

# KIC 009850409

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009850409-01	OBS	No	3.423187	131.713026	66.8	12.487	8.4	8.0	0.82	5435	0.71	280.37
009850409-02	OBS	No	1.003005	132.456509	125.2	1.270	8.0	8.8	0.82	5435	0.92	1440.70

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009850409-01	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—CENT_KIC_POS
009850409-02	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT

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

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

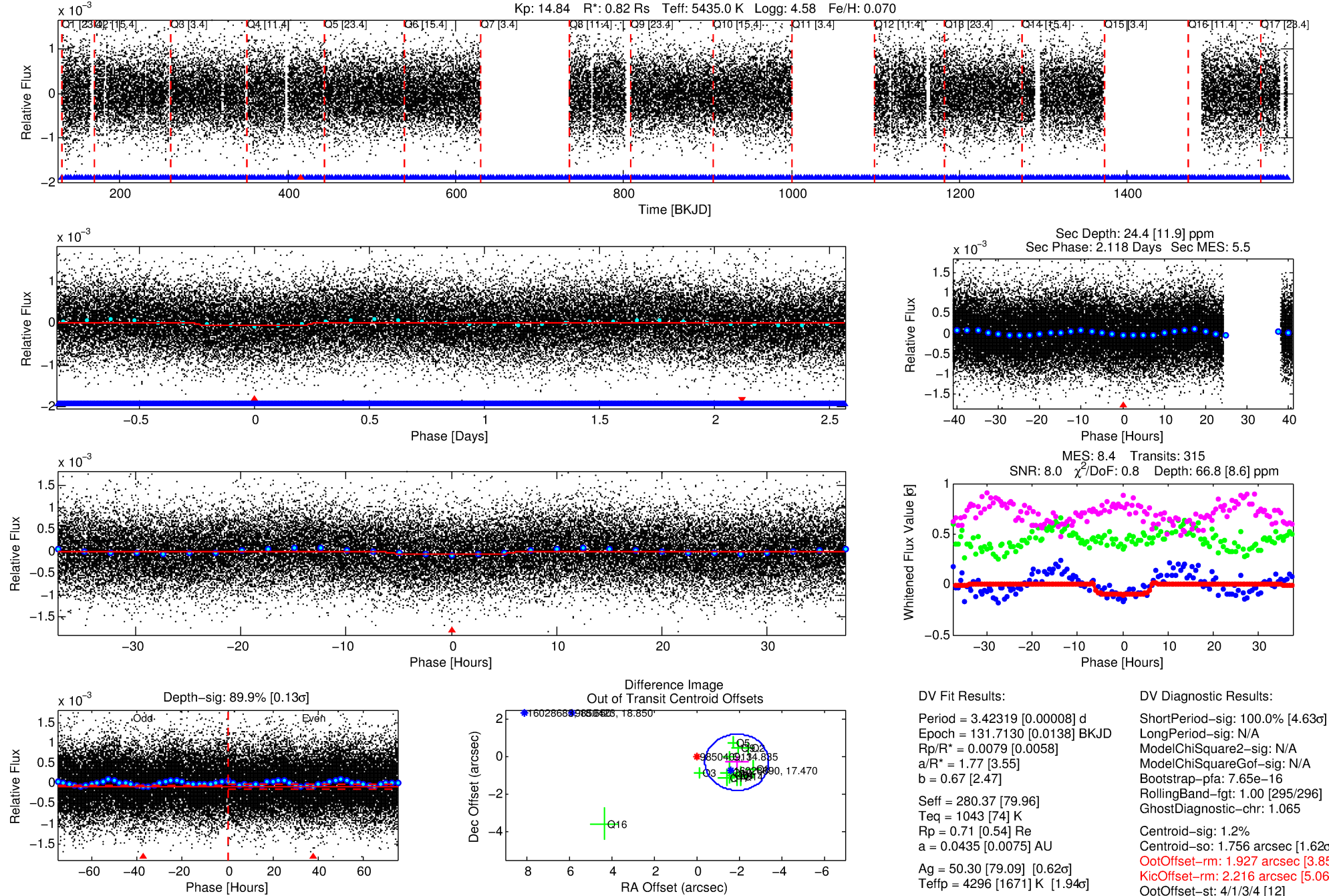
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 009850409-01

No Significant Match Found

# DV One-Page Summary

KIC: 9850409 Candidate: 1 of 2 Period: 3.423 d



## DV Fit Results:

Period = 3.42319 [0.00008] d  
Epoch = 131.7130 [0.0138] BKJD  
Rp/R\* = 0.0079 [0.0058]  
a/R\* = 1.77 [3.55]  
b = 0.67 [2.47]  
Seff = 280.37 [79.96]  
Teff = 1043 [74] K  
Rp = 0.71 [0.54] Re  
a = 0.0435 [0.0075] AU  
Ag = 50.30 [79.09] [0.62 $\sigma$ ]  
Teffp = 4296 [1671] K [1.94 $\sigma$ ]

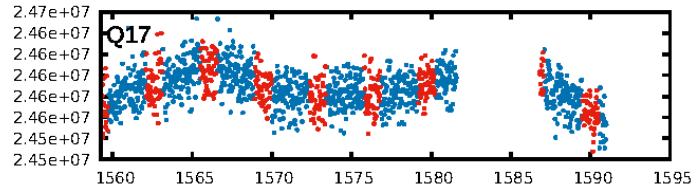
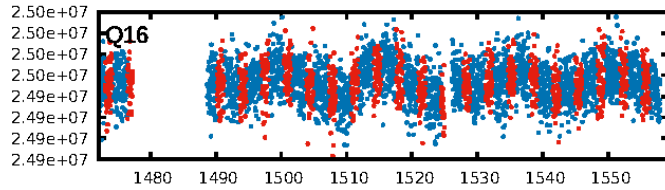
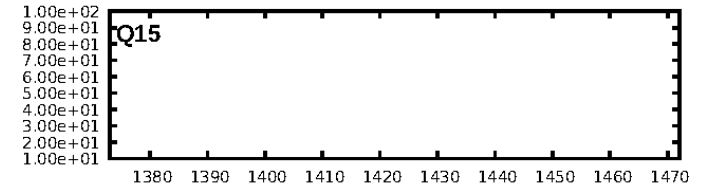
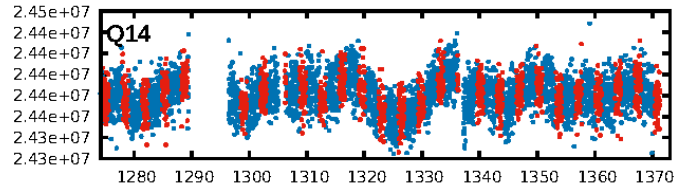
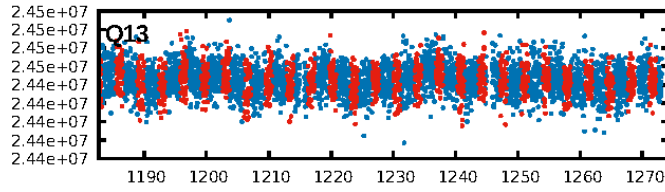
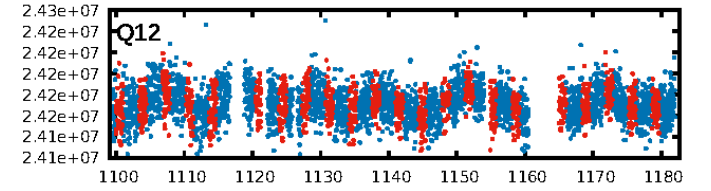
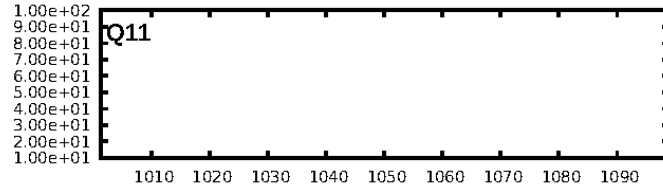
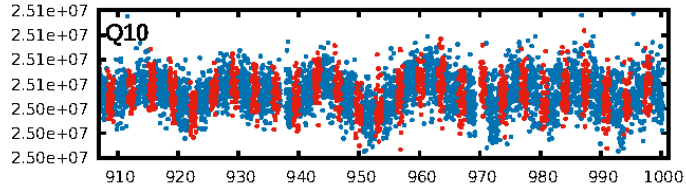
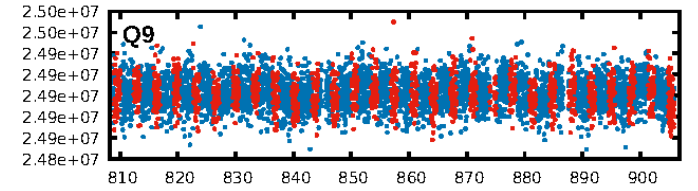
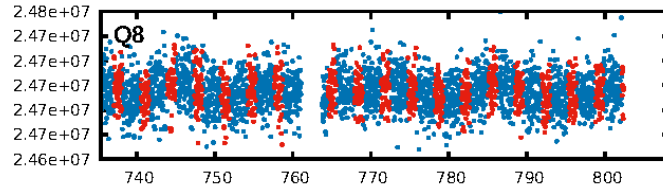
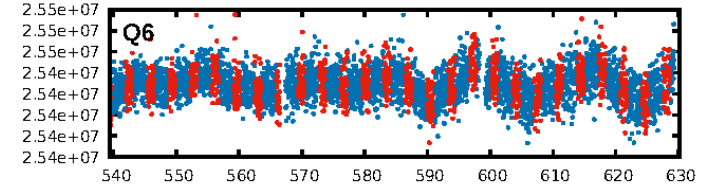
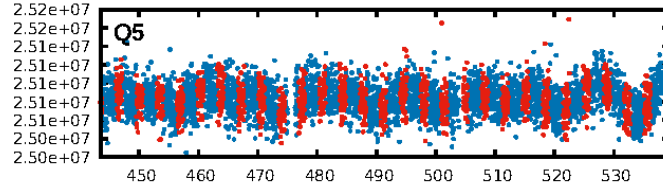
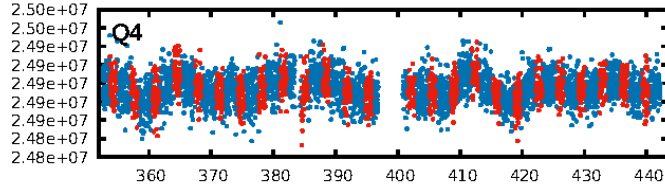
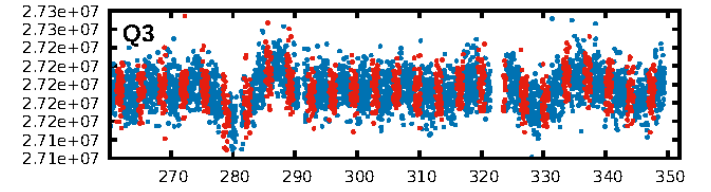
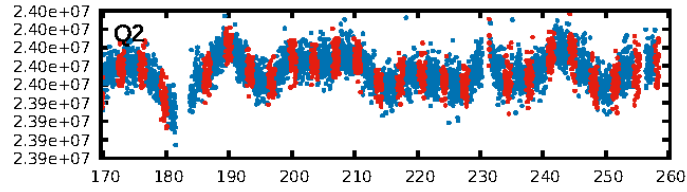
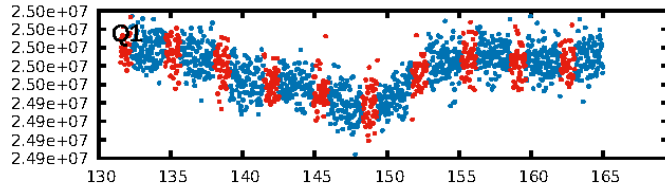
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [4.63 $\sigma$ ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: 7.65e-16  
RollingBand-fgt: 1.00 [295/296]  
GhostDiagnostic-chr: 1.065  
Centroid-sig: 1.2%  
Centroid-so: 1.756 arcsec [1.62 $\sigma$ ]  
OotOffset-rm: 1.927 arcsec [3.85 $\sigma$ ]  
KicOffset-rm: 2.216 arcsec [5.06 $\sigma$ ]  
OotOffset-st: 4/1/3/4 [12]  
KicOffset-st: 4/1/3/4 [12]  
DiffImageQuality-fgm: 0.92 [11/12]  
DiffImageOverlap-fno: 0.00 [0/14]

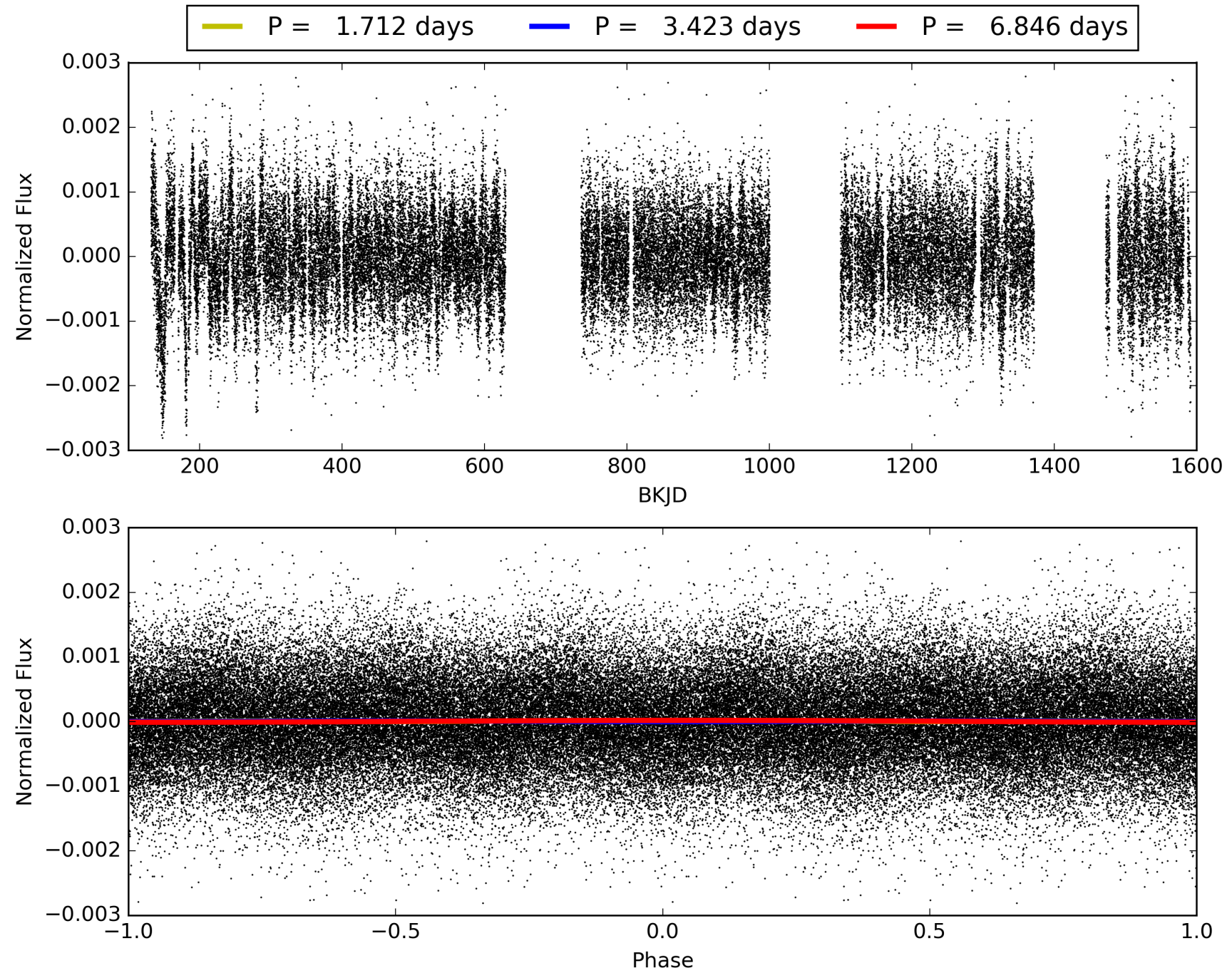
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This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 009850409-01, PDC Light Curves



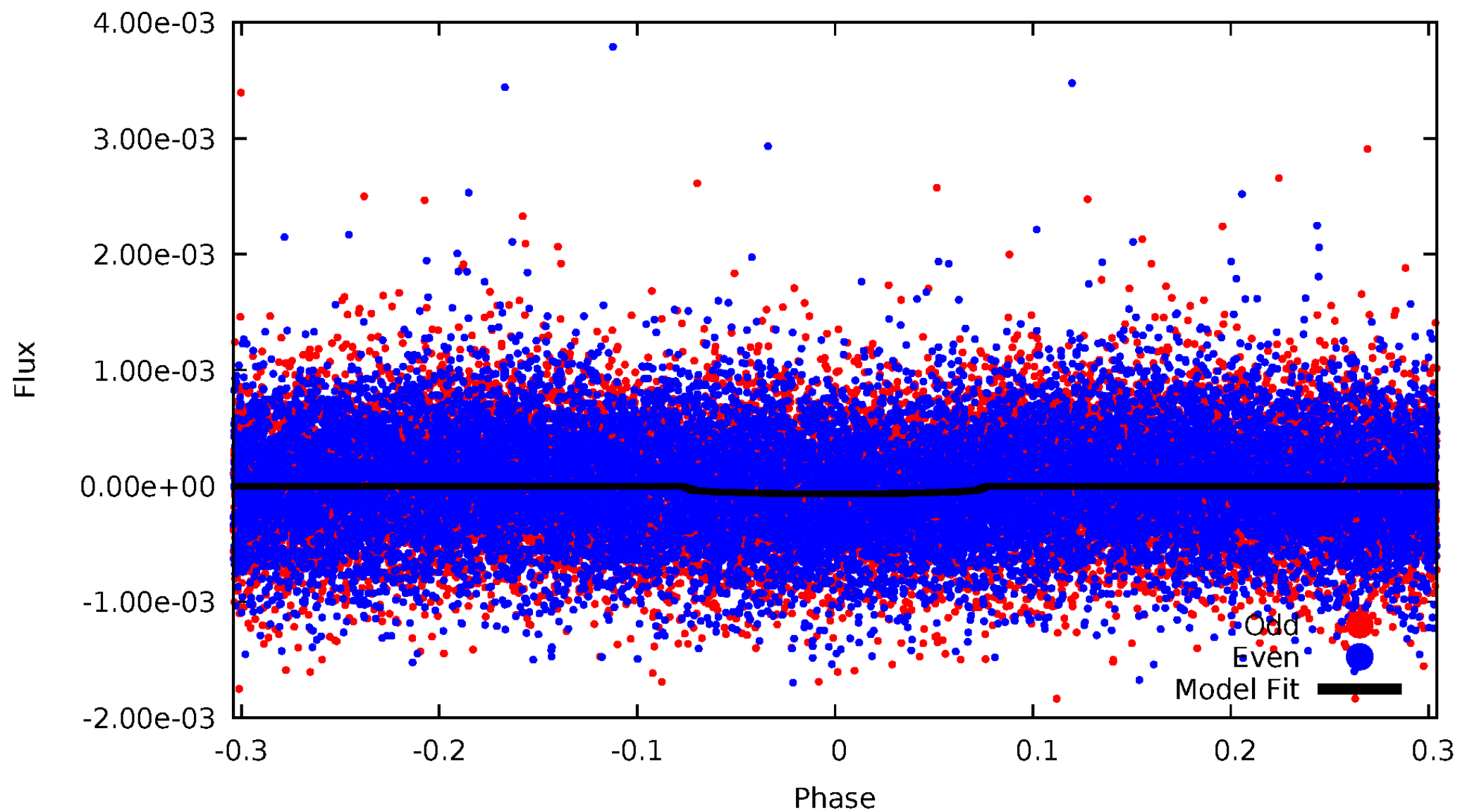
TCE 009850409-01





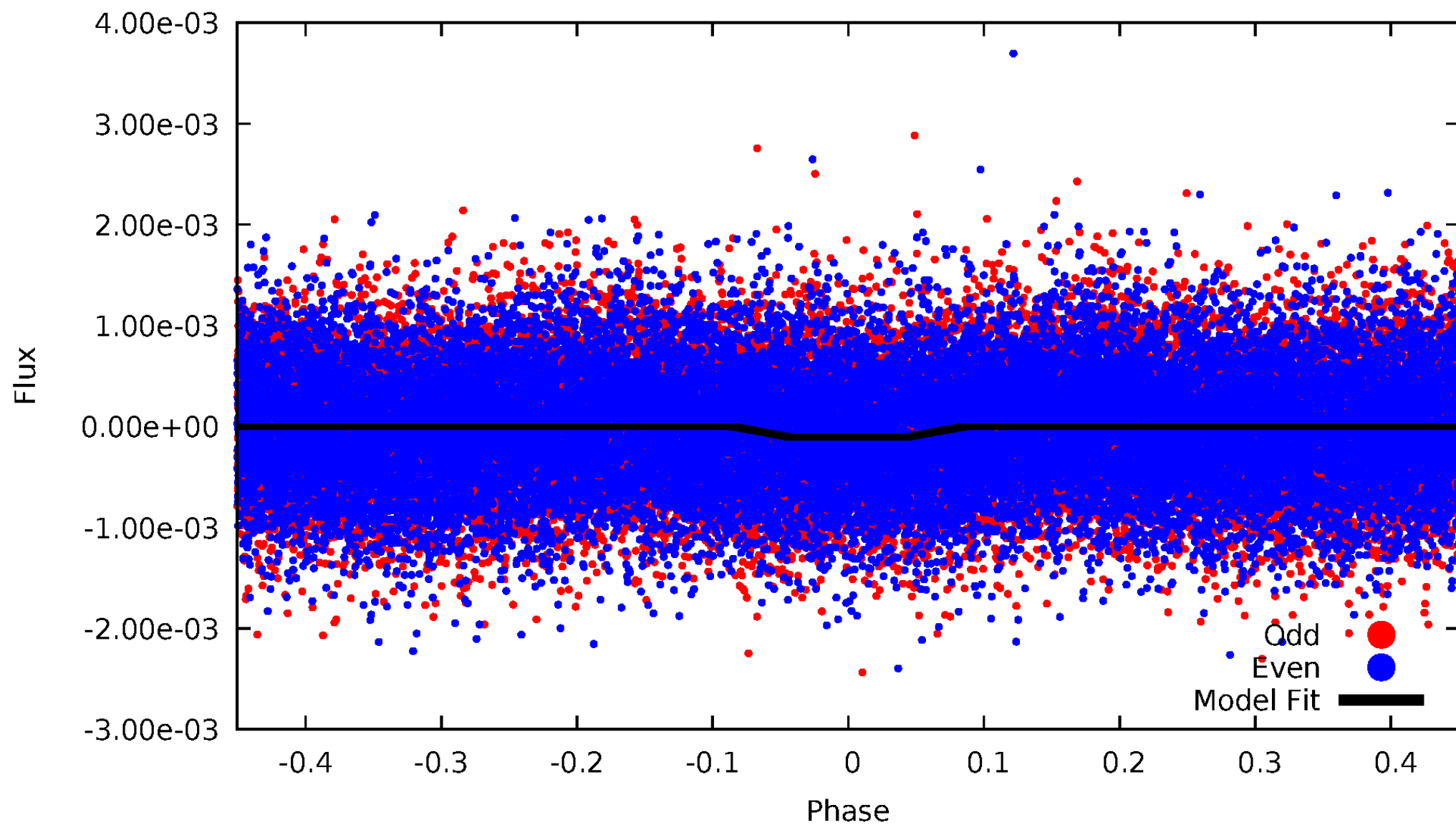
# DV Odd/Even

TCE 009850409-01



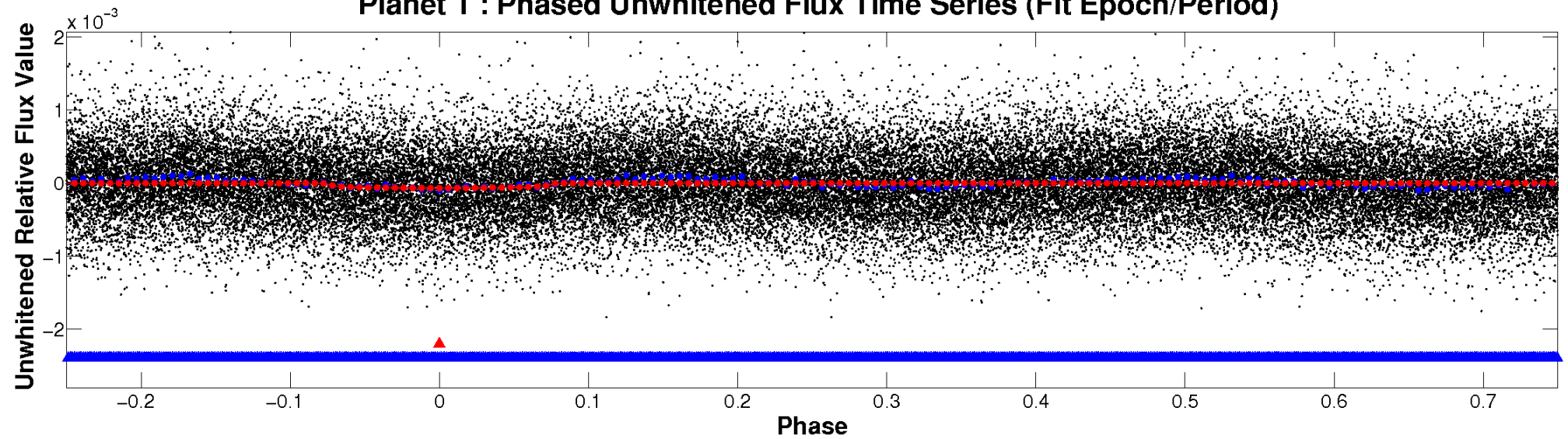
# ALT Odd/Even

TCE 009850409-01

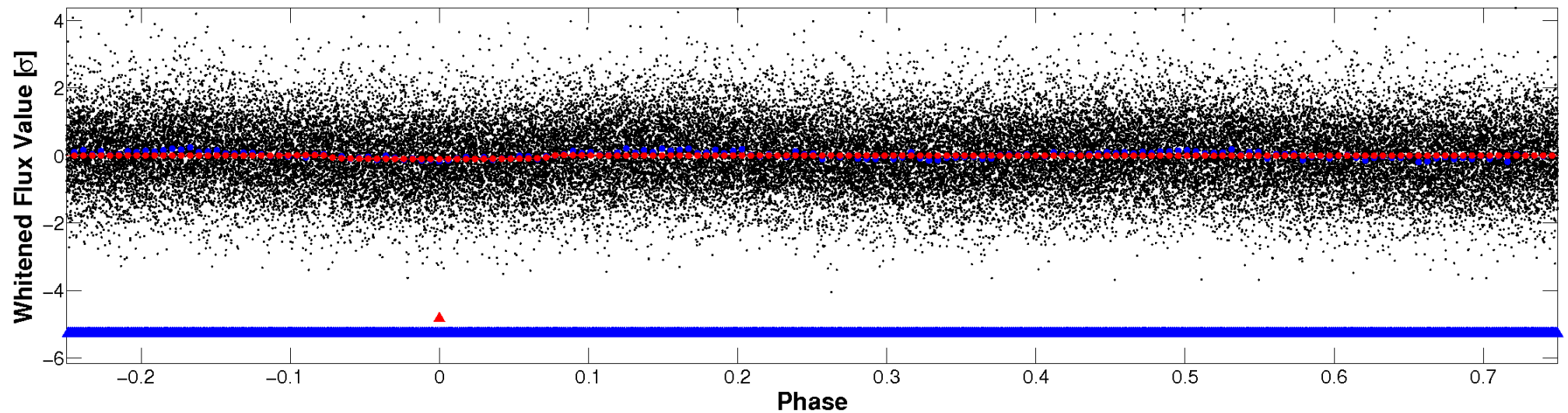


# Non-Whitened Vs. Whitened Light Curve

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

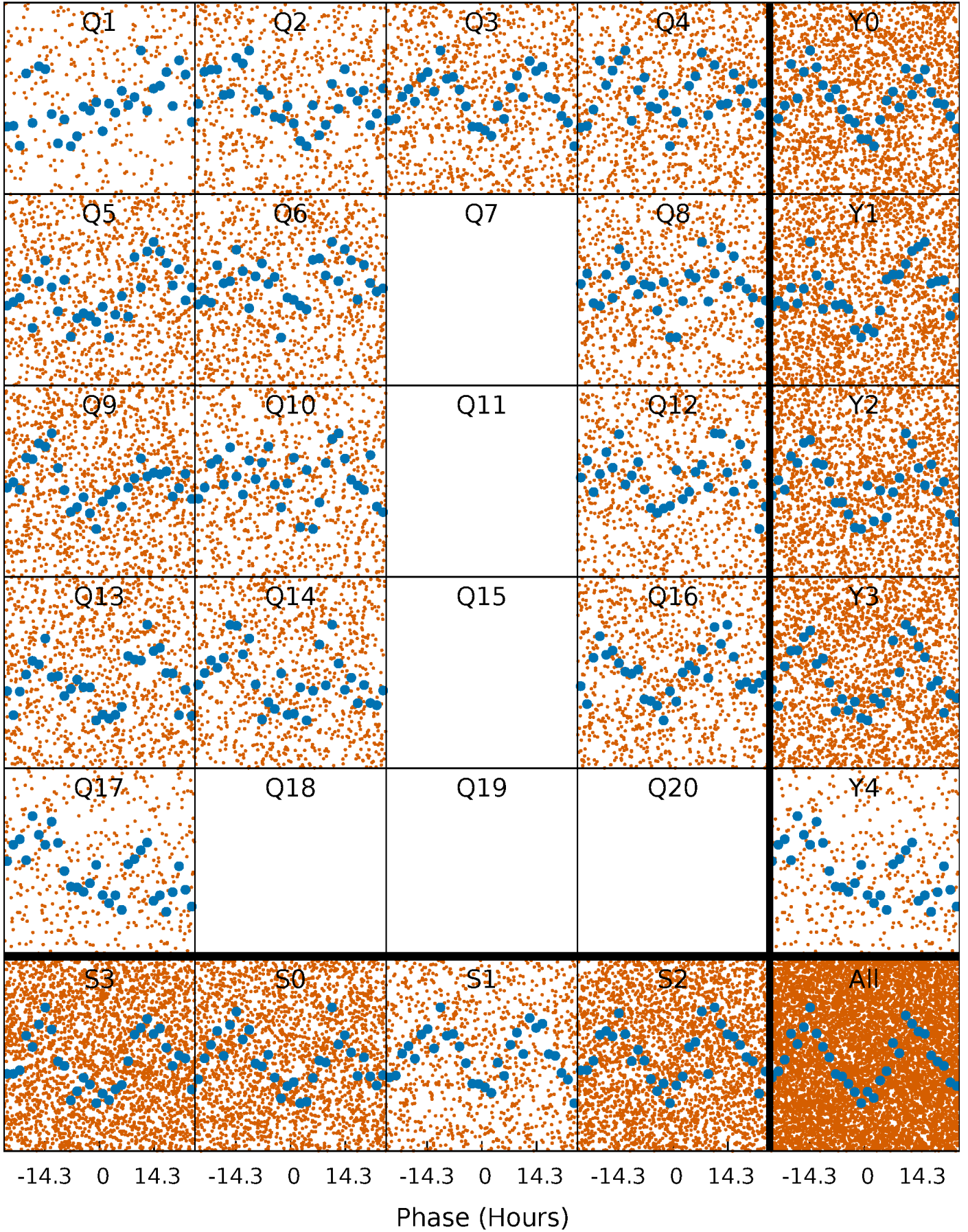


**Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



# PDC Quarter-Phased Transit Curves

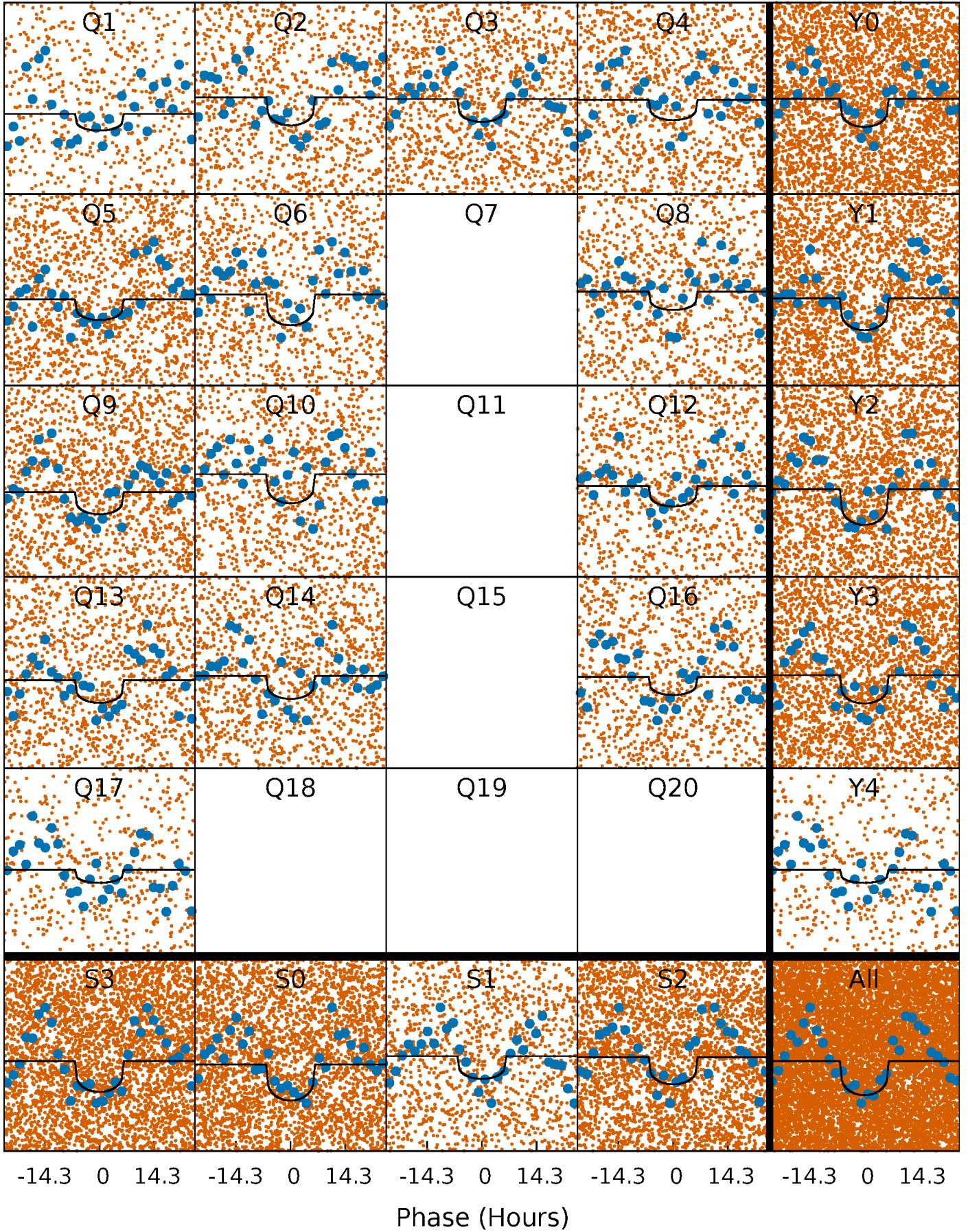
TCE 009850409-01 P= 3.423187 Days  $T_0=131.713026$  (BKJD)





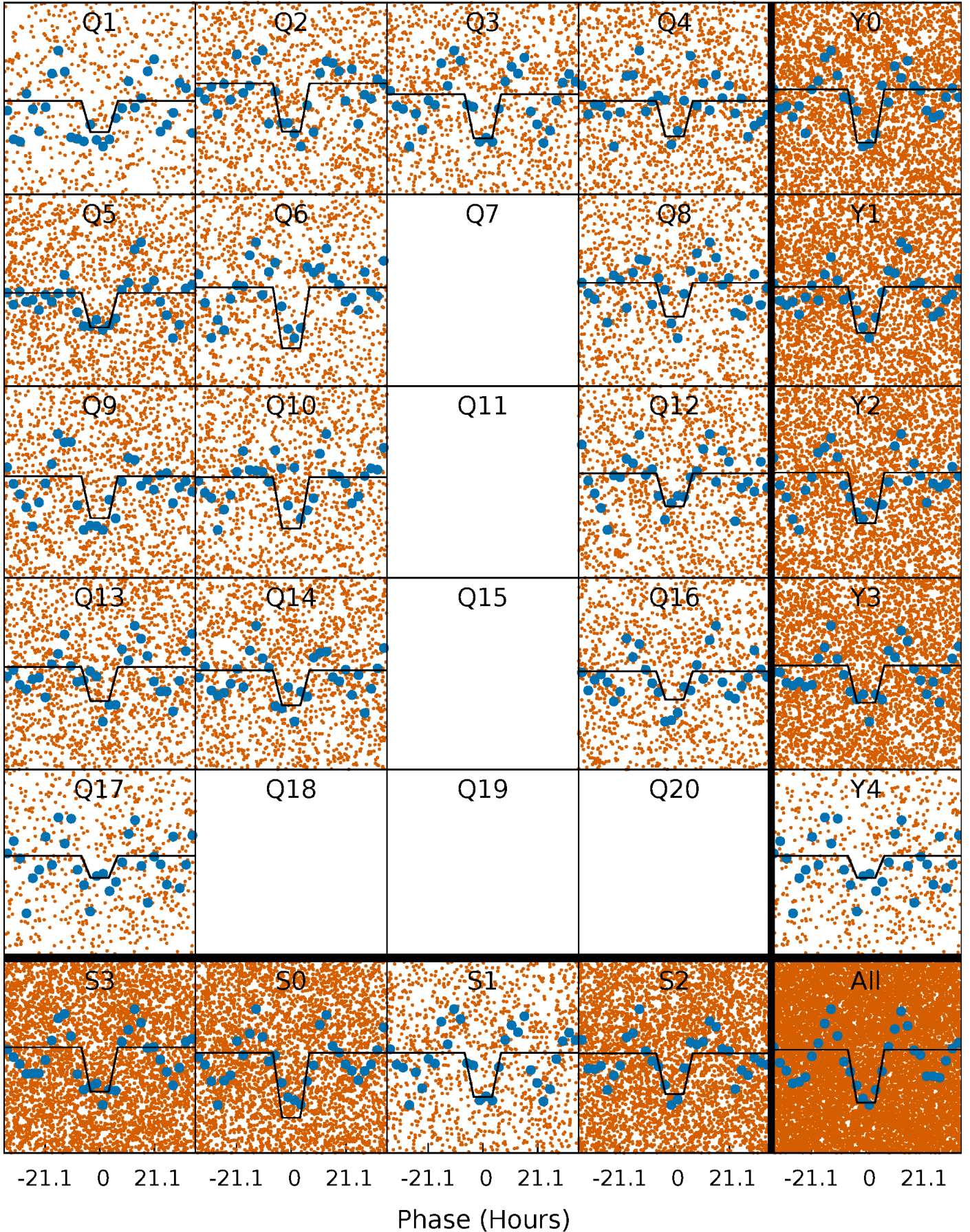
# DV Quarter-Phased Transit Curves

TCE 009850409-01 P= 3.423187 Days  $T_0=131.713026$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

TCE 009850409-01 P= 3.422987 Days  $T_0=131.729569$  (BKJD)

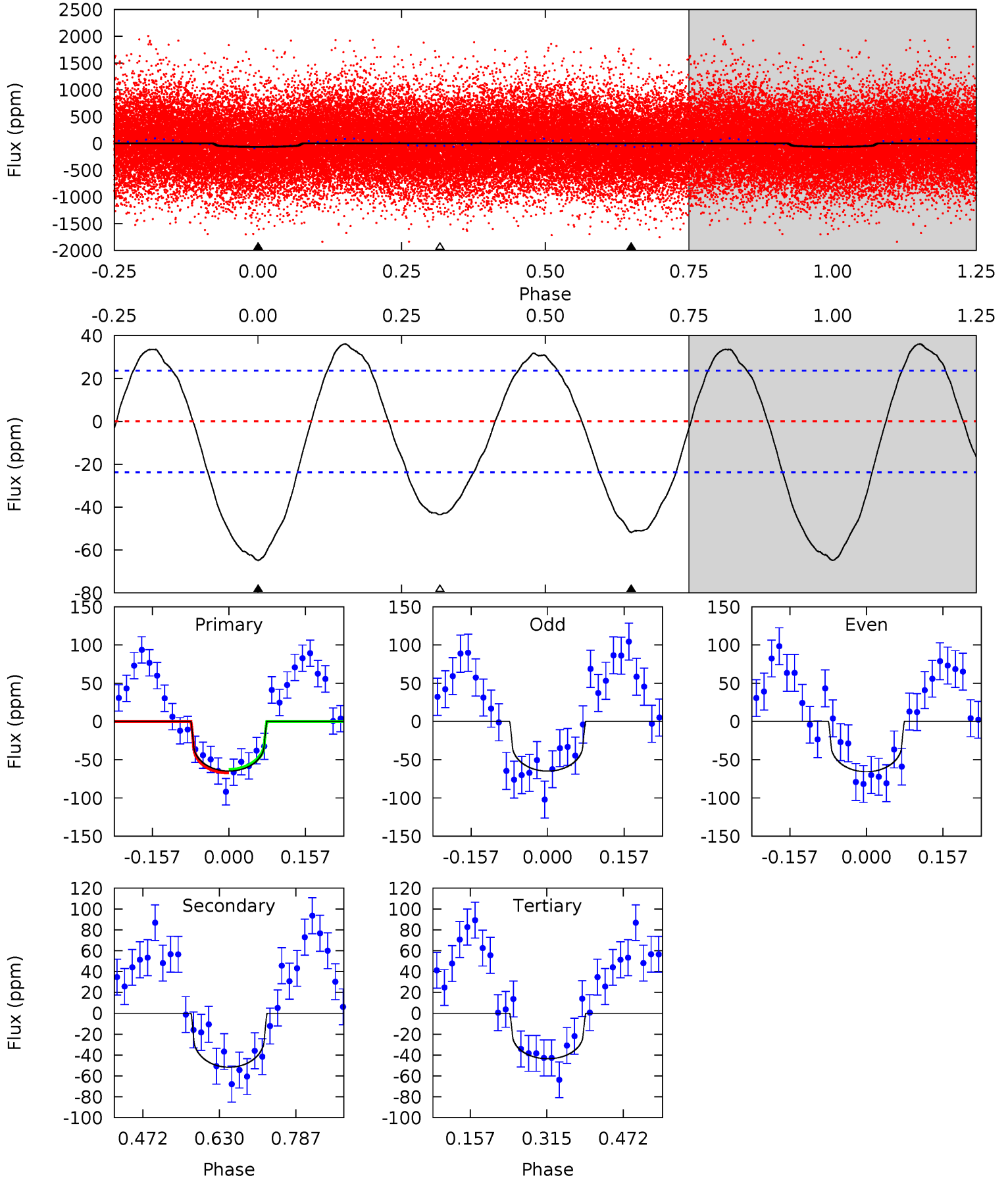




# DV Model-Shift Uniqueness Test

009850409-01, P = 3.423187 Days, E = 128.289839 Days

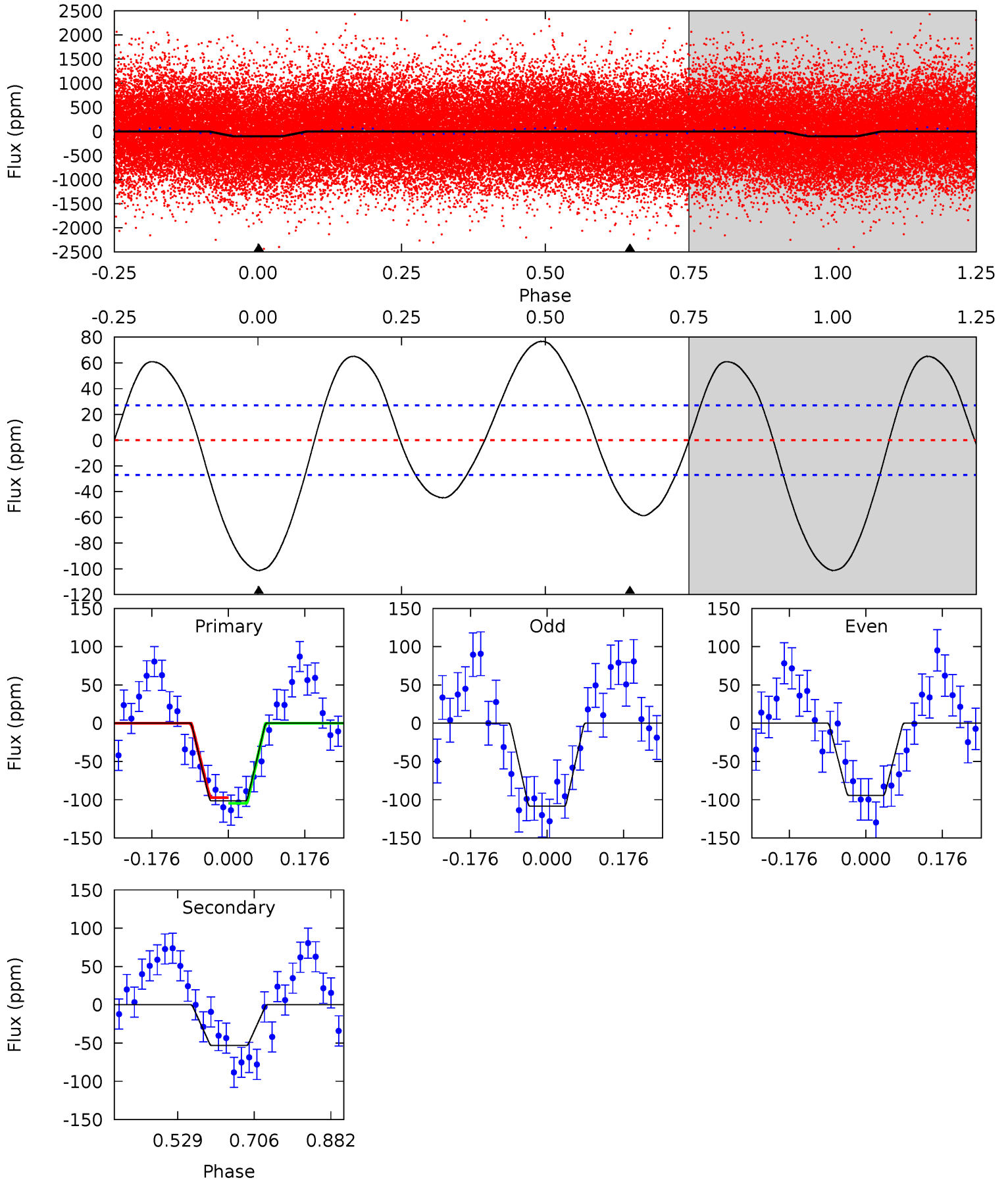
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
12.2	9.77	8.23	0	4.47	1.41	5.33	4.01	12.2	1.54	9.77	0.08	1.03	0.36	0.43



# Alt Model-Shift Uniqueness Test

009850409-01, P = 3.422987 Days, E = 128.306582 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
16.6	8.75	0	0	4.44	1.35	6.30	16.6	16.6	8.75	8.75	1.16	0.99	0.43	0.62





### Stellar Parameters For KIC 009850409

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5435^{+163}_{-146}$	$4.578^{+0.026}_{-0.145}$	$0.070^{+0.250}_{-0.300}$	$0.824^{+0.163}_{-0.058}$	$0.937^{+0.065}_{-0.101}$	$2.358^{+0.324}_{-0.948}$
	+3%/-3%	+1%/-3%	+357%/-429%	+20%/-7%	+7%/-11%	+14%/-40%
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 009850409-01 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-52 \pm 5$	$0.78^{+0.51}_{-0.42}$	$1490^{+76}_{-62}$	$5090^{+2438}_{-940}$	$86^{+295}_{-55}$
Alt.	$-53 \pm 6$	$1.00^{+0.53}_{-0.50}$	$1490^{+75}_{-62}$	$4598^{+1769}_{-643}$	$54^{+165}_{-31}$

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

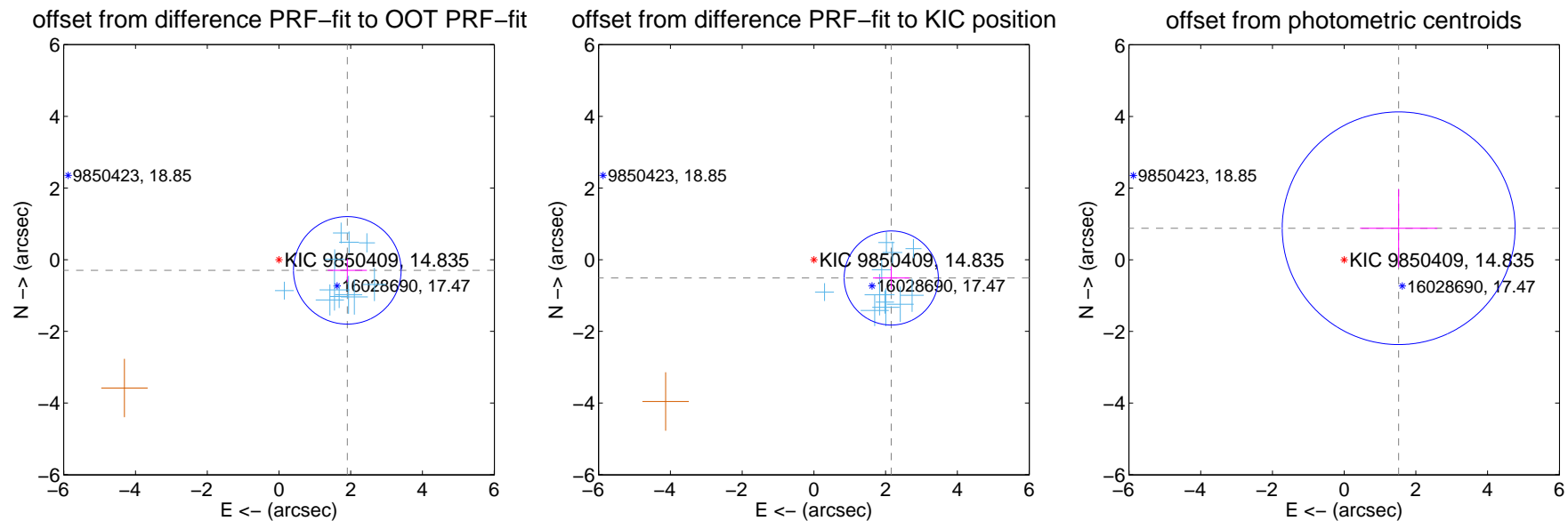
## DV Centroid Data

Supplemental centroid analysis for 009850409-01. Kepler magnitude: 14.84. Transit SNR 7.95

There are 11 quarters with good PRF difference image offsets

The direct PRF centroid is offset from the target star catalog position by about 0.40 arcsec

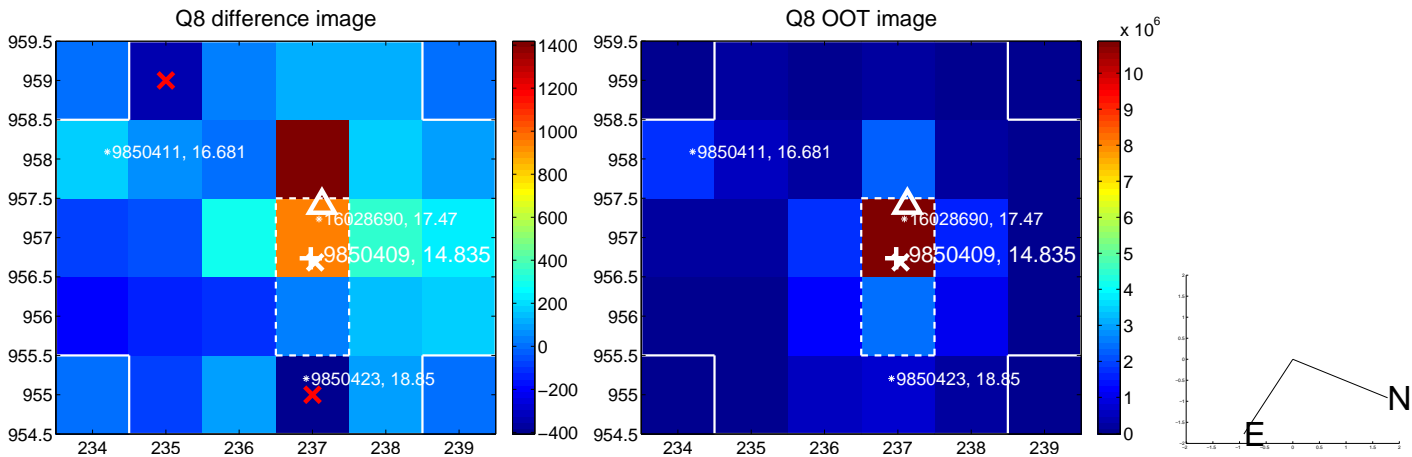
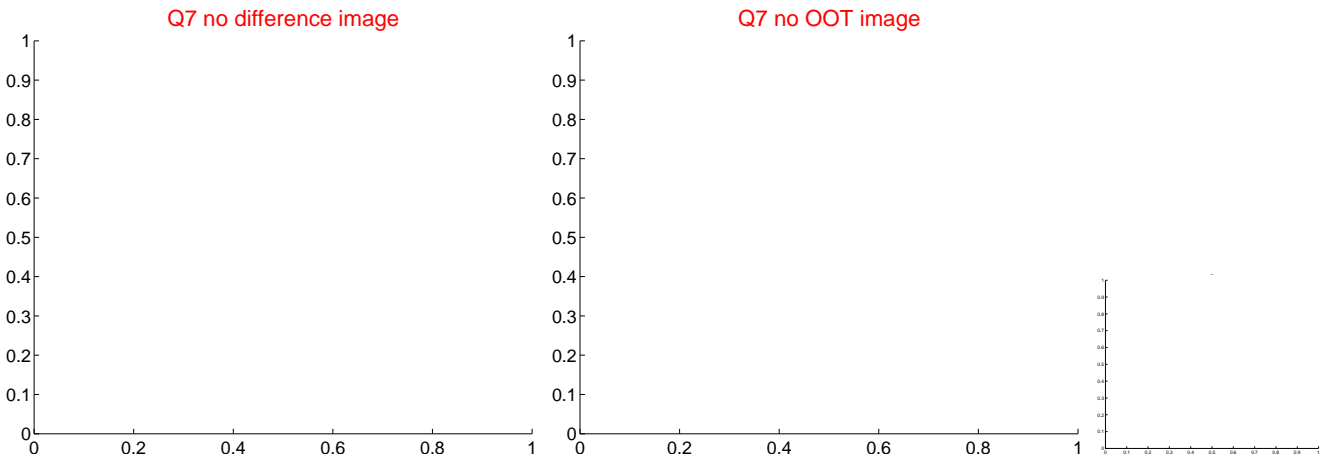
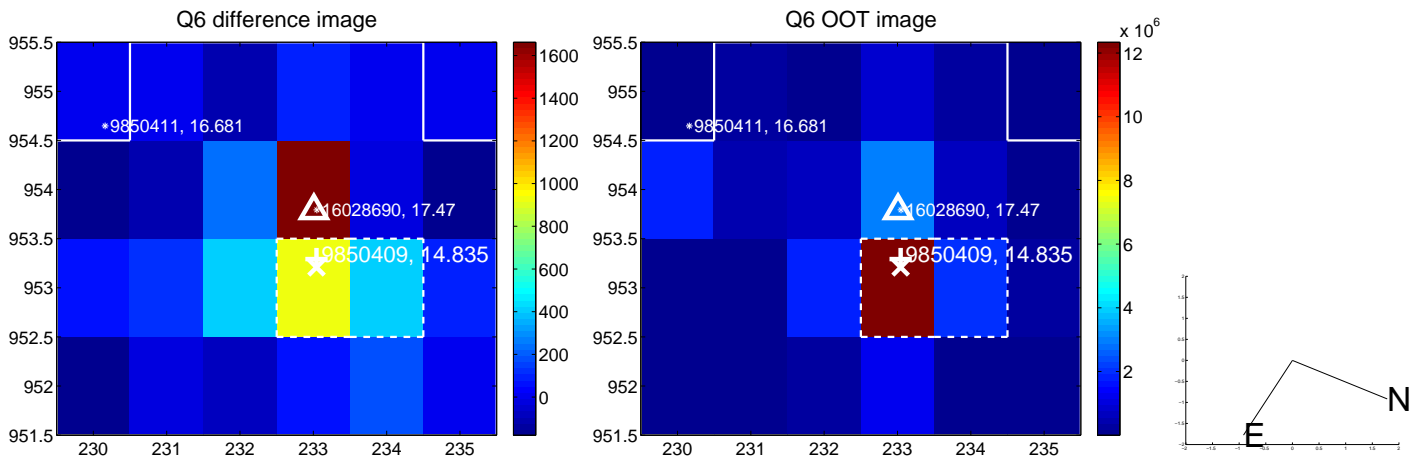
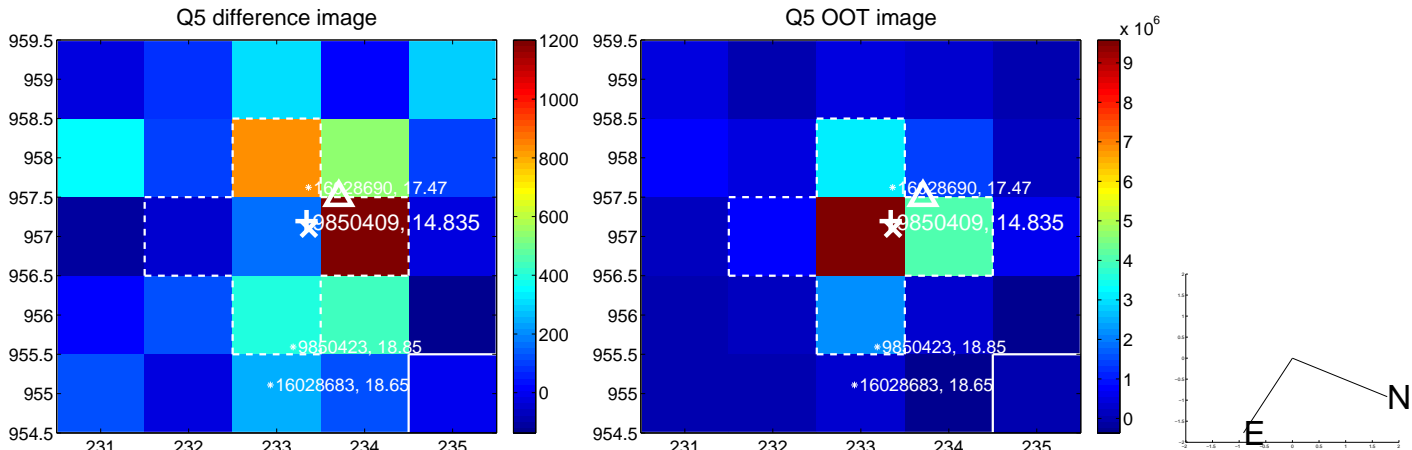
	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.927 \pm 0.500$	<b>3.85</b>	$-1.904 \pm 0.547$	$-0.297 \pm 0.324$
PRF-fit source offset from KIC position	$2.216 \pm 0.438$	<b>5.06</b>	$-2.156 \pm 0.509$	$-0.511 \pm 0.322$
photometric centroid source offset	$1.76 \pm 1.08$	1.62	$-1.52 \pm 1.08$	$0.88 \pm 1.09$



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.

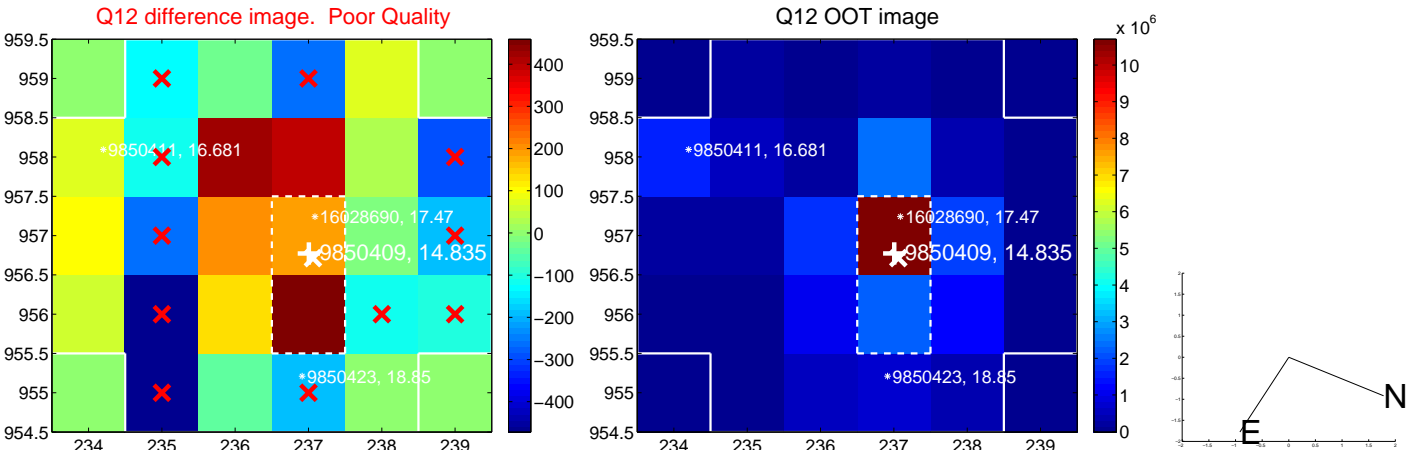
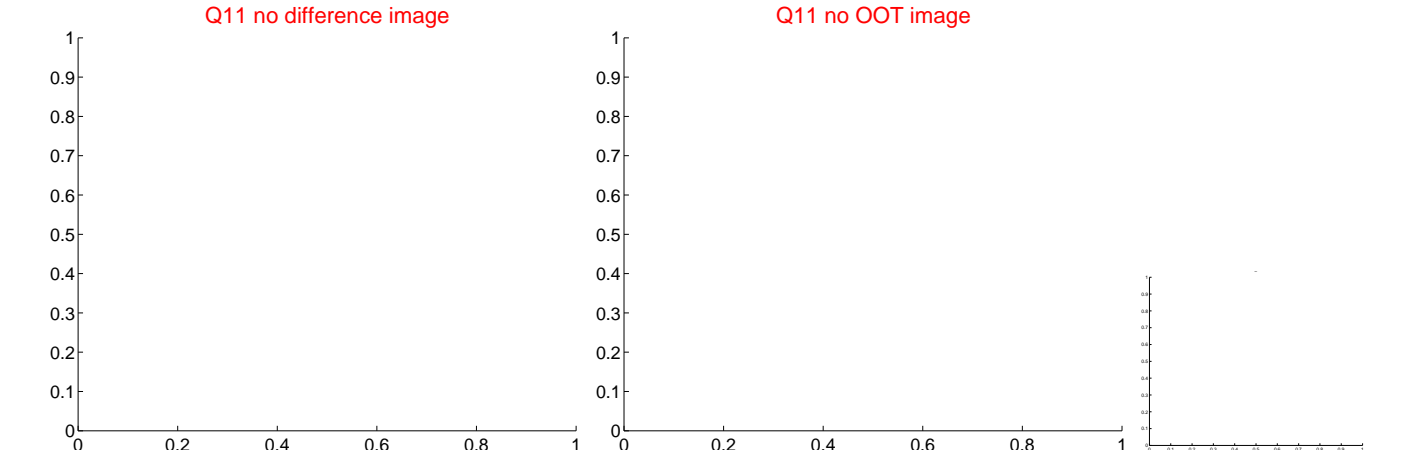
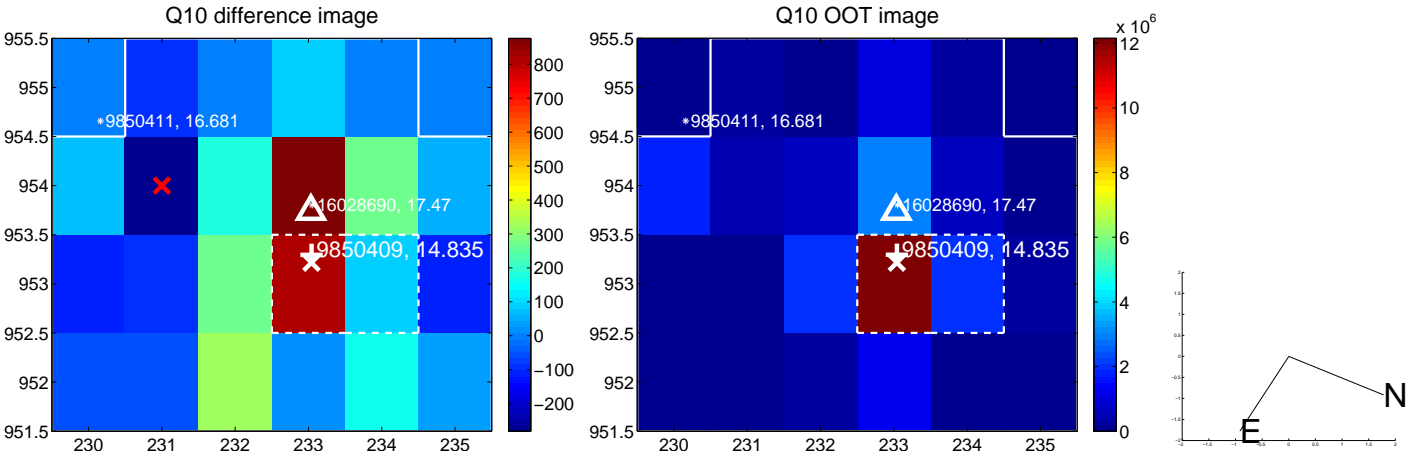
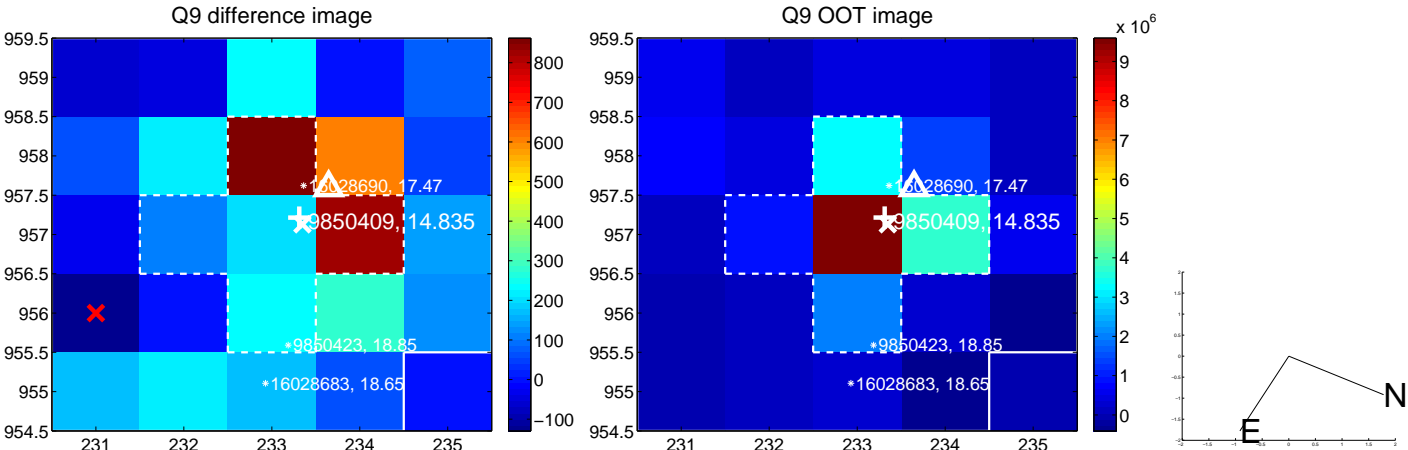


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

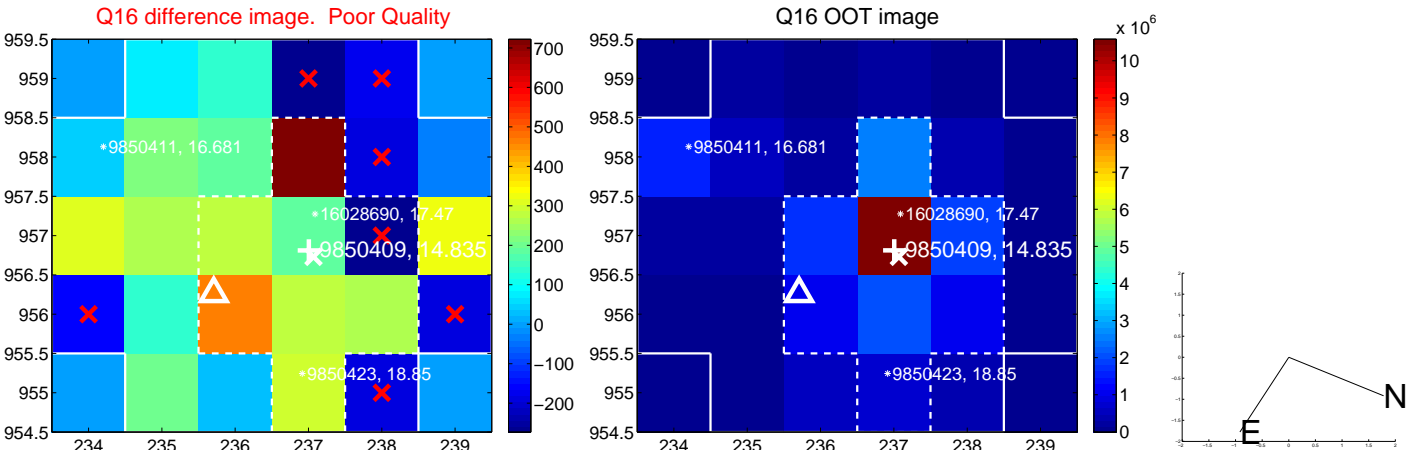
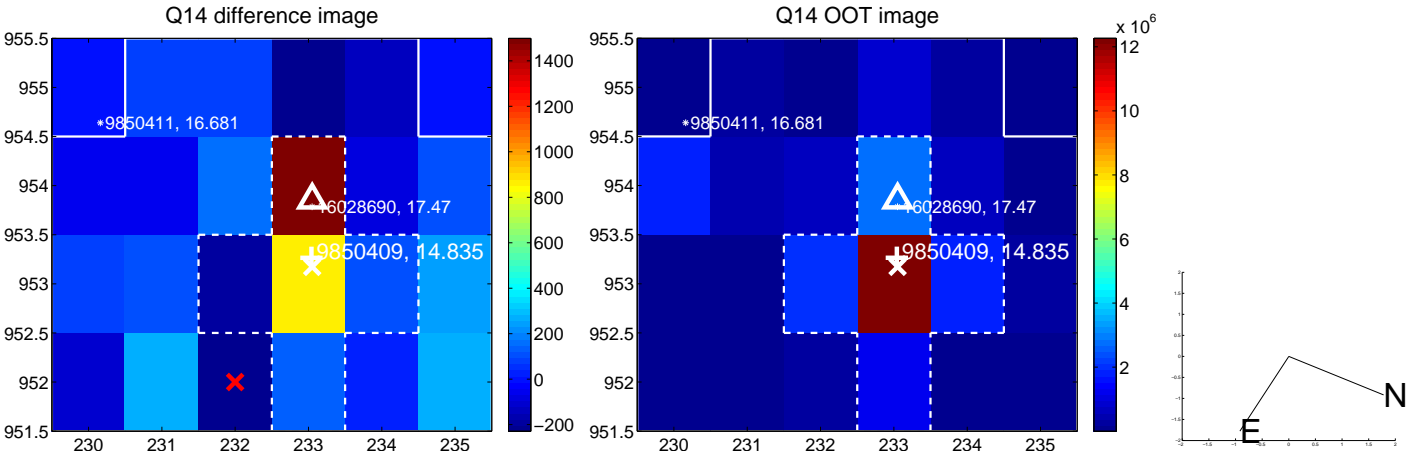
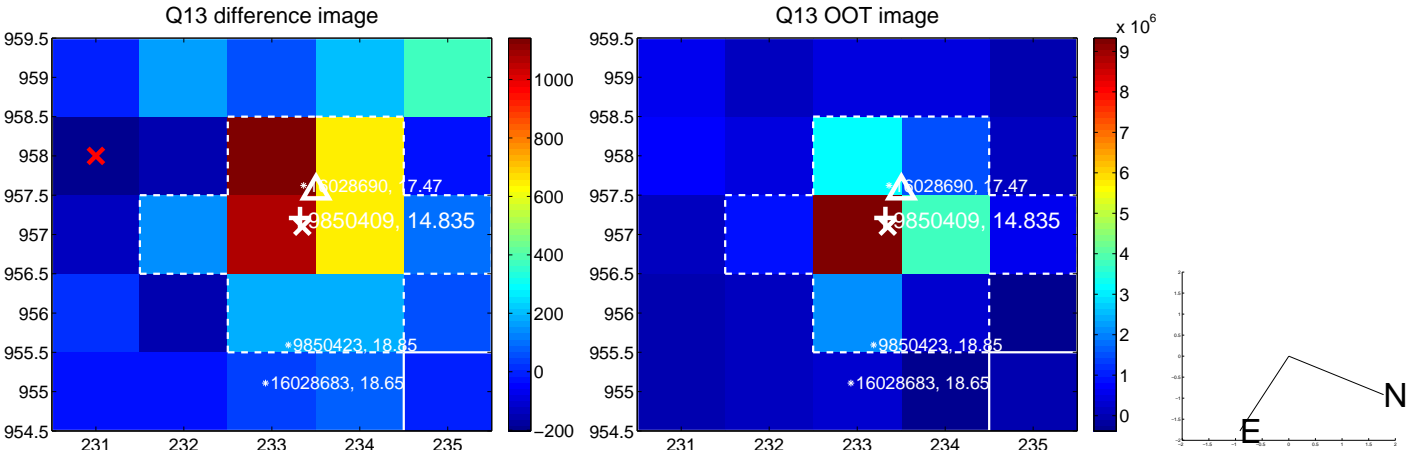




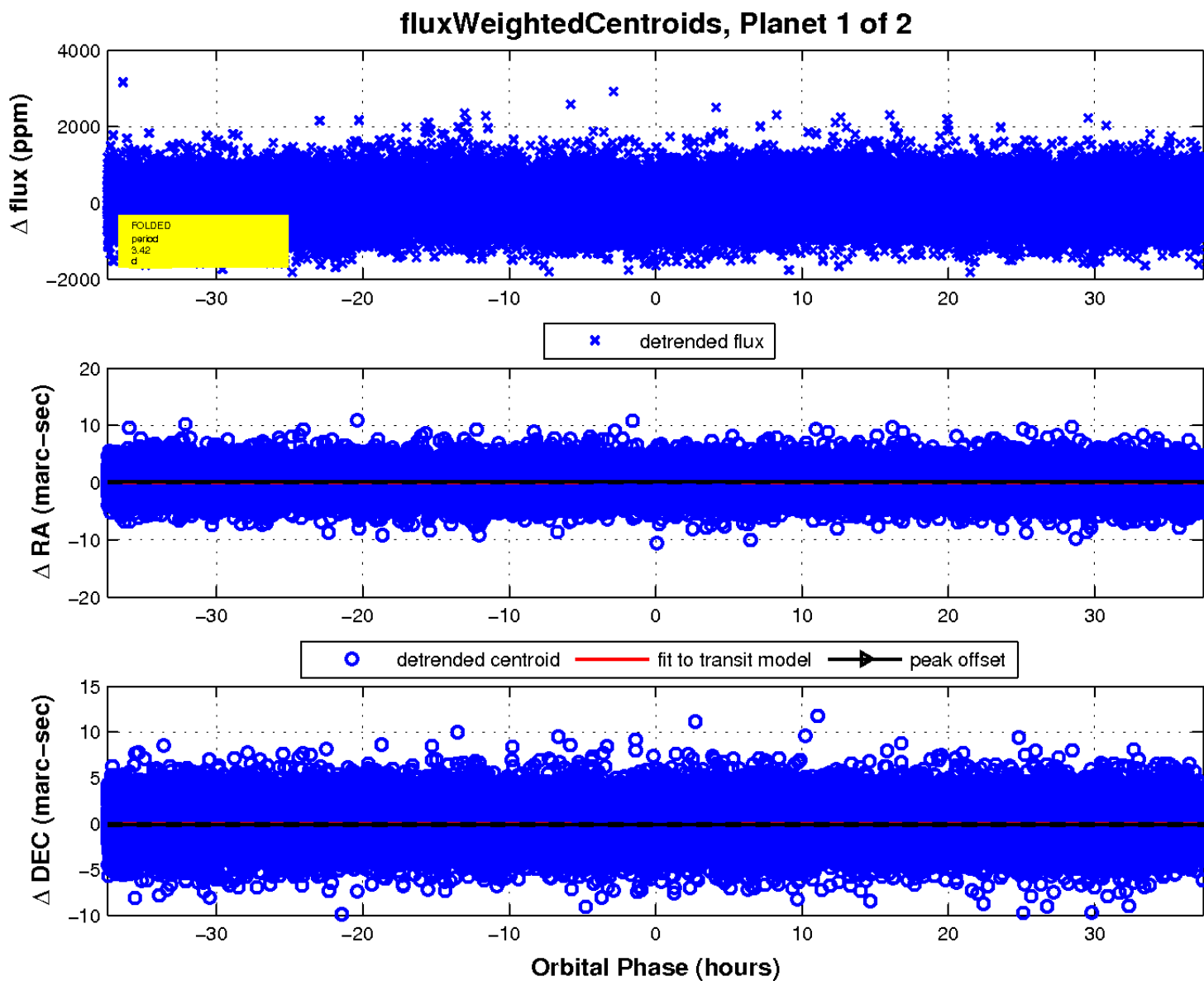
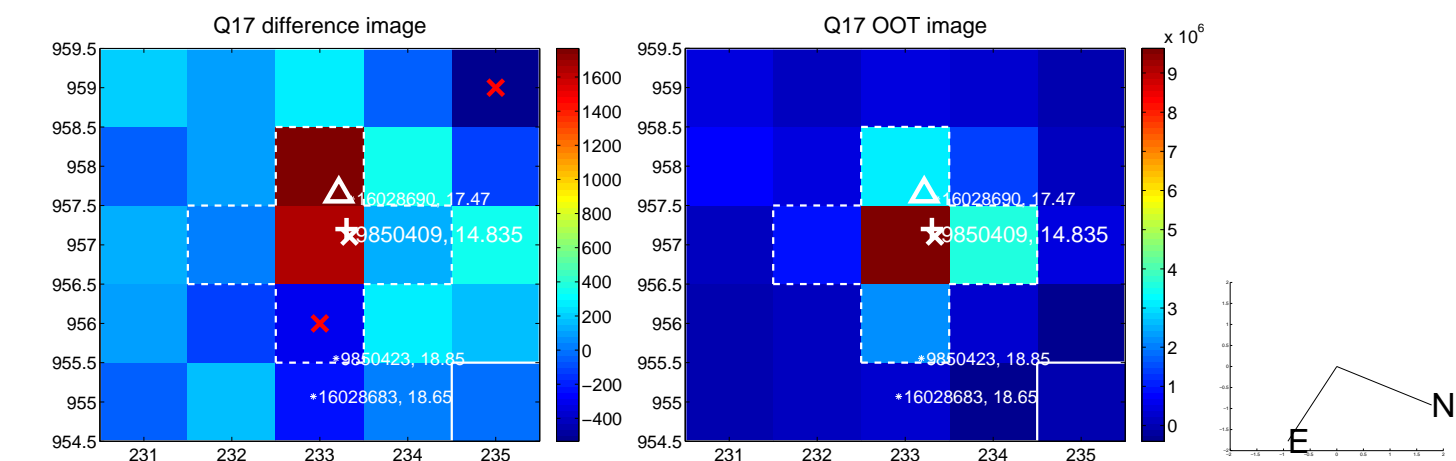
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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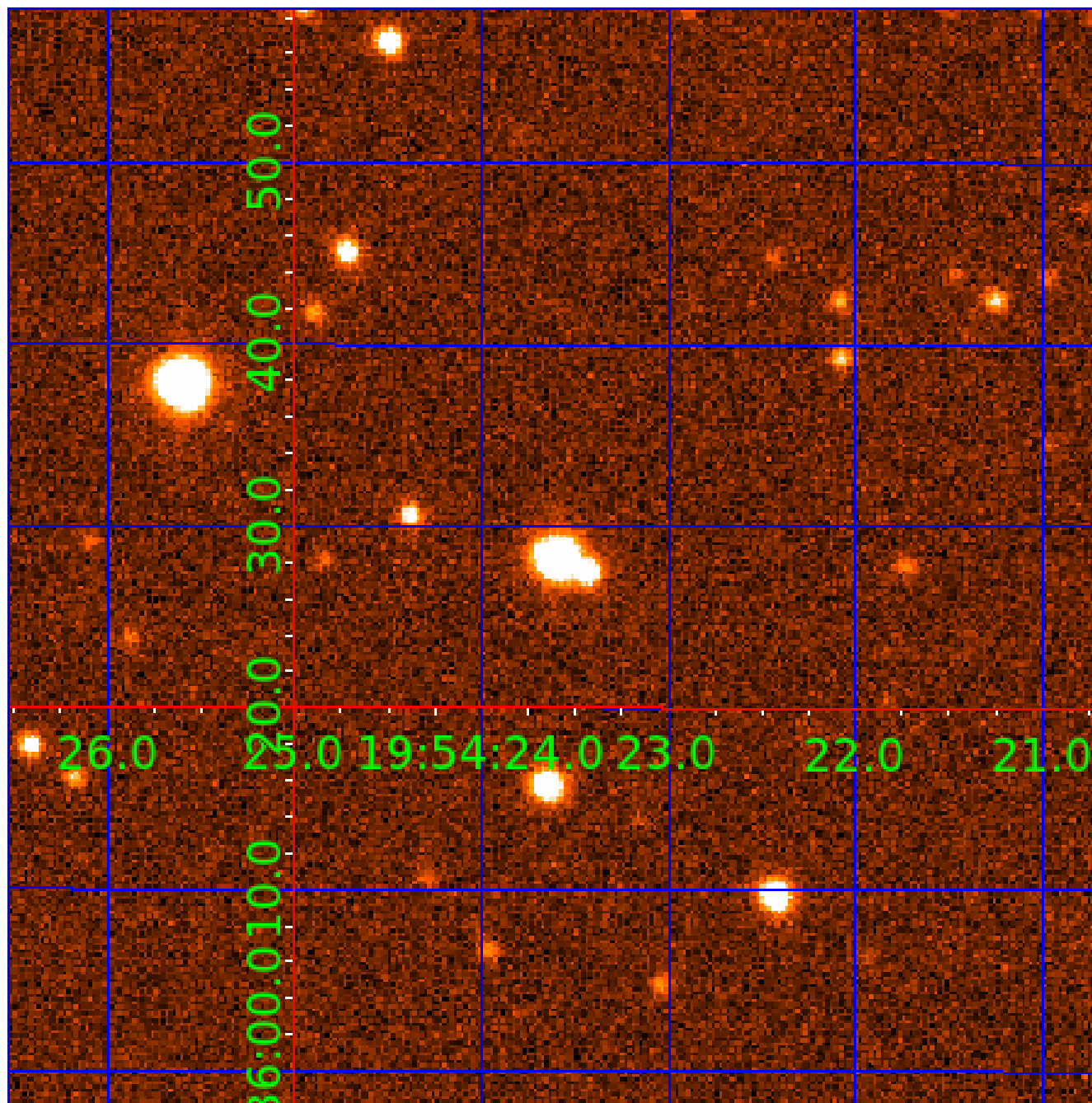


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination





# KIC 009850409

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
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## Robovetter Results

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009850409-01	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—CENT_KIC_POS
009850409-02	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT

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

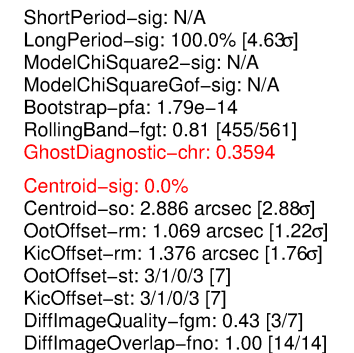
N = Not Transit-Like. S = Stellar Eclipse. C = Centroid Offset. E = Ephemeris Match.

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

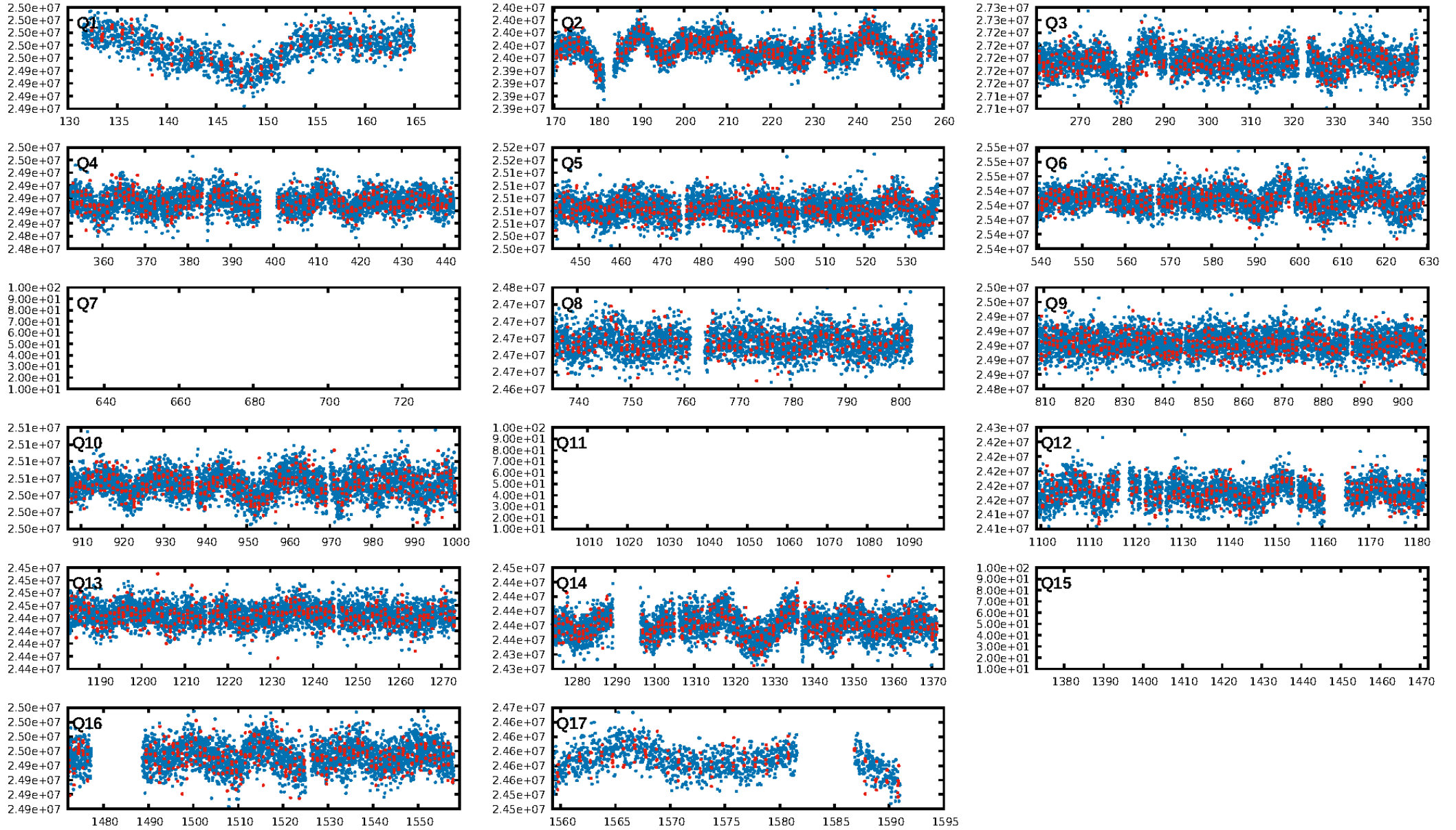
## Ephemeris Match Information For 009850409-02

No Significant Match Found

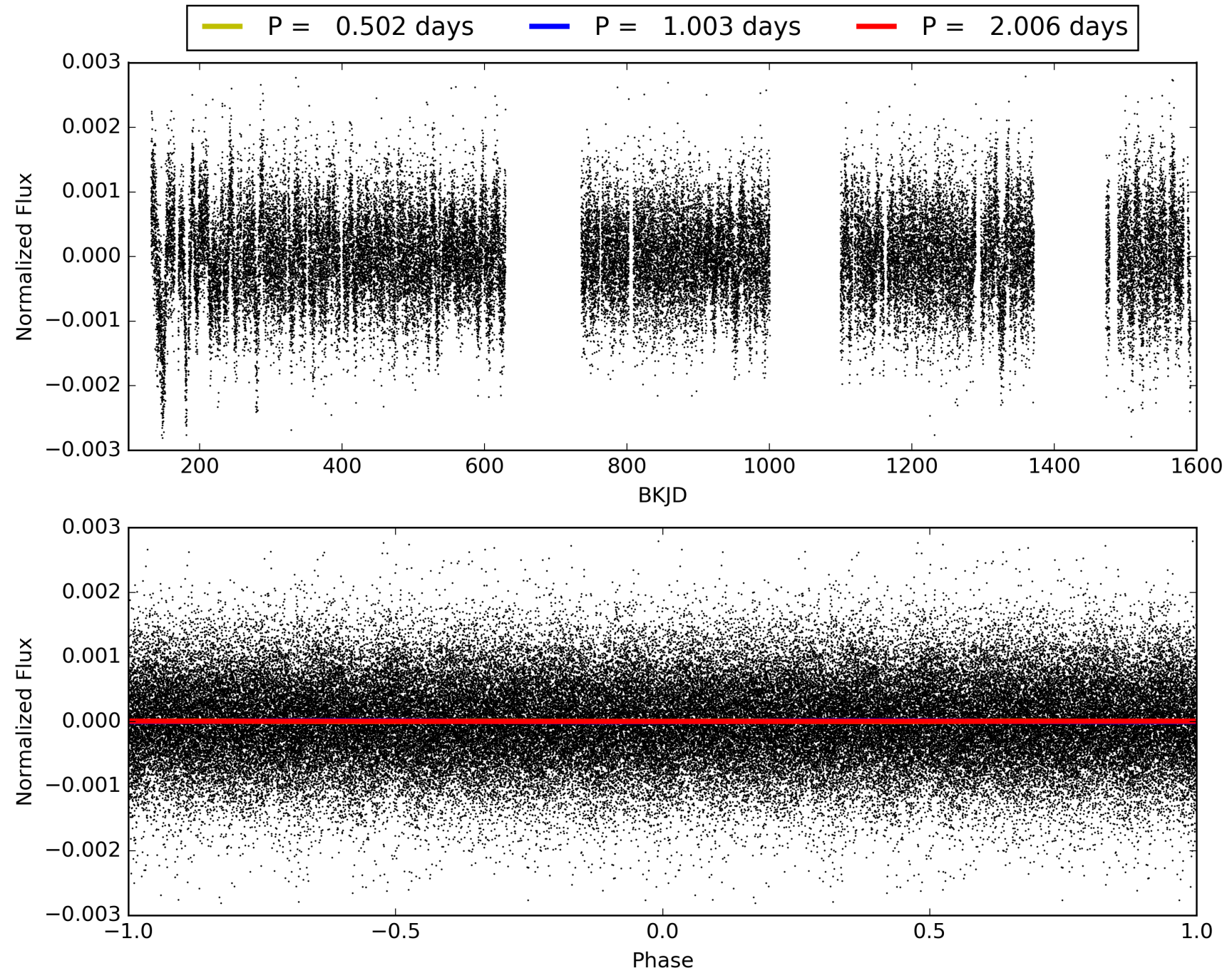
## KIC: 9850409    Candidate: 2 of 2    Period: 1.003 d



# TCE 009850409-02, PDC Light Curves



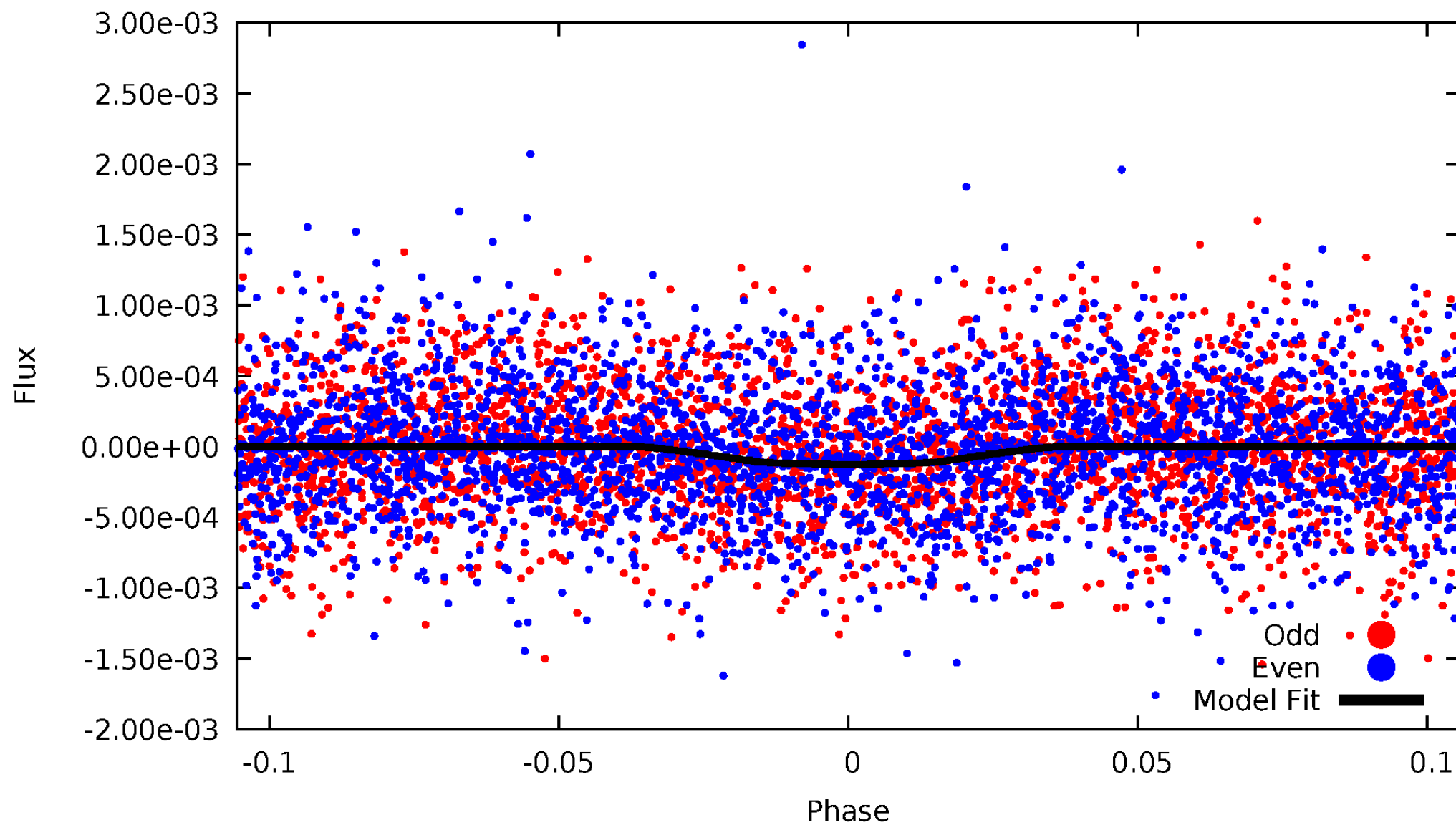
TCE 009850409-02





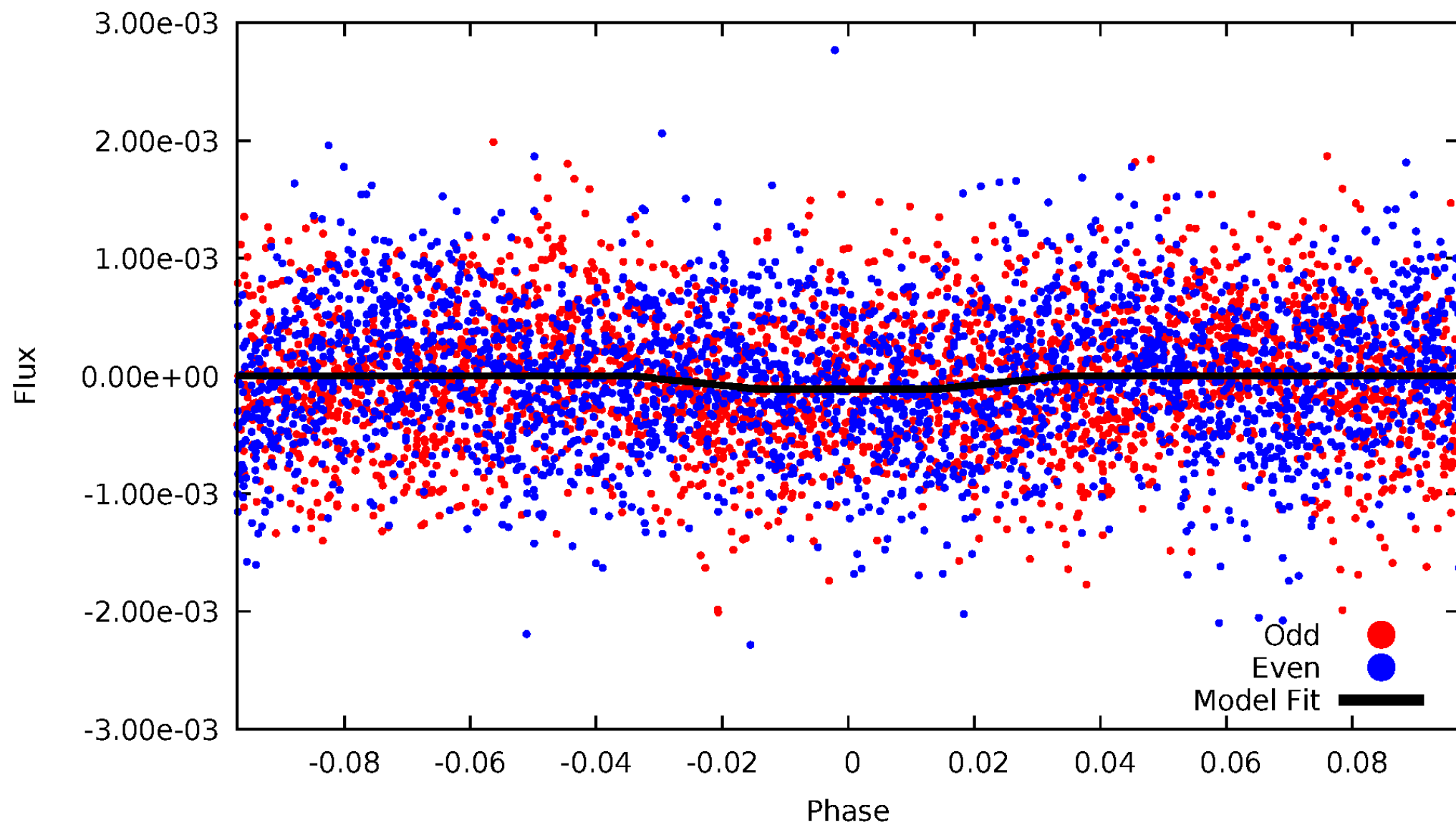
# DV Odd/Even

TCE 009850409-02



# ALT Odd/Even

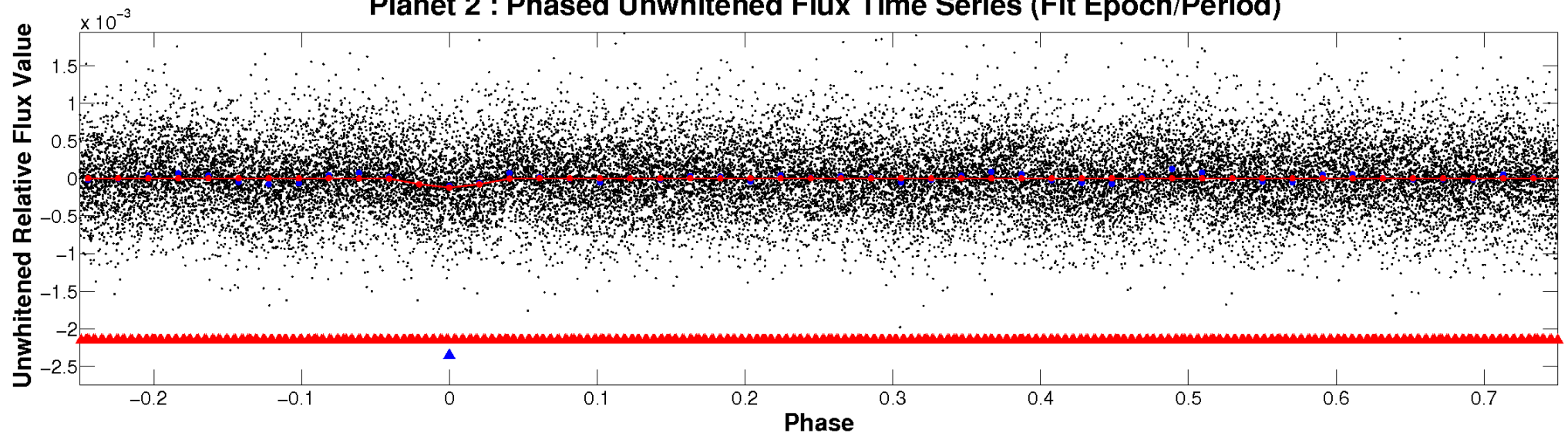
TCE 009850409-02



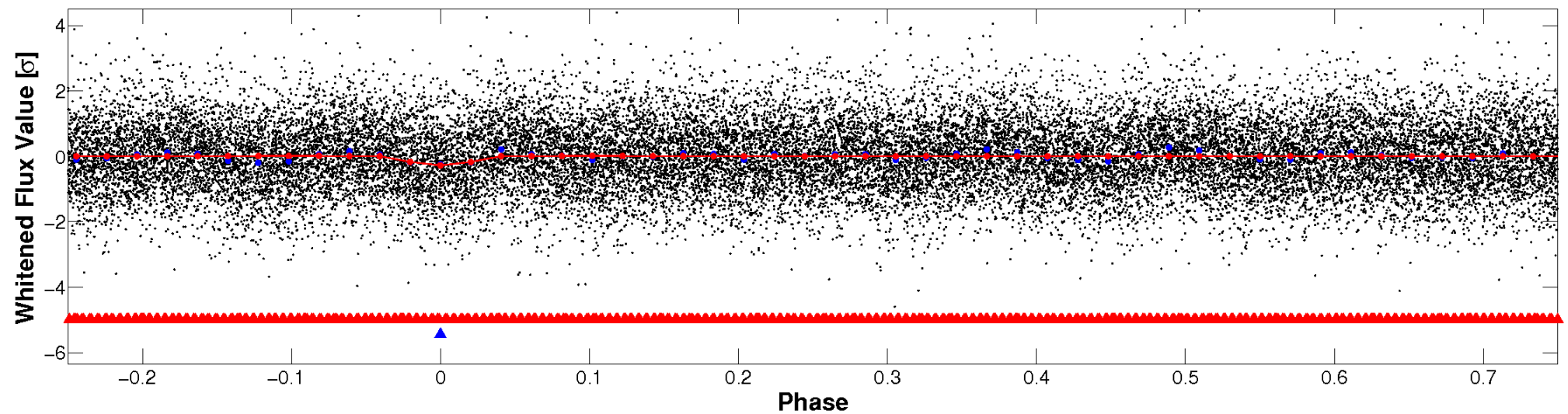


# Non-Whitened Vs. Whitened Light Curve

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

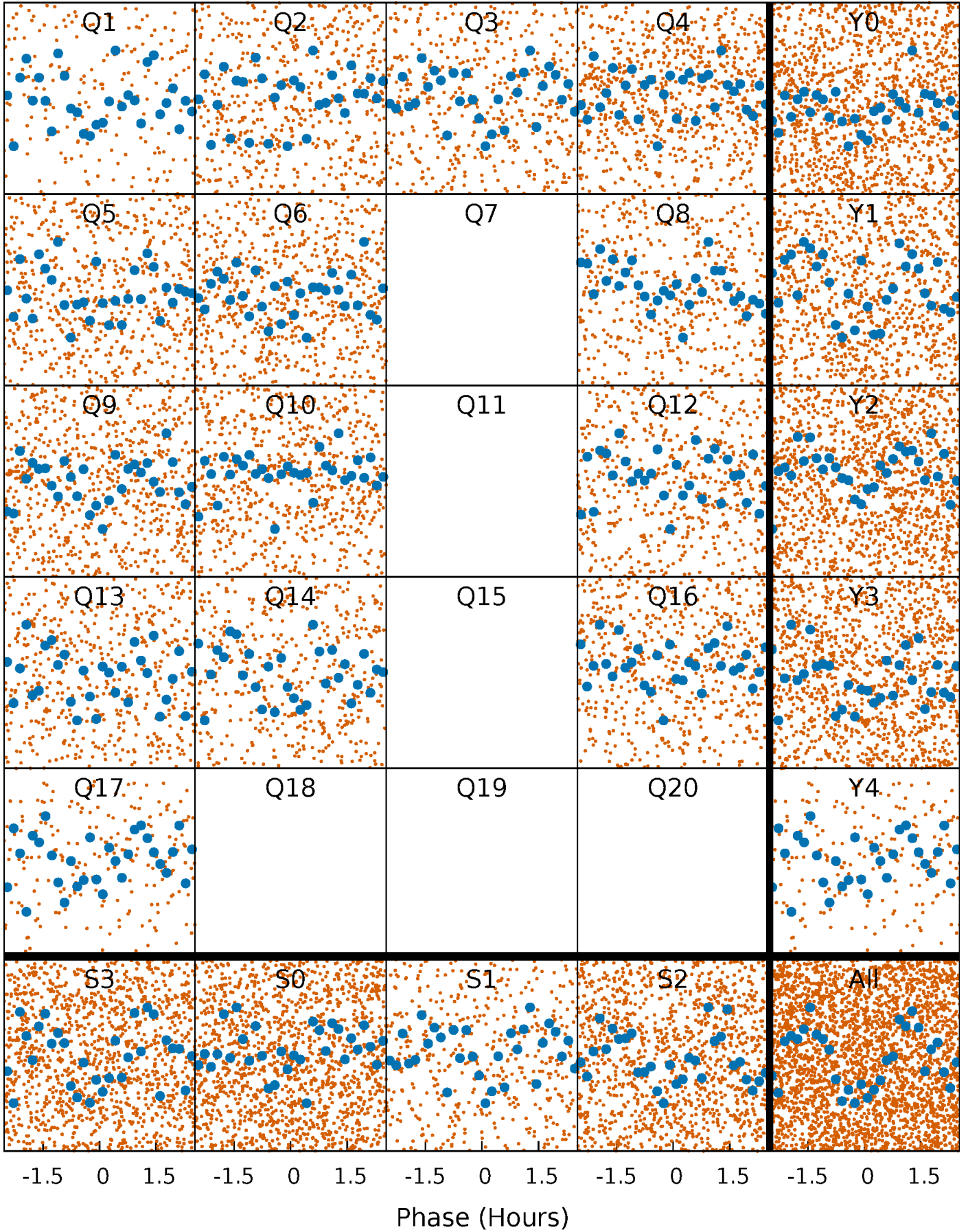


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



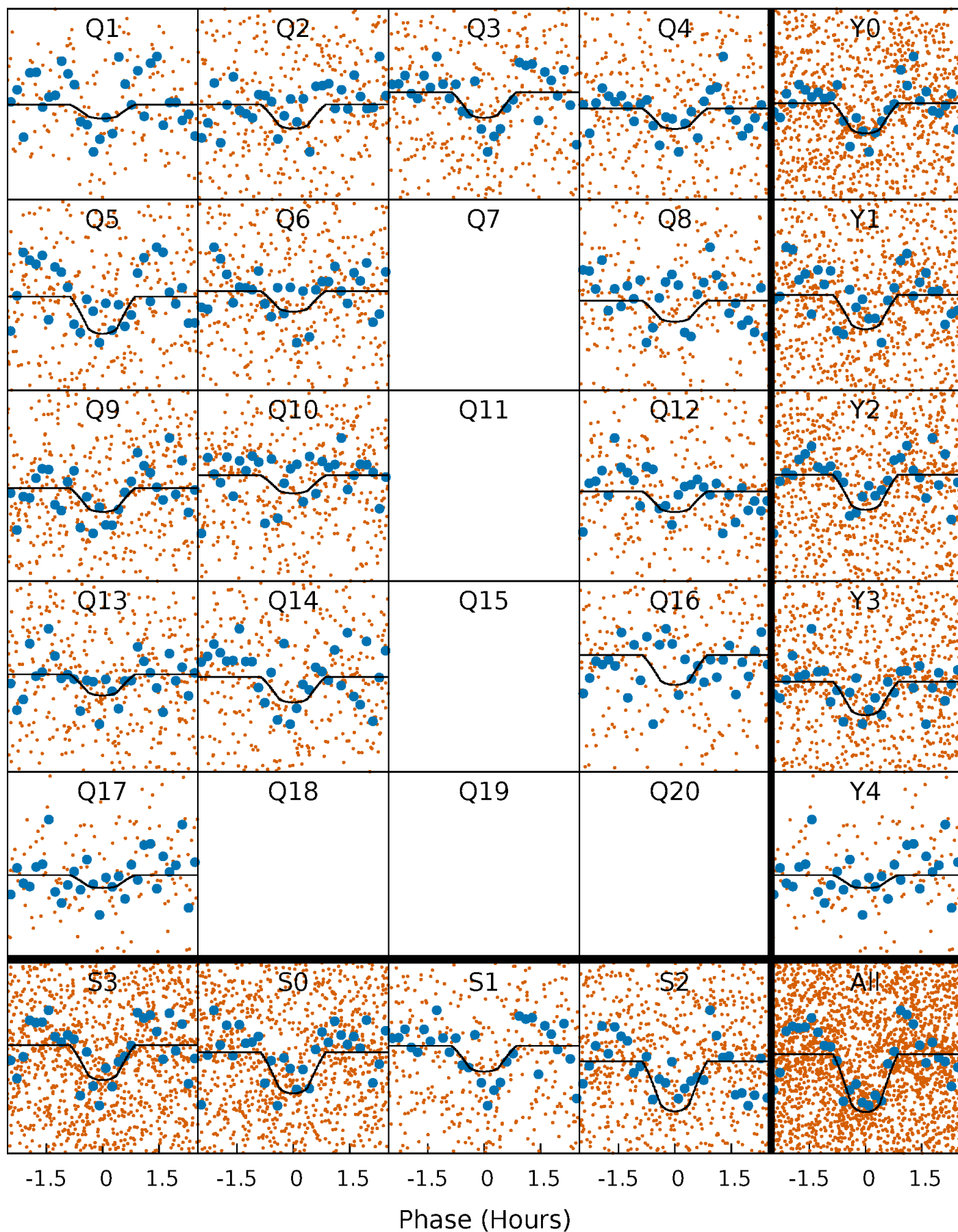
# PDC Quarter-Phased Transit Curves

TCE 009850409-02   P= 1.003005 Days    $T_0=132.456509$  (BKJD)



# DV Quarter-Phased Transit Curves

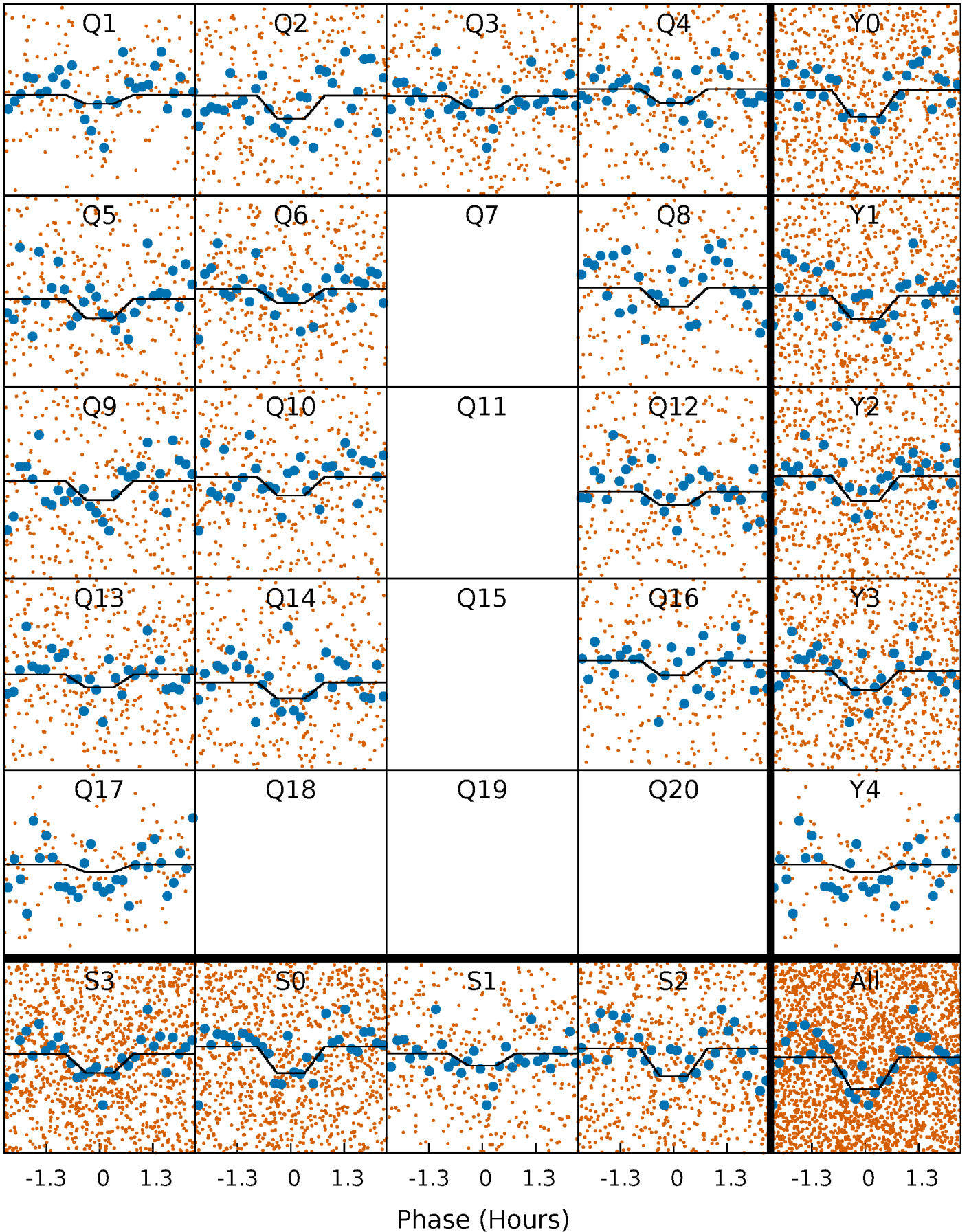
TCE 009850409-02 P= 1.003005 Days  $T_0=132.456509$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

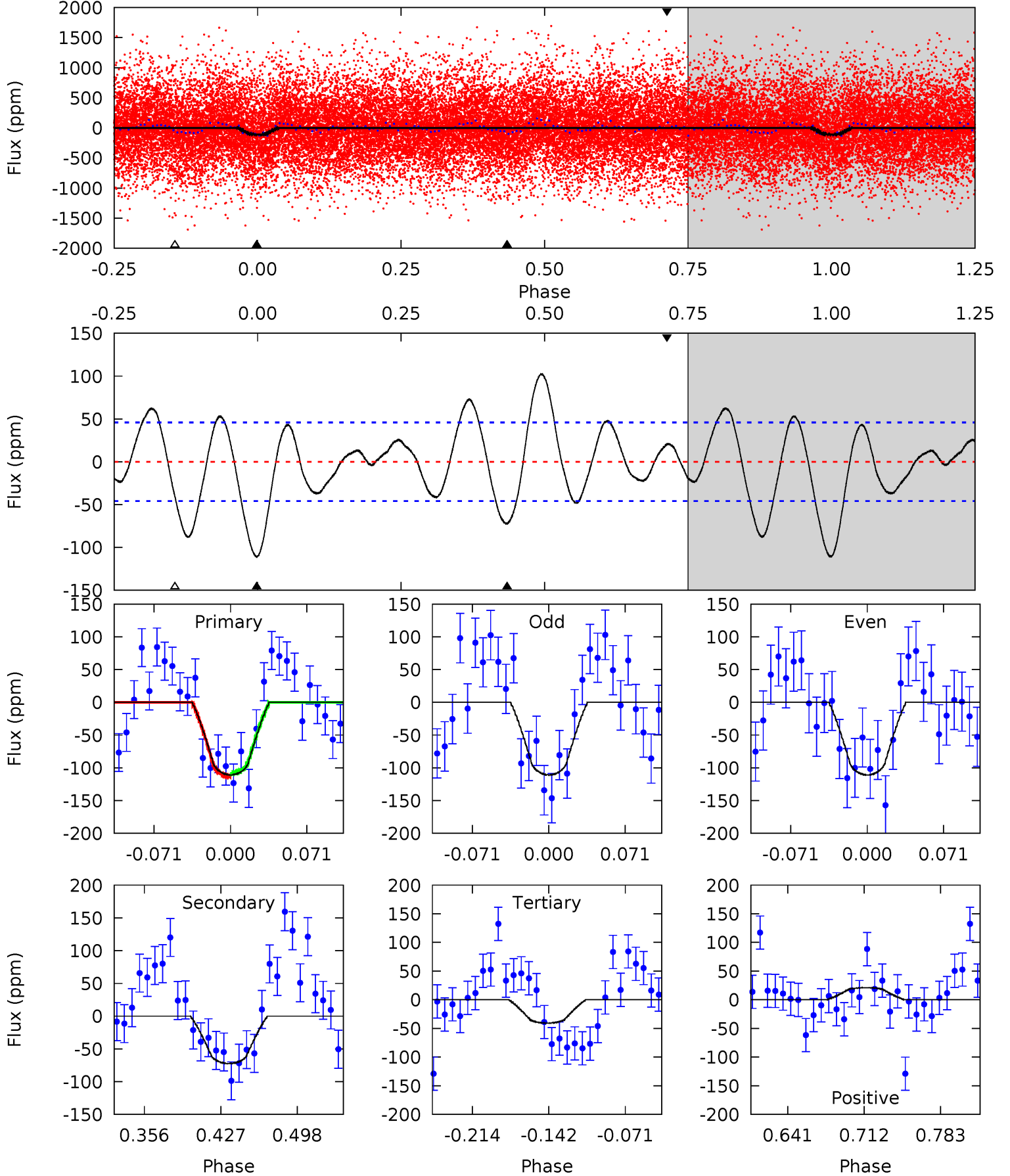
TCE 009850409-02   P= 1.003004 Days    $T_0=132.451898$  (BKJD)



# DV Model-Shift Uniqueness Test

009850409-02, P = 1.003005 Days, E = 132.456509 Days

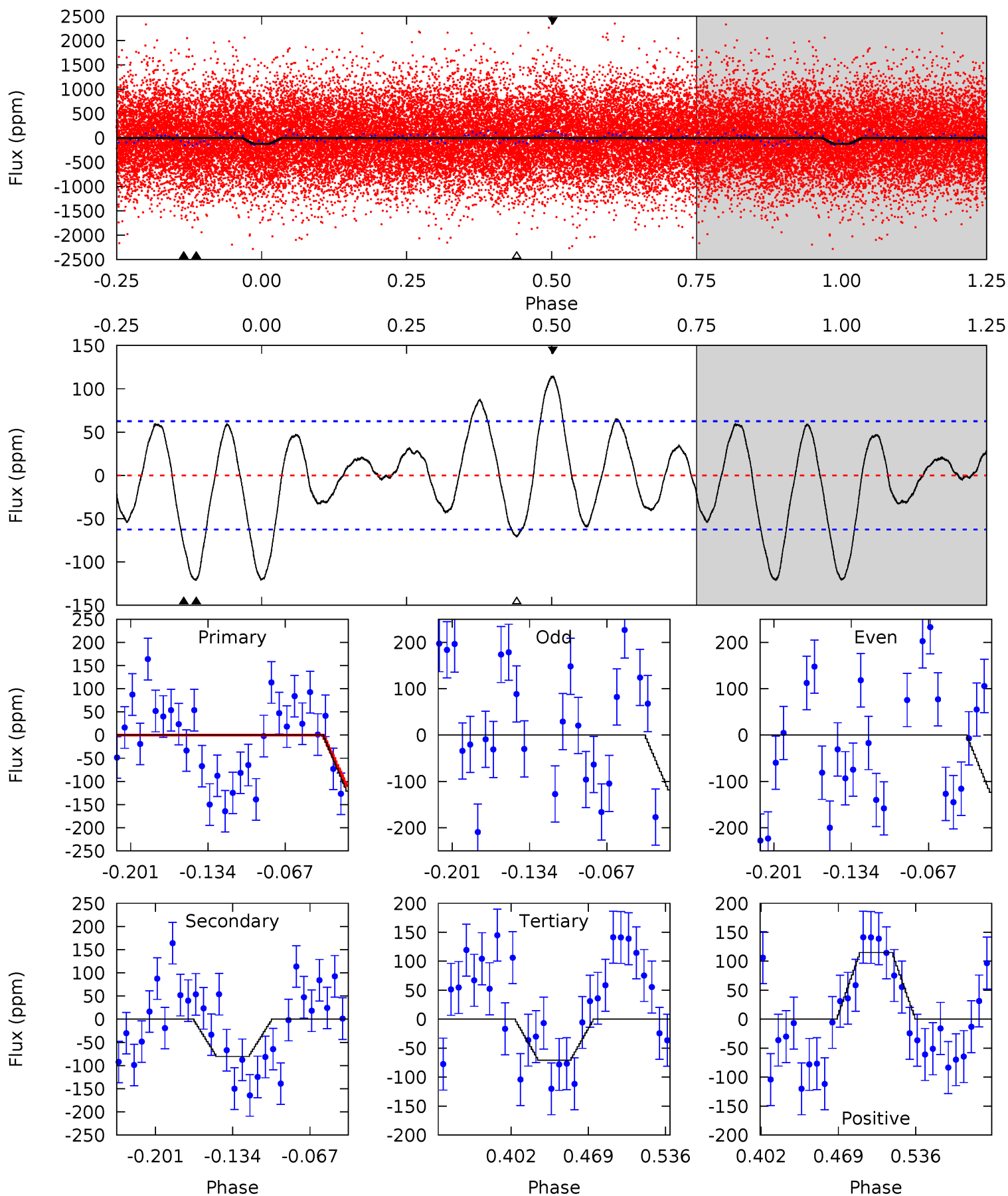
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
11.2	7.32	4.12	2.13	4.64	1.80	3.30	7.09	9.09	3.20	5.19	0.00	0.95	0.48	0.25



# Alt Model-Shift Uniqueness Test

009850409-02, P = 1.003004 Days, E = 132.451898 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
8.99	5.99	5.26	8.55	4.65	1.83	3.39	3.72	0.44	0.72	-2.56	0.19	1.03	0.49	0.89





### Stellar Parameters For KIC 009850409

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5435^{+163}_{-146}$	$4.578^{+0.026}_{-0.145}$	$0.070^{+0.250}_{-0.300}$	$0.824^{+0.163}_{-0.058}$	$0.937^{+0.065}_{-0.101}$	$2.358^{+0.324}_{-0.948}$
	+3%/-3%	+1%/-3%	+357%/-429%	+20%/-7%	+7%/-11%	+14%/-40%
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 009850409-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-72 \pm 10$	$1.48^{+1.42}_{-1.01}$	$2237^{+115}_{-78}$	$4190^{+2910}_{-902}$	$6.556^{+56.869}_{-4.826}$
Alt.	$-81 \pm 13$	$1.60^{+1.37}_{-1.08}$	$2241^{+110}_{-89}$	$4163^{+2717}_{-869}$	$6.214^{+51.959}_{-4.489}$

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

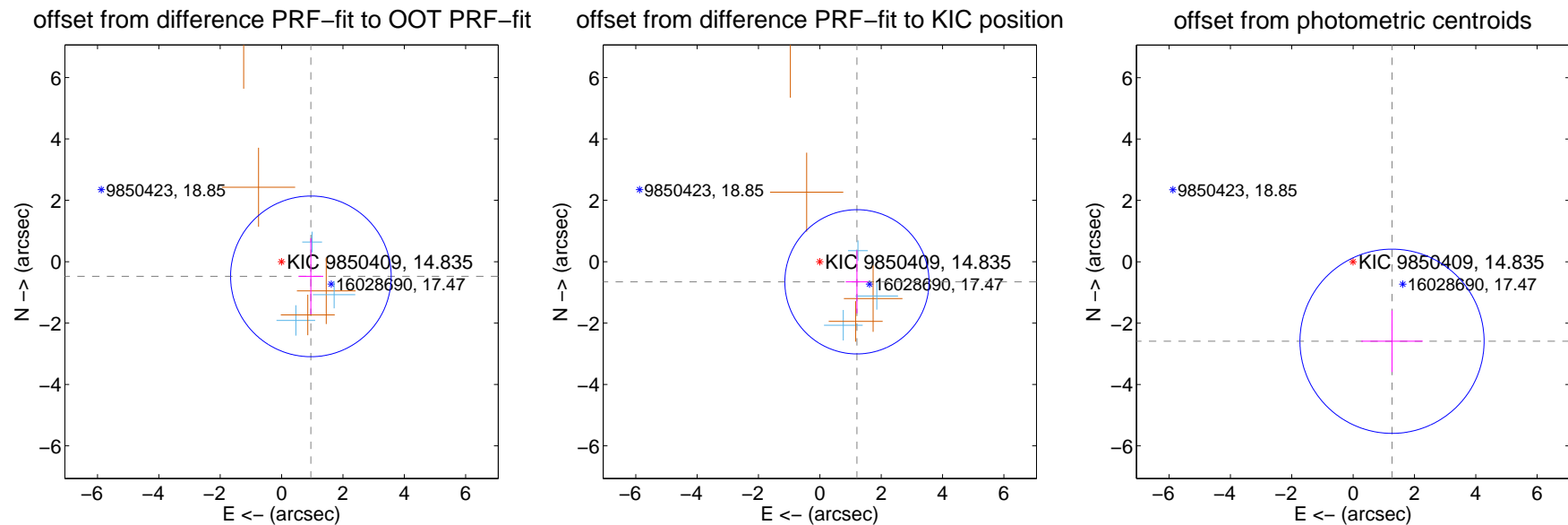
## DV Centroid Data

Supplemental centroid analysis for 009850409-02. Kepler magnitude: 14.84. Transit SNR 8.78

There are 3 quarters with good PRF difference image offsets

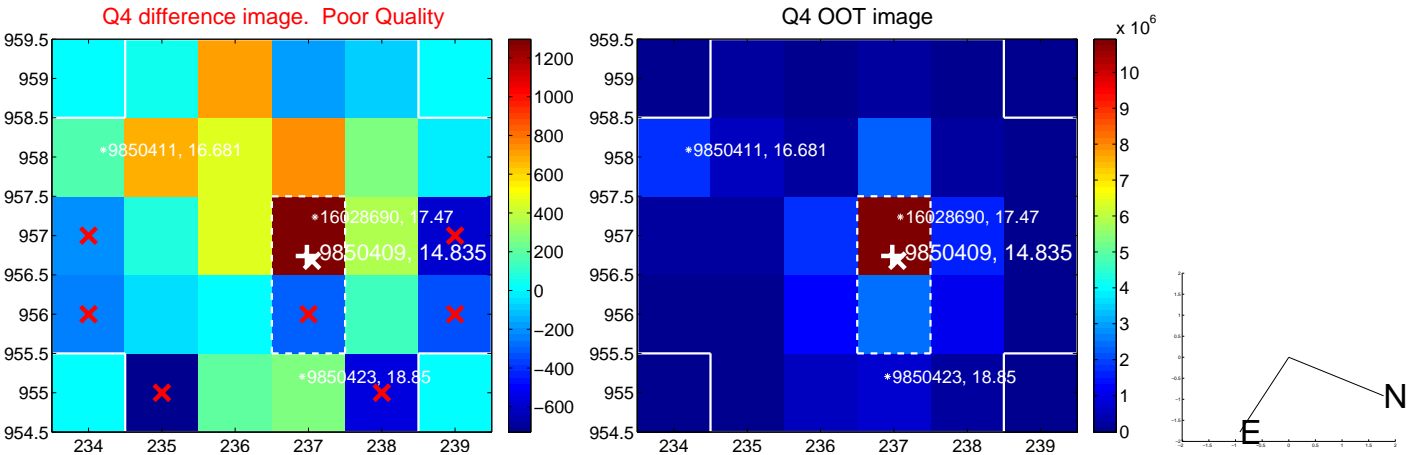
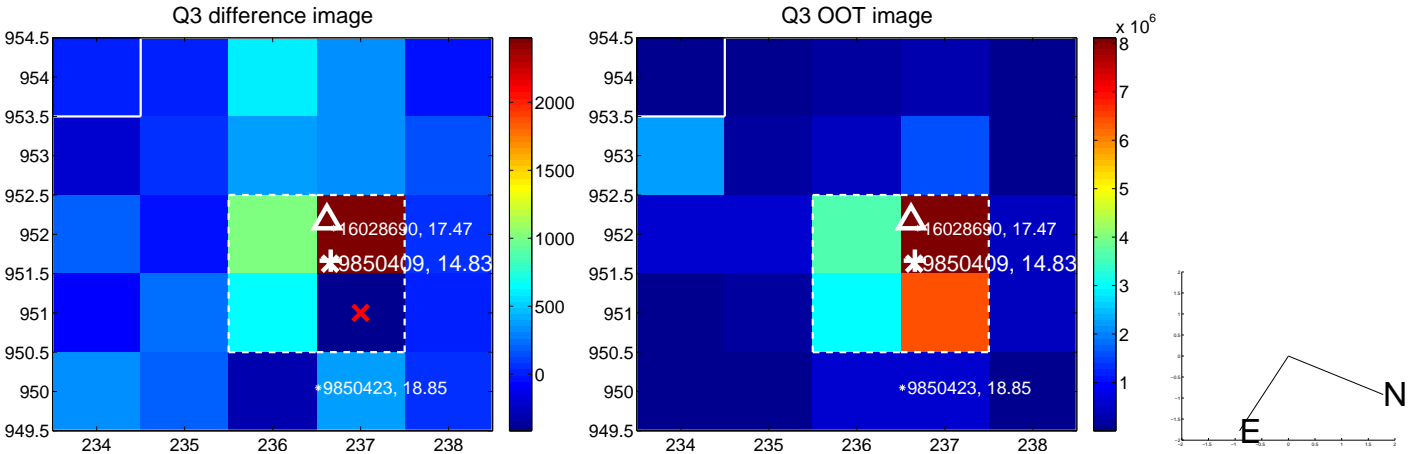
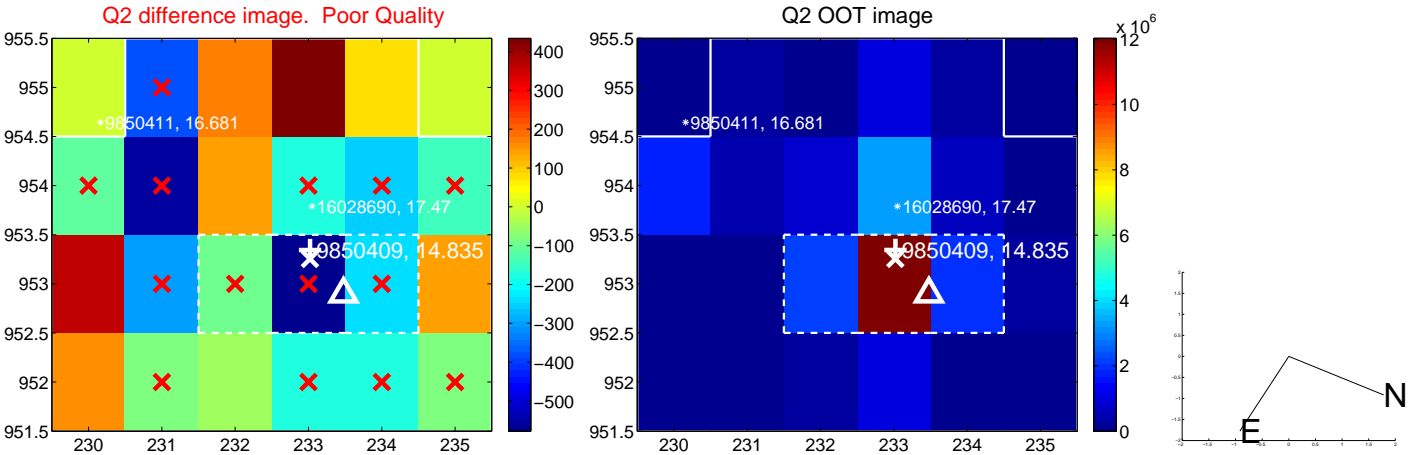
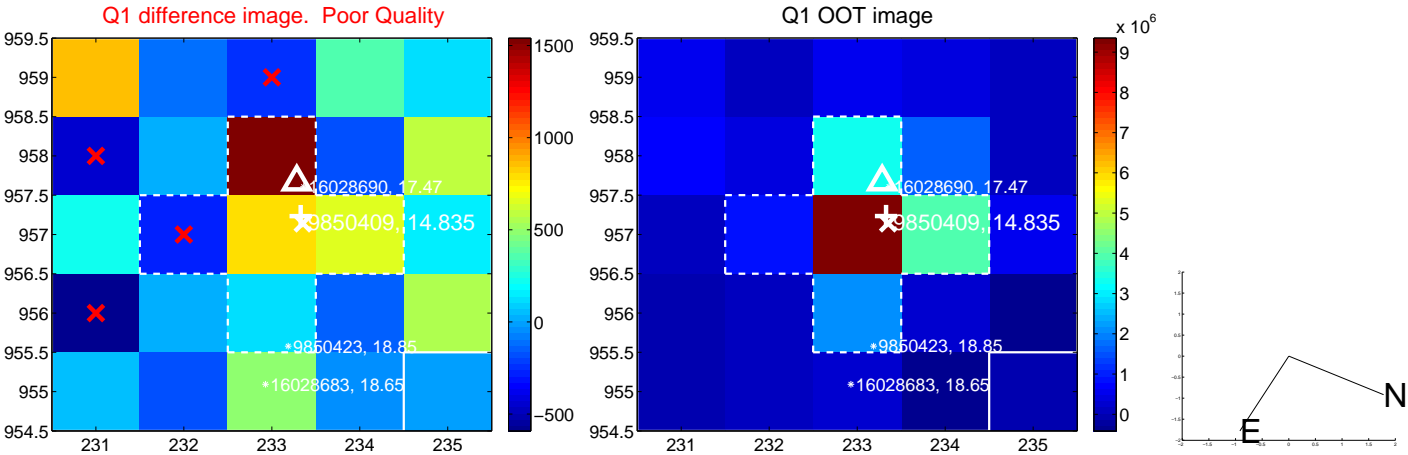
The direct PRF centroid is offset from the target star catalog position by about 0.40 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.069 \pm 0.873$	1.22	$-0.956 \pm 0.403$	$-0.478 \pm 1.241$
PRF-fit source offset from KIC position	$1.376 \pm 0.784$	1.76	$-1.209 \pm 0.365$	$-0.655 \pm 1.029$
photometric centroid source offset	$2.89 \pm 1.00$	2.88	$-1.27 \pm 1.00$	$-2.59 \pm 1.00$

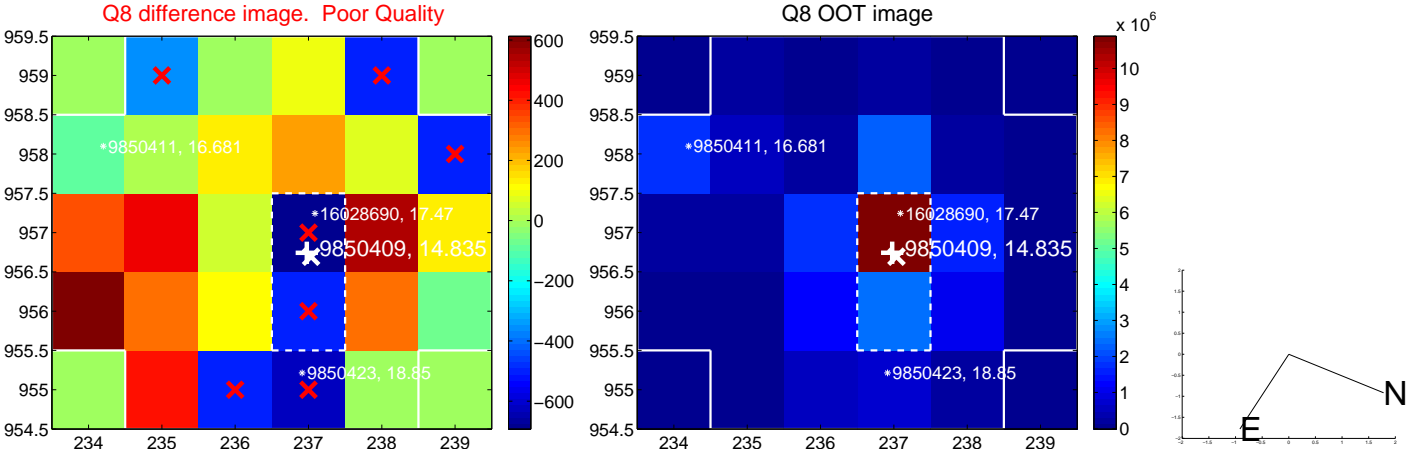
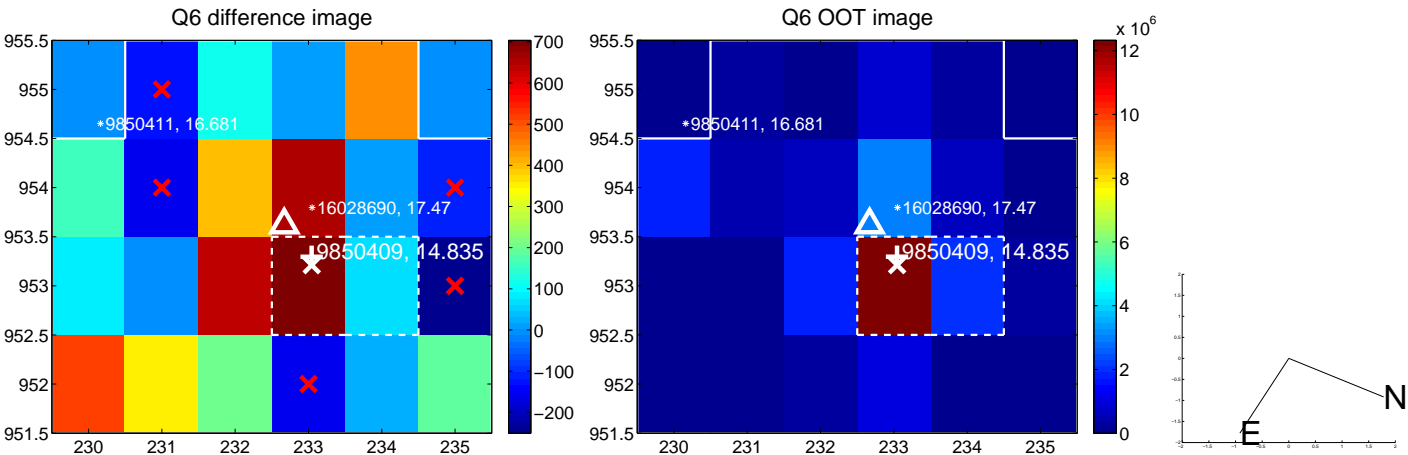
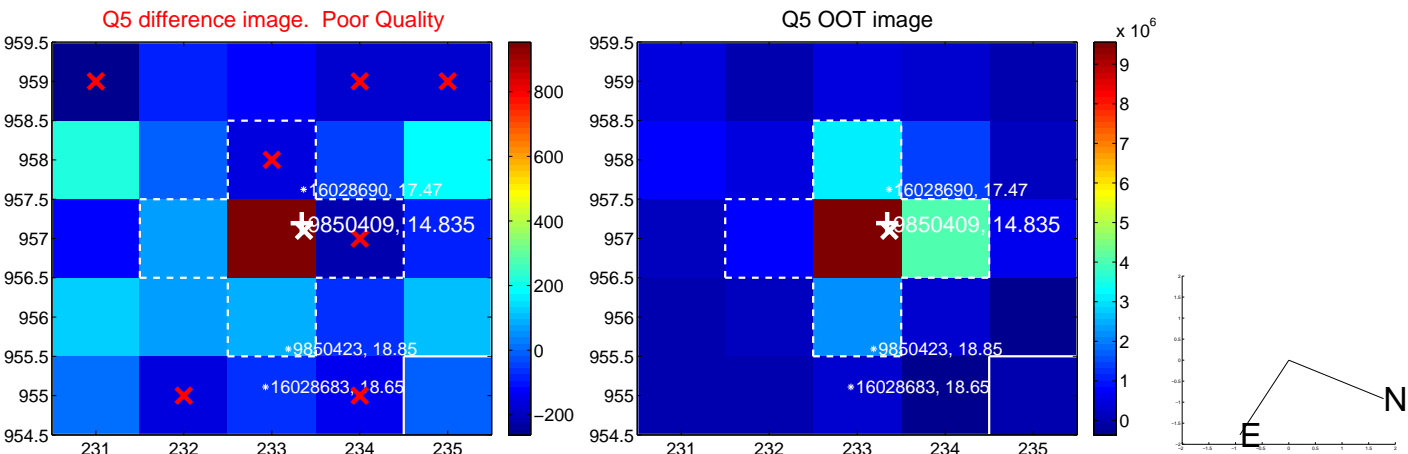


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

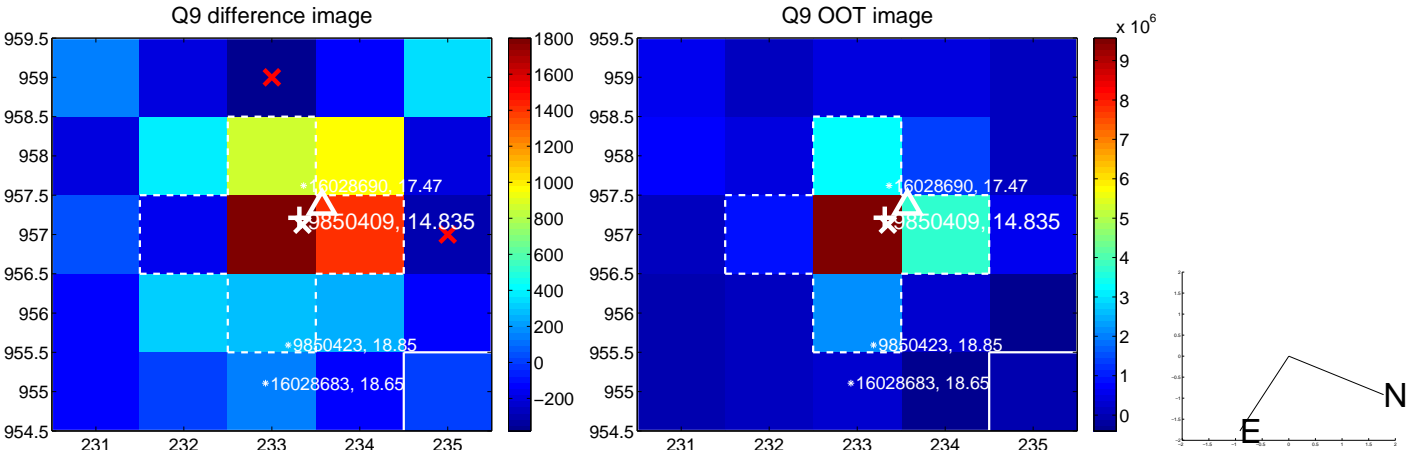
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



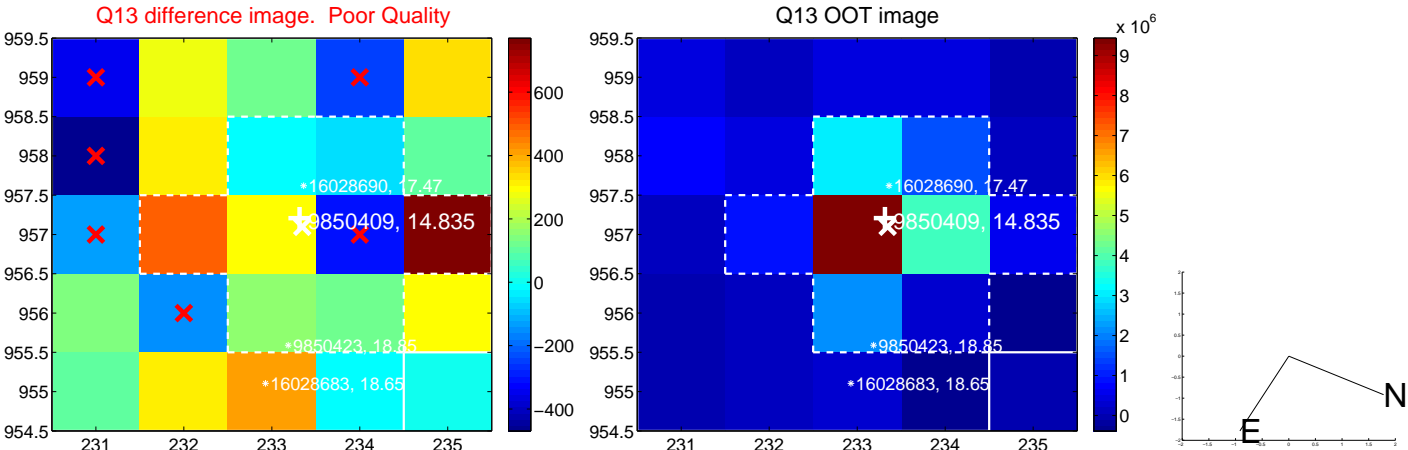
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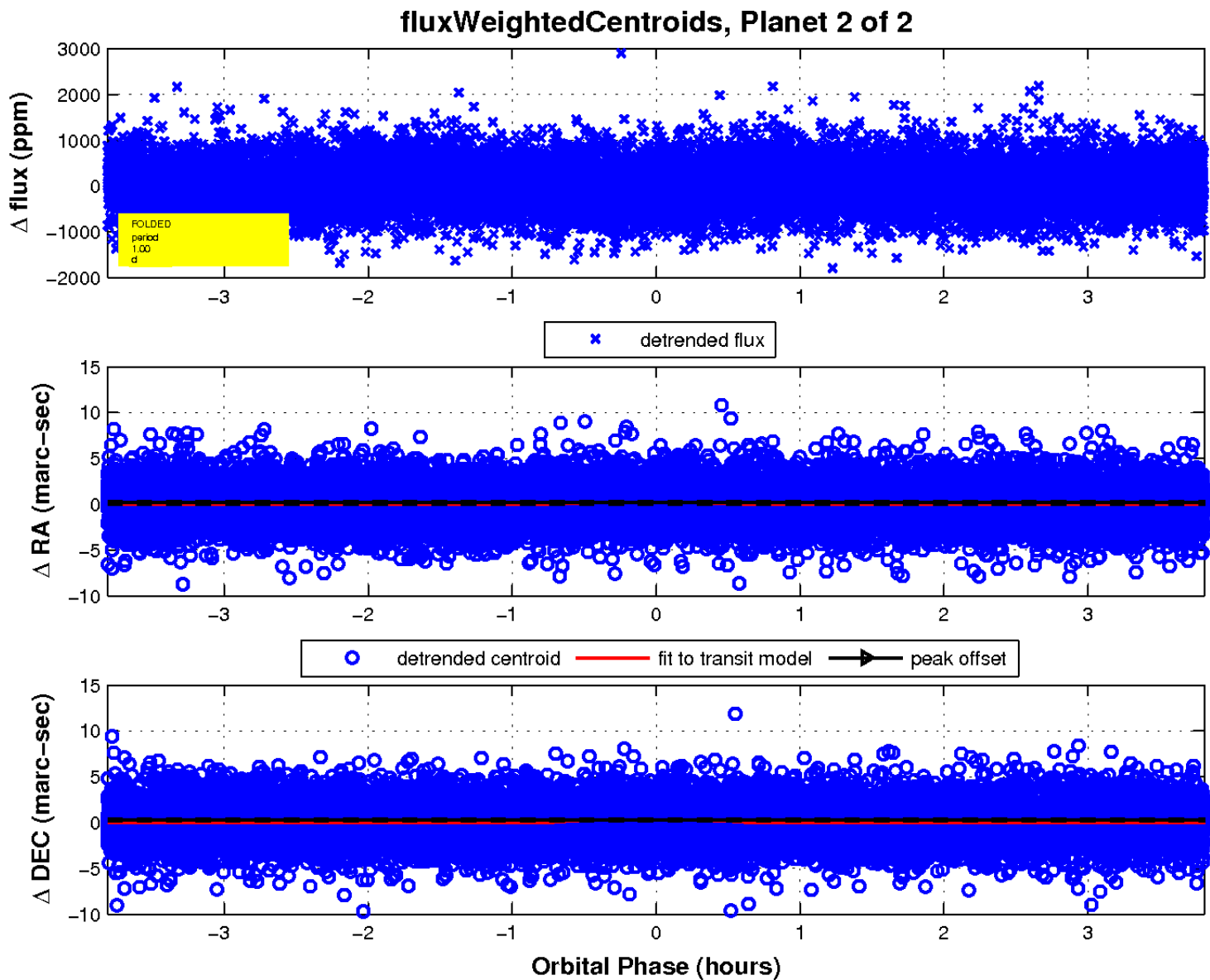
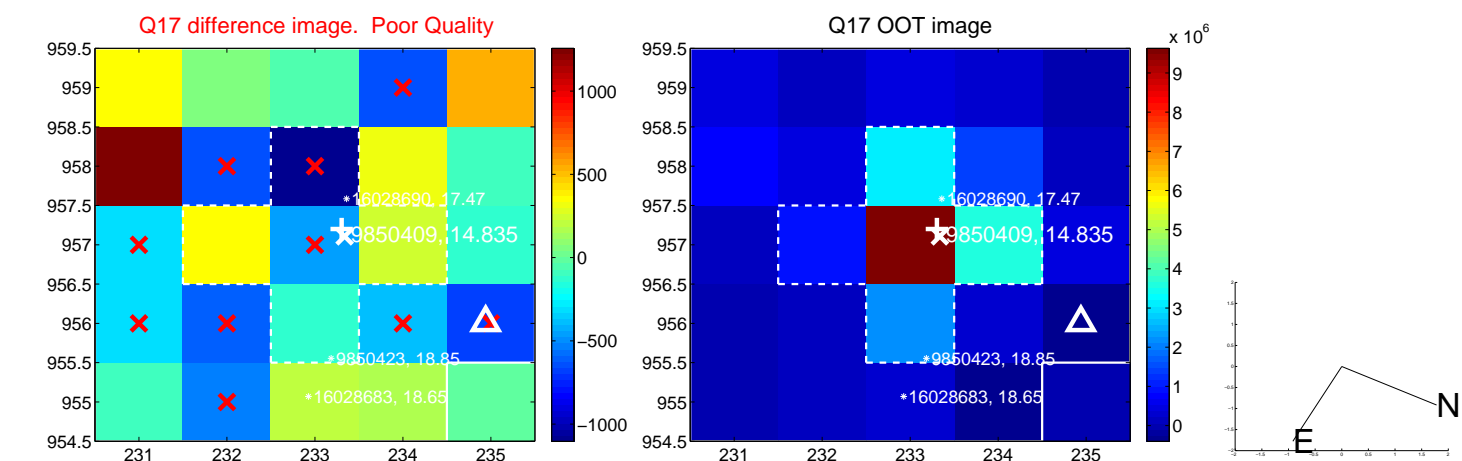


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UKIRT Image

