

## KIC 009851970

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009851970-01	OBS	4122.01	1.081931	131.550019	107.5	6.343	13.0	13.4	0.74	4965	0.74	871.41
009851970-02	OBS	No	318.191396	287.691504	2963.9	7.500	18.3	-1.0	0.74	4965	3.89	0.45
009851970-03	OBS	No	87.131904	158.497311	1337.3	12.255	11.1	8.0	0.74	4965	4.18	2.51
009851970-04	OBS	No	98.329975	161.538824	746.0	4.930	12.1	5.3	0.74	4965	2.36	2.13
009851970-05	OBS	No	58.028718	183.047579	986.5	7.168	11.4	8.4	0.74	4965	2.50	4.31
009851970-06	OBS	No	34.155362	145.442225	495.6	5.928	10.4	4.7	0.74	4965	1.86	8.73
009851970-07	OBS	No	43.866421	135.859401	759.6	3.082	10.4	4.7	0.74	4965	2.21	6.26
009851970-08	OBS	No	485.794267	253.271172	1176.7	9.000	9.7	-1.0	0.74	4965	2.45	0.25
009851970-09	OBS	No	69.926614	193.429290	667.9	4.803	9.9	4.1	0.74	4965	2.11	3.36
009851970-10	OBS	No	665.534623	173.054303	2457.4	17.077	9.5	8.7	0.74	4965	6.96	0.17

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009851970-01	OBS	FP	0.00	0	1	1	1	MOD_SEC_ALT—CENT_RESOLVED_OFFSET—HALO_GHOST—EPHEM_MATCH
009851970-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_ZUMA—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_NOFITS
009851970-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_ALT—CENT_FEW_DIFFS
009851970-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_ZUMA_TRACKER—TRANS_GAPPED—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009851970-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE—TRANS_GAPPED—LPP_DV—CENT_FEW_DIFFS
009851970-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
009851970-07	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_TRACKER—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
009851970-08	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL—LPP_DV—ALL_TRANS_CHASES—NO_FITS—CENT_NOFITS
009851970-09	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE_TRACKER—TRANS_GAPPED—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS—HALO_GHOST
009851970-10	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_SKYE—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—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.

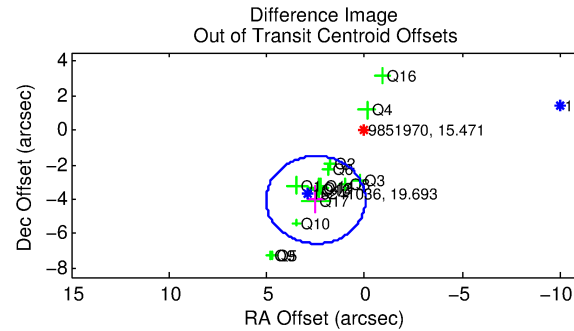
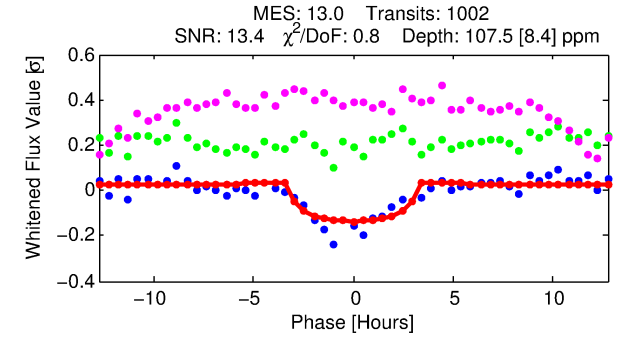
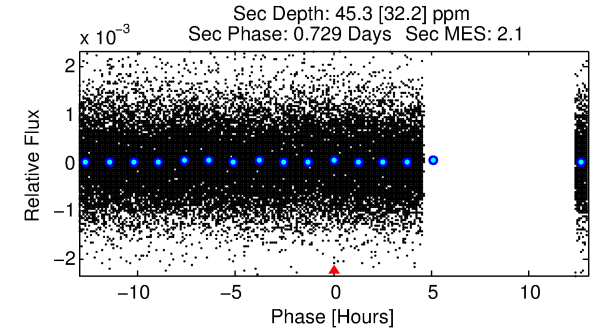
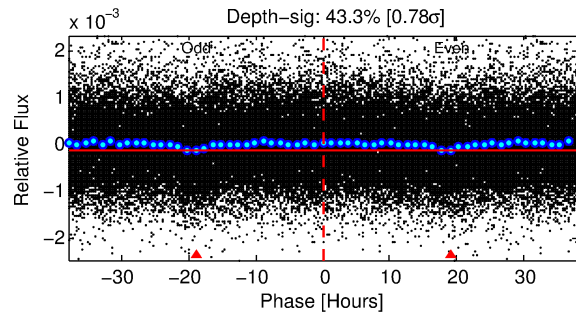
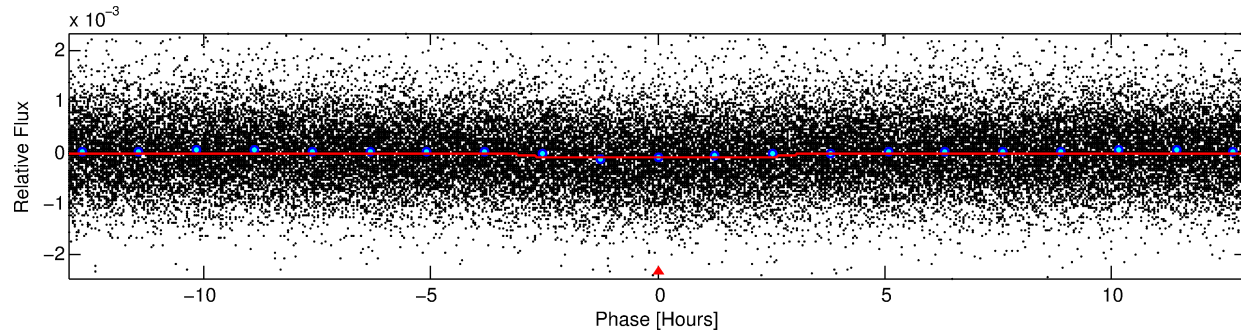
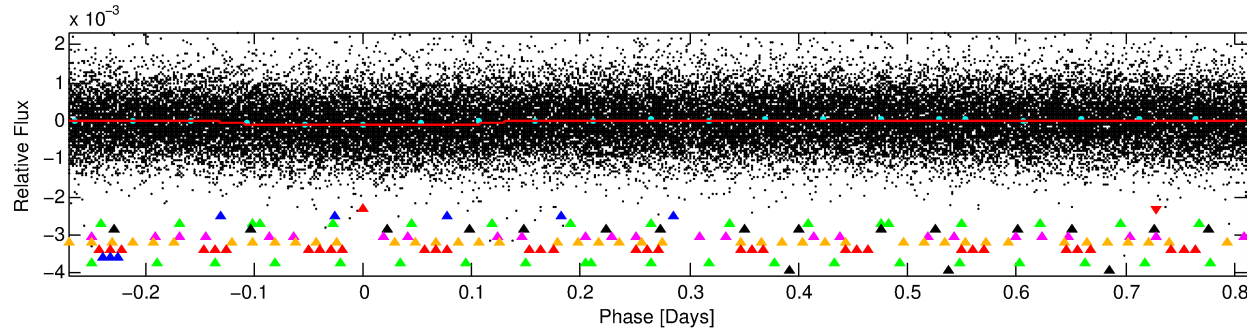
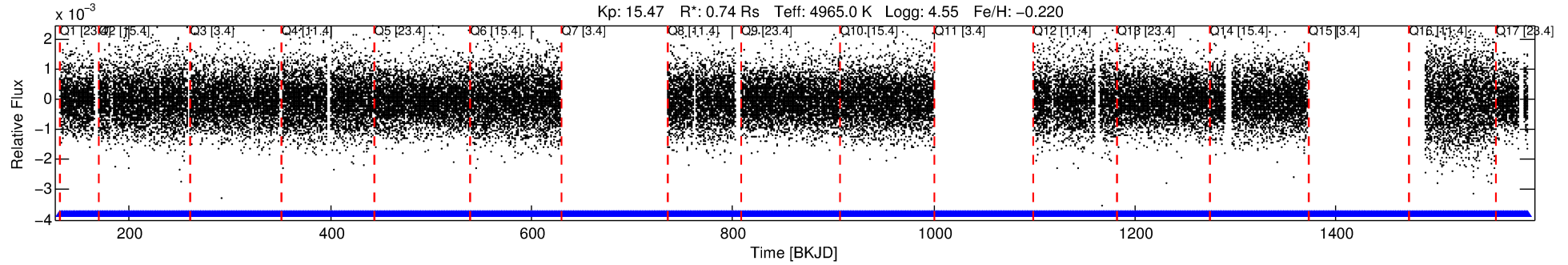
# Ephemeris Match Information For 009851970-01

TCE (1)	KIC	Parent (2)	Parent KIC	P <sub>1</sub> :P <sub>2</sub>	Dist (″)	ΔRow	ΔCol	m <sub>2</sub>	m <sub>1</sub>	D <sub>2</sub> /D <sub>1</sub>	Mechanism	Flag	σ <sub>P</sub>	σ <sub>T</sub>
009851970-01	9851970	009851944-pri	9851944	1:2	89.4	-14	17	11.25	15.47	1939.30	Direct-PRF	0	3.32	3.37

**Notes:** P<sub>1</sub>:P<sub>2</sub> is the period ratio. Dist is the distance in arcseconds. ΔRow and ΔCol are the number of pixels apart in row and column. m<sub>2</sub> and m<sub>1</sub> are the magnitudes of the parent and child. D<sub>2</sub>/D<sub>1</sub> is the parent's transit depth divided by the child's. σ<sub>P</sub> and σ<sub>T</sub> are the significance of the match in period and epoch. For a match to be considered significant σ<sub>P</sub> < 5.0 and σ<sub>T</sub> < 5.0. Matches which have σ<sub>P</sub> and σ<sub>T</sub> very close to this cutoff should receive extra scrutiny, especially if the period ratio is very large.

# DV One-Page Summary

KIC: 9851970 Candidate: 1 of 10 Period: 1.082 d  
KOI: K04122.01 Corr: 0.961



## DV Fit Results:

Period = 1.08193 [0.00001] d  
Epoch = 131.5500 [0.0049] BKJD  
Rp/R\* = 0.0092 [0.0097]  
a/R\* = 1.45 [2.76]  
b = 0.00 [1886.34]  
Seff = 871.41 [156.21]  
Teff = 1385 [62] K  
Rp = 0.74 [0.78] Re  
a = 0.0184 [0.0017] AU  
Ag = 15.45 [34.38] [0.42 $\sigma$ ]  
Teffp = 4247 [2362] K [1.21 $\sigma$ ]

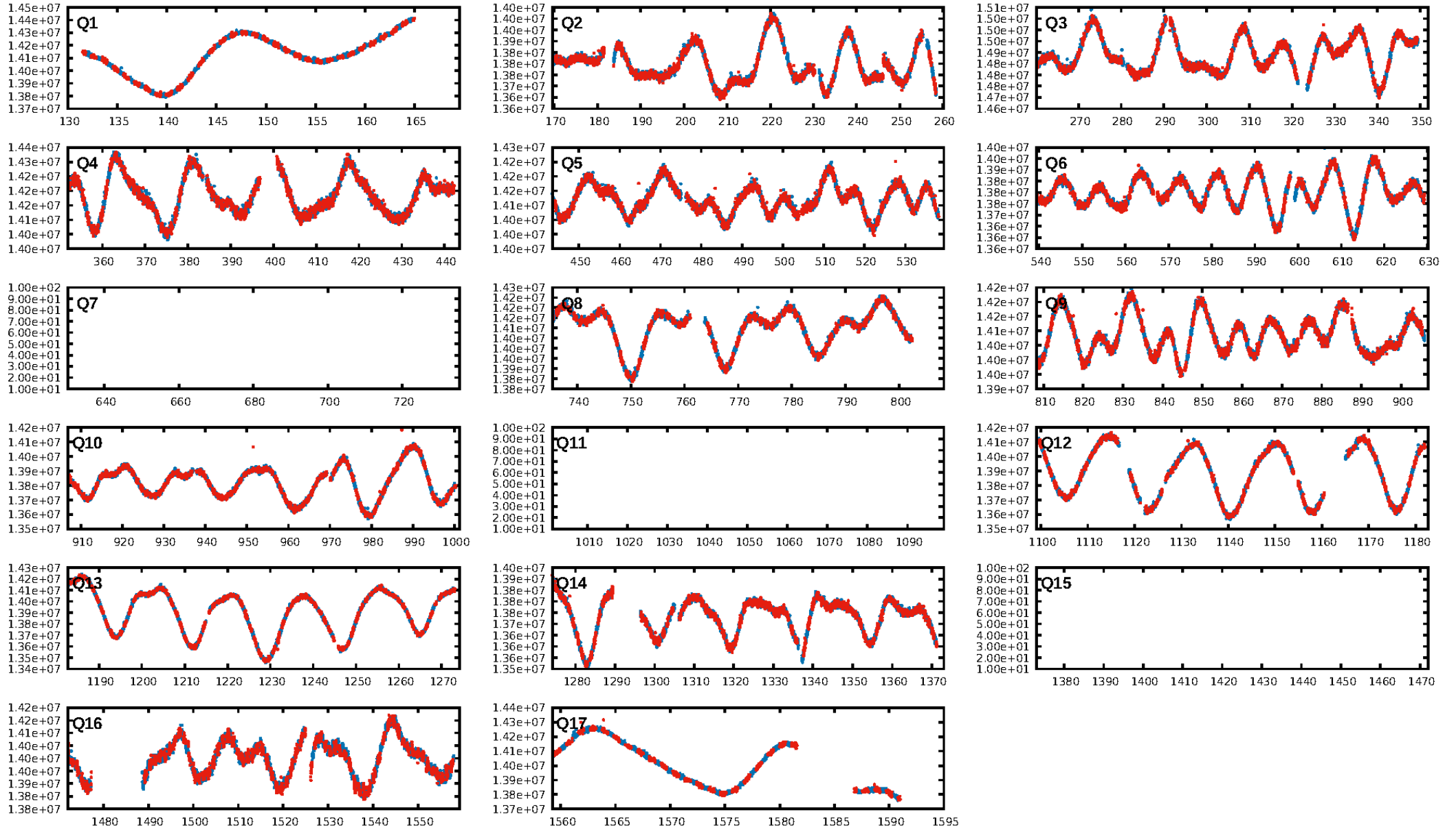
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [91.43 $\sigma$ ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [944/944]  
GhostDiagnostic-chr: -0.07418  
Centroid-sig: 0.0%  
Centroid-so: 3.806 arcsec [4.27 $\sigma$ ]  
OotOffset-rm: 4.748 arcsec [5.61 $\sigma$ ]  
KicOffset-rm: 4.901 arcsec [6.18 $\sigma$ ]  
OotOffset-st: 4/1/4/5 [14]  
KicOffset-st: 4/1/4/5 [14]  
DiffImageQuality-fgm: 0.00 [0/14]  
DiffImageOverlap-fno: 1.00 [14/14]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 08:50:11 Z

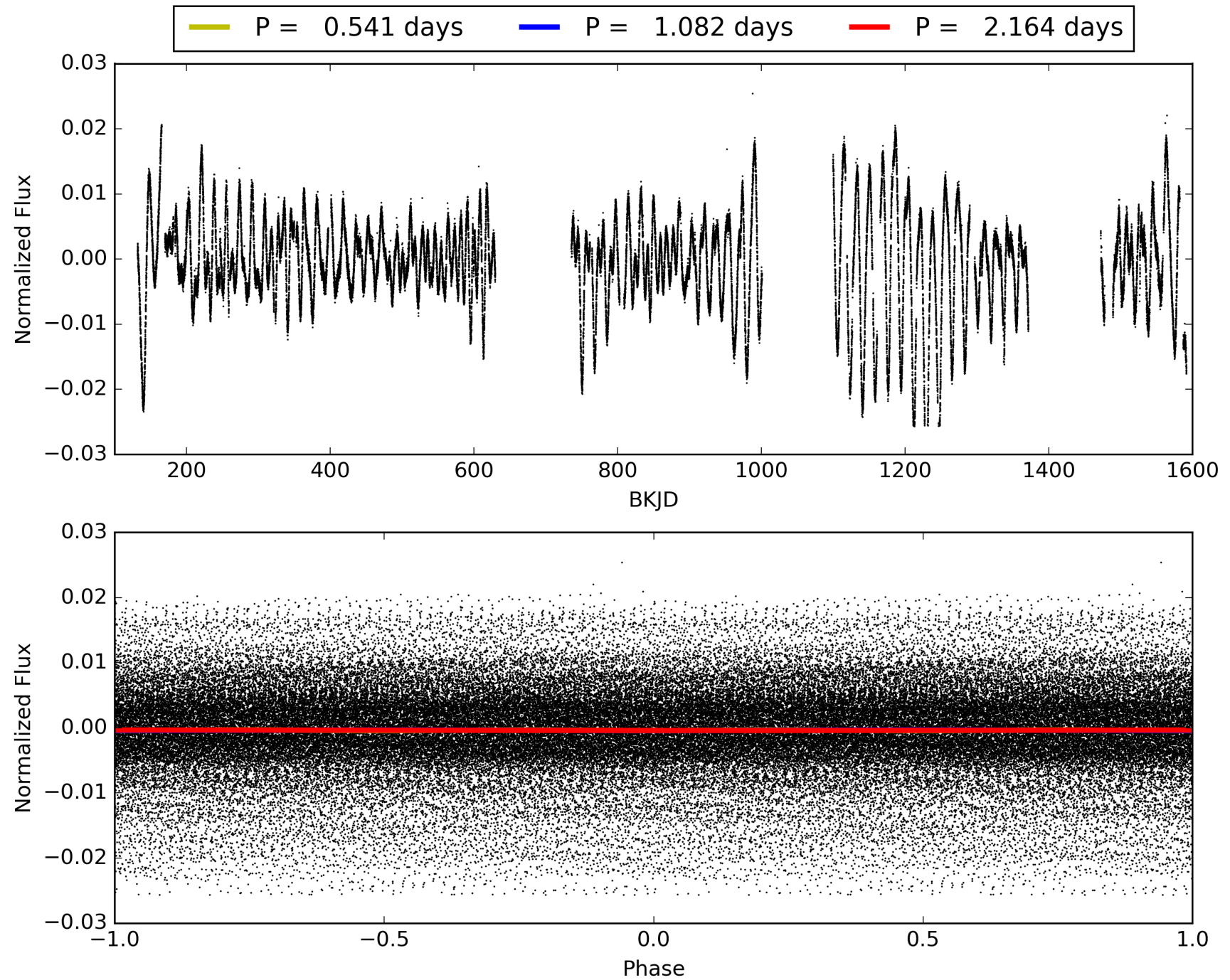
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 009851970-01, PDC Light Curves



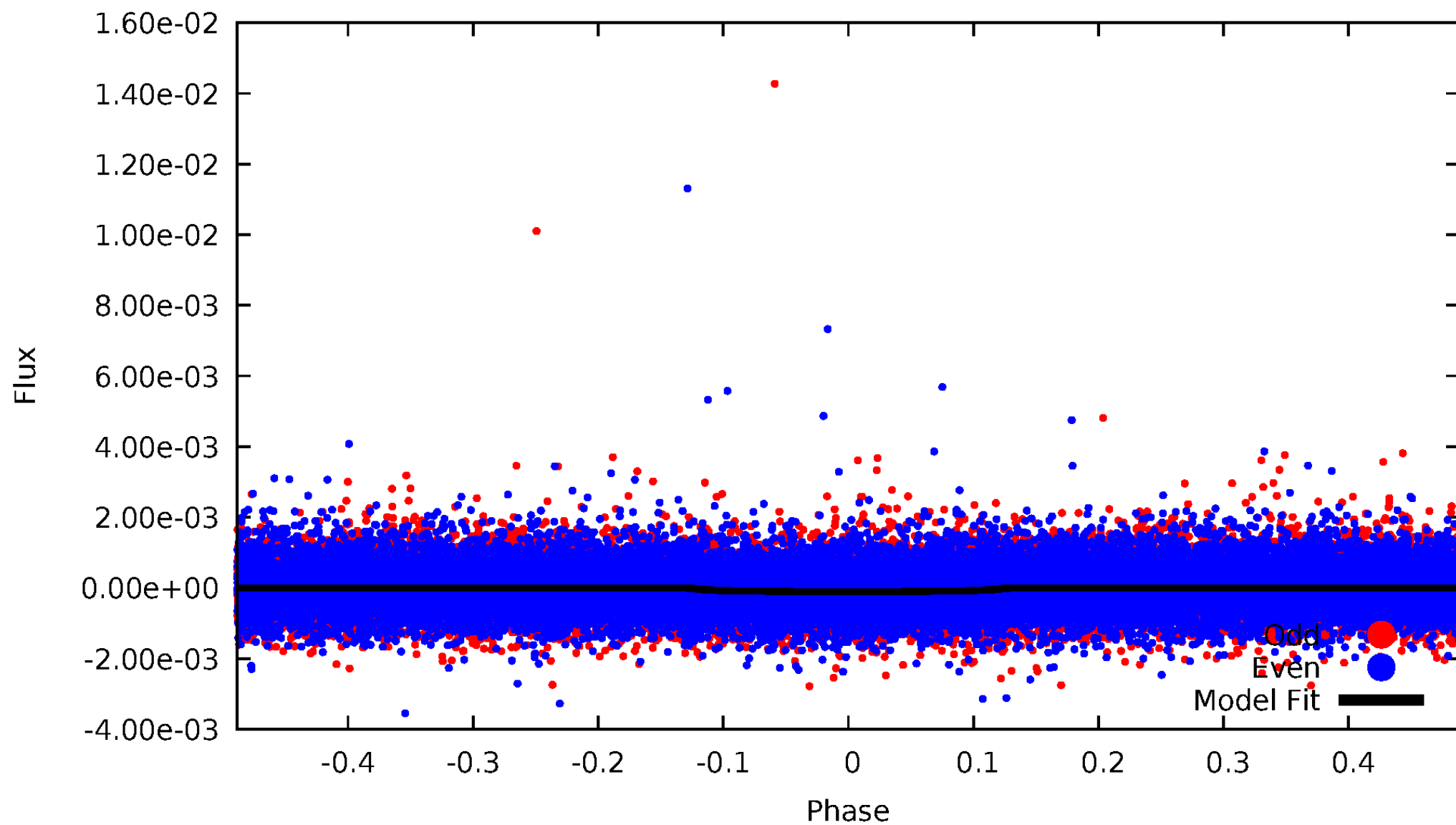


TCE 009851970-01



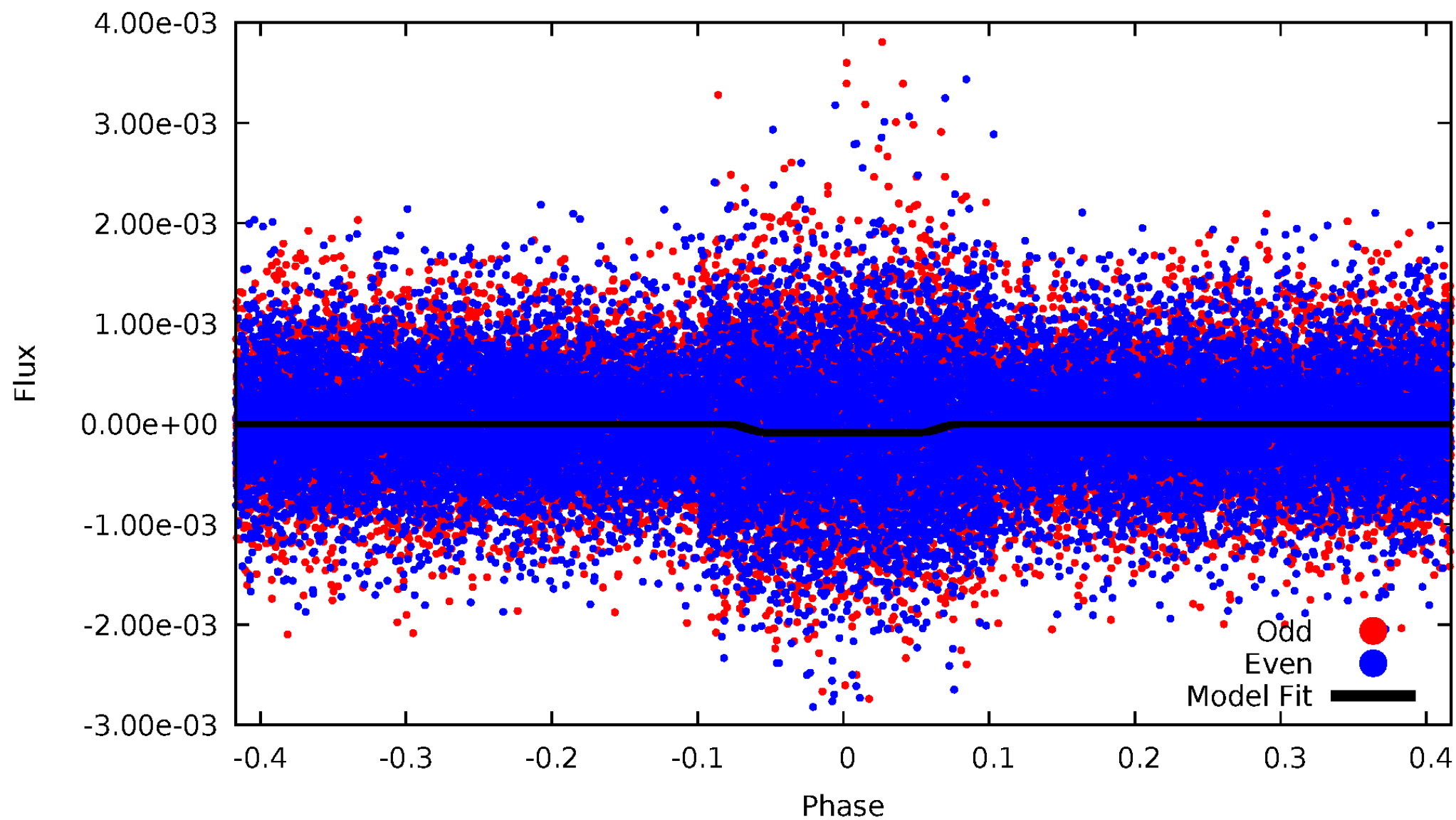
# DV Odd/Even

TCE 009851970-01



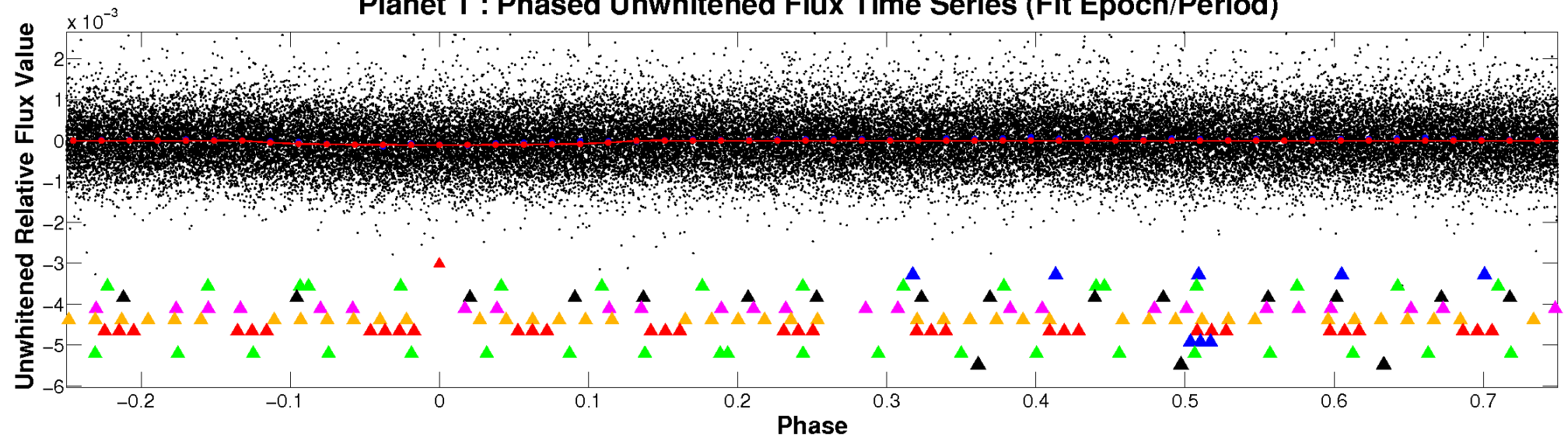
# ALT Odd/Even

TCE 009851970-01

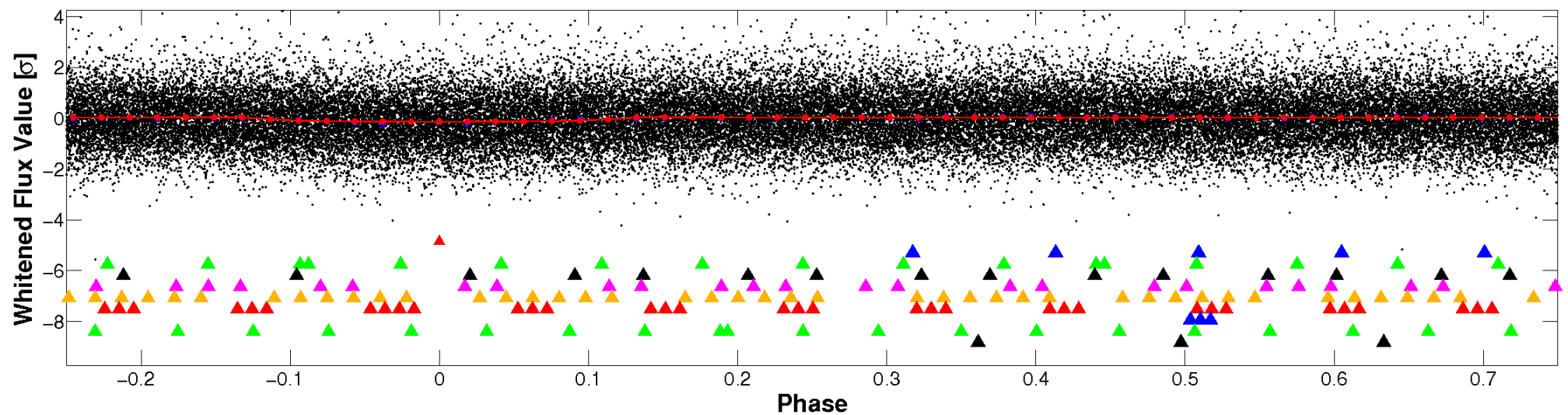


# Non-Whitened Vs. Whitened Light Curve

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

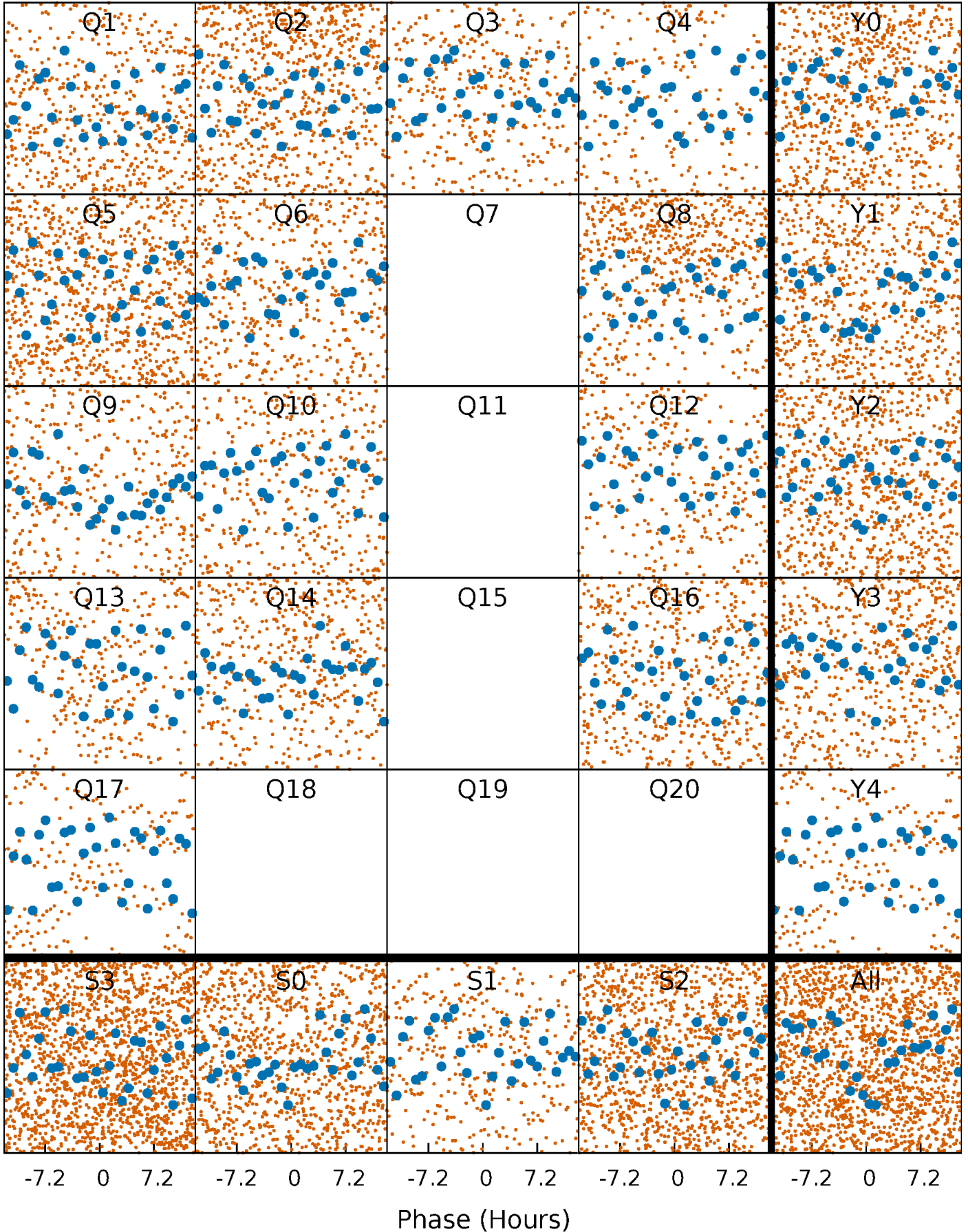


## Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

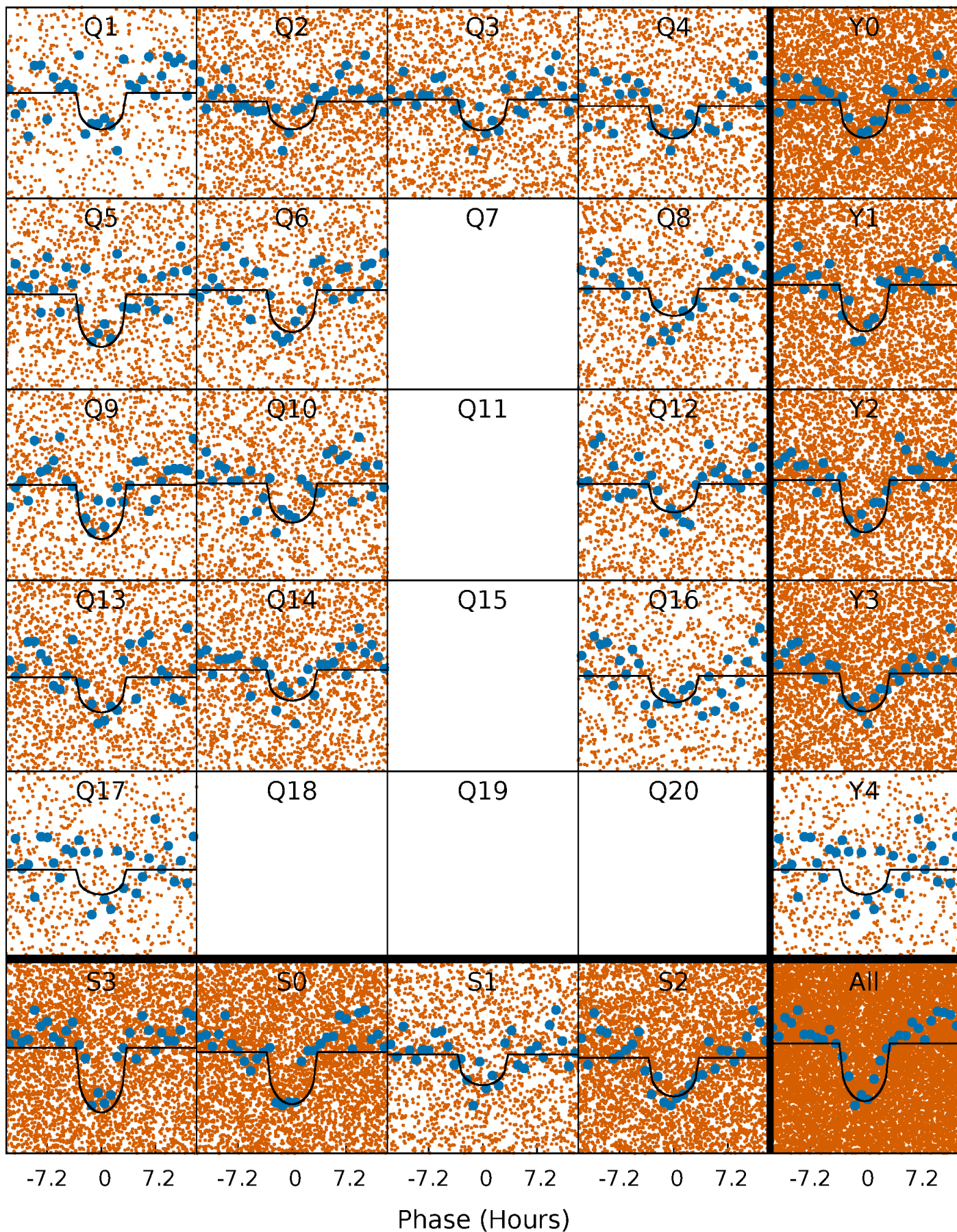
TCE 009851970-01 P= 1.081931 Days  $T_0=131.550019$  (BKJD)





# DV Quarter-Phased Transit Curves

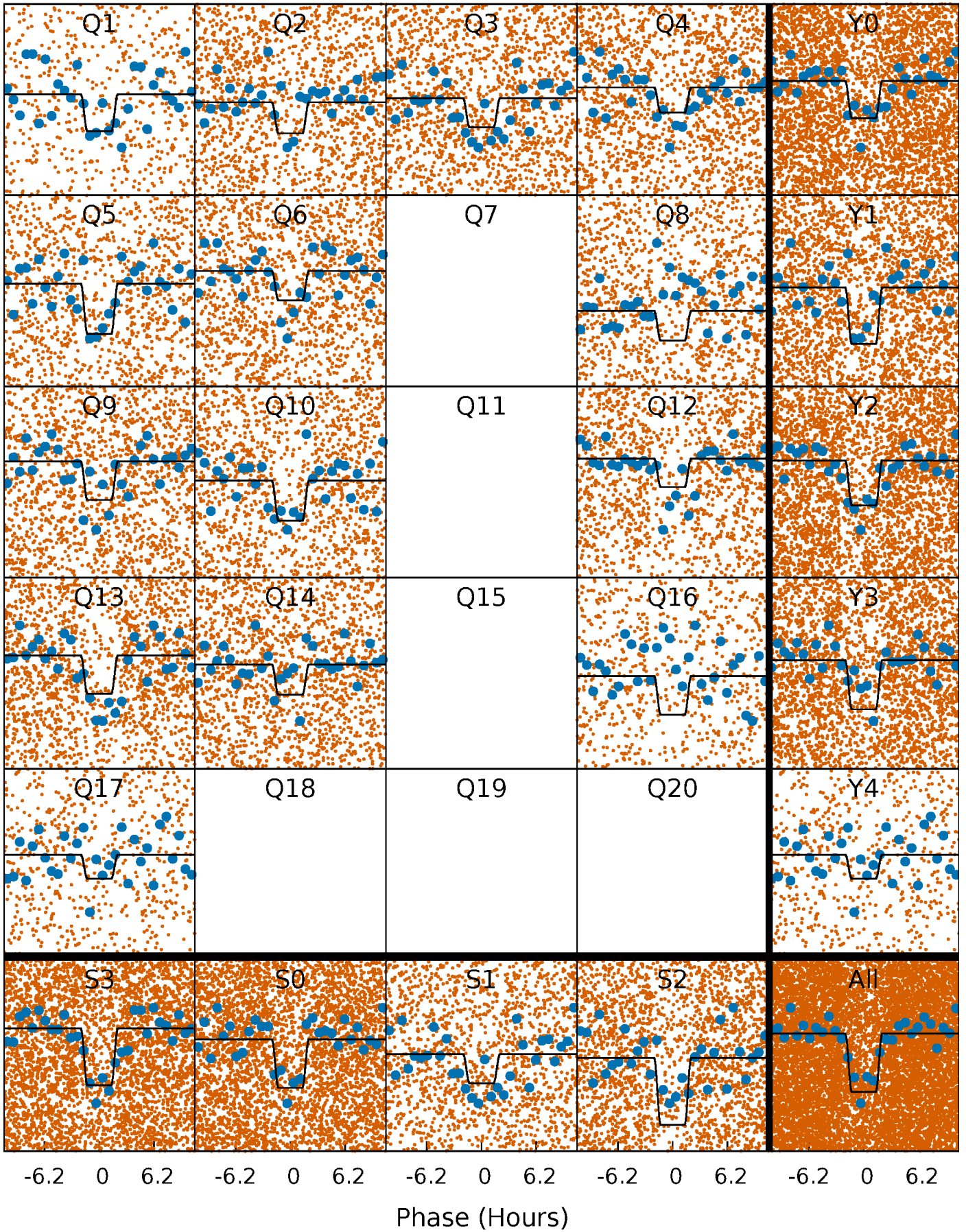
TCE 009851970-01 P= 1.081931 Days  $T_0=131.550019$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

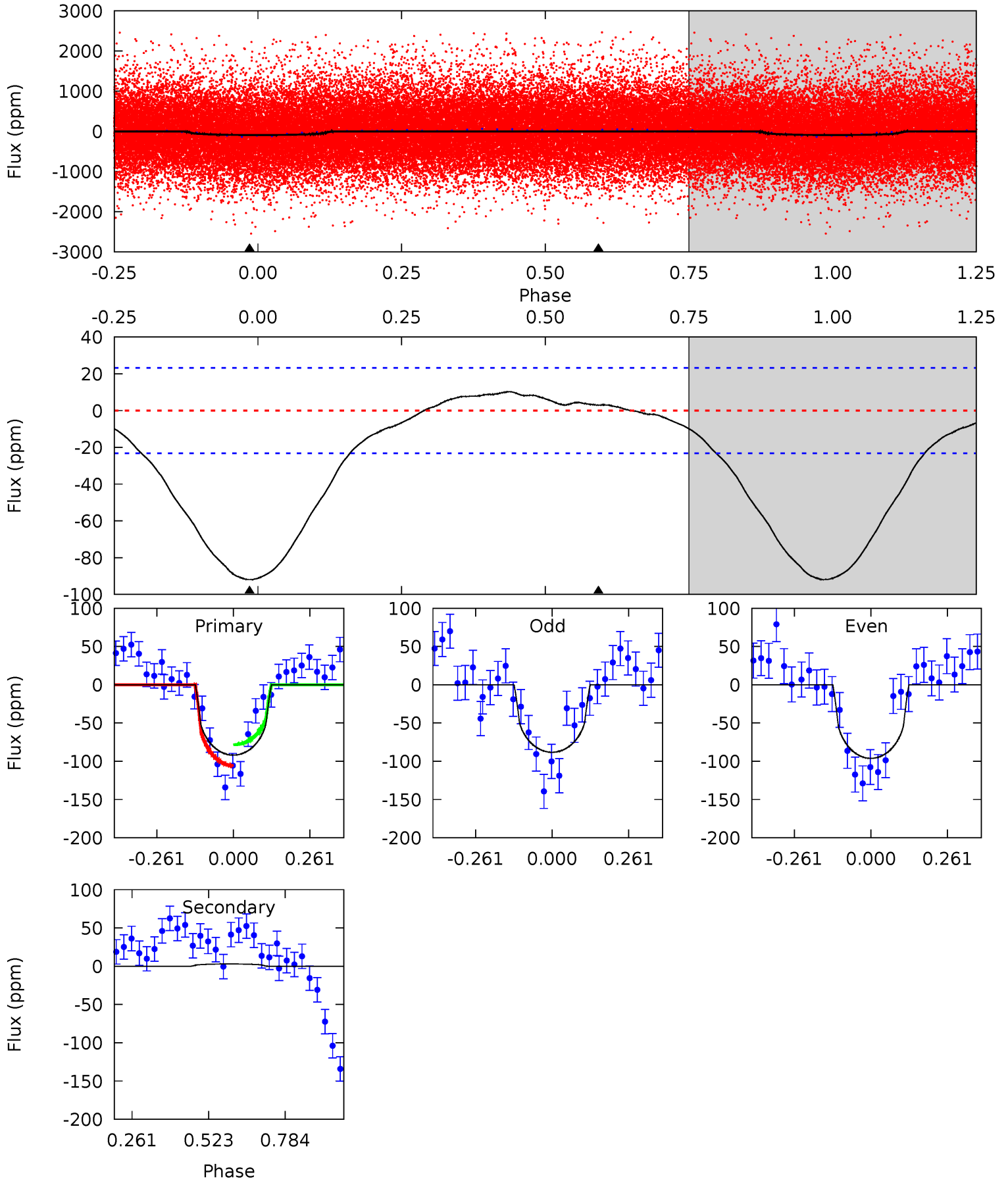
TCE 009851970-01 P= 1.081936 Days  $T_0=131.528771$  (BKJD)



# DV Model-Shift Uniqueness Test

009851970-01, P = 1.081931 Days, E = 130.468088 Days

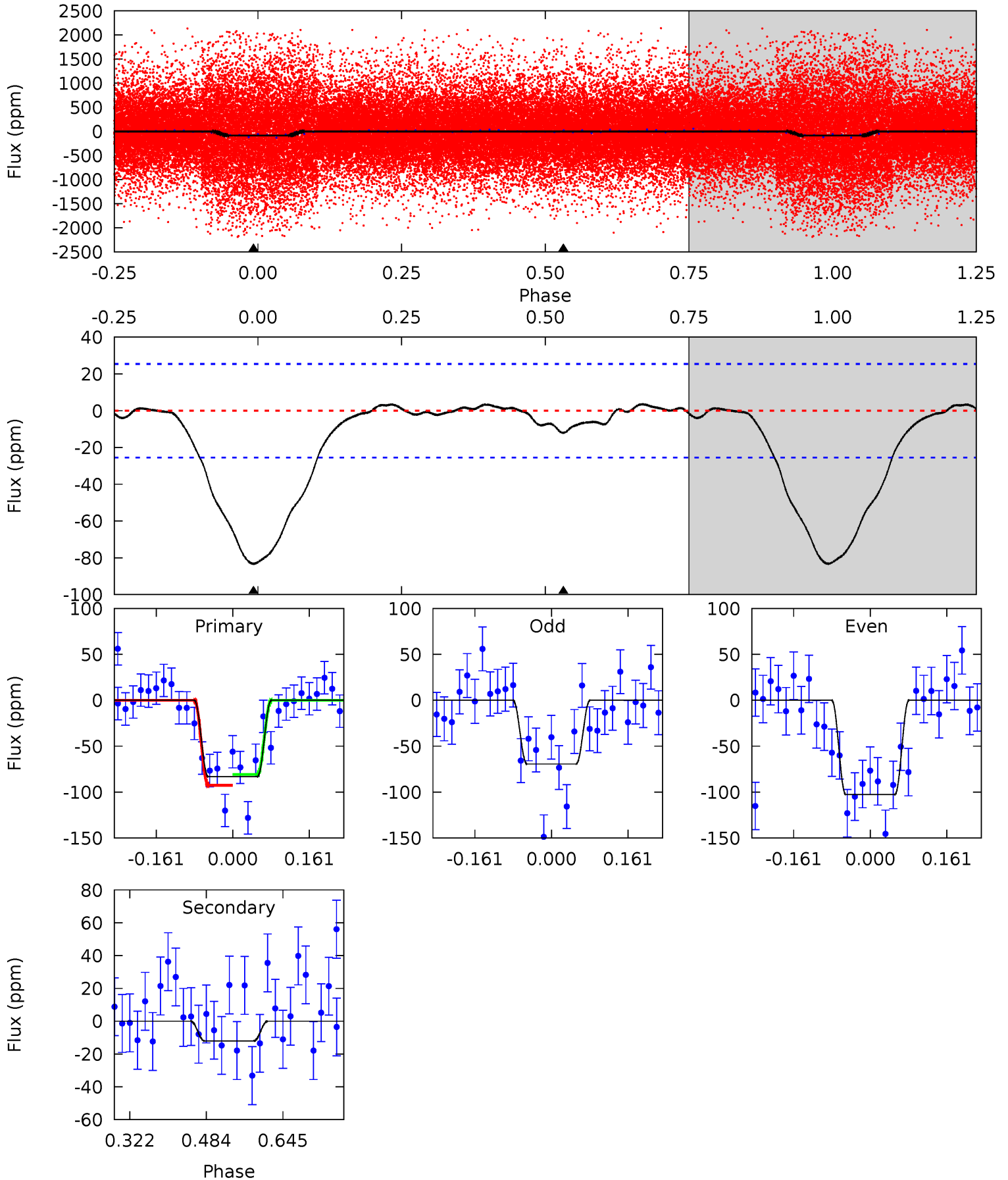
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
17.3	-0.55	0	0	4.36	1.12	0.82	17.3	17.3	-0.55	-0.55	0.75	0.97	0.10	2.57



# Alt Model-Shift Uniqueness Test

009851970-01, P = 1.081936 Days, E = 130.446835 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
14.6	2.11	0	0	4.46	1.40	0.33	14.6	14.6	2.11	2.11	2.92	0.86	0.04	1.04



### Stellar Parameters For KIC 009851970

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$4965^{+151}_{-136}$	$4.555^{+0.072}_{-0.044}$	$-0.220^{+0.300}_{-0.300}$	$0.736^{+0.065}_{-0.079}$	$0.709^{+0.093}_{-0.050}$	$2.508^{+0.760}_{-0.407}$
	+3%/-3%	+2%/-1%	+136%/-136%	+9%/-11%	+13%/-7%	+30%/-16%
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 009851970-01 / KOI 4122.01

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$3 \pm 5$	$0.88^{+0.67}_{-0.54}$	$1926^{+71}_{-73}$	$-2719^{+5047}_{-901}$	$-0.453^{+0.965}_{-4.550}$
Alt.	$-12 \pm 6$	$0.91^{+0.70}_{-0.55}$	$1931^{+70}_{-74}$	$3151^{+1266}_{-672}$	$2.532^{+14.502}_{-1.896}$

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

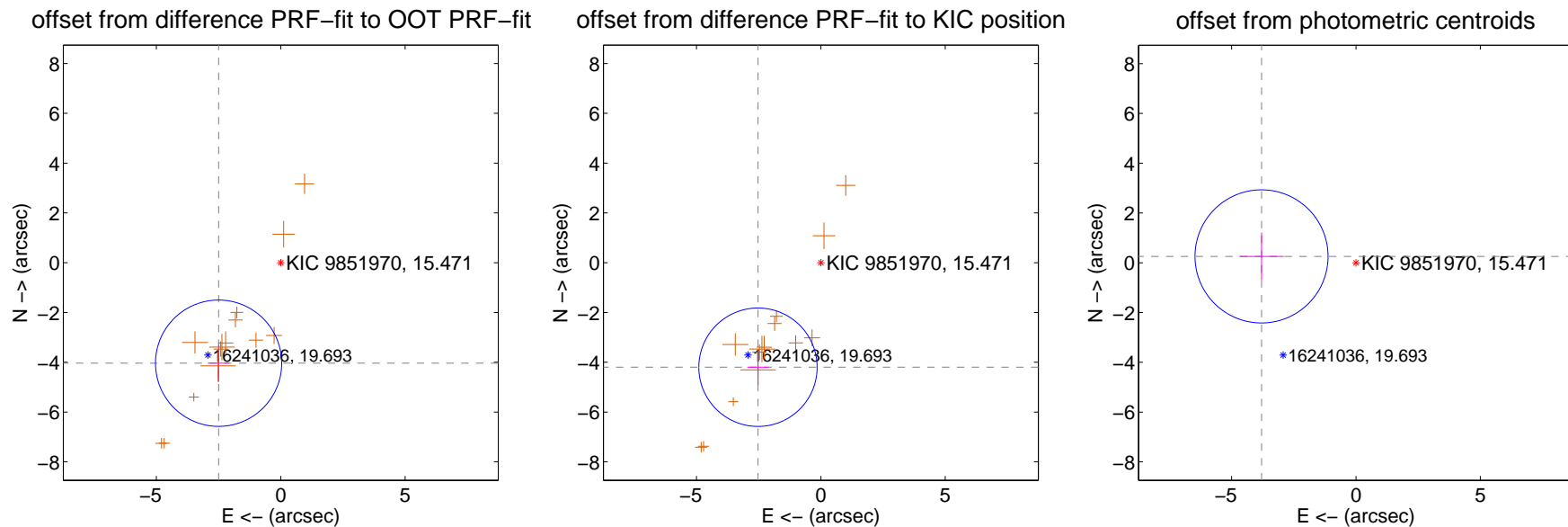
## DV Centroid Data

Supplemental centroid analysis for 009851970-01. Kepler magnitude: 15.47. Transit SNR 13.41

There are 0 quarters with good PRF difference image offsets

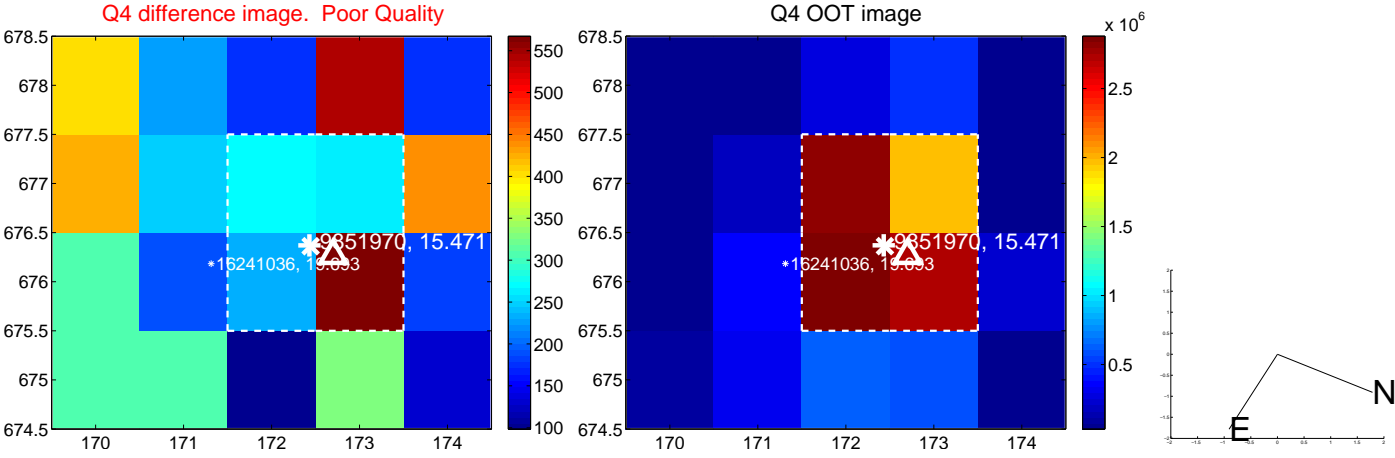
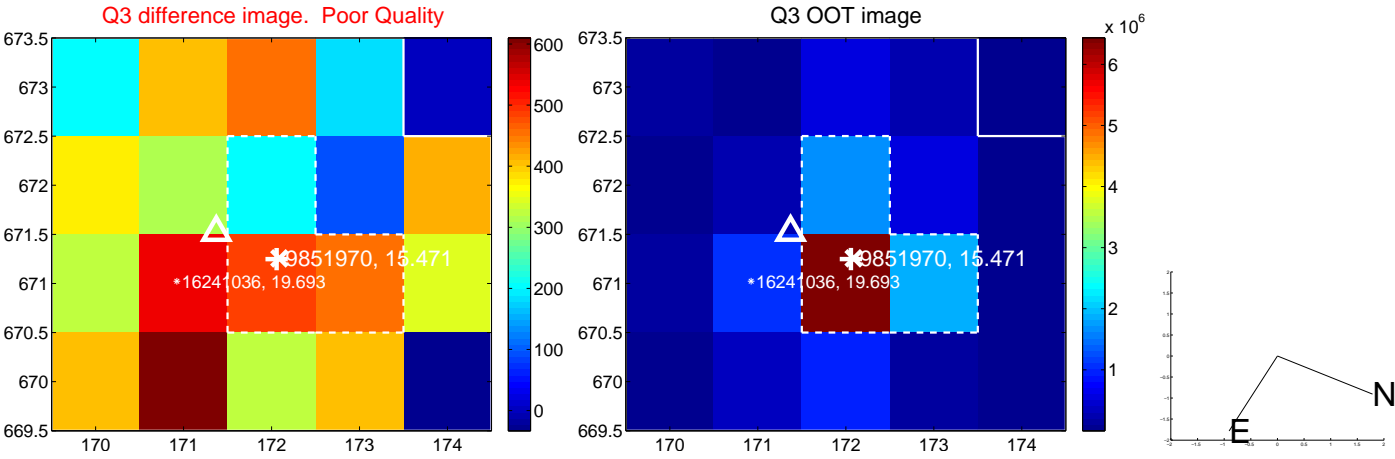
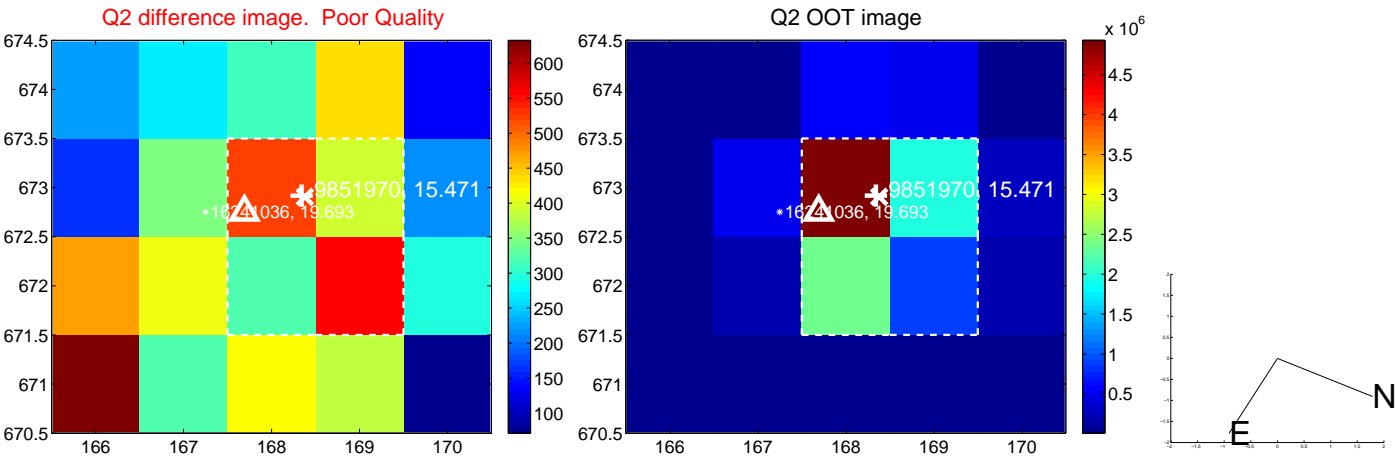
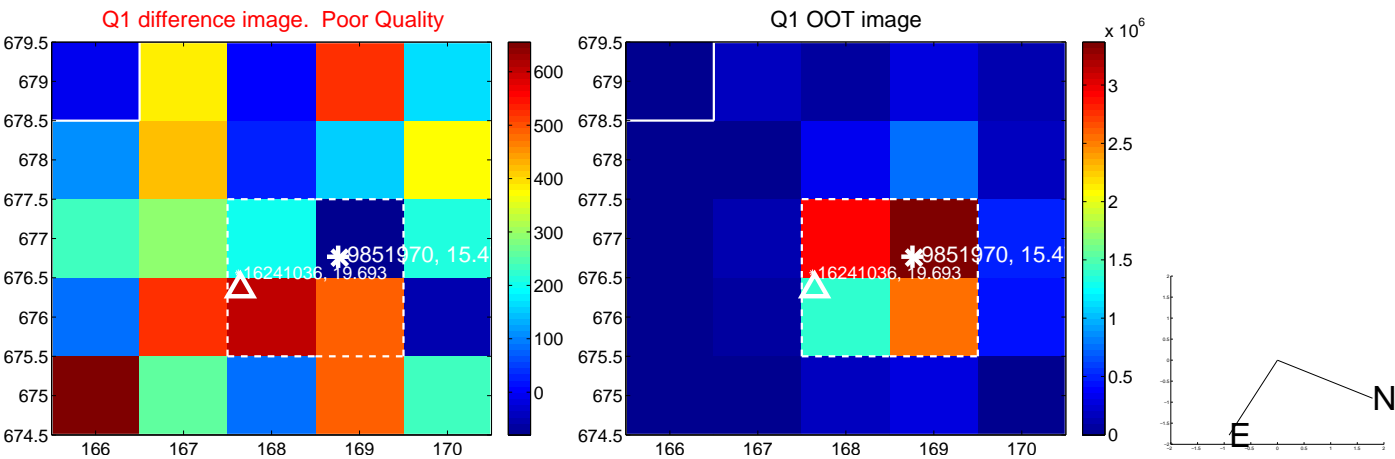
The direct PRF centroid is offset from the target star catalog position by about 0.16 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$4.748 \pm 0.846$	5.61	$2.498 \pm 0.433$	$-4.037 \pm 0.747$
PRF-fit source offset from KIC position	$4.901 \pm 0.793$	6.18	$2.528 \pm 0.426$	$-4.198 \pm 0.689$
photometric centroid source offset	$3.81 \pm 0.89$	4.27	$3.80 \pm 0.89$	$0.26 \pm 0.95$



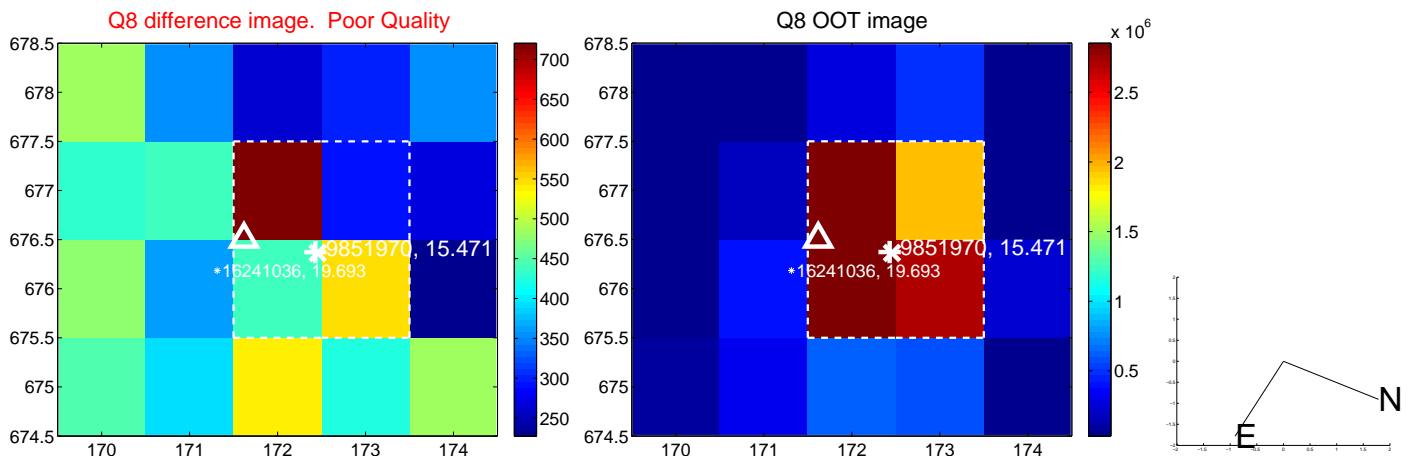
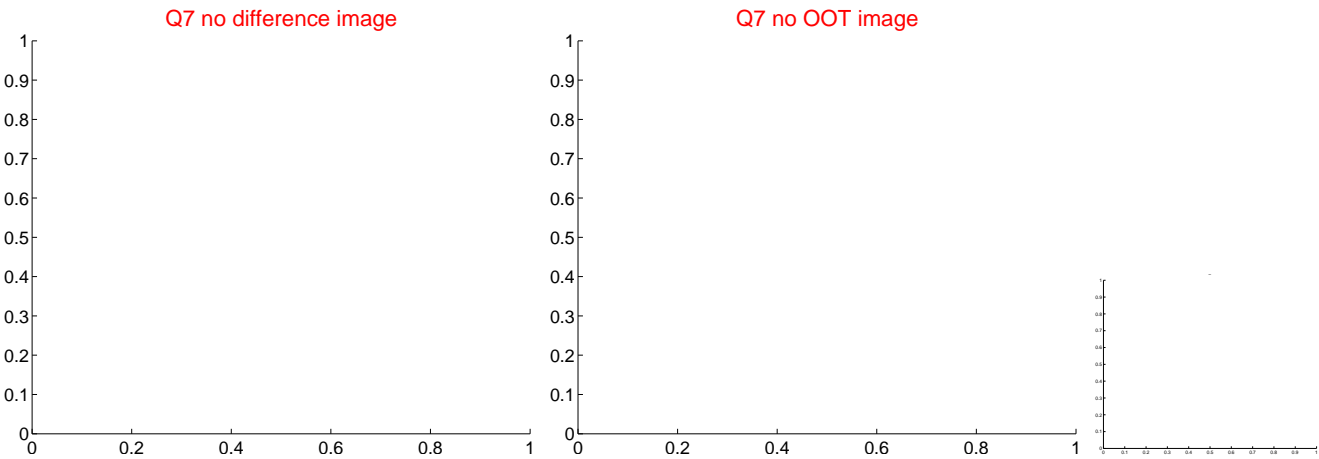
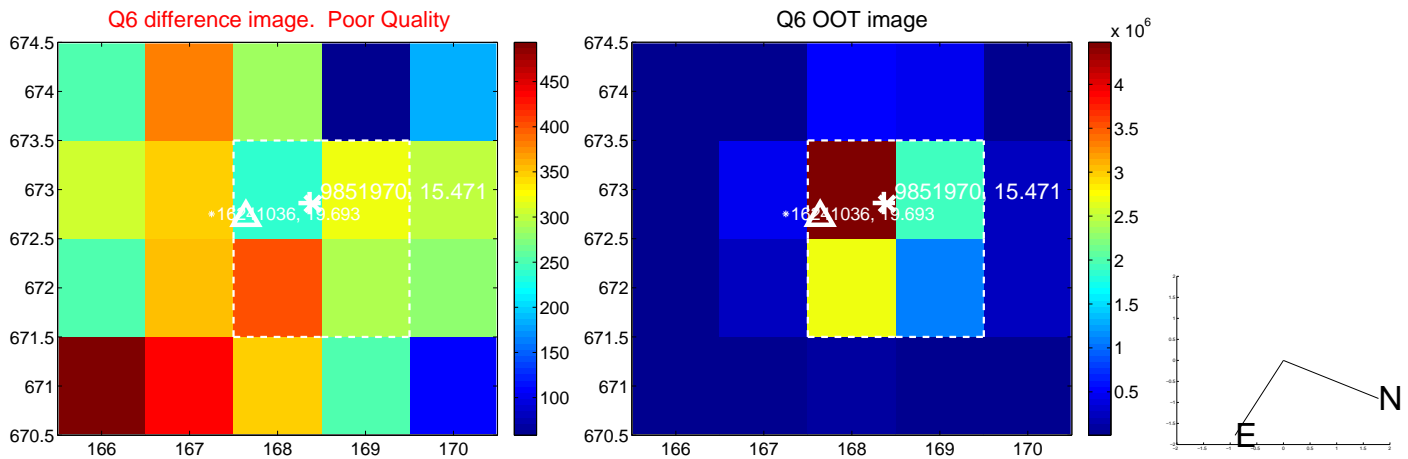
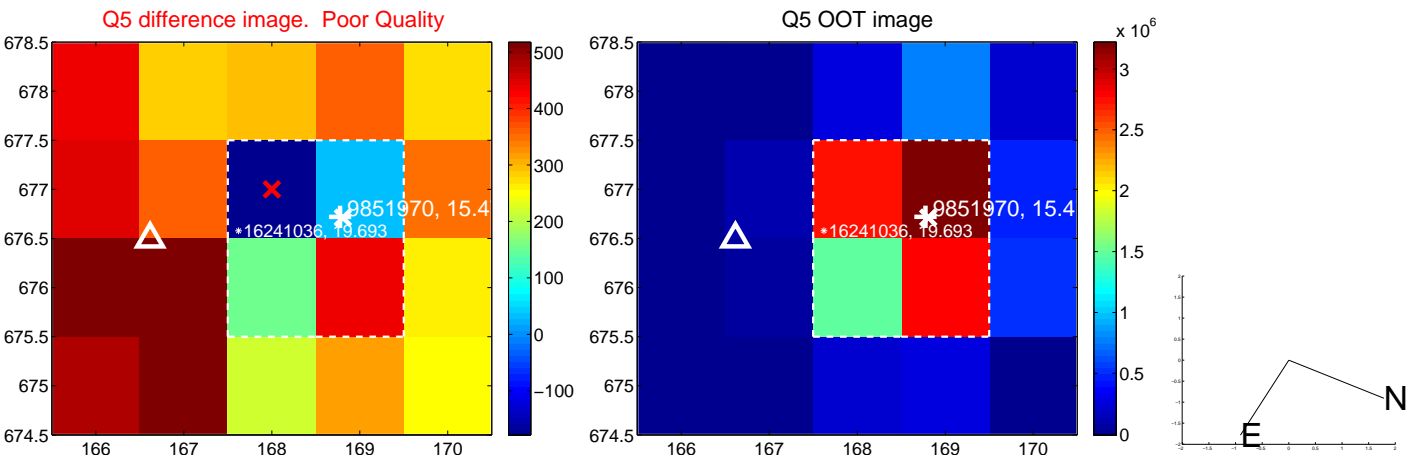
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

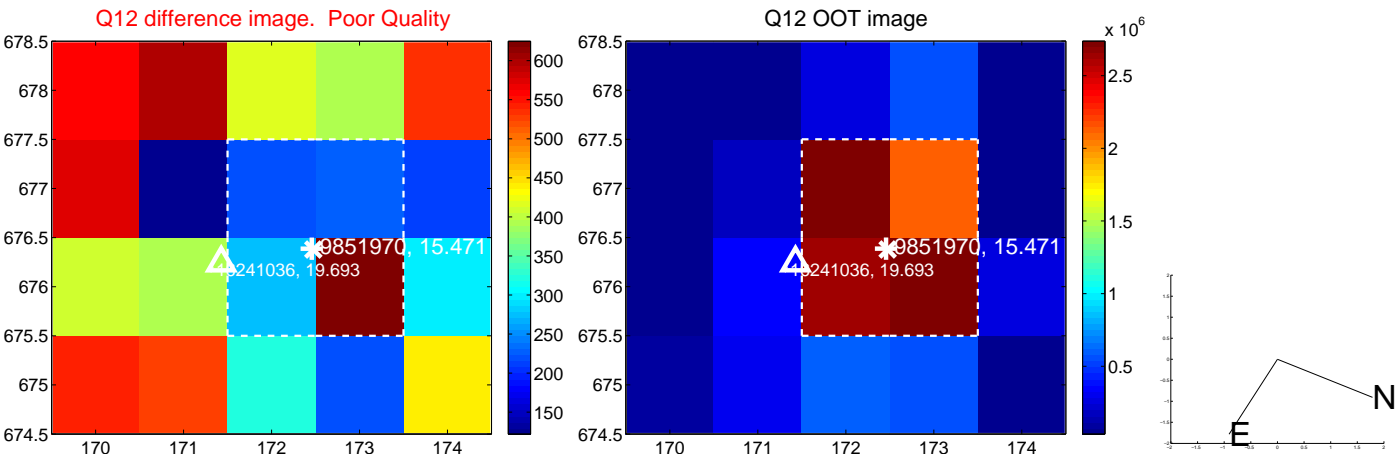
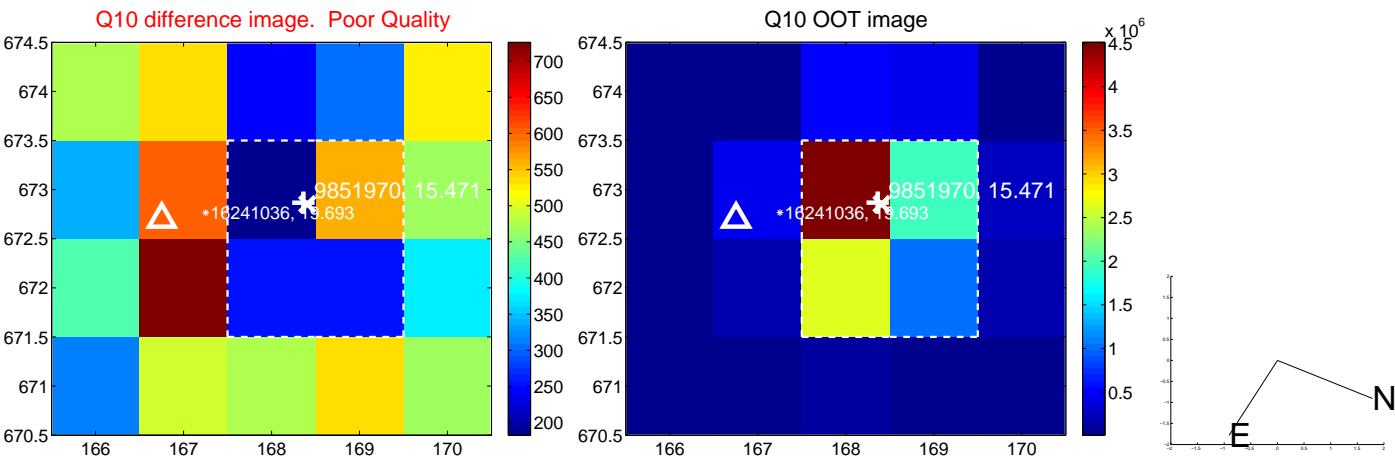
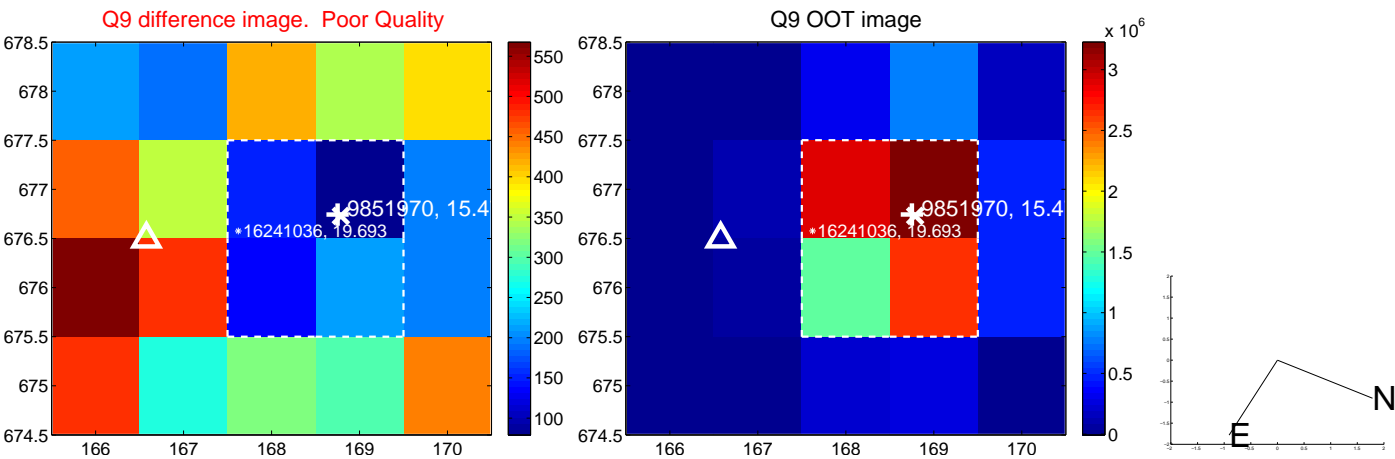




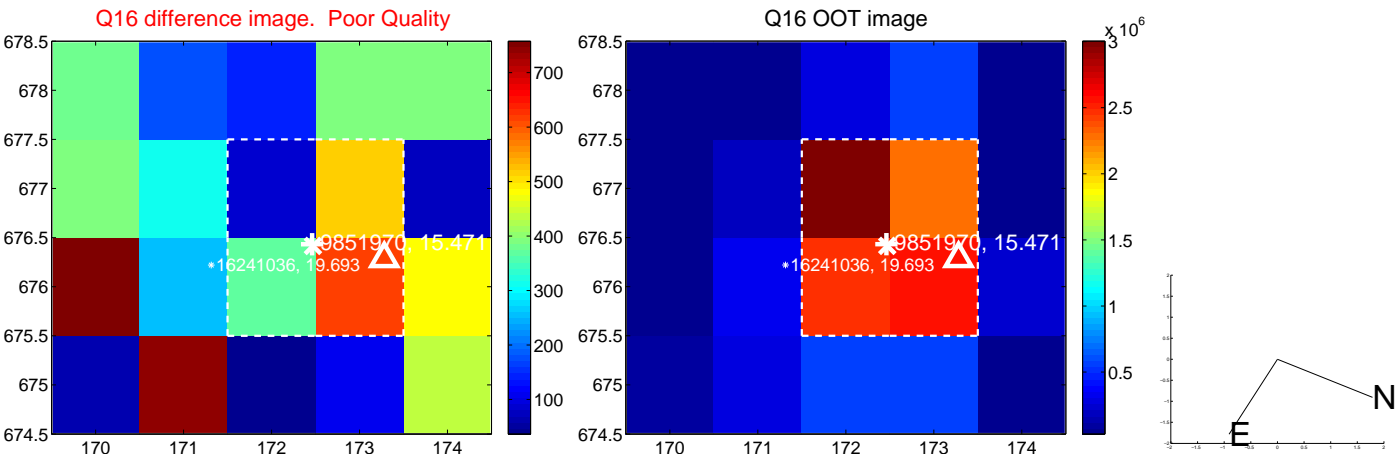
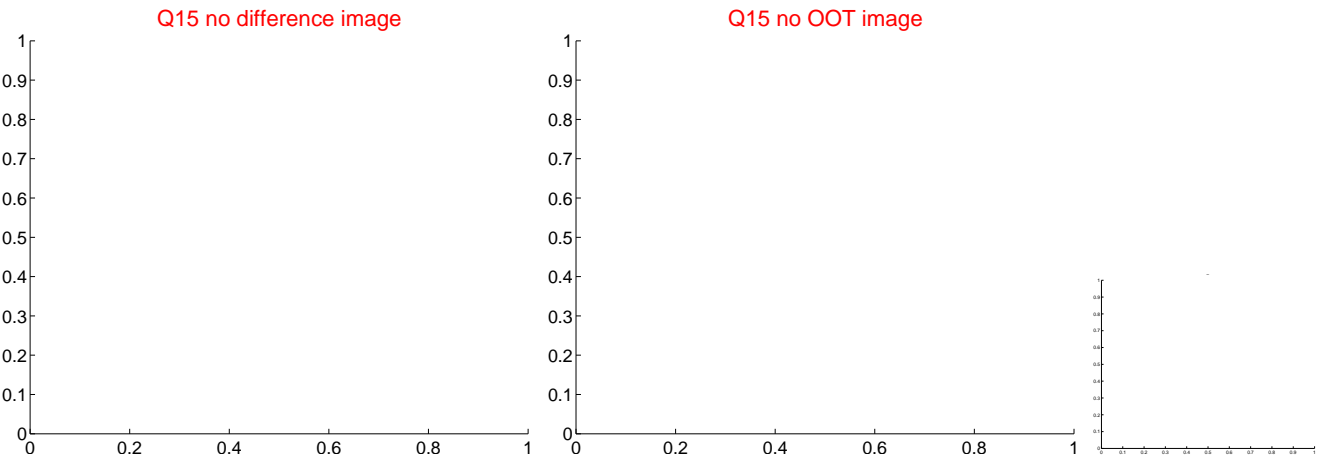
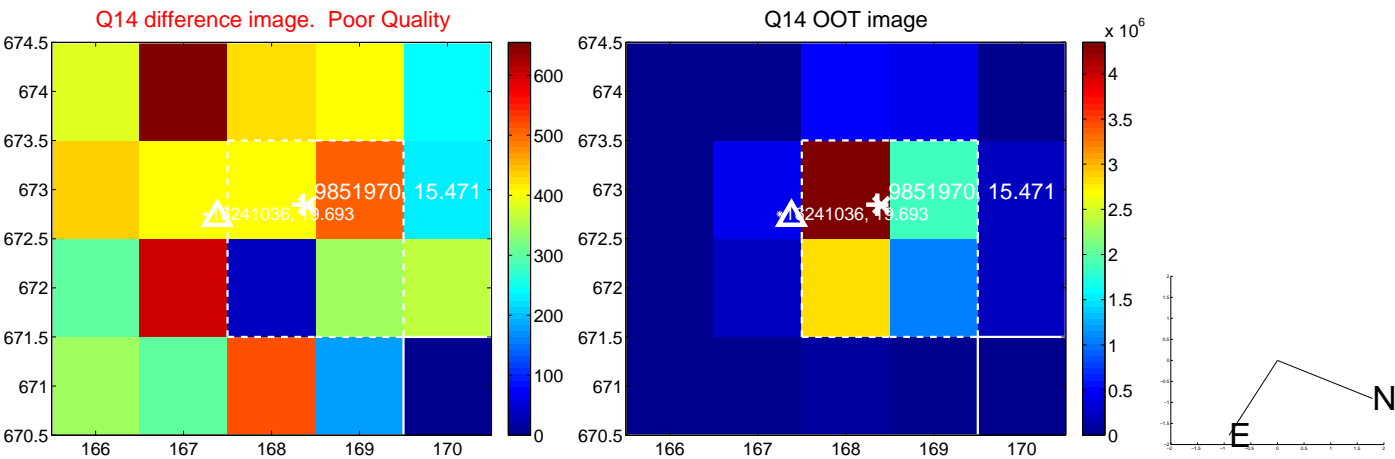
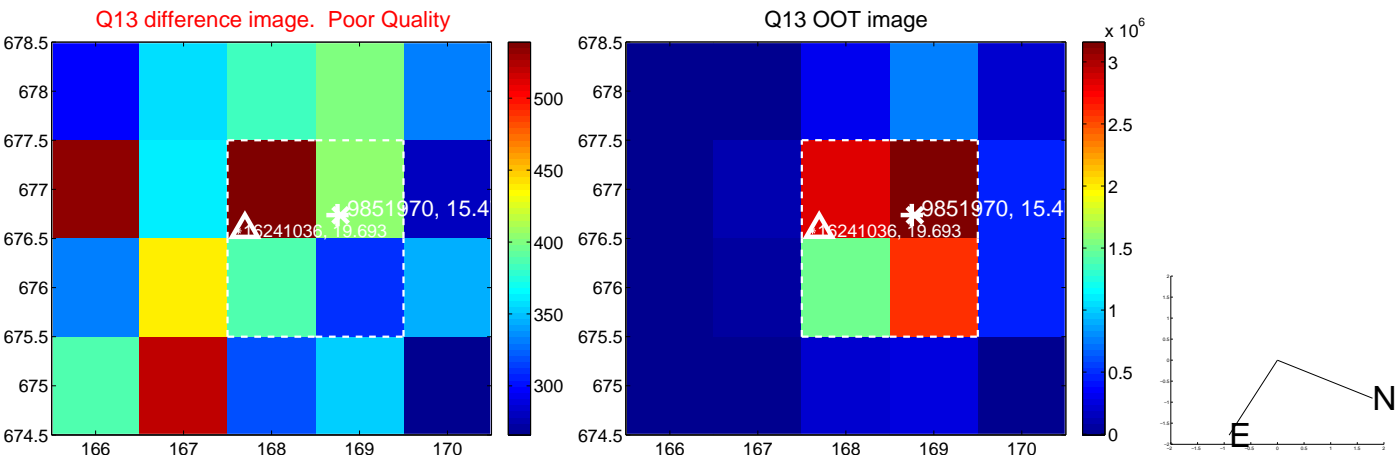
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



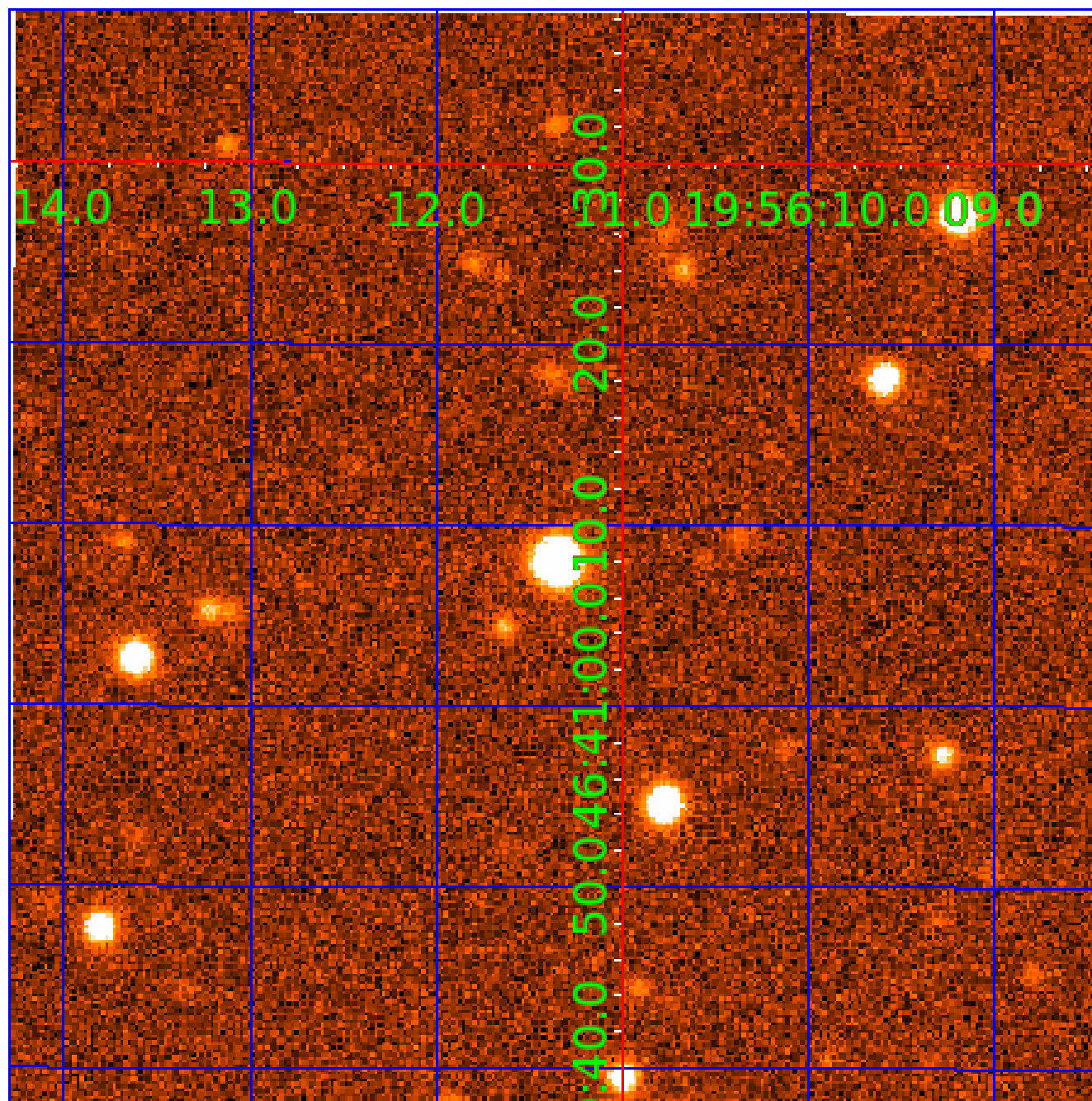
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





UKIRT Image

Declination



## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009851970-01	OBS	4122.01	1.081931	131.550019	107.5	6.343	13.0	13.4	0.74	4965	0.74	871.41
009851970-02	OBS	No	318.191396	287.691504	2963.9	7.500	18.3	-1.0	0.74	4965	3.89	0.45
009851970-03	OBS	No	87.131904	158.497311	1337.3	12.255	11.1	8.0	0.74	4965	4.18	2.51
009851970-04	OBS	No	98.329975	161.538824	746.0	4.930	12.1	5.3	0.74	4965	2.36	2.13
009851970-05	OBS	No	58.028718	183.047579	986.5	7.168	11.4	8.4	0.74	4965	2.50	4.31
009851970-06	OBS	No	34.155362	145.442225	495.6	5.928	10.4	4.7	0.74	4965	1.86	8.73
009851970-07	OBS	No	43.866421	135.859401	759.6	3.082	10.4	4.7	0.74	4965	2.21	6.26
009851970-08	OBS	No	485.794267	253.271172	1176.7	9.000	9.7	-1.0	0.74	4965	2.45	0.25
009851970-09	OBS	No	69.926614	193.429290	667.9	4.803	9.9	4.1	0.74	4965	2.11	3.36
009851970-10	OBS	No	665.534623	173.054303	2457.4	17.077	9.5	8.7	0.74	4965	6.96	0.17

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009851970-01	OBS	FP	0.00	0	1	1	1	MOD_SEC_ALT—CENT_RESOLVED_OFFSET—HALO_GHOST—EPHEM_MATCH
009851970-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_ZUMA—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_NOFITS
009851970-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_ALT—CENT_FEW_DIFFS
009851970-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_ZUMA_TRACKER—TRANS_GAPPED—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009851970-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE—TRANS_GAPPED—LPP_DV—CENT_FEW_DIFFS
009851970-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
009851970-07	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_TRACKER—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
009851970-08	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL—LPP_DV—ALL_TRANS_CHASES—NO_FITS—CENT_NOFITS
009851970-09	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE_TRACKER—TRANS_GAPPED—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS—HALO_GHOST
009851970-10	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_SKYE—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—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 009851970-02

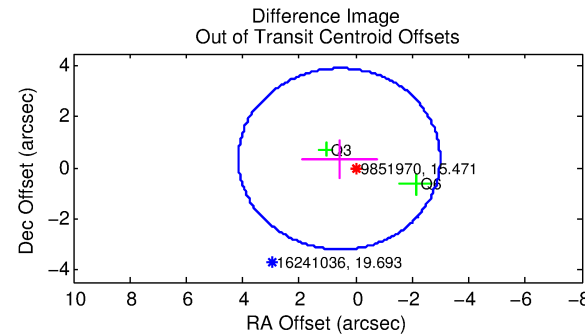
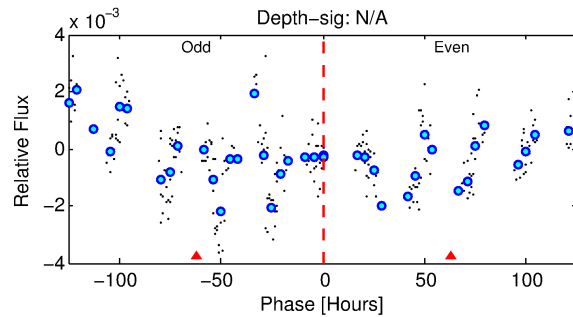
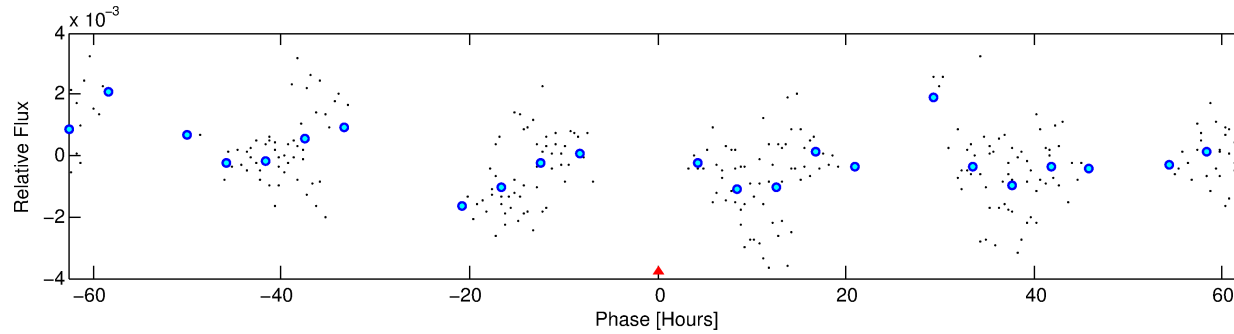
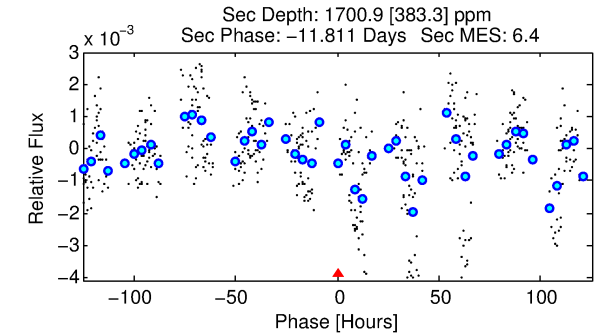
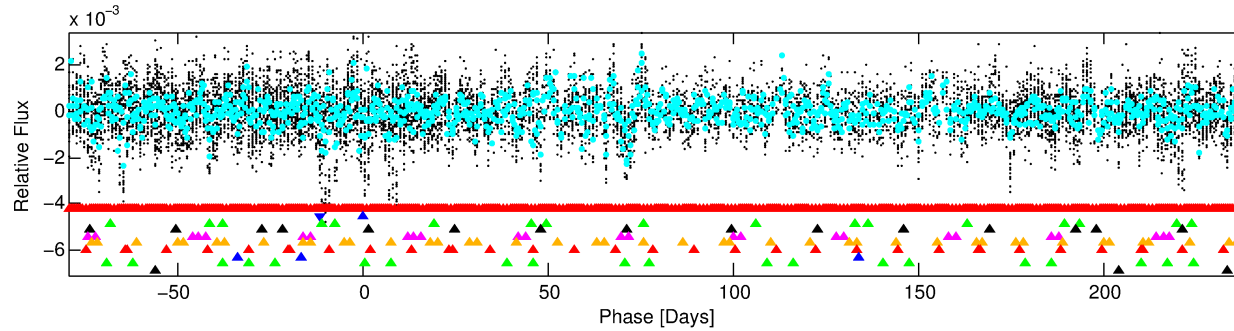
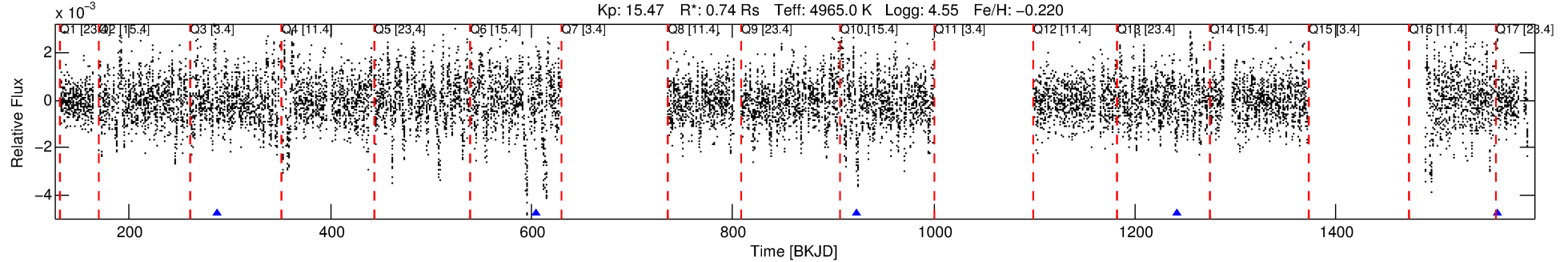
No Significant Match Found



# DV One-Page Summary

KIC: 9851970 Candidate: 2 of 10 Period: 318.191 d  
KOI: K04122 Corr: No Ephemeris Match

Kp: 15.47 R\*: 0.74 Rs Teff: 4965.0 K Logg: 4.55 Fe/H: -0.220



## TPS TCE Results:

Period = 318.19140 d  
Epoch = 287.6915 BKJD

DV fit results are unavailable

## DV Diagnostic Results:

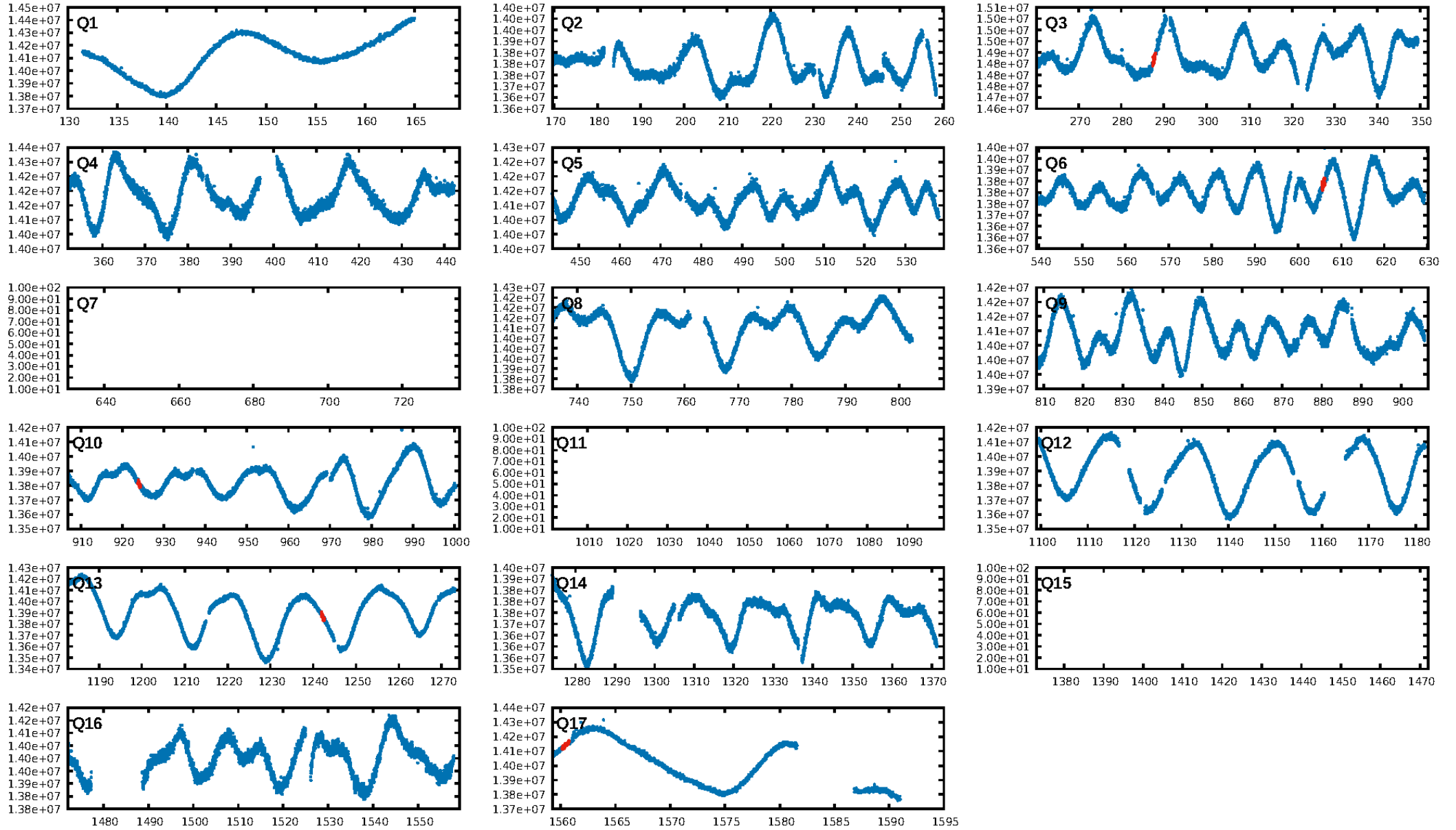
ShortPeriod-sig: 100.0% [587.91 $\sigma$ ]  
LongPeriod-sig: 100.0% [343.35 $\sigma$ ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [4/4]  
GhostDiagnostic-chr: -0.8912

Centroid-sig: 37.3%  
Centroid-so: 0.550 arcsec [0.80 $\sigma$ ]  
OotOffset-rm: 0.678 arcsec [0.57 $\sigma$ ]  
KicOffset-rm: 0.721 arcsec [0.58 $\sigma$ ]  
OotOffset-st: 1/1/0/0 [2]  
KicOffset-st: 1/1/0/0 [2]  
DiffImageQuality-fgm: 1.00 [2/2]  
DiffImageOverlap-fno: 0.00 [0/3]

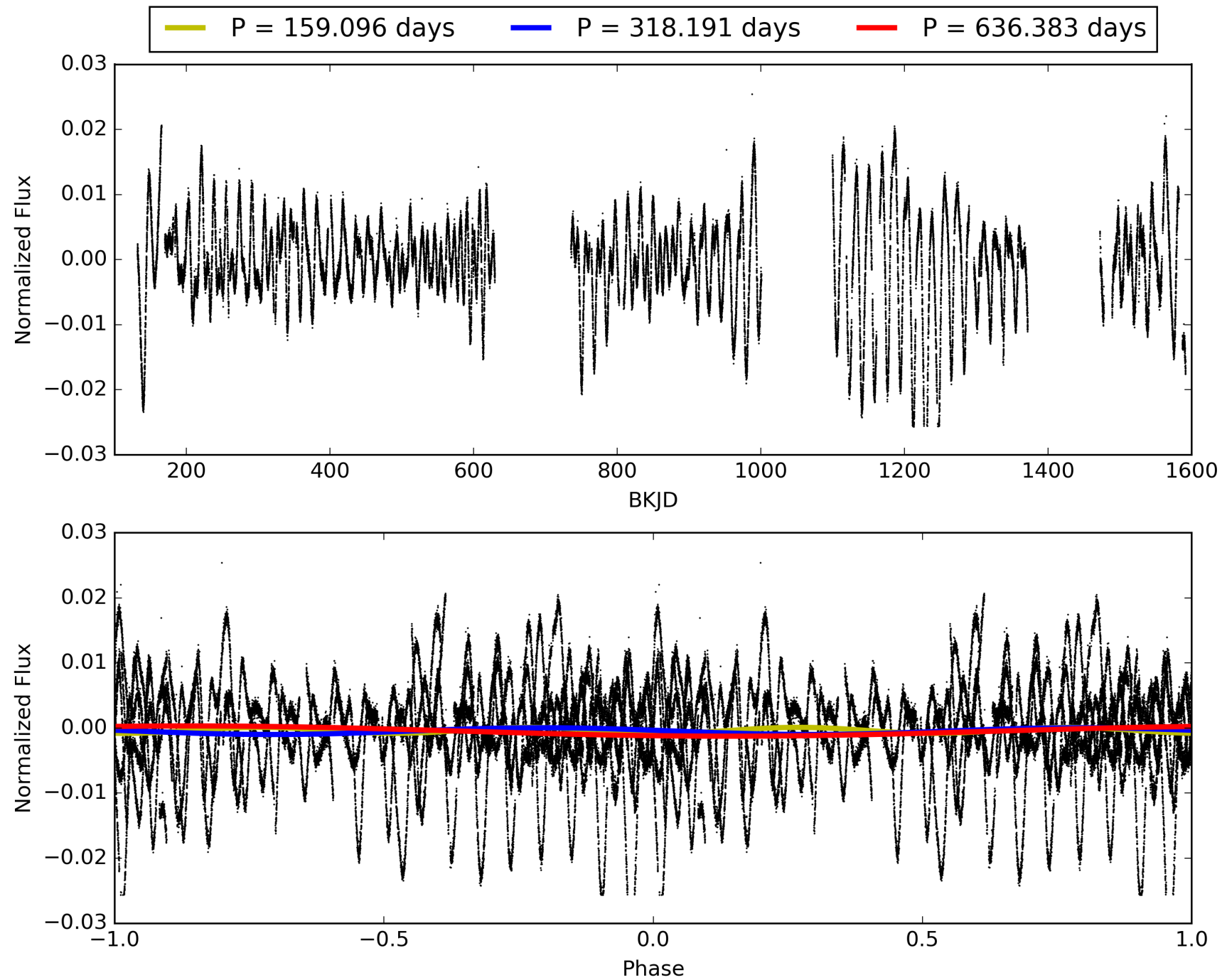
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 08:50:21 Z

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

# TCE 009851970-02, PDC Light Curves

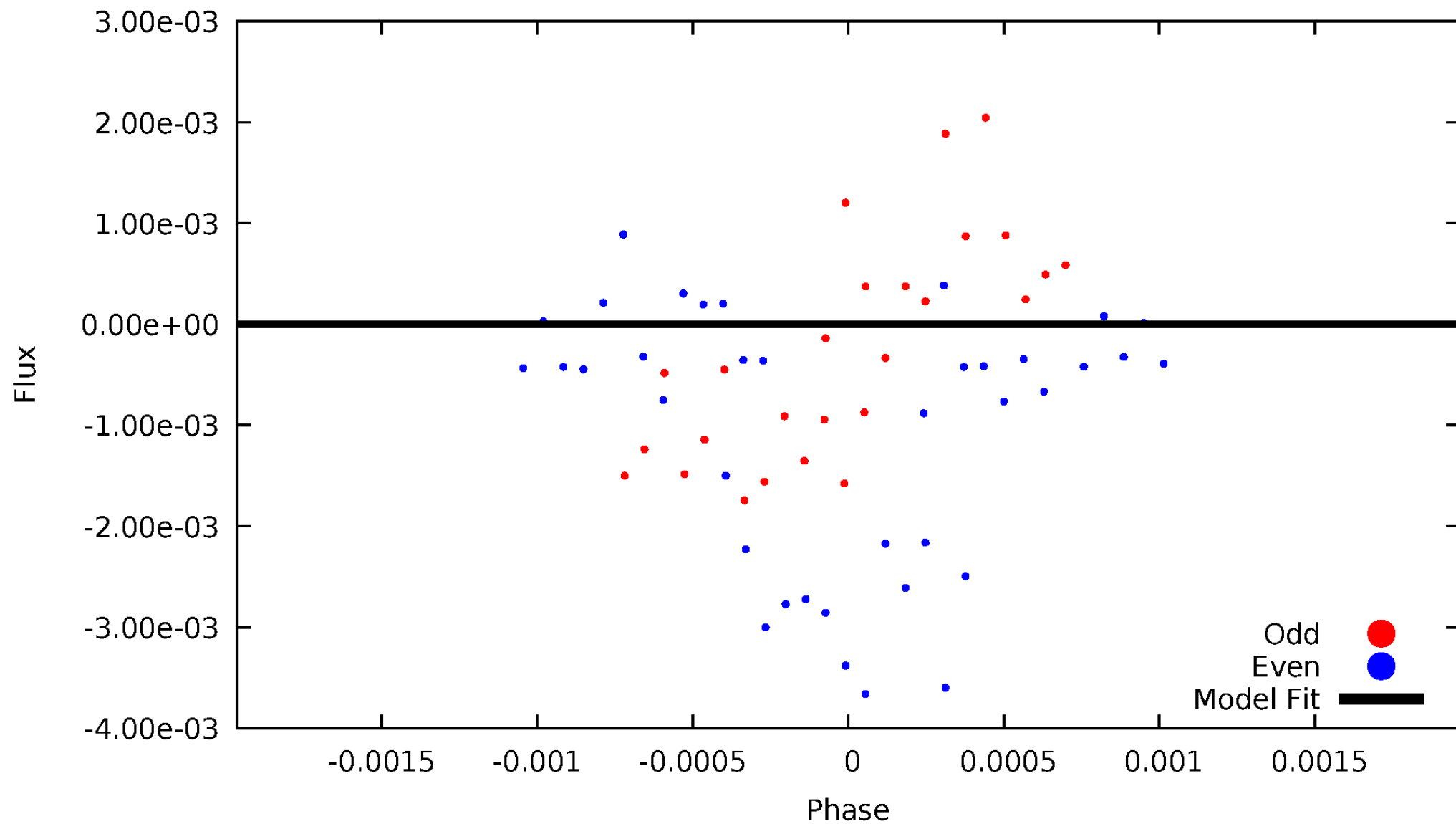


TCE 009851970-02



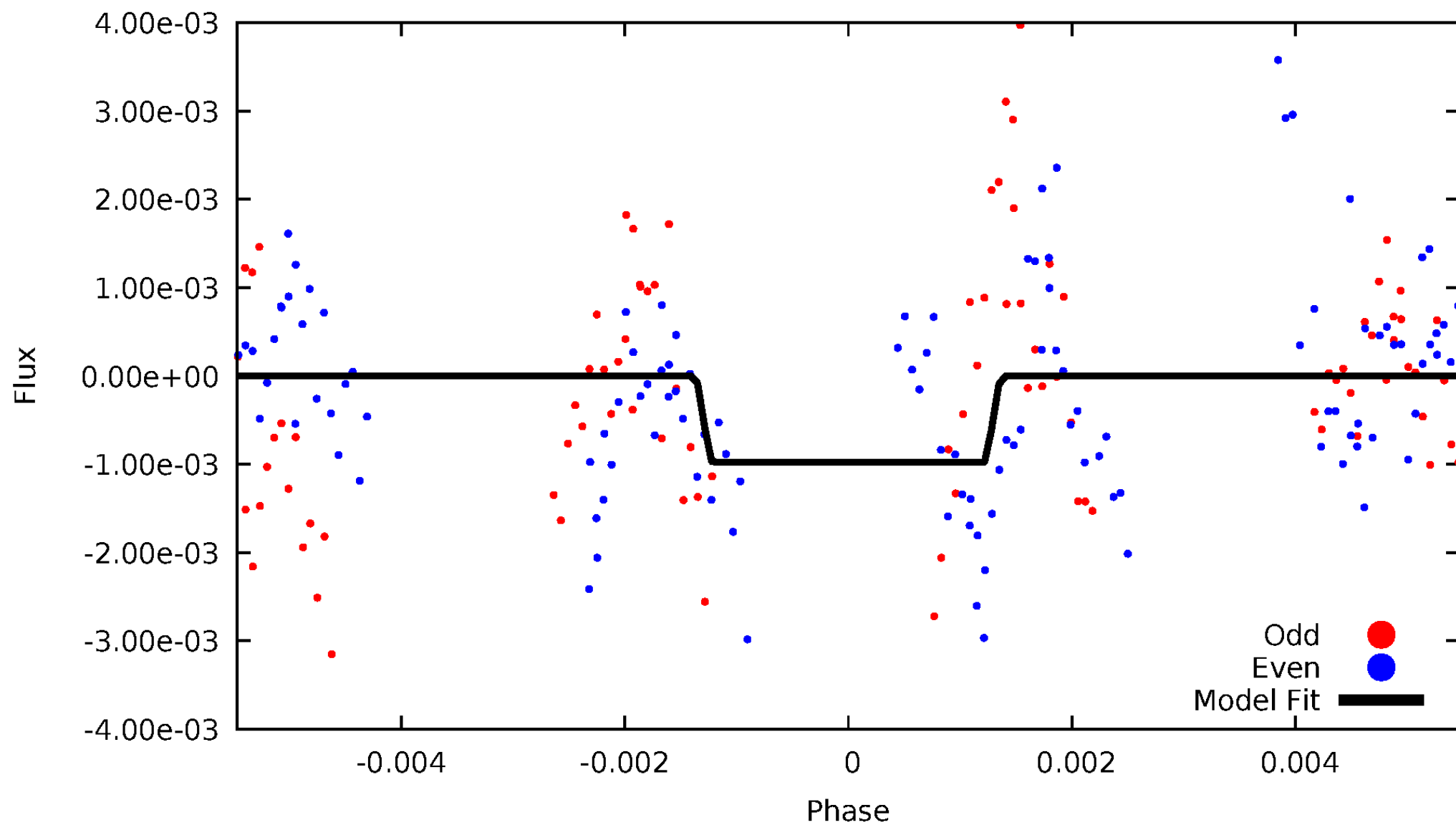
# DV Odd/Even

TCE 009851970-02



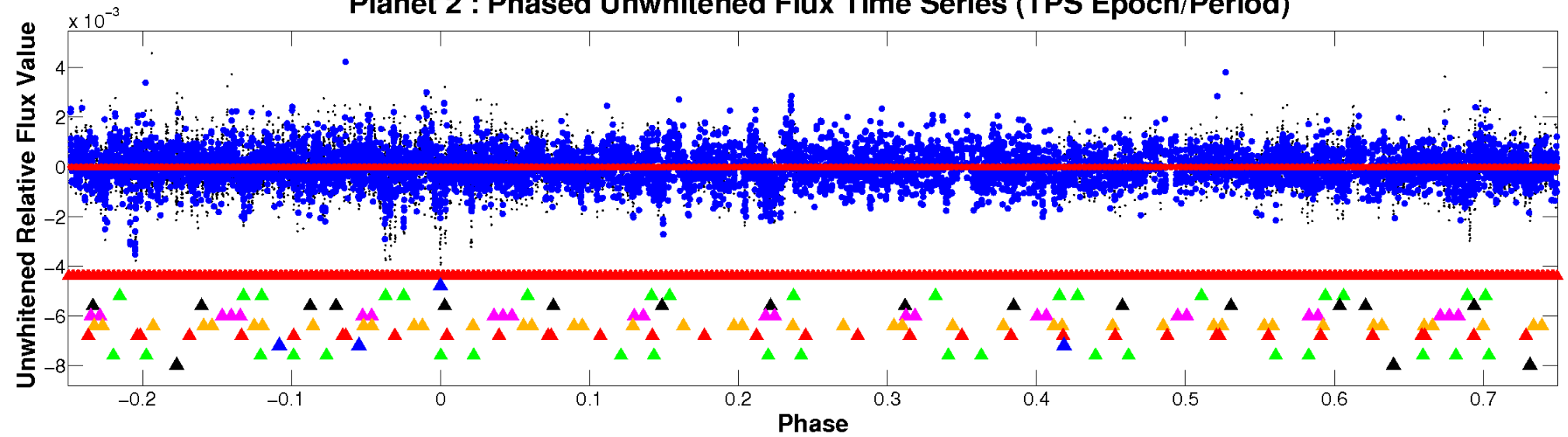
# ALT Odd/Even

TCE 009851970-02

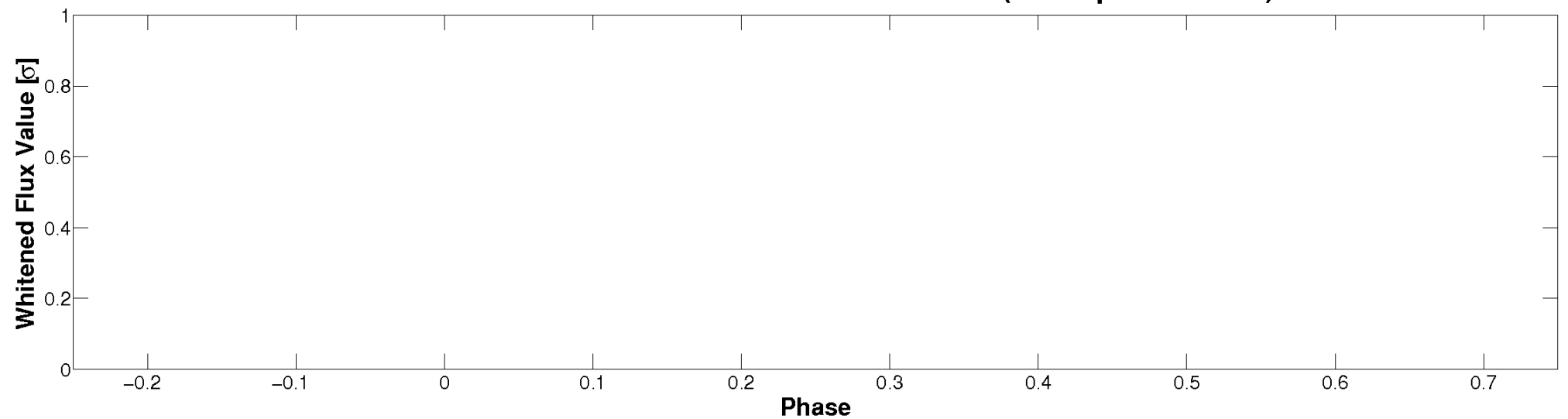


# Non-Whitened Vs. Whitened Light Curve

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



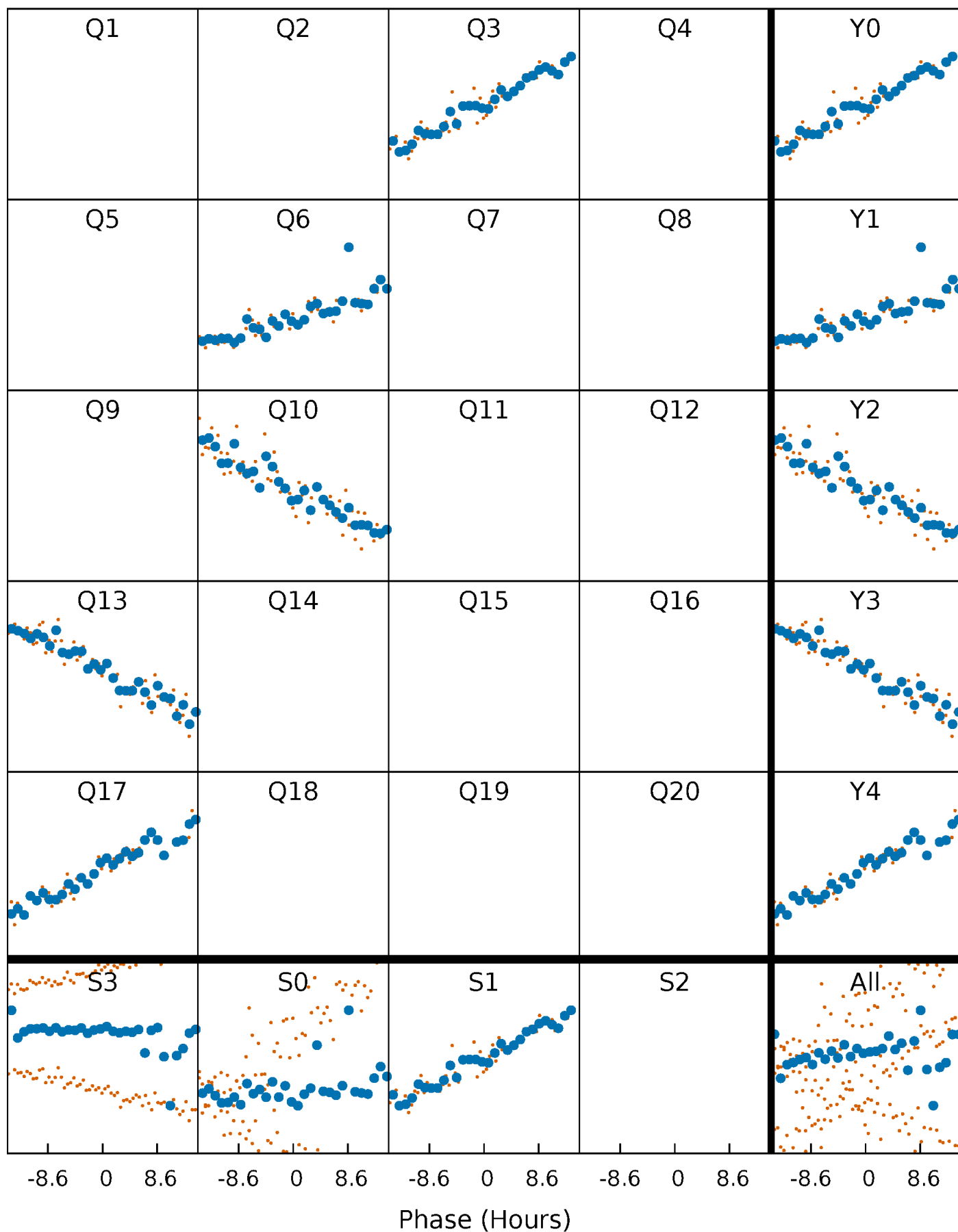
Planet 2 : Phased Whitened Flux Time Series (TPS Epoch/Period)





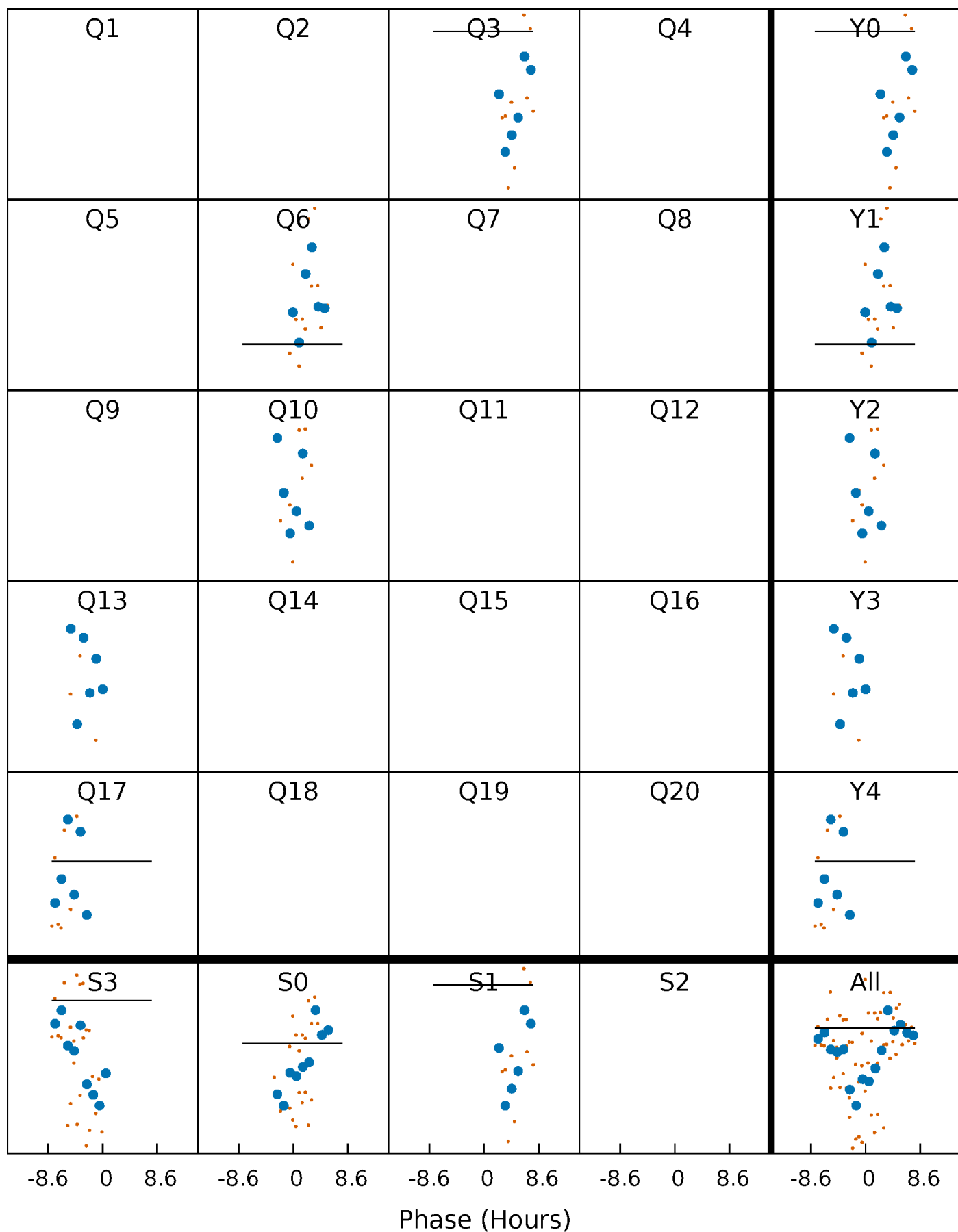
# PDC Quarter-Phased Transit Curves

TCE 009851970-02 P=318.191396 Days  $T_0=287.691504$  (BKJD)



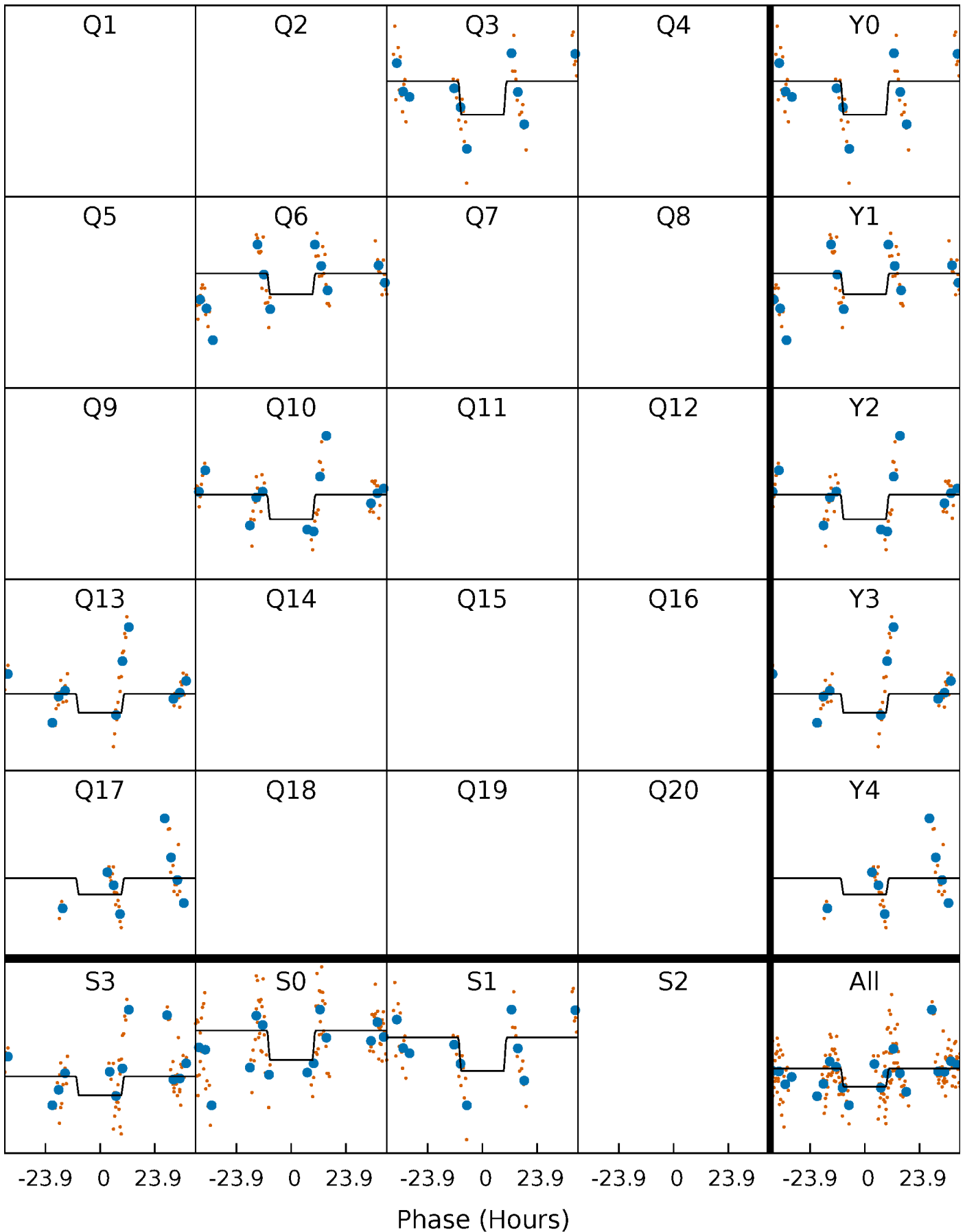
# DV Quarter-Phased Transit Curves

TCE 009851970-02 P=318.191396 Days  $T_0=287.691504$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

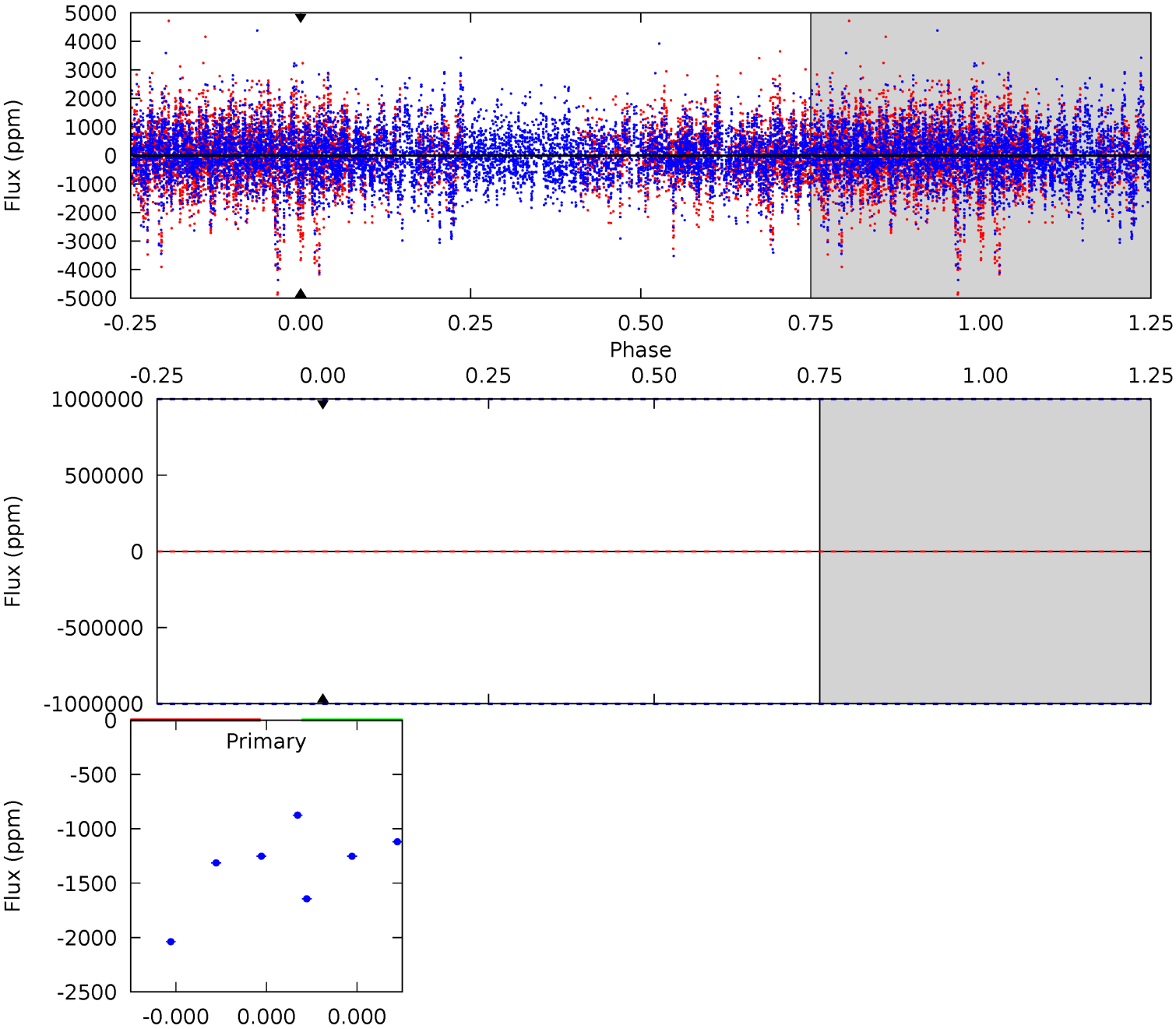
TCE 009851970-02 P=318.191396 Days  $T_0=287.218338$  (BKJD)



# DV Model-Shift Uniqueness Test

009851970-02, P = 318.191396 Days, E = 287.691504 Days

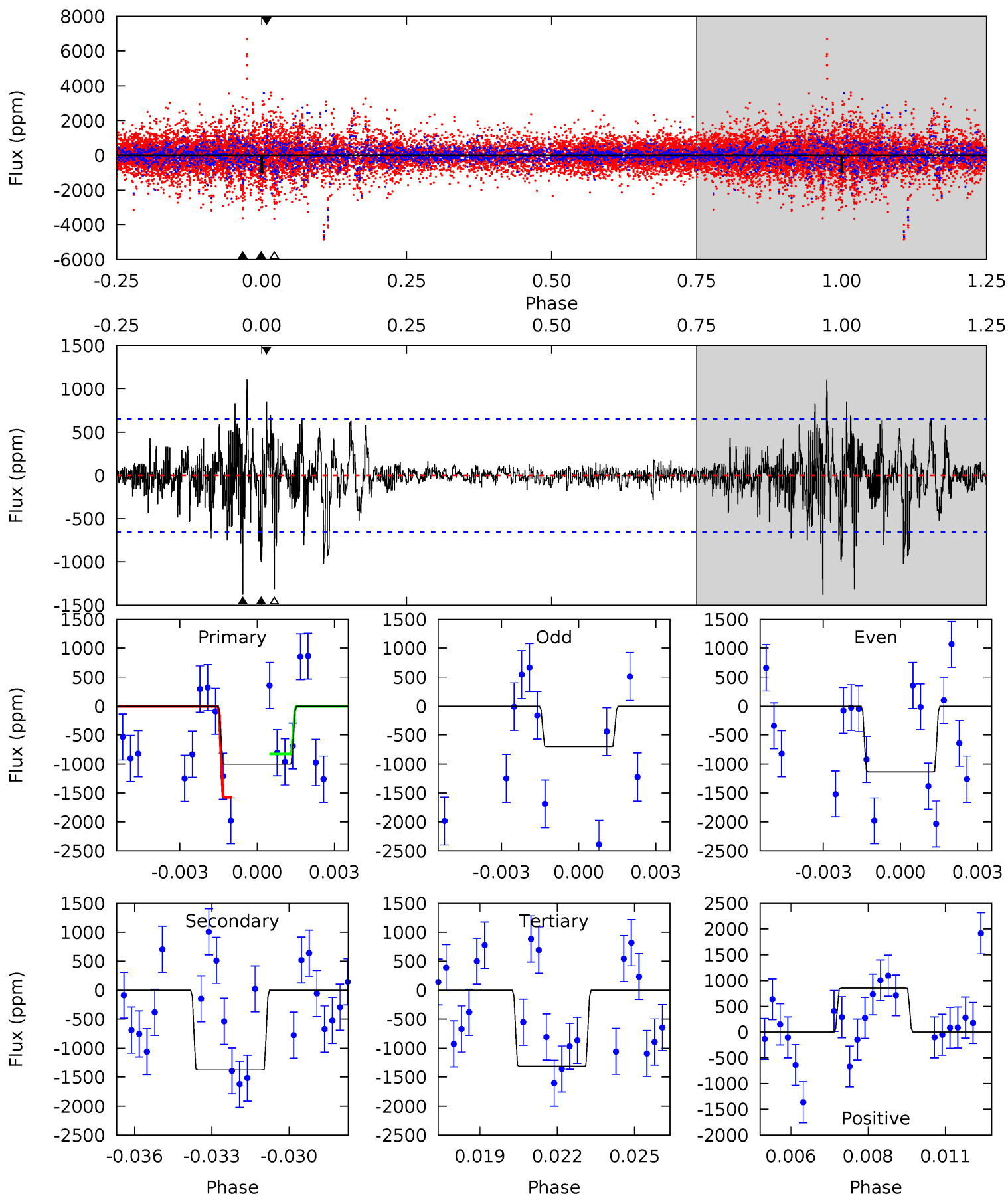
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
0	0	0	0	1.00	1.00	1.00	0	0	0	0	0	0	0	0



# Alt Model-Shift Uniqueness Test

009851970-02,  $P = 318.191396$  Days,  $E = 287.218338$  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
8.13	11.2	10.6	6.90	5.27	2.99	1.64	-2.51	1.23	0.52	4.26	1.58	0.92	0.45	2.71



### Stellar Parameters For KIC 009851970

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$4965^{+151}_{-136}$	$4.555^{+0.072}_{-0.044}$	$-0.220^{+0.300}_{-0.300}$	$0.736^{+0.065}_{-0.079}$	$0.709^{+0.093}_{-0.050}$	$2.508^{+0.760}_{-0.407}$
	+3%/-3%	+2%/-1%	+136%/-136%	+9%/-11%	+13%/-7%	+30%/-16%
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 009851970-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$0 \pm 1000000$	$6.88^{+6.44}_{-4.60}$	$291^{+11}_{-10}$	$4243^{+9084}_{-15374}$	$25523^{+1429708}_{-1041925}$
Alt.	$-1377 \pm 123$	$6.45^{+6.57}_{-4.38}$	$290^{+11}_{-10}$	$3717^{+2073}_{-698}$	$12284^{+103795}_{-9247}$

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



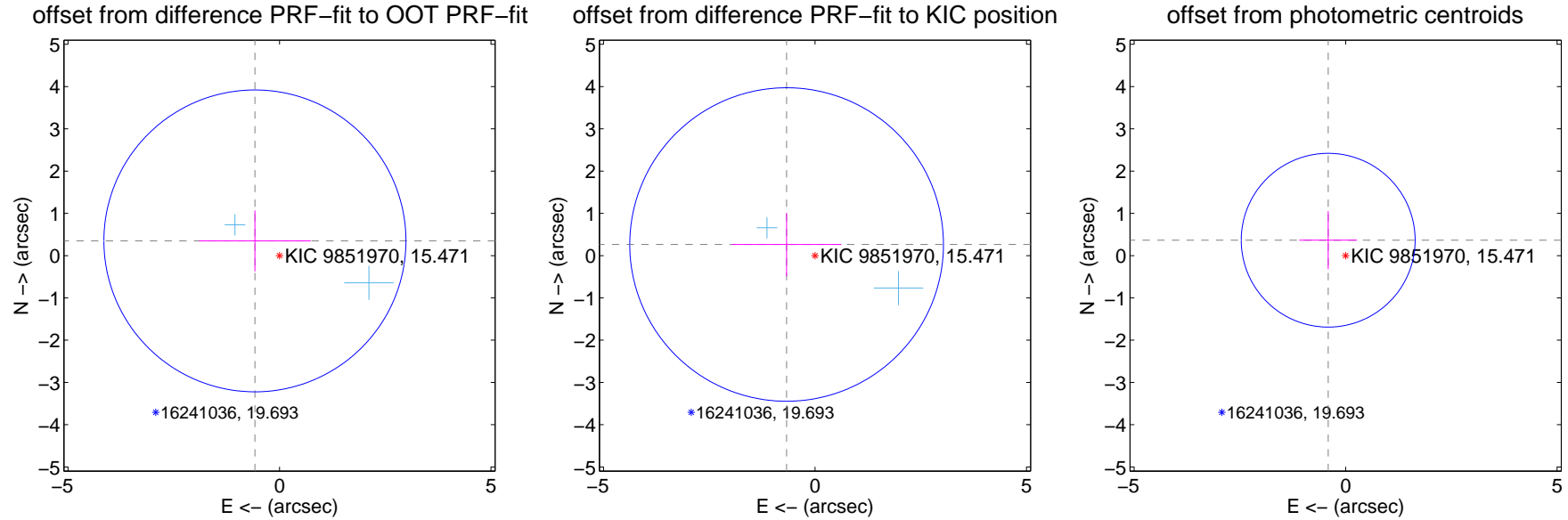
## DV Centroid Data

Supplemental centroid analysis for 009851970-02. Kepler magnitude: 15.47. Transit SNR -1.00

There are 2 quarters with good PRF difference image offsets

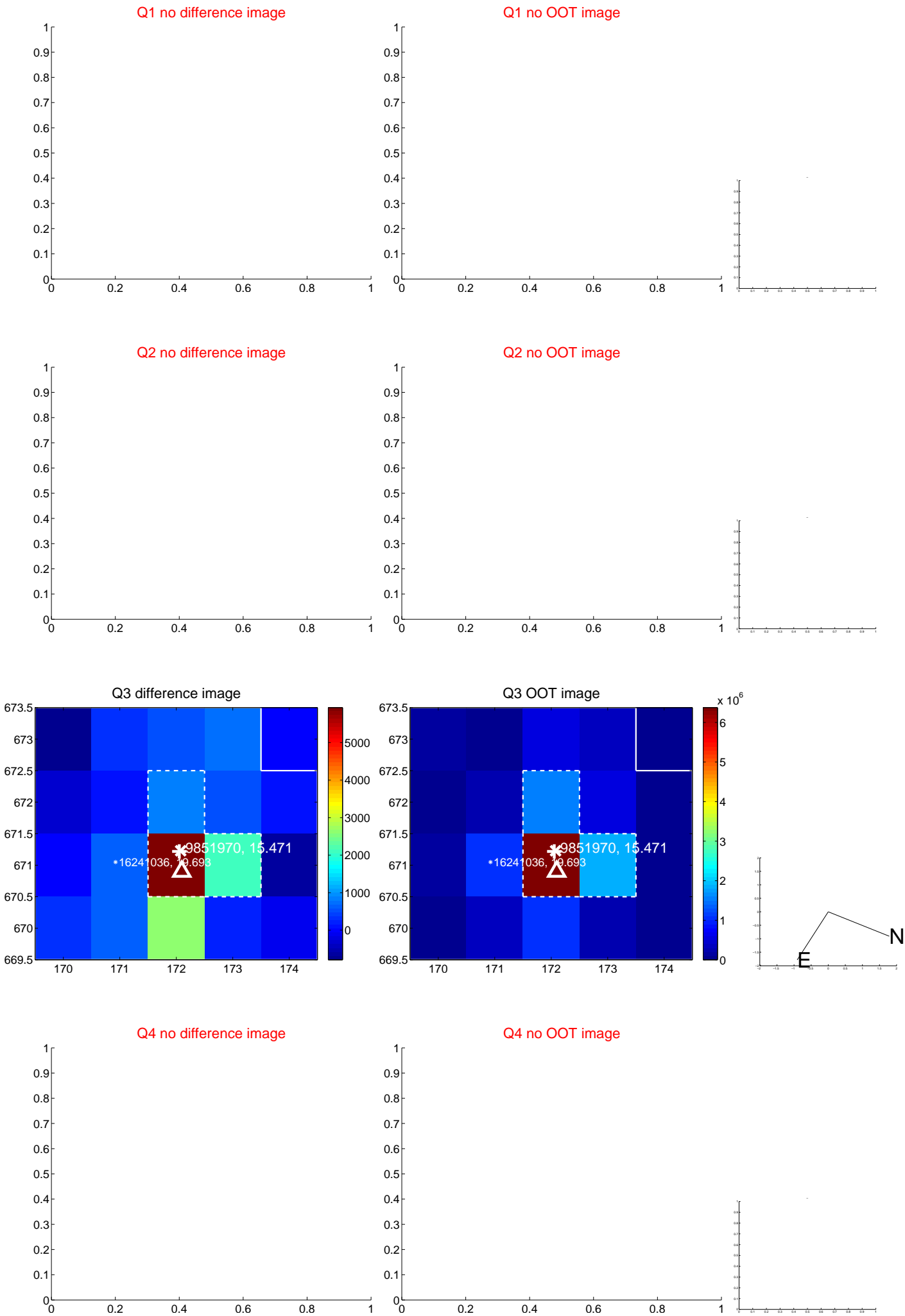
The direct PRF centroid is offset from the target star catalog position by about 0.19 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.678 \pm 1.190$	0.57	$0.581 \pm 1.319$	$0.349 \pm 0.721$
PRF-fit source offset from KIC position	$0.721 \pm 1.236$	0.58	$0.671 \pm 1.295$	$0.263 \pm 0.749$
photometric centroid source offset	$0.55 \pm 0.69$	0.80	$0.41 \pm 0.68$	$0.37 \pm 0.69$



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 ×: 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.

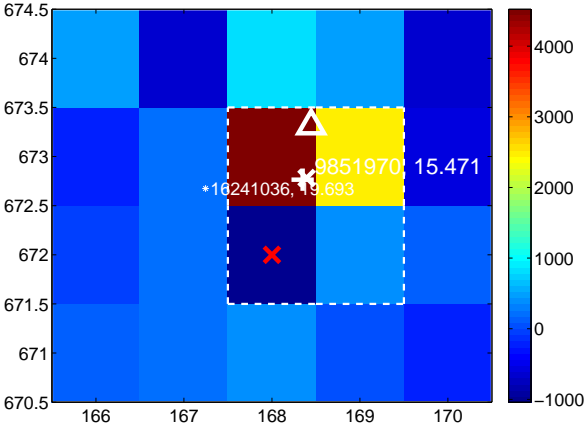
Q5 no difference image



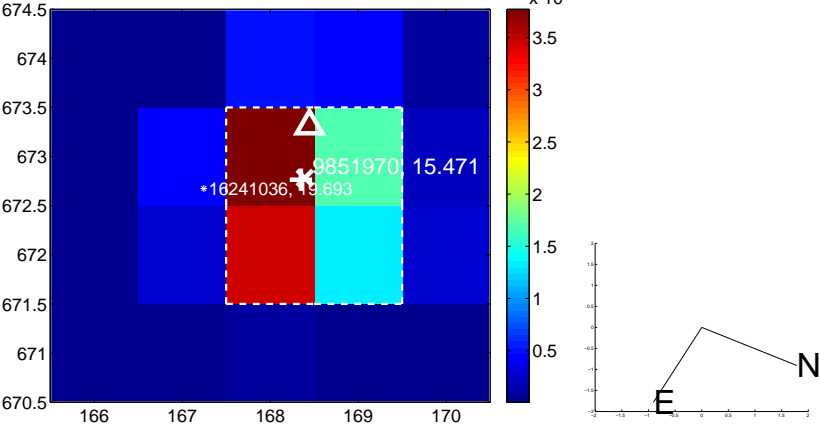
Q5 no OOT image



Q6 difference image



Q6 OOT image



Q7 no difference image



Q7 no OOT image



Q8 no difference image



Q8 no OOT image

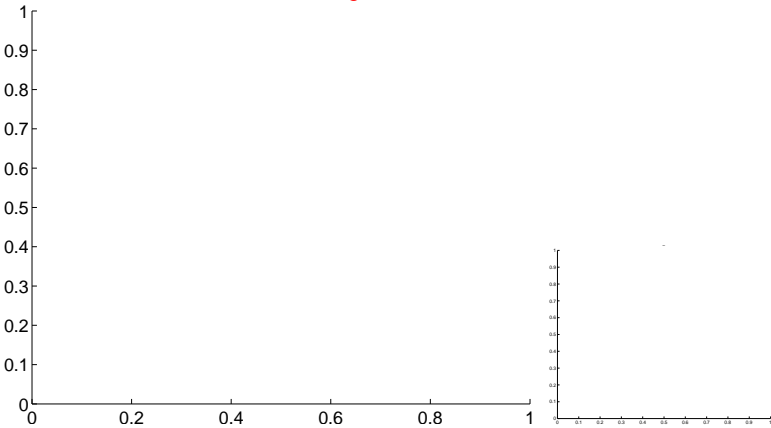


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

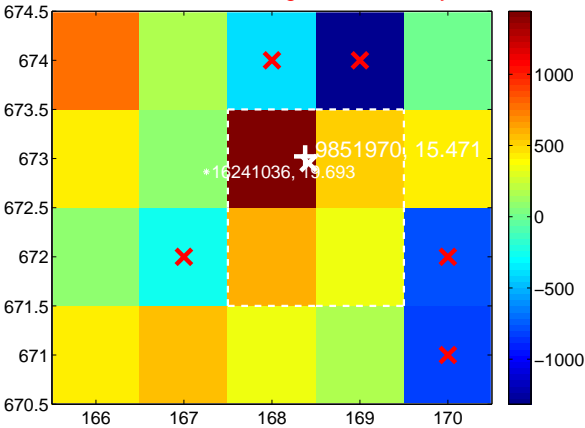
Q9 no difference image



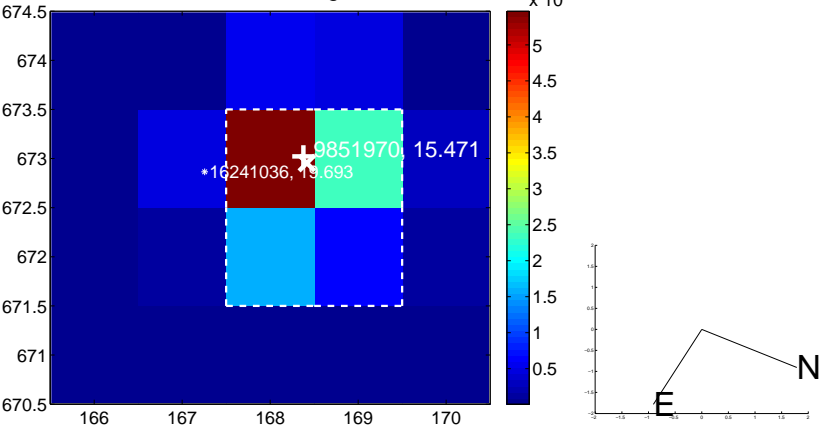
Q9 no OOT image



Q10 difference image. Poor Quality



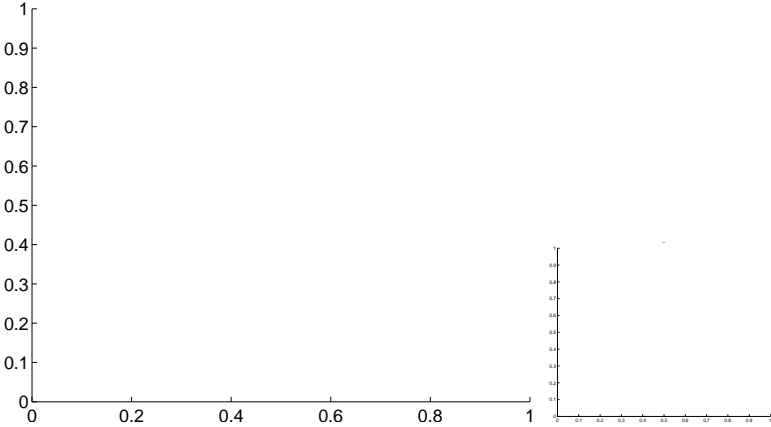
Q10 OOT image



Q11 no difference image



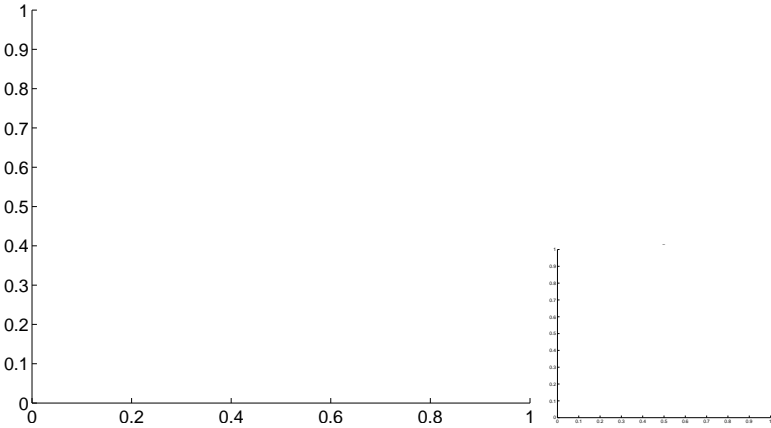
Q11 no OOT image



Q12 no difference image



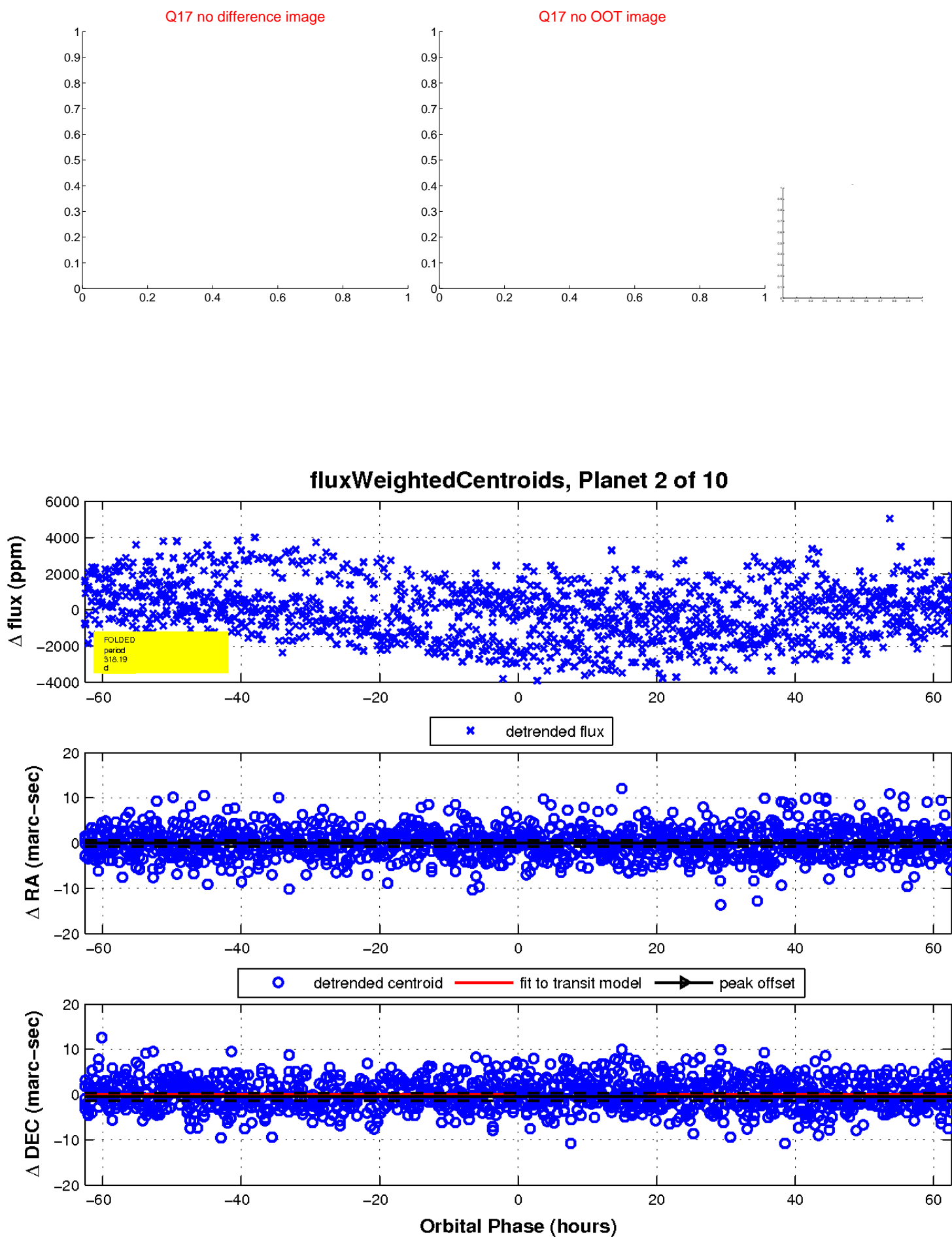
Q12 no OOT image



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



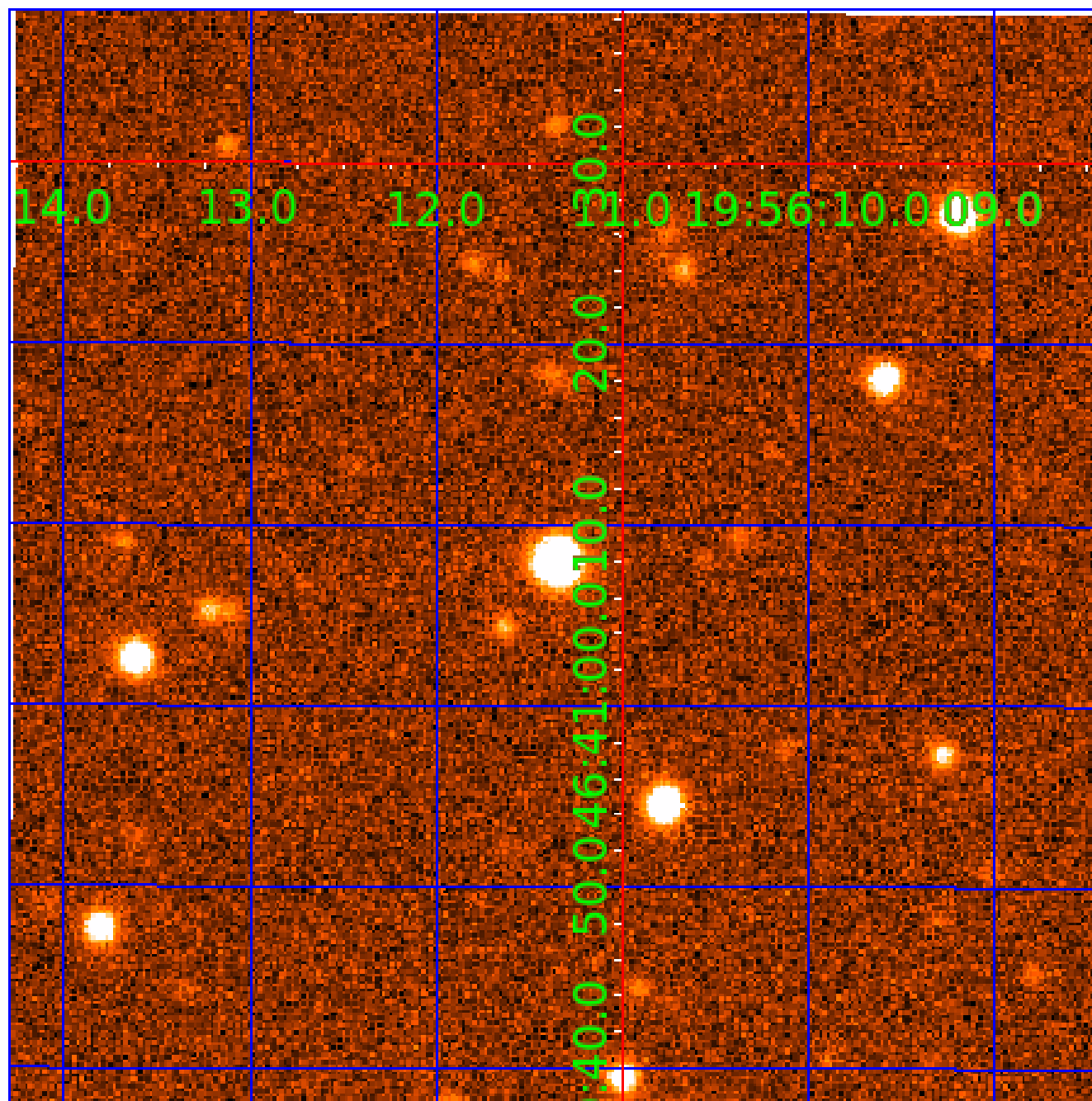
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





UKIRT Image

Declination



## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009851970-01	OBS	4122.01	1.081931	131.550019	107.5	6.343	13.0	13.4	0.74	4965	0.74	871.41
009851970-02	OBS	No	318.191396	287.691504	2963.9	7.500	18.3	-1.0	0.74	4965	3.89	0.45
009851970-03	OBS	No	87.131904	158.497311	1337.3	12.255	11.1	8.0	0.74	4965	4.18	2.51
009851970-04	OBS	No	98.329975	161.538824	746.0	4.930	12.1	5.3	0.74	4965	2.36	2.13
009851970-05	OBS	No	58.028718	183.047579	986.5	7.168	11.4	8.4	0.74	4965	2.50	4.31
009851970-06	OBS	No	34.155362	145.442225	495.6	5.928	10.4	4.7	0.74	4965	1.86	8.73
009851970-07	OBS	No	43.866421	135.859401	759.6	3.082	10.4	4.7	0.74	4965	2.21	6.26
009851970-08	OBS	No	485.794267	253.271172	1176.7	9.000	9.7	-1.0	0.74	4965	2.45	0.25
009851970-09	OBS	No	69.926614	193.429290	667.9	4.803	9.9	4.1	0.74	4965	2.11	3.36
009851970-10	OBS	No	665.534623	173.054303	2457.4	17.077	9.5	8.7	0.74	4965	6.96	0.17

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009851970-01	OBS	FP	0.00	0	1	1	1	MOD_SEC_ALT—CENT_RESOLVED_OFFSET—HALO_GHOST—EPHEM_MATCH
009851970-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_ZUMA—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_NOFITS
009851970-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_ALT—CENT_FEW_DIFFS
009851970-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_ZUMA_TRACKER—TRANS_GAPPED—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009851970-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE—TRANS_GAPPED—LPP_DV—CENT_FEW_DIFFS
009851970-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
009851970-07	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_TRACKER—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
009851970-08	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL—LPP_DV—ALL_TRANS_CHASES—NO_FITS—CENT_NOFITS
009851970-09	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE_TRACKER—TRANS_GAPPED—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS—HALO_GHOST
009851970-10	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_SKYE—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—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 009851970-03

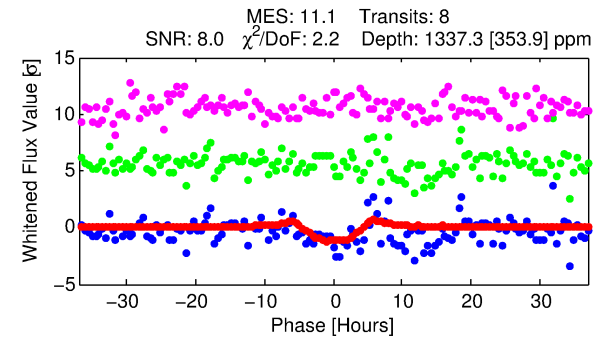
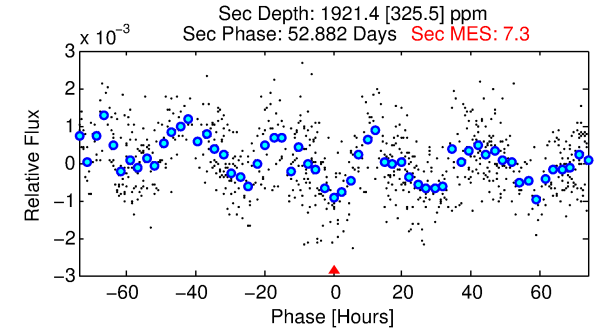
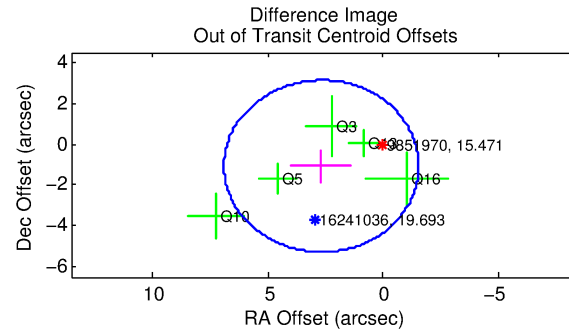
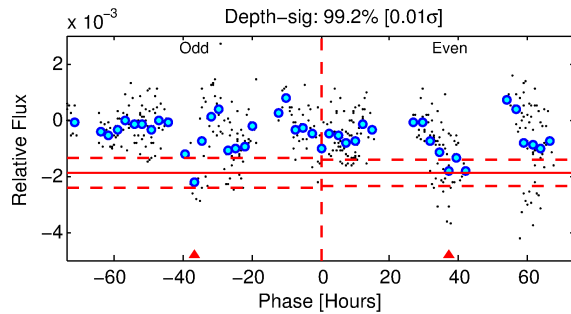
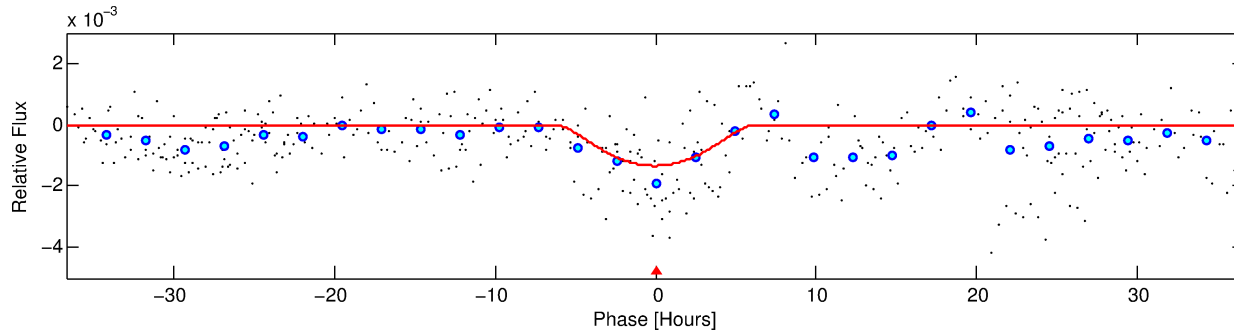
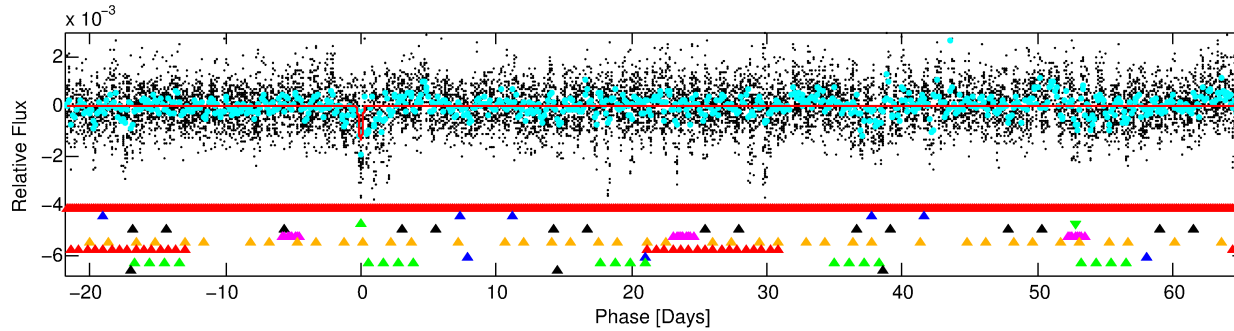
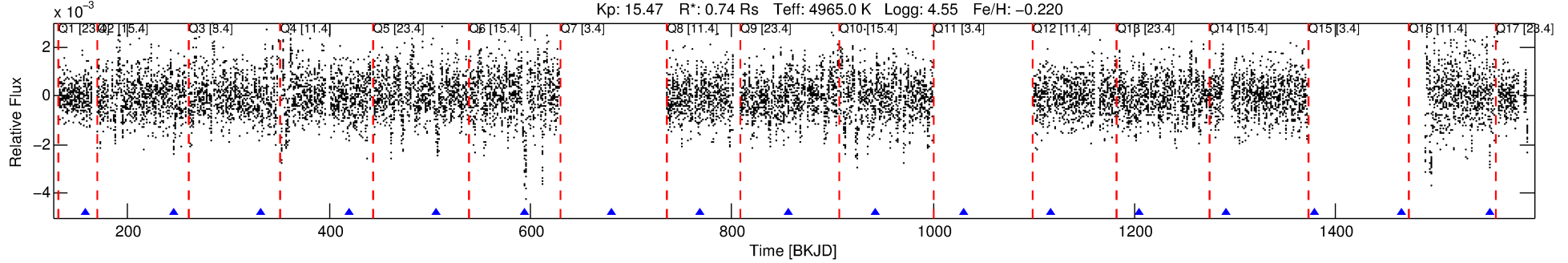
No Significant Match Found

# DV One-Page Summary

KIC: 9851970 Candidate: 3 of 10 Period: 87.132 d

KOI: K04122 Corr: No Ephemeris Match

Kp: 15.47 R\*: 0.74 Rs Teff: 4965.0 K Logg: 4.55 Fe/H: -0.220



## DV Fit Results:

Period = 87.13190 [0.00542] d  
Epoch = 158.4973 [0.0501] BKJD  
Rp/R\* = 0.0520 [0.0808]  
a/R\* = 21.52 [13.32]  
b = 0.97 [0.16]  
Seff = 2.51 [0.45]  
Teq = 321 [14] K  
Rp = 4.18 [6.50] Re  
a = 0.3431 [0.0310] AU  
Ag = 7131.03 [22209.43] [0.32σ]  
Teff = 4558 [3549] K [1.19σ]

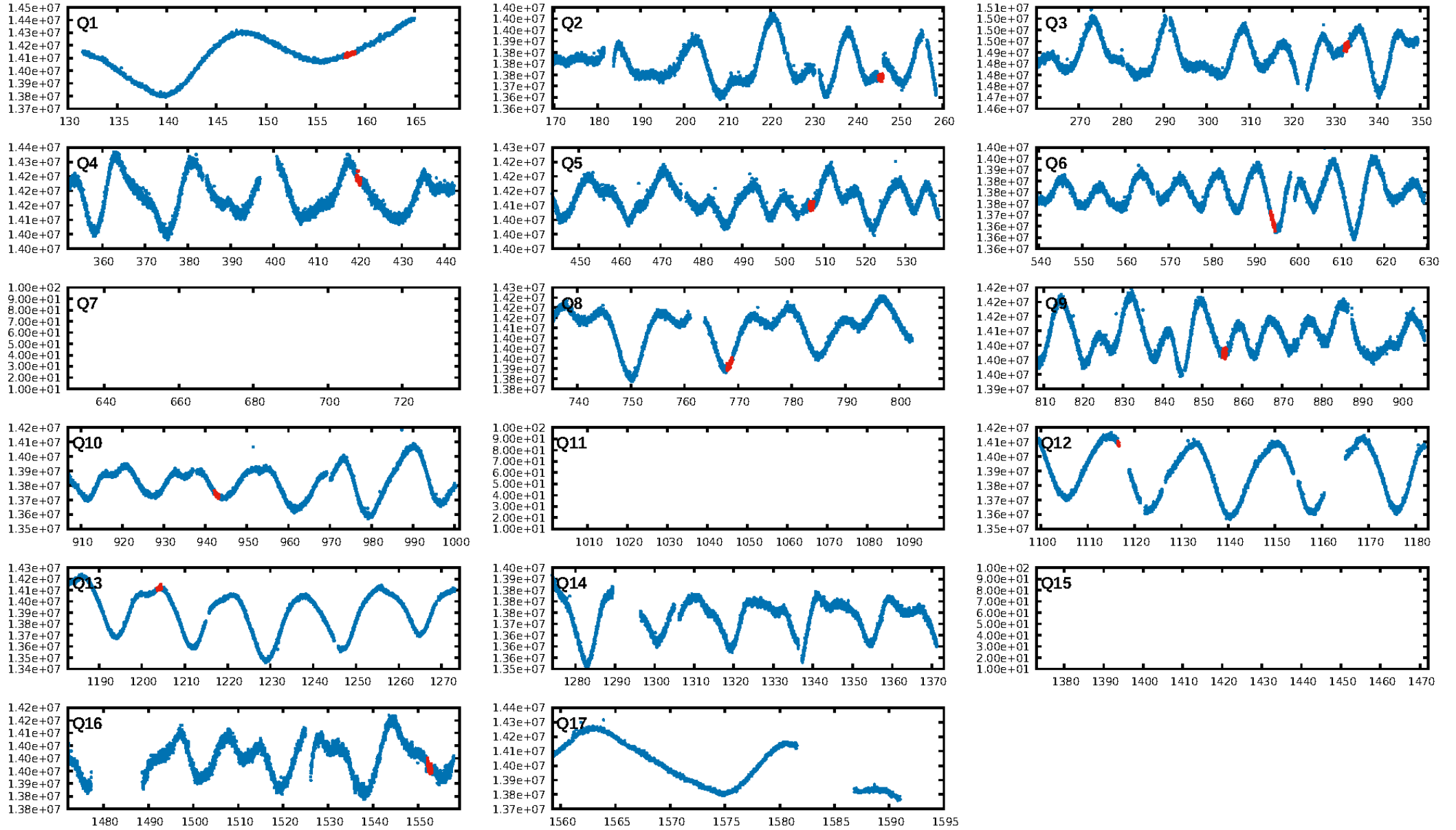
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [31.37σ]  
LongPeriod-sig: 100.0% [20.34σ]  
ModelChiSquare2-sig: 0.3%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [8/8]  
GhostDiagnostic-chr: 4.276  
Centroid-sig: 11.7%  
Centroid-so: 0.584 arcsec [0.93σ]  
OotOffset-rm: 2.888 arcsec [2.06σ]  
OotOffset-st: 1/1/1/2 [5]  
KicOffset-rm: 2.962 arcsec [2.10σ]  
KicOffset-st: 1/1/1/2 [5]  
DiffImageQuality-fgm: 0.20 [1/5]  
DiffImageOverlap-fno: 0.00 [0/10]

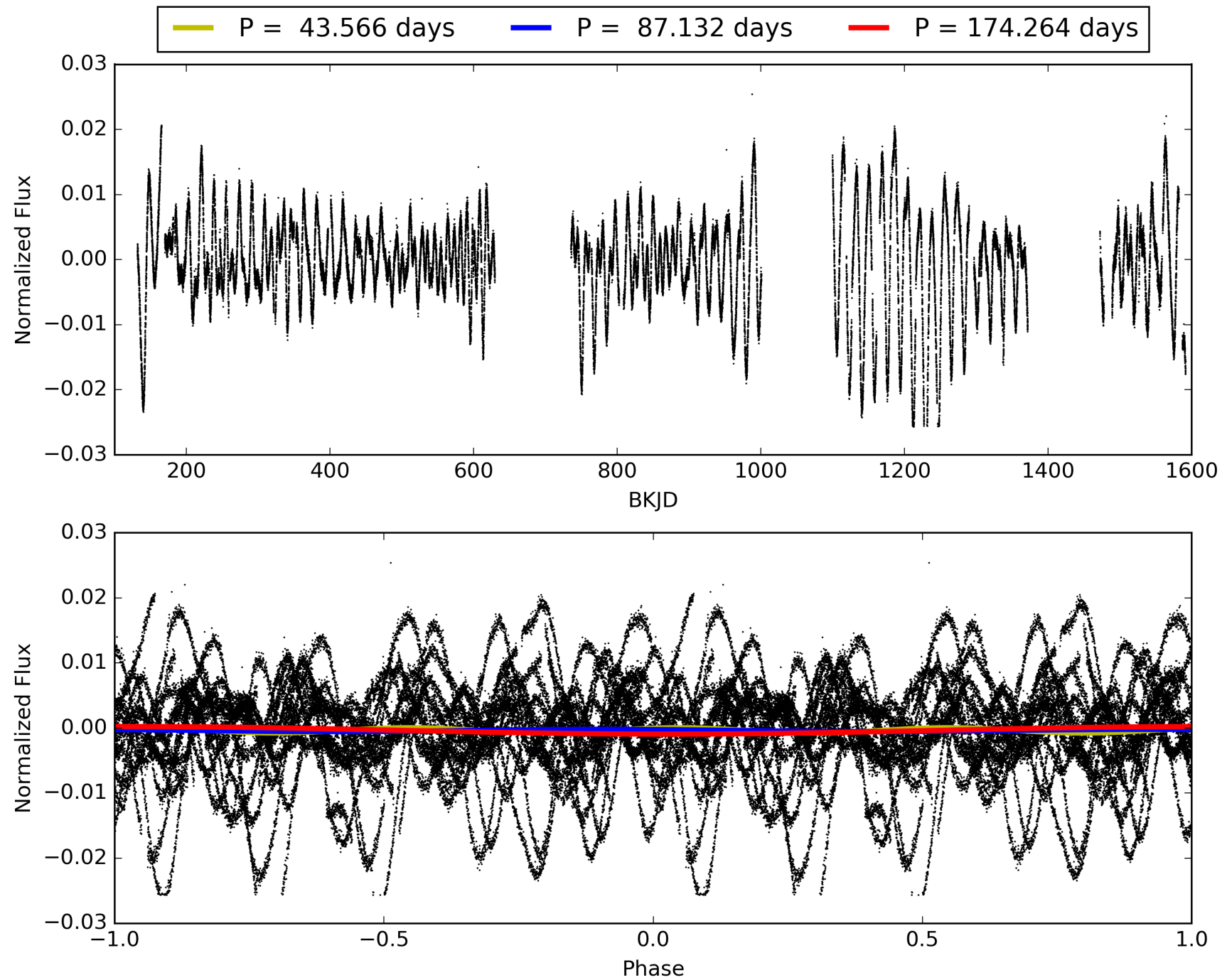
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 08:50:25 Z

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

# TCE 009851970-03, PDC Light Curves

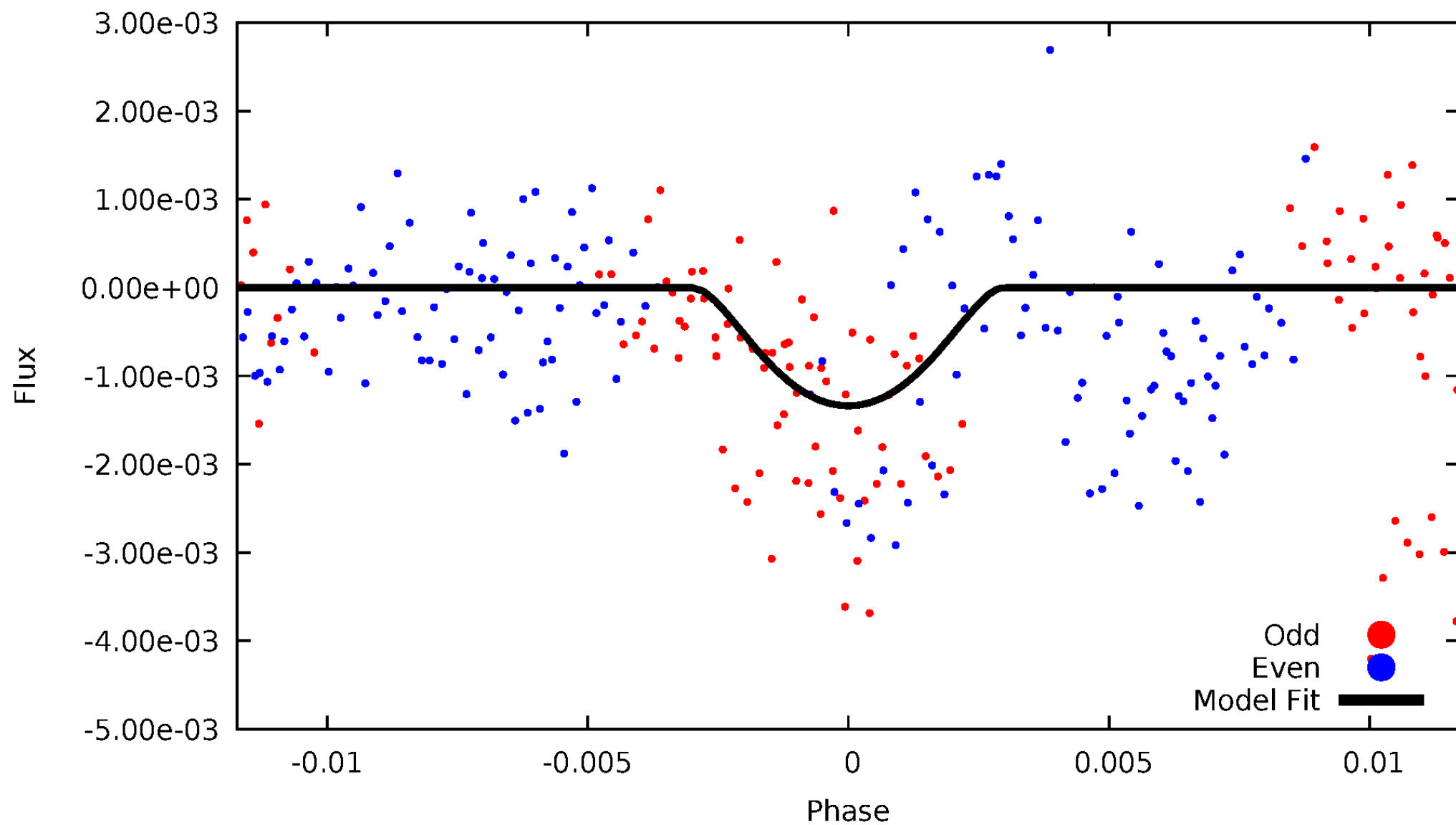


# TCE 009851970-03



# DV Odd/Even

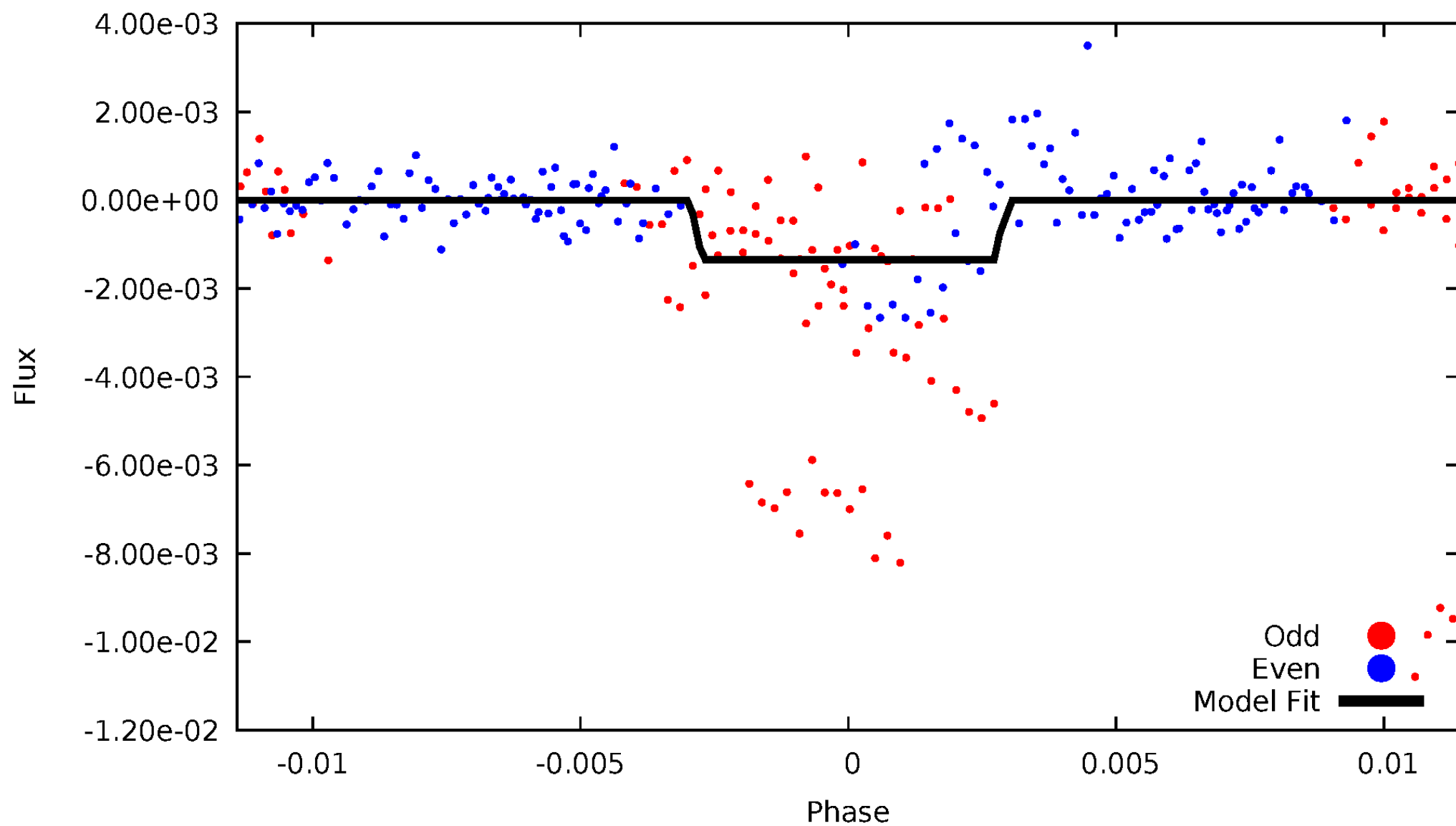
TCE 009851970-03



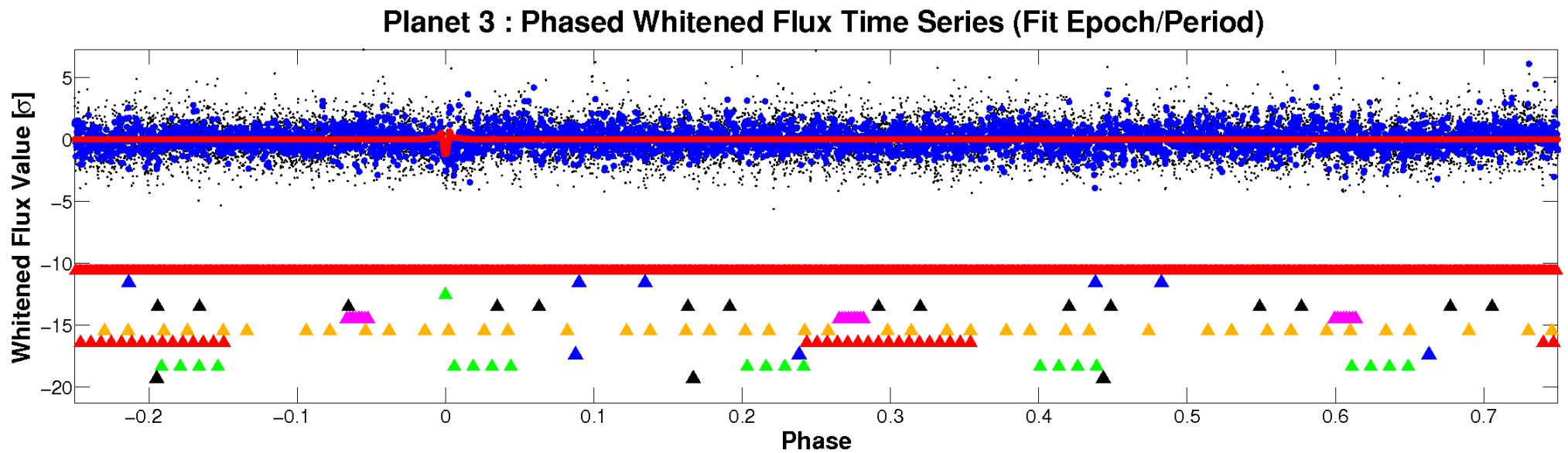
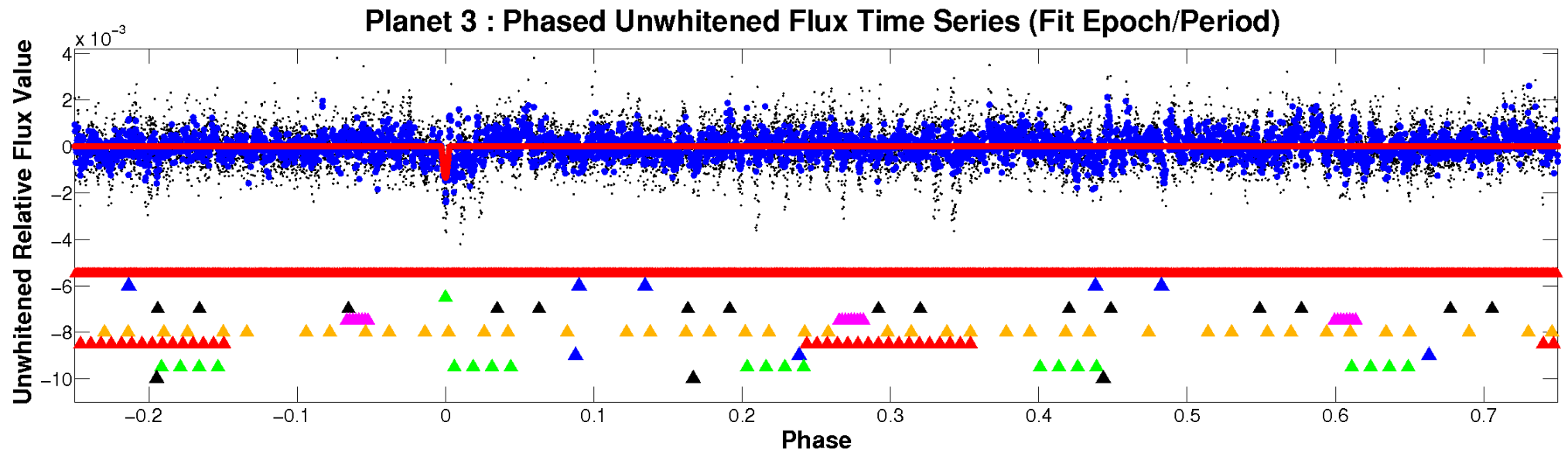


# ALT Odd/Even

TCE 009851970-03

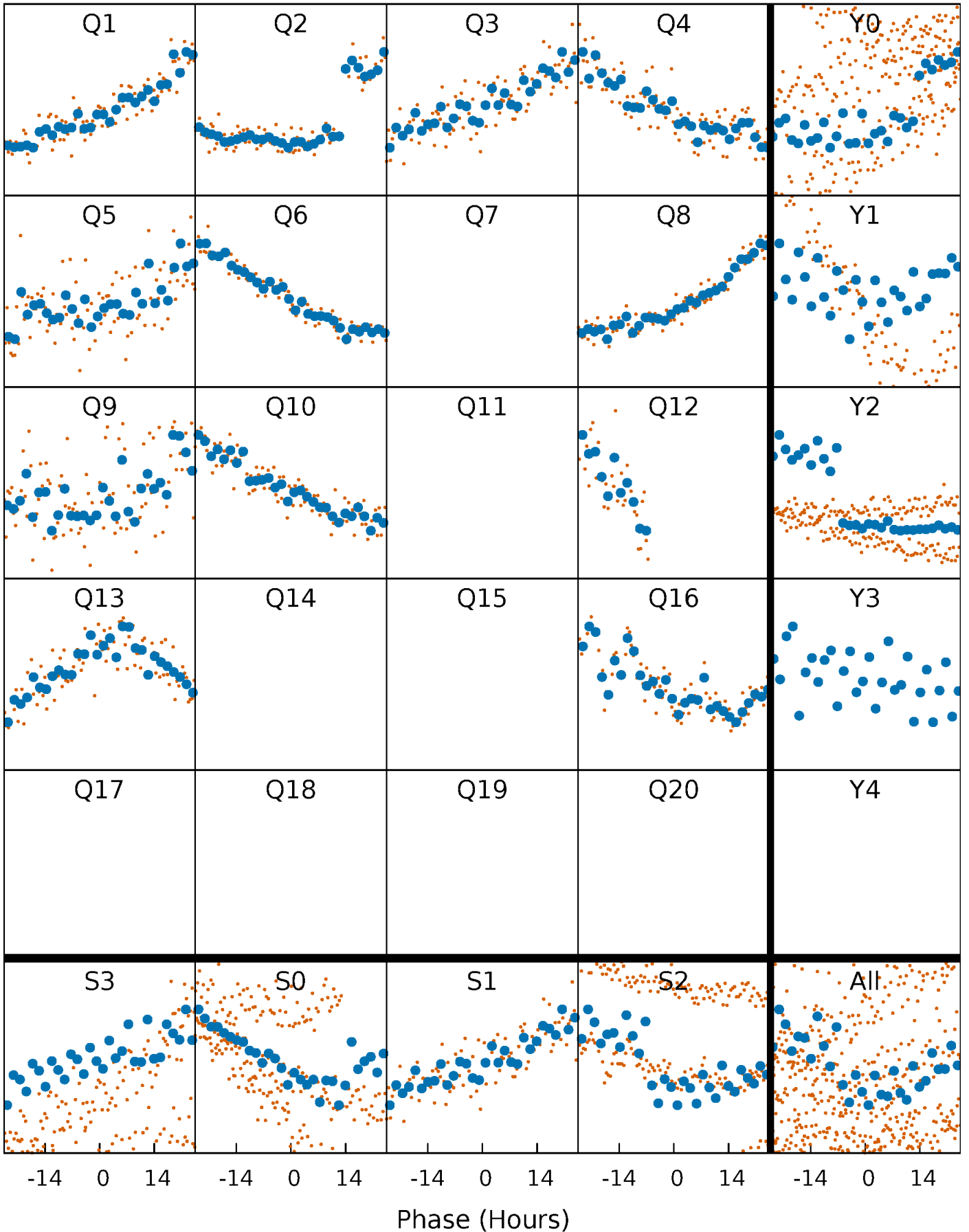


# Non-Whitened Vs. Whitened Light Curve



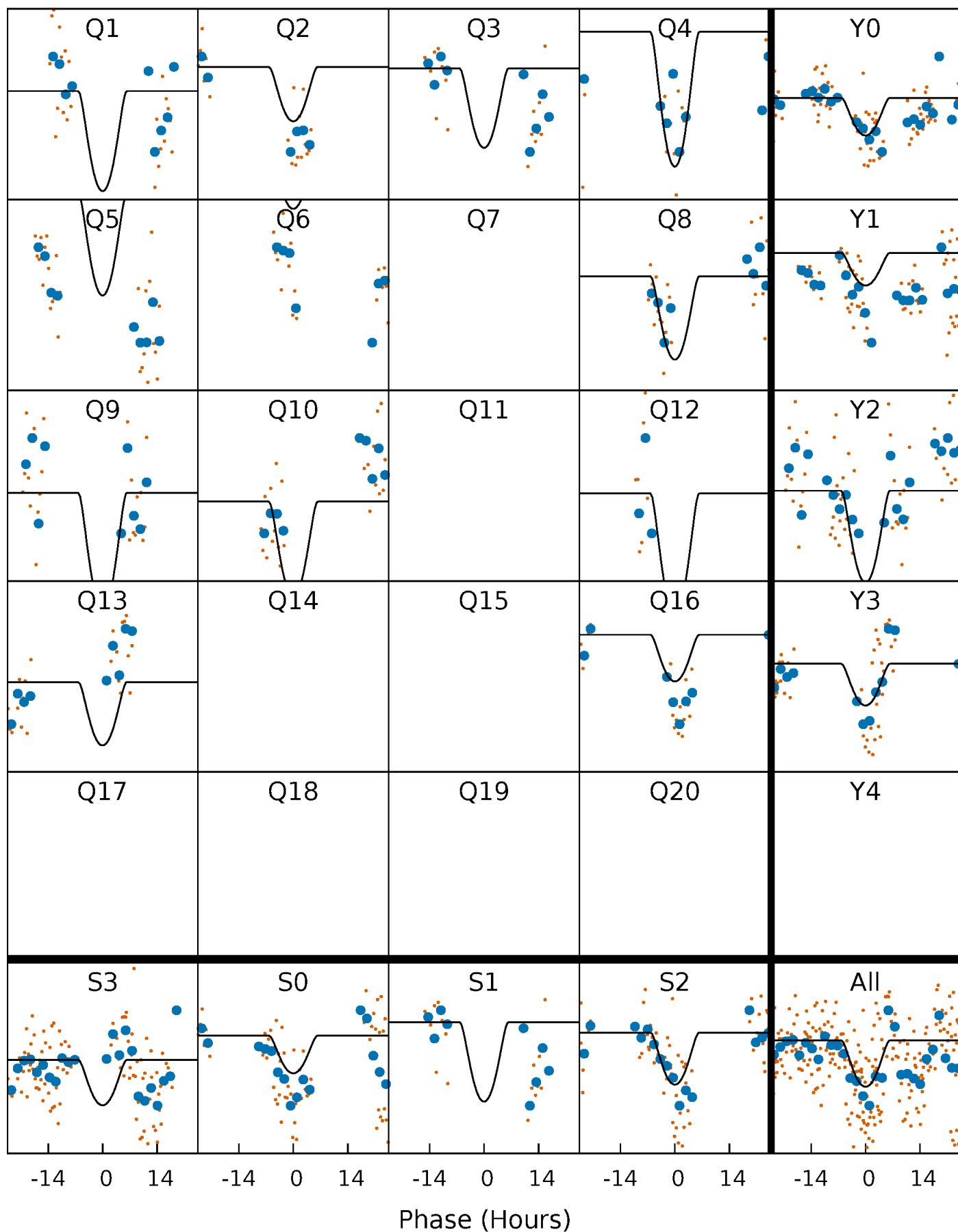
# PDC Quarter-Phased Transit Curves

TCE 009851970-03   P= 87.131904 Days    $T_0=158.497311$  (BKJD)



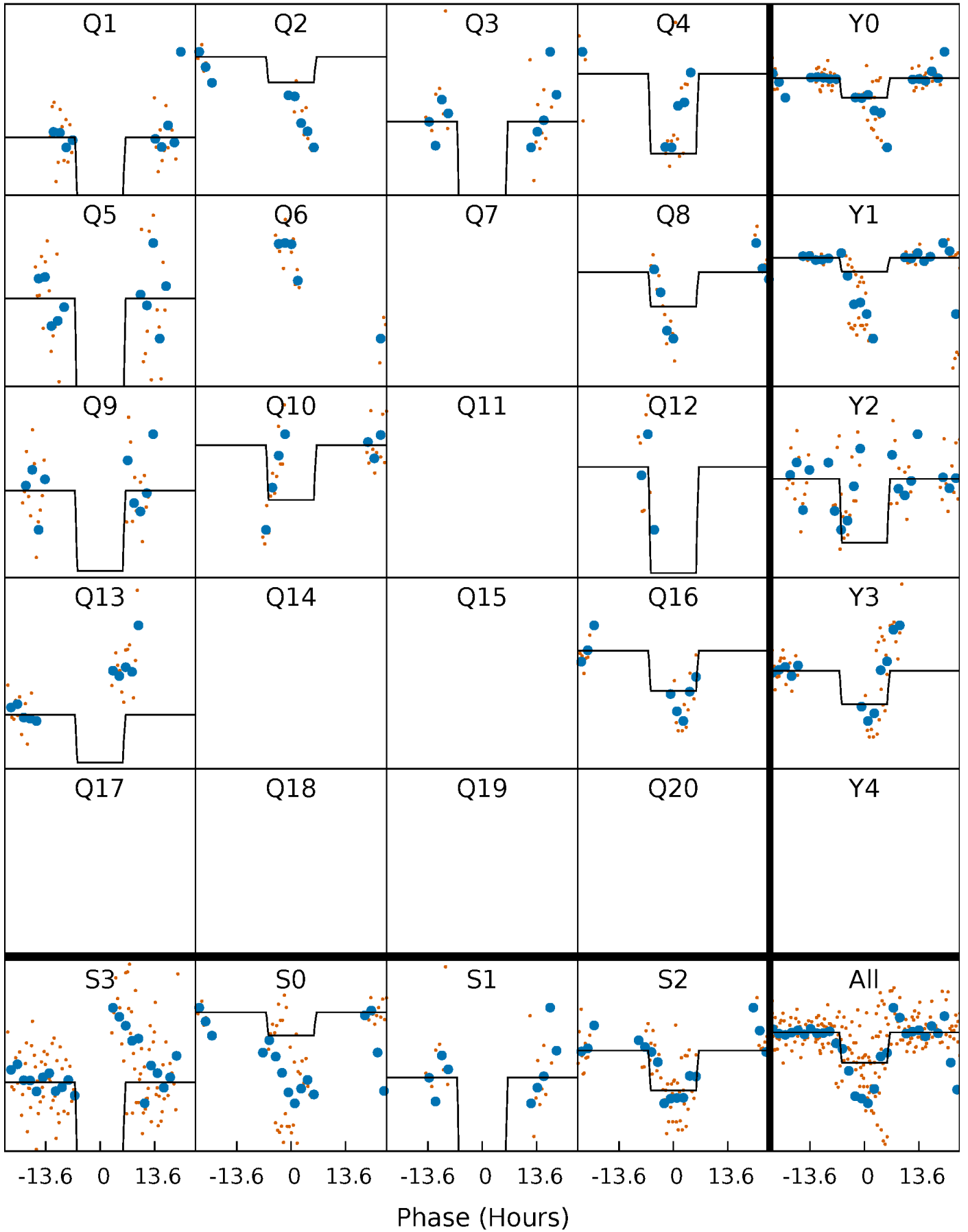
# DV Quarter-Phased Transit Curves

TCE 009851970-03 P= 87.131904 Days  $T_0=158.497311$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

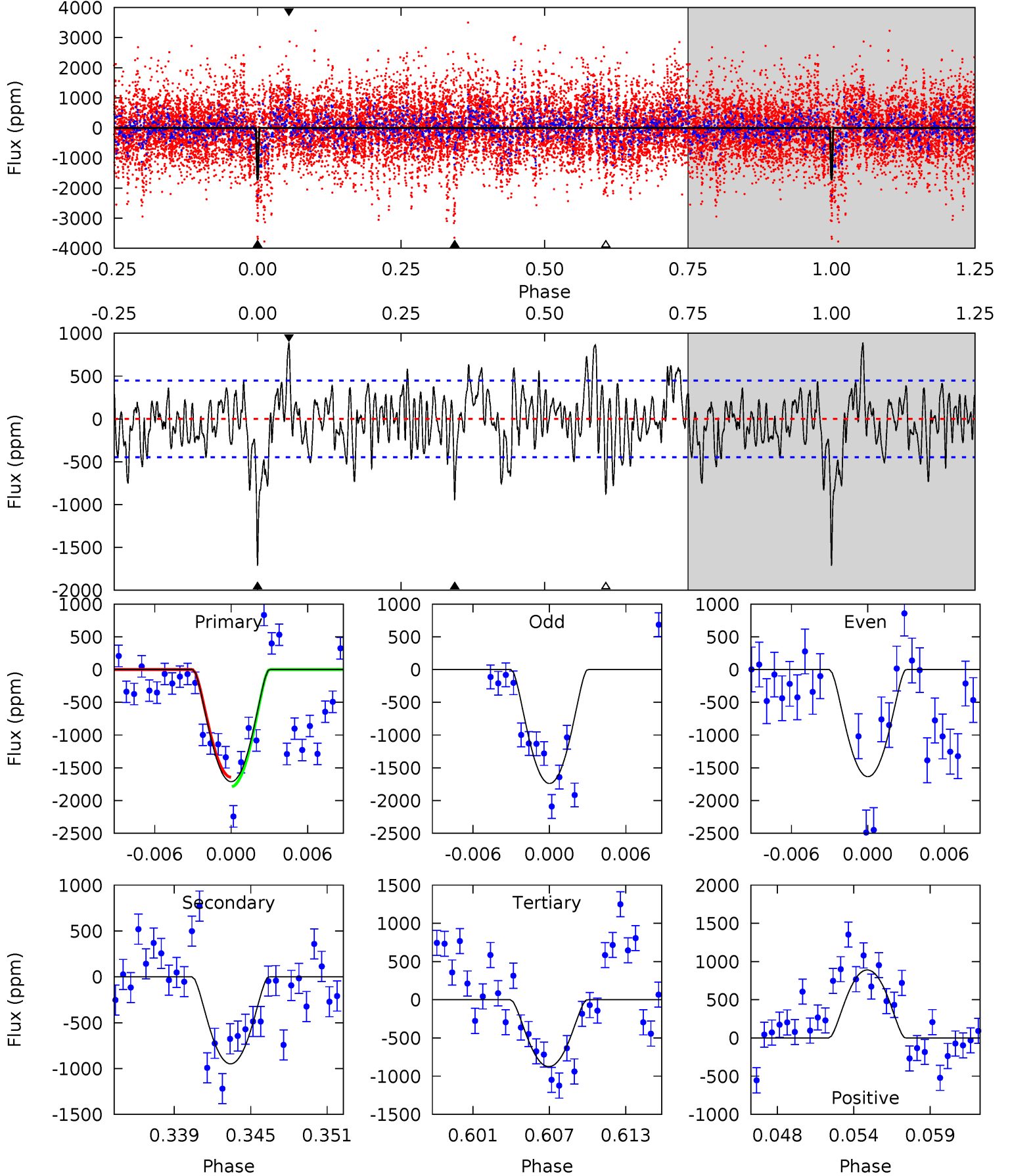
TCE 009851970-03 P= 87.131384 Days  $T_0=158.451128$  (BKJD)



# DV Model-Shift Uniqueness Test

009851970-03, P = 87.131904 Days, E = 71.365407 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
19.6	10.9	10.0	10.2	5.13	2.75	3.22	9.60	9.42	0.85	0.67	0.55	1.00	0.34	0.81

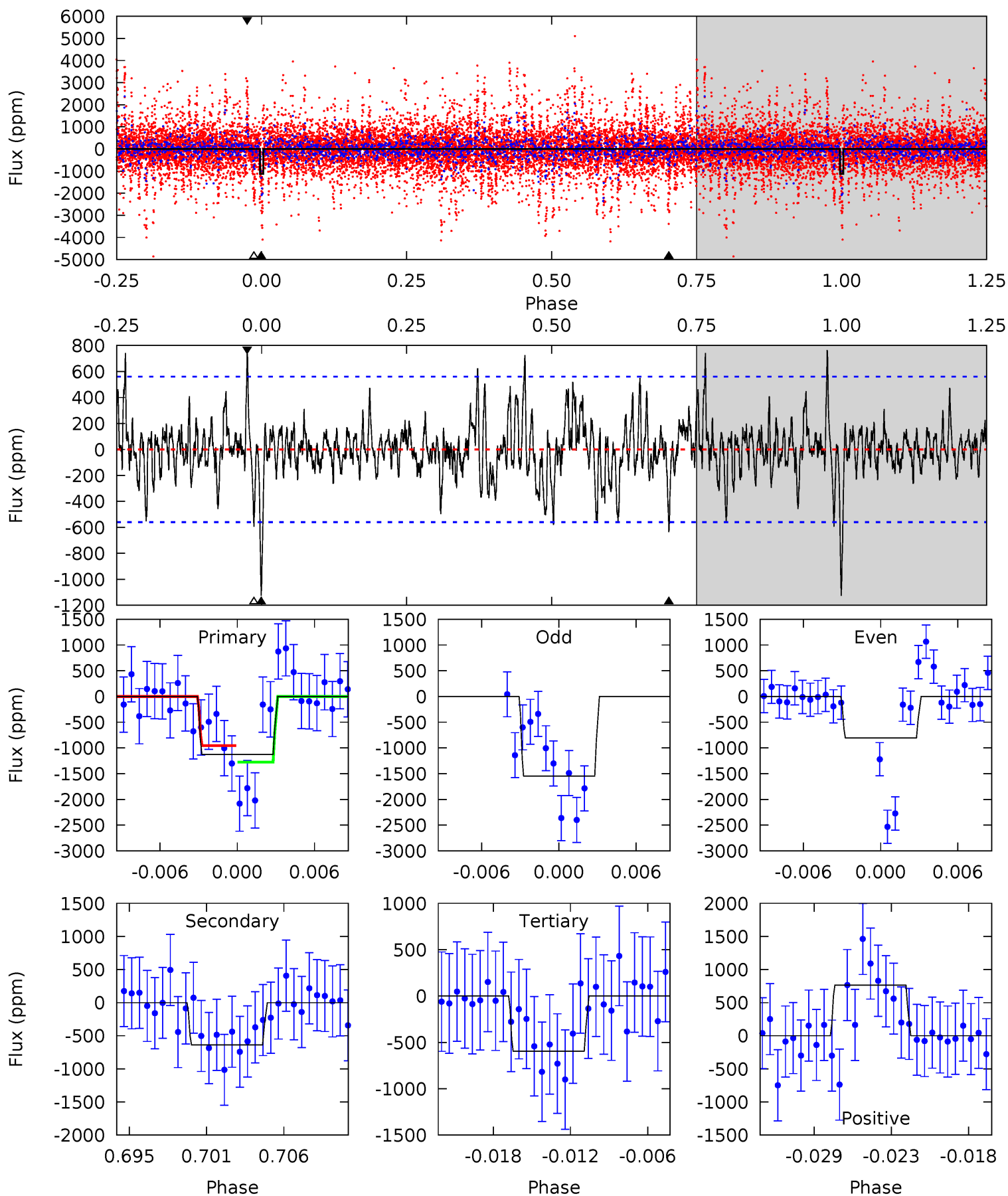




# Alt Model-Shift Uniqueness Test

009851970-03, P = 87.131384 Days, E = 71.319744 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
10.3	5.84	5.45	7.01	5.13	2.76	1.77	4.87	3.31	0.39	-1.17	3.27	1.77	0.40	1.48



### Stellar Parameters For KIC 009851970

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$4965^{+151}_{-136}$	$4.555^{+0.072}_{-0.044}$	$-0.220^{+0.300}_{-0.300}$	$0.736^{+0.065}_{-0.079}$	$0.709^{+0.093}_{-0.050}$	$2.508^{+0.760}_{-0.407}$
	+3%/-3%	+2%/-1%	+136%/-136%	+9%/-11%	+13%/-7%	+30%/-16%
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 009851970-03 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-949 \pm 87$	$6.51^{+5.87}_{-4.24}$	$447^{+16}_{-18}$	$3480^{+1640}_{-576}$	$1470^{+9793}_{-1061}$
Alt.	$-637 \pm 109$	$5.91^{+5.42}_{-4.14}$	$445^{+18}_{-15}$	$3375^{+1797}_{-582}$	$1185^{+11774}_{-867}$

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

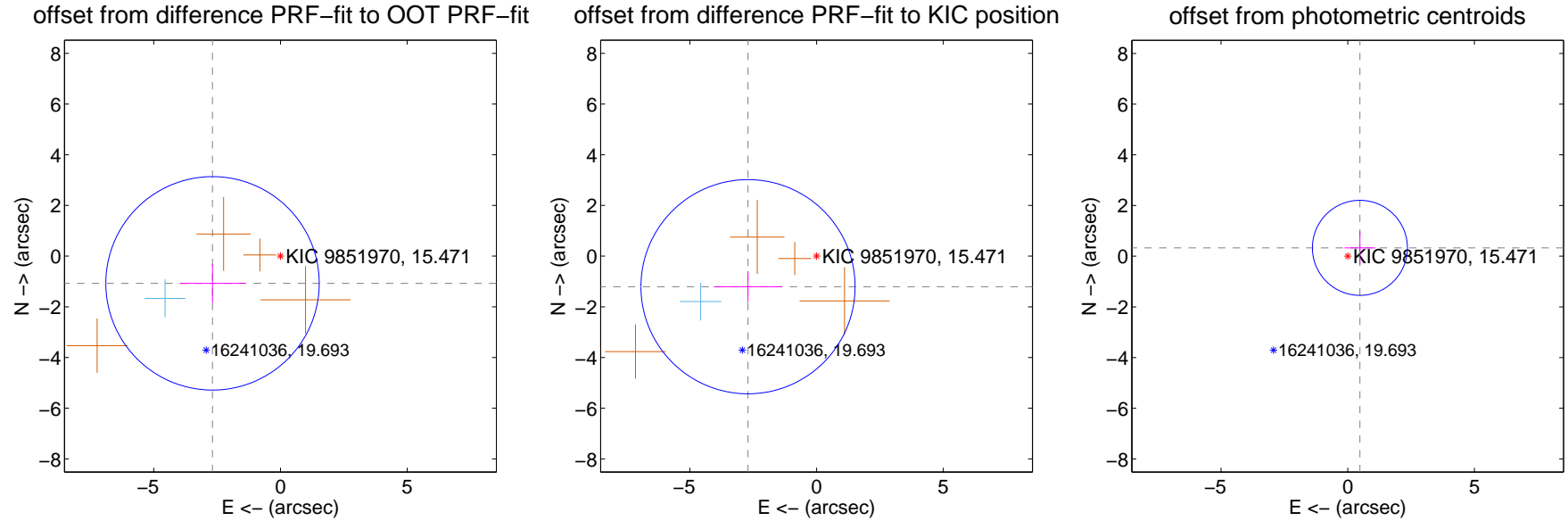
## DV Centroid Data

Supplemental centroid analysis for 009851970-03. Kepler magnitude: 15.47. Transit SNR 7.99

There are 1 quarters with good PRF difference image offsets

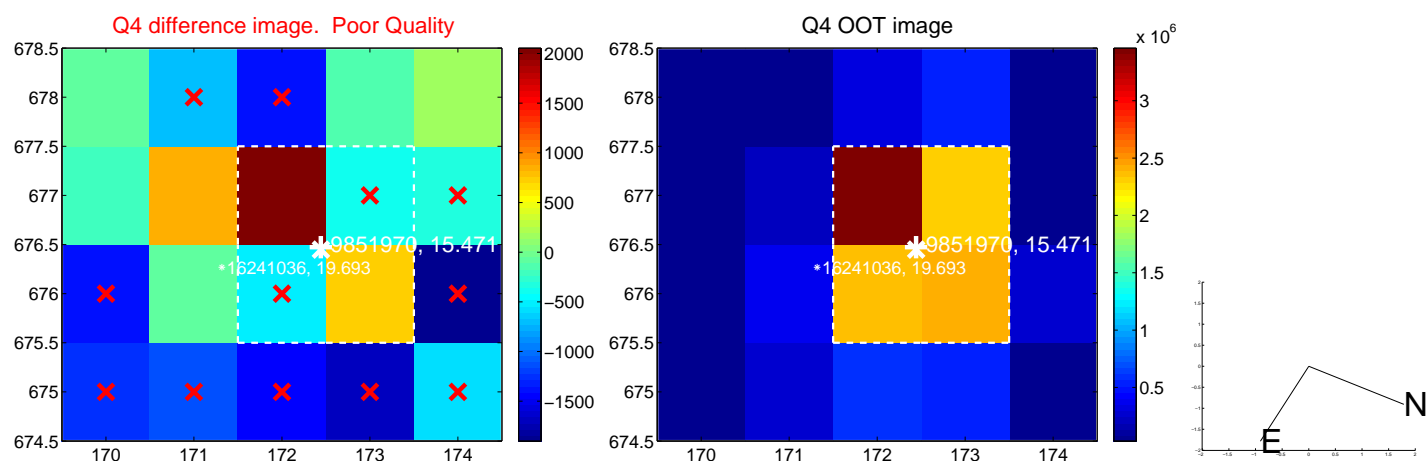
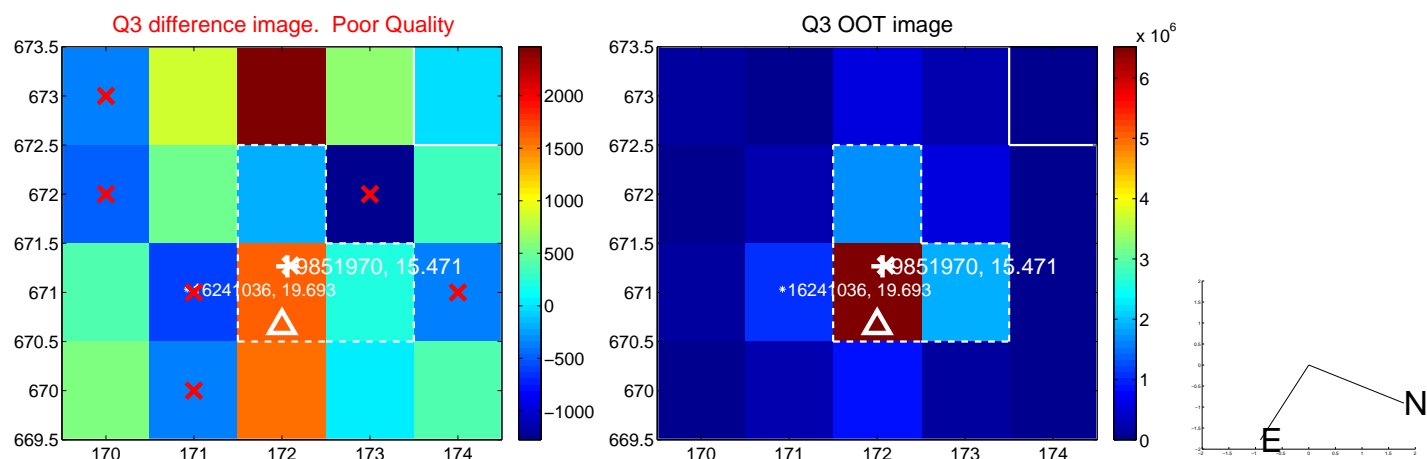
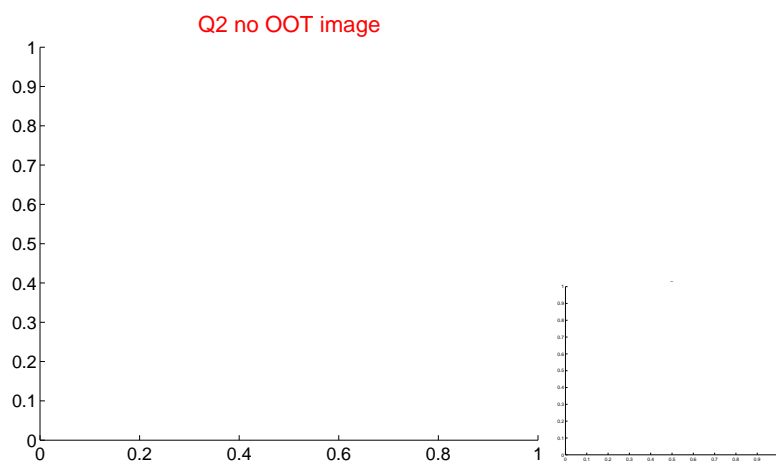
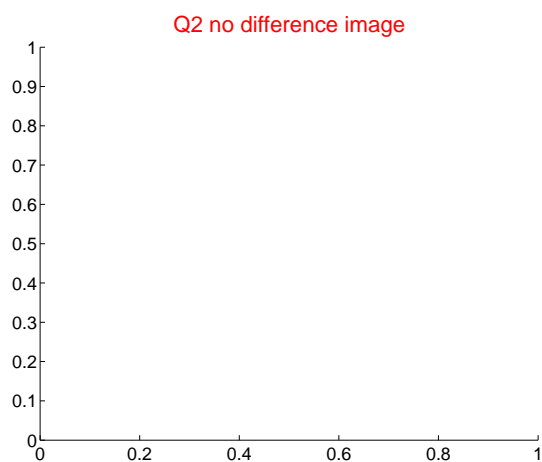
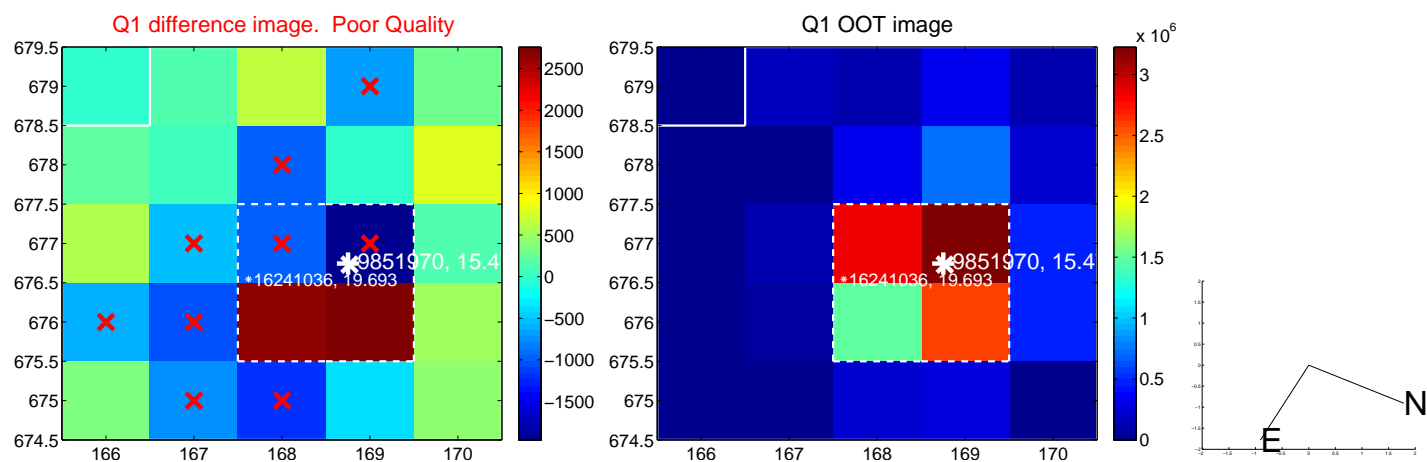
The direct PRF centroid is offset from the target star catalog position by about 0.12 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$2.888 \pm 1.403$	2.06	$2.680 \pm 1.291$	$-1.074 \pm 0.768$
PRF-fit source offset from KIC position	$2.962 \pm 1.408$	2.10	$2.705 \pm 1.354$	$-1.206 \pm 0.611$
photometric centroid source offset	$0.58 \pm 0.62$	0.93	$-0.48 \pm 0.61$	$0.33 \pm 0.66$

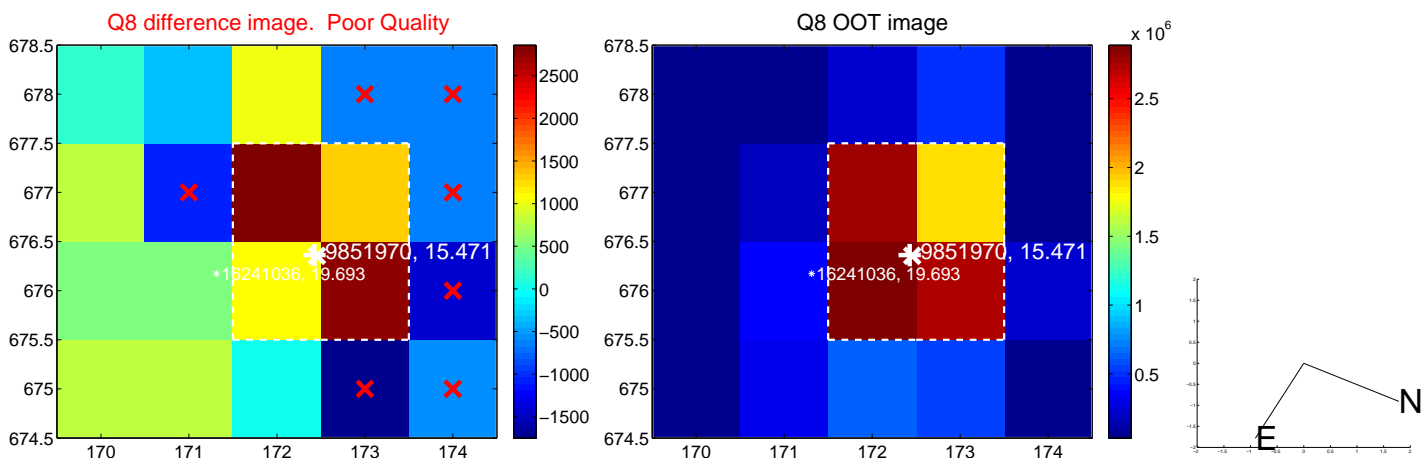
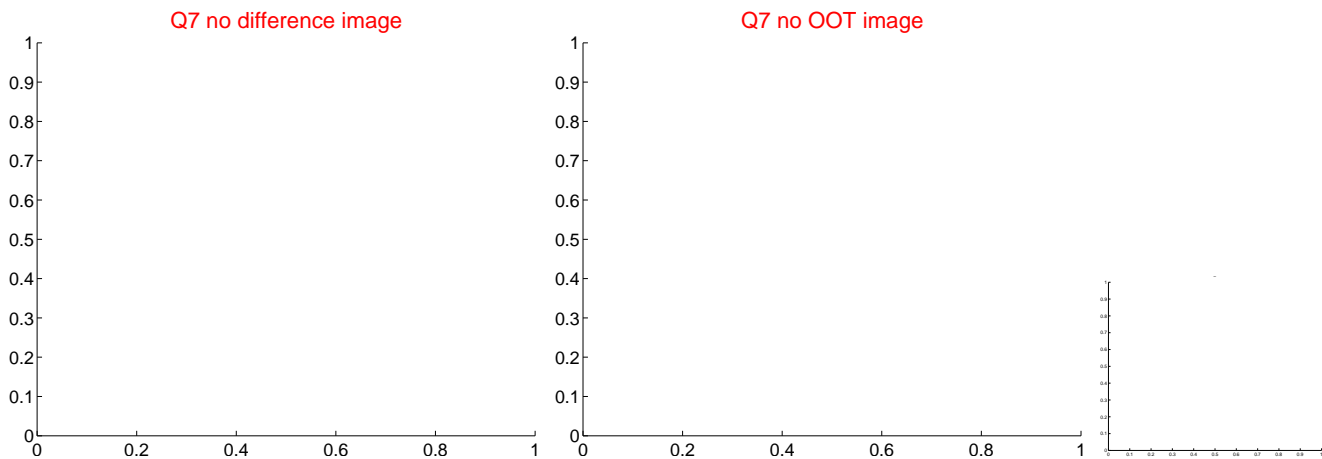
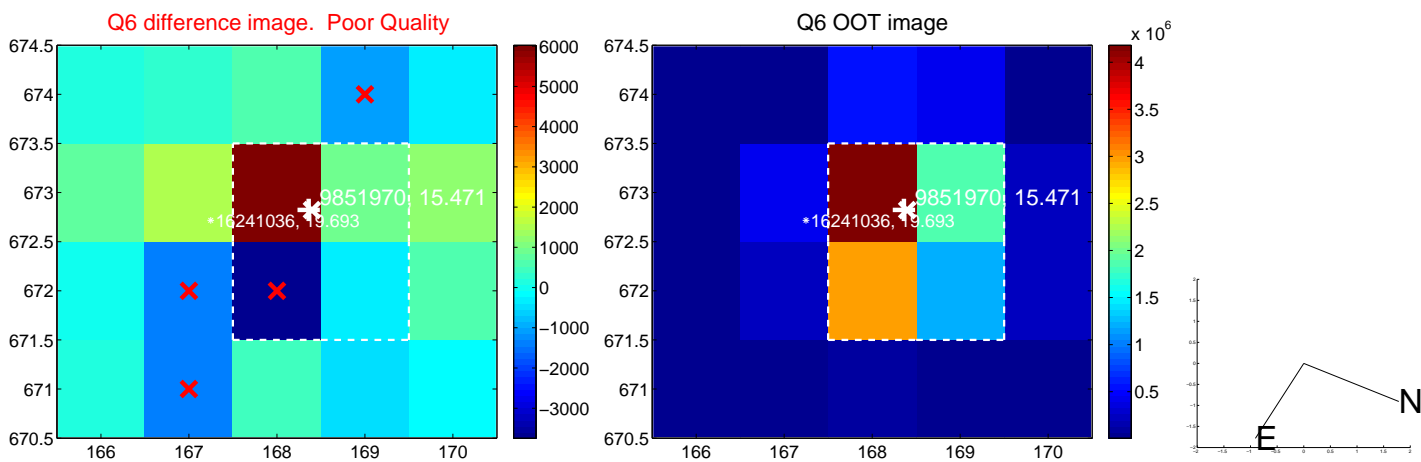
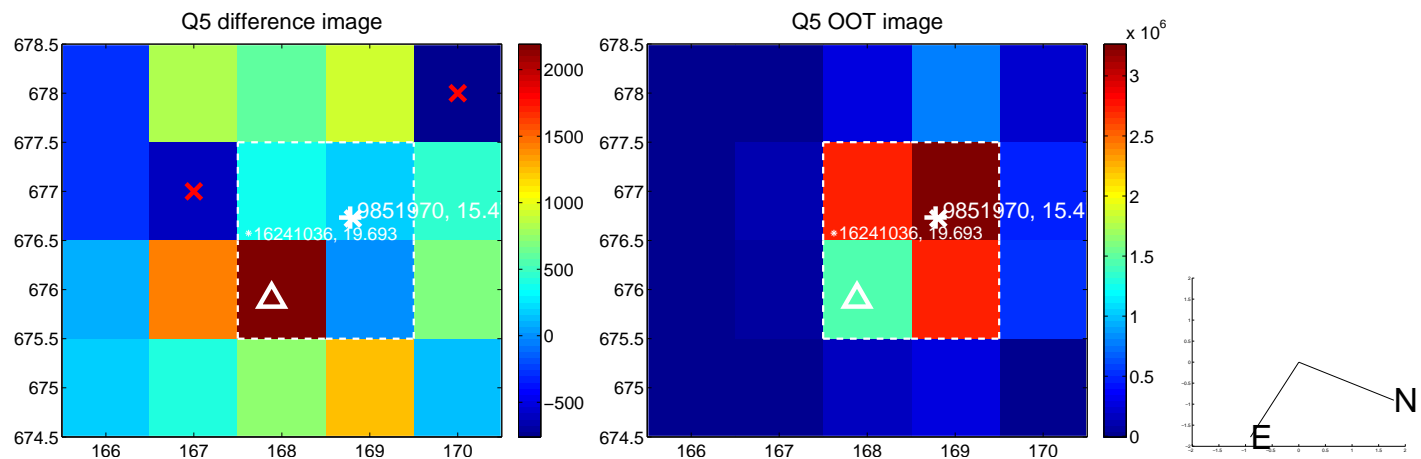


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

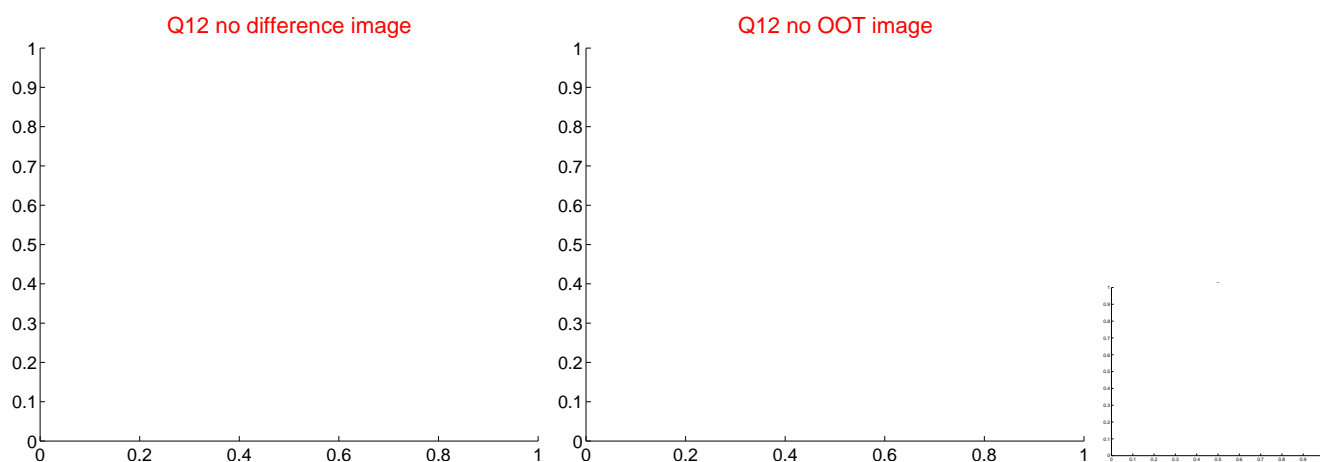
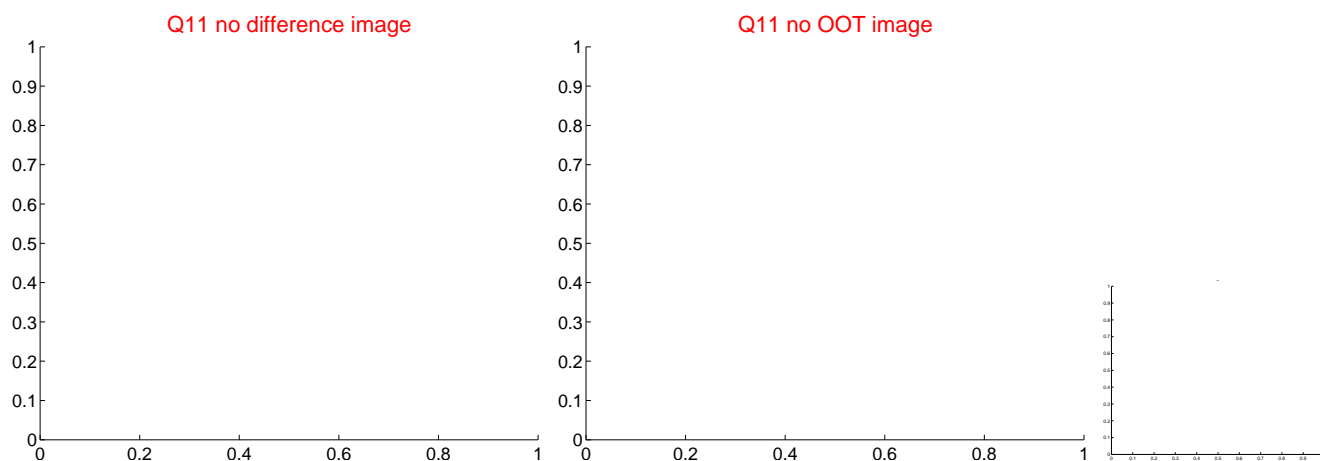
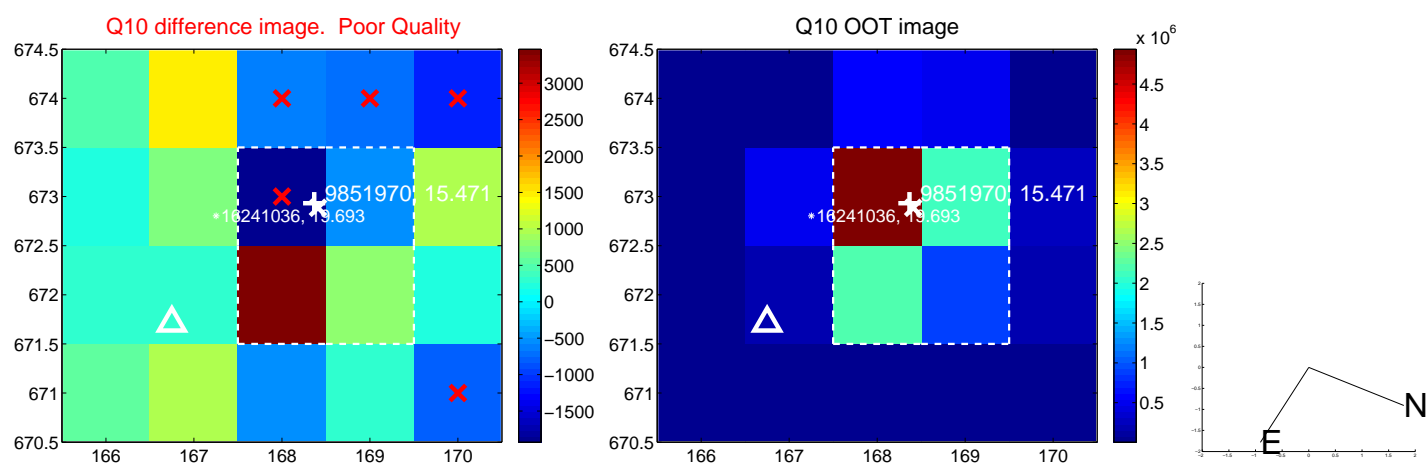
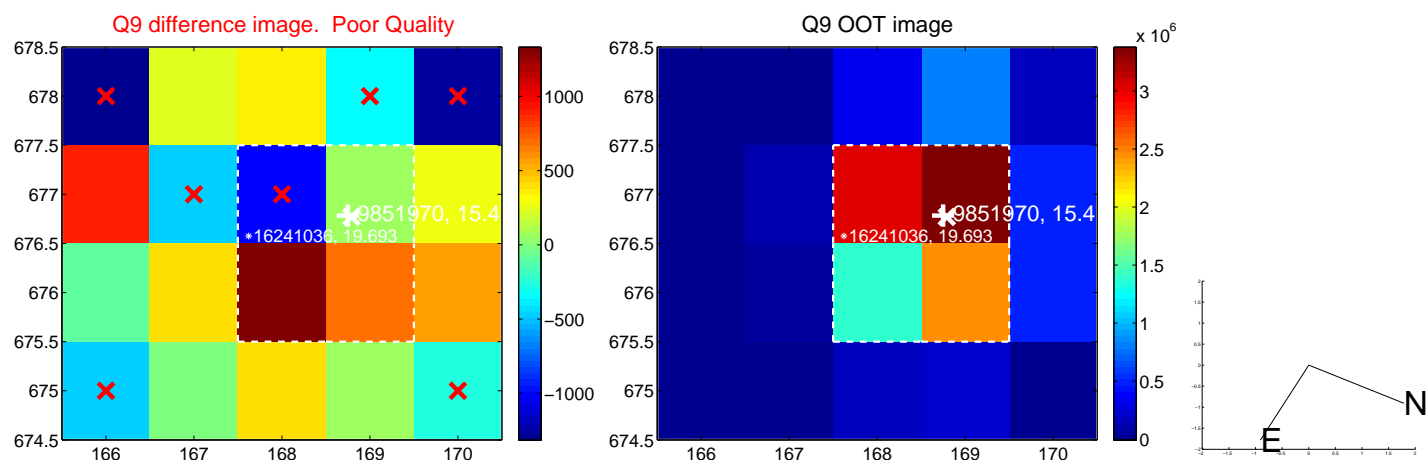
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



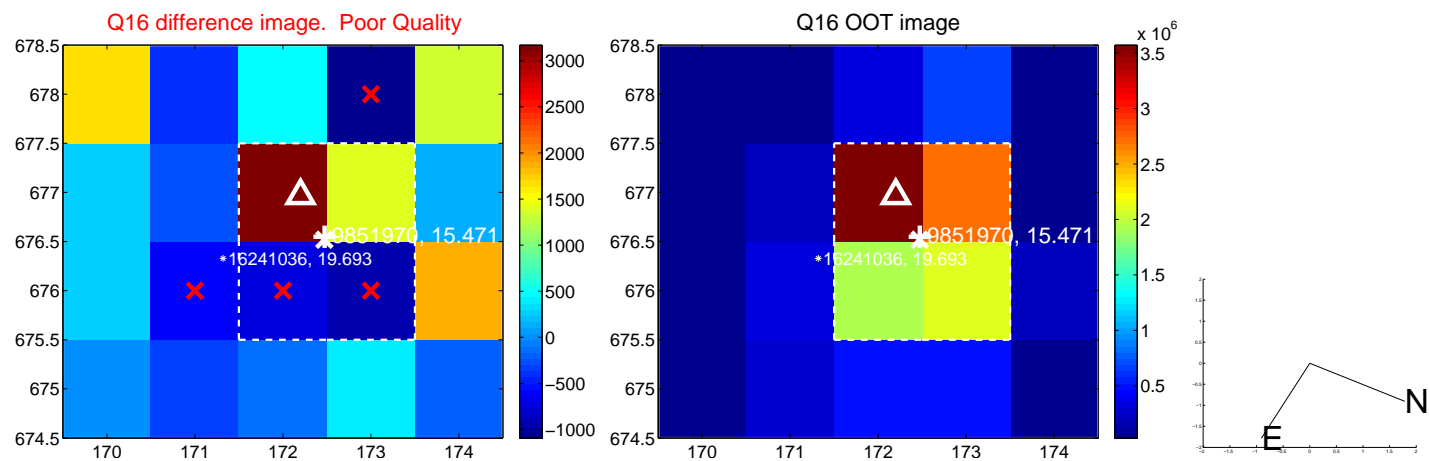
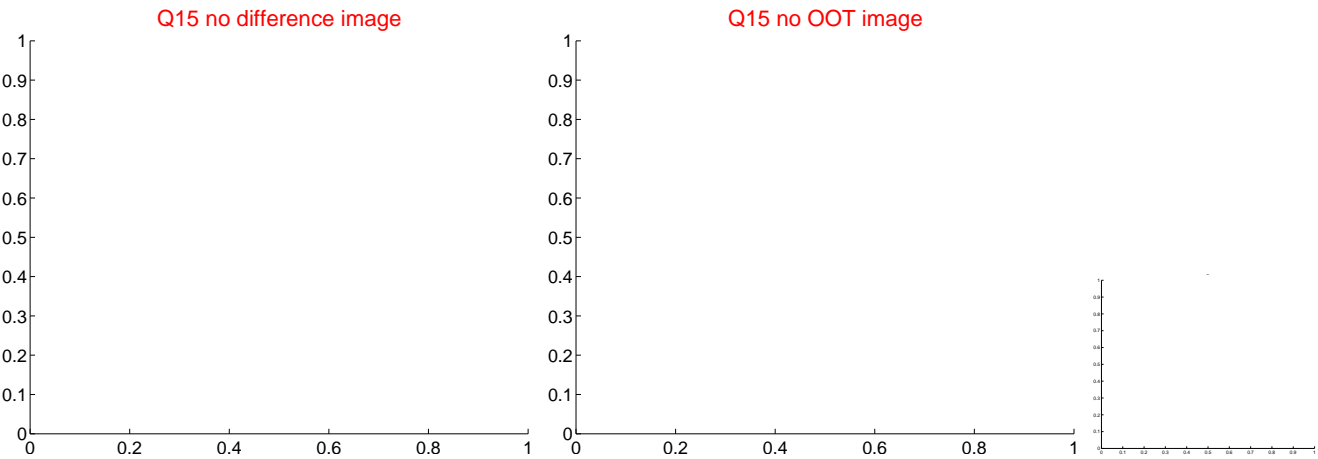
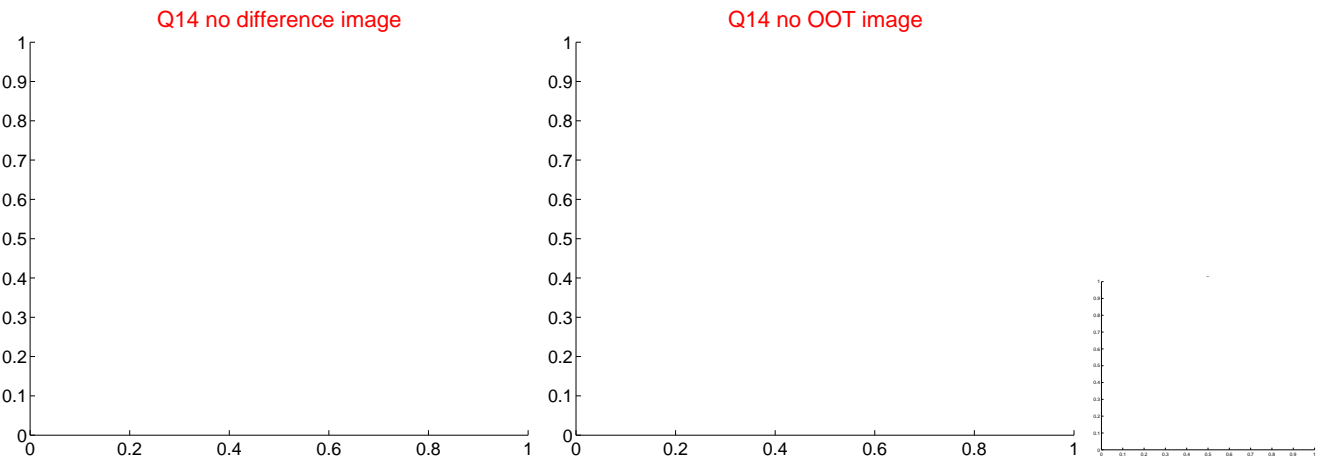
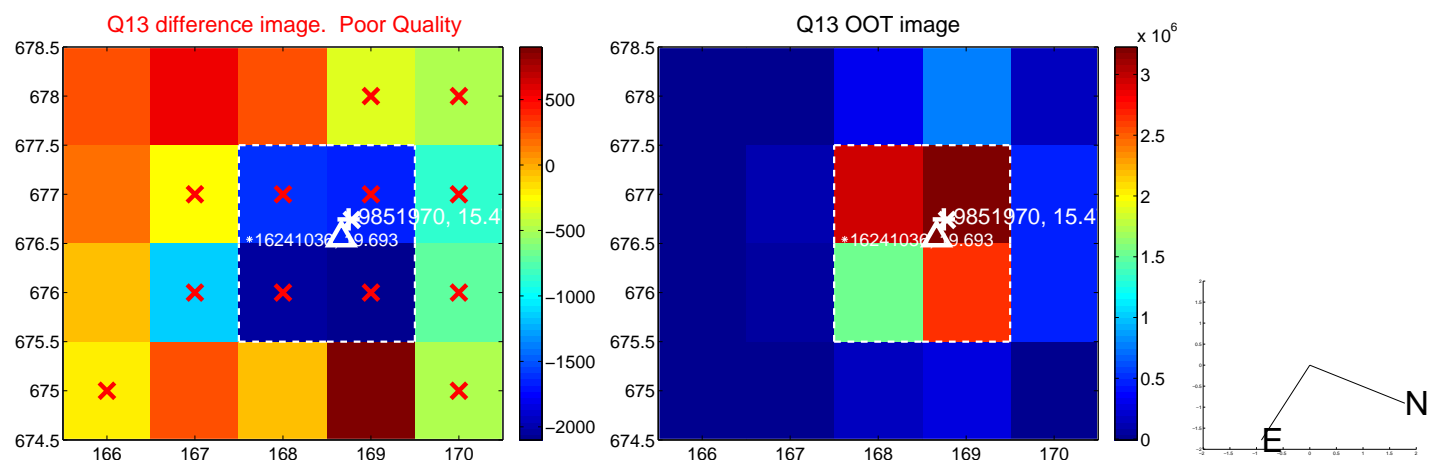
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



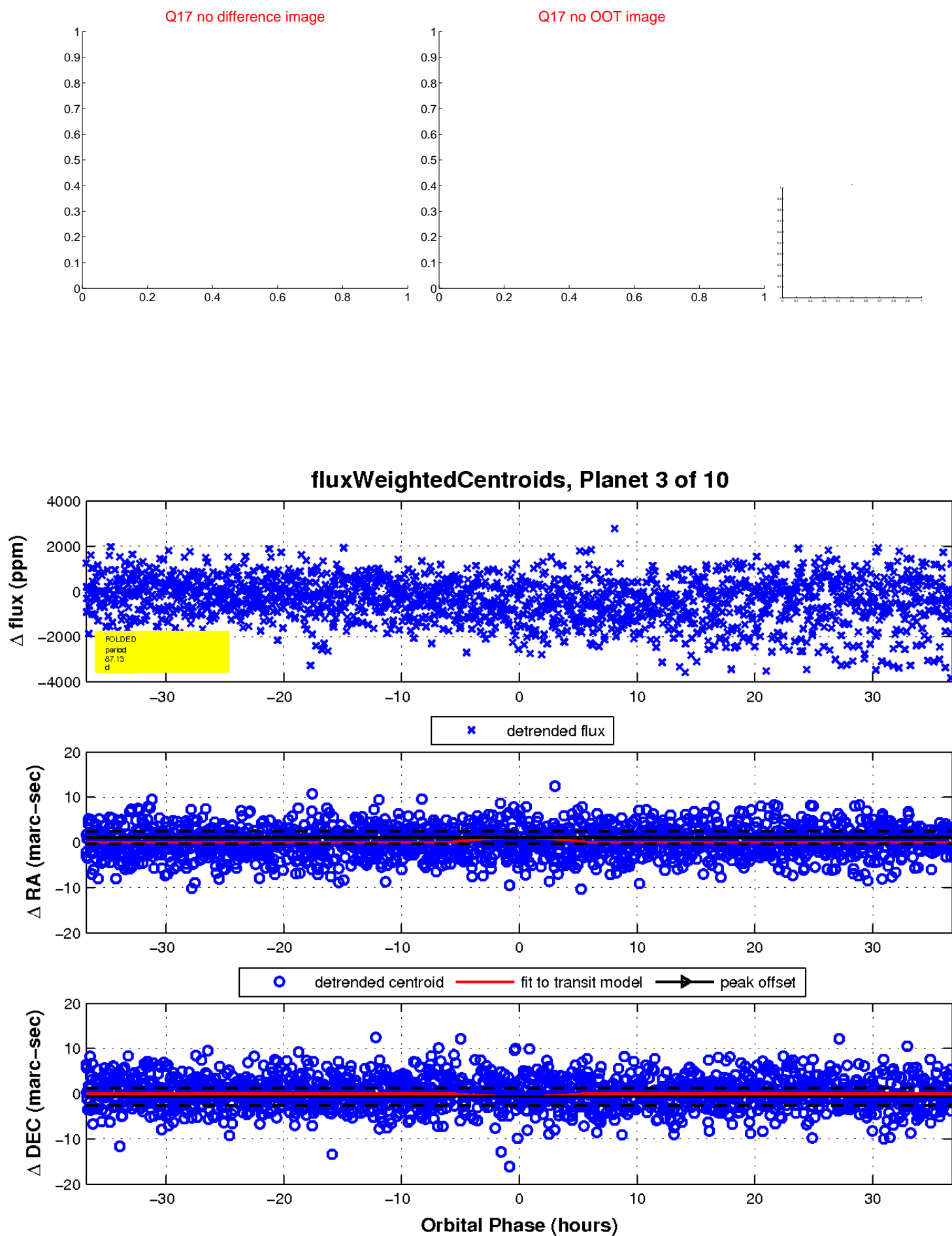
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



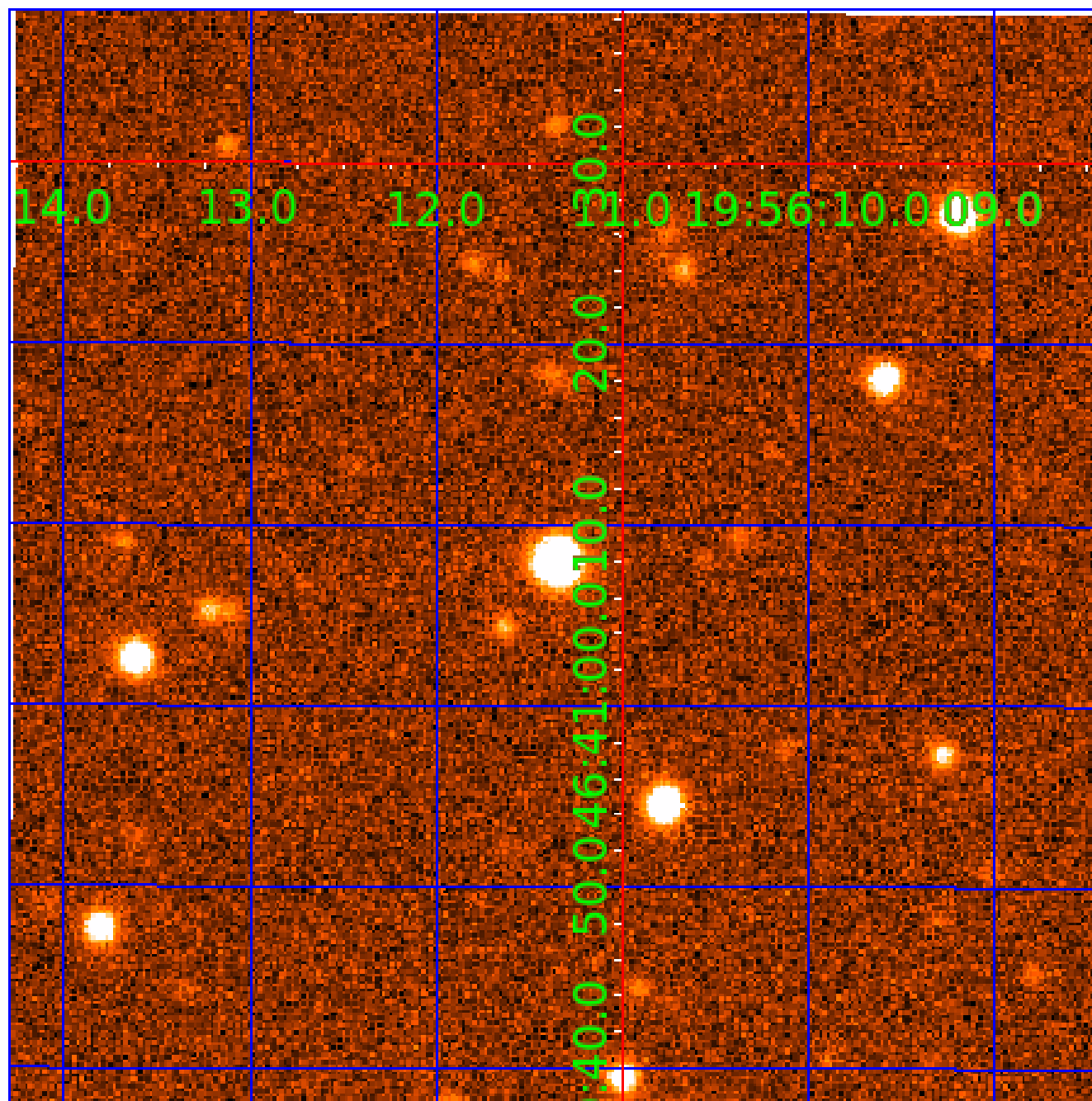
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





UKIRT Image

Declination



## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009851970-01	OBS	4122.01	1.081931	131.550019	107.5	6.343	13.0	13.4	0.74	4965	0.74	871.41
009851970-02	OBS	No	318.191396	287.691504	2963.9	7.500	18.3	-1.0	0.74	4965	3.89	0.45
009851970-03	OBS	No	87.131904	158.497311	1337.3	12.255	11.1	8.0	0.74	4965	4.18	2.51
009851970-04	OBS	No	98.329975	161.538824	746.0	4.930	12.1	5.3	0.74	4965	2.36	2.13
009851970-05	OBS	No	58.028718	183.047579	986.5	7.168	11.4	8.4	0.74	4965	2.50	4.31
009851970-06	OBS	No	34.155362	145.442225	495.6	5.928	10.4	4.7	0.74	4965	1.86	8.73
009851970-07	OBS	No	43.866421	135.859401	759.6	3.082	10.4	4.7	0.74	4965	2.21	6.26
009851970-08	OBS	No	485.794267	253.271172	1176.7	9.000	9.7	-1.0	0.74	4965	2.45	0.25
009851970-09	OBS	No	69.926614	193.429290	667.9	4.803	9.9	4.1	0.74	4965	2.11	3.36
009851970-10	OBS	No	665.534623	173.054303	2457.4	17.077	9.5	8.7	0.74	4965	6.96	0.17

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009851970-01	OBS	FP	0.00	0	1	1	1	MOD_SEC_ALT—CENT_RESOLVED_OFFSET—HALO_GHOST—EPHEM_MATCH
009851970-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_ZUMA—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_NOFITS
009851970-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_ALT—CENT_FEW_DIFFS
009851970-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_ZUMA_TRACKER—TRANS_GAPPED—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009851970-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE—TRANS_GAPPED—LPP_DV—CENT_FEW_DIFFS
009851970-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
009851970-07	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_TRACKER—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
009851970-08	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL—LPP_DV—ALL_TRANS_CHASES—NO_FITS—CENT_NOFITS
009851970-09	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE_TRACKER—TRANS_GAPPED—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS—HALO_GHOST
009851970-10	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_SKYE—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—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.

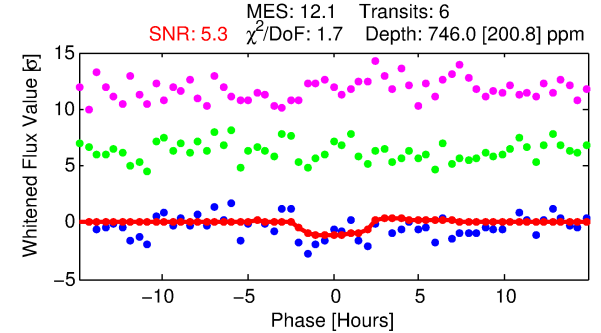
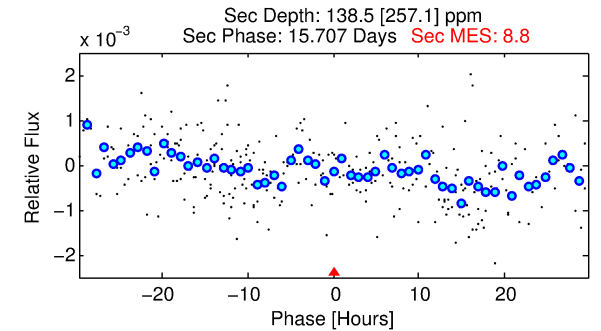
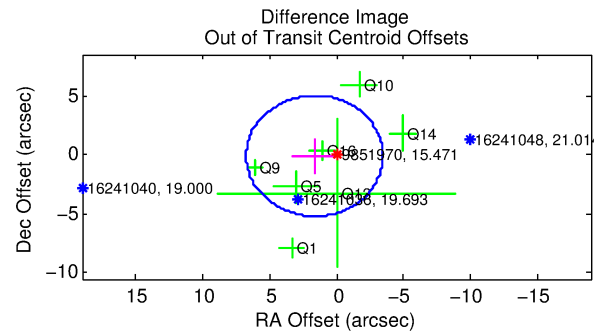
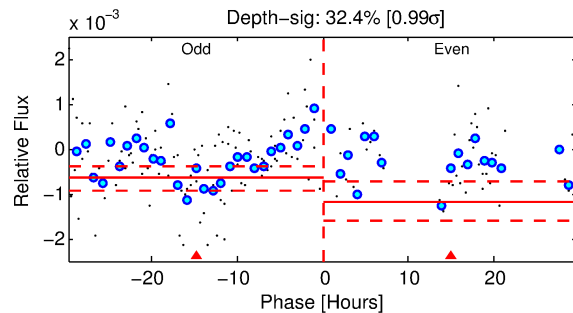
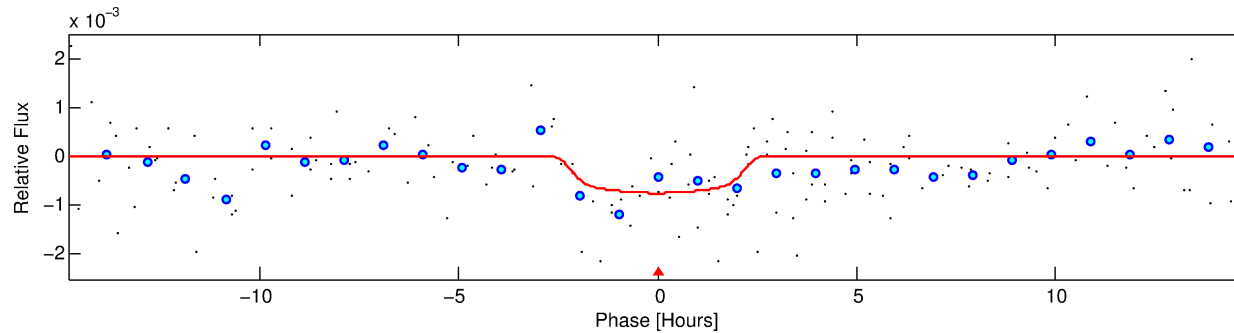
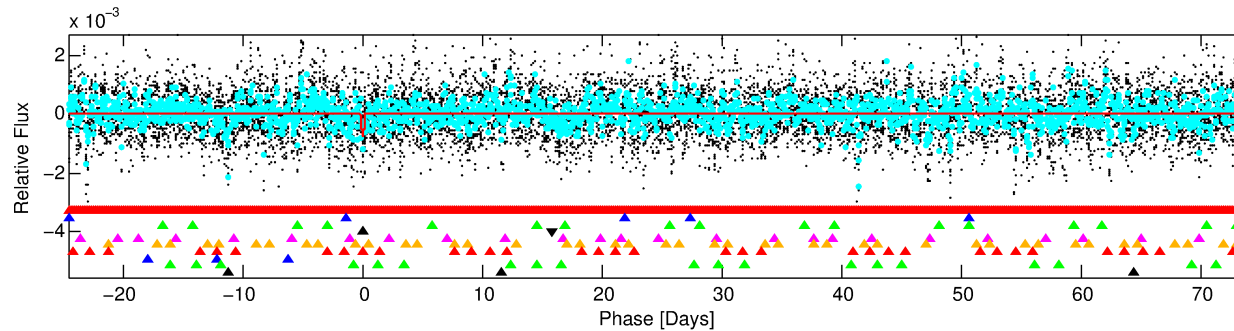
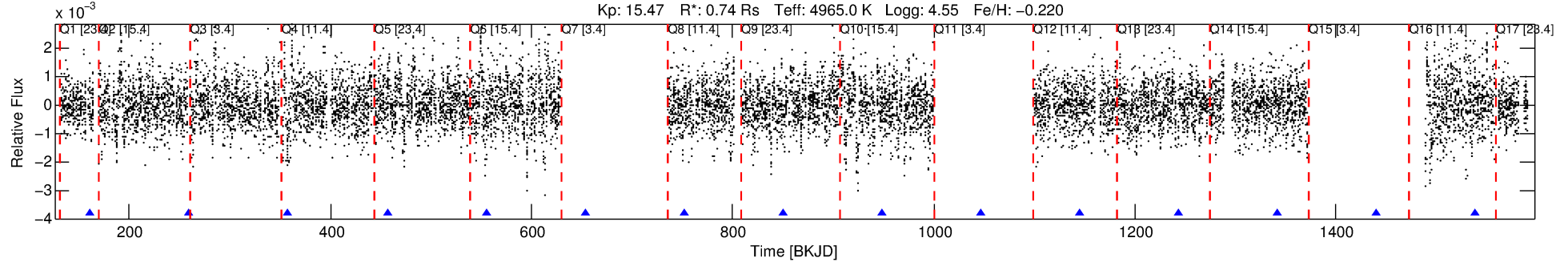
## Ephemeris Match Information For 009851970-04

No Significant Match Found

# DV One-Page Summary

KIC: 9851970 Candidate: 4 of 10 Period: 98.330 d  
KOI: K04122 Corr: No Ephemeris Match

Kp: 15.47 R\*: 0.74 Rs Teff: 4965.0 K Logg: 4.55 Fe/H: -0.220



## DV Fit Results:

Period = 98.32998 [0.00308] d  
Epoch = 161.5388 [0.0279] BKJD  
Rp/R\* = 0.0294 [0.0217]  
a/R\* = 84.99 [229.12]  
b = 0.87 [0.80]  
Seff = 2.13 [0.38]  
Teq = 308 [14] K  
Rp = 2.36 [1.76] Re  
a = 0.3719 [0.0336] AU  
Ag = 1891.62 [4490.91] [0.42σ]  
Teffp = 3142 [1864] K [1.52σ]

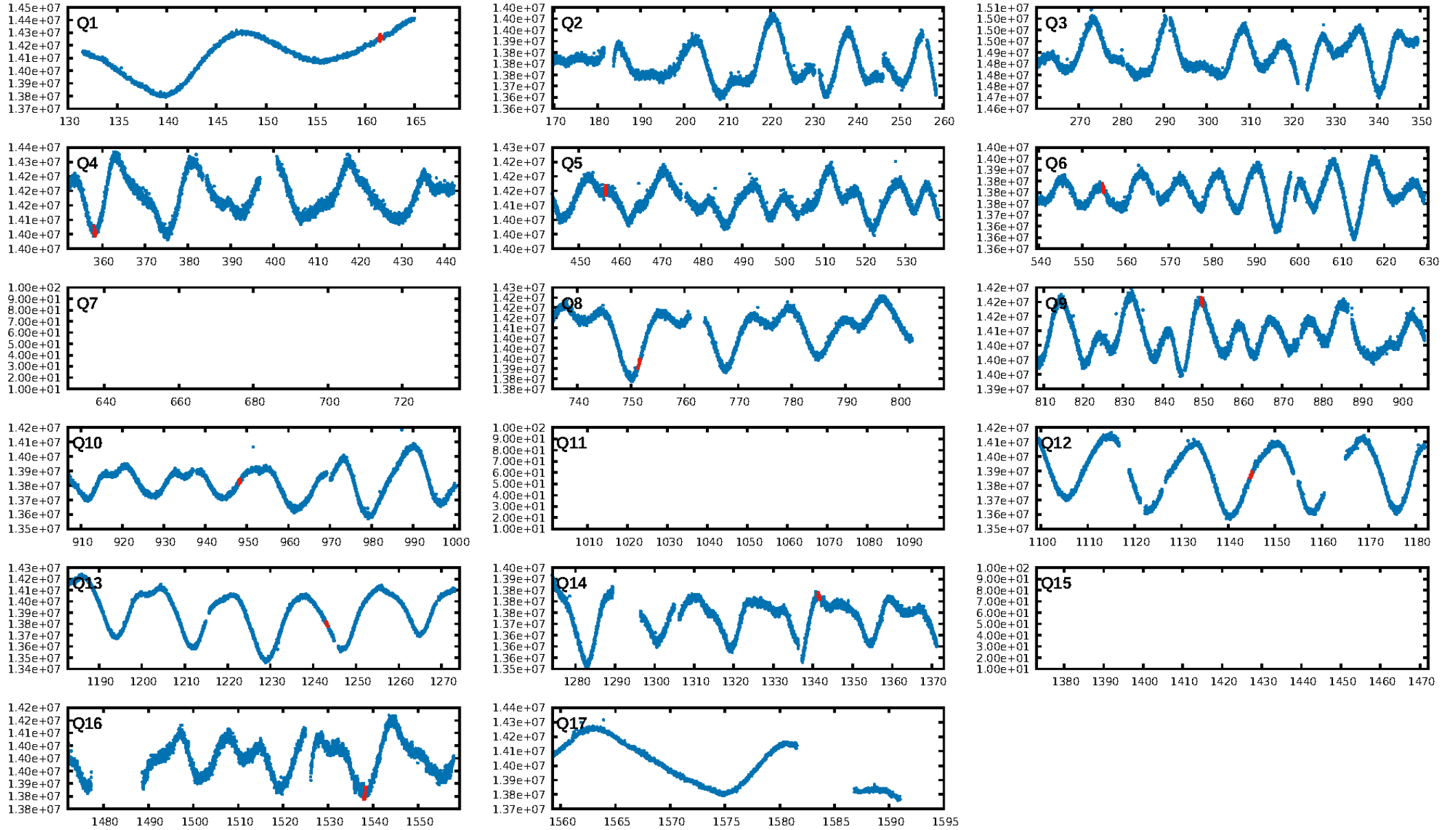
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [20.34σ]  
LongPeriod-sig: 100.0% [587.91σ]  
ModelChiSquare2-sig: 1.8%  
ModelChiSquareGof-sig: 98.8%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [5/5]  
GhostDiagnostic-chr: -0.2603  
Centroid-sig: 4.0%  
Centroid-so: 2.477 arcsec [1.66σ]  
OotOffset-rm: 1.644 arcsec [0.97σ]  
KicOffset-rm: 1.613 arcsec [0.95σ]  
OotOffset-st: 2/0/1/4 [7]  
KicOffset-st: 2/0/1/4 [7]  
DiffImageQuality-fgm: 0.14 [1/7]  
DiffImageOverlap-fno: 0.00 [0/11]

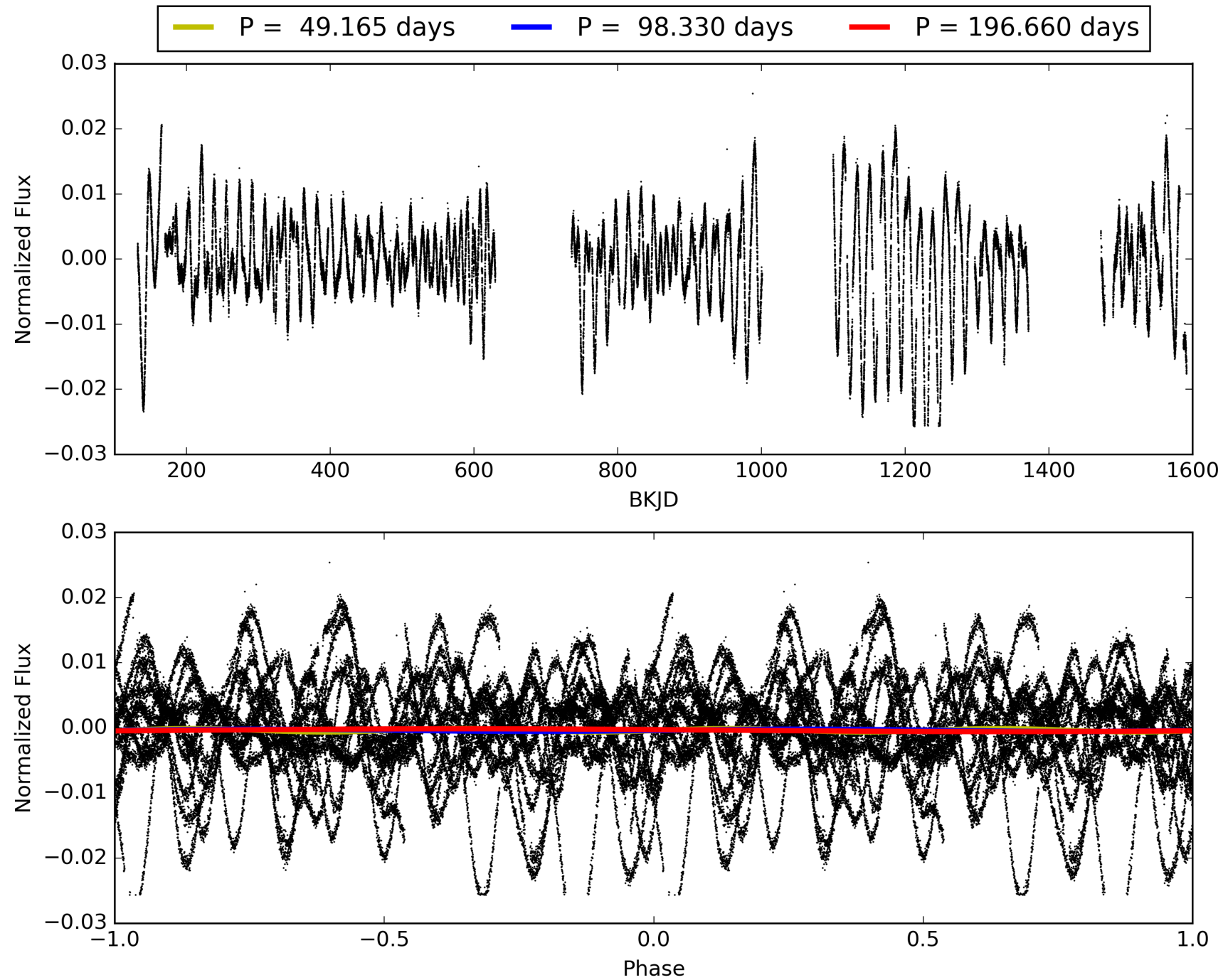
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 08:50:29 Z

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

# TCE 009851970-04, PDC Light Curves

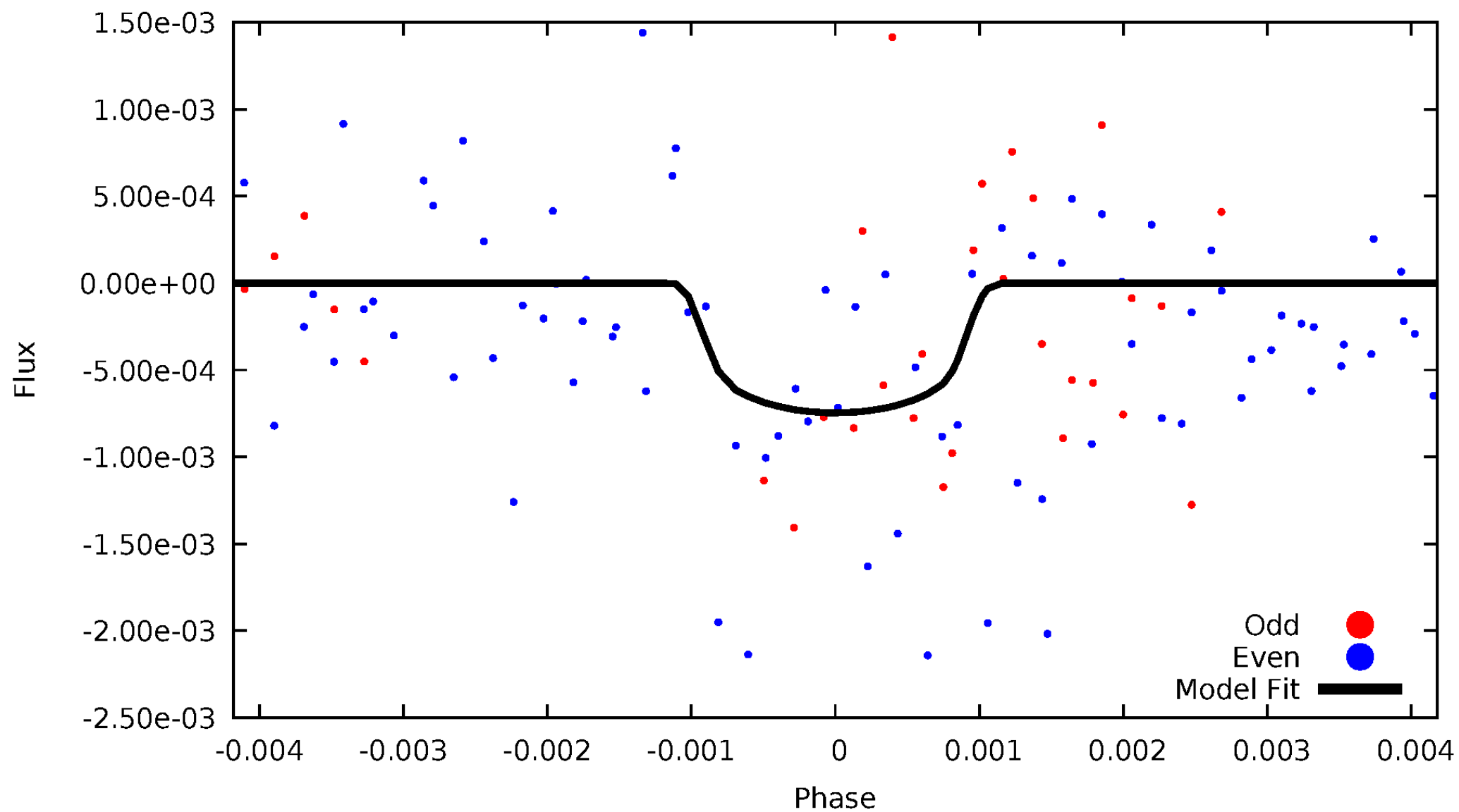


TCE 009851970-04



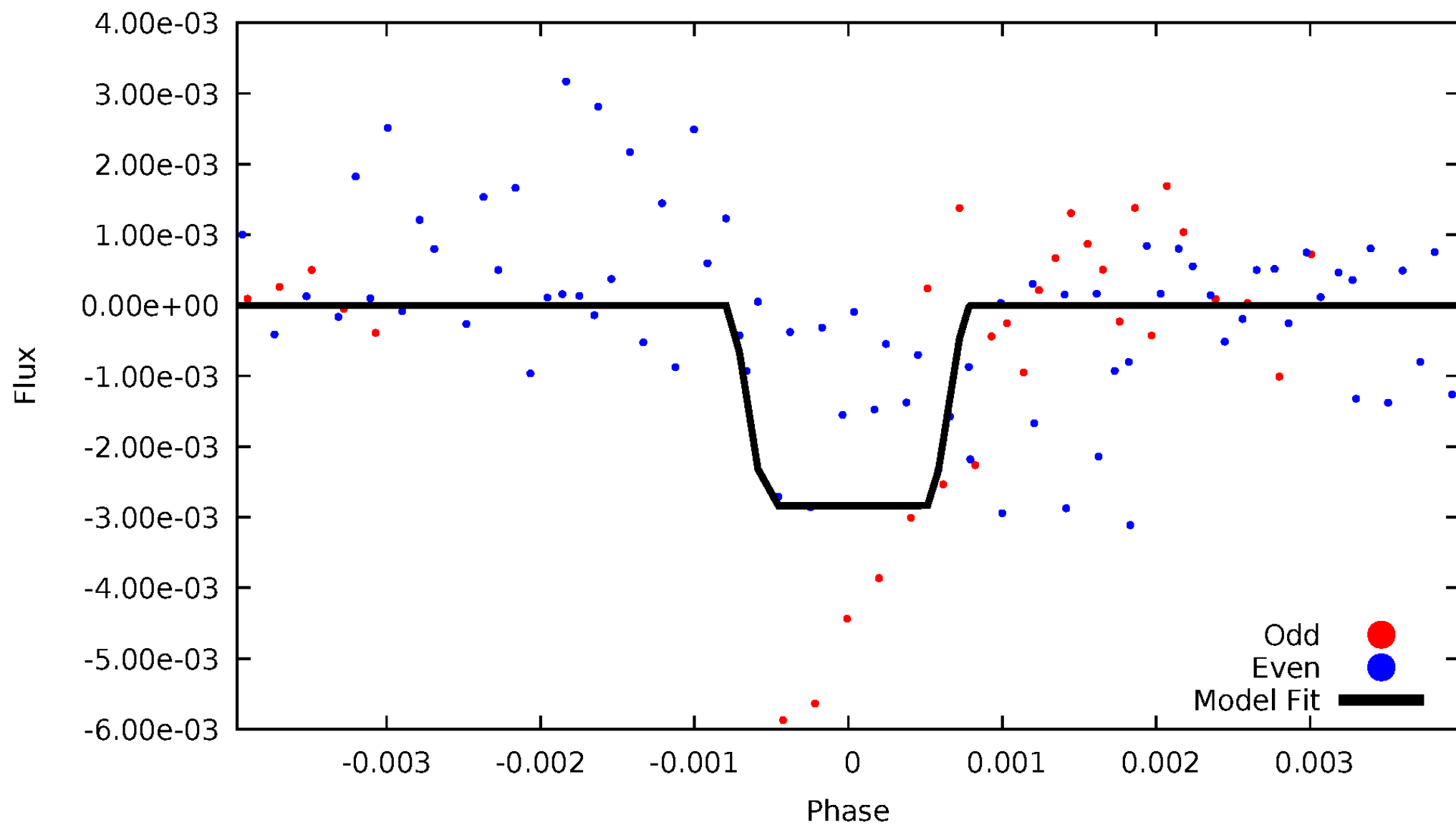
# DV Odd/Even

TCE 009851970-04



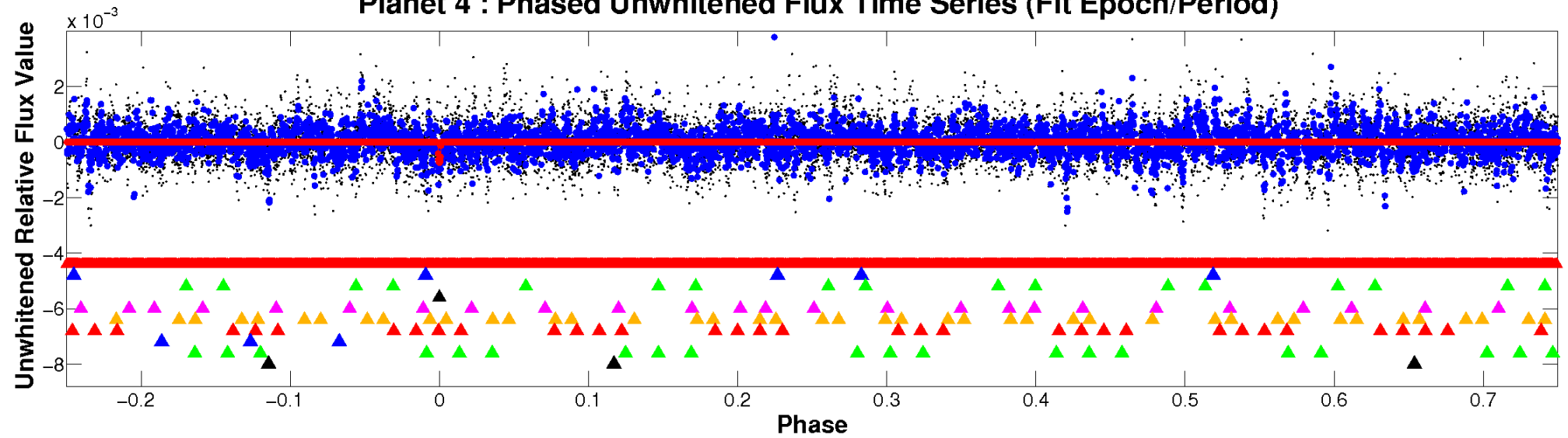
# ALT Odd/Even

TCE 009851970-04

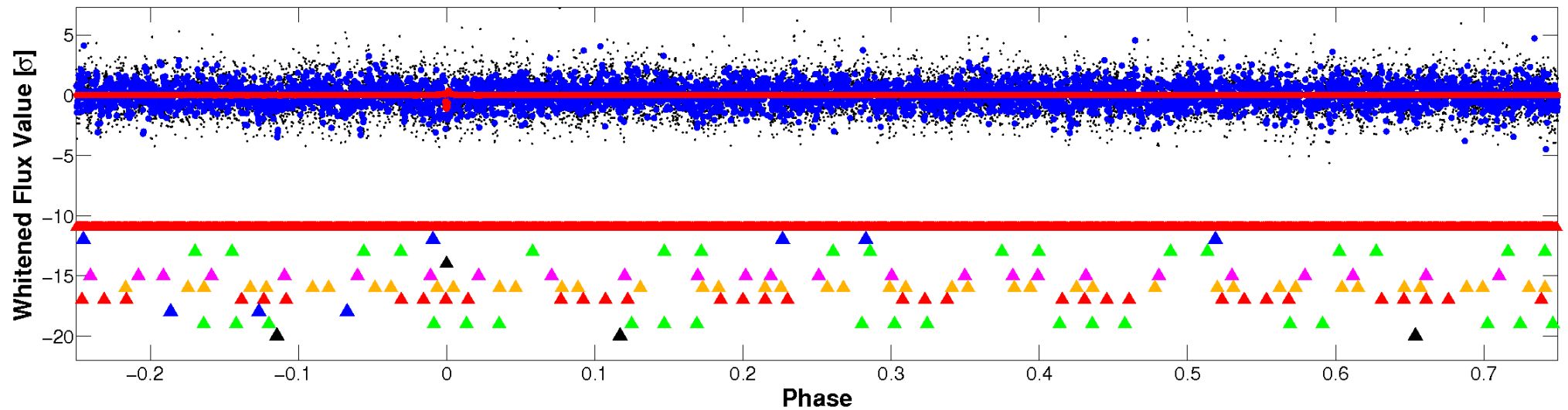


# Non-Whitened Vs. Whitened Light Curve

## Planet 4 : Phased Unwhitened Flux Time Series (Fit Epoch/Period)



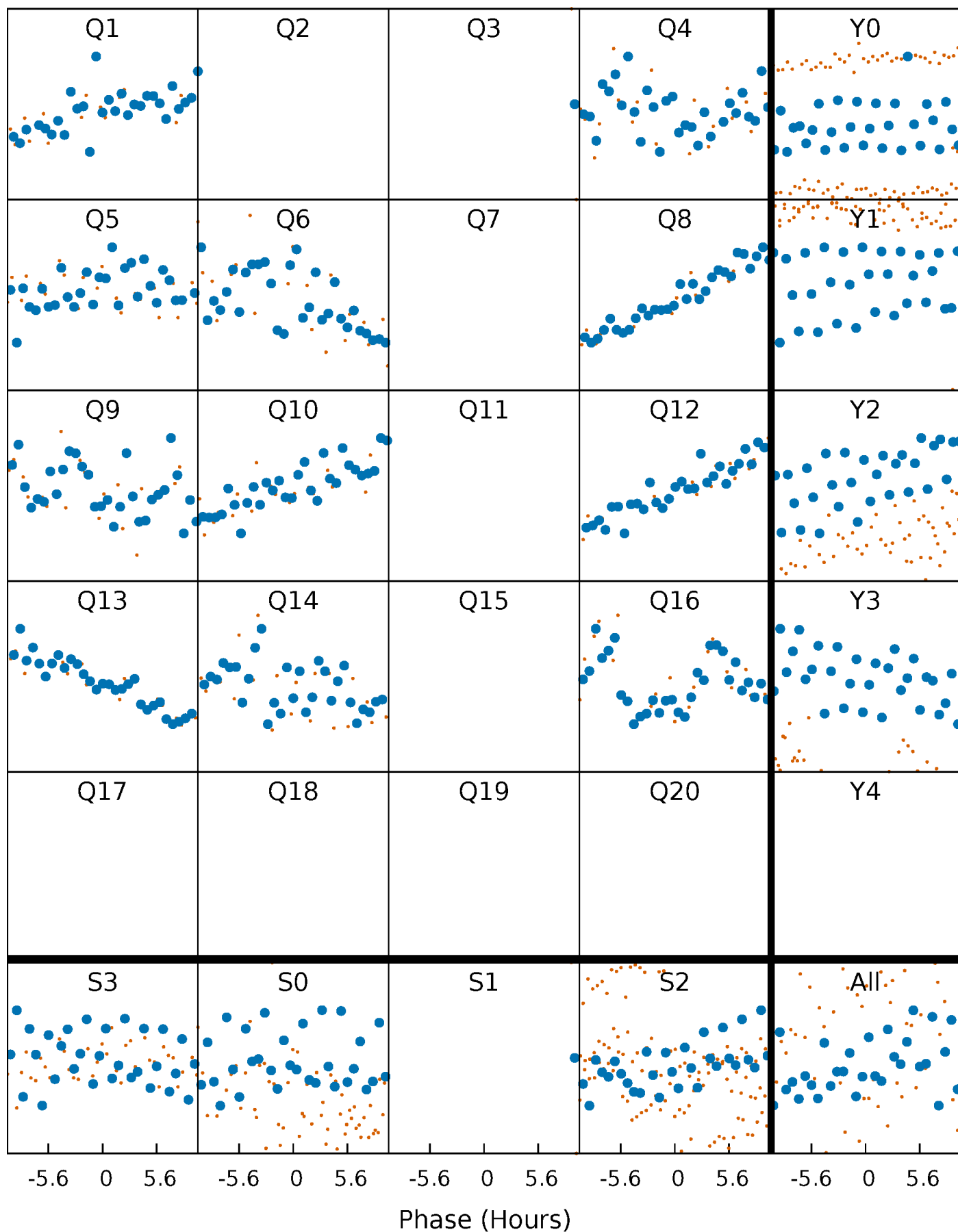
## Planet 4 : Phased Whitened Flux Time Series (Fit Epoch/Period)





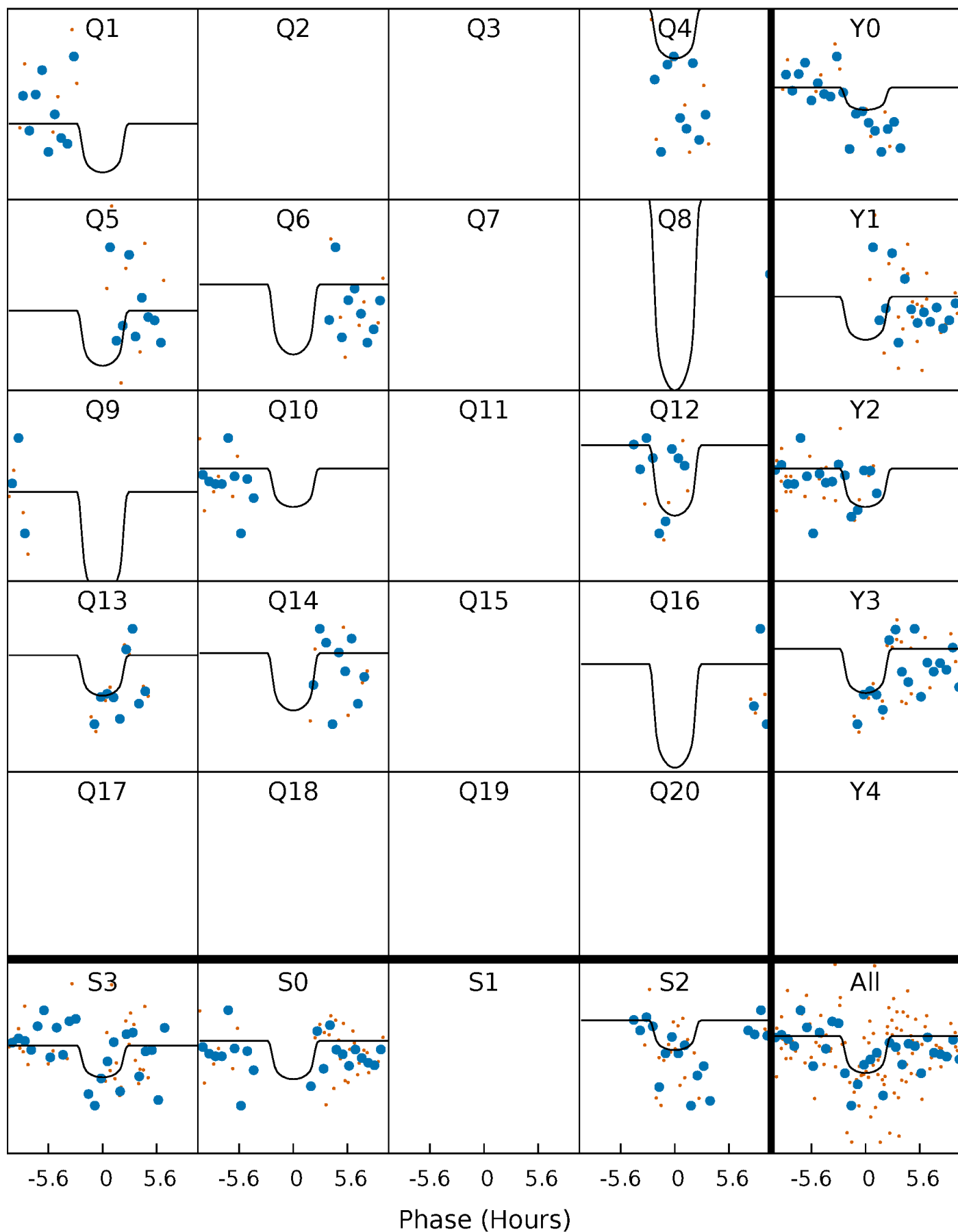
# PDC Quarter-Phased Transit Curves

TCE 009851970-04   P= 98.329975 Days    $T_0=161.538824$  (BKJD)



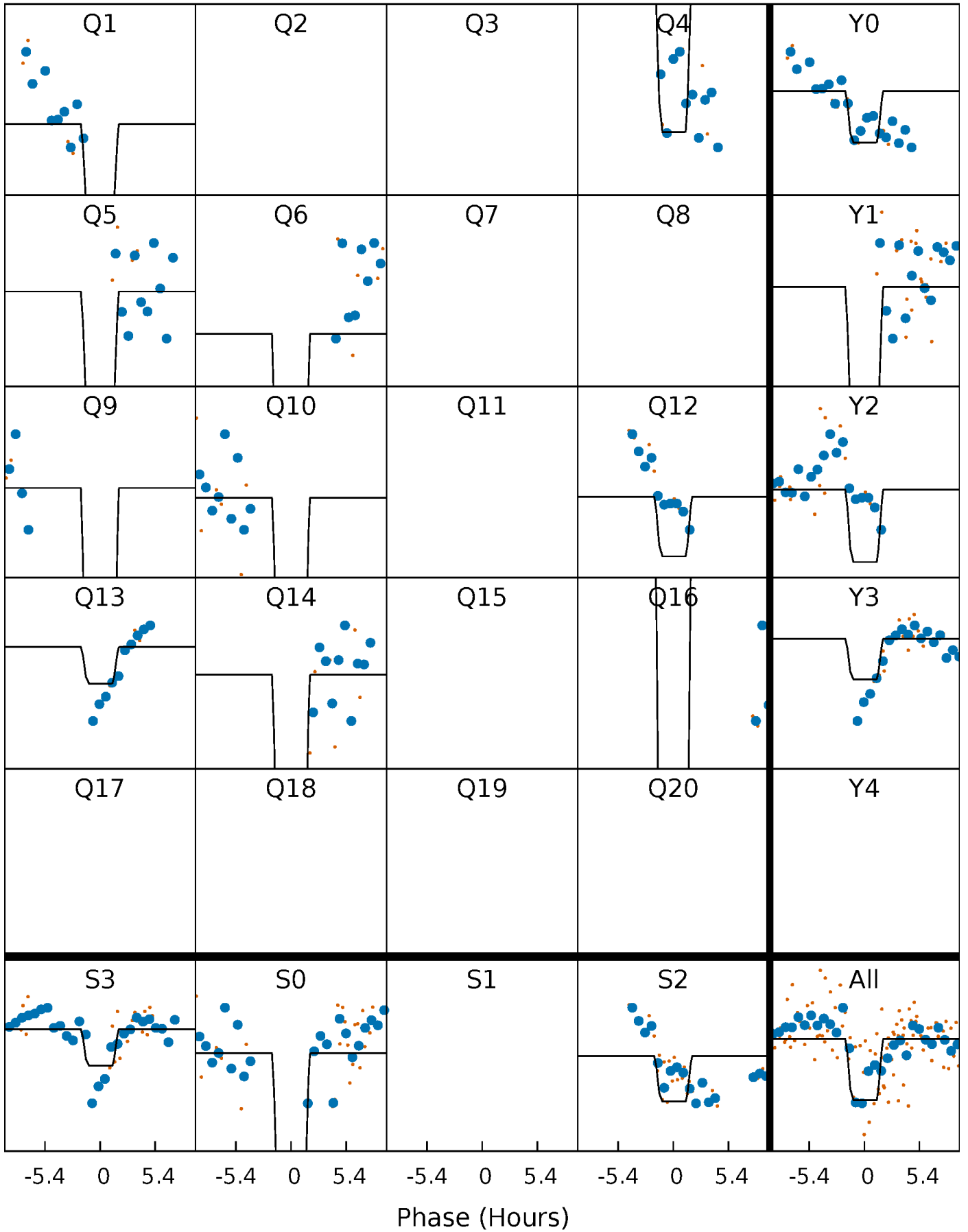
# DV Quarter-Phased Transit Curves

TCE 009851970-04   P= 98.329975 Days    $T_0=161.538824$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

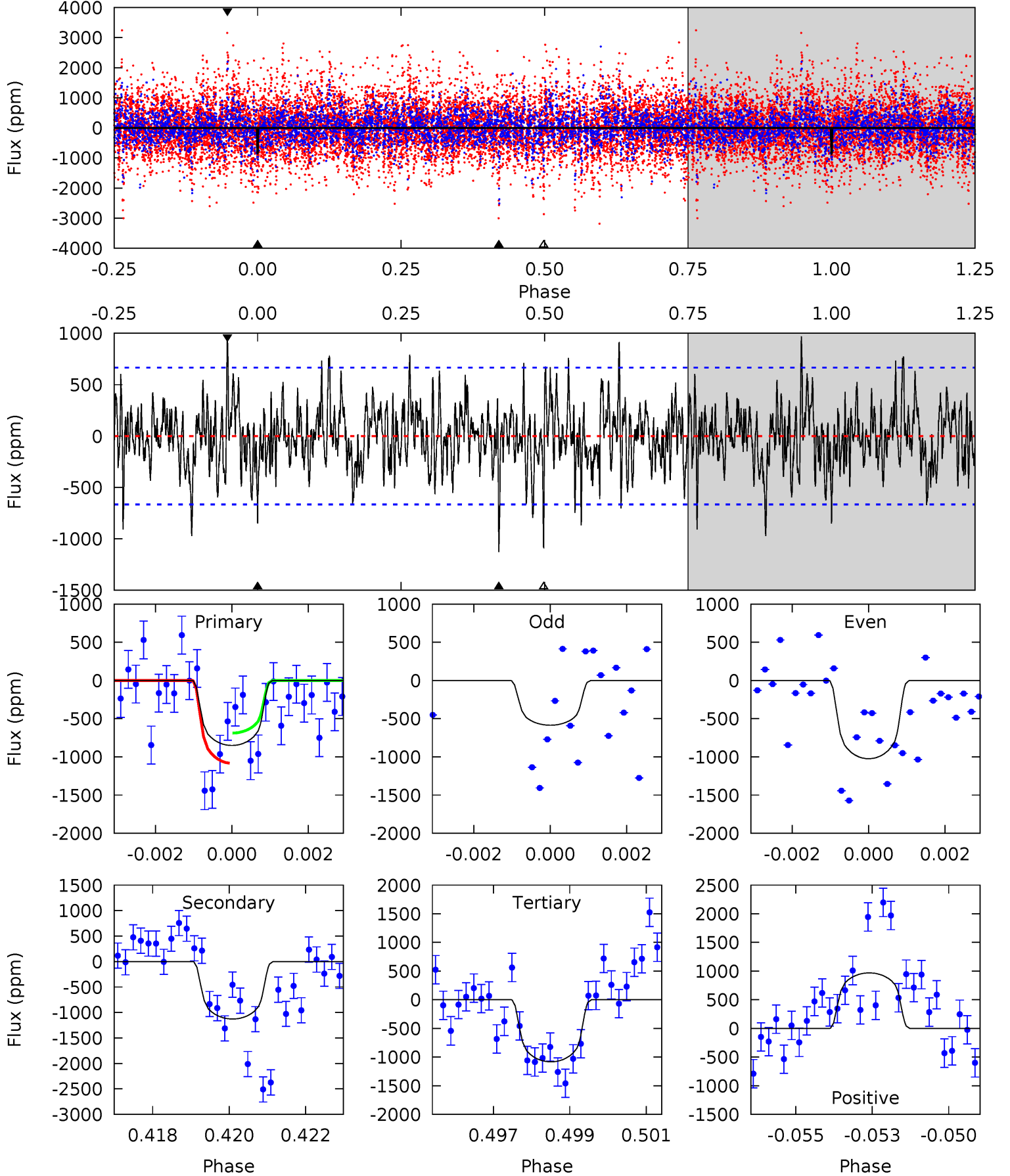
TCE 009851970-04 P= 98.333102 Days  $T_0=161.497313$  (BKJD)



# DV Model-Shift Uniqueness Test

009851970-04, P = 98.329975 Days, E = 63.208849 Days

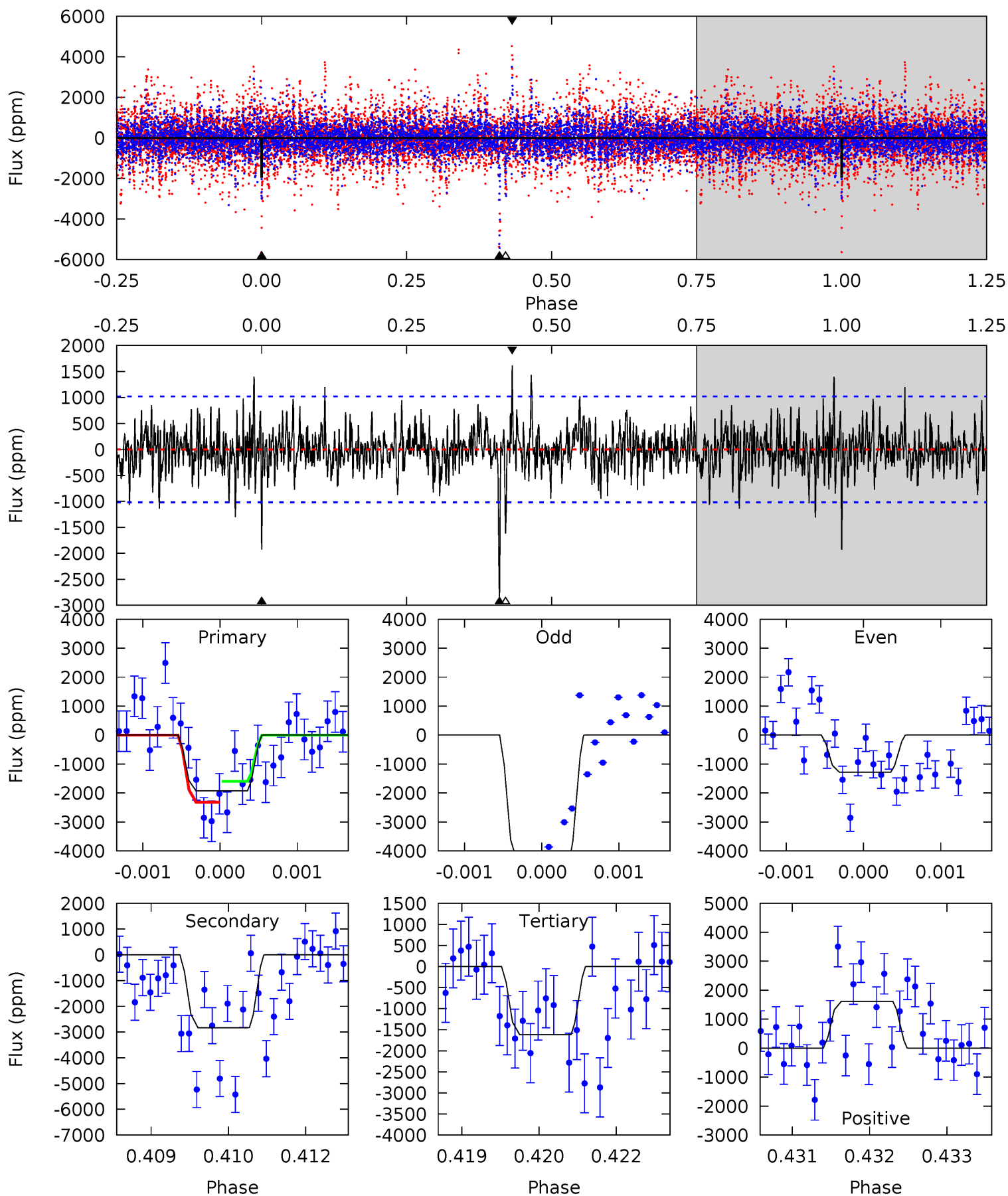
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
6.78	9.00	8.64	7.73	5.31	3.06	2.09	-1.85	-0.94	0.36	1.27	1.72	0.77	0.46	1.55



# Alt Model-Shift Uniqueness Test

009851970-04, P = 98.333102 Days, E = 63.164211 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
10.2	15.0	8.56	8.57	5.38	3.18	1.82	1.63	1.62	6.42	6.41	7.68	1.29	0.36	1.85



### Stellar Parameters For KIC 009851970

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$\rho_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$4965^{+151}_{-136}$	$4.555^{+0.072}_{-0.044}$	$-0.220^{+0.300}_{-0.300}$	$0.736^{+0.065}_{-0.079}$	$0.709^{+0.093}_{-0.050}$	$2.508^{+0.760}_{-0.407}$
	+3%/-3%	+2%/-1%	+136%/-136%	+9%/-11%	+13%/-7%	+30%/-16%
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 009851970-04 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-1128 \pm 125$	$2.59^{+1.76}_{-1.45}$	$429^{+16}_{-15}$	$5052^{+2601}_{-935}$	$12729^{+56673}_{-8035}$
Alt.	$-2833 \pm 189$	$4.28^{+1.70}_{-1.83}$	$429^{+16}_{-16}$	$4954^{+1534}_{-636}$	$11940^{+25153}_{-5946}$

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

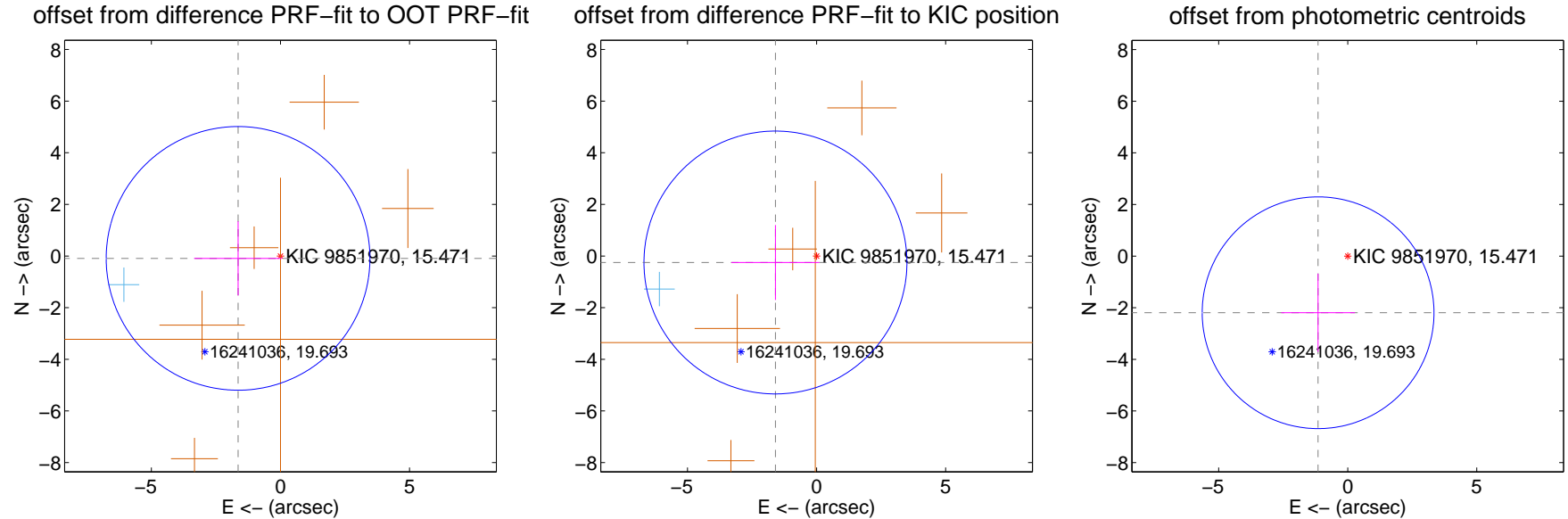
## DV Centroid Data

Supplemental centroid analysis for 009851970-04. Kepler magnitude: 15.47. Transit SNR 5.32

There are 1 quarters with good PRF difference image offsets

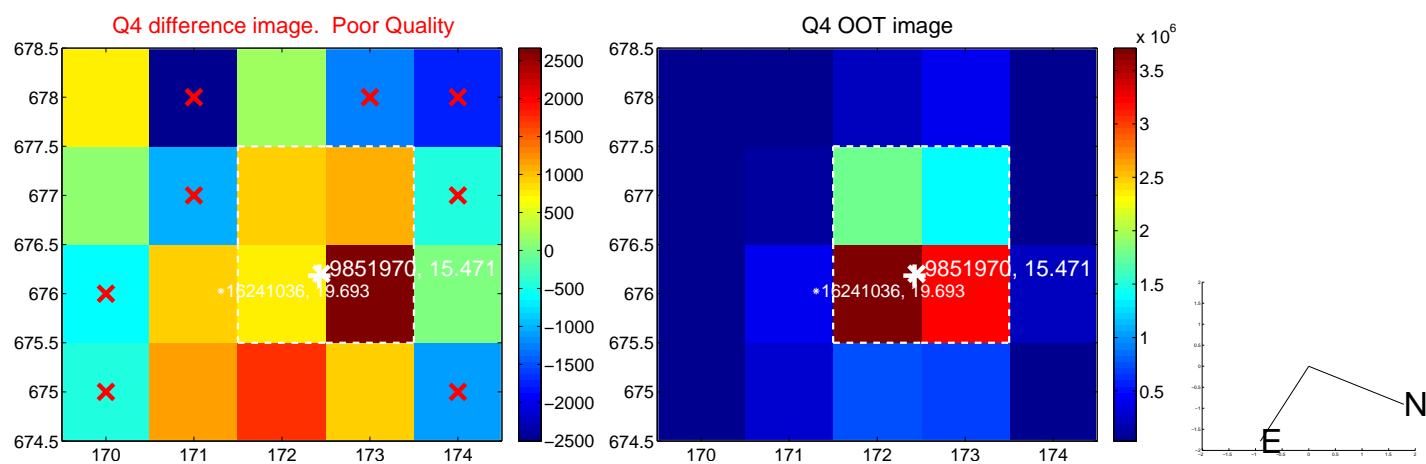
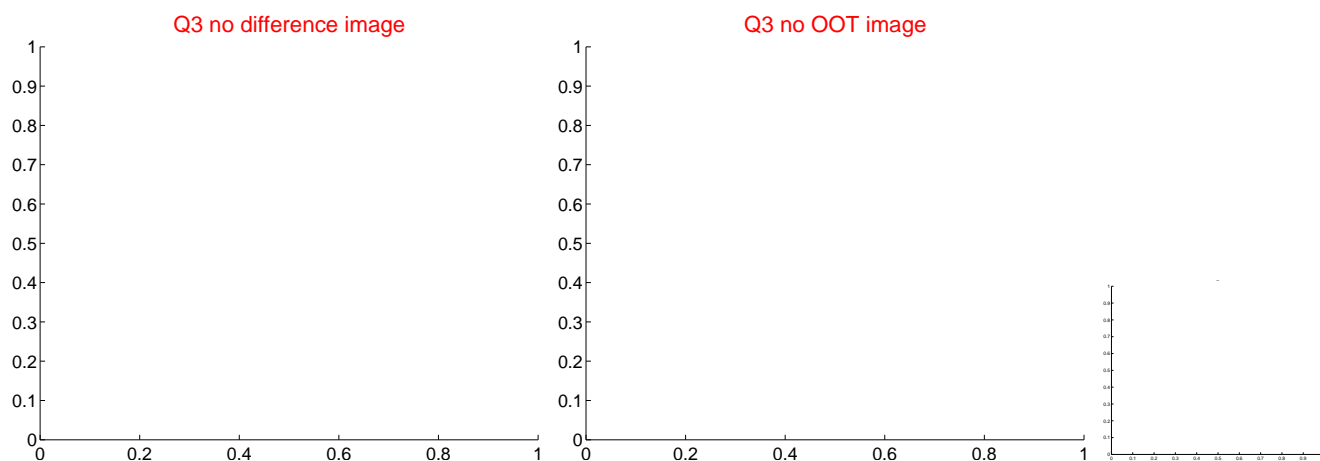
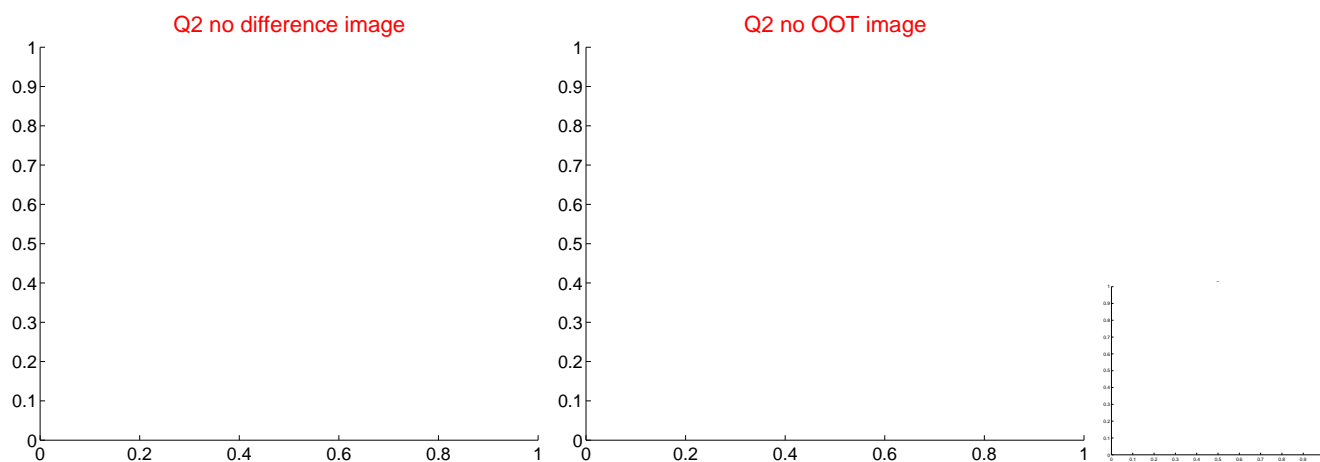
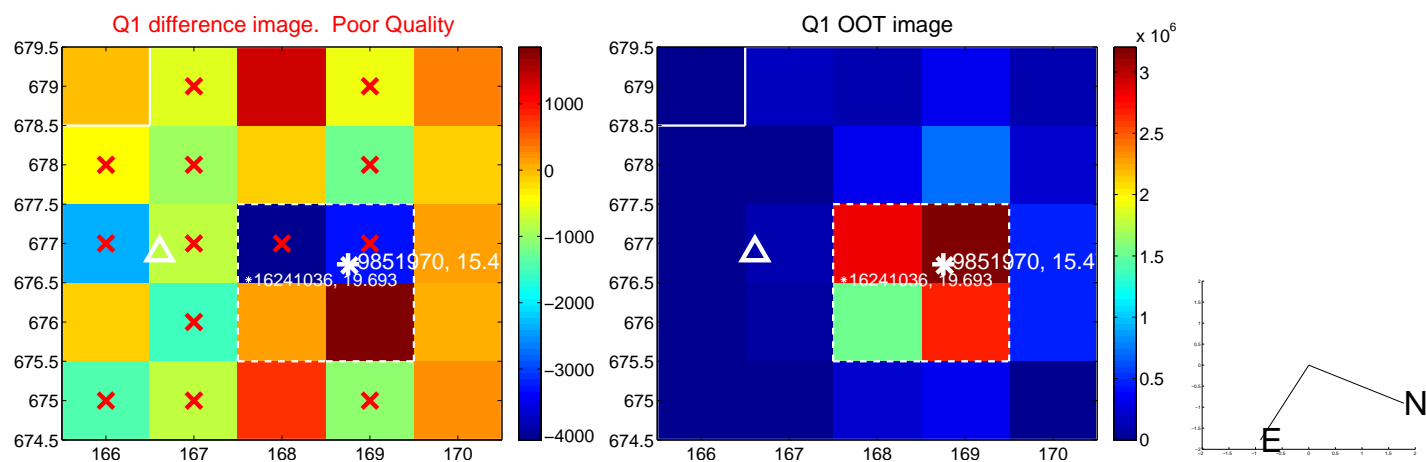
The direct PRF centroid is offset from the target star catalog position by about 0.11 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.644 \pm 1.702$	0.97	$1.641 \pm 1.703$	$-0.091 \pm 1.437$
PRF-fit source offset from KIC position	$1.613 \pm 1.697$	0.95	$1.593 \pm 1.703$	$-0.251 \pm 1.452$
photometric centroid source offset	$2.48 \pm 1.50$	1.66	$1.15 \pm 1.42$	$-2.20 \pm 1.52$



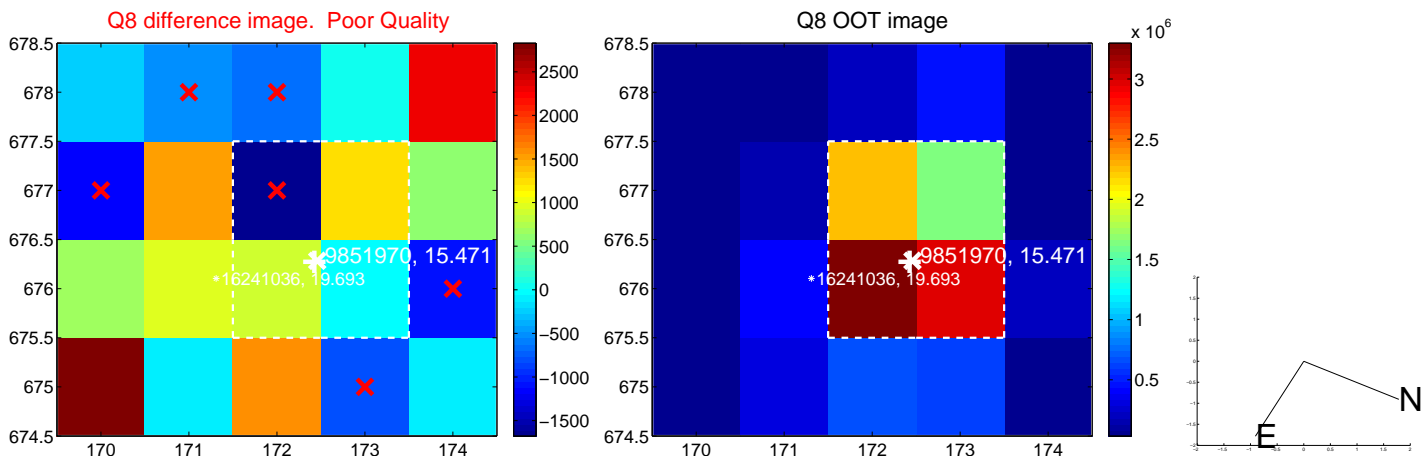
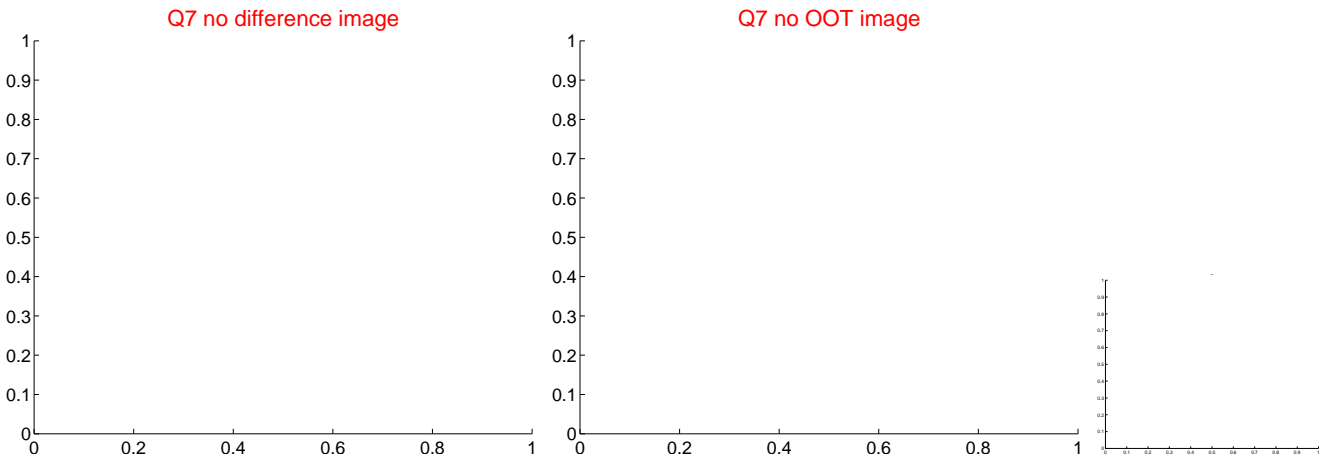
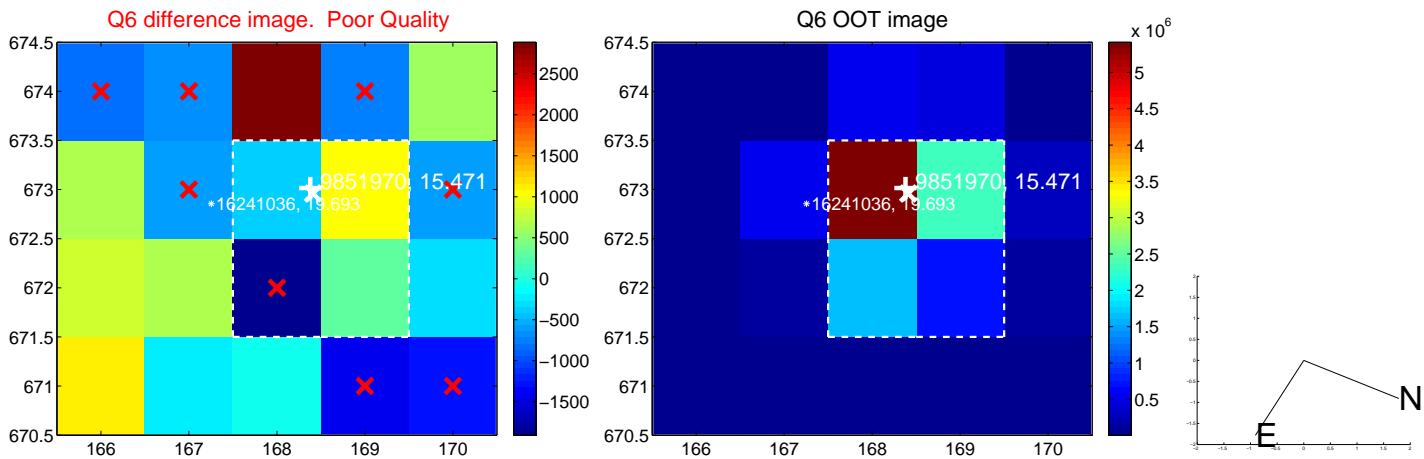
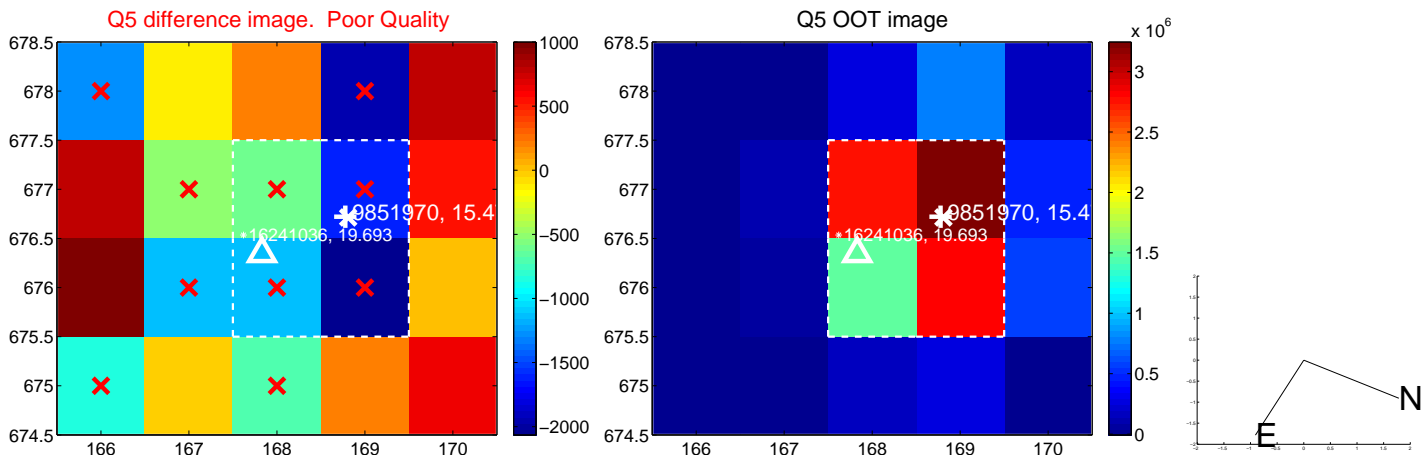
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

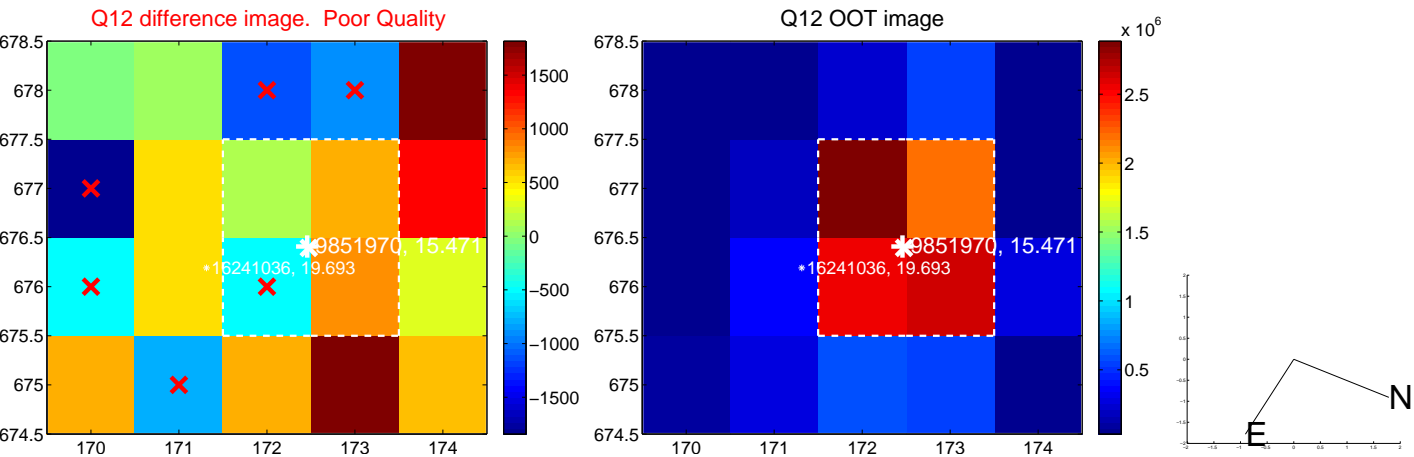
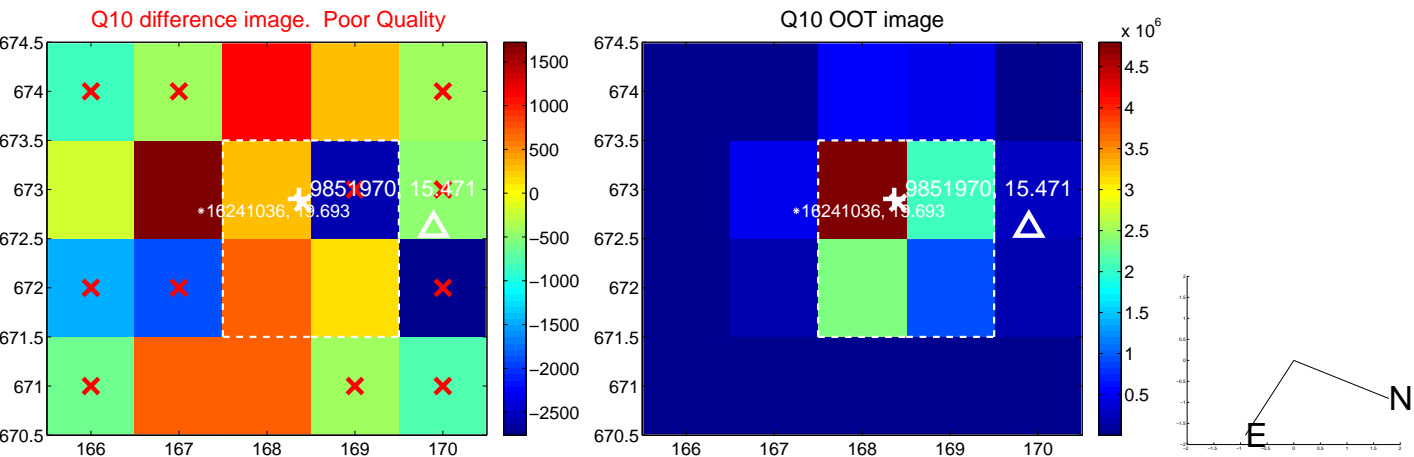
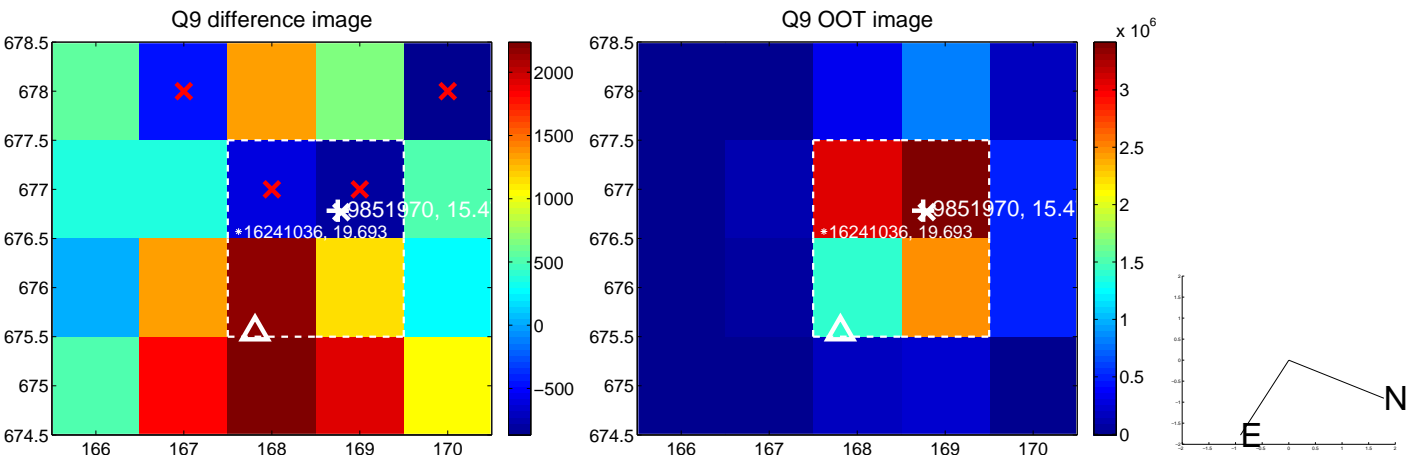




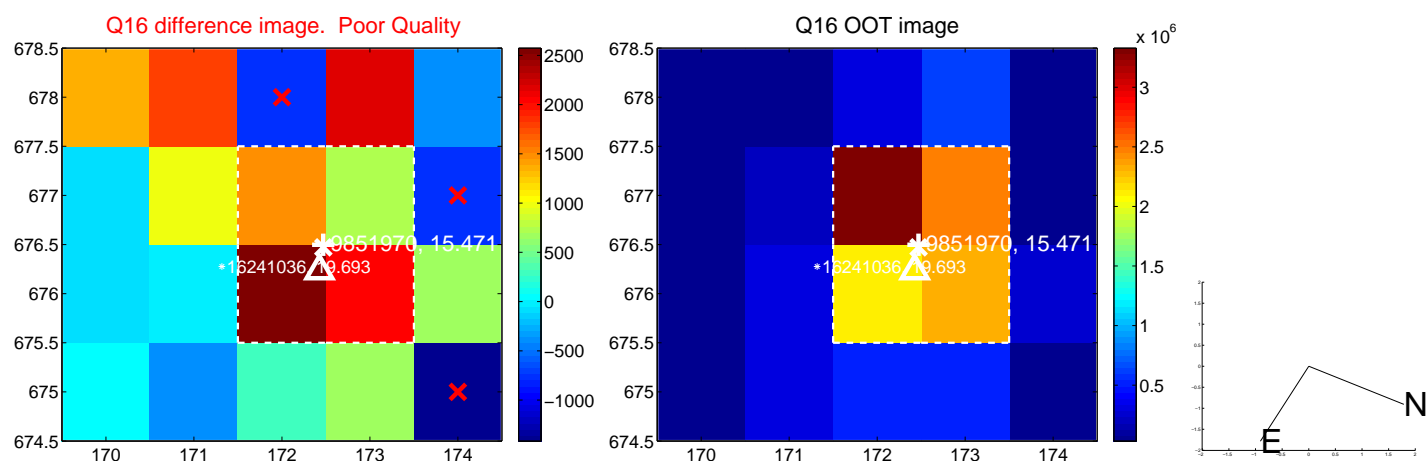
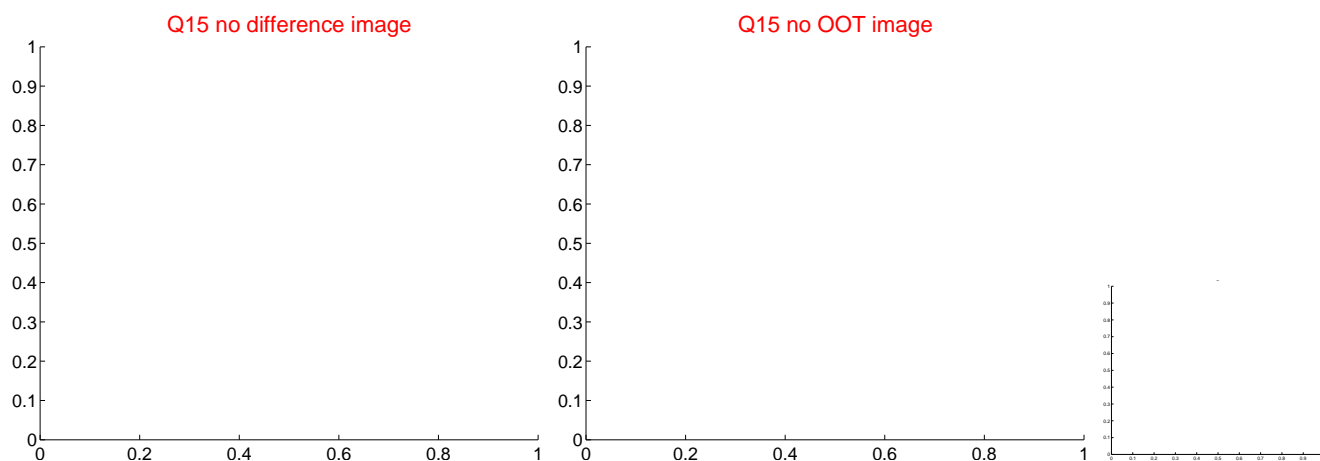
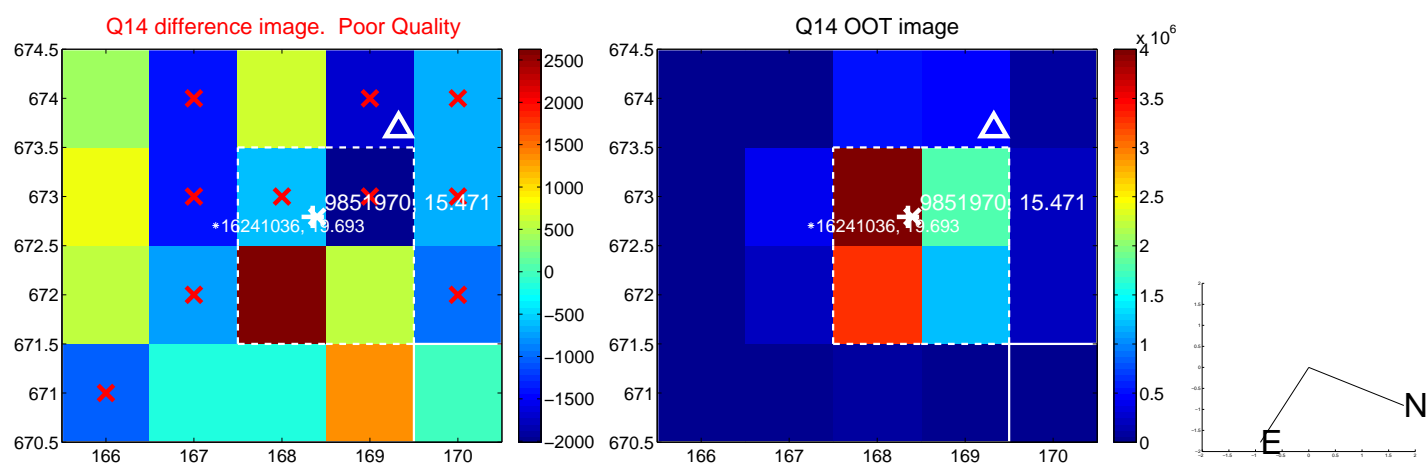
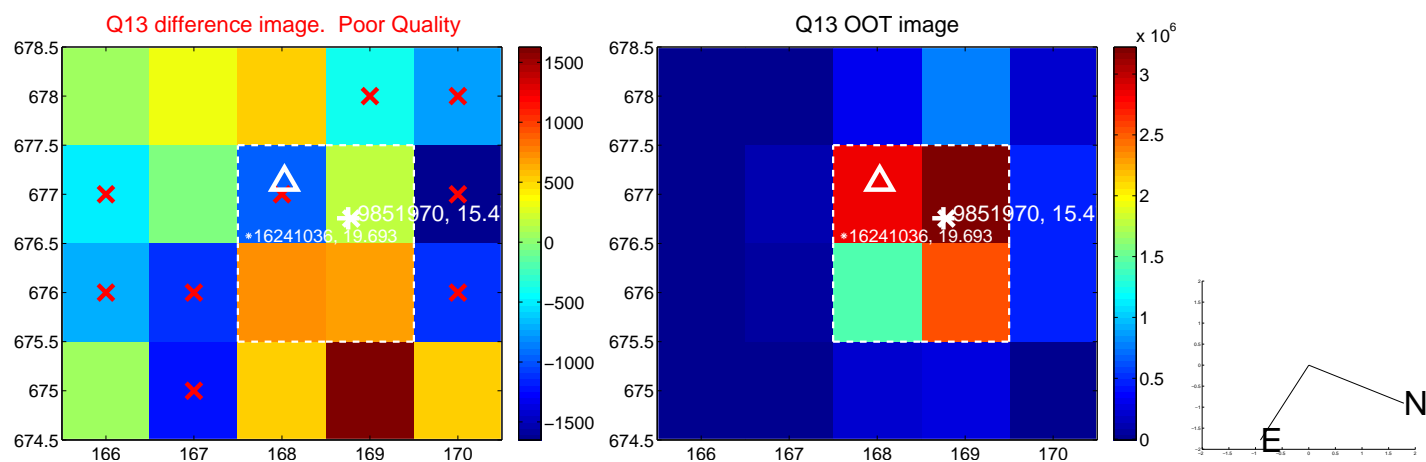
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



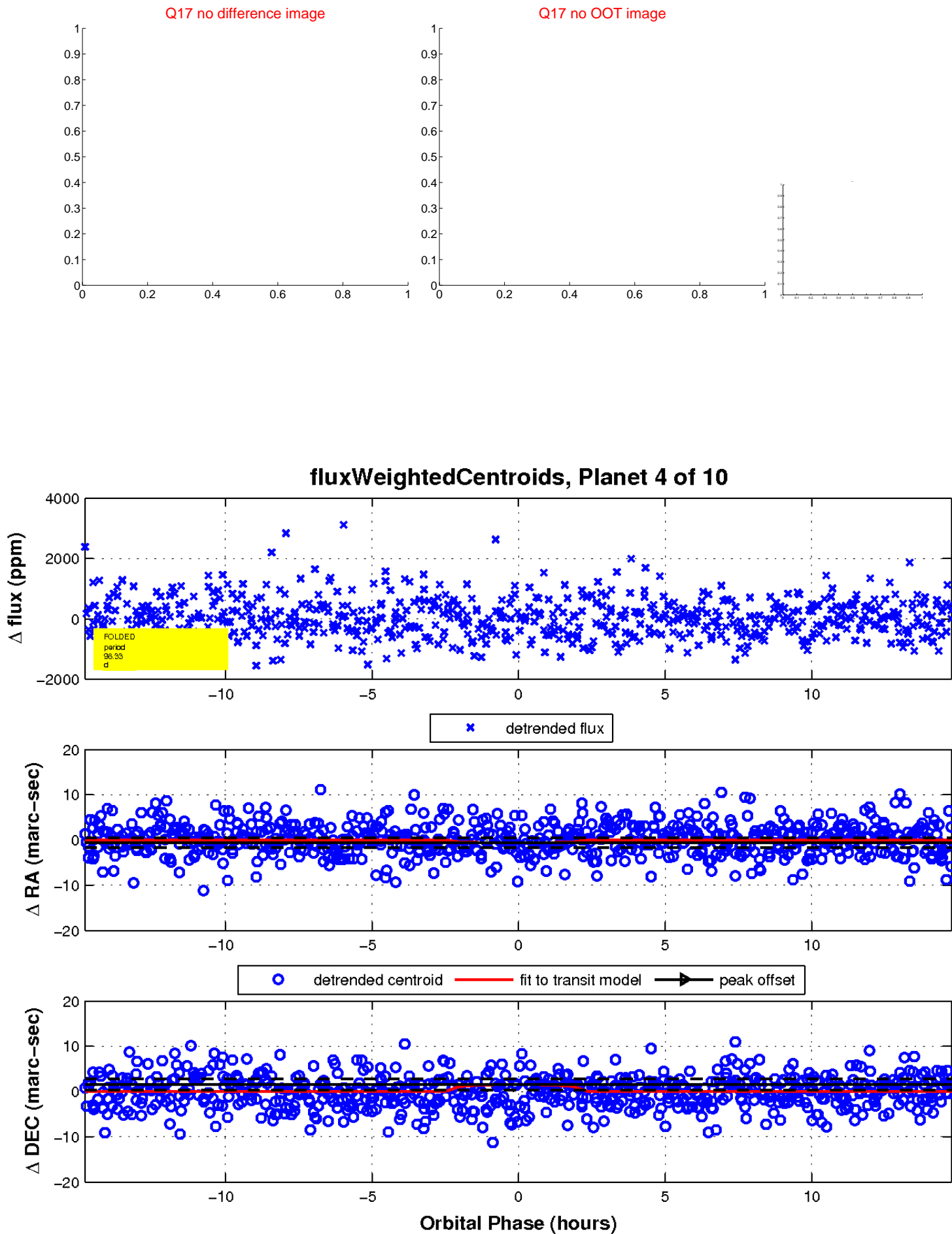
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

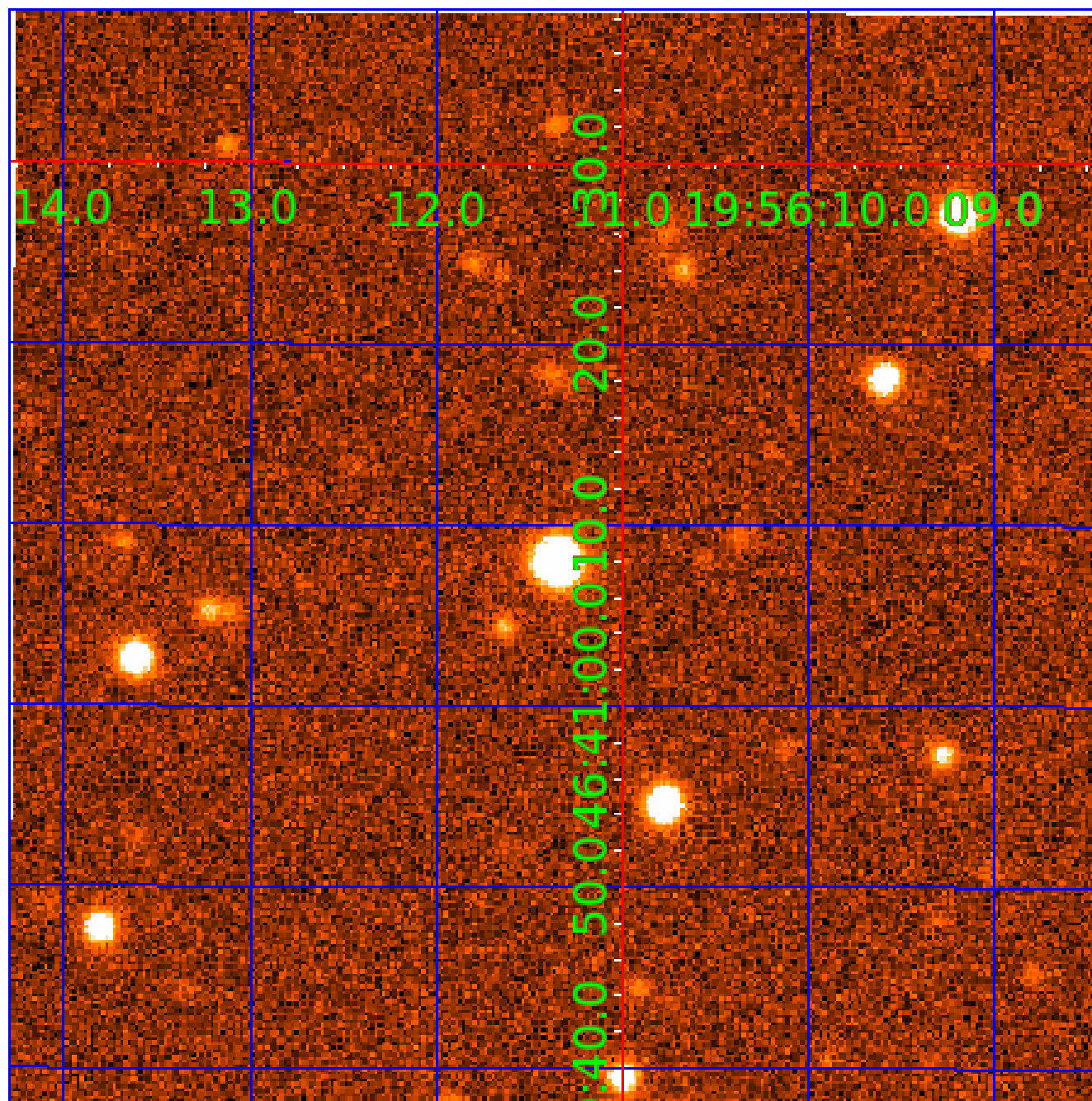


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009851970-01	OBS	4122.01	1.081931	131.550019	107.5	6.343	13.0	13.4	0.74	4965	0.74	871.41
009851970-02	OBS	No	318.191396	287.691504	2963.9	7.500	18.3	-1.0	0.74	4965	3.89	0.45
009851970-03	OBS	No	87.131904	158.497311	1337.3	12.255	11.1	8.0	0.74	4965	4.18	2.51
009851970-04	OBS	No	98.329975	161.538824	746.0	4.930	12.1	5.3	0.74	4965	2.36	2.13
009851970-05	OBS	No	58.028718	183.047579	986.5	7.168	11.4	8.4	0.74	4965	2.50	4.31
009851970-06	OBS	No	34.155362	145.442225	495.6	5.928	10.4	4.7	0.74	4965	1.86	8.73
009851970-07	OBS	No	43.866421	135.859401	759.6	3.082	10.4	4.7	0.74	4965	2.21	6.26
009851970-08	OBS	No	485.794267	253.271172	1176.7	9.000	9.7	-1.0	0.74	4965	2.45	0.25
009851970-09	OBS	No	69.926614	193.429290	667.9	4.803	9.9	4.1	0.74	4965	2.11	3.36
009851970-10	OBS	No	665.534623	173.054303	2457.4	17.077	9.5	8.7	0.74	4965	6.96	0.17

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009851970-01	OBS	FP	0.00	0	1	1	1	MOD_SEC_ALT—CENT_RESOLVED_OFFSET—HALO_GHOST—EPHEM_MATCH
009851970-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_ZUMA—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_NOFITS
009851970-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_ALT—CENT_FEW_DIFFS
009851970-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_ZUMA_TRACKER—TRANS_GAPPED—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009851970-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE—TRANS_GAPPED—LPP_DV—CENT_FEW_DIFFS
009851970-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
009851970-07	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_TRACKER—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
009851970-08	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL—LPP_DV—ALL_TRANS_CHASES—NO_FITS—CENT_NOFITS
009851970-09	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE_TRACKER—TRANS_GAPPED—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS—HALO_GHOST
009851970-10	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_SKYE—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—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.

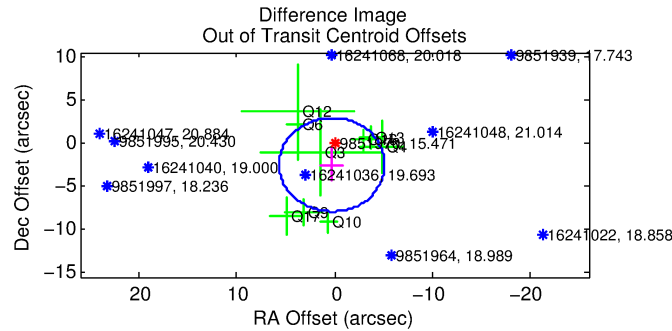
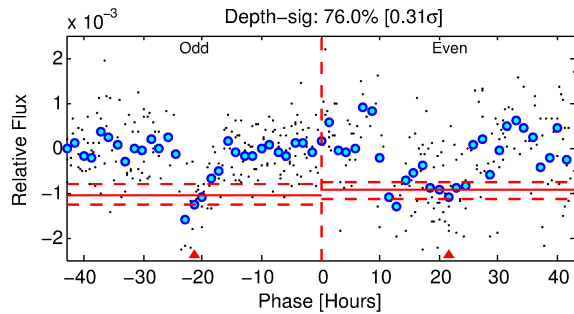
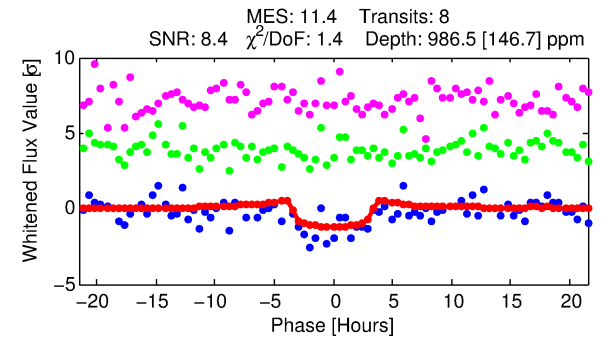
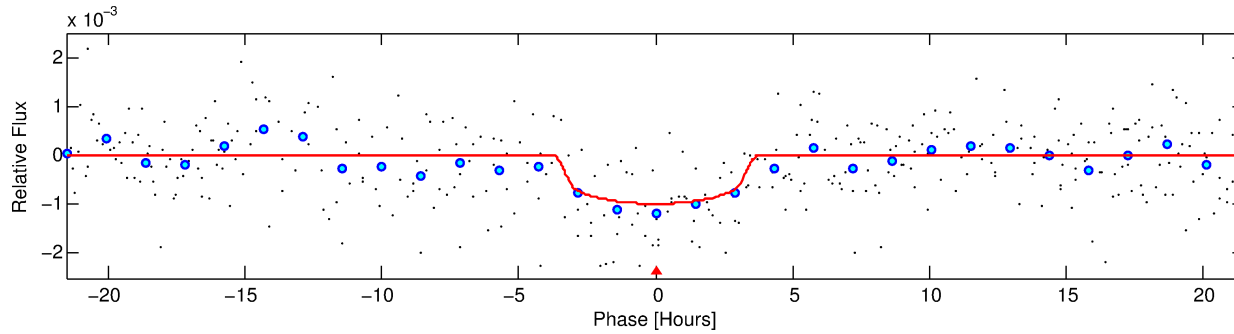
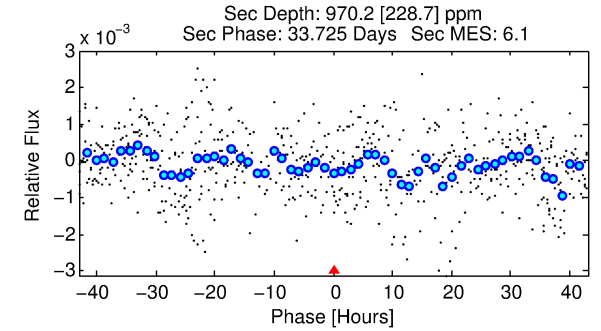
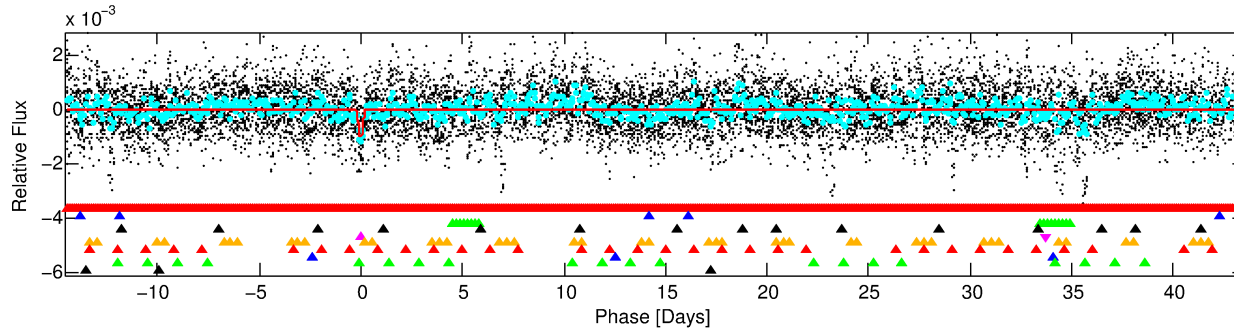
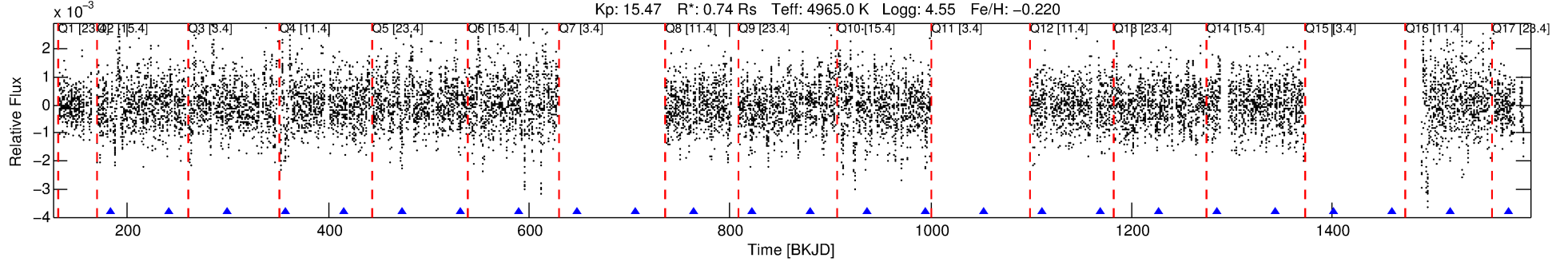
Ephemeris Match Information For 009851970-05

No Significant Match Found

# DV One-Page Summary

KIC: 9851970 Candidate: 5 of 10 Period: 58.029 d  
KOI: K04122 Corr: No Ephemeris Match

Kp: 15.47 R\*: 0.74 Rs Teff: 4965.0 K Logg: 4.55 Fe/H: -0.220



## DV Fit Results:

Period = 58.02872 [0.00163] d  
Epoch = 183.0476 [0.0241] BKJD  
Rp/R\* = 0.0311 [0.0261]  
a/R\* = 44.84 [133.02]  
b = 0.73 [1.90]  
Seff = 4.31 [0.77]  
Teq = 367 [16] K  
Rp = 2.50 [2.11] Re  
a = 0.2616 [0.0237] AU  
Ag = 5850.06 [9942.00] [0.59σ]  
Teff = 4967 [2110] K [2.18σ]

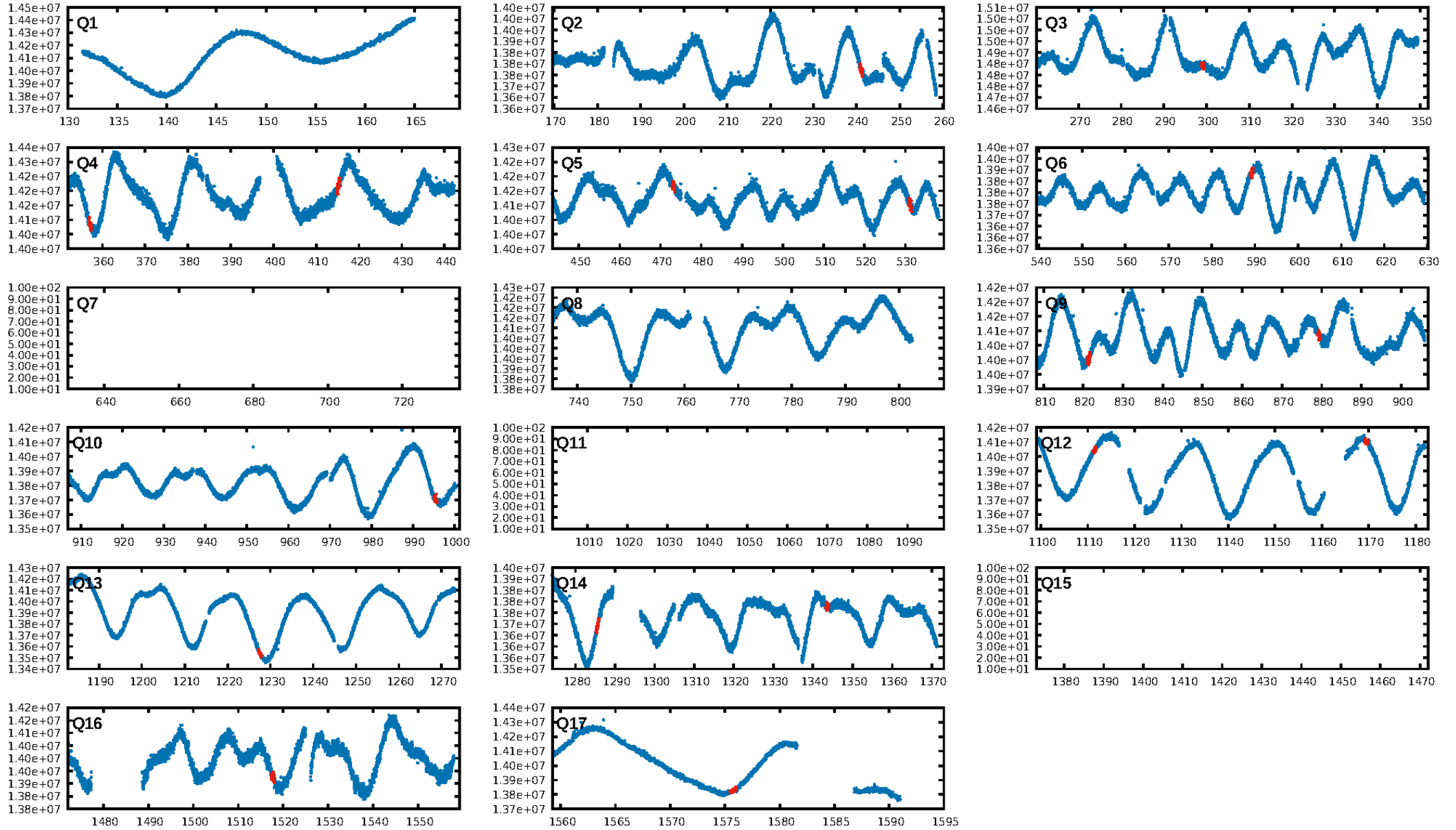
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [43.56σ]  
LongPeriod-sig: 100.0% [33.10σ]  
ModelChiSquare2-sig: 1.9%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [8/8]  
GhostDiagnostic-chr: 1.527  
Centroid-sig: 56.2%  
Centroid-so: 0.519 arcsec [0.70σ]  
OotOffset-rm: 2.534 arcsec [1.40σ]  
KicOffset-rm: 2.676 arcsec [1.48σ]  
OotOffset-st: 2/1/3/3 [9]  
KicOffset-st: 2/1/3/3 [9]  
DiffImageQuality-fgm: 0.00 [0/9]  
DiffImageOverlap-fno: 0.00 [0/12]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 08:50:32 Z

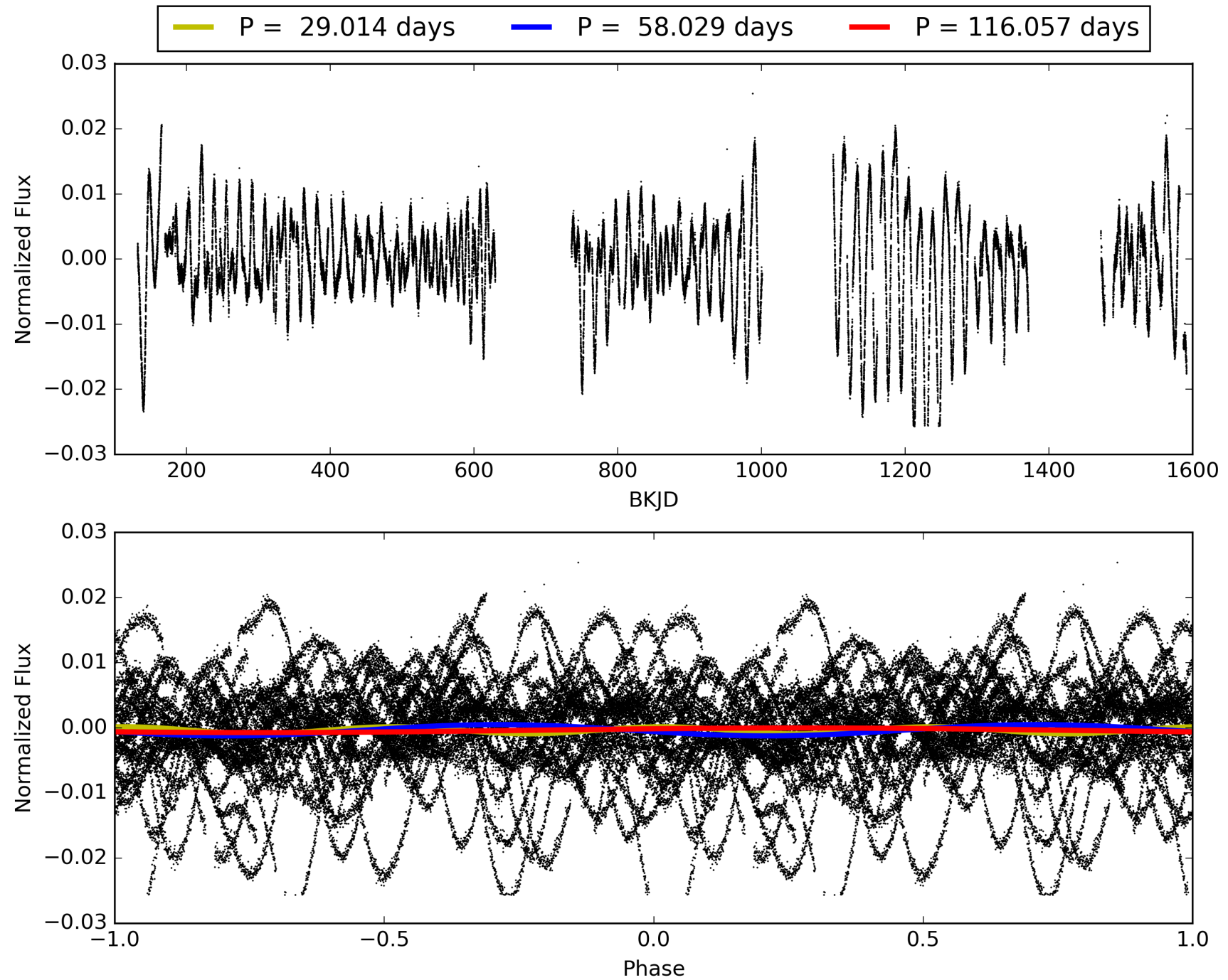
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 009851970-05, PDC Light Curves



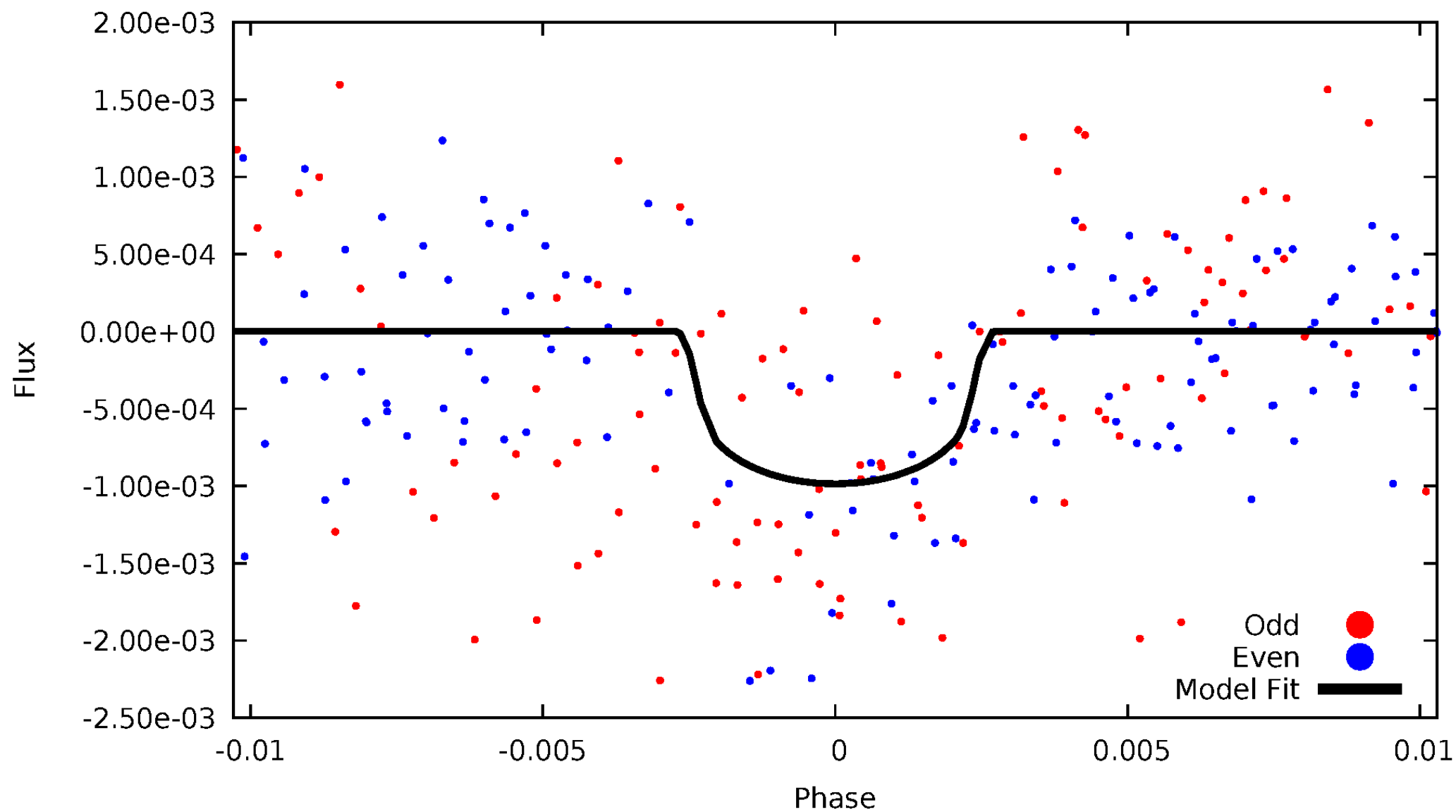


TCE 009851970-05



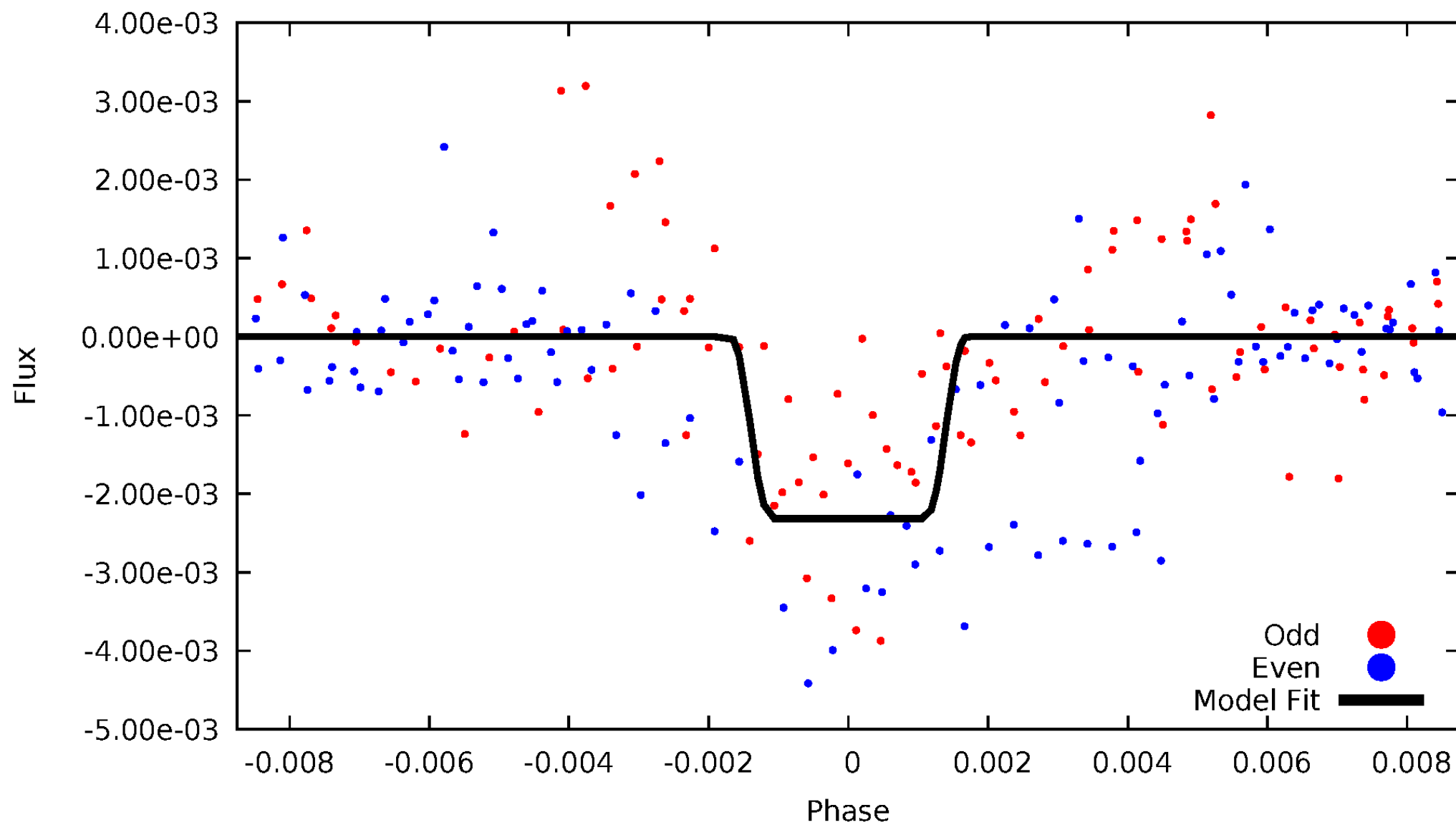
# DV Odd/Even

TCE 009851970-05



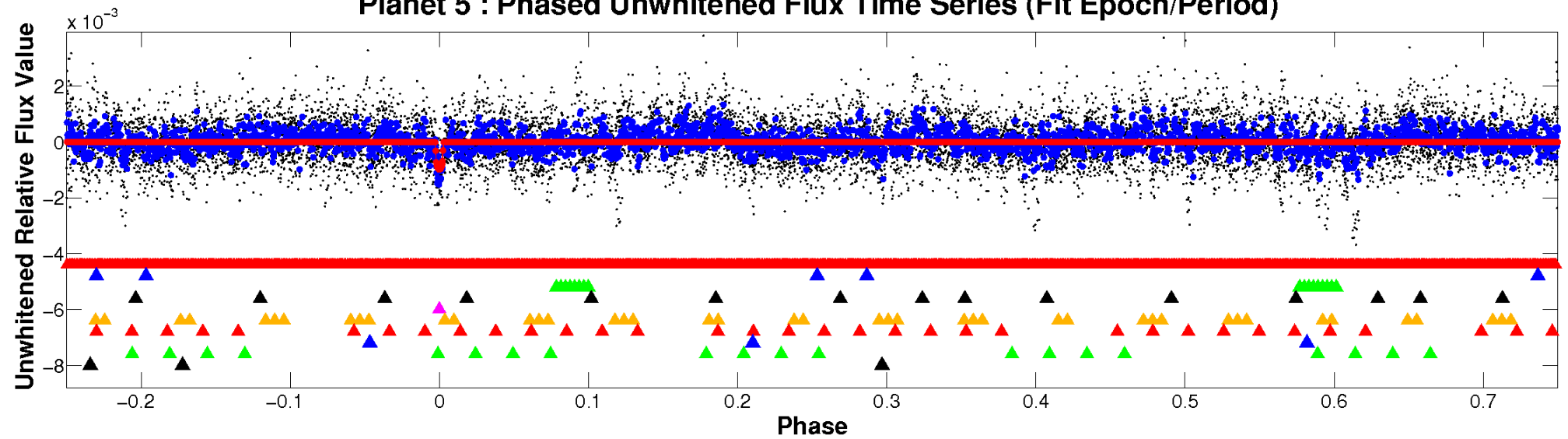
# ALT Odd/Even

TCE 009851970-05

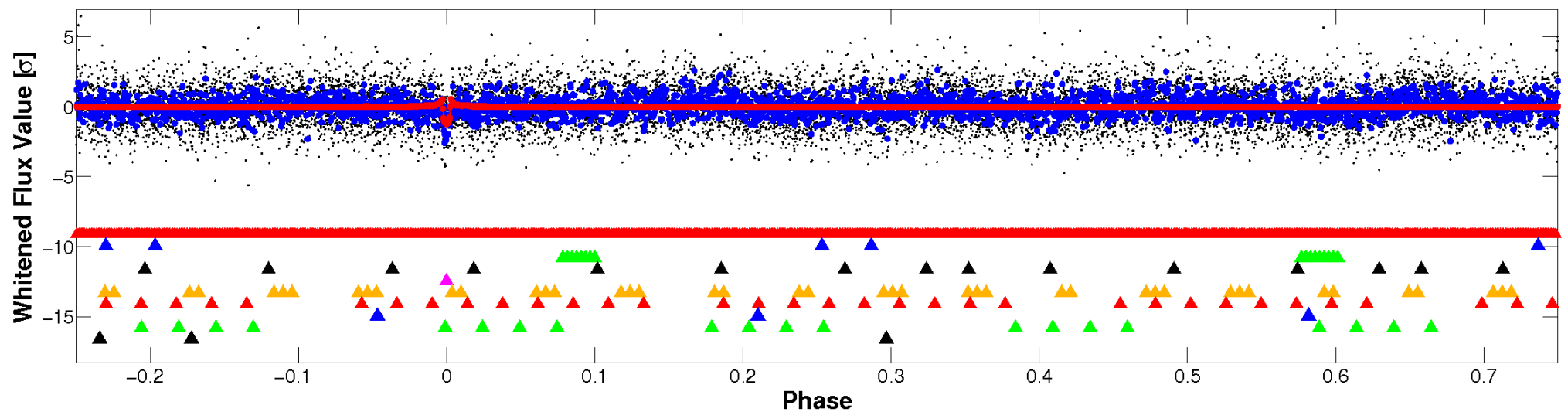


# Non-Whitened Vs. Whitened Light Curve

## Planet 5 : Phased Unwhitened Flux Time Series (Fit Epoch/Period)

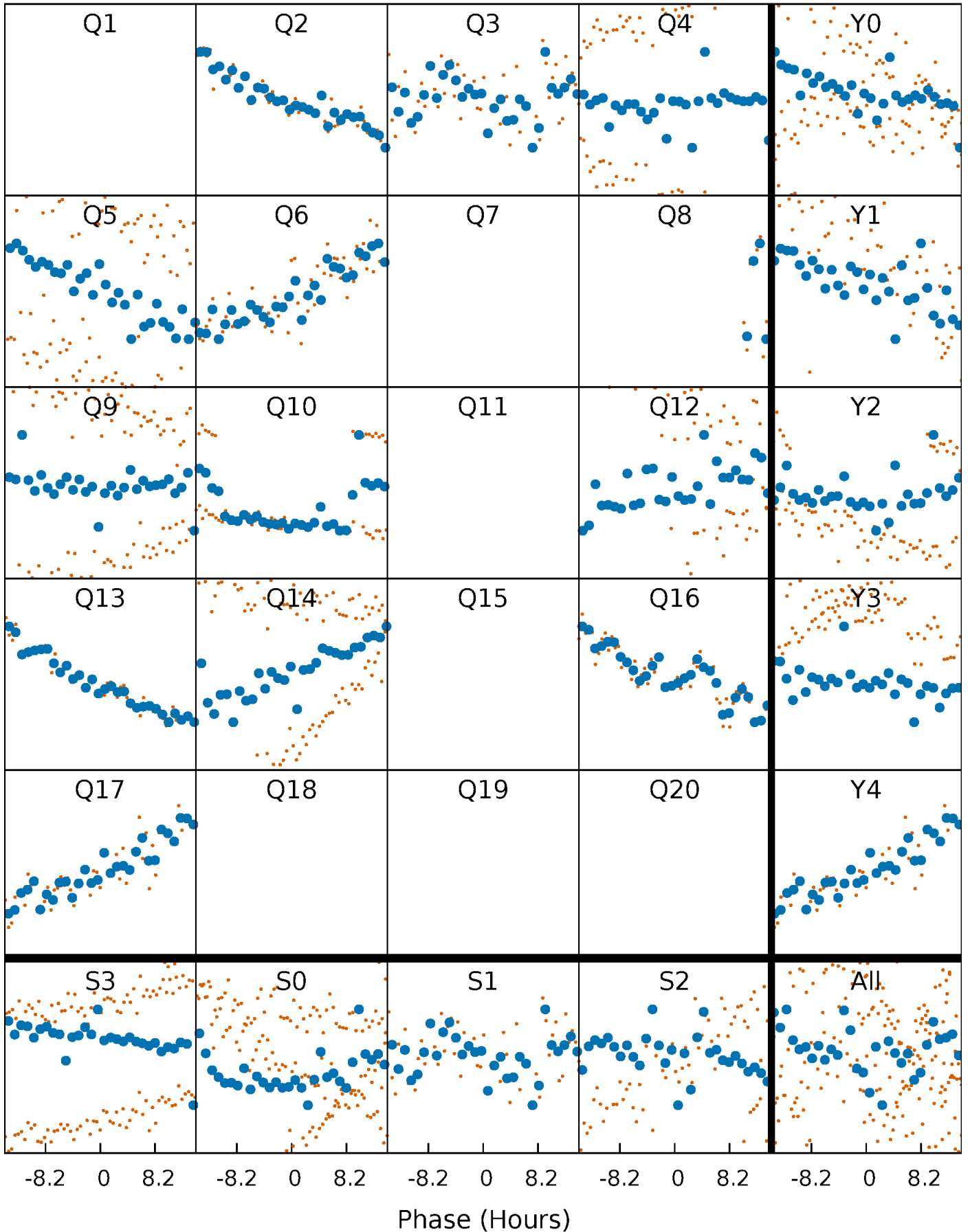


## Planet 5 : Phased Whitened Flux Time Series (Fit Epoch/Period)



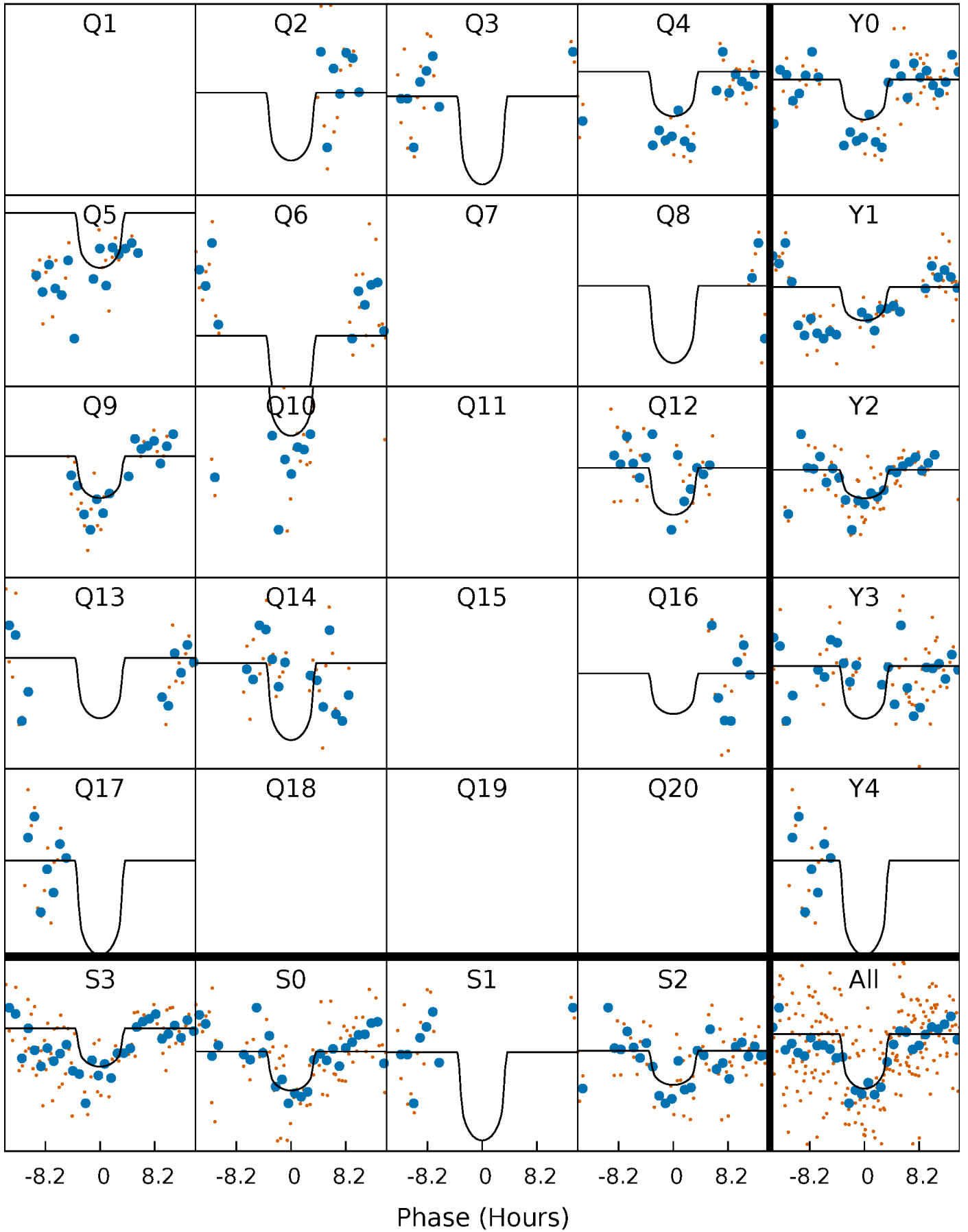
# PDC Quarter-Phased Transit Curves

TCE 009851970-05   P= 58.028718 Days    $T_0=183.047579$  (BKJD)



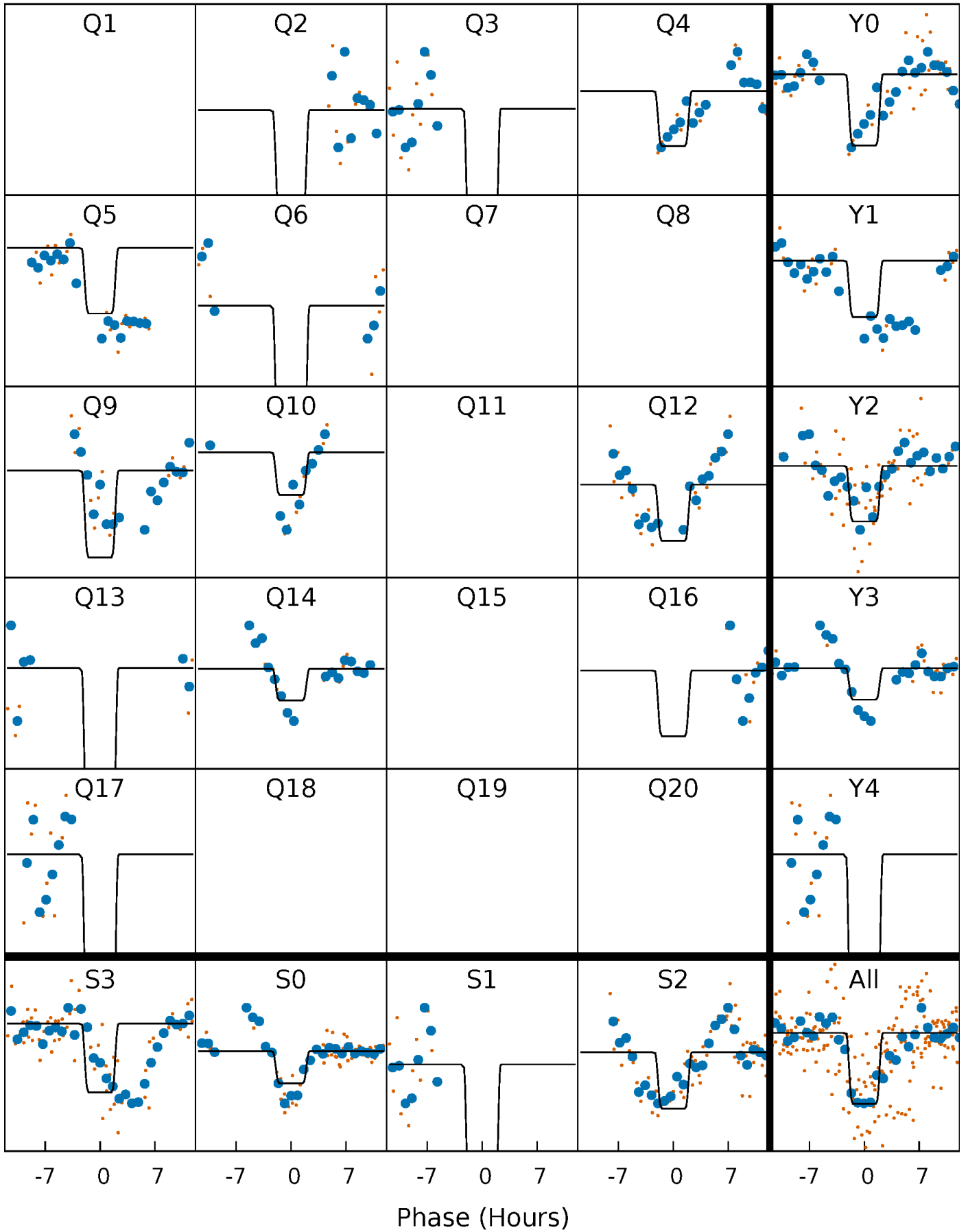
# DV Quarter-Phased Transit Curves

TCE 009851970-05   P= 58.028718 Days    $T_0=183.047579$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

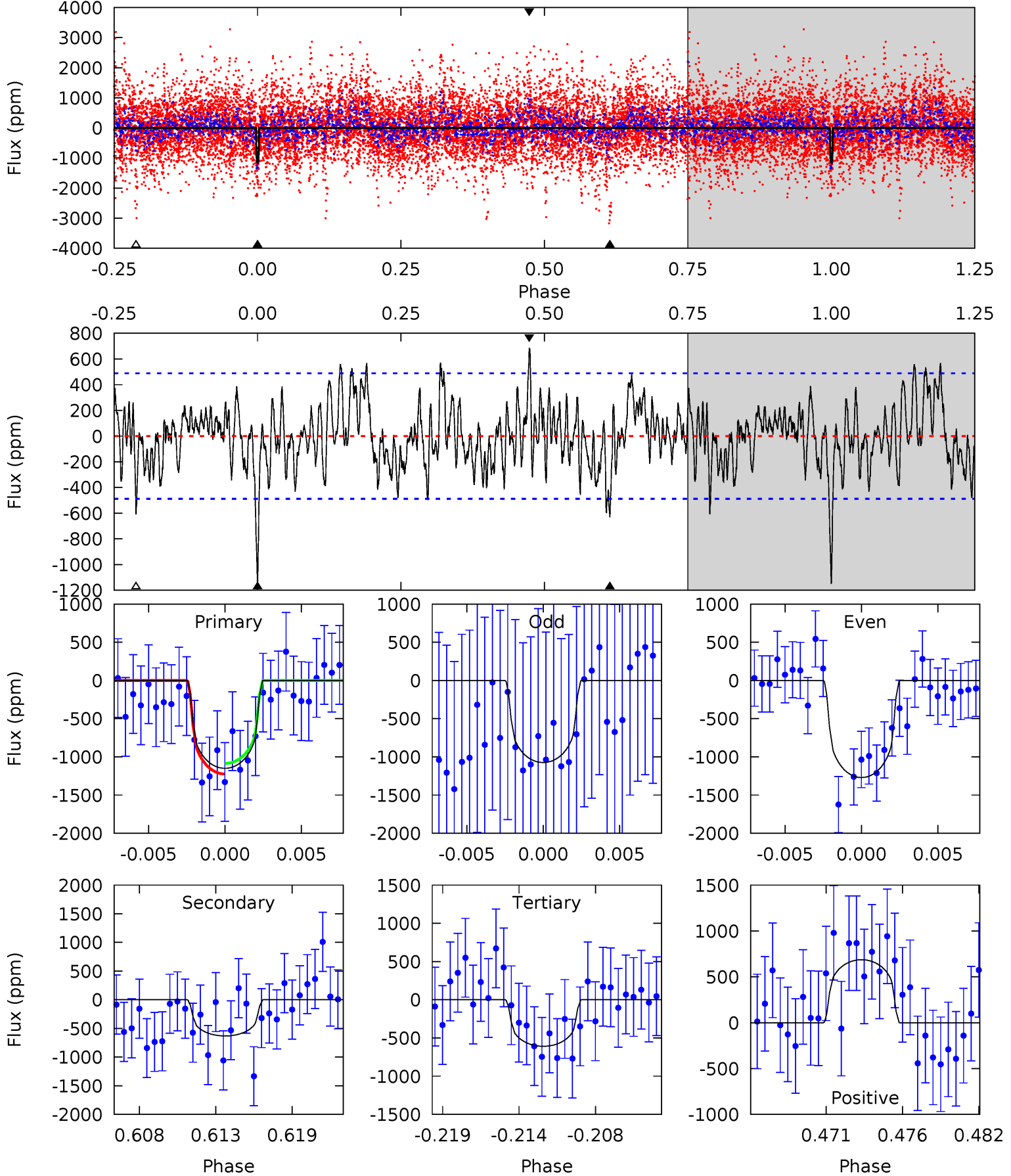
TCE 009851970-05   P= 58.027353 Days    $T_0=183.015293$  (BKJD)



# DV Model-Shift Uniqueness Test

009851970-05, P = 58.028718 Days, E = 125.018861 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
12.1	6.64	6.41	7.23	5.14	2.78	2.17	5.69	4.87	0.24	-0.58	1.03	0.93	0.37	0.72

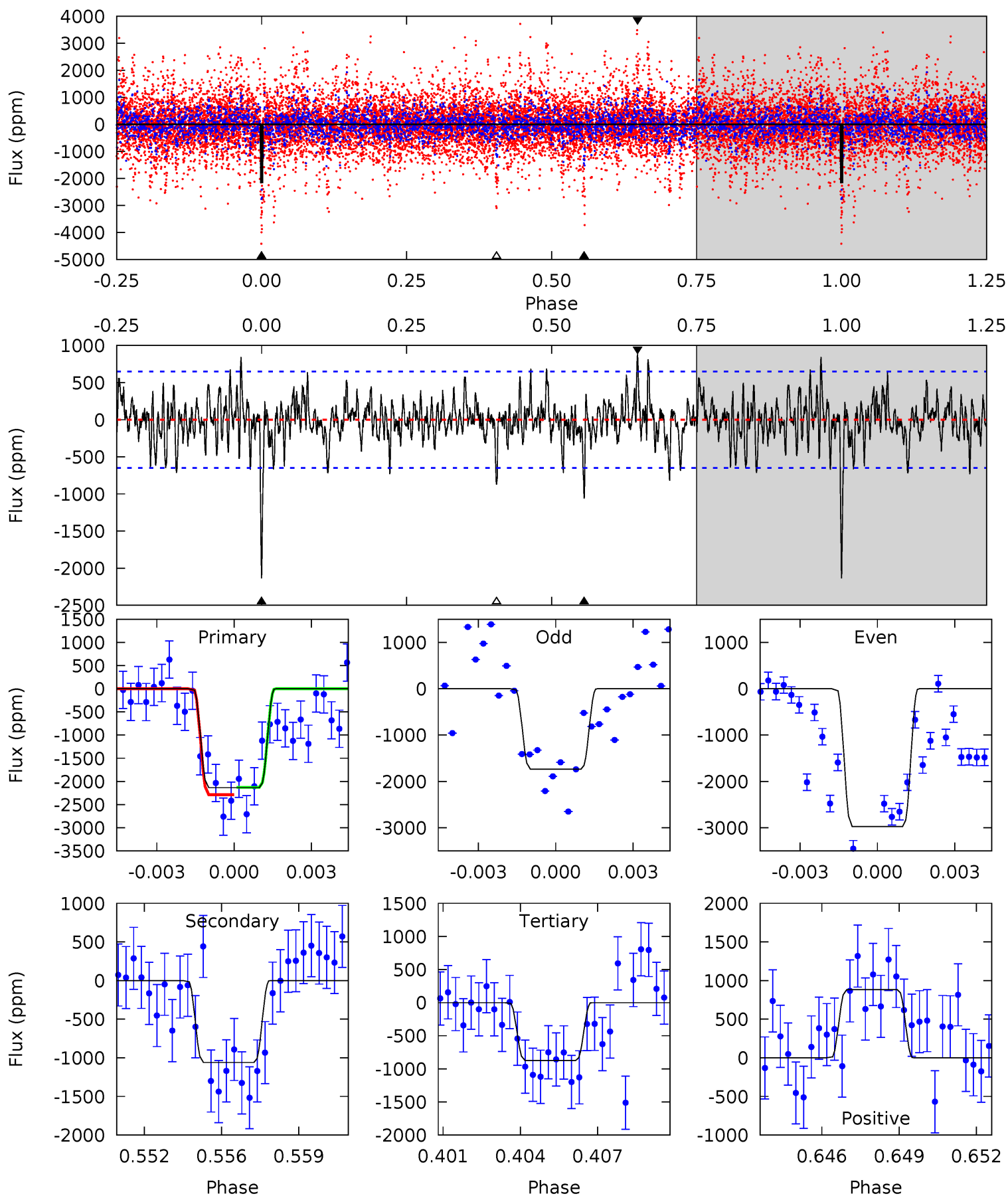




# Alt Model-Shift Uniqueness Test

009851970-05, P = 58.027353 Days, E = 124.987940 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
17.2	8.56	7.06	7.13	5.24	2.94	1.87	10.2	10.1	1.50	1.43	4.64	0.93	0.29	0.63



### Stellar Parameters For KIC 009851970

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$4965^{+151}_{-136}$	$4.555^{+0.072}_{-0.044}$	$-0.220^{+0.300}_{-0.300}$	$0.736^{+0.065}_{-0.079}$	$0.709^{+0.093}_{-0.050}$	$2.508^{+0.760}_{-0.407}$
	+3%/-3%	+2%/-1%	+136%/-136%	+9%/-11%	+13%/-7%	+30%/-16%
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 009851970-05 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-631 \pm 95$	$2.88^{+2.03}_{-1.69}$	$512^{+17}_{-19}$	$4338^{+1948}_{-770}$	$2887^{+14150}_{-1913}$
Alt.	$-1060 \pm 124$	$3.96^{+2.02}_{-1.89}$	$512^{+20}_{-18}$	$4221^{+1319}_{-577}$	$2613^{+6915}_{-1492}$

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

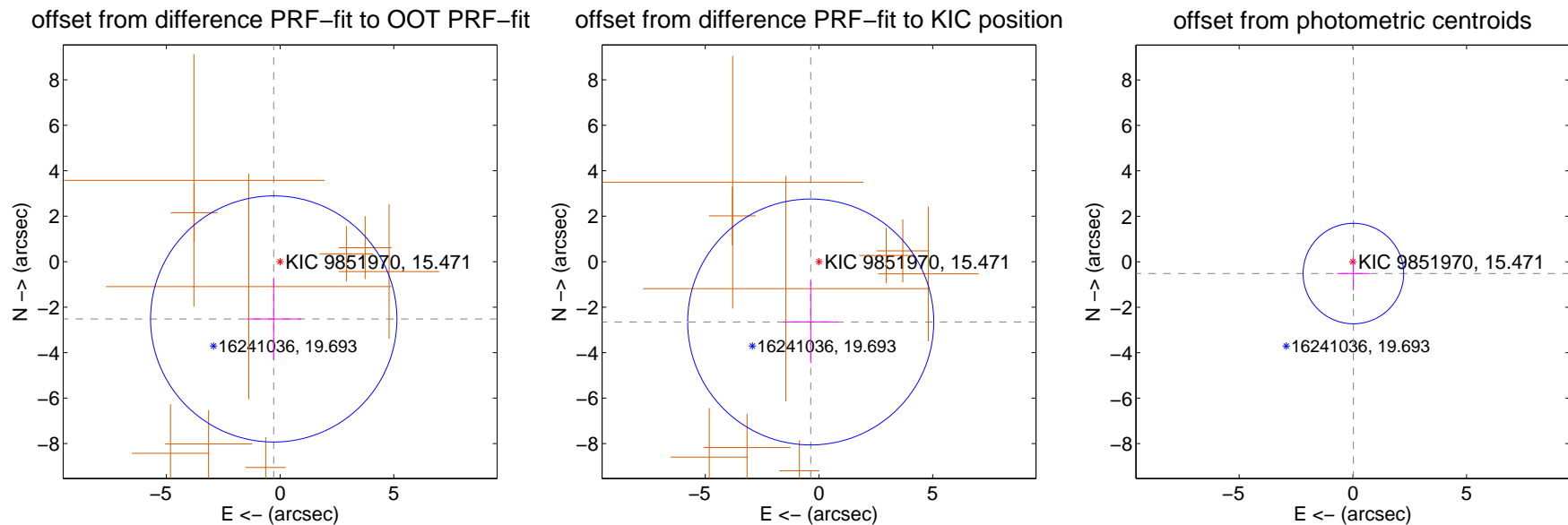
## DV Centroid Data

Supplemental centroid analysis for 009851970-05. Kepler magnitude: 15.47. Transit SNR 8.44

There are 0 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	$2.534 \pm 1.804$	1.40	$0.280 \pm 1.211$	$-2.518 \pm 1.810$
PRF-fit source offset from KIC position	$2.676 \pm 1.802$	1.48	$0.364 \pm 1.215$	$-2.652 \pm 1.812$
photometric centroid source offset	$0.52 \pm 0.74$	0.70	$-0.02 \pm 0.71$	$-0.52 \pm 0.74$



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.

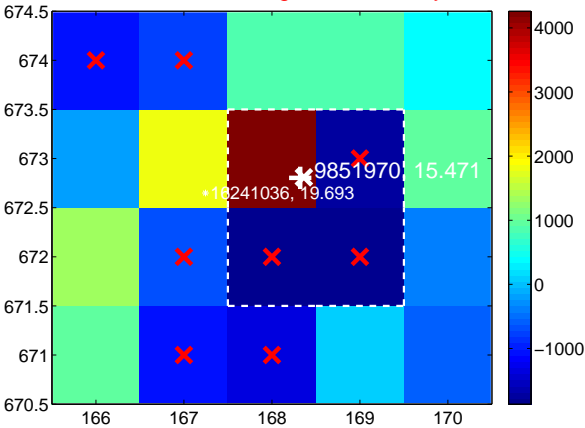
Q1 no difference image



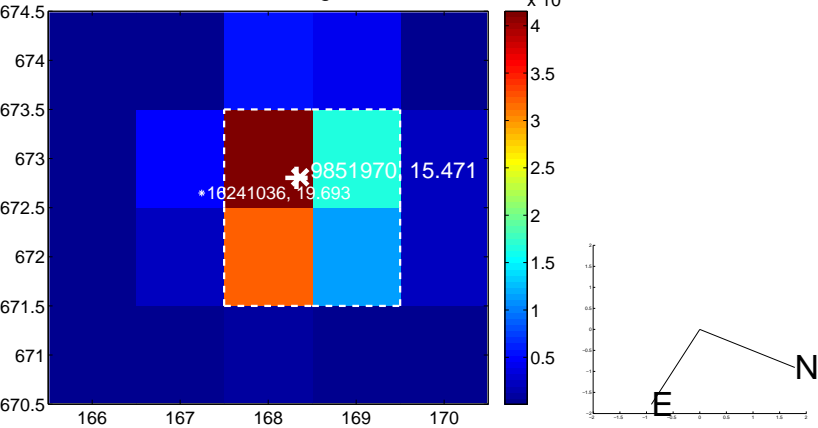
Q1 no OOT image



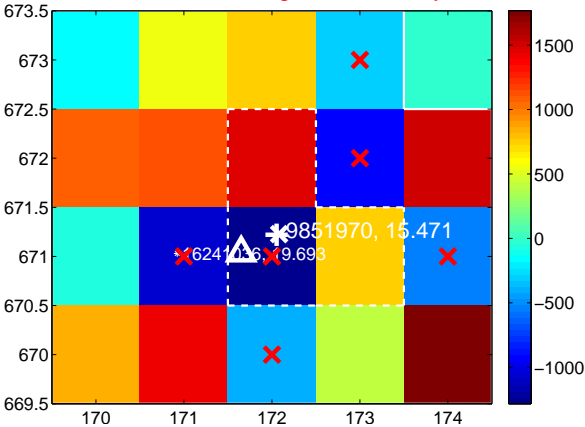
Q2 difference image. Poor Quality



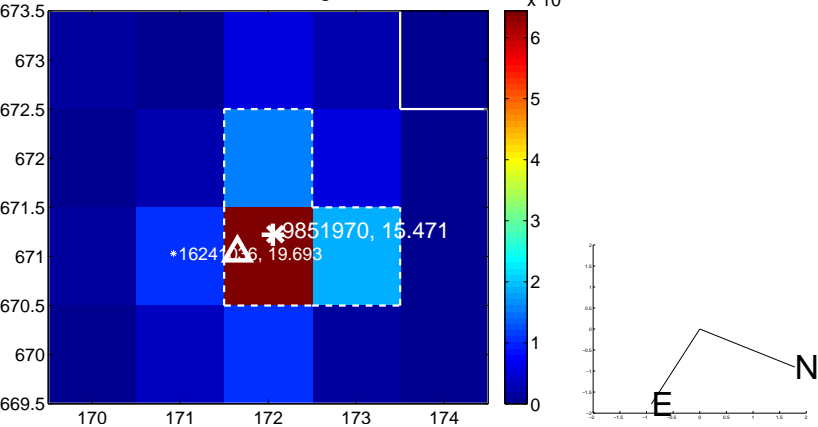
Q2 OOT image



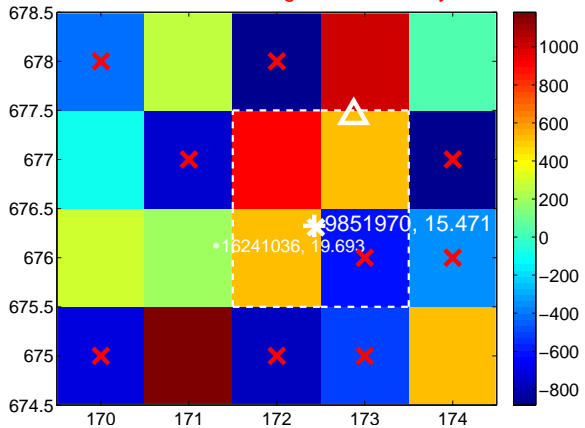
Q3 difference image. Poor Quality



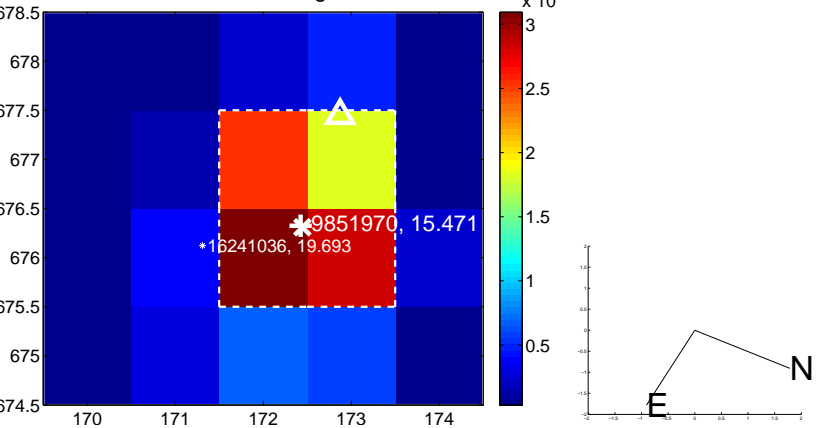
Q3 OOT image



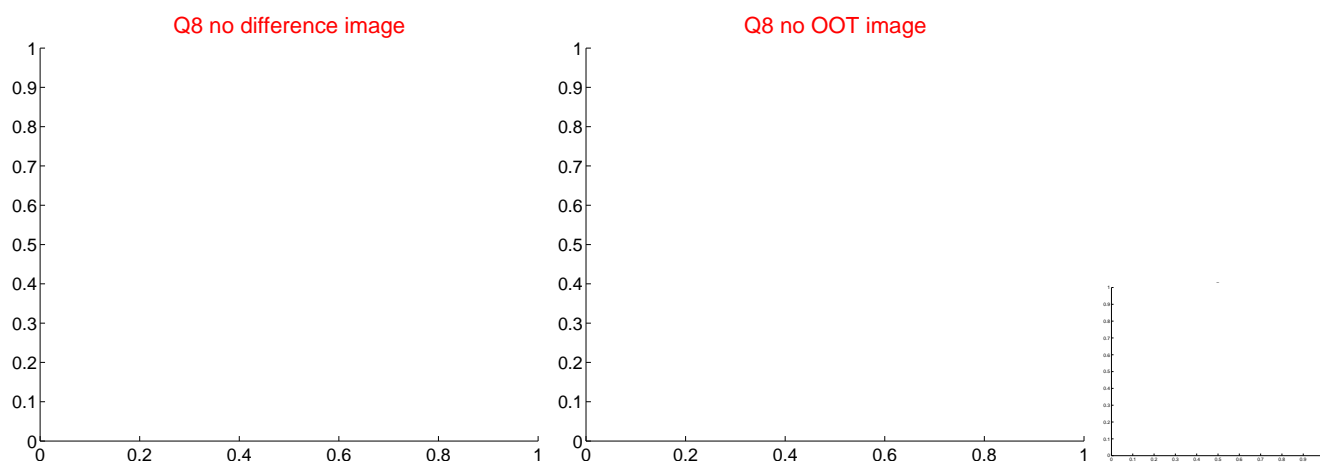
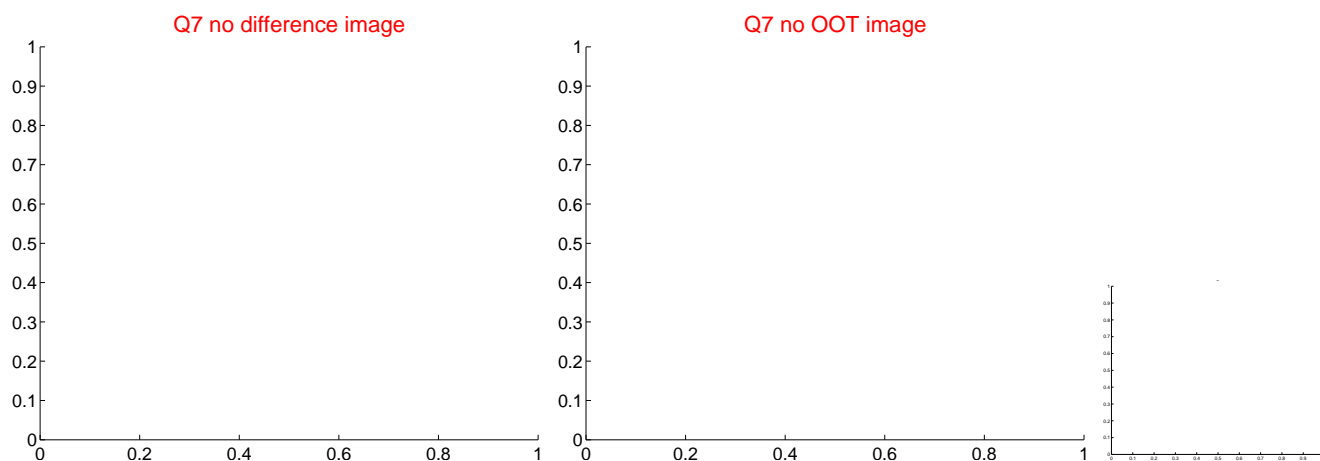
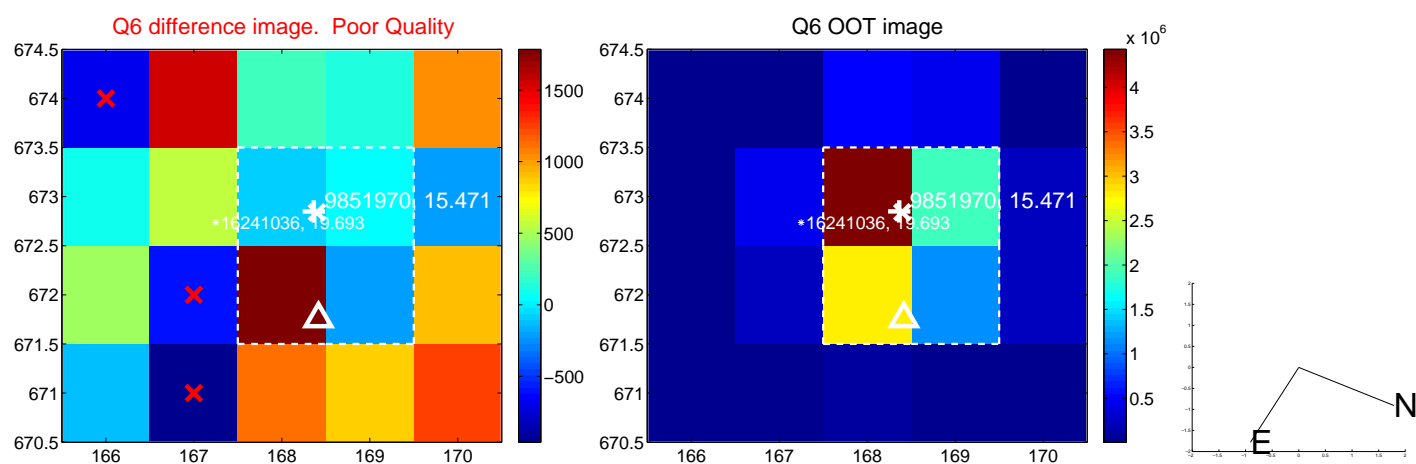
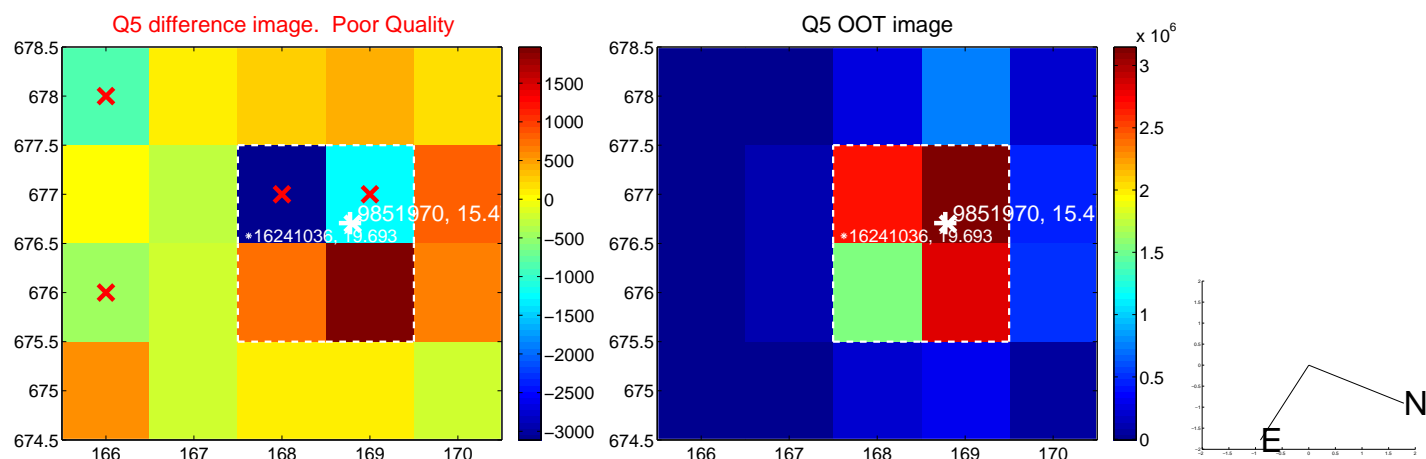
Q4 difference image. Poor Quality



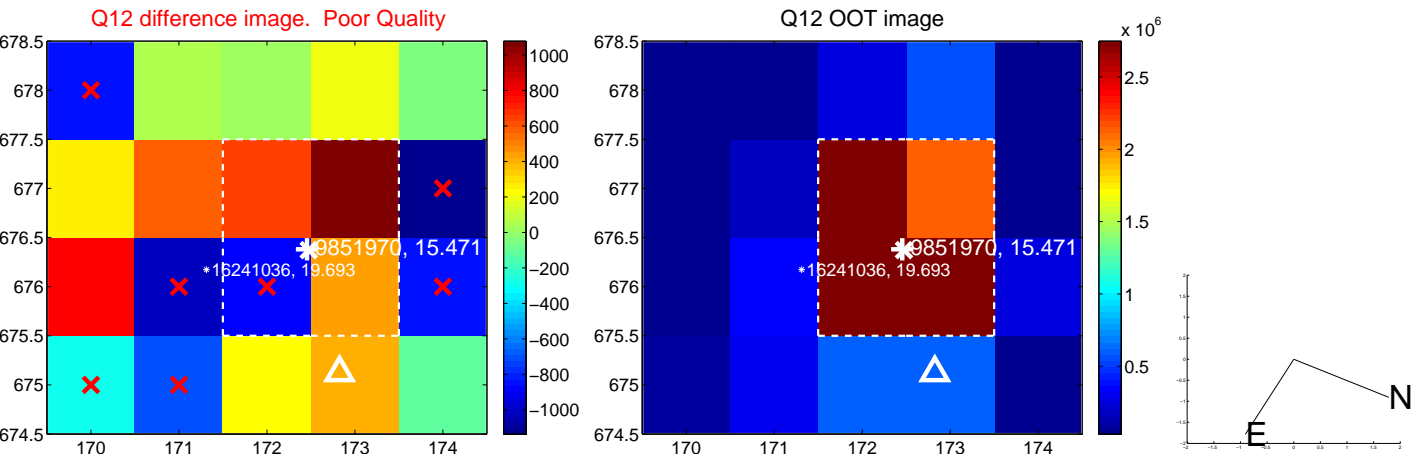
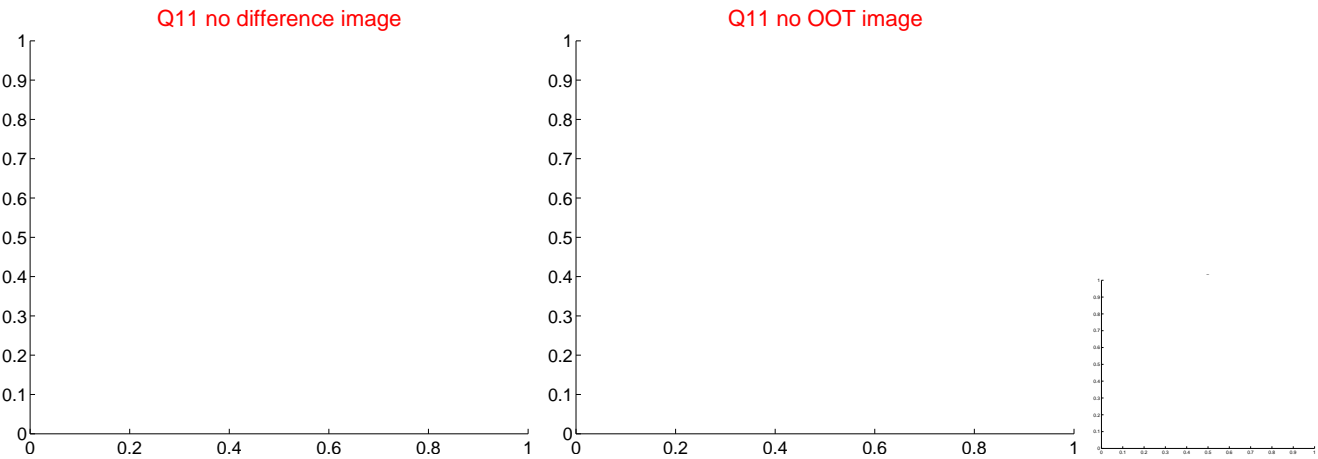
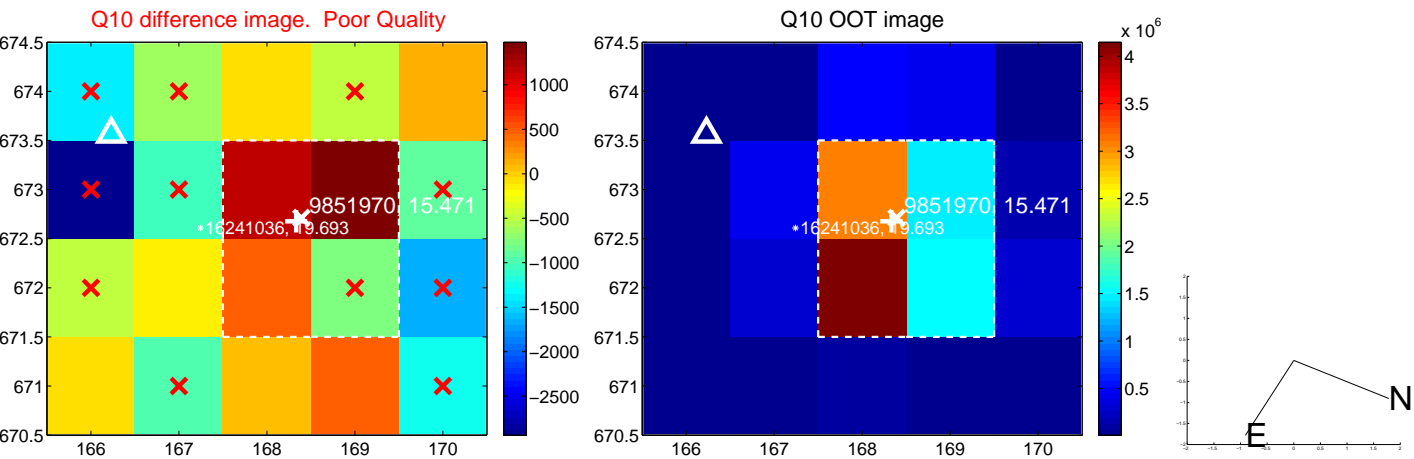
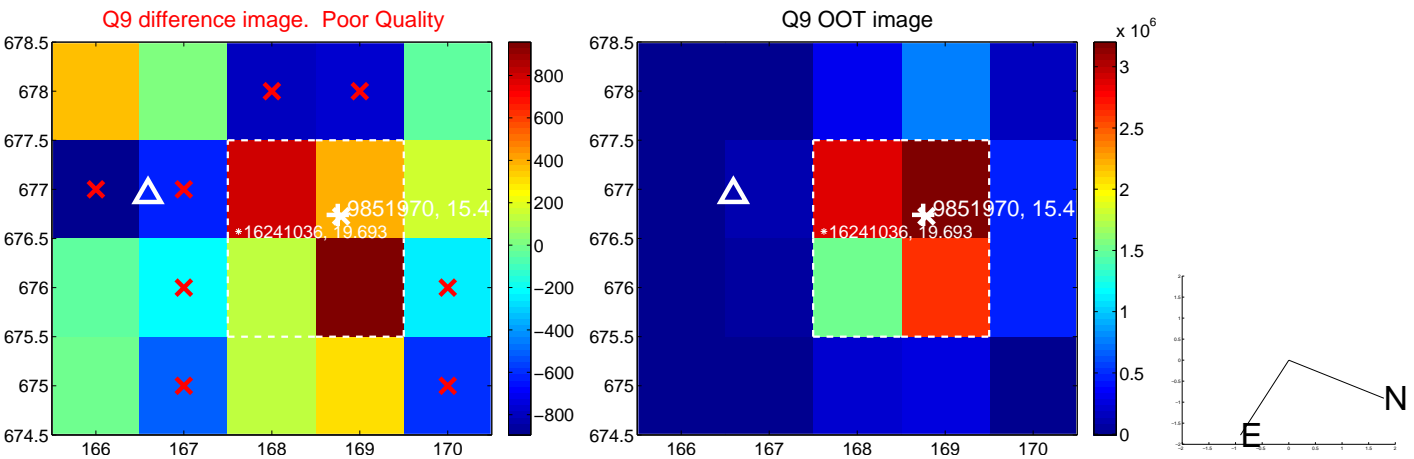
Q4 OOT image



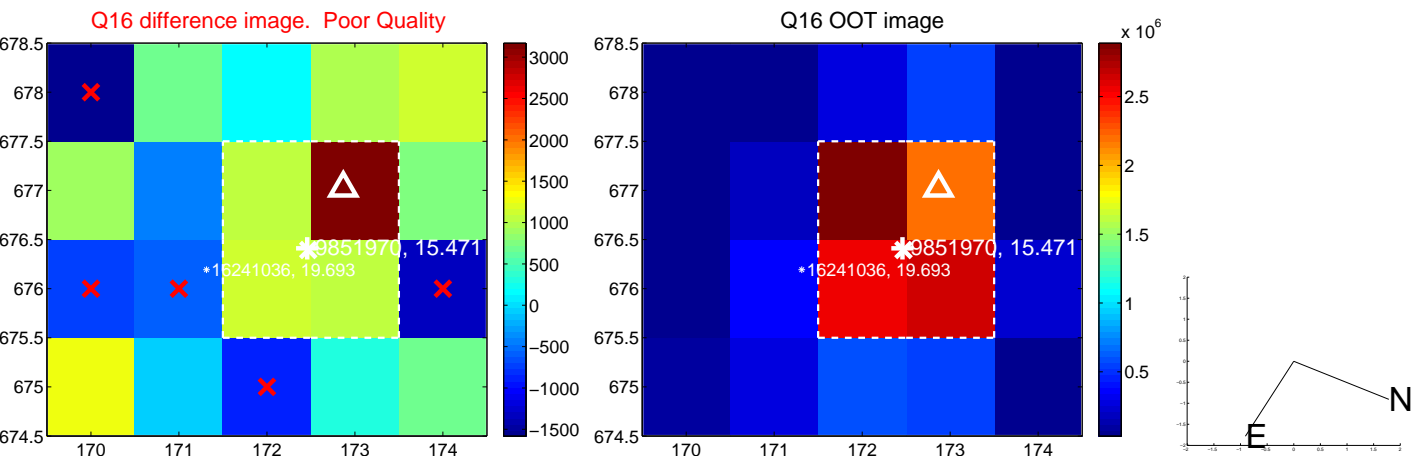
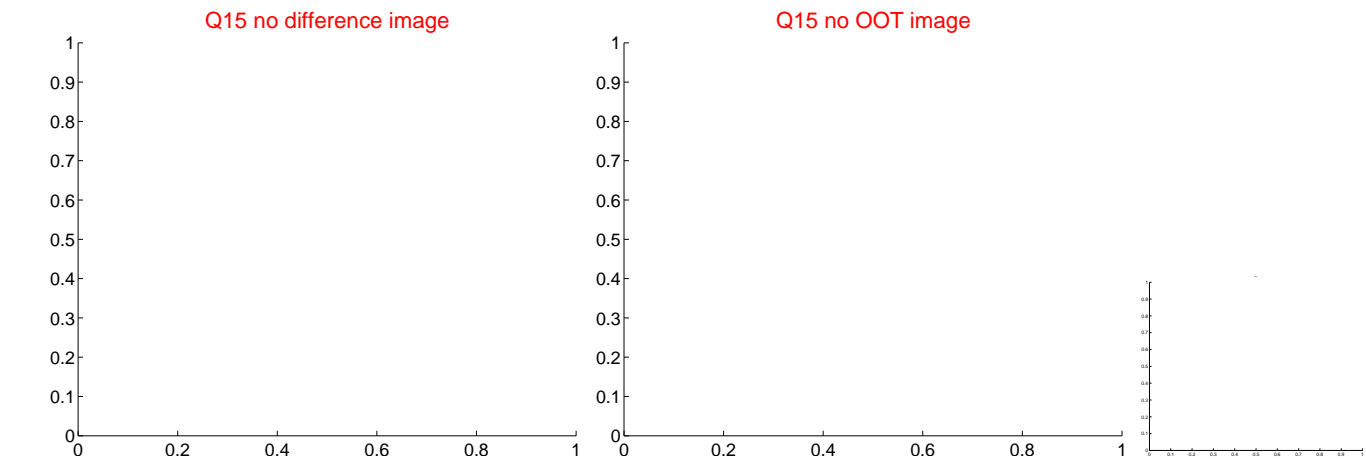
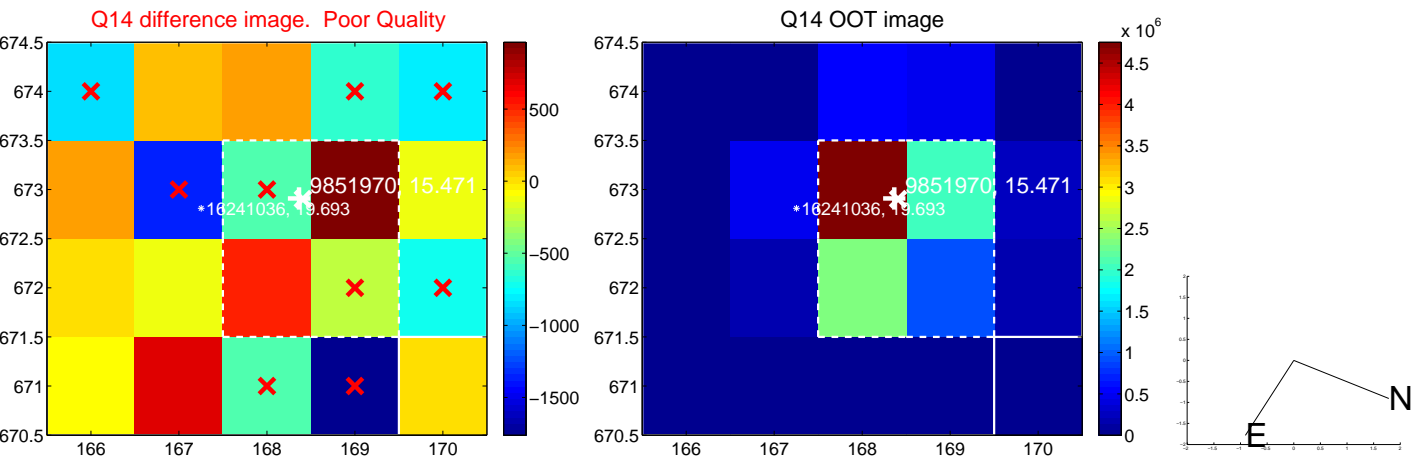
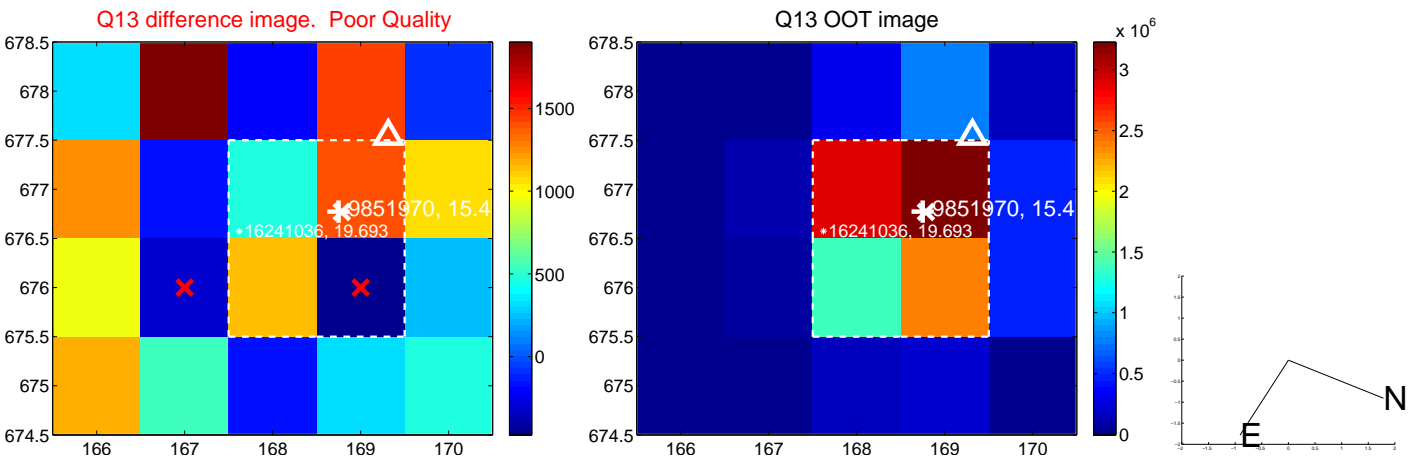
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



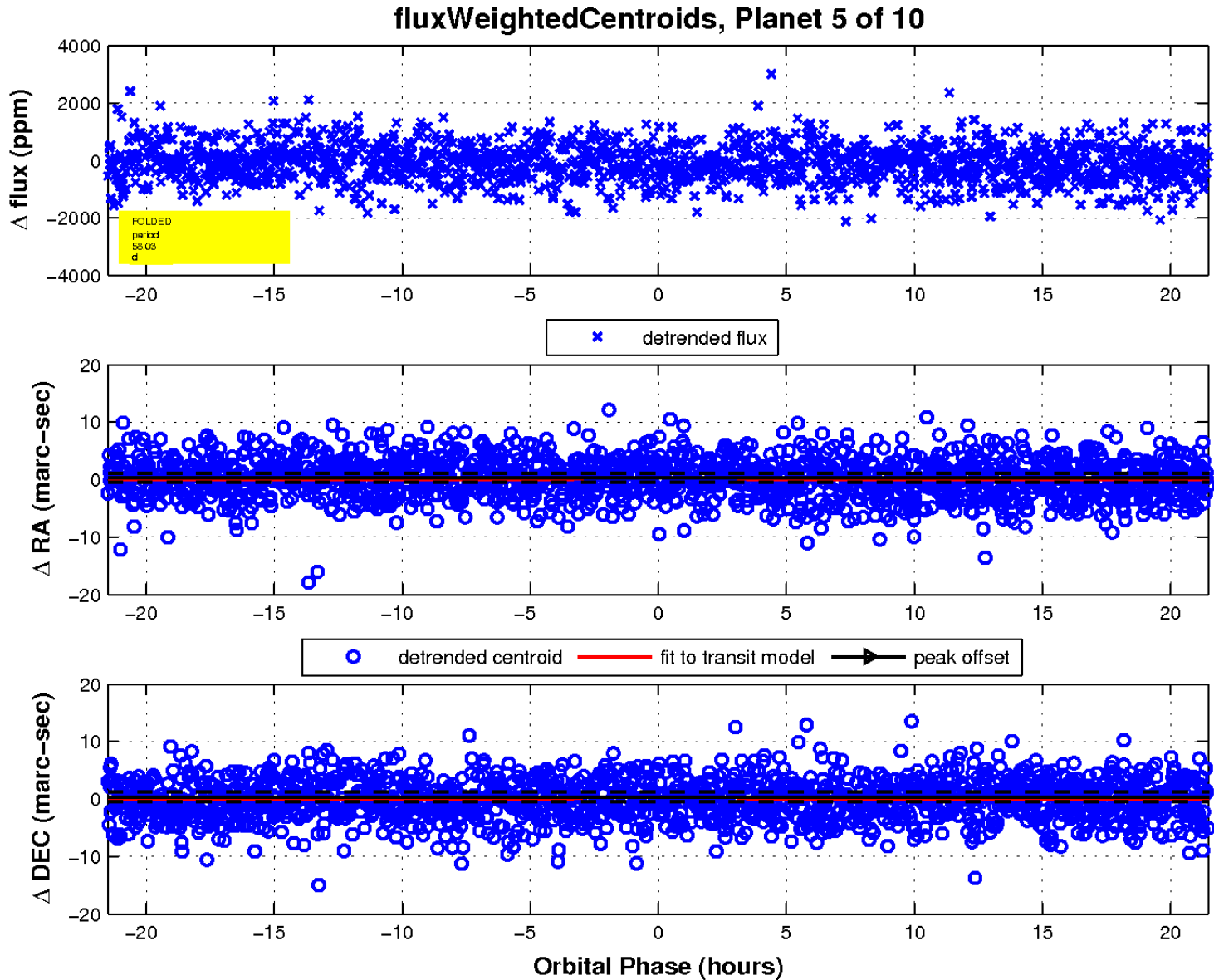
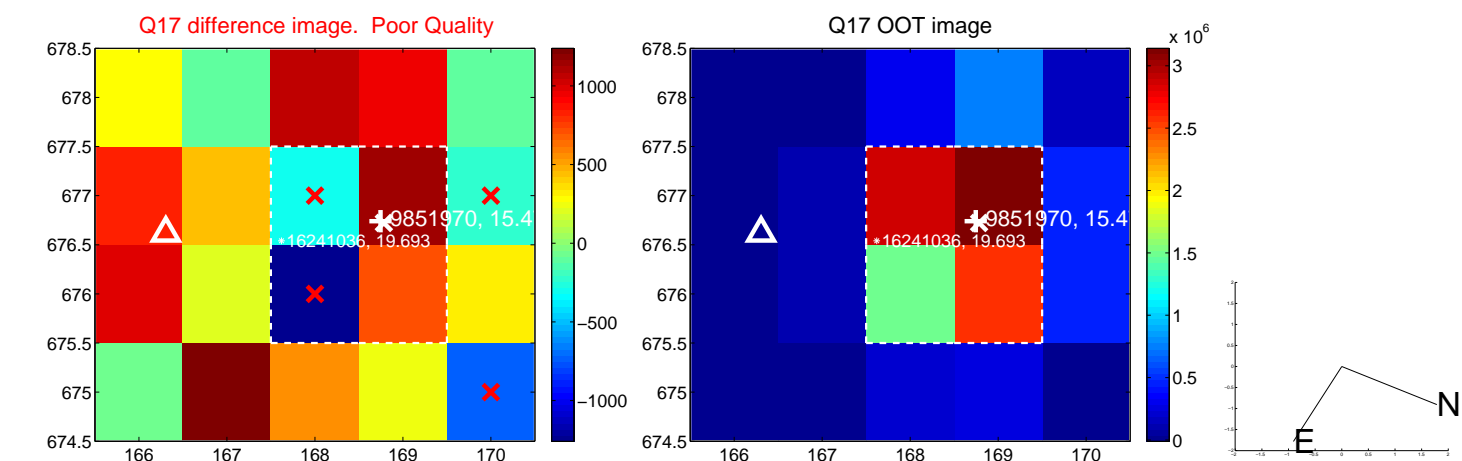
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



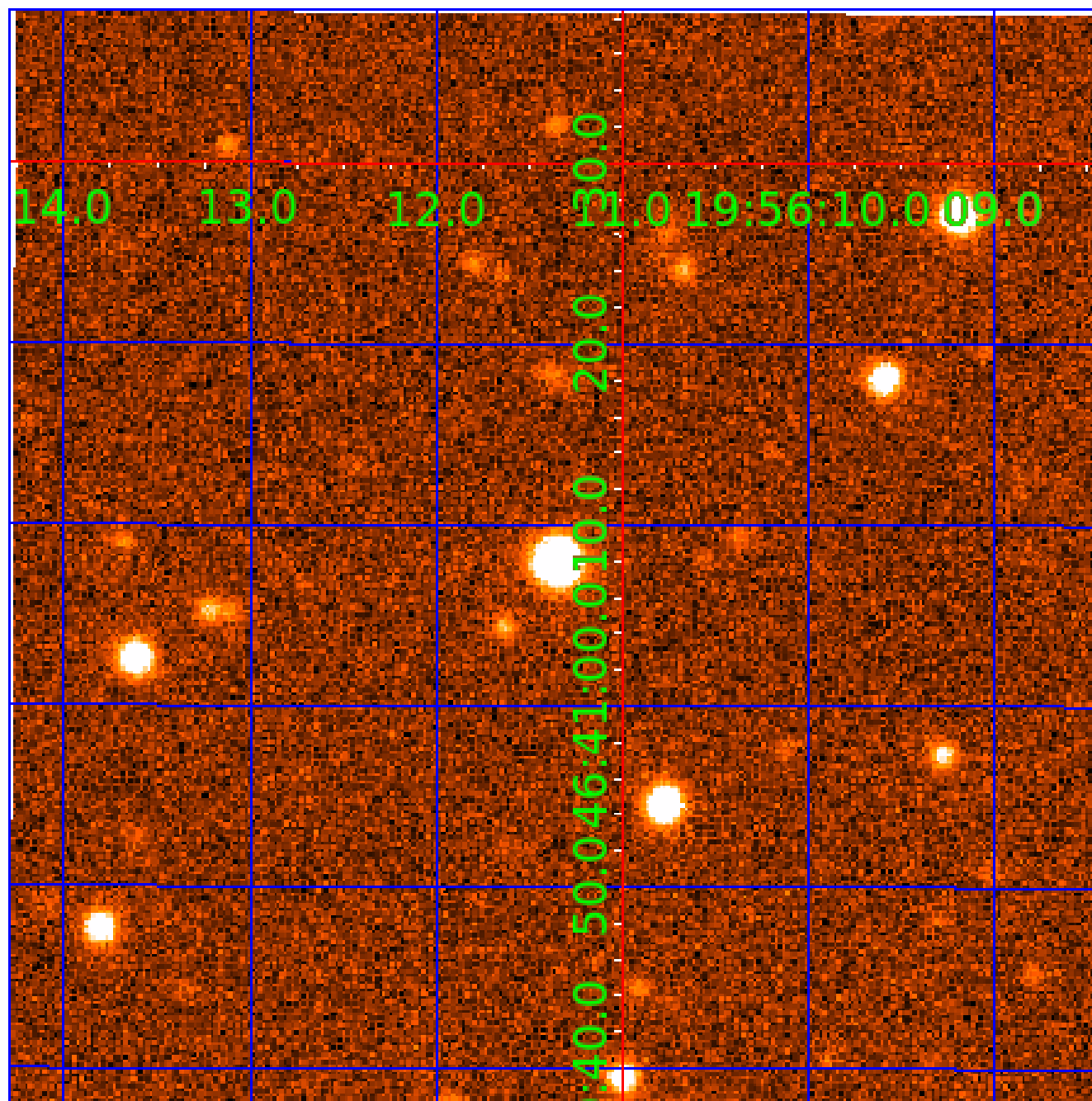
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





UKIRT Image

Declination



## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009851970-01	OBS	4122.01	1.081931	131.550019	107.5	6.343	13.0	13.4	0.74	4965	0.74	871.41
009851970-02	OBS	No	318.191396	287.691504	2963.9	7.500	18.3	-1.0	0.74	4965	3.89	0.45
009851970-03	OBS	No	87.131904	158.497311	1337.3	12.255	11.1	8.0	0.74	4965	4.18	2.51
009851970-04	OBS	No	98.329975	161.538824	746.0	4.930	12.1	5.3	0.74	4965	2.36	2.13
009851970-05	OBS	No	58.028718	183.047579	986.5	7.168	11.4	8.4	0.74	4965	2.50	4.31
009851970-06	OBS	No	34.155362	145.442225	495.6	5.928	10.4	4.7	0.74	4965	1.86	8.73
009851970-07	OBS	No	43.866421	135.859401	759.6	3.082	10.4	4.7	0.74	4965	2.21	6.26
009851970-08	OBS	No	485.794267	253.271172	1176.7	9.000	9.7	-1.0	0.74	4965	2.45	0.25
009851970-09	OBS	No	69.926614	193.429290	667.9	4.803	9.9	4.1	0.74	4965	2.11	3.36
009851970-10	OBS	No	665.534623	173.054303	2457.4	17.077	9.5	8.7	0.74	4965	6.96	0.17

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009851970-01	OBS	FP	0.00	0	1	1	1	MOD_SEC_ALT—CENT_RESOLVED_OFFSET—HALO_GHOST—EPHEM_MATCH
009851970-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_ZUMA—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_NOFITS
009851970-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_ALT—CENT_FEW_DIFFS
009851970-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_ZUMA_TRACKER—TRANS_GAPPED—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009851970-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE—TRANS_GAPPED—LPP_DV—CENT_FEW_DIFFS
009851970-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
009851970-07	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_TRACKER—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
009851970-08	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL—LPP_DV—ALL_TRANS_CHASES—NO_FITS—CENT_NOFITS
009851970-09	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE_TRACKER—TRANS_GAPPED—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS—HALO_GHOST
009851970-10	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_SKYE—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—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.

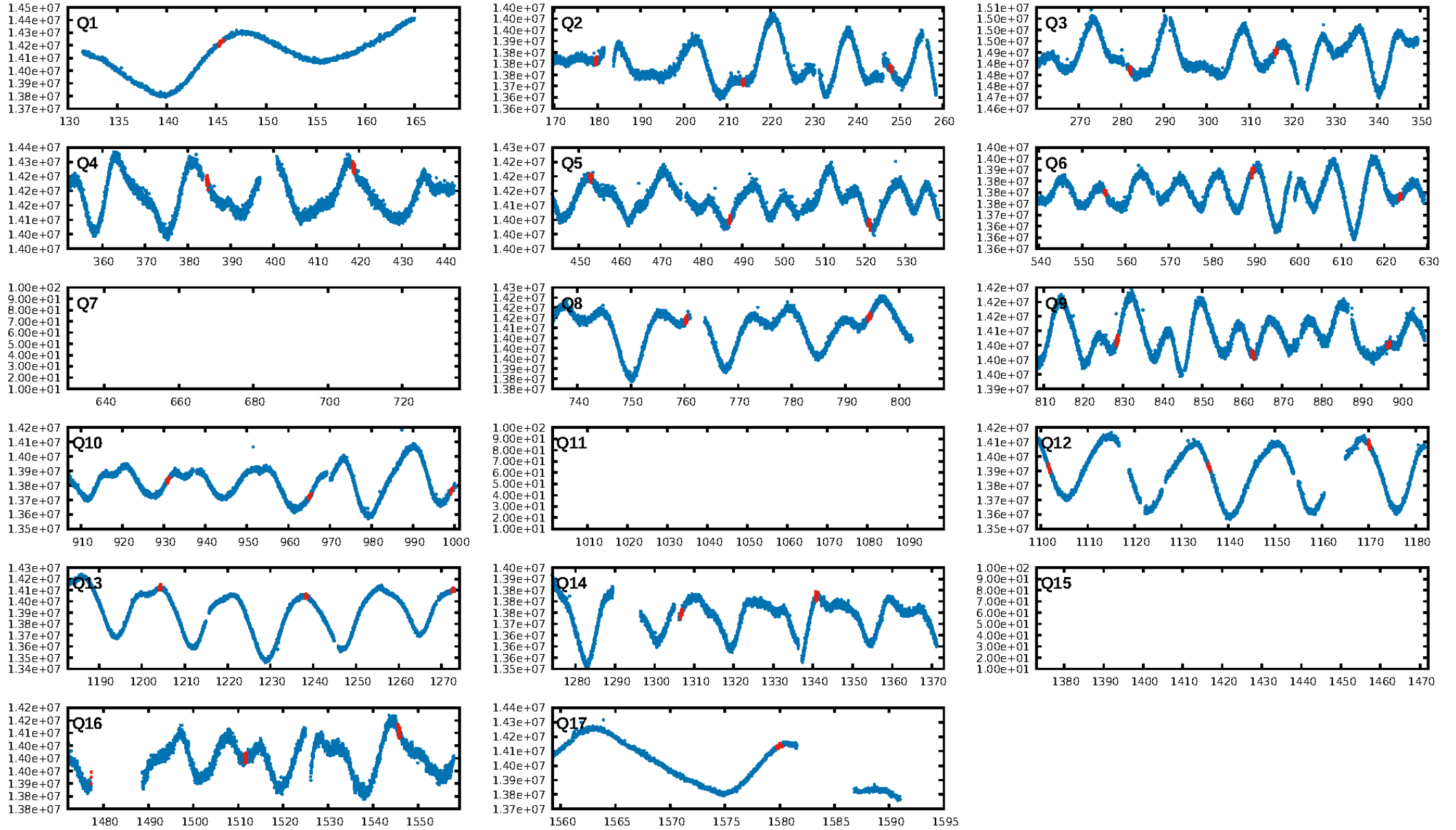
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 009851970-06

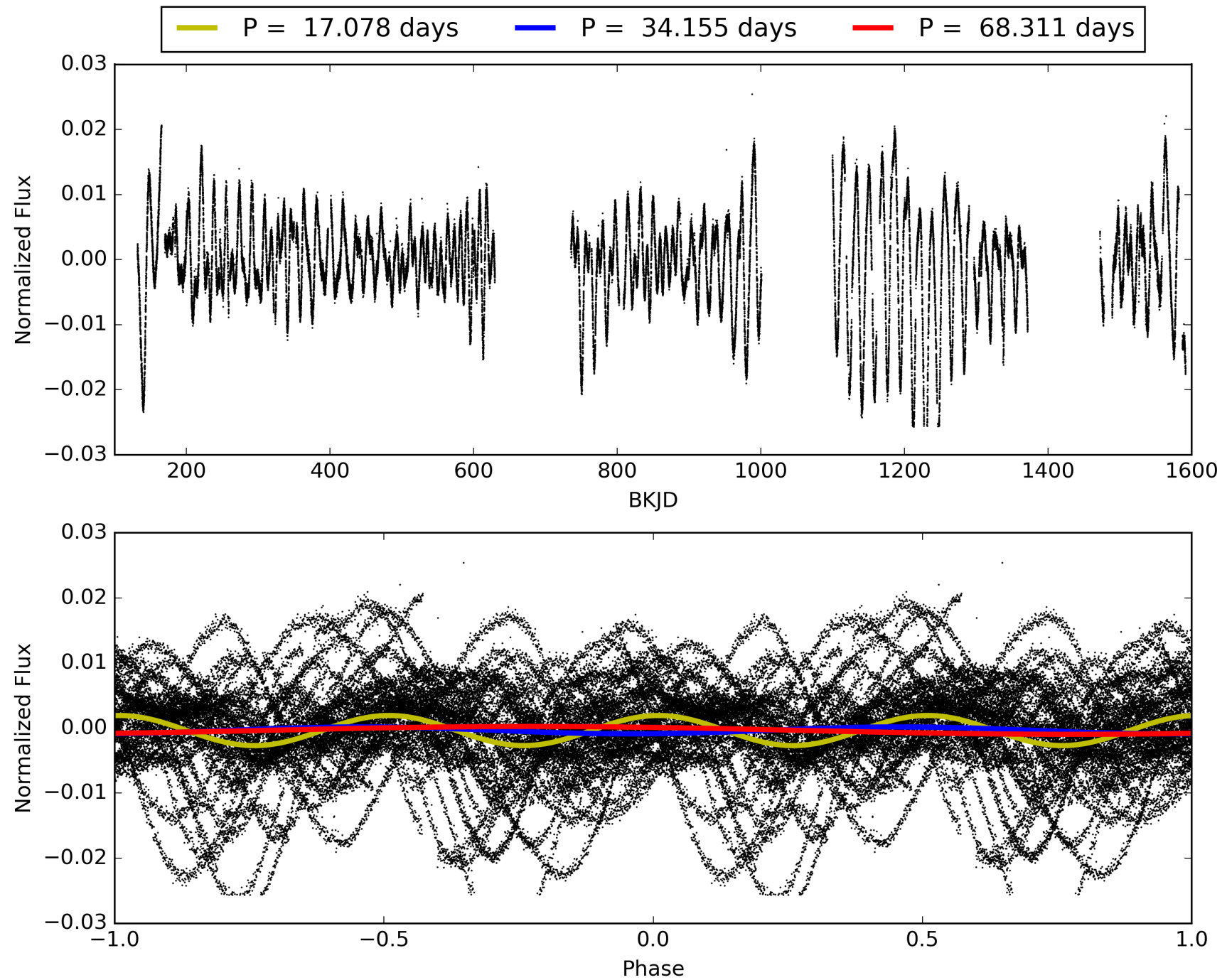
No Significant Match Found

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

# TCE 009851970-06, PDC Light Curves

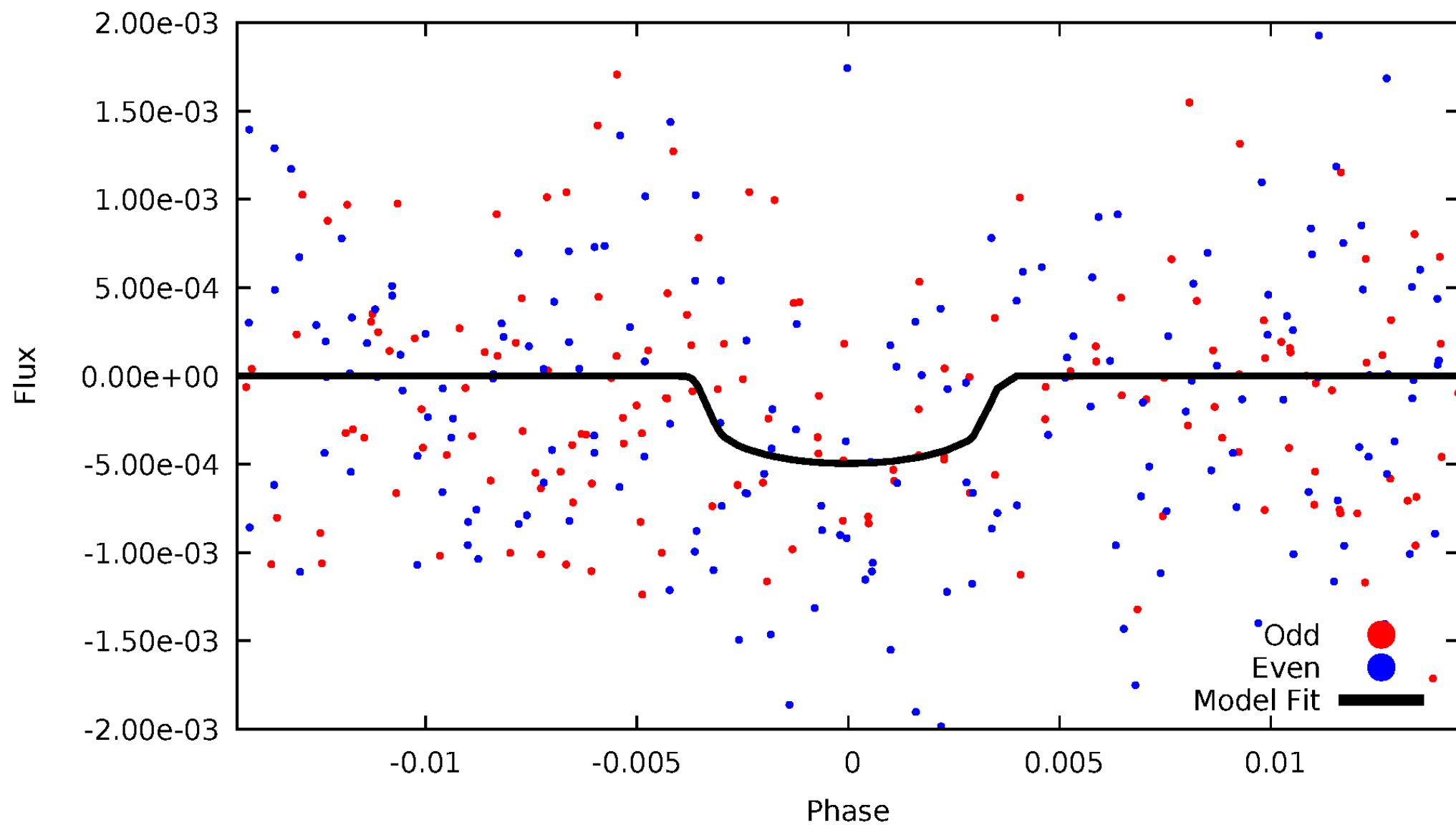


TCE 009851970-06



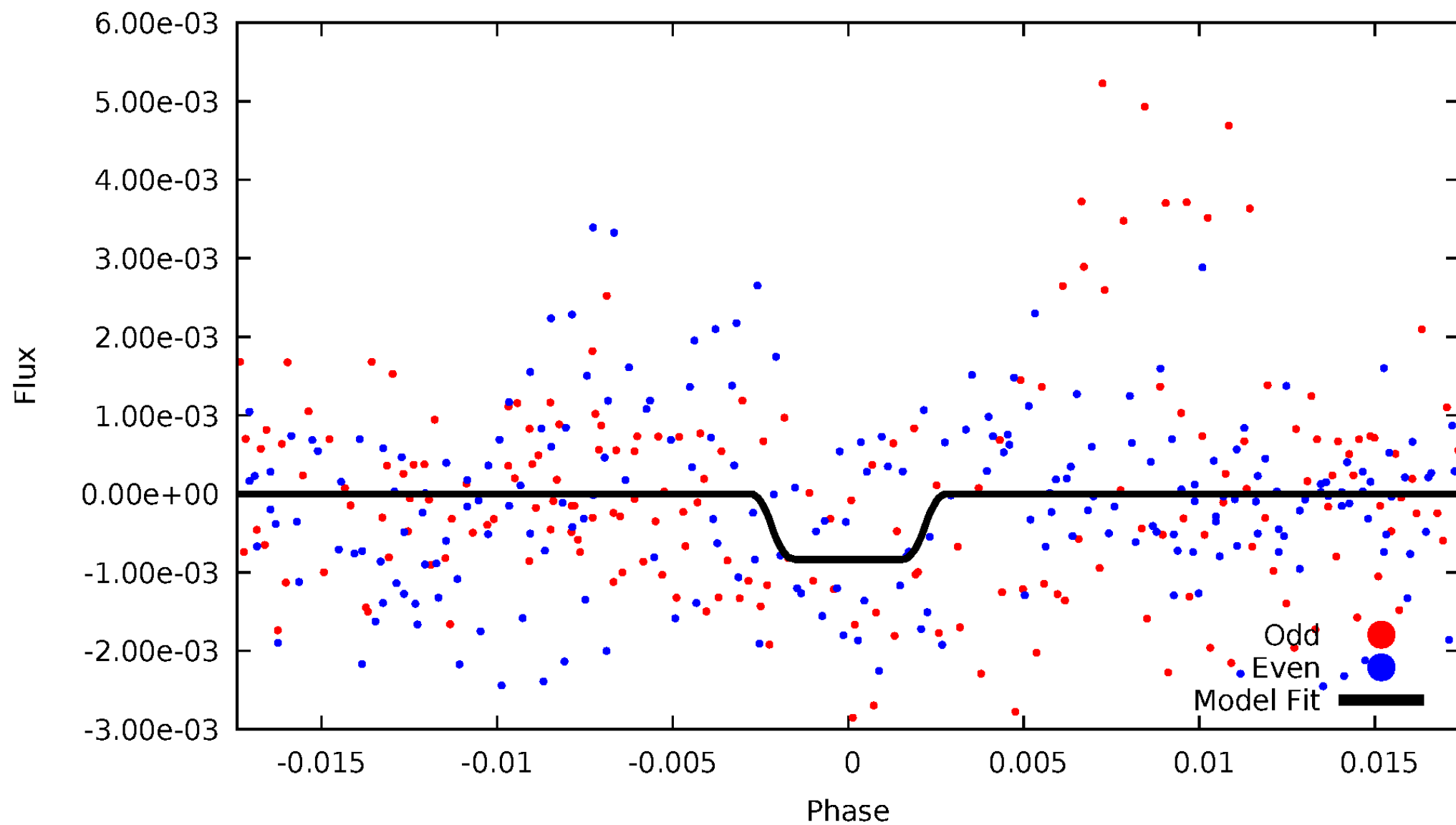
# DV Odd/Even

TCE 009851970-06



# ALT Odd/Even

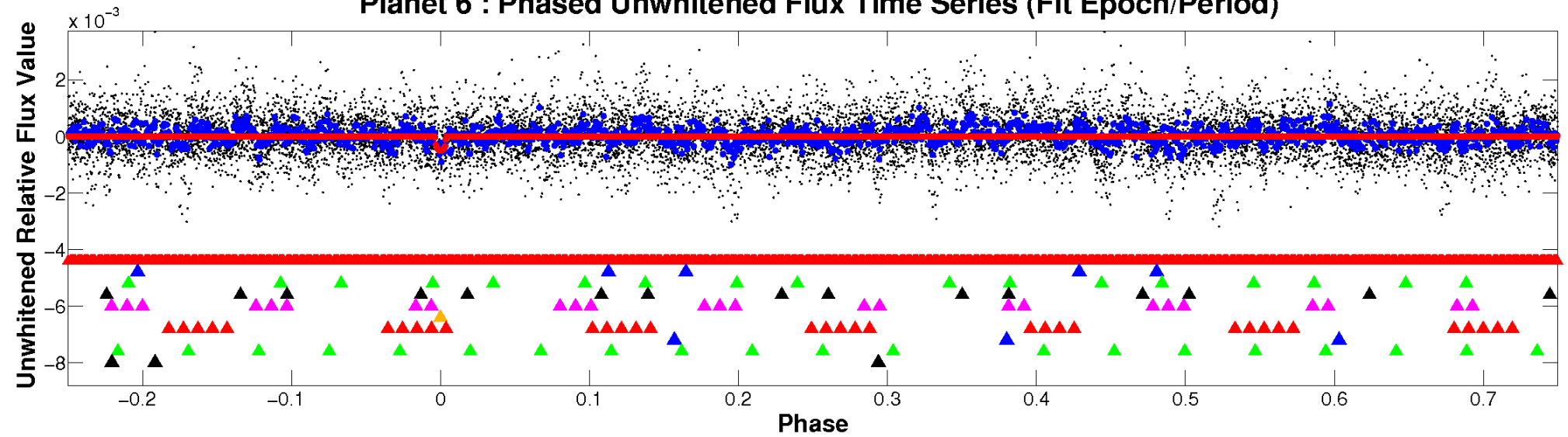
TCE 009851970-06



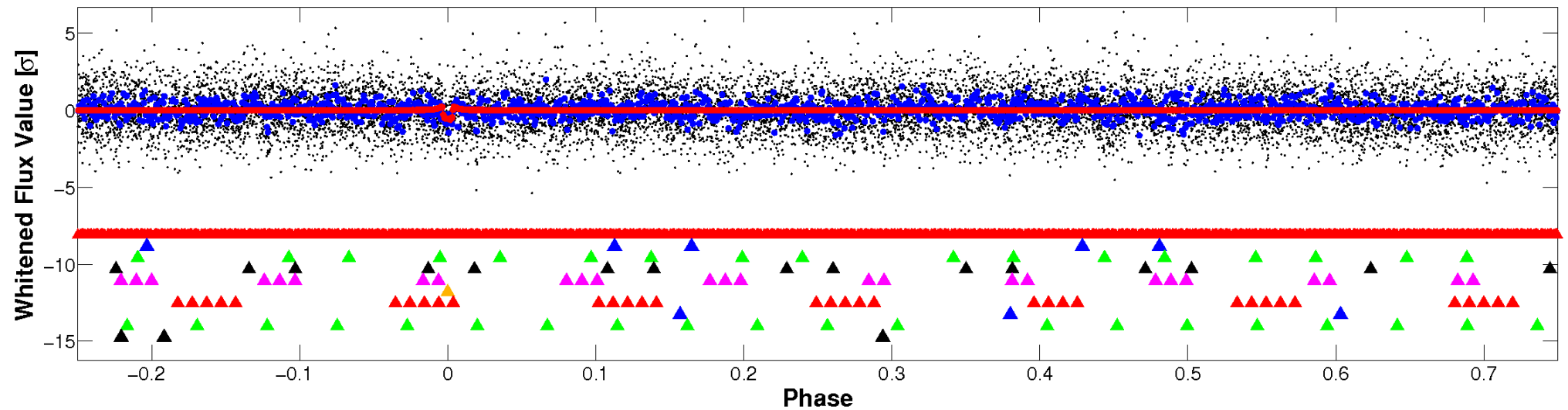


# Non-Whitened Vs. Whitened Light Curve

## Planet 6 : Phased Unwhitened Flux Time Series (Fit Epoch/Period)



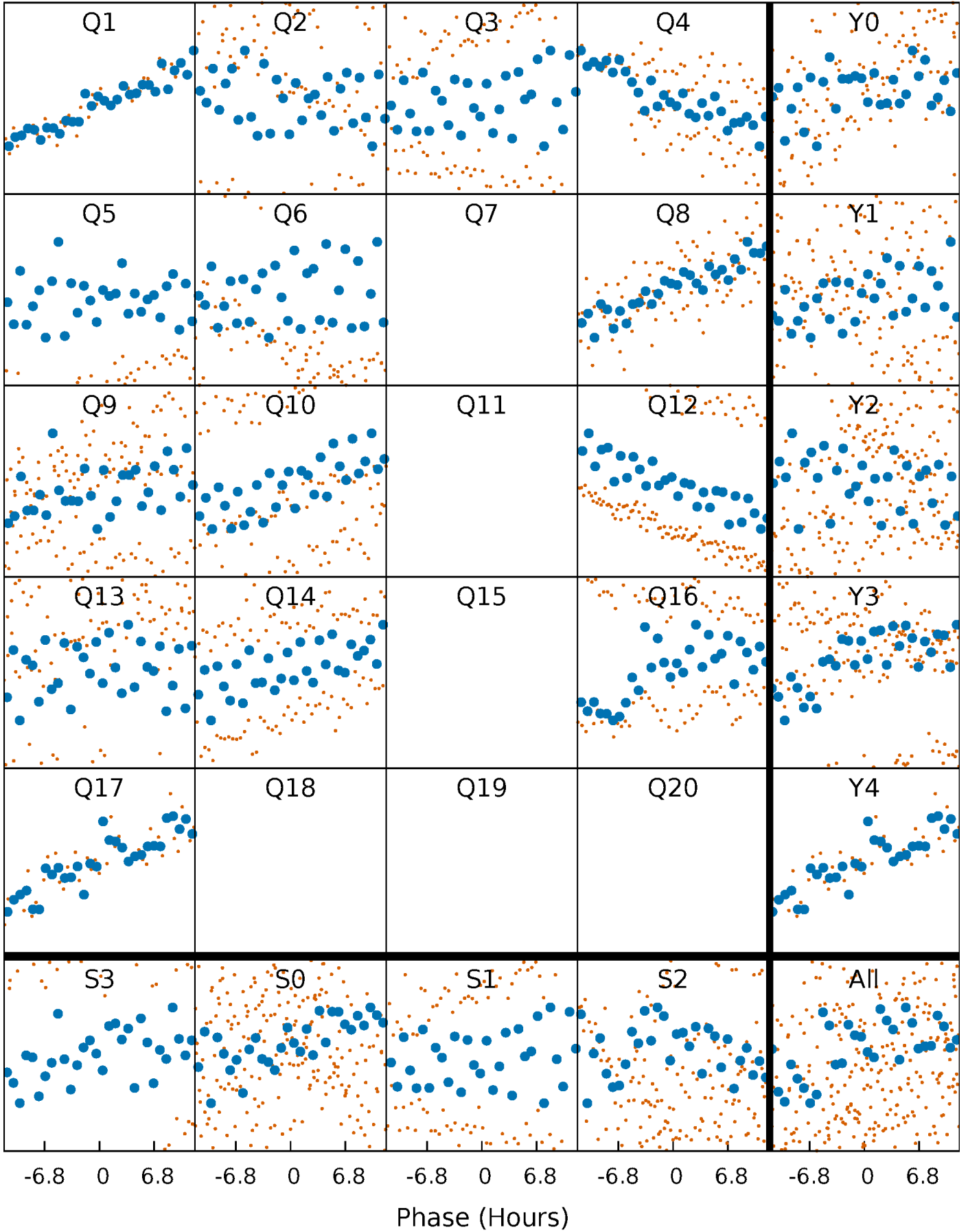
## Planet 6 : Phased Whitened Flux Time Series (Fit Epoch/Period)





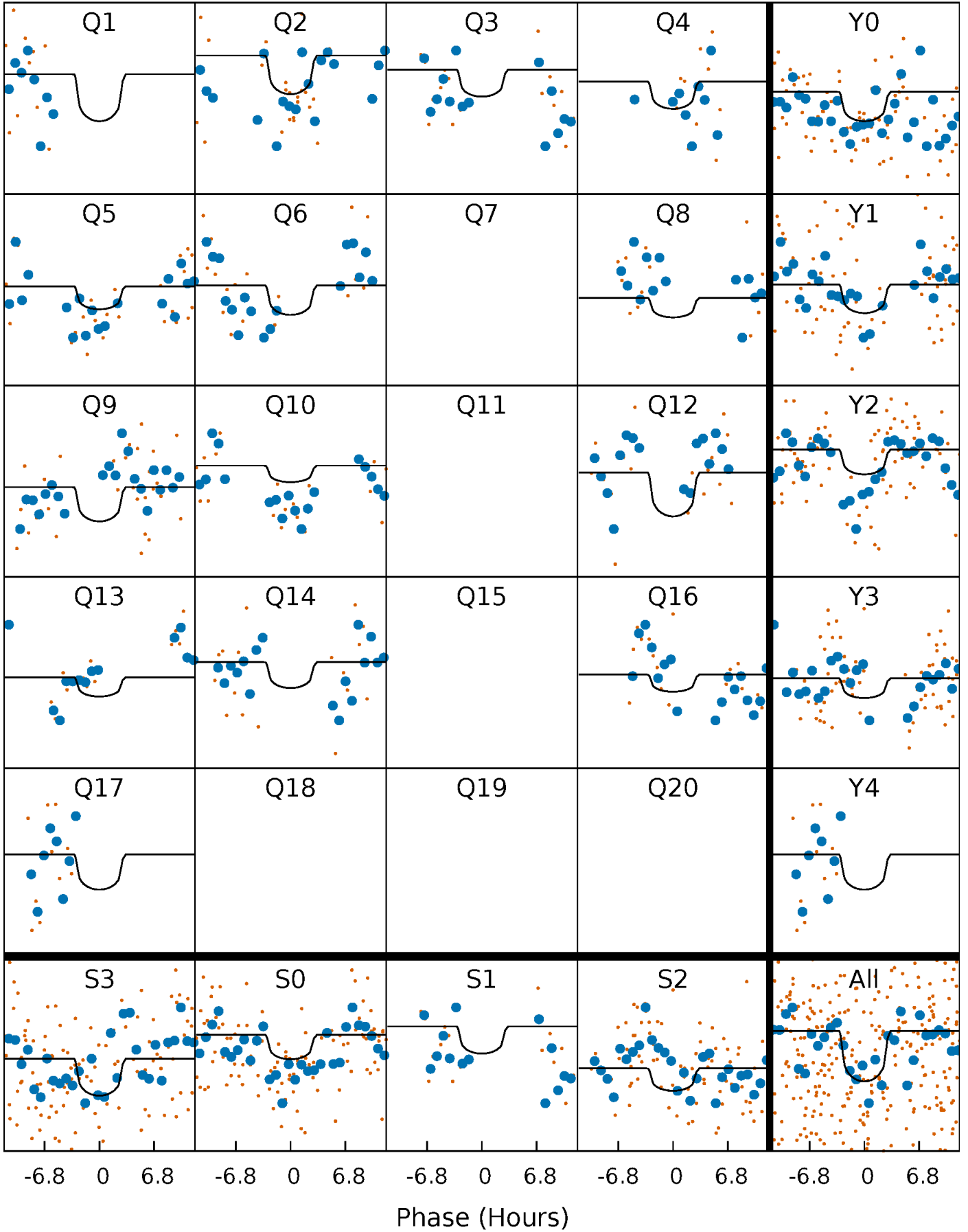
# PDC Quarter-Phased Transit Curves

TCE 009851970-06   P= 34.155362 Days    $T_0=145.442225$  (BKJD)



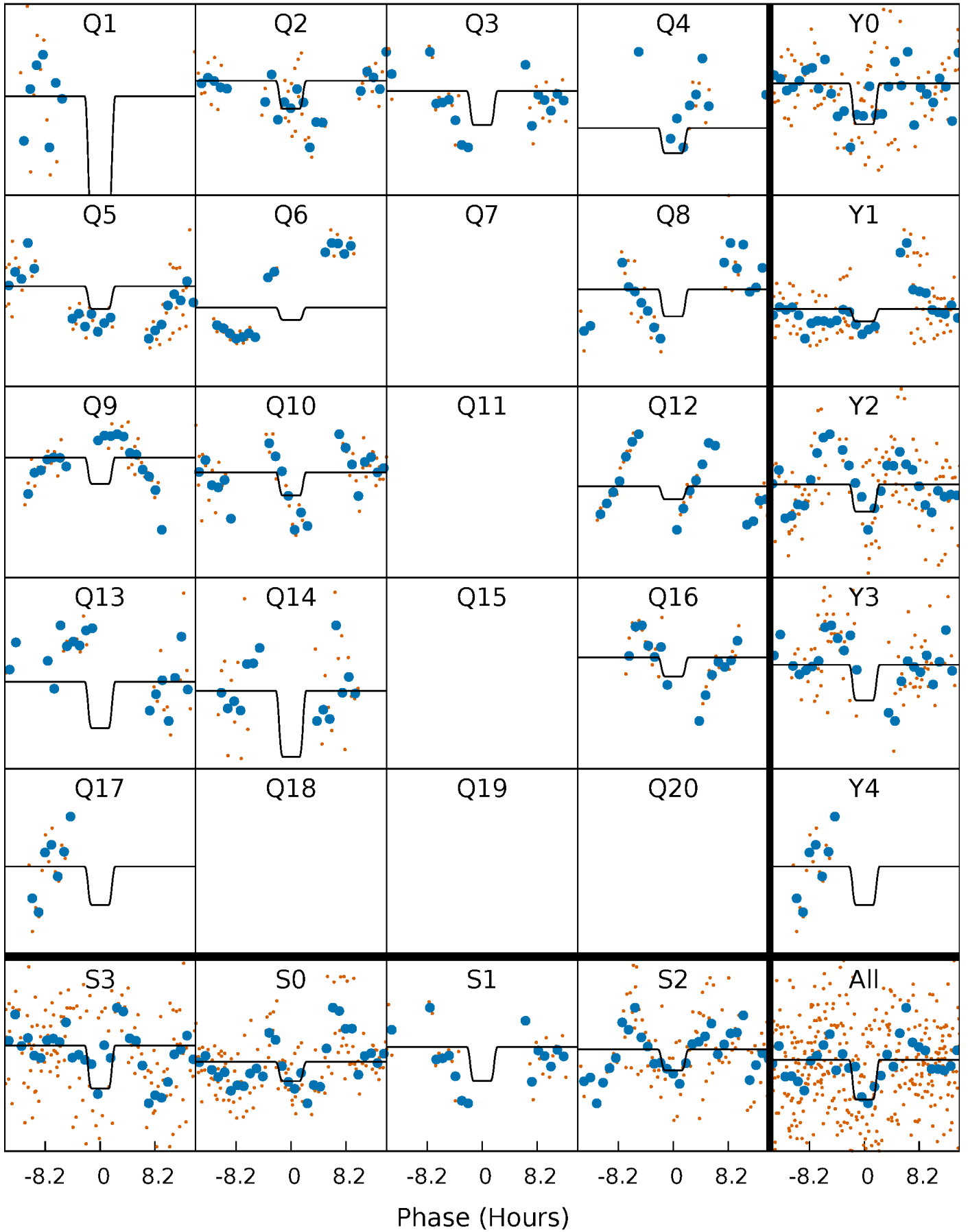
# DV Quarter-Phased Transit Curves

TCE 009851970-06   P= 34.155362 Days    $T_0=145.442225$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

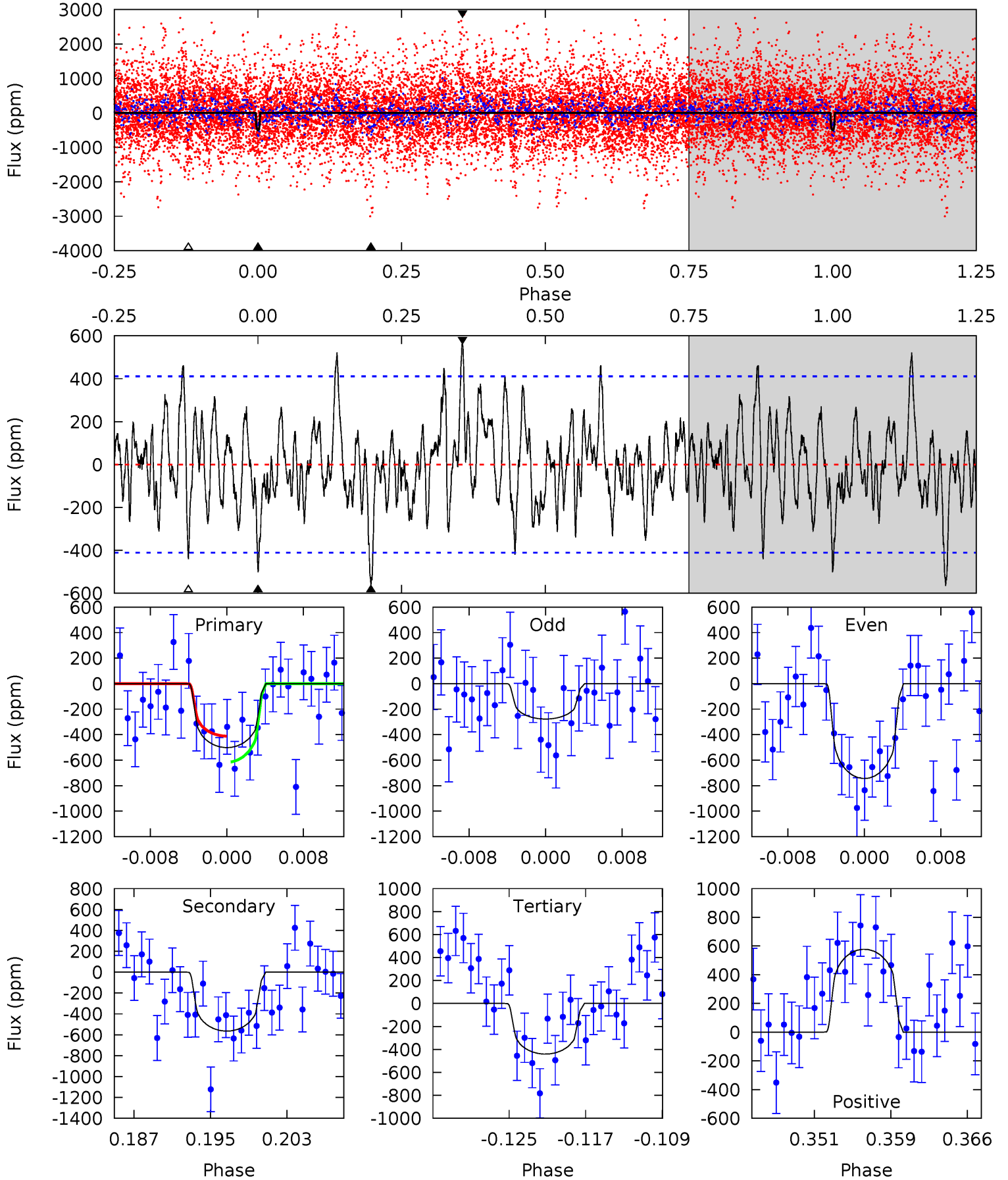
TCE 009851970-06   P= 34.156884 Days    $T_0=145.450851$  (BKJD)



# DV Model-Shift Uniqueness Test

009851970-06,  $P = 34.155362$  Days,  $E = 111.286863$  Days

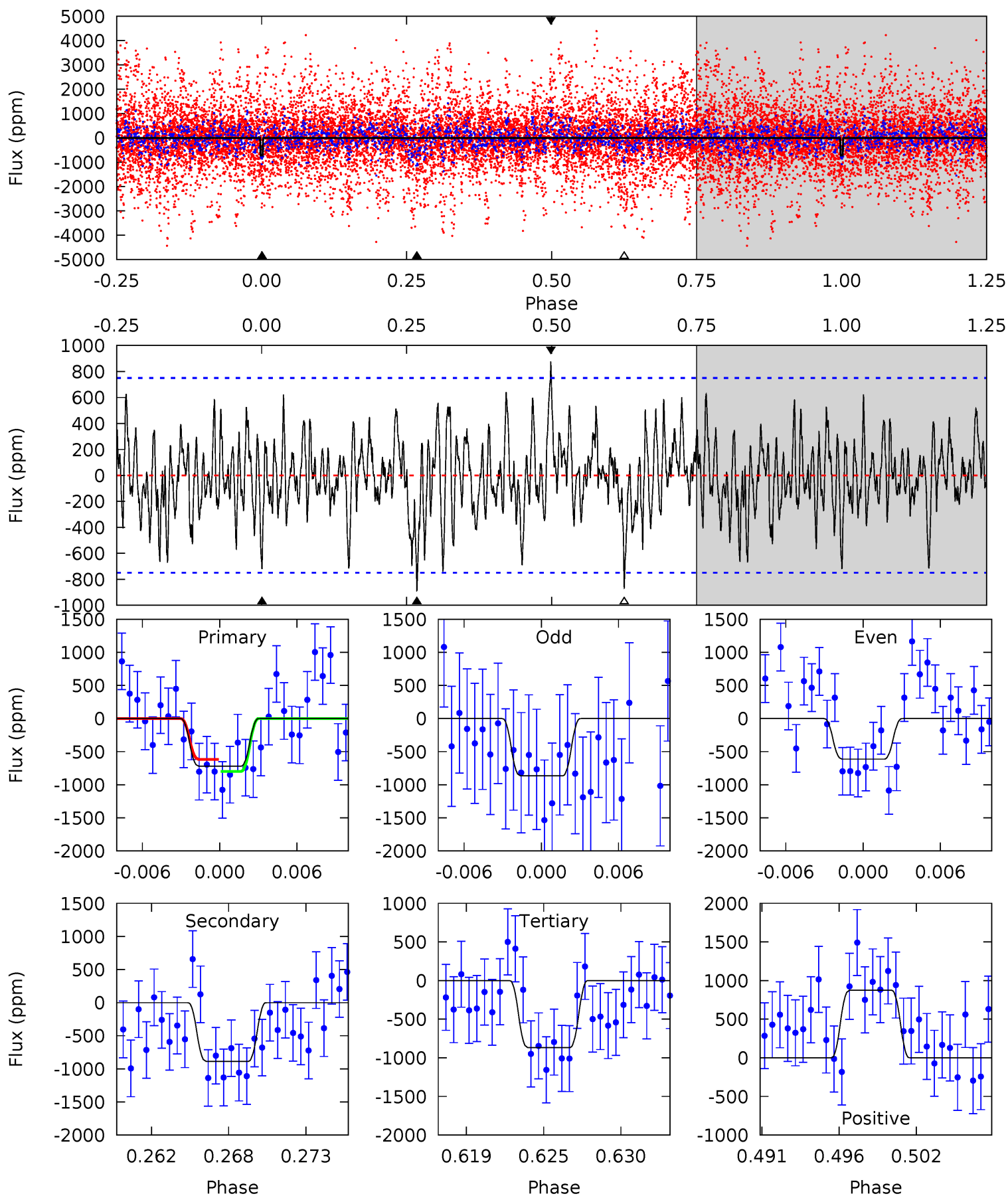
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
6.19	6.97	5.44	7.13	5.07	2.66	2.03	0.75	-0.94	1.53	-0.16	2.84	0.79	0.51	1.24



# Alt Model-Shift Uniqueness Test

009851970-06, P = 34.156884 Days, E = 111.293967 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
4.93	6.08	5.94	5.99	5.14	2.77	1.75	-1.01	-1.05	0.14	0.09	0.83	2.60	0.50	0.63



### Stellar Parameters For KIC 009851970

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$4965^{+151}_{-136}$	$4.555^{+0.072}_{-0.044}$	$-0.220^{+0.300}_{-0.300}$	$0.736^{+0.065}_{-0.079}$	$0.709^{+0.093}_{-0.050}$	$2.508^{+0.760}_{-0.407}$
	+3%/-3%	+2%/-1%	+136%/-136%	+9%/-11%	+13%/-7%	+30%/-16%
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 009851970-06 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-565 \pm 81$	$2.23^{+1.71}_{-1.32}$	$610^{+23}_{-23}$	$4644^{+2392}_{-907}$	$2093^{+10681}_{-1432}$
Alt.	$-887 \pm 146$	$2.65^{+1.71}_{-1.60}$	$610^{+23}_{-24}$	$4770^{+2683}_{-868}$	$2334^{+11883}_{-1477}$

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

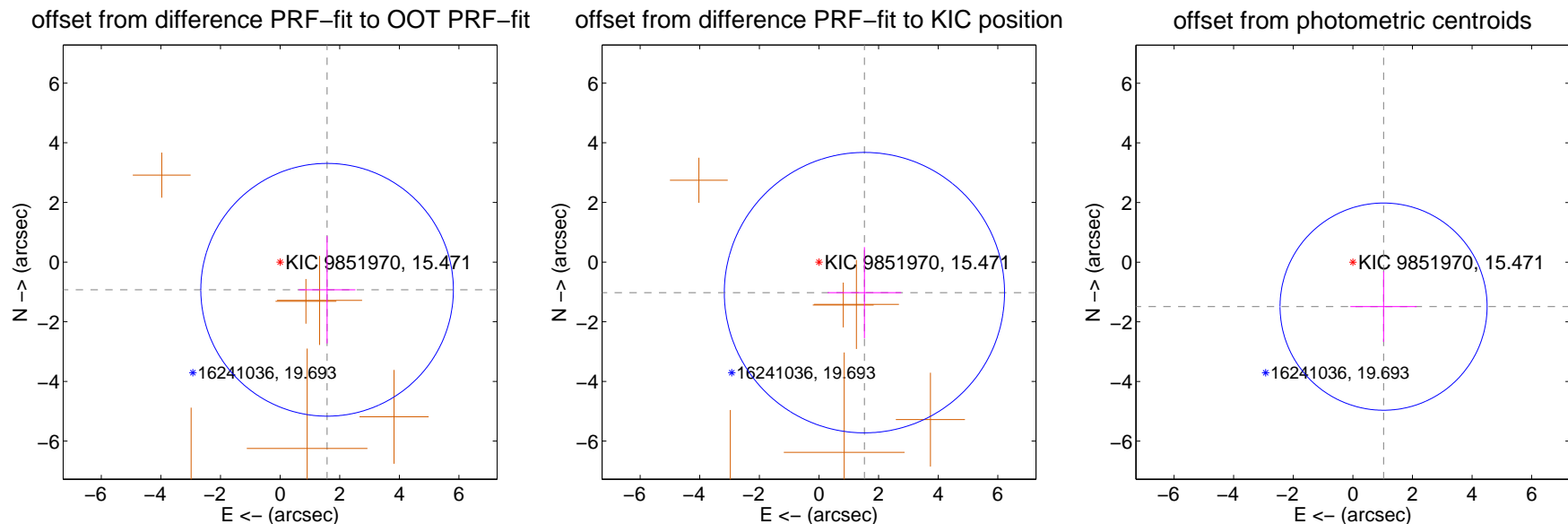
## DV Centroid Data

Supplemental centroid analysis for 009851970-06. Kepler magnitude: 15.47. Transit SNR 4.68

There are 0 quarters with good PRF difference image offsets

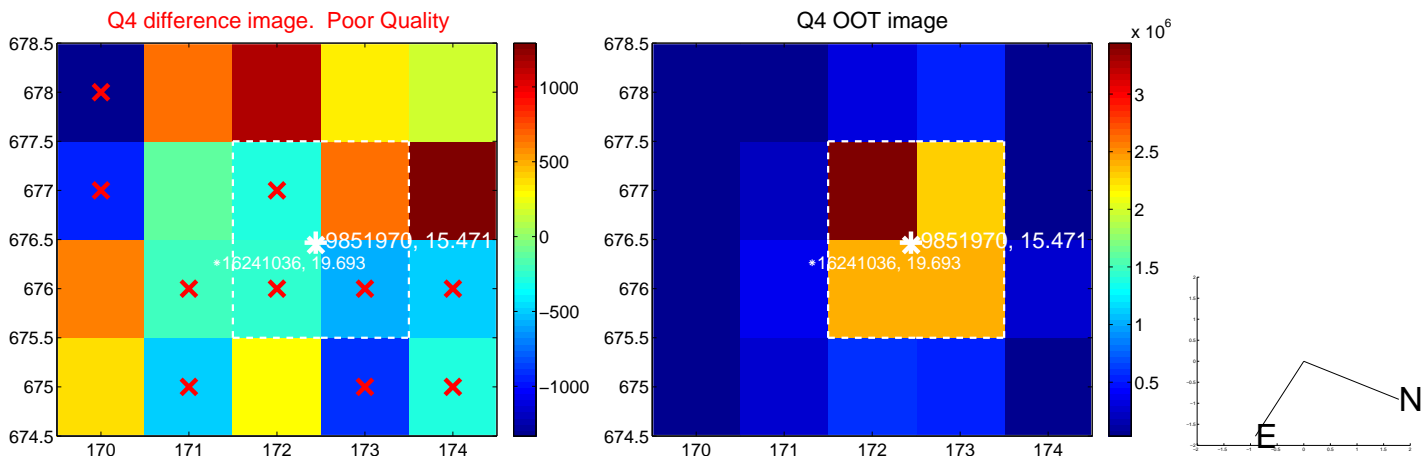
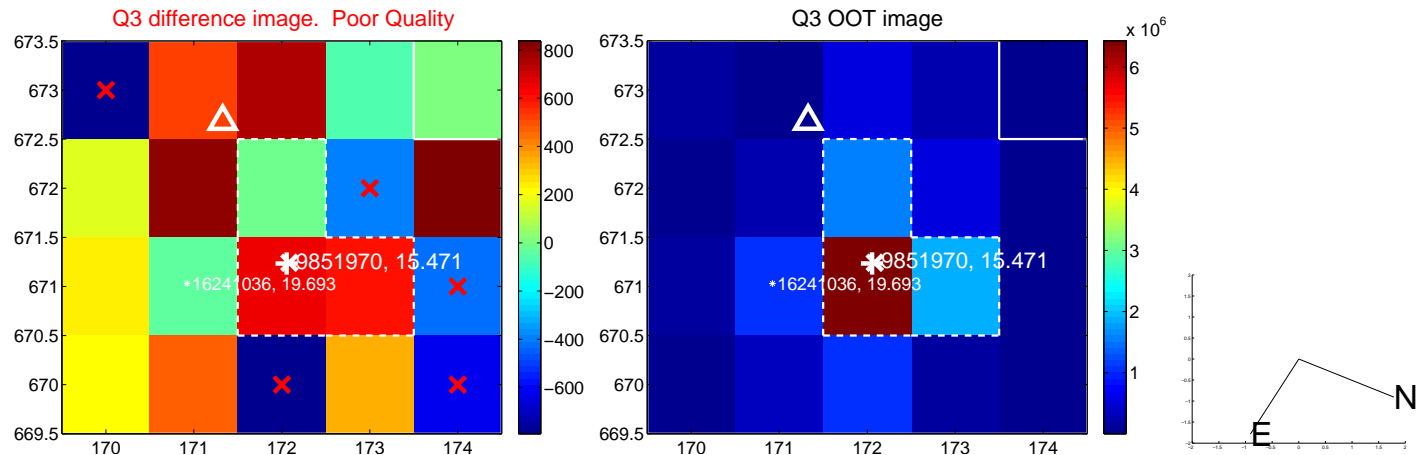
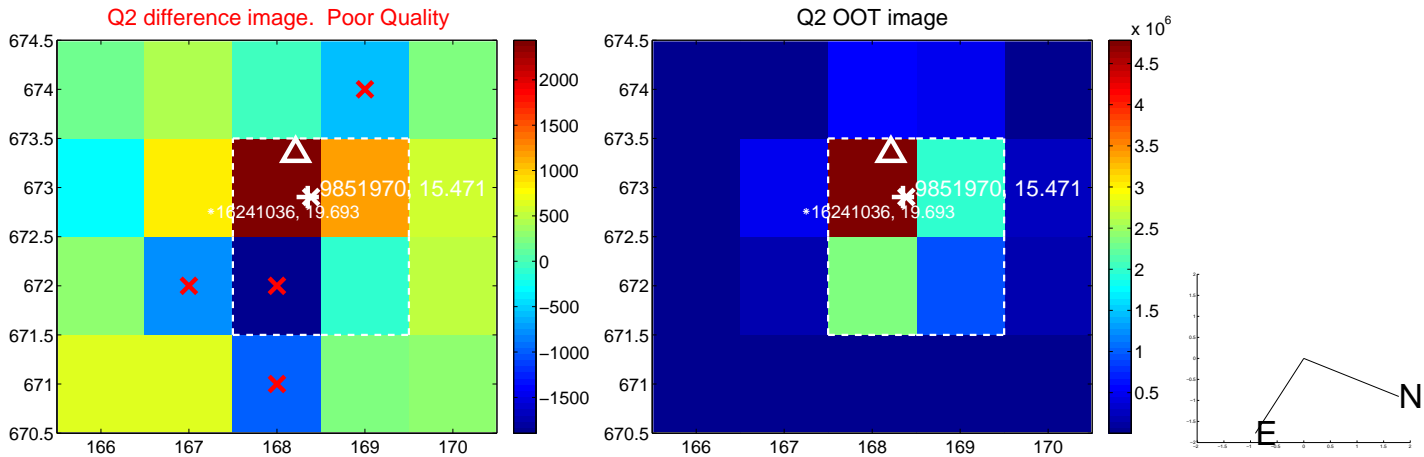
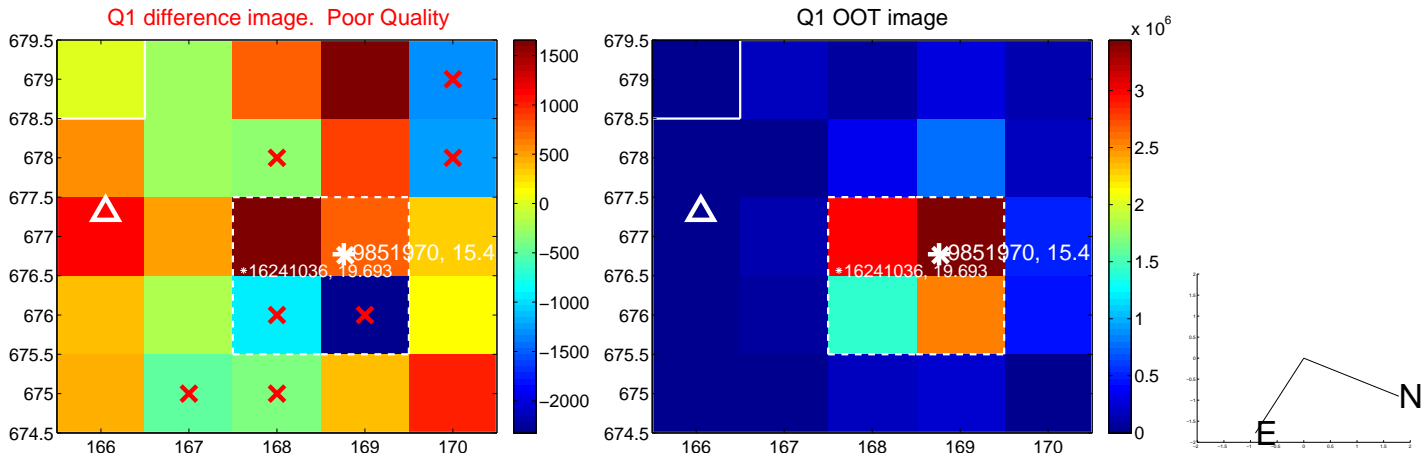
The direct PRF centroid is offset from the target star catalog position by about 0.13 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.829 \pm 1.412$	1.30	$-1.576 \pm 0.952$	$-0.929 \pm 1.797$
PRF-fit source offset from KIC position	$1.836 \pm 1.567$	1.17	$-1.524 \pm 1.232$	$-1.024 \pm 1.526$
photometric centroid source offset	$1.81 \pm 1.16$	1.57	$-1.03 \pm 1.11$	$-1.49 \pm 1.18$



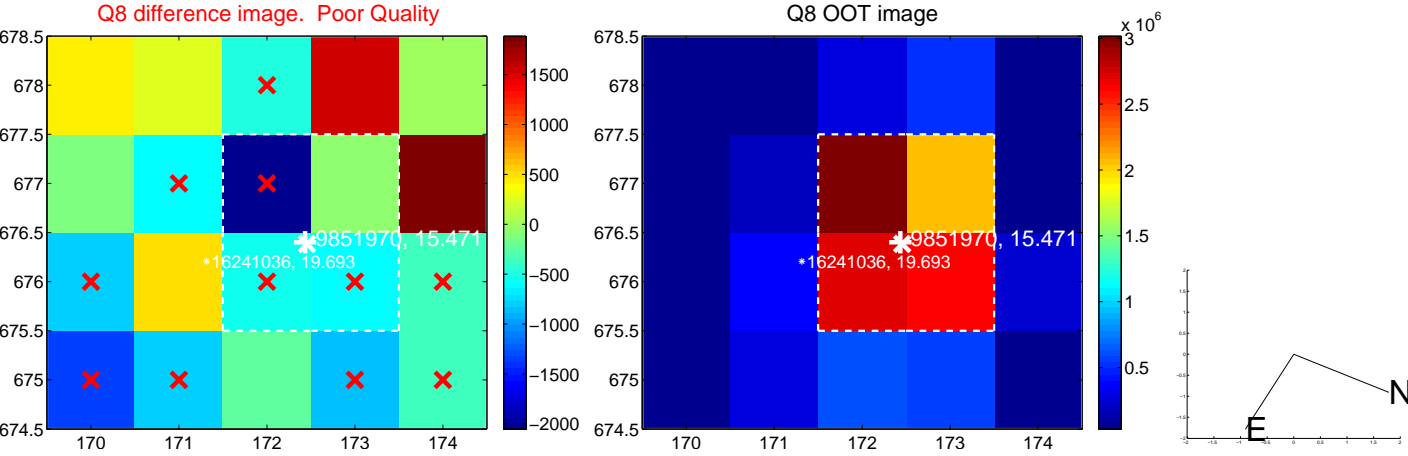
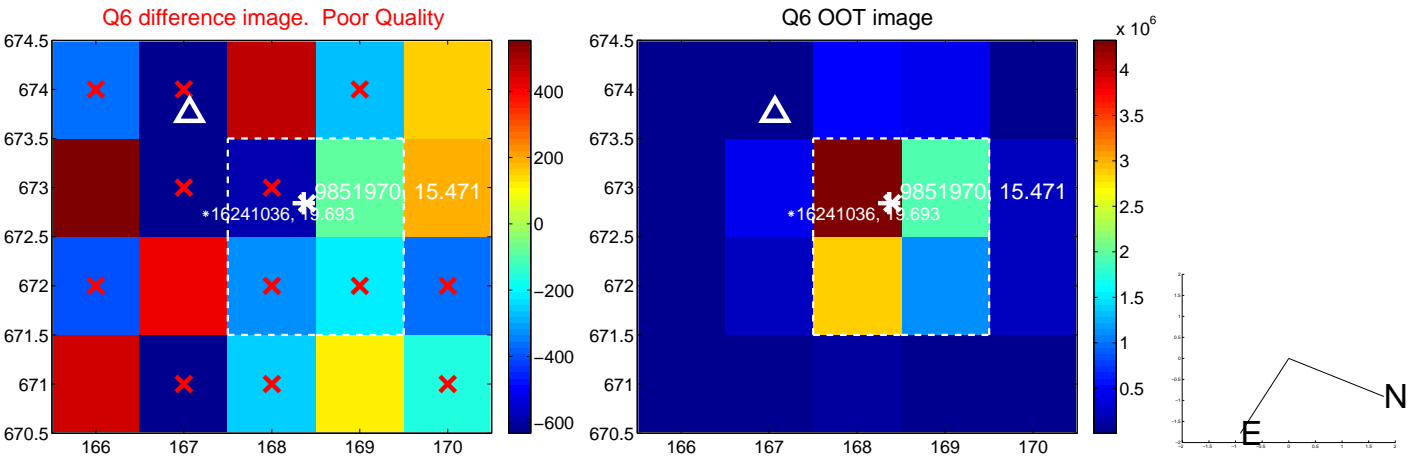
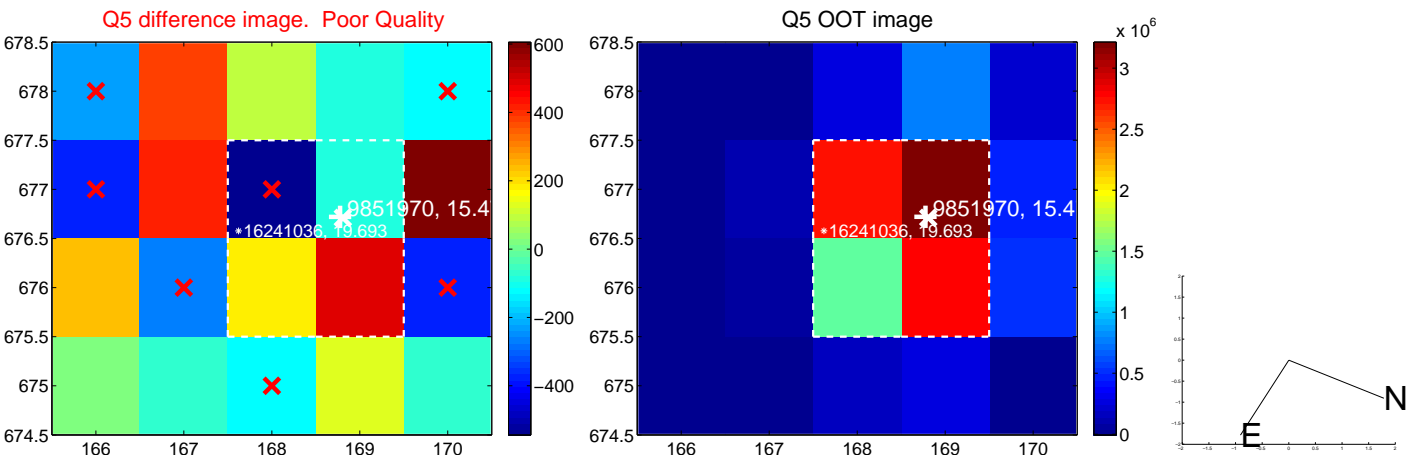
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

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

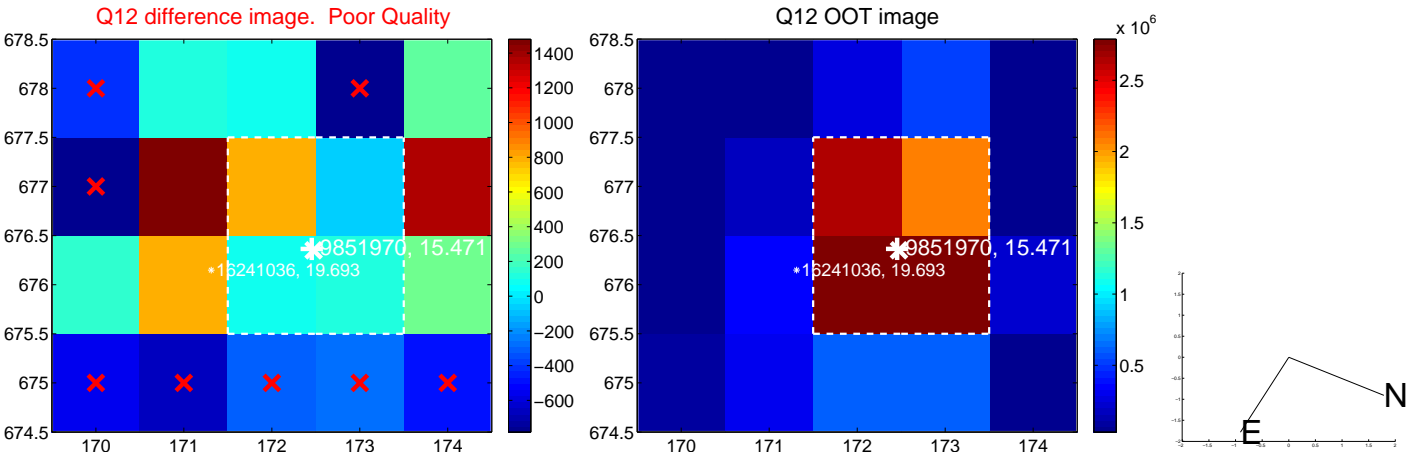
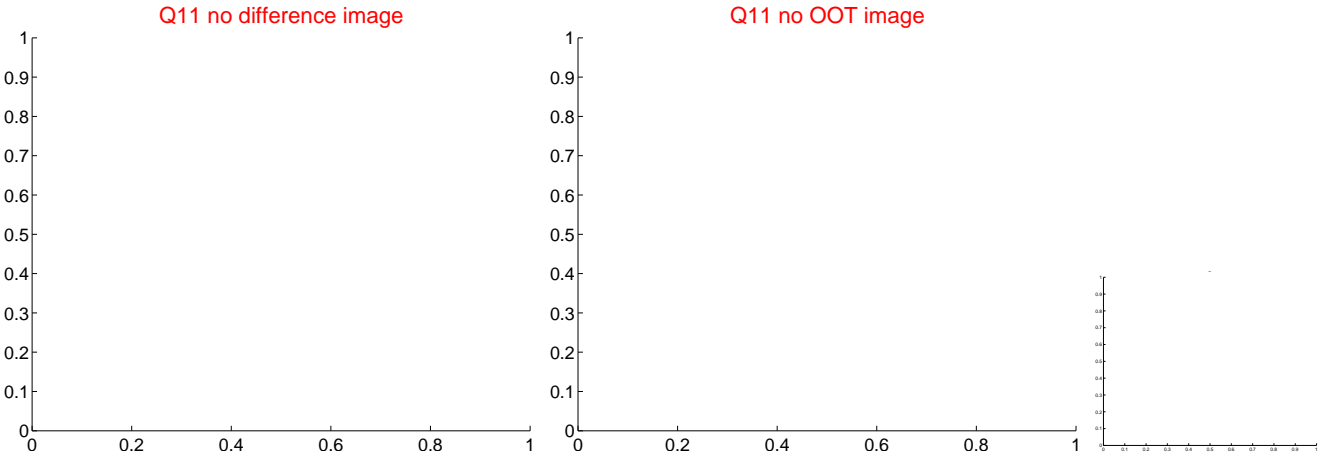
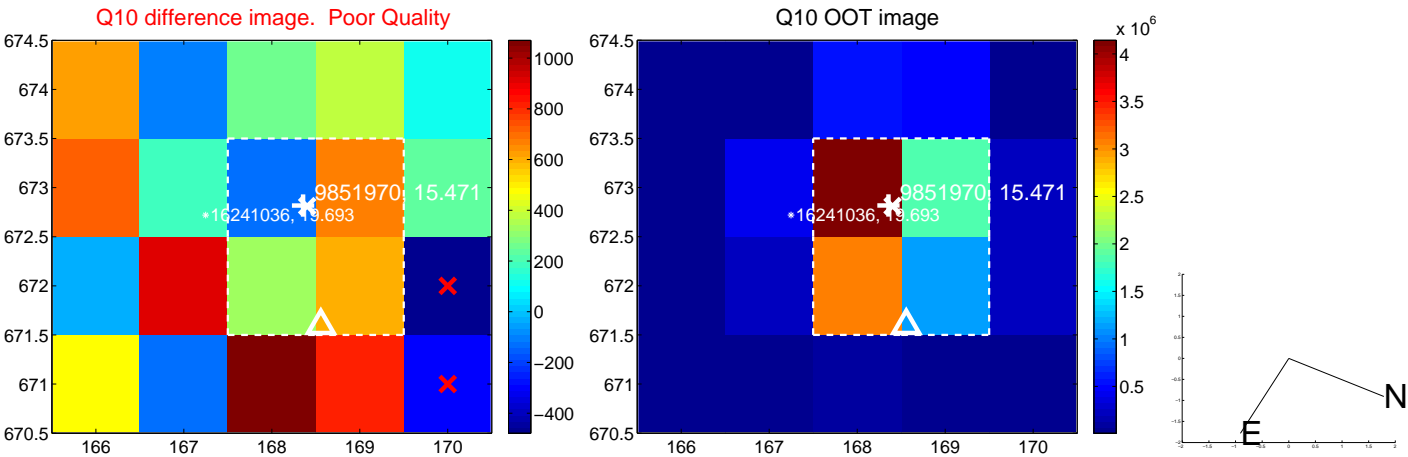
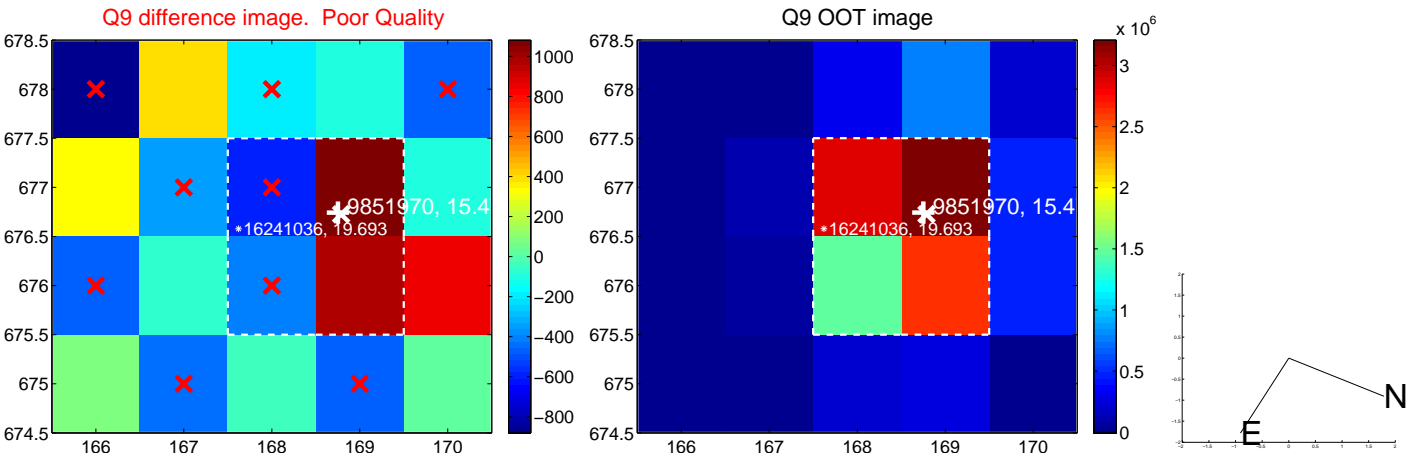




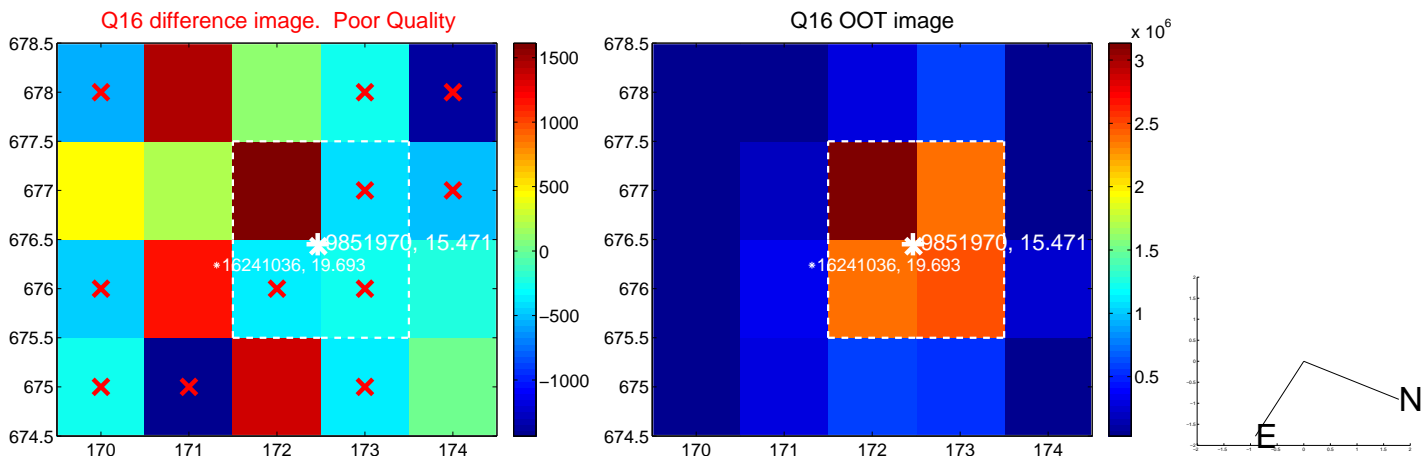
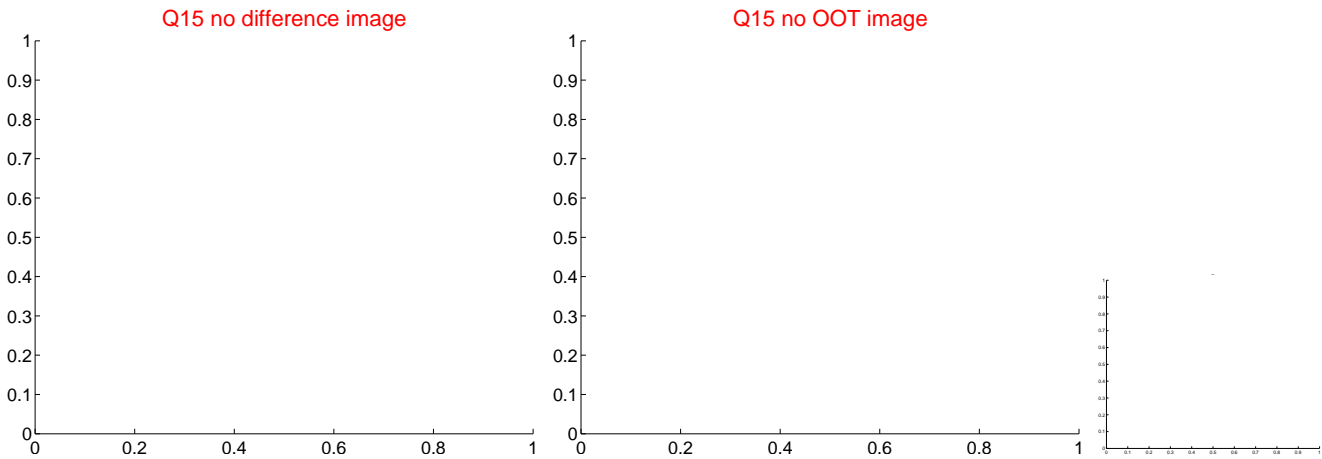
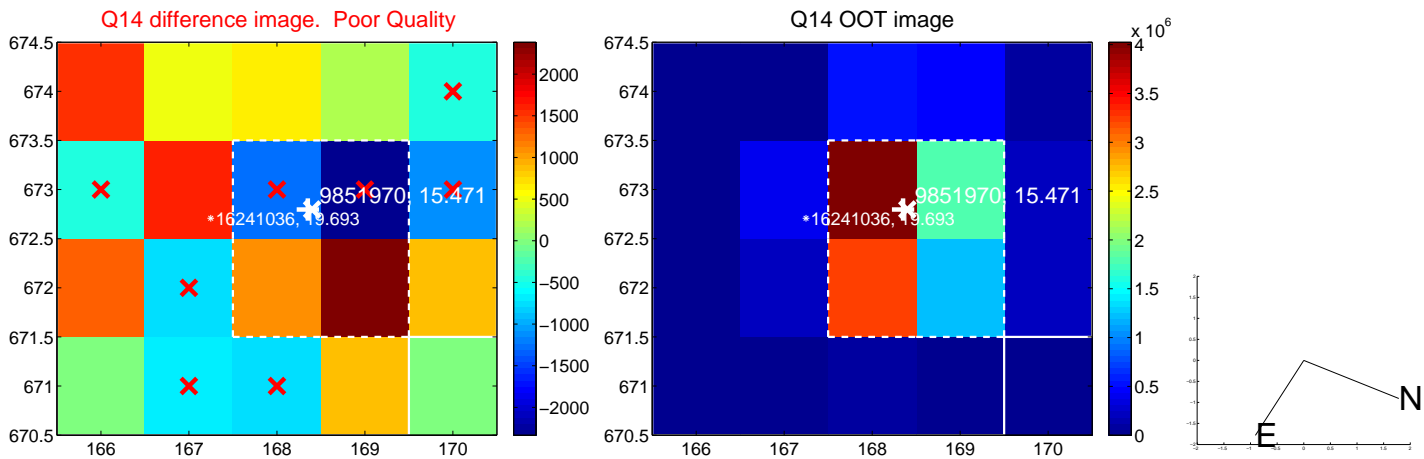
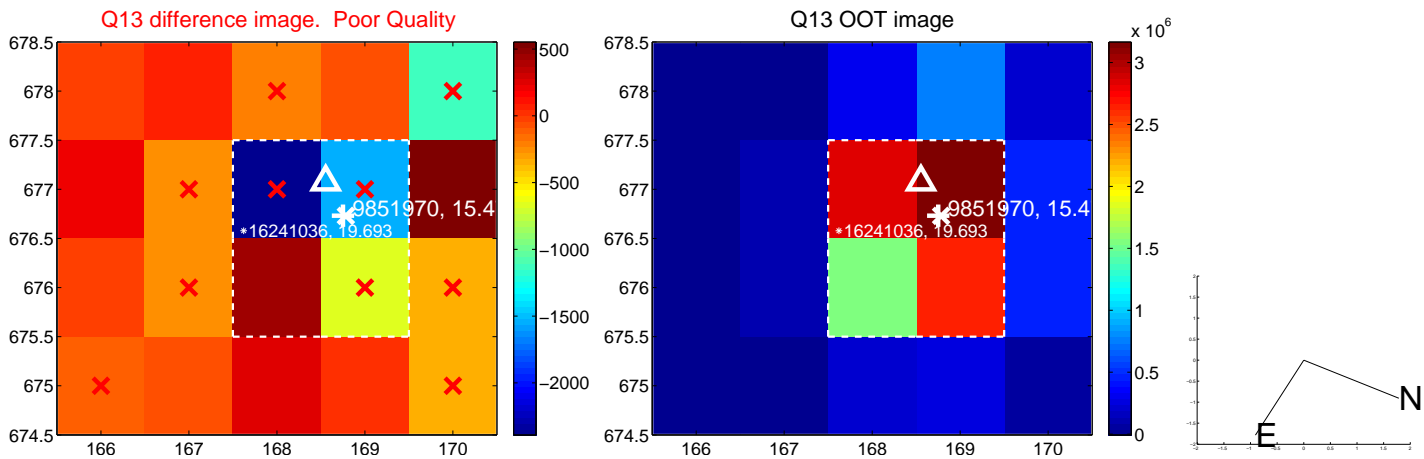
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



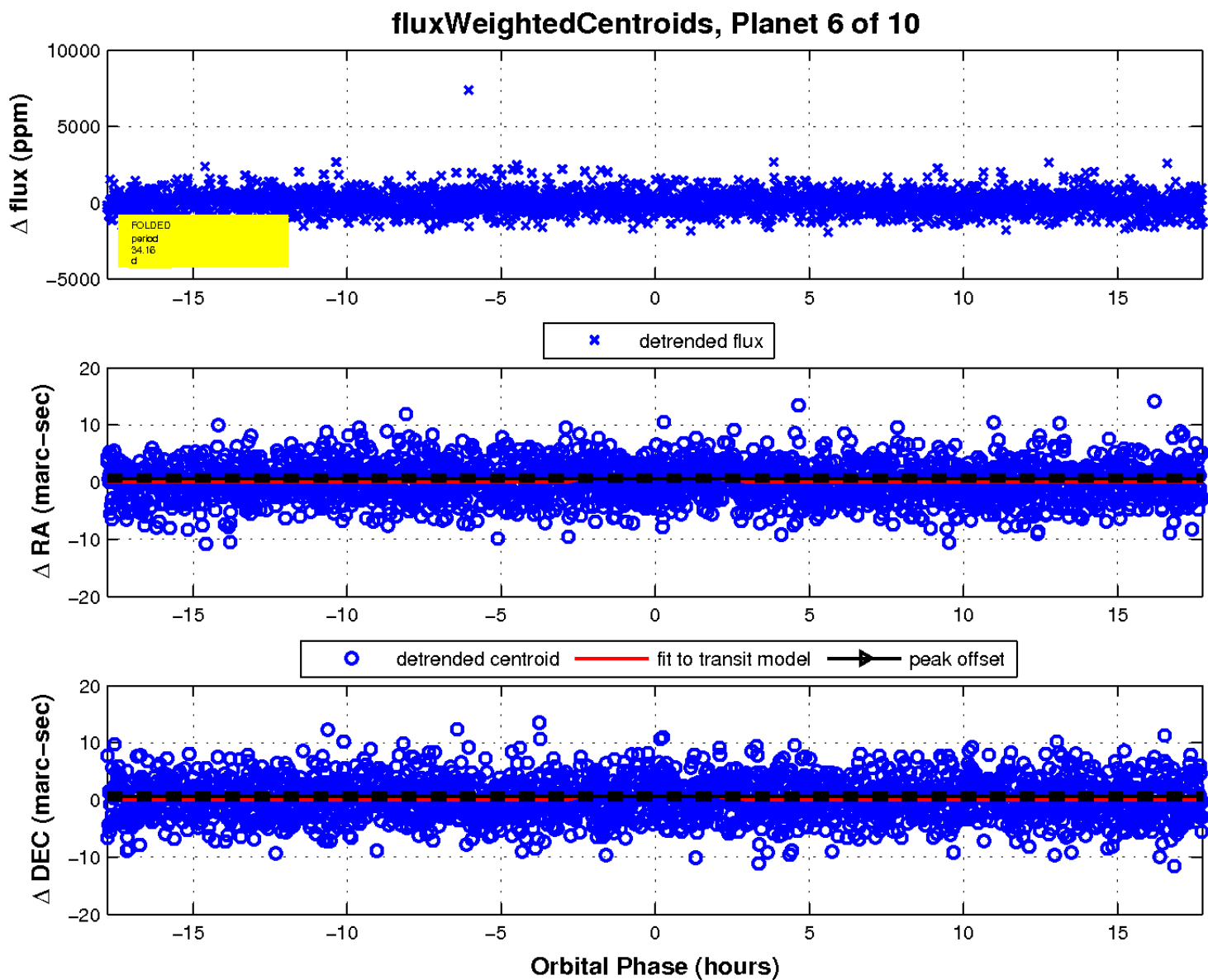
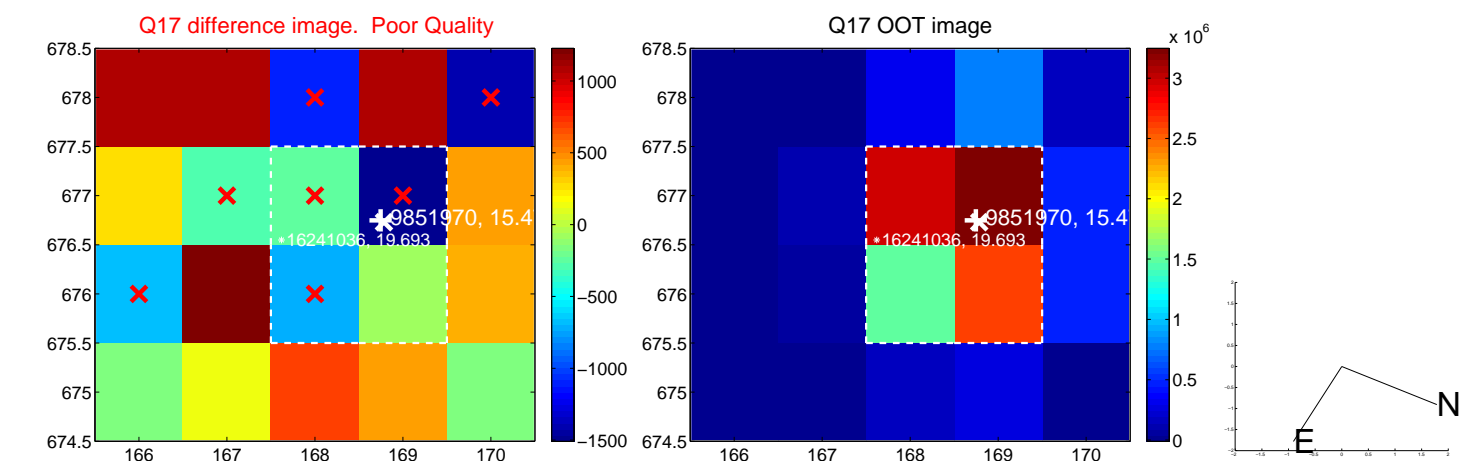
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

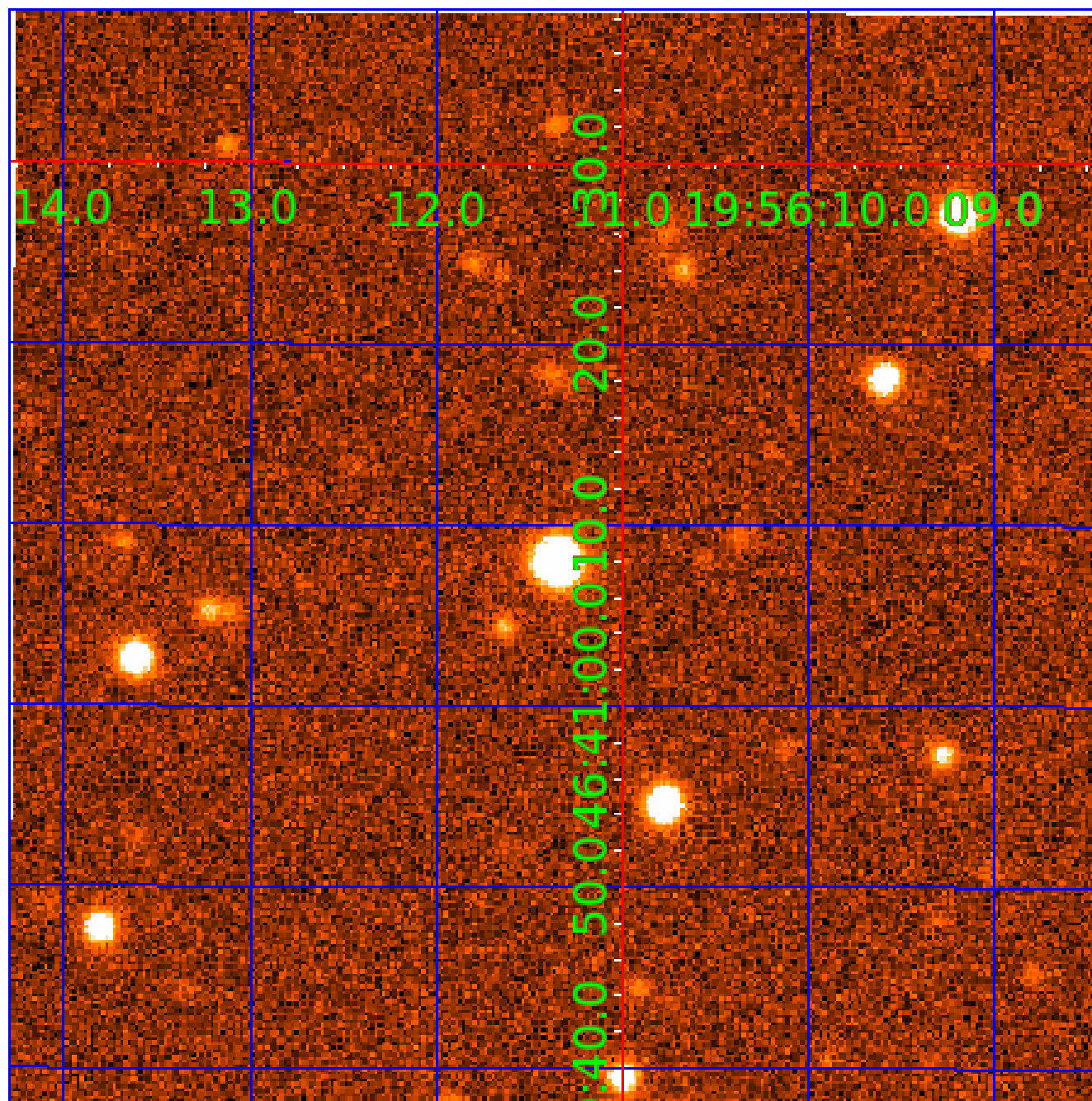


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009851970-01	OBS	4122.01	1.081931	131.550019	107.5	6.343	13.0	13.4	0.74	4965	0.74	871.41
009851970-02	OBS	No	318.191396	287.691504	2963.9	7.500	18.3	-1.0	0.74	4965	3.89	0.45
009851970-03	OBS	No	87.131904	158.497311	1337.3	12.255	11.1	8.0	0.74	4965	4.18	2.51
009851970-04	OBS	No	98.329975	161.538824	746.0	4.930	12.1	5.3	0.74	4965	2.36	2.13
009851970-05	OBS	No	58.028718	183.047579	986.5	7.168	11.4	8.4	0.74	4965	2.50	4.31
009851970-06	OBS	No	34.155362	145.442225	495.6	5.928	10.4	4.7	0.74	4965	1.86	8.73
009851970-07	OBS	No	43.866421	135.859401	759.6	3.082	10.4	4.7	0.74	4965	2.21	6.26
009851970-08	OBS	No	485.794267	253.271172	1176.7	9.000	9.7	-1.0	0.74	4965	2.45	0.25
009851970-09	OBS	No	69.926614	193.429290	667.9	4.803	9.9	4.1	0.74	4965	2.11	3.36
009851970-10	OBS	No	665.534623	173.054303	2457.4	17.077	9.5	8.7	0.74	4965	6.96	0.17

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009851970-01	OBS	FP	0.00	0	1	1	1	MOD_SEC_ALT—CENT_RESOLVED_OFFSET—HALO_GHOST—EPHEM_MATCH
009851970-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_ZUMA—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_NOFITS
009851970-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_ALT—CENT_FEW_DIFFS
009851970-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_ZUMA_TRACKER—TRANS_GAPPED—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009851970-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE—TRANS_GAPPED—LPP_DV—CENT_FEW_DIFFS
009851970-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
009851970-07	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_TRACKER—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
009851970-08	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL—LPP_DV—ALL_TRANS_CHASES—NO_FITS—CENT_NOFITS
009851970-09	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE_TRACKER—TRANS_GAPPED—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS—HALO_GHOST
009851970-10	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_SKYE—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—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 009851970-07

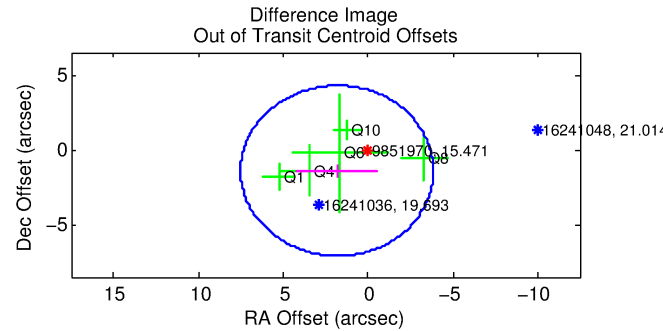
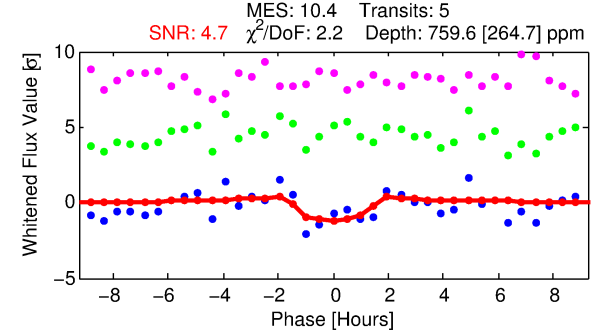
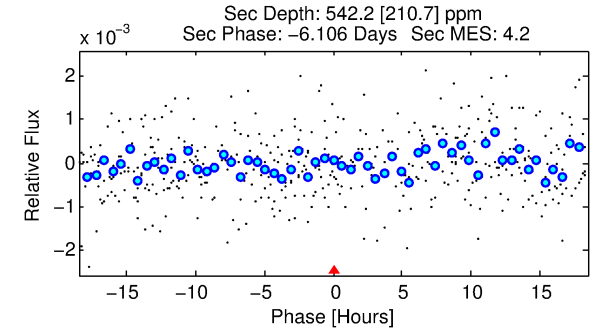
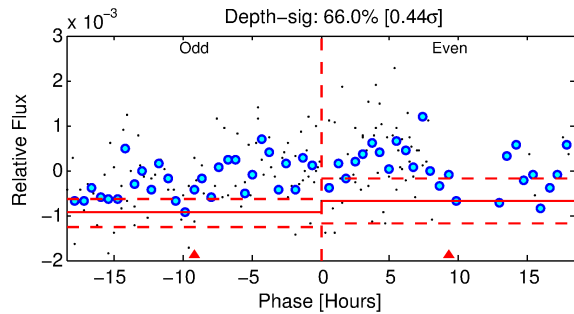
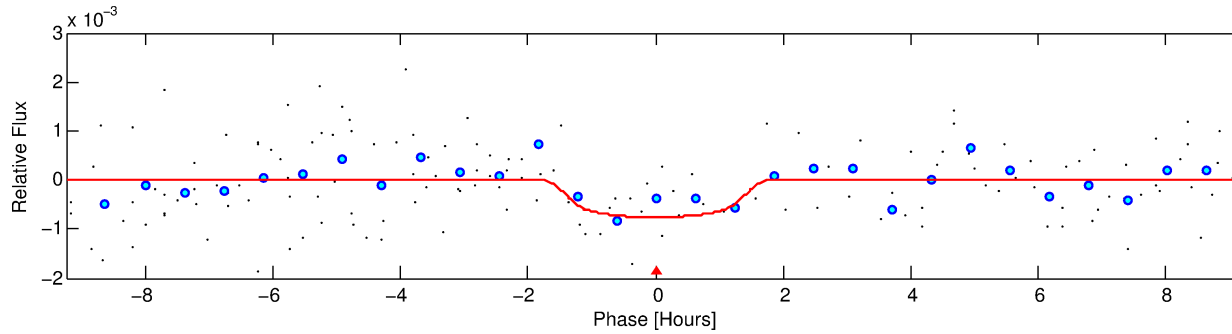
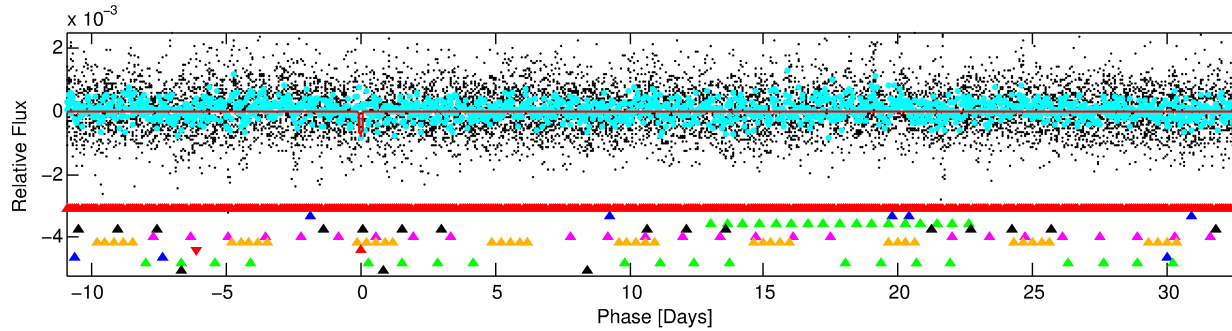
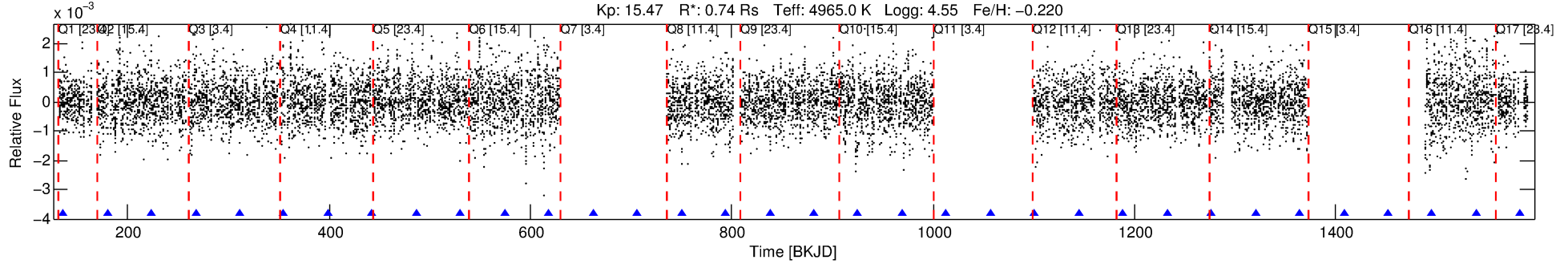
No Significant Match Found

# DV One-Page Summary

KIC: 9851970 Candidate: 7 of 10 Period: 43.866 d

KOI: K04122 Corr: No Ephemeris Match

Kp: 15.47 R\*: 0.74 Rs Teff: 4965.0 K Logg: 4.55 Fe/H: -0.220



## DV Fit Results:

Period = 43.86642 [0.00142] d  
Epoch = 135.8594 [0.0262] BKJD  
Rp/R\* = 0.0275 [0.1222]  
a/R\* = 76.99 [1210.76]  
b = 0.74 [9.64]  
Seff = 6.26 [1.12]  
Teq = 403 [18] K  
Rp = 2.21 [9.82] Re  
a = 0.2171 [0.0196] AU  
Ag = 2888.01 [25716.01] [0.11σ]  
Teffp = 4571 [10175] K [0.4σ]

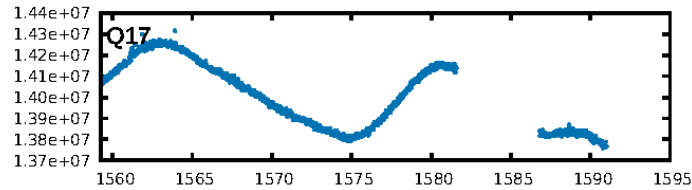
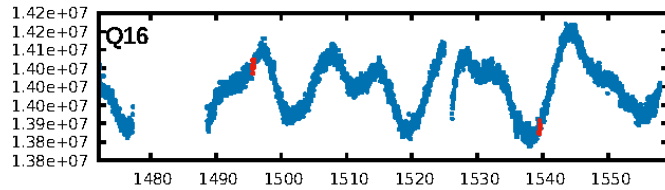
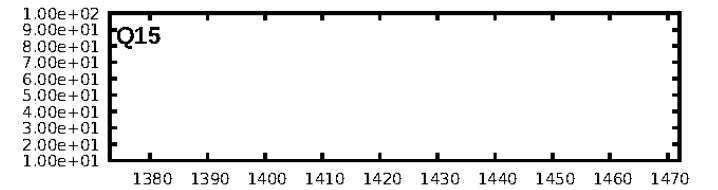
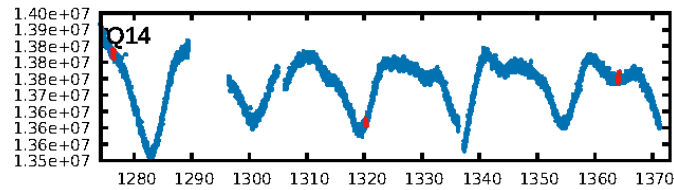
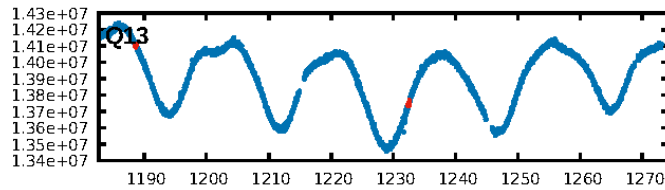
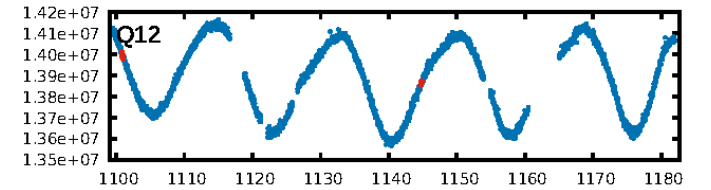
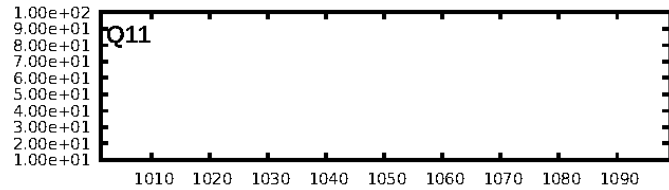
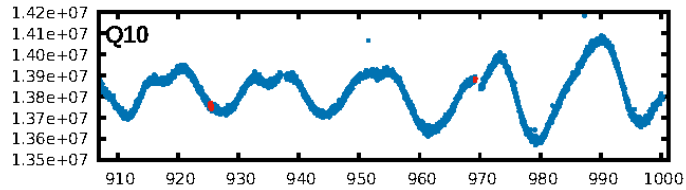
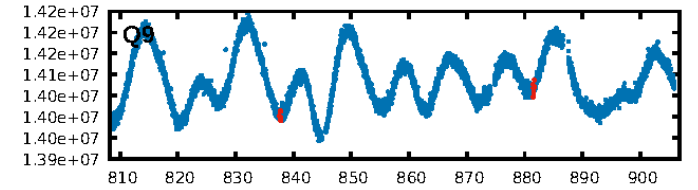
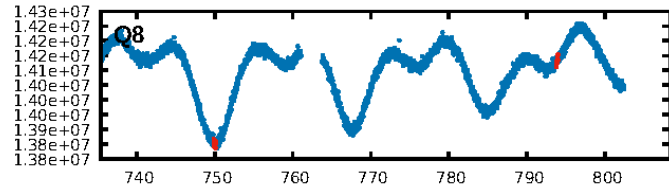
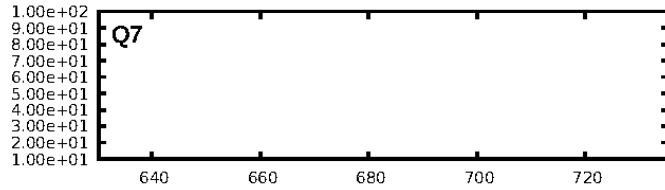
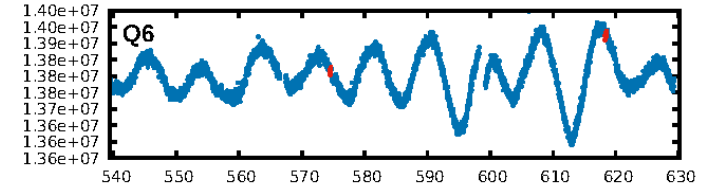
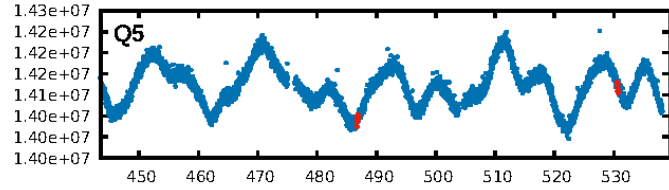
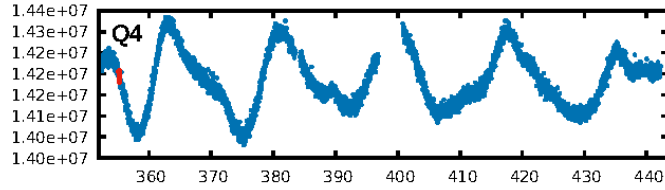
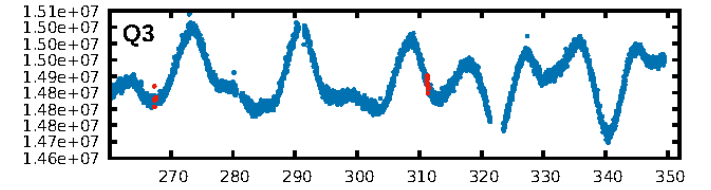
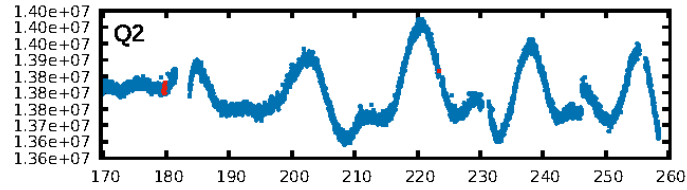
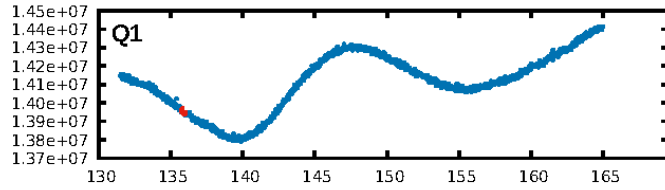
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [34.88σ]  
LongPeriod-sig: 100.0% [43.56σ]  
ModelChiSquare2-sig: 1.5%  
ModelChiSquareGof-sig: 95.5%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [5/5]  
GhostDiagnostic-chr: 0.6152  
Centroid-sig: 6.6%  
Centroid-so: 2.230 arcsec [1.75σ]  
OotOffset-rm: 2.304 arcsec [1.22σ]  
KicOffset-rm: 2.307 arcsec [1.36σ]  
OotOffset-st: 2/0/2/1 [5]  
KicOffset-st: 2/0/2/1 [5]  
DiffImageQuality-fgm: 0.00 [0/5]  
DiffImageOverlap-fno: 0.08 [1/13]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 08:50:40 Z

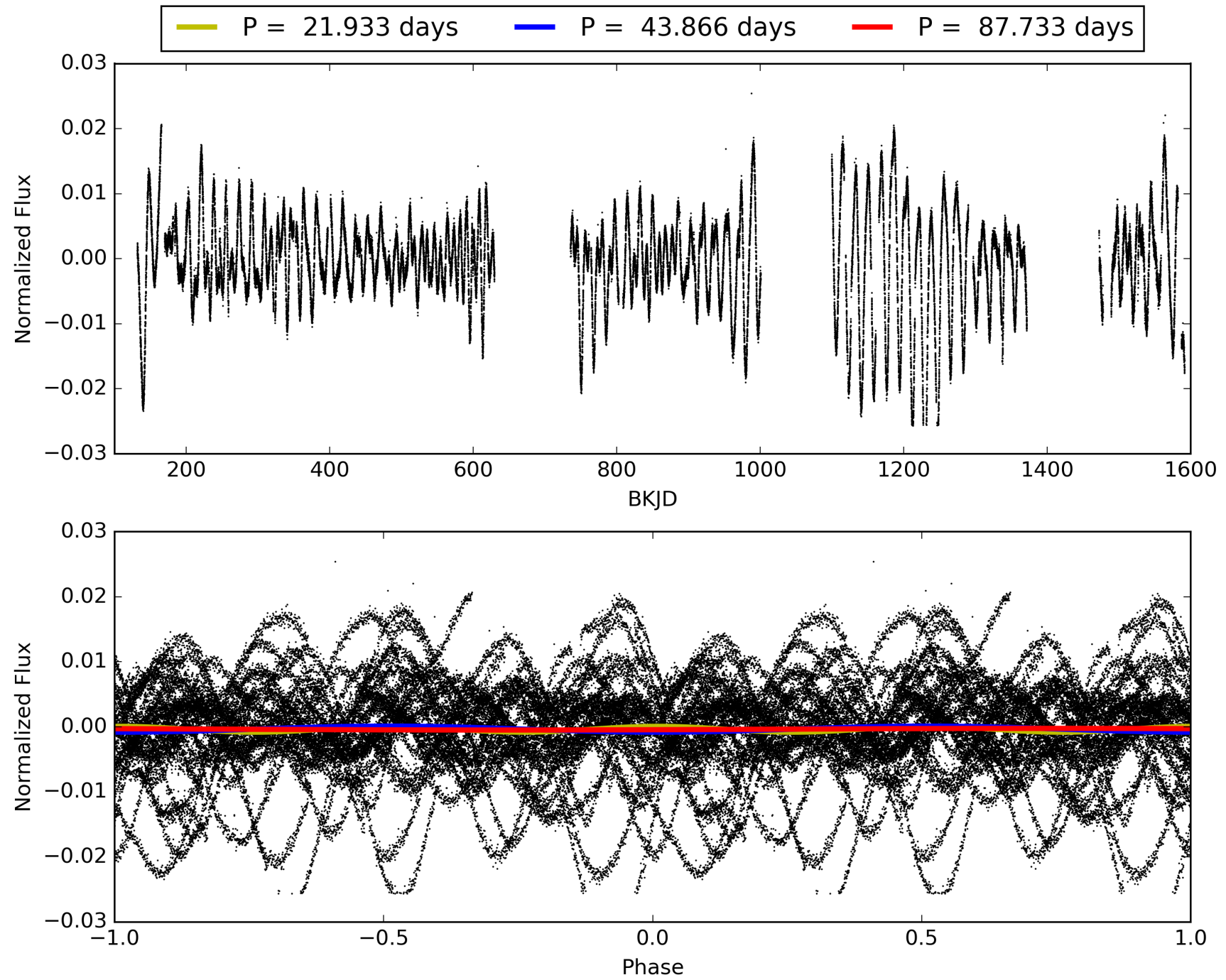
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 009851970-07, PDC Light Curves



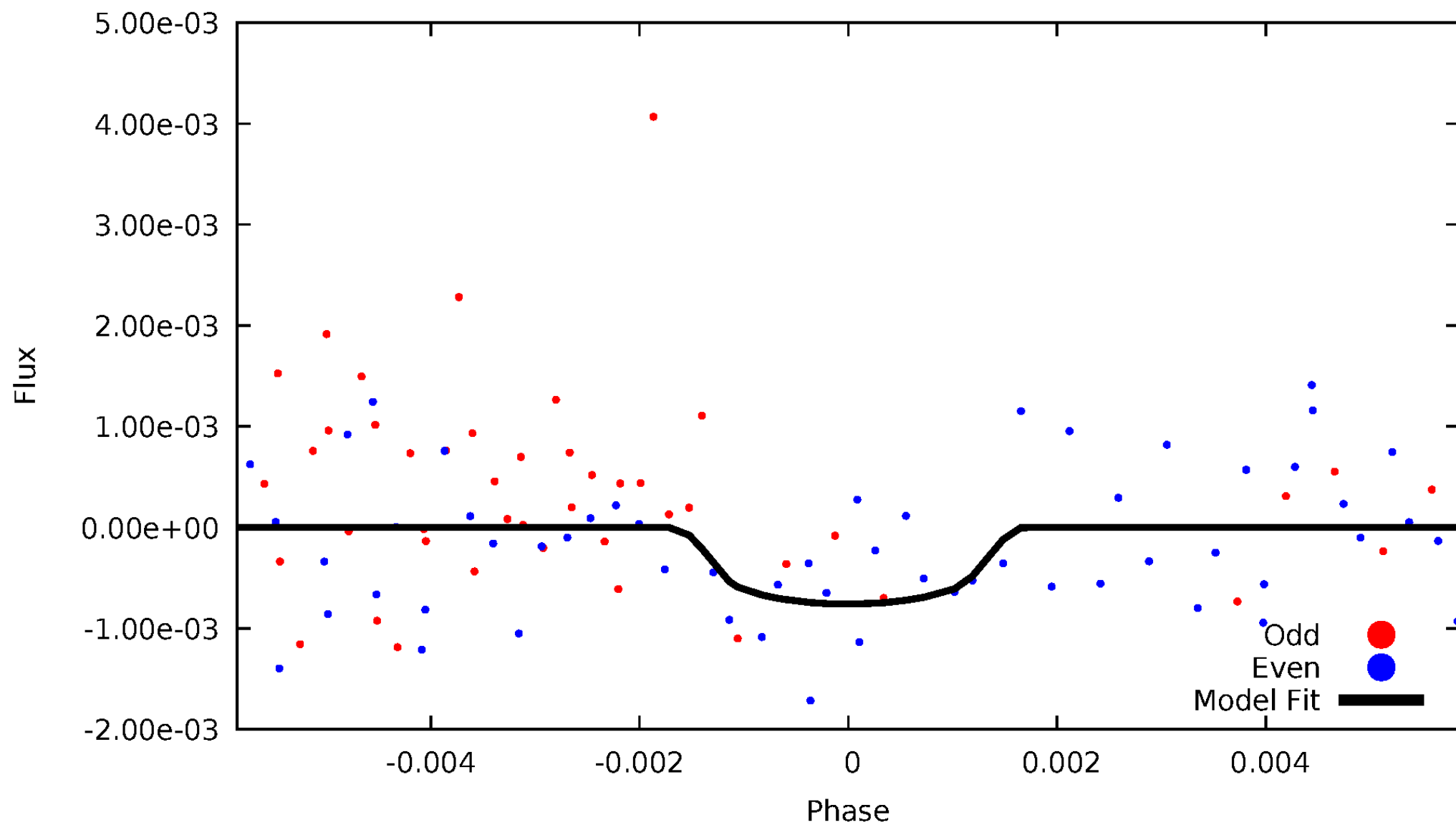


TCE 009851970-07



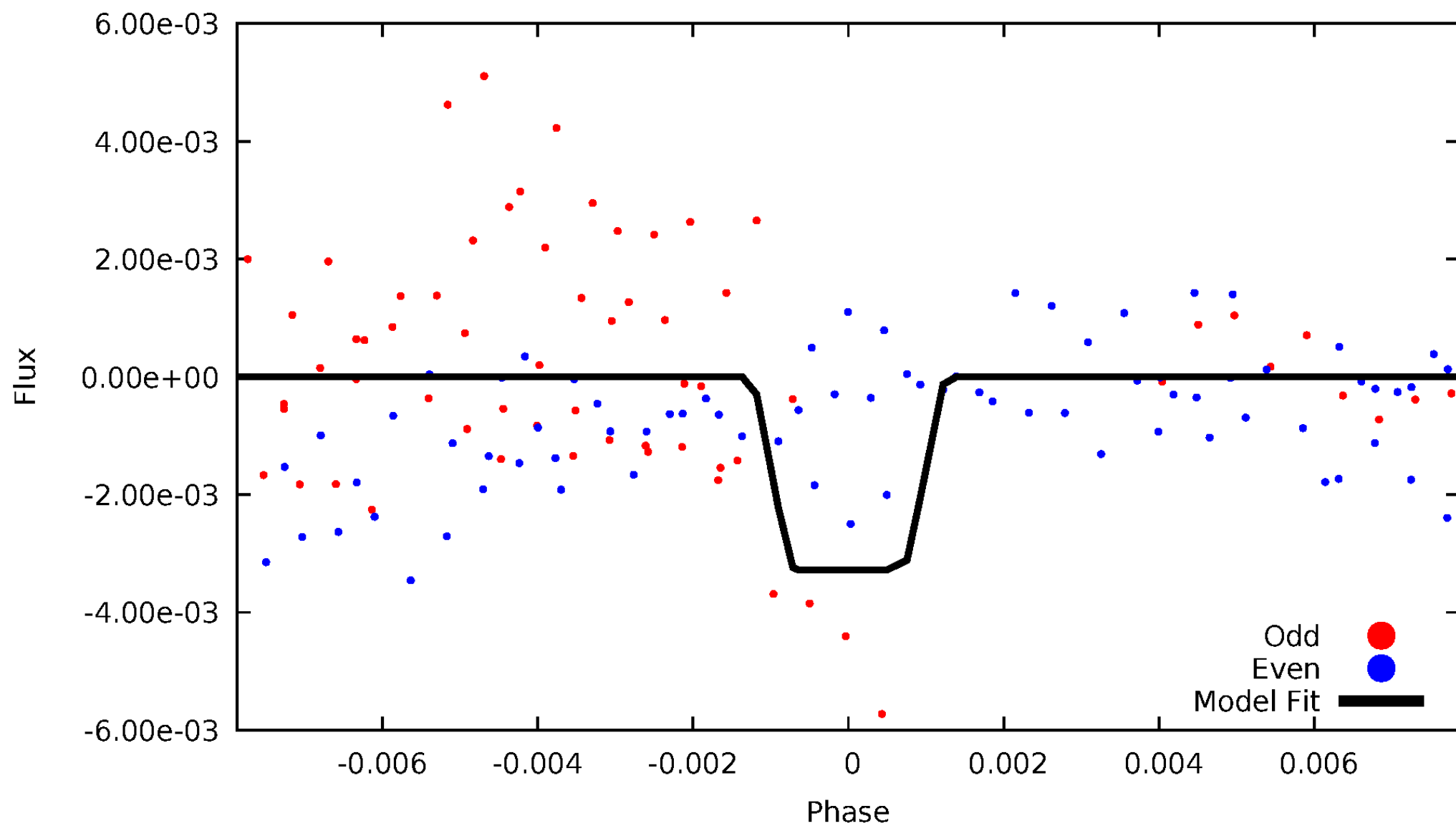
# DV Odd/Even

TCE 009851970-07



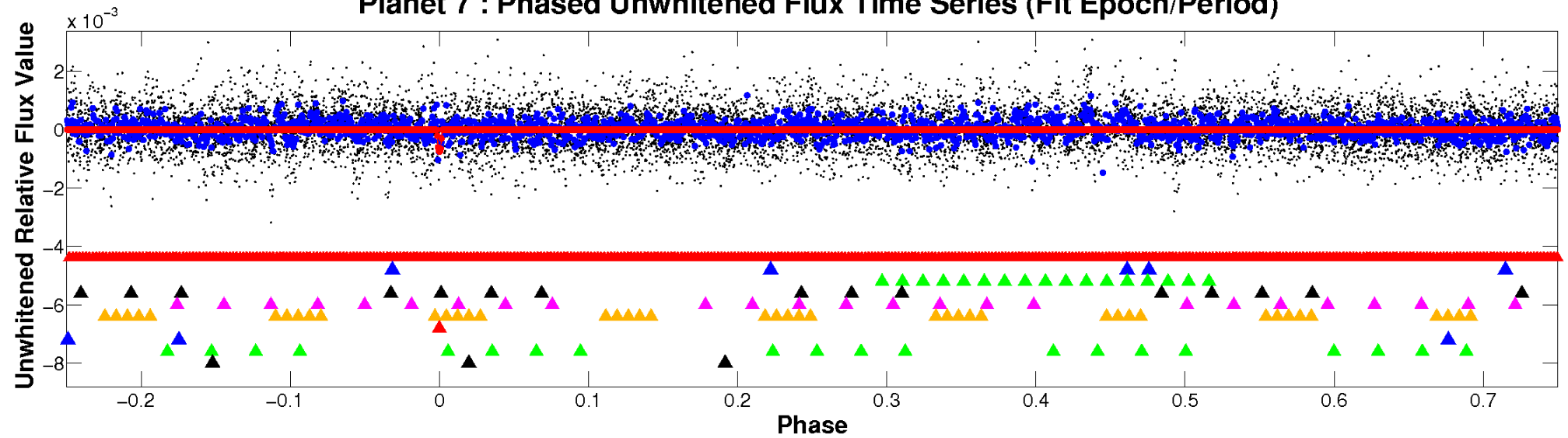
# ALT Odd/Even

TCE 009851970-07

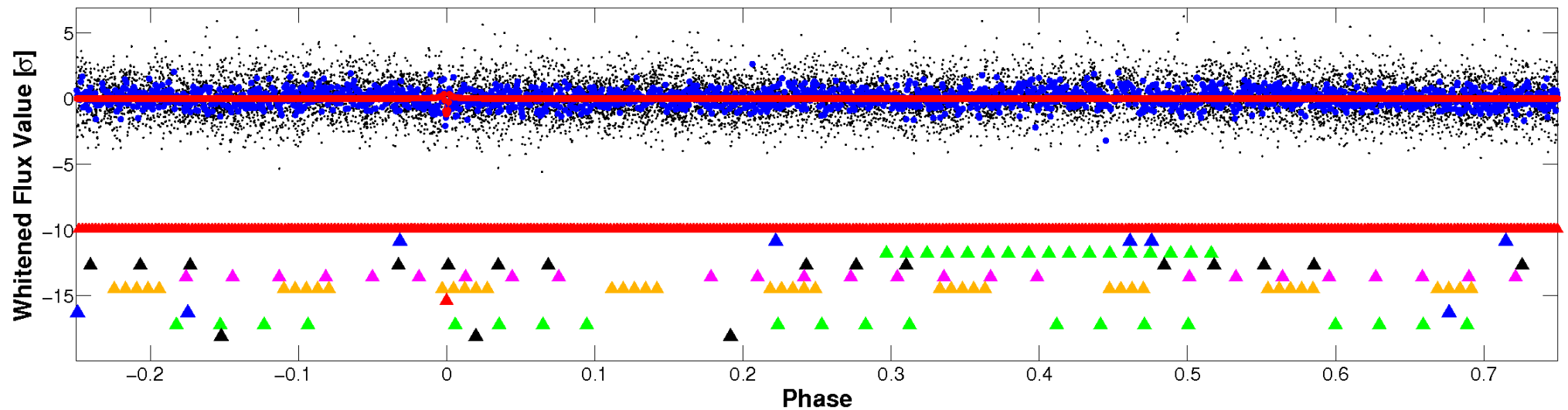


# Non-Whitened Vs. Whitened Light Curve

## Planet 7 : Phased Unwhitened Flux Time Series (Fit Epoch/Period)

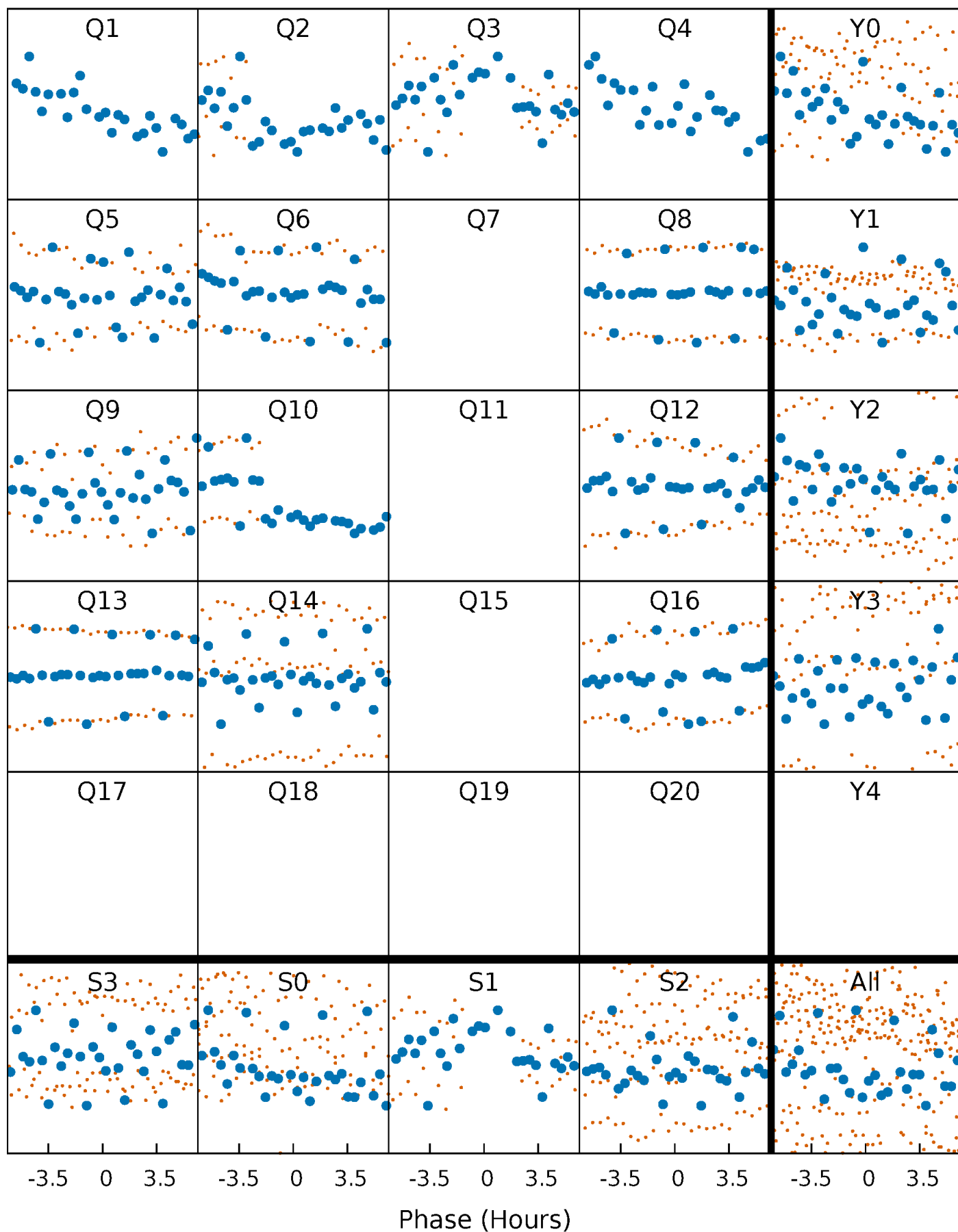


## Planet 7 : Phased Whitened Flux Time Series (Fit Epoch/Period)



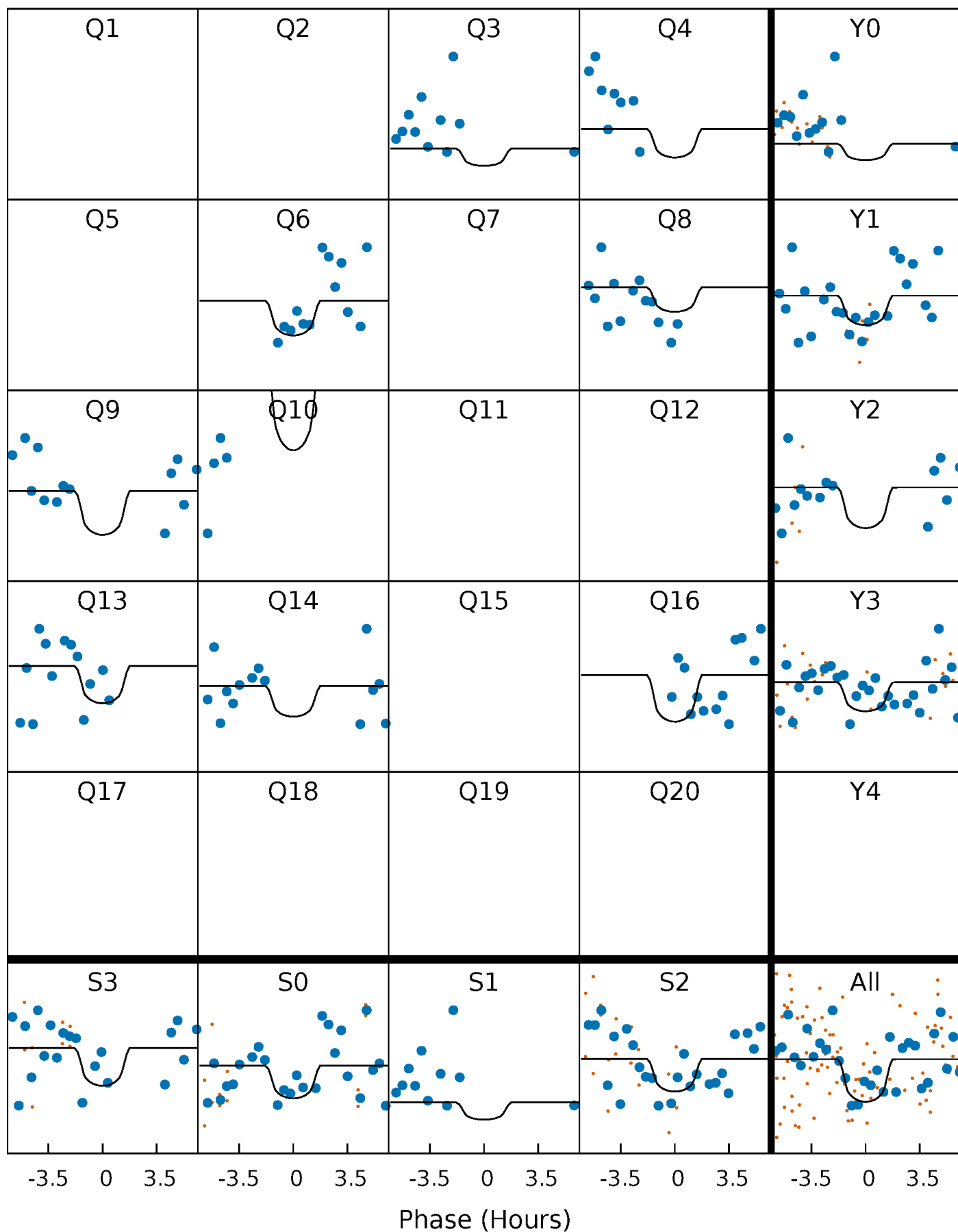
# PDC Quarter-Phased Transit Curves

TCE 009851970-07 P= 43.866421 Days  $T_0=135.859400$  (BKJD)



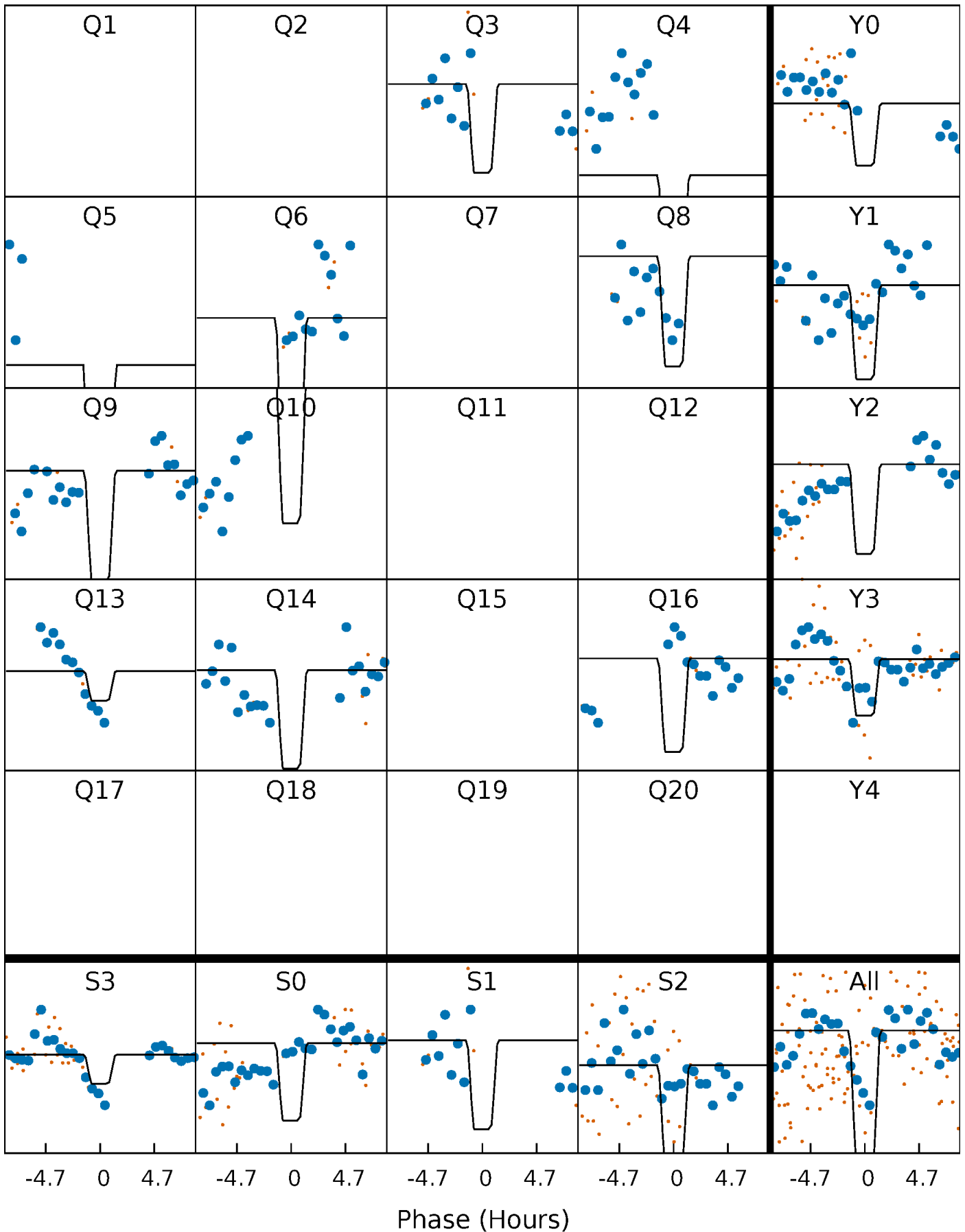
# DV Quarter-Phased Transit Curves

TCE 009851970-07 P= 43.866421 Days  $T_0=135.859400$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

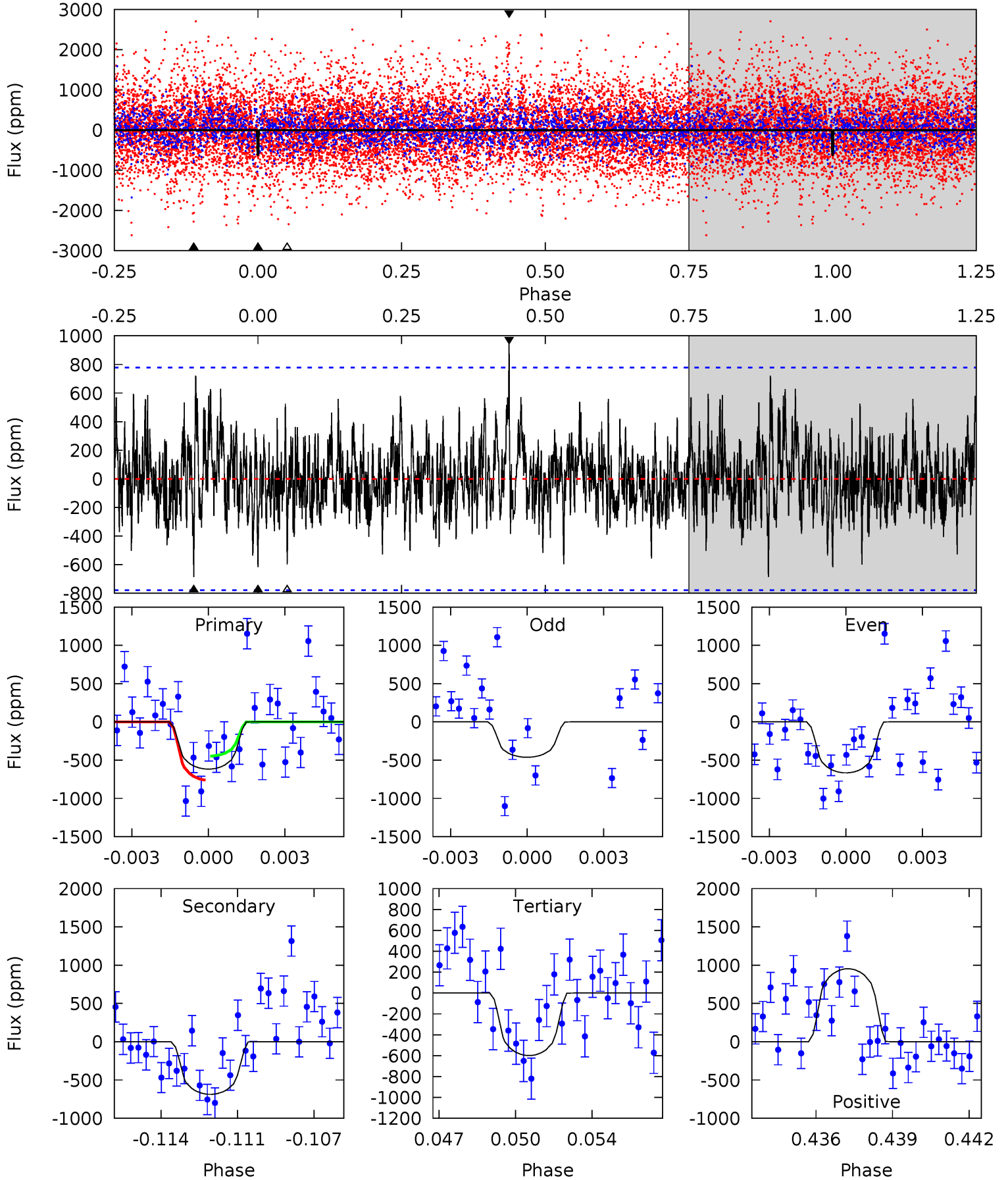
TCE 009851970-07     $P = 43.867600$  Days     $T_0 = 135.825724$  (BKJD)



# DV Model-Shift Uniqueness Test

009851970-07, P = 43.866421 Days, E = 91.992979 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
4.14	4.62	4.02	6.40	5.23	2.93	1.33	0.12	-2.26	0.59	-1.79	0.54	1.13	0.58	1.06

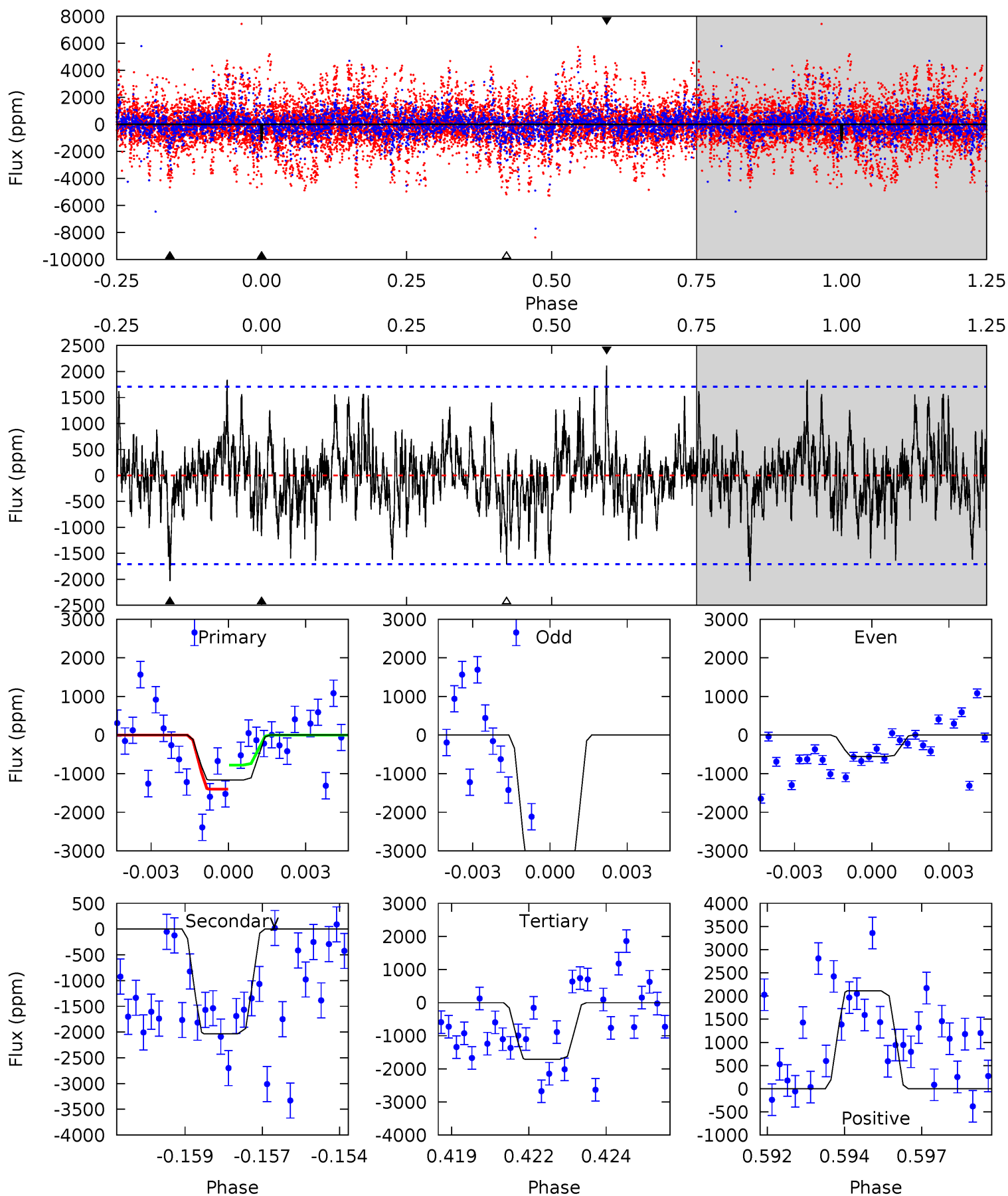




# Alt Model-Shift Uniqueness Test

009851970-07, P = 43.867600 Days, E = 91.958124 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
3.60	6.28	5.30	6.52	5.28	3.01	1.57	-1.70	-2.92	0.98	-0.24	4.28	4.41	0.51	0.95



### Stellar Parameters For KIC 009851970

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$4965^{+151}_{-136}$	$4.555^{+0.072}_{-0.044}$	$-0.220^{+0.300}_{-0.300}$	$0.736^{+0.065}_{-0.079}$	$0.709^{+0.093}_{-0.050}$	$2.508^{+0.760}_{-0.407}$
	+3%/-3%	+2%/-1%	+136%/-136%	+9%/-11%	+13%/-7%	+30%/-16%
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 009851970-07 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-687 \pm 149$	$7.19^{+8.30}_{-4.87}$	$561^{+21}_{-20}$	$3189^{+1546}_{-583}$	$337^{+3013}_{-265}$
Alt.	$-2032 \pm 324$	$8.47^{+8.41}_{-5.66}$	$561^{+22}_{-20}$	$3630^{+1863}_{-692}$	$740^{+6005}_{-553}$

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

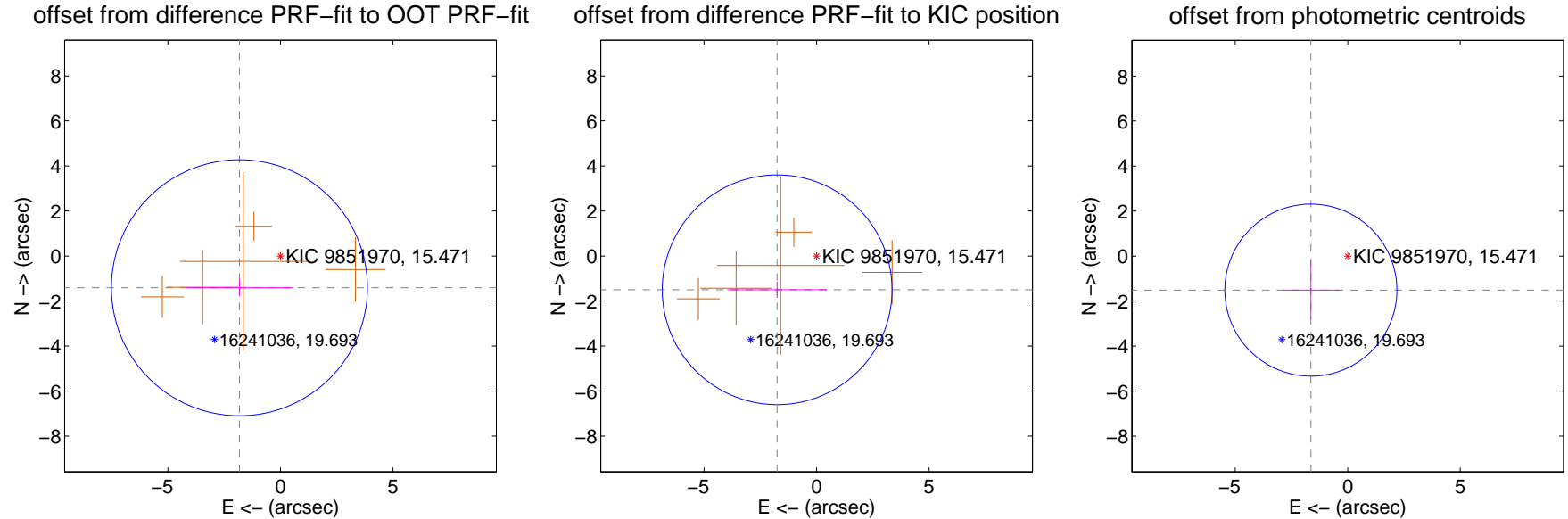
## DV Centroid Data

Supplemental centroid analysis for 009851970-07. Kepler magnitude: 15.47. Transit SNR 4.71

There are 0 quarters with good PRF difference image offsets

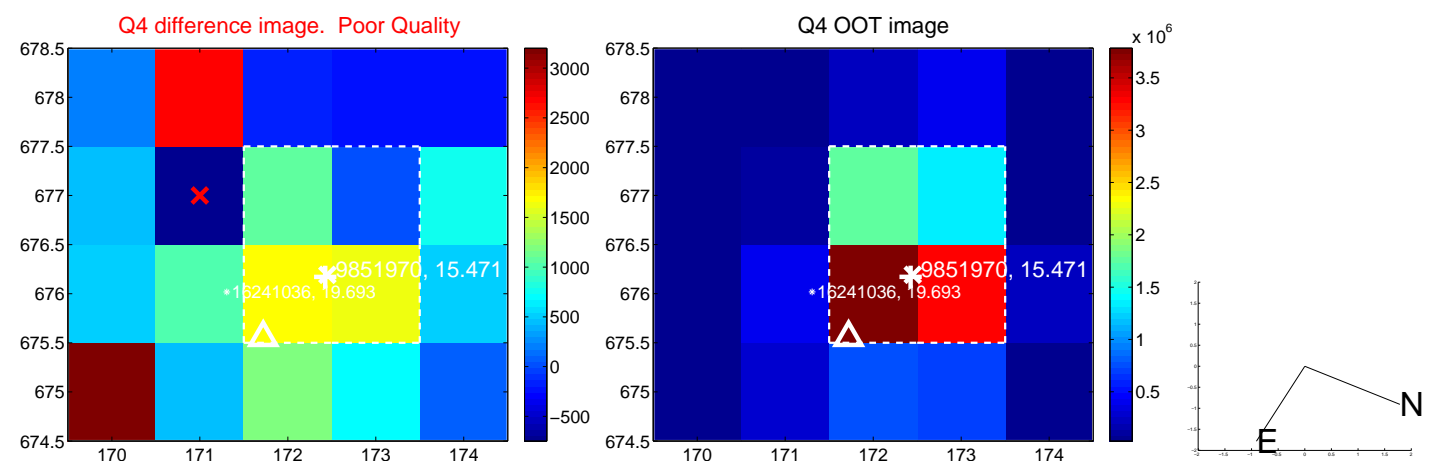
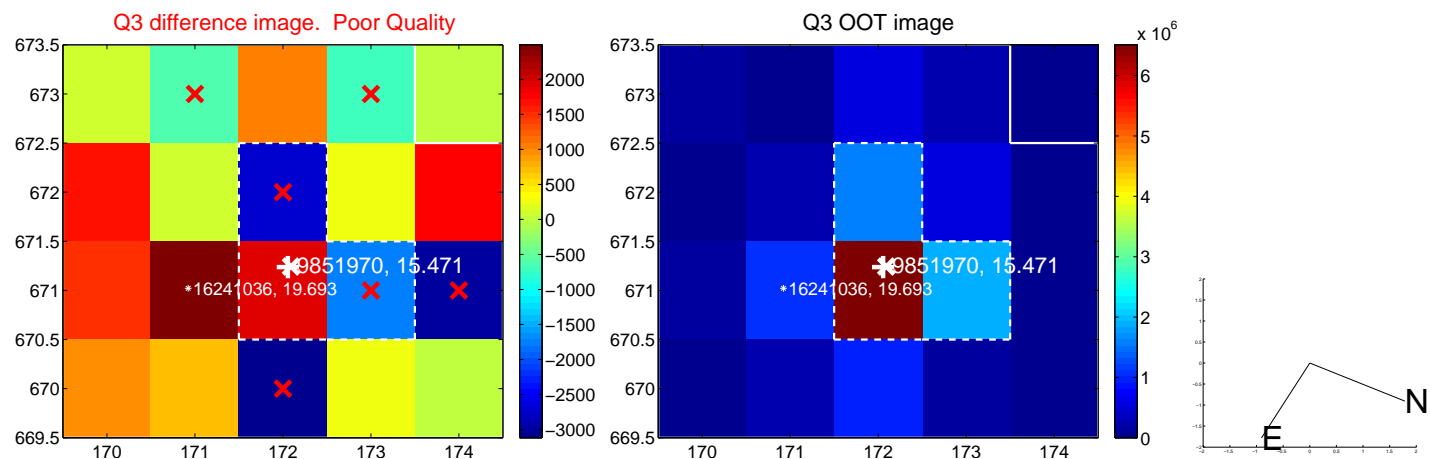
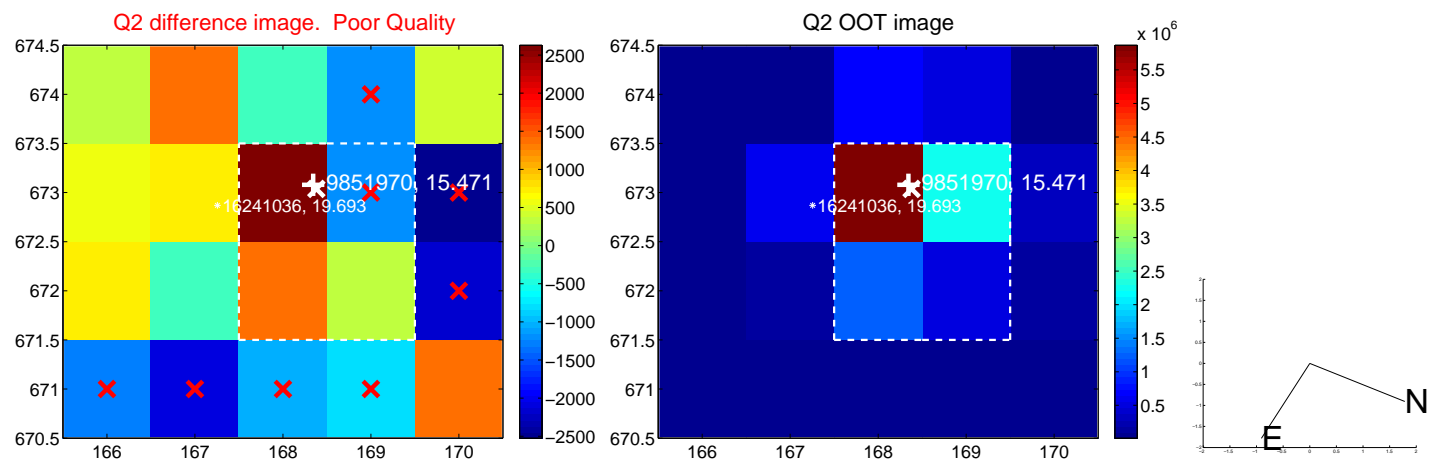
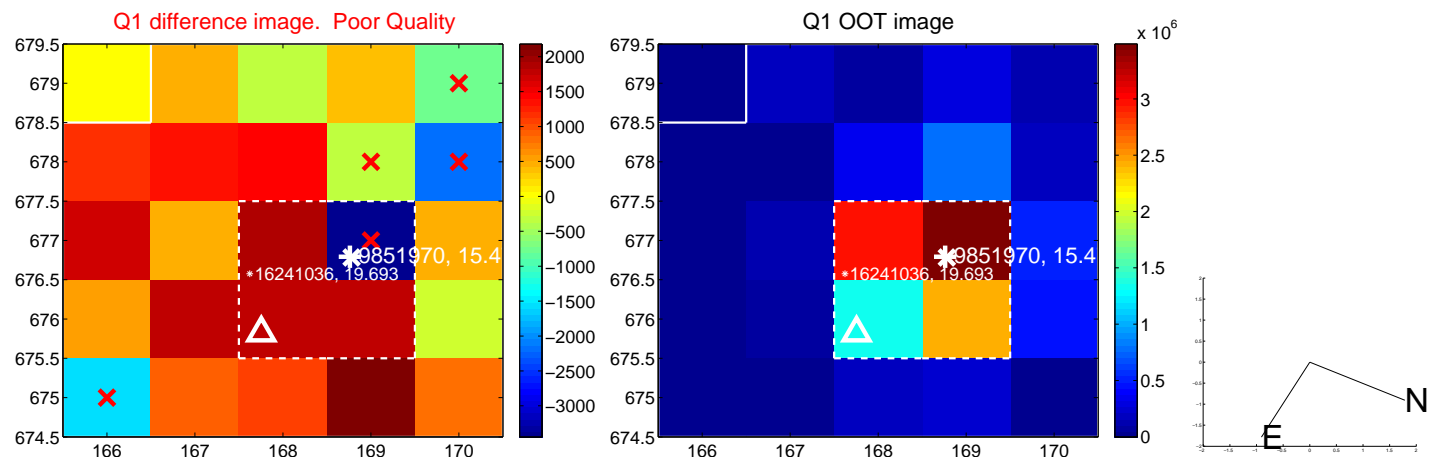
The direct PRF centroid is offset from the target star catalog position by about 0.31 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$2.304 \pm 1.896$	1.22	$1.823 \pm 2.379$	$-1.410 \pm 0.377$
PRF-fit source offset from KIC position	$2.307 \pm 1.701$	1.36	$1.752 \pm 2.219$	$-1.500 \pm 0.357$
photometric centroid source offset	$2.23 \pm 1.27$	1.75	$1.64 \pm 1.25$	$-1.51 \pm 1.30$

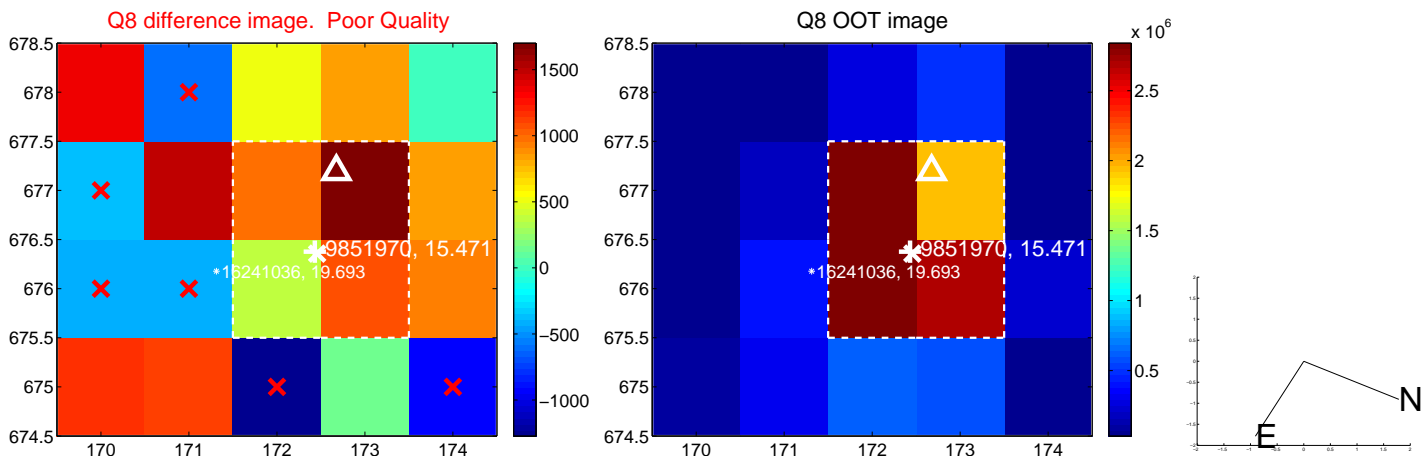
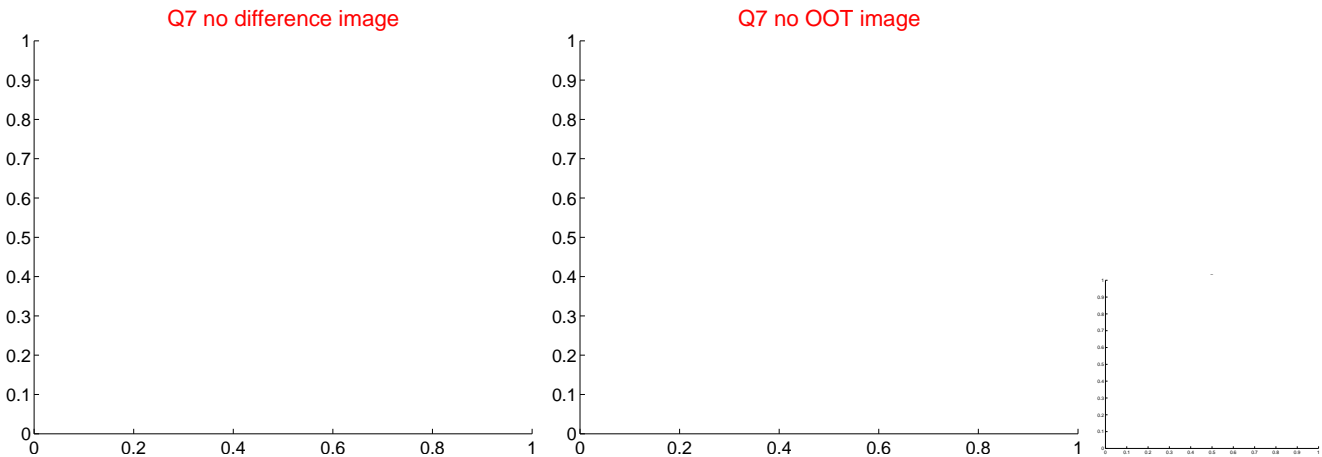
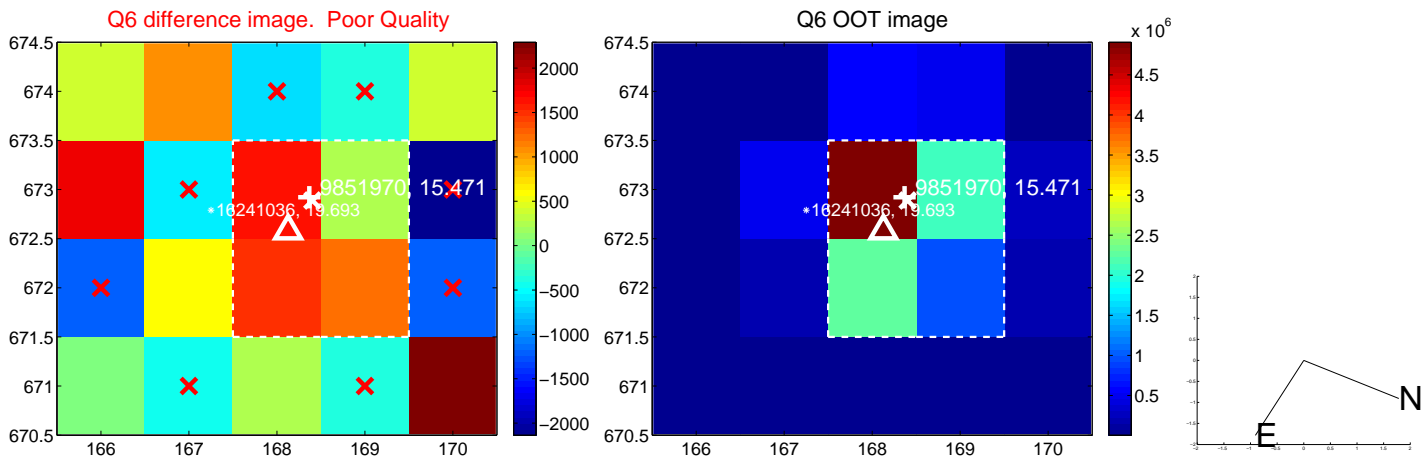
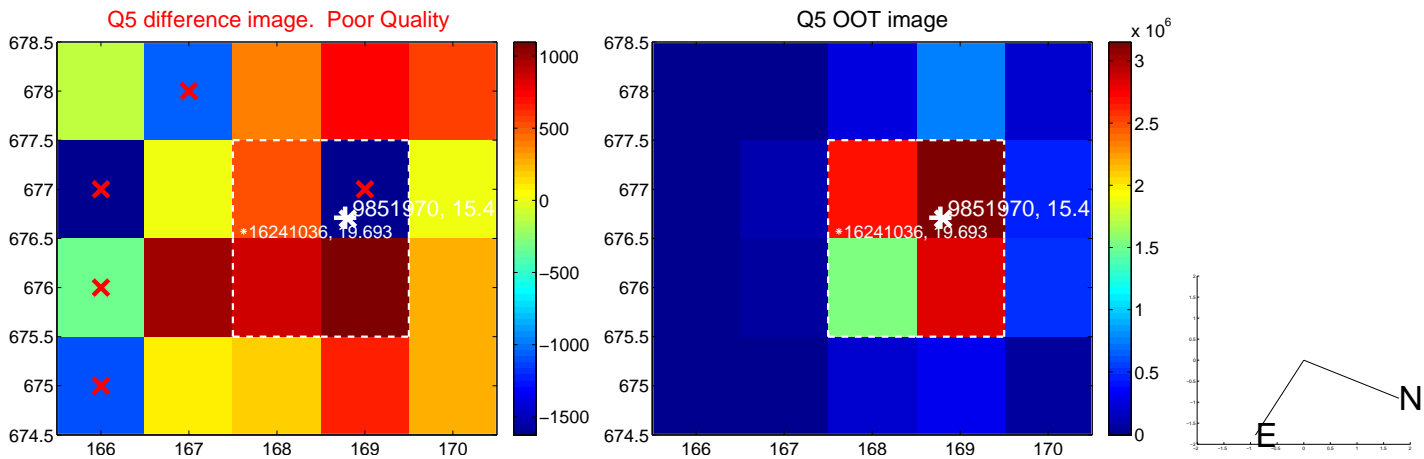


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

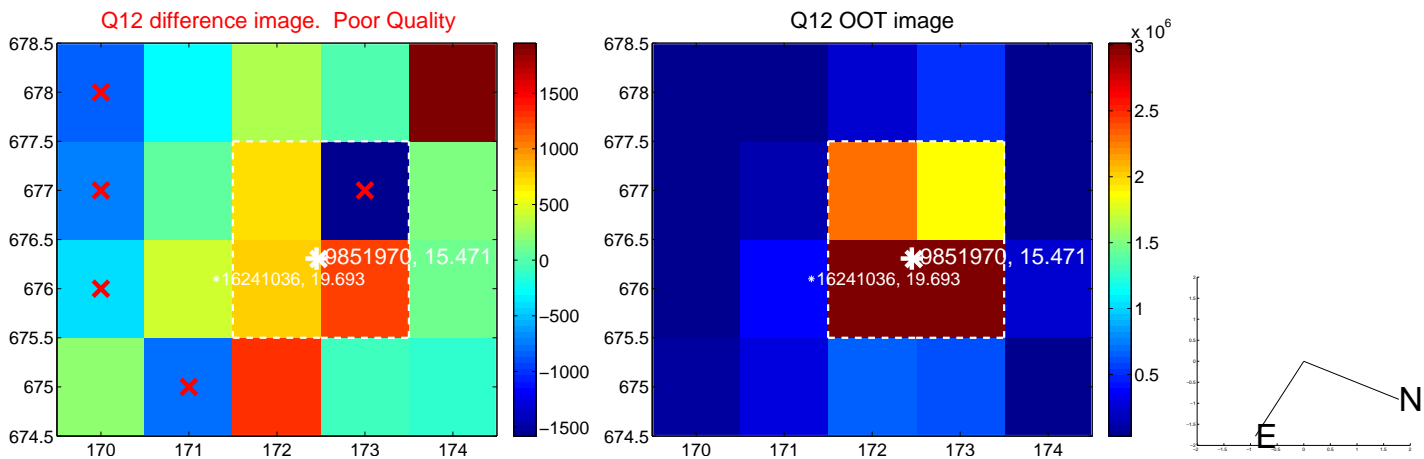
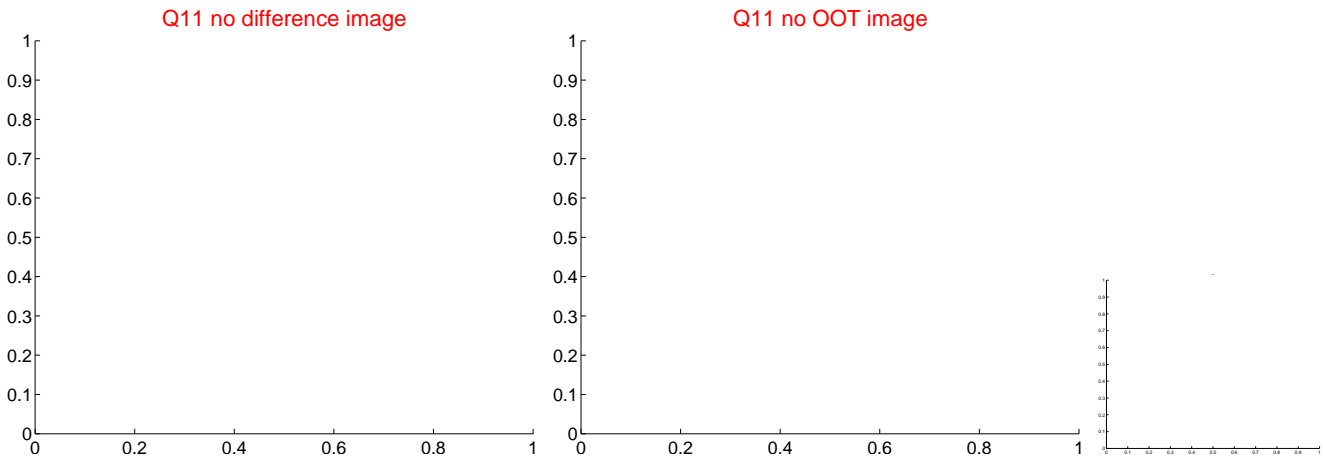
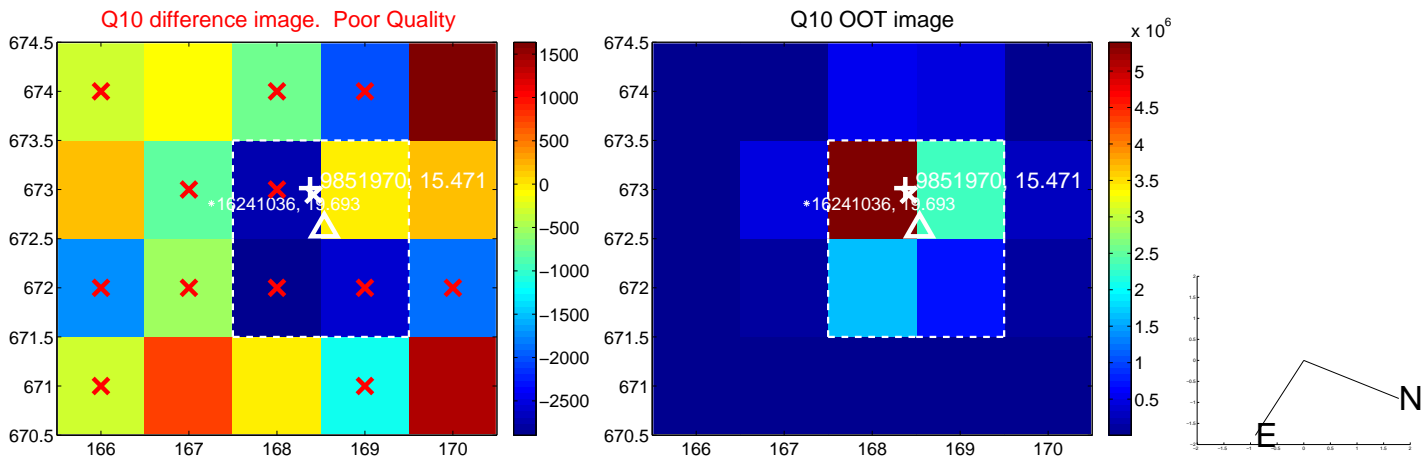
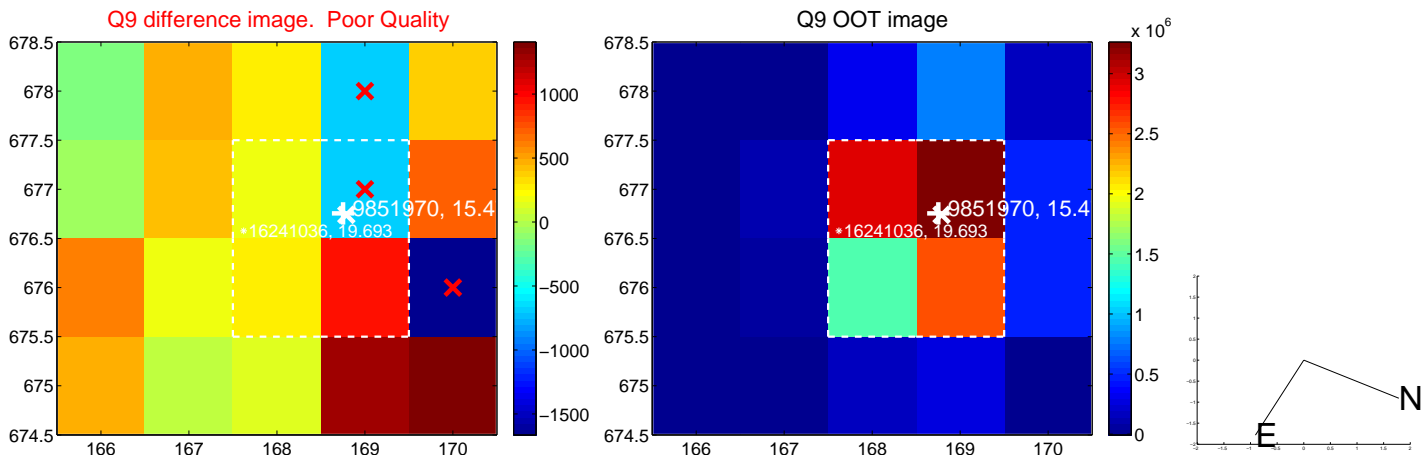
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



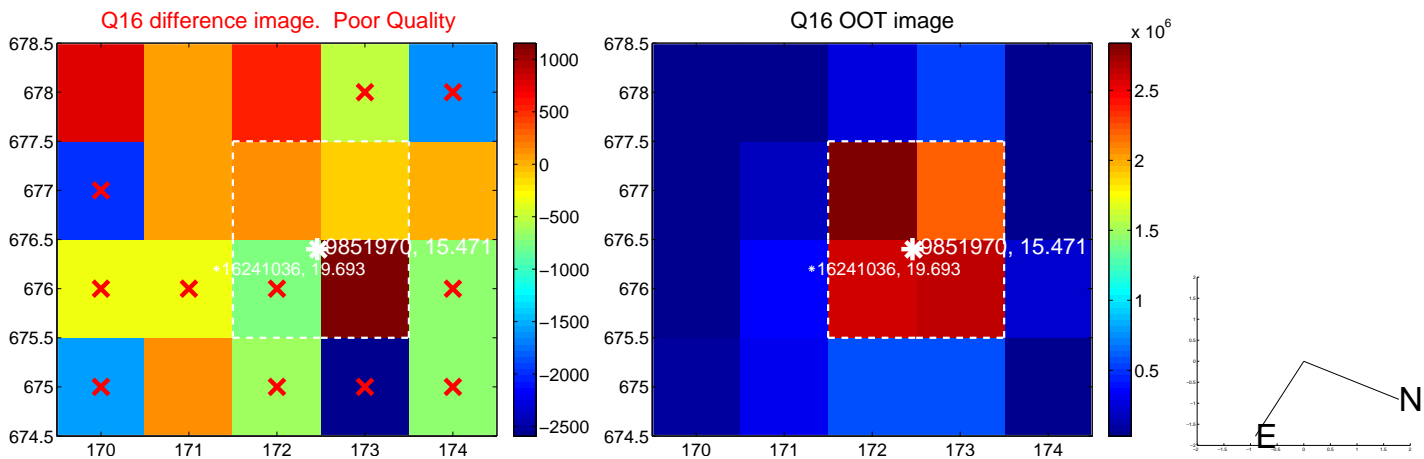
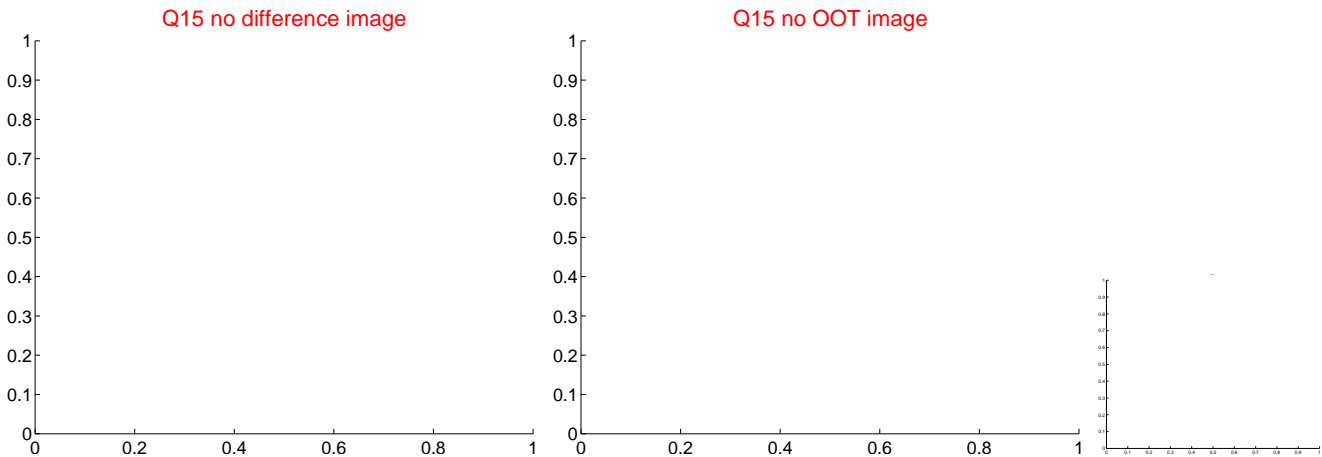
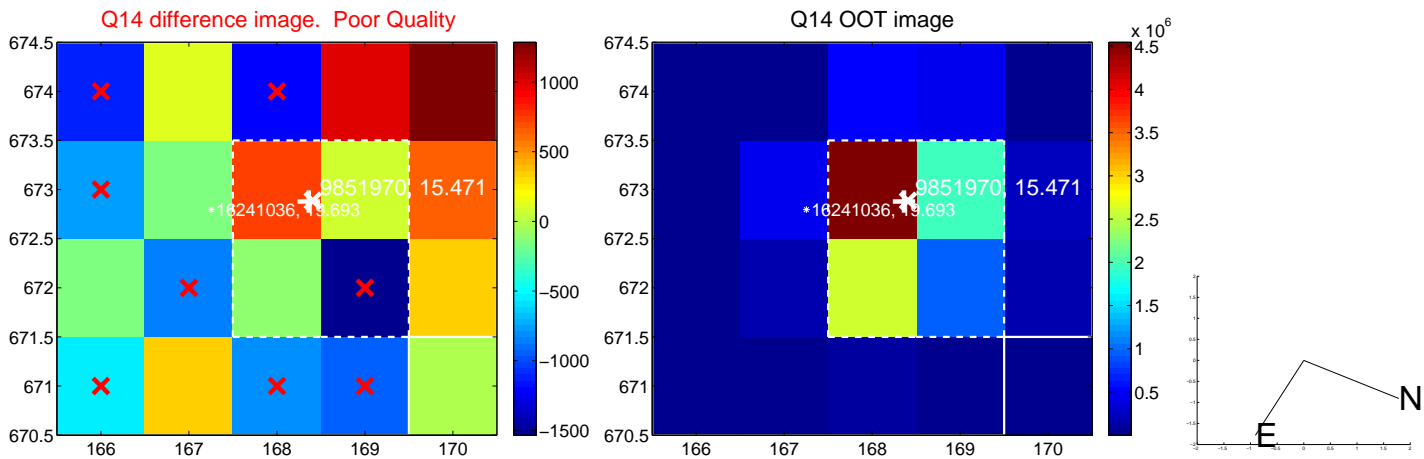
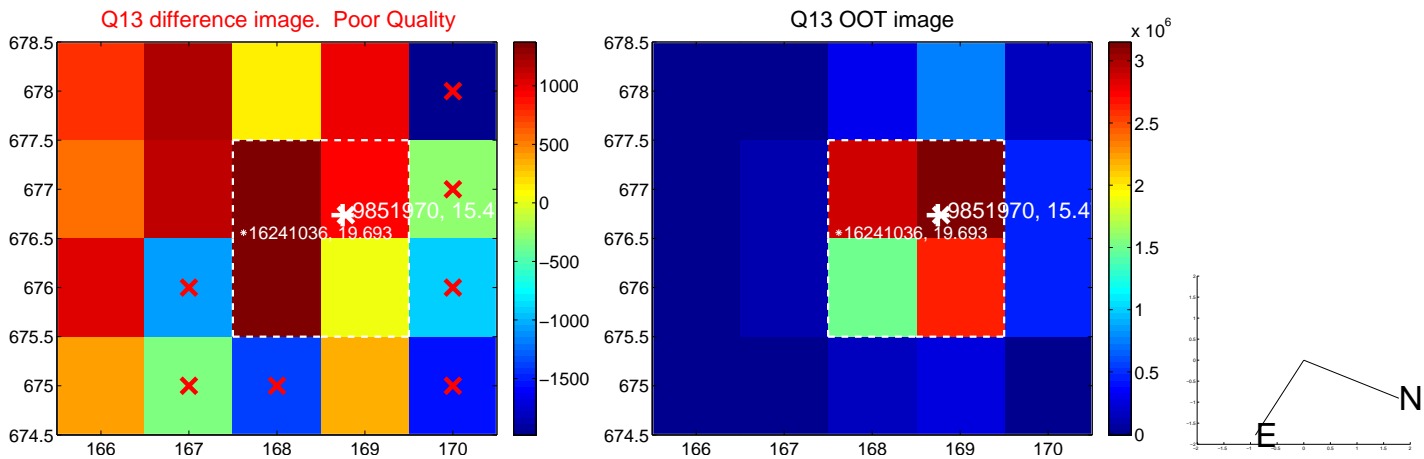
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



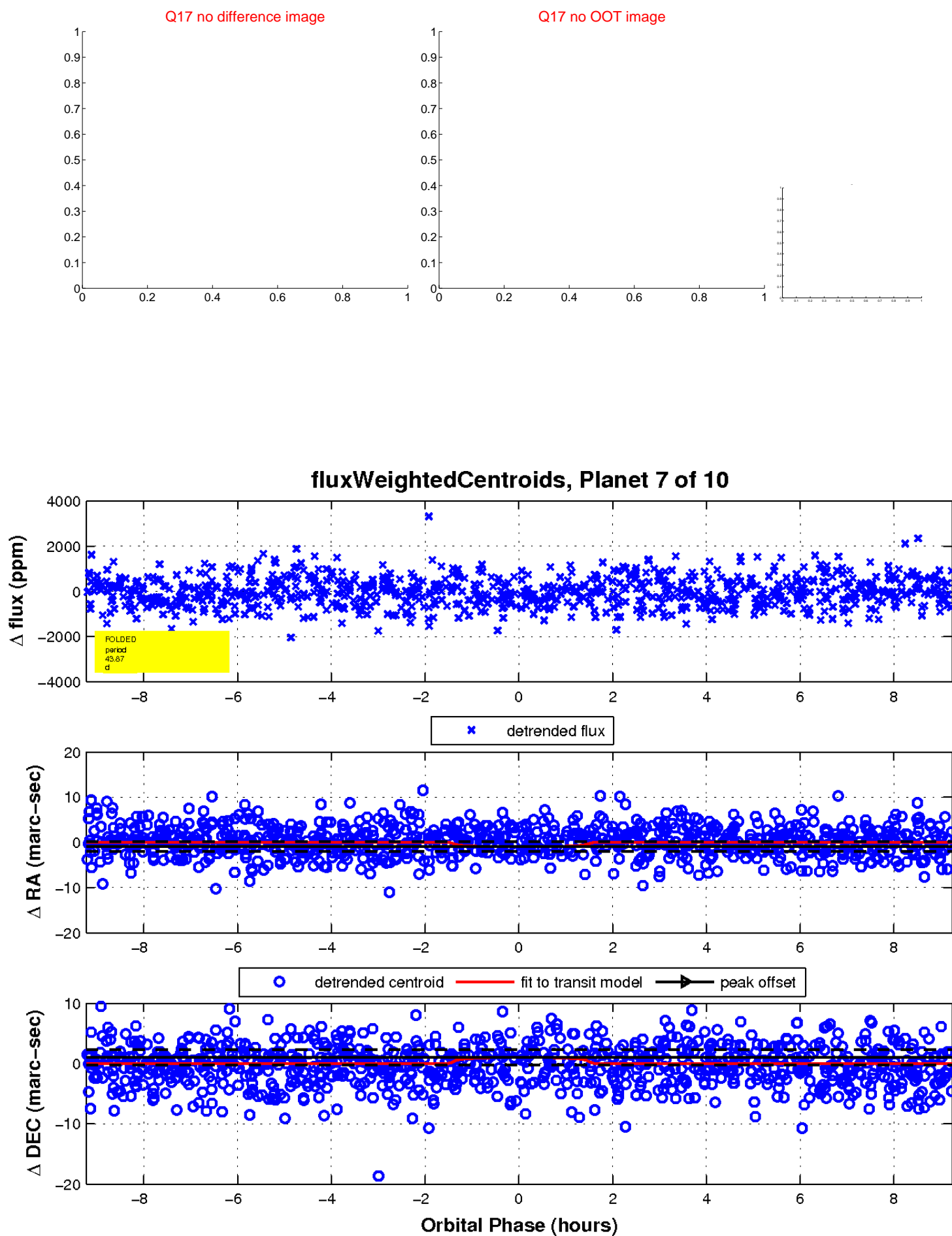
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



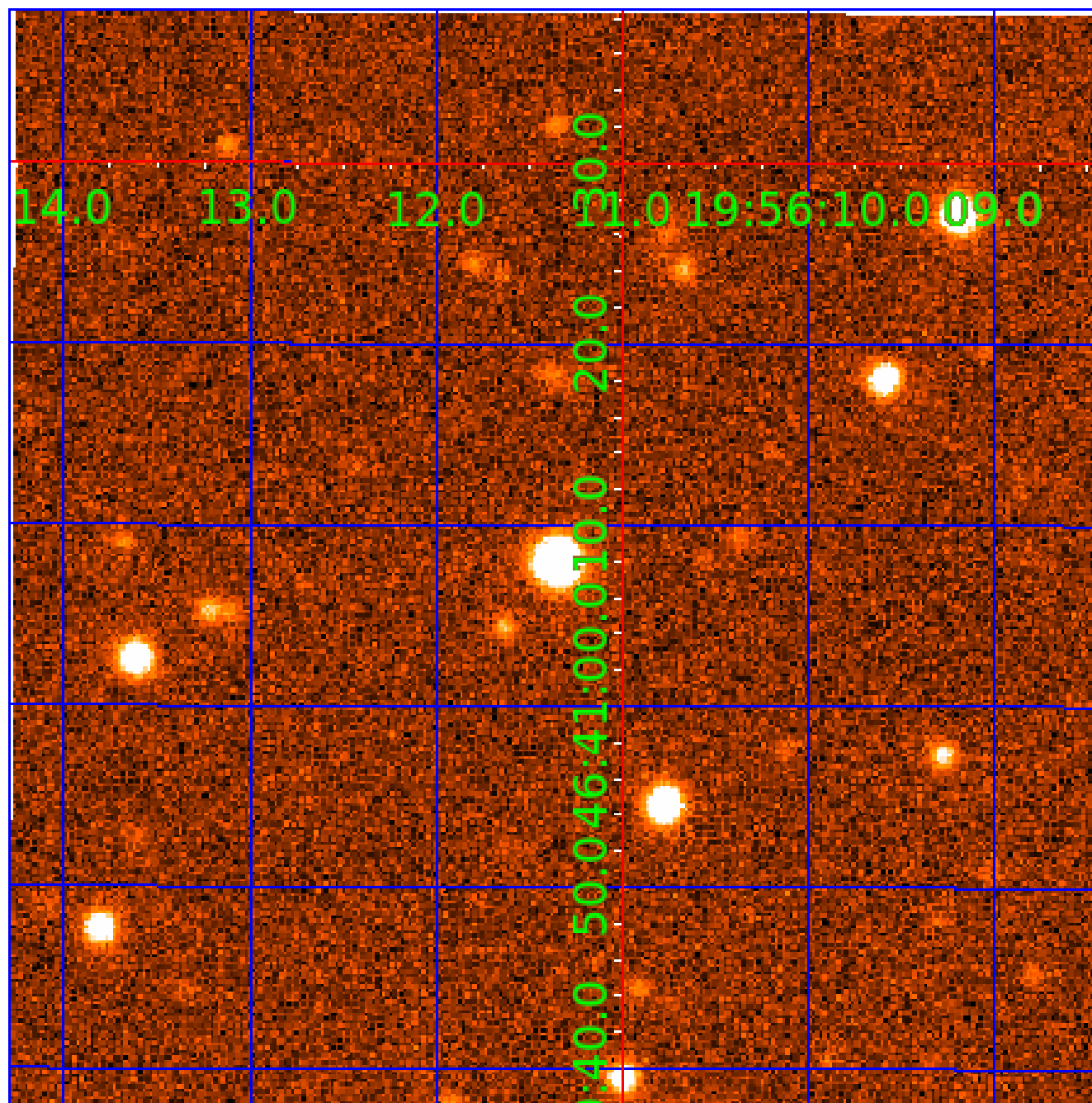
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





UKIRT Image

Declination



## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009851970-01	OBS	4122.01	1.081931	131.550019	107.5	6.343	13.0	13.4	0.74	4965	0.74	871.41
009851970-02	OBS	No	318.191396	287.691504	2963.9	7.500	18.3	-1.0	0.74	4965	3.89	0.45
009851970-03	OBS	No	87.131904	158.497311	1337.3	12.255	11.1	8.0	0.74	4965	4.18	2.51
009851970-04	OBS	No	98.329975	161.538824	746.0	4.930	12.1	5.3	0.74	4965	2.36	2.13
009851970-05	OBS	No	58.028718	183.047579	986.5	7.168	11.4	8.4	0.74	4965	2.50	4.31
009851970-06	OBS	No	34.155362	145.442225	495.6	5.928	10.4	4.7	0.74	4965	1.86	8.73
009851970-07	OBS	No	43.866421	135.859401	759.6	3.082	10.4	4.7	0.74	4965	2.21	6.26
009851970-08	OBS	No	485.794267	253.271172	1176.7	9.000	9.7	-1.0	0.74	4965	2.45	0.25
009851970-09	OBS	No	69.926614	193.429290	667.9	4.803	9.9	4.1	0.74	4965	2.11	3.36
009851970-10	OBS	No	665.534623	173.054303	2457.4	17.077	9.5	8.7	0.74	4965	6.96	0.17

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009851970-01	OBS	FP	0.00	0	1	1	1	MOD_SEC_ALT—CENT_RESOLVED_OFFSET—HALO_GHOST—EPHEM_MATCH
009851970-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_ZUMA—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_NOFITS
009851970-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_ALT—CENT_FEW_DIFFS
009851970-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_ZUMA_TRACKER—TRANS_GAPPED—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009851970-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE—TRANS_GAPPED—LPP_DV—CENT_FEW_DIFFS
009851970-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
009851970-07	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_TRACKER—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
009851970-08	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL—LPP_DV—ALL_TRANS_CHASES—NO_FITS—CENT_NOFITS
009851970-09	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE_TRACKER—TRANS_GAPPED—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS—HALO_GHOST
009851970-10	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_SKYE—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—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 009851970-08

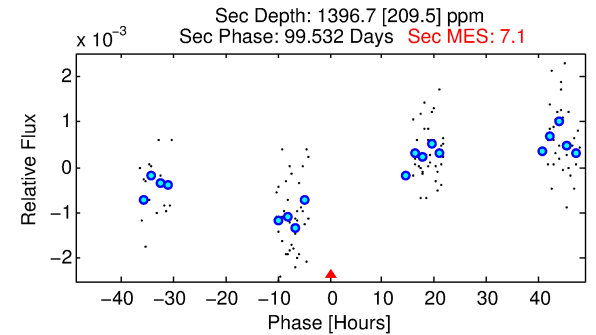
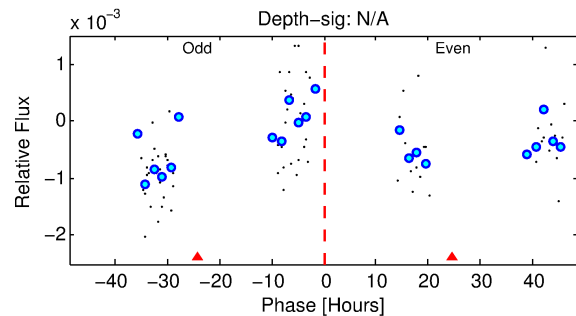
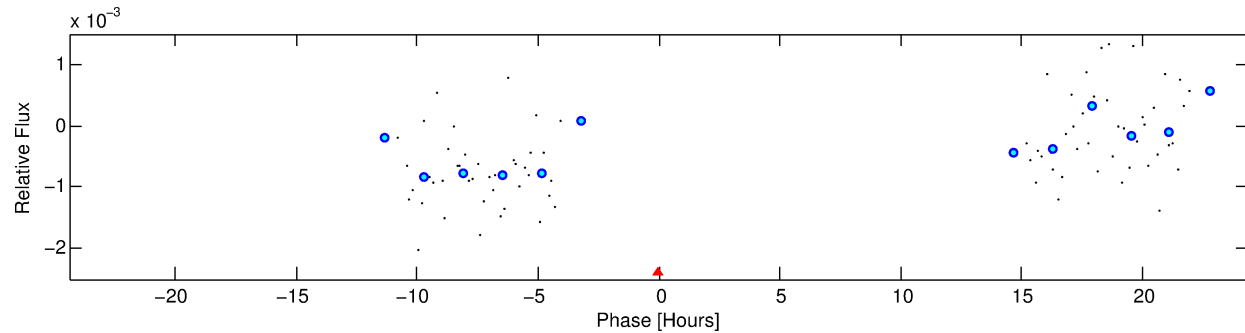
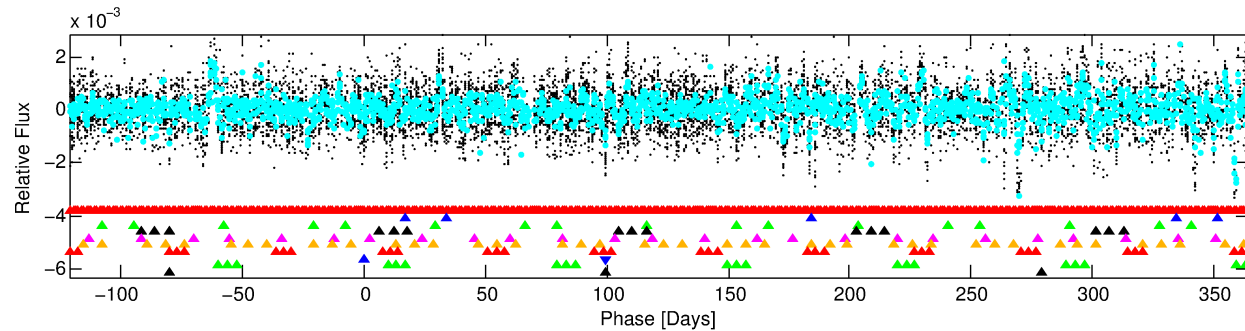
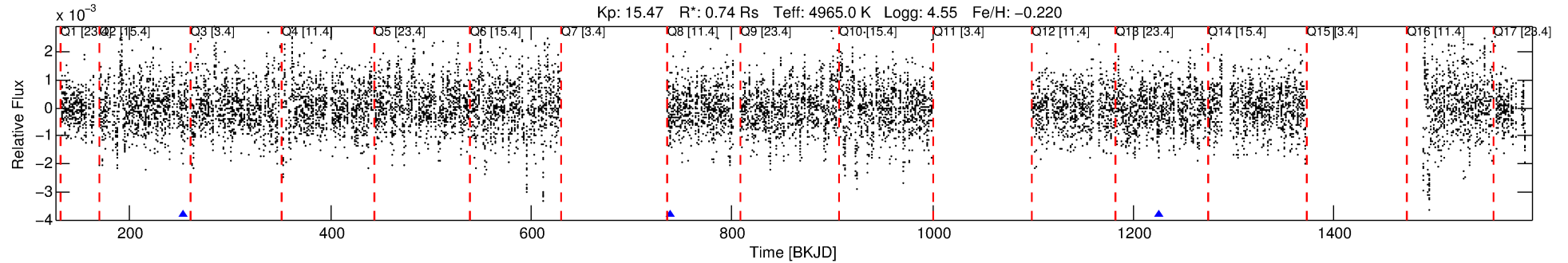
No Significant Match Found

# DV One-Page Summary

KIC: 9851970 Candidate: 8 of 10 Period: 485.794 d

KOI: K04122 Corr: No Ephemeris Match

Kp: 15.47 R\*: 0.74 Rs Teff: 4965.0 K Logg: 4.55 Fe/H: -0.220



## TPS TCE Results:

Period = 485.79427 d  
Epoch = 253.2712 BKJD

DV fit results are unavailable

## DV Diagnostic Results:

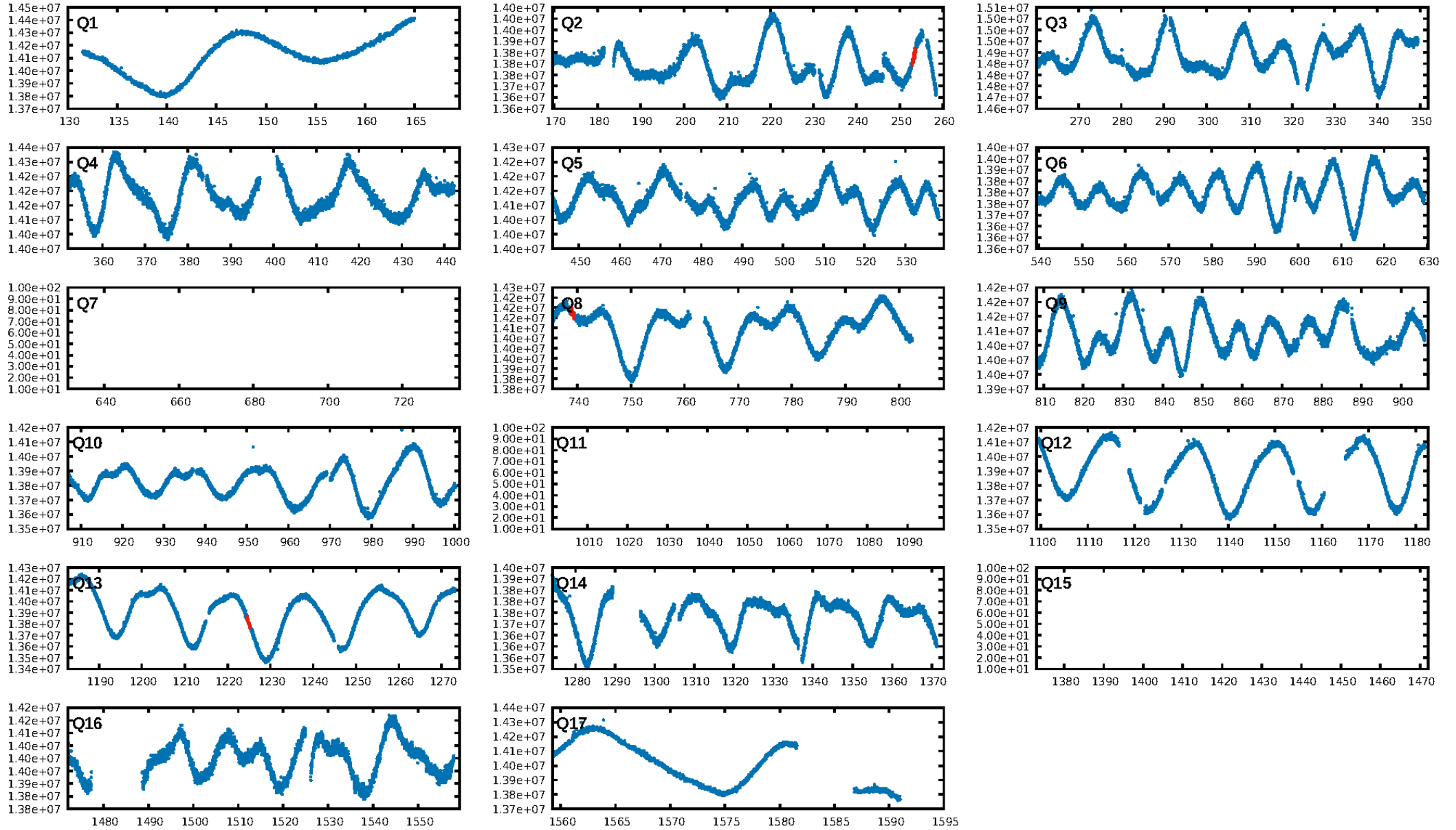
ShortPeriod-sig: 100.0% [343.35σ]  
LongPeriod-sig: 100.0% [223.47σ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [2/2]  
GhostDiagnostic-chr: 1.818

Centroid-sig: 40.4%  
Centroid-so: 0.256 arcsec [0.77σ]  
OotOffset-rm: N/A  
KicOffset-rm: N/A  
OotOffset-st: 0/0/0/0 [0]  
KicOffset-st: 0/0/0/0 [0]  
DiffImageQuality-fgm: N/A  
DiffImageOverlap-fno: 0.00 [0/3]

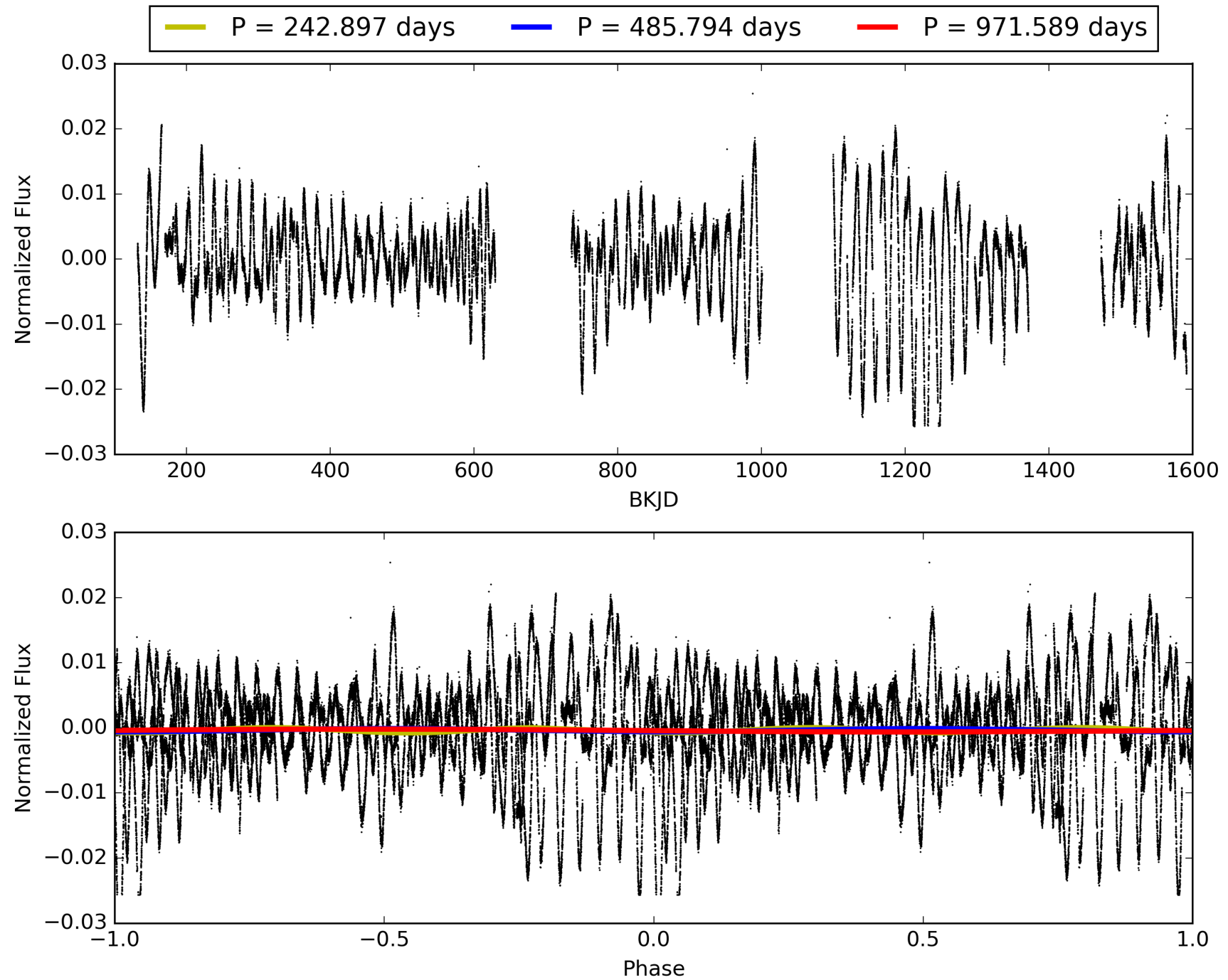
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 08:50:44 Z

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

# TCE 009851970-08, PDC Light Curves

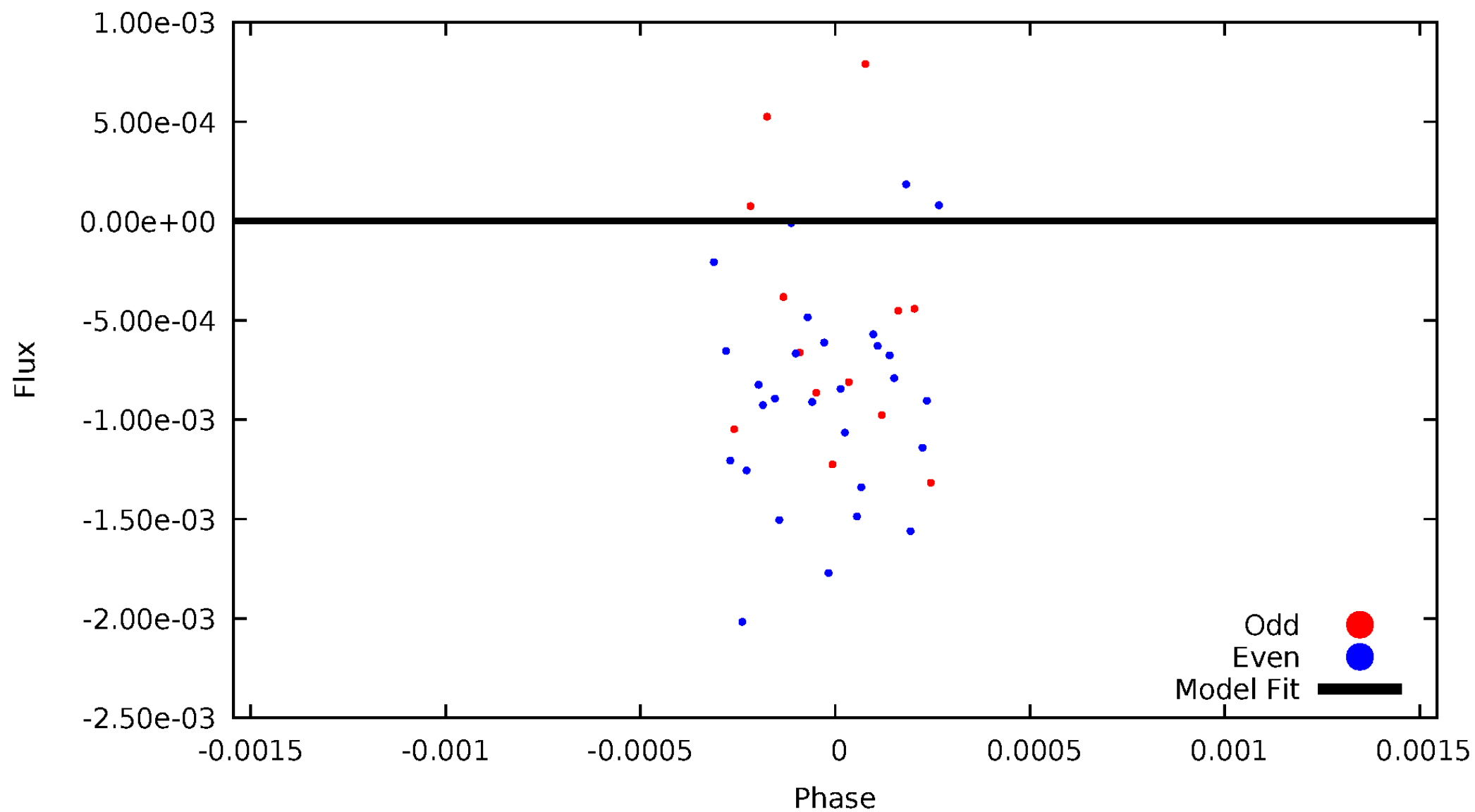


TCE 009851970-08



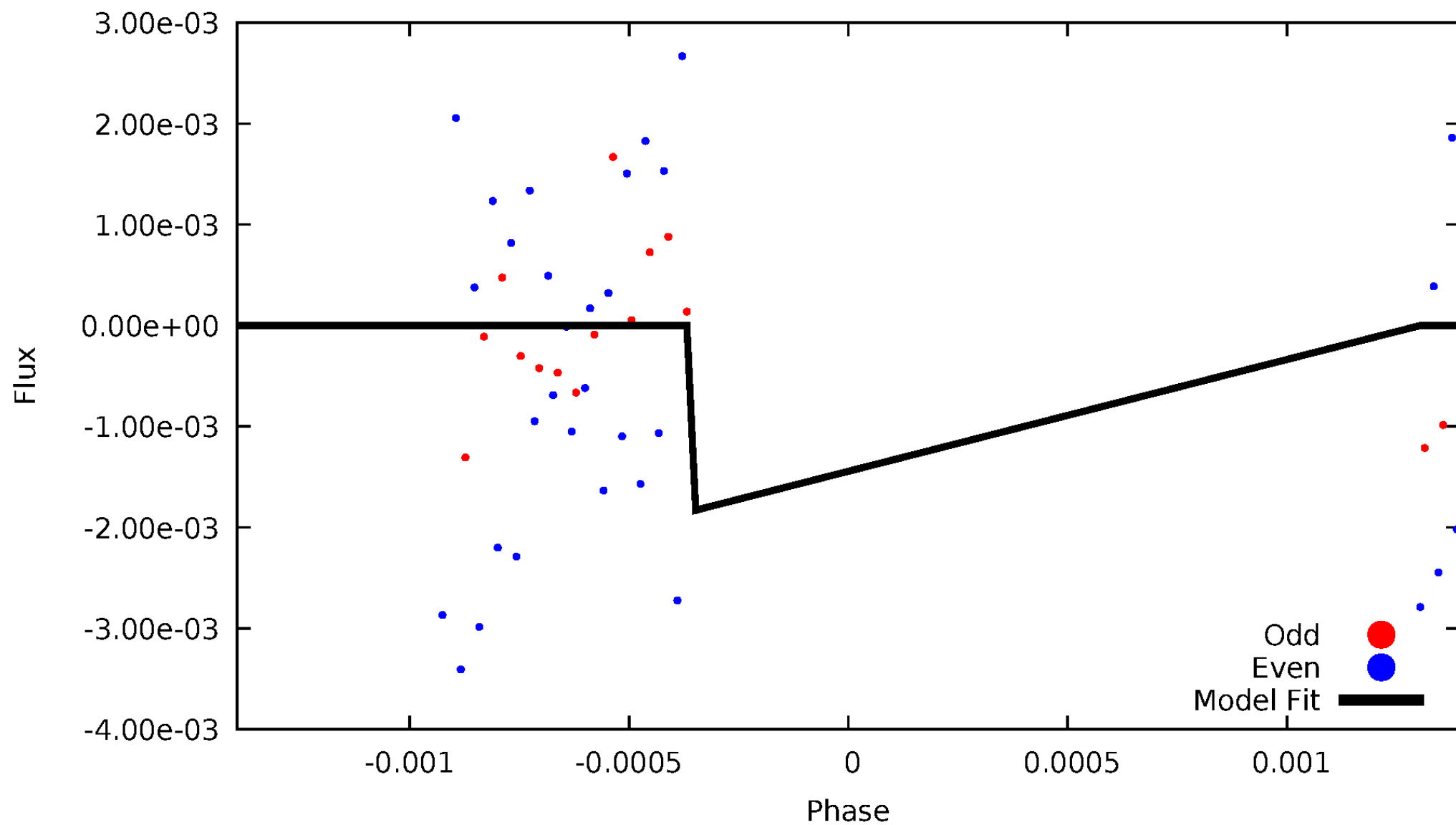
# DV Odd/Even

TCE 009851970-08



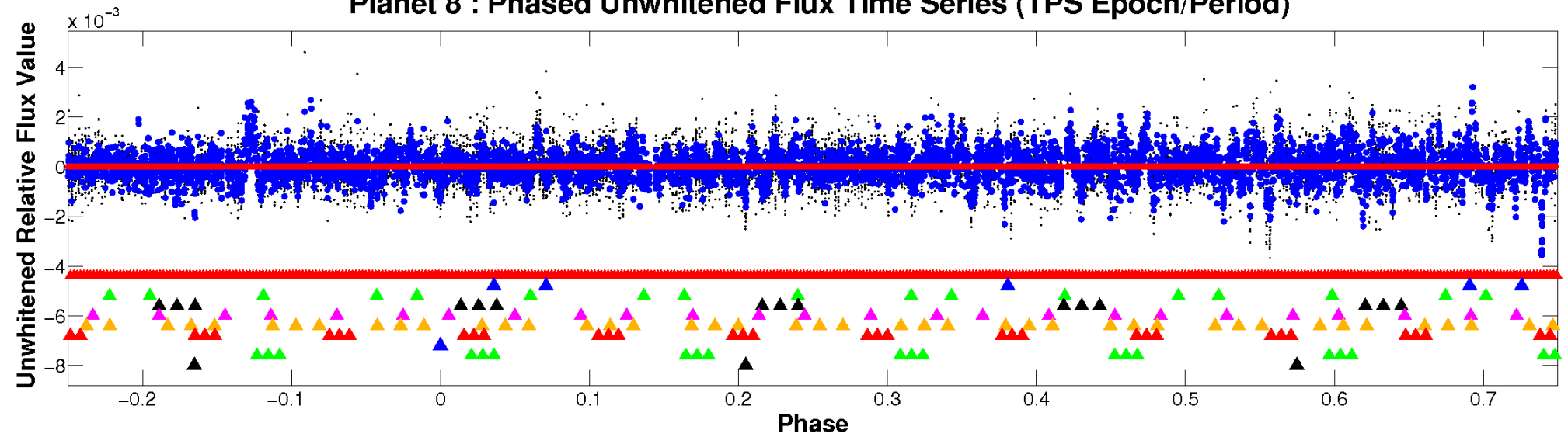
# ALT Odd/Even

TCE 009851970-08

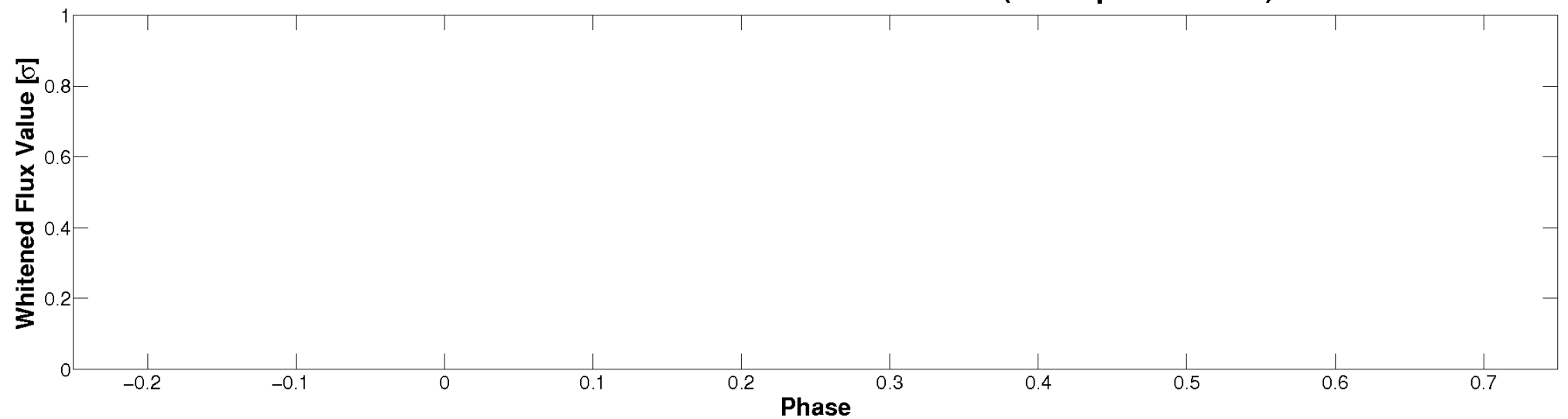


# Non-Whitened Vs. Whitened Light Curve

Planet 8 : Phased Unwhitened Flux Time Series (TPS Epoch/Period)



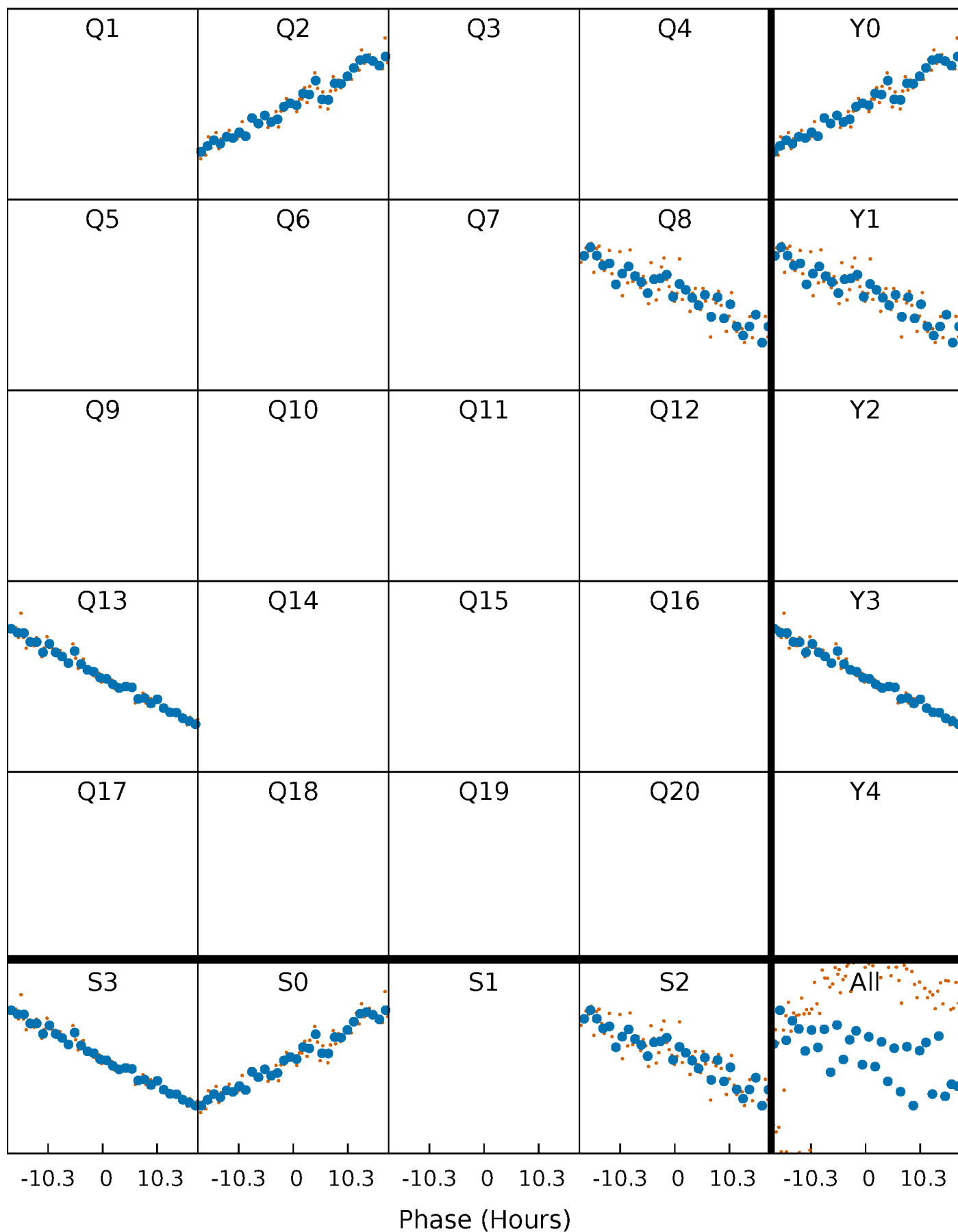
Planet 8 : Phased Whitened Flux Time Series (TPS Epoch/Period)





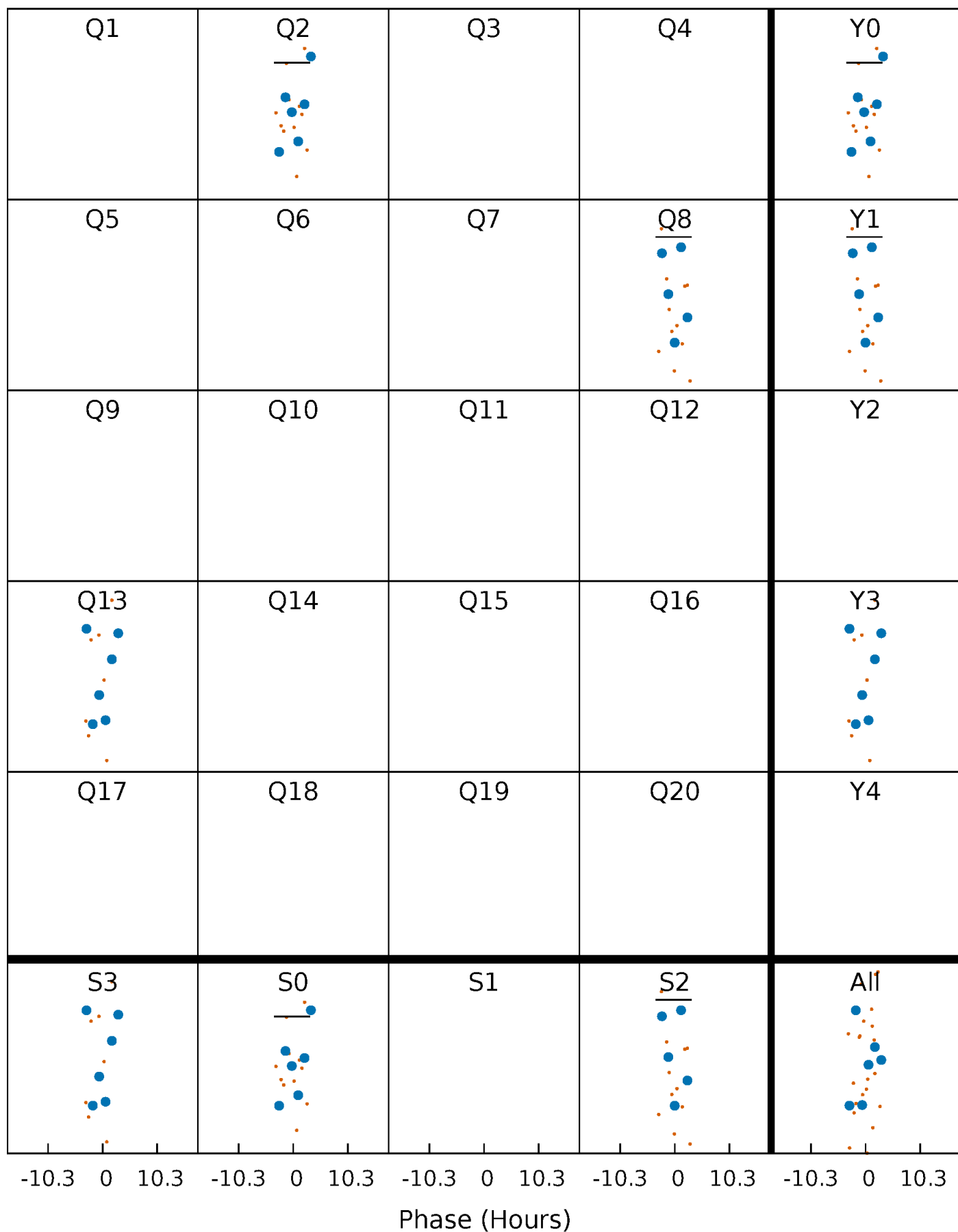
# PDC Quarter-Phased Transit Curves

TCE 009851970-08     $P=485.794267$  Days     $T_0=253.271172$  (BKJD)



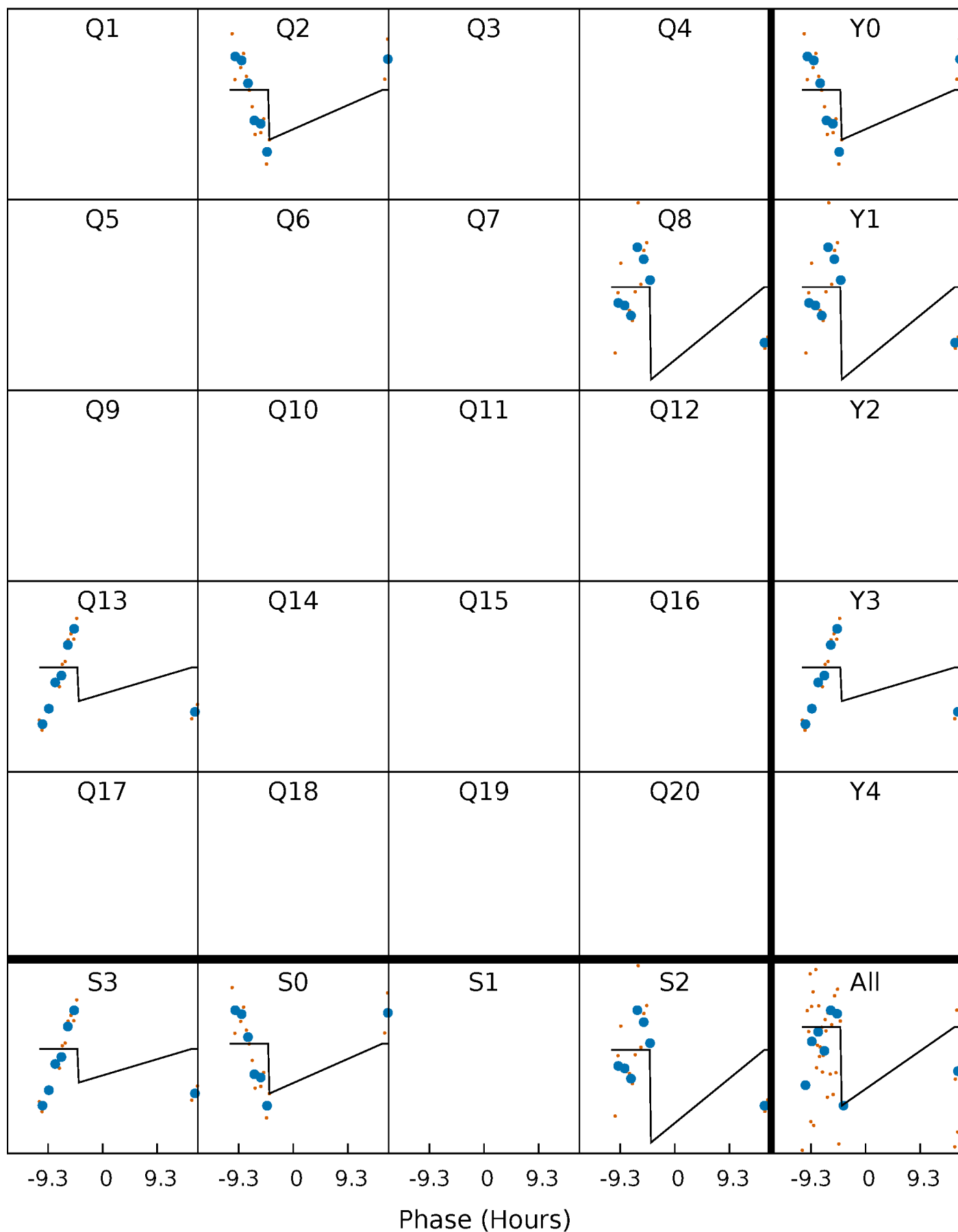
# DV Quarter-Phased Transit Curves

TCE 009851970-08 P=485.794267 Days  $T_0=253.271172$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

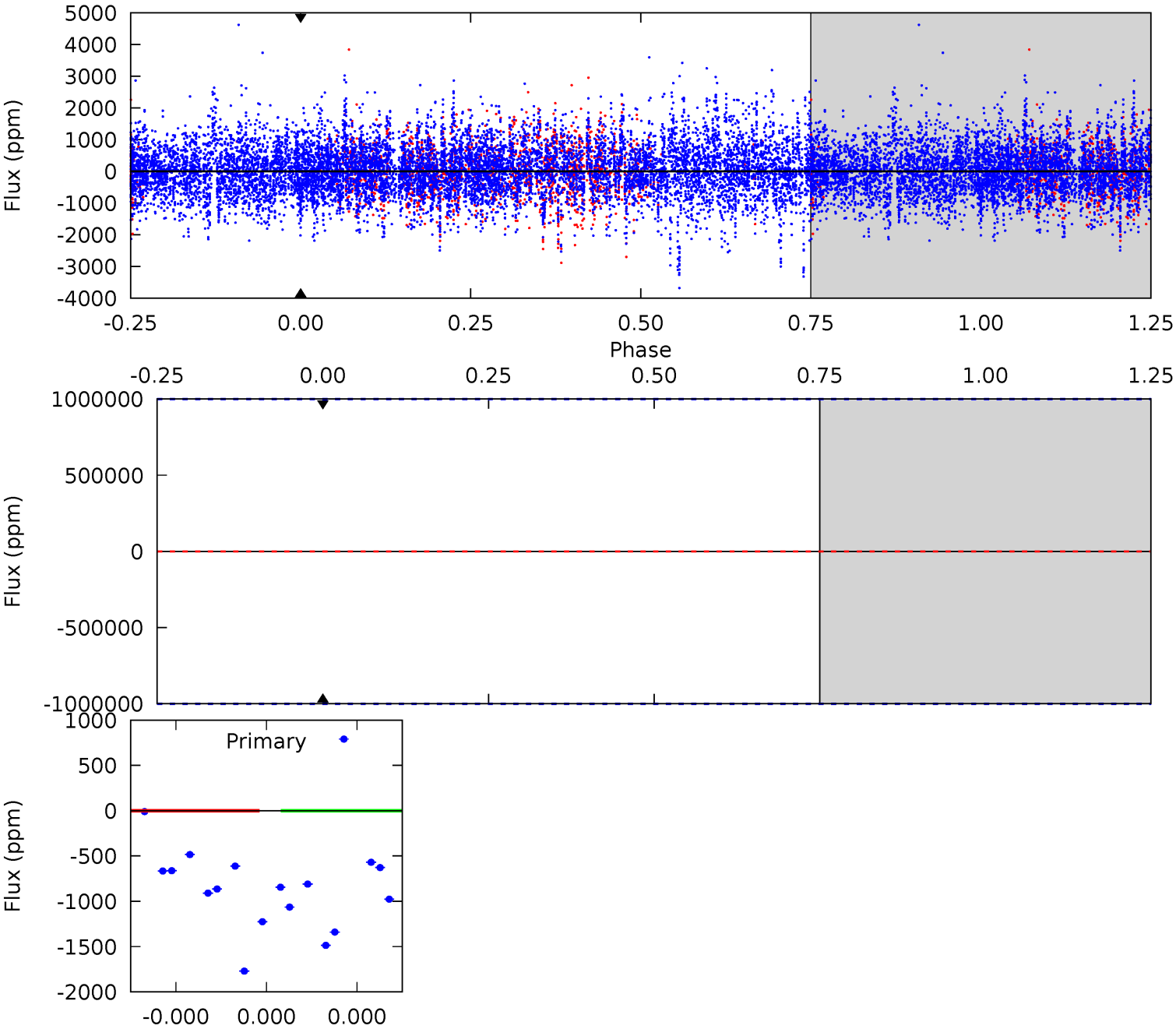
TCE 009851970-08 P=485.794267 Days  $T_0=253.569429$  (BKJD)



# DV Model-Shift Uniqueness Test

009851970-08, P = 485.794267 Days, E = 253.271172 Days

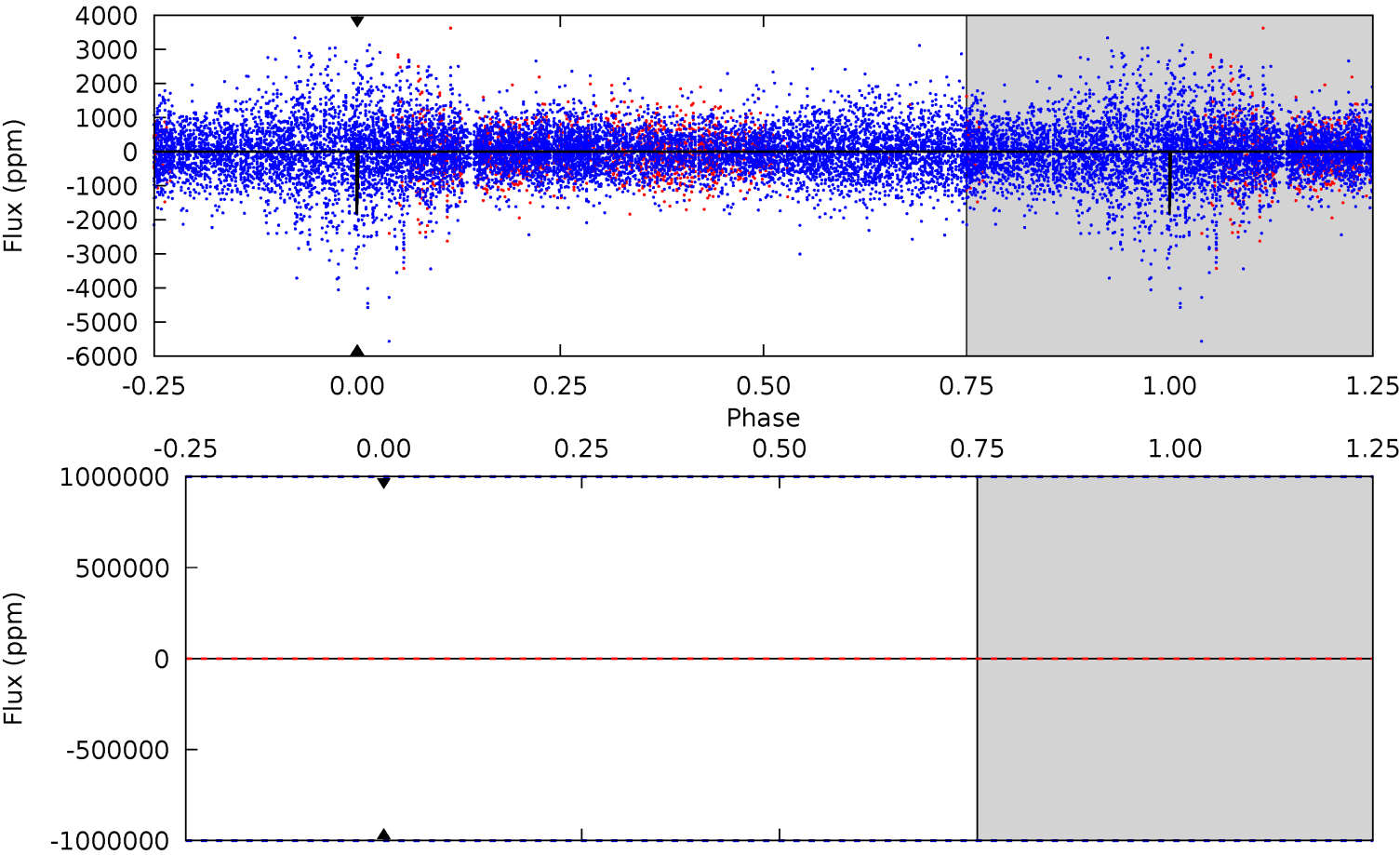
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
0	0	0	0	1.00	1.00	1.00	0	0	0	0	0	0	0	0



# Alt Model-Shift Uniqueness Test

009851970-08, P = 485.794267 Days, E = 253.569429 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
0	0	0	0	1.00	1.00	1.00	0	0	0	0	0.00	0	0	0



### Stellar Parameters For KIC 009851970

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$4965^{+151}_{-136}$	$4.555^{+0.072}_{-0.044}$	$-0.220^{+0.300}_{-0.300}$	$0.736^{+0.065}_{-0.079}$	$0.709^{+0.093}_{-0.050}$	$2.508^{+0.760}_{-0.407}$
	+3%/-3%	+2%/-1%	+136%/-136%	+9%/-11%	+13%/-7%	+30%/-16%
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 009851970-08 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$0 \pm 1000000$	$6.49^{+6.03}_{-4.39}$	$252^{+9}_{-9}$	$3530^{+11234}_{-16700}$	$16145^{+3235518}_{-2403901}$
Alt.	$-0 \pm 1000000$	$8.32^{+6.84}_{-5.47}$	$252^{+9}_{-10}$	$3339^{+8224}_{-13362}$	$10411^{+1781012}_{-1411651}$

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

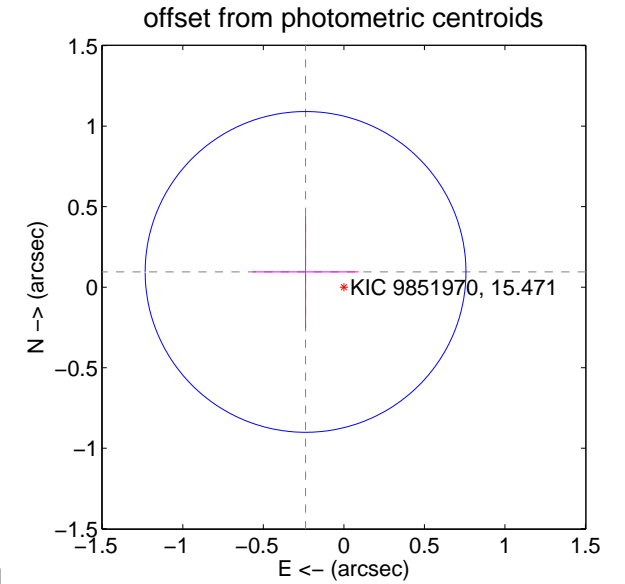
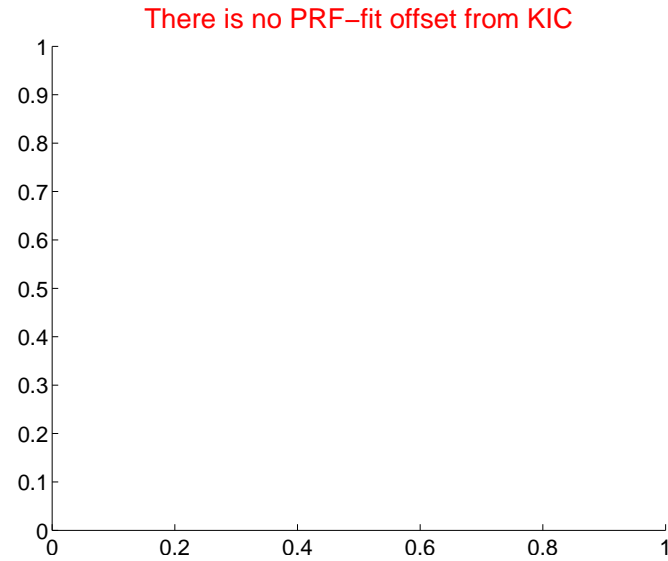
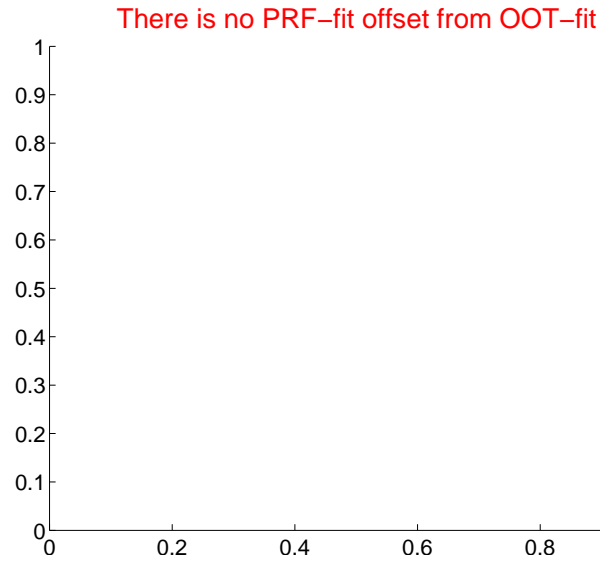
## DV Centroid Data

Supplemental centroid analysis for 009851970-08. Kepler magnitude: 15.47. Transit SNR -1.00

There are 0 quarters with good PRF difference image offsets

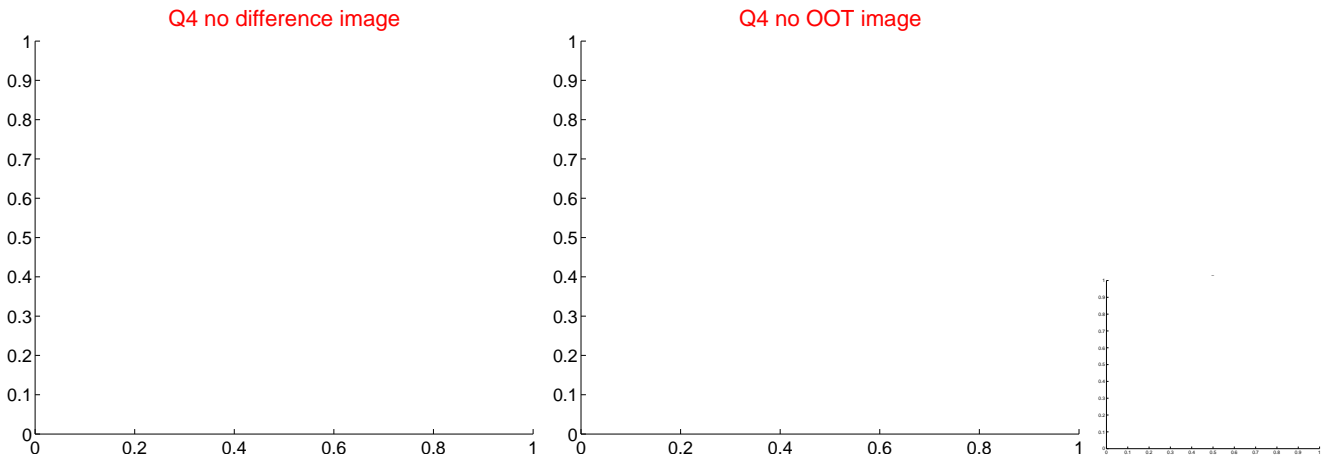
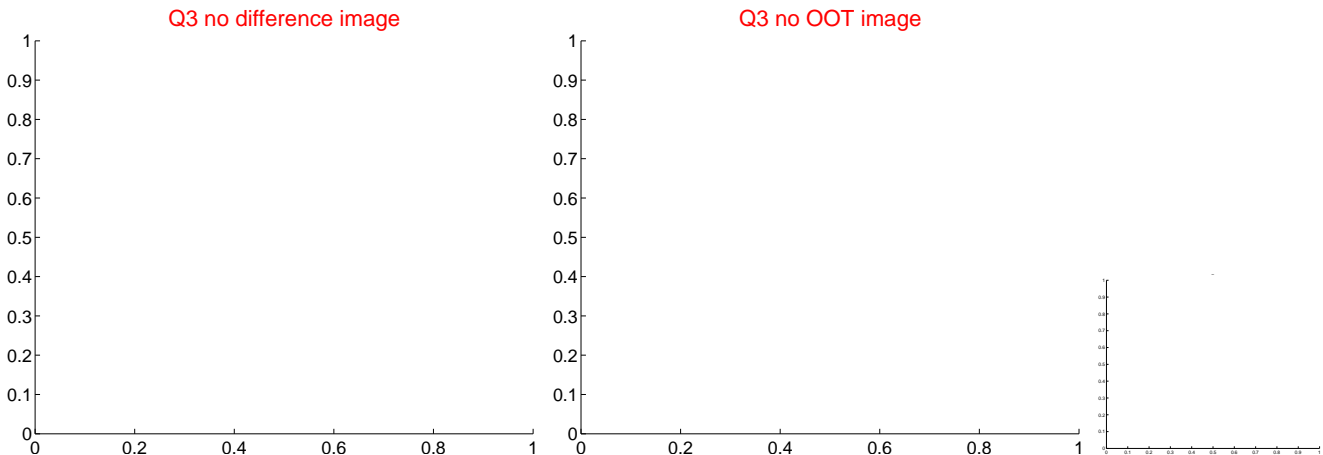
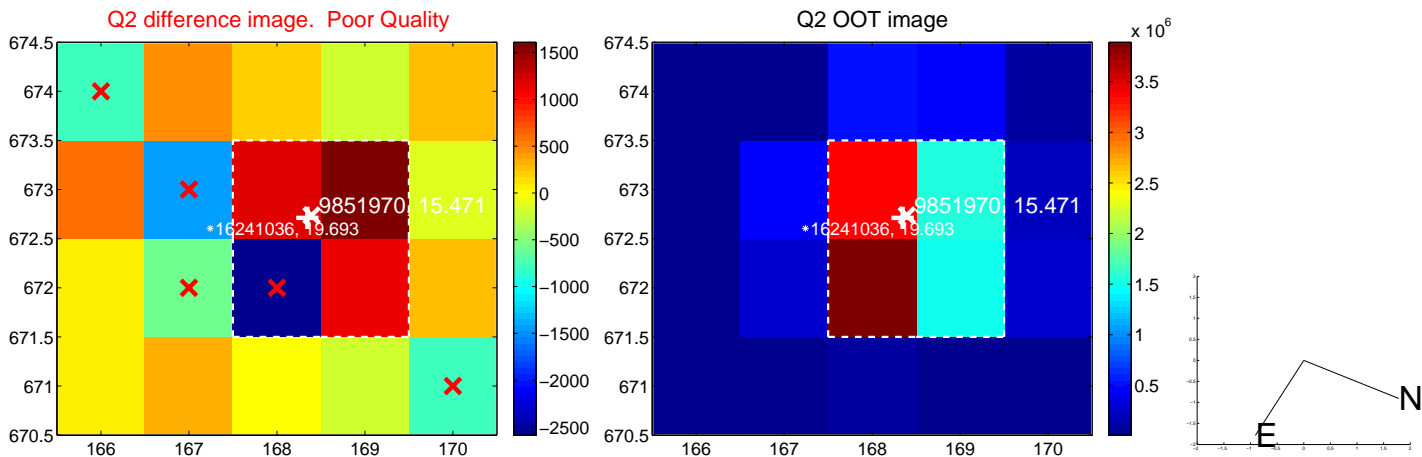
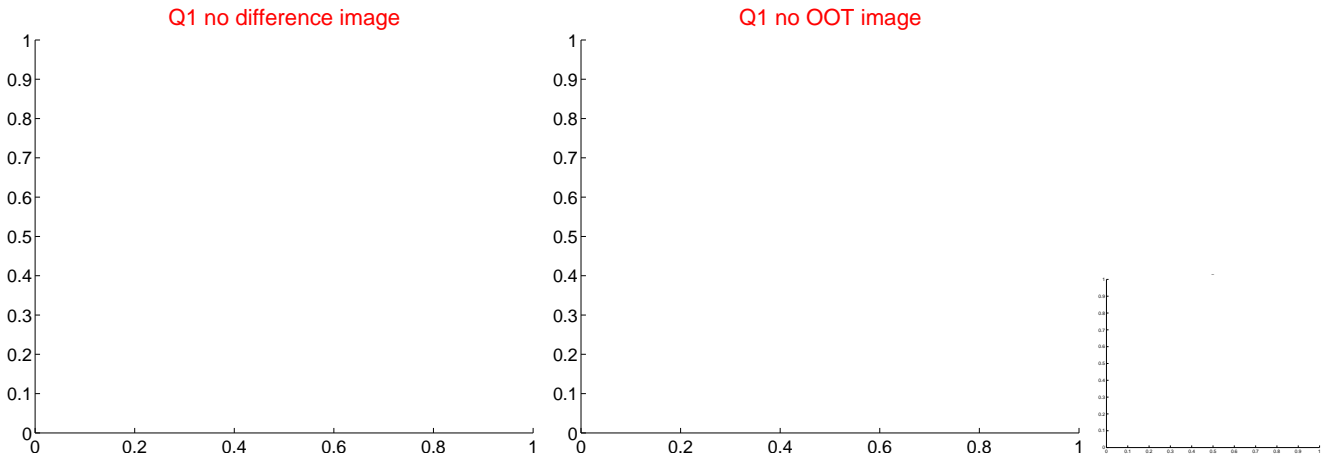
The direct PRF centroid is offset from the target star catalog position by about NaN arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	—	—	—	—
PRF-fit source offset from KIC position	—	—	—	—
photometric centroid source offset	$0.26 \pm 0.33$	0.77	$0.24 \pm 0.33$	$0.09 \pm 0.35$



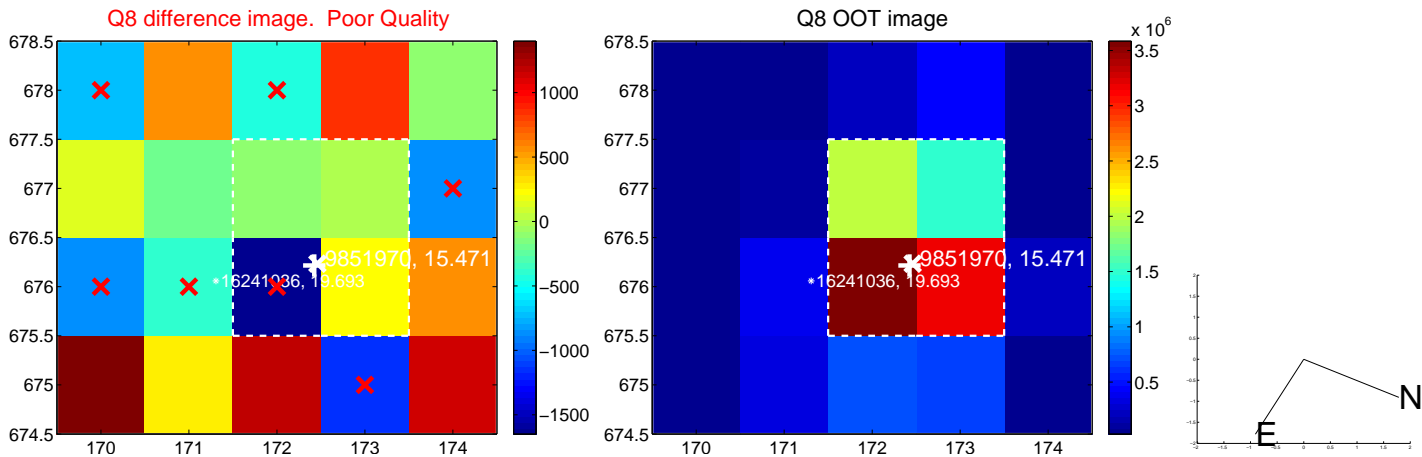
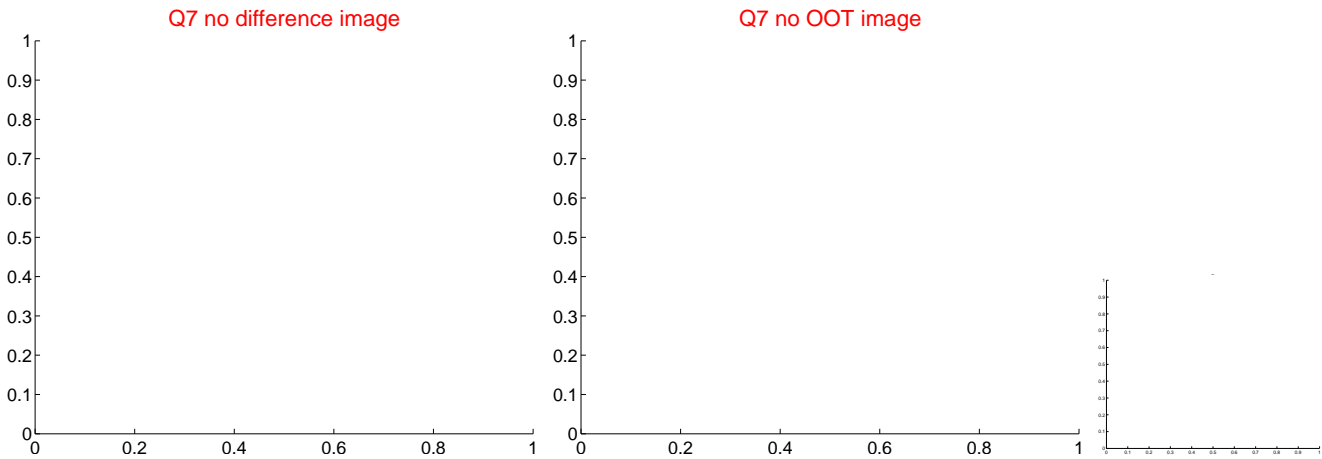
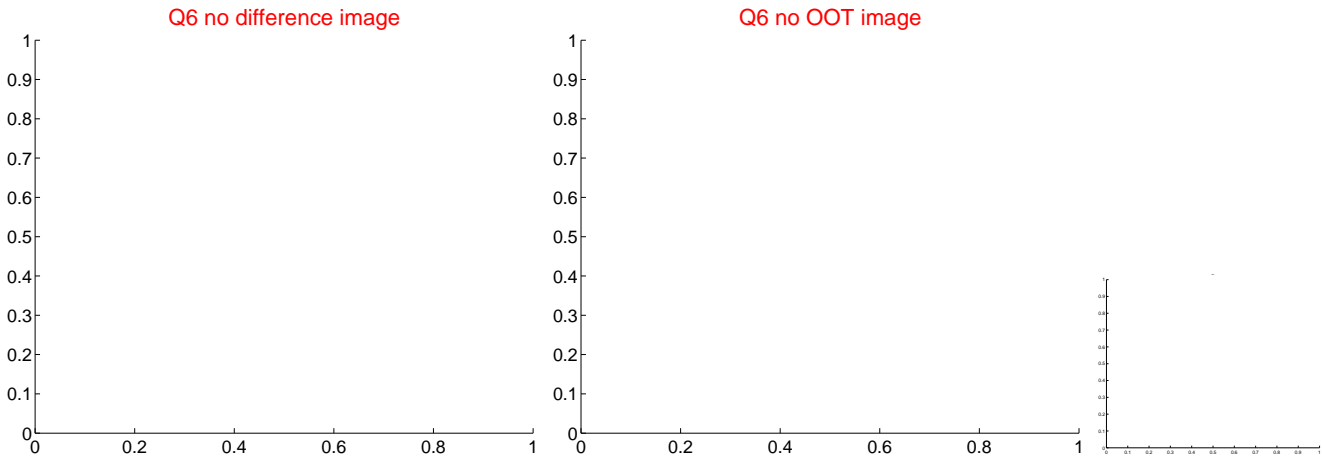
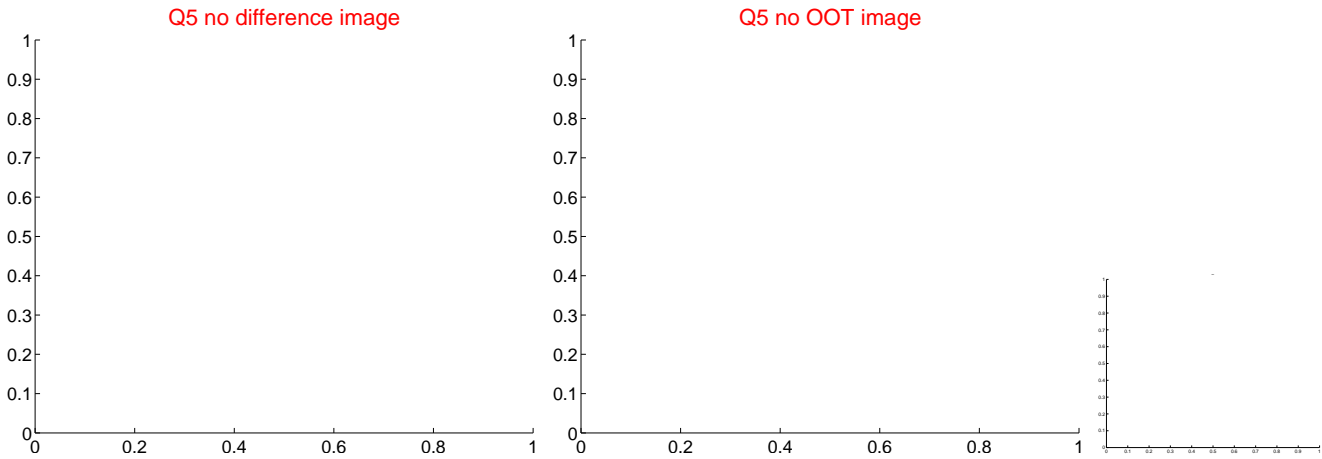
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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





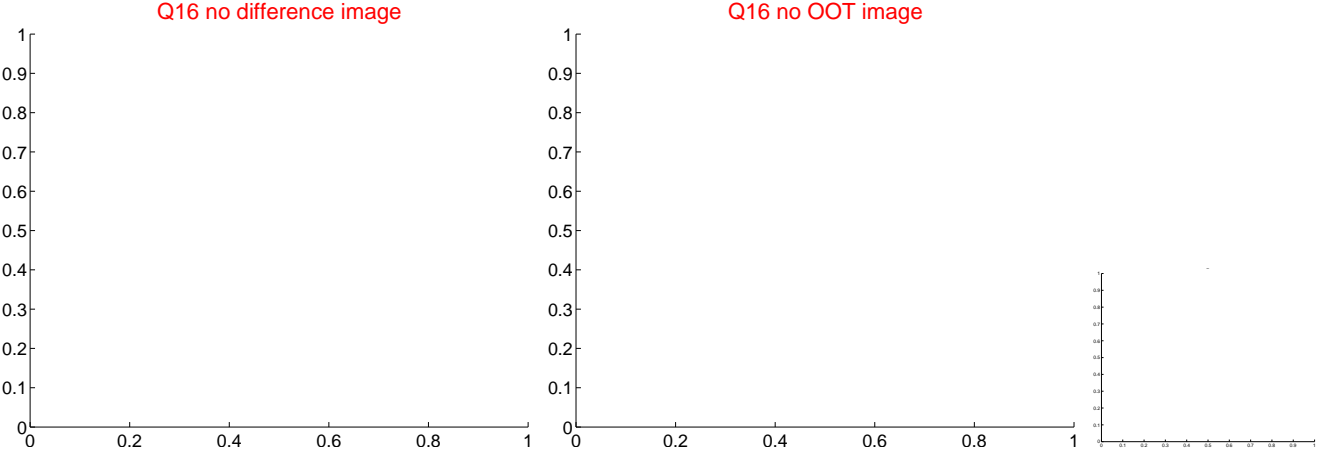
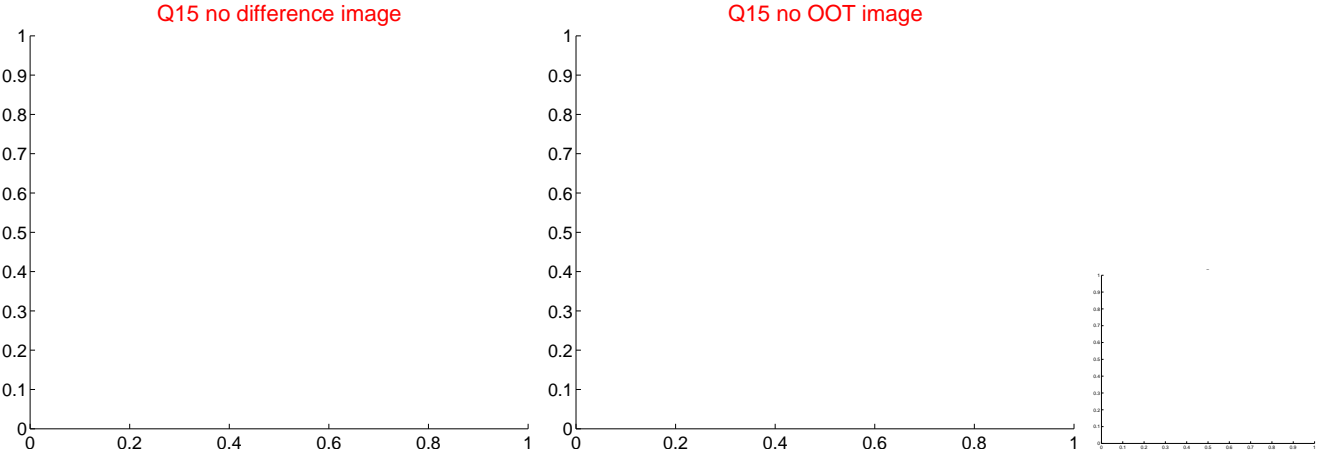
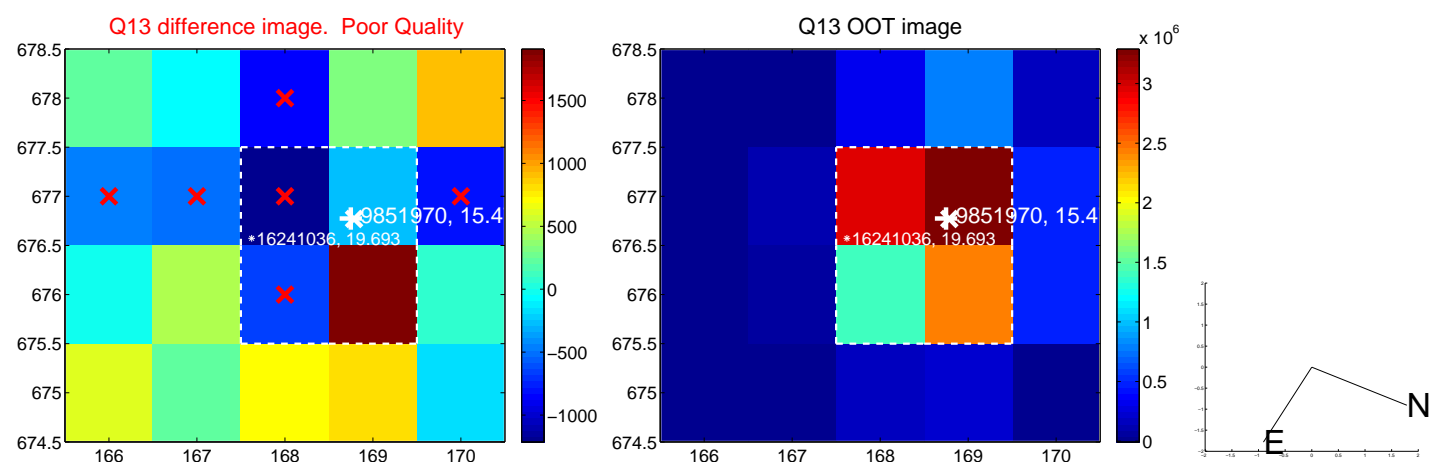
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value



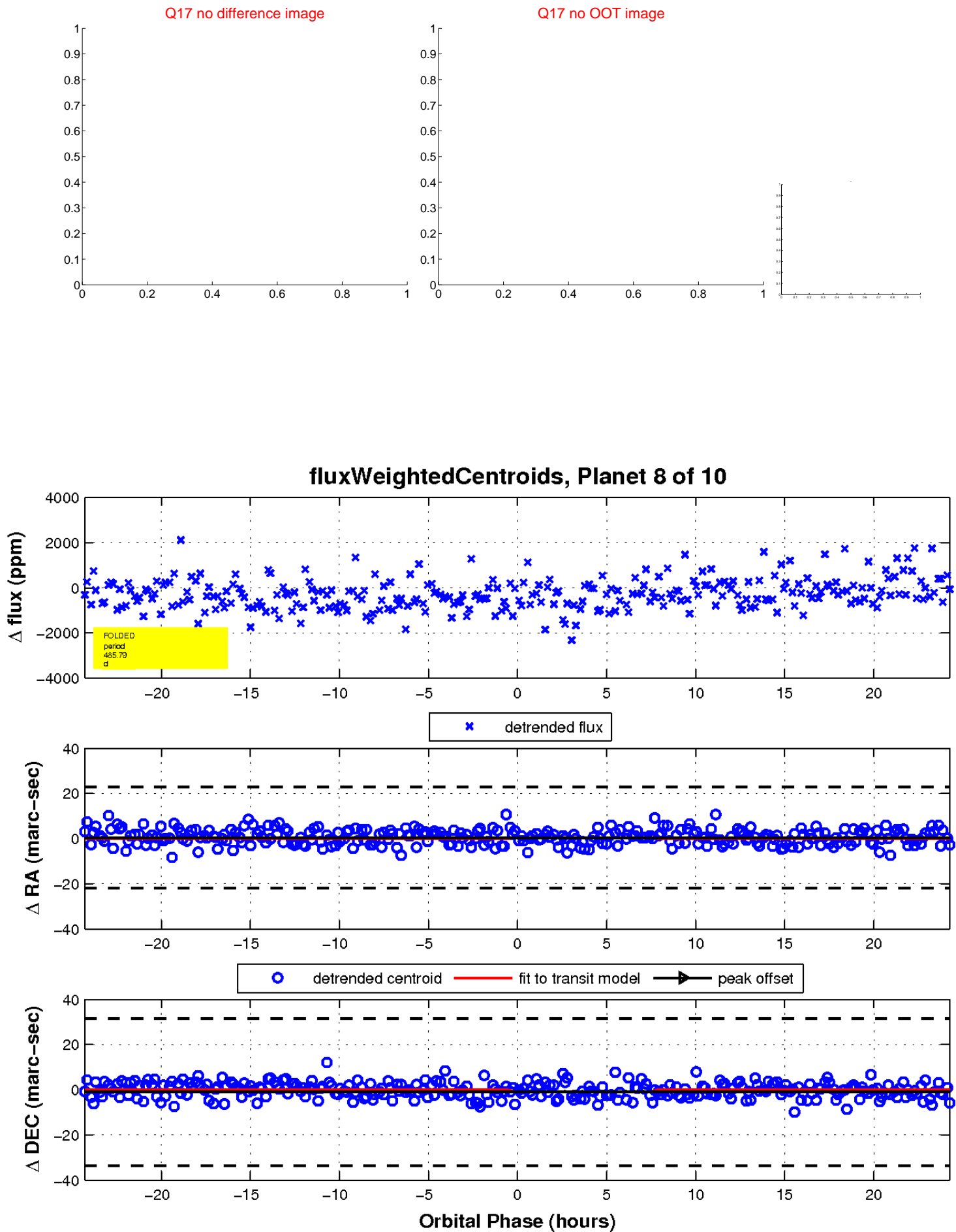
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

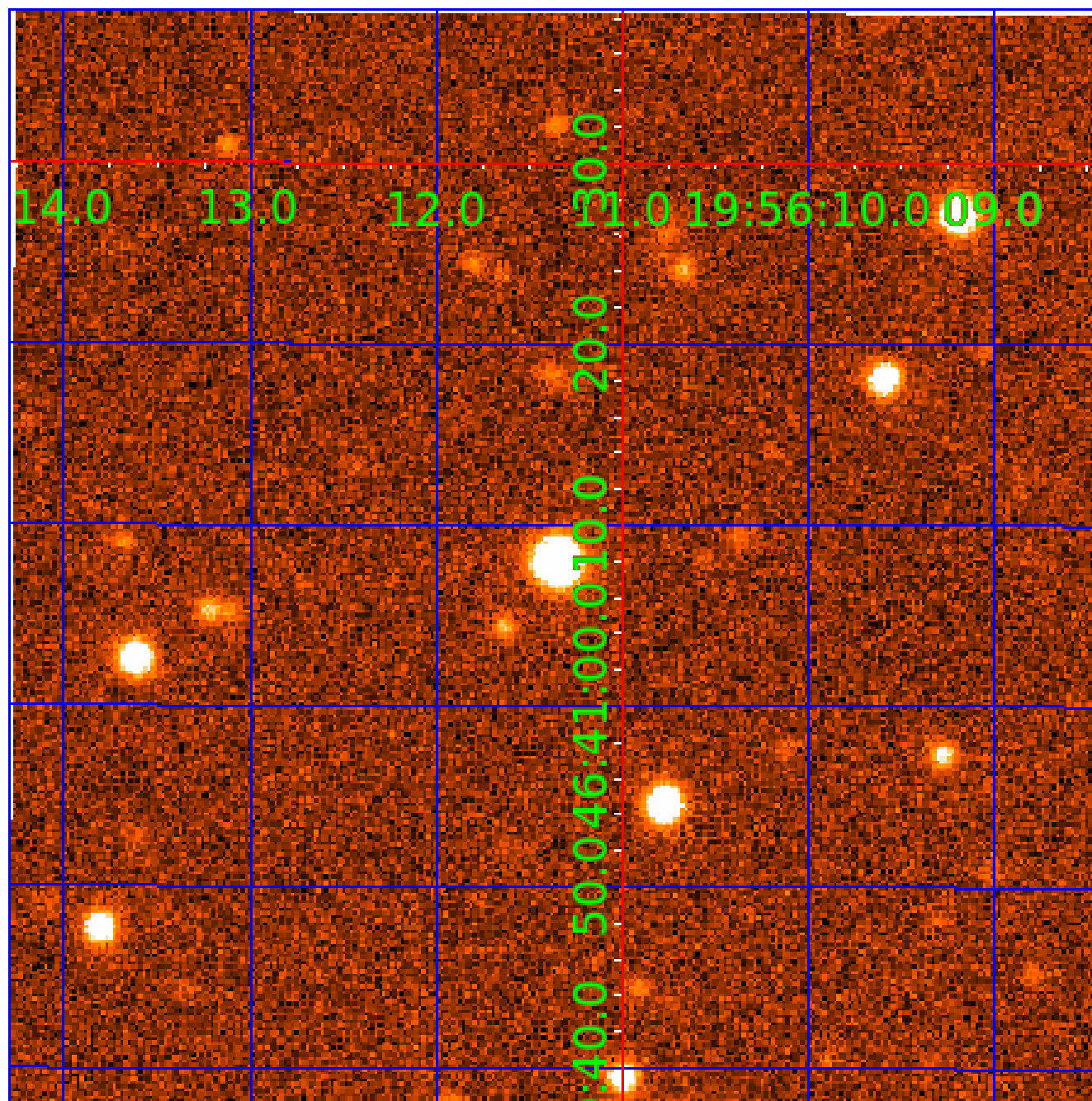


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009851970-01	OBS	4122.01	1.081931	131.550019	107.5	6.343	13.0	13.4	0.74	4965	0.74	871.41
009851970-02	OBS	No	318.191396	287.691504	2963.9	7.500	18.3	-1.0	0.74	4965	3.89	0.45
009851970-03	OBS	No	87.131904	158.497311	1337.3	12.255	11.1	8.0	0.74	4965	4.18	2.51
009851970-04	OBS	No	98.329975	161.538824	746.0	4.930	12.1	5.3	0.74	4965	2.36	2.13
009851970-05	OBS	No	58.028718	183.047579	986.5	7.168	11.4	8.4	0.74	4965	2.50	4.31
009851970-06	OBS	No	34.155362	145.442225	495.6	5.928	10.4	4.7	0.74	4965	1.86	8.73
009851970-07	OBS	No	43.866421	135.859401	759.6	3.082	10.4	4.7	0.74	4965	2.21	6.26
009851970-08	OBS	No	485.794267	253.271172	1176.7	9.000	9.7	-1.0	0.74	4965	2.45	0.25
009851970-09	OBS	No	69.926614	193.429290	667.9	4.803	9.9	4.1	0.74	4965	2.11	3.36
009851970-10	OBS	No	665.534623	173.054303	2457.4	17.077	9.5	8.7	0.74	4965	6.96	0.17

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009851970-01	OBS	FP	0.00	0	1	1	1	MOD_SEC_ALT—CENT_RESOLVED_OFFSET—HALO_GHOST—EPHEM_MATCH
009851970-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_ZUMA—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_NOFITS
009851970-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_ALT—CENT_FEW_DIFFS
009851970-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_ZUMA_TRACKER—TRANS_GAPPED—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009851970-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE—TRANS_GAPPED—LPP_DV—CENT_FEW_DIFFS
009851970-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
009851970-07	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_TRACKER—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
009851970-08	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL—LPP_DV—ALL_TRANS_CHASES—NO_FITS—CENT_NOFITS
009851970-09	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE_TRACKER—TRANS_GAPPED—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS—HALO_GHOST
009851970-10	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_SKYE—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—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 009851970-09

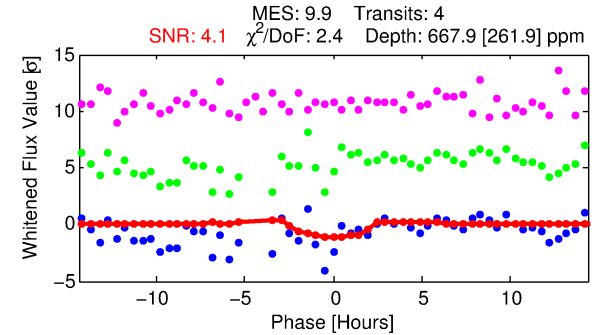
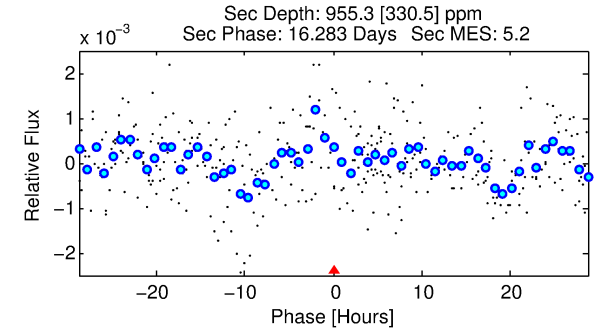
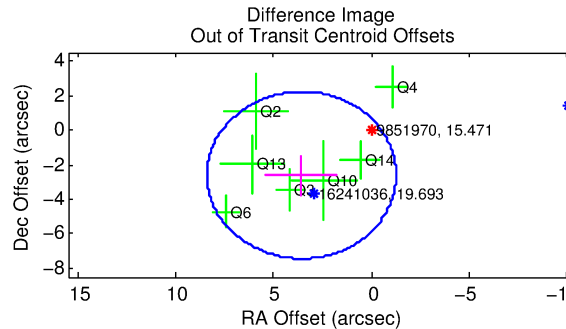
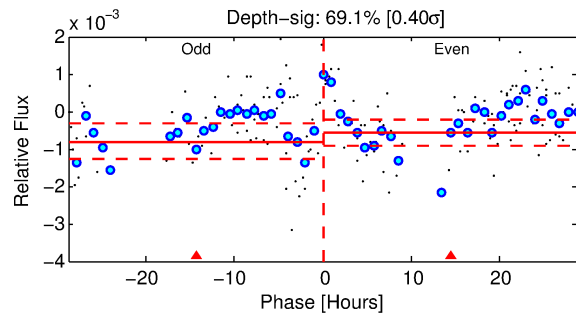
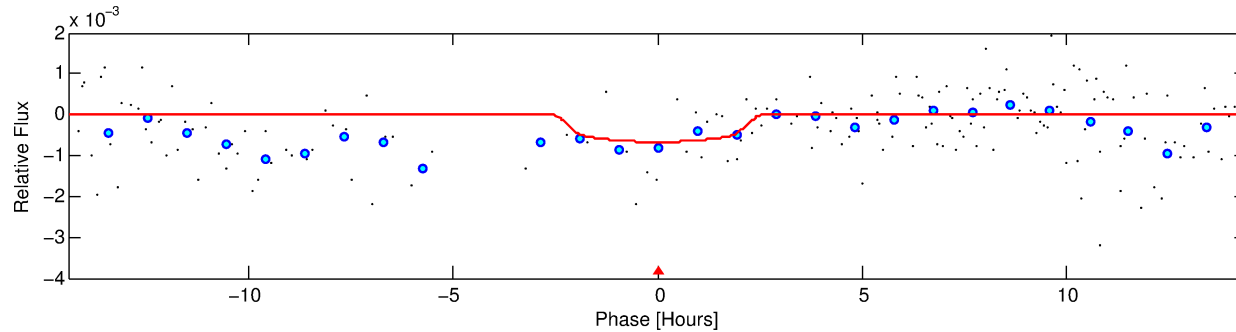
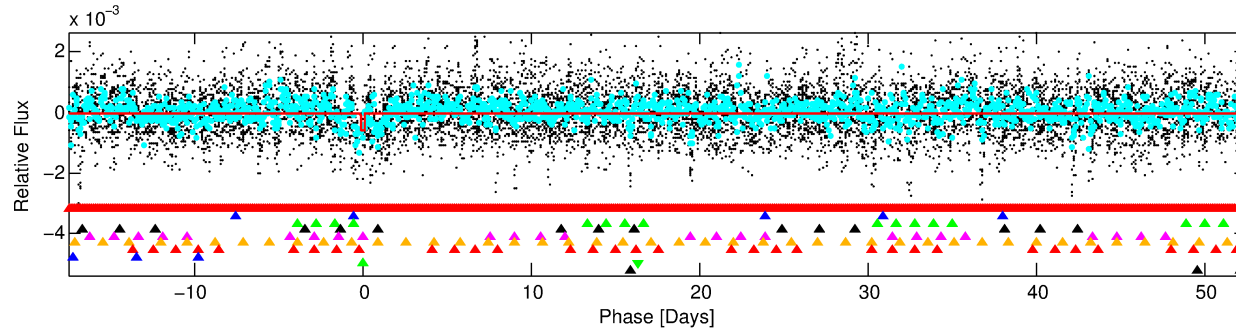
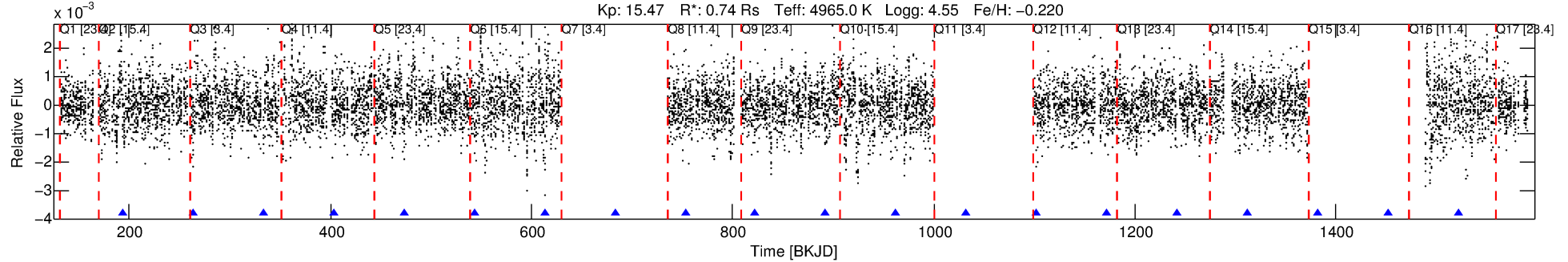
No Significant Match Found

# DV One-Page Summary

KIC: 9851970 Candidate: 9 of 10 Period: 69.927 d

KOI: K04122 Corr: No Ephemeris Match

Kp: 15.47 R\*: 0.74 Rs Teff: 4965.0 K Logg: 4.55 Fe/H: -0.220



## DV Fit Results:

Period = 69.92661 [0.00479] d  
Epoch = 193.4293 [0.0544] BKJD  
Rp/R\* = 0.0263 [0.0573]  
a/R\* = 73.31 [575.75]  
b = 0.79 [3.87]  
Seff = 3.36 [0.60]  
Teq = 345 [15] K  
Rp = 2.11 [4.61] Re  
a = 0.2963 [0.0268] AU  
Ag = 10335.33 [45193.83] [0.23σ]  
Teffp = 5382 [5883] K [0.86σ]

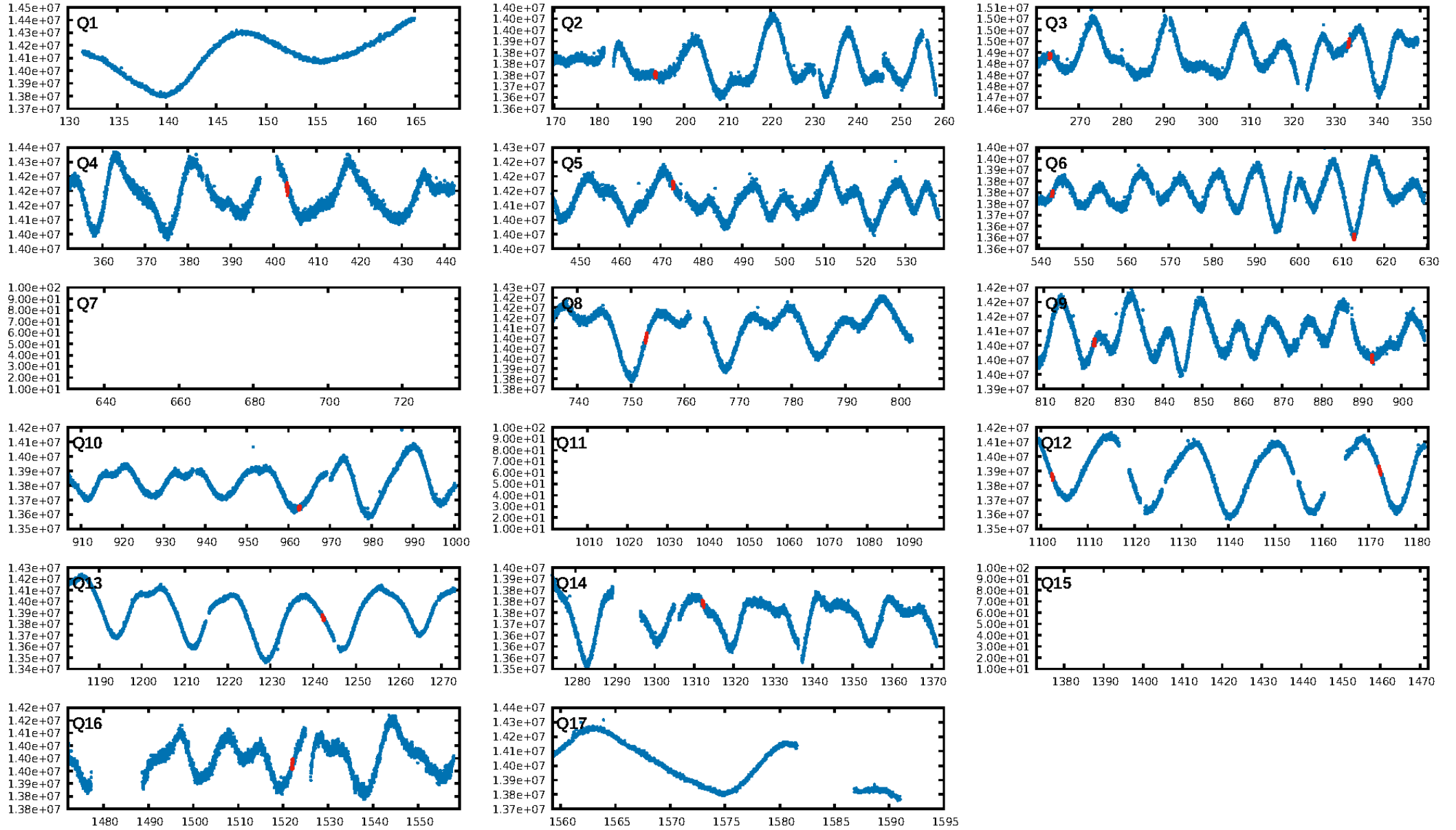
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [33.10σ]  
LongPeriod-sig: 100.0% [31.37σ]  
ModelChiSquare2-sig: 67.0%  
ModelChiSquareGof-sig: 64.0%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [4/4]  
GhostDiagnostic-chr: -0.217  
Centroid-sig: 40.3%  
Centroid-so: 0.882 arcsec [0.65σ]  
OotOffset-rm: 4.426 arcsec [2.75σ]  
OotOffset-st: 4/1/1/1 [7]  
KicOffset-rm: 4.602 arcsec [2.84σ]  
KicOffset-st: 4/1/1/1 [7]  
DiffImageQuality-fgm: 0.00 [0/7]  
DiffImageOverlap-fno: 0.00 [0/12]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 08:50:48 Z

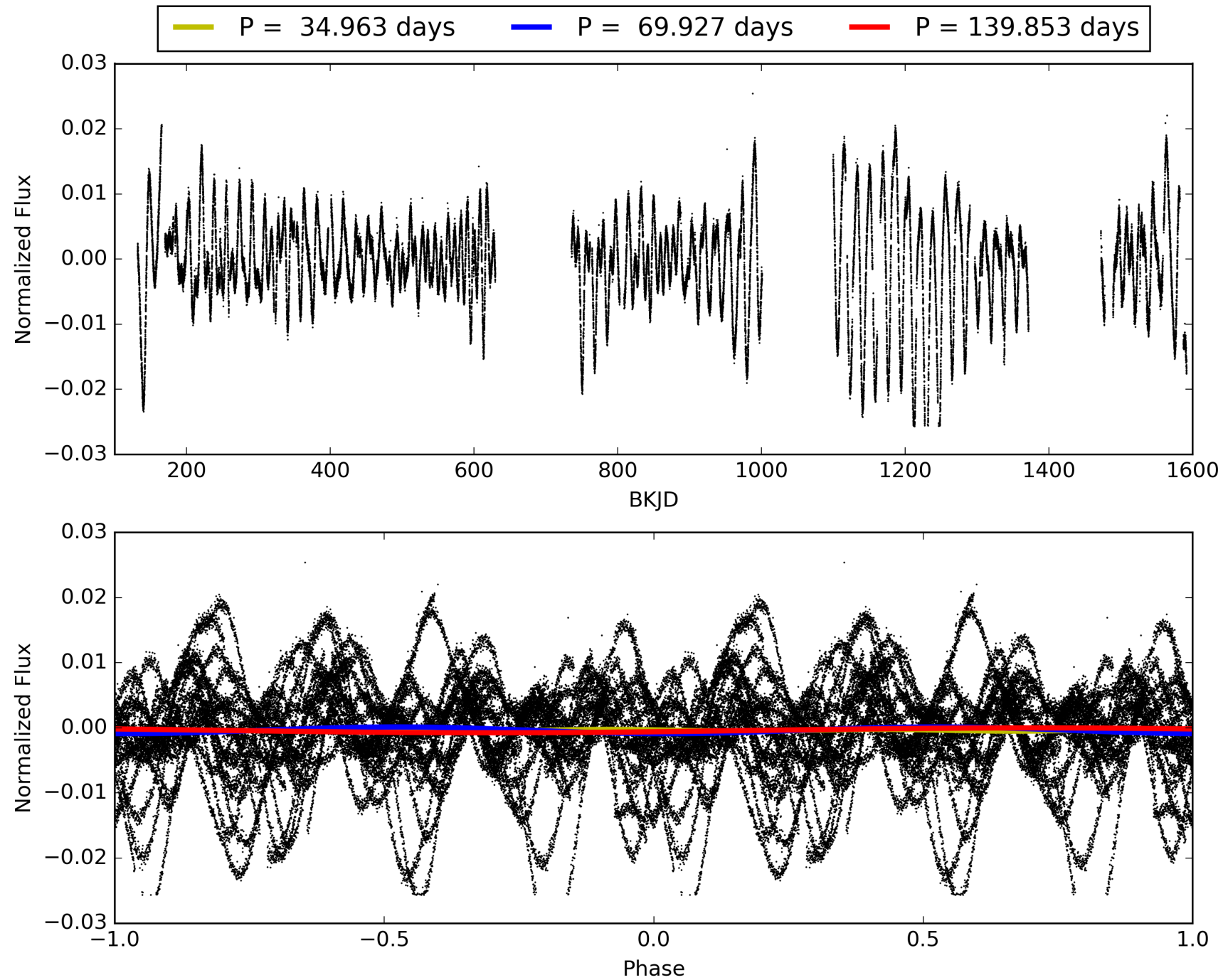
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 009851970-09, PDC Light Curves



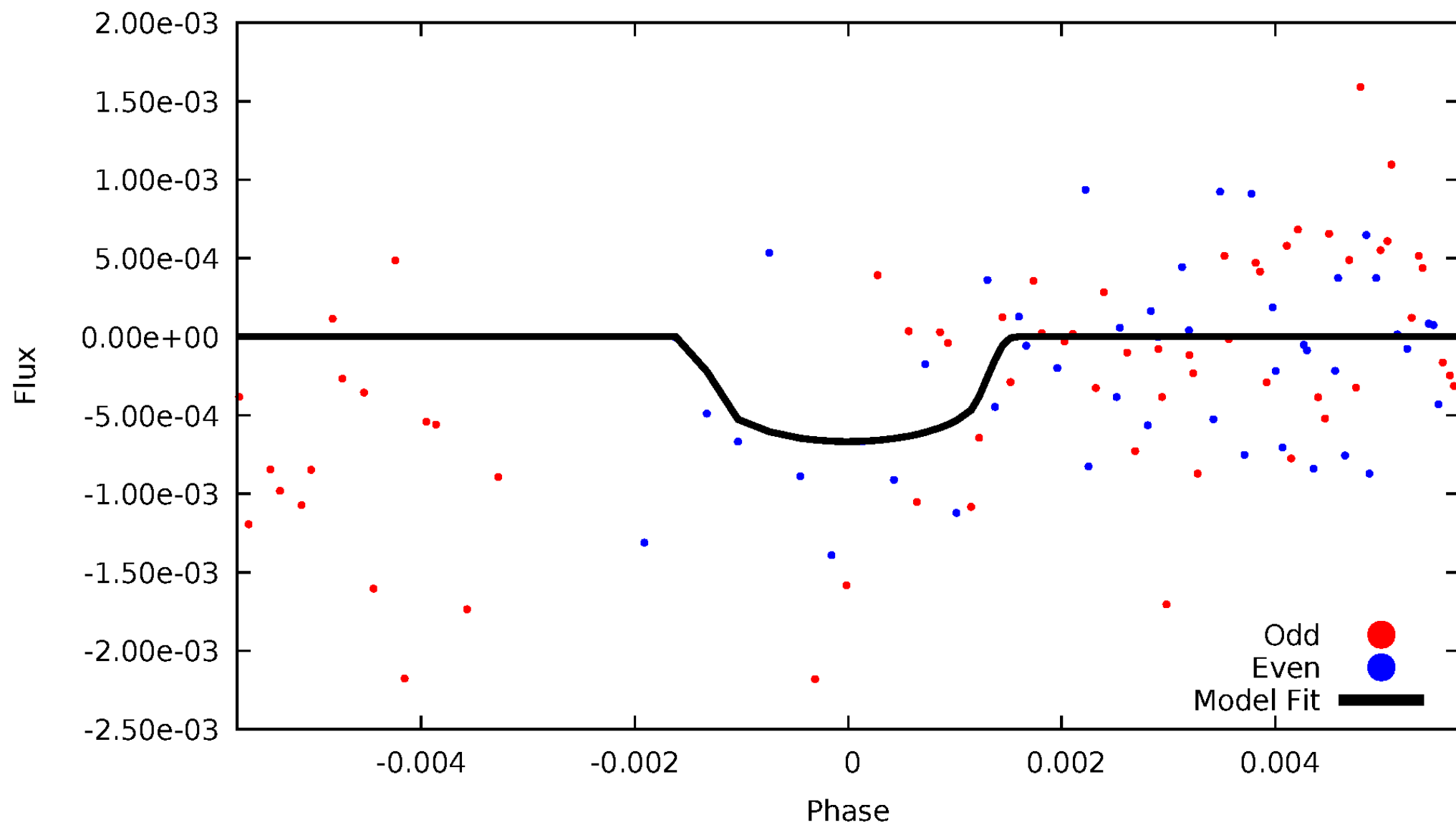


TCE 009851970-09



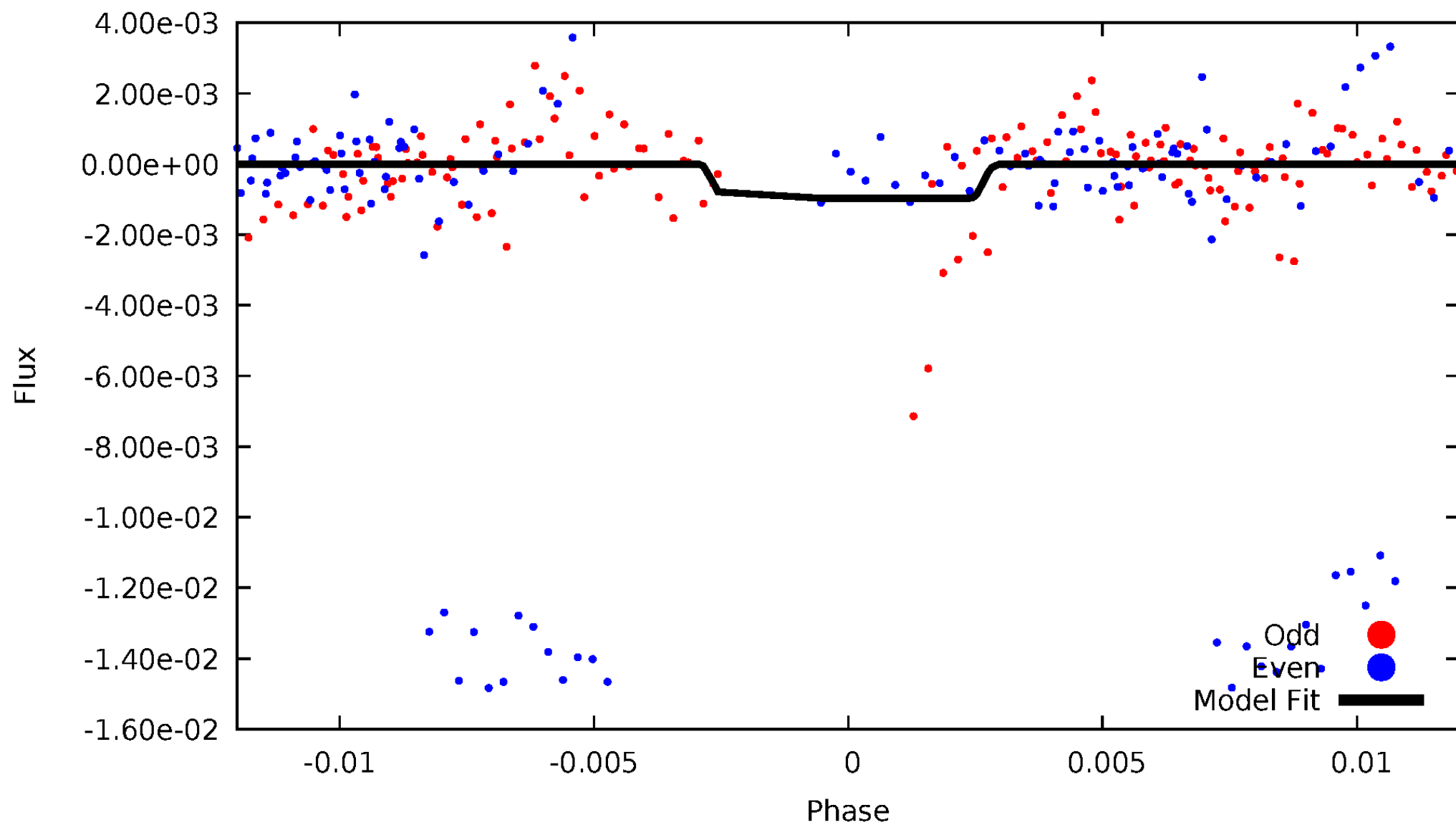
# DV Odd/Even

TCE 009851970-09



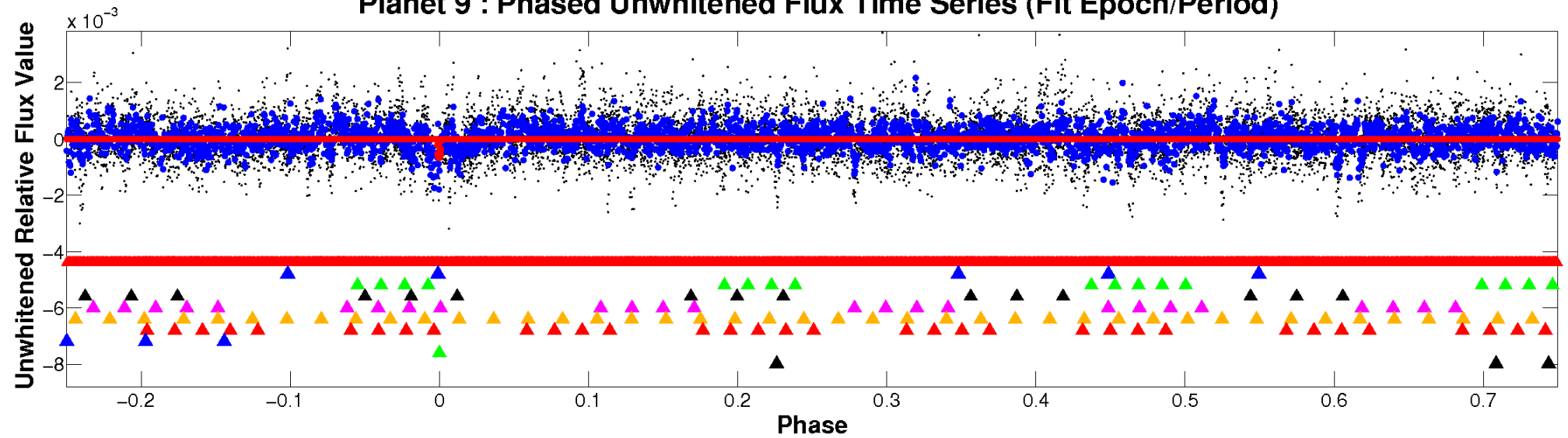
# ALT Odd/Even

TCE 009851970-09

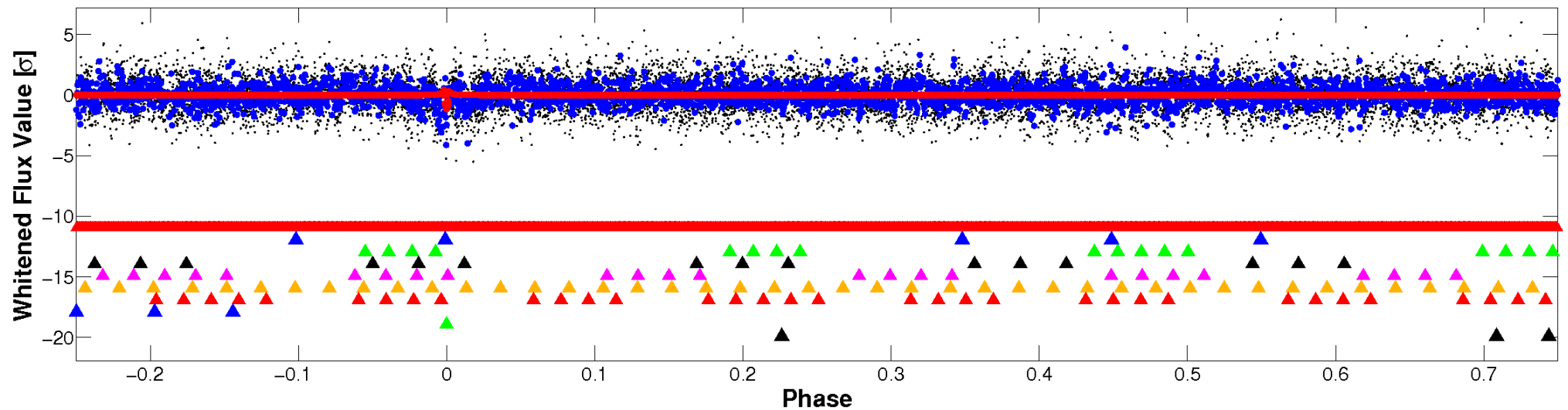


# Non-Whitened Vs. Whitened Light Curve

## Planet 9 : Phased Unwhitened Flux Time Series (Fit Epoch/Period)

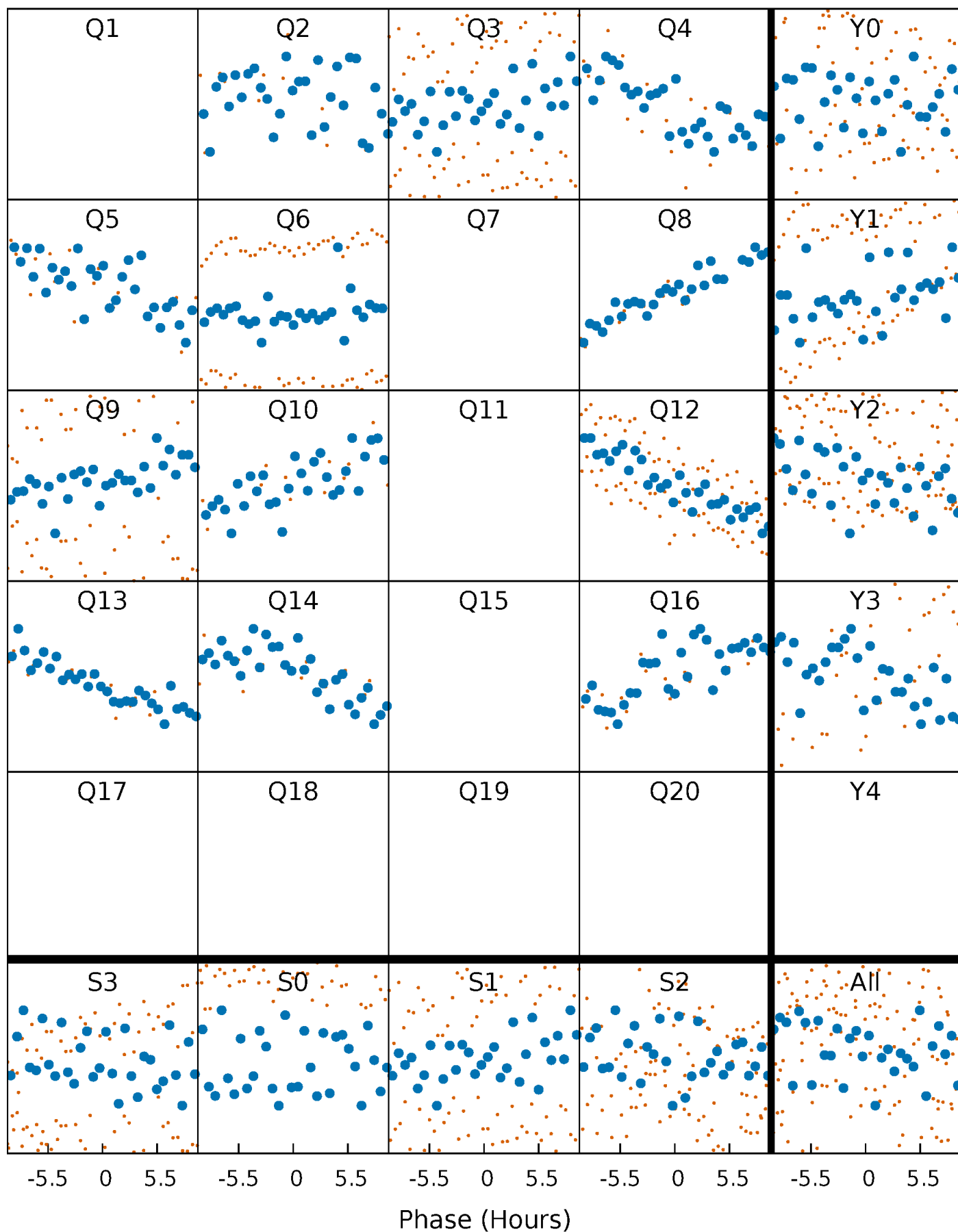


## Planet 9 : Phased Whitened Flux Time Series (Fit Epoch/Period)



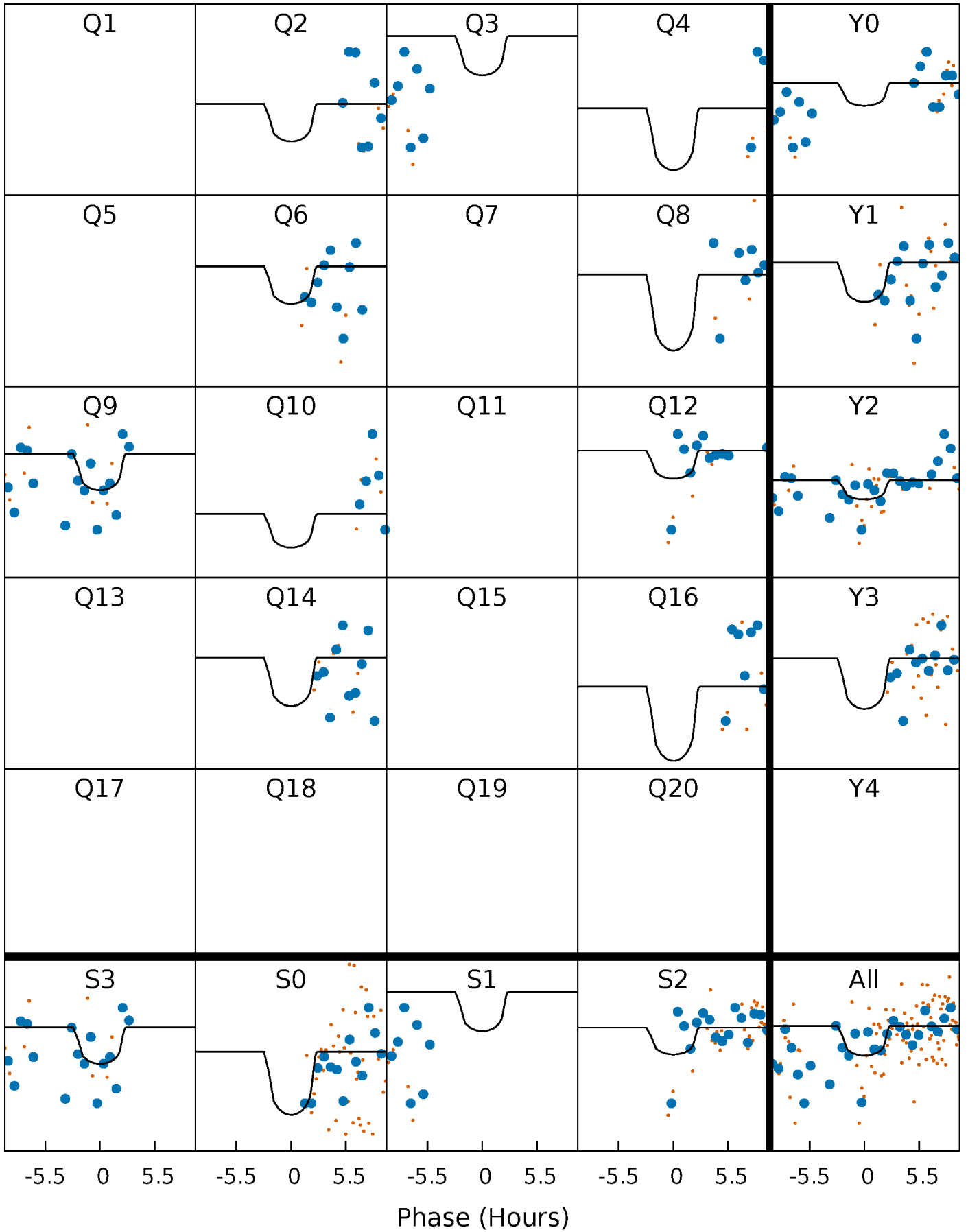
# PDC Quarter-Phased Transit Curves

TCE 009851970-09 P= 69.926614 Days  $T_0=193.429290$  (BKJD)



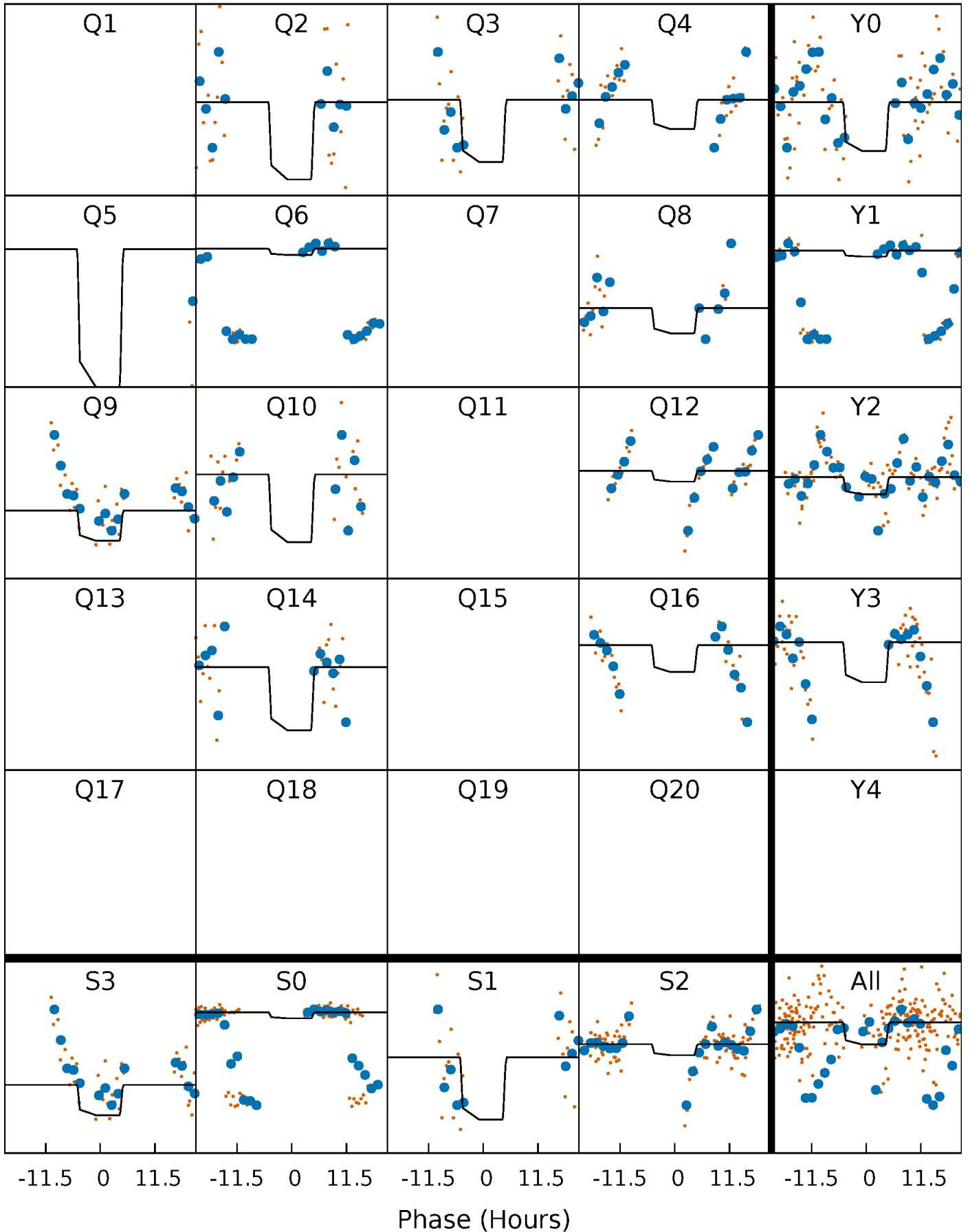
# DV Quarter-Phased Transit Curves

TCE 009851970-09   P= 69.926614 Days    $T_0=193.429290$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

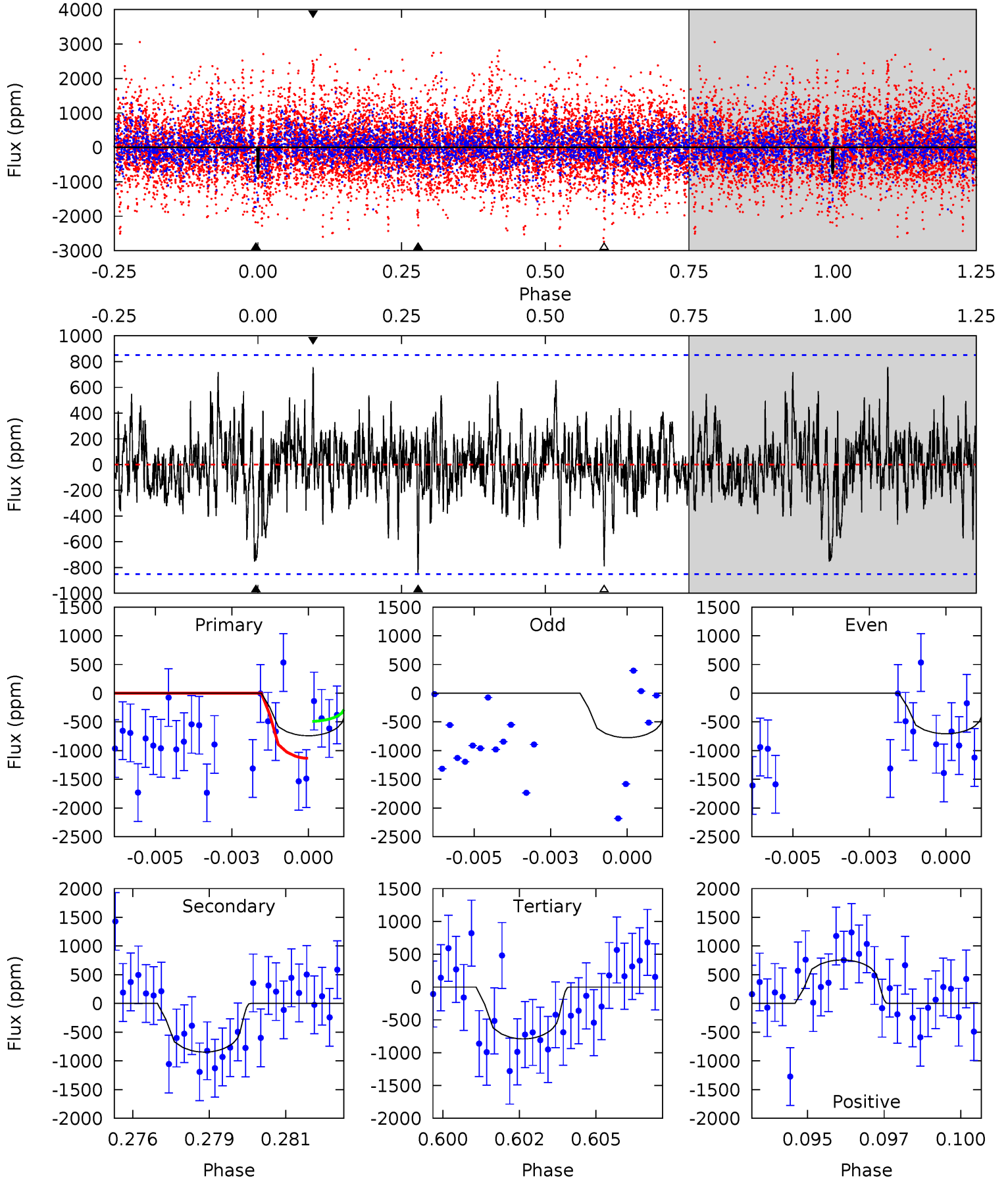
TCE 009851970-09     $P = 69.921517$  Days     $T_0 = 193.384289$  (BKJD)



# DV Model-Shift Uniqueness Test

009851970-09, P = 69.926614 Days, E = 123.502676 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
4.60	5.25	4.90	4.70	5.28	3.01	1.22	-0.30	-0.10	0.35	0.56	0.22	1.01	0.47	1.73

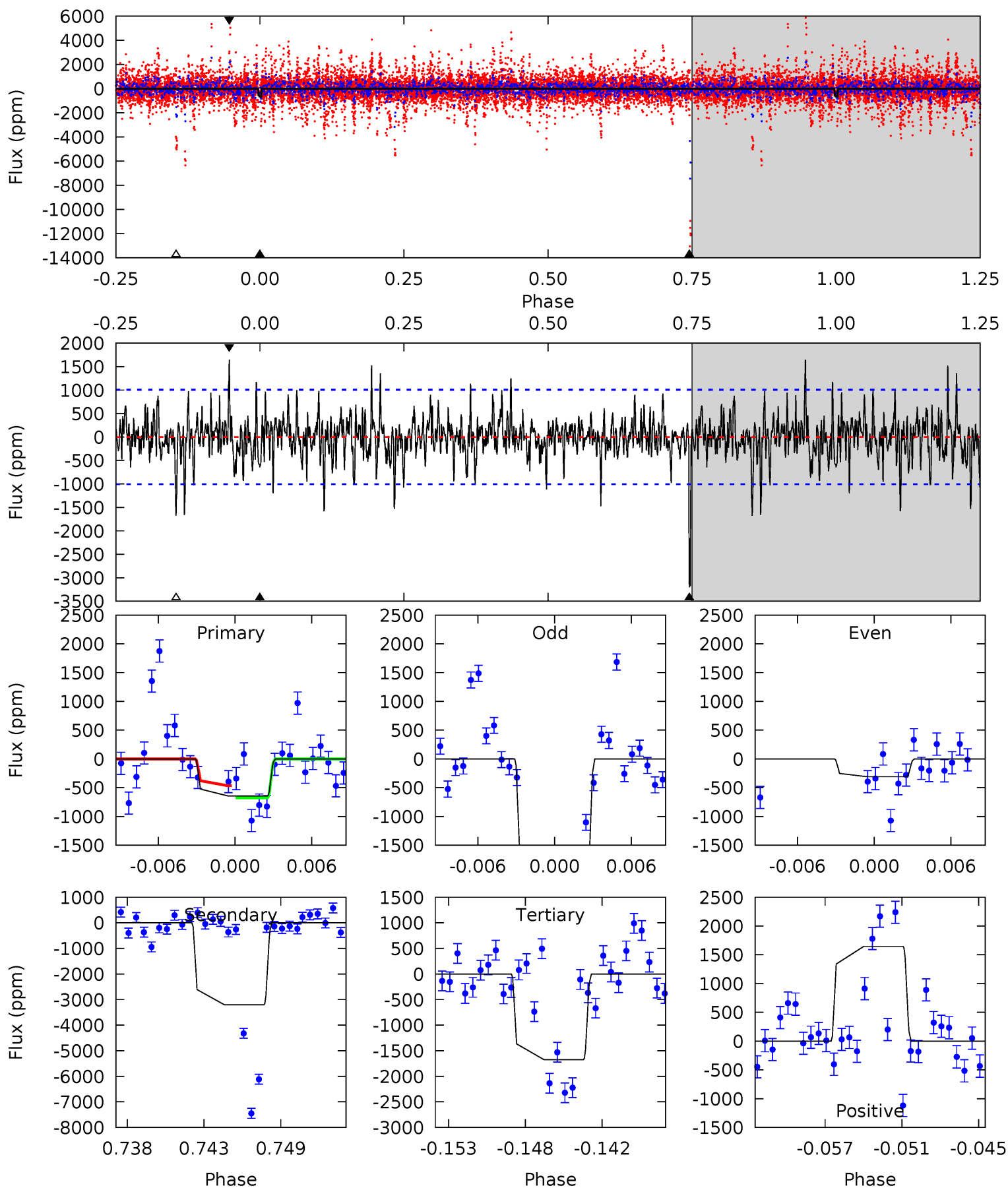




# Alt Model-Shift Uniqueness Test

009851970-09, P = 69.921517 Days, E = 123.462772 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
3.28	16.4	8.56	8.40	5.13	2.77	1.87	-5.27	-5.11	7.81	7.96	3.24	3.31	0.34	0.44



### Stellar Parameters For KIC 009851970

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$4965^{+151}_{-136}$	$4.555^{+0.072}_{-0.044}$	$-0.220^{+0.300}_{-0.300}$	$0.736^{+0.065}_{-0.079}$	$0.709^{+0.093}_{-0.050}$	$2.508^{+0.760}_{-0.407}$
	+3%/-3%	+2%/-1%	+136%/-136%	+9%/-11%	+13%/-7%	+30%/-16%
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 009851970-09 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-847 \pm 161$	$3.84^{+3.70}_{-2.68}$	$480^{+17}_{-18}$	$4125^{+2728}_{-866}$	$2914^{+26378}_{-2234}$
Alt.	$-3204 \pm 196$	$4.14^{+4.37}_{-2.90}$	$481^{+19}_{-18}$	$5222^{+4942}_{-1286}$	$9256^{+94113}_{-7095}$

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

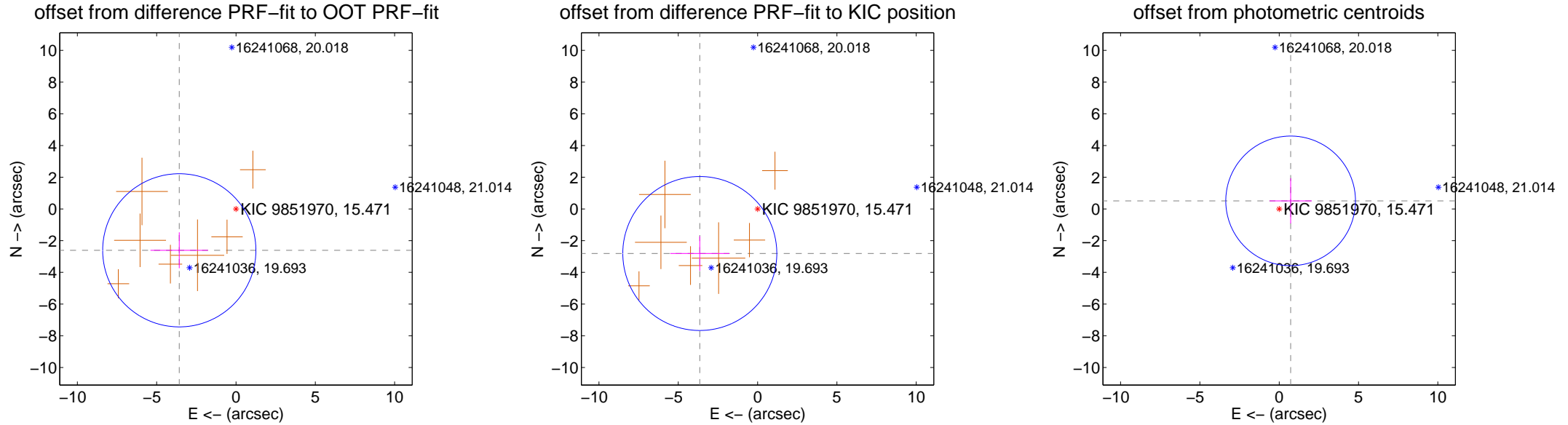
## DV Centroid Data

Supplemental centroid analysis for 009851970-09. Kepler magnitude: 15.47. Transit SNR 4.09

There are 0 quarters with good PRF difference image offsets

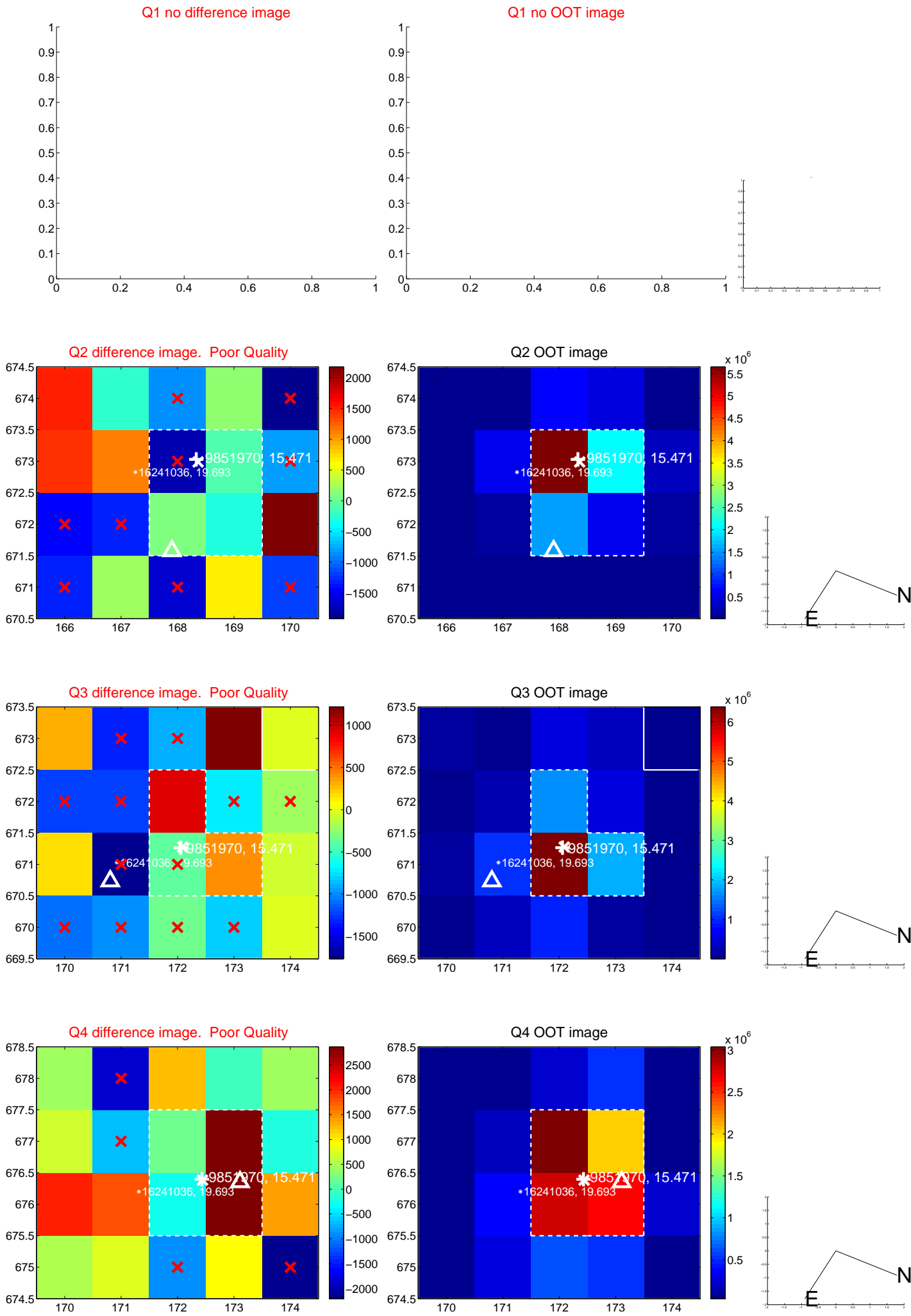
The direct PRF centroid is offset from the target star catalog position by about 0.21 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$4.426 \pm 1.610$	2.75	$3.575 \pm 1.814$	$-2.609 \pm 1.133$
PRF-fit source offset from KIC position	$4.602 \pm 1.618$	2.84	$3.644 \pm 1.864$	$-2.810 \pm 1.087$
photometric centroid source offset	$0.88 \pm 1.36$	0.65	$-0.72 \pm 1.33$	$0.51 \pm 1.43$

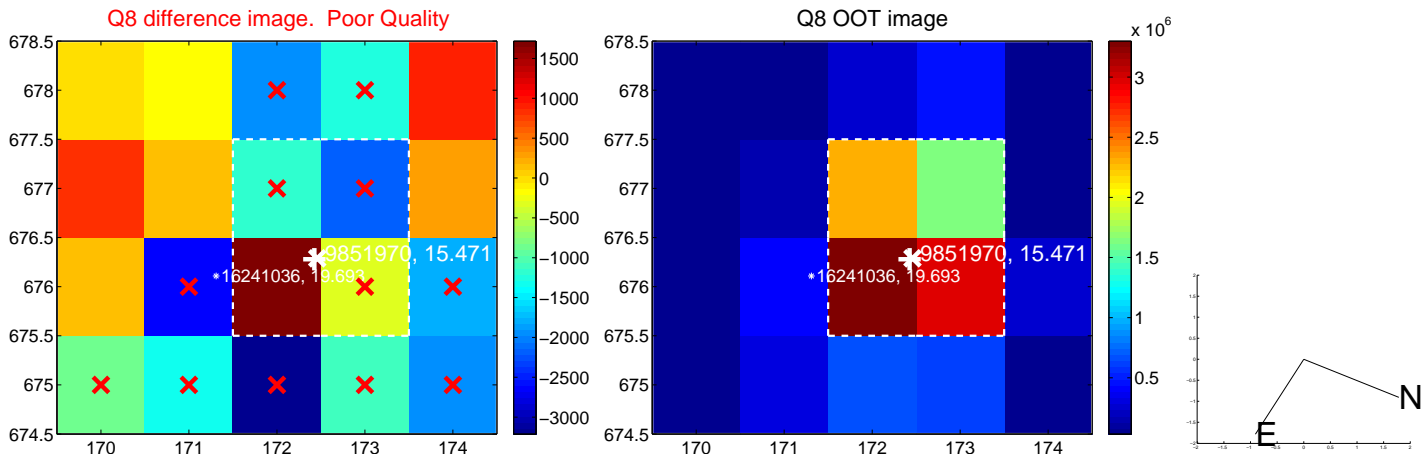
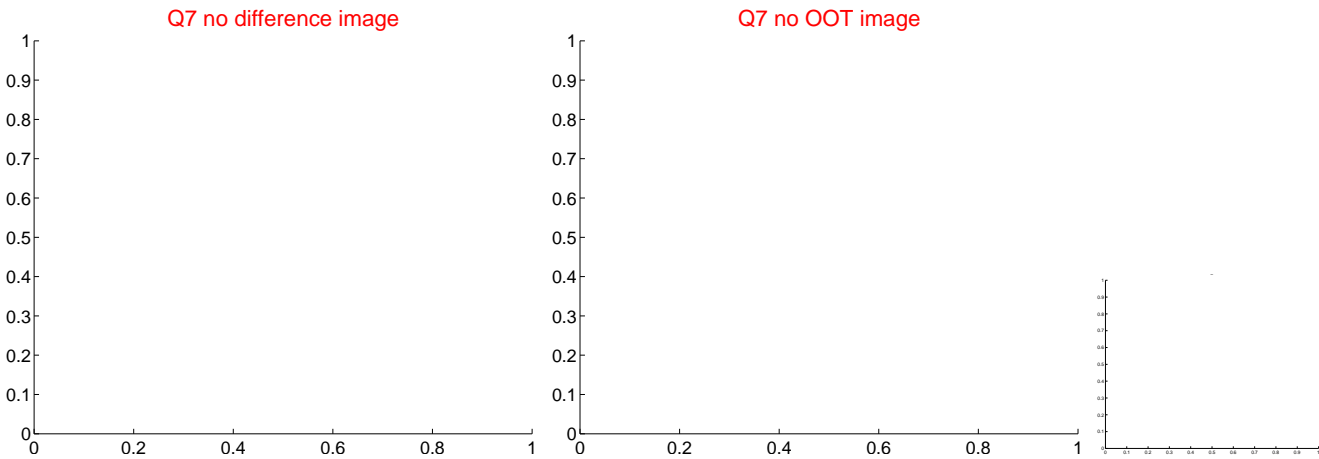
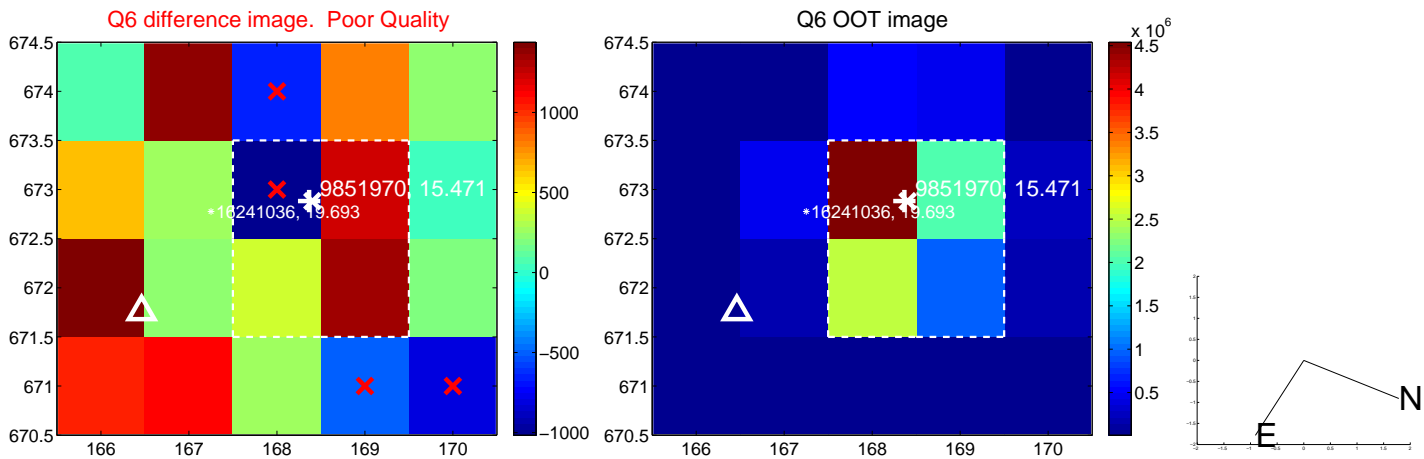
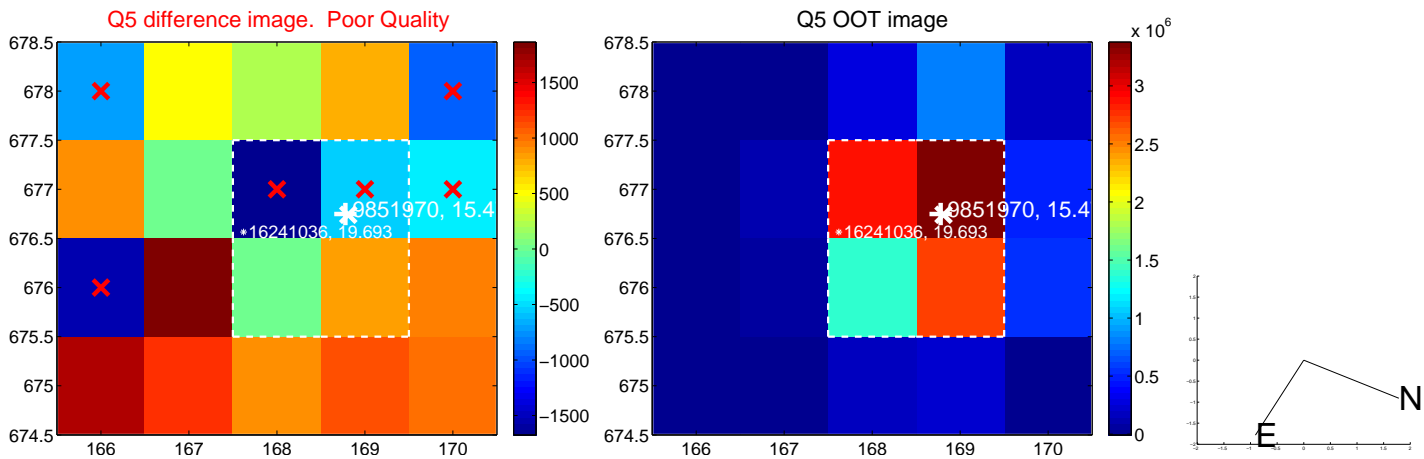


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

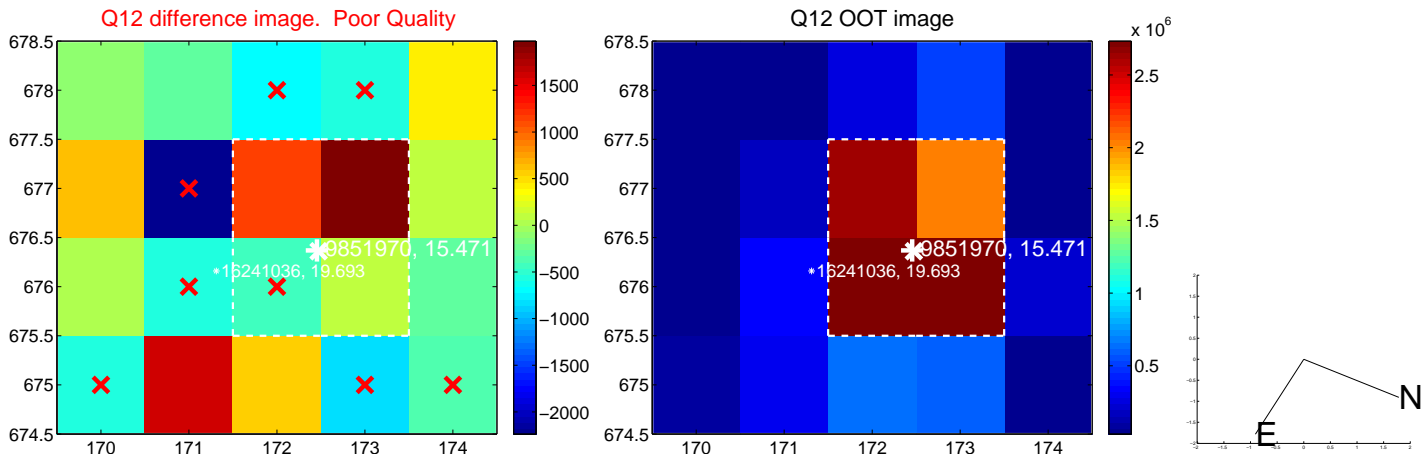
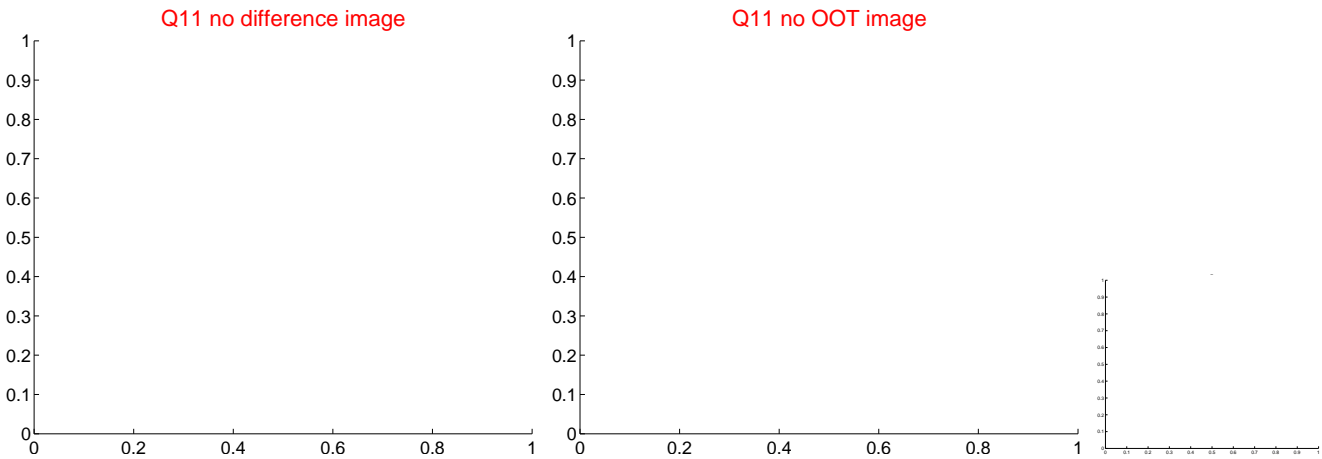
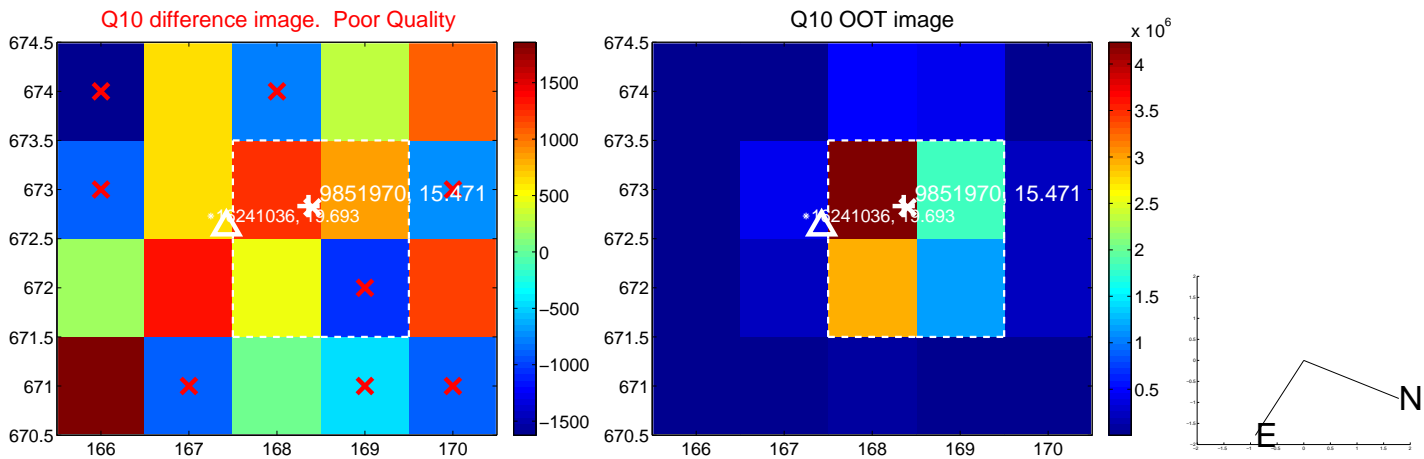
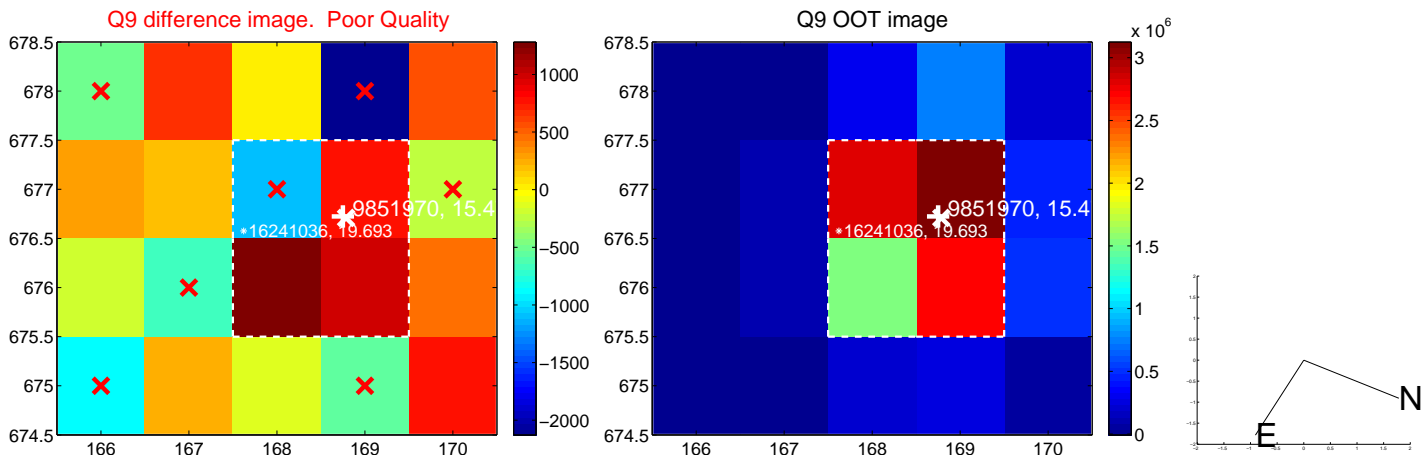
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



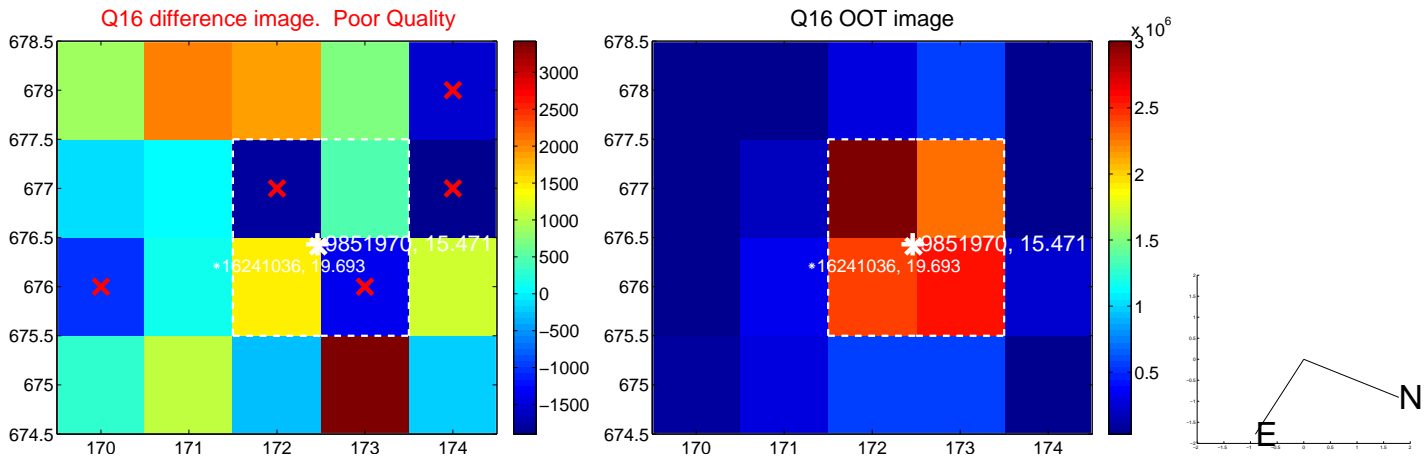
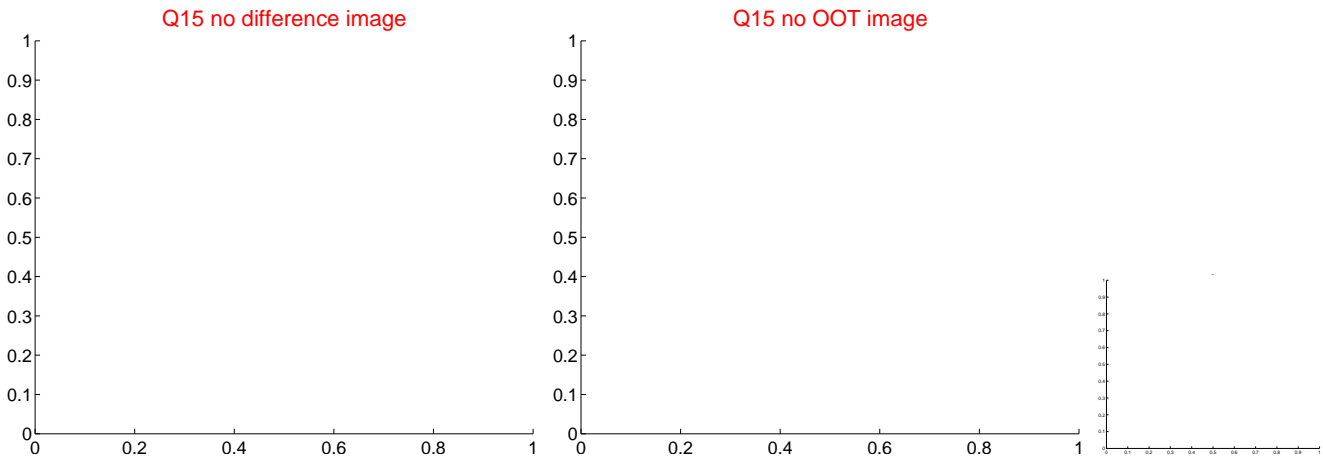
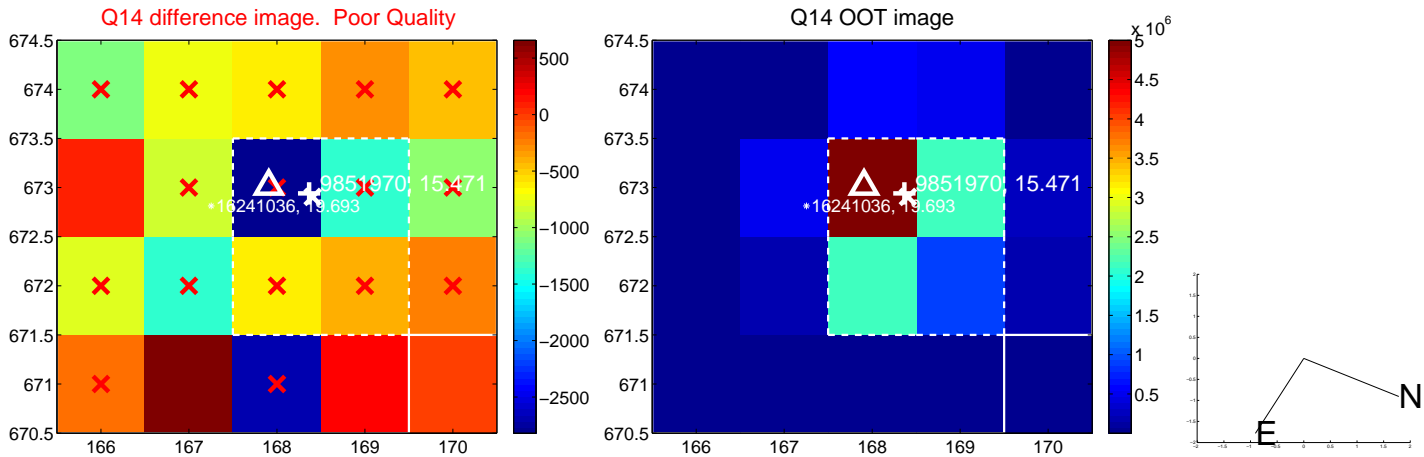
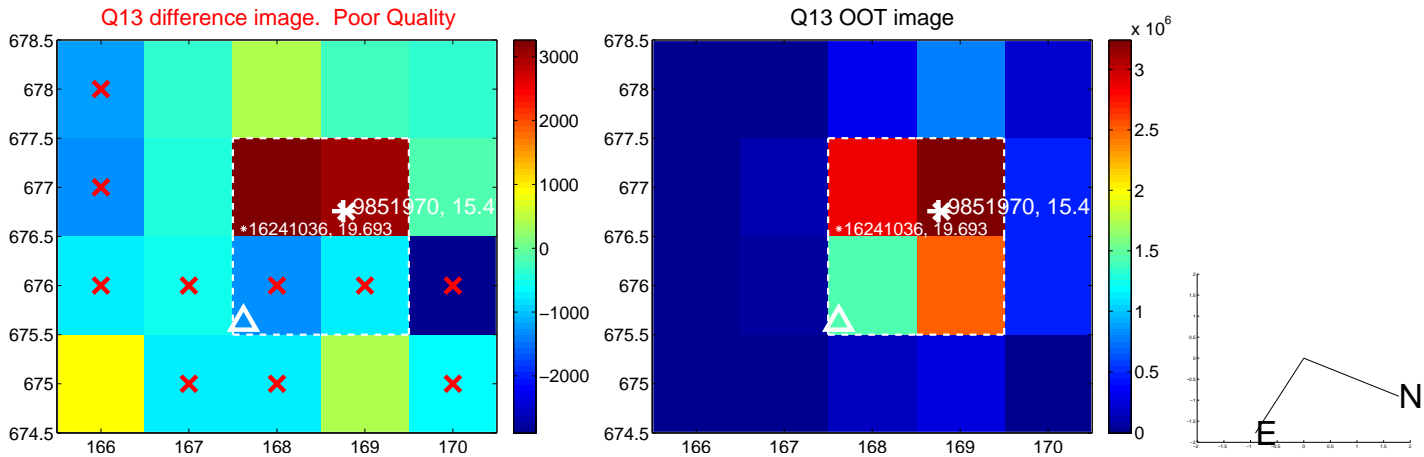
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



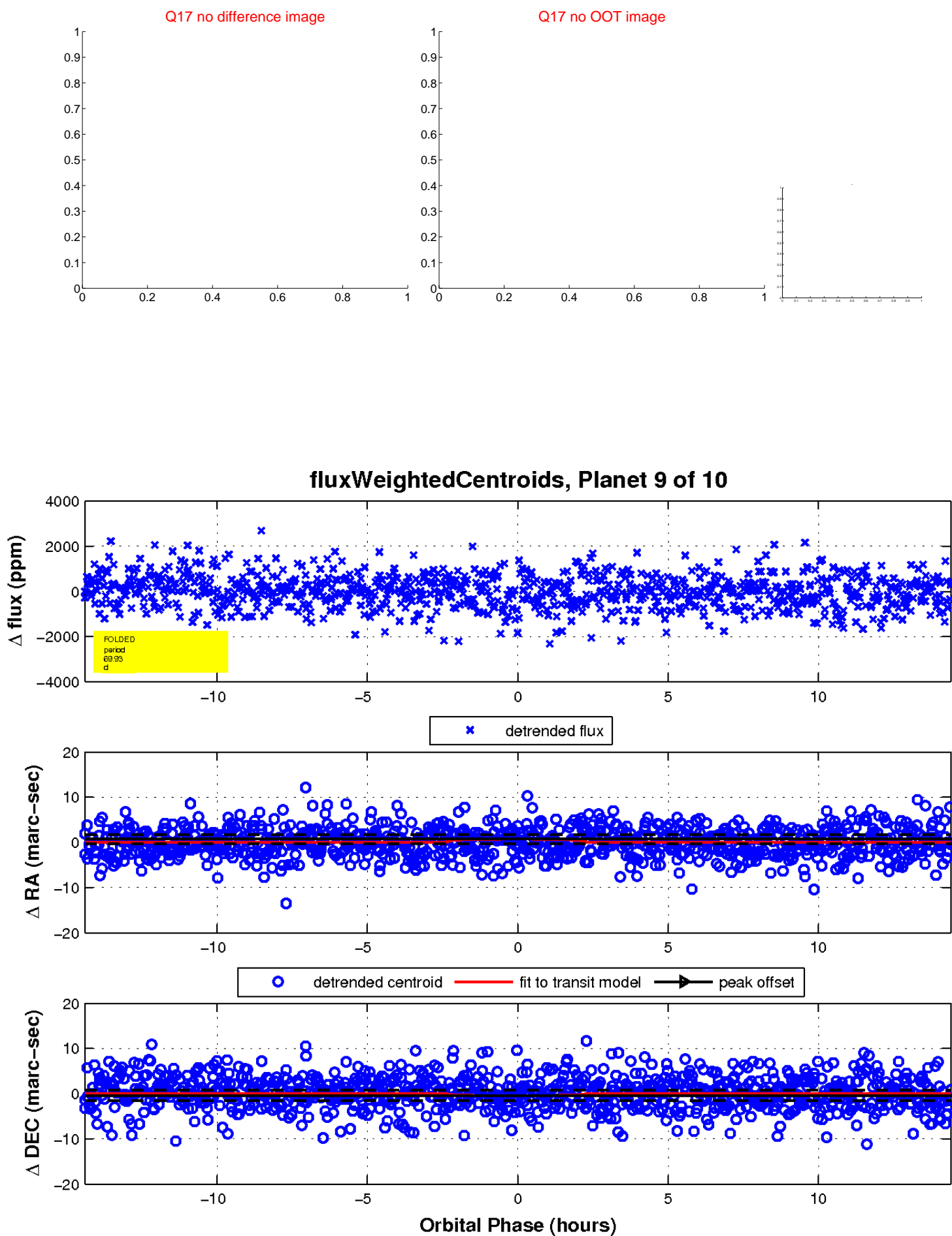
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



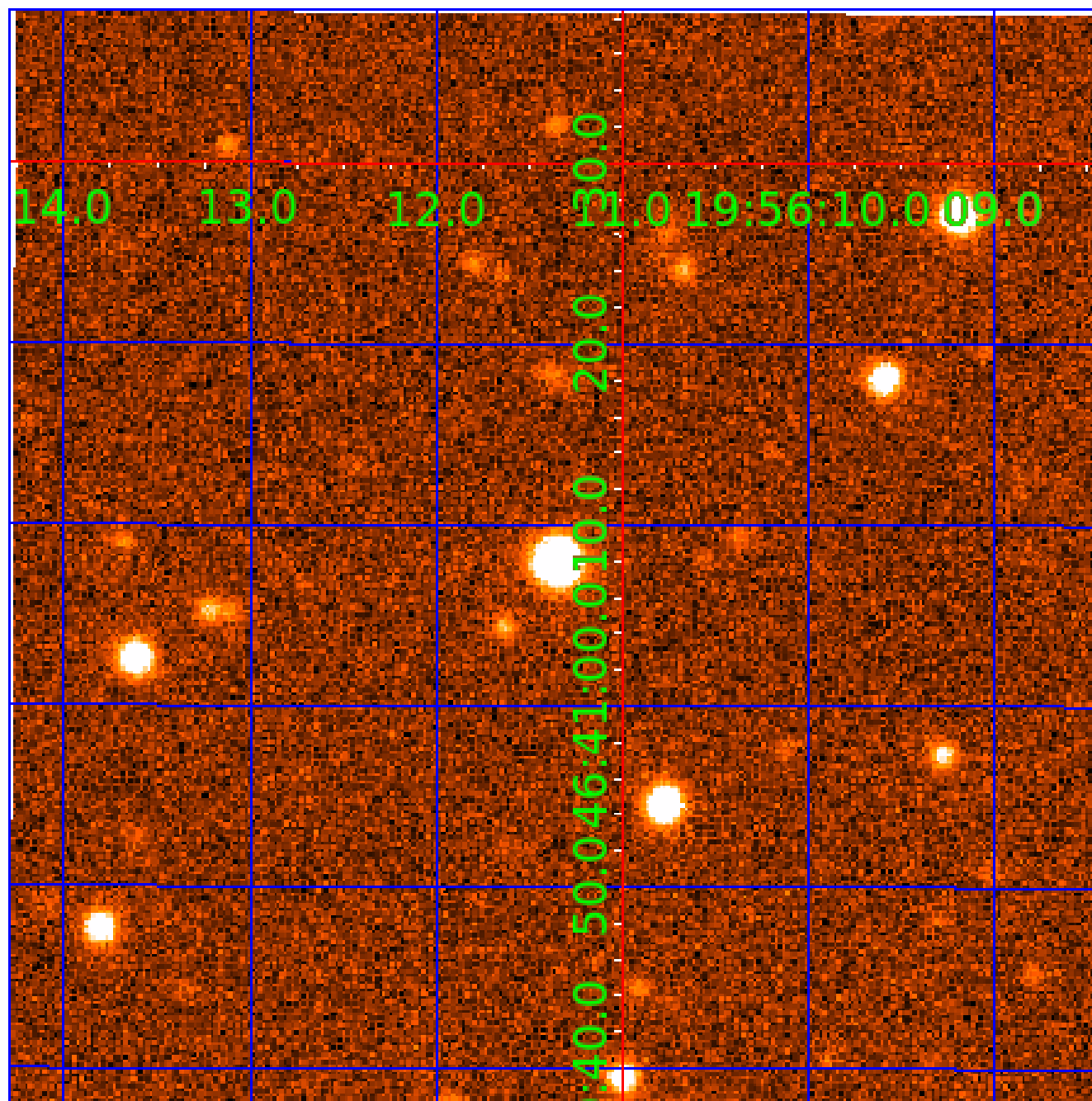
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





UKIRT Image

Declination



## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009851970-01	OBS	4122.01	1.081931	131.550019	107.5	6.343	13.0	13.4	0.74	4965	0.74	871.41
009851970-02	OBS	No	318.191396	287.691504	2963.9	7.500	18.3	-1.0	0.74	4965	3.89	0.45
009851970-03	OBS	No	87.131904	158.497311	1337.3	12.255	11.1	8.0	0.74	4965	4.18	2.51
009851970-04	OBS	No	98.329975	161.538824	746.0	4.930	12.1	5.3	0.74	4965	2.36	2.13
009851970-05	OBS	No	58.028718	183.047579	986.5	7.168	11.4	8.4	0.74	4965	2.50	4.31
009851970-06	OBS	No	34.155362	145.442225	495.6	5.928	10.4	4.7	0.74	4965	1.86	8.73
009851970-07	OBS	No	43.866421	135.859401	759.6	3.082	10.4	4.7	0.74	4965	2.21	6.26
009851970-08	OBS	No	485.794267	253.271172	1176.7	9.000	9.7	-1.0	0.74	4965	2.45	0.25
009851970-09	OBS	No	69.926614	193.429290	667.9	4.803	9.9	4.1	0.74	4965	2.11	3.36
009851970-10	OBS	No	665.534623	173.054303	2457.4	17.077	9.5	8.7	0.74	4965	6.96	0.17

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009851970-01	OBS	FP	0.00	0	1	1	1	MOD_SEC_ALT—CENT_RESOLVED_OFFSET—HALO_GHOST—EPHEM_MATCH
009851970-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_ZUMA—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_NOFITS
009851970-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_ALT—CENT_FEW_DIFFS
009851970-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_ZUMA_TRACKER—TRANS_GAPPED—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009851970-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE—TRANS_GAPPED—LPP_DV—CENT_FEW_DIFFS
009851970-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
009851970-07	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_TRACKER—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
009851970-08	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL—LPP_DV—ALL_TRANS_CHASES—NO_FITS—CENT_NOFITS
009851970-09	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE_TRACKER—TRANS_GAPPED—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS—HALO_GHOST
009851970-10	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_SKYE—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—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.

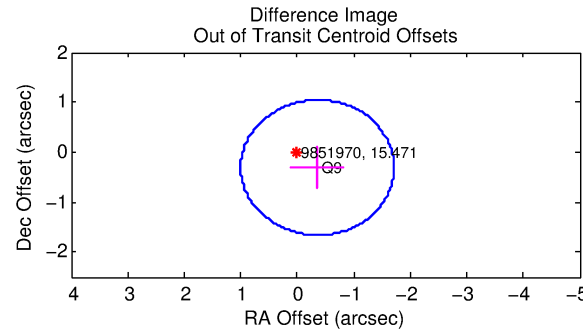
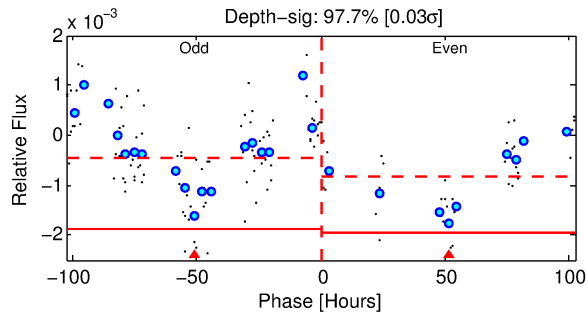
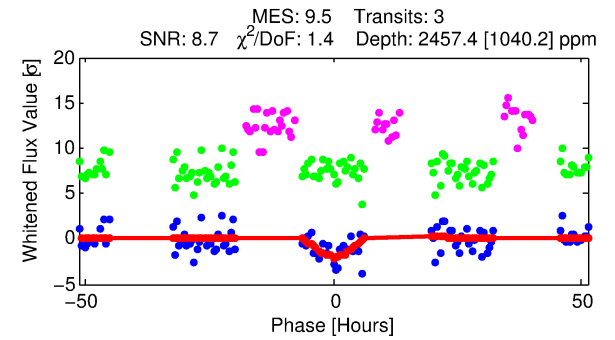
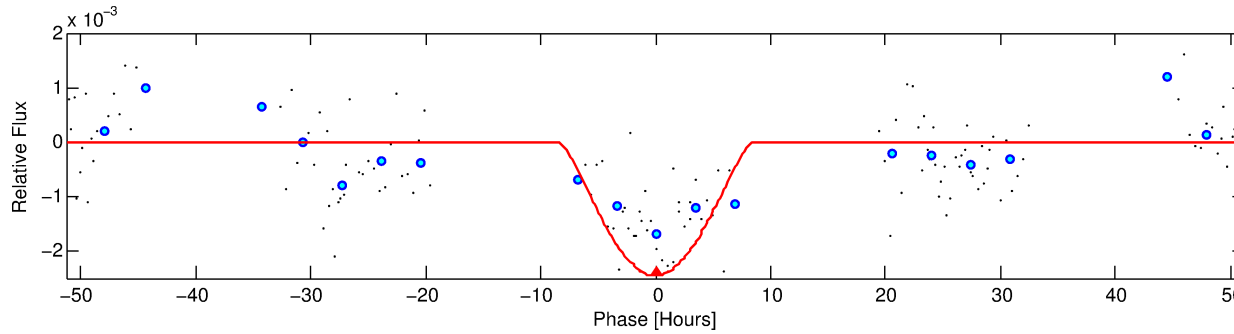
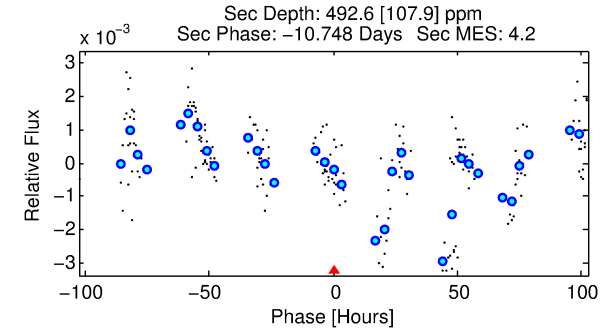
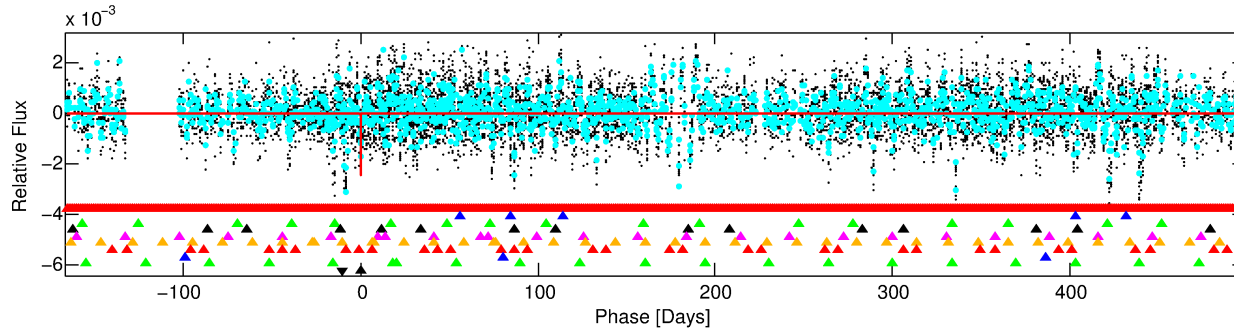
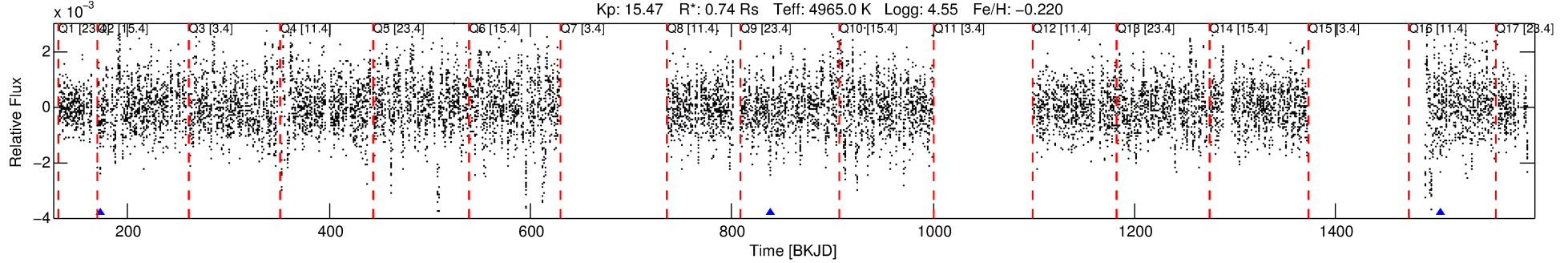
Ephemeris Match Information For 009851970-10

No Significant Match Found

# DV One-Page Summary

KIC: 9851970 Candidate: 10 of 10 Period: 665.535 d  
KOI: K04122 Corr: No Ephemeris Match

Kp: 15.47 R\*: 0.74 Rs Teff: 4965.0 K Logg: 4.55 Fe/H: -0.220



## DV Fit Results:

Period = 665.53462 [0.09610] d  
Epoch = 173.0543 [0.1014] BKJD  
Rp/R\* = 0.0867 [0.4752]  
a/R\* = 128.98 [169.39]  
b = 1.00 [0.70]  
Seff = 0.17 [0.03]  
Teq = 163 [7] K  
Rp = 6.96 [38.17] Re  
a = 1.3306 [0.1203] AU  
Ag = 9895.45 [108502.86] [0.09σ]  
Teffp = 2512 [6886] K [0.34σ]

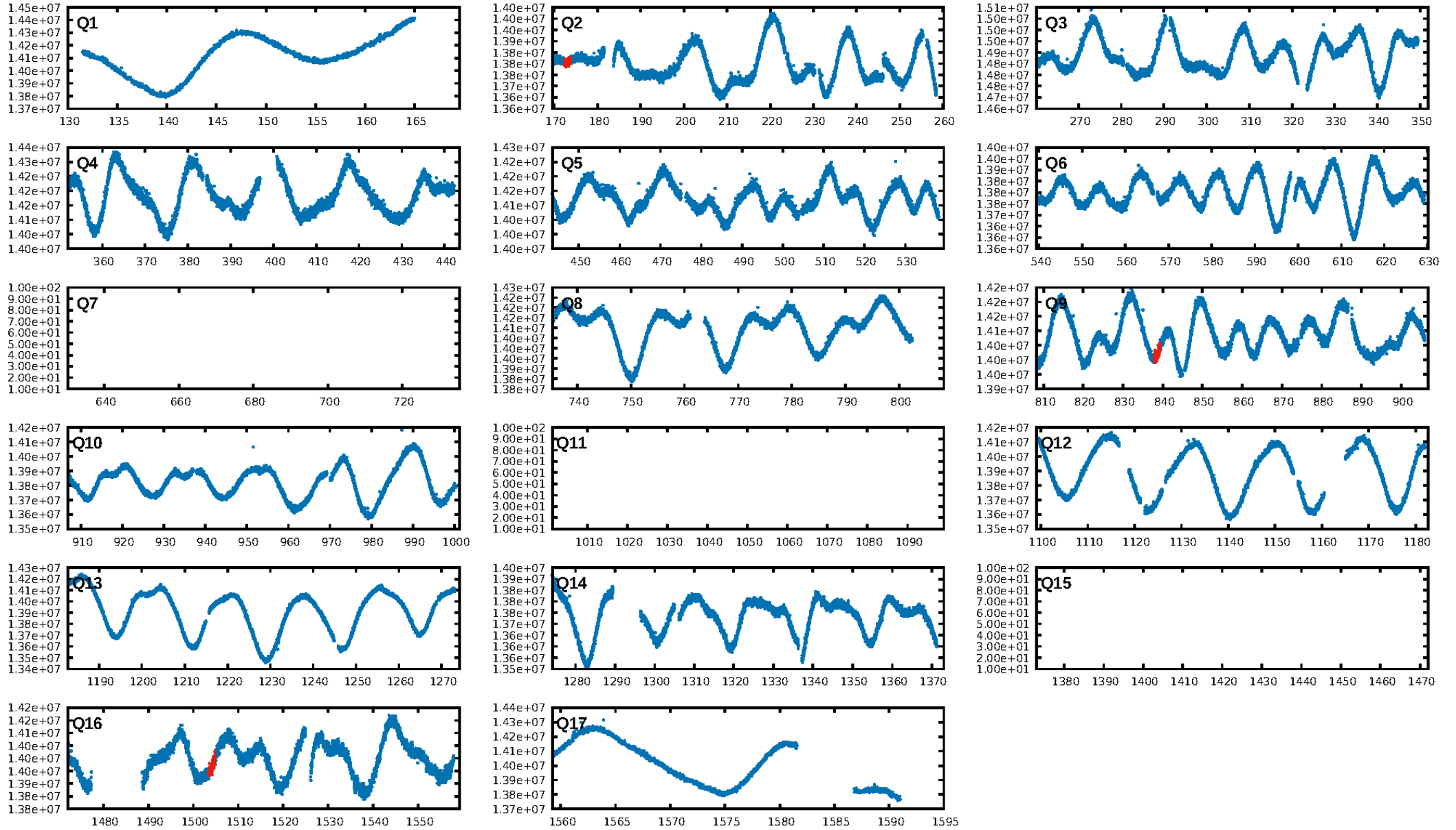
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [223.47σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 84.8%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [3/3]  
**GhostDiagnostic-chr: 2.816**  
Centroid-sig: 56.1%  
Centroid-so: 0.314 arcsec [0.50σ]  
OotOffset-rm: 0.472 arcsec [1.05σ]  
OotOffset-st: 0/0/0/1 [1]  
KicOffset-rm: 0.581 arcsec [1.32σ]  
KicOffset-st: 0/0/0/1 [1]  
DiffImageQuality-fgm: 1.00 [1/1]  
DiffImageOverlap-fno: 0.00 [0/3]

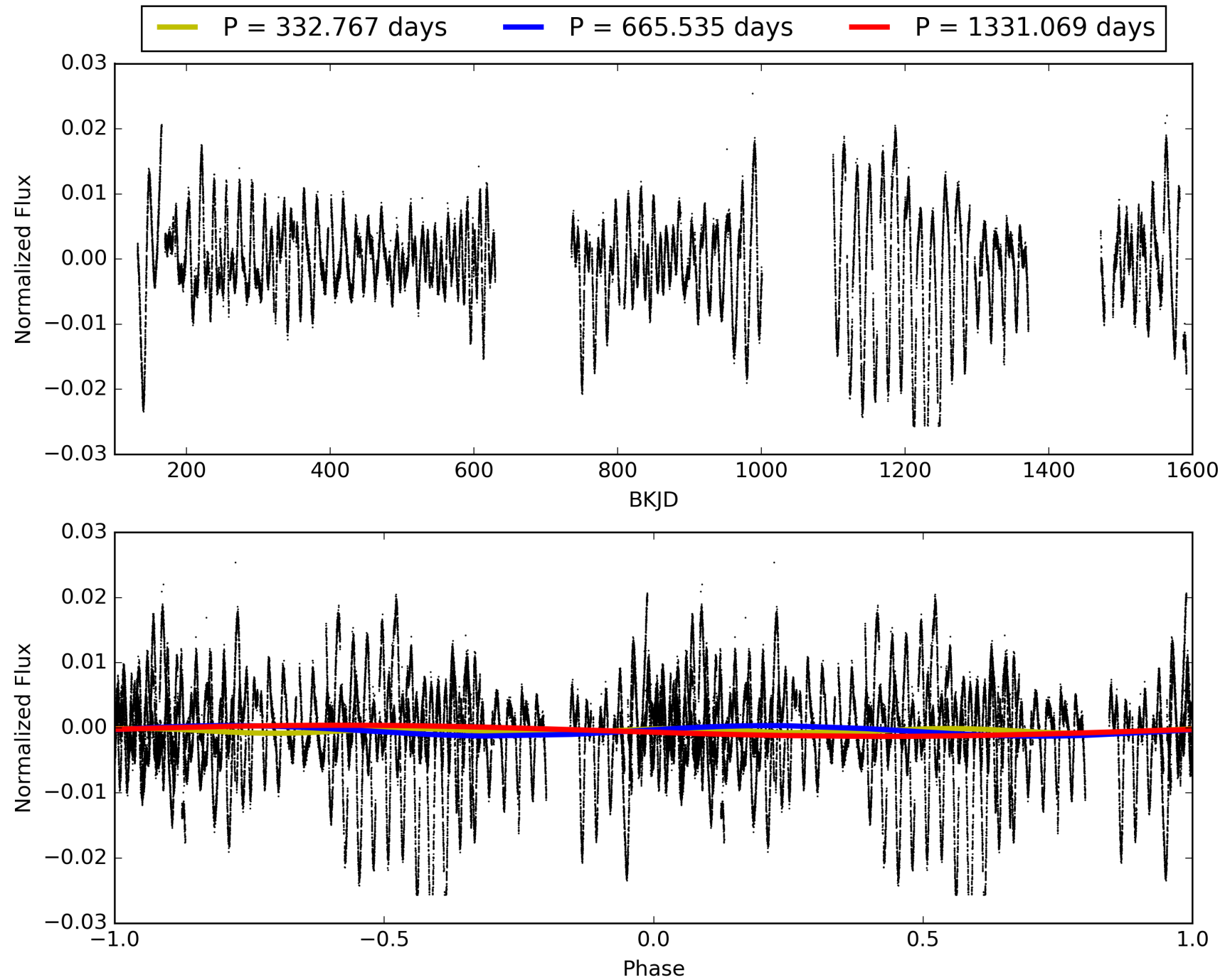
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 08:50:52 Z

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

# TCE 009851970-10, PDC Light Curves

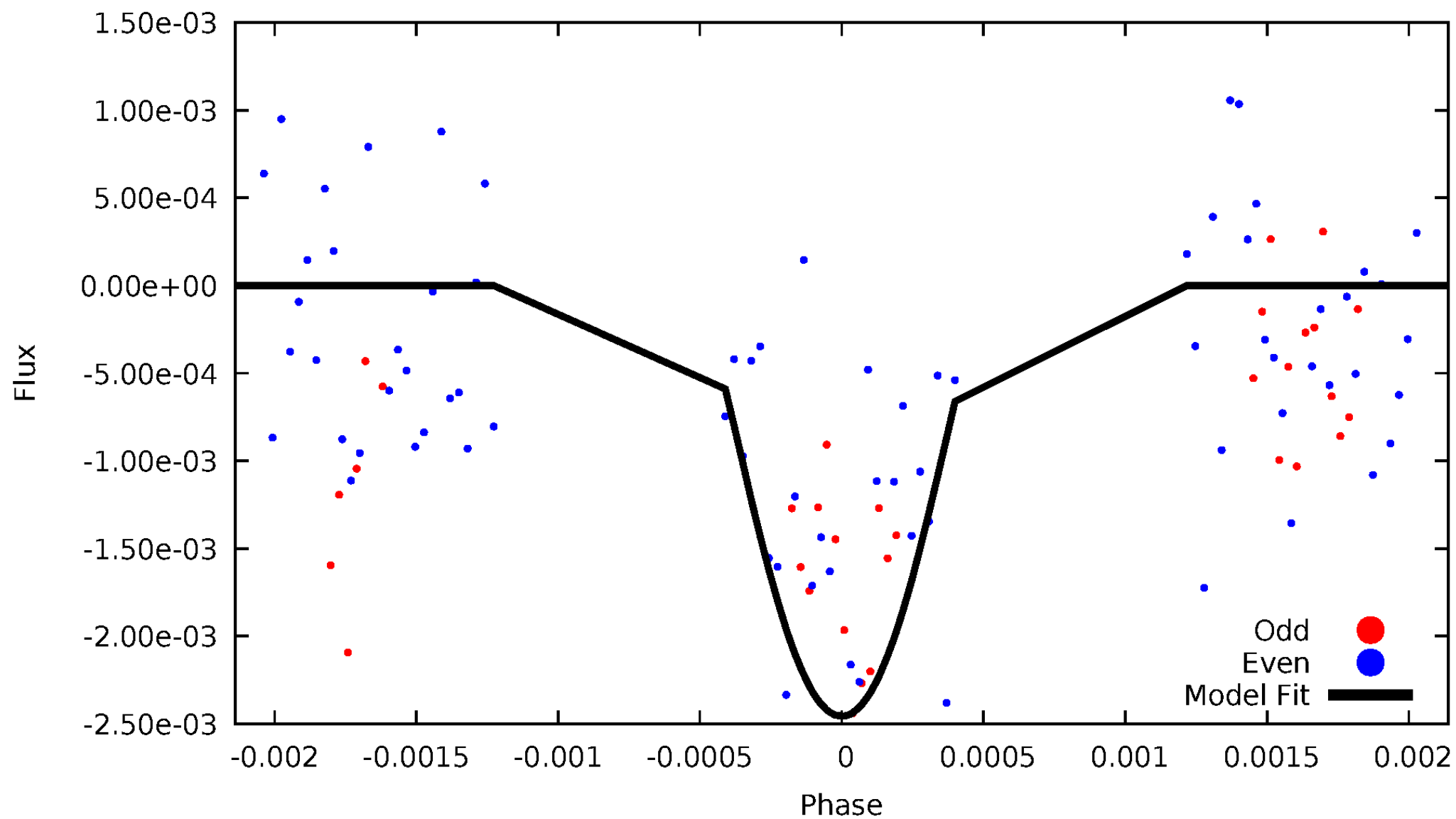


# TCE 009851970-10



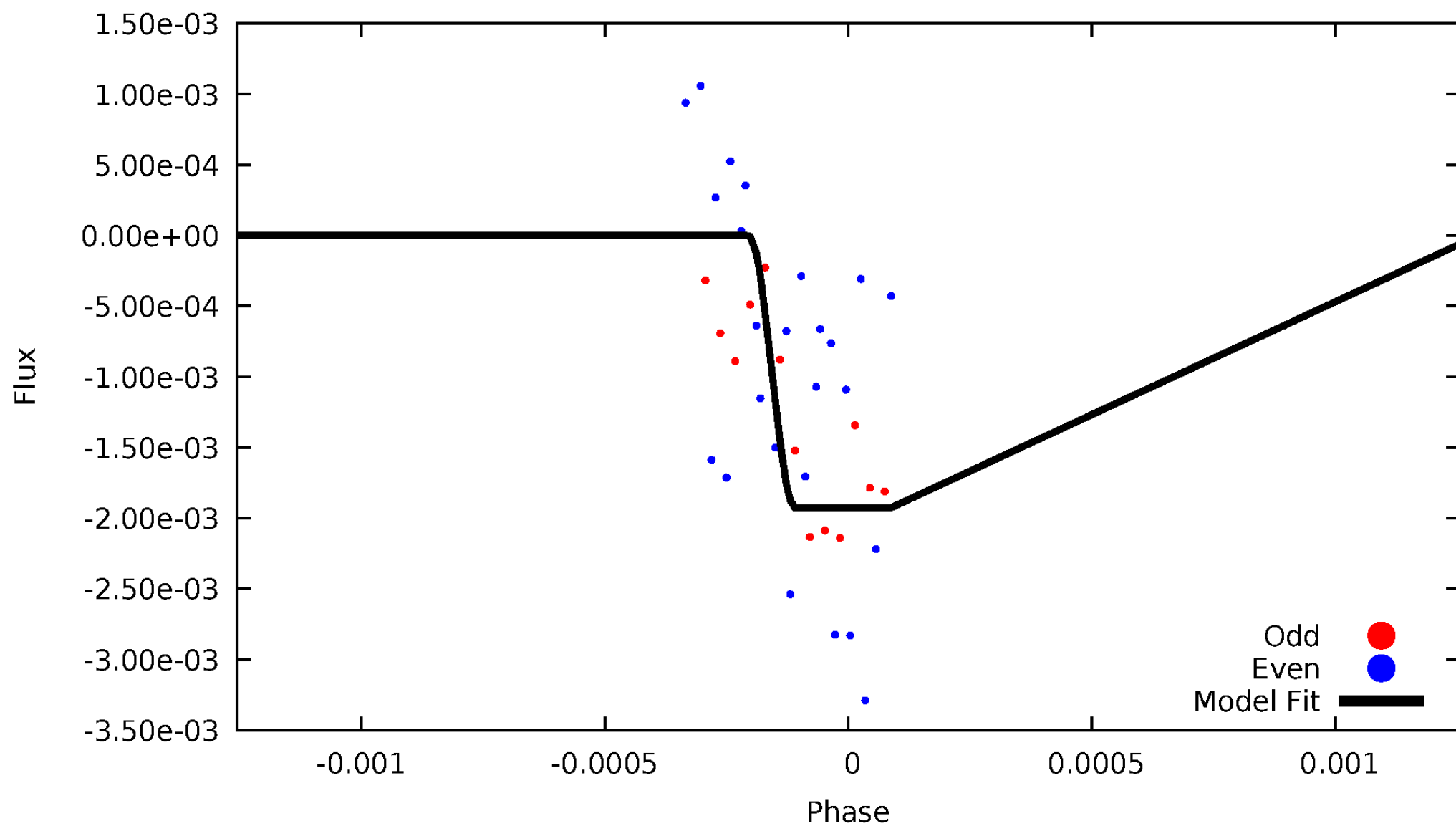
# DV Odd/Even

TCE 009851970-10



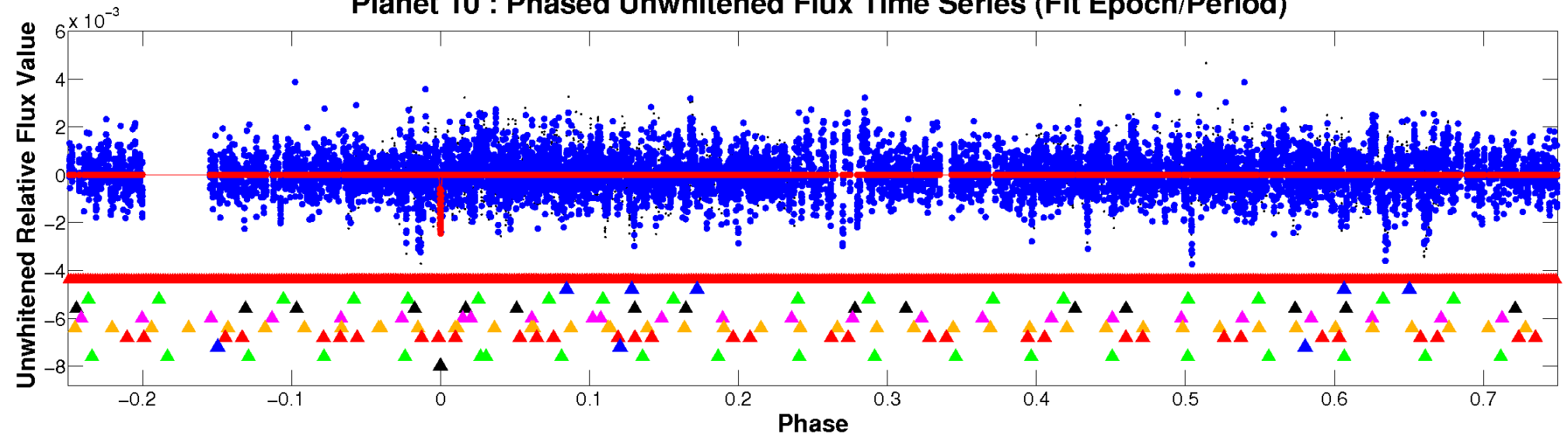
# ALT Odd/Even

TCE 009851970-10

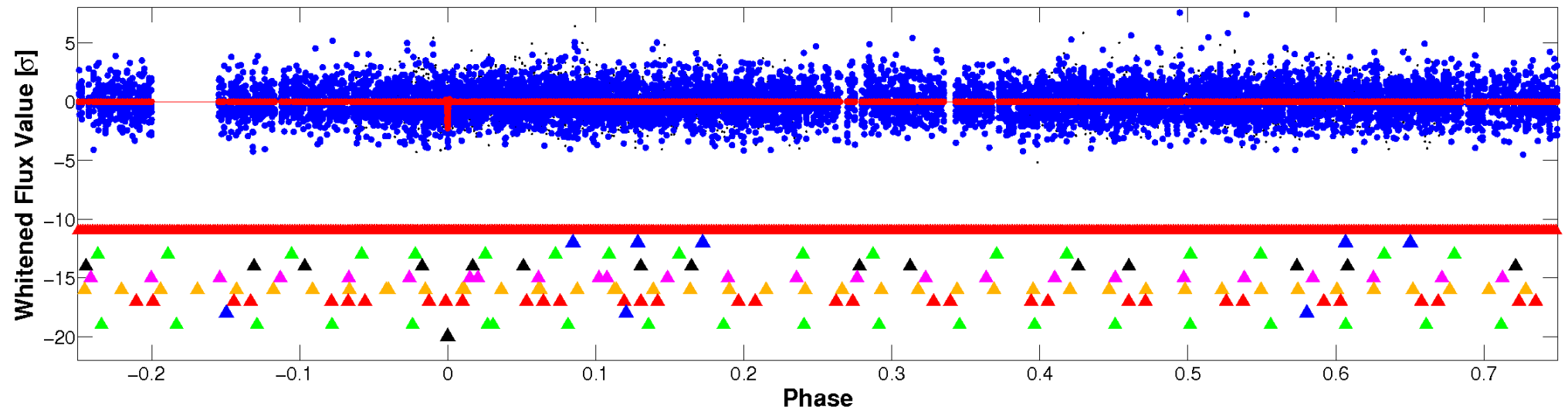


# Non-Whitened Vs. Whitened Light Curve

Planet 10 : Phased Unwhitened Flux Time Series (Fit Epoch/Period)



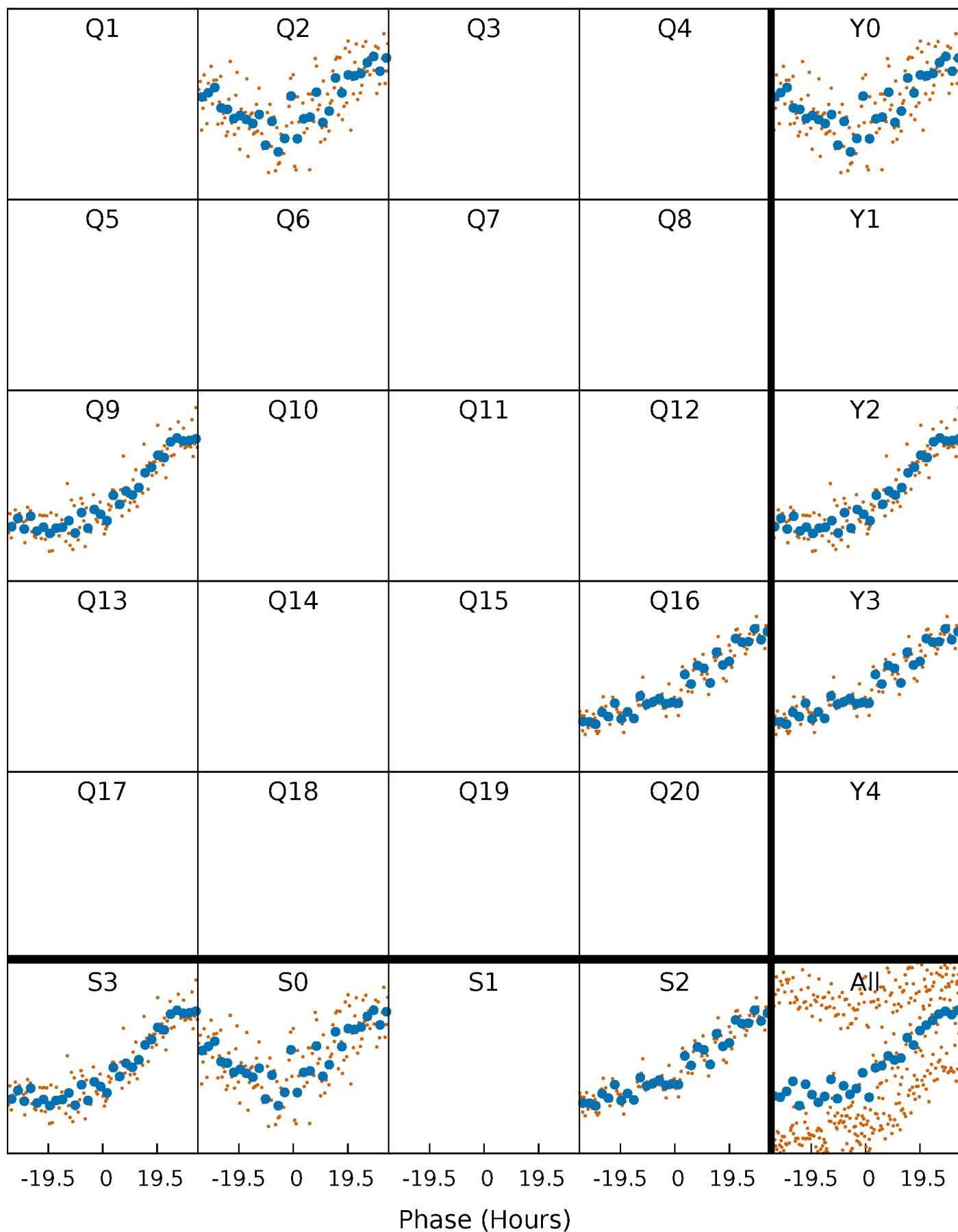
Planet 10 : Phased Whitened Flux Time Series (Fit Epoch/Period)





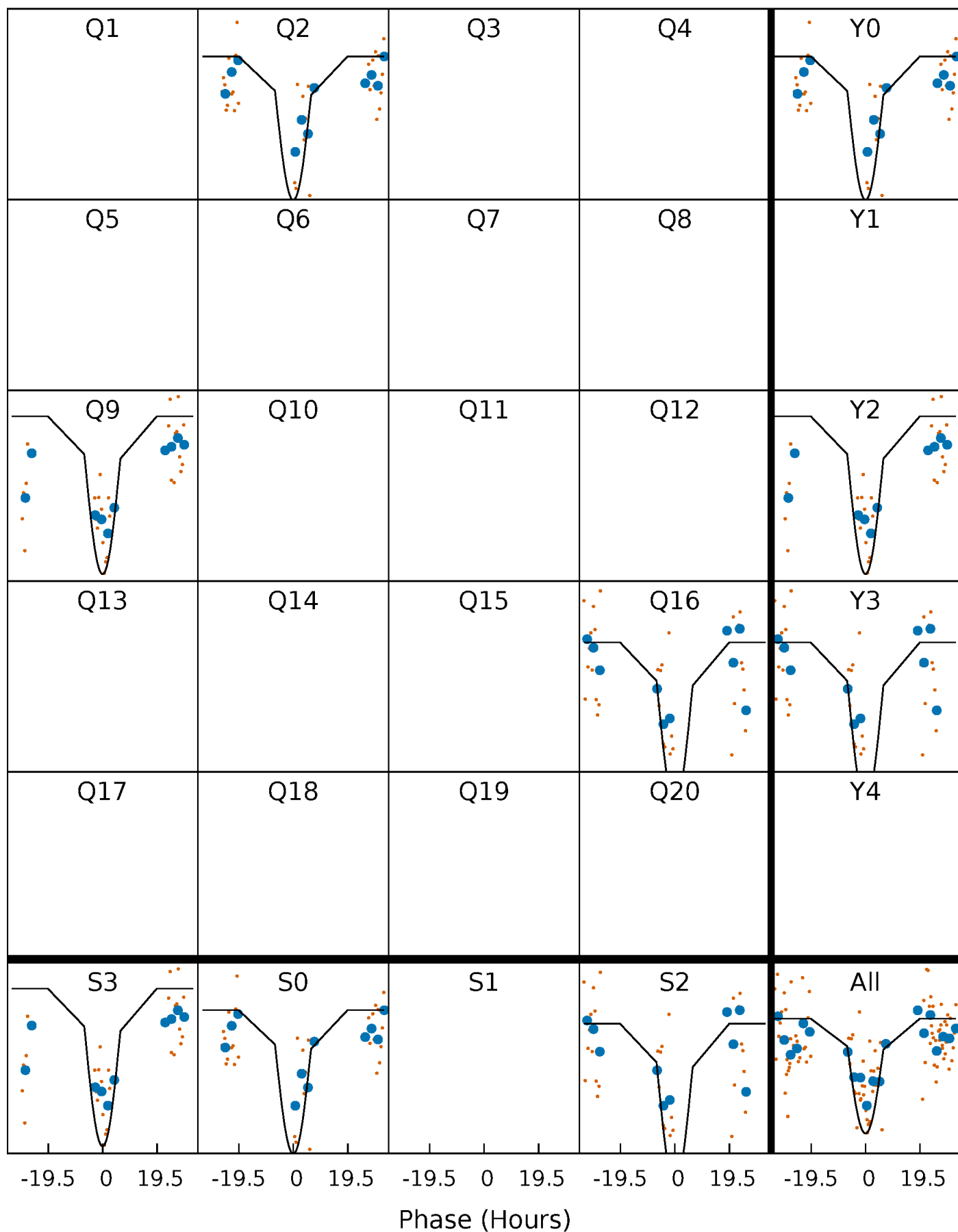
# PDC Quarter-Phased Transit Curves

TCE 009851970-10   P=665.534622 Days    $T_0=173.054303$  (BKJD)



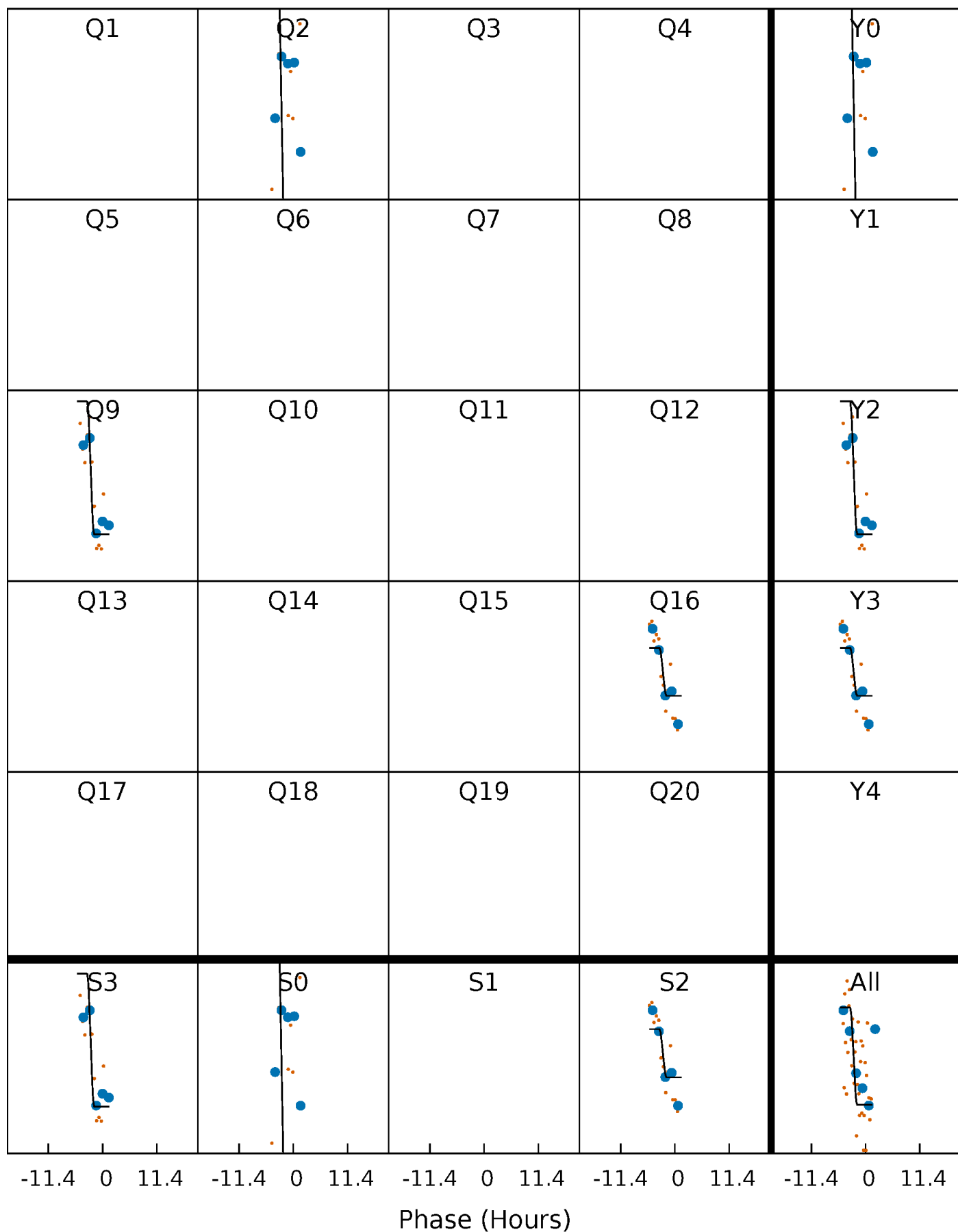
# DV Quarter-Phased Transit Curves

TCE 009851970-10 P=665.534622 Days  $T_0=173.054303$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

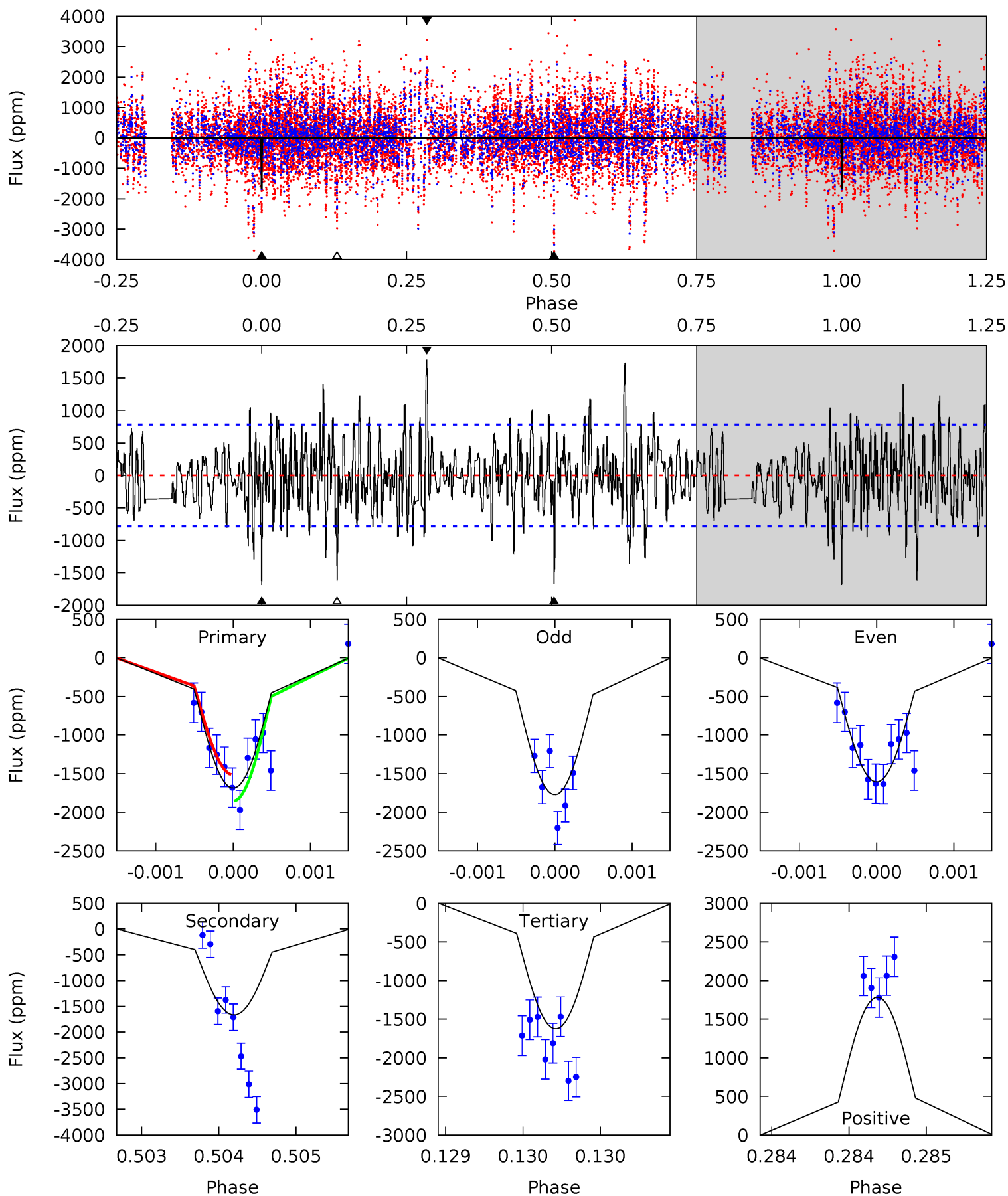
TCE 009851970-10 P=665.405259 Days  $T_0=173.262215$  (BKJD)



# DV Model-Shift Uniqueness Test

009851970-10, P = 665.534622 Days, E = 173.054303 Days

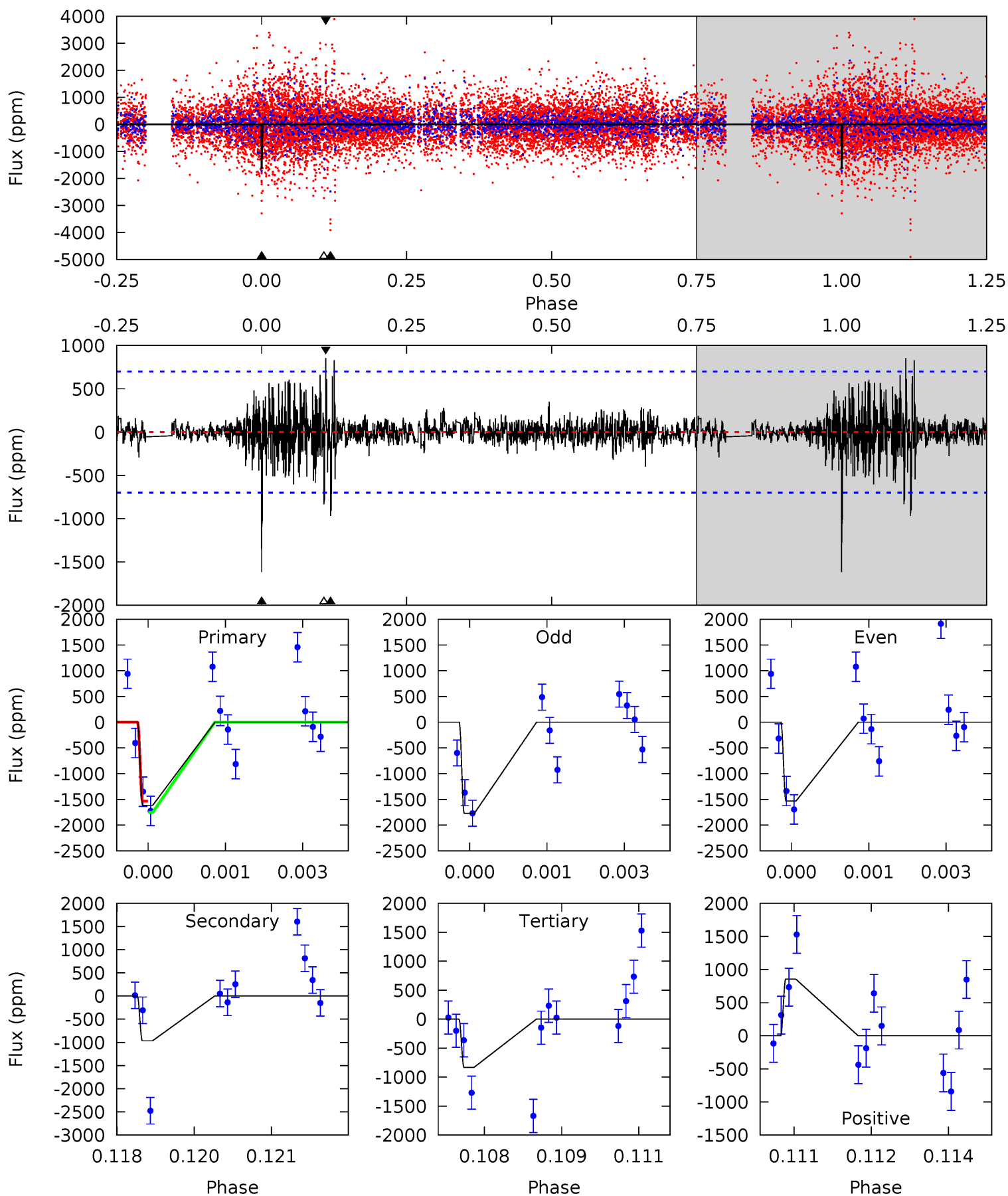
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
11.8	11.7	11.4	12.5	5.49	3.35	3.17	0.43	-0.68	0.30	-0.81	0.56	0.99	0.51	1.20



# Alt Model-Shift Uniqueness Test

009851970-10, P = 665.405259 Days, E = 173.262215 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
12.4	7.44	6.38	6.57	5.38	3.18	1.09	6.02	5.84	1.06	0.87	0.88	0.94	0.35	0.76



### Stellar Parameters For KIC 009851970

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$4965^{+151}_{-136}$	$4.555^{+0.072}_{-0.044}$	$-0.220^{+0.300}_{-0.300}$	$0.736^{+0.065}_{-0.079}$	$0.709^{+0.093}_{-0.050}$	$2.508^{+0.760}_{-0.407}$
	+3%/-3%	+2%/-1%	+136%/-136%	+9%/-11%	+13%/-7%	+30%/-16%
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 009851970-10 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-1667 \pm 143$	$28.29^{+29.28}_{-19.67}$	$227^{+7}_{-8}$	$2507^{+1003}_{-370}$	$2077^{+20442}_{-1590}$
Alt.	$-969 \pm 130$	$25.38^{+27.99}_{-18.33}$	$227^{+9}_{-8}$	$2412^{+1009}_{-363}$	$1426^{+18282}_{-1097}$

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

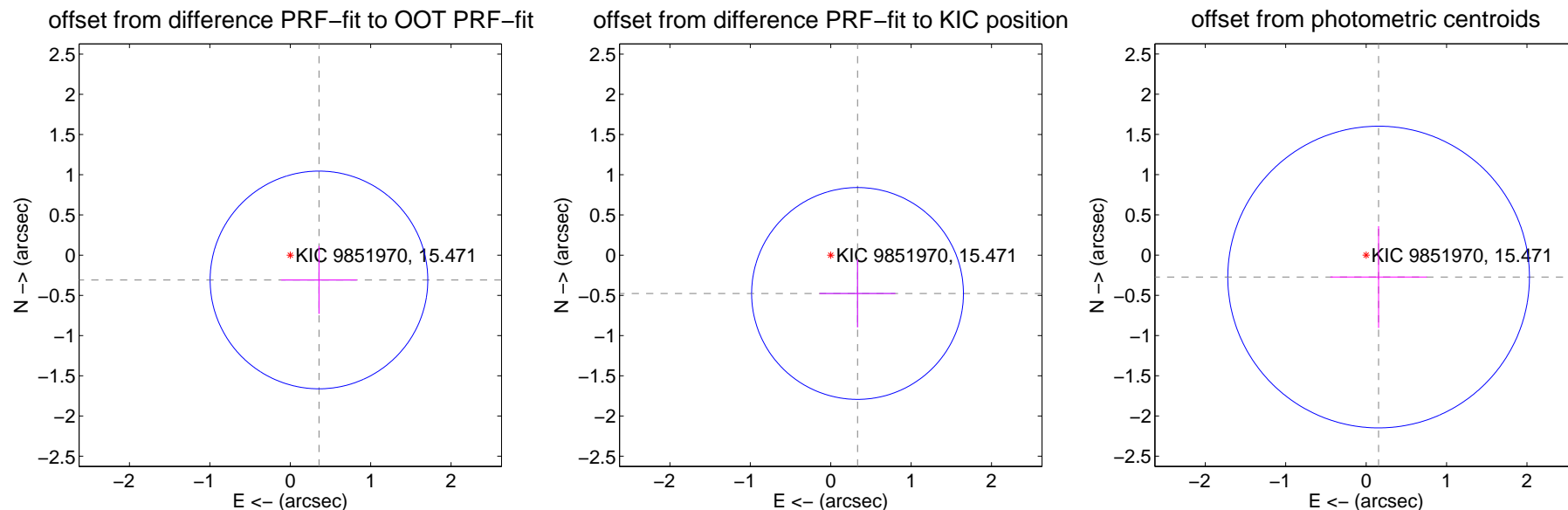
## DV Centroid Data

Supplemental centroid analysis for 009851970-10. Kepler magnitude: 15.47. Transit SNR 8.71

There are 1 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	$0.472 \pm 0.451$	1.05	$-0.357 \pm 0.472$	$-0.308 \pm 0.422$
PRF-fit source offset from KIC position	$0.581 \pm 0.439$	1.32	$-0.333 \pm 0.472$	$-0.476 \pm 0.422$
photometric centroid source offset	$0.31 \pm 0.63$	0.50	$-0.16 \pm 0.60$	$-0.27 \pm 0.63$



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.

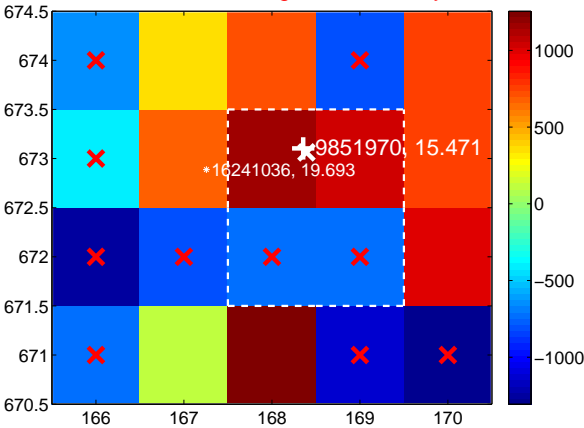
Q1 no difference image



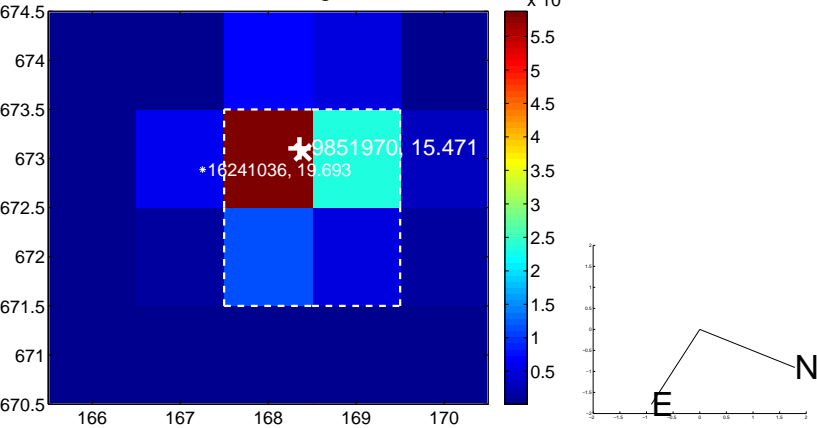
Q1 no OOT image



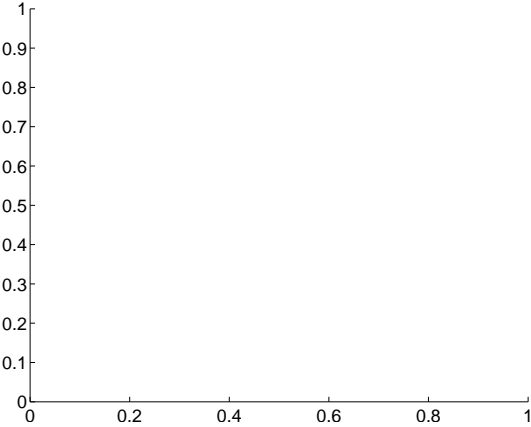
Q2 difference image. Poor Quality



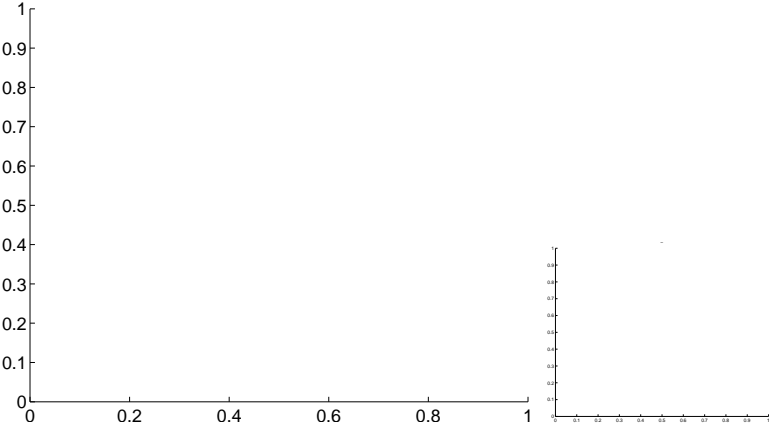
Q2 OOT image



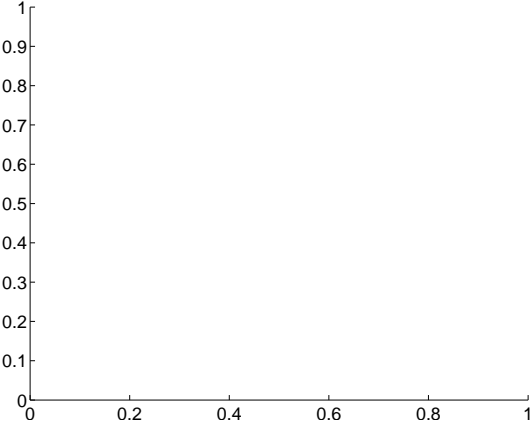
Q3 no difference image



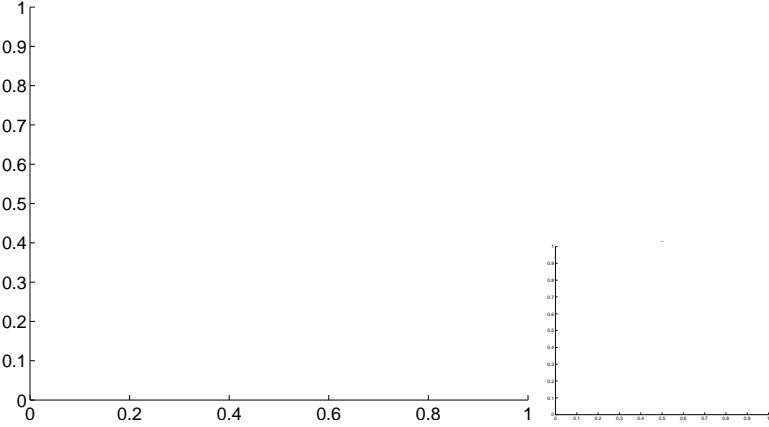
Q3 no OOT image



Q4 no difference image



Q4 no OOT image

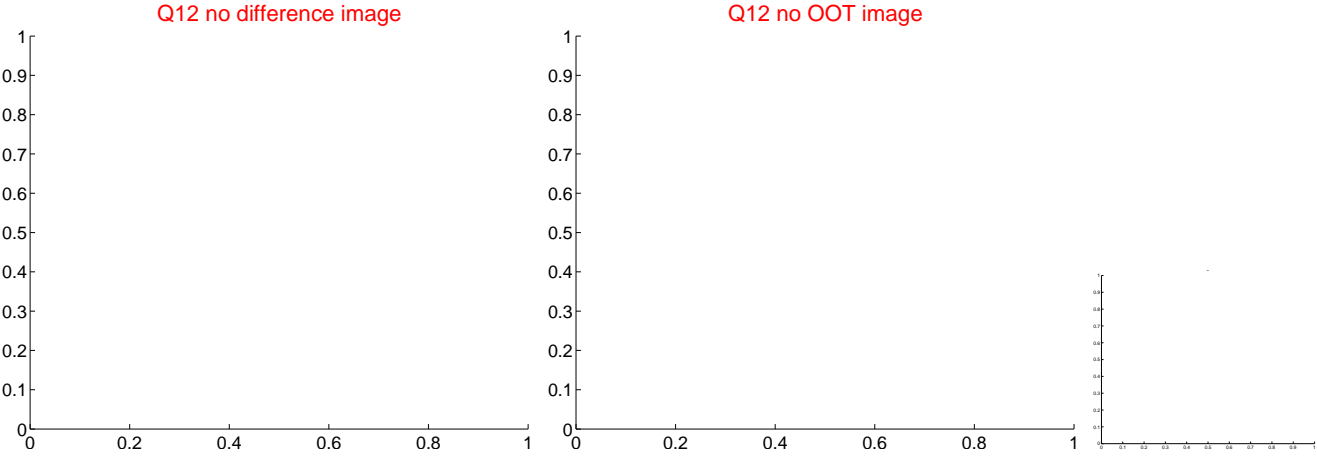
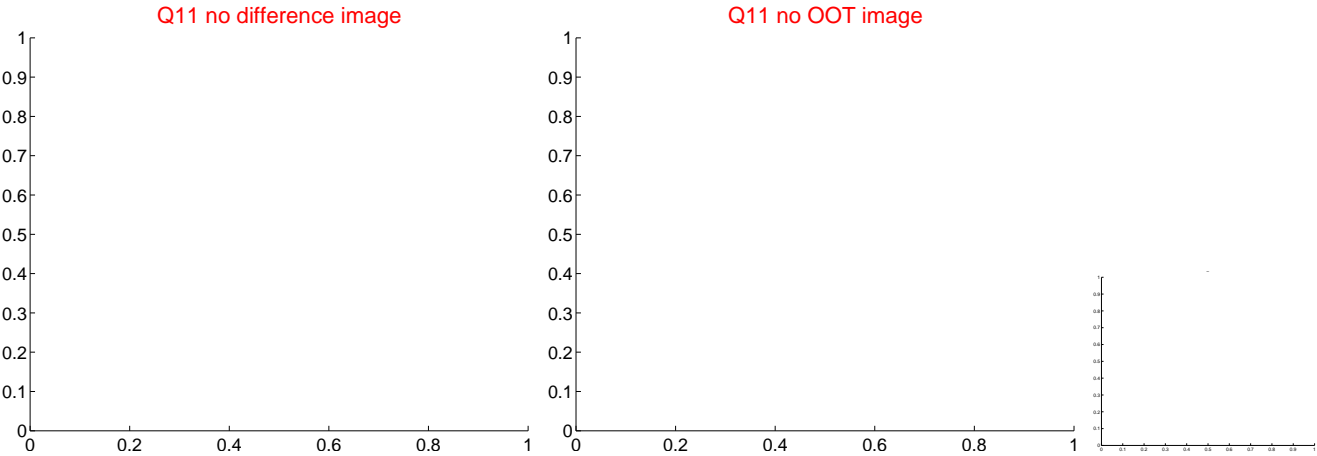
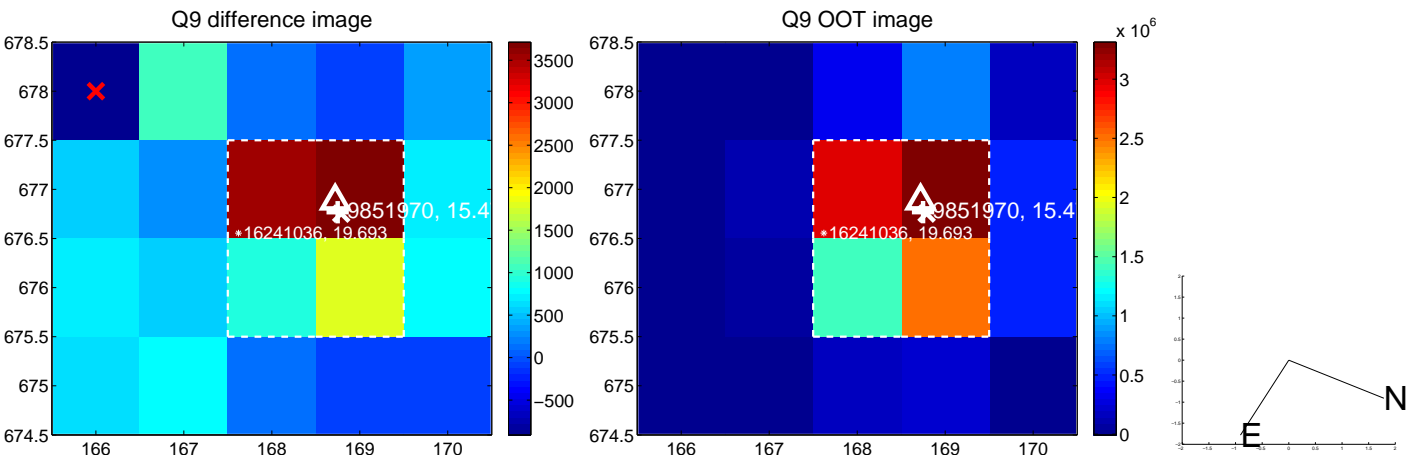




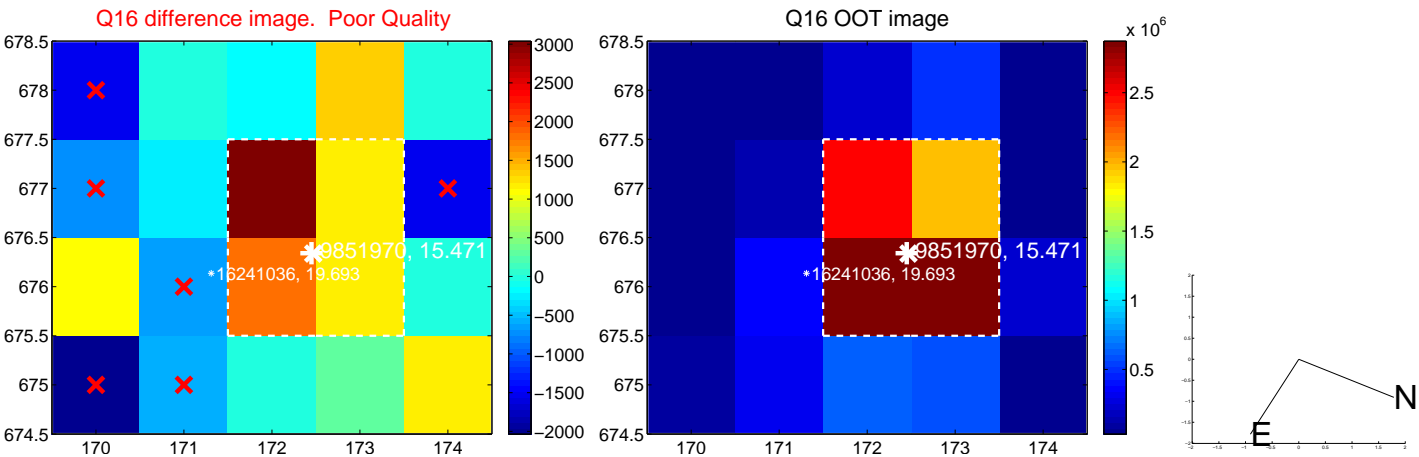
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



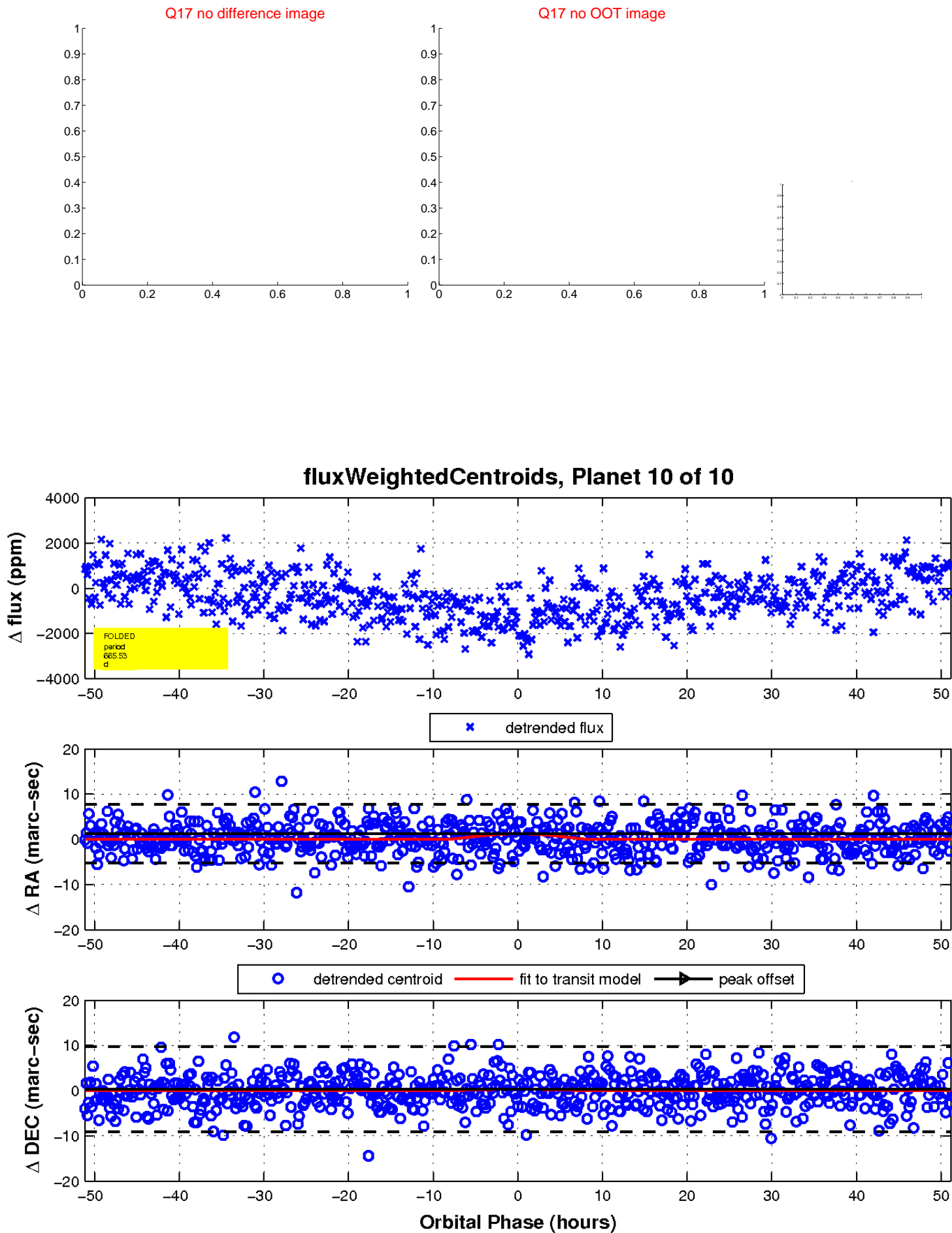
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



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



UKIRT Image

Declination

