

# KIC 009156461

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009156461-01	OBS	No	2.296149	132.431446	4.2	10.825	8.7	2.7	1.82	6480	0.43	3717.29
009156461-02	OBS	No	208.639795	204.712221	146.7	5.006	9.0	9.5	1.82	6480	2.51	9.10
009156461-03	OBS	No	296.023030	308.965620	22.4	13.754	7.9	1.0	1.82	6480	0.97	5.71
009156461-04	OBS	No	27.813822	141.128479	61.1	10.671	9.1	8.2	1.82	6480	1.55	133.62
009156461-05	OBS	No	77.564421	198.190936	103.7	8.284	8.5	7.9	1.82	6480	2.09	34.04
009156461-06	OBS	No	337.753157	364.928677	153.2	3.194	8.2	8.4	1.82	6480	2.65	4.79
009156461-08	OBS	No	138.291040	142.658043	108.4	10.011	8.3	6.9	1.82	6480	2.05	15.75
009156461-09	OBS	No	129.035096	161.225143	92.7	6.643	8.0	6.8	1.82	6480	2.33	17.27
009156461-10	OBS	No	110.241909	238.739506	55.7	3.500	7.6	-1.0	1.82	6480	1.37	21.30

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009156461-01	OBS	FP	0.00	1	0	0	0	SWEET_NTL—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—CENT_SATURATED
009156461-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_CHASES_MARSHALL—TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_SATURATED
009156461-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_TRACKER—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_SATURATED
009156461-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_ZUMA—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
009156461-05	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—CENT_SATURATED—HALO_GHOST
009156461-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
009156461-08	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—INCONSISTENT_TRANS—CENT_SATURATED
009156461-09	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_CHASES—TRANS_GAPPED—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
009156461-10	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED

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

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

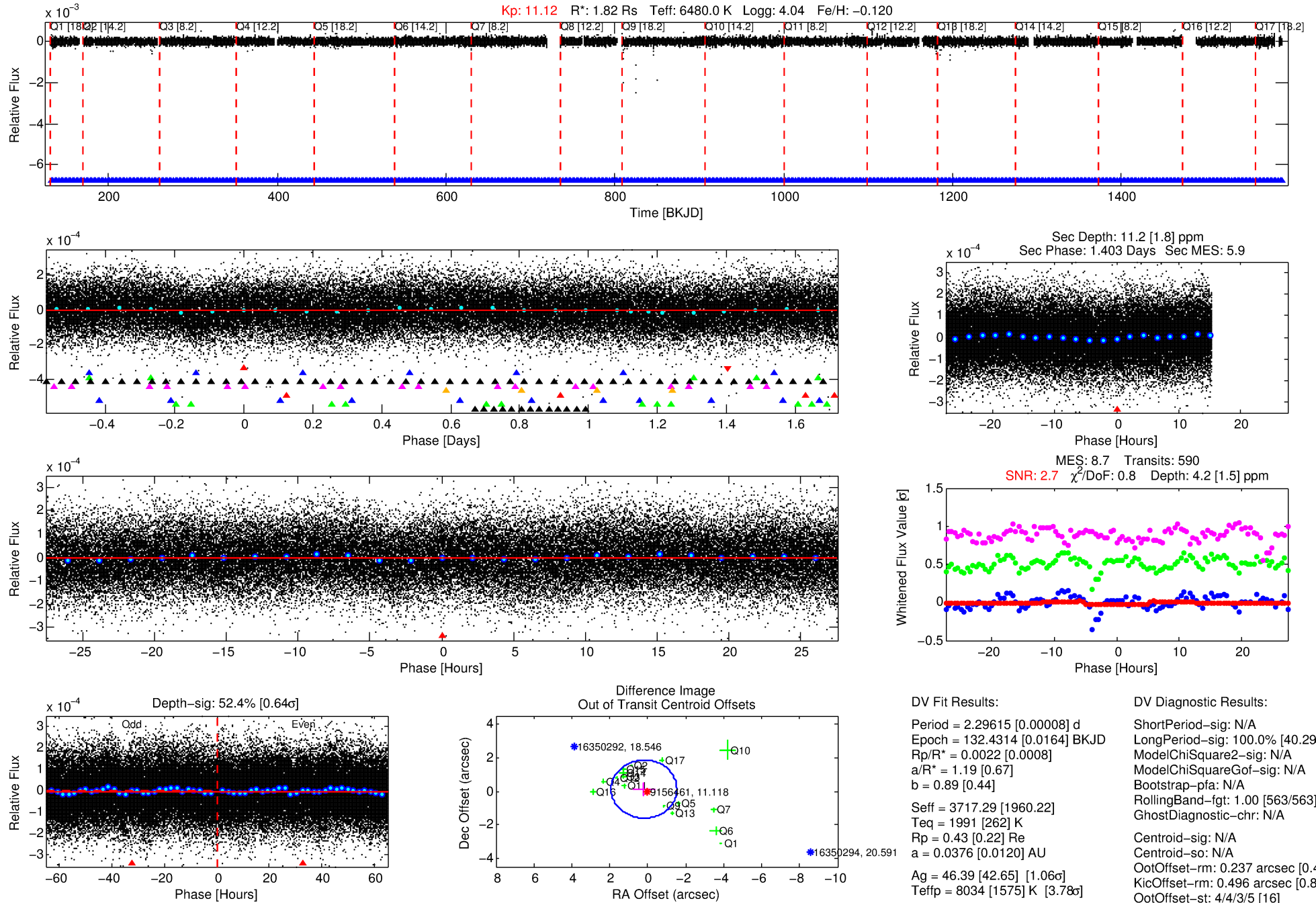
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 009156461-01

No Significant Match Found

# DV One-Page Summary

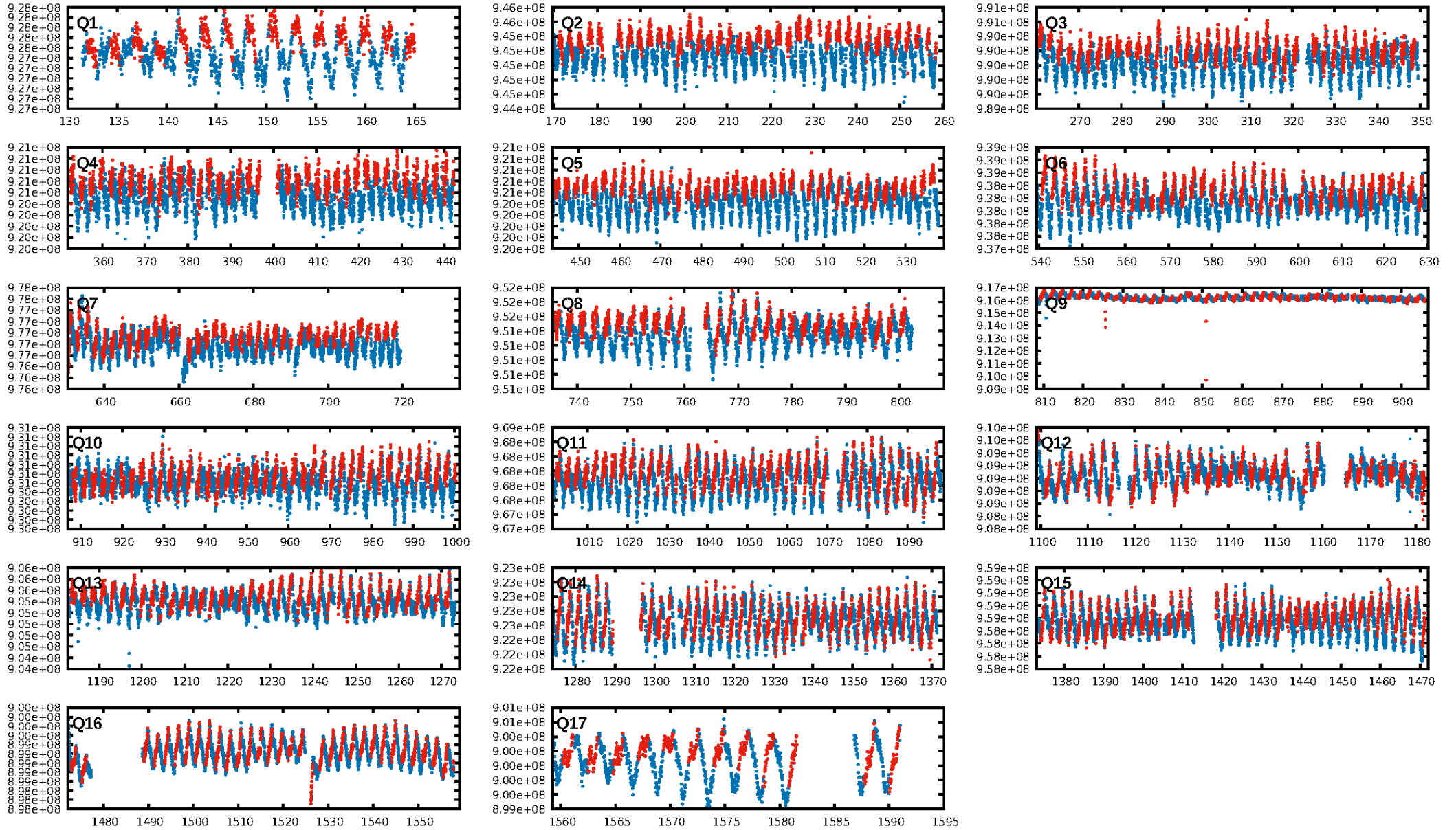
KIC: 9156461 Candidate: 1 of 10 Period: 2.296 d



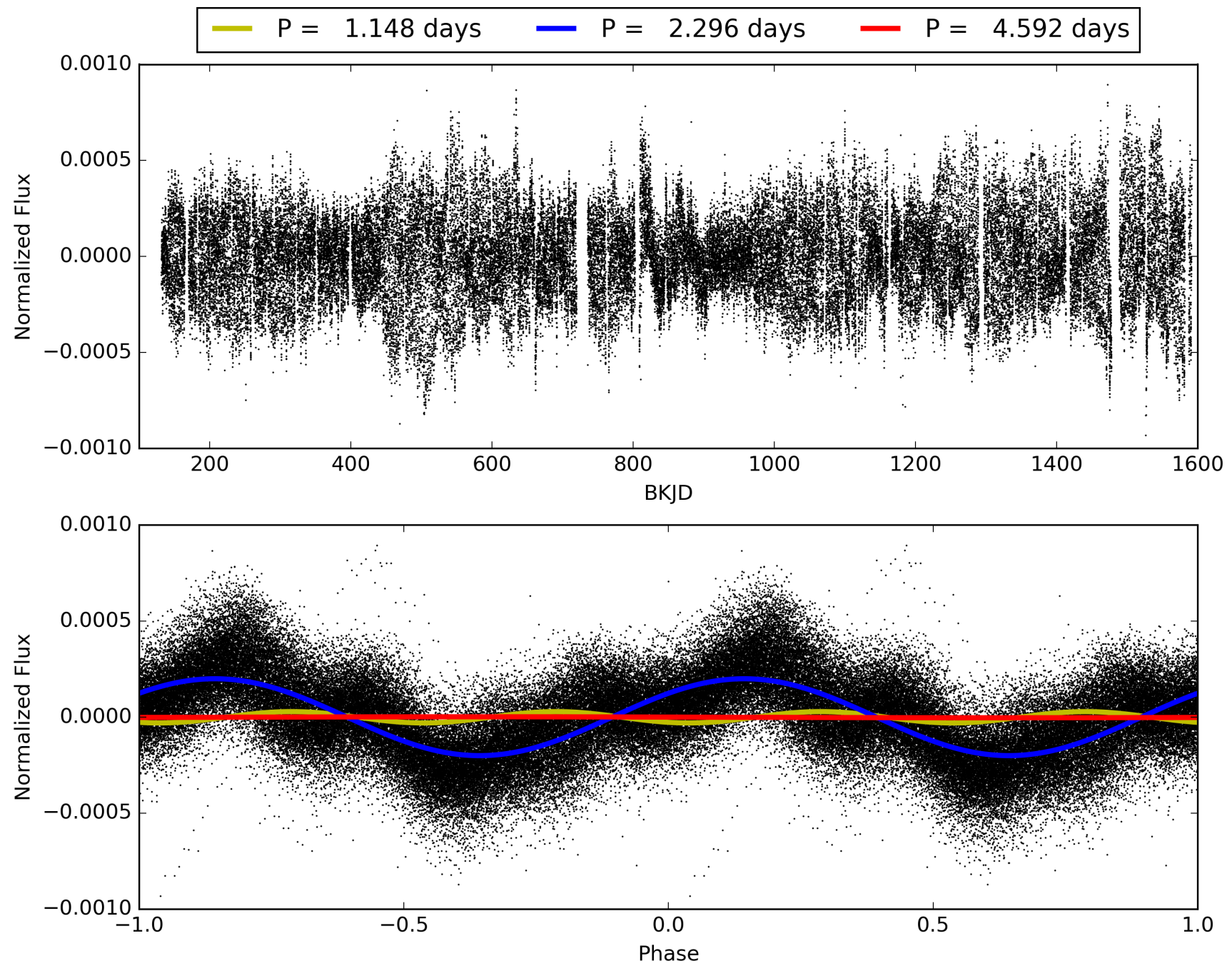
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This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 009156461-01, PDC Light Curves



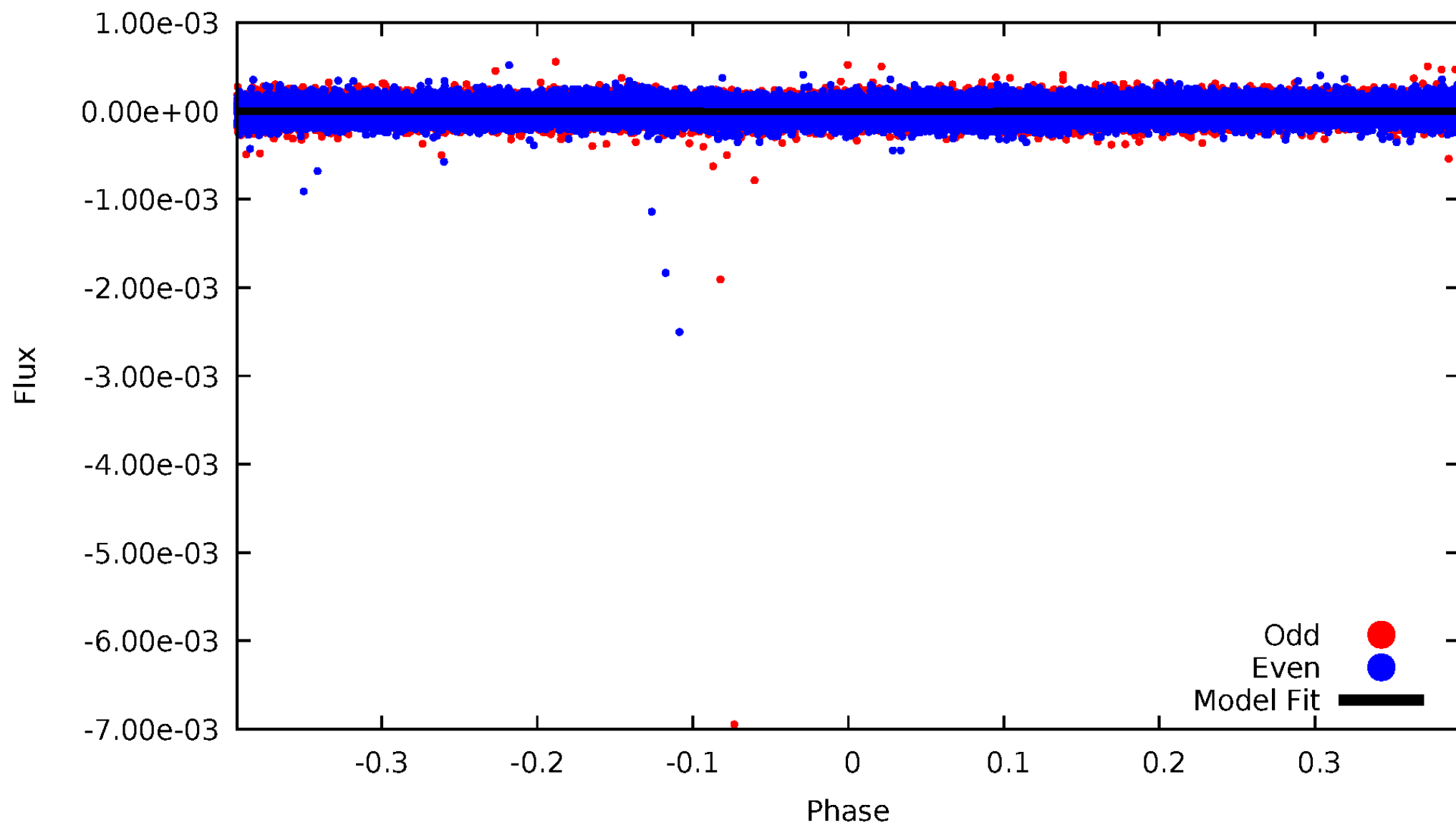
TCE 009156461-01





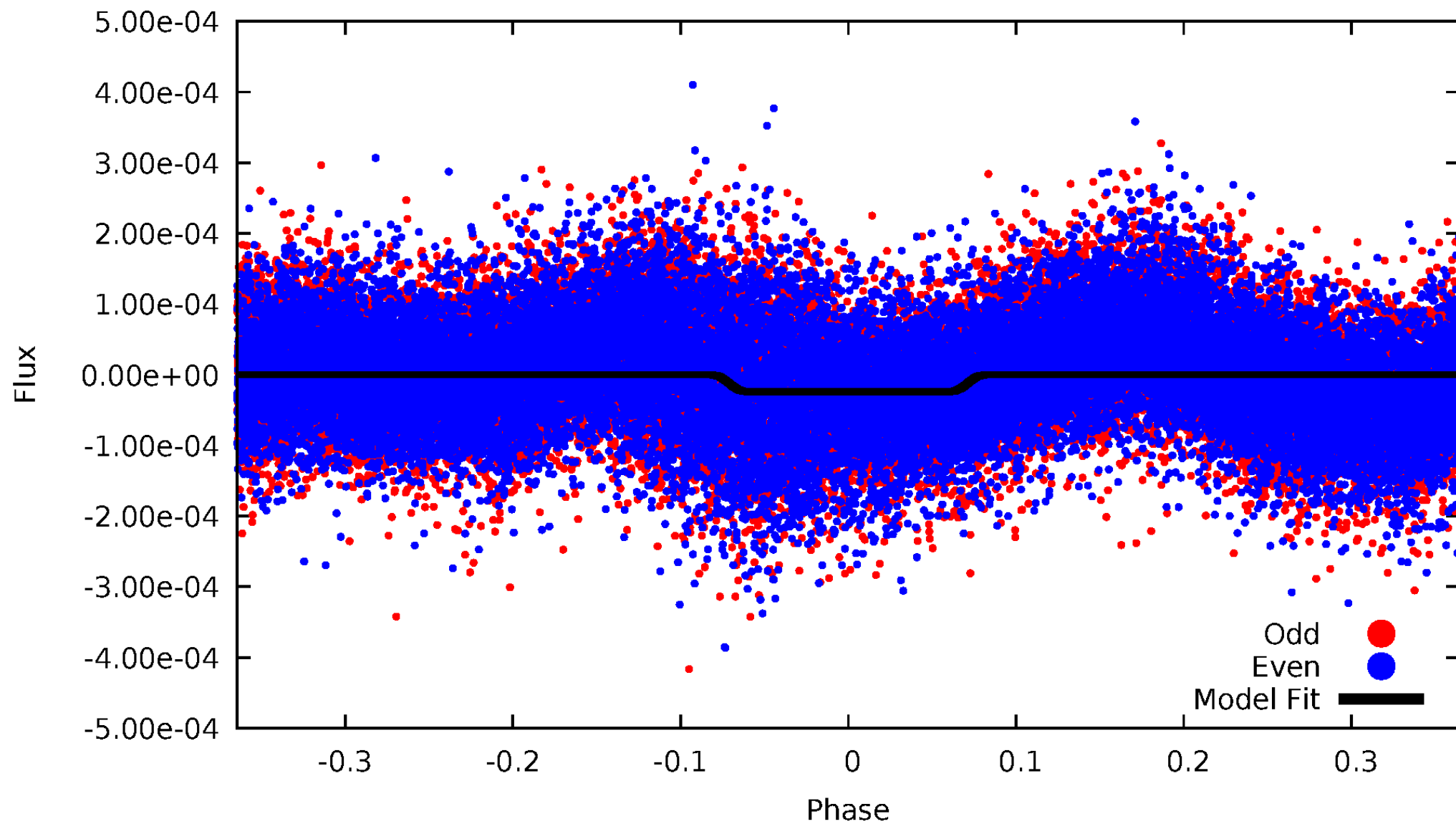
# DV Odd/Even

TCE 009156461-01

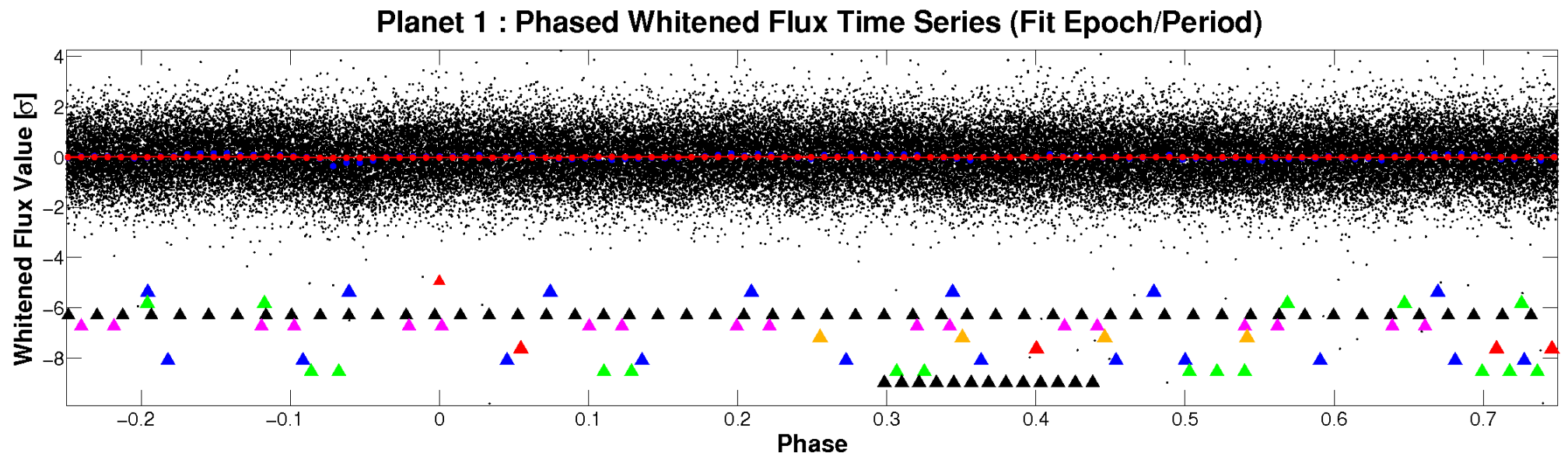
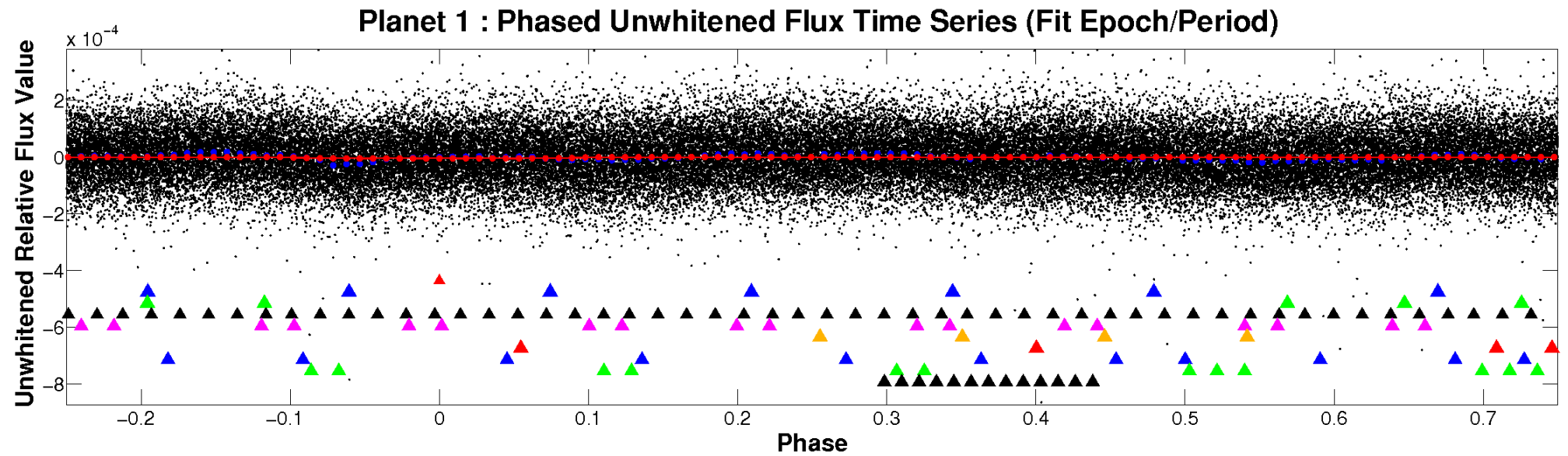


# ALT Odd/Even

TCE 009156461-01

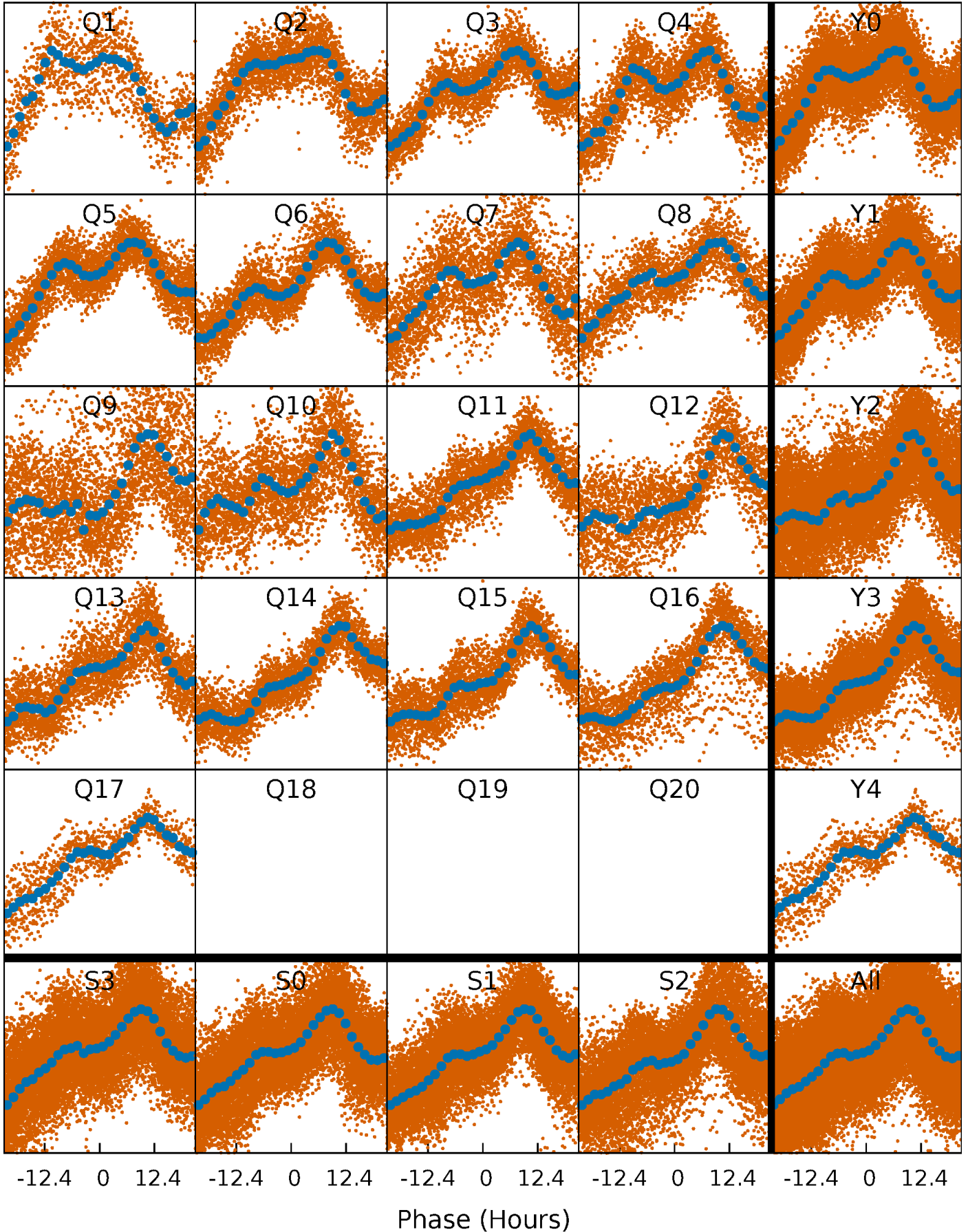


# Non-Whitened Vs. Whitened Light Curve



# PDC Quarter-Phased Transit Curves

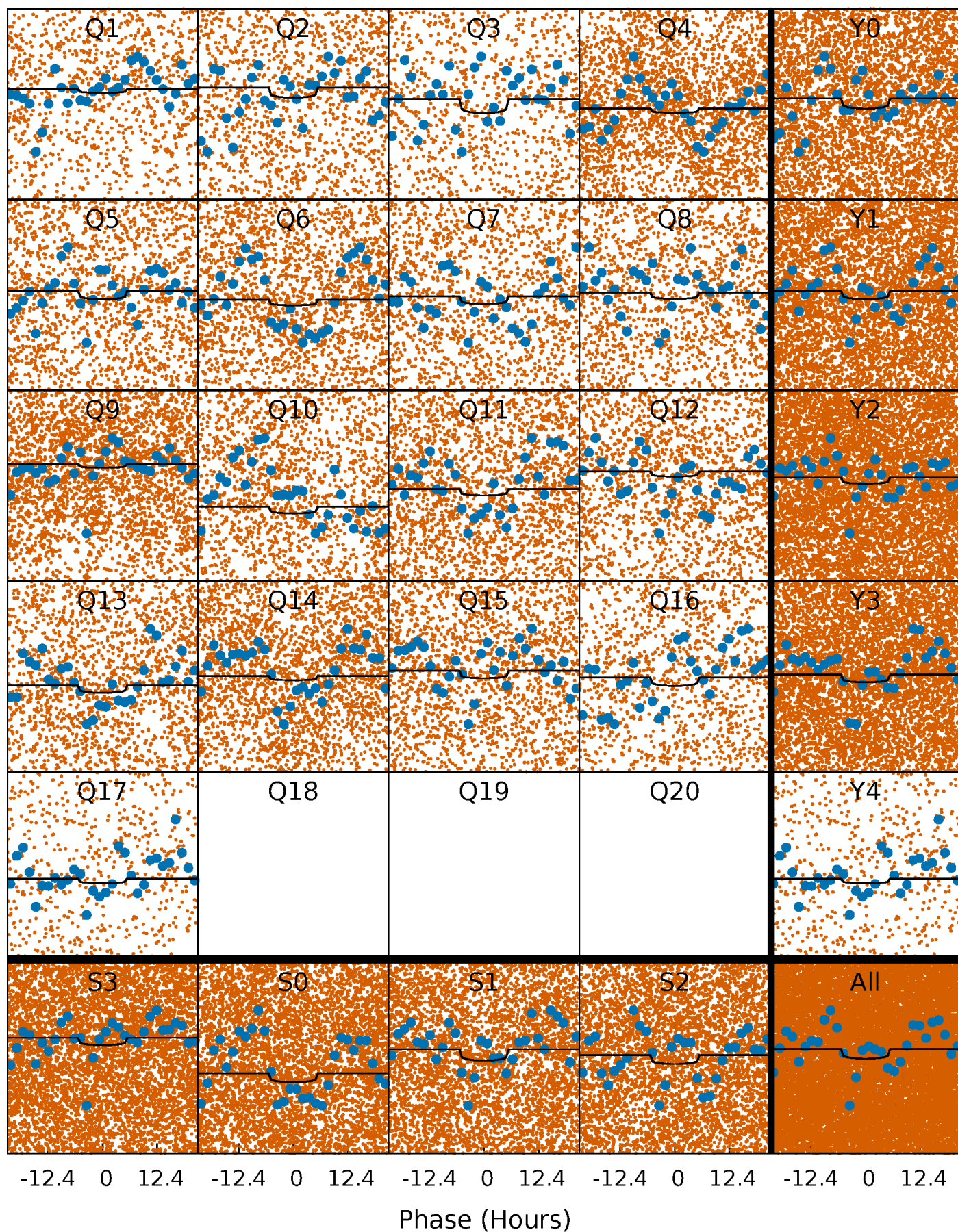
TCE 009156461-01   P= 2.296149 Days    $T_0=132.431446$  (BKJD)





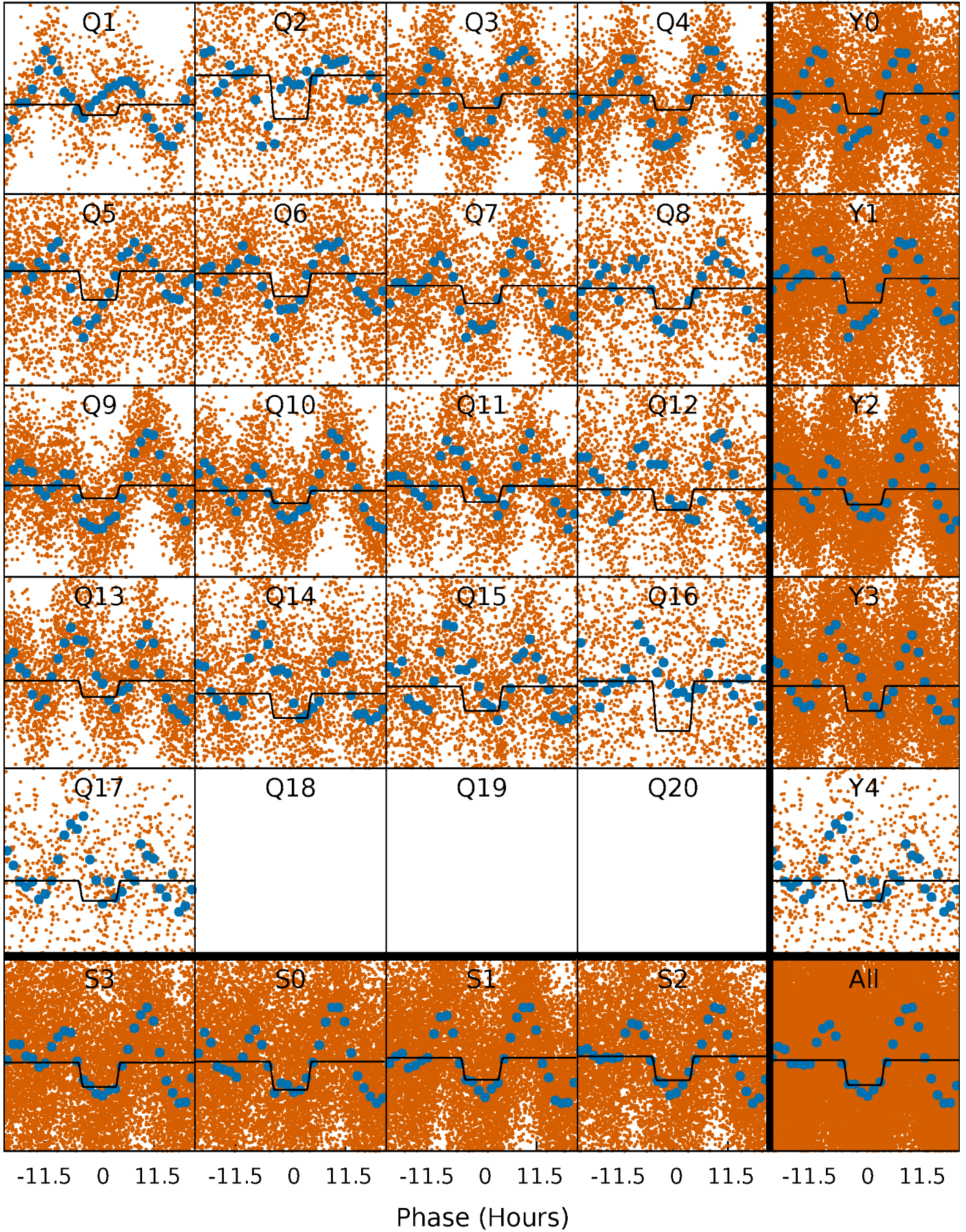
# DV Quarter-Phased Transit Curves

TCE 009156461-01 P= 2.296149 Days  $T_0=132.431446$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

TCE 009156461-01 P= 2.296258 Days  $T_0=132.420414$  (BKJD)

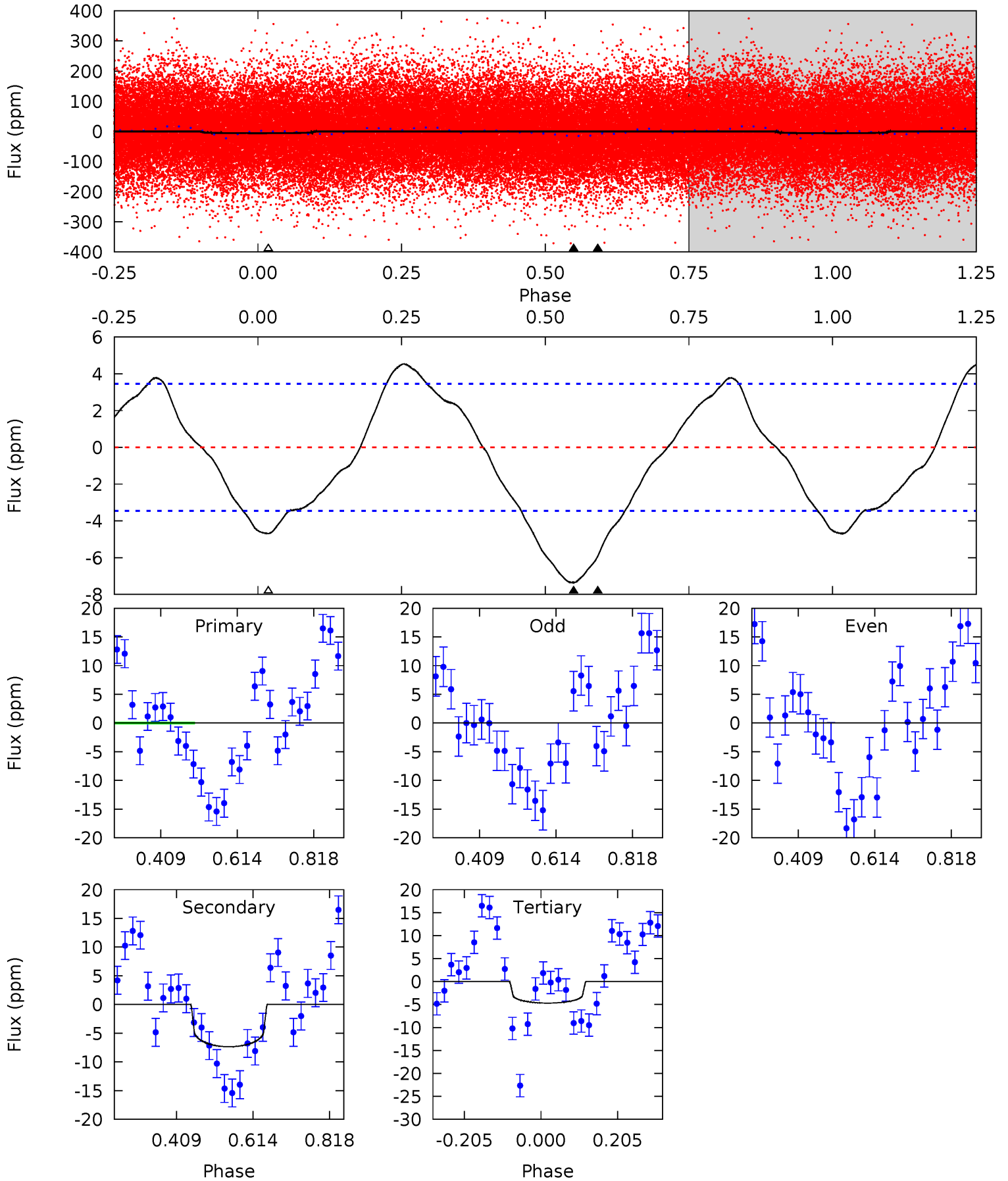




# DV Model-Shift Uniqueness Test

009156461-01, P = 2.296149 Days, E = 130.135297 Days

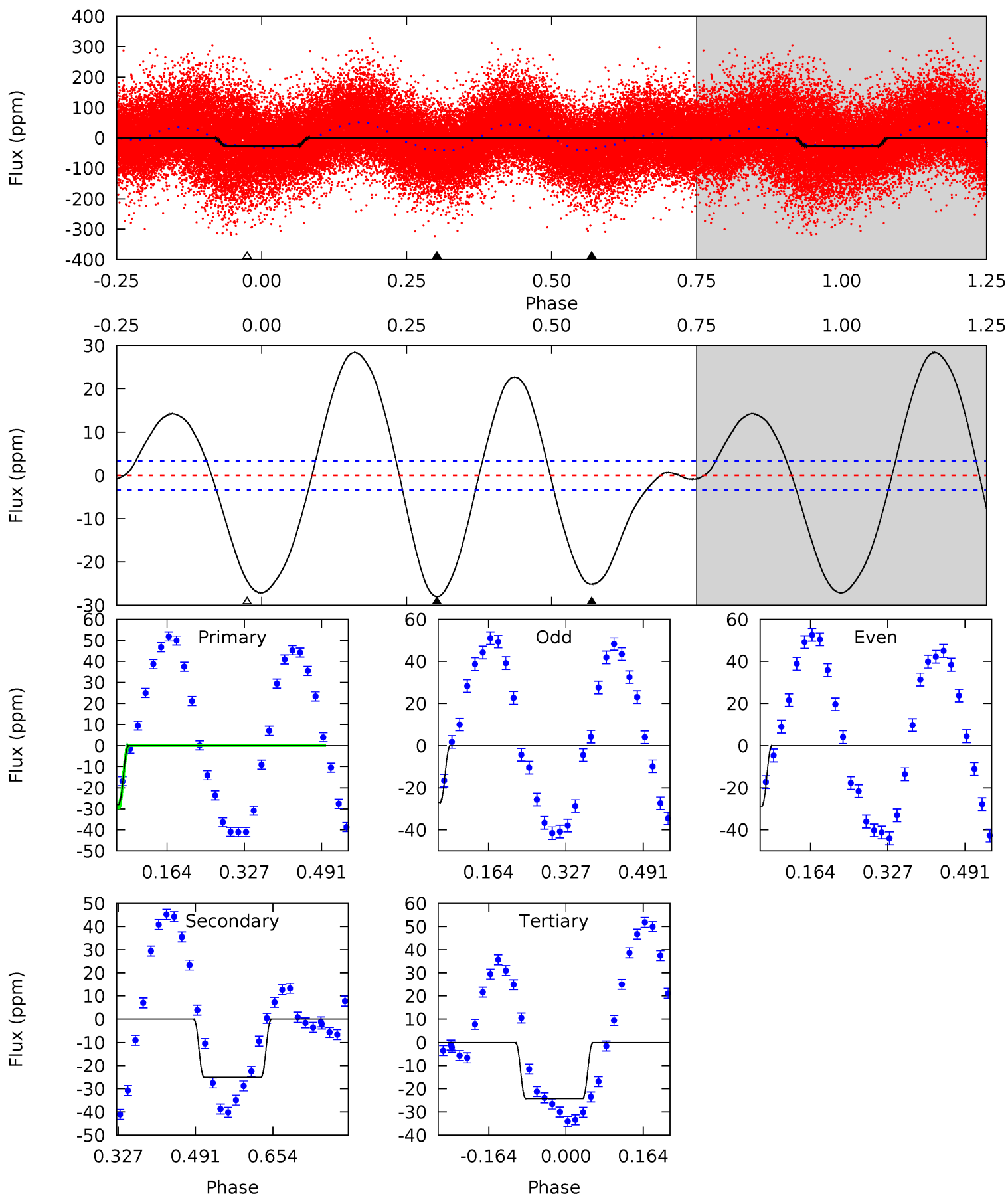
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
7.56	9.39	5.99	0	4.41	1.27	3.82	1.57	7.56	3.40	9.39	2.04	1.41	0.38	5.54



# Alt Model-Shift Uniqueness Test

009156461-01, P = 2.296258 Days, E = 130.124156 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
37.6	33.7	32.6	0	4.46	1.39	19.7	4.95	37.6	1.06	33.7	1.21	1.14	0.50	1.64





### Stellar Parameters For KIC 009156461

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6480^{+181}_{-250}$	$4.044^{+0.293}_{-0.158}$	$-0.120^{+0.250}_{-0.300}$	$1.822^{+0.510}_{-0.623}$	$1.345^{+0.193}_{-0.289}$	$0.313^{+0.619}_{-0.139}$
	+3%/-4%	+7%/-4%	+208%/-250%	+28%/-34%	+14%/-21%	+198%/-44%
Source	PHO54	PHO54	PHO54	DSEP		

KIC = Kepler Input Catalog; PHO = Photometry; SPE = Spectroscopy; AST = Asteroseismology  
 TRA = Transits; DESP = Dartmouth Models; MULT = Multiple Models

### Secondary Eclipse Parameters for KIC 009156461-01 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-7 \pm 1$	$0.42^{+0.18}_{-0.16}$	$2752^{+211}_{-251}$	$7199^{+2497}_{-1110}$	$33^{+58}_{-17}$
Alt.	$-25 \pm 1$	$0.93^{+0.26}_{-0.21}$	$2723^{+226}_{-251}$	$6483^{+706}_{-514}$	$22^{+15}_{-8}$

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

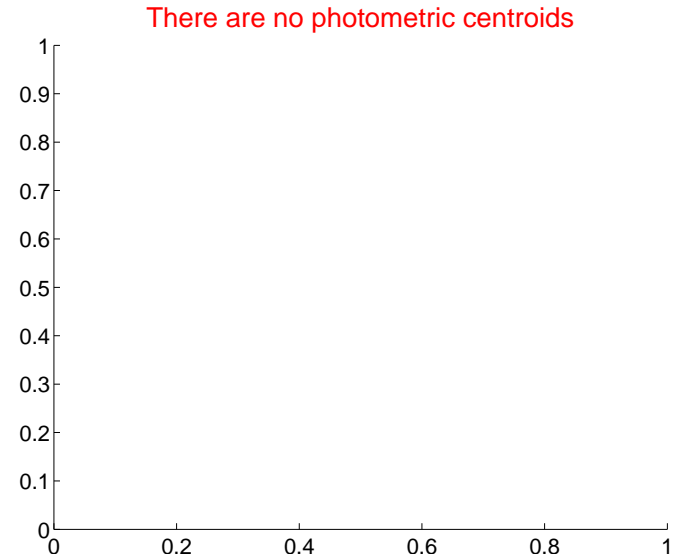
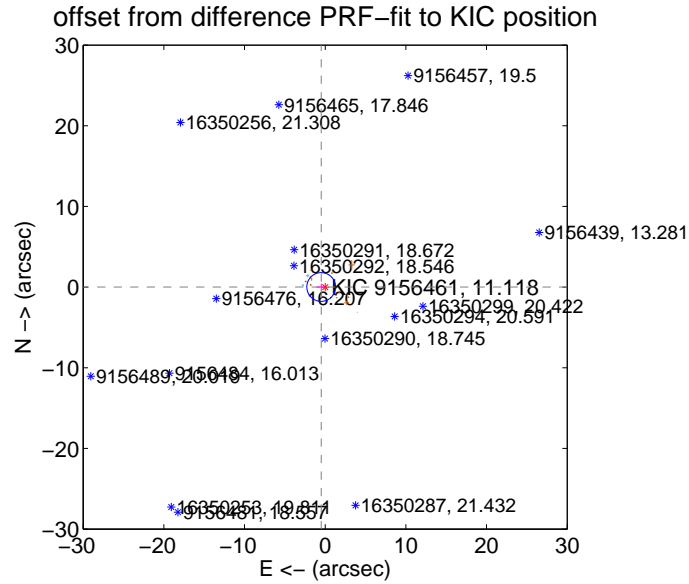
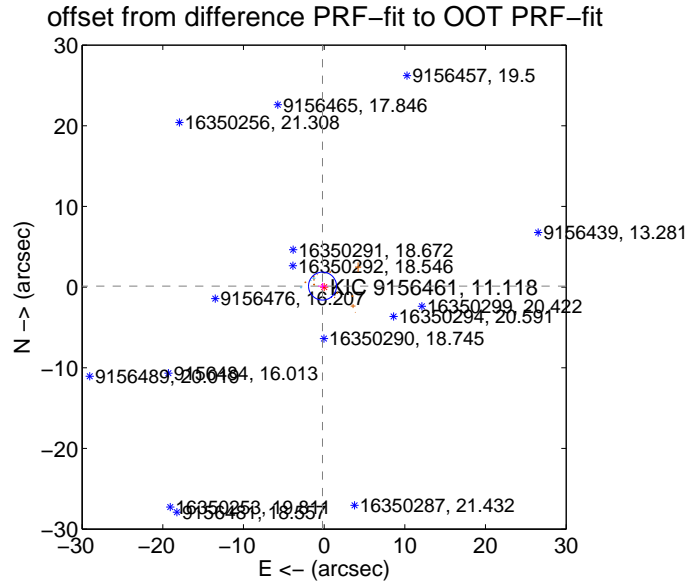
## DV Centroid Data

Supplemental centroid analysis for 009156461-01. **Kepler magnitude: 11.12.** Transit SNR 2.70

There are 4 quarters with good PRF difference image offsets

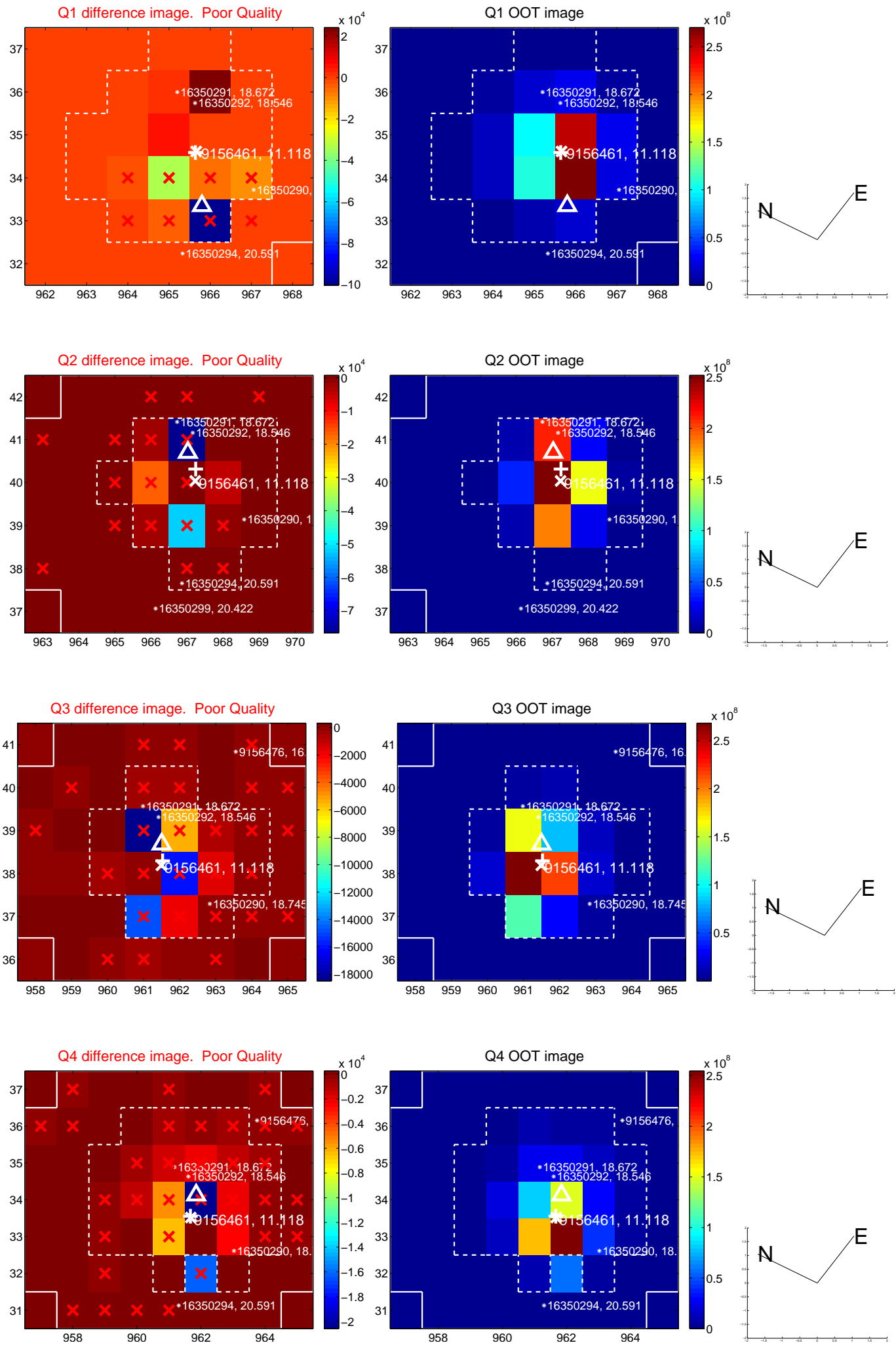
The direct PRF centroid is offset from the target star catalog position by about 0.16 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.237 \pm 0.578$	0.41	$0.200 \pm 0.549$	$0.126 \pm 0.388$
PRF-fit source offset from KIC position	$0.496 \pm 0.593$	0.84	$0.495 \pm 0.588$	$0.014 \pm 0.402$
photometric centroid source offset	—	—	—	—

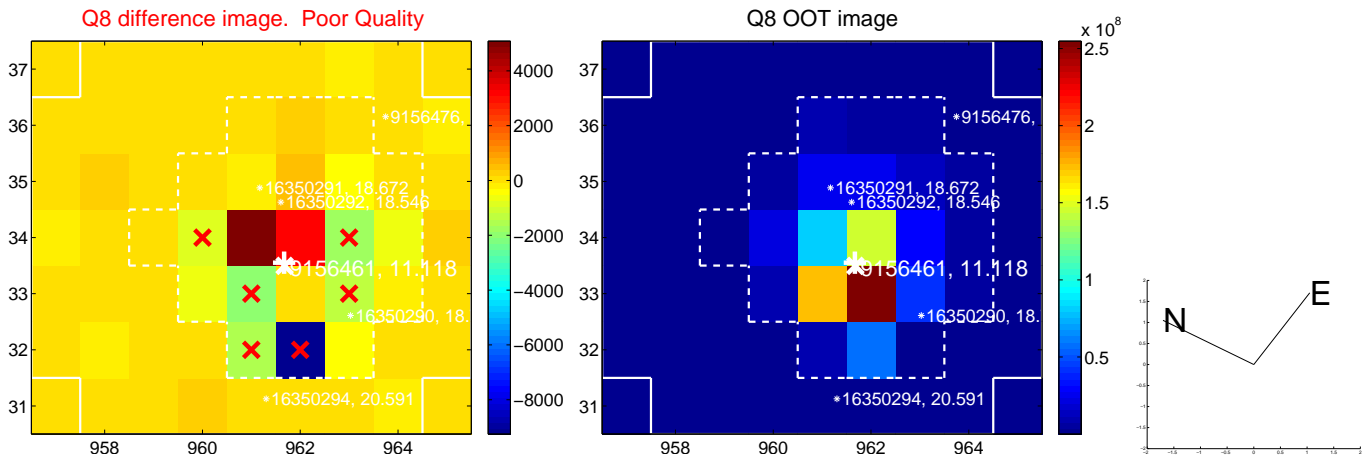
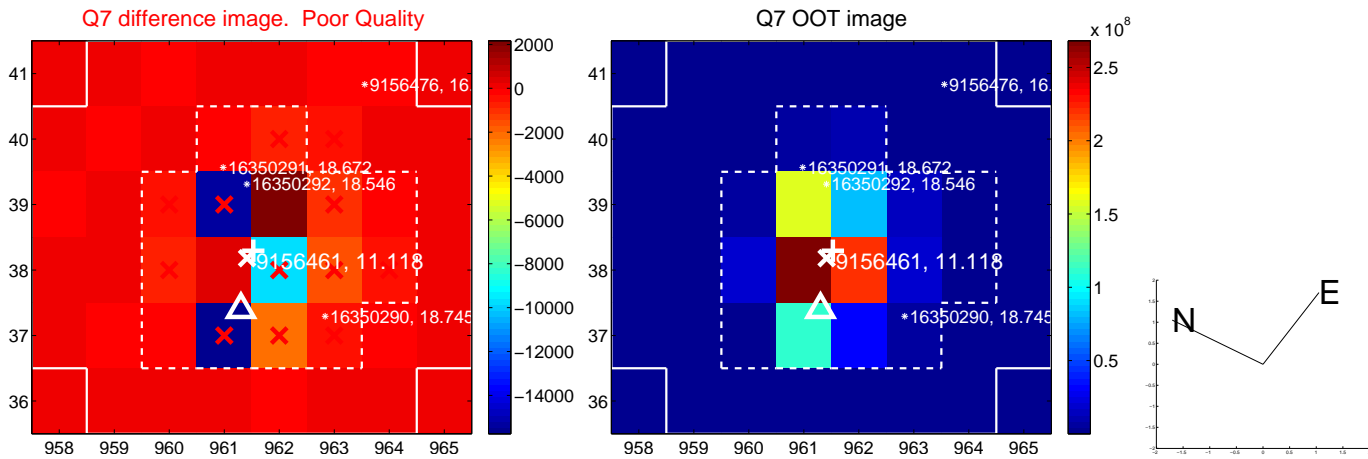
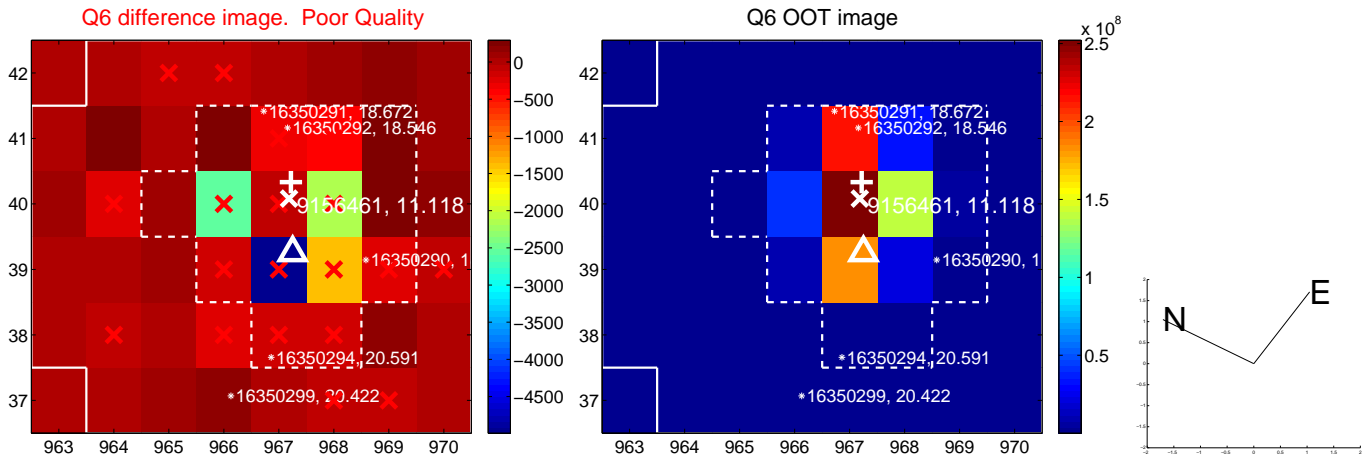
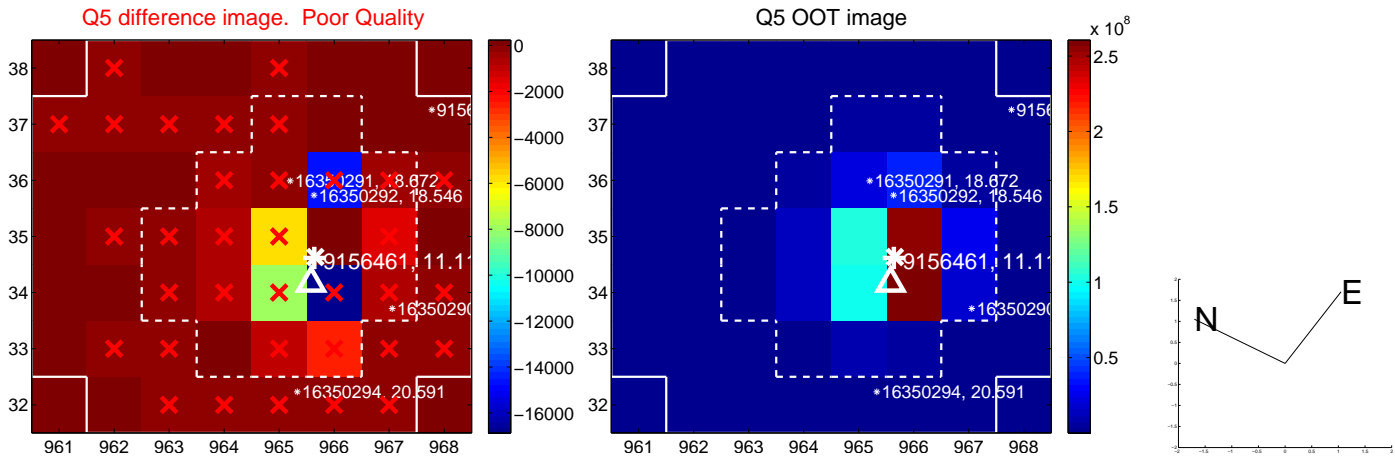


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

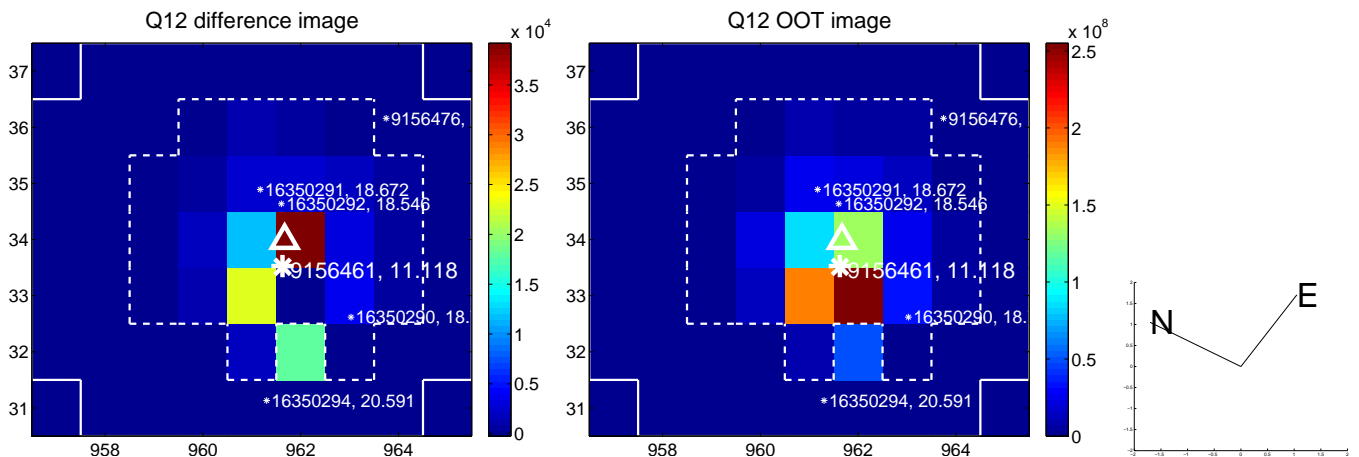
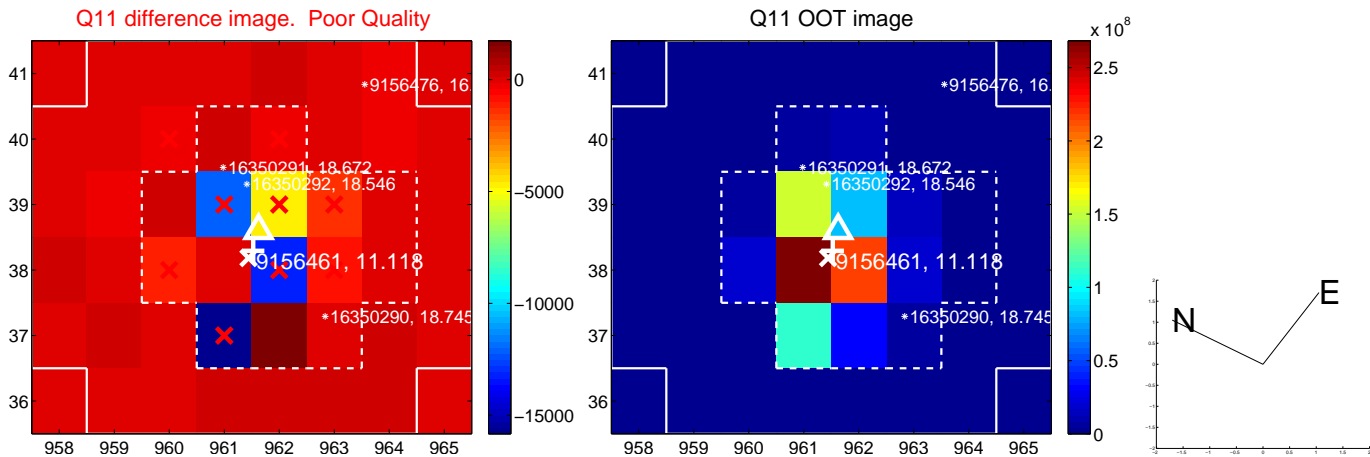
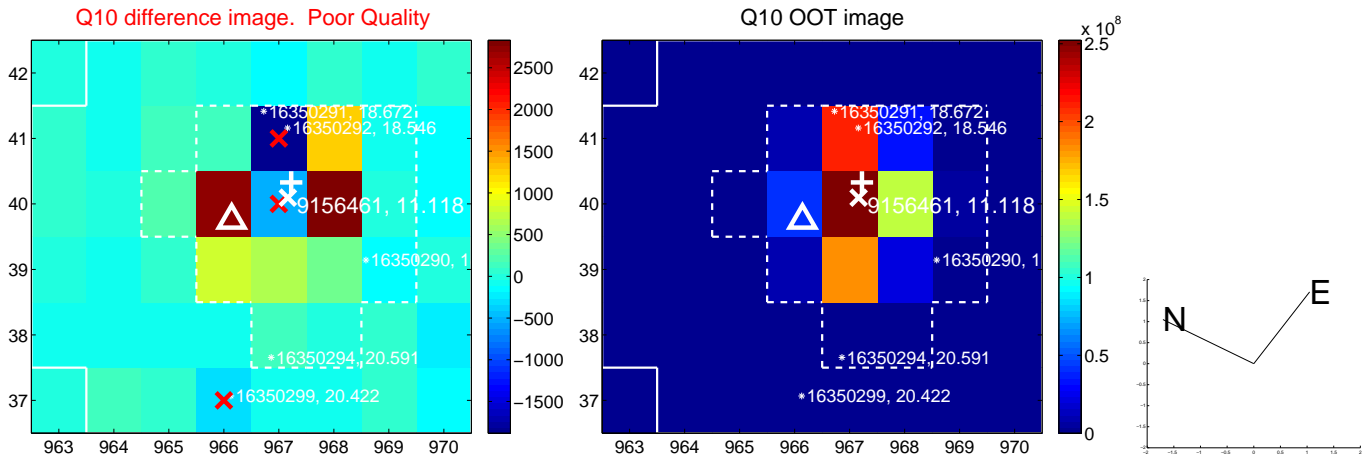
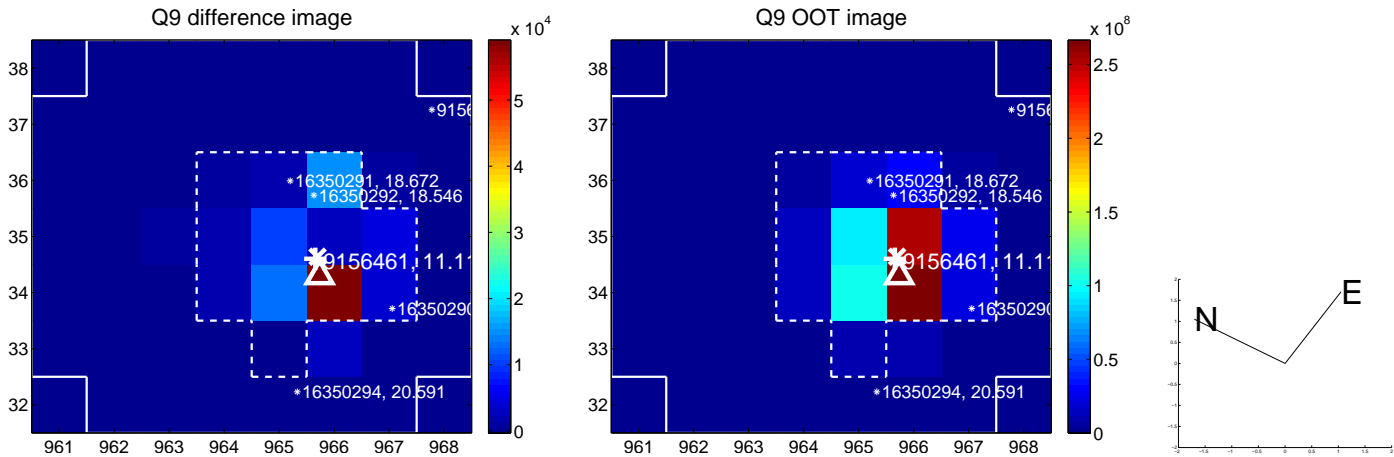


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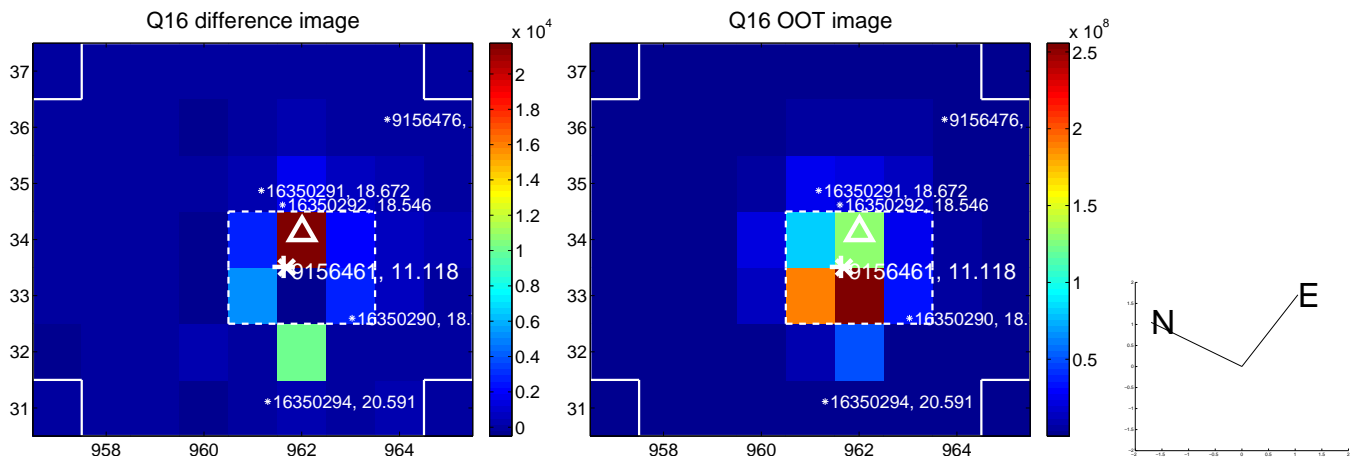
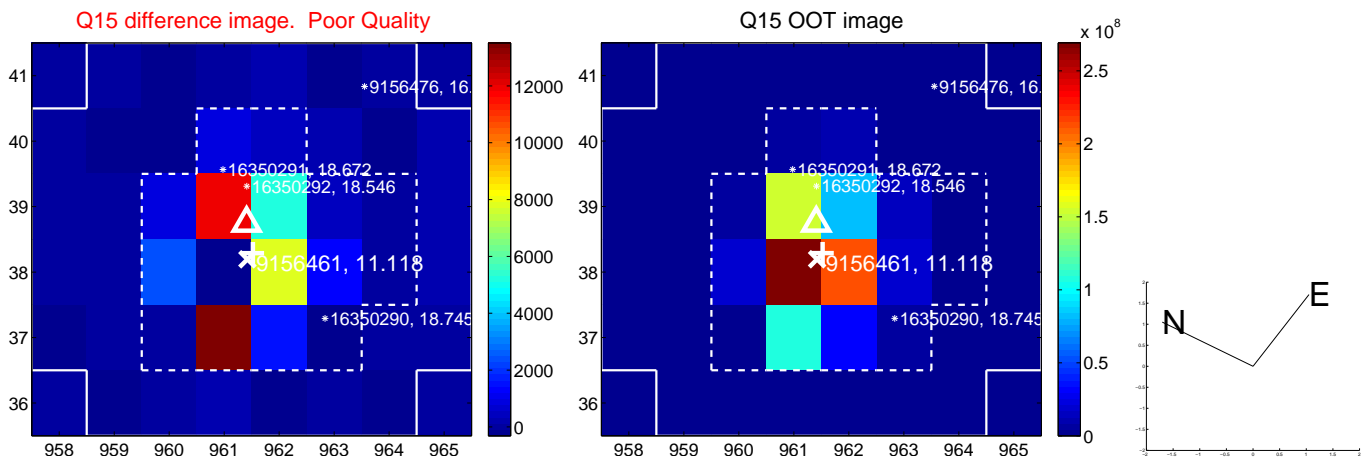
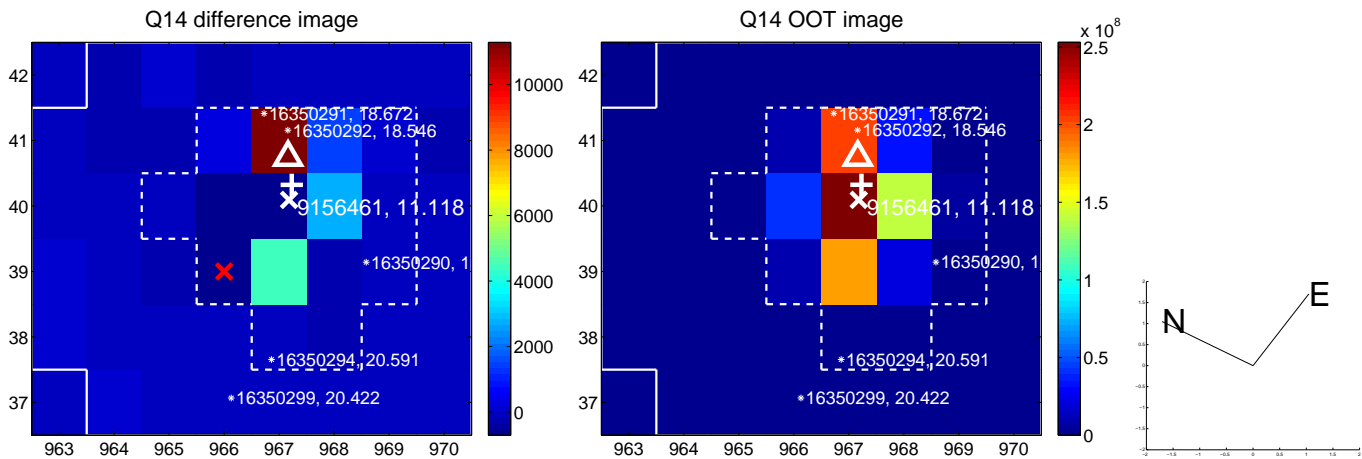
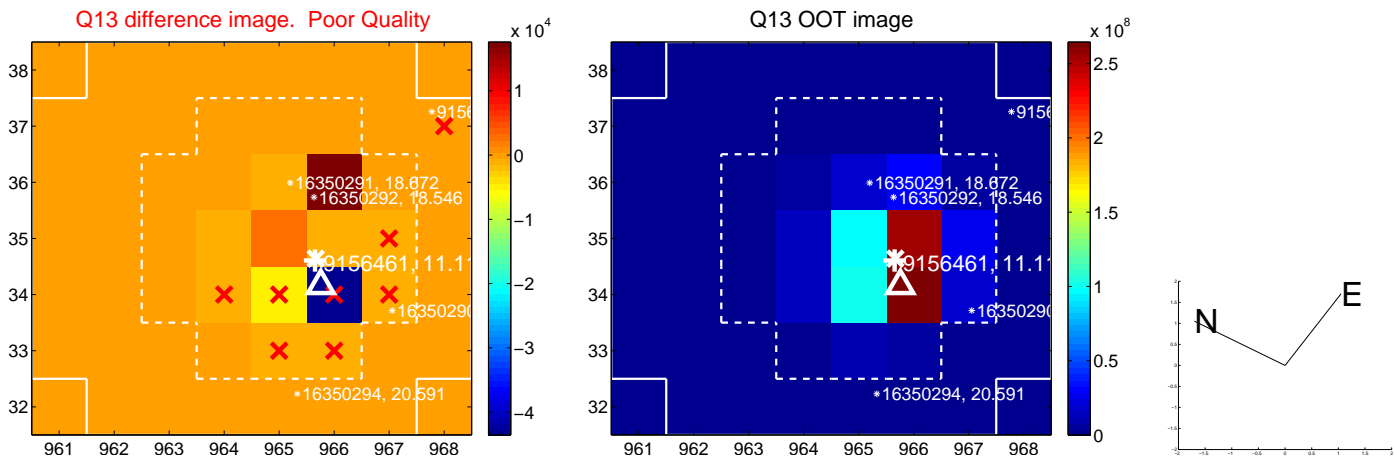




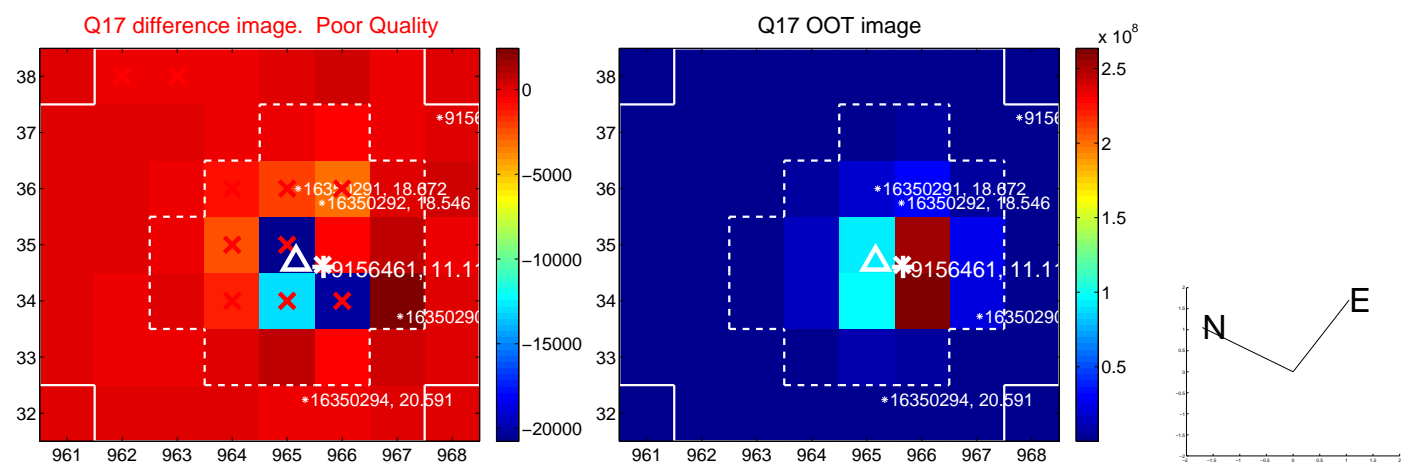
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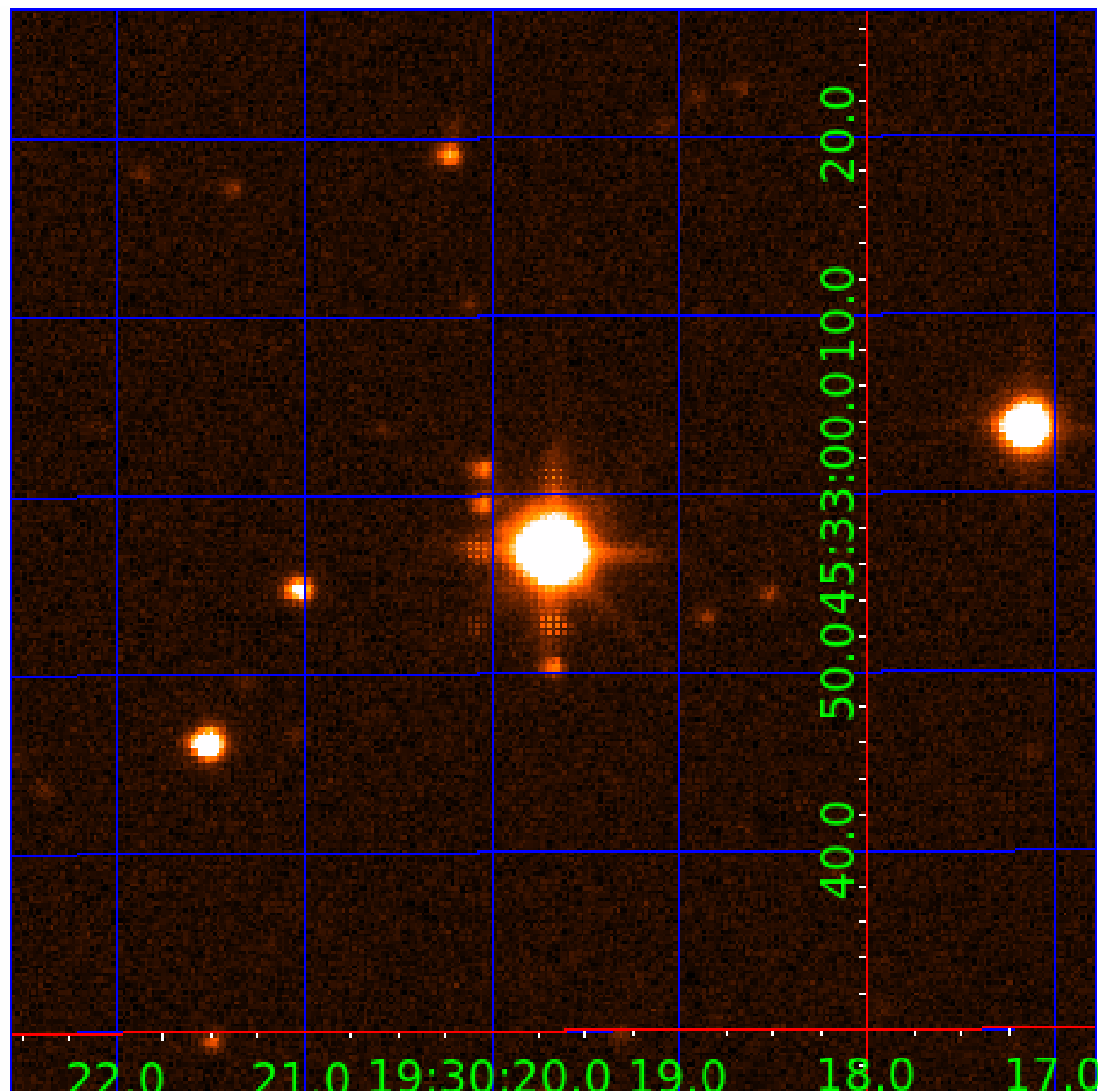
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folded centroid time series figure for this object.

UKIRT Image

Declination





## KIC 009156461

## 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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009156461-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_ZUMA—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
009156461-05	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—CENT_SATURATED—HALO_GHOST
009156461-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
009156461-08	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—INCONSISTENT_TRANS—CENT_SATURATED
009156461-09	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_CHASES—TRANS_GAPPED—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
009156461-10	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED

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

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

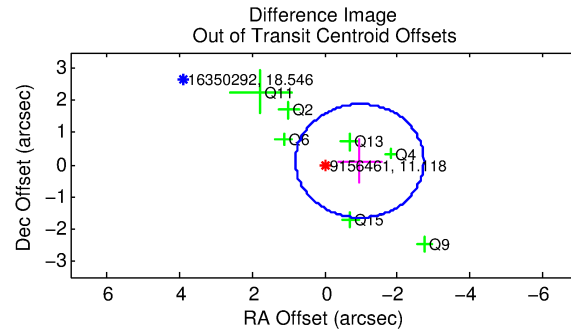
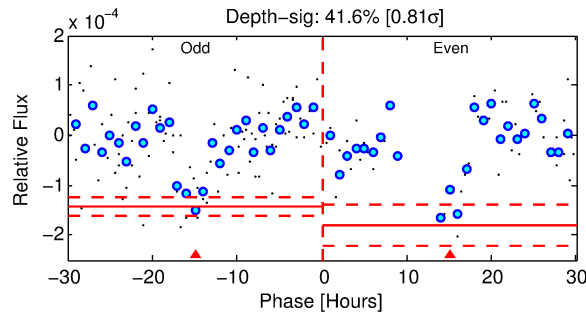
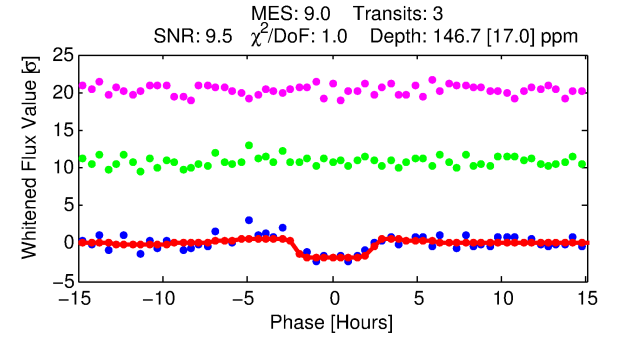
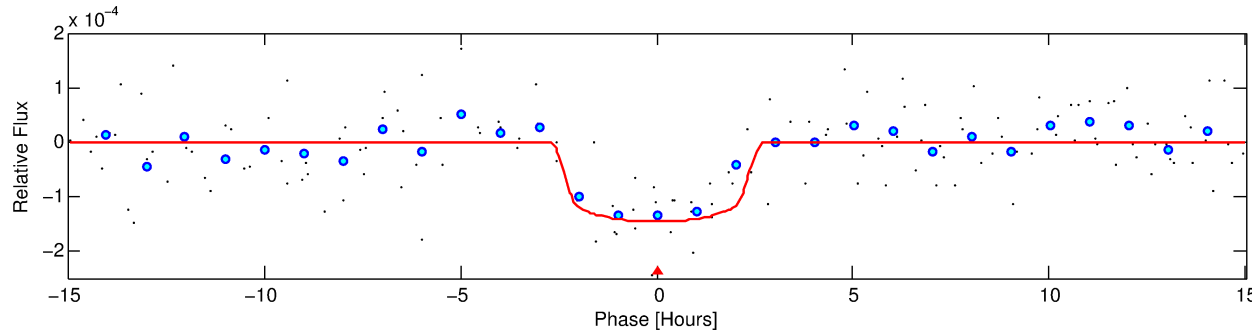
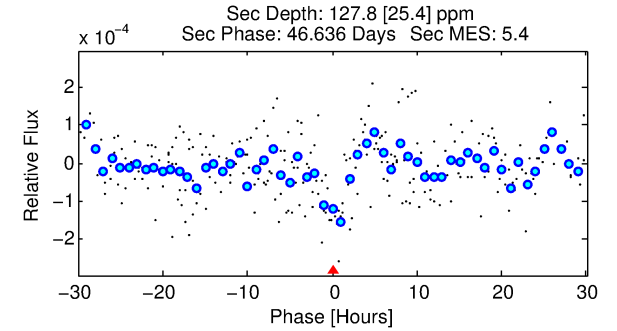
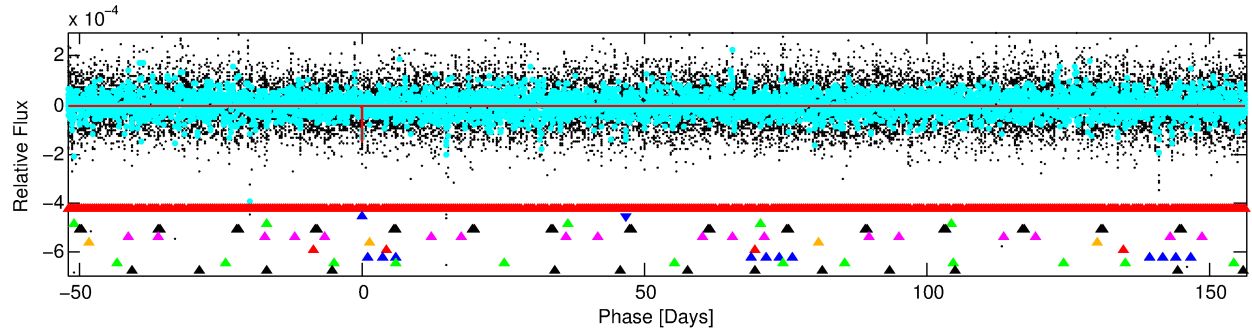
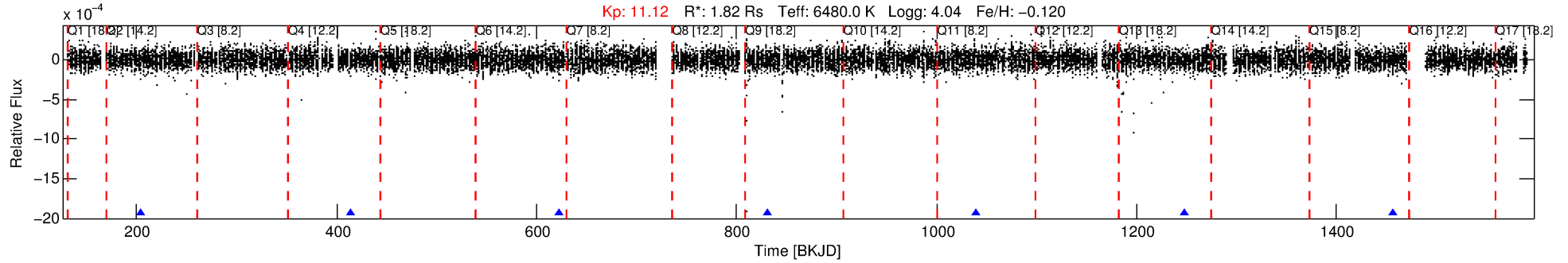
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 009156461-02

No Significant Match Found

# DV One-Page Summary

KIC: 9156461 Candidate: 2 of 10 Period: 208.640 d



## DV Fit Results:

Period = 208.63980 [0.00291] d  
Epoch = 204.7122 [0.0093] BKJD  
Rp/R\* = 0.0126 [0.0114]  
a/R\* = 170.52 [867.98]  
b = 0.86 [1.57]  
Seff = 9.10 [4.80]  
Teq = 443 [58] K  
Rp = 2.51 [2.43] Re  
a = 0.7591 [0.2431] AU  
Ag = 6441.29 [12168.88] [0.53σ]  
Teffp = 6134 [2802] K [2.03σ]

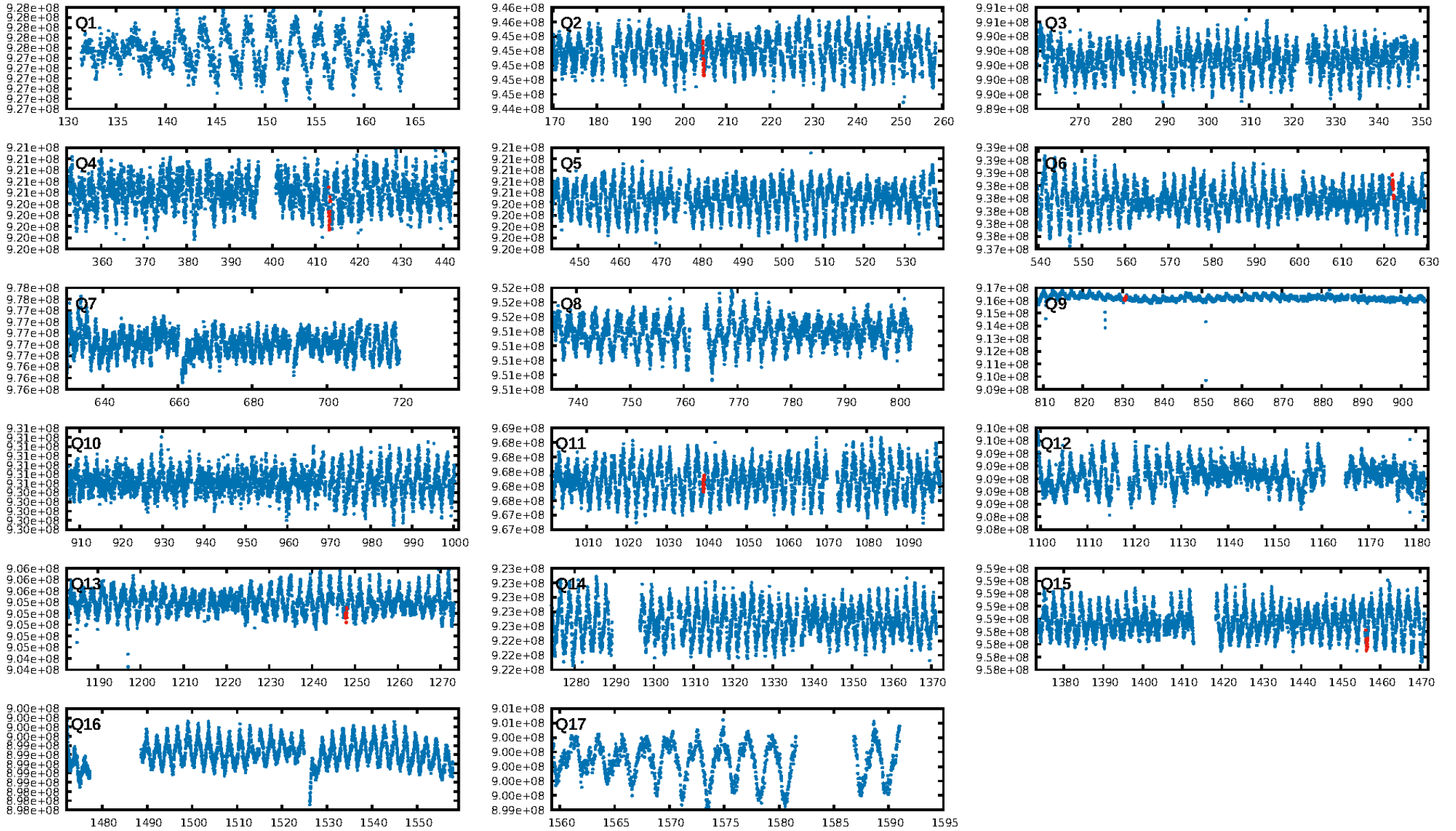
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [150.84σ]  
LongPeriod-sig: 100.0% [143.29σ]  
ModelChiSquare2-sig: 62.4%  
ModelChiSquareGof-sig: 99.4%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: 0.8636  
Centroid-sig: 27.1%  
Centroid-so: 0.479 arcsec [0.64σ]  
OotOffset-rm: 0.970 arcsec [1.65σ]  
OotOffset-st: 2/2/1/2 [7]  
KicOffset-rm: 0.710 arcsec [0.95σ]  
KicOffset-st: 2/2/1/2 [7]  
DiffImageQuality-fgm: 0.57 [4/7]  
DiffImageOverlap-fno: 0.43 [3/7]

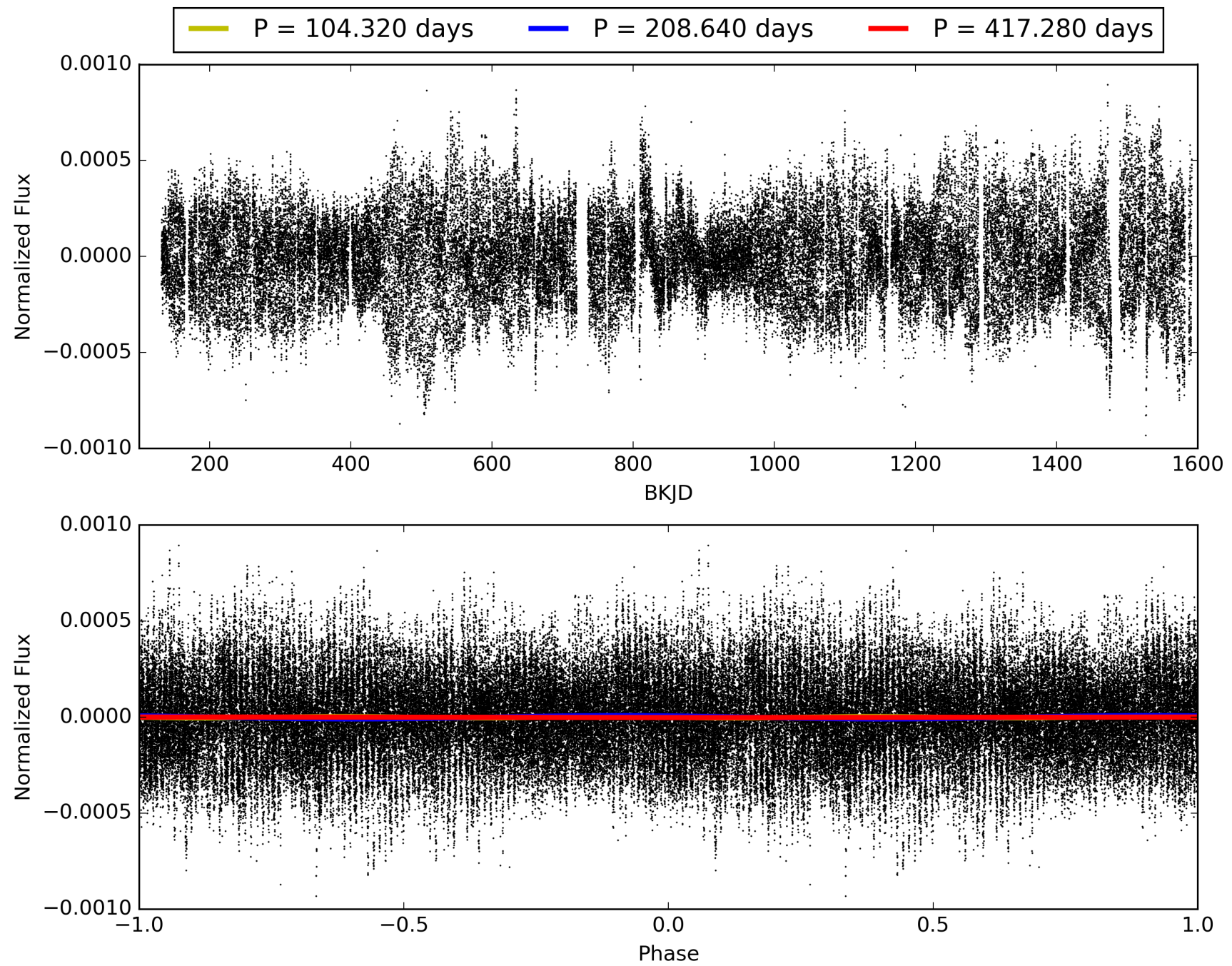
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 22:28:38 Z

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

# TCE 009156461-02, PDC Light Curves

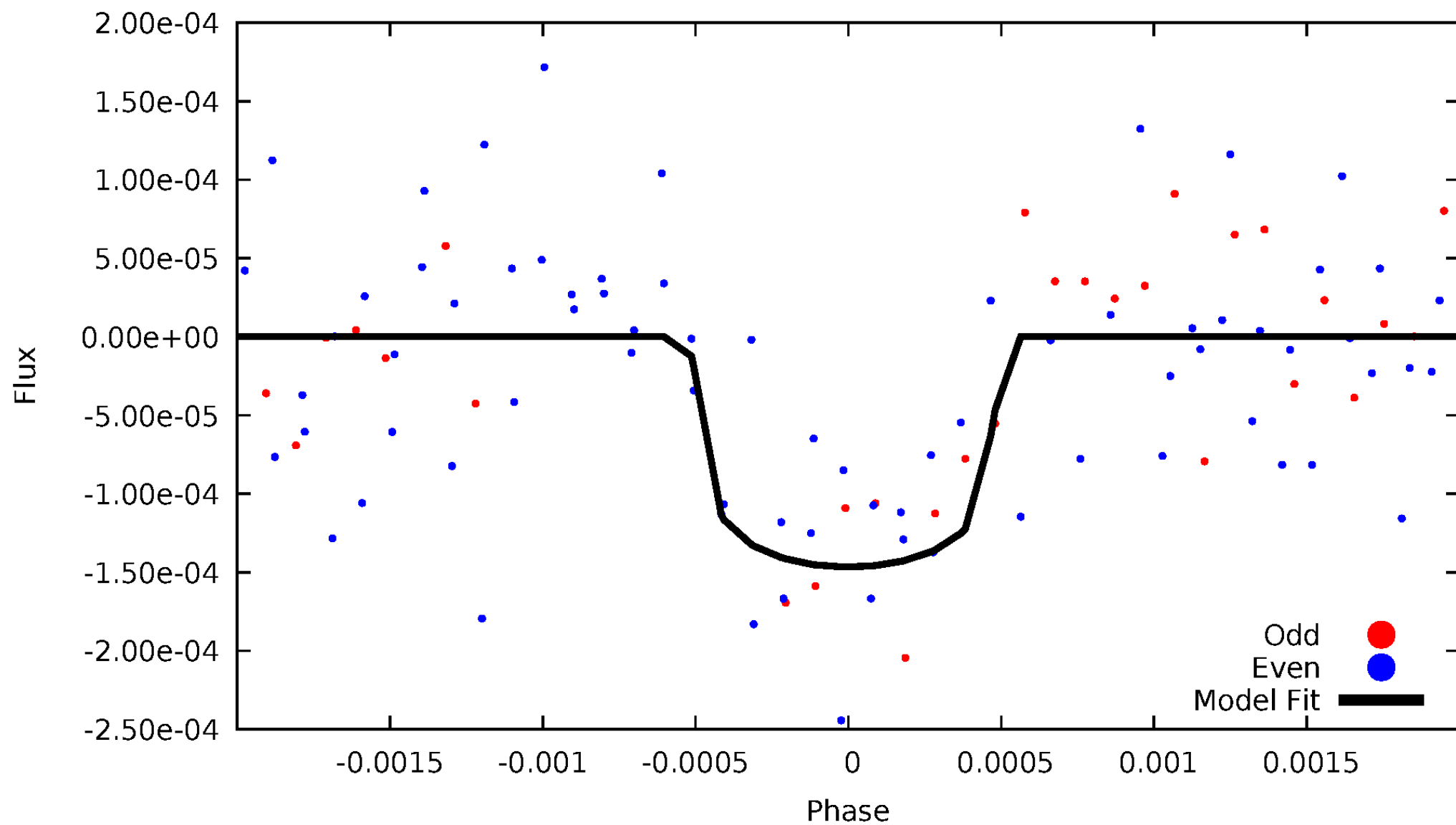


TCE 009156461-02



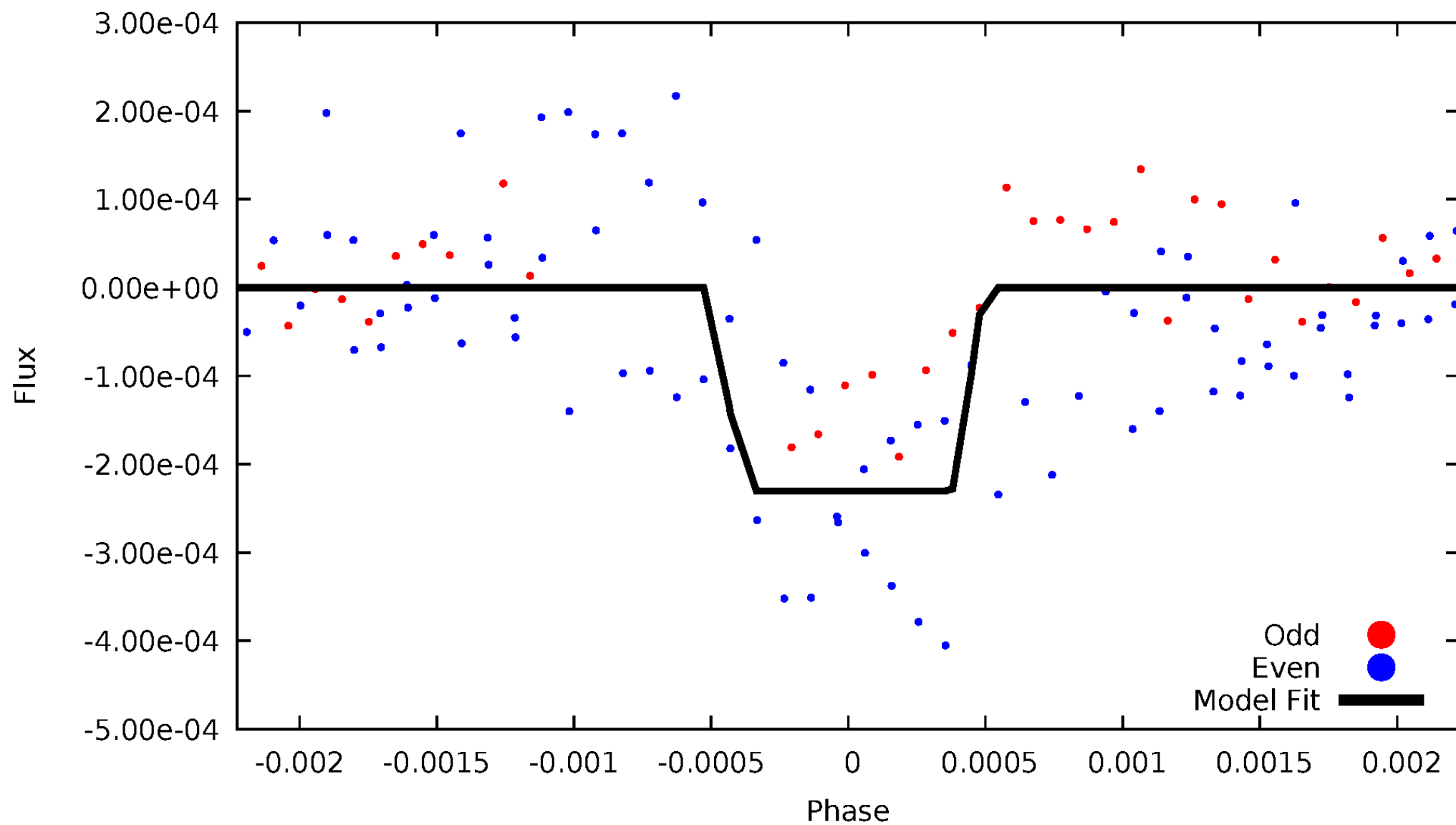
# DV Odd/Even

TCE 009156461-02



# ALT Odd/Even

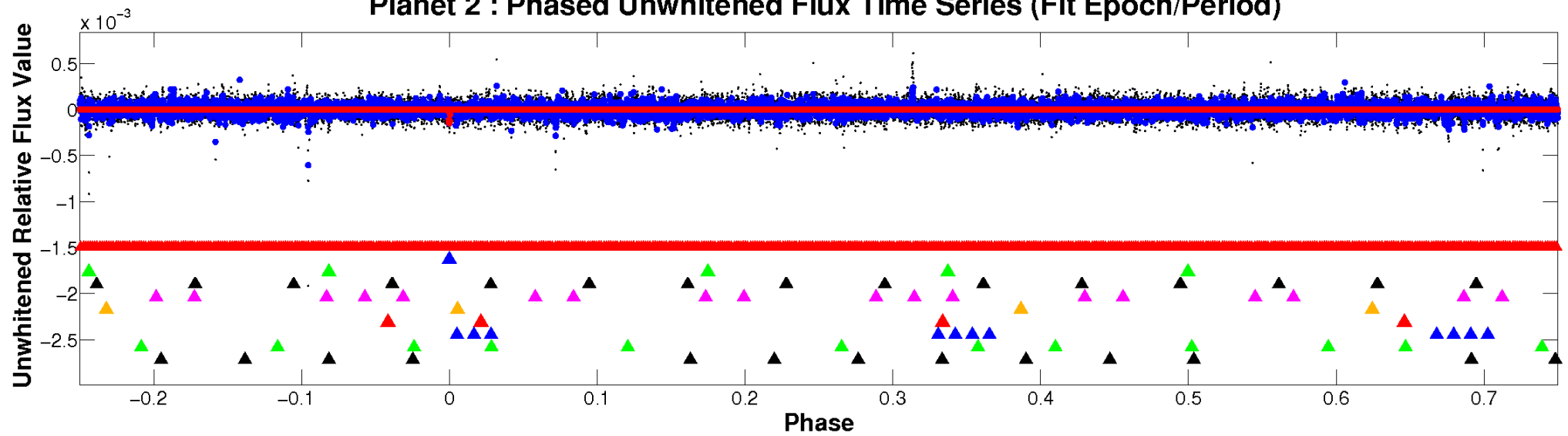
TCE 009156461-02



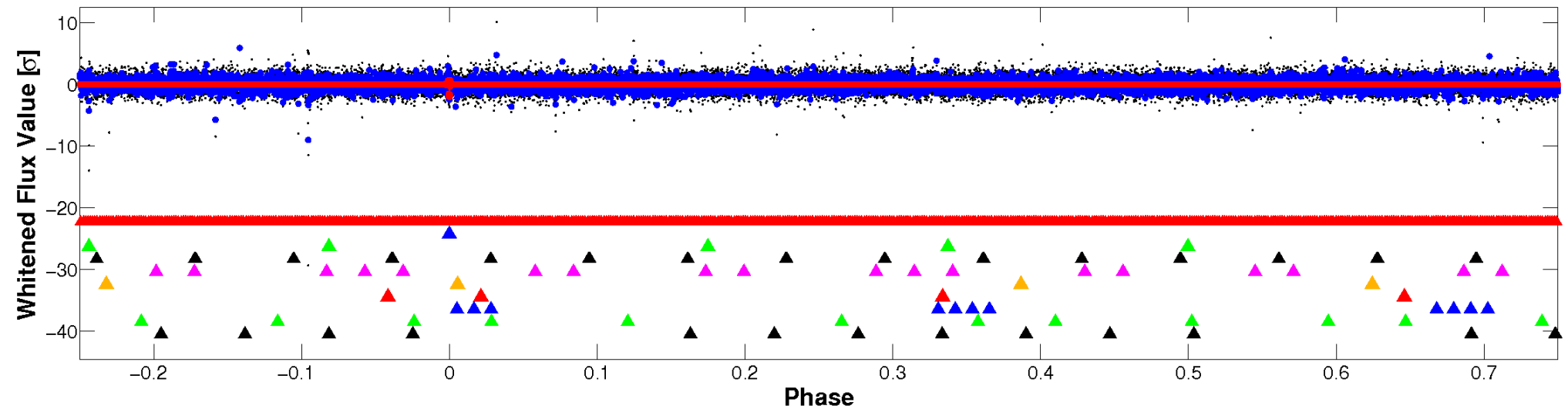


# Non-Whitened Vs. Whitened Light Curve

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

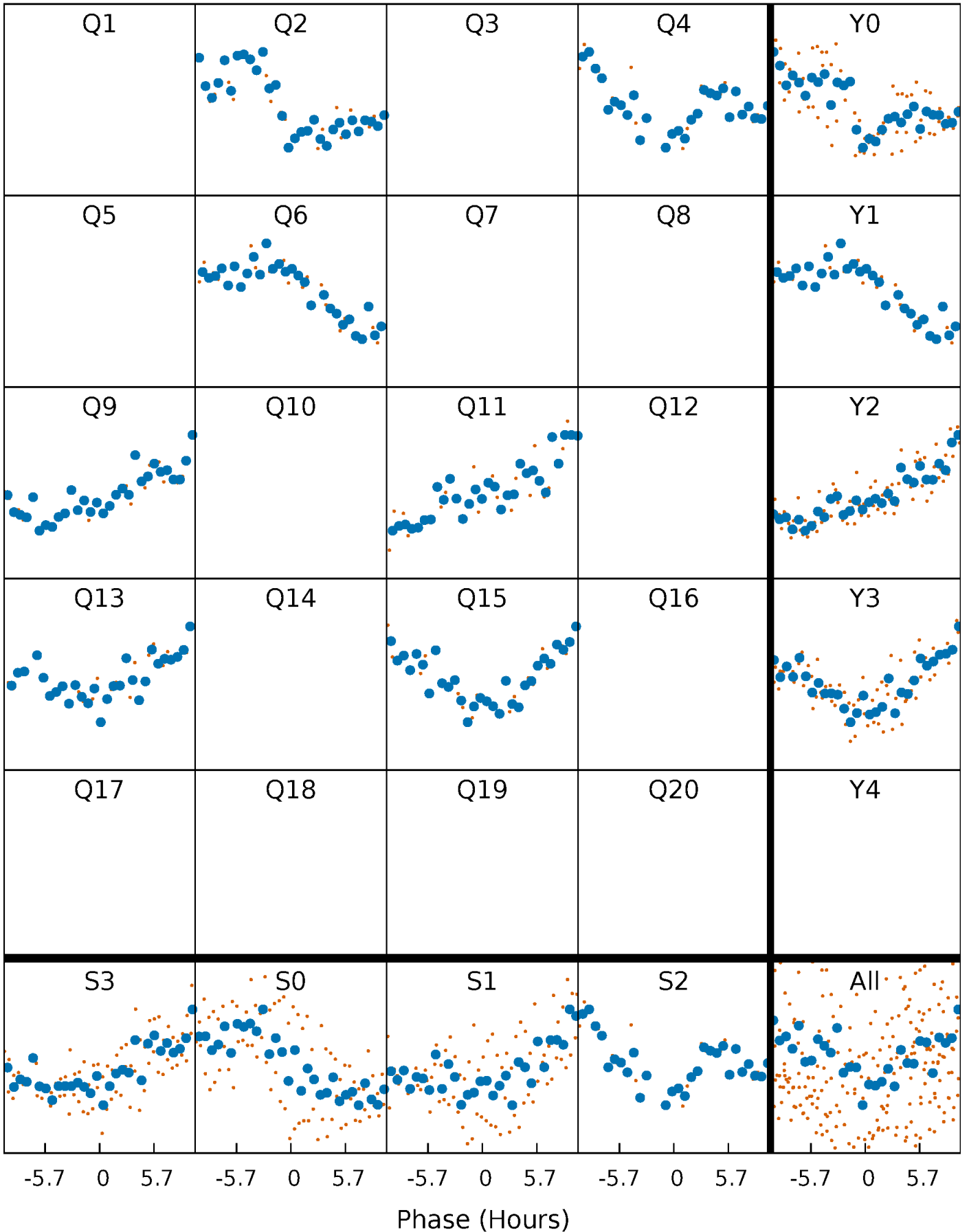


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



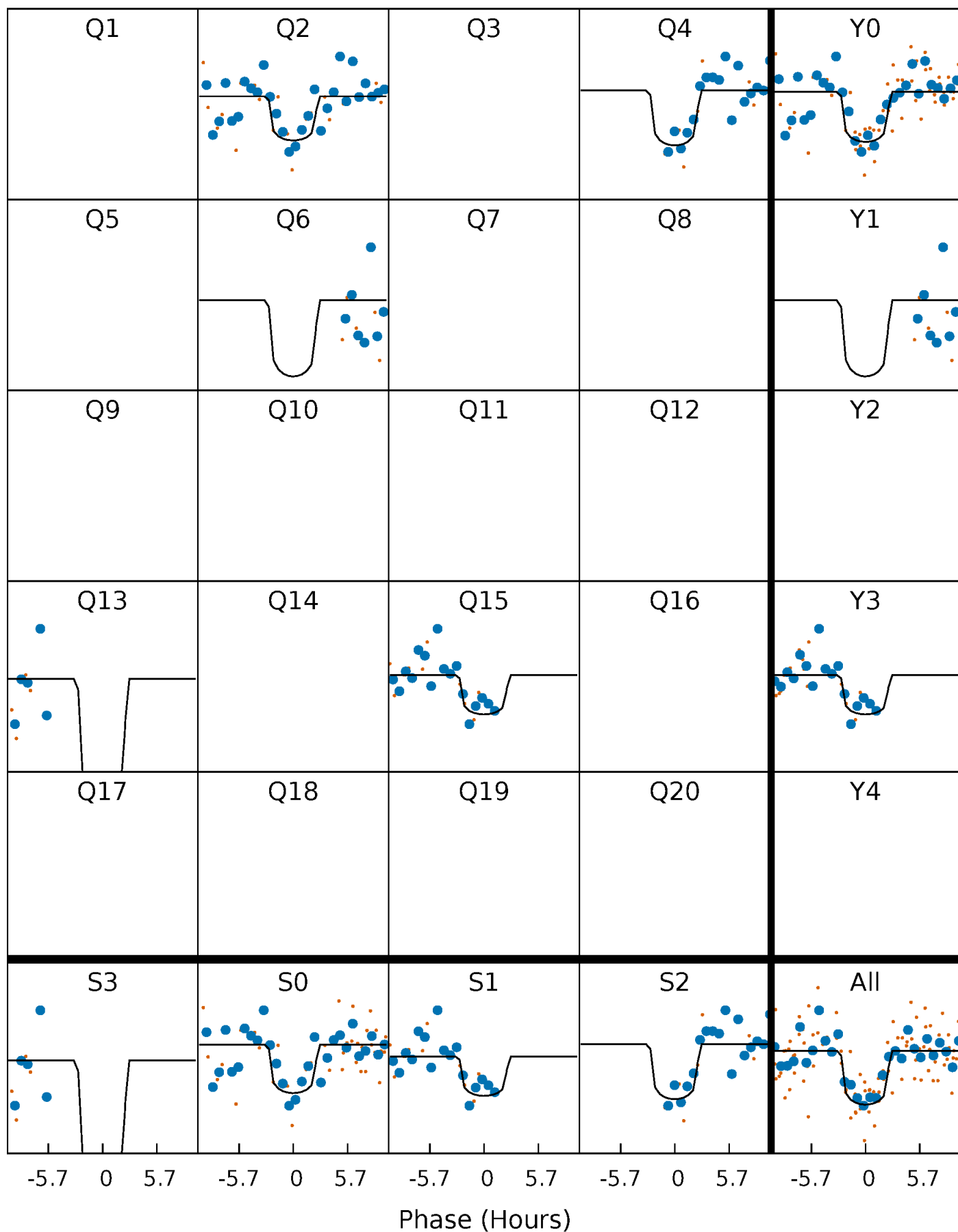
# PDC Quarter-Phased Transit Curves

TCE 009156461-02     $P=208.639795$  Days     $T_0=204.712221$  (BKJD)



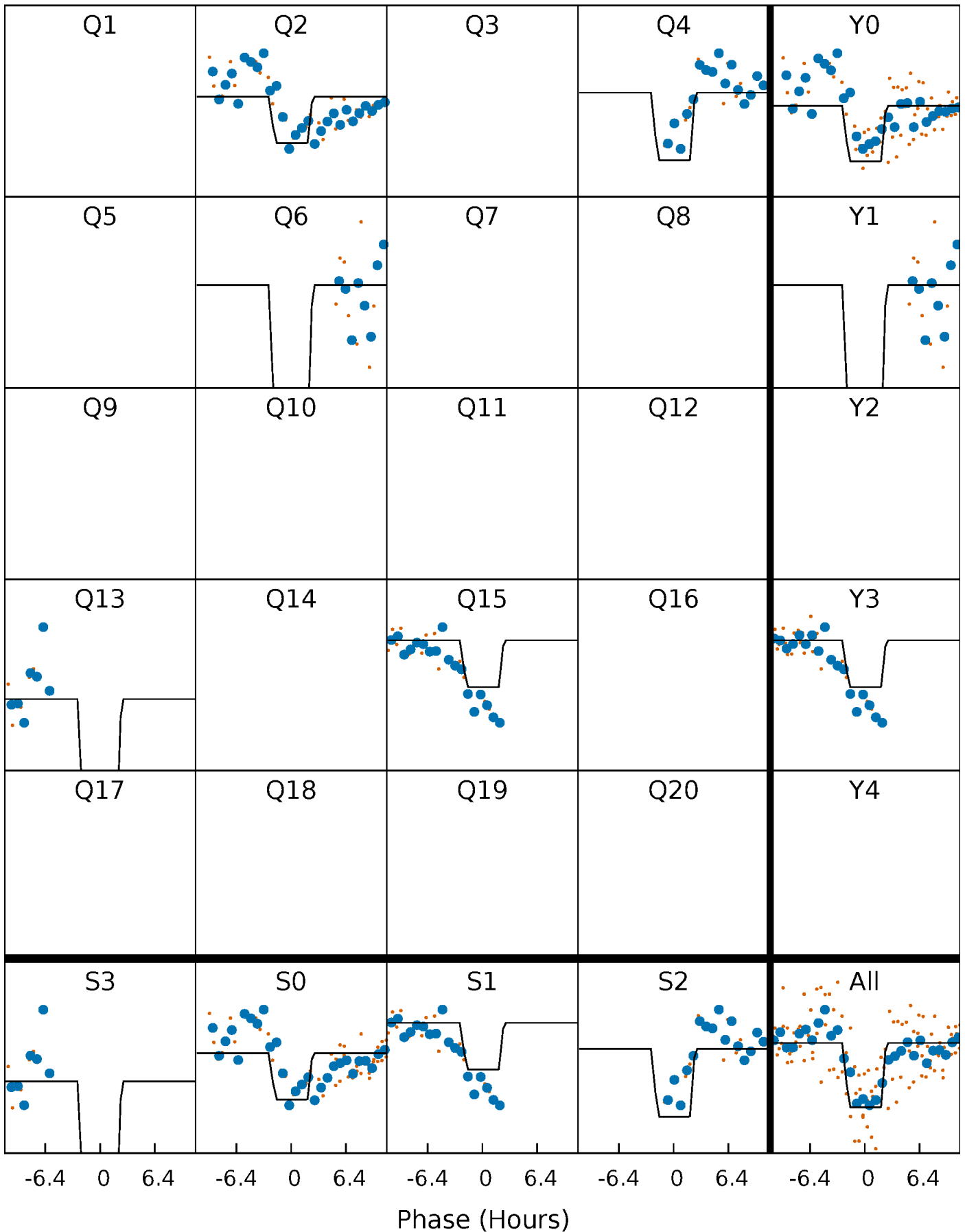
# DV Quarter-Phased Transit Curves

TCE 009156461-02   P=208.639795 Days    $T_0=204.712221$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

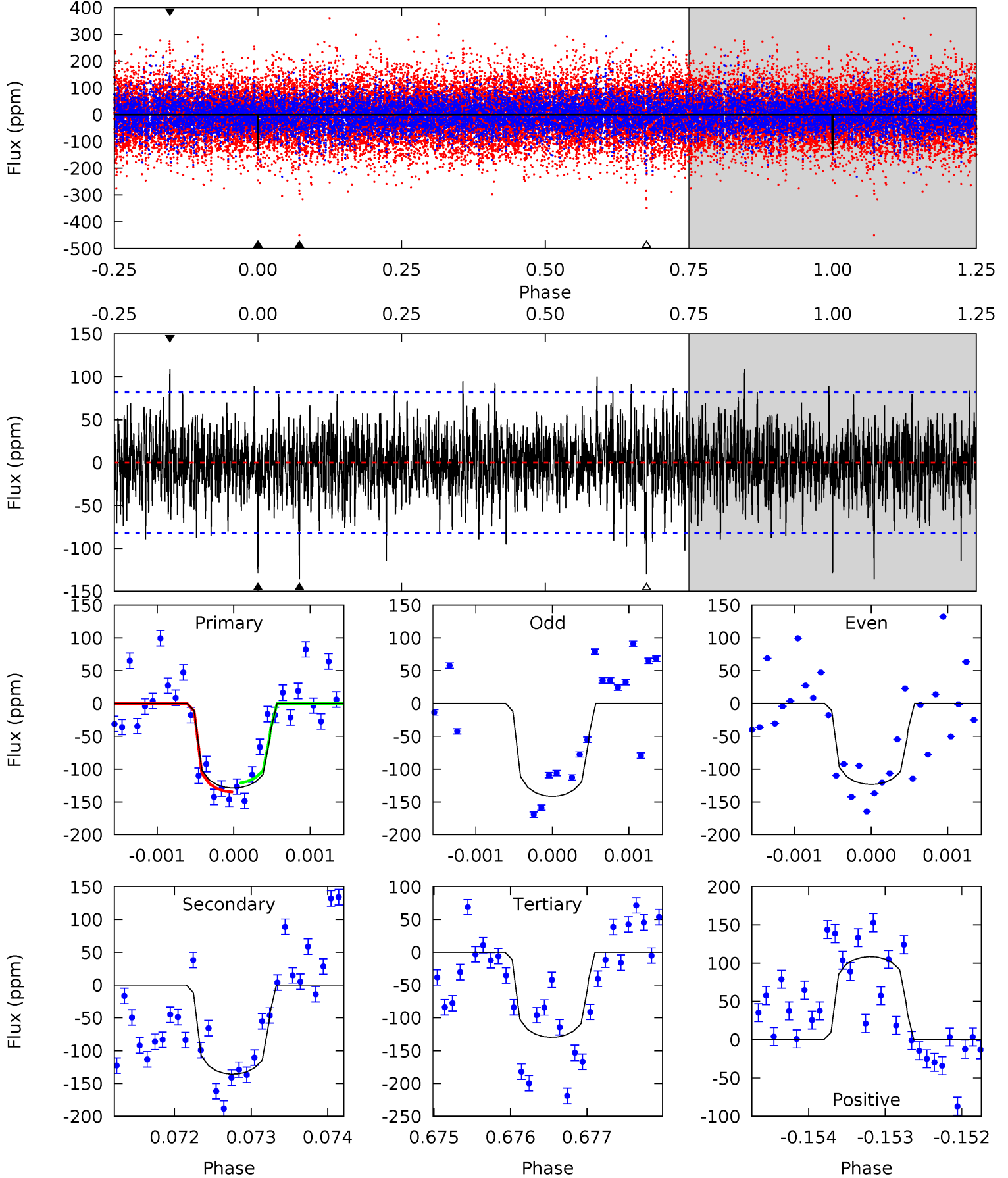
TCE 009156461-02 P=208.636543 Days  $T_0=204.715866$  (BKJD)



# DV Model-Shift Uniqueness Test

009156461-02, P = 208.639795 Days, E = 204.712221 Days

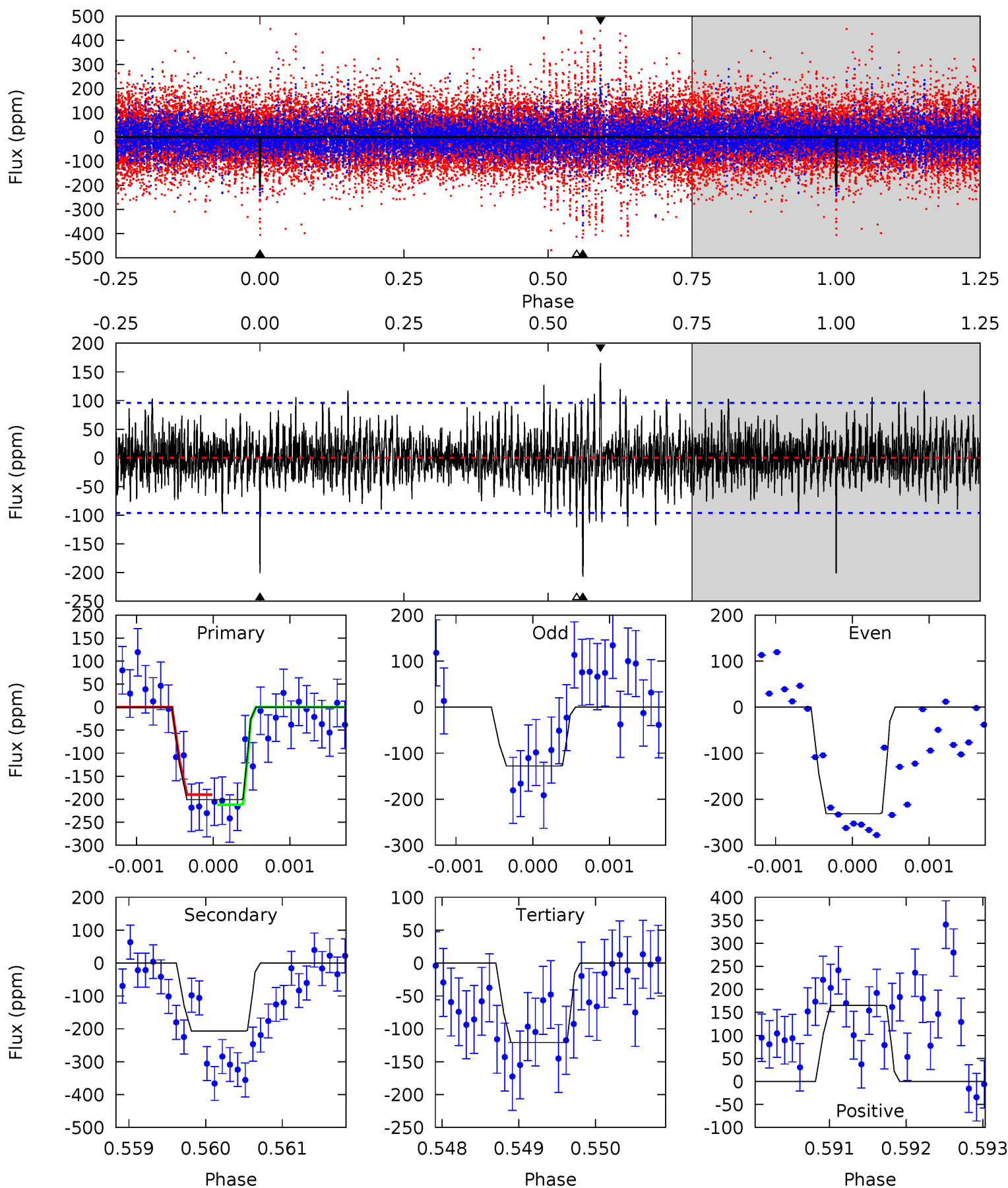
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
8.53	8.99	8.58	7.19	5.45	3.29	1.92	-0.05	1.34	0.42	1.80	0.53	1.01	0.44	0.45



# Alt Model-Shift Uniqueness Test

009156461-02, P = 208.636543 Days, E = 204.715866 Days

Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
11.4	11.8	6.87	9.39	5.46	3.30	1.82	4.57	2.06	4.90	2.39	2.65	1.47	0.44	0.62



### Stellar Parameters For KIC 009156461

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6480^{+181}_{-250}$	$4.044^{+0.293}_{-0.158}$	$-0.120^{+0.250}_{-0.300}$	$1.822^{+0.510}_{-0.623}$	$1.345^{+0.193}_{-0.289}$	$0.313^{+0.619}_{-0.139}$
	+3%/-4%	+7%/-4%	+208%/-250%	+28%/-34%	+14%/-21%	+198%/-44%
Source	PHO54	PHO54	PHO54	DSEP		

KIC = Kepler Input Catalog; PHO = Photometry; SPE = Spectroscopy; AST = Asteroseismology  
 TRA = Transits; DESP = Dartmouth Models; MULT = Multiple Models

### Secondary Eclipse Parameters for KIC 009156461-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-136 \pm 15$	$2.70^{+2.19}_{-1.69}$	$608^{+47}_{-55}$	$5820^{+4429}_{-1264}$	$6011^{+35587}_{-4176}$
Alt.	$-207 \pm 18$	$3.15^{+2.27}_{-1.81}$	$612^{+47}_{-55}$	$5914^{+3852}_{-1138}$	$6522^{+25664}_{-4321}$

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



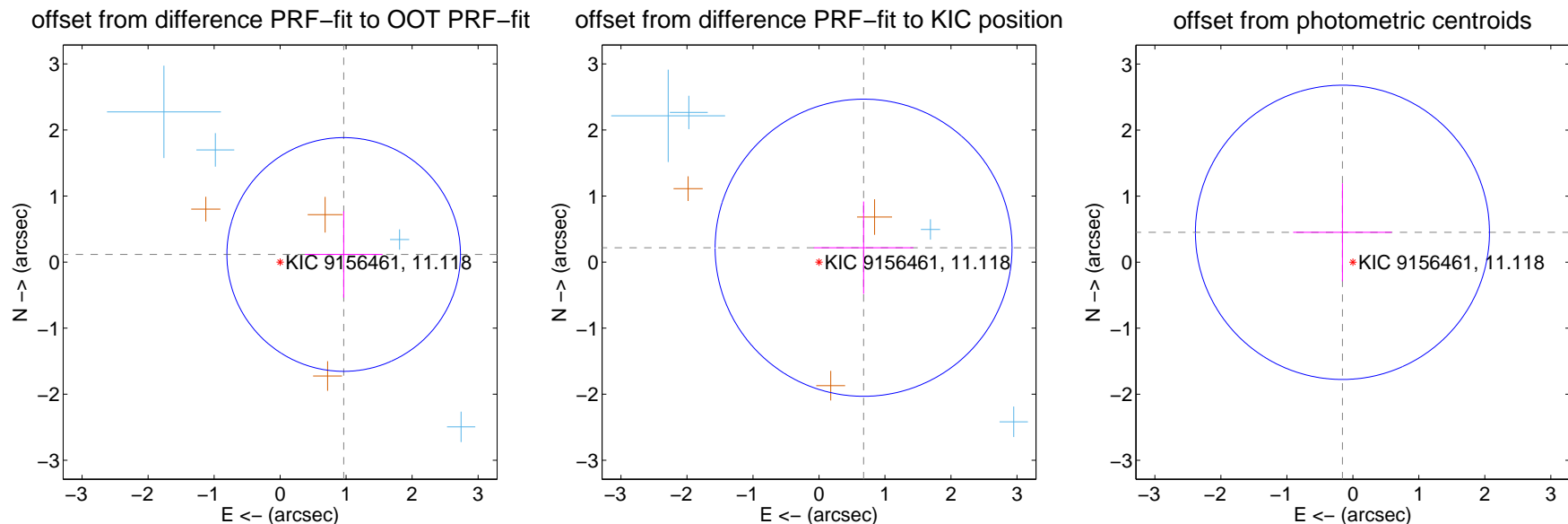
## DV Centroid Data

Supplemental centroid analysis for 009156461-02. **Kepler magnitude: 11.12.** Transit SNR 9.50

There are 4 quarters with good PRF difference image offsets

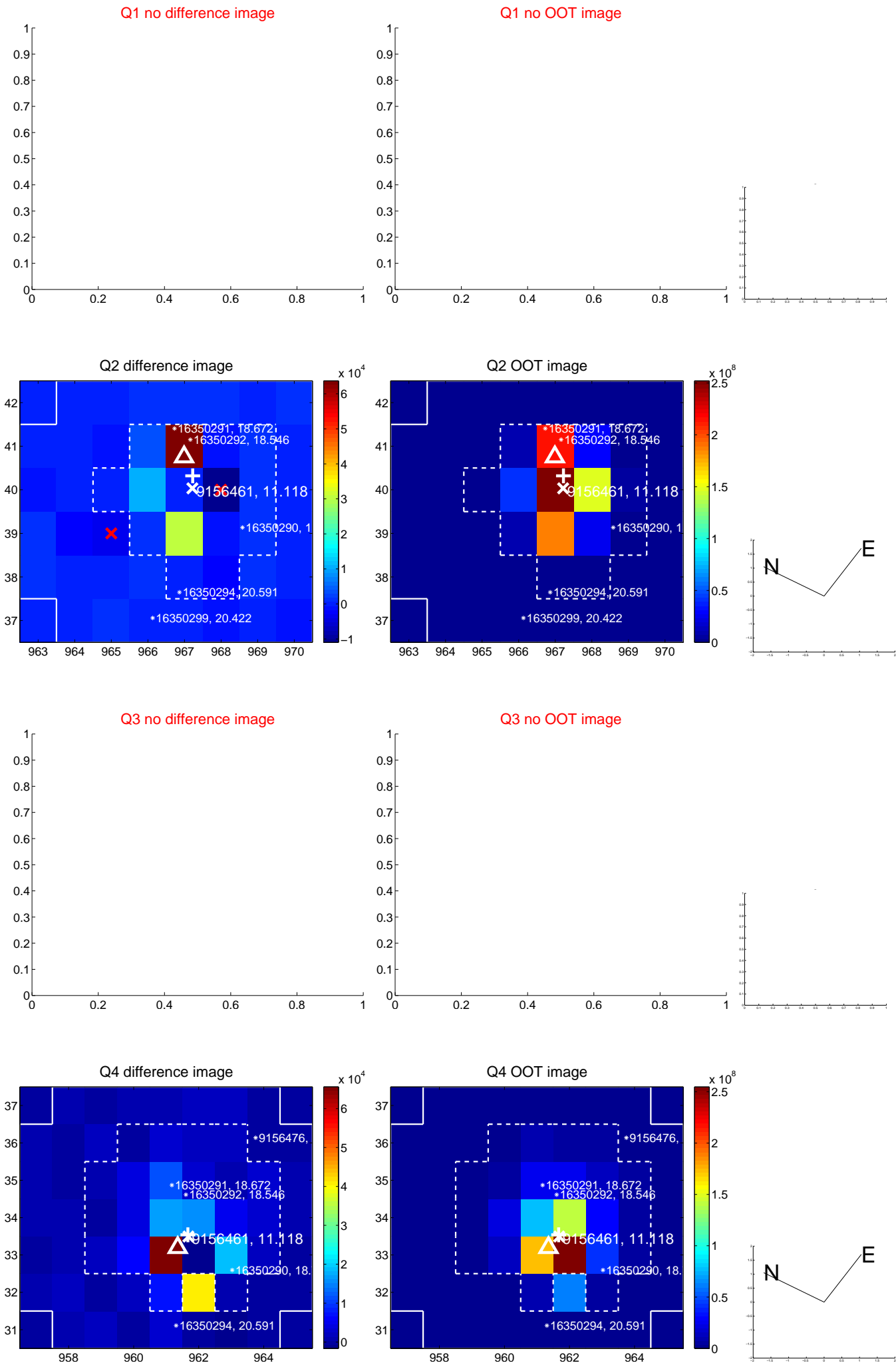
The direct PRF centroid is offset from the target star catalog position by about 0.56 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.970 \pm 0.590$	1.65	$-0.963 \pm 0.589$	$0.115 \pm 0.655$
PRF-fit source offset from KIC position	$0.710 \pm 0.750$	0.95	$-0.676 \pm 0.755$	$0.218 \pm 0.700$
photometric centroid source offset	$0.48 \pm 0.74$	0.64	$0.16 \pm 0.75$	$0.45 \pm 0.74$

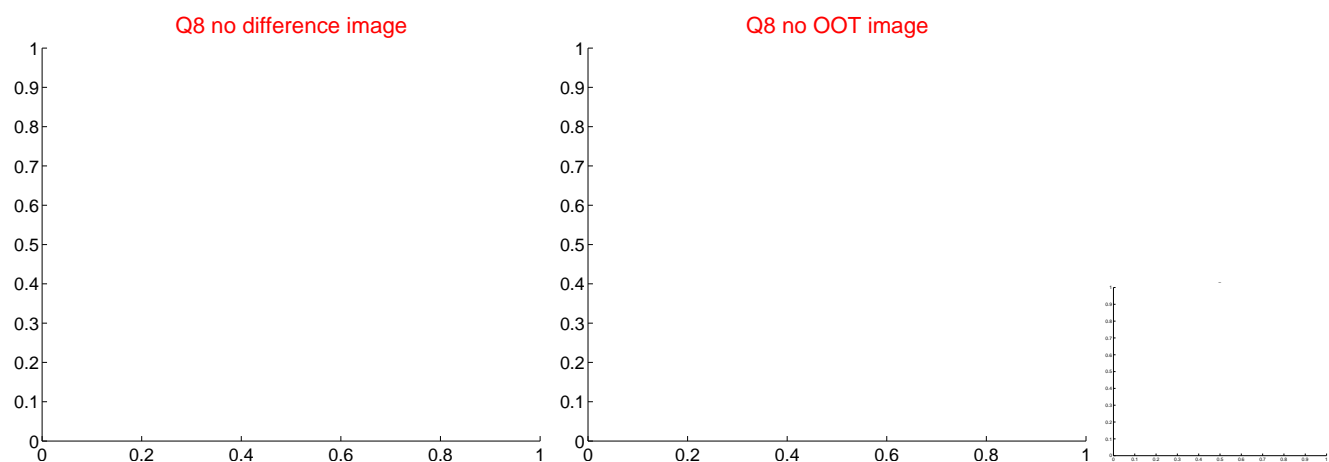
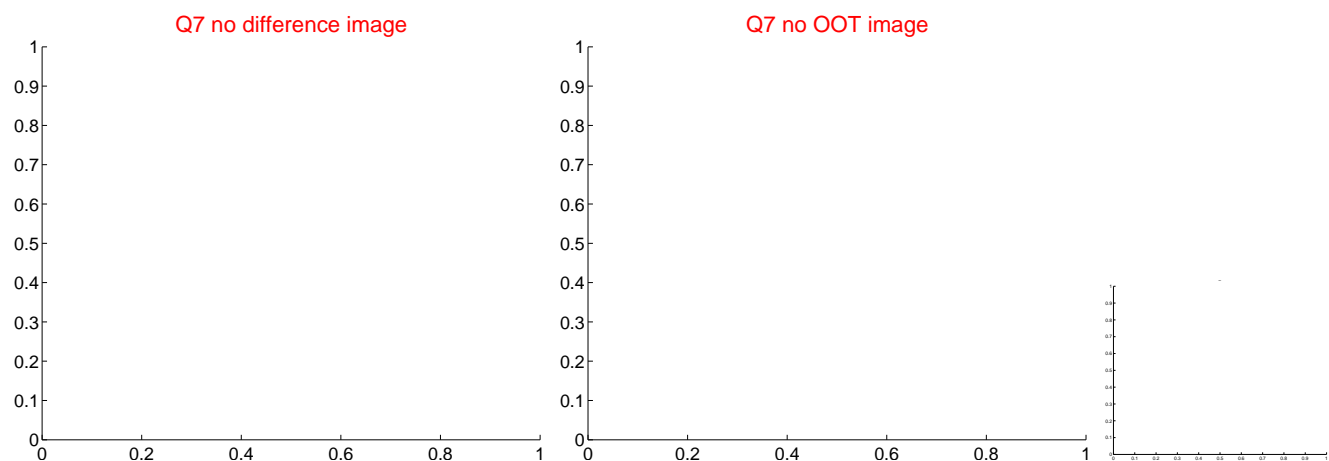
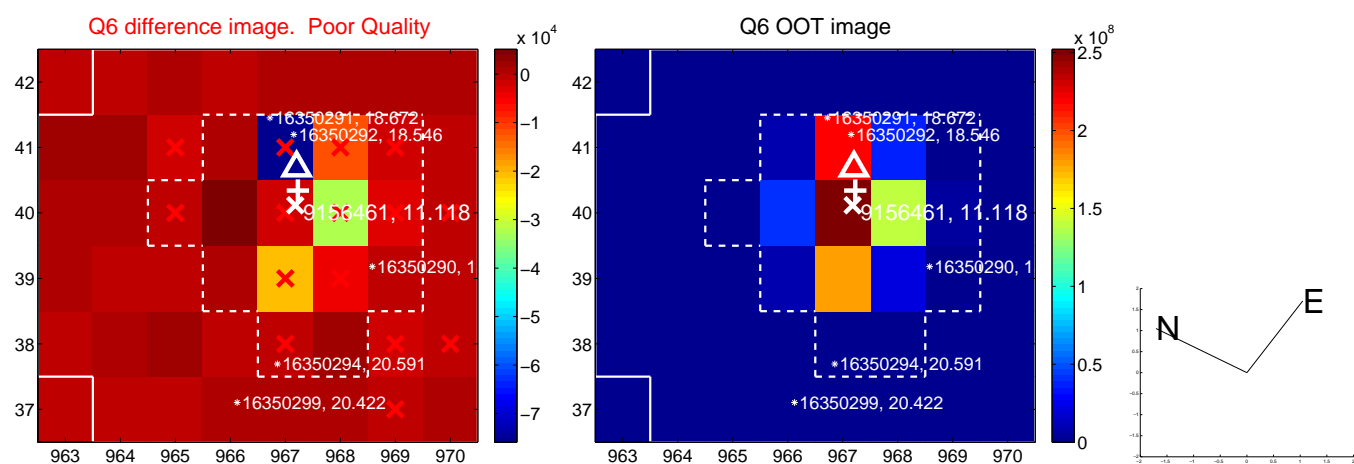
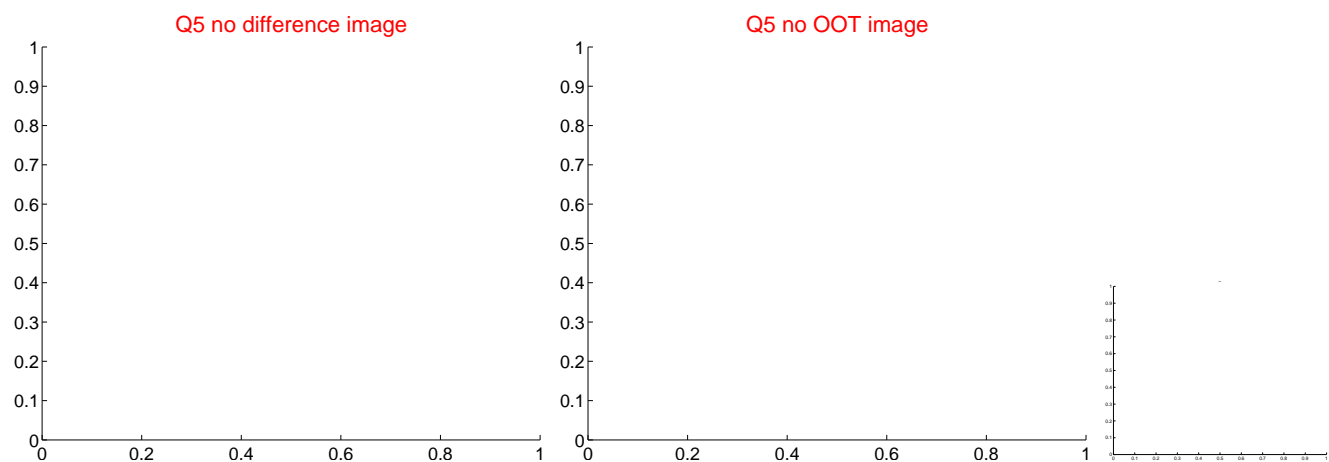


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

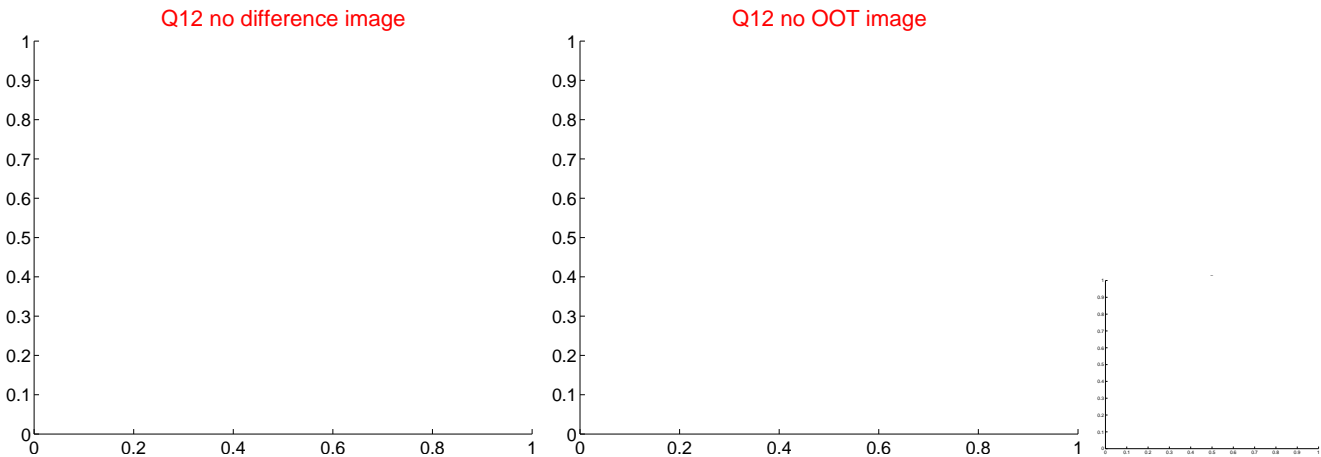
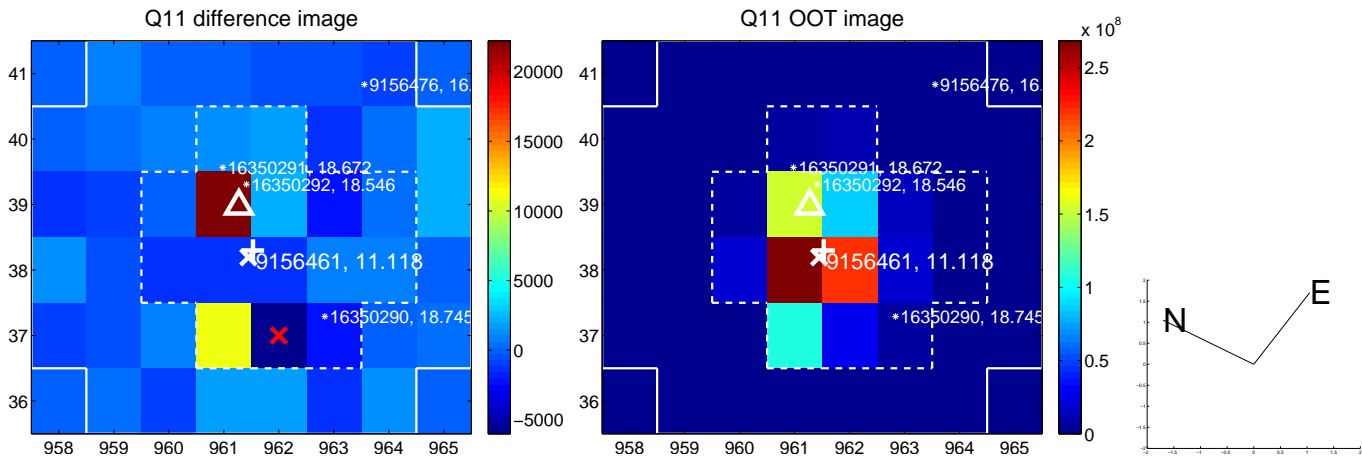
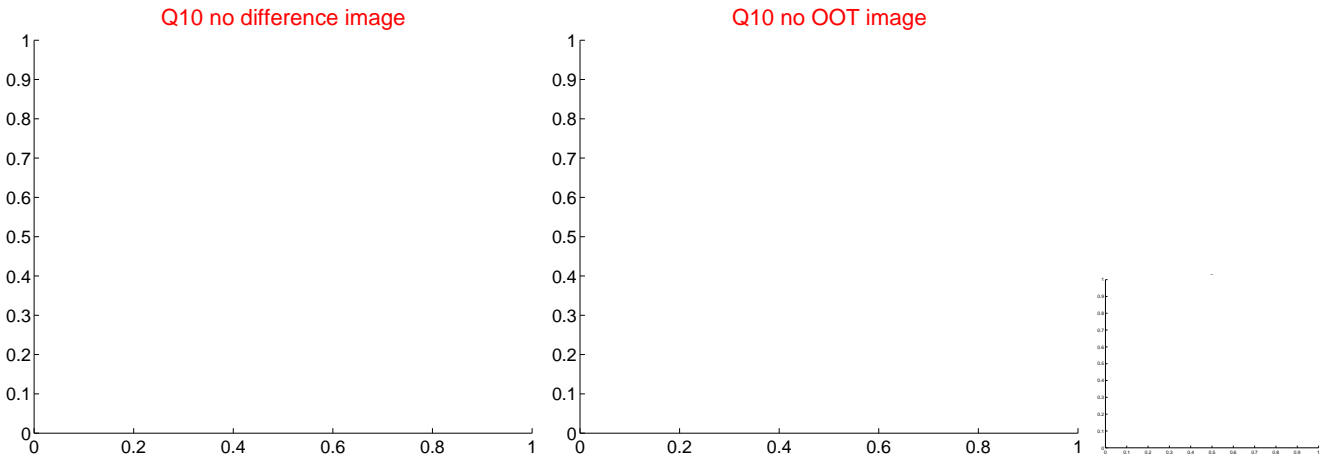
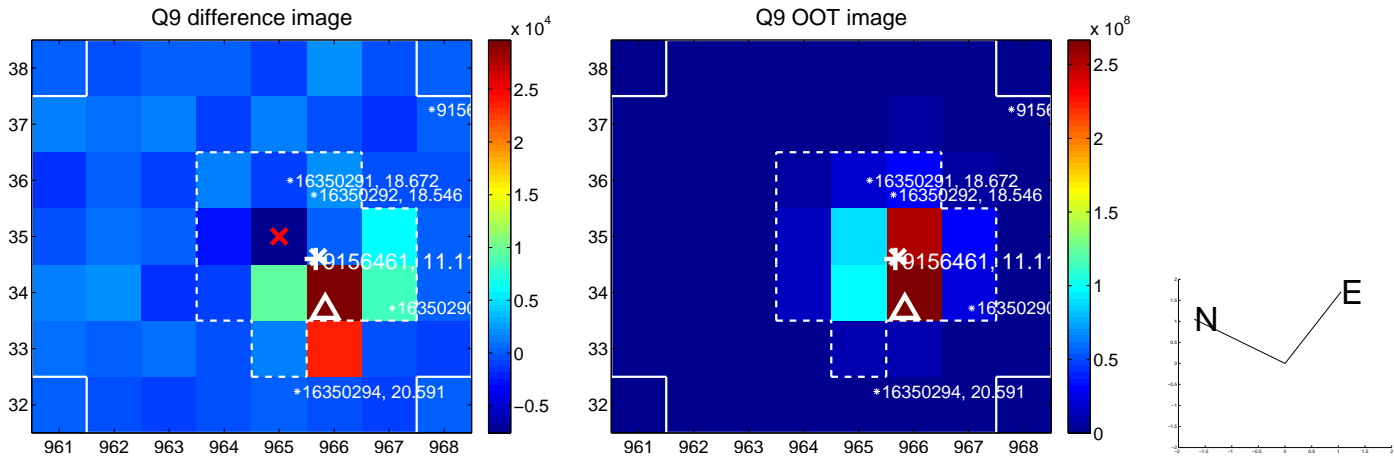
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\Delta$ : difference centroid. red  $\times$ : large negative pixel value.



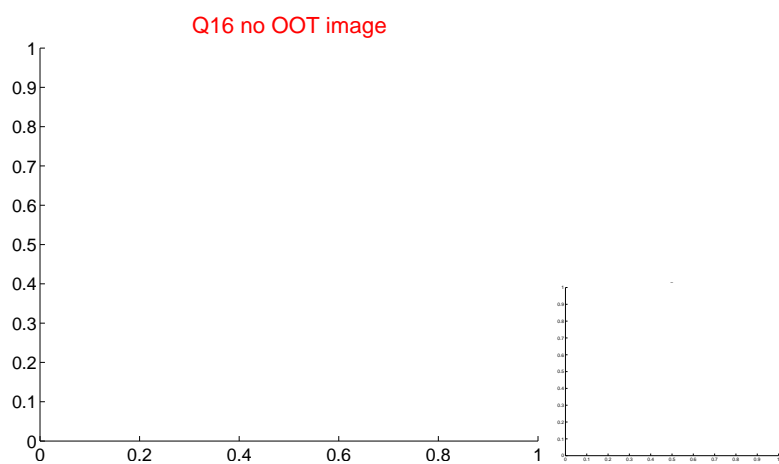
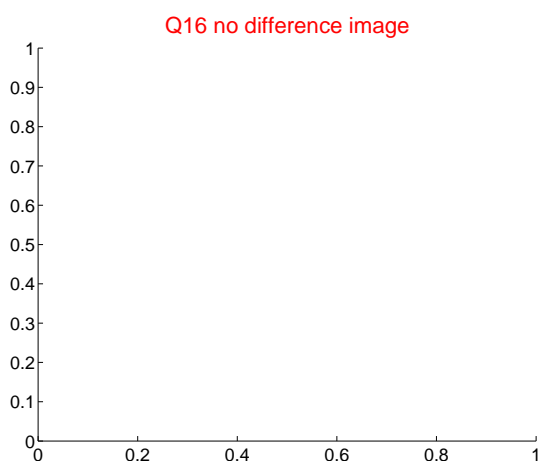
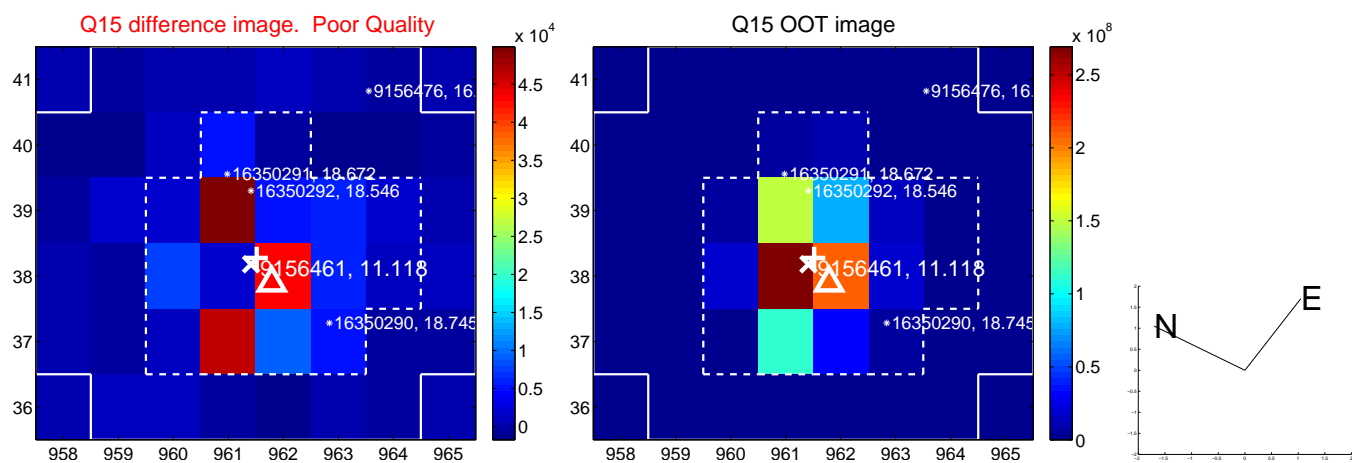
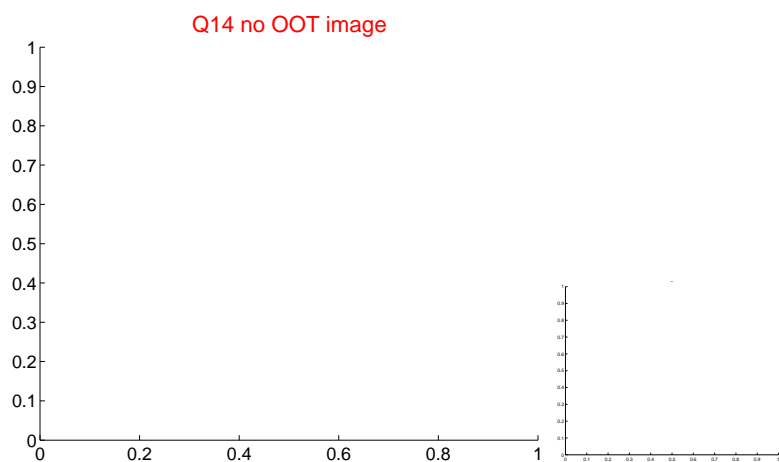
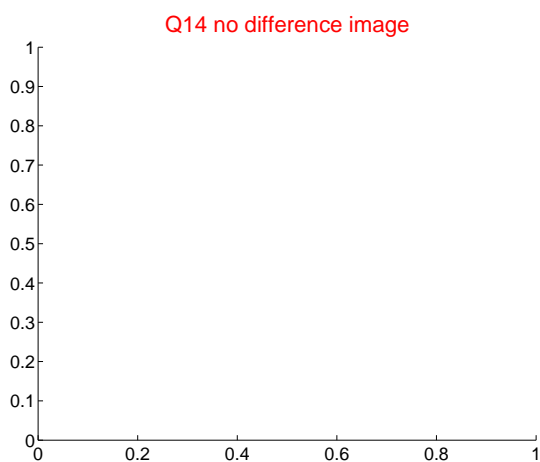
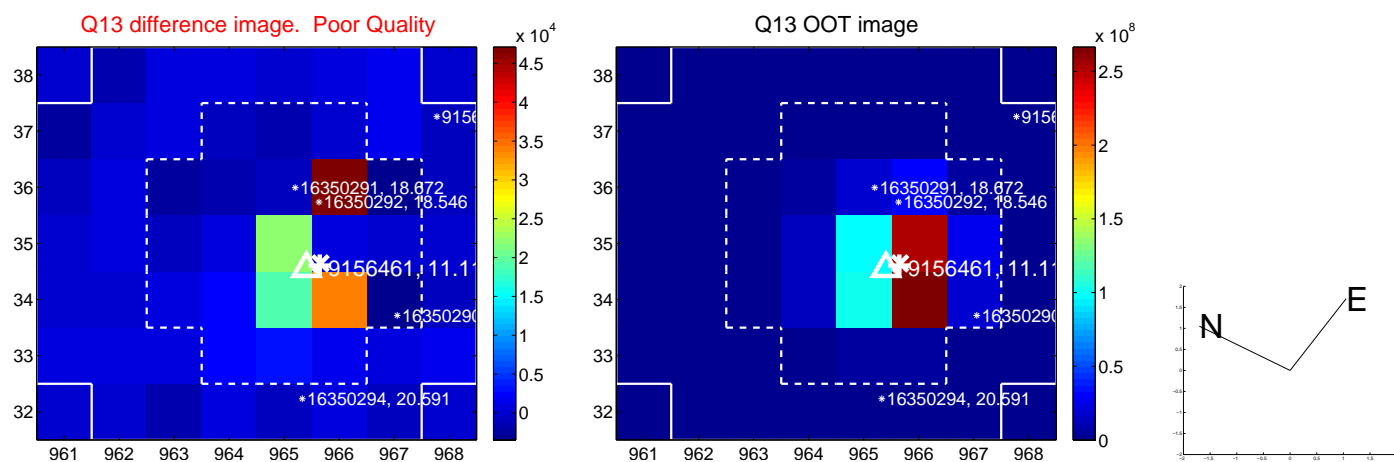
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value



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

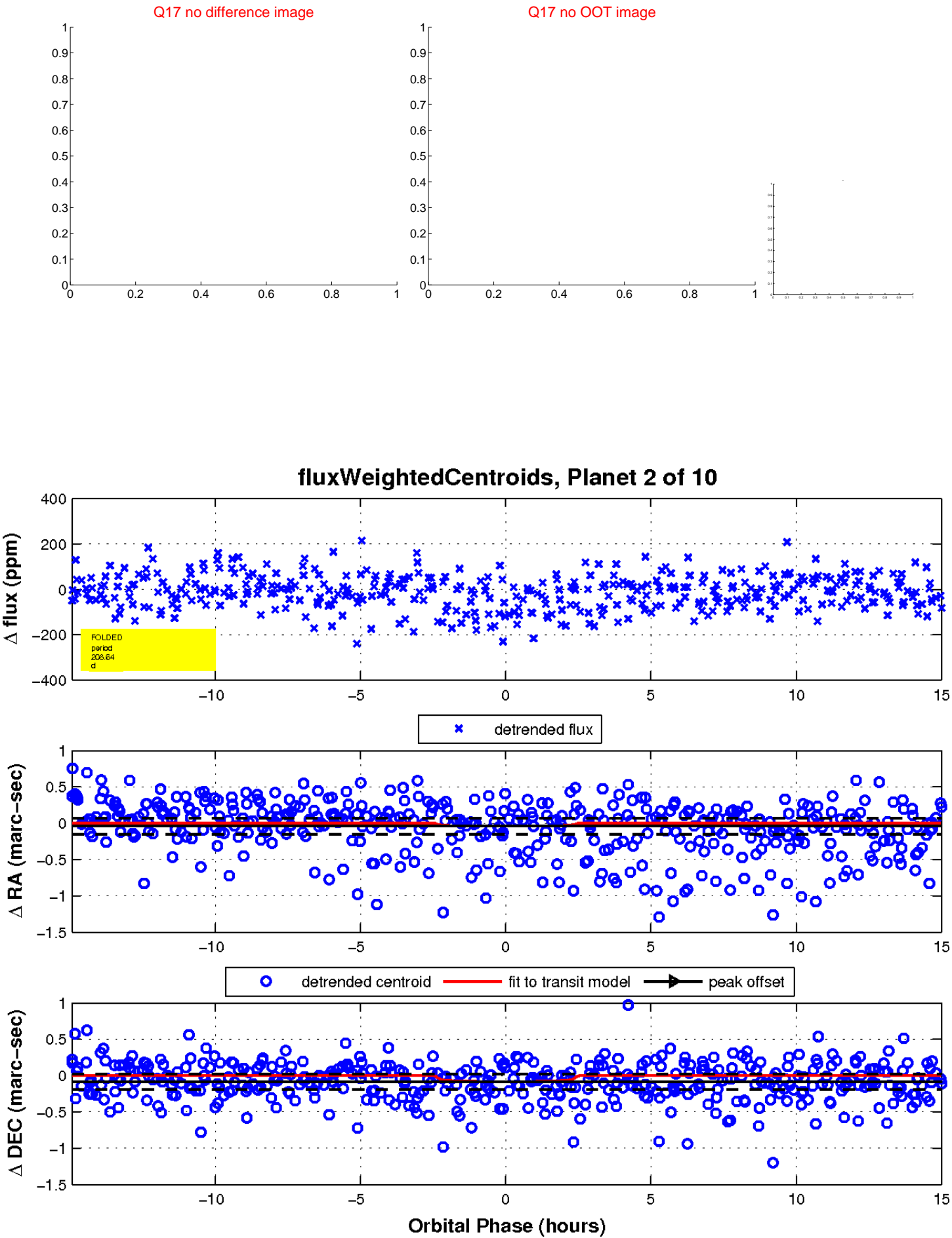


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



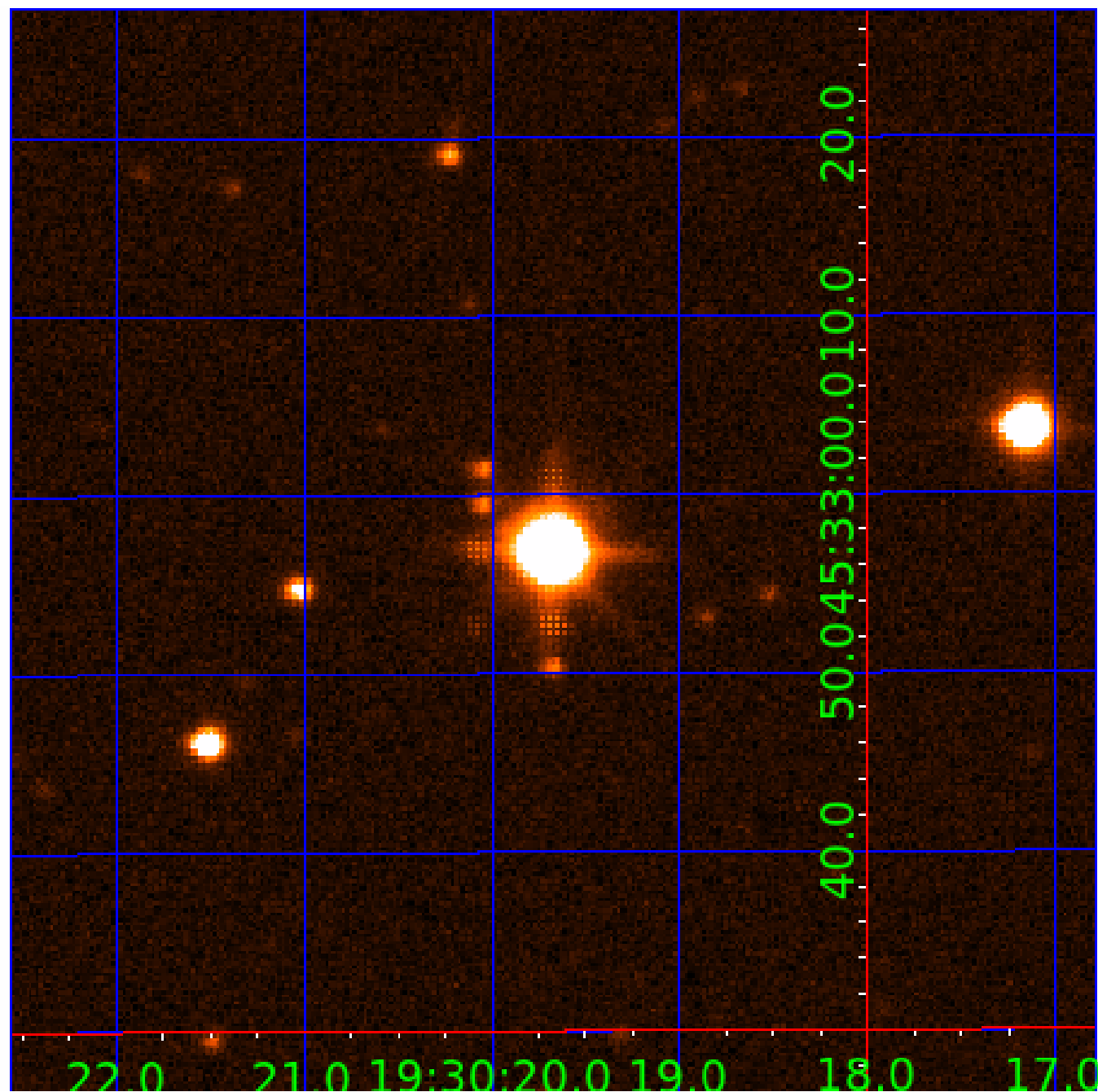


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



## KIC 009156461

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009156461-01	OBS	No	2.296149	132.431446	4.2	10.825	8.7	2.7	1.82	6480	0.43	3717.29
009156461-02	OBS	No	208.639795	204.712221	146.7	5.006	9.0	9.5	1.82	6480	2.51	9.10
009156461-03	OBS	No	296.023030	308.965620	22.4	13.754	7.9	1.0	1.82	6480	0.97	5.71
009156461-04	OBS	No	27.813822	141.128479	61.1	10.671	9.1	8.2	1.82	6480	1.55	133.62
009156461-05	OBS	No	77.564421	198.190936	103.7	8.284	8.5	7.9	1.82	6480	2.09	34.04
009156461-06	OBS	No	337.753157	364.928677	153.2	3.194	8.2	8.4	1.82	6480	2.65	4.79
009156461-08	OBS	No	138.291040	142.658043	108.4	10.011	8.3	6.9	1.82	6480	2.05	15.75
009156461-09	OBS	No	129.035096	161.225143	92.7	6.643	8.0	6.8	1.82	6480	2.33	17.27
009156461-10	OBS	No	110.241909	238.739506	55.7	3.500	7.6	-1.0	1.82	6480	1.37	21.30

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009156461-01	OBS	FP	0.00	1	0	0	0	SWEET_NTL—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—CENT_SATURATED
009156461-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_CHASES_MARSHALL—TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_SATURATED
009156461-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_TRACKER—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_SATURATED
009156461-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_ZUMA—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
009156461-05	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—CENT_SATURATED—HALO_GHOST
009156461-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
009156461-08	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—INCONSISTENT_TRANS—CENT_SATURATED
009156461-09	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_CHASES—TRANS_GAPPED—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
009156461-10	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED

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

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

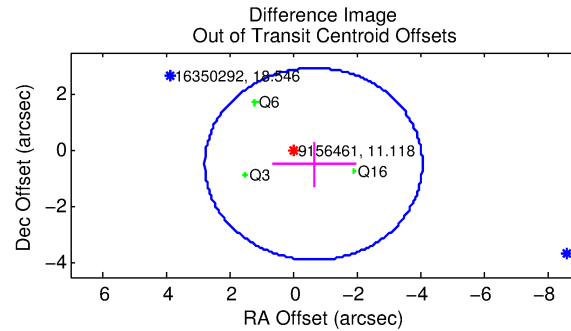
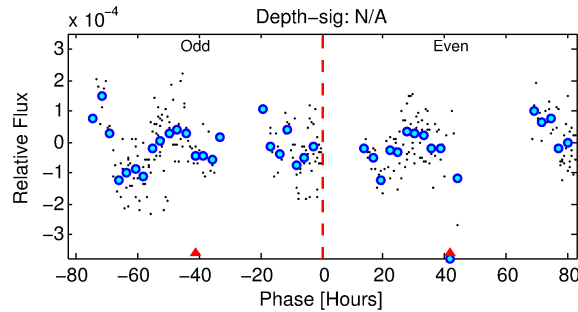
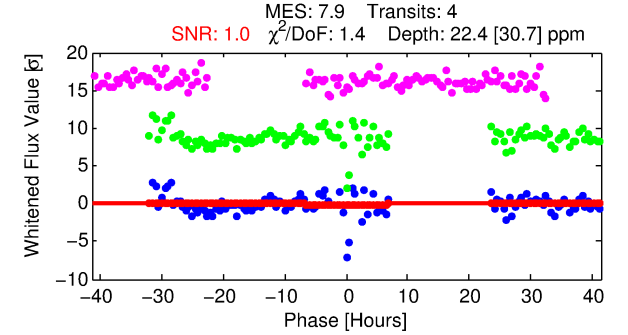
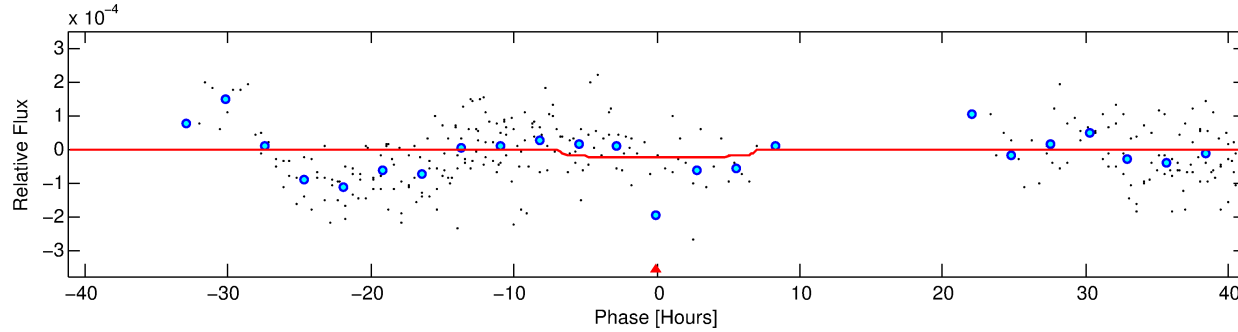
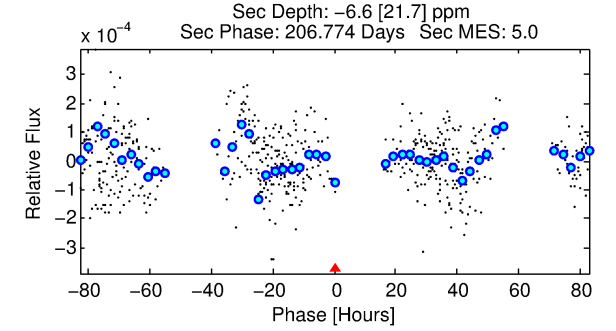
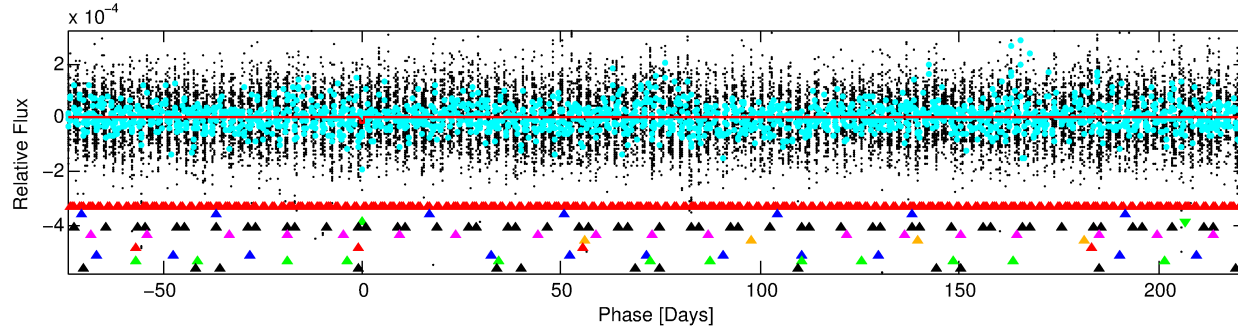
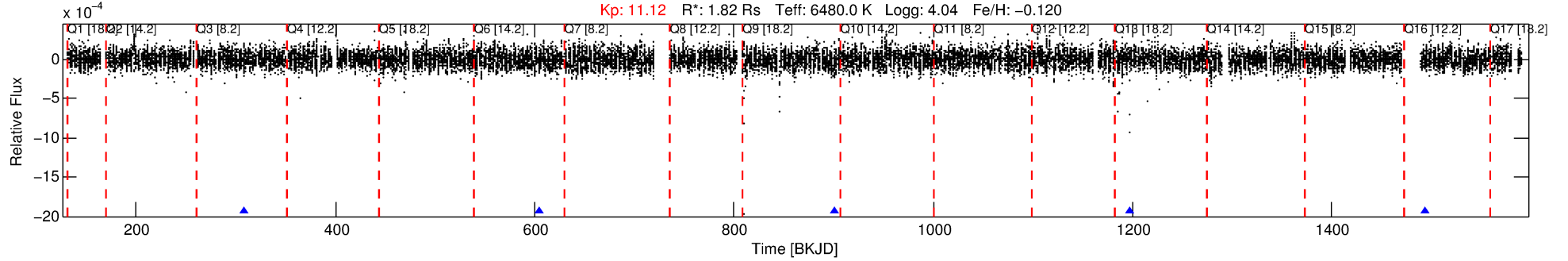
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 009156461-03

No Significant Match Found

# DV One-Page Summary

KIC: 9156461 Candidate: 3 of 10 Period: 296.023 d



## DV Fit Results:

Period = 296.02303 [0.06414] d  
Epoch = 308.9656 [0.2172] BKJD  
Rp/R\* = 0.0049 [0.0071]  
a/R\* = 92.73 [636.93]  
b = 0.83 [2.63]  
Seff = 5.71 [3.01]  
Teq = 394 [52] K  
Rp = 0.97 [1.44] Re  
a = 0.9585 [0.3069] AU  
Ag = N/A  
Teffp = N/A

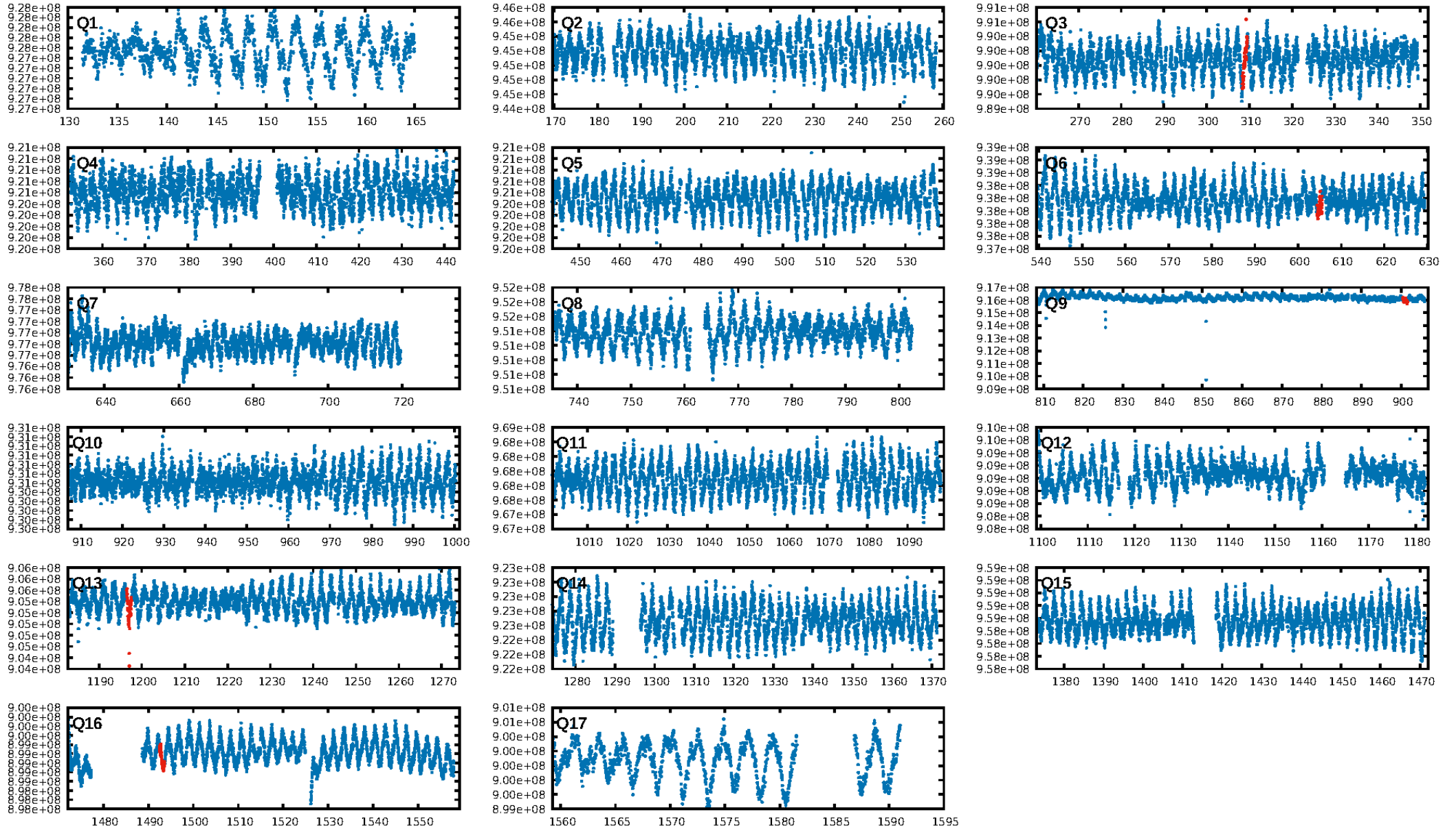
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [143.29 $\sigma$ ]  
LongPeriod-sig: 100.0% [70.93 $\sigma$ ]  
ModelChiSquare2-sig: 19.7%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [4/4]  
GhostDiagnostic-chr: -1.205  
Centroid-sig: 0.8%  
Centroid-so: 9.284 arcsec [2.13 $\sigma$ ]  
OotOffset-rm: 0.810 arcsec [0.71 $\sigma$ ]  
KicOffset-rm: 0.793 arcsec [0.62 $\sigma$ ]  
OotOffset-st: 1/1/1/0 [3]  
KicOffset-st: 1/1/1/0 [3]  
DiffImageQuality-fgm: 0.33 [1/3]  
DiffImageOverlap-fno: 0.00 [0/4]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 22:28:44 Z

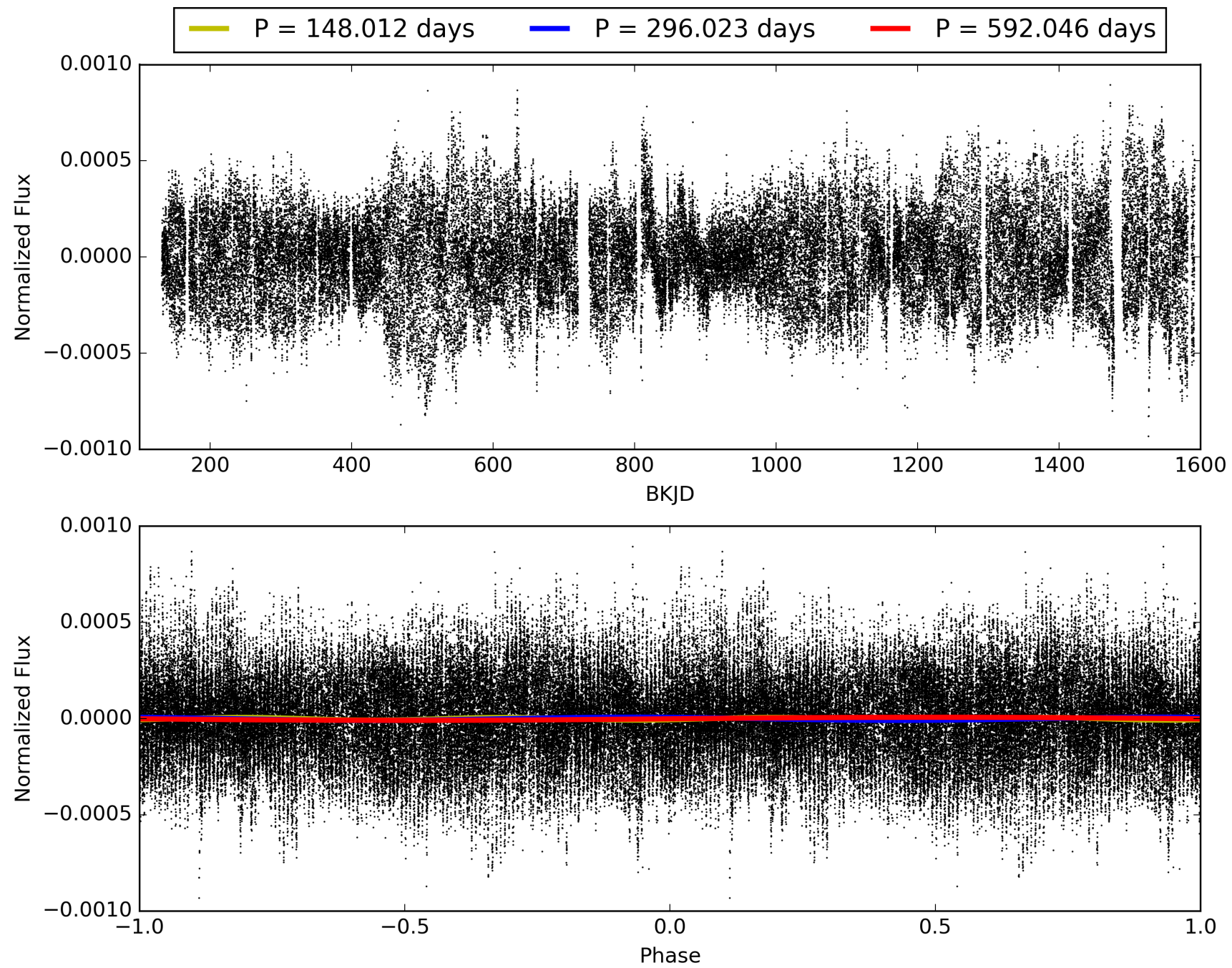
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 009156461-03, PDC Light Curves



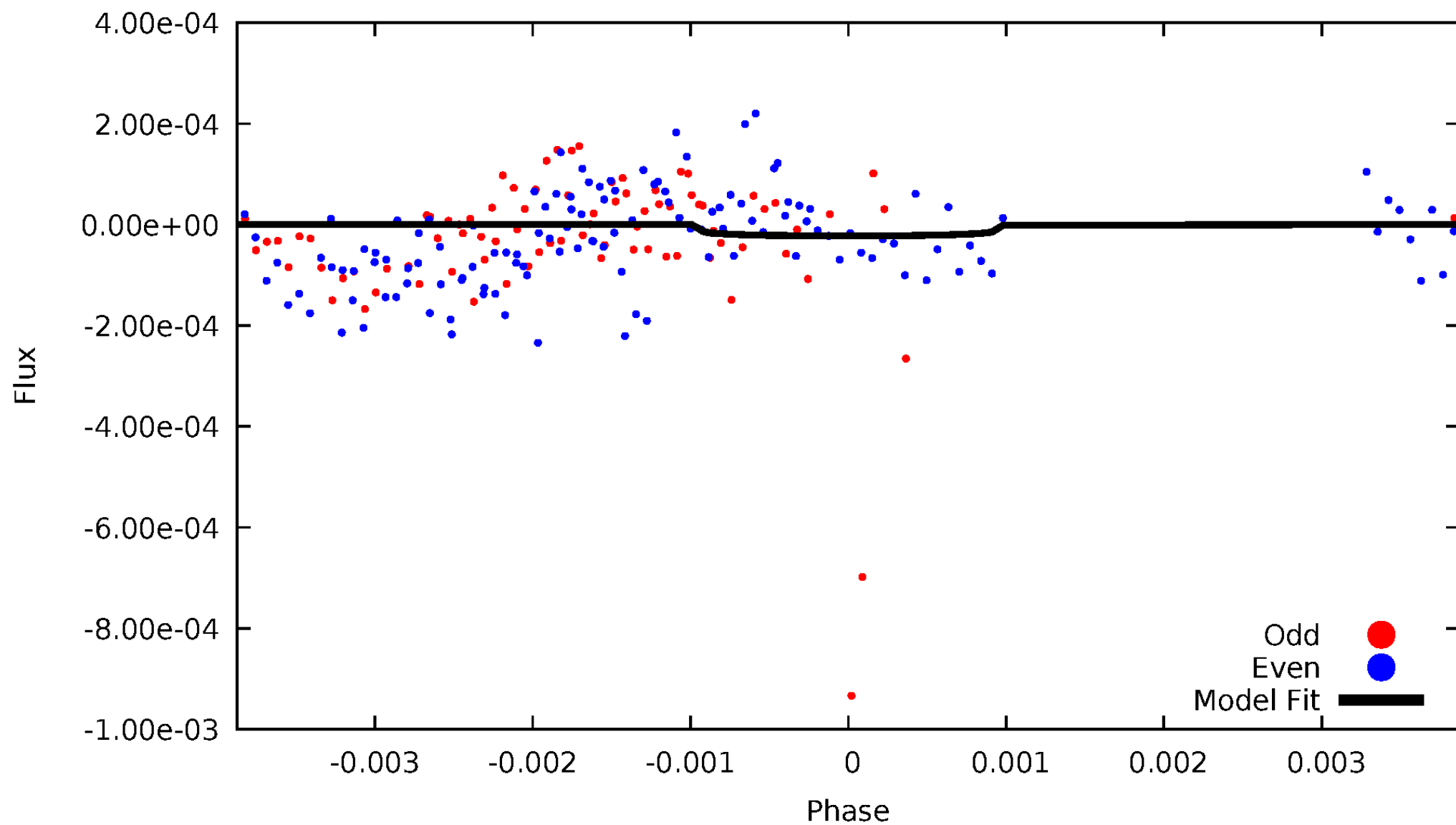


TCE 009156461-03



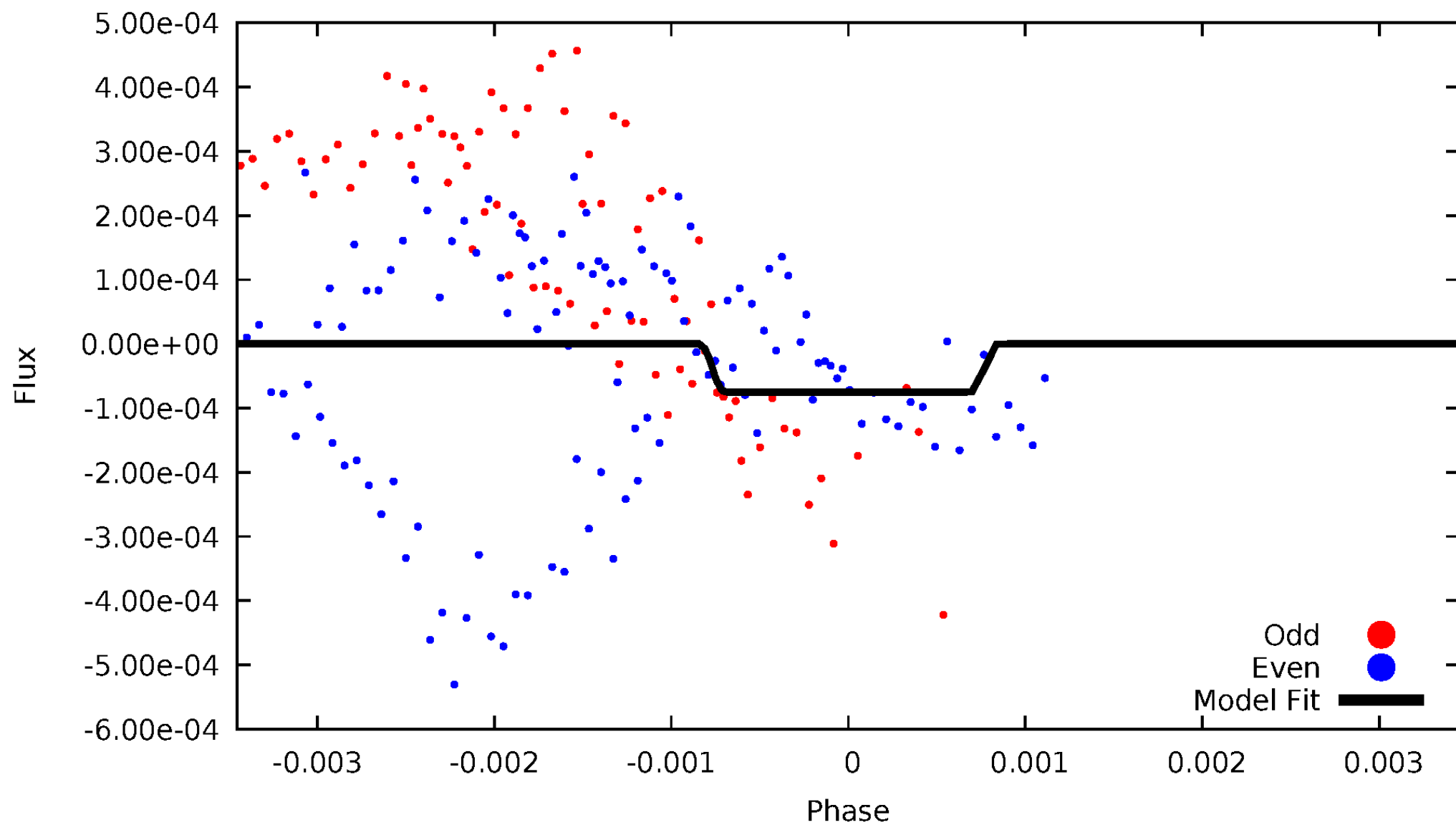
# DV Odd/Even

TCE 009156461-03

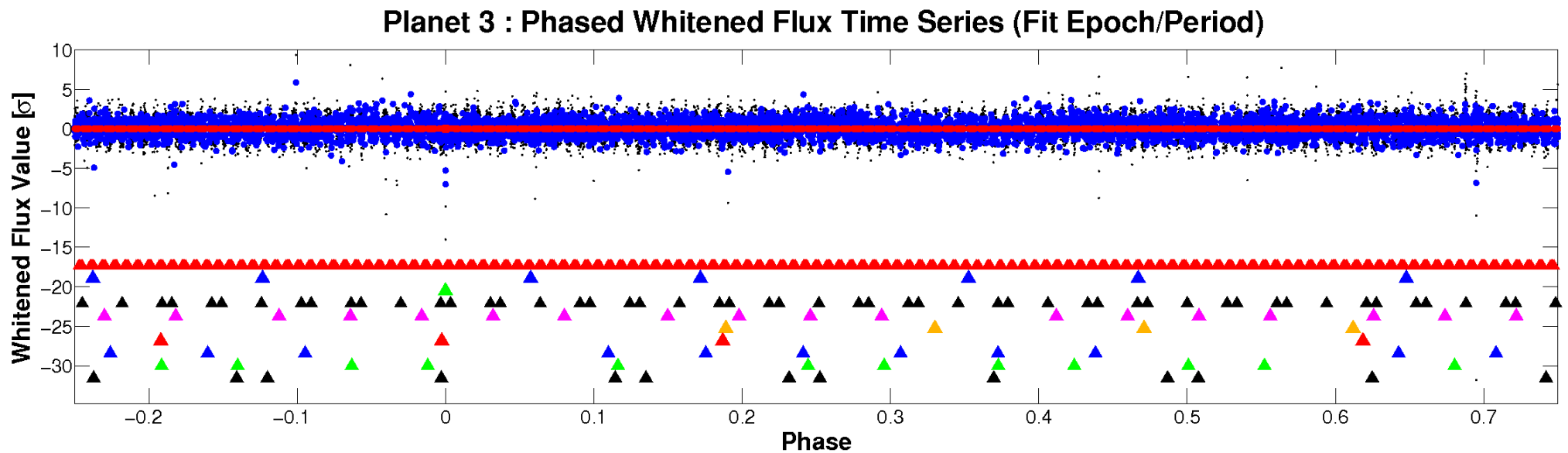
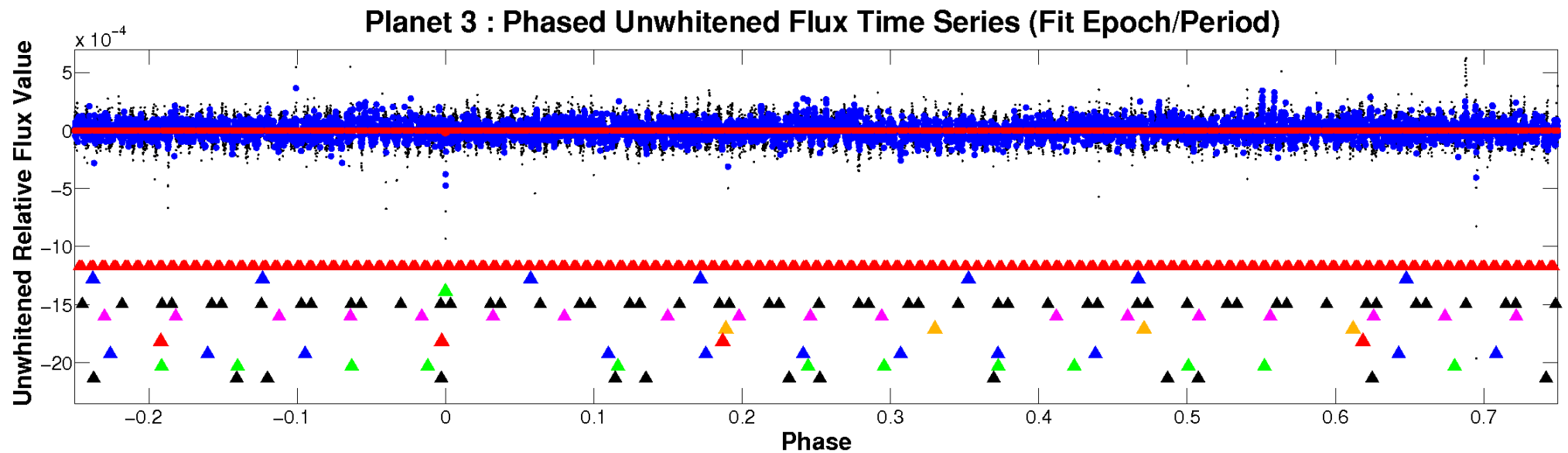


# ALT Odd/Even

TCE 009156461-03

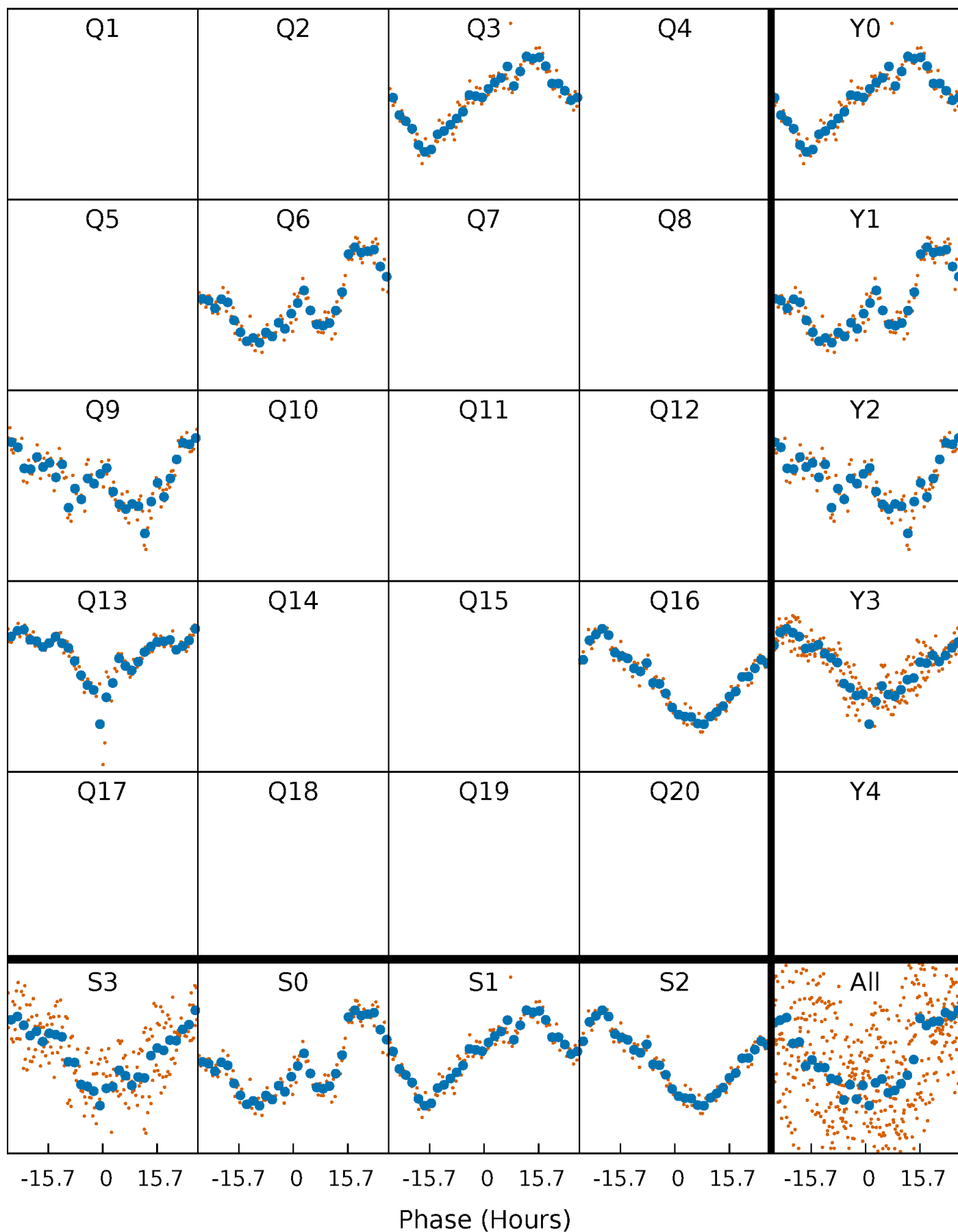


# Non-Whitened Vs. Whitened Light Curve



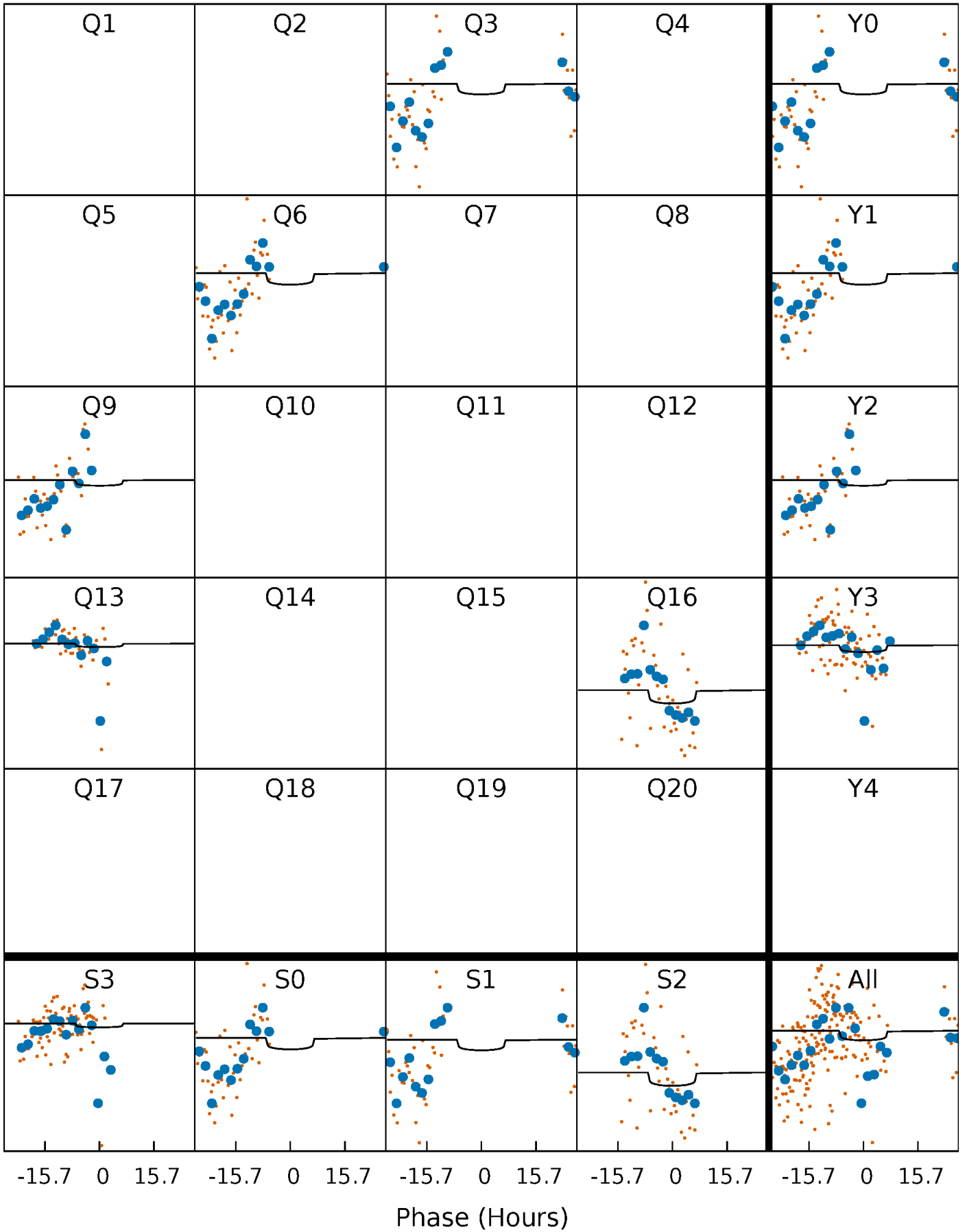
# PDC Quarter-Phased Transit Curves

TCE 009156461-03     $P=296.023030$  Days     $T_0=308.965620$  (BKJD)



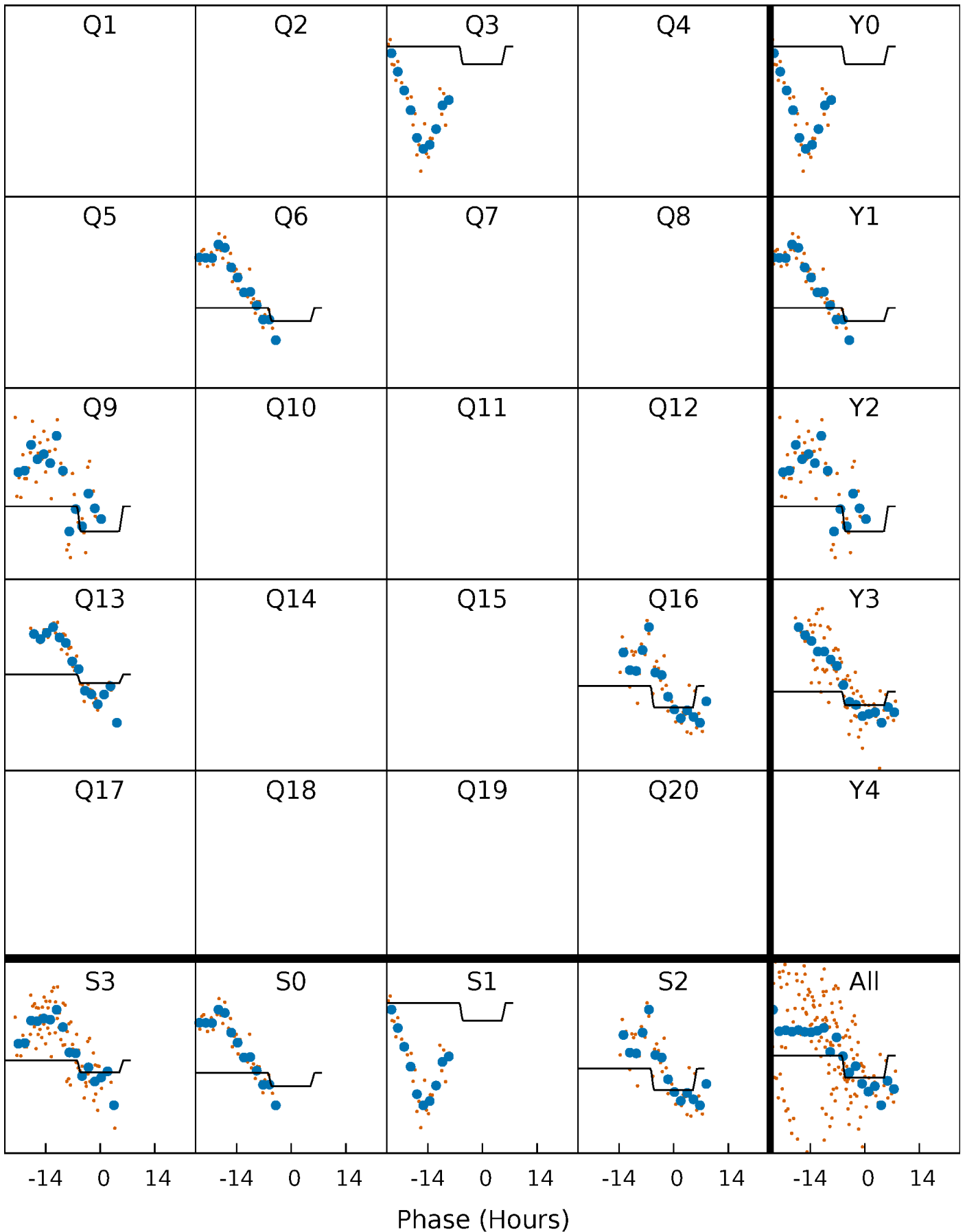
# DV Quarter-Phased Transit Curves

TCE 009156461-03     $P=296.023030$  Days     $T_0=308.965620$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

TCE 009156461-03 P=296.034606 Days  $T_0=308.880249$  (BKJD)

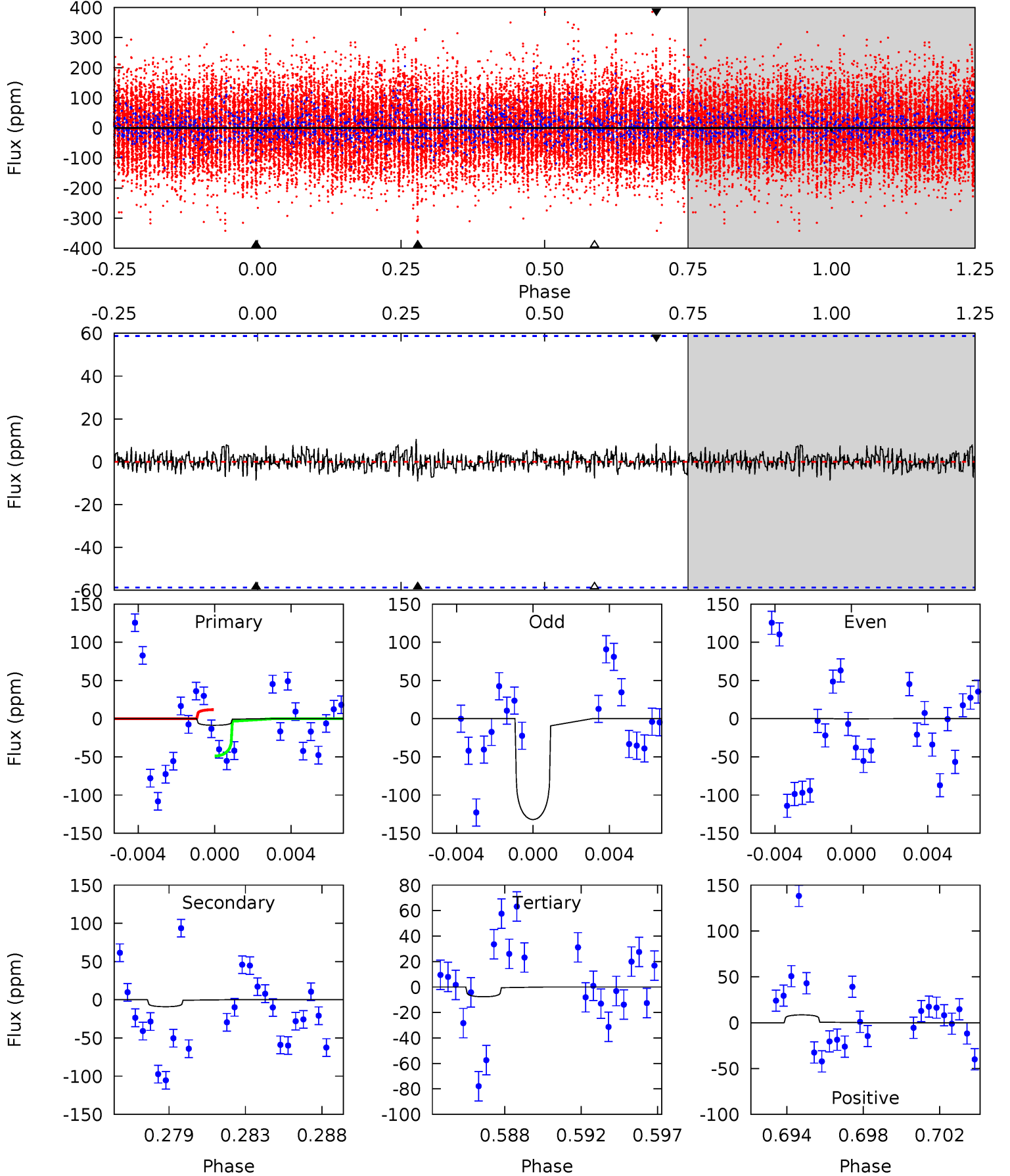




# DV Model-Shift Uniqueness Test

009156461-03,  $P = 296.023030$  Days,  $E = 12.942590$  Days

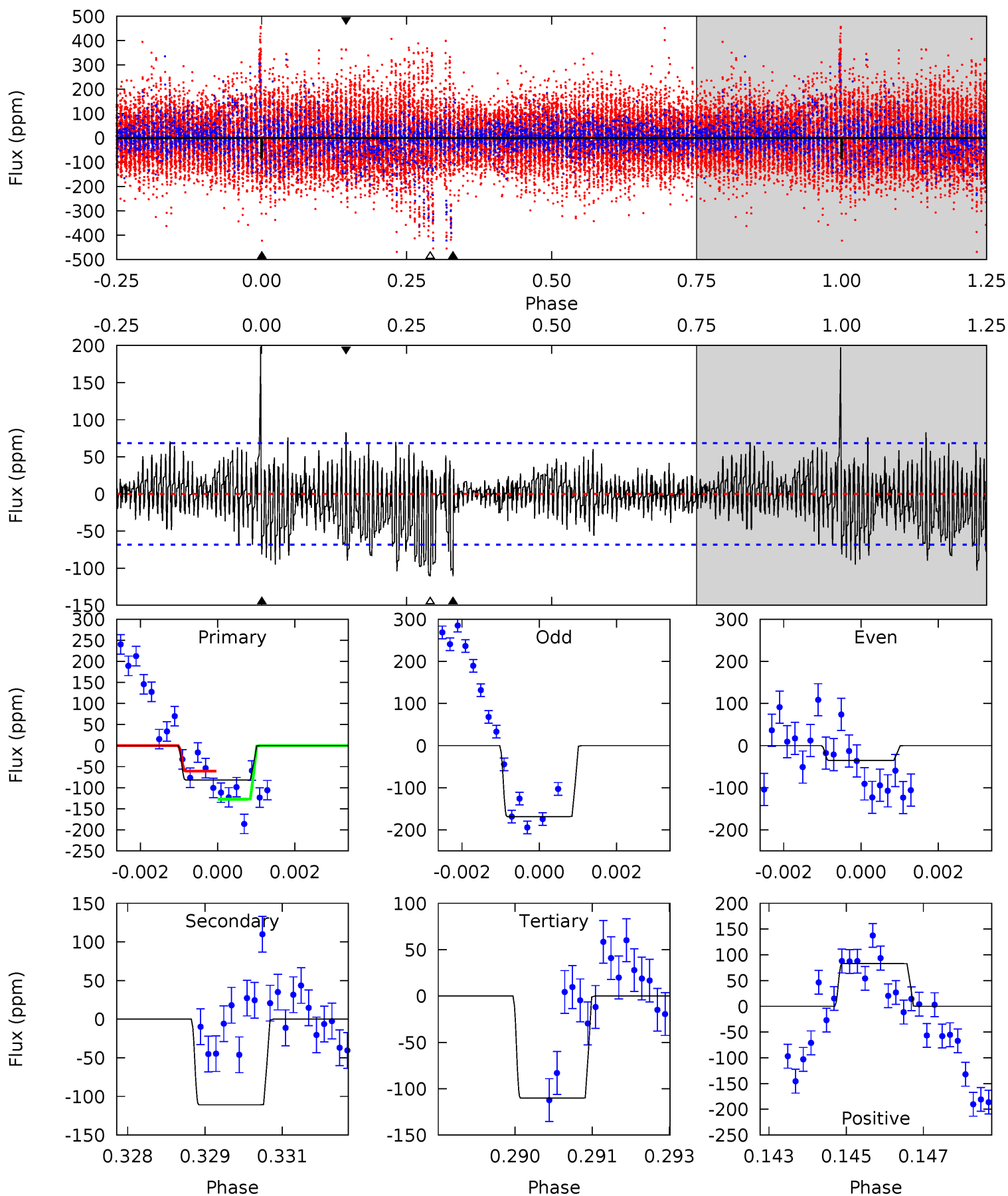
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
0.76	0.80	0.68	0.75	5.19	2.86	0.23	0.09	0.01	0.12	0.05	5.42	3.83	0.54	1.55



# Alt Model-Shift Uniqueness Test

009156461-03,  $P = 296.034606$  Days,  $E = 12.845643$  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
6.38	8.68	8.63	6.50	5.36	3.15	2.10	-2.25	-0.11	0.05	2.19	5.11	1.02	0.64	2.37



### Stellar Parameters For KIC 009156461

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$\rho_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6480^{+181}_{-250}$	$4.044^{+0.293}_{-0.158}$	$-0.120^{+0.250}_{-0.300}$	$1.822^{+0.510}_{-0.623}$	$1.345^{+0.193}_{-0.289}$	$0.313^{+0.619}_{-0.139}$
	+3%/-4%	+7%/-4%	+208%/-250%	+28%/-34%	+14%/-21%	+198%/-44%
Source	PHO54	PHO54	PHO54	DSEP		

KIC = Kepler Input Catalog; PHO = Photometry; SPE = Spectroscopy; AST = Asteroseismology  
 TRA = Transits; DESP = Dartmouth Models; MULT = Multiple Models

### Secondary Eclipse Parameters for KIC 009156461-03 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-9 \pm 11$	$1.30^{+1.20}_{-0.84}$	$545^{+43}_{-50}$	$4162^{+3046}_{-7328}$	$1820^{+18462}_{-2175}$
Alt.	$-111 \pm 13$	$1.82^{+1.42}_{-1.17}$	$545^{+42}_{-50}$	$6779^{+6861}_{-1599}$	$16911^{+108692}_{-11572}$

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

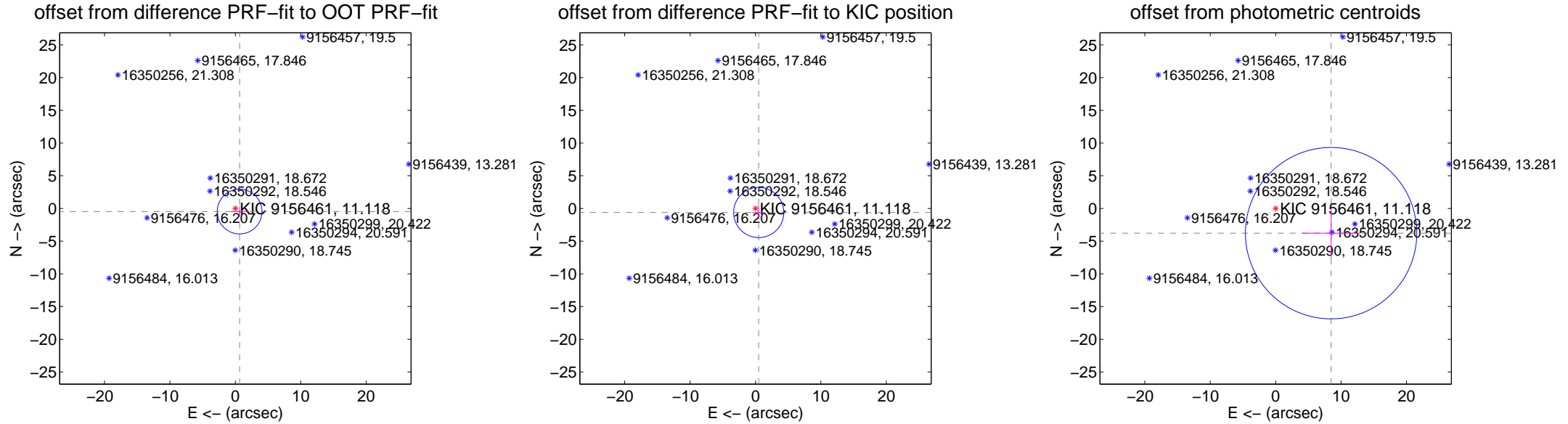
## DV Centroid Data

Supplemental centroid analysis for 009156461-03. **Kepler magnitude: 11.12.** Transit SNR 0.96

**There are 1 quarters with good PRF difference image offsets**

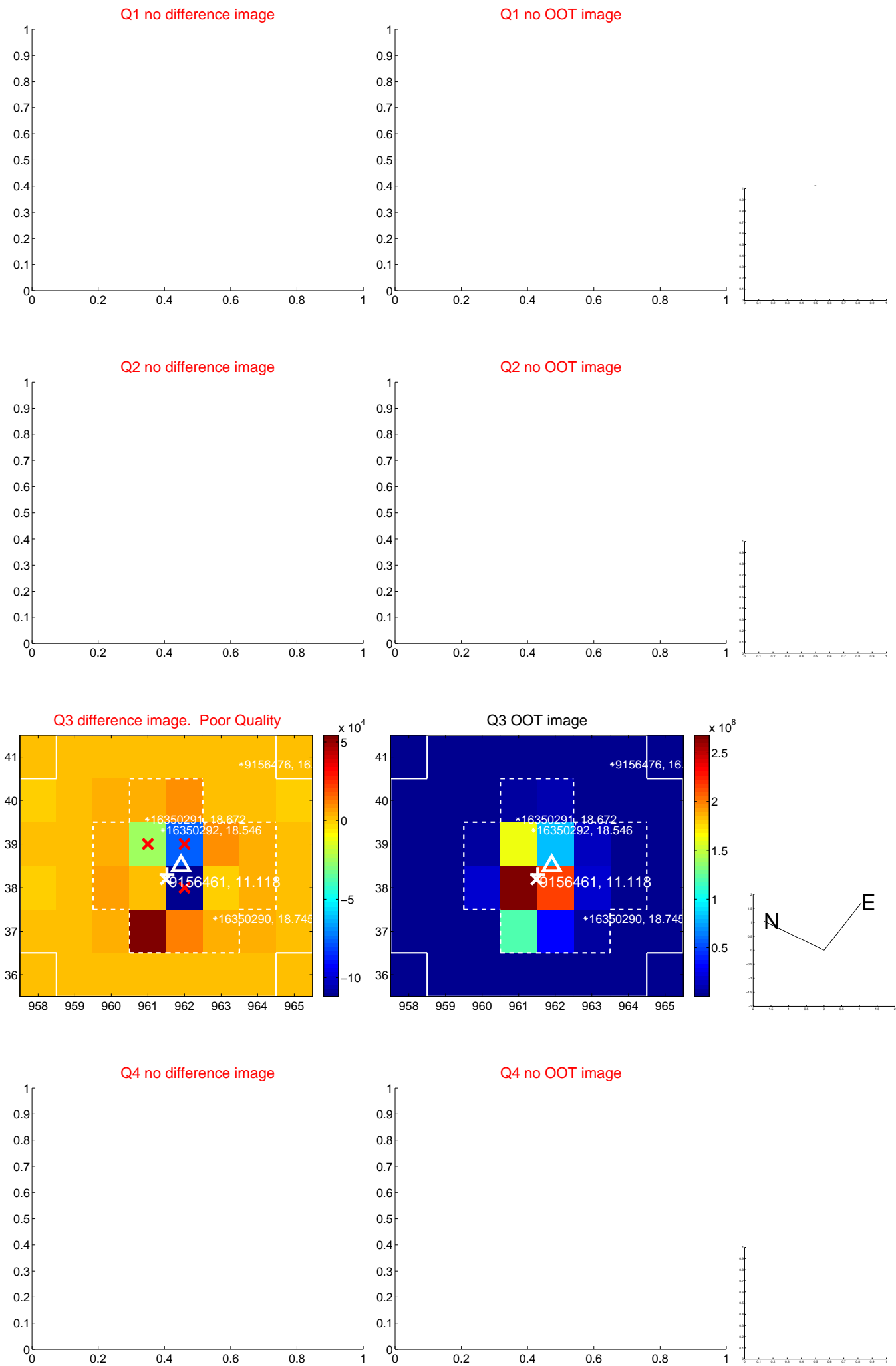
The direct PRF centroid is offset from the target star catalog position by about 0.21 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.810 \pm 1.140$	0.71	$-0.654 \pm 1.297$	$-0.478 \pm 0.763$
PRF-fit source offset from KIC position	$0.793 \pm 1.278$	0.62	$-0.494 \pm 0.991$	$-0.620 \pm 1.115$
photometric centroid source offset	$9.28 \pm 4.37$	2.13	$-8.48 \pm 4.46$	$-3.78 \pm 3.87$

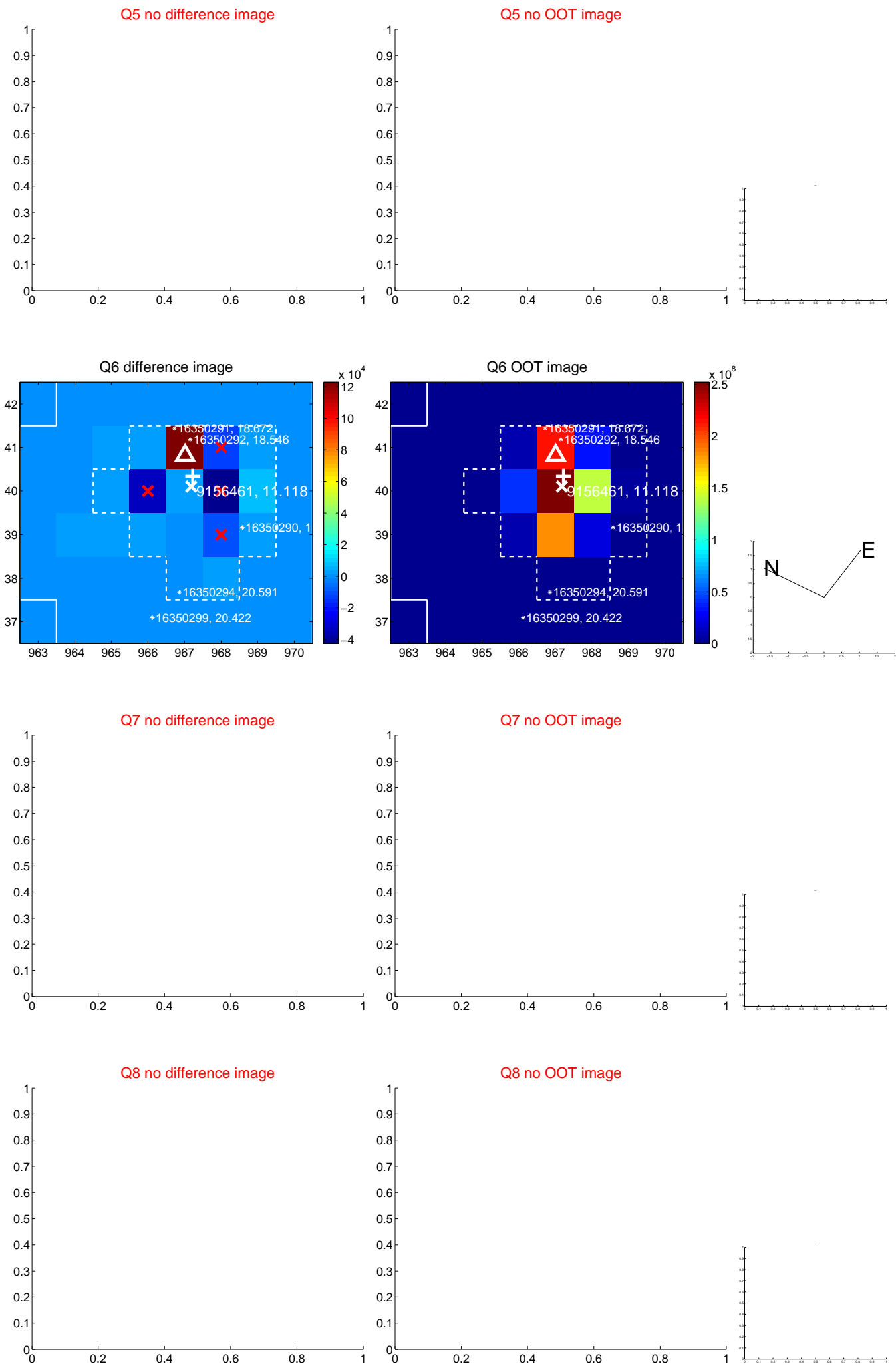


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

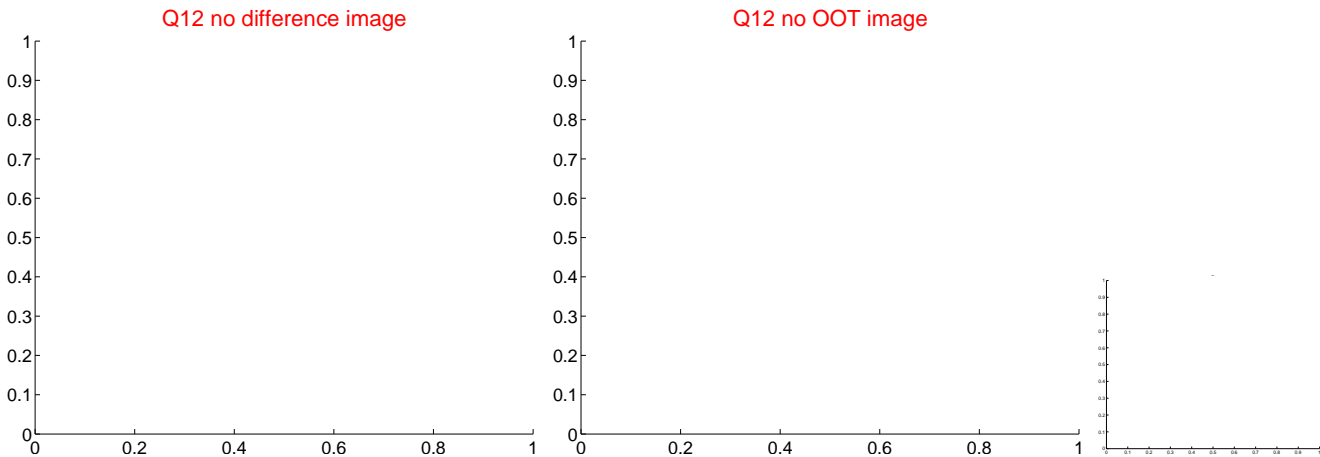
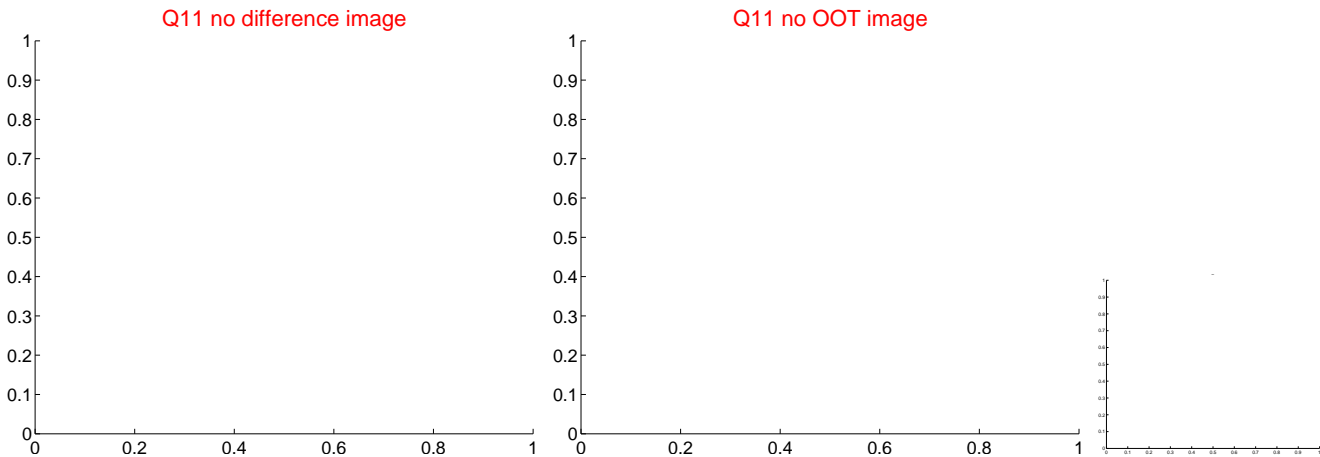
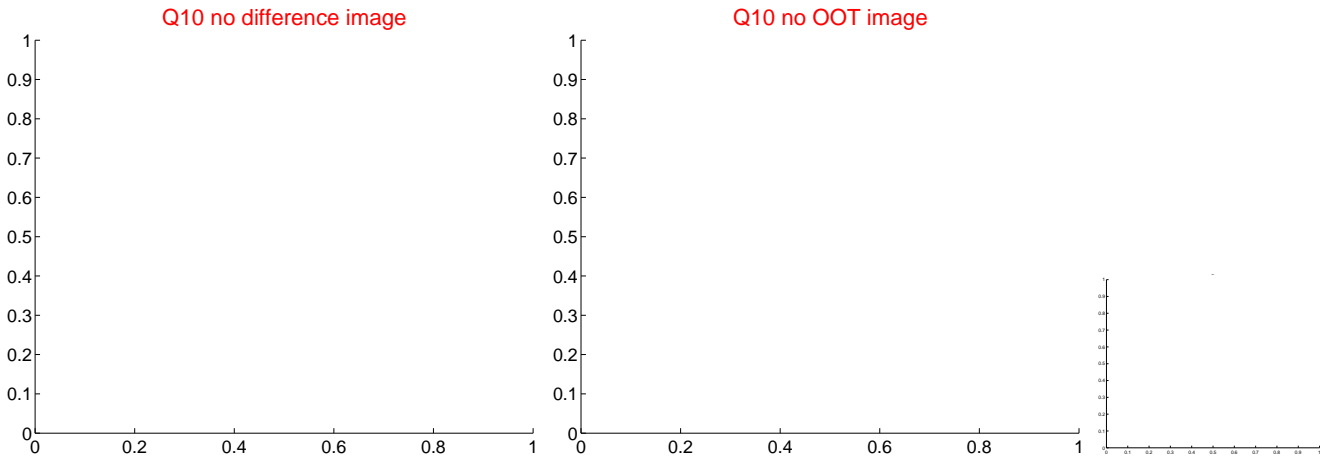
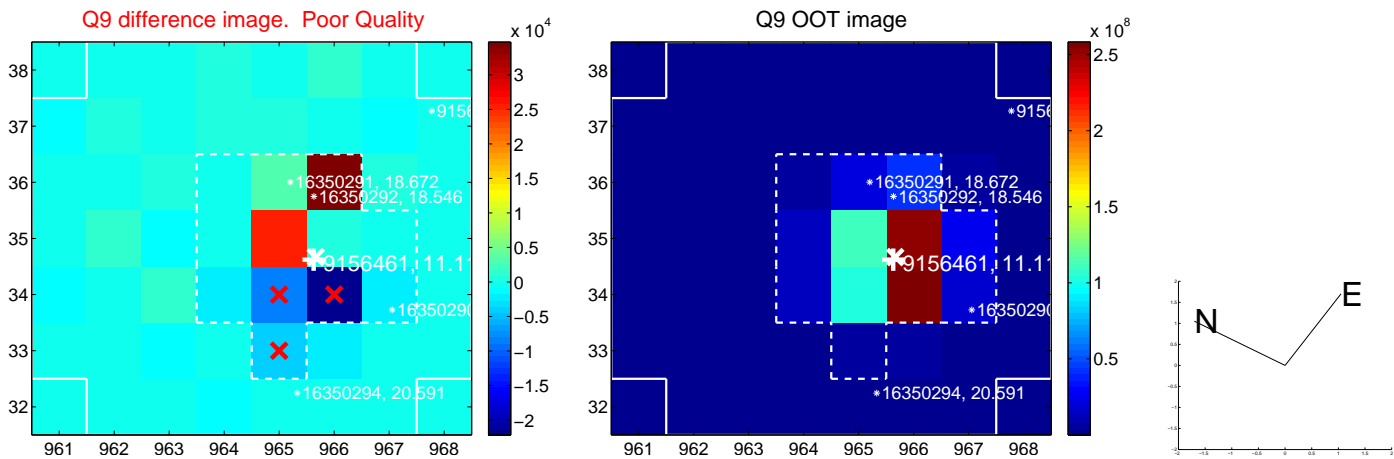
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

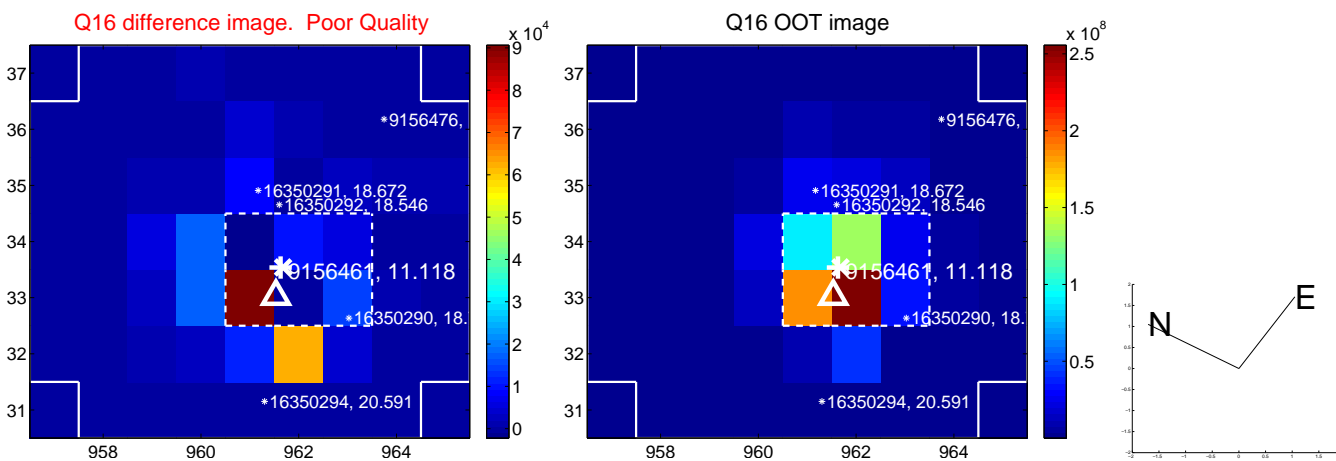
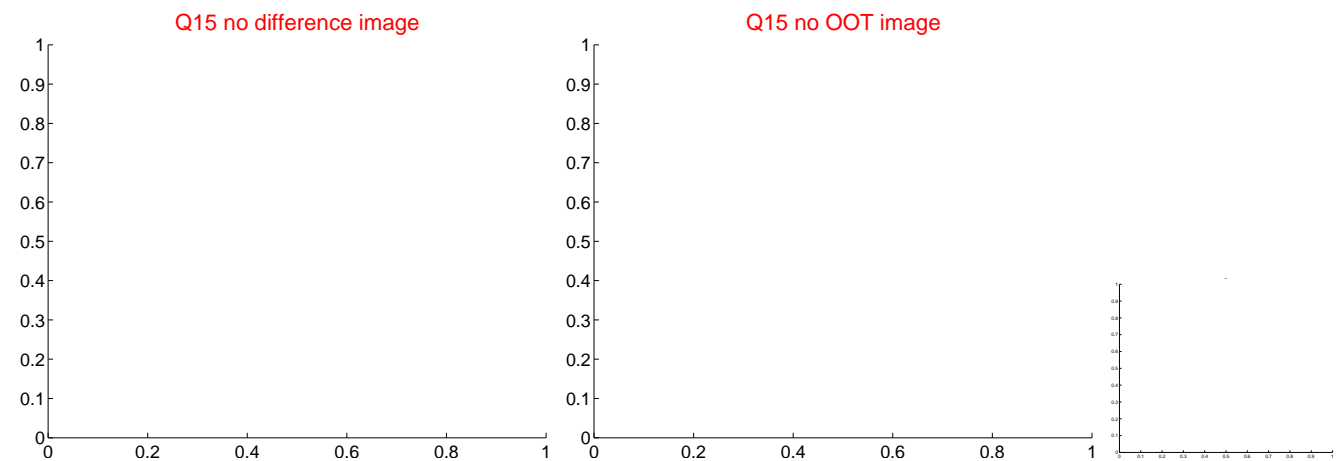
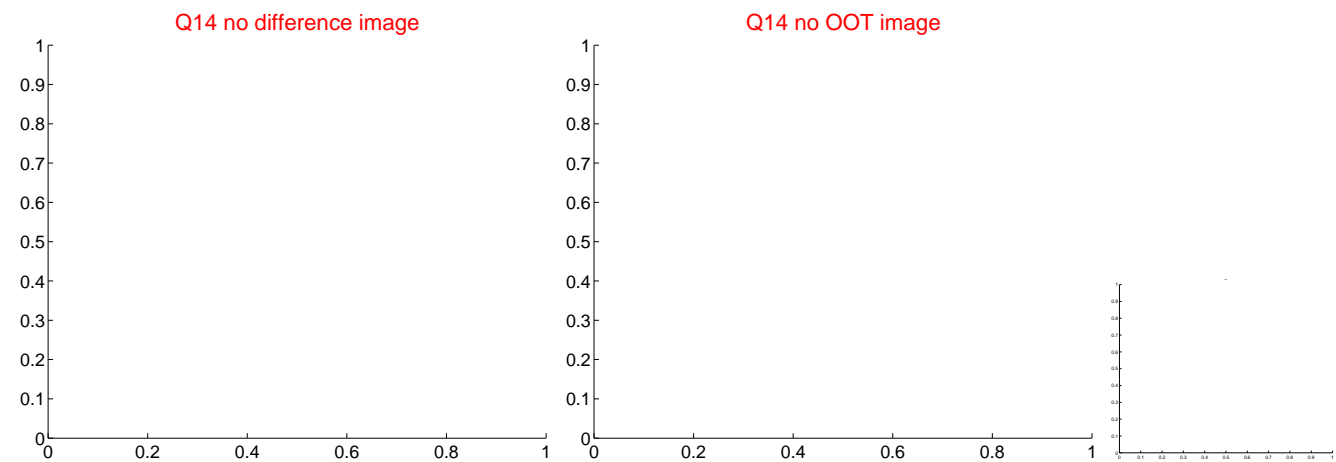
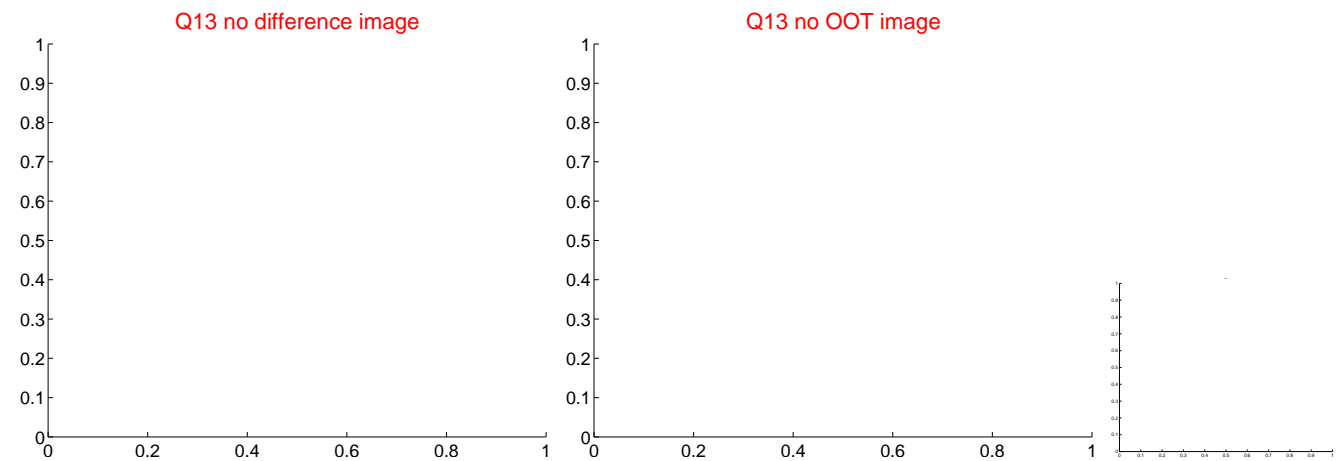


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

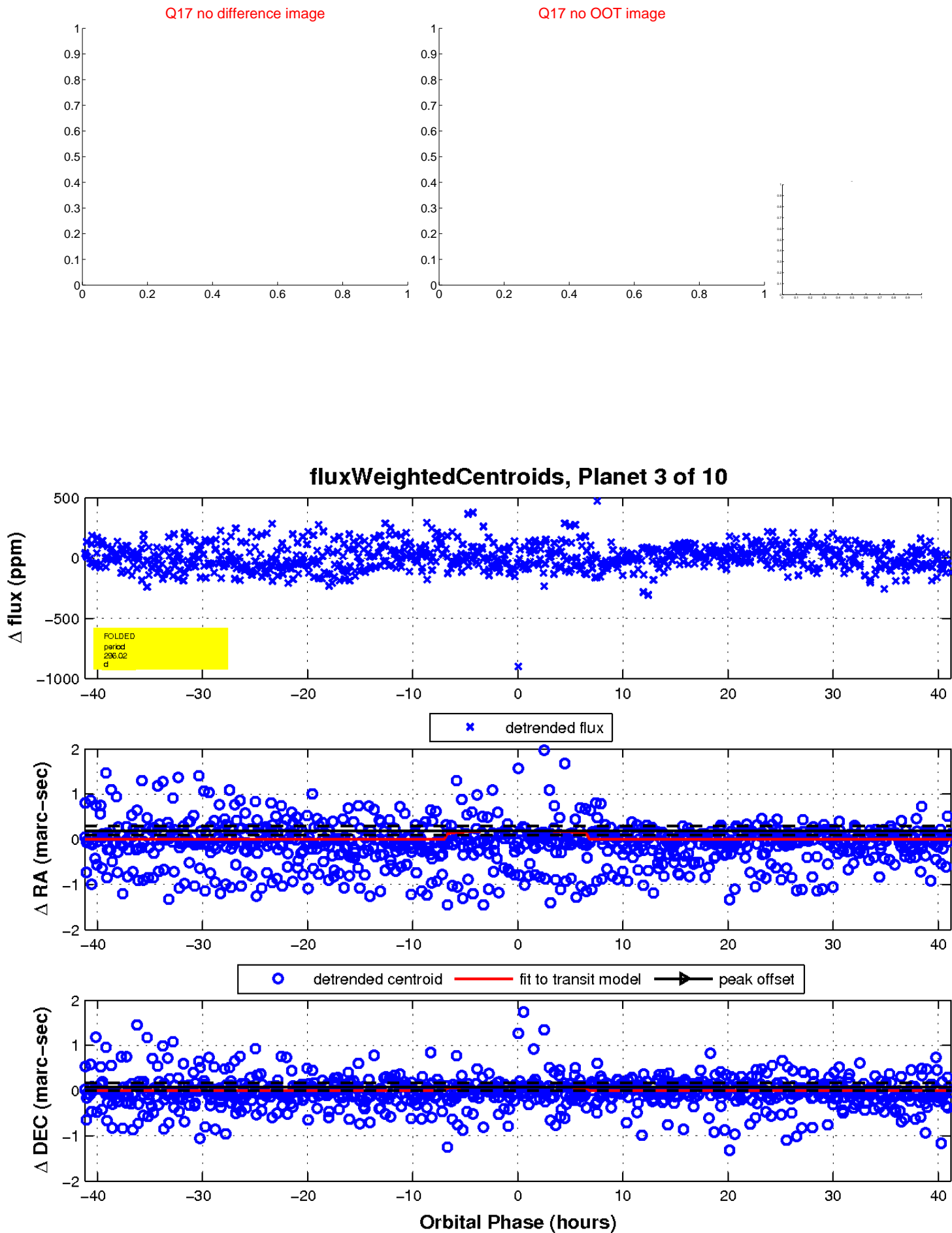




white ×: KIC target position; +: OOT centroid; △: difference centroid. red ✕: large negative pixel value.

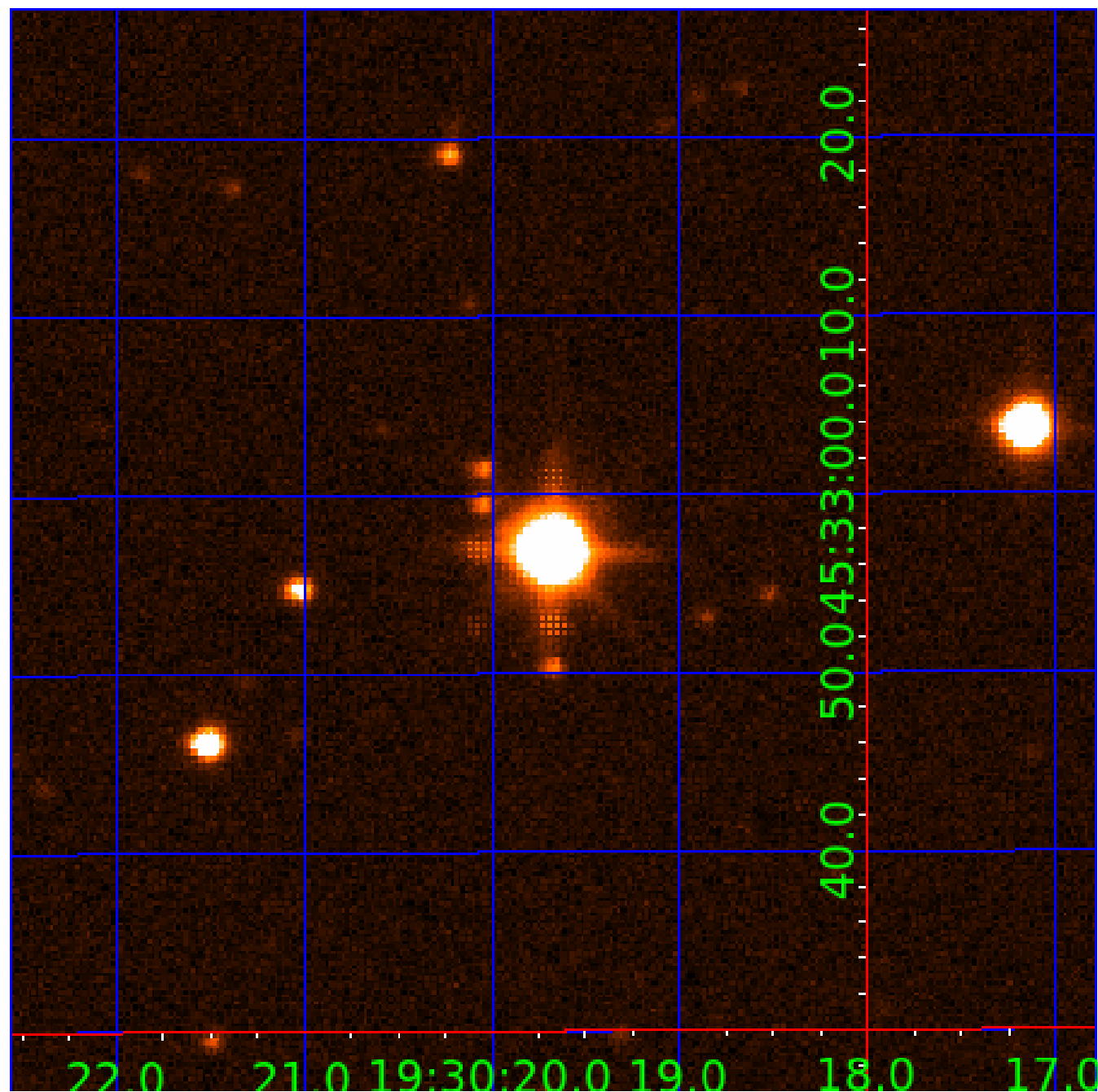


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



## KIC 009156461

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009156461-01	OBS	No	2.296149	132.431446	4.2	10.825	8.7	2.7	1.82	6480	0.43	3717.29
009156461-02	OBS	No	208.639795	204.712221	146.7	5.006	9.0	9.5	1.82	6480	2.51	9.10
009156461-03	OBS	No	296.023030	308.965620	22.4	13.754	7.9	1.0	1.82	6480	0.97	5.71
009156461-04	OBS	No	27.813822	141.128479	61.1	10.671	9.1	8.2	1.82	6480	1.55	133.62
009156461-05	OBS	No	77.564421	198.190936	103.7	8.284	8.5	7.9	1.82	6480	2.09	34.04
009156461-06	OBS	No	337.753157	364.928677	153.2	3.194	8.2	8.4	1.82	6480	2.65	4.79
009156461-08	OBS	No	138.291040	142.658043	108.4	10.011	8.3	6.9	1.82	6480	2.05	15.75
009156461-09	OBS	No	129.035096	161.225143	92.7	6.643	8.0	6.8	1.82	6480	2.33	17.27
009156461-10	OBS	No	110.241909	238.739506	55.7	3.500	7.6	-1.0	1.82	6480	1.37	21.30

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009156461-01	OBS	FP	0.00	1	0	0	0	SWEET_NTL—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—CENT_SATURATED
009156461-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_CHASES_MARSHALL—TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_SATURATED
009156461-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_TRACKER—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_SATURATED
009156461-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_ZUMA—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
009156461-05	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—CENT_SATURATED—HALO_GHOST
009156461-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
009156461-08	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—INCONSISTENT_TRANS—CENT_SATURATED
009156461-09	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_CHASES—TRANS_GAPPED—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
009156461-10	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED

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

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

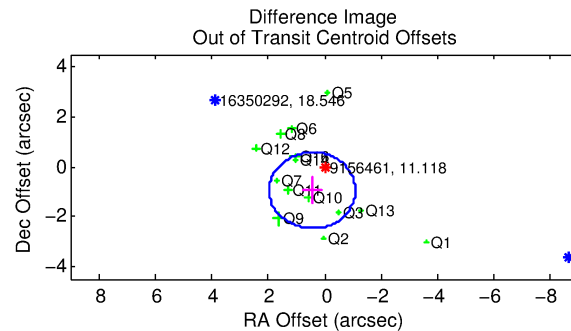
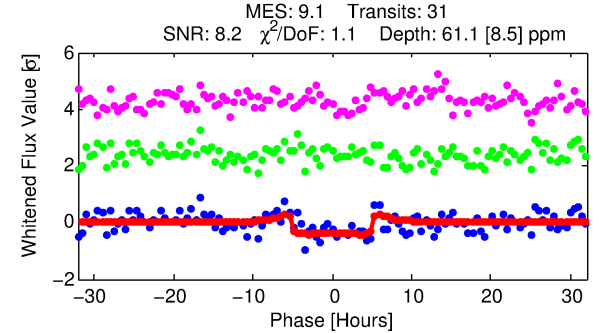
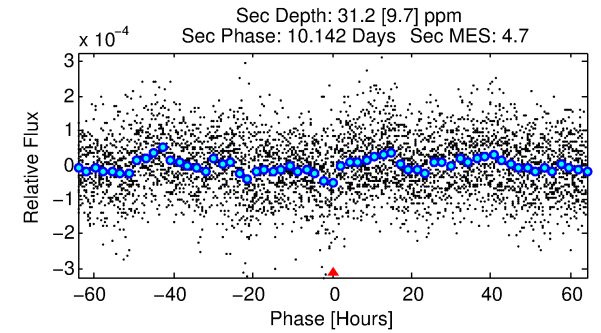
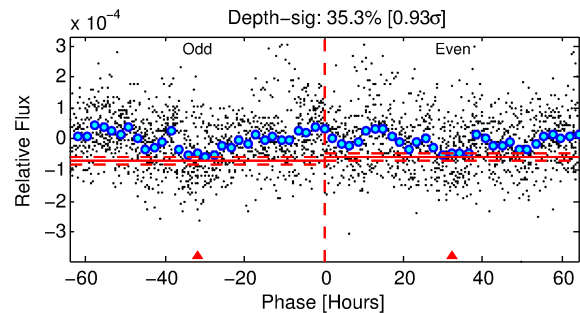
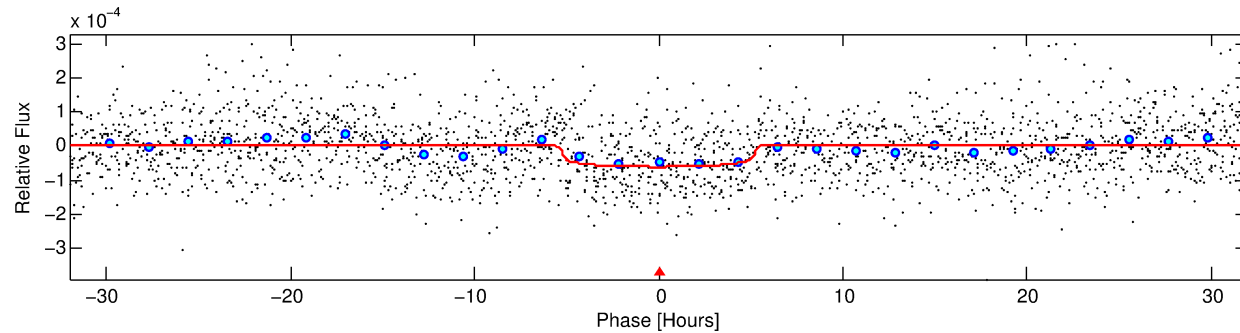
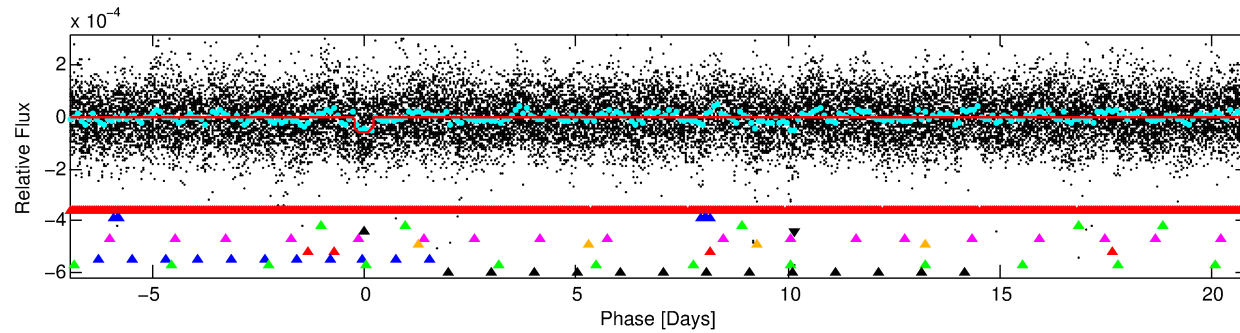
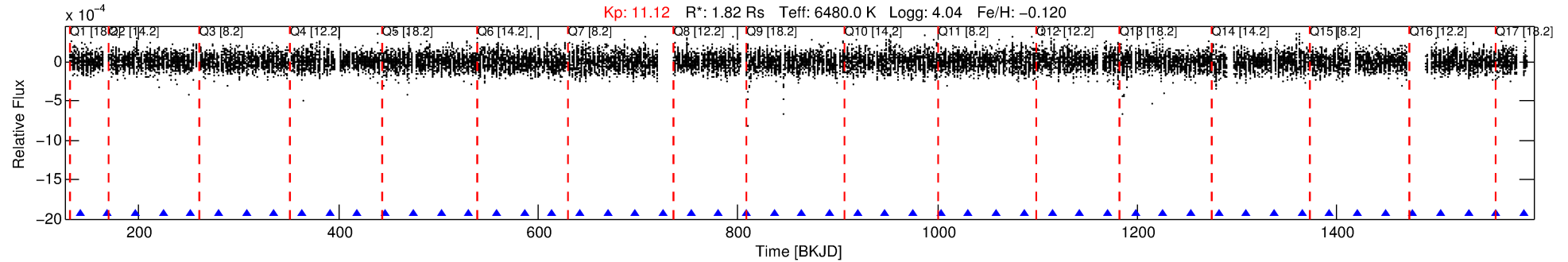
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 009156461-04

No Significant Match Found

# DV One-Page Summary

KIC: 9156461 Candidate: 4 of 10 Period: 27.814 d



## DV Fit Results:

Period = 27.81382 [0.00040] d  
Epoch = 141.1285 [0.0124] BKJD  
Rp/R\* = 0.0078 [0.0020]  
a/R\* = 13.15 [17.19]  
b = 0.76 [0.73]  
Seff = 133.62 [70.46]  
Teq = 867 [114] K  
Rp = 1.55 [0.66] Re  
a = 0.1981 [0.0634] AU  
Ag = 279.58 [218.41] [1.28 $\sigma$ ]  
Teff = 5481 [844] K [5.41 $\sigma$ ]

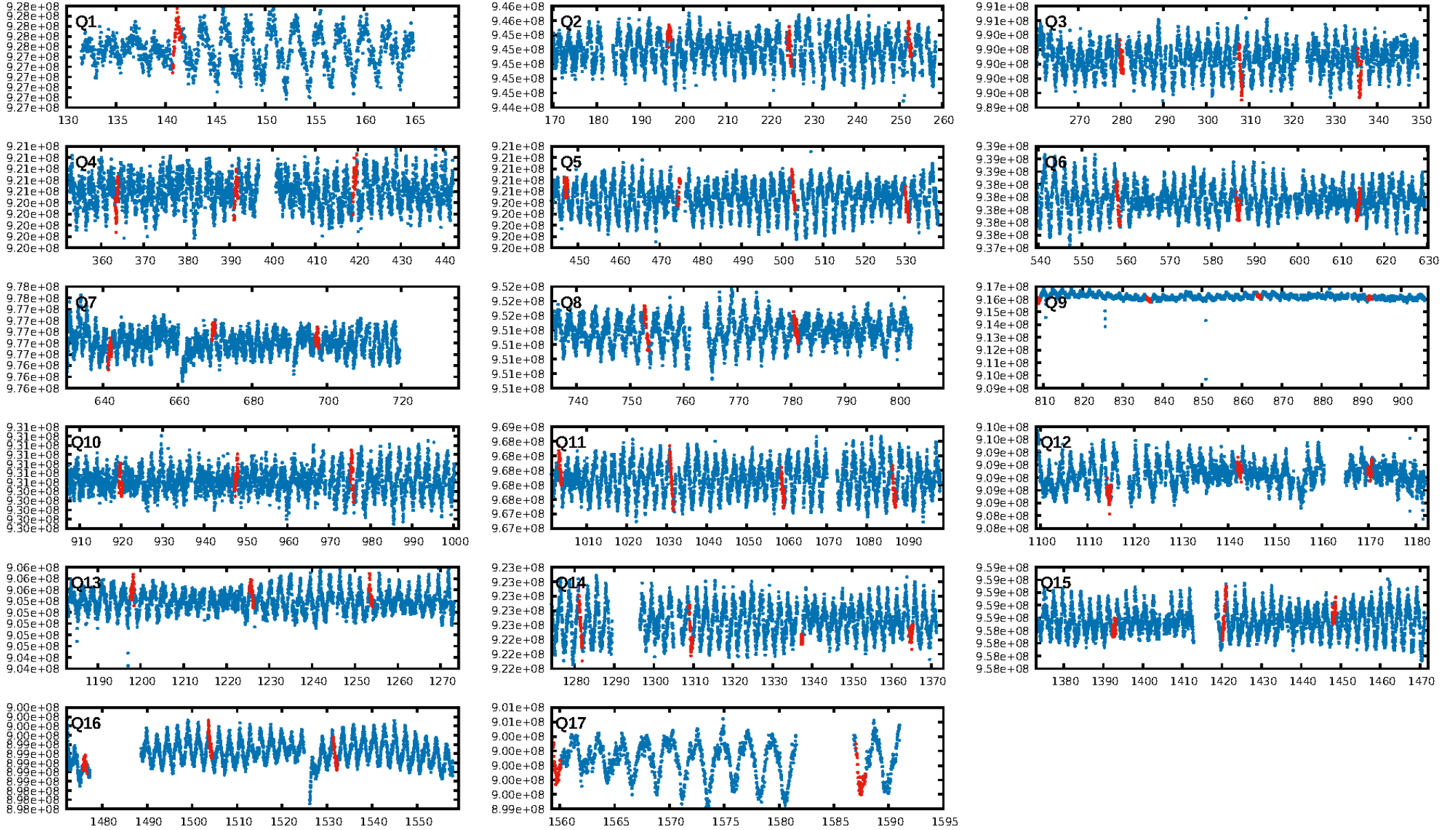
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [40.29 $\sigma$ ]  
LongPeriod-sig: 100.0% [88.39 $\sigma$ ]  
ModelChiSquare2-sig: 2.2%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [28/28]  
GhostDiagnostic-chr: 1.275  
Centroid-sig: 3.6%  
Centroid-so: 1.206 arcsec [1.97 $\sigma$ ]  
OotOffset-rm: 1.048 arcsec [2.06 $\sigma$ ]  
KicOffset-rm: 1.232 arcsec [2.86 $\sigma$ ]  
OotOffset-st: 4/3/3/4 [14]  
KicOffset-st: 4/3/3/4 [14]  
DiffImageQuality-fgm: 0.29 [4/14]  
DiffImageOverlap-fno: 0.19 [3/16]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 22:28:49 Z

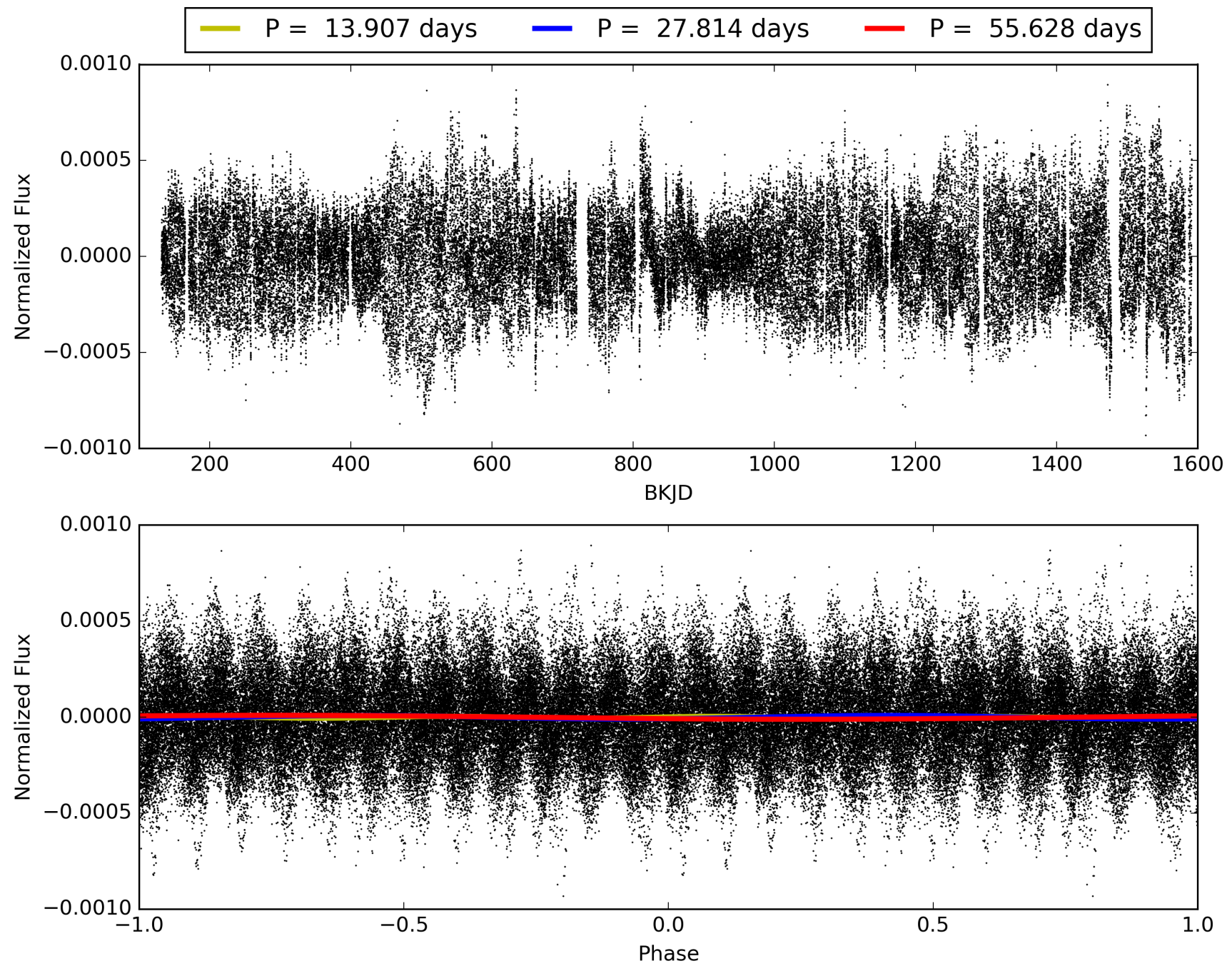
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 009156461-04, PDC Light Curves





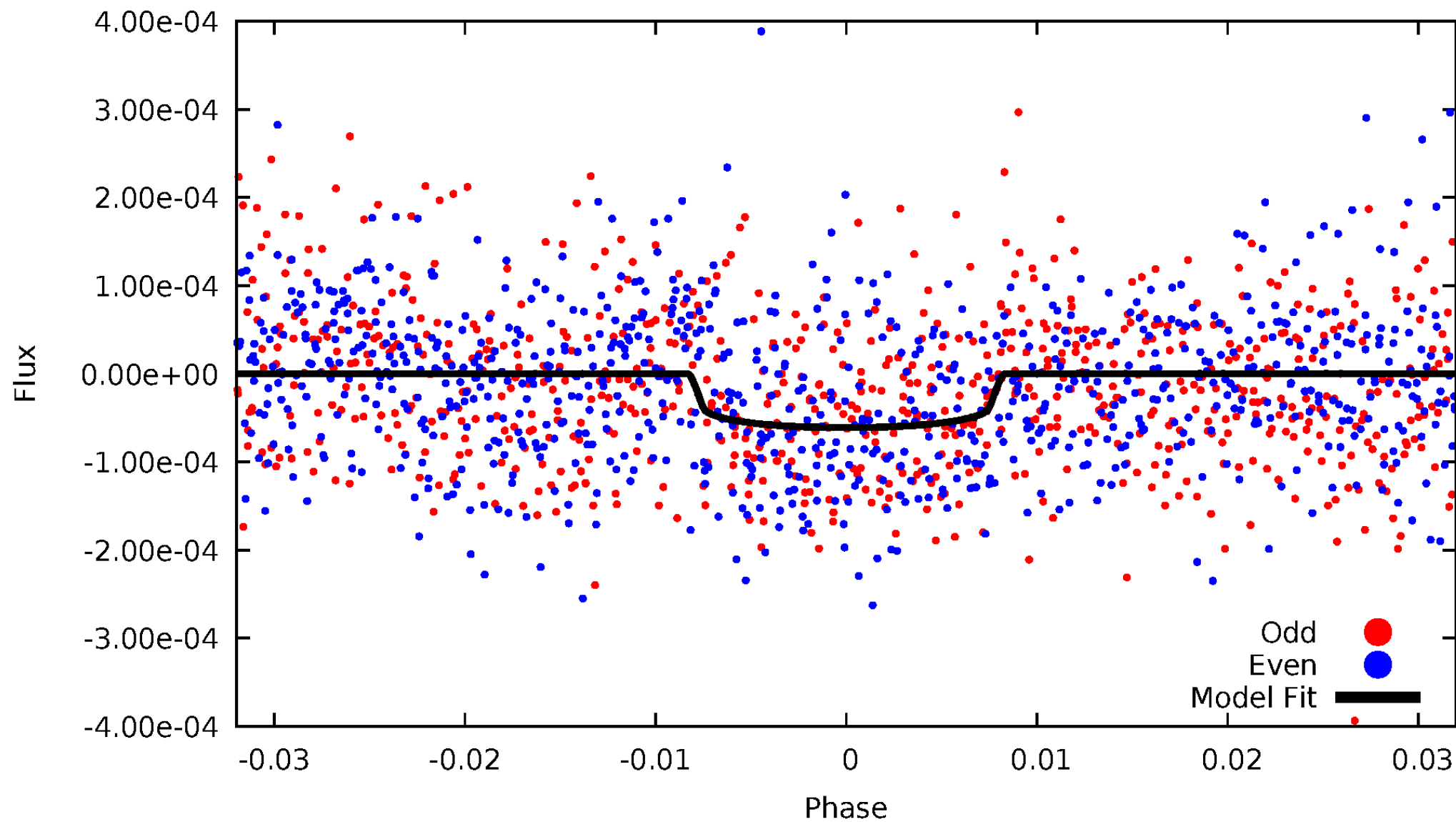
TCE 009156461-04





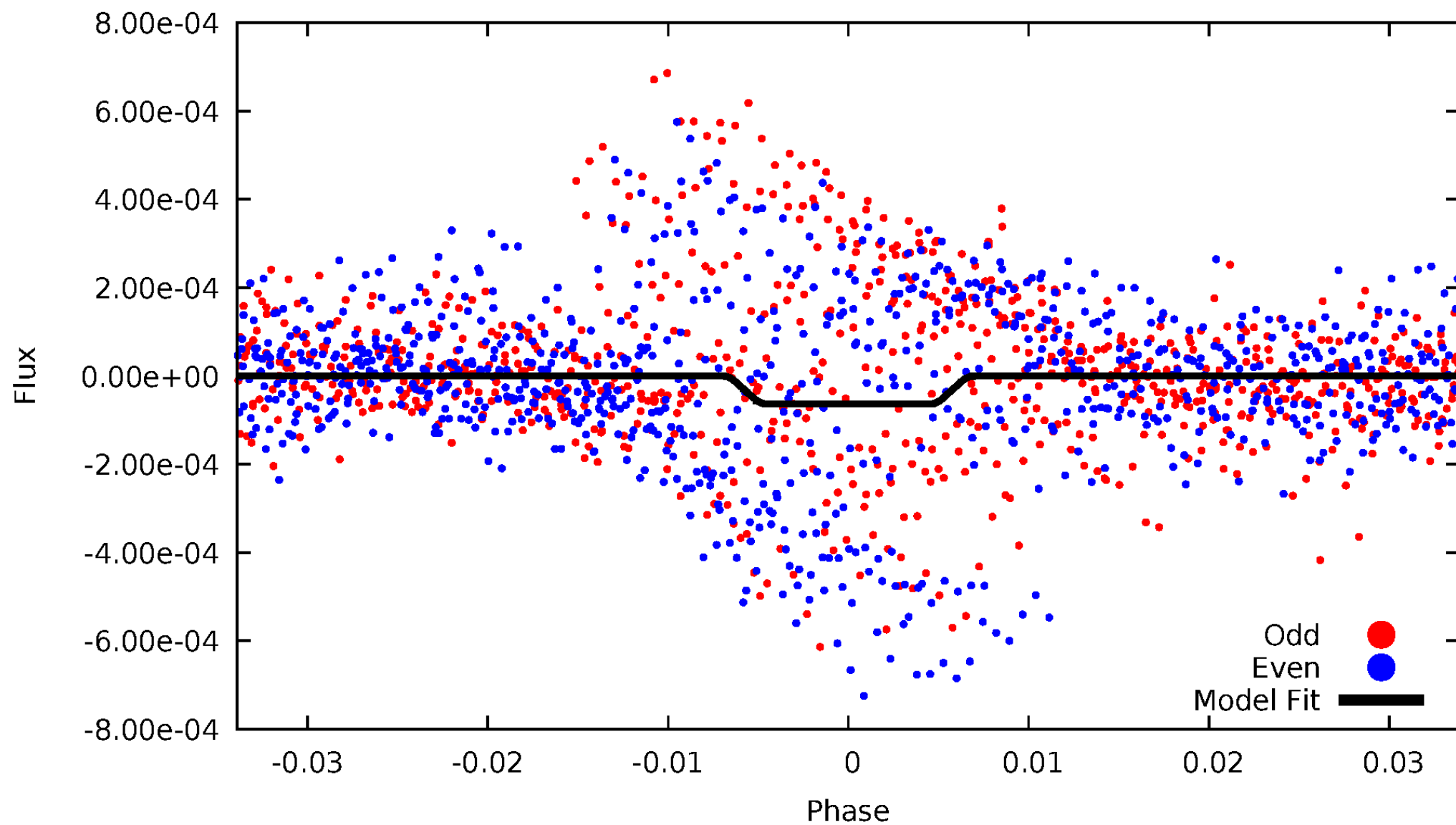
# DV Odd/Even

TCE 009156461-04



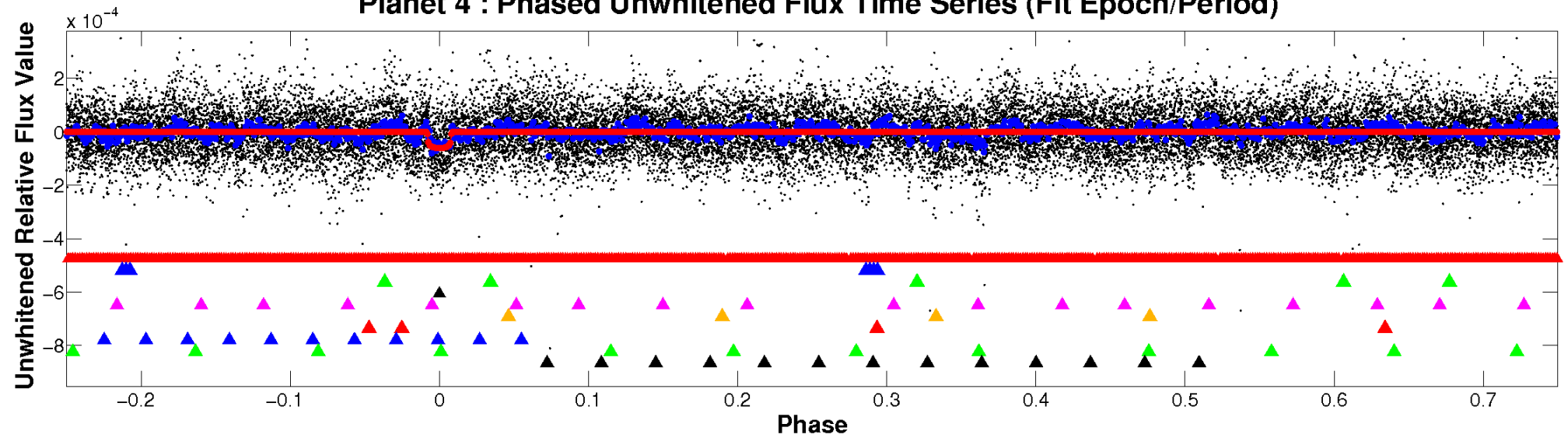
# ALT Odd/Even

TCE 009156461-04

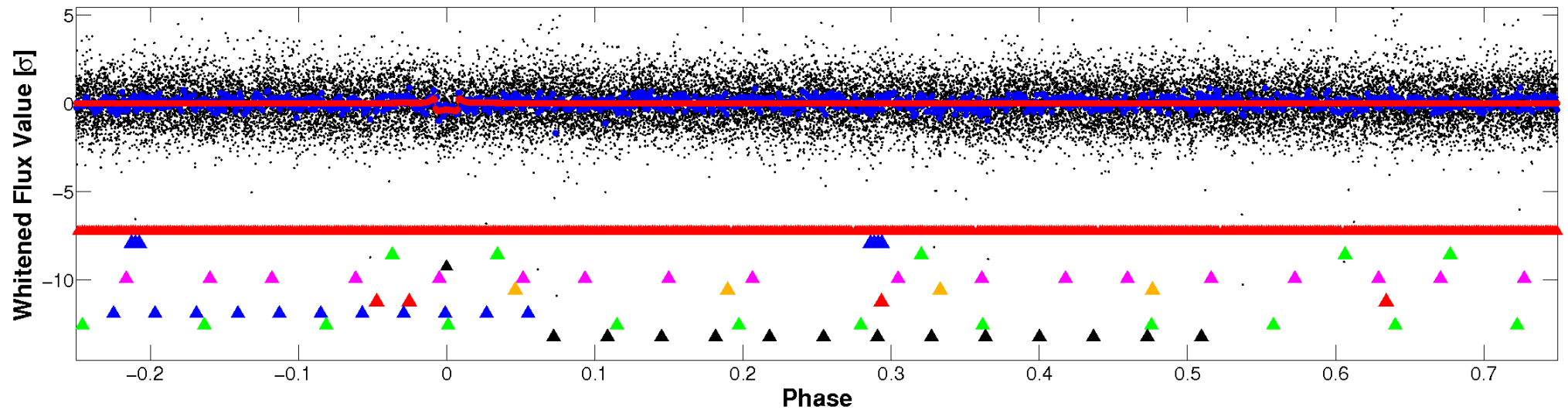


# Non-Whitened Vs. Whitened Light Curve

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

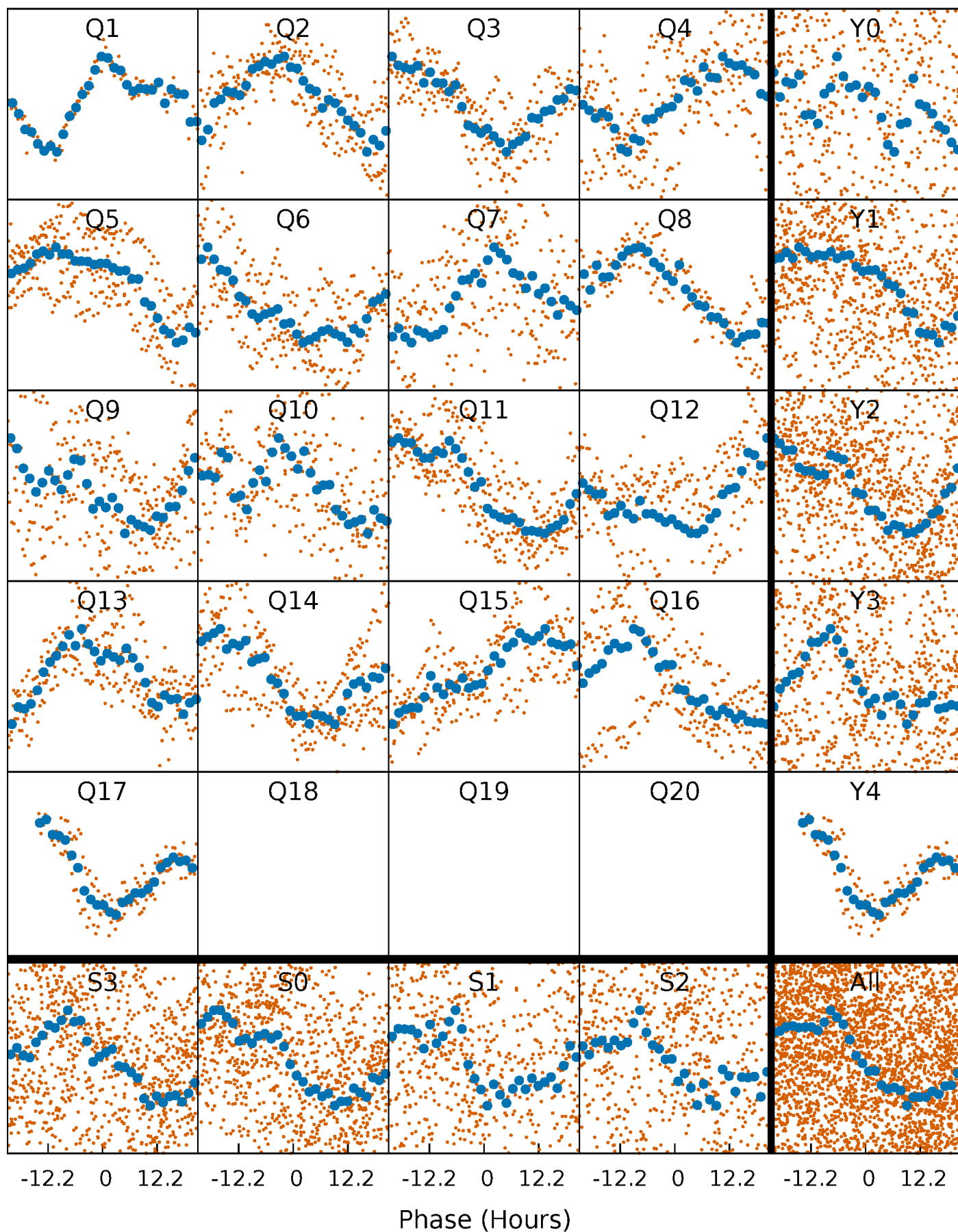


## Planet 4 : Phased Whitened Flux Time Series (Fit Epoch/Period)



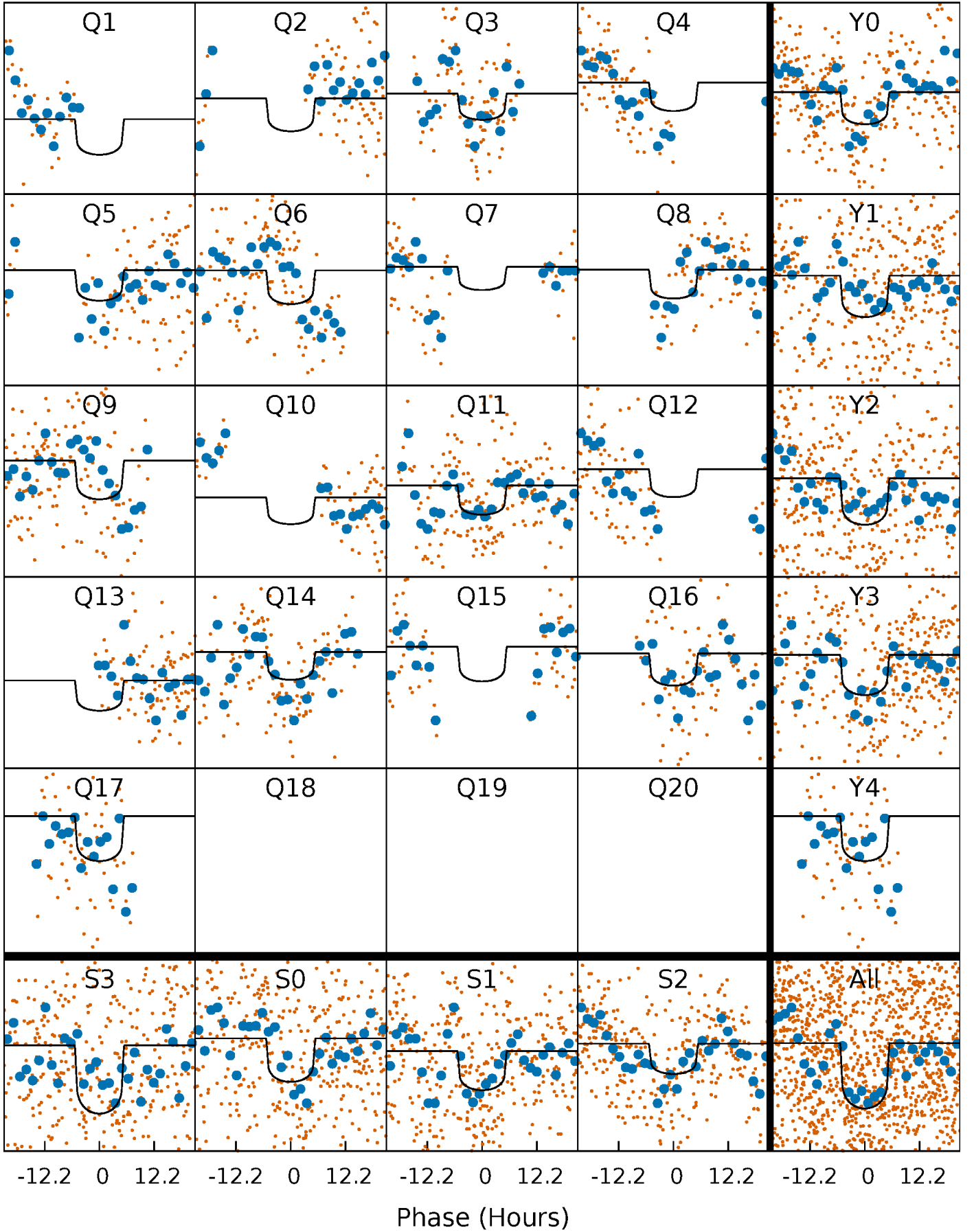
# PDC Quarter-Phased Transit Curves

TCE 009156461-04 P= 27.813822 Days  $T_0=141.128479$  (BKJD)



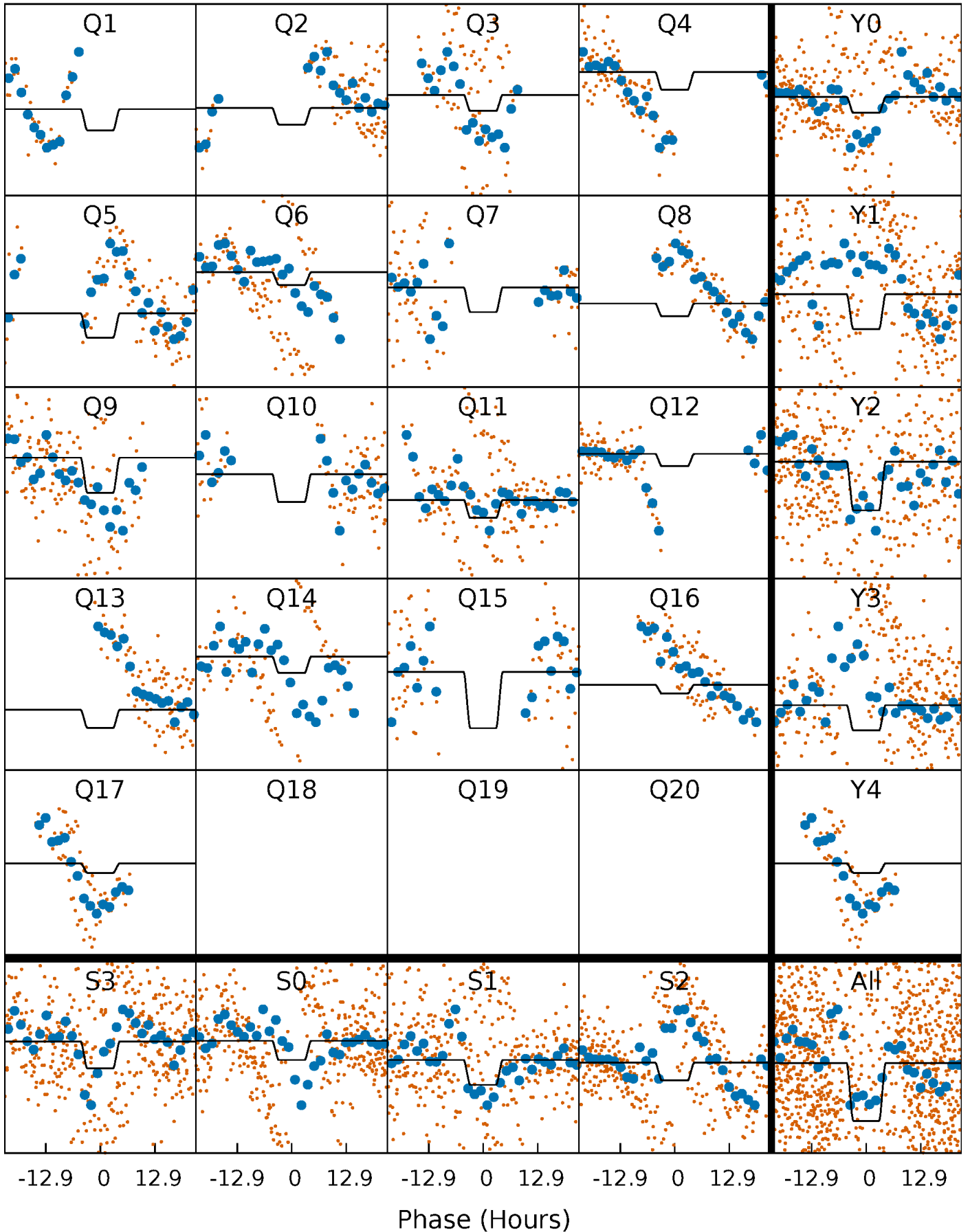
# DV Quarter-Phased Transit Curves

TCE 009156461-04   P= 27.813822 Days    $T_0=141.128479$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

TCE 009156461-04 P= 27.814135 Days  $T_0=141.129939$  (BKJD)

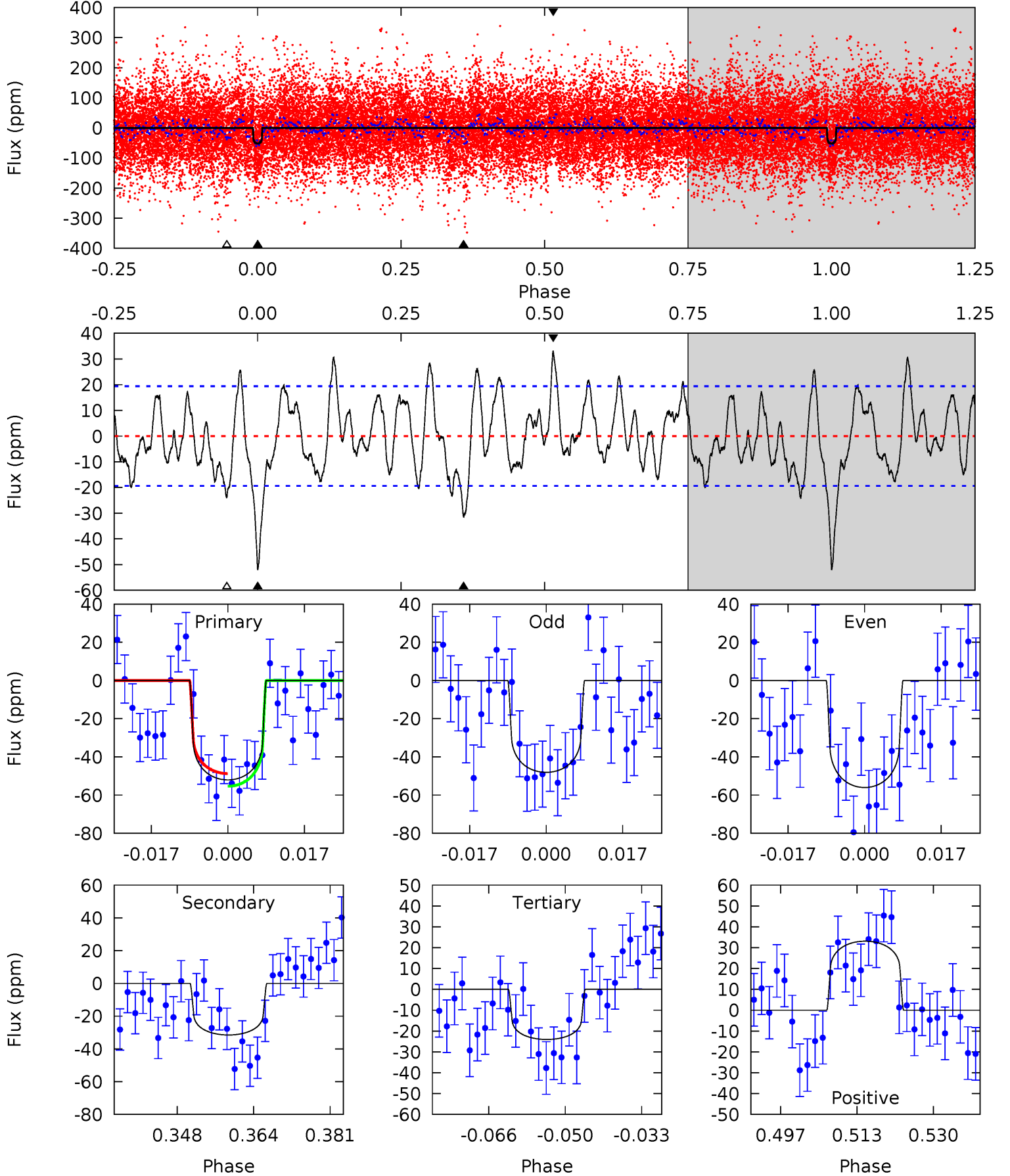




# DV Model-Shift Uniqueness Test

009156461-04, P = 27.813822 Days, E = 113.314657 Days

Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
13.2	8.01	6.12	8.42	4.93	2.40	2.96	7.12	4.82	1.89	-0.41	1.01	0.63	0.39	0.85

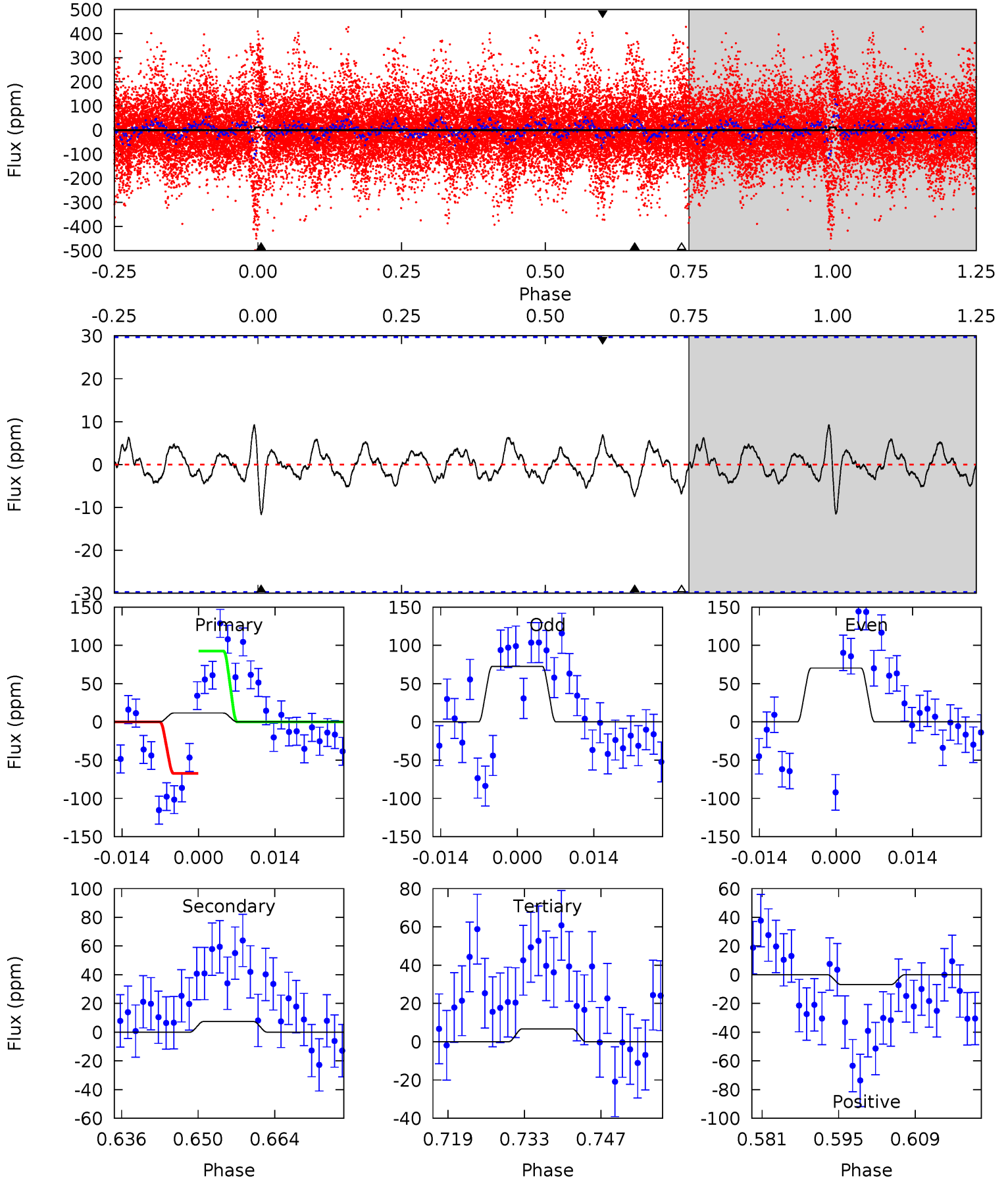




# Alt Model-Shift Uniqueness Test

009156461-04, P = 27.814135 Days, E = 113.315804 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
1.93	1.24	1.13	1.15	4.96	2.46	0.46	0.80	0.78	0.11	0.08	0.19	87.1	0.45	2.09



### Stellar Parameters For KIC 009156461

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6480^{+181}_{-250}$	$4.044^{+0.293}_{-0.158}$	$-0.120^{+0.250}_{-0.300}$	$1.822^{+0.510}_{-0.623}$	$1.345^{+0.193}_{-0.289}$	$0.313^{+0.619}_{-0.139}$
	+3%/-4%	+7%/-4%	+208%/-250%	+28%/-34%	+14%/-21%	+198%/-44%
Source	PHO54	PHO54	PHO54	DSEP		

KIC = Kepler Input Catalog; PHO = Photometry; SPE = Spectroscopy; AST = Asteroseismology  
 TRA = Transits; DESP = Dartmouth Models; MULT = Multiple Models

### Secondary Eclipse Parameters for KIC 009156461-04 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-32 \pm 4$	$1.50^{+0.49}_{-0.46}$	$1193^{+96}_{-117}$	$5443^{+823}_{-543}$	$301^{+306}_{-131}$
Alt.	$-7 \pm 6$	$1.54^{+0.55}_{-0.48}$	$1196^{+97}_{-112}$	$4050^{+733}_{-840}$	$67^{+107}_{-51}$

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

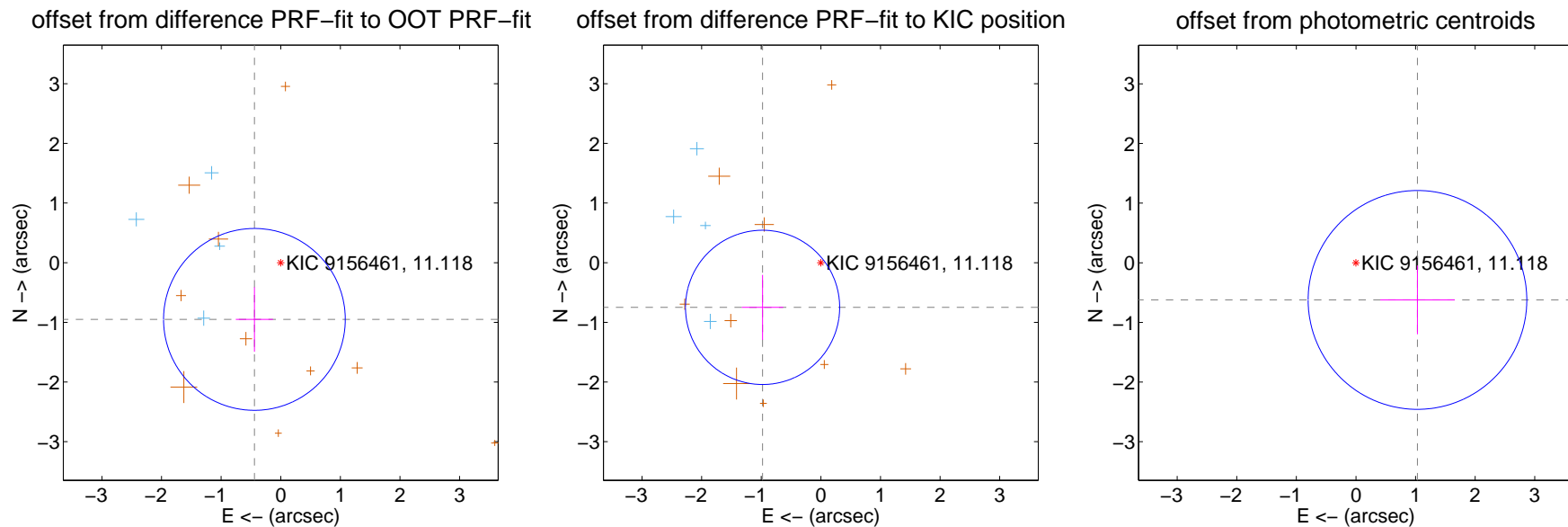
## DV Centroid Data

Supplemental centroid analysis for 009156461-04. **Kepler magnitude: 11.12.** Transit SNR 8.21

There are 4 quarters with good PRF difference image offsets

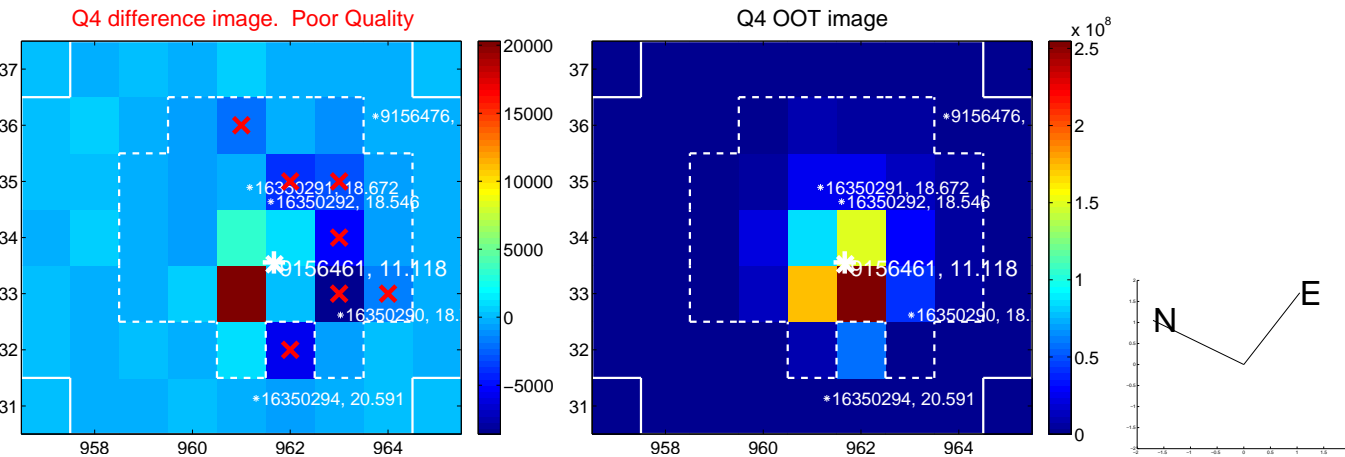
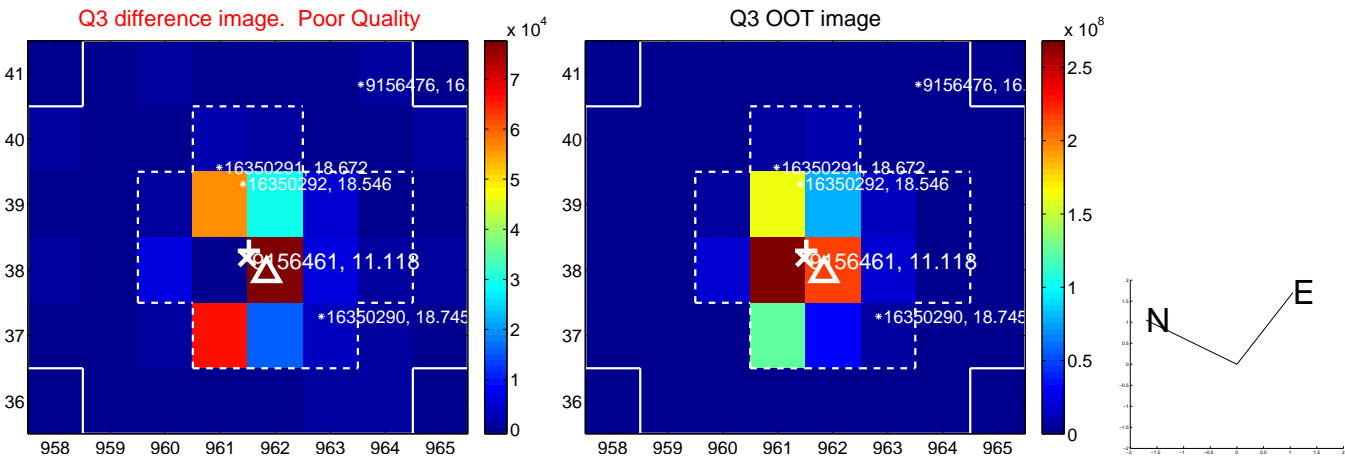
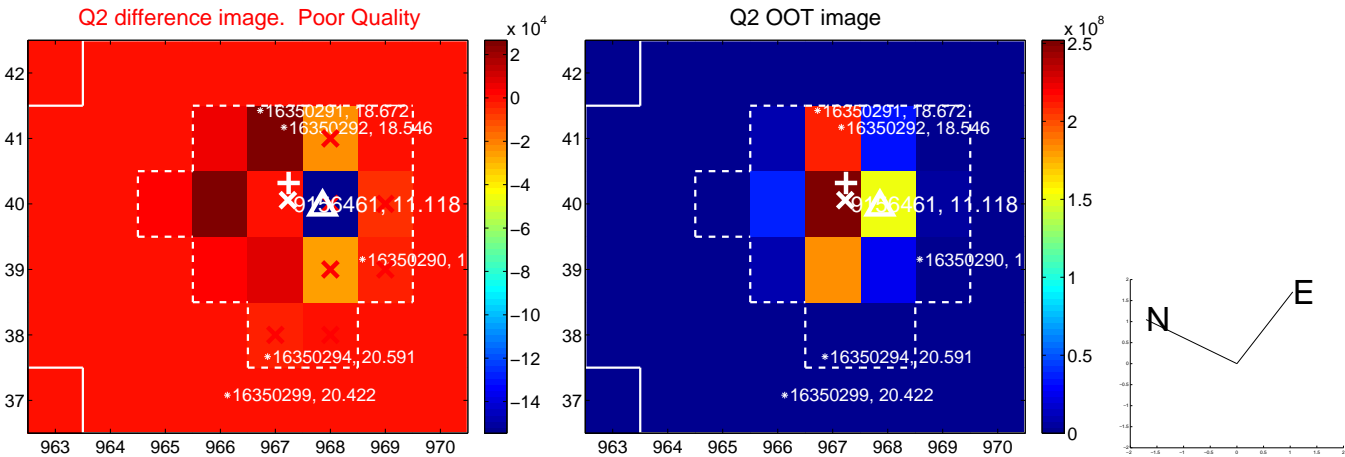
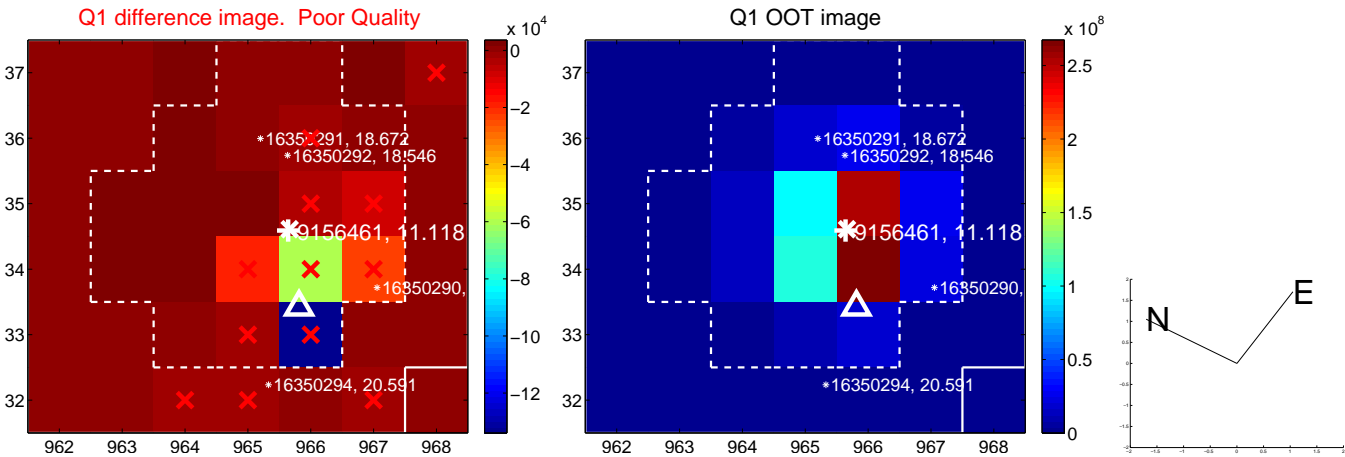
The direct PRF centroid is offset from the target star catalog position by about 0.26 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.048 \pm 0.508$	2.06	$0.442 \pm 0.311$	$-0.951 \pm 0.541$
PRF-fit source offset from KIC position	$1.232 \pm 0.431$	2.86	$0.978 \pm 0.348$	$-0.749 \pm 0.544$
photometric centroid source offset	$1.21 \pm 0.61$	1.97	$-1.03 \pm 0.62$	$-0.62 \pm 0.58$

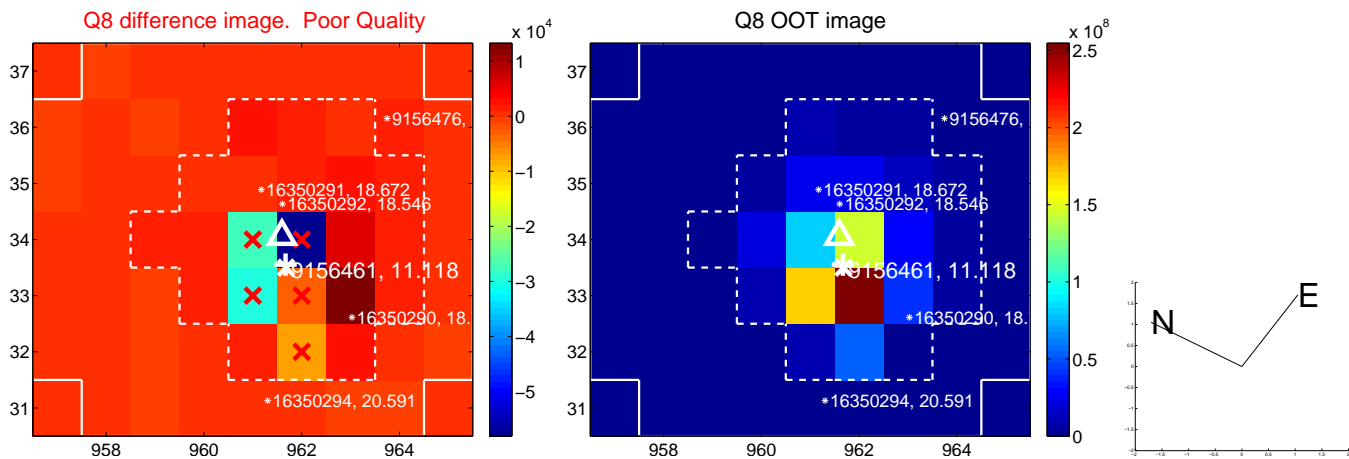
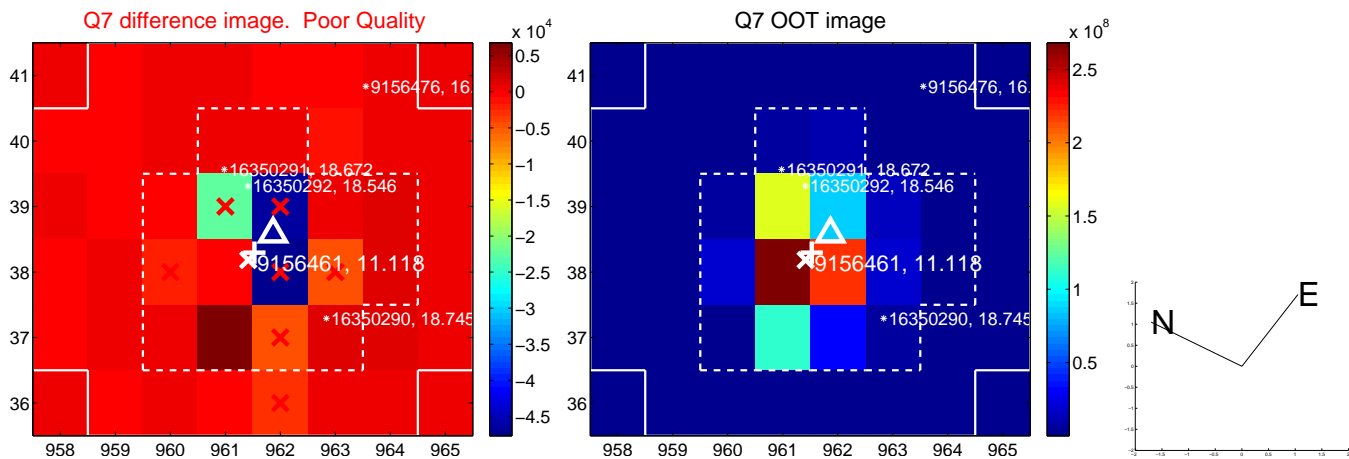
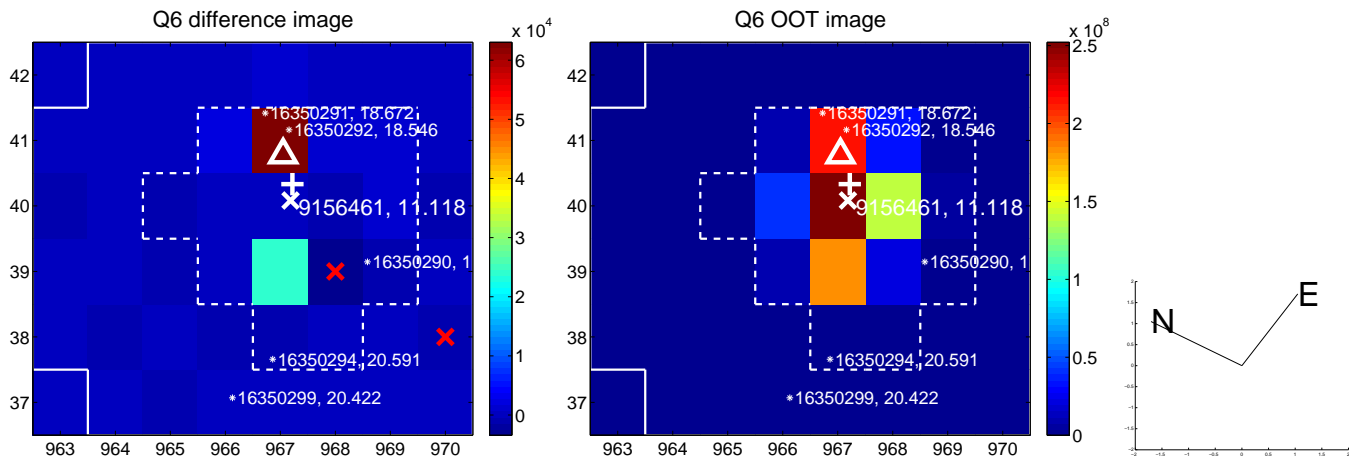
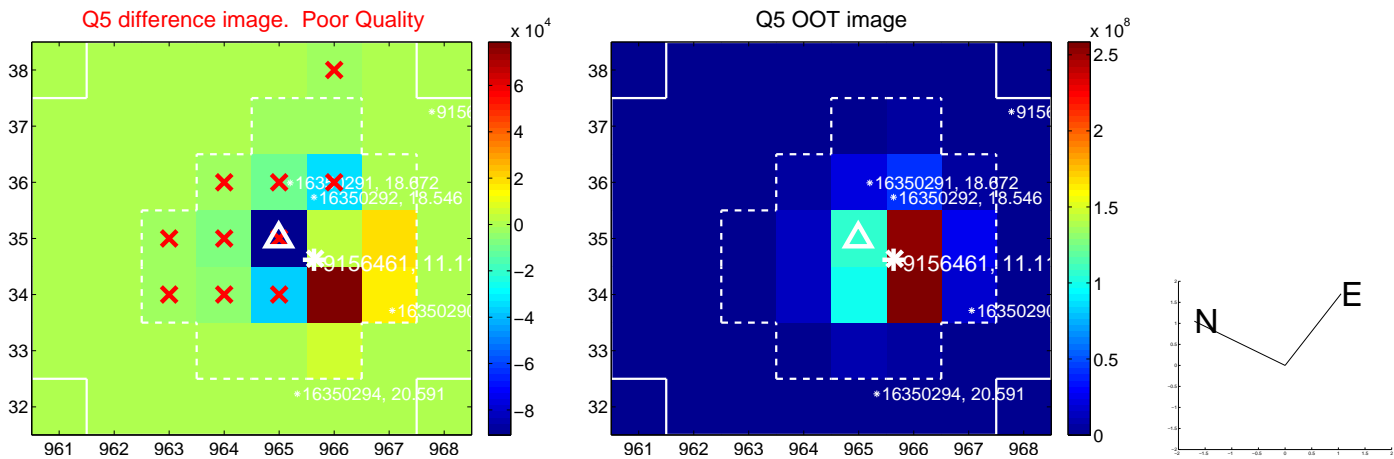


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

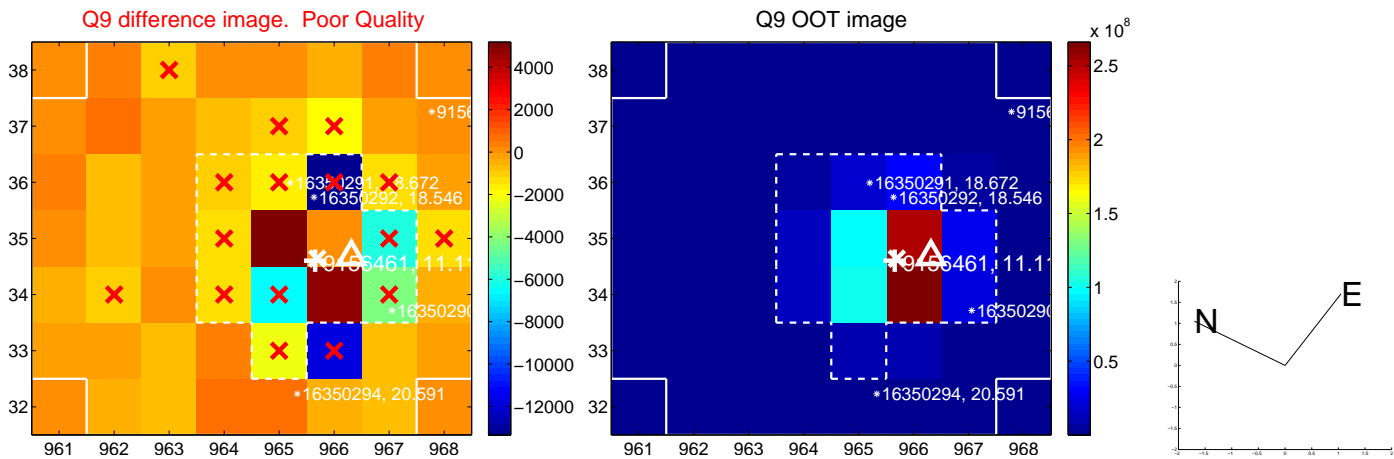
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



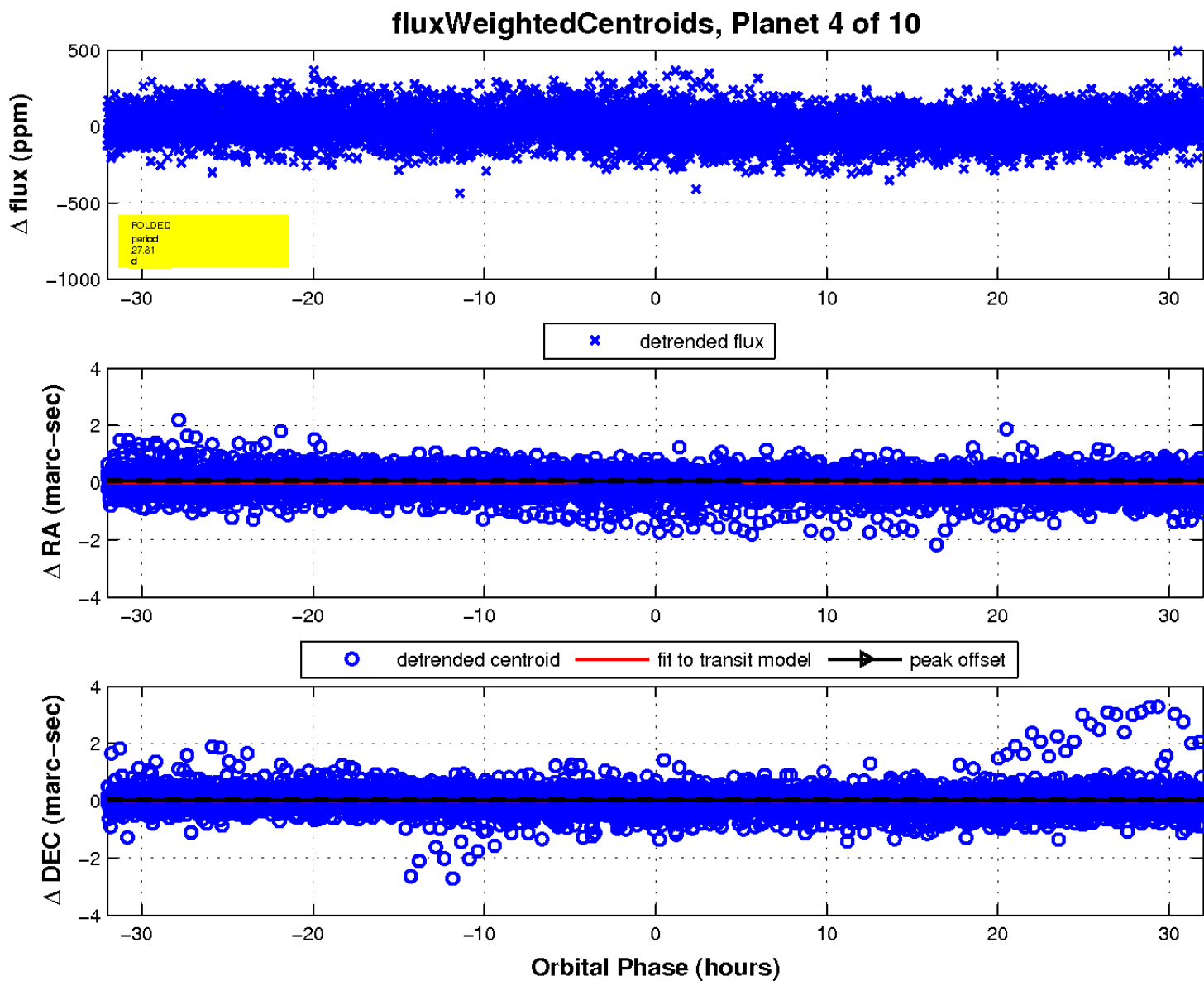
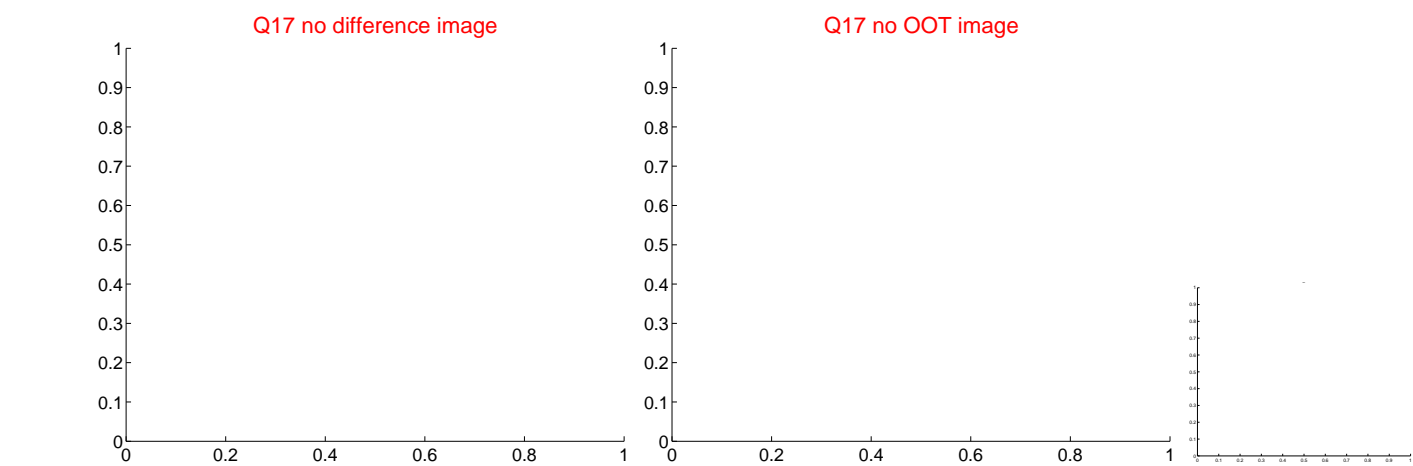
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





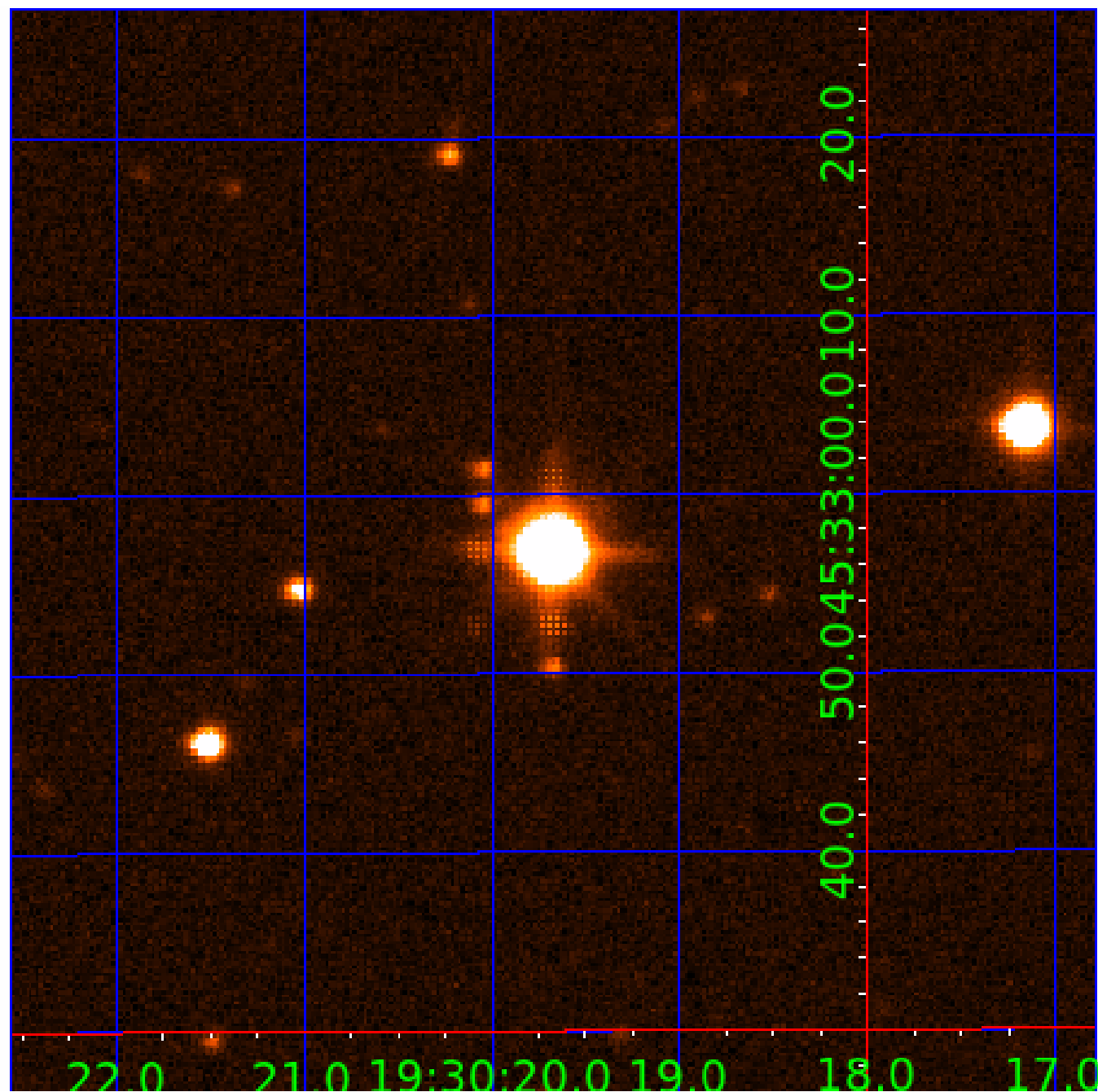


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



## KIC 009156461

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009156461-01	OBS	No	2.296149	132.431446	4.2	10.825	8.7	2.7	1.82	6480	0.43	3717.29
009156461-02	OBS	No	208.639795	204.712221	146.7	5.006	9.0	9.5	1.82	6480	2.51	9.10
009156461-03	OBS	No	296.023030	308.965620	22.4	13.754	7.9	1.0	1.82	6480	0.97	5.71
009156461-04	OBS	No	27.813822	141.128479	61.1	10.671	9.1	8.2	1.82	6480	1.55	133.62
009156461-05	OBS	No	77.564421	198.190936	103.7	8.284	8.5	7.9	1.82	6480	2.09	34.04
009156461-06	OBS	No	337.753157	364.928677	153.2	3.194	8.2	8.4	1.82	6480	2.65	4.79
009156461-08	OBS	No	138.291040	142.658043	108.4	10.011	8.3	6.9	1.82	6480	2.05	15.75
009156461-09	OBS	No	129.035096	161.225143	92.7	6.643	8.0	6.8	1.82	6480	2.33	17.27
009156461-10	OBS	No	110.241909	238.739506	55.7	3.500	7.6	-1.0	1.82	6480	1.37	21.30

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009156461-01	OBS	FP	0.00	1	0	0	0	SWEET_NTL—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—CENT_SATURATED
009156461-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_CHASES_MARSHALL—TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_SATURATED
009156461-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_TRACKER—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_SATURATED
009156461-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_ZUMA—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
009156461-05	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—CENT_SATURATED—HALO_GHOST
009156461-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
009156461-08	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—INCONSISTENT_TRANS—CENT_SATURATED
009156461-09	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_CHASES—TRANS_GAPPED—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
009156461-10	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED

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

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

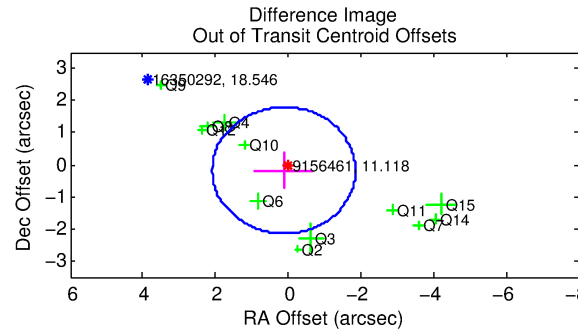
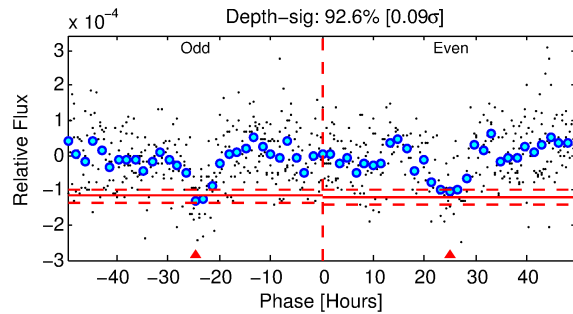
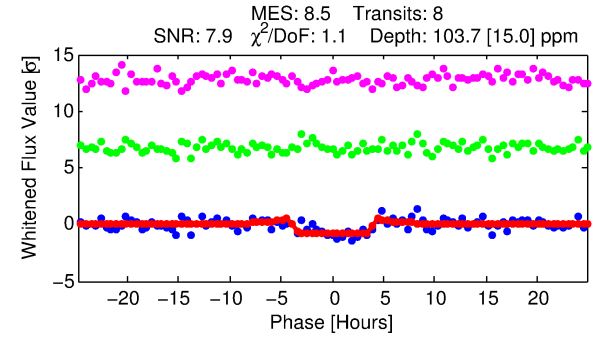
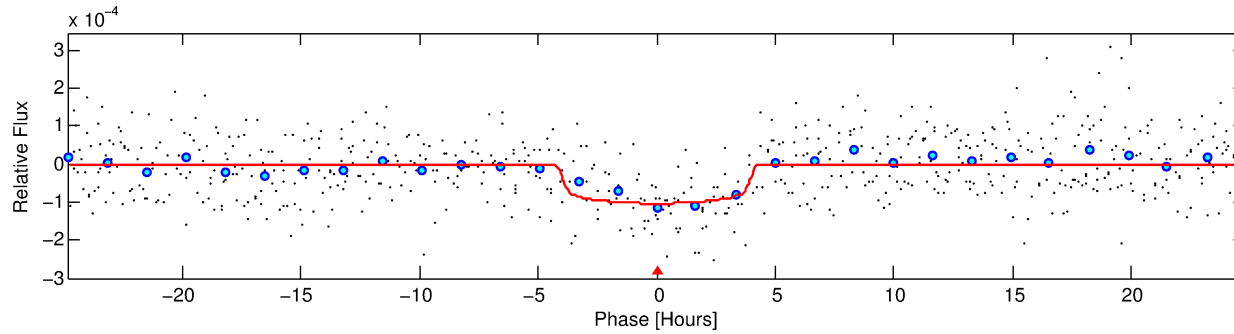
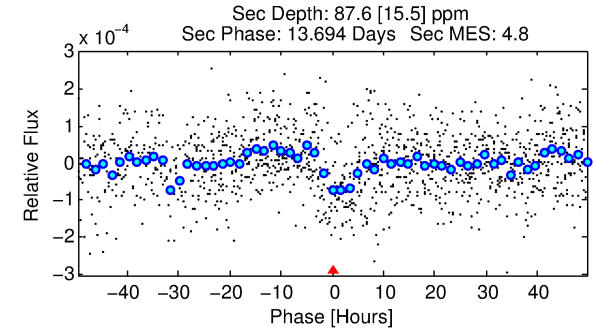
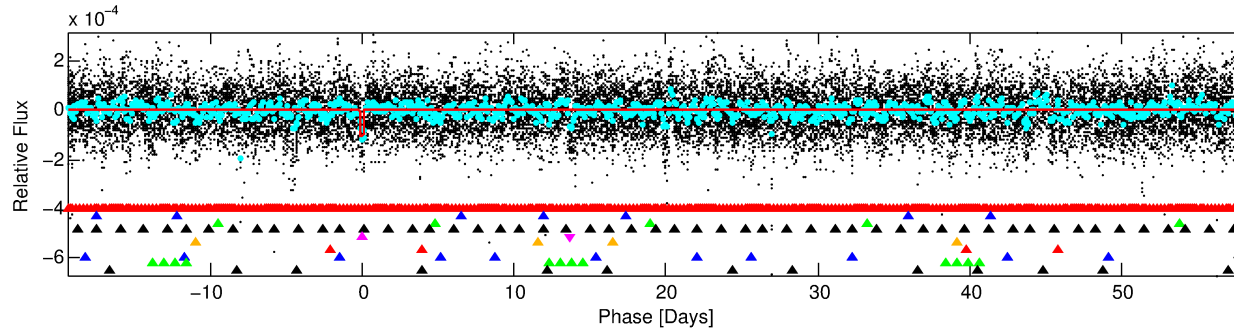
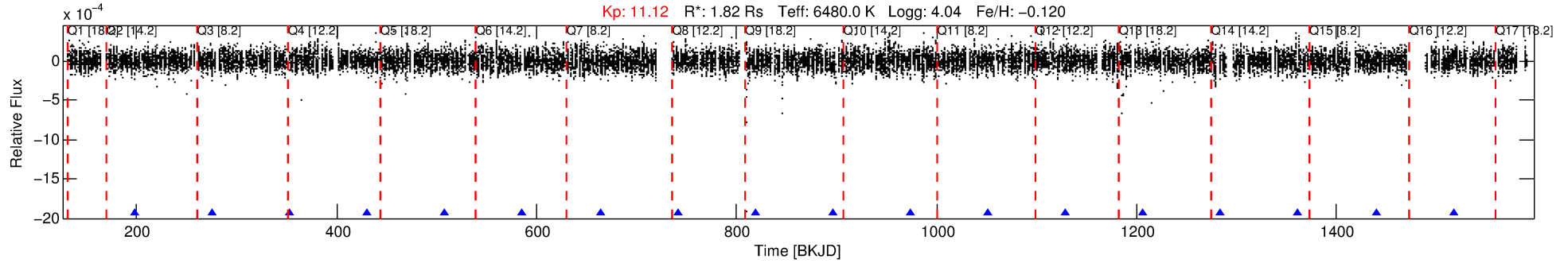
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 009156461-05

No Significant Match Found

# DV One-Page Summary

KIC: 9156461 Candidate: 5 of 10 Period: 77.564 d



## DV Fit Results:

Period = 77.56442 [0.00111] d  
Epoch = 198.1909 [0.0109] BKJD  
Rp/R\* = 0.0105 [0.0043]  
a/R\* = 39.52 [89.47]  
b = 0.85 [0.77]  
Seff = 34.04 [17.95]  
Teq = 616 [81] K  
Rp = 2.09 [1.12] Re  
a = 0.3925 [0.1257] AU  
Ag = 1695.38 [1665.56] [1.02σ]  
Teffp = 6111 [1309] K [4.19σ]

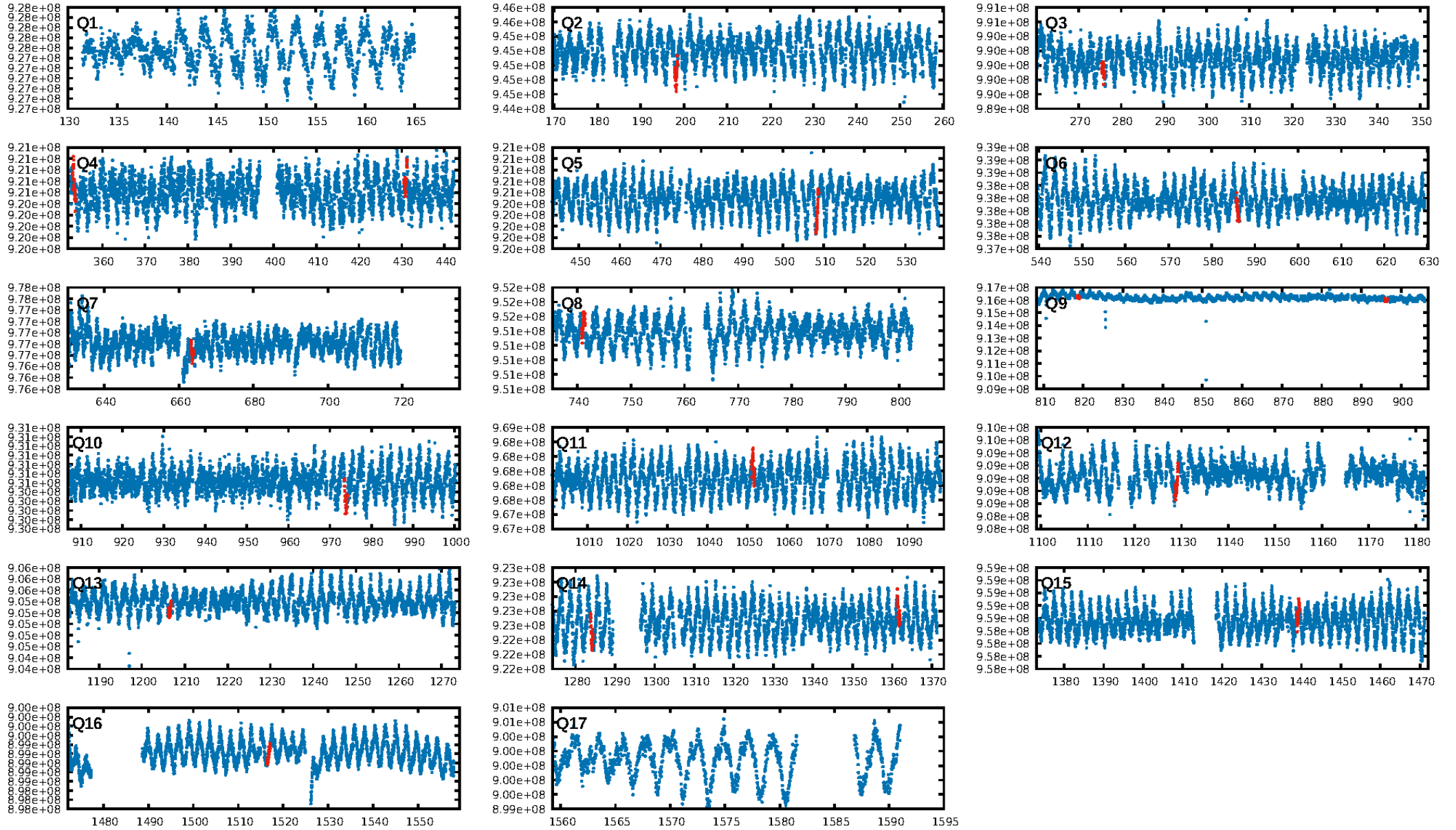
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [88.39σ]  
LongPeriod-sig: 100.0% [87.21σ]  
ModelChiSquare2-sig: 87.0%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [8/8]  
GhostDiagnostic-chr: 0.1901  
Centroid-sig: 83.9%  
Centroid-so: 0.247 arcsec [0.45σ]  
OotOffset-rm: 0.217 arcsec [0.33σ]  
KicOffset-rm: 0.784 arcsec [1.13σ]  
OotOffset-st: 4/4/3/1 [12]  
KicOffset-st: 4/4/3/1 [12]  
DiffImageQuality-fgm: 0.58 [7/12]  
DiffImageOverlap-fno: 0.21 [3/14]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 22:28:53 Z

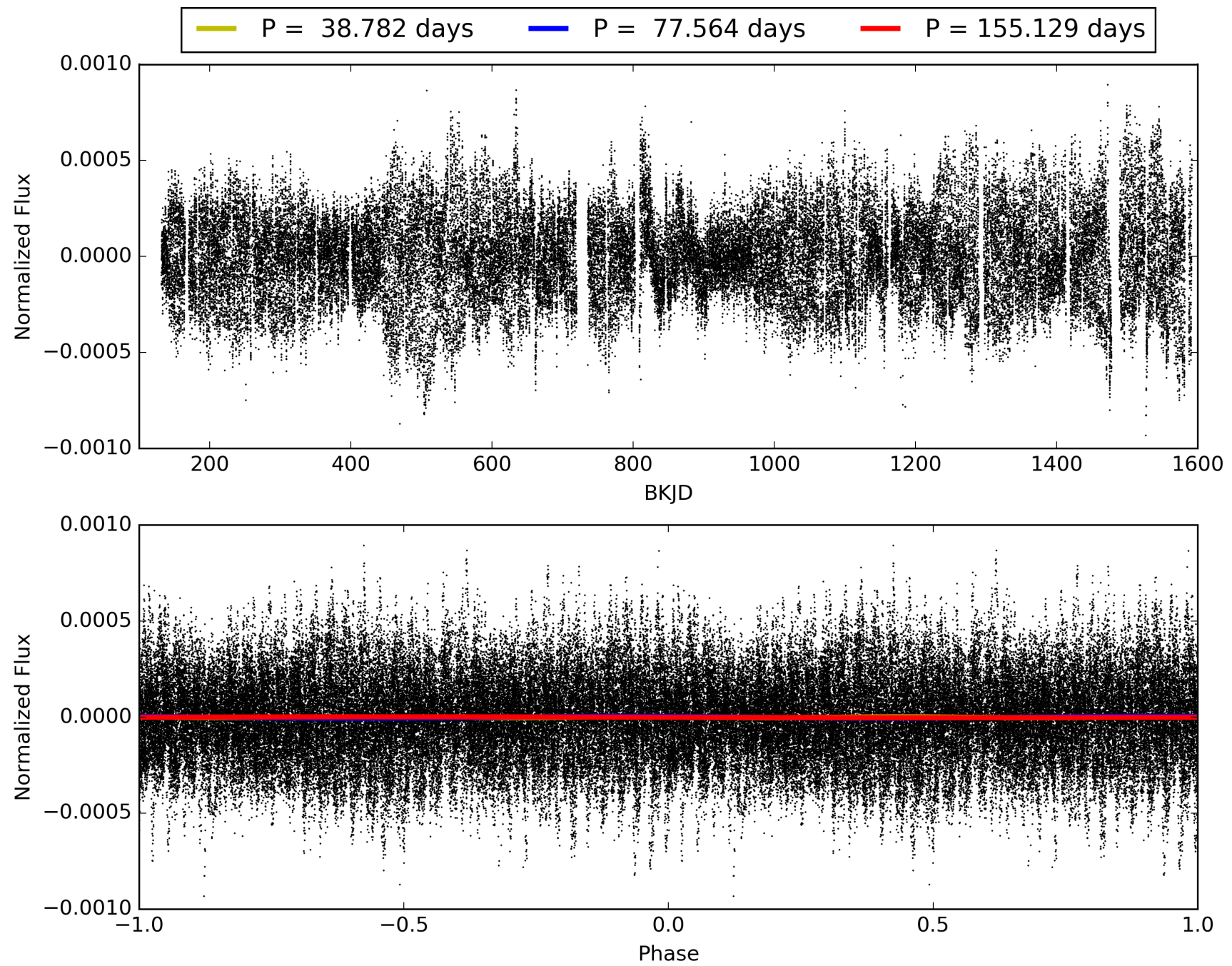
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 009156461-05, PDC Light Curves



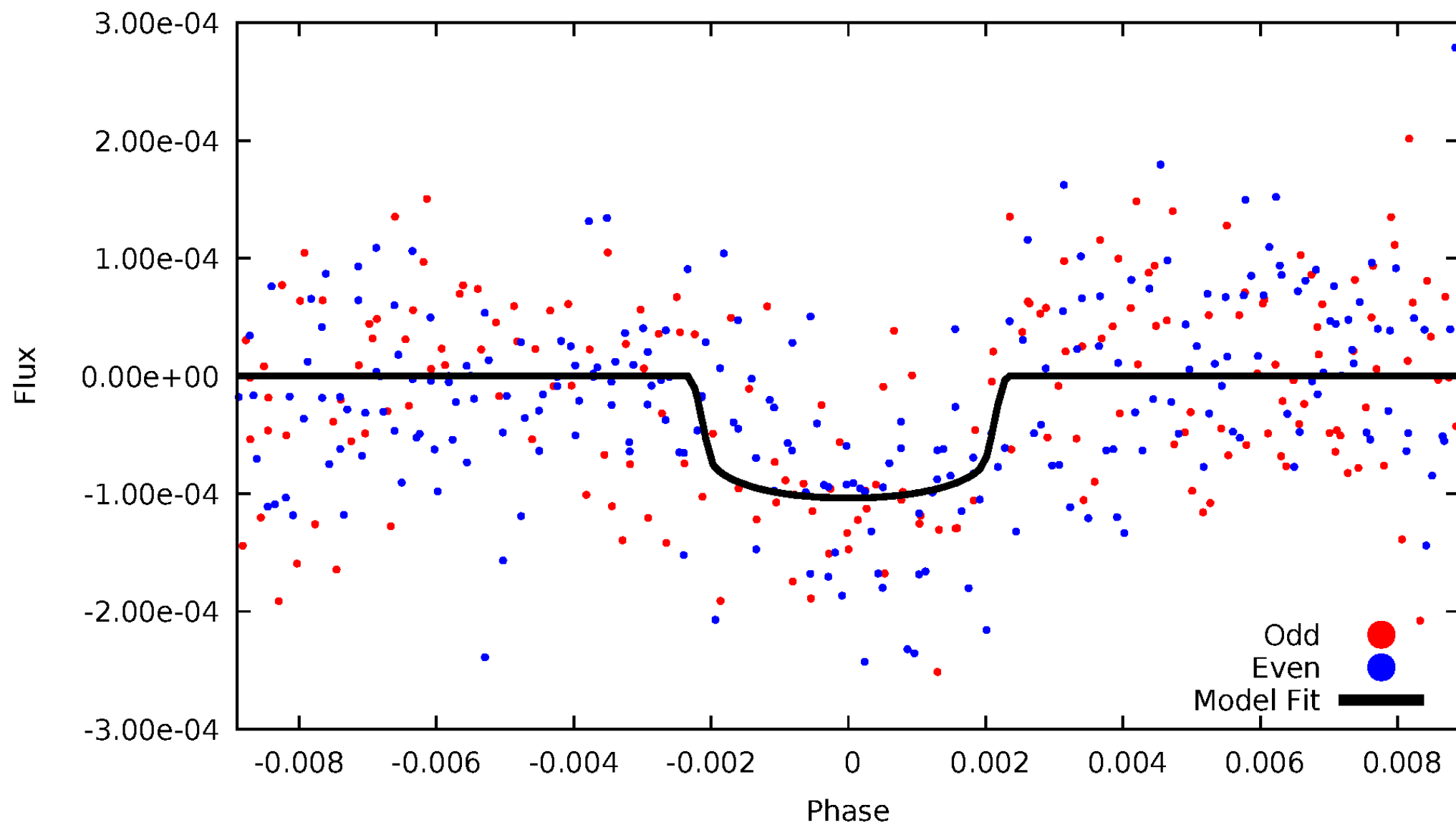


TCE 009156461-05



# DV Odd/Even

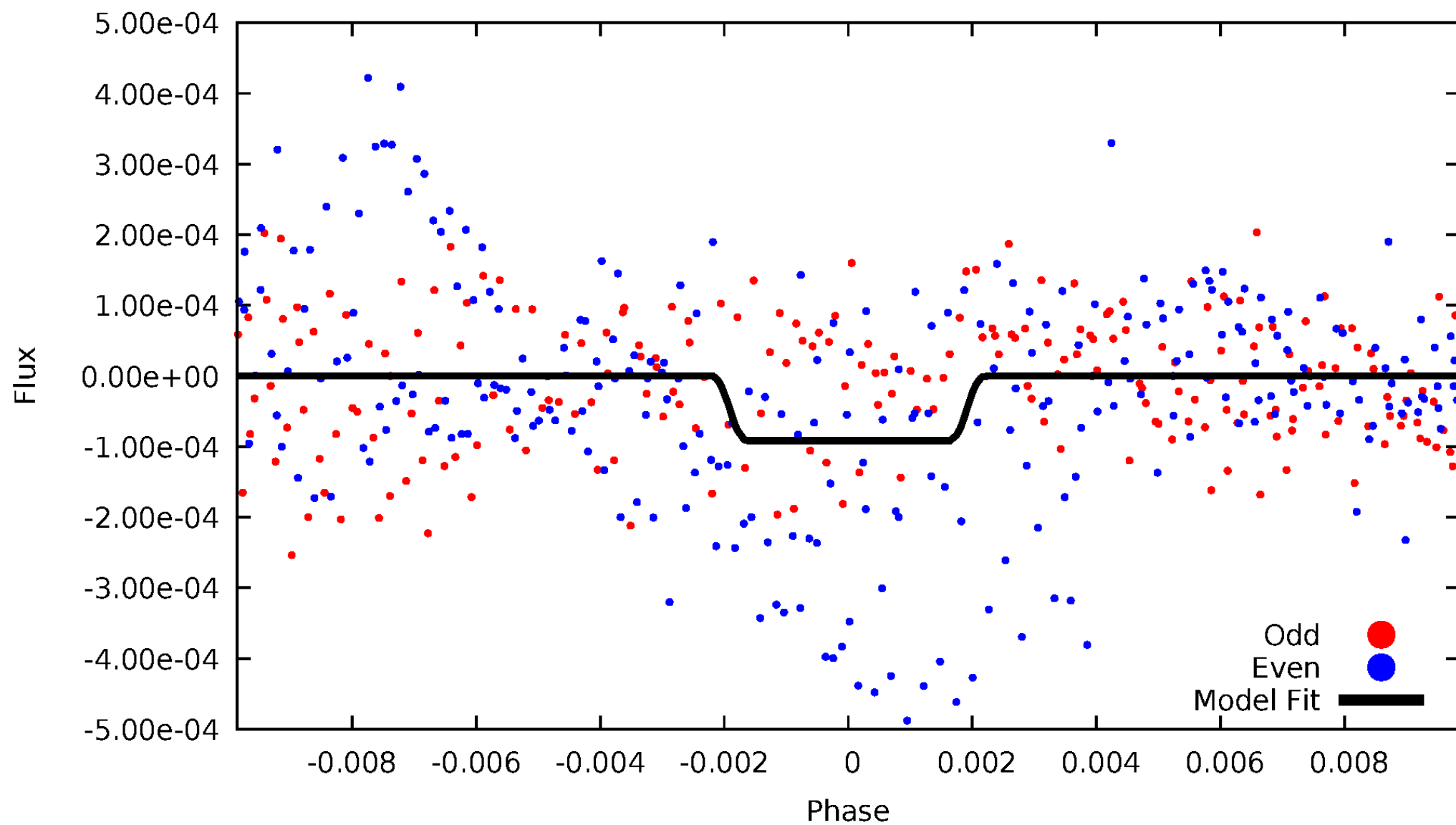
TCE 009156461-05



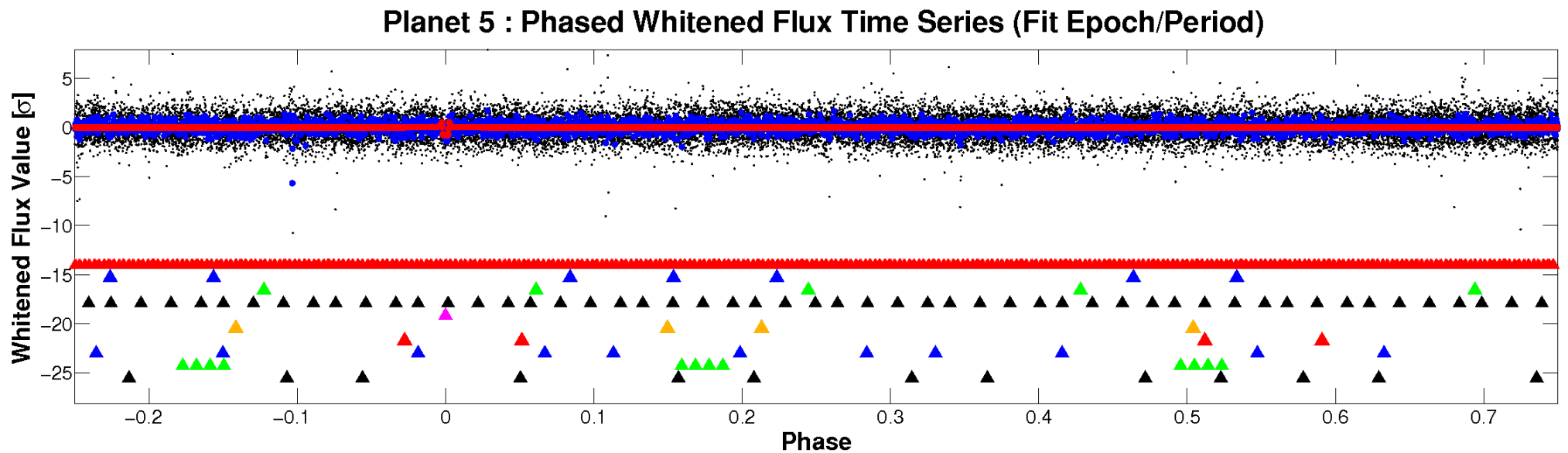
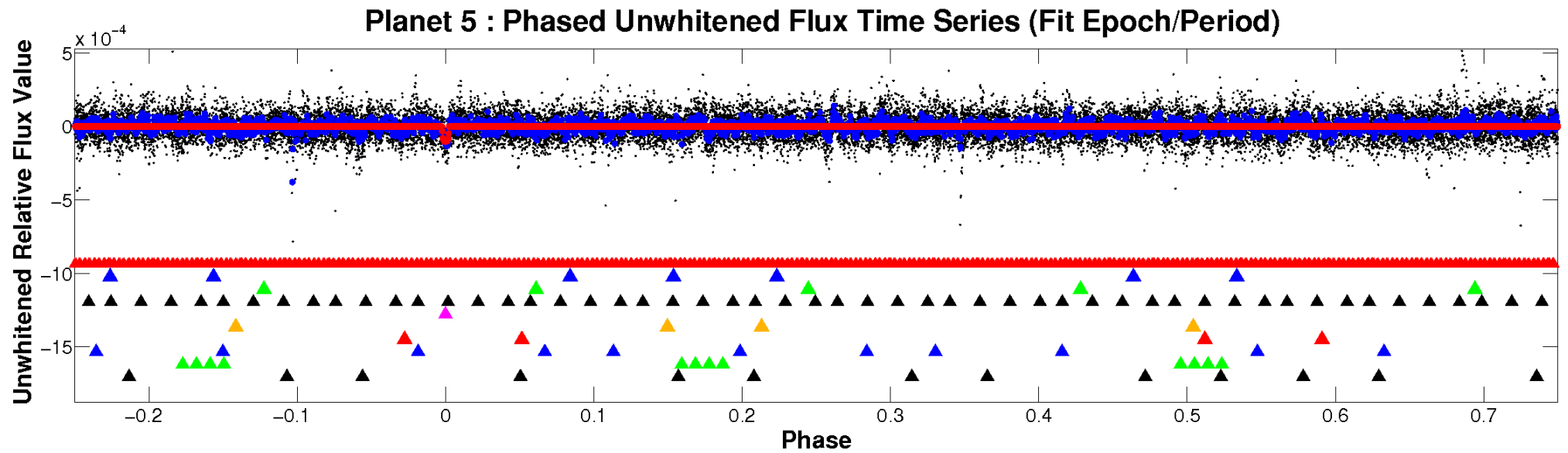


# ALT Odd/Even

TCE 009156461-05

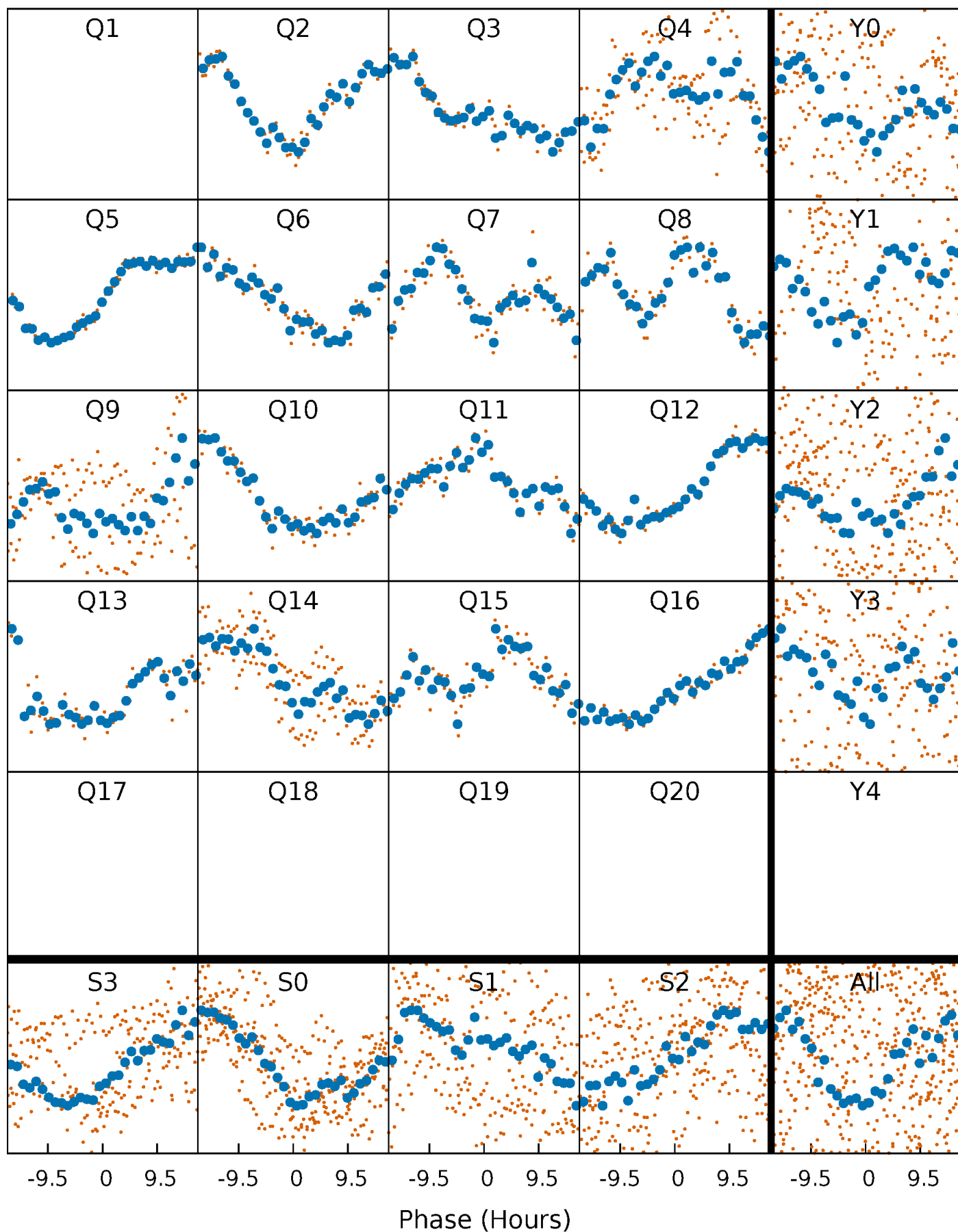


# Non-Whitened Vs. Whitened Light Curve



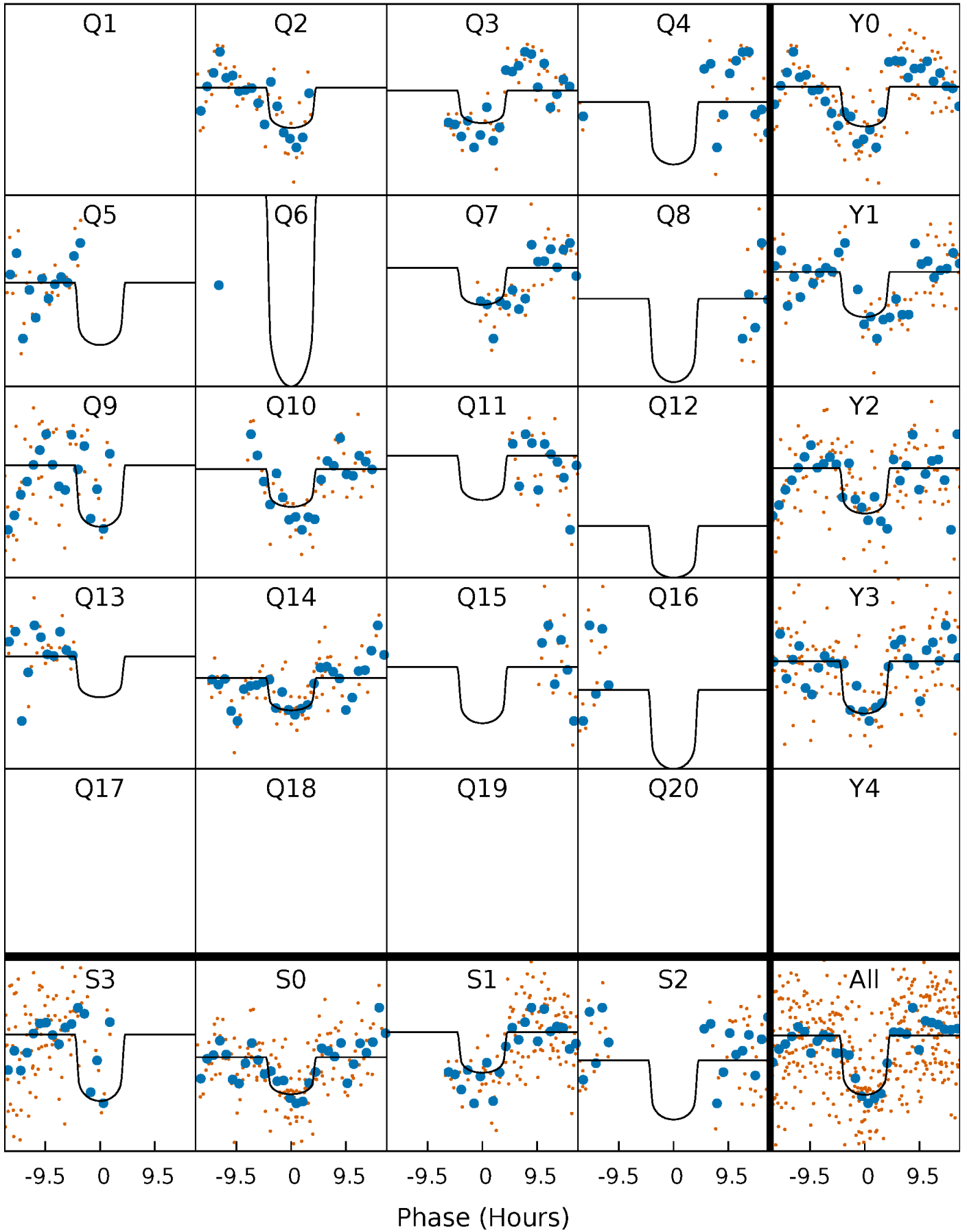
# PDC Quarter-Phased Transit Curves

TCE 009156461-05   P= 77.564421 Days    $T_0=198.190936$  (BKJD)



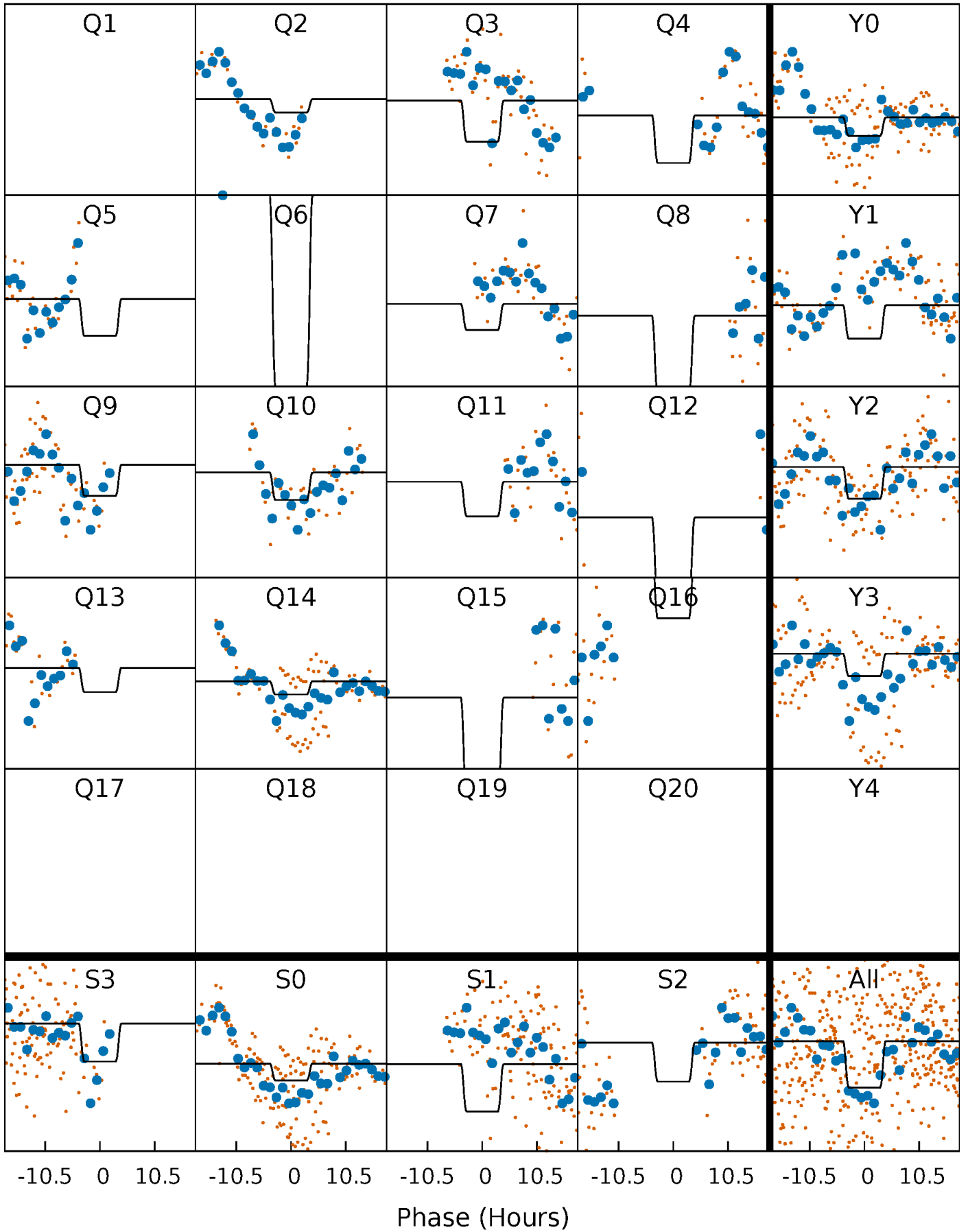
# DV Quarter-Phased Transit Curves

TCE 009156461-05   P= 77.564421 Days    $T_0=198.190936$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

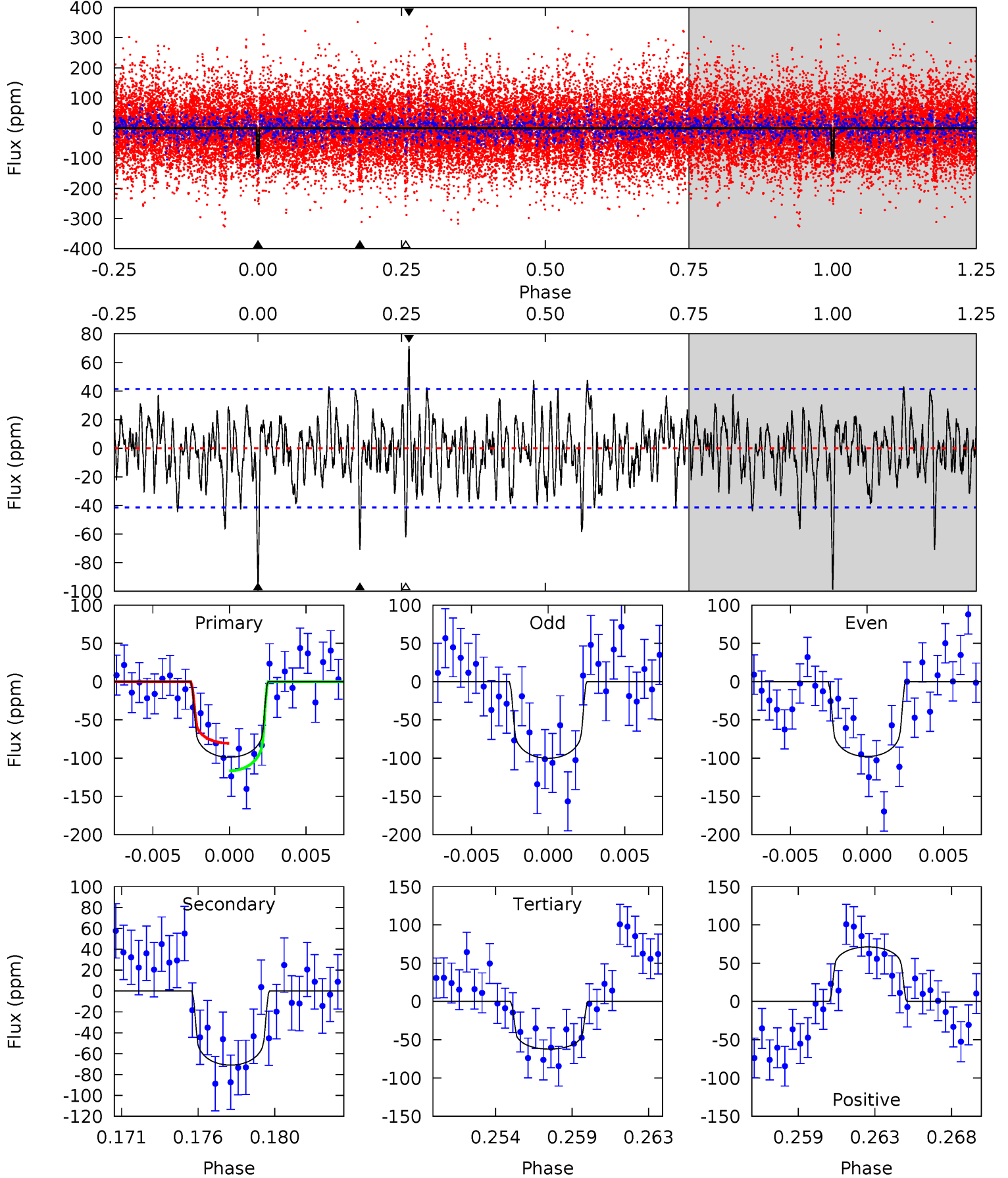
TCE 009156461-05     $P = 77.562195$  Days     $T_0 = 198.228354$  (BKJD)



# DV Model-Shift Uniqueness Test

009156461-05, P = 77.564421 Days, E = 120.626515 Days

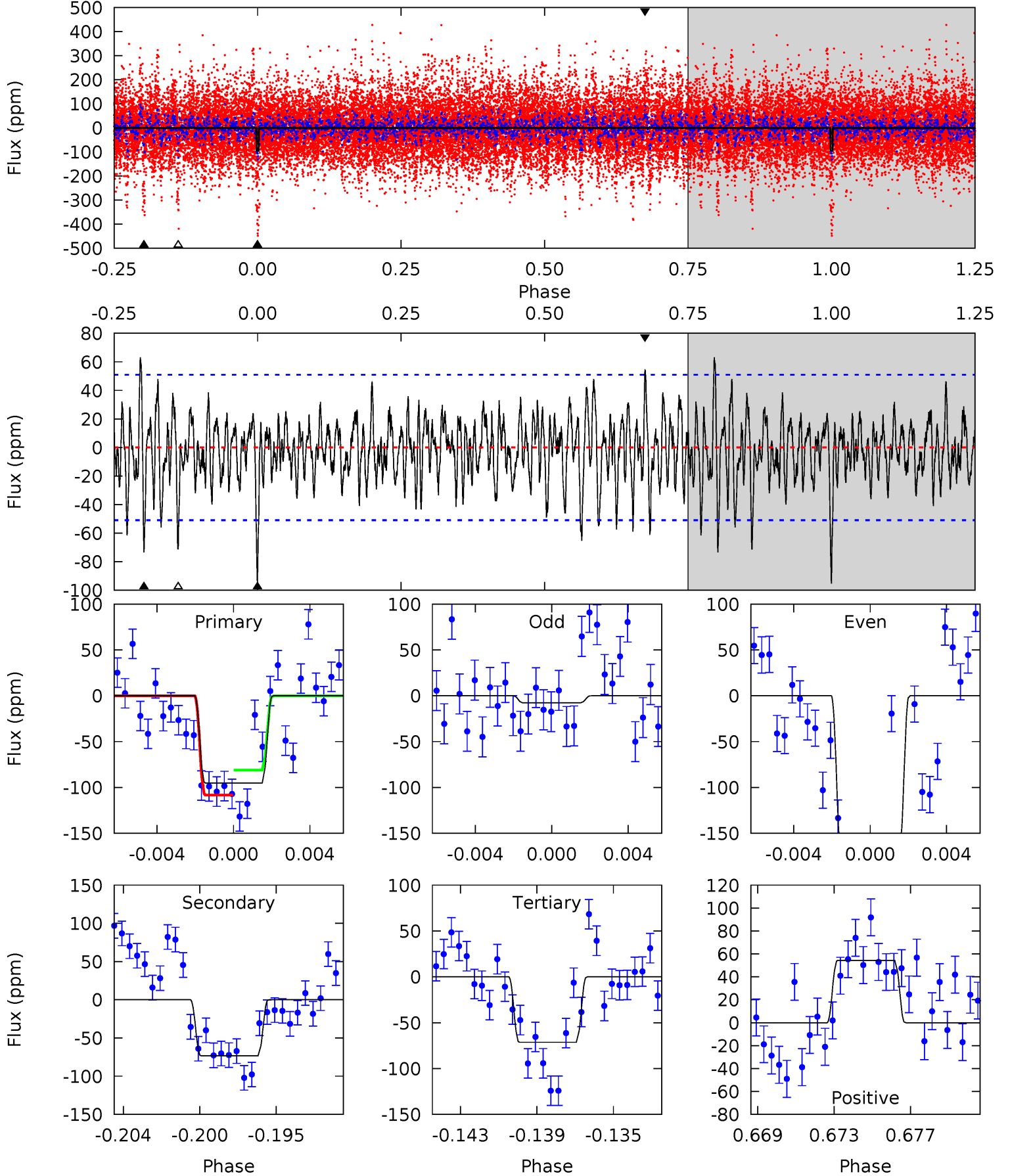
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
12.4	8.88	7.78	8.91	5.17	2.83	2.23	4.58	3.45	1.10	-0.04	0.14	0.69	0.42	2.25



# Alt Model-Shift Uniqueness Test

009156461-05, P = 77.562195 Days, E = 120.666159 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
9.69	7.47	7.26	5.54	5.18	2.85	1.99	2.42	4.15	0.21	1.93	8.62	1.05	0.40	1.39





### Stellar Parameters For KIC 009156461

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$\rho_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6480^{+181}_{-250}$	$4.044^{+0.293}_{-0.158}$	$-0.120^{+0.250}_{-0.300}$	$1.822^{+0.510}_{-0.623}$	$1.345^{+0.193}_{-0.289}$	$0.313^{+0.619}_{-0.139}$
	+3%/-4%	+7%/-4%	+208%/-250%	+28%/-34%	+14%/-21%	+198%/-44%
Source	PHO54	PHO54	PHO54	DSEP		

KIC = Kepler Input Catalog; PHO = Photometry; SPE = Spectroscopy; AST = Asteroseismology  
 TRA = Transits; DESP = Dartmouth Models; MULT = Multiple Models

### Secondary Eclipse Parameters for KIC 009156461-05 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-71 \pm 8$	$1.95^{+0.92}_{-0.78}$	$852^{+64}_{-84}$	$5825^{+1840}_{-813}$	$1556^{+2897}_{-843}$
Alt.	$-73 \pm 10$	$1.79^{+1.00}_{-0.87}$	$850^{+65}_{-74}$	$6131^{+2592}_{-1032}$	$1893^{+5245}_{-1102}$

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

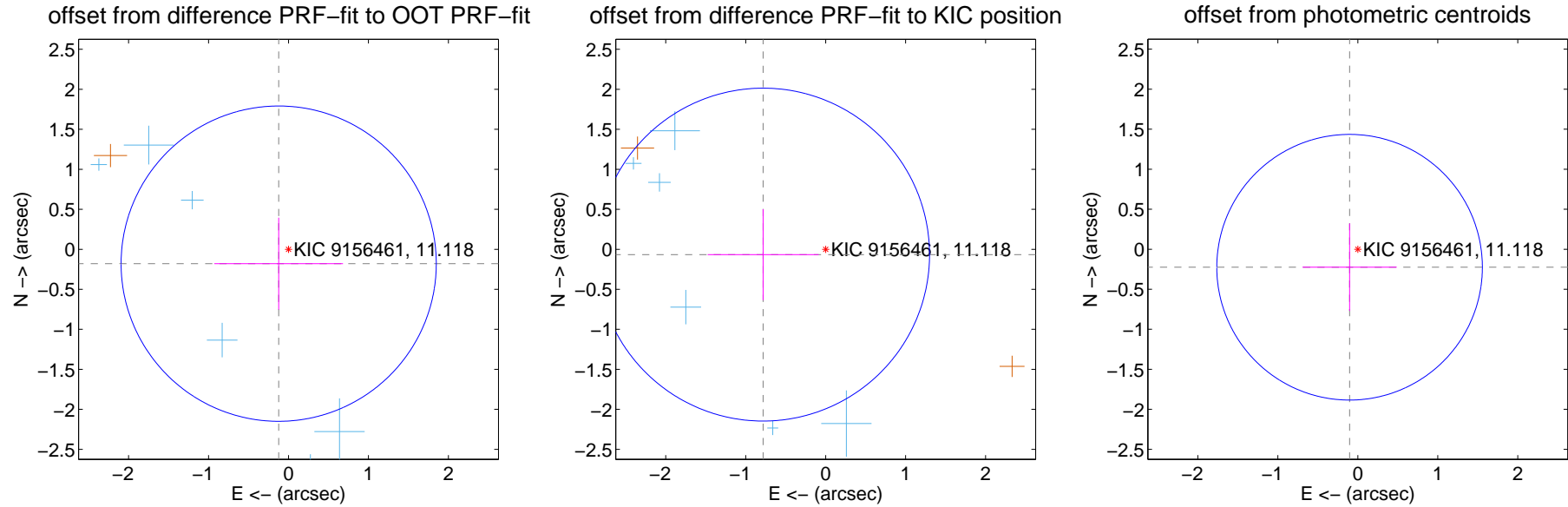
## DV Centroid Data

Supplemental centroid analysis for 009156461-05. **Kepler magnitude: 11.12.** Transit SNR 7.86

There are 7 quarters with good PRF difference image offsets

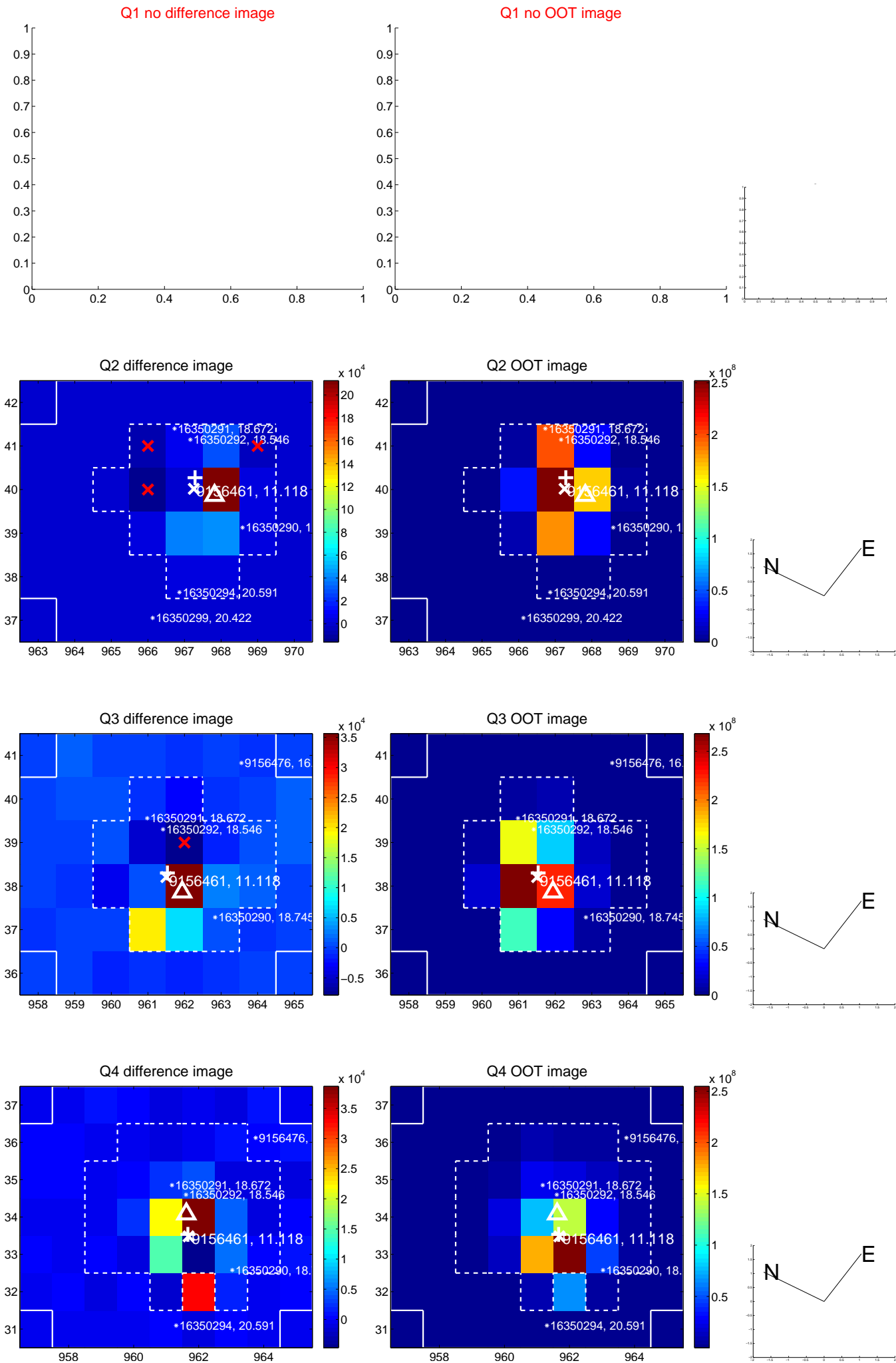
The direct PRF centroid is offset from the target star catalog position by about 0.56 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.217 \pm 0.657$	0.33	$0.123 \pm 0.804$	$-0.179 \pm 0.575$
PRF-fit source offset from KIC position	$0.784 \pm 0.693$	1.13	$0.782 \pm 0.694$	$-0.066 \pm 0.568$
photometric centroid source offset	$0.25 \pm 0.55$	0.45	$0.10 \pm 0.59$	$-0.22 \pm 0.55$

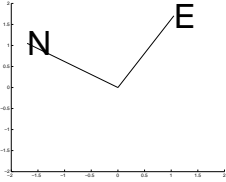
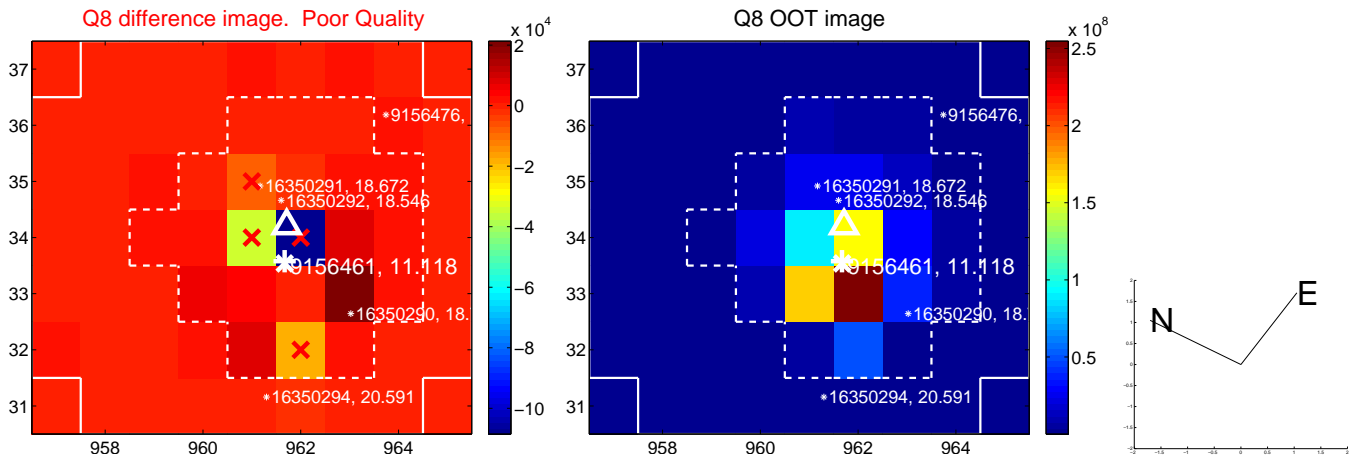
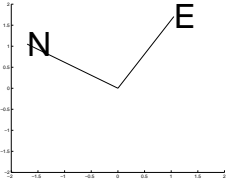
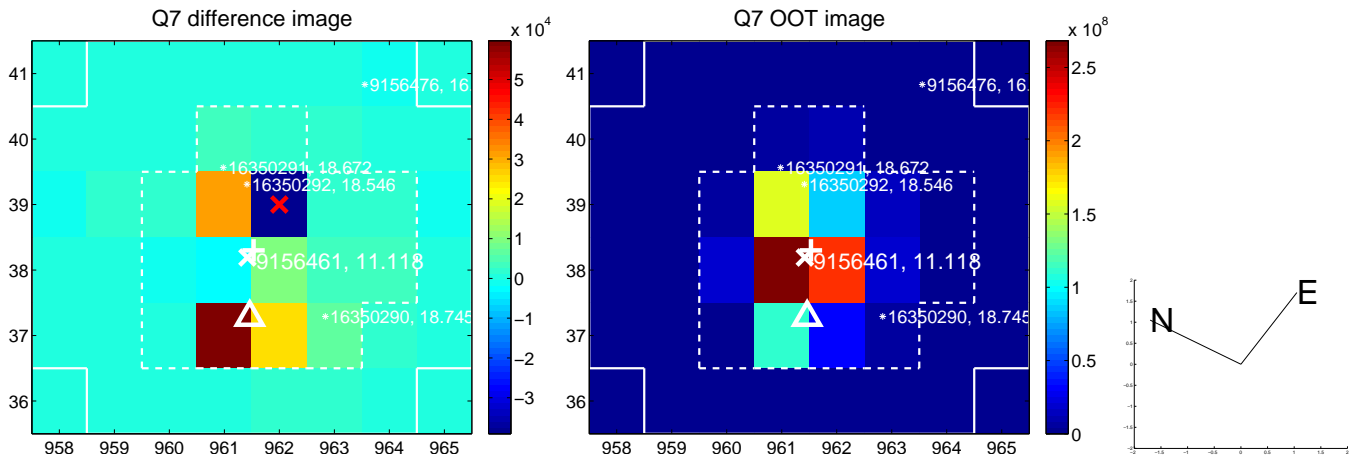
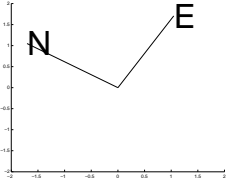
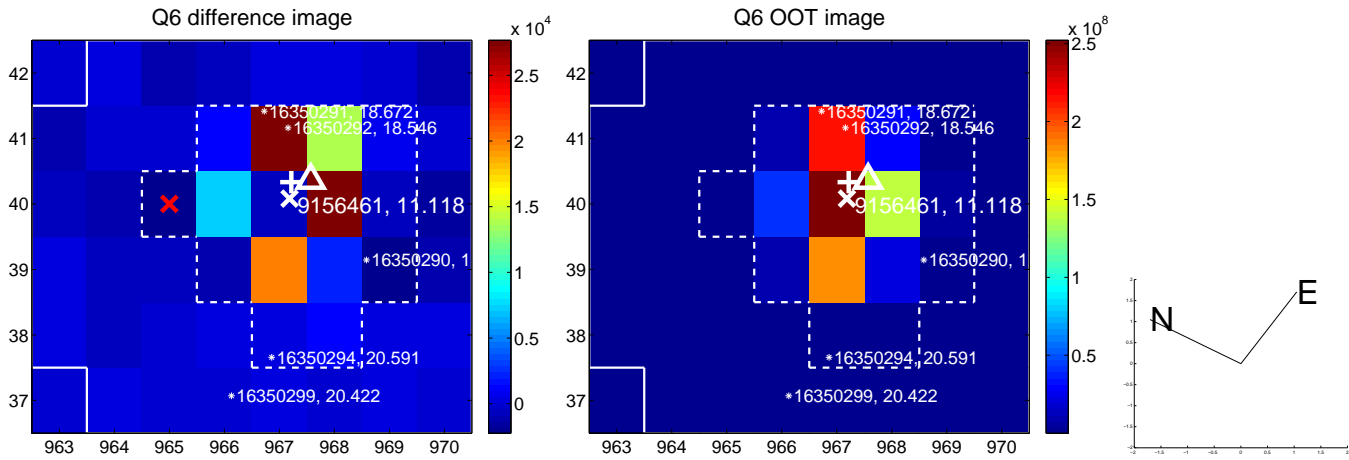
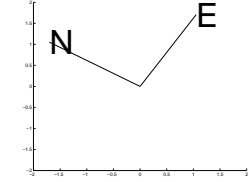
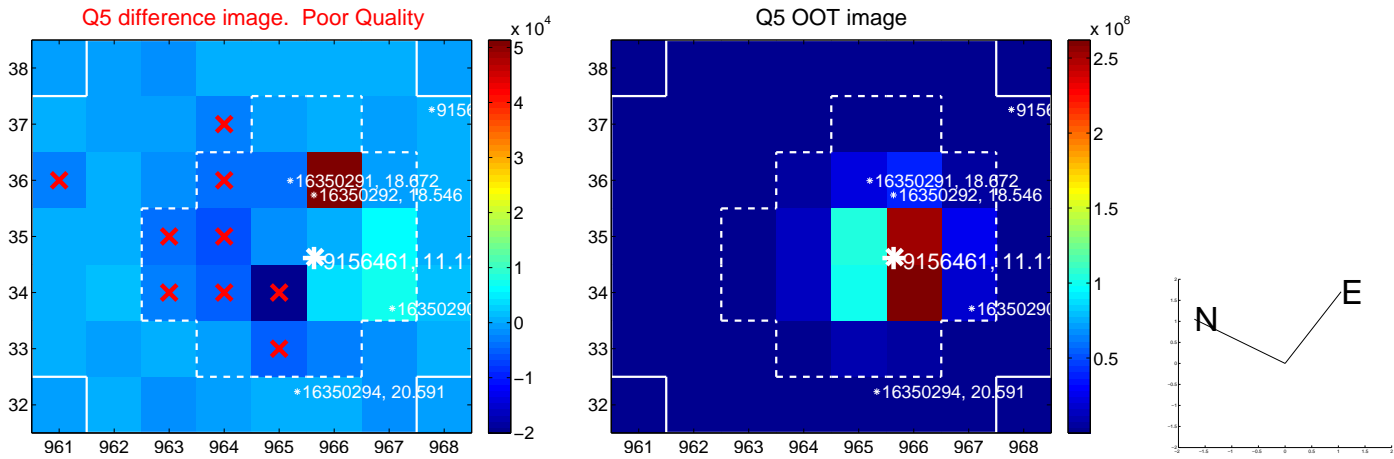


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

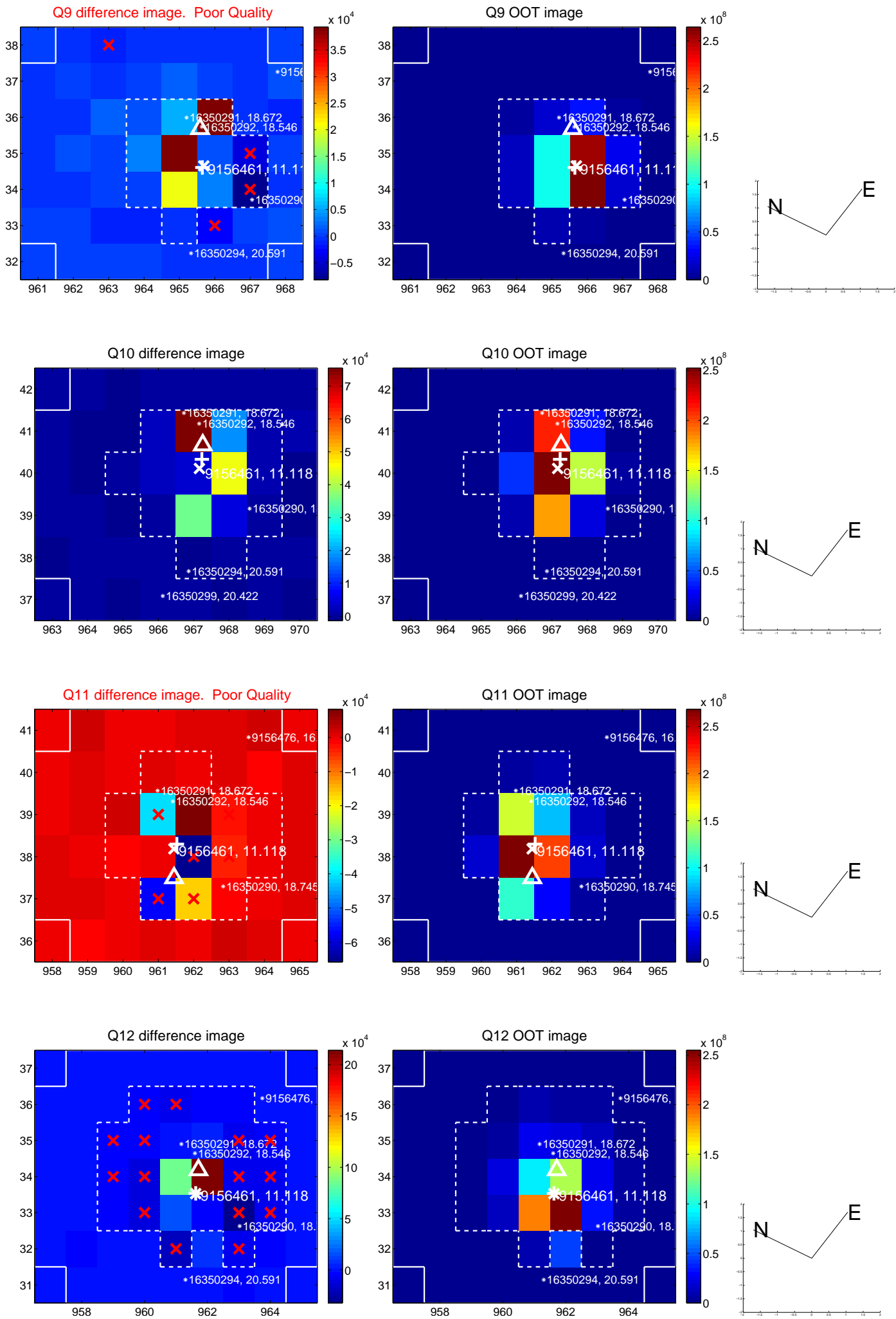
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



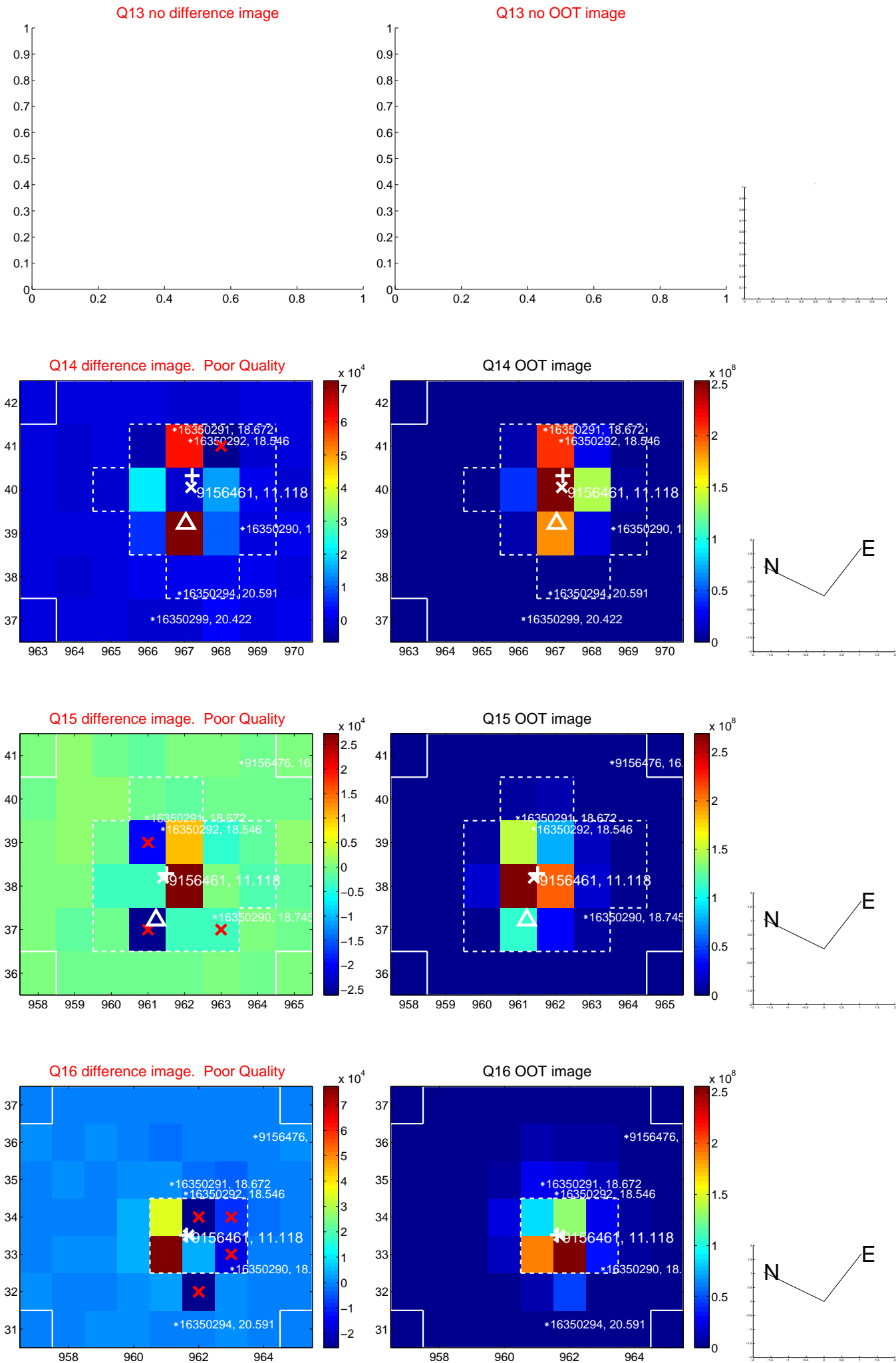
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



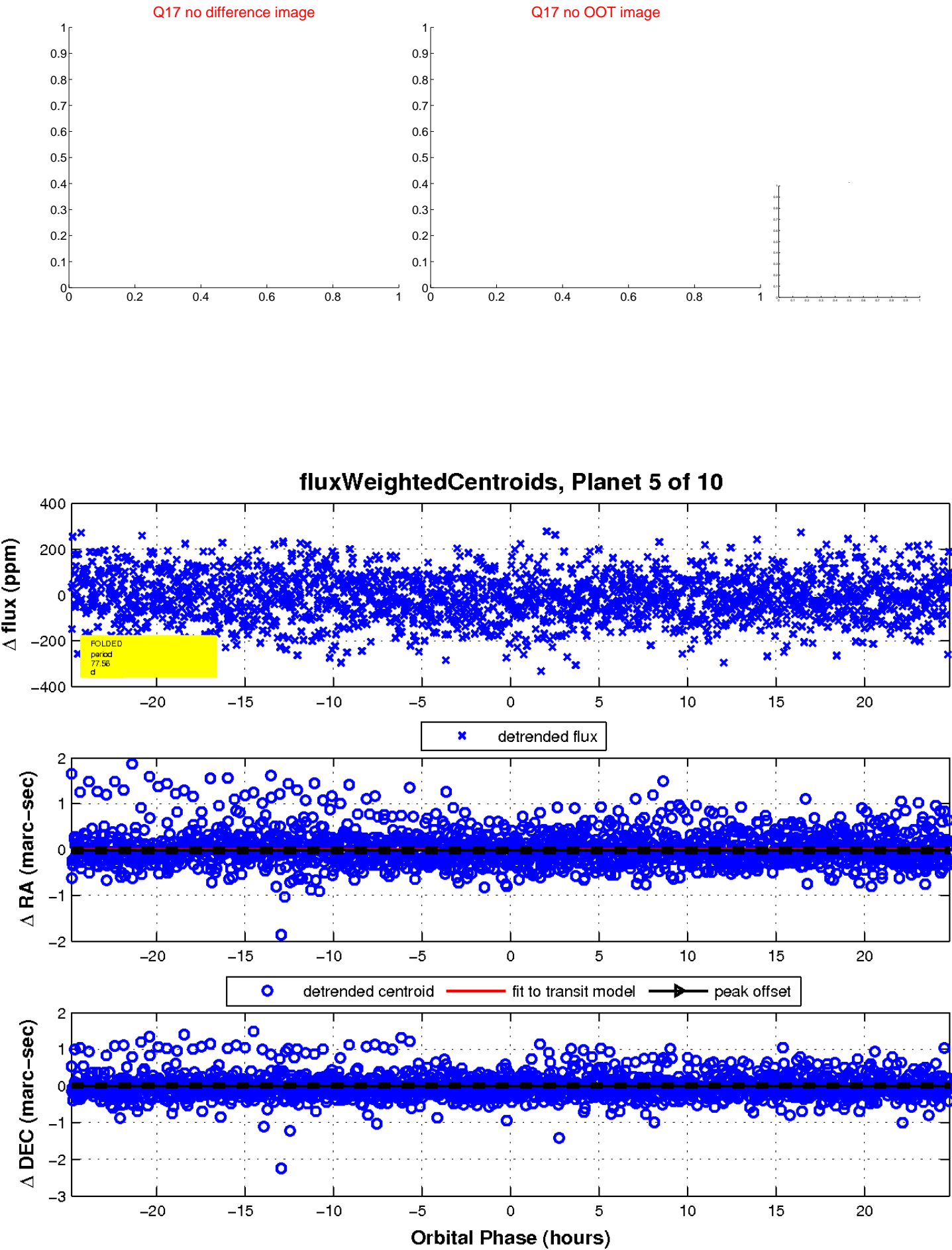
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



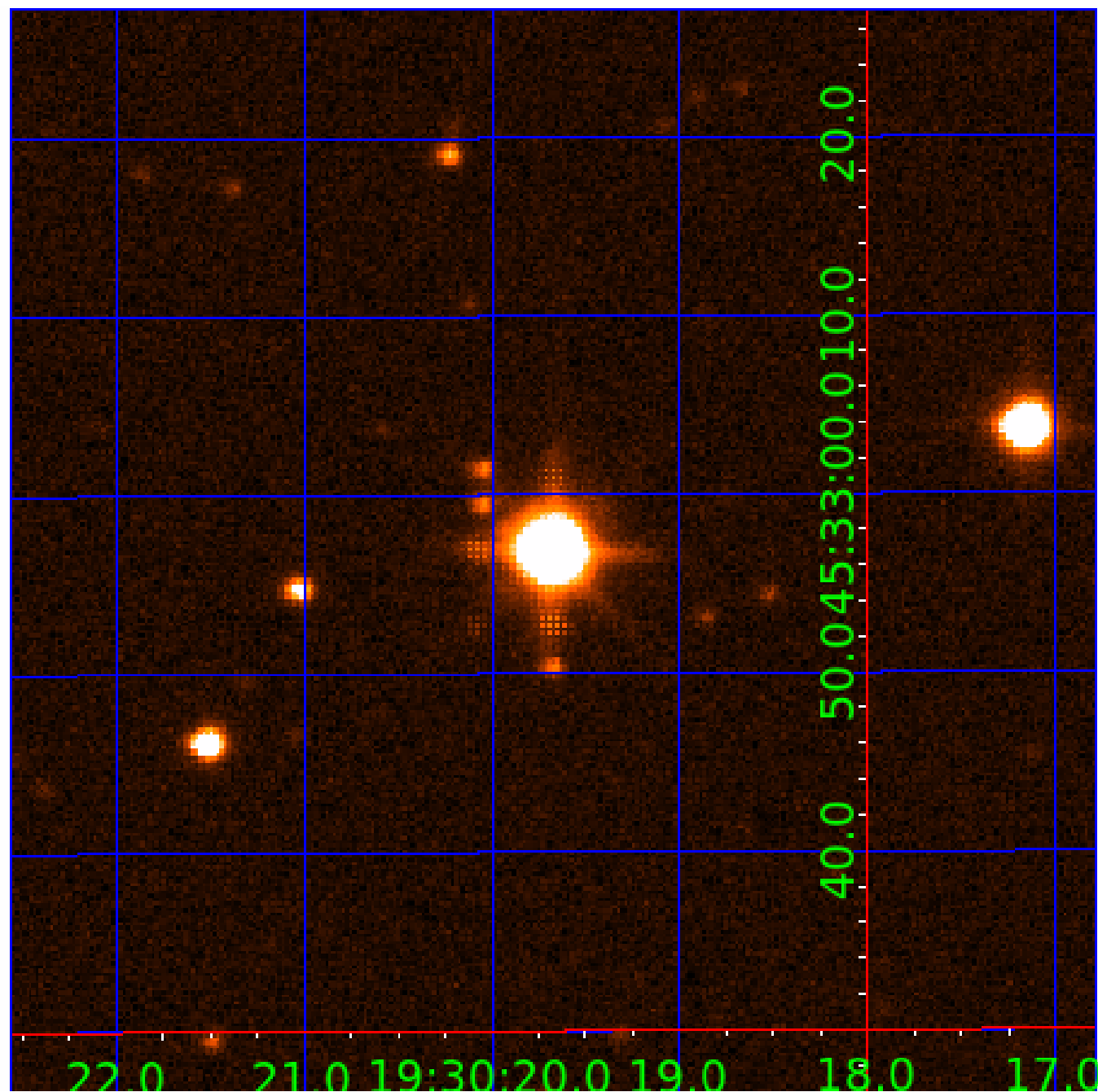
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





UKIRT Image

Declination



## KIC 009156461

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009156461-01	OBS	No	2.296149	132.431446	4.2	10.825	8.7	2.7	1.82	6480	0.43	3717.29
009156461-02	OBS	No	208.639795	204.712221	146.7	5.006	9.0	9.5	1.82	6480	2.51	9.10
009156461-03	OBS	No	296.023030	308.965620	22.4	13.754	7.9	1.0	1.82	6480	0.97	5.71
009156461-04	OBS	No	27.813822	141.128479	61.1	10.671	9.1	8.2	1.82	6480	1.55	133.62
009156461-05	OBS	No	77.564421	198.190936	103.7	8.284	8.5	7.9	1.82	6480	2.09	34.04
009156461-06	OBS	No	337.753157	364.928677	153.2	3.194	8.2	8.4	1.82	6480	2.65	4.79
009156461-08	OBS	No	138.291040	142.658043	108.4	10.011	8.3	6.9	1.82	6480	2.05	15.75
009156461-09	OBS	No	129.035096	161.225143	92.7	6.643	8.0	6.8	1.82	6480	2.33	17.27
009156461-10	OBS	No	110.241909	238.739506	55.7	3.500	7.6	-1.0	1.82	6480	1.37	21.30

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009156461-01	OBS	FP	0.00	1	0	0	0	SWEET_NTL—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—CENT_SATURATED
009156461-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_CHASES_MARSHALL—TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_SATURATED
009156461-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_TRACKER—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_SATURATED
009156461-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_ZUMA—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
009156461-05	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—CENT_SATURATED—HALO_GHOST
009156461-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
009156461-08	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—INCONSISTENT_TRANS—CENT_SATURATED
009156461-09	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_CHASES—TRANS_GAPPED—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
009156461-10	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED

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

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

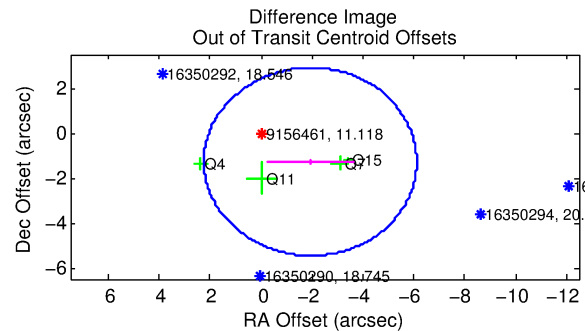
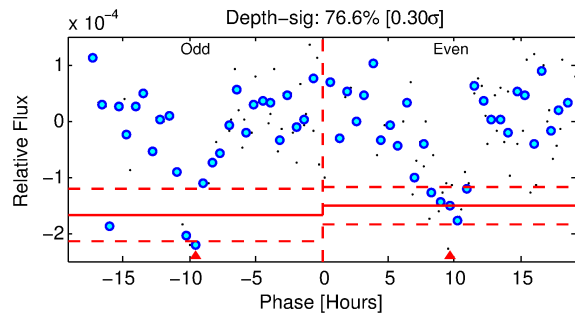
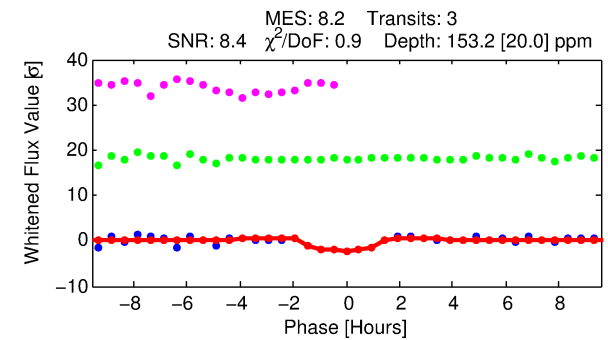
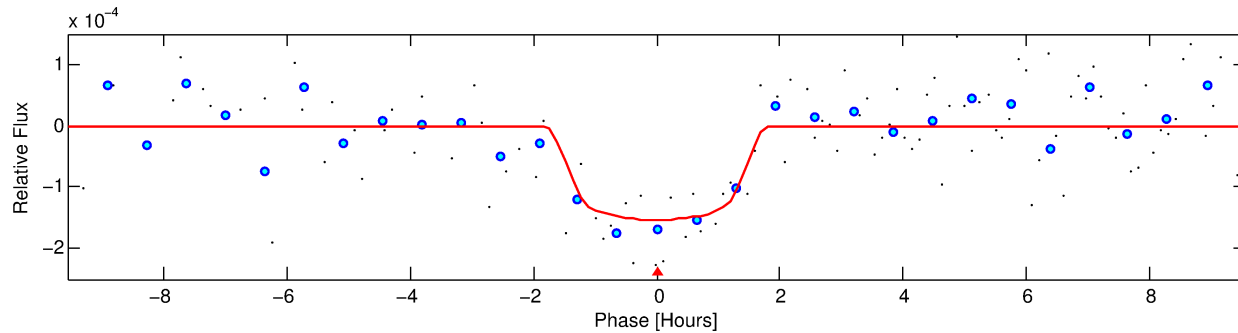
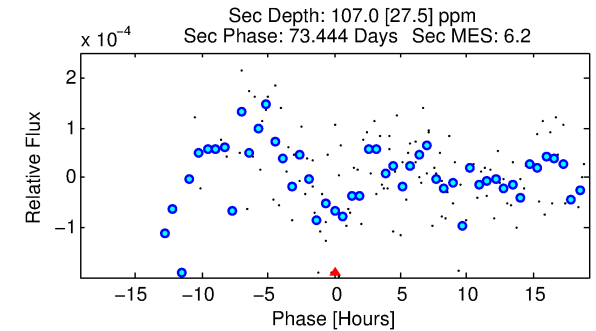
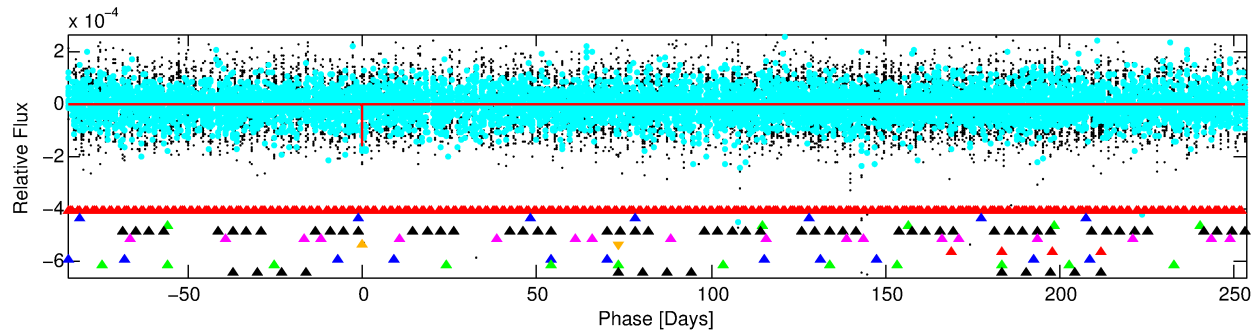
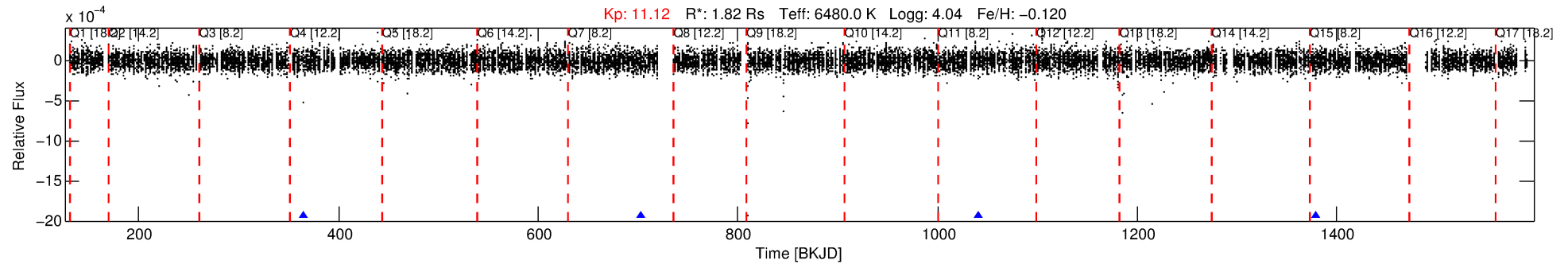
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 009156461-06

No Significant Match Found

# DV One-Page Summary

KIC: 9156461 Candidate: 6 of 10 Period: 337.753 d



## DV Fit Results:

Period = 337.75316 [0.00549] d  
Epoch = 364.9287 [0.0126] BKJD  
Rp/R\* = 0.0133 [0.0068]  
a/R\* = 363.76 [1057.99]  
b = 0.91 [0.57]  
Seff = 4.79 [2.52]  
Teq = 377 [50] K  
Rp = 2.65 [1.63] Re  
a = 1.0466 [0.3351] AU  
Ag = 9153.05 [10680.77] [0.86 $\sigma$ ]  
Teffp = 5704 [1517] K [3.51 $\sigma$ ]

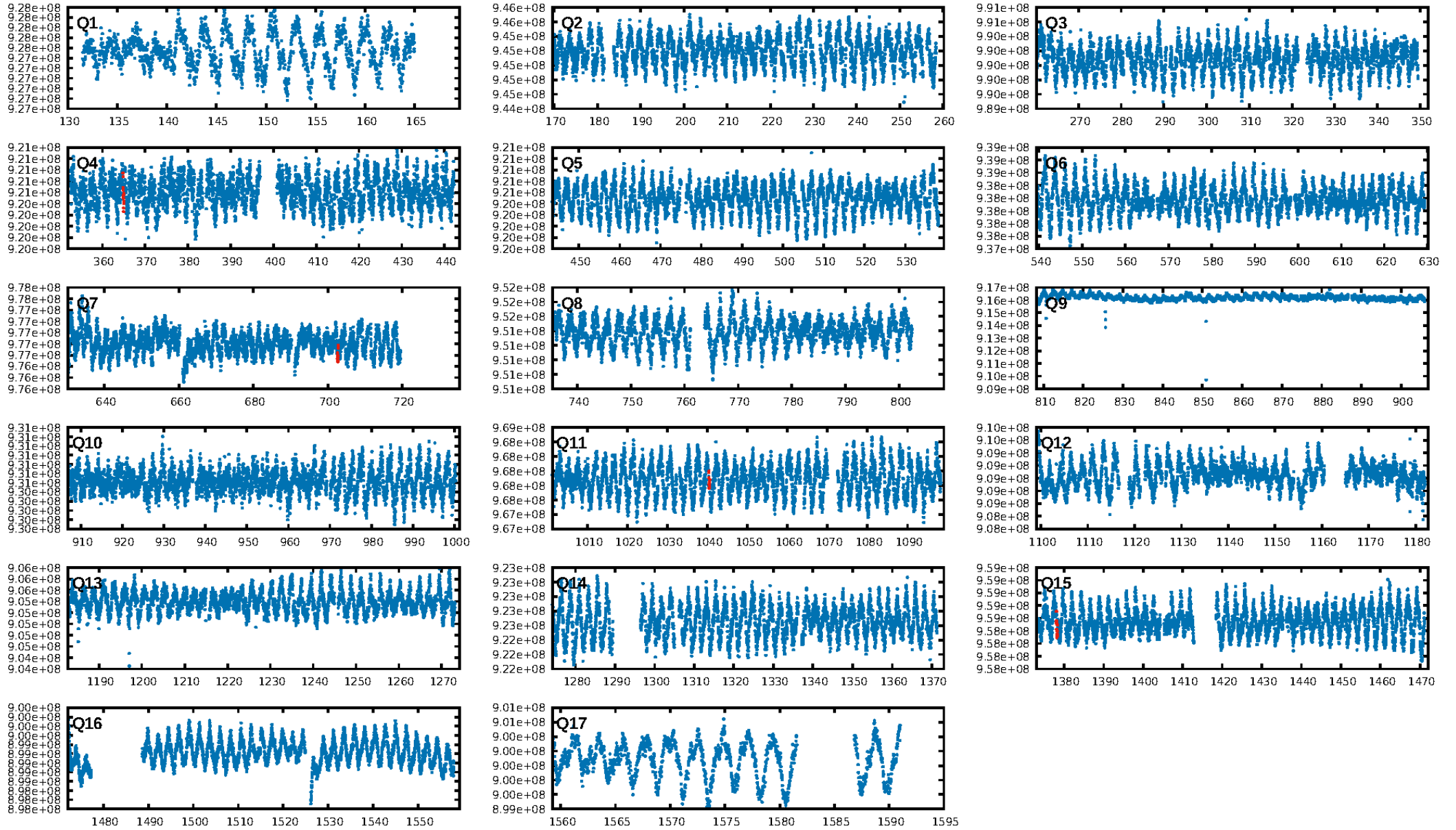
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [70.93 $\sigma$ ]  
LongPeriod-sig: 100.0% [10.13 $\sigma$ ]  
ModelChiSquare2-sig: 79.3%  
ModelChiSquareGof-sig: 98.9%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: 0.9239  
Centroid-sig: 52.1%  
Centroid-so: 0.681 arcsec [0.70 $\sigma$ ]  
OotOffset-rm: 2.323 arcsec [1.67 $\sigma$ ]  
KicOffset-rm: 2.036 arcsec [1.80 $\sigma$ ]  
OotOffset-st: 0/3/1/0 [4]  
KicOffset-st: 0/3/1/0 [4]  
DiffImageQuality-fgm: 0.50 [2/4]  
DiffImageOverlap-fno: 1.00 [4/4]

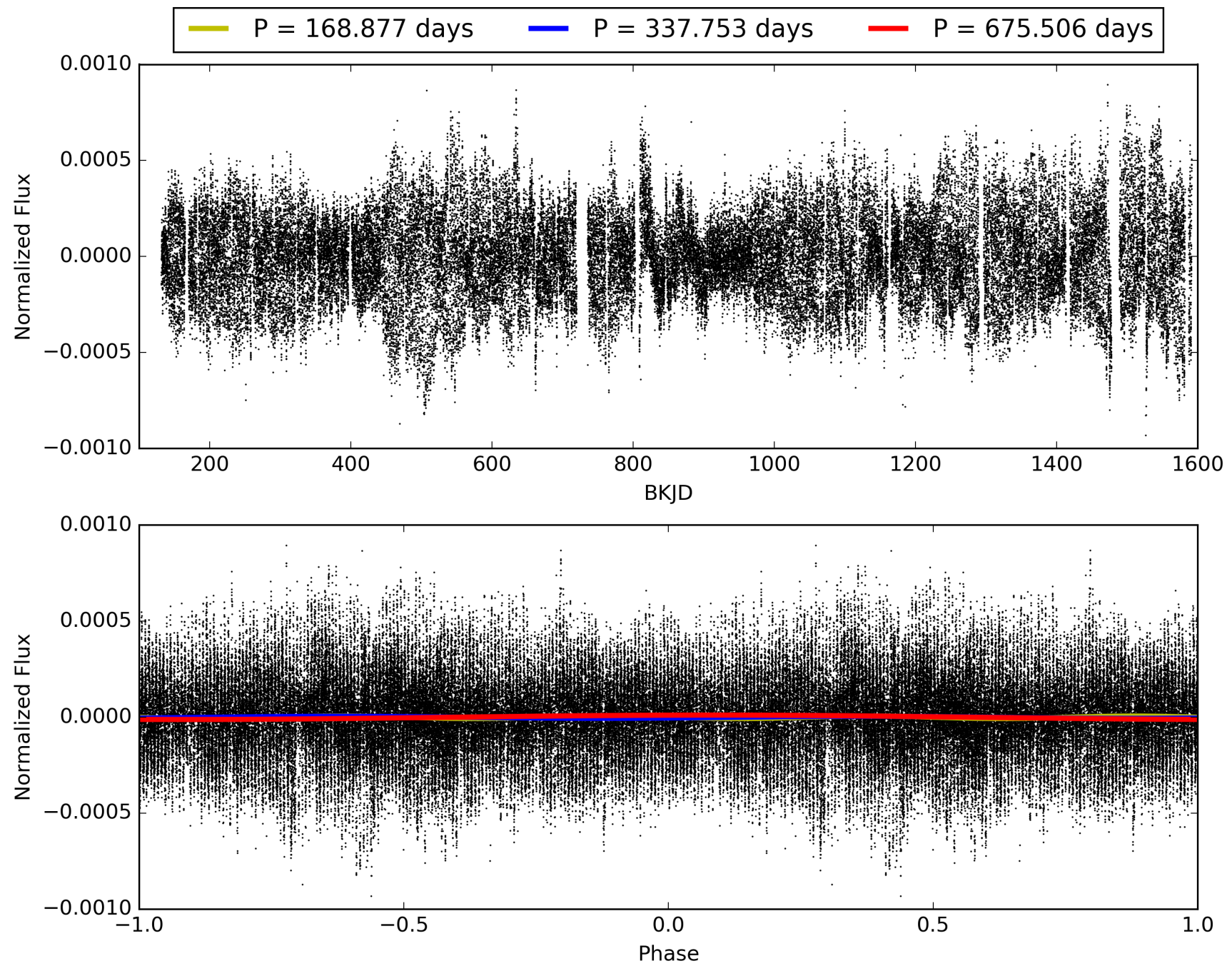
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 22:29:01 Z

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

# TCE 009156461-06, PDC Light Curves

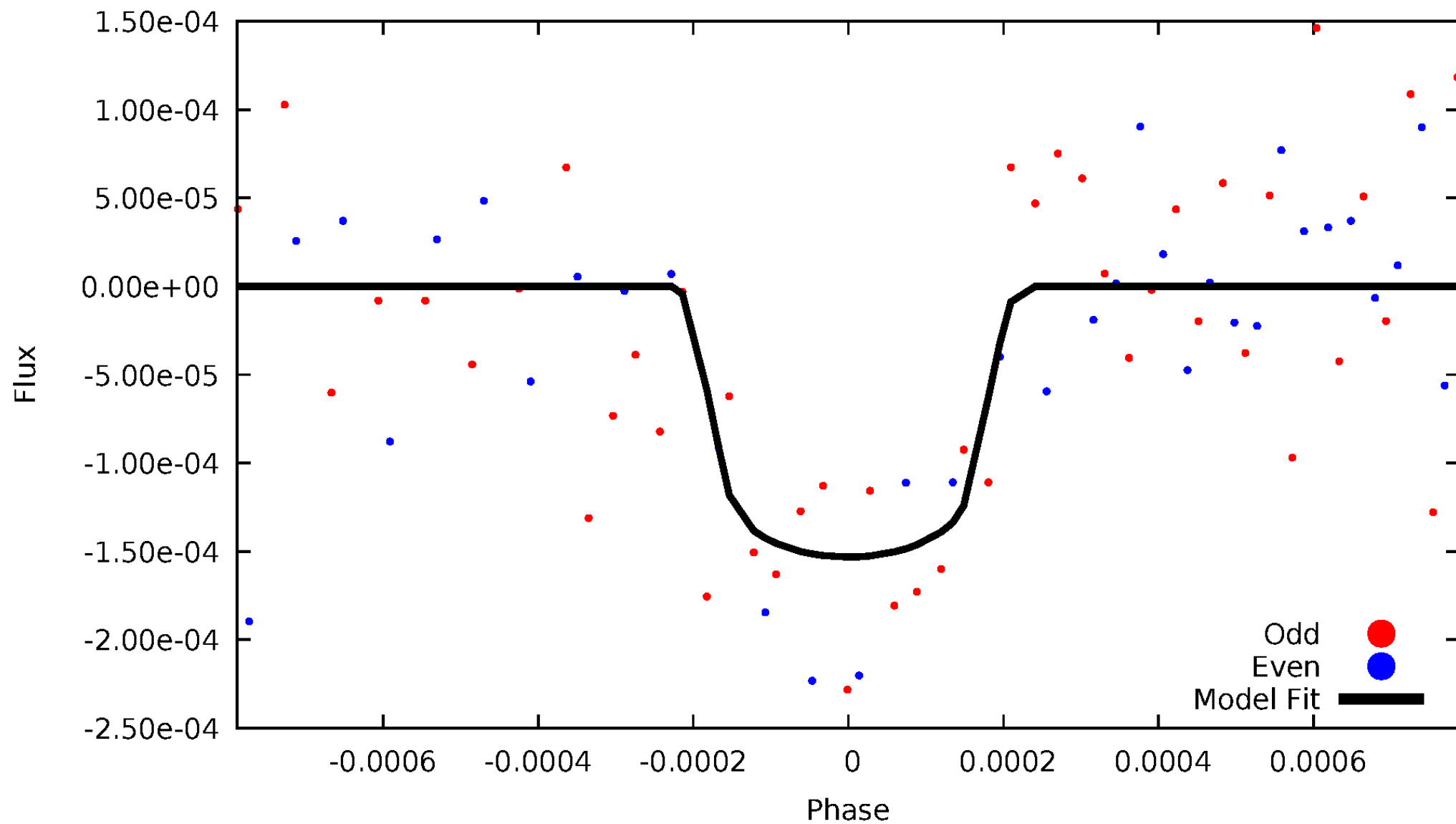


TCE 009156461-06



# DV Odd/Even

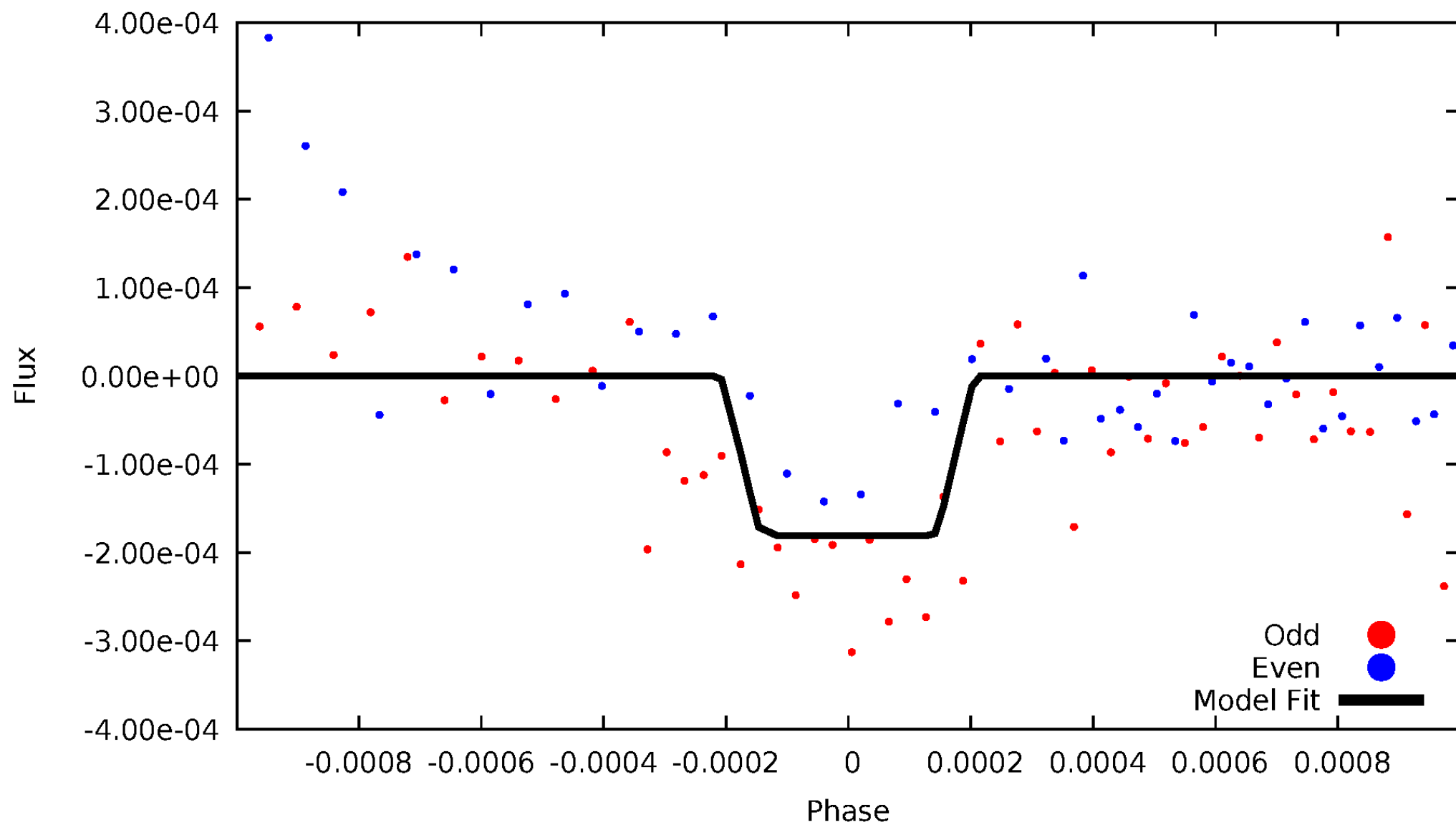
TCE 009156461-06





# ALT Odd/Even

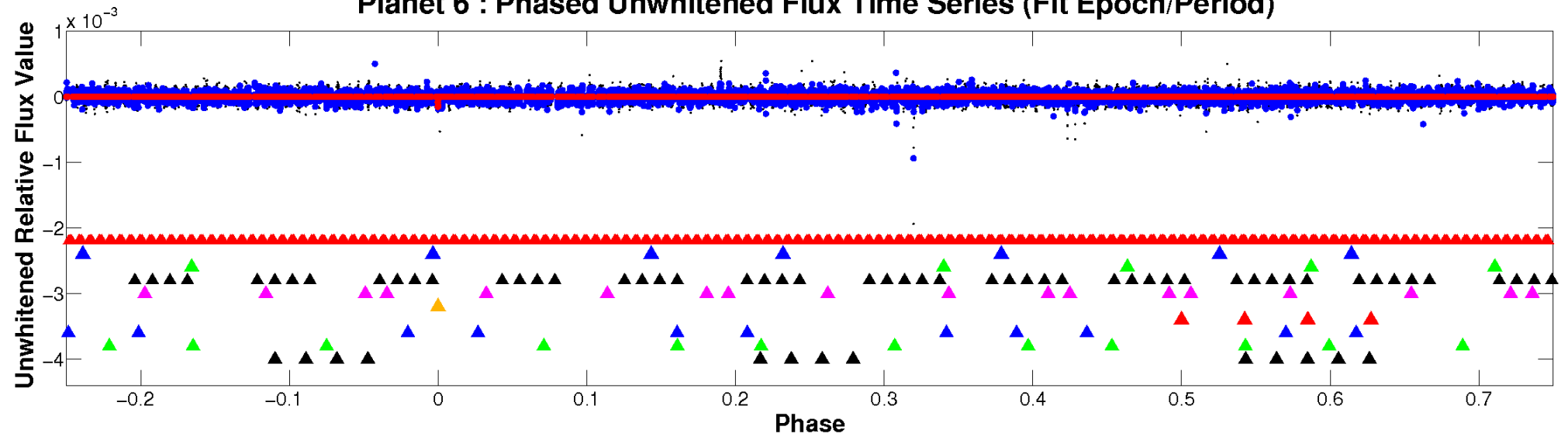
TCE 009156461-06



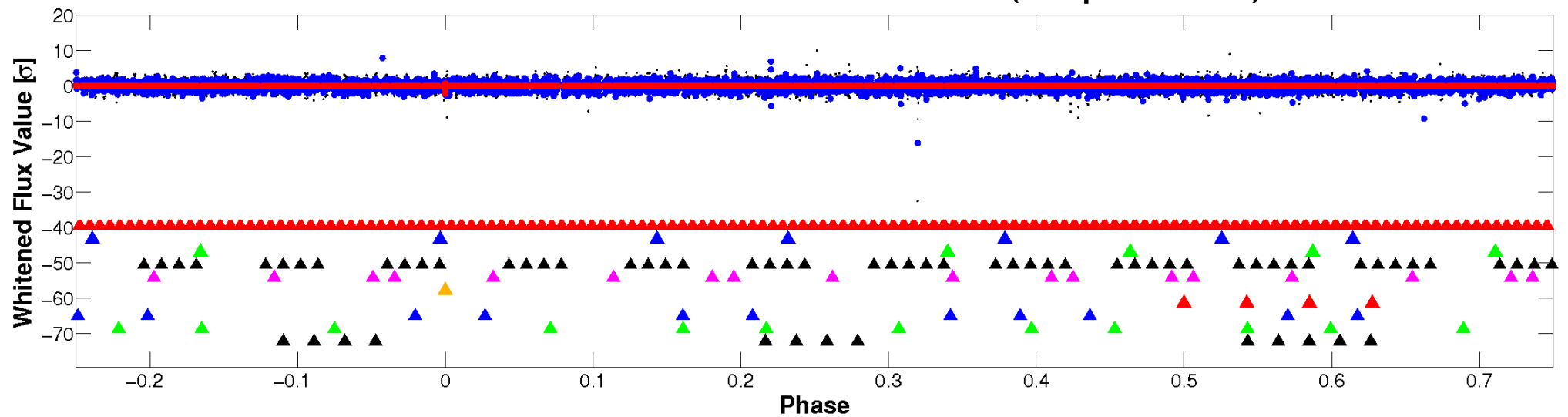


# Non-Whitened Vs. Whitened Light Curve

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

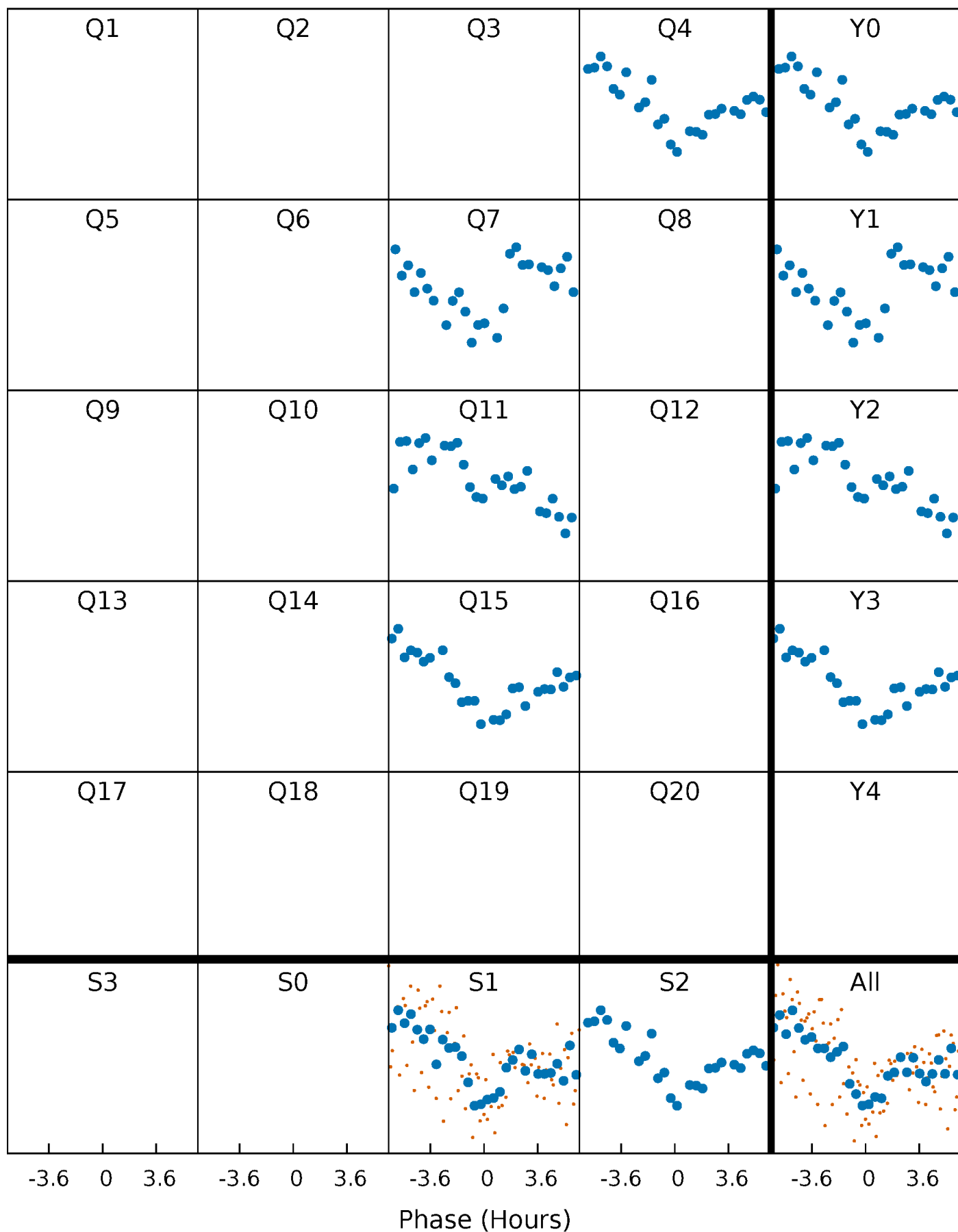


## Planet 6 : Phased Whitened Flux Time Series (Fit Epoch/Period)



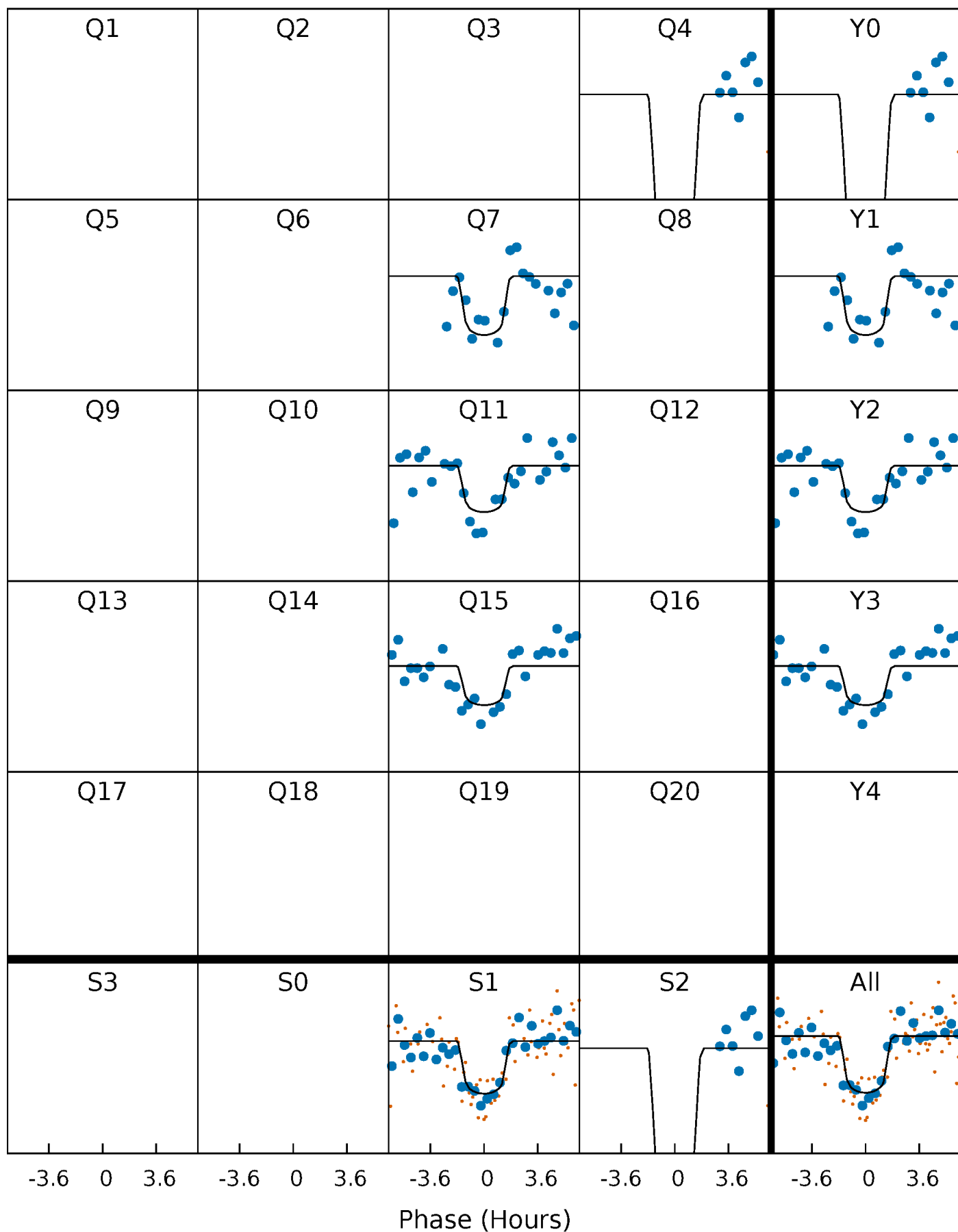
# PDC Quarter-Phased Transit Curves

TCE 009156461-06 P=337.753157 Days  $T_0=364.928677$  (BKJD)



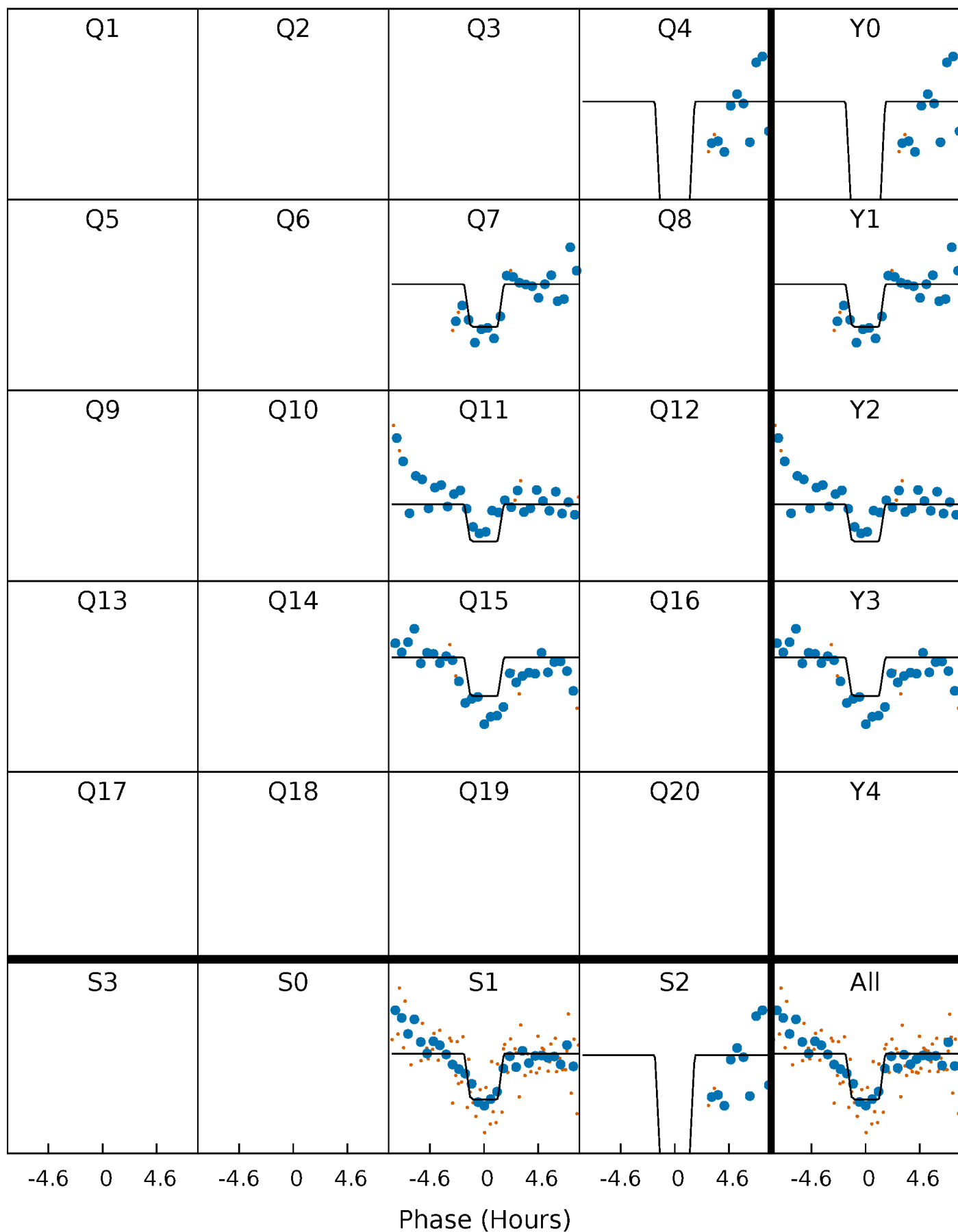
# DV Quarter-Phased Transit Curves

TCE 009156461-06 P=337.753157 Days  $T_0=364.928677$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

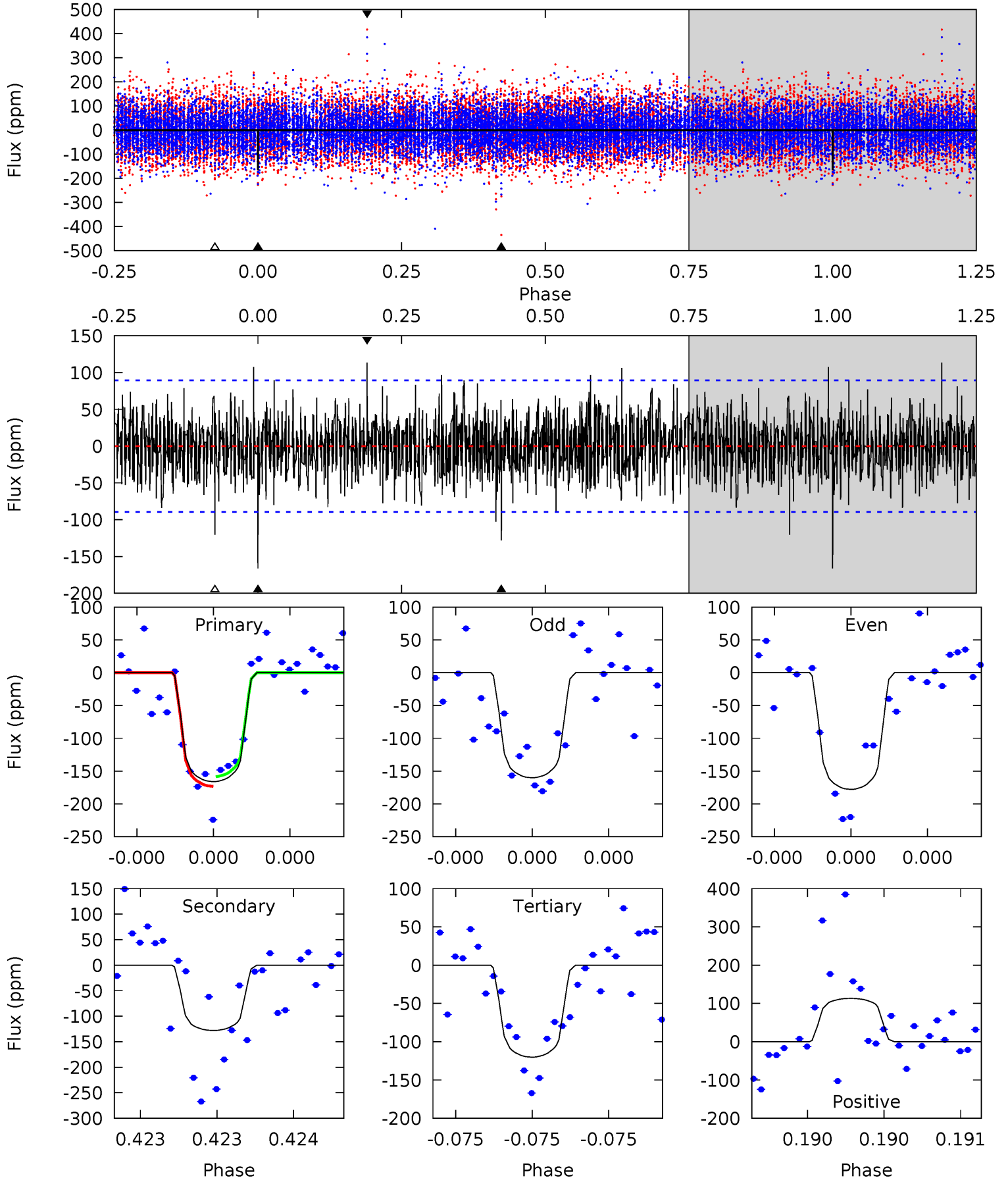
TCE 009156461-06 P=337.753180 Days  $T_0=364.926347$  (BKJD)



# DV Model-Shift Uniqueness Test

009156461-06, P = 337.753157 Days, E = 27.175520 Days

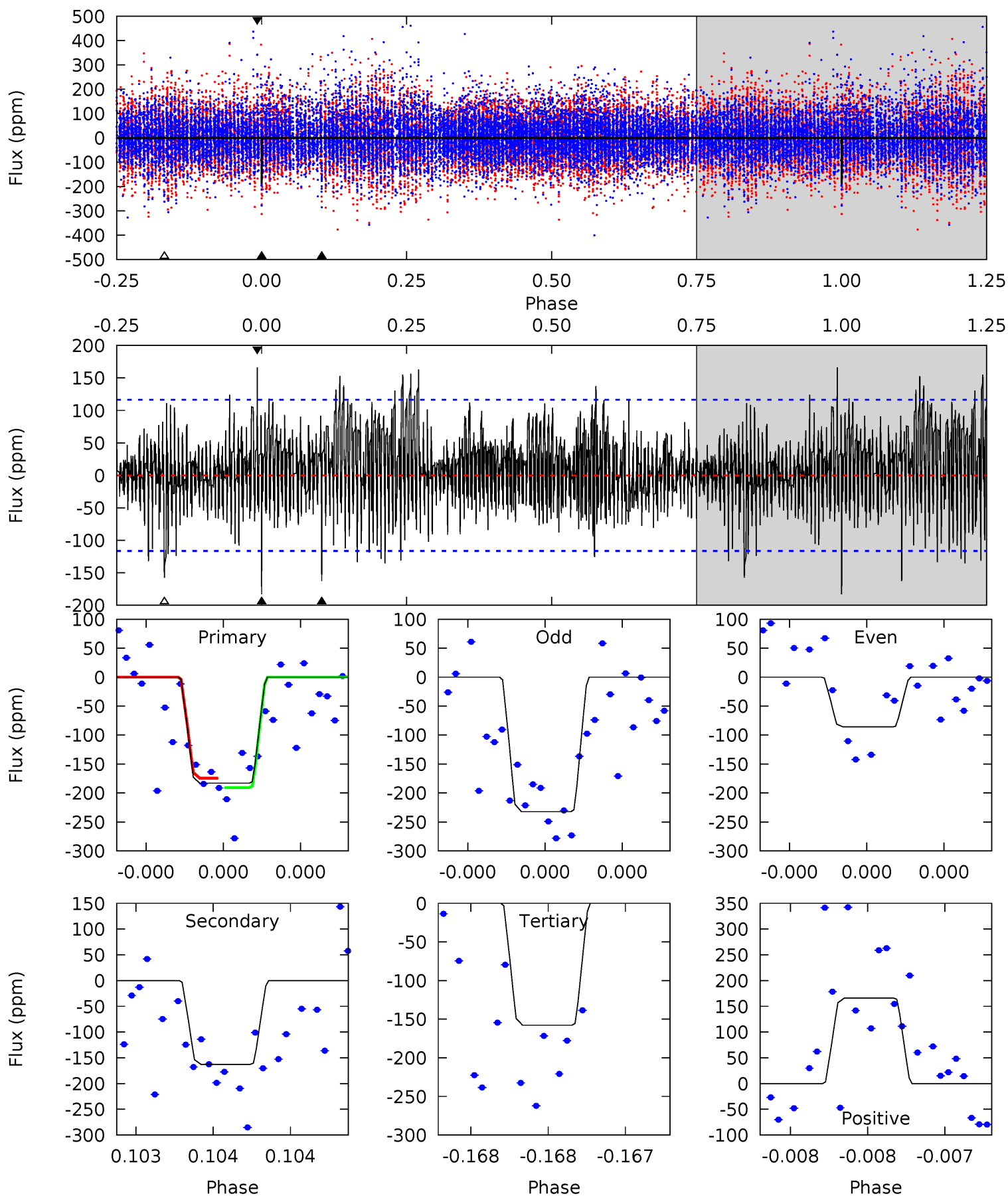
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
10.4	8.02	7.53	7.10	5.60	3.53	1.70	2.88	3.31	0.49	0.92	0.52	0.93	0.41	0.46



# Alt Model-Shift Uniqueness Test

009156461-06,  $P = 337.753180$  Days,  $E = 27.173167$  Days

Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
8.83	7.85	7.61	8.01	5.62	3.56	1.83	1.22	0.82	0.24	-0.16	3.38	0.92	0.48	0.39



### Stellar Parameters For KIC 009156461

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6480^{+181}_{-250}$	$4.044^{+0.293}_{-0.158}$	$-0.120^{+0.250}_{-0.300}$	$1.822^{+0.510}_{-0.623}$	$1.345^{+0.193}_{-0.289}$	$0.313^{+0.619}_{-0.139}$
	+3%/-4%	+7%/-4%	+208%/-250%	+28%/-34%	+14%/-21%	+198%/-44%
Source	PHO54	PHO54	PHO54	DSEP		

KIC = Kepler Input Catalog; PHO = Photometry; SPE = Spectroscopy; AST = Asteroseismology  
 TRA = Transits; DESP = Dartmouth Models; MULT = Multiple Models

### Secondary Eclipse Parameters for KIC 009156461-06 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-128 \pm 16$	$2.47^{+1.44}_{-1.18}$	$515^{+41}_{-50}$	$5948^{+2460}_{-991}$	$12762^{+32802}_{-7846}$
Alt.	$-163 \pm 21$	$2.62^{+1.42}_{-1.28}$	$520^{+44}_{-48}$	$6229^{+3063}_{-1083}$	$14363^{+39269}_{-8338}$

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



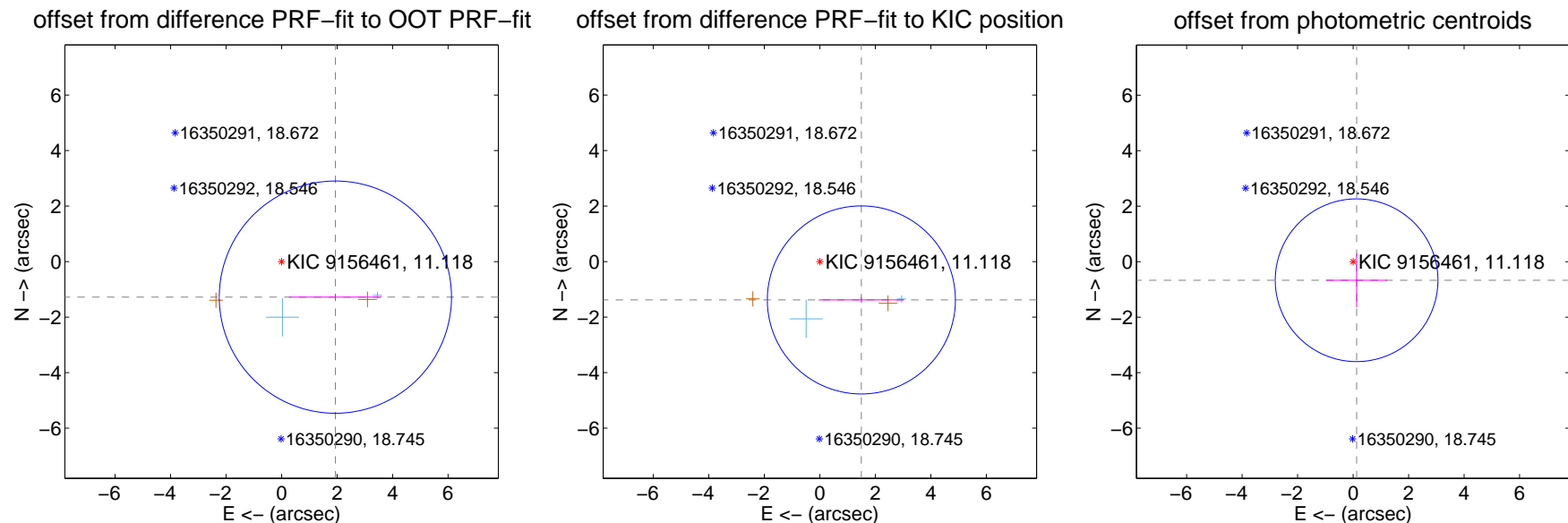
## DV Centroid Data

Supplemental centroid analysis for 009156461-06. **Kepler magnitude: 11.12.** Transit SNR 8.40

**There are 2 quarters with good PRF difference image offsets**

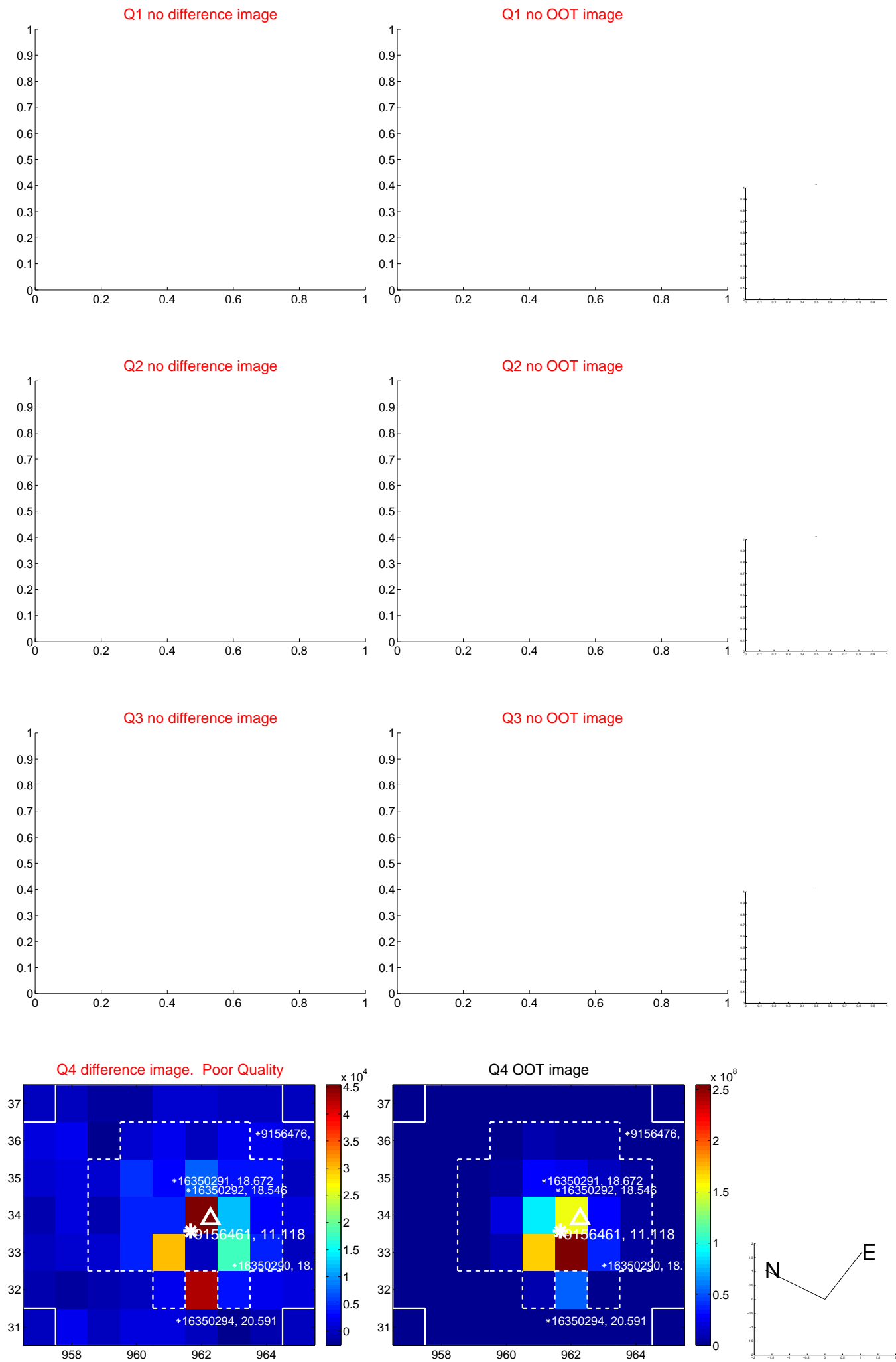
The direct PRF centroid is offset from the target star catalog position by about 0.52 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$2.323 \pm 1.394$	1.67	$-1.938 \pm 1.669$	$-1.280 \pm 0.110$
PRF-fit source offset from KIC position	$2.036 \pm 1.129$	1.80	$-1.496 \pm 1.534$	$-1.381 \pm 0.102$
photometric centroid source offset	$0.68 \pm 0.98$	0.70	$-0.13 \pm 1.09$	$-0.67 \pm 0.97$

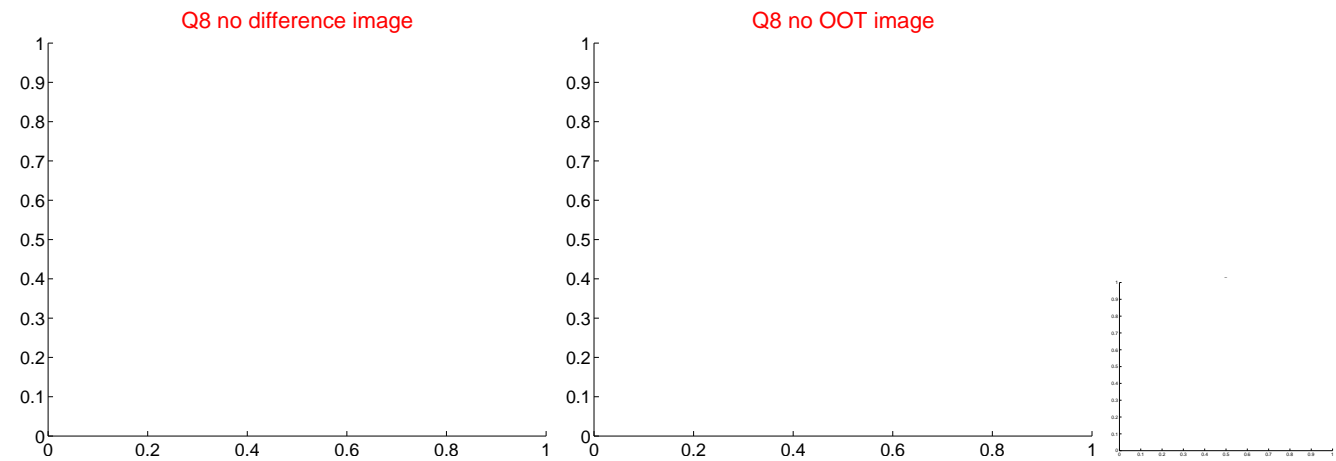
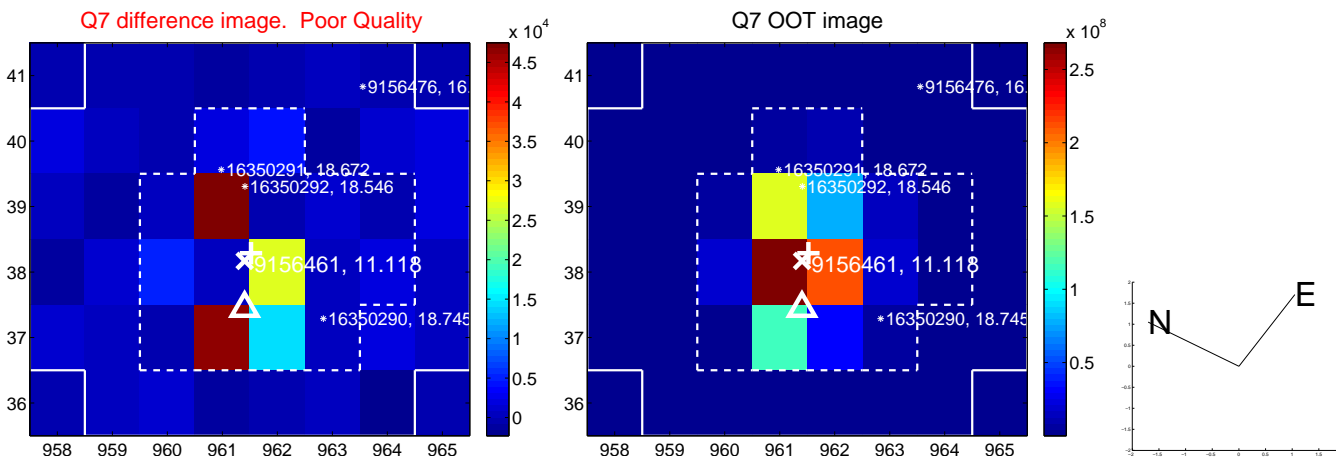
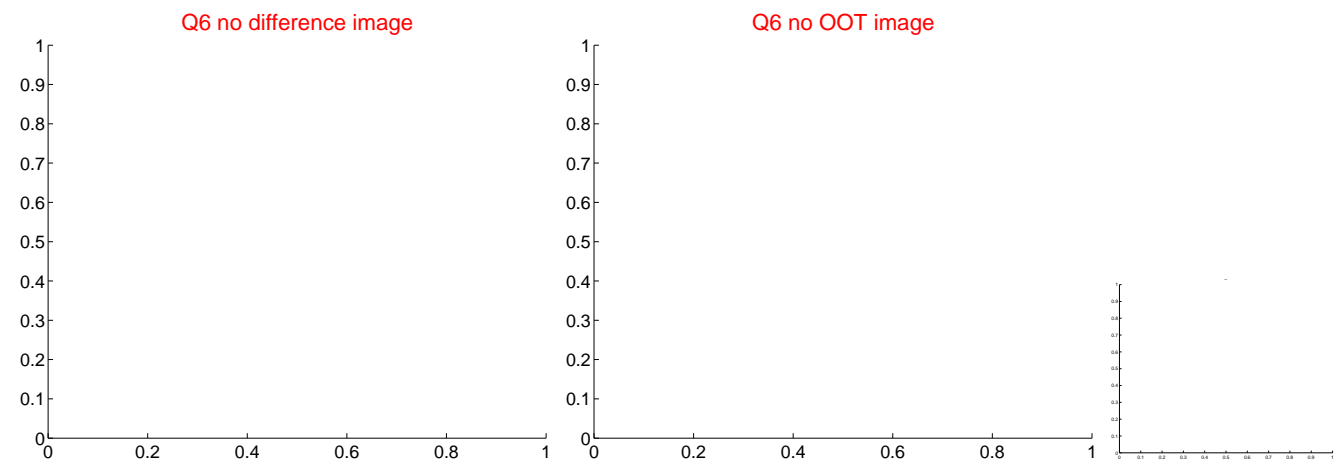
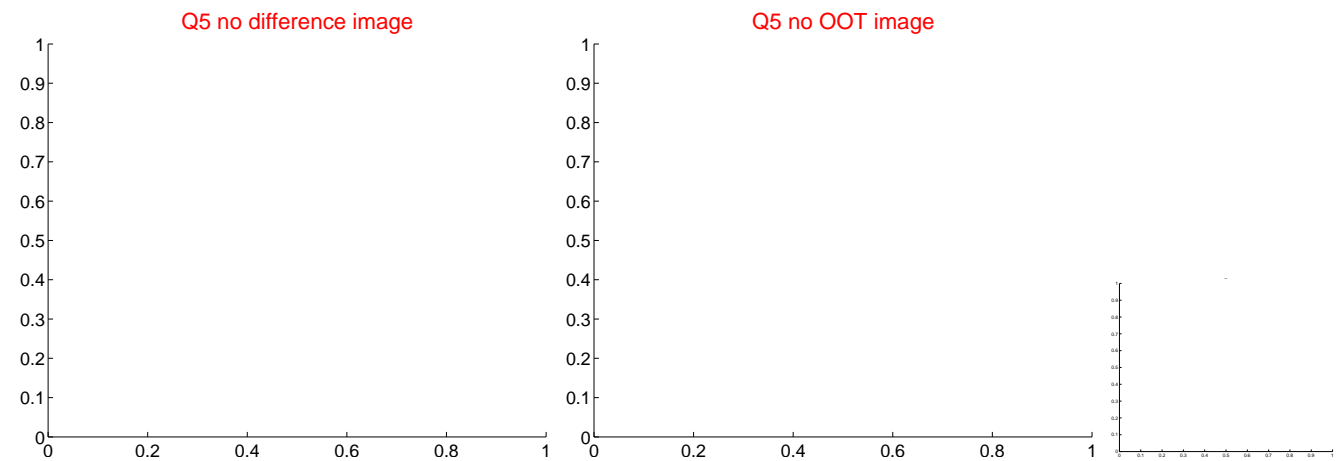


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

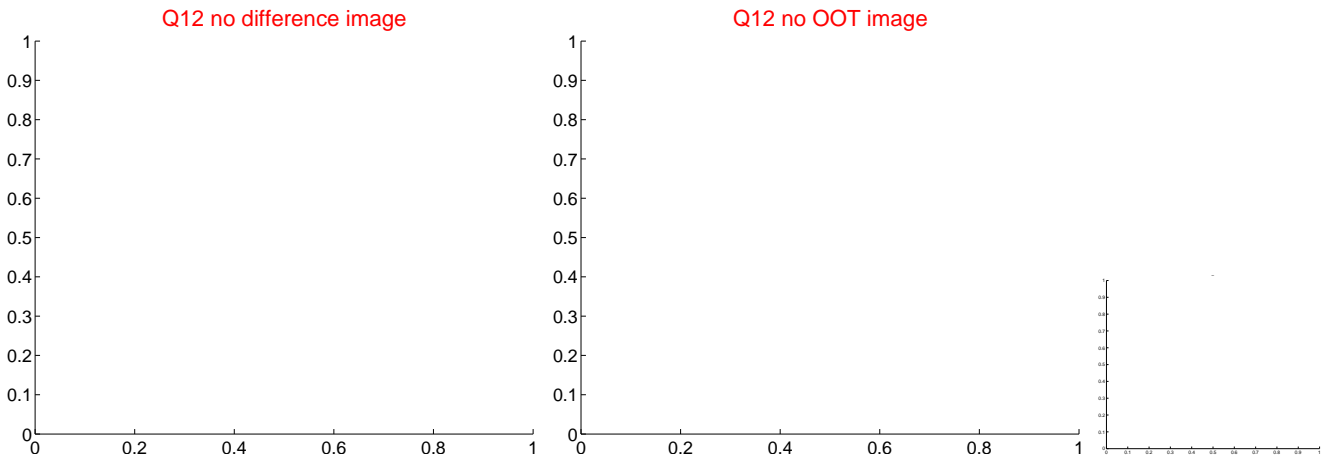
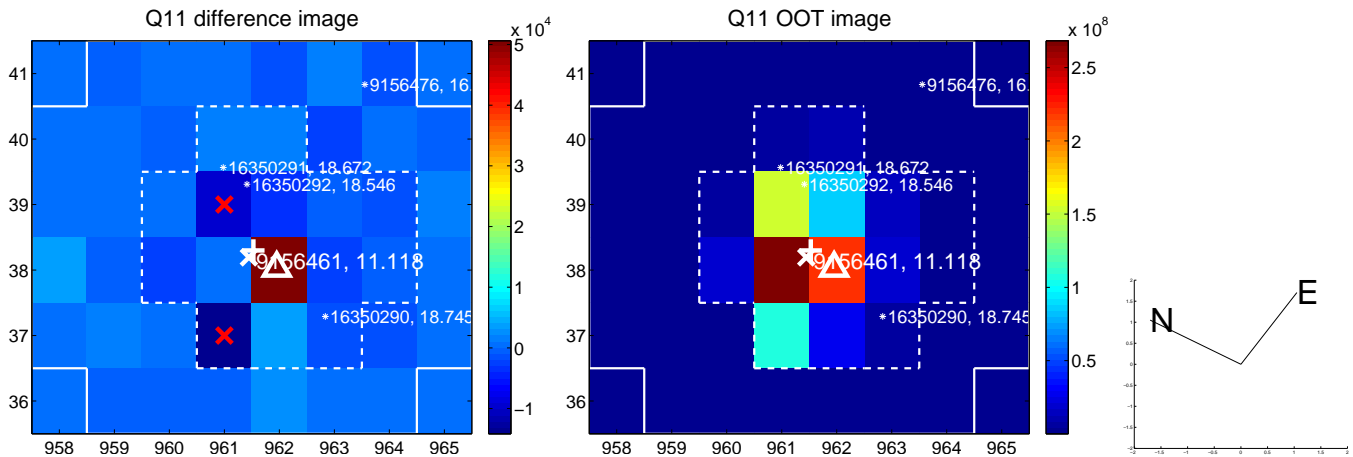
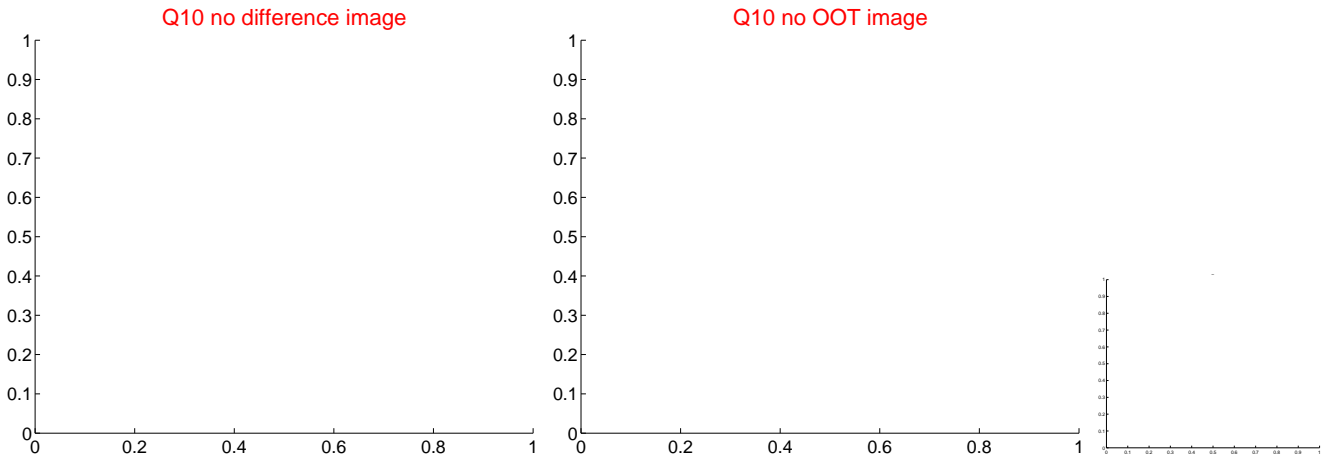
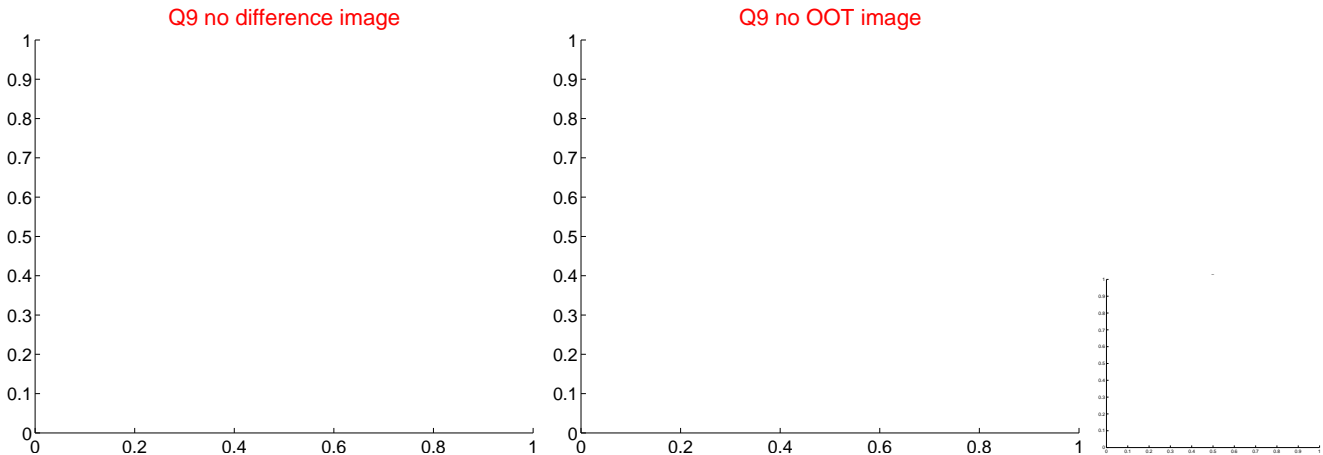
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



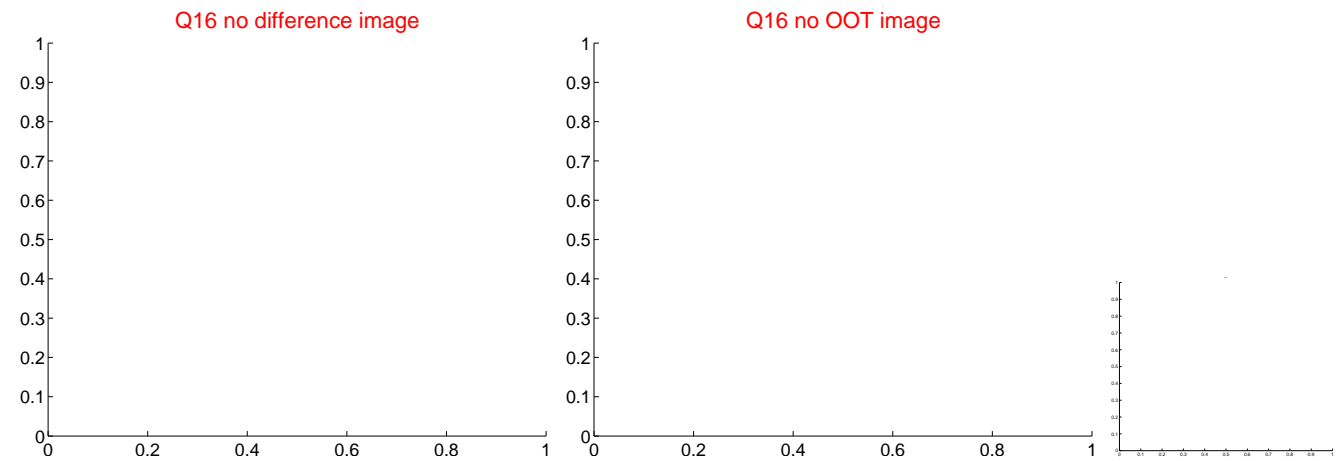
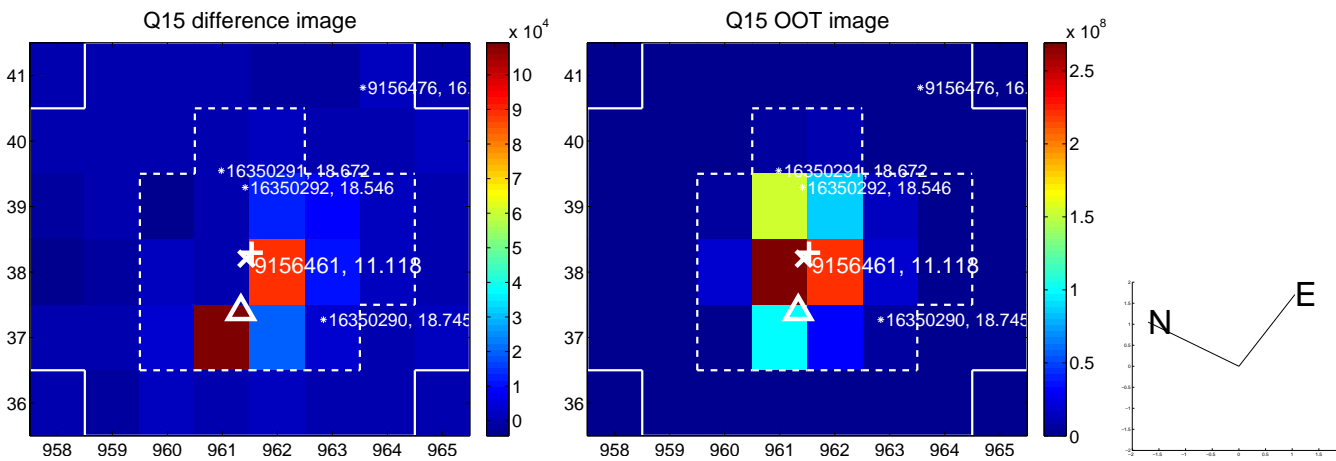
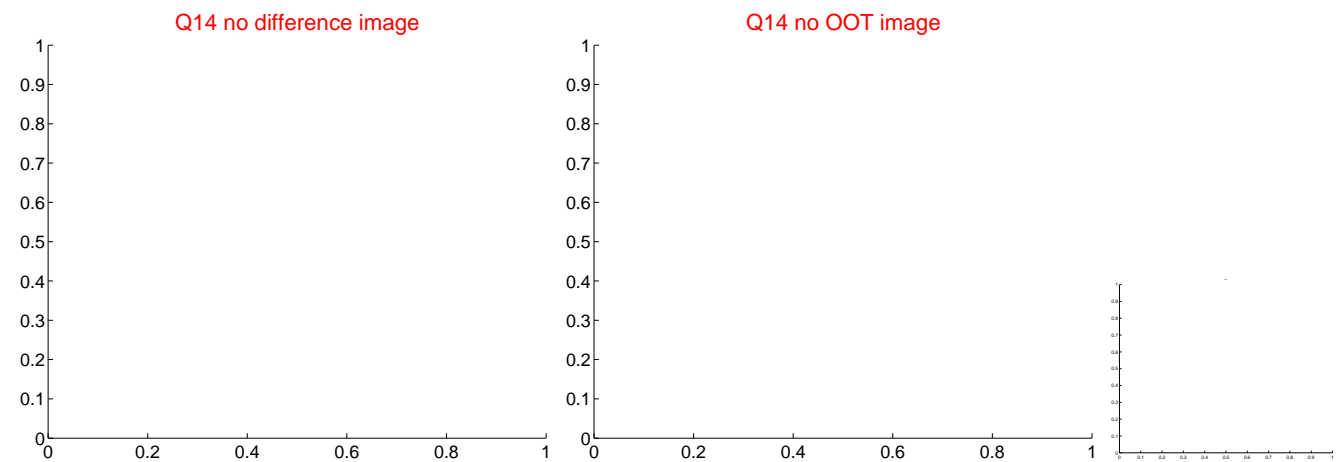
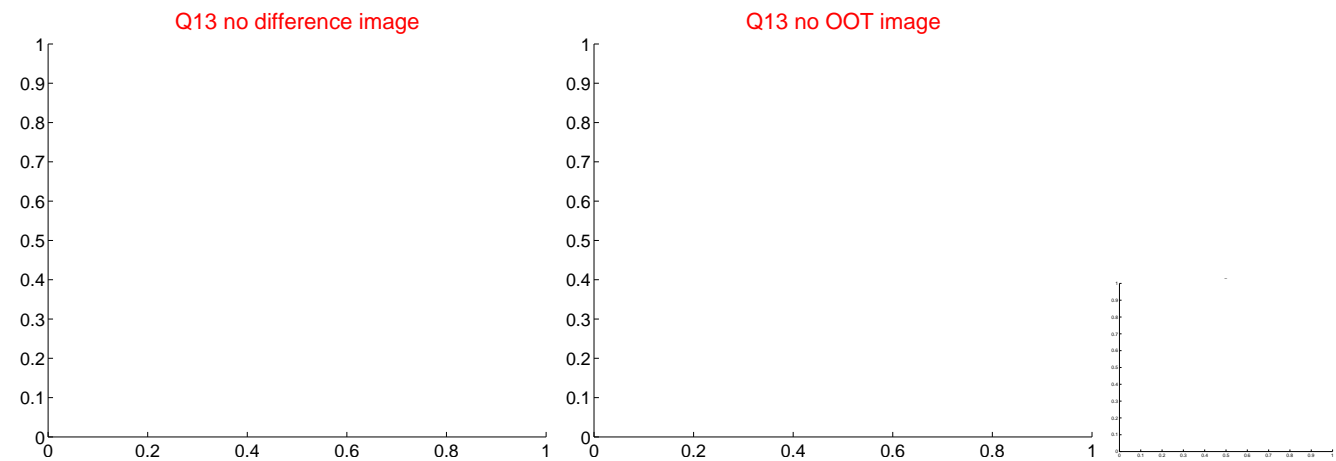
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



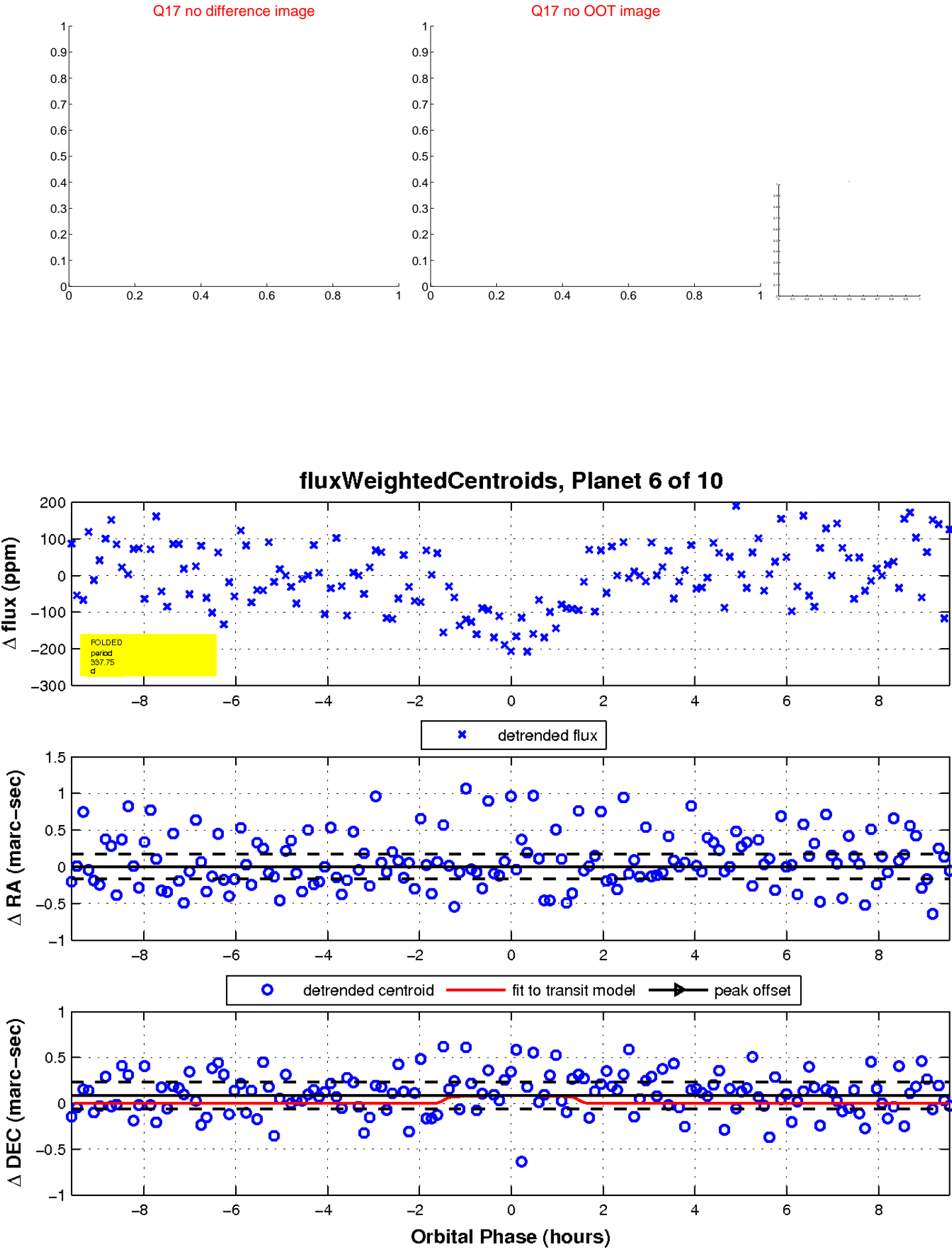
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value



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

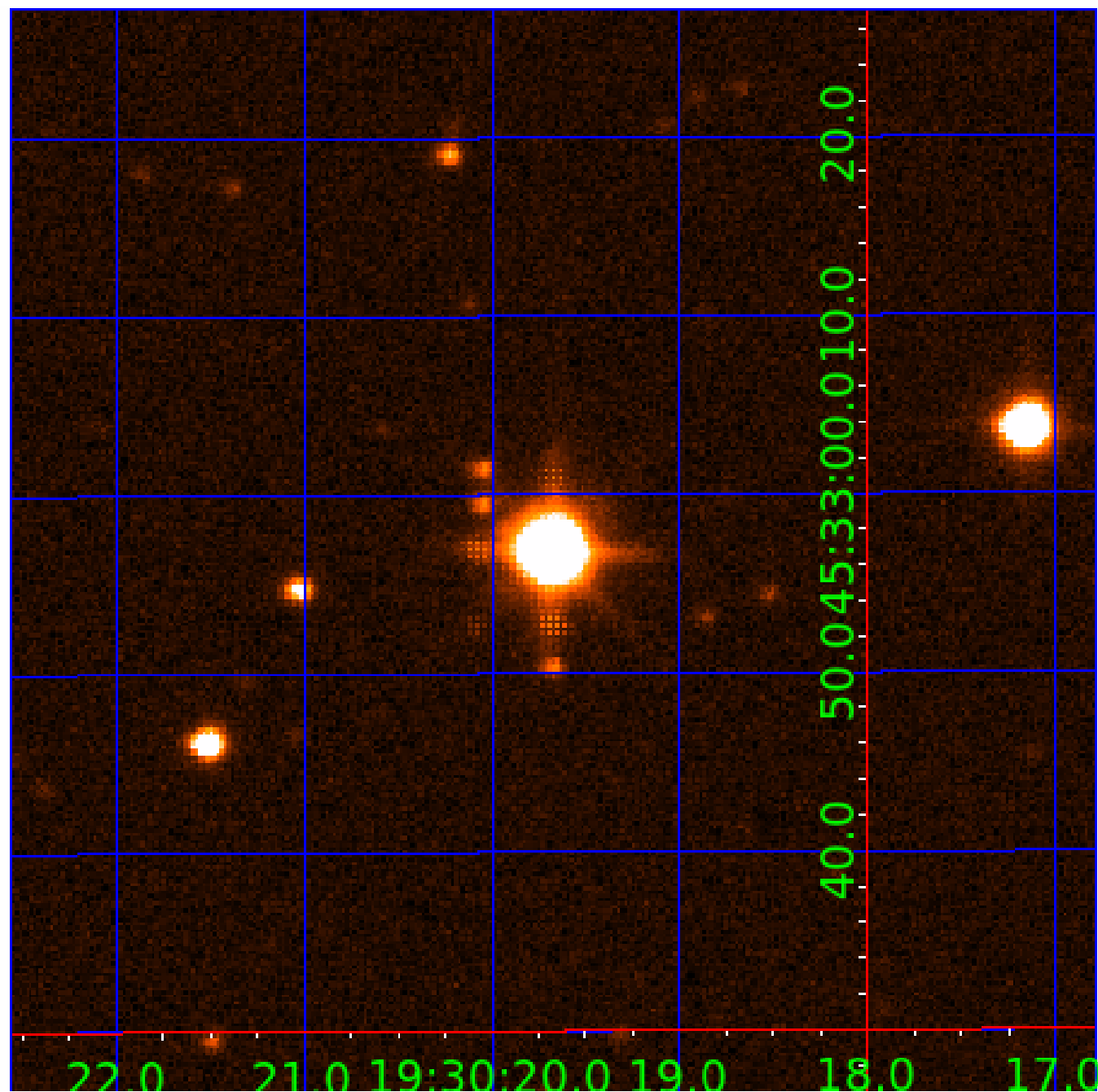


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination





## KIC 009156461

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009156461-01	OBS	No	2.296149	132.431446	4.2	10.825	8.7	2.7	1.82	6480	0.43	3717.29
009156461-02	OBS	No	208.639795	204.712221	146.7	5.006	9.0	9.5	1.82	6480	2.51	9.10
009156461-03	OBS	No	296.023030	308.965620	22.4	13.754	7.9	1.0	1.82	6480	0.97	5.71
009156461-04	OBS	No	27.813822	141.128479	61.1	10.671	9.1	8.2	1.82	6480	1.55	133.62
009156461-05	OBS	No	77.564421	198.190936	103.7	8.284	8.5	7.9	1.82	6480	2.09	34.04
009156461-06	OBS	No	337.753157	364.928677	153.2	3.194	8.2	8.4	1.82	6480	2.65	4.79
009156461-08	OBS	No	138.291040	142.658043	108.4	10.011	8.3	6.9	1.82	6480	2.05	15.75
009156461-09	OBS	No	129.035096	161.225143	92.7	6.643	8.0	6.8	1.82	6480	2.33	17.27
009156461-10	OBS	No	110.241909	238.739506	55.7	3.500	7.6	-1.0	1.82	6480	1.37	21.30

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009156461-01	OBS	FP	0.00	1	0	0	0	SWEET_NTL—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—CENT_SATURATED
009156461-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_CHASES_MARSHALL—TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_SATURATED
009156461-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_TRACKER—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_SATURATED
009156461-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_ZUMA—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
009156461-05	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—CENT_SATURATED—HALO_GHOST
009156461-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
009156461-08	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—INCONSISTENT_TRANS—CENT_SATURATED
009156461-09	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_CHASES—TRANS_GAPPED—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
009156461-10	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED

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

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

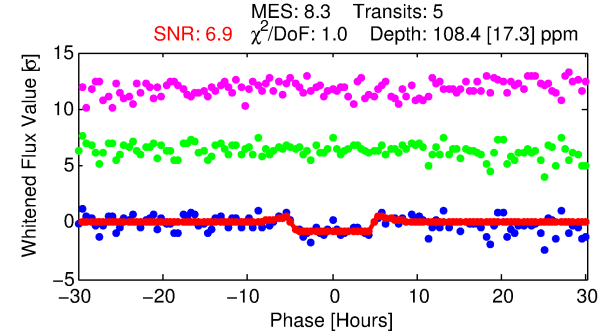
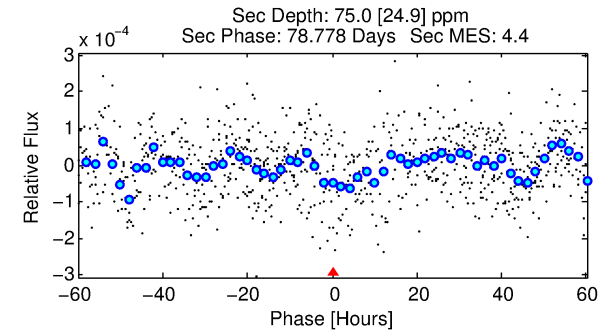
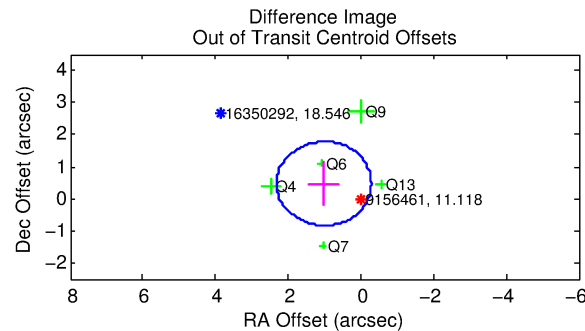
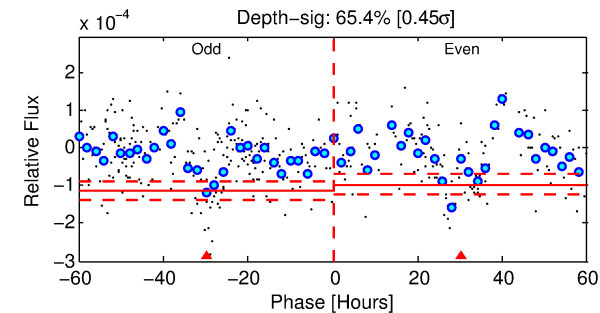
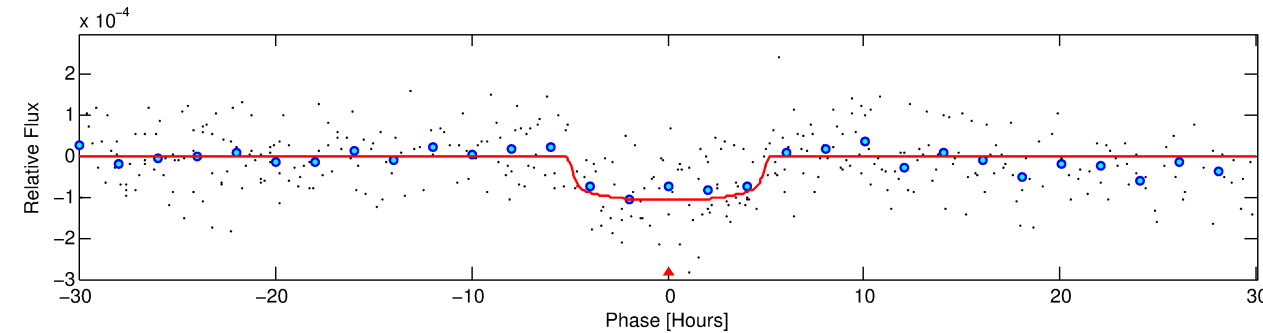
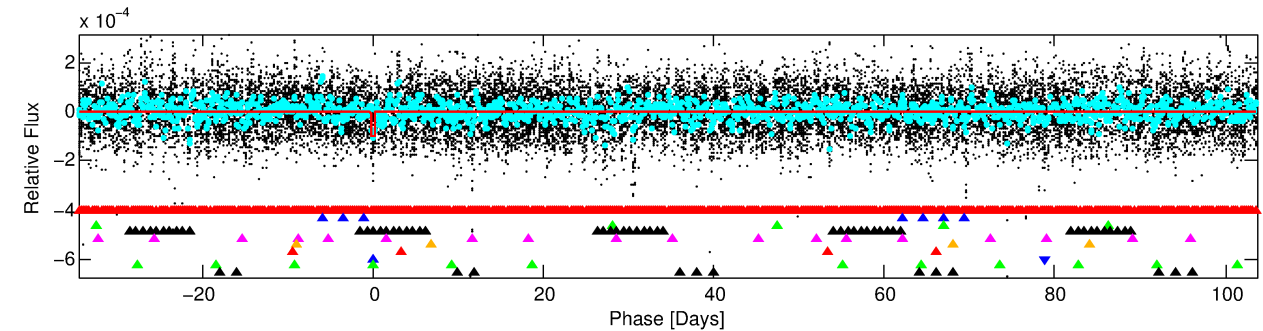
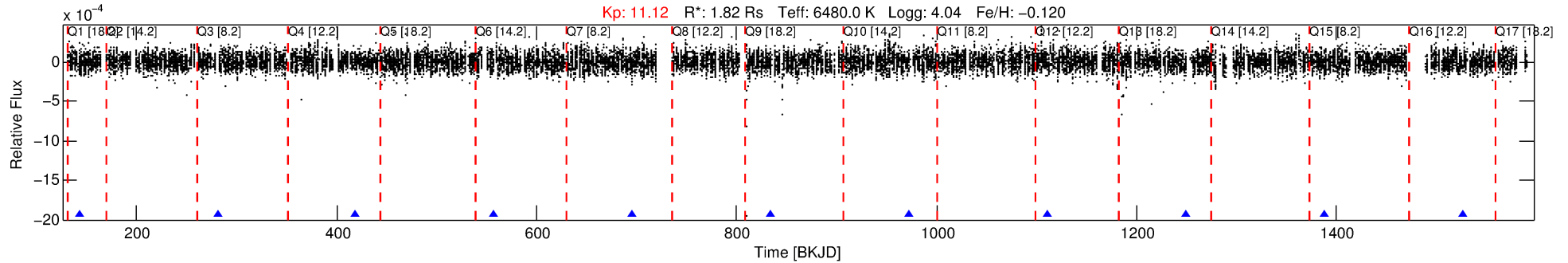
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 009156461-08

No Significant Match Found

# DV One-Page Summary

KIC: 9156461 Candidate: 8 of 10 Period: 138.291 d



## DV Fit Results:

Period = 138.29104 [0.00213] d  
Epoch = 142.6580 [0.0142] BKJD  
Rp/R\* = 0.0103 [0.0043]  
a/R\* = 73.20 [163.41]  
b = 0.73 [1.40]  
Seff = 15.75 [8.30]  
Teq = 508 [67] K  
Rp = 2.05 [1.10] Re  
a = 0.5771 [0.1848] AU  
Ag = 3271.22 [3367.67] [0.97 $\sigma$ ]  
Teffp = 5939 [1352] K [4.01 $\sigma$ ]

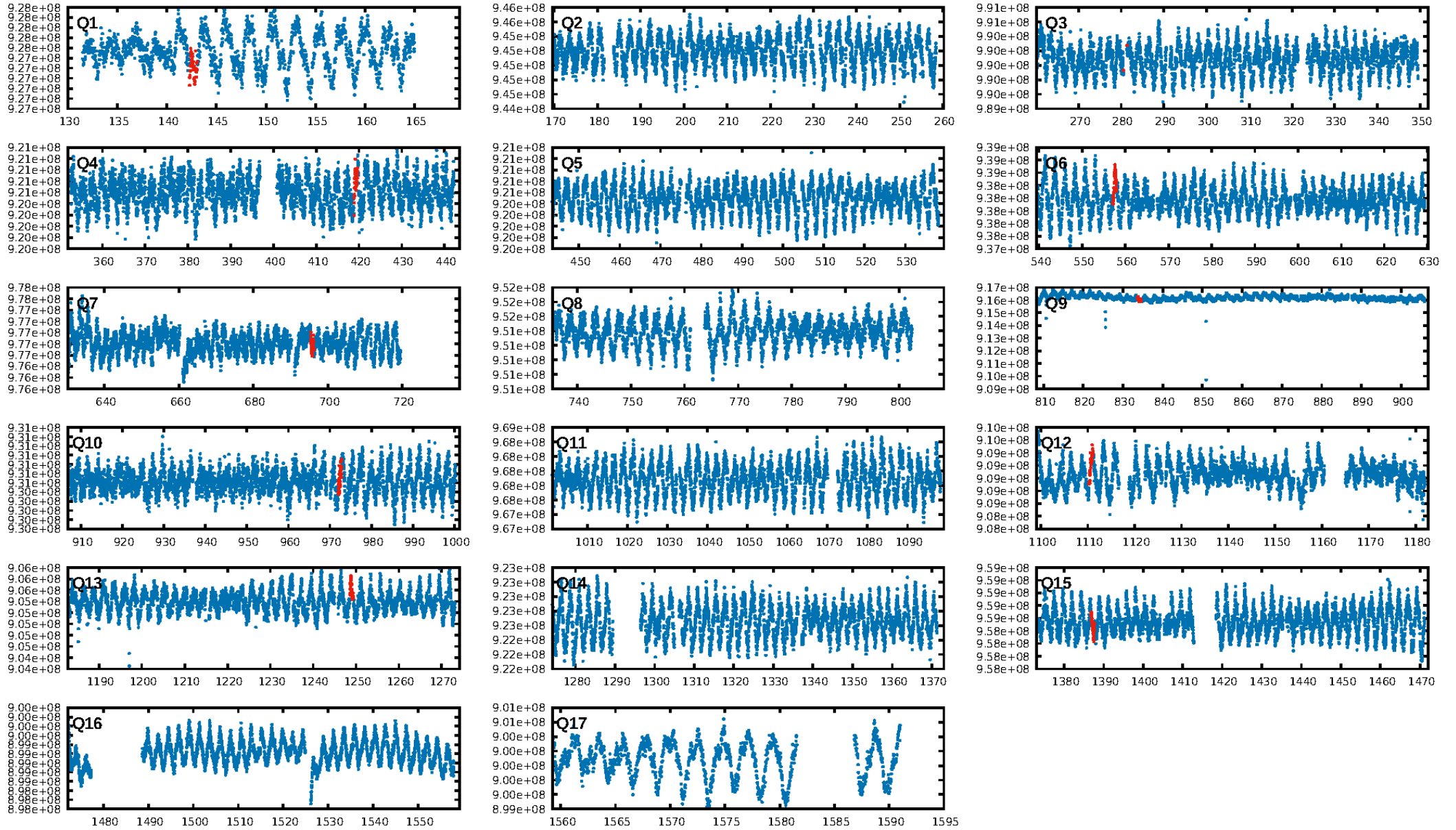
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [18.49 $\sigma$ ]  
LongPeriod-sig: 100.0% [150.84 $\sigma$ ]  
ModelChiSquare2-sig: 0.8%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [4/4]  
GhostDiagnostic-chr: -2.111  
Centroid-sig: 34.9%  
Centroid-so: 0.956 arcsec [1.06 $\sigma$ ]  
OotOffset-rm: 1.122 arcsec [2.57 $\sigma$ ]  
OotOffset-st: 1/1/1/2 [5]  
KicOffset-rm: 1.915 arcsec [3.48 $\sigma$ ]  
KicOffset-st: 1/1/1/2 [5]  
DiffImageQuality-fgm: 0.20 [1/5]  
DiffImageOverlap-fno: 0.14 [1/7]

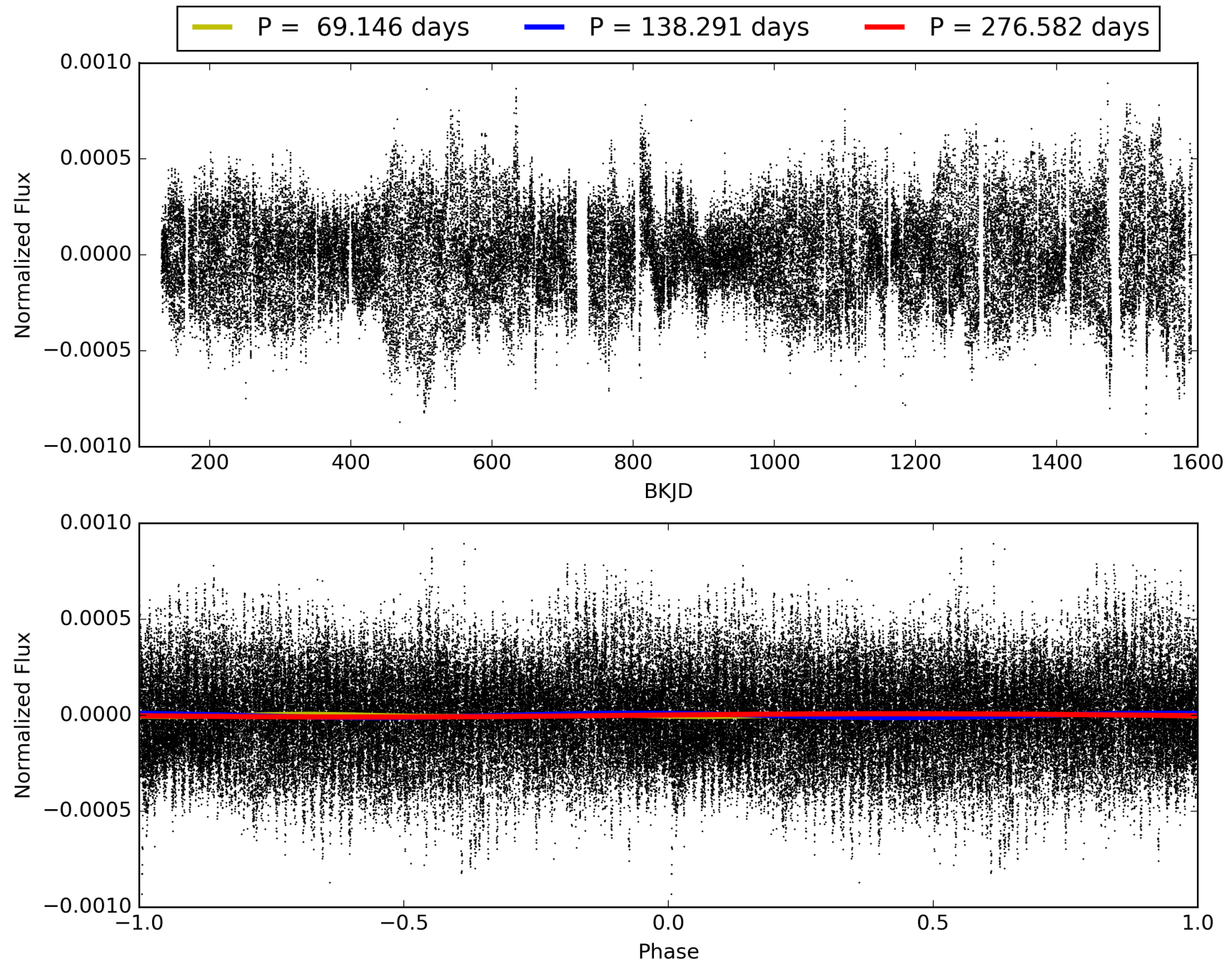
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 22:29:12 Z

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

# TCE 009156461-08, PDC Light Curves

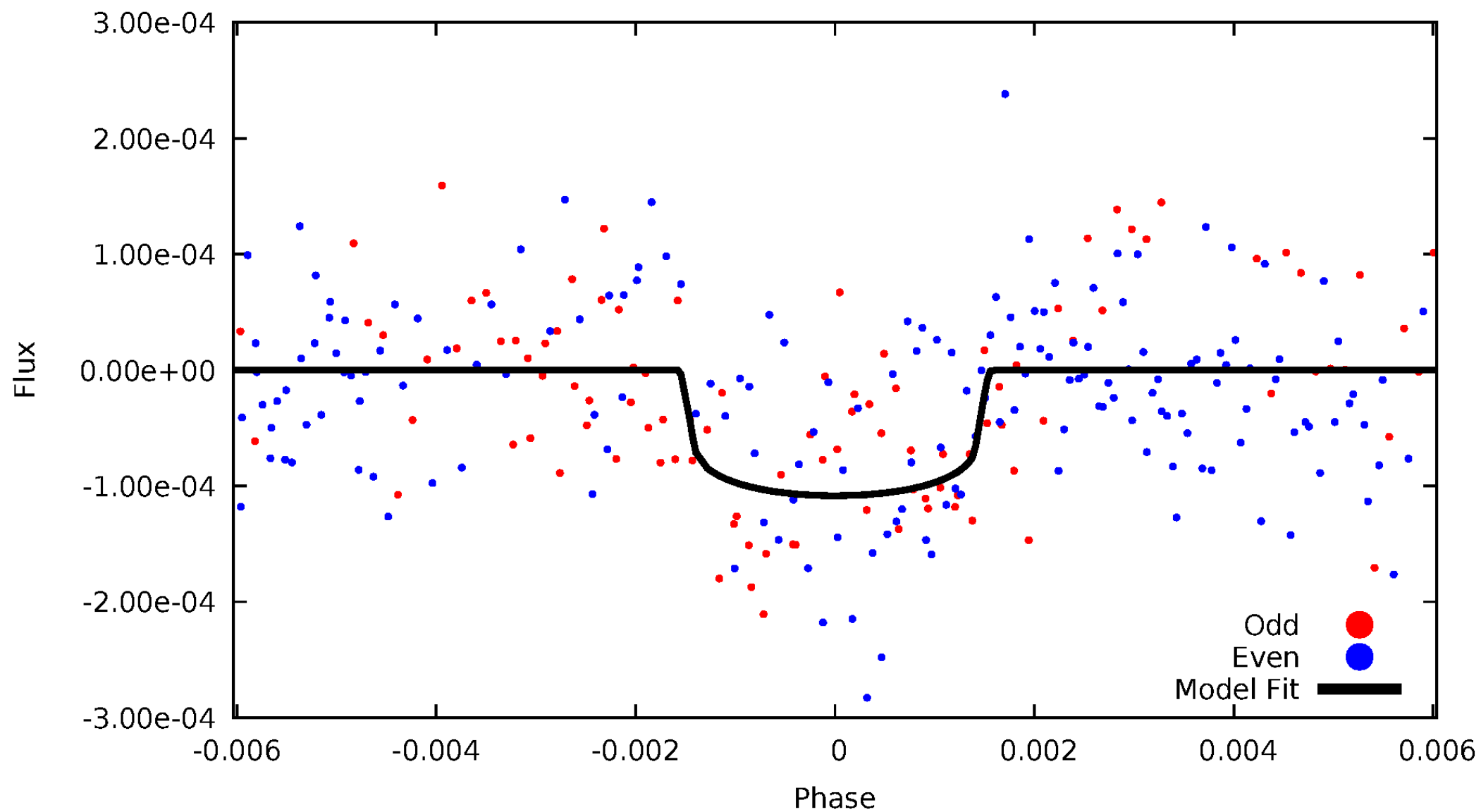


TCE 009156461-08



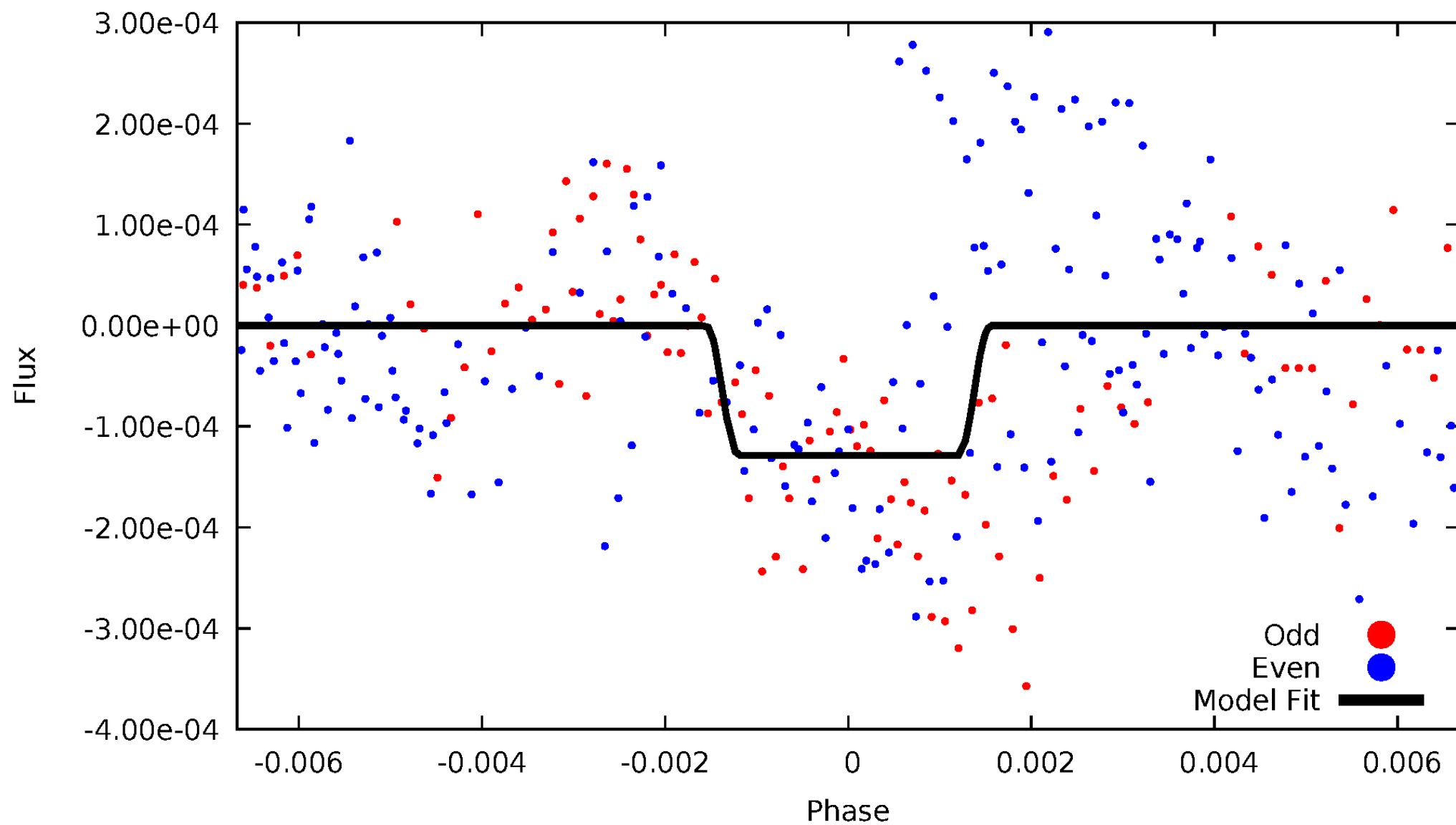
# DV Odd/Even

TCE 009156461-08



# ALT Odd/Even

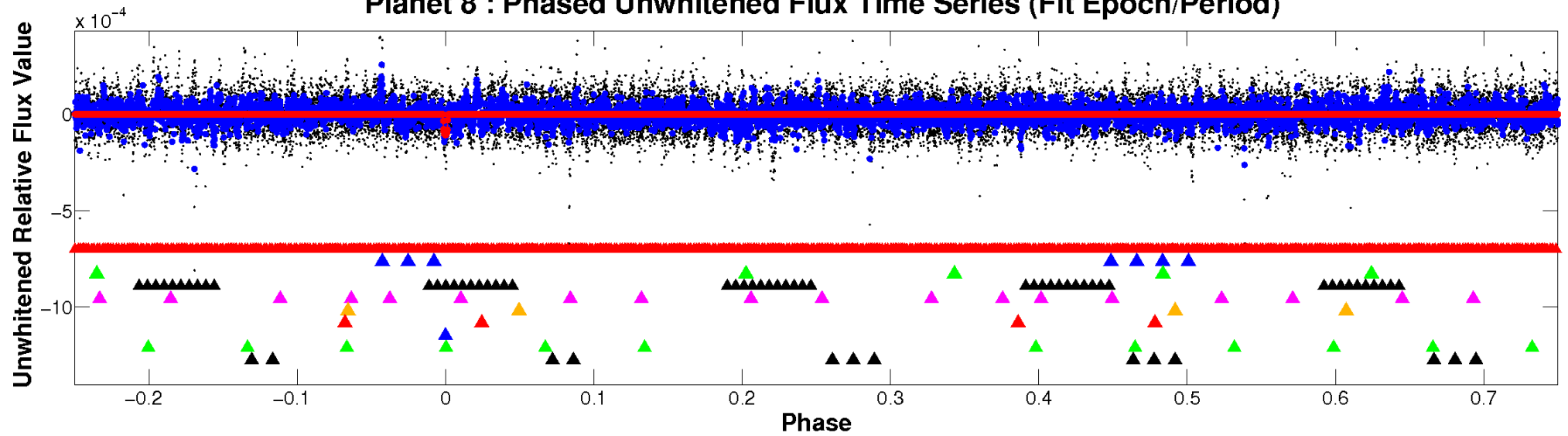
TCE 009156461-08



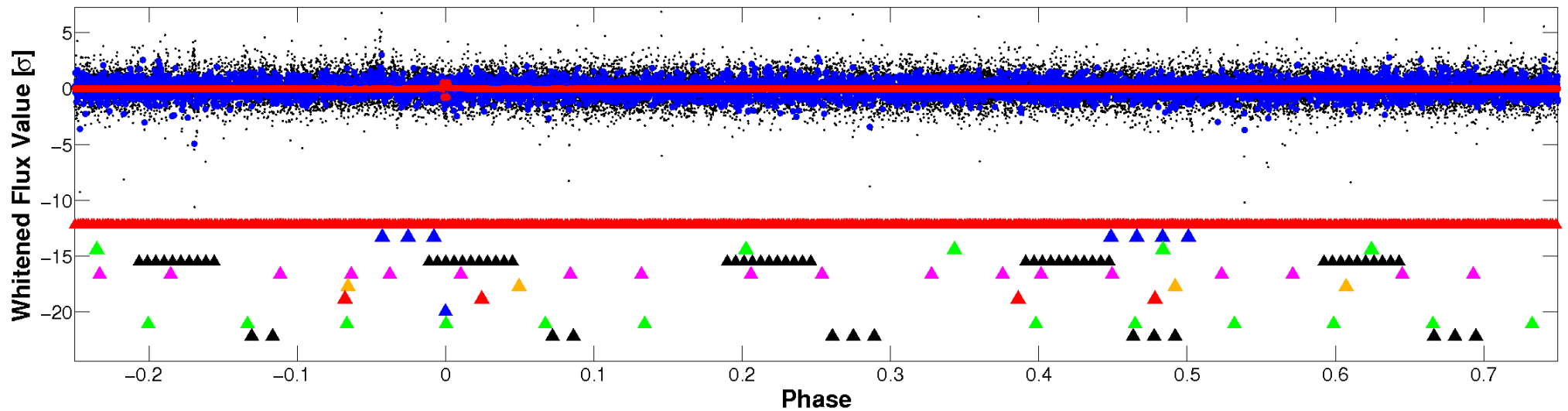


# Non-Whitened Vs. Whitened Light Curve

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

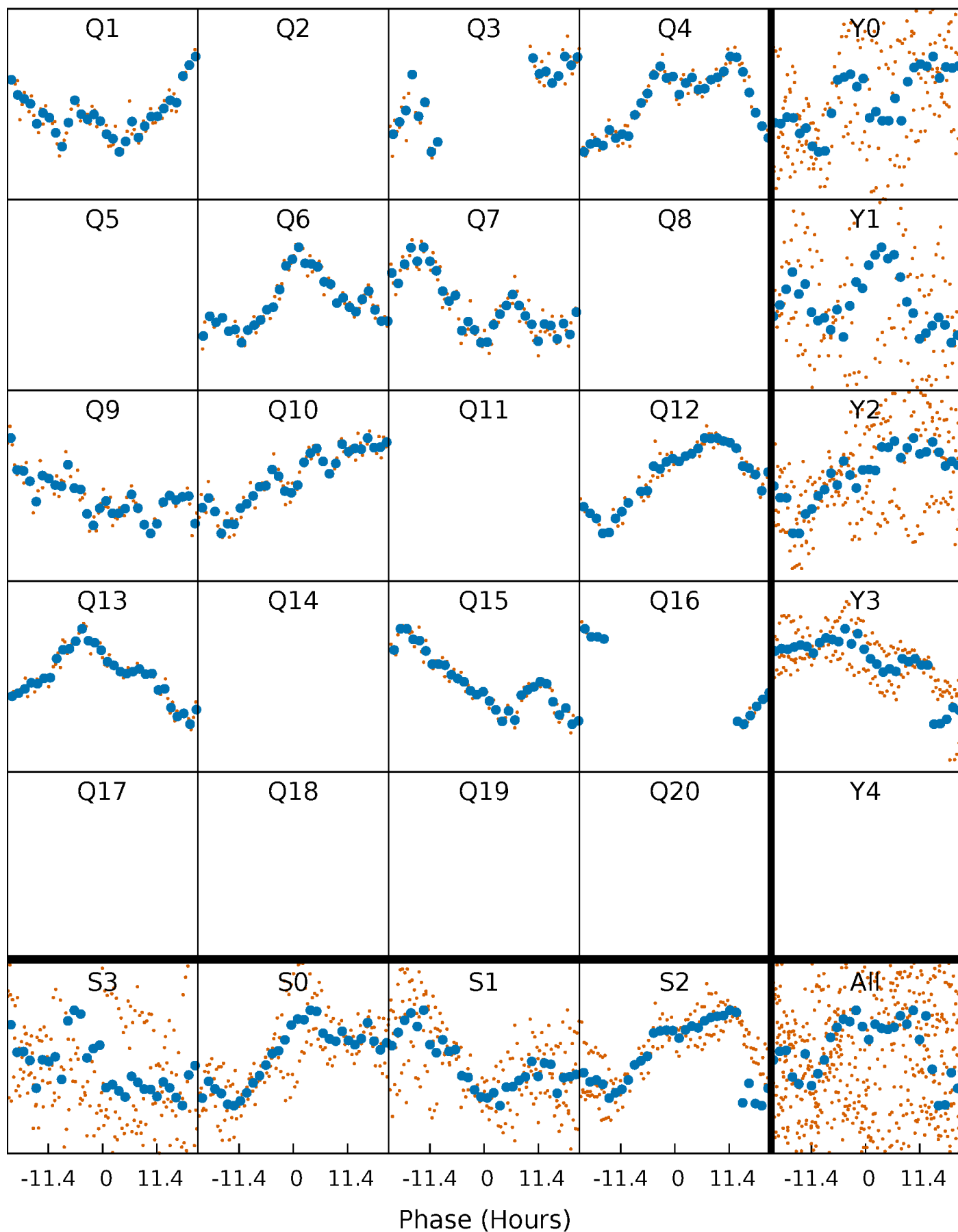


## Planet 8 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

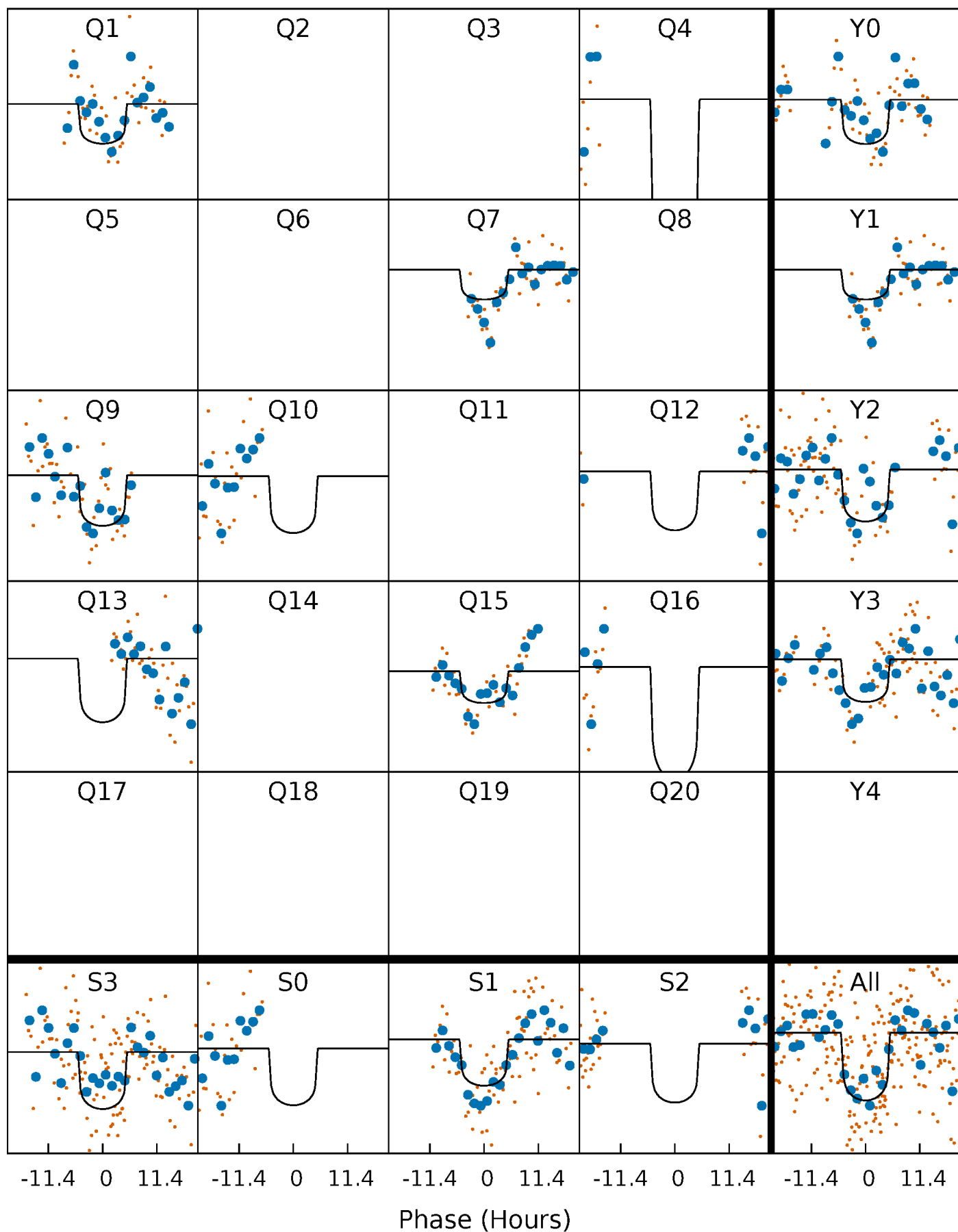
TCE 009156461-08 P=138.291040 Days  $T_0=142.658043$  (BKJD)





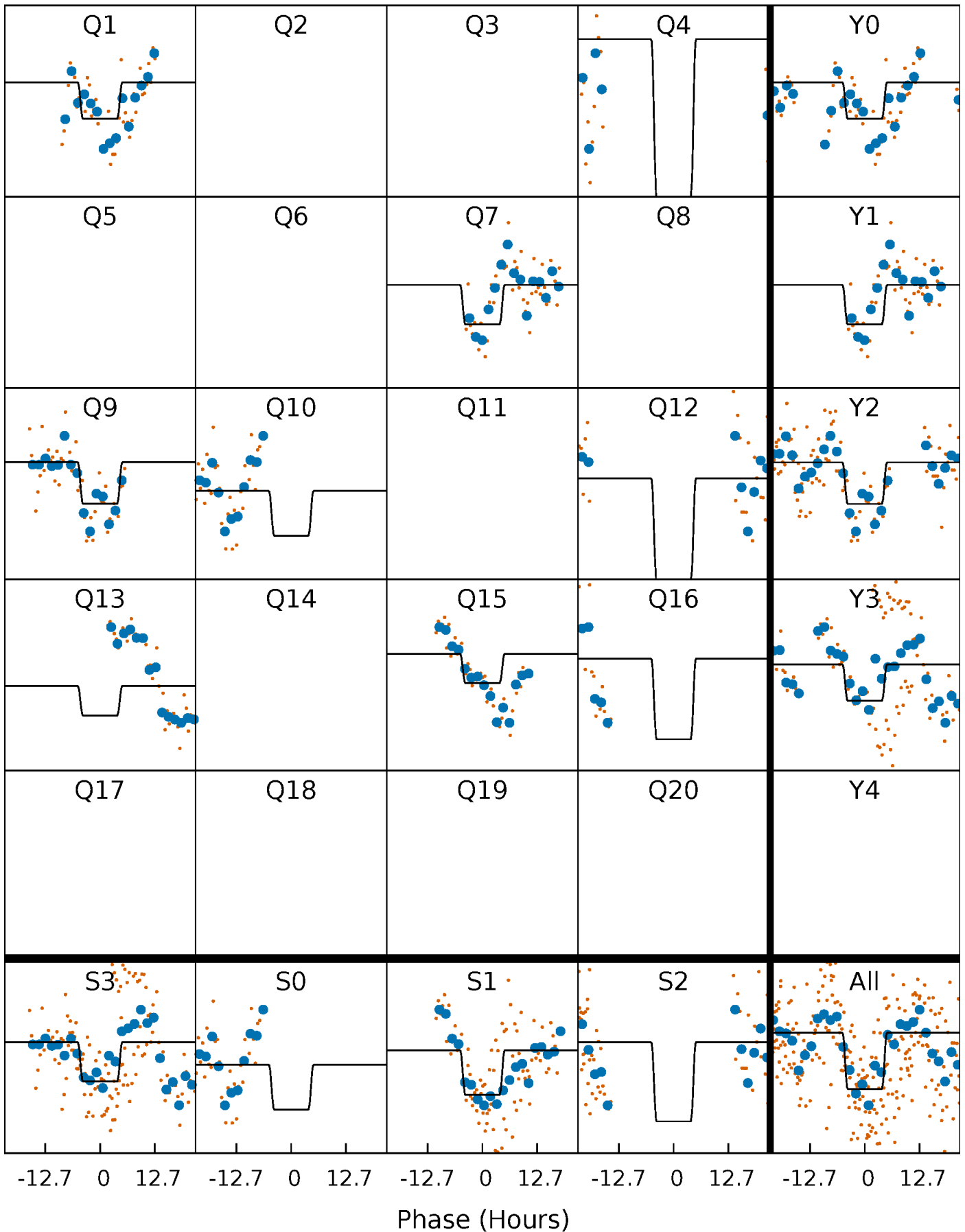
# DV Quarter-Phased Transit Curves

TCE 009156461-08 P=138.291040 Days  $T_0=142.658043$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

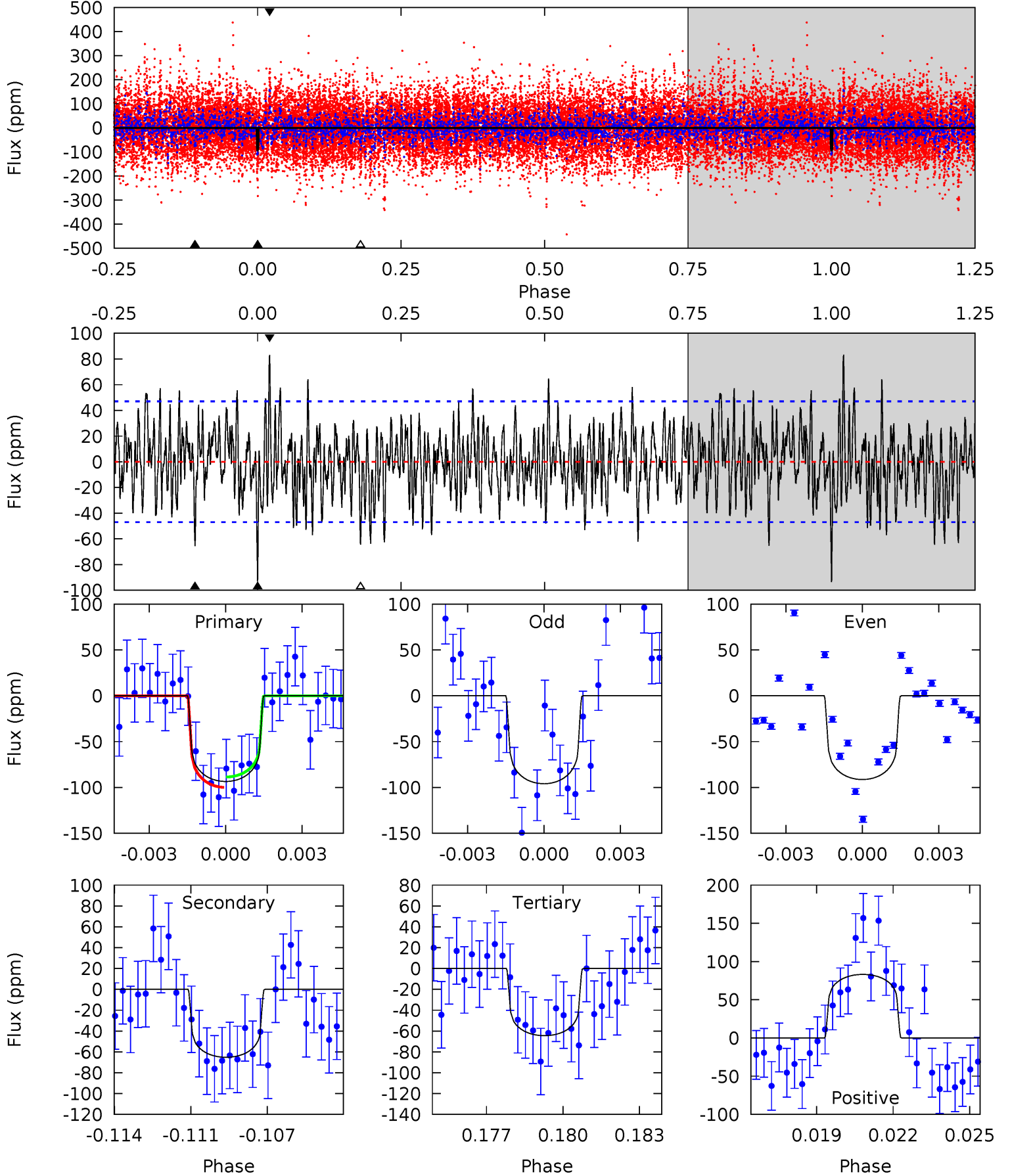
TCE 009156461-08 P=138.287523 Days  $T_0=142.689746$  (BKJD)



# DV Model-Shift Uniqueness Test

009156461-08, P = 138.291040 Days, E = 4.367003 Days

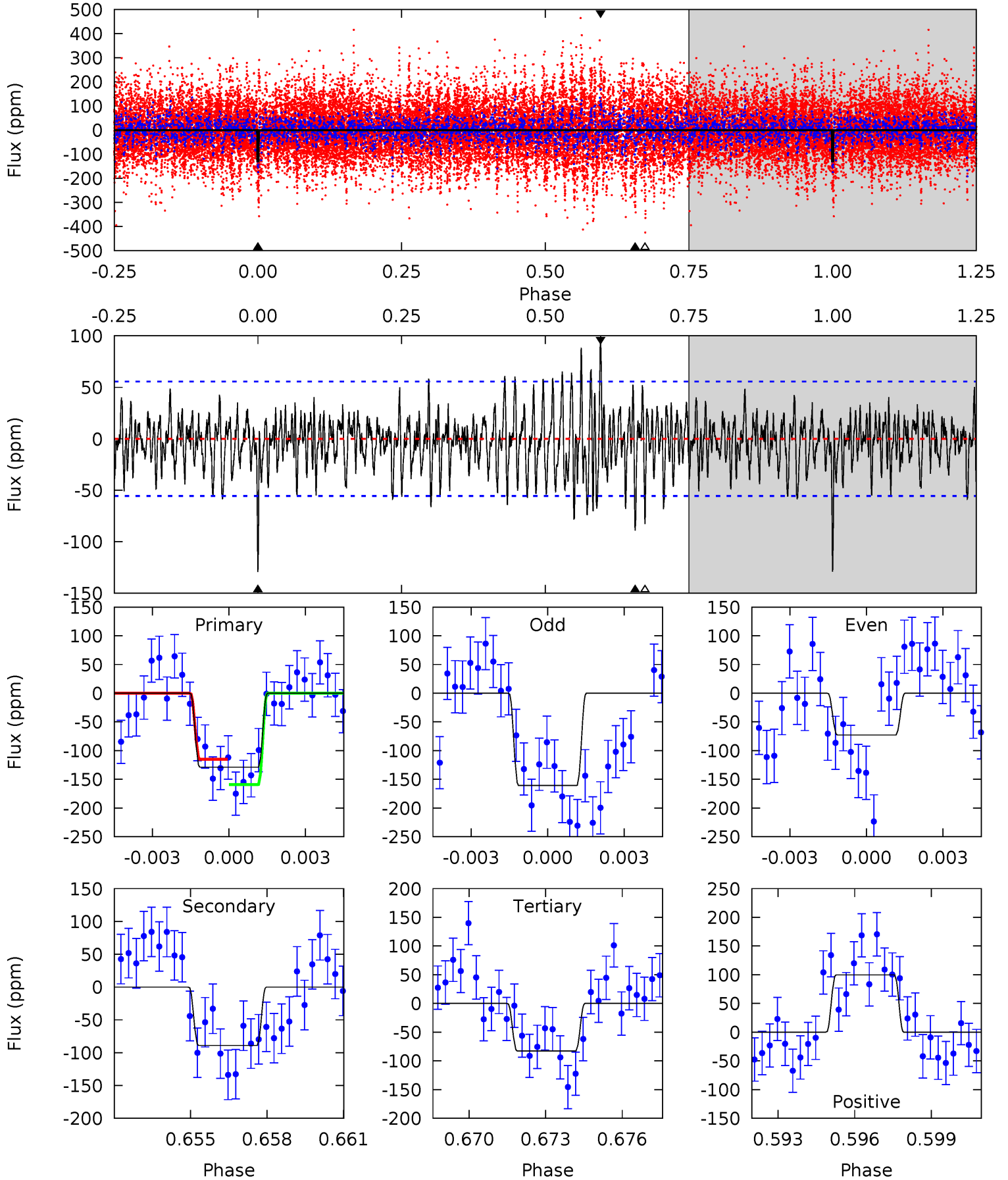
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
10.4	7.28	7.19	9.28	5.24	2.95	2.43	3.24	1.15	0.08	-2.01	0.25	0.95	0.47	0.62



# Alt Model-Shift Uniqueness Test

009156461-08, P = 138.287523 Days, E = 4.402223 Days

Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
12.2	8.40	7.81	9.41	5.25	2.96	2.25	4.34	2.75	0.59	-1.01	4.23	0.45	0.44	2.03



### Stellar Parameters For KIC 009156461

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$\rho_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6480^{+181}_{-250}$	$4.044^{+0.293}_{-0.158}$	$-0.120^{+0.250}_{-0.300}$	$1.822^{+0.510}_{-0.623}$	$1.345^{+0.193}_{-0.289}$	$0.313^{+0.619}_{-0.139}$
	+3%/-4%	+7%/-4%	+208%/-250%	+28%/-34%	+14%/-21%	+198%/-44%
Source	PHO54	PHO54	PHO54	DSEP		

KIC = Kepler Input Catalog; PHO = Photometry; SPE = Spectroscopy; AST = Asteroseismology  
 TRA = Transits; DESP = Dartmouth Models; MULT = Multiple Models

### Secondary Eclipse Parameters for KIC 009156461-08 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-65 \pm 9$	$1.94^{+0.97}_{-0.80}$	$699^{+58}_{-69}$	$5721^{+1720}_{-844}$	$3174^{+5980}_{-1737}$
Alt.	$-89 \pm 11$	$2.18^{+0.95}_{-0.84}$	$700^{+57}_{-65}$	$5904^{+1651}_{-874}$	$3470^{+5493}_{-1791}$

$T_{\text{max}}$  = 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

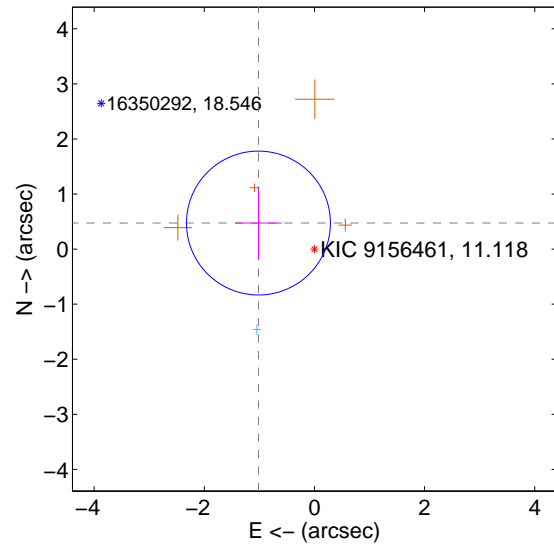
Supplemental centroid analysis for 009156461-08. **Kepler magnitude: 11.12.** Transit SNR 6.92

**There are 1 quarters with good PRF difference image offsets**

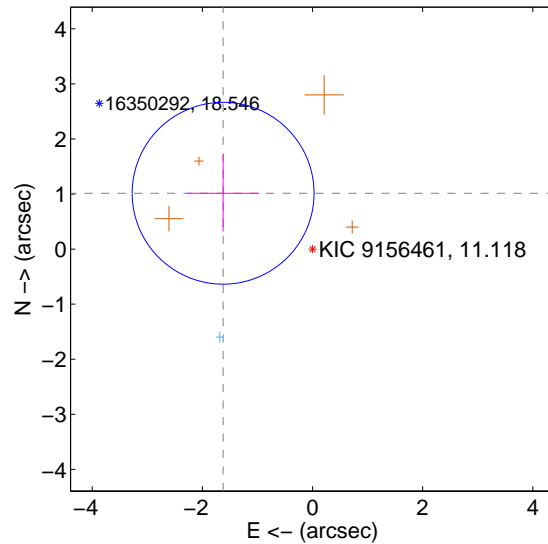
The direct PRF centroid is offset from the target star catalog position by about 0.16 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.122 \pm 0.436$	2.57	$1.017 \pm 0.422$	$0.473 \pm 0.653$
PRF-fit source offset from KIC position	<b><math>1.915 \pm 0.550</math></b>	<b>3.48</b>	$1.624 \pm 0.651$	$1.014 \pm 0.698$
photometric centroid source offset	$0.96 \pm 0.90$	1.06	$0.95 \pm 0.90$	$0.05 \pm 0.78$

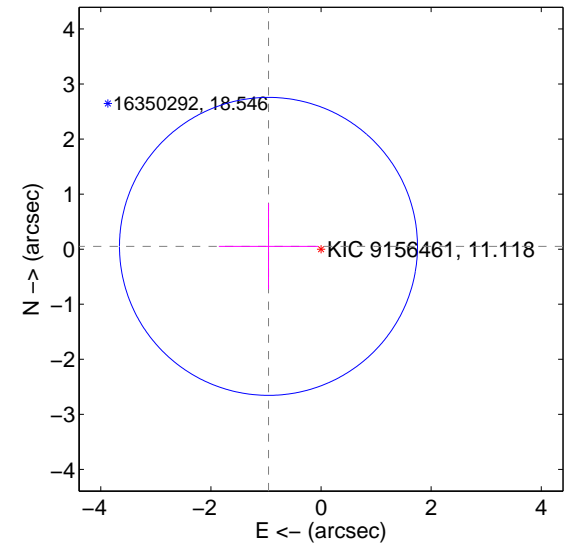
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

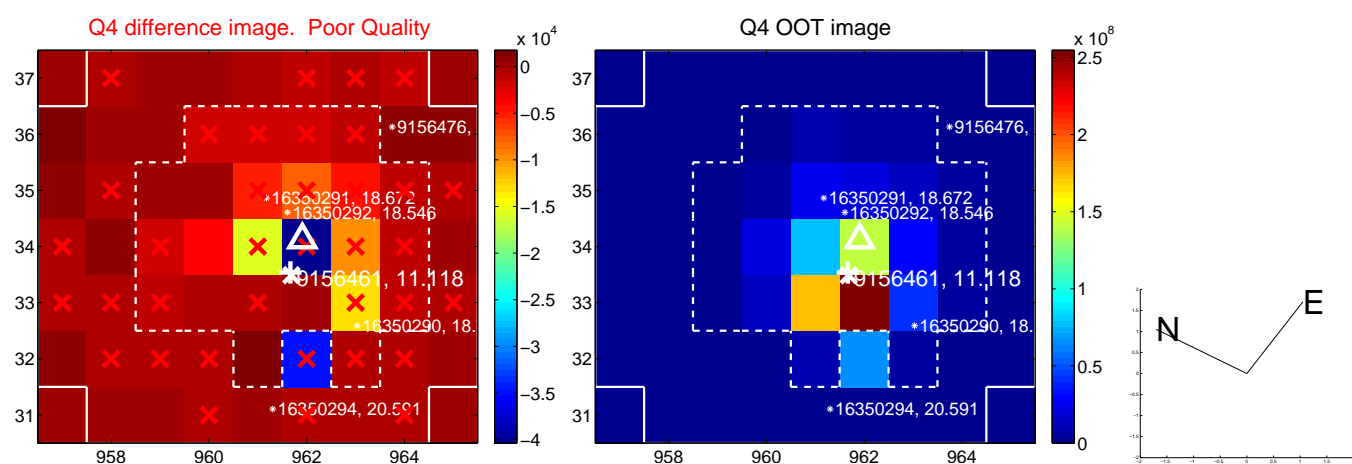
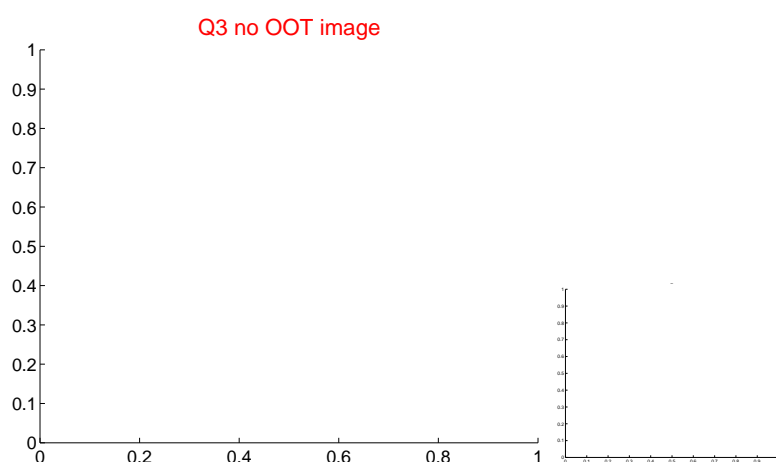
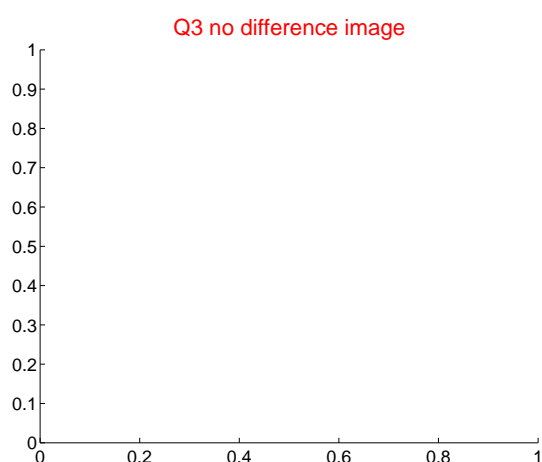
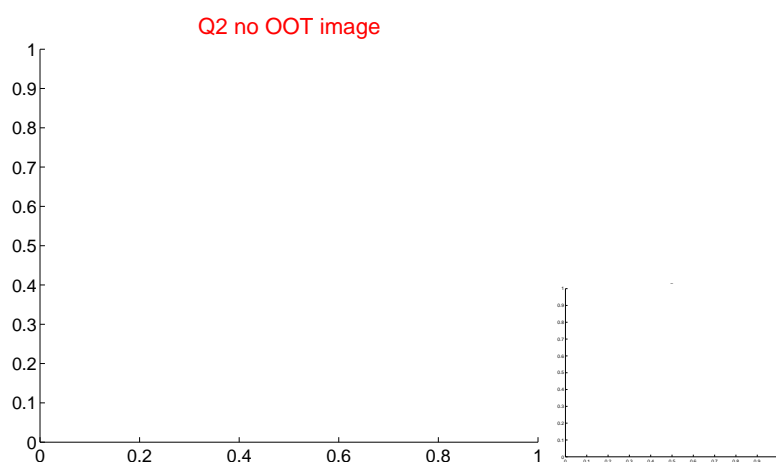
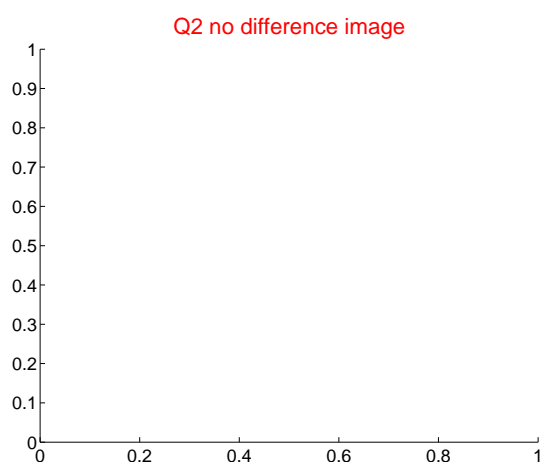
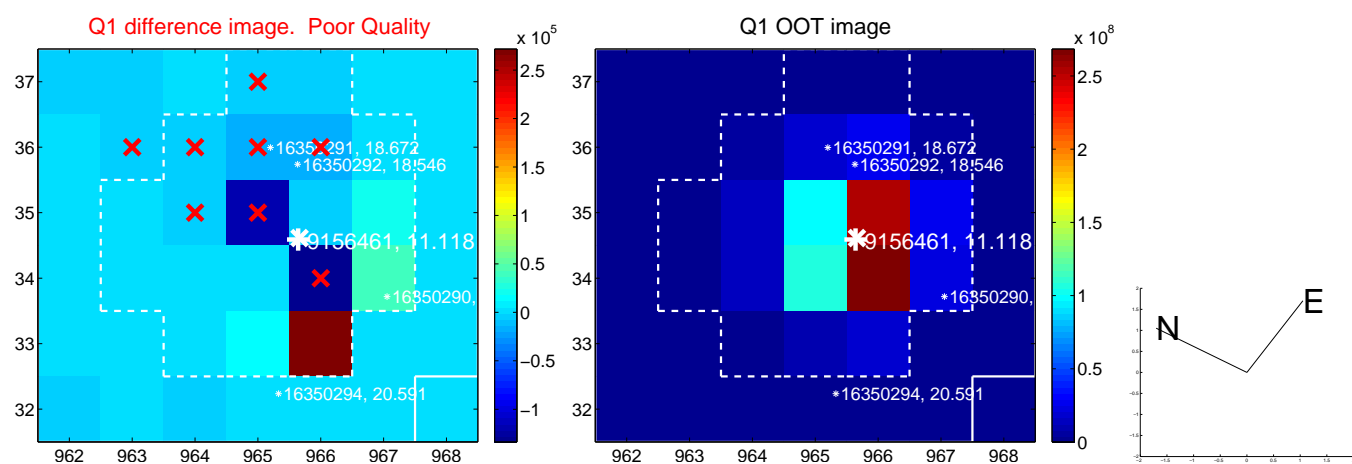


offset from photometric centroids

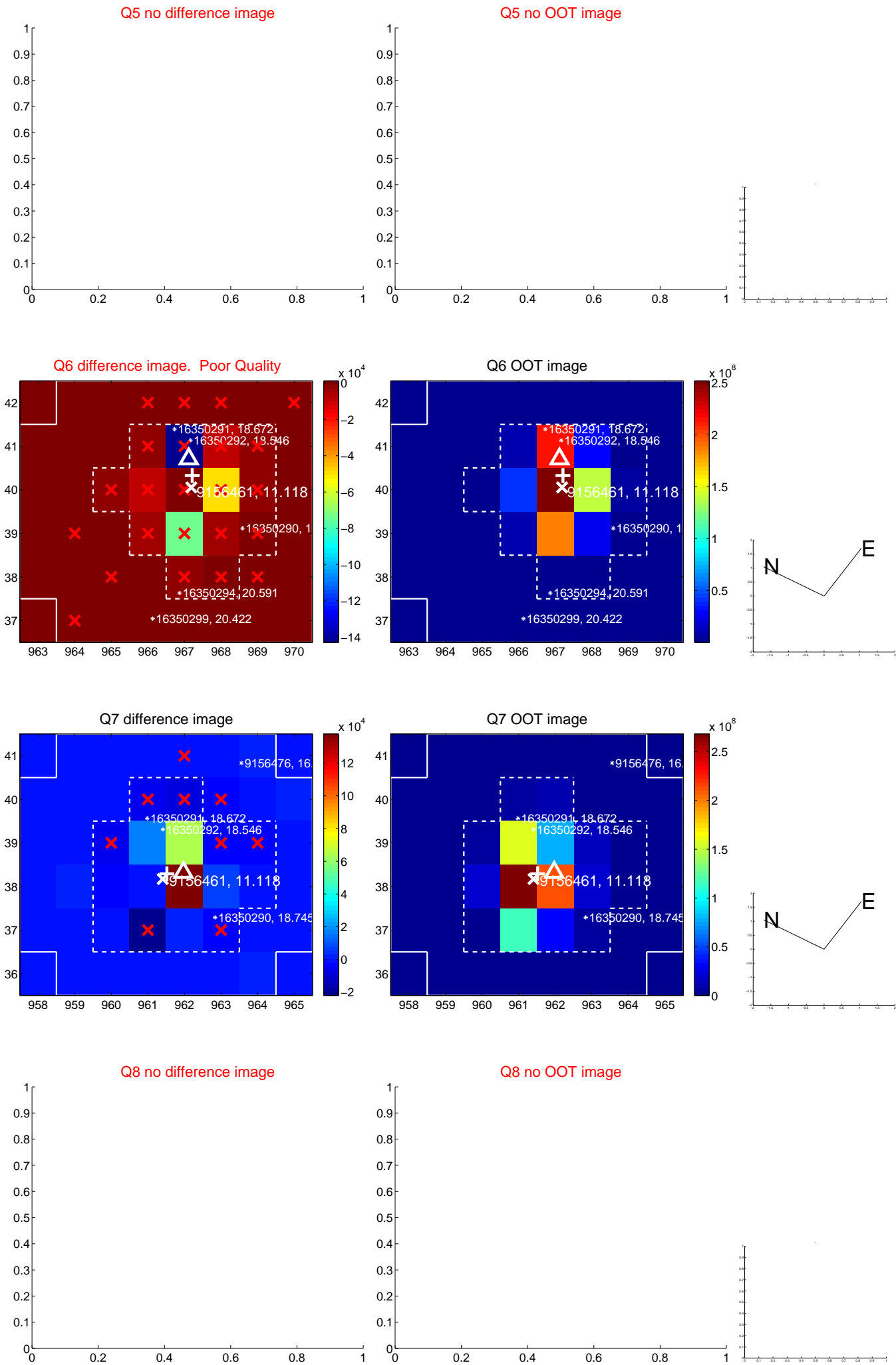


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

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

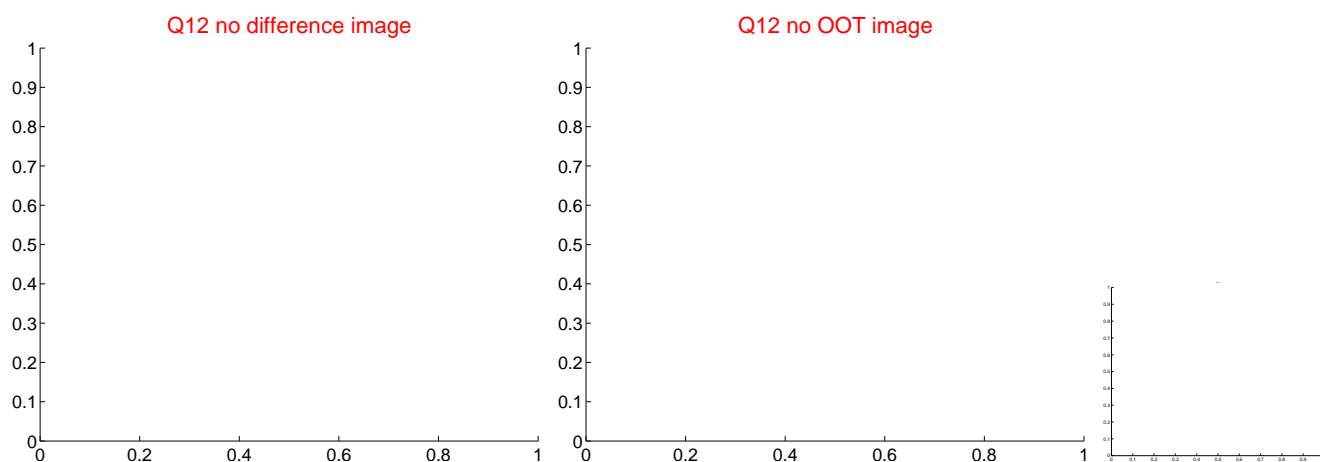
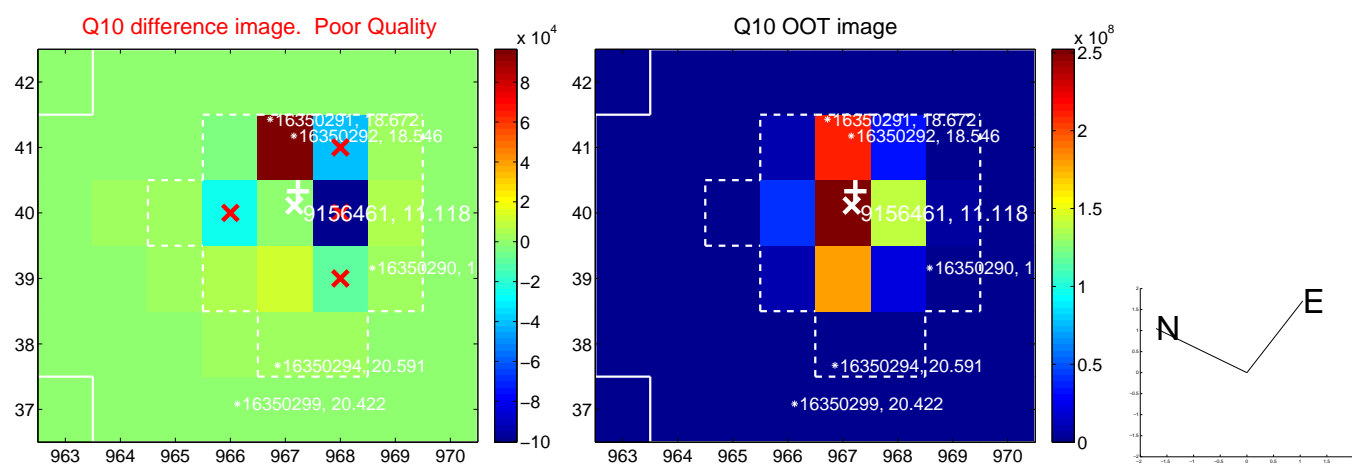
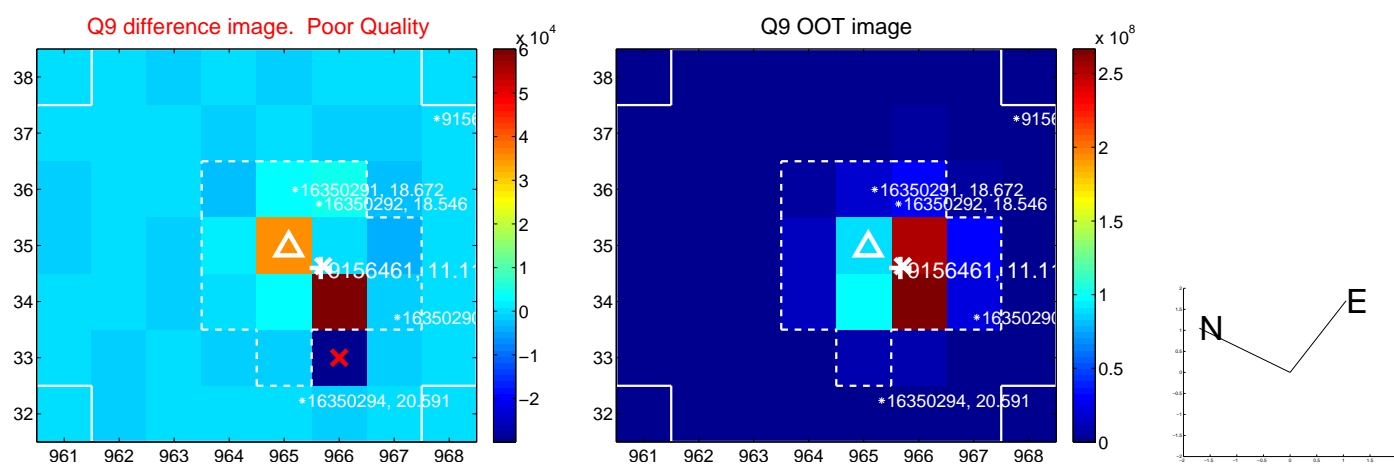


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

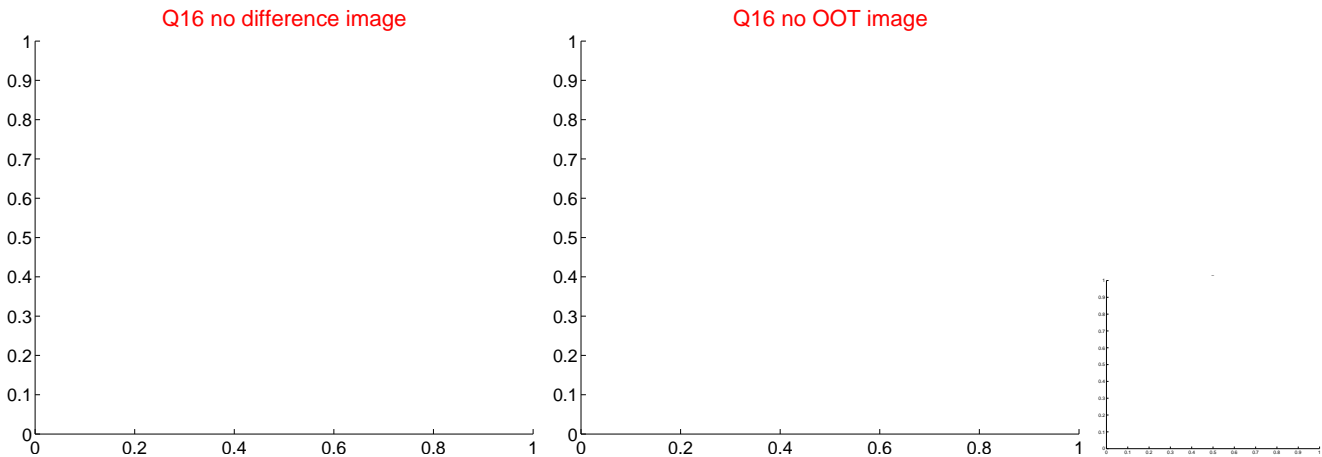
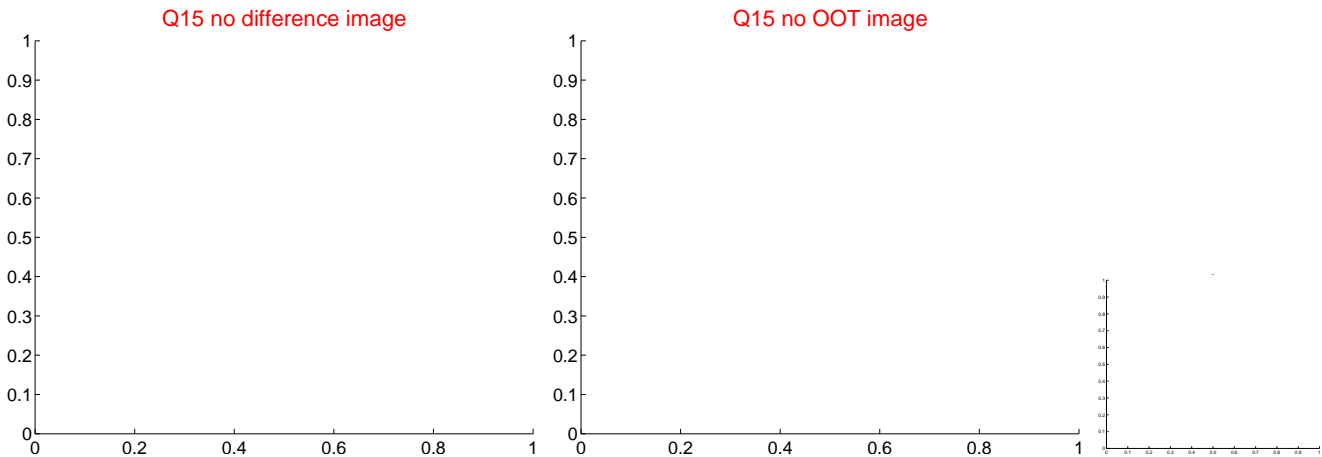
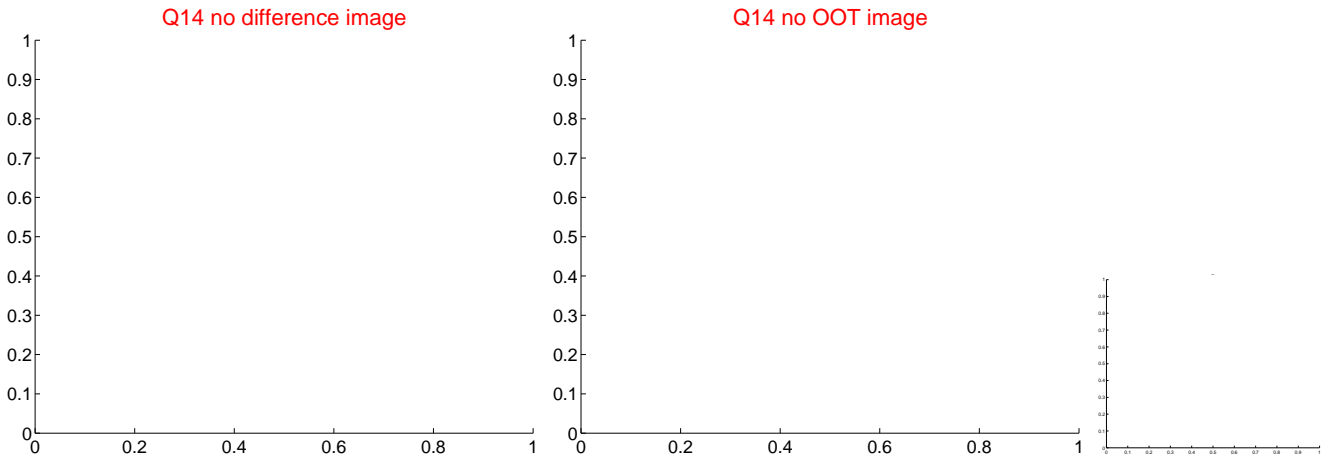
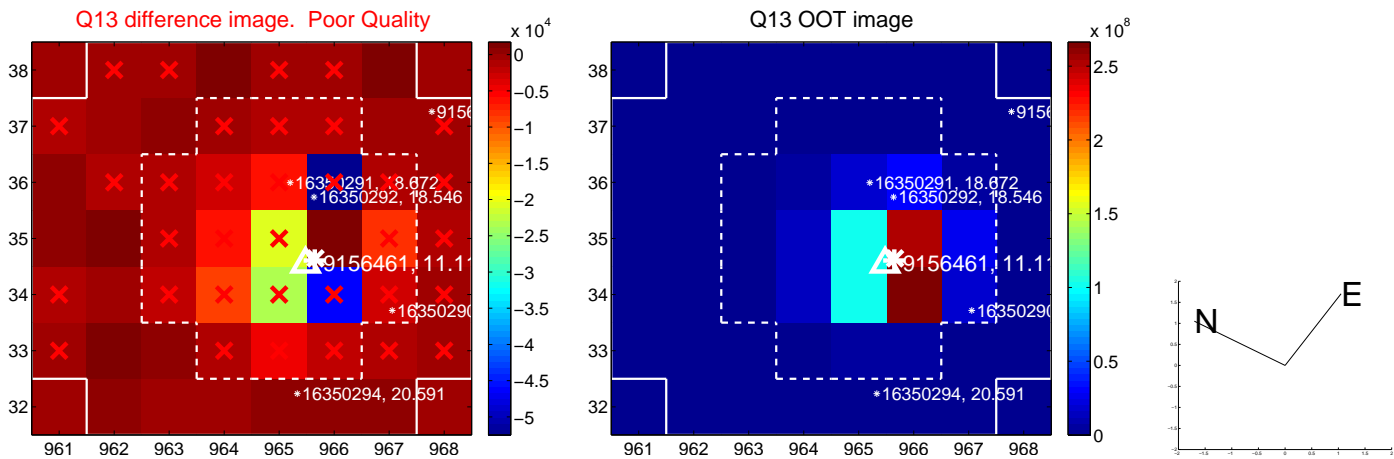




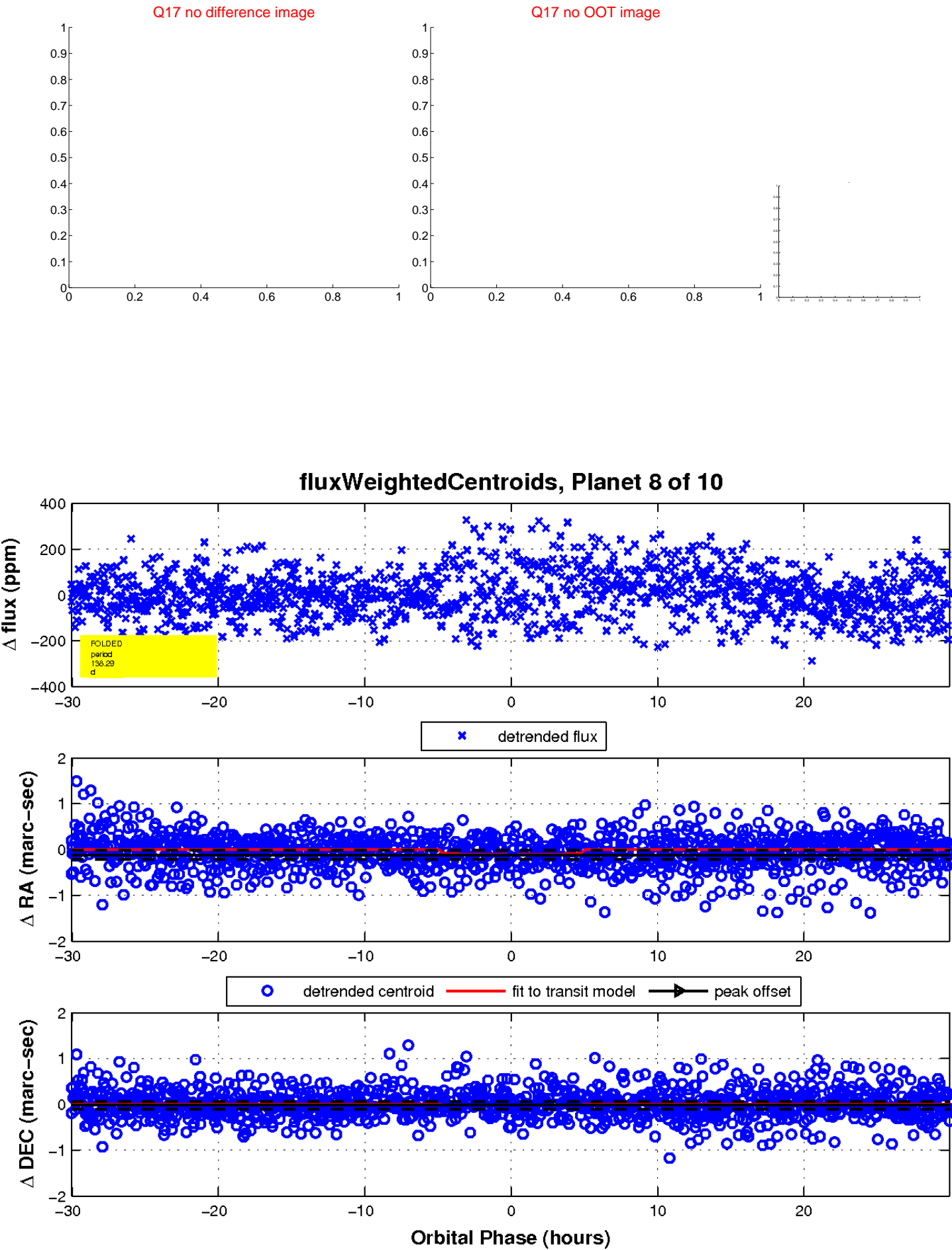
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value



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

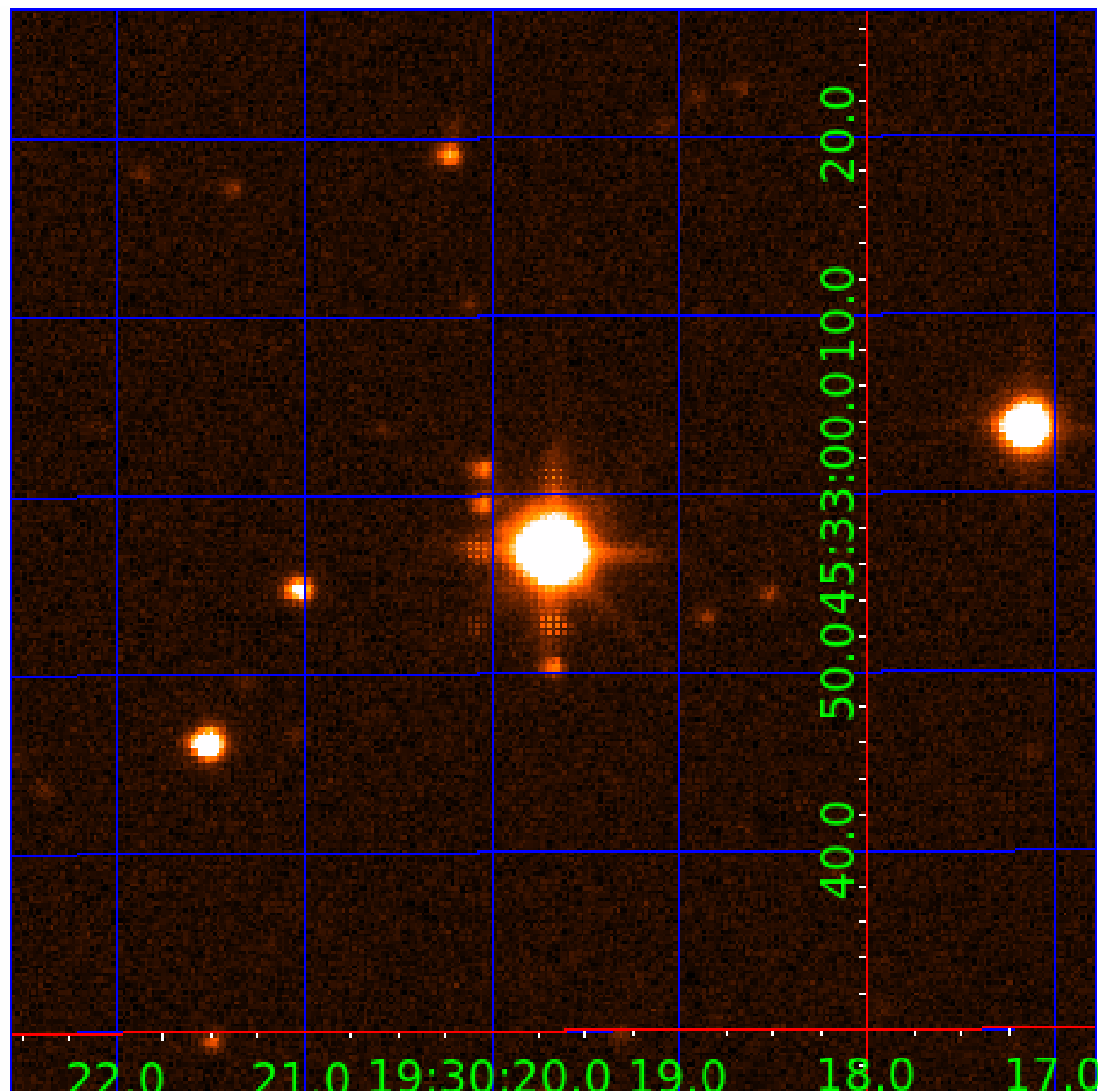


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 009156461

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009156461-01	OBS	No	2.296149	132.431446	4.2	10.825	8.7	2.7	1.82	6480	0.43	3717.29
009156461-02	OBS	No	208.639795	204.712221	146.7	5.006	9.0	9.5	1.82	6480	2.51	9.10
009156461-03	OBS	No	296.023030	308.965620	22.4	13.754	7.9	1.0	1.82	6480	0.97	5.71
009156461-04	OBS	No	27.813822	141.128479	61.1	10.671	9.1	8.2	1.82	6480	1.55	133.62
009156461-05	OBS	No	77.564421	198.190936	103.7	8.284	8.5	7.9	1.82	6480	2.09	34.04
009156461-06	OBS	No	337.753157	364.928677	153.2	3.194	8.2	8.4	1.82	6480	2.65	4.79
009156461-08	OBS	No	138.291040	142.658043	108.4	10.011	8.3	6.9	1.82	6480	2.05	15.75
009156461-09	OBS	No	129.035096	161.225143	92.7	6.643	8.0	6.8	1.82	6480	2.33	17.27
009156461-10	OBS	No	110.241909	238.739506	55.7	3.500	7.6	-1.0	1.82	6480	1.37	21.30

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009156461-01	OBS	FP	0.00	1	0	0	0	SWEET_NTL—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—CENT_SATURATED
009156461-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_CHASES_MARSHALL—TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_SATURATED
009156461-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_TRACKER—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_SATURATED
009156461-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_ZUMA—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
009156461-05	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—CENT_SATURATED—HALO_GHOST
009156461-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
009156461-08	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—INCONSISTENT_TRANS—CENT_SATURATED
009156461-09	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_CHASES—TRANS_GAPPED—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
009156461-10	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED

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

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

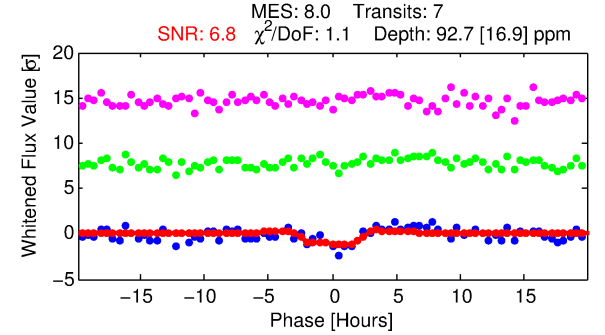
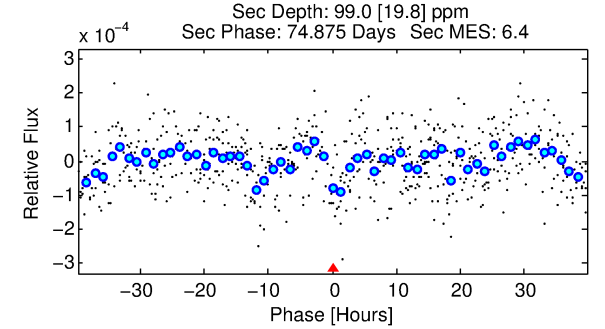
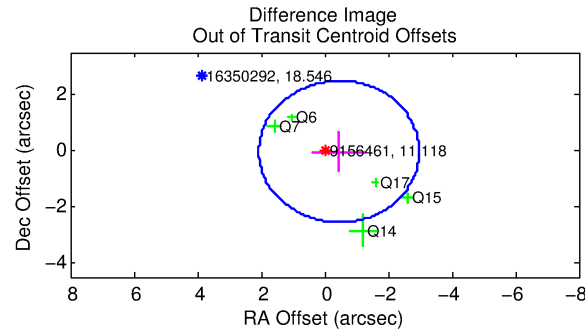
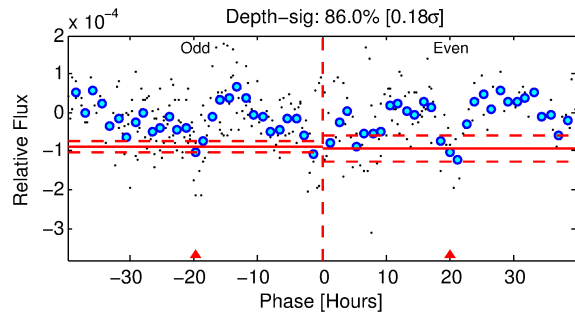
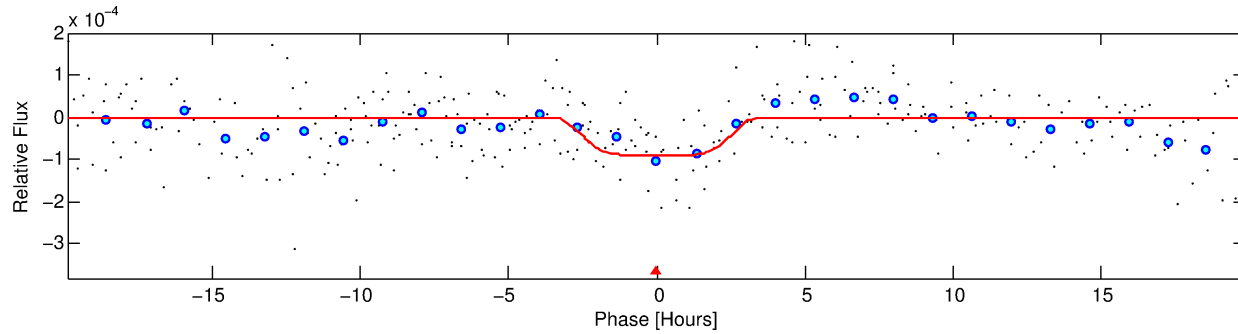
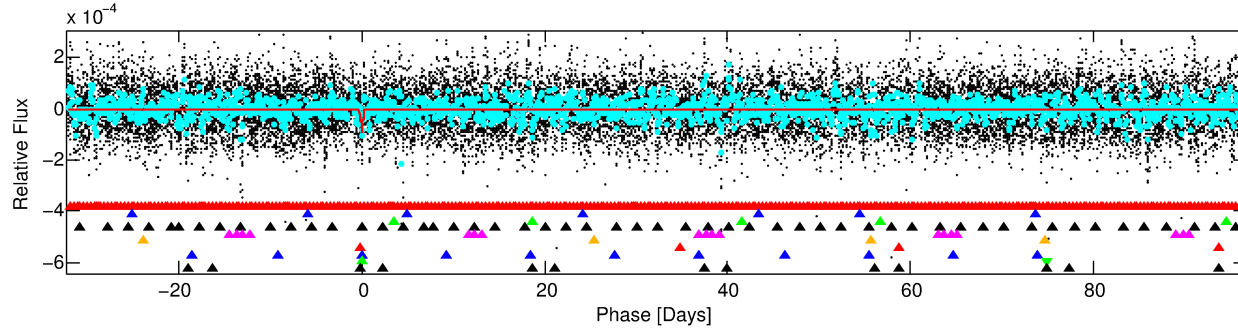
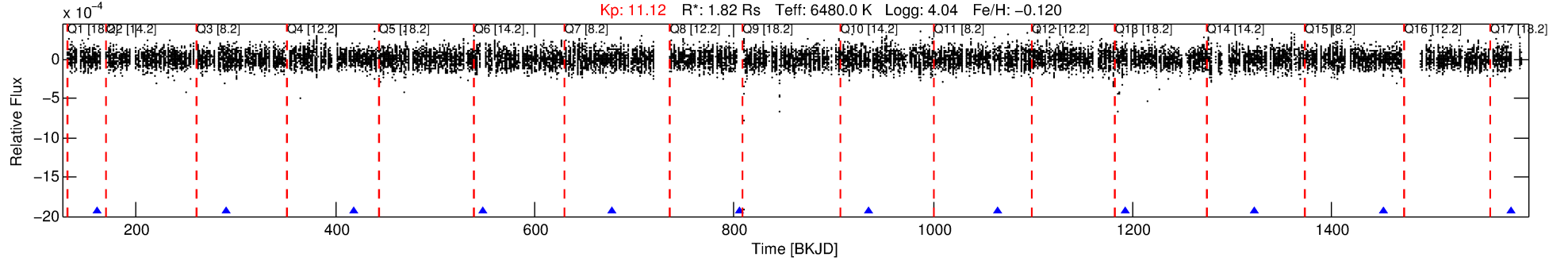
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 009156461-09

No Significant Match Found

# DV One-Page Summary

KIC: 9156461 Candidate: 9 of 10 Period: 129.035 d



## DV Fit Results:

Period = 129.03510 [0.00231] d  
Epoch = 161.2251 [0.0175] BKJD  
Rp/R\* = 0.0117 [0.0014]  
a/R\* = 36.81 [12.53]  
b = 0.98 [0.01]  
Seff = 17.27 [9.11]  
Teq = 520 [69] K  
Rp = 2.33 [0.84] Re  
a = 0.5511 [0.1765] AU  
Ag = 3039.07 [1799.39] [1.69 $\sigma$ ]  
Teffp = 5967 [517] K [10.44 $\sigma$ ]

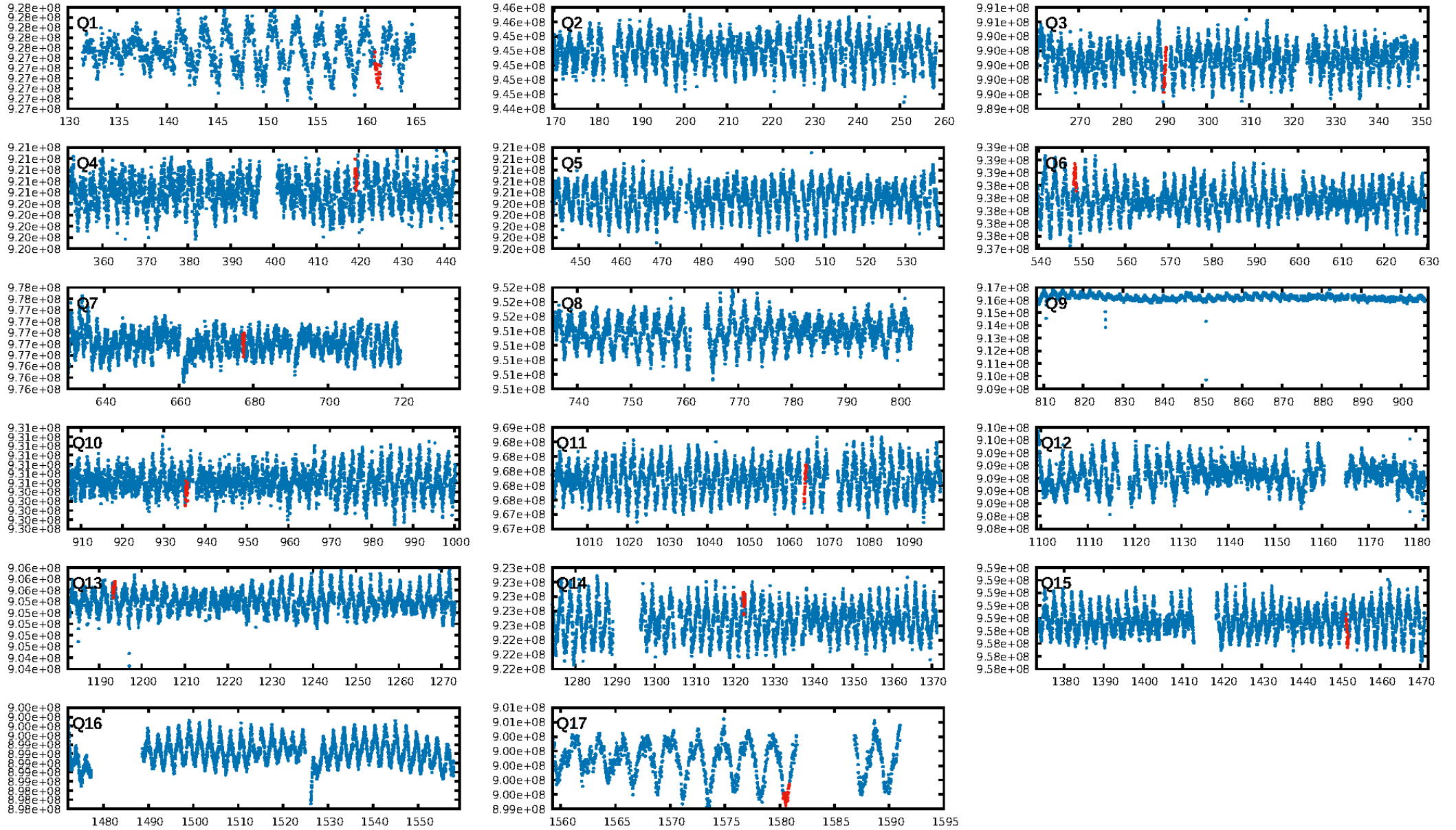
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [60.07 $\sigma$ ]  
LongPeriod-sig: 100.0% [18.49 $\sigma$ ]  
ModelChiSquare2-sig: 54.3%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [5/5]  
GhostDiagnostic-chr: -2.929  
Centroid-sig: 26.8%  
Centroid-so: 0.830 arcsec [0.91 $\sigma$ ]  
OotOffset-rm: 0.454 arcsec [0.54 $\sigma$ ]  
KicOffset-rm: 0.095 arcsec [0.11 $\sigma$ ]  
OotOffset-st: 2/2/0/1 [5]  
KicOffset-st: 2/2/0/1 [5]  
DiffImageQuality-fgm: 0.80 [4/5]  
DiffImageOverlap-fno: 0.12 [1/8]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 22:29:18 Z

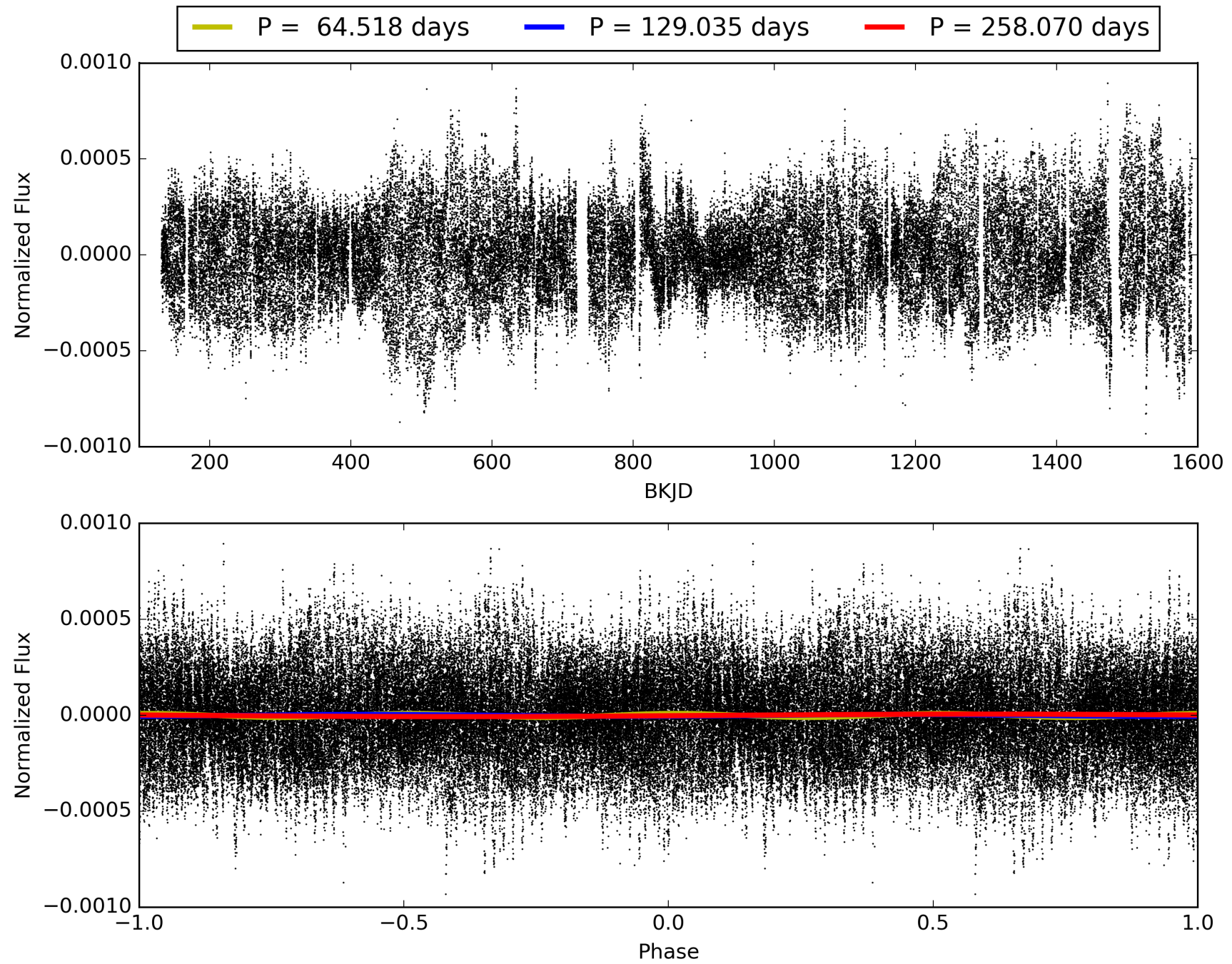
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 009156461-09, PDC Light Curves





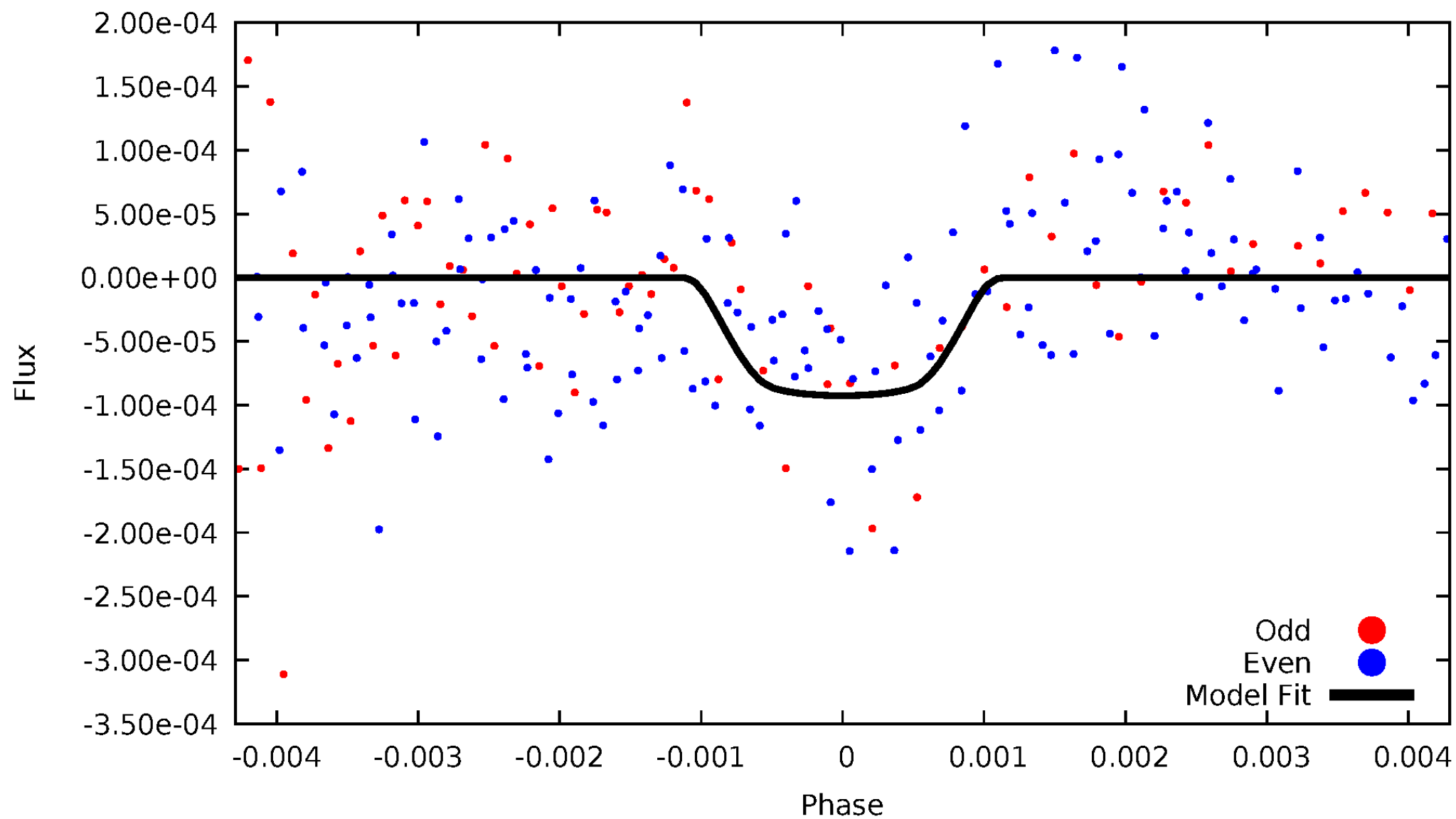
TCE 009156461-09





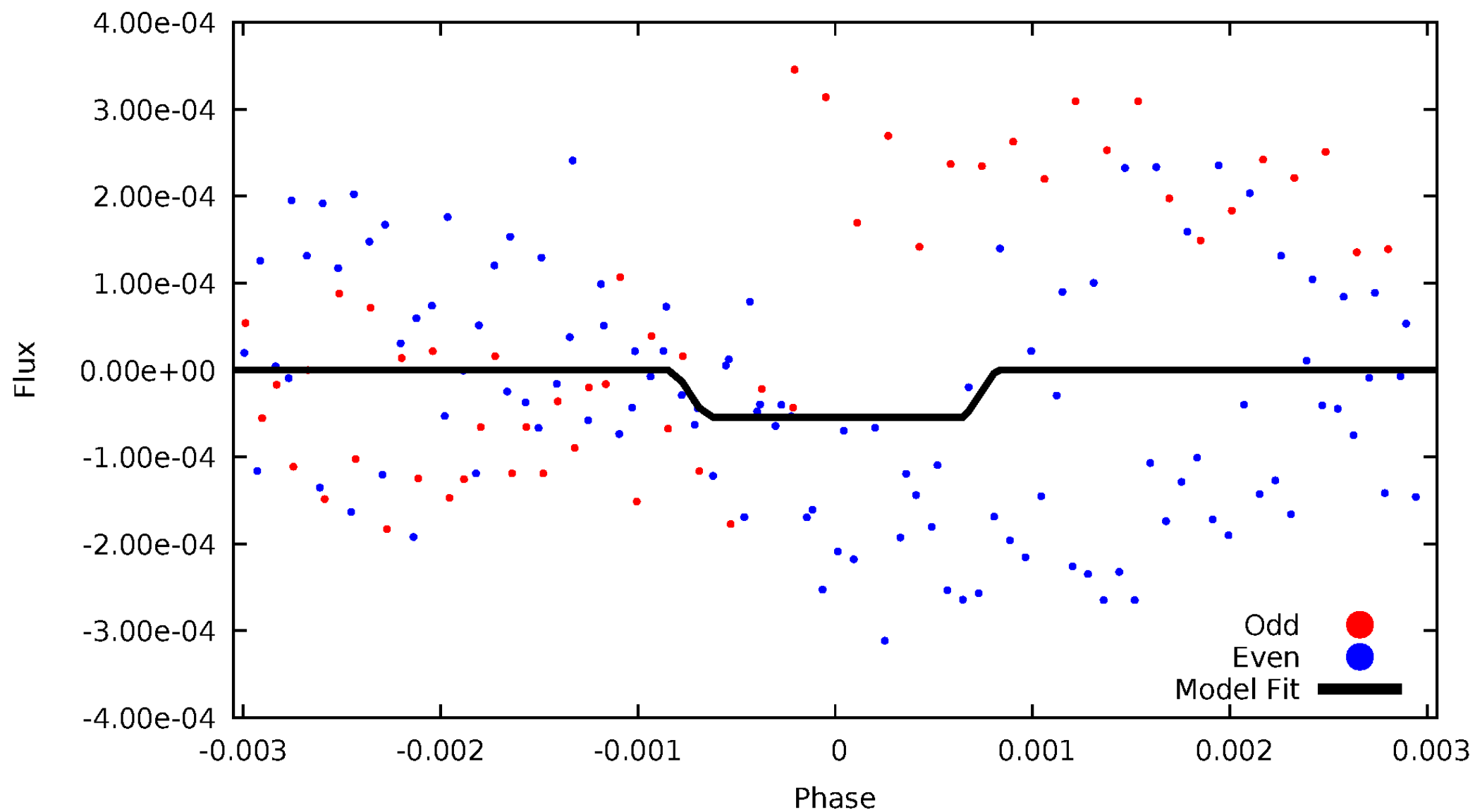
# DV Odd/Even

TCE 009156461-09

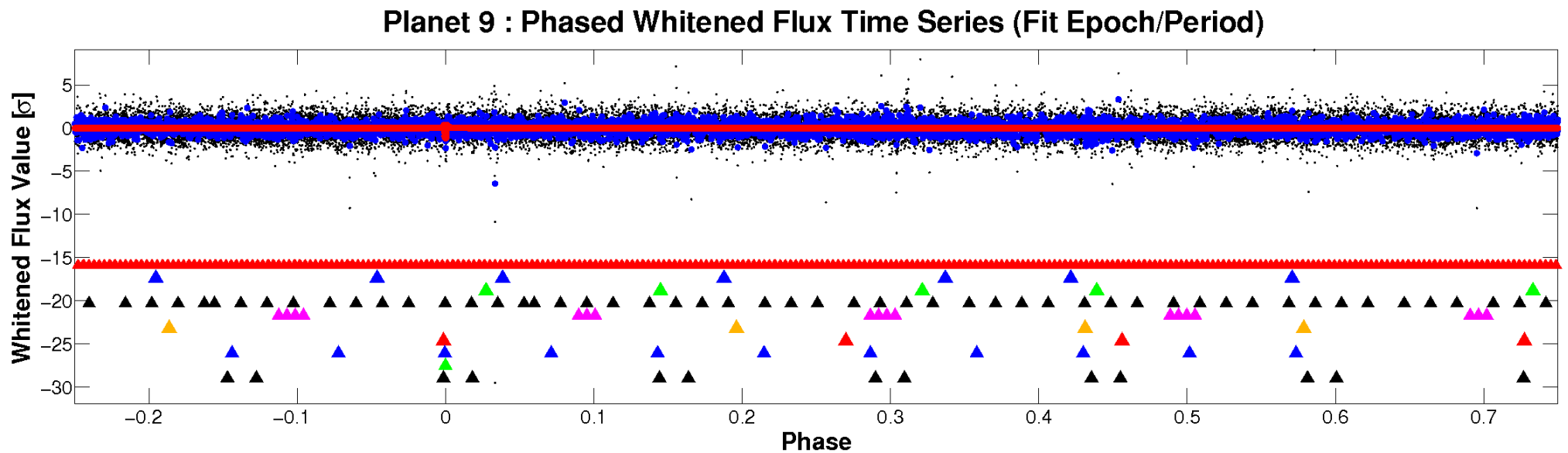
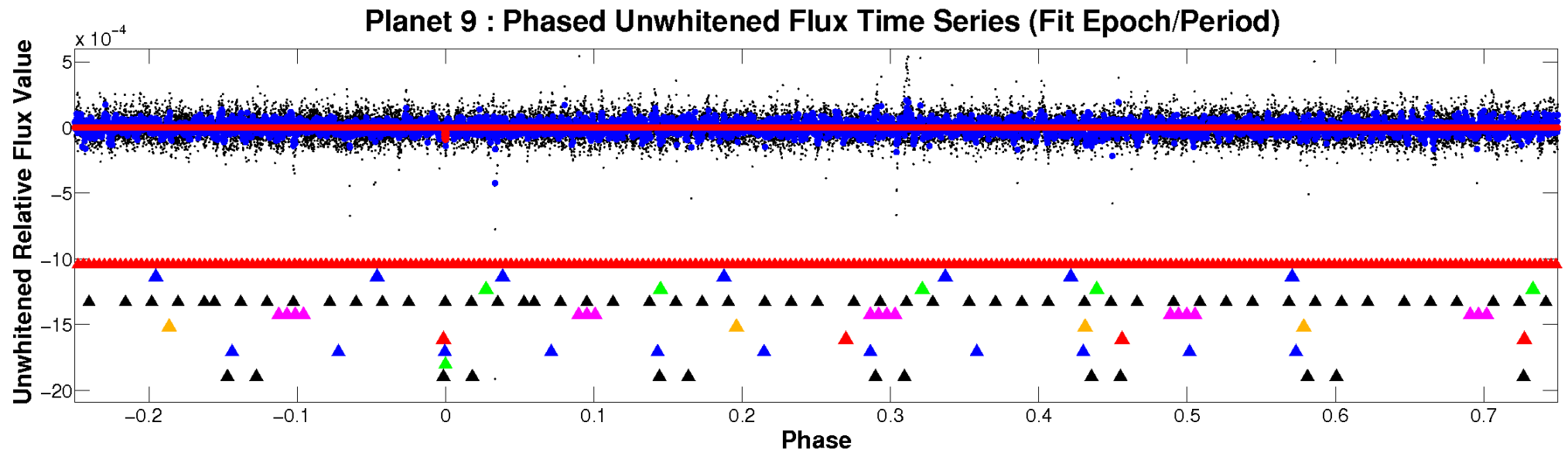


# ALT Odd/Even

TCE 009156461-09

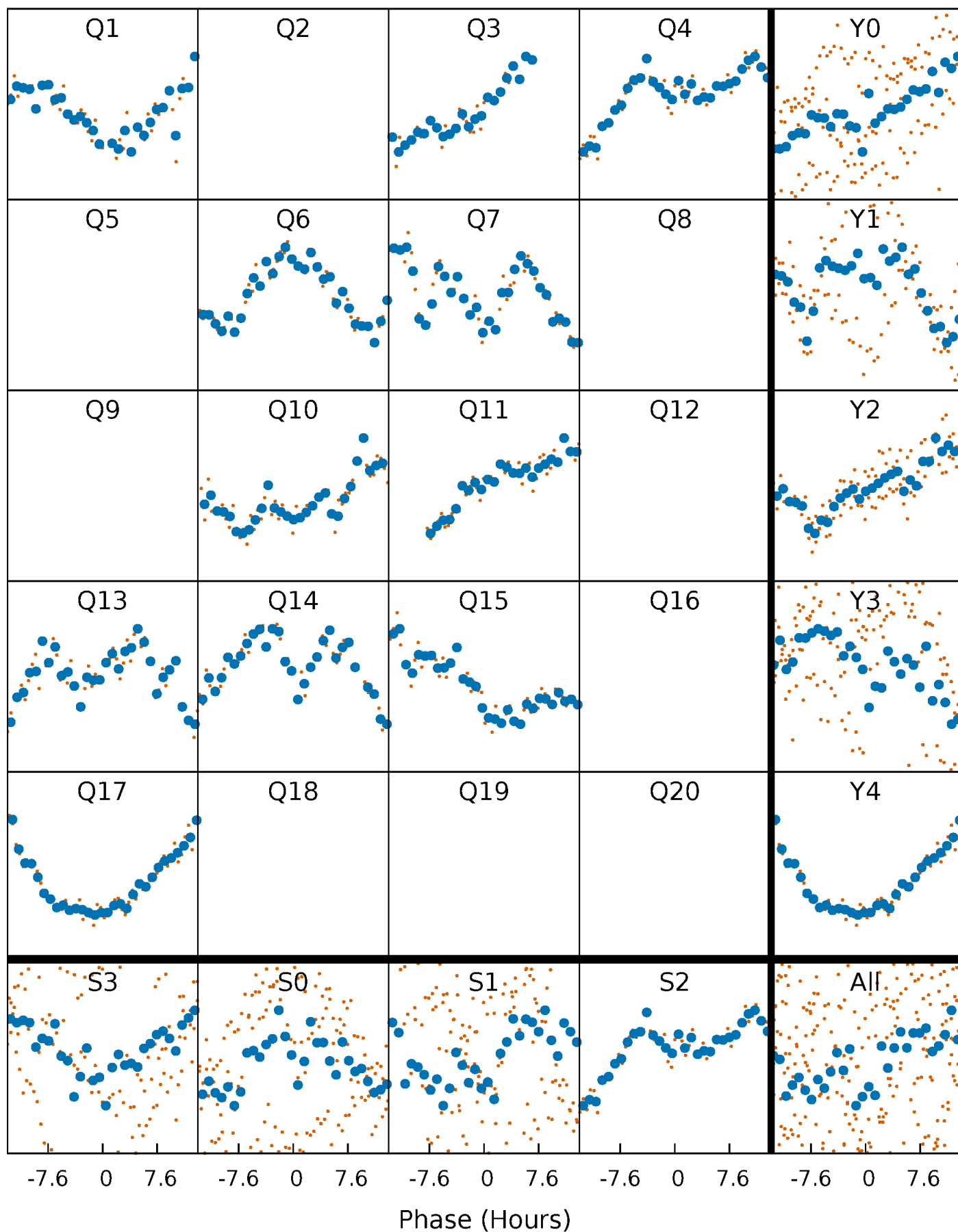


# Non-Whitened Vs. Whitened Light Curve



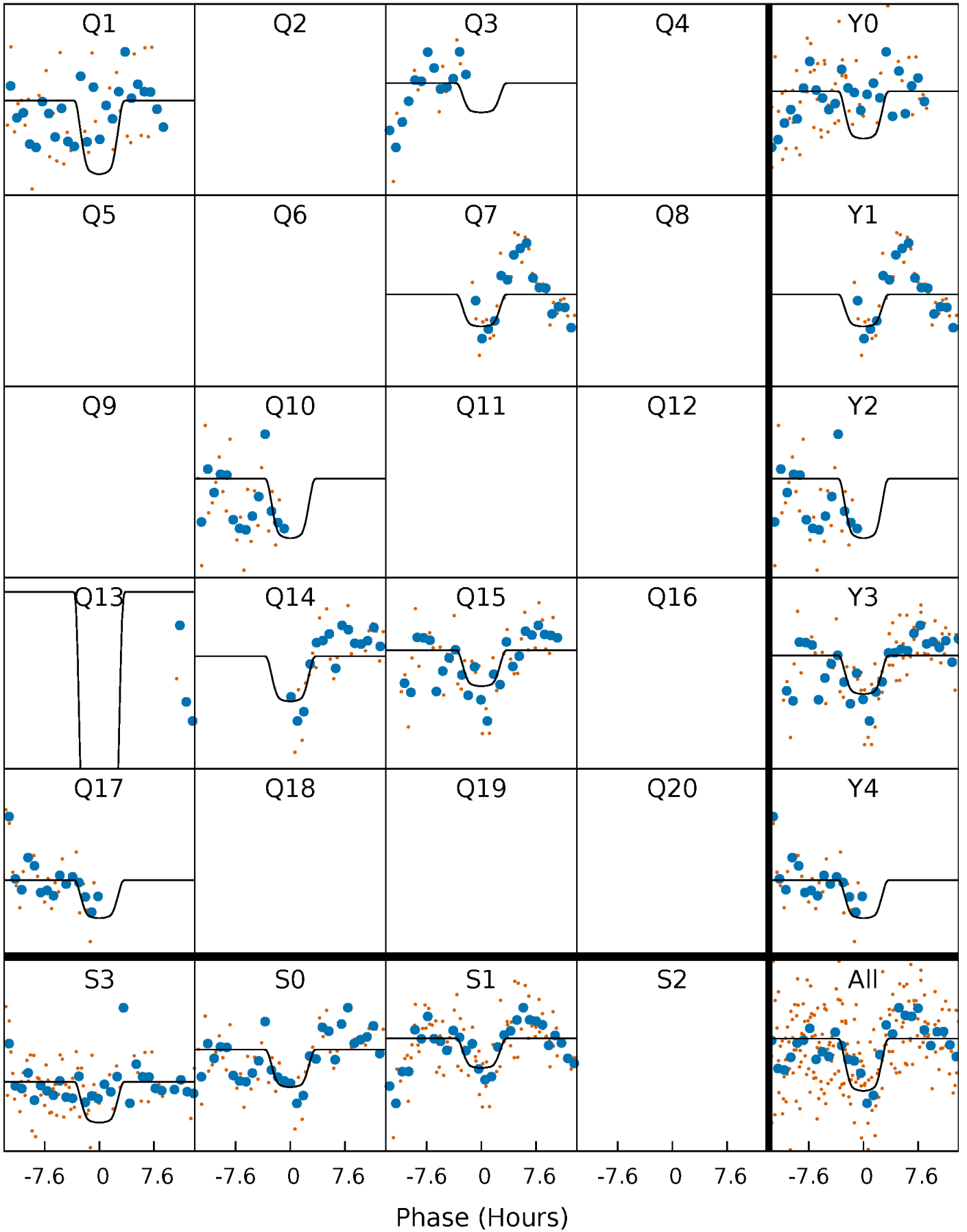
# PDC Quarter-Phased Transit Curves

TCE 009156461-09     $P=129.035097$  Days     $T_0=161.225143$  (BKJD)



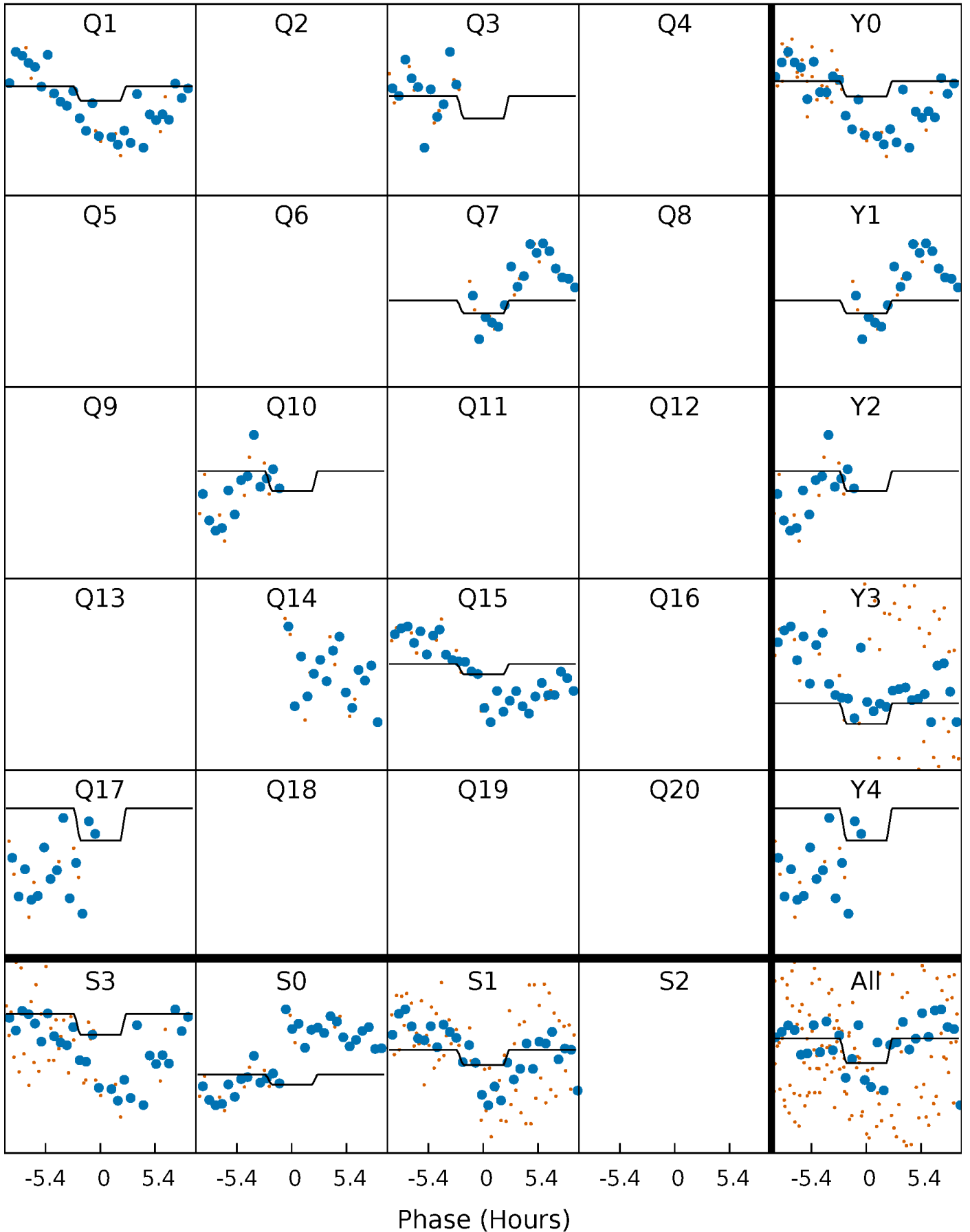
# DV Quarter-Phased Transit Curves

TCE 009156461-09   P=129.035097 Days    $T_0=161.225143$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

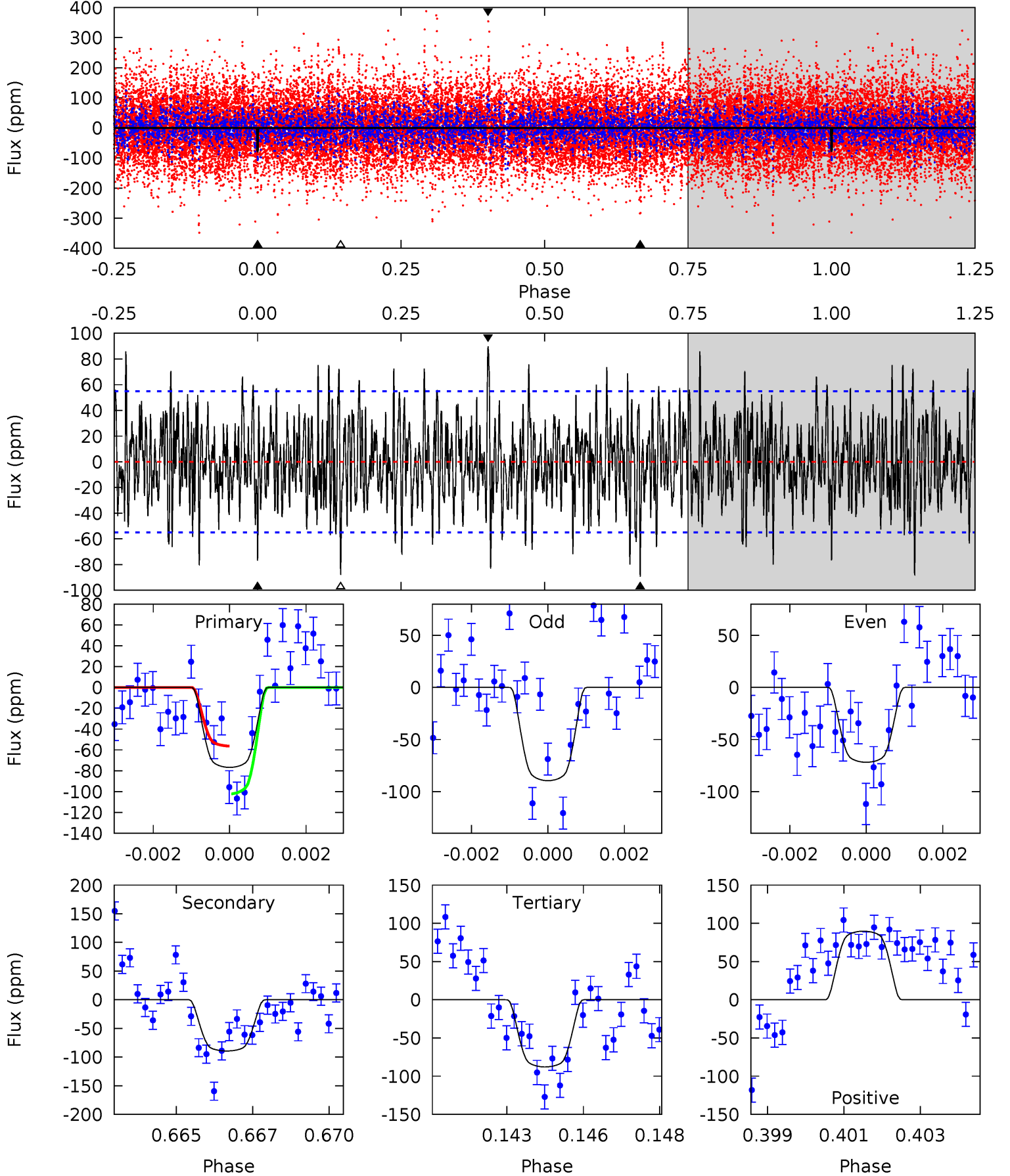
TCE 009156461-09     $P=129.036893$  Days     $T_0=161.221873$  (BKJD)



# DV Model-Shift Uniqueness Test

009156461-09, P = 129.035097 Days, E = 32.190046 Days

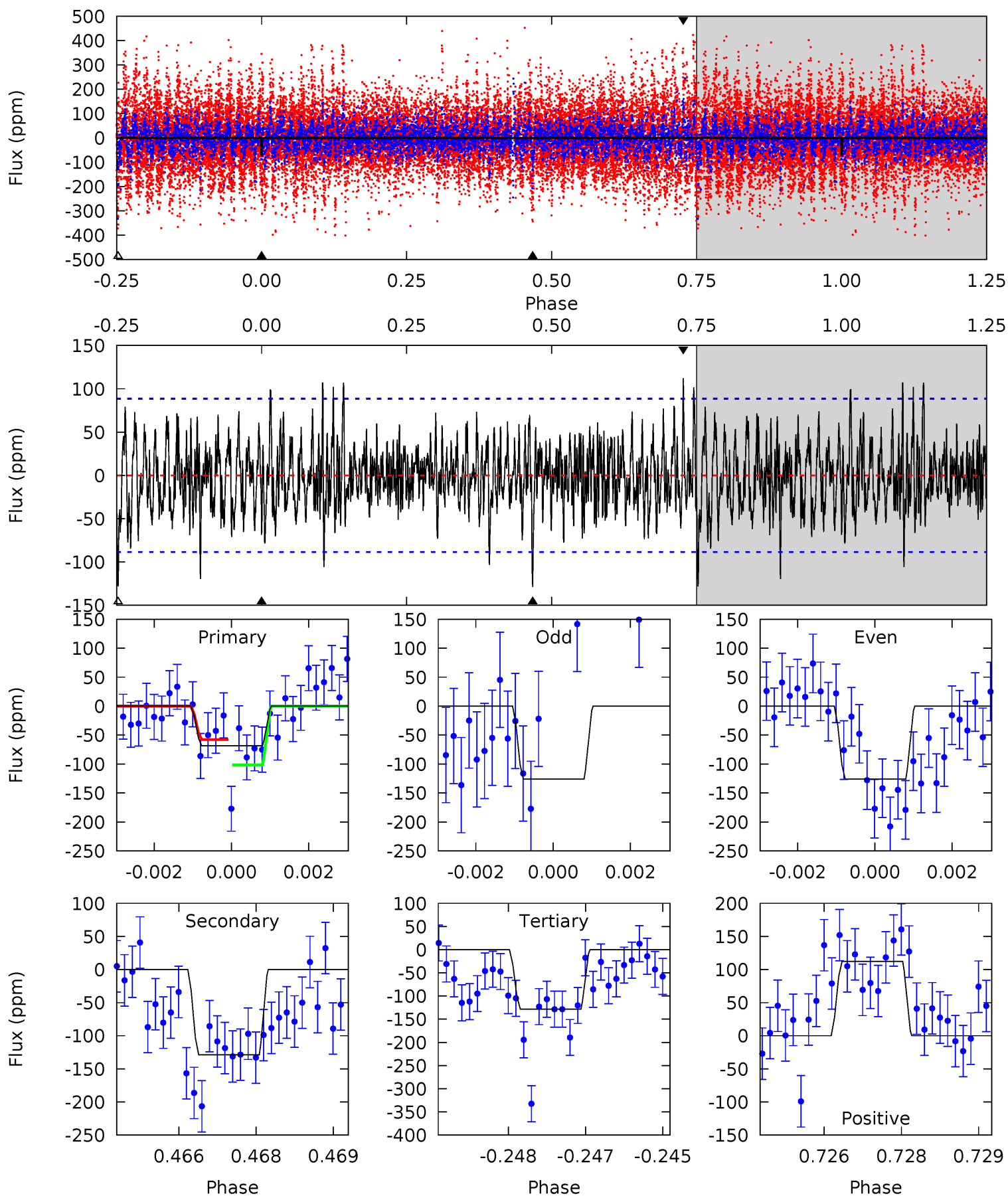
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
7.42	8.63	8.49	8.67	5.30	3.05	2.57	-1.07	-1.25	0.15	-0.03	0.77	0.71	0.50	2.21



# Alt Model-Shift Uniqueness Test

009156461-09, P = 129.036893 Days, E = 32.184980 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
4.16	7.80	7.77	6.81	5.37	3.15	1.99	-3.61	-2.64	0.03	1.00	0.01	0.57	0.47	0





### Stellar Parameters For KIC 009156461

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6480^{+181}_{-250}$	$4.044^{+0.293}_{-0.158}$	$-0.120^{+0.250}_{-0.300}$	$1.822^{+0.510}_{-0.623}$	$1.345^{+0.193}_{-0.289}$	$0.313^{+0.619}_{-0.139}$
	+3%/-4%	+7%/-4%	+208%/-250%	+28%/-34%	+14%/-21%	+198%/-44%
Source	PHO54	PHO54	PHO54	DSEP		

KIC = Kepler Input Catalog; PHO = Photometry; SPE = Spectroscopy; AST = Asteroseismology  
 TRA = Transits; DESP = Dartmouth Models; MULT = Multiple Models

### Secondary Eclipse Parameters for KIC 009156461-09 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-89 \pm 10$	$2.25^{+0.47}_{-0.46}$	$719^{+54}_{-67}$	$5806^{+469}_{-352}$	$2950^{+1481}_{-926}$
Alt.	$-129 \pm 16$	$1.41^{+0.39}_{-0.35}$	$713^{+62}_{-65}$	$8297^{+1262}_{-987}$	$10799^{+8268}_{-4133}$

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

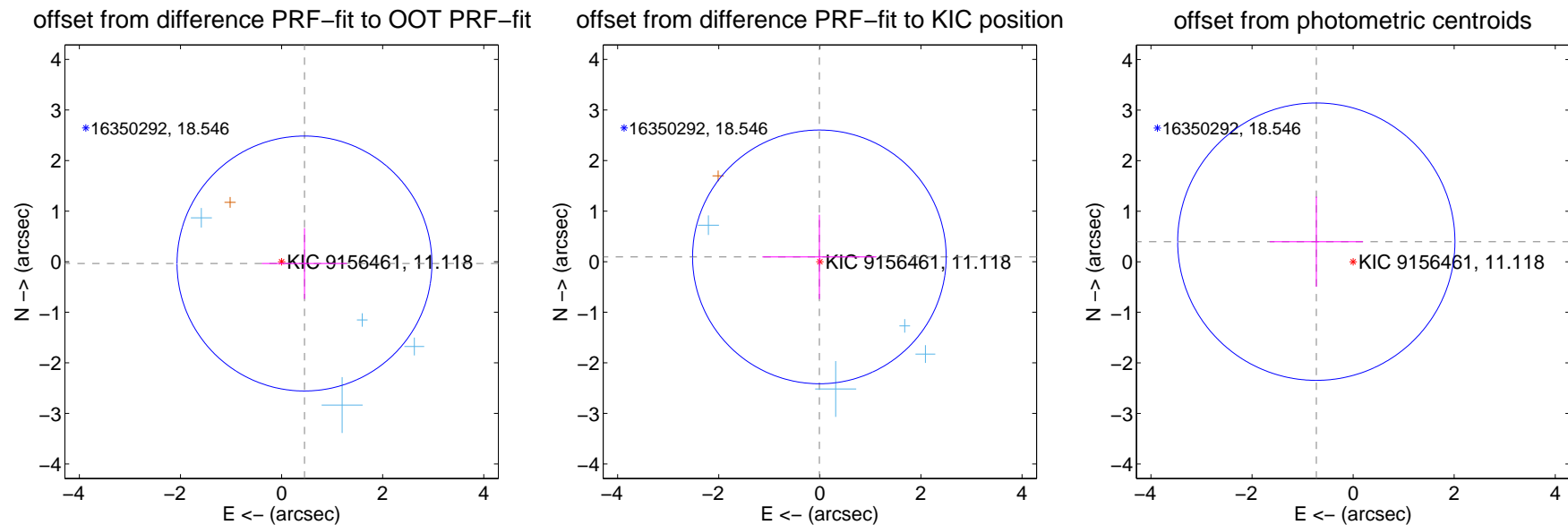
## DV Centroid Data

Supplemental centroid analysis for 009156461-09. **Kepler magnitude: 11.12.** Transit SNR 6.80

There are 4 quarters with good PRF difference image offsets

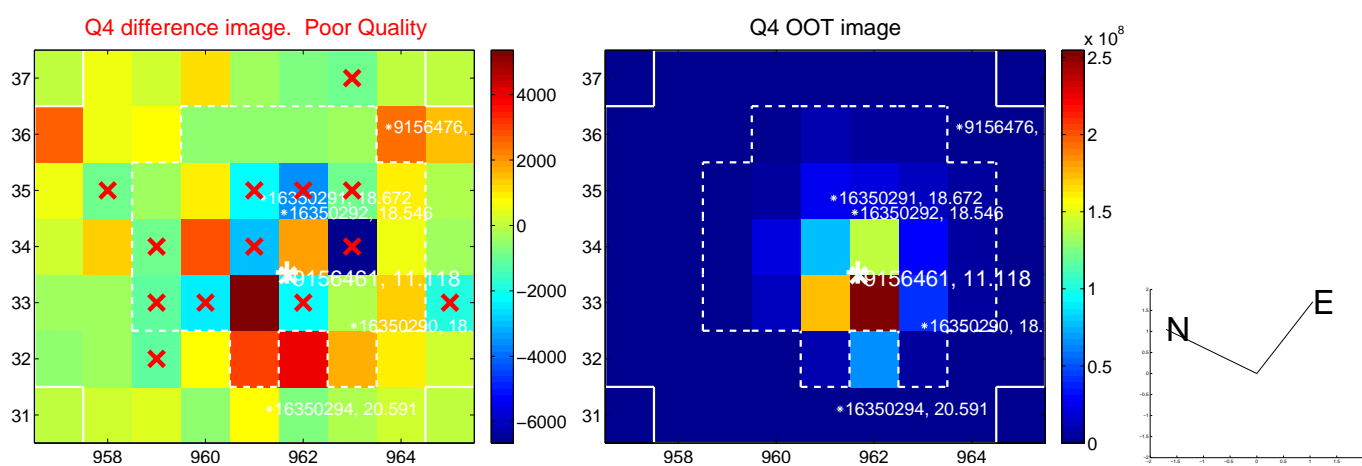
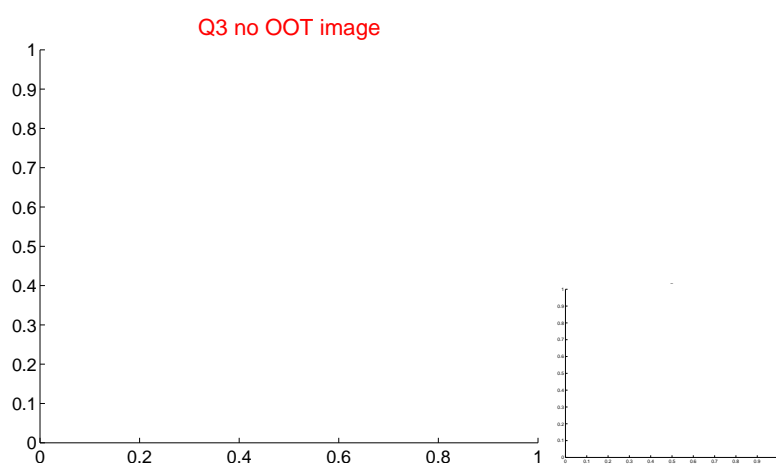
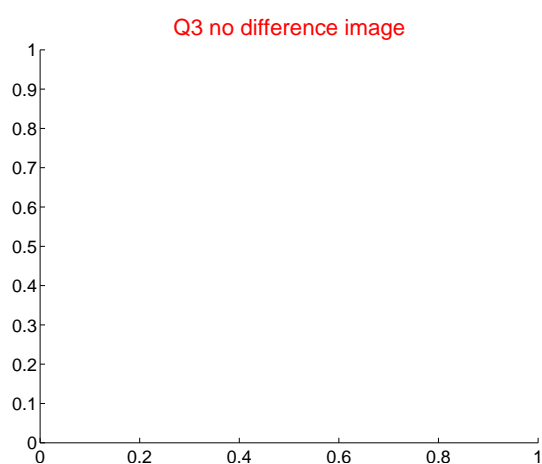
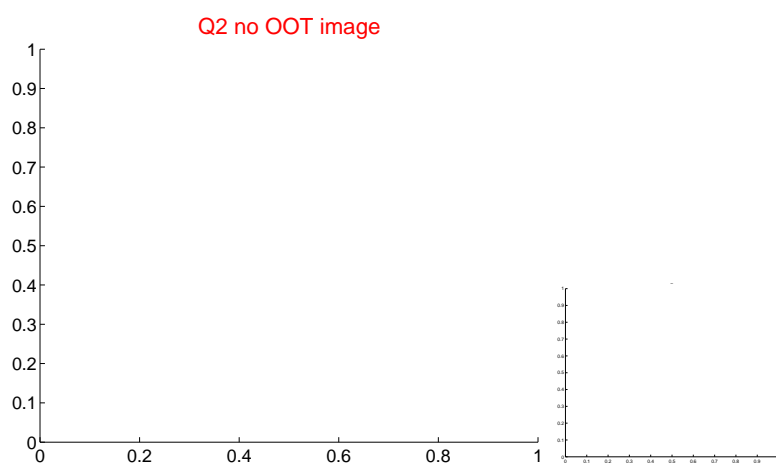
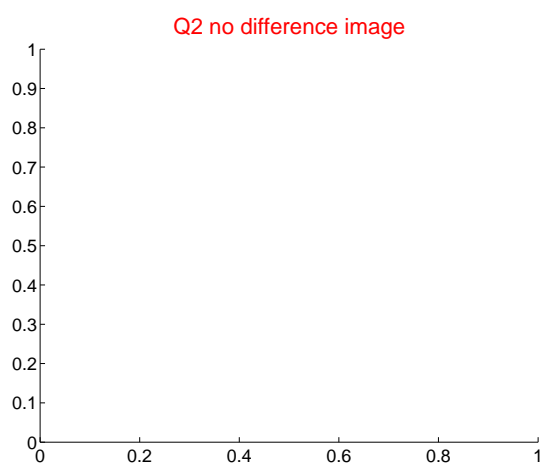
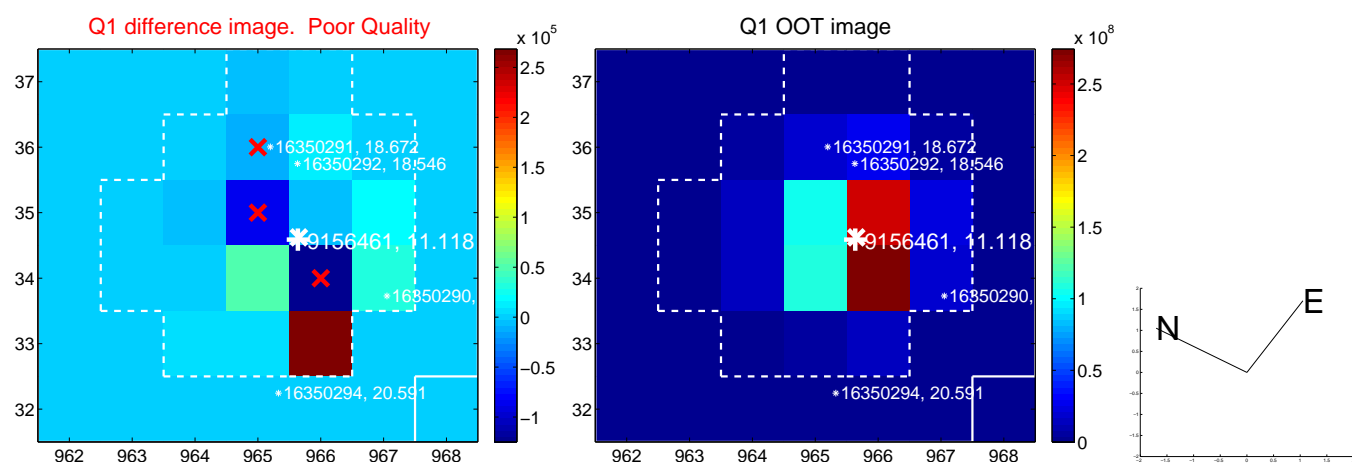
The direct PRF centroid is offset from the target star catalog position by about 0.14 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.454 \pm 0.840$	0.54	$-0.453 \pm 0.841$	$-0.036 \pm 0.701$
PRF-fit source offset from KIC position	$0.095 \pm 0.836$	0.11	$0.009 \pm 1.128$	$0.095 \pm 0.833$
photometric centroid source offset	$0.83 \pm 0.91$	0.91	$0.73 \pm 0.92$	$0.40 \pm 0.89$

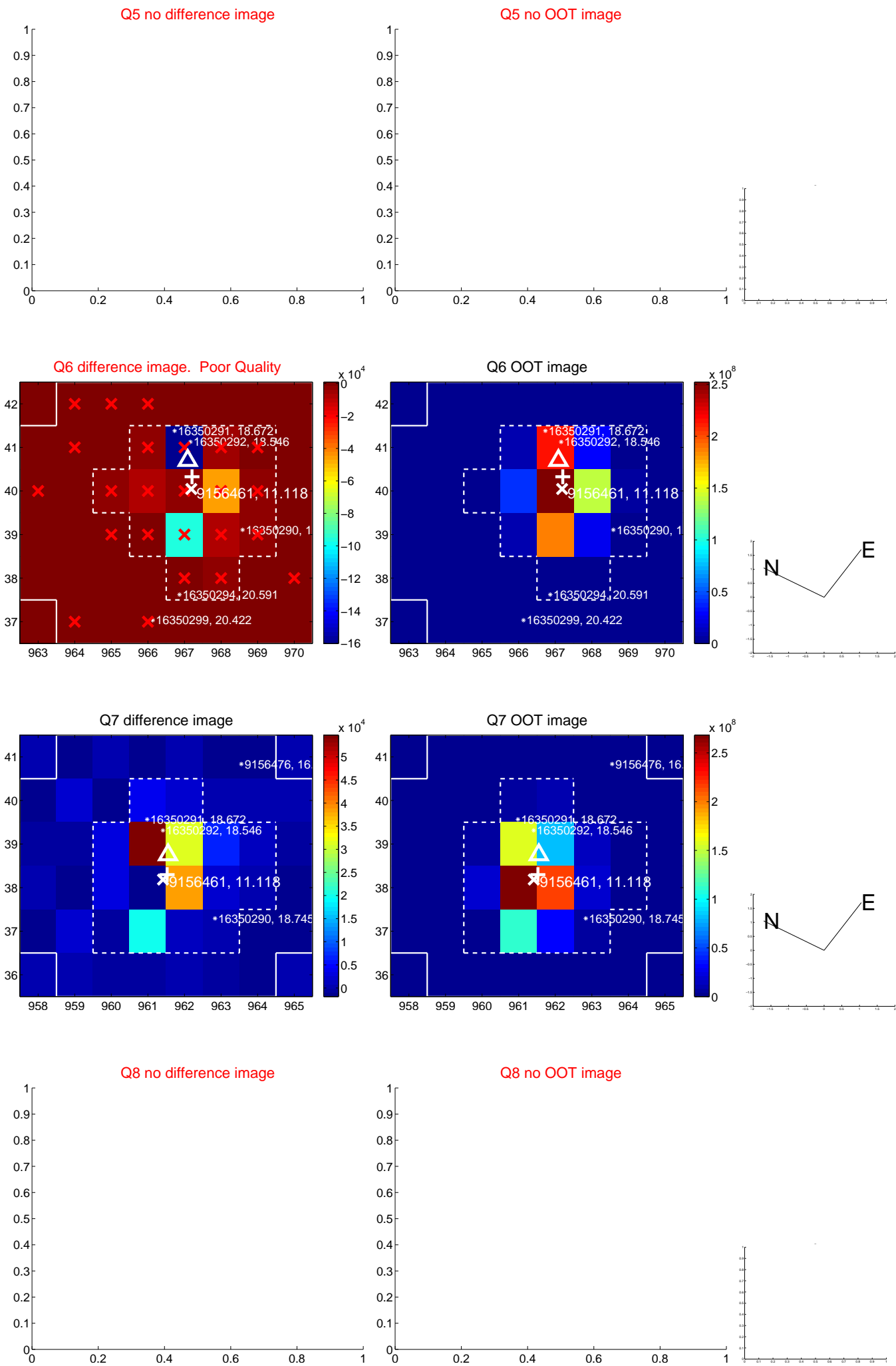


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

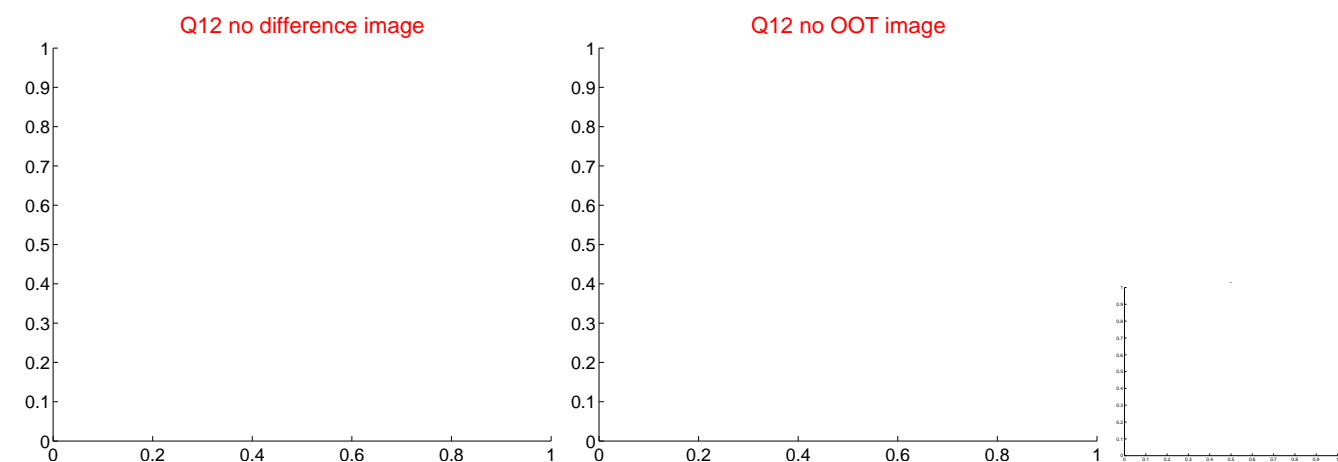
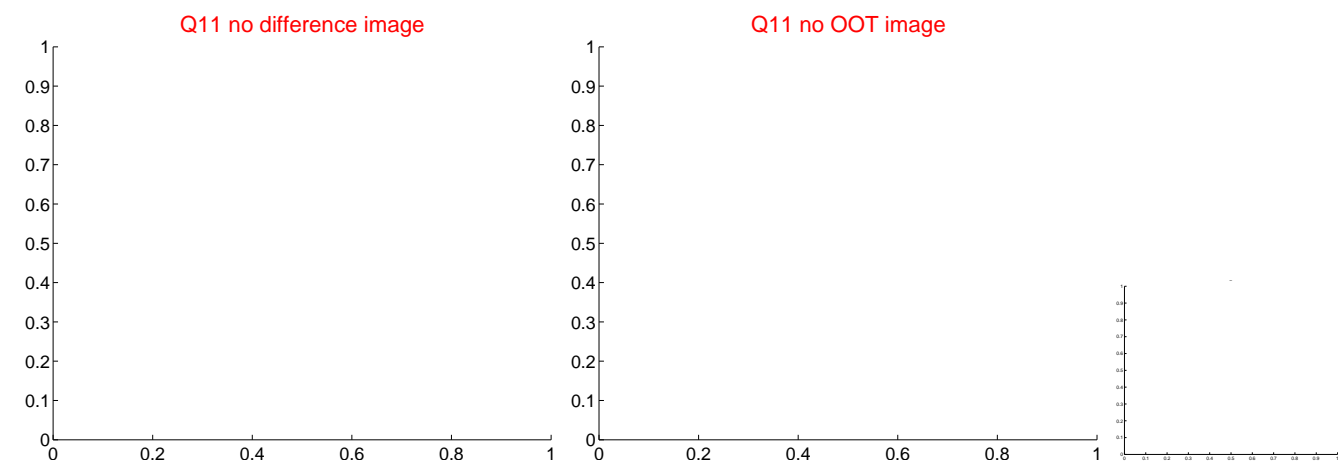
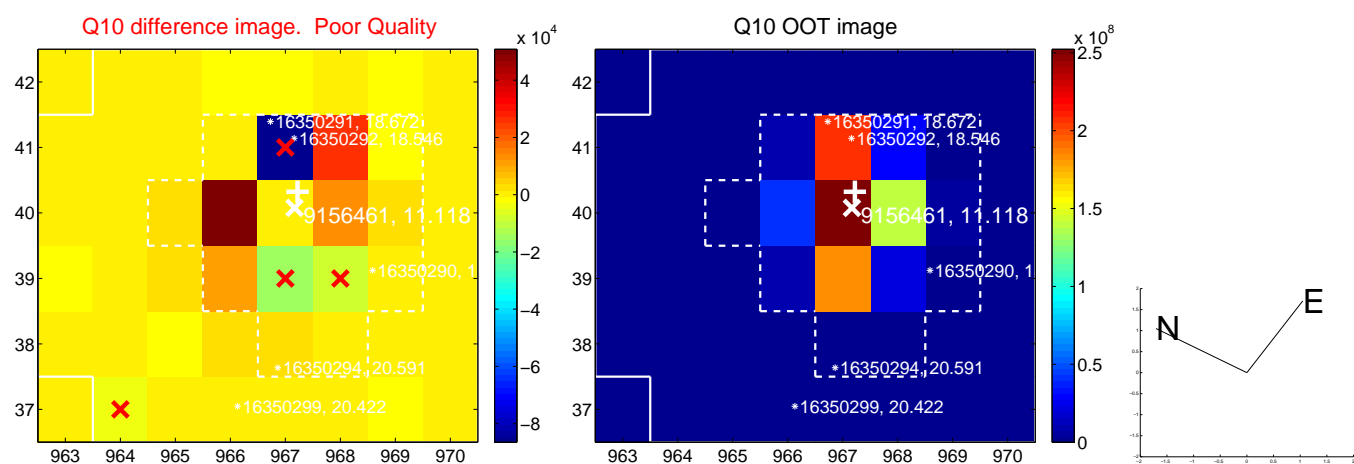
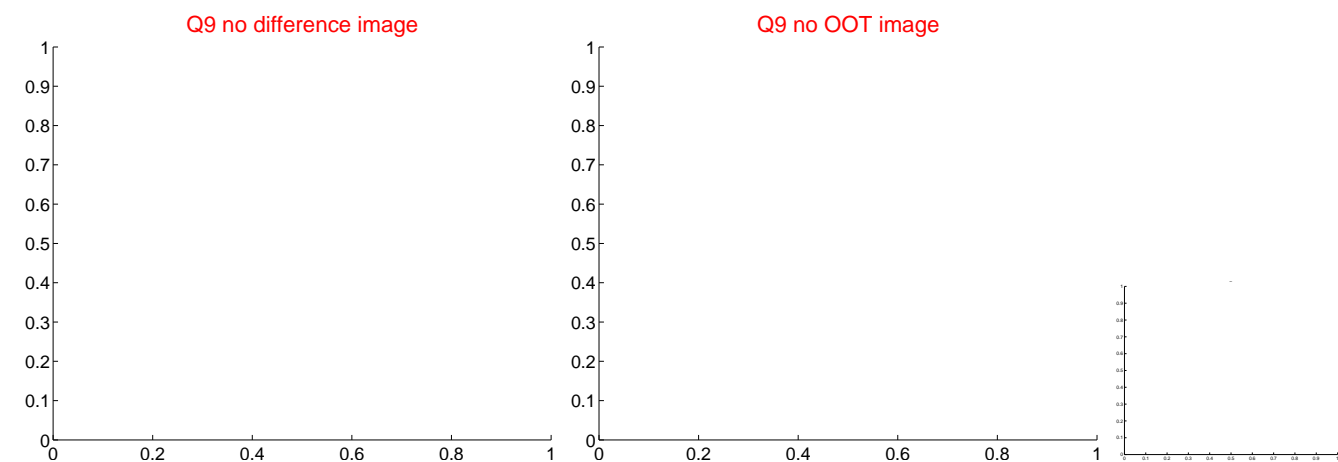
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value



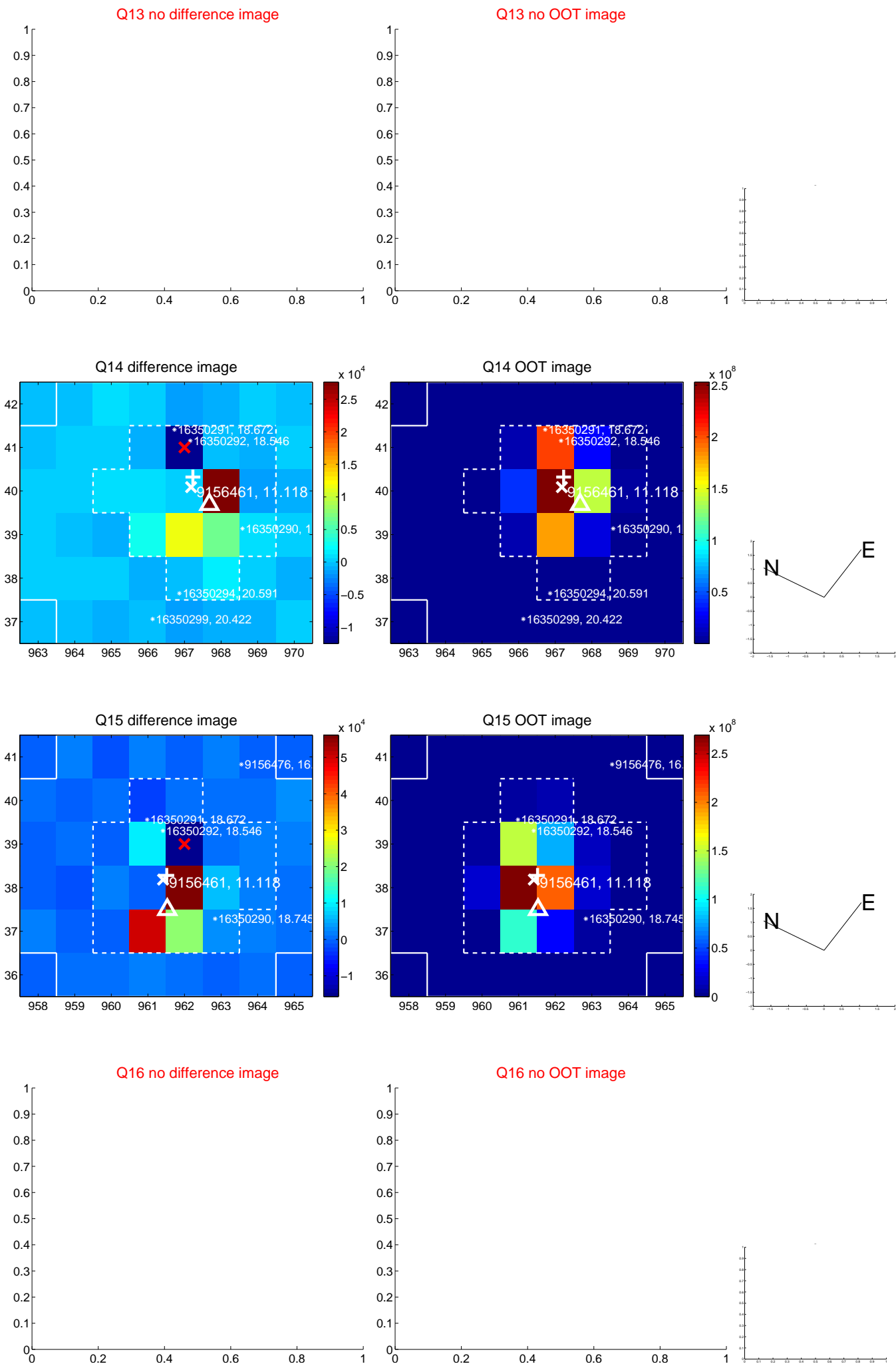
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



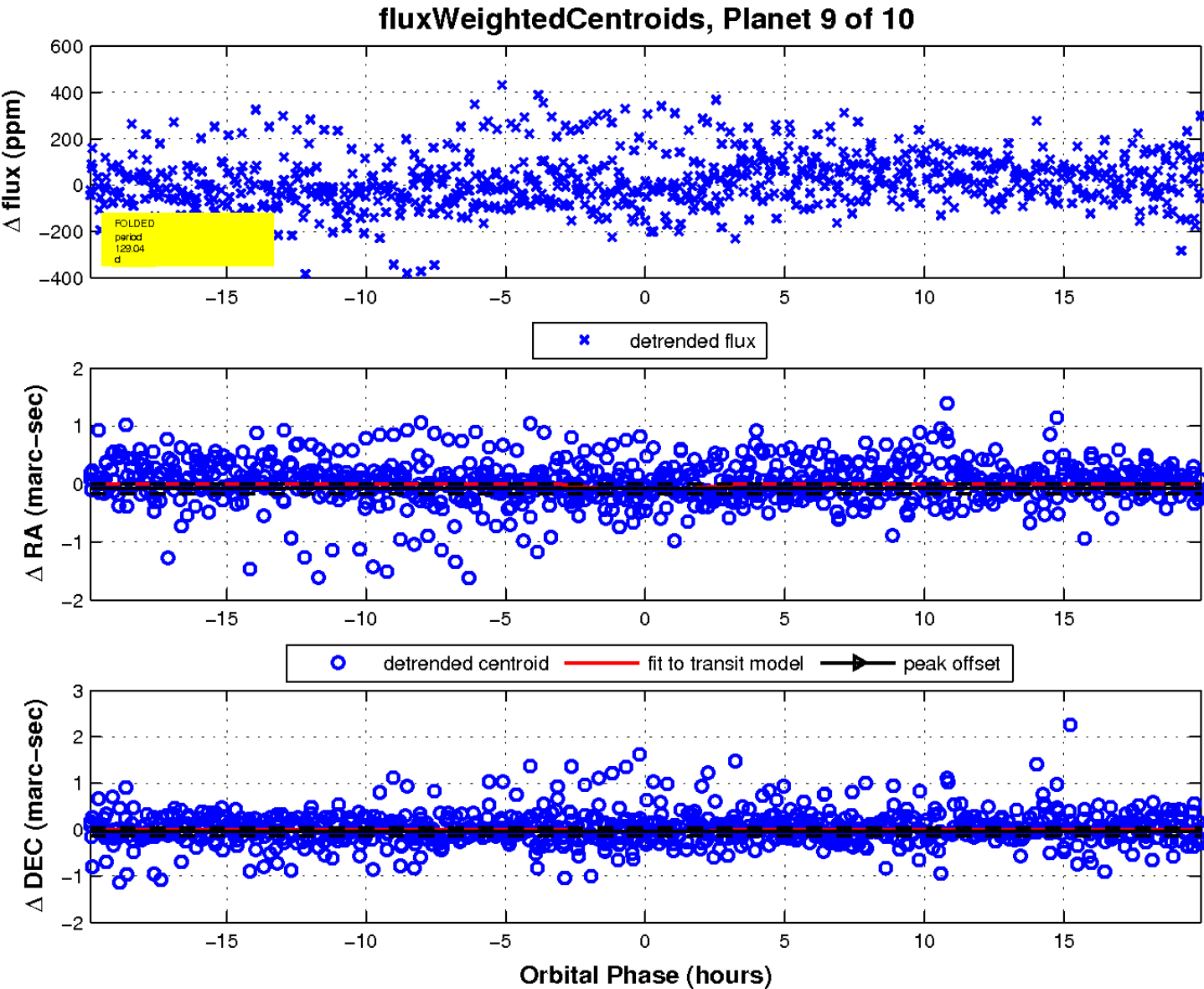
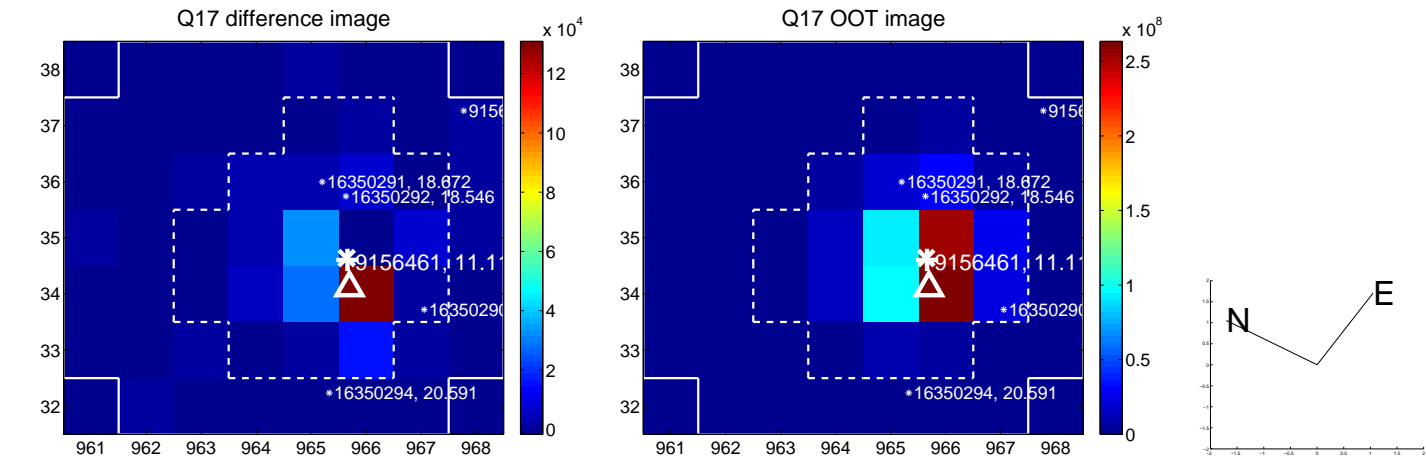
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value



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

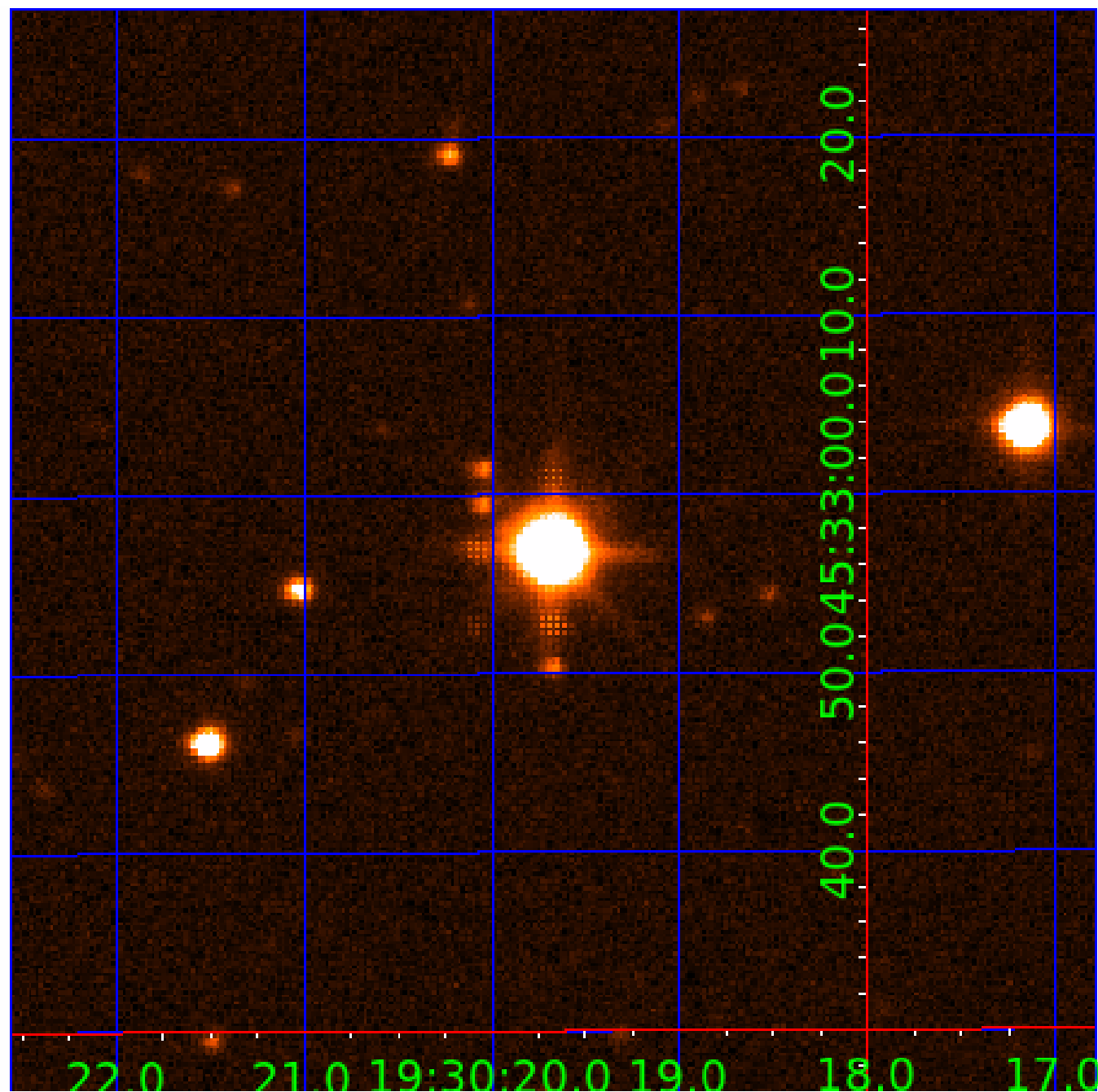


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination





## KIC 009156461

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009156461-01	OBS	No	2.296149	132.431446	4.2	10.825	8.7	2.7	1.82	6480	0.43	3717.29
009156461-02	OBS	No	208.639795	204.712221	146.7	5.006	9.0	9.5	1.82	6480	2.51	9.10
009156461-03	OBS	No	296.023030	308.965620	22.4	13.754	7.9	1.0	1.82	6480	0.97	5.71
009156461-04	OBS	No	27.813822	141.128479	61.1	10.671	9.1	8.2	1.82	6480	1.55	133.62
009156461-05	OBS	No	77.564421	198.190936	103.7	8.284	8.5	7.9	1.82	6480	2.09	34.04
009156461-06	OBS	No	337.753157	364.928677	153.2	3.194	8.2	8.4	1.82	6480	2.65	4.79
009156461-08	OBS	No	138.291040	142.658043	108.4	10.011	8.3	6.9	1.82	6480	2.05	15.75
009156461-09	OBS	No	129.035096	161.225143	92.7	6.643	8.0	6.8	1.82	6480	2.33	17.27
009156461-10	OBS	No	110.241909	238.739506	55.7	3.500	7.6	-1.0	1.82	6480	1.37	21.30

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009156461-01	OBS	FP	0.00	1	0	0	0	SWEET_NTL—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—CENT_SATURATED
009156461-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_CHASES_MARSHALL—TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_SATURATED
009156461-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL_TRACKER—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_SATURATED
009156461-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_ZUMA—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
009156461-05	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—CENT_SATURATED—HALO_GHOST
009156461-06	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
009156461-08	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—INCONSISTENT_TRANS—CENT_SATURATED
009156461-09	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_CHASES—TRANS_GAPPED—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
009156461-10	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED

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

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

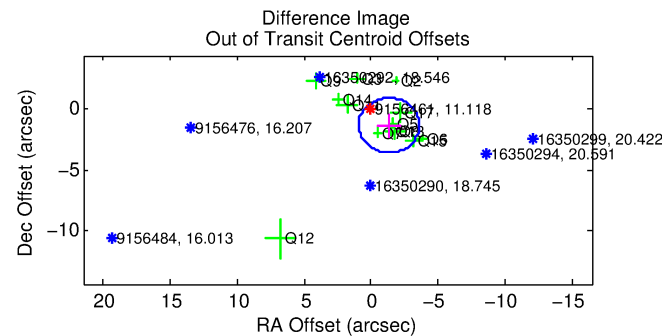
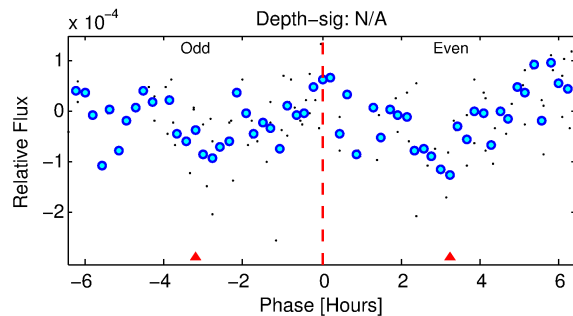
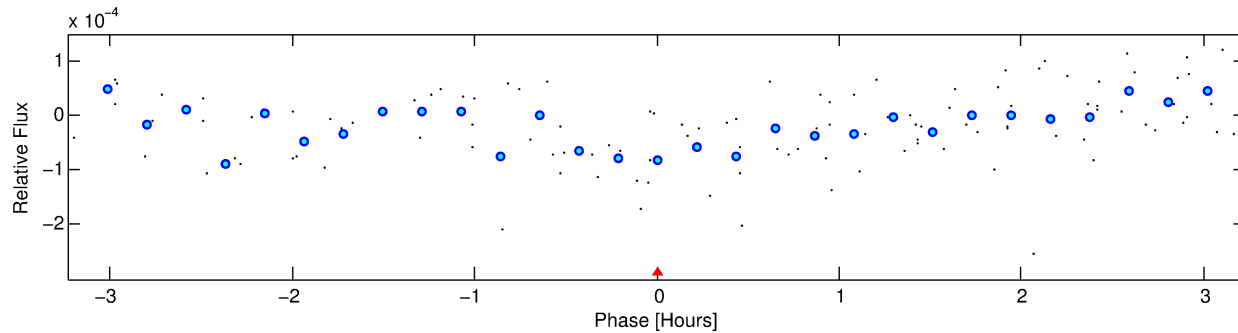
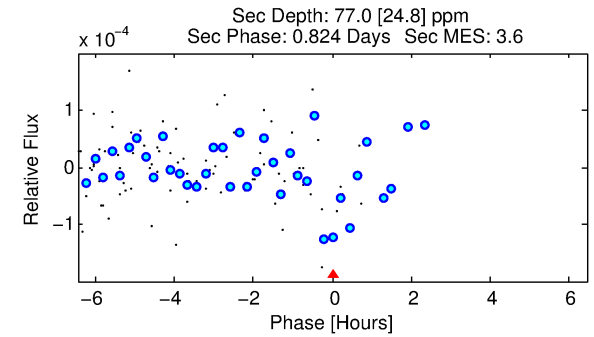
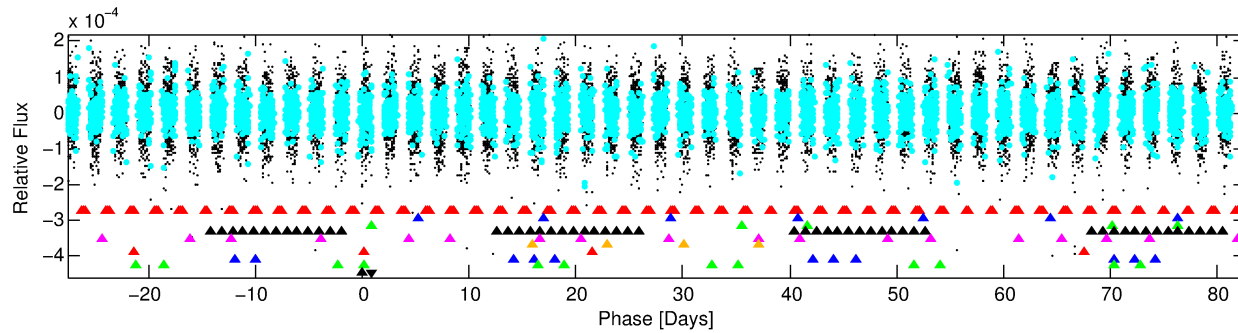
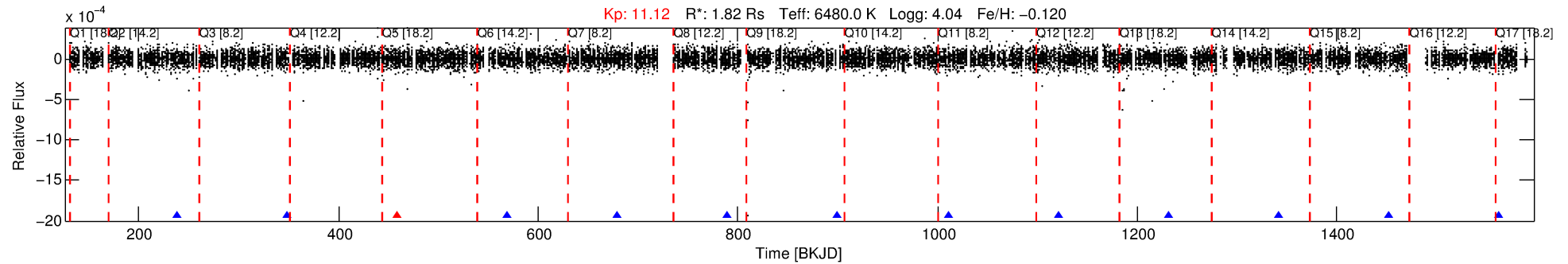
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 009156461-10

No Significant Match Found

# DV One-Page Summary

KIC: 9156461 Candidate: 10 of 10 Period: 110.242 d



TPS TCE Results:

Period = 110.2419 d  
Epoch = 238.7395 BKJD

DV fit results are unavailable

DV Diagnostic Results:

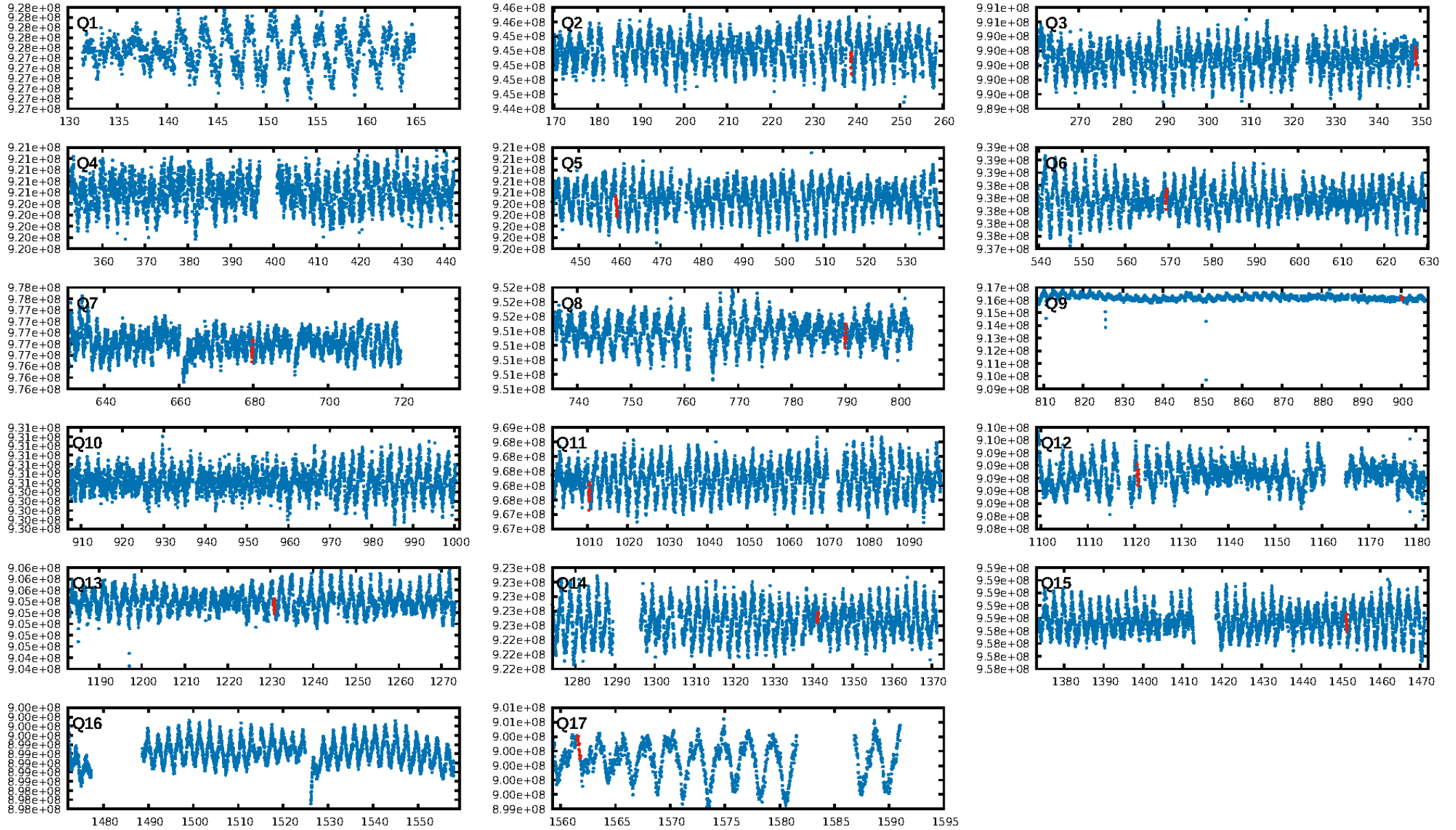
ShortPeriod-sig: 100.0% [87.21 $\sigma$ ]  
LongPeriod-sig: 100.0% [60.07 $\sigma$ ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: N/A  
RollingBand-fgt: 0.89 [8/9]  
GhostDiagnostic-chr: -9.075

Centroid-sig: 30.2%  
Centroid-so: 2.118 arcsec [0.98 $\sigma$ ]  
OotOffset-rm: 1.866 arcsec [2.46 $\sigma$ ]  
KicOffset-rm: 1.345 arcsec [1.65 $\sigma$ ]  
OotOffset-st: 3/4/2/4 [13]  
KicOffset-st: 3/4/2/4 [13]  
DiffImageQuality-fgm: 0.62 [8/13]  
DiffImageOverlap-fno: 0.85 [11/13]

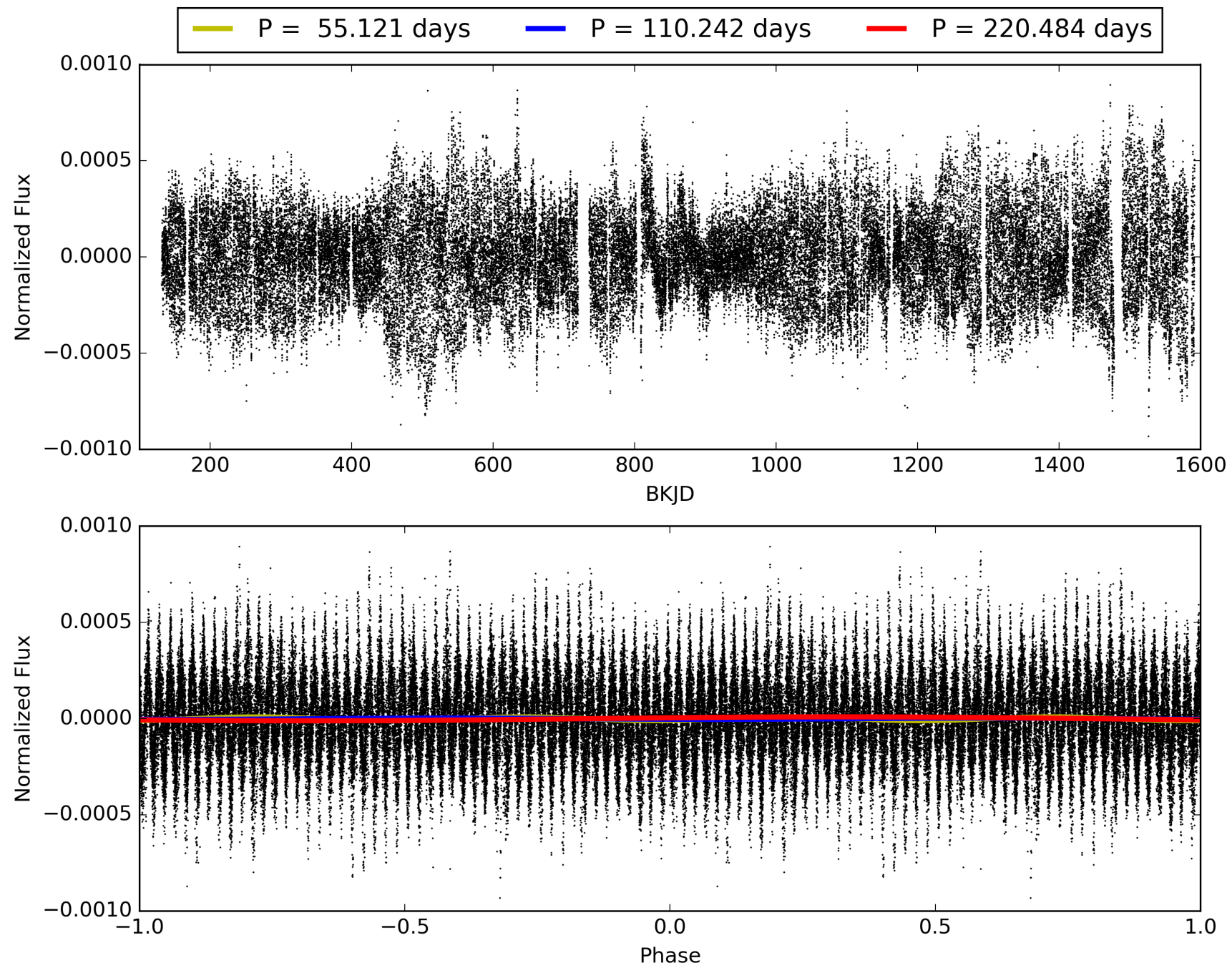
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 22:29:26 Z

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

# TCE 009156461-10, PDC Light Curves

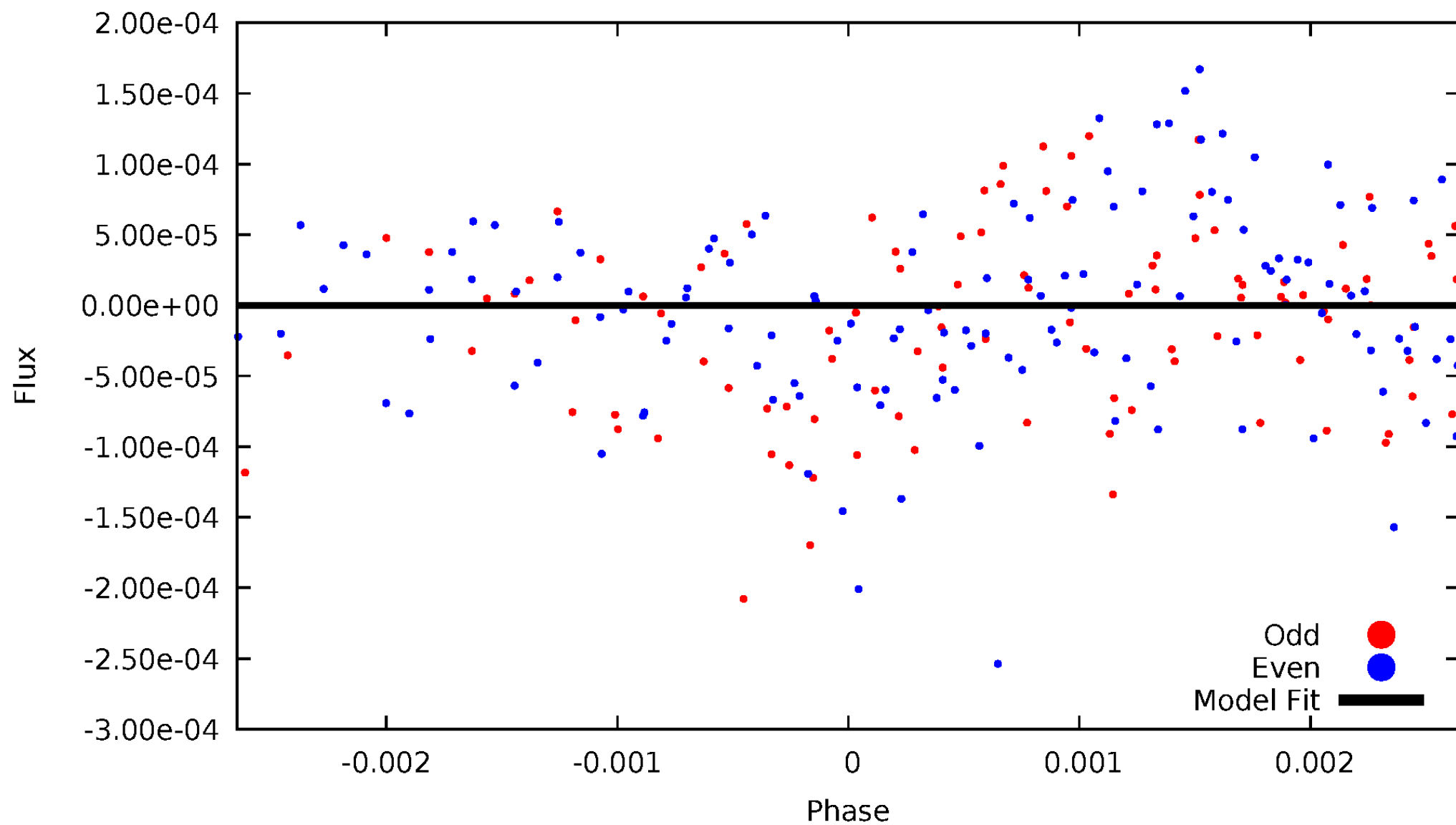


# TCE 009156461-10



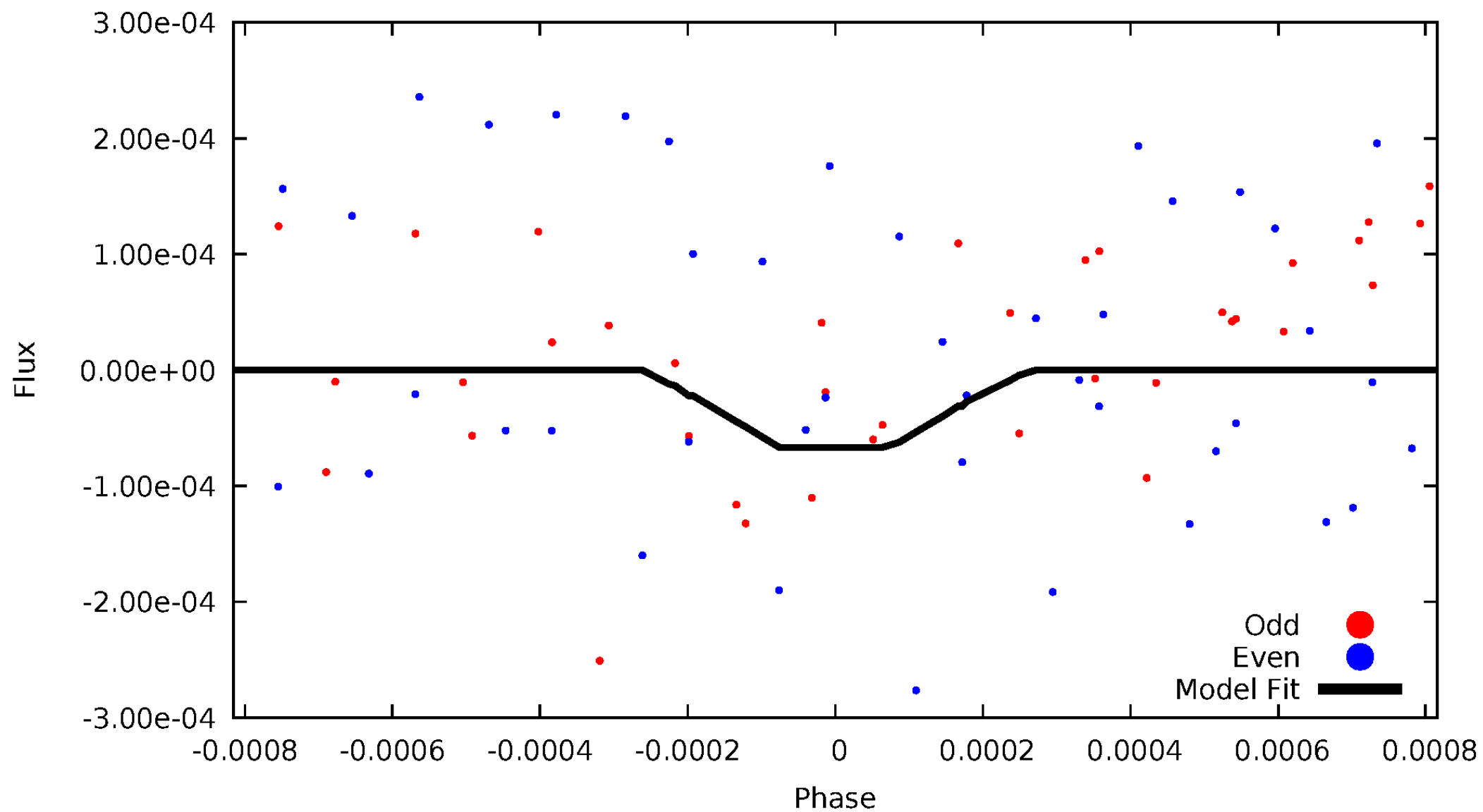
# DV Odd/Even

TCE 009156461-10



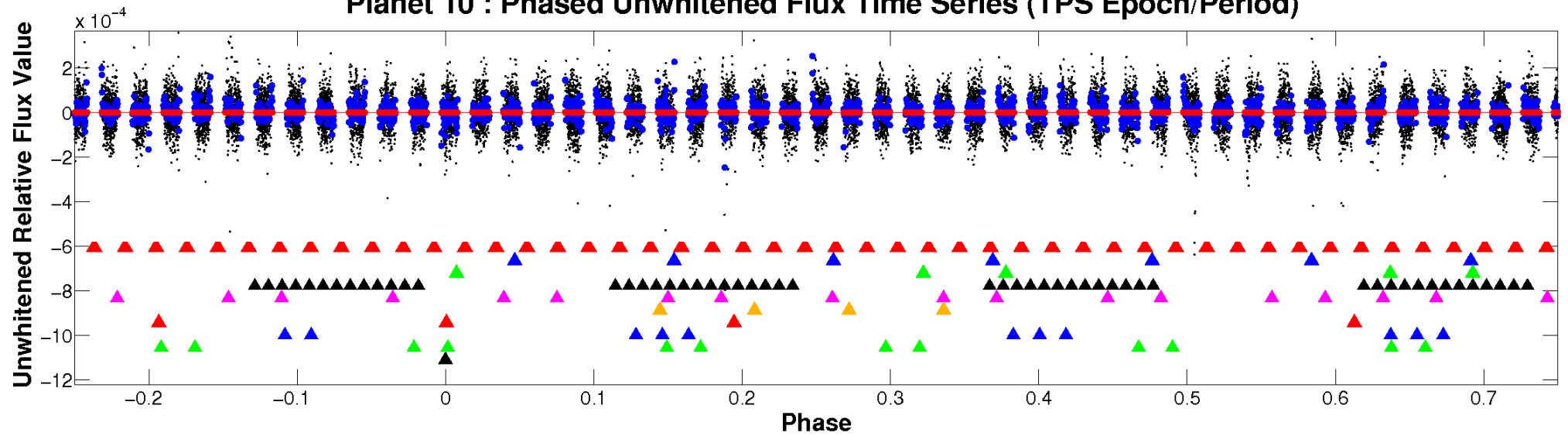
# ALT Odd/Even

TCE 009156461-10

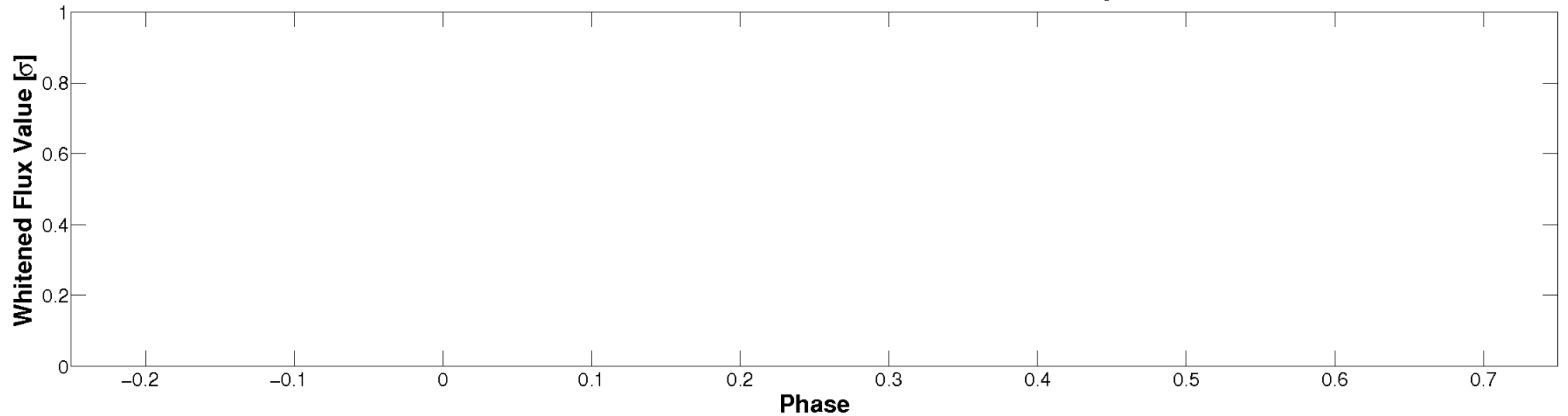


# Non-Whitened Vs. Whitened Light Curve

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



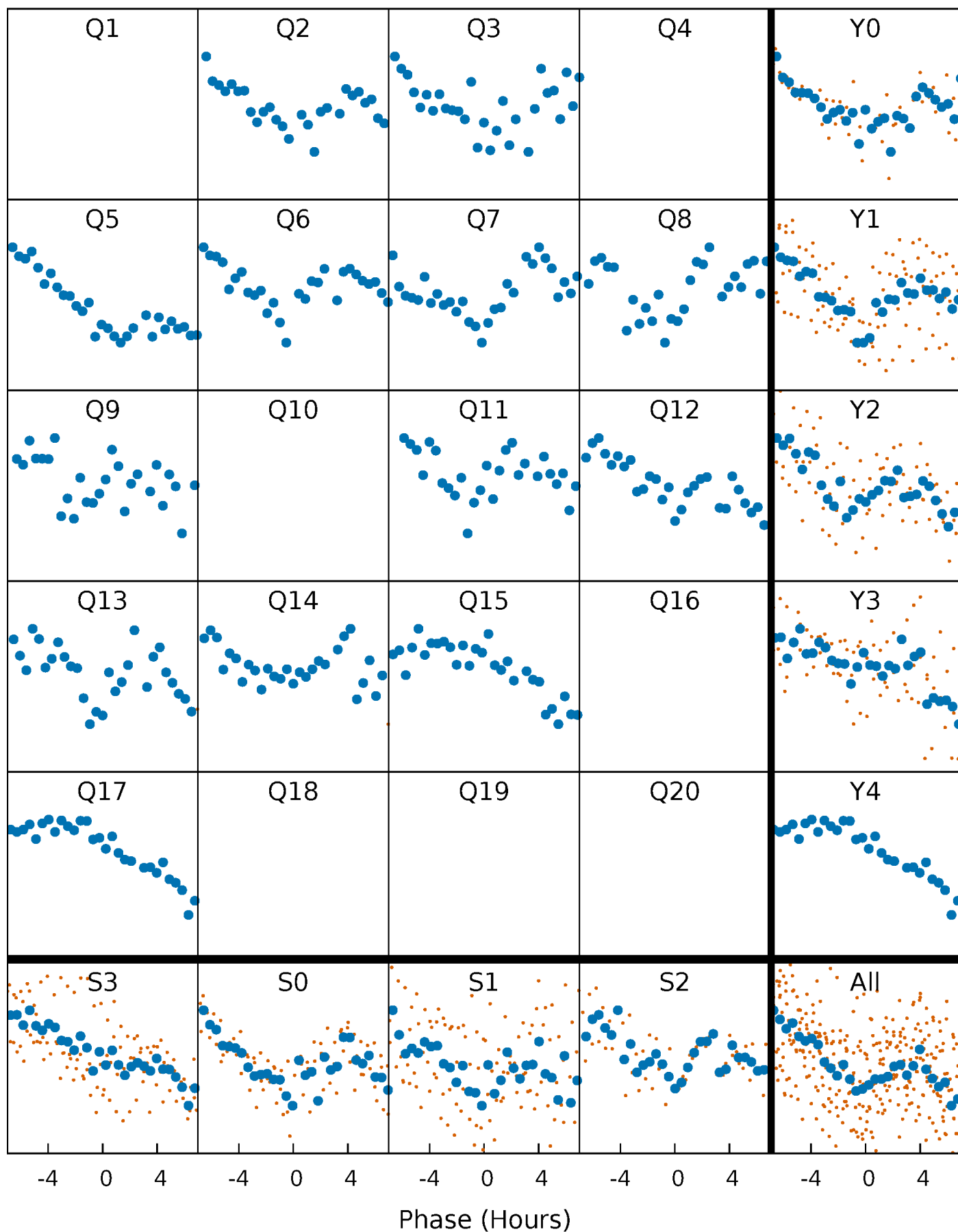
Planet 10 : Phased Whitened Flux Time Series (TPS Epoch/Period)





# PDC Quarter-Phased Transit Curves

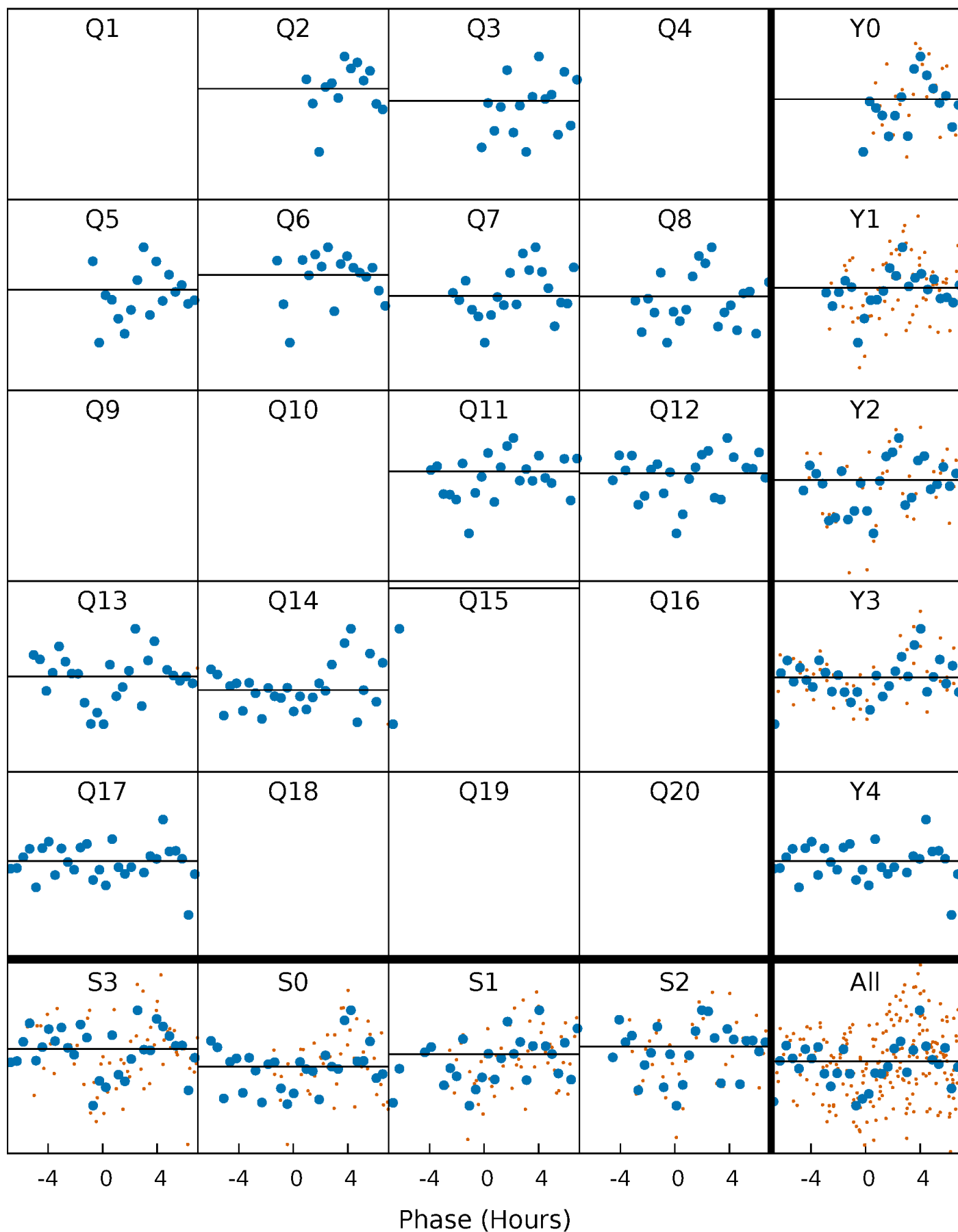
TCE 009156461-10 P=110.241909 Days  $T_0=238.739506$  (BKJD)





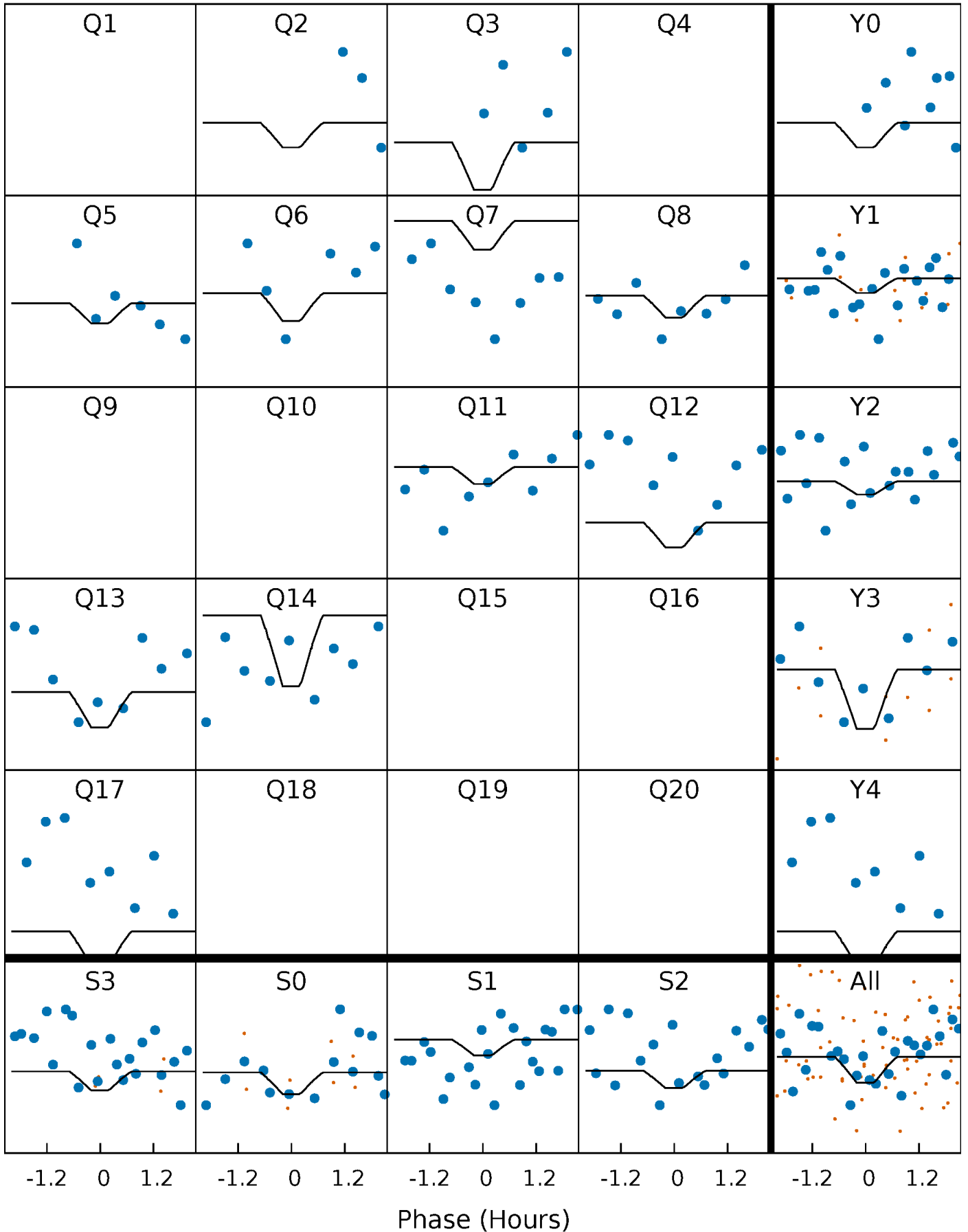
# DV Quarter-Phased Transit Curves

TCE 009156461-10 P=110.241909 Days  $T_0=238.739506$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

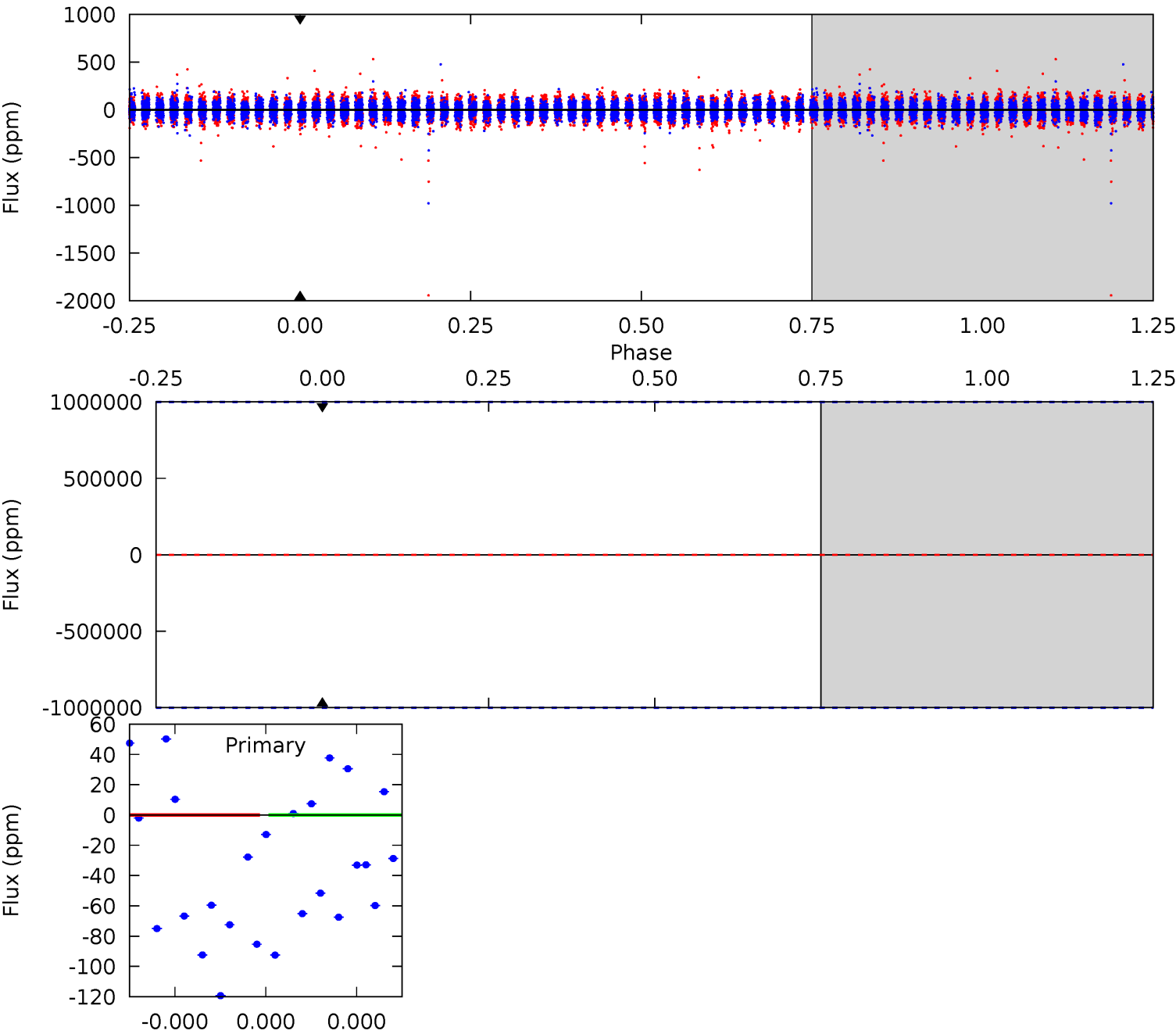
TCE 009156461-10 P=110.241909 Days  $T_0=238.724741$  (BKJD)



# DV Model-Shift Uniqueness Test

009156461-10, P = 110.241909 Days, E = 128.497597 Days

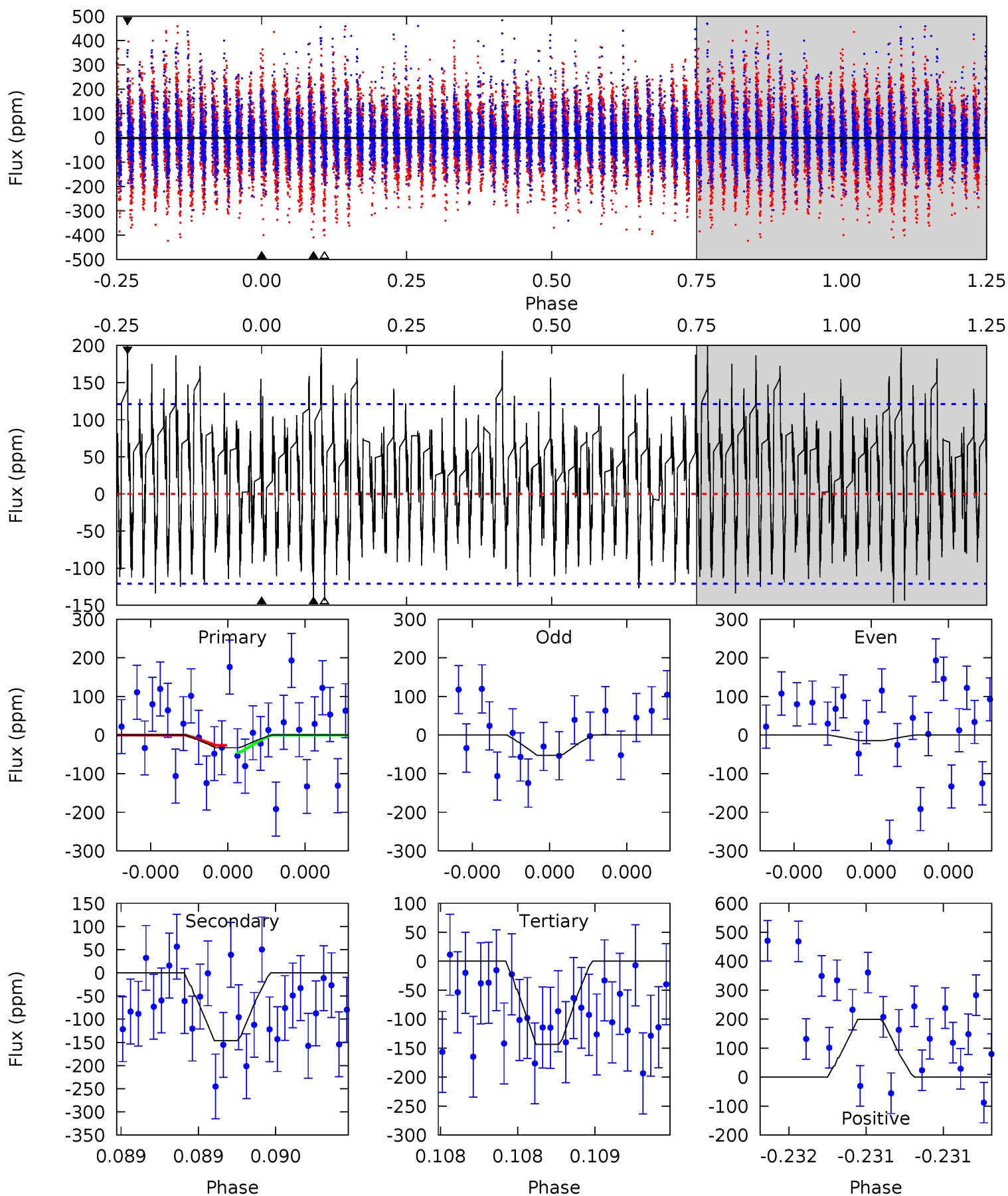
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
0	0	0	0	1.00	1.00	1.00	0	0	0	0	0	0	0	0



# Alt Model-Shift Uniqueness Test

009156461-10, P = 110.241909 Days, E = 128.482832 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
1.51	6.76	6.62	9.18	5.58	3.49	2.68	-5.11	-7.67	0.14	-2.42	0.89	0.58	0.58	0.43



### Stellar Parameters For KIC 009156461

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6480^{+181}_{-250}$	$4.044^{+0.293}_{-0.158}$	$-0.120^{+0.250}_{-0.300}$	$1.822^{+0.510}_{-0.623}$	$1.345^{+0.193}_{-0.289}$	$0.313^{+0.619}_{-0.139}$
	+3%/-4%	+7%/-4%	+208%/-250%	+28%/-34%	+14%/-21%	+198%/-44%
Source	PHO54	PHO54	PHO54	DSEP		

KIC = Kepler Input Catalog; PHO = Photometry; SPE = Spectroscopy; AST = Asteroseismology  
 TRA = Transits; DESP = Dartmouth Models; MULT = Multiple Models

### Secondary Eclipse Parameters for KIC 009156461-10 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$0 \pm 1000000$	$13.17^{+15.37}_{-9.07}$	$754^{+62}_{-68}$	$-5258^{+37066}_{-23823}$	$-1413.126^{+142004.145}_{-138802.903}$
Alt.	$-146 \pm 22$	$13.99^{+14.42}_{-10.12}$	$754^{+60}_{-69}$	$3179^{+1719}_{-547}$	$98^{+1208}_{-75}$

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

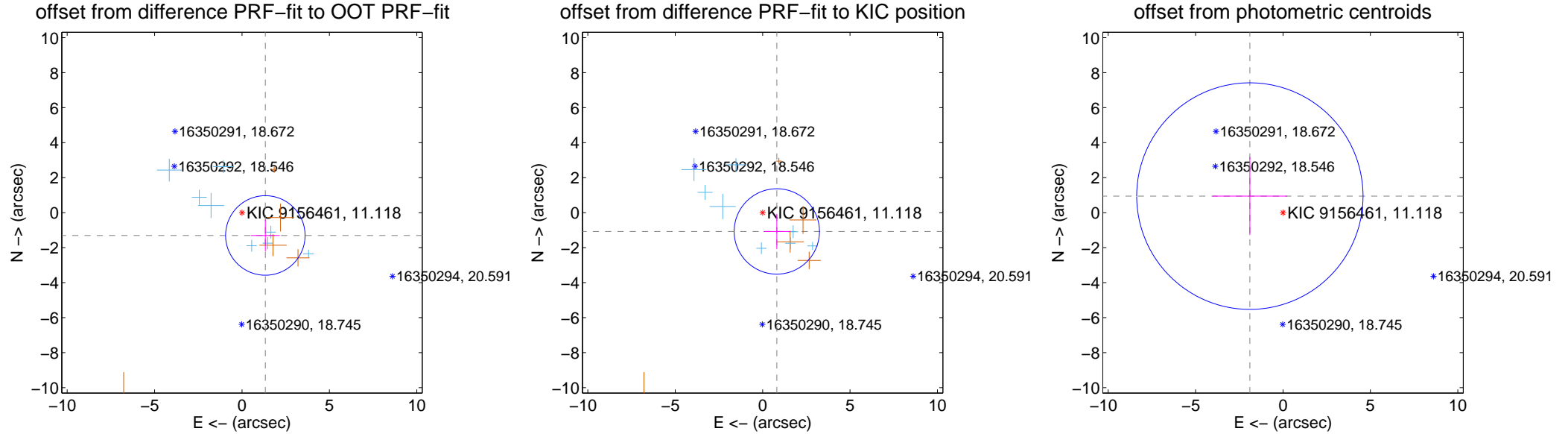
## DV Centroid Data

Supplemental centroid analysis for 009156461-10. **Kepler magnitude: 11.12.** Transit SNR -1.00

There are 8 quarters with good PRF difference image offsets

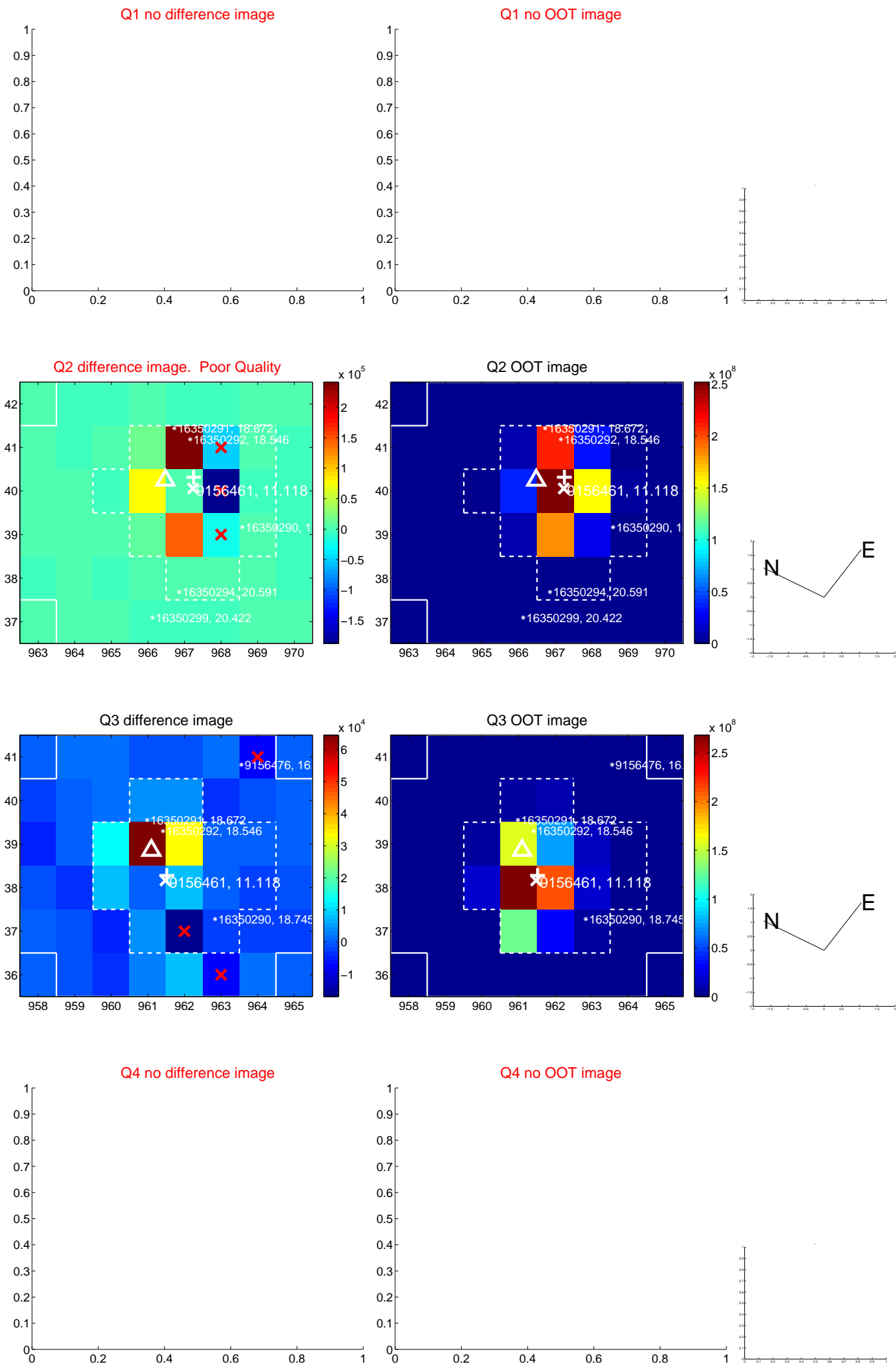
The direct PRF centroid is offset from the target star catalog position by about 0.17 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.866 \pm 0.758$	2.46	$-1.335 \pm 0.825$	$-1.303 \pm 0.899$
PRF-fit source offset from KIC position	$1.345 \pm 0.813$	1.65	$-0.811 \pm 0.760$	$-1.074 \pm 1.006$
photometric centroid source offset	$2.12 \pm 2.16$	0.98	$1.90 \pm 2.14$	$0.95 \pm 2.23$

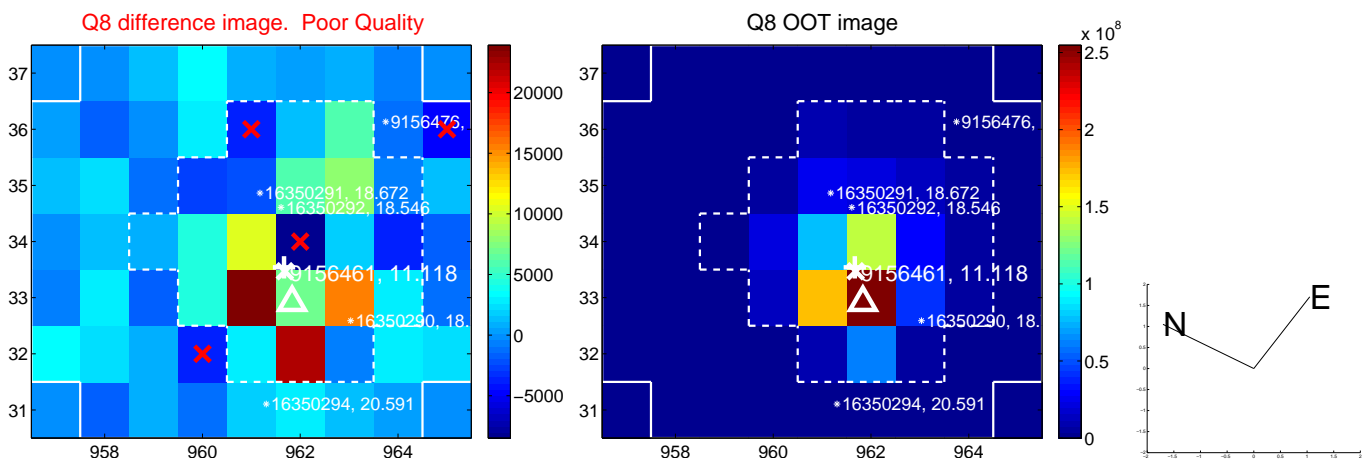
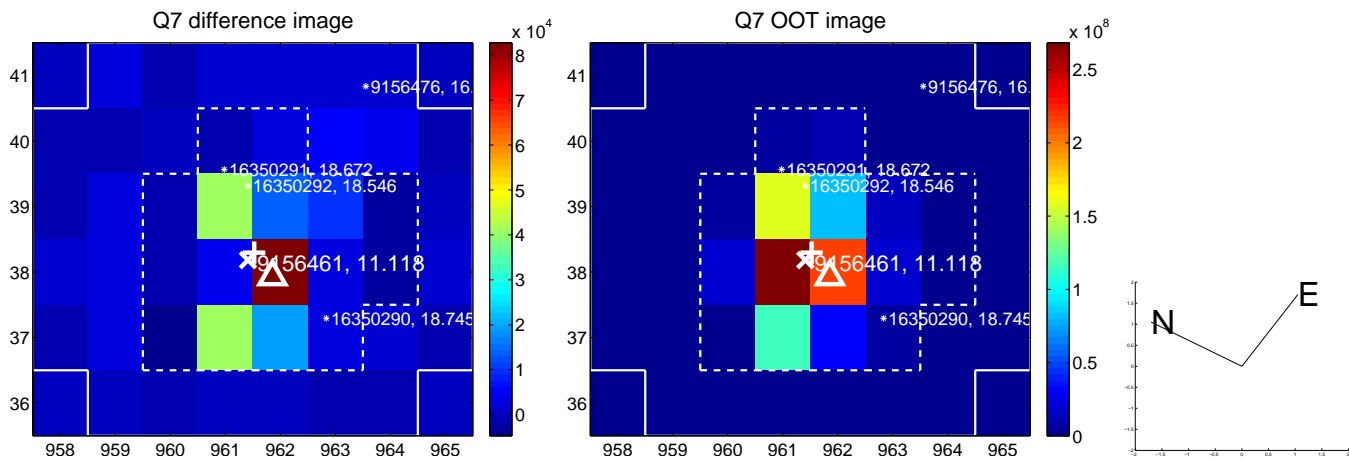
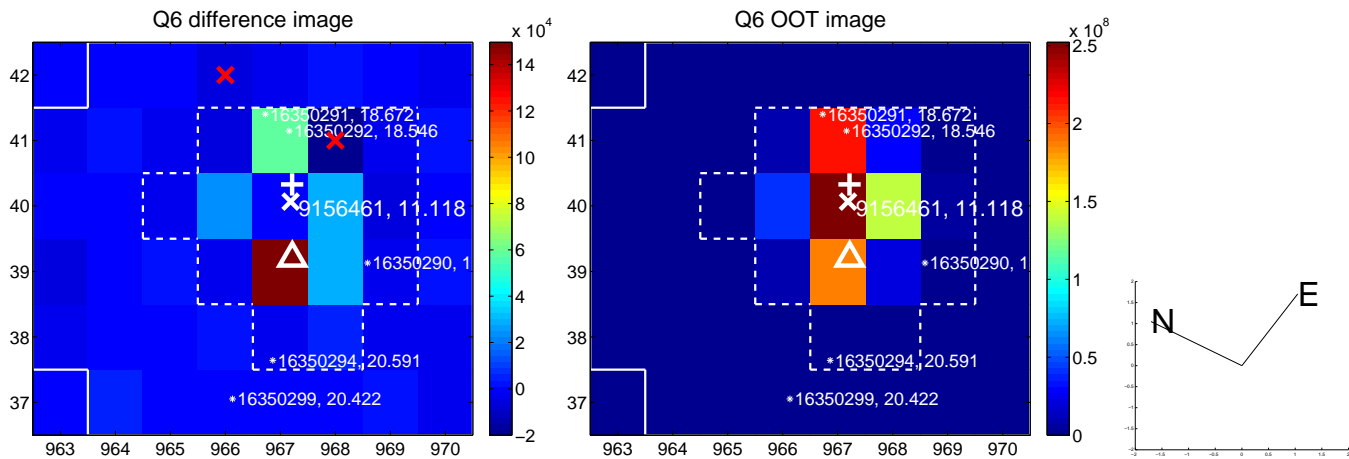
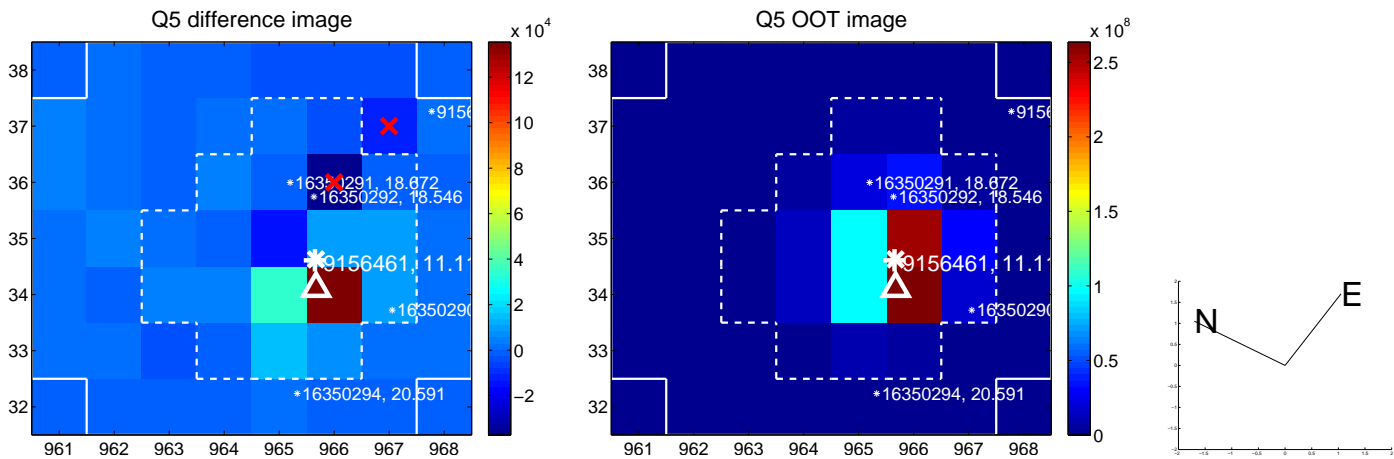


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

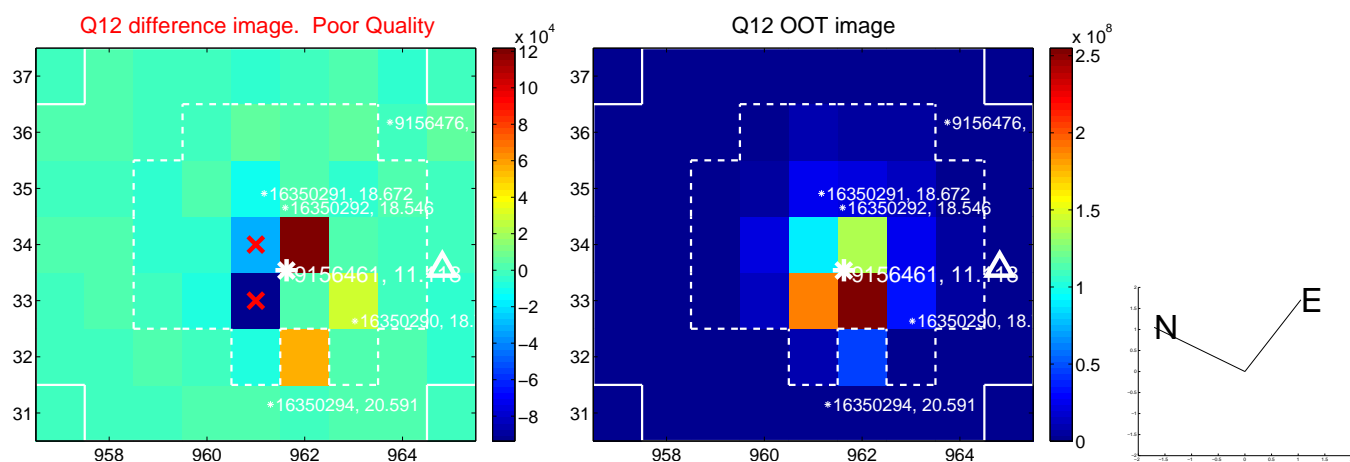
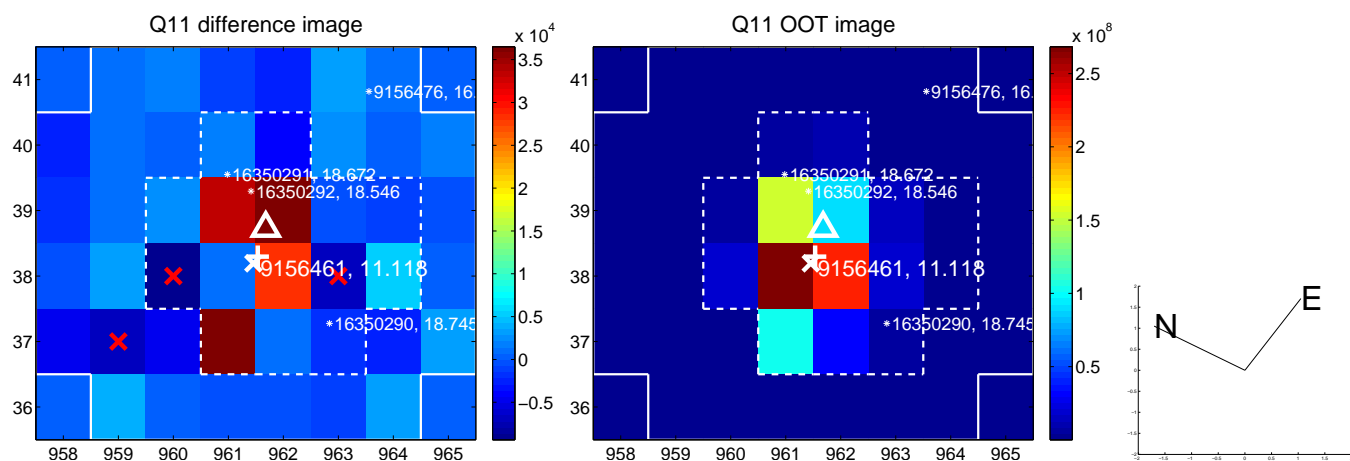
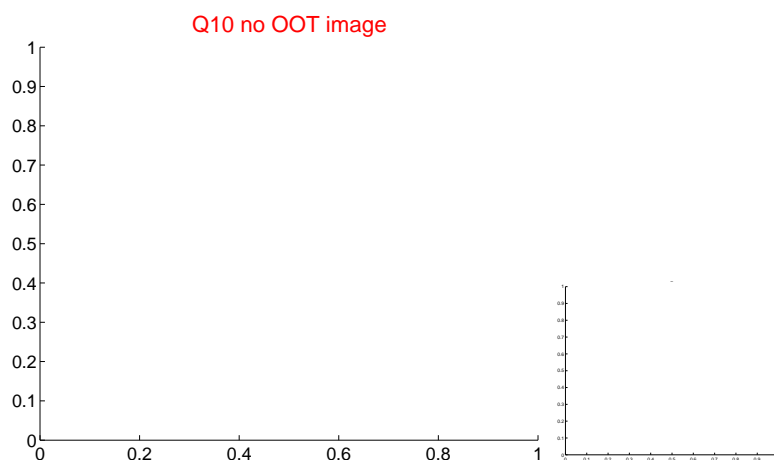
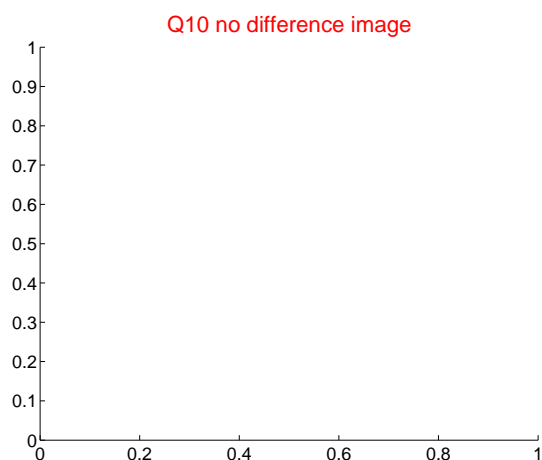
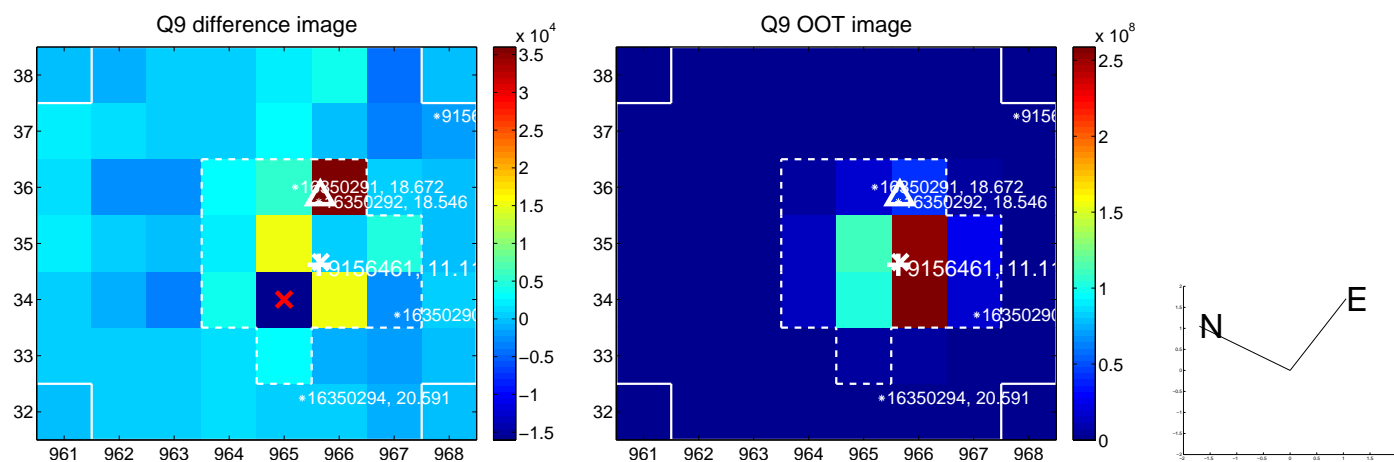


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

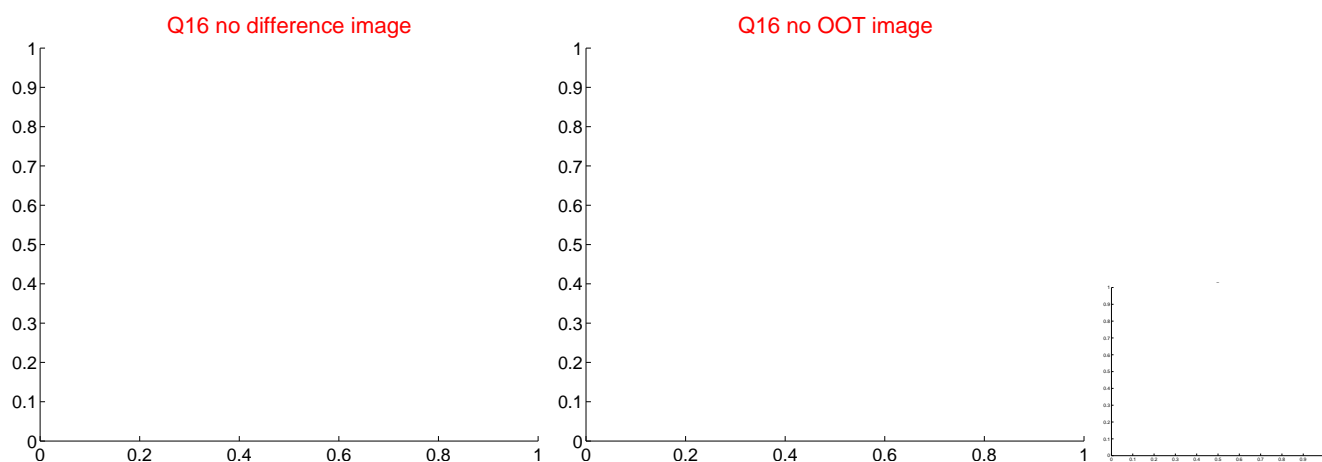
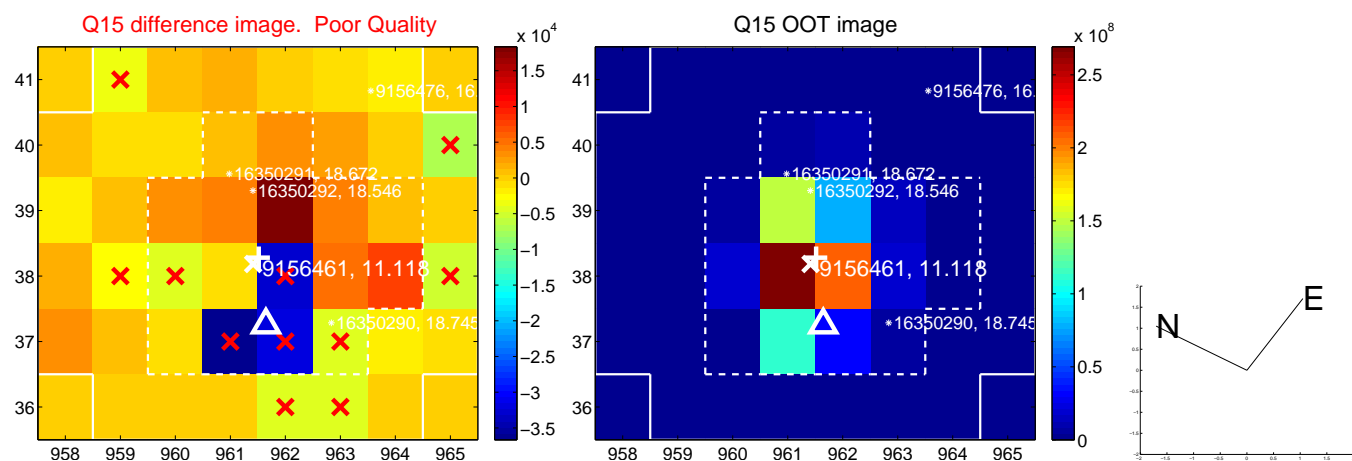
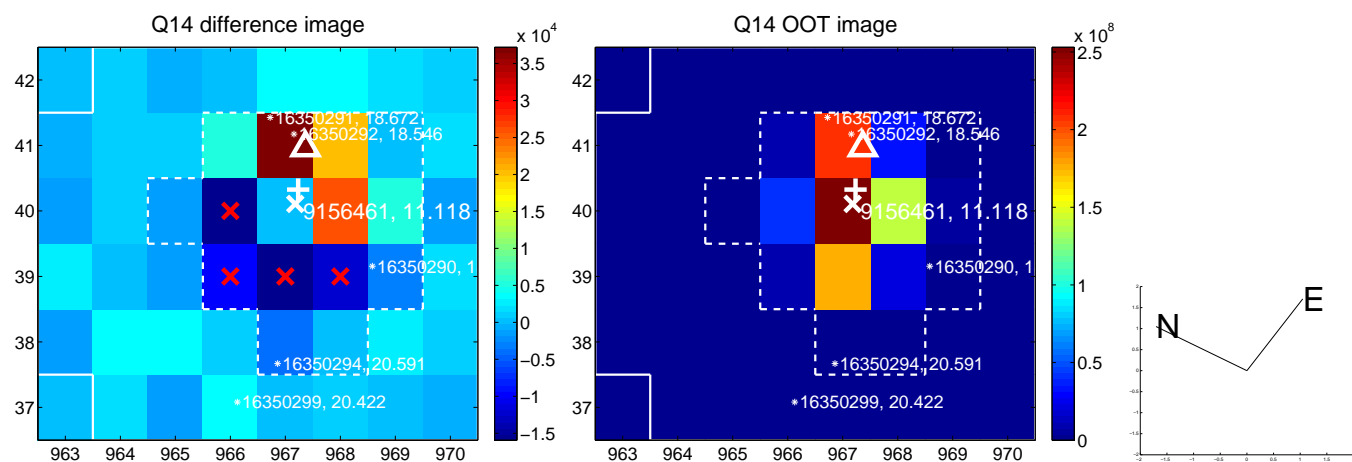
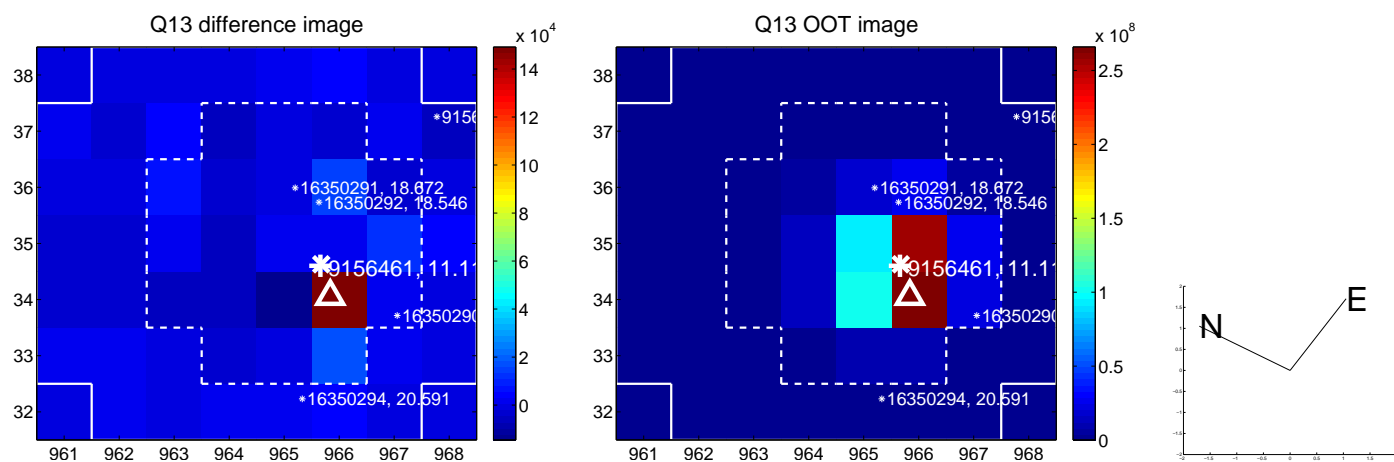




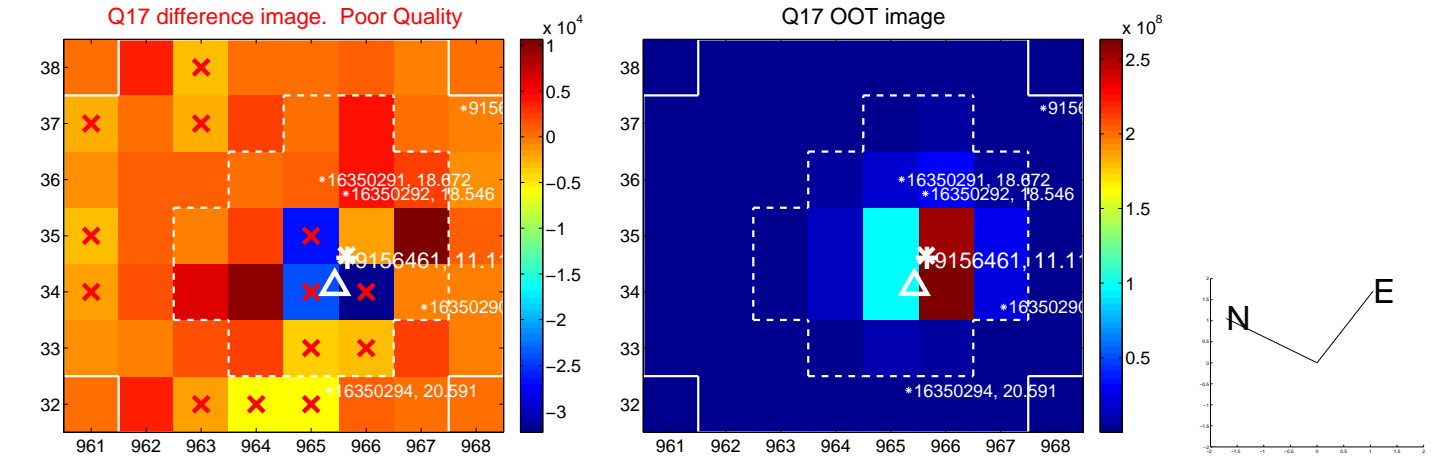
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



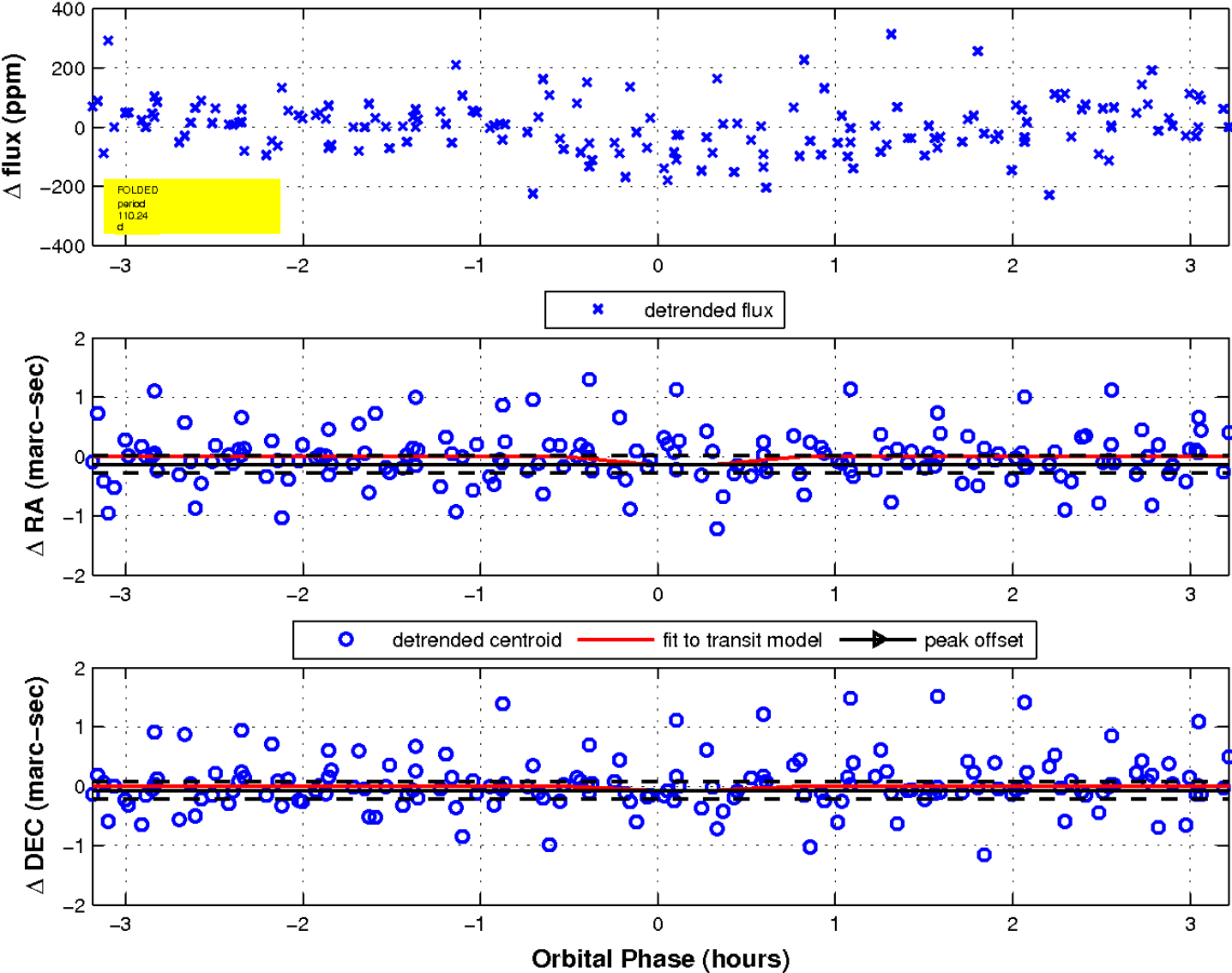
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



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UKIRT Image

Declination

