

# KIC 005991591

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
005991591-01	OBS	No	4.135316	133.693387	19.1	18.343	9.5	10.4	3.50	8615	1.73	12982.71
005991591-02	OBS	No	4.135761	131.596035	18.6	20.595	10.5	12.2	3.50	8615	1.68	12980.84

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
005991591-01	OBS	FP	0.00	1	0	0	0	LPP_DV
005991591-02	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—SAME_NTL_PERIOD

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

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

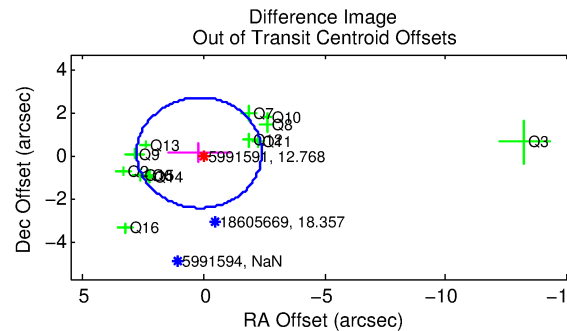
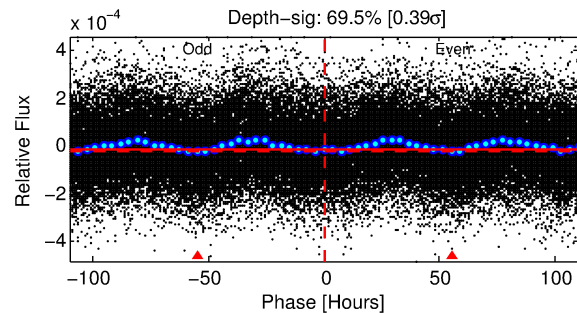
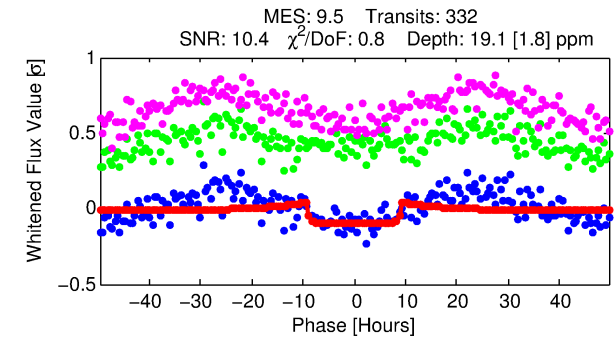
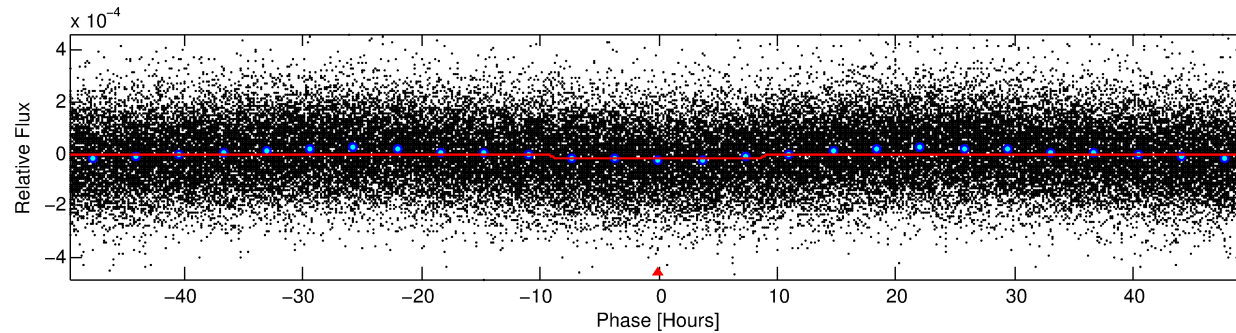
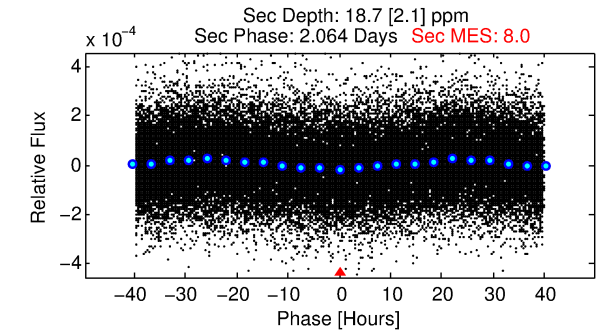
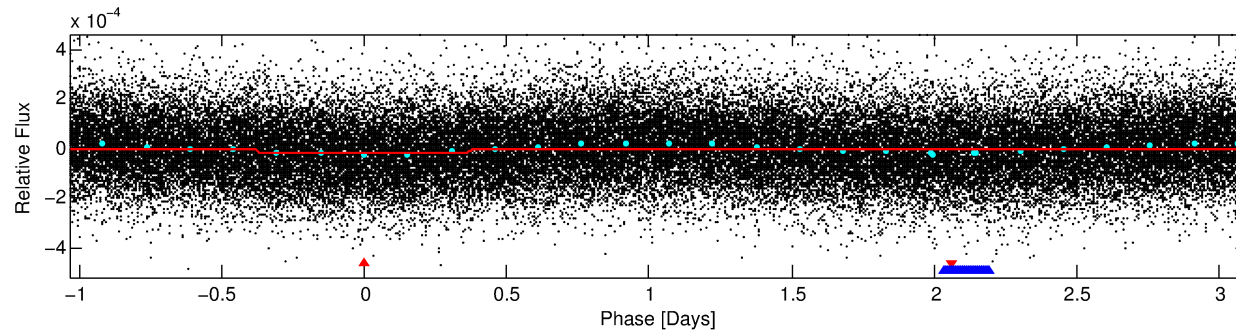
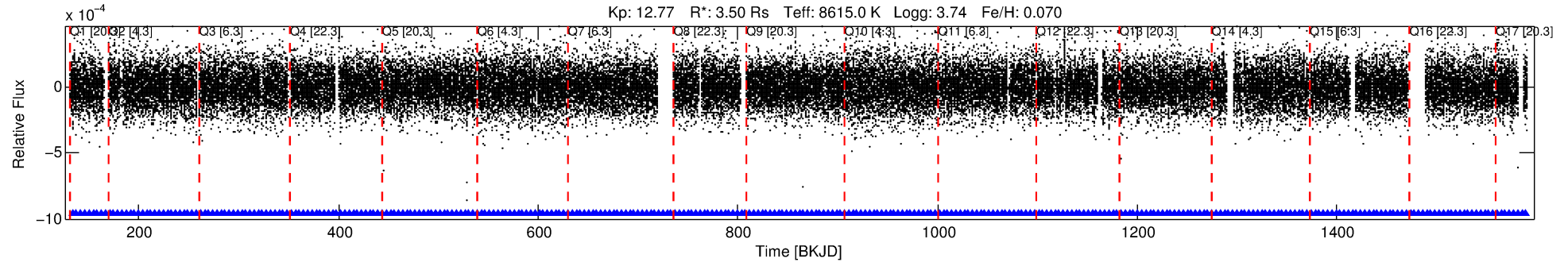
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 005991591-01

No Significant Match Found

# DV One-Page Summary

KIC: 5991591 Candidate: 1 of 2 Period: 4.135 d



## DV Fit Results:

Period = 4.13532 [0.00006] d  
Epoch = 133.6934 [0.0107] BKJD  
Rp/R\* = 0.0045 [0.0006]  
a/R\* = 1.29 [0.46]  
b = 0.85 [0.29]  
Seff = 12982.71 [9857.94]  
Teff = 2722 [517] K  
Rp = 1.73 [0.90] Re  
a = 0.0683 [0.0319] AU  
Ag = 16.10 [12.82] [1.18σ]  
Teffp = 8430 [756] K [6.24σ]

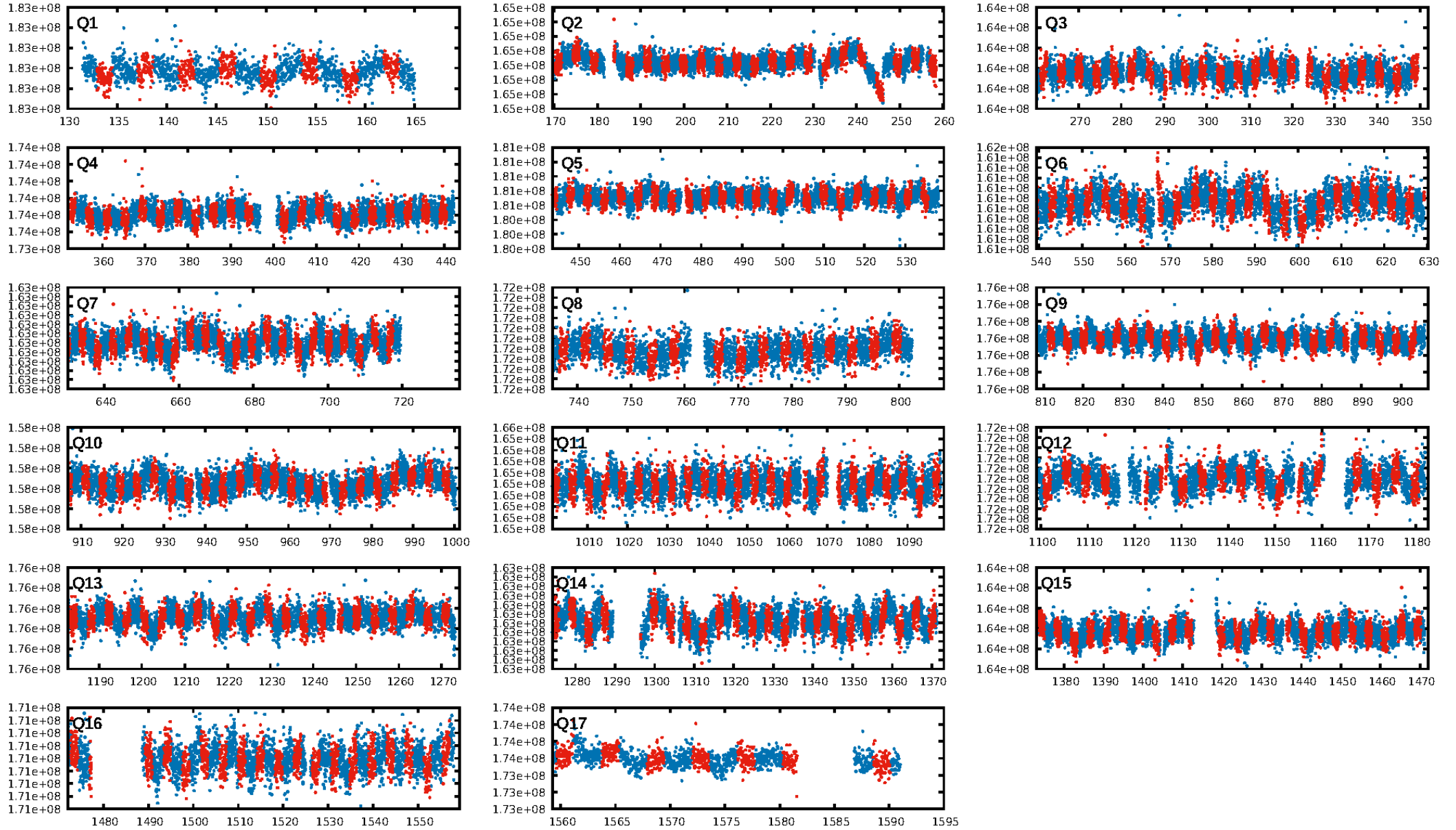
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 0.0% [0.00σ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [317/317]  
GhostDiagnostic-chr: 12.2  
Centroid-sig: 11.1%  
Centroid-so: 1.281 arcsec [0.97σ]  
OotOffset-rm: 0.229 arcsec [0.27σ]  
KicOffset-rm: 0.344 arcsec [0.44σ]  
OotOffset-st: 4/4/3/2 [13]  
KicOffset-st: 4/4/3/2 [13]  
DiffImageQuality-fgm: 0.62 [8/13]  
DiffImageOverlap-fno: 1.00 [17/17]

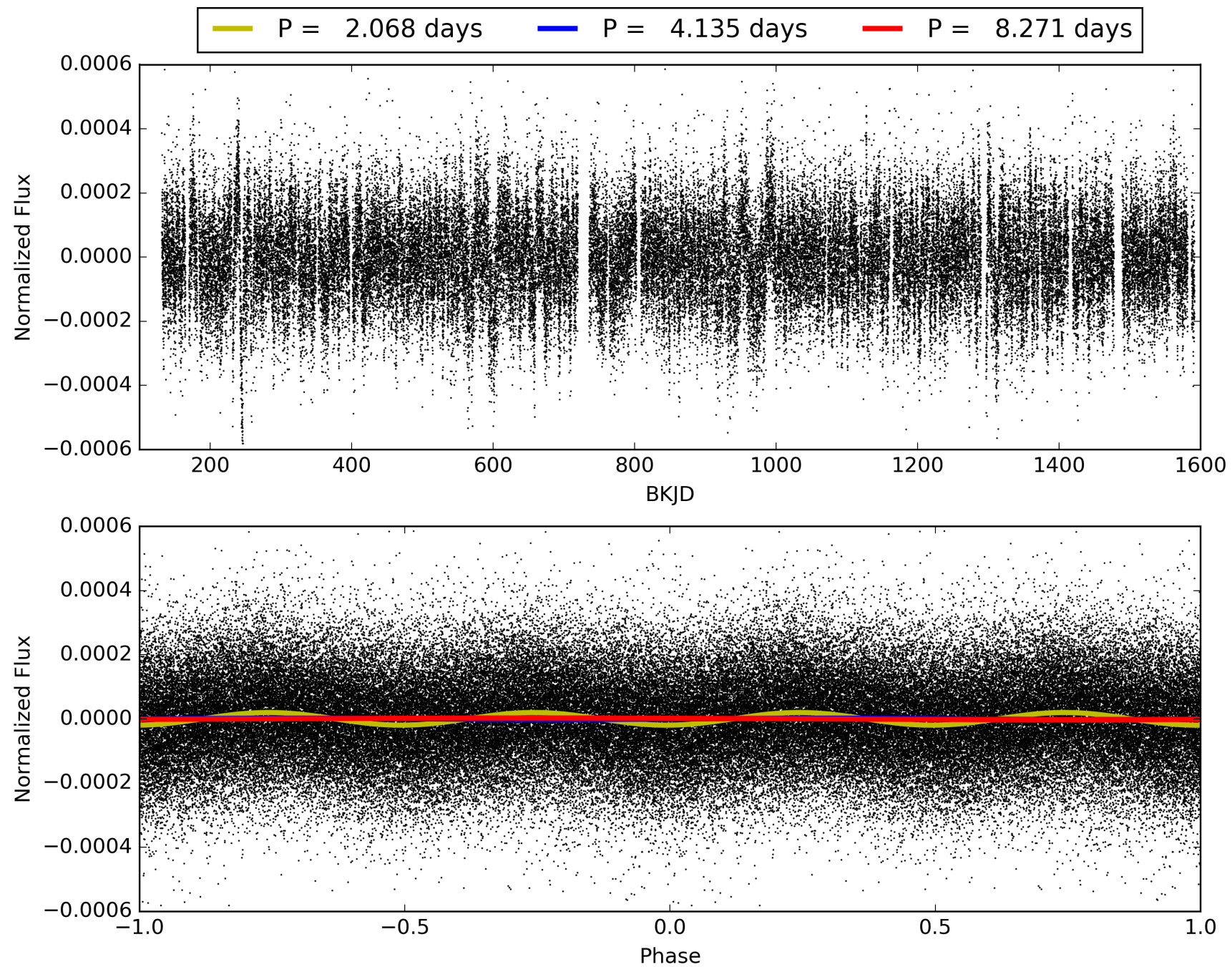
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 29-Jan-2016 10:43:16 Z

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

# TCE 005991591-01, PDC Light Curves



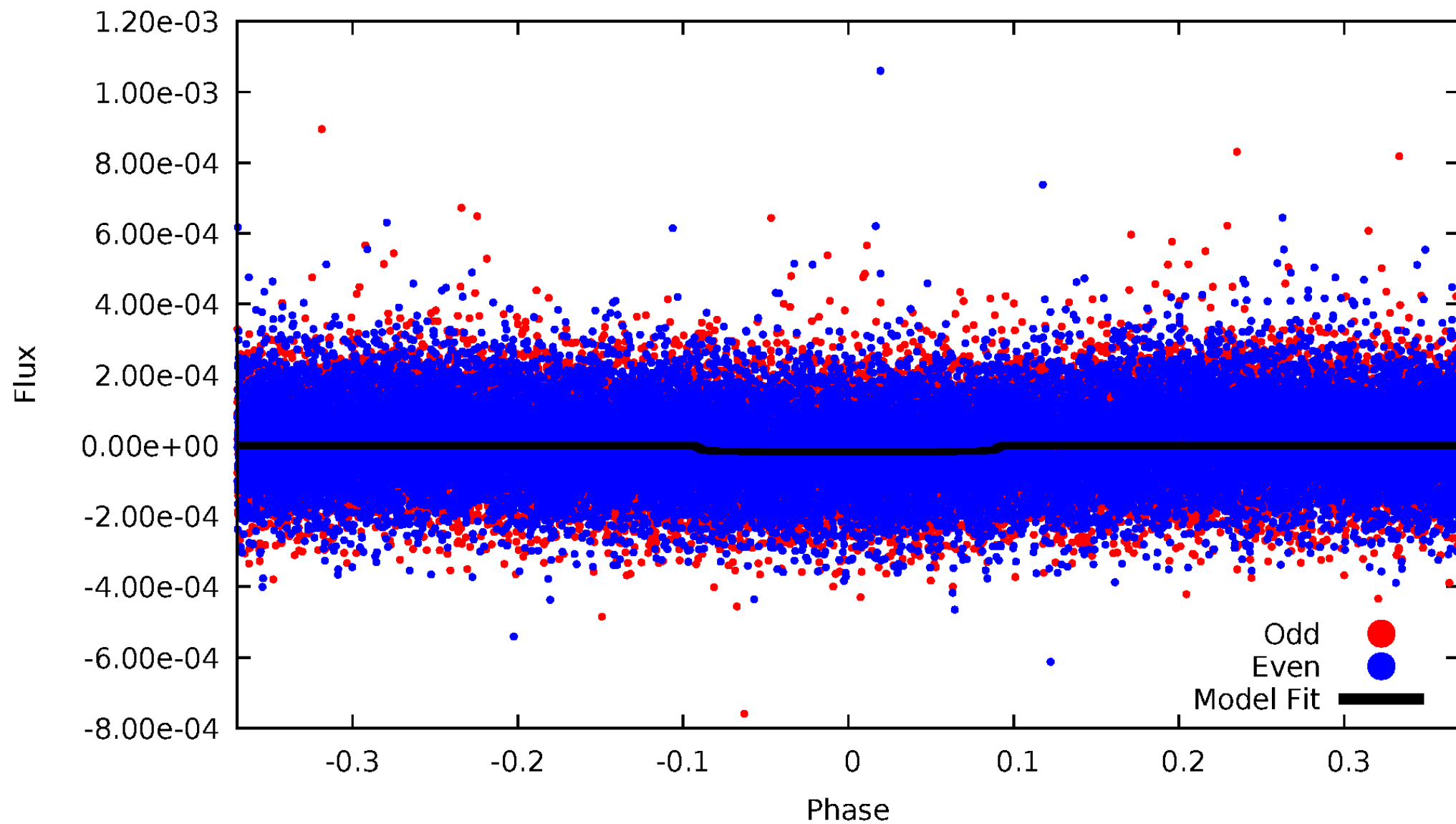
# TCE 005991591-01





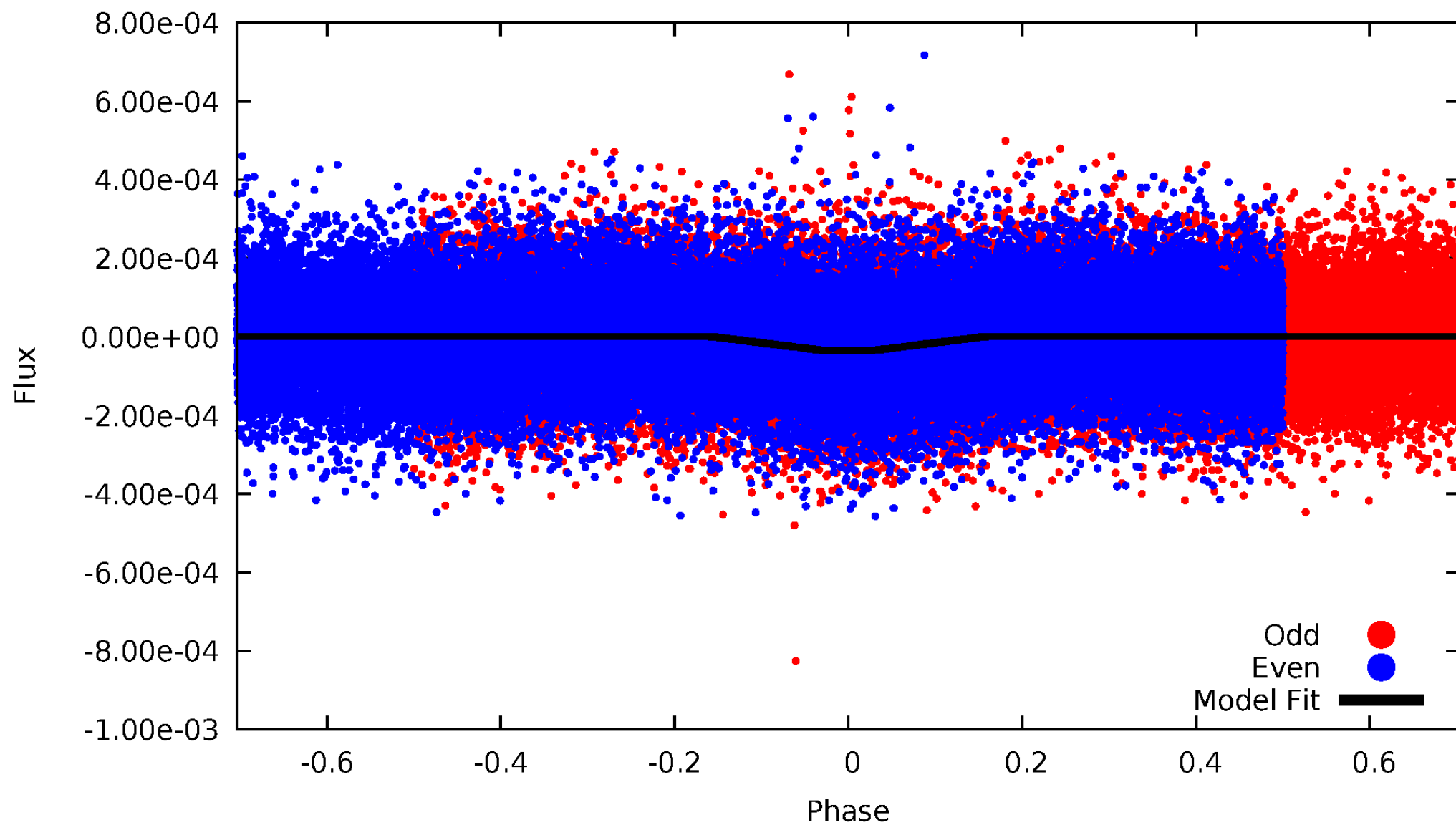
# DV Odd/Even

TCE 005991591-01



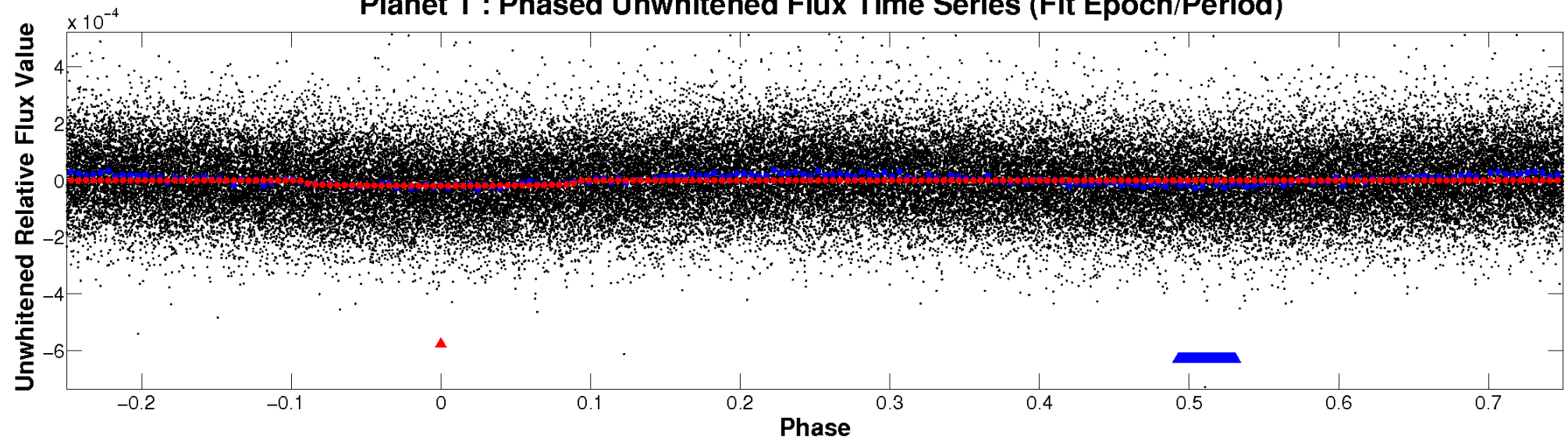
# ALT Odd/Even

TCE 005991591-01

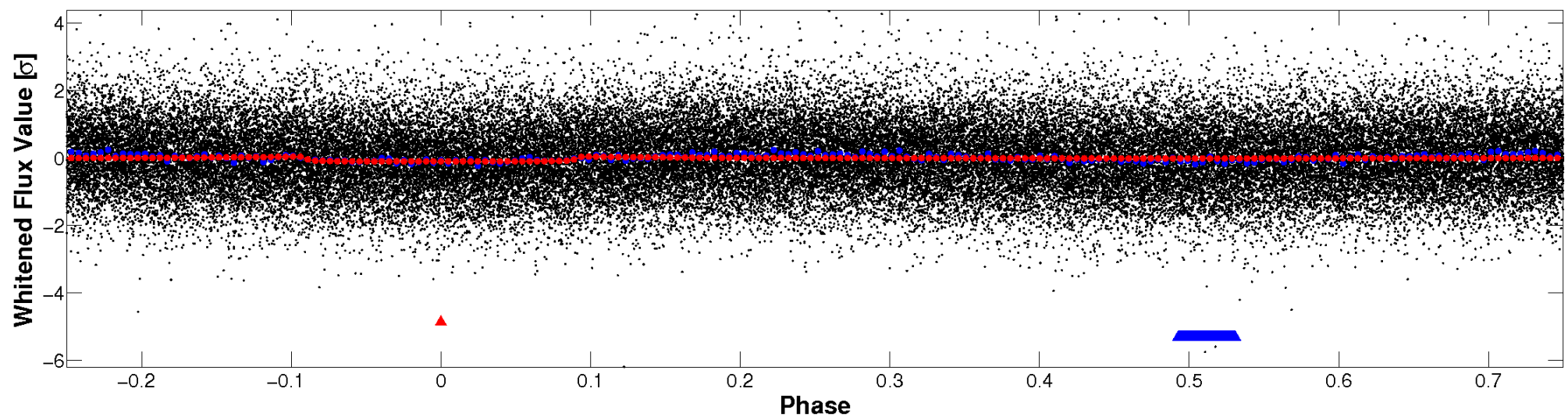


# Non-Whitened Vs. Whitened Light Curve

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

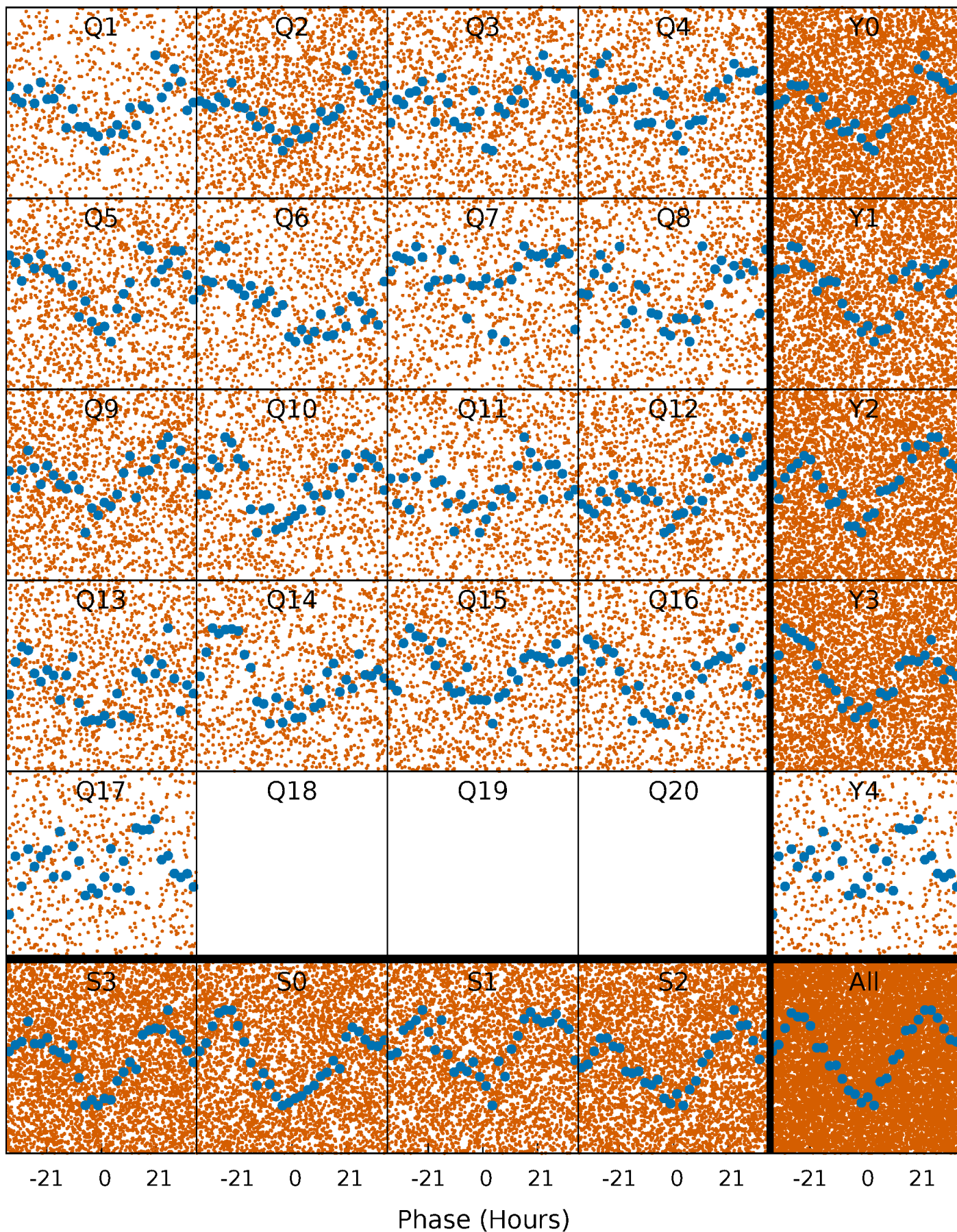


**Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



# PDC Quarter-Phased Transit Curves

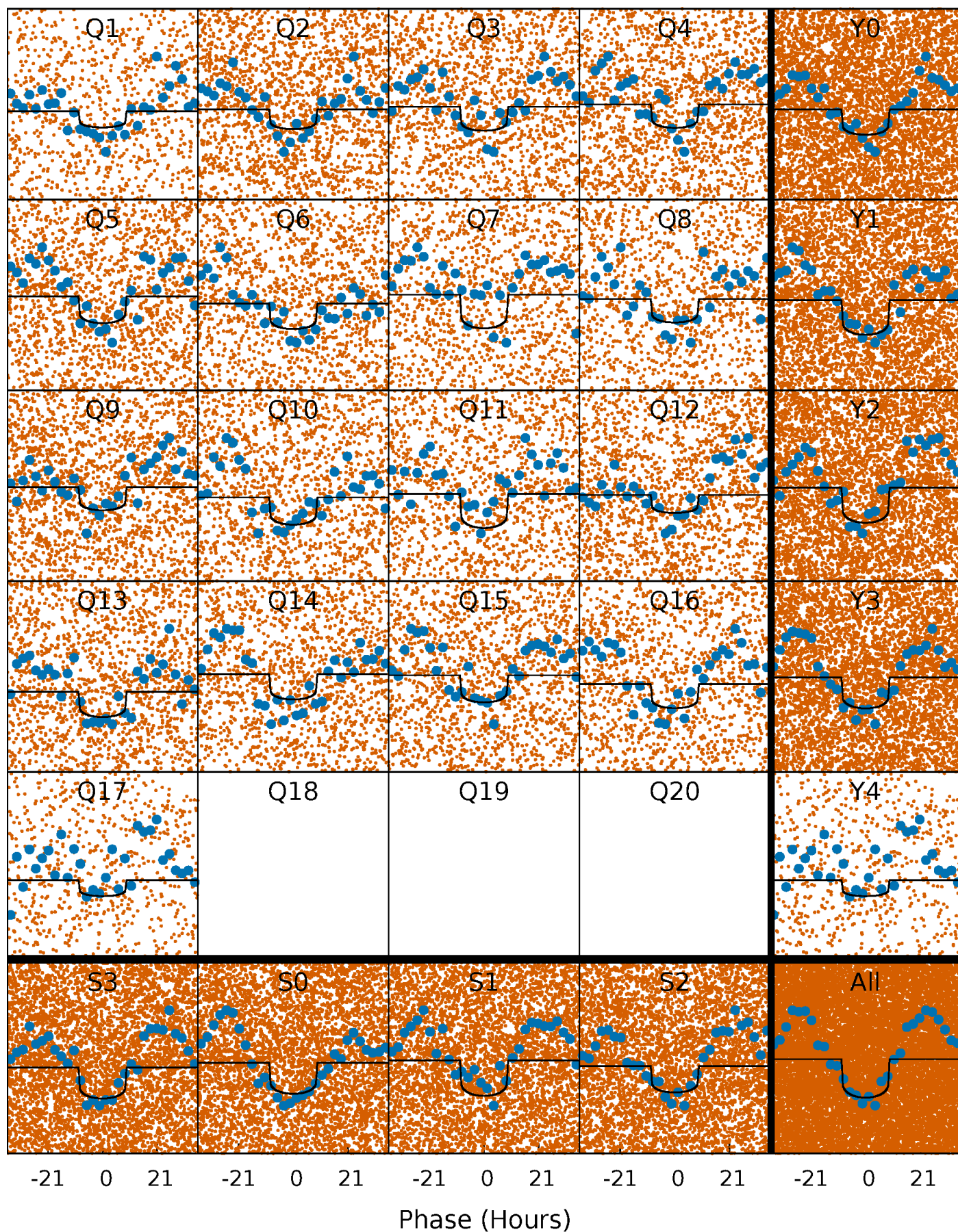
TCE 005991591-01 P= 4.135316 Days  $T_0=133.693387$  (BKJD)





# DV Quarter-Phased Transit Curves

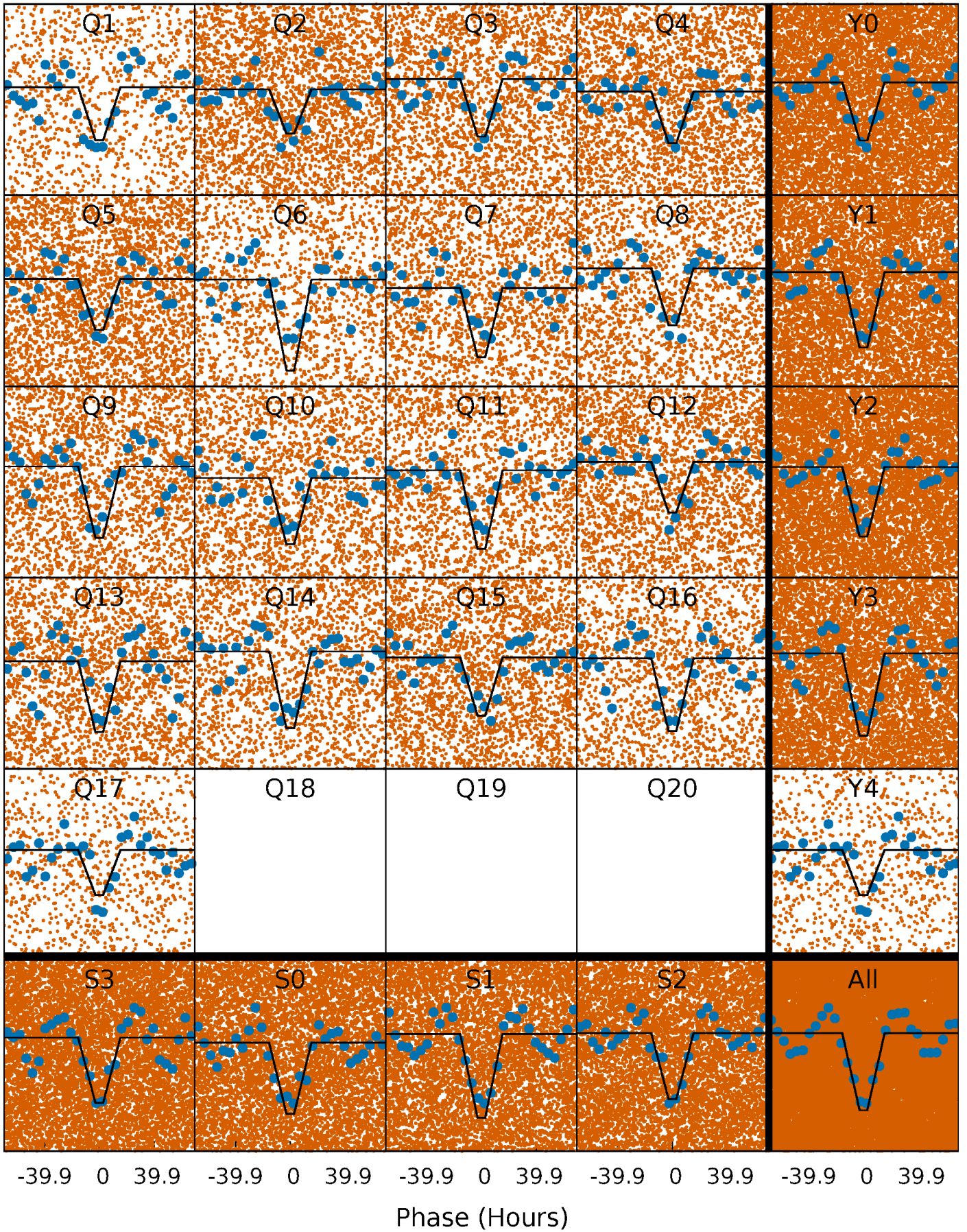
TCE 005991591-01 P= 4.135316 Days  $T_0=133.693387$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

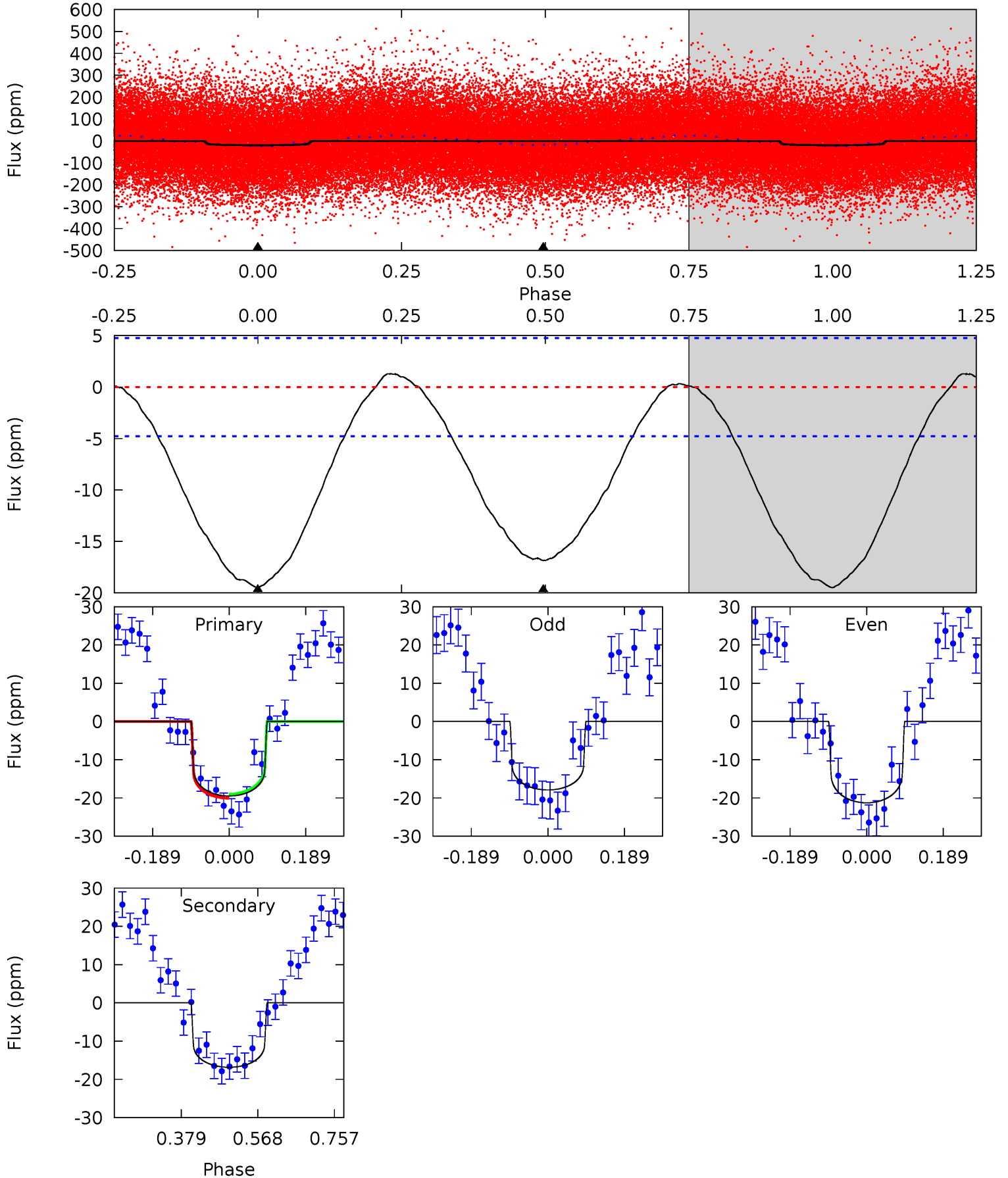
TCE 005991591-01   P= 4.134494 Days    $T_0=133.828921$  (BKJD)



# DV Model-Shift Uniqueness Test

005991591-01, P = 4.135316 Days, E = 129.558071 Days

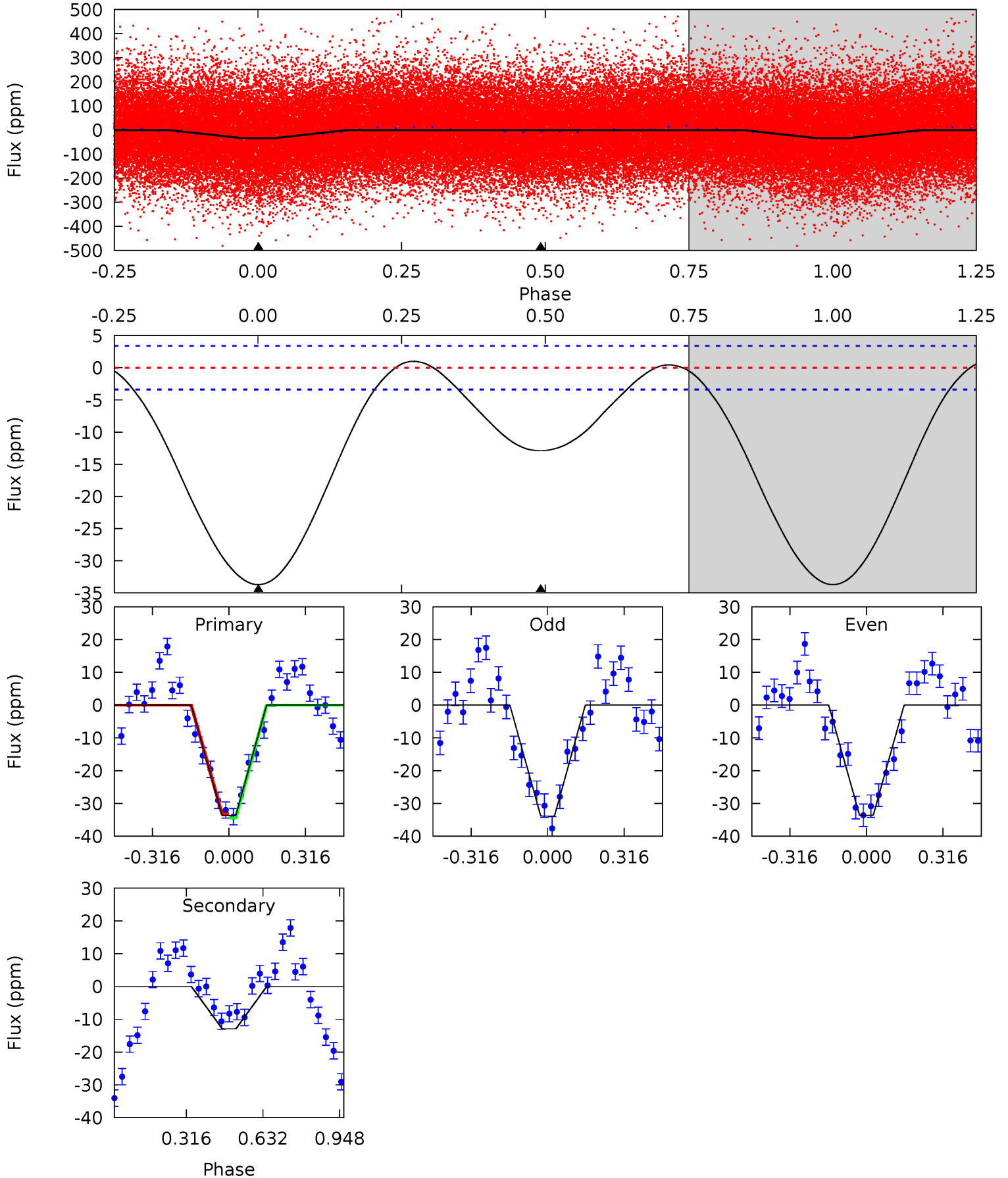
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
18.1	15.7	0	0	4.43	1.31	0.96	18.1	18.1	15.7	15.7	1.57	0.99	0.06	0.47



# Alt Model-Shift Uniqueness Test

005991591-01, P = 4.134494 Days, E = 129.694427 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
42.9	16.4	0	0	4.32	1.00	1.15	42.9	42.9	16.4	16.4	0.16	1.08	0.03	0.74





### Stellar Parameters For KIC 005991591

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$8615^{+236}_{-405}$	$3.744^{+0.427}_{-0.171}$	$0.070^{+0.300}_{-0.550}$	$3.501^{+0.944}_{-1.754}$	$2.477^{+0.290}_{-0.871}$	$0.081^{+0.317}_{-0.041}$
	+3%/-5%	+11%/-5%	+429%/-786%	+27%/-50%	+12%/-35%	+390%/-50%
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 005991591-01 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	$-17 \pm 1$	$1.61^{+0.47}_{-0.42}$	$3730^{+328}_{-442}$	$8048^{+829}_{-764}$	$16^{+12}_{-6}$
Alt.	$-13 \pm 1$	$2.20^{+0.46}_{-0.56}$	$3725^{+329}_{-426}$	$6314^{+454}_{-372}$	$6.742^{+4.656}_{-2.009}$

$T_{\text{max}}$  = 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

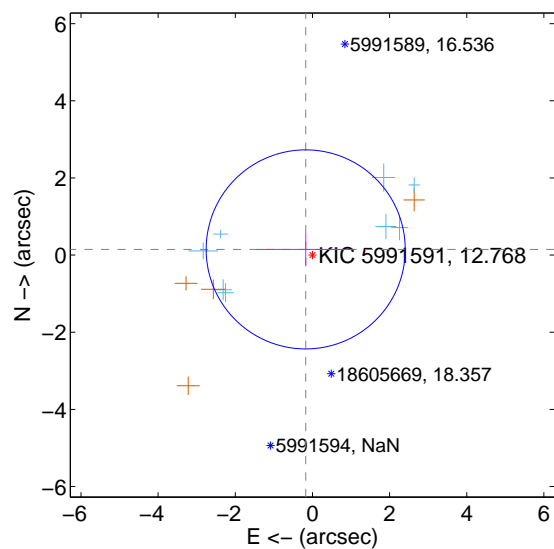
Supplemental centroid analysis for 005991591-01. Kepler magnitude: 12.77. Transit SNR 10.35

There are 8 quarters with good PRF difference image offsets

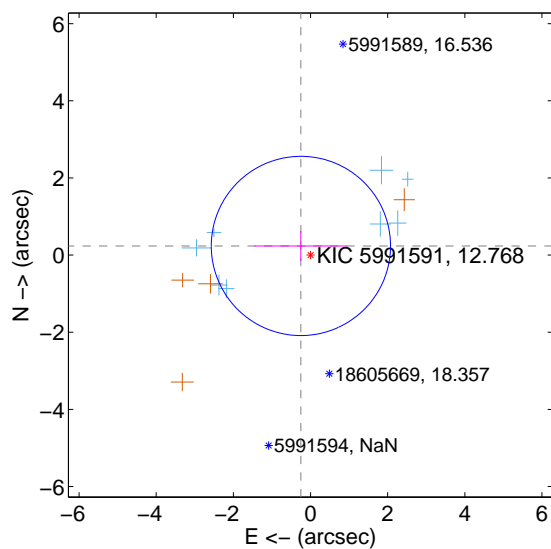
The direct PRF centroid is offset from the target star catalog position by about 0.14 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.229 \pm 0.860$	0.27	$0.175 \pm 1.275$	$0.148 \pm 0.421$
PRF-fit source offset from KIC position	$0.344 \pm 0.774$	0.44	$0.249 \pm 1.208$	$0.237 \pm 0.387$
photometric centroid source offset	$1.28 \pm 1.32$	0.97	$-0.59 \pm 1.06$	$1.13 \pm 1.38$

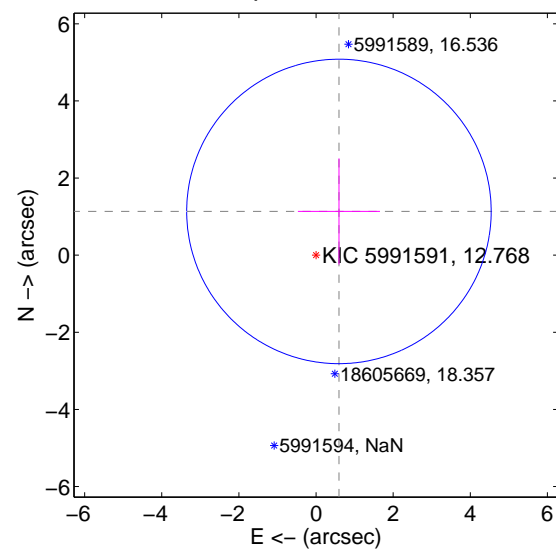
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

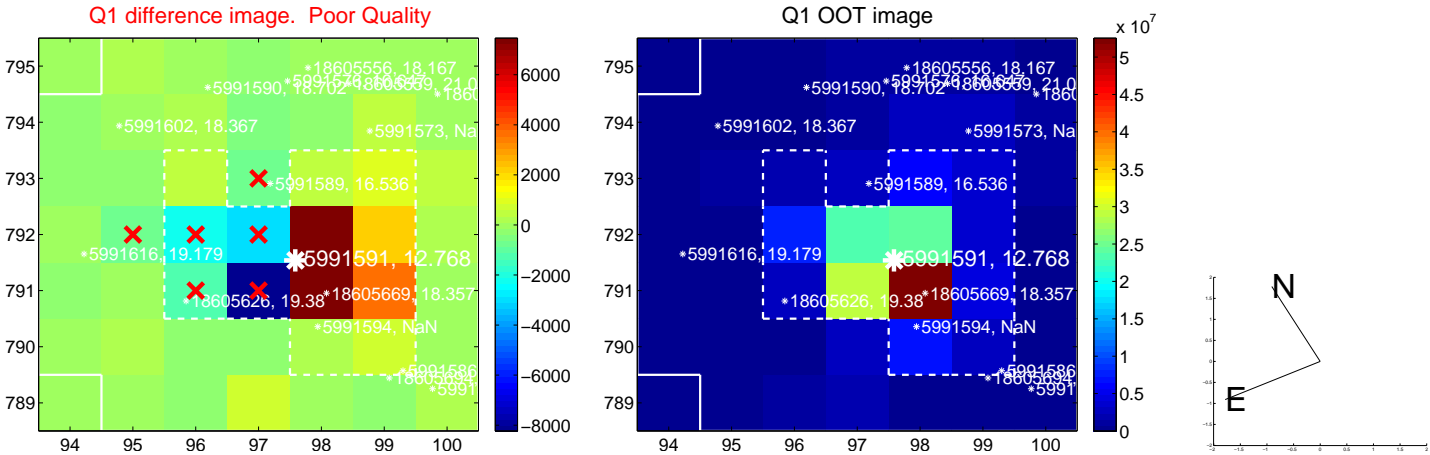


offset from photometric centroids

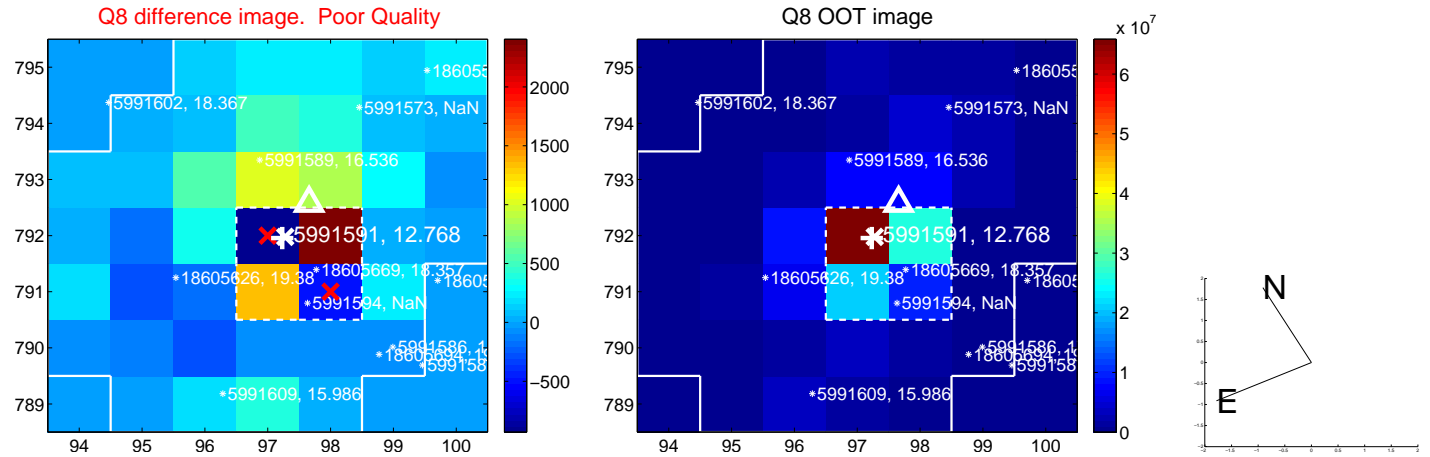
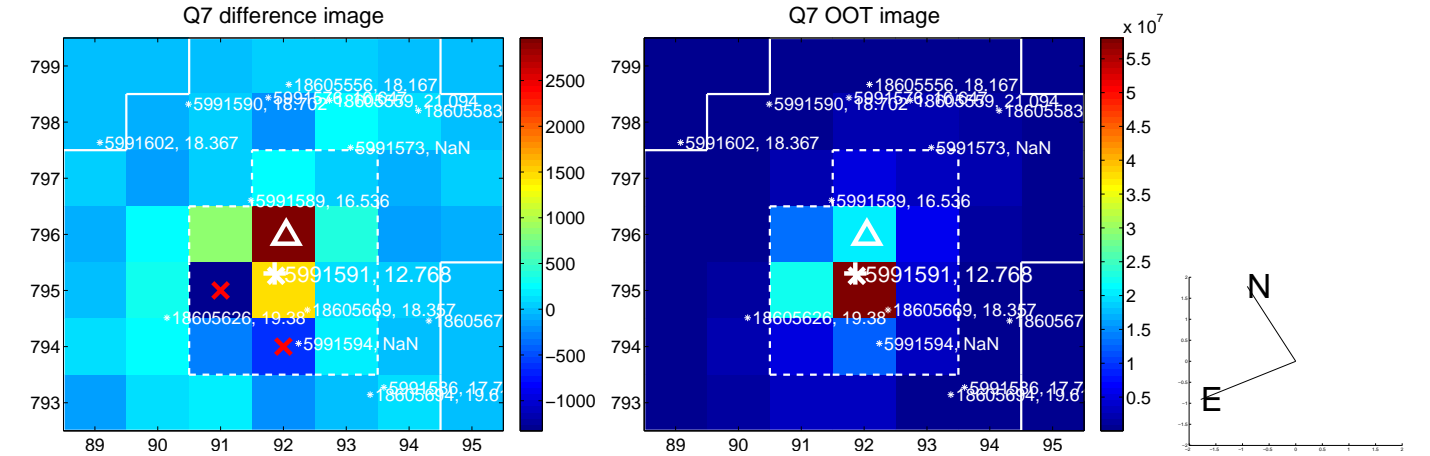
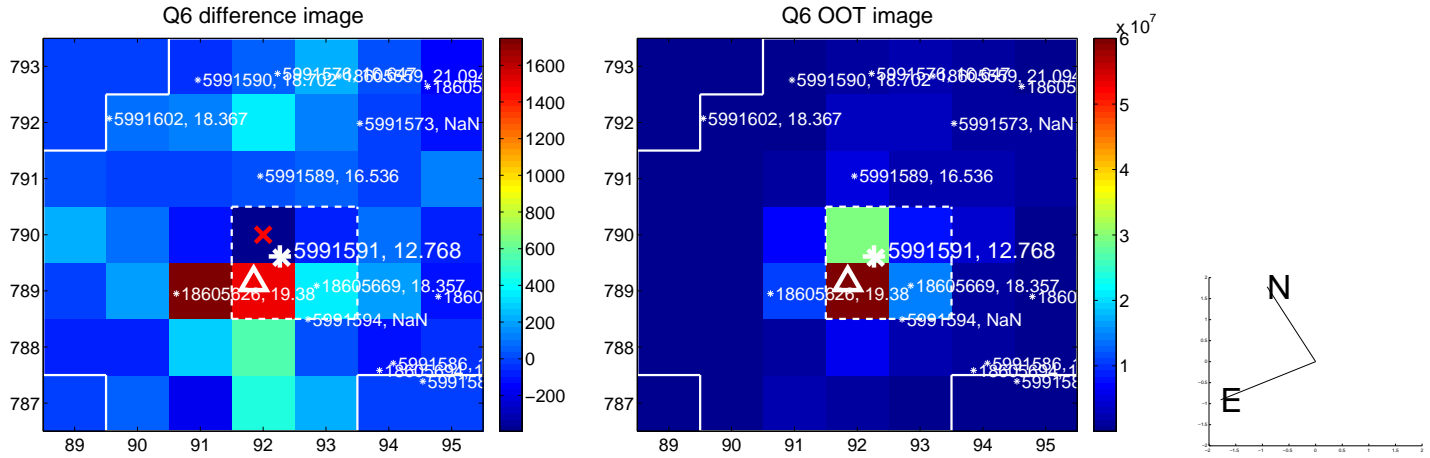
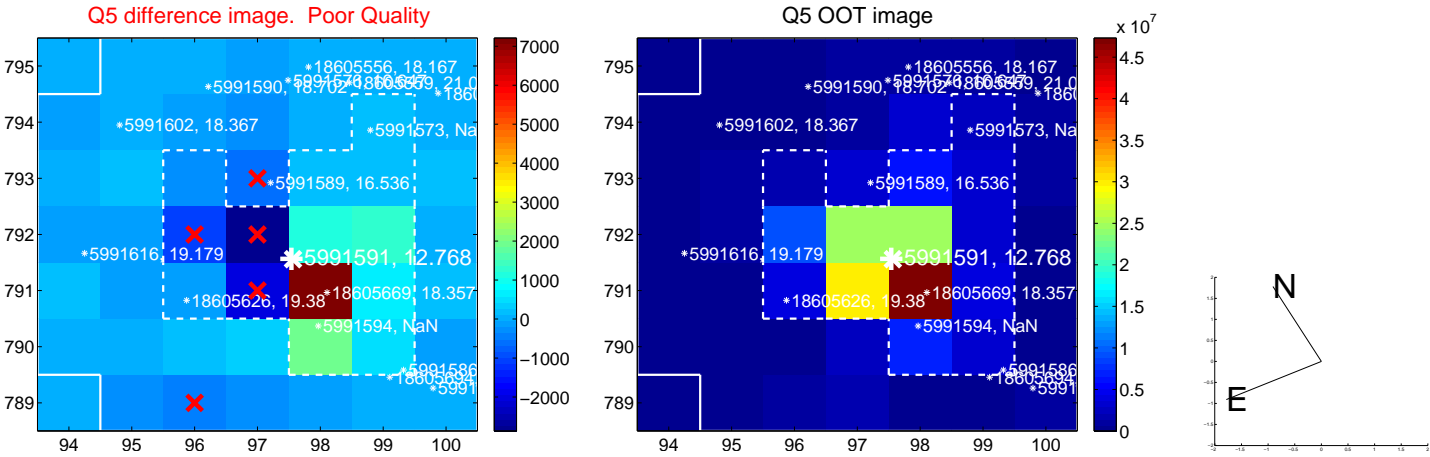


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

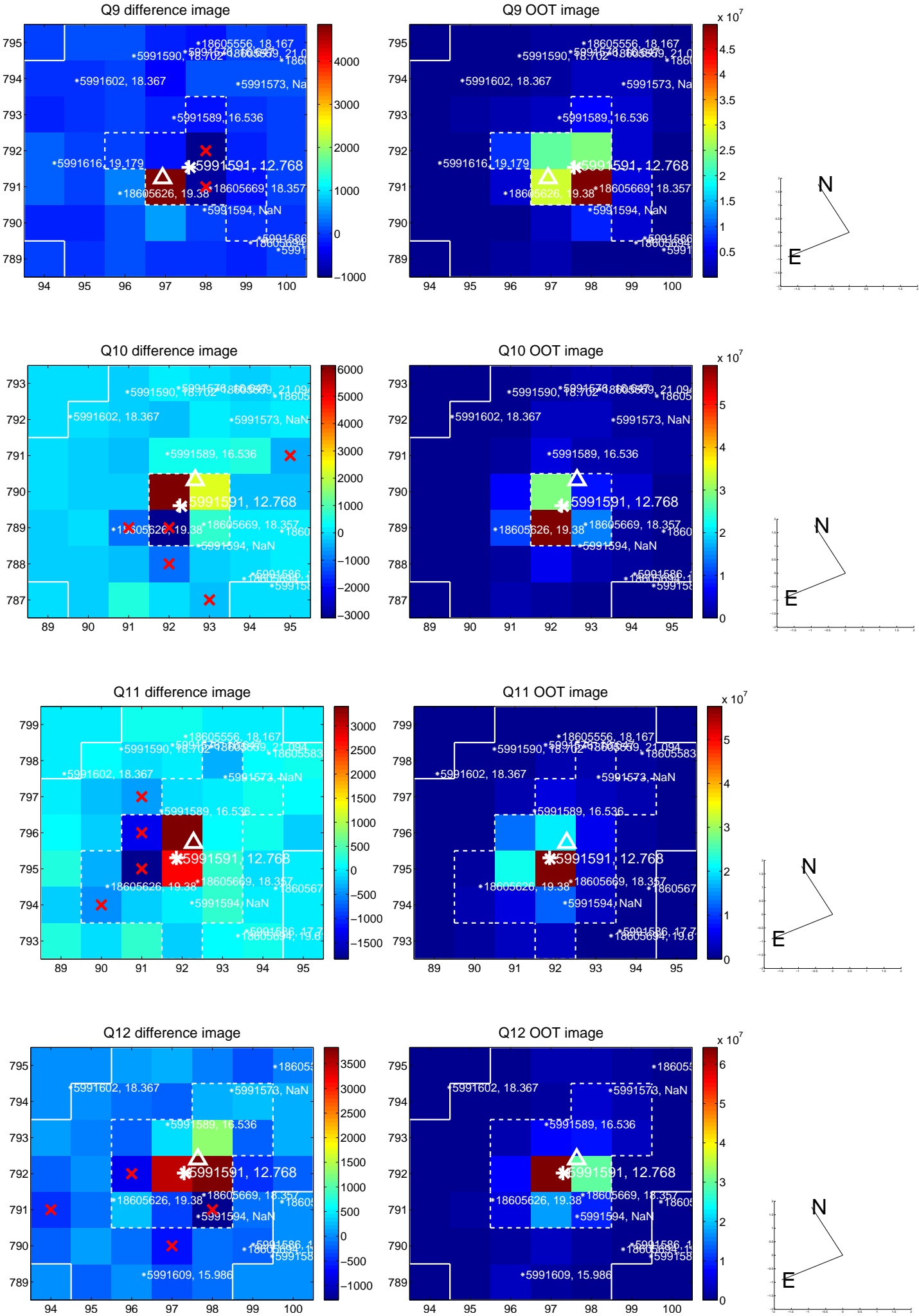


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

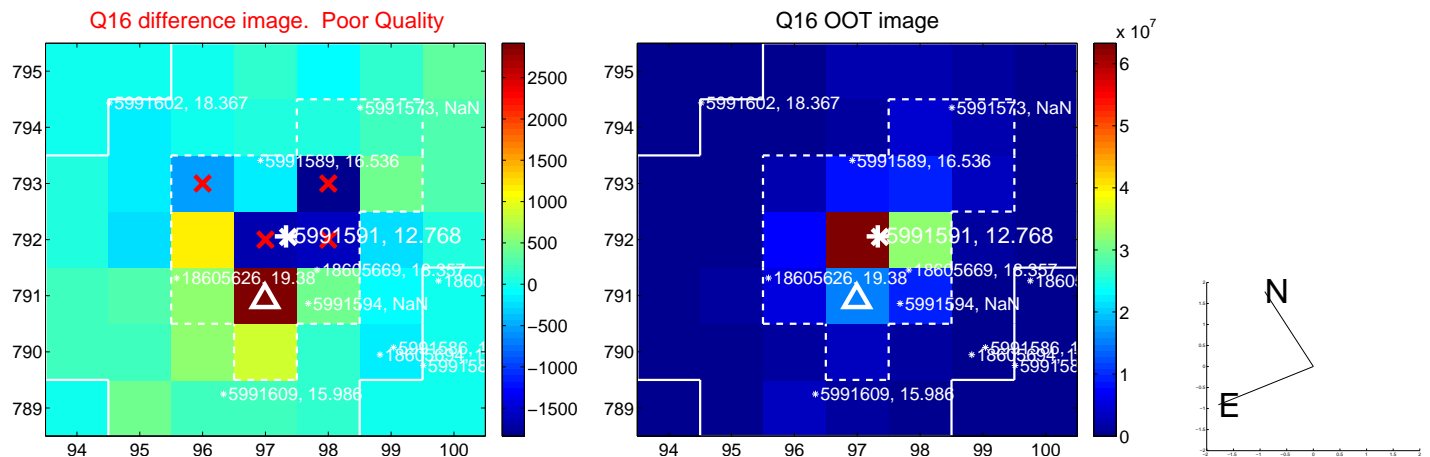
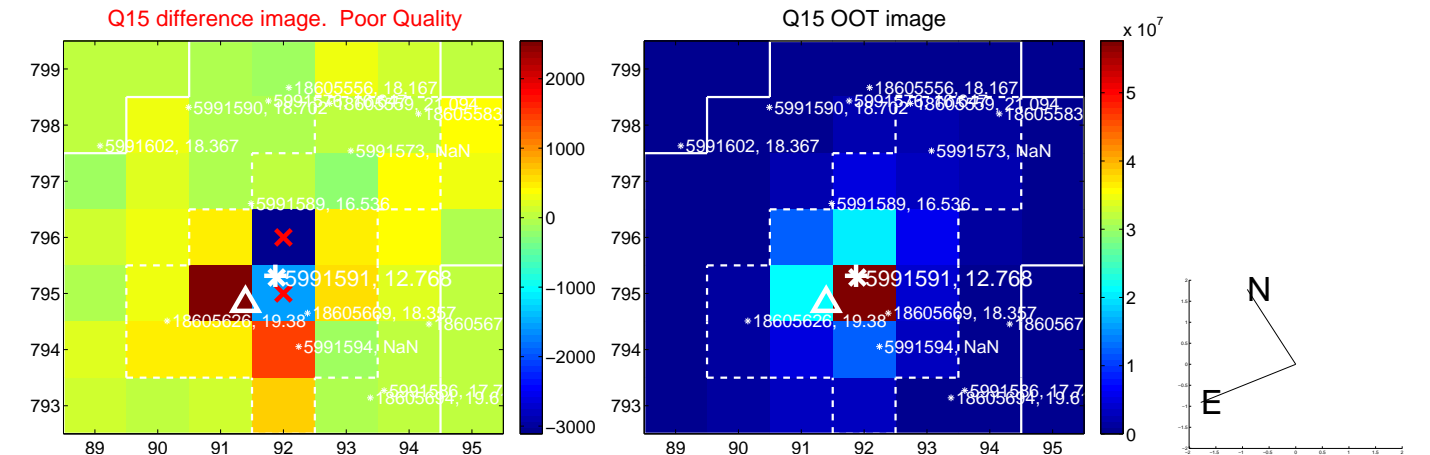
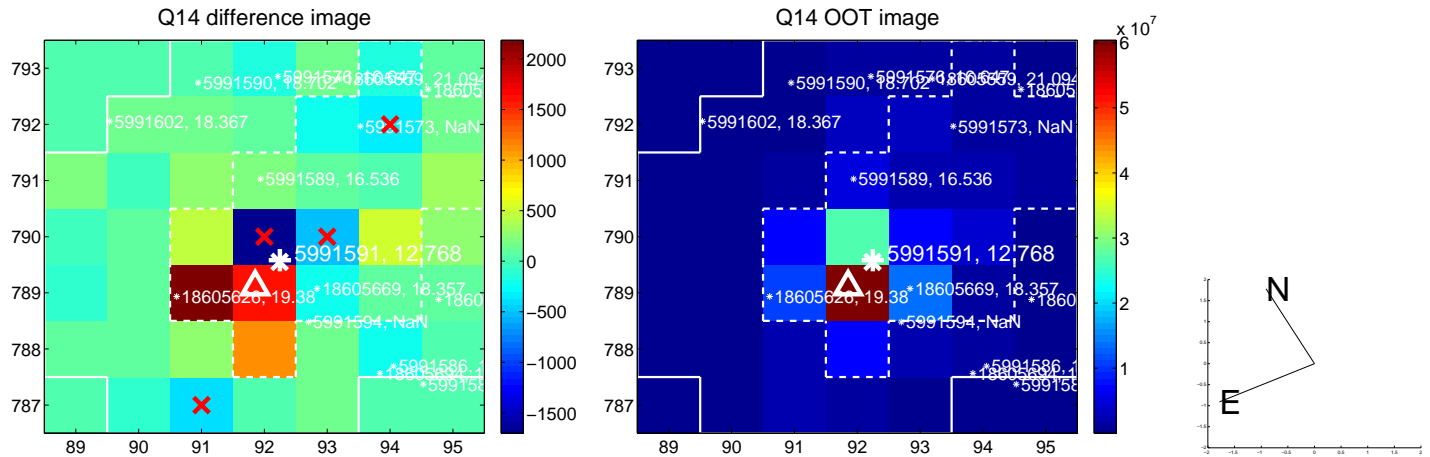
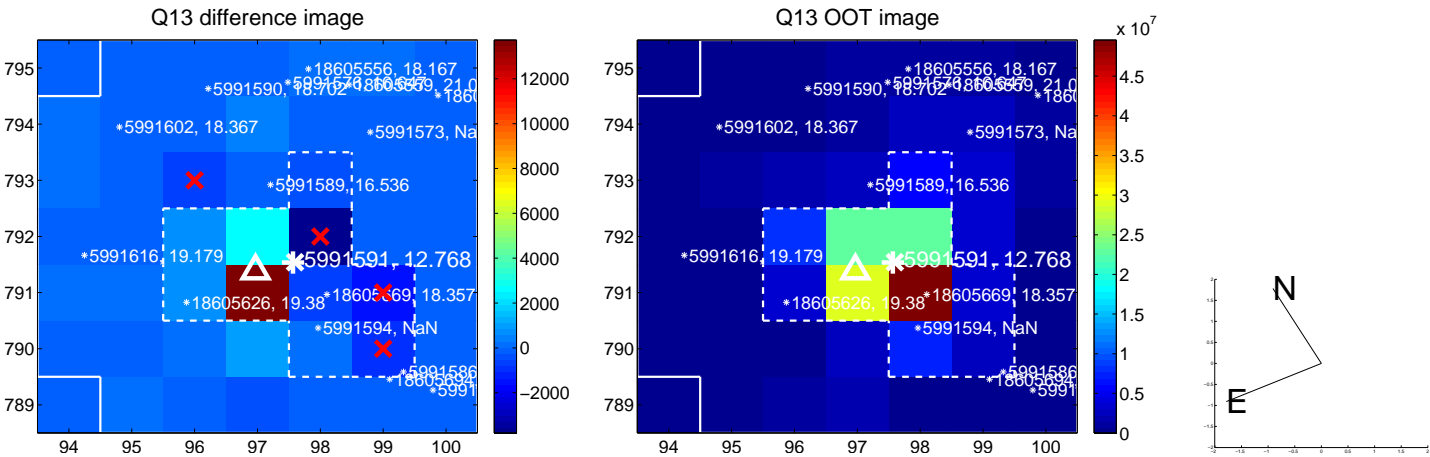




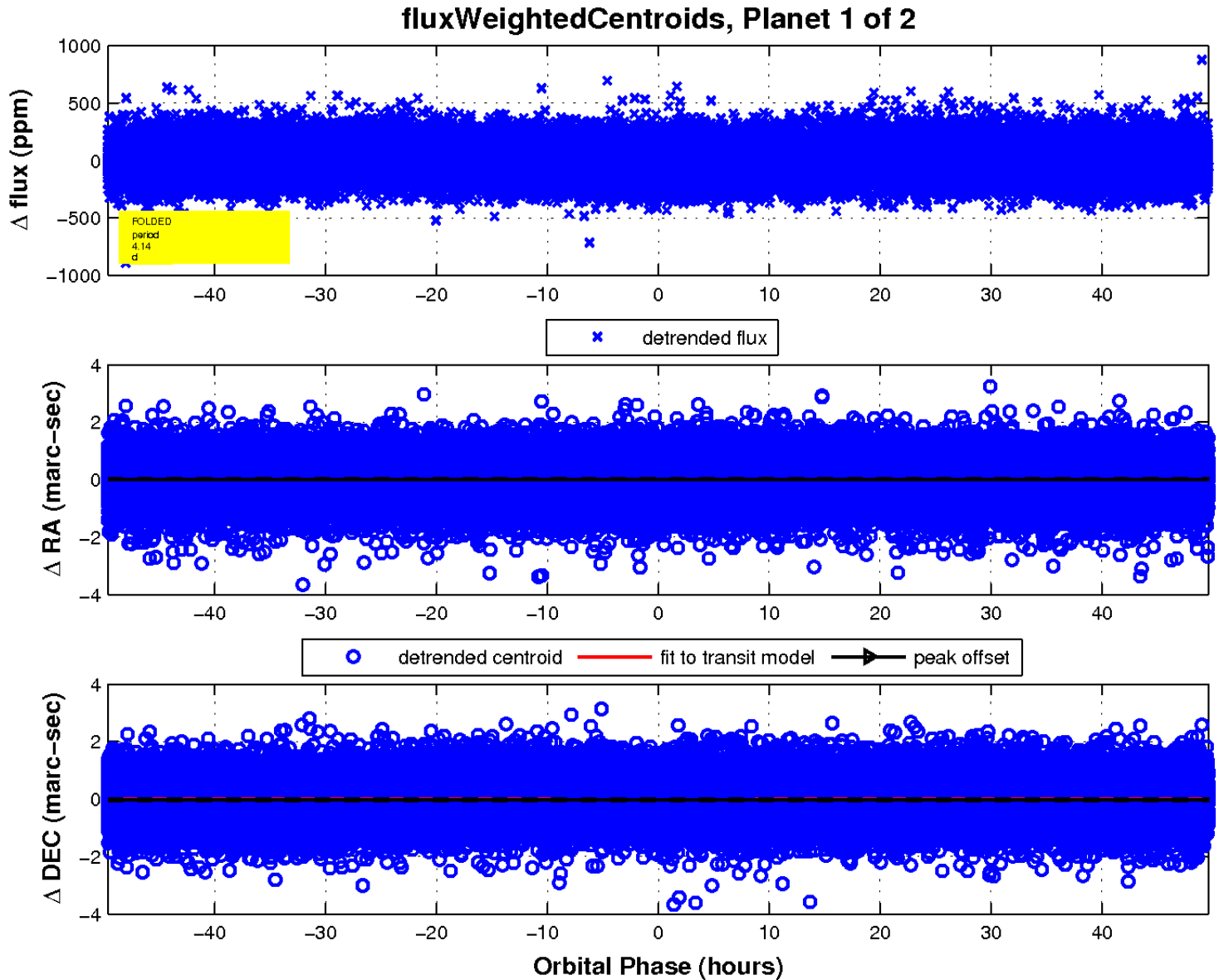
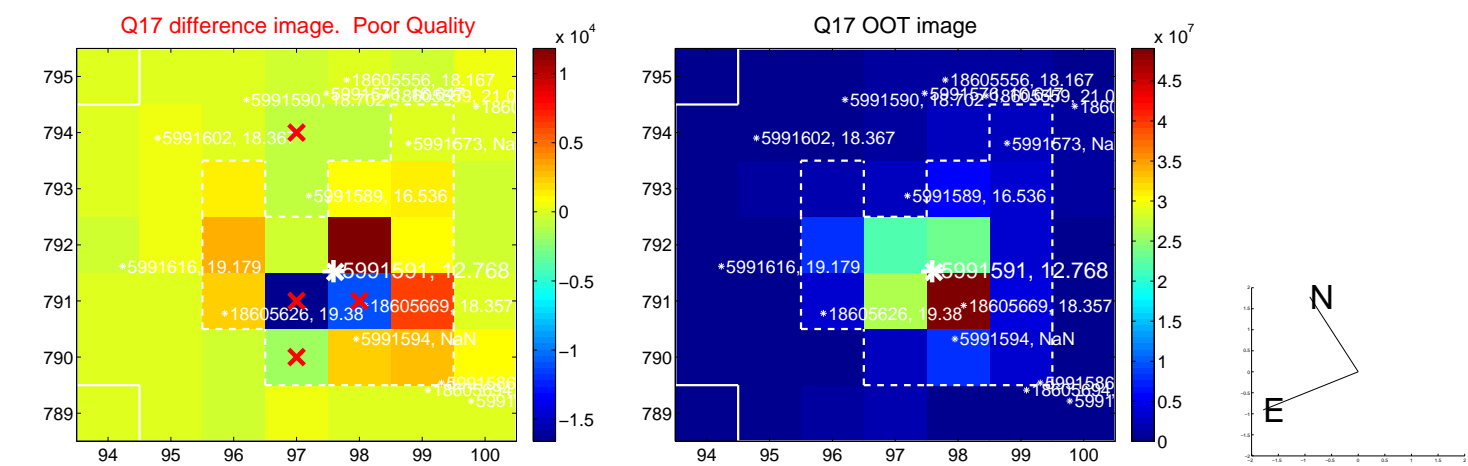
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

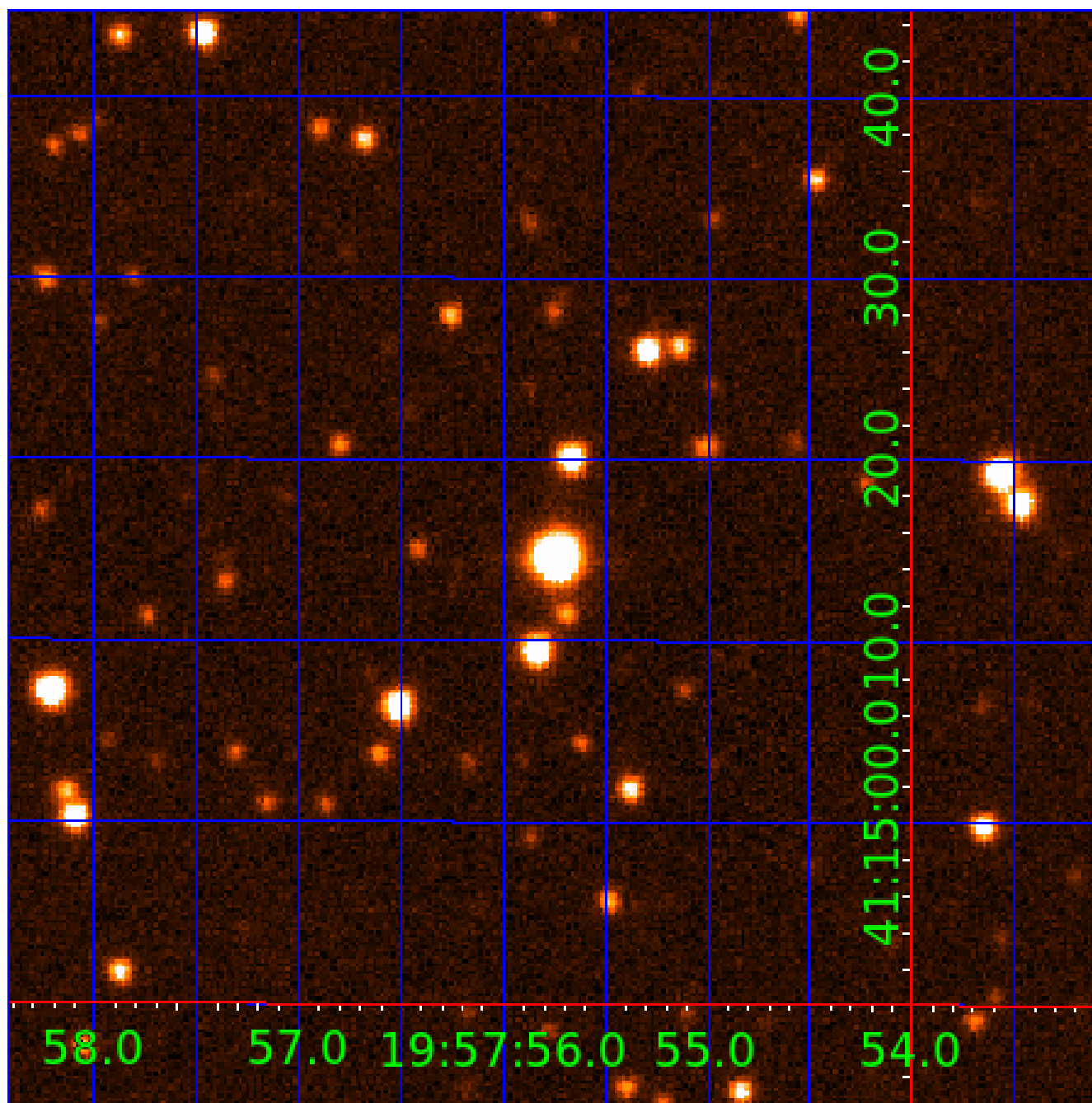


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination





# KIC 005991591

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
005991591-01	OBS	No	4.135316	133.693387	19.1	18.343	9.5	10.4	3.50	8615	1.73	12982.71
005991591-02	OBS	No	4.135761	131.596035	18.6	20.595	10.5	12.2	3.50	8615	1.68	12980.84

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
005991591-01	OBS	FP	0.00	1	0	0	0	LPP_DV
005991591-02	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—SAME_NTL_PERIOD

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

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

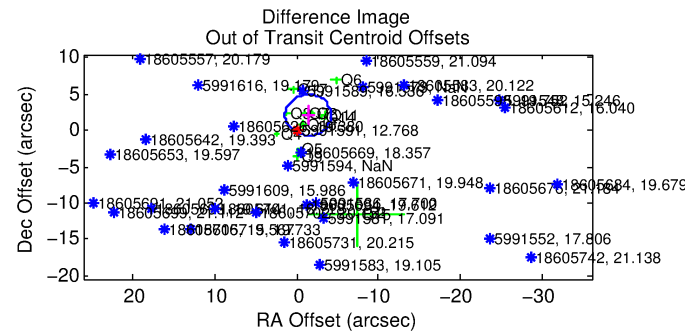
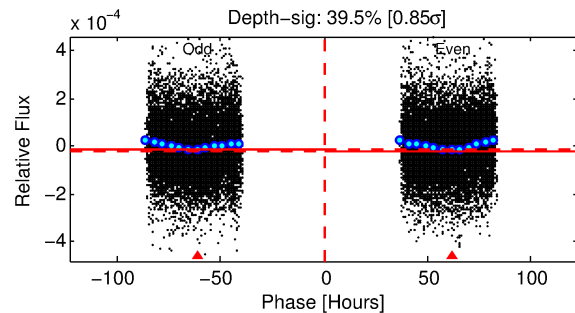
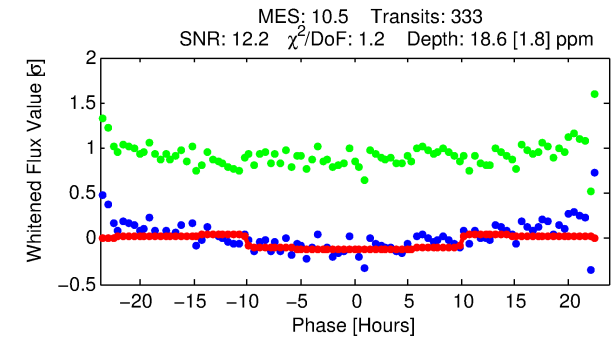
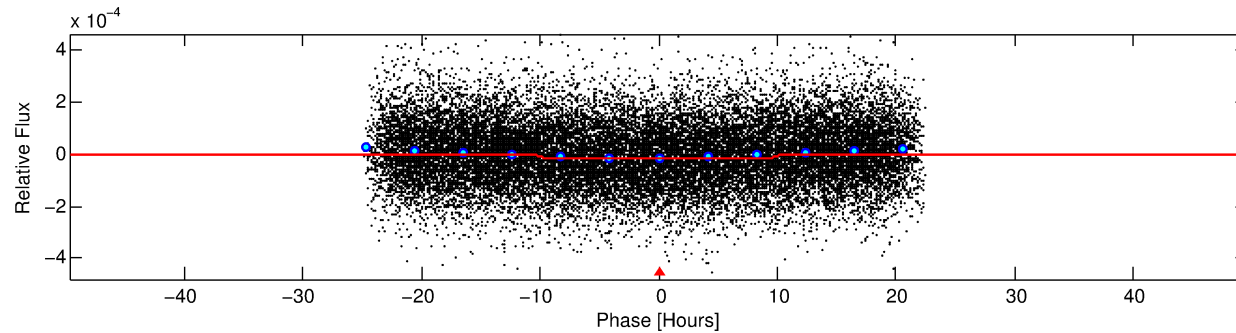
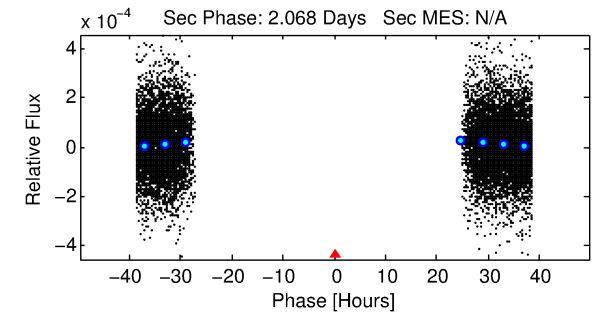
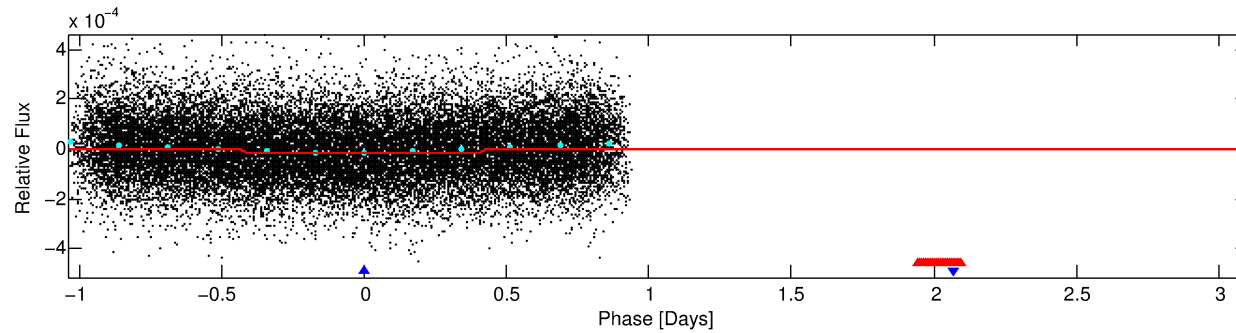
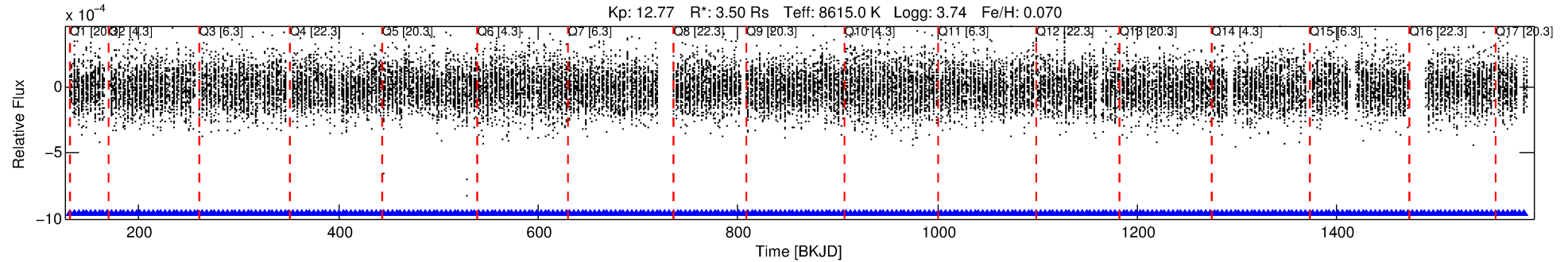
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 005991591-02

No Significant Match Found

# DV One-Page Summary

KIC: 5991591 Candidate: 2 of 2 Period: 4.136 d



## DV Fit Results:

Period = 4.13576 [0.00007] d  
Epoch = 131.5960 [0.0115] BKJD  
Rp/R\* = 0.0044 [0.0007]  
a/R\* = 1.25 [0.47]  
b = 0.83 [0.40]  
Seff = 12980.84 [9856.52]  
Teq = 2722 [517] K  
Rp = 1.68 [0.88] Re  
a = 0.0683 [0.0319] AU

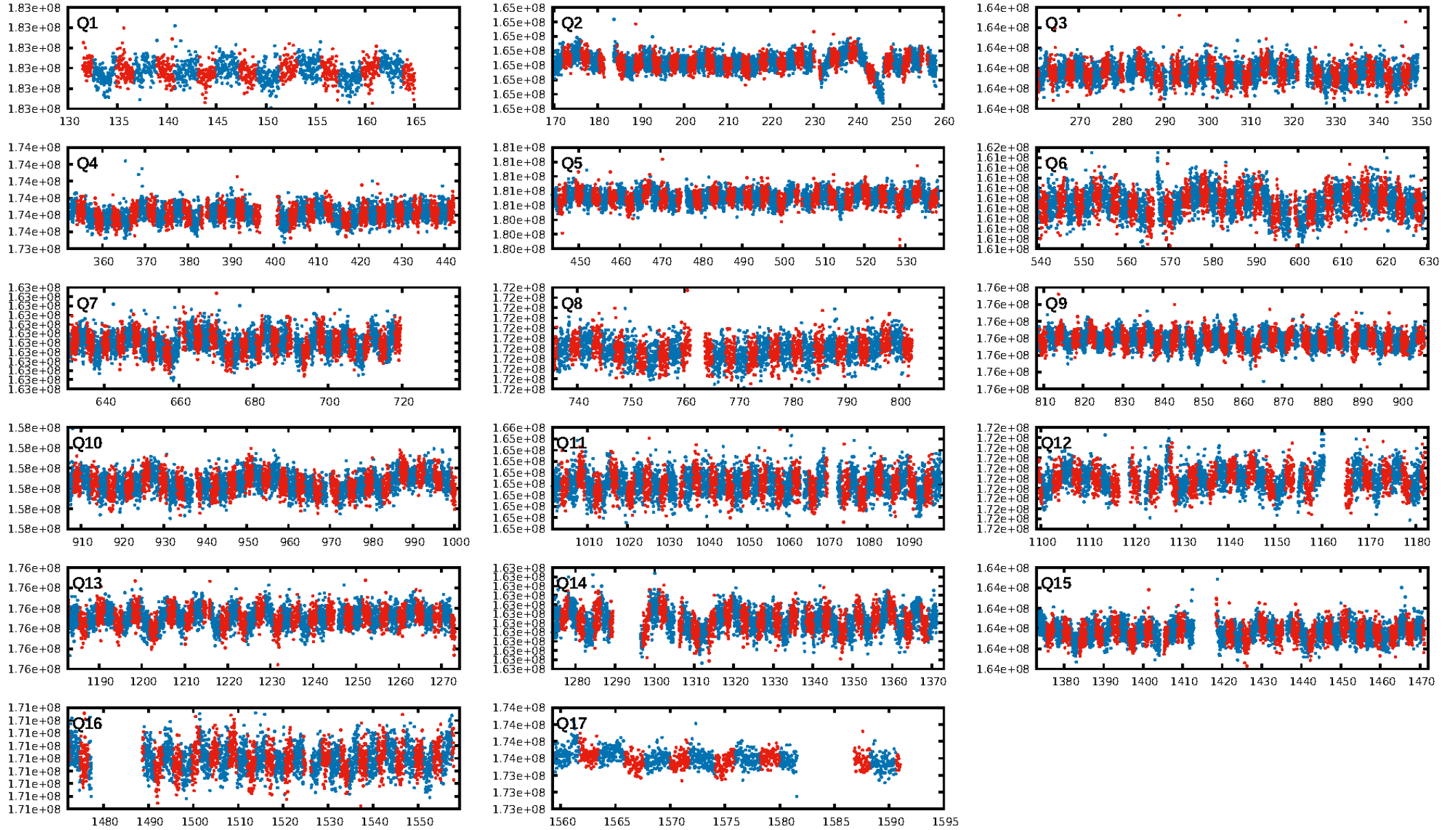
## DV Diagnostic Results:

ShortPeriod-sig: 0.0% [0.00σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: N/A  
RollingBand-ftg: 1.00 [318/318]  
GhostDiagnostic-chr: -7.775  
Centroid-sig: 2.8%  
Centroid-so: 1.826 arcsec [1.57σ]  
OotOffset-rm: 2.549 arcsec [2.71σ]  
KicOffset-rm: 2.620 arcsec [2.53σ]  
OotOffset-st: 4/4/2/3 [13]  
KicOffset-st: 4/4/2/3 [13]  
DiffImageQuality-fgm: 0.69 [9/13]  
DiffImageOverlap-fno: 1.00 [17/17]

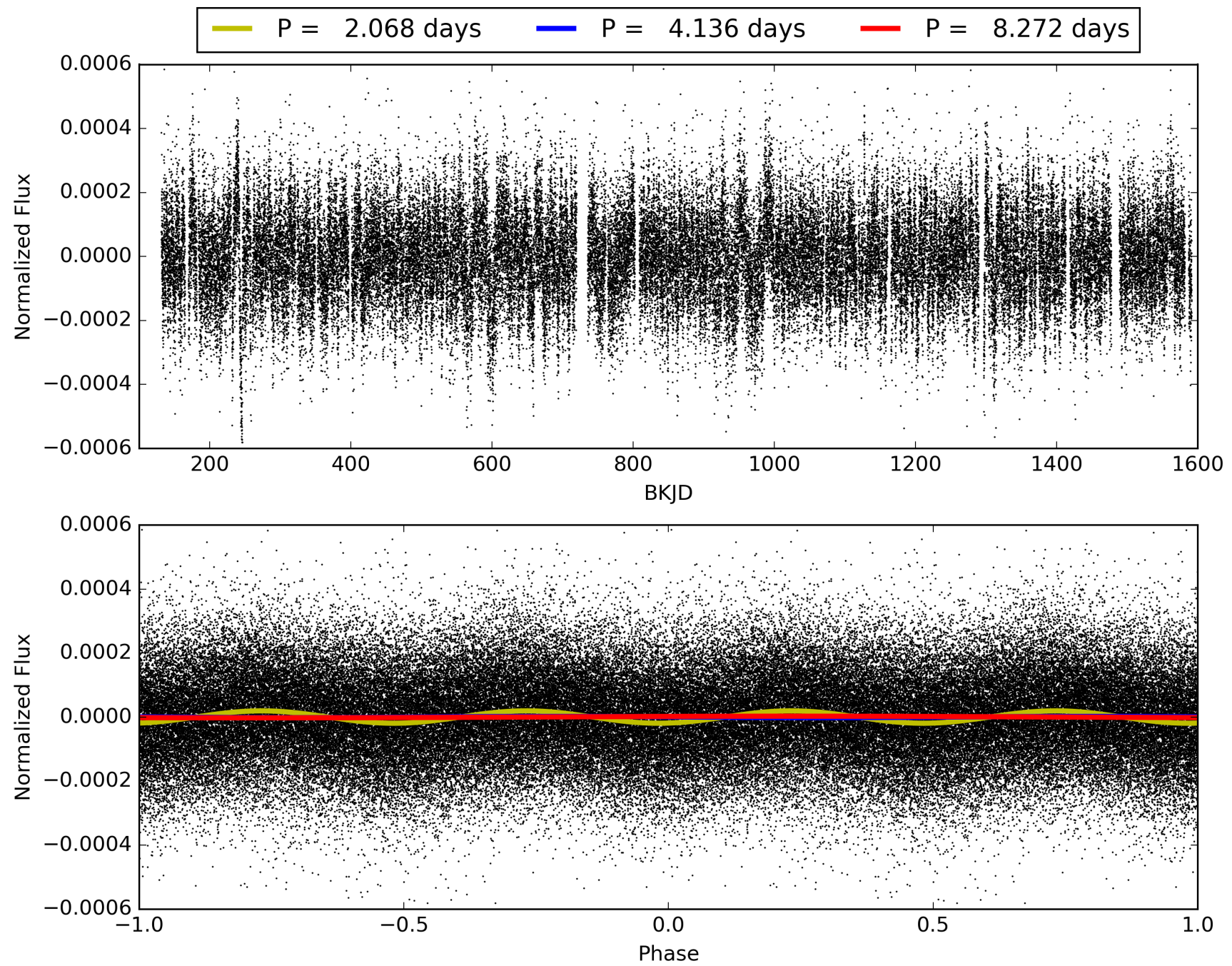
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 29-Jan-2016 10:43:30 Z

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

# TCE 005991591-02, PDC Light Curves



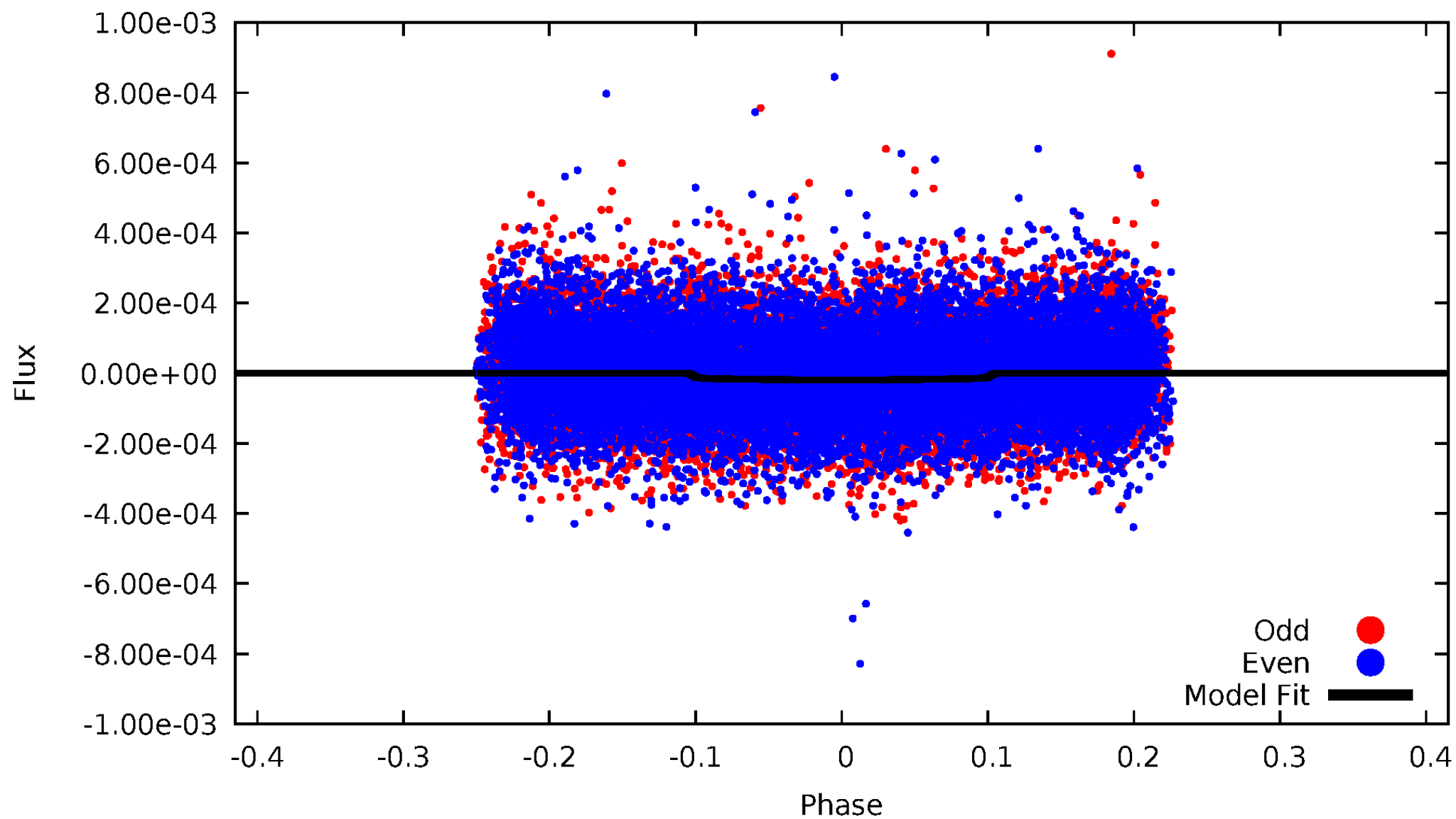
# TCE 005991591-02





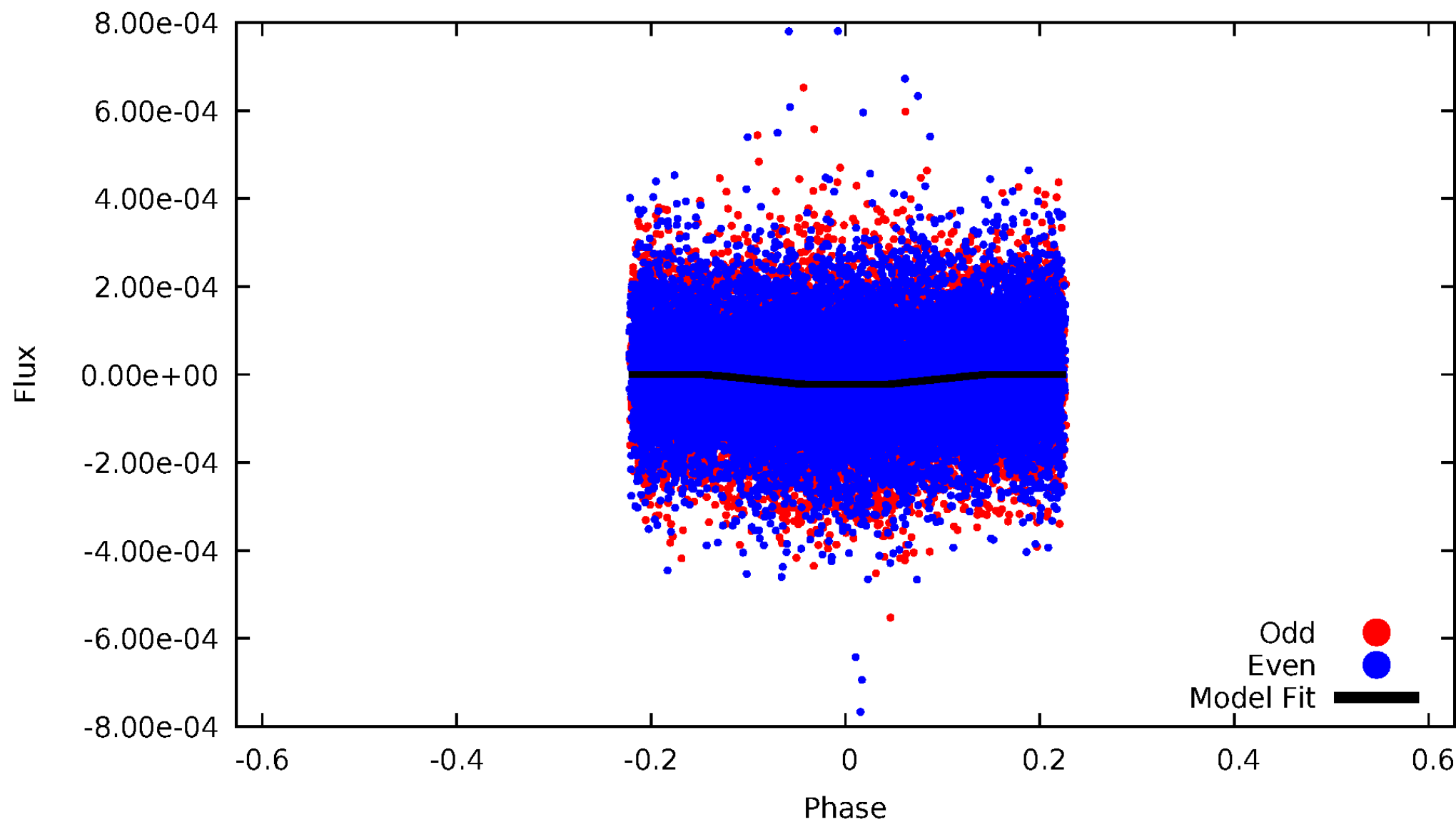
DV Odd/Even

TCE 005991591-02



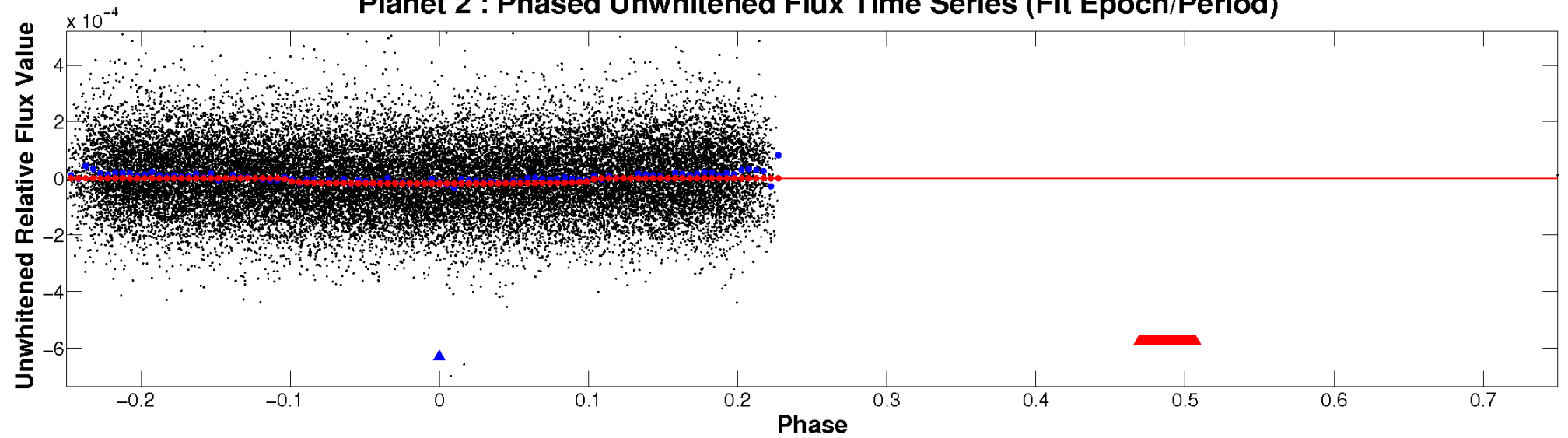
# ALT Odd/Even

TCE 005991591-02

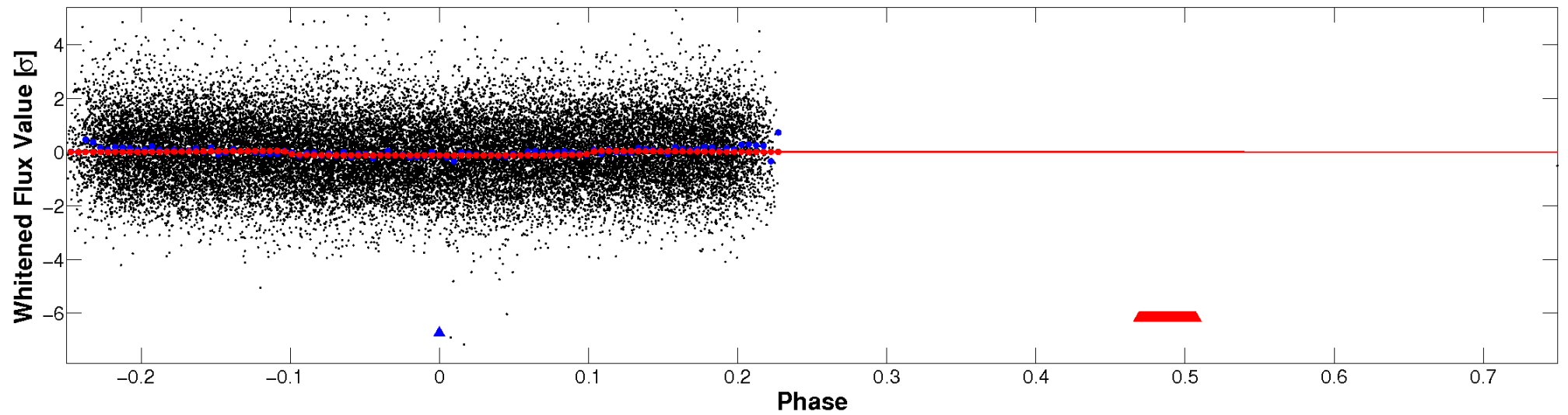


# Non-Whitened Vs. Whitened Light Curve

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

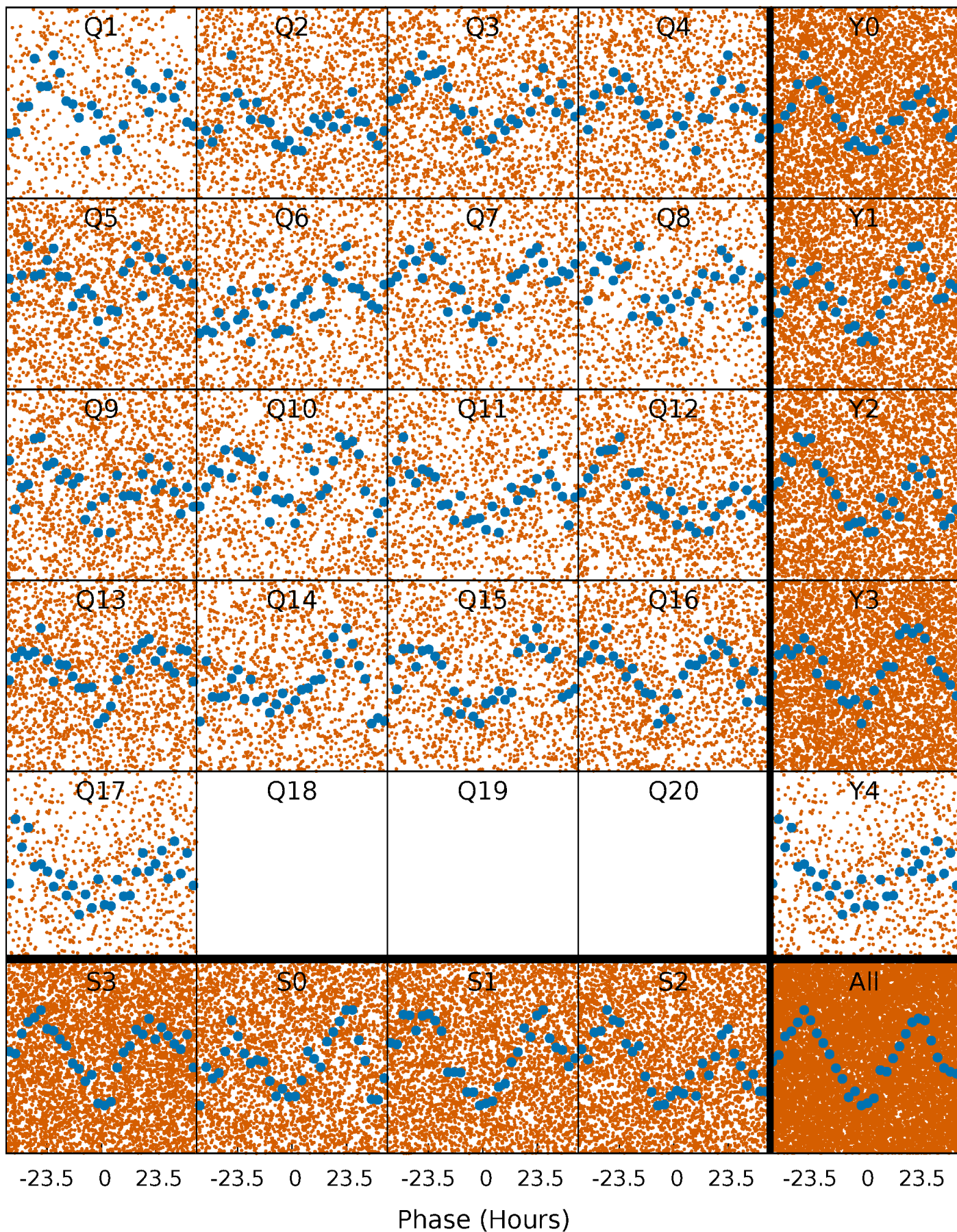


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

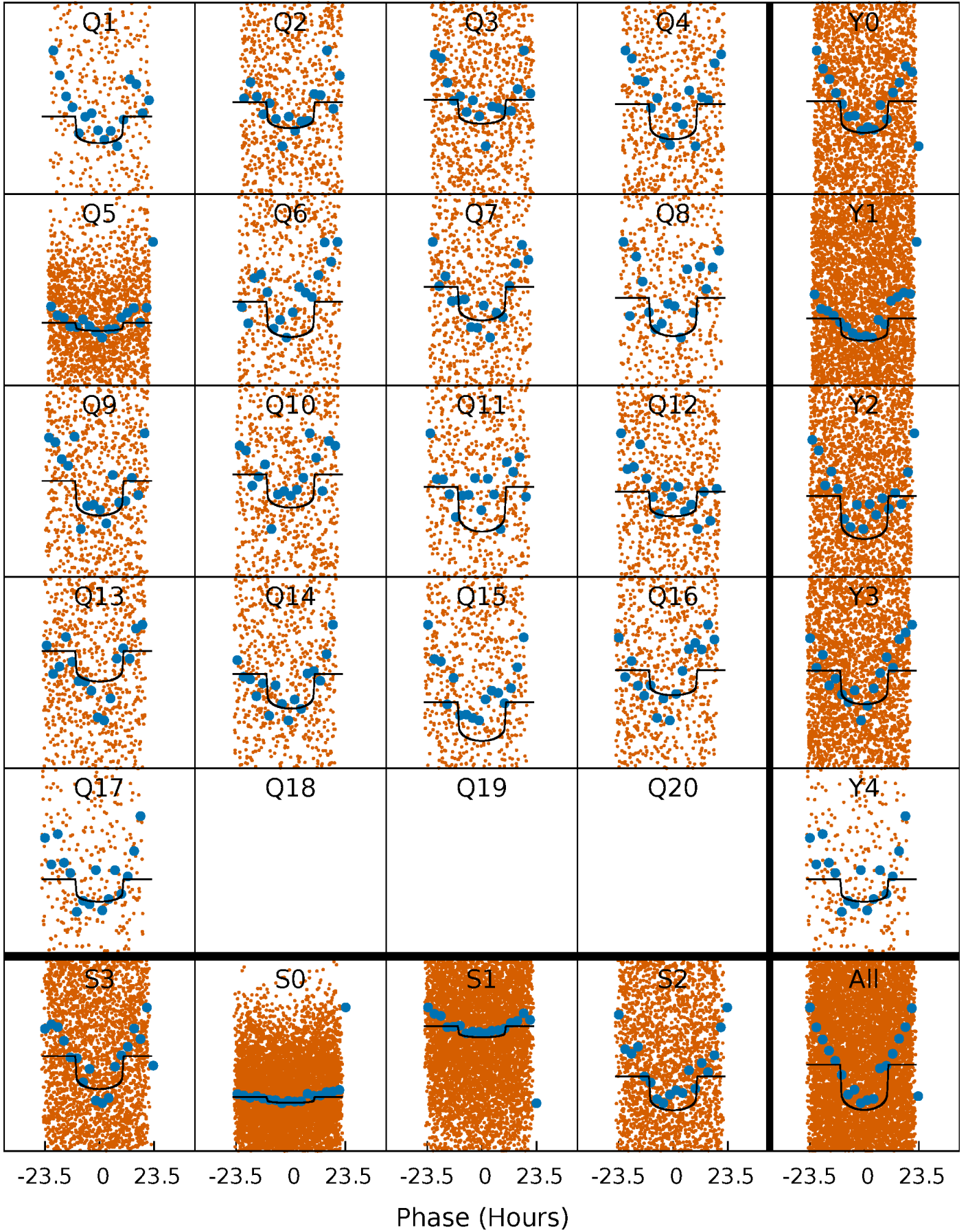
TCE 005991591-02 P= 4.135761 Days  $T_0=131.596035$  (BKJD)





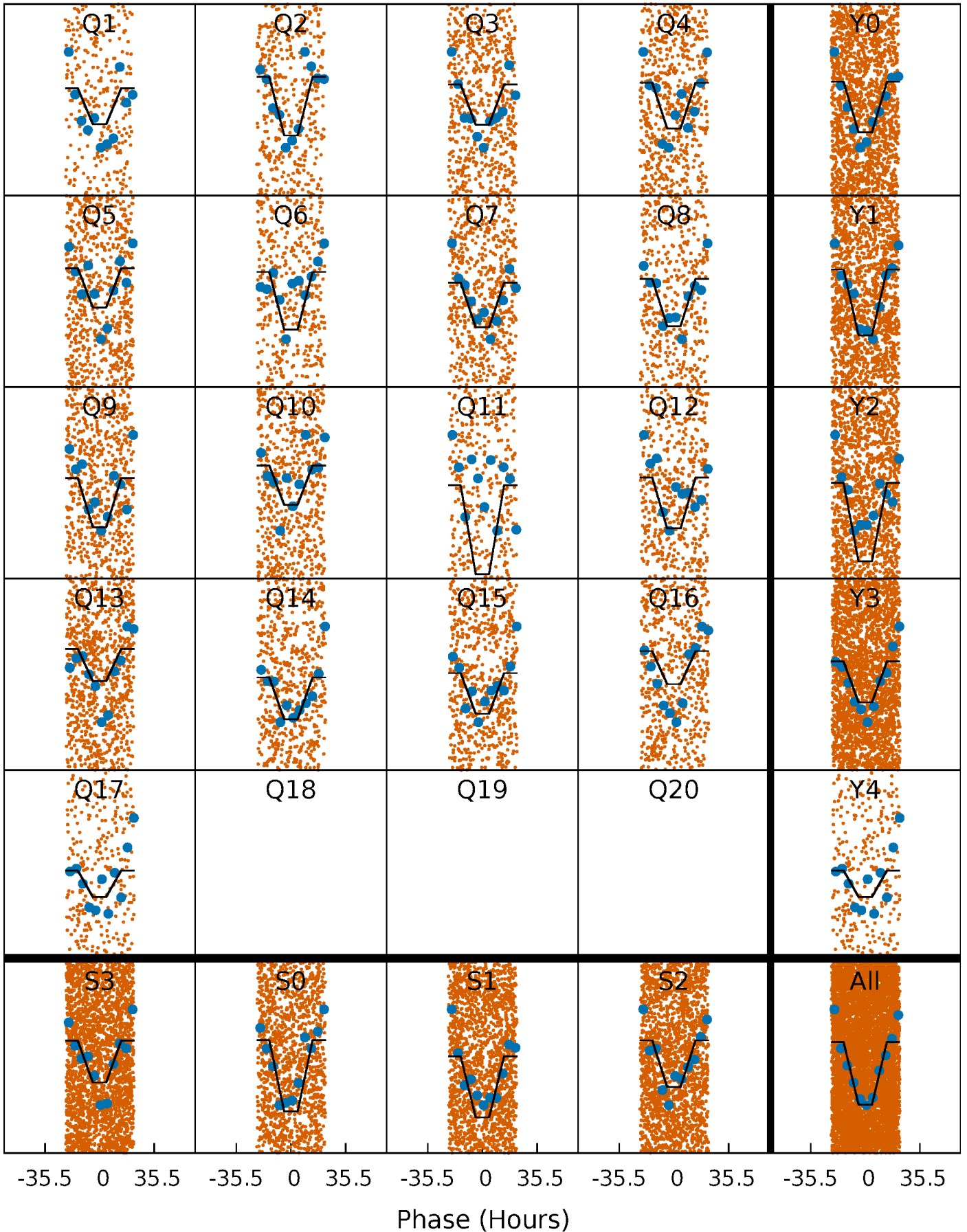
# DV Quarter-Phased Transit Curves

TCE 005991591-02     $P = 4.135761$  Days     $T_0 = 131.596035$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

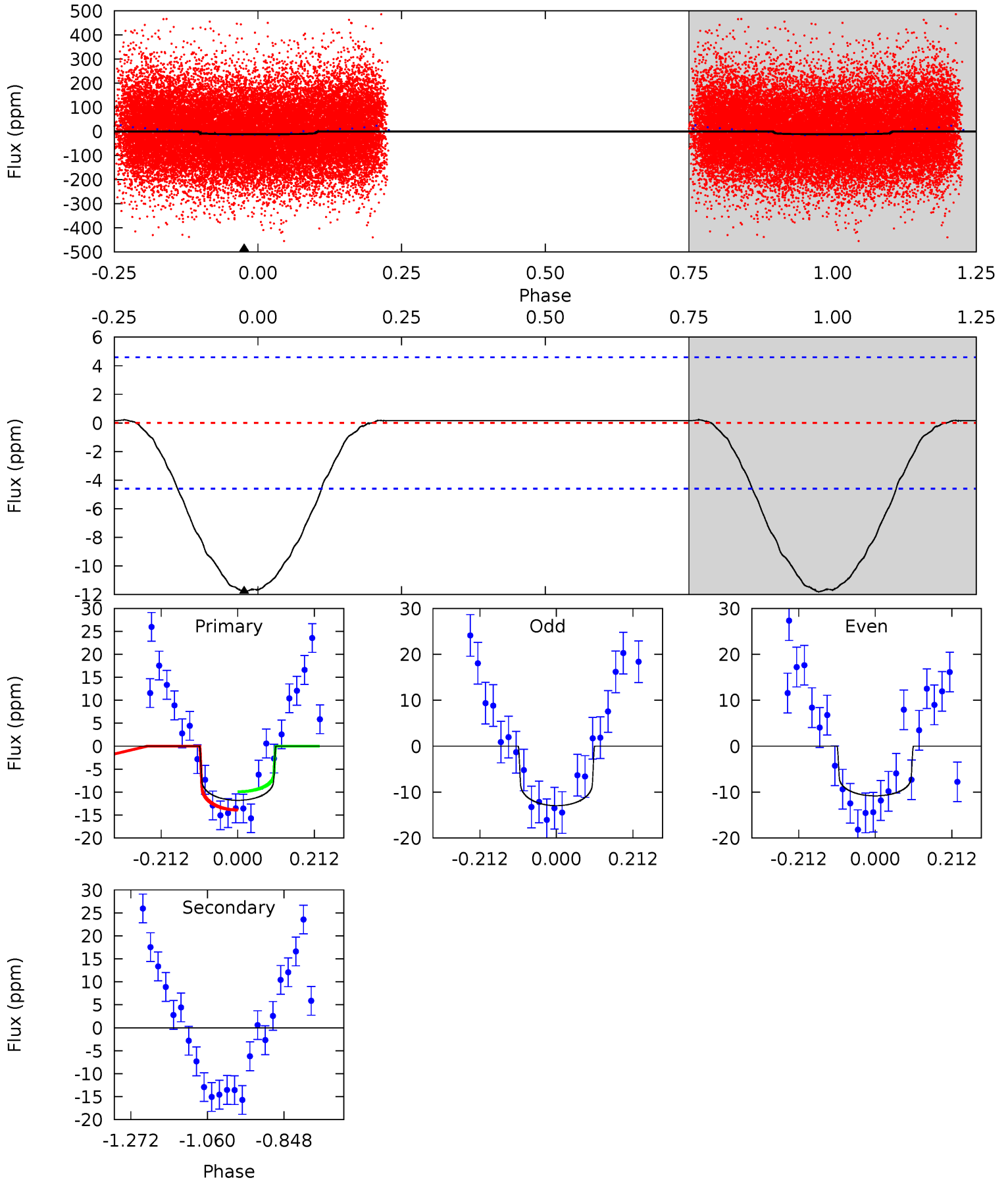
TCE 005991591-02   P= 4.135201 Days    $T_0=131.637253$  (BKJD)



# DV Model-Shift Uniqueness Test

005991591-02, P = 4.135761 Days, E = 127.460274 Days

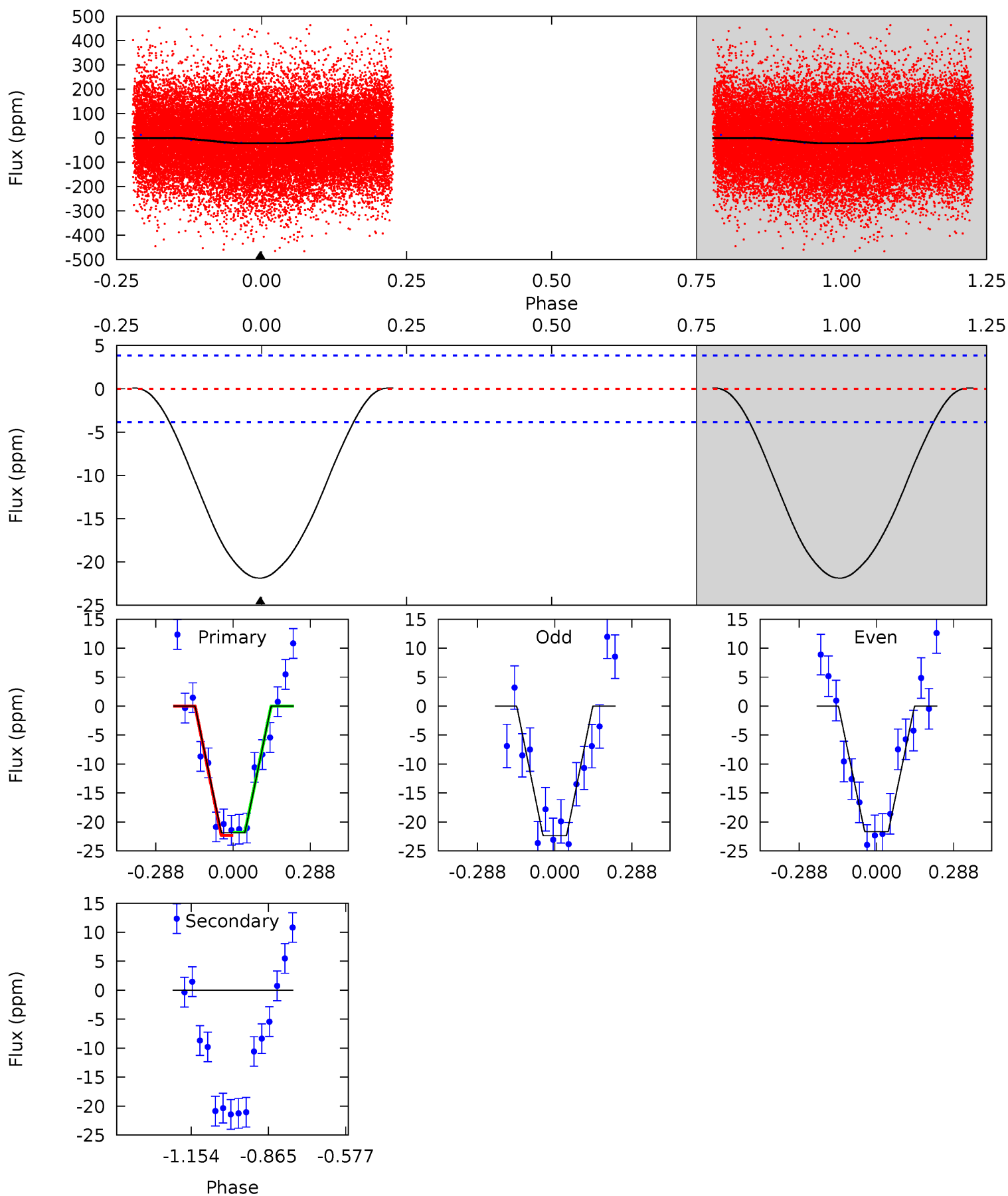
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
11.3	0	0	0	4.40	1.25	0.18	11.3	11.3	0	0	1.03	0.87	0.02	1.94



# Alt Model-Shift Uniqueness Test

005991591-02, P = 4.135201 Days, E = 127.502052 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
24.6	0	0	0	4.34	1.06	0.15	24.6	24.6	0	0	0.39	1.04	0.00	0.29





### Stellar Parameters For KIC 005991591

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$\rho_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$8615^{+236}_{-405}$	$3.744^{+0.427}_{-0.171}$	$0.070^{+0.300}_{-0.550}$	$3.501^{+0.944}_{-1.754}$	$2.477^{+0.290}_{-0.871}$	$0.081^{+0.317}_{-0.041}$
	+3%/-5%	+11%/-5%	+429%/-786%	+27%/-50%	+12%/-35%	+390%/-50%
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 005991591-02 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	$0 \pm 1$	$1.57^{+0.46}_{-0.42}$	$3725^{+337}_{-444}$	$-3534^{+7440}_{-935}$	$-0.065^{+1.101}_{-1.121}$
Alt.	$0 \pm 1$	$1.70^{+0.44}_{-0.48}$	$3705^{+338}_{-450}$	$-3449^{+7193}_{-852}$	$-0.011^{+0.852}_{-0.870}$

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

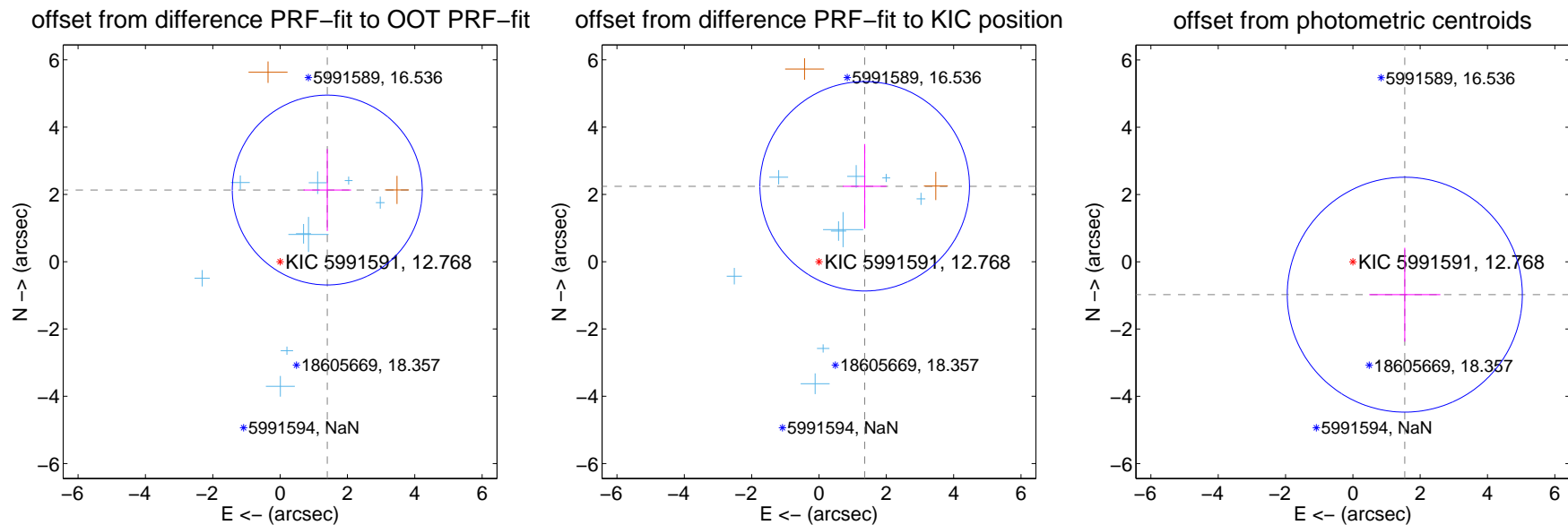
## DV Centroid Data

Supplemental centroid analysis for 005991591-02. Kepler magnitude: 12.77. Transit SNR 12.18

There are 9 quarters with good PRF difference image offsets

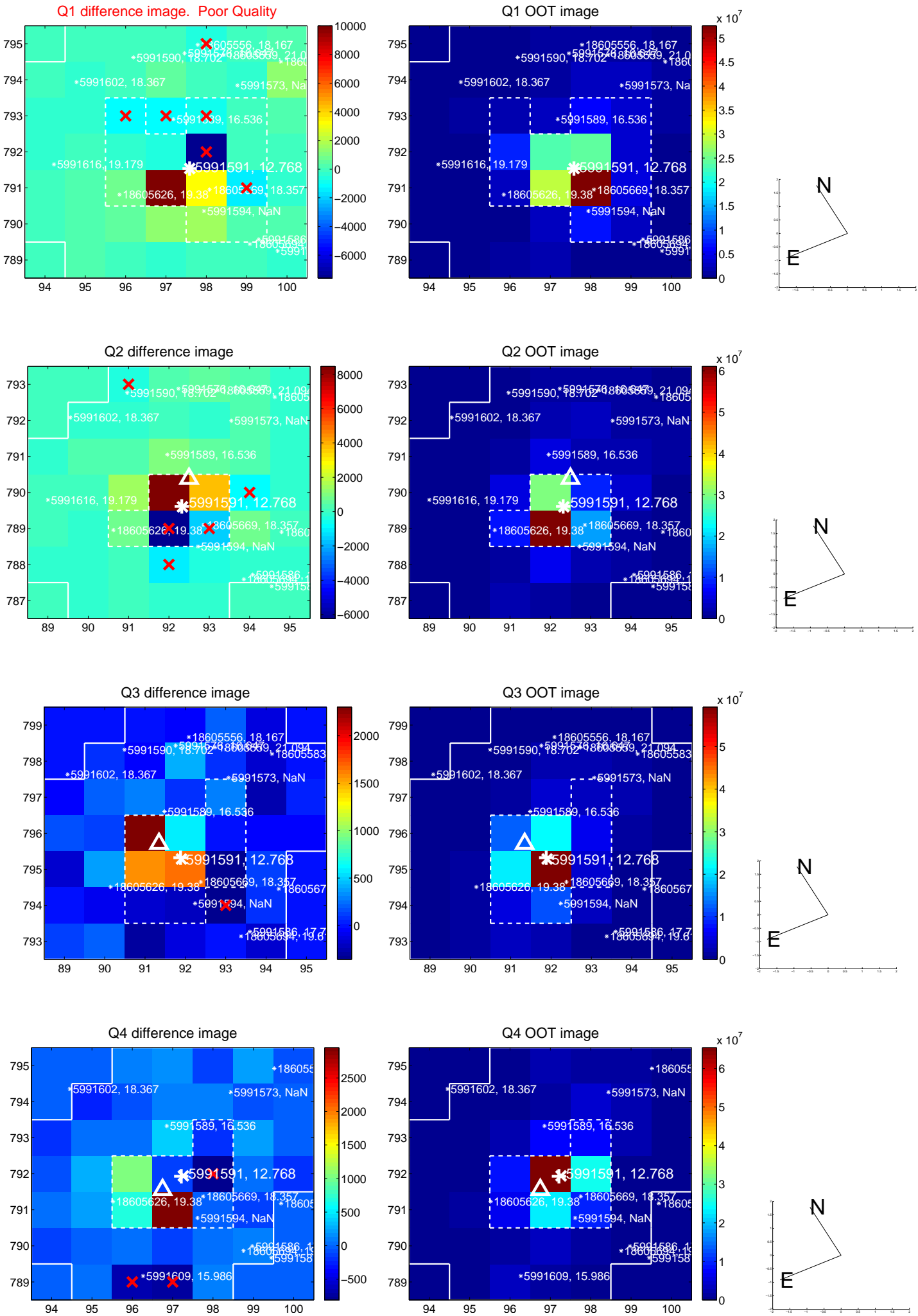
The direct PRF centroid is offset from the target star catalog position by about 0.12 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$2.549 \pm 0.940$	2.71	$-1.400 \pm 0.707$	$2.129 \pm 1.216$
PRF-fit source offset from KIC position	$2.620 \pm 1.037$	2.53	$-1.357 \pm 0.648$	$2.241 \pm 1.256$
photometric centroid source offset	$1.83 \pm 1.16$	1.57	$-1.54 \pm 1.06$	$-0.98 \pm 1.40$

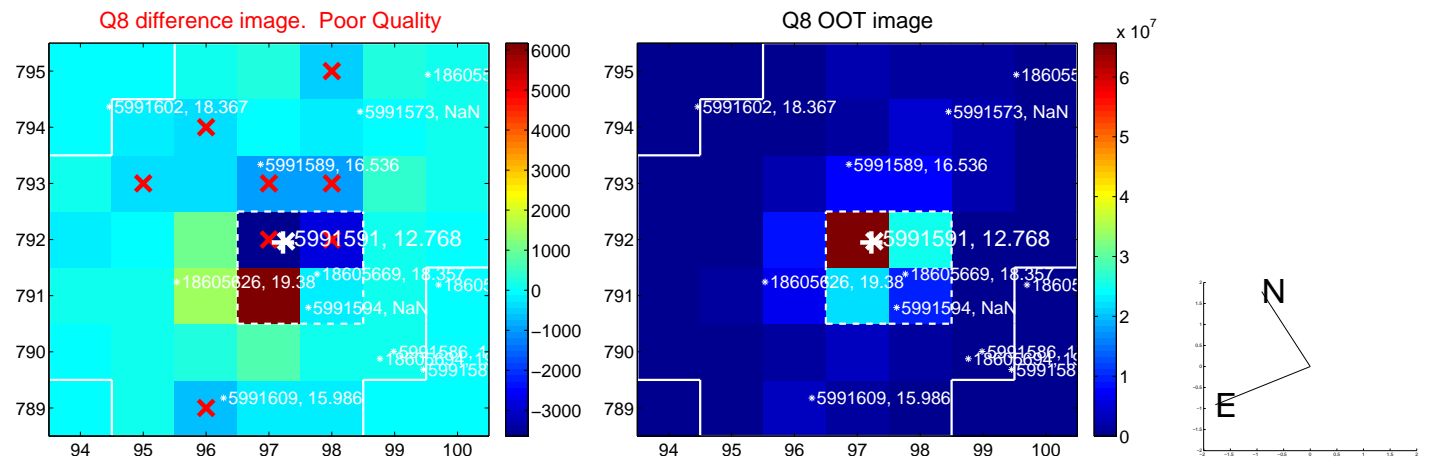
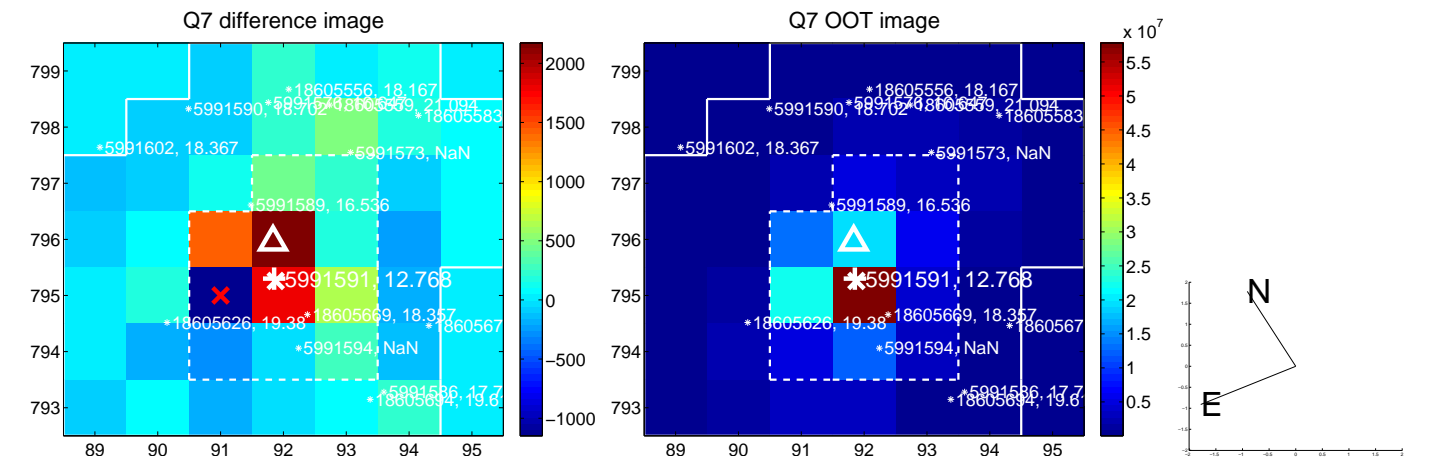
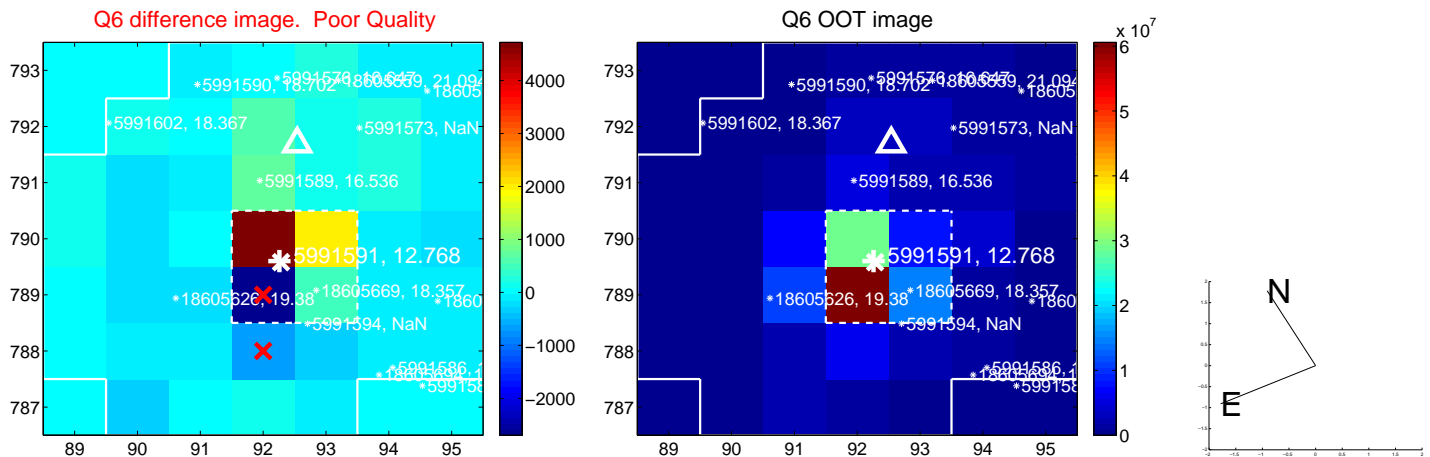
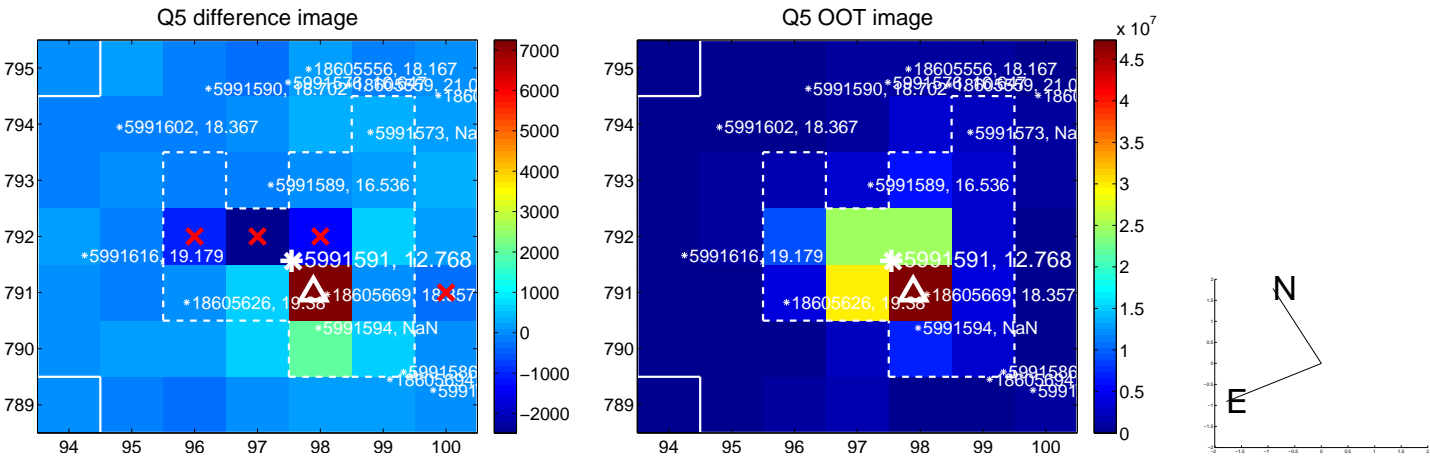


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

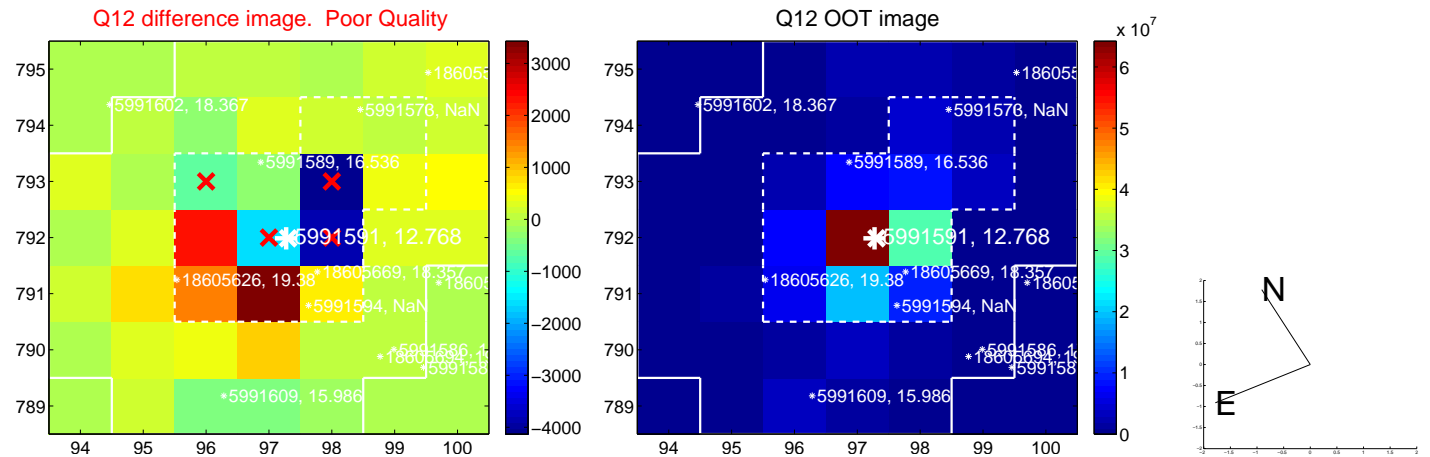
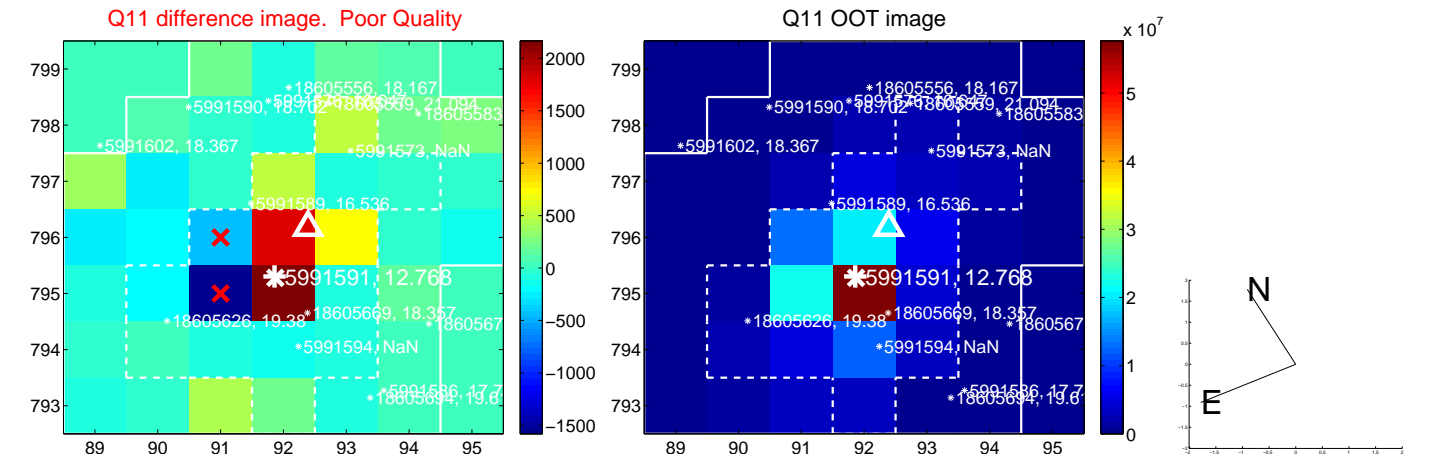
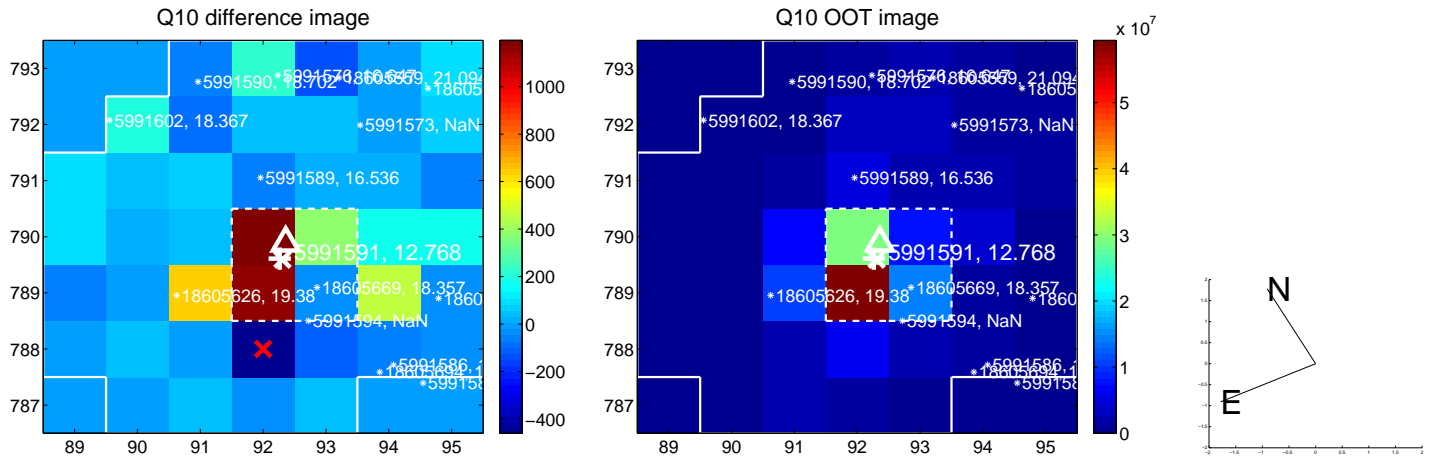
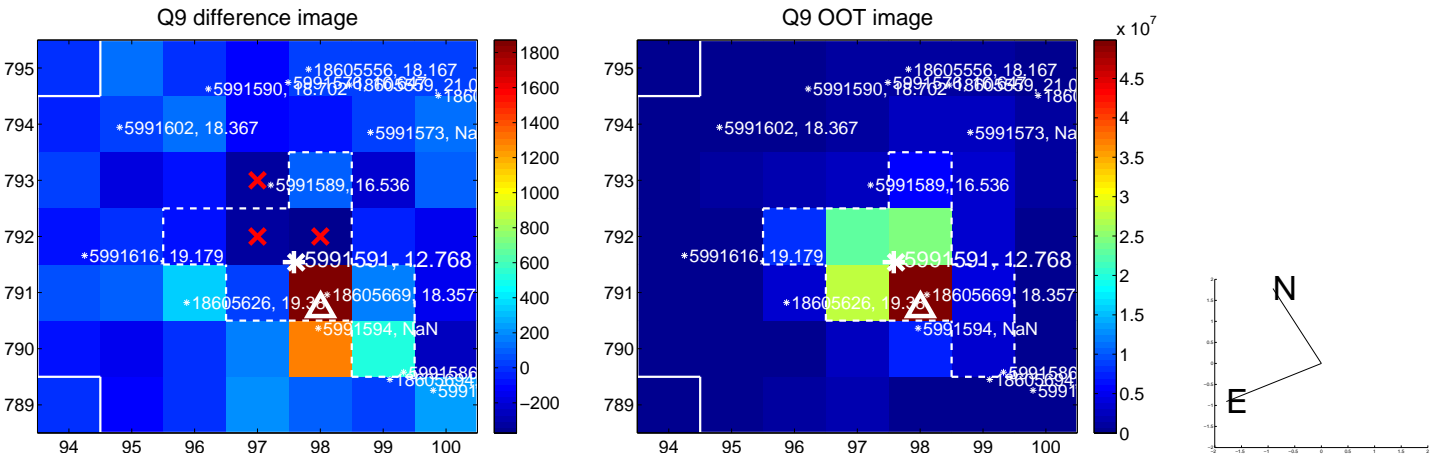


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

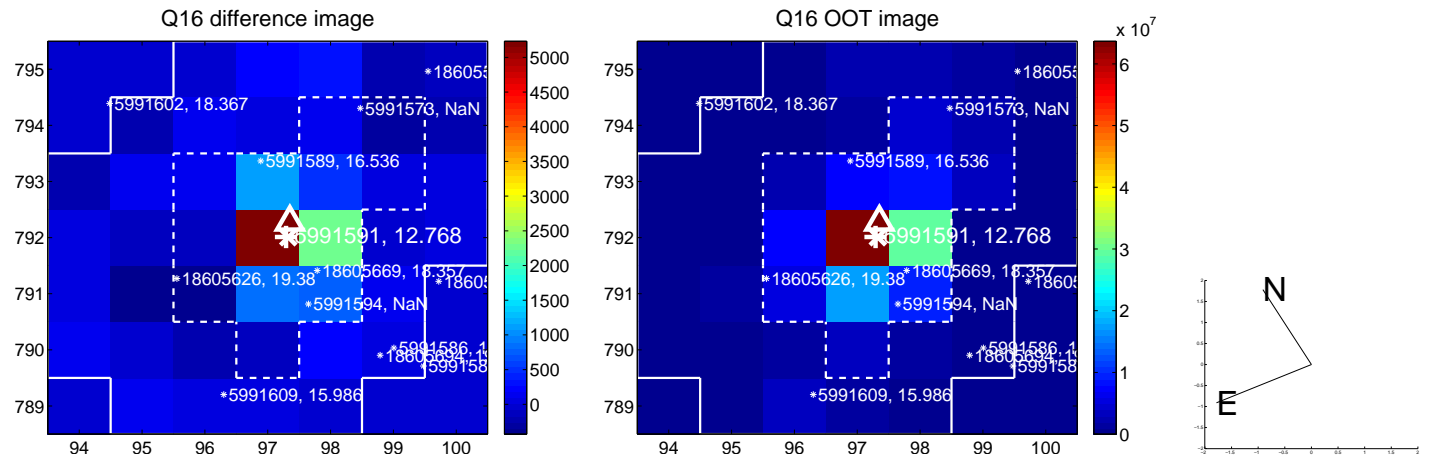
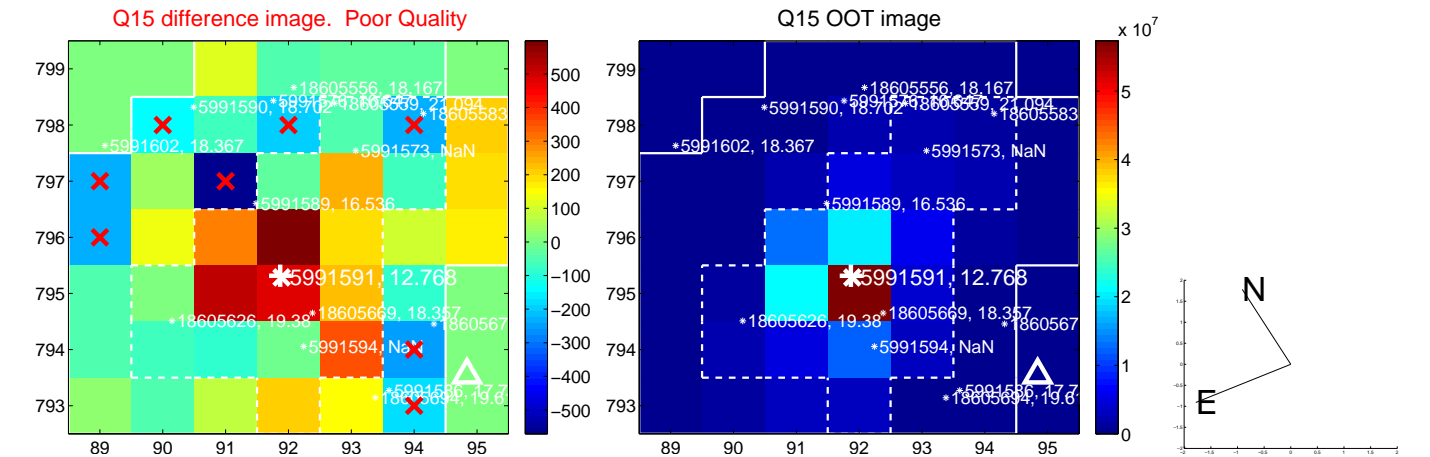
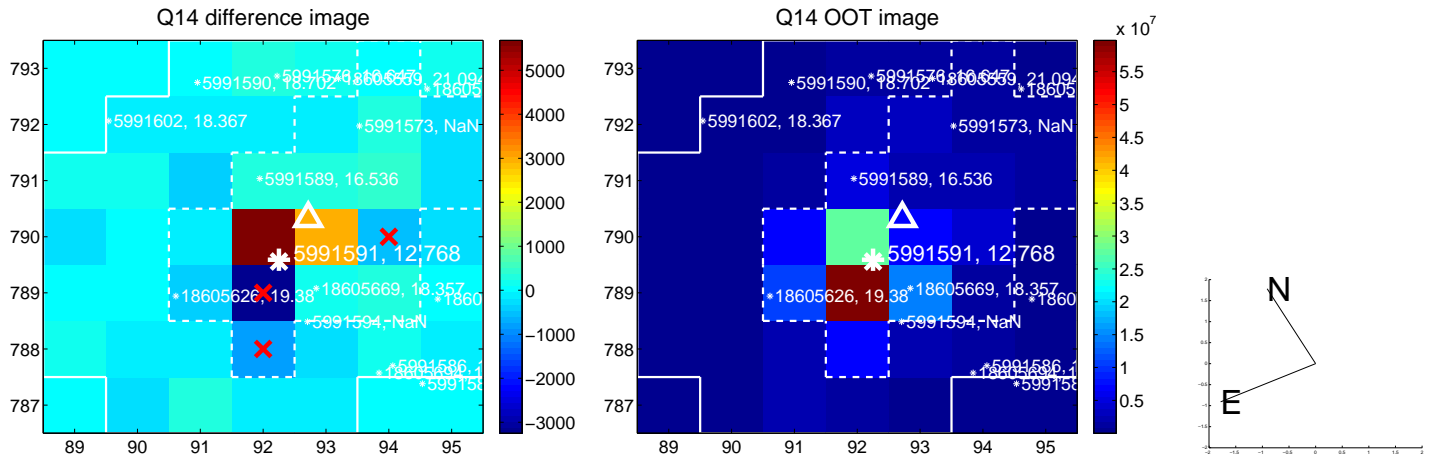
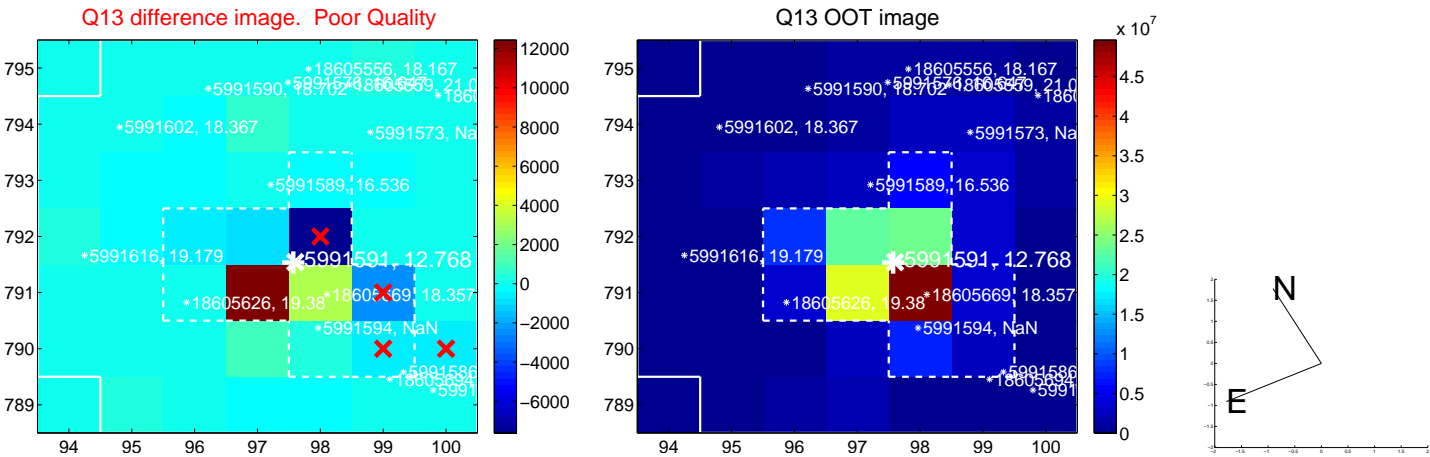




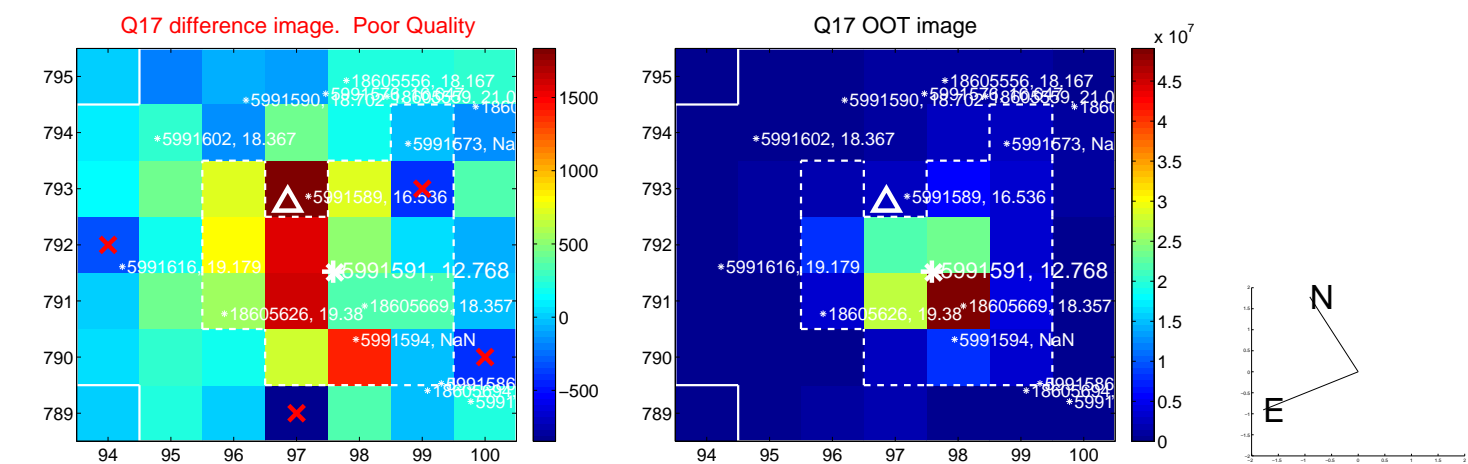
white ×: KIC target position; +: OOT centroid; △: difference centroid. red ×: large negative pixel value.



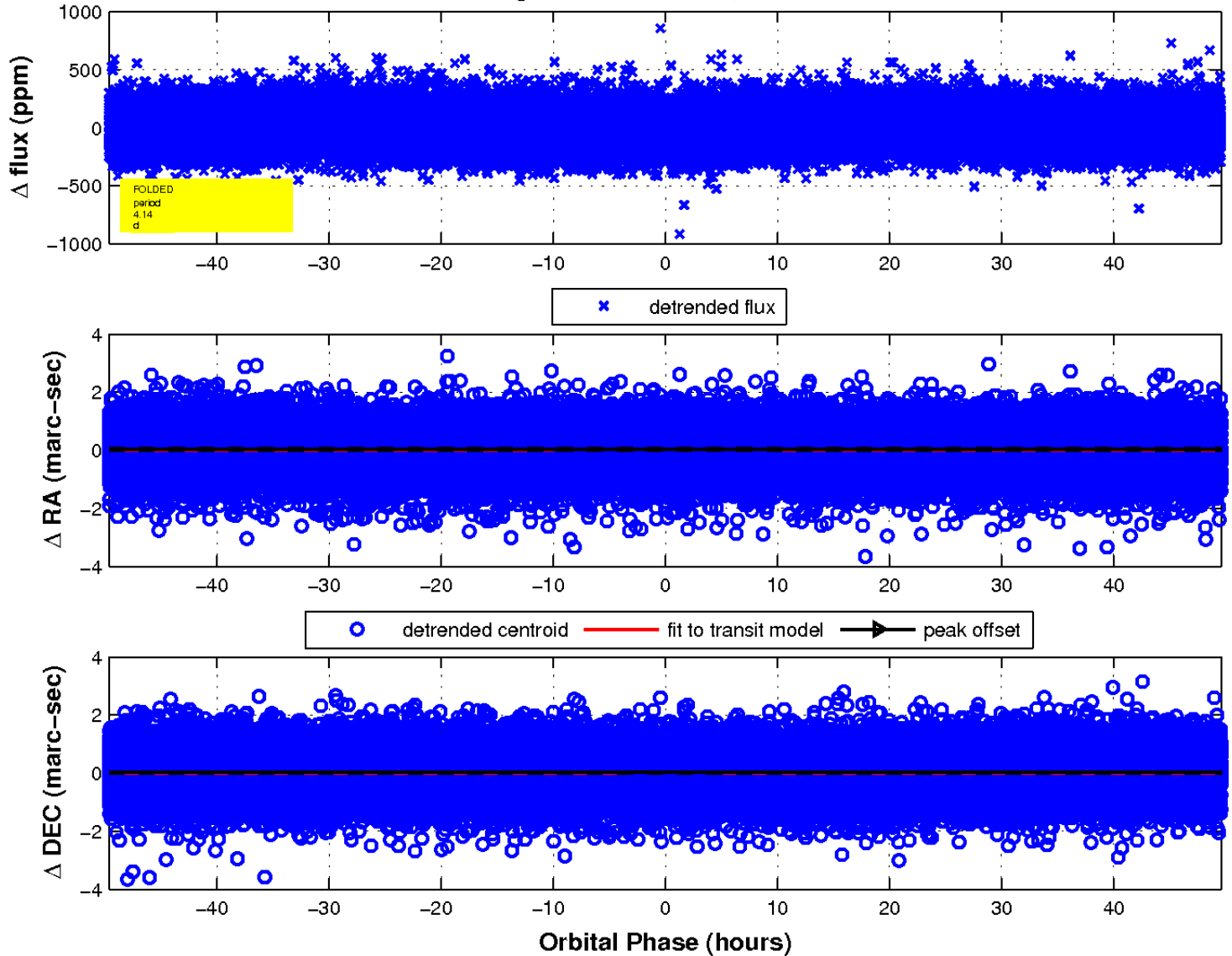
white ×: KIC target position; +: OOT centroid; △: difference centroid. red ✕: large negative pixel value.



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



fluxWeightedCentroids, Planet 2 of 2



UKIRT Image

Declination

