

# KIC 004579598

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
004579598-01	OBS	4414.01	0.866360	131.622136	38.8	1.620	9.2	9.8	1.13	6241	0.84	5207.41
004579598-02	OBS	No	0.866329	132.080444	26.1	2.407	8.0	7.5	1.13	6241	0.68	5207.65

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
004579598-01	OBS	FP	0.00	1	0	0	1	MOD_NONUNIQ_ALT—EPHEM_MATCH
004579598-02	OBS	FP	0.00	1	0	0	1	LPP_DV—LPP_ALT—MOD_NONUNIQ_ALT—SAME_NTL_PERIOD—EPHEM_MATCH

**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.

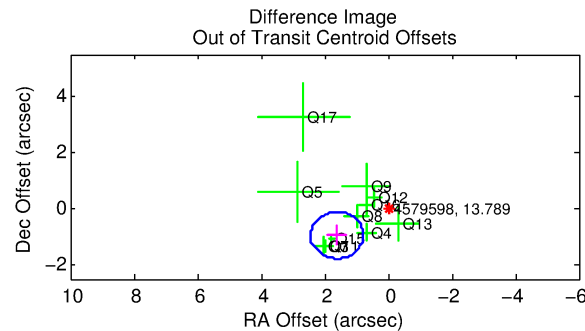
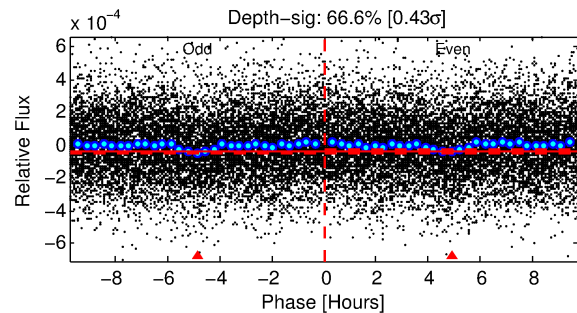
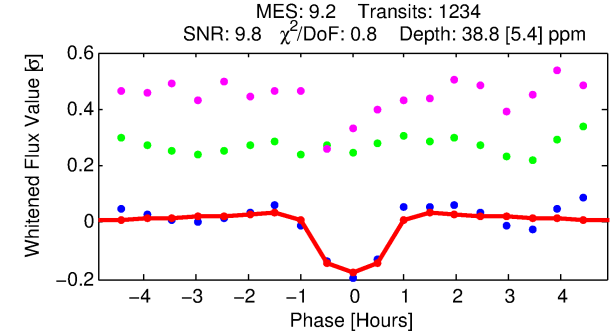
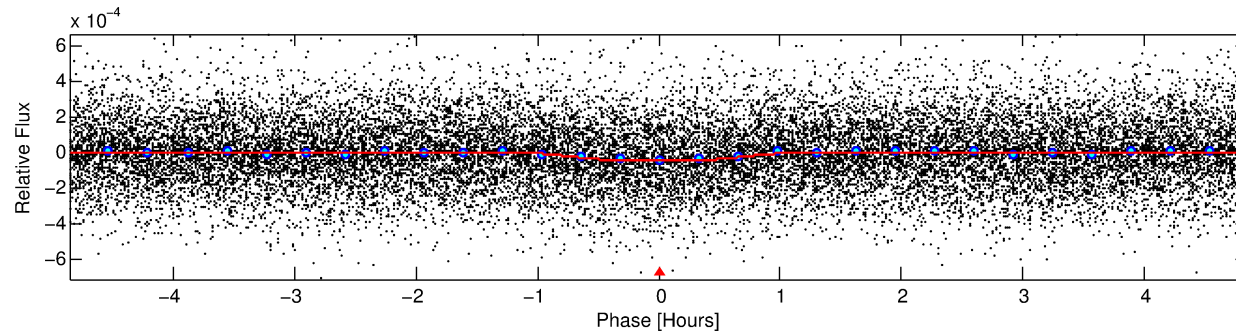
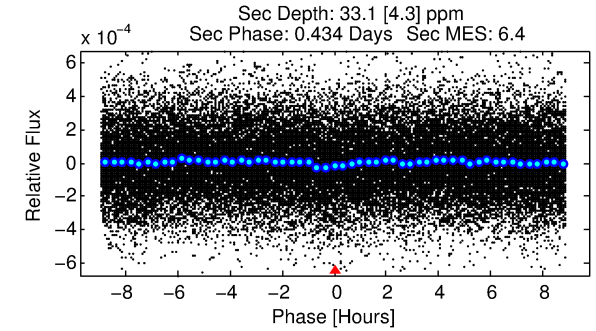
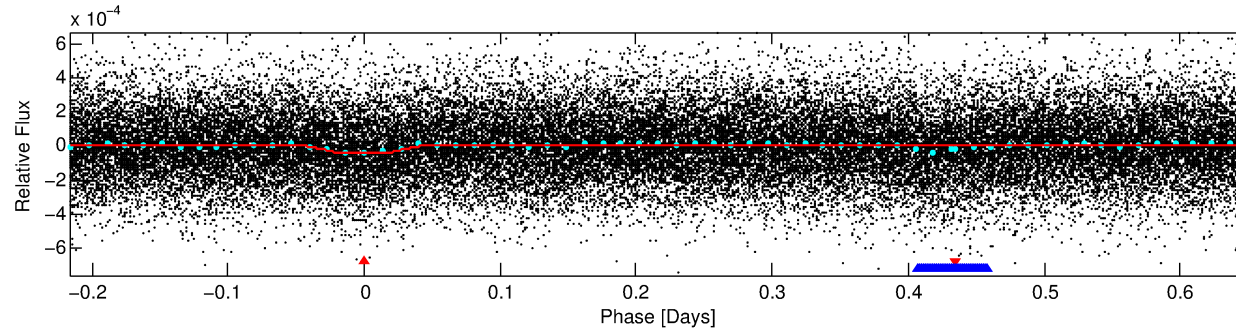
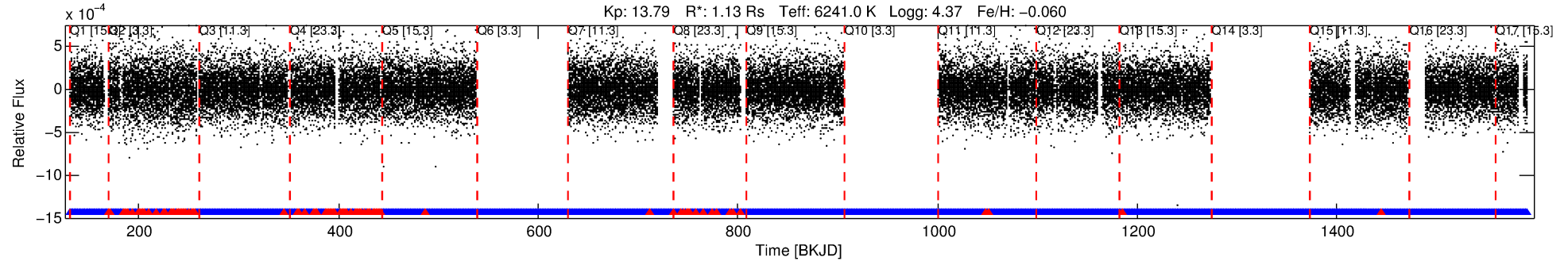
## Ephemeris Match Information For 004579598-01

TCE (1)	KIC	Parent (2)	Parent KIC	$P_1:P_2$	Dist (")	$\Delta\text{Row}$	$\Delta\text{Col}$	$m_2$	$m_1$	$D_2/D_1$	Mechanism	Flag	$\sigma_P$	$\sigma_T$
004579598-01	4579598	004482738-02	4482738	1:1	136.2	34	2	12.95	13.79	2.15	Direct-PRF	1	1.22	0.64

**Notes:**  $P_1:P_2$  is the period ratio. Dist is the distance in arcseconds.  $\Delta\text{Row}$  and  $\Delta\text{Col}$  are the number of pixels apart in row and column.  $m_2$  and  $m_1$  are the magnitudes of the parent and child.  $D_2/D_1$  is the parent's transit depth divided by the child's.  $\sigma_P$  and  $\sigma_T$  are the significance of the match in period and epoch. For a match to be considered significant  $\sigma_P < 5.0$  and  $\sigma_T < 5.0$ . Matches which have  $\sigma_P$  and  $\sigma_T$  very close to this cutoff should receive extra scrutiny, especially if the period ratio is very large.

# DV One-Page Summary

KIC: 4579598 Candidate: 1 of 2 Period: 0.866 d  
KOI: K04414.01 Corr: 0.872



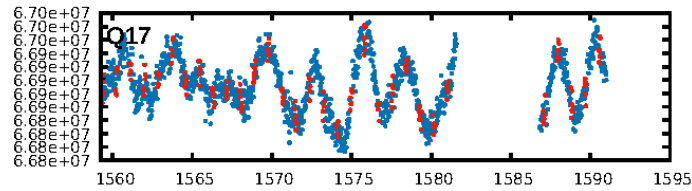
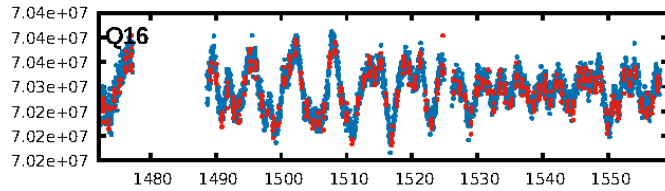
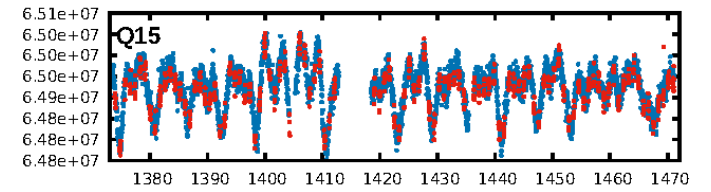
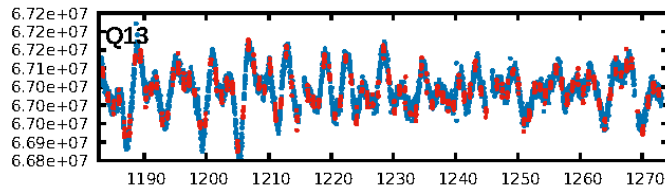
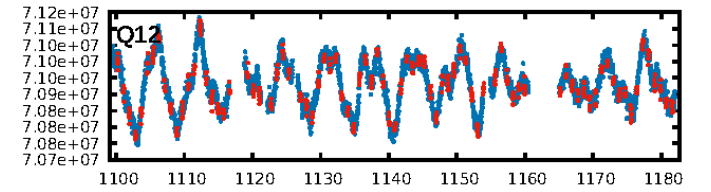
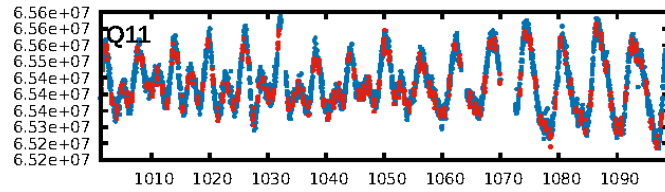
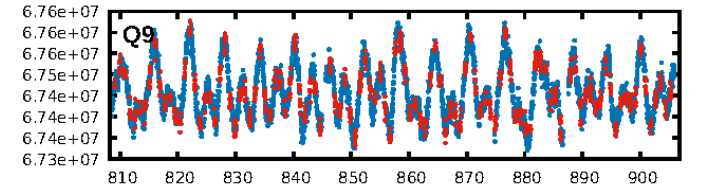
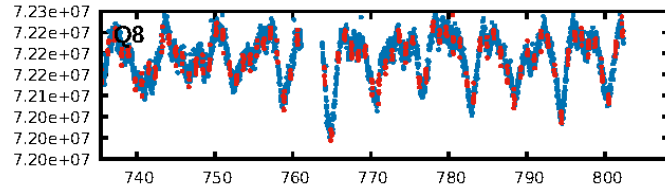
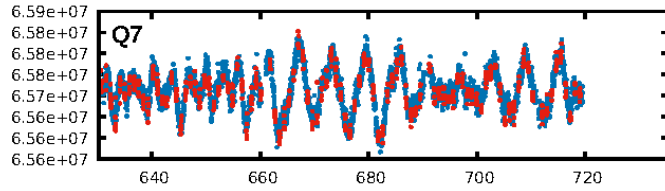
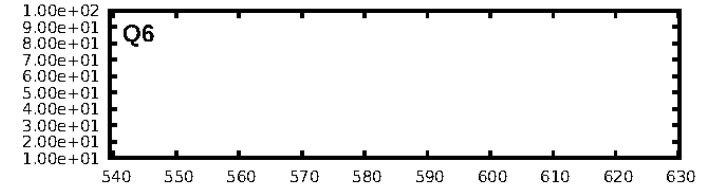
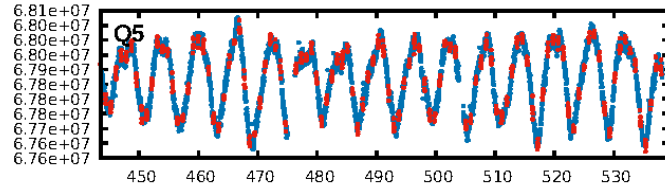
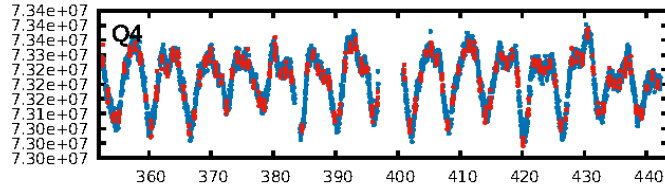
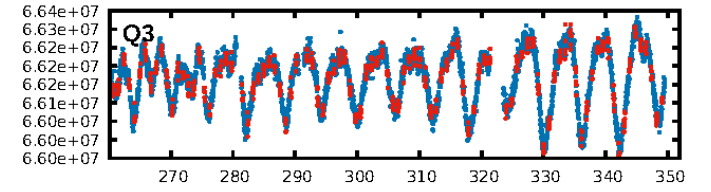
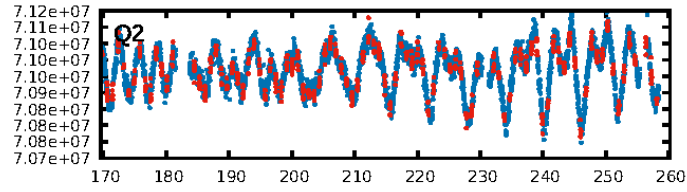
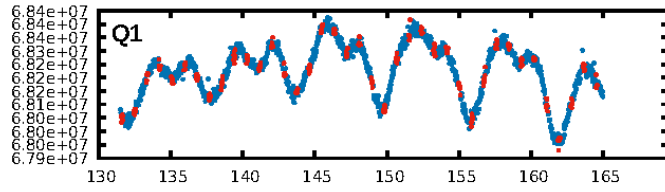
## DV Fit Results:

Period = 0.86636 [0.00001] d  
Epoch = 131.6221 [0.0021] BKJD  
Rp/R\* = 0.0068 [0.0035]  
a/R\* = 2.00 [4.26]  
b = 0.91 [0.55]  
Seff = 5207.41 [2212.67]  
Teq = 2166 [230] K  
Rp = 0.84 [0.52] Re  
a = 0.0183 [0.0050] AU  
Ag = 8.70 [9.72] [0.79σ]  
Teffp = 5751 [1524] K [2.33σ]

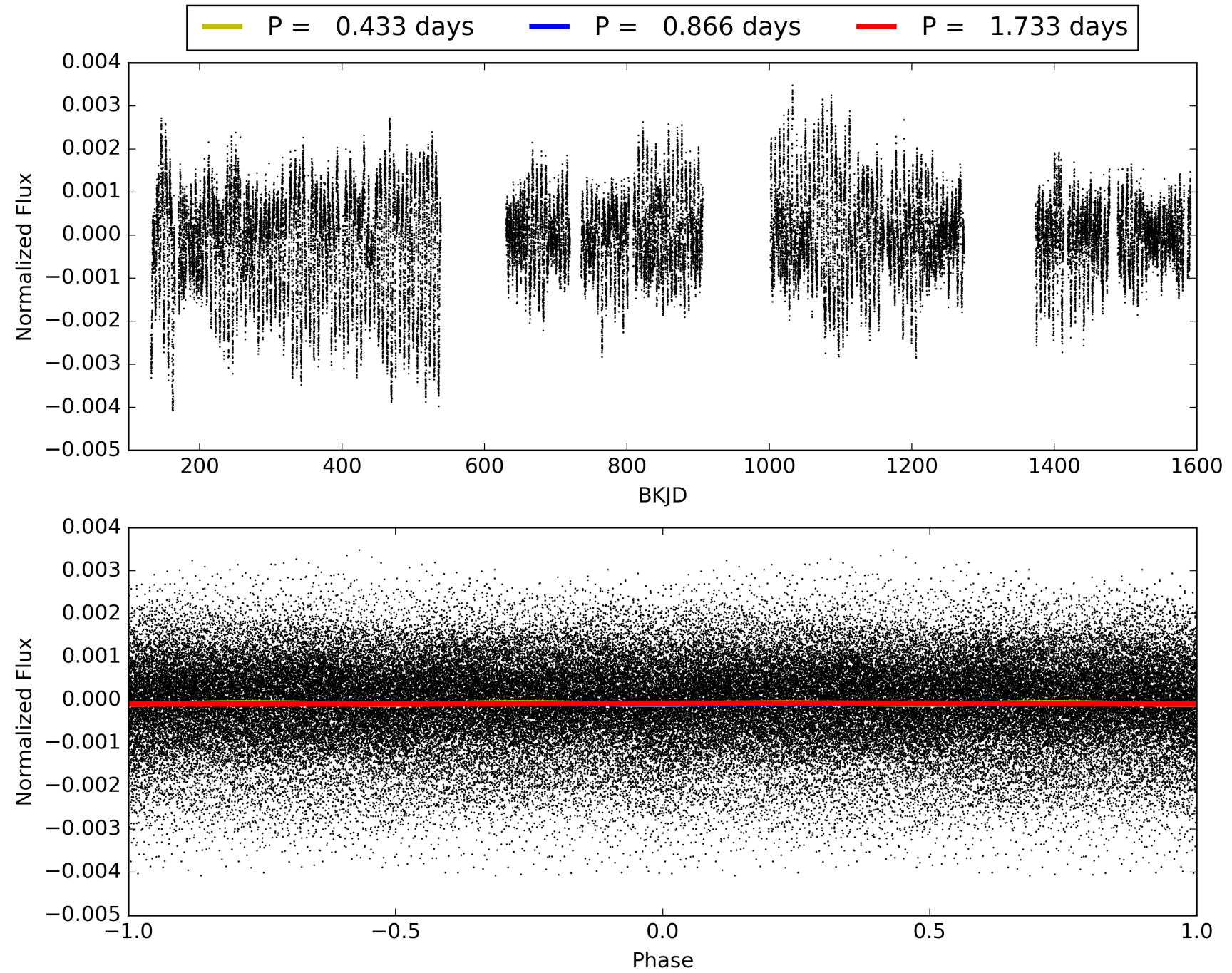
## DV Diagnostic Results:

ShortPeriod-sig: 0.0% [0.00σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: 1.27e-19  
RollingBand-fgt: 0.92 [1067/1164]  
GhostDiagnostic-chr: 2.184  
Centroid-sig: 6.5%  
Centroid-so: 1.941 arcsec [1.53σ]  
OotOffset-rm: 1.873 arcsec [6.78σ]  
KicOffset-rm: 1.778 arcsec [7.50σ]  
OotOffset-st: 0/4/4/4 [12]  
KicOffset-st: 0/4/4/4 [12]  
DiffImageQuality-fgm: 0.83 [10/12]  
DiffImageOverlap-fno: 1.00 [14/14]

# TCE 004579598-01, PDC Light Curves



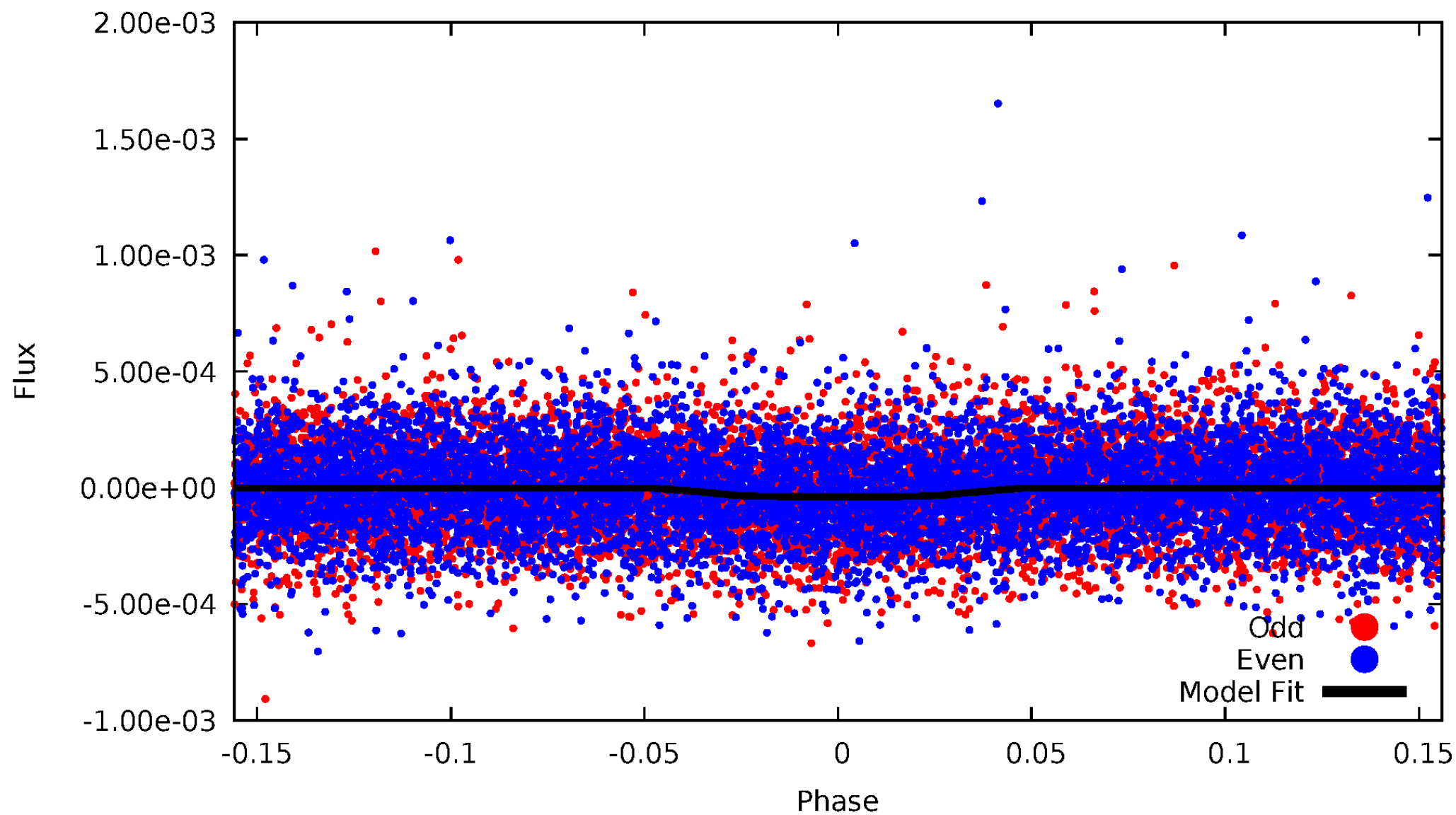
TCE 004579598-01





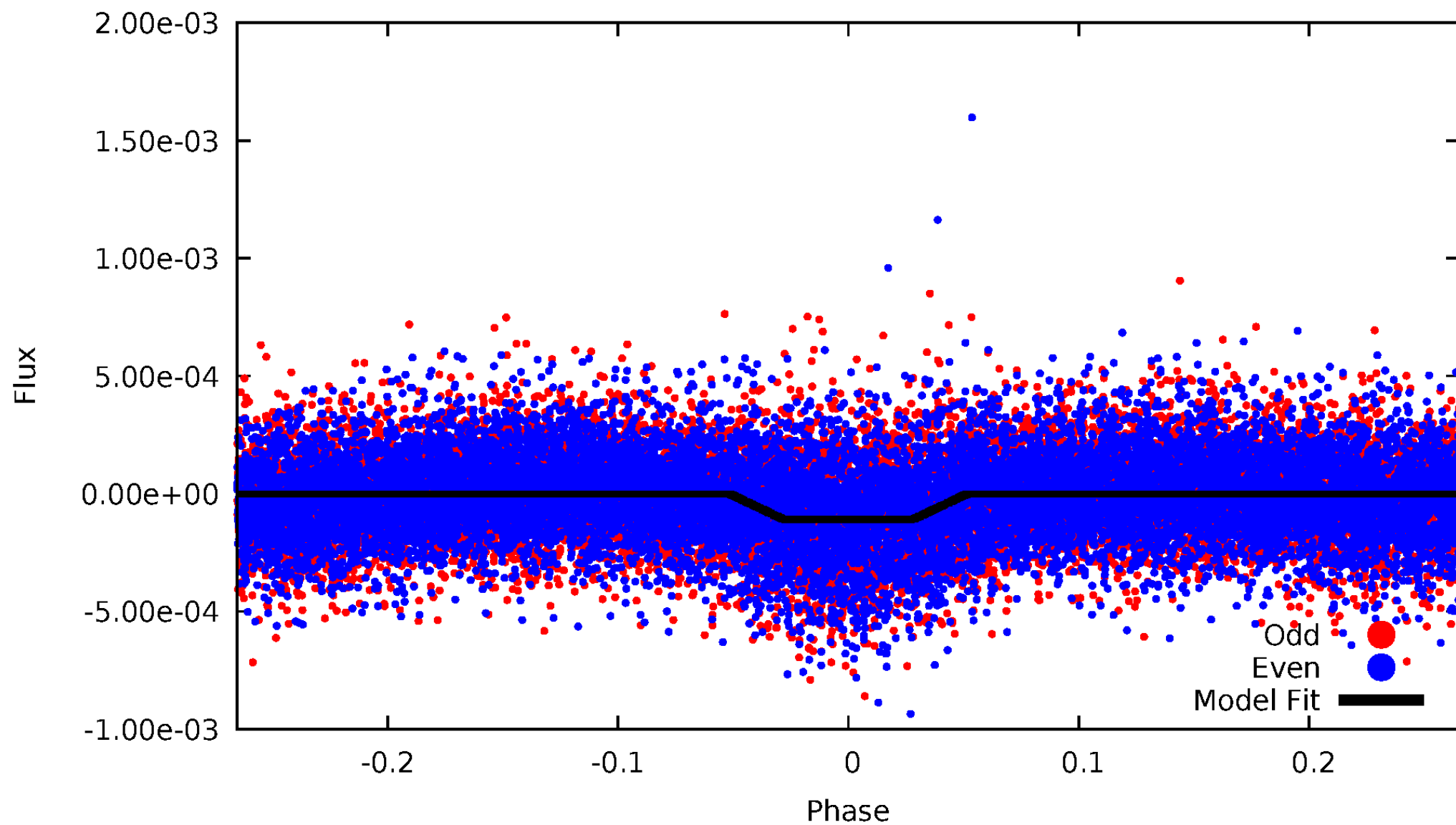
# DV Odd/Even

TCE 004579598-01

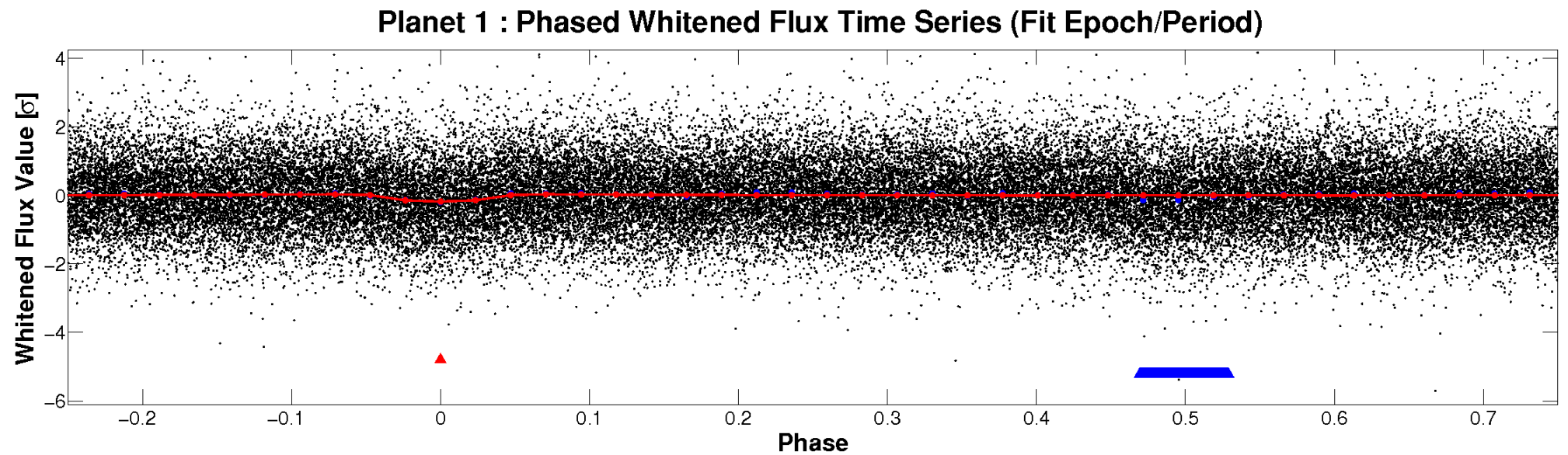
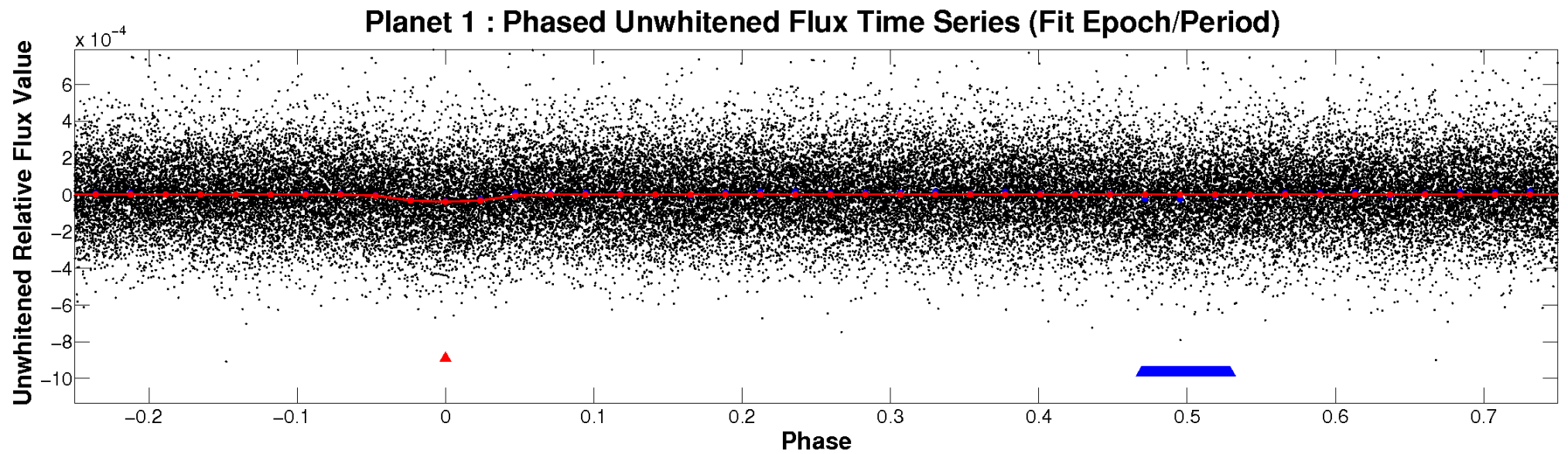


# ALT Odd/Even

TCE 004579598-01

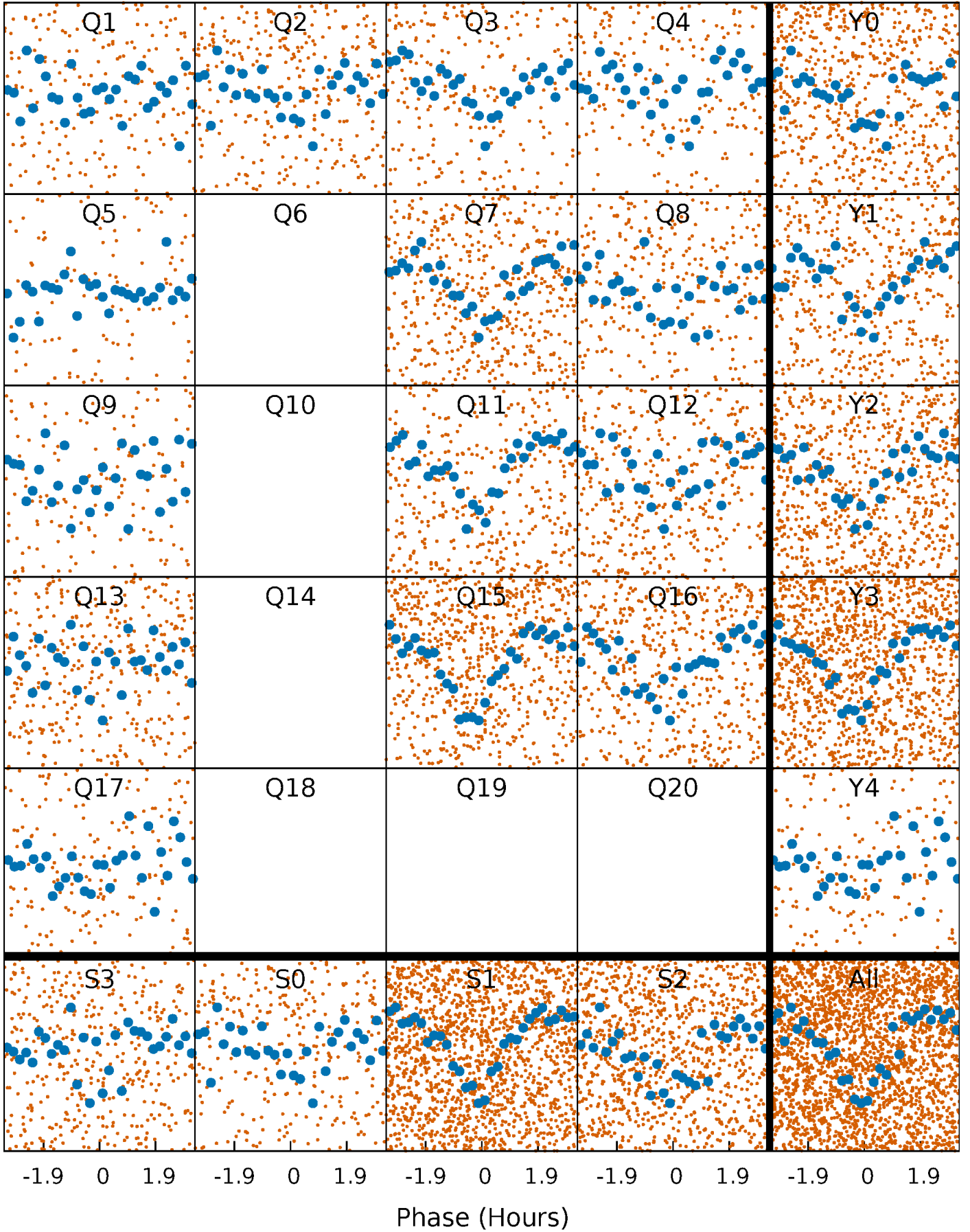


# Non-Whitened Vs. Whitened Light Curve



# PDC Quarter-Phased Transit Curves

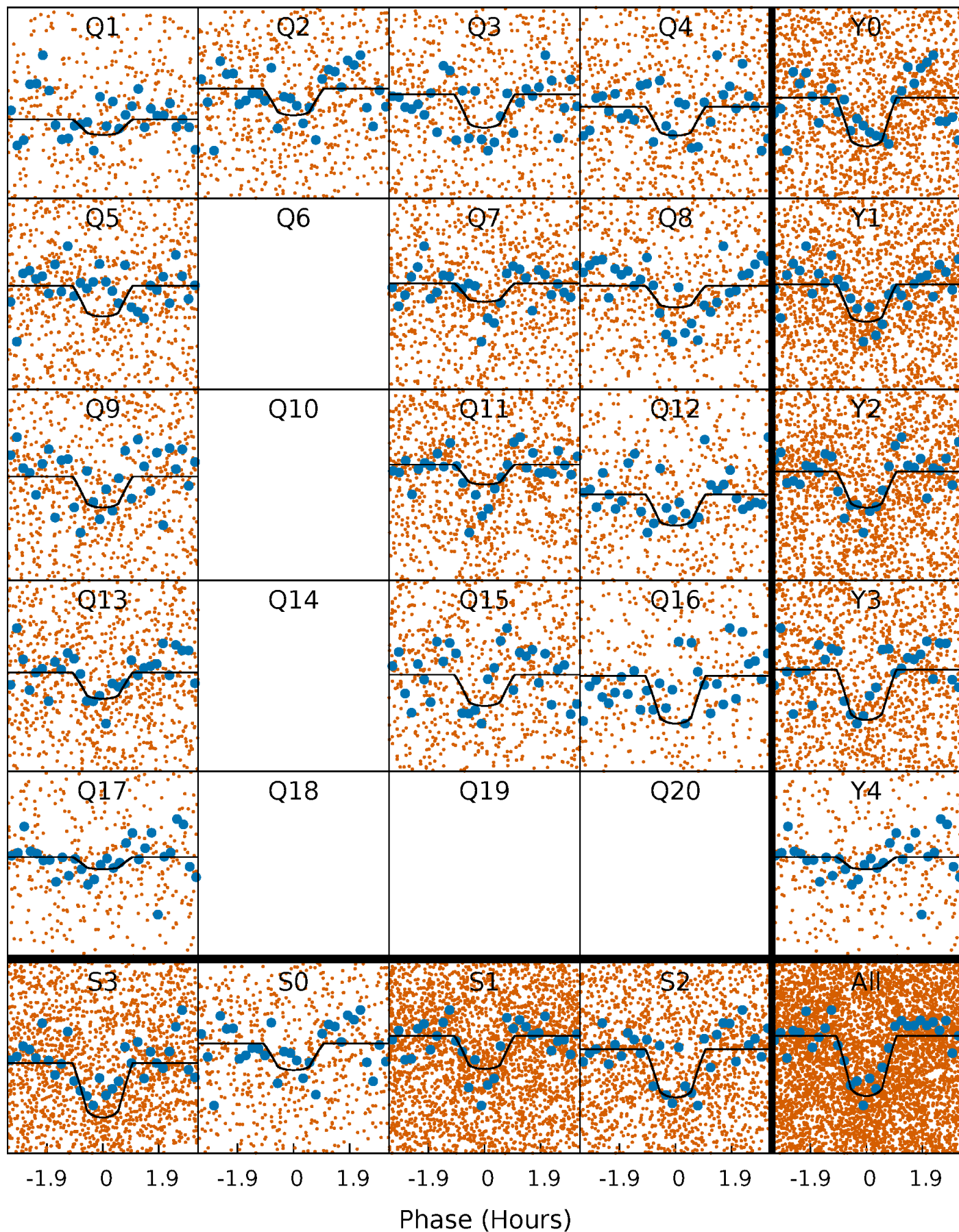
TCE 004579598-01   P= 0.866360 Days    $T_0=131.622136$  (BKJD)





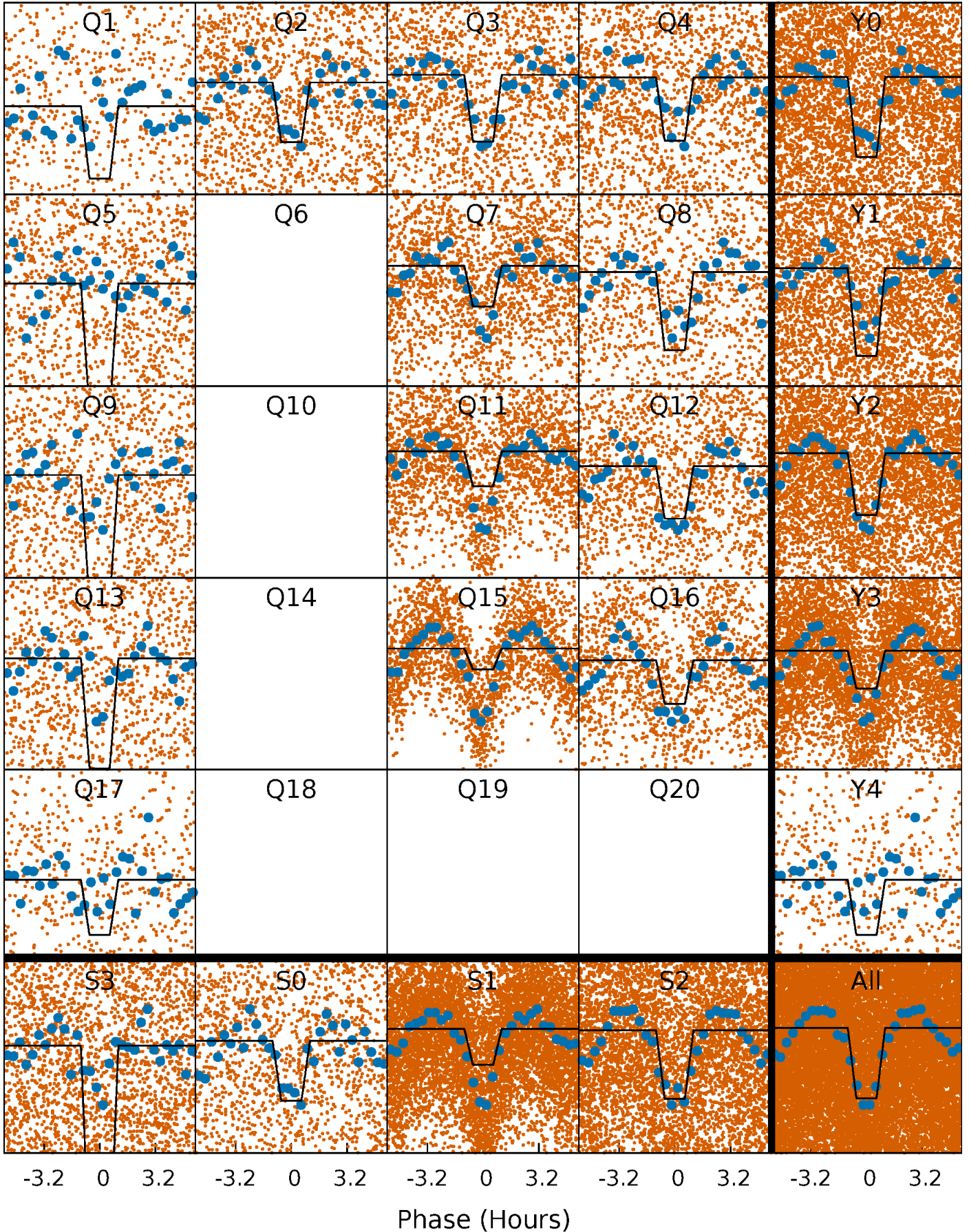
# DV Quarter-Phased Transit Curves

TCE 004579598-01 P= 0.866360 Days  $T_0=131.622136$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

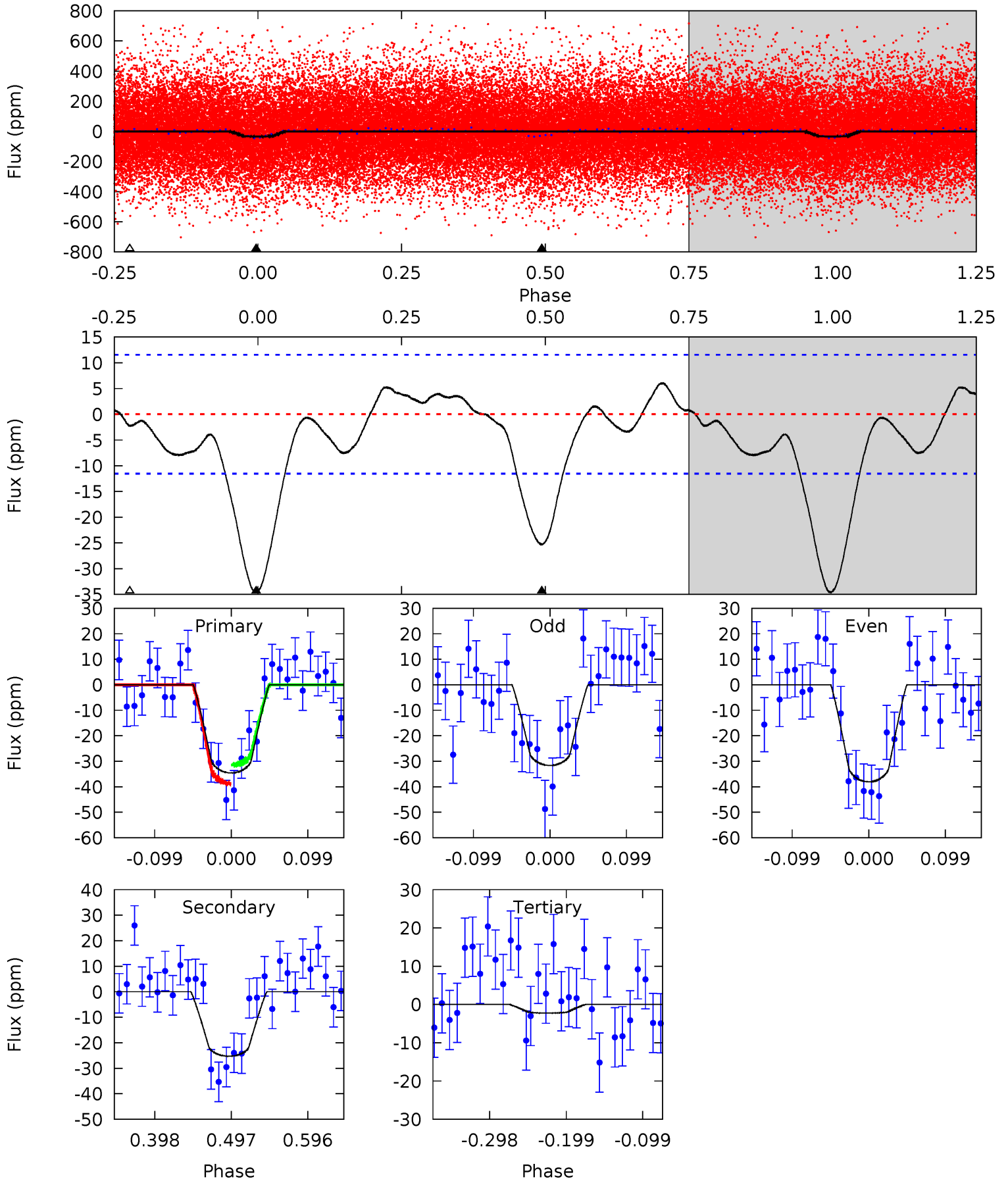
TCE 004579598-01 P= 0.866350 Days  $T_0=131.626973$  (BKJD)



# DV Model-Shift Uniqueness Test

004579598-01, P = 0.866360 Days, E = 130.755776 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
13.7	10.00	0.89	0	4.57	1.65	1.62	12.8	13.7	9.11	10.00	1.28	0.96	0.15	1.44

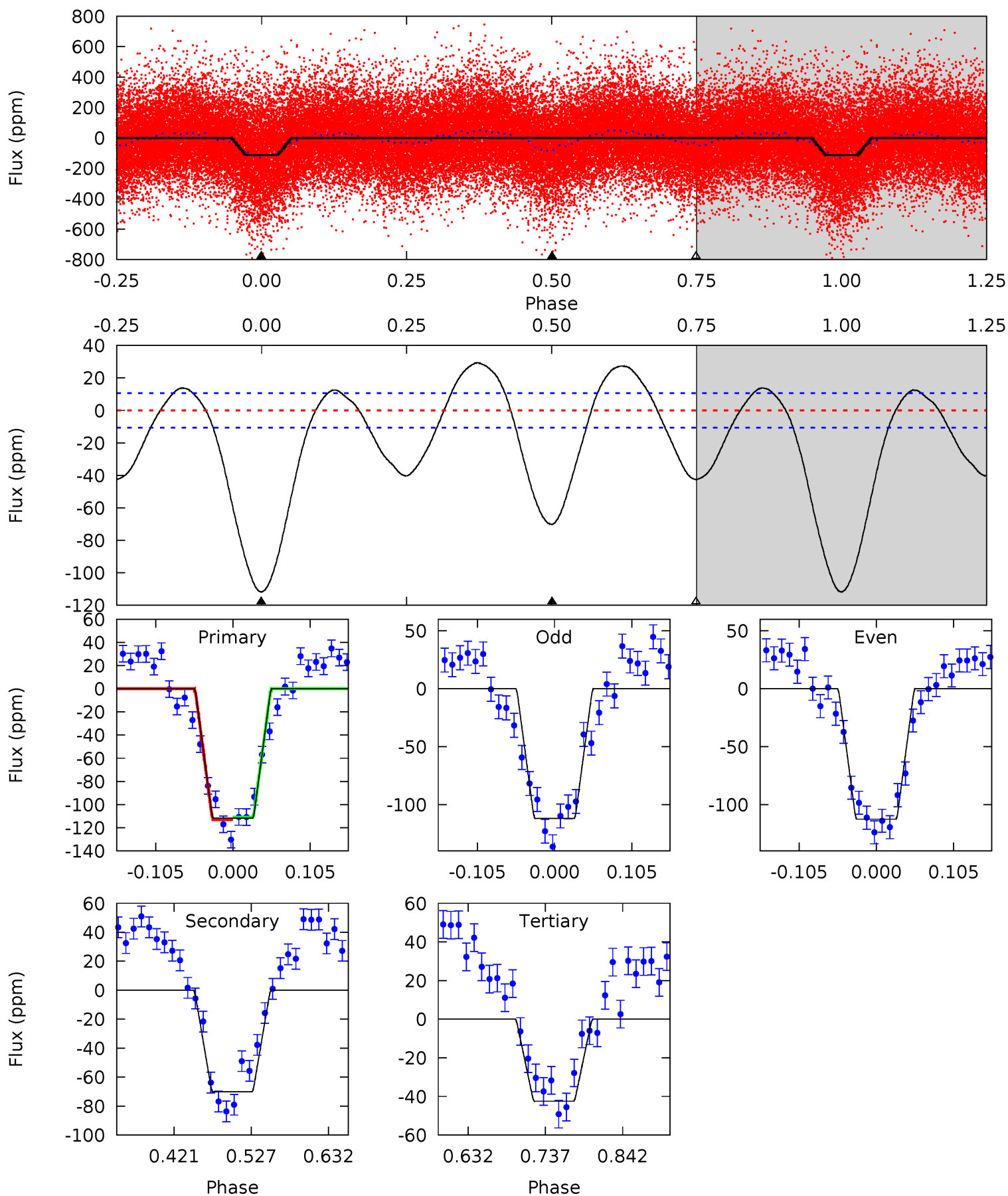




# Alt Model-Shift Uniqueness Test

004579598-01, P = 0.866350 Days, E = 130.760623 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
47.7	29.9	18.1	0	4.55	1.62	9.73	29.6	47.7	11.8	29.9	0.16	1.06	0.21	0.45





### Stellar Parameters For KIC 004579598

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6241^{+195}_{-260}$	$4.366^{+0.090}_{-0.210}$	$-0.060^{+0.250}_{-0.300}$	$1.131^{+0.375}_{-0.161}$	$1.079^{+0.189}_{-0.131}$	$1.049^{+0.487}_{-0.556}$
	+3%/-4%	+2%/-5%	+417%/-500%	+33%/-14%	+18%/-12%	+46%/-53%
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 004579598-01 / KOI 4414.01

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-25 \pm 3$	$0.91^{+0.48}_{-0.47}$	$3061^{+239}_{-204}$	$5158^{+2431}_{-815}$	$5.531^{+17.464}_{-3.133}$
Alt.	$-70 \pm 2$	$1.31^{+0.51}_{-0.45}$	$3068^{+235}_{-175}$	$5577^{+1283}_{-731}$	$7.328^{+9.250}_{-3.387}$

$T_{\text{max}}$  = 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

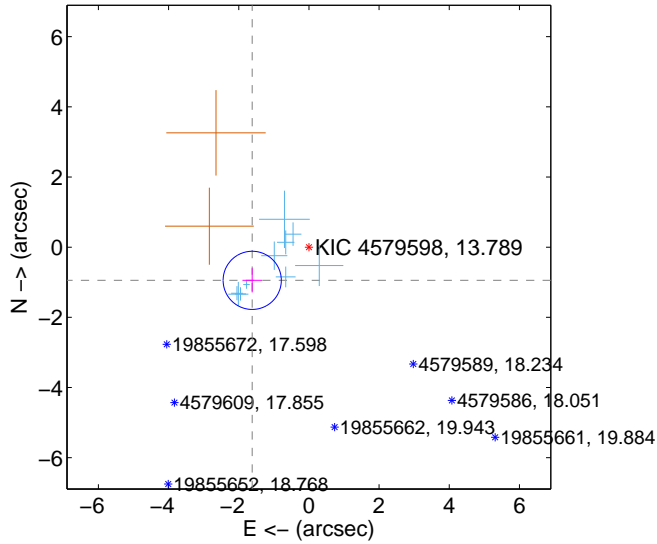
Supplemental centroid analysis for 004579598-01. Kepler magnitude: 13.79. Transit SNR 9.77

There are 10 quarters with good PRF difference image offsets

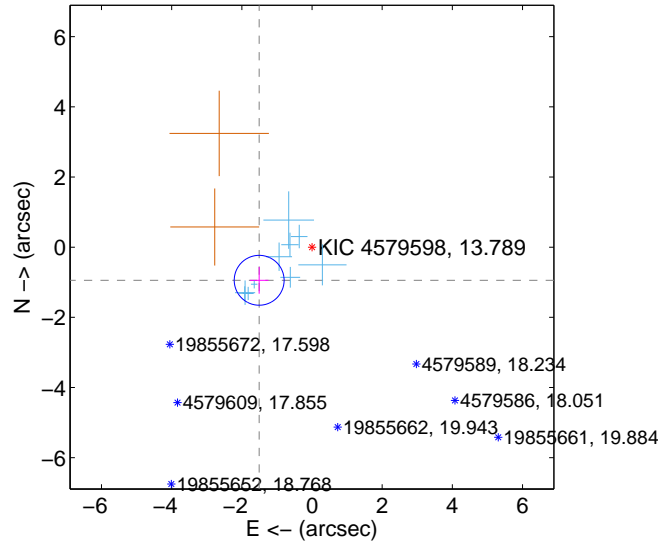
The direct PRF centroid is offset from the target star catalog position by about 0.02 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.873 \pm 0.276$	6.78	$1.617 \pm 0.278$	$-0.946 \pm 0.346$
PRF-fit source offset from KIC position	$1.778 \pm 0.237$	7.50	$1.506 \pm 0.266$	$-0.944 \pm 0.382$
photometric centroid source offset	$1.94 \pm 1.27$	1.53	$1.93 \pm 1.27$	$0.21 \pm 1.27$

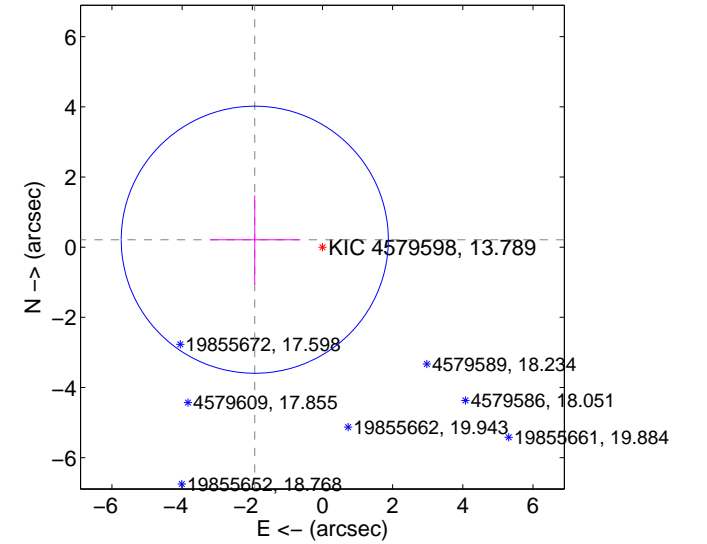
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

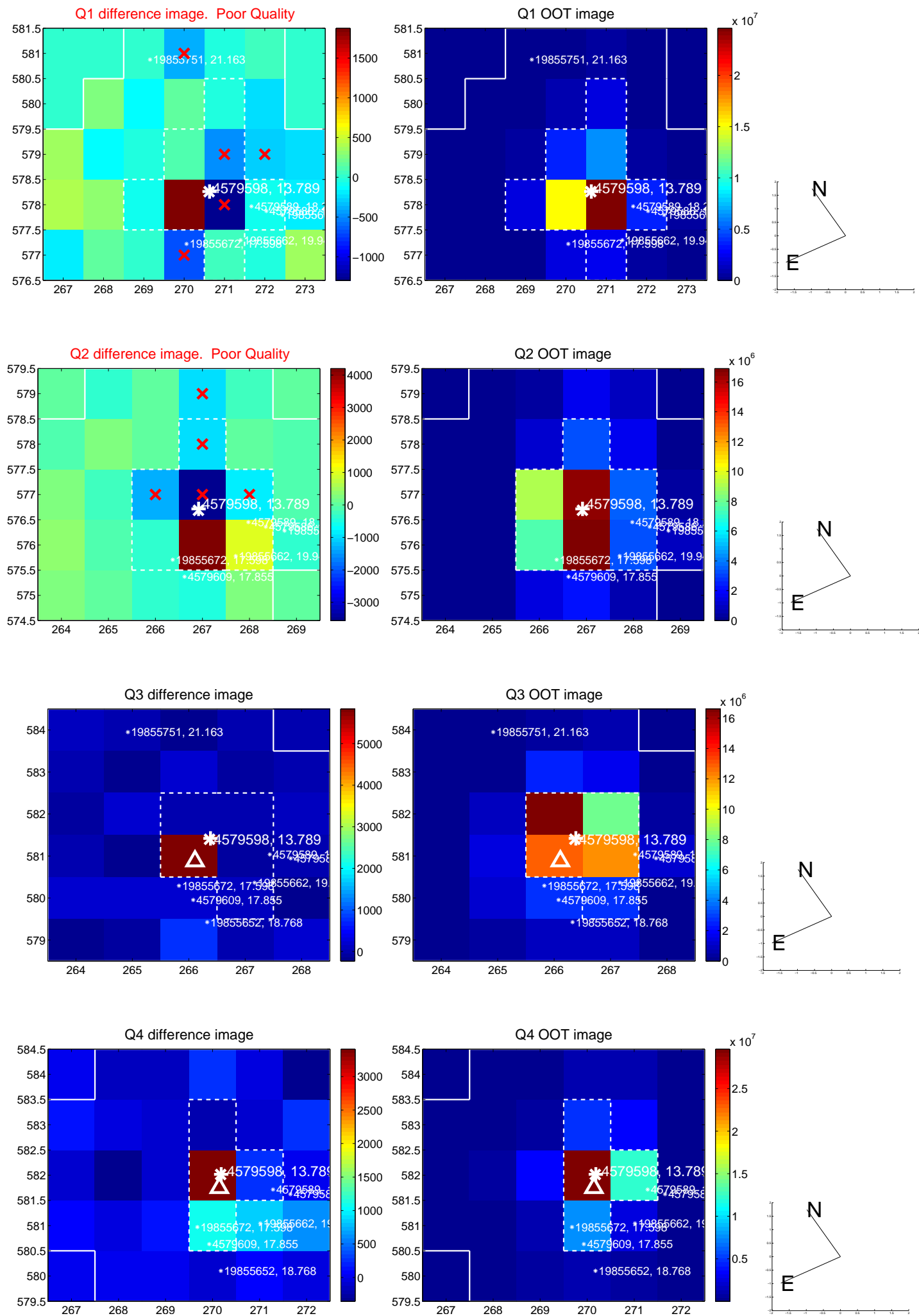


offset from photometric centroids

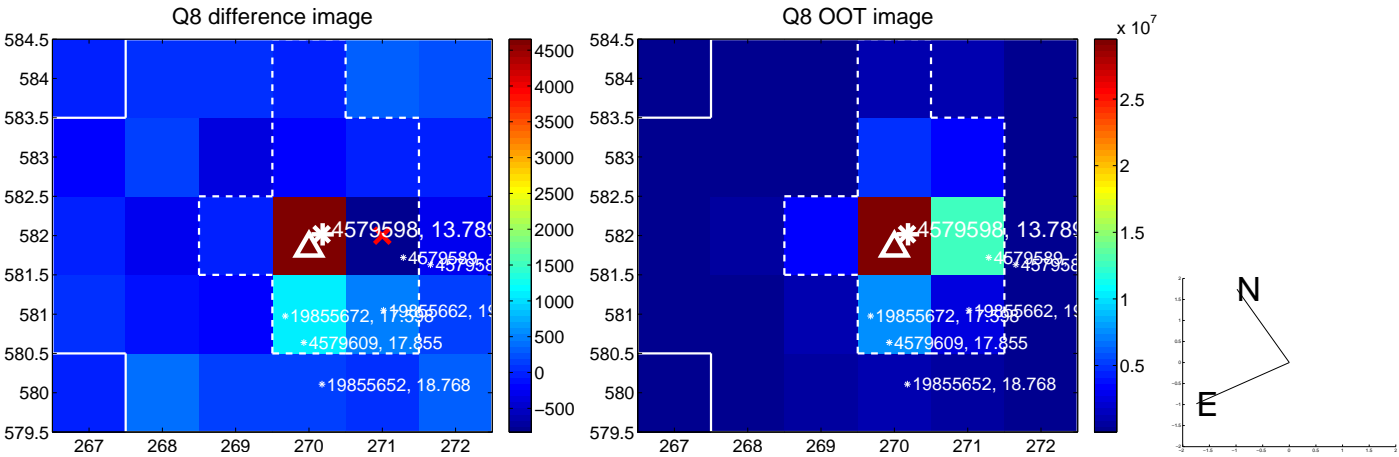
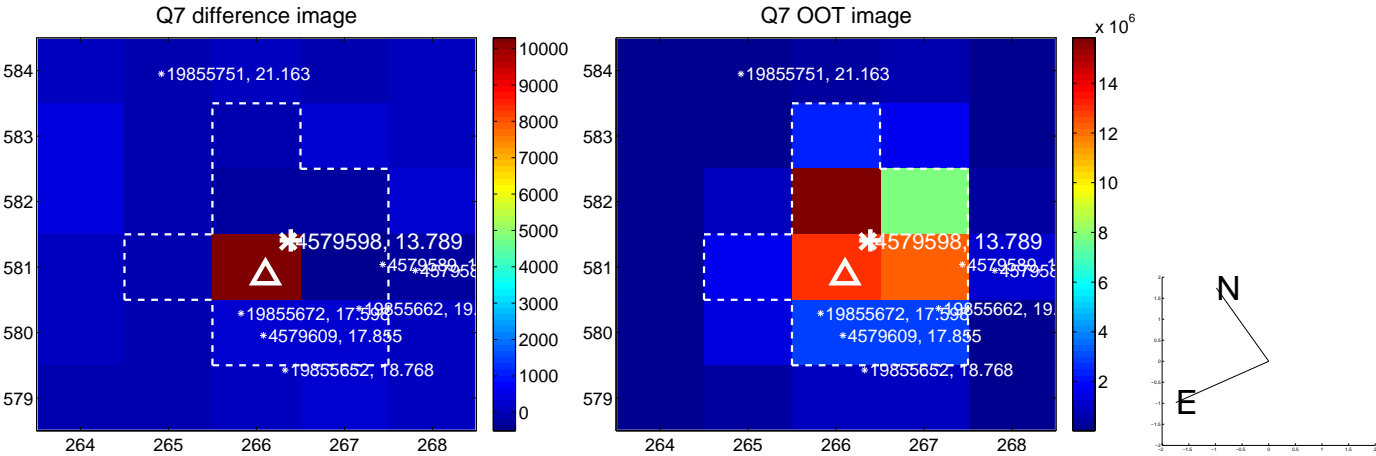
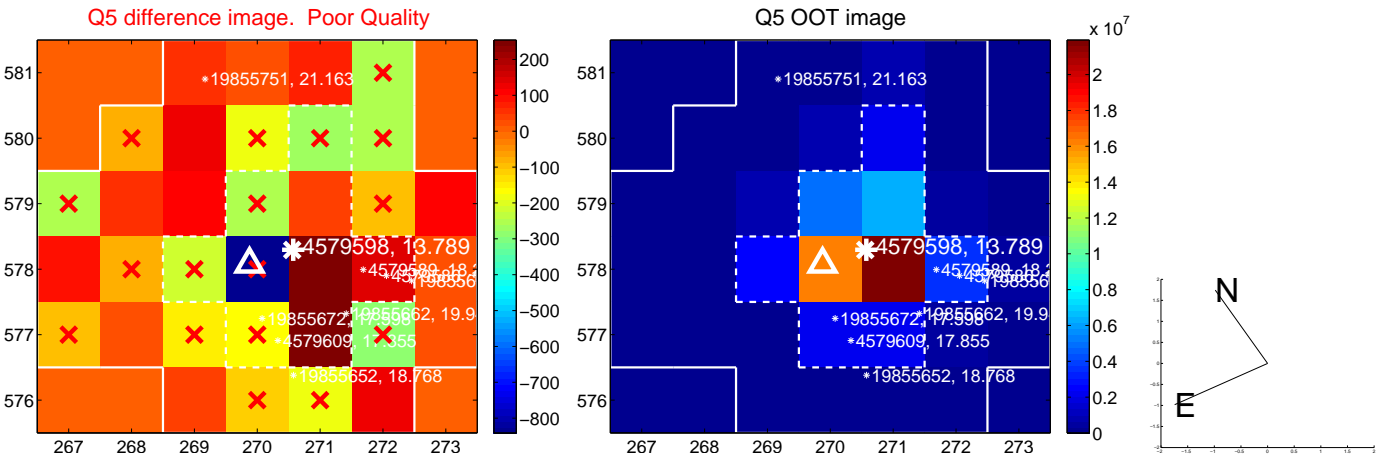


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

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

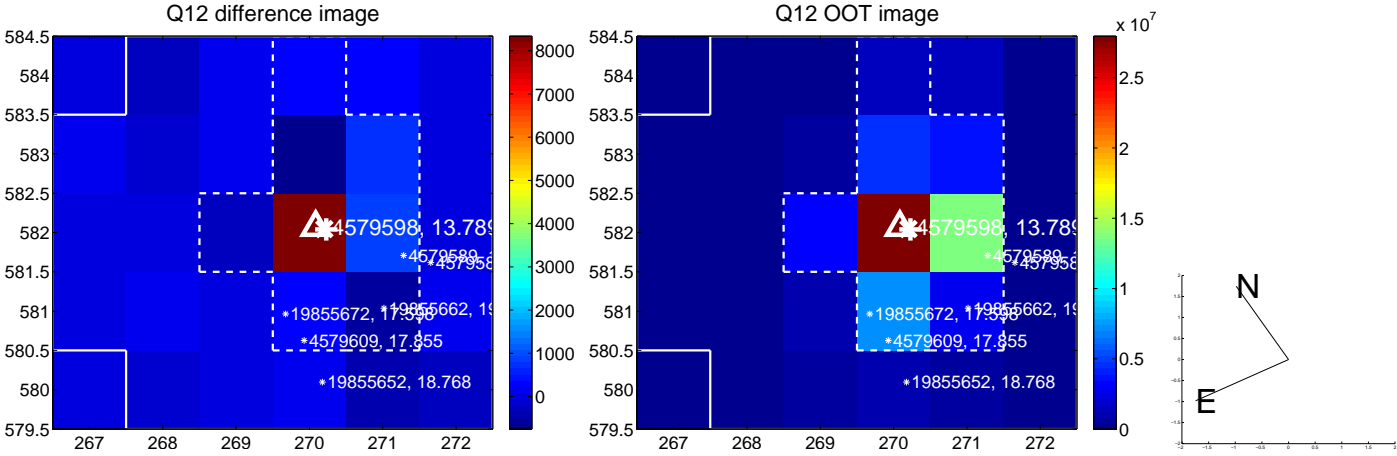
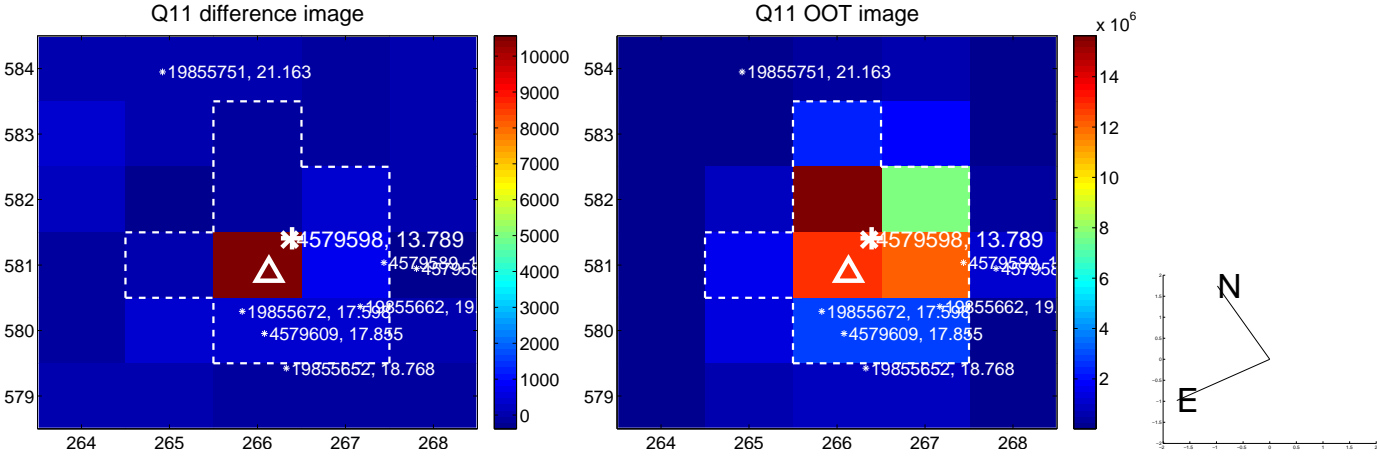
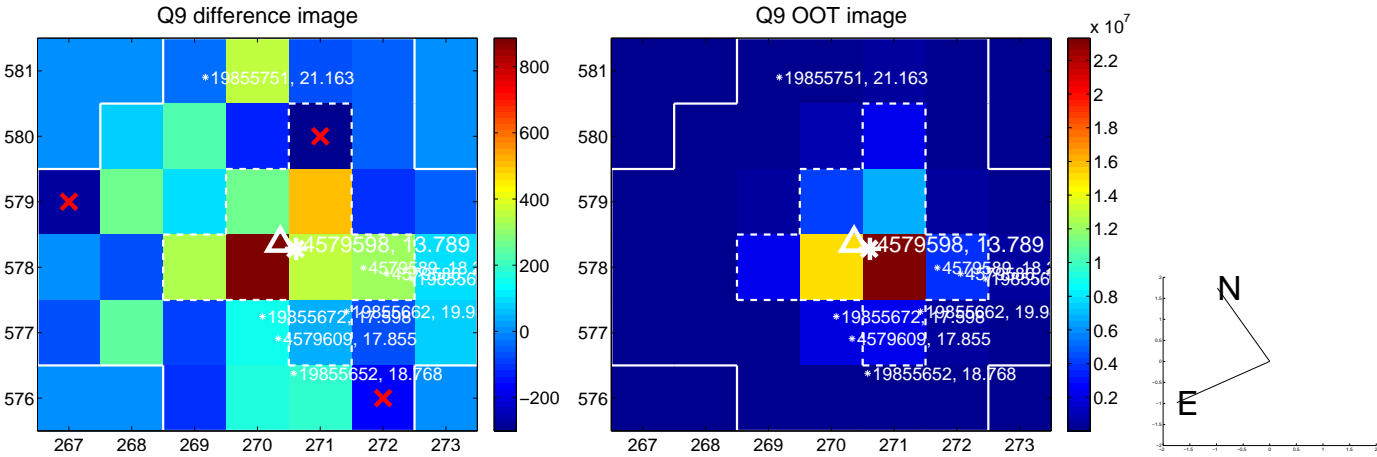


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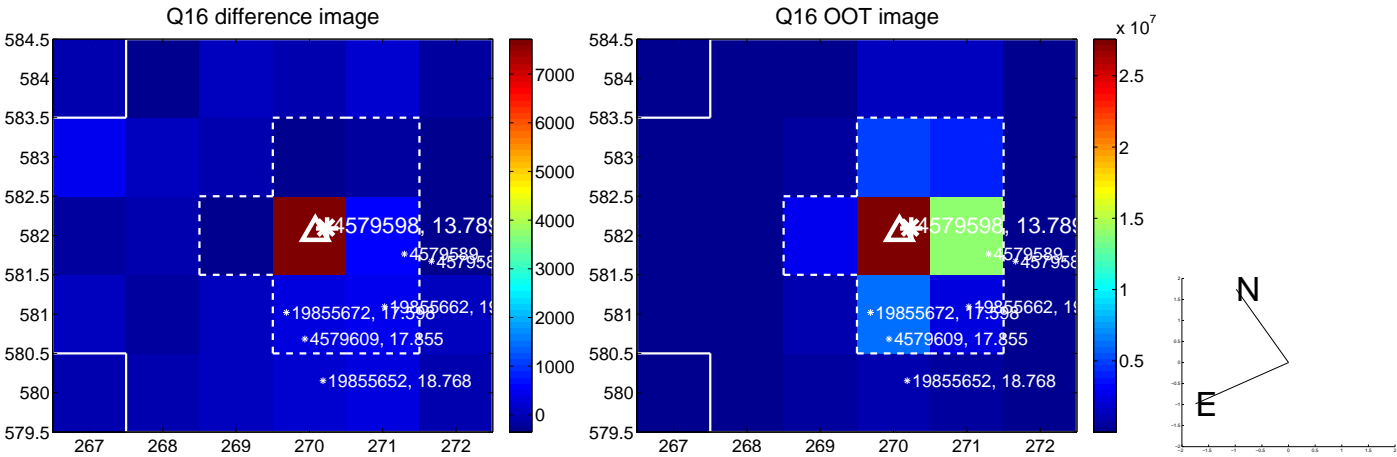
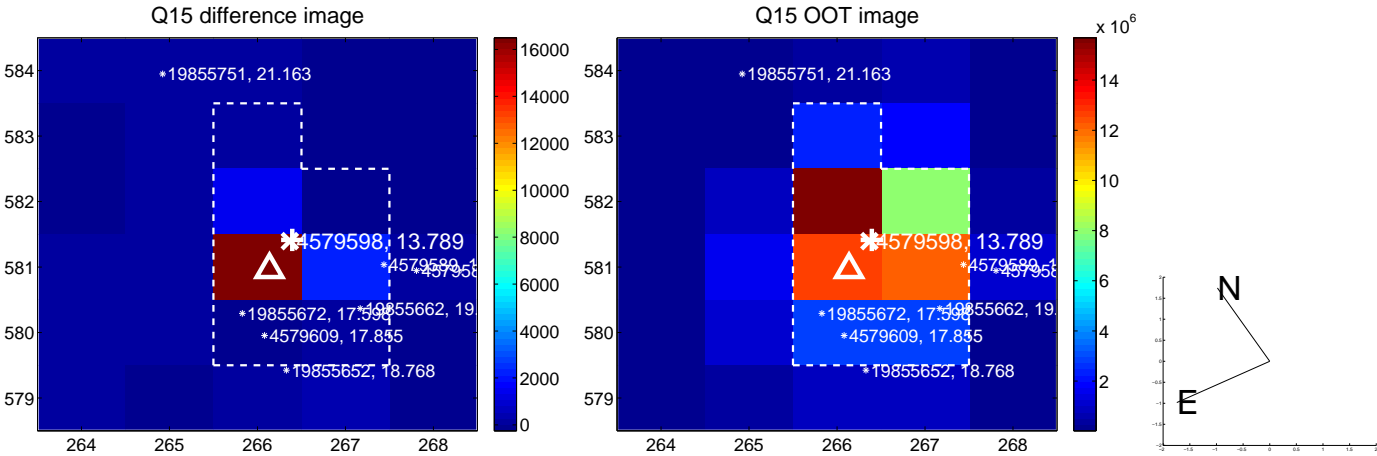
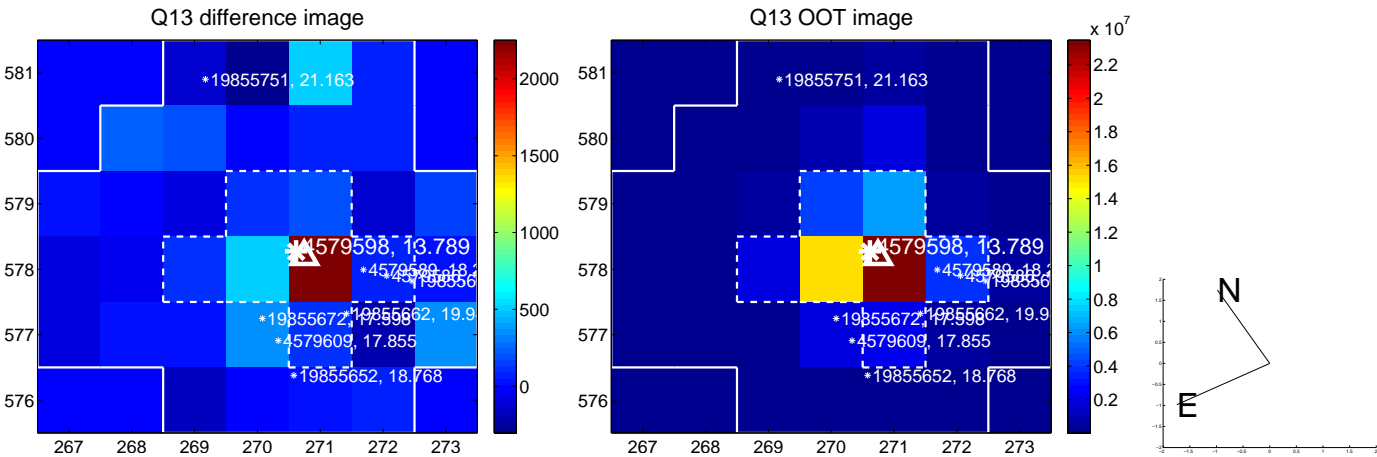




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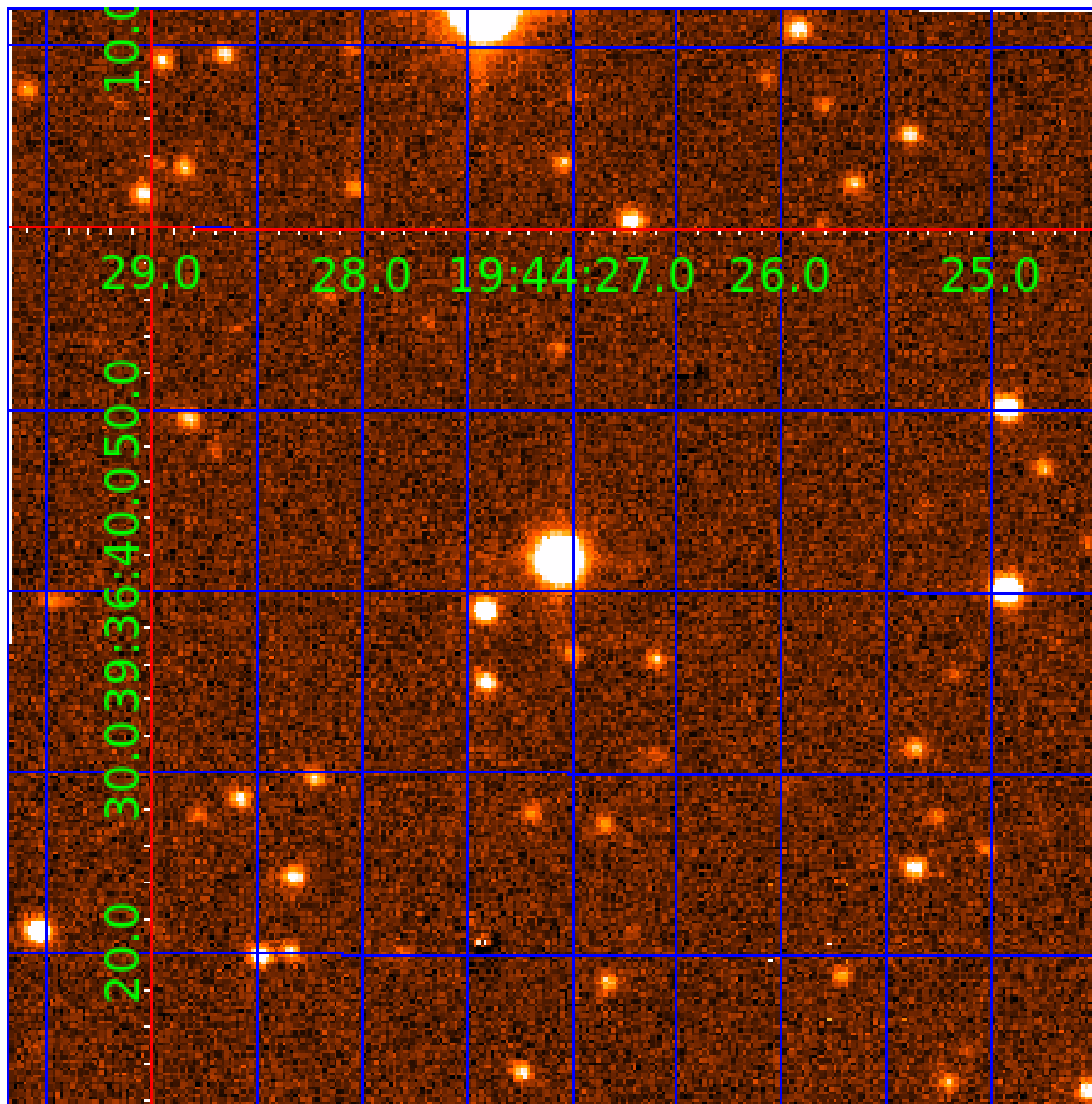
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





UKIRT Image

Declination





# KIC 004579598

## 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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004579598-02	OBS	No	0.866329	132.080444	26.1	2.407	8.0	7.5	1.13	6241	0.68	5207.65

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
004579598-01	OBS	FP	0.00	1	0	0	1	MOD_NONUNIQ_ALT—EPHEM_MATCH
004579598-02	OBS	FP	0.00	1	0	0	1	LPP_DV—LPP_ALT—MOD_NONUNIQ_ALT—SAME_NTL_PERIOD—EPHEM_MATCH

**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 004579598-02

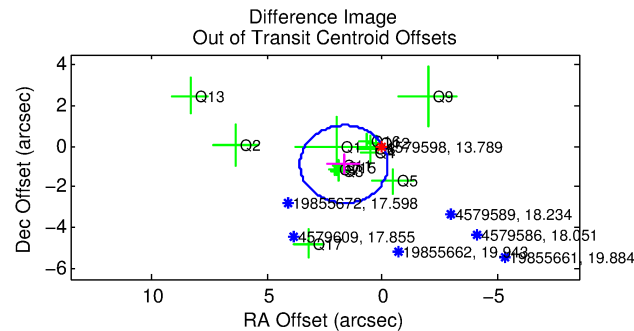
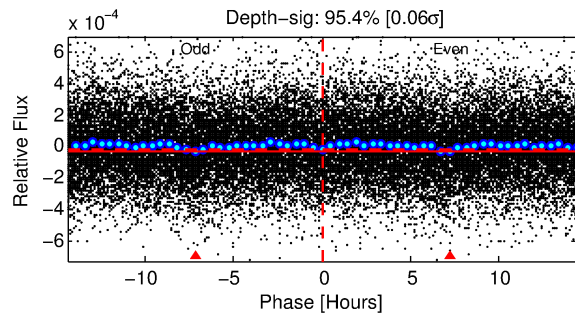
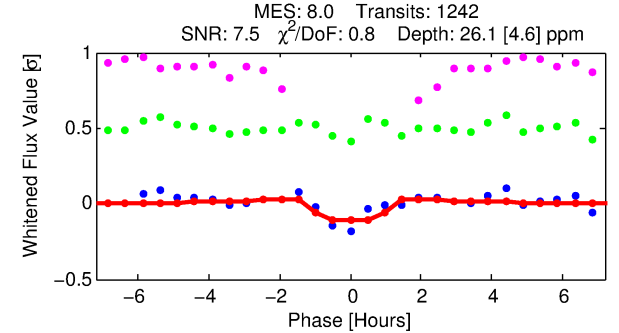
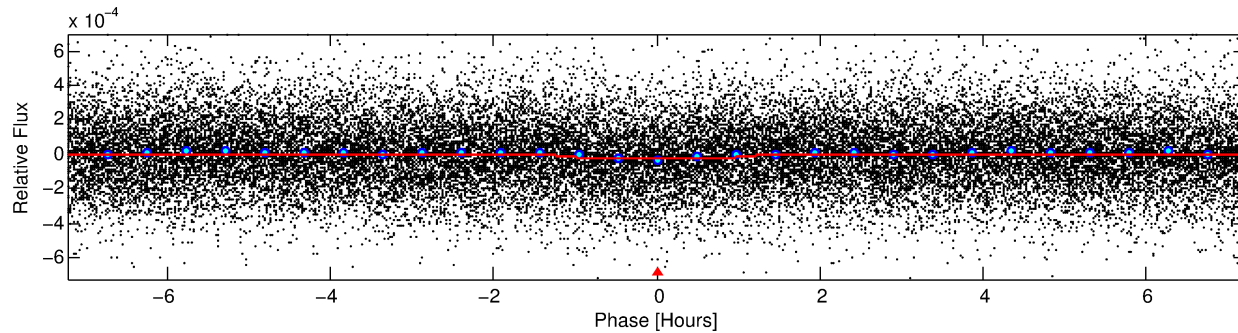
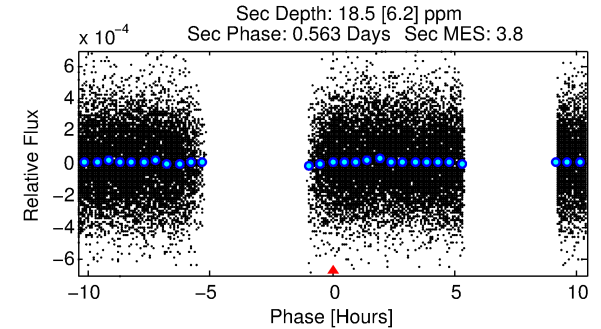
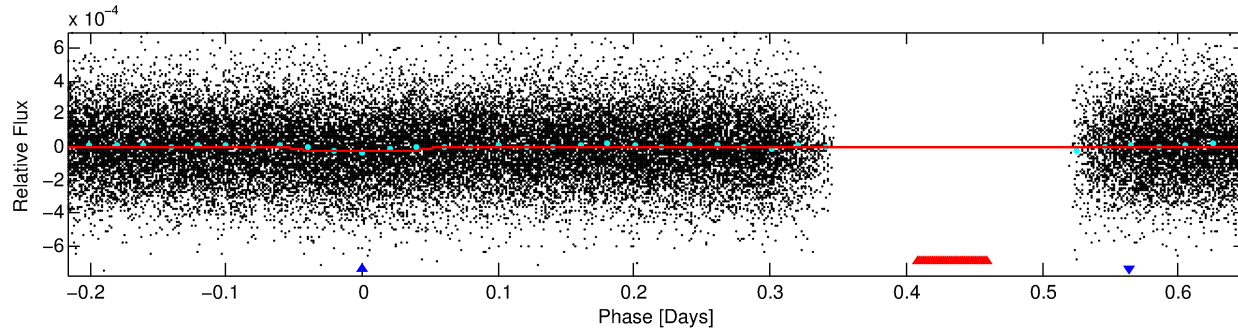
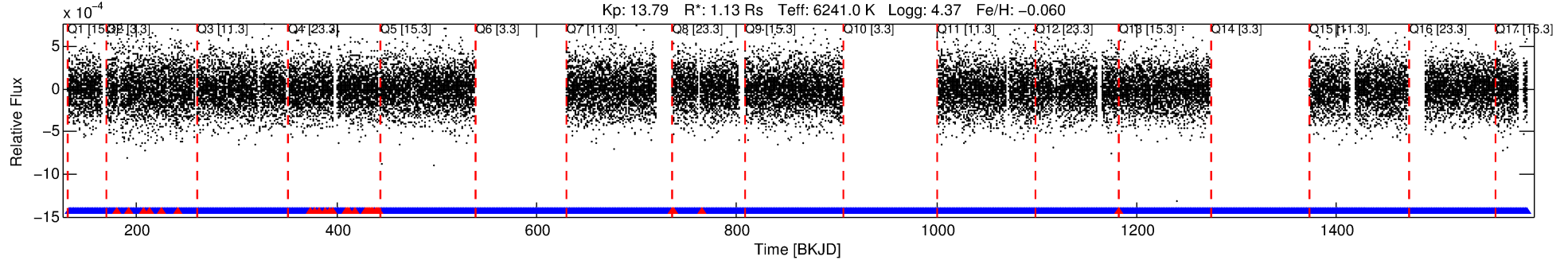
TCE (1)	KIC	Parent (2)	Parent KIC	$P_1:P_2$	Dist (")	$\Delta\text{Row}$	$\Delta\text{Col}$	$m_2$	$m_1$	$D_2/D_1$	Mechanism	Flag	$\sigma_P$	$\sigma_T$
004579598-02	4579598	004482738-01	4482738	1:1	136.2	34	2	12.95	13.79	3.31	Direct-PRF	1	0.33	0.44

**Notes:**  $P_1:P_2$  is the period ratio. Dist is the distance in arcseconds.  $\Delta\text{Row}$  and  $\Delta\text{Col}$  are the number of pixels apart in row and column.  $m_2$  and  $m_1$  are the magnitudes of the parent and child.  $D_2/D_1$  is the parent's transit depth divided by the child's.  $\sigma_P$  and  $\sigma_T$  are the significance of the match in period and epoch. For a match to be considered significant  $\sigma_P < 5.0$  and  $\sigma_T < 5.0$ . Matches which have  $\sigma_P$  and  $\sigma_T$  very close to this cutoff should receive extra scrutiny, especially if the period ratio is very large.

# DV One-Page Summary

KIC: 4579598 Candidate: 2 of 2 Period: 0.866 d  
KOI: K04414 Corr: No Ephemeris Match

Kp: 13.79 R\*: 1.13 Rs Teff: 6241.0 K Logg: 4.37 Fe/H: -0.060



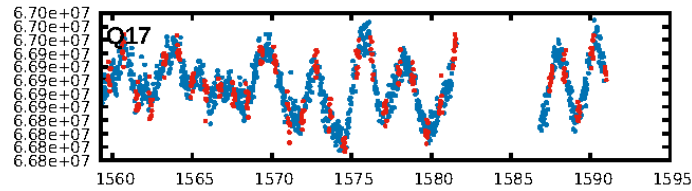
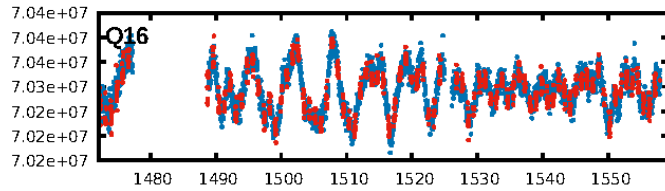
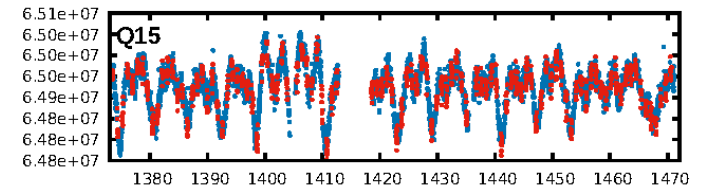
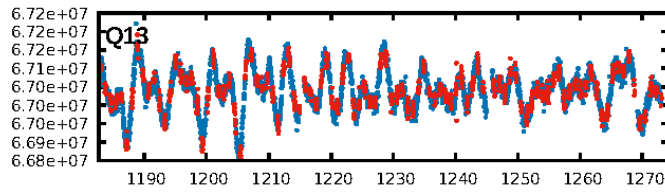
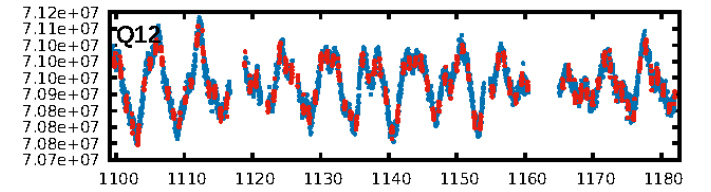
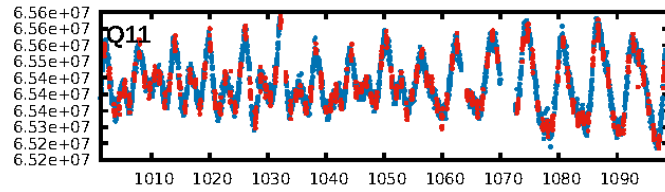
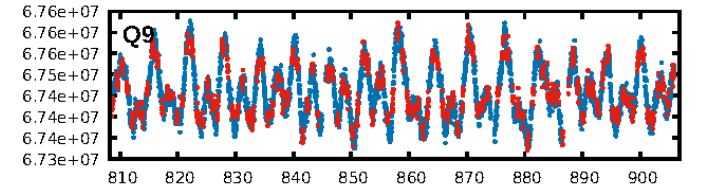
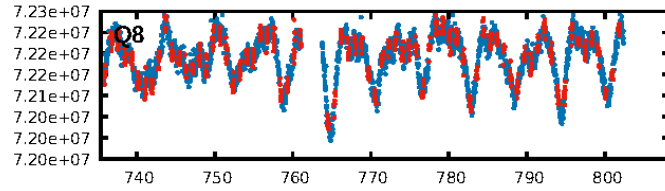
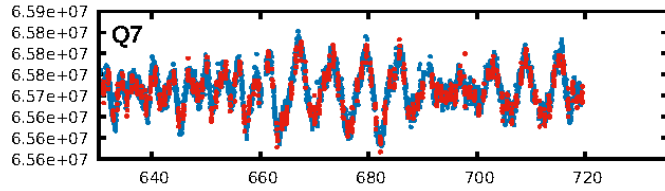
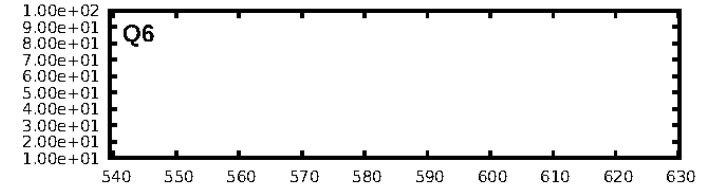
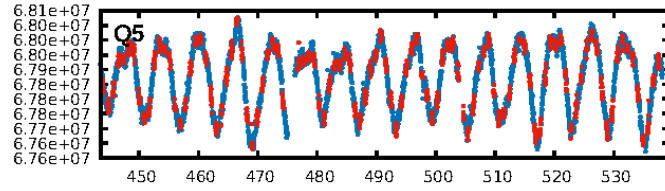
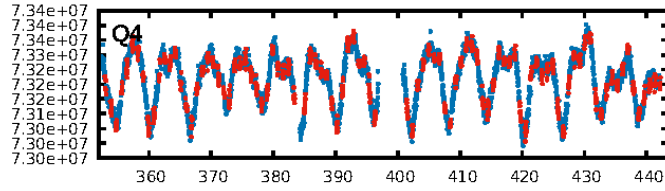
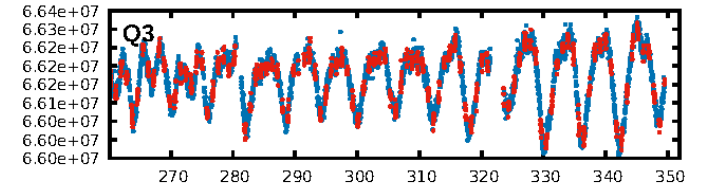
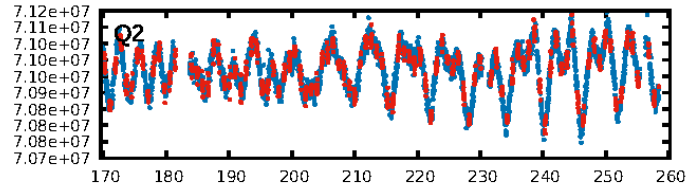
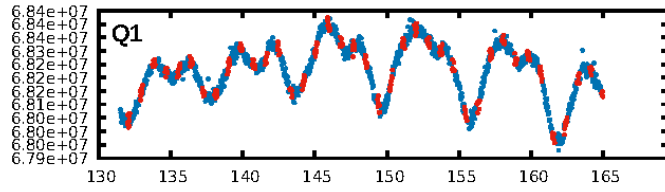
## DV Fit Results:

Period = 0.86633 [0.00001] d  
Epoch = 132.0804 [0.0034] BKJD  
Rp/R\* = 0.0055 [0.0027]  
a/R\* = 1.54 [2.33]  
b = 0.90 [0.55]  
Seff = 5207.65 [2212.77]  
Teq = 2166 [230] K  
Rp = 0.68 [0.40] Re  
a = 0.0183 [0.0050] AU  
Ag = 7.33 [8.00] [0.79σ]  
Teff = 5511 [1422] K [2.32σ]

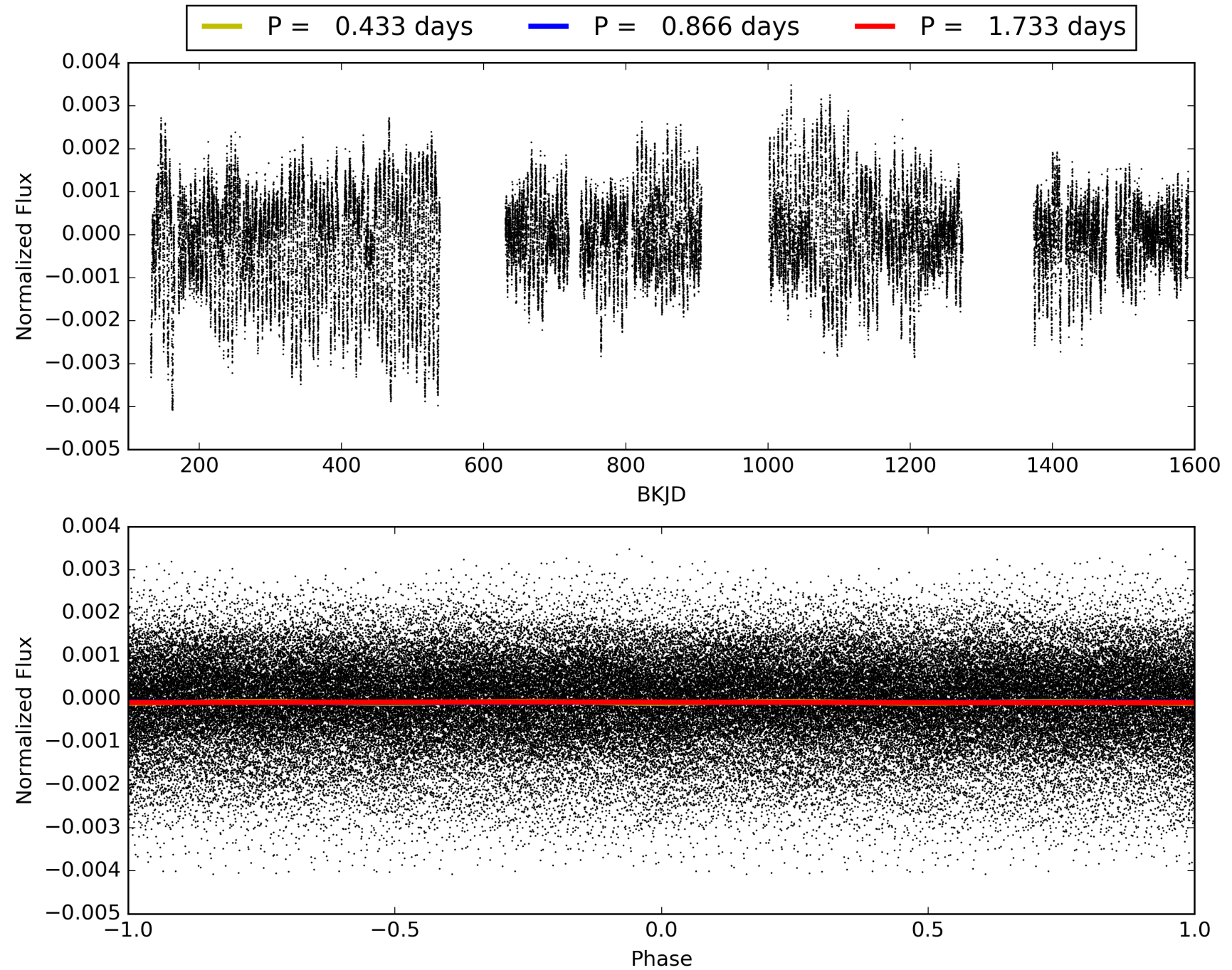
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 0.0% [0.00σ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: 1.72e-15  
RollingBand-fgt: 0.97 [1139/1172]  
GhostDiagnostic-chr: 32.84  
Centroid-sig: 0.0%  
Centroid-so: 4.361 arcsec [2.85σ]  
OotOffset-rm: 1.883 arcsec [2.96σ]  
KicOffset-rm: 1.783 arcsec [2.74σ]  
OotOffset-st: 1/4/4/5 [14]  
KicOffset-st: 1/4/4/5 [14]  
DiffImageQuality-fgm: 0.64 [9/14]  
DiffImageOverlap-fno: 1.00 [14/14]

# TCE 004579598-02, PDC Light Curves



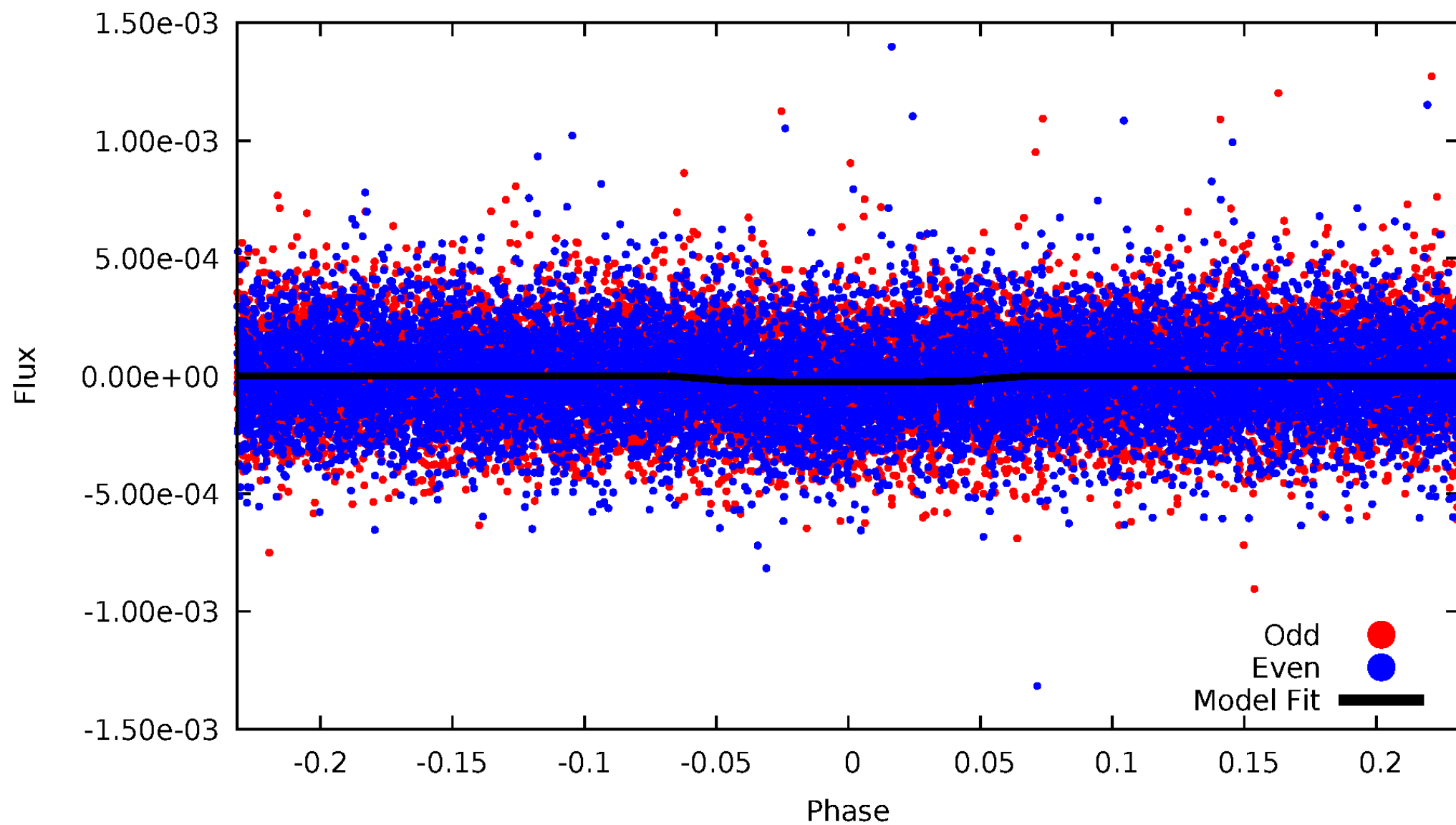
# TCE 004579598-02





# DV Odd/Even

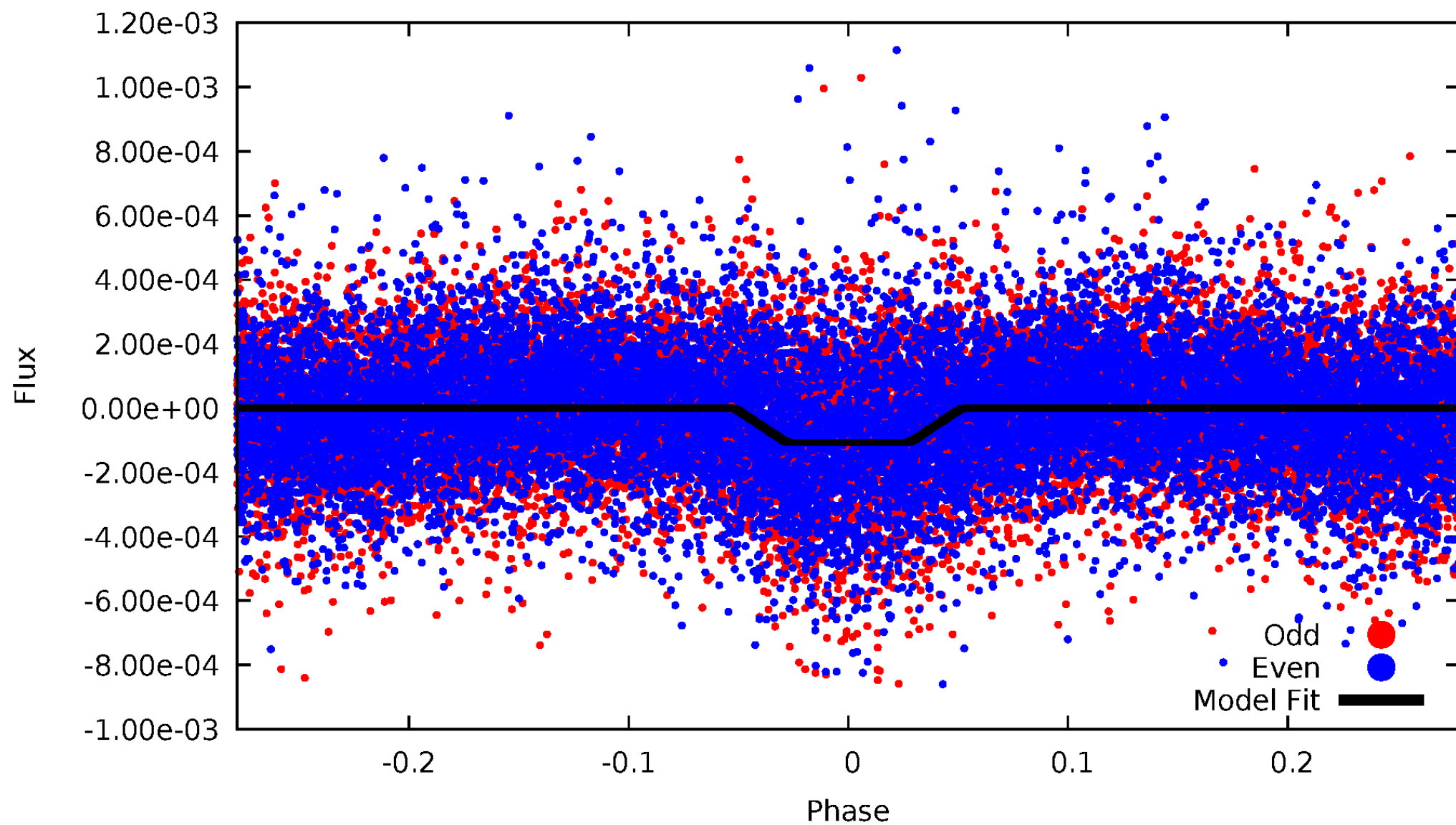
TCE 004579598-02





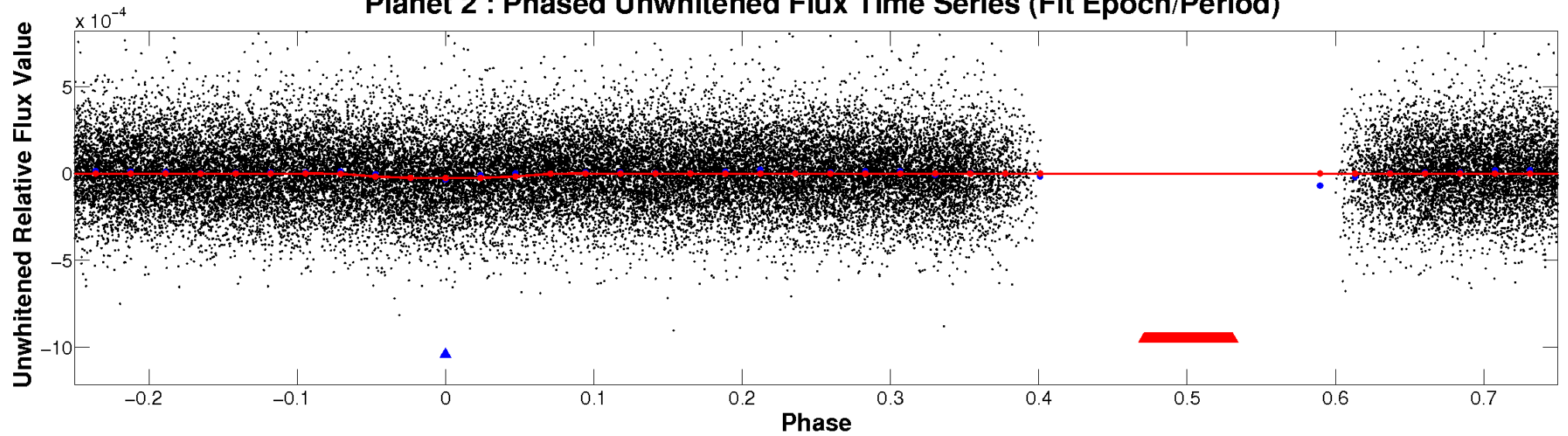
# ALT Odd/Even

TCE 004579598-02

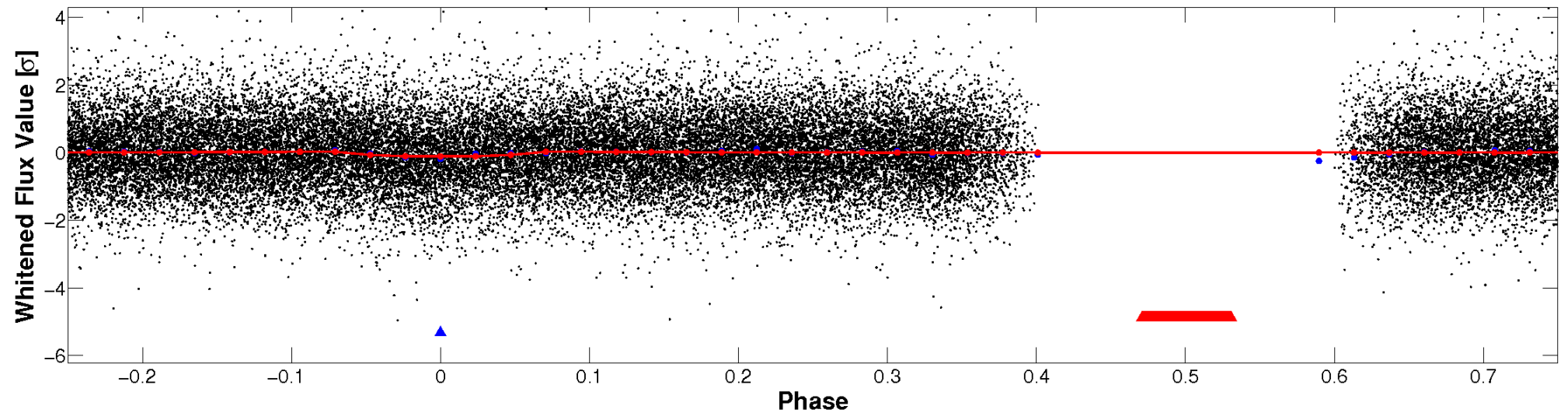


# Non-Whitened Vs. Whitened Light Curve

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

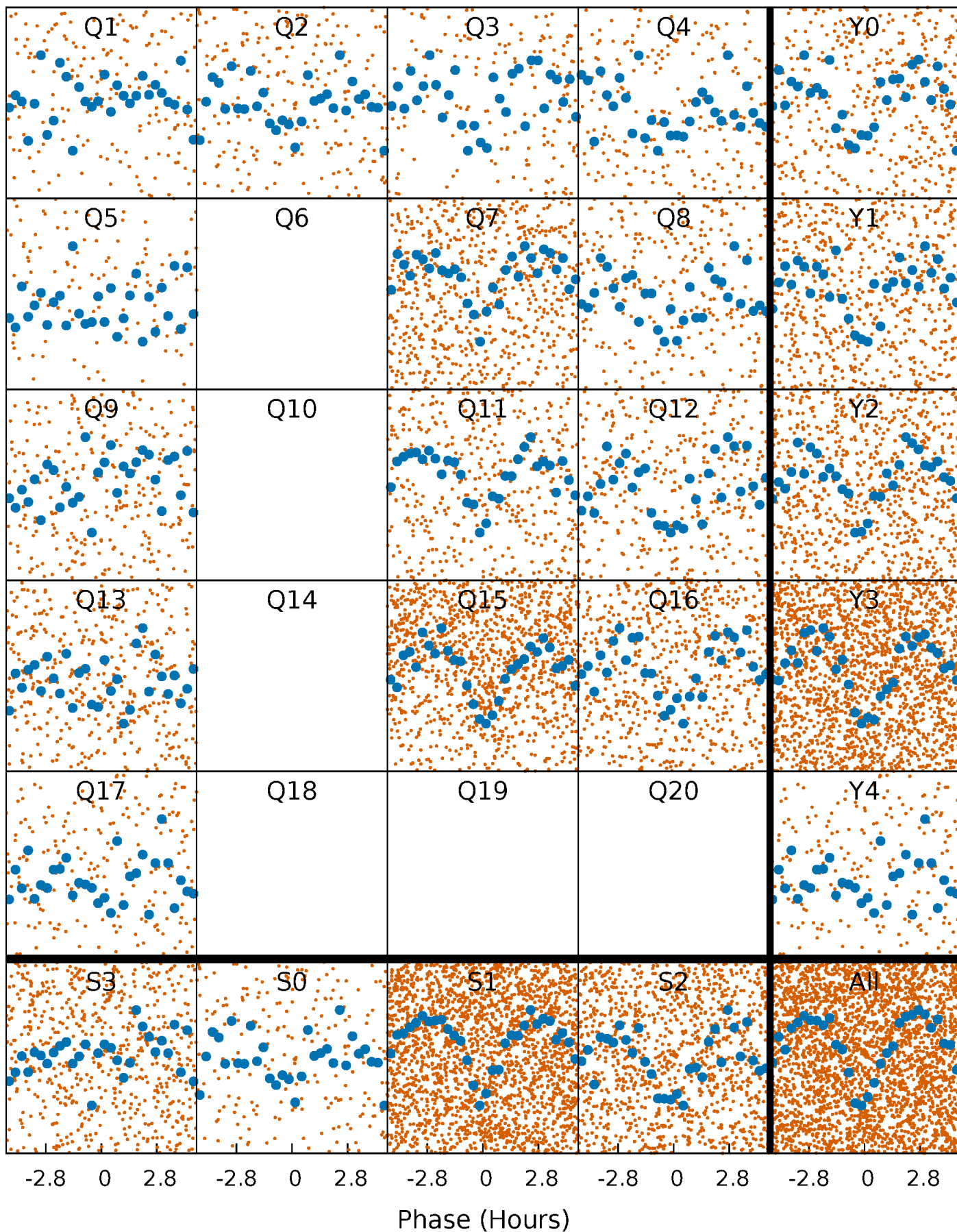


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

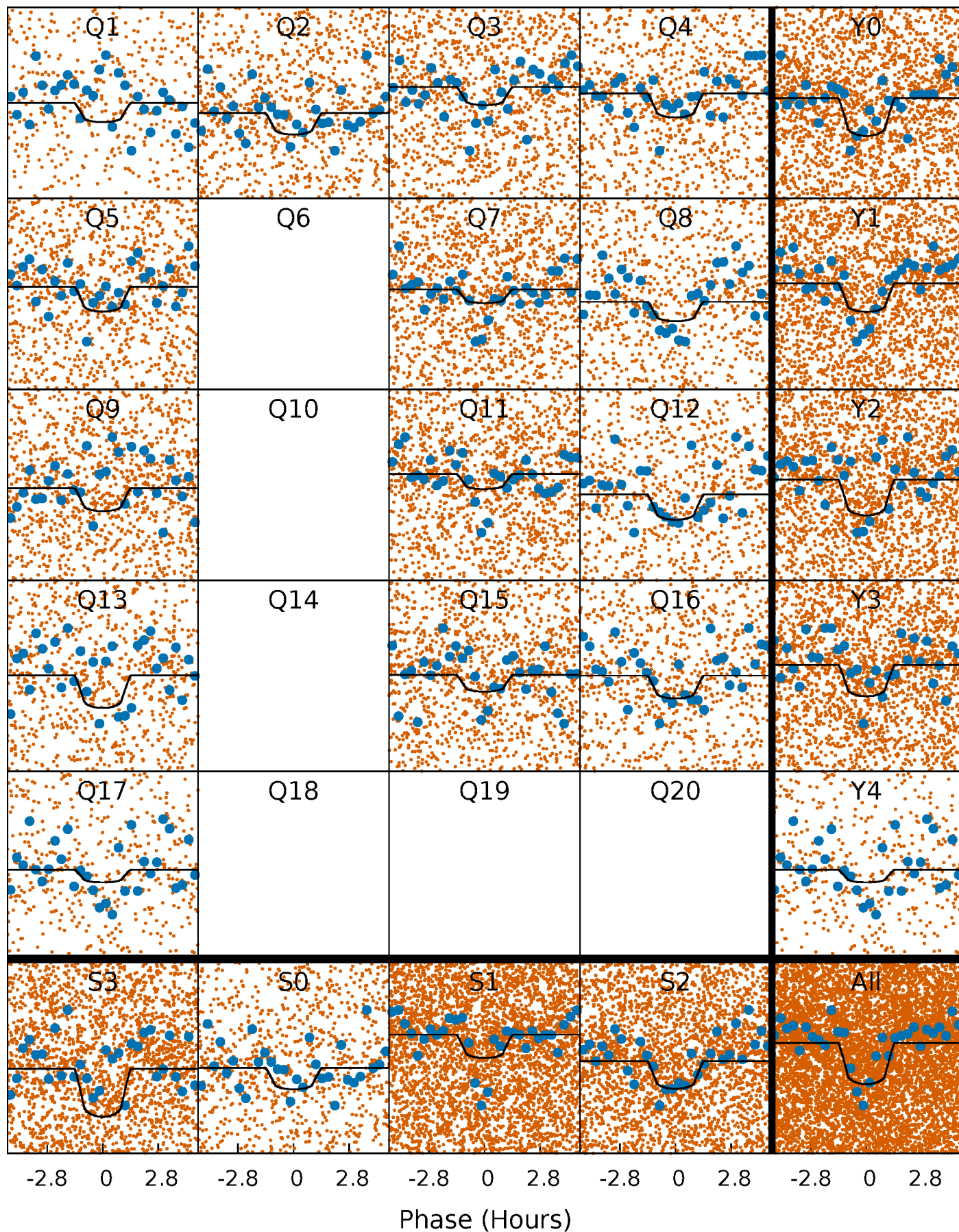
TCE 004579598-02     $P = 0.866329$  Days     $T_0 = 132.080444$  (BKJD)





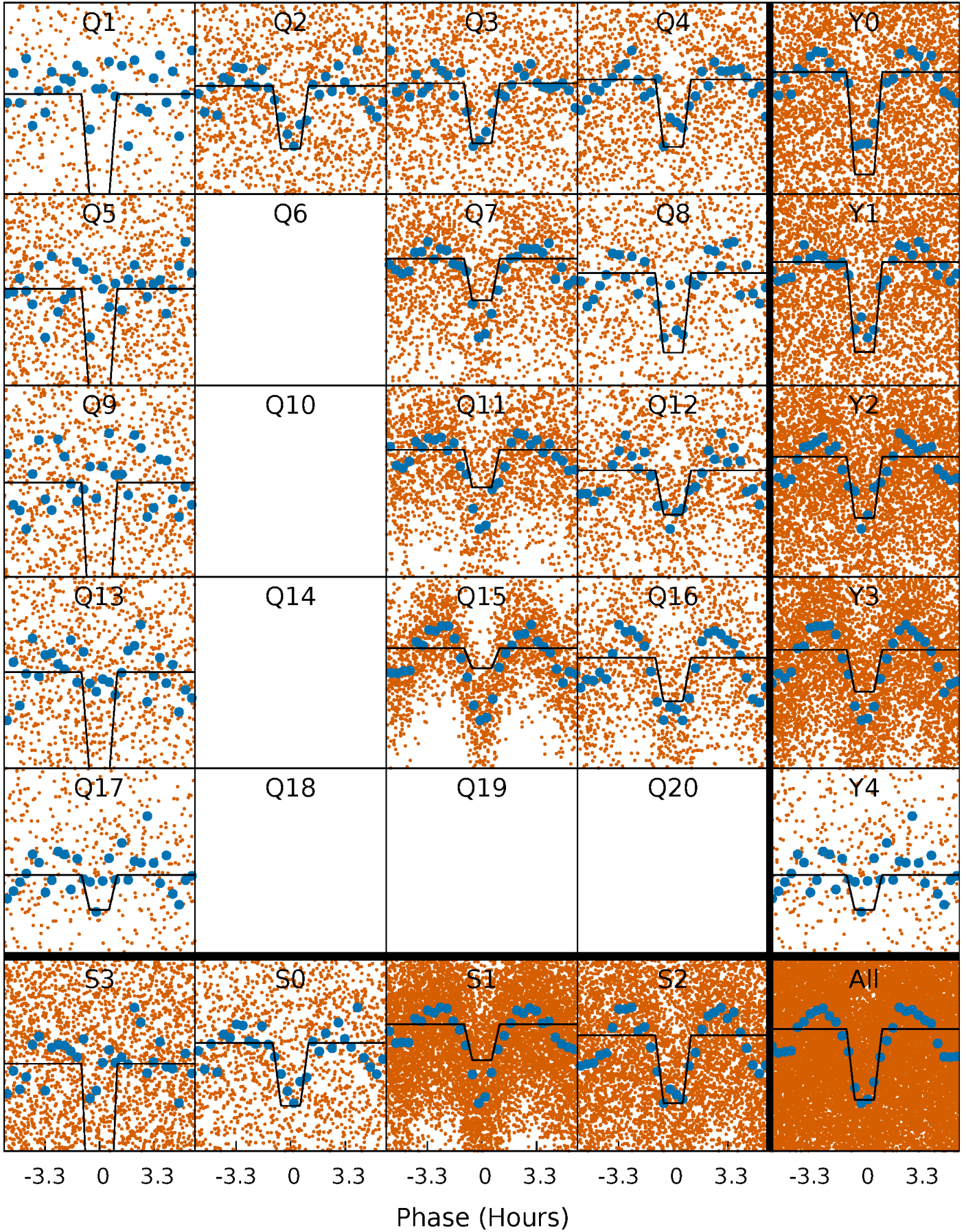
# DV Quarter-Phased Transit Curves

TCE 004579598-02   P= 0.866329 Days    $T_0=132.080444$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

TCE 004579598-02     $P = 0.866343$  Days     $T_0 = 132.065510$  (BKJD)

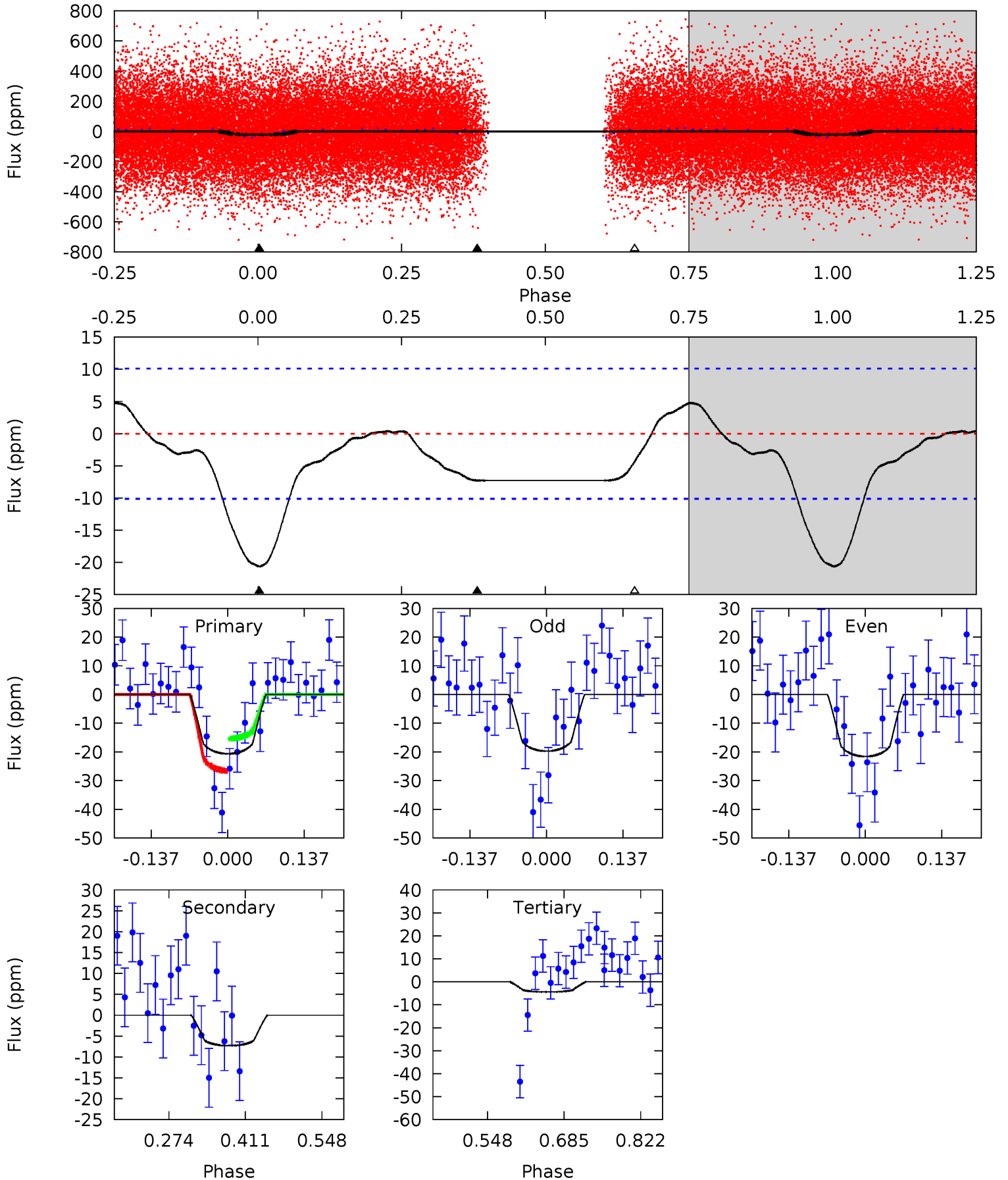




# DV Model-Shift Uniqueness Test

004579598-02, P = 0.866329 Days, E = 131.214115 Days

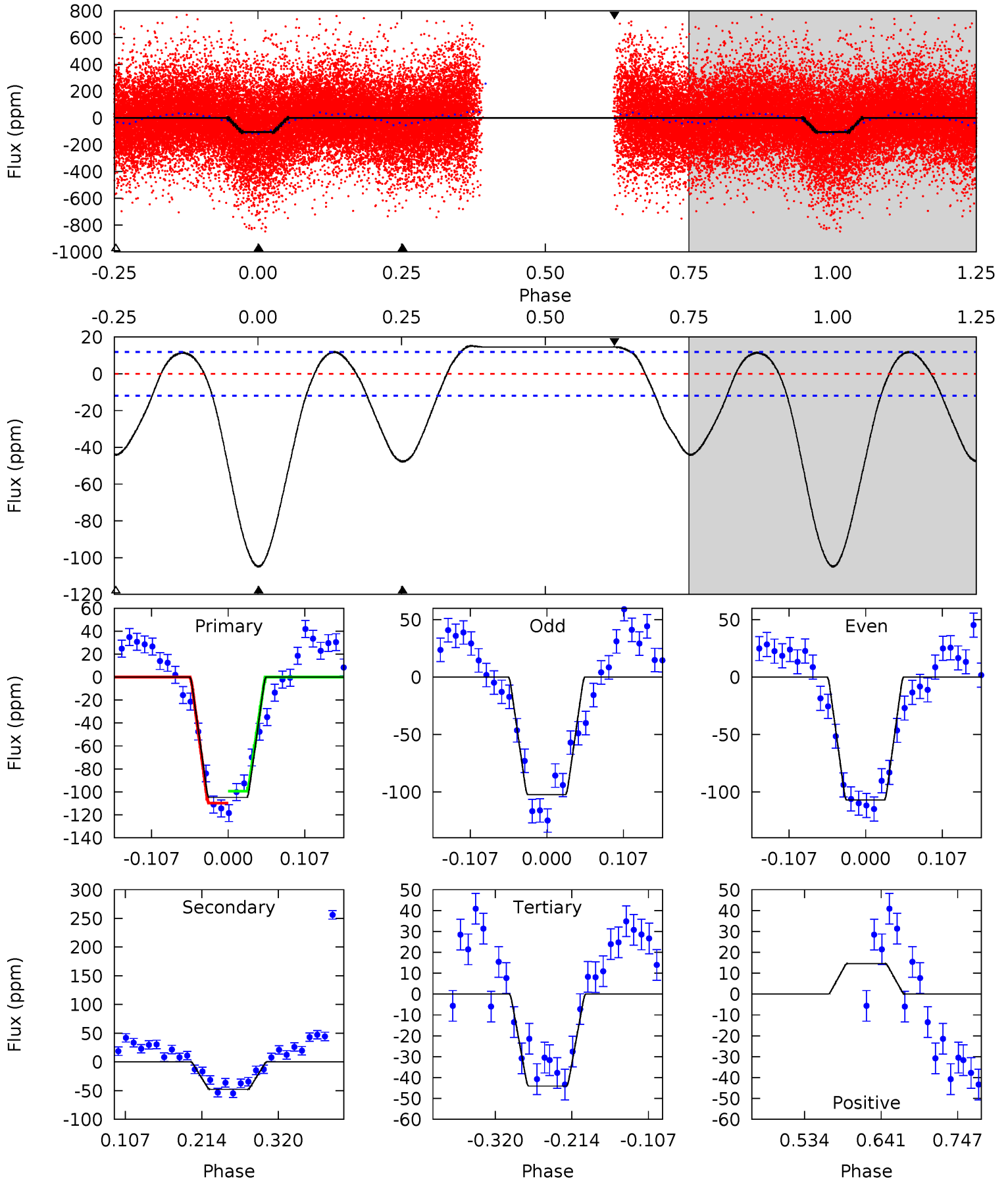
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
9.18	3.25	1.96	0	4.50	1.49	1.30	7.22	9.18	1.29	3.25	0.42	1.02	0.19	2.52



# Alt Model-Shift Uniqueness Test

004579598-02, P = 0.866343 Days, E = 131.199167 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
40.1	18.2	16.9	5.59	4.55	1.61	7.84	23.2	34.5	1.38	12.7	0.91	1.02	0.13	2.13



### Stellar Parameters For KIC 004579598

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6241^{+195}_{-260}$	$4.366^{+0.090}_{-0.210}$	$-0.060^{+0.250}_{-0.300}$	$1.131^{+0.375}_{-0.161}$	$1.079^{+0.189}_{-0.131}$	$1.049^{+0.487}_{-0.556}$
	+3%/-4%	+2%/-5%	+417%/-500%	+33%/-14%	+18%/-12%	+46%/-53%
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 004579598-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-7 \pm 2$	$0.72^{+0.36}_{-0.32}$	$3072^{+249}_{-168}$	$4368^{+1374}_{-737}$	$2.508^{+5.708}_{-1.468}$
Alt.	$-48 \pm 3$	$1.35^{+0.41}_{-0.37}$	$3067^{+247}_{-173}$	$5043^{+797}_{-516}$	$4.677^{+4.243}_{-1.839}$

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

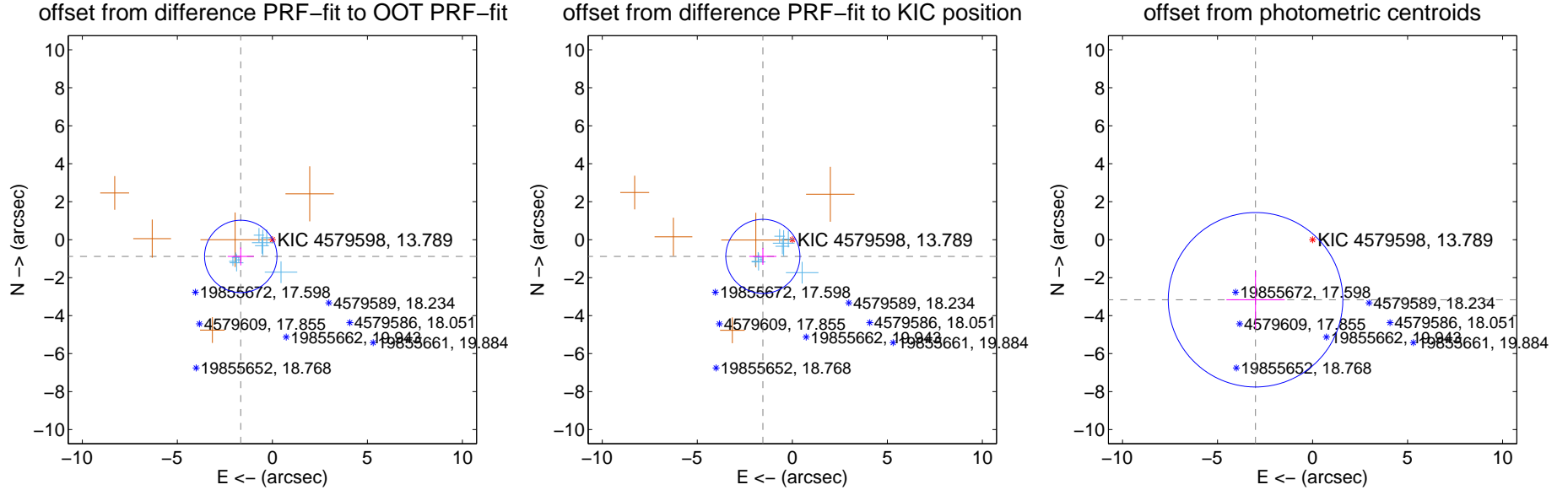
## DV Centroid Data

Supplemental centroid analysis for 004579598-02. Kepler magnitude: 13.79. Transit SNR 7.52

There are 9 quarters with good PRF difference image offsets

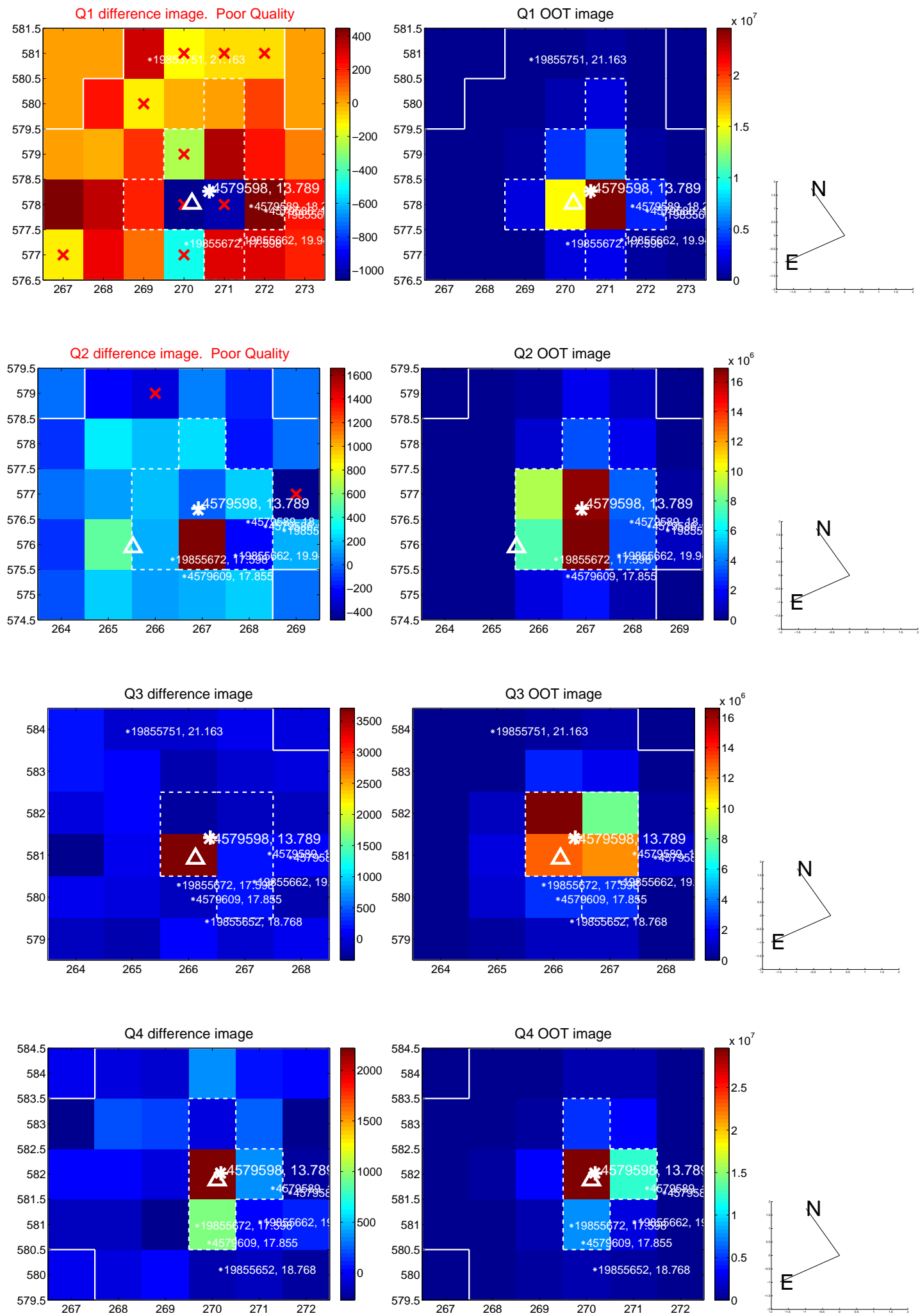
The direct PRF centroid is offset from the target star catalog position by about 0.01 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.883 \pm 0.635$	2.96	$1.663 \pm 0.687$	$-0.883 \pm 0.472$
PRF-fit source offset from KIC position	$1.783 \pm 0.650$	2.74	$1.550 \pm 0.713$	$-0.880 \pm 0.445$
photometric centroid source offset	$4.36 \pm 1.53$	2.85	$3.00 \pm 1.53$	$-3.16 \pm 1.53$



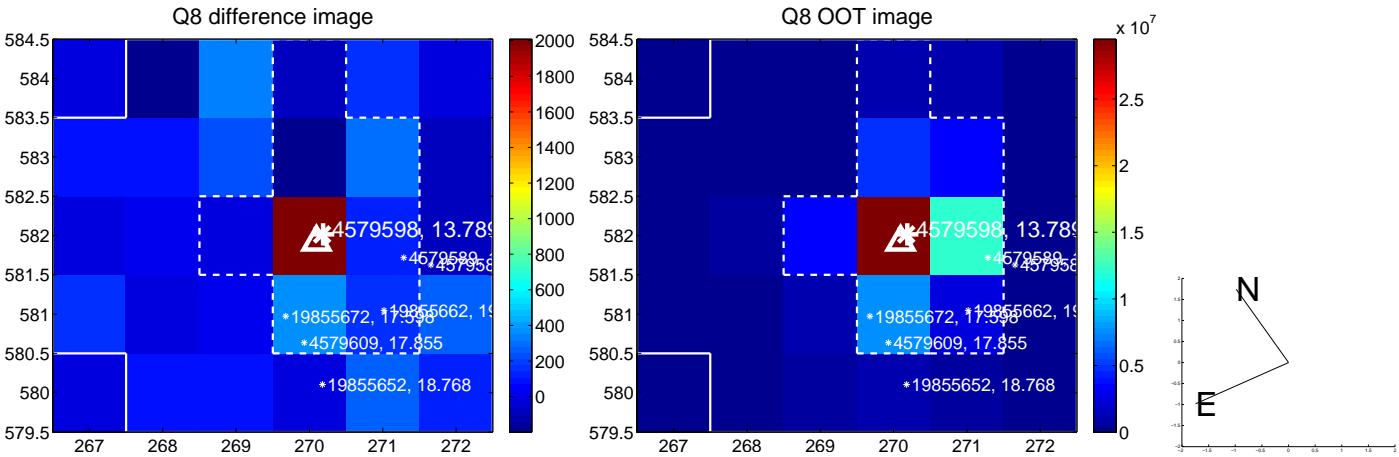
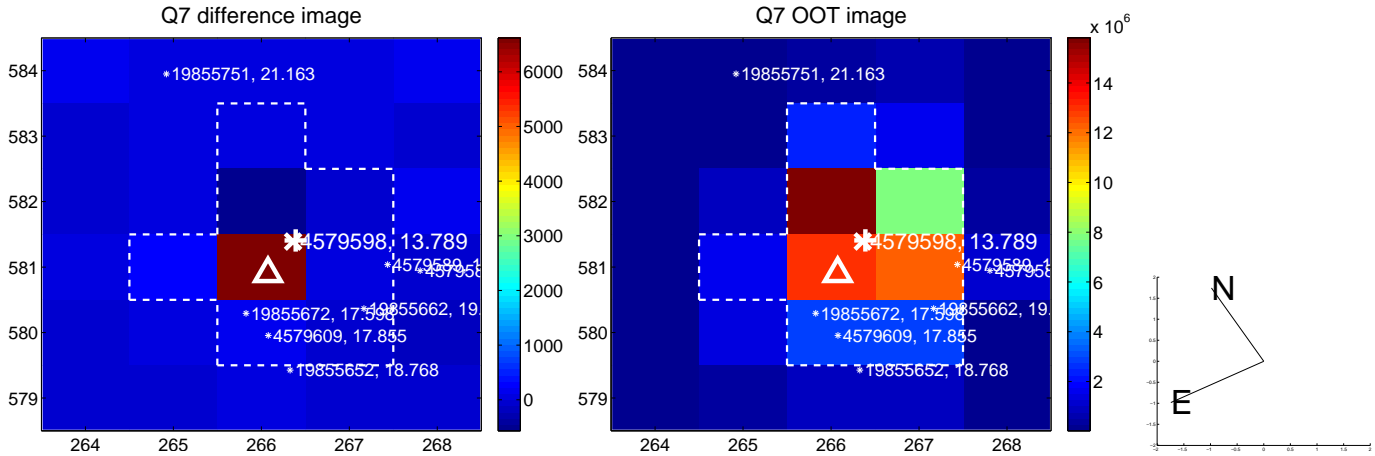
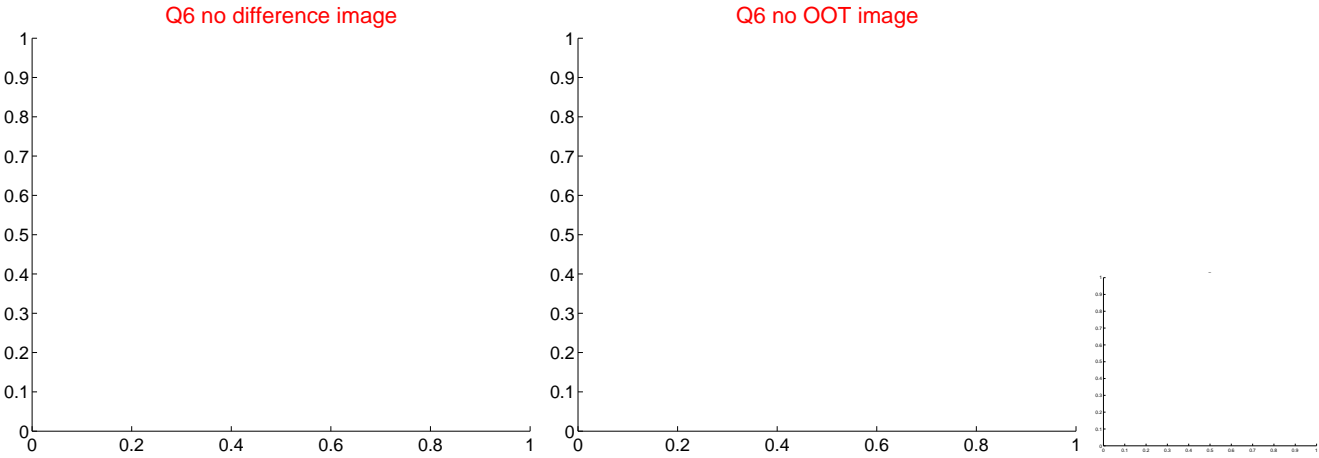
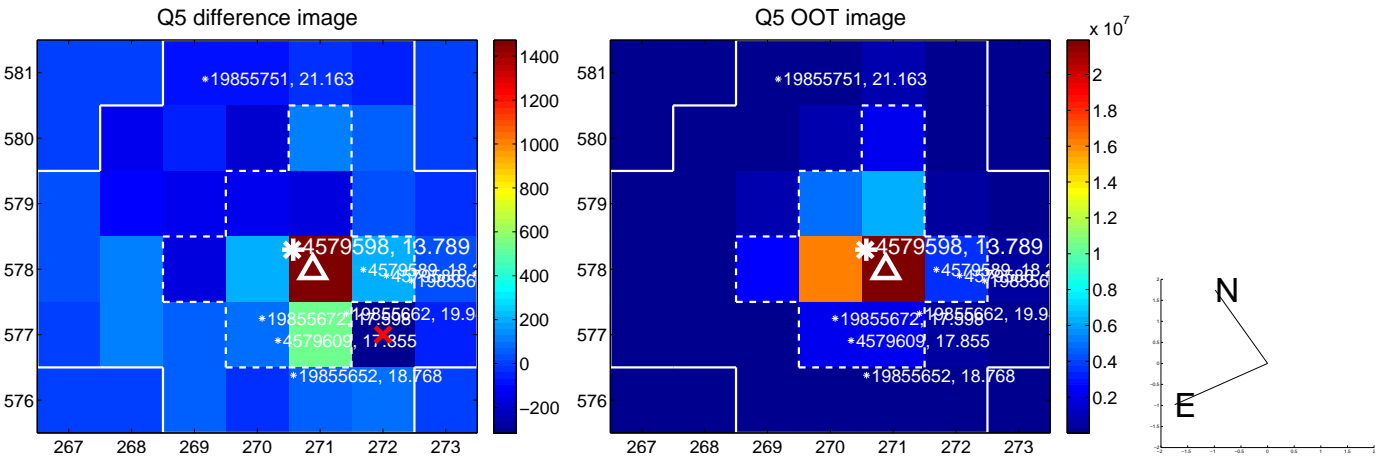
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

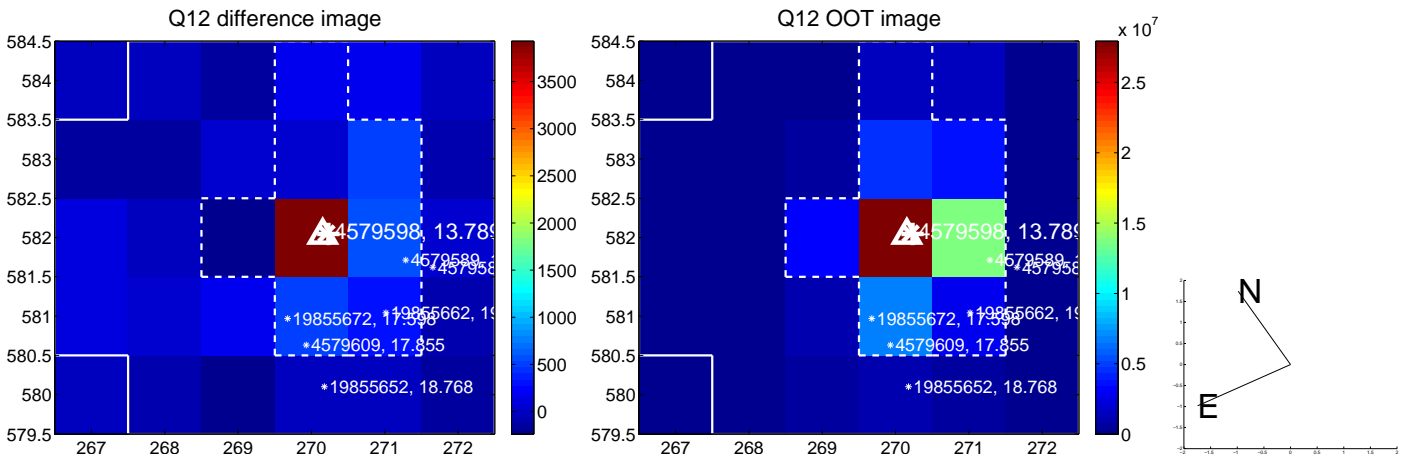
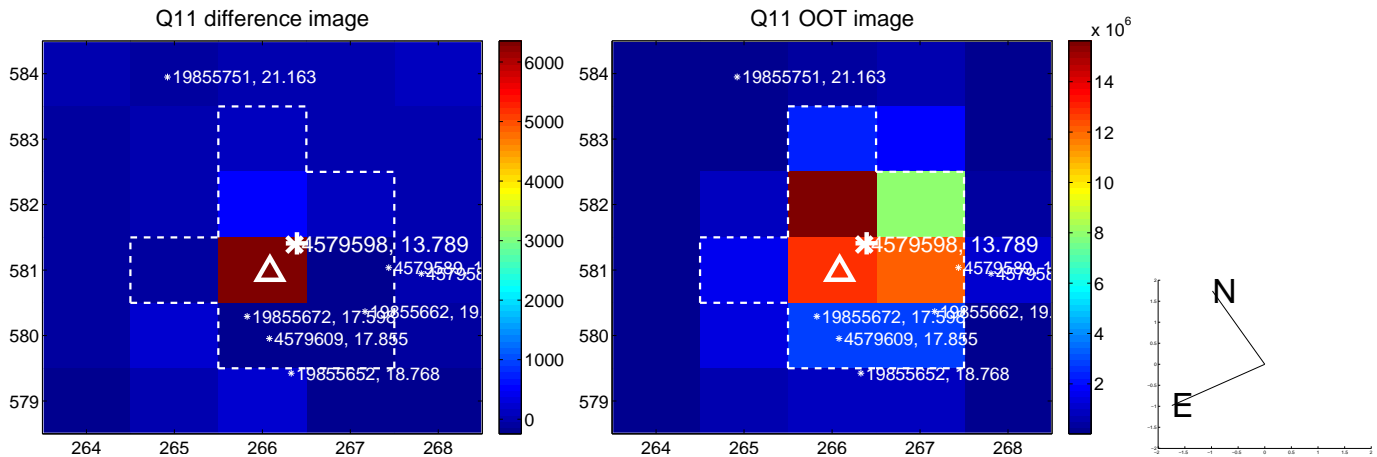
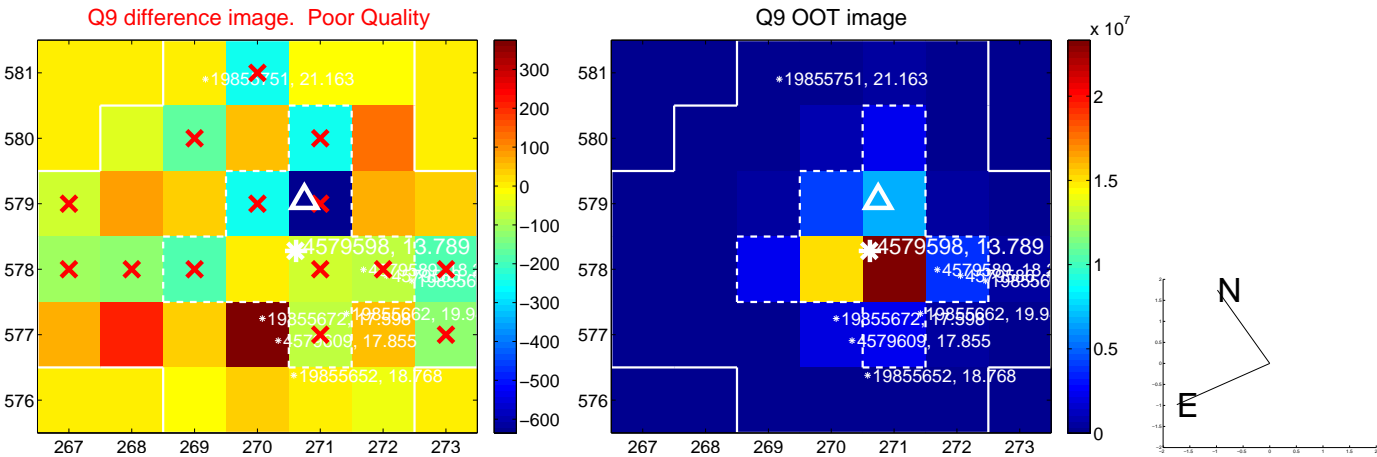




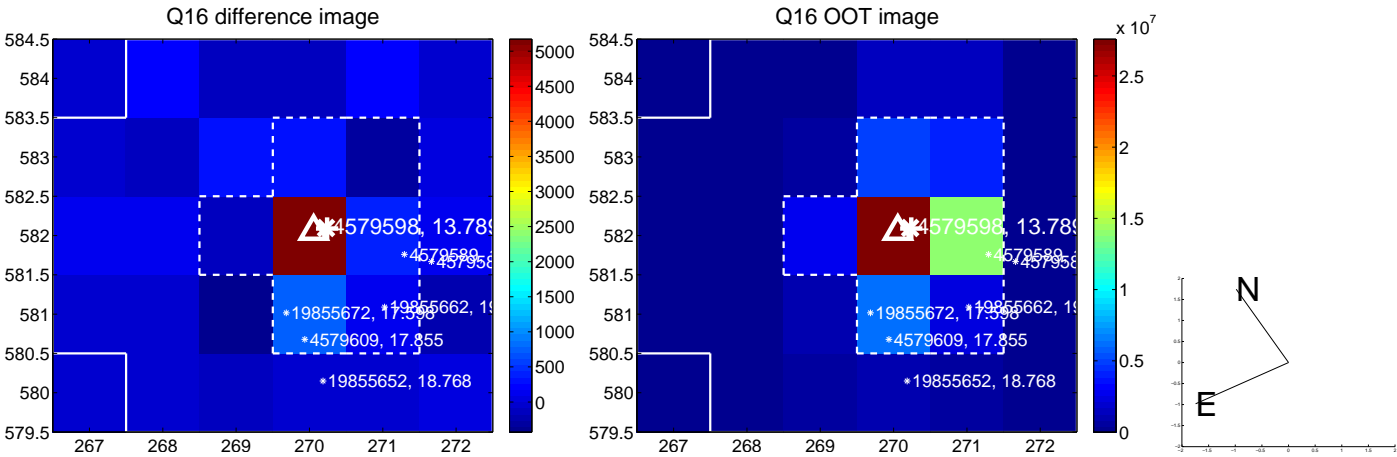
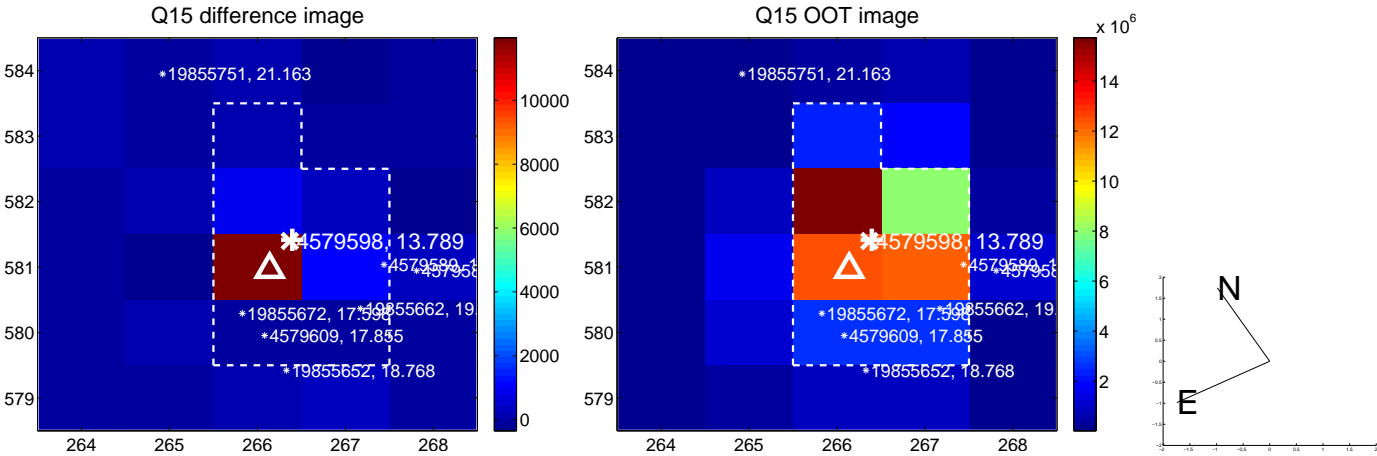
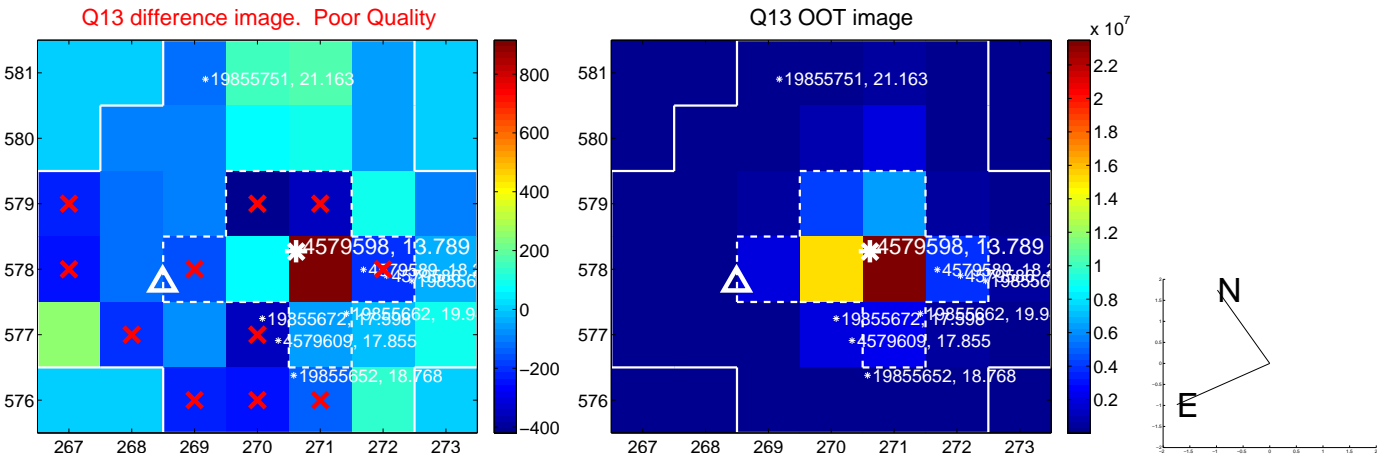
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



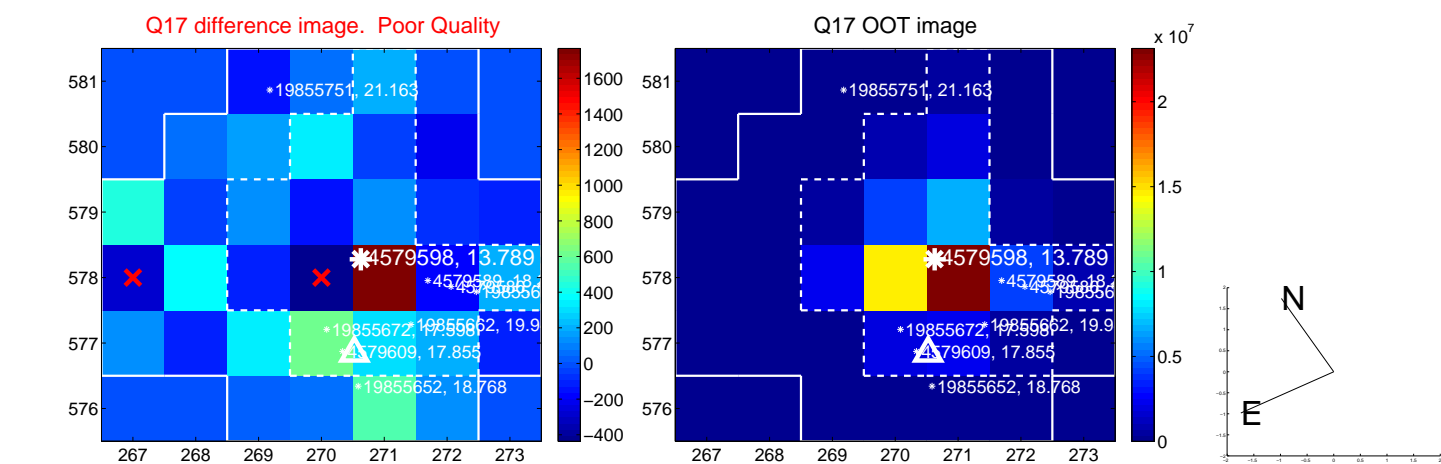
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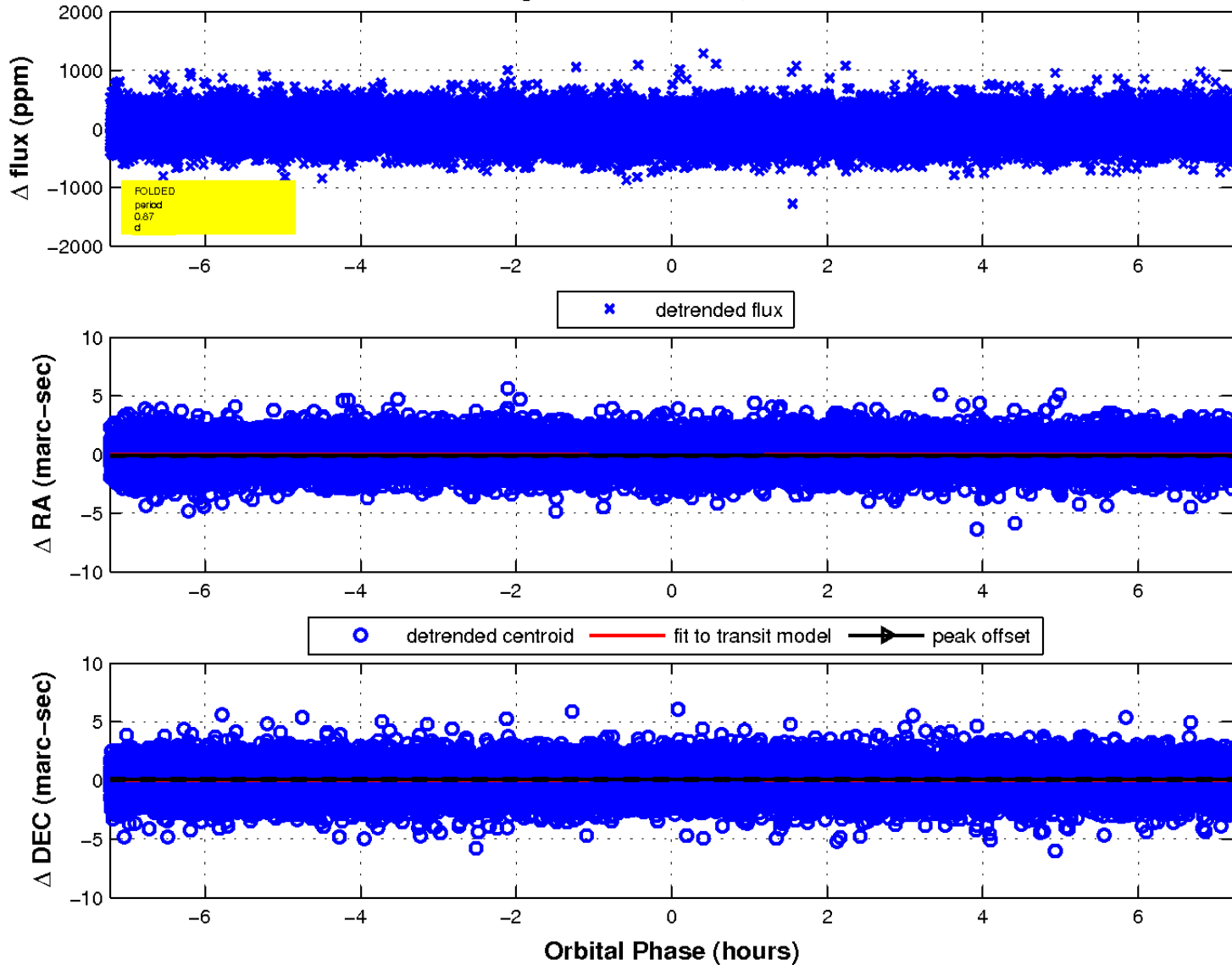
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white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



fluxWeightedCentroids, Planet 2 of 2



UKIRT Image

Declination

