

# KIC 003644116

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
003644116-01	OBS	No	0.545167	131.525019	23.9	1.879	16.1	14.0	2.01	7737	1.14	49761.91
003644116-02	OBS	No	0.859100	131.685256	17.6	4.947	9.3	9.1	2.01	7737	0.86	27135.97

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
003644116-01	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—CENT_SATURATED
003644116-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE_ZUMA—TRANS_GAPPED—LPP_DV—LPP_ALT—CENT_SATURATED

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

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

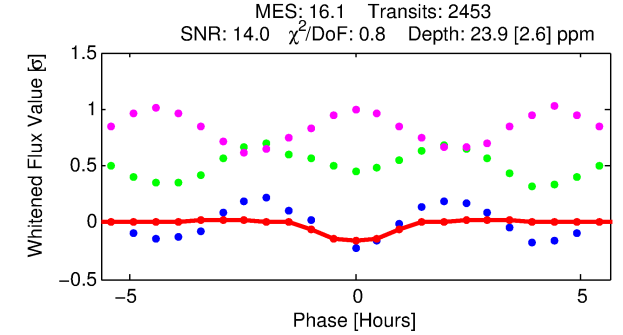
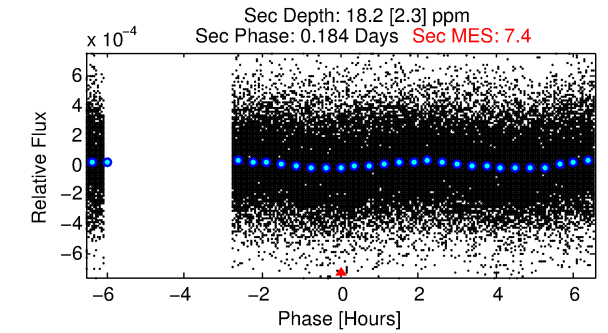
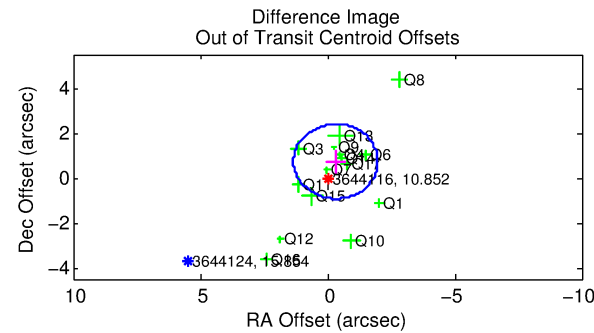
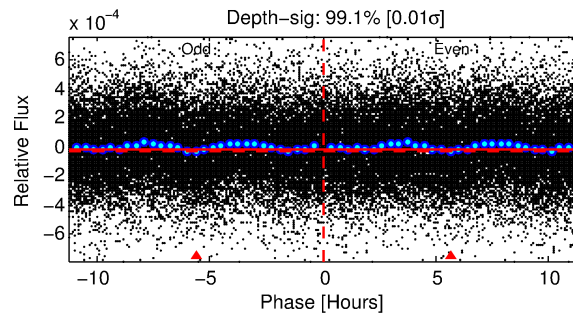
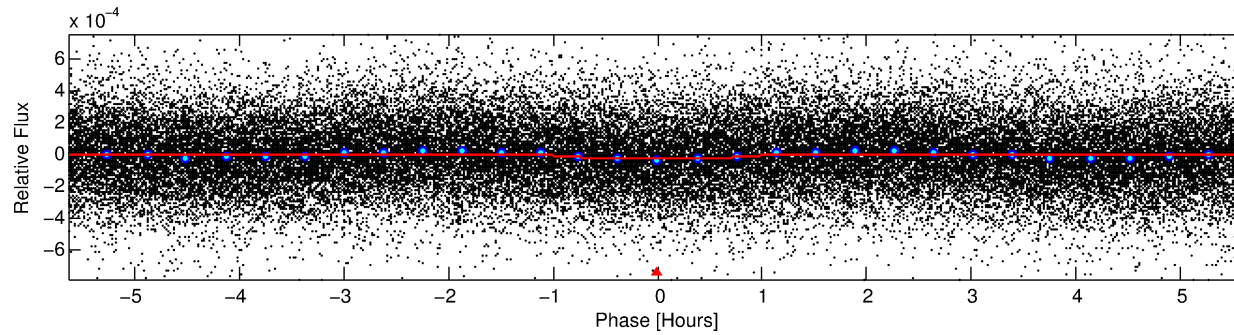
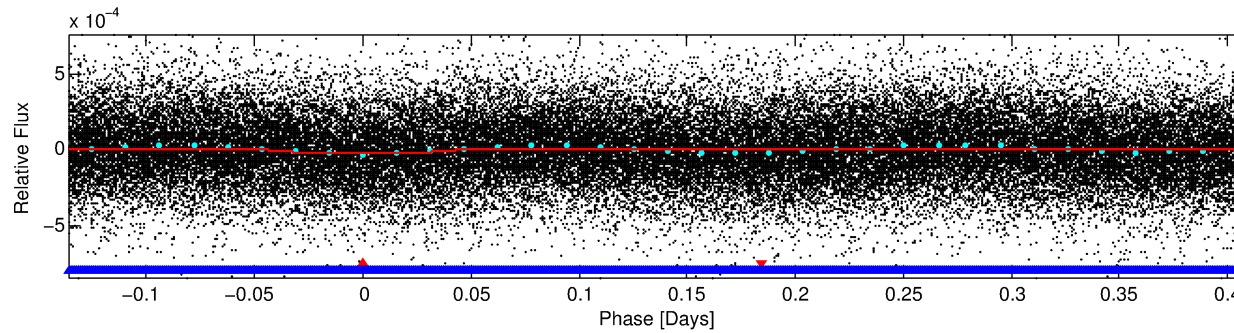
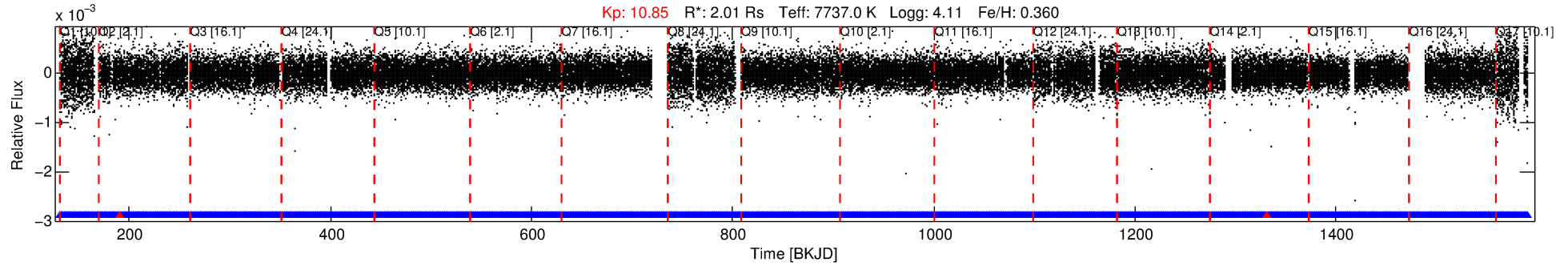
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 003644116-01

No Significant Match Found

# DV One-Page Summary

KIC: 3644116 Candidate: 1 of 2 Period: 0.545 d



## DV Fit Results:

Period = 0.54517 [0.00001] d  
Epoch = 131.5250 [0.0023] BKJD  
Rp/R\* = 0.0052 [0.0019]  
a/R\* = 1.36 [1.44]  
b = 0.90 [0.49]  
Seff = 49761.91 [18570.05]  
Teq = 3808 [355] K  
Rp = 1.14 [0.50] Re  
a = 0.0162 [0.0036] AU  
Ag = 2.01 [1.60] [0.63σ]  
Teffp = 7013 [1306] K [2.37σ]

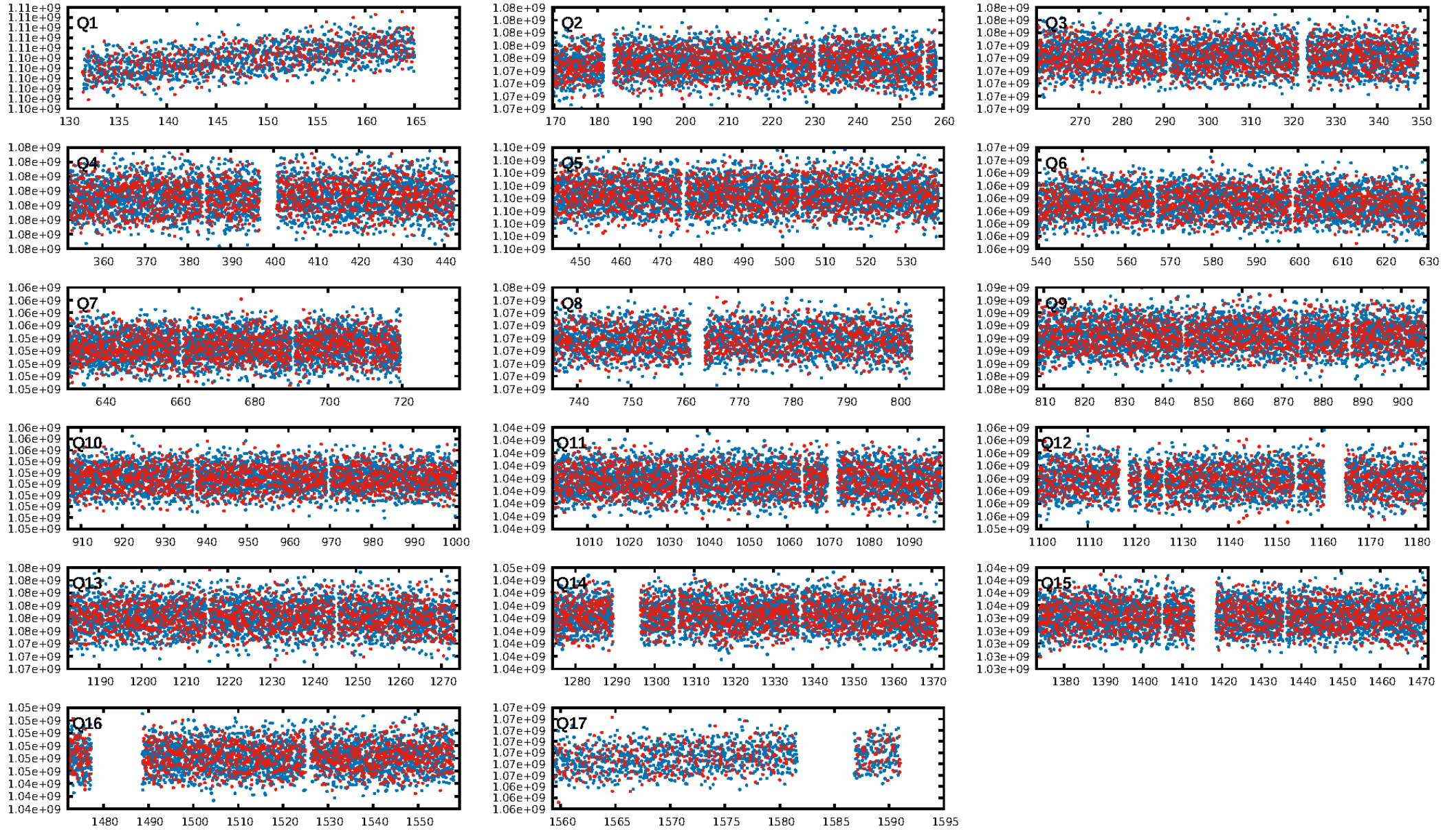
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 84.5% [1.42σ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: 7.50e-23  
RollingBand-fgt: 1.00 [2340/2342]  
GhostDiagnostic-chr: 2.174  
Centroid-sig: 16.1%  
Centroid-so: 0.458 arcsec [0.89σ]  
OotOffset-rm: 0.797 arcsec [1.44σ]  
KicOffset-rm: 0.975 arcsec [1.65σ]  
OotOffset-st: 3/4/4/4 [15]  
KicOffset-st: 3/4/4/4 [15]  
DiffImageQuality-fgm: 0.80 [12/15]  
DiffImageOverlap-fno: 1.00 [17/17]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 04:43:17 Z

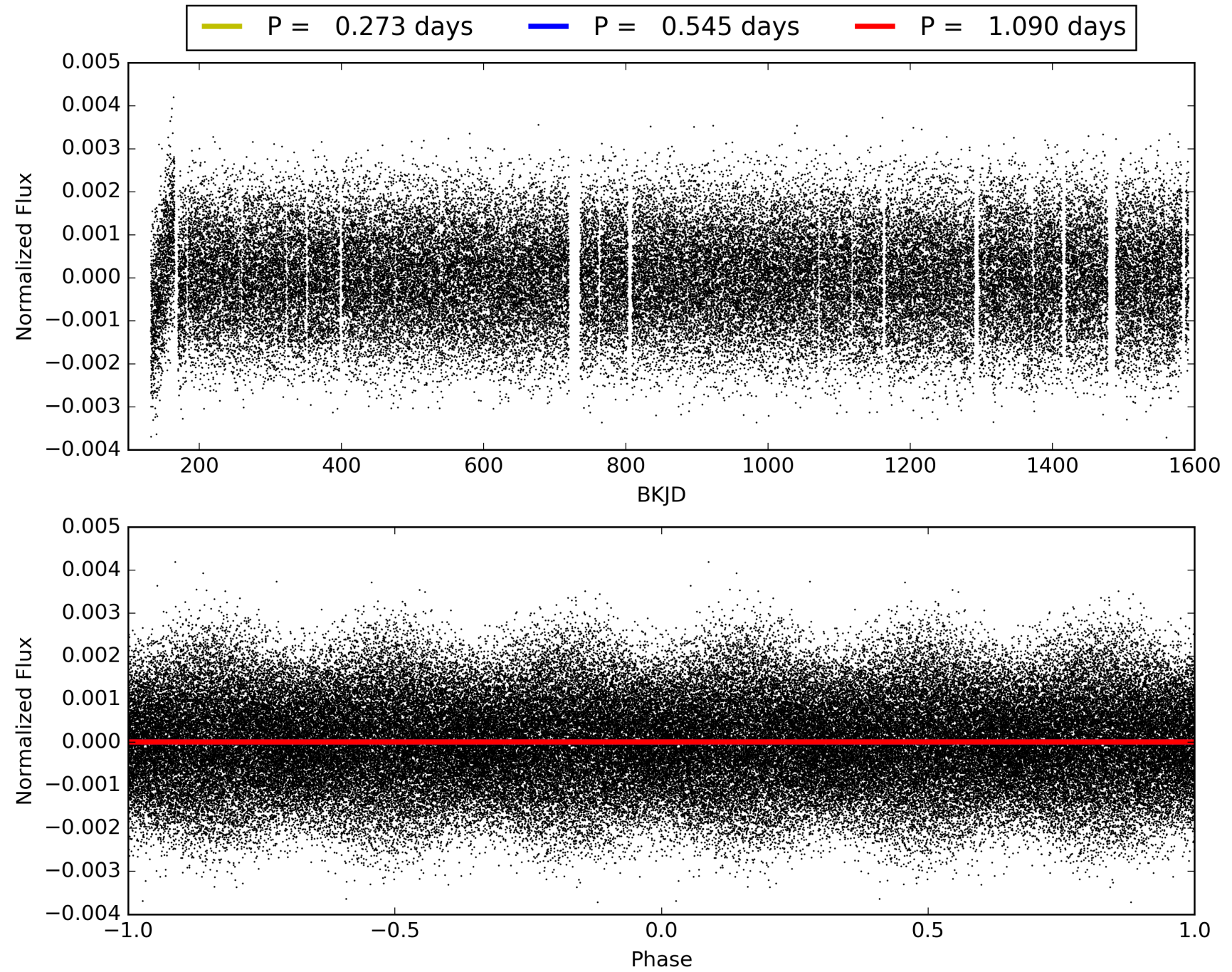
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 003644116-01, PDC Light Curves



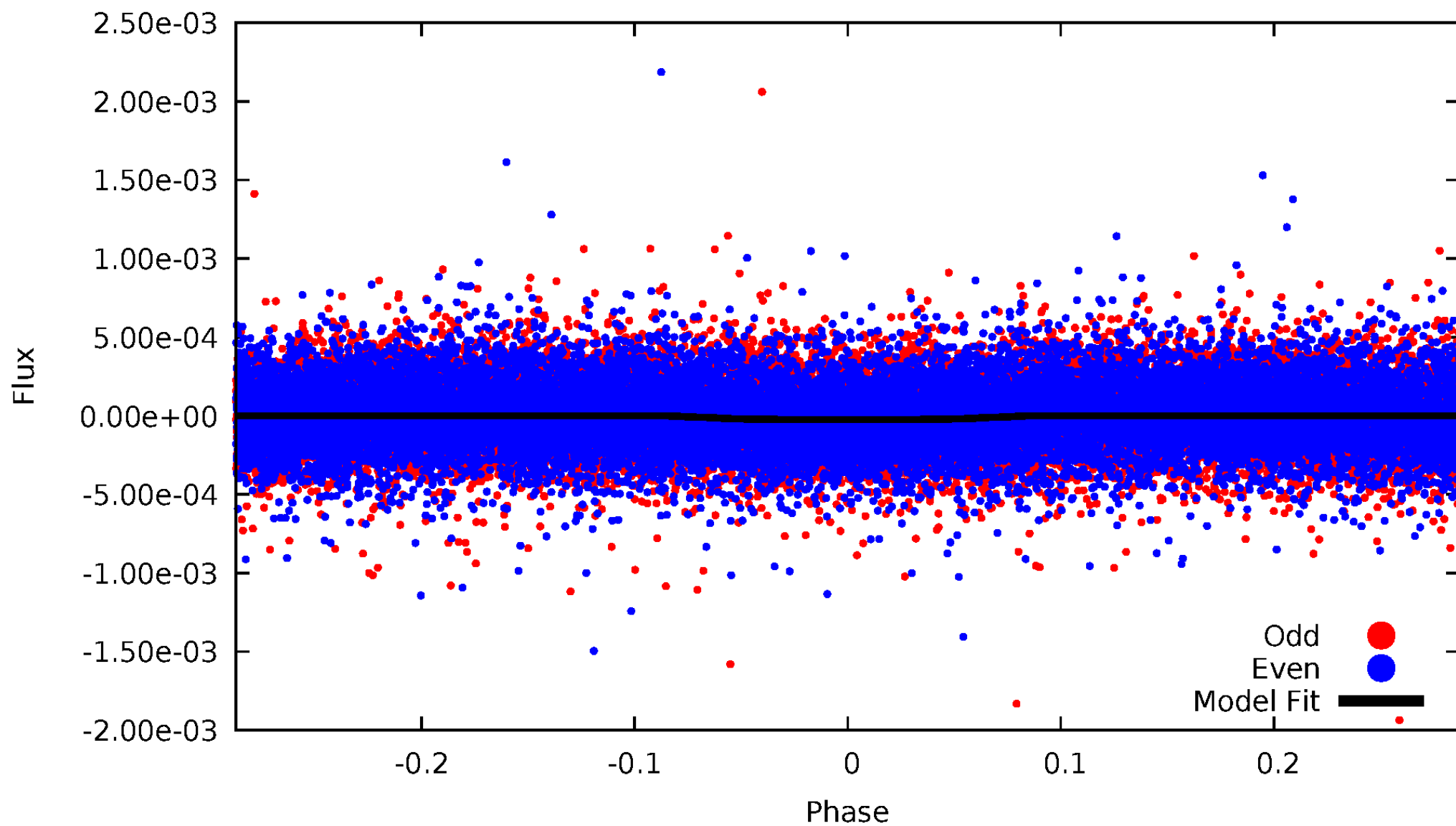


# TCE 003644116-01



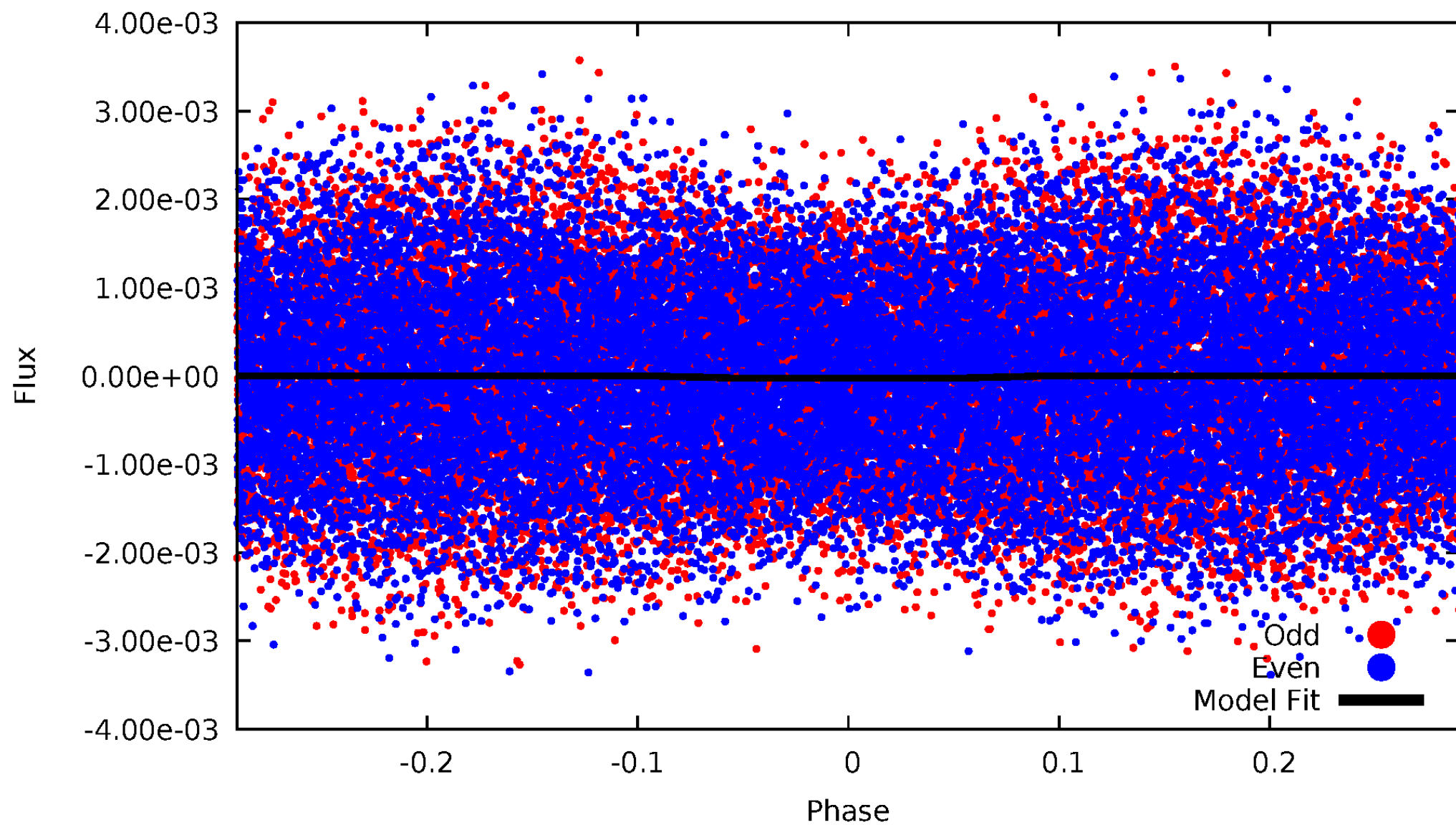
# DV Odd/Even

TCE 003644116-01



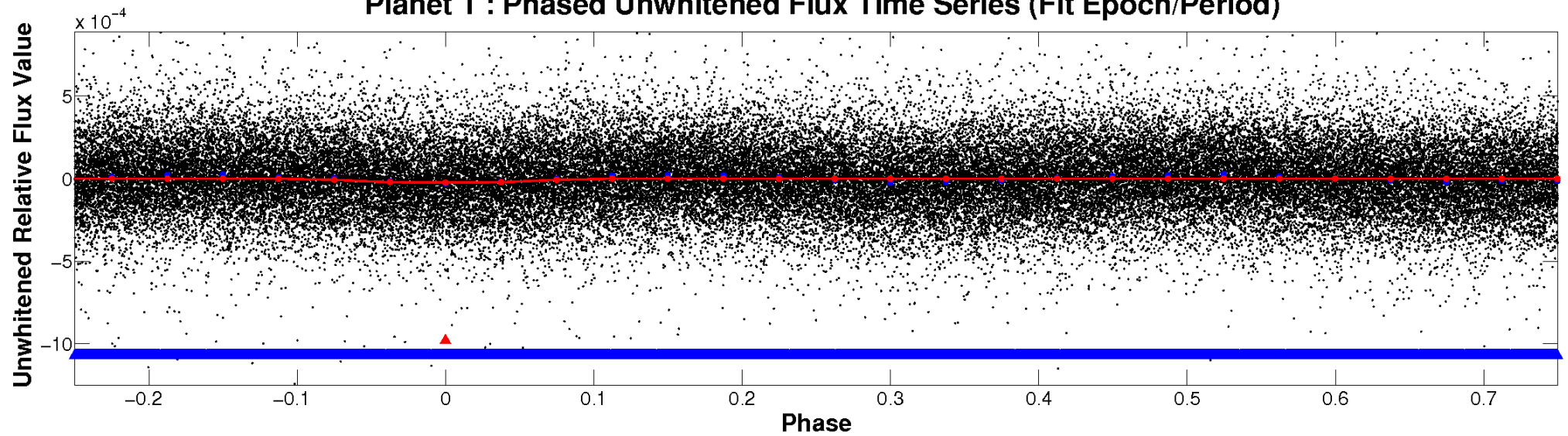
# ALT Odd/Even

TCE 003644116-01

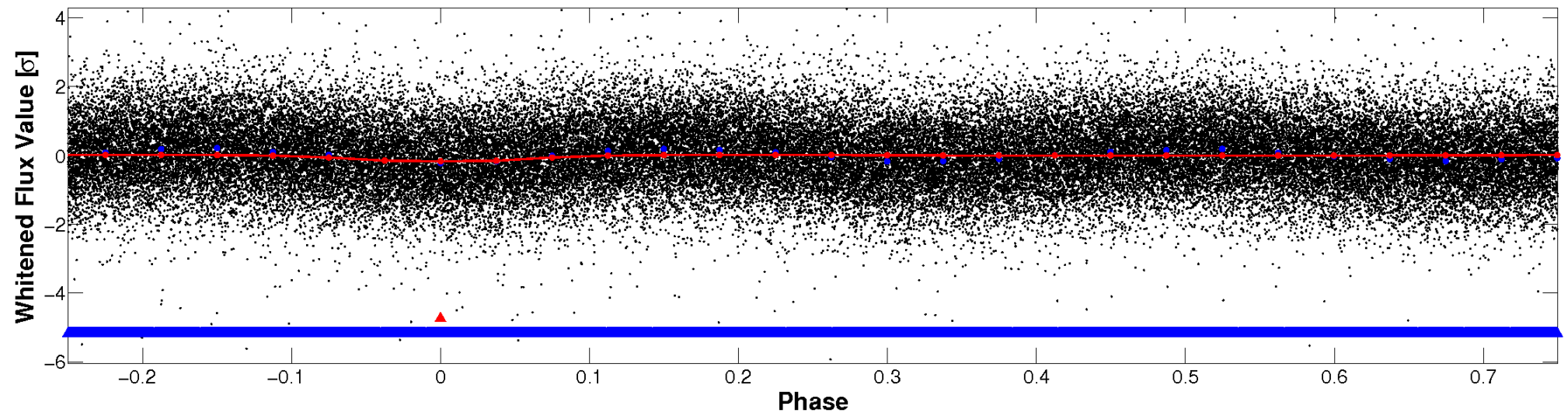


# Non-Whitened Vs. Whitened Light Curve

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



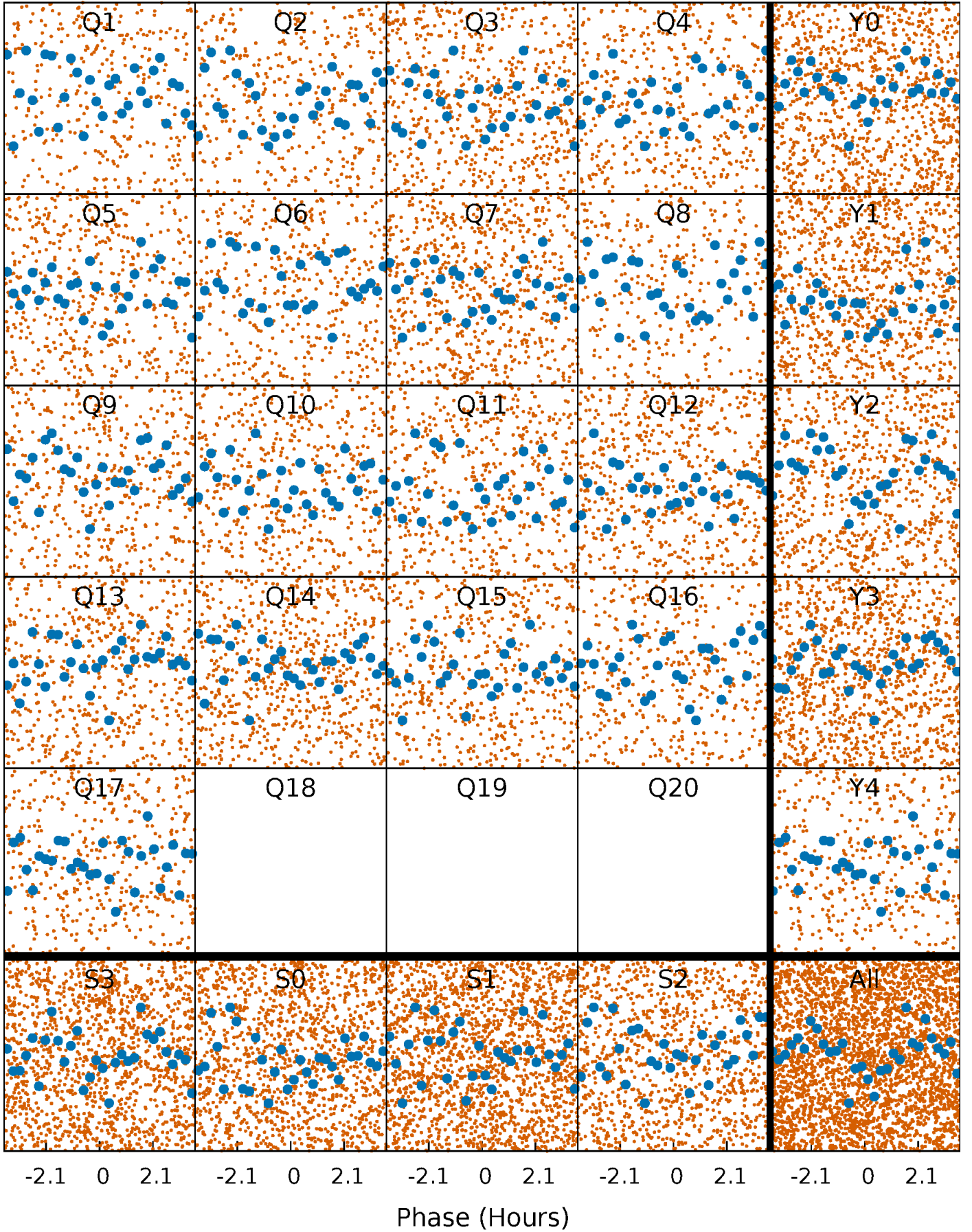
**Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)**





# PDC Quarter-Phased Transit Curves

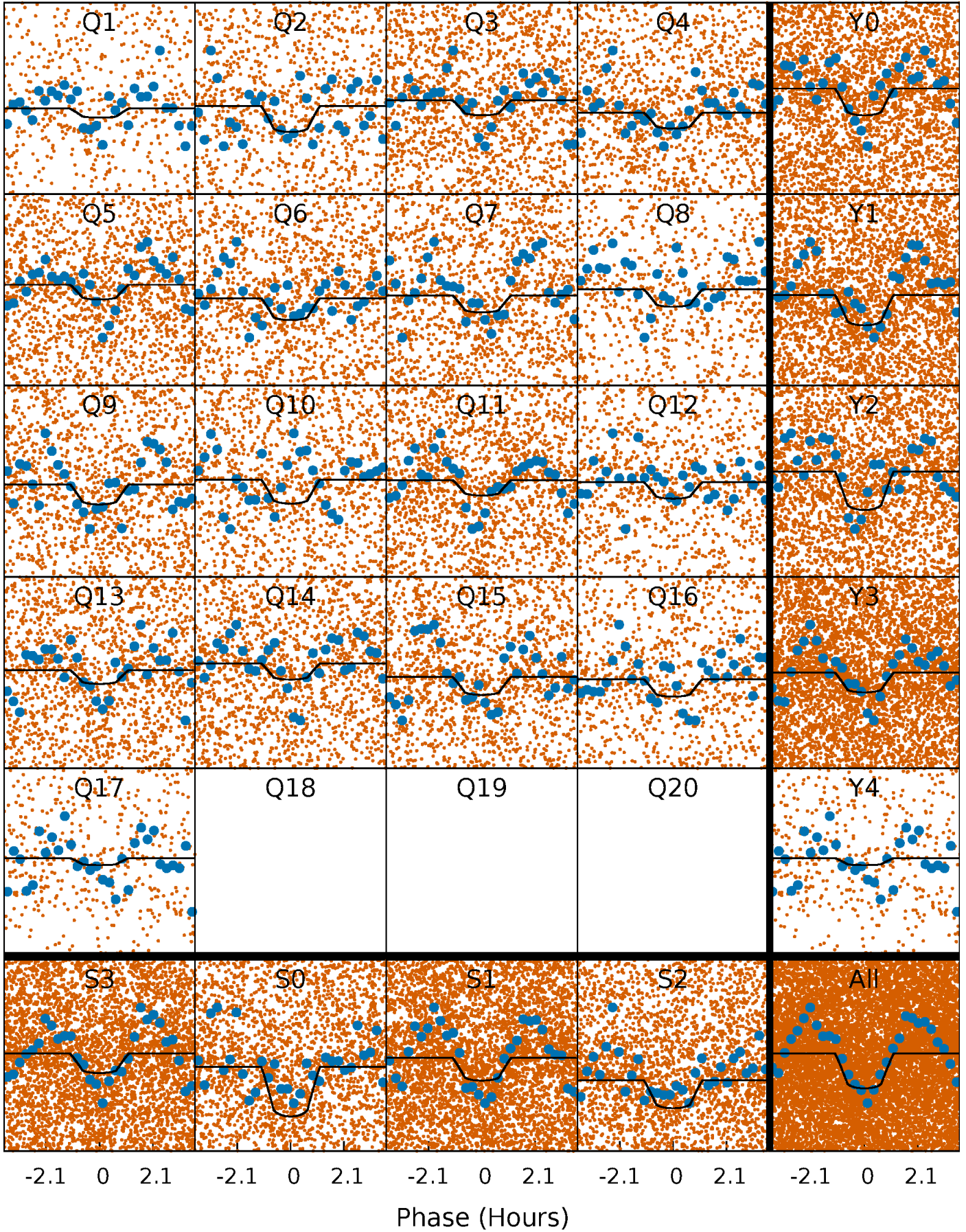
TCE 003644116-01 P= 0.545167 Days  $T_0=131.525018$  (BKJD)





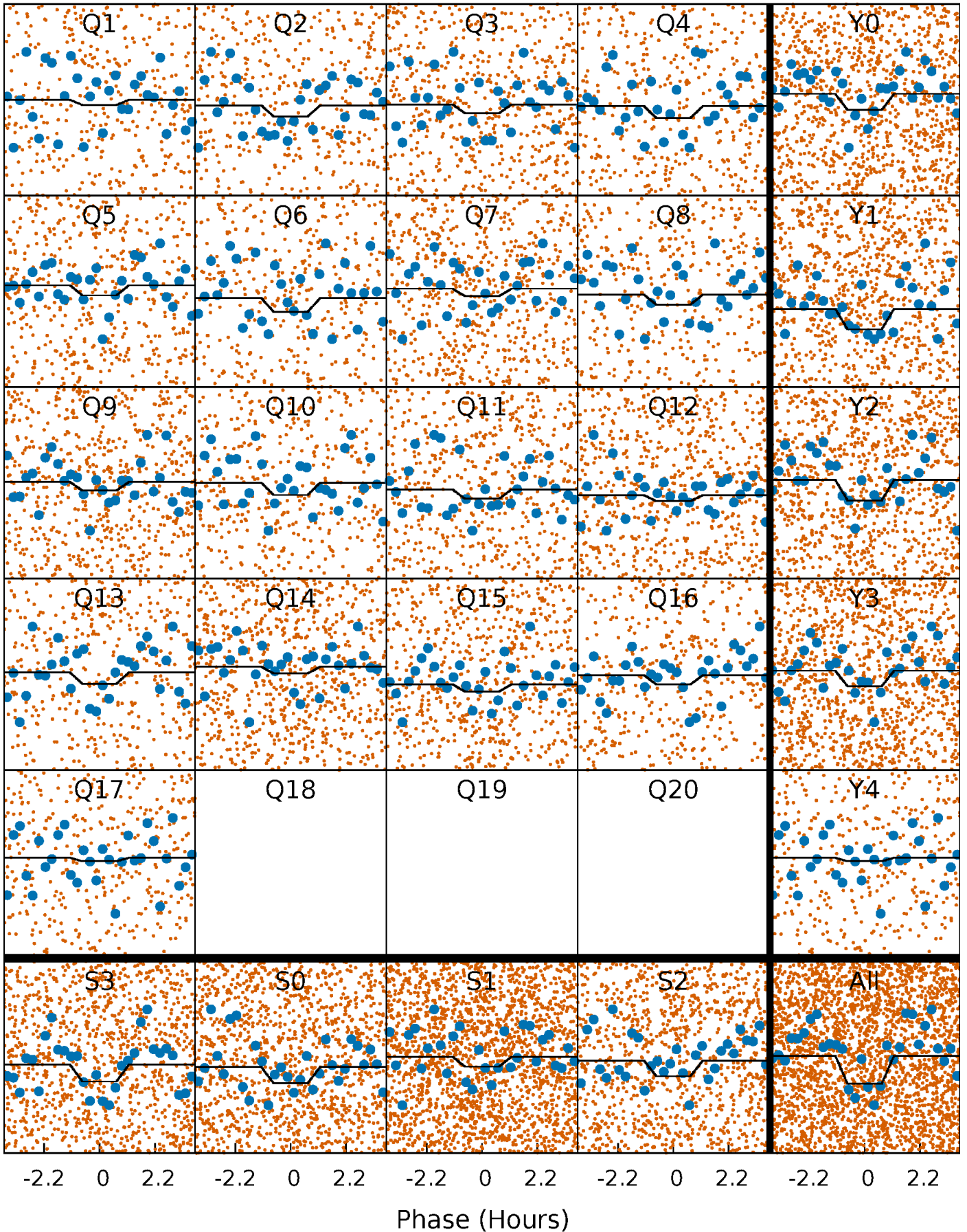
# DV Quarter-Phased Transit Curves

TCE 003644116-01 P= 0.545167 Days  $T_0=131.525018$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

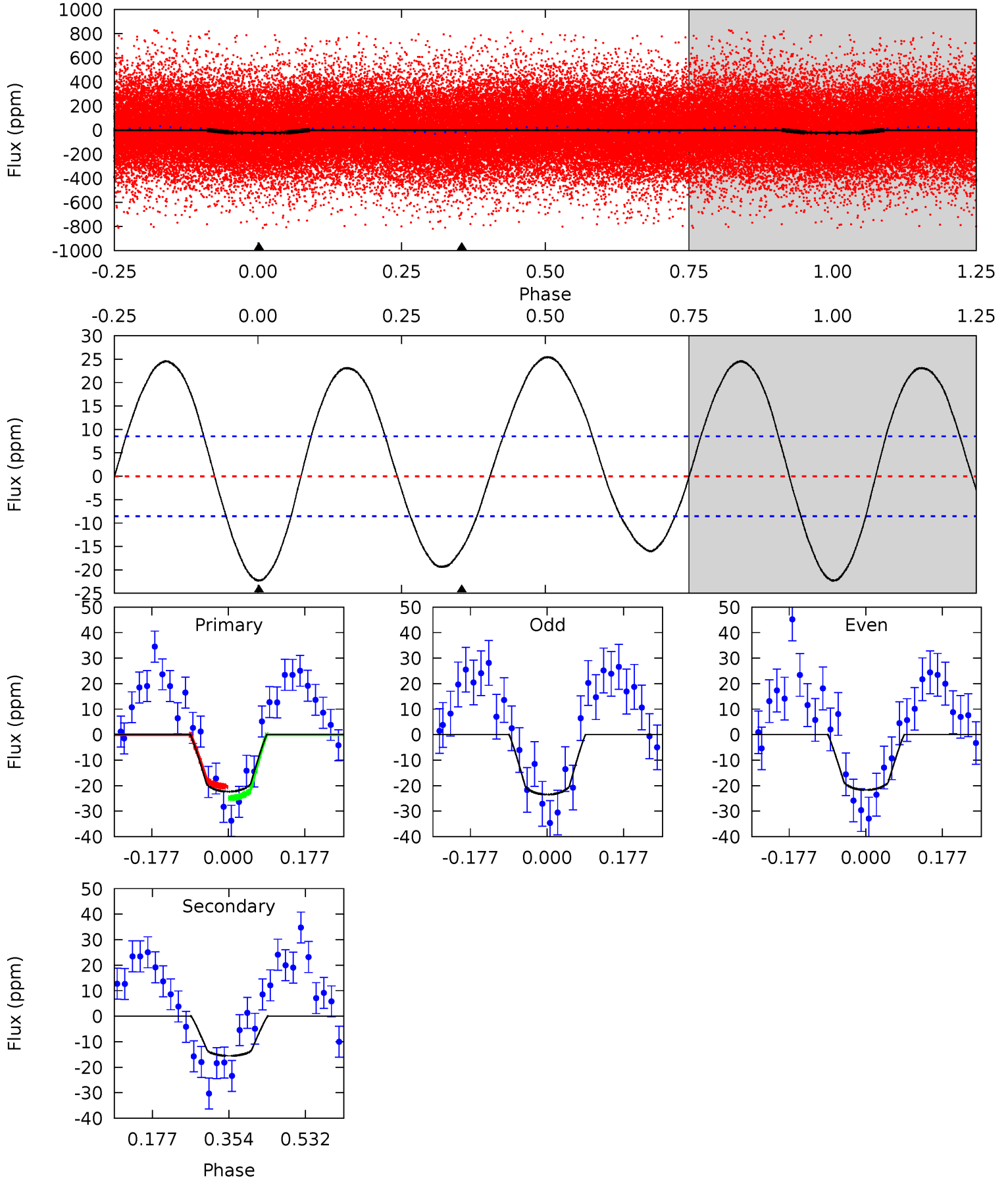
TCE 003644116-01 P= 0.545168 Days  $T_0=131.525016$  (BKJD)



# DV Model-Shift Uniqueness Test

003644116-01, P = 0.545167 Days, E = 130.979851 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
11.6	8.08	0	0	4.44	1.35	6.82	11.6	11.6	8.08	8.08	0.47	0.95	0.53	1.18

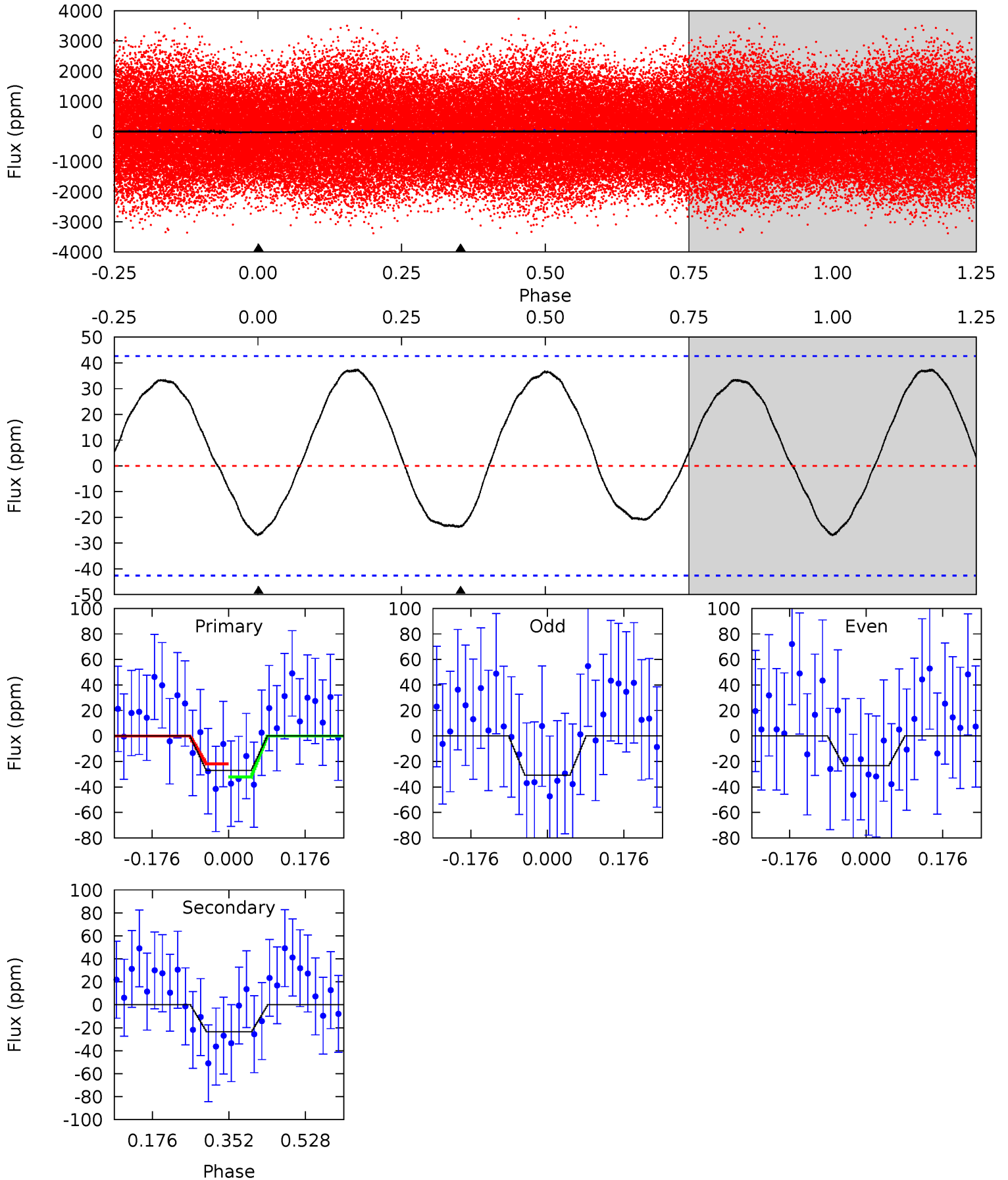




# Alt Model-Shift Uniqueness Test

003644116-01, P = 0.545168 Days, E = 130.979848 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
2.82	2.46	0	0	4.44	1.35	1.90	2.82	2.82	2.46	2.46	0.39	1.02	0.58	0.55





### Stellar Parameters For KIC 003644116

	$T_{\text{eff}} (K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (g \cdot \text{cm}^{-3})$
	$7737^{+216}_{-339}$	$4.108^{+0.098}_{-0.182}$	$0.360^{+0.050}_{-0.500}$	$2.012^{+0.527}_{-0.351}$	$1.893^{+0.174}_{-0.322}$	$0.328^{+0.173}_{-0.154}$
	+3%/-4%	+2%/-4%	+14%/-139%	+26%/-17%	+9%/-17%	+53%/-47%
Source	KIC0	KIC0	KIC0	DSEP		

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

### Secondary Eclipse Parameters for KIC 003644116-01 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-16 \pm 2$	$1.17^{+0.42}_{-0.43}$	$5355^{+381}_{-300}$	$6232^{+2004}_{-1144}$	$1.595^{+2.433}_{-0.745}$
Alt.	$-24 \pm 10$	$1.16^{+0.43}_{-0.40}$	$5379^{+372}_{-322}$	$6985^{+2519}_{-1562}$	$2.342^{+3.713}_{-1.393}$

$T_{max}$  = Theoretical Maximum Planetary Temperature

$T_{obs}$  = Observed Planetary Temperature (Assuming  $A=0.3$ )

$A_{obs}$  = Observed Albedo (Assuming  $T=0$ )

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

## DV Centroid Data

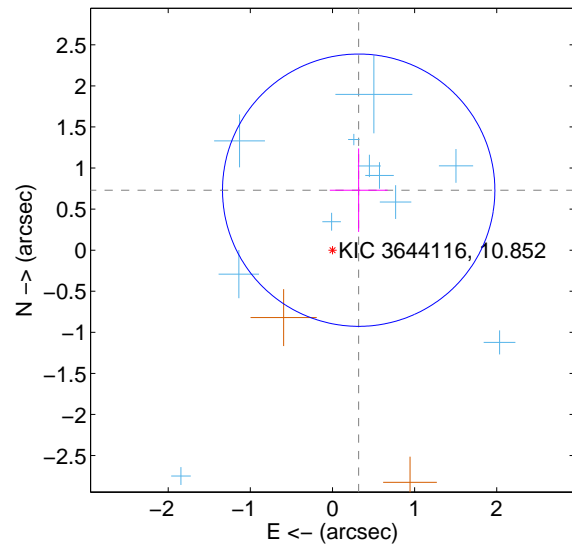
Supplemental centroid analysis for 003644116-01. **Kepler magnitude: 10.85.** Transit SNR 14.00

There are 12 quarters with good PRF difference image offsets

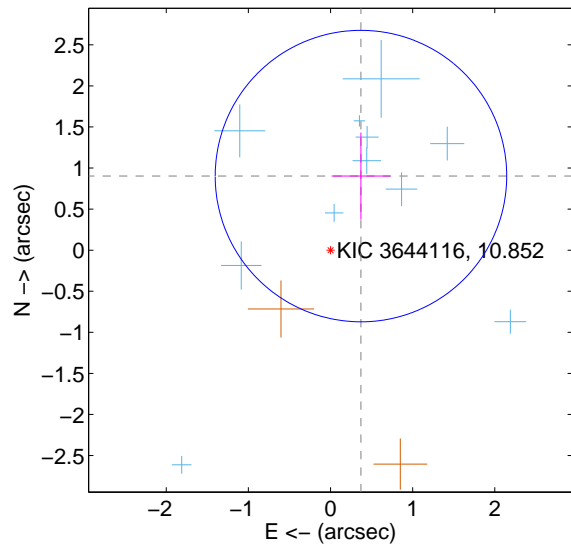
The direct PRF centroid is offset from the target star catalog position by about 0.18 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.797 \pm 0.553$	1.44	$-0.319 \pm 0.352$	$0.730 \pm 0.508$
PRF-fit source offset from KIC position	$0.975 \pm 0.591$	1.65	$-0.371 \pm 0.358$	$0.902 \pm 0.531$
photometric centroid source offset	$0.46 \pm 0.51$	0.89	$0.21 \pm 0.32$	$0.41 \pm 0.55$

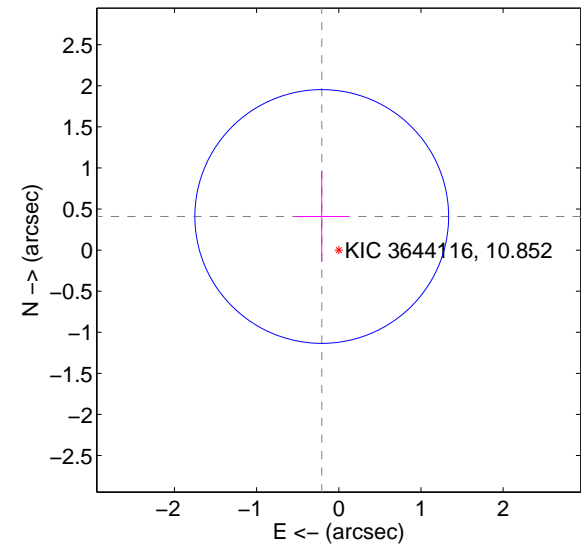
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

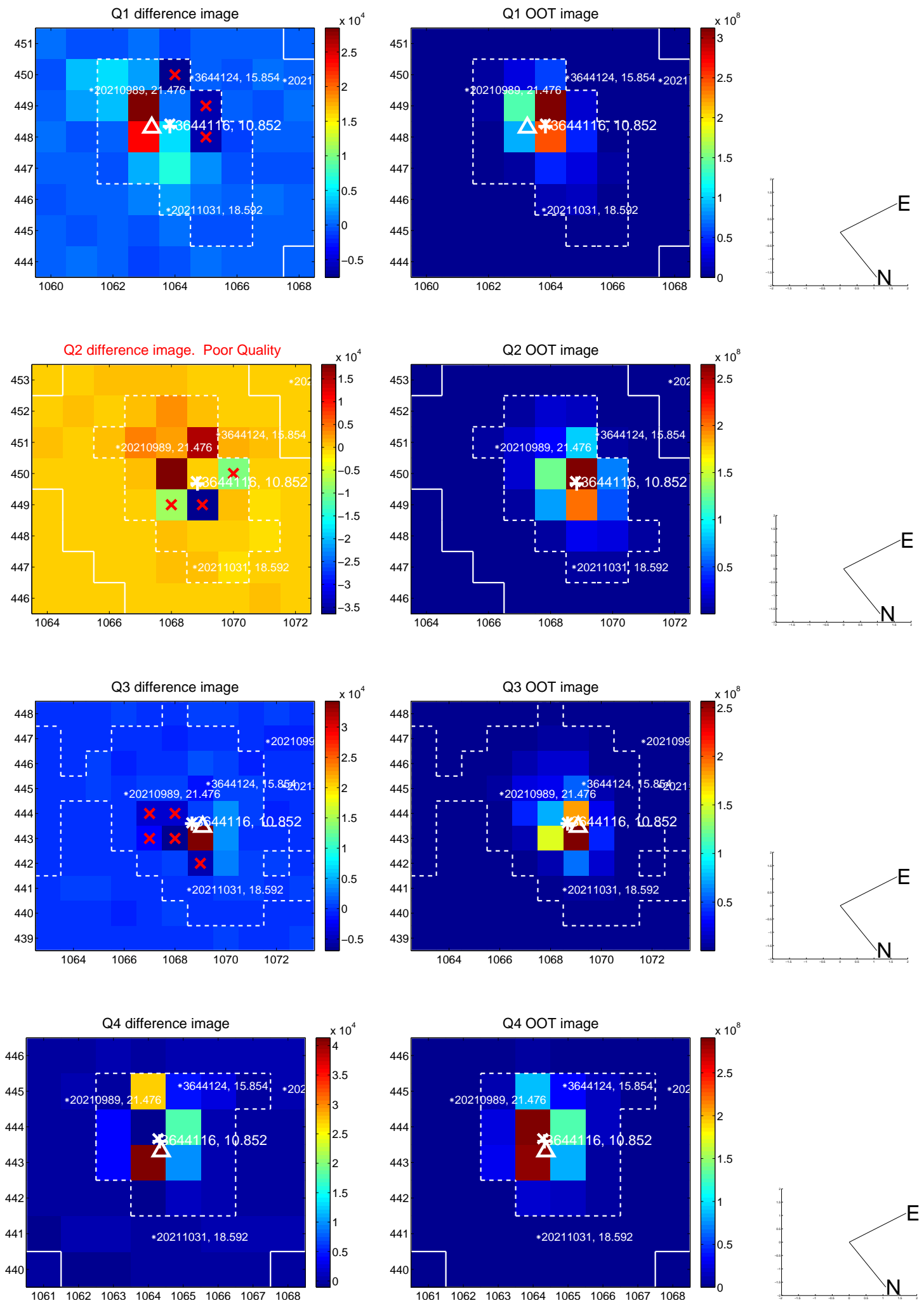


offset from photometric centroids

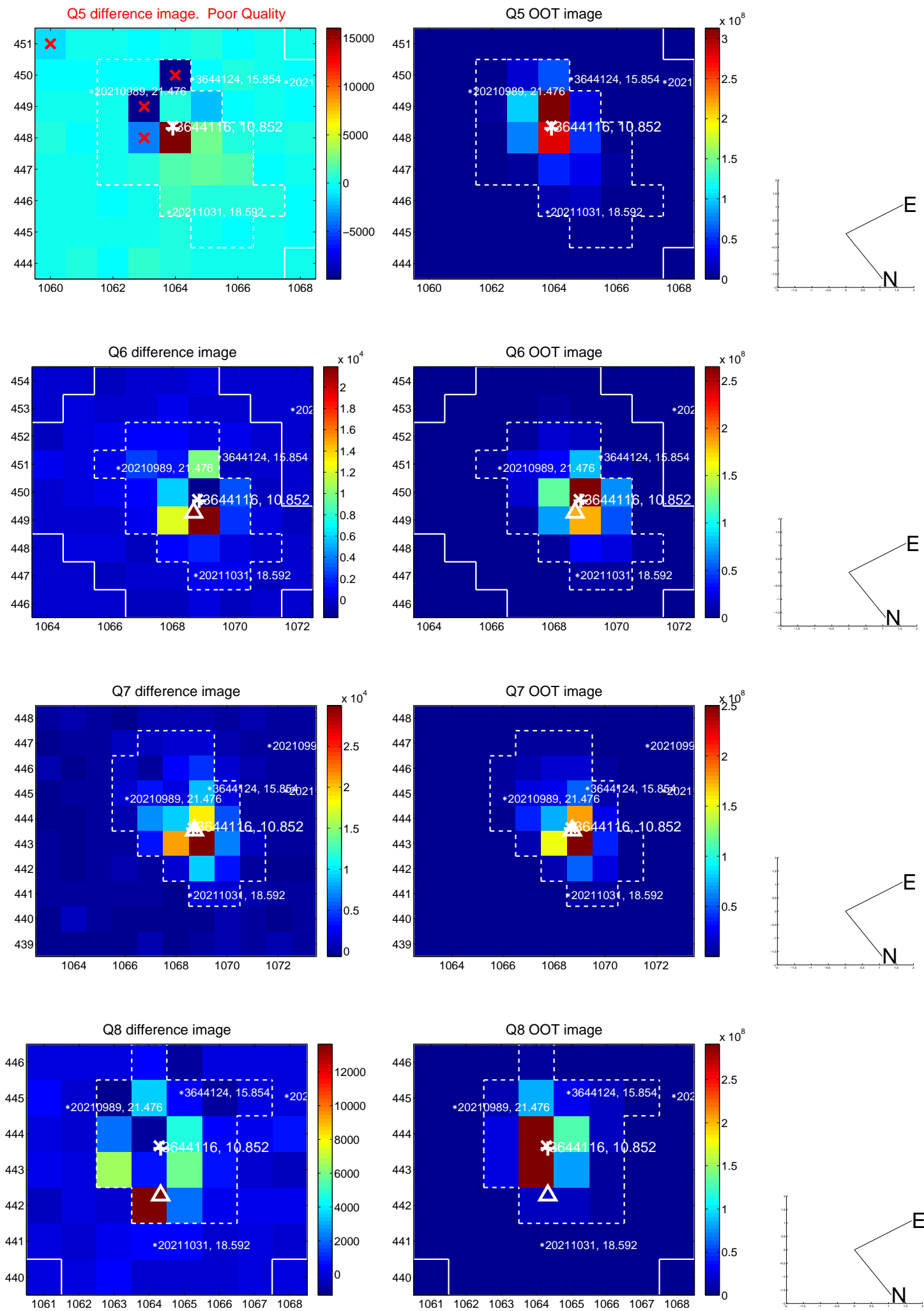


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

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

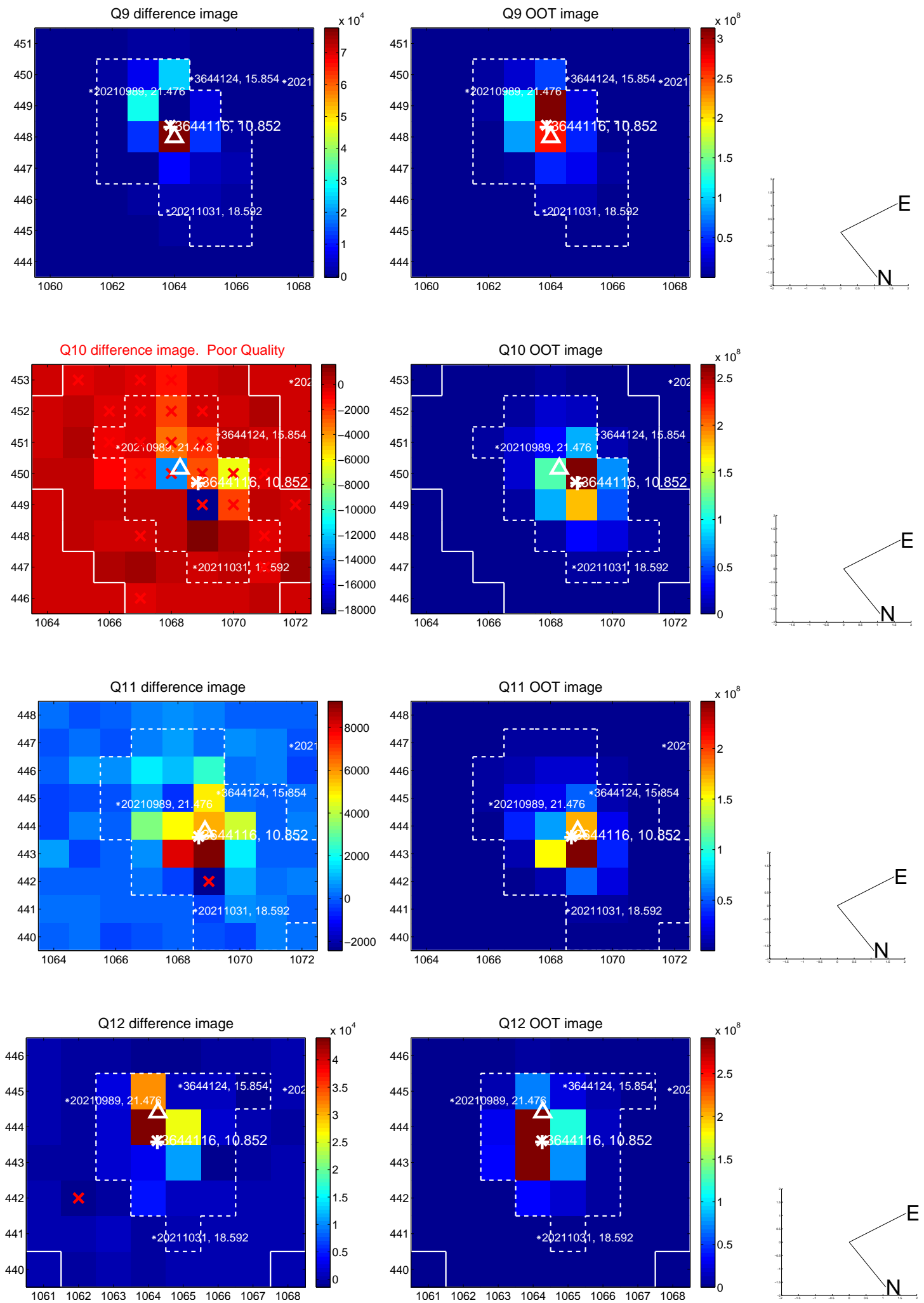


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

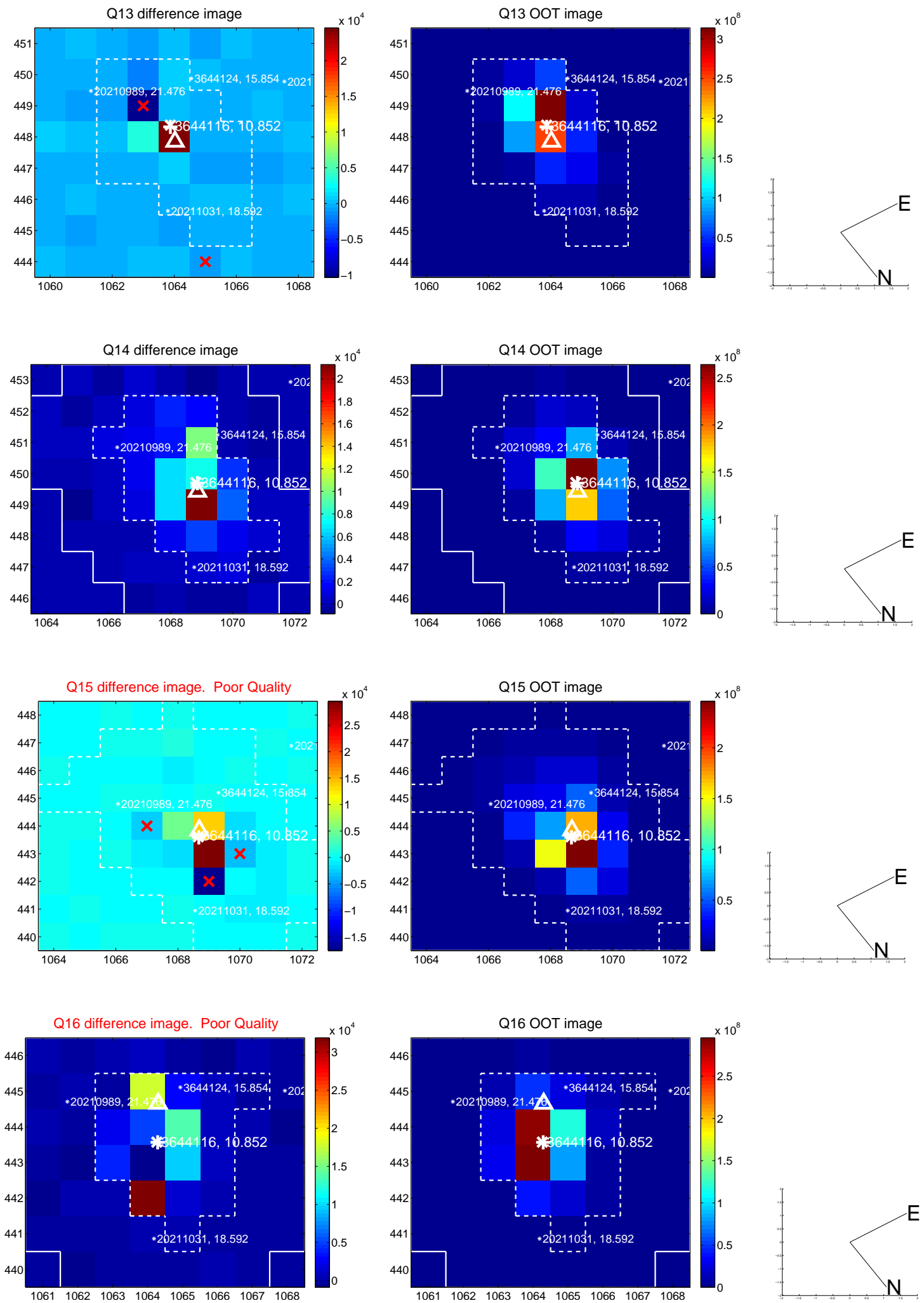




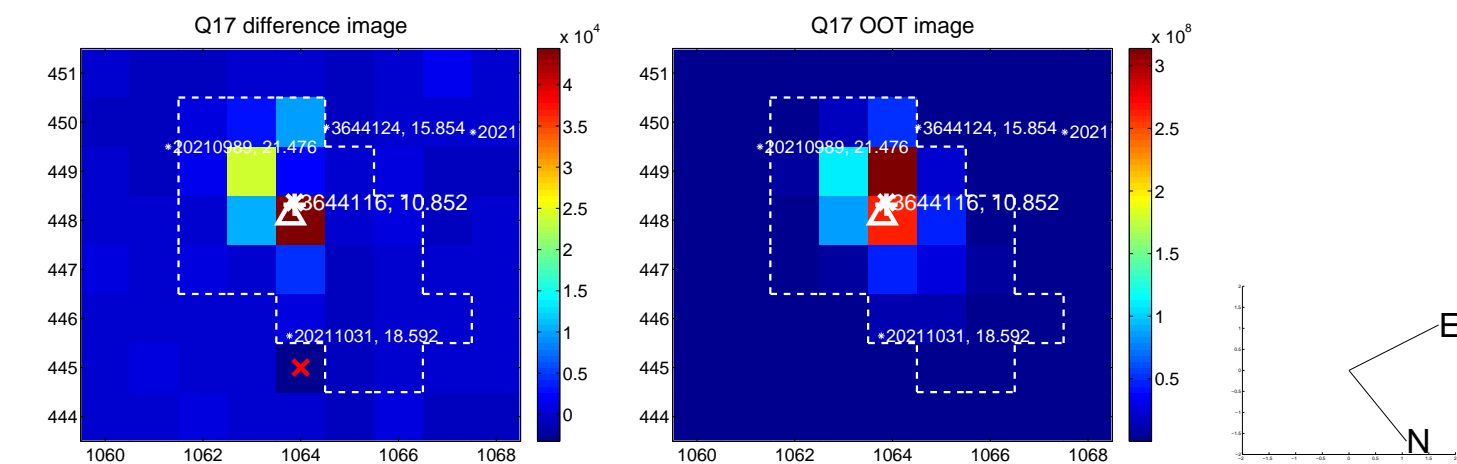
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



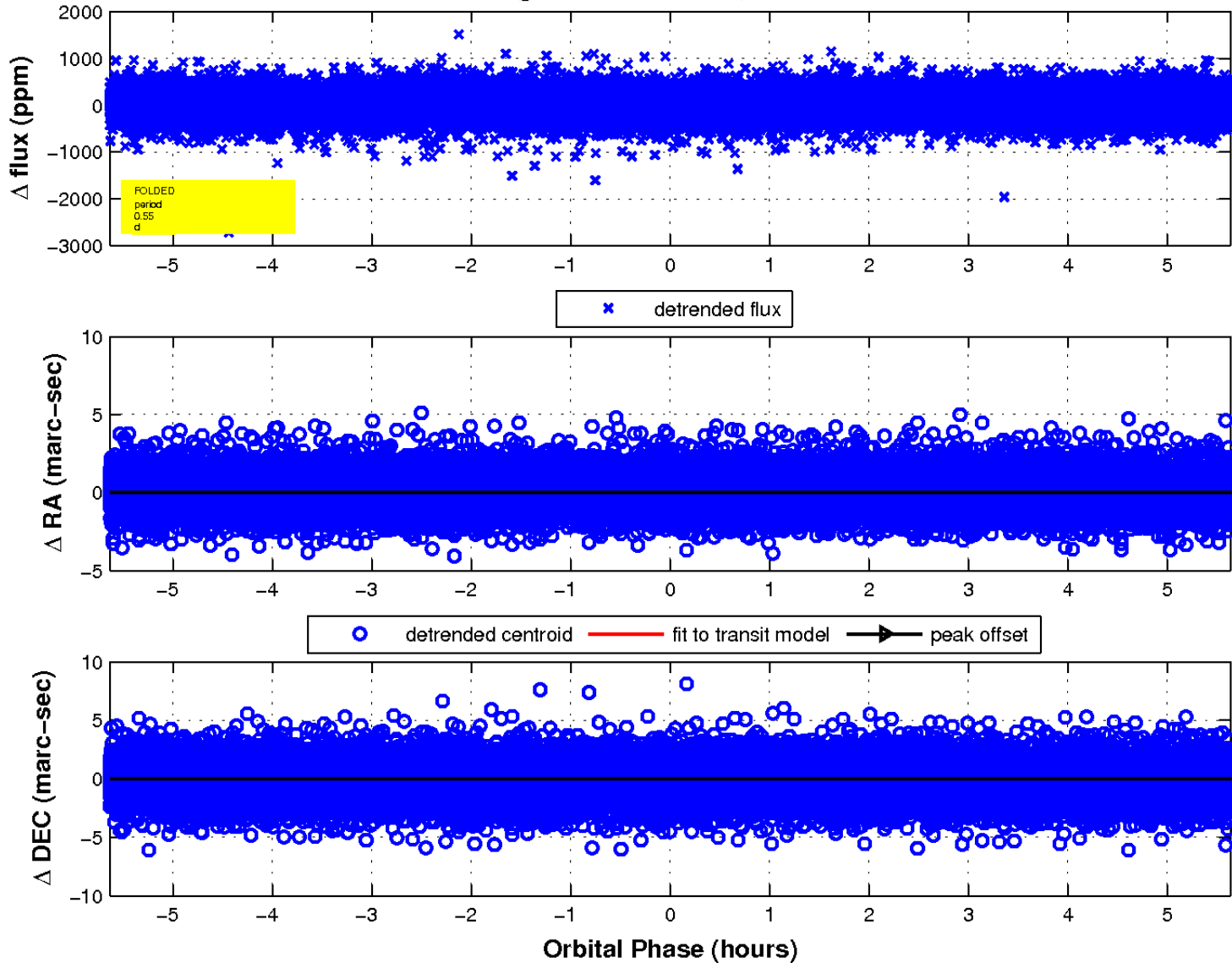
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

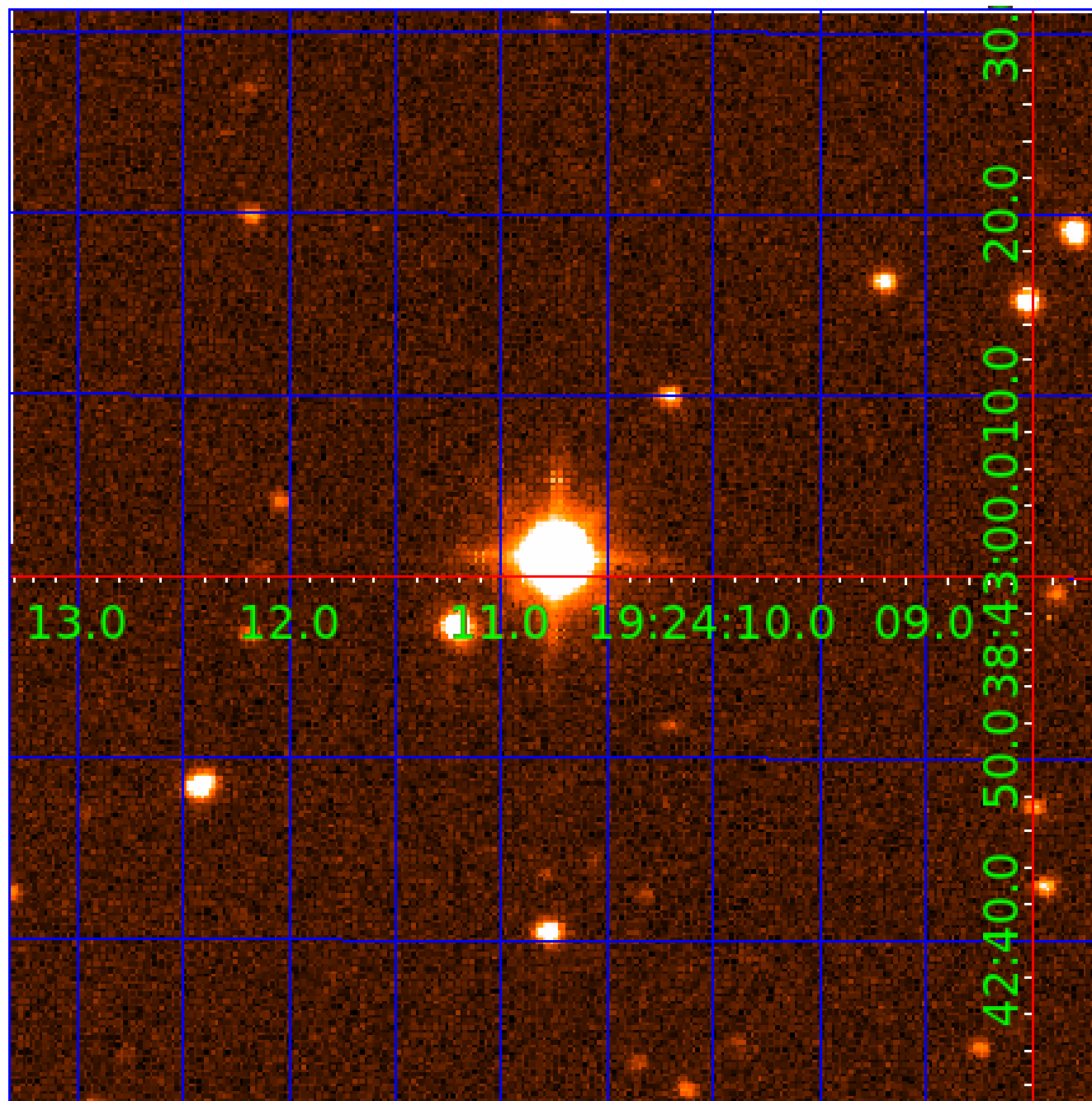


fluxWeightedCentroids, Planet 1 of 2



UKIRT Image

Declination





# KIC 003644116

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
003644116-01	OBS	No	0.545167	131.525019	23.9	1.879	16.1	14.0	2.01	7737	1.14	49761.91
003644116-02	OBS	No	0.859100	131.685256	17.6	4.947	9.3	9.1	2.01	7737	0.86	27135.97

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
003644116-01	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—CENT_SATURATED
003644116-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE_ZUMA—TRANS_GAPPED—LPP_DV—LPP_ALT—CENT_SATURATED

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

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

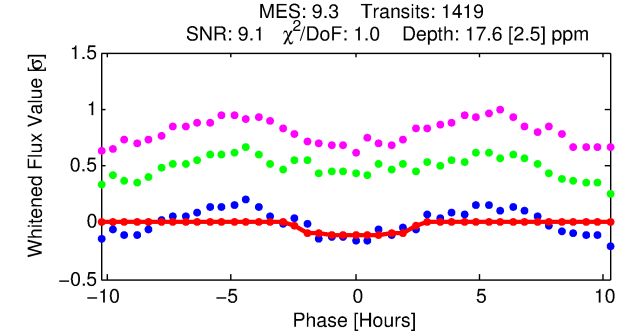
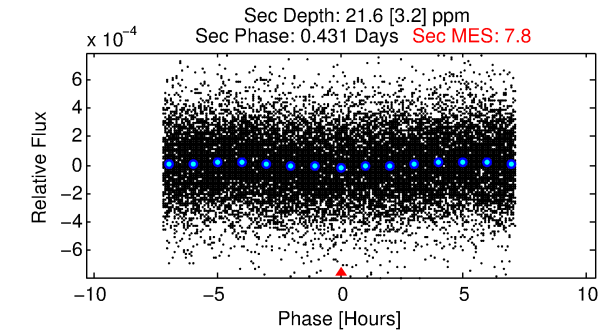
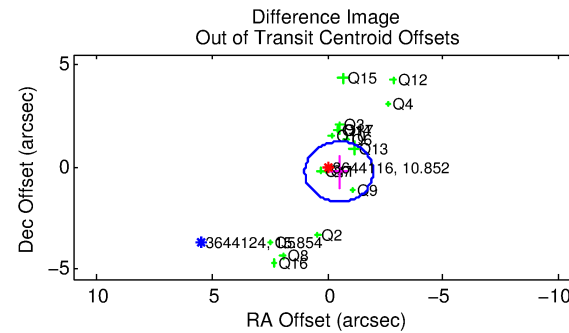
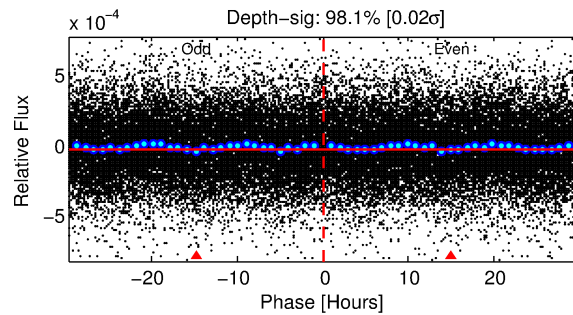
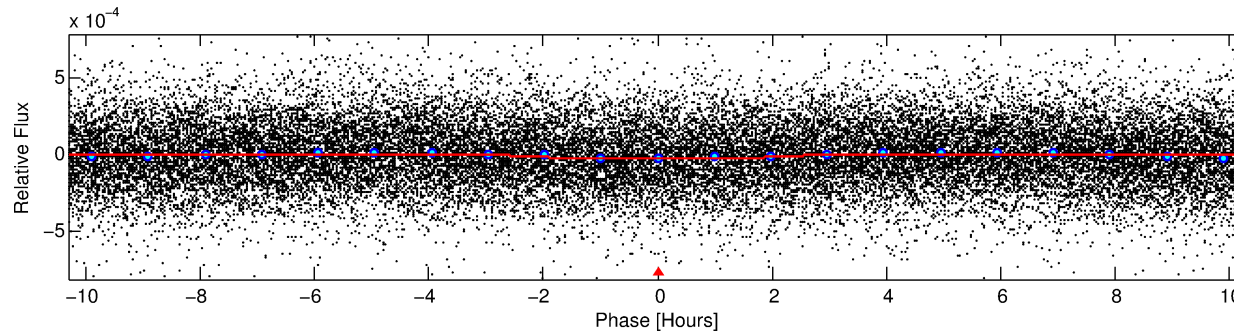
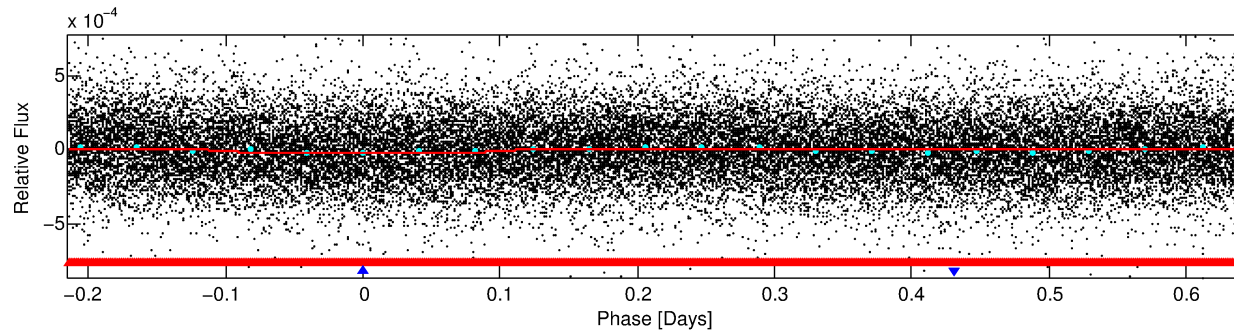
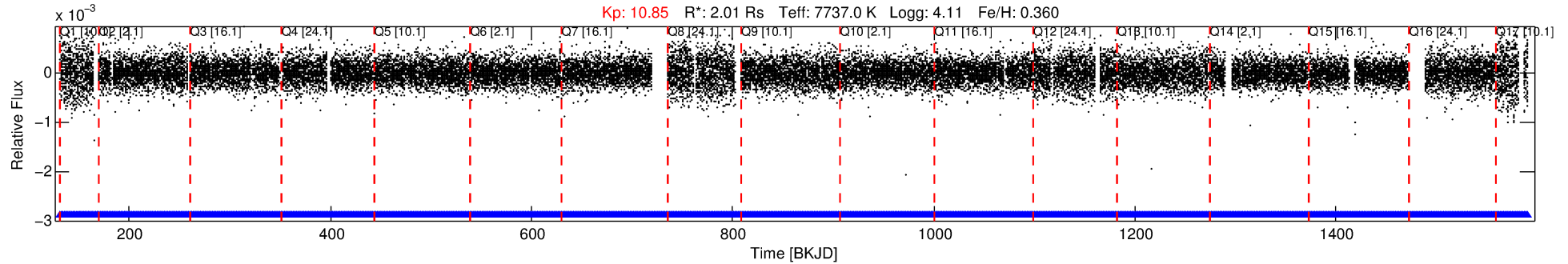
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 003644116-02

No Significant Match Found

# DV One-Page Summary

KIC: 3644116 Candidate: 2 of 2 Period: 0.859 d



## DV Fit Results:

Period = 0.85910 [0.00002] d  
Epoch = 131.6853 [0.0076] BKJD  
 $R_p/R^*$  = 0.0039 [0.0038]  
 $a/R^*$  = 1.42 [4.16]  
 $b$  = 0.36 [14.23]  
 $S_{\text{eff}}$  = 27135.97 [10126.55]  
 $T_{\text{eq}}$  = 3273 [305] K  
 $R_p$  = 0.86 [0.87]  $R_{\text{e}}$   
 $a$  = 0.0219 [0.0049] AU  
 $A_g$  = 7.62 [15.11] [0.44 $\sigma$ ]  
 $T_{\text{eff}}$  = 8408 [4125] K [1.24 $\sigma$ ]

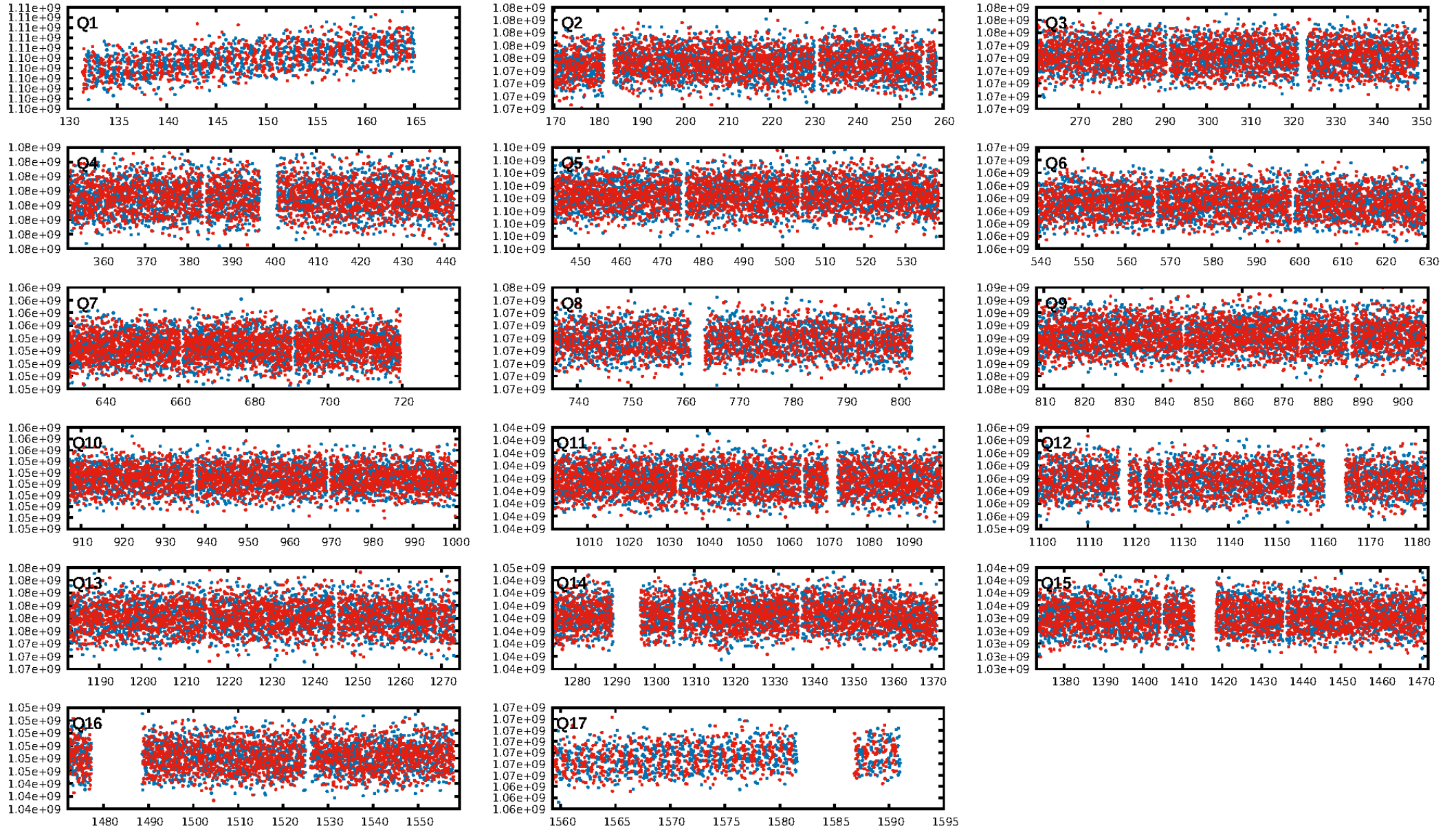
## DV Diagnostic Results:

ShortPeriod-sig: 84.5% [1.42 $\sigma$ ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: 2.68e-09  
RollingBand-fgt: 1.00 [1354/1354]  
GhostDiagnostic-chr: 3.671  
Centroid-sig: 22.2%  
Centroid-so: 0.435 arcsec [0.65 $\sigma$ ]  
OotOffset-rm: 0.556 arcsec [1.13 $\sigma$ ]  
KicOffset-rm: 0.512 arcsec [1.33 $\sigma$ ]  
OotOffset-st: 4/4/4/4 [16]  
KicOffset-st: 4/4/4/4 [16]  
DiffImageQuality-fgm: 0.75 [12/16]  
DiffImageOverlap-fno: 0.00 [0/17]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 04:43:30 Z

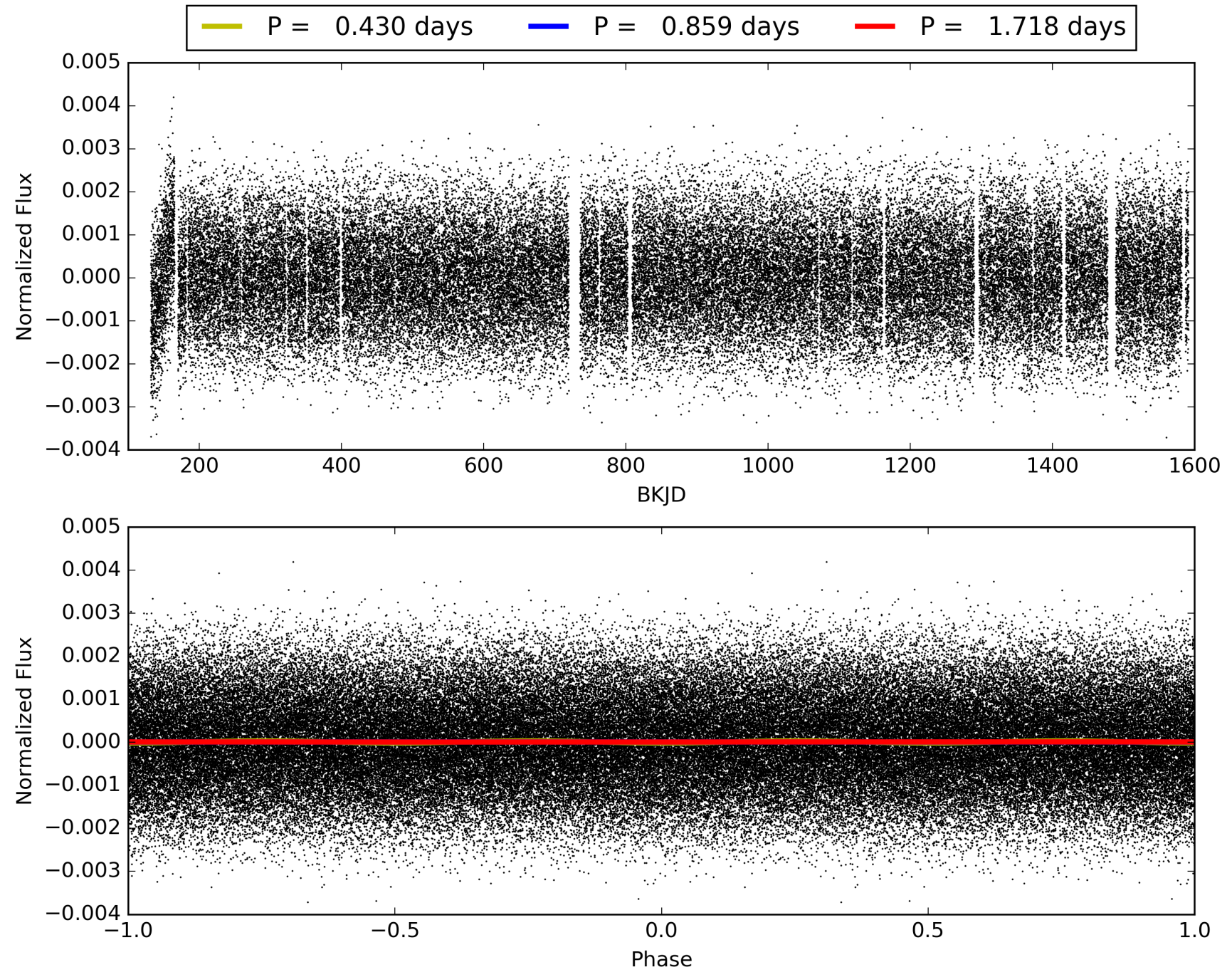
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 003644116-02, PDC Light Curves





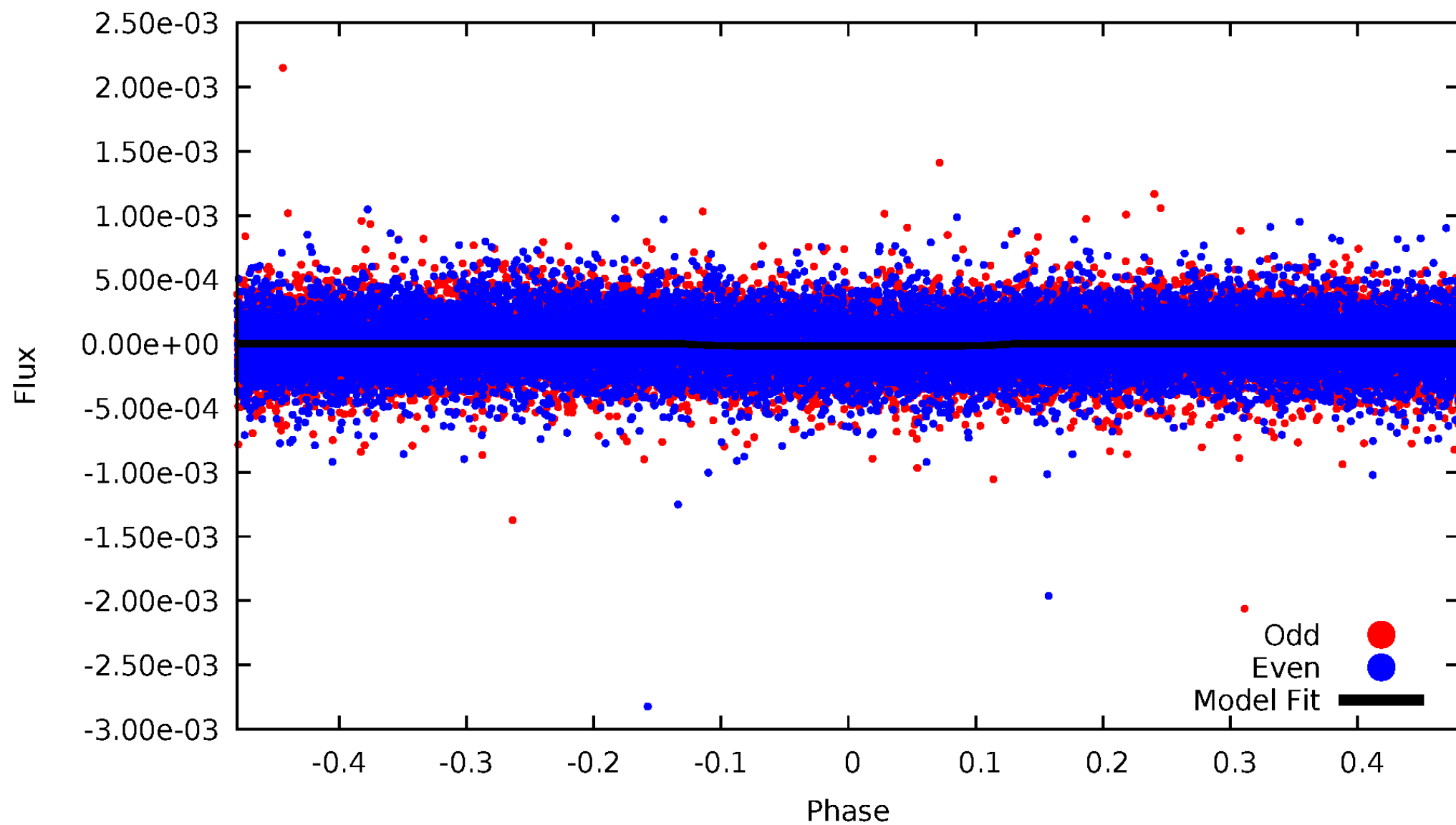
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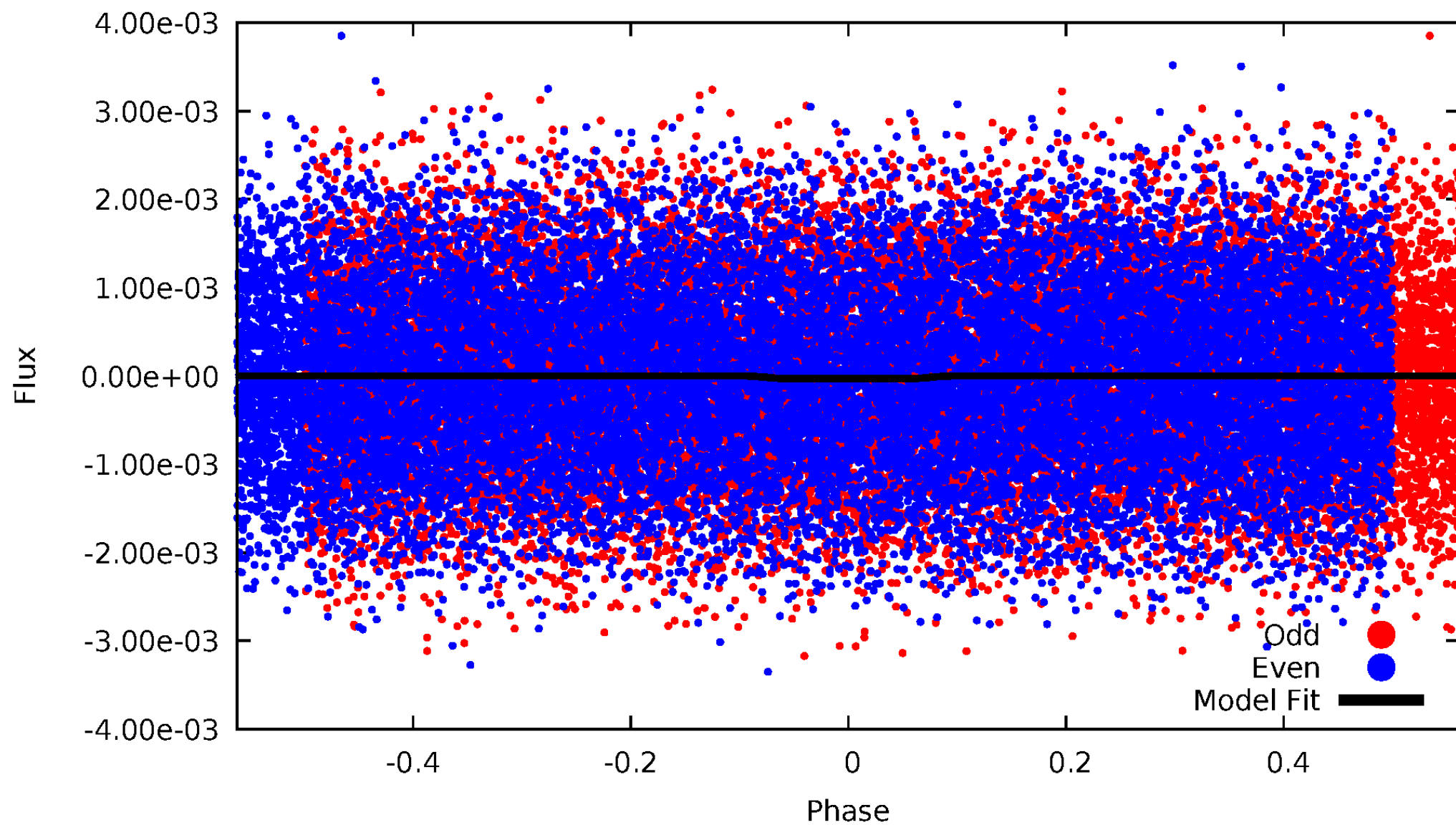
# DV Odd/Even

TCE 003644116-02



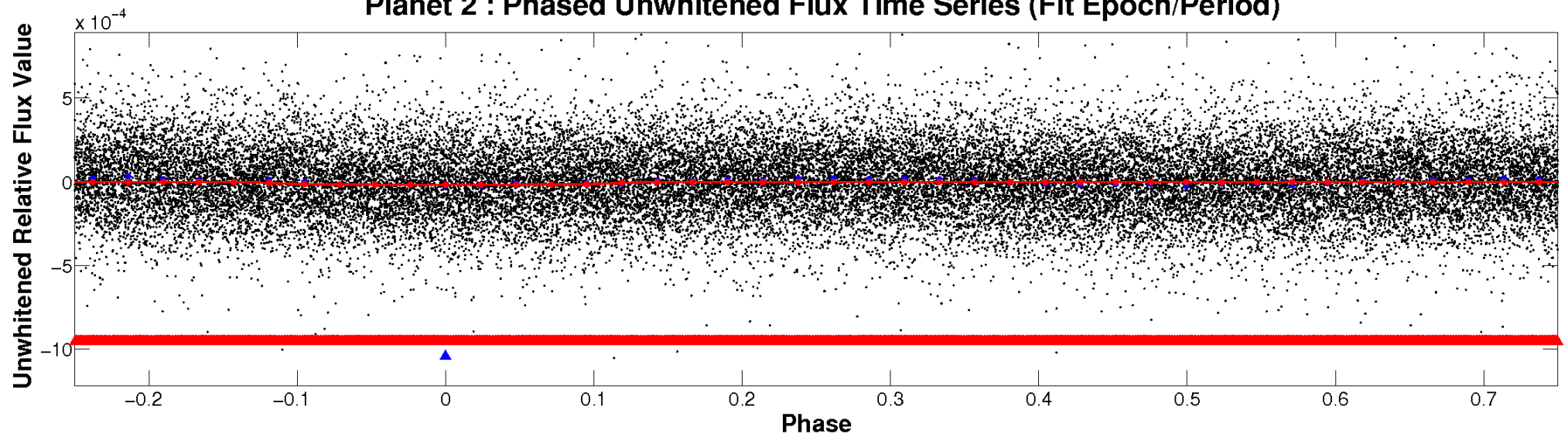
# ALT Odd/Even

TCE 003644116-02

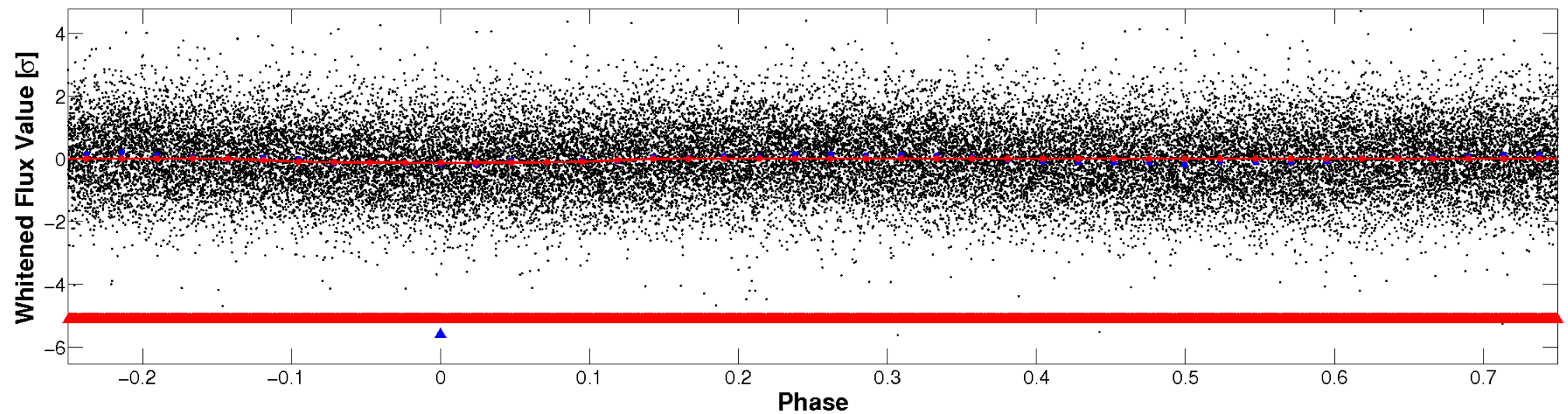


# Non-Whitened Vs. Whitened Light Curve

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

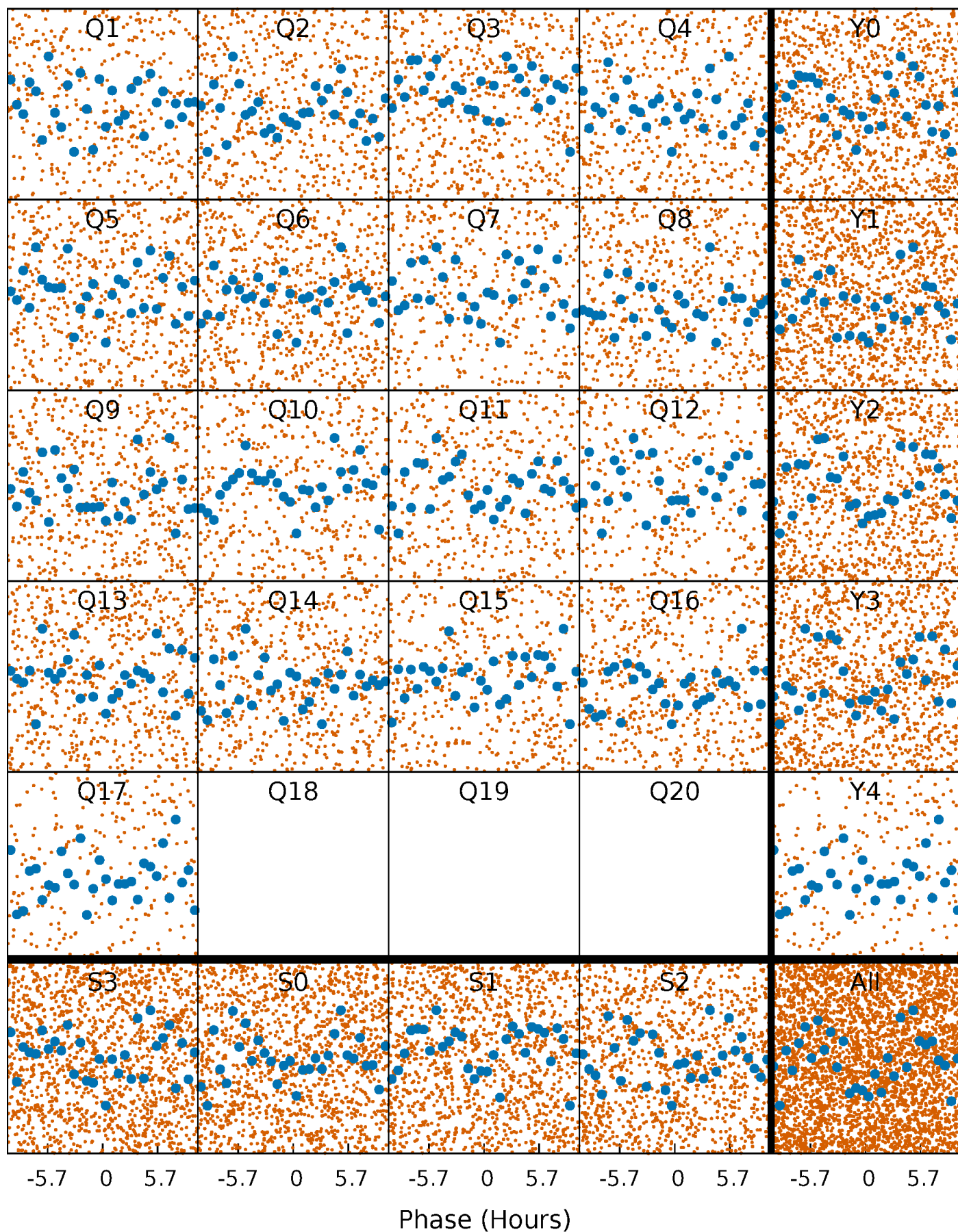


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

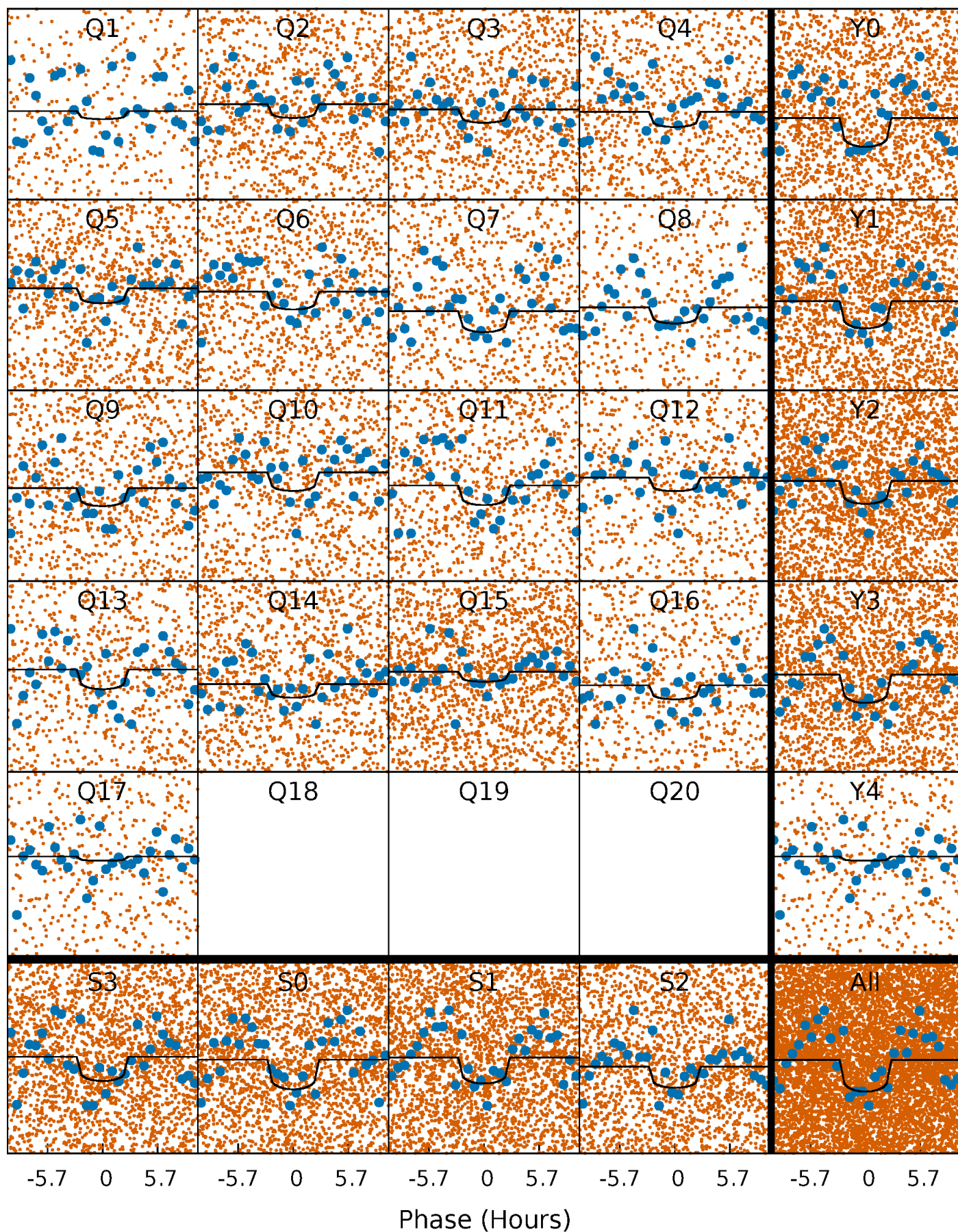
TCE 003644116-02 P= 0.859100 Days  $T_0=131.685256$  (BKJD)





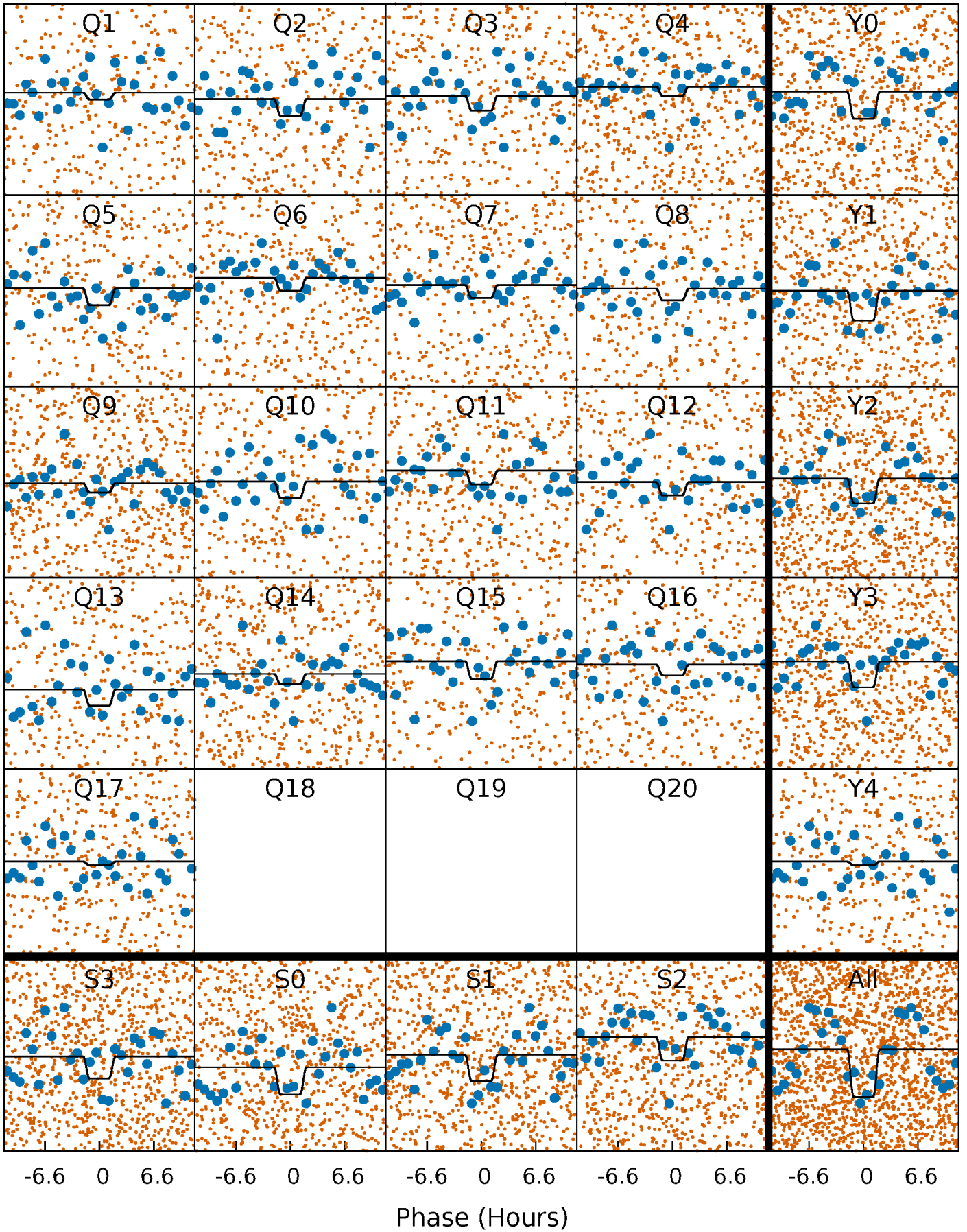
# DV Quarter-Phased Transit Curves

TCE 003644116-02 P= 0.859100 Days  $T_0=131.685256$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

TCE 003644116-02 P= 0.859157 Days  $T_0=131.634900$  (BKJD)

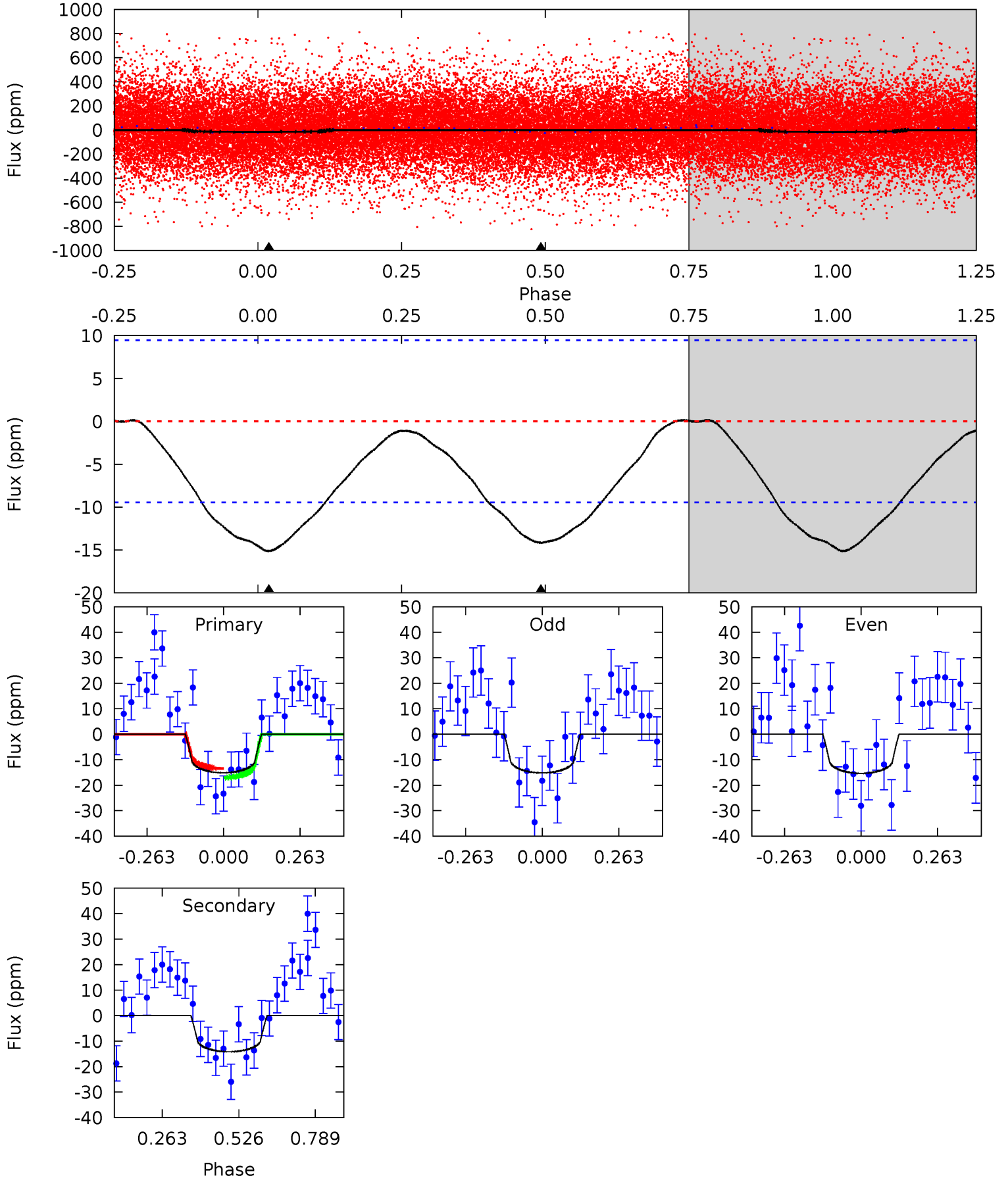




# DV Model-Shift Uniqueness Test

003644116-02, P = 0.859100 Days, E = 130.826156 Days

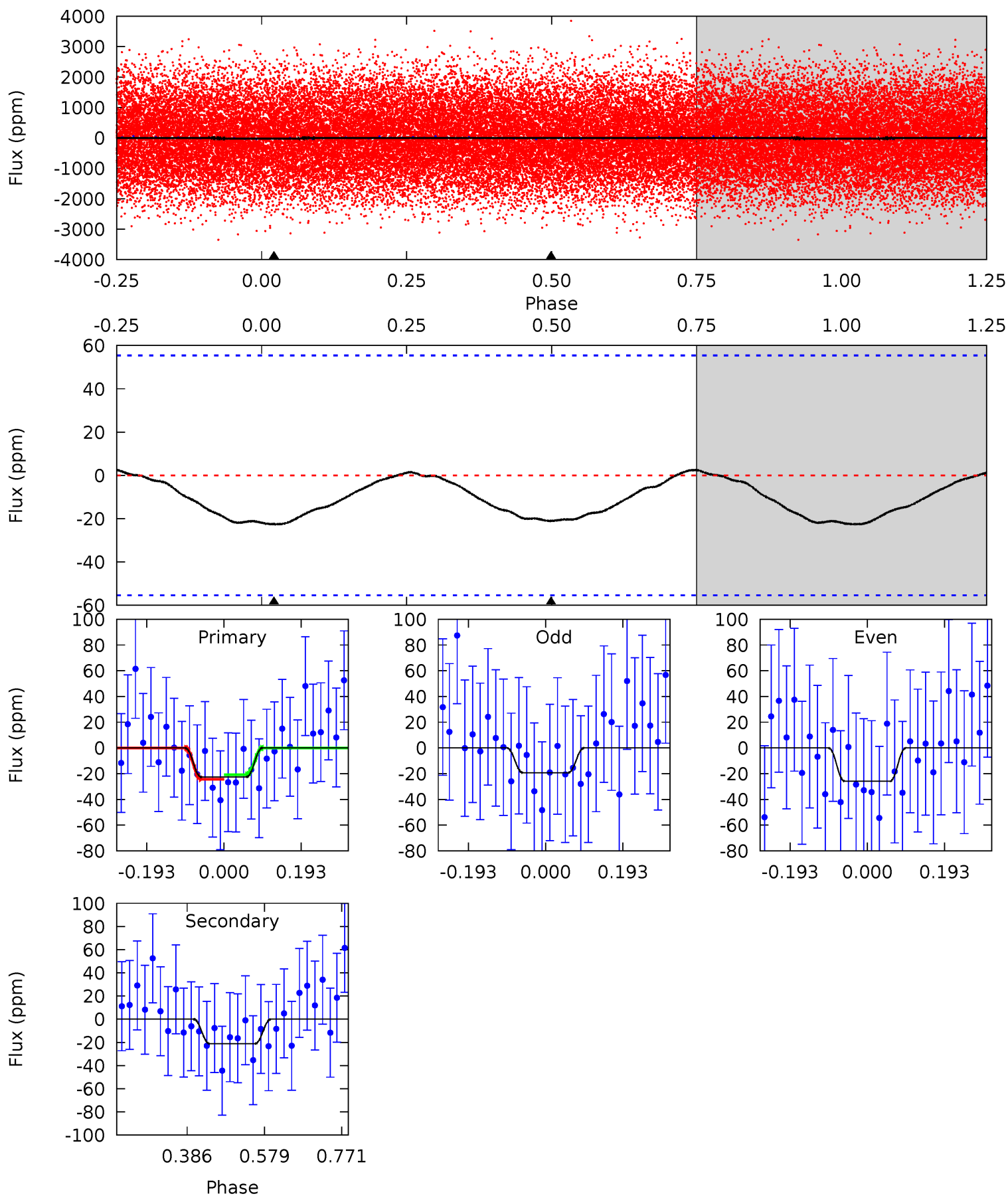
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
6.97	6.52	0	0	4.36	1.12	0.23	6.97	6.97	6.52	6.52	0.04	1.03	0.01	0.83



# Alt Model-Shift Uniqueness Test

003644116-02, P = 0.859157 Days, E = 131.634900 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
1.81	1.69	0	0	4.43	1.30	0.11	1.81	1.81	1.69	1.69	0.27	0.69	0.10	0.14



### Stellar Parameters For KIC 003644116

	$T_{\text{eff}} (K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M (M_{\odot})$	$\rho_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$7737^{+216}_{-339}$	$4.108^{+0.098}_{-0.182}$	$0.360^{+0.050}_{-0.500}$	$2.012^{+0.527}_{-0.351}$	$1.893^{+0.174}_{-0.322}$	$0.328^{+0.173}_{-0.154}$
	+3%/-4%	+2%/-4%	+14%/-139%	+26%/-17%	+9%/-17%	+53%/-47%
Source	KIC0	KIC0	KIC0	DSEP		

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

### Secondary Eclipse Parameters for KIC 003644116-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-14 \pm 2$	$1.01^{+0.81}_{-0.64}$	$4626^{+323}_{-297}$	$6678^{+7531}_{-1868}$	$3.516^{+23.580}_{-2.489}$
Alt.	$-21 \pm 13$	$1.28^{+0.82}_{-0.75}$	$4608^{+341}_{-275}$	$6415^{+5673}_{-2005}$	$3.096^{+15.886}_{-2.341}$

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

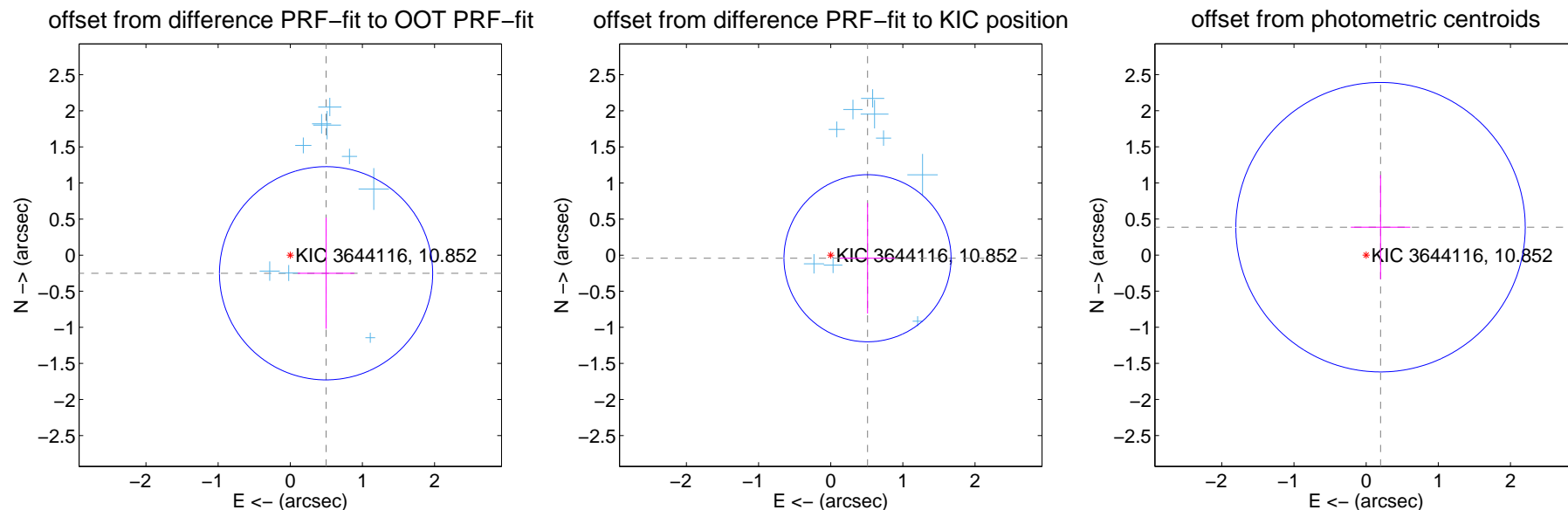
## DV Centroid Data

Supplemental centroid analysis for 003644116-02. **Kepler magnitude: 10.85.** Transit SNR 9.10

There are 12 quarters with good PRF difference image offsets

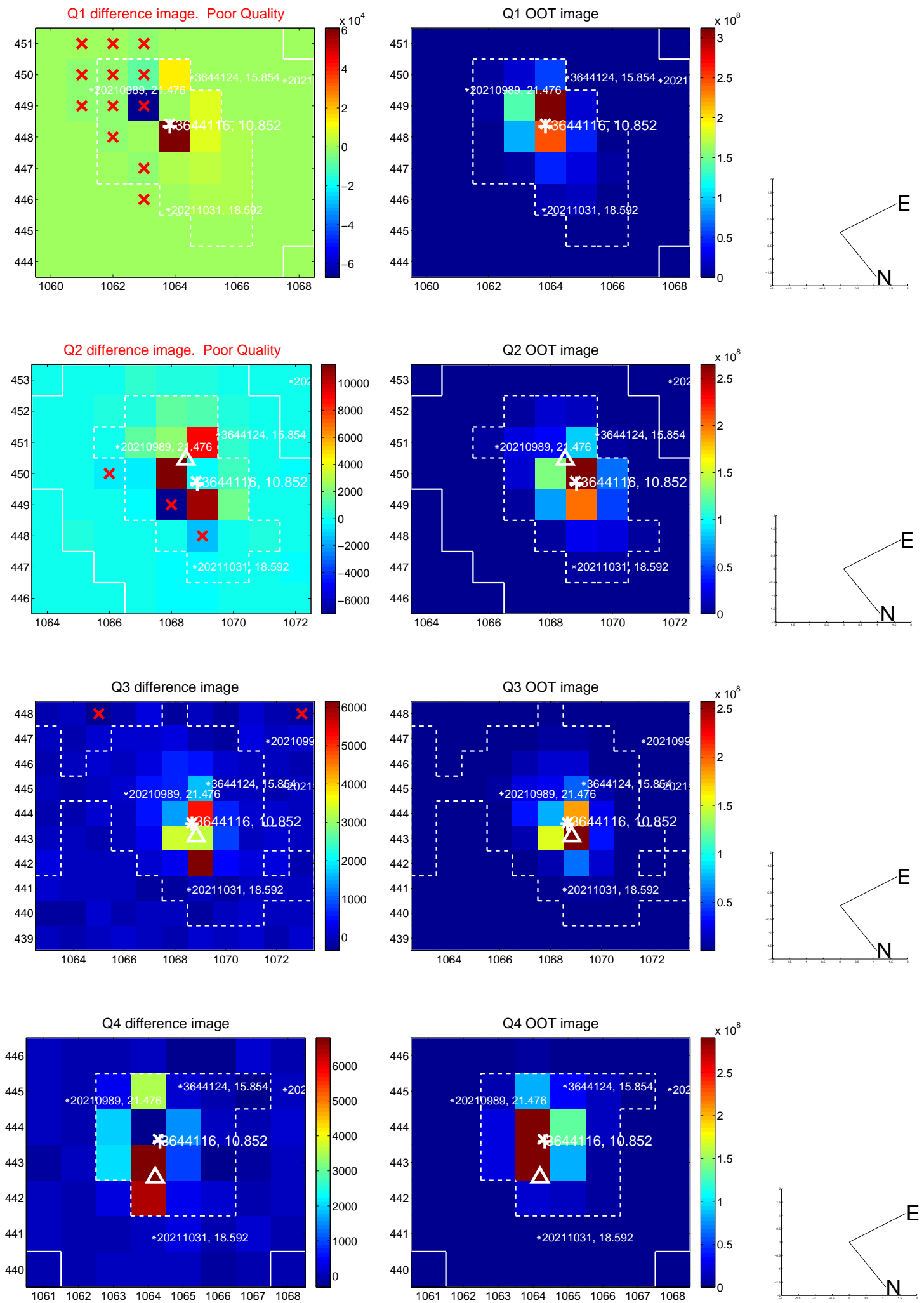
The direct PRF centroid is offset from the target star catalog position by about 0.18 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.556 \pm 0.493$	1.13	$-0.496 \pm 0.391$	$-0.251 \pm 0.769$
PRF-fit source offset from KIC position	$0.512 \pm 0.386$	1.33	$-0.510 \pm 0.382$	$-0.043 \pm 0.766$
photometric centroid source offset	$0.43 \pm 0.67$	0.65	$-0.20 \pm 0.41$	$0.39 \pm 0.72$

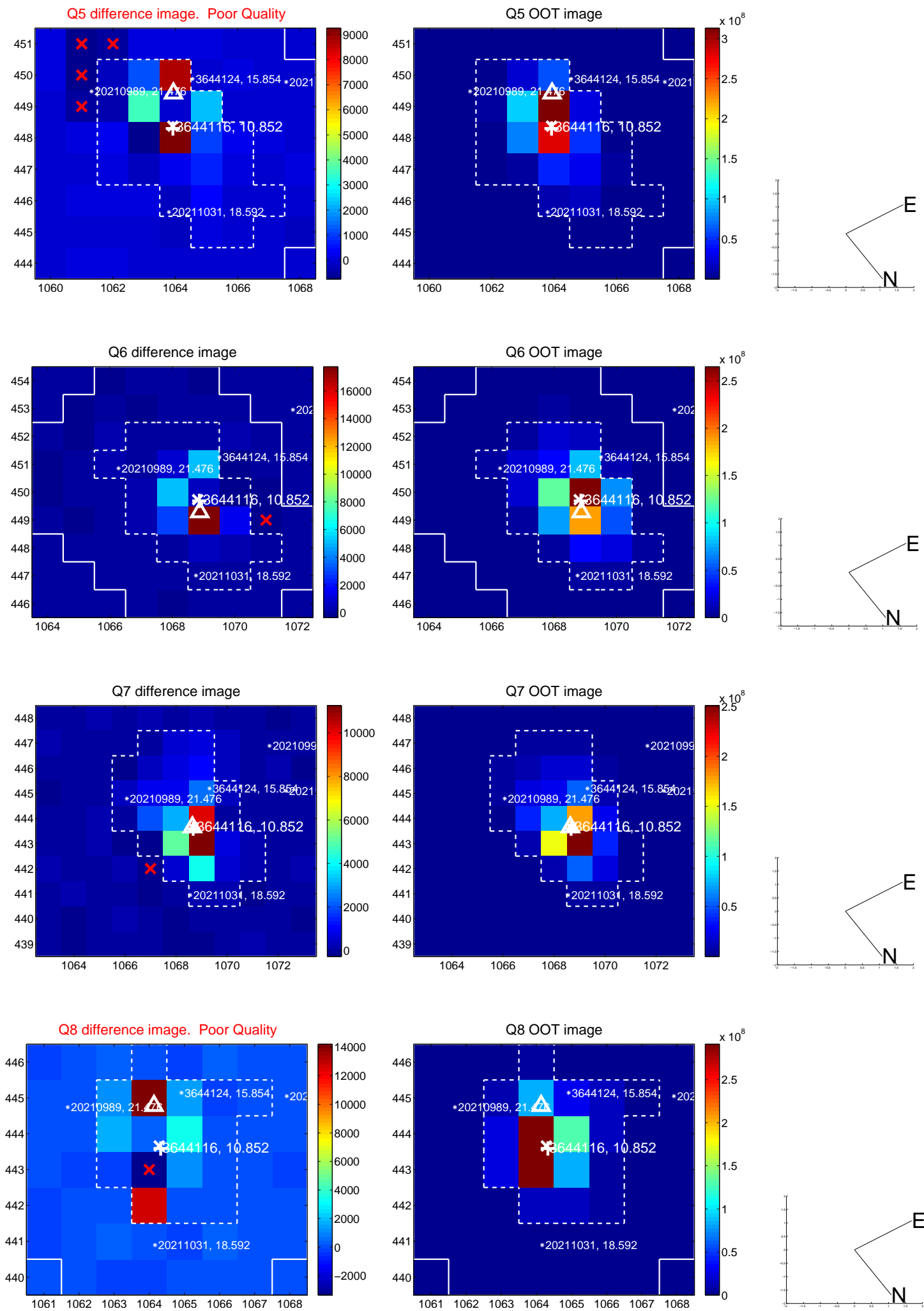


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

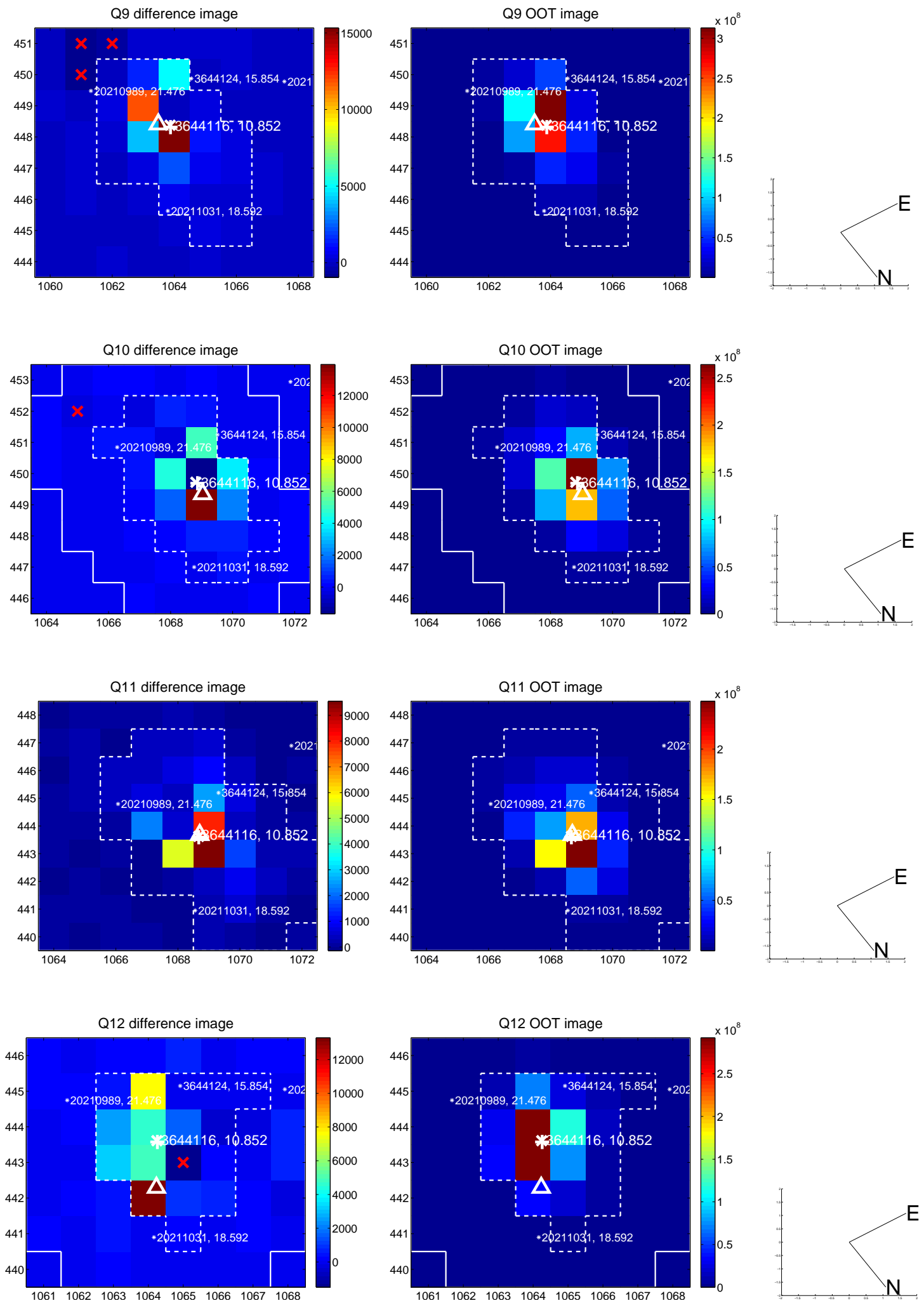


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

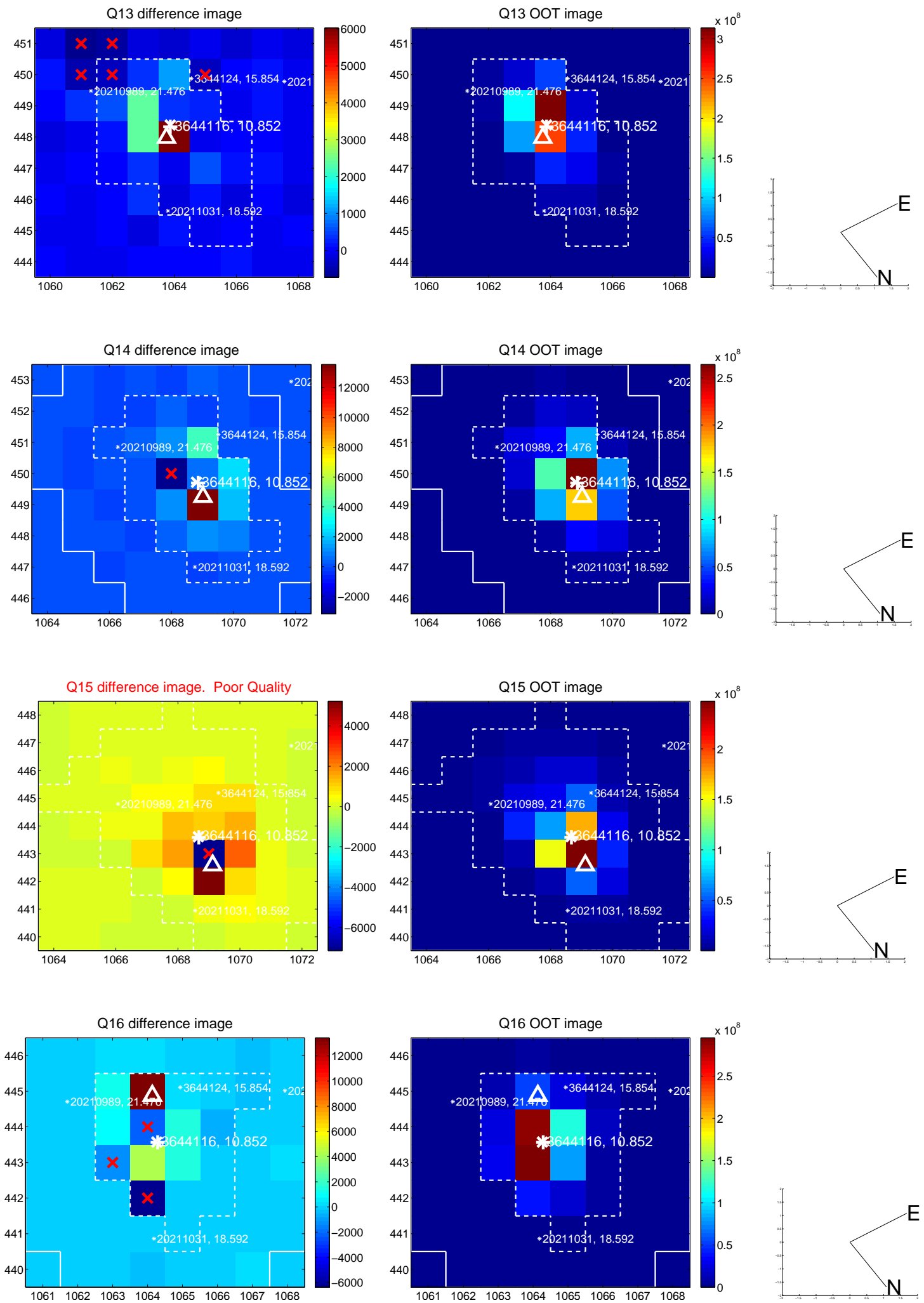




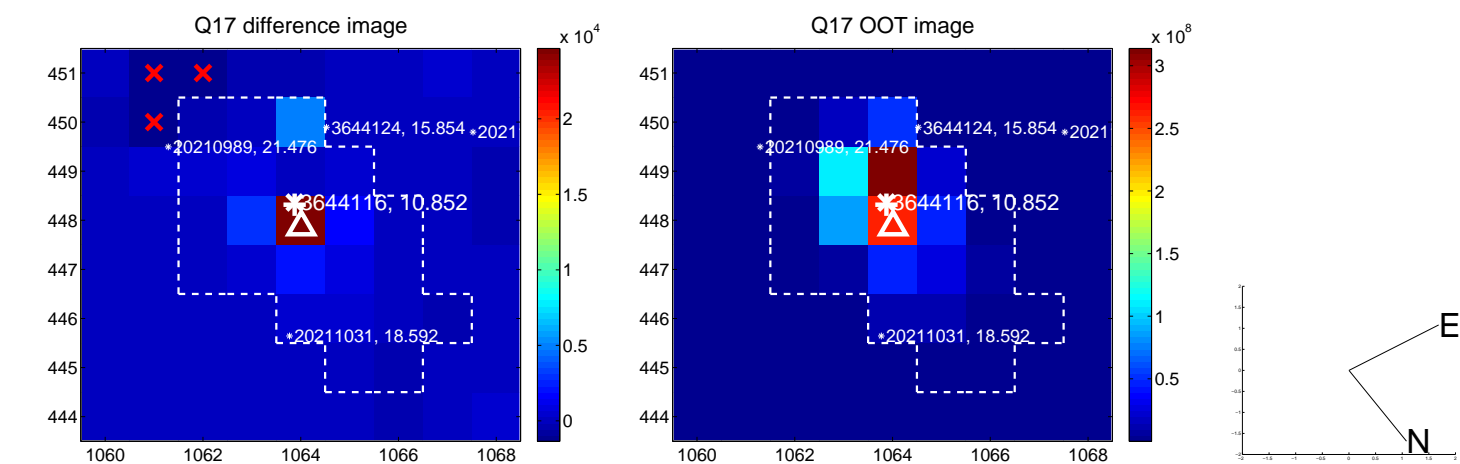
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



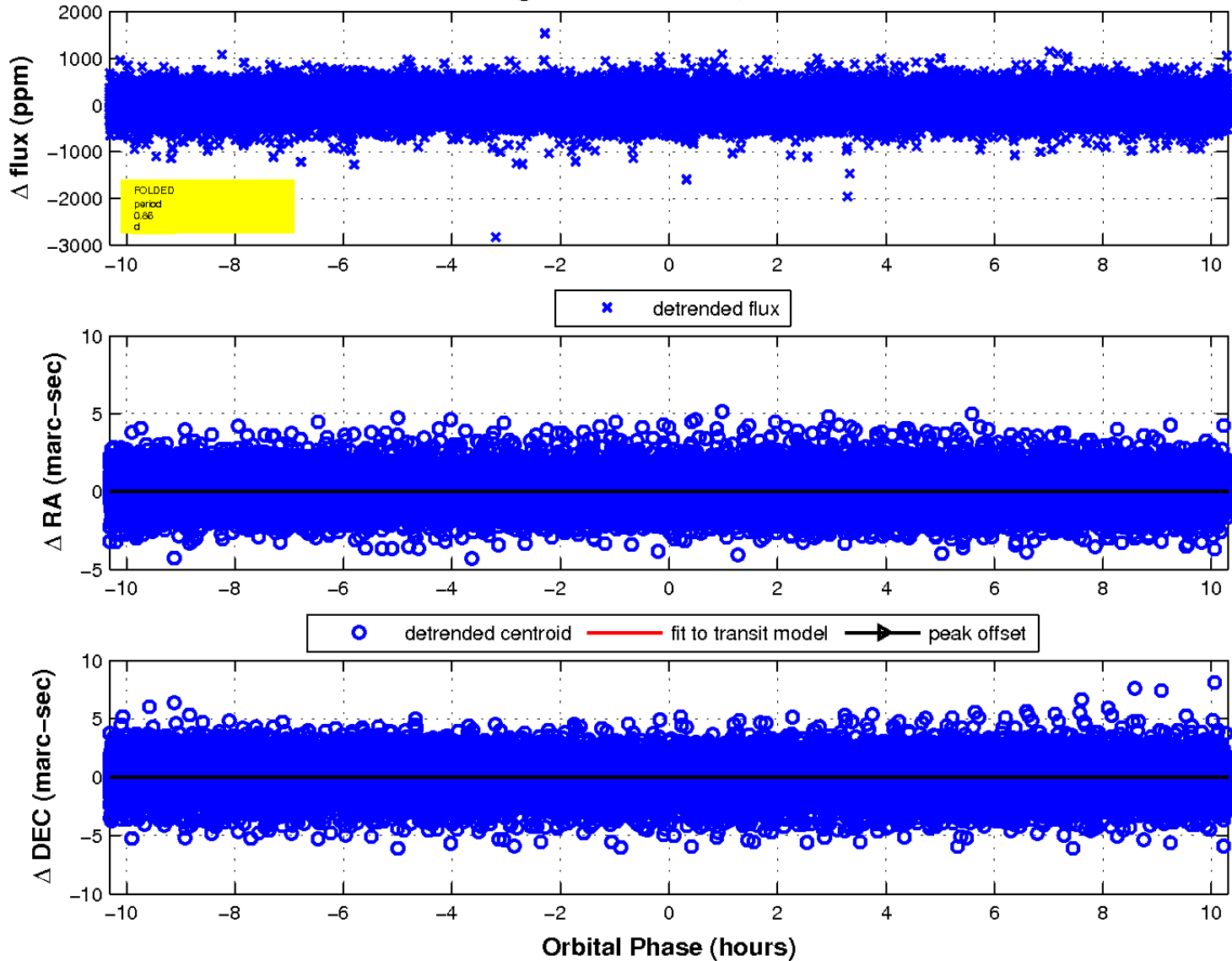
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



### fluxWeightedCentroids, Planet 2 of 2



UKIRT Image

Declination

