

# KIC 002998561

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
002998561-01	OBS	No	0.558661	131.532336	149.5	2.182	15.6	16.8	2.37	7426	3.35	59374.98
002998561-02	OBS	No	0.558642	131.967888	145.6	4.694	18.8	13.5	2.37	7426	2.92	59377.65

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
002998561-01	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT
002998561-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE_ZUMA—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—SAME_NTL_PERIOD—CENT_FEW_DIFFS

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

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

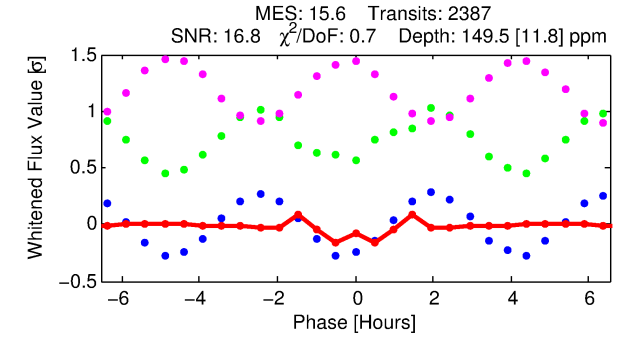
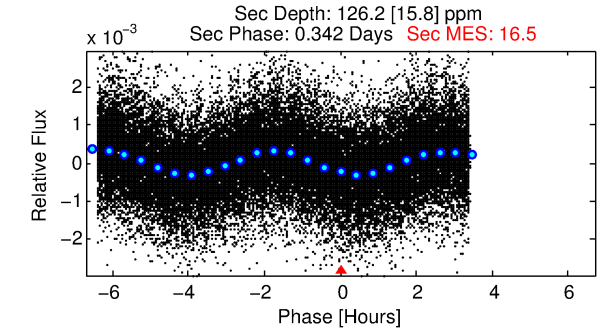
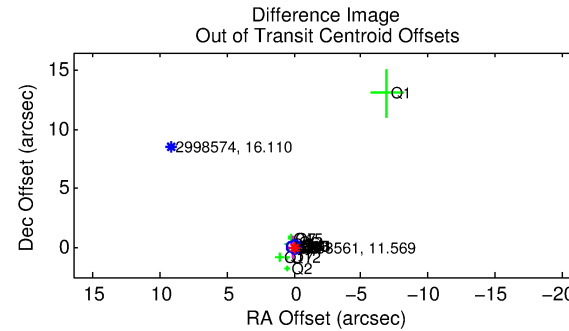
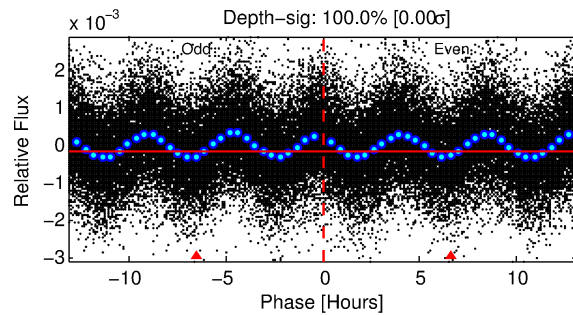
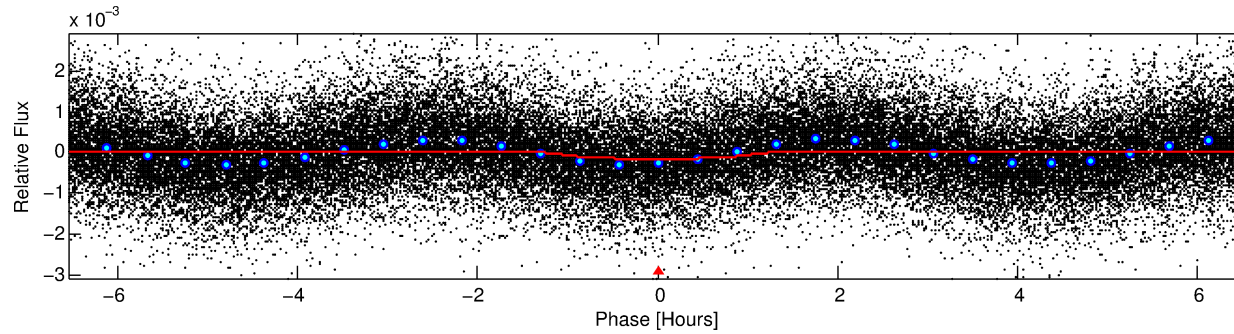
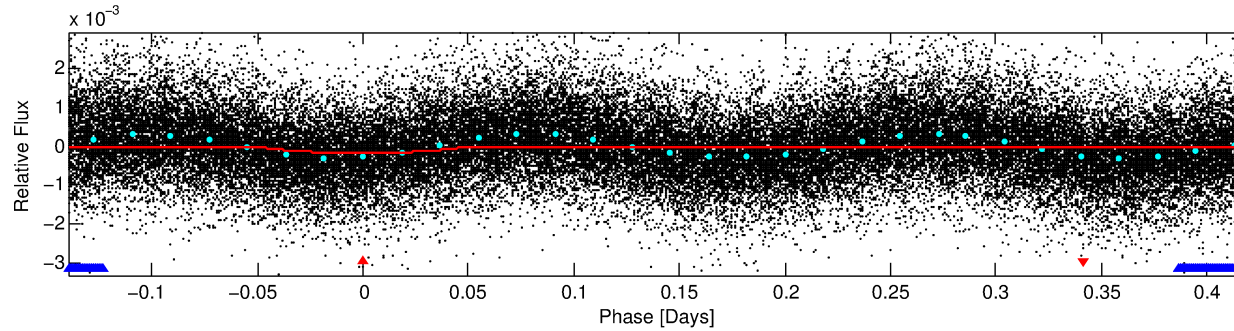
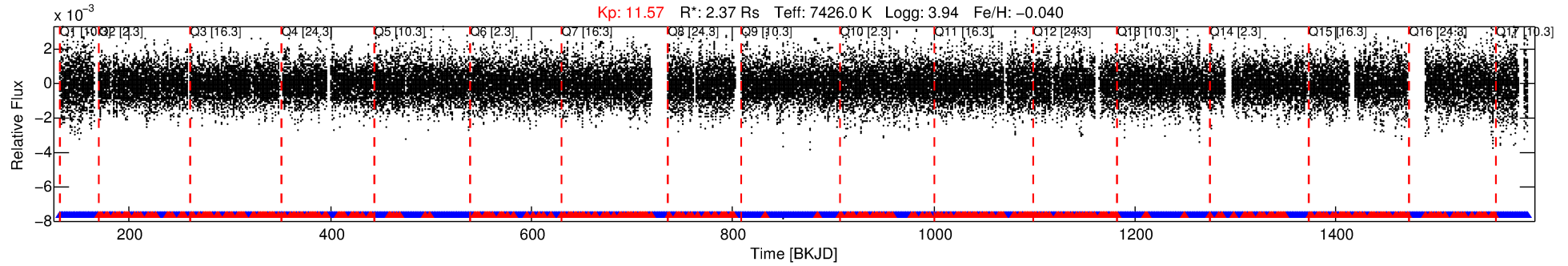
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 002998561-01

No Significant Match Found

# DV One-Page Summary

KIC: 2998561 Candidate: 1 of 2 Period: 0.559 d



## DV Fit Results:

Period = 0.55866 [0.00001] d  
Epoch = 131.5323 [0.0006] BKJD  
Rp/R\* = 0.0130 [0.0014]  
a/R\* = 1.31 [0.32]  
b = 0.90 [0.13]  
Seff = 59374.98 [29555.31]  
Teq = 3980 [495] K  
Rp = 3.35 [1.24] Re  
a = 0.0160 [0.0049] AU  
Ag = 1.59 [0.83] [0.70 $\sigma$ ]  
Teffp = 6908 [530] K [4.04 $\sigma$ ]

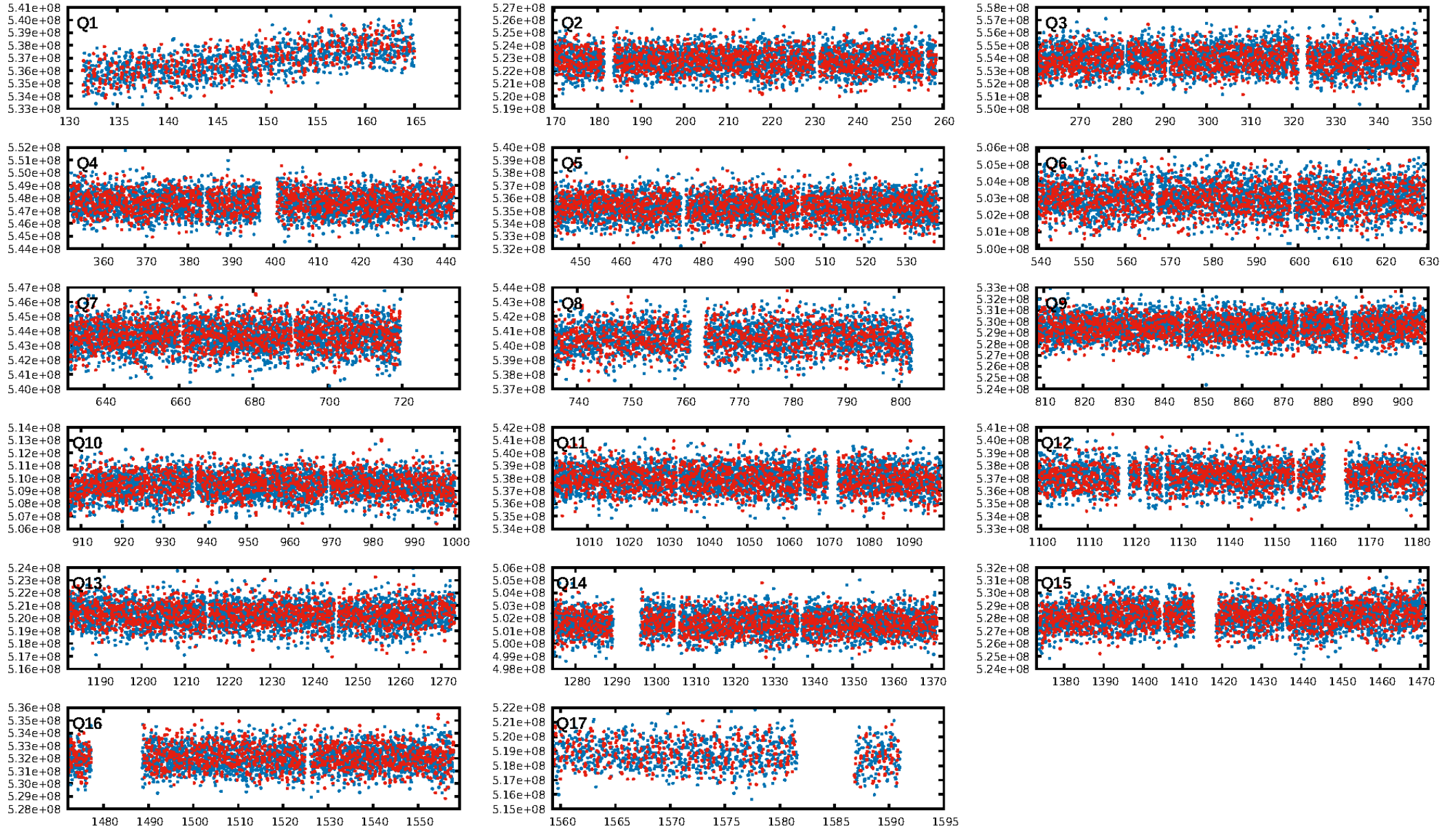
## DV Diagnostic Results:

ShortPeriod-sig: 0.0% [0.00 $\sigma$ ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: N/A  
RollingBand-fgt: 0.82 [1870/2279]  
GhostDiagnostic-chr: 1.789  
Centroid-sig: 0.9%  
Centroid-so: 0.462 arcsec [4.48 $\sigma$ ]  
OotOffset-rm: 0.051 arcsec [0.29 $\sigma$ ]  
KicOffset-rm: 0.098 arcsec [0.21 $\sigma$ ]  
OotOffset-st: 4/4/4/5 [17]  
KicOffset-st: 4/4/4/5 [17]  
DiffImageQuality-fgm: 0.76 [13/17]  
DiffImageOverlap-fno: 0.00 [0/17]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 04:39:43 Z

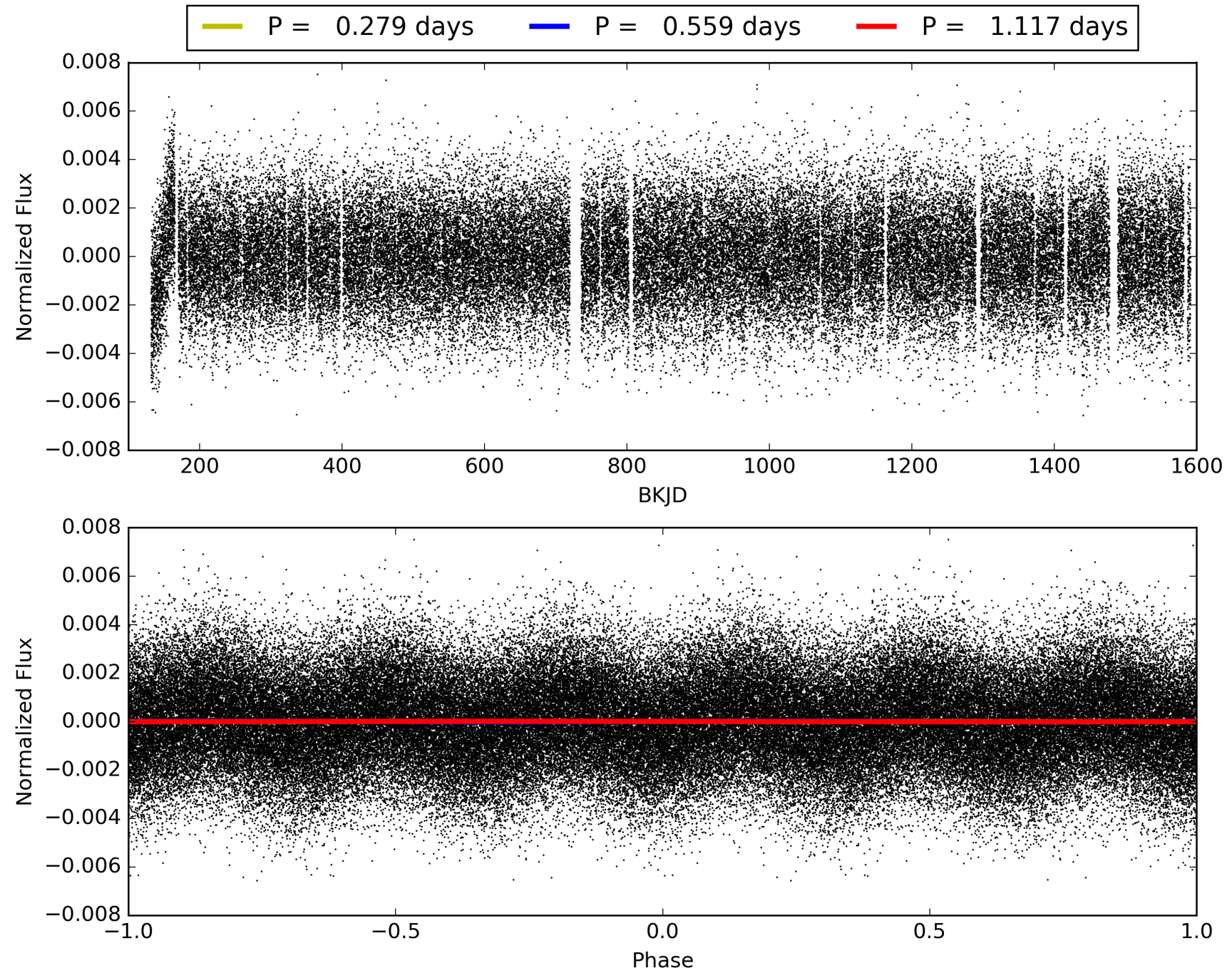
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 002998561-01, PDC Light Curves



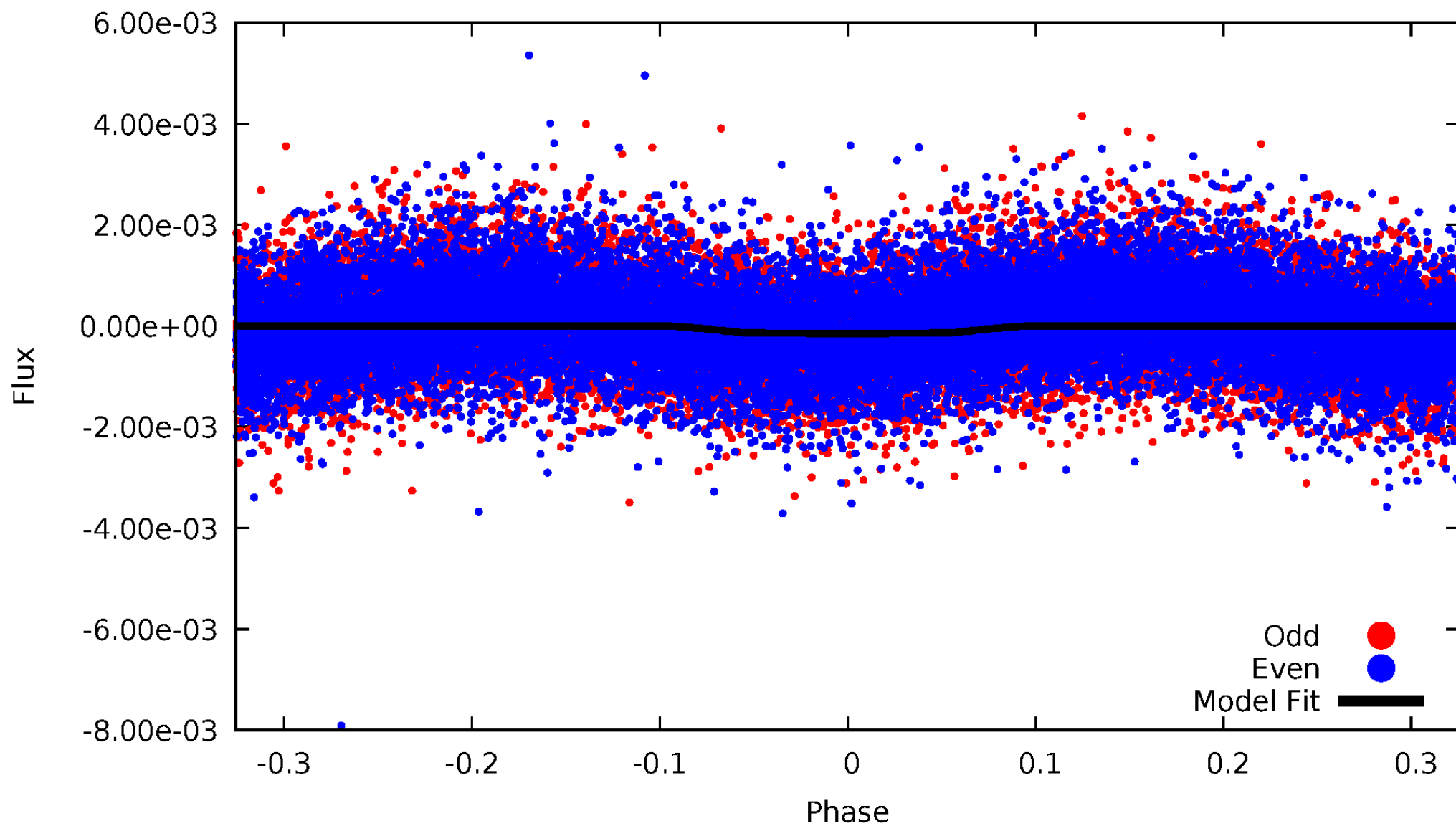


TCE 002998561-01



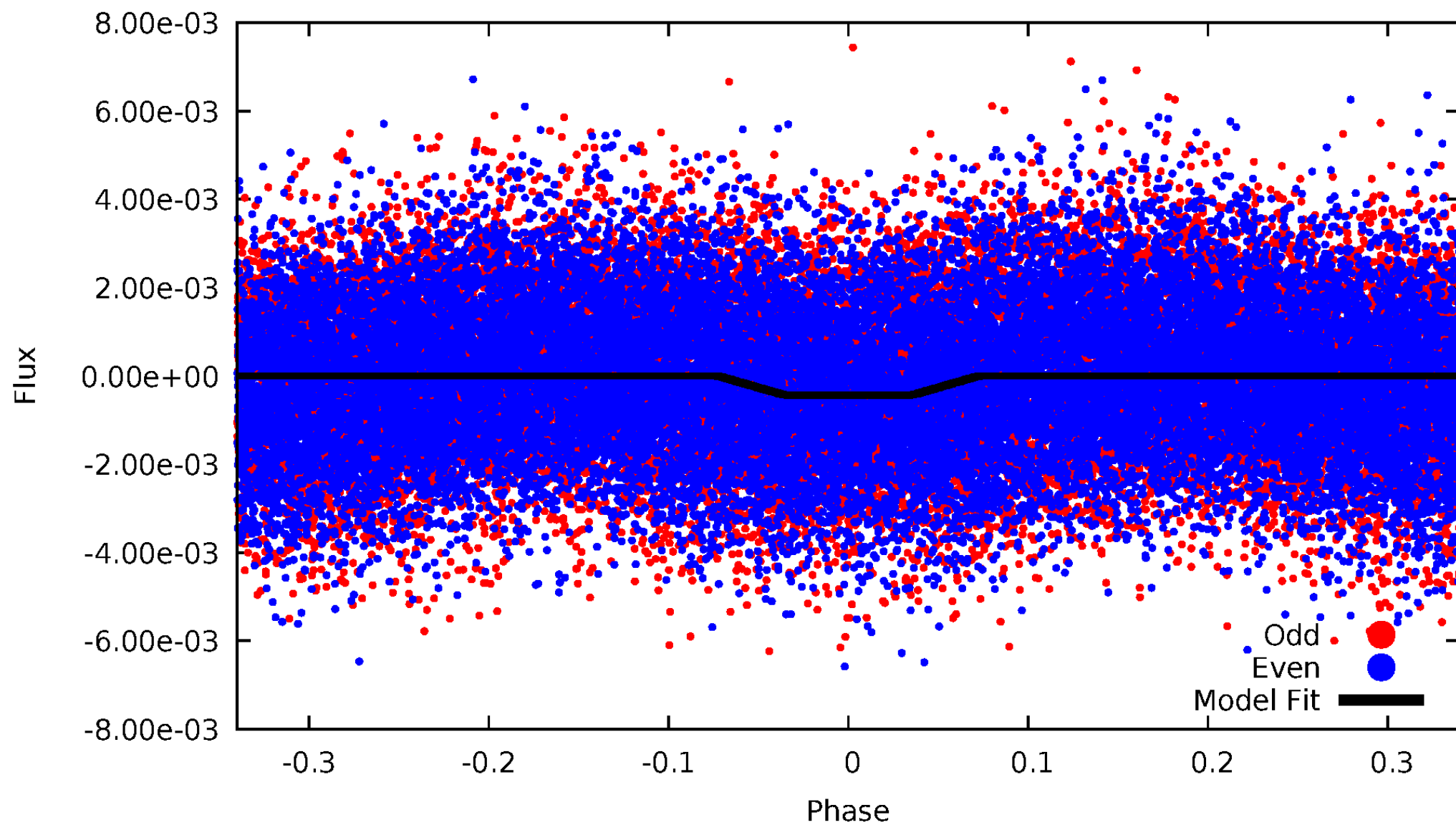
# DV Odd/Even

TCE 002998561-01



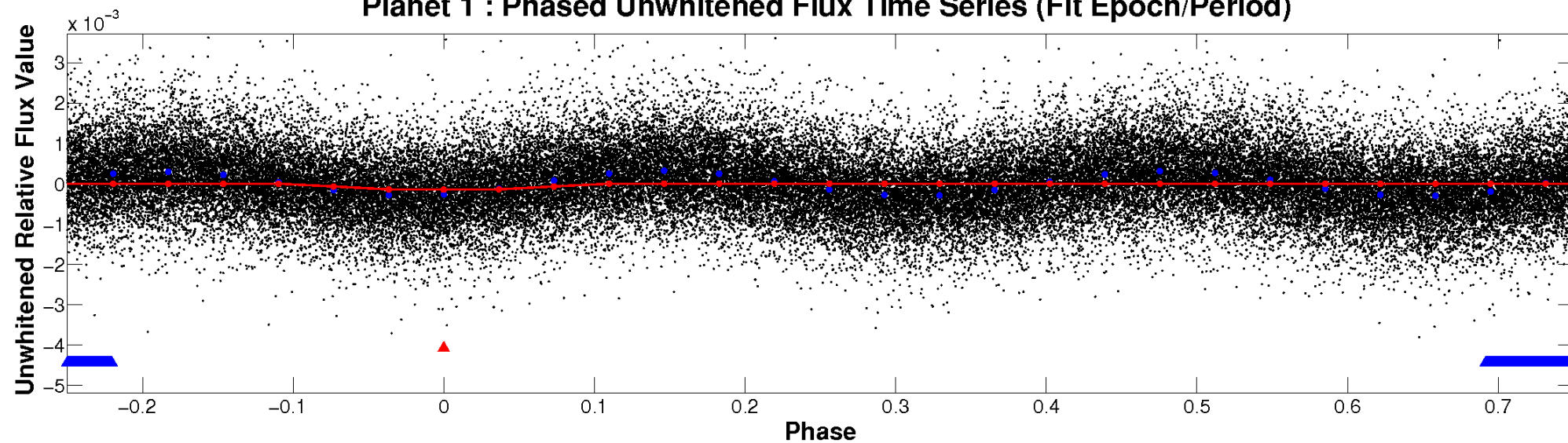
# ALT Odd/Even

TCE 002998561-01

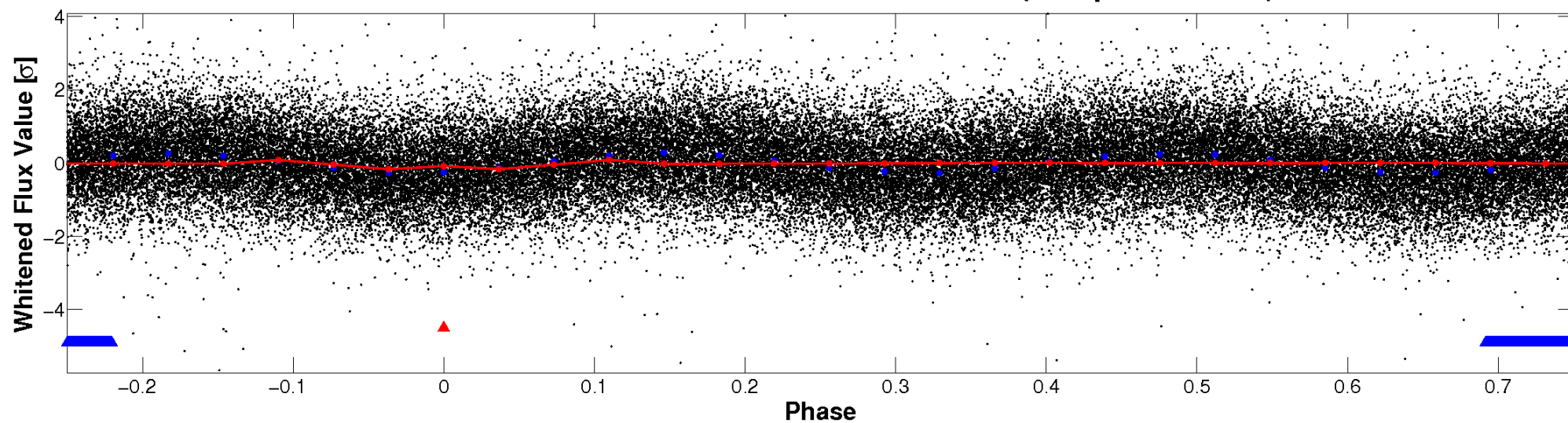


# Non-Whitened Vs. Whitened Light Curve

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



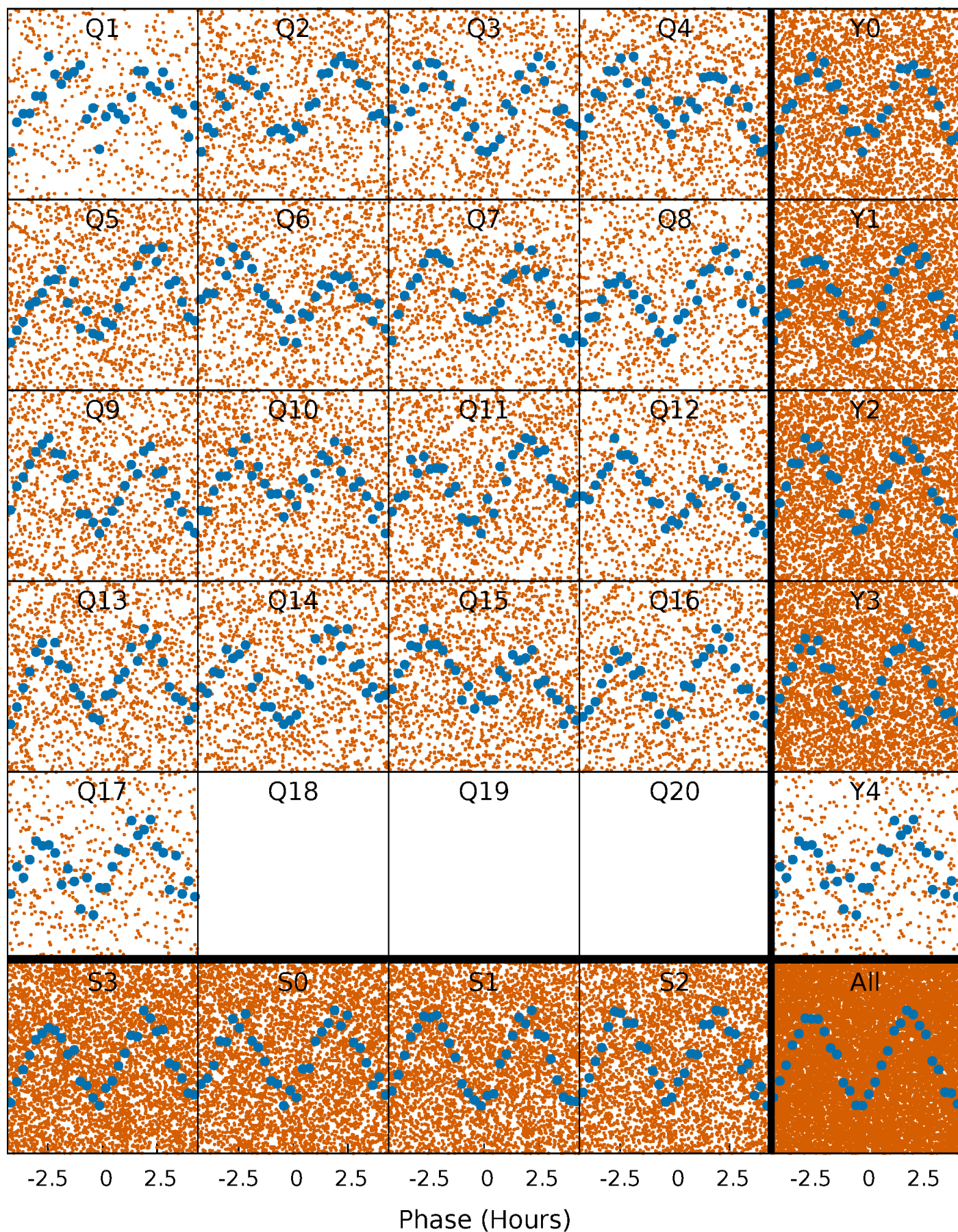
**Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)**





# PDC Quarter-Phased Transit Curves

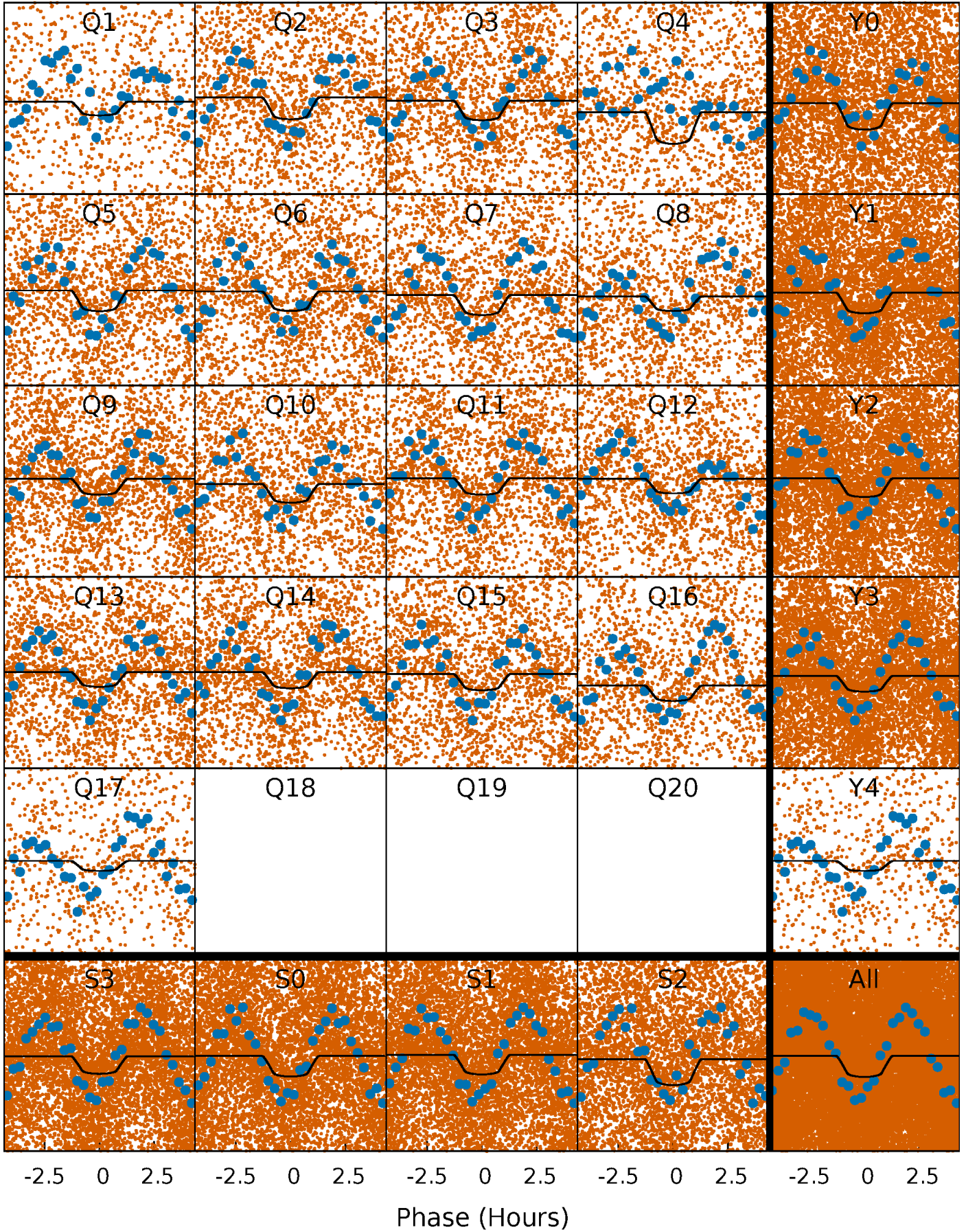
TCE 002998561-01 P= 0.558661 Days  $T_0=131.532336$  (BKJD)





# DV Quarter-Phased Transit Curves

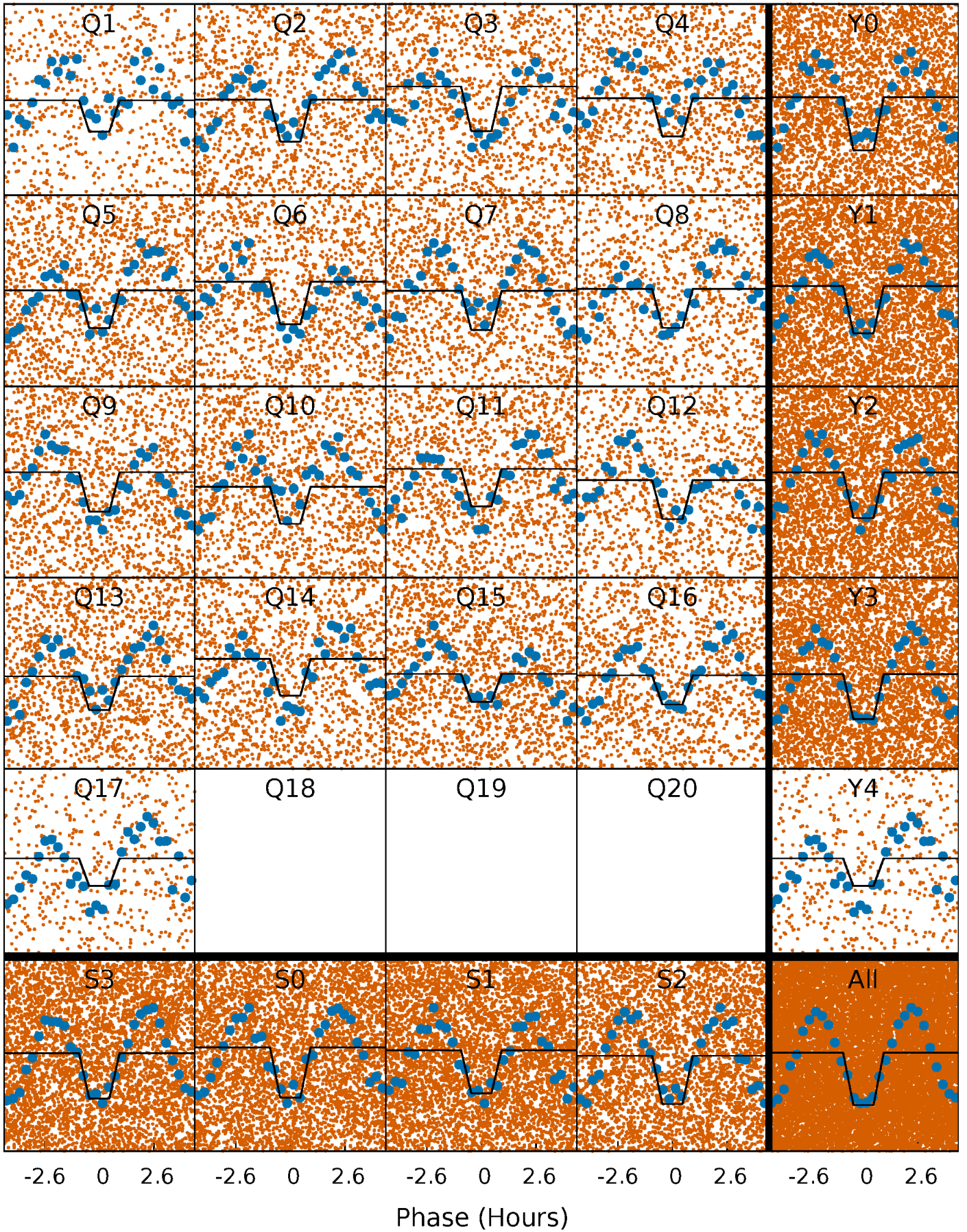
TCE 002998561-01   P= 0.558661 Days    $T_0=131.532336$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

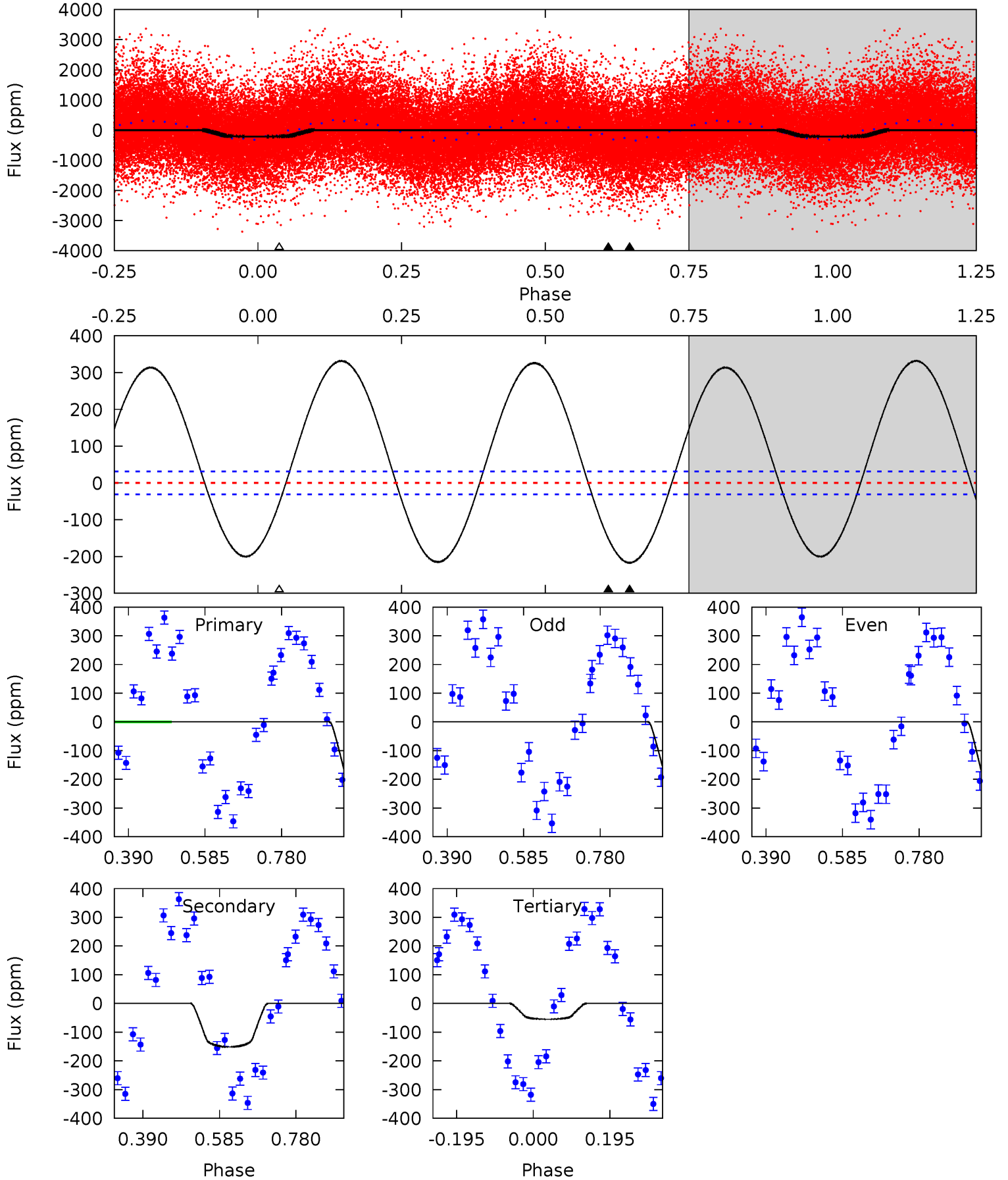
TCE 002998561-01 P= 0.558655 Days  $T_0=131.530570$  (BKJD)



# DV Model-Shift Uniqueness Test

002998561-01, P = 0.558661 Days, E = 130.973675 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
30.8	21.5	7.80	0	4.42	1.30	25.5	23.0	30.8	13.7	21.5	1.59	1.16	0.60	12.3

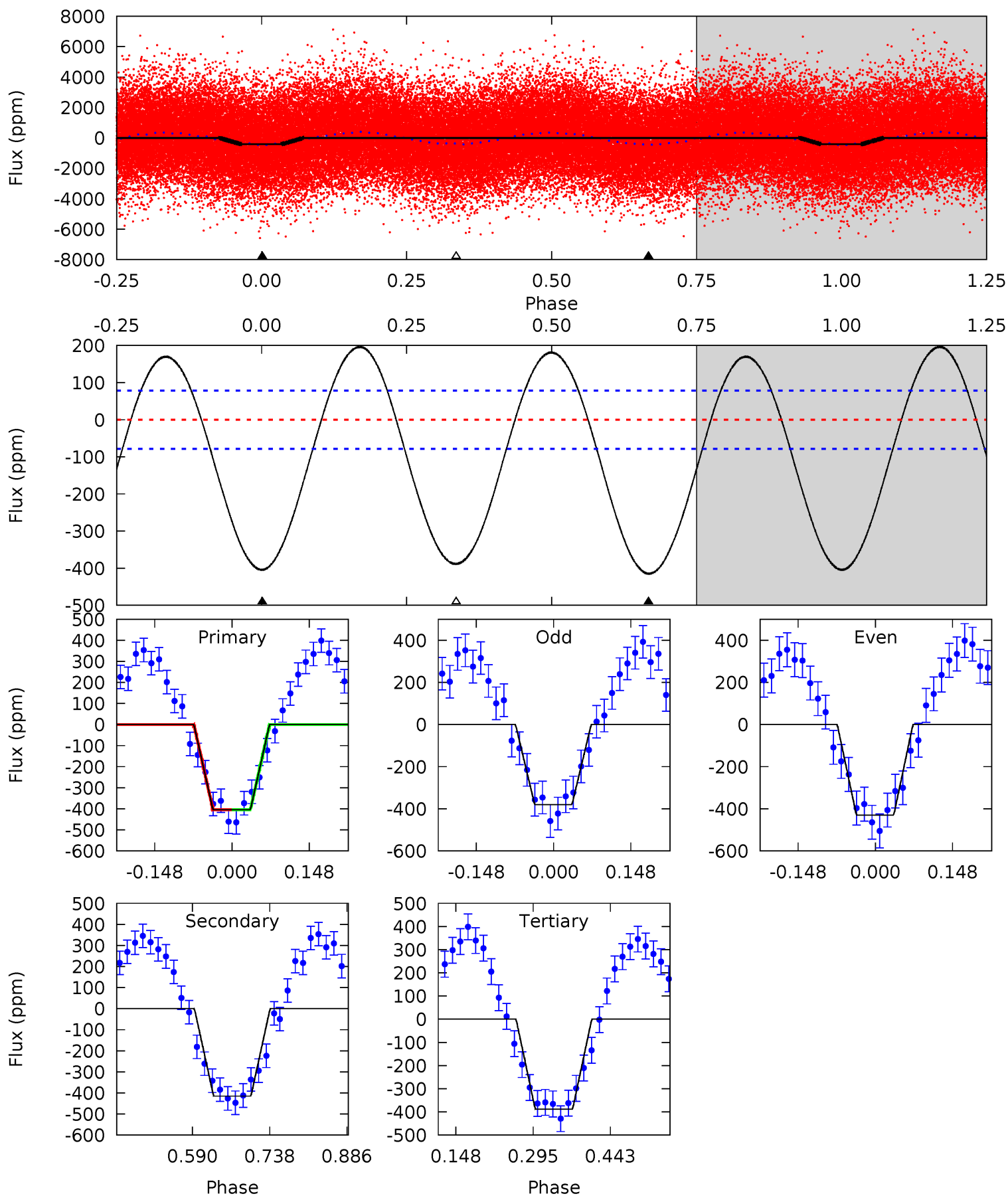




# Alt Model-Shift Uniqueness Test

002998561-01, P = 0.558655 Days, E = 130.971915 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
23.1	23.7	22.2	0	4.48	1.45	12.2	0.91	23.1	1.50	23.7	1.43	1.07	0.32	0.01



### Stellar Parameters For KIC 002998561

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$7426^{+207}_{-337}$	$3.935^{+0.260}_{-0.140}$	$-0.040^{+0.200}_{-0.350}$	$2.365^{+0.514}_{-0.836}$	$1.756^{+0.186}_{-0.373}$	$0.187^{+0.320}_{-0.078}$
	+3%/-5%	+7%/-4%	+500%/-875%	+22%/-35%	+11%/-21%	+171%/-42%
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 002998561-01 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-151 \pm 7$	$3.23^{+0.62}_{-0.58}$	$5498^{+393}_{-465}$	$6819^{+626}_{-490}$	$1.993^{+0.957}_{-0.571}$
Alt.	$-415 \pm 18$	$5.22^{+0.83}_{-0.95}$	$5474^{+387}_{-470}$	$7003^{+434}_{-401}$	$2.132^{+0.867}_{-0.495}$

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

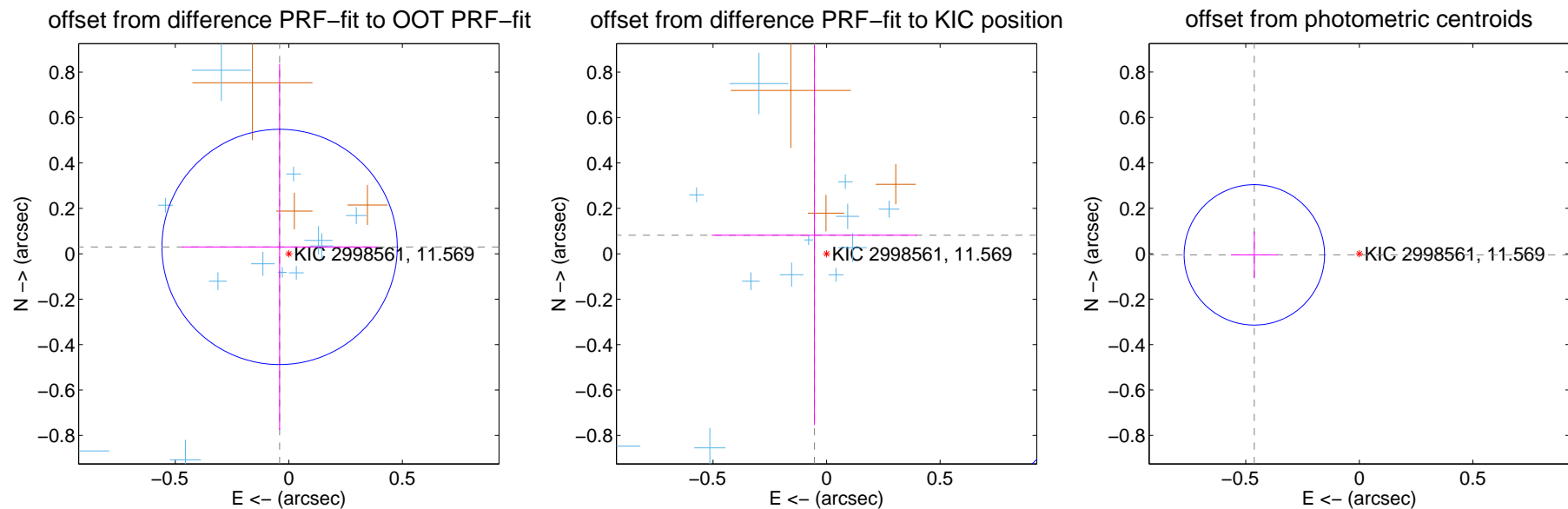
## DV Centroid Data

Supplemental centroid analysis for 002998561-01. **Kepler magnitude: 11.57.** Transit SNR 16.81

There are 13 quarters with good PRF difference image offsets

The direct PRF centroid is offset from the target star catalog position by about 0.04 arcsec

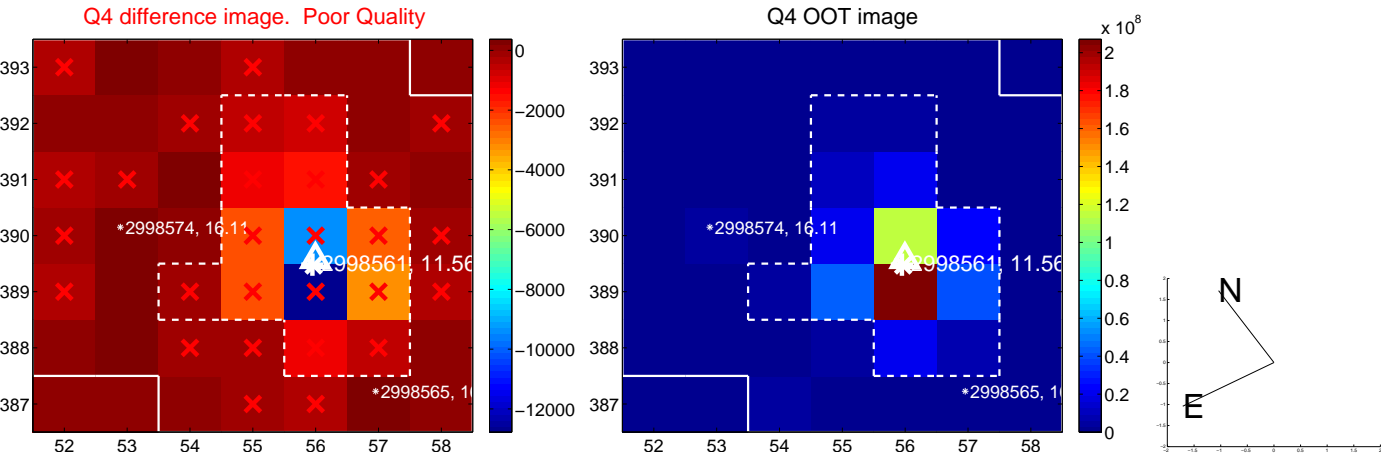
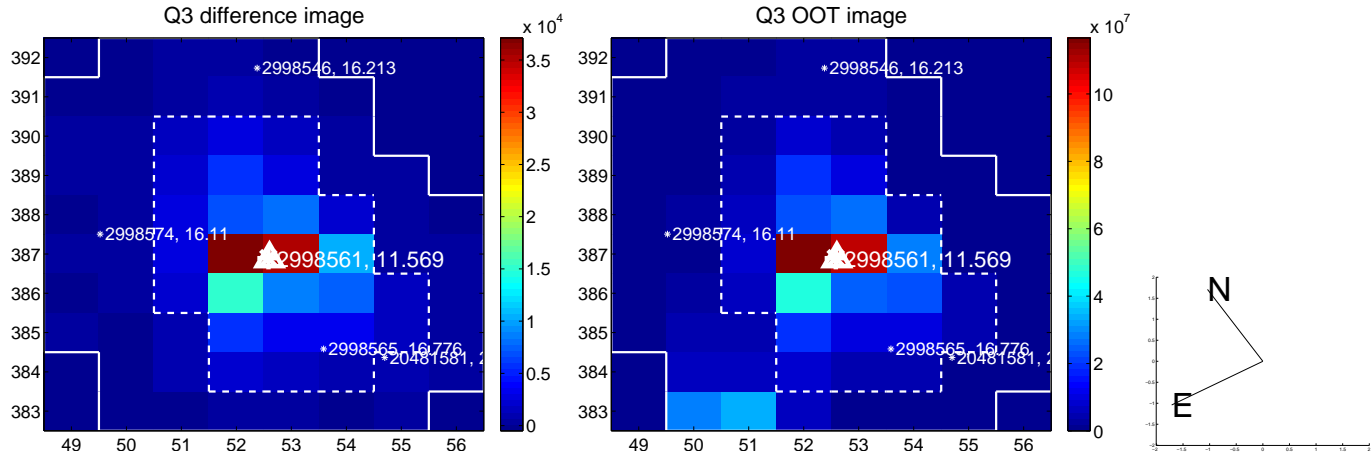
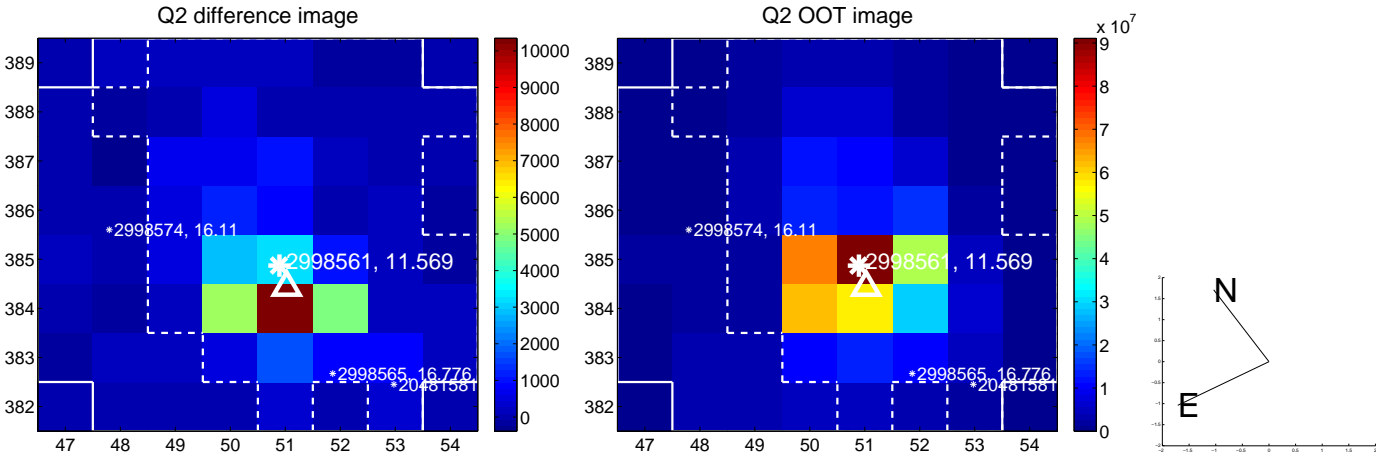
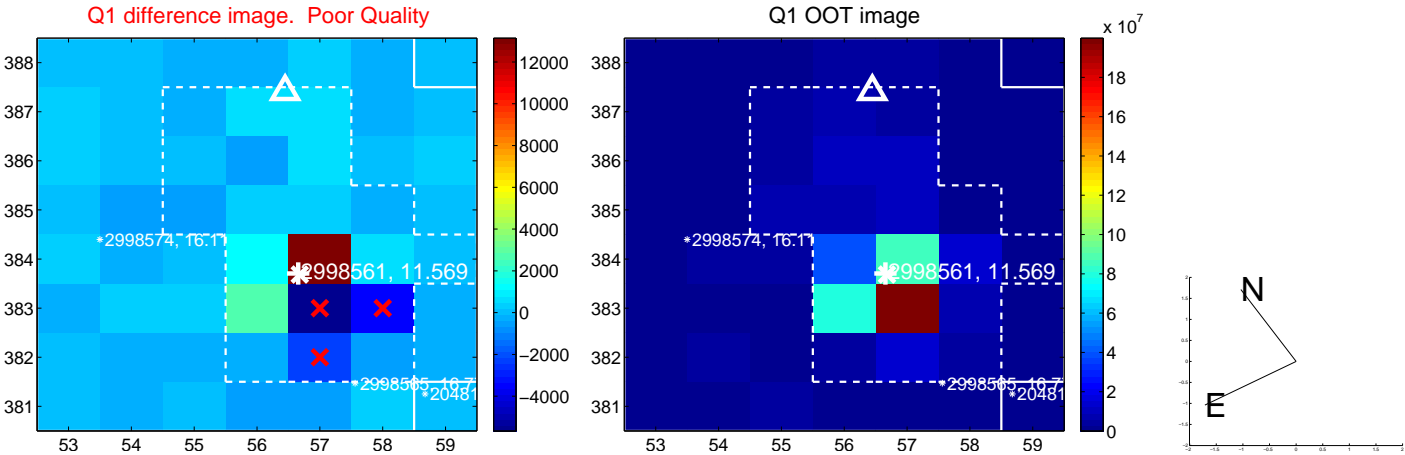
	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.051 \pm 0.173$	0.29	$0.041 \pm 0.430$	$0.030 \pm 0.805$
PRF-fit source offset from KIC position	$0.098 \pm 0.463$	0.21	$0.053 \pm 0.453$	$0.082 \pm 0.835$
photometric centroid source offset	$0.46 \pm 0.10$	4.48	$0.46 \pm 0.10$	$-0.01 \pm 0.10$



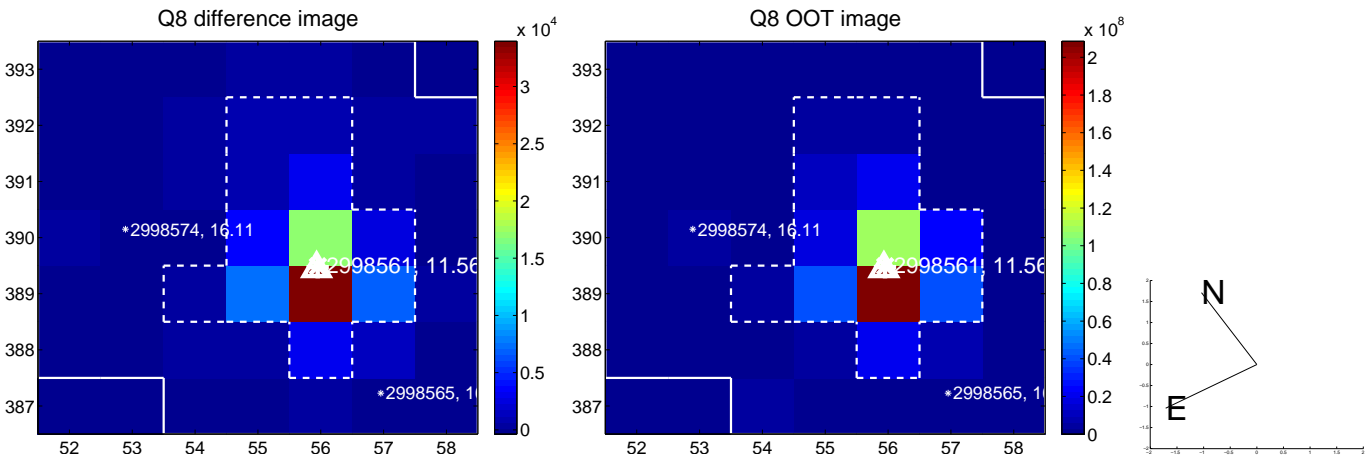
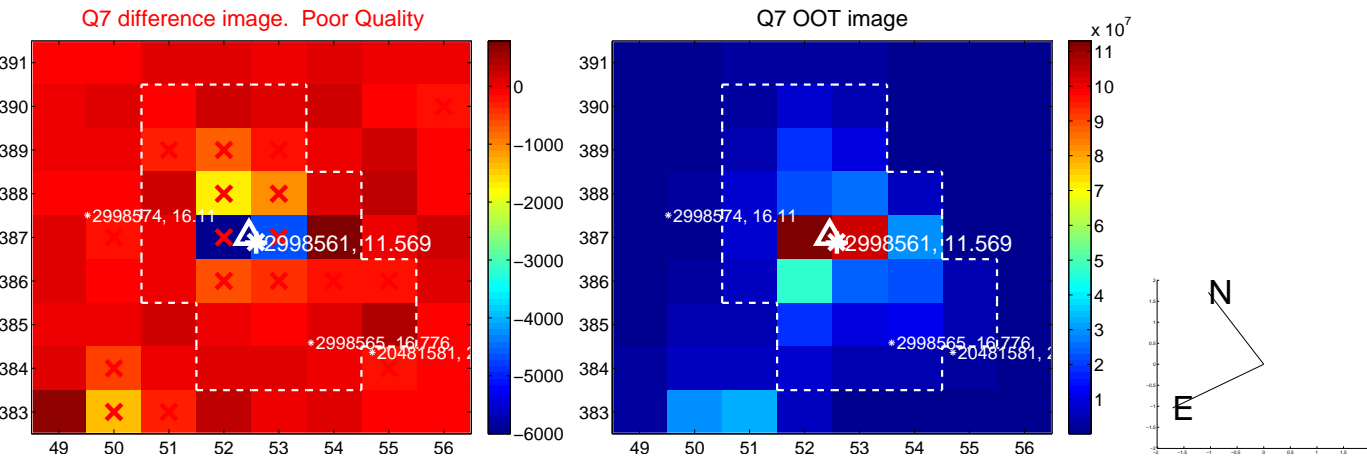
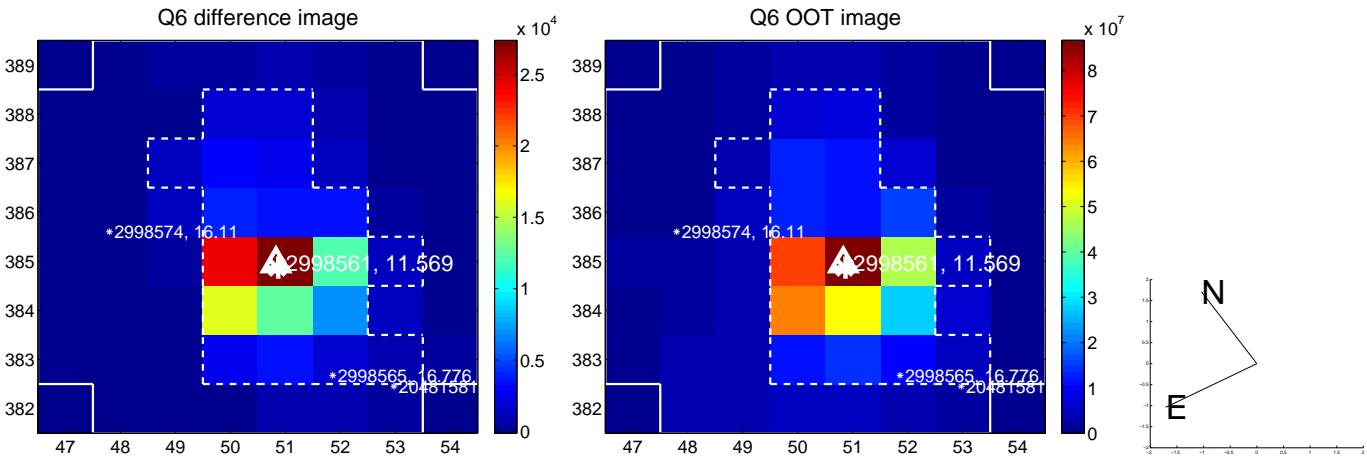
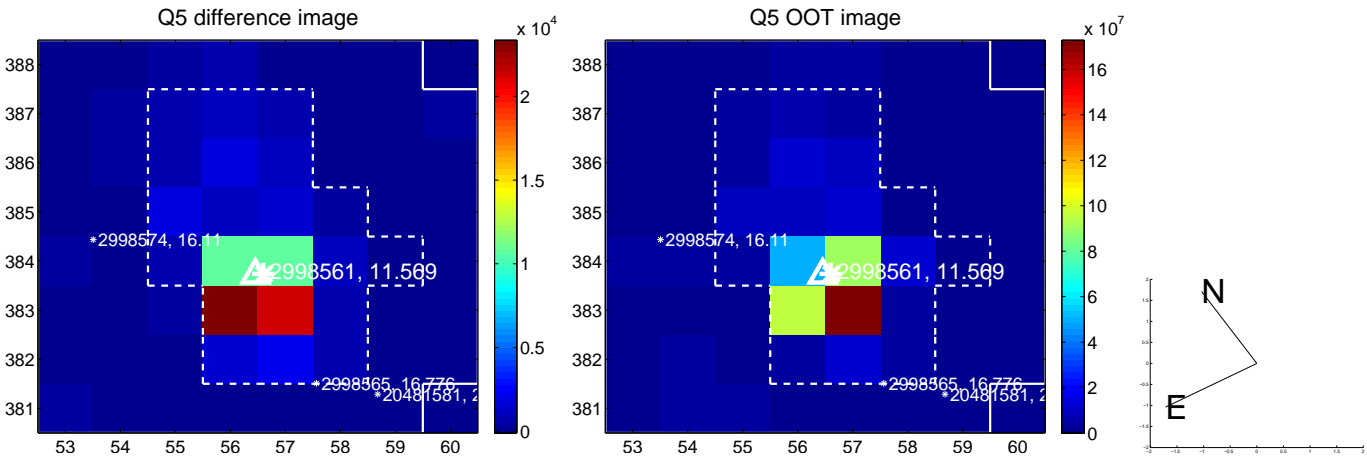
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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



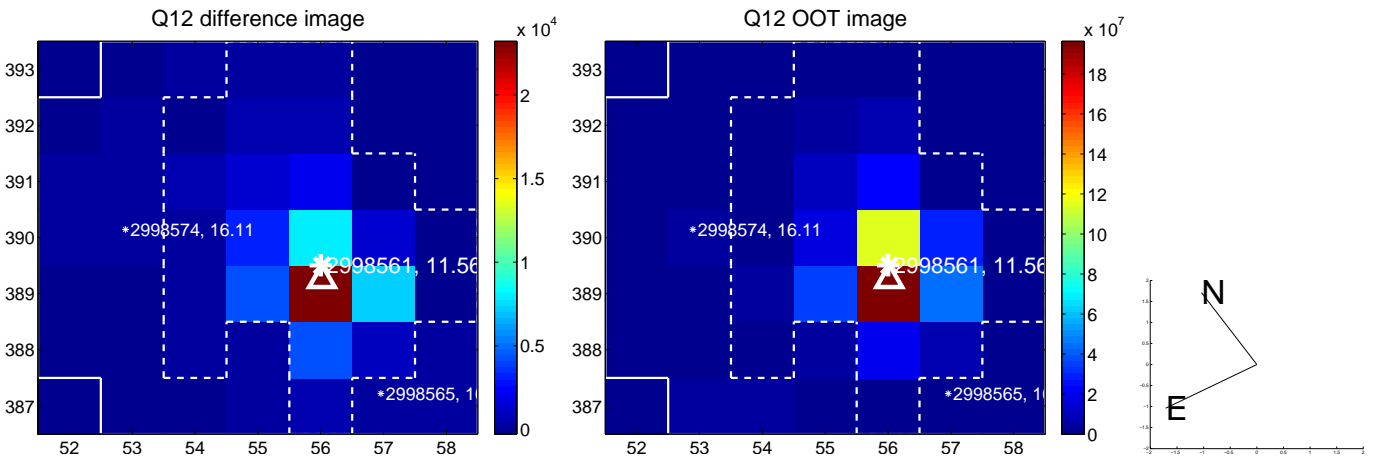
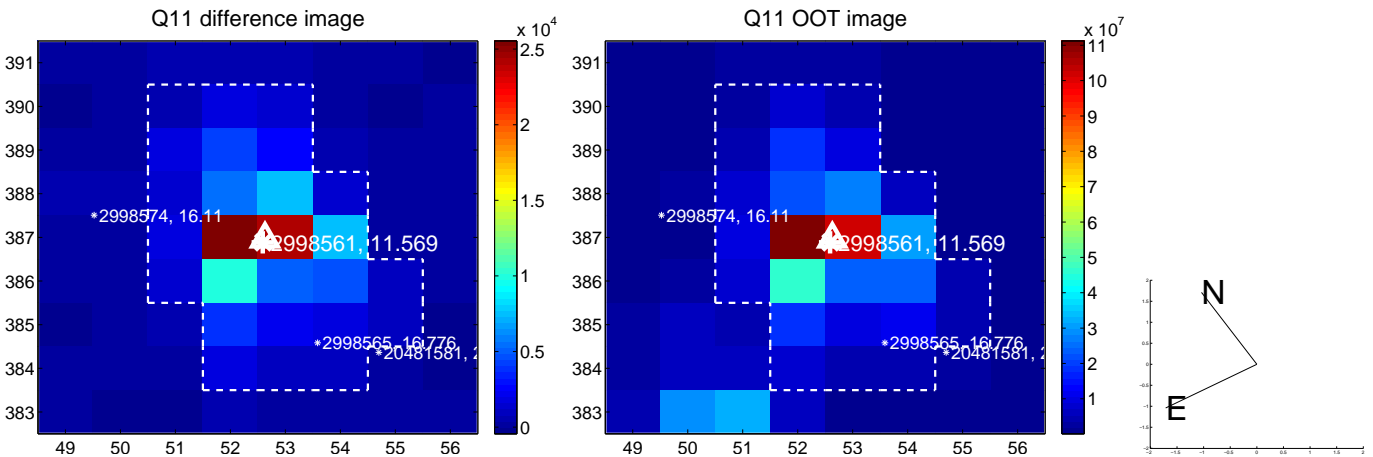
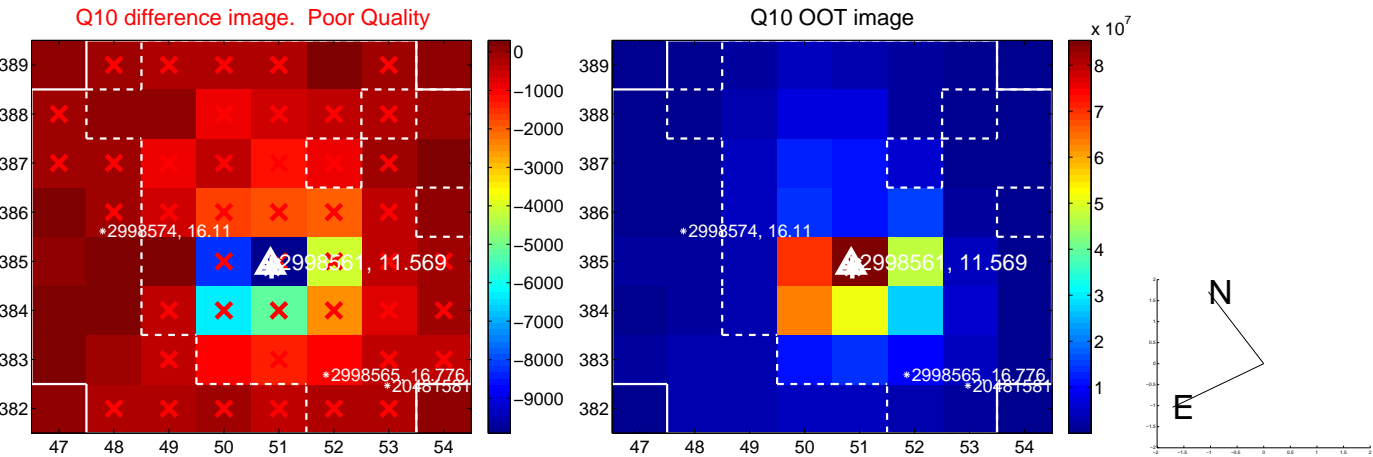
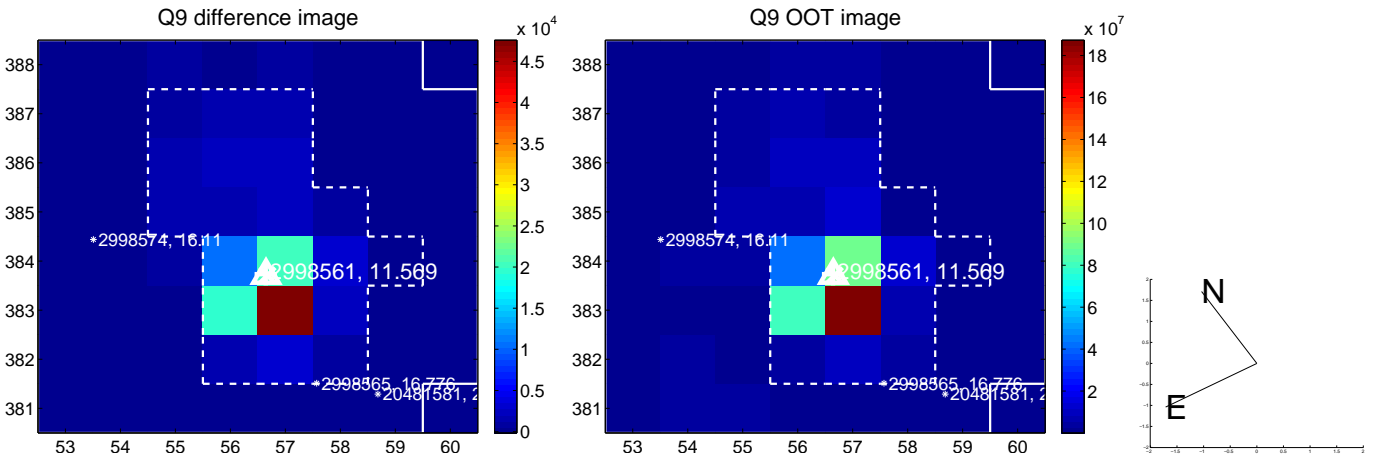
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

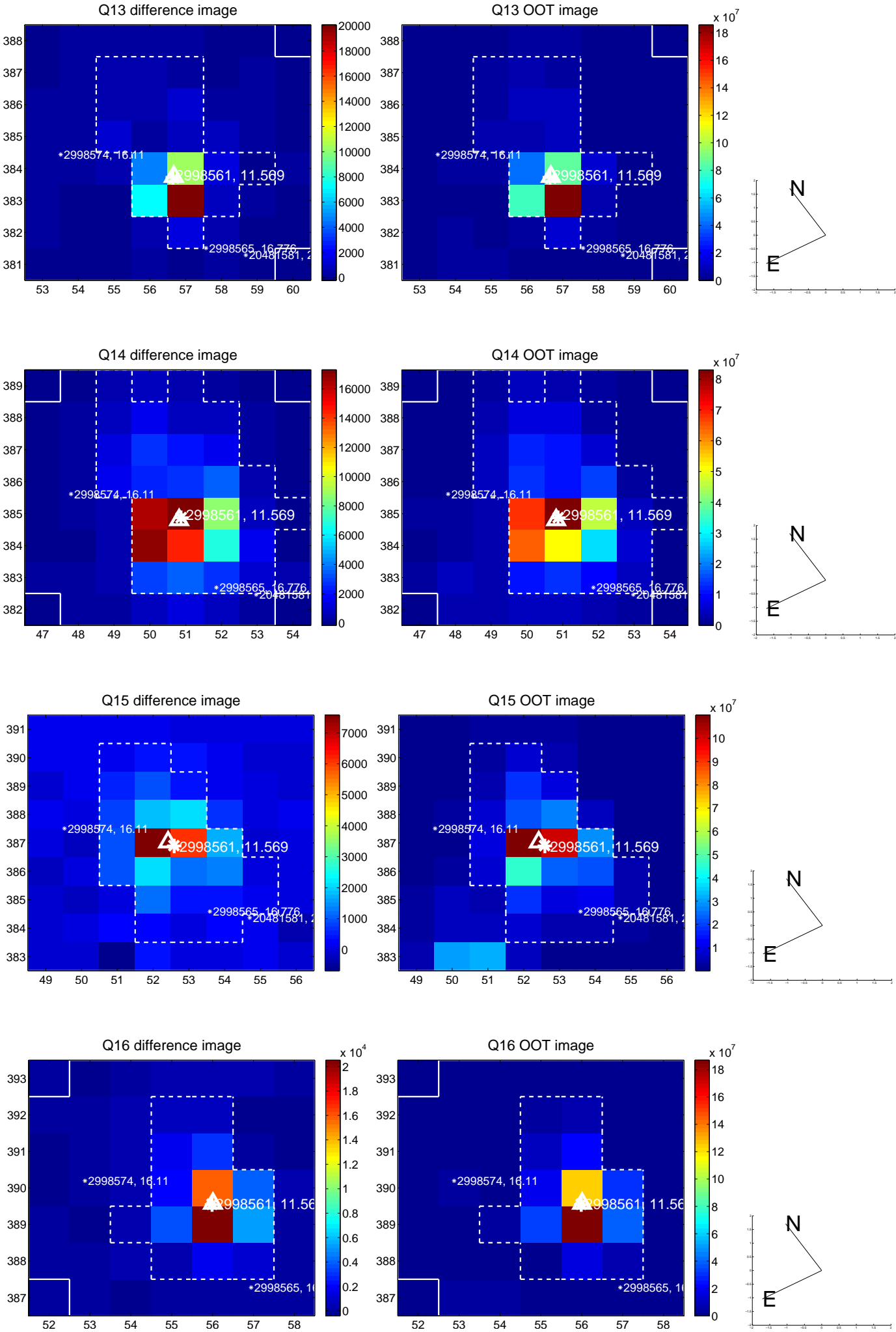


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

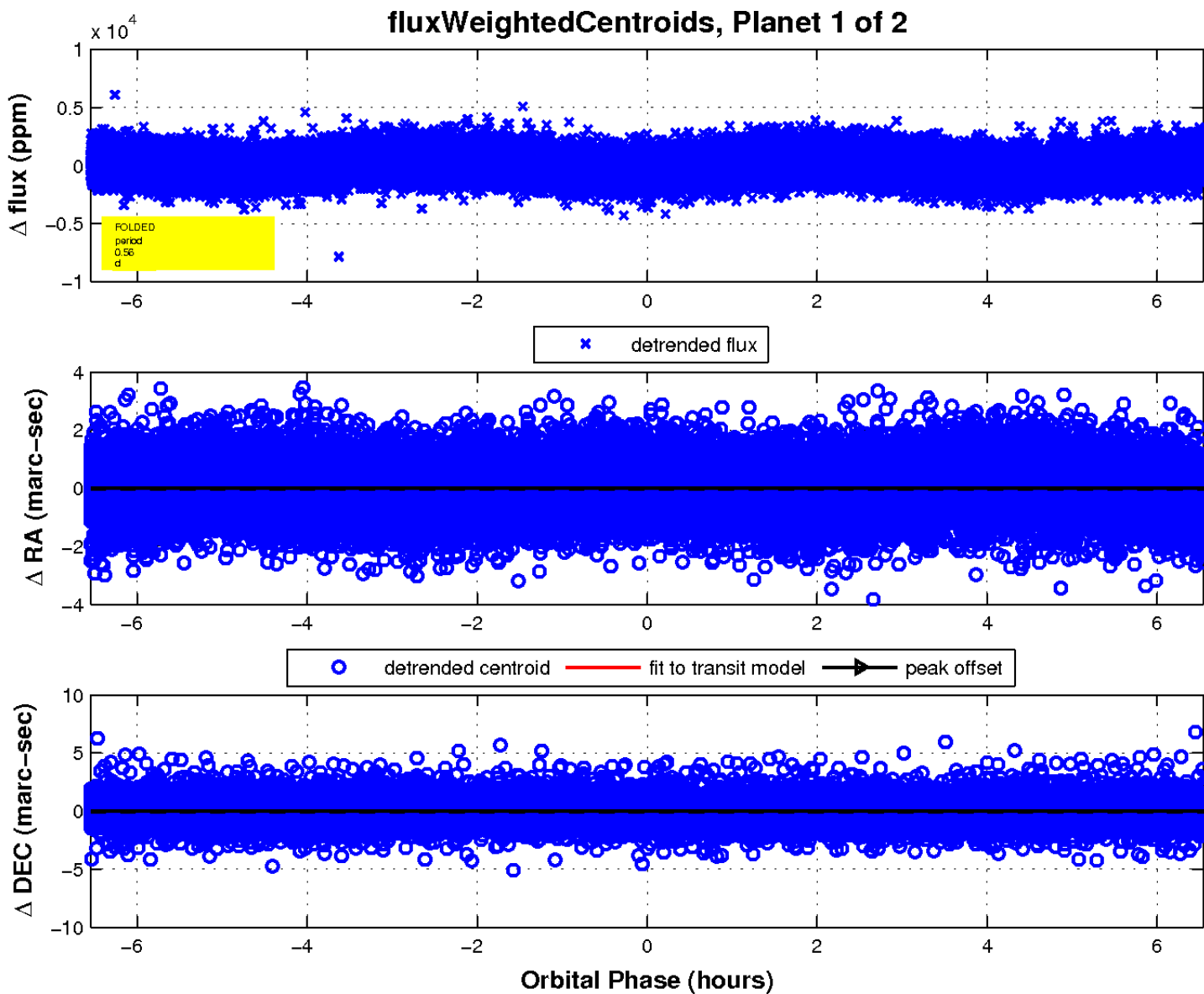
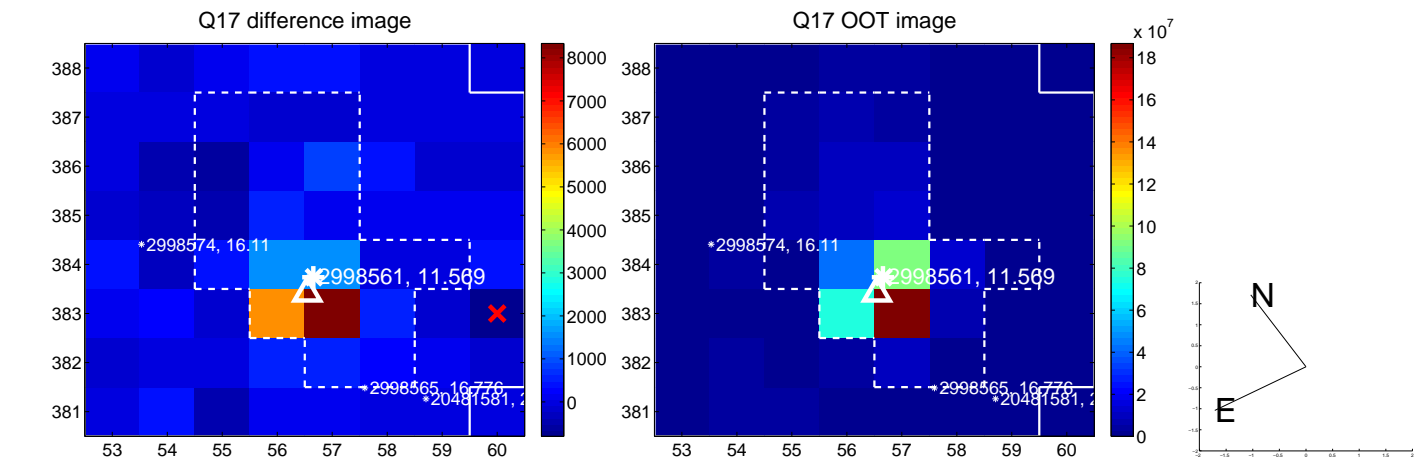




white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

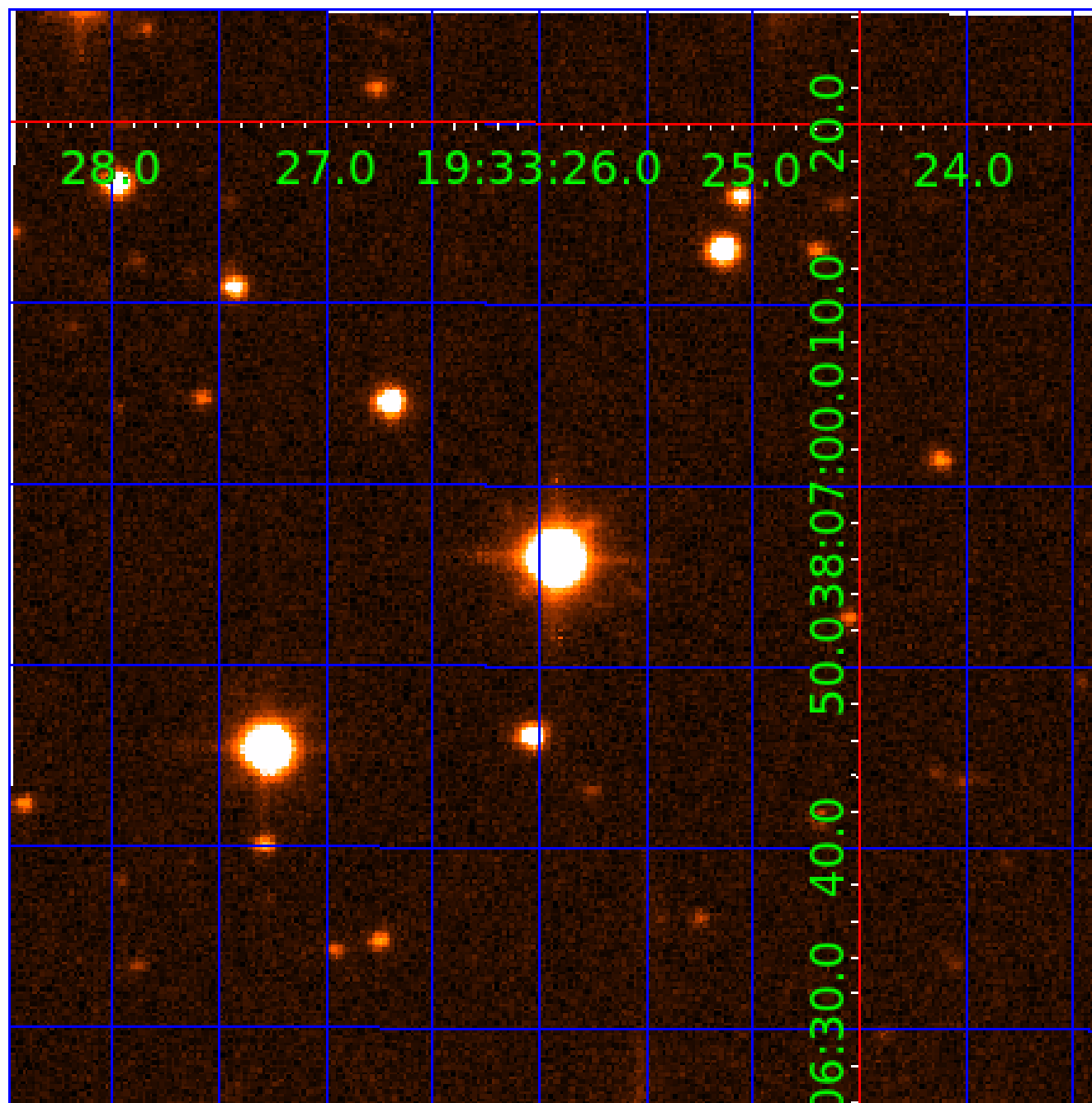


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination





# KIC 002998561

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
002998561-01	OBS	No	0.558661	131.532336	149.5	2.182	15.6	16.8	2.37	7426	3.35	59374.98
002998561-02	OBS	No	0.558642	131.967888	145.6	4.694	18.8	13.5	2.37	7426	2.92	59377.65

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
002998561-01	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT
002998561-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE_ZUMA—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—SAME_NTL_PERIOD—CENT_FEW_DIFFS

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

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

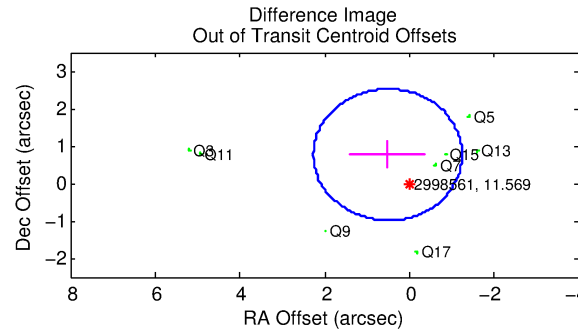
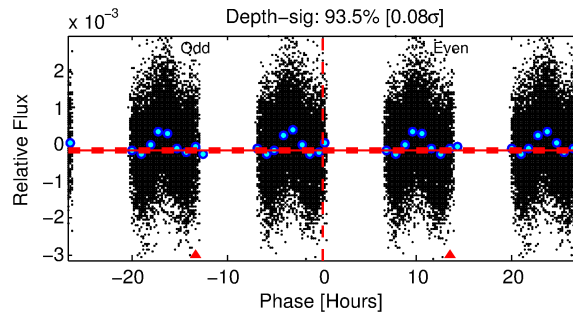
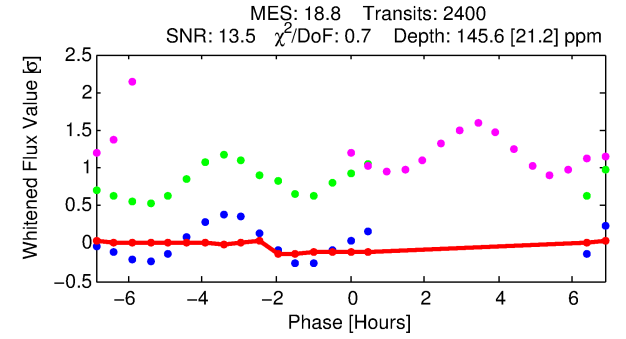
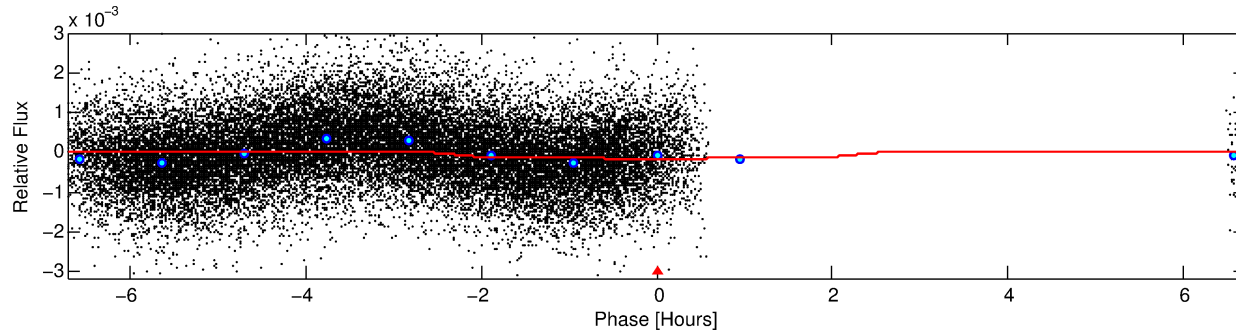
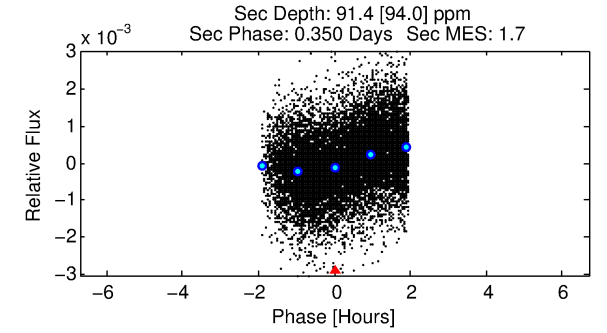
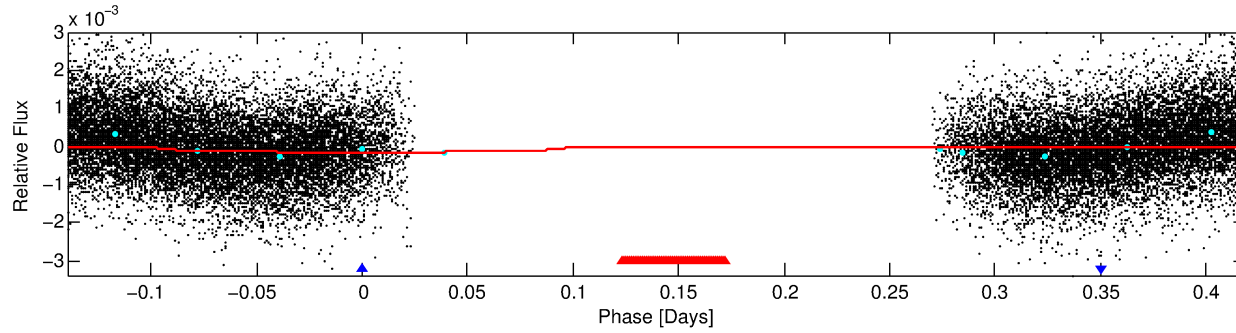
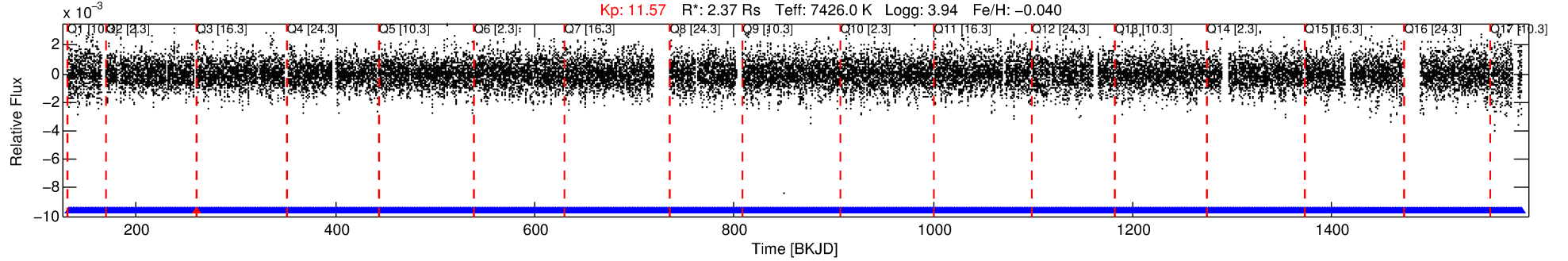
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 002998561-02

No Significant Match Found

# DV One-Page Summary

KIC: 2998561 Candidate: 2 of 2 Period: 0.559 d



## DV Fit Results:

Period = 0.55864 [0.00001] d  
Epoch = 131.9679 [0.0044] BKJD  
Rp/R\* = 0.0113 [0.0045]  
a/R\* = 1.12 [0.56]  
b = 0.30 [7.23]  
Seff = 59377.65 [29556.64]  
Teq = 3980 [495] K  
Rp = 2.92 [1.55] Re  
a = 0.0160 [0.0049] AU  
Ag = 1.52 [2.09] [0.25σ]  
Teffp = 6828 [2235] K [1.24σ]

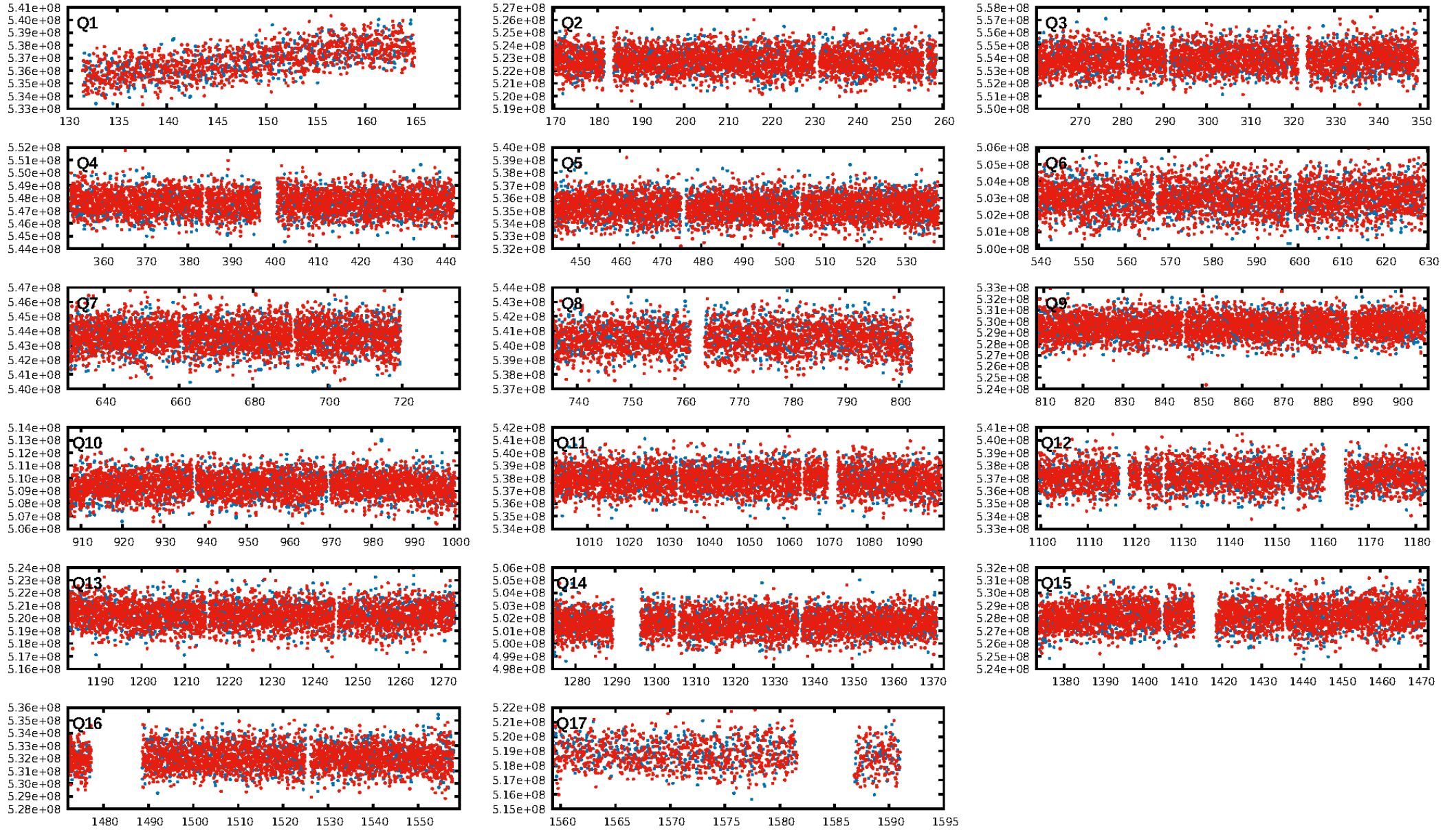
## DV Diagnostic Results:

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 [2291/2292]  
GhostDiagnostic-chr: -1.548  
Centroid-sig: 1.1%  
Centroid-so: 0.554 arcsec [7.42σ]  
OotOffset-rm: 0.921 arcsec [1.57σ]  
KicOffset-rm: 0.947 arcsec [1.50σ]  
OotOffset-st: 0/4/0/4 [8]  
KicOffset-st: 0/4/0/4 [8]  
DiffImageQuality-fgm: 0.38 [3/8]  
DiffImageOverlap-fno: 0.00 [0/17]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 04:39:58 Z

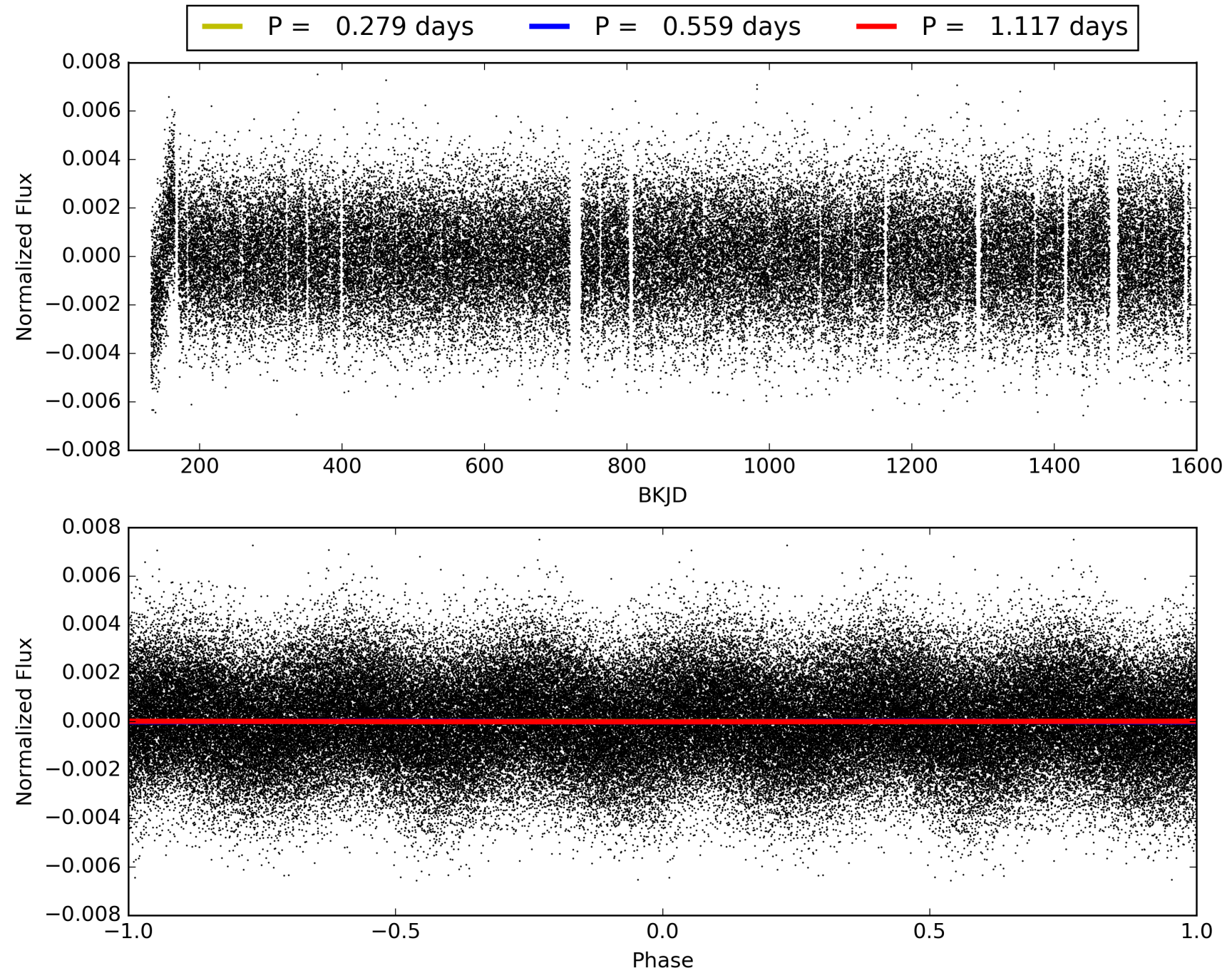
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 002998561-02, PDC Light Curves



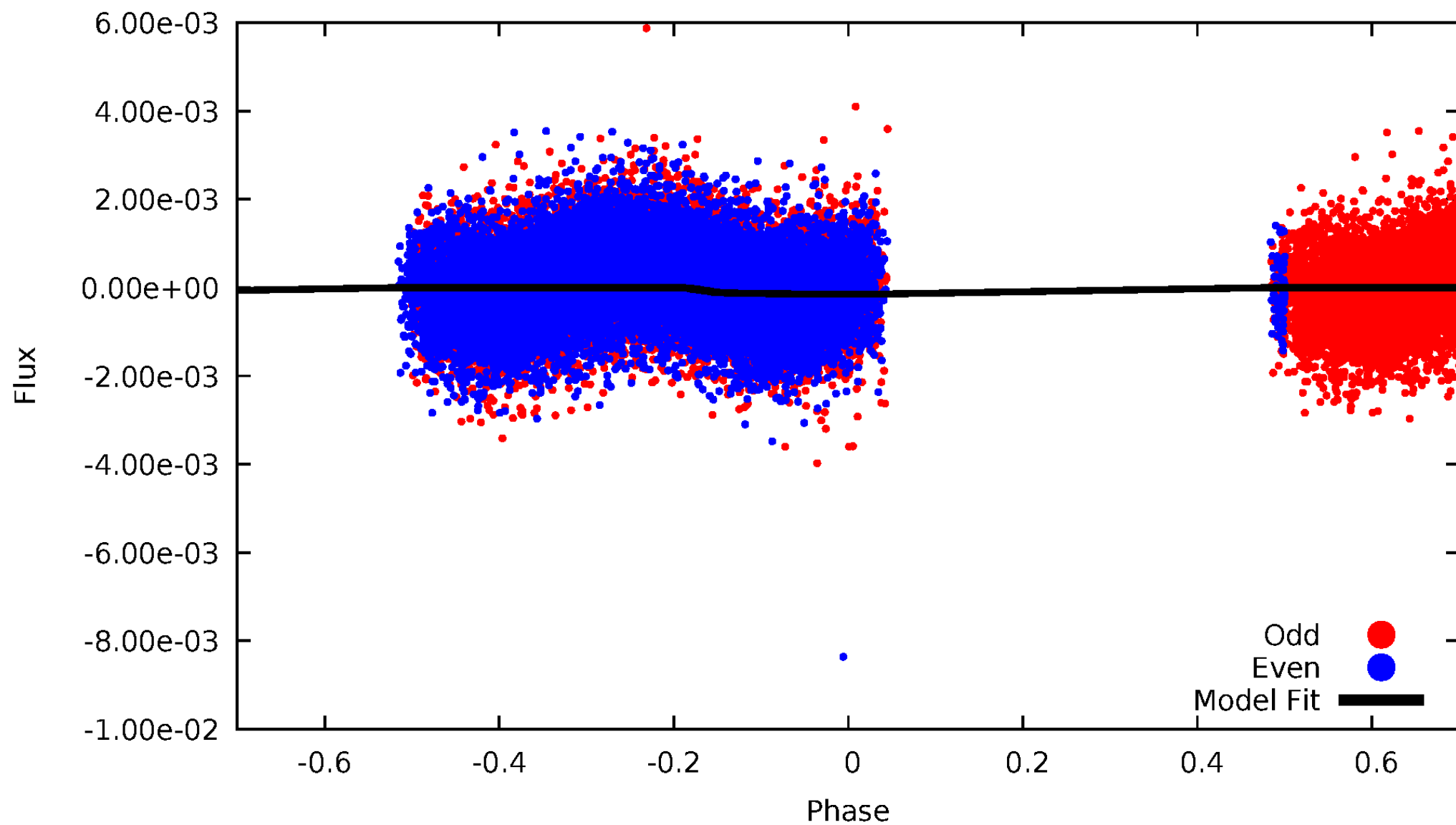


TCE 002998561-02



# DV Odd/Even

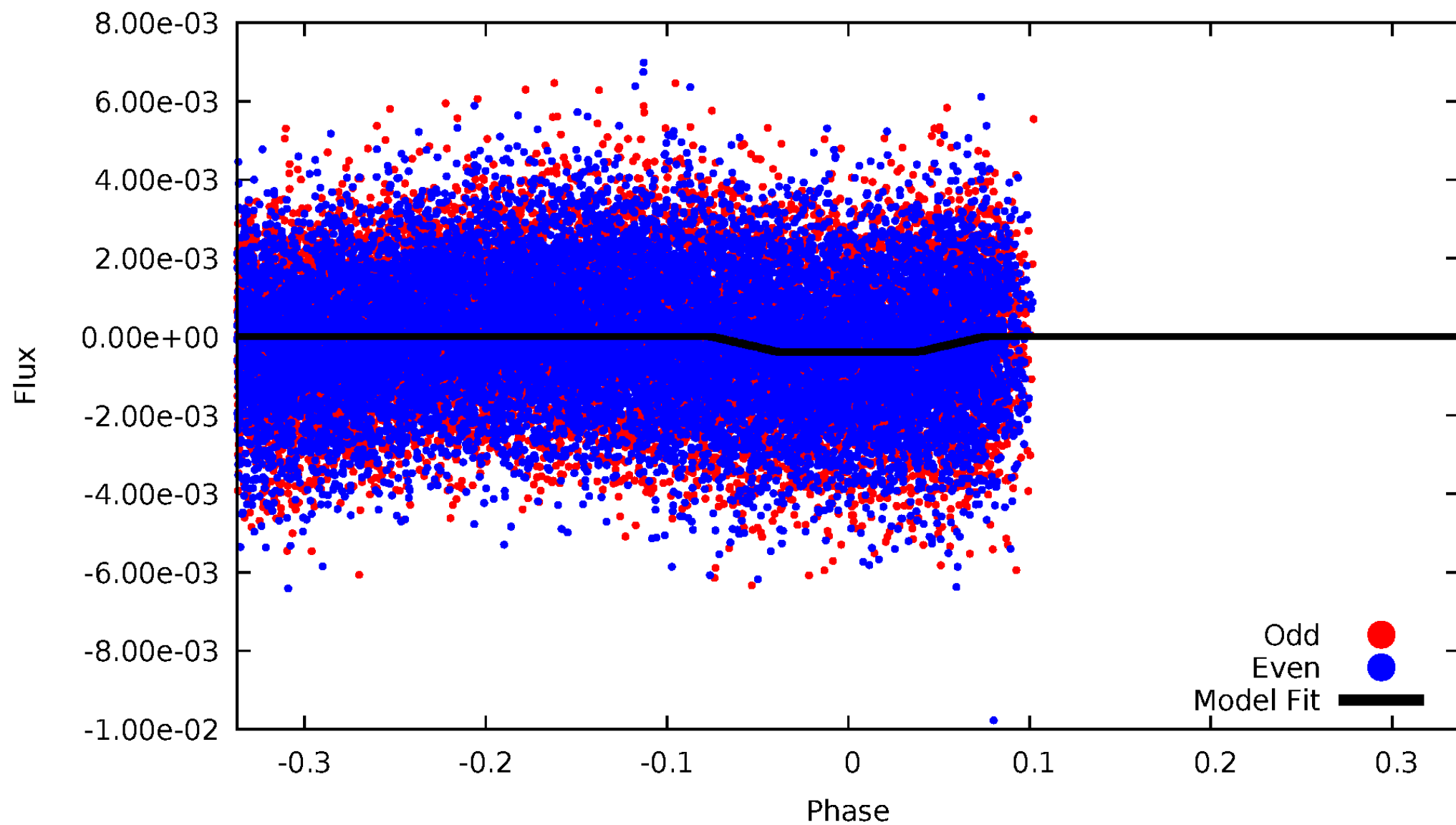
TCE 002998561-02





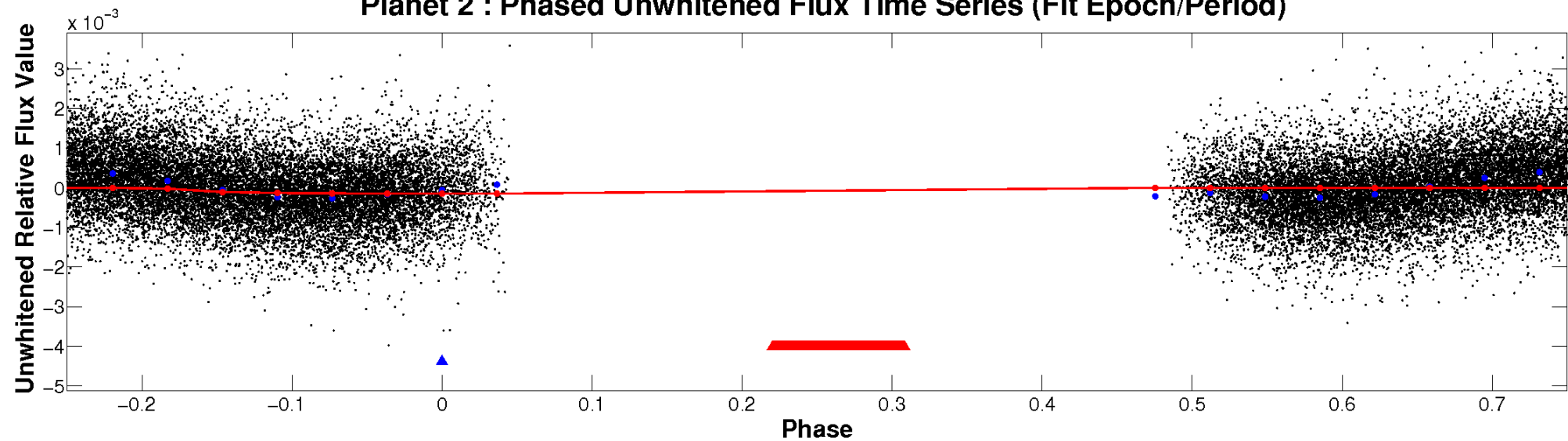
# ALT Odd/Even

TCE 002998561-02

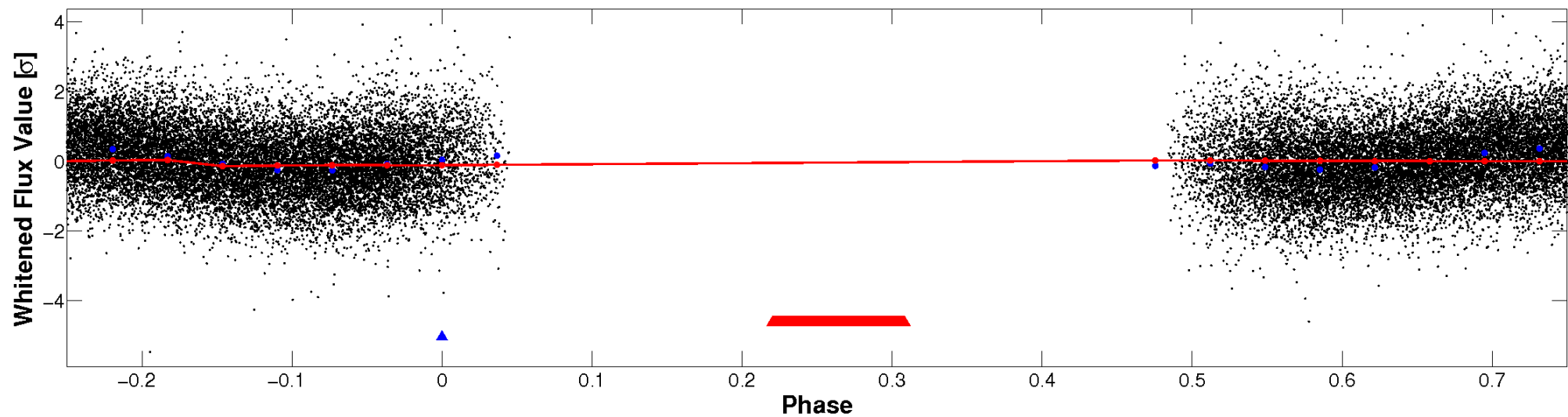


# Non-Whitened Vs. Whitened Light Curve

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

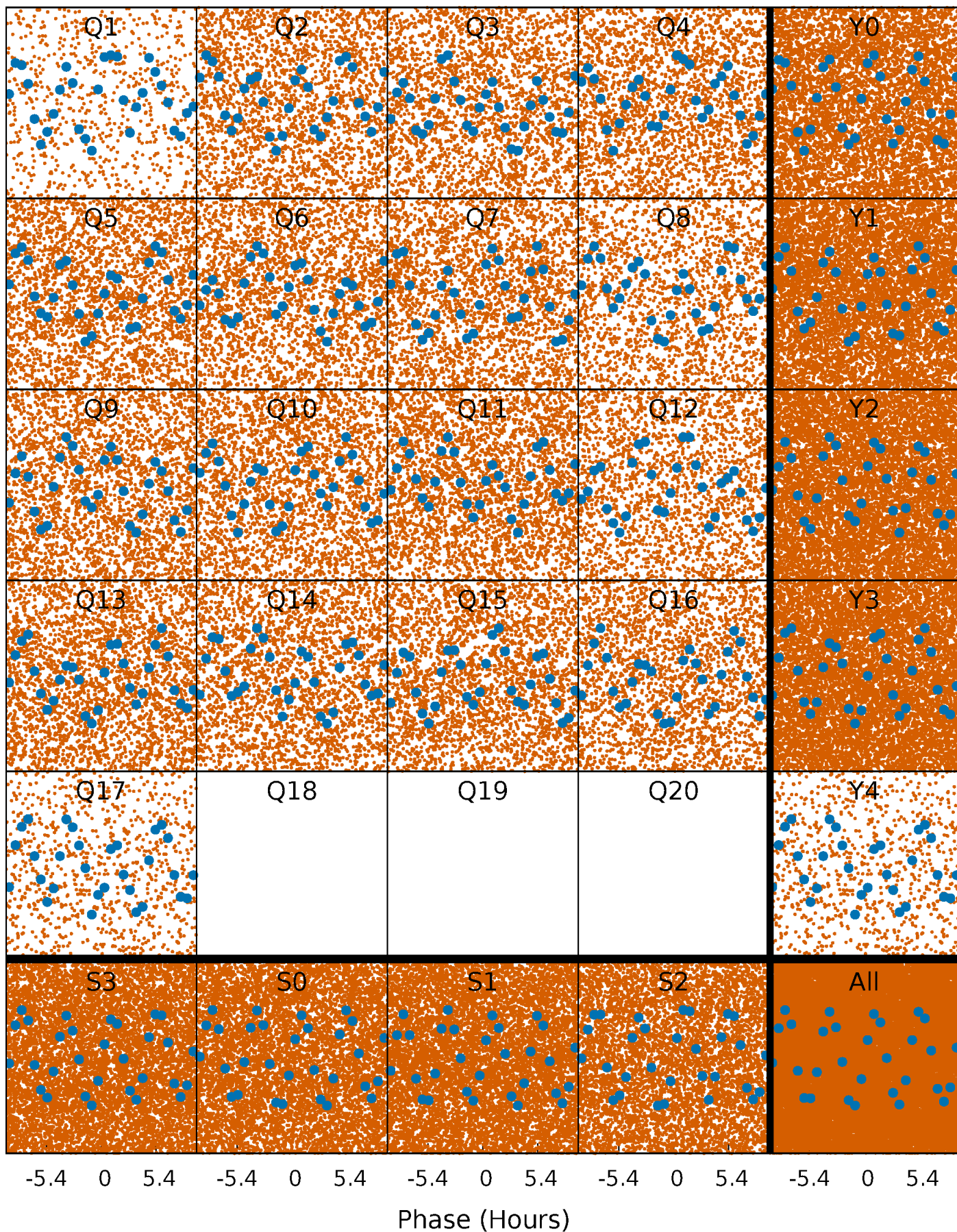


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

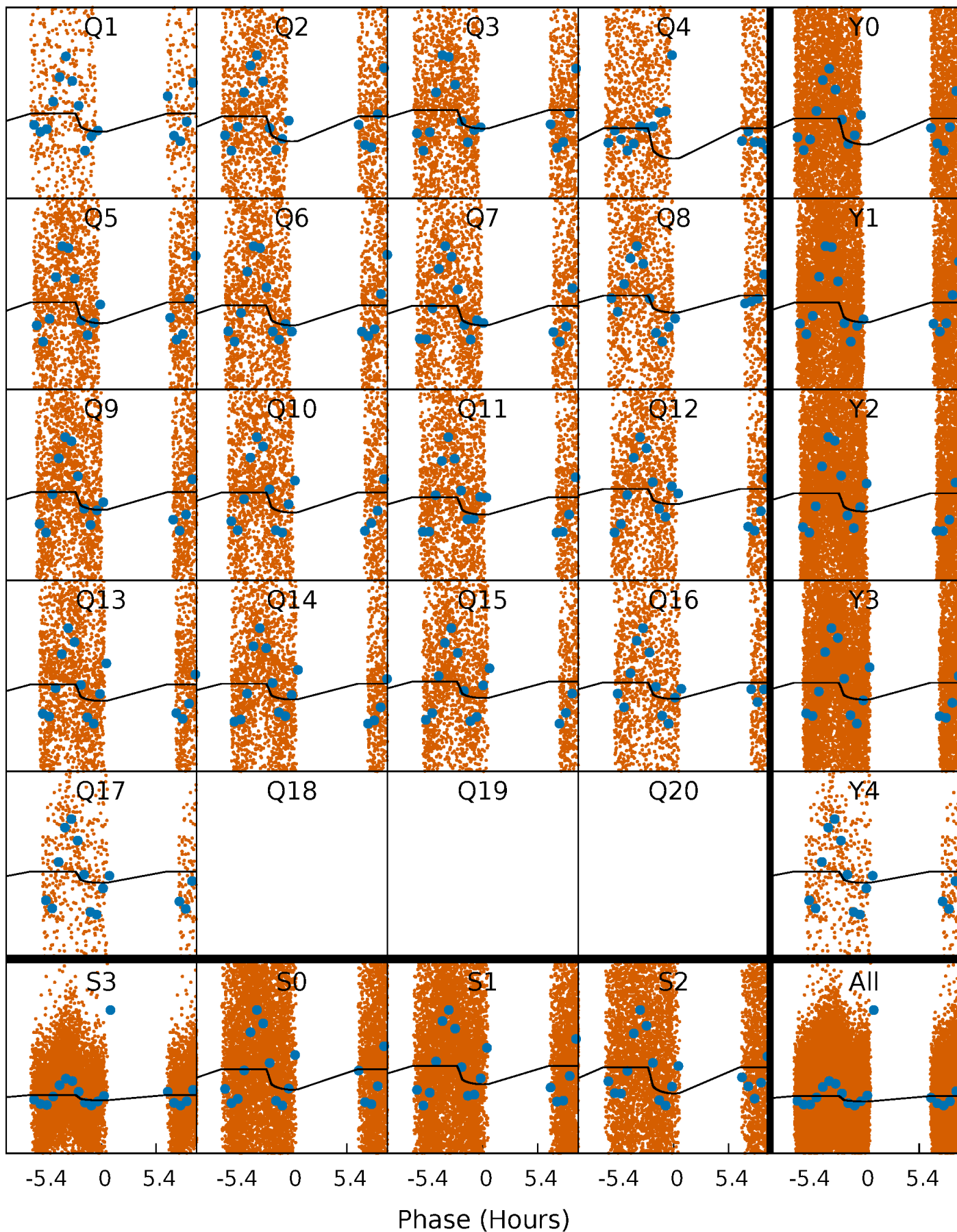
TCE 002998561-02   P= 0.558642 Days    $T_0=131.967888$  (BKJD)





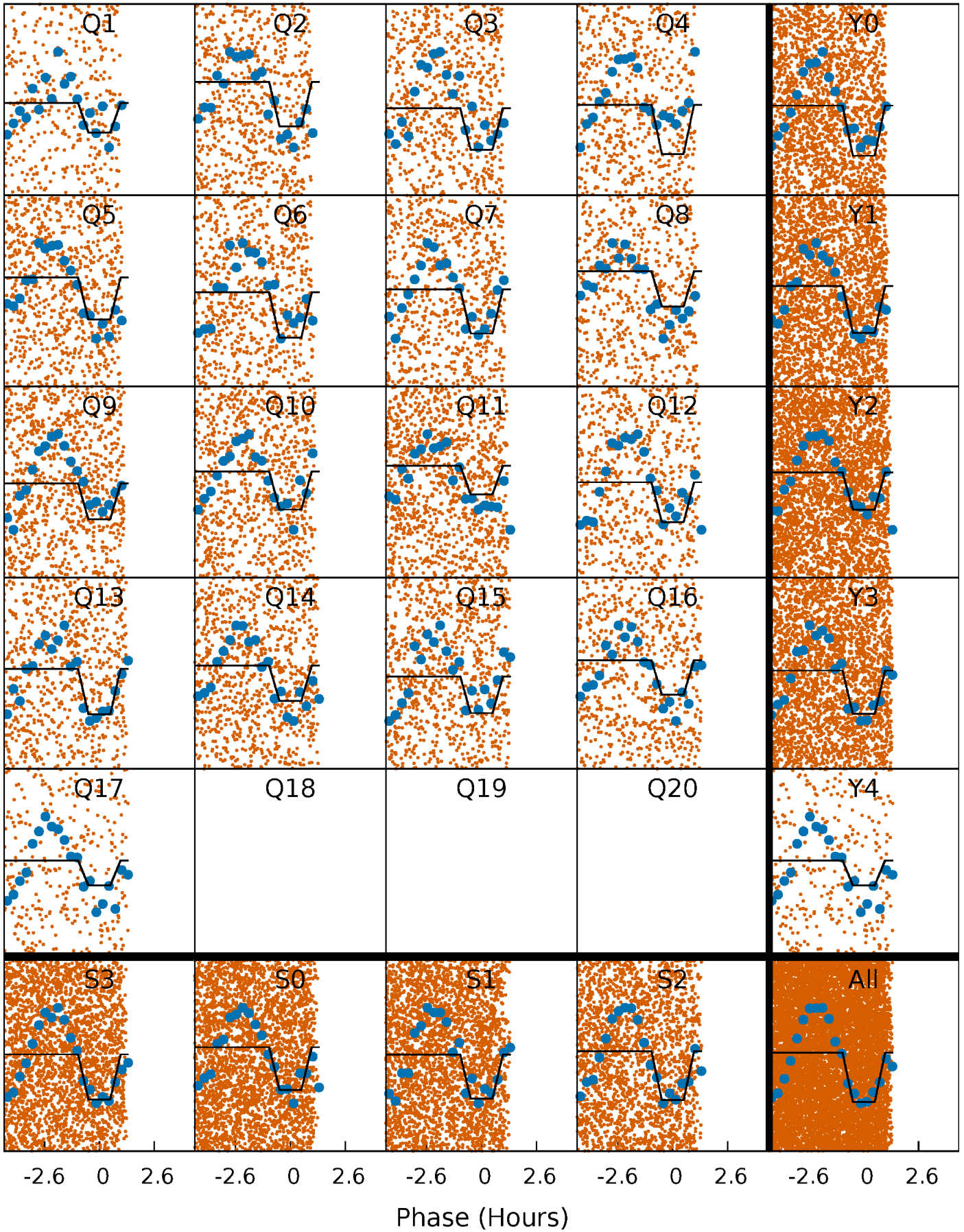
# DV Quarter-Phased Transit Curves

TCE 002998561-02   P= 0.558642 Days    $T_0=131.967888$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

TCE 002998561-02   P= 0.558655 Days    $T_0=131.903958$  (BKJD)

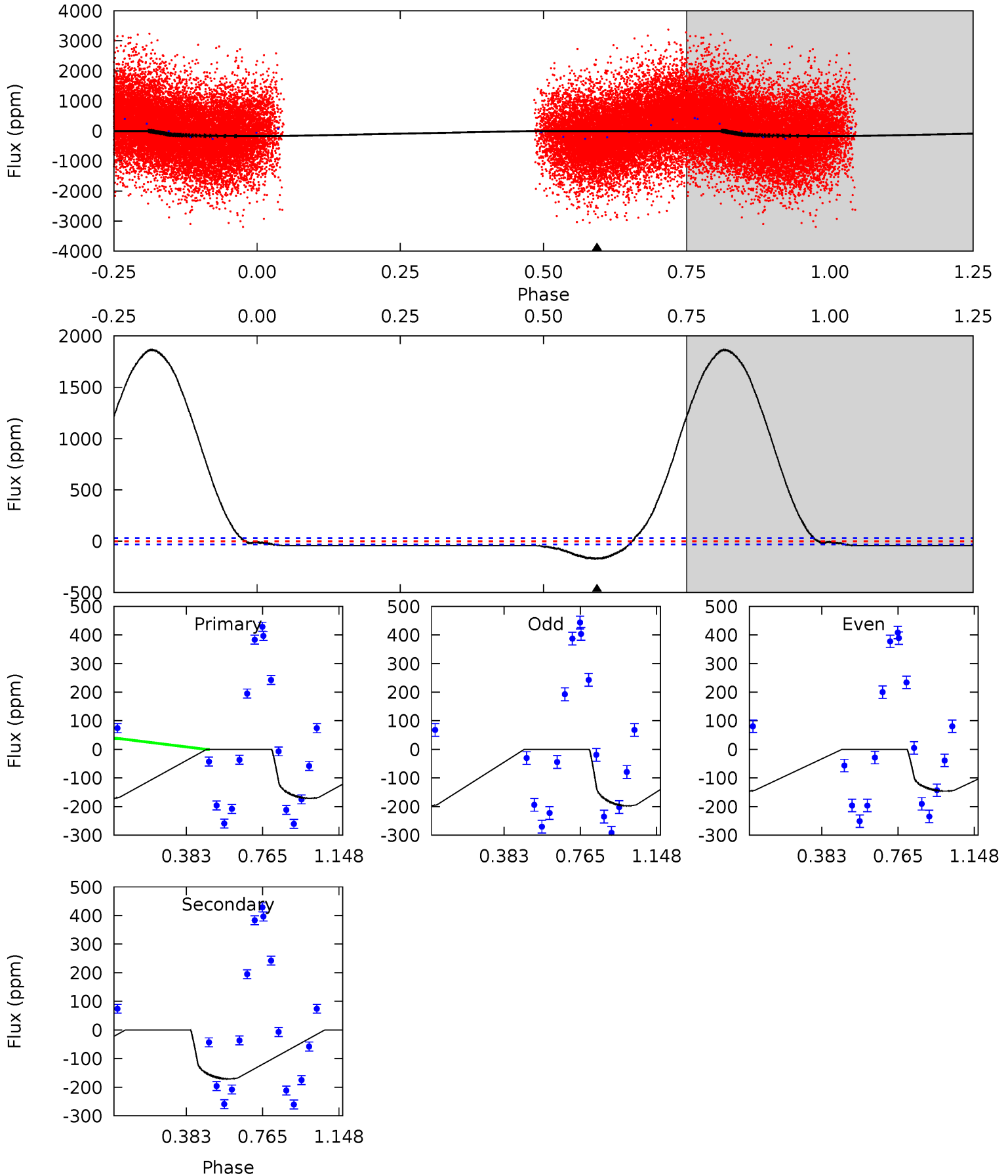




# DV Model-Shift Uniqueness Test

002998561-02, P = 0.558642 Days, E = 131.409246 Days

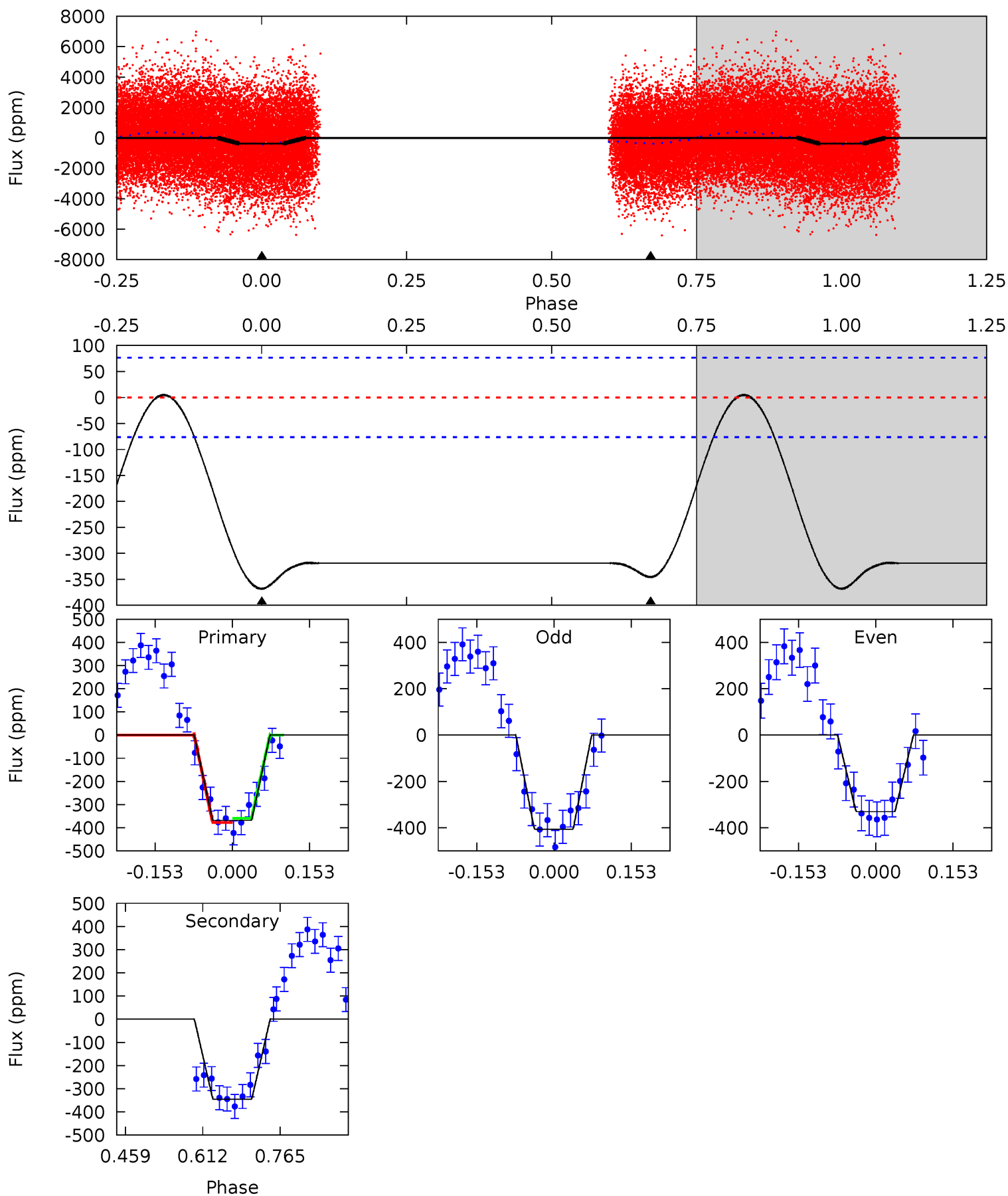
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
24.3	24.3	0	0	4.27	0.87	8.48	24.3	24.3	24.3	24.3	3.67	1.18	0.92	4.46



# Alt Model-Shift Uniqueness Test

002998561-02, P = 0.558655 Days, E = 131.345303 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
21.5	20.2	0	0	4.47	1.43	0.38	21.5	21.5	20.2	20.2	2.20	1.19	0.01	0.53



### Stellar Parameters For KIC 002998561

	$T_{\text{eff}}(K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$7426^{+207}_{-337}$	$3.935^{+0.260}_{-0.140}$	$-0.040^{+0.200}_{-0.350}$	$2.365^{+0.514}_{-0.836}$	$1.756^{+0.186}_{-0.373}$	$0.187^{+0.320}_{-0.078}$
	+3%/-5%	+7%/-4%	+500%/-875%	+22%/-35%	+11%/-21%	+171%/-42%
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 002998561-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-171 \pm 7$	$2.80^{+1.26}_{-1.16}$	$5501^{+382}_{-517}$	$7702^{+3741}_{-1473}$	$2.988^{+5.877}_{-1.568}$
Alt.	$-346 \pm 17$	$4.89^{+1.48}_{-1.40}$	$5501^{+392}_{-540}$	$6775^{+1384}_{-843}$	$2.007^{+1.738}_{-0.798}$

$T_{max}$  = 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

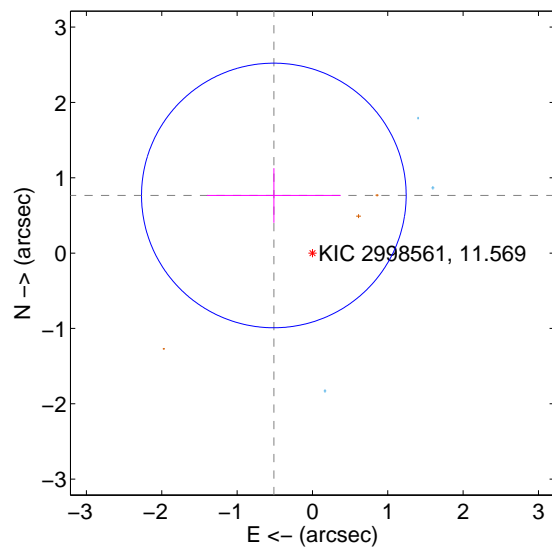
Supplemental centroid analysis for 002998561-02. **Kepler magnitude: 11.57.** Transit SNR 13.52

**There are 3 quarters with good PRF difference image offsets**

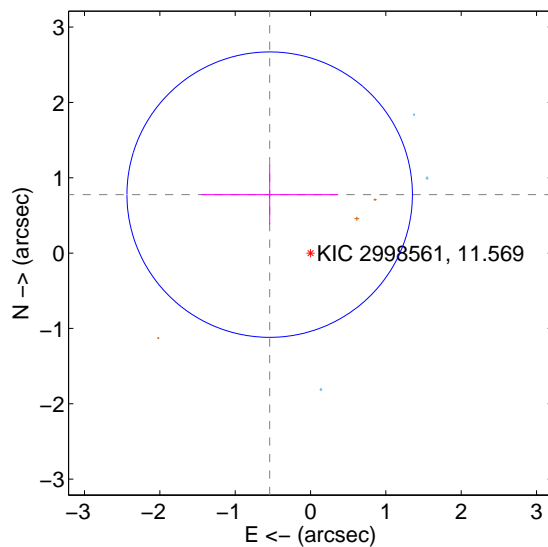
The direct PRF centroid is offset from the target star catalog position by about 0.03 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.921 \pm 0.585$	1.57	$0.512 \pm 0.888$	$0.765 \pm 0.362$
PRF-fit source offset from KIC position	$0.947 \pm 0.631$	1.50	$0.542 \pm 0.908$	$0.776 \pm 0.393$
photometric centroid source offset	$0.55 \pm 0.07$	7.42	$0.48 \pm 0.08$	$-0.27 \pm 0.07$

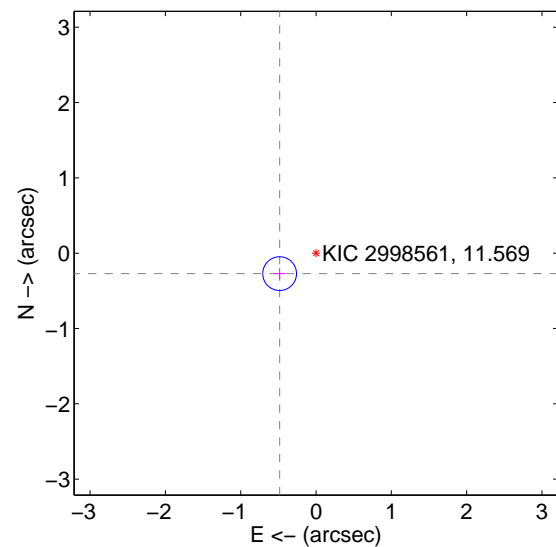
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

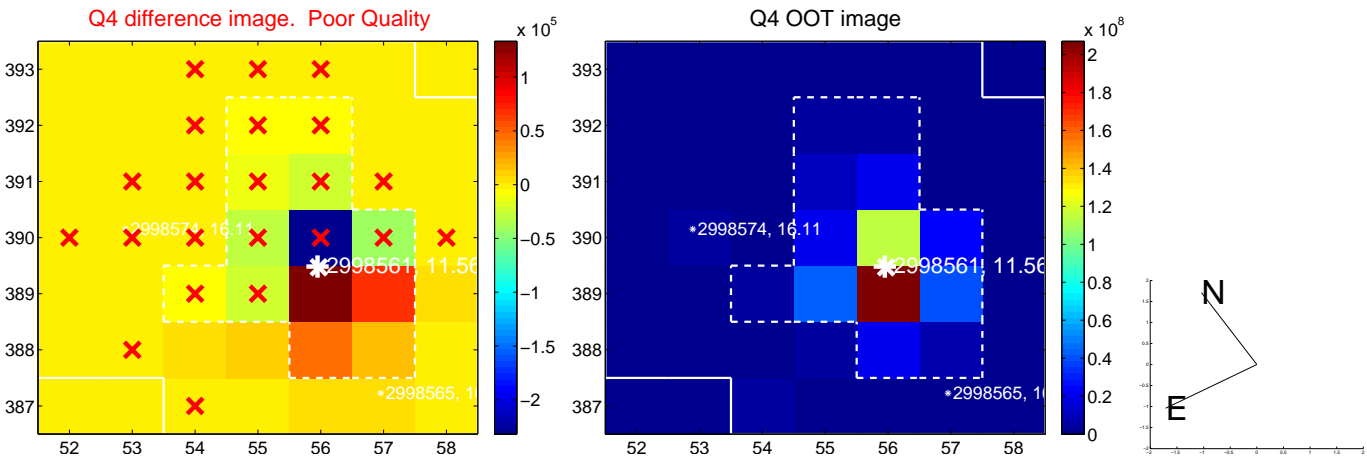
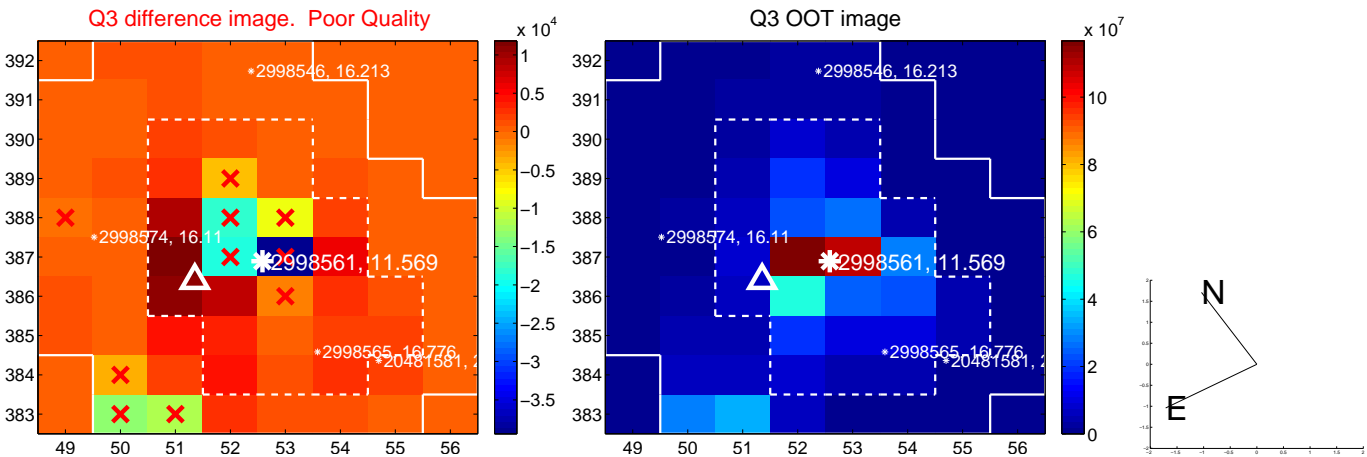
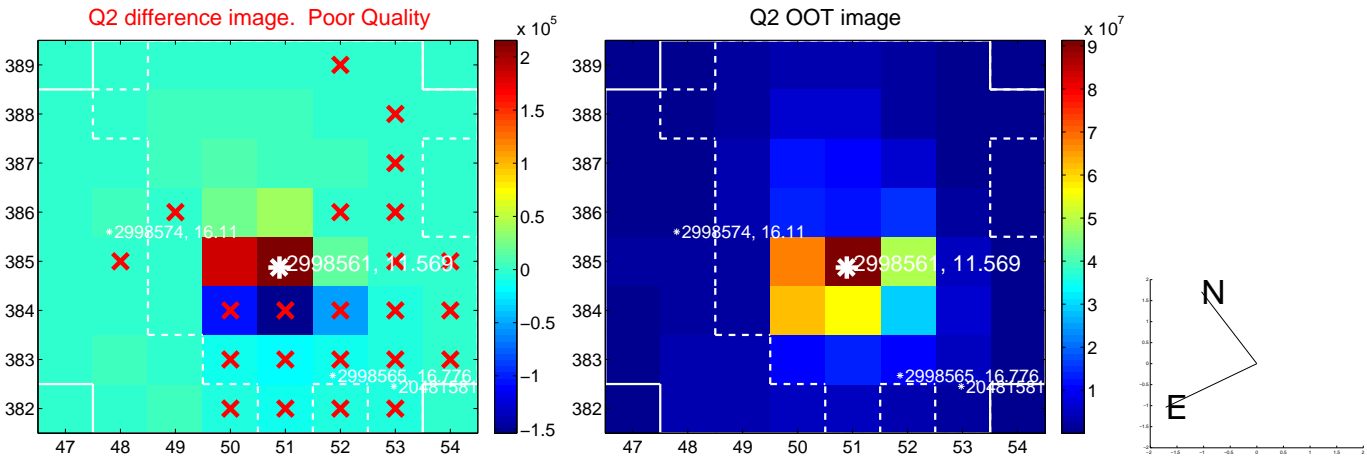
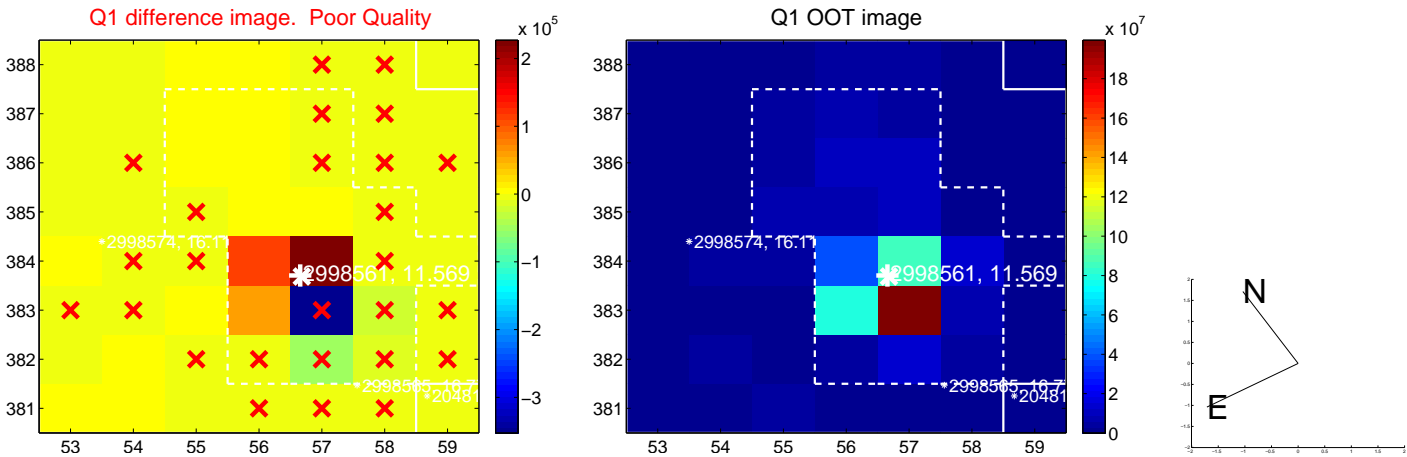


offset from photometric centroids



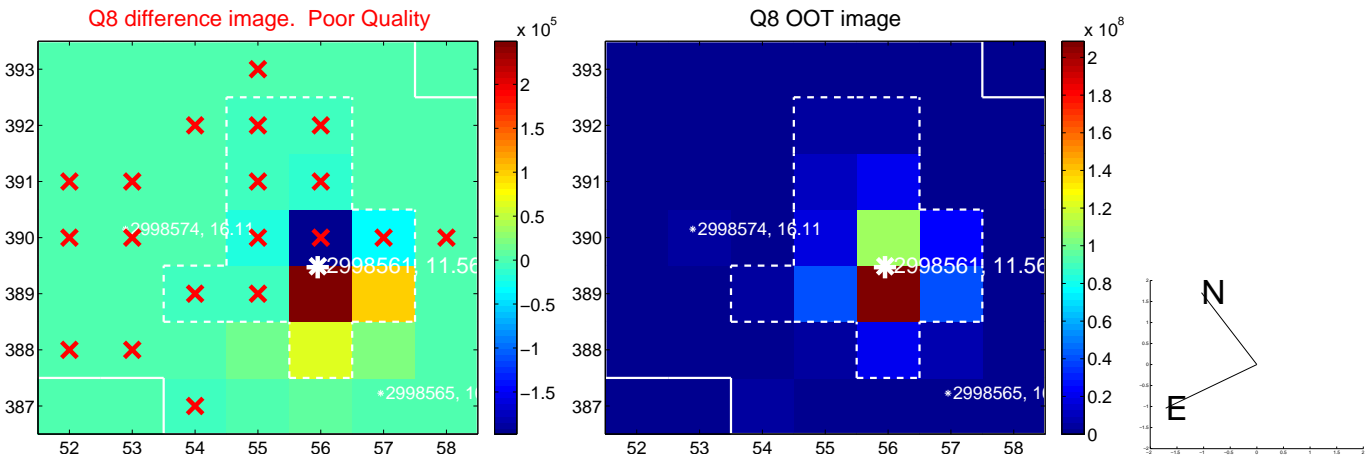
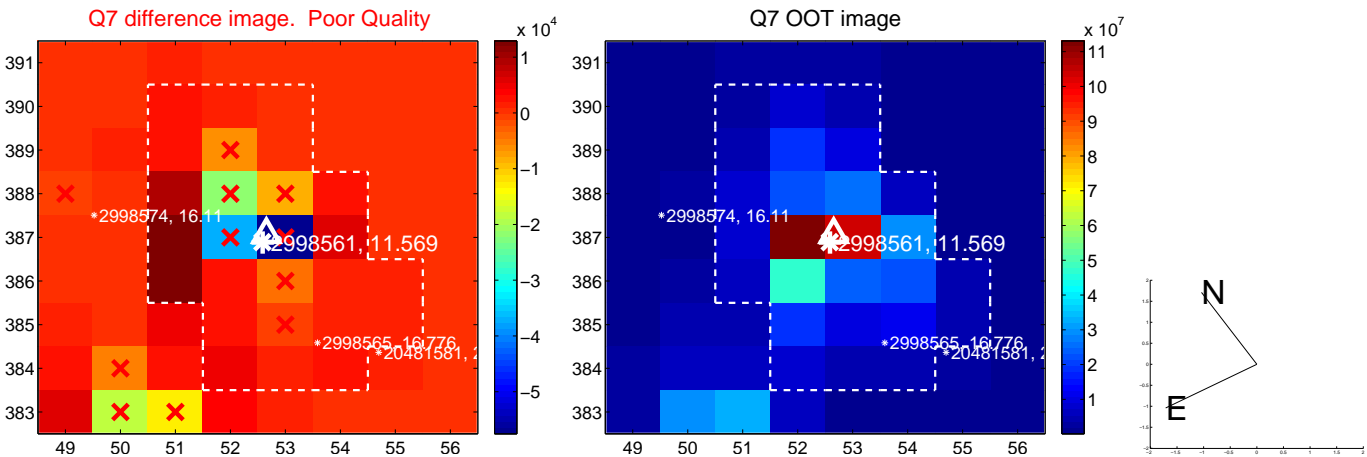
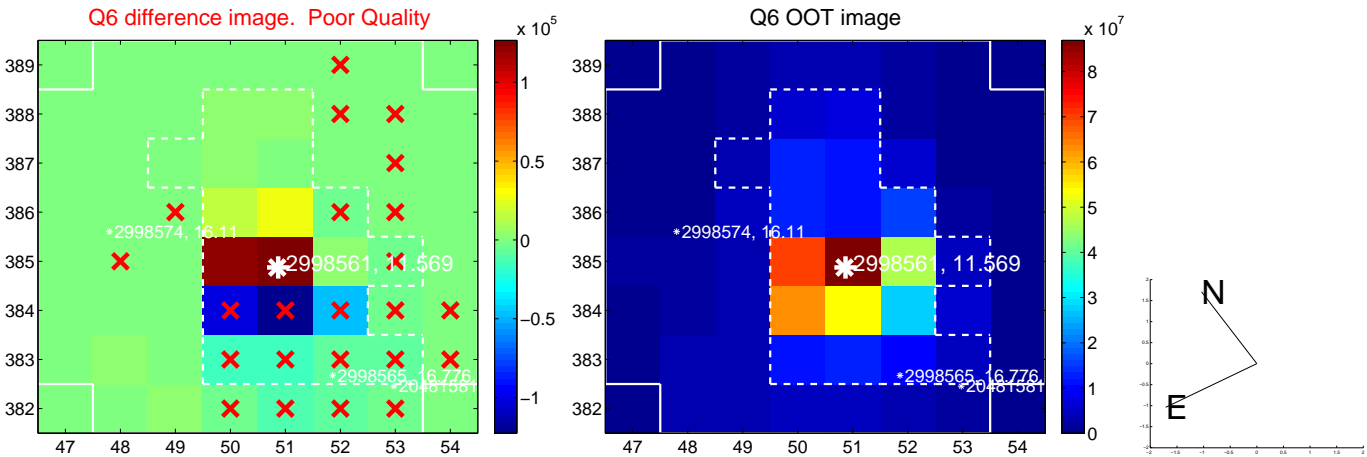
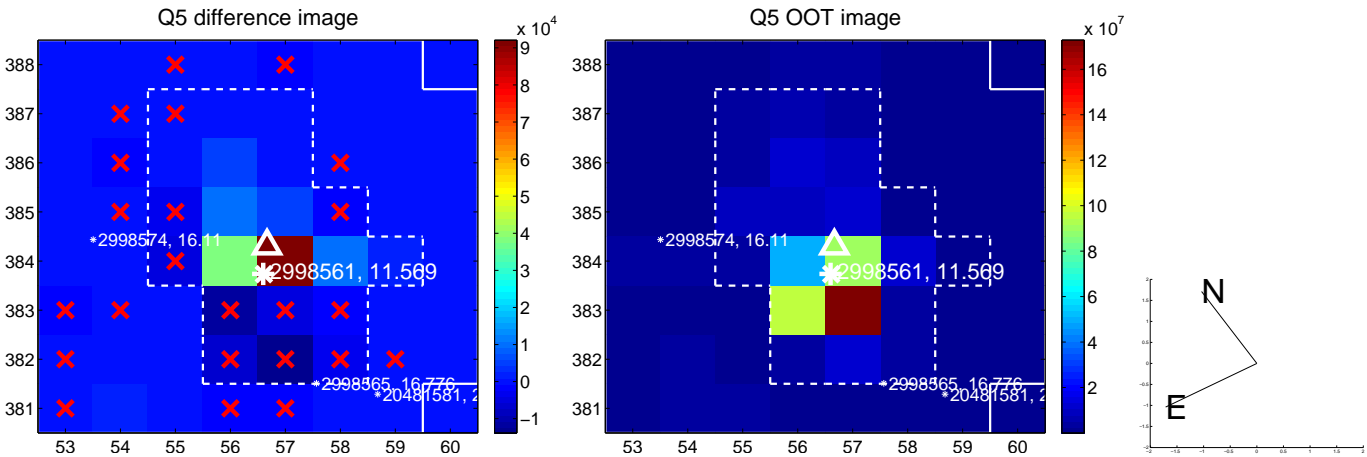
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

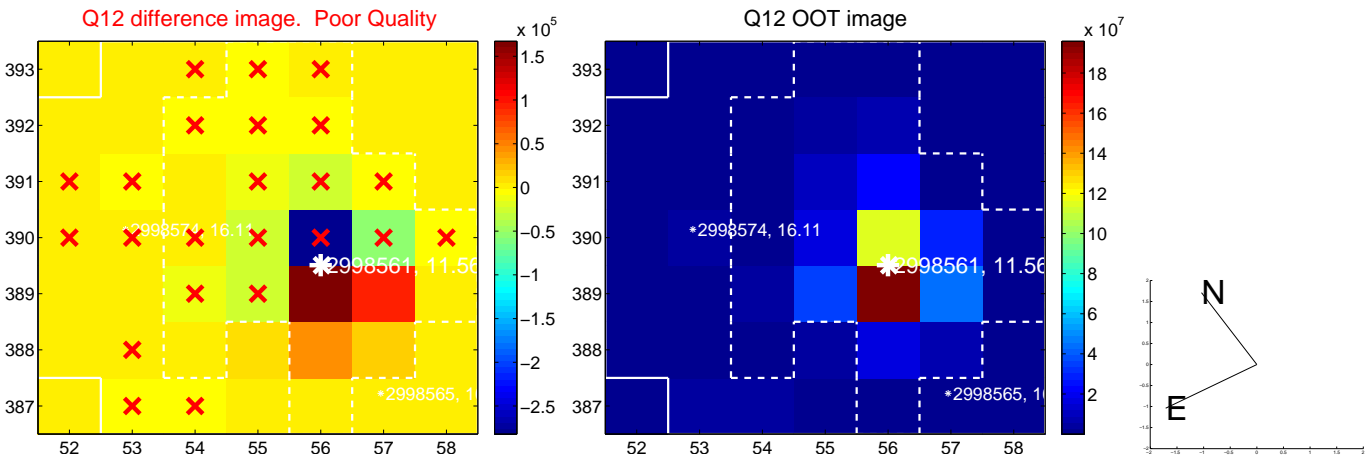
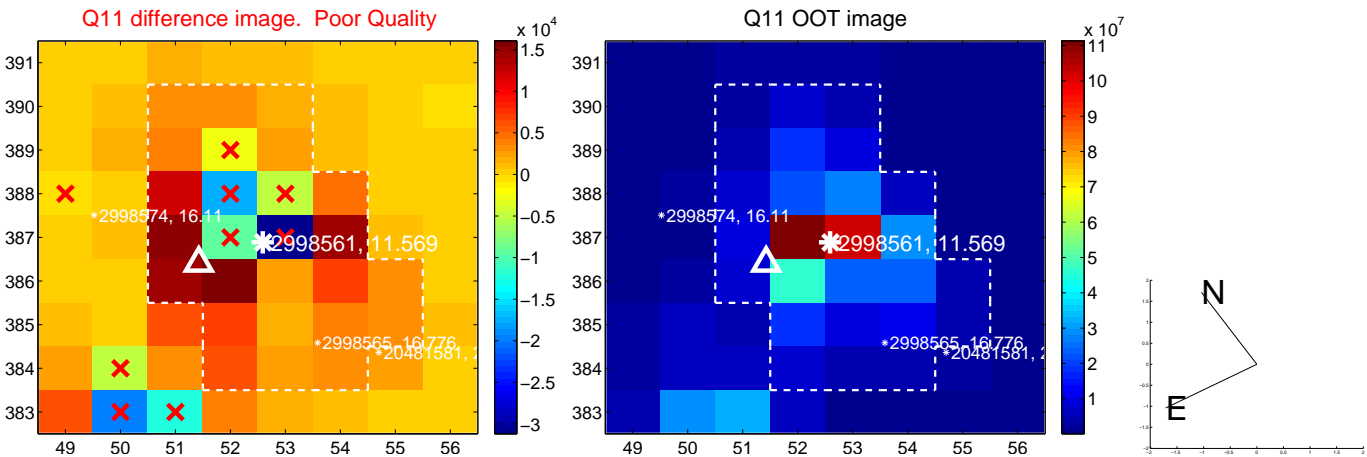
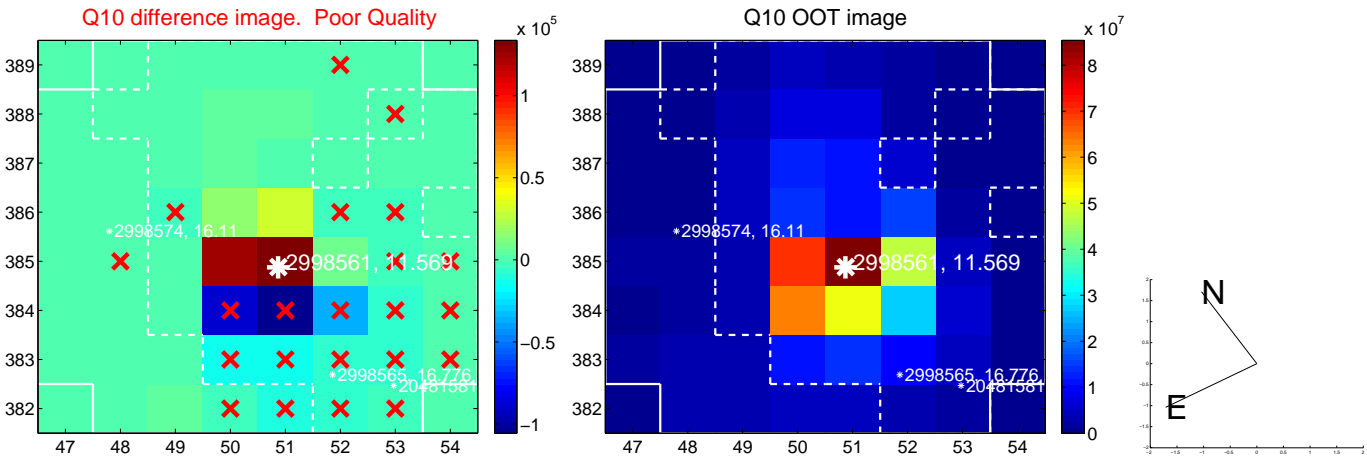
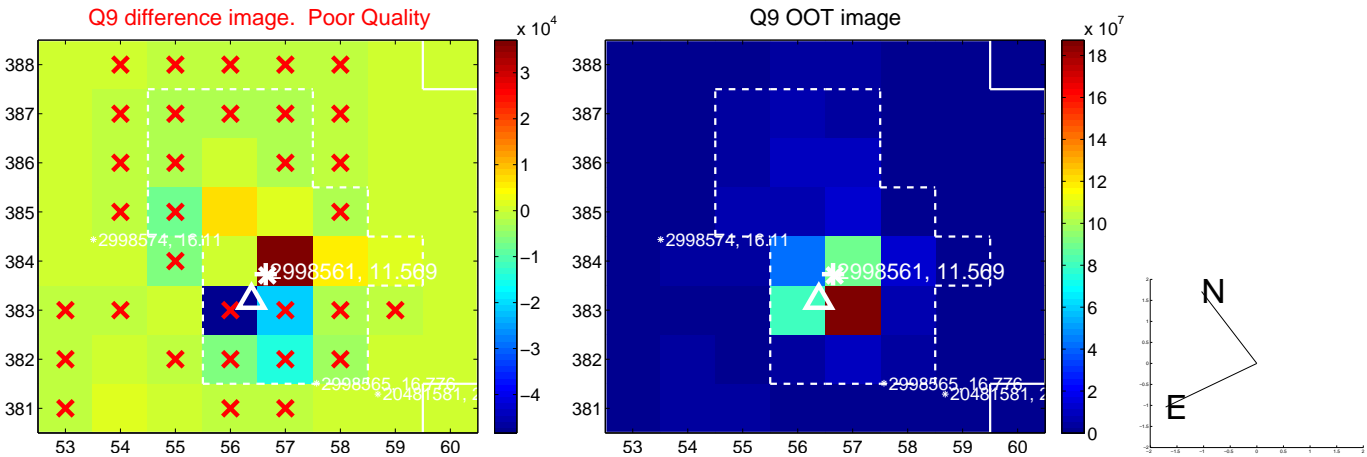




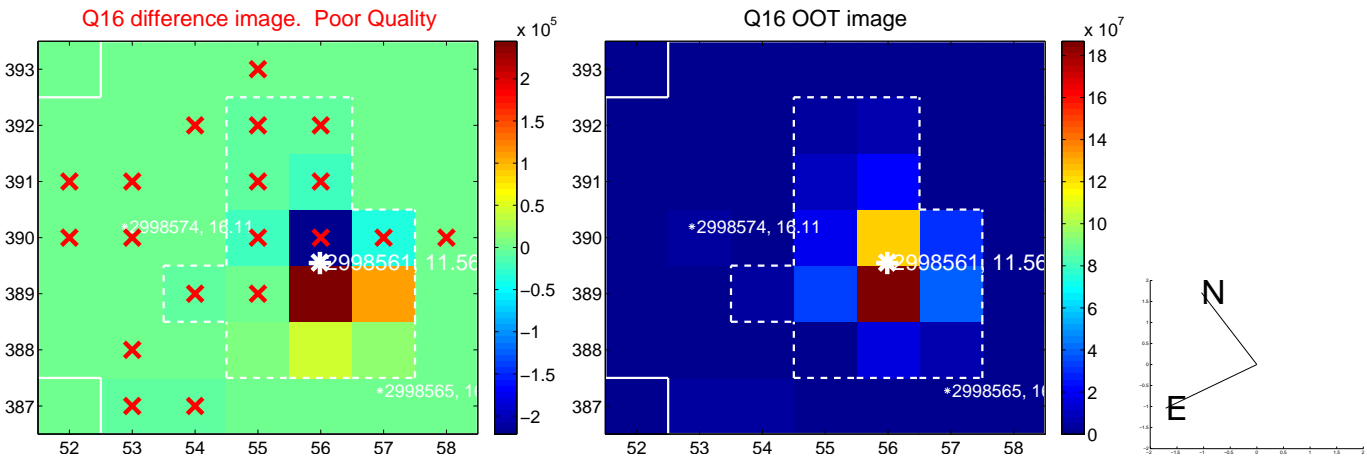
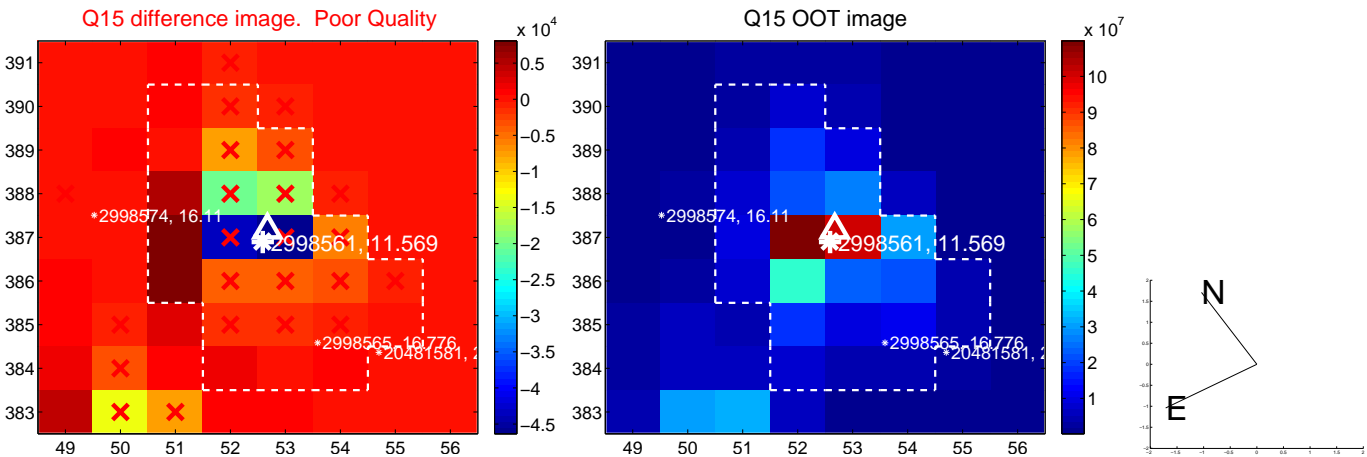
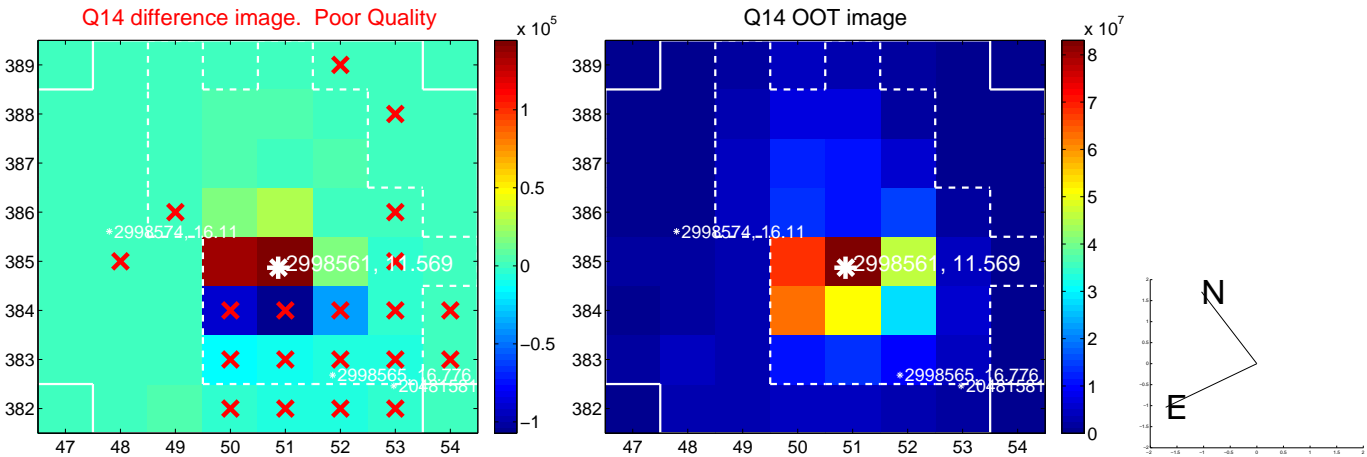
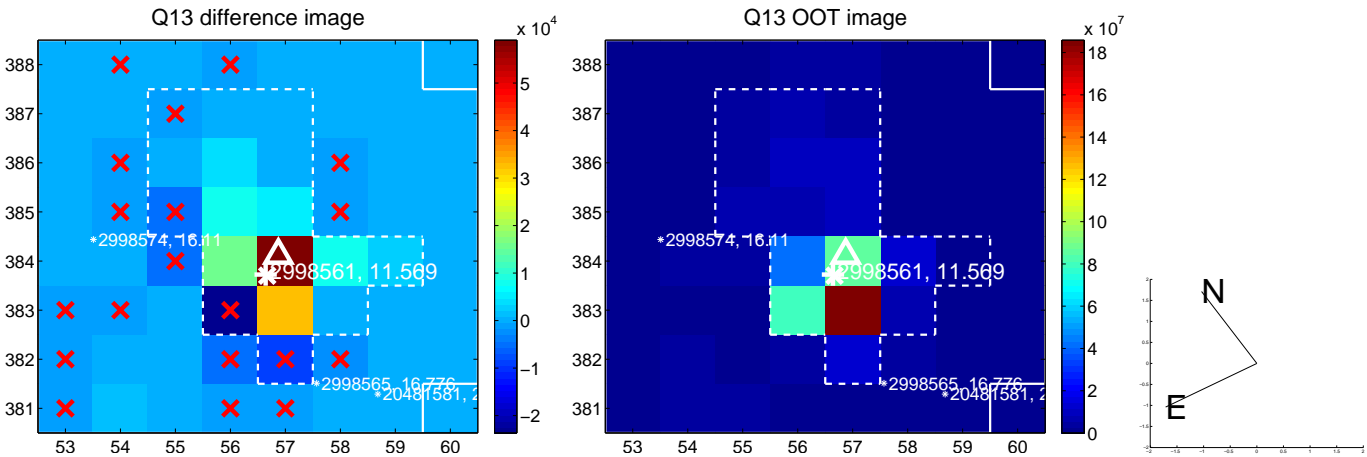
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



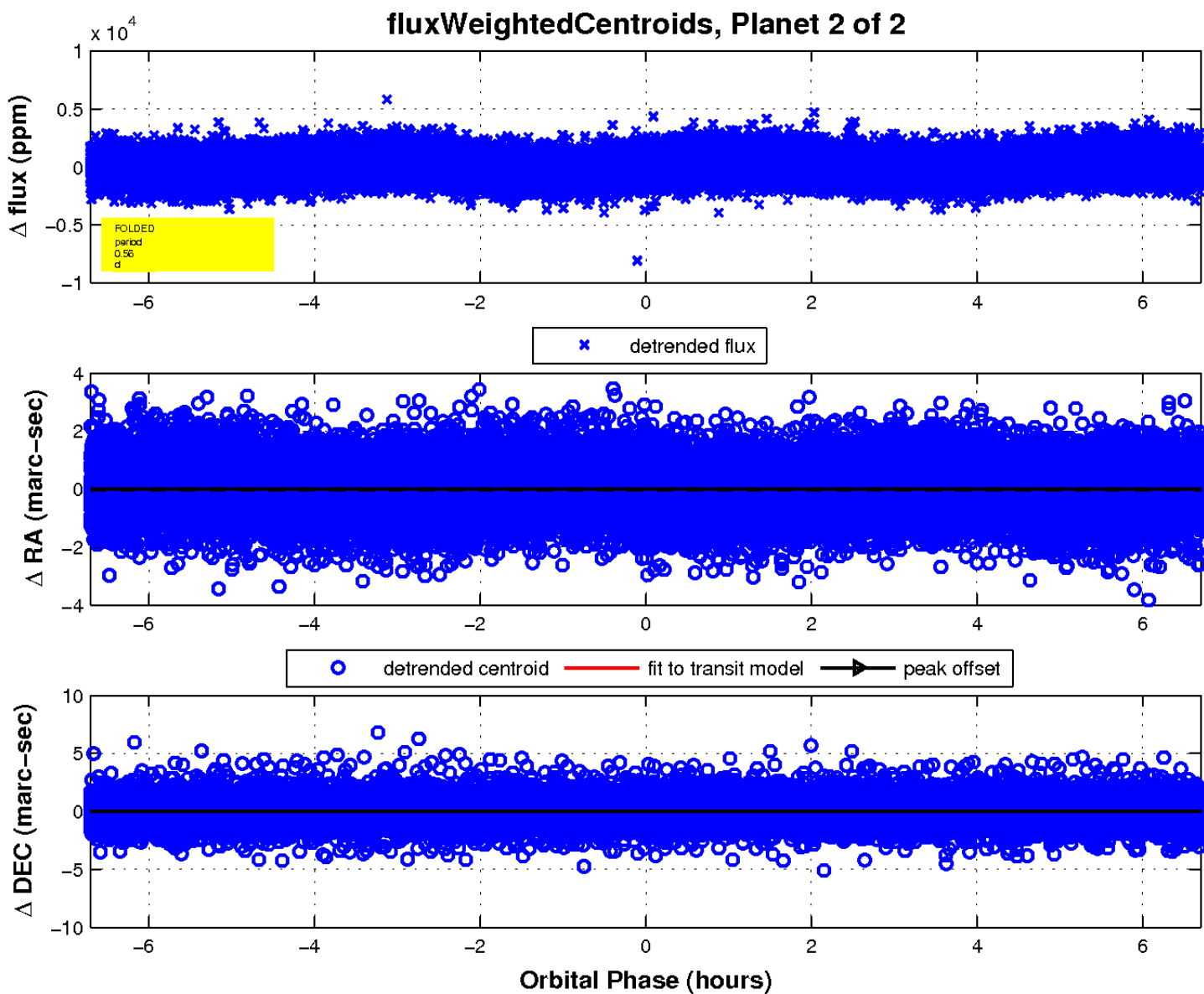
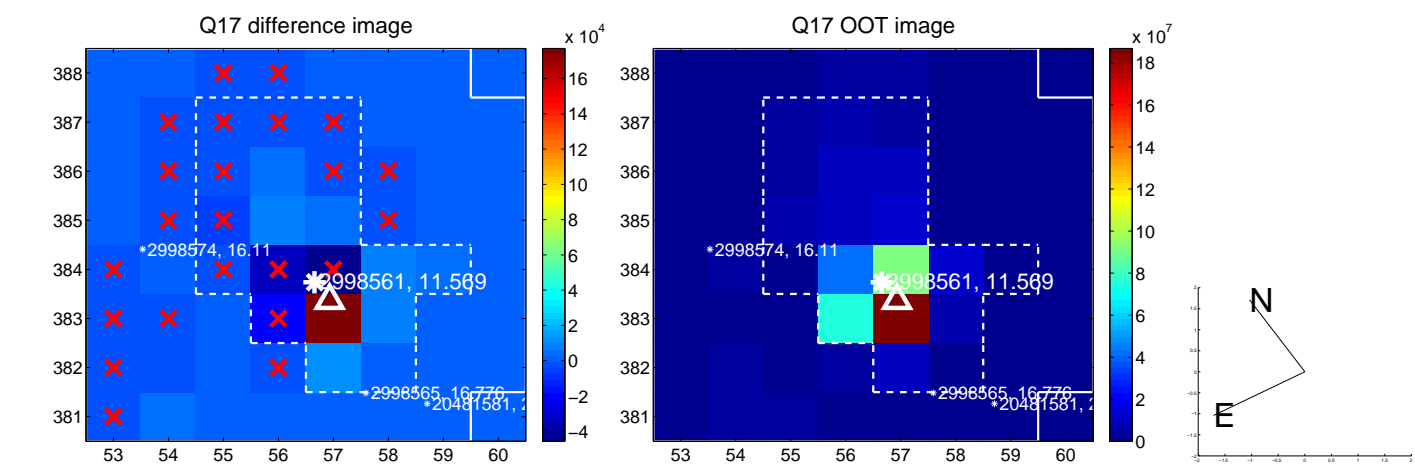
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

