

# KIC 009520443

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009520443-01	OBS	2893.01	0.990143	132.029448	246.2	0.961	14.7	17.7	0.75	5072	1.44	997.46
009520443-02	OBS	No	0.990143	131.537618	182.1	1.051	11.0	14.3	0.75	5072	0.99	997.46

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009520443-01	OBS	FP	0.00	0	1	1	0	MOD_SEC_DV—MOD_SEC_ALT—HAS_SEC_TCE—CENT_RESOLVED_OFFSET
009520443-02	OBS	FP	0.00	1	1	1	0	IS_SEC_TCE—CENT_RESOLVED_OFFSET

**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.

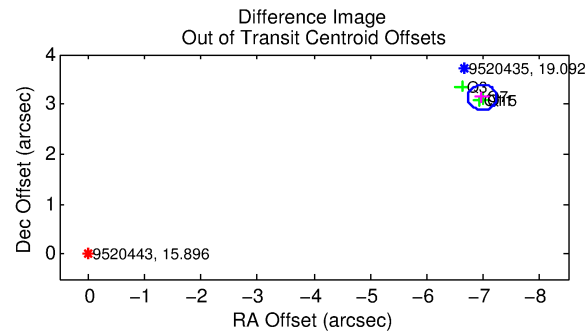
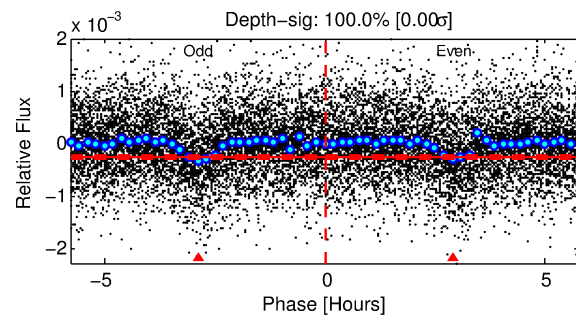
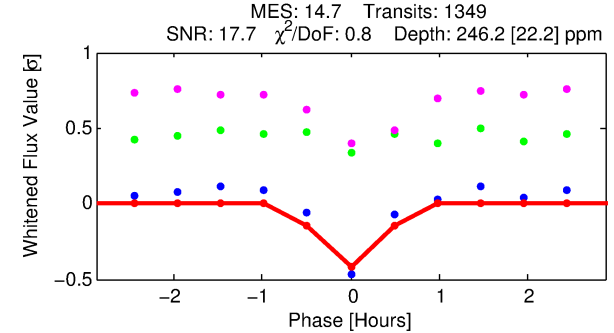
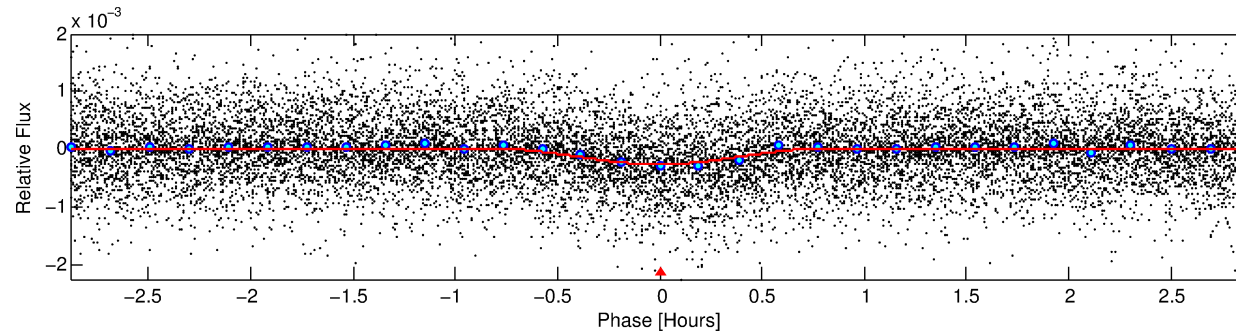
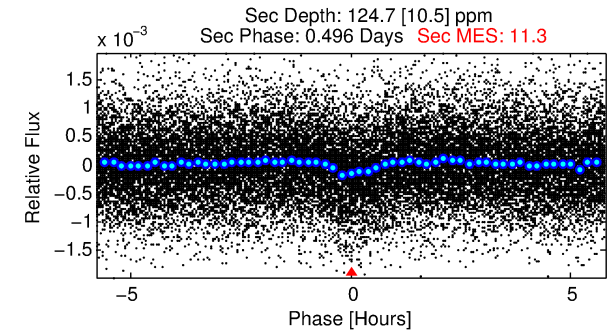
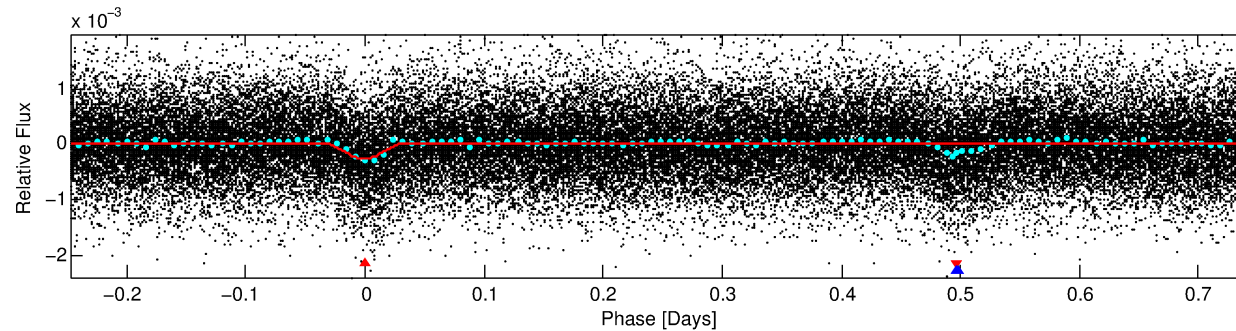
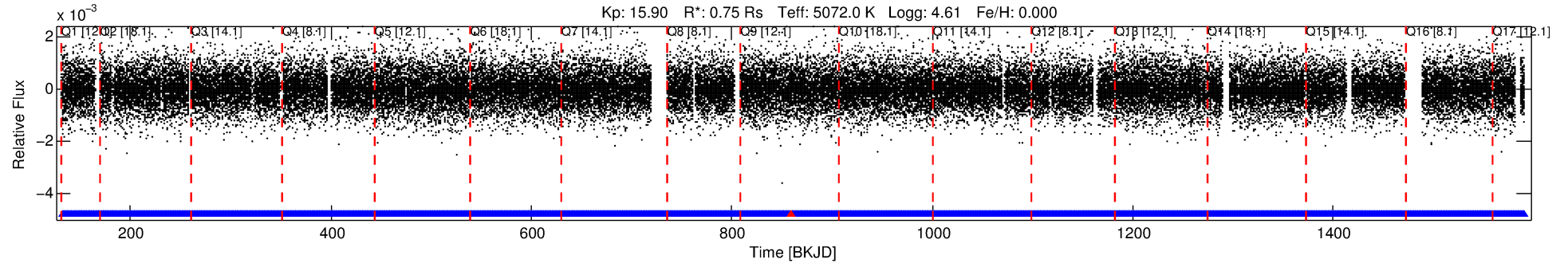
## Ephemeris Match Information For 009520443-01

No Significant Match Found

# DV One-Page Summary

KIC: 9520443 Candidate: 1 of 2 Period: 0.990 d  
KOI: K02893 Corr: No Ephemeris Match

Kp: 15.90 R\*: 0.75 Rs Teff: 5072.0 K Logg: 4.61 Fe/H: 0.000



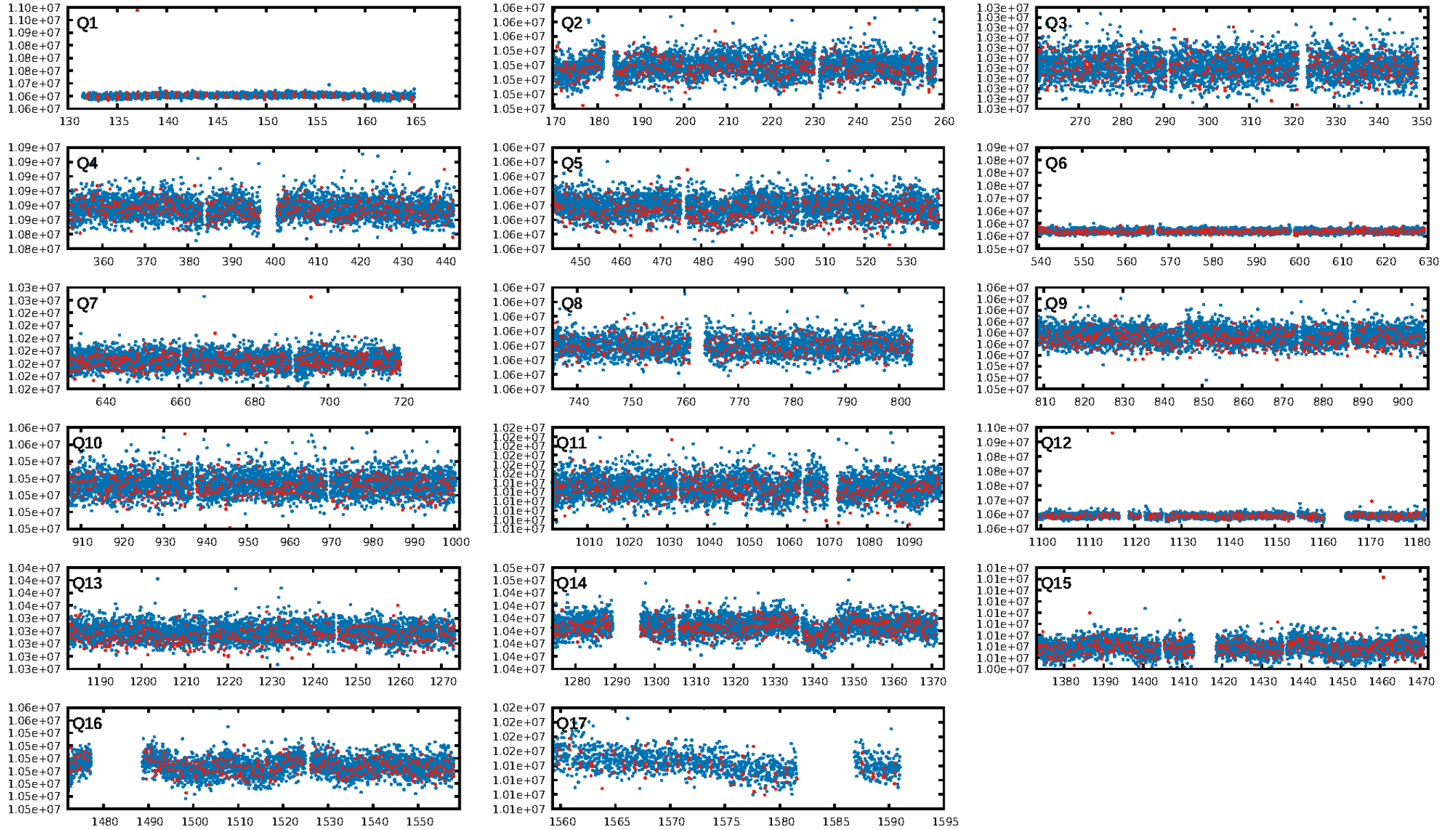
## DV Fit Results:

Period = 0.99014 [0.00001] d  
Epoch = 132.0294 [0.0009] BKJD  
Rp/R\* = 0.0177 [0.0097]  
a/R\* = 3.86 [7.86]  
b = 0.90 [0.48]  
Seff = 997.46 [193.78]  
Teq = 1433 [70] K  
Rp = 1.44 [0.81] Re  
a = 0.0182 [0.0019] AU  
Ag = 10.93 [12.14] [0.82σ]  
Teff = 4029 [1114] K [2.32σ]

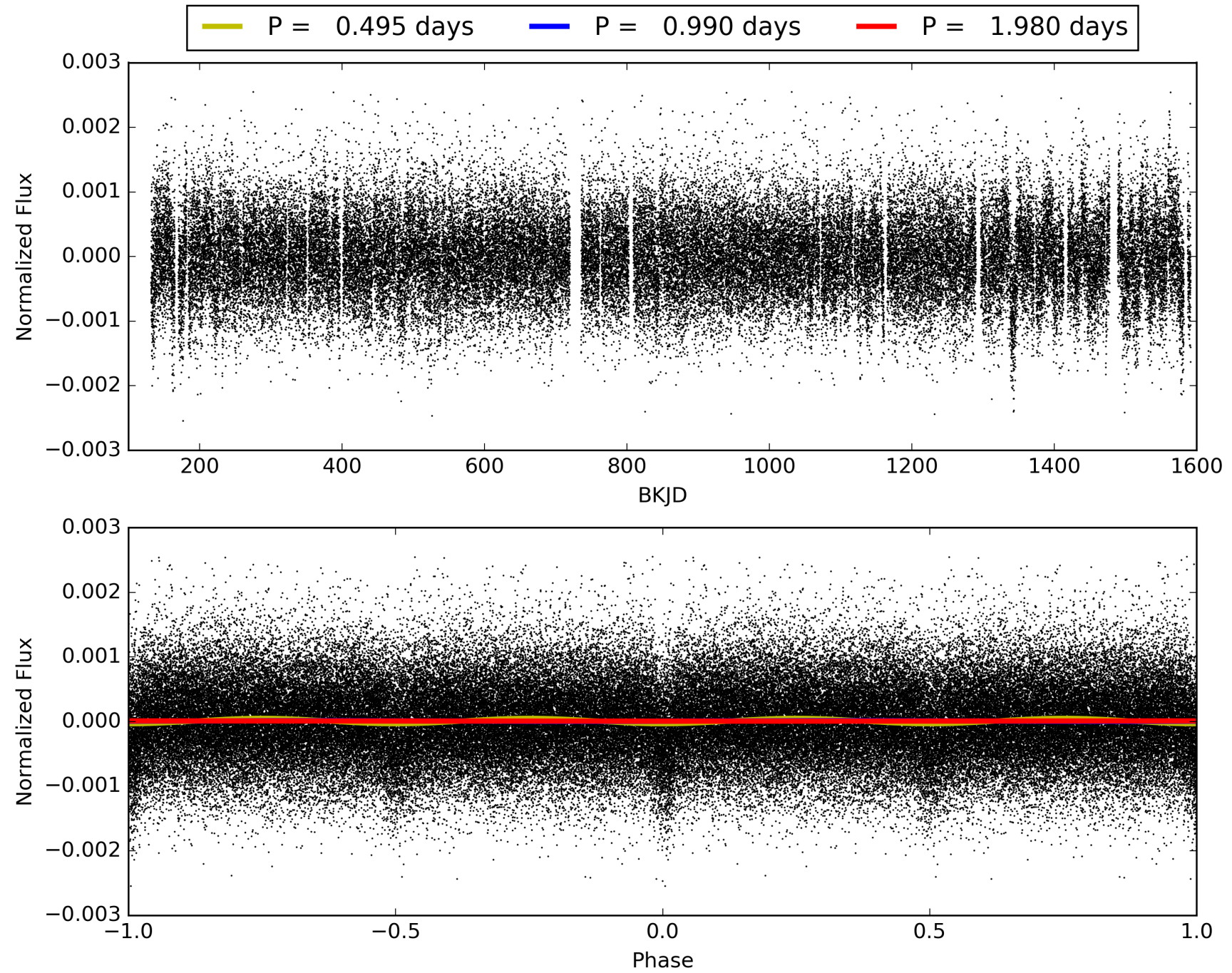
## DV Diagnostic Results:

ShortPeriod-sig: 0.0% [0.00σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: N/A  
ModelChiSquareGoF-sig: N/A  
Bootstrap-pfa: 3.84e-48  
RollingBand-fgt: 1.00 [1287/1288]  
GhostDiagnostic-chr: -0.6709  
Centroid-sig: 0.0%  
Centroid-so: 47.582 arcsec [62.01σ]  
OotOffset-rm: 7.649 arcsec [89.99σ]  
KicOffset-rm: 7.491 arcsec [77.11σ]  
OotOffset-st: 0/4/0/0 [4]  
KicOffset-st: 0/4/0/0 [4]  
DiffImageQuality-fgm: 1.00 [4/4]  
DiffImageOverlap-fno: 1.00 [17/17]

# TCE 009520443-01, PDC Light Curves



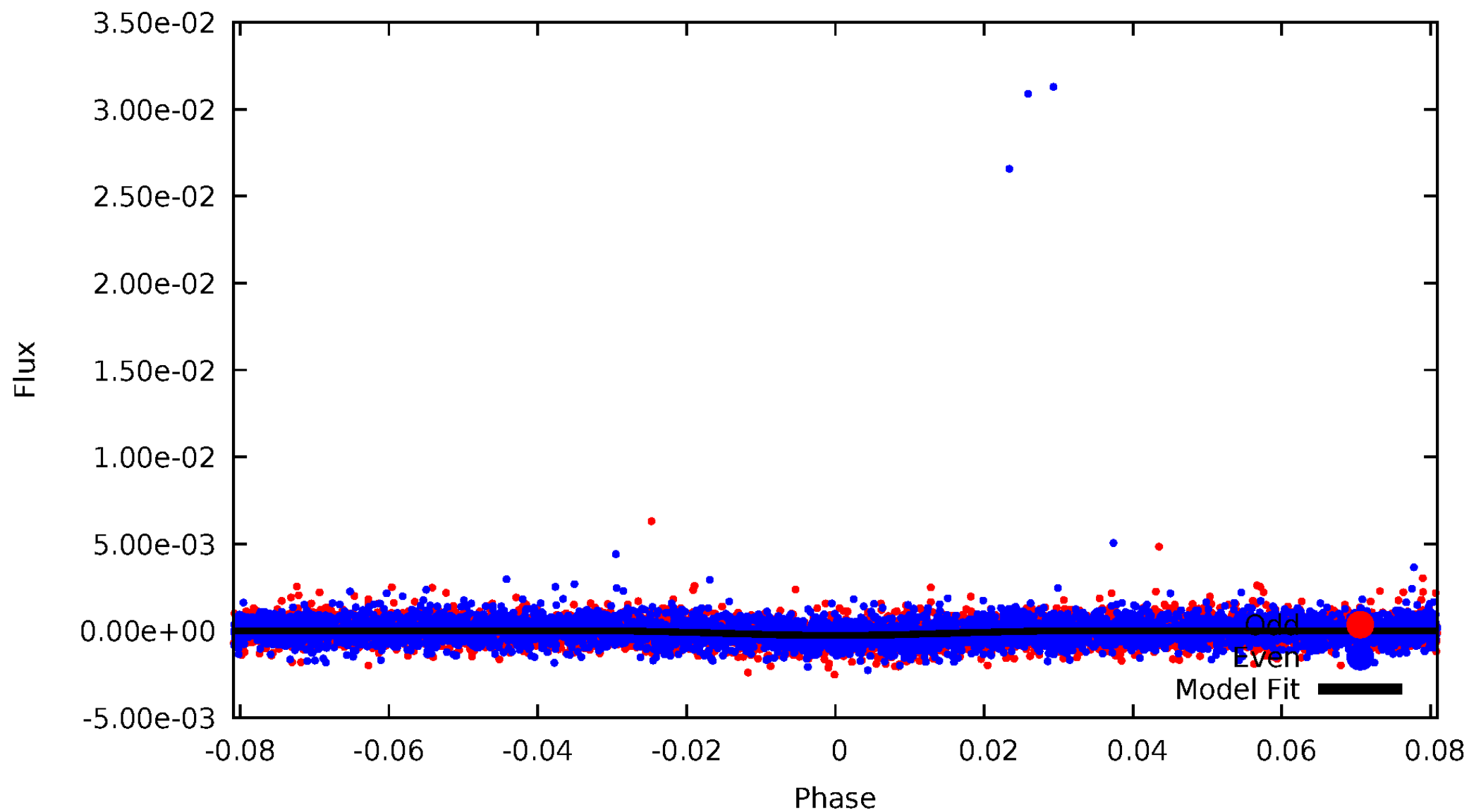
TCE 009520443-01





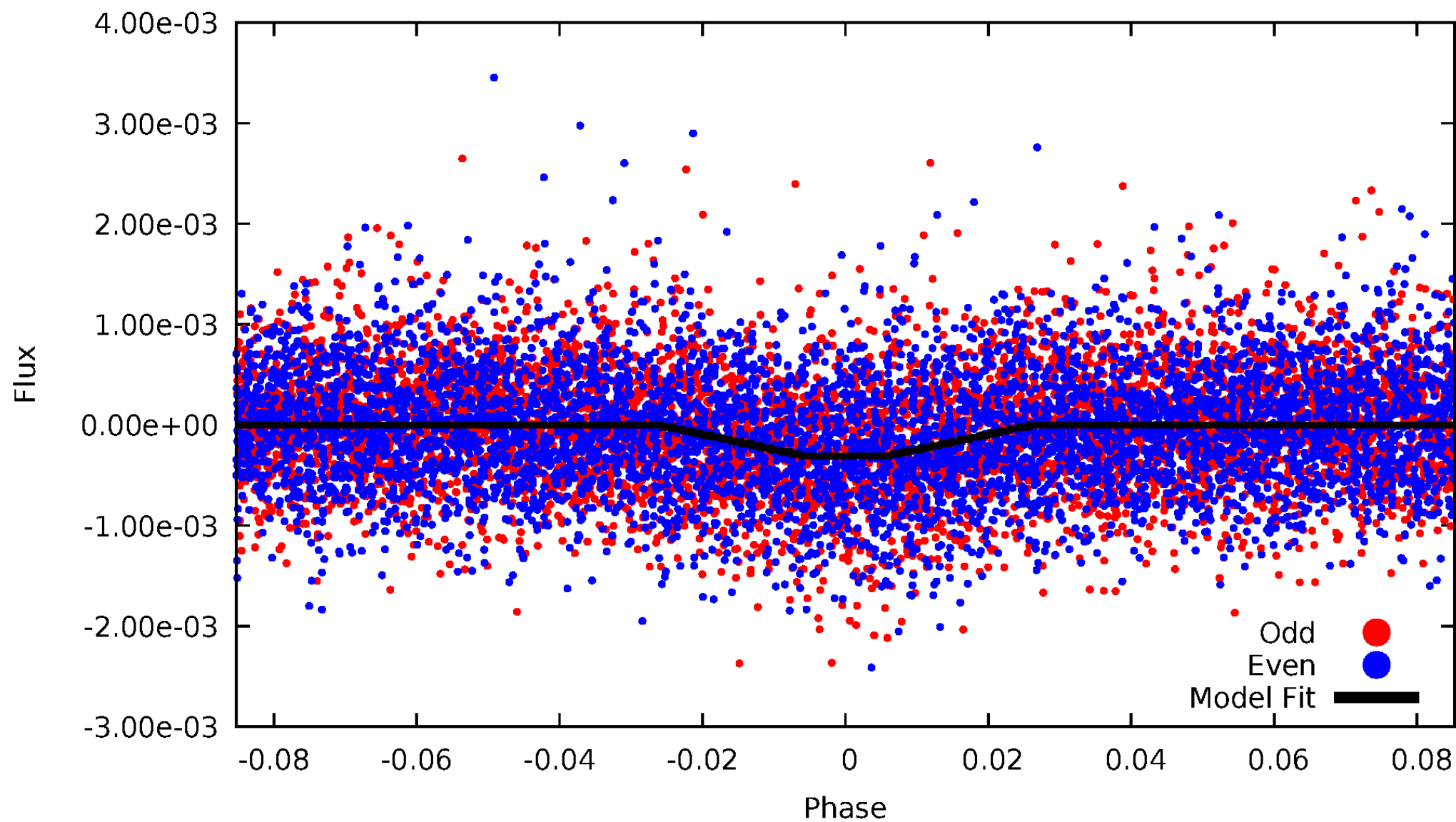
# DV Odd/Even

TCE 009520443-01

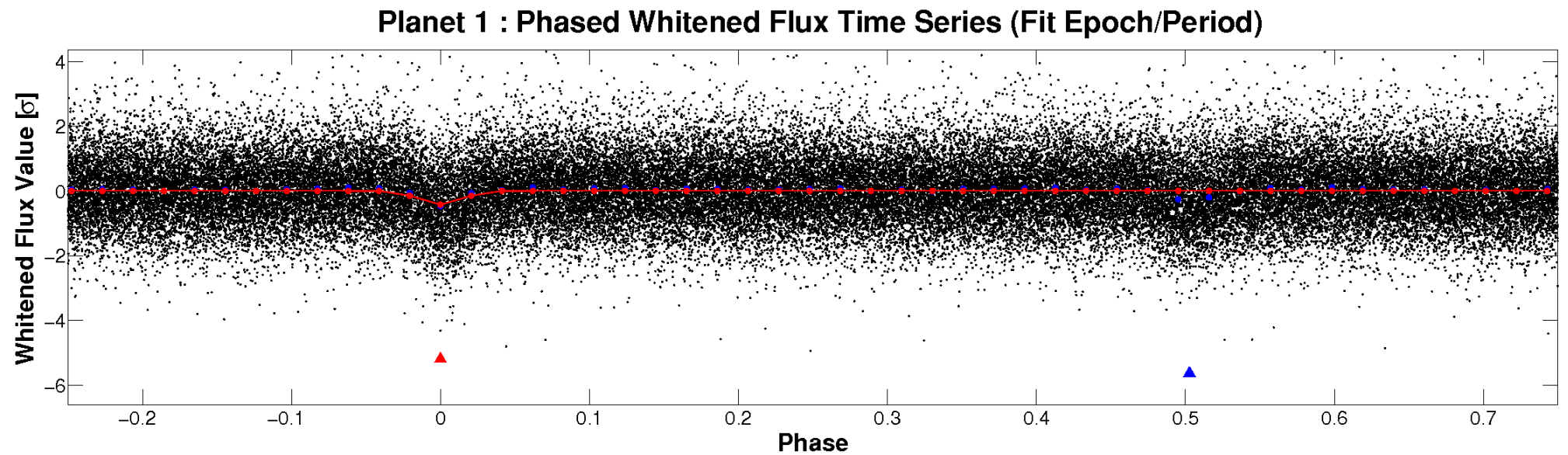
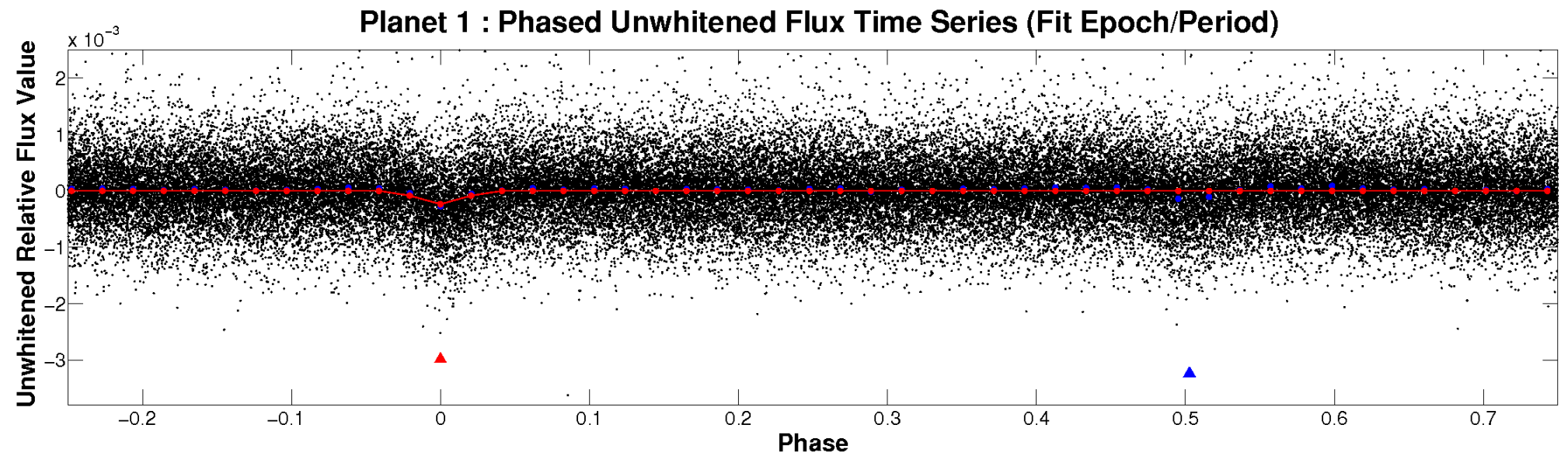


# ALT Odd/Even

TCE 009520443-01

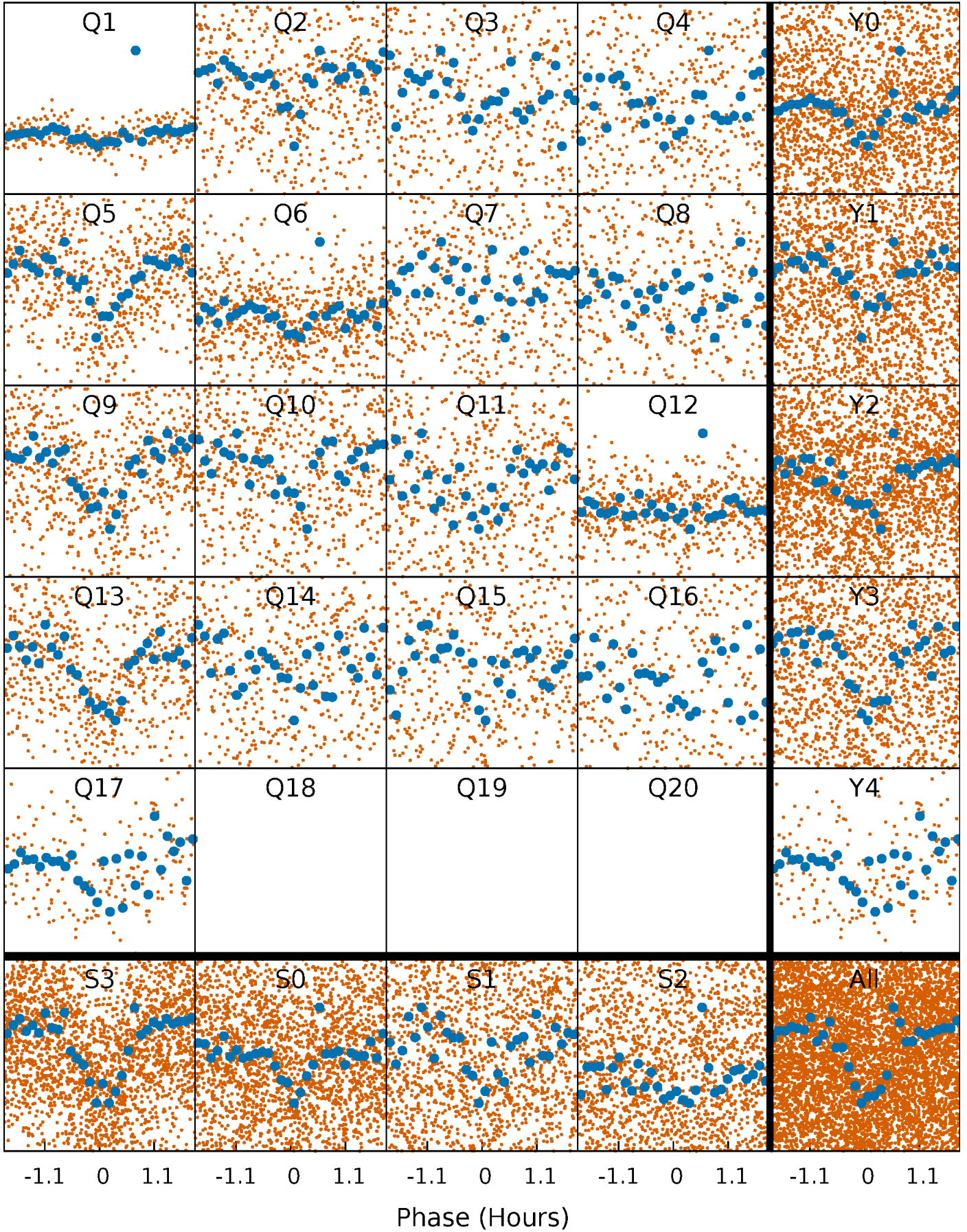


# Non-Whitened Vs. Whitened Light Curve



# PDC Quarter-Phased Transit Curves

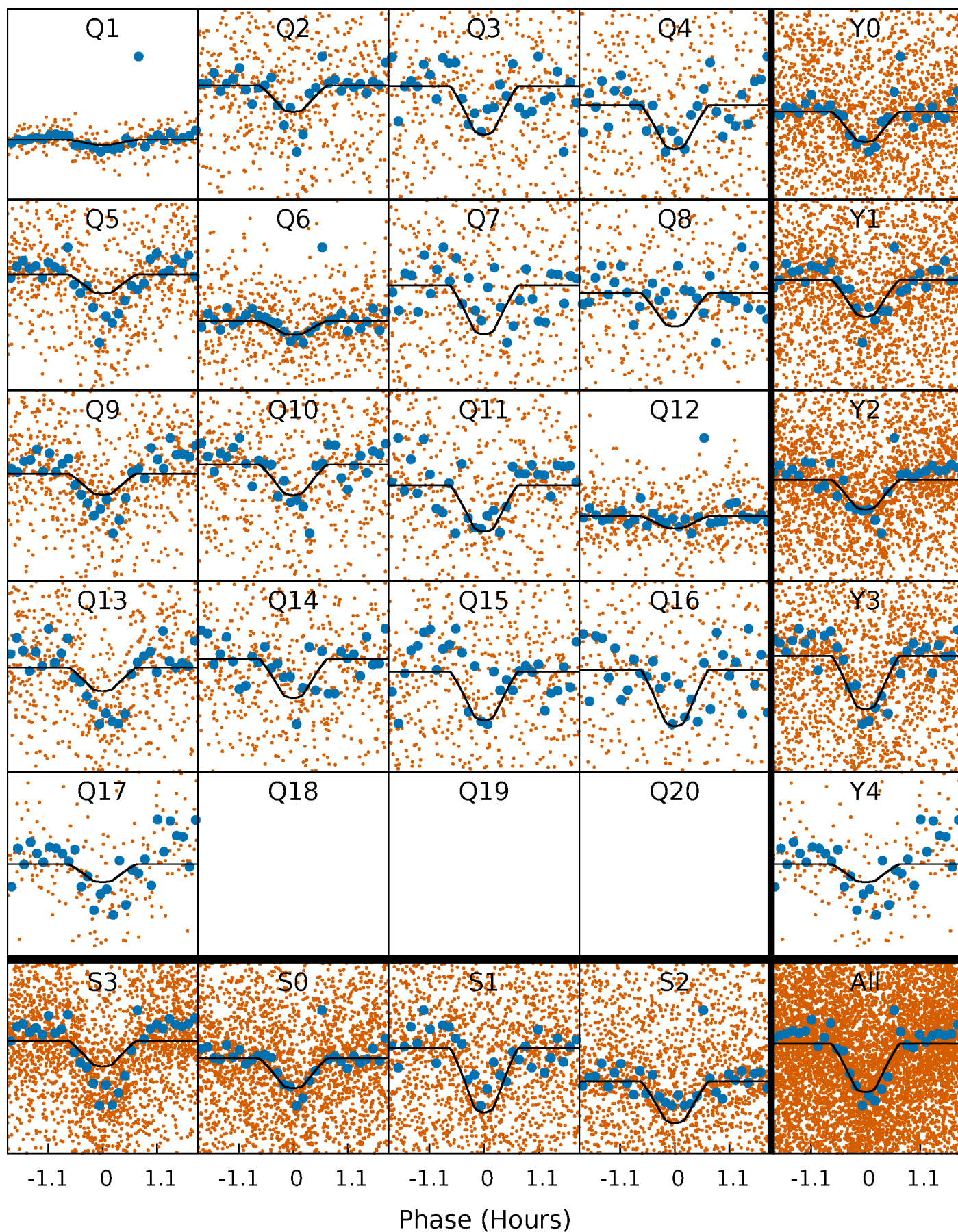
TCE 009520443-01 P= 0.990143 Days  $T_0=132.029448$  (BKJD)





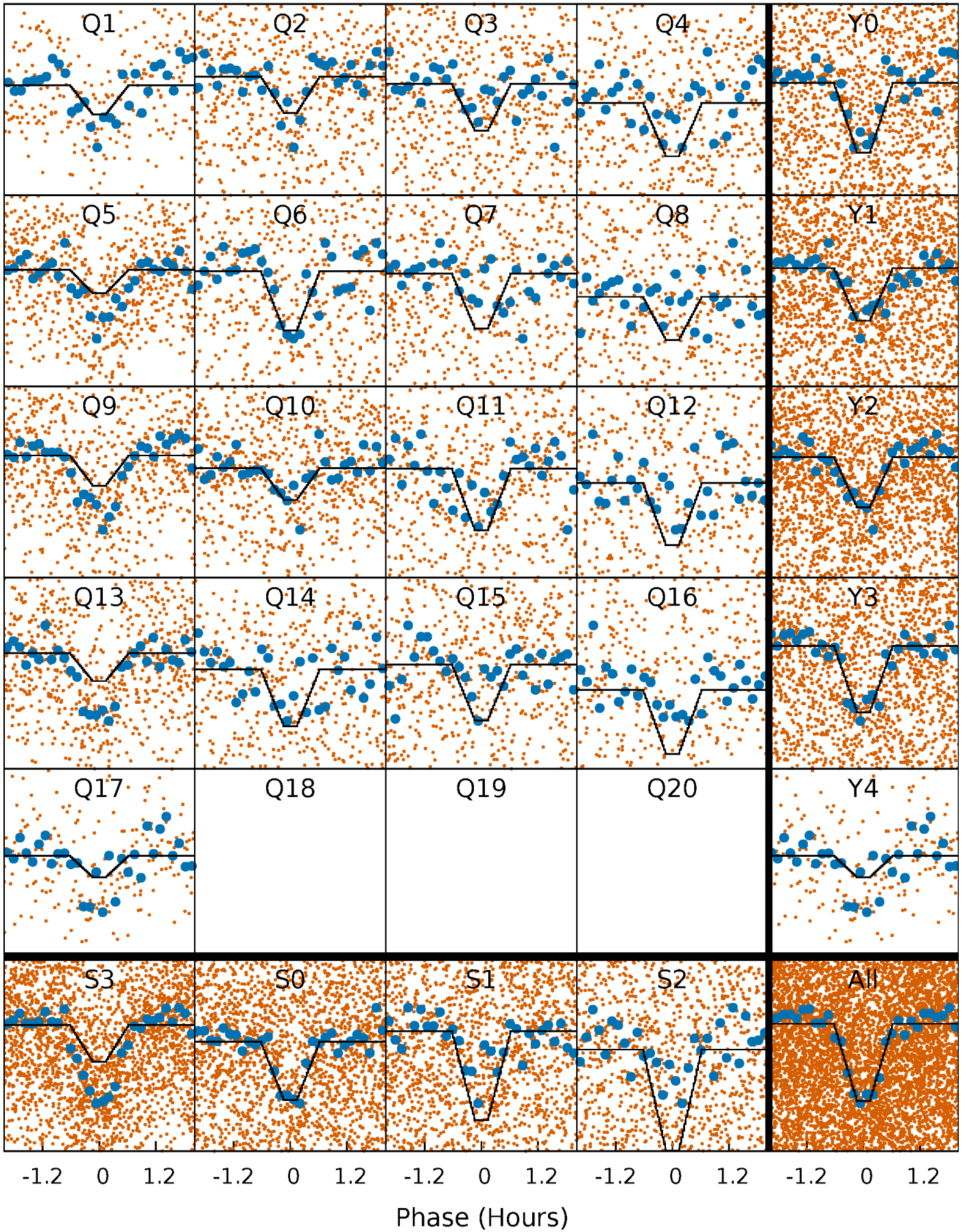
# DV Quarter-Phased Transit Curves

TCE 009520443-01   P= 0.990143 Days    $T_0=132.029448$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

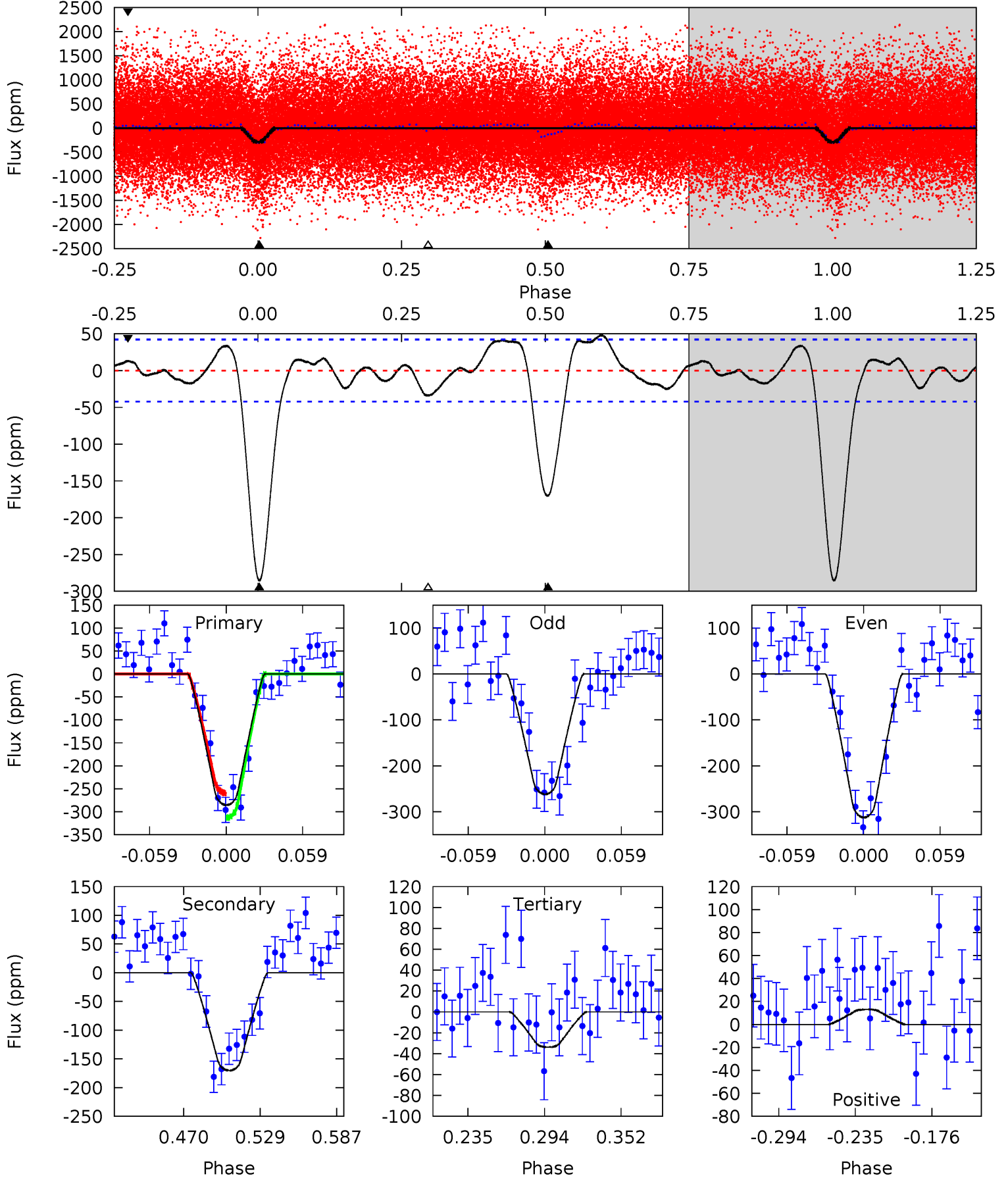
TCE 009520443-01 P= 0.990146 Days  $T_0=132.030031$  (BKJD)



# DV Model-Shift Uniqueness Test

009520443-01, P = 0.990143 Days, E = 131.039305 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
31.6	18.9	3.75	1.44	4.68	1.89	2.16	27.9	30.2	15.1	17.4	2.82	1.06	0.14	2.94

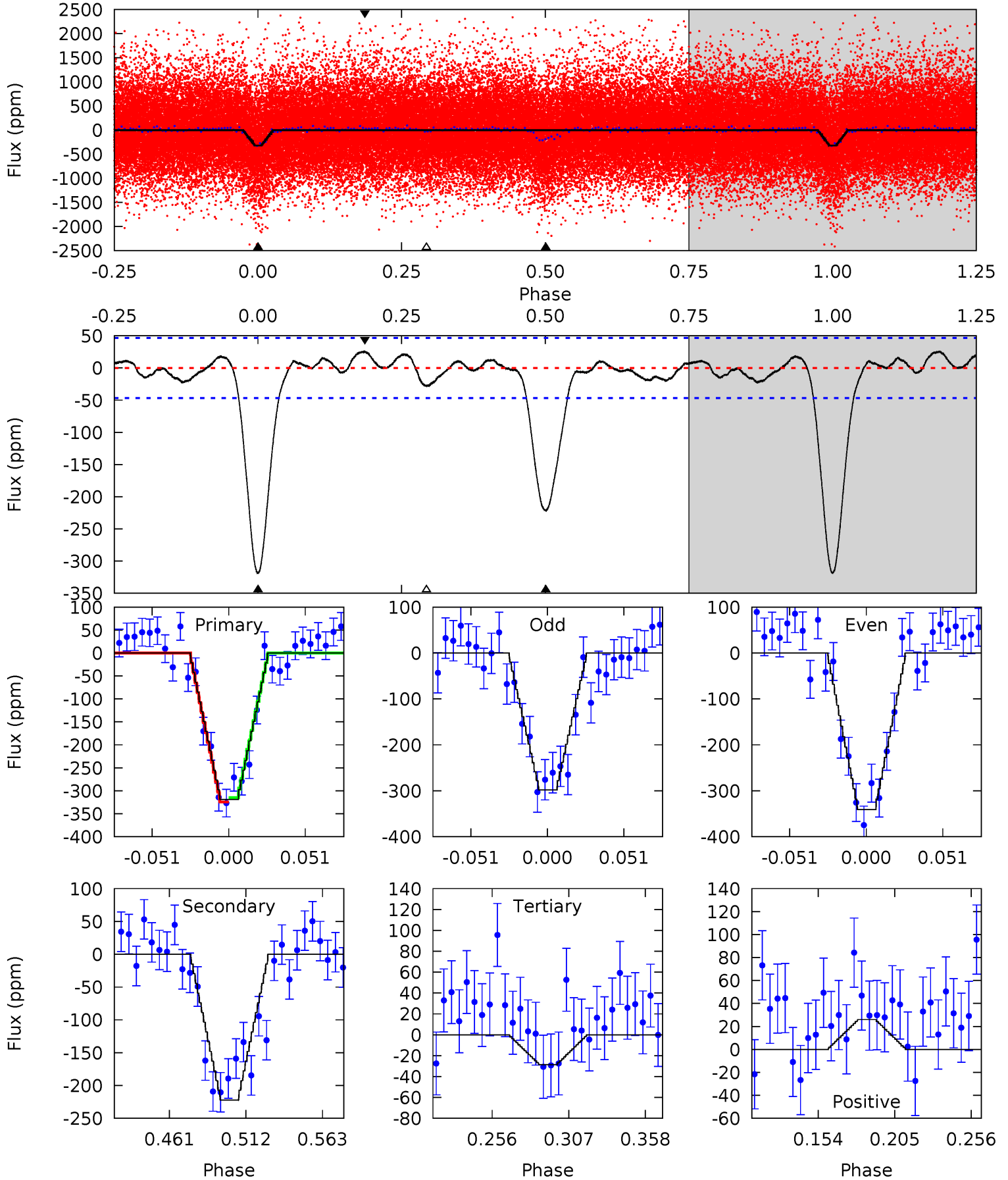




# Alt Model-Shift Uniqueness Test

009520443-01, P = 0.990146 Days, E = 131.039885 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
32.1	22.3	2.88	2.61	4.70	1.95	1.17	29.2	29.5	19.4	19.7	2.17	0.96	0.08	0.47





### Stellar Parameters For KIC 009520443

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5072^{+153}_{-153}$	$4.606^{+0.027}_{-0.082}$	$0.000^{+0.250}_{-0.300}$	$0.747^{+0.096}_{-0.052}$	$0.837^{+0.051}_{-0.088}$	$2.834^{+0.422}_{-0.784}$
	+3%/-3%	+1%/-2%	+inf%/-inf%	+13%/-7%	+6%/-11%	+15%/-28%
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 009520443-01 / KOI 2893.01

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-170 \pm 9$	$1.49^{+0.77}_{-0.73}$	$2020^{+83}_{-75}$	$4437^{+1477}_{-651}$	$14^{+38}_{-8}$
Alt.	$-222 \pm 10$	$1.48^{+0.78}_{-0.79}$	$2024^{+78}_{-69}$	$4697^{+2023}_{-710}$	$19^{+67}_{-11}$

$T_{\text{max}}$  = 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

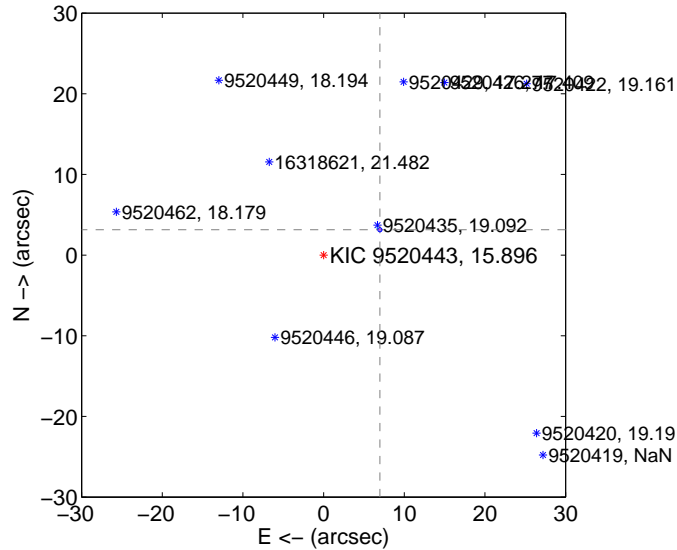
Supplemental centroid analysis for 009520443-01. Kepler magnitude: 15.90. Transit SNR 17.65

There are 4 quarters with good PRF difference image offsets

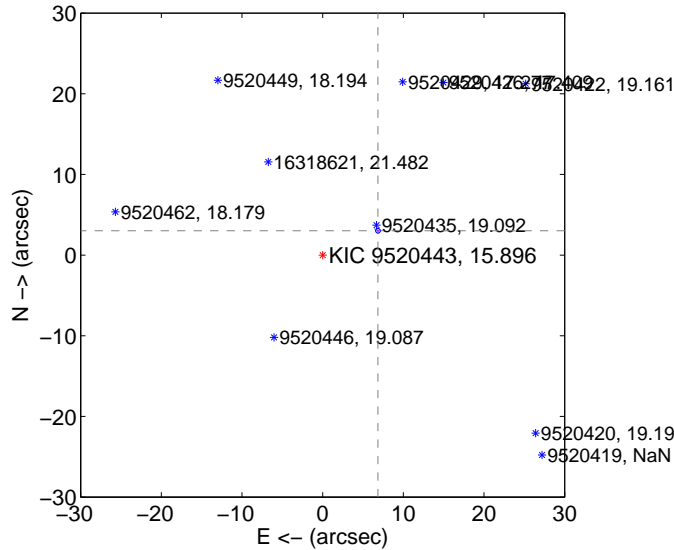
The direct PRF centroid is offset from the target star catalog position by about 0.17 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$7.649 \pm 0.085$	89.99	$-6.974 \pm 0.105$	$3.141 \pm 0.087$
PRF-fit source offset from KIC position	$7.491 \pm 0.097$	77.11	$-6.857 \pm 0.126$	$3.016 \pm 0.097$
photometric centroid source offset	$47.58 \pm 0.77$	62.01	$-46.41 \pm 0.77$	$10.47 \pm 0.74$

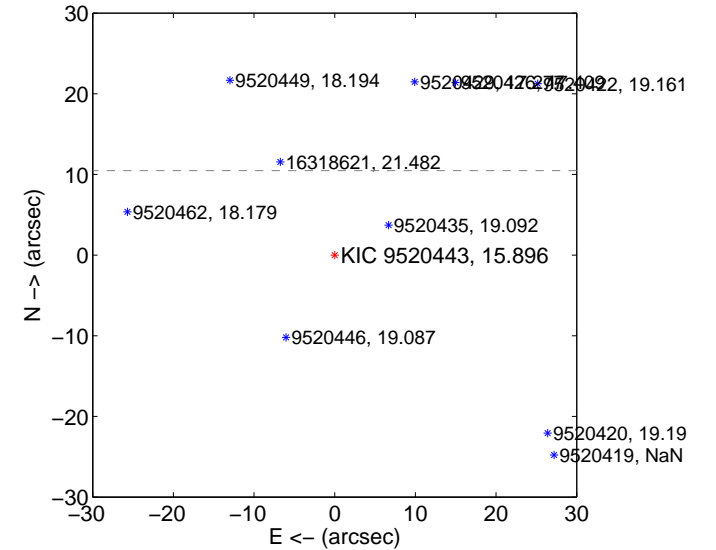
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

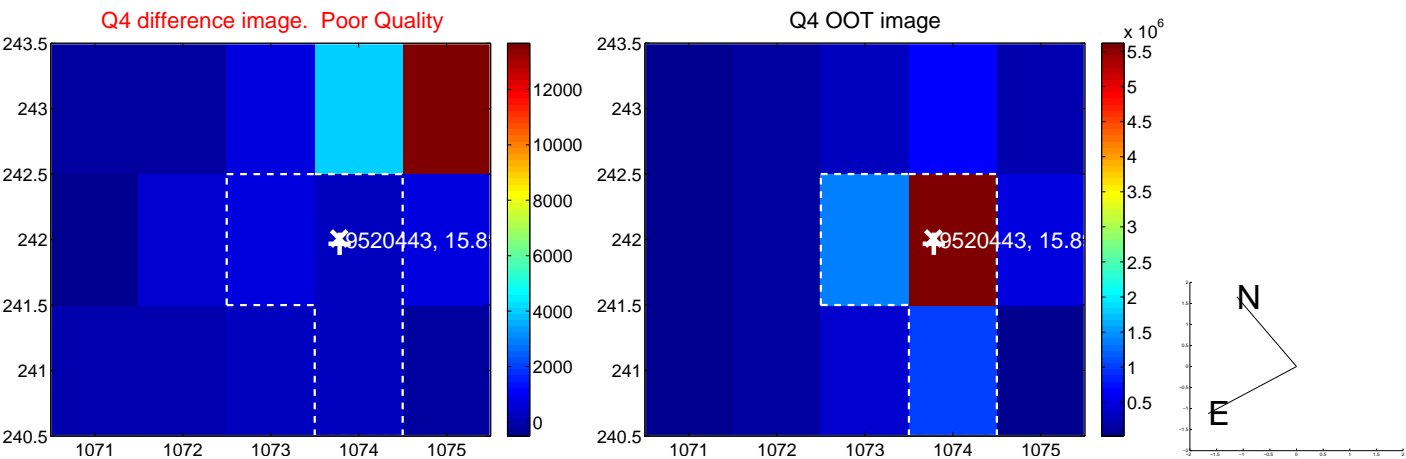
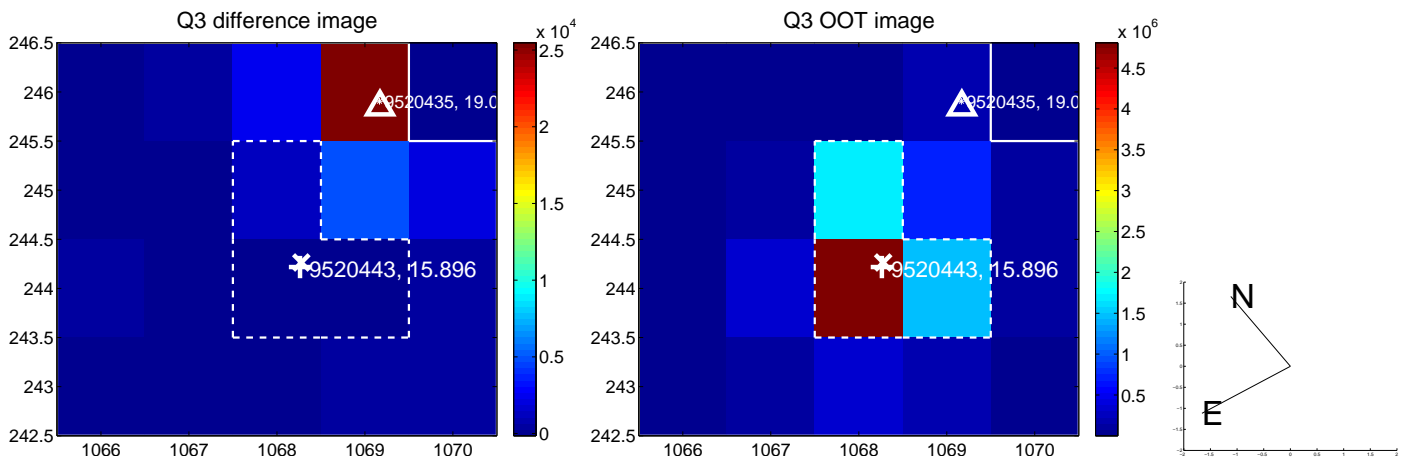
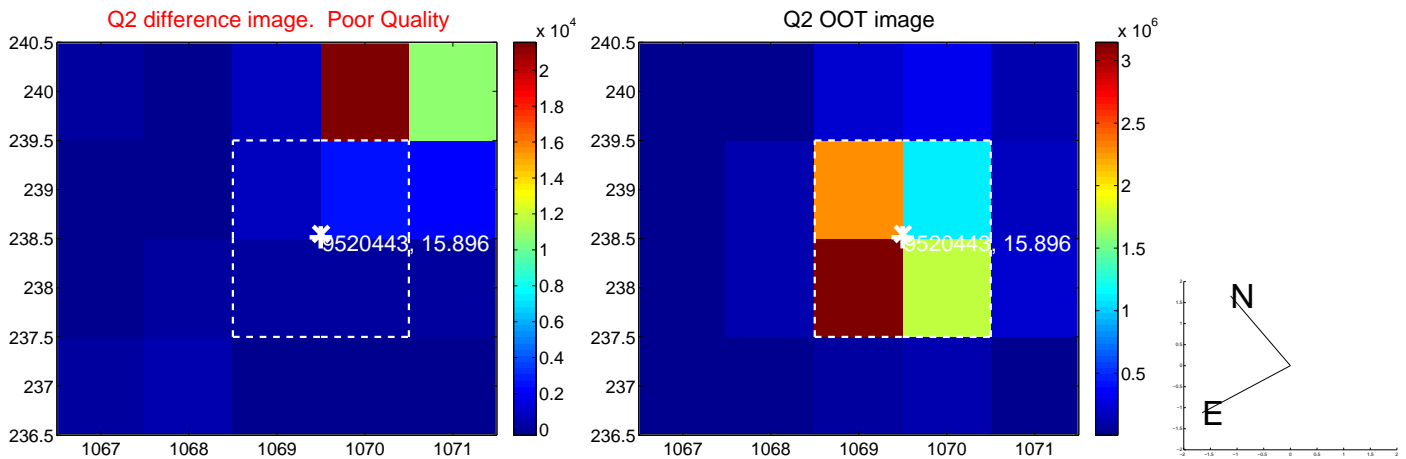
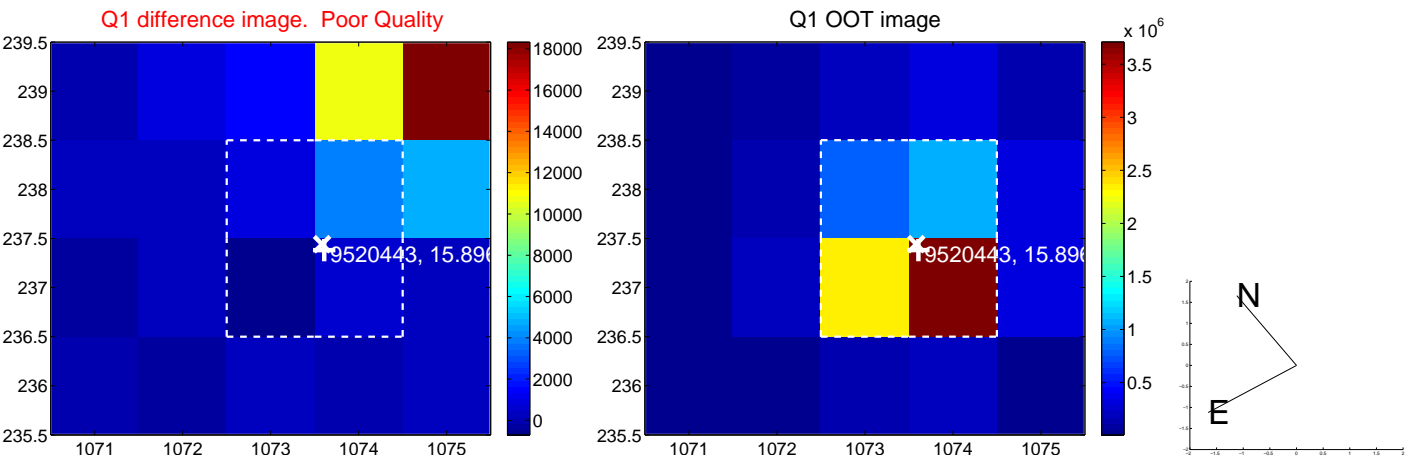


offset from photometric centroids

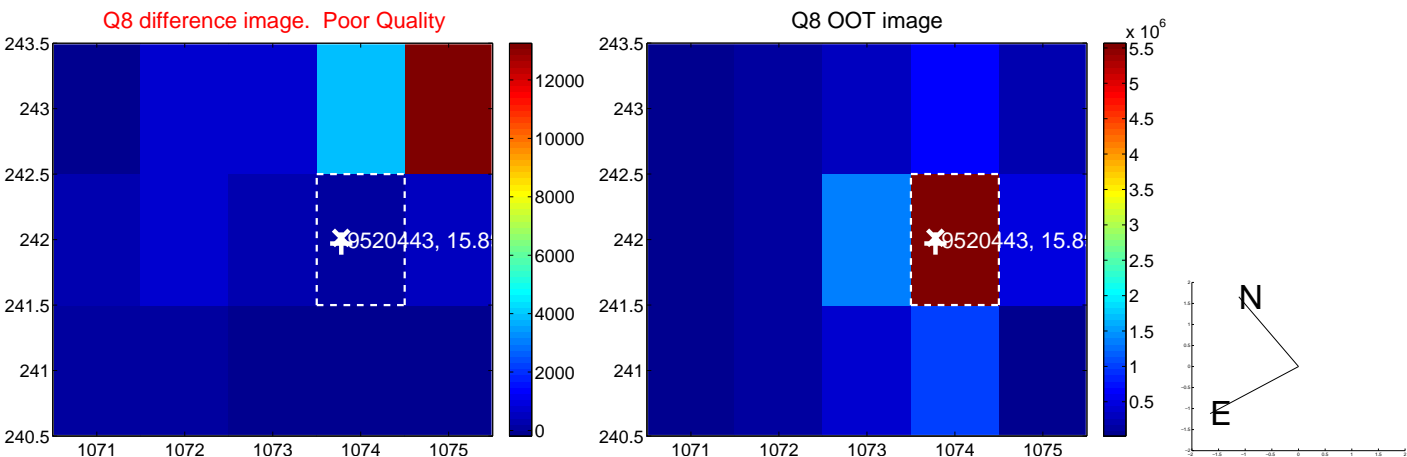
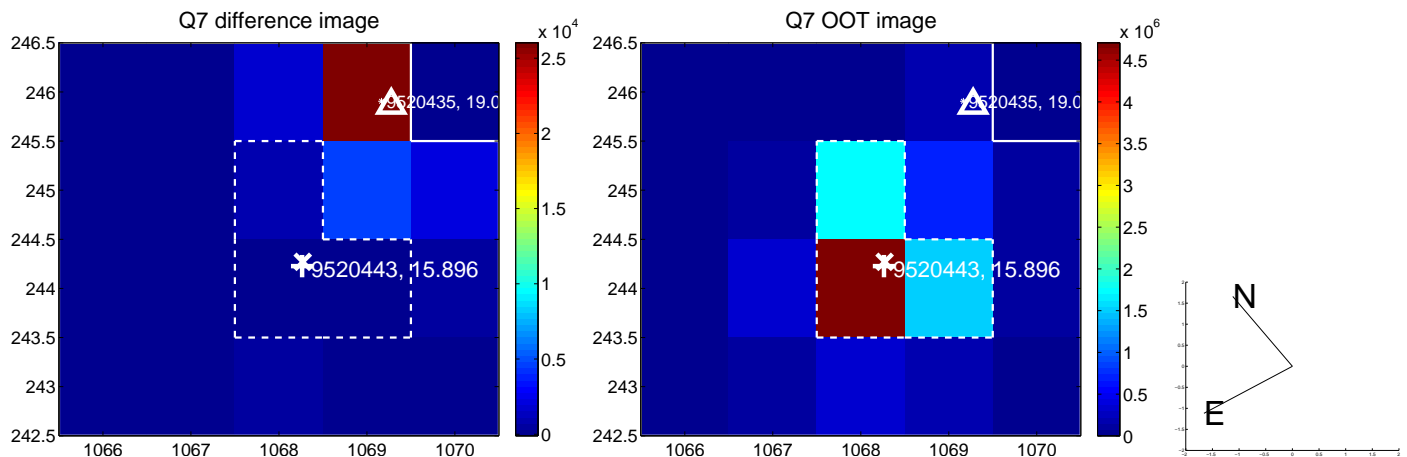
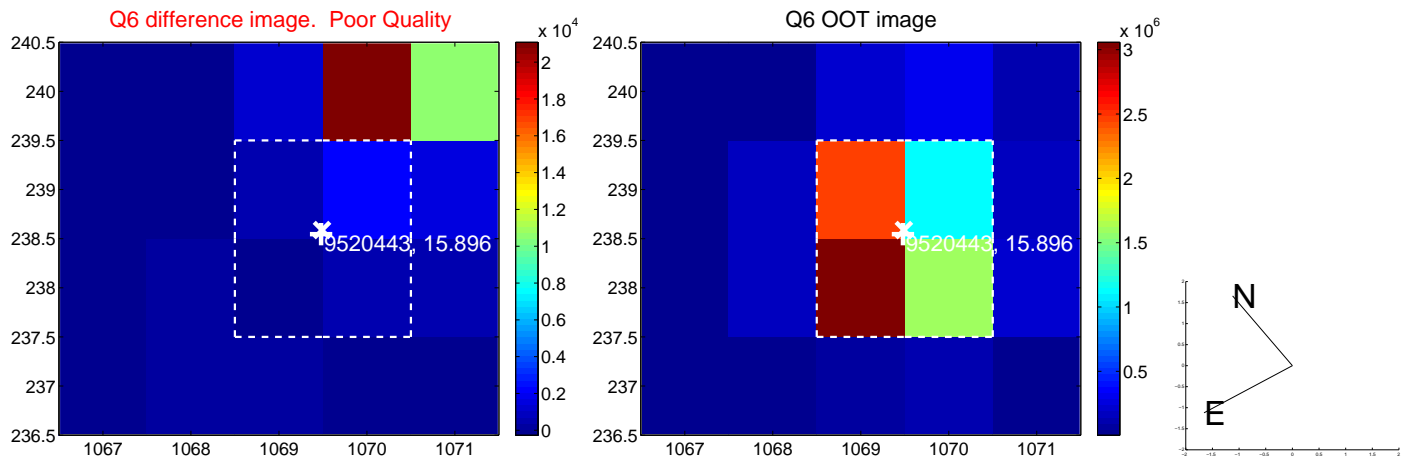
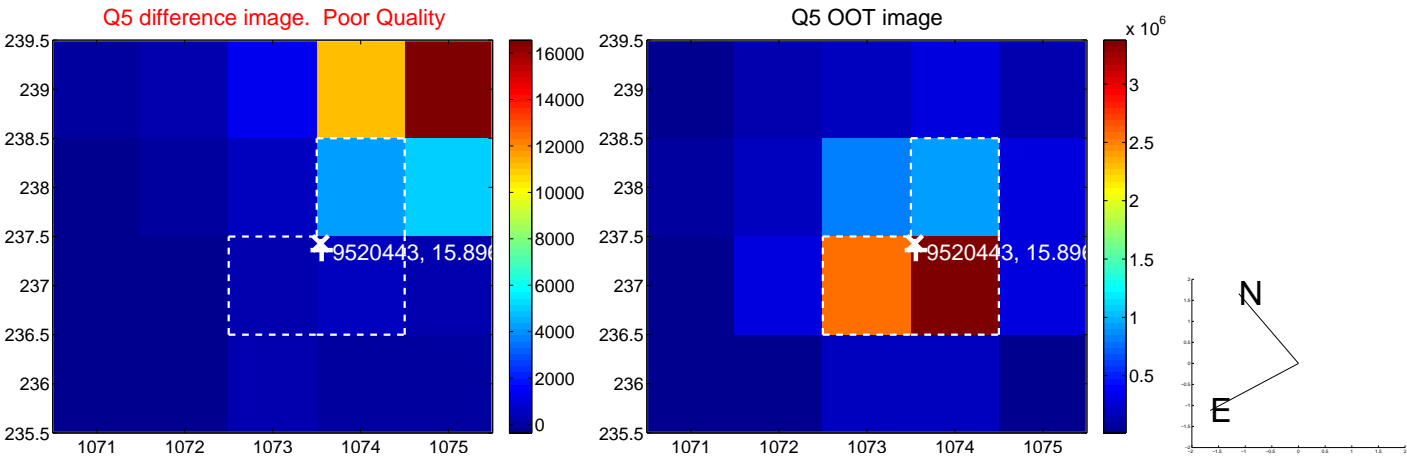


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

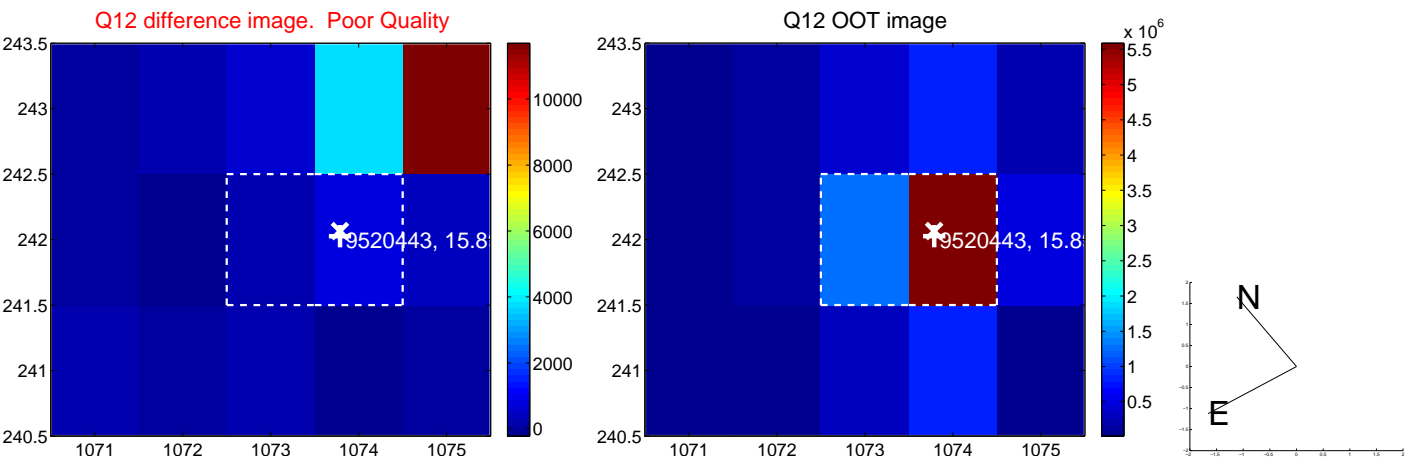
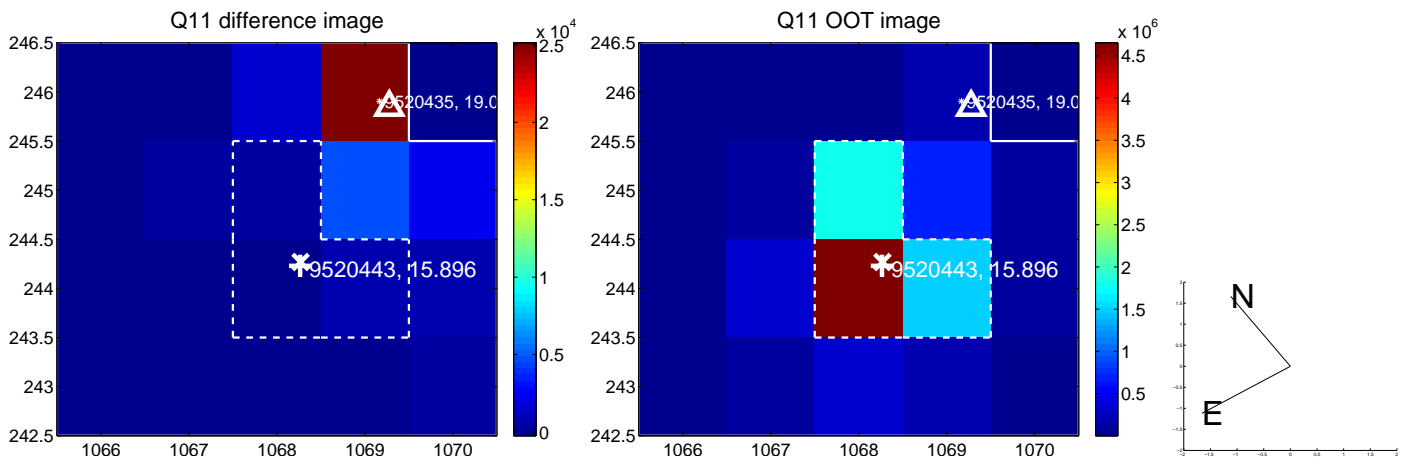
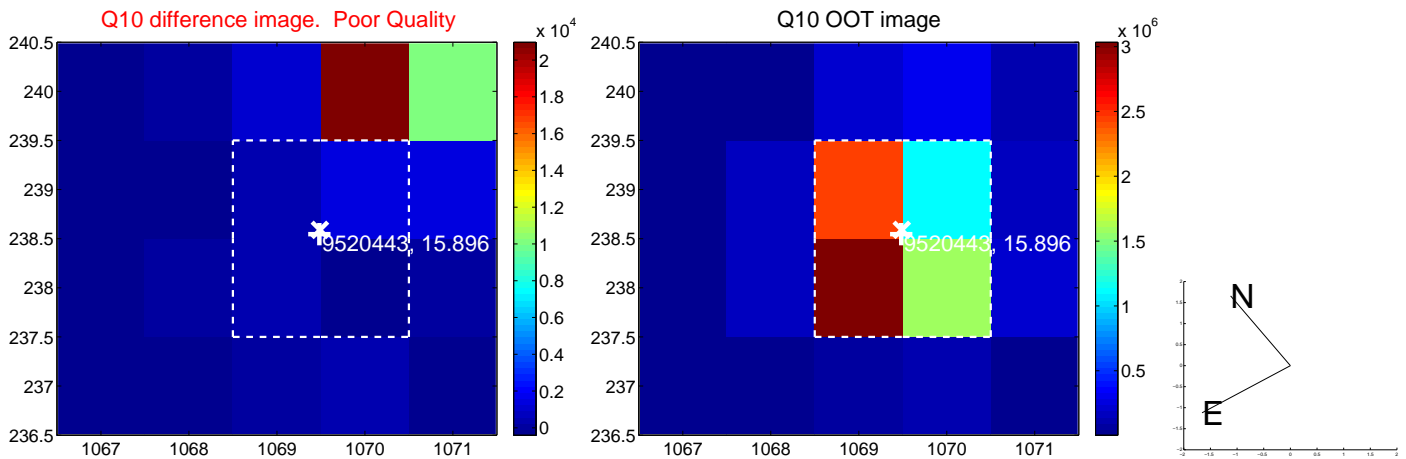
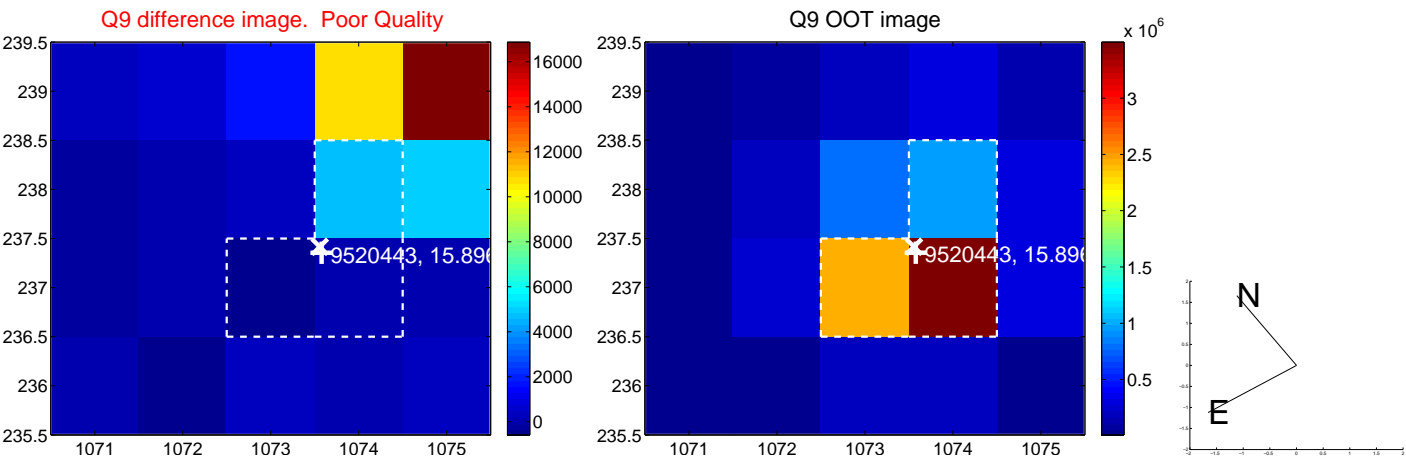


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

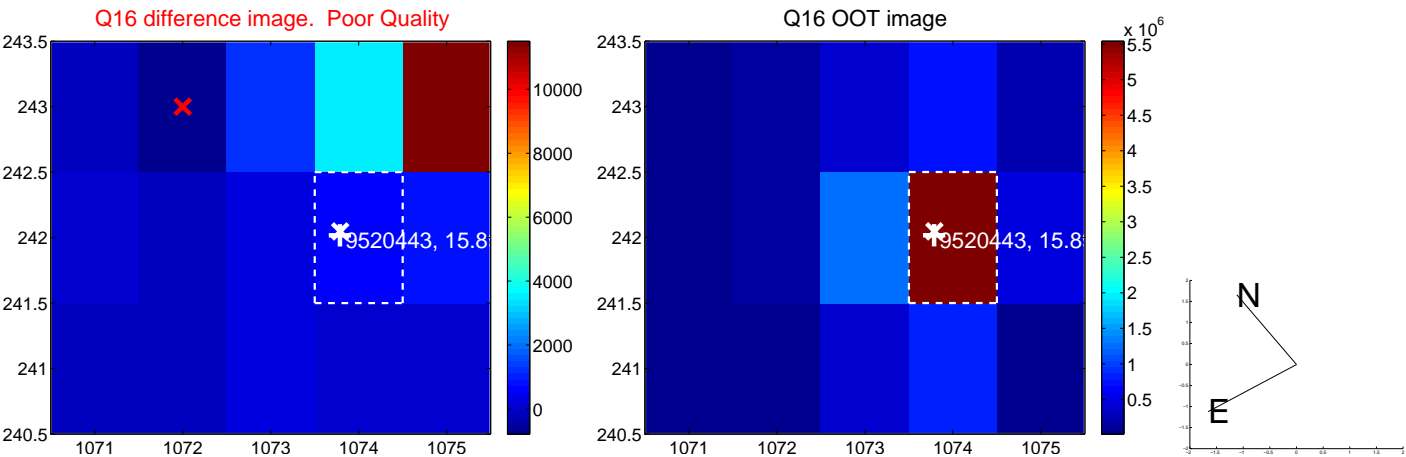
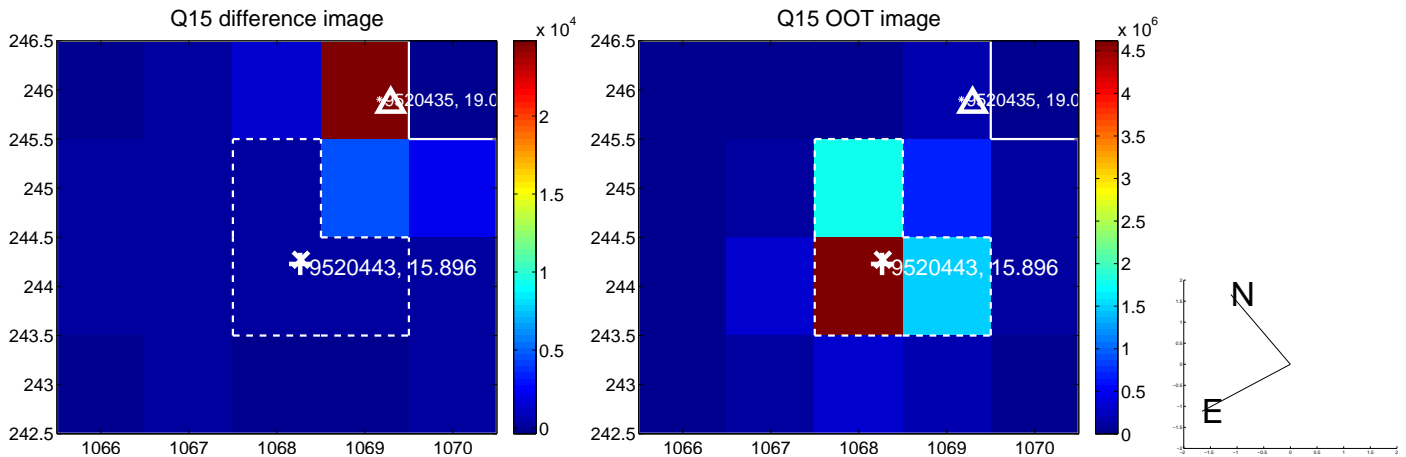
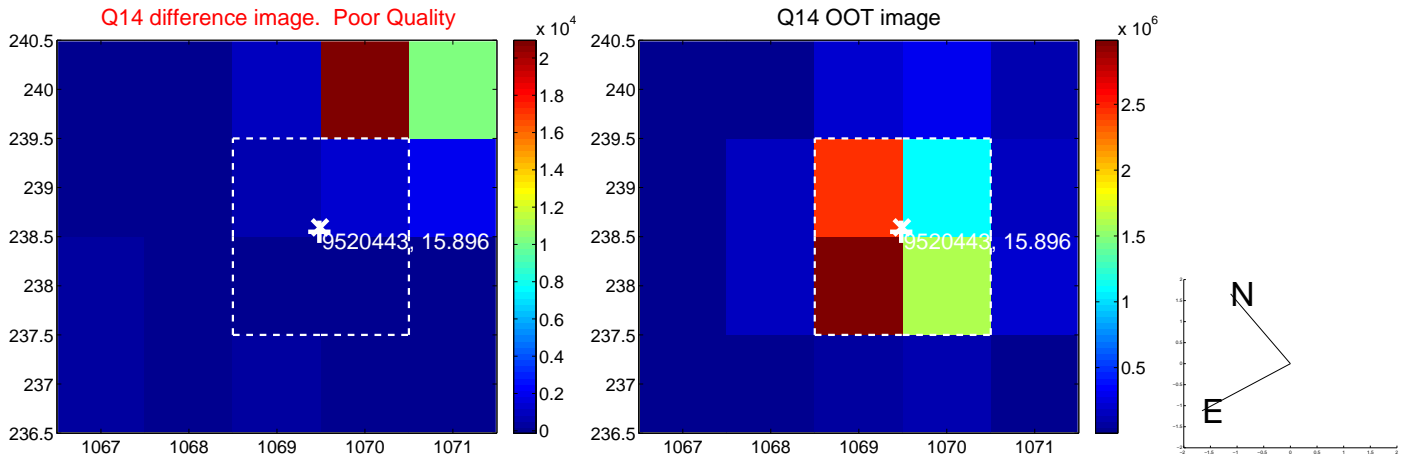
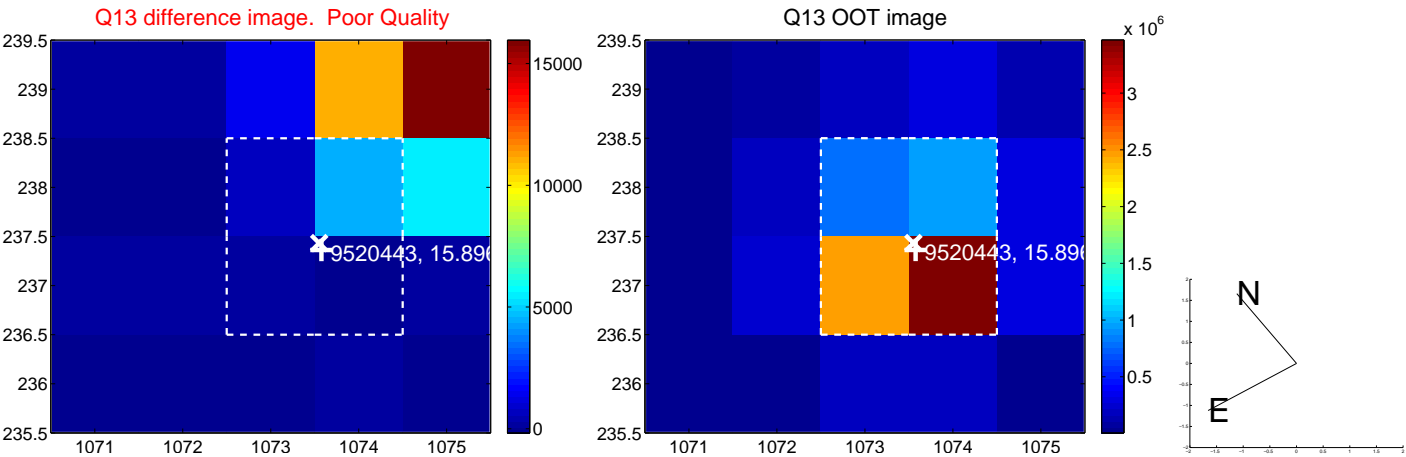




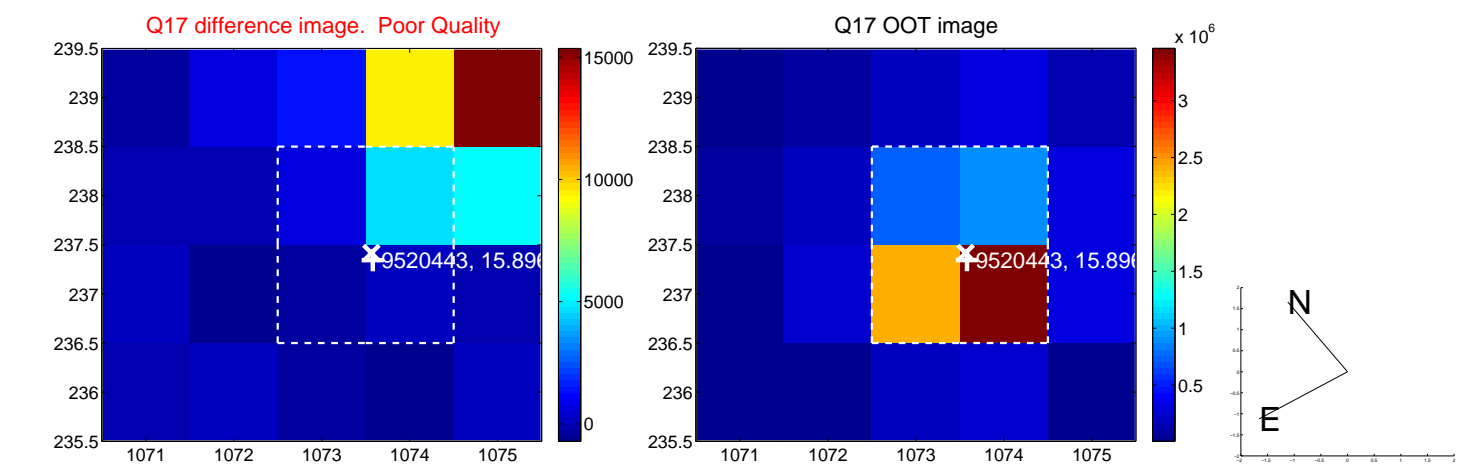
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



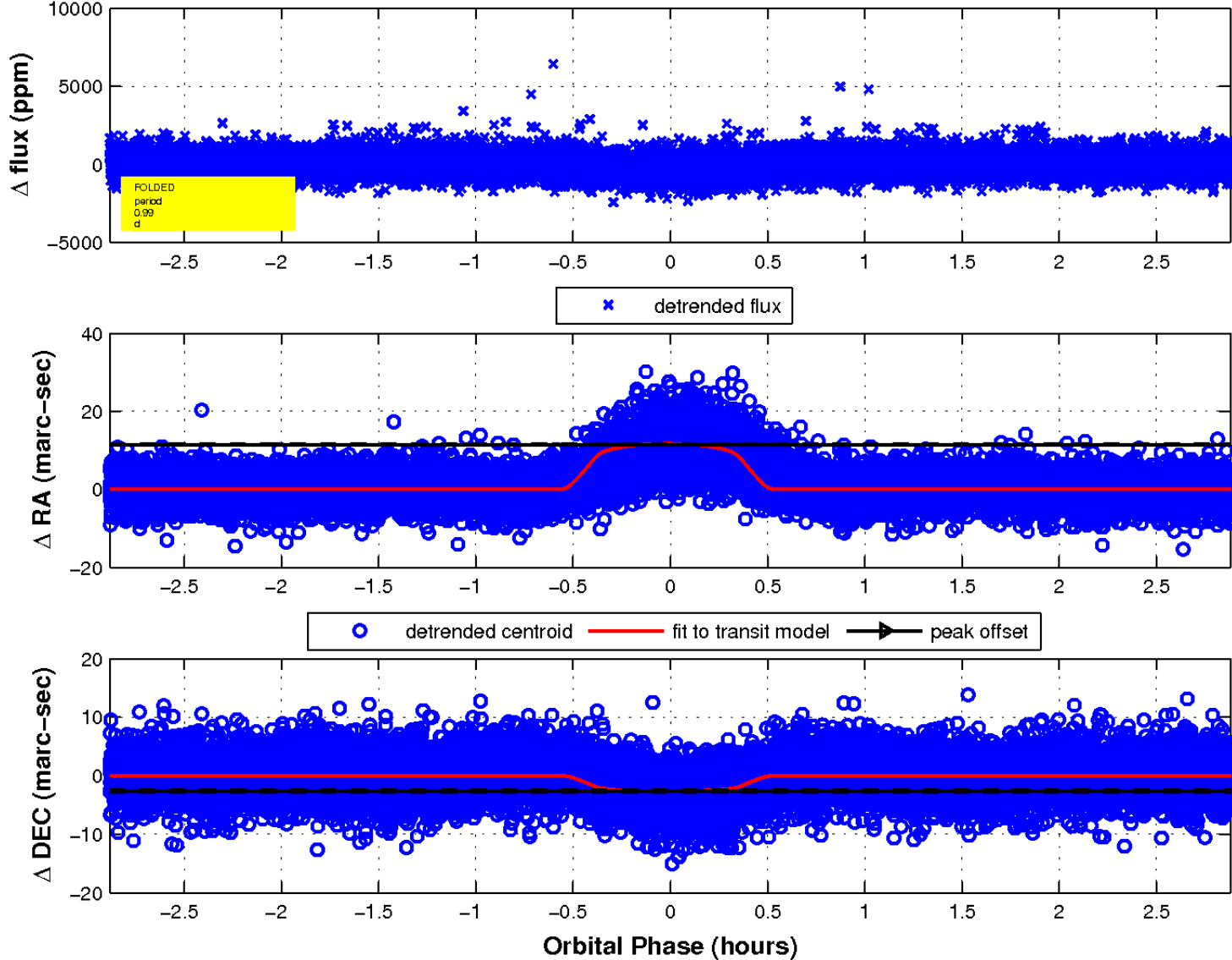
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

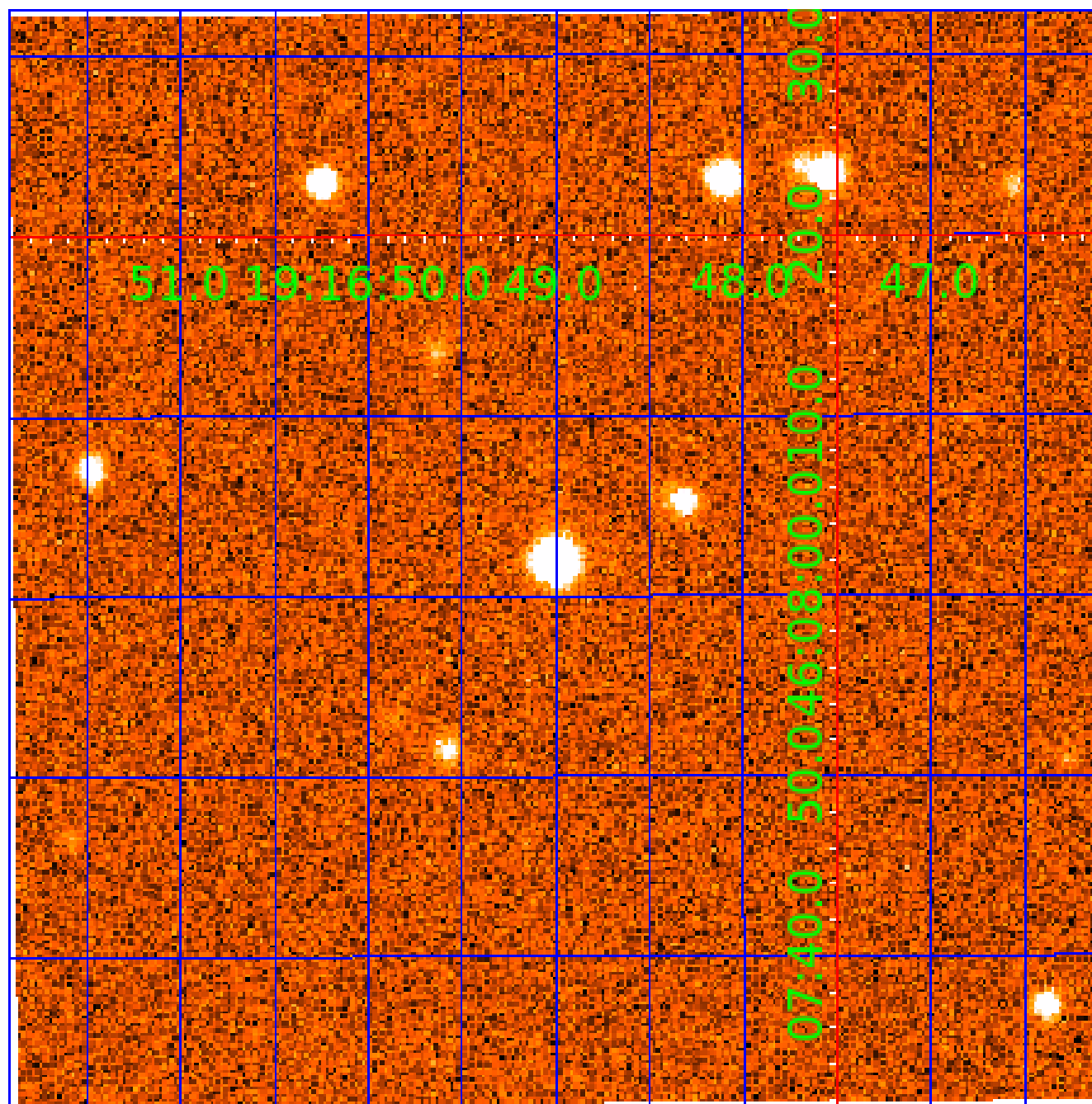


fluxWeightedCentroids, Planet 1 of 2



# UKIRT Image

Declination





# KIC 009520443

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009520443-01	OBS	2893.01	0.990143	132.029448	246.2	0.961	14.7	17.7	0.75	5072	1.44	997.46
009520443-02	OBS	No	0.990143	131.537618	182.1	1.051	11.0	14.3	0.75	5072	0.99	997.46

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009520443-01	OBS	FP	0.00	0	1	1	0	MOD_SEC_DV—MOD_SEC_ALT—HAS_SEC_TCE—CENT_RESOLVED_OFFSET
009520443-02	OBS	FP	0.00	1	1	1	0	IS_SEC_TCE—CENT_RESOLVED_OFFSET

**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.

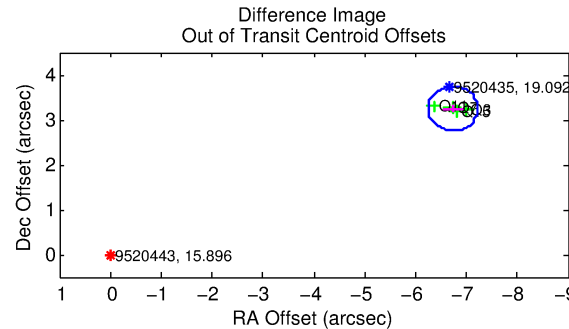
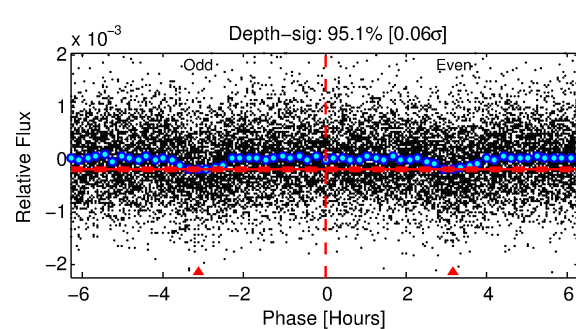
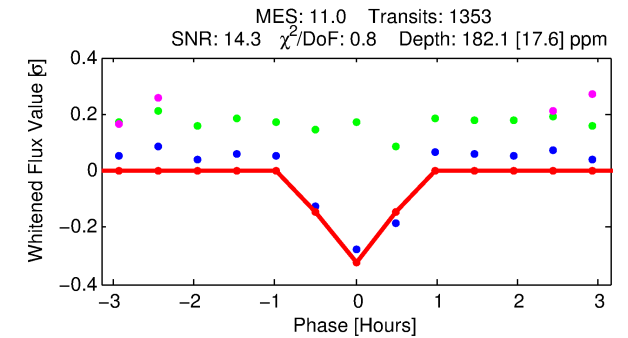
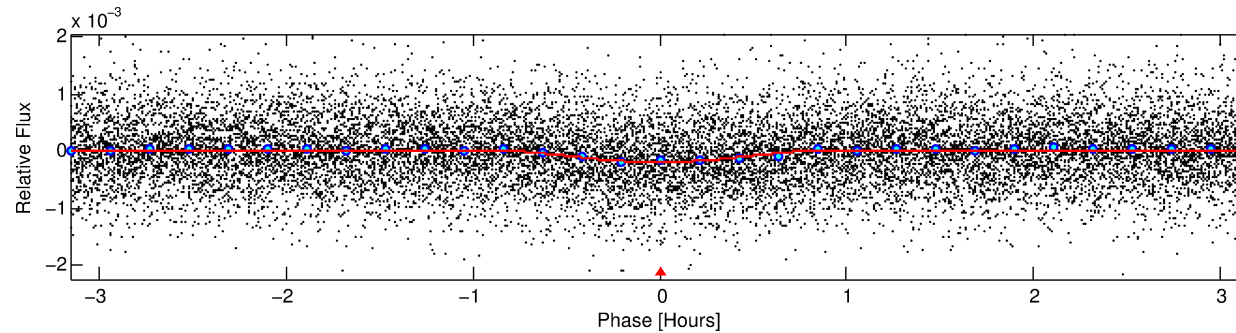
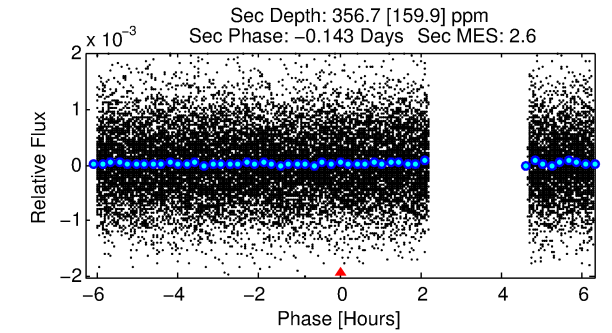
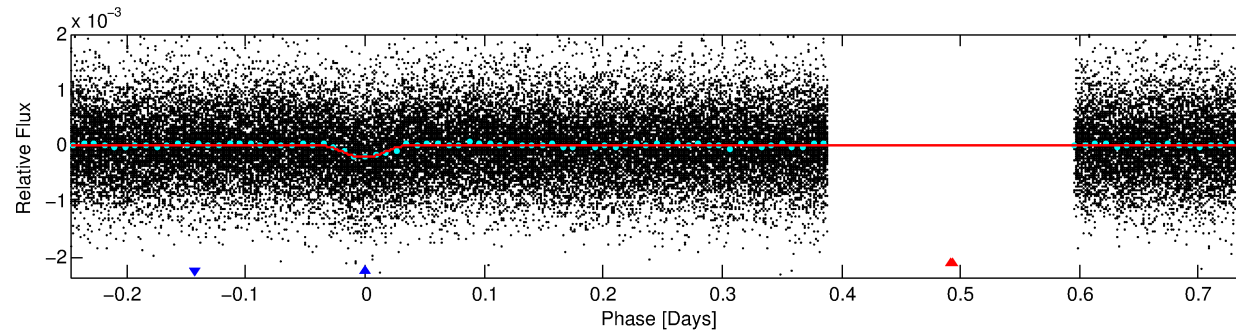
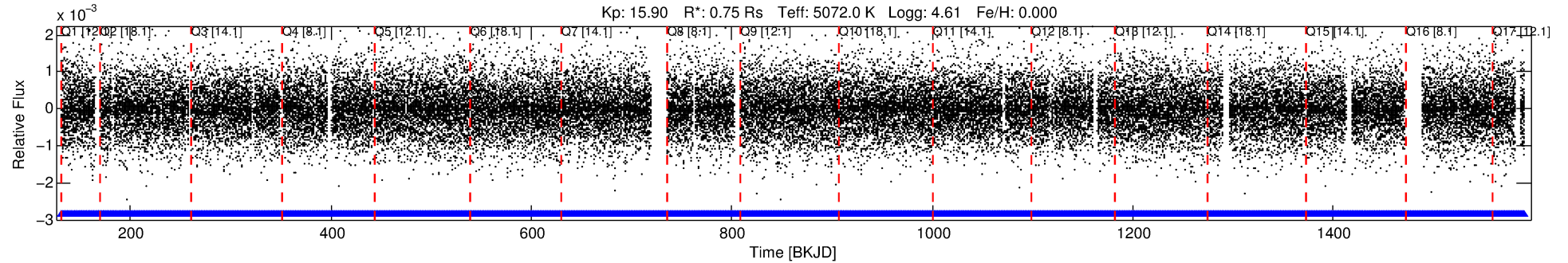
## Ephemeris Match Information For 009520443-02

No Significant Match Found

# DV One-Page Summary

KIC: 9520443 Candidate: 2 of 2 Period: 0.990 d  
KOI: K02893 Corr: No Ephemeris Match

Kp: 15.90 R\*: 0.75 Rs Teff: 5072.0 K Logg: 4.61 Fe/H: 0.000



## DV Fit Results:

Period = 0.99014 [0.00001] d  
Epoch = 131.5376 [0.0013] BKJD  
Rp/R\* = 0.0122 [0.0164]  
a/R\* = 7.20 [33.18]  
b = 0.17 [26.35]  
Seff = 997.46 [193.78]  
Teq = 1433 [70] K  
Rp = 0.99 [1.34] Re  
a = 0.0182 [0.0019] AU  
Ag = 66.21 [180.84] [0.36σ]  
Teff = 6320 [4313] K [1.13σ]

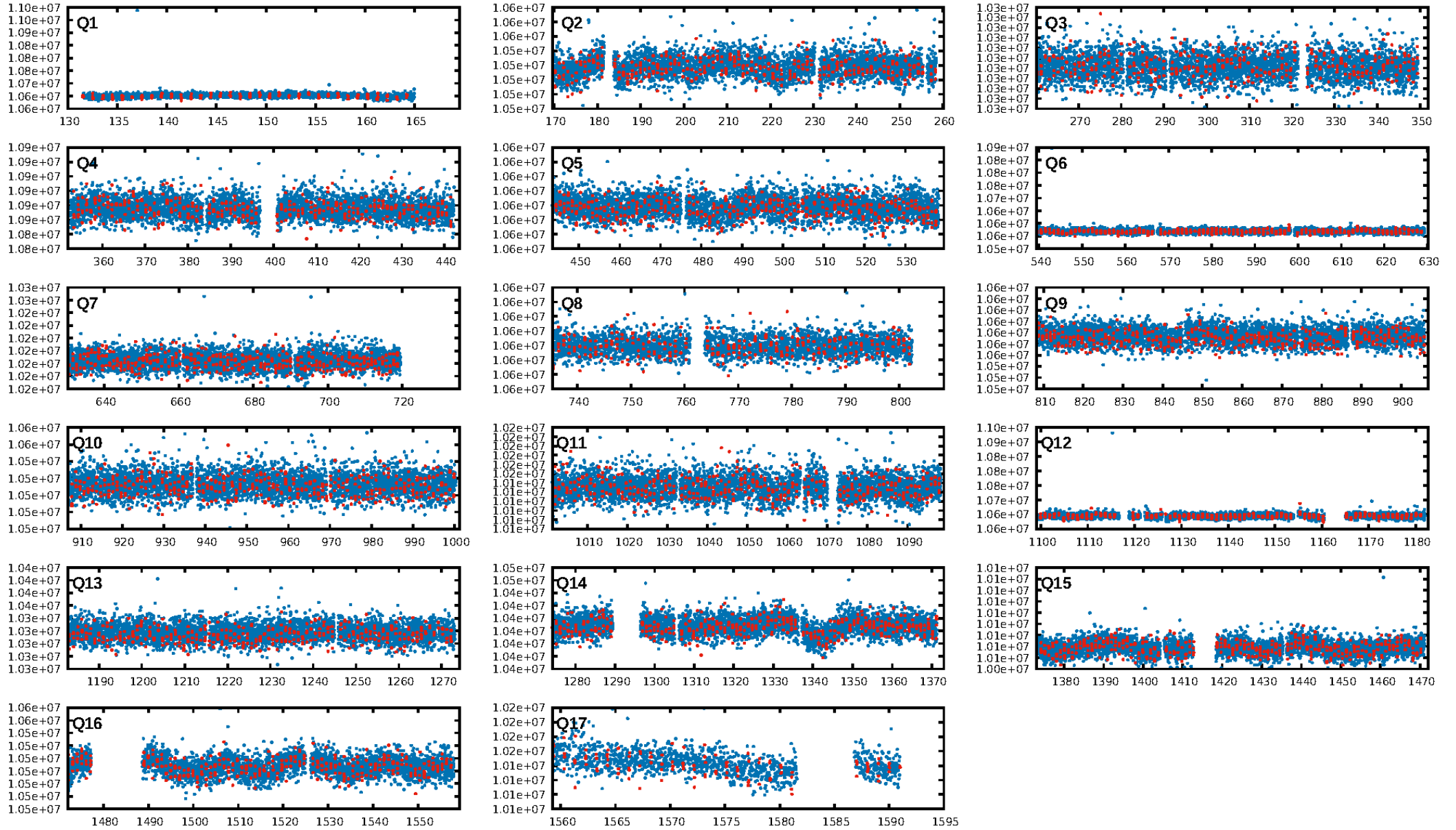
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 0.0% [0.00σ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGoF-sig: N/A  
Bootstrap-pfa: 1.99e-28  
RollingBand-fgt: 1.00 [1291/1291]  
GhostDiagnostic-chr: -3.12  
Centroid-sig: 0.0%  
Centroid-so: 15.791 arcsec [16.63σ]  
OotOffset-rm: 7.477 arcsec [45.80σ]  
KicOffset-rm: 7.312 arcsec [47.43σ]  
OotOffset-st: 0/4/0/0 [4]  
KicOffset-st: 0/4/0/0 [4]  
DiffImageQuality-fgm: 1.00 [4/4]  
DiffImageOverlap-fno: 1.00 [17/17]

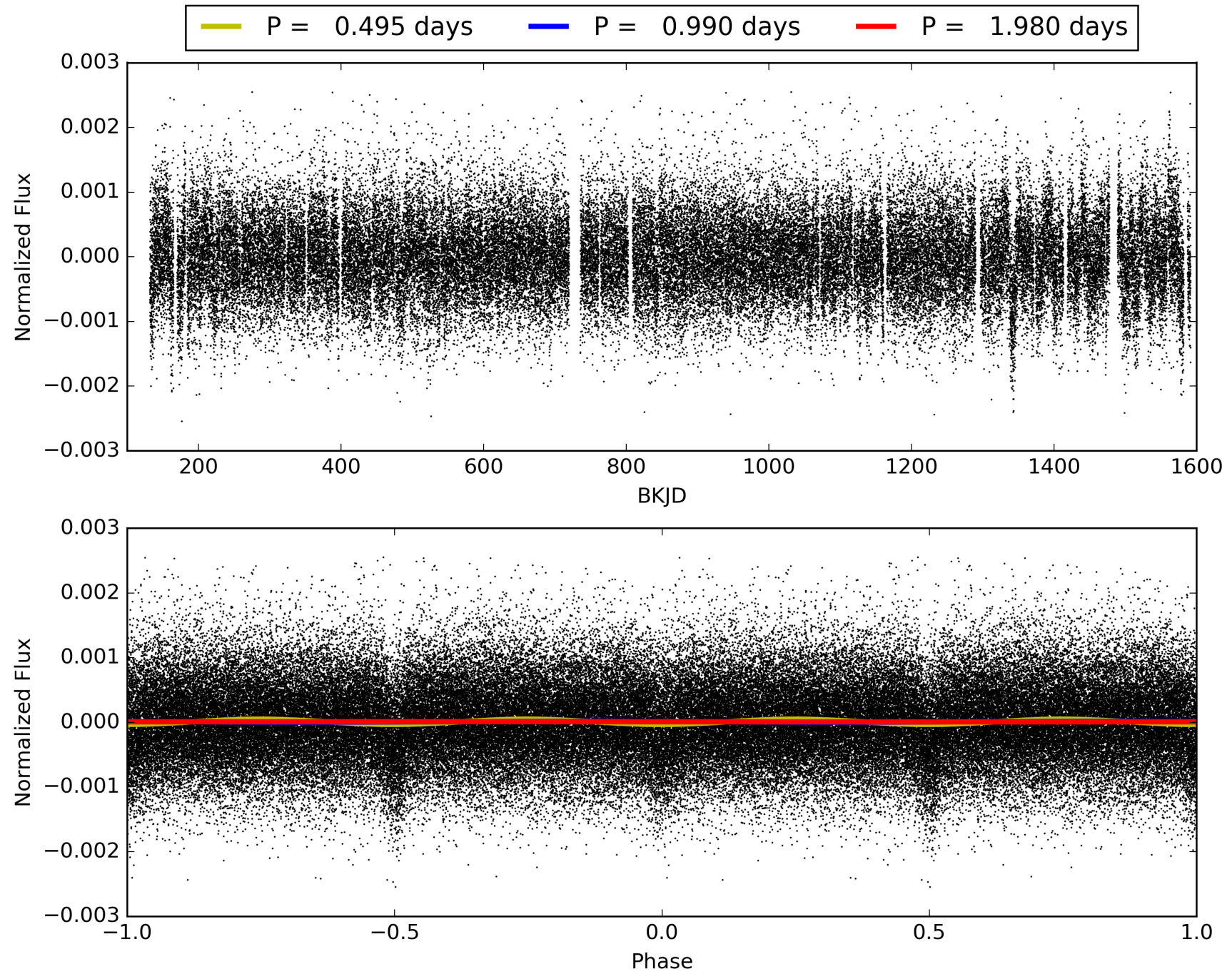
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 29-Jan-2016 10:35:49 Z

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

# TCE 009520443-02, PDC Light Curves



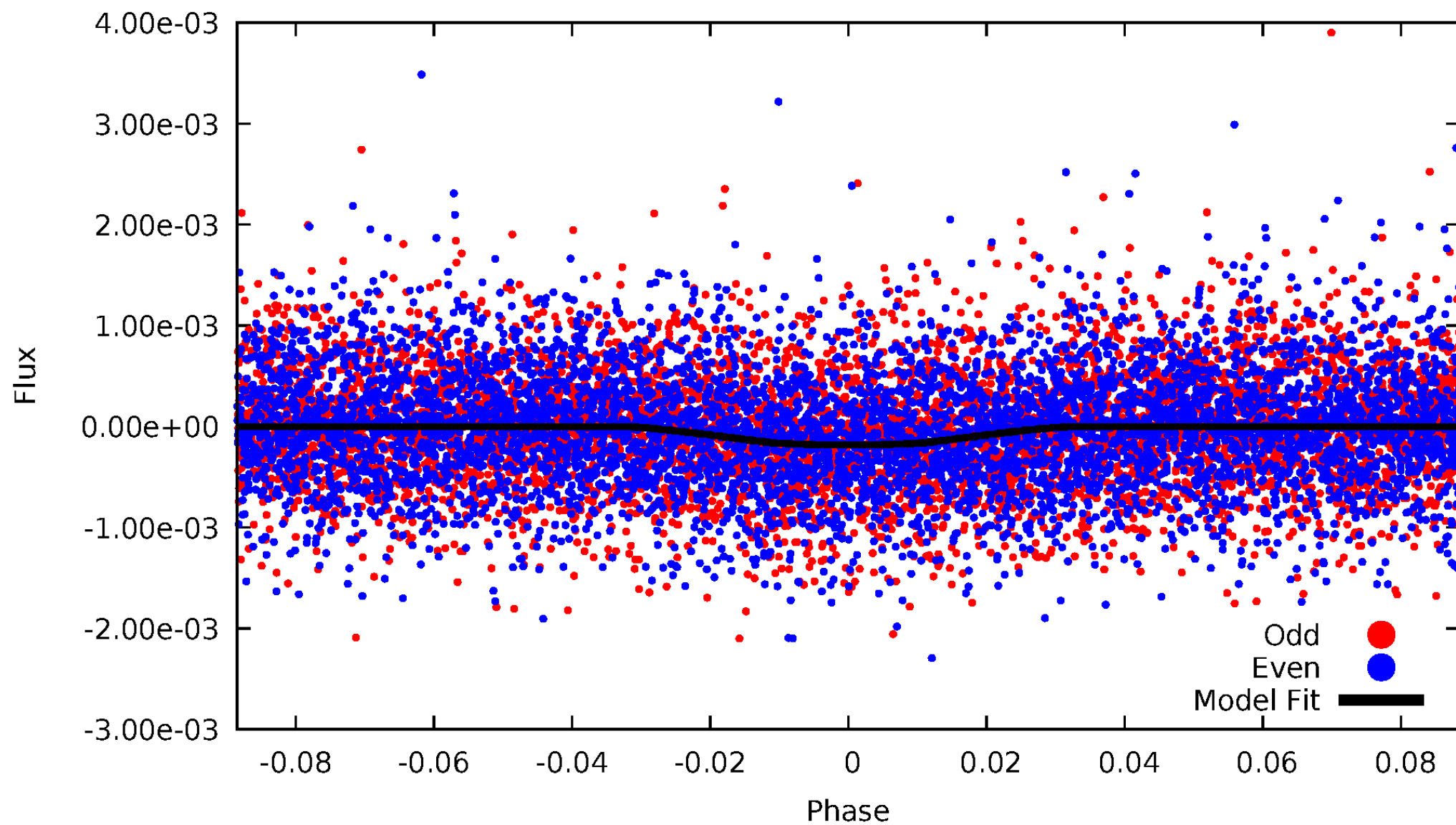
TCE 009520443-02





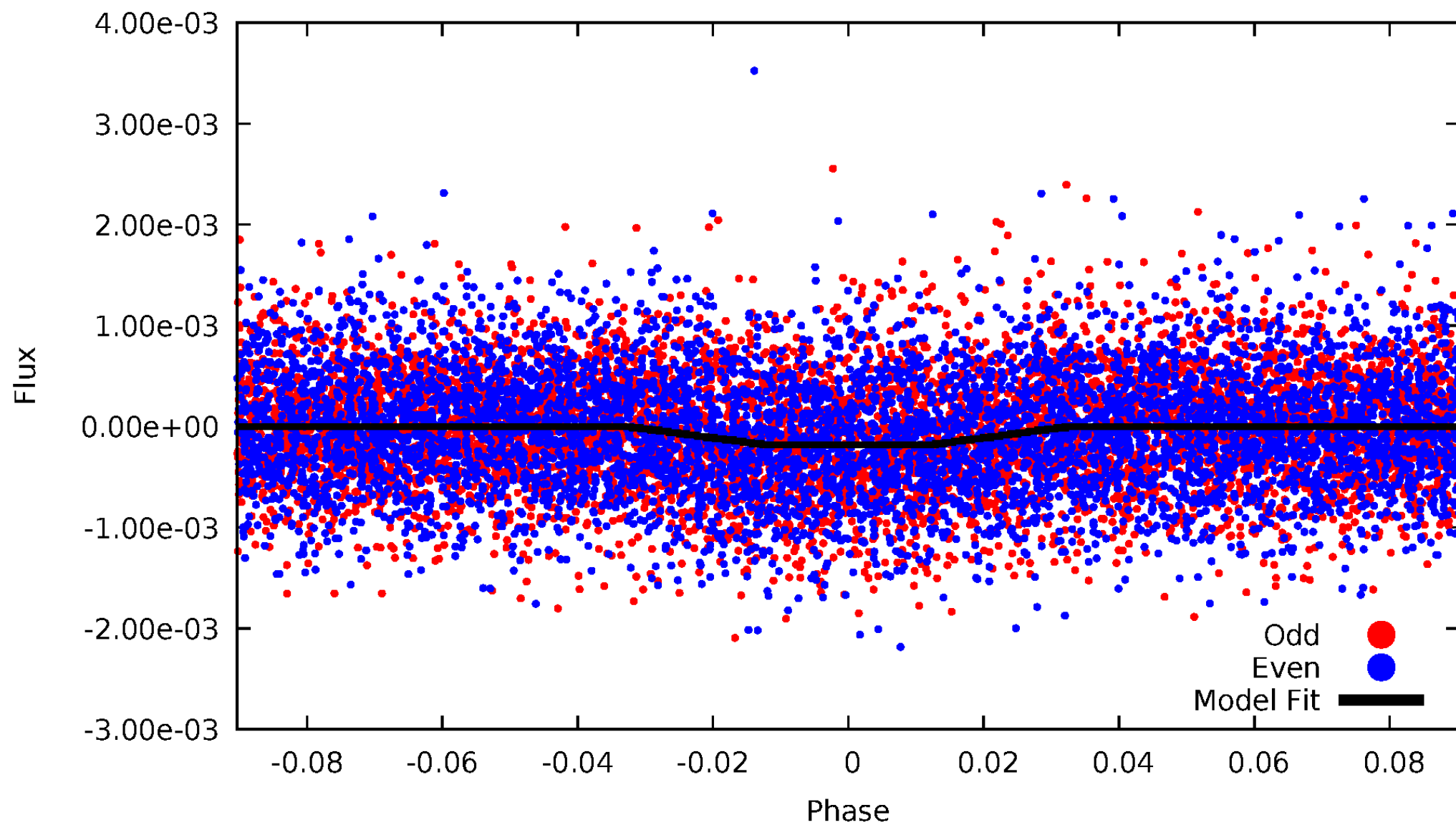
# DV Odd/Even

TCE 009520443-02



# ALT Odd/Even

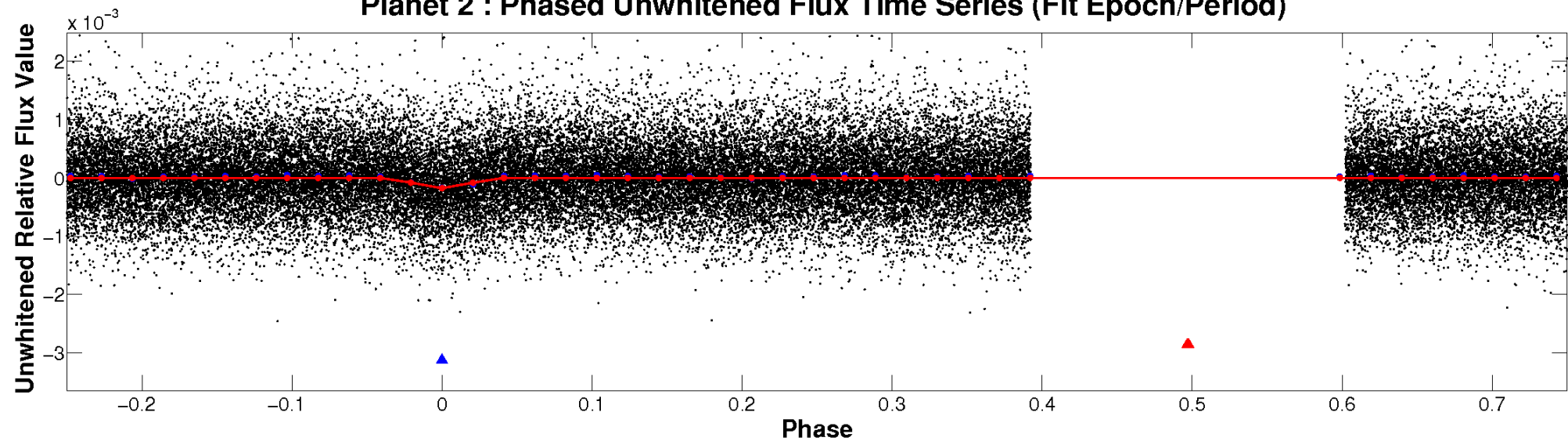
TCE 009520443-02



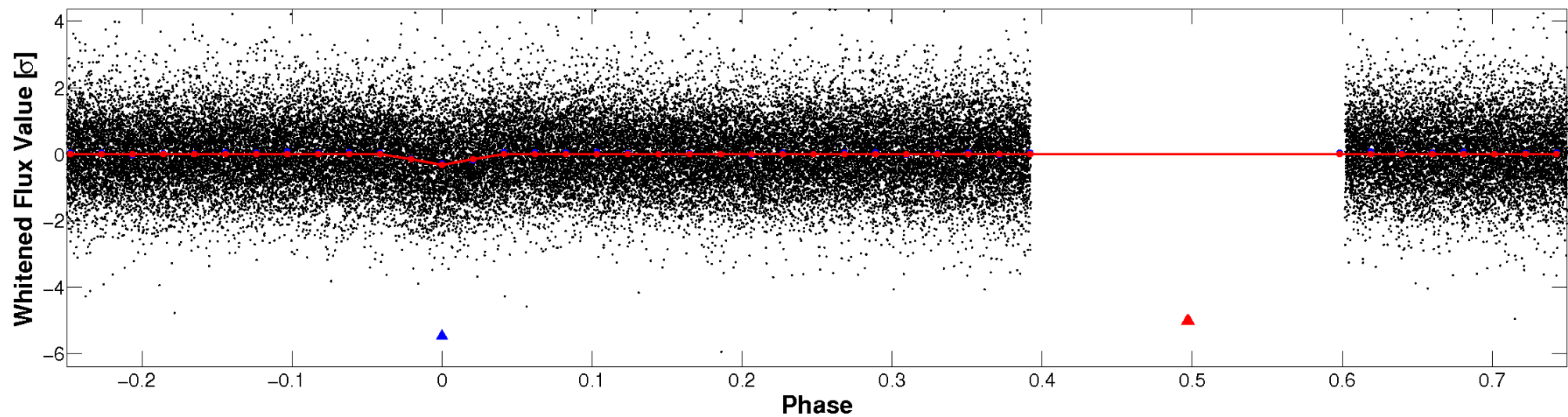


# Non-Whitened Vs. Whitened Light Curve

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

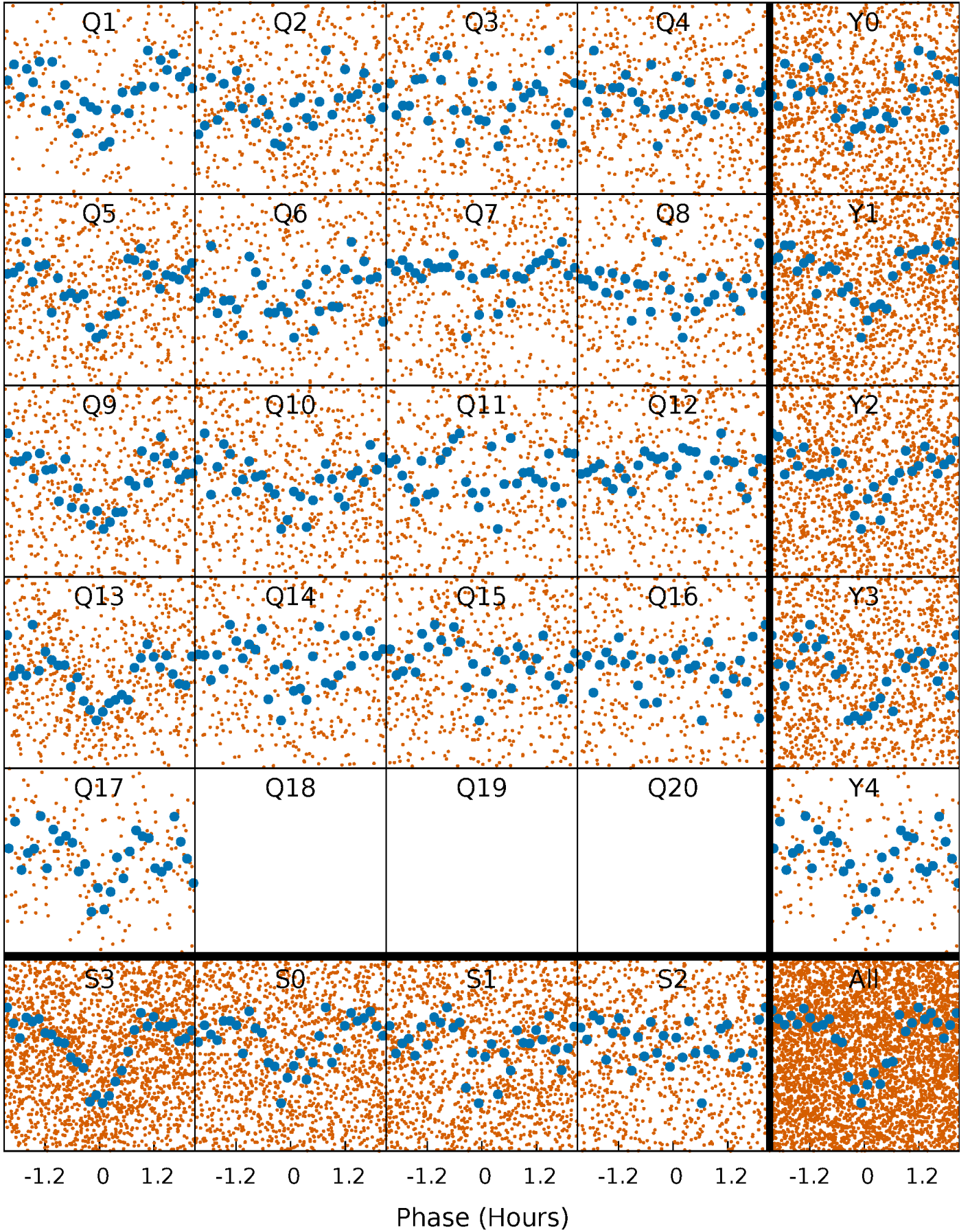


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



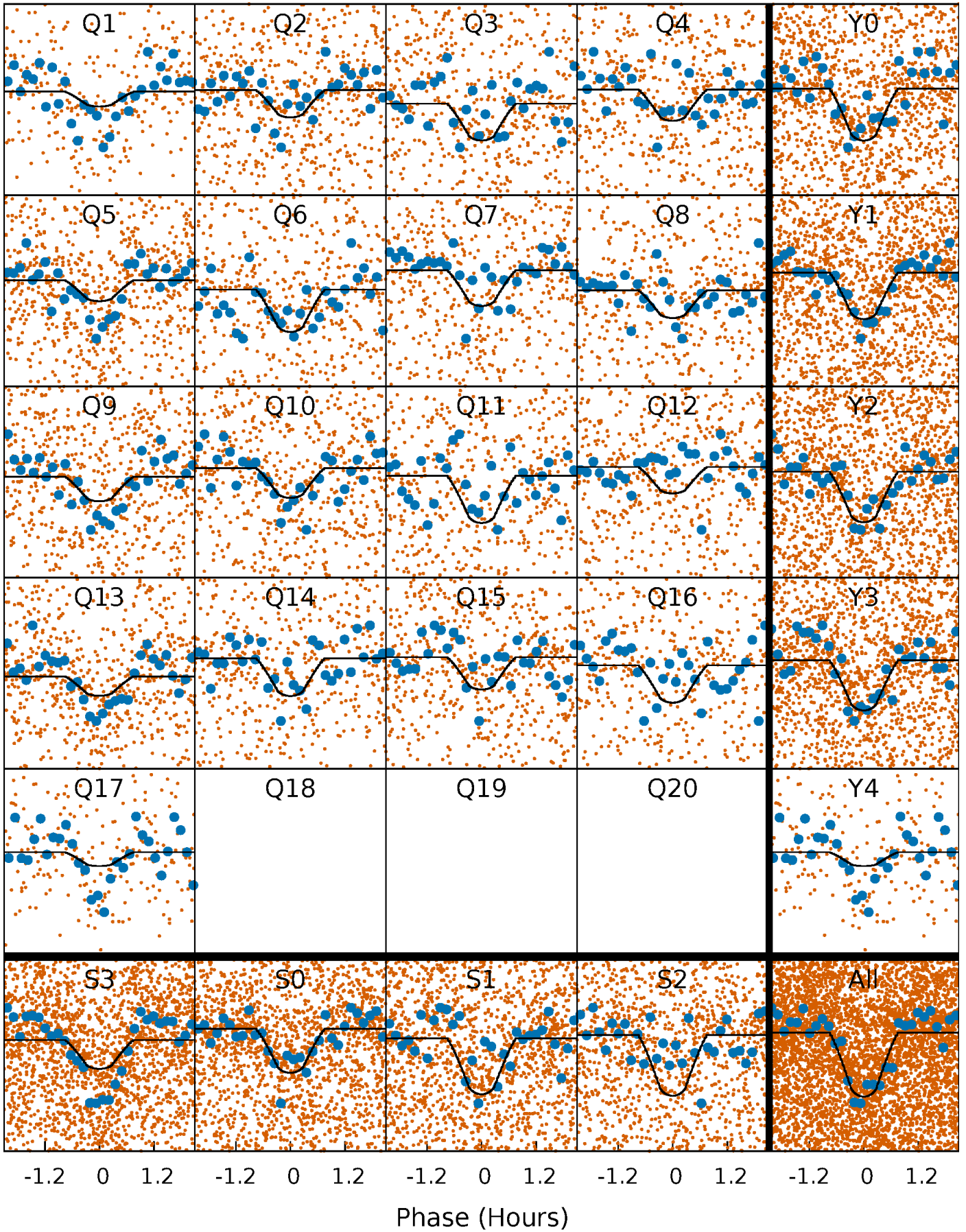
# PDC Quarter-Phased Transit Curves

TCE 009520443-02   P= 0.990143 Days    $T_0=131.537618$  (BKJD)



# DV Quarter-Phased Transit Curves

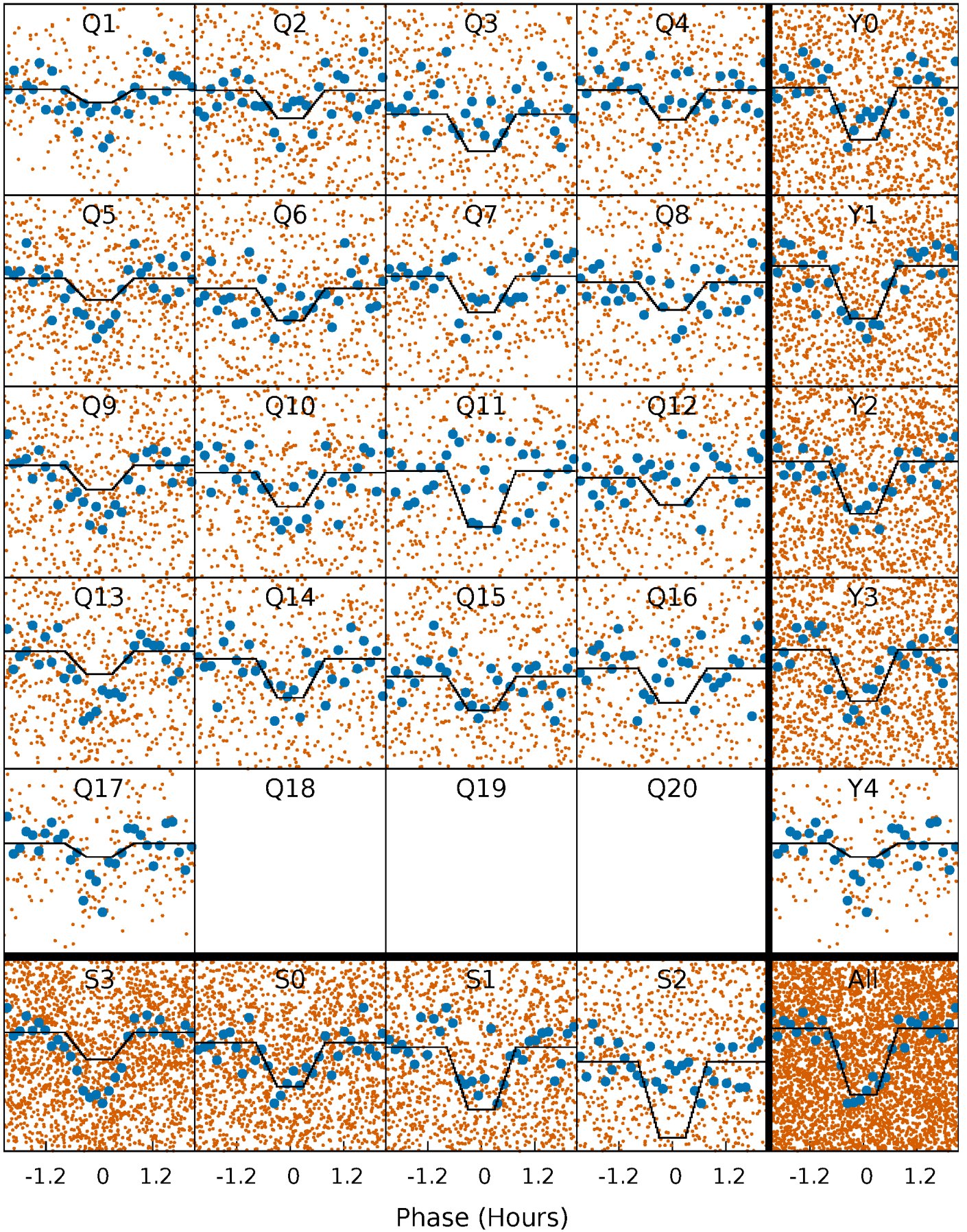
TCE 009520443-02   P= 0.990143 Days    $T_0=131.537618$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

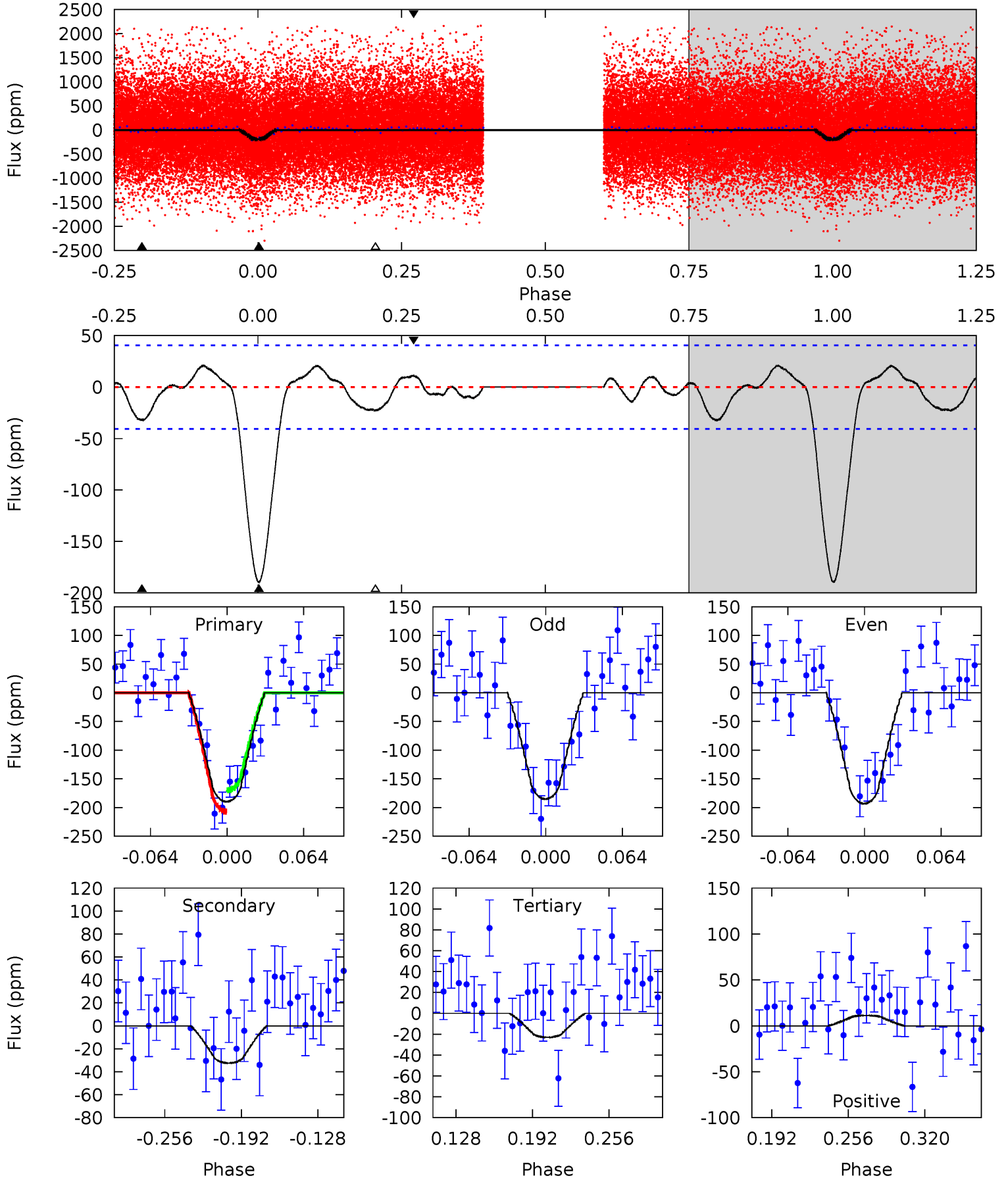
TCE 009520443-02 P= 0.990146 Days  $T_0=131.537563$  (BKJD)



# DV Model-Shift Uniqueness Test

009520443-02, P = 0.990143 Days, E = 130.547475 Days

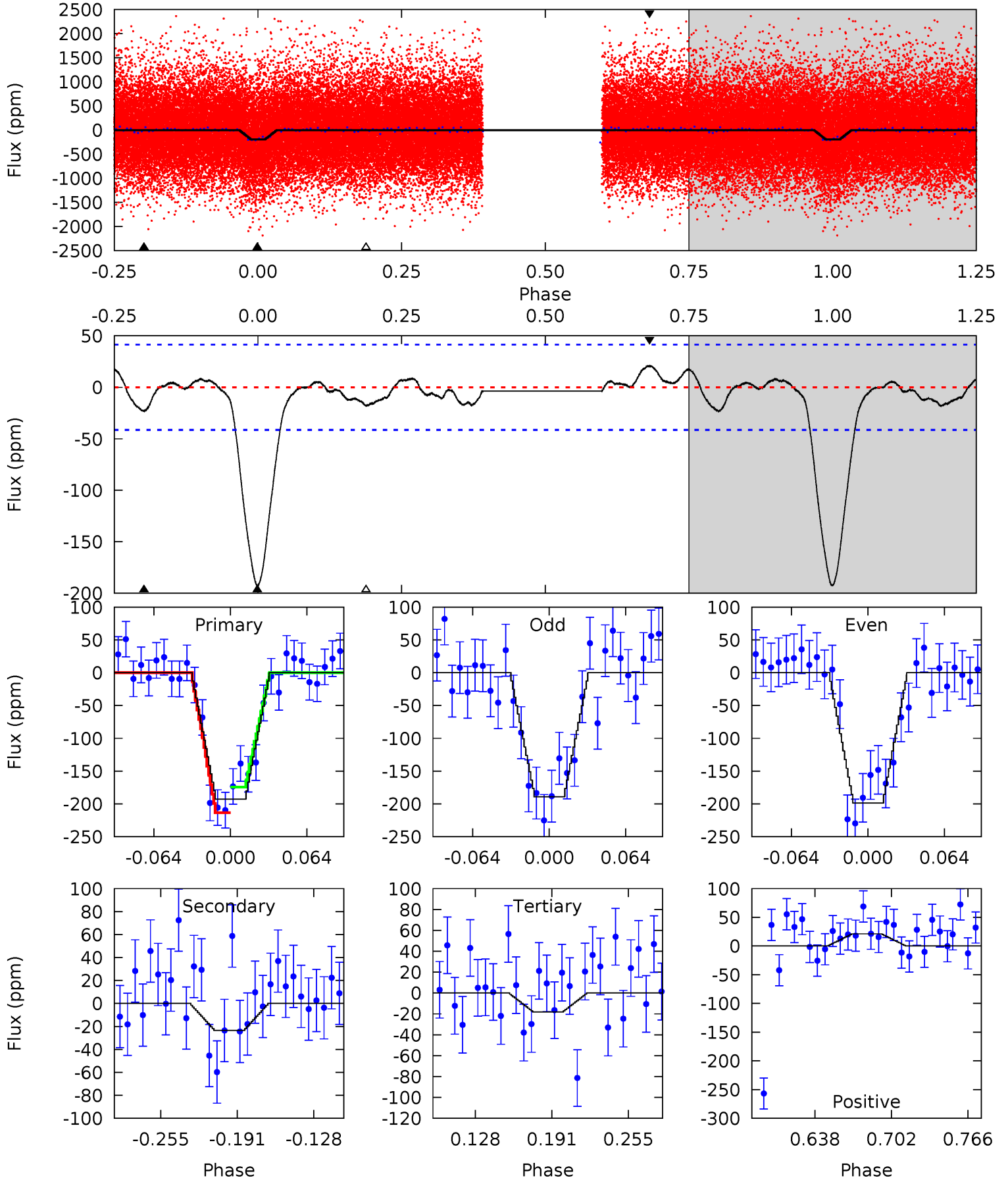
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
21.8	3.72	2.64	1.30	4.66	1.85	1.27	19.1	20.5	1.08	2.42	0.46	1.07	0.10	2.14



# Alt Model-Shift Uniqueness Test

009520443-02, P = 0.990146 Days, E = 130.547417 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
21.7	2.65	2.05	2.39	4.66	1.85	1.05	19.6	19.3	0.59	0.26	0.56	1.00	0.10	2.20





### Stellar Parameters For KIC 009520443

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5072^{+153}_{-153}$	$4.606^{+0.027}_{-0.082}$	$0.000^{+0.250}_{-0.300}$	$0.747^{+0.096}_{-0.052}$	$0.837^{+0.051}_{-0.088}$	$2.834^{+0.422}_{-0.784}$
	+3%/-3%	+1%/-2%	+inf%/-inf%	+13%/-7%	+6%/-11%	+15%/-28%
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 009520443-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-32 \pm 9$	$1.47^{+1.24}_{-1.00}$	$2027^{+75}_{-70}$	$3313^{+1766}_{-673}$	$2.699^{+22.185}_{-1.945}$
Alt.	$-24 \pm 9$	$1.56^{+1.18}_{-0.98}$	$2028^{+77}_{-72}$	$3055^{+1258}_{-712}$	$1.701^{+9.500}_{-1.224}$

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

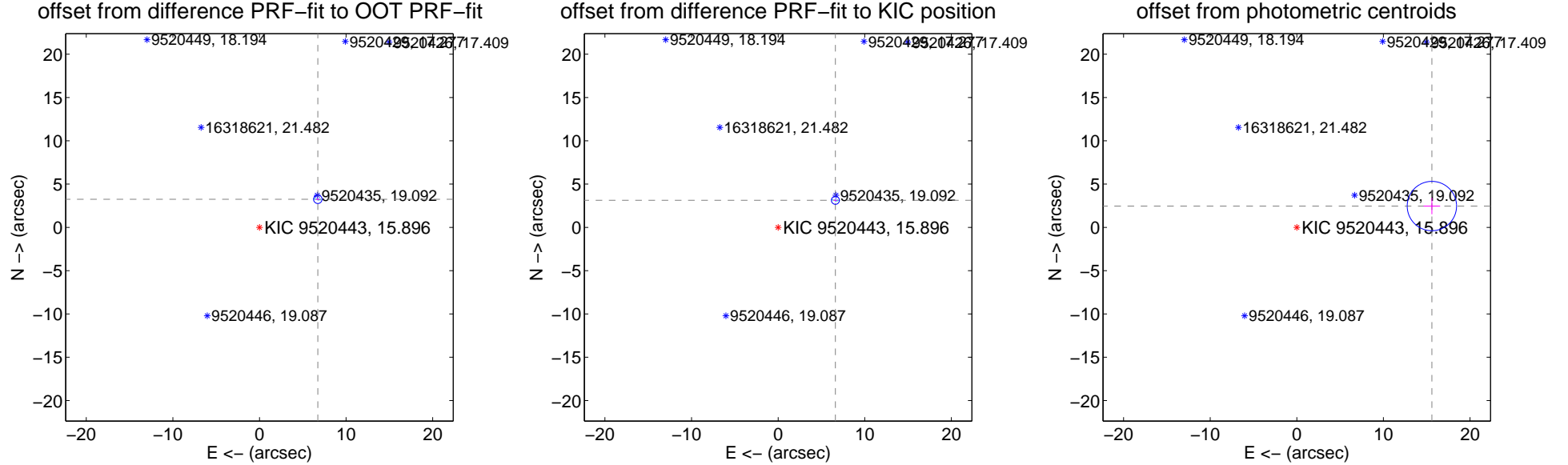
## DV Centroid Data

Supplemental centroid analysis for 009520443-02. Kepler magnitude: 15.90. Transit SNR 14.31

There are 4 quarters with good PRF difference image offsets

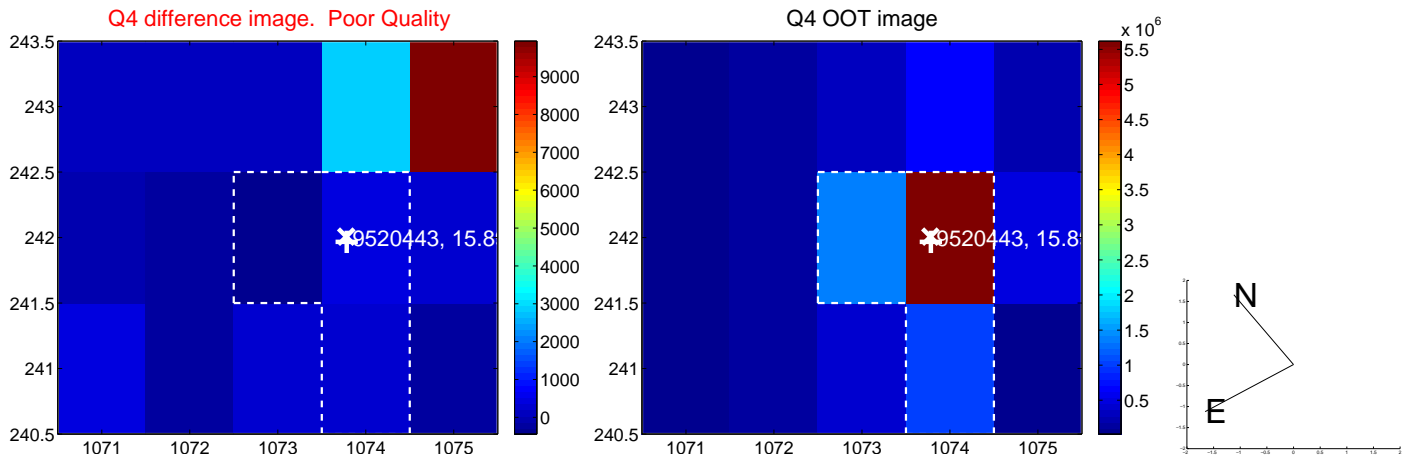
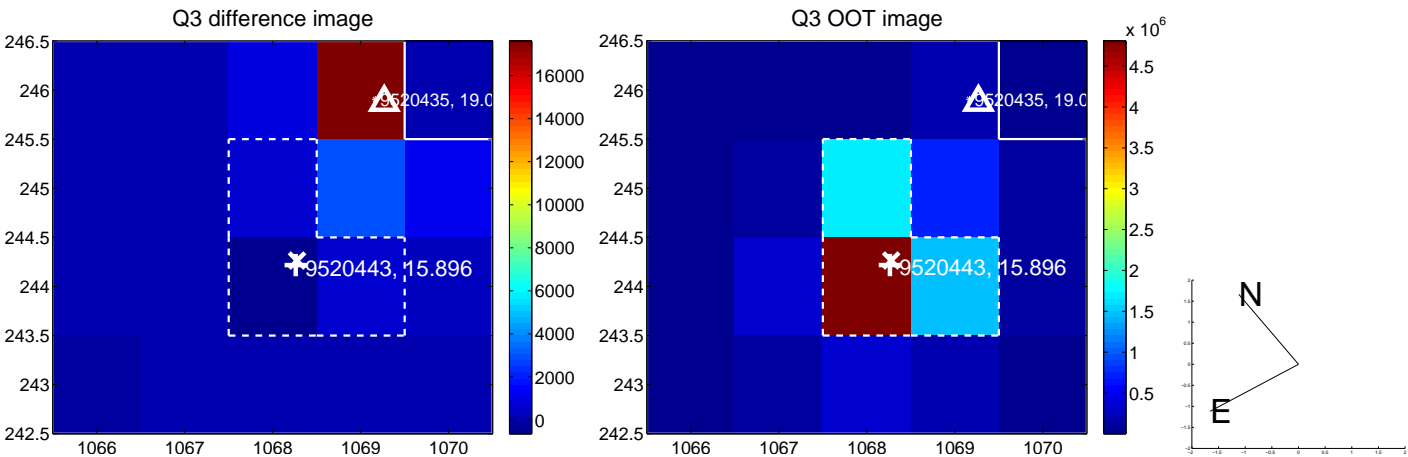
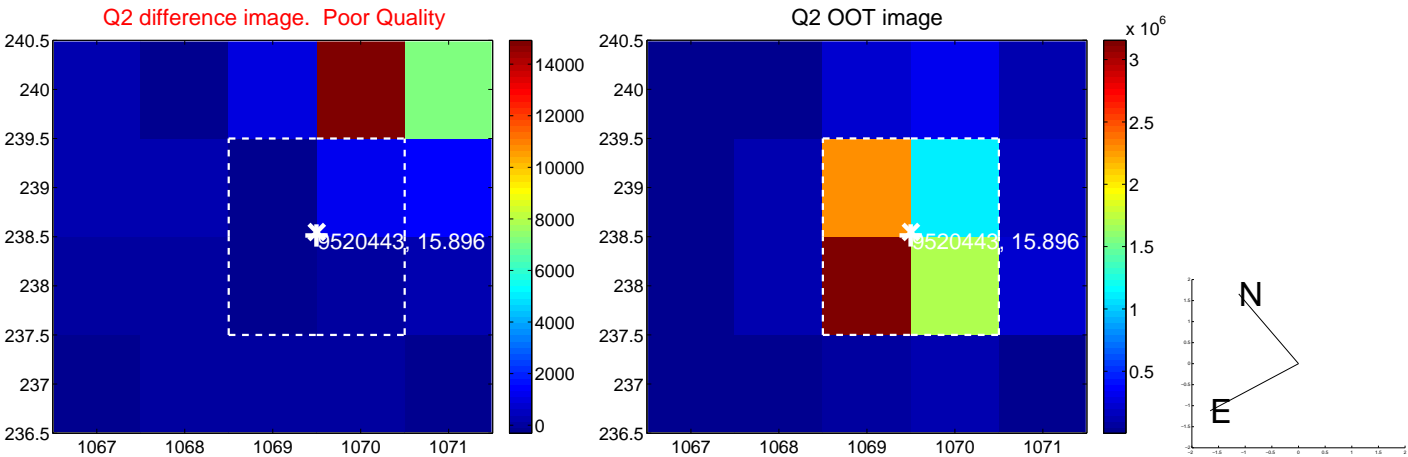
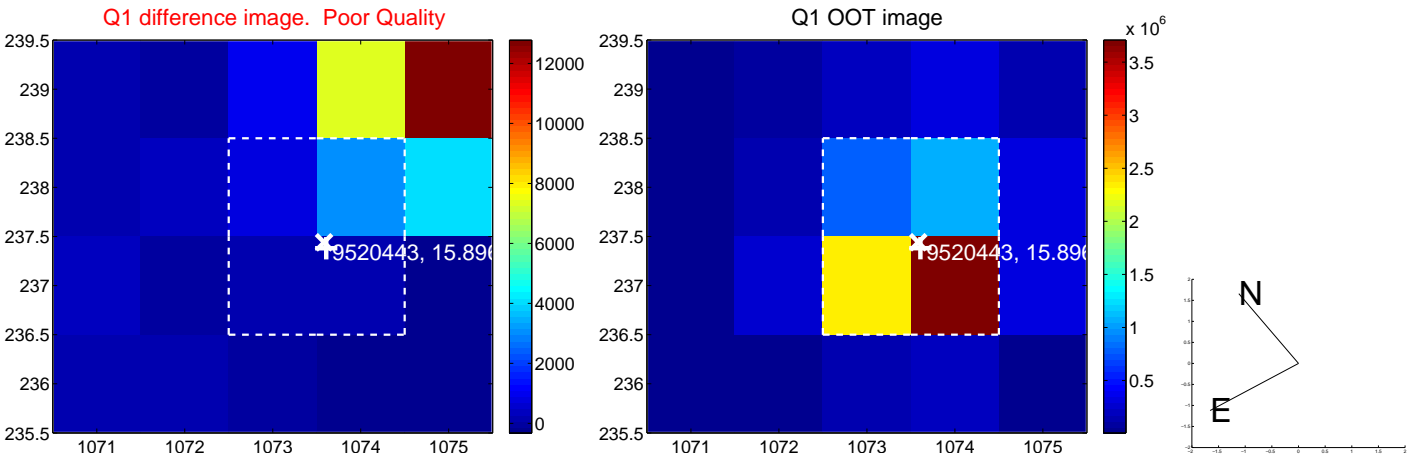
The direct PRF centroid is offset from the target star catalog position by about 0.17 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$7.477 \pm 0.163$	45.80	$-6.735 \pm 0.178$	$3.248 \pm 0.072$
PRF-fit source offset from KIC position	$7.312 \pm 0.154$	47.43	$-6.610 \pm 0.167$	$3.126 \pm 0.072$
photometric centroid source offset	$15.79 \pm 0.95$	16.63	$-15.60 \pm 0.95$	$2.46 \pm 0.95$

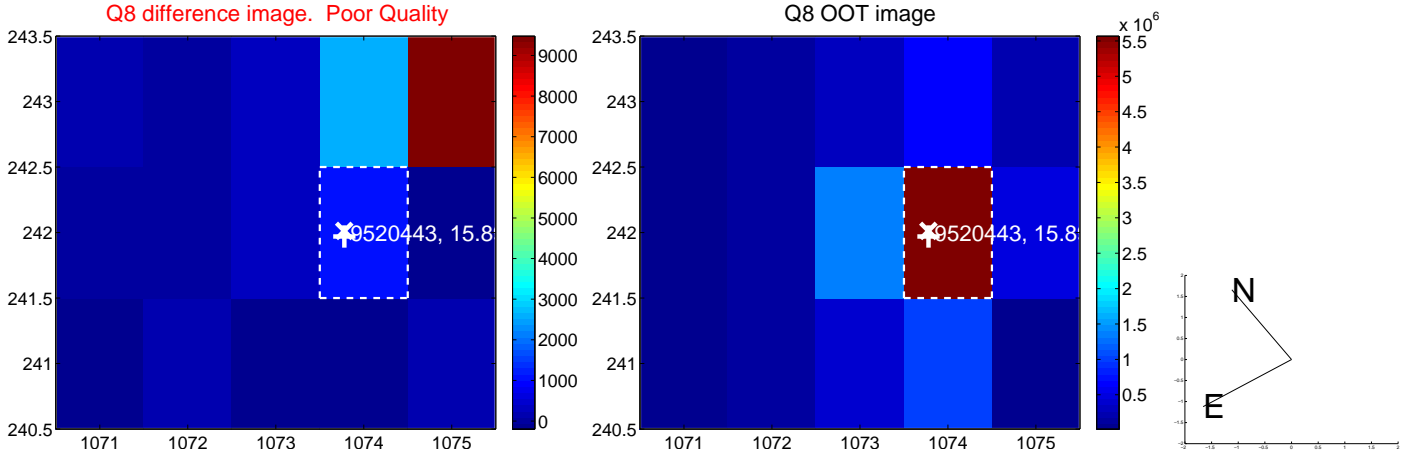
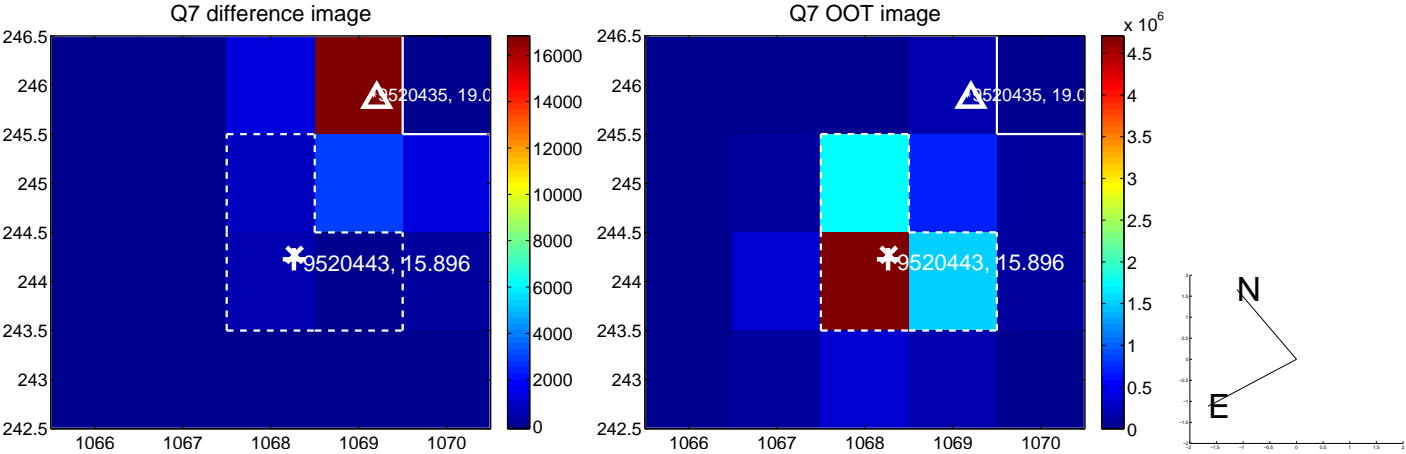
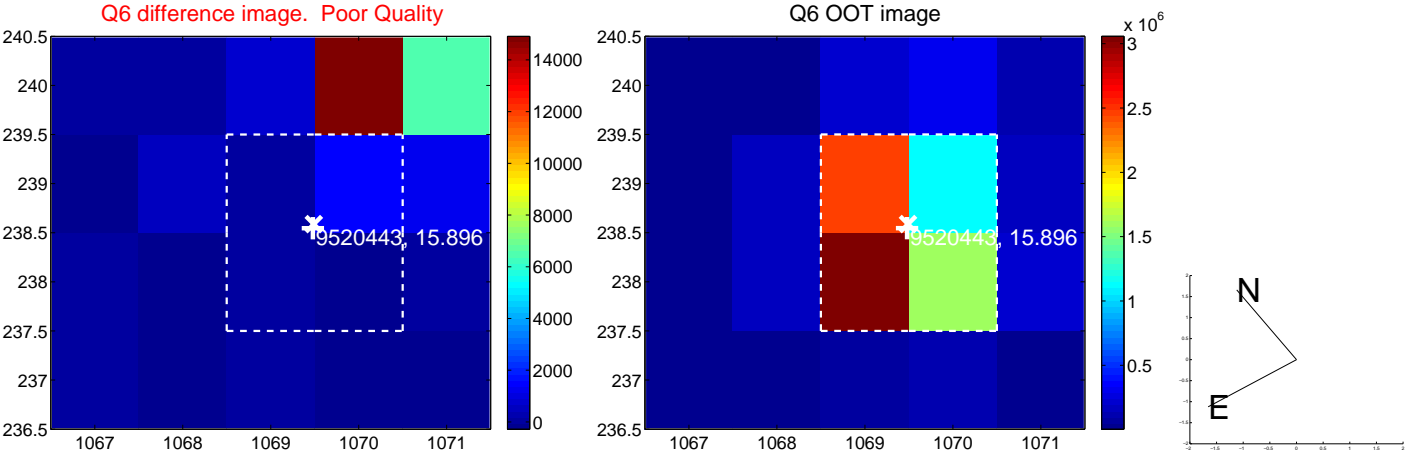
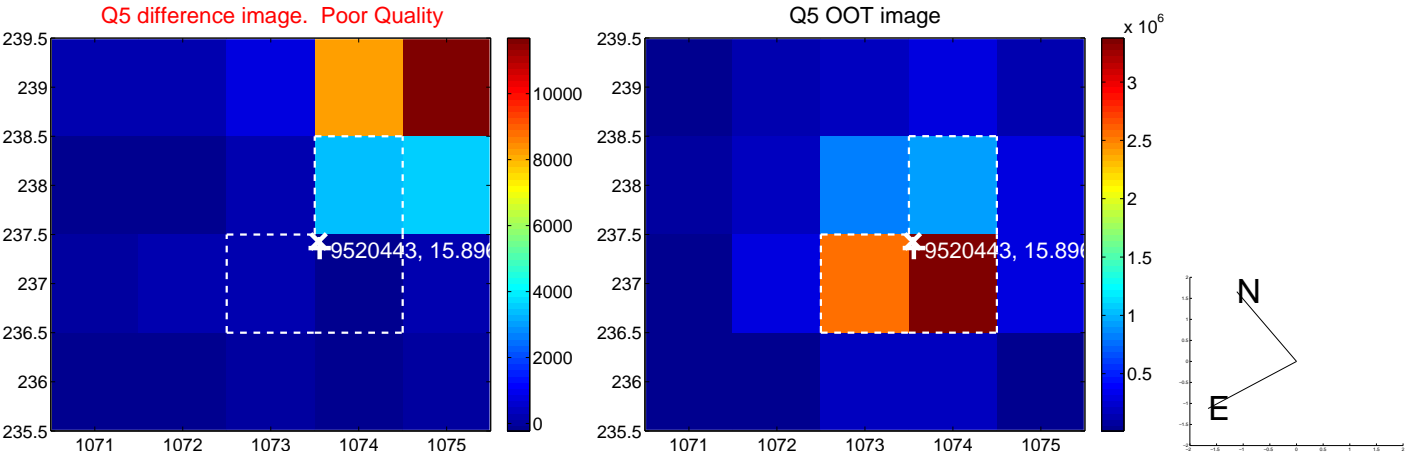


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

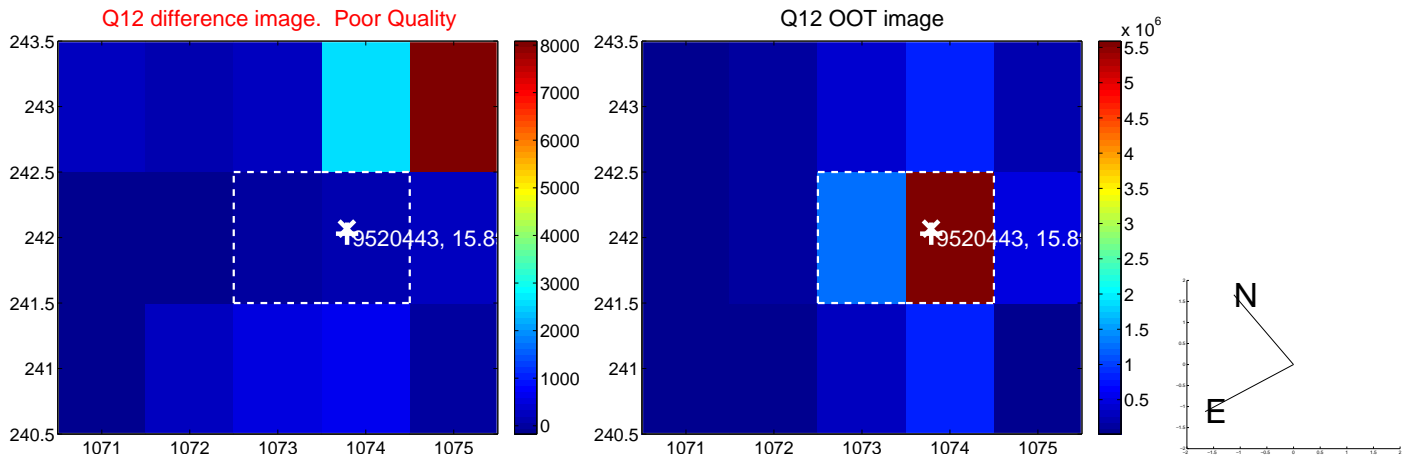
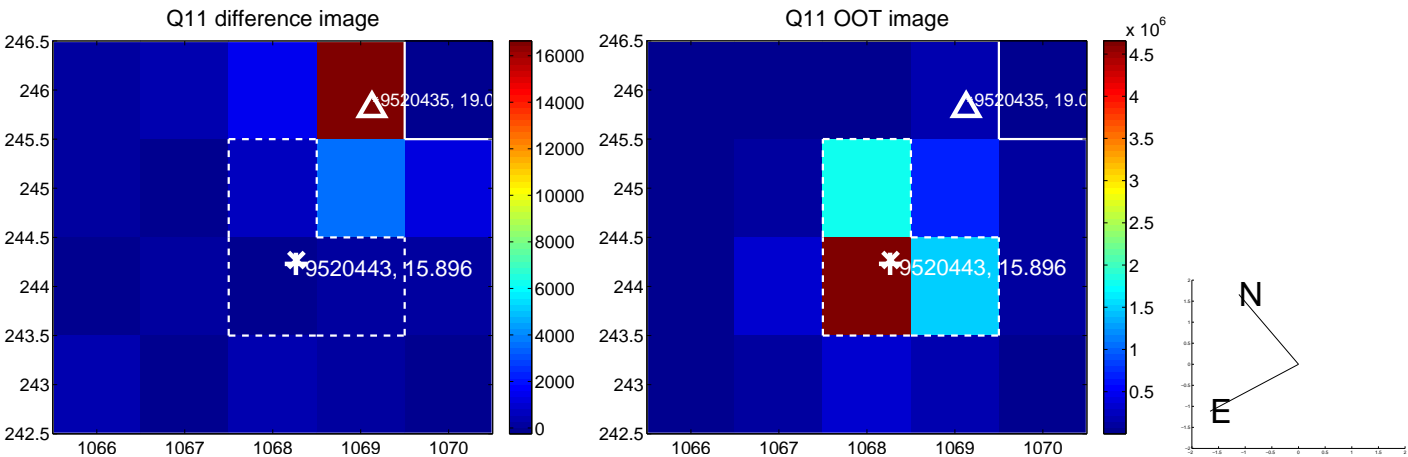
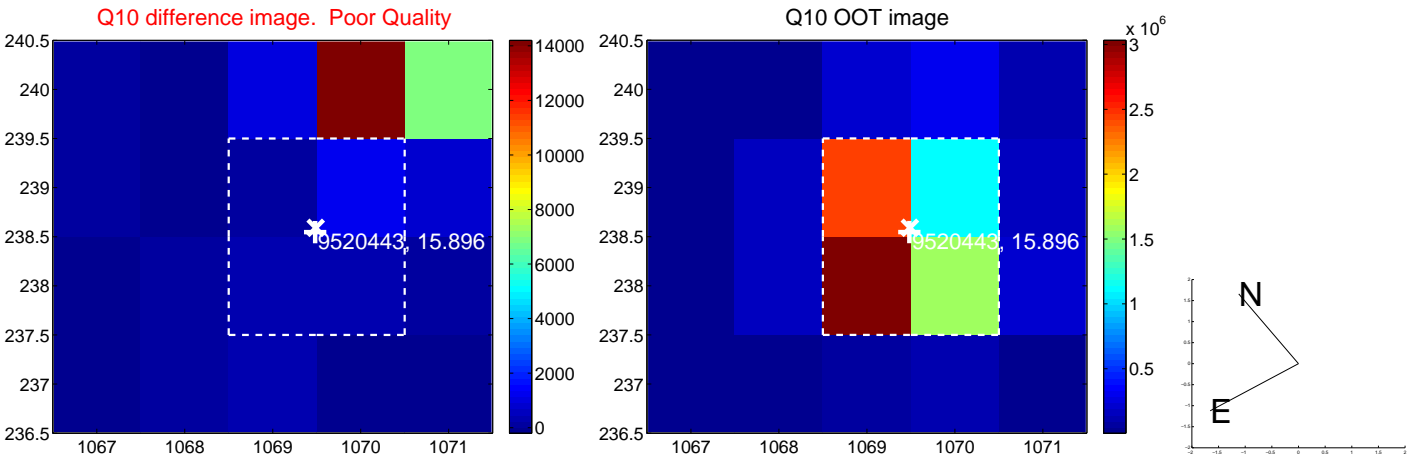
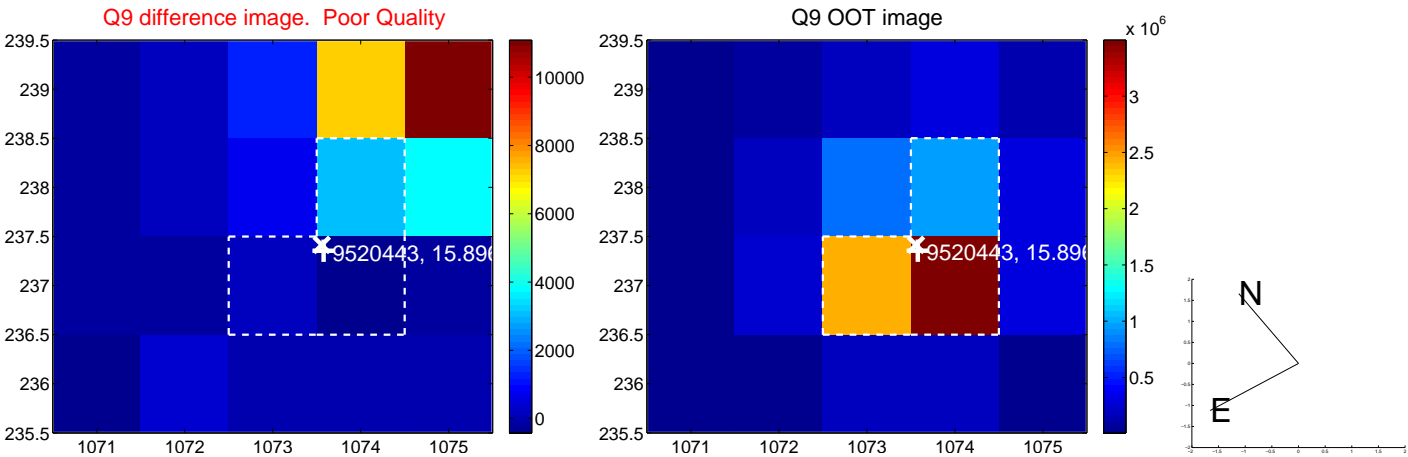
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



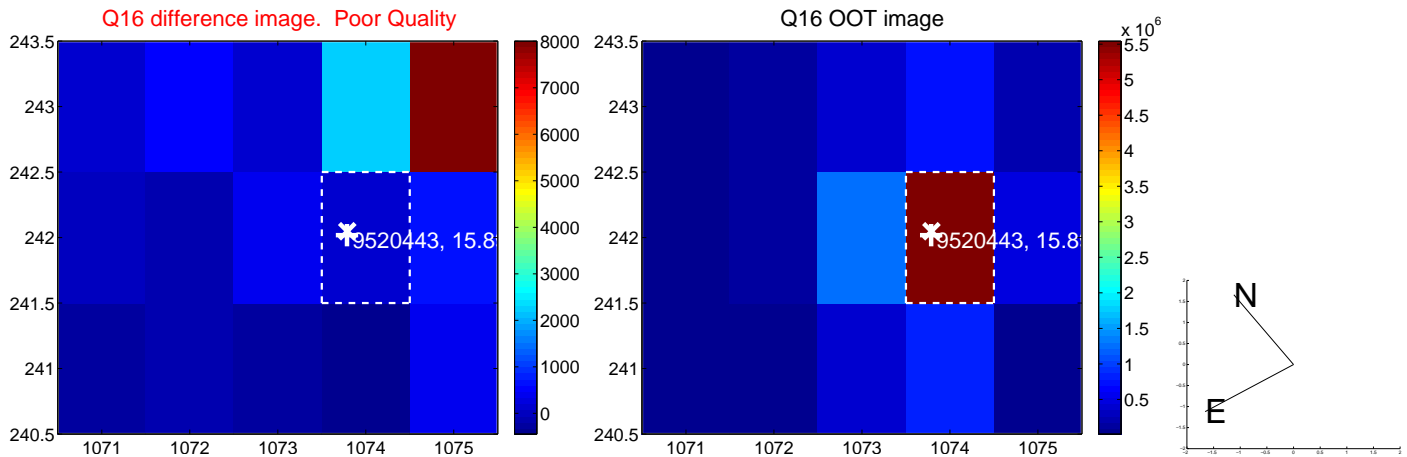
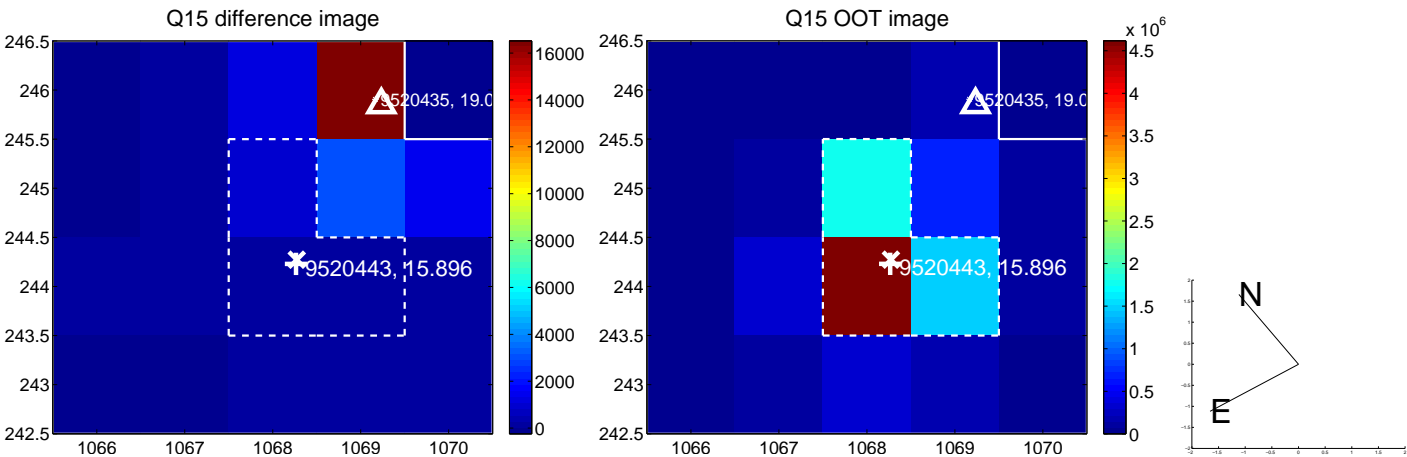
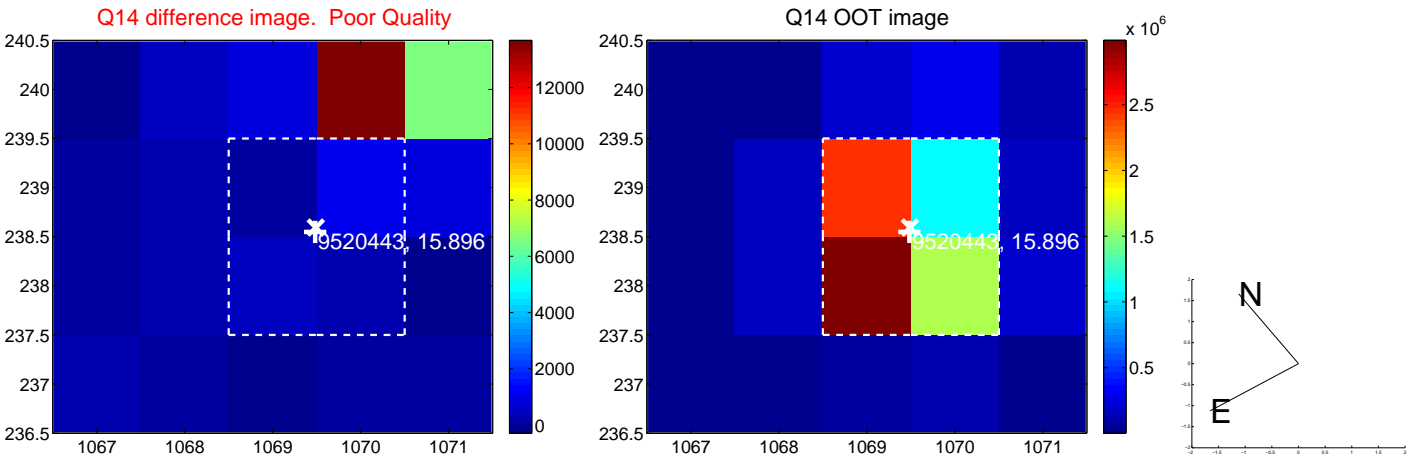
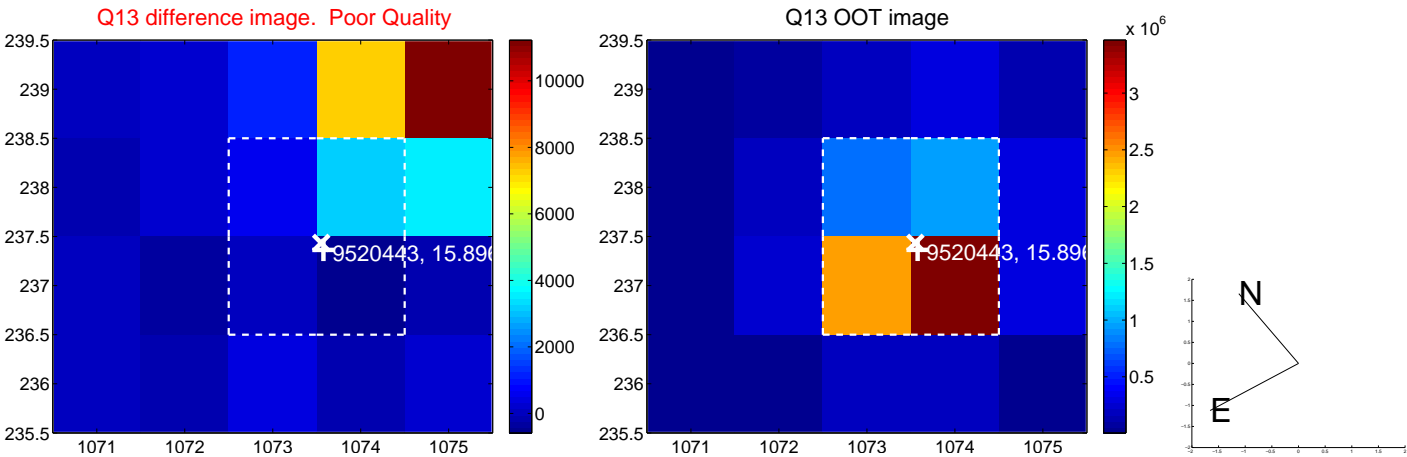
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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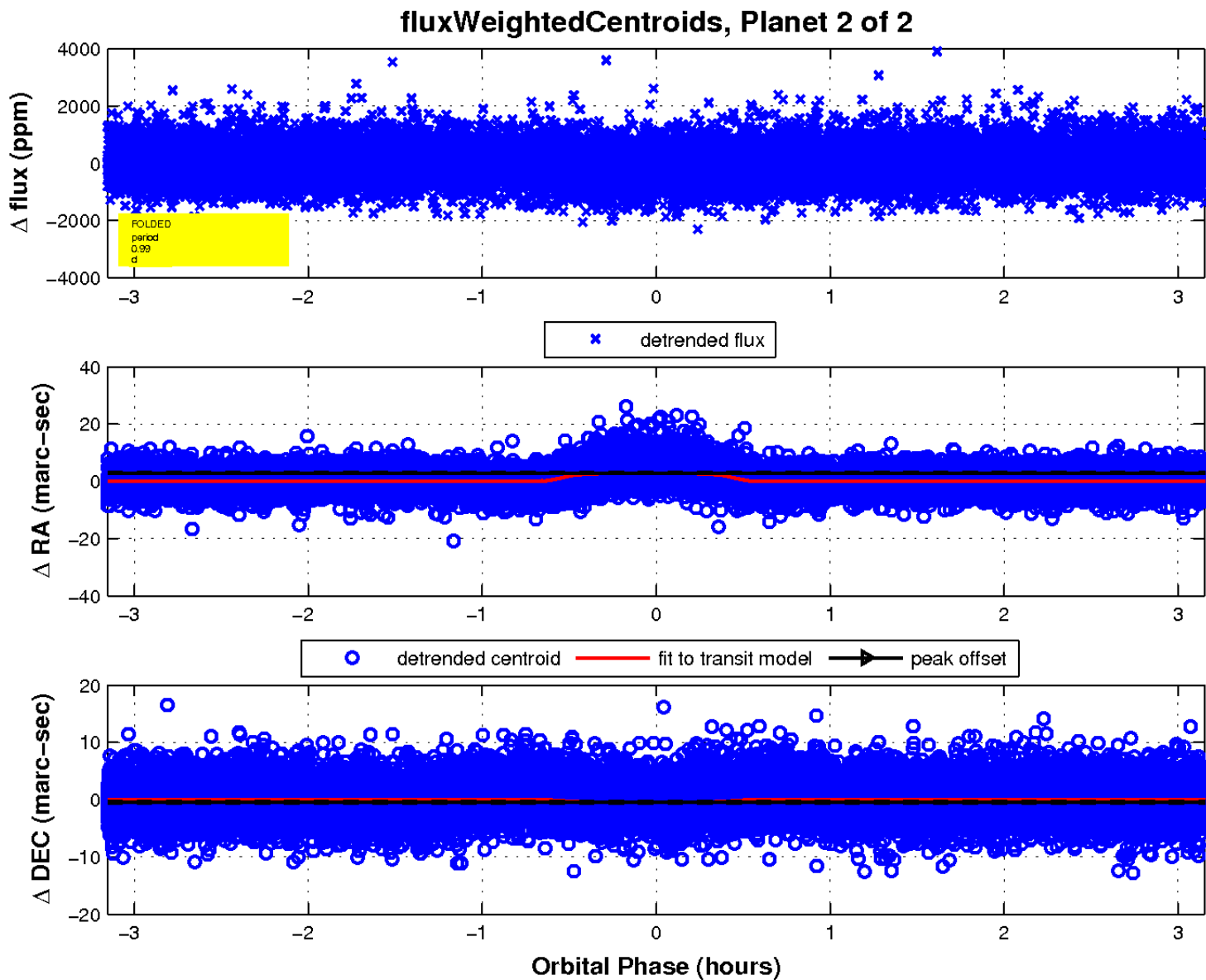
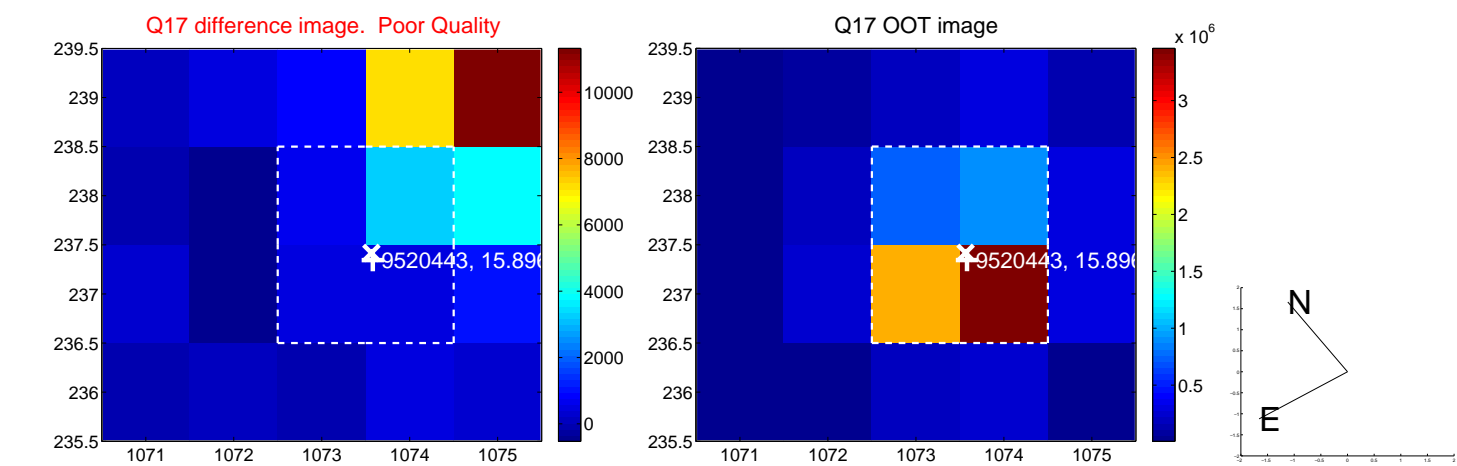


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





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



# UKIRT Image

Declination

