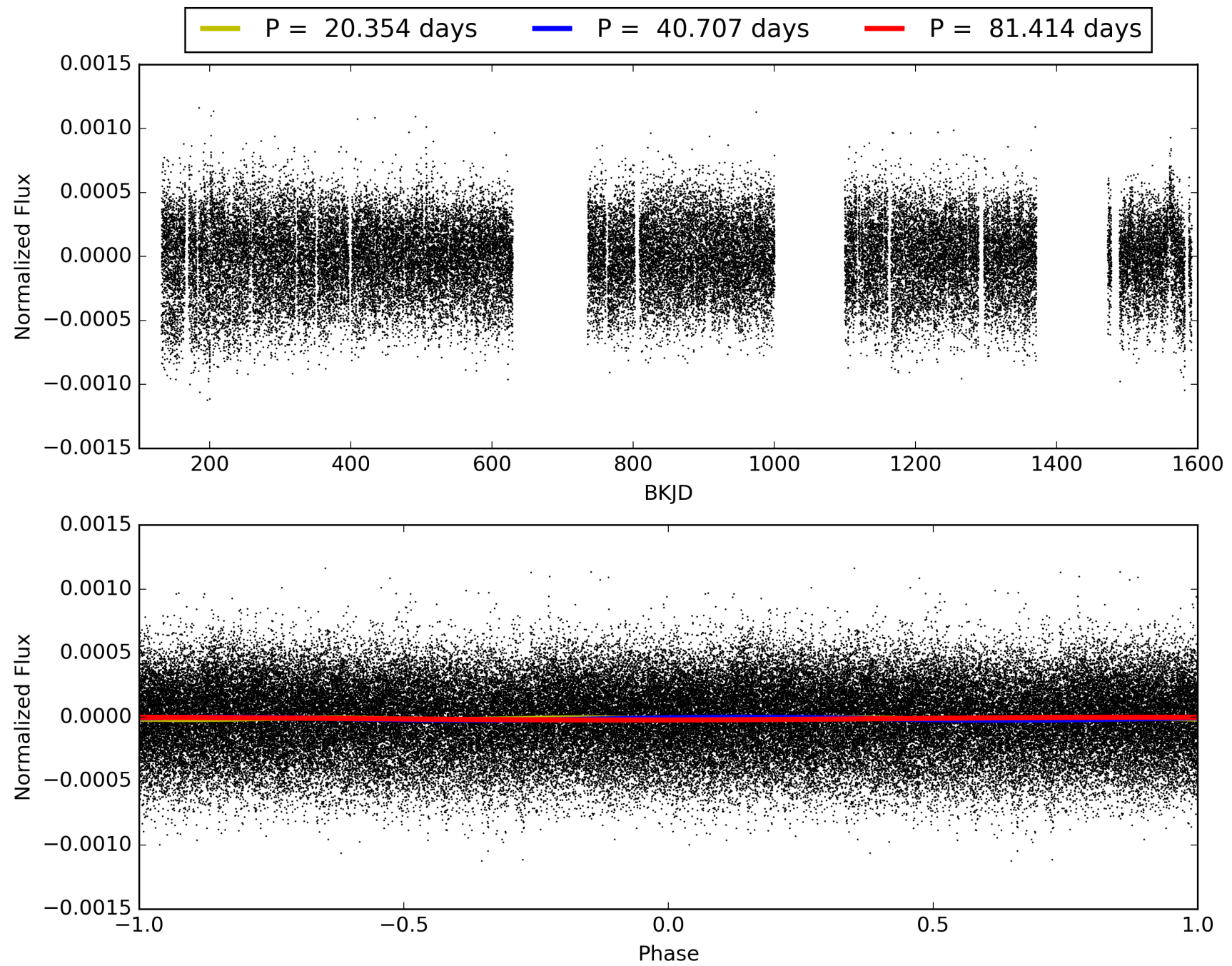
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 010989859-07, PDC Light Curves





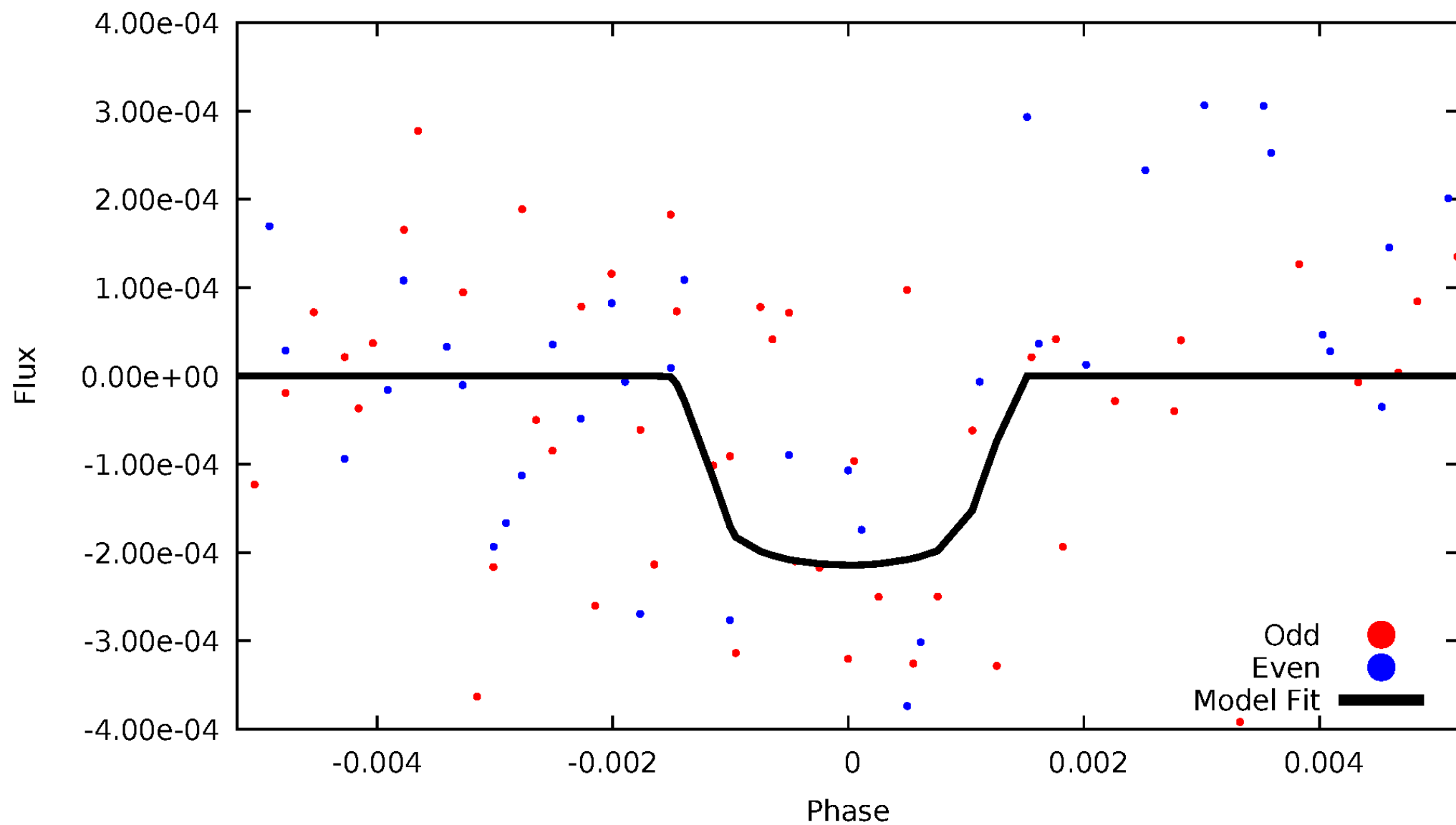
TCE 010989859-07





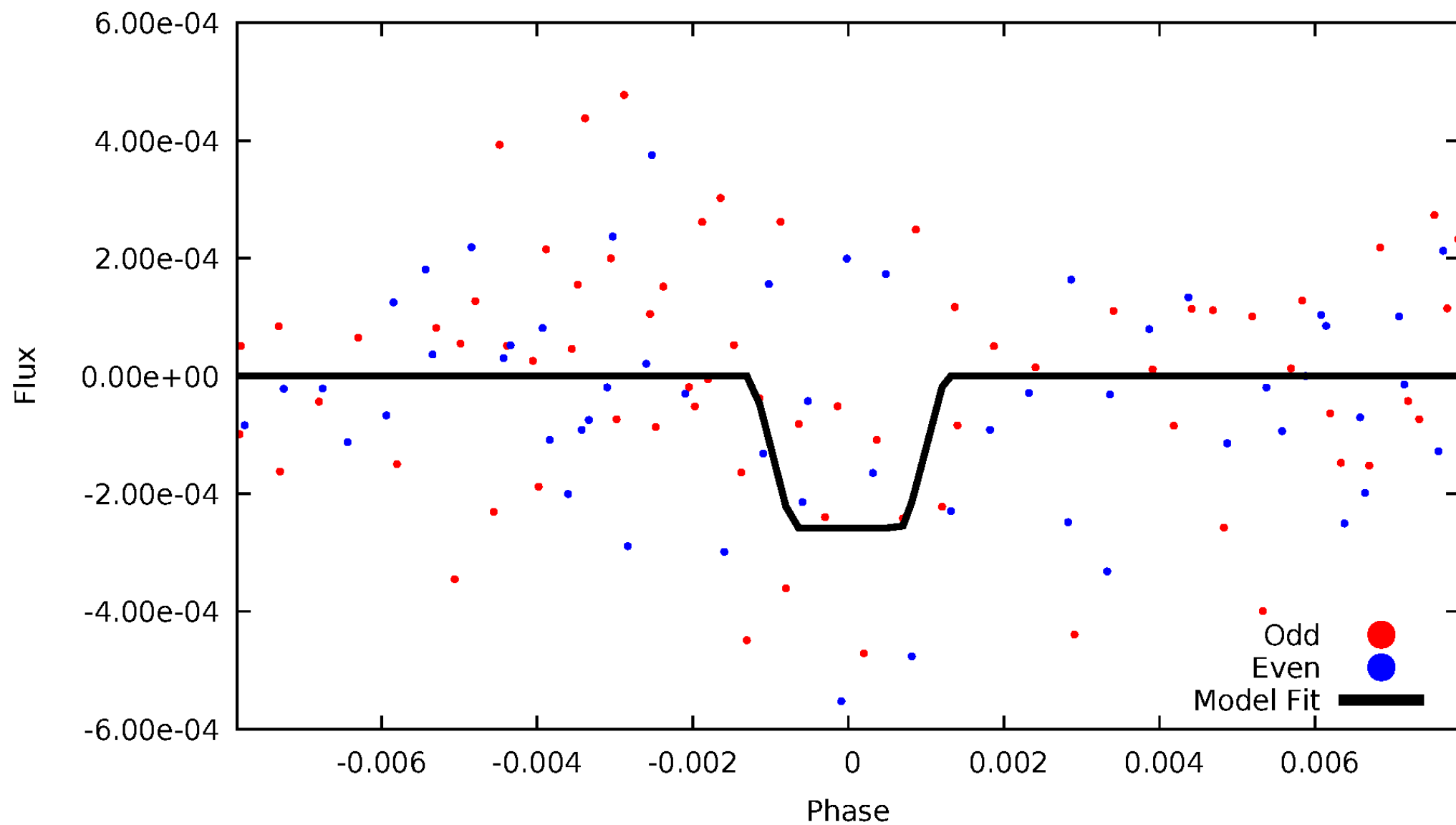
# DV Odd/Even

TCE 010989859-07



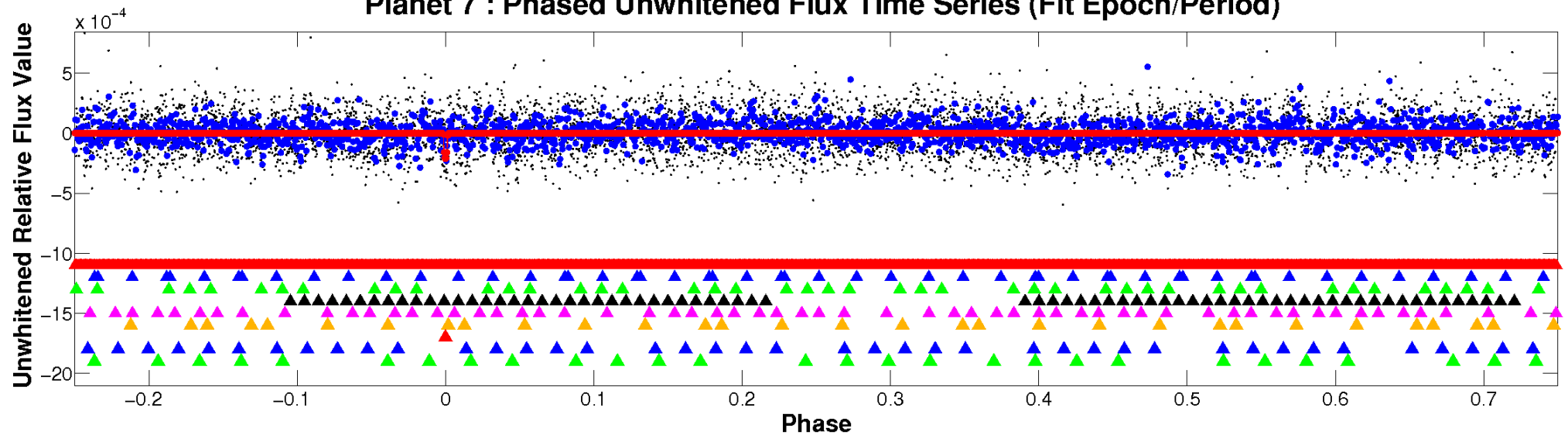
# ALT Odd/Even

TCE 010989859-07

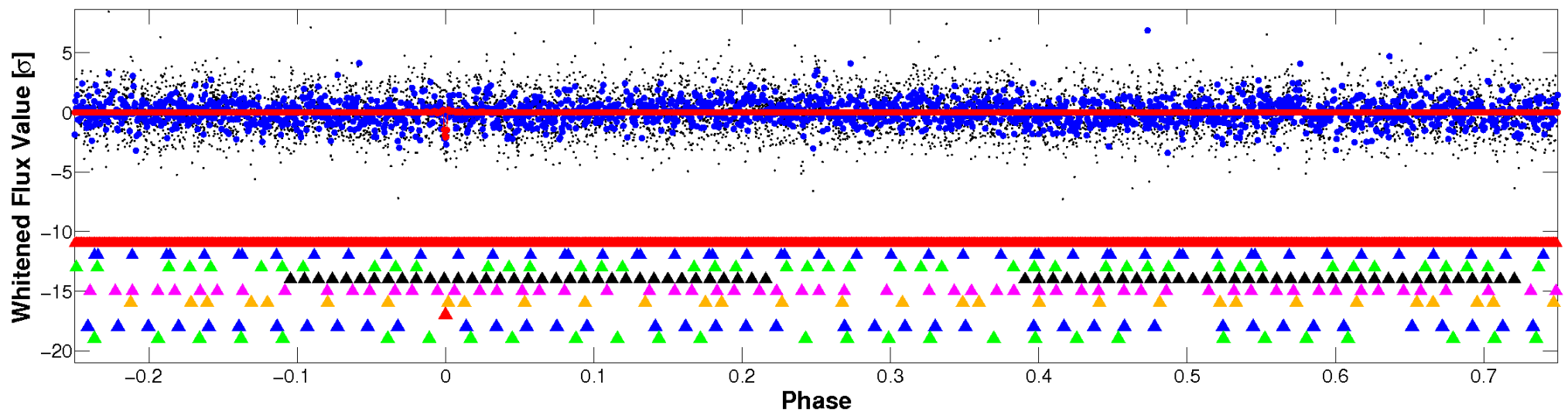


# Non-Whitened Vs. Whitened Light Curve

Planet 7 : Phased Unwhitened Flux Time Series (Fit Epoch/Period)

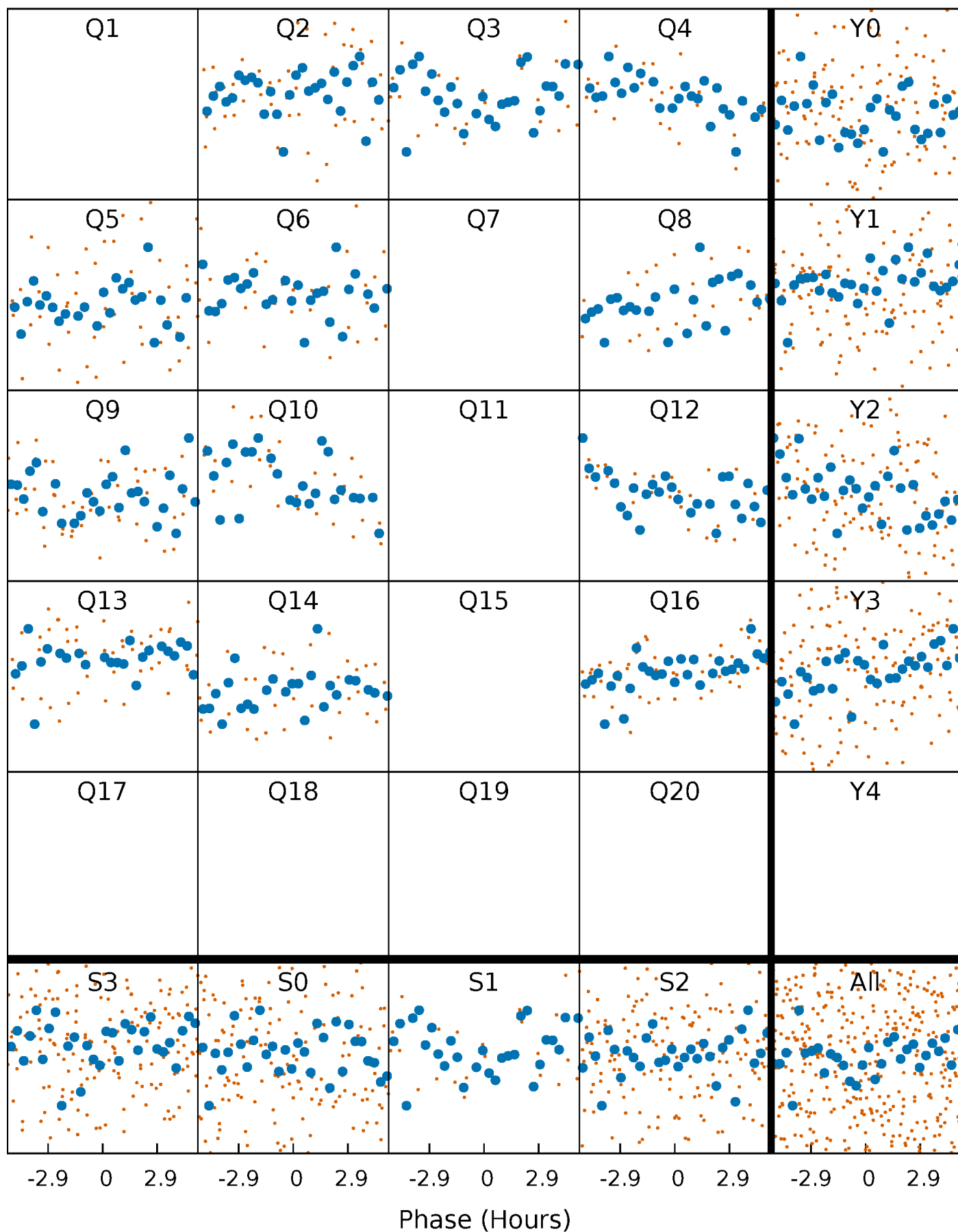


Planet 7 : Phased Whitened Flux Time Series (Fit Epoch/Period)



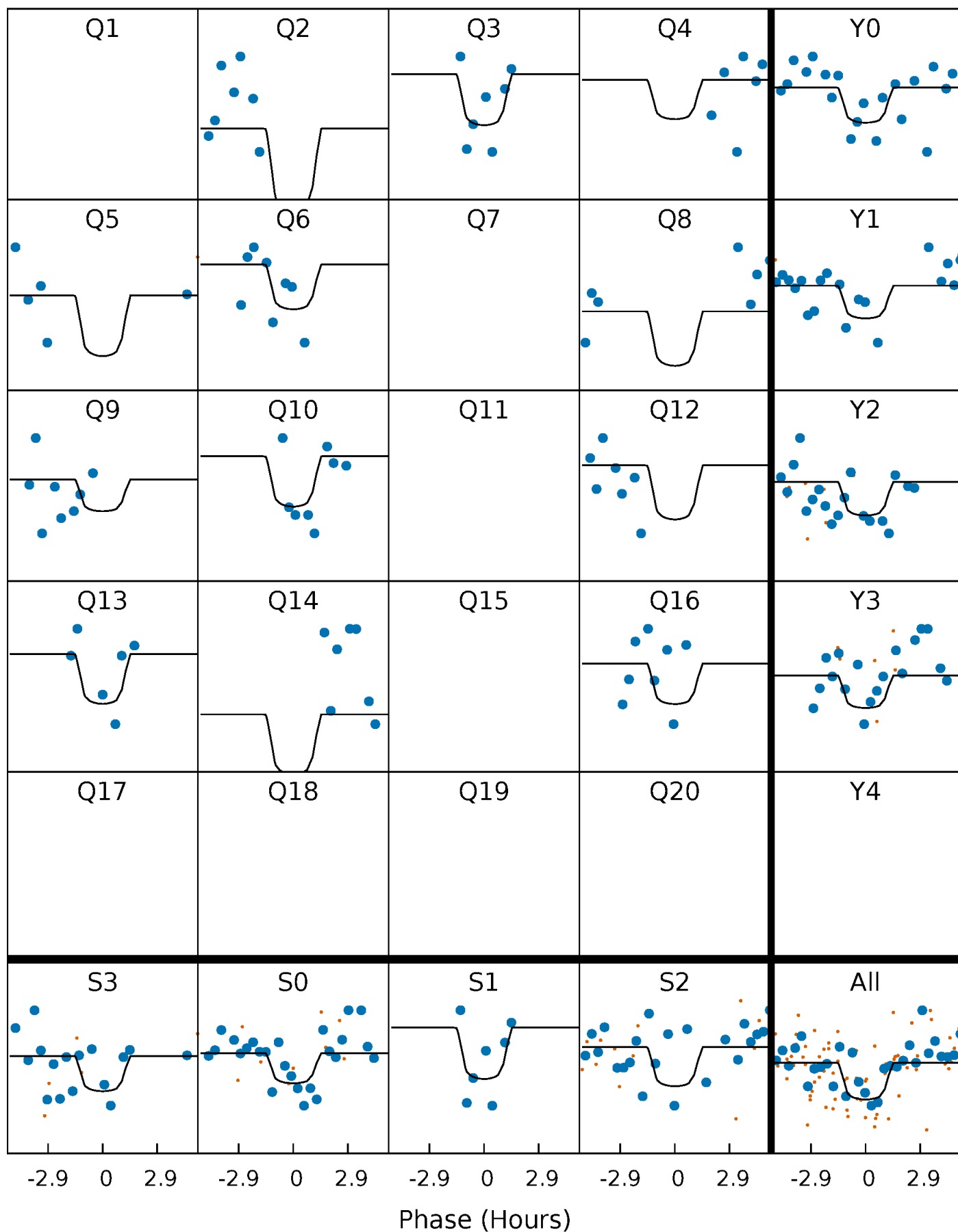
# PDC Quarter-Phased Transit Curves

TCE 010989859-07     $P = 40.707094$  Days     $T_0 = 170.263260$  (BKJD)



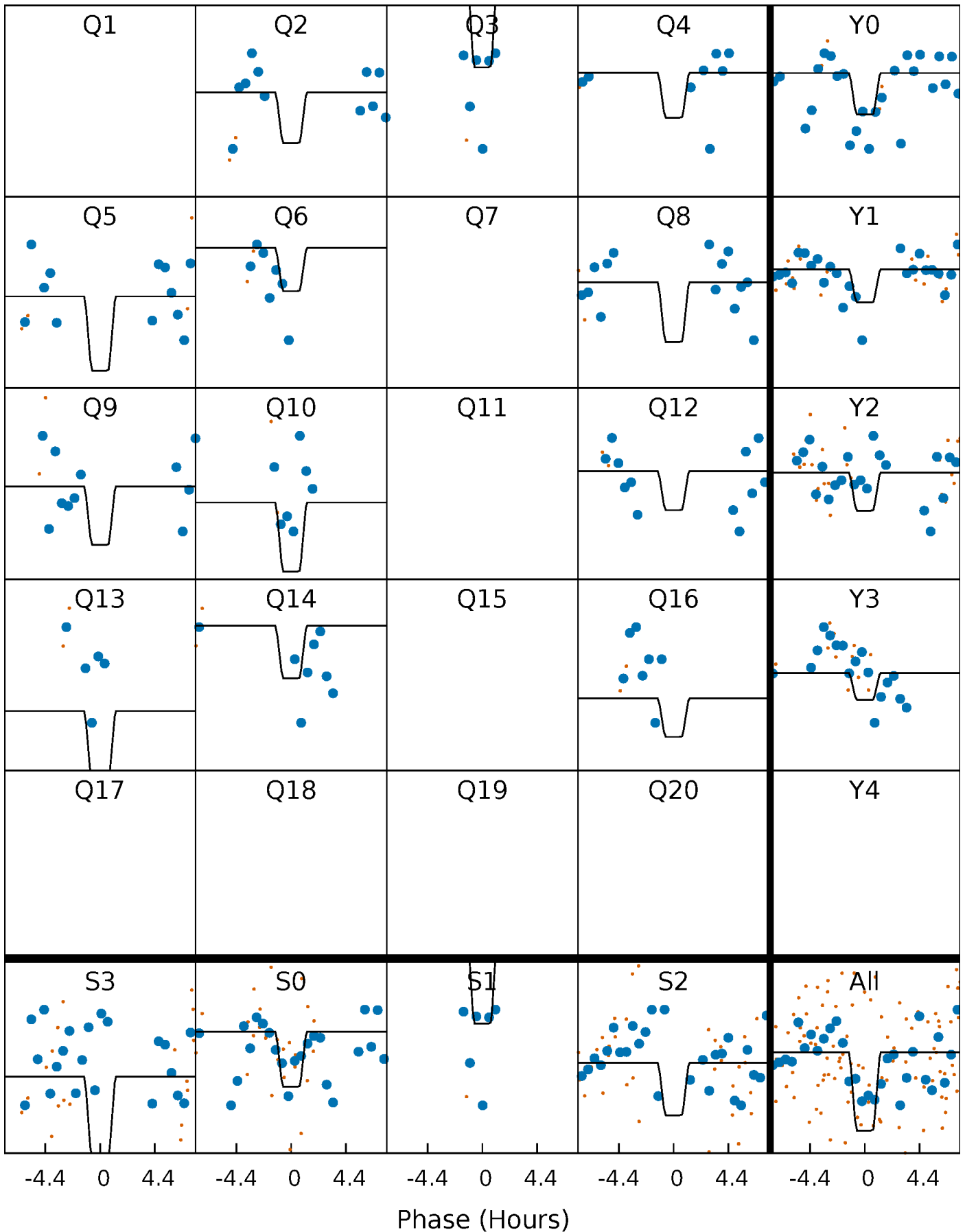
# DV Quarter-Phased Transit Curves

TCE 010989859-07 P= 40.707094 Days  $T_0=170.263260$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

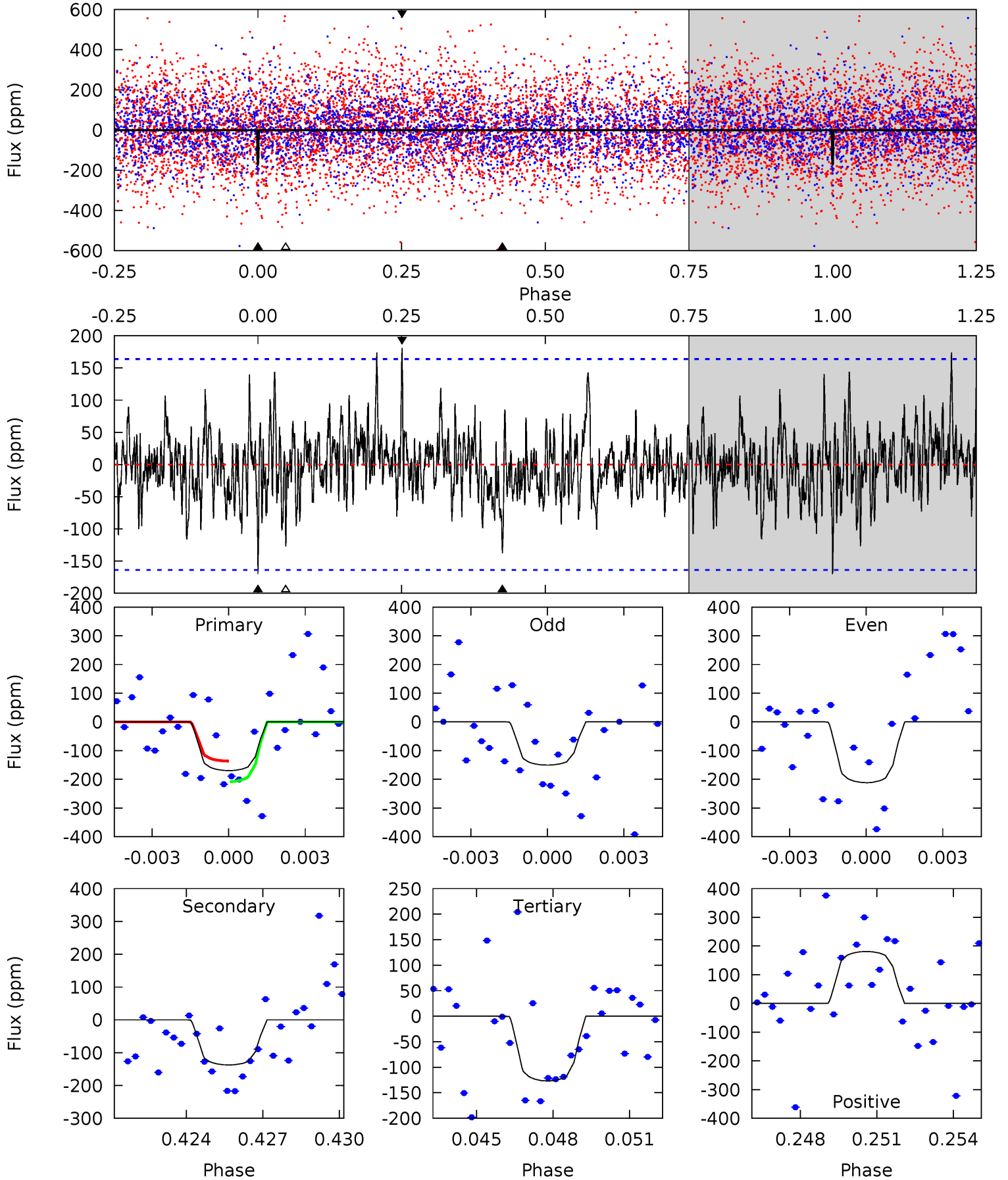
TCE 010989859-07     $P = 40.708482$  Days     $T_0 = 170.273365$  (BKJD)



# DV Model-Shift Uniqueness Test

010989859-07, P = 40.707094 Days, E = 129.556166 Days

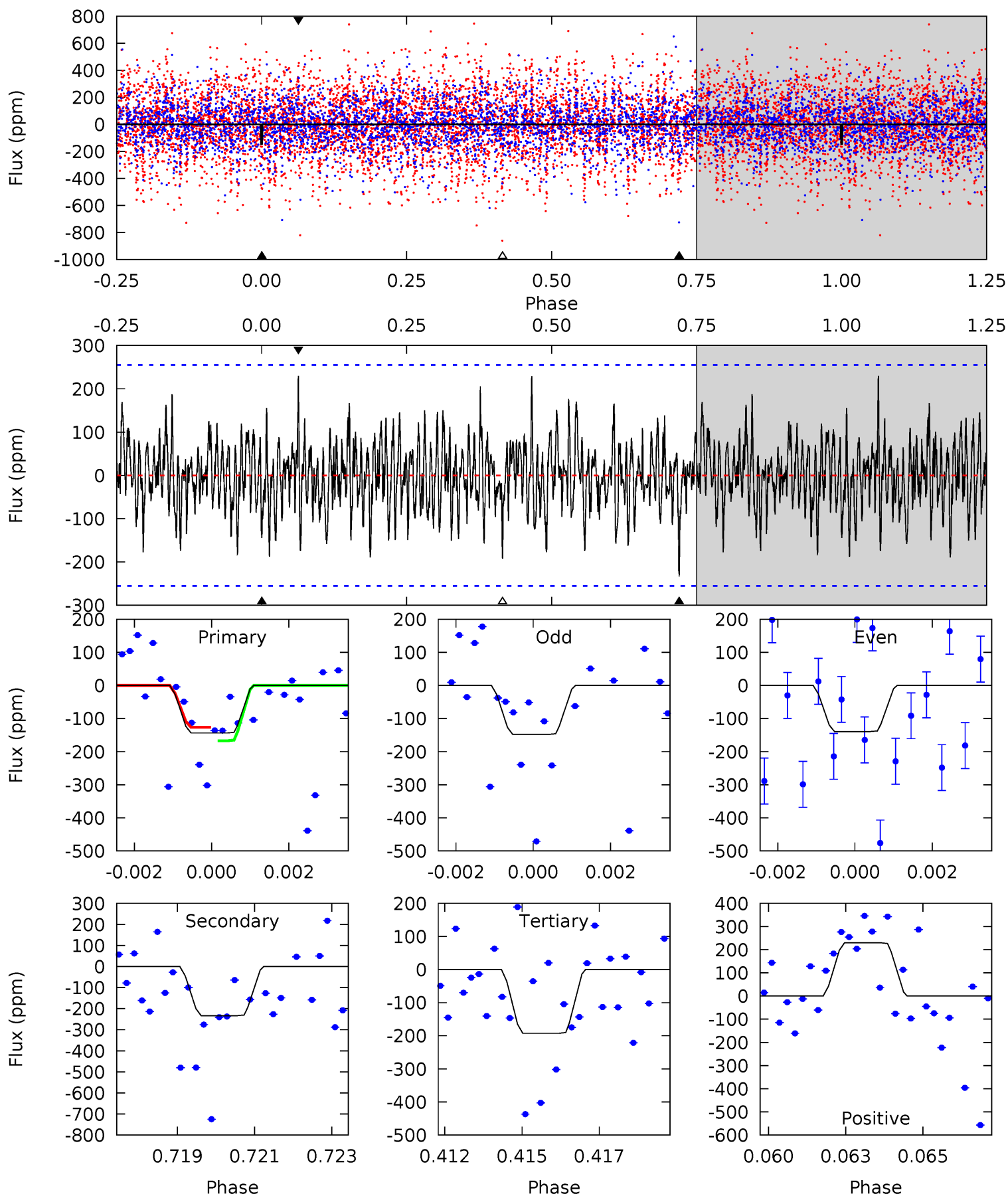
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
5.45	4.41	4.07	5.81	5.25	2.97	1.33	1.38	-0.36	0.34	-1.40	0.93	0.78	0.52	1.14



# Alt Model-Shift Uniqueness Test

010989859-07, P = 40.708482 Days, E = 129.564883 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
2.98	4.84	4.00	4.76	5.29	3.03	1.44	-1.01	-1.78	0.84	0.08	0.09	0.58	0.50	0.42





### Stellar Parameters For KIC 010989859

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$7291^{+207}_{-285}$	$4.307^{+0.084}_{-0.182}$	$-0.600^{+0.250}_{-0.300}$	$1.278^{+0.380}_{-0.163}$	$1.208^{+0.166}_{-0.136}$	$0.815^{+0.355}_{-0.399}$
	+3%/-4%	+2%/-4%	+42%/-50%	+30%/-13%	+14%/-11%	+44%/-49%
Source	PHO1	KIC0	KIC0	DSEP		

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

### Secondary Eclipse Parameters for KIC 010989859-07 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-138 \pm 31$	$2.48^{+1.85}_{-1.59}$	$1034^{+67}_{-51}$	$5923^{+5431}_{-1309}$	$765^{+4856}_{-539}$
Alt.	$-233 \pm 48$	$2.74^{+1.96}_{-1.75}$	$1032^{+76}_{-55}$	$6291^{+6303}_{-1320}$	$958^{+7166}_{-627}$

$T_{\text{max}}$  = 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

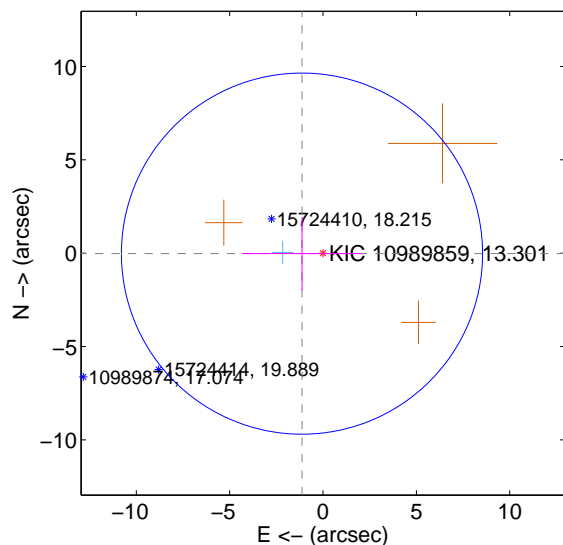
Supplemental centroid analysis for 010989859-07. Kepler magnitude: 13.30. Transit SNR 8.36

There are 1 quarters with good PRF difference image offsets

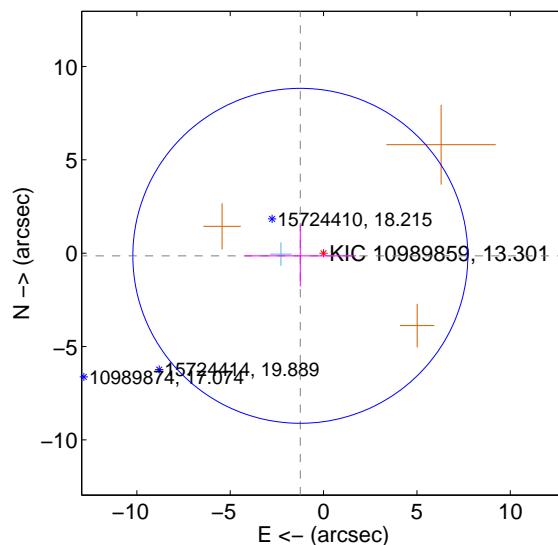
The direct PRF centroid is offset from the target star catalog position by about 0.23 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.128 \pm 3.224$	0.35	$1.128 \pm 3.206$	$-0.025 \pm 1.961$
PRF-fit source offset from KIC position	$1.253 \pm 2.990$	0.42	$1.245 \pm 2.992$	$-0.142 \pm 1.641$
photometric centroid source offset	$0.91 \pm 0.97$	0.94	$0.15 \pm 0.93$	$0.90 \pm 0.97$

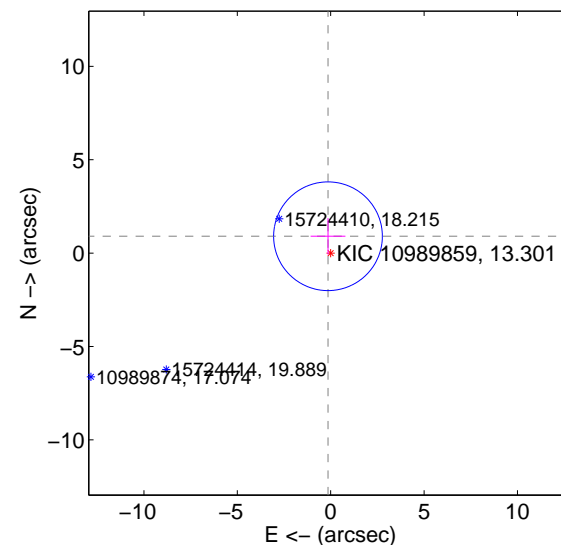
offset from difference PRF-fit to OOT PRF-fit



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.

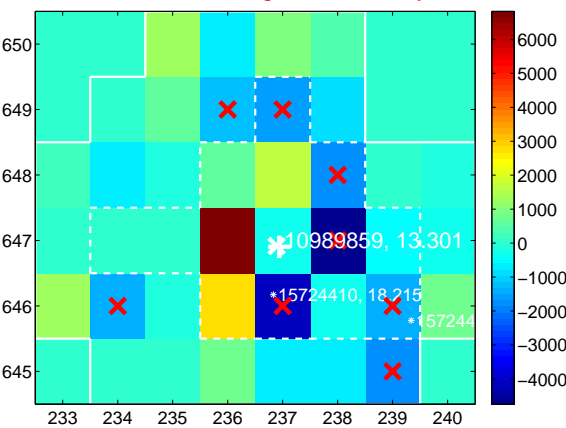
Q1 no difference image



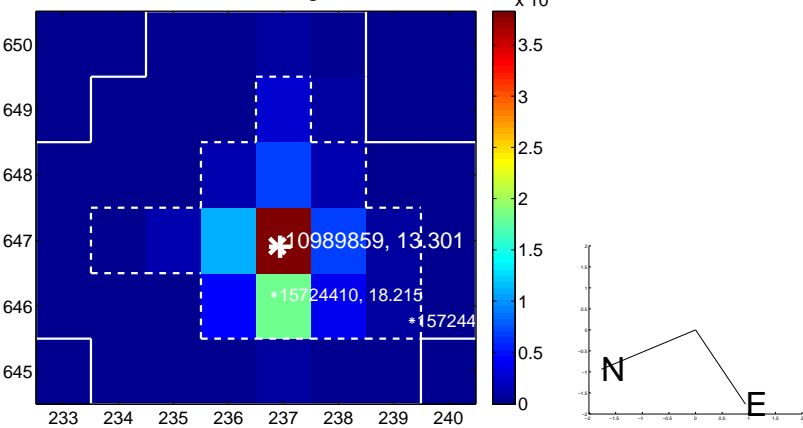
Q1 no OOT image



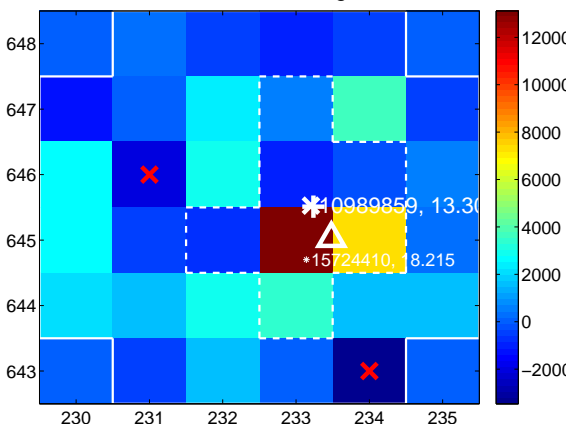
Q2 difference image. Poor Quality



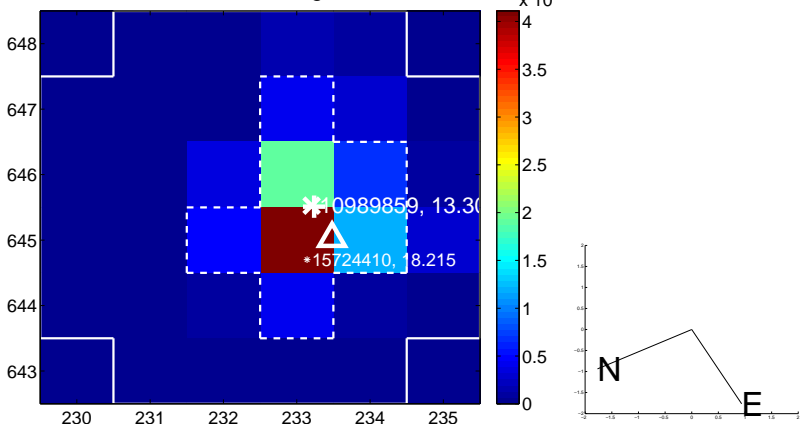
Q2 OOT image



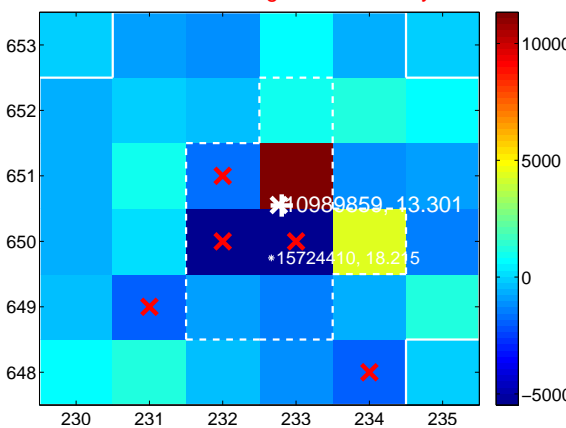
Q3 difference image



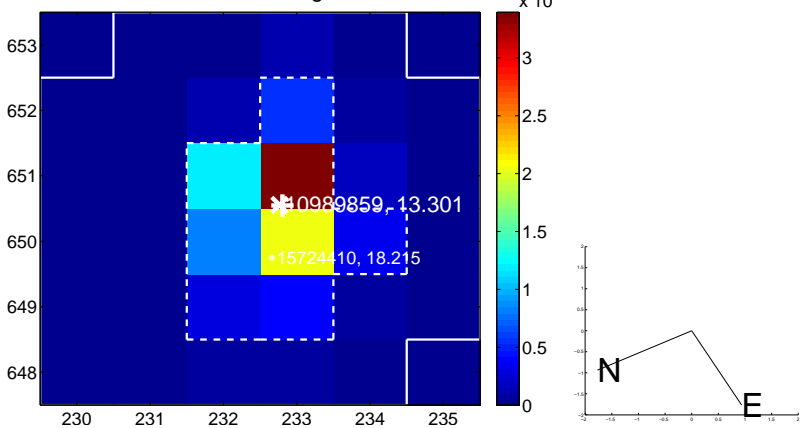
Q3 OOT image



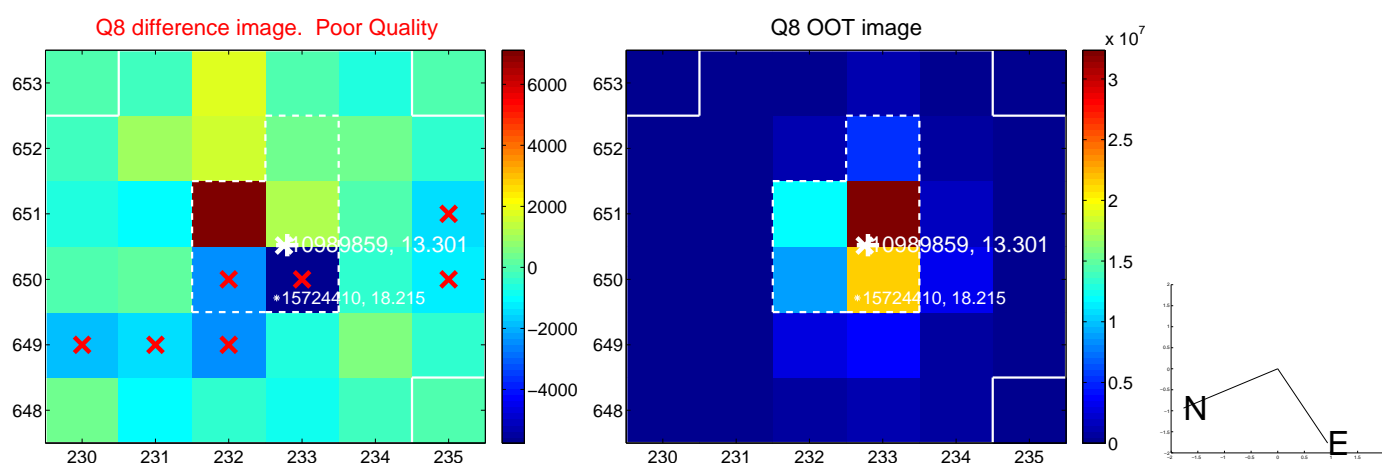
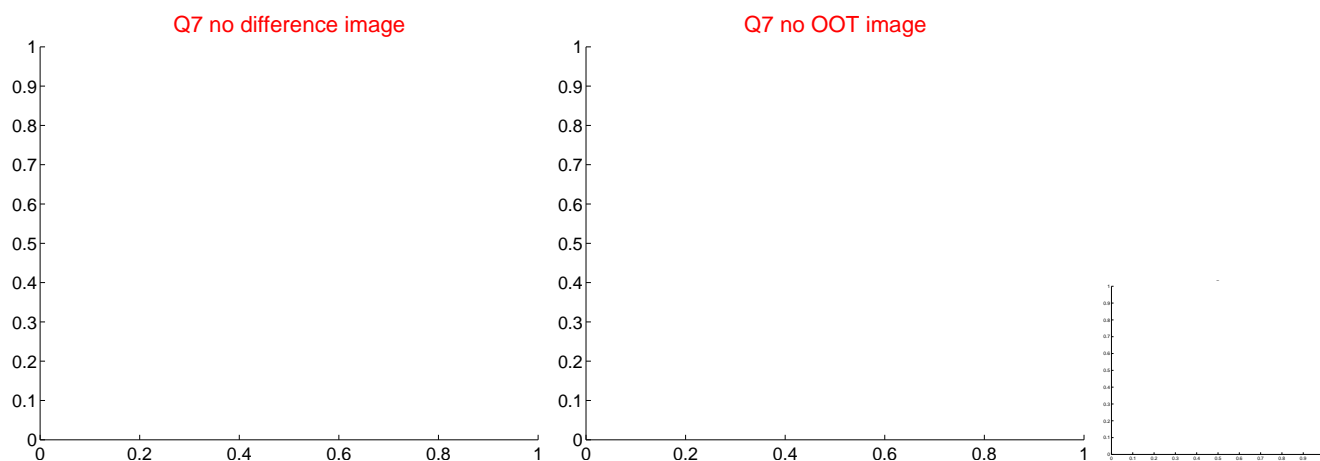
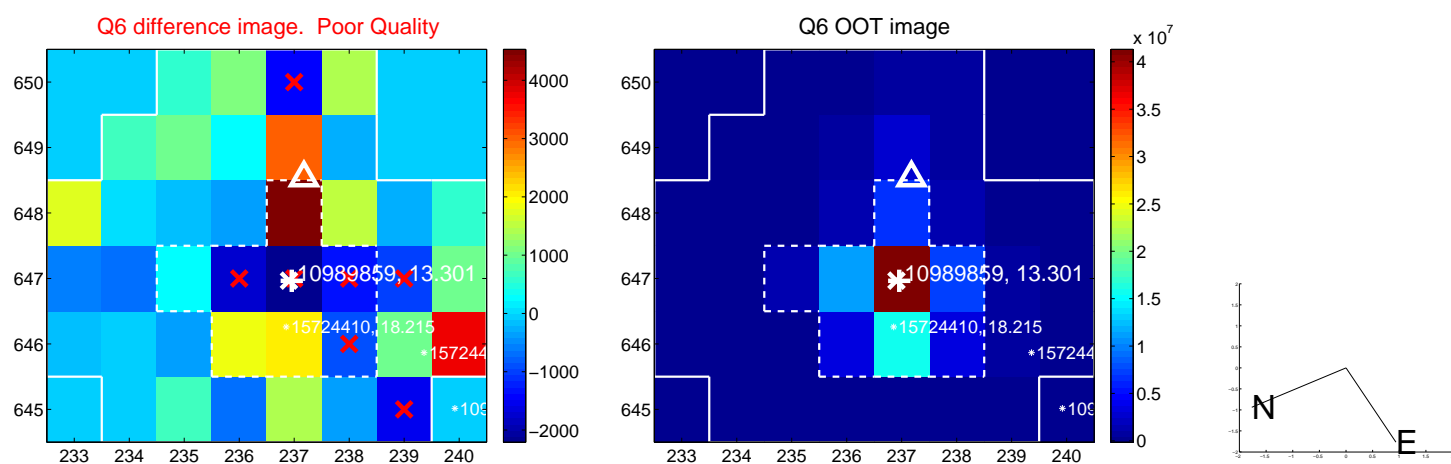
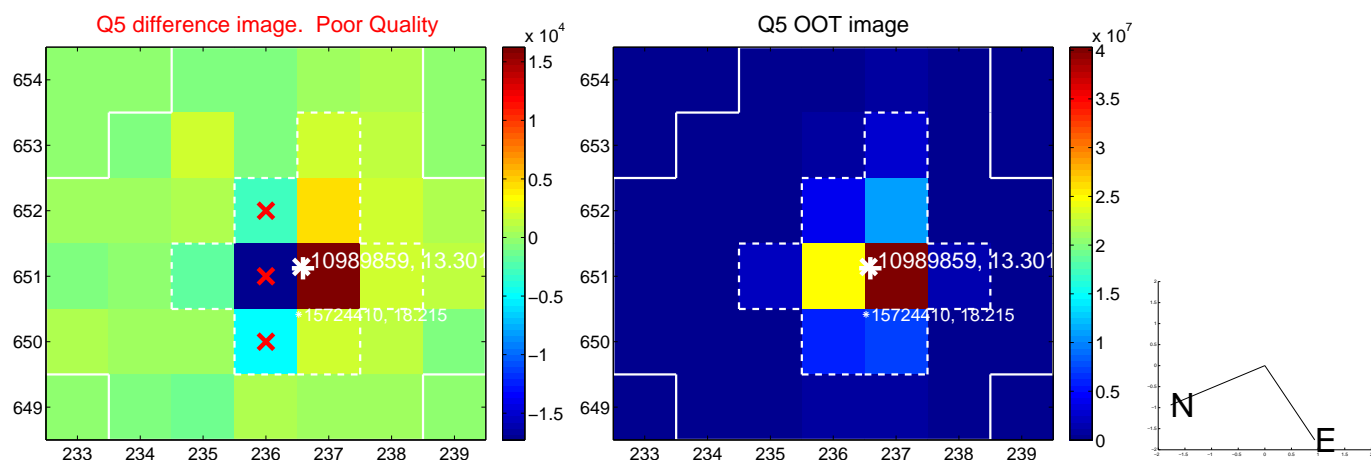
Q4 difference image. Poor Quality



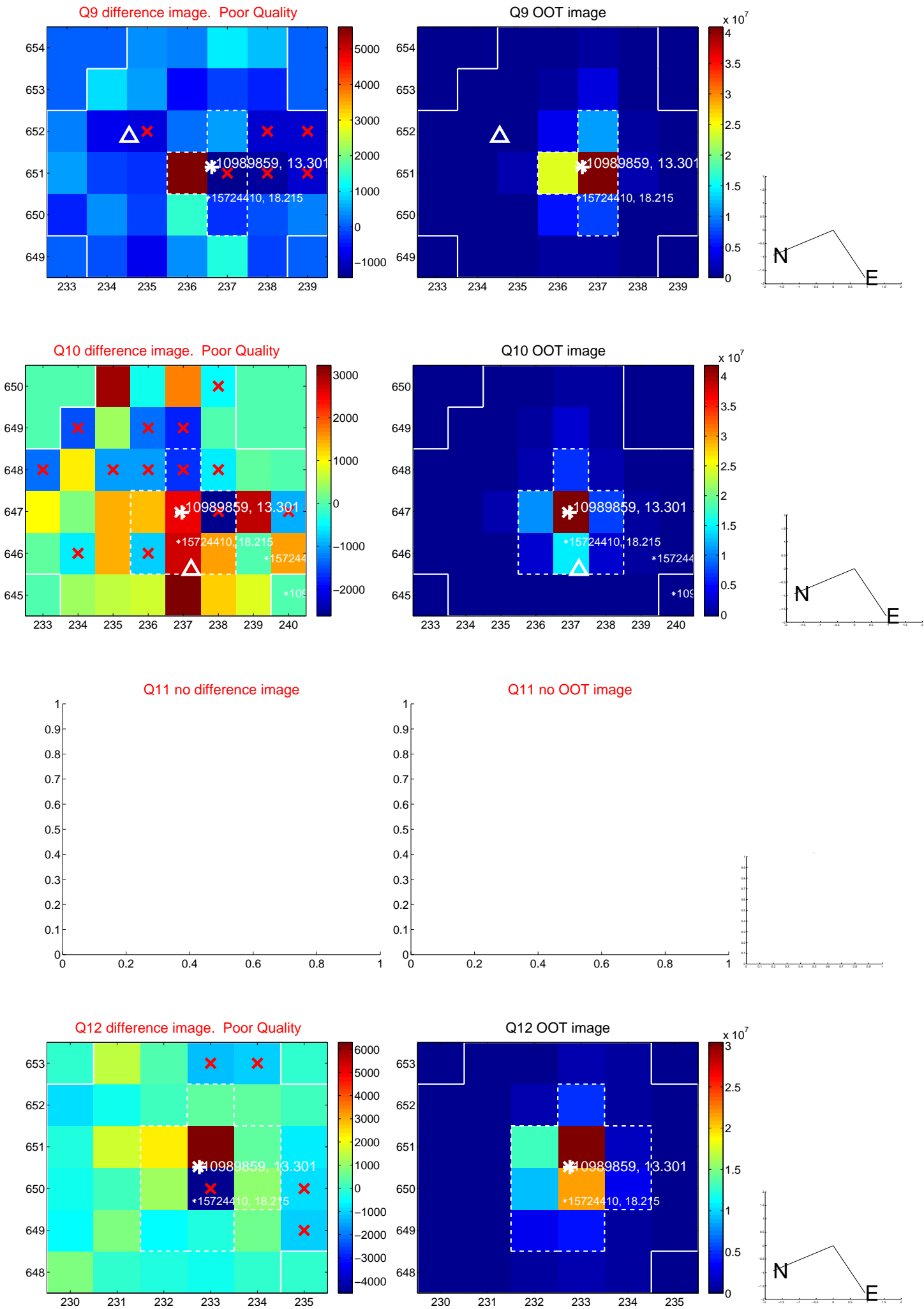
Q4 OOT image



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.

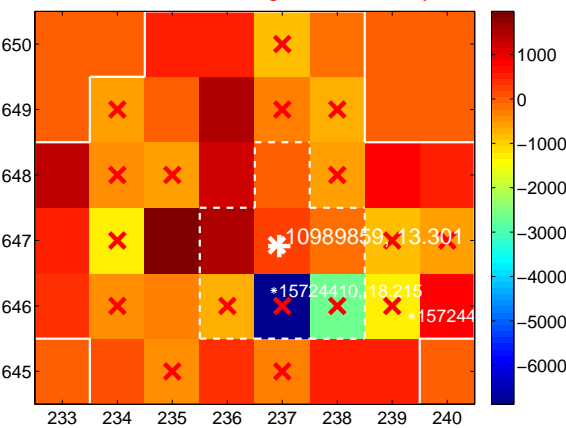
Q13 no difference image



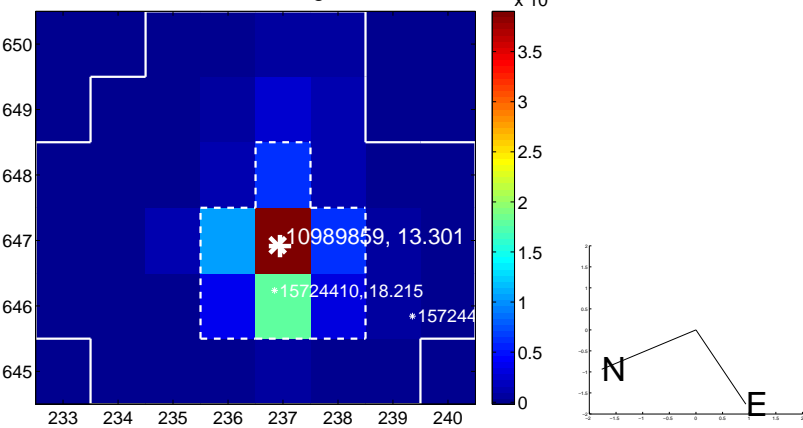
Q13 no OOT image



Q14 difference image. Poor Quality



Q14 OOT image



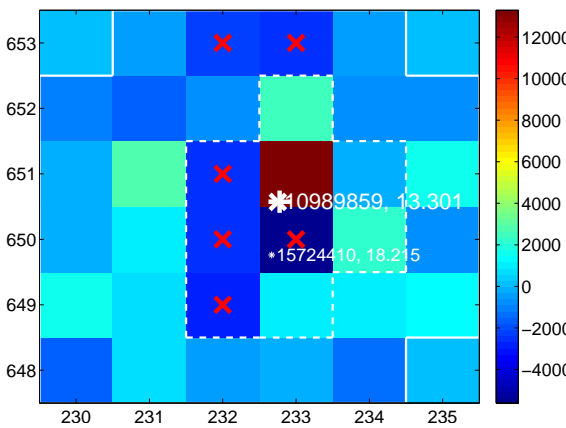
Q15 no difference image



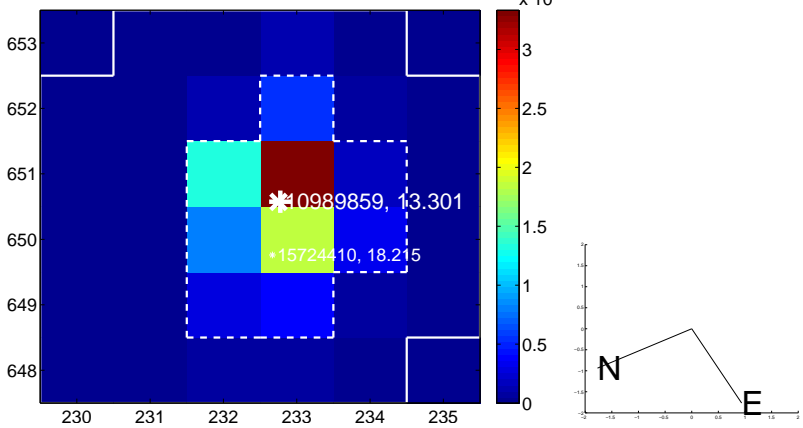
Q15 no OOT image



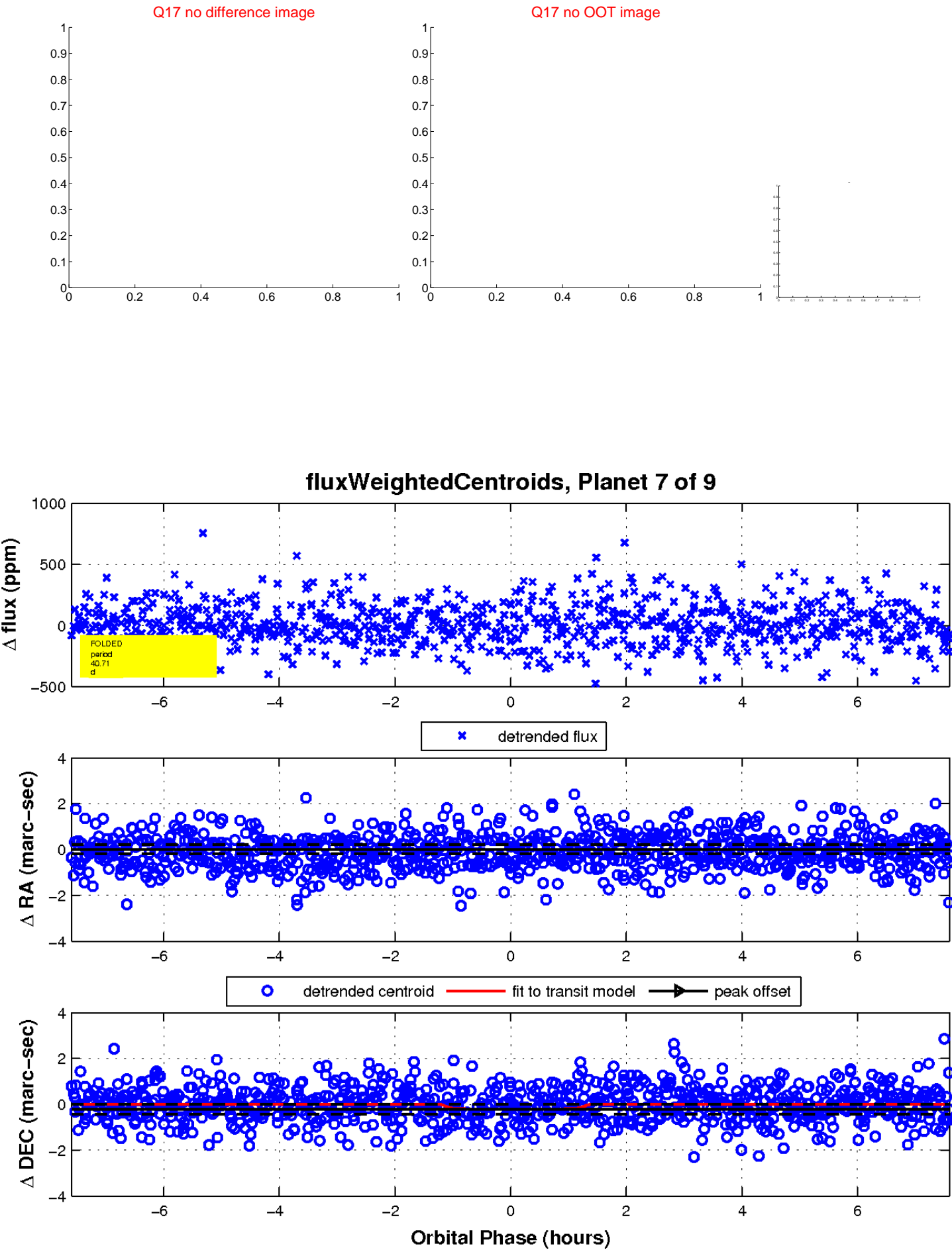
Q16 difference image. Poor Quality



Q16 OOT image

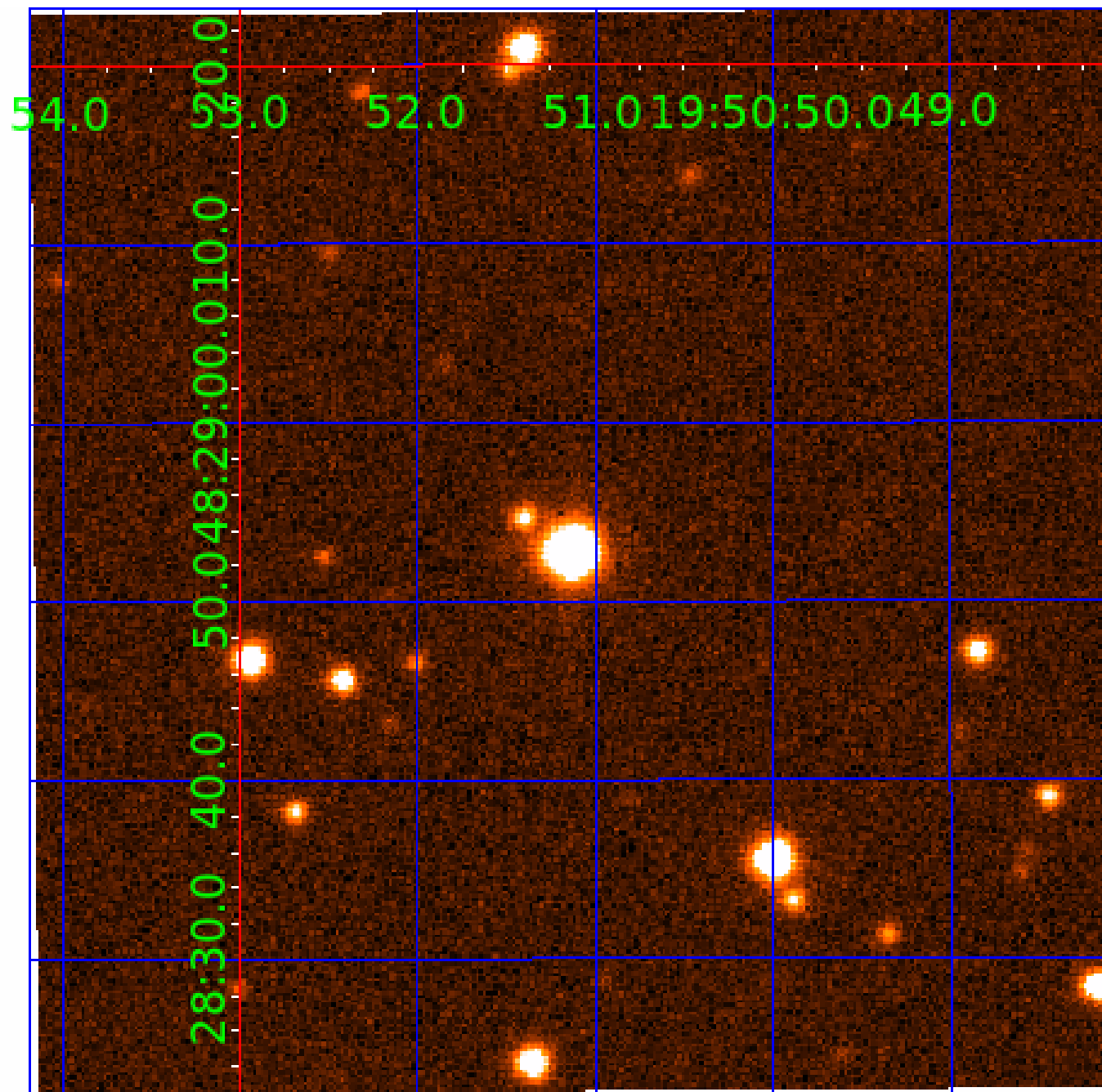


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination





# KIC 010989859

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
010989859-01	OBS	No	1.032262	131.862720	14.6	6.908	8.1	7.1	1.28	7291	0.49	9120.32
010989859-02	OBS	No	27.797714	145.835134	231.8	2.094	11.2	11.5	1.28	7291	3.06	112.99
010989859-03	OBS	No	31.943139	158.167322	296.6	2.043	10.5	11.7	1.28	7291	2.57	93.88
010989859-04	OBS	No	20.545399	145.462444	122.0	2.279	8.7	5.7	1.28	7291	1.66	169.09
010989859-05	OBS	No	24.191498	148.647136	134.3	2.949	8.0	6.8	1.28	7291	1.72	135.99
010989859-06	OBS	No	47.767277	156.662618	384.1	1.137	8.9	8.6	1.28	7291	2.71	54.90
010989859-07	OBS	No	40.707094	170.263259	214.2	2.535	8.8	8.4	1.28	7291	2.09	67.95
010989859-08	OBS	No	35.515074	164.594190	363.2	1.016	8.8	9.6	1.28	7291	2.63	81.50
010989859-09	OBS	No	52.174965	160.628549	285.1	0.641	8.9	4.4	1.28	7291	2.23	48.80

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
010989859-01	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT
010989859-02	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT
010989859-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT
010989859-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT
010989859-05	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—HALO_GHOST
010989859-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_DV—CENT_UNCERTAIN
010989859-07	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
010989859-08	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—CENT_FEW_DIFFS
010989859-09	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_TRACKER—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS

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

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

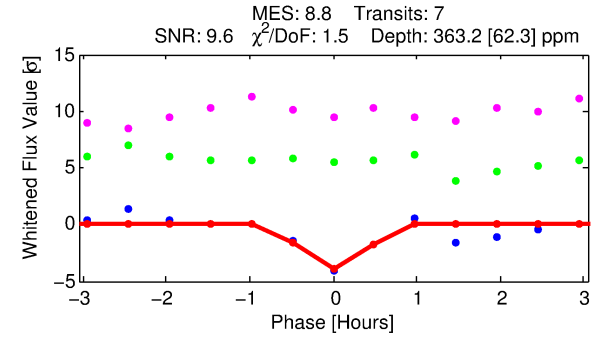
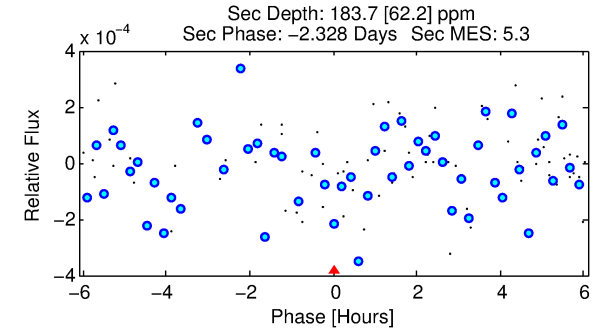
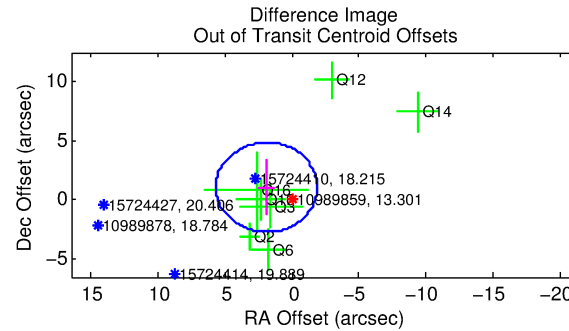
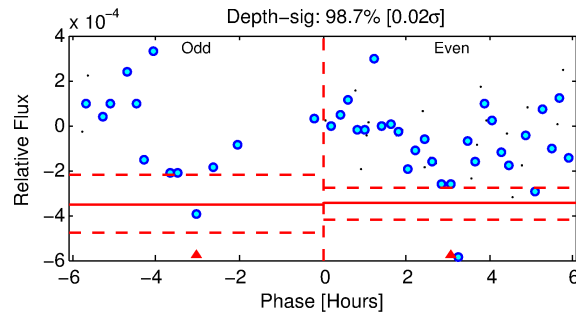
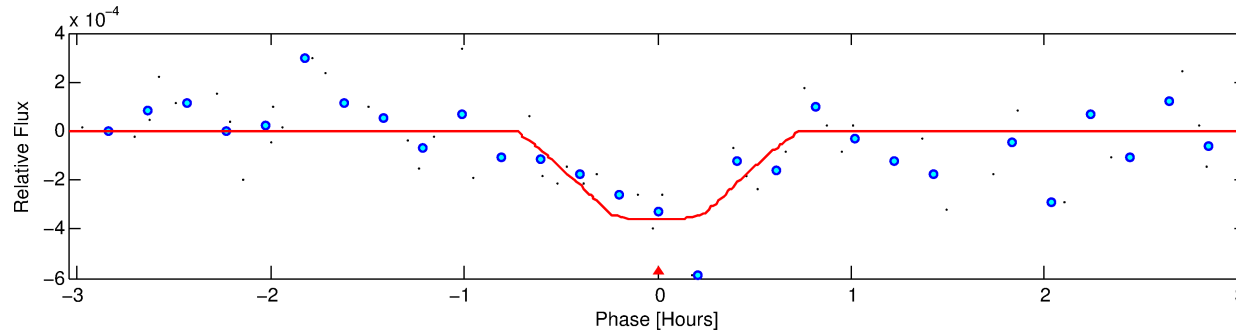
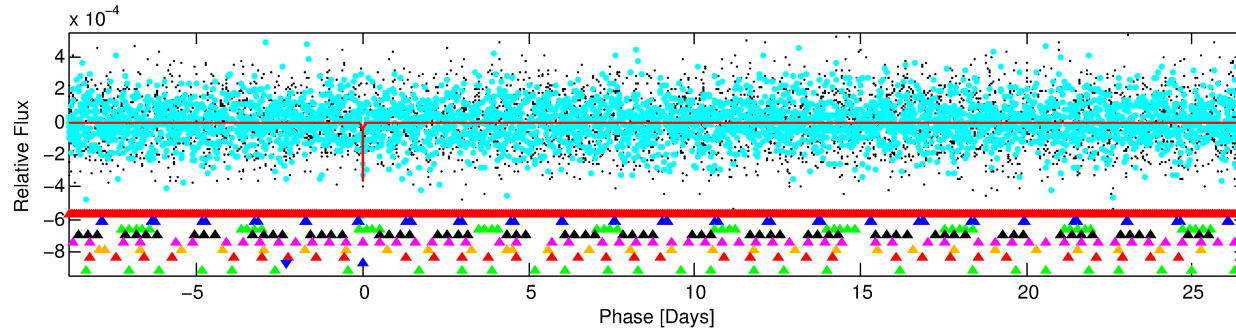
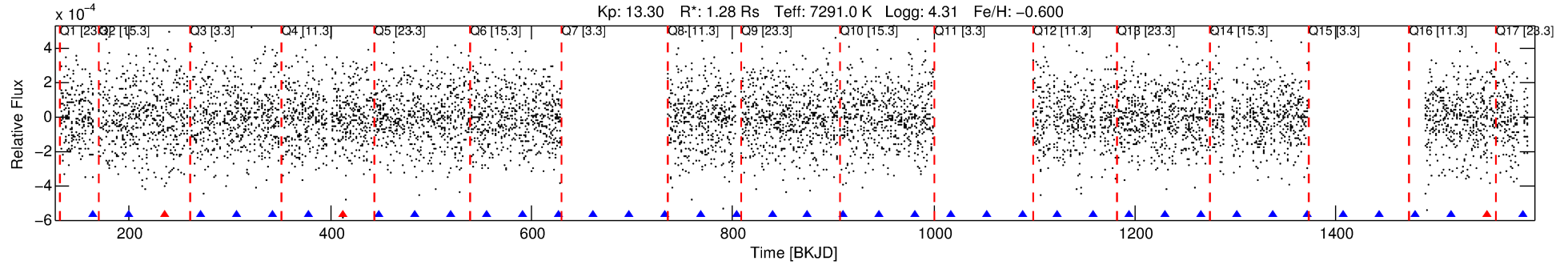
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 010989859-08

No Significant Match Found

# DV One-Page Summary

KIC: 10989859 Candidate: 8 of 9 Period: 35.515 d



## DV Fit Results:

Period = 35.51507 [0.00022] d  
Epoch = 164.5942 [0.0045] BKJD  
Rp/R\* = 0.0189 [0.0138]  
a/R\* = 196.06 [860.76]  
b = 0.71 [3.12]  
Seff = 81.50 [30.69]  
Teq = 766 [72] K  
Rp = 2.63 [2.08] Re  
a = 0.2252 [0.0546] AU  
Ag = 740.10 [1139.86] [0.65σ]  
Teffp = 6179 [2332] K [2.32σ]

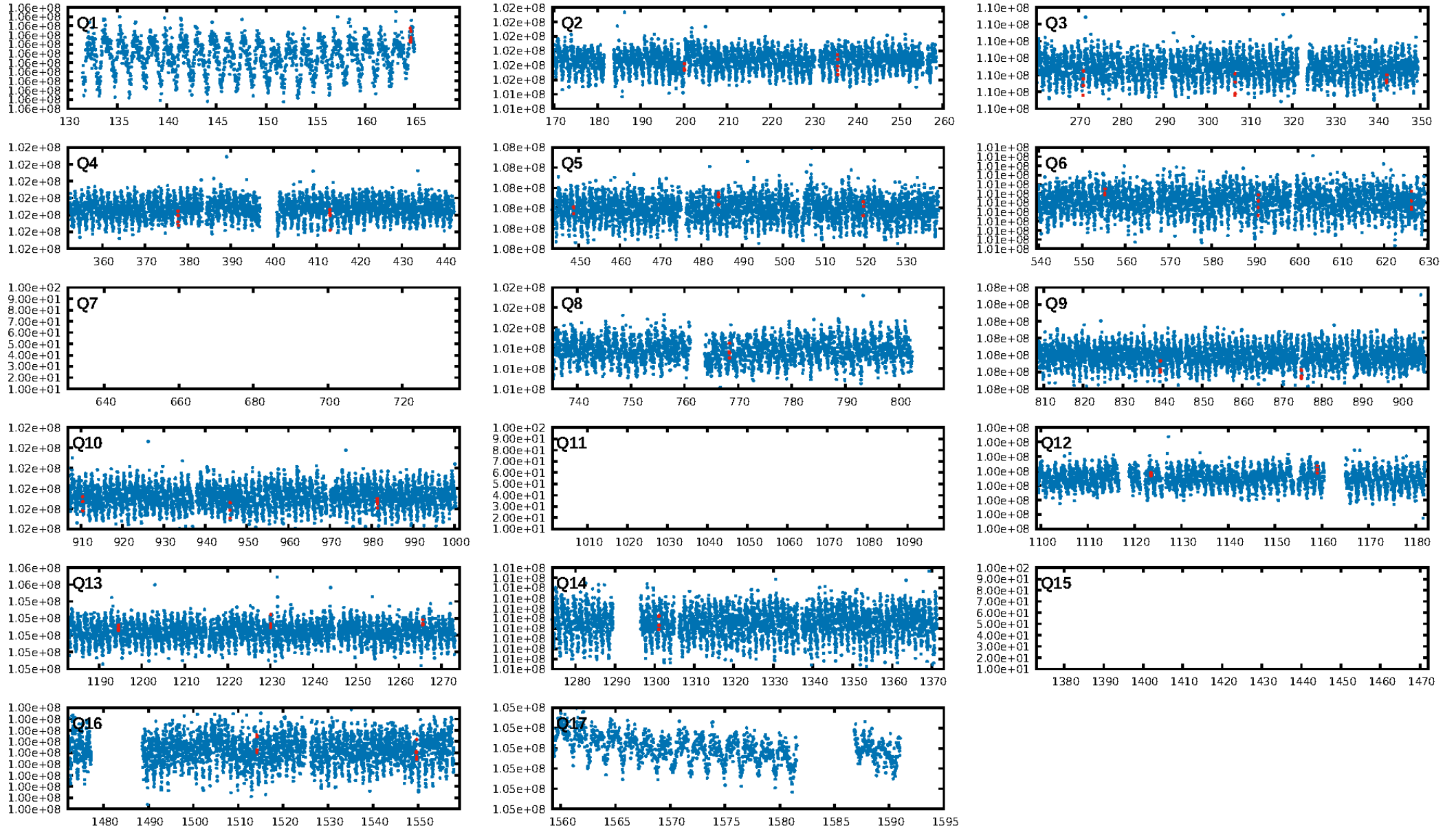
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [37.57σ]  
LongPeriod-sig: 100.0% [45.63σ]  
ModelChiSquare2-sig: 61.8%  
ModelChiSquareGof-sig: 92.1%  
Bootstrap-pfa: 3.46e-08  
RollingBand-fgt: 0.57 [4/7]  
GhostDiagnostic-chr: 2.377  
Centroid-sig: 86.3%  
Centroid-so: 0.485 arcsec [0.55σ]  
OotOffset-rm: 2.200 arcsec [1.74σ]  
KicOffset-rm: 2.242 arcsec [2.01σ]  
OotOffset-st: 4/1/2/0 [7]  
KicOffset-st: 4/1/2/0 [7]  
DiffImageQuality-fgm: 0.00 [0/7]  
DiffImageOverlap-fno: 0.54 [7/13]

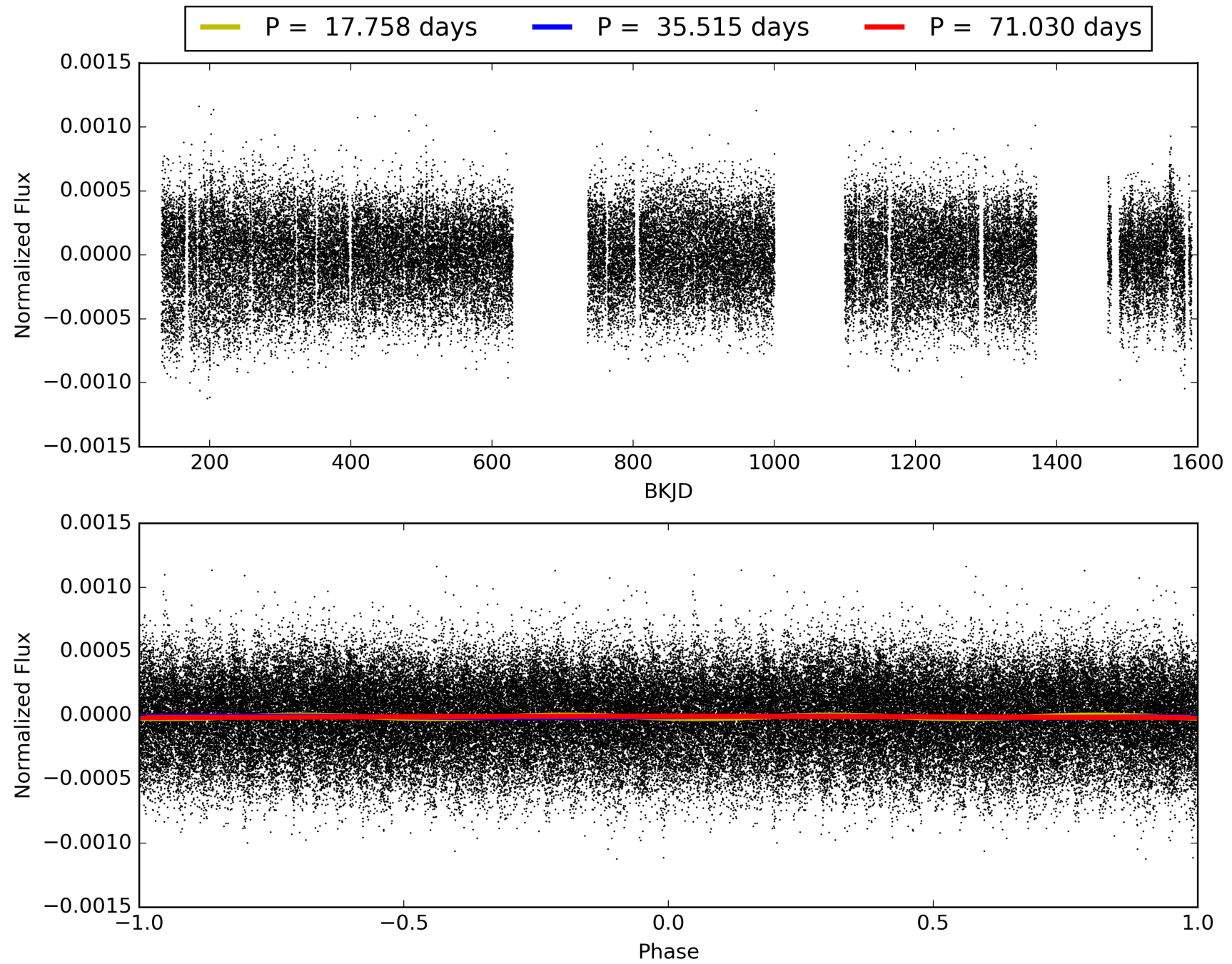
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 09:38:33 Z

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

# TCE 010989859-08, PDC Light Curves

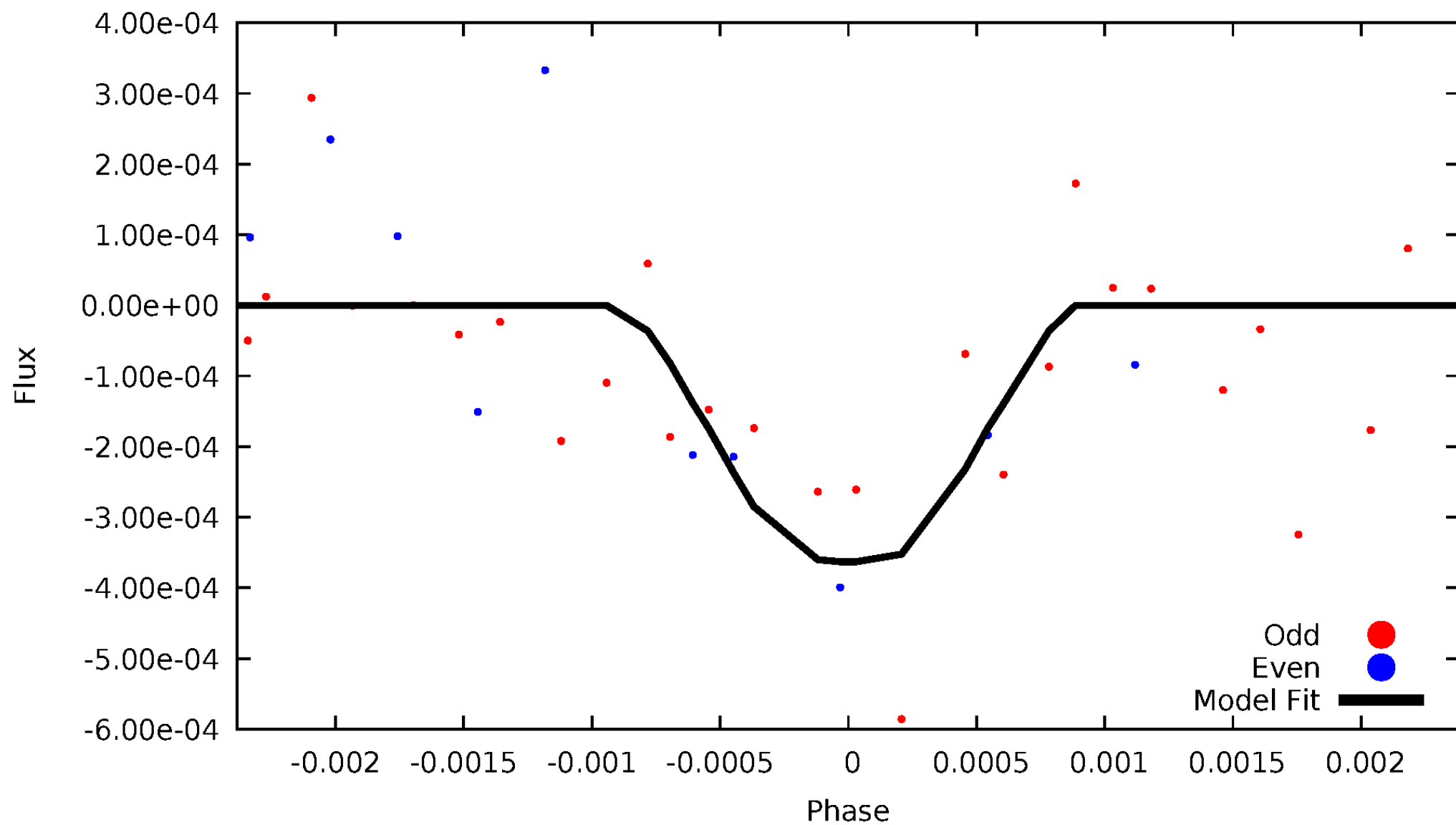


TCE 010989859-08



# DV Odd/Even

TCE 010989859-08



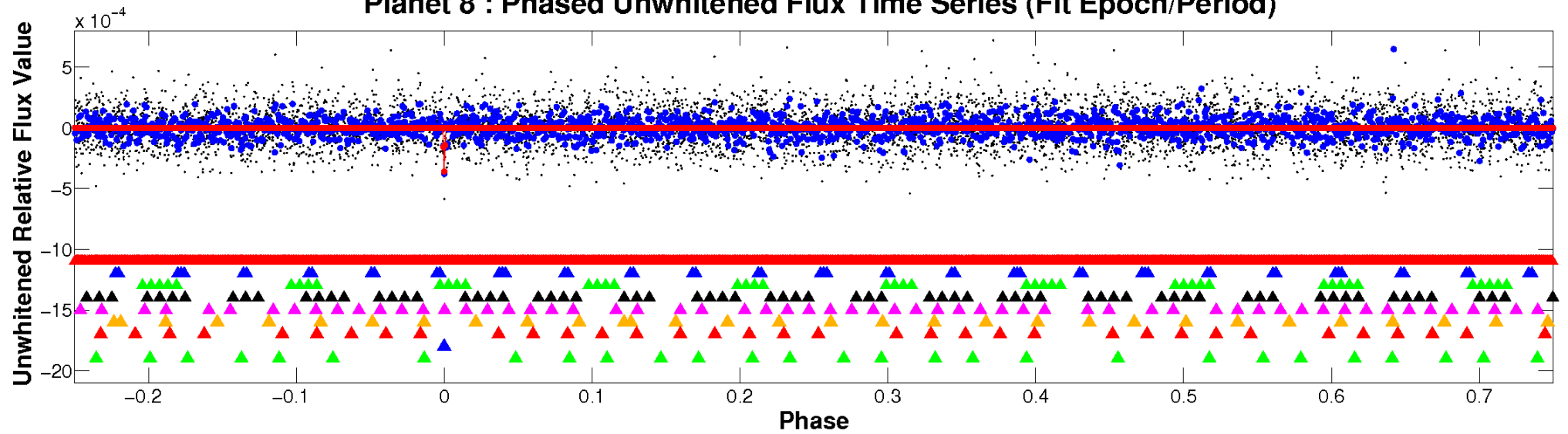


ALT Odd/Even

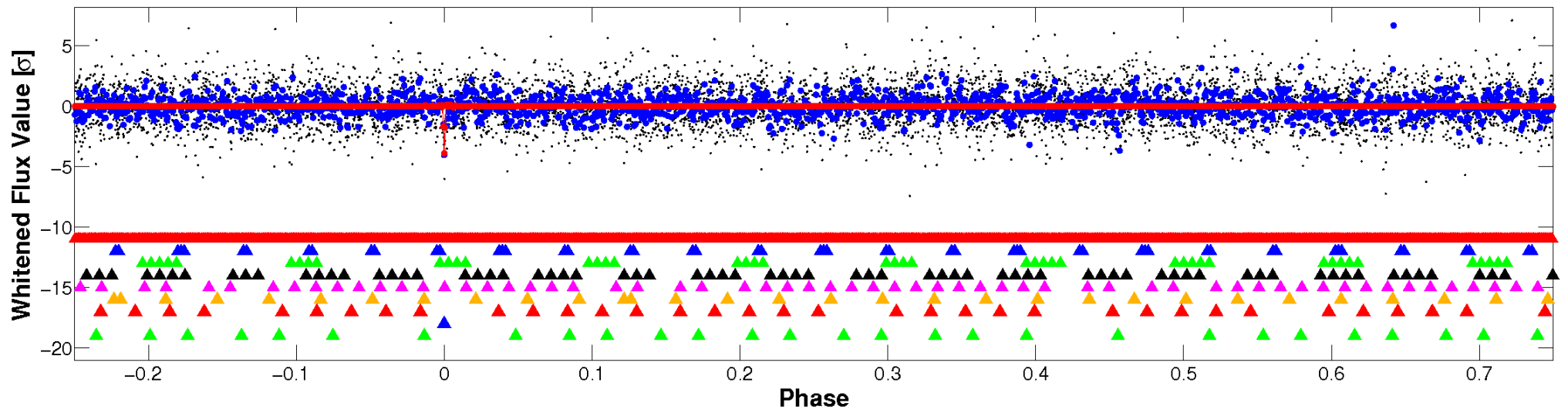
This plot does not exist for this TCE.

# Non-Whitened Vs. Whitened Light Curve

Planet 8 : Phased Unwhitened Flux Time Series (Fit Epoch/Period)



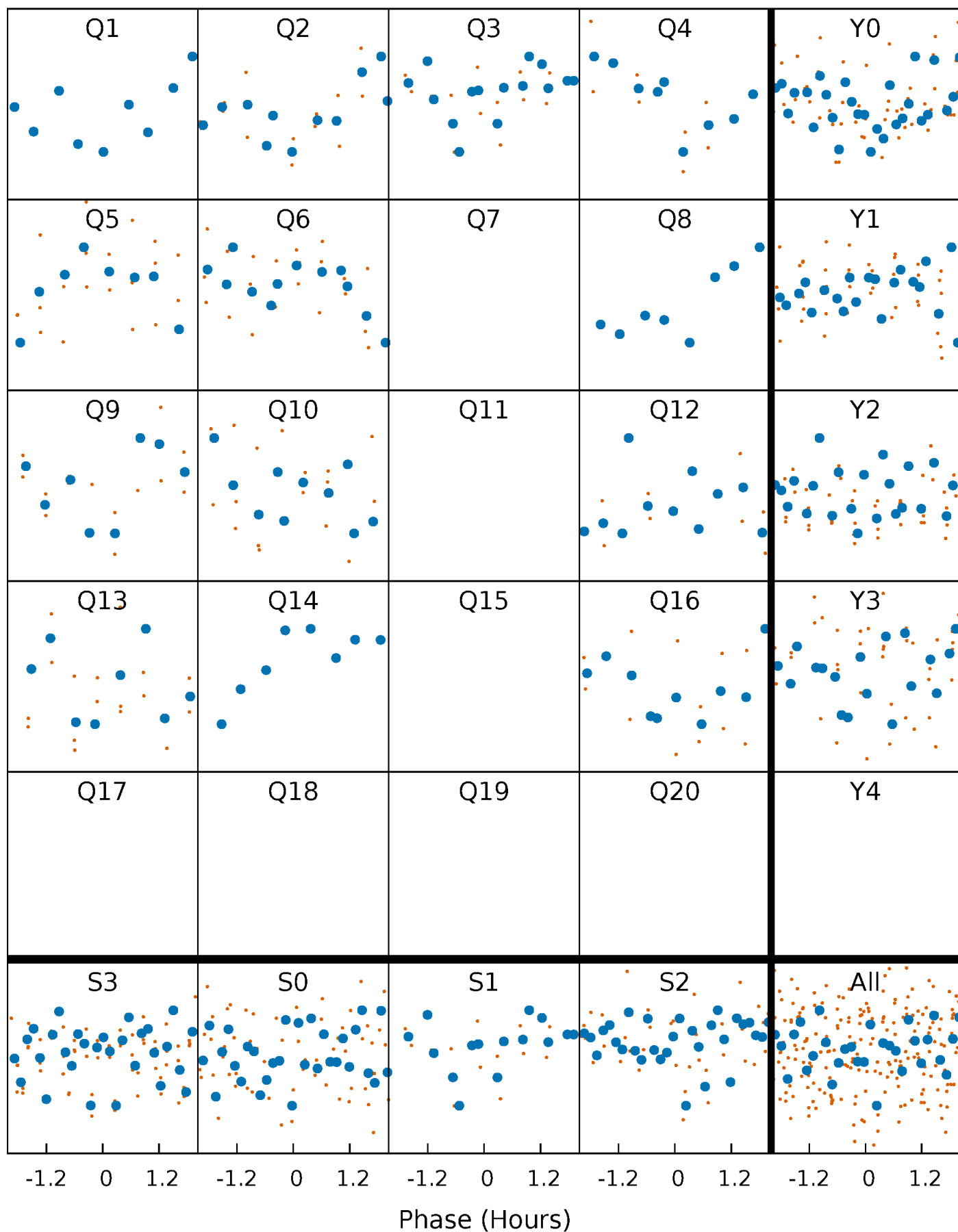
Planet 8 : Phased Whitened Flux Time Series (Fit Epoch/Period)





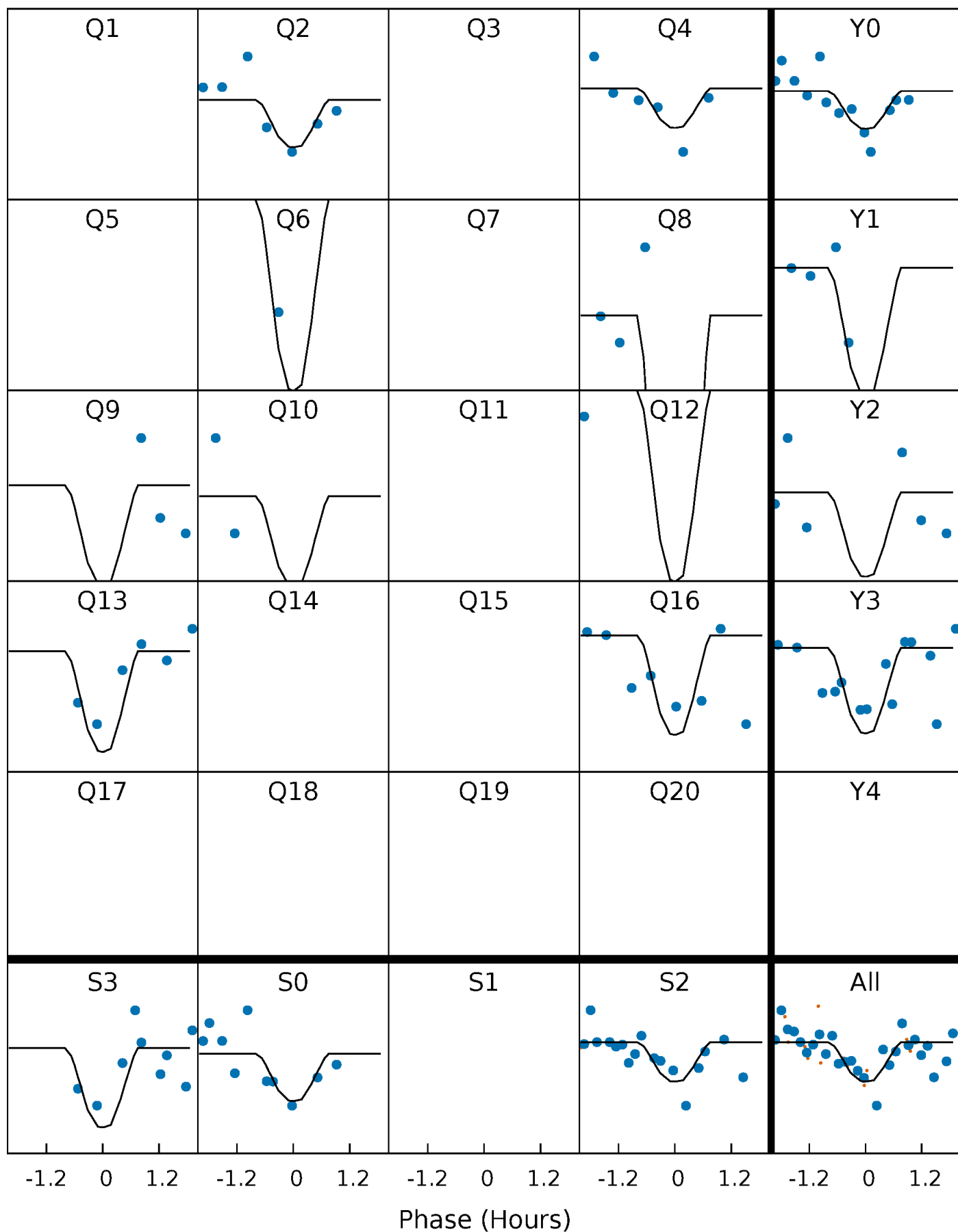
# PDC Quarter-Phased Transit Curves

TCE 010989859-08   P= 35.515074 Days    $T_0=164.594190$  (BKJD)



# DV Quarter-Phased Transit Curves

TCE 010989859-08 P= 35.515074 Days  $T_0=164.594190$  (BKJD)

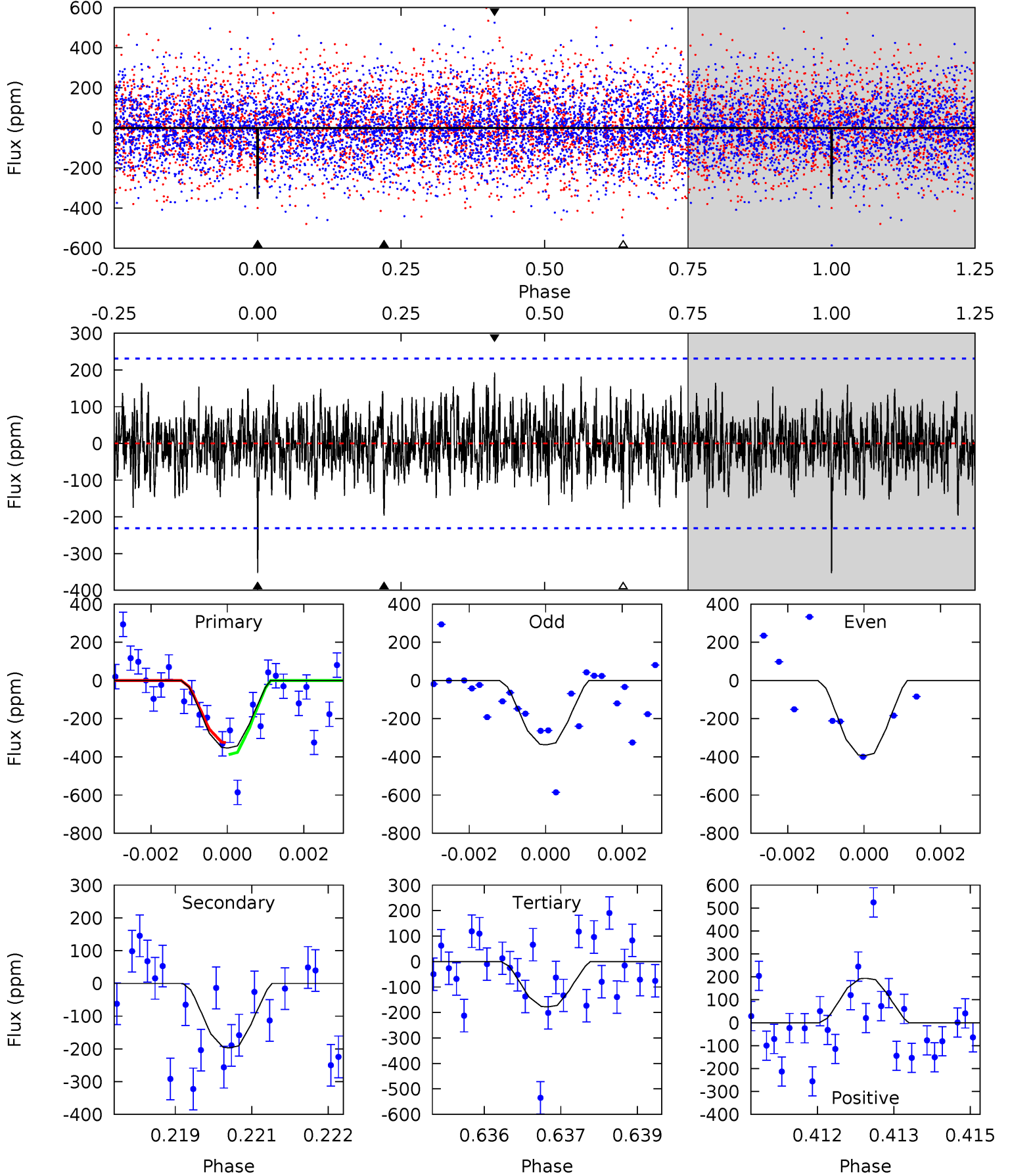


This plot does not exist for this TCE.

# DV Model-Shift Uniqueness Test

010989859-08, P = 35.515074 Days, E = 129.079116 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
8.20	4.56	4.13	4.49	5.37	3.16	1.39	4.07	3.71	0.44	0.07	0.62	0.98	0.35	0.72



## Alt Model-Shift Uniqueness Test

This plot does not exist for this TCE.

### Stellar Parameters For KIC 010989859

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$7291^{+207}_{-285}$	$4.307^{+0.084}_{-0.182}$	$-0.600^{+0.250}_{-0.300}$	$1.278^{+0.380}_{-0.163}$	$1.208^{+0.166}_{-0.136}$	$0.815^{+0.355}_{-0.399}$
	+3%/-4%	+2%/-4%	+42%/-50%	+30%/-13%	+14%/-11%	+44%/-49%
Source	PHO1	KIC0	KIC0	DSEP		

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

### Secondary Eclipse Parameters for KIC 010989859-08 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-196 \pm 43$	$2.98^{+1.97}_{-1.80}$	$1079^{+71}_{-56}$	$5887^{+4414}_{-1191}$	$628^{+3452}_{-404}$
Alt.	N/A	N/A	N/A	N/A	N/A

$T_{\text{max}}$  = 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

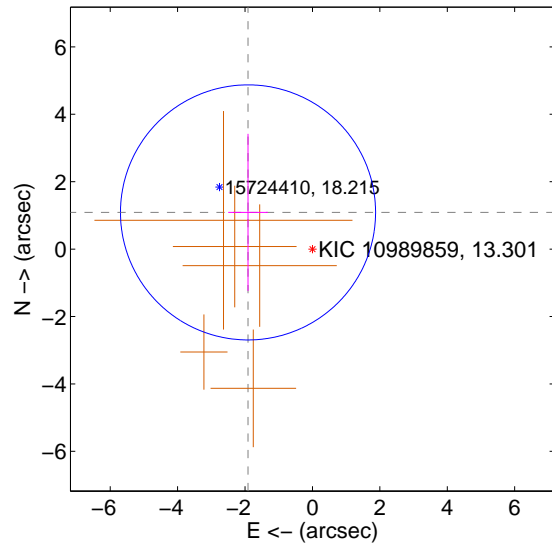
Supplemental centroid analysis for 010989859-08. Kepler magnitude: 13.30. Transit SNR 9.64

There are 0 quarters with good PRF difference image offsets

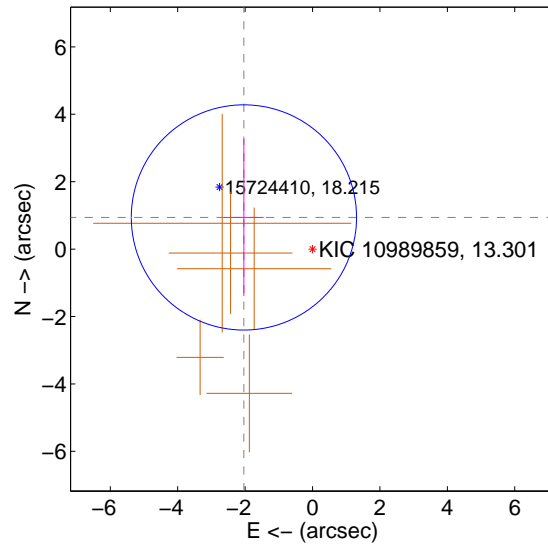
The direct PRF centroid is offset from the target star catalog position by about 0.10 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$2.200 \pm 1.261$	1.74	$1.911 \pm 0.587$	$1.089 \pm 2.331$
PRF-fit source offset from KIC position	$2.242 \pm 1.114$	2.01	$2.036 \pm 0.588$	$0.940 \pm 2.333$
photometric centroid source offset	$0.48 \pm 0.89$	0.55	$0.26 \pm 0.82$	$-0.41 \pm 0.91$

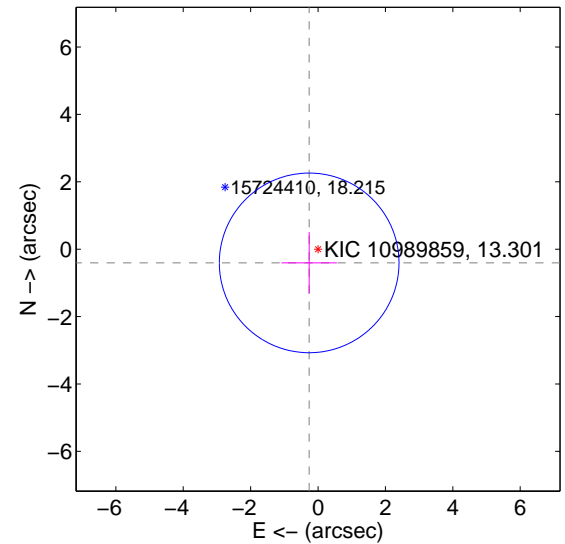
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

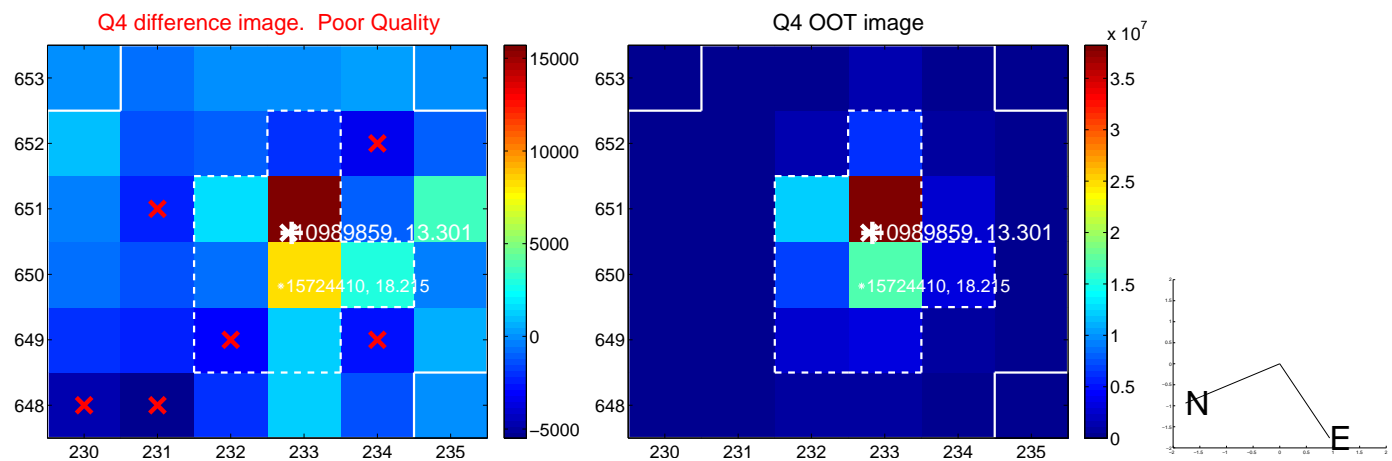
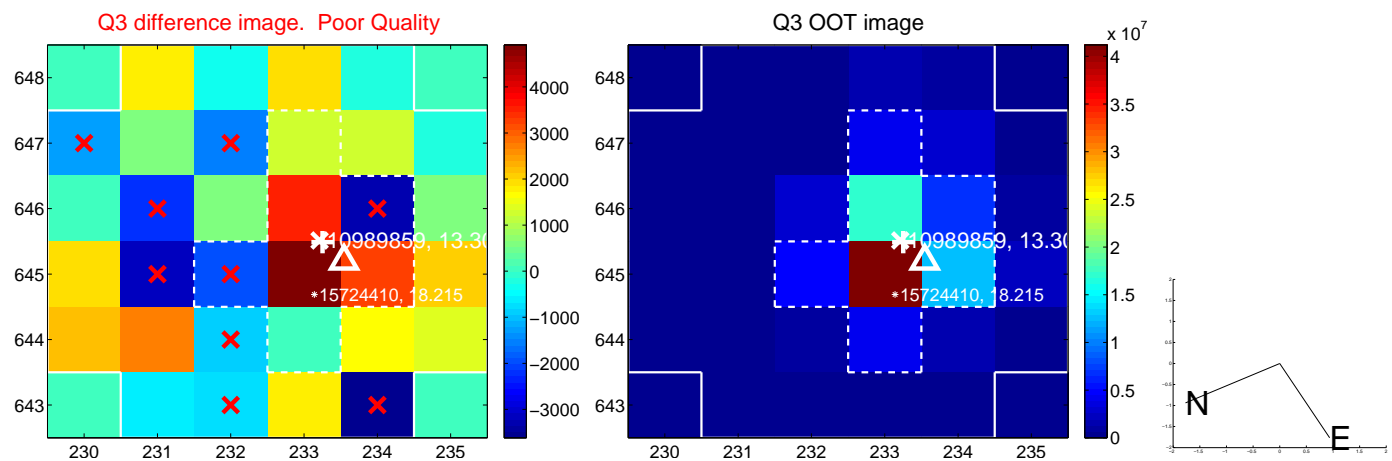
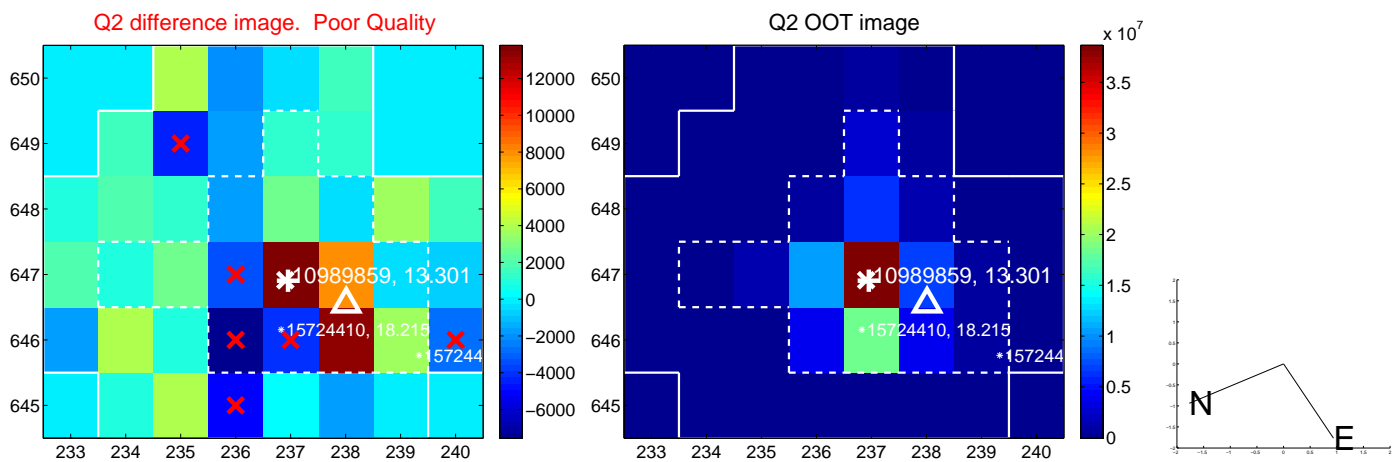
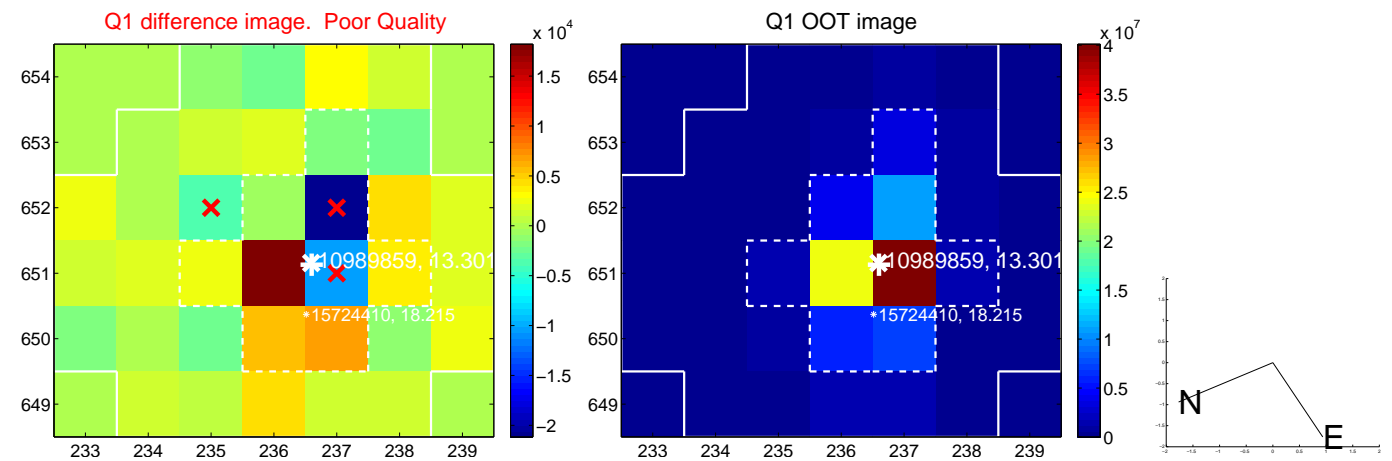


offset from photometric centroids



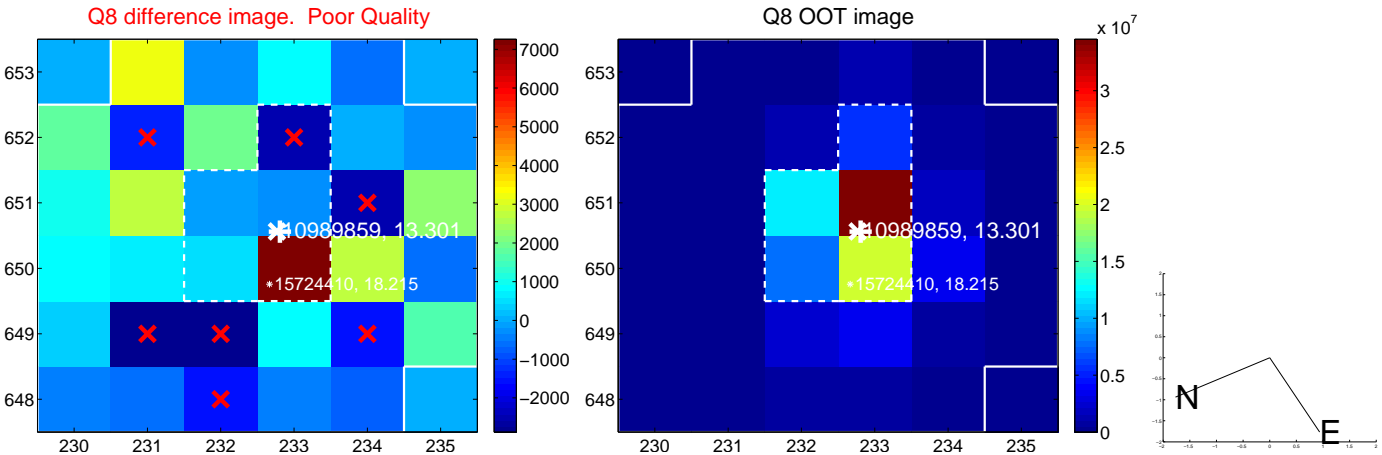
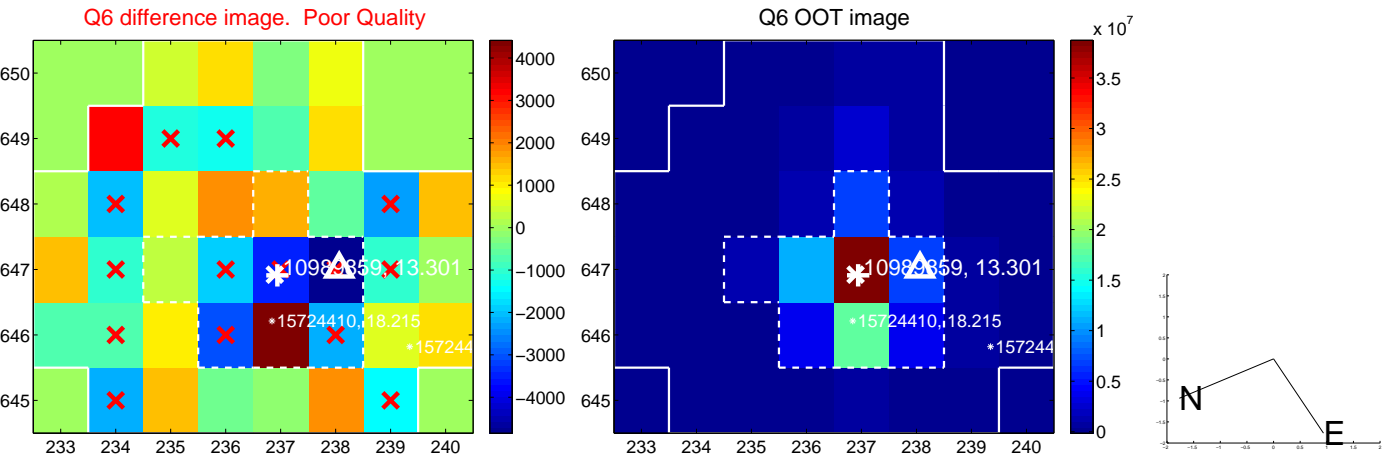
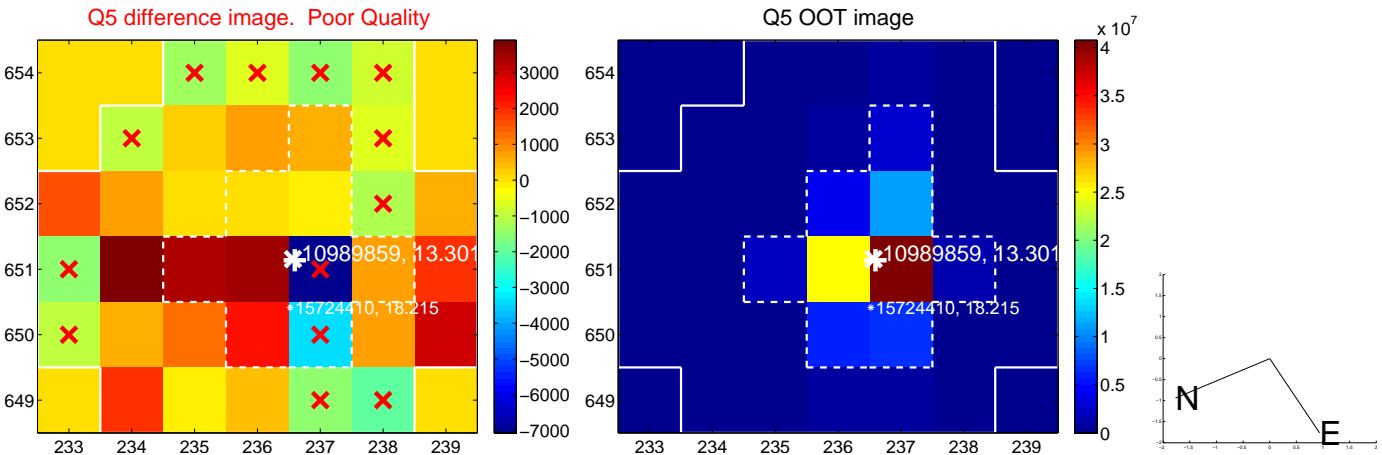
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

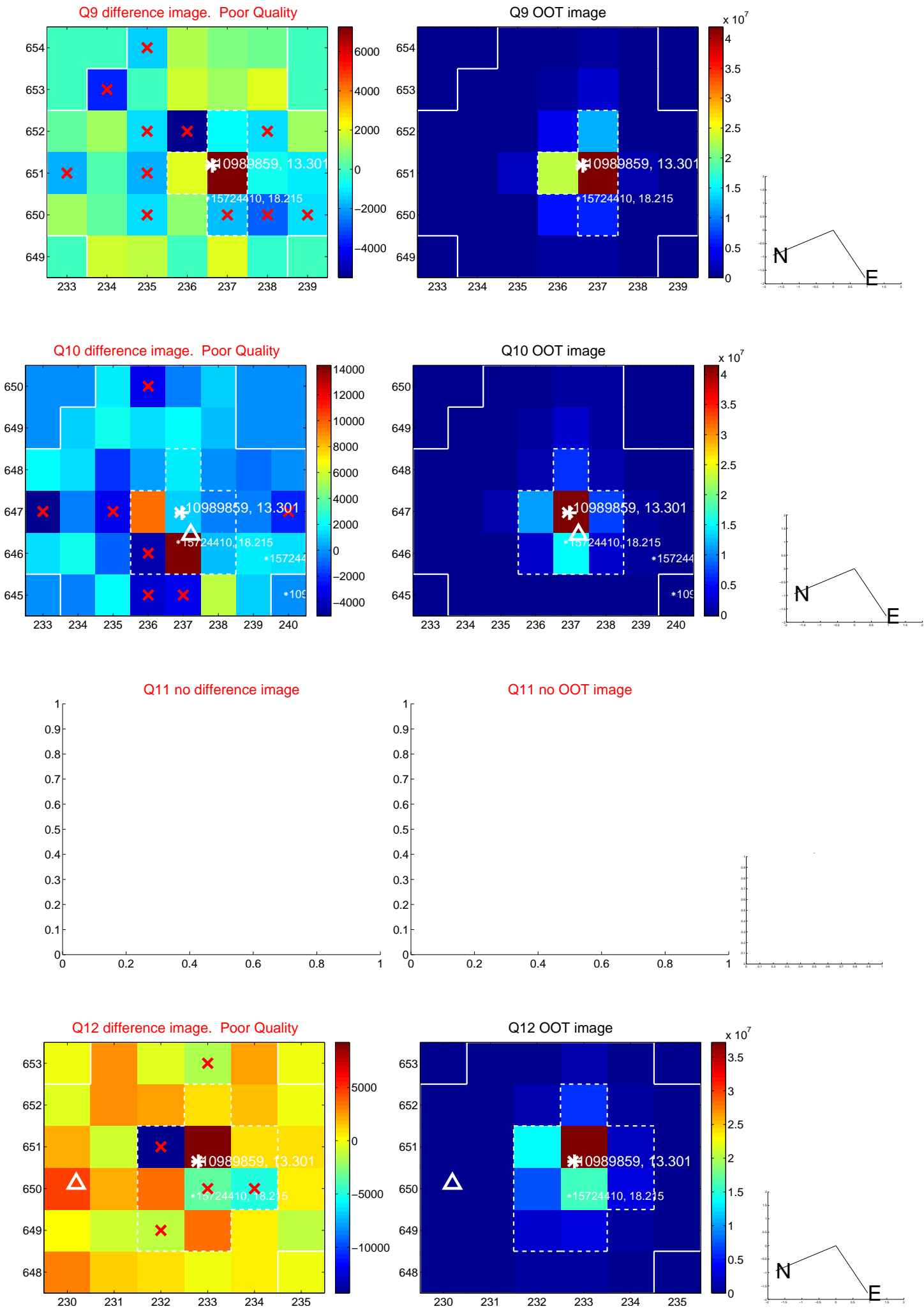




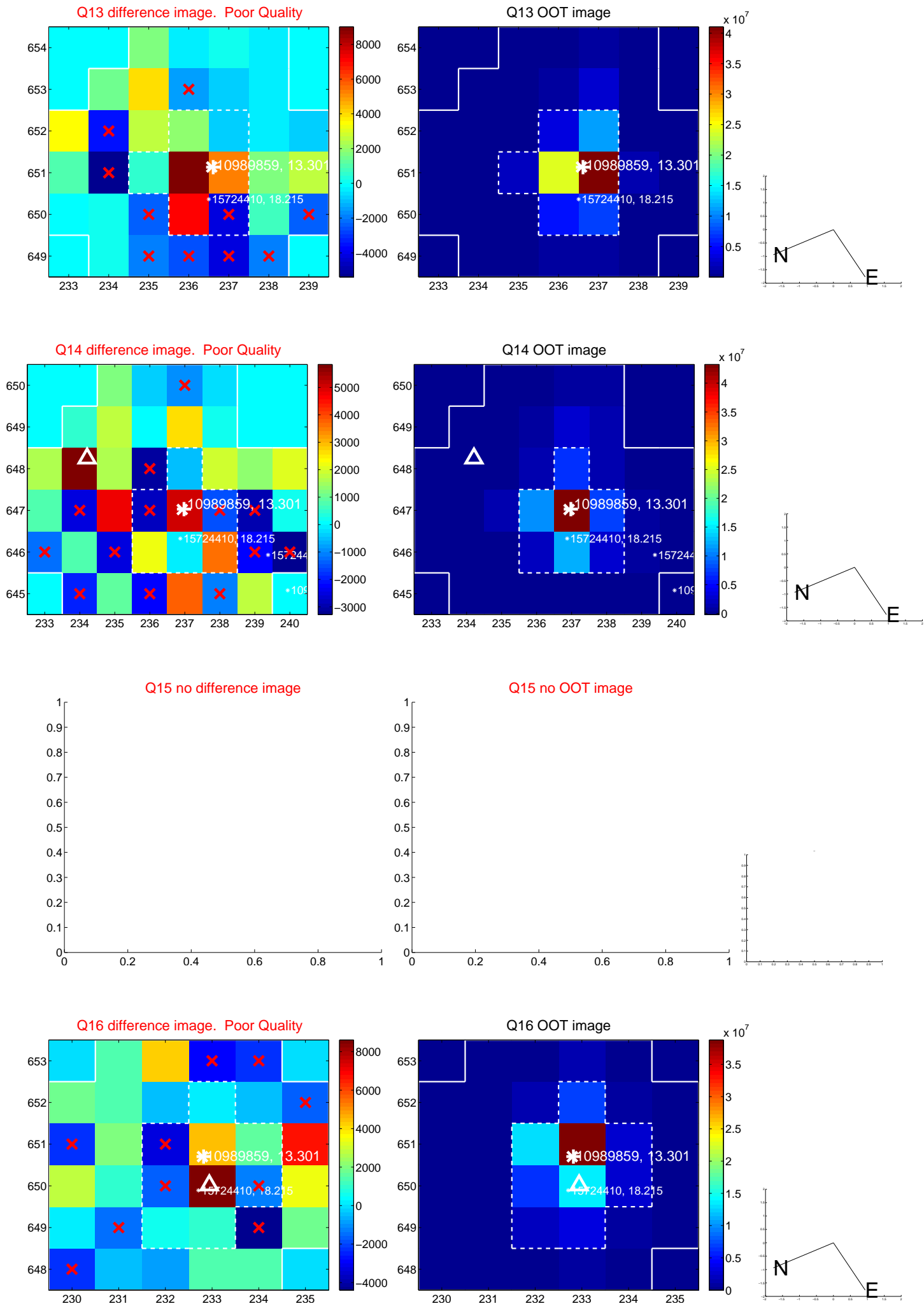
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



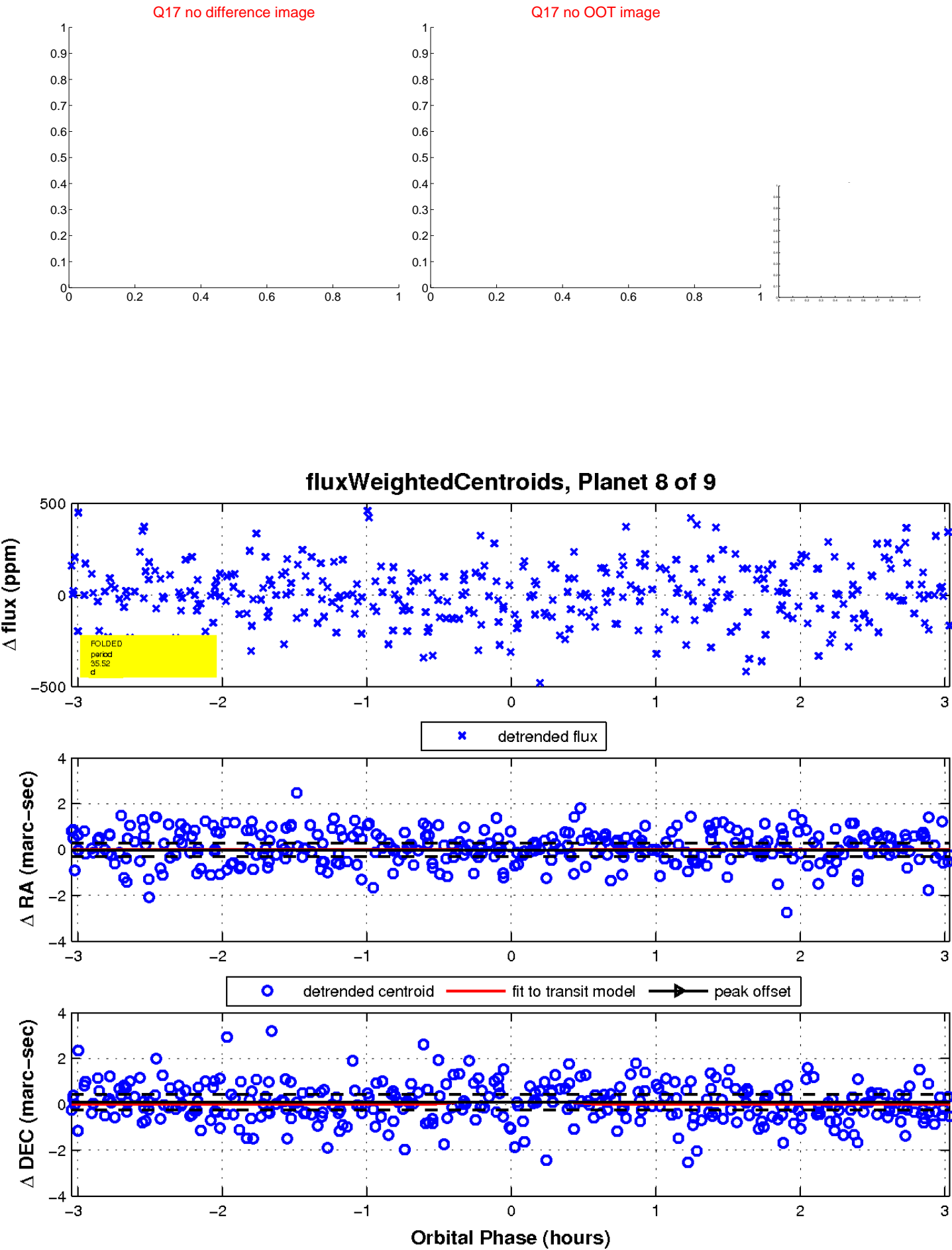
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

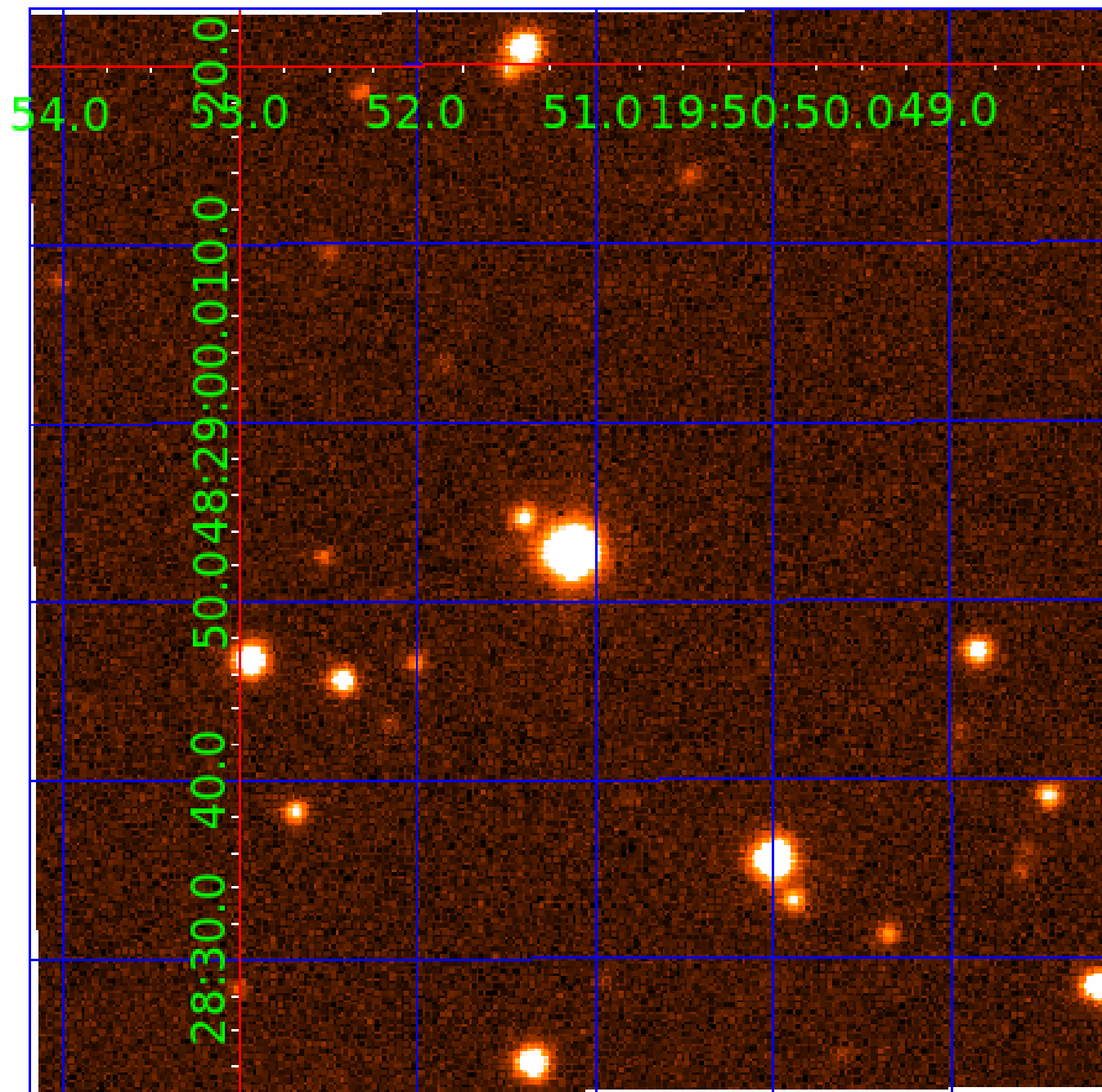


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 010989859

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
010989859-01	OBS	No	1.032262	131.862720	14.6	6.908	8.1	7.1	1.28	7291	0.49	9120.32
010989859-02	OBS	No	27.797714	145.835134	231.8	2.094	11.2	11.5	1.28	7291	3.06	112.99
010989859-03	OBS	No	31.943139	158.167322	296.6	2.043	10.5	11.7	1.28	7291	2.57	93.88
010989859-04	OBS	No	20.545399	145.462444	122.0	2.279	8.7	5.7	1.28	7291	1.66	169.09
010989859-05	OBS	No	24.191498	148.647136	134.3	2.949	8.0	6.8	1.28	7291	1.72	135.99
010989859-06	OBS	No	47.767277	156.662618	384.1	1.137	8.9	8.6	1.28	7291	2.71	54.90
010989859-07	OBS	No	40.707094	170.263259	214.2	2.535	8.8	8.4	1.28	7291	2.09	67.95
010989859-08	OBS	No	35.515074	164.594190	363.2	1.016	8.8	9.6	1.28	7291	2.63	81.50
010989859-09	OBS	No	52.174965	160.628549	285.1	0.641	8.9	4.4	1.28	7291	2.23	48.80

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
010989859-01	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT
010989859-02	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT
010989859-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT
010989859-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT
010989859-05	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—HALO_GHOST
010989859-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_DV—CENT_UNCERTAIN
010989859-07	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
010989859-08	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—CENT_FEW_DIFFS
010989859-09	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_TRACKER—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS

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

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

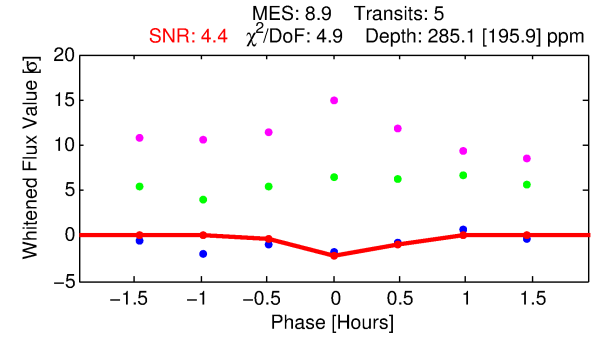
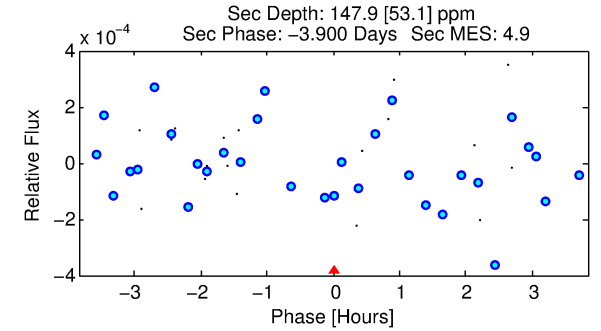
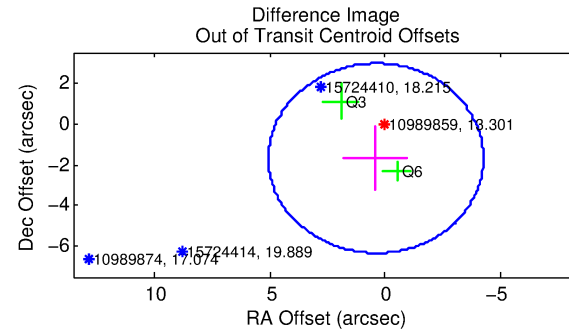
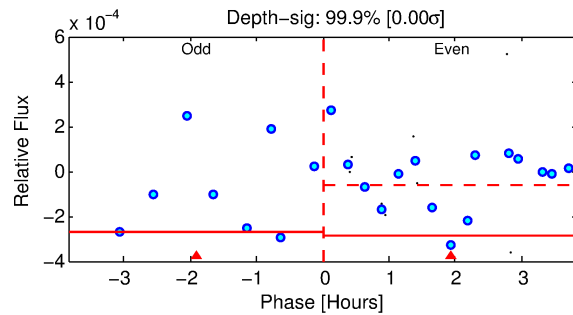
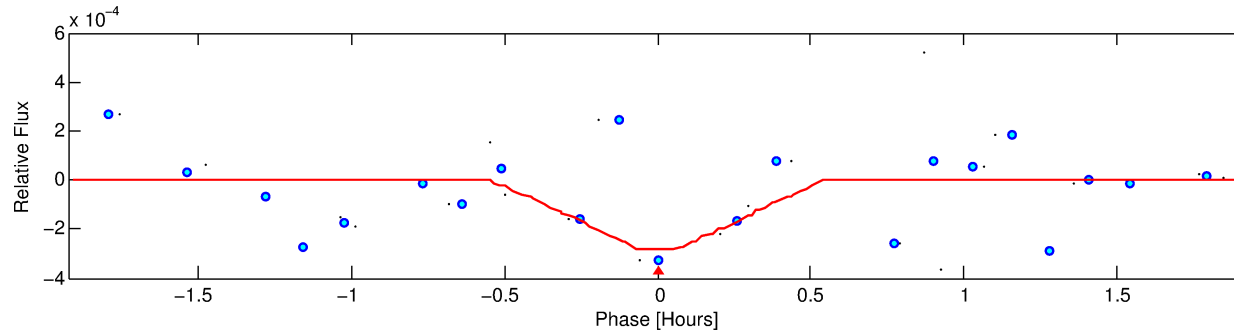
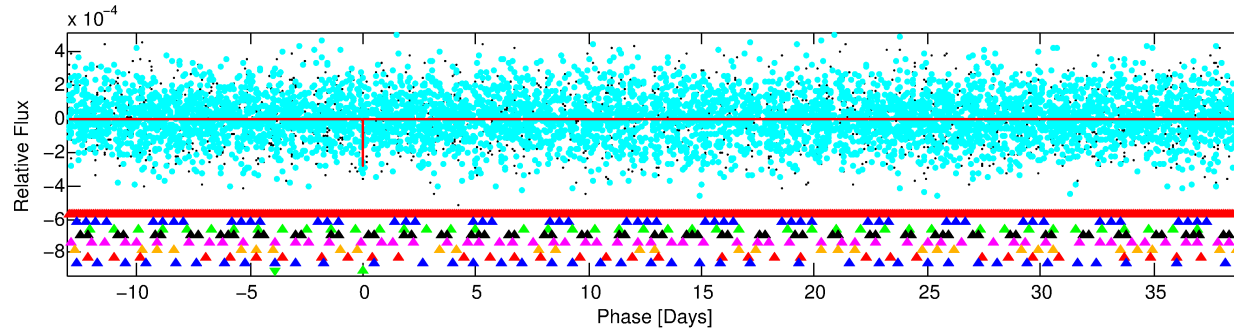
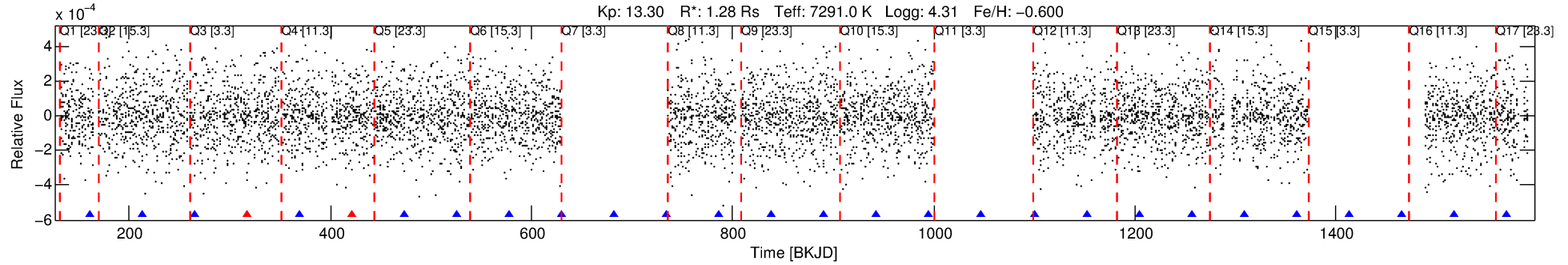
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 010989859-09

No Significant Match Found

# DV One-Page Summary

KIC: 10989859 Candidate: 9 of 9 Period: 52.175 d



## DV Fit Results:

Period = 52.17497 [0.00133] d  
Epoch = 160.6285 [0.0222] BKJD  
Rp/R\* = 0.0160 [1.4214]  
a/R\* = 630.91 [326658.37]  
b = 0.04 [14003.90]  
Seff = 48.80 [18.38]  
Teq = 674 [63] K  
Rp = 2.23 [198.23] Re  
a = 0.2911 [0.0706] AU  
Ag = 1384.10 [245900.89] [0.01σ]  
Teffp = 6356 [282294] K [0.02σ]

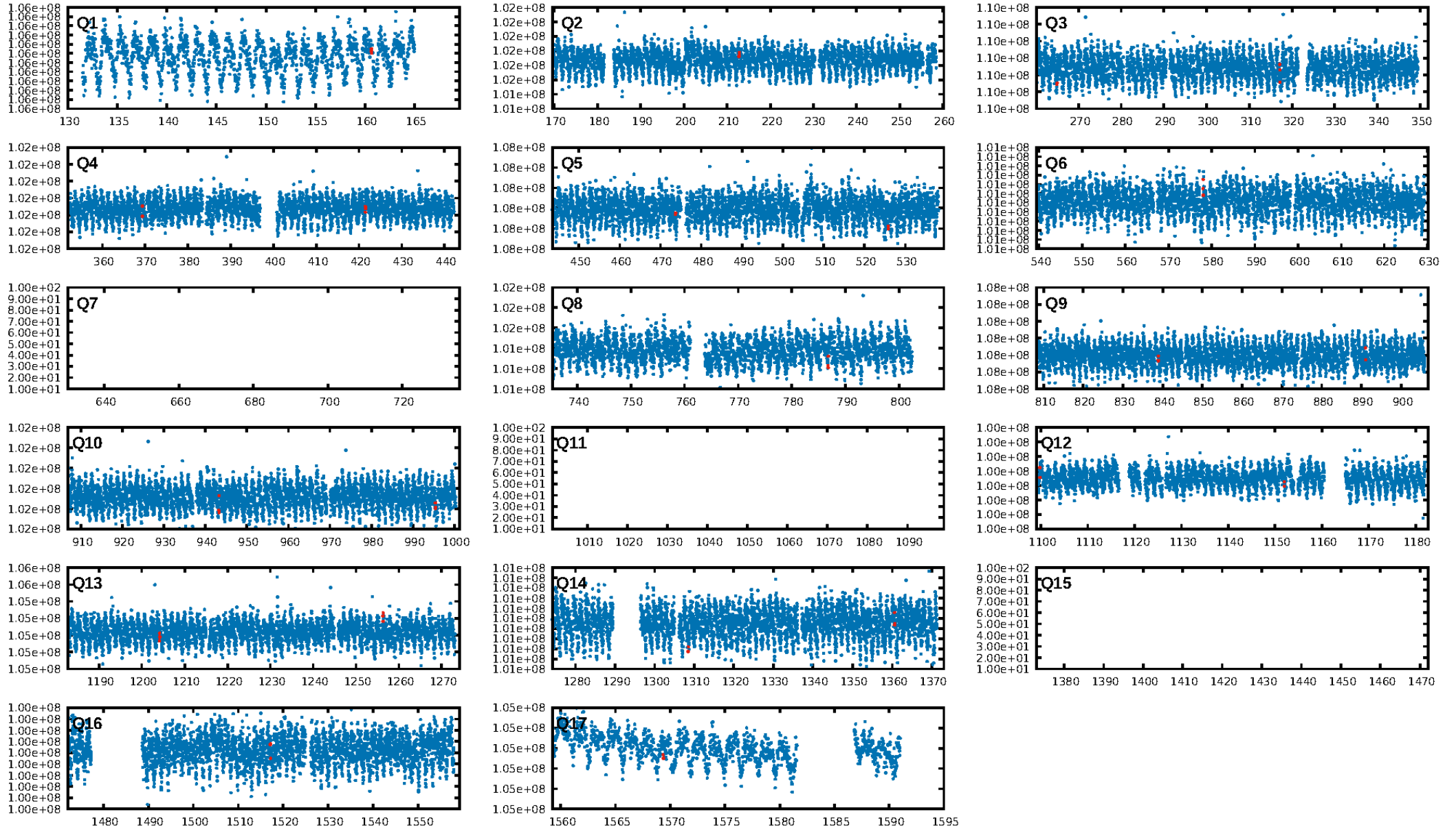
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [81.04σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 36.3%  
ModelChiSquareGof-sig: 27.0%  
Bootstrap-pfa: 1.15e-08  
RollingBand-fgt: 0.50 [2/4]  
GhostDiagnostic-chr: 13.33  
Centroid-sig: 88.4%  
Centroid-so: 0.390 arcsec [0.26σ]  
OotOffset-rm: 1.734 arcsec [1.12σ]  
OotOffset-st: 1/1/0/0 [2]  
KicOffset-rm: 1.912 arcsec [1.21σ]  
KicOffset-st: 1/1/0/0 [2]  
DiffImageQuality-fgm: 0.50 [1/2]  
DiffImageOverlap-fno: 0.45 [5/11]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 09:38:37 Z

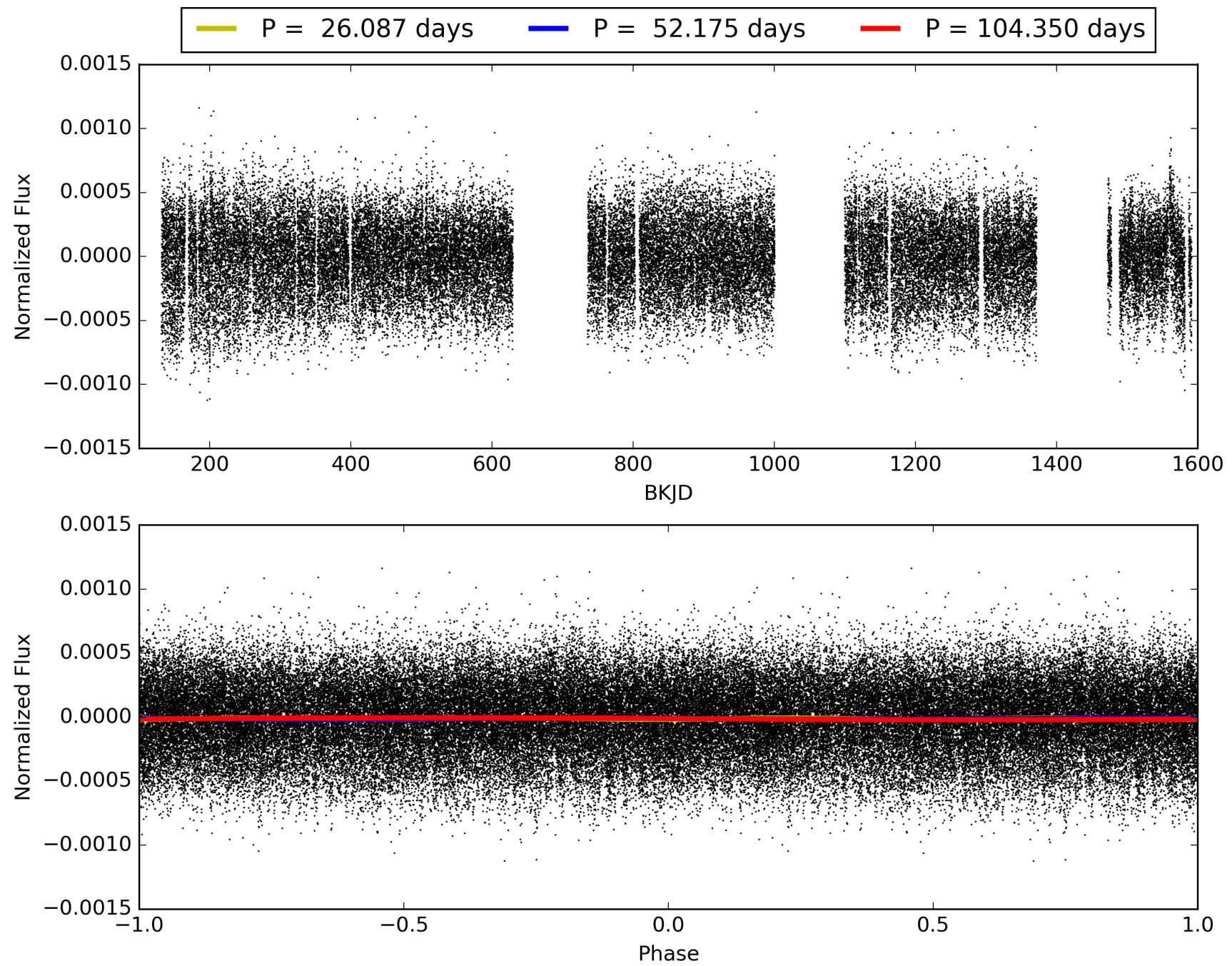
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 010989859-09, PDC Light Curves



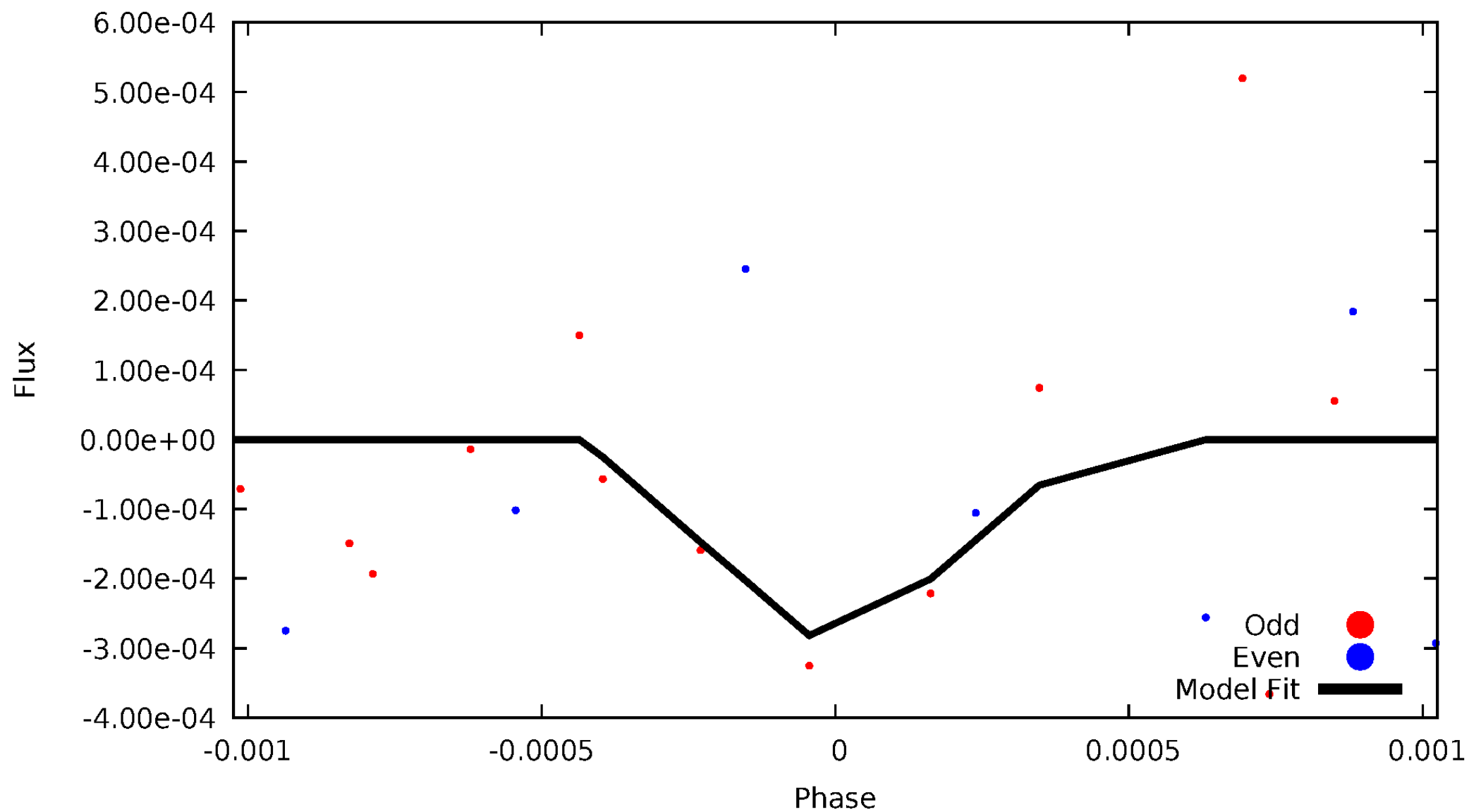


TCE 010989859-09



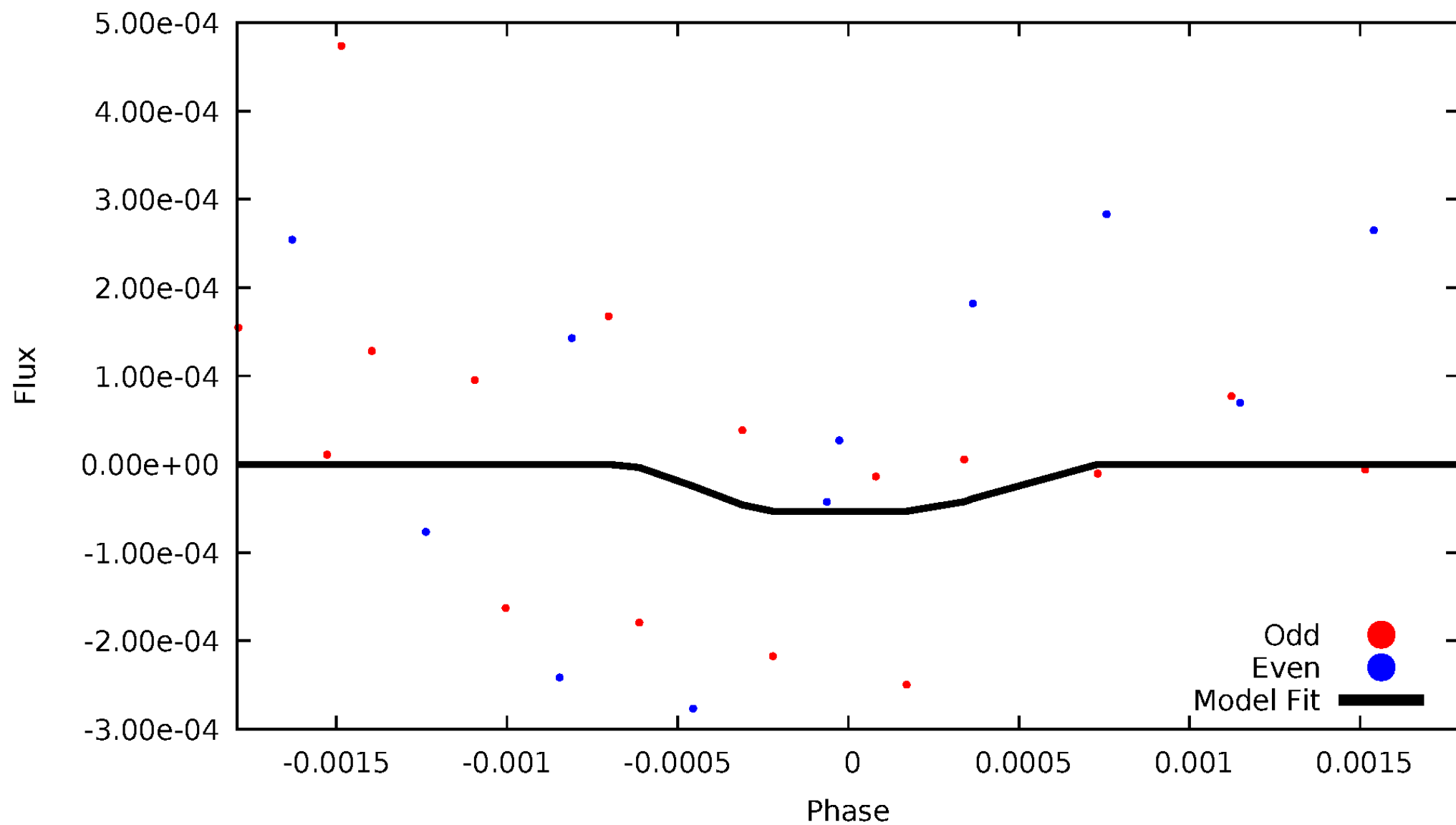
# DV Odd/Even

TCE 010989859-09

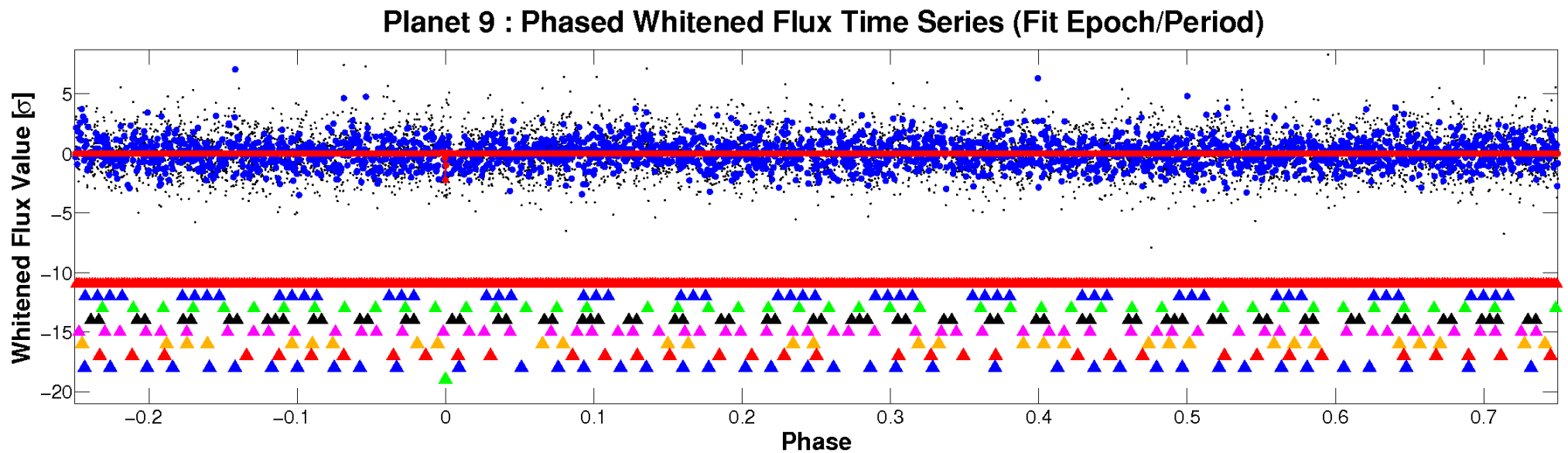
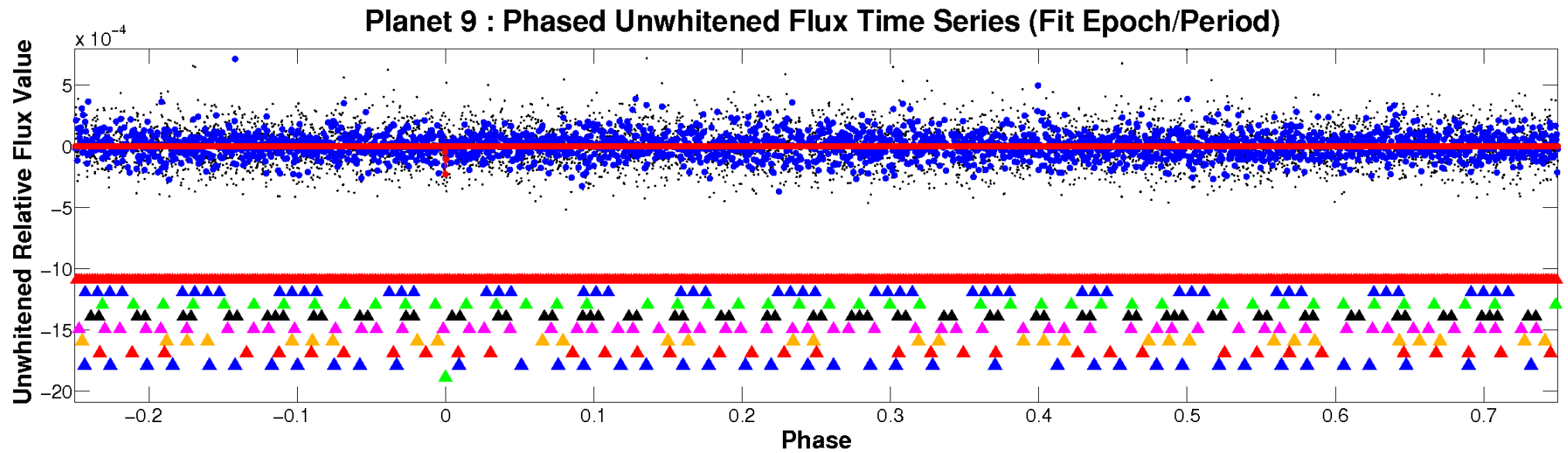


# ALT Odd/Even

TCE 010989859-09

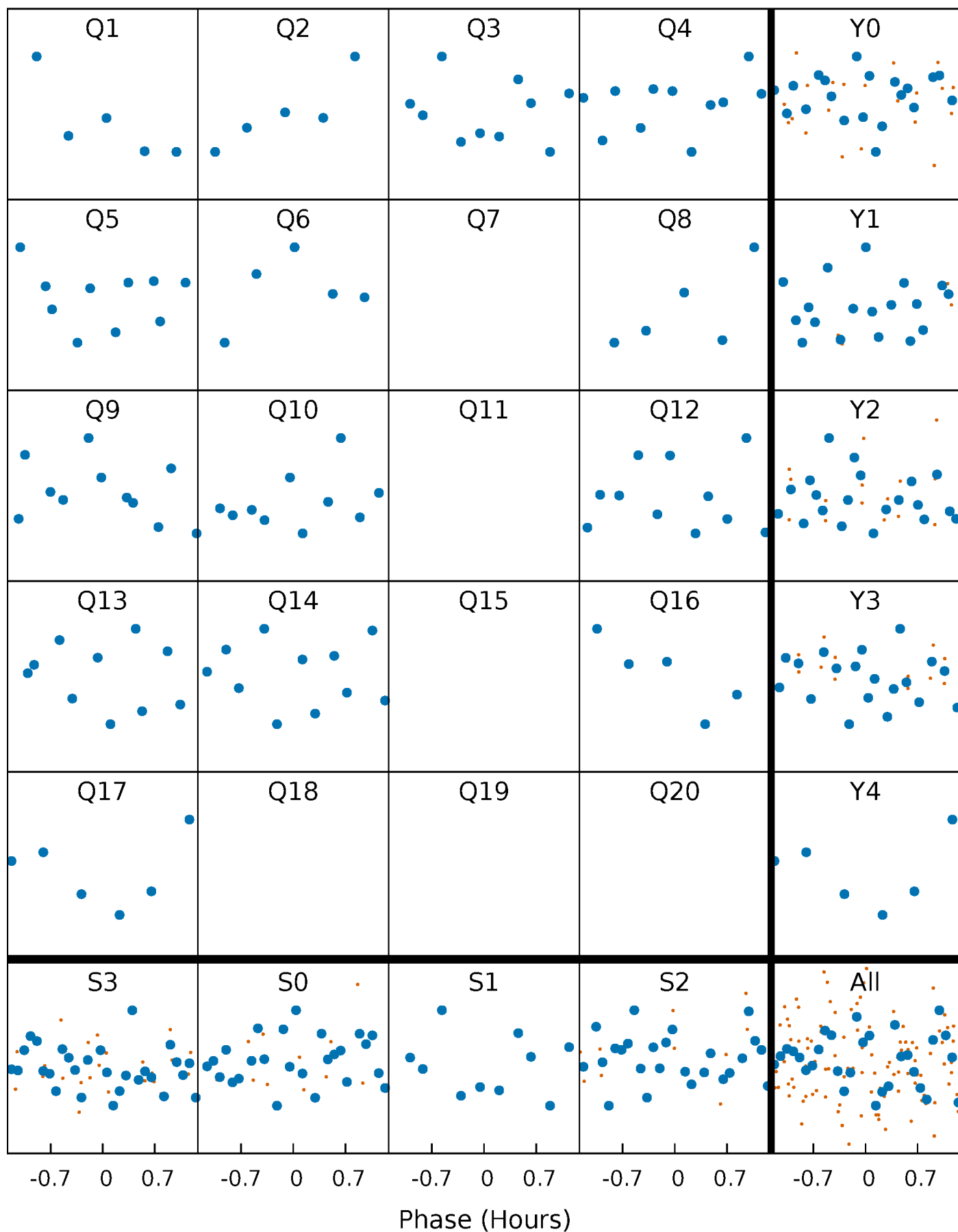


# Non-Whitened Vs. Whitened Light Curve



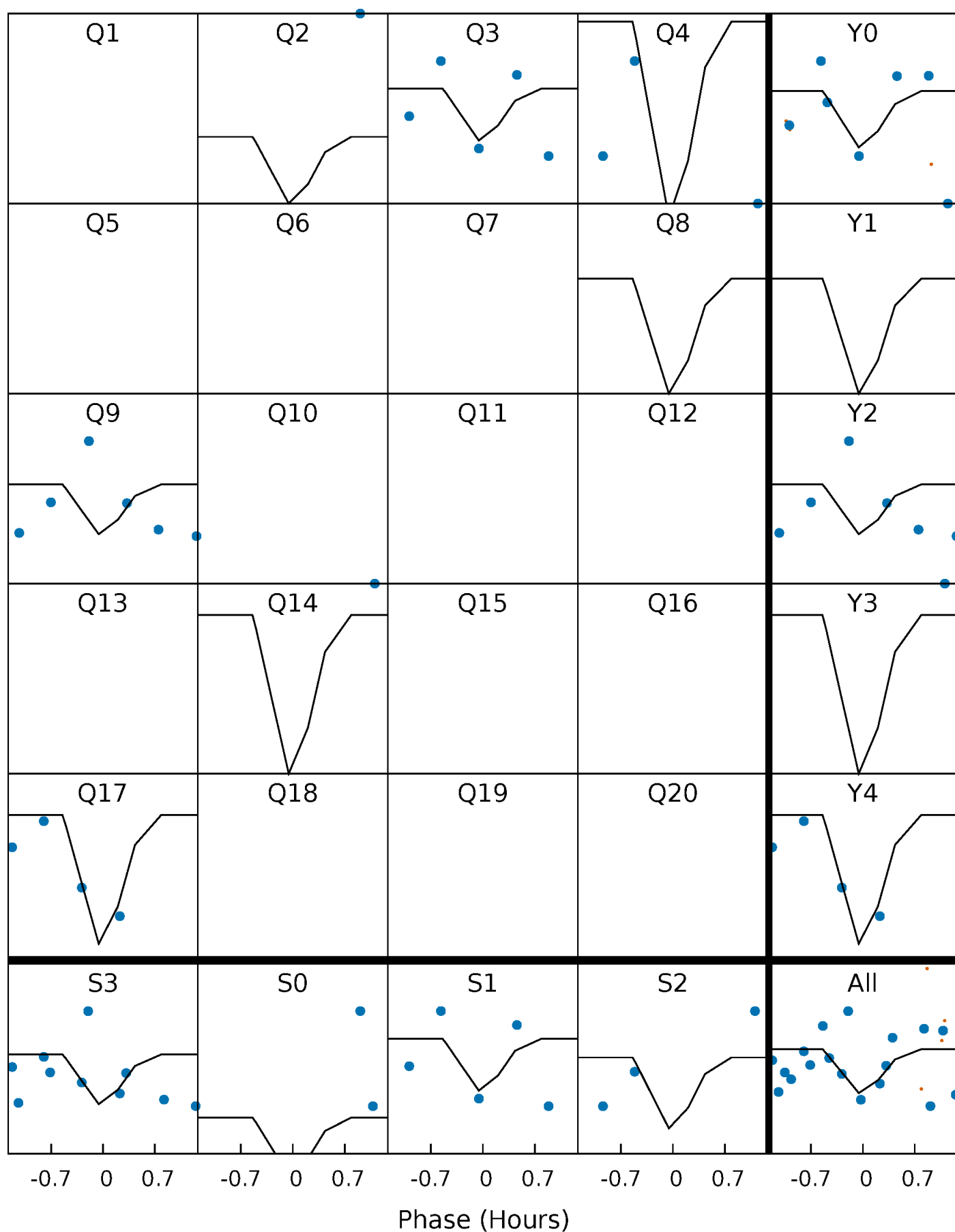
# PDC Quarter-Phased Transit Curves

TCE 010989859-09   P= 52.174965 Days    $T_0=160.628549$  (BKJD)



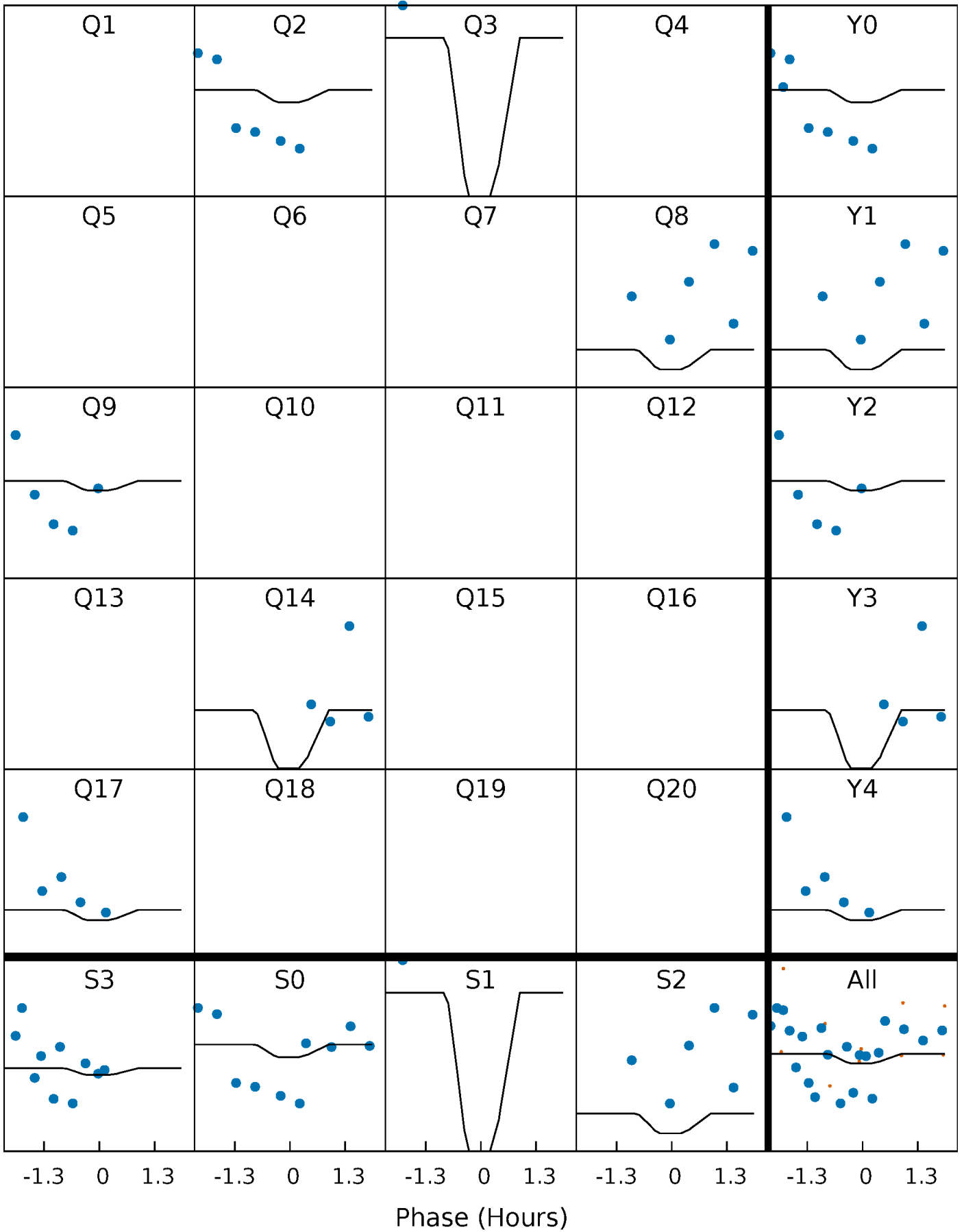
# DV Quarter-Phased Transit Curves

TCE 010989859-09     $P = 52.174965$  Days     $T_0 = 160.628549$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

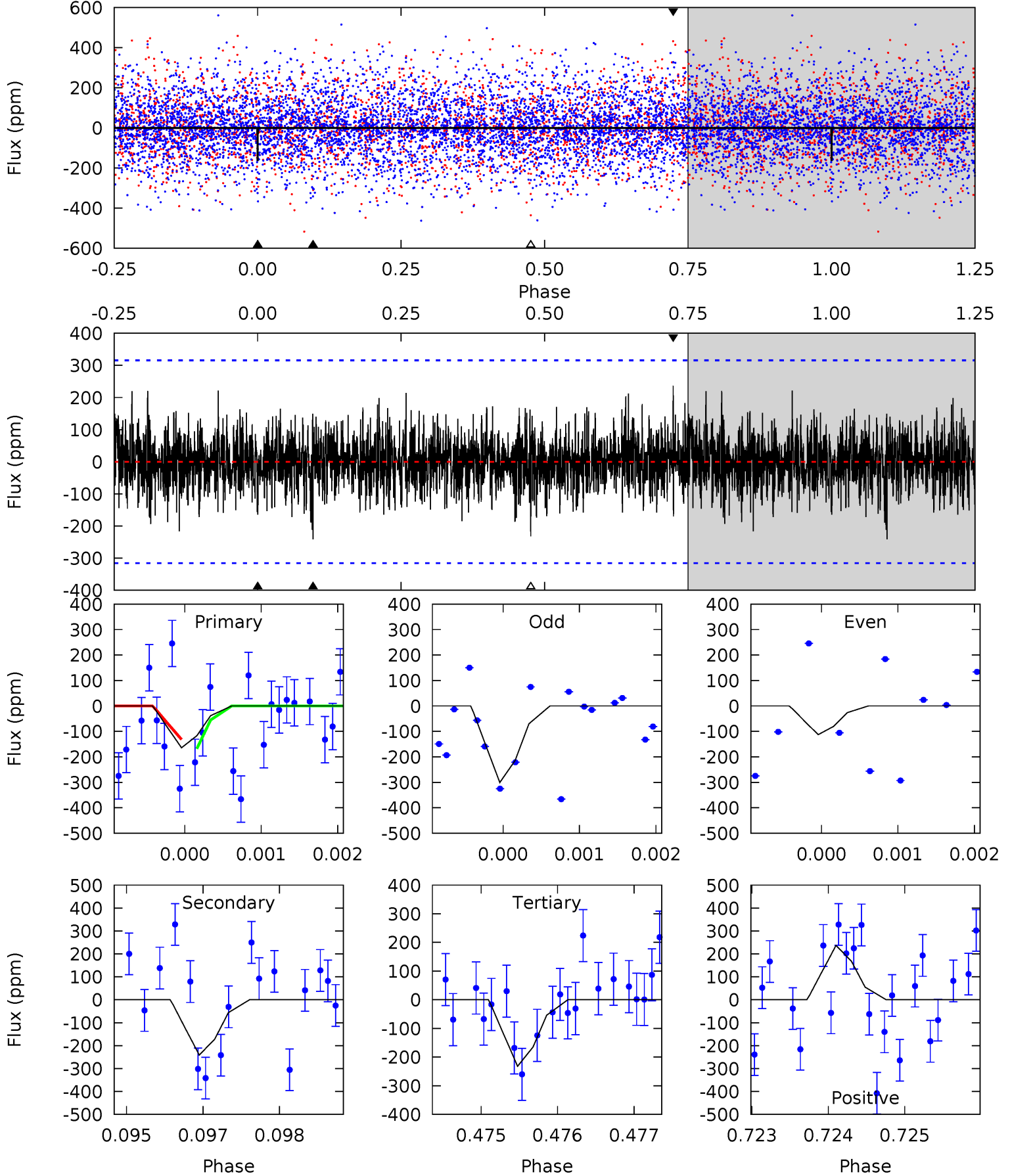
TCE 010989859-09 P= 52.169365 Days  $T_0=160.784012$  (BKJD)



# DV Model-Shift Uniqueness Test

010989859-09, P = 52.174965 Days, E = 108.453584 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
2.84	4.17	4.01	4.09	5.45	3.28	1.08	-1.17	-1.25	0.16	0.08	1.53	0.51	0.50	0.32

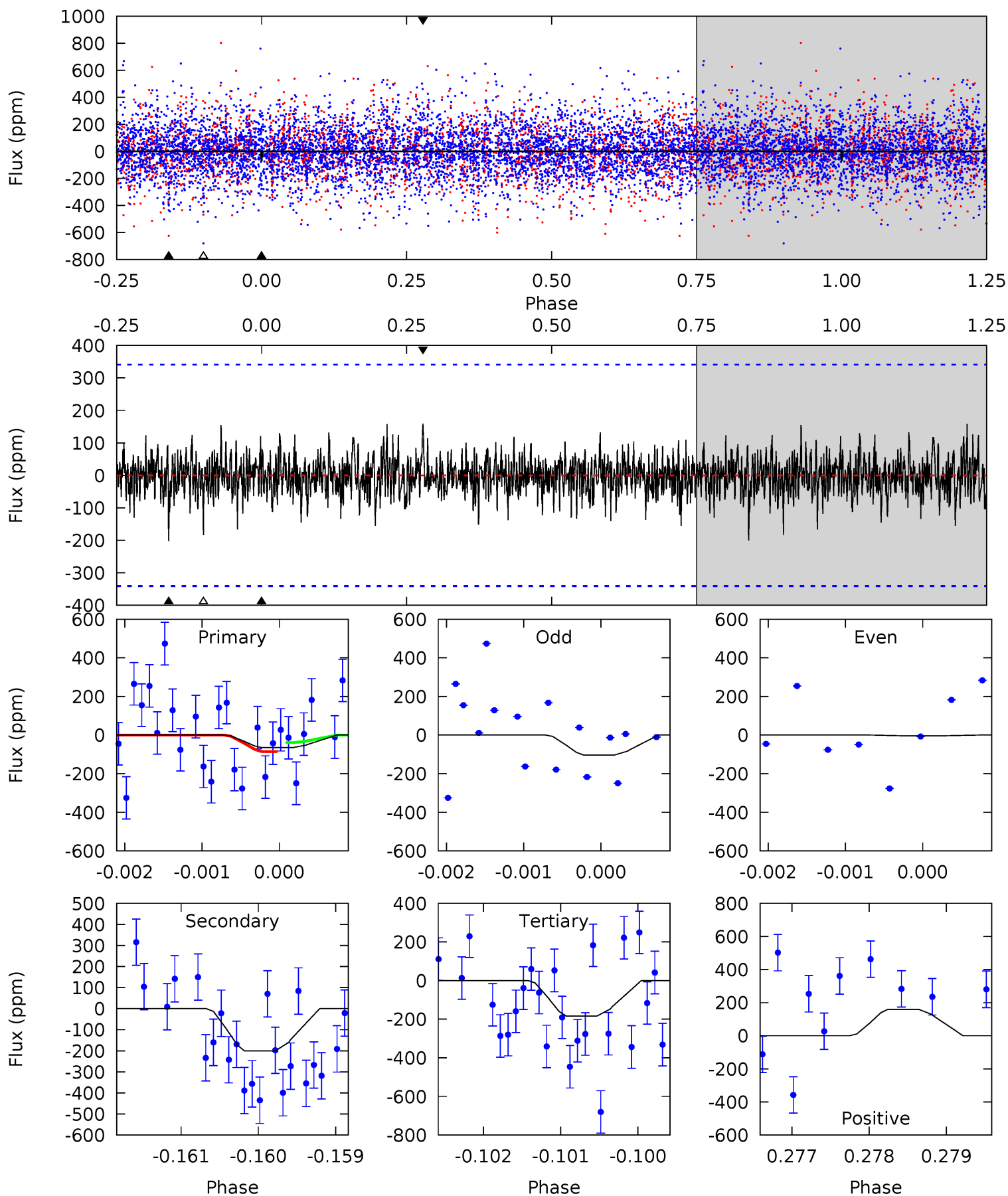




# Alt Model-Shift Uniqueness Test

010989859-09, P = 52.169365 Days, E = 108.614647 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
1.04	3.20	2.94	2.55	5.46	3.30	0.76	-1.90	-1.51	0.26	0.65	0.78	1.02	0.44	0.36



### Stellar Parameters For KIC 010989859

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$\rho_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$7291^{+207}_{-285}$	$4.307^{+0.084}_{-0.182}$	$-0.600^{+0.250}_{-0.300}$	$1.278^{+0.380}_{-0.163}$	$1.208^{+0.166}_{-0.136}$	$0.815^{+0.355}_{-0.399}$
	+3%/-4%	+2%/-4%	+42%/-50%	+30%/-13%	+14%/-11%	+44%/-49%
Source	PHO1	KIC0	KIC0	DSEP		

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

### Secondary Eclipse Parameters for KIC 010989859-09 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-241 \pm 58$	$143.57^{+145.91}_{-97.74}$	$948^{+68}_{-51}$	$1747^{+705}_{-3463}$	$0.513^{+4.845}_{-0.384}$
Alt.	$-200 \pm 62$	$143.13^{+149.68}_{-98.67}$	$951^{+62}_{-50}$	$1691^{+760}_{-3440}$	$0.437^{+4.372}_{-0.339}$

$T_{\text{max}}$  = 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

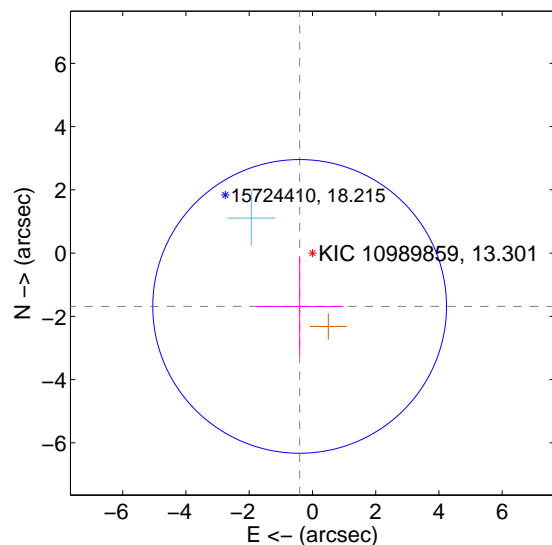
Supplemental centroid analysis for 010989859-09. Kepler magnitude: 13.30. Transit SNR 4.41

There are 1 quarters with good PRF difference image offsets

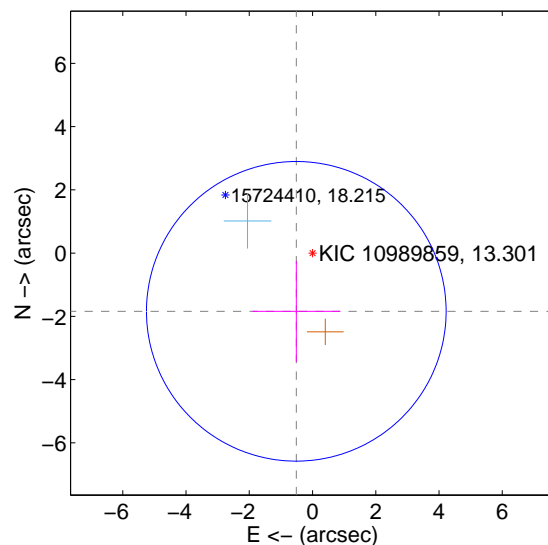
The direct PRF centroid is offset from the target star catalog position by about 0.20 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.734 \pm 1.548$	1.12	$0.405 \pm 1.379$	$-1.686 \pm 1.558$
PRF-fit source offset from KIC position	$1.912 \pm 1.580$	1.21	$0.513 \pm 1.390$	$-1.842 \pm 1.593$
photometric centroid source offset	$0.39 \pm 1.52$	0.26	$0.29 \pm 1.47$	$0.26 \pm 1.58$

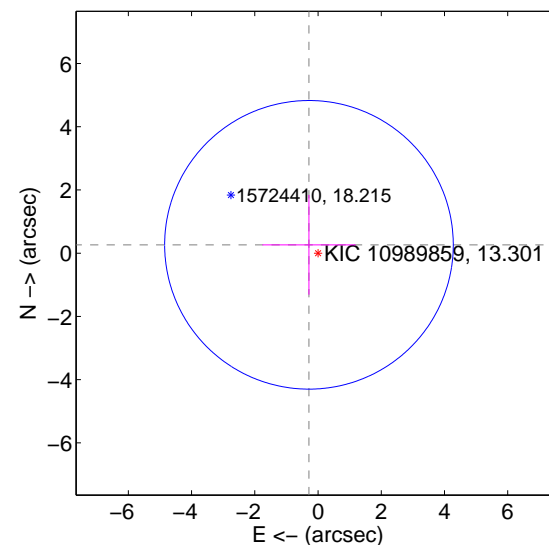
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

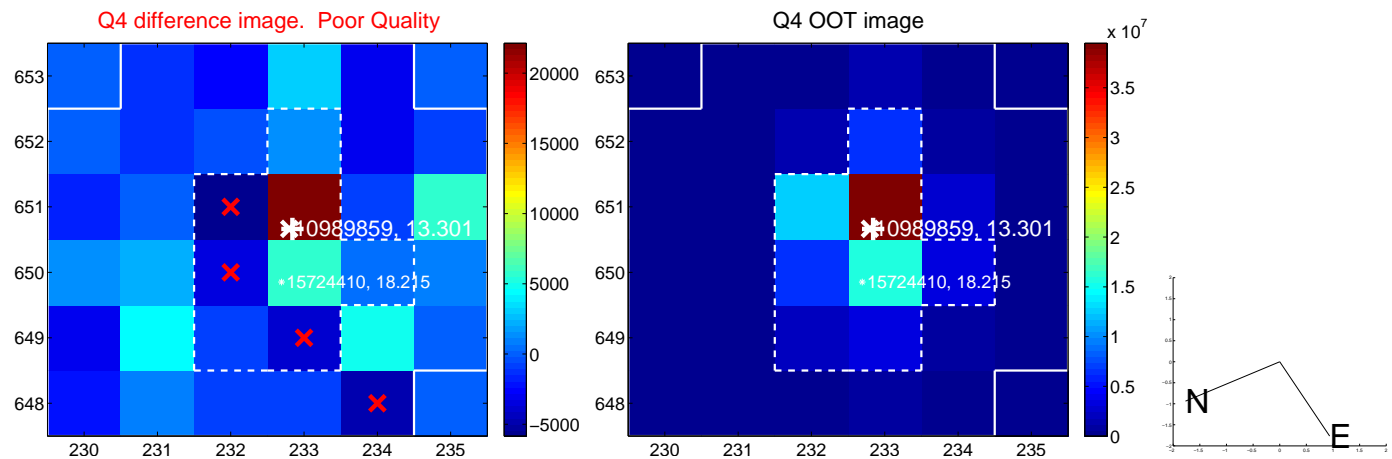
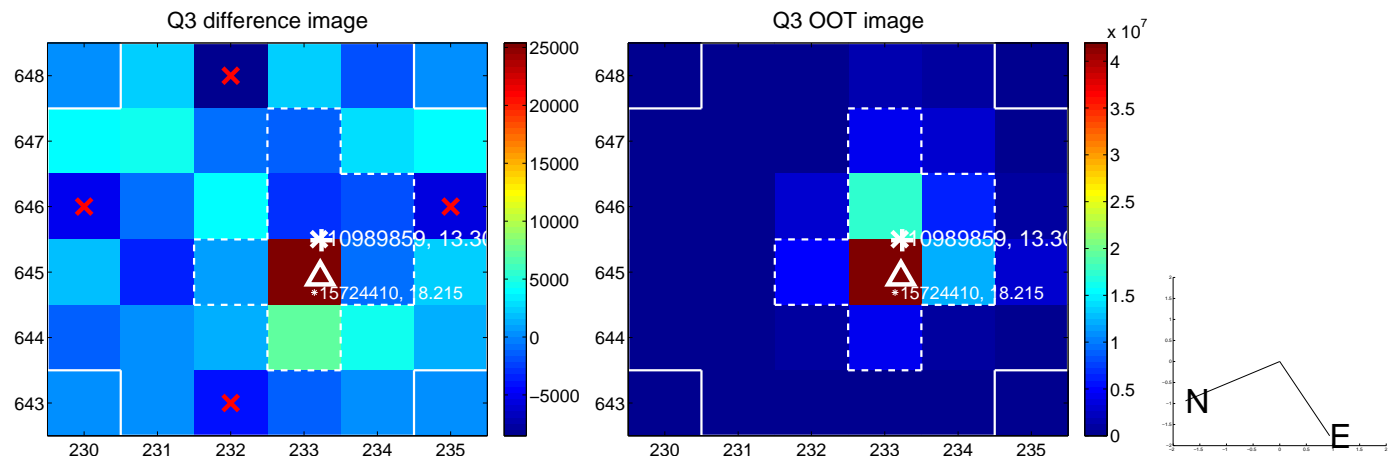
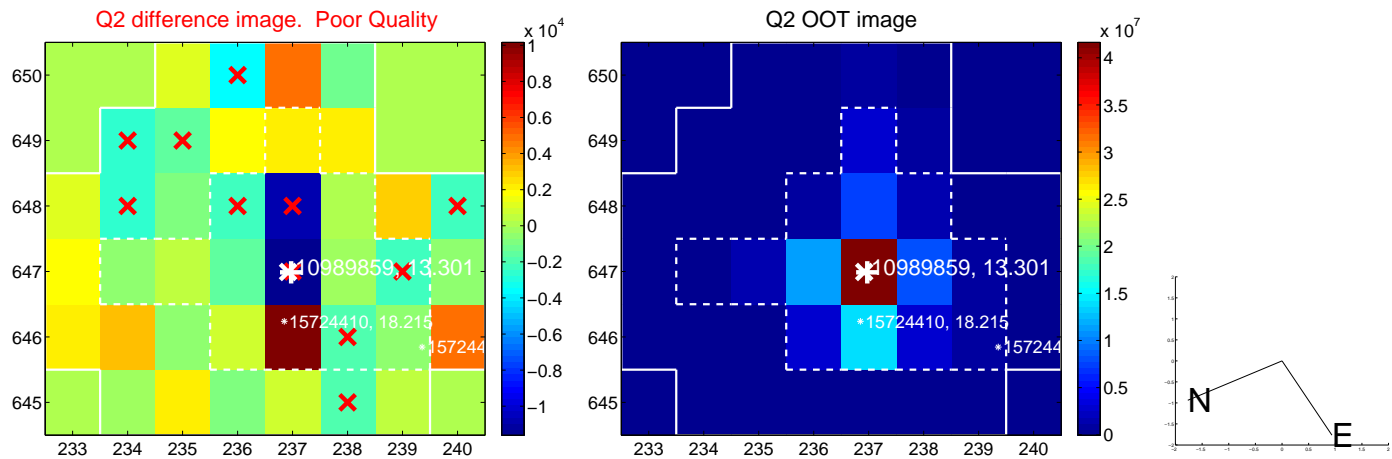
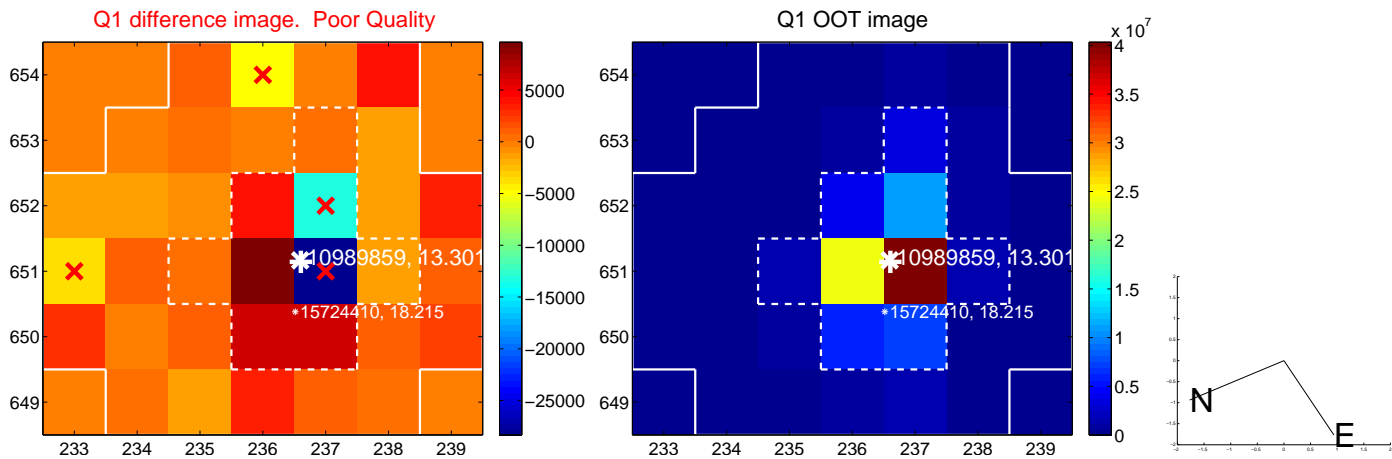


offset from photometric centroids

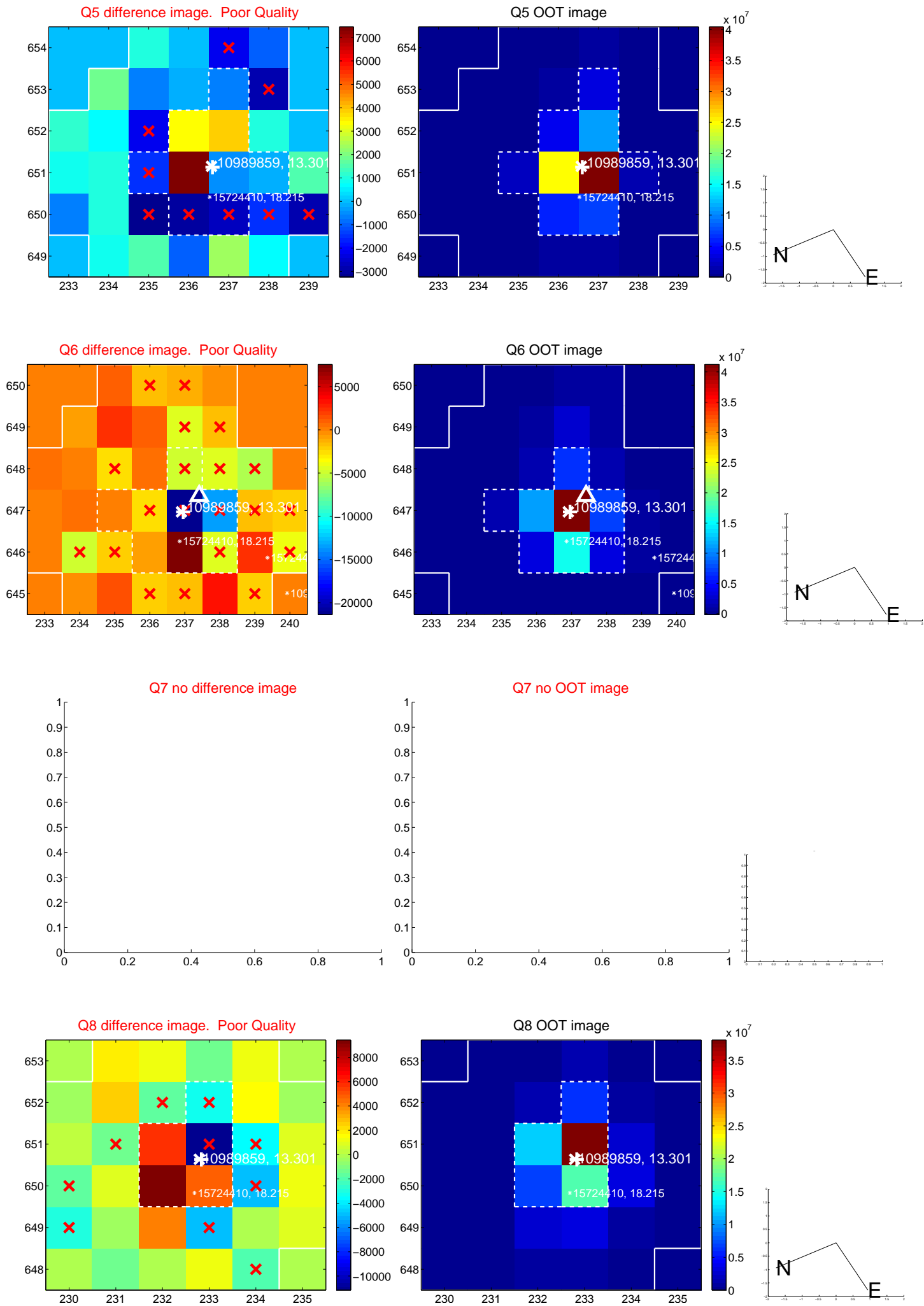


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

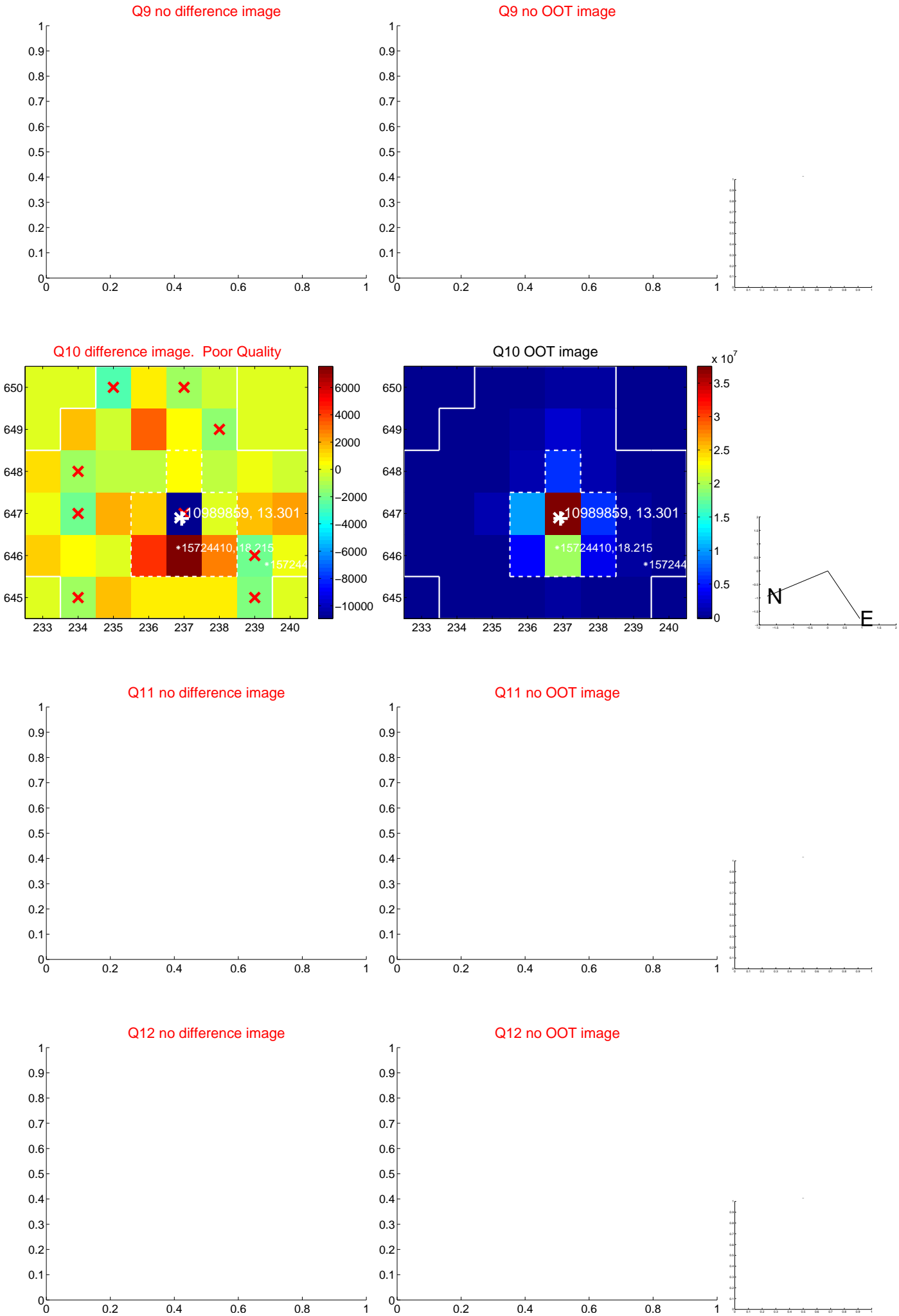
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



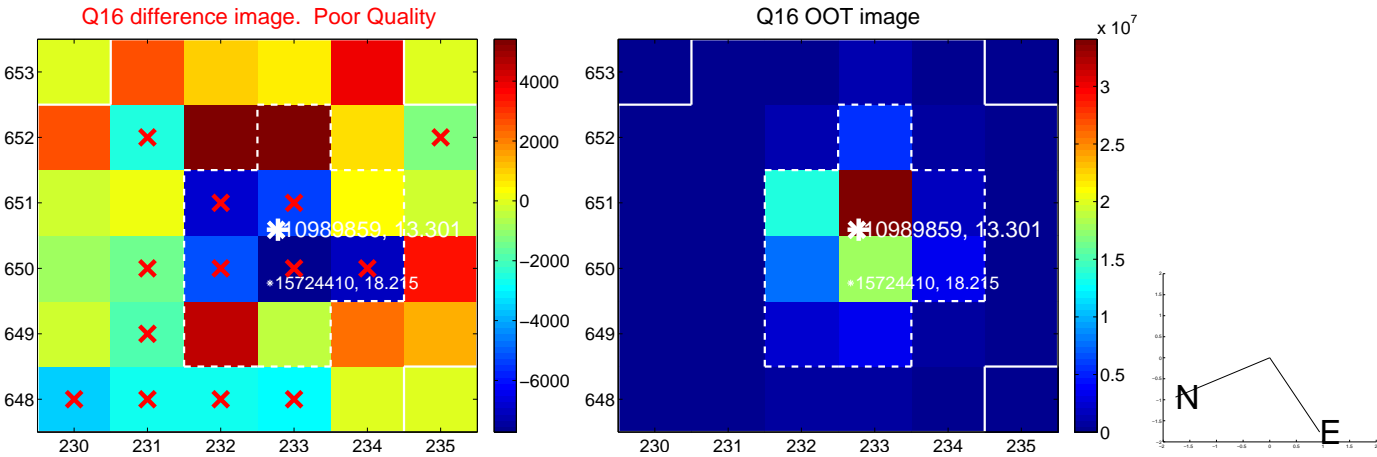
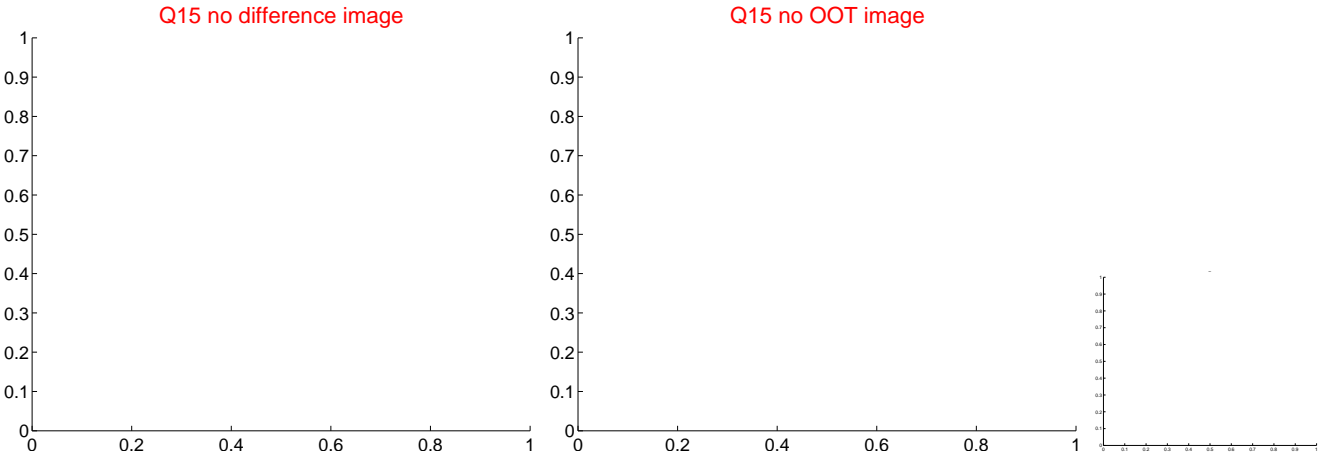
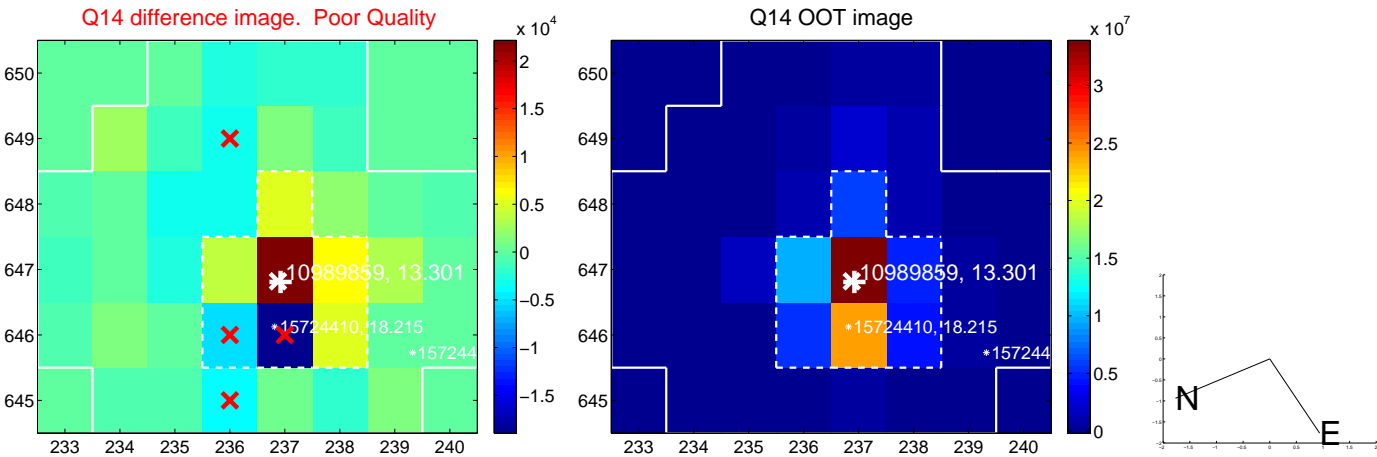
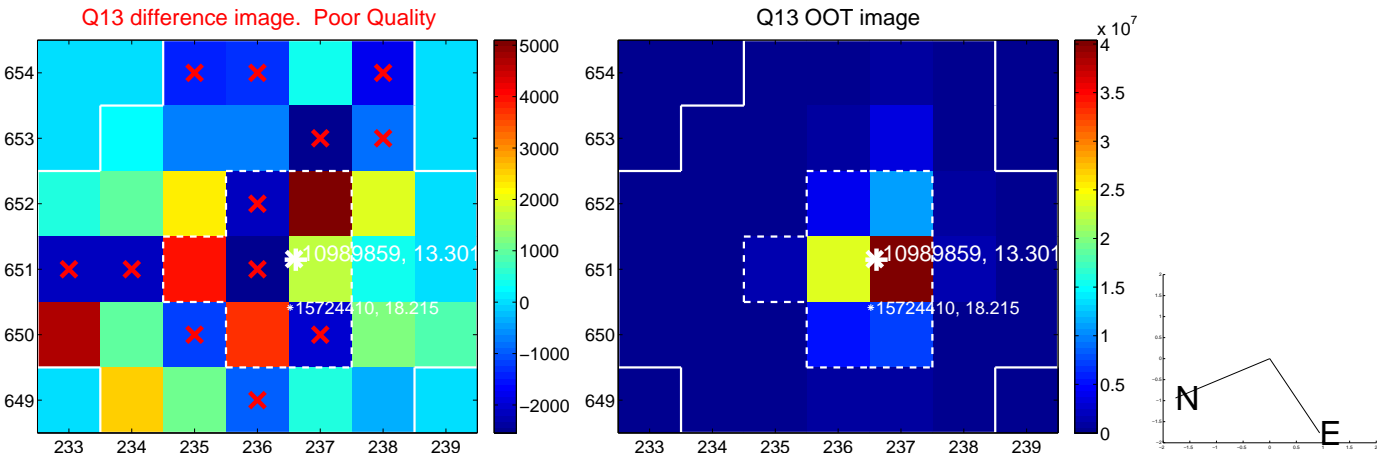
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



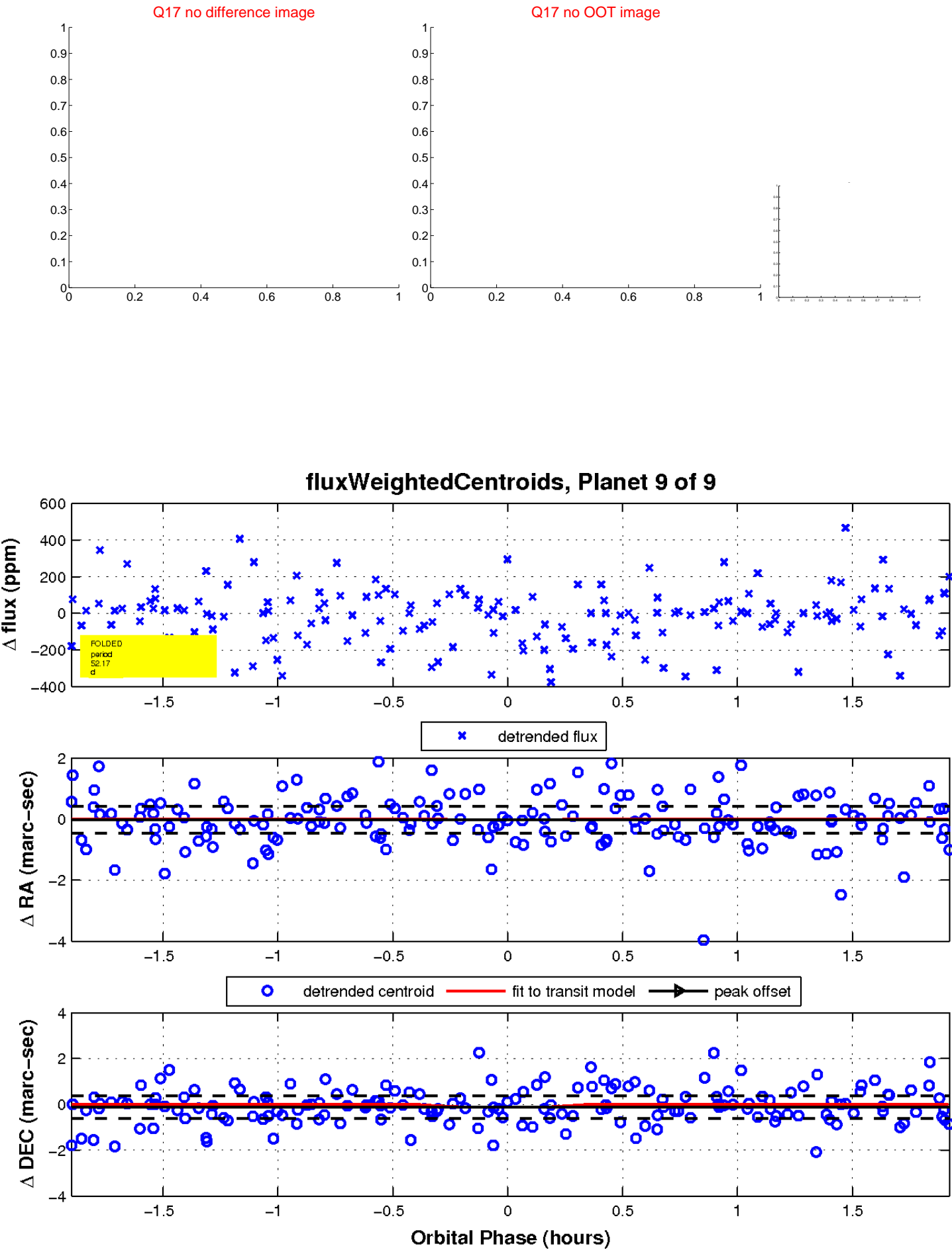
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

Declination

