

# KIC 009048551

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009048551-01	OBS	No	315.960993	412.736558	1108.2	3.262	15.2	8.9	0.64	4121	2.21	0.17
009048551-02	OBS	No	458.095786	295.711690	1262.4	5.021	14.1	9.4	0.64	4121	2.26	0.10
009048551-03	OBS	No	491.011724	162.990025	1163.3	16.705	13.2	6.2	0.64	4121	2.61	0.10
009048551-04	OBS	No	350.482711	239.011801	859.4	3.416	13.7	6.8	0.64	4121	1.79	0.15
009048551-05	OBS	No	408.379130	517.458281	846.0	6.355	11.3	6.3	0.64	4121	2.01	0.12
009048551-06	OBS	No	514.912717	311.009898	707.7	8.063	11.1	5.5	0.64	4121	1.73	0.09
009048551-07	OBS	No	419.473543	248.293169	161.8	16.653	13.0	1.0	0.64	4121	0.90	0.12

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009048551-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS
009048551-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_POS_DV
009048551-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL—LPP_DV—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009048551-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009048551-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009048551-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009048551-07	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_TRACKER—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—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.

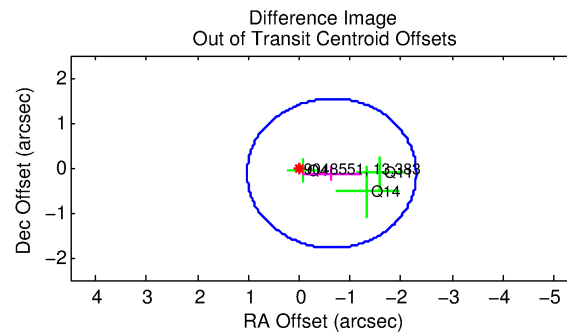
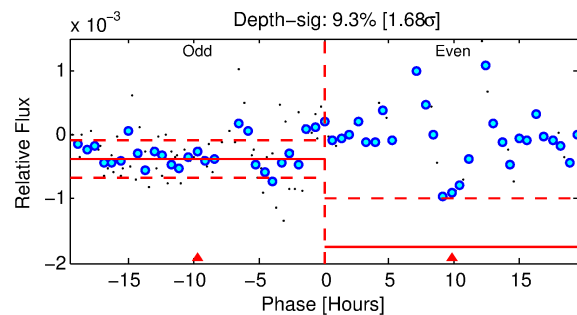
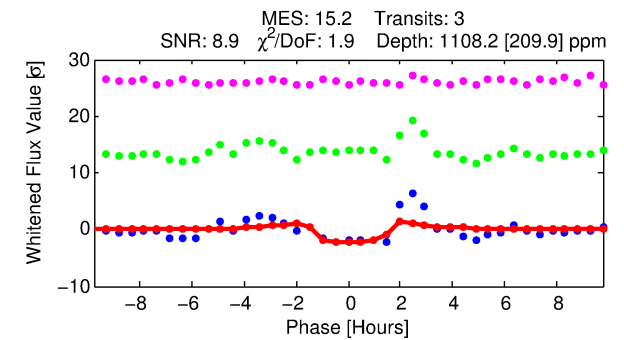
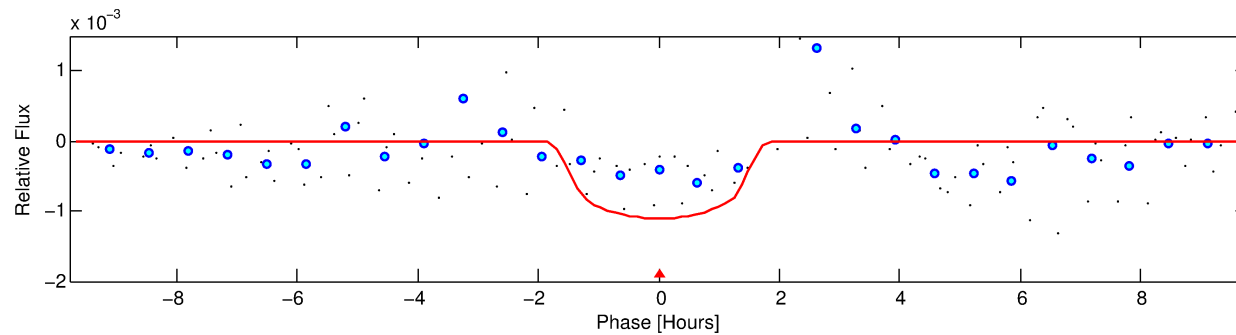
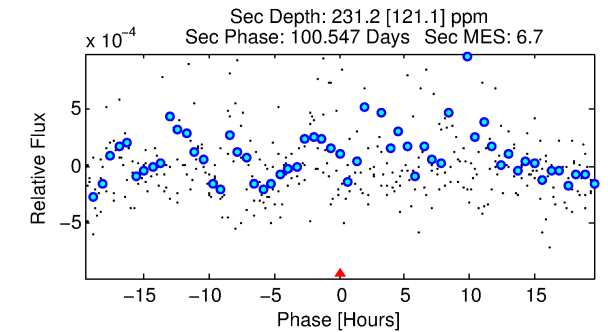
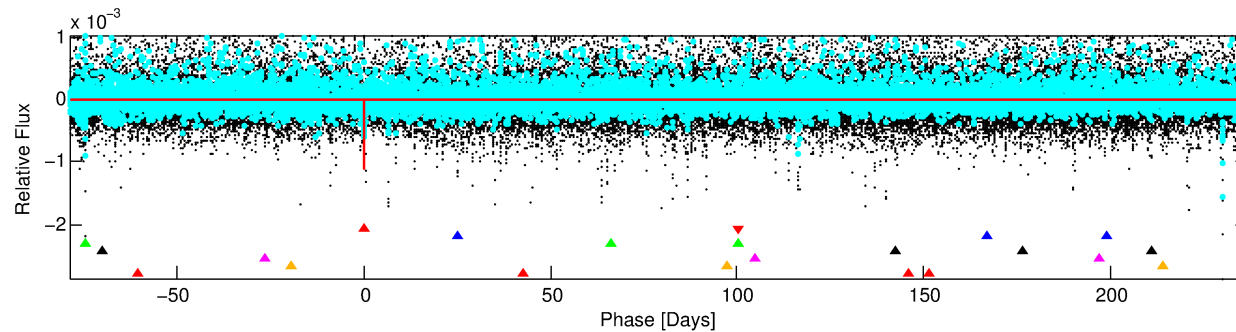
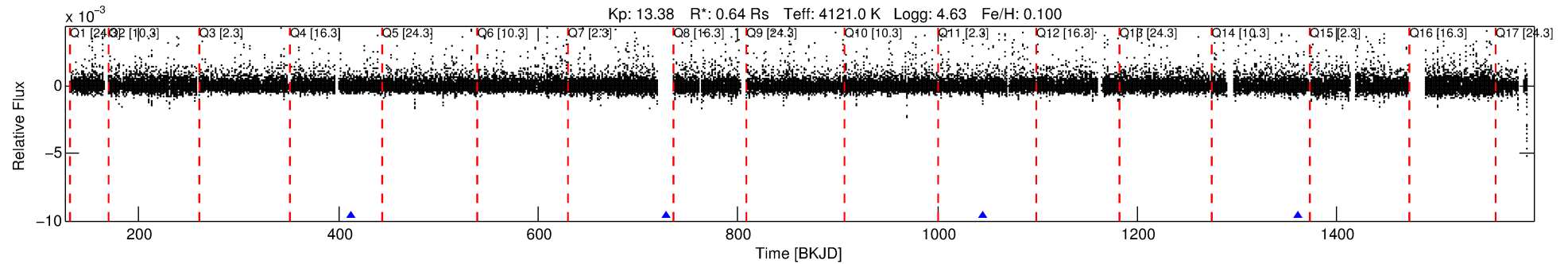
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 009048551-01

No Significant Match Found

# DV One-Page Summary

KIC: 9048551 Candidate: 1 of 7 Period: 315.961 d



## DV Fit Results:

Period = 315.96099 [0.00320] d  
Epoch = 412.7366 [0.0071] BKJD  
Rp/R\* = 0.0318 [0.0545]  
a/R\* = 600.93 [3365.54]  
b = 0.64 [5.35]  
Seff = 0.17 [0.03]  
Teq = 164 [7] K  
Rp = 2.21 [3.79] Re  
a = 0.7788 [0.0557] AU  
Ag = 15810.45 [54762.88] [0.29 $\sigma$ ]  
Teffp = 2848 [2467] K [1.09 $\sigma$ ]

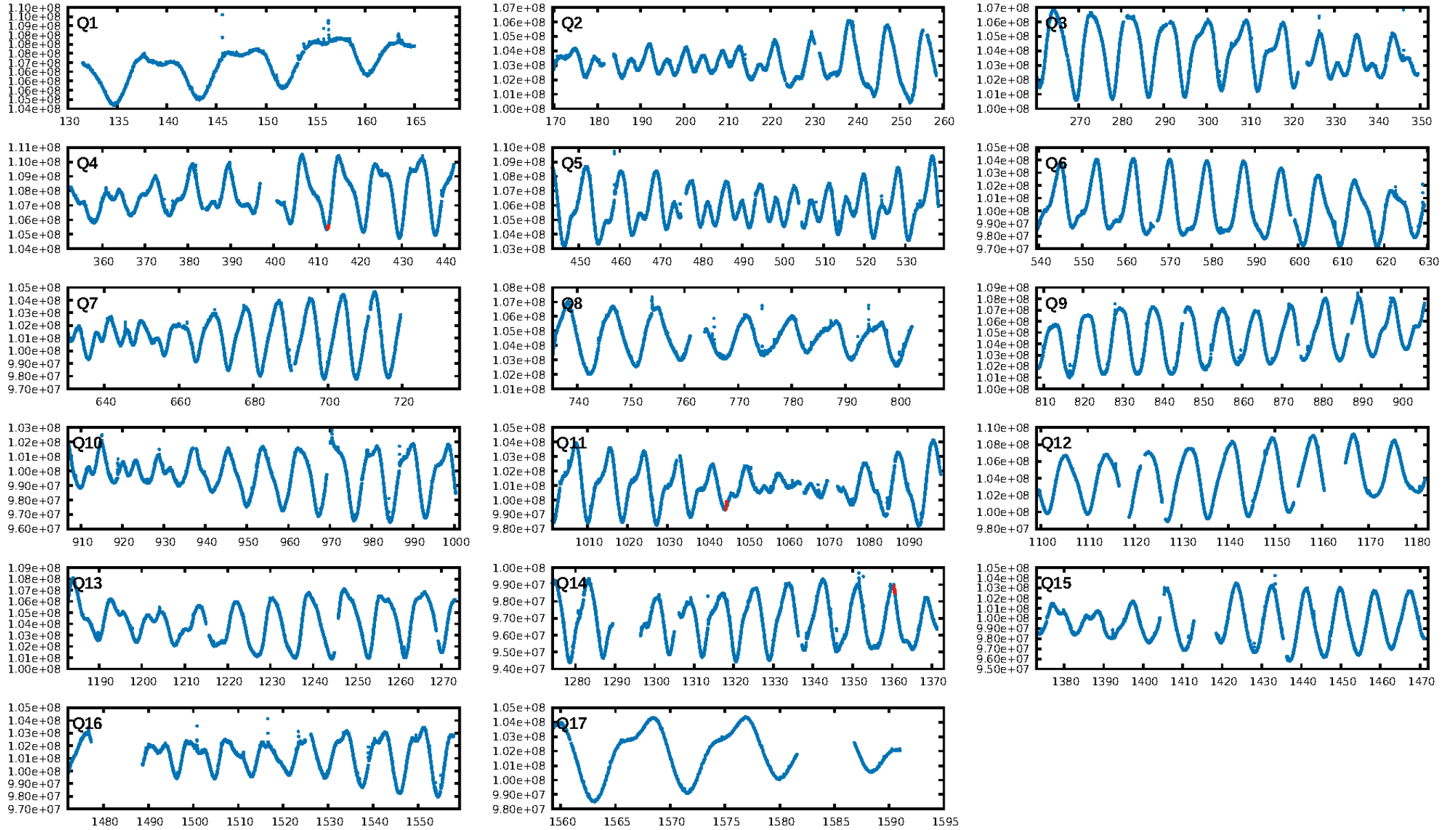
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [175.42 $\sigma$ ]  
**ModelChiSquare2-sig: 0.0%**  
ModelChiSquareGof-sig: 15.6%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: -2.481  
Centroid-sig: 82.5%  
Centroid-so: 0.703 arcsec [1.03 $\sigma$ ]  
OotOffset-rm: 0.652 arcsec [1.18 $\sigma$ ]  
OotOffset-st: 1/1/1/0 [3]  
KicOffset-rm: 0.334 arcsec [0.60 $\sigma$ ]  
KicOffset-st: 1/1/1/0 [3]  
DiffImageQuality-fgm: 1.00 [3/3]  
DiffImageOverlap-fno: 1.00 [3/3]

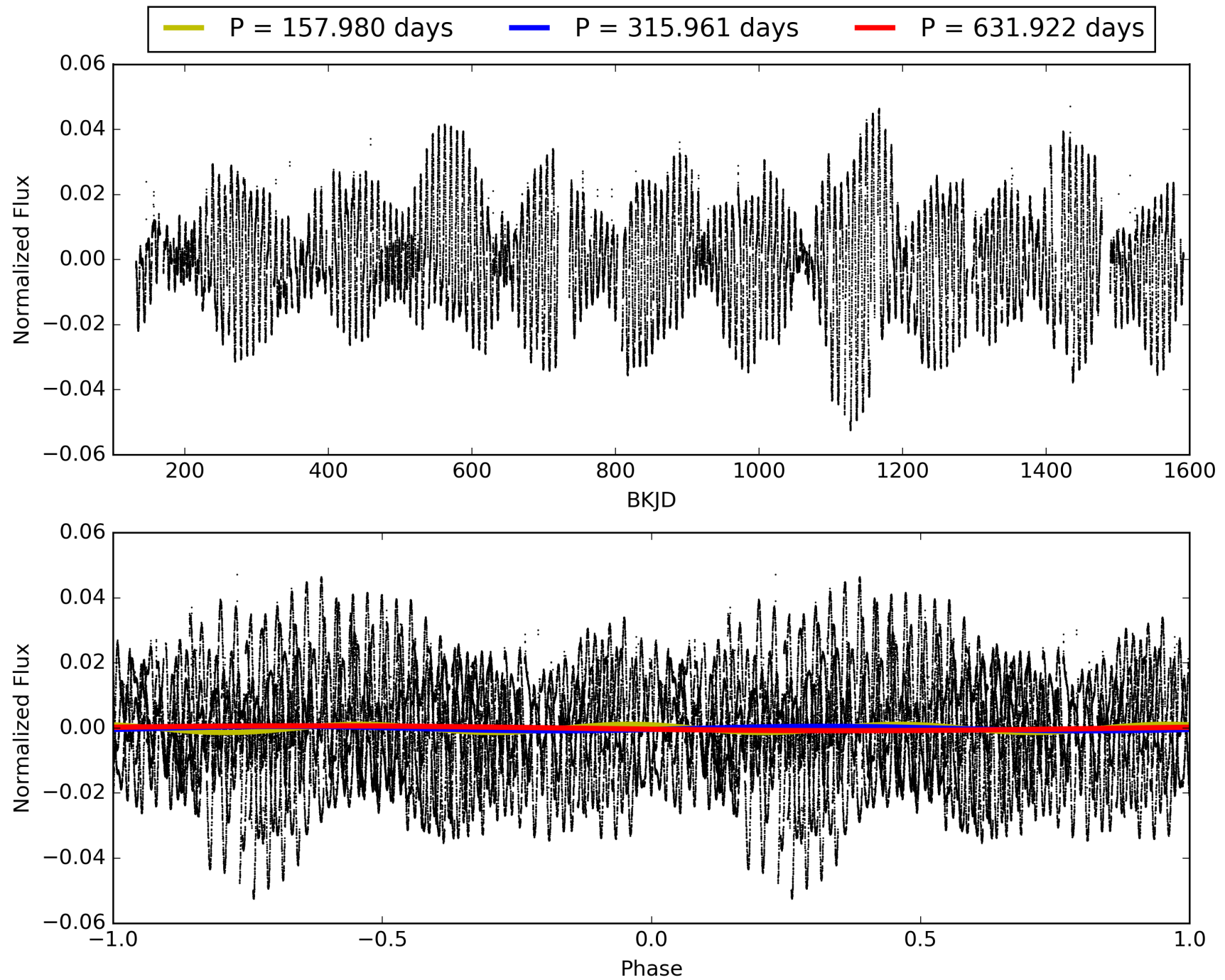
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 13:47:29 Z

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

# TCE 009048551-01, PDC Light Curves



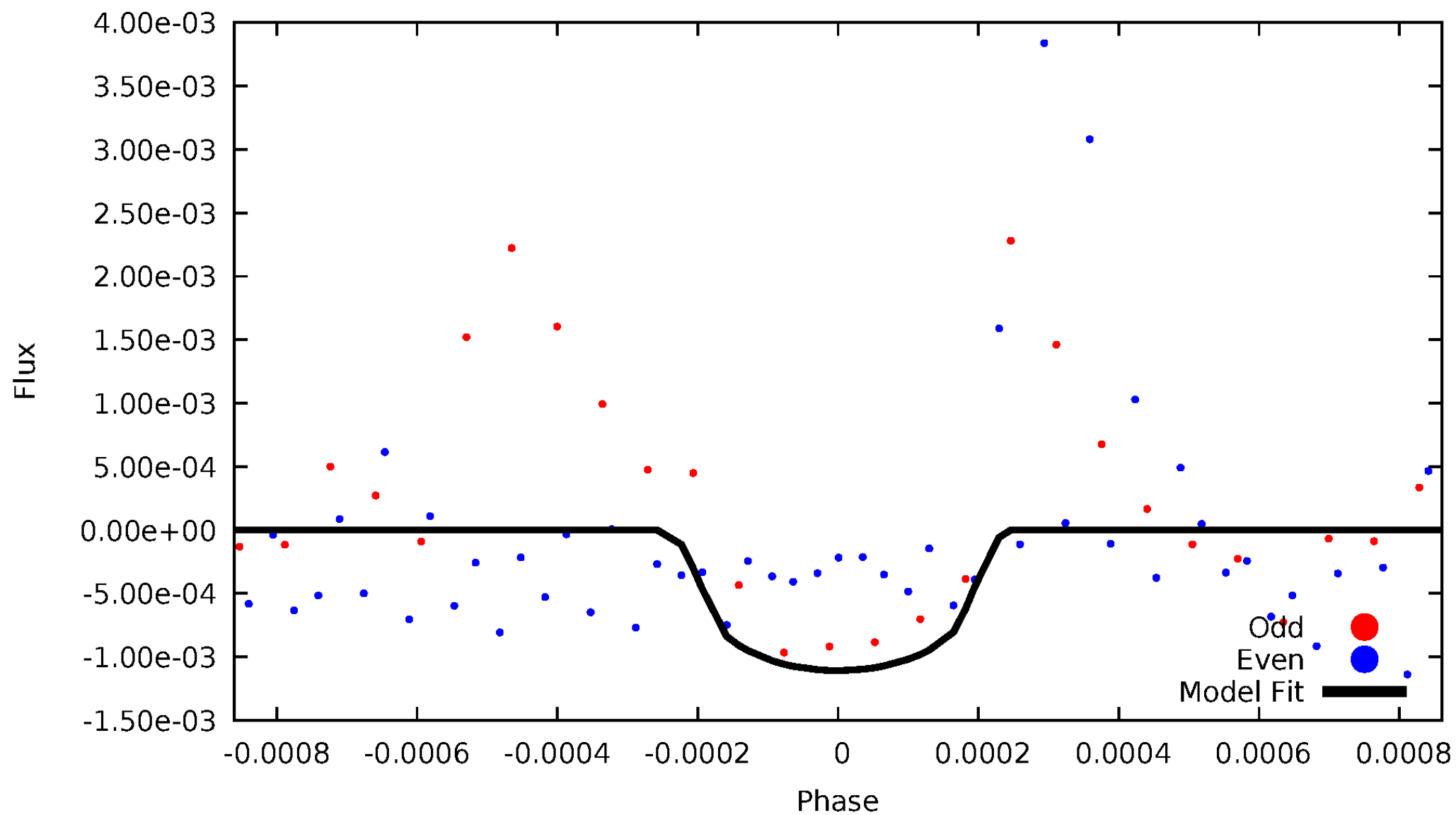
TCE 009048551-01





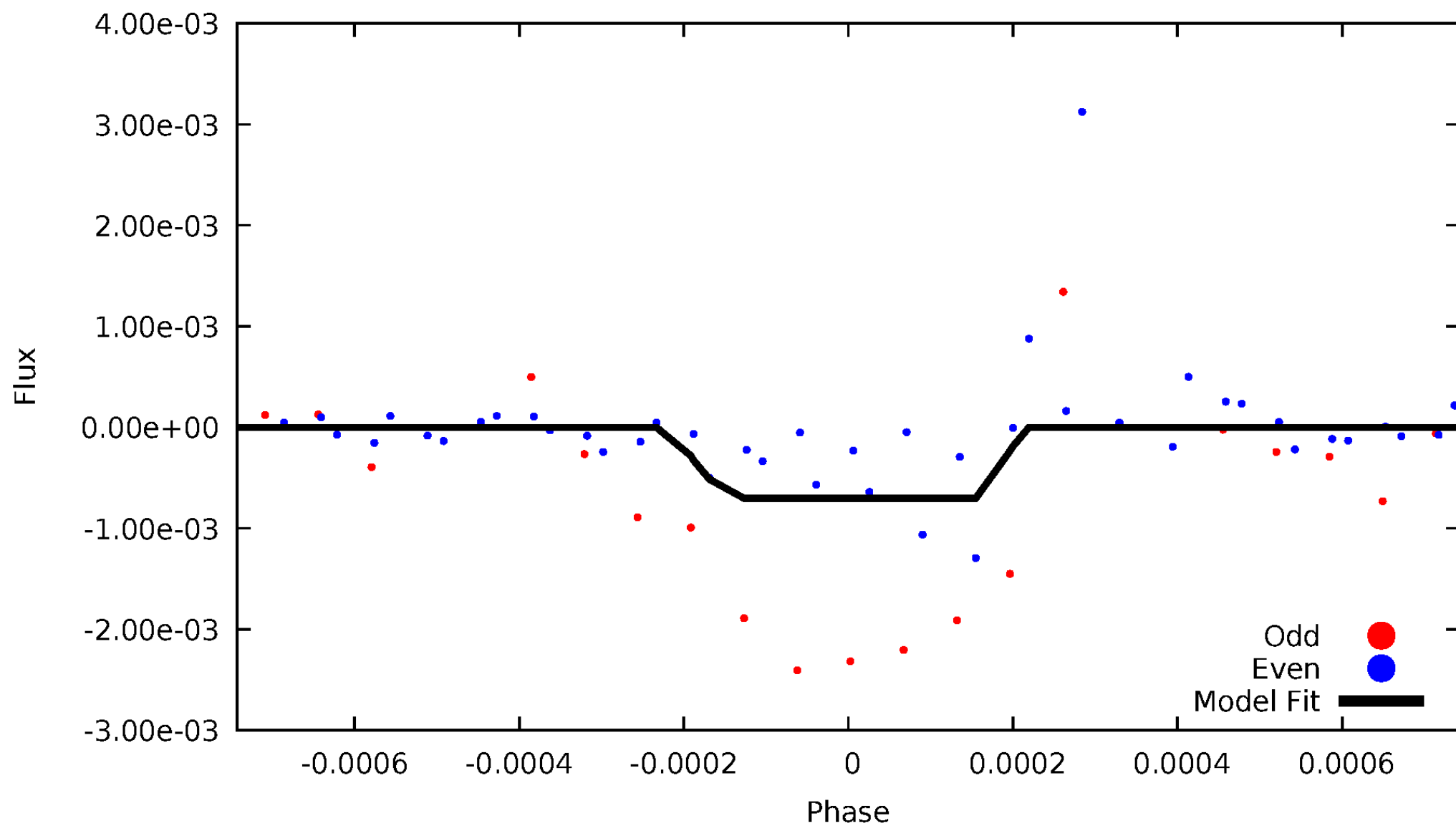
# DV Odd/Even

TCE 009048551-01



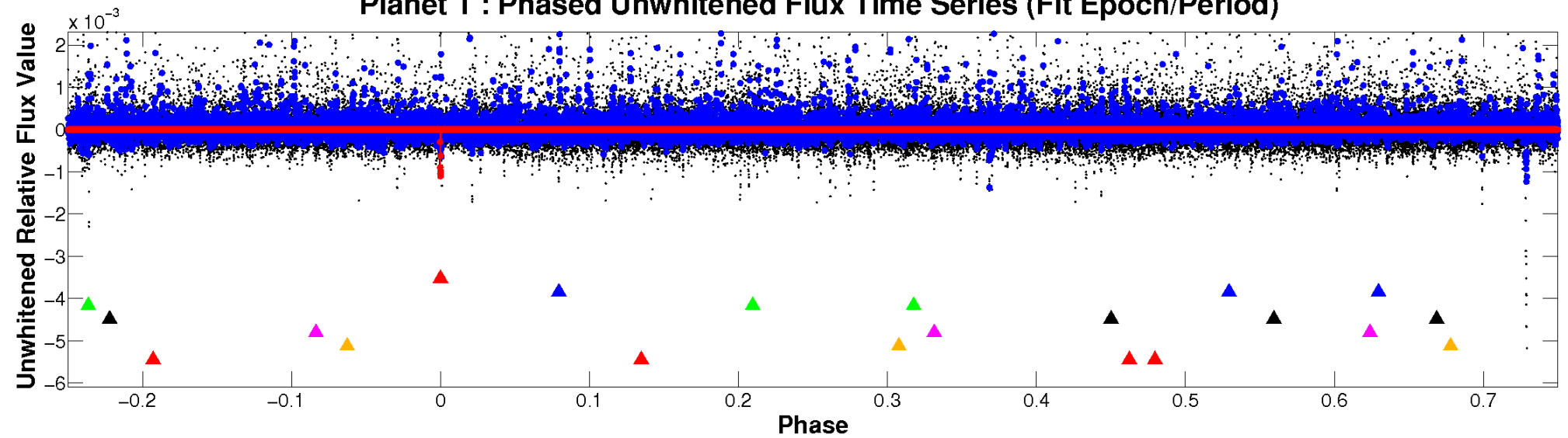
# ALT Odd/Even

TCE 009048551-01

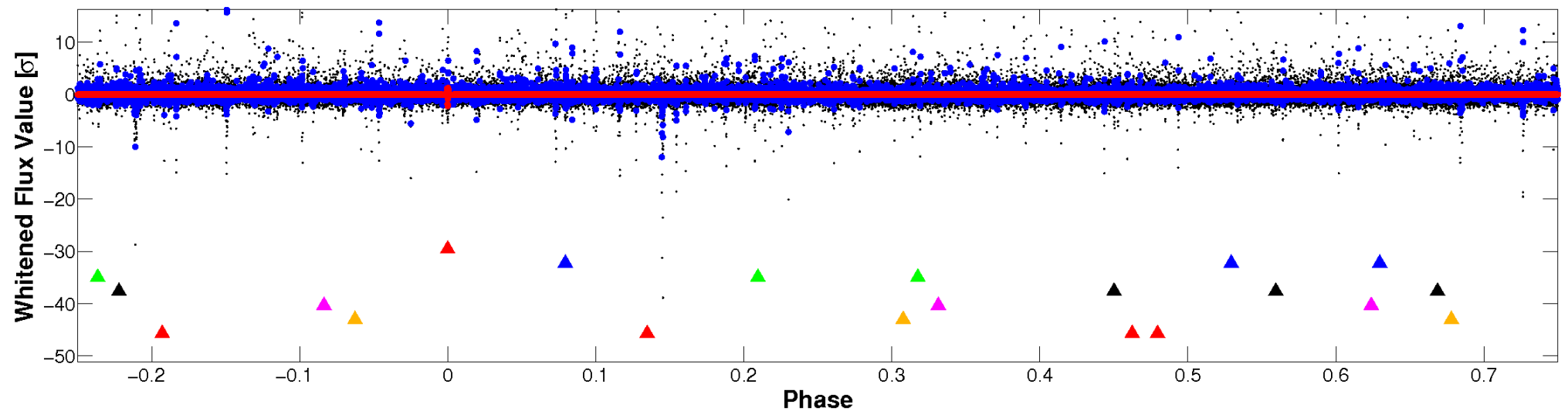


# Non-Whitened Vs. Whitened Light Curve

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

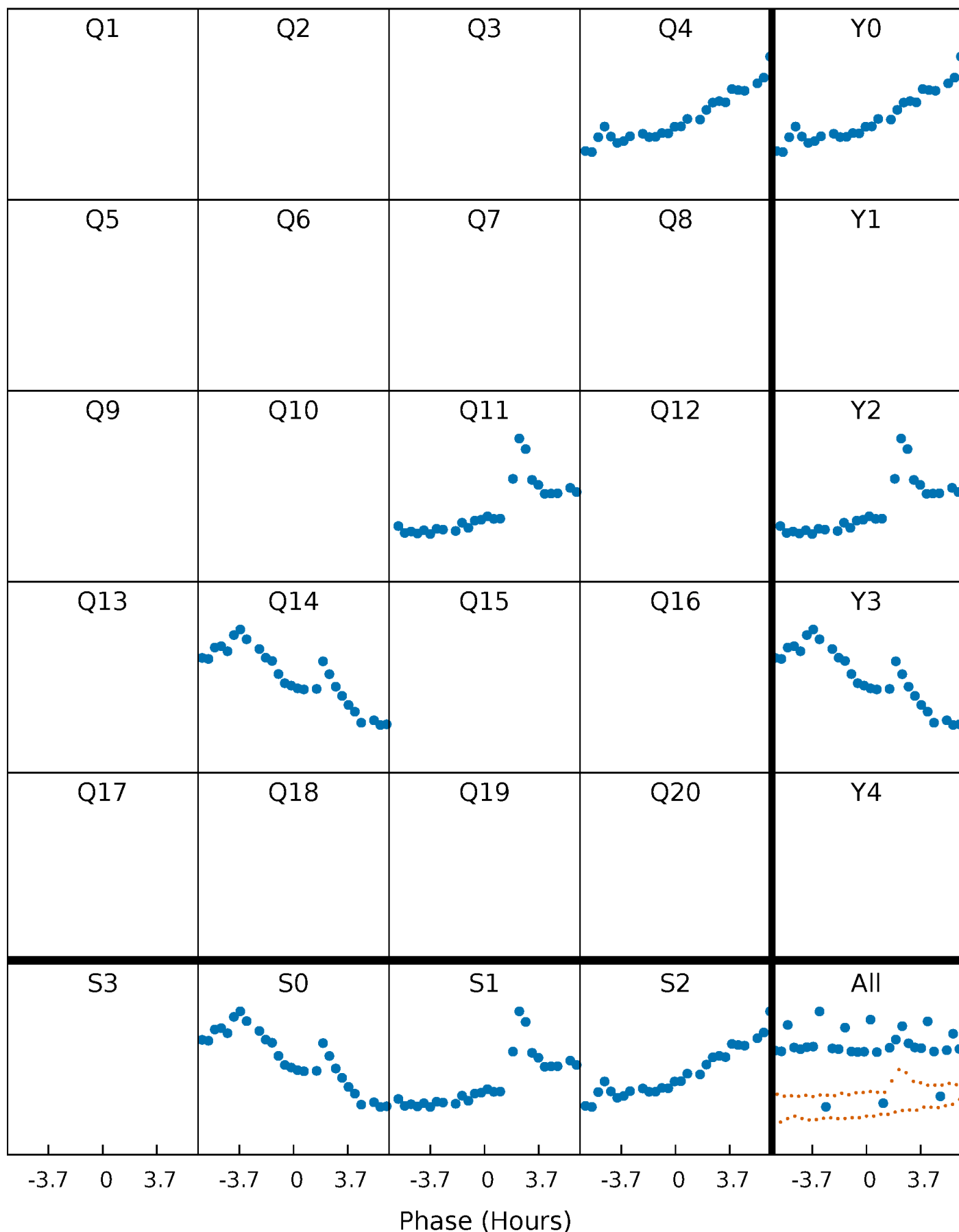


Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)



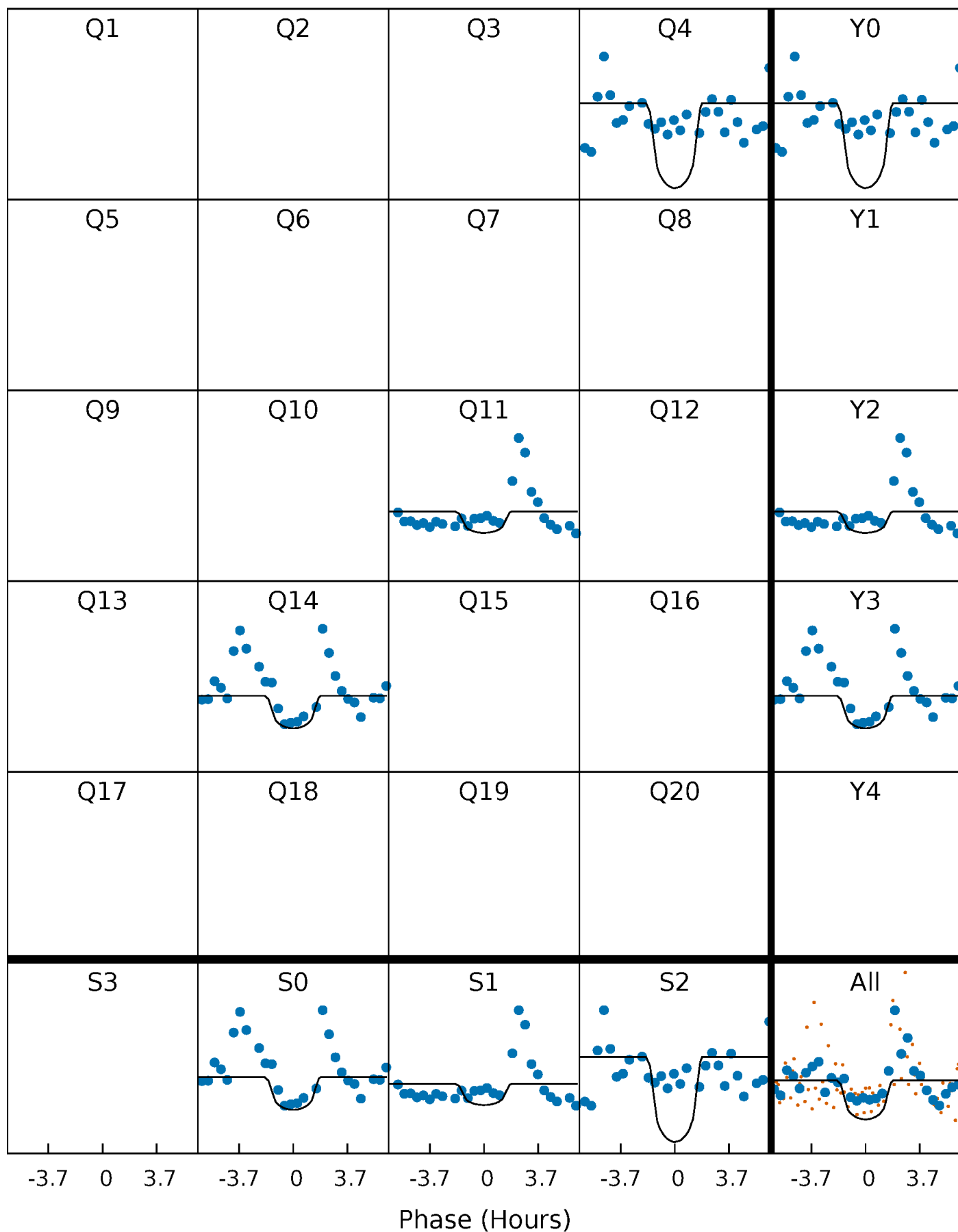
# PDC Quarter-Phased Transit Curves

TCE 009048551-01 P=315.960993 Days  $T_0=412.736558$  (BKJD)



# DV Quarter-Phased Transit Curves

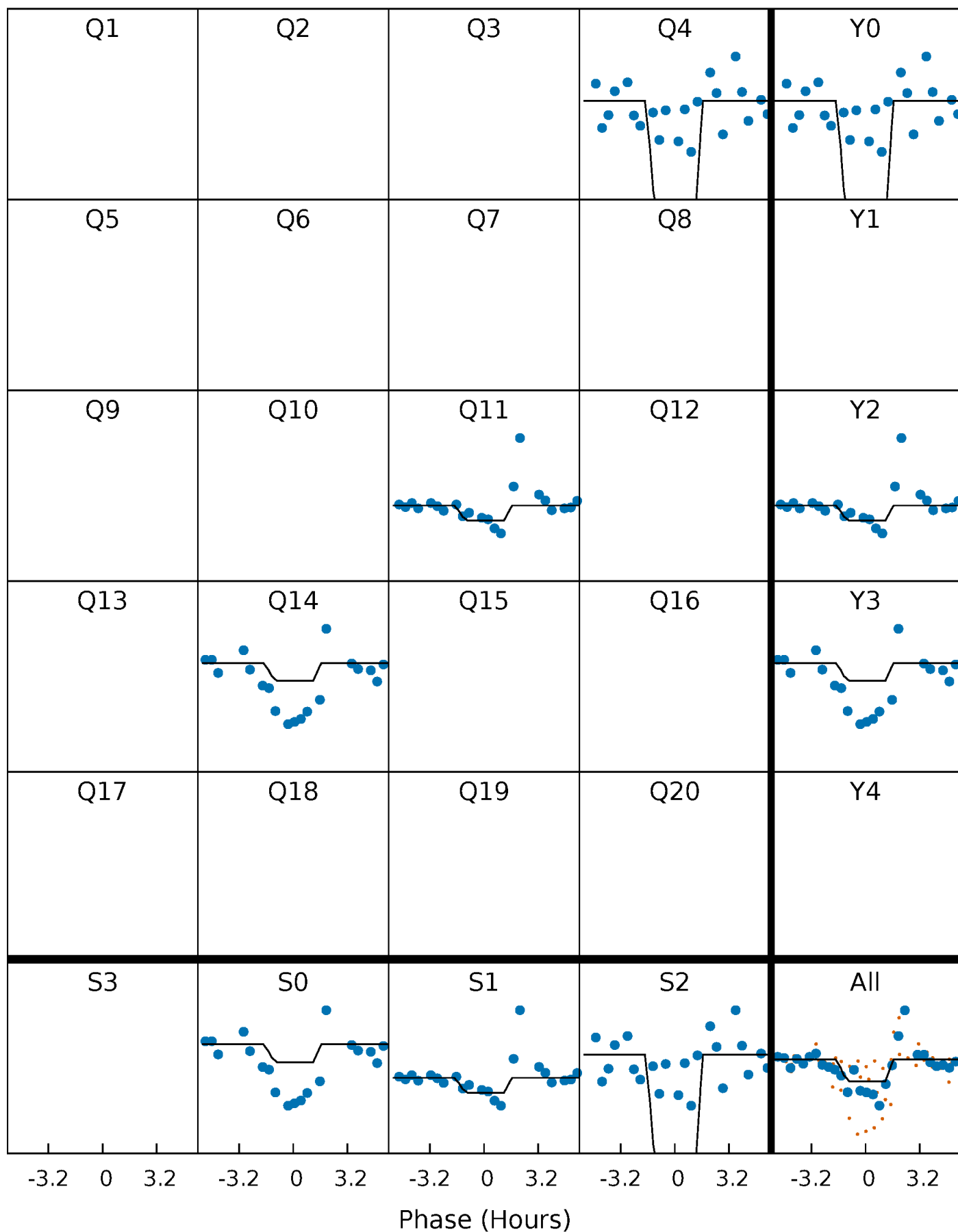
TCE 009048551-01     $P=315.960993$  Days     $T_0=412.736558$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

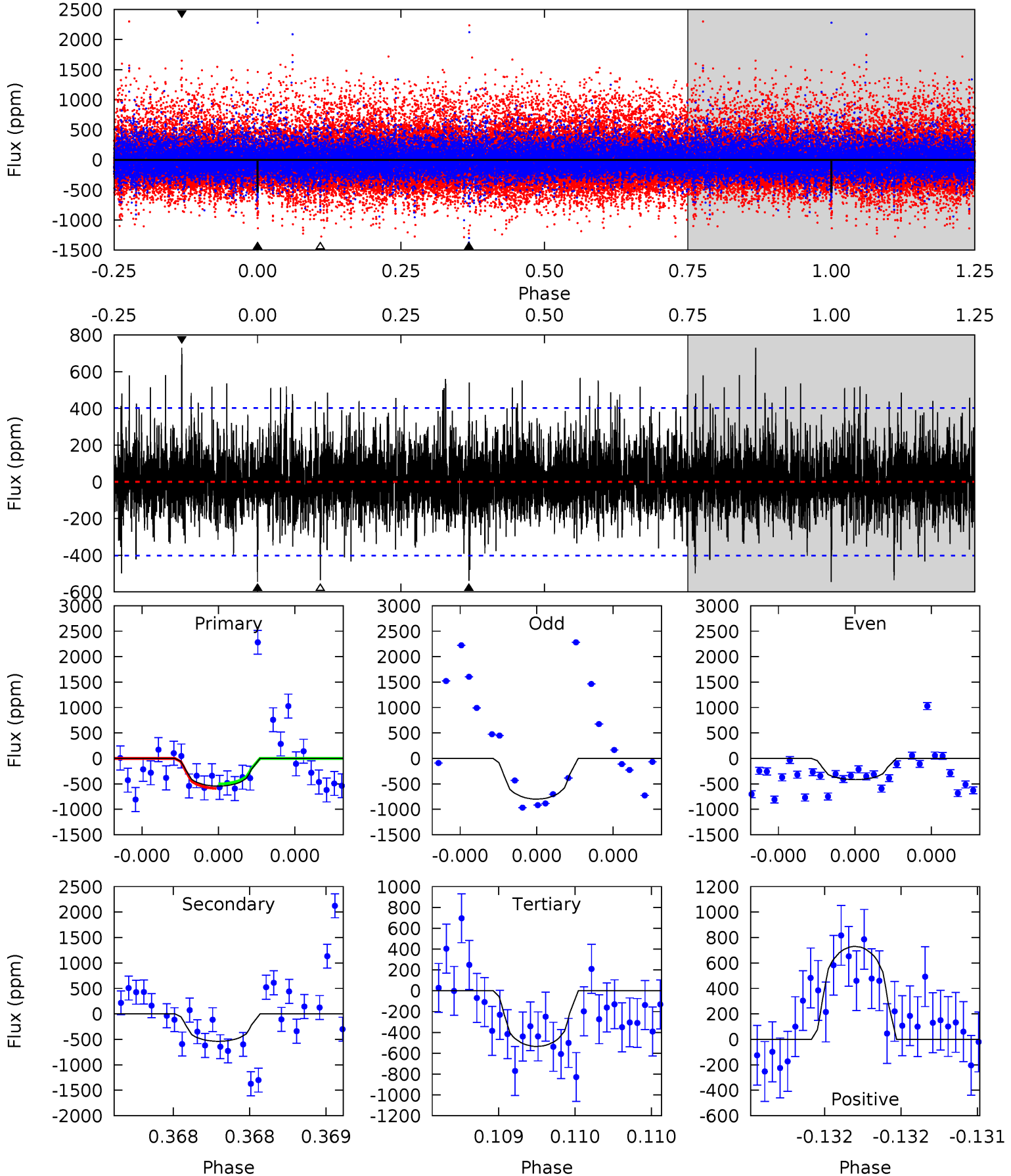
TCE 009048551-01 P=315.953175 Days  $T_0=412.755326$  (BKJD)



# DV Model-Shift Uniqueness Test

009048551-01, P = 315.960993 Days, E = 96.775565 Days

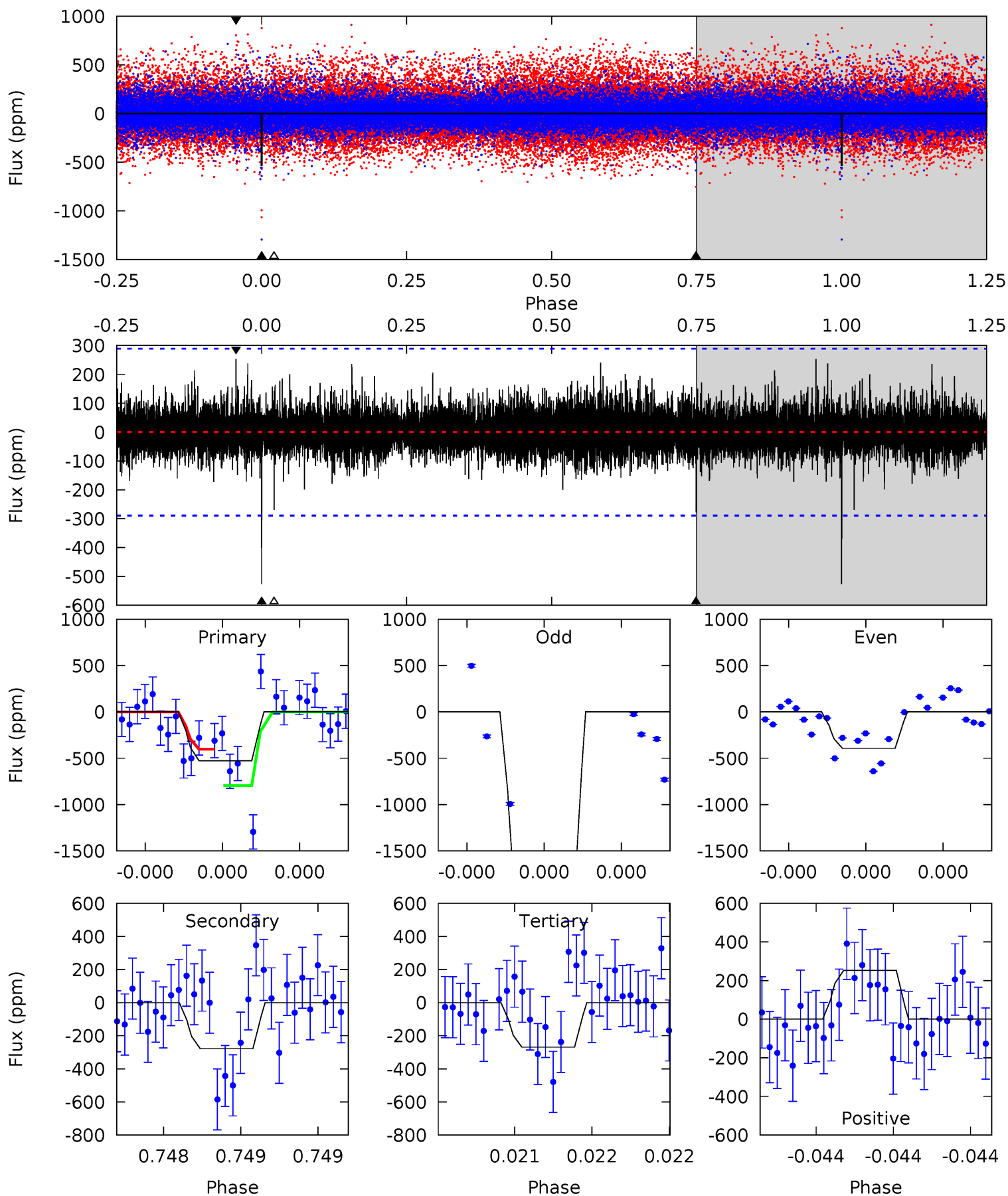
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
7.58	7.50	7.44	10.2	5.59	3.51	1.77	0.13	-2.58	0.06	-2.66	2.14	1.13	0.57	0.62



# Alt Model-Shift Uniqueness Test

009048551-01, P = 315.953175 Days, E = 96.802151 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	5.39	5.22	4.91	5.61	3.54	0.92	5.00	5.31	0.17	0.48	19.0	1.36	0.32	3.66



### Stellar Parameters For KIC 009048551

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$4121^{+123}_{-136}$	$4.631^{+0.049}_{-0.017}$	$0.100^{+0.250}_{-0.300}$	$0.636^{+0.031}_{-0.058}$	$0.631^{+0.050}_{-0.056}$	$3.455^{+0.811}_{-0.299}$
	+3%/-3%	+1%/-0%	+250%/-300%	+5%/-9%	+8%/-9%	+23%/-9%
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 009048551-01 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-539 \pm 72$	$3.63^{+3.13}_{-2.41}$	$228^{+8}_{-9}$	$3163^{+1405}_{-511}$	$14101^{+108092}_{-10179}$
Alt.	$-278 \pm 52$	$3.31^{+3.04}_{-2.24}$	$228^{+8}_{-8}$	$2931^{+1299}_{-452}$	$8460^{+79053}_{-6183}$

$T_{max}$  = Theoretical Maximum Planetary Temperature

$T_{obs}$  = Observed Planetary Temperature (Assuming  $A=0.3$ )

$A_{obs}$  = Observed Albedo (Assuming  $T=0$ )

If a secondary eclipse is present, the system is likely an EB if  $T_{obs} \gg T_{max}$  AND  $A_{obs} \gg 1.0$

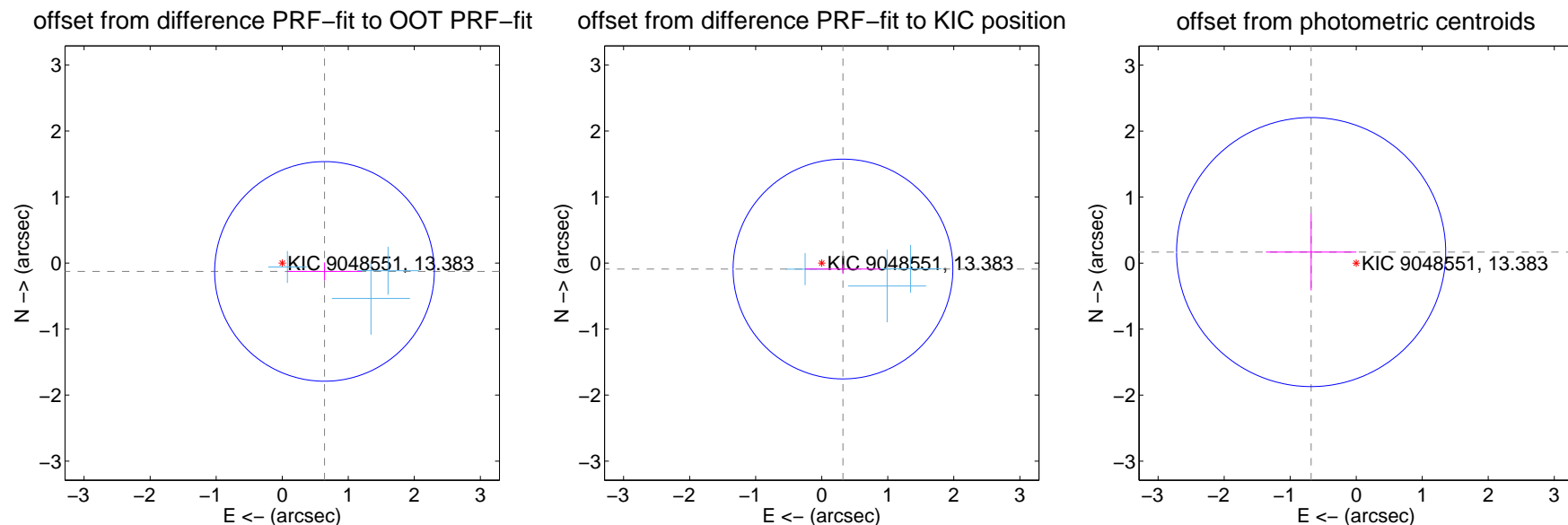
## DV Centroid Data

Supplemental centroid analysis for 009048551-01. Kepler magnitude: 13.38. Transit SNR 8.94

There are 3 quarters with good PRF difference image offsets

The direct PRF centroid is offset from the target star catalog position by about 0.40 arcsec

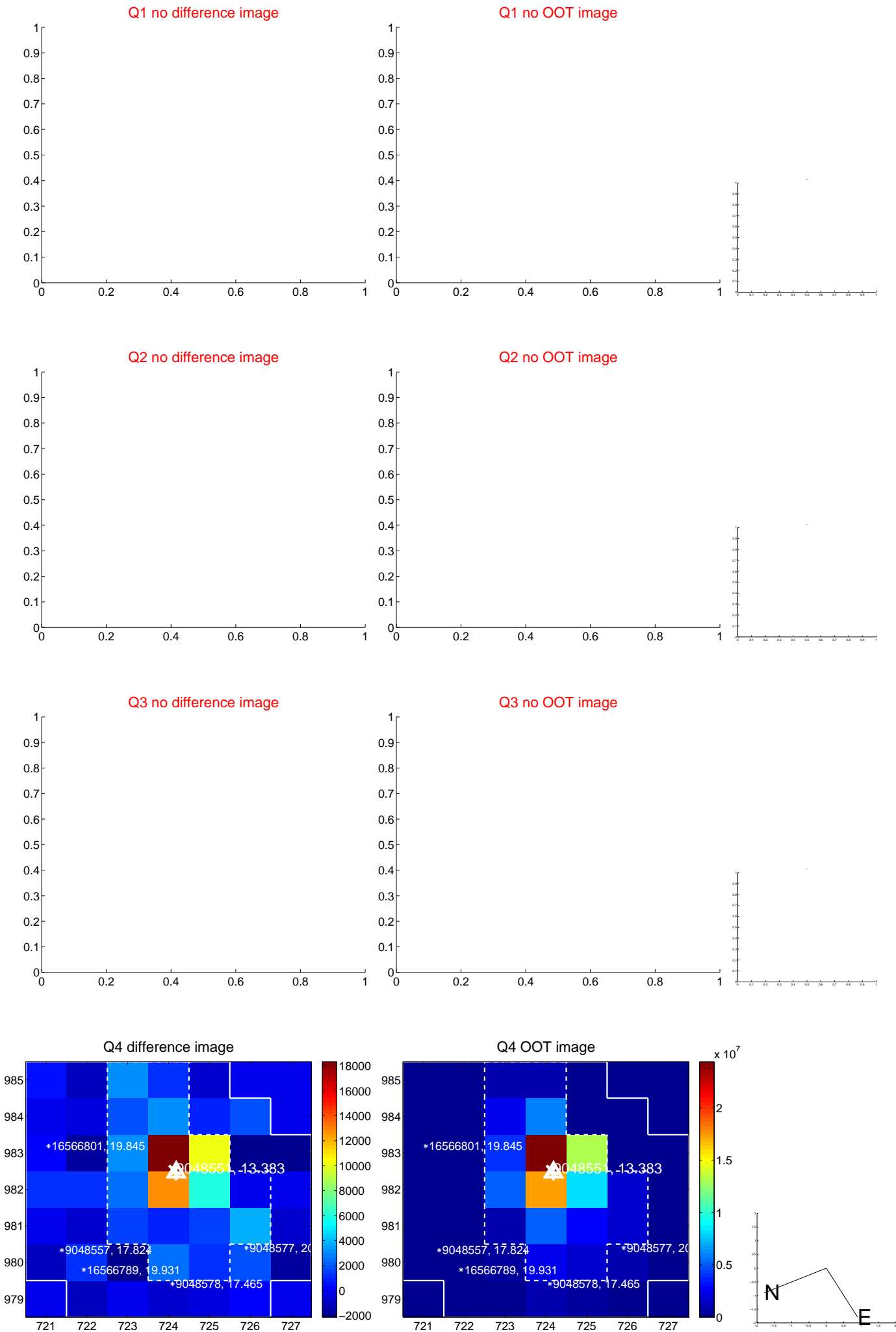
	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.652 \pm 0.554$	1.18	$-0.640 \pm 0.565$	$-0.127 \pm 0.137$
PRF-fit source offset from KIC position	$0.334 \pm 0.555$	0.60	$-0.322 \pm 0.576$	$-0.091 \pm 0.073$
photometric centroid source offset	$0.70 \pm 0.68$	1.03	$0.68 \pm 0.68$	$0.17 \pm 0.58$



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



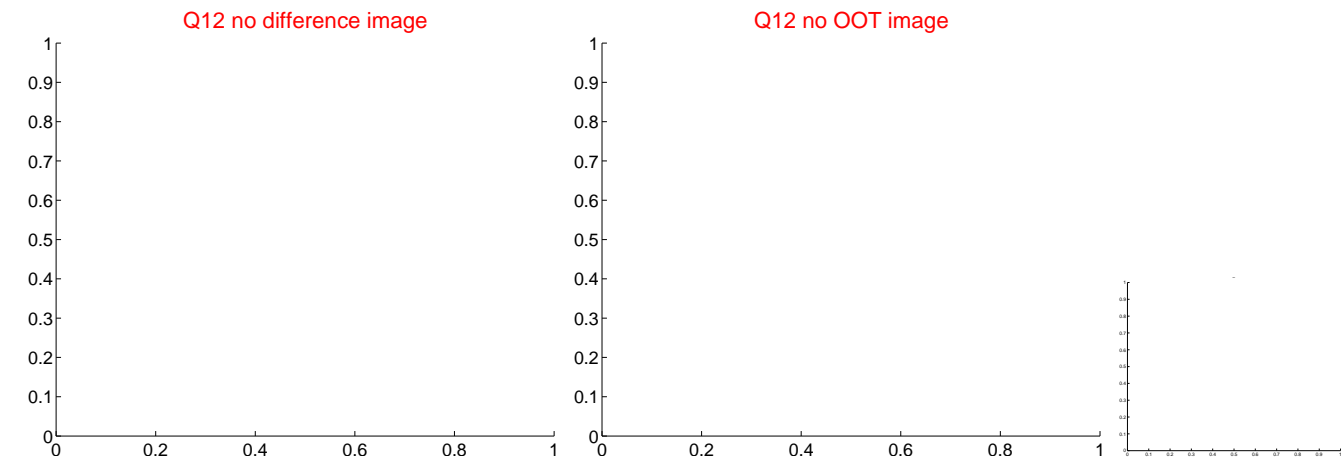
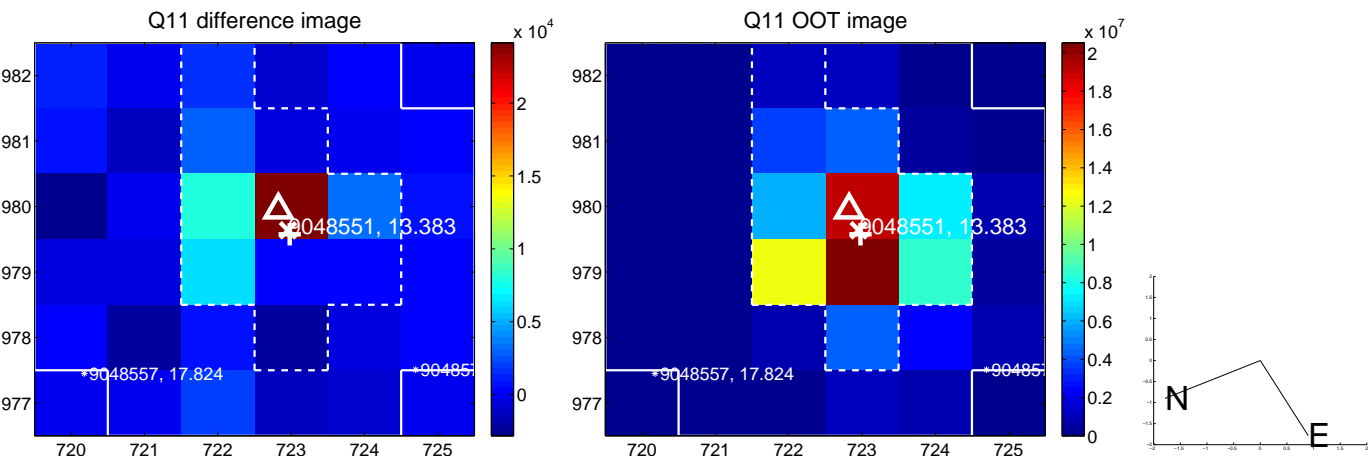
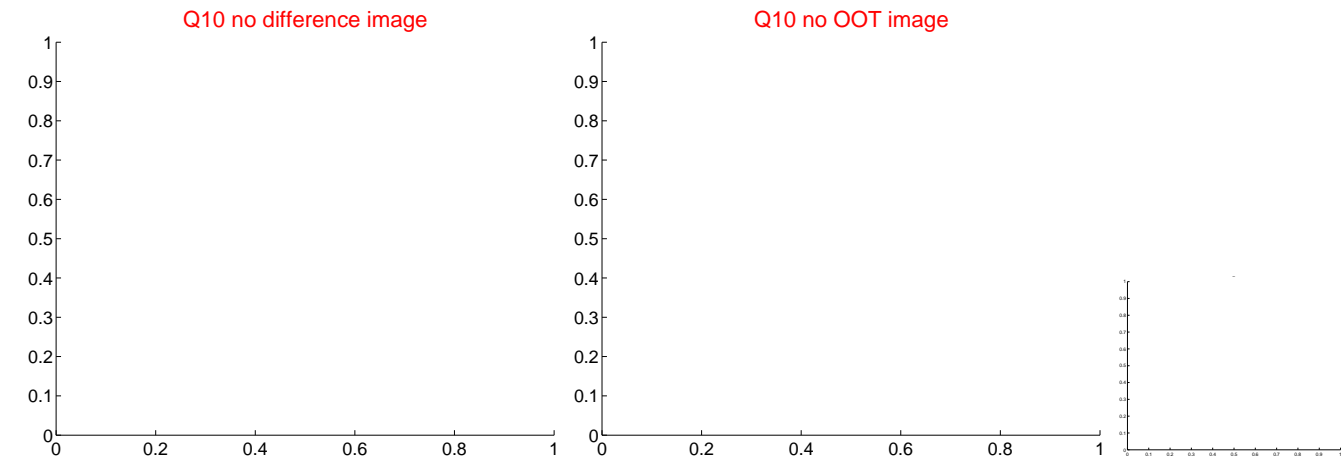
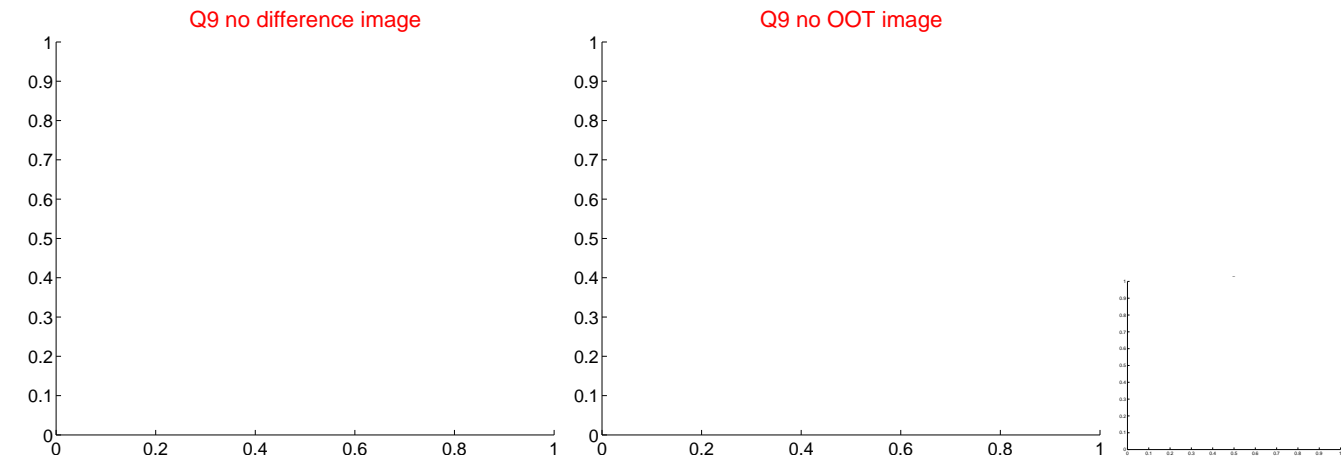
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



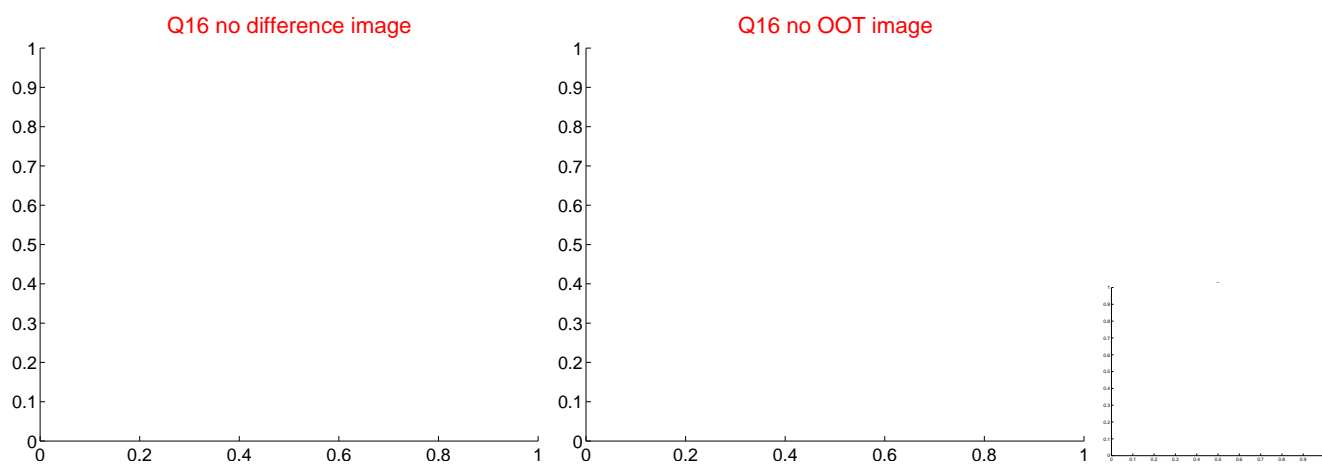
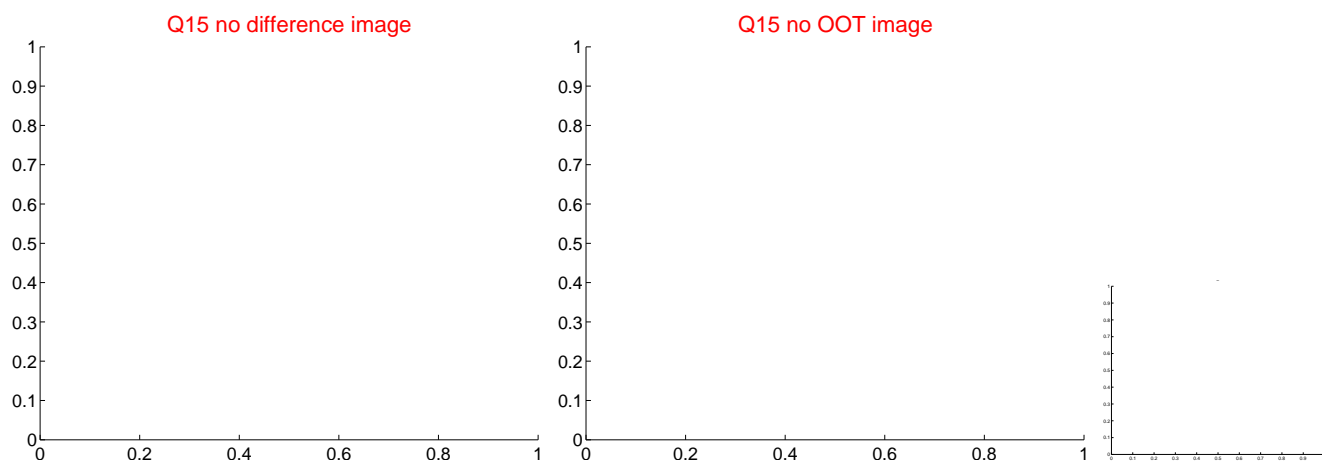
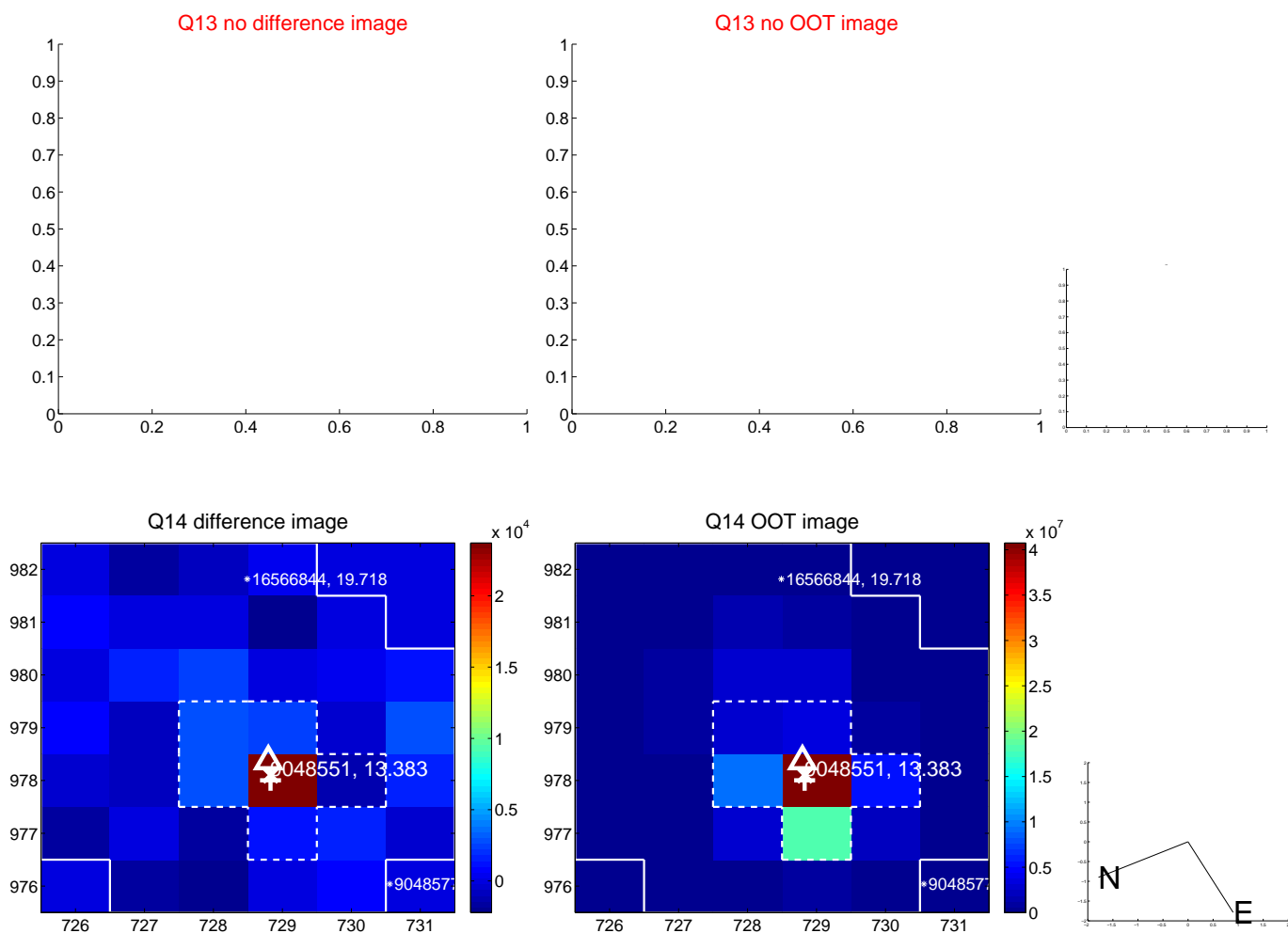
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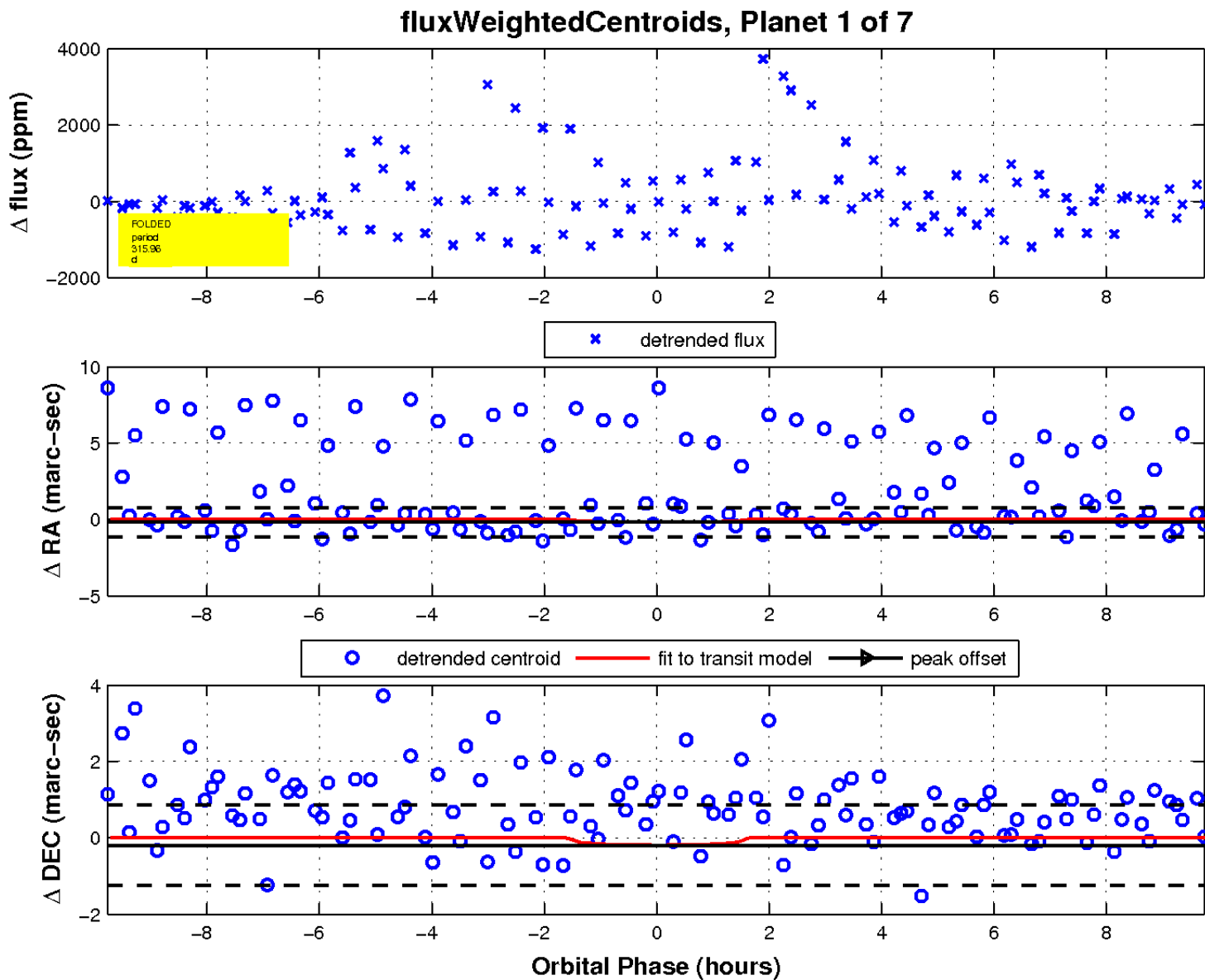
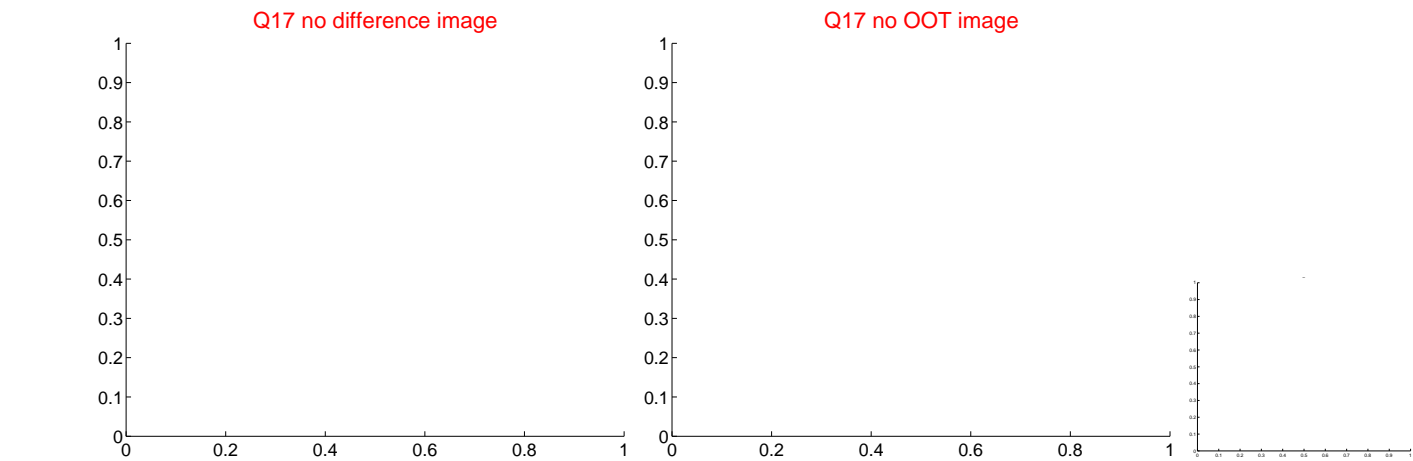
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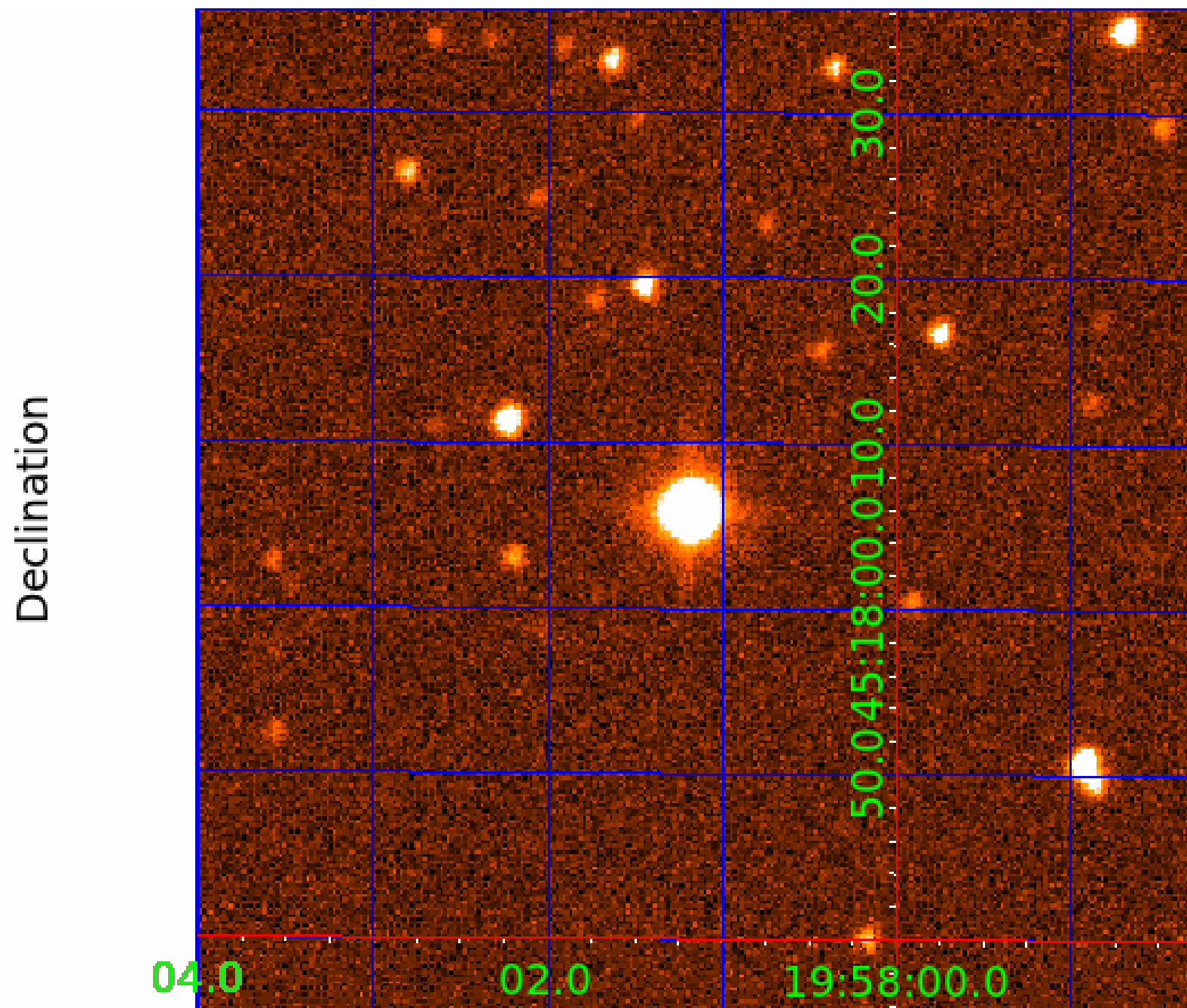


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





UKIRT Image



# KIC 009048551

## Q1-17 DR25 TCE Parameters

TCE	Run Type	KOI?	Period (Days)	Epoch (BKJD)	Depth (ppm)	Duration (Hours)	MES	SNR	$R_{\star}$ ( $R_{\odot}$ )	$T_{\star}$ (K)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
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009048551-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_POS_DV
009048551-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL—LPP_DV—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009048551-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009048551-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009048551-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009048551-07	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_TRACKER—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—CENT_FEW_DIFFS

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

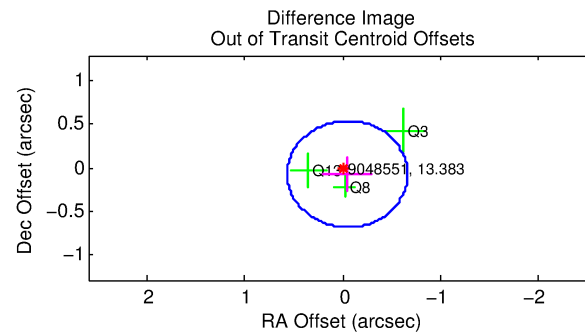
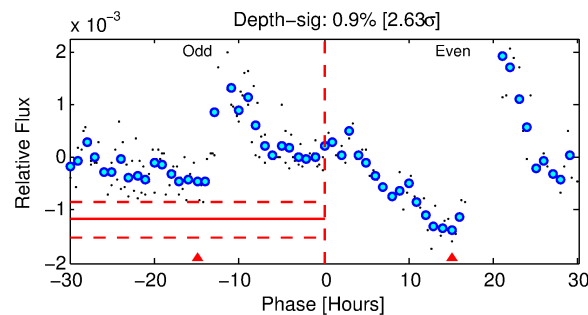
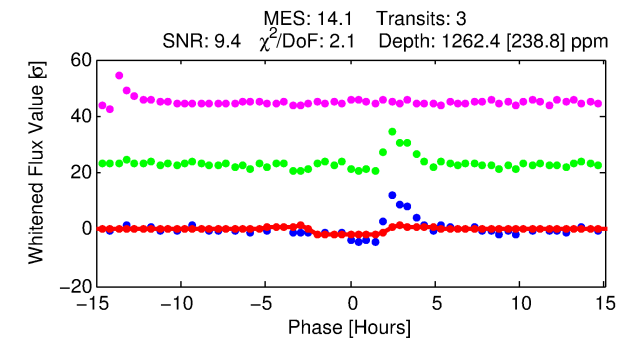
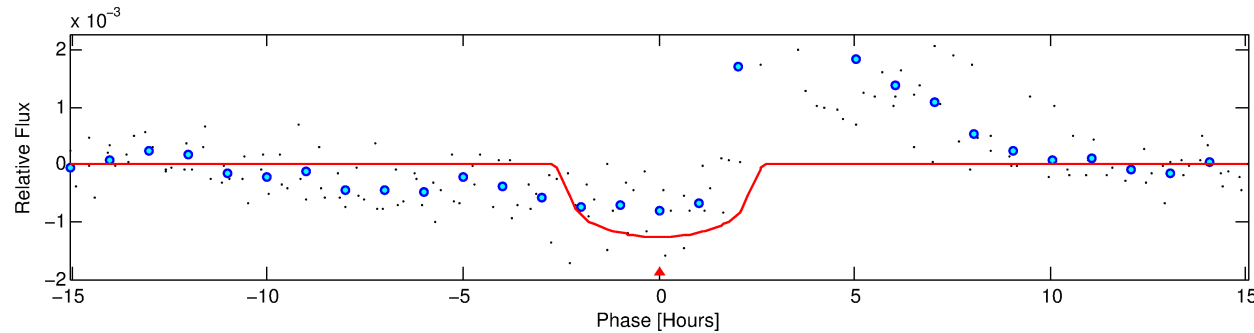
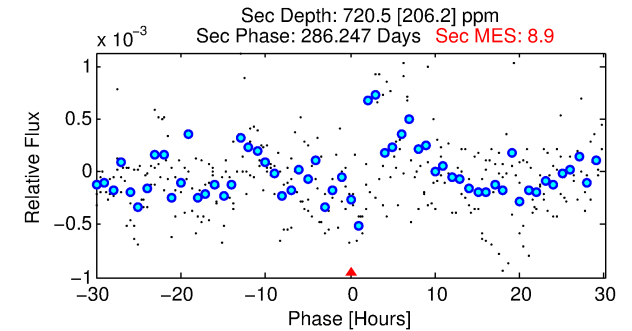
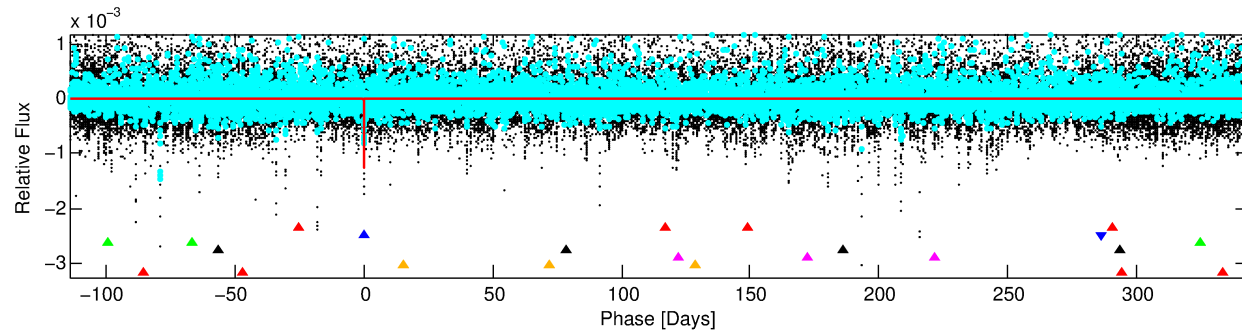
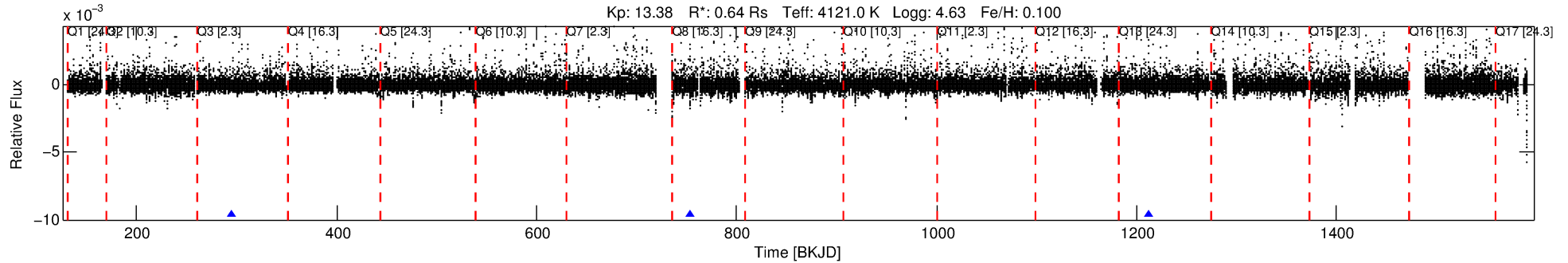
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Ephemeris Match Information For 009048551-02

No Significant Match Found

# DV One-Page Summary

KIC: 9048551 Candidate: 2 of 7 Period: 458.096 d



## DV Fit Results:

Period = 458.09579 [0.00608] d  
Epoch = 295.7117 [0.0079] BKJD  
Rp/R\* = 0.0326 [0.0404]  
a/R\* = 638.09 [2496.29]  
b = 0.48 [6.46]  
Seff = 0.11 [0.02]  
Teq = 145 [6] K  
Rp = 2.26 [2.81] Re  
a = 0.9976 [0.0713] AU  
Ag = 77017.29 [192356.83] [0.40 $\sigma$ ]  
Teffp = 3739 [2336] K [1.54 $\sigma$ ]

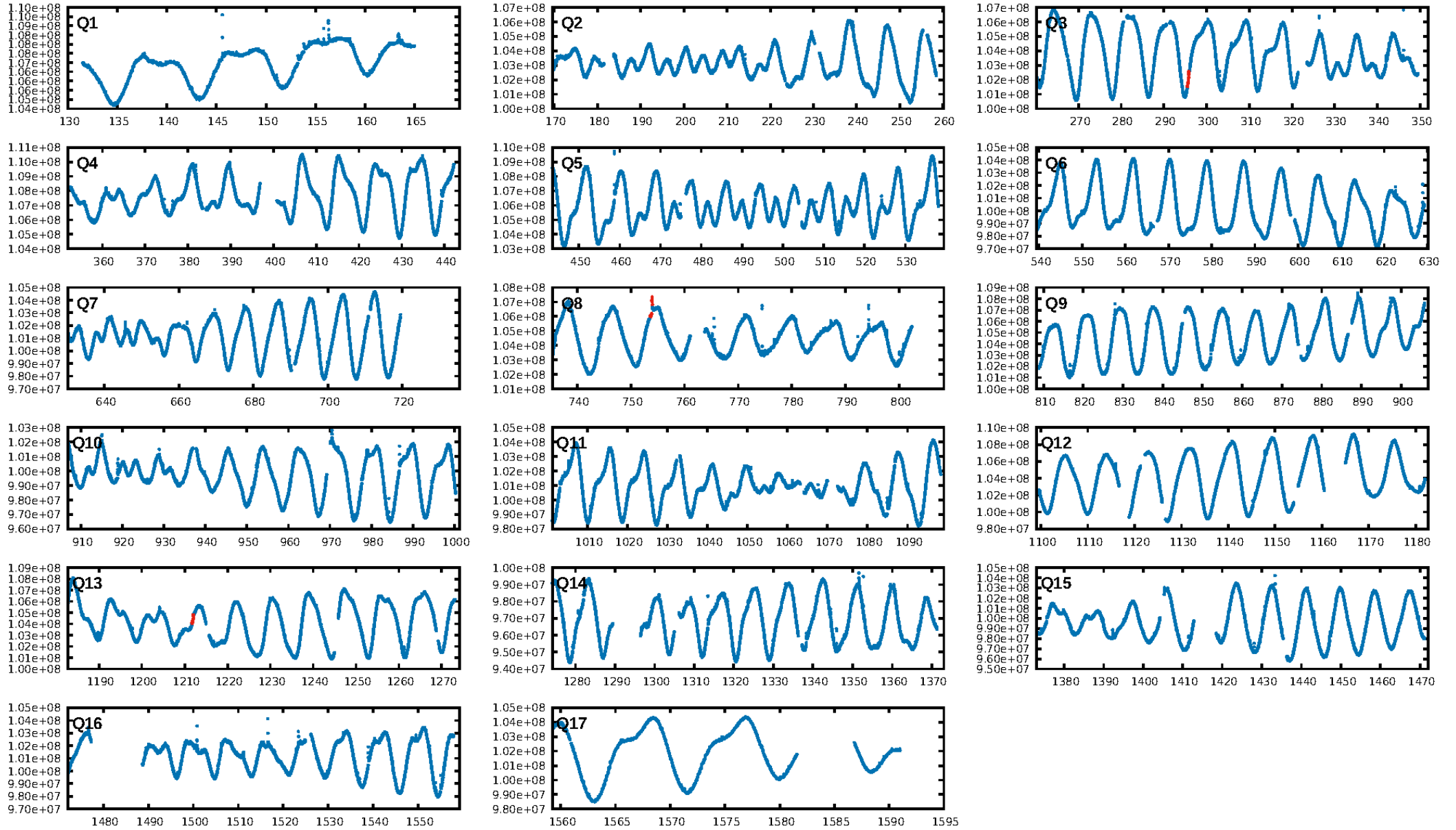
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [53.29 $\sigma$ ]  
LongPeriod-sig: 100.0% [45.29 $\sigma$ ]  
**ModelChiSquare2-sig: 0.0%**  
ModelChiSquareGof-sig: 18.7%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: 3.424  
Centroid-sig: 44.2%  
Centroid-so: 0.584 arcsec [0.93 $\sigma$ ]  
OotOffset-rm: 0.089 arcsec [0.43 $\sigma$ ]  
OotOffset-st: 0/1/1/1 [3]  
KicOffset-rm: 0.267 arcsec [0.91 $\sigma$ ]  
KicOffset-st: 0/1/1/1 [3]  
DiffImageQuality-fgm: 1.00 [3/3]  
DiffImageOverlap-fno: 1.00 [3/3]

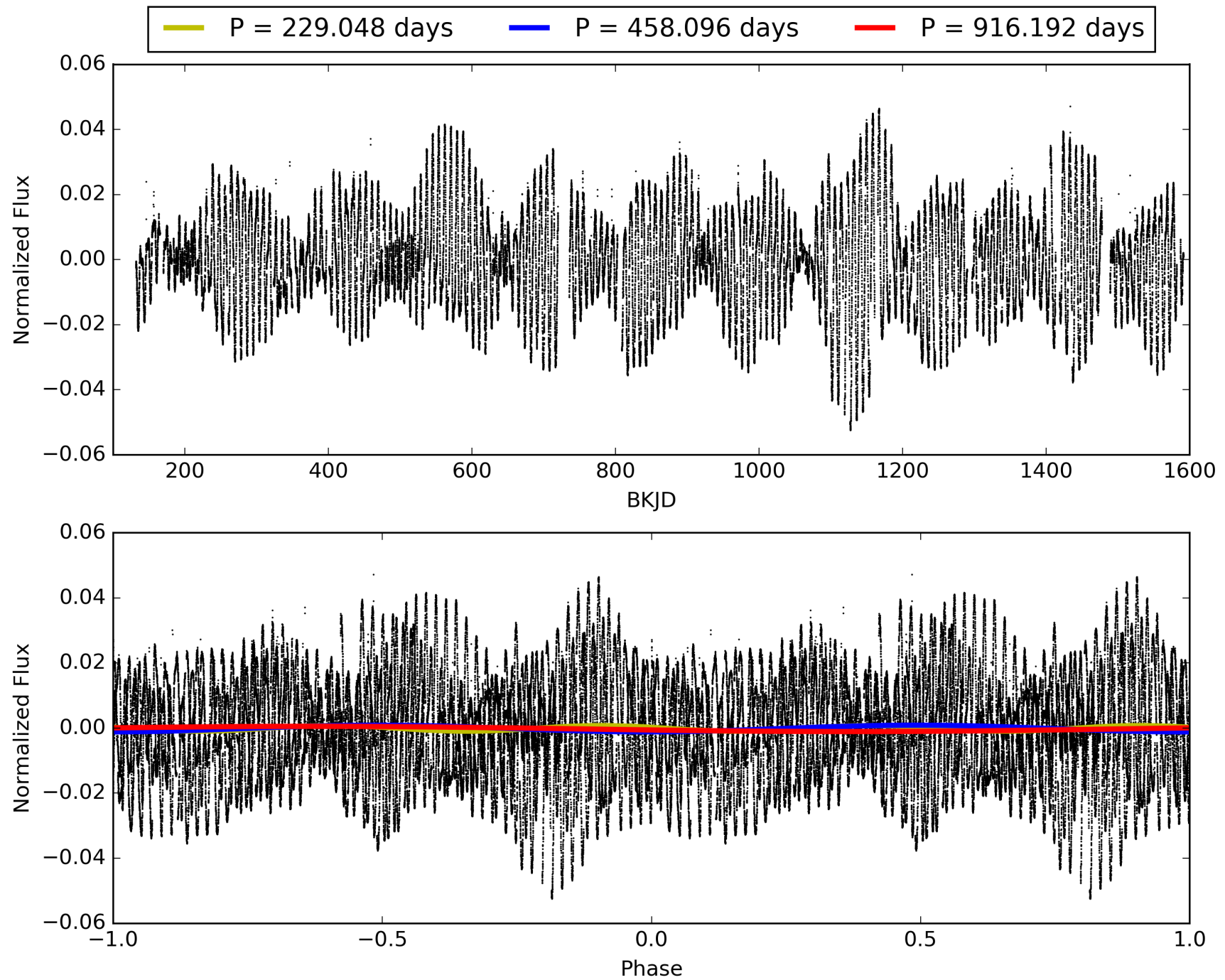
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 13:47:44 Z

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

# TCE 009048551-02, PDC Light Curves

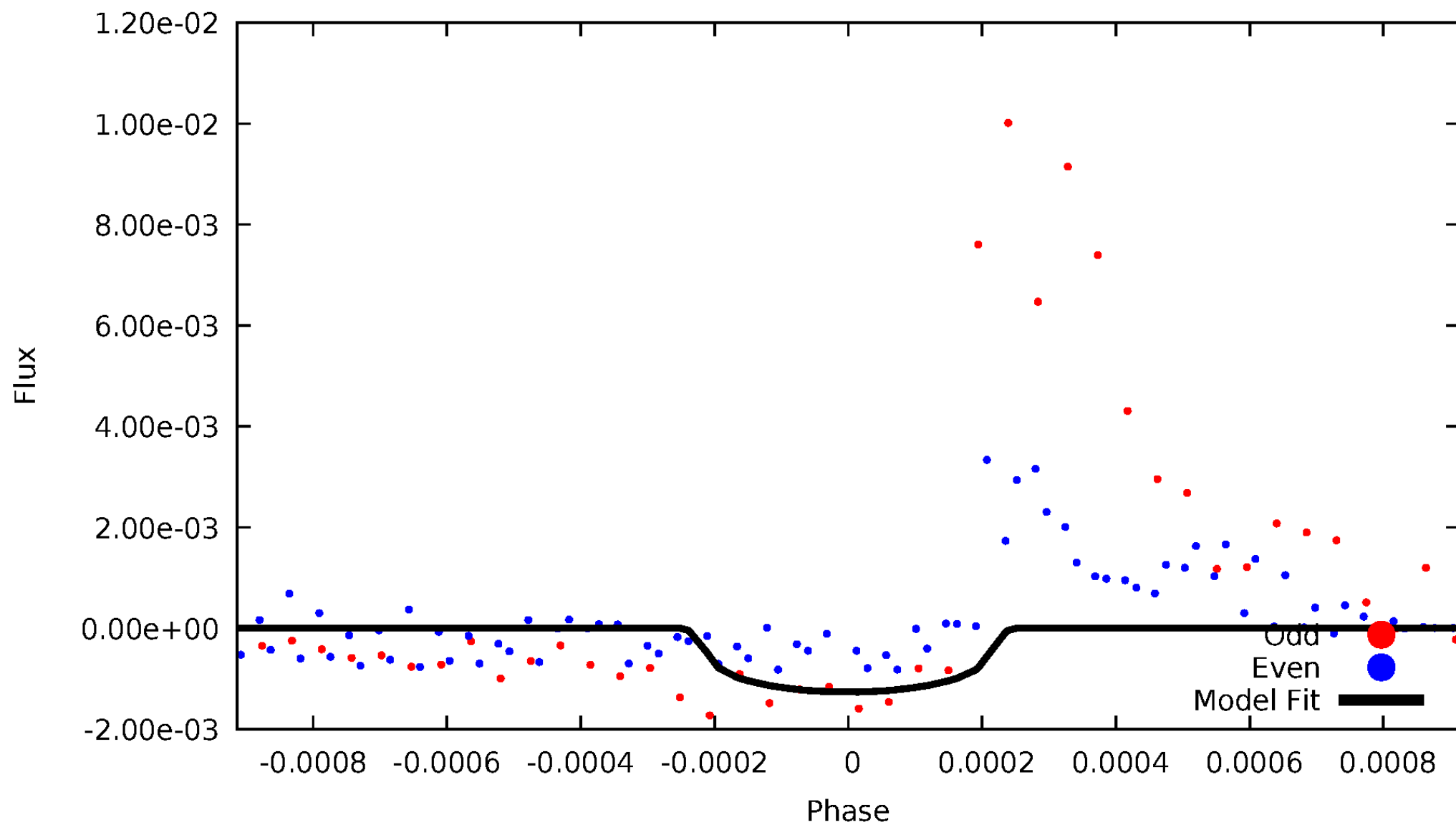


TCE 009048551-02



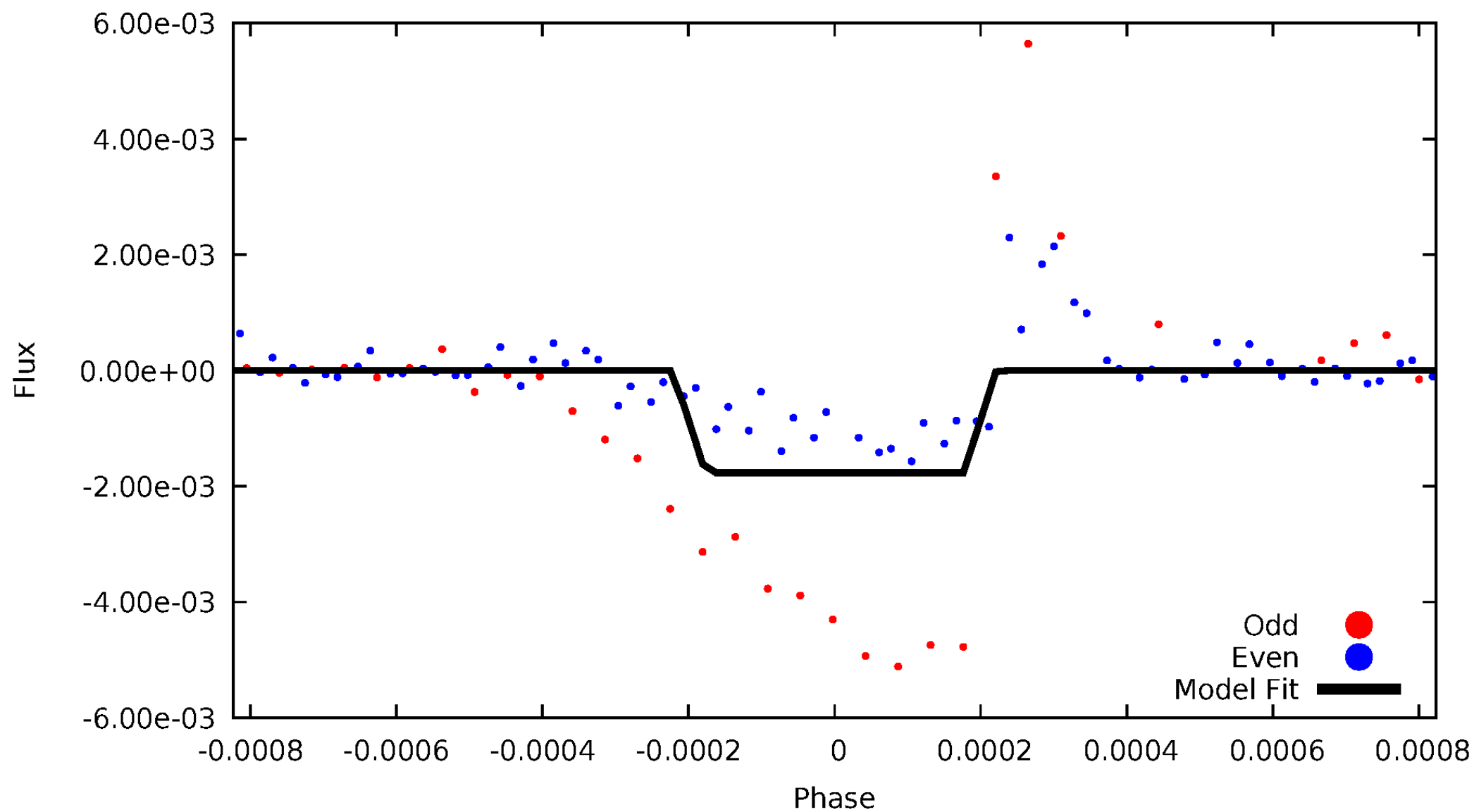
# DV Odd/Even

TCE 009048551-02



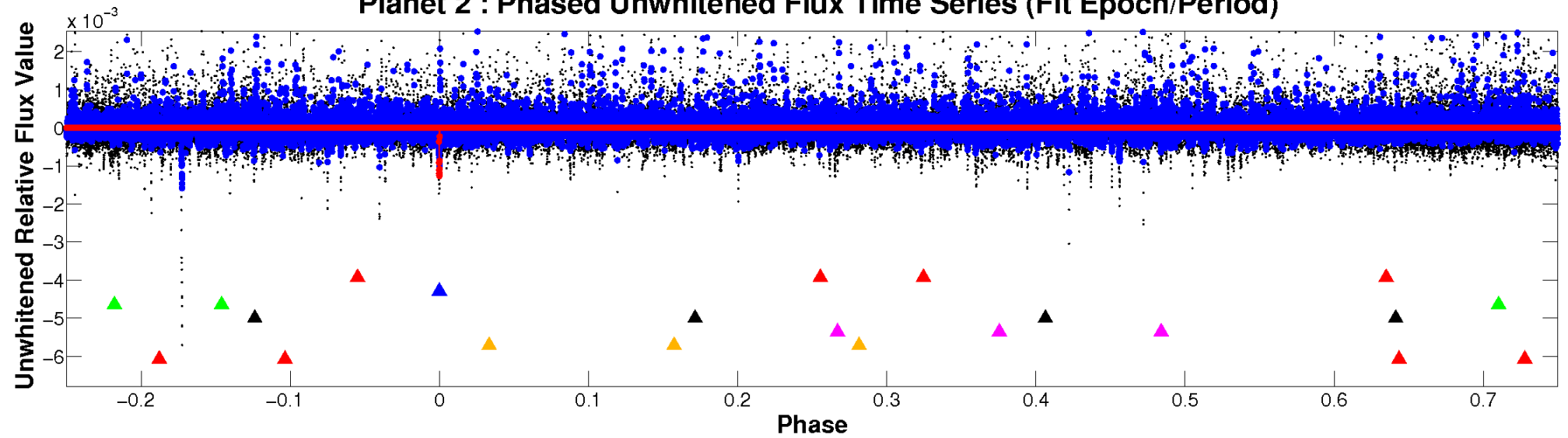
# ALT Odd/Even

TCE 009048551-02

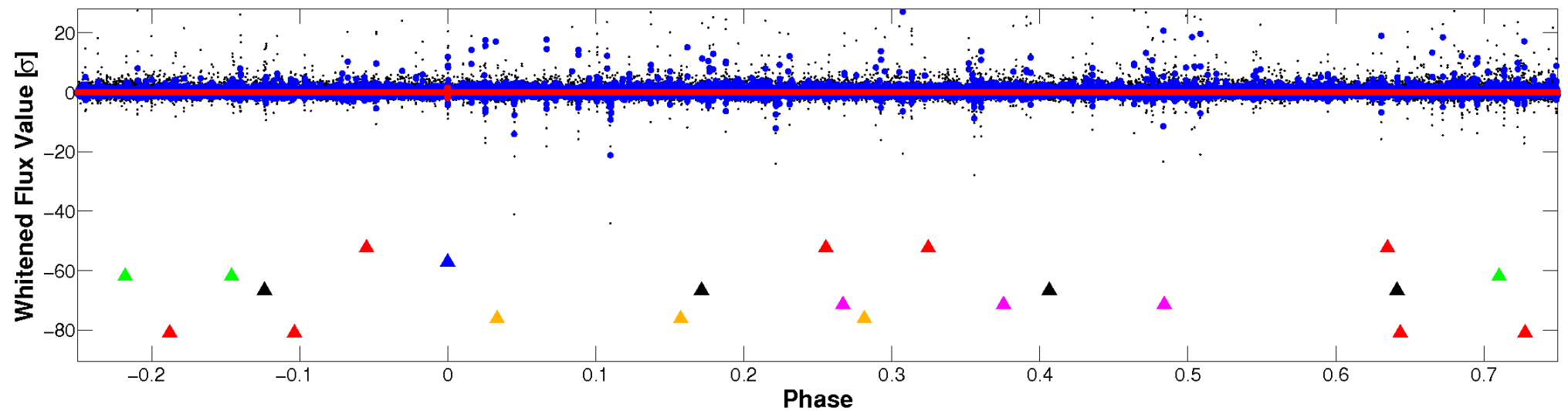


# Non-Whitened Vs. Whitened Light Curve

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



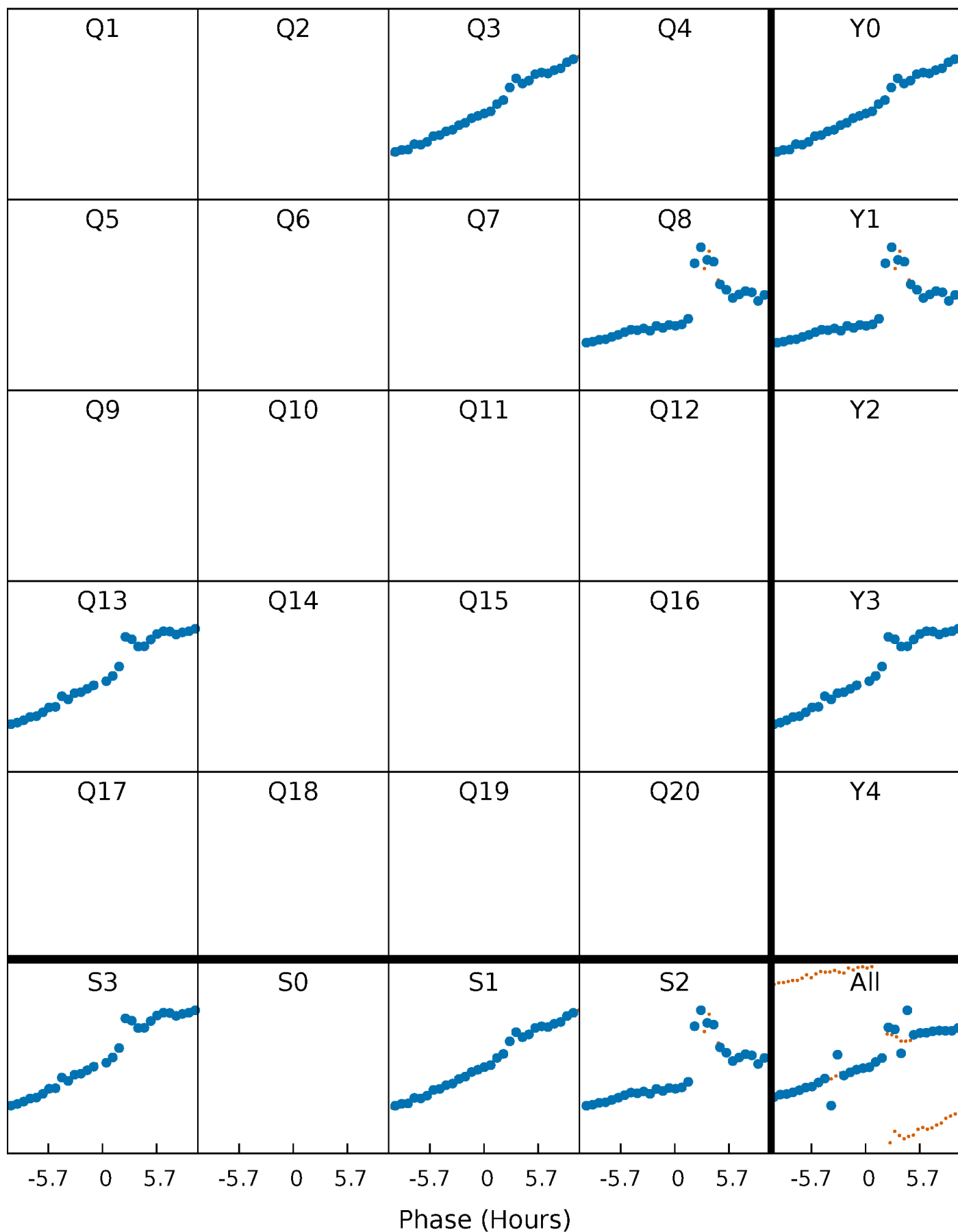
## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)





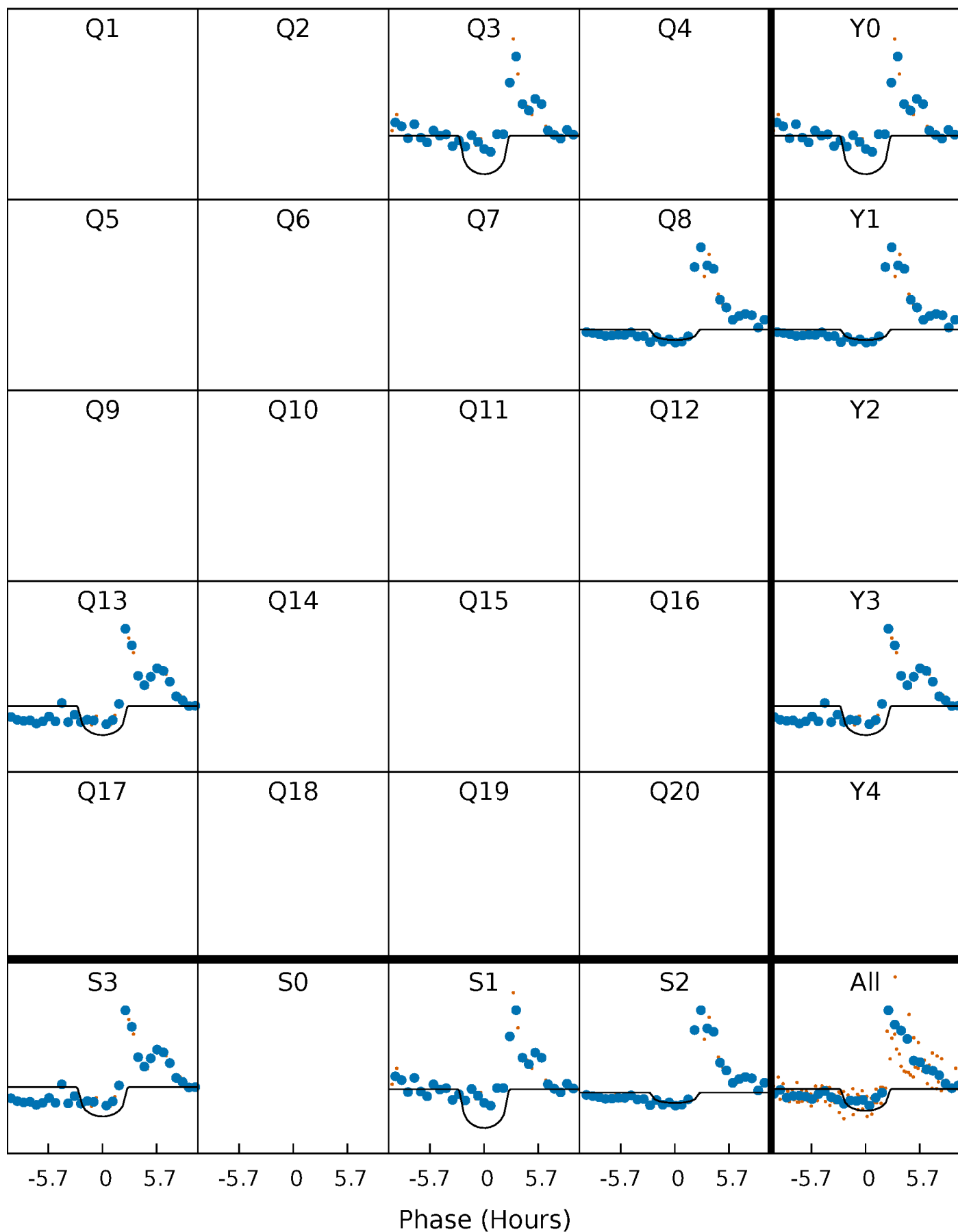
# PDC Quarter-Phased Transit Curves

TCE 009048551-02     $P=458.095786$  Days     $T_0=295.711690$  (BKJD)



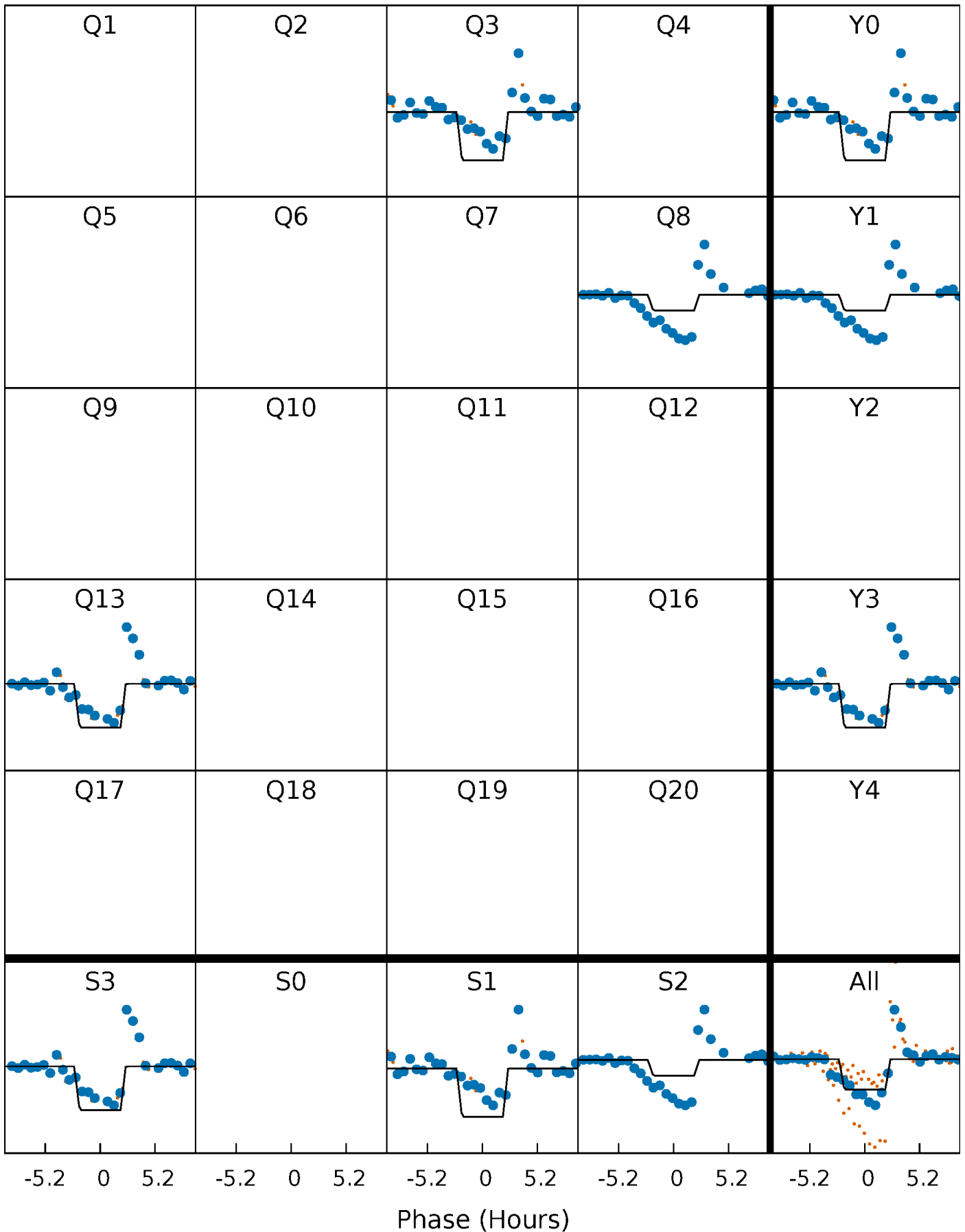
# DV Quarter-Phased Transit Curves

TCE 009048551-02     $P=458.095786$  Days     $T_0=295.711690$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

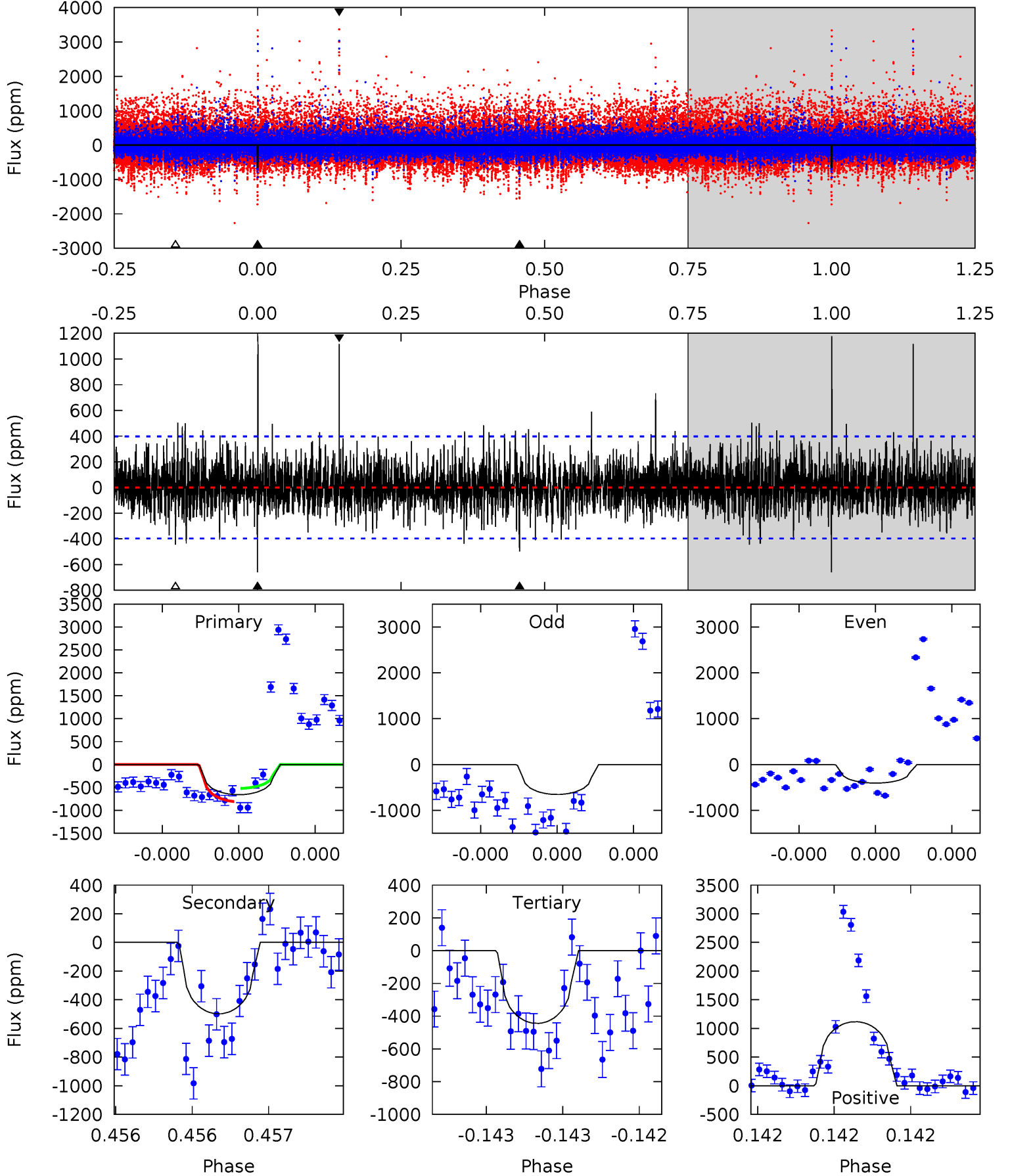
TCE 009048551-02 P=458.093170 Days  $T_0=295.702180$  (BKJD)



# DV Model-Shift Uniqueness Test

009048551-02, P = 458.095786 Days, E = 295.711690 Days

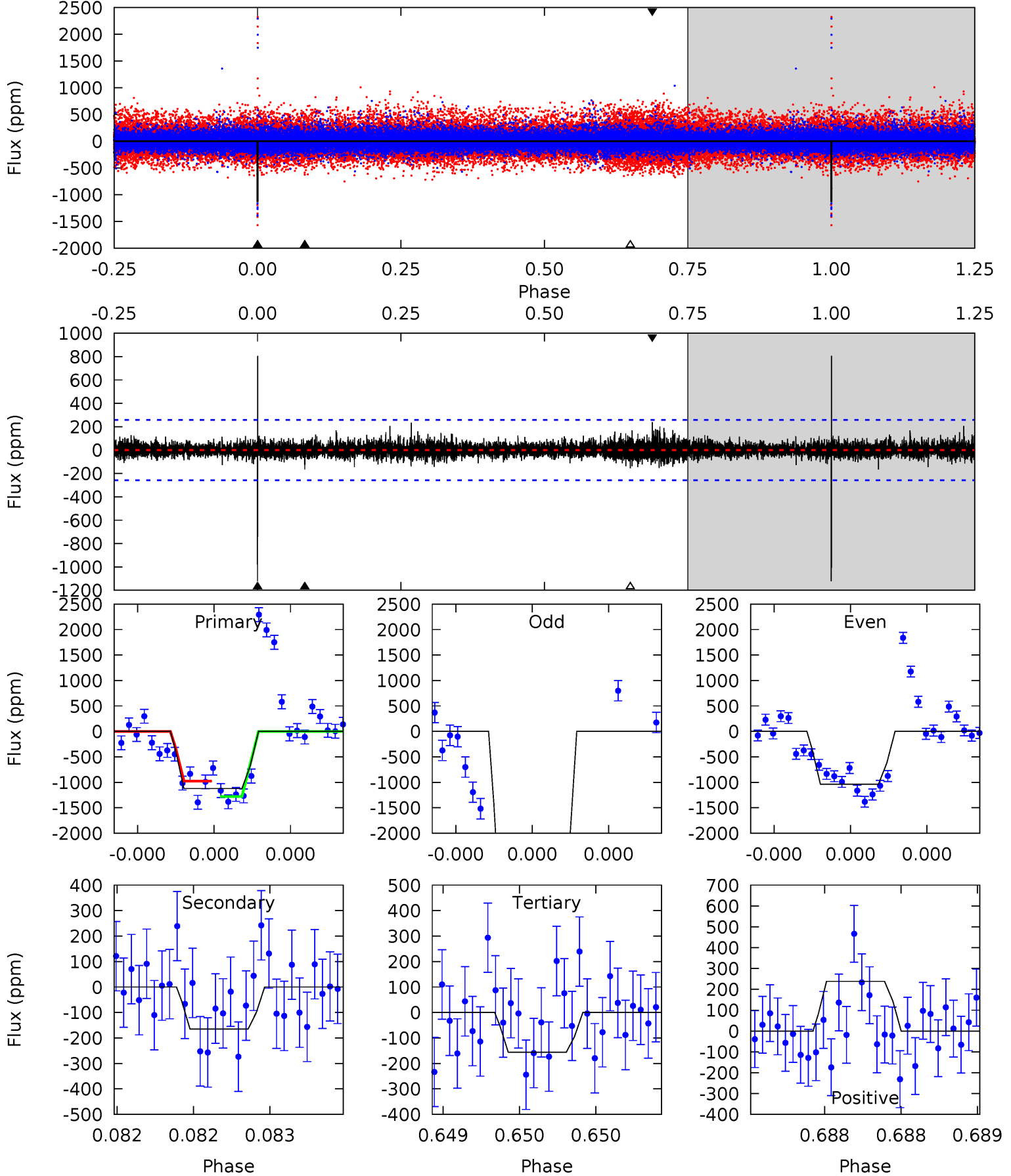
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
9.26	7.01	6.25	15.7	5.59	3.50	1.75	3.01	-6.45	0.76	-8.70	1.23	1.02	0.64	2.03



# Alt Model-Shift Uniqueness Test

009048551-02, P = 458.093170 Days, E = 295.702180 Days

Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
24.4	3.59	3.39	5.18	5.61	3.53	0.75	21.0	19.2	0.20	-1.58	41.2	1.66	0.42	0



### Stellar Parameters For KIC 009048551

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$4121^{+123}_{-136}$	$4.631^{+0.049}_{-0.017}$	$0.100^{+0.250}_{-0.300}$	$0.636^{+0.031}_{-0.058}$	$0.631^{+0.050}_{-0.056}$	$3.455^{+0.811}_{-0.299}$
	+3%/-3%	+1%/-0%	+250%/-300%	+5%/-9%	+8%/-9%	+23%/-9%
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 009048551-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-498 \pm 71$	$2.93^{+2.31}_{-1.94}$	$201^{+7}_{-7}$	$3331^{+1510}_{-529}$	$31993^{+252562}_{-21753}$
Alt.	$-165 \pm 46$	$3.43^{+2.46}_{-2.25}$	$202^{+6}_{-7}$	$2720^{+1005}_{-351}$	$7791^{+57089}_{-5294}$

$T_{max}$  = Theoretical Maximum Planetary Temperature

$T_{obs}$  = Observed Planetary Temperature (Assuming  $A=0.3$ )

$A_{obs}$  = Observed Albedo (Assuming  $T=0$ )

If a secondary eclipse is present, the system is likely an EB if  $T_{obs} \gg T_{max}$  AND  $A_{obs} \gg 1.0$

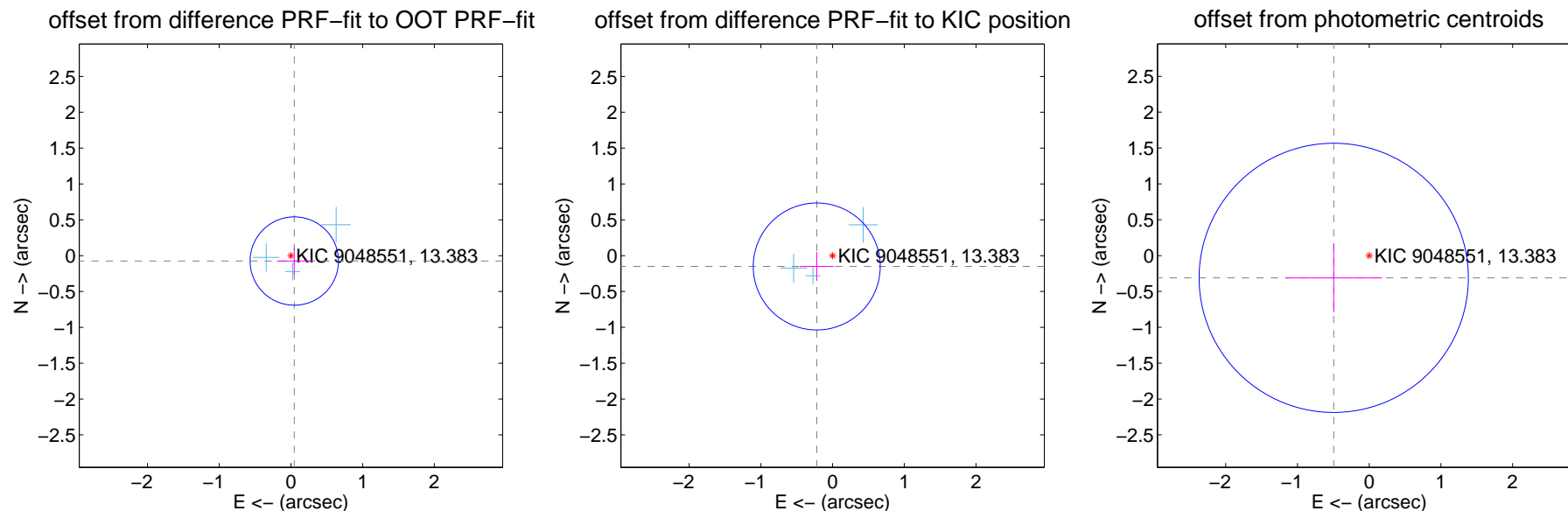
## DV Centroid Data

Supplemental centroid analysis for 009048551-02. Kepler magnitude: 13.38. Transit SNR 9.40

There are 3 quarters with good PRF difference image offsets

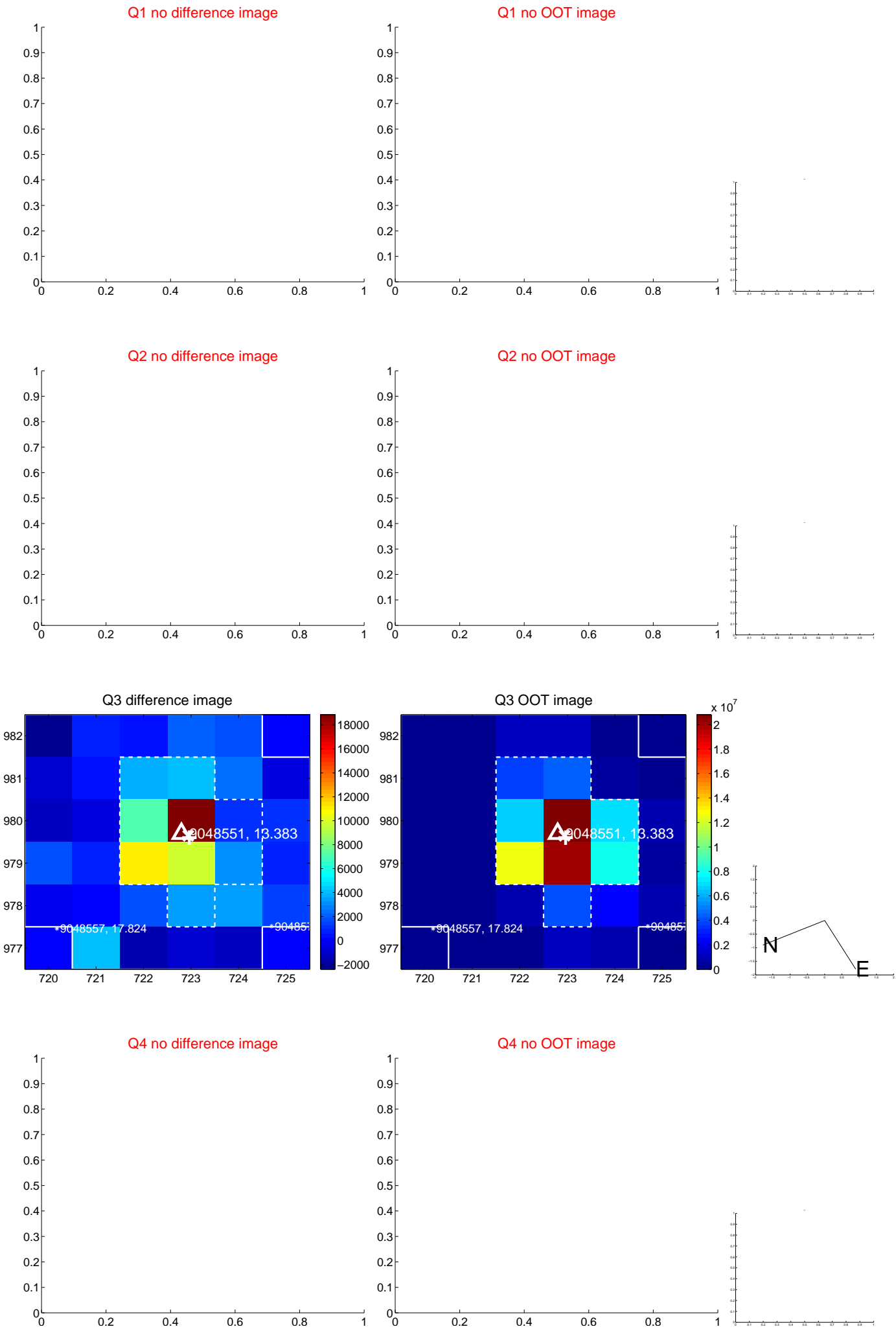
The direct PRF centroid is offset from the target star catalog position by about 0.25 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.089 \pm 0.205$	0.43	$-0.047 \pm 0.242$	$-0.075 \pm 0.189$
PRF-fit source offset from KIC position	$0.267 \pm 0.295$	0.91	$0.221 \pm 0.237$	$-0.151 \pm 0.202$
photometric centroid source offset	$0.58 \pm 0.63$	0.93	$0.49 \pm 0.67$	$-0.31 \pm 0.48$



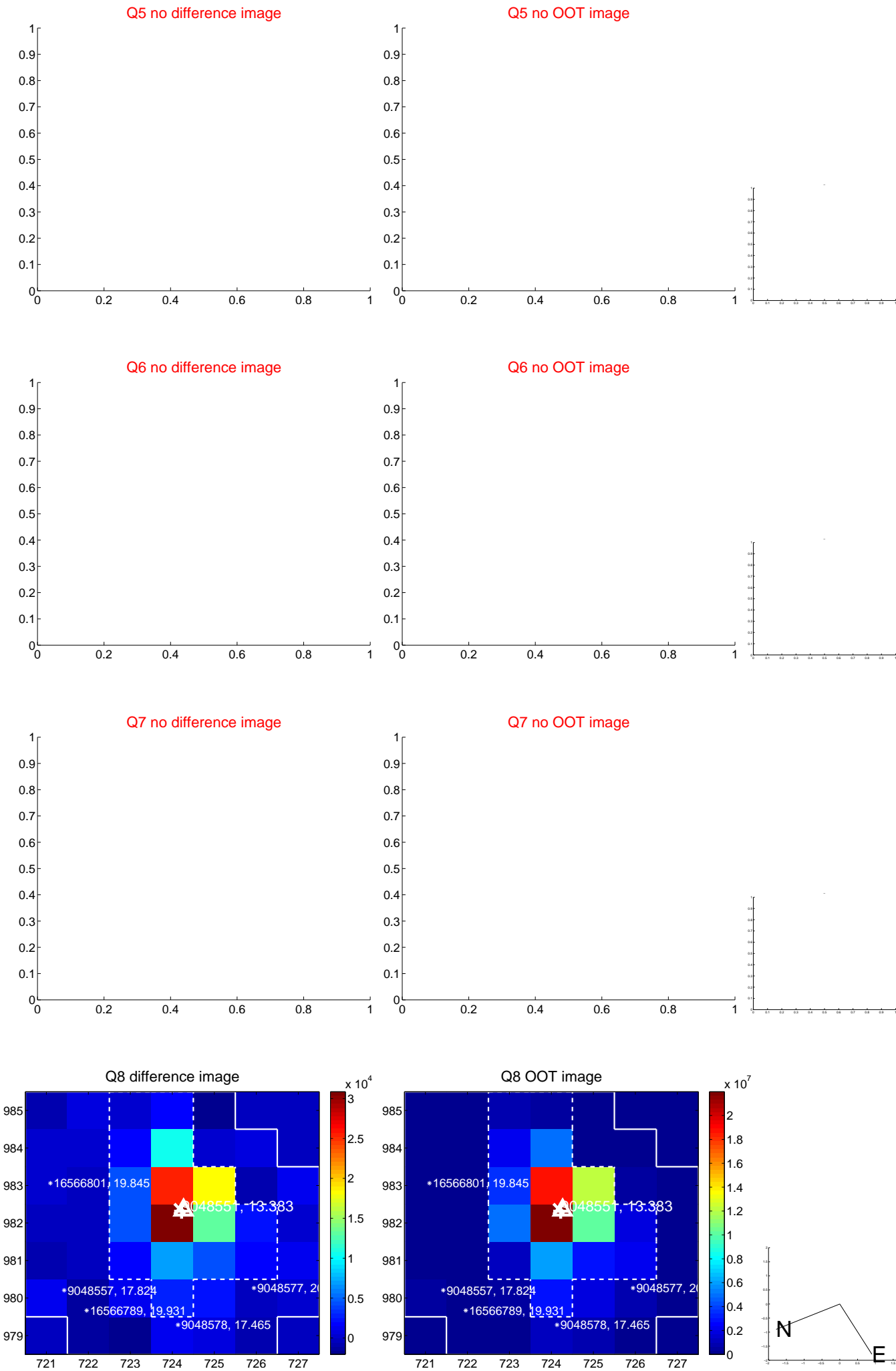
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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





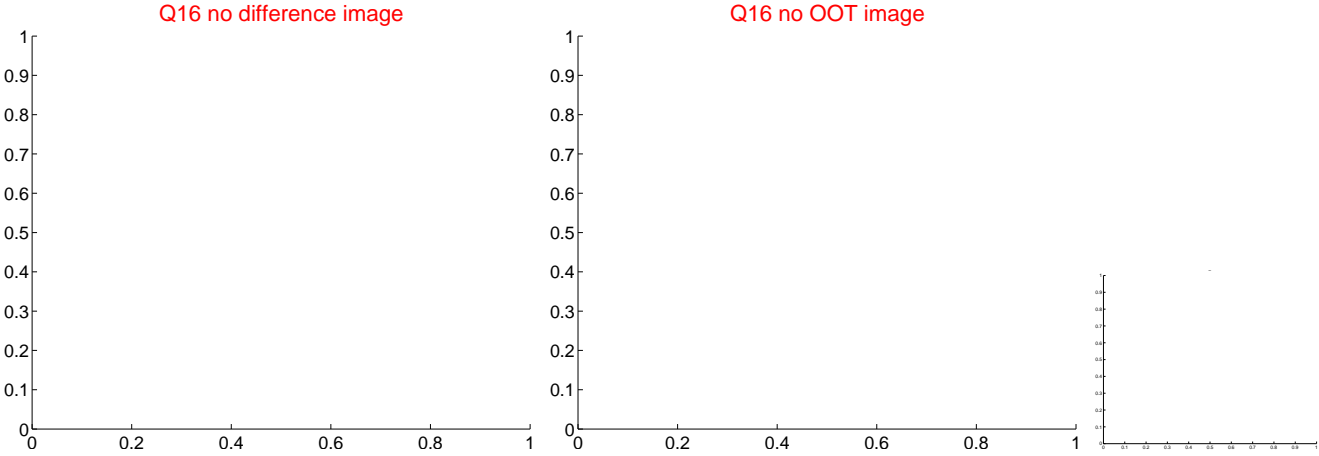
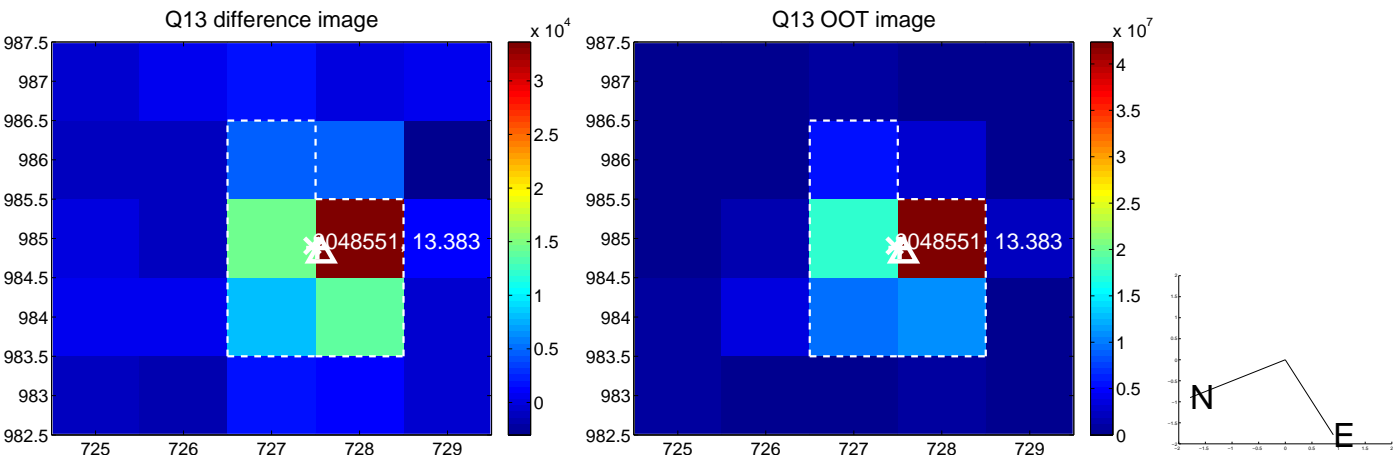
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



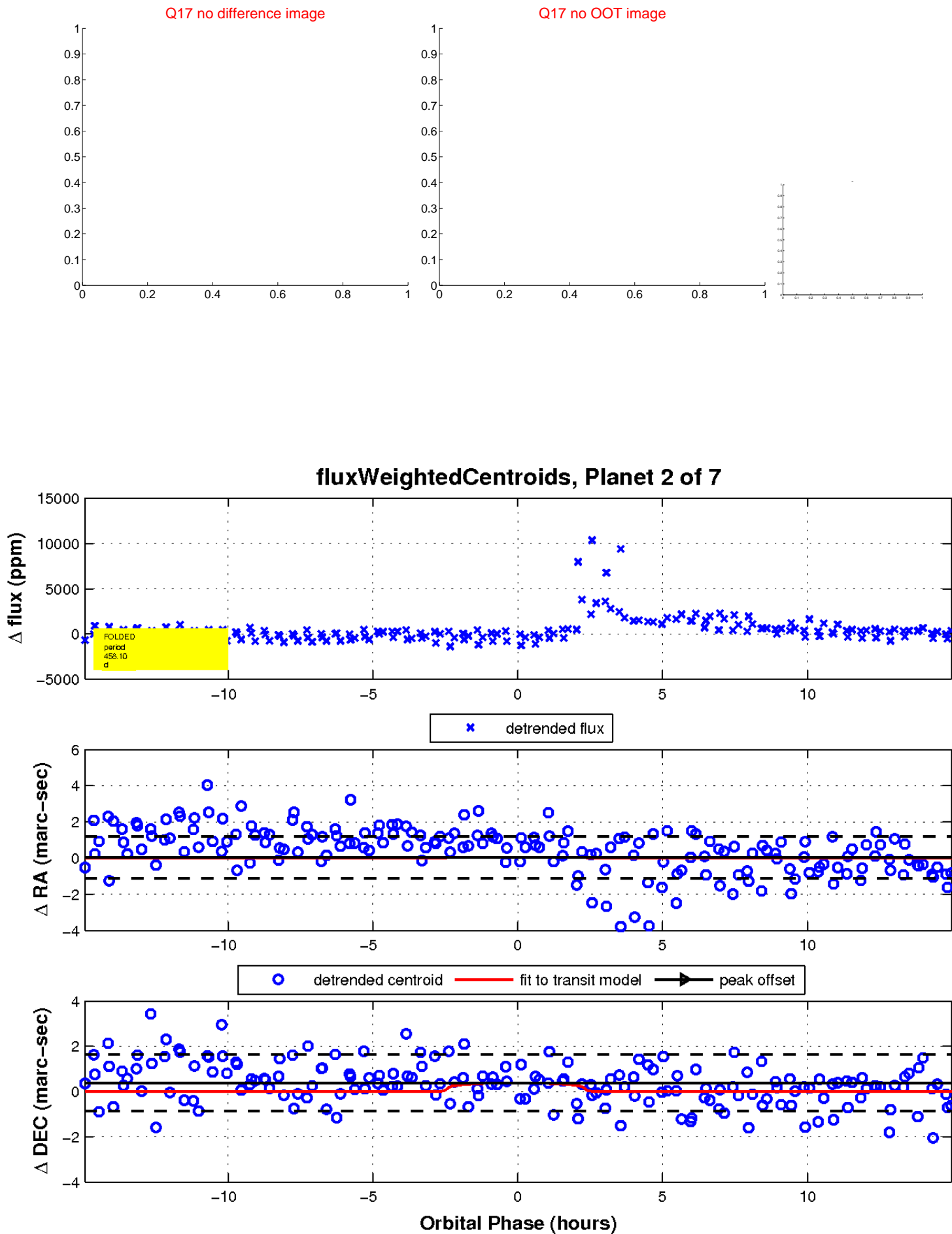
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



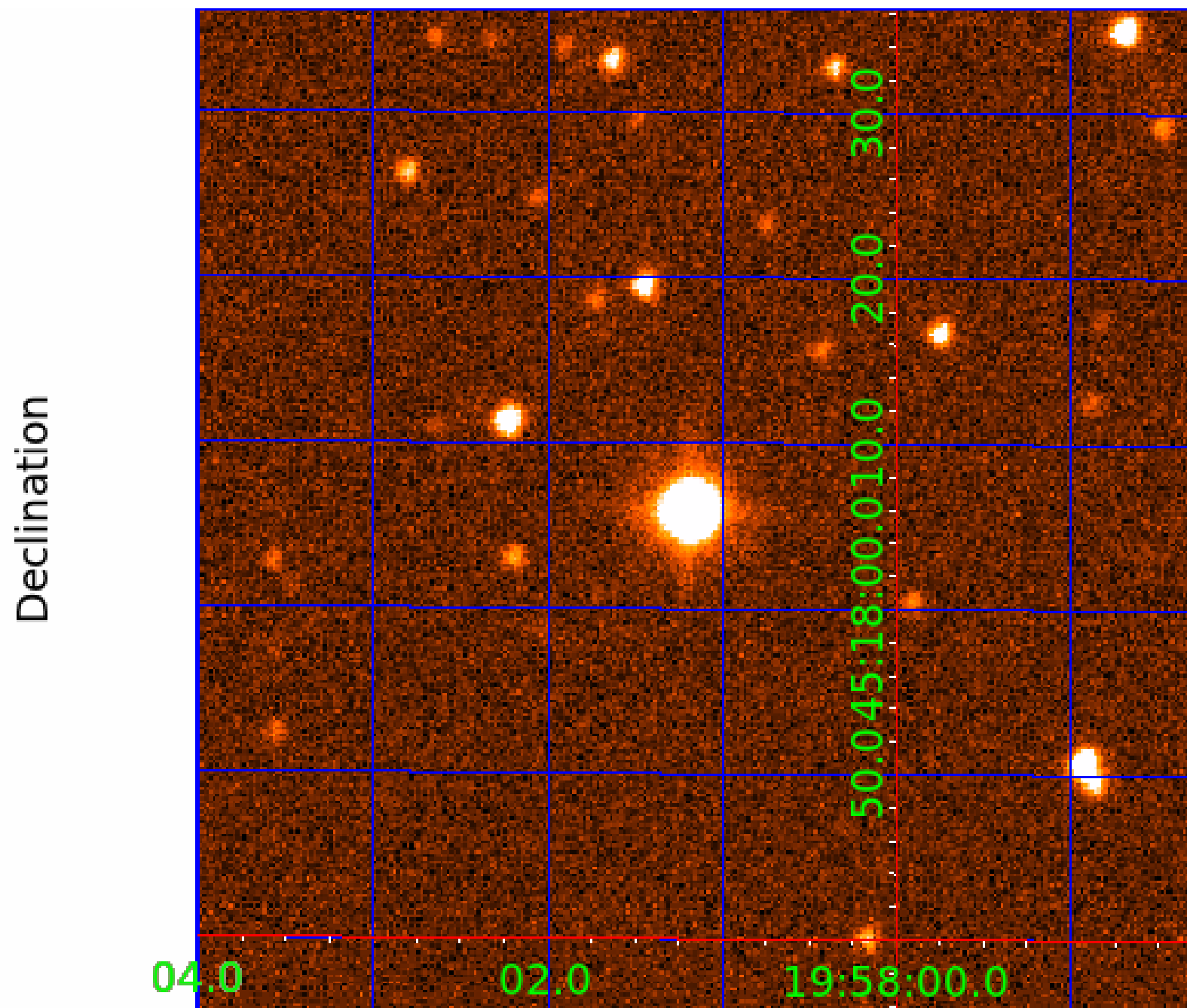
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



UKIRT Image



# KIC 009048551

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009048551-01	OBS	No	315.960993	412.736558	1108.2	3.262	15.2	8.9	0.64	4121	2.21	0.17
009048551-02	OBS	No	458.095786	295.711690	1262.4	5.021	14.1	9.4	0.64	4121	2.26	0.10
009048551-03	OBS	No	491.011724	162.990025	1163.3	16.705	13.2	6.2	0.64	4121	2.61	0.10
009048551-04	OBS	No	350.482711	239.011801	859.4	3.416	13.7	6.8	0.64	4121	1.79	0.15
009048551-05	OBS	No	408.379130	517.458281	846.0	6.355	11.3	6.3	0.64	4121	2.01	0.12
009048551-06	OBS	No	514.912717	311.009898	707.7	8.063	11.1	5.5	0.64	4121	1.73	0.09
009048551-07	OBS	No	419.473543	248.293169	161.8	16.653	13.0	1.0	0.64	4121	0.90	0.12

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009048551-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS
009048551-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_POS_DV
009048551-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL—LPP_DV—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009048551-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009048551-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009048551-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009048551-07	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_TRACKER—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—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.

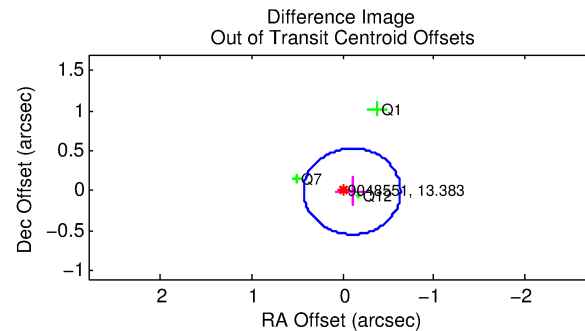
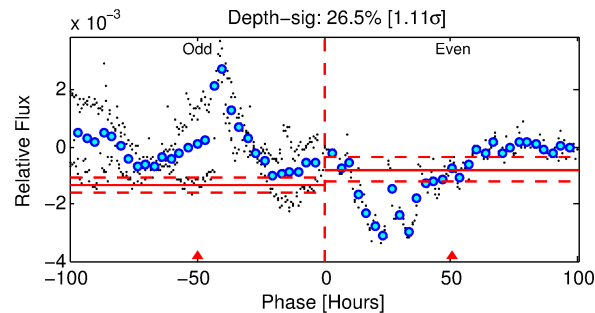
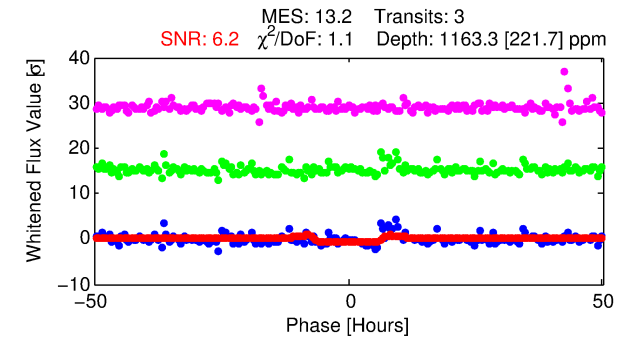
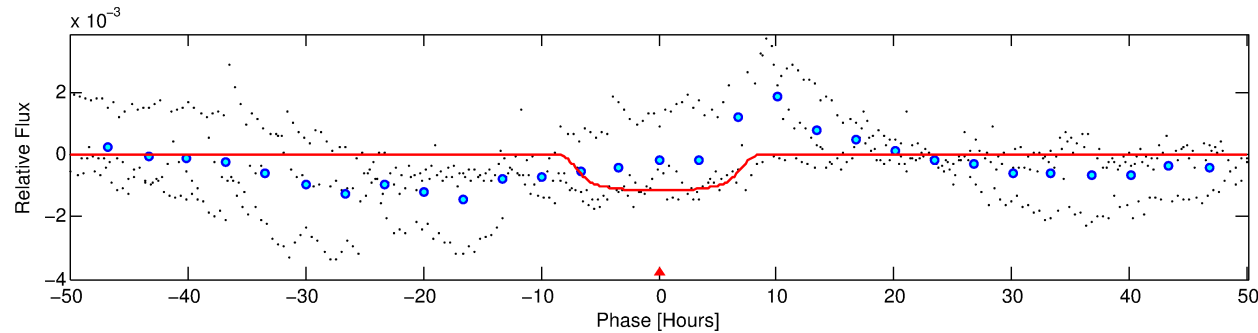
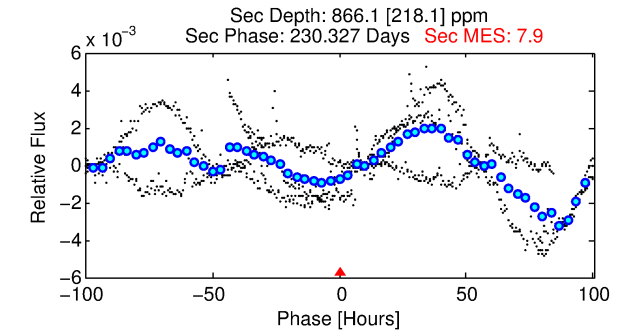
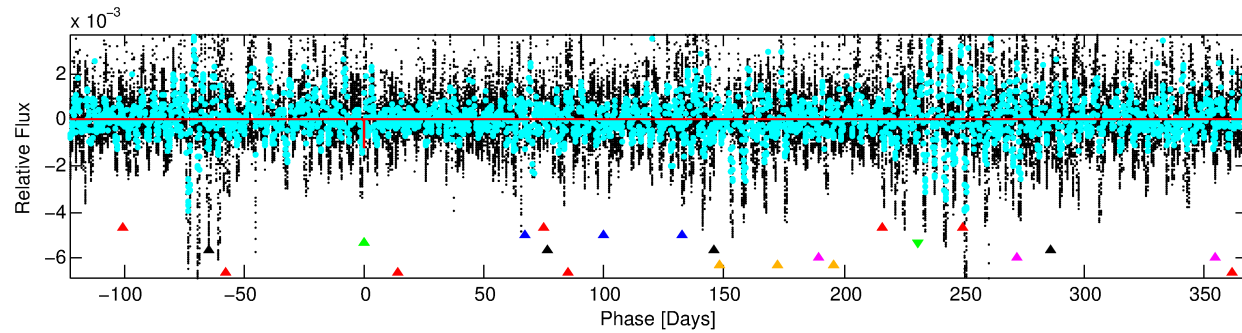
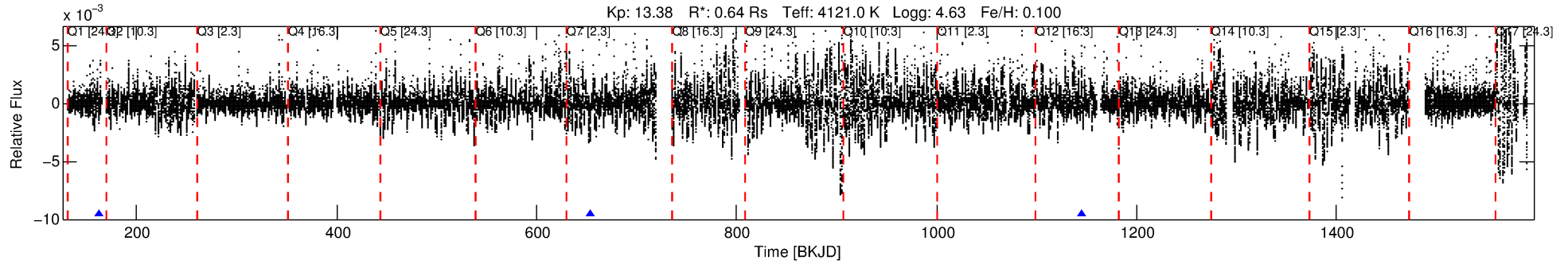
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 009048551-03

No Significant Match Found

# DV One-Page Summary

KIC: 9048551 Candidate: 3 of 7 Period: 491.012 d



## DV Fit Results:

Period = 491.01172 [0.01456] d  
Epoch = 162.9900 [0.0182] BKJD  
Rp/R\* = 0.0377 [0.0042]  
a/R\* = 121.34 [21.56]  
b = 0.89 [0.04]  
Seff = 0.10 [0.02]  
Teq = 142 [6] K  
Rp = 2.61 [0.38] Re  
a = 1.0449 [0.0747] AU  
Ag = 76187.29 [26630.70] [2.86 $\sigma$ ]  
Teffp = 3643 [329] K [10.65 $\sigma$ ]

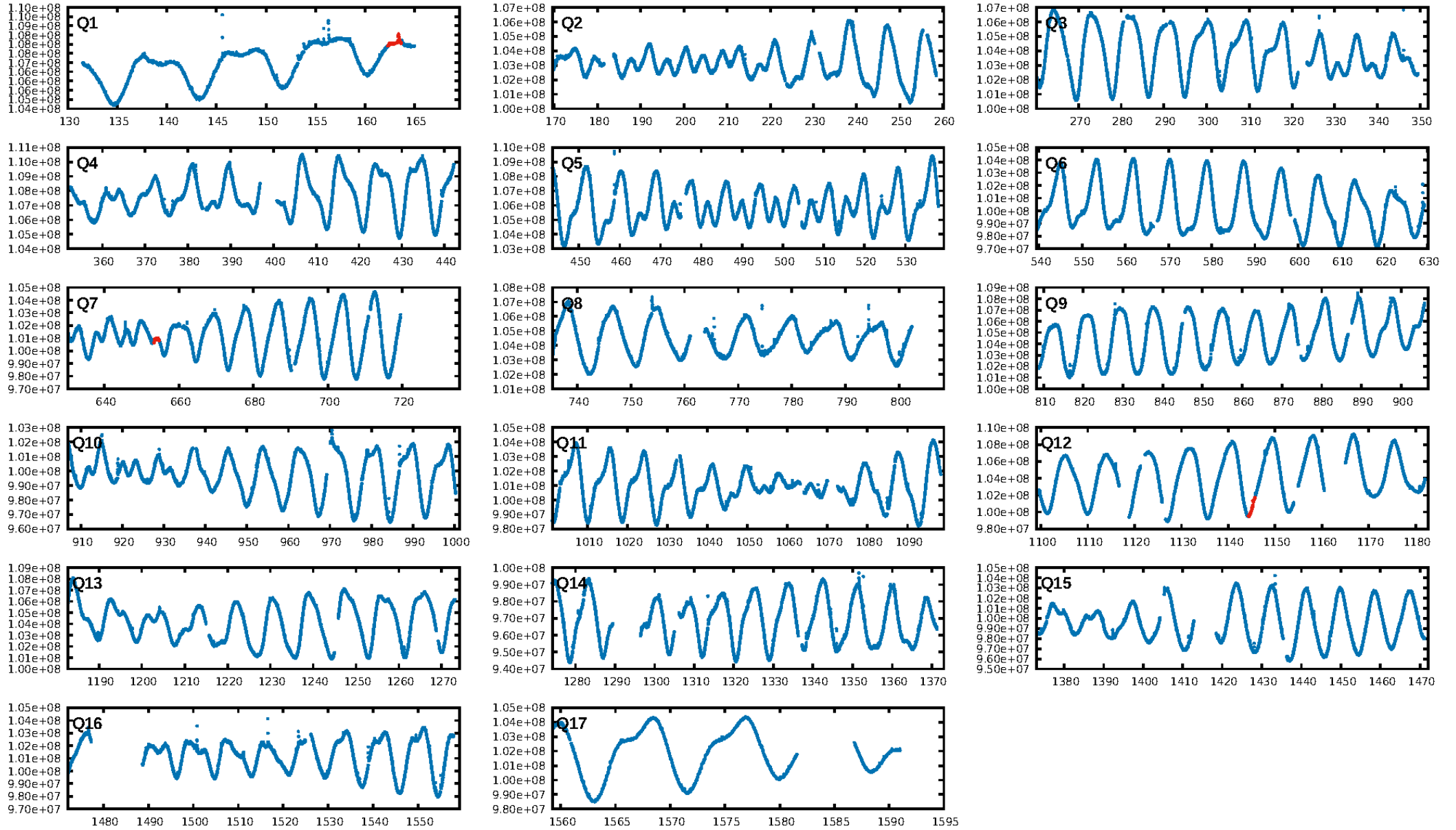
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [45.29 $\sigma$ ]  
LongPeriod-sig: 100.0% [30.93 $\sigma$ ]  
ModelChiSquare2-sig: 30.7%  
ModelChiSquareGof-sig: 99.8%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [2/2]  
GhostDiagnostic-chr: -1.195  
Centroid-sig: 43.5%  
Centroid-so: 0.843 arcsec [1.83 $\sigma$ ]  
OotOffset-rm: 0.104 arcsec [0.58 $\sigma$ ]  
OotOffset-st: 0/1/1/1 [3]  
KicOffset-rm: 0.220 arcsec [0.84 $\sigma$ ]  
KicOffset-st: 0/1/1/1 [3]  
DiffImageQuality-fgm: 0.33 [1/3]  
DiffImageOverlap-fno: 1.00 [3/3]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 13:47:53 Z

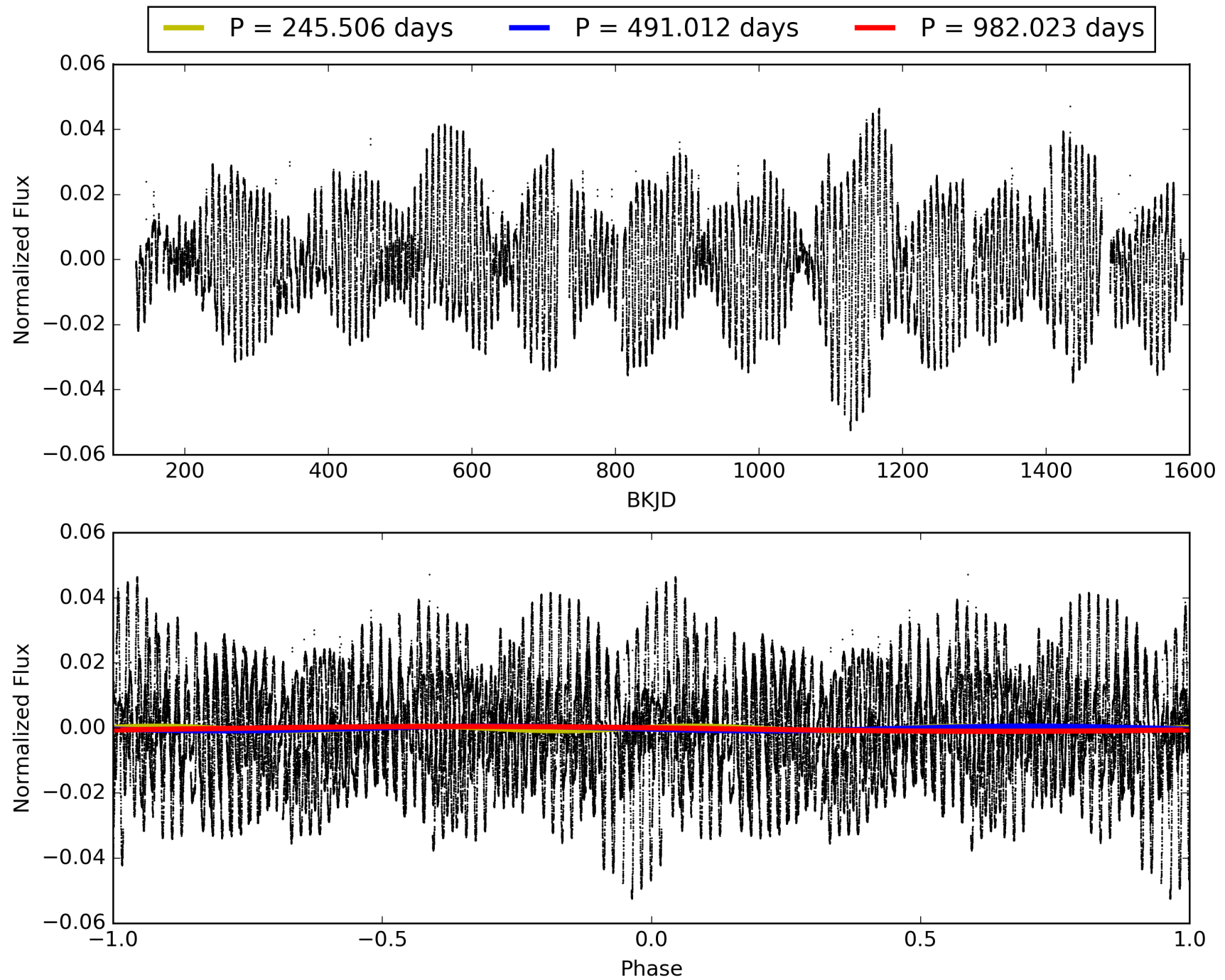
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 009048551-03, PDC Light Curves



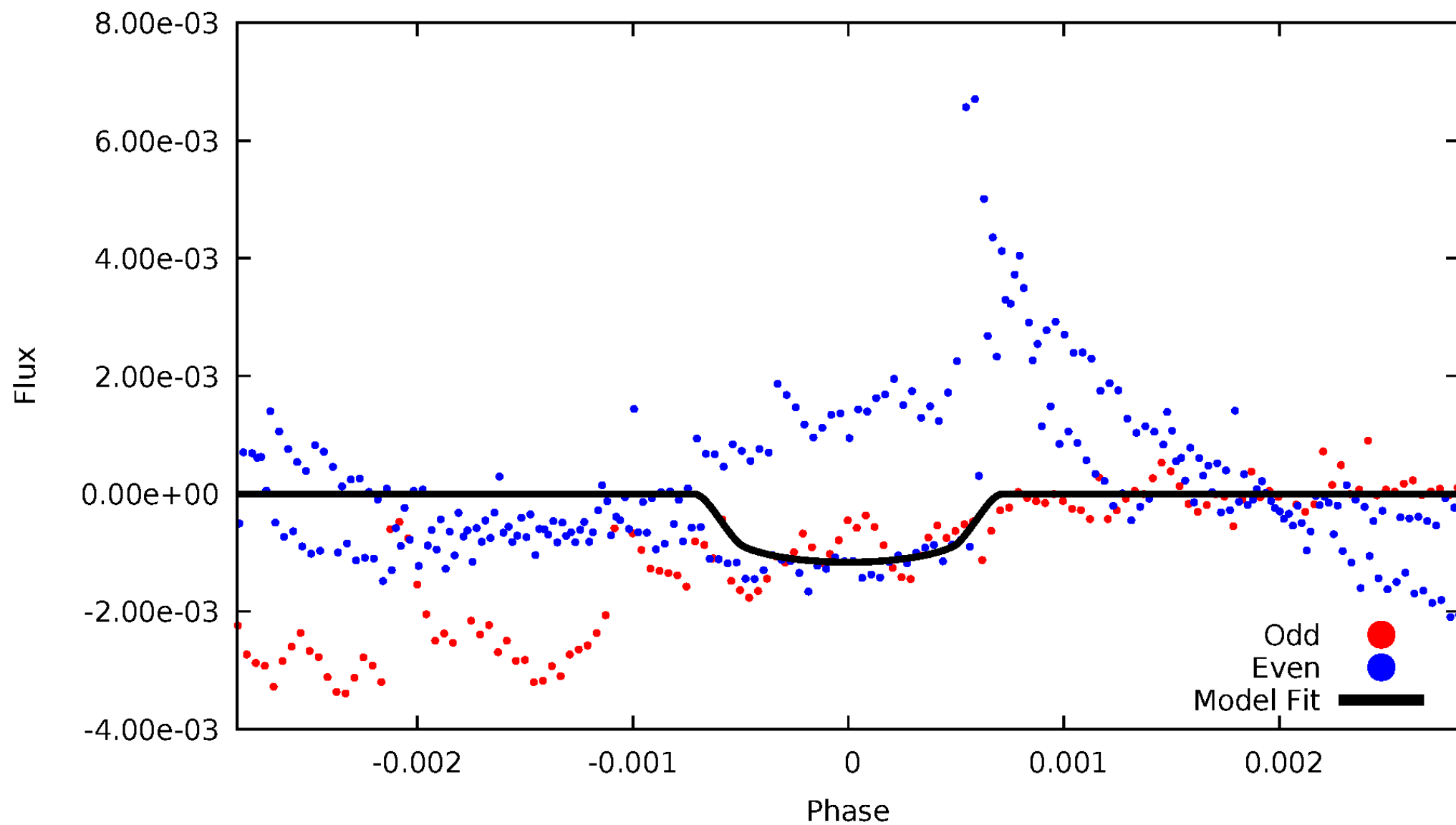


TCE 009048551-03



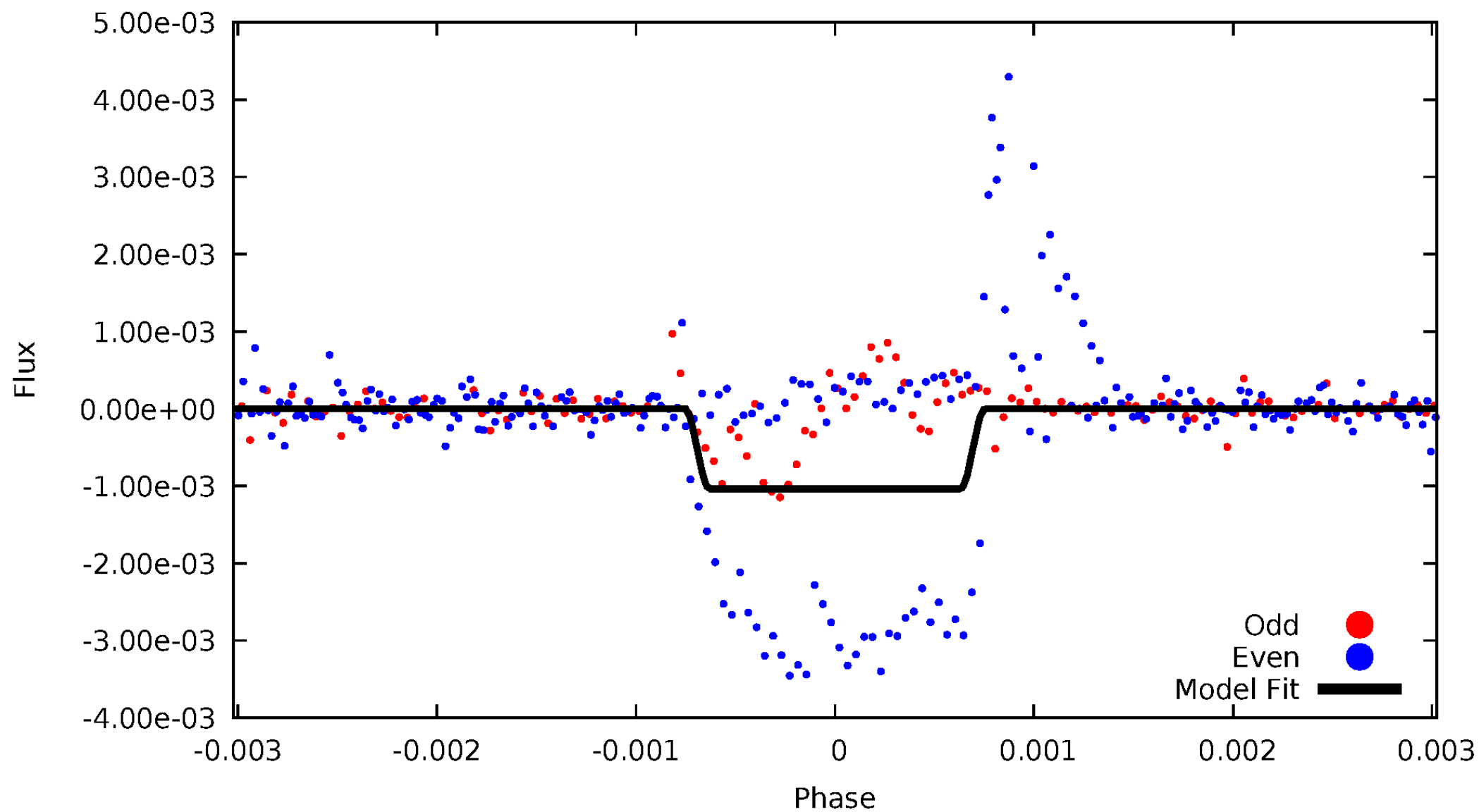
# DV Odd/Even

TCE 009048551-03



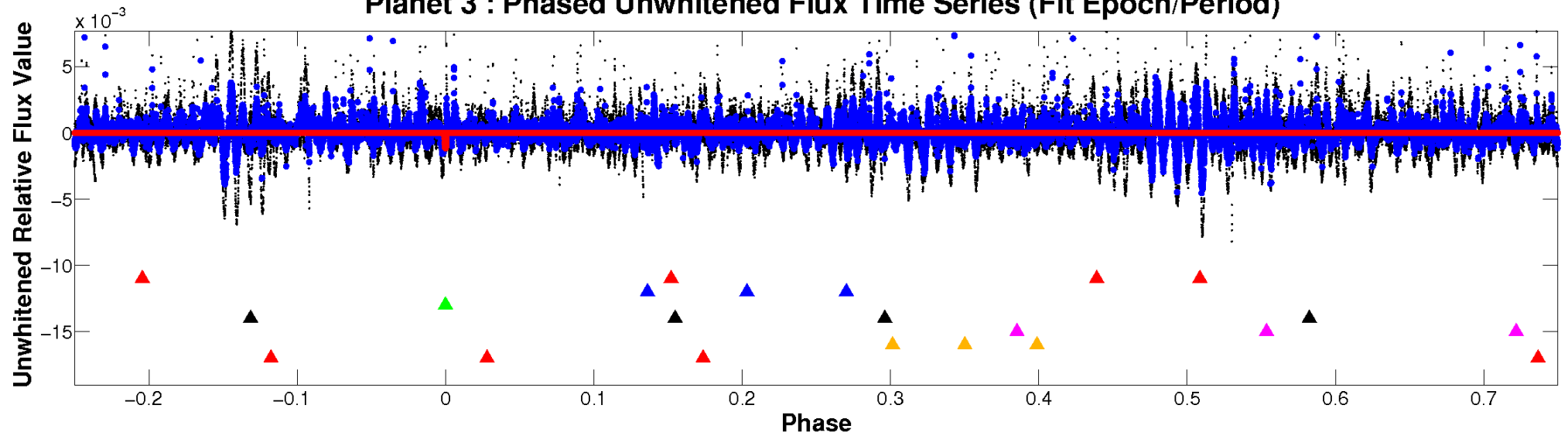
# ALT Odd/Even

TCE 009048551-03

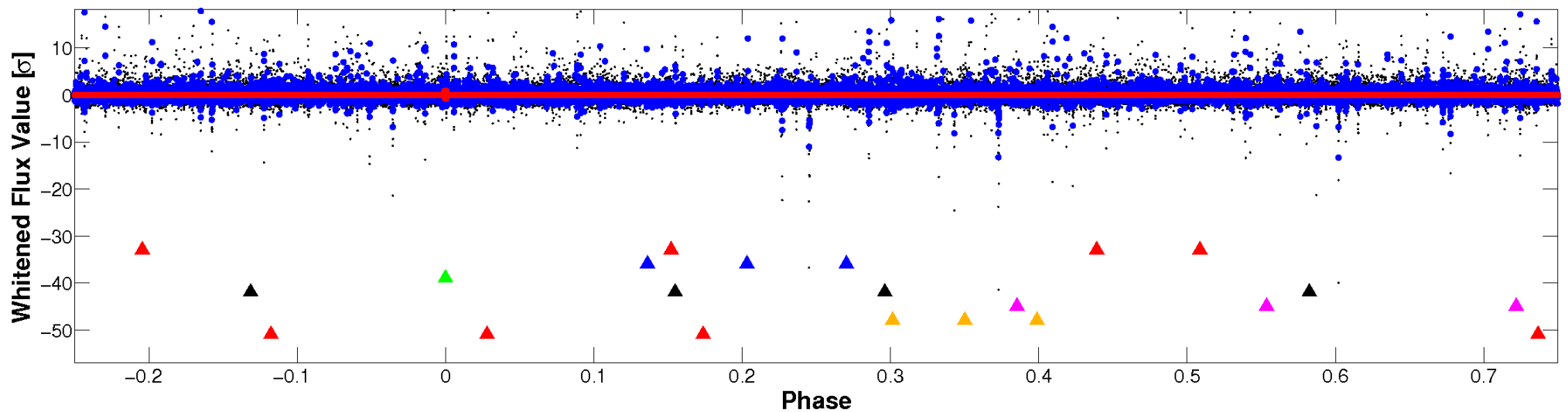


# Non-Whitened Vs. Whitened Light Curve

Planet 3 : Phased Unwhitened Flux Time Series (Fit Epoch/Period)

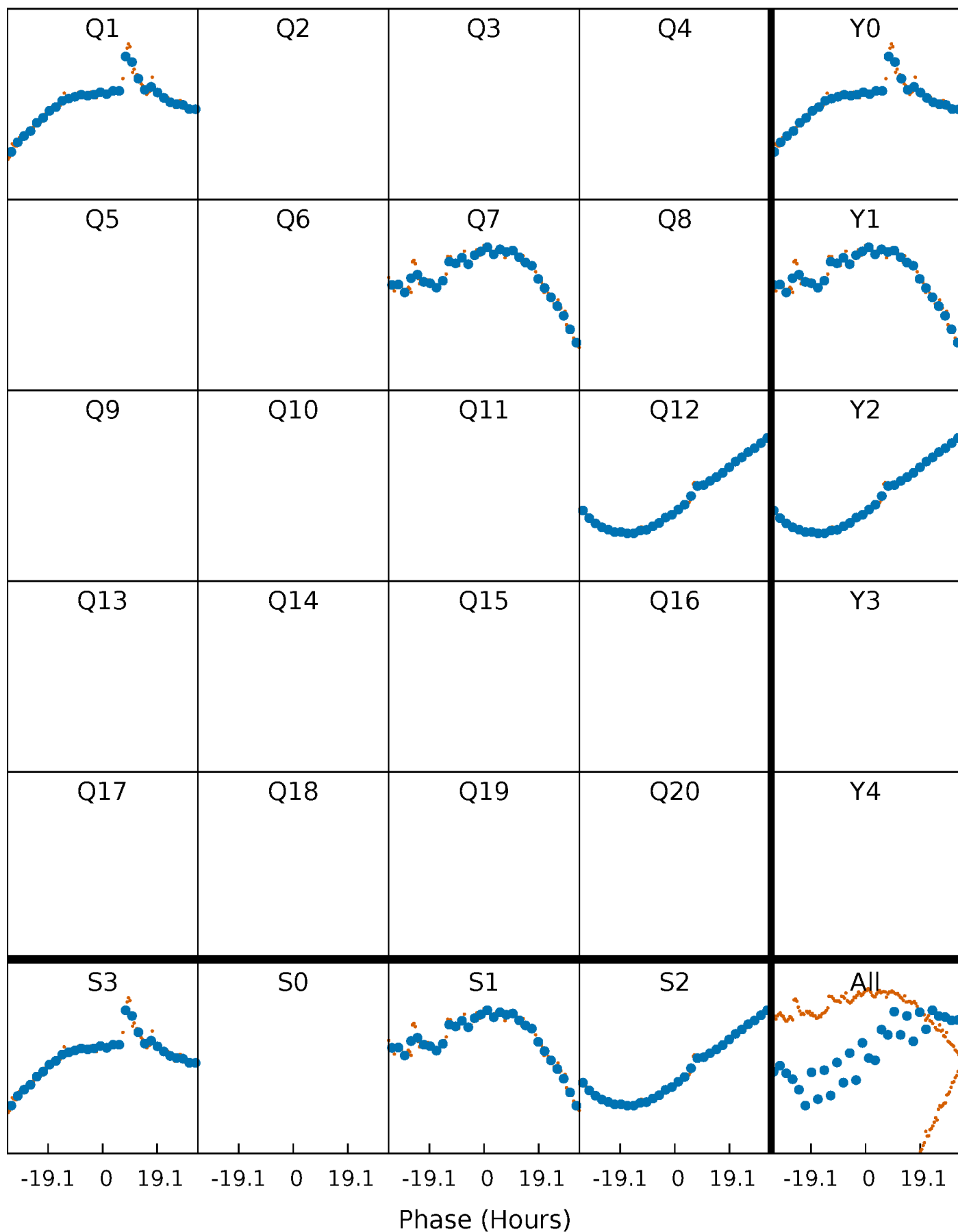


Planet 3 : Phased Whitened Flux Time Series (Fit Epoch/Period)



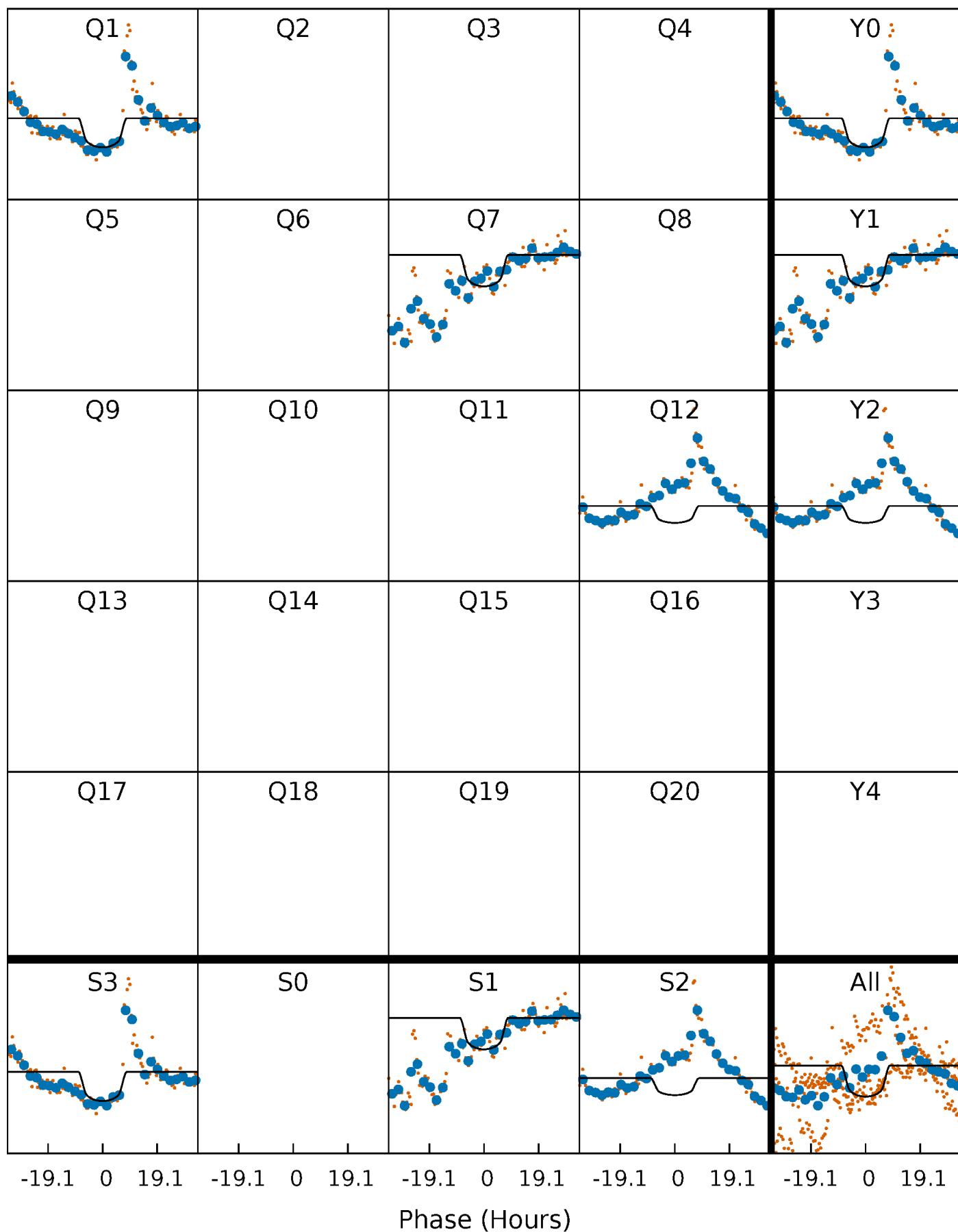
# PDC Quarter-Phased Transit Curves

TCE 009048551-03     $P=491.011724$  Days     $T_0=162.990025$  (BKJD)



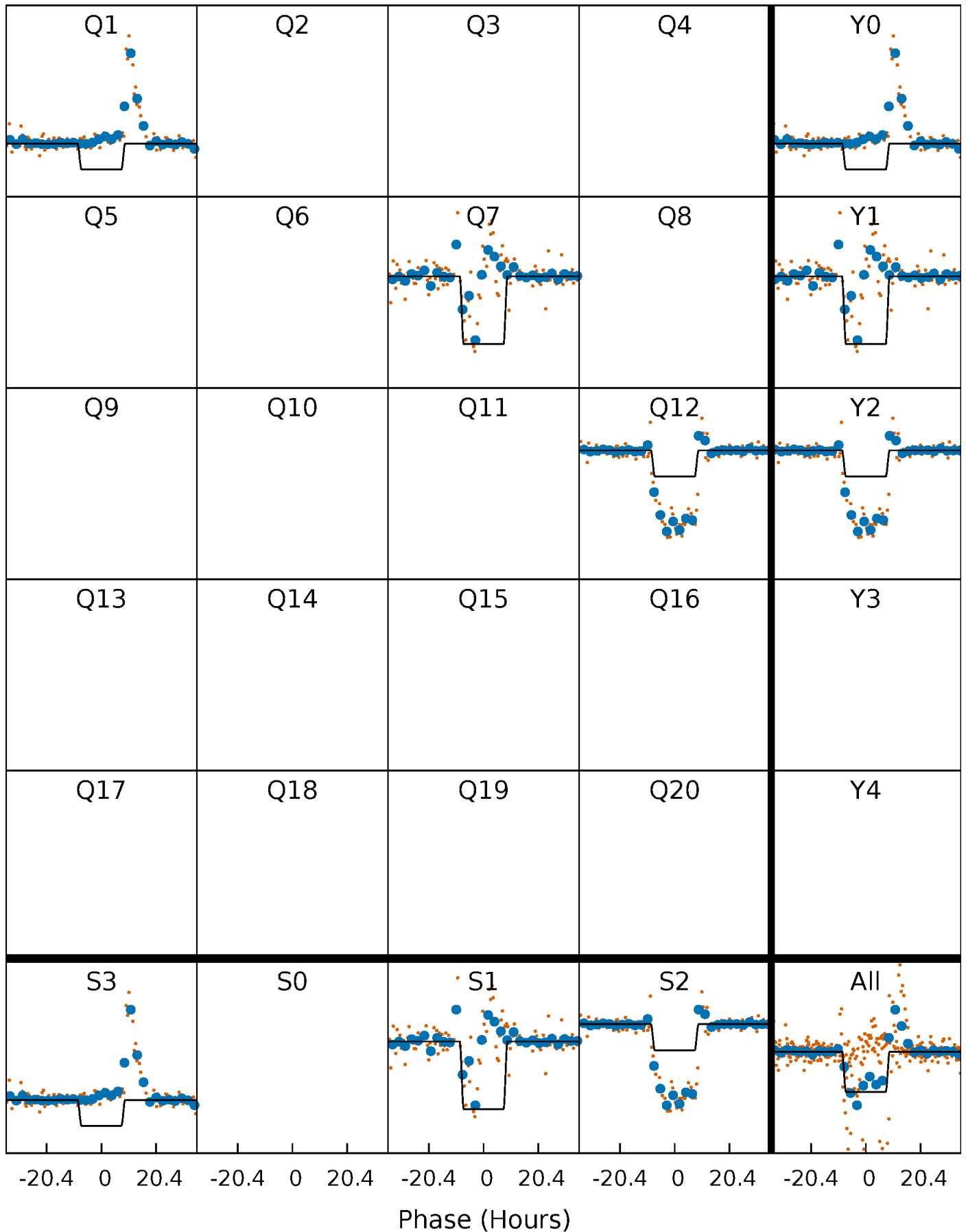
# DV Quarter-Phased Transit Curves

TCE 009048551-03 P=491.011724 Days  $T_0=162.990025$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

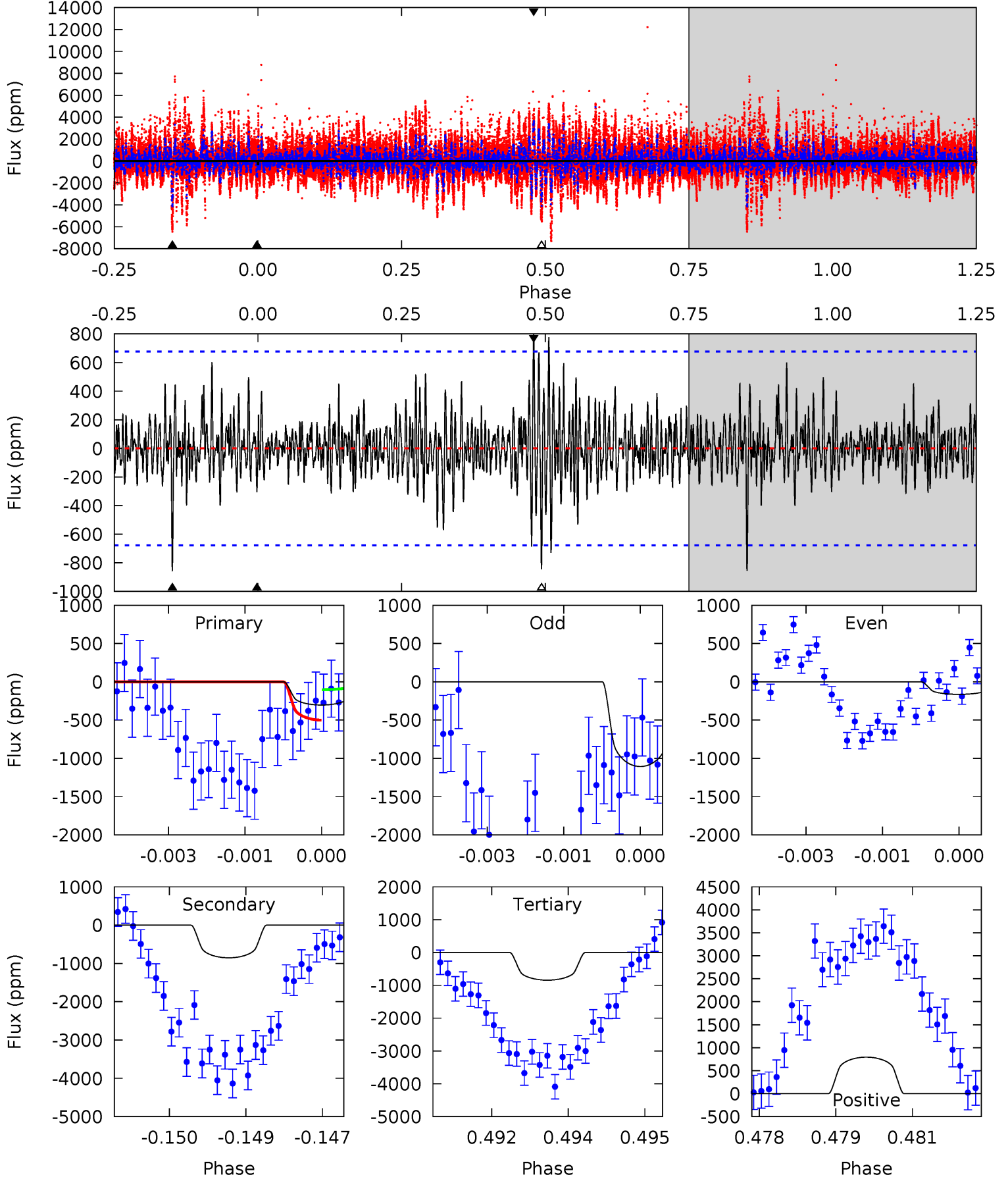
TCE 009048551-03 P=490.991202 Days  $T_0=162.920271$  (BKJD)



# DV Model-Shift Uniqueness Test

009048551-03, P = 491.011724 Days, E = 162.990025 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
2.41	6.78	6.70	6.31	5.38	3.18	1.42	-4.29	-3.90	0.08	0.47	3.17	0.18	0.48	1.60

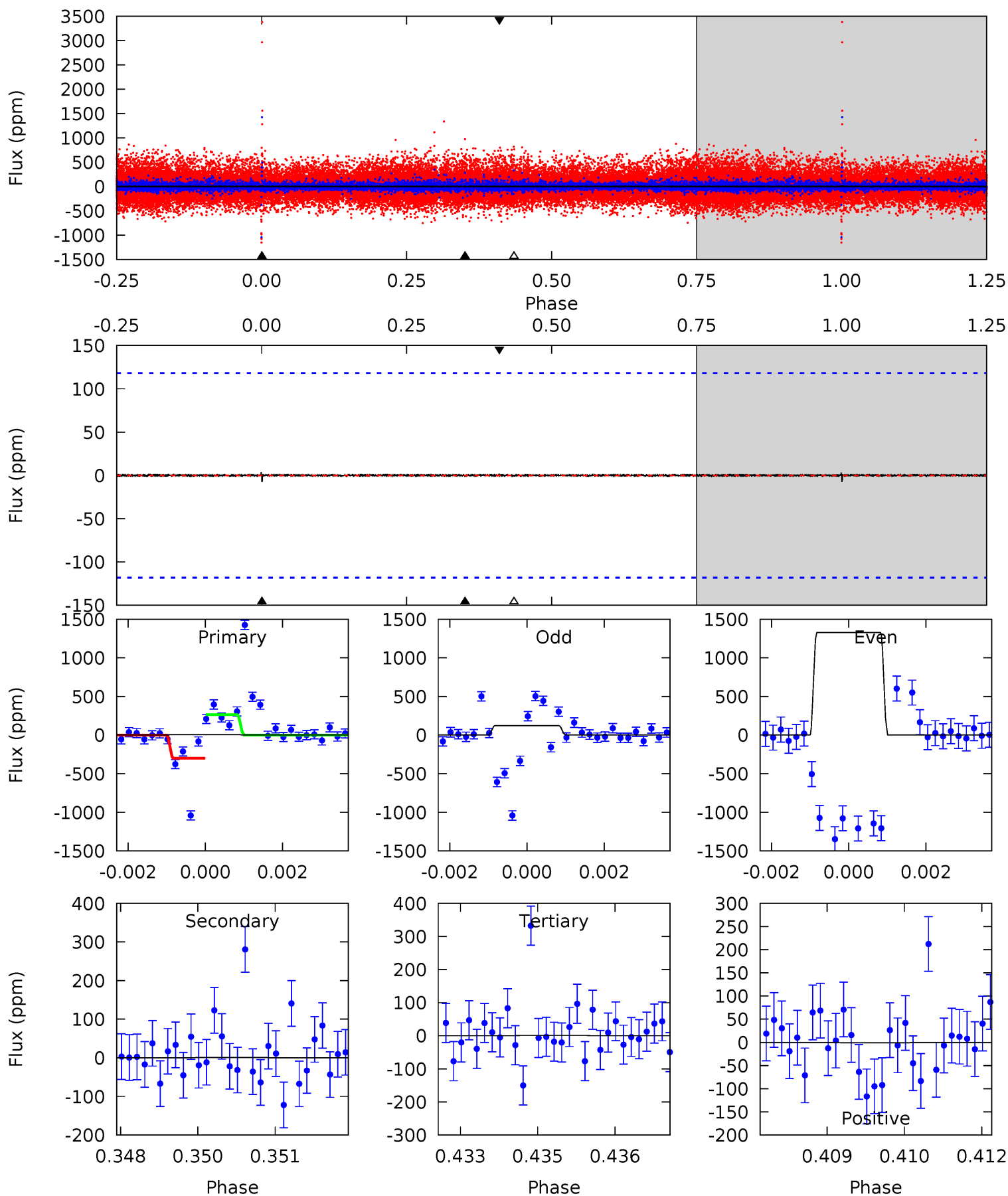




# Alt Model-Shift Uniqueness Test

009048551-03, P = 490.991202 Days, E = 162.920271 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
0.32	0.05	0.04	0.05	5.38	3.17	0.01	0.28	0.27	0.01	0.00	32.0	7.98	0.31	0.86



### Stellar Parameters For KIC 009048551

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$4121^{+123}_{-136}$	$4.631^{+0.049}_{-0.017}$	$0.100^{+0.250}_{-0.300}$	$0.636^{+0.031}_{-0.058}$	$0.631^{+0.050}_{-0.056}$	$3.455^{+0.811}_{-0.299}$
	+3%/-3%	+1%/-0%	+250%/-300%	+5%/-9%	+8%/-9%	+23%/-9%
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 009048551-03 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	$-854 \pm 126$	$2.63^{+0.31}_{-0.32}$	$196^{+7}_{-7}$	$3742^{+216}_{-189}$	$75580^{+25542}_{-17541}$
Alt.	$-1 \pm 22$	$2.20^{+0.31}_{-0.29}$	$197^{+7}_{-7}$	$1557^{+841}_{-3910}$	$39^{+3075}_{-2633}$

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

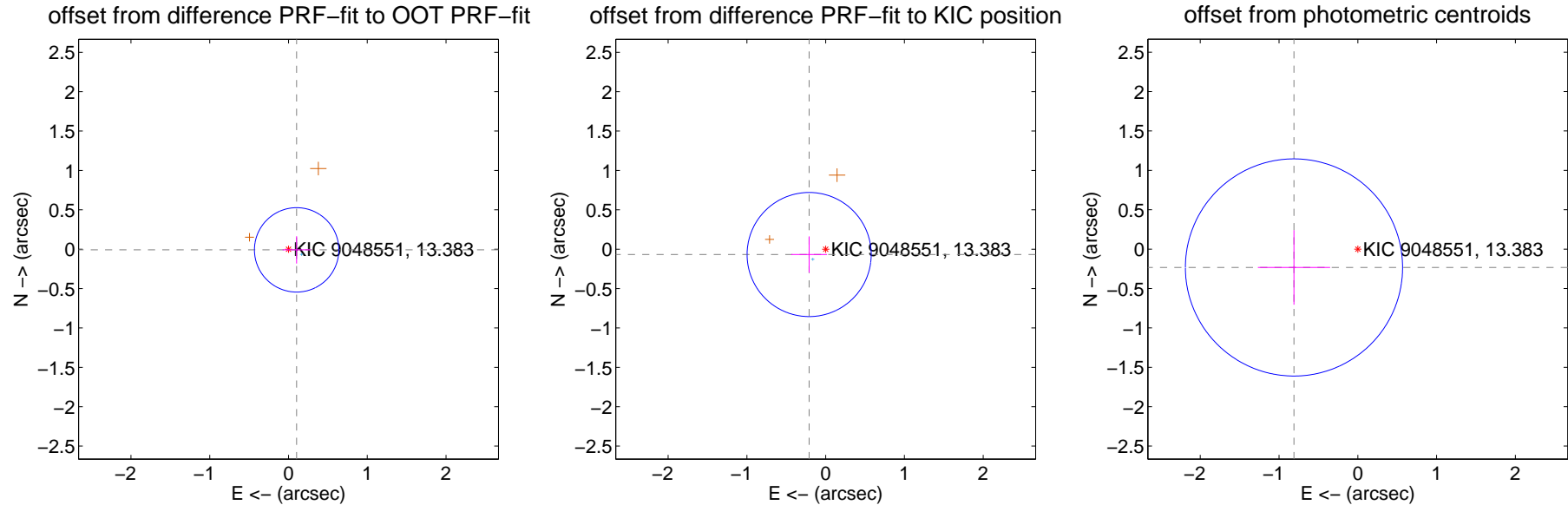
## DV Centroid Data

Supplemental centroid analysis for 009048551-03. Kepler magnitude: 13.38. Transit SNR 6.24

There are 1 quarters with good PRF difference image offsets

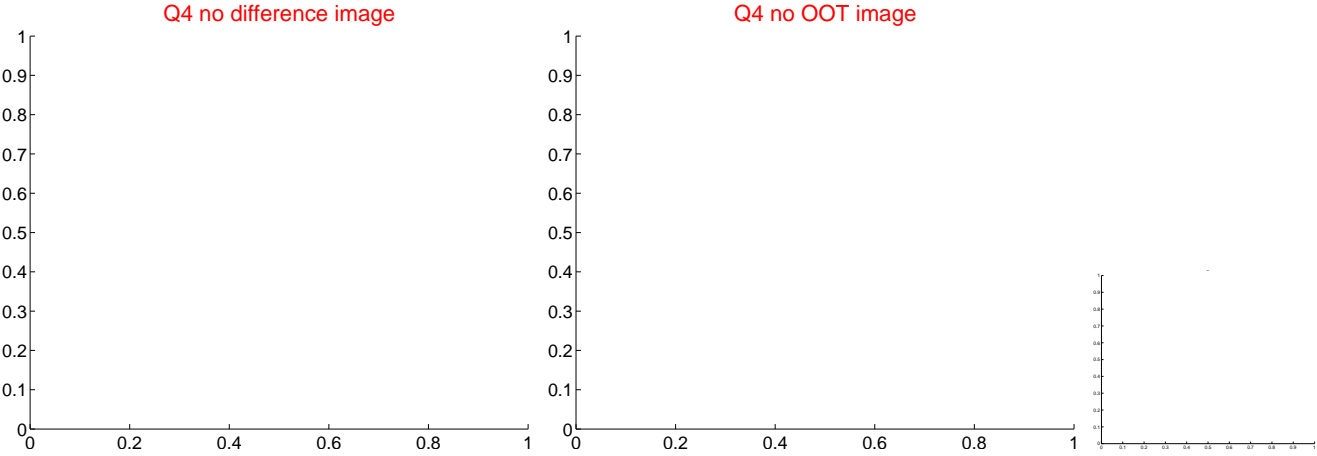
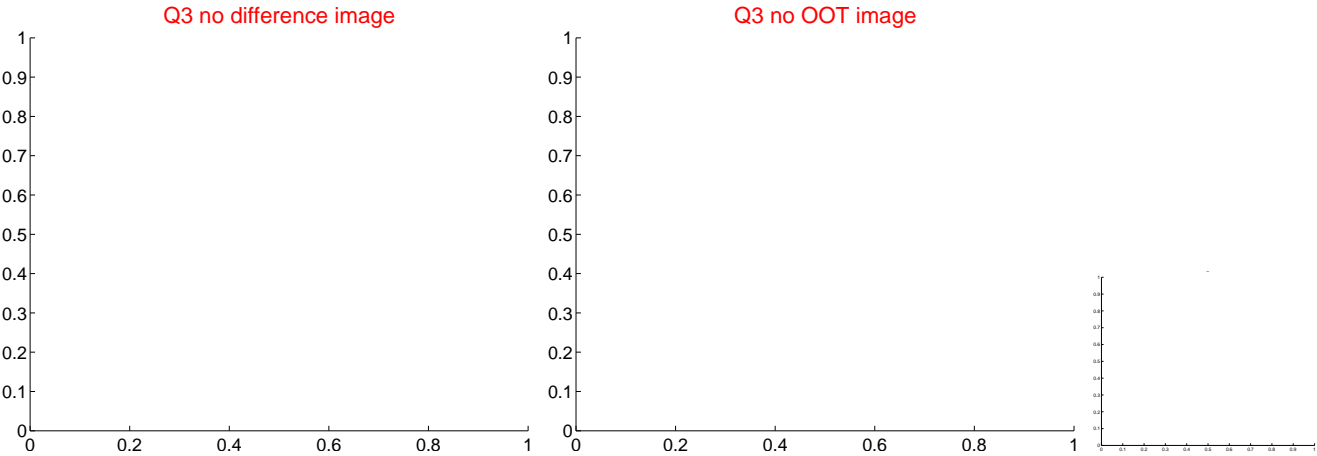
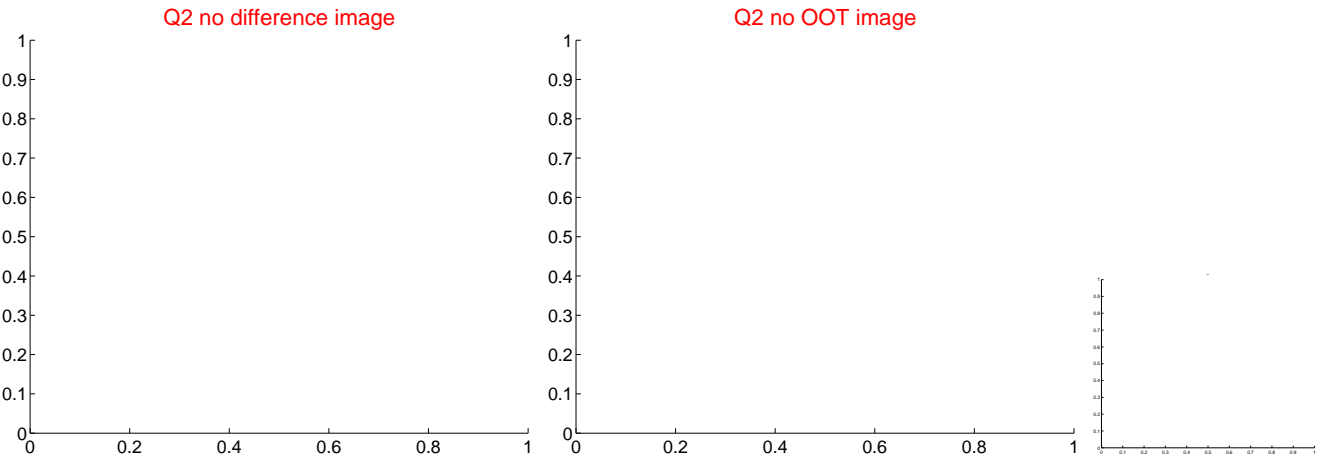
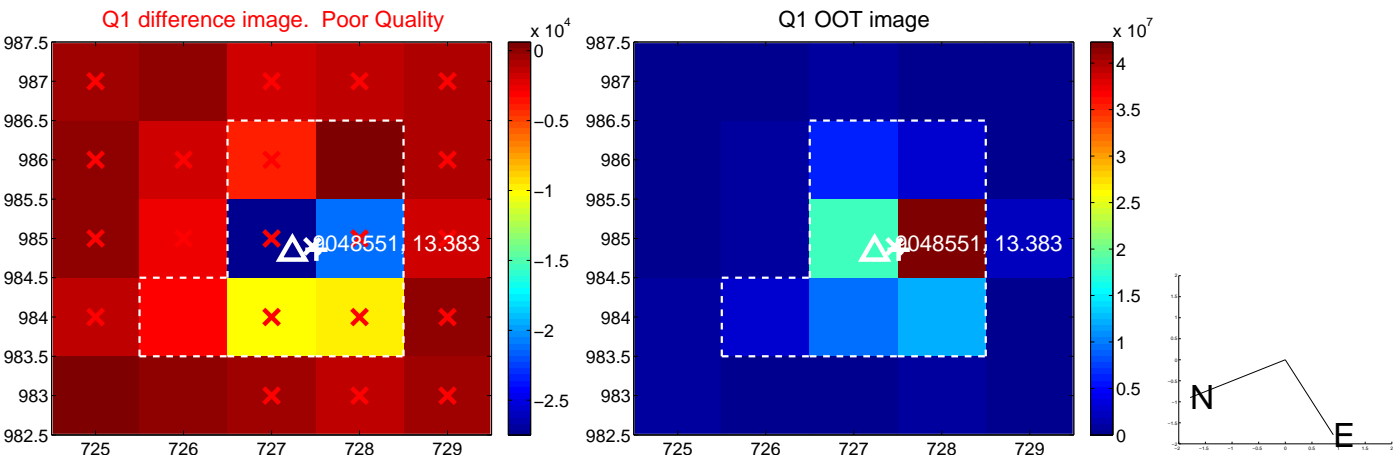
The direct PRF centroid is offset from the target star catalog position by about 0.33 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.104 \pm 0.179$	0.58	$-0.103 \pm 0.179$	$-0.009 \pm 0.174$
PRF-fit source offset from KIC position	$0.220 \pm 0.263$	0.84	$0.210 \pm 0.226$	$-0.068 \pm 0.230$
photometric centroid source offset	$0.84 \pm 0.46$	1.83	$0.81 \pm 0.46$	$-0.23 \pm 0.47$

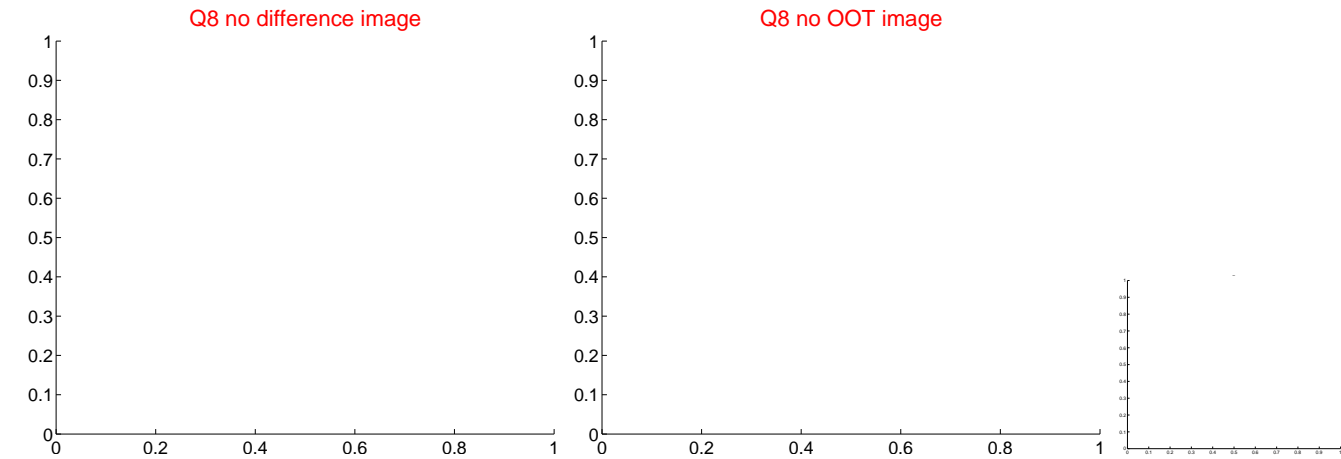
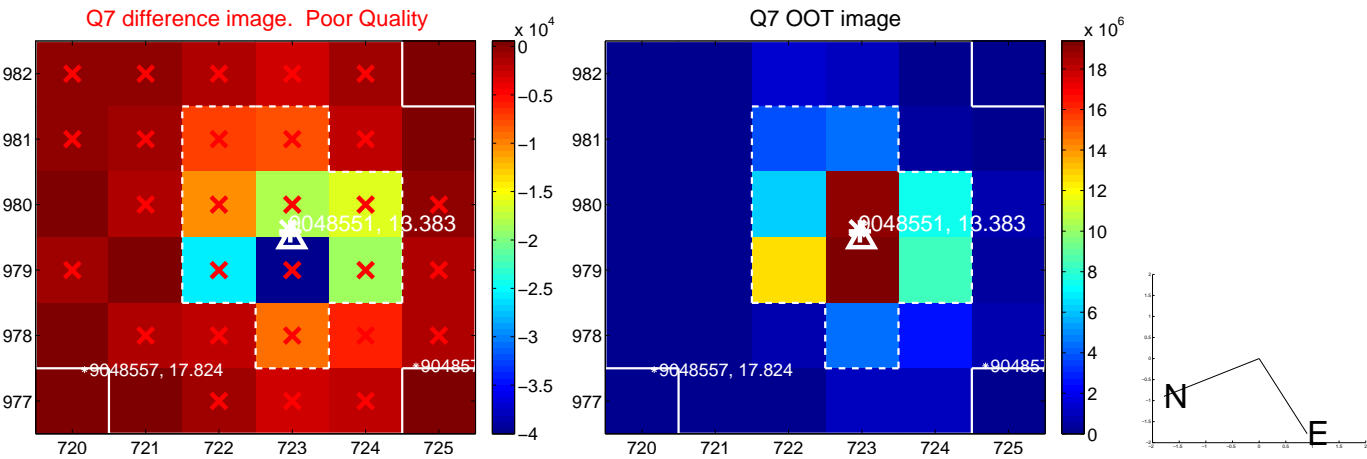
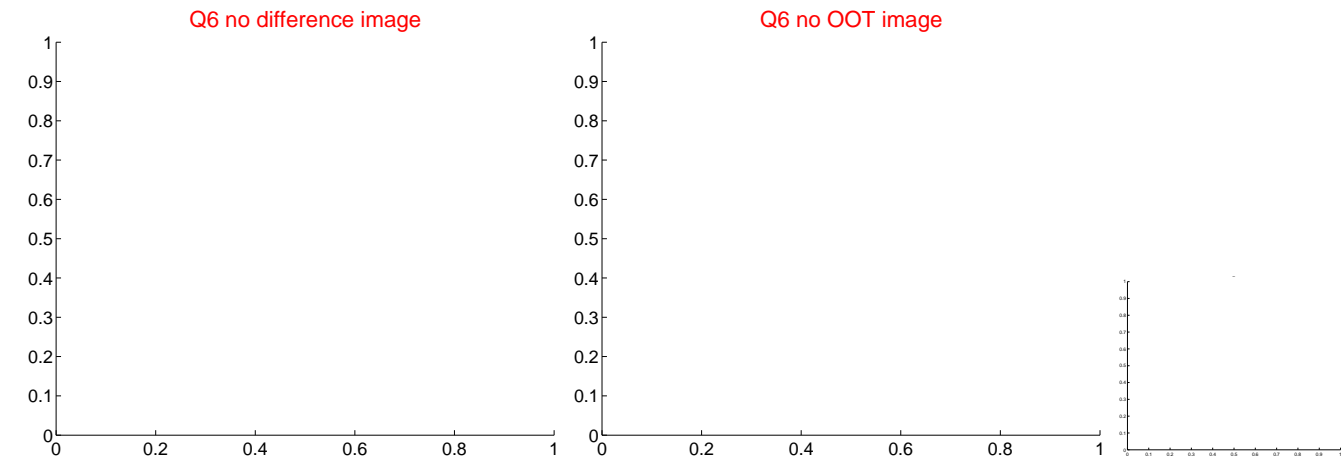


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

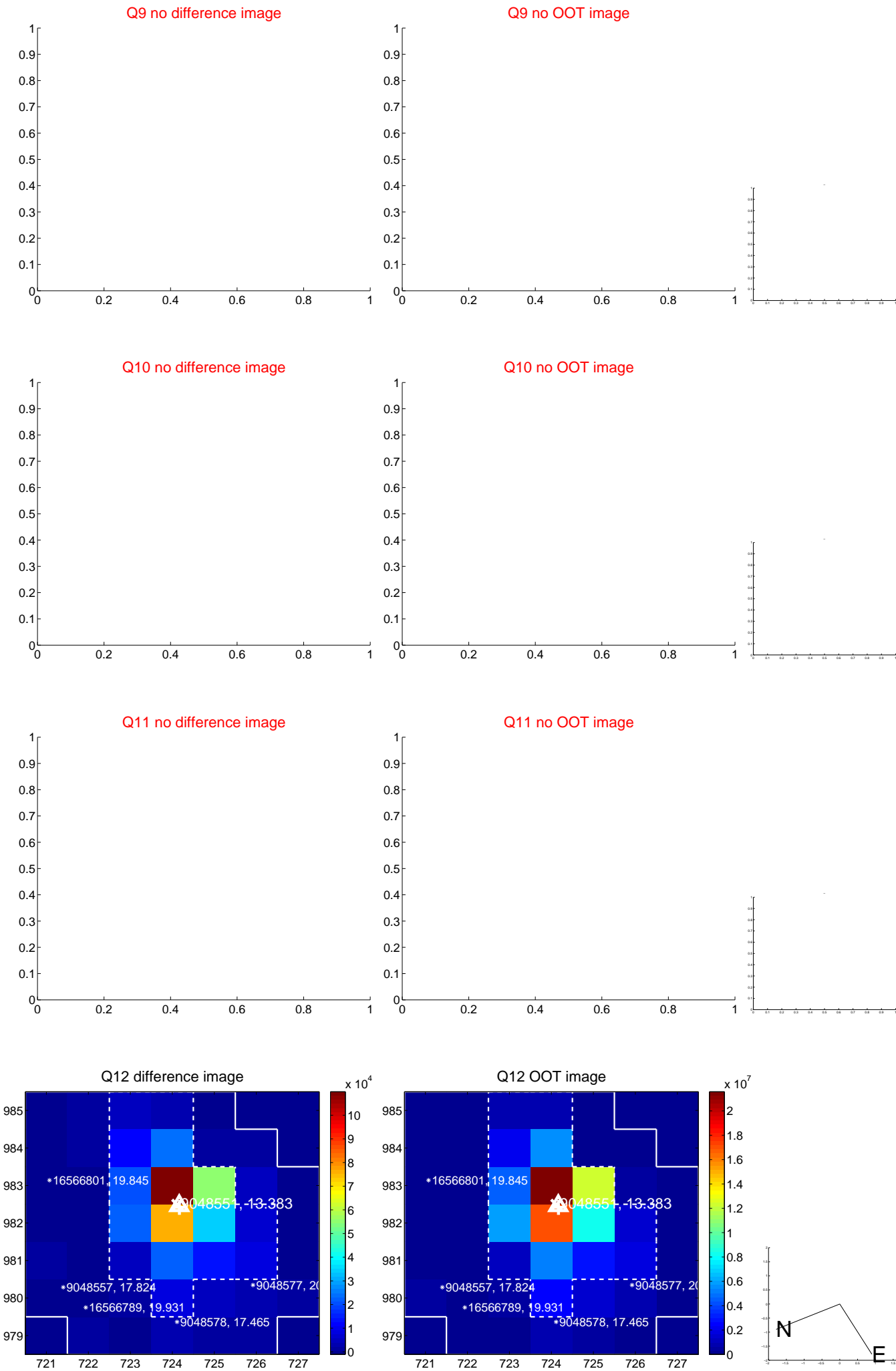
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



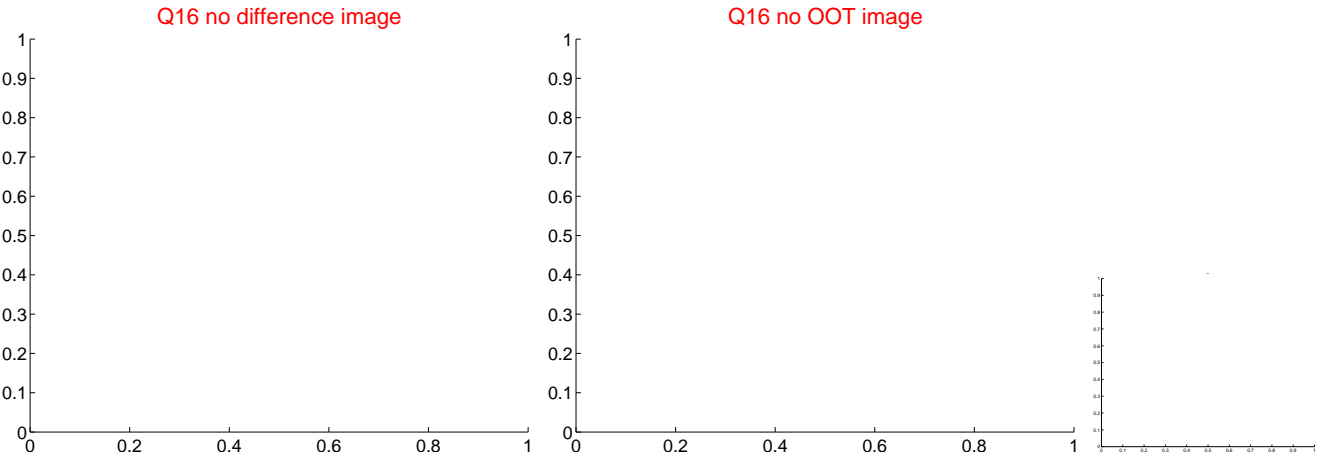
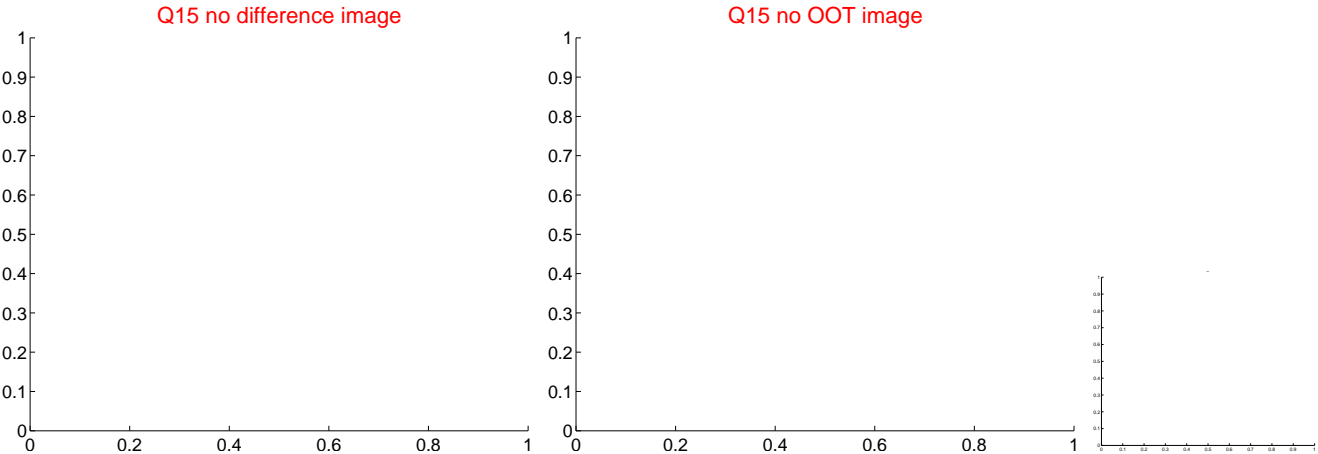
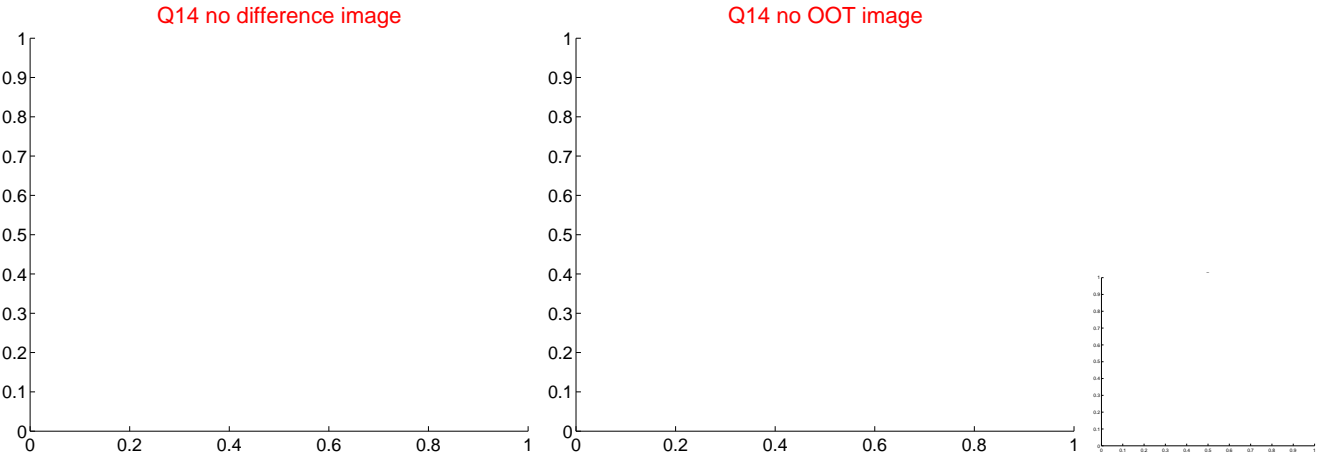
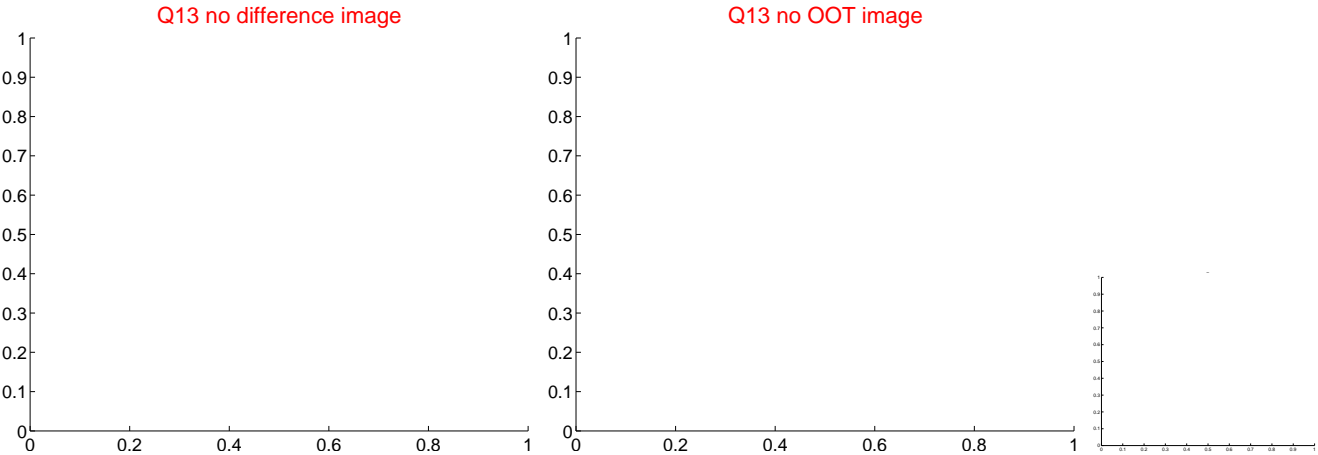
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



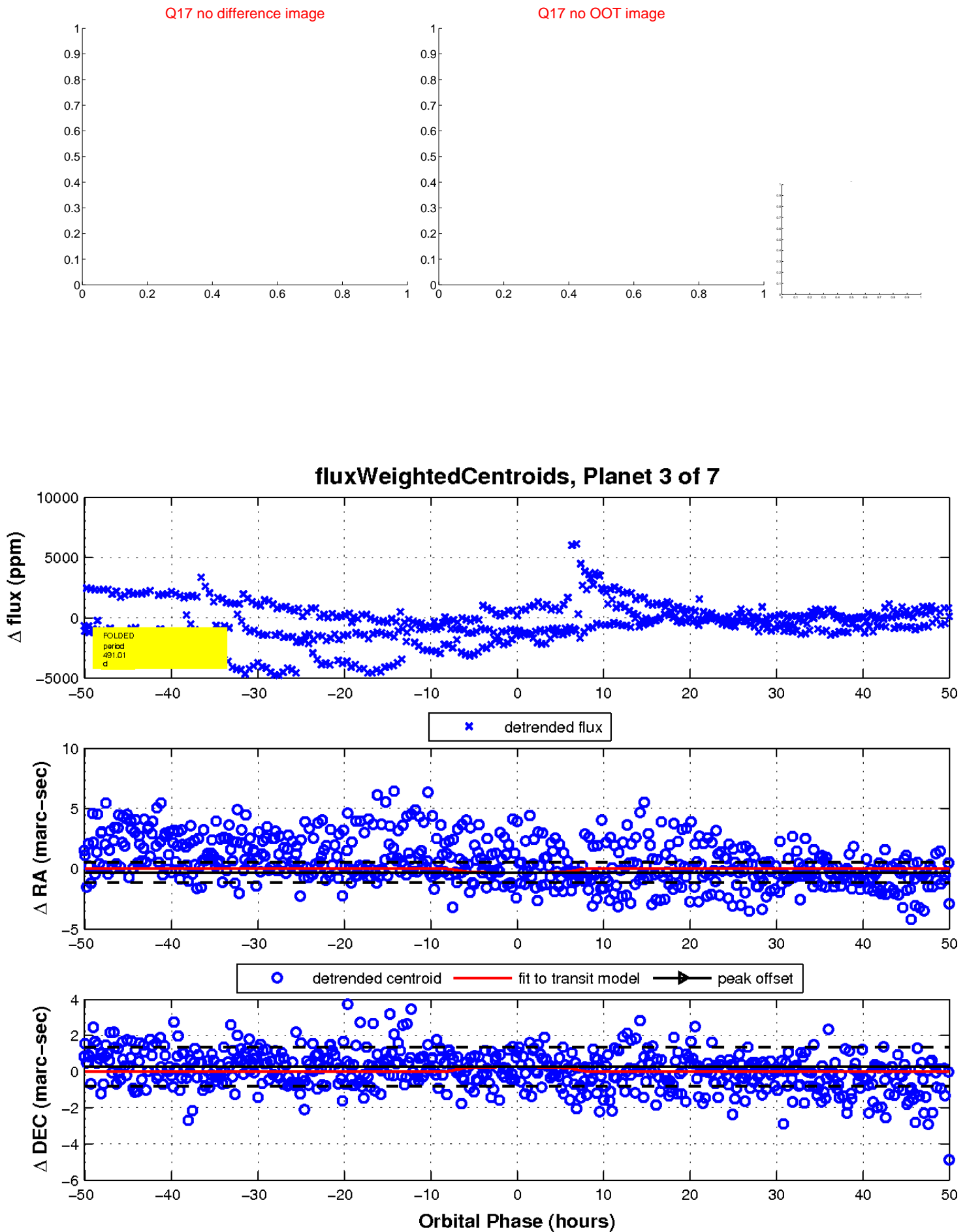
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

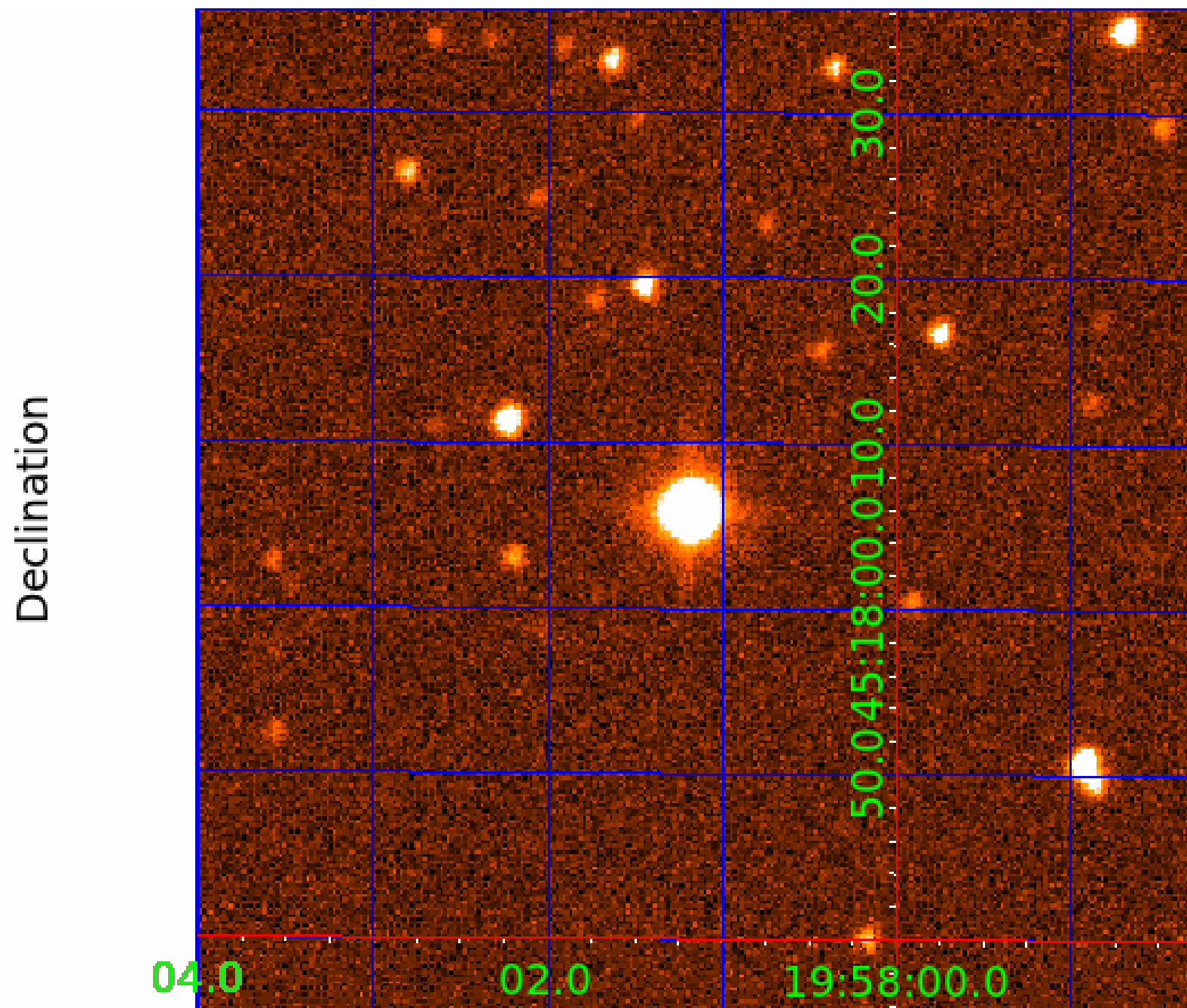


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





UKIRT Image



# KIC 009048551

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009048551-01	OBS	No	315.960993	412.736558	1108.2	3.262	15.2	8.9	0.64	4121	2.21	0.17
009048551-02	OBS	No	458.095786	295.711690	1262.4	5.021	14.1	9.4	0.64	4121	2.26	0.10
009048551-03	OBS	No	491.011724	162.990025	1163.3	16.705	13.2	6.2	0.64	4121	2.61	0.10
009048551-04	OBS	No	350.482711	239.011801	859.4	3.416	13.7	6.8	0.64	4121	1.79	0.15
009048551-05	OBS	No	408.379130	517.458281	846.0	6.355	11.3	6.3	0.64	4121	2.01	0.12
009048551-06	OBS	No	514.912717	311.009898	707.7	8.063	11.1	5.5	0.64	4121	1.73	0.09
009048551-07	OBS	No	419.473543	248.293169	161.8	16.653	13.0	1.0	0.64	4121	0.90	0.12

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009048551-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS
009048551-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_POS_DV
009048551-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL—LPP_DV—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009048551-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009048551-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009048551-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009048551-07	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_TRACKER—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—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.

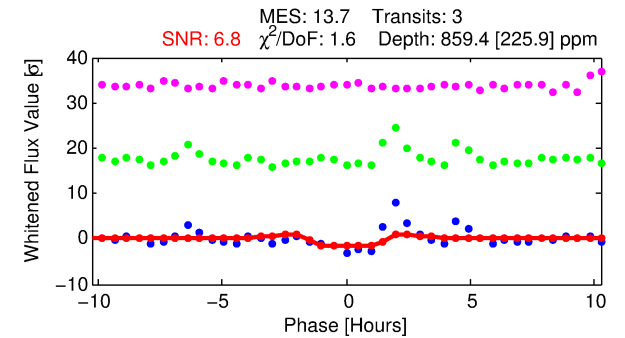
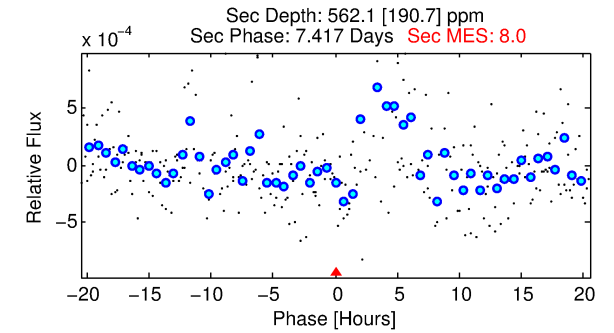
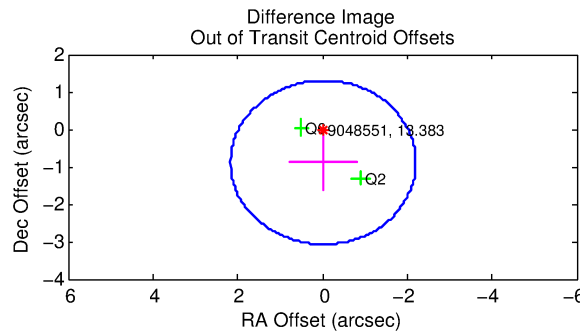
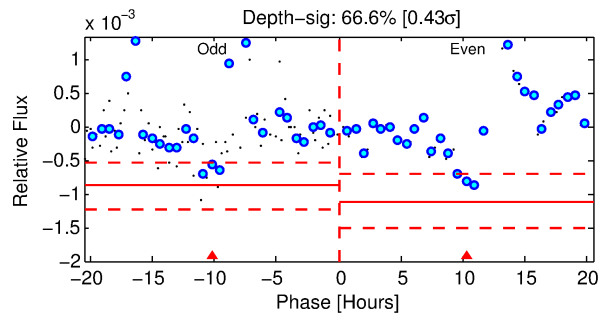
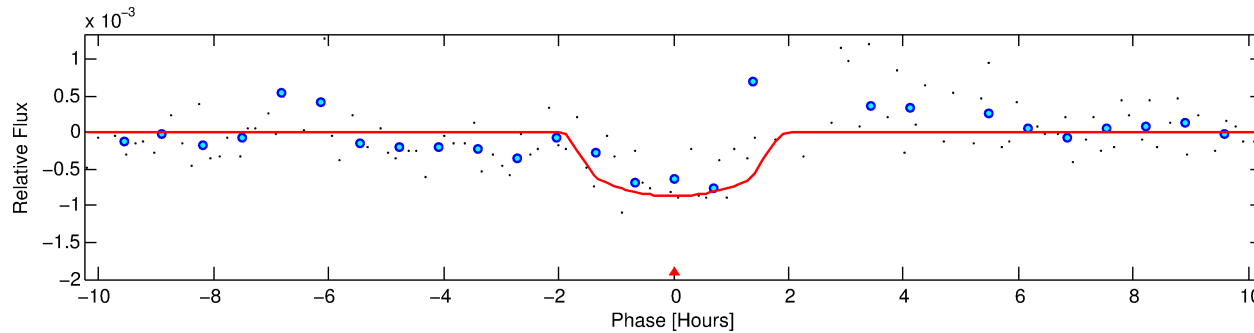
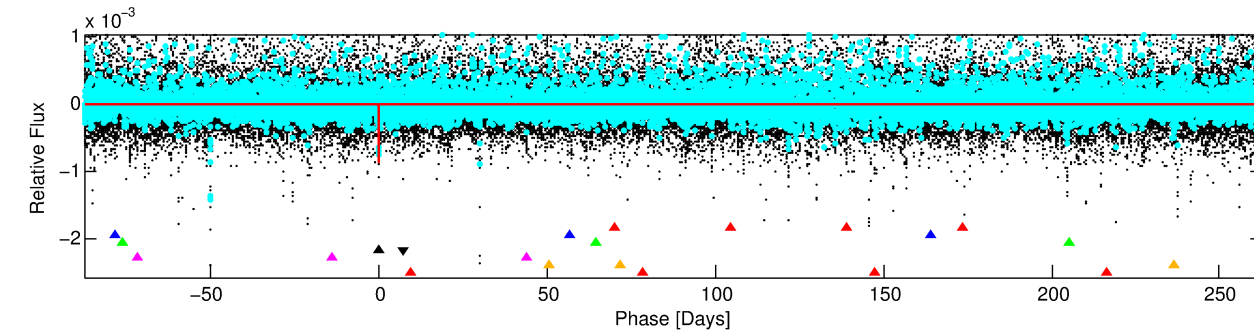
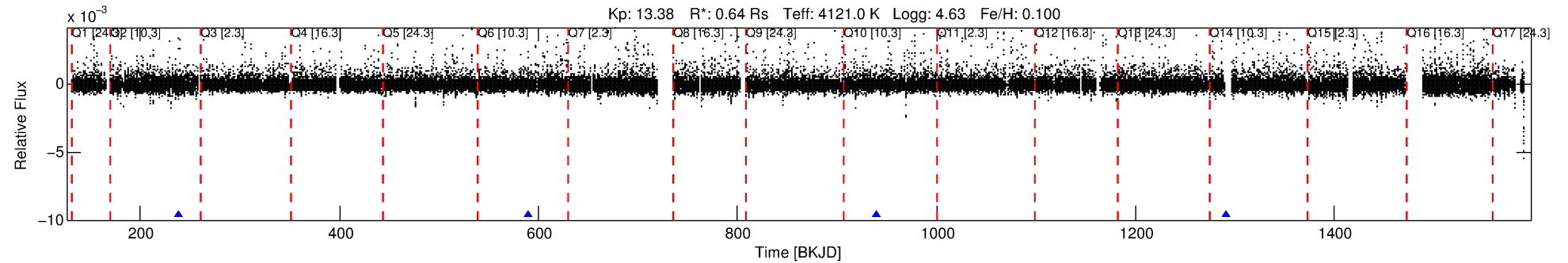
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 009048551-04

No Significant Match Found

# DV One-Page Summary

KIC: 9048551 Candidate: 4 of 7 Period: 350.483 d



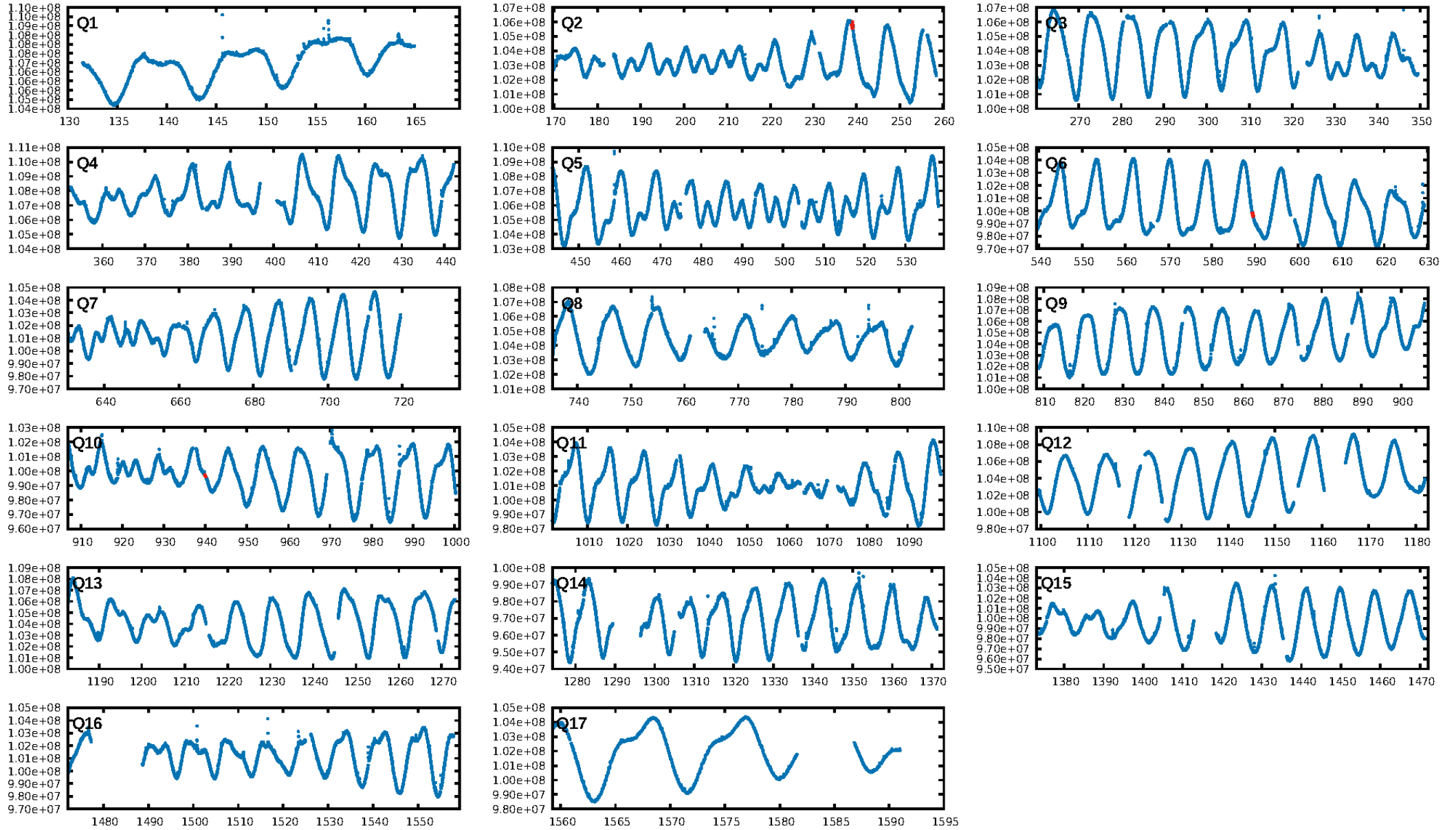
## DV Fit Results:

Period = 350.48271 [0.00687] d  
Epoch = 239.0118 [0.0096] BKJD  
Rp/R\* = 0.0258 [0.0510]  
a/R\* = 804.09 [4912.65]  
b = 0.01 [619.53]  
Seff = 0.15 [0.02]  
Teq = 159 [6] K  
Rp = 1.79 [3.55] Re  
a = 0.8345 [0.0597] AU  
Ag = 67088.73 [266303.07] [0.25 $\sigma$ ]  
Teffp = 3949 [3920] K [0.97 $\sigma$ ]

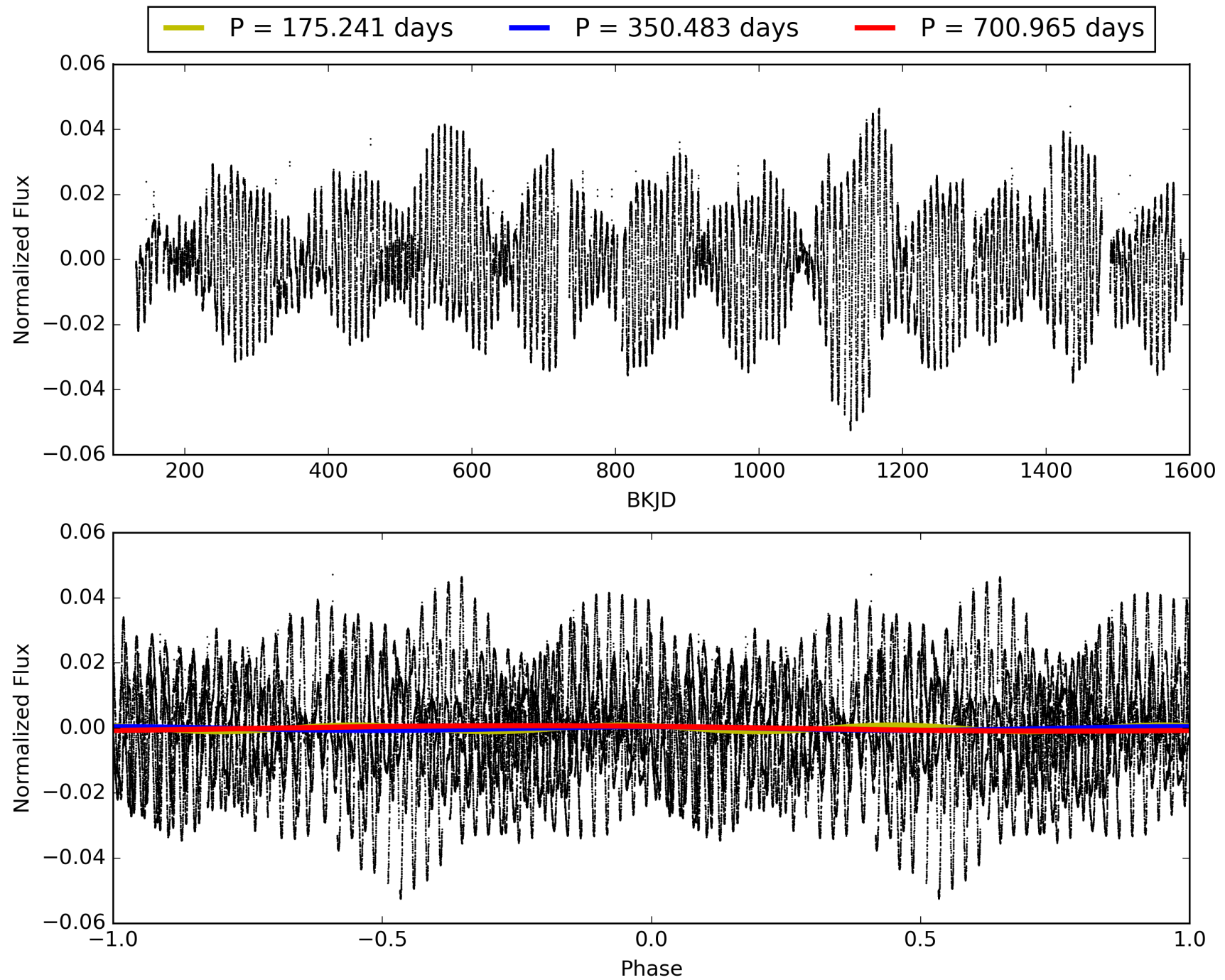
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [175.42 $\sigma$ ]  
LongPeriod-sig: 100.0% [192.58 $\sigma$ ]  
**ModelChiSquare2-sig: 0.1%**  
ModelChiSquareGof-sig: 44.2%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: -7.404  
Centroid-sig: 6.3%  
Centroid-so: 1.716 arcsec [1.68 $\sigma$ ]  
OotOffset-rm: 0.888 arcsec [1.22 $\sigma$ ]  
OotOffset-st: 2/0/0/0 [2]  
KicOffset-rm: 0.812 arcsec [1.08 $\sigma$ ]  
KicOffset-st: 2/0/0/0 [2]  
DiffImageQuality-fgm: 1.00 [2/2]  
DiffImageOverlap-fno: 1.00 [3/3]

# TCE 009048551-04, PDC Light Curves

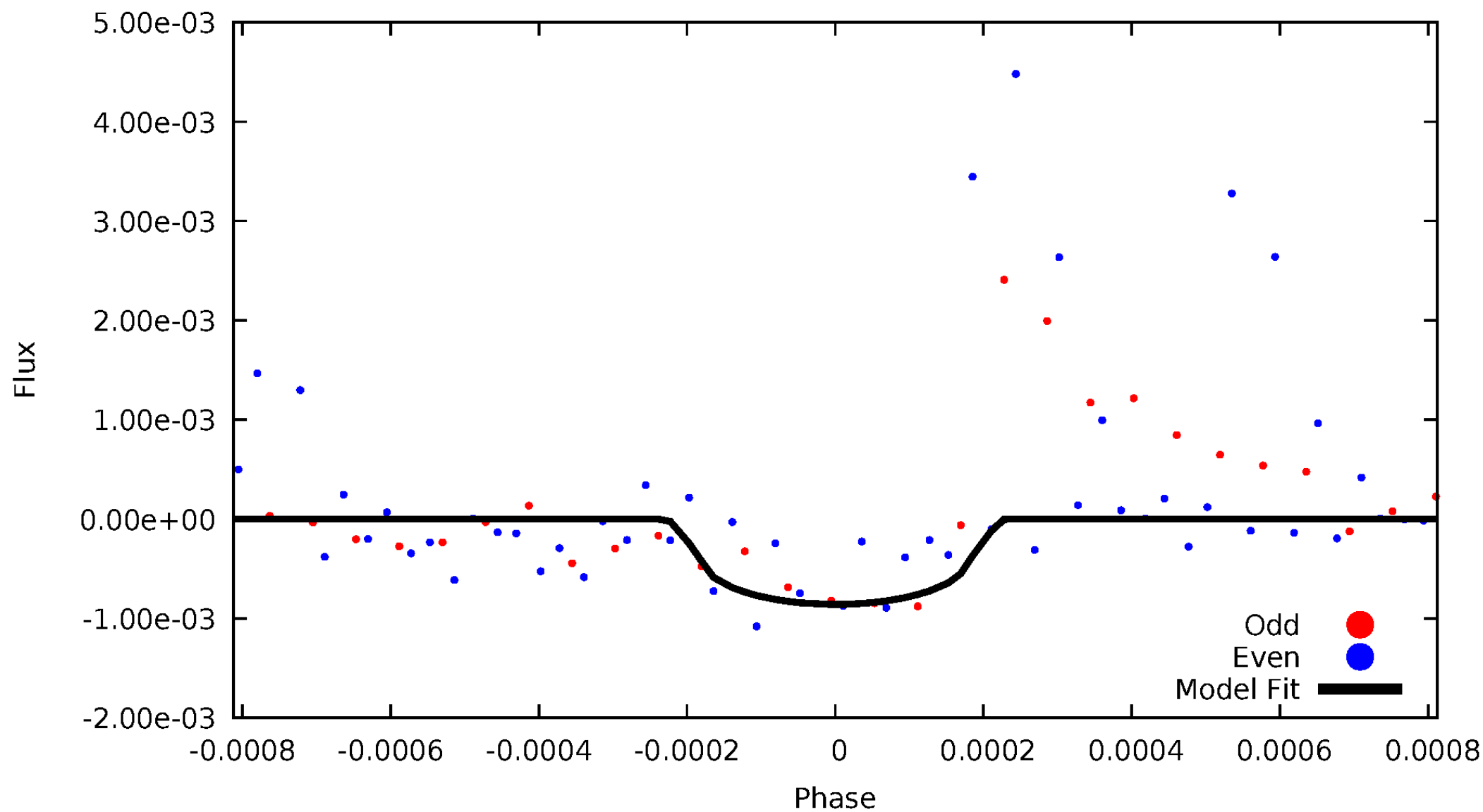


TCE 009048551-04



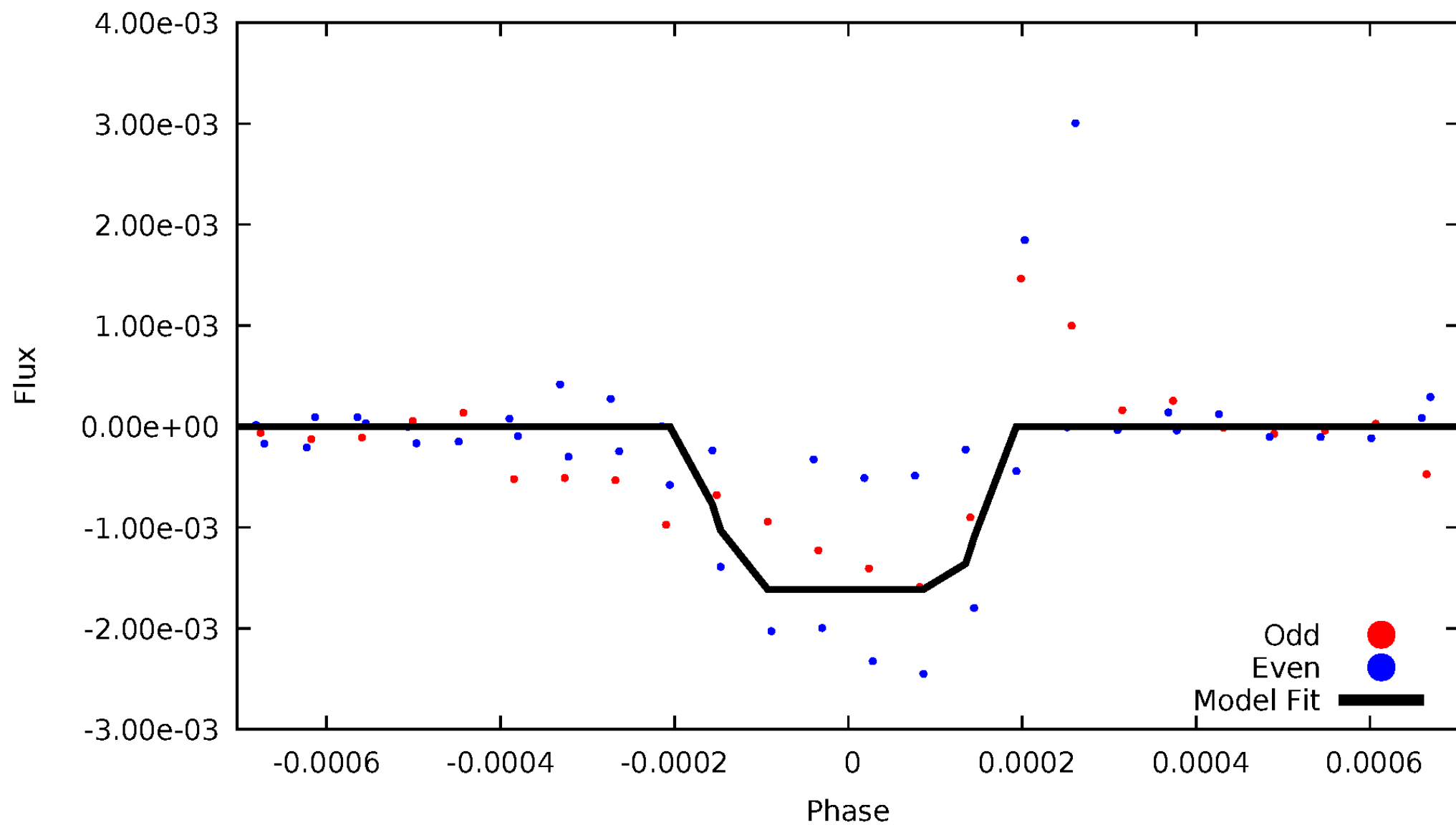
# DV Odd/Even

TCE 009048551-04



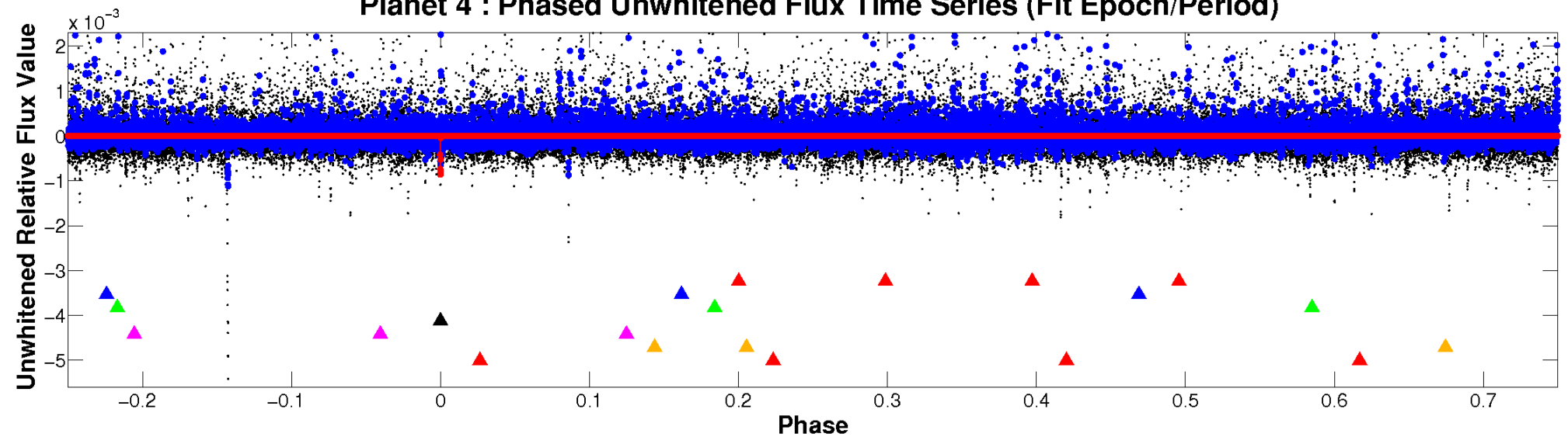
# ALT Odd/Even

TCE 009048551-04

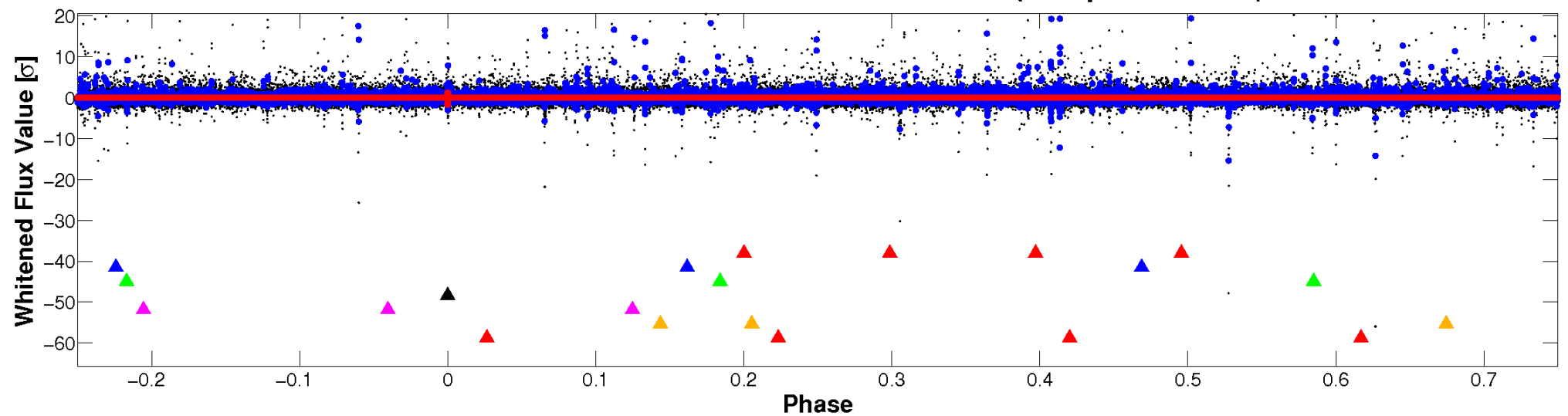


# Non-Whitened Vs. Whitened Light Curve

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



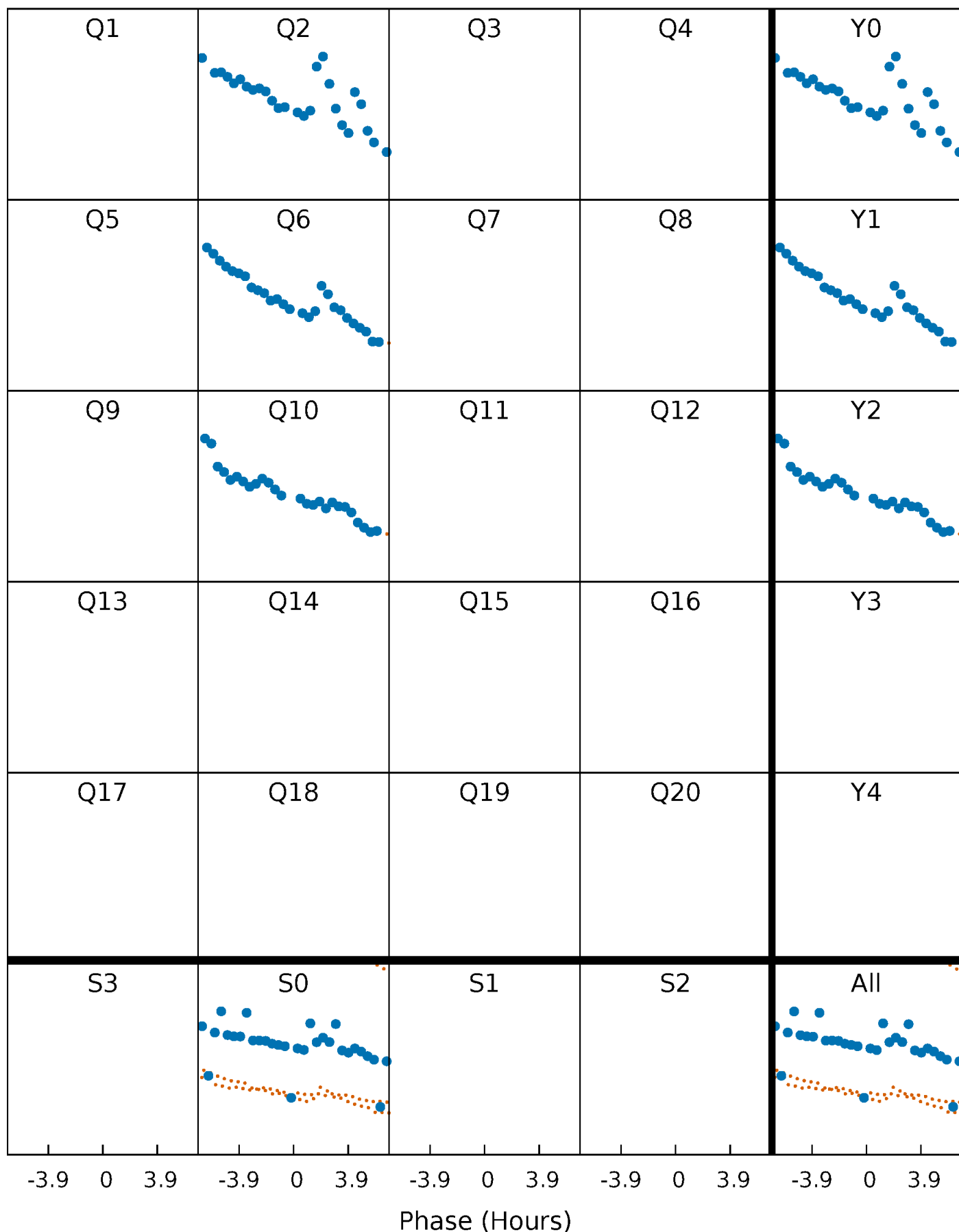
## Planet 4 : Phased Whitened Flux Time Series (Fit Epoch/Period)





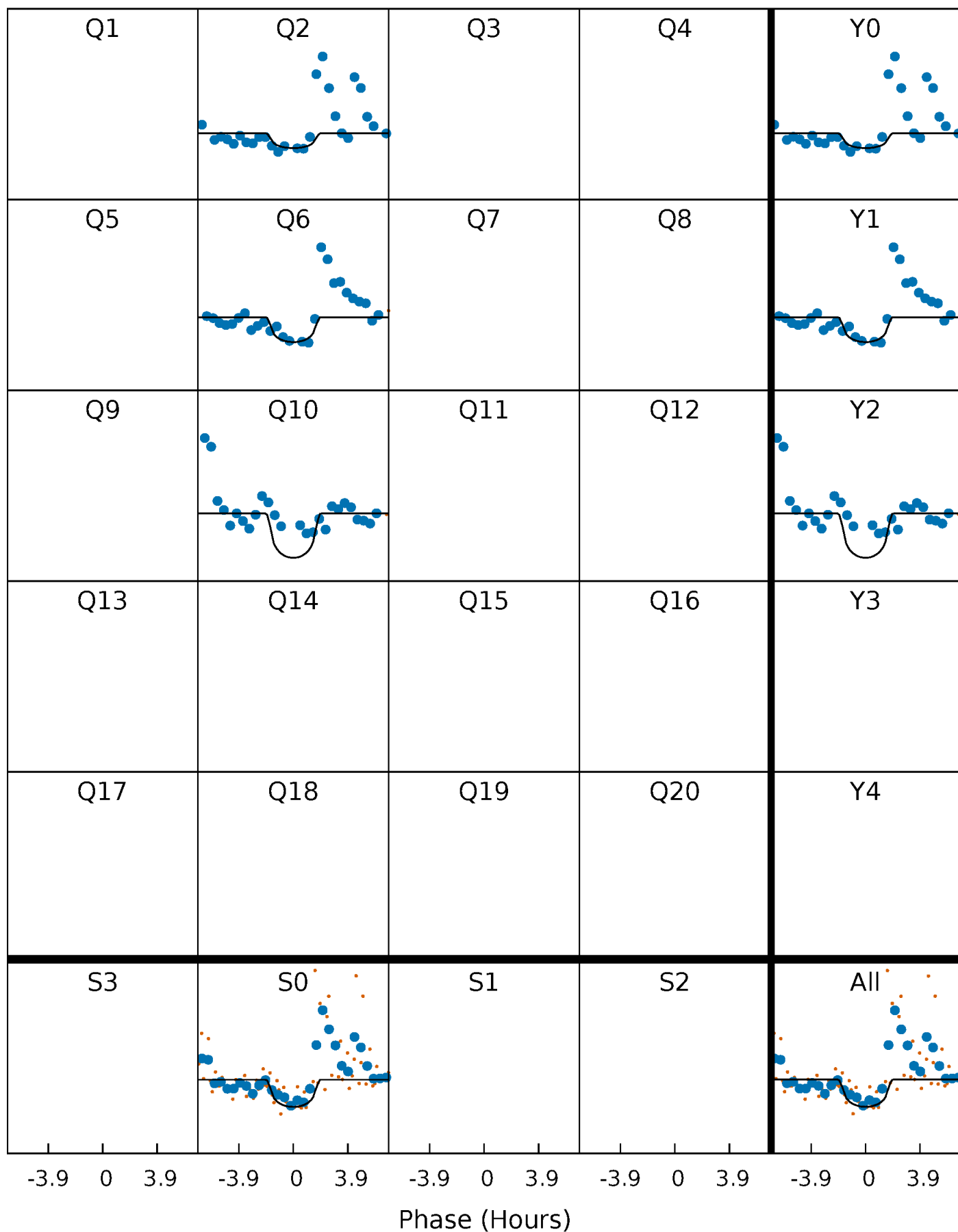
# PDC Quarter-Phased Transit Curves

TCE 009048551-04 P=350.482711 Days  $T_0=239.011801$  (BKJD)



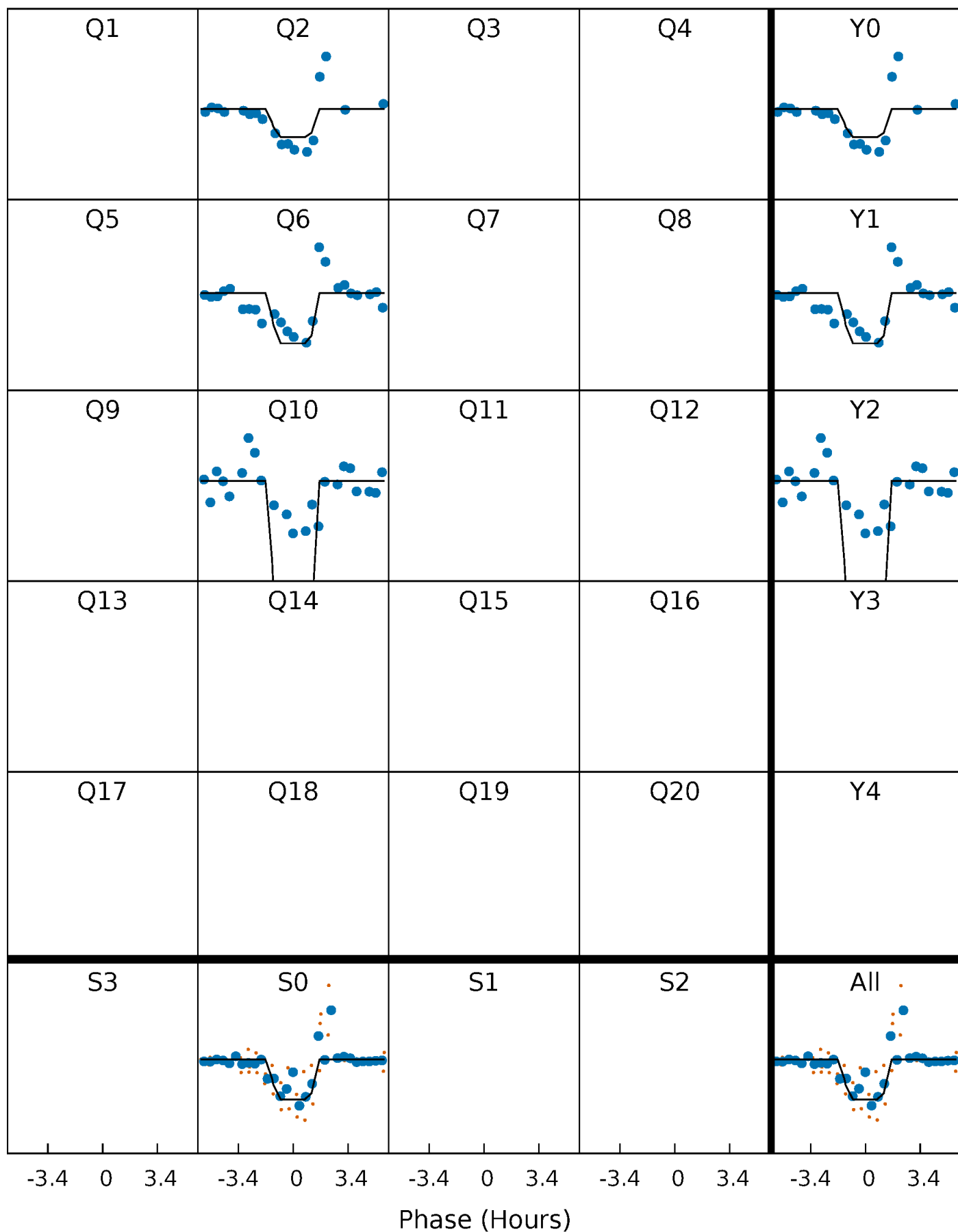
# DV Quarter-Phased Transit Curves

TCE 009048551-04 P=350.482711 Days  $T_0=239.011801$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

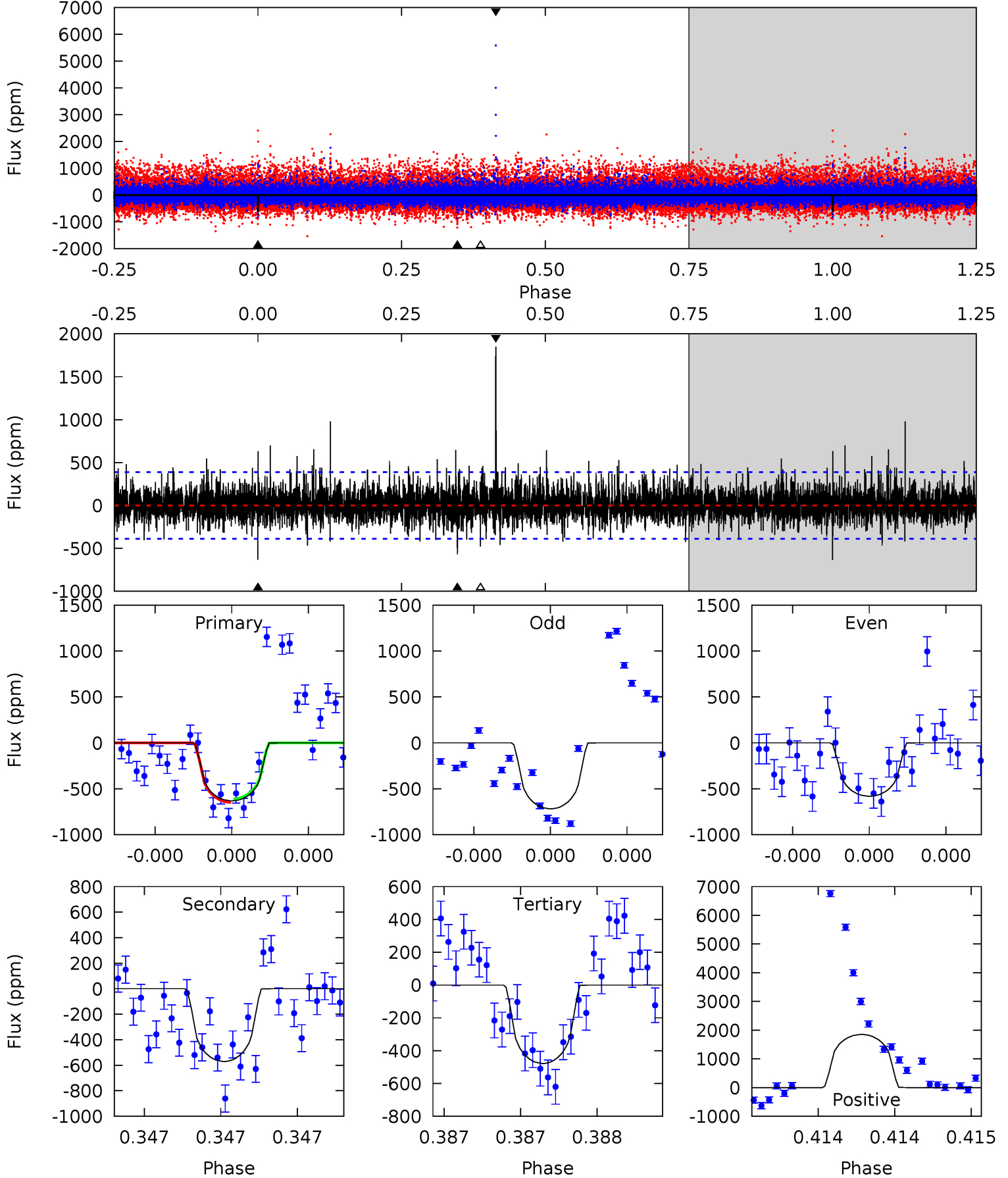
TCE 009048551-04 P=350.499077 Days  $T_0=239.005656$  (BKJD)



# DV Model-Shift Uniqueness Test

009048551-04, P = 350.482711 Days, E = 239.011801 Days

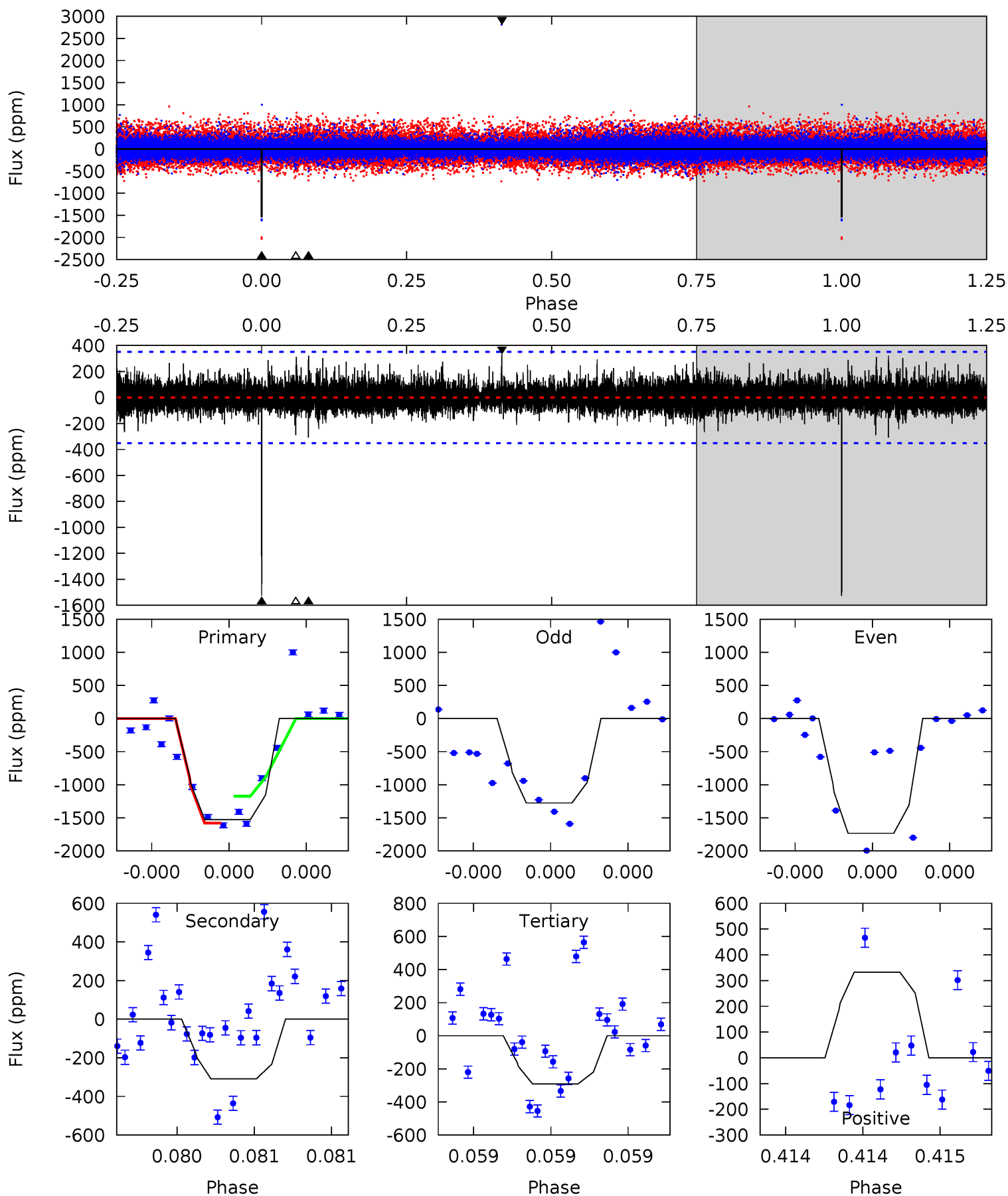
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
9.06	8.18	6.86	26.5	5.59	3.50	1.88	2.20	-17.5	1.32	-18.4	0.80	0.96	0.75	0.27



# Alt Model-Shift Uniqueness Test

009048551-04,  $P = 350.499077$  Days,  $E = 239.005656$  Days

Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
24.6	4.97	4.68	5.36	5.66	3.62	0.96	19.9	19.3	0.29	-0.40	4.44	1.03	0.18	3.50



### Stellar Parameters For KIC 009048551

	$T_{\text{eff}}(K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$4121^{+123}_{-136}$	$4.631^{+0.049}_{-0.017}$	$0.100^{+0.250}_{-0.300}$	$0.636^{+0.031}_{-0.058}$	$0.631^{+0.050}_{-0.056}$	$3.455^{+0.811}_{-0.299}$
	+3%/-3%	+1%/-0%	+250%/-300%	+5%/-9%	+8%/-9%	+23%/-9%
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 009048551-04 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-571 \pm 70$	$3.20^{+2.93}_{-2.16}$	$220^{+7}_{-8}$	$3301^{+1551}_{-568}$	$22714^{+169581}_{-17128}$
Alt.	$-308 \pm 62$	$3.80^{+2.98}_{-2.42}$	$221^{+7}_{-8}$	$2867^{+1085}_{-402}$	$7985^{+53992}_{-5510}$

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

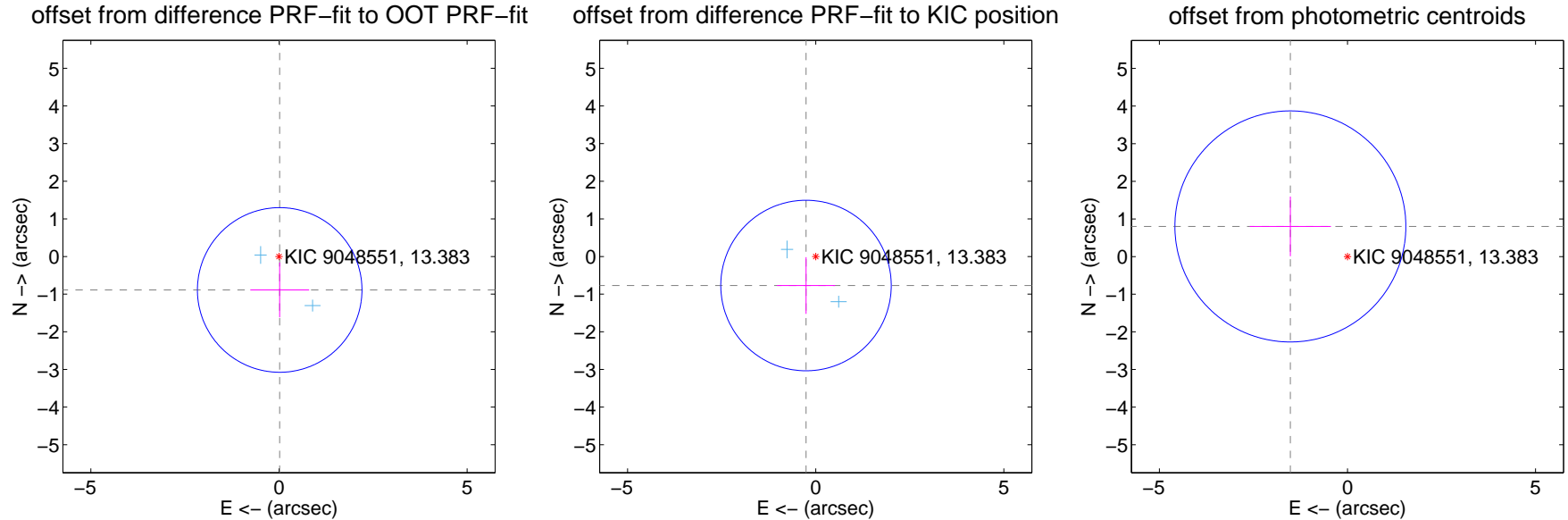
## DV Centroid Data

Supplemental centroid analysis for 009048551-04. Kepler magnitude: 13.38. Transit SNR 6.79

There are 2 quarters with good PRF difference image offsets

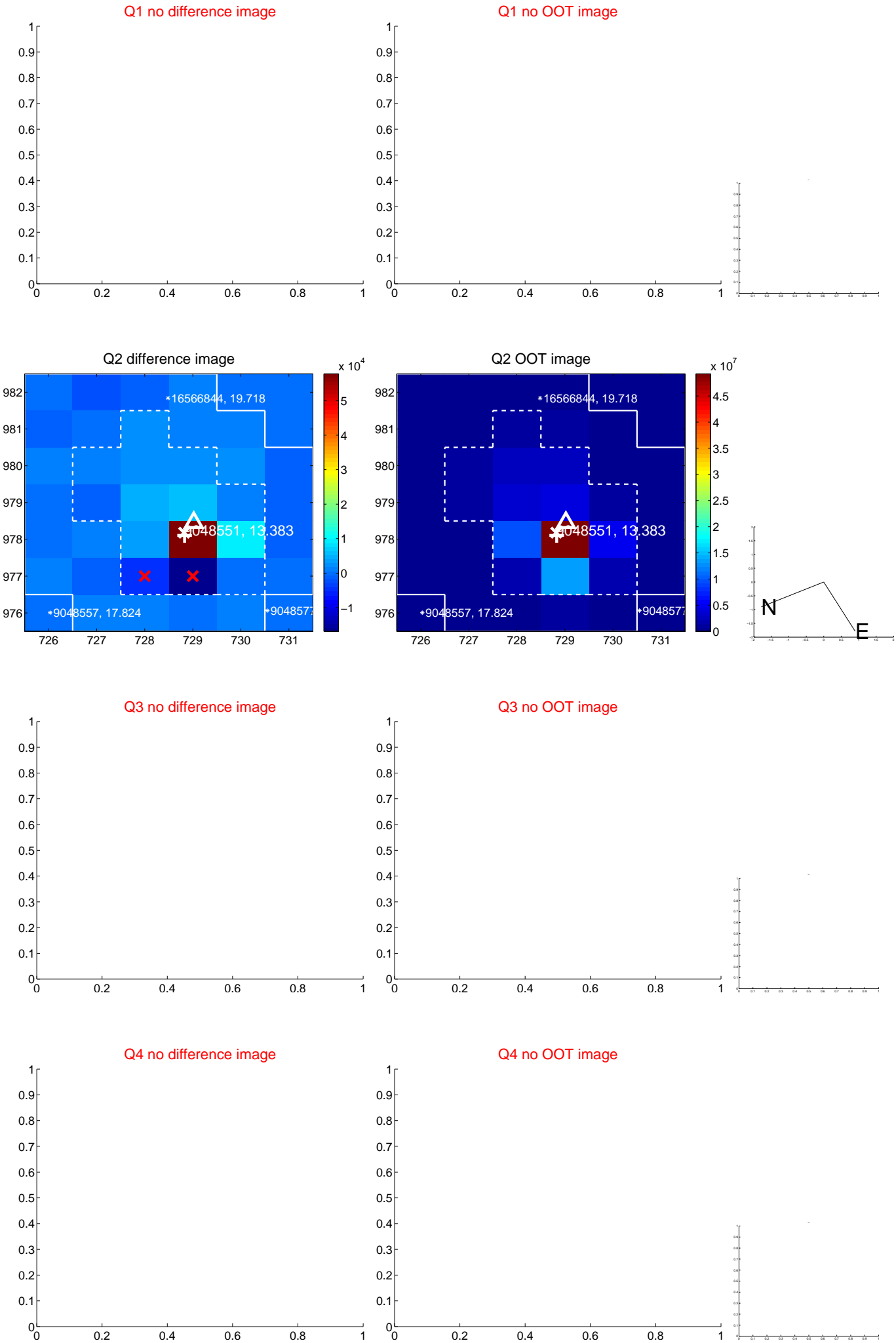
The direct PRF centroid is offset from the target star catalog position by about 0.31 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.888 \pm 0.729$	1.22	$-0.019 \pm 0.781$	$-0.888 \pm 0.729$
PRF-fit source offset from KIC position	$0.812 \pm 0.755$	1.08	$0.258 \pm 0.775$	$-0.770 \pm 0.753$
photometric centroid source offset	$1.72 \pm 1.02$	1.68	$1.52 \pm 1.08$	$0.80 \pm 0.79$



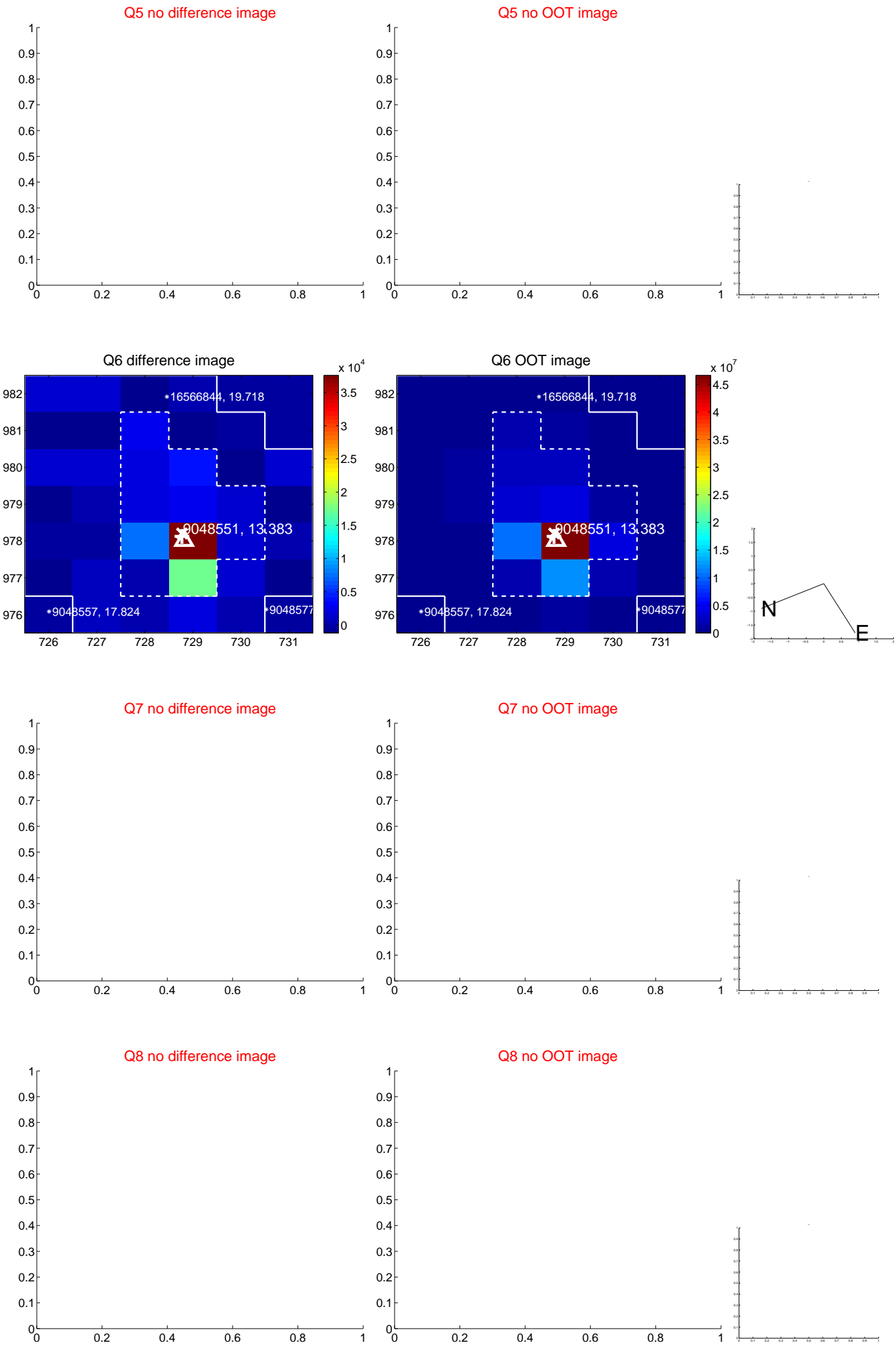
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

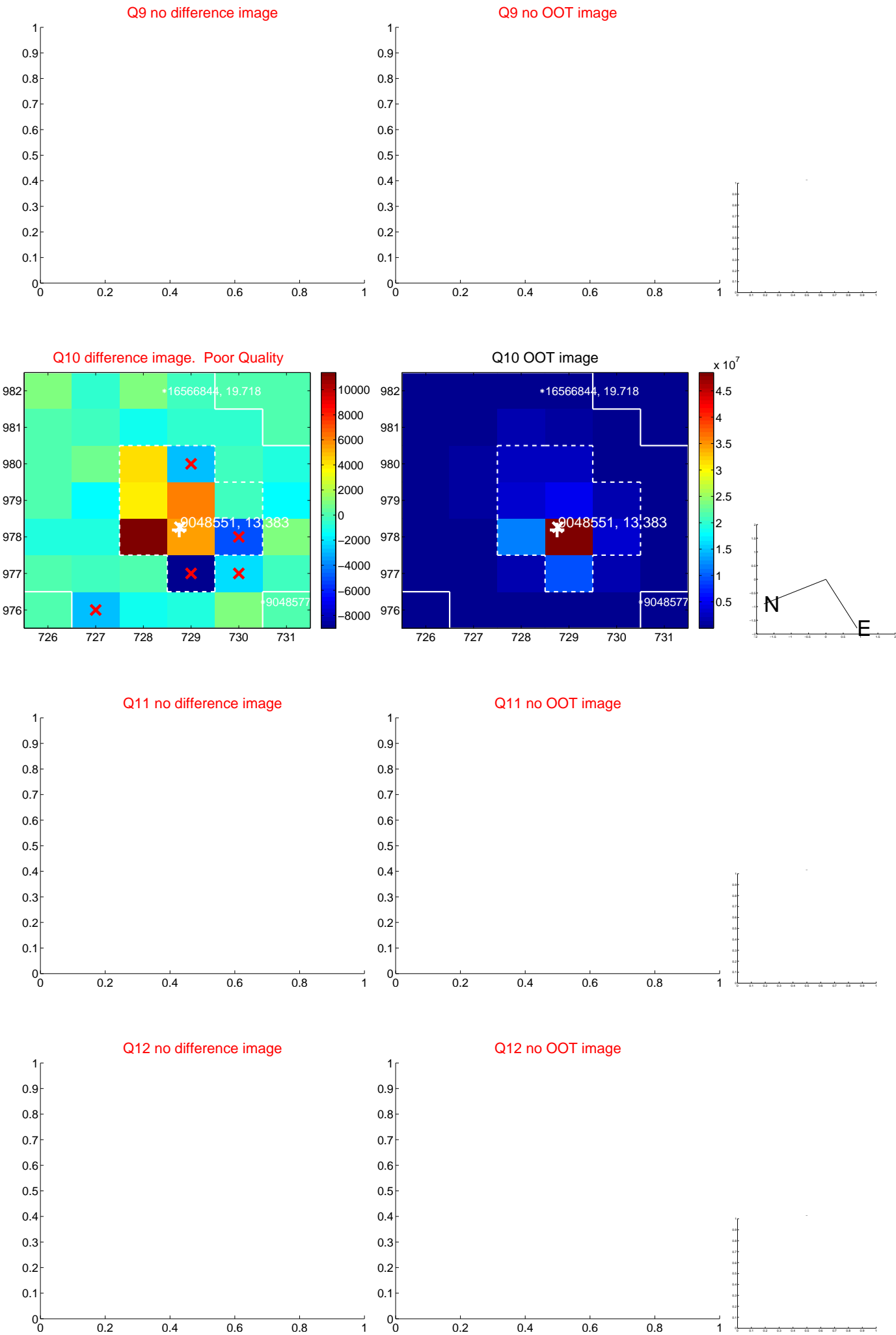




white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



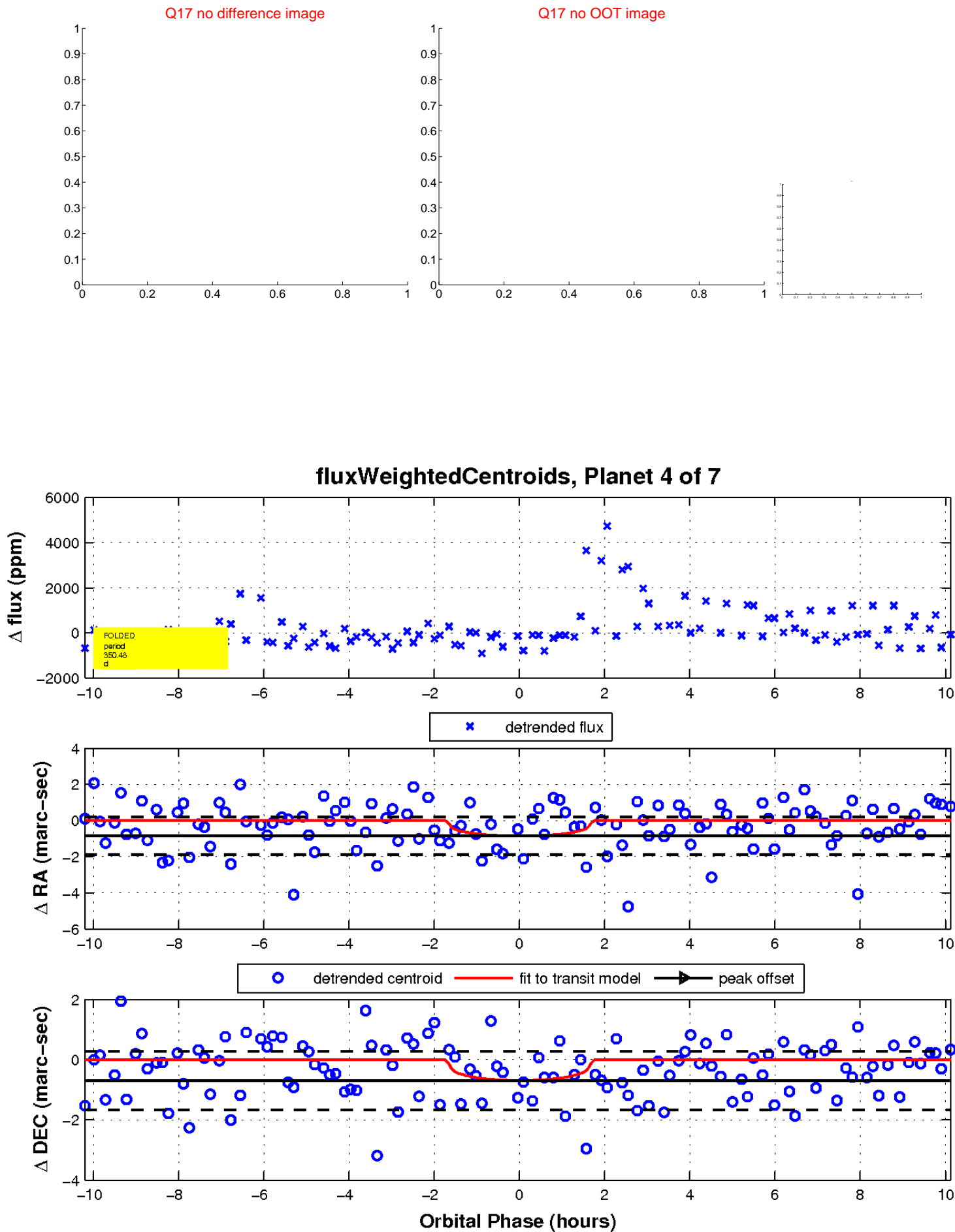
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



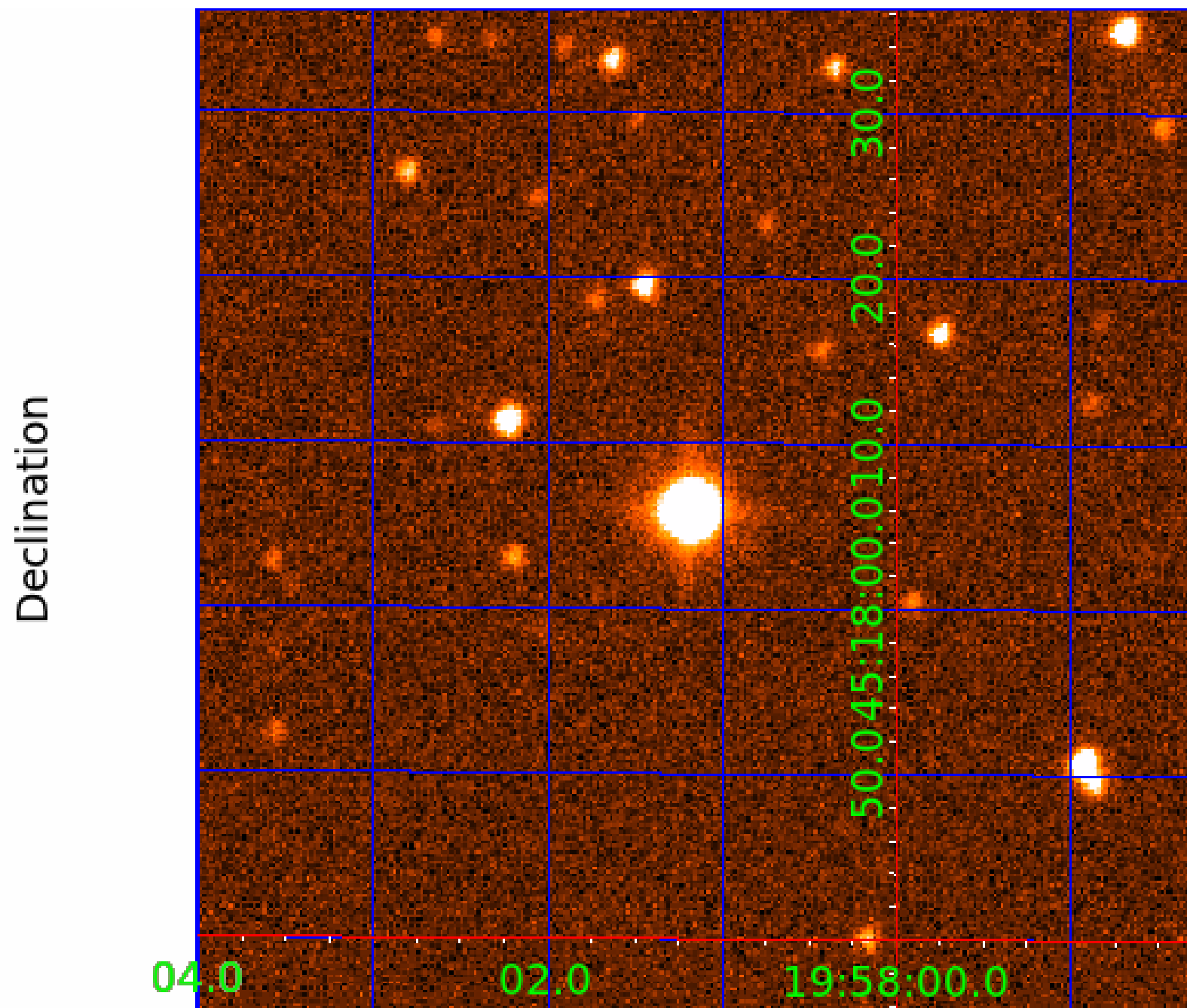
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



UKIRT Image



# KIC 009048551

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009048551-01	OBS	No	315.960993	412.736558	1108.2	3.262	15.2	8.9	0.64	4121	2.21	0.17
009048551-02	OBS	No	458.095786	295.711690	1262.4	5.021	14.1	9.4	0.64	4121	2.26	0.10
009048551-03	OBS	No	491.011724	162.990025	1163.3	16.705	13.2	6.2	0.64	4121	2.61	0.10
009048551-04	OBS	No	350.482711	239.011801	859.4	3.416	13.7	6.8	0.64	4121	1.79	0.15
009048551-05	OBS	No	408.379130	517.458281	846.0	6.355	11.3	6.3	0.64	4121	2.01	0.12
009048551-06	OBS	No	514.912717	311.009898	707.7	8.063	11.1	5.5	0.64	4121	1.73	0.09
009048551-07	OBS	No	419.473543	248.293169	161.8	16.653	13.0	1.0	0.64	4121	0.90	0.12

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009048551-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS
009048551-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_POS_DV
009048551-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL—LPP_DV—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009048551-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009048551-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009048551-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009048551-07	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_TRACKER—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—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.

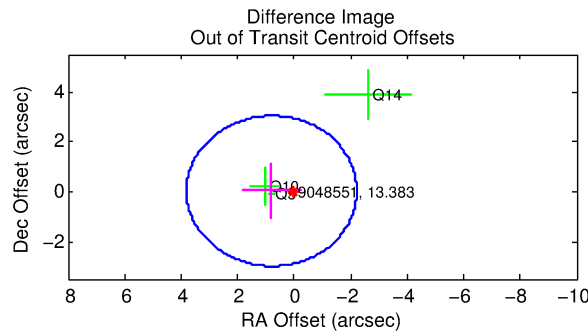
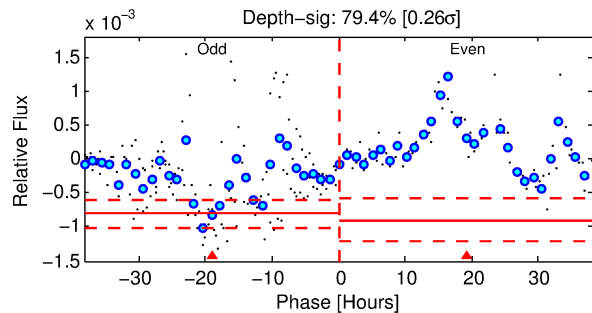
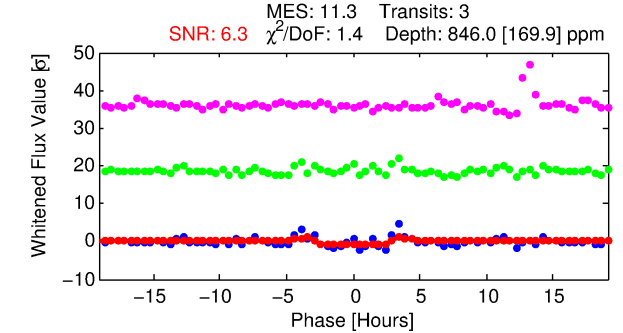
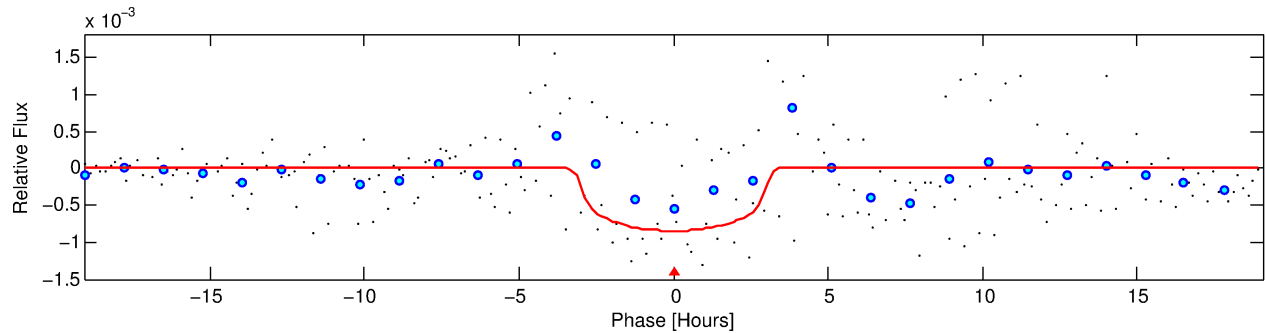
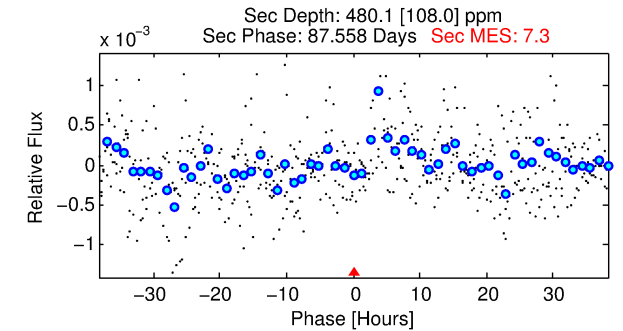
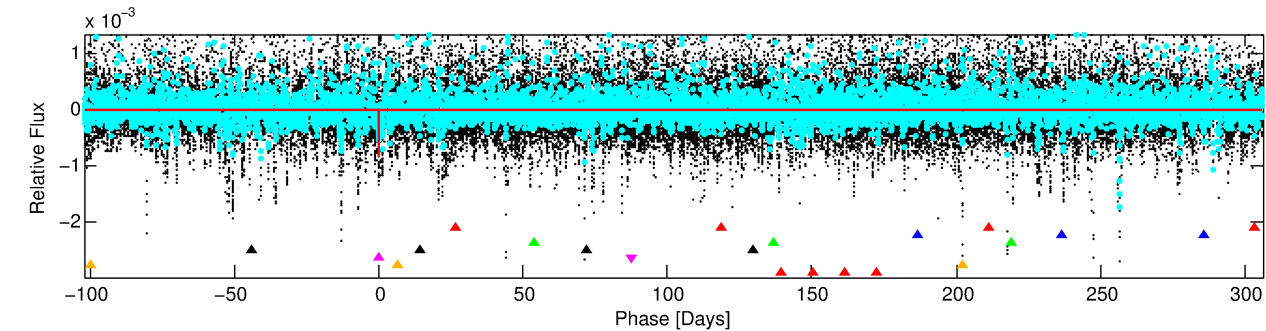
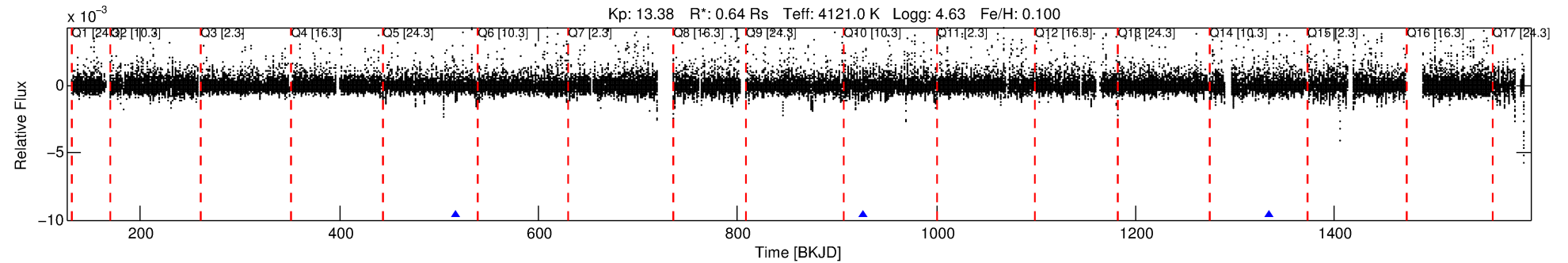
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 009048551-05

No Significant Match Found

# DV One-Page Summary

KIC: 9048551 Candidate: 5 of 7 Period: 408.379 d



## DV Fit Results:

Period = 408.37913 [0.00608] d  
Epoch = 517.4583 [0.0082] BKJD  
Rp/R\* = 0.0290 [0.0156]  
a/R\* = 350.76 [628.48]  
b = 0.74 [1.11]  
Seff = 0.12 [0.02]  
Teq = 151 [6] K  
Rp = 2.01 [1.10] Re  
a = 0.9241 [0.0661] AU  
Ag = 55852.10 [61897.32] [0.90σ]  
**Teffp = 3585 [996] K [3.45σ]**

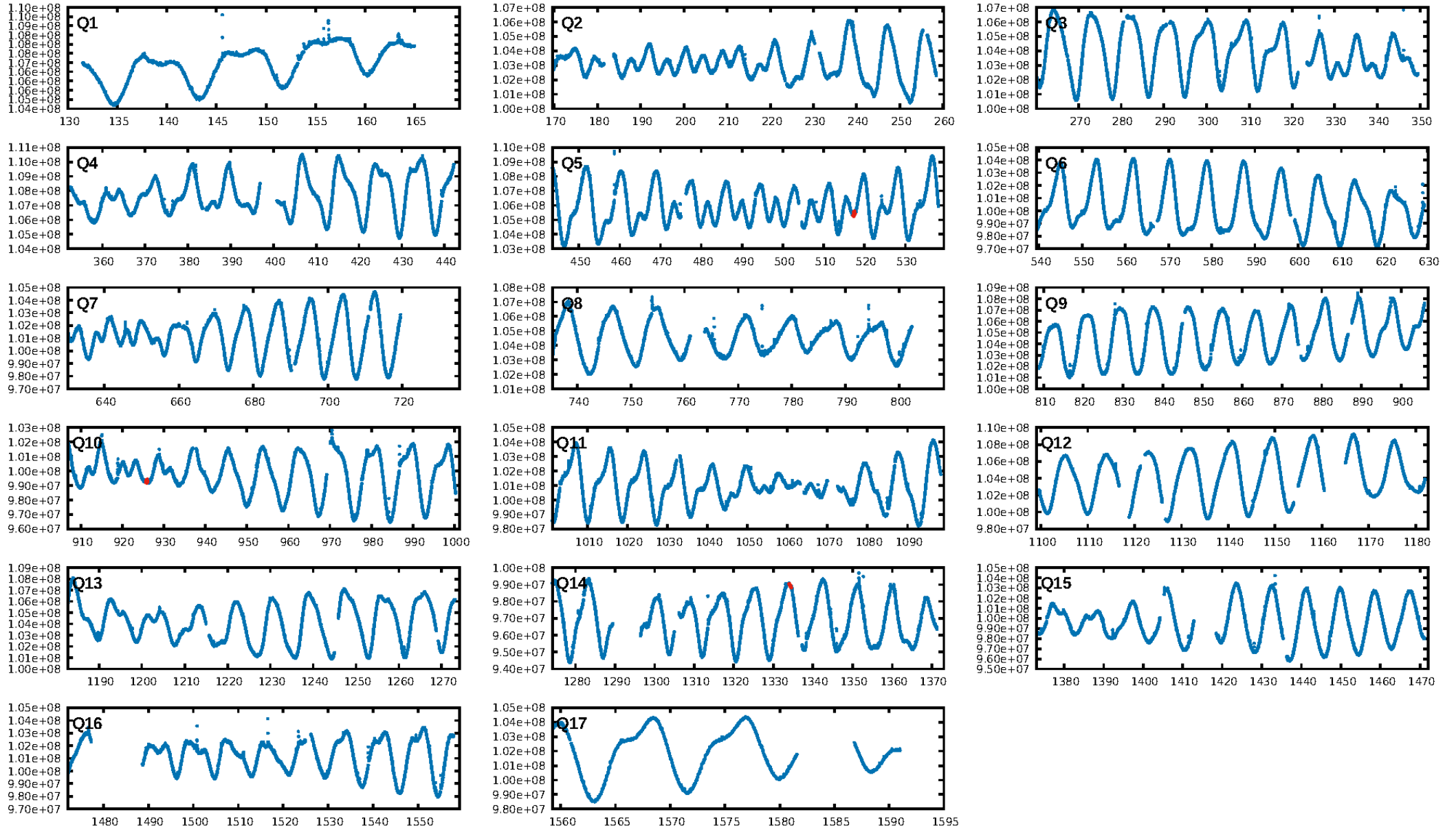
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [192.58σ]  
LongPeriod-sig: 100.0% [14.94σ]  
ModelChiSquare2-sig: 14.8%  
ModelChiSquareGof-sig: 87.6%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: -2.196  
Centroid-sig: 20.6%  
Centroid-so: 0.691 arcsec [1.16σ]  
OotOffset-rm: 0.800 arcsec [0.80σ]  
KicOffset-rm: 0.979 arcsec [0.86σ]  
OotOffset-st: 2/0/0/1 [3]  
KicOffset-st: 2/0/0/1 [3]  
DiffImageQuality-fgm: 0.67 [2/3]  
DiffImageOverlap-fno: 1.00 [3/3]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 13:48:20 Z

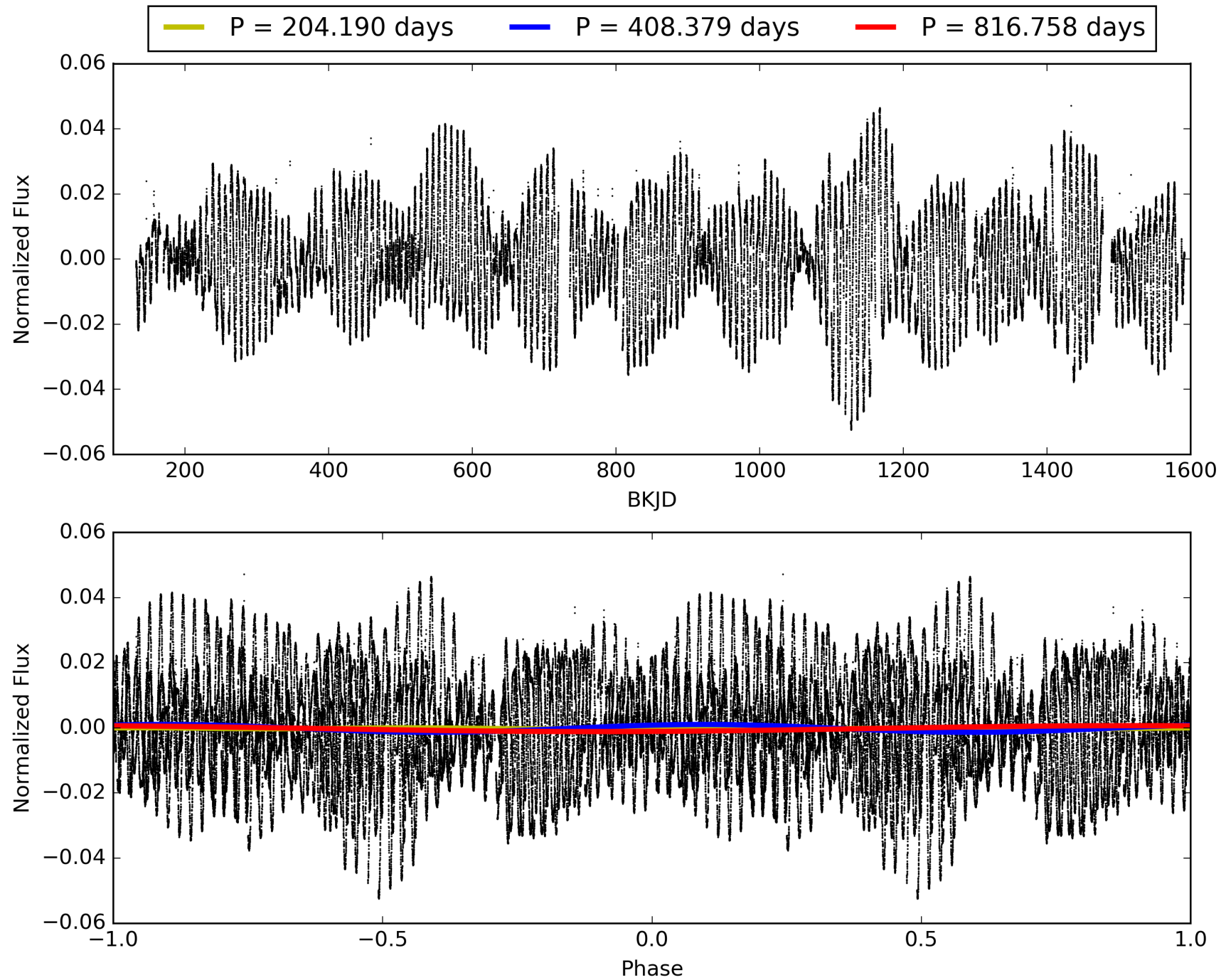
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 009048551-05, PDC Light Curves



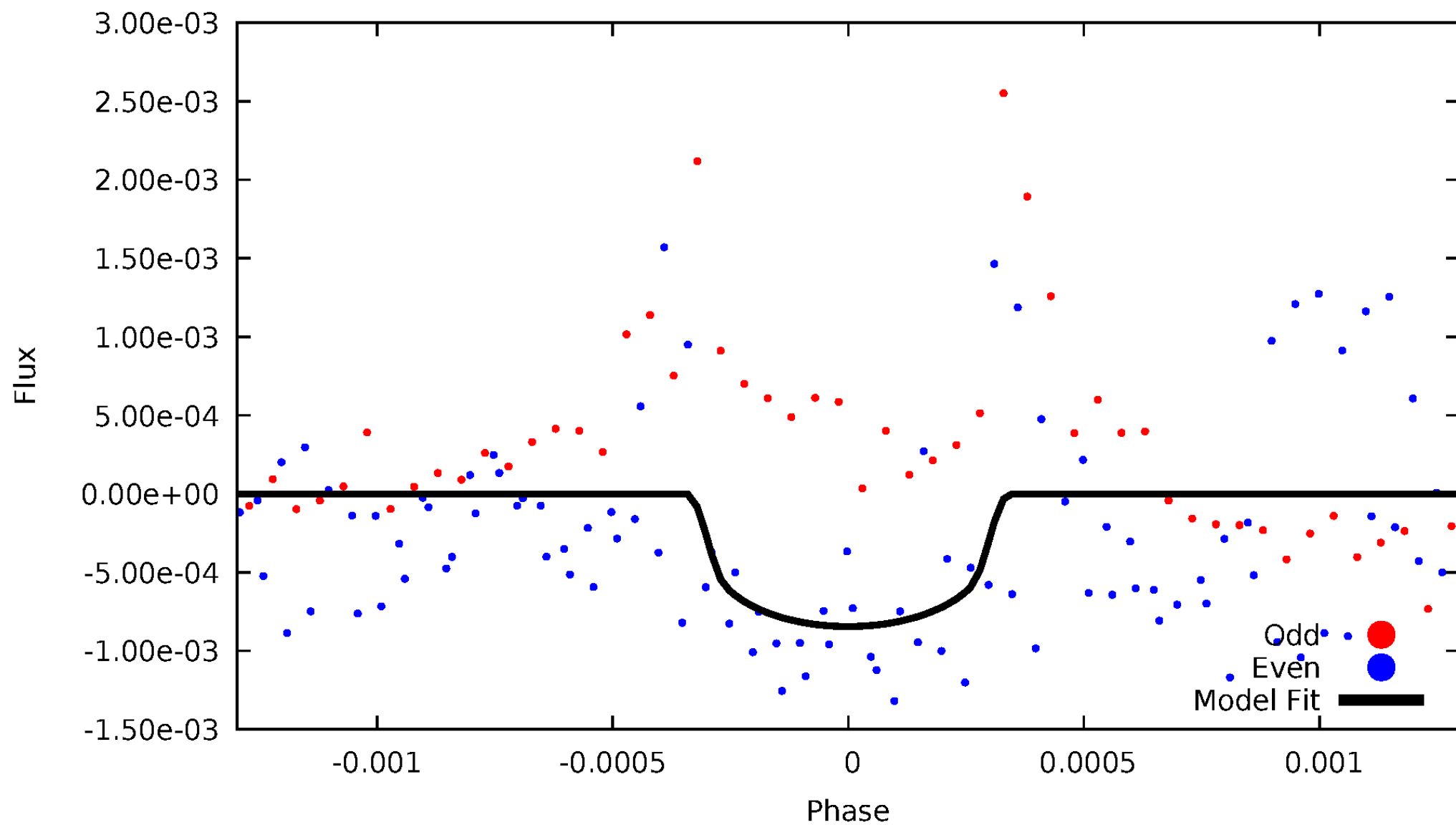


TCE 009048551-05



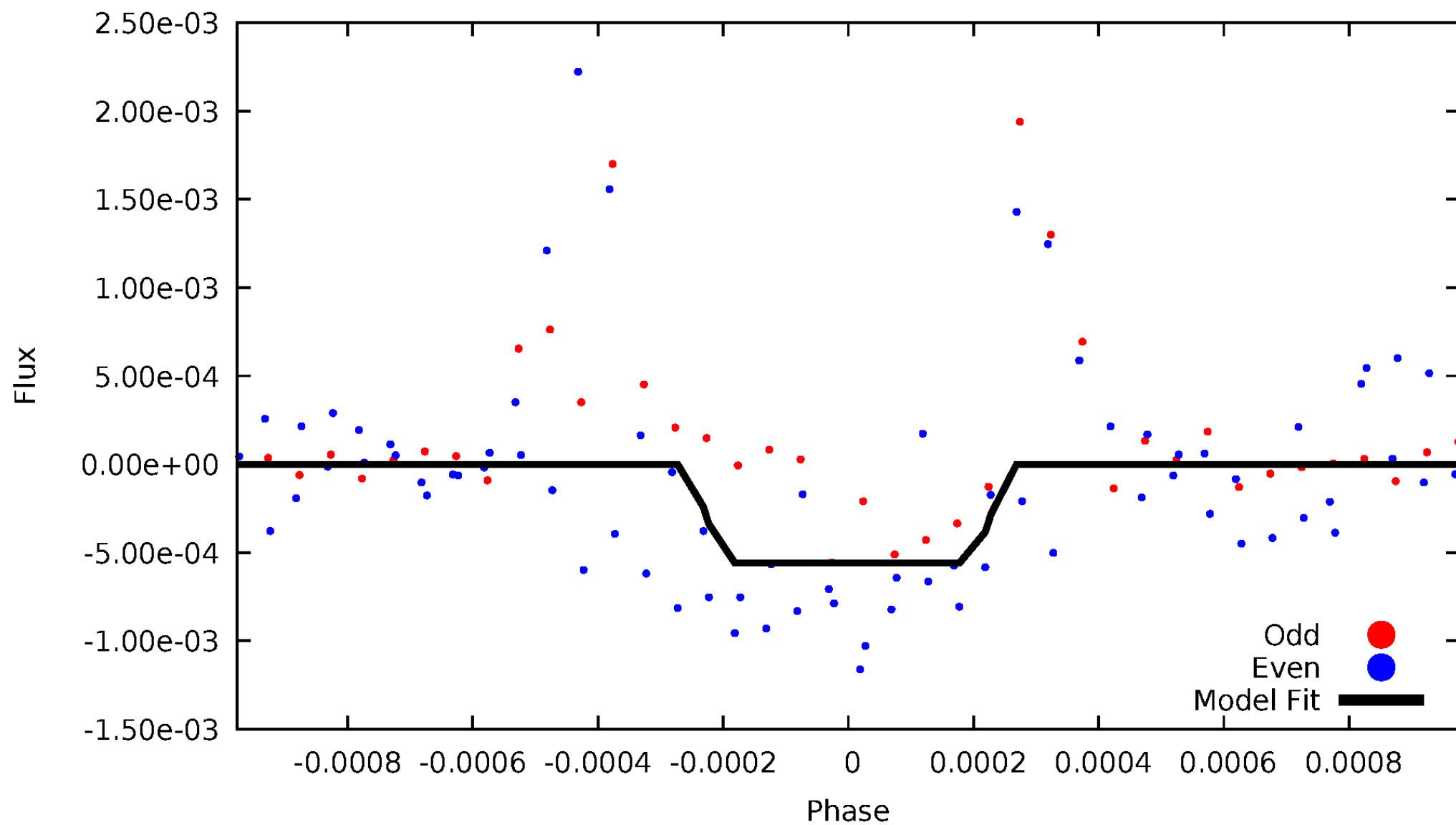
# DV Odd/Even

TCE 009048551-05



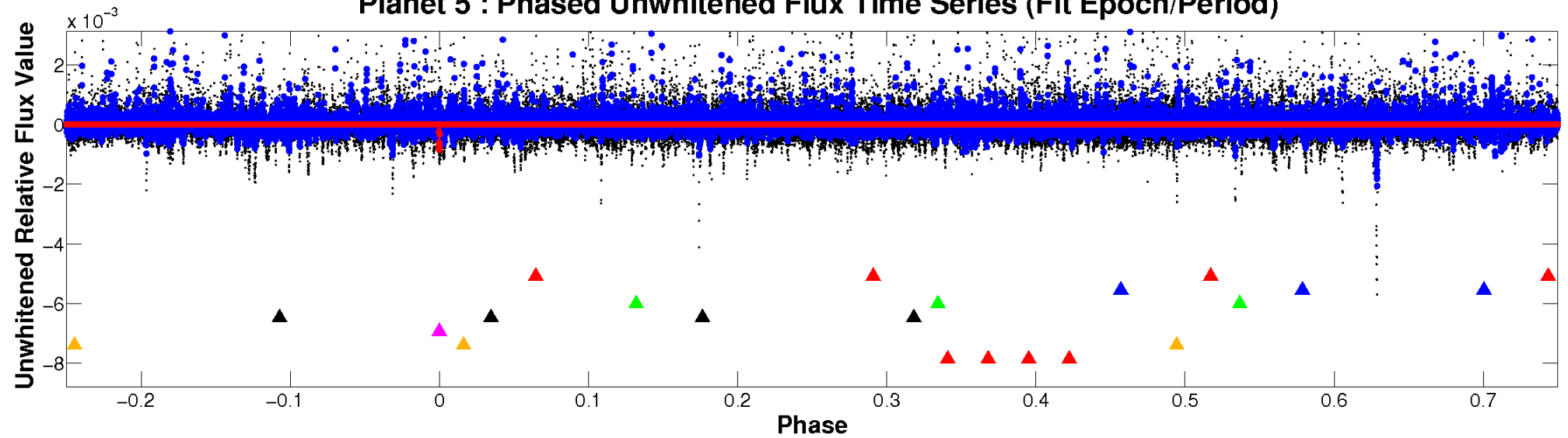
# ALT Odd/Even

TCE 009048551-05

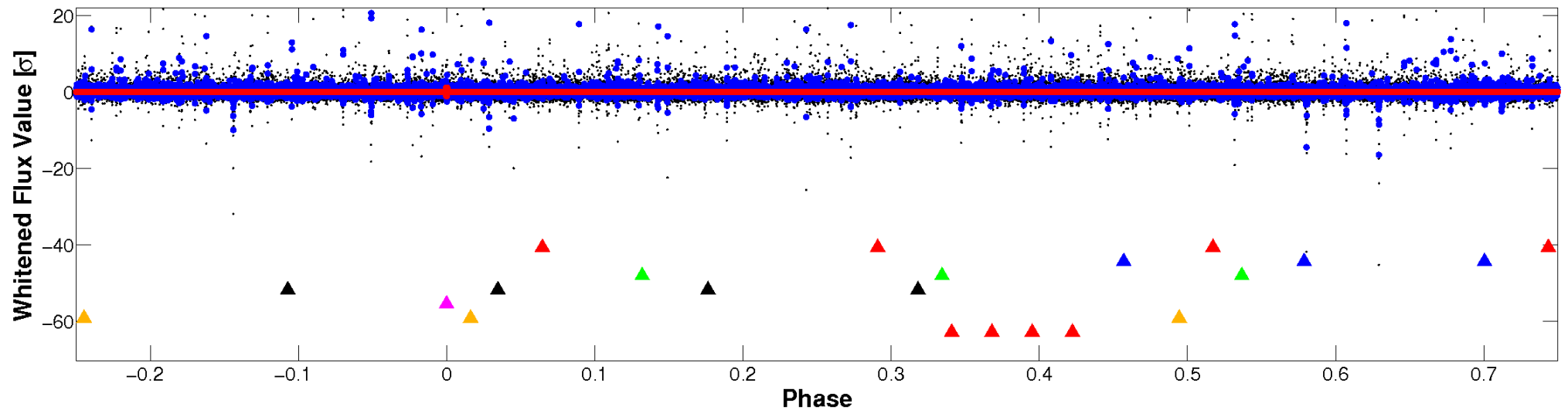


# Non-Whitened Vs. Whitened Light Curve

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

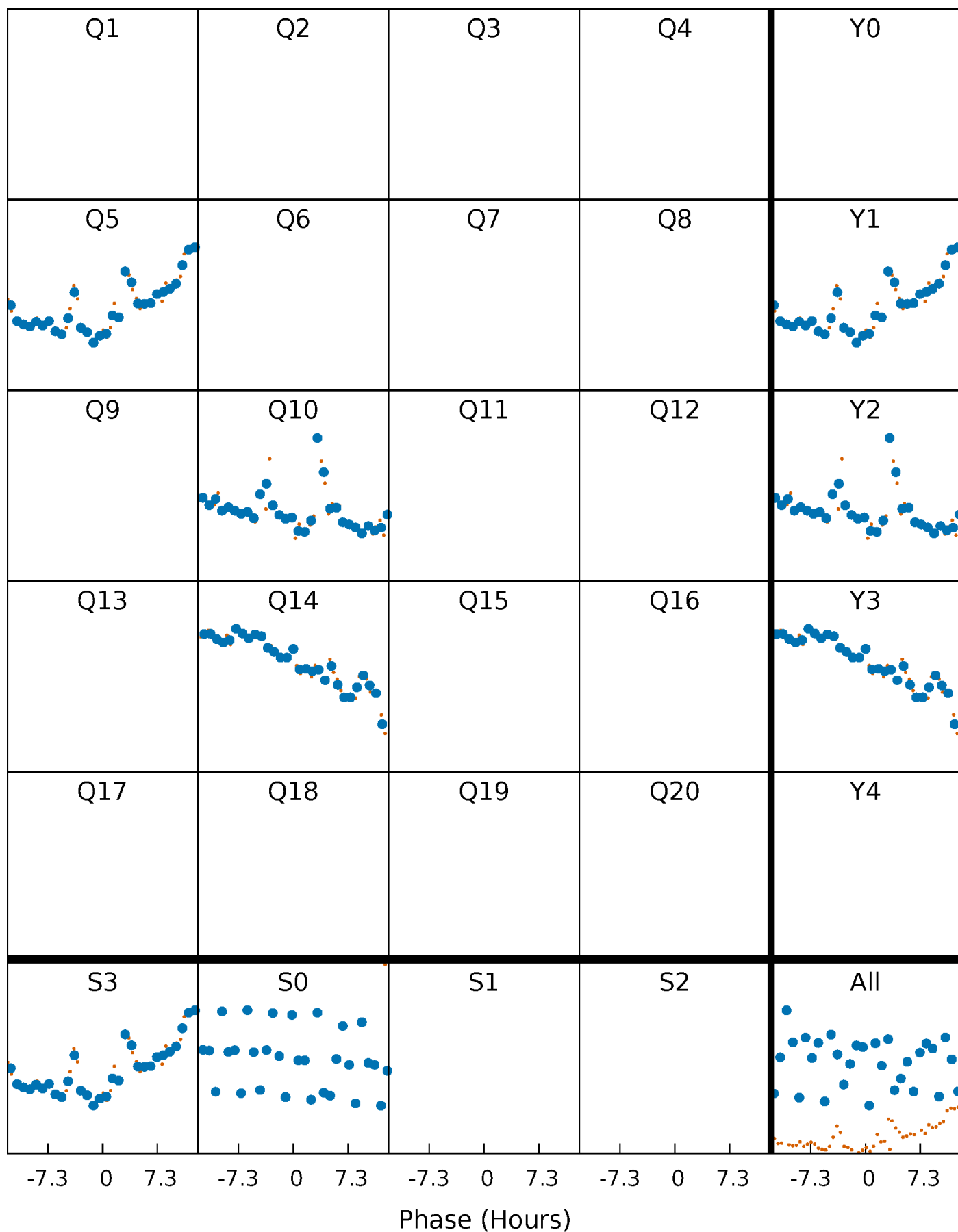


## Planet 5 : Phased Whitened Flux Time Series (Fit Epoch/Period)



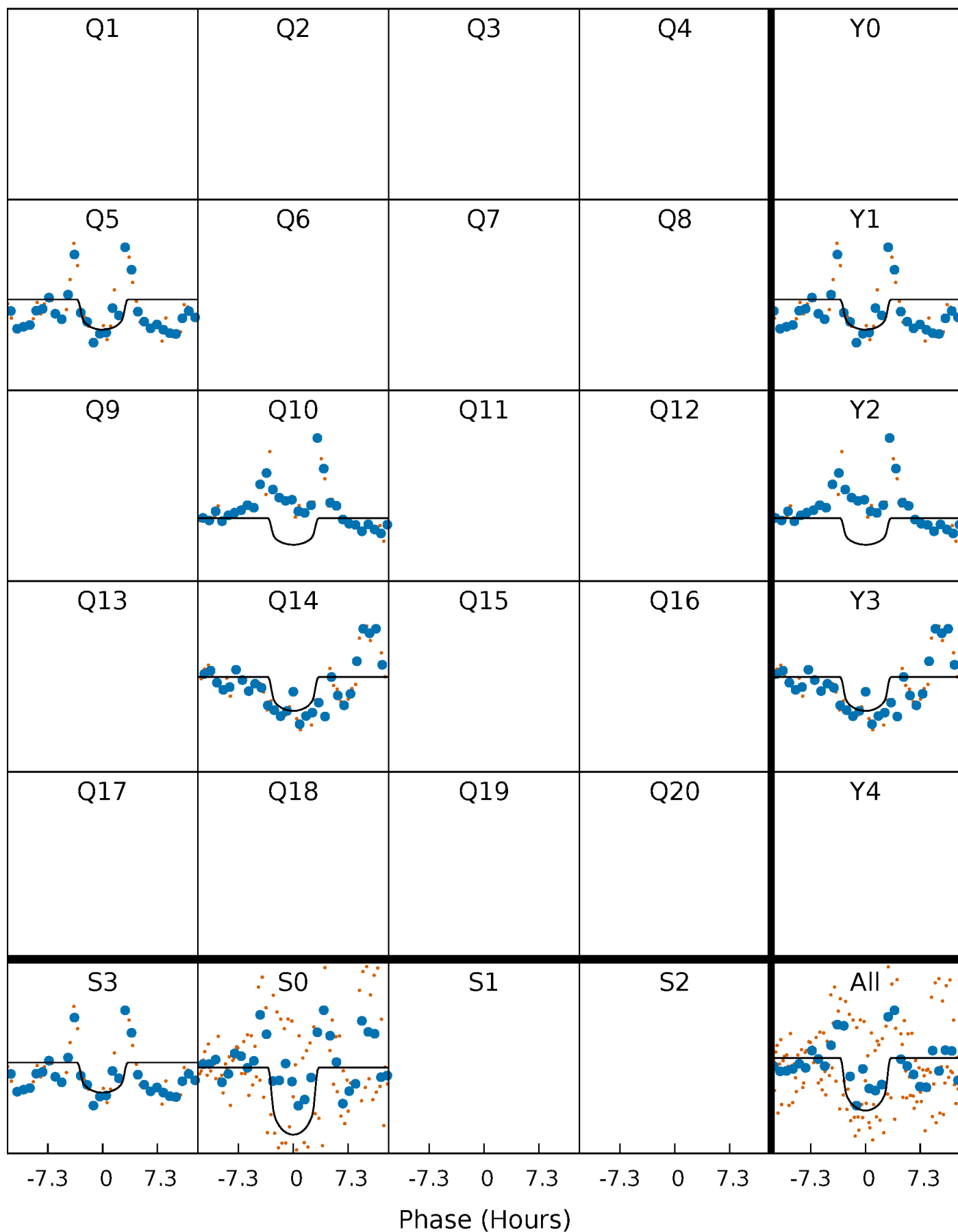
# PDC Quarter-Phased Transit Curves

TCE 009048551-05     $P=408.379130$  Days     $T_0=517.458281$  (BKJD)



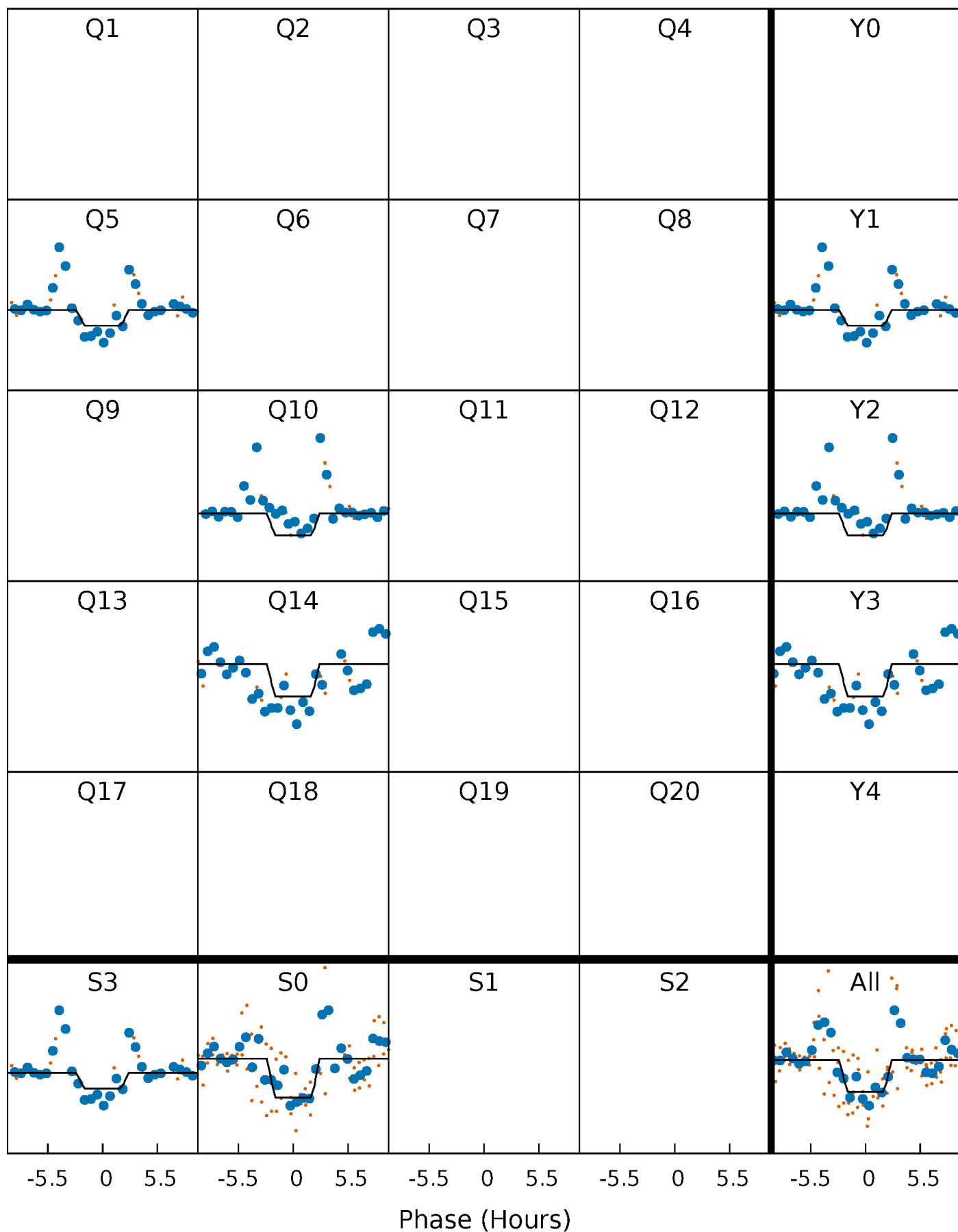
# DV Quarter-Phased Transit Curves

TCE 009048551-05     $P=408.379130$  Days     $T_0=517.458281$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

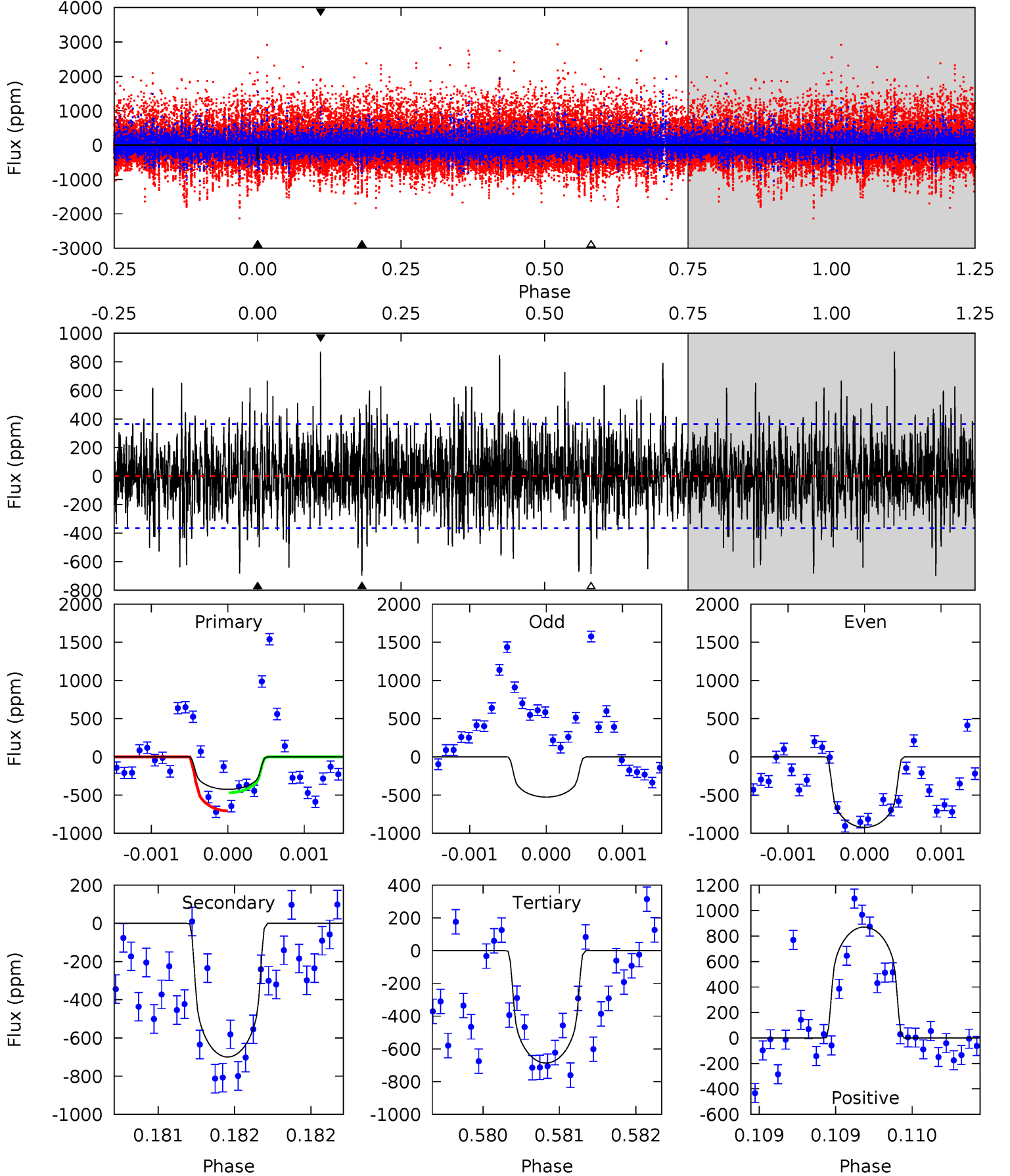
TCE 009048551-05     $P=408.385130$  Days     $T_0=517.474982$  (BKJD)



# DV Model-Shift Uniqueness Test

009048551-05, P = 408.379130 Days, E = 109.079151 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
6.45	10.6	10.4	13.2	5.52	3.39	2.72	-3.95	-6.75	0.20	-2.60	2.14	0.56	0.55	1.69

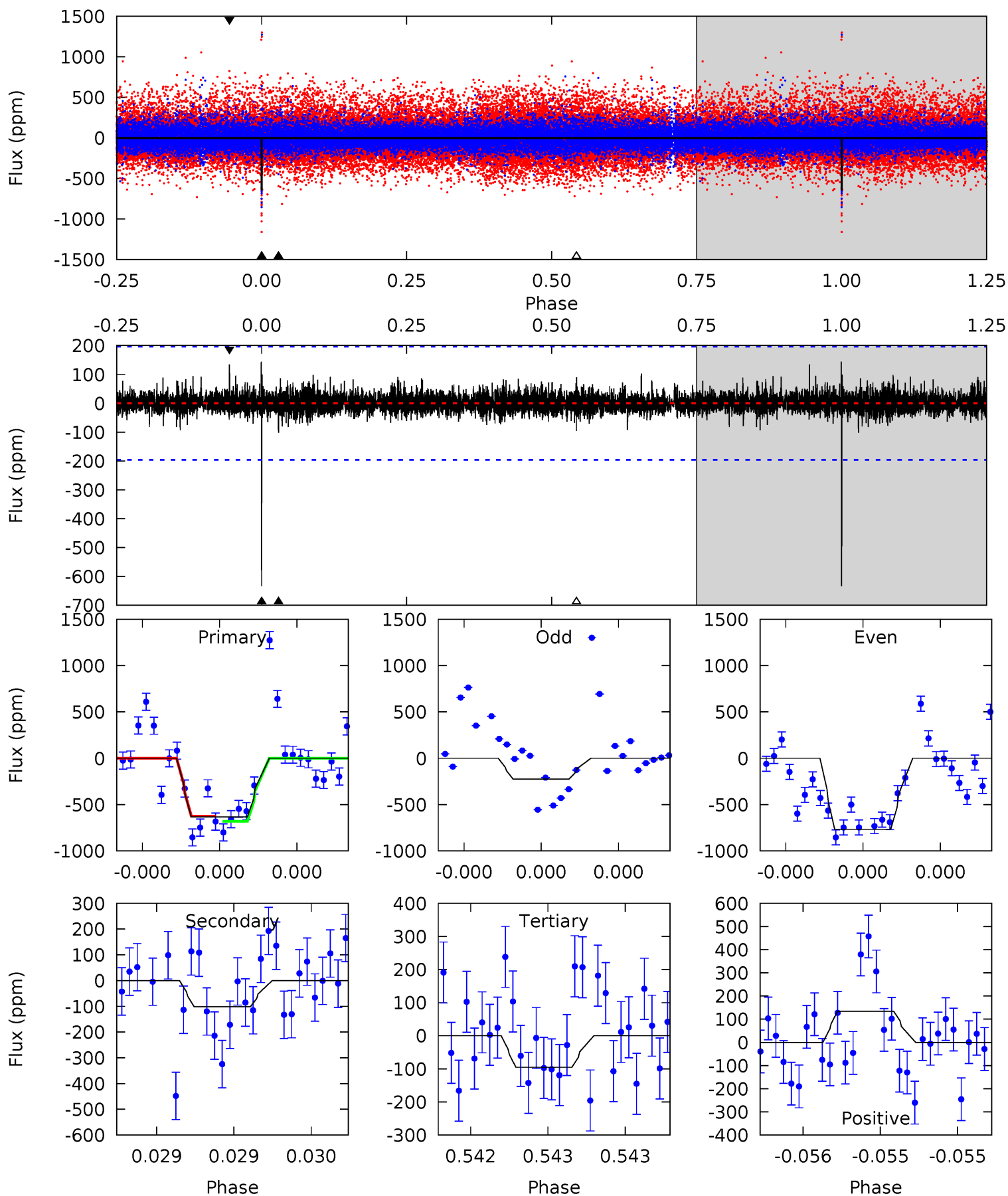




# Alt Model-Shift Uniqueness Test

009048551-05, P = 408.385130 Days, E = 109.089852 Days

Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
18.0	2.90	2.71	3.82	5.57	3.48	0.60	15.3	14.2	0.19	-0.92	7.14	0.80	0.18	0.78



### Stellar Parameters For KIC 009048551

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$4121^{+123}_{-136}$	$4.631^{+0.049}_{-0.017}$	$0.100^{+0.250}_{-0.300}$	$0.636^{+0.031}_{-0.058}$	$0.631^{+0.050}_{-0.056}$	$3.455^{+0.811}_{-0.299}$
	+3%/-3%	+1%/-0%	+250%/-300%	+5%/-9%	+8%/-9%	+23%/-9%
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 009048551-05 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-700 \pm 66$	$2.07^{+1.00}_{-0.98}$	$209^{+7}_{-7}$	$3946^{+1094}_{-507}$	$79272^{+198950}_{-44018}$
Alt.	$-102 \pm 35$	$1.71^{+1.08}_{-0.94}$	$209^{+7}_{-8}$	$3072^{+899}_{-431}$	$15983^{+63017}_{-10264}$

$T_{max}$  = Theoretical Maximum Planetary Temperature

$T_{obs}$  = Observed Planetary Temperature (Assuming  $A=0.3$ )

$A_{obs}$  = Observed Albedo (Assuming  $T=0$ )

If a secondary eclipse is present, the system is likely an EB if  $T_{obs} \gg T_{max}$  AND  $A_{obs} \gg 1.0$

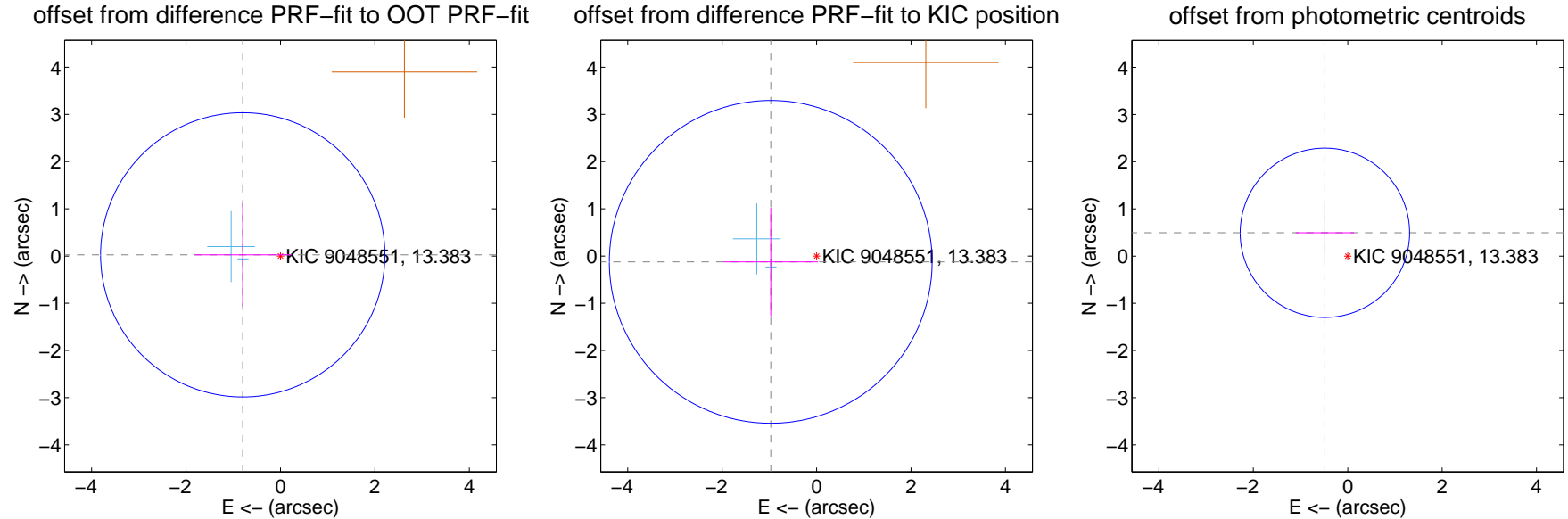
## DV Centroid Data

Supplemental centroid analysis for 009048551-05. Kepler magnitude: 13.38. Transit SNR 6.27

There are 2 quarters with good PRF difference image offsets

The direct PRF centroid is offset from the target star catalog position by about 0.37 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.800 \pm 1.004$	0.80	$0.799 \pm 1.038$	$0.025 \pm 1.095$
PRF-fit source offset from KIC position	$0.979 \pm 1.140$	0.86	$0.971 \pm 1.003$	$-0.124 \pm 1.150$
photometric centroid source offset	$0.69 \pm 0.60$	1.16	$0.48 \pm 0.62$	$0.49 \pm 0.58$

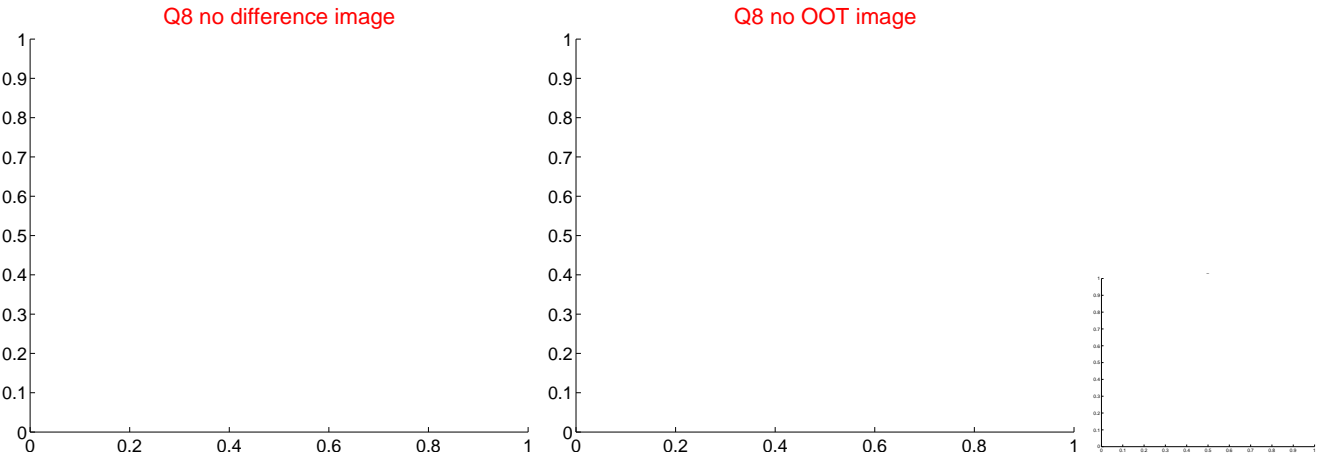
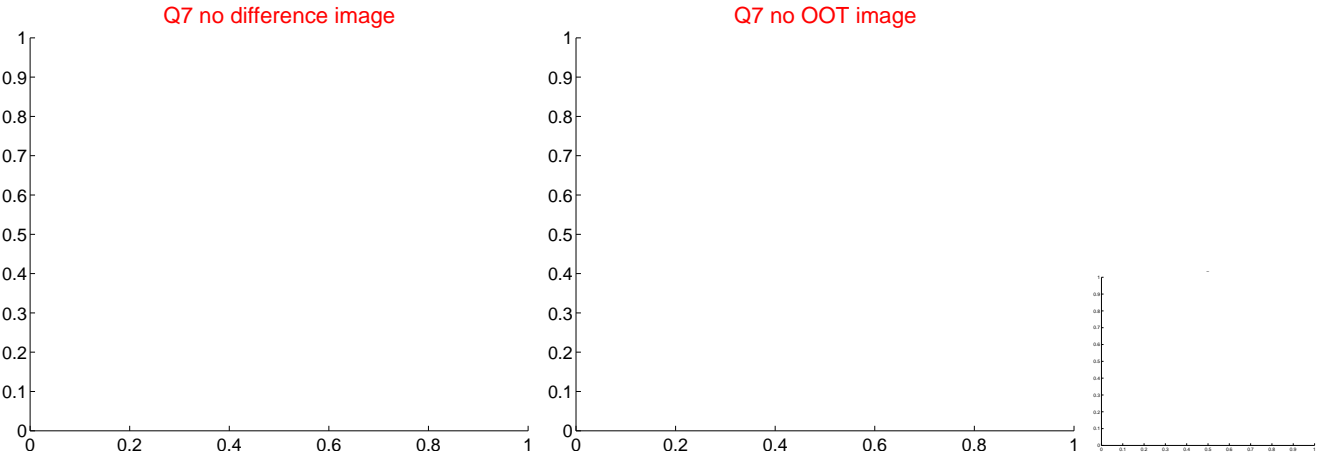
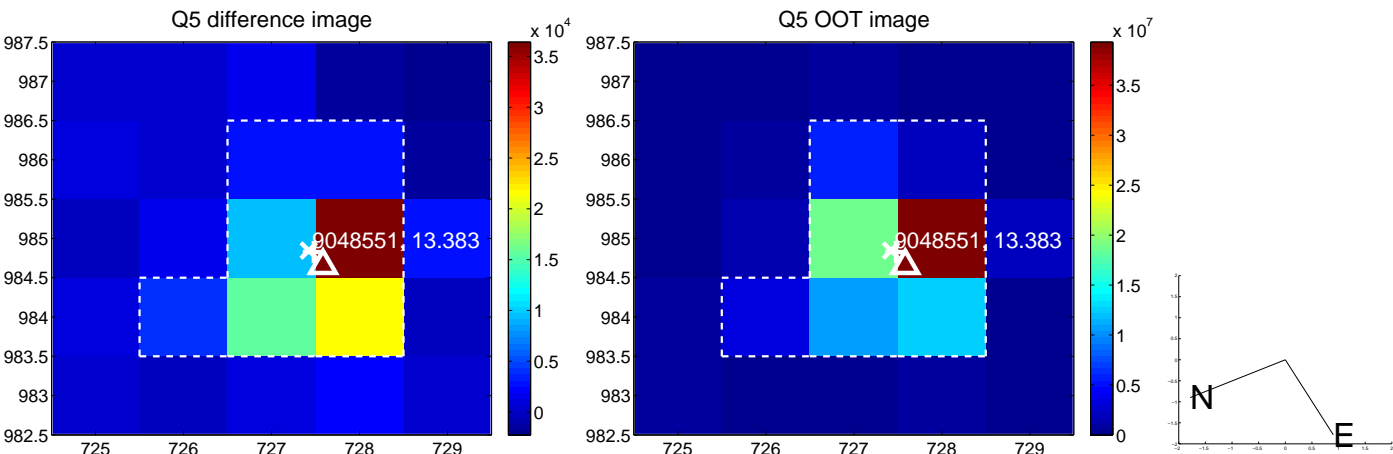


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

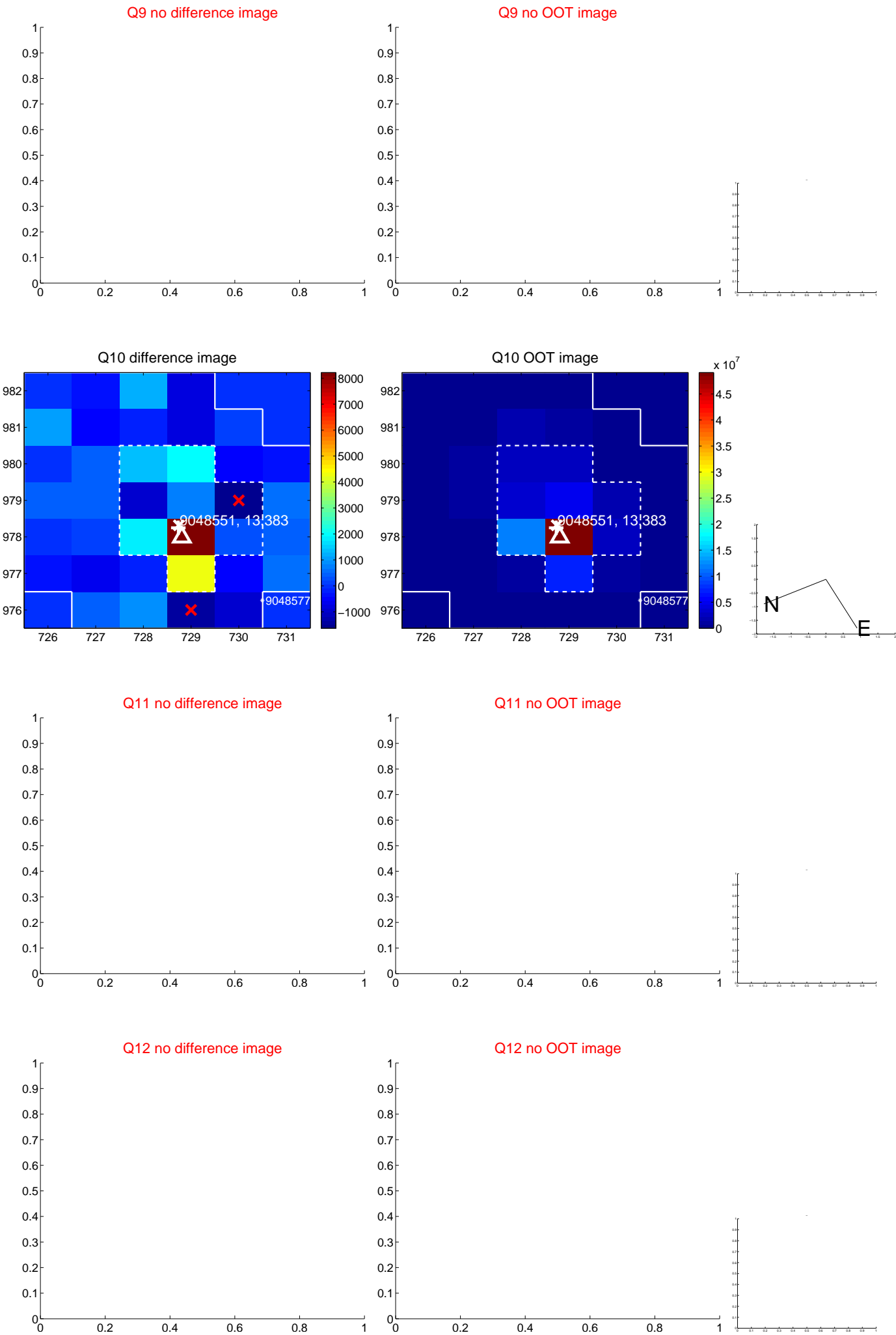
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



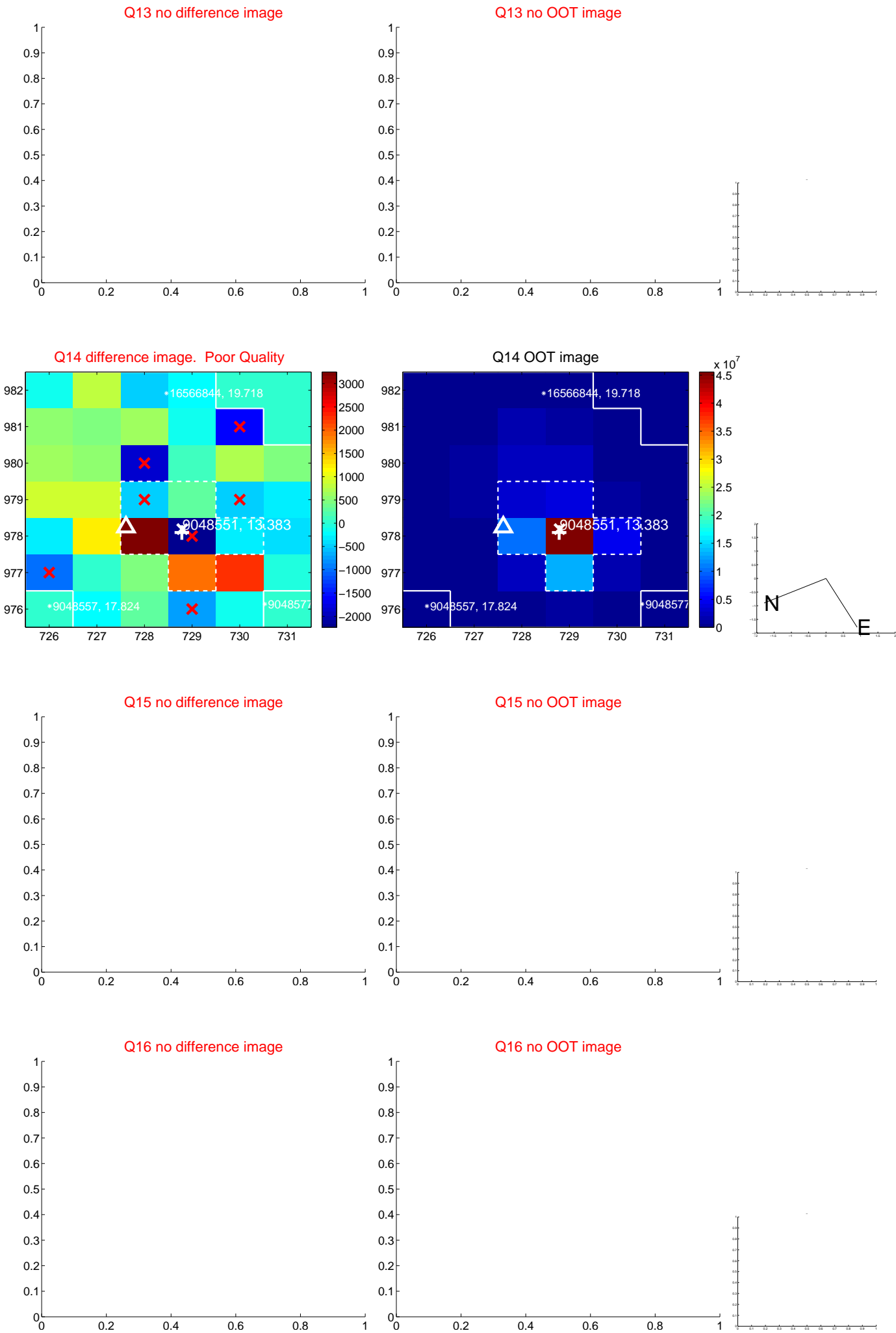
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



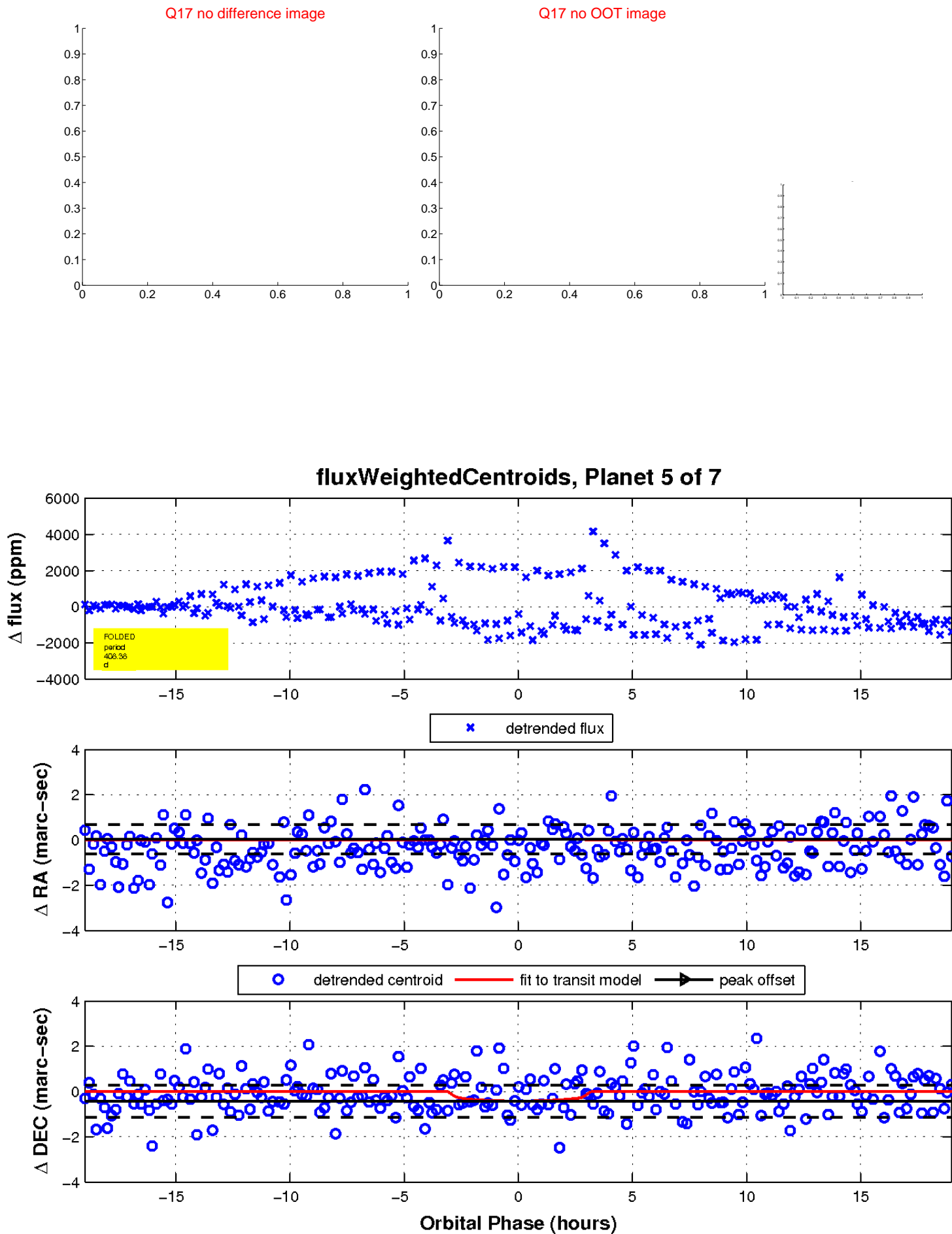
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

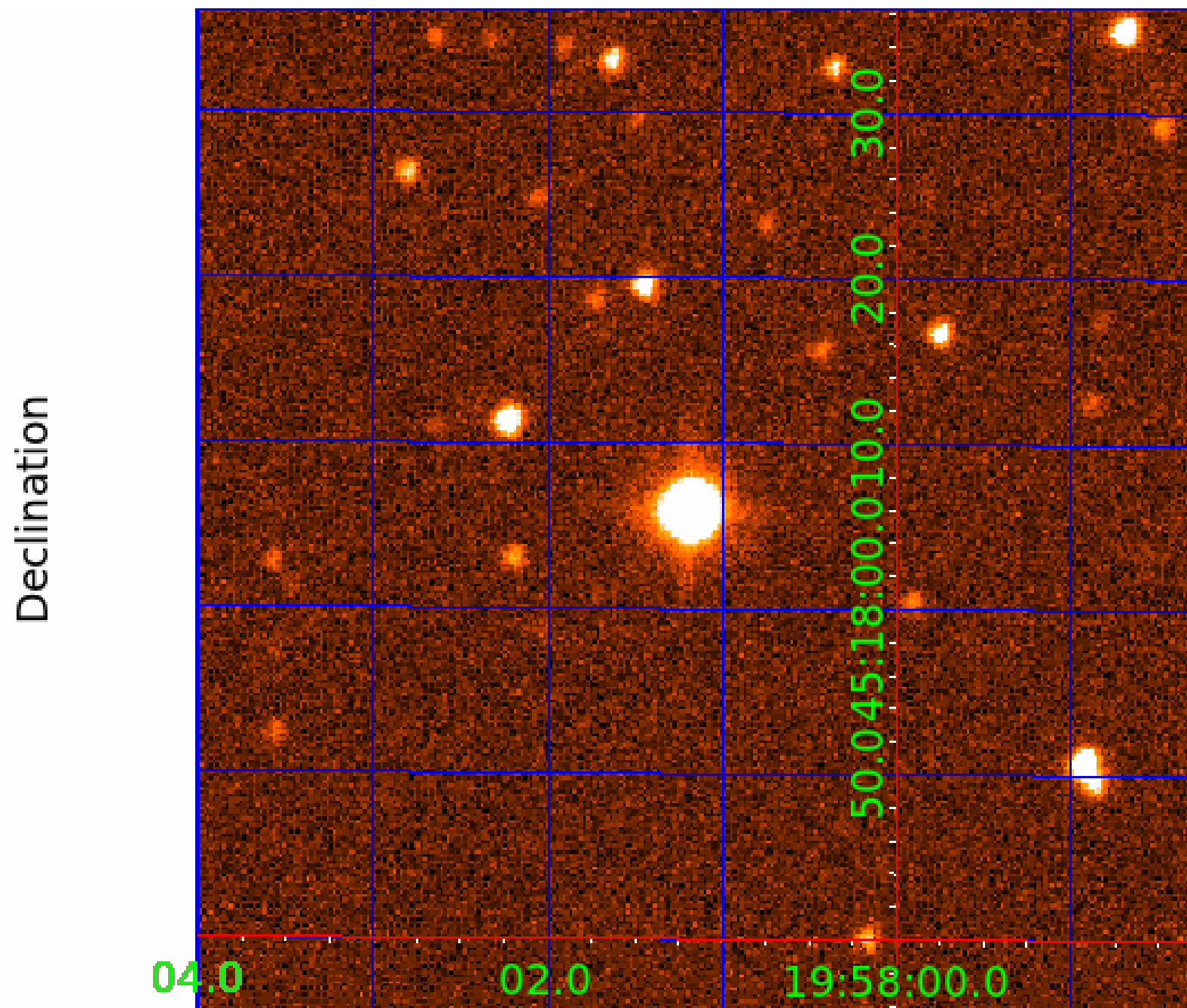


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





UKIRT Image



# KIC 009048551

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009048551-01	OBS	No	315.960993	412.736558	1108.2	3.262	15.2	8.9	0.64	4121	2.21	0.17
009048551-02	OBS	No	458.095786	295.711690	1262.4	5.021	14.1	9.4	0.64	4121	2.26	0.10
009048551-03	OBS	No	491.011724	162.990025	1163.3	16.705	13.2	6.2	0.64	4121	2.61	0.10
009048551-04	OBS	No	350.482711	239.011801	859.4	3.416	13.7	6.8	0.64	4121	1.79	0.15
009048551-05	OBS	No	408.379130	517.458281	846.0	6.355	11.3	6.3	0.64	4121	2.01	0.12
009048551-06	OBS	No	514.912717	311.009898	707.7	8.063	11.1	5.5	0.64	4121	1.73	0.09
009048551-07	OBS	No	419.473543	248.293169	161.8	16.653	13.0	1.0	0.64	4121	0.90	0.12

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009048551-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS
009048551-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_POS_DV
009048551-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL—LPP_DV—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009048551-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009048551-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009048551-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009048551-07	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_TRACKER—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—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.

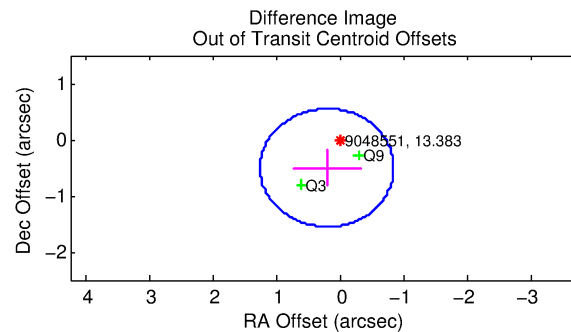
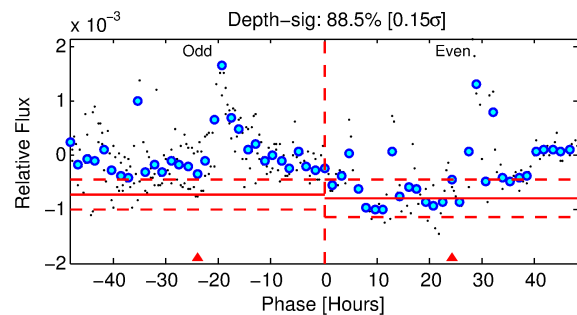
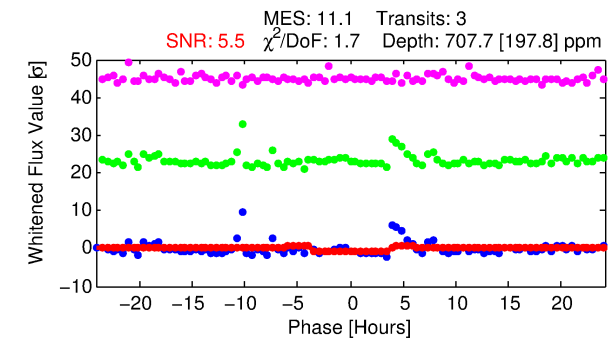
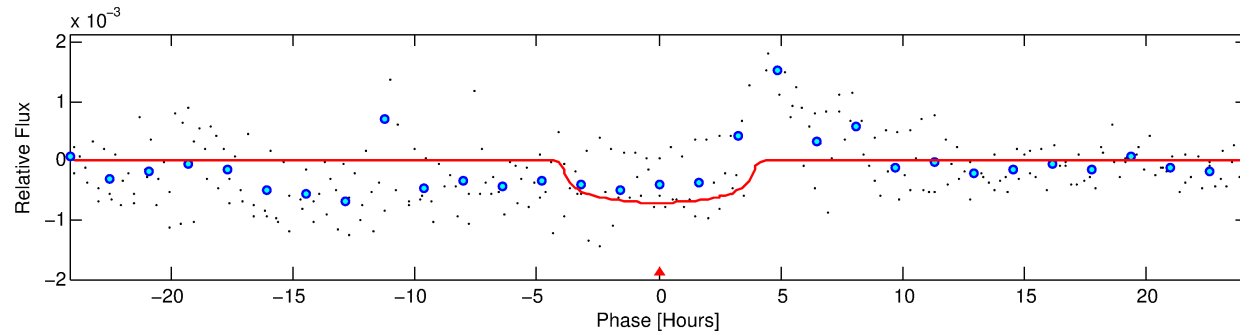
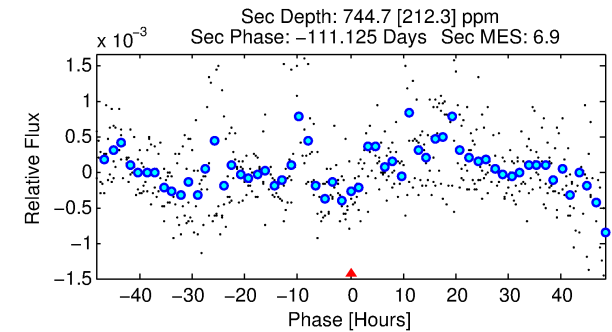
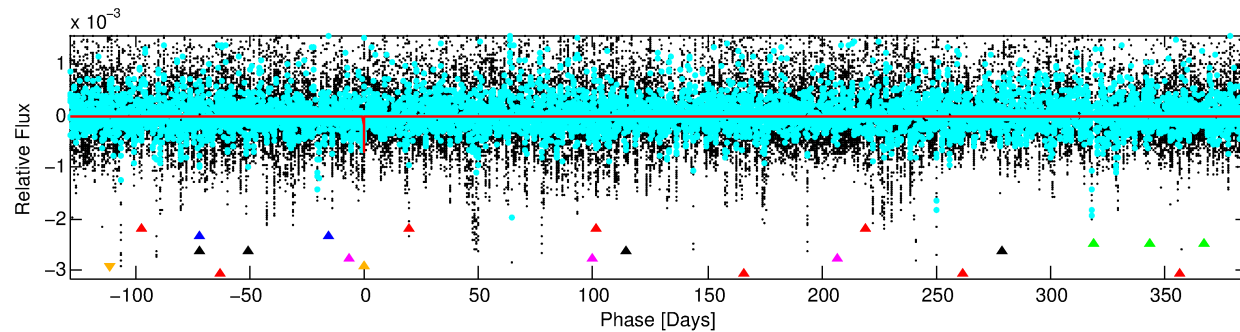
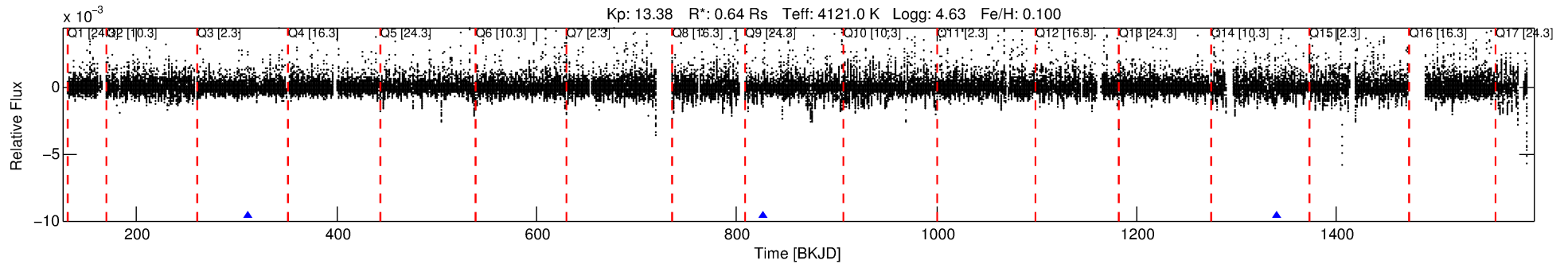
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 009048551-06

No Significant Match Found

# DV One-Page Summary

KIC: 9048551 Candidate: 6 of 7 Period: 514.913 d



## DV Fit Results:

Period = 514.91272 [0.01079] d  
Epoch = 311.0099 [0.0145] BKJD  
Rp/R\* = 0.0249 [0.0248]  
a/R\* = 418.27 [1369.05]  
b = 0.56 [4.03]  
Seff = 0.09 [0.01]  
Teq = 140 [6] K  
Rp = 1.73 [1.73] Re  
a = 1.0785 [0.0771] AU  
Ag = 160116.68 [323423.11] [0.50 $\sigma$ ]  
Teffp = 4318 [2183] K [1.91 $\sigma$ ]

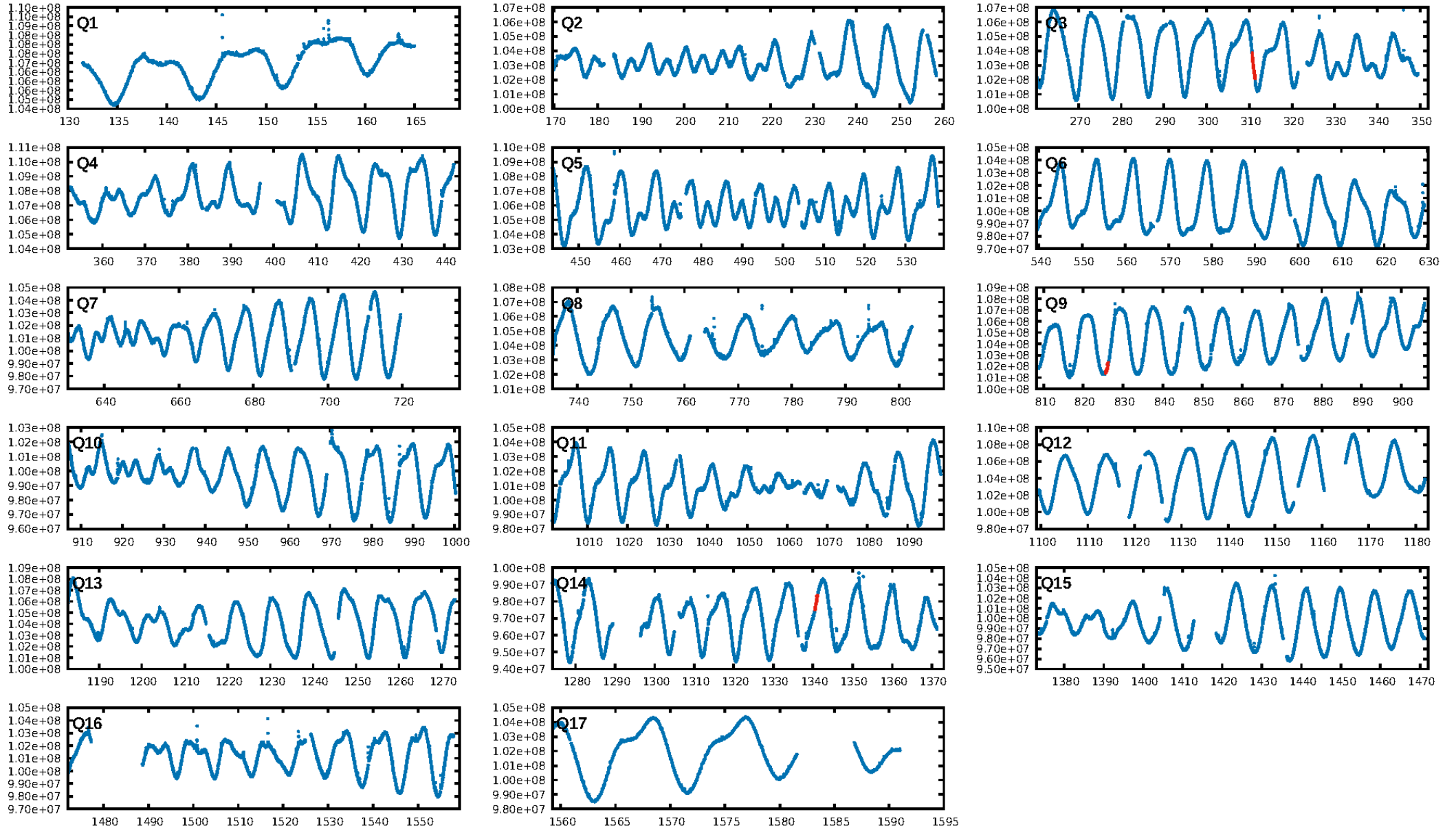
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [30.93 $\sigma$ ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 3.8%  
ModelChiSquareGof-sig: 83.5%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [3/3]  
**GhostDiagnostic-chr: -0.5413**  
Centroid-sig: 1.6%  
Centroid-so: 1.204 arcsec [1.70 $\sigma$ ]  
OotOffset-rm: 0.546 arcsec [1.56 $\sigma$ ]  
OotOffset-st: 0/1/0/1 [2]  
KicOffset-rm: 0.739 arcsec [1.89 $\sigma$ ]  
KicOffset-st: 0/1/0/1 [2]  
DiffImageQuality-fgm: 1.00 [2/2]  
DiffImageOverlap-fno: 1.00 [3/3]

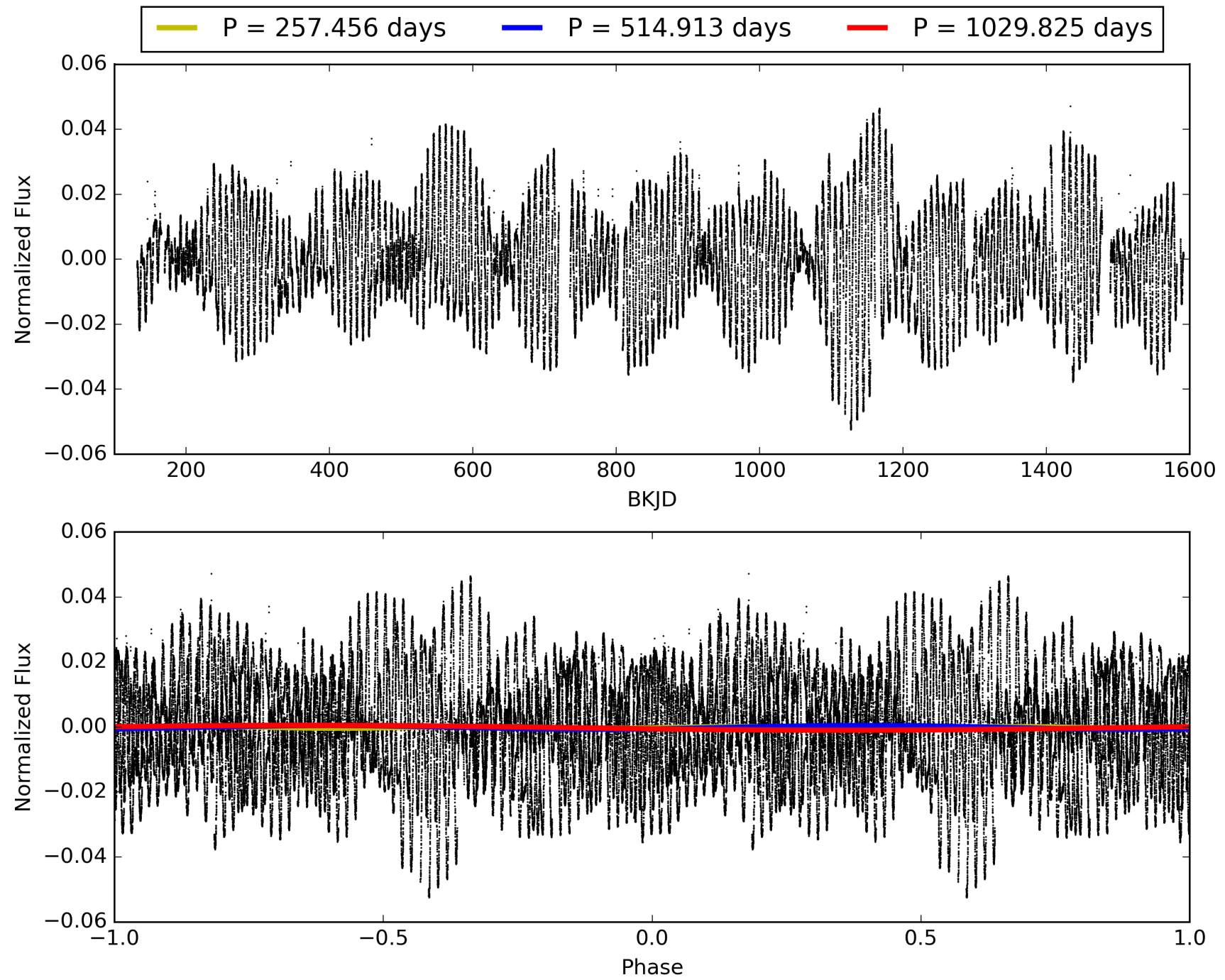
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 13:48:32 Z

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

# TCE 009048551-06, PDC Light Curves

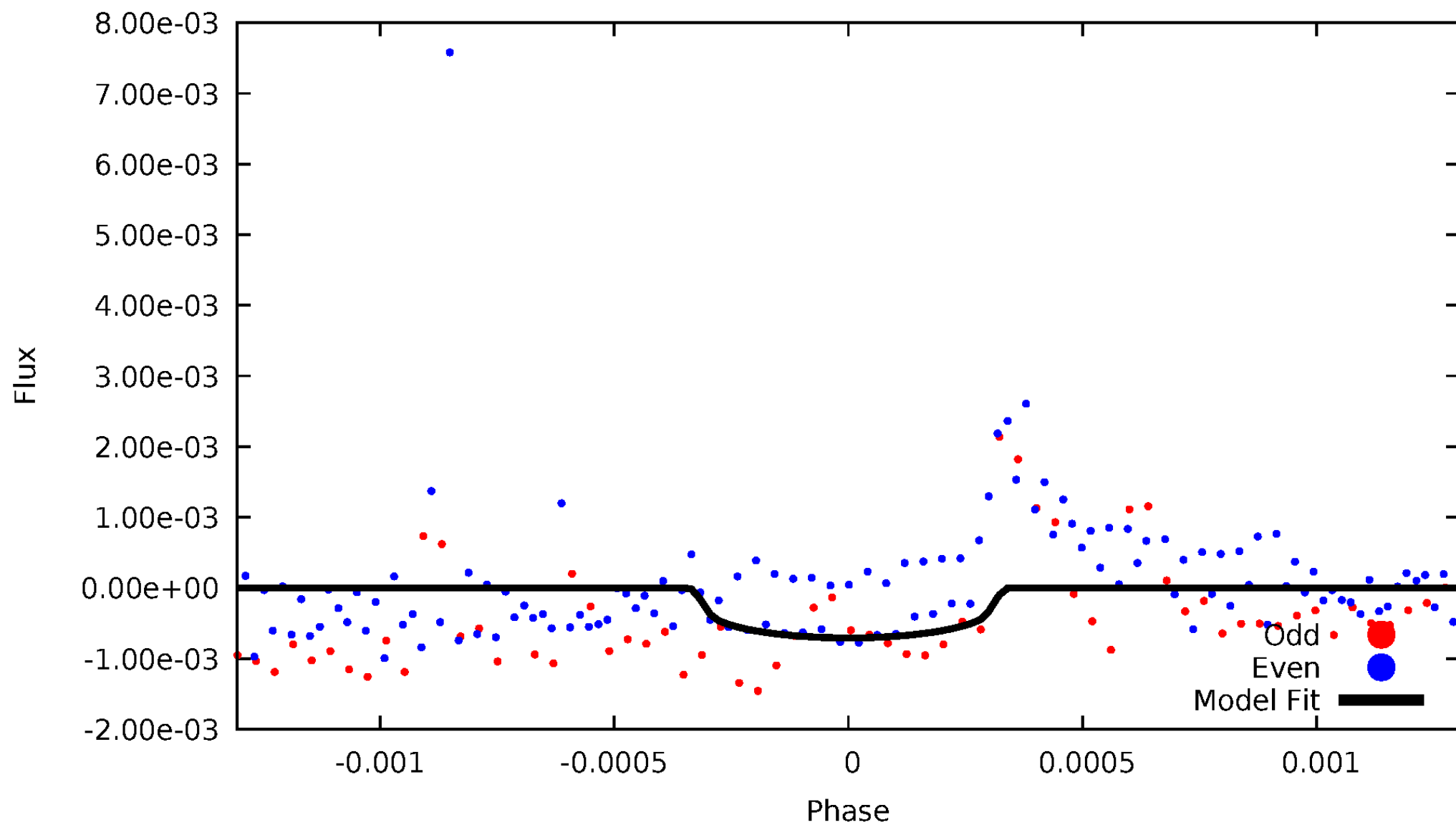


TCE 009048551-06



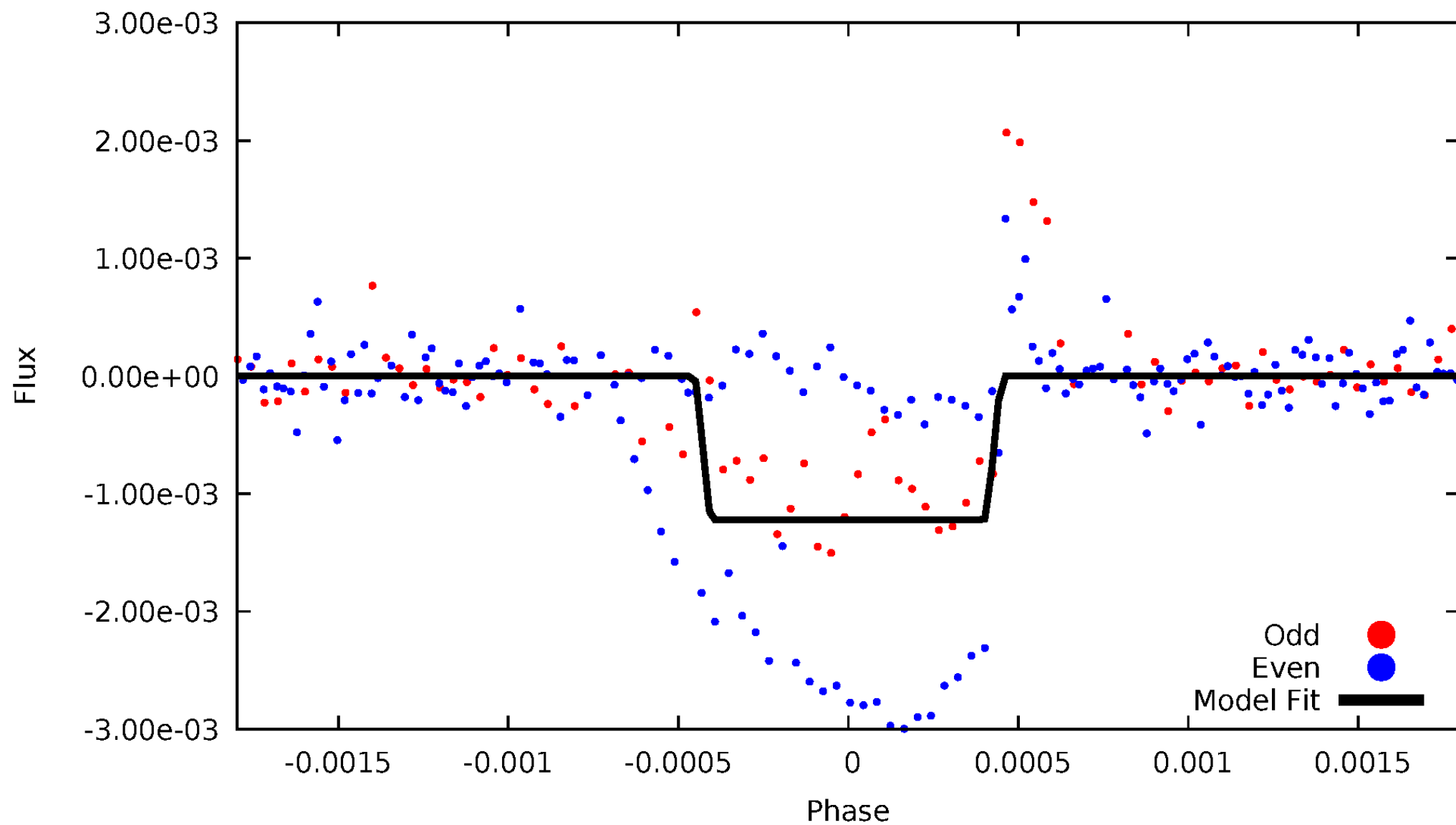
# DV Odd/Even

TCE 009048551-06



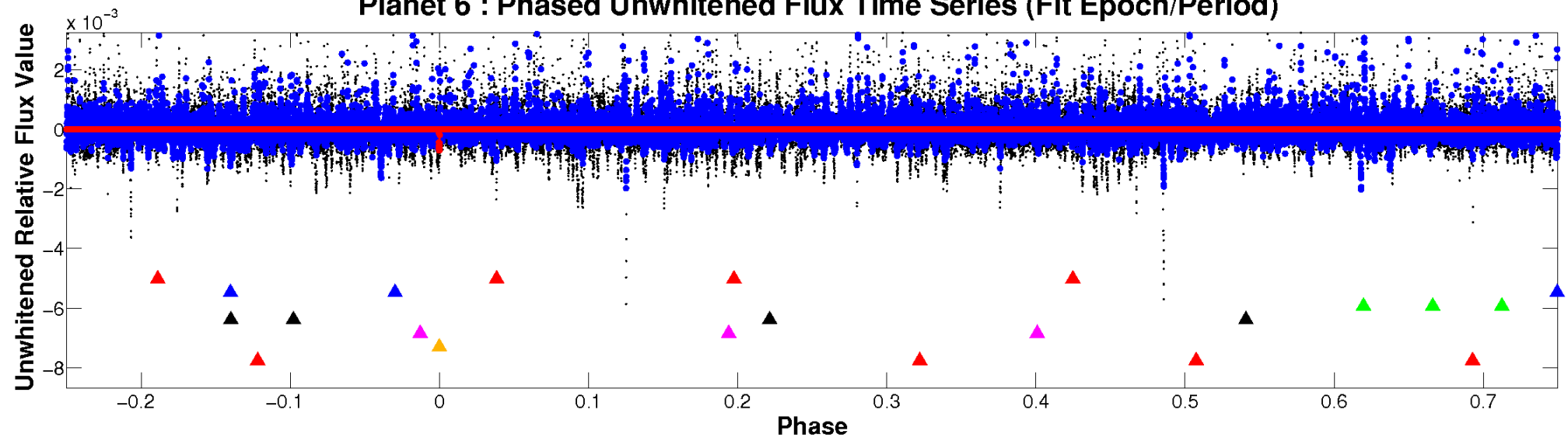
# ALT Odd/Even

TCE 009048551-06

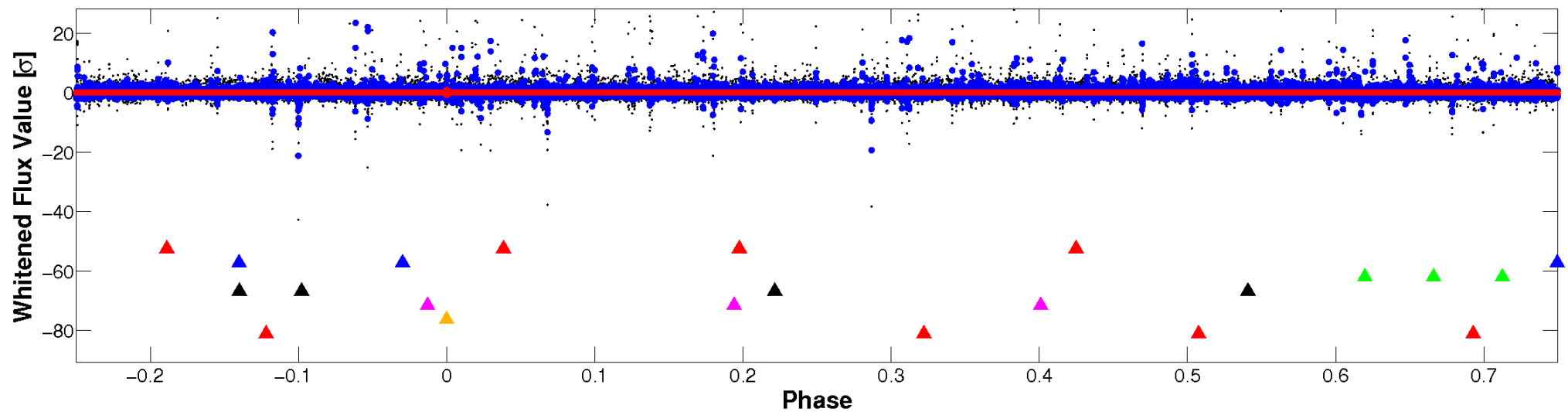


# Non-Whitened Vs. Whitened Light Curve

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



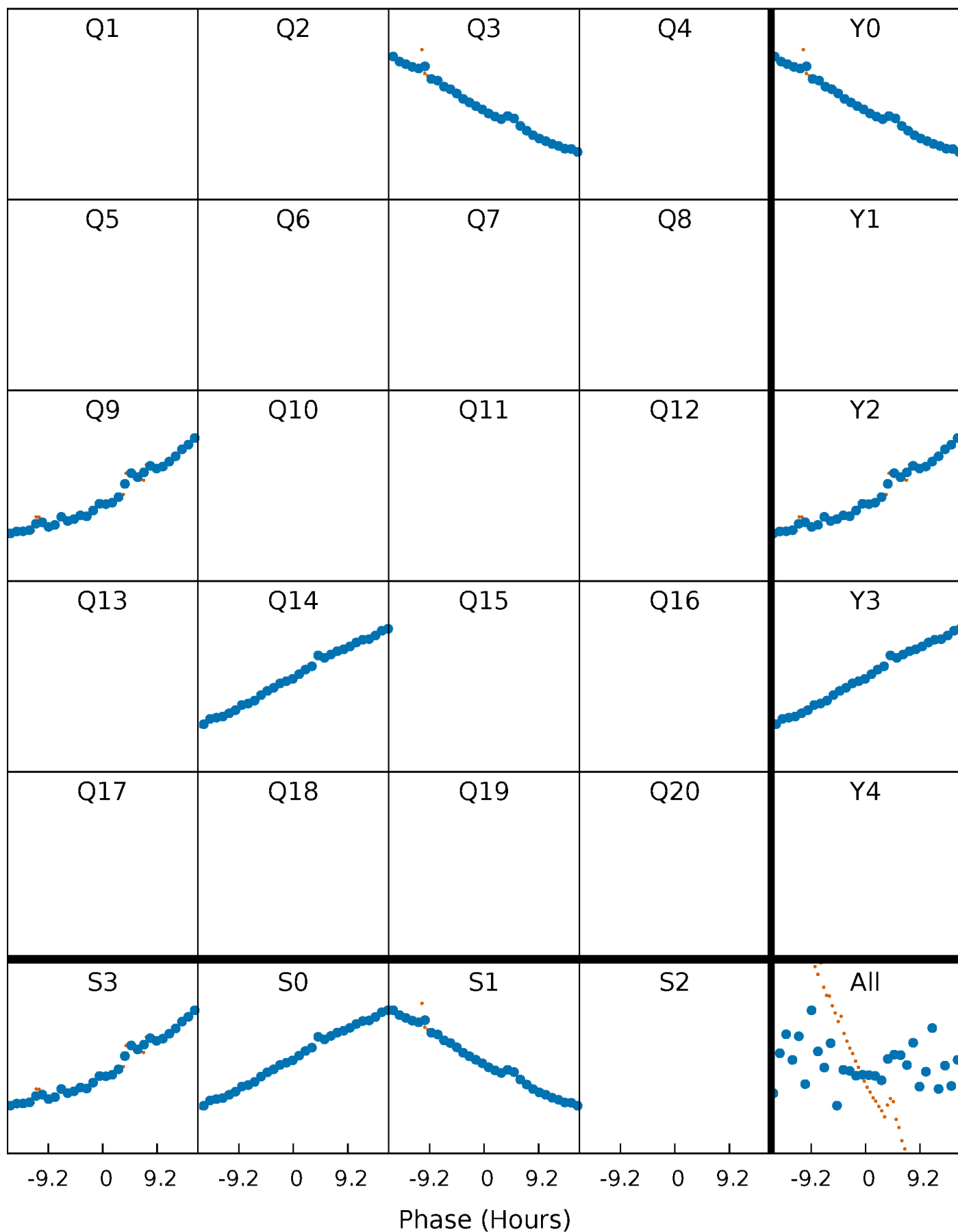
## Planet 6 : Phased Whitened Flux Time Series (Fit Epoch/Period)





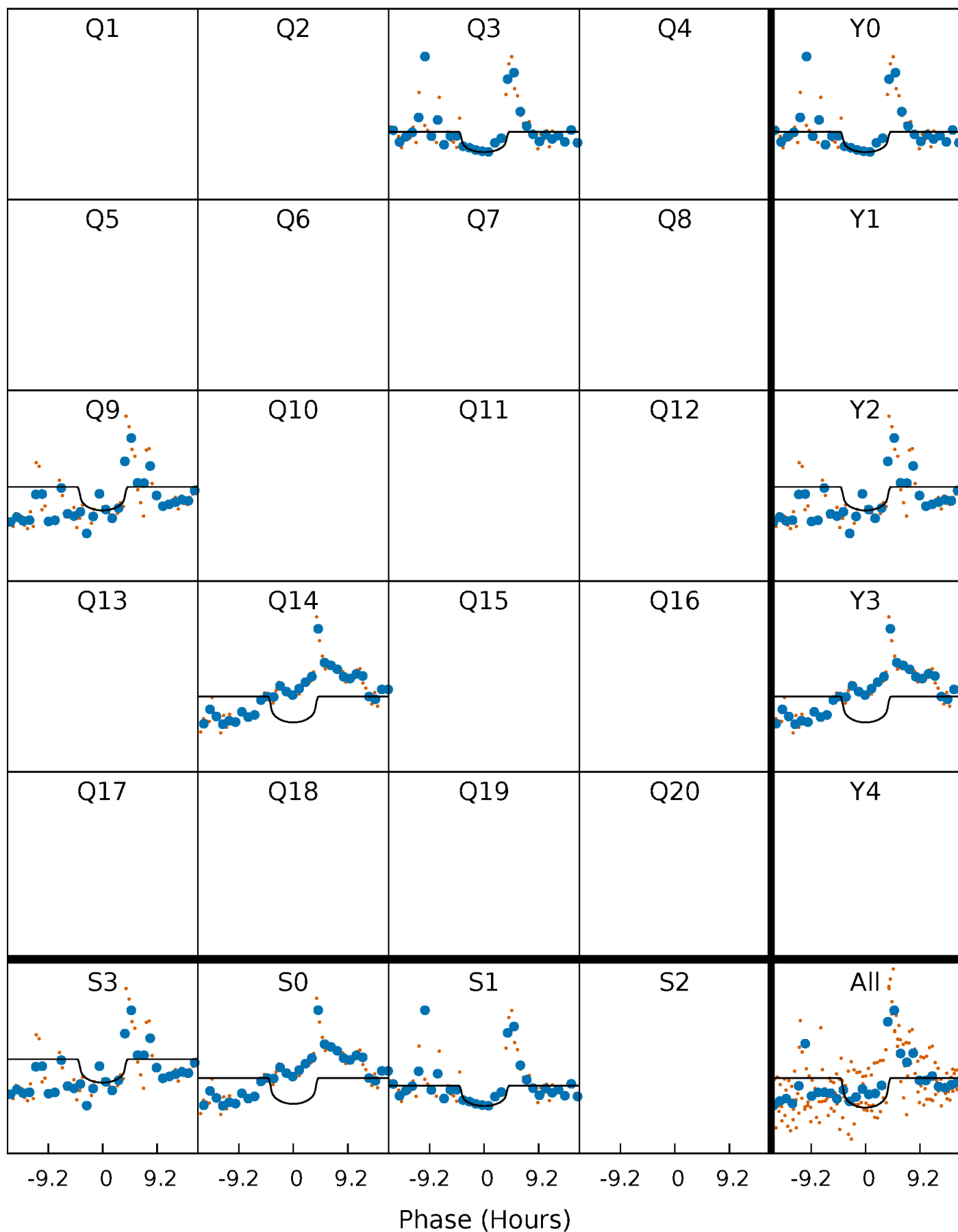
# PDC Quarter-Phased Transit Curves

TCE 009048551-06 P=514.912717 Days  $T_0=311.009898$  (BKJD)



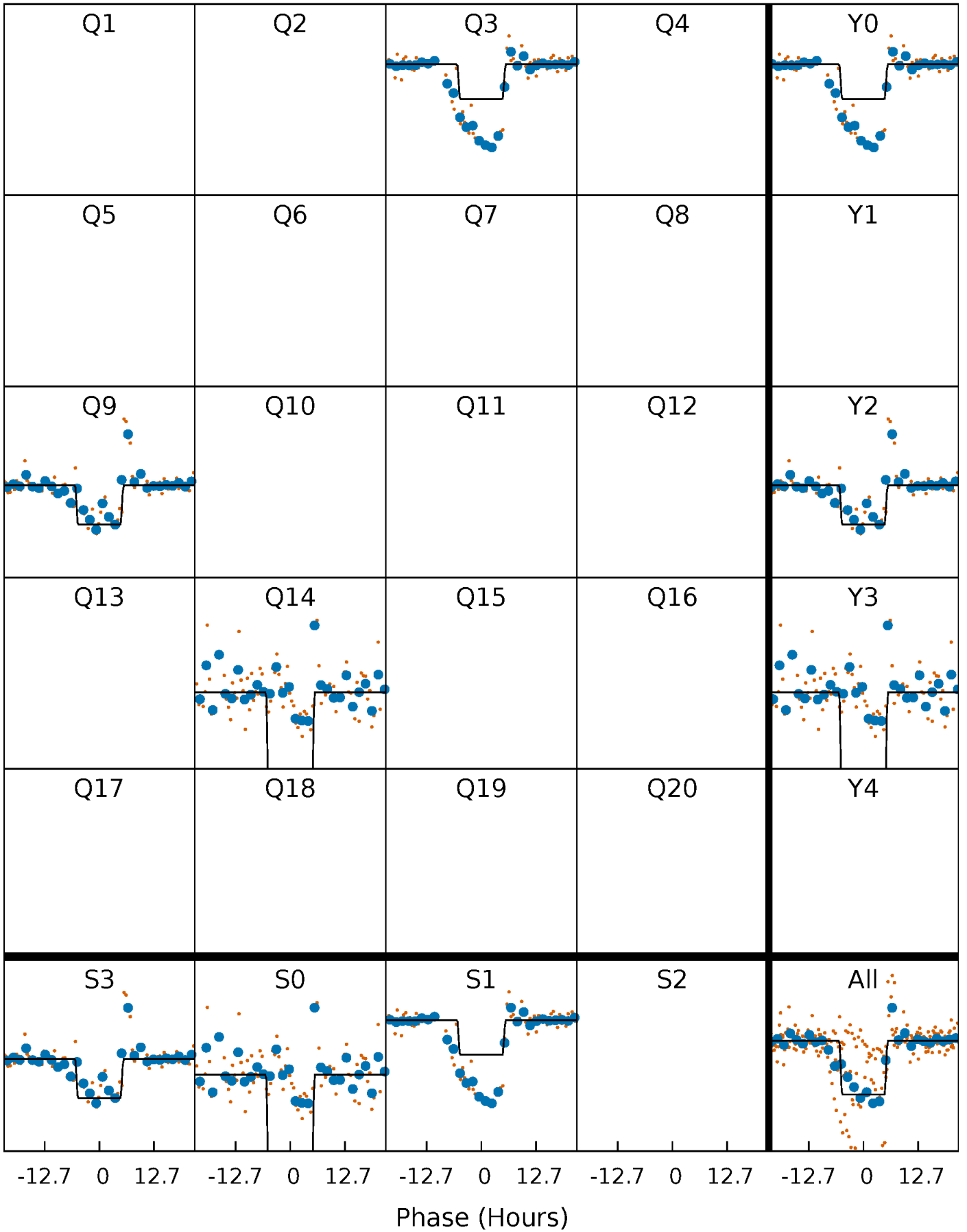
# DV Quarter-Phased Transit Curves

TCE 009048551-06 P=514.912717 Days  $T_0=311.009898$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

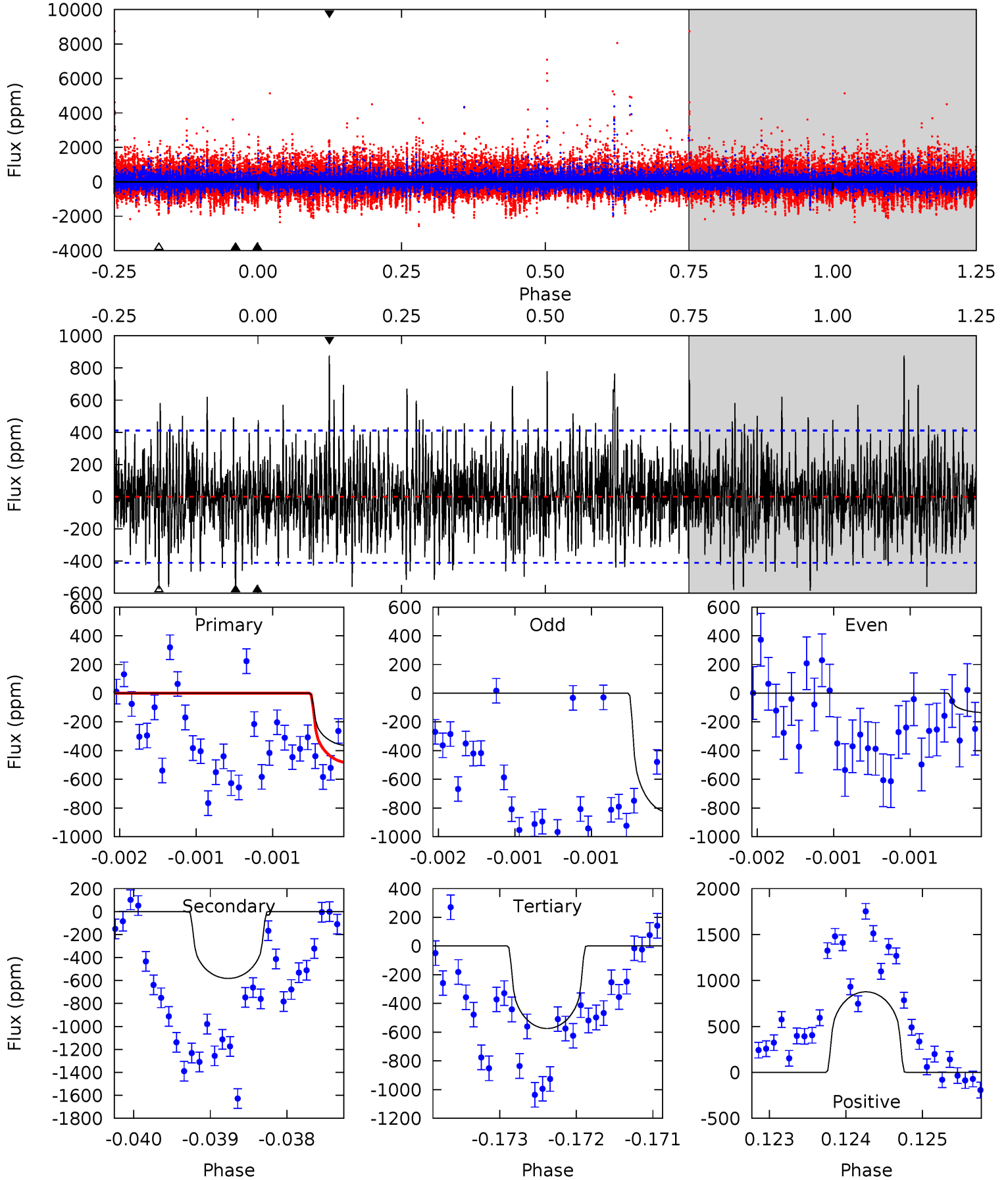
TCE 009048551-06 P=514.912090 Days  $T_0=310.937079$  (BKJD)



# DV Model-Shift Uniqueness Test

009048551-06, P = 514.912717 Days, E = 311.009898 Days

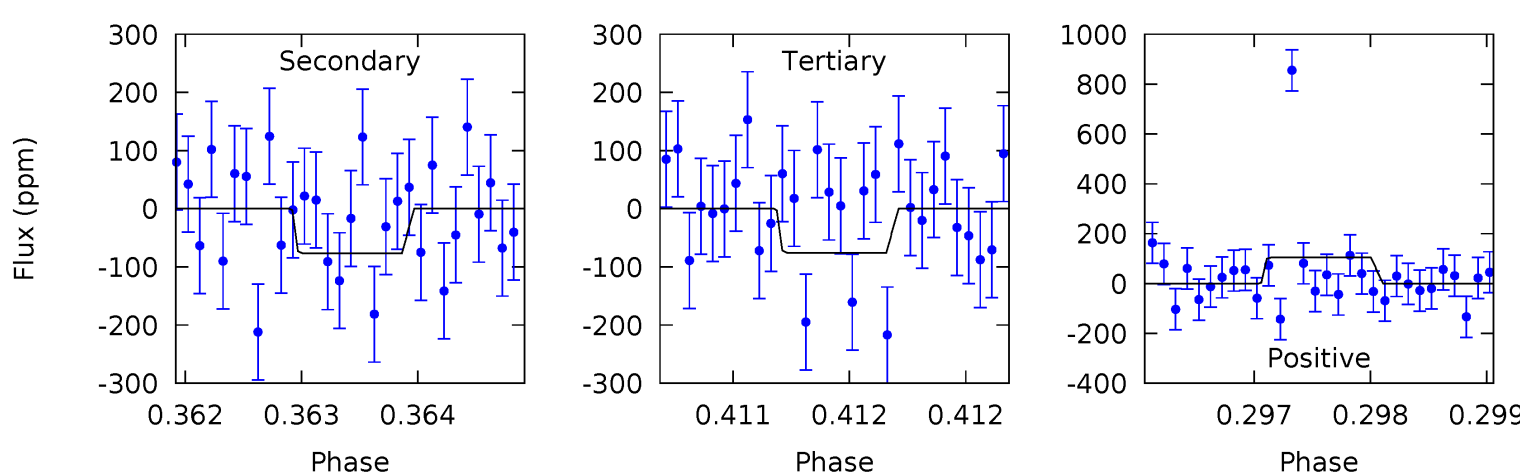
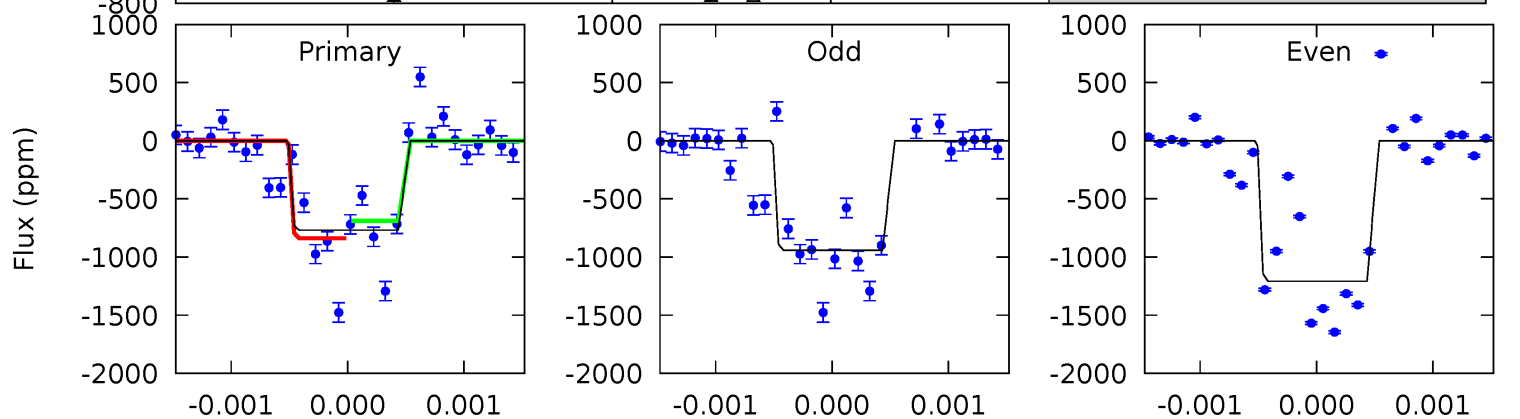
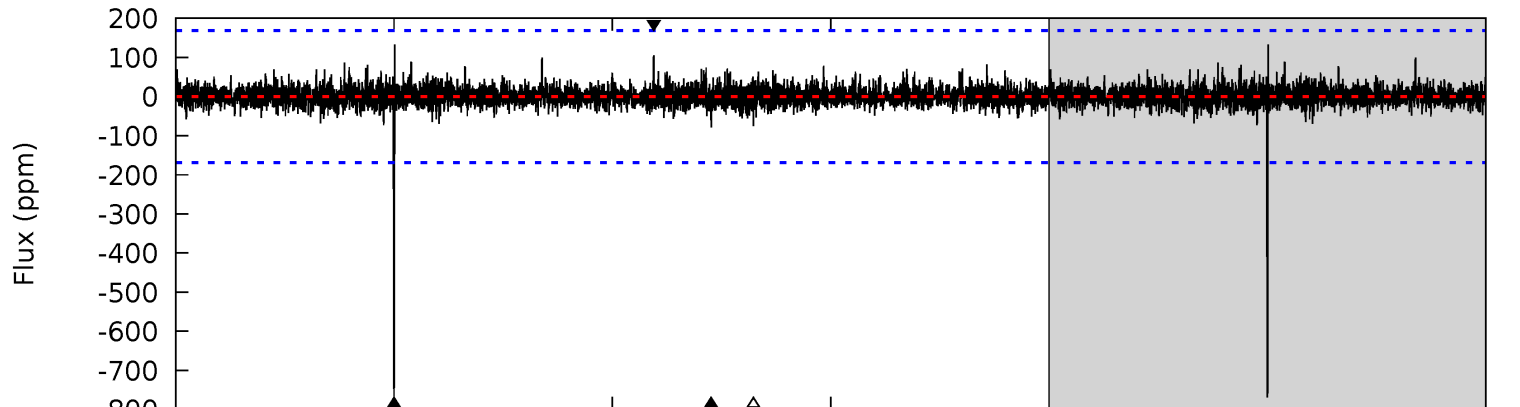
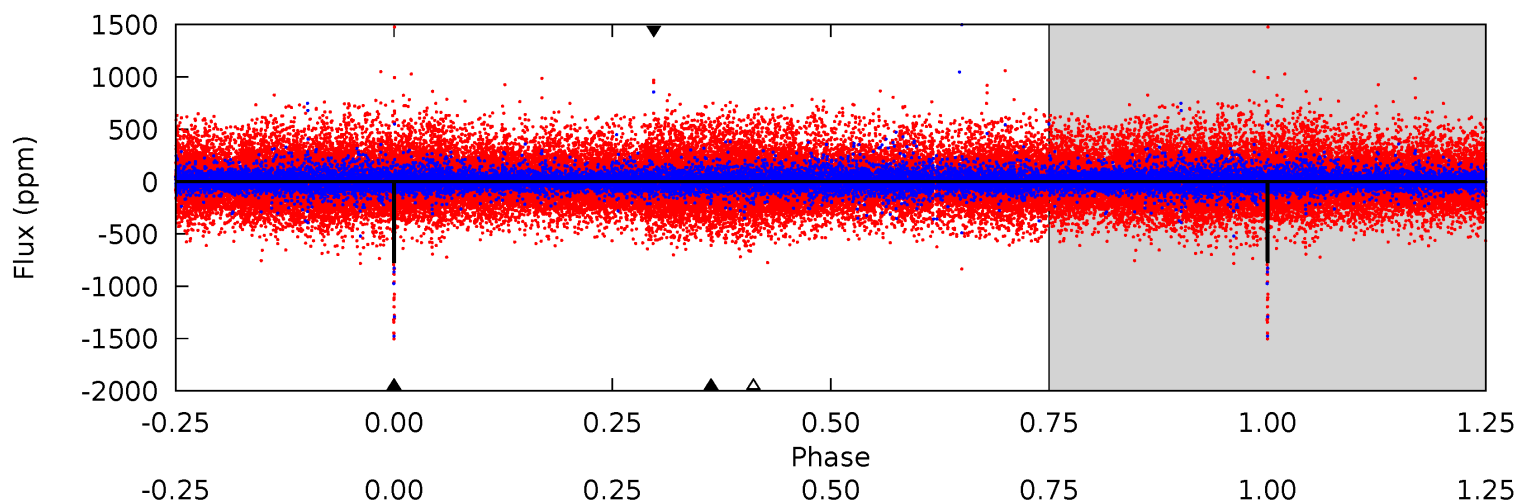
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
4.92	7.82	7.72	11.8	5.52	3.40	2.33	-2.80	-6.86	0.10	-3.96	3.38	0.67	0.60	1.54



# Alt Model-Shift Uniqueness Test

009048551-06, P = 514.912090 Days, E = 310.937079 Days

Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
24.9	2.49	2.45	3.40	5.47	3.32	0.55	22.5	21.5	0.04	-0.91	5.39	1.25	0.15	2.39



### Stellar Parameters For KIC 009048551

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$4121^{+123}_{-136}$	$4.631^{+0.049}_{-0.017}$	$0.100^{+0.250}_{-0.300}$	$0.636^{+0.031}_{-0.058}$	$0.631^{+0.050}_{-0.056}$	$3.455^{+0.811}_{-0.299}$
	+3%/-3%	+1%/-0%	+250%/-300%	+5%/-9%	+8%/-9%	+23%/-9%
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 009048551-06 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-582 \pm 74$	$2.04^{+1.58}_{-1.27}$	$193^{+7}_{-7}$	$3838^{+1722}_{-664}$	$91254^{+572509}_{-62402}$
Alt.	$-77 \pm 31$	$2.50^{+1.83}_{-1.33}$	$194^{+6}_{-7}$	$2634^{+707}_{-334}$	$6788^{+30039}_{-4490}$

$T_{max}$  = Theoretical Maximum Planetary Temperature

$T_{obs}$  = Observed Planetary Temperature (Assuming  $A=0.3$ )

$A_{obs}$  = Observed Albedo (Assuming  $T=0$ )

If a secondary eclipse is present, the system is likely an EB if  $T_{obs} \gg T_{max}$  AND  $A_{obs} \gg 1.0$

## DV Centroid Data

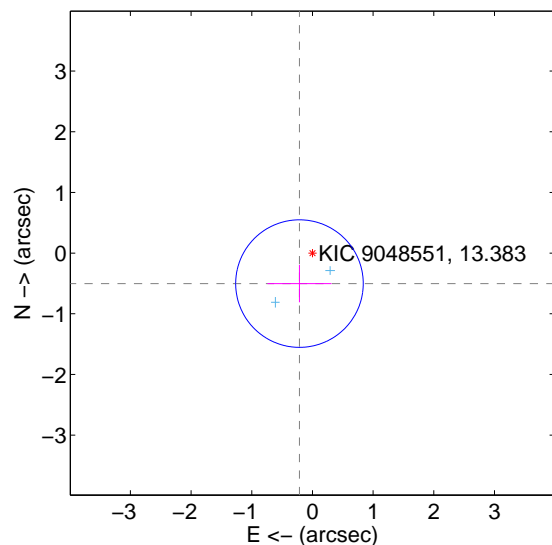
Supplemental centroid analysis for 009048551-06. Kepler magnitude: 13.38. Transit SNR 5.49

There are 2 quarters with good PRF difference image offsets

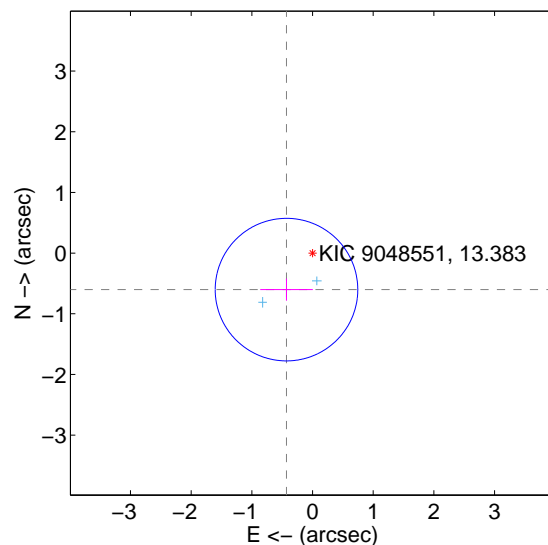
The direct PRF centroid is offset from the target star catalog position by about 0.28 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.546 \pm 0.350$	1.56	$0.214 \pm 0.528$	$-0.503 \pm 0.308$
PRF-fit source offset from KIC position	$0.739 \pm 0.392$	1.89	$0.429 \pm 0.433$	$-0.602 \pm 0.182$
photometric centroid source offset	$1.20 \pm 0.71$	1.70	$0.83 \pm 0.79$	$0.87 \pm 0.62$

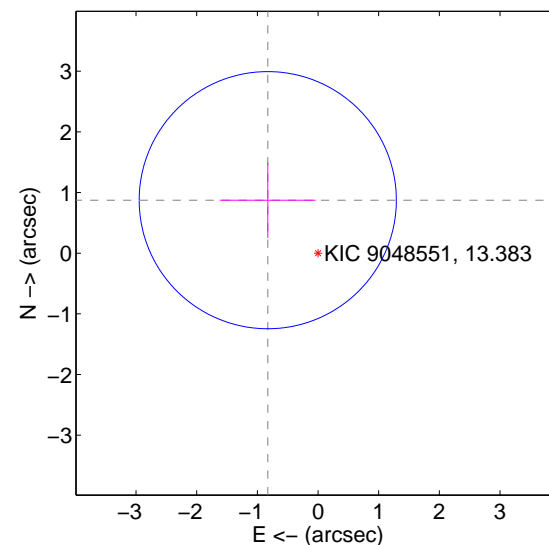
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

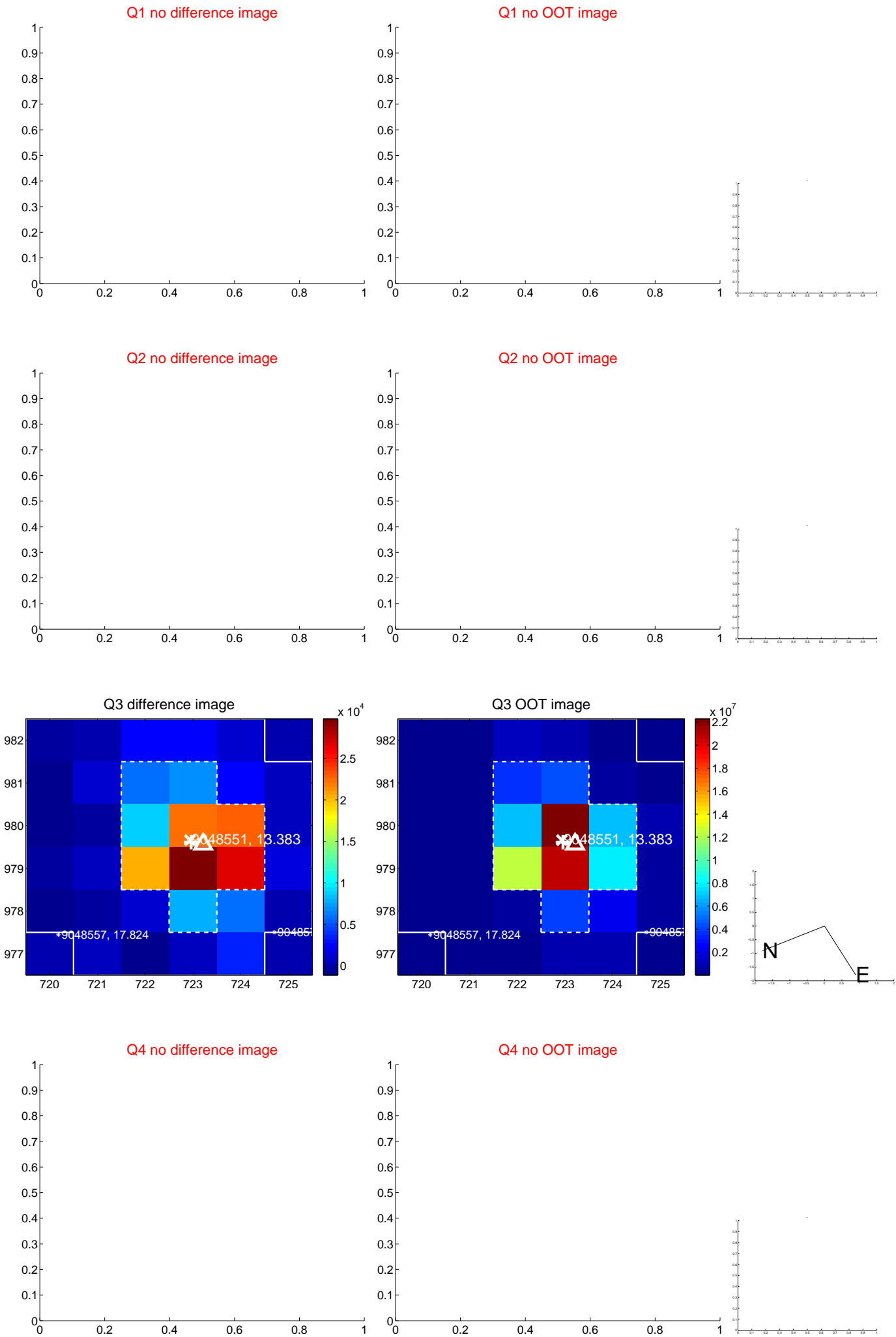


offset from photometric centroids



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

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

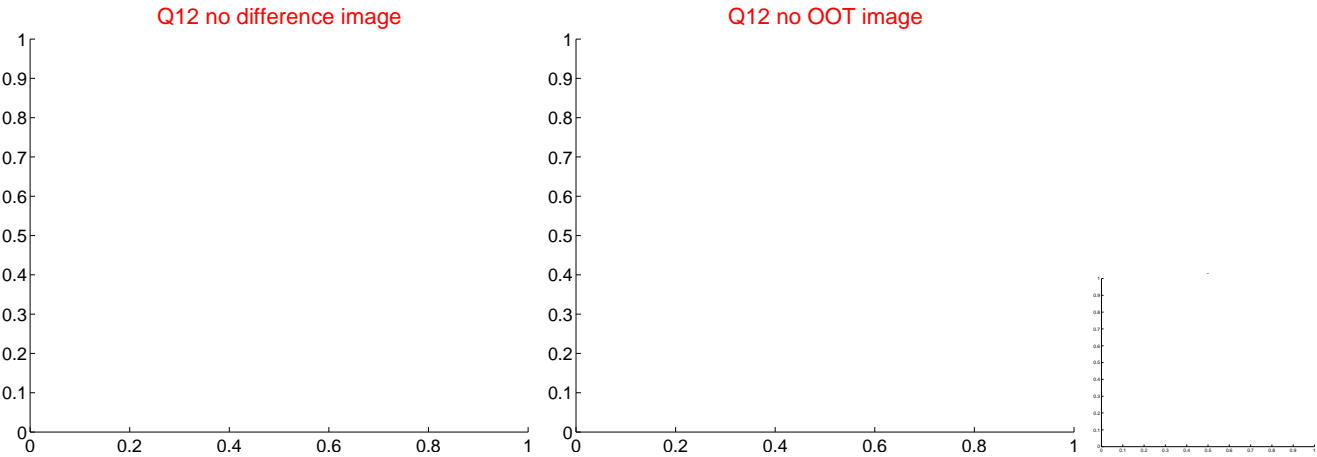
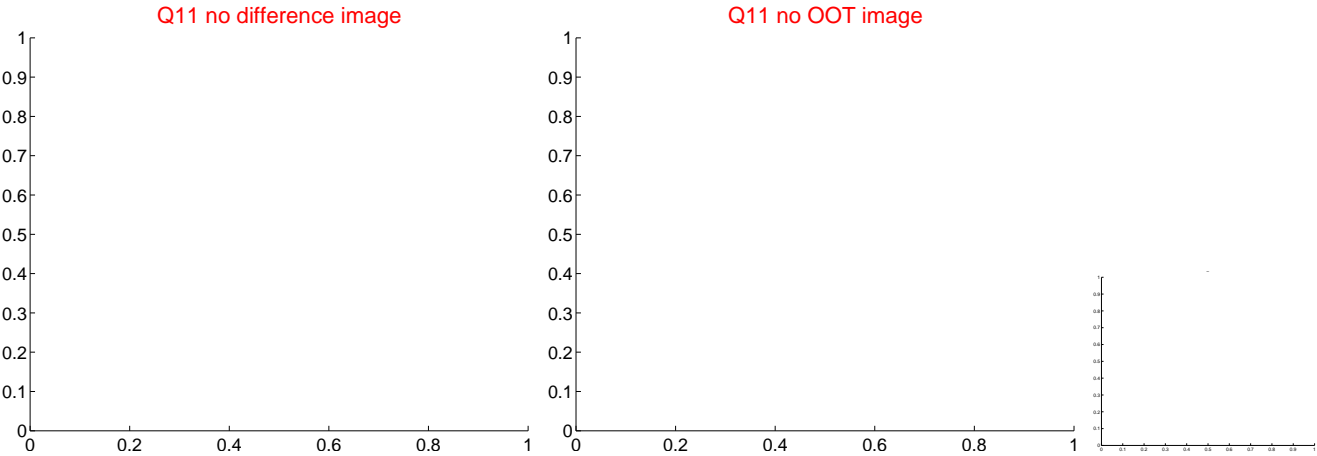
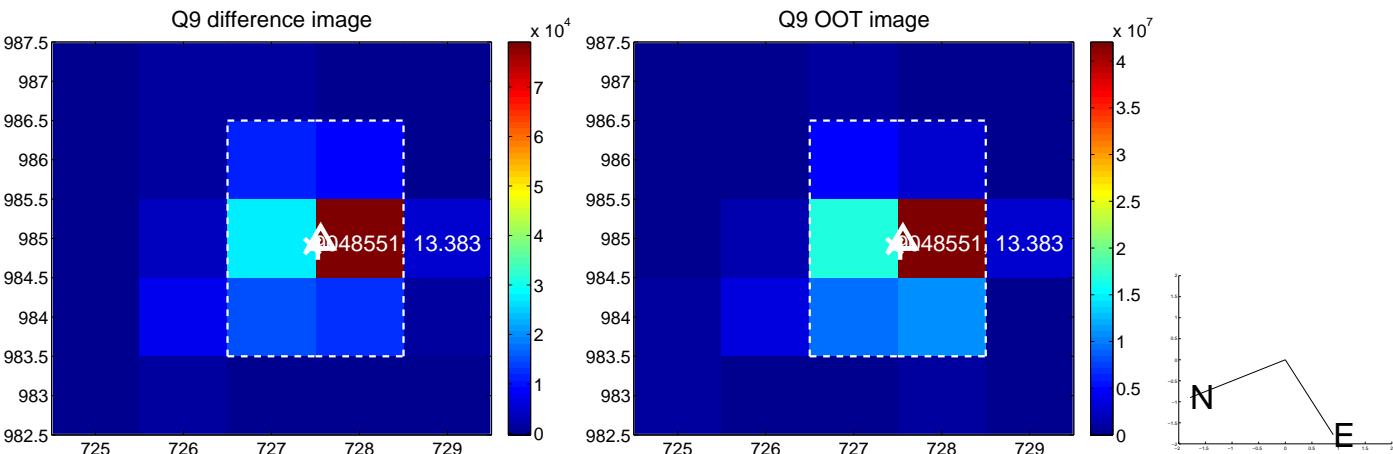




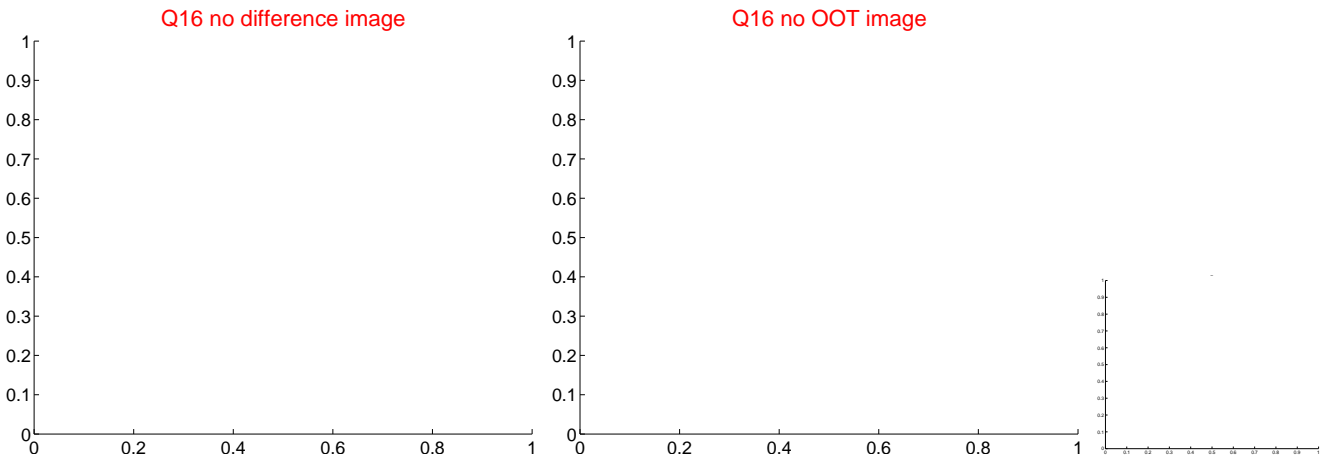
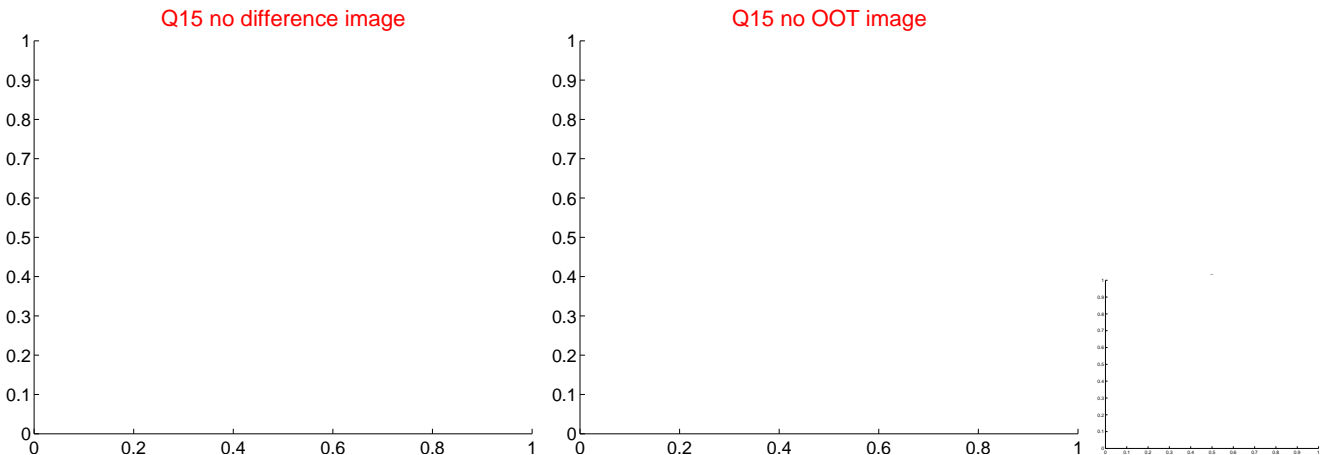
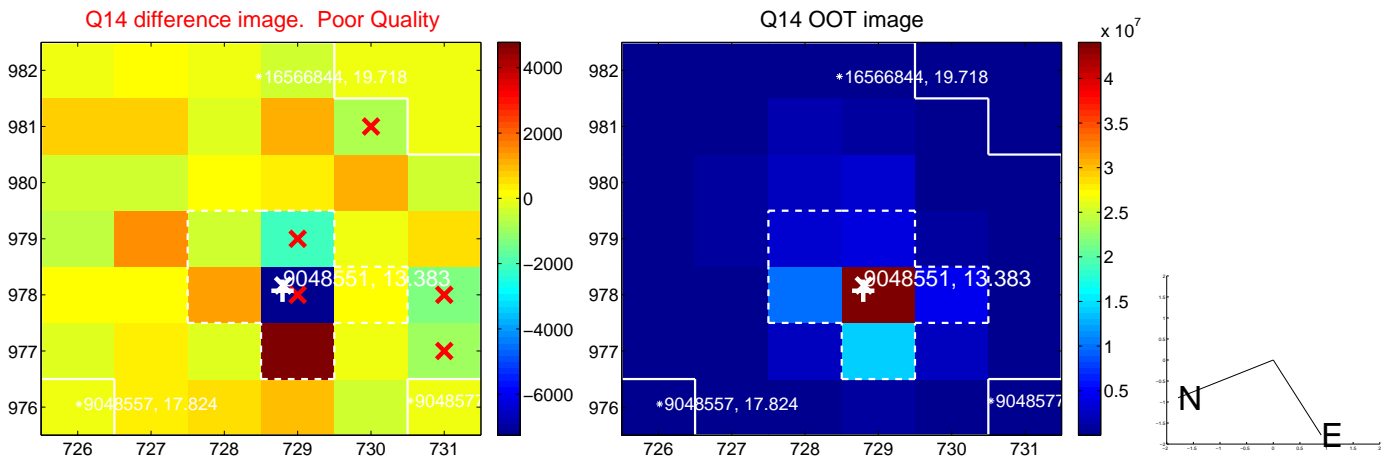
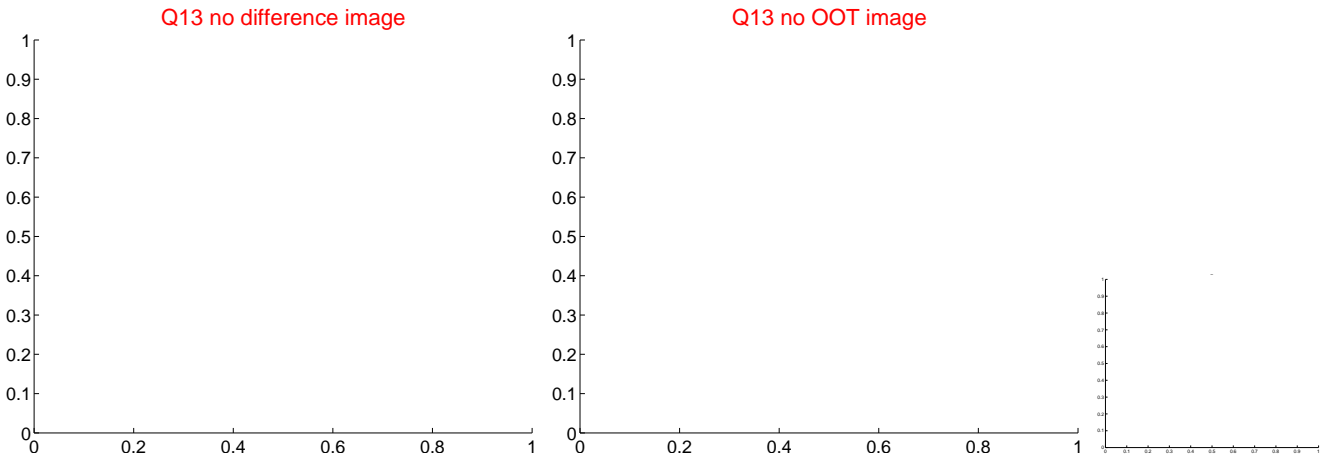
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



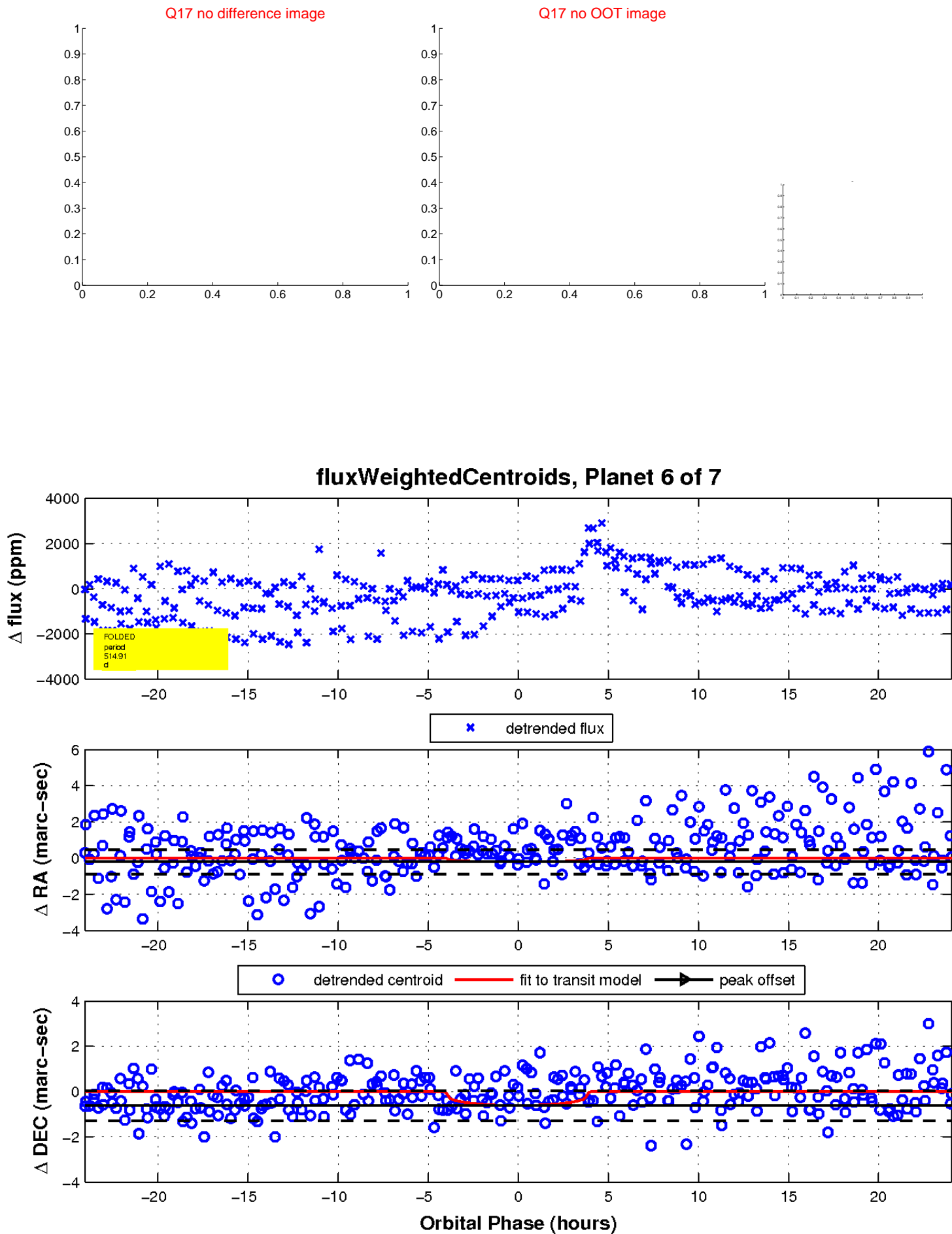
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



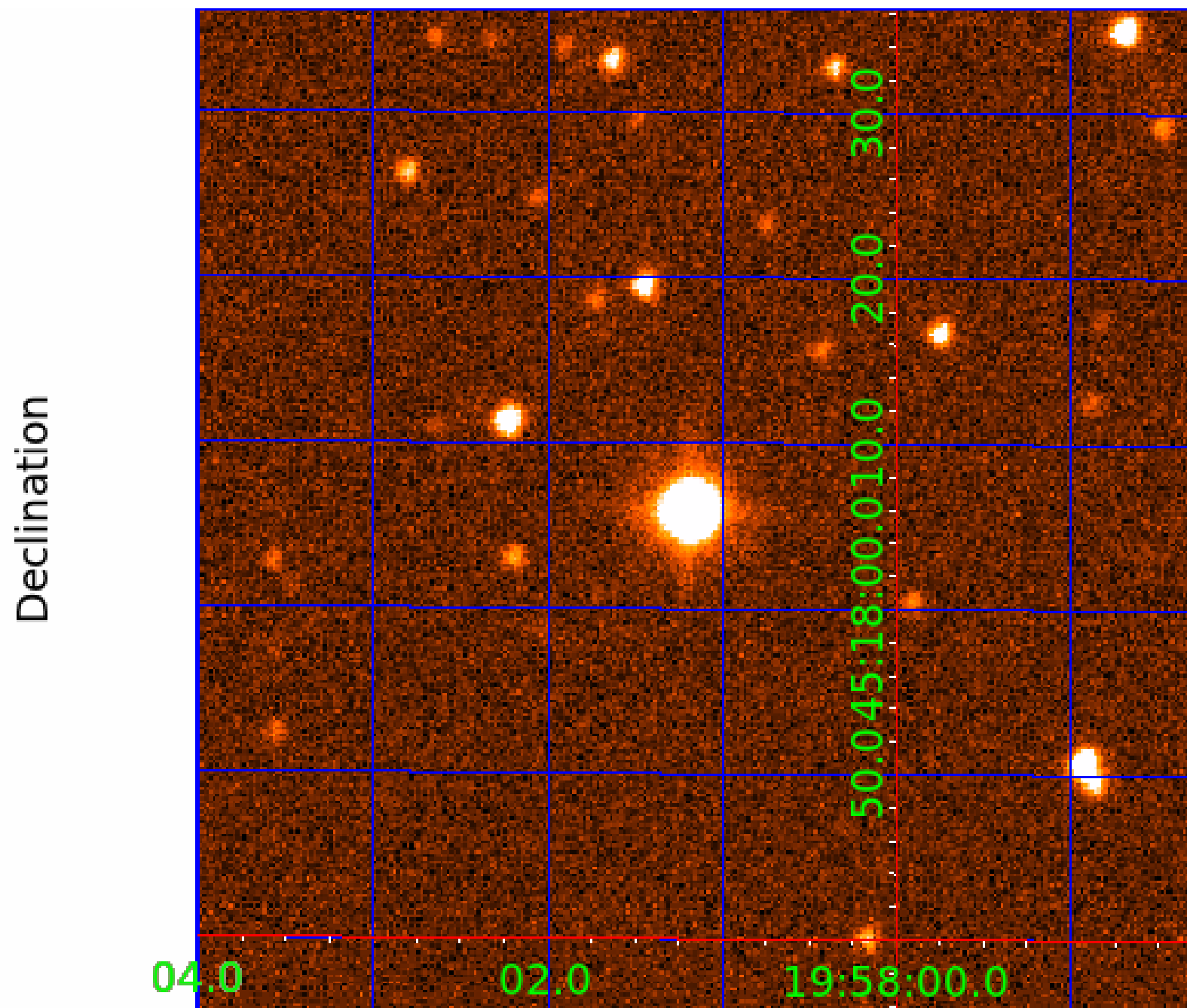
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value



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



UKIRT Image



# KIC 009048551

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009048551-01	OBS	No	315.960993	412.736558	1108.2	3.262	15.2	8.9	0.64	4121	2.21	0.17
009048551-02	OBS	No	458.095786	295.711690	1262.4	5.021	14.1	9.4	0.64	4121	2.26	0.10
009048551-03	OBS	No	491.011724	162.990025	1163.3	16.705	13.2	6.2	0.64	4121	2.61	0.10
009048551-04	OBS	No	350.482711	239.011801	859.4	3.416	13.7	6.8	0.64	4121	1.79	0.15
009048551-05	OBS	No	408.379130	517.458281	846.0	6.355	11.3	6.3	0.64	4121	2.01	0.12
009048551-06	OBS	No	514.912717	311.009898	707.7	8.063	11.1	5.5	0.64	4121	1.73	0.09
009048551-07	OBS	No	419.473543	248.293169	161.8	16.653	13.0	1.0	0.64	4121	0.90	0.12

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009048551-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS
009048551-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_POS_DV
009048551-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL—LPP_DV—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009048551-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009048551-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009048551-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009048551-07	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_TRACKER—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—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.

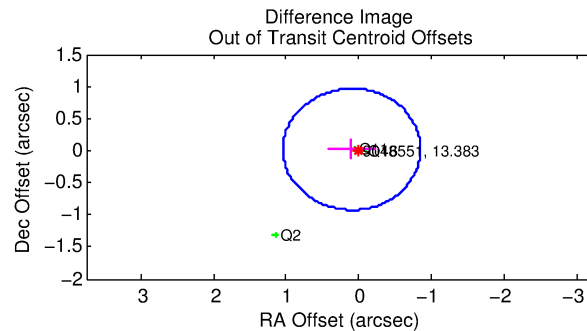
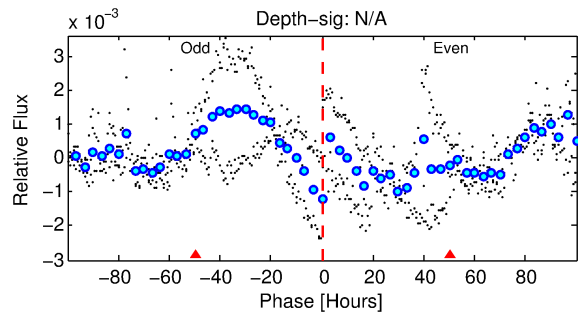
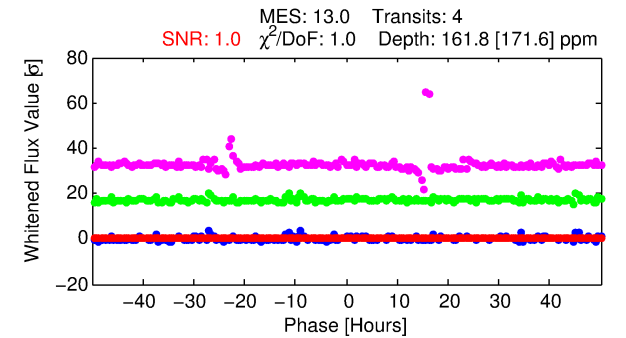
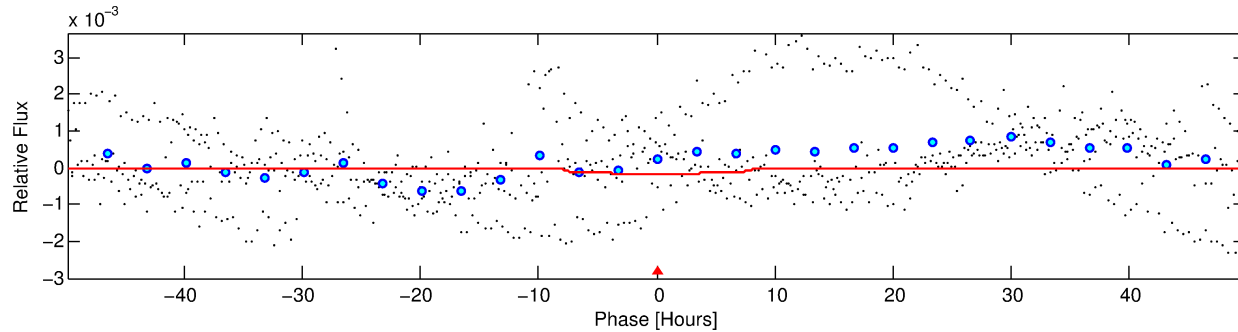
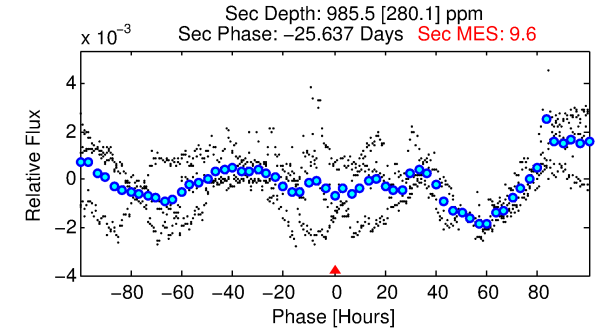
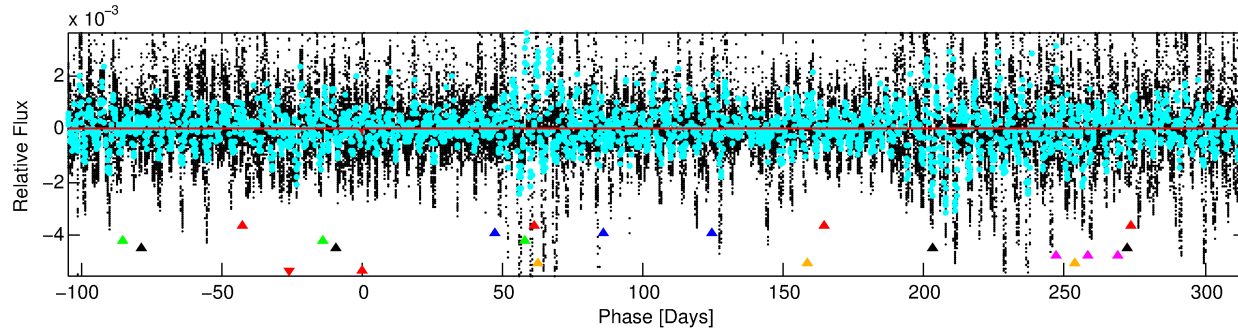
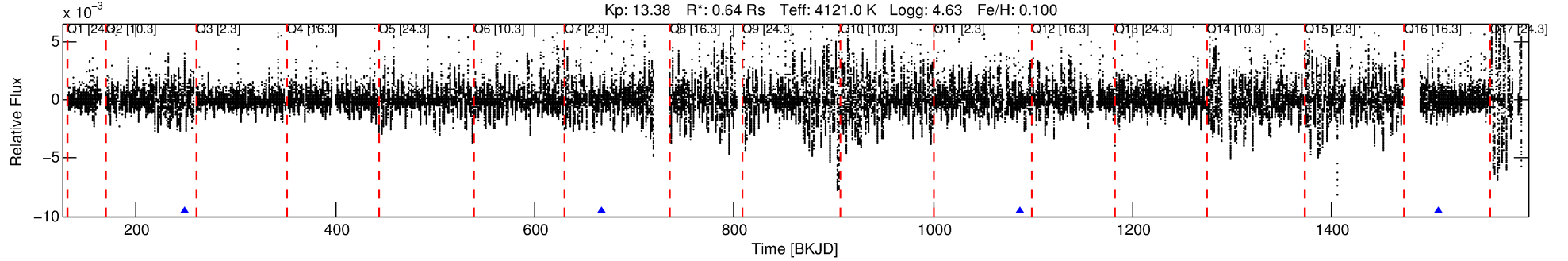
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 009048551-07

No Significant Match Found

# DV One-Page Summary

KIC: 9048551 Candidate: 7 of 7 Period: 419.474 d



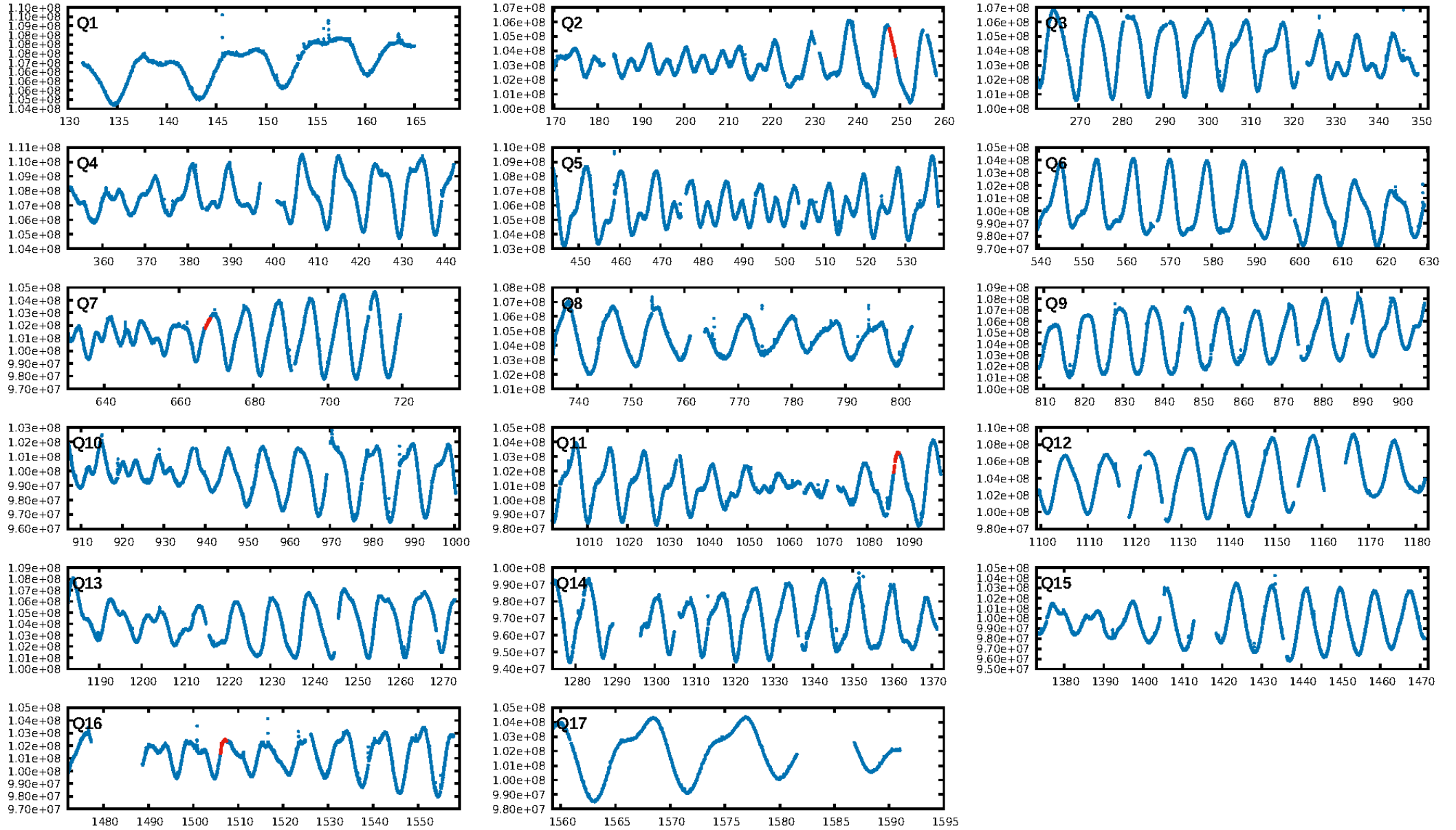
## DV Fit Results:

Period = 419.47354 [0.03543] d  
Epoch = 248.2932 [0.0639] BKJD  
Rp/R\* = 0.0130 [0.0133]  
a/R\* = 122.32 [355.02]  
b = 0.79 [1.40]  
Seff = 0.12 [0.02]  
Teq = 149 [6] K  
Rp = 0.90 [0.92] Re  
a = 0.9407 [0.0673] AU  
Ag = 590654.26 [1220020.10] [0.48] $\sigma$   
Teffp = 6407 [3312] K [1.89] $\sigma$

## DV Diagnostic Results:

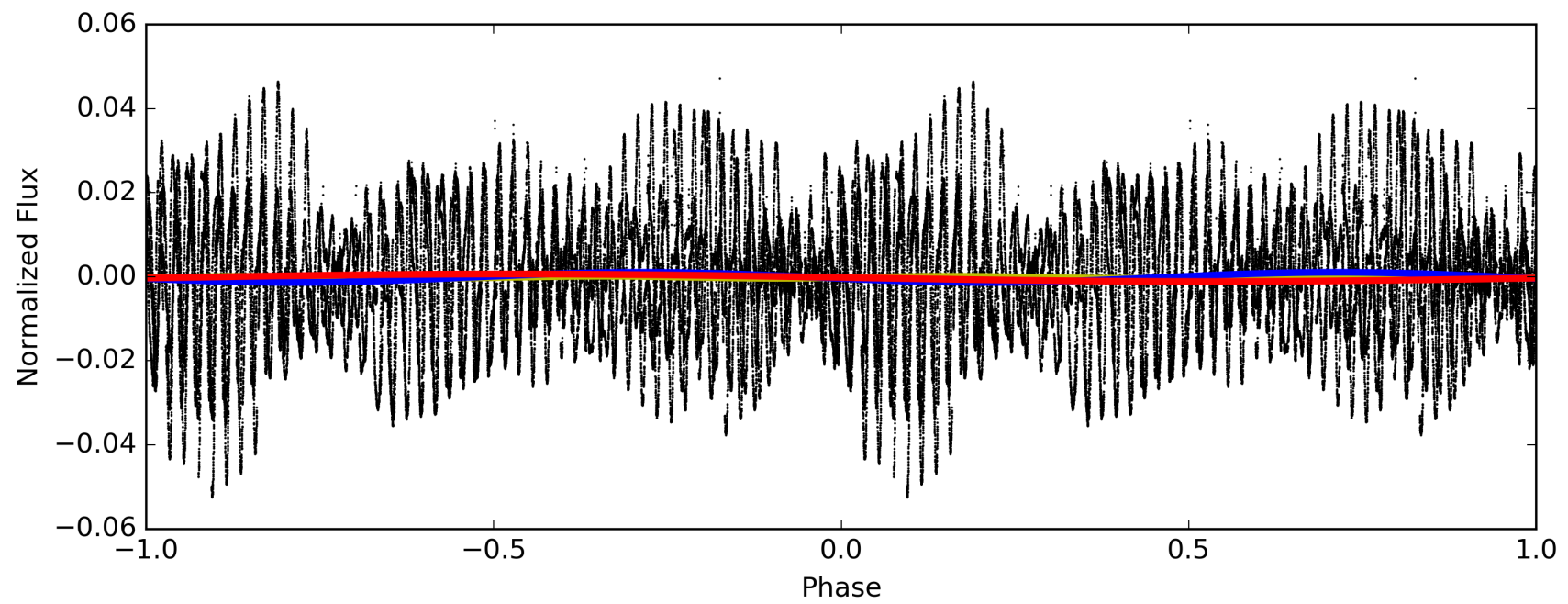
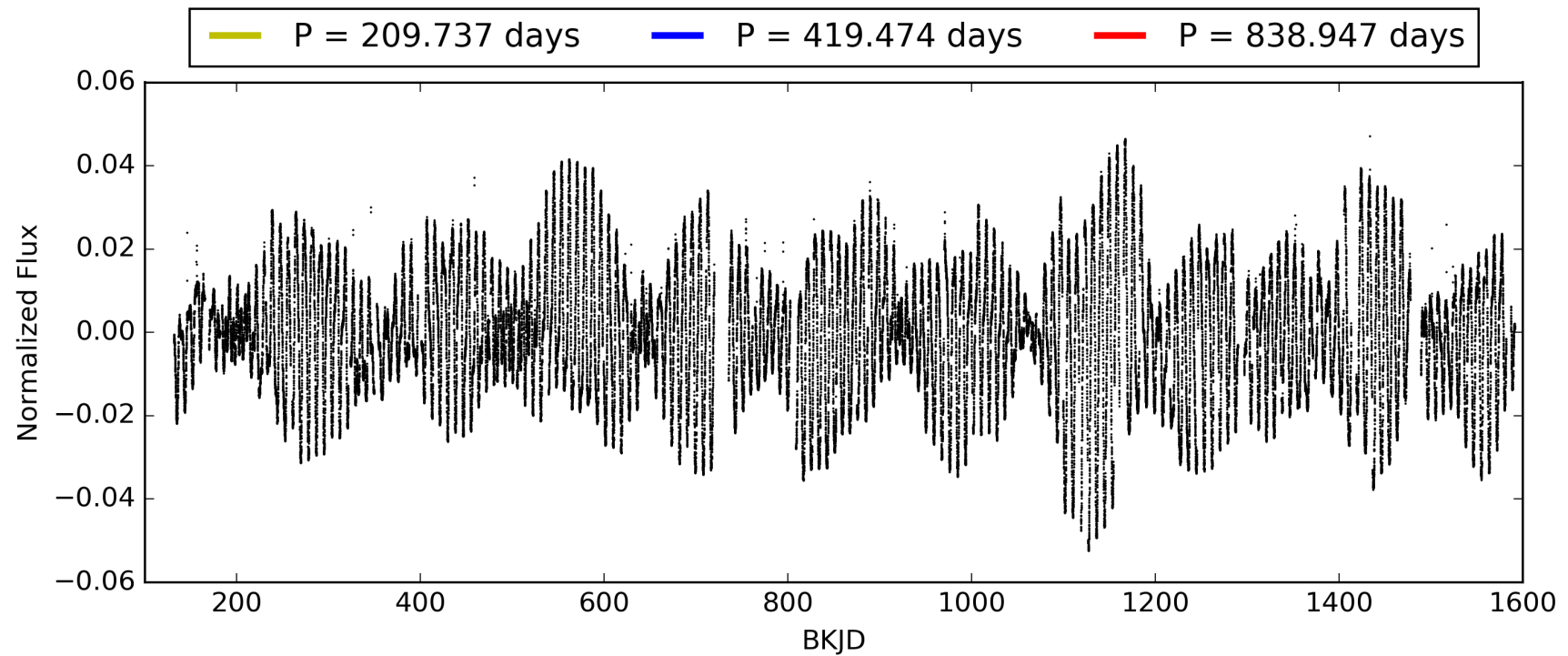
ShortPeriod-sig: 100.0% [14.94] $\sigma$   
LongPeriod-sig: 100.0% [53.29] $\sigma$   
ModelChiSquare2-sig: 75.7%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [4/4]  
GhostDiagnostic-chr: -0.8434  
Centroid-sig: 61.9%  
Centroid-so: 1.822 arcsec [0.45] $\sigma$   
OotOffset-rm: 0.100 arcsec [0.32] $\sigma$   
OotOffset-st: 1/1/1/0 [3]  
KicOffset-rm: 0.364 arcsec [1.57] $\sigma$   
KicOffset-st: 1/1/1/0 [3]  
DiffImageQuality-fgm: 0.00 [0/3]  
DiffImageOverlap-fno: 1.00 [4/4]

# TCE 009048551-07, PDC Light Curves



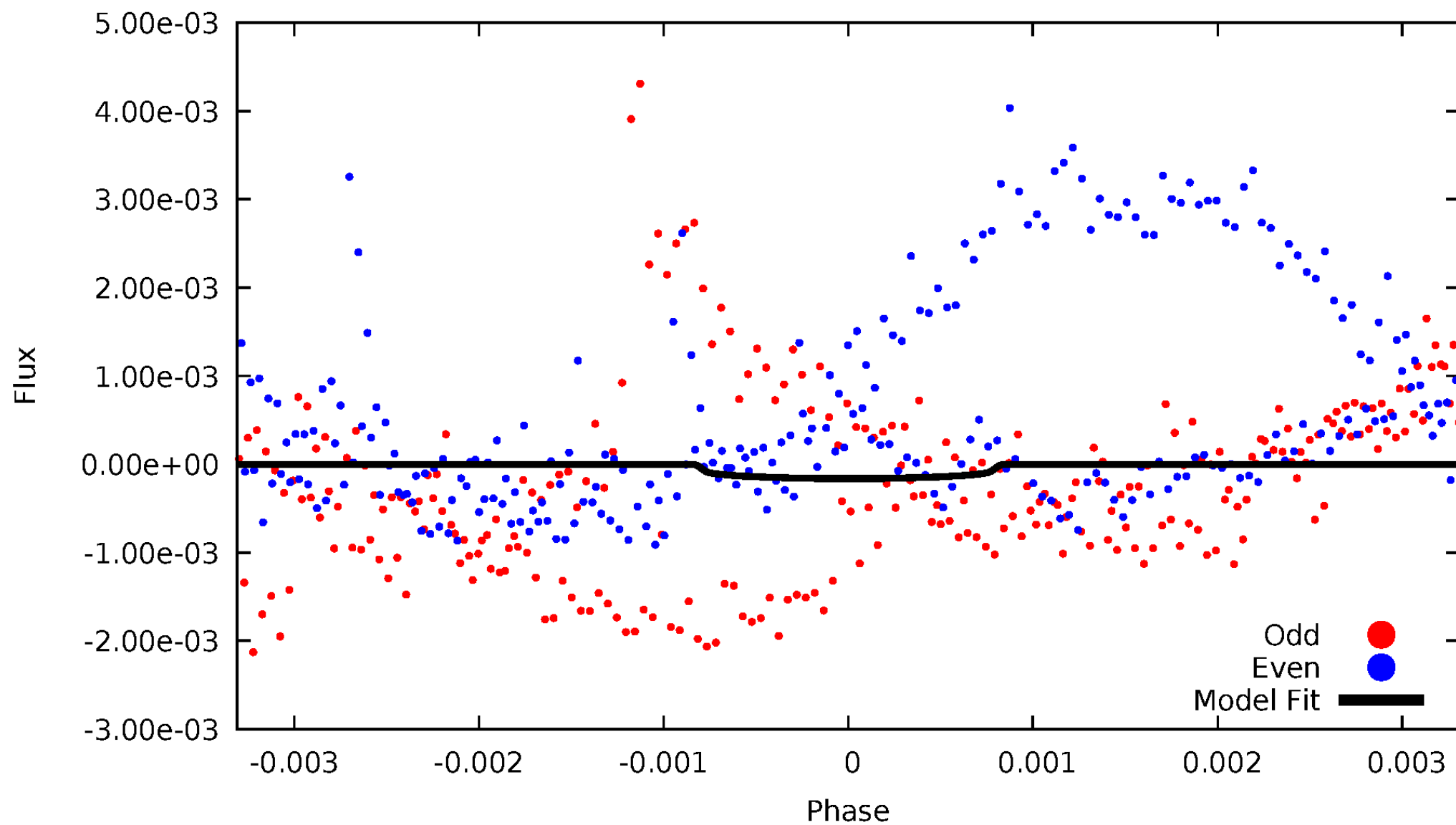


TCE 009048551-07



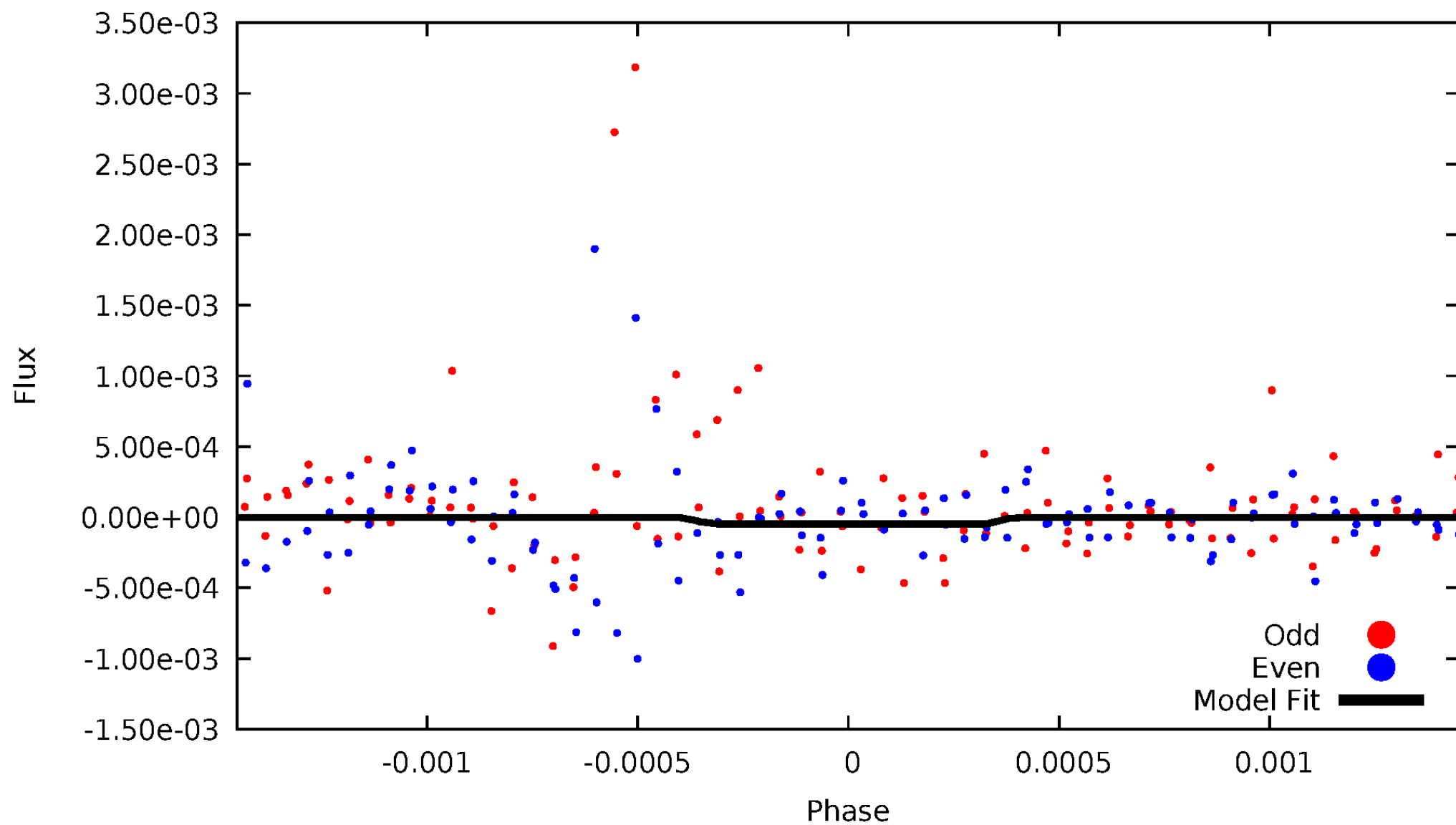
# DV Odd/Even

TCE 009048551-07



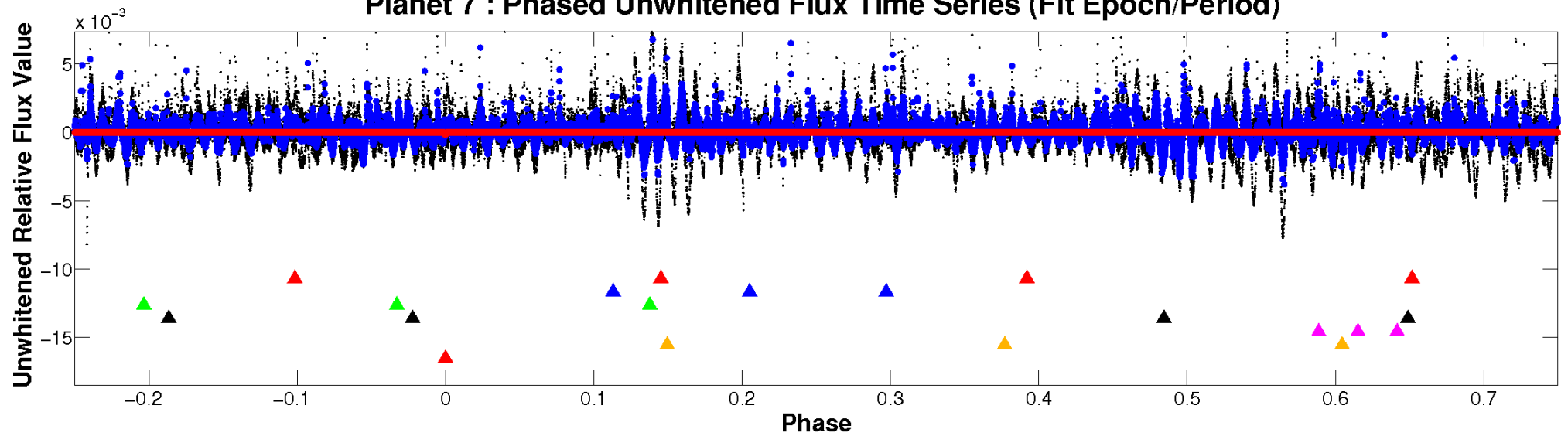
# ALT Odd/Even

TCE 009048551-07

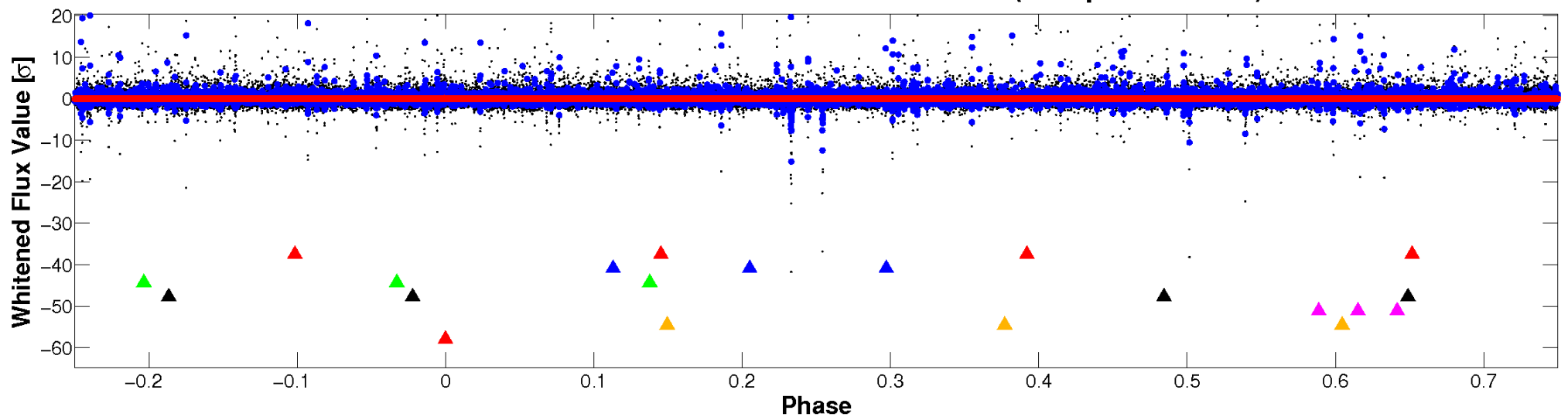


# Non-Whitened Vs. Whitened Light Curve

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

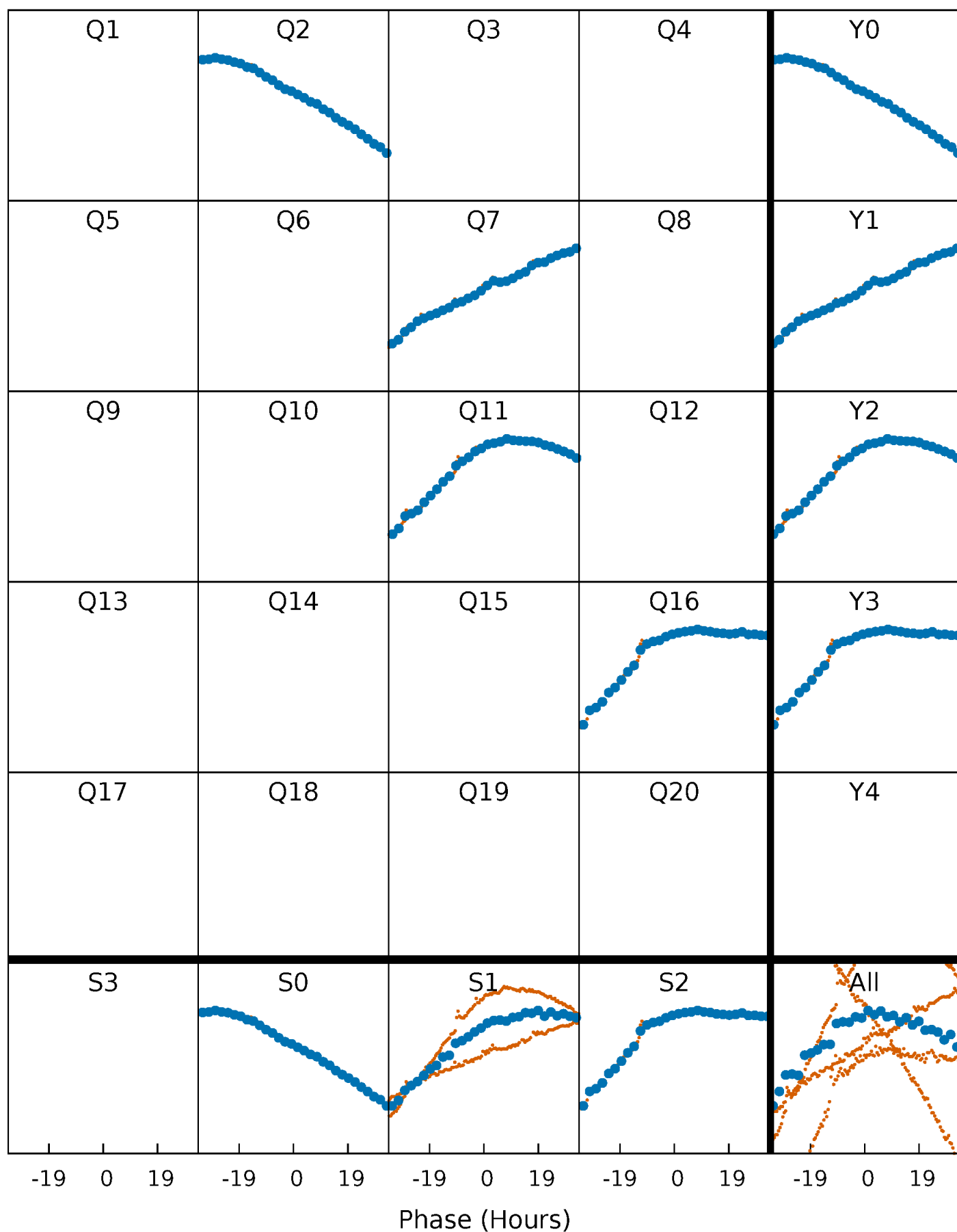


## Planet 7 : Phased Whitened Flux Time Series (Fit Epoch/Period)



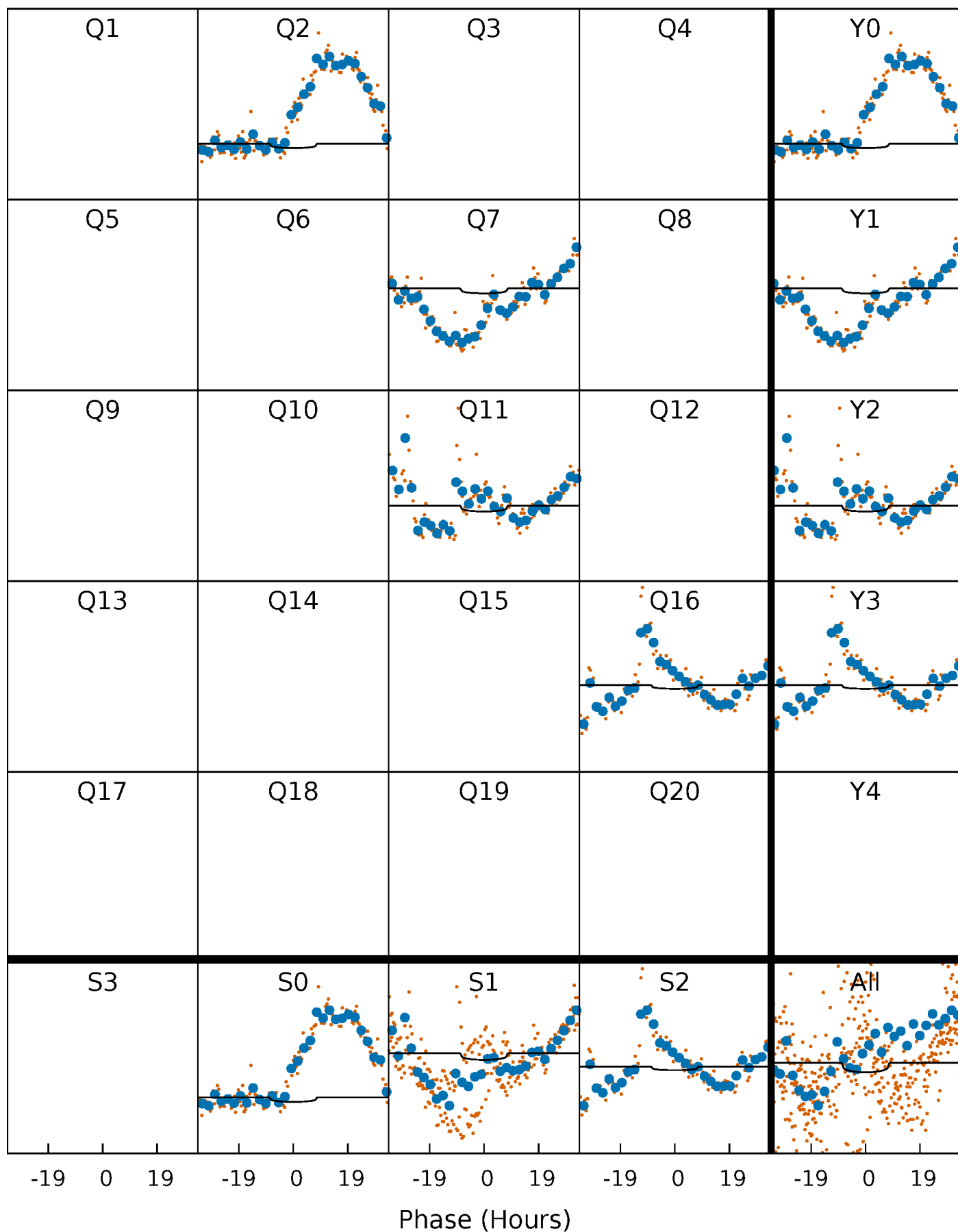
# PDC Quarter-Phased Transit Curves

TCE 009048551-07 P=419.473543 Days  $T_0=248.293169$  (BKJD)



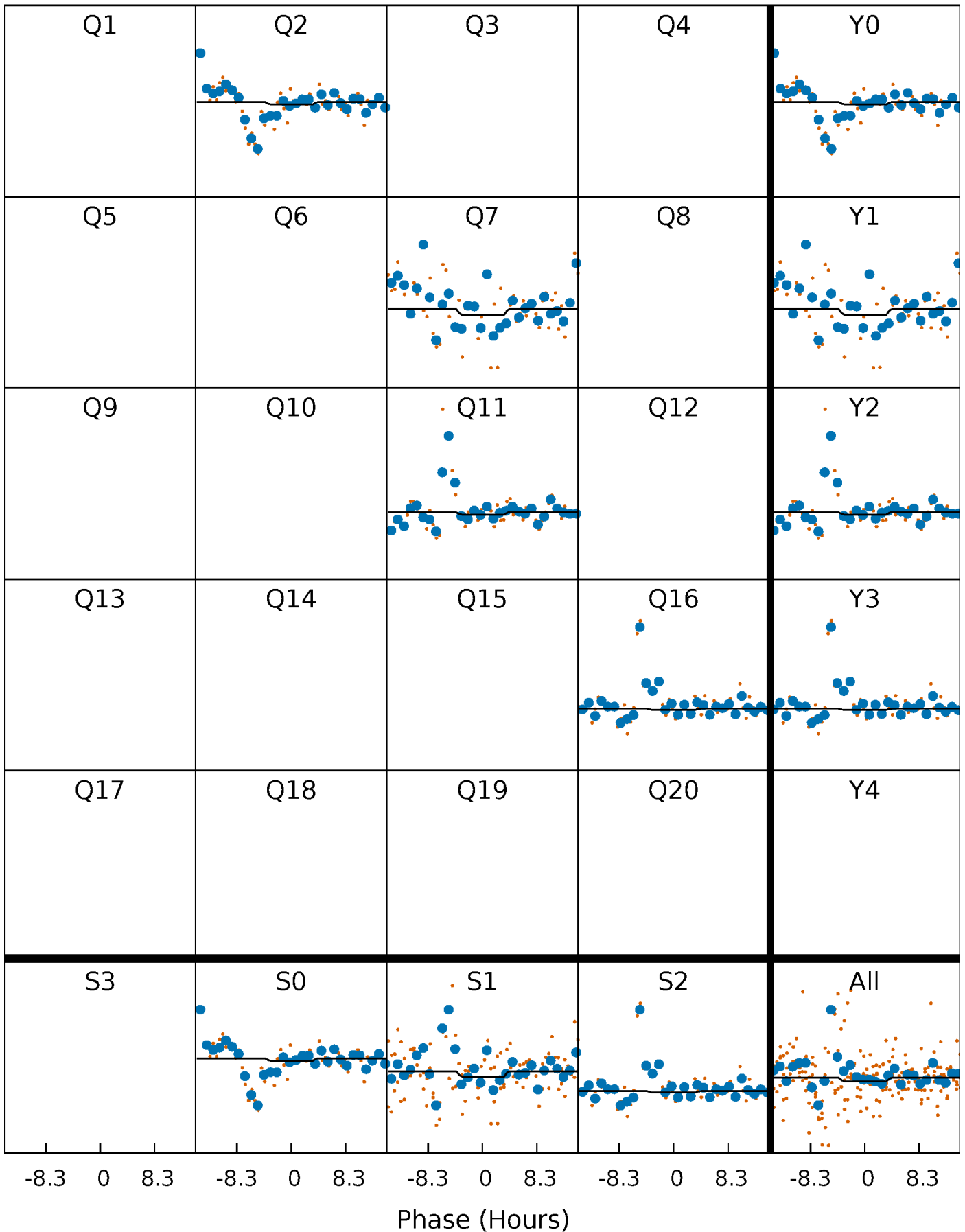
# DV Quarter-Phased Transit Curves

TCE 009048551-07 P=419.473543 Days  $T_0=248.293169$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

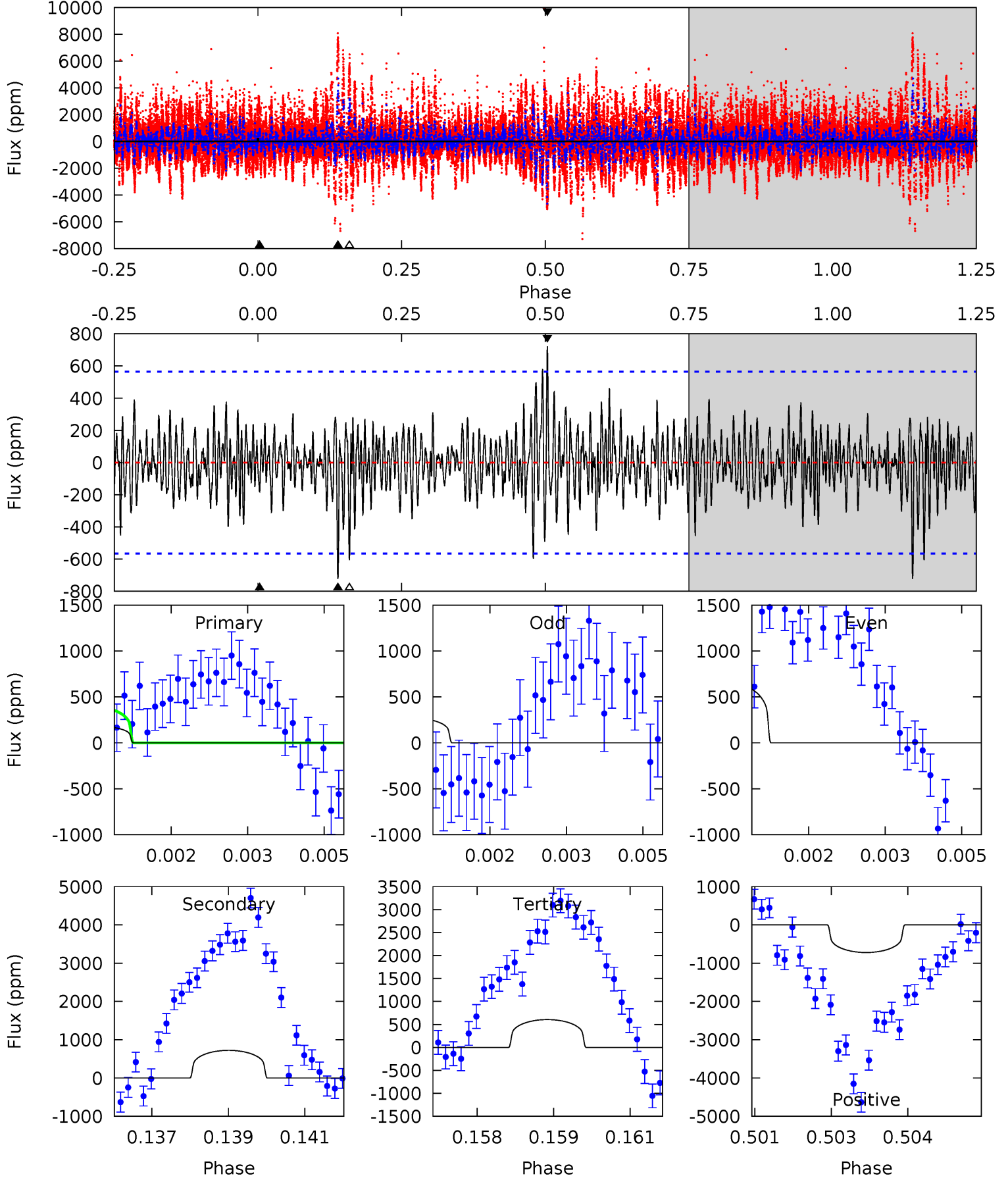
TCE 009048551-07 P=419.357952 Days  $T_0=248.379255$  (BKJD)



# DV Model-Shift Uniqueness Test

009048551-07, P = 419.473543 Days, E = 248.293169 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
1.73	6.85	5.74	6.84	5.36	3.14	1.48	-4.00	-5.10	1.11	0.01	1.61	0.46	0.50	1.77

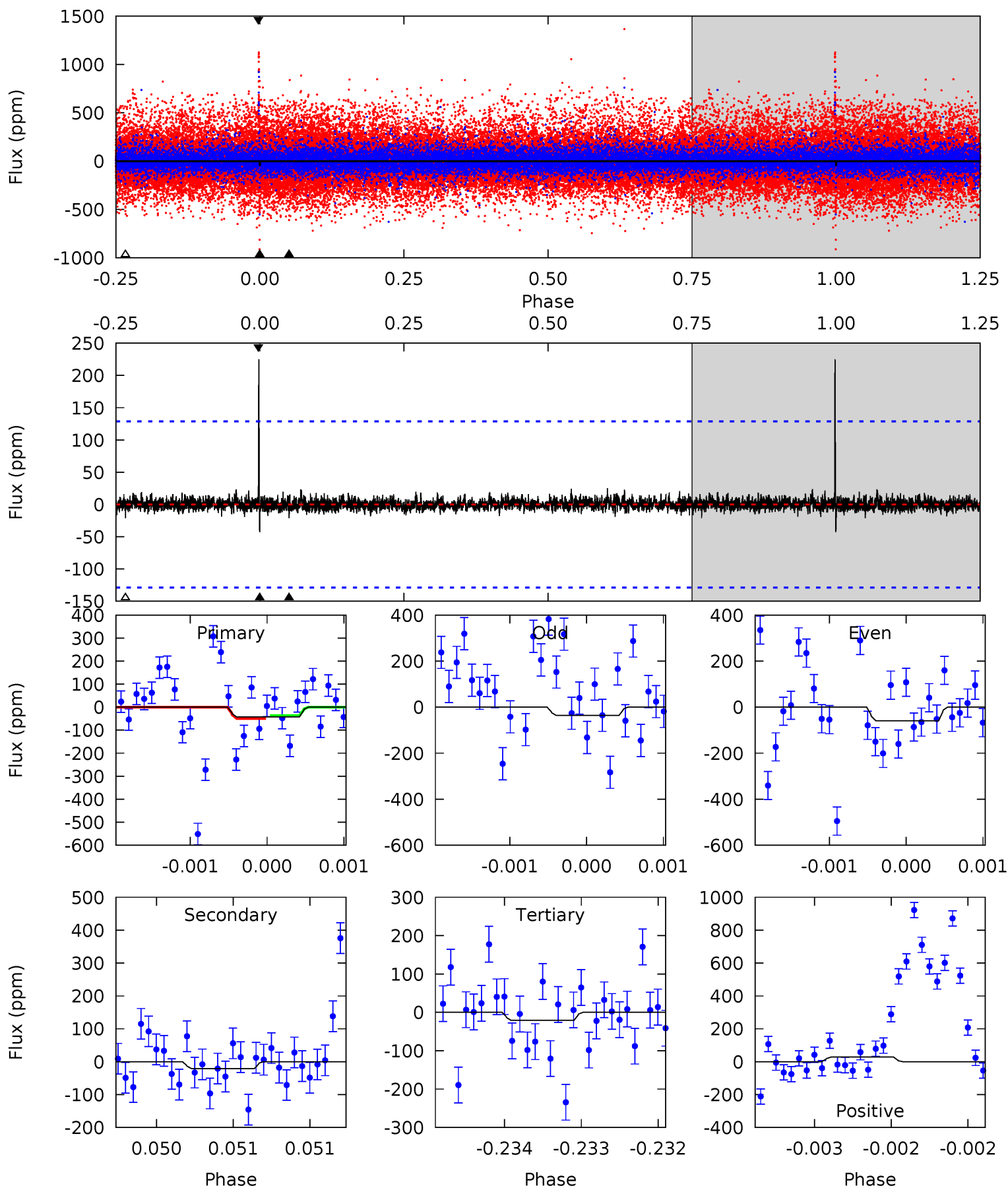




# Alt Model-Shift Uniqueness Test

009048551-07, P = 419.357952 Days, E = 248.379255 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
1.82	0.90	0.90	1.19	5.50	3.36	0.34	0.93	0.63	0.01	-0.29	0.49	-0.07	0.84	0.27



### Stellar Parameters For KIC 009048551

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$4121^{+123}_{-136}$	$4.631^{+0.049}_{-0.017}$	$0.100^{+0.250}_{-0.300}$	$0.636^{+0.031}_{-0.058}$	$0.631^{+0.050}_{-0.056}$	$3.455^{+0.811}_{-0.299}$
	+3%/-3%	+1%/-0%	+250%/-300%	+5%/-9%	+8%/-9%	+23%/-9%
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 009048551-07 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-723 \pm 106$	$1.10^{+0.86}_{-0.70}$	$207^{+7}_{-8}$	$5070^{+3583}_{-1059}$	$299921^{+2017680}_{-206647}$
Alt.	$-21 \pm 23$	$0.83^{+0.75}_{-0.57}$	$207^{+7}_{-7}$	$2934^{+1226}_{-5238}$	$11737^{+93476}_{-13442}$

$T_{max}$  = Theoretical Maximum Planetary Temperature

$T_{obs}$  = Observed Planetary Temperature (Assuming  $A=0.3$ )

$A_{obs}$  = Observed Albedo (Assuming  $T=0$ )

If a secondary eclipse is present, the system is likely an EB if  $T_{obs} \gg T_{max}$  AND  $A_{obs} \gg 1.0$

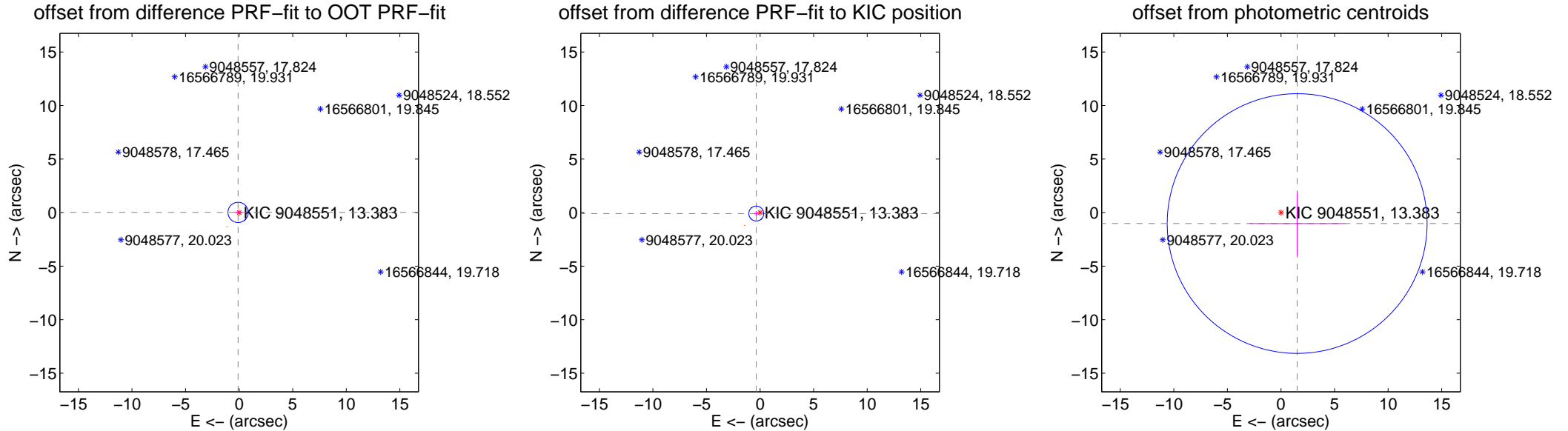
## DV Centroid Data

Supplemental centroid analysis for 009048551-07. Kepler magnitude: 13.38. Transit SNR 1.02

There are 0 quarters with good PRF difference image offsets

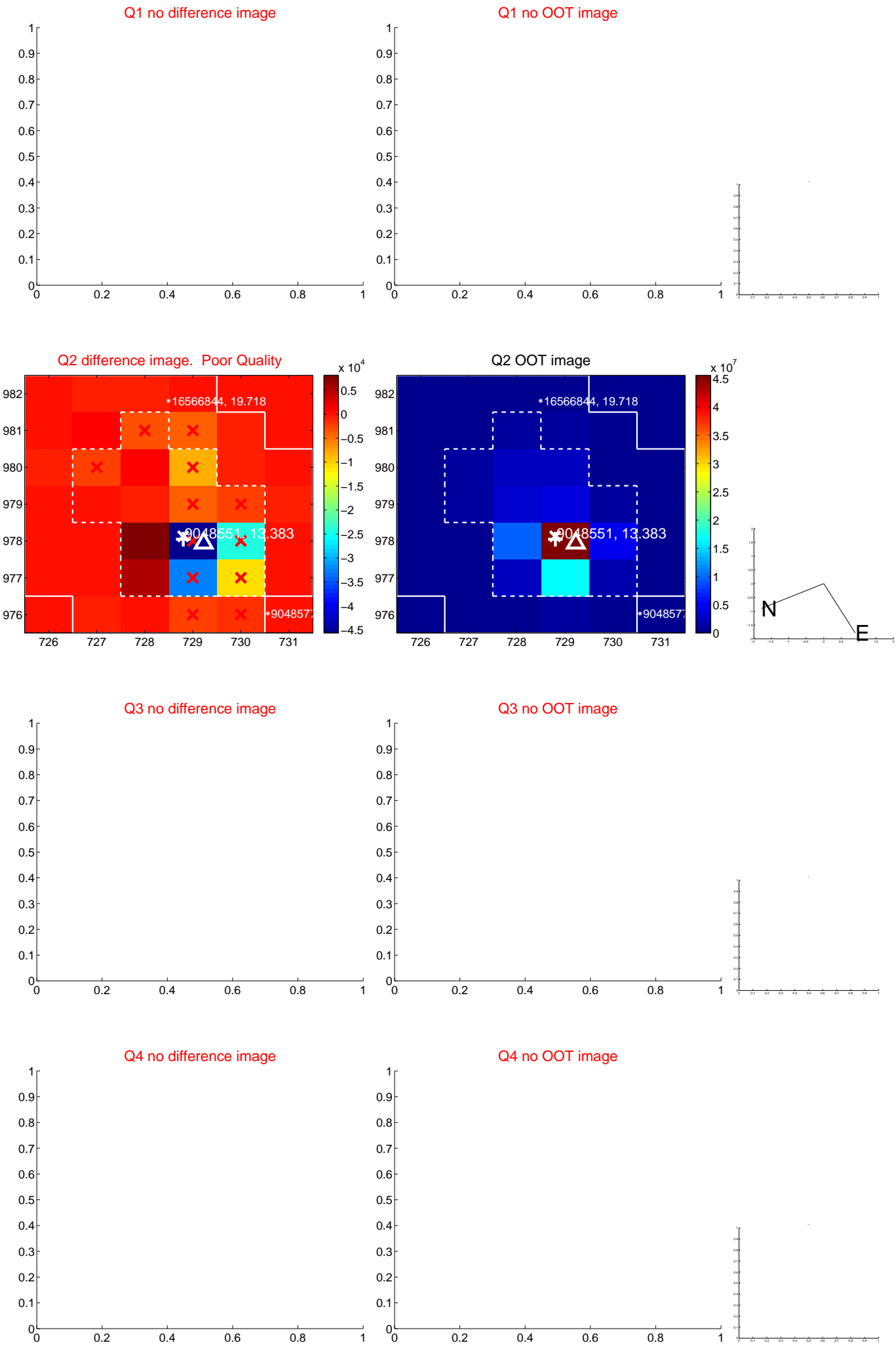
The direct PRF centroid is offset from the target star catalog position by about 0.41 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.100 \pm 0.315$	0.32	$0.098 \pm 0.321$	$0.020 \pm 0.148$
PRF-fit source offset from KIC position	$0.364 \pm 0.232$	1.57	$0.353 \pm 0.192$	$-0.088 \pm 0.215$
photometric centroid source offset	$1.82 \pm 4.04$	0.45	$-1.51 \pm 4.44$	$-1.02 \pm 2.98$



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.

Q5 no difference image



Q5 no OOT image



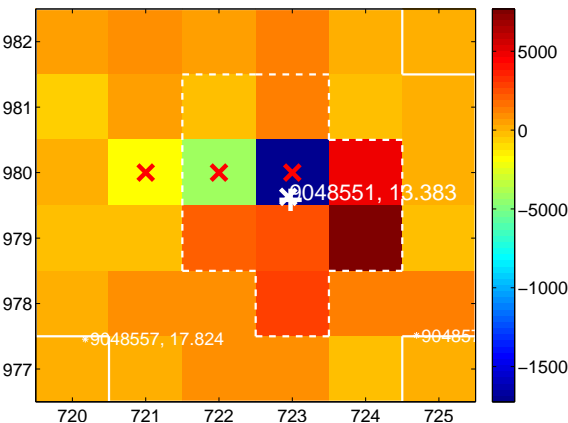
Q6 no difference image



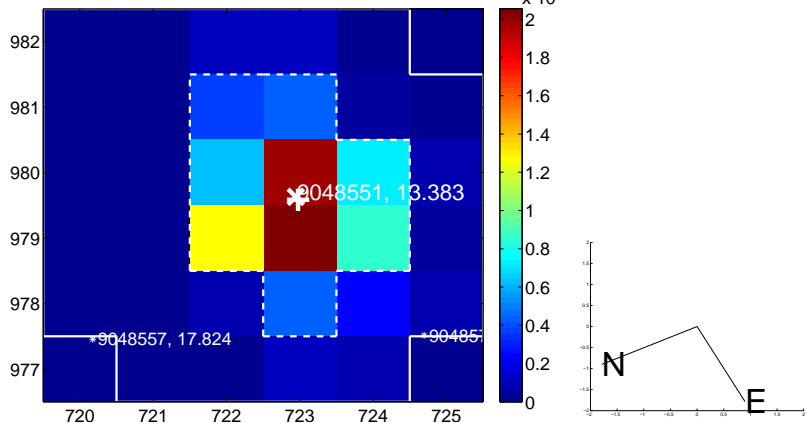
Q6 no OOT image



Q7 difference image. Poor Quality



Q7 OOT image



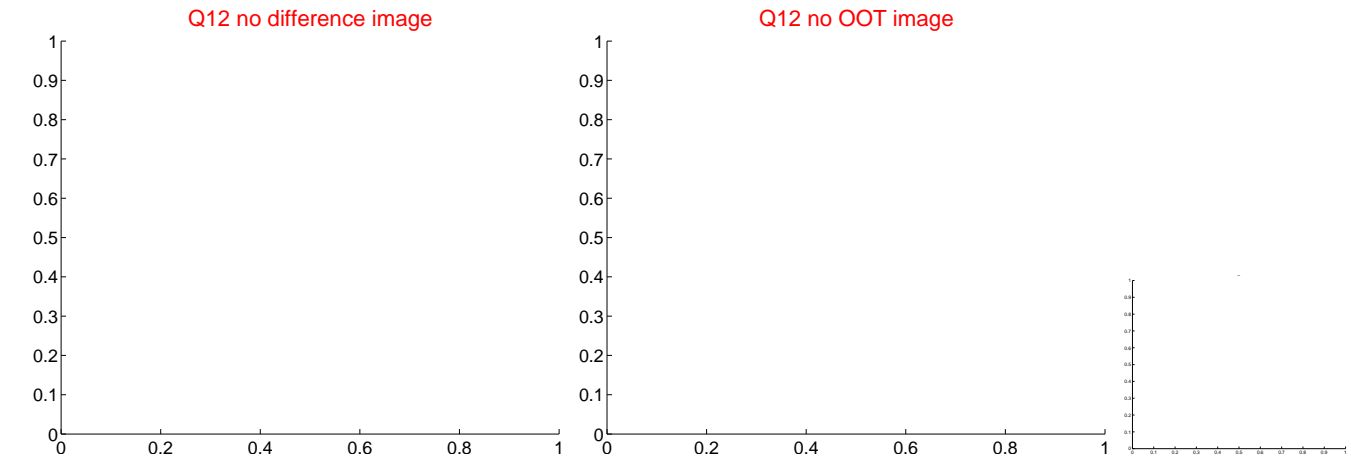
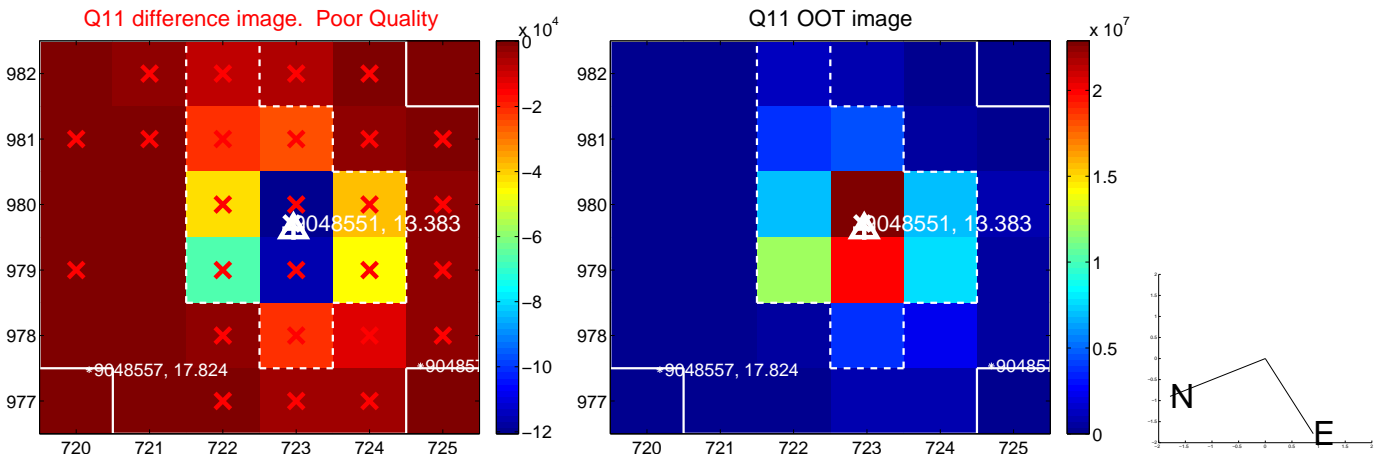
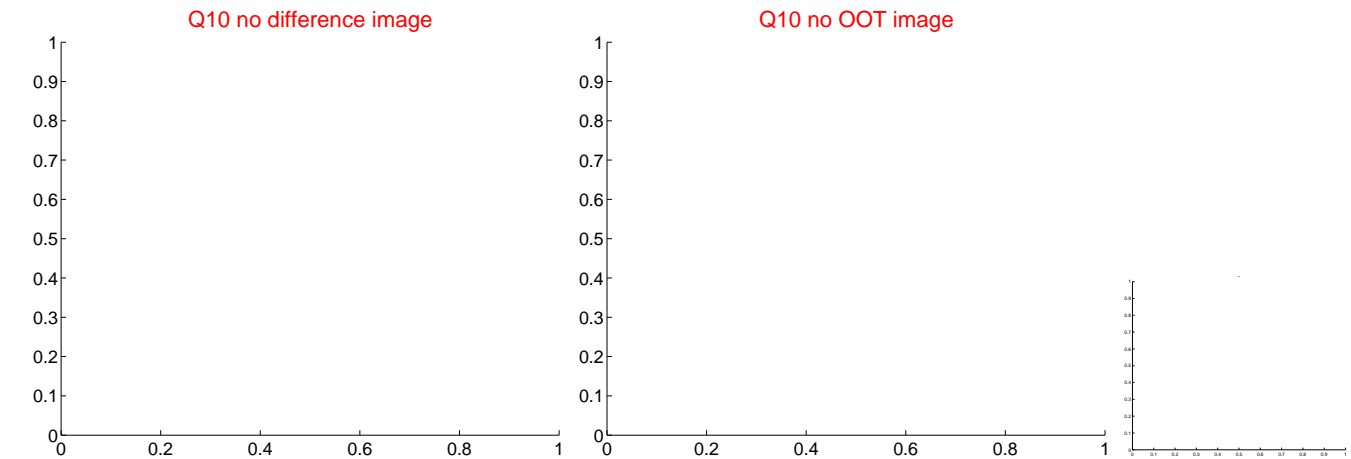
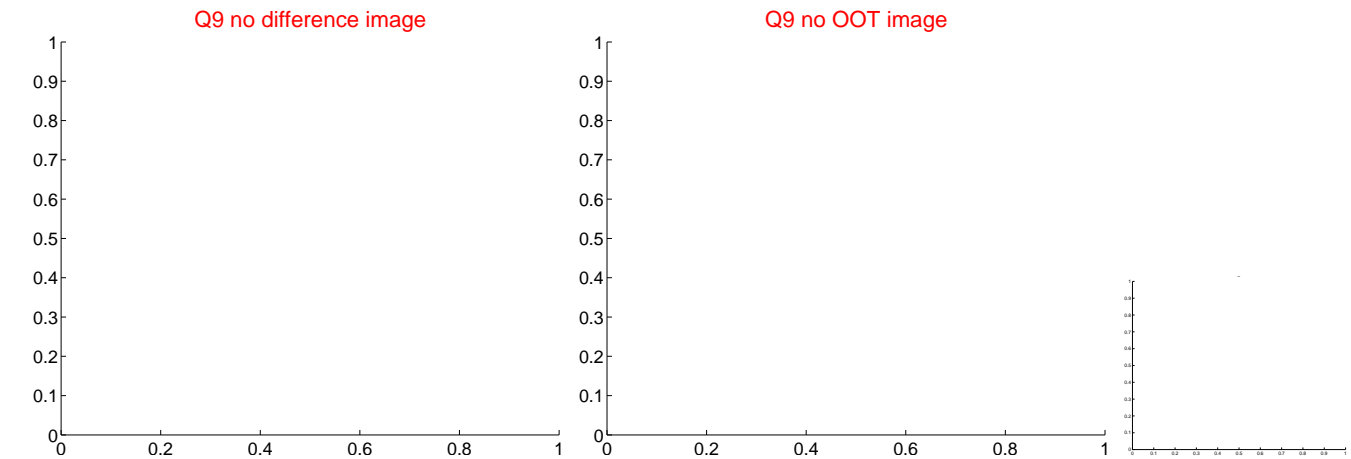
Q8 no difference image



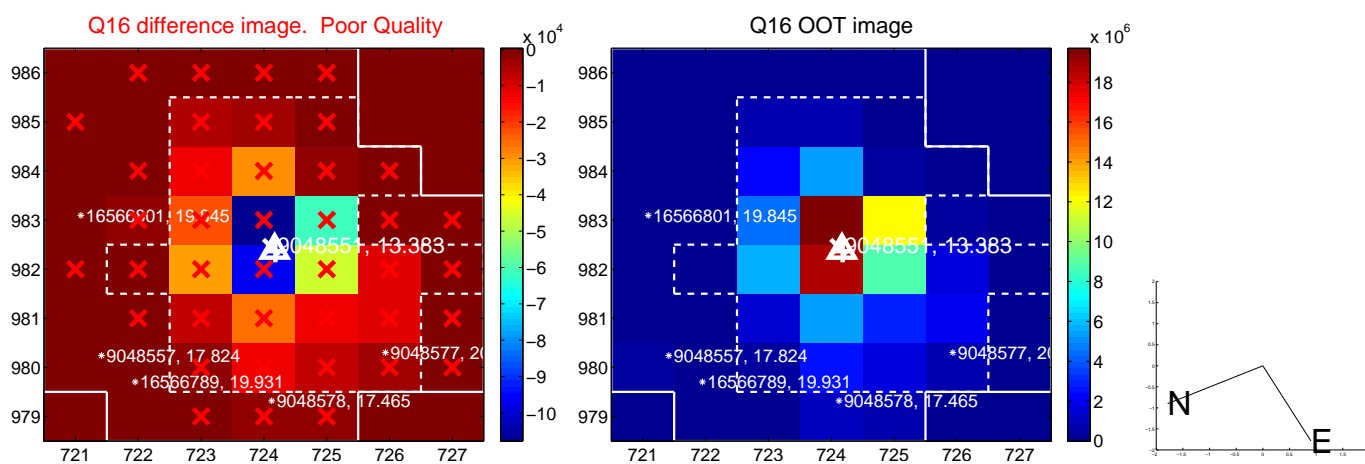
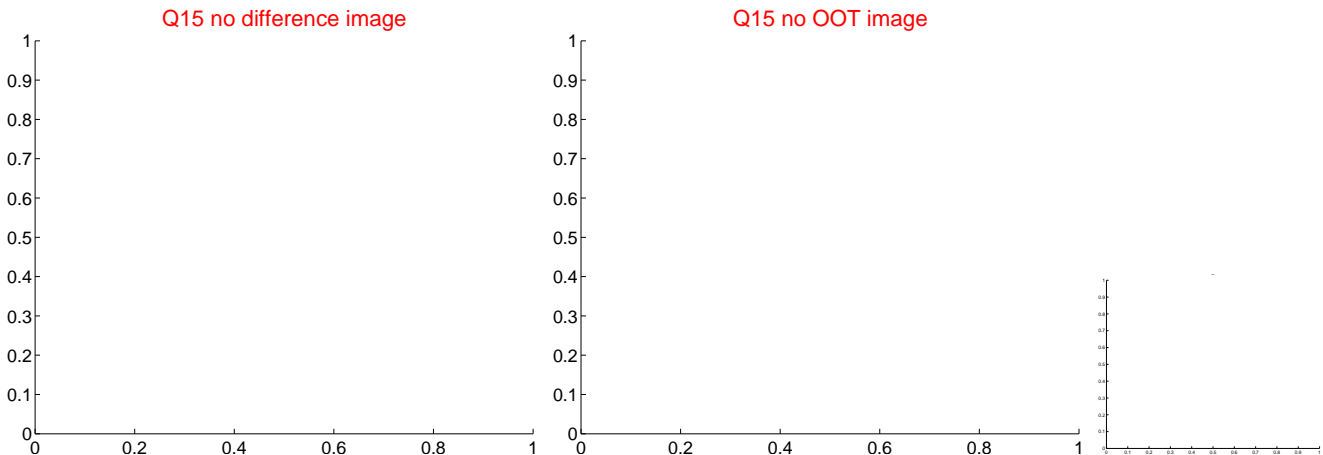
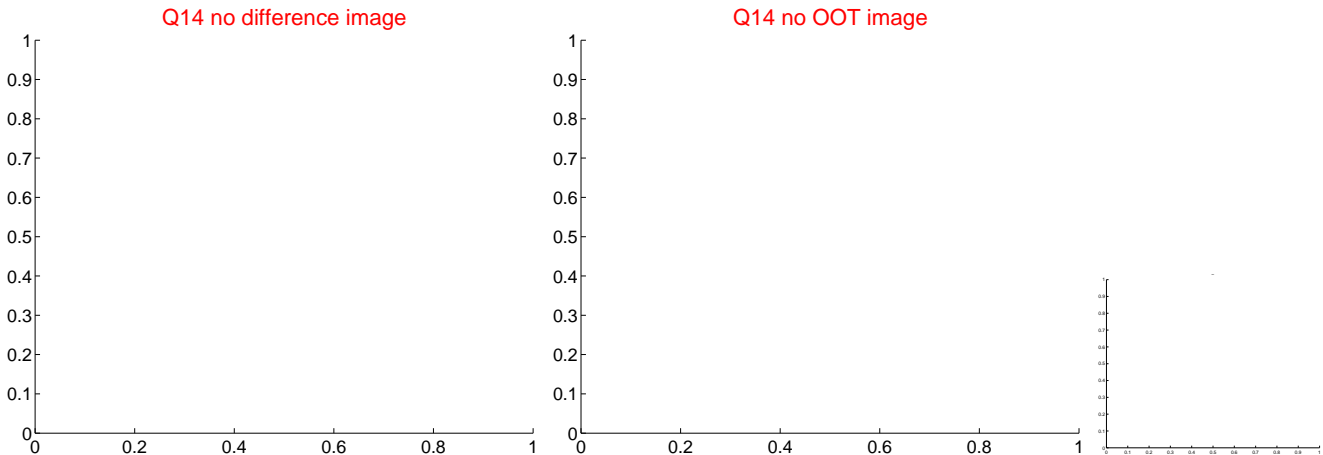
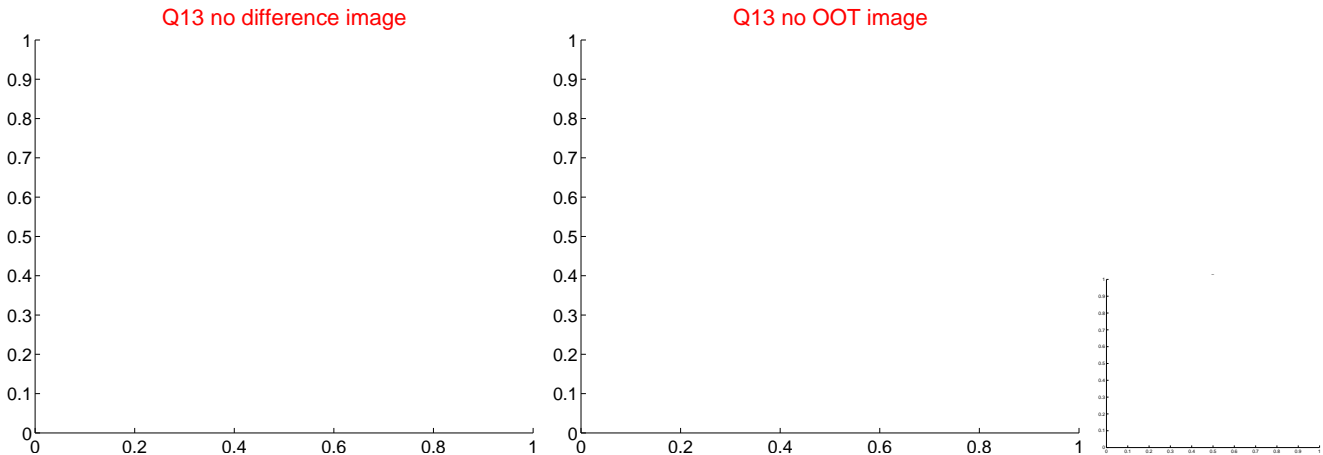
Q8 no OOT image



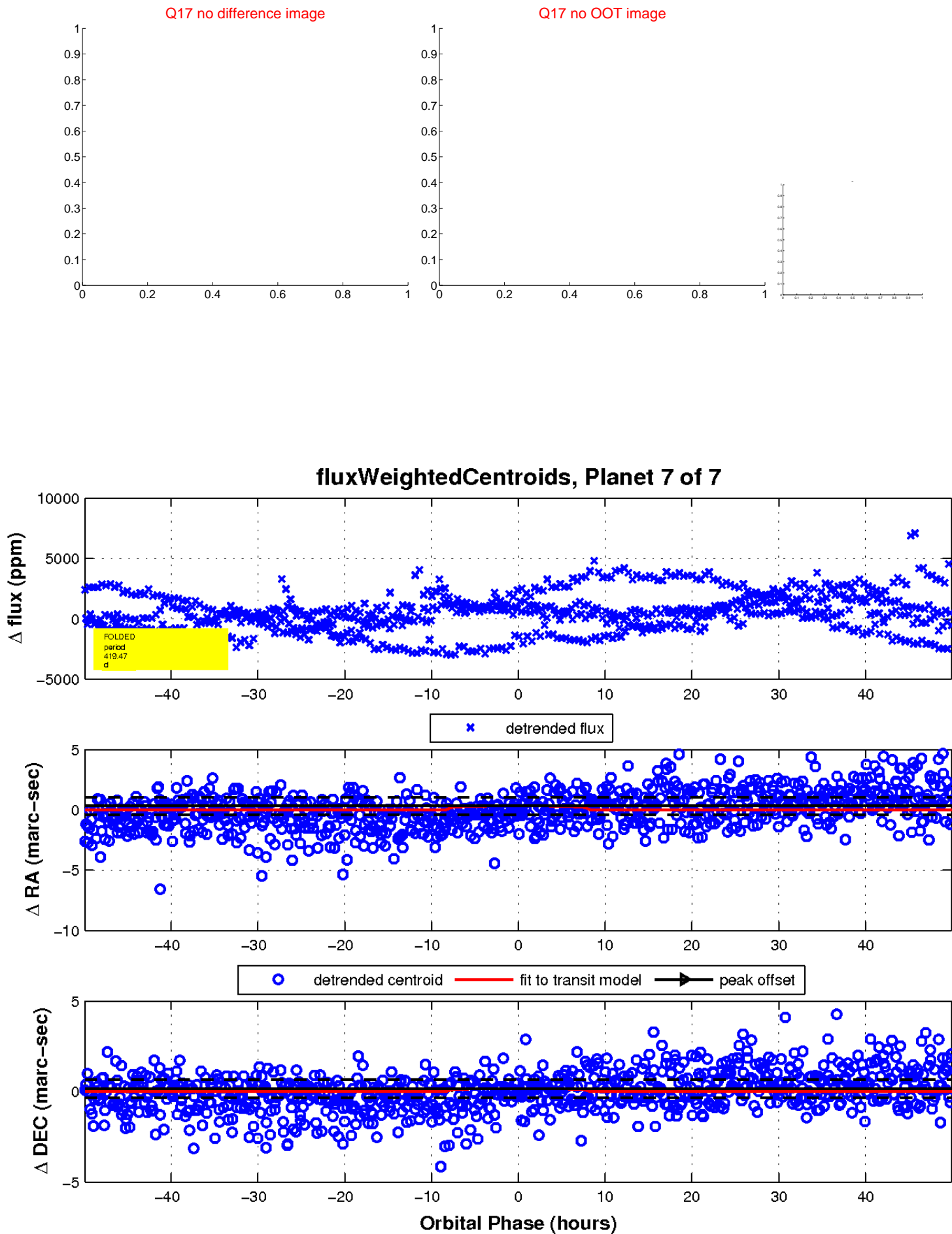
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

