

# KIC 004737705

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
004737705-01	OBS	No	367.562815	176.319697	845.3	2.357	27.0	3.8	8.52	5026	28.11	23.36
004737705-02	OBS	No	365.959908	179.504843	7034.2	10.959	29.1	11.9	8.52	5026	87.52	23.49

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
004737705-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL_SKYE_ZUMA_TRACKER—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS
004737705-02	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_SKYE—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_POS_DV—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS—HALO_GHOST

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

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

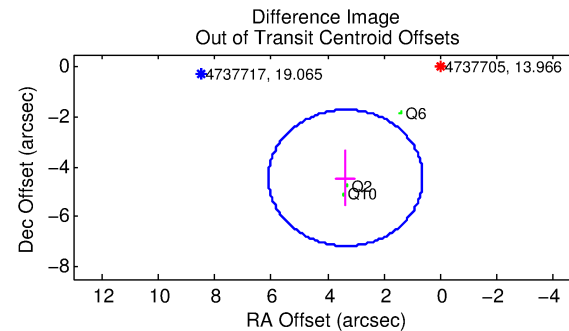
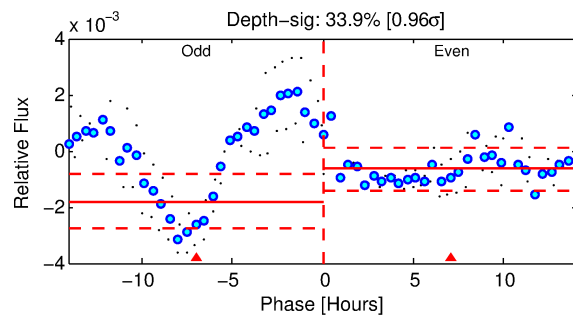
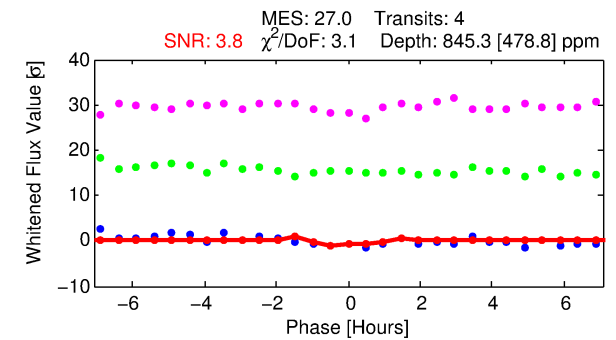
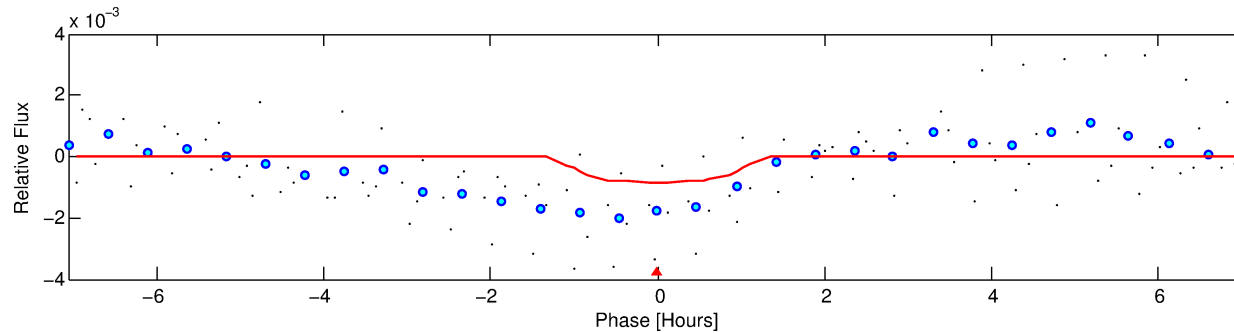
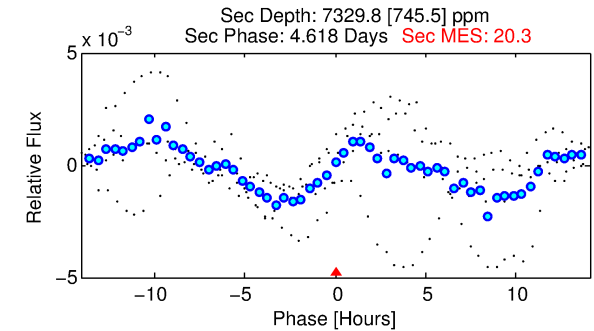
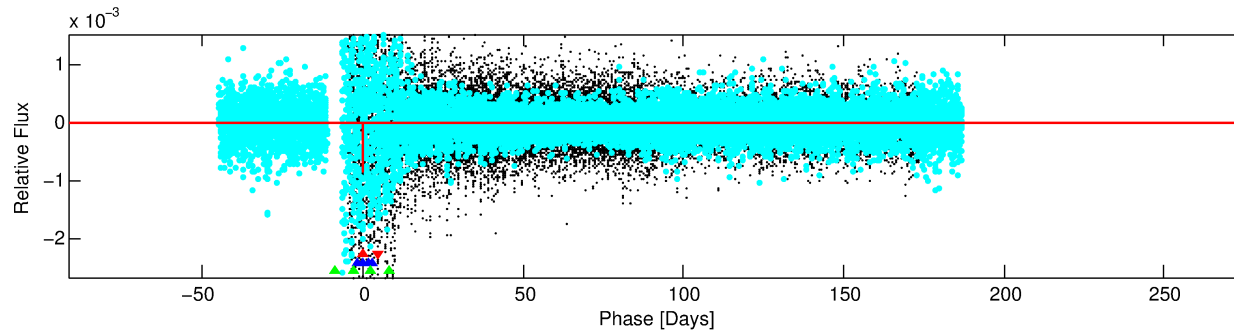
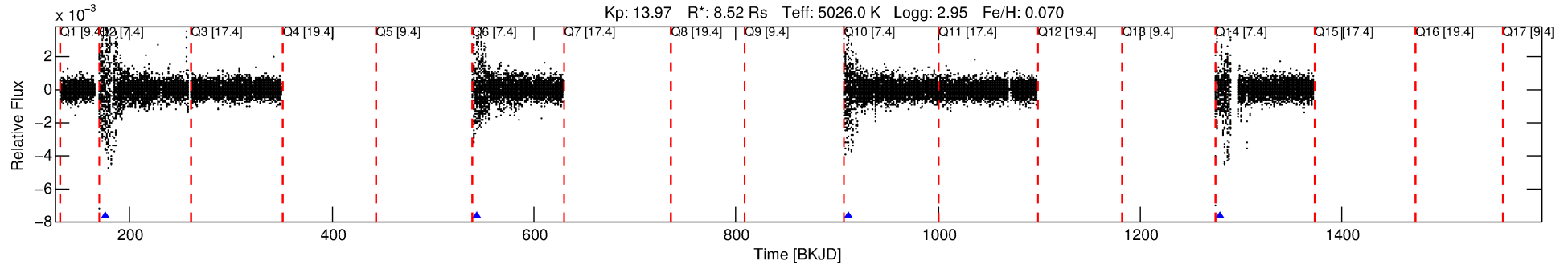
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 004737705-01

No Significant Match Found

# DV One-Page Summary

KIC: 4737705 Candidate: 1 of 3 Period: 367.563 d



## DV Fit Results:

Period = 367.56281 [0.00689] d  
Epoch = 176.3197 [0.0143] BKJD  
Rp/R\* = 0.0302 [0.0733]  
a/R\* = 745.95 [6604.89]  
b = 0.82 [3.67]  
Seff = 23.36 [6.22]  
Teq = 561 [37] K  
**Rp = 28.11 [68.75] Re**  
a = 1.3335 [0.2752] AU  
Ag = 9077.21 [44110.38] [0.21σ]  
Teffp = 8460 [10273] K [0.7σ]

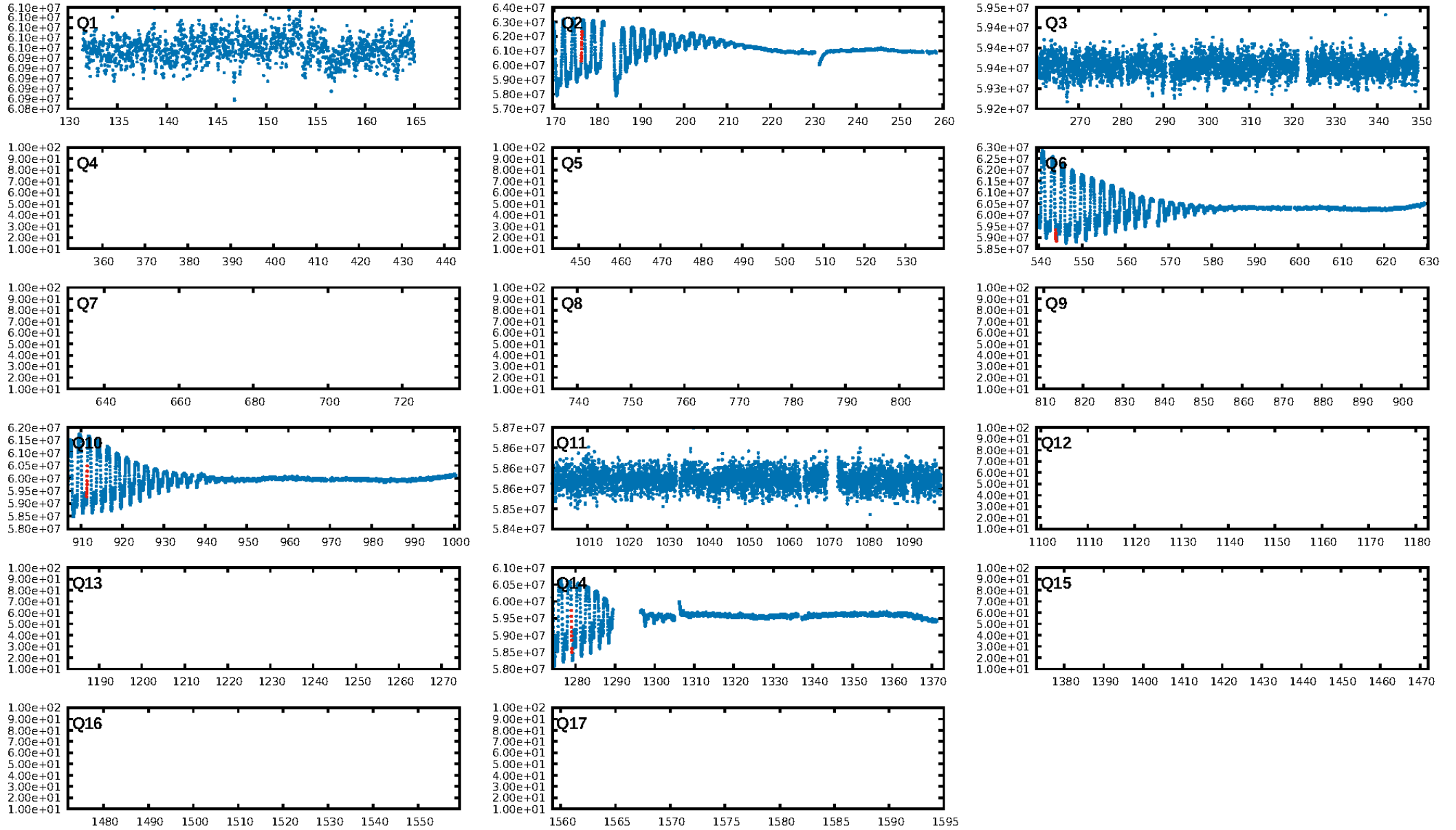
## DV Diagnostic Results:

ShortPeriod-sig: 99.9% [3.43σ]  
LongPeriod-sig: N/A  
**ModelChiSquare2-sig: 0.2%**  
ModelChiSquareGof-sig: 14.5%  
Bootstrap-pfa: 1.69e-35  
RollingBand-fgt: 1.00 [4/4]  
GhostDiagnostic-chr: 2.506  
**Centroid-sig: 0.1%**  
Centroid-so: 4.139 arcsec [2.27σ]  
**OotOffset-rm: 5.578 arcsec [6.14σ]**  
**KicOffset-rm: 5.688 arcsec [6.20σ]**  
OotOffset-st: 3/0/0/0 [3]  
KicOffset-st: 3/0/0/0 [3]  
DiffImageQuality-fgm: 0.00 [0/3]  
DiffImageOverlap-fno: 0.67 [2/3]

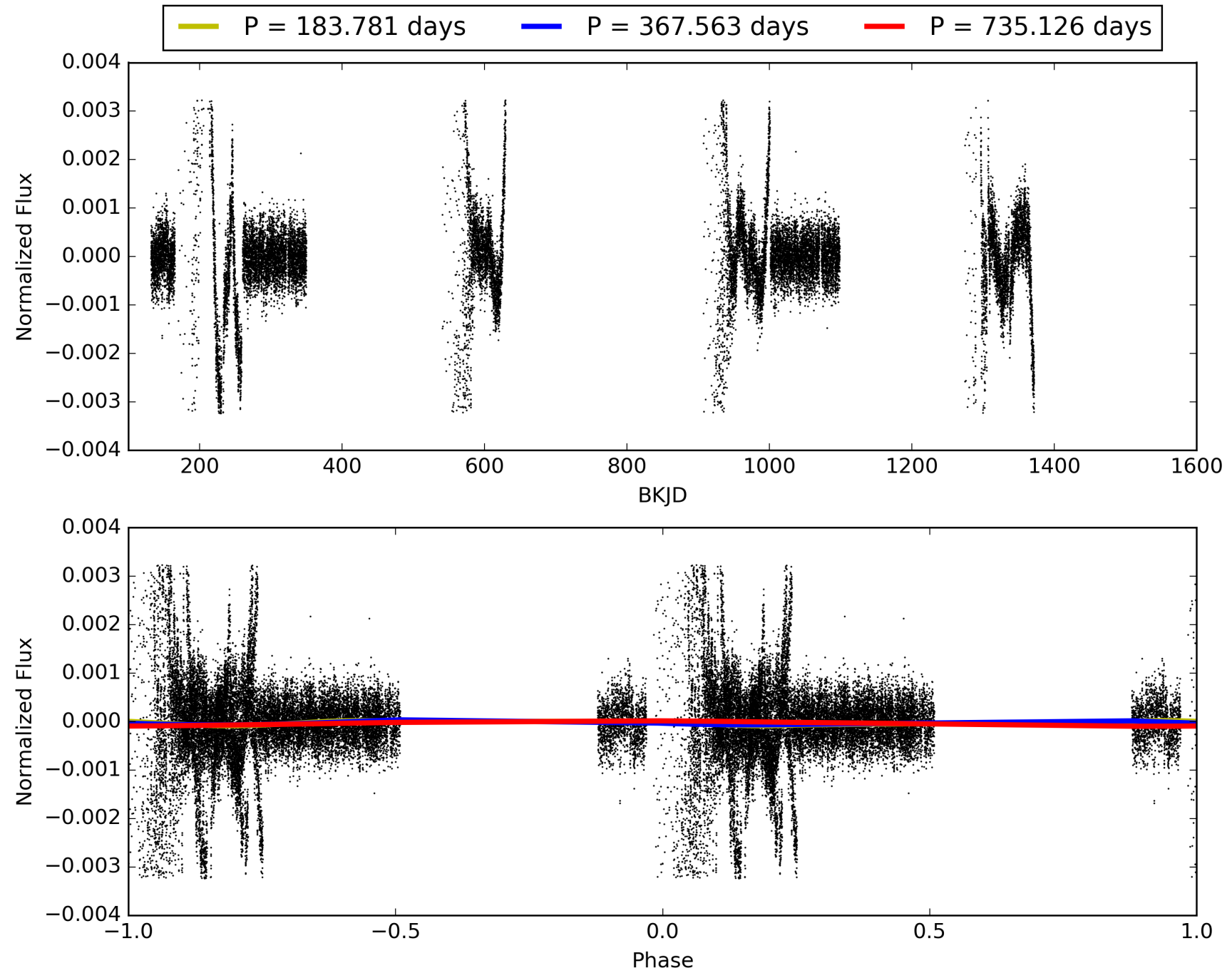
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This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 004737705-01, PDC Light Curves

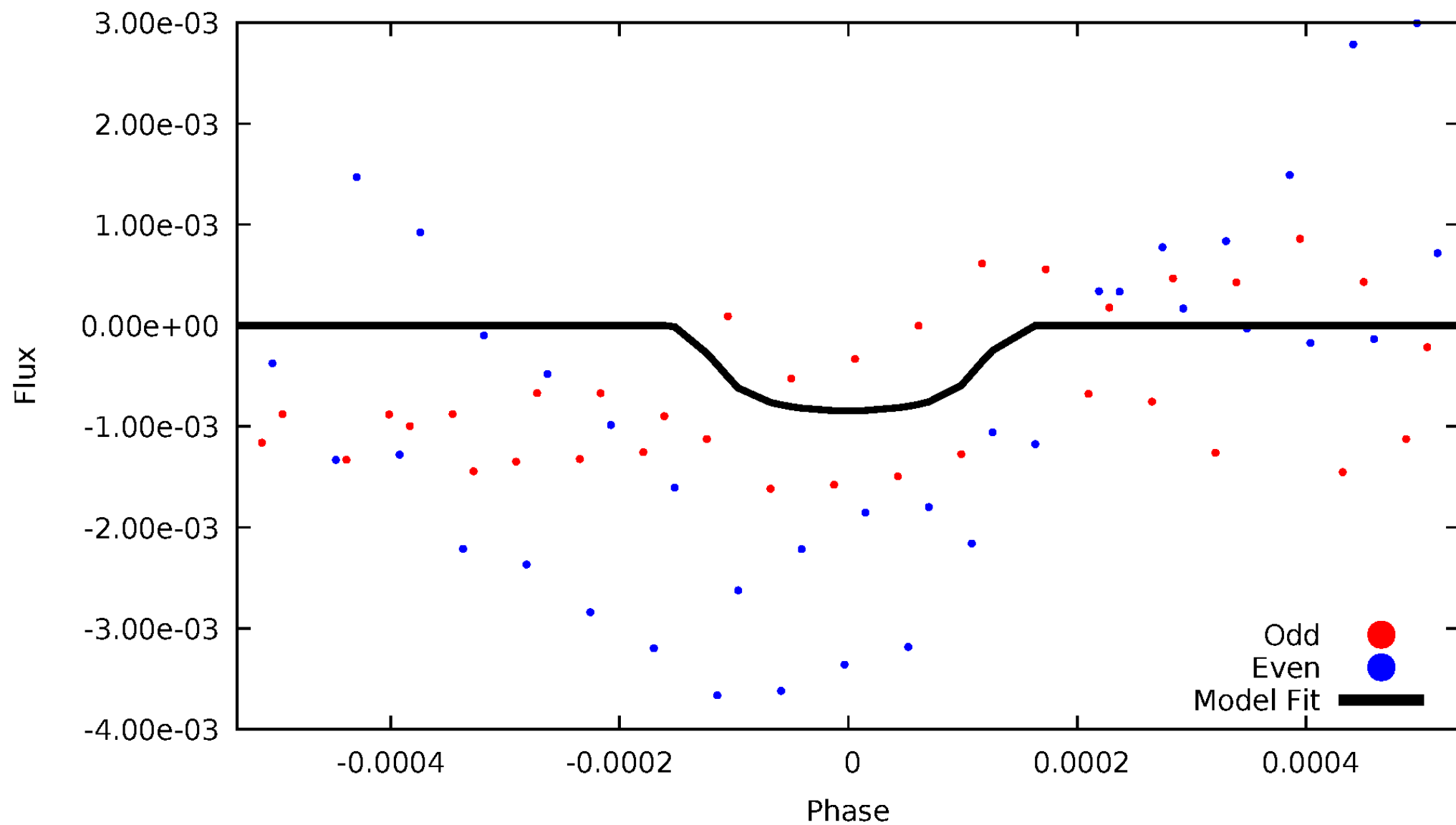


TCE 004737705-01



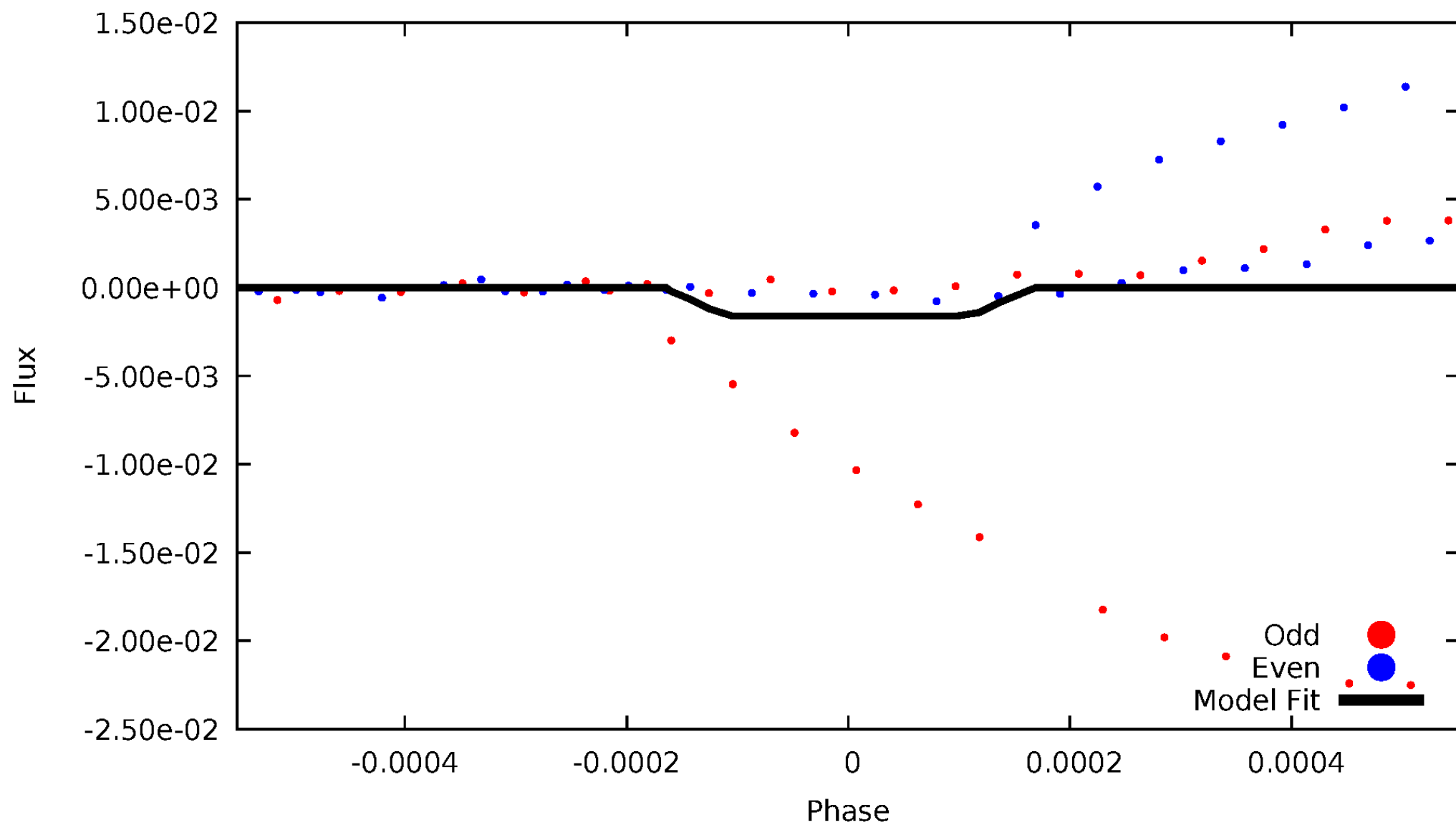
# DV Odd/Even

TCE 004737705-01



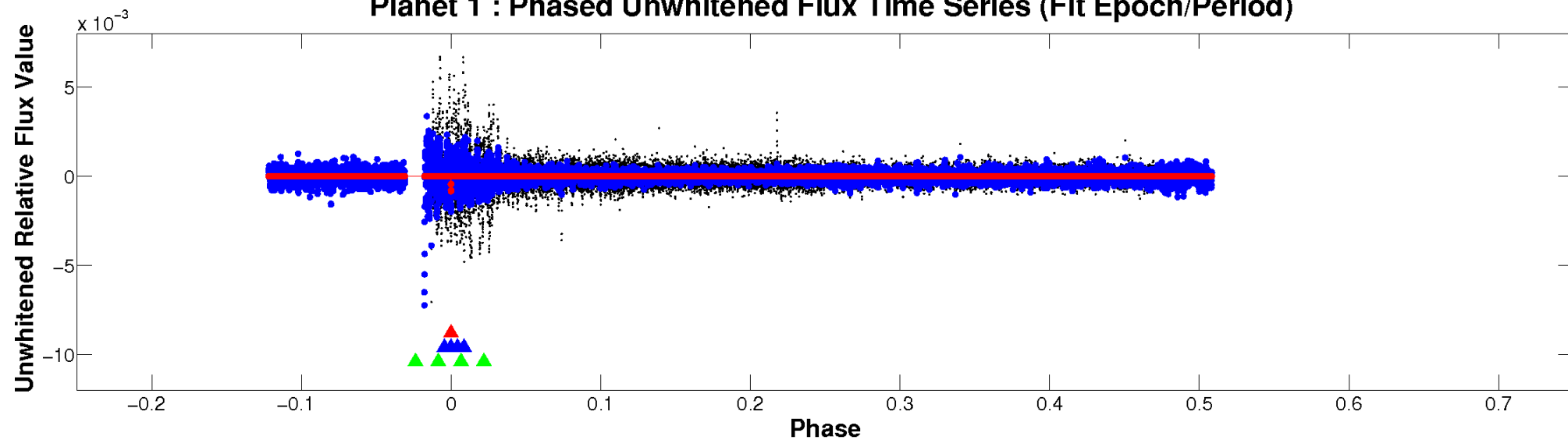
# ALT Odd/Even

TCE 004737705-01

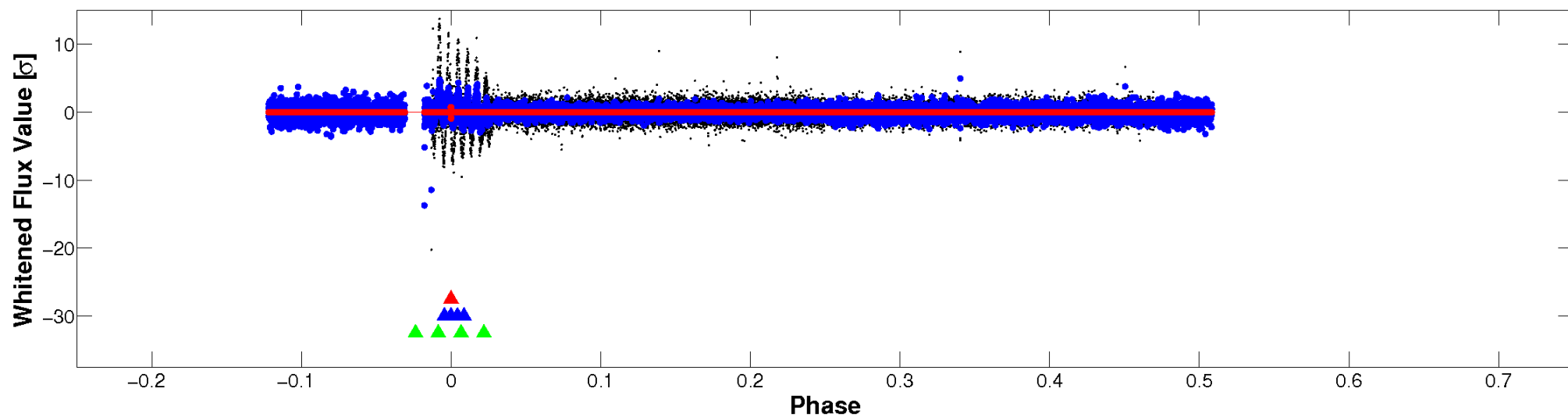


# Non-Whitened Vs. Whitened Light Curve

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

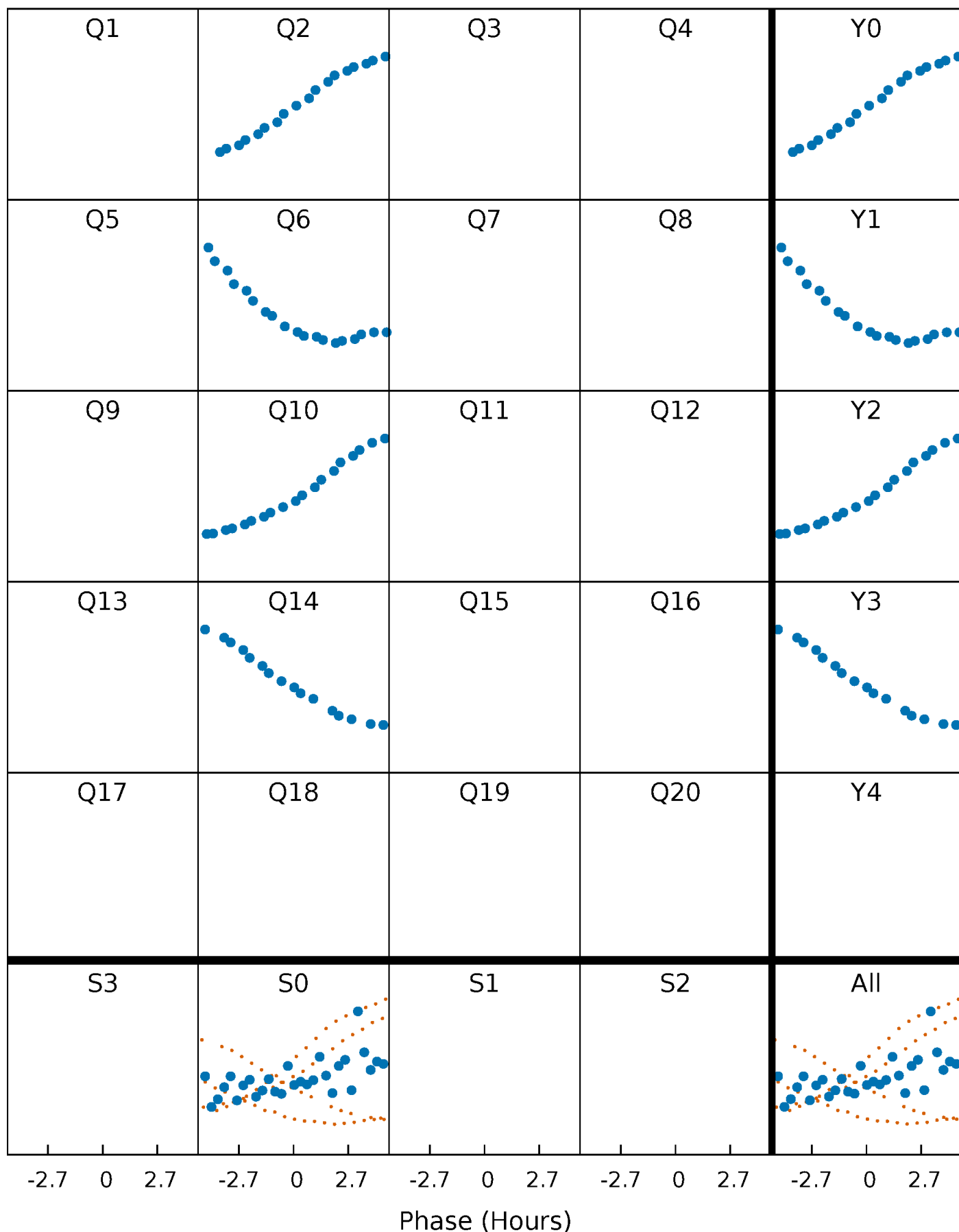


**Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



# PDC Quarter-Phased Transit Curves

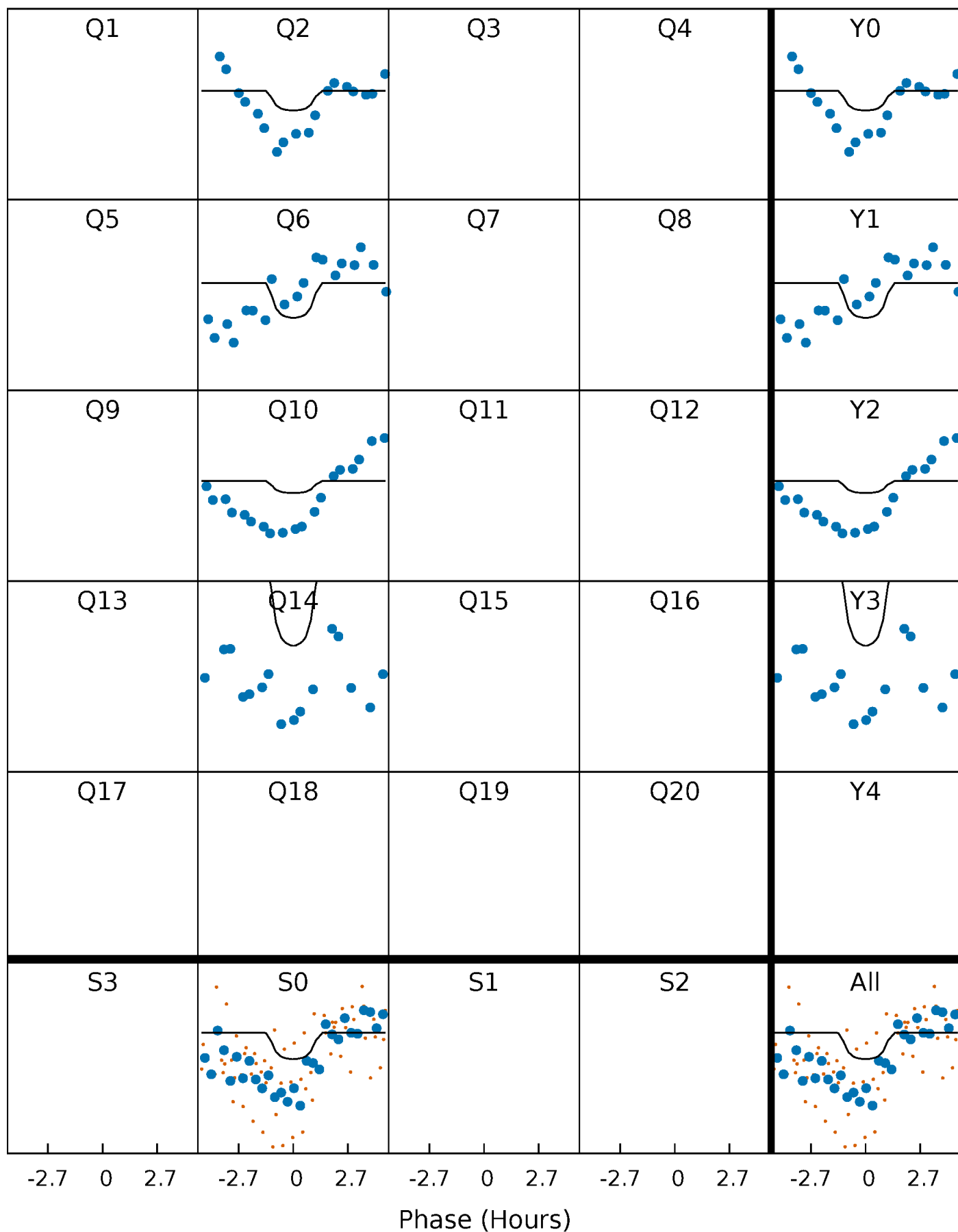
TCE 004737705-01 P=367.562815 Days  $T_0=176.319697$  (BKJD)





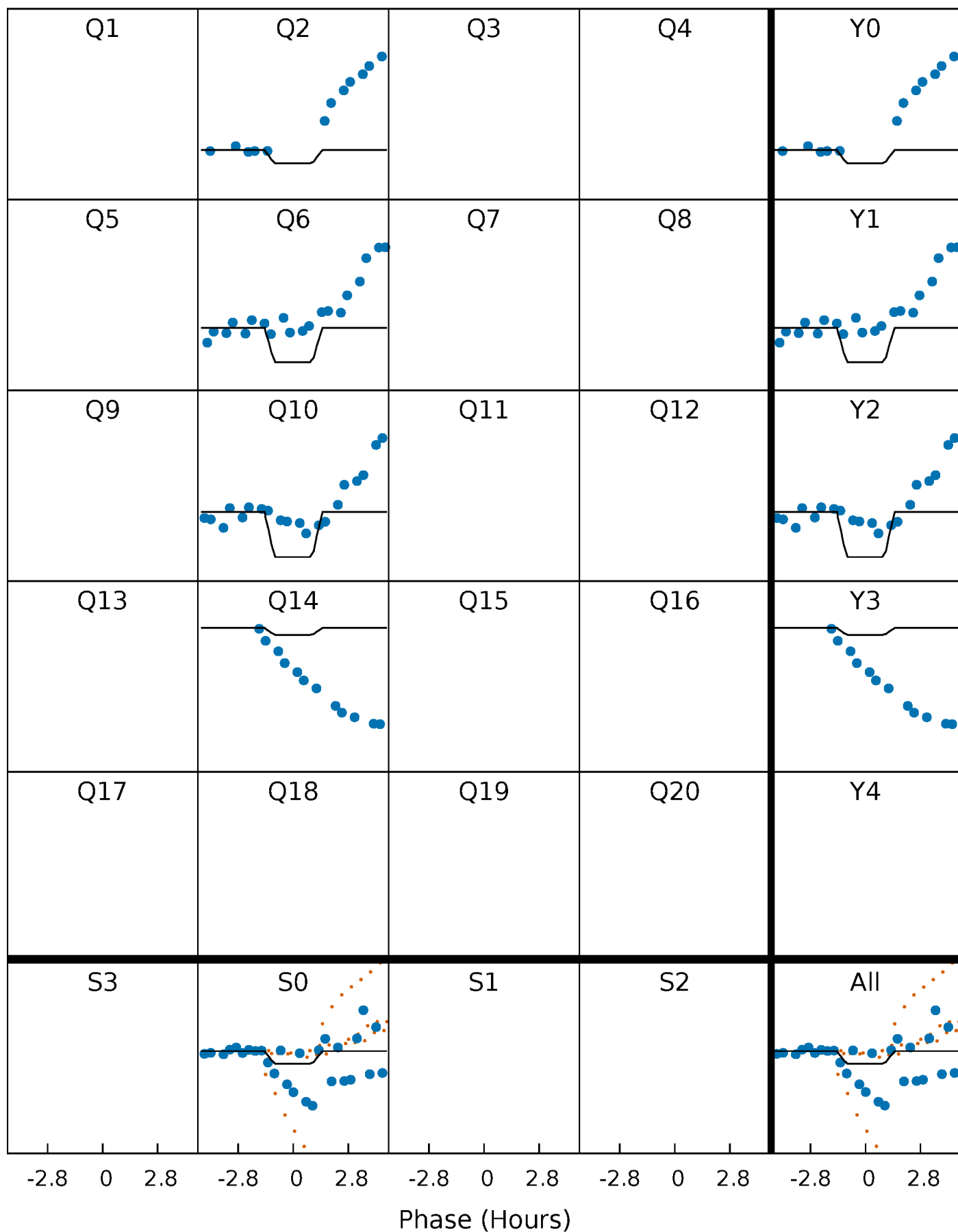
# DV Quarter-Phased Transit Curves

TCE 004737705-01 P=367.562815 Days  $T_0=176.319697$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

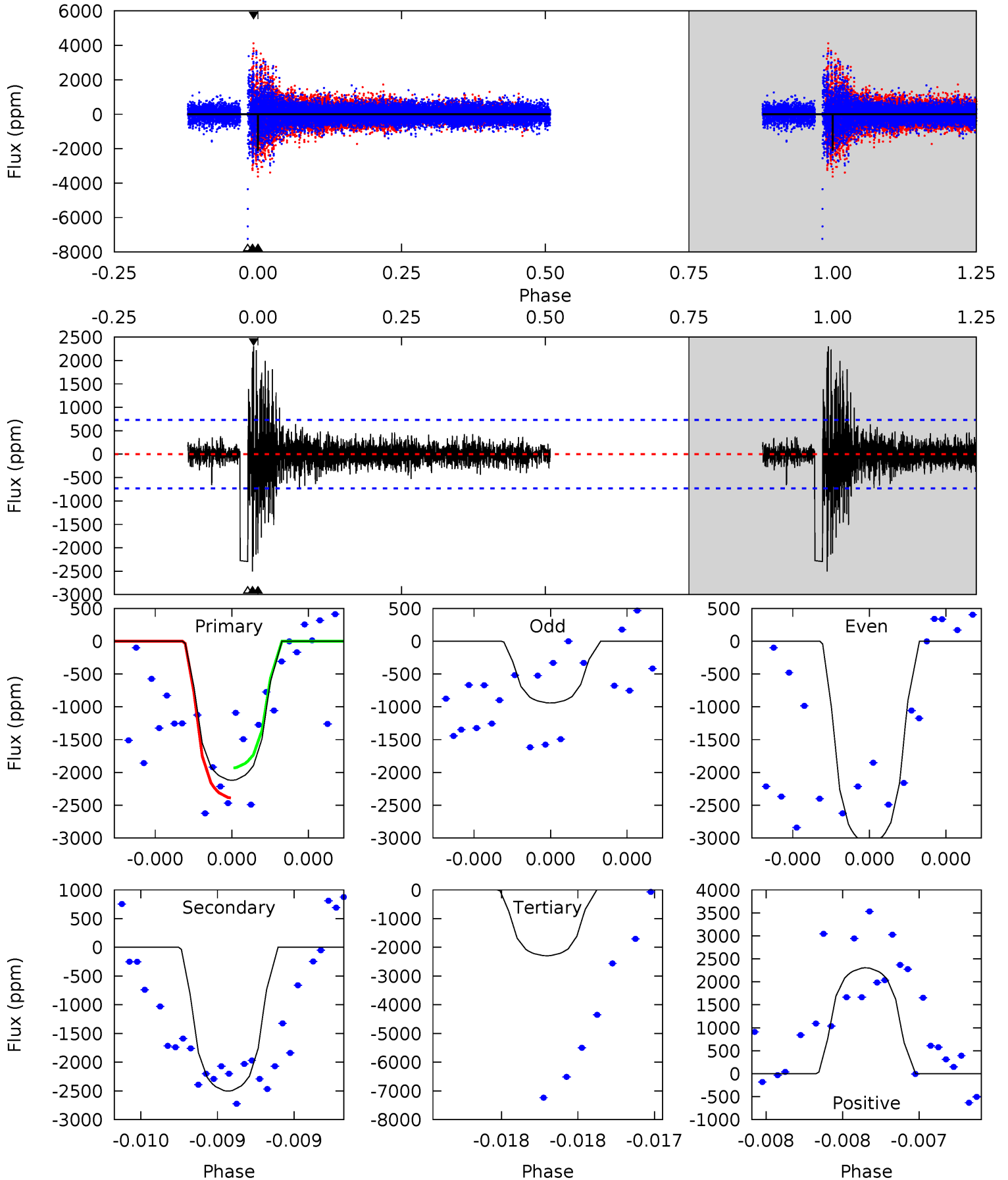
TCE 004737705-01 P=367.565689 Days  $T_0=176.303877$  (BKJD)



# DV Model-Shift Uniqueness Test

004737705-01, P = 367.562815 Days, E = 176.319697 Days

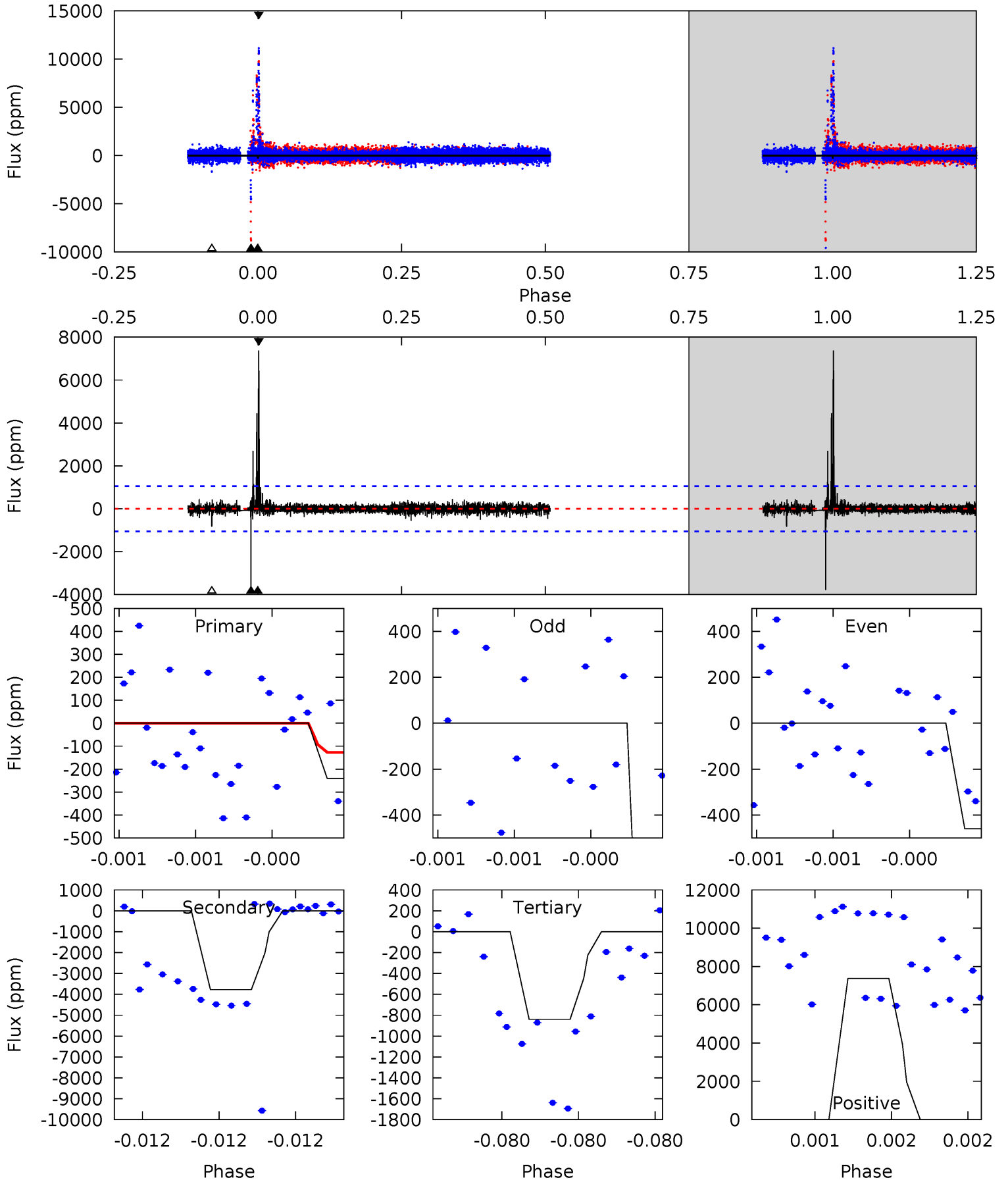
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
16.5	19.5	17.9	18.0	5.69	3.66	2.32	-1.35	-1.44	1.64	1.55	7.54	0.99	0.48	1.33



# Alt Model-Shift Uniqueness Test

004737705-01, P = 367.565689 Days, E = 176.303877 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
1.29	20.2	4.50	39.5	5.65	3.61	1.68	-3.21	-38.2	15.7	-19.3	1.76	7.75	0.66	0.62



### Stellar Parameters For KIC 004737705

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5026^{+58}_{-204}$	$2.946^{+0.030}_{-0.033}$	$0.070^{+0.150}_{-0.350}$	$8.523^{+0.462}_{-2.619}$	$2.336^{+0.383}_{-1.149}$	$0.005^{+0.002}_{-0.000}$
	+1%/-4%	+1%/-1%	+214%/-500%	+5%/-31%	+16%/-49%	+45%/-6%
Source	PHO1	AST9	KIC0	DSEP		

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

### Secondary Eclipse Parameters for KIC 004737705-01 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-2503 \pm 128$	$62.26^{+56.67}_{-41.31}$	$780^{+17}_{-32}$	$4466^{+3008}_{-943}$	$632^{+5165}_{-456}$
Alt.	$-3775 \pm 187$	$62.77^{+56.24}_{-41.00}$	$781^{+18}_{-33}$	$4794^{+3264}_{-1012}$	$933^{+7029}_{-661}$

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

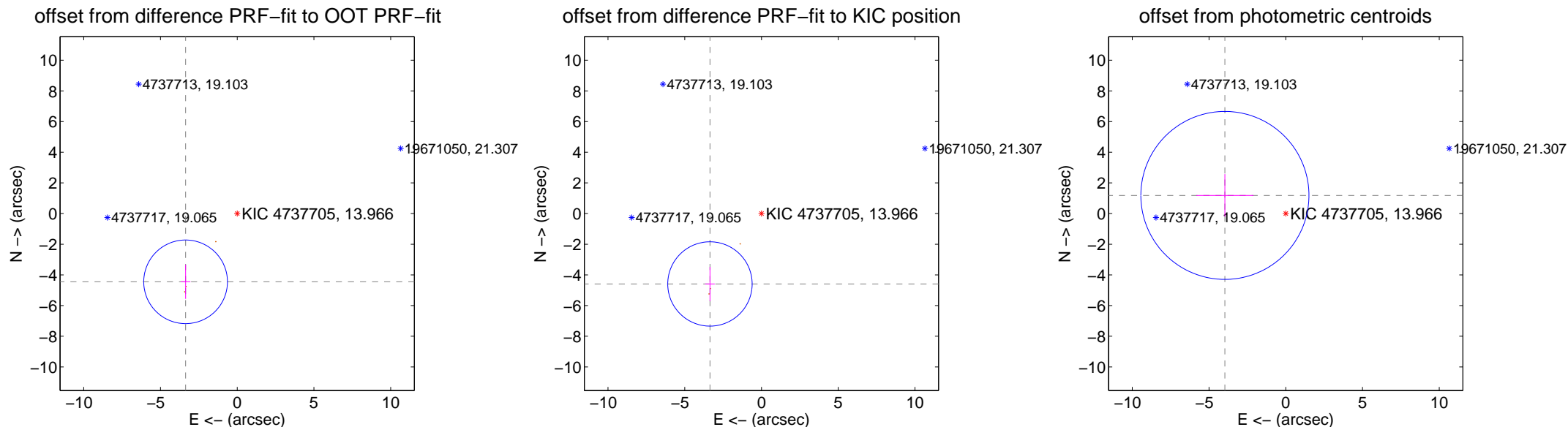
## DV Centroid Data

Supplemental centroid analysis for 004737705-01. Kepler magnitude: 13.97. Transit SNR 3.78

There are 0 quarters with good PRF difference image offsets

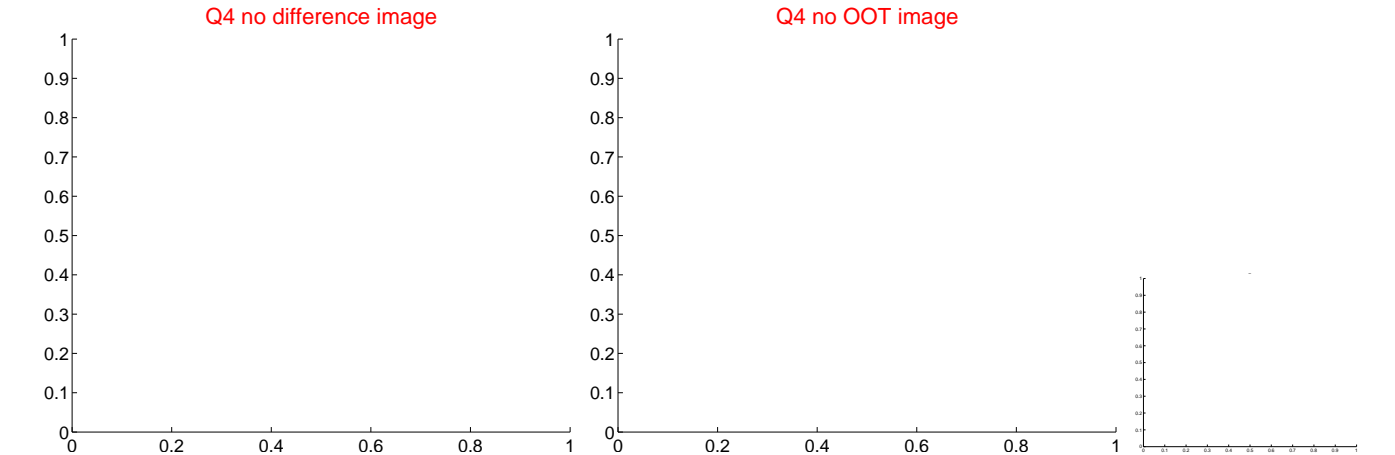
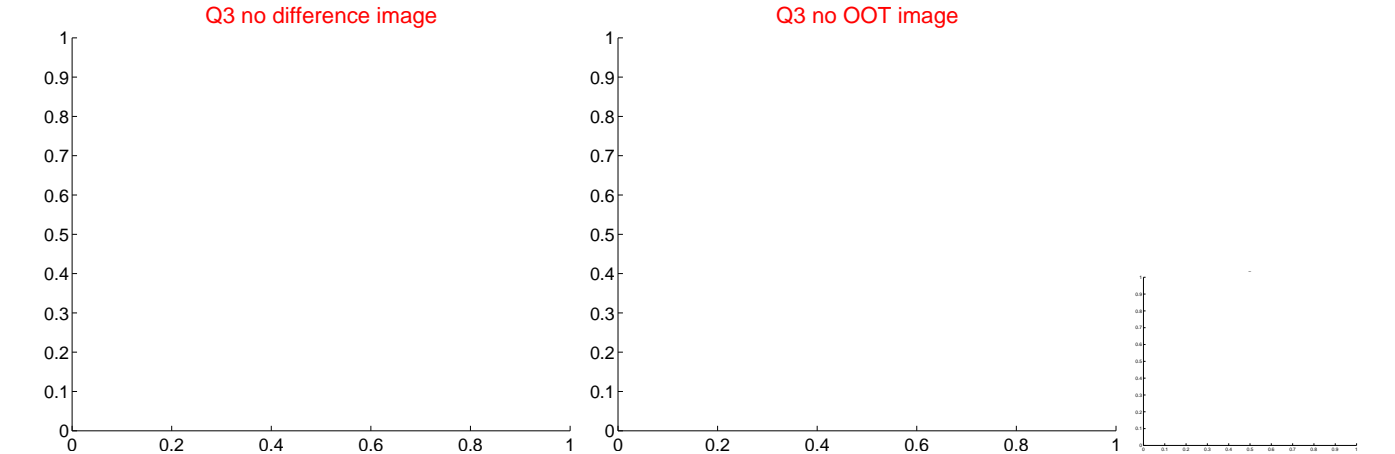
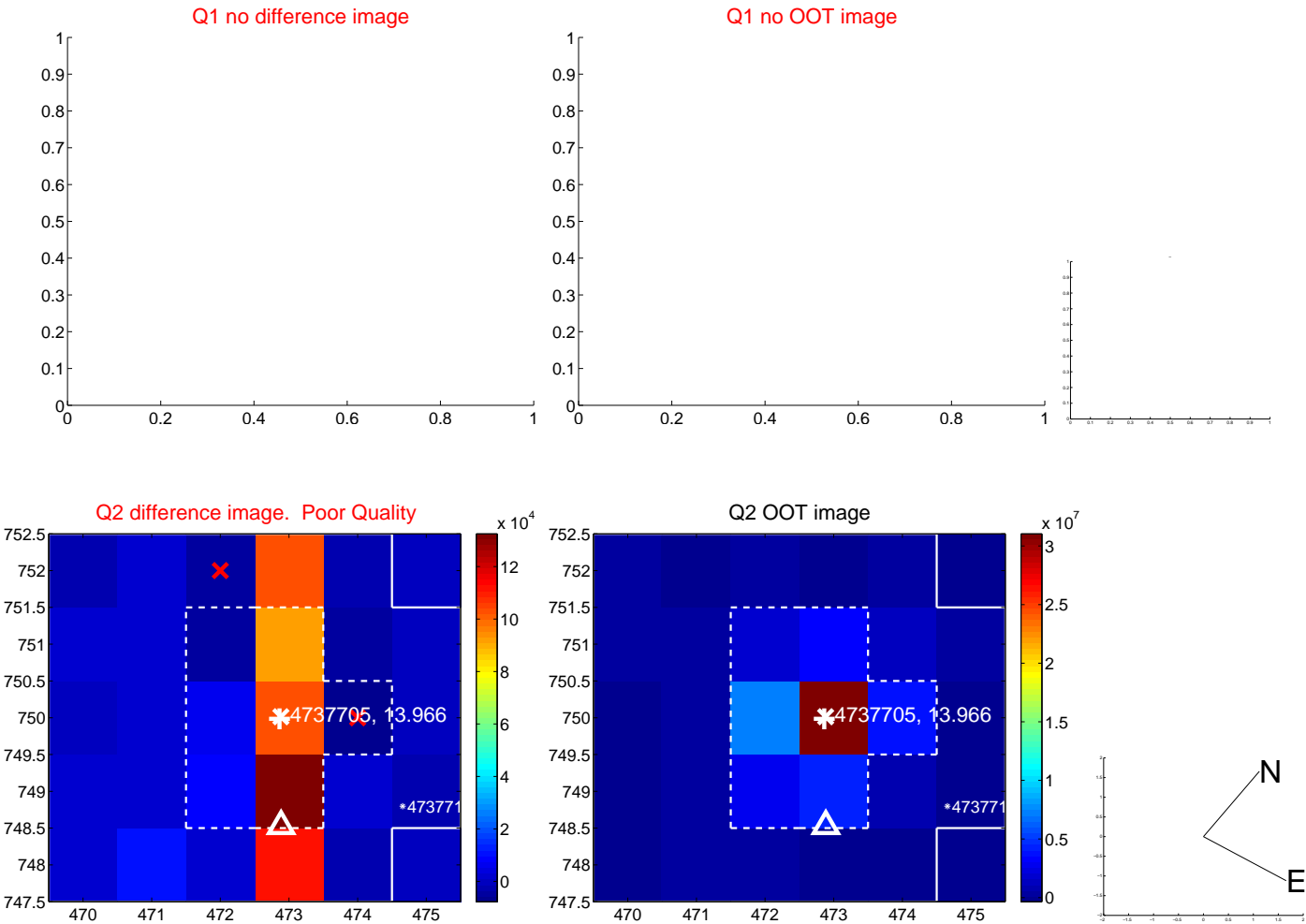
The direct PRF centroid is offset from the target star catalog position by about 0.14 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$5.578 \pm 0.909$	6.14	$3.363 \pm 0.314$	$-4.450 \pm 1.115$
PRF-fit source offset from KIC position	$5.688 \pm 0.917$	6.20	$3.359 \pm 0.314$	$-4.590 \pm 1.112$
photometric centroid source offset	$4.14 \pm 1.83$	2.27	$3.97 \pm 1.86$	$1.18 \pm 1.39$

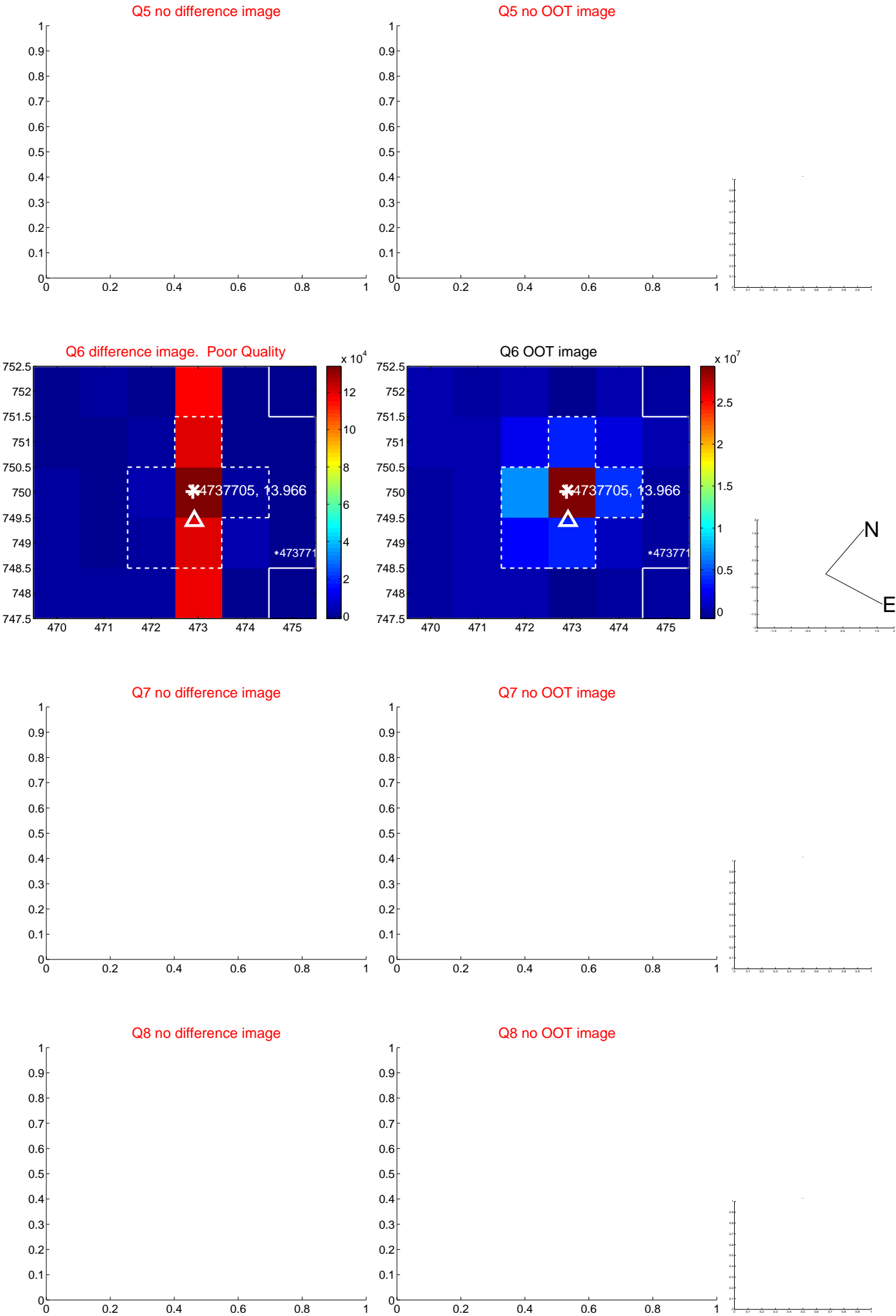


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

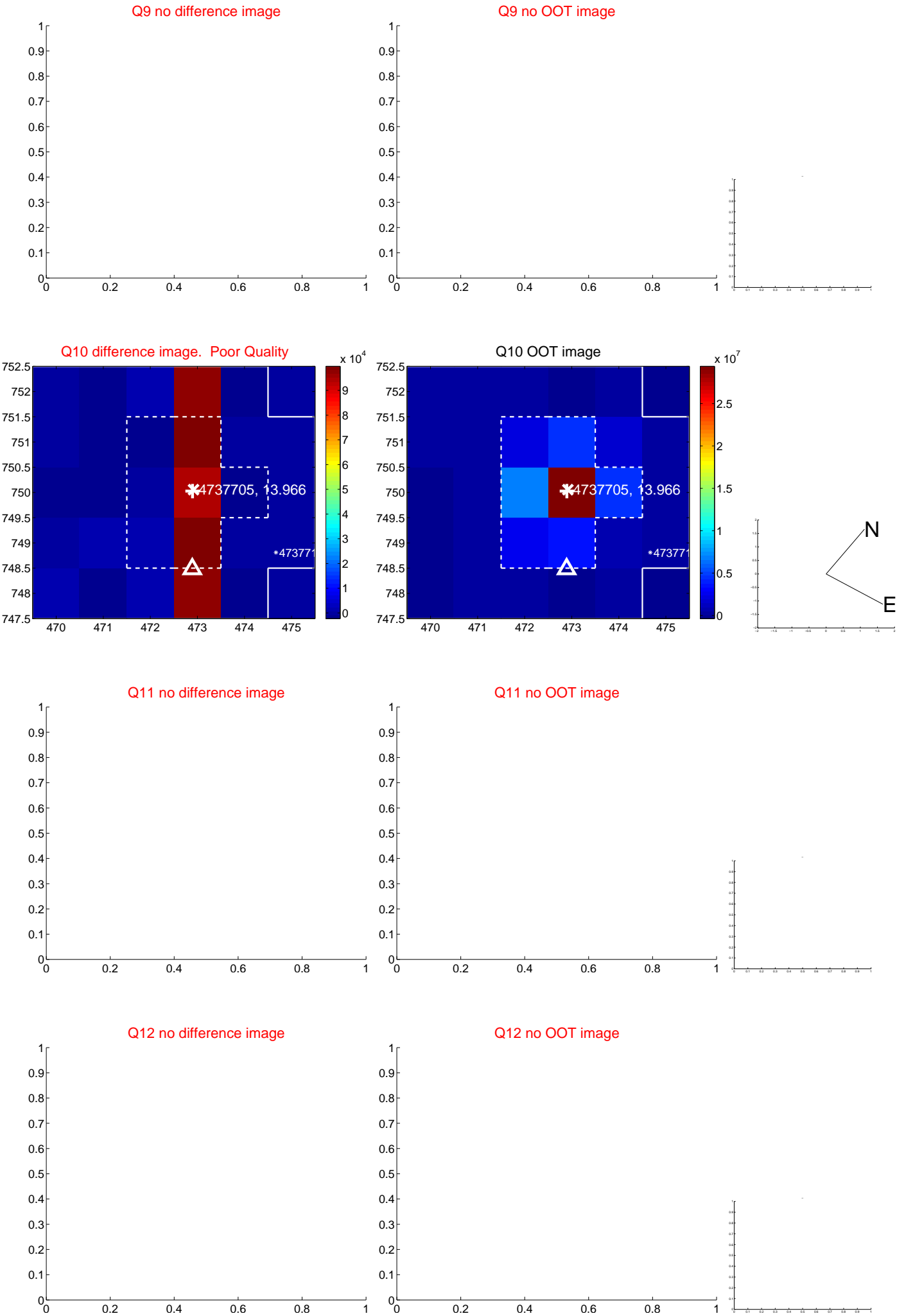


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





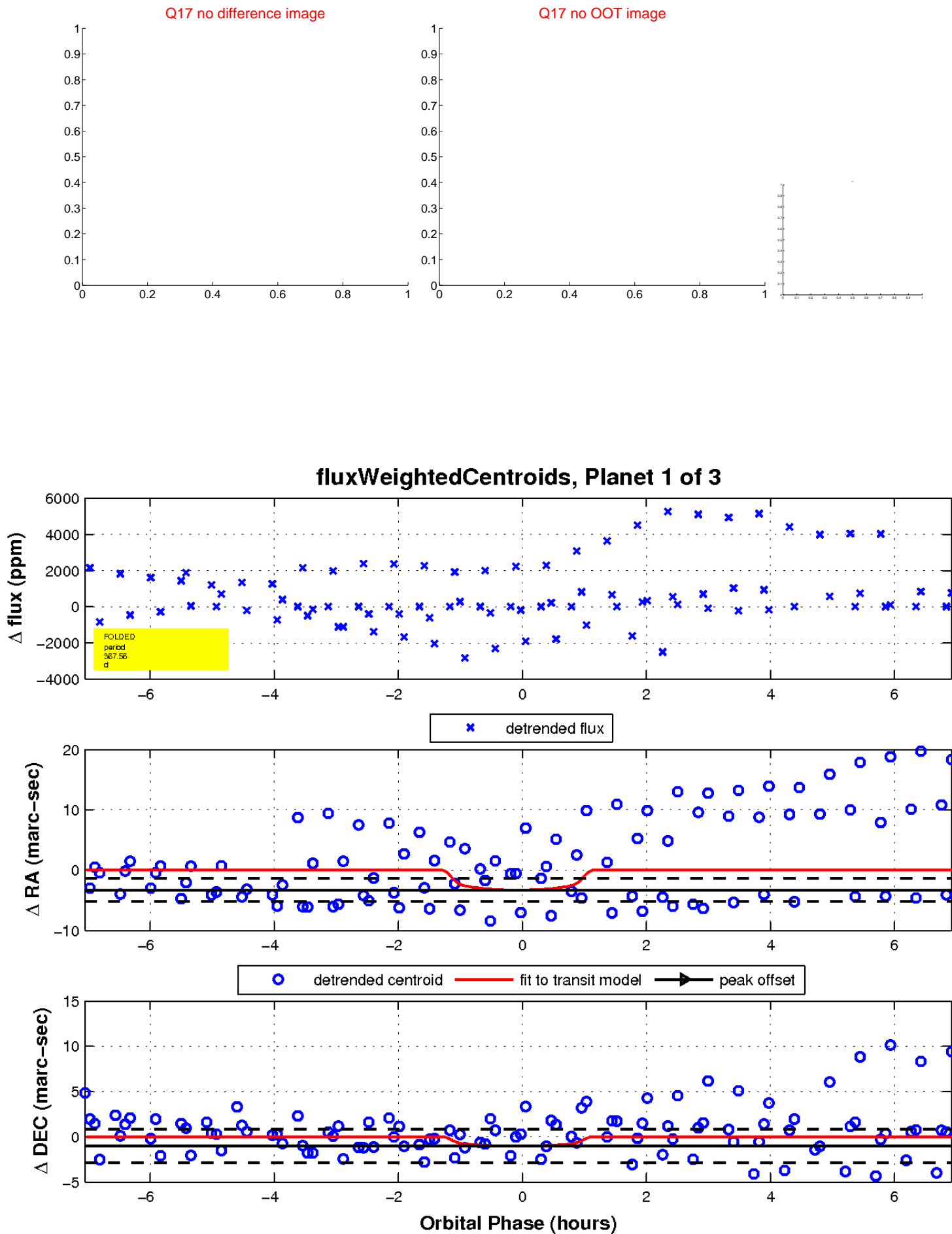
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

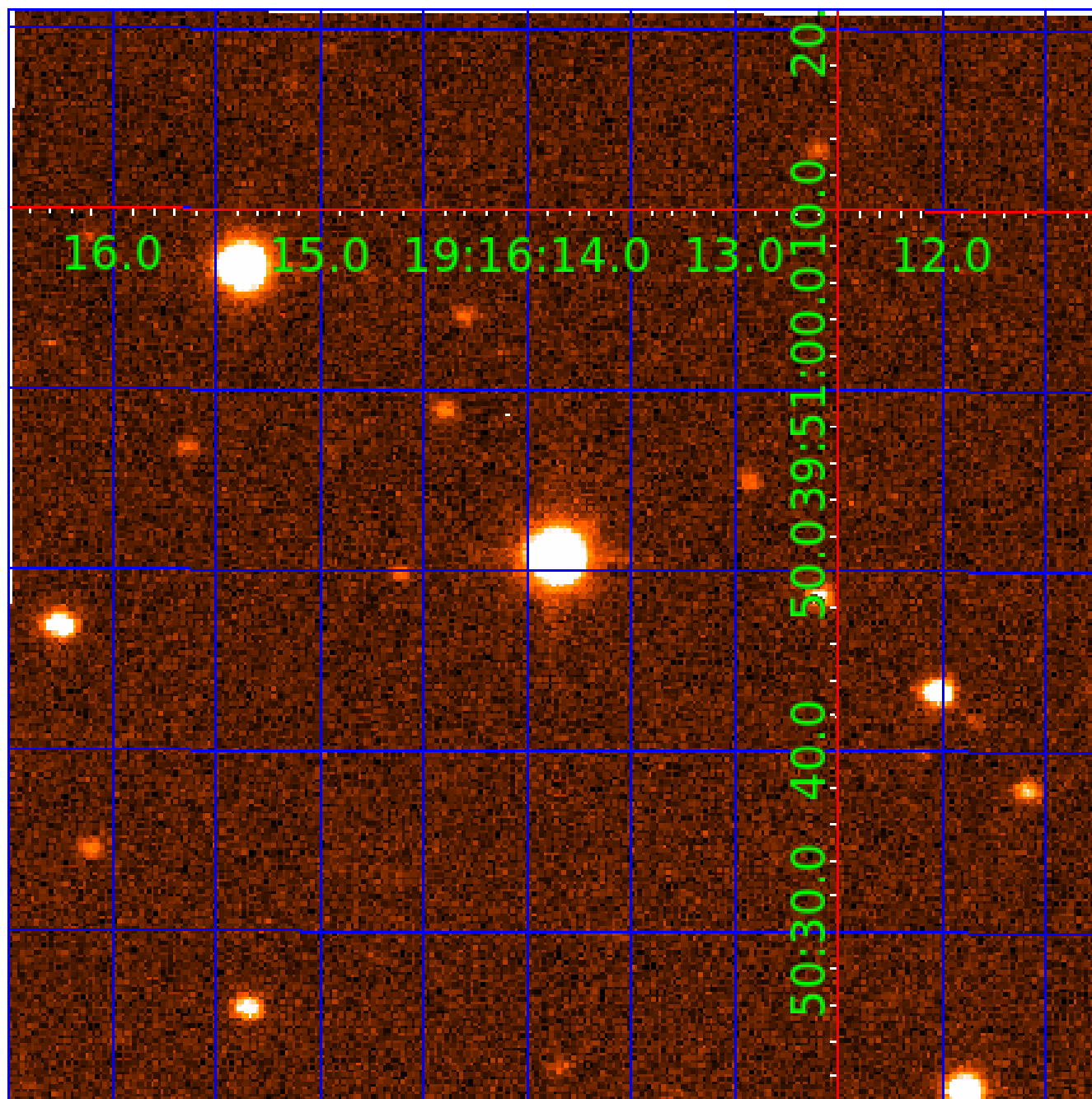


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 004737705

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
004737705-01	OBS	No	367.562815	176.319697	845.3	2.357	27.0	3.8	8.52	5026	28.11	23.36
004737705-02	OBS	No	365.959908	179.504843	7034.2	10.959	29.1	11.9	8.52	5026	87.52	23.49

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
004737705-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL_SKYE_ZUMA_TRACKER—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS
004737705-02	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_SKYE—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_POS_DV—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS—HALO_GHOST

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

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

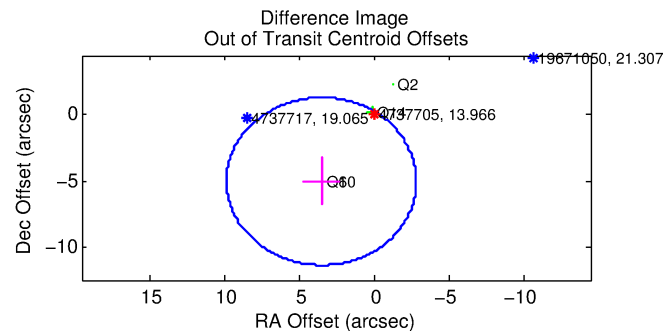
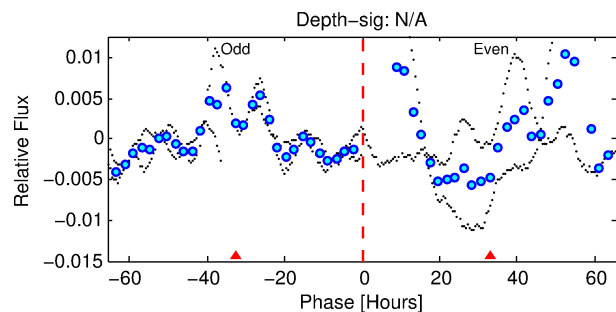
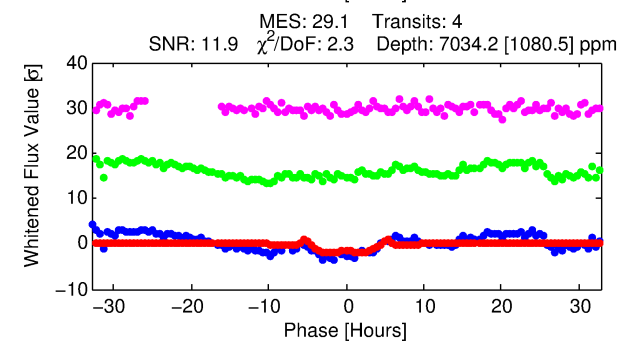
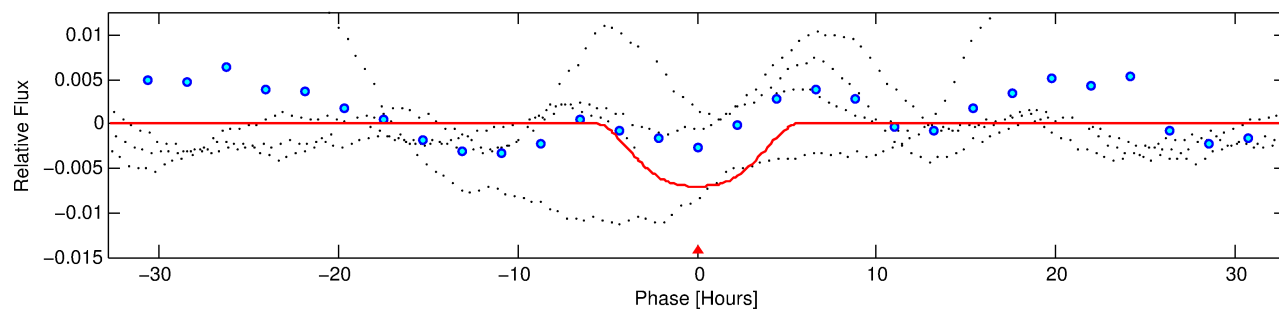
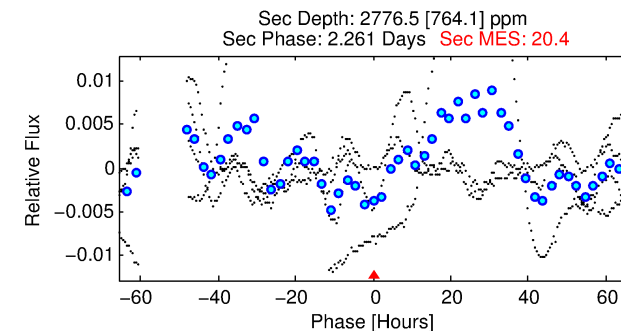
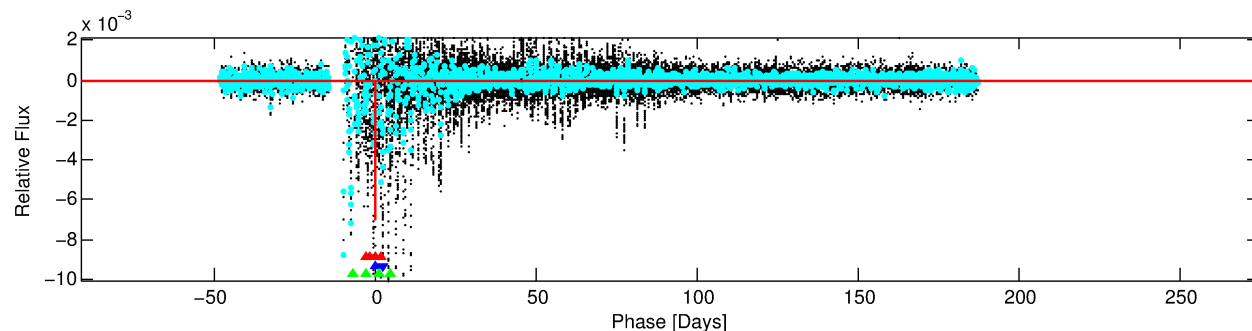
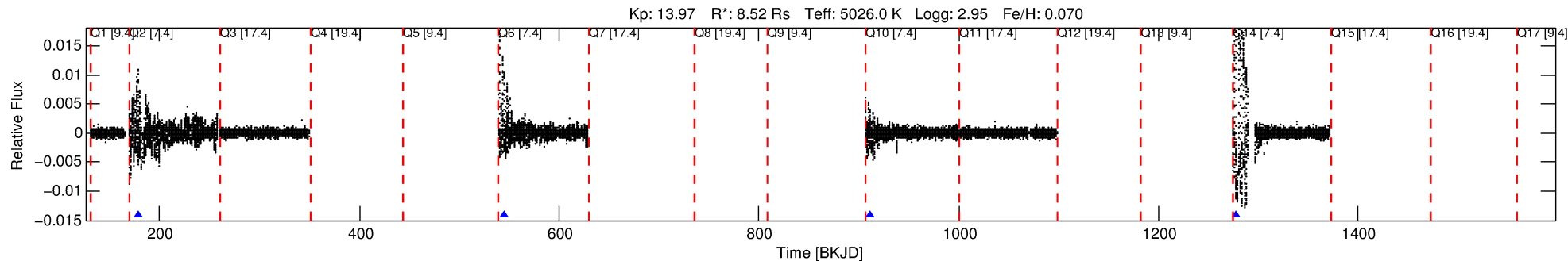
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 004737705-02

No Significant Match Found

# DV One-Page Summary

KIC: 4737705 Candidate: 2 of 3 Period: 365.960 d



## DV Fit Results:

Period = 365.95991 [0.00809] d  
Epoch = 179.5048 [0.0144] BKJD  
Rp/R\* = 0.0941 [0.0085]  
a/R\* = 159.71 [10.58]  
b = 0.90 [0.02]  
Seff = 23.49 [6.26]  
Teq = 561 [37] K  
Rp = 87.52 [28.04] Re  
a = 1.3296 [0.2744] AU  
Ag = 352.52 [137.95] [2.55σ]  
Teffp = 3761 [345] K [9.21σ]

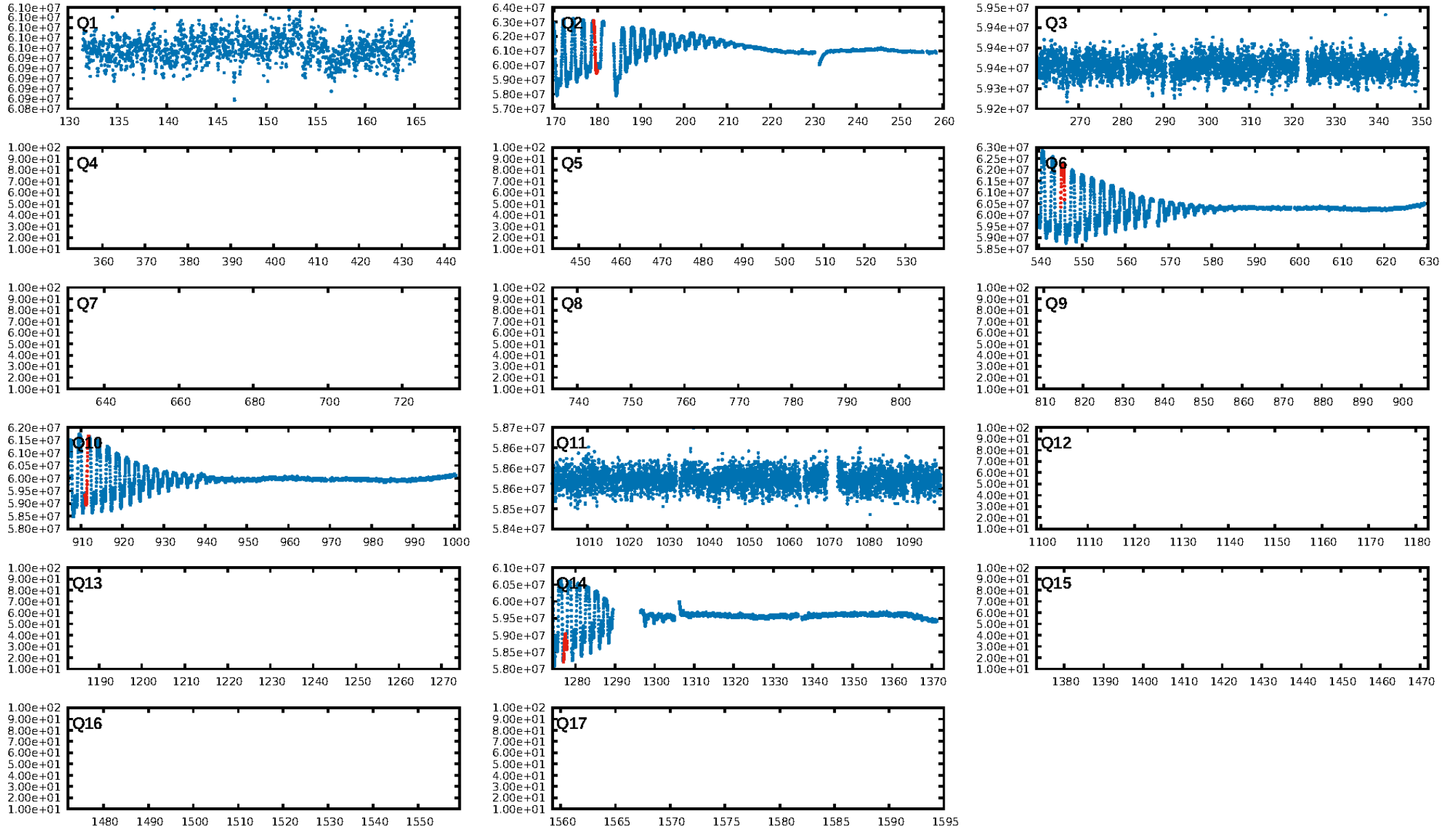
## DV Diagnostic Results:

ShortPeriod-sig: 99.8% [3.09σ]  
LongPeriod-sig: 99.9% [3.43σ]  
ModelChiSquare2-sig: 0.0%  
ModelChiSquareGof-sig: 0.0%  
Bootstrap-pfa: 1.44e-39  
RollingBand-fgt: 1.00 [4/4]  
GhostDiagnostic-chr: 0.1721  
Centroid-sig: 31.5%  
Centroid-so: 0.261 arcsec [1.47σ]  
OotOffset-rm: 6.125 arcsec [2.90σ]  
KicOffset-rm: 6.243 arcsec [2.79σ]  
OotOffset-st: 4/0/0/0 [4]  
KicOffset-st: 4/0/0/0 [4]  
DiffImageQuality-fgm: 0.00 [0/4]  
DiffImageOverlap-fno: 0.50 [2/4]

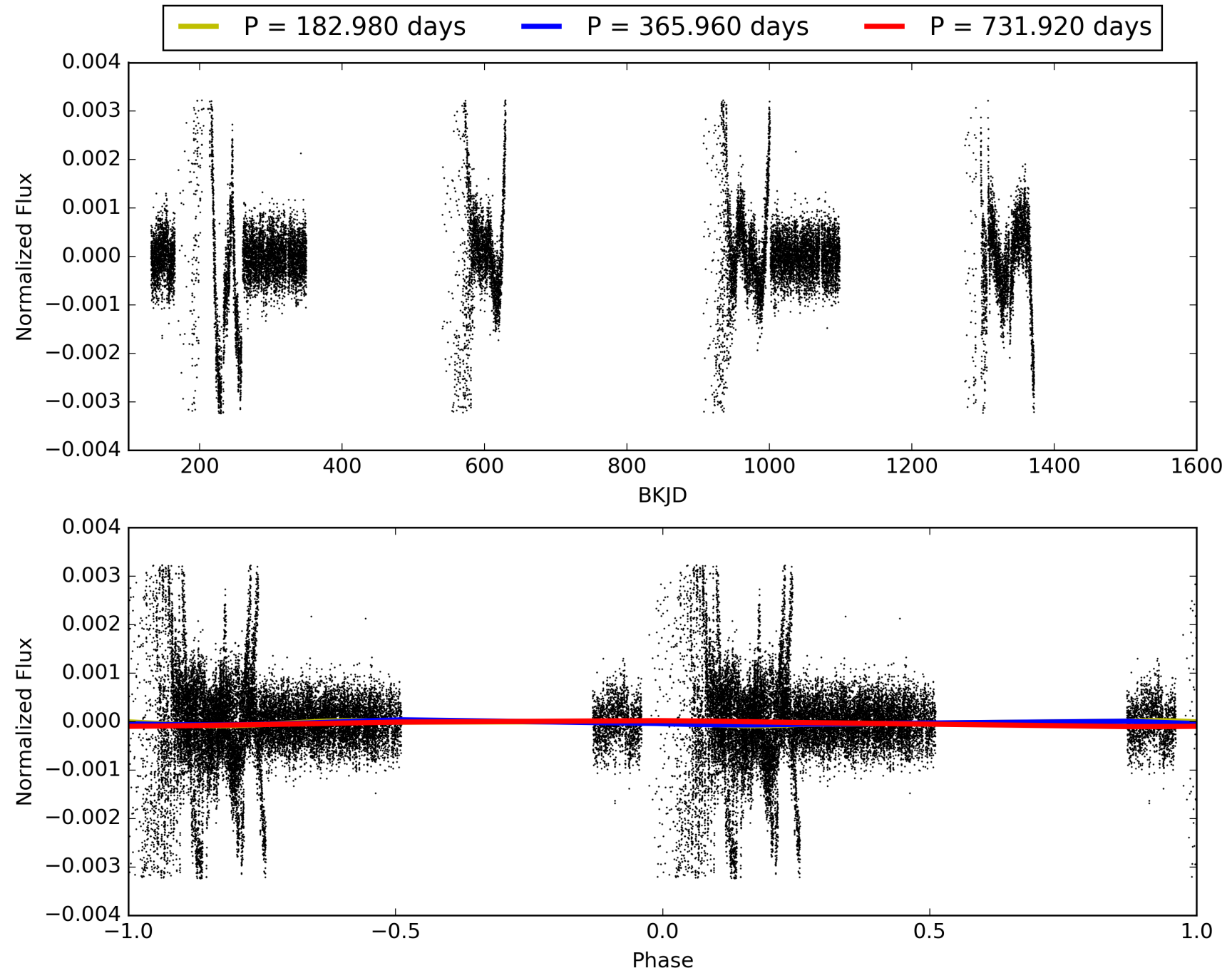
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 01:40:46 Z

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

# TCE 004737705-02, PDC Light Curves



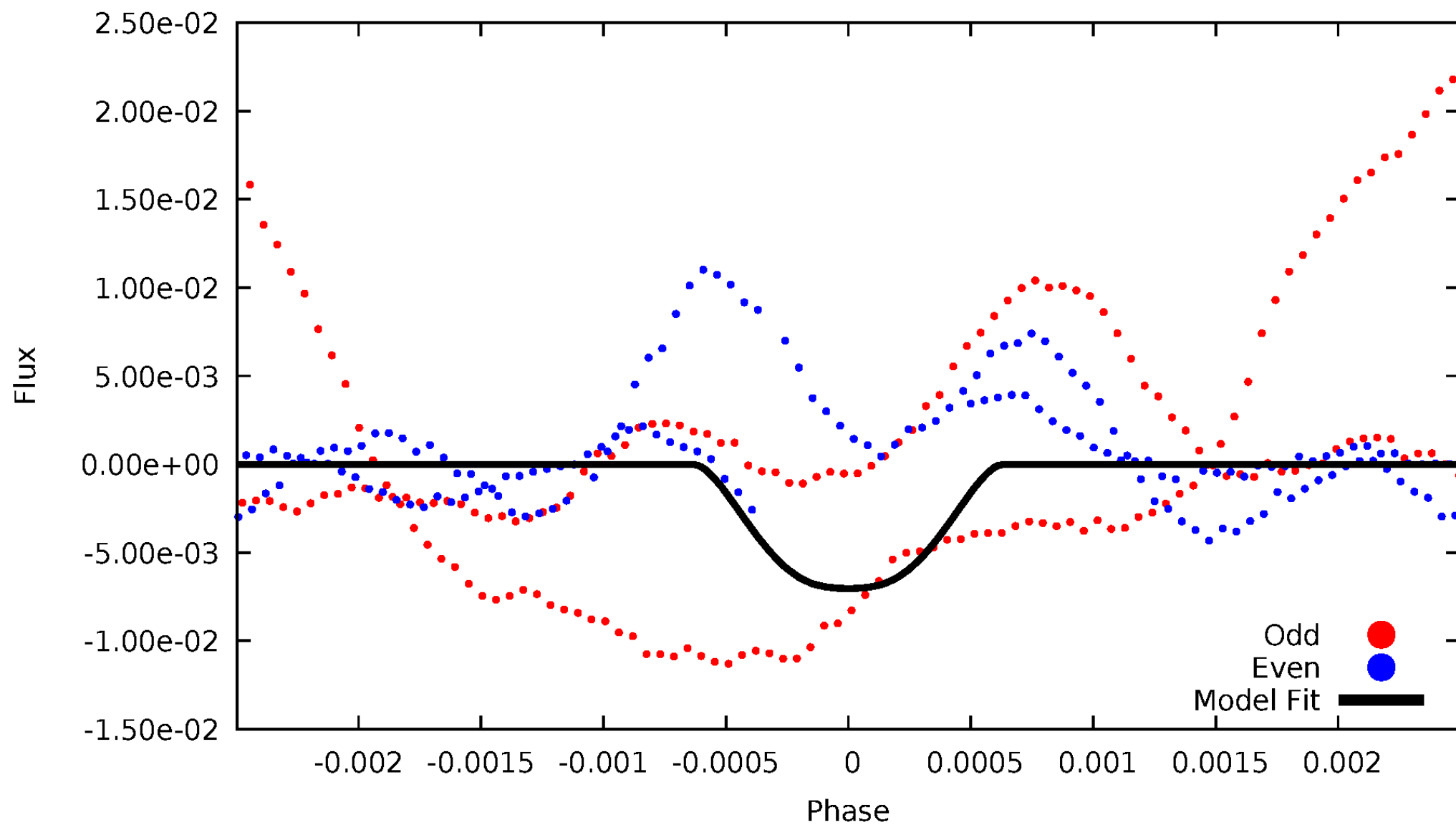
TCE 004737705-02





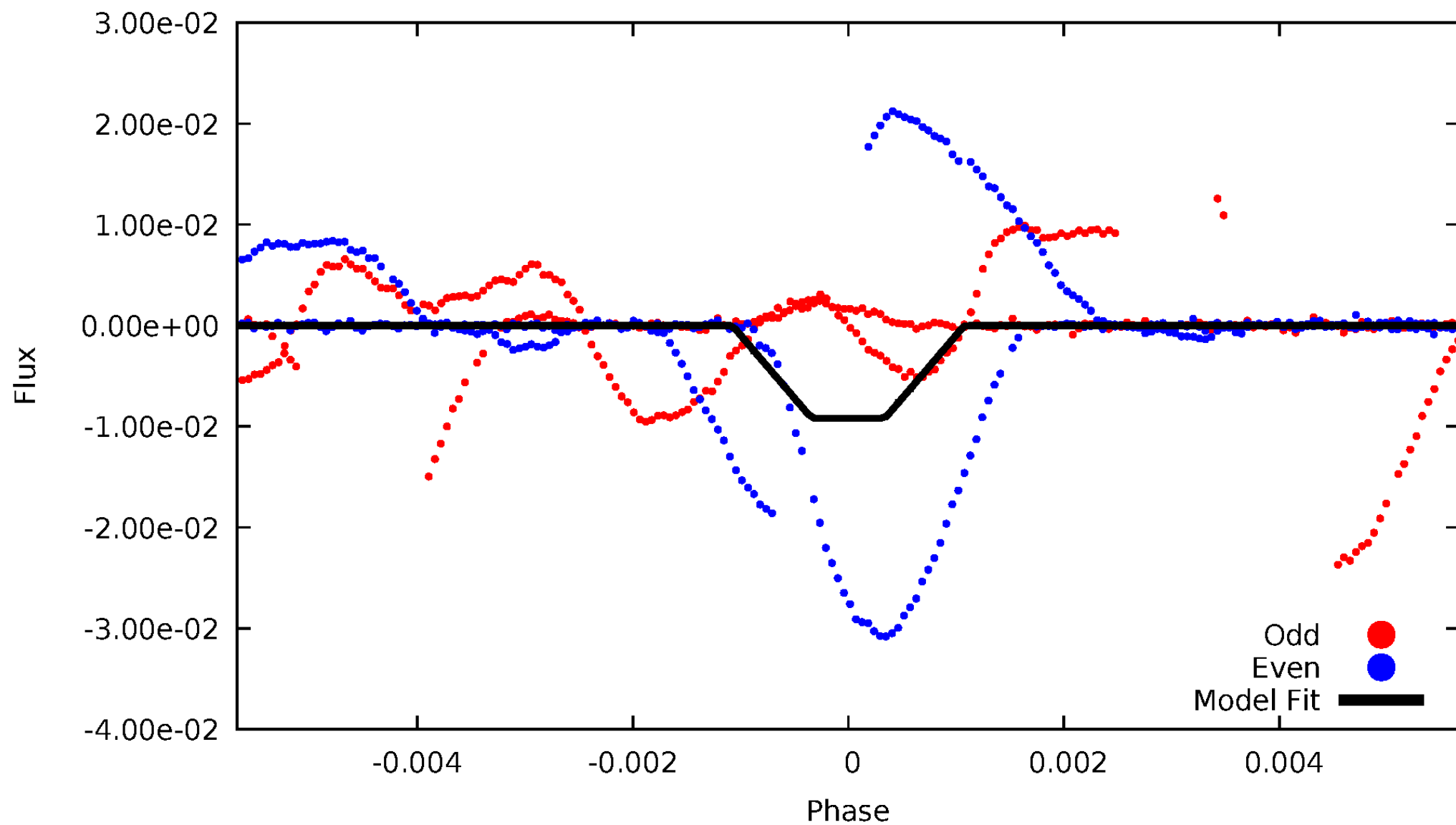
# DV Odd/Even

TCE 004737705-02



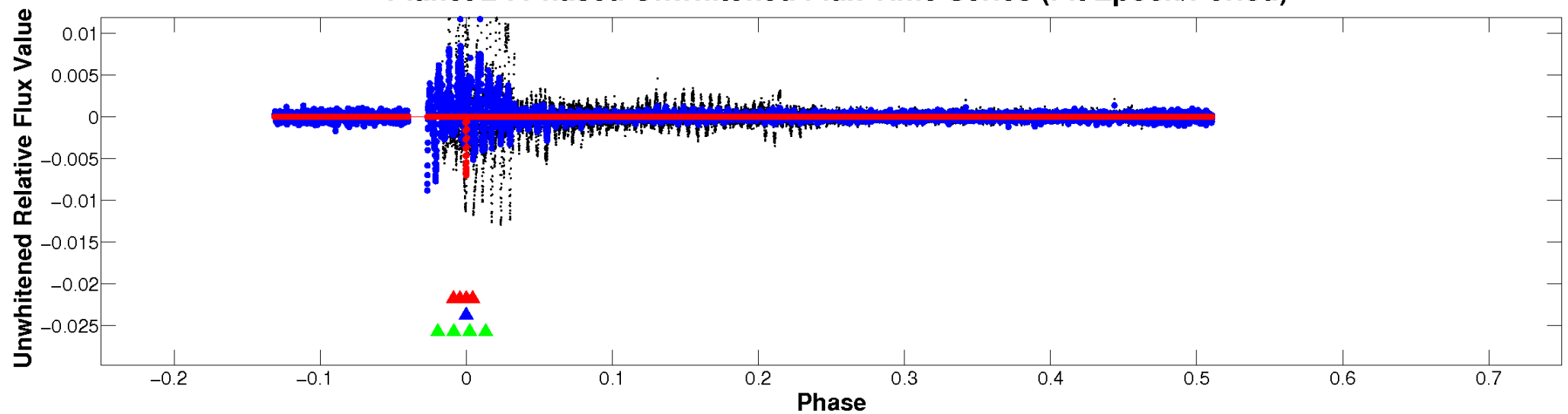
# ALT Odd/Even

TCE 004737705-02

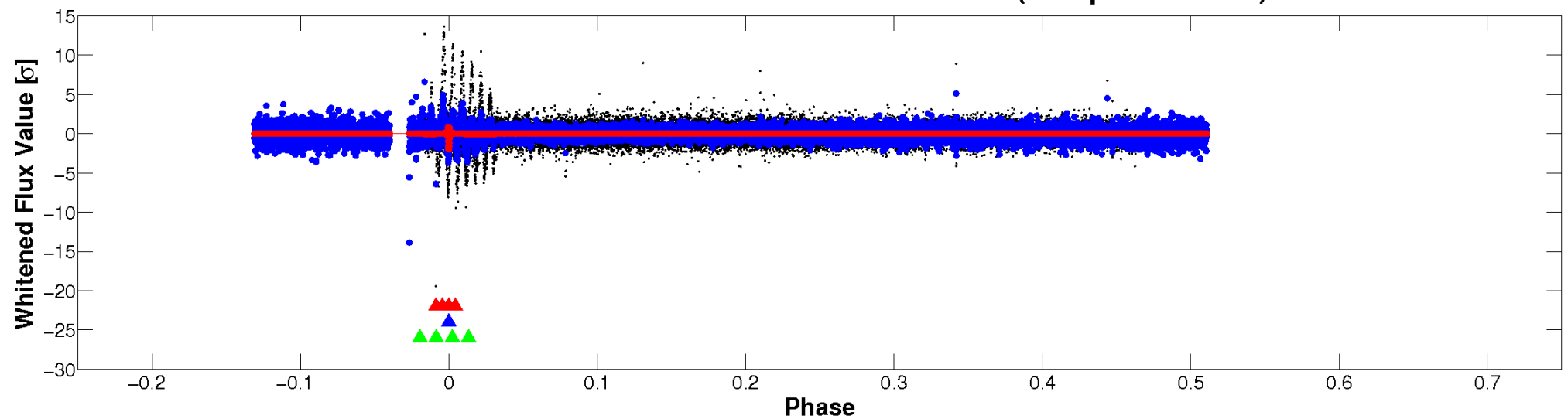


# Non-Whitened Vs. Whitened Light Curve

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

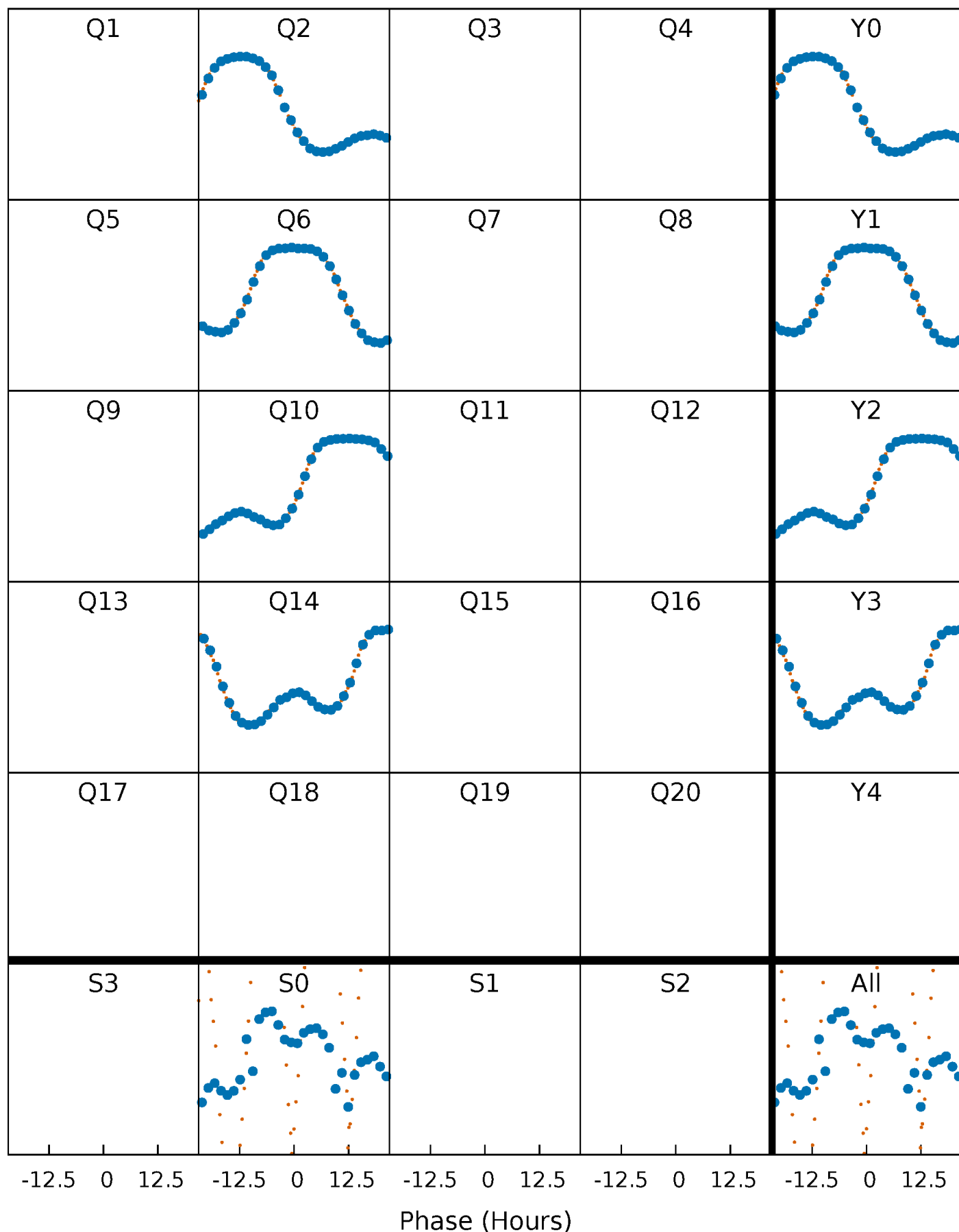


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



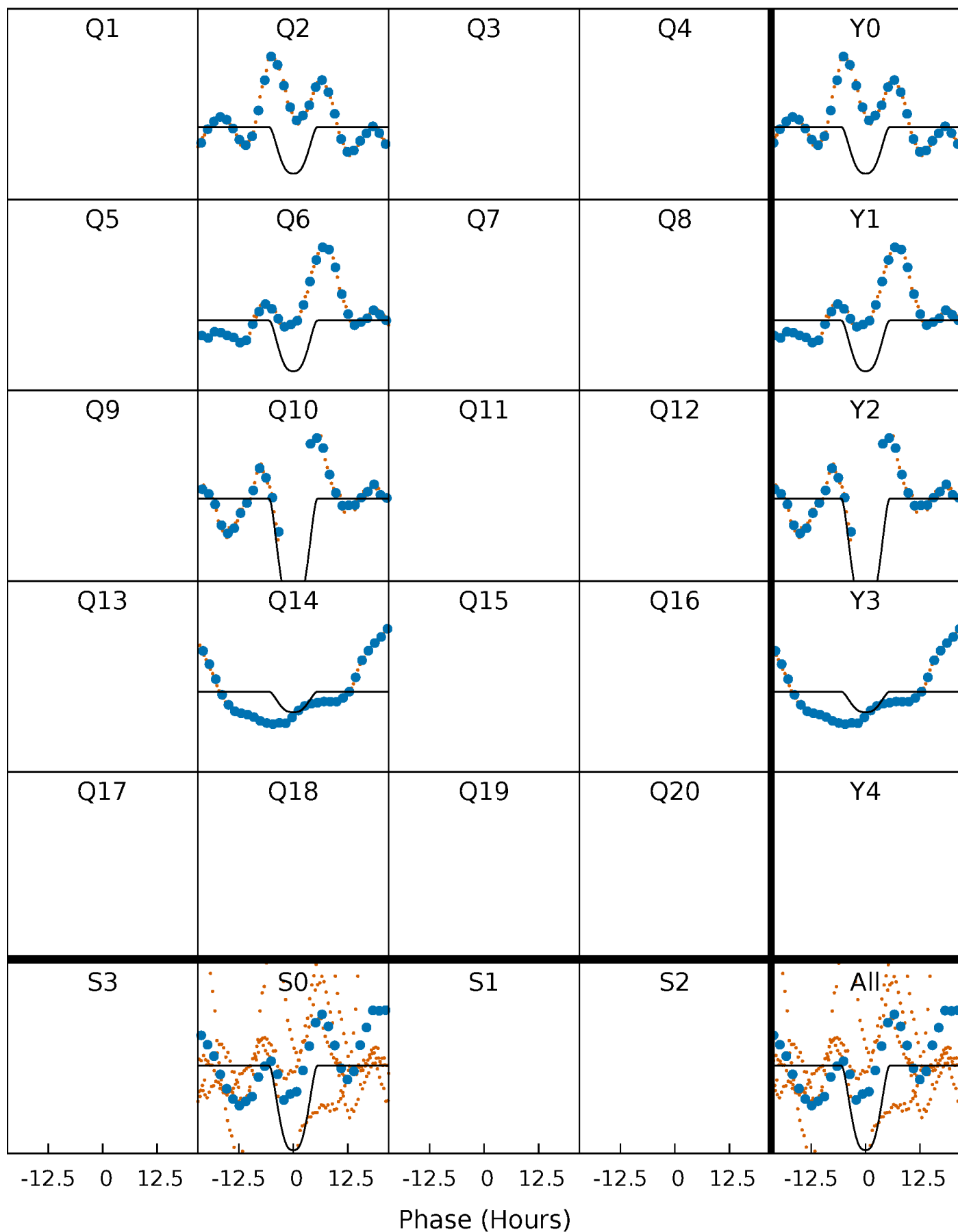
# PDC Quarter-Phased Transit Curves

TCE 004737705-02 P=365.959908 Days  $T_0=179.504843$  (BKJD)



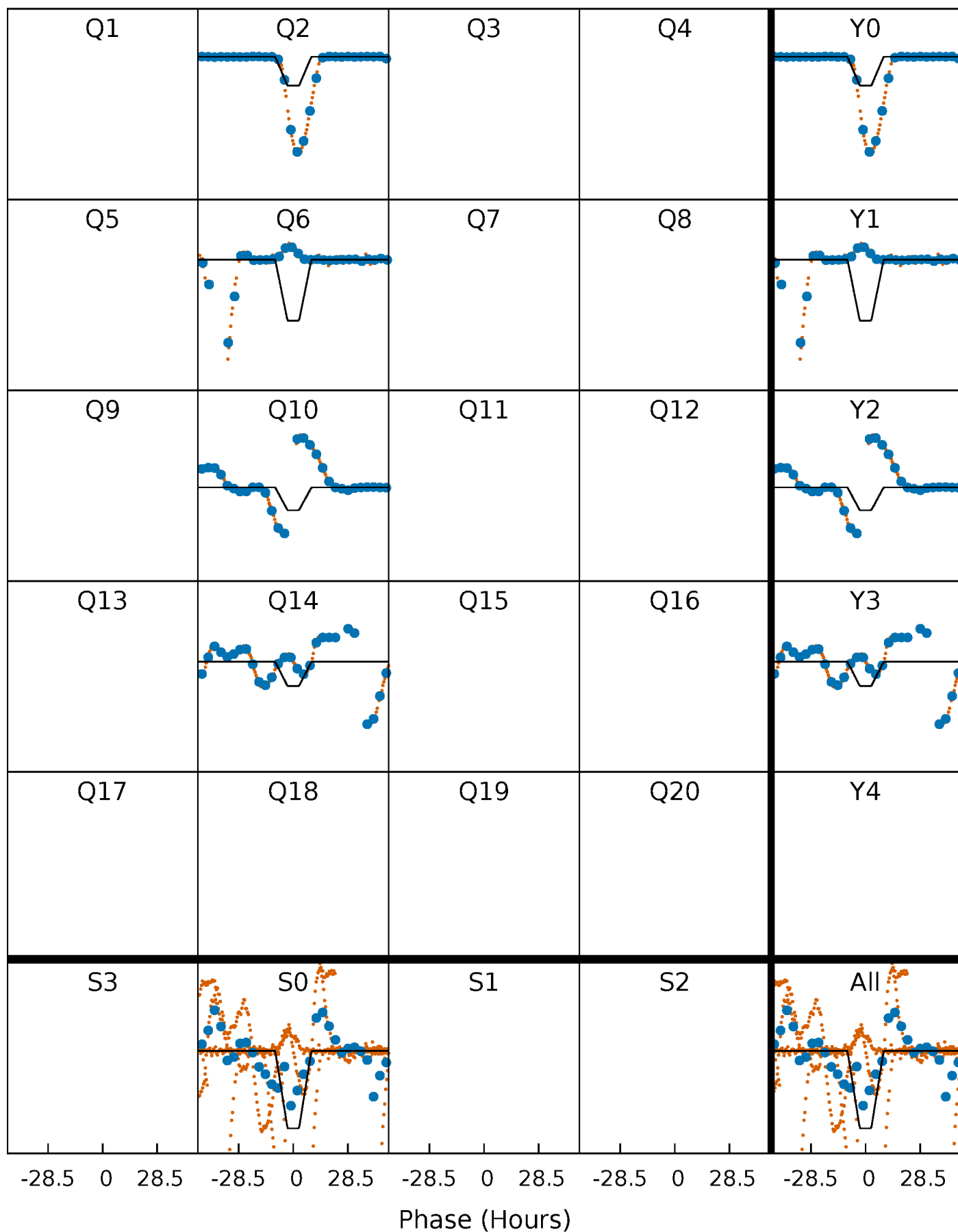
# DV Quarter-Phased Transit Curves

TCE 004737705-02 P=365.959908 Days  $T_0=179.504843$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

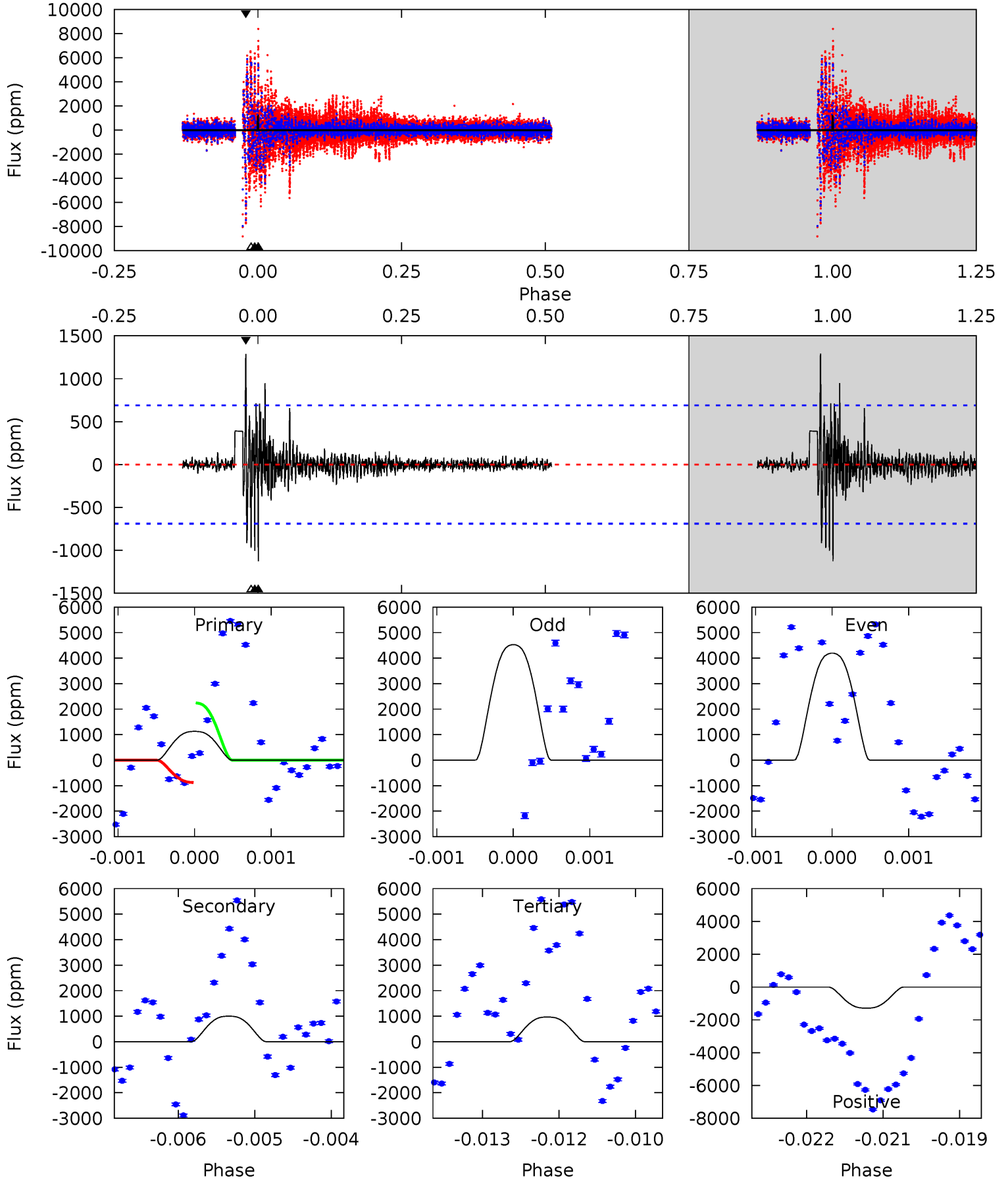
TCE 004737705-02 P=366.005927 Days  $T_0=179.527774$  (BKJD)



# DV Model-Shift Uniqueness Test

004737705-02, P = 365.959908 Days, E = 179.504843 Days

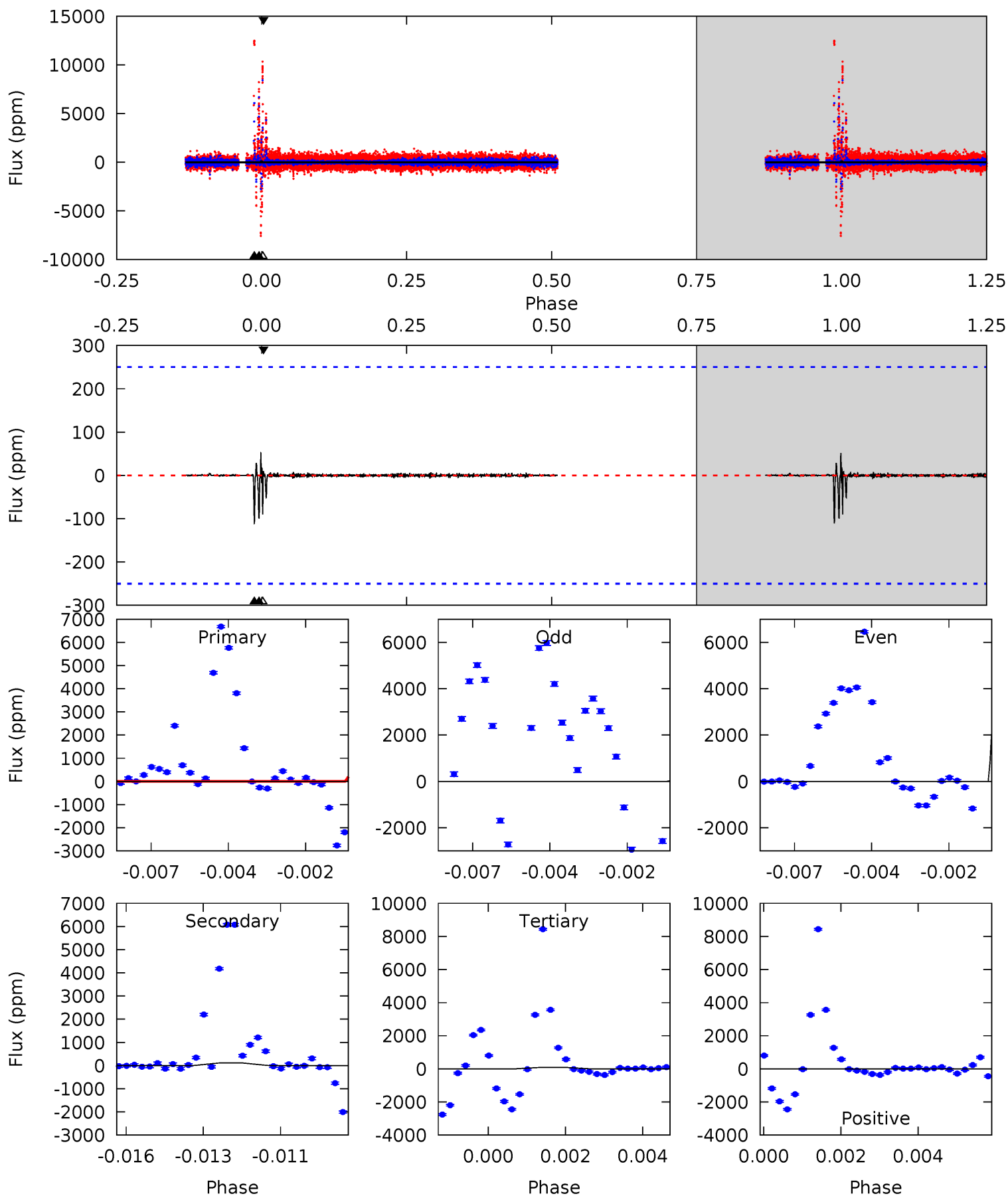
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
8.83	7.85	7.59	10.1	5.40	3.22	0.90	1.24	-1.25	0.27	-2.23	0.63	3.55	0.53	3.77



# Alt Model-Shift Uniqueness Test

004737705-02, P = 366.005927 Days, E = 179.527774 Days

Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
2.08	2.34	1.90	0.19	5.31	3.06	0.10	0.18	1.89	0.44	2.15	136.6	-5.88	0.32	2.27





### Stellar Parameters For KIC 004737705

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M$ ( $M_{\odot}$ )	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$5026^{+58}_{-204}$	$2.946^{+0.030}_{-0.033}$	$0.070^{+0.150}_{-0.350}$	$8.523^{+0.462}_{-2.619}$	$2.336^{+0.383}_{-1.149}$	$0.005^{+0.002}_{-0.000}$
	+1%/-4%	+1%/-1%	+214%/-500%	+5%/-31%	+16%/-49%	+45%/-6%
Source	PHO1	AST9	KIC0	DSEP		

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

### Secondary Eclipse Parameters for KIC 004737705-02 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	$-1003 \pm 128$	$89.49^{+9.06}_{-10.55}$	$783^{+19}_{-31}$	$3365^{+142}_{-127}$	$126^{+33}_{-26}$
Alt.	$-110 \pm 47$	$90.64^{+9.36}_{-10.47}$	$783^{+17}_{-34}$	$2474^{+140}_{-187}$	$13^{+7}_{-6}$

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

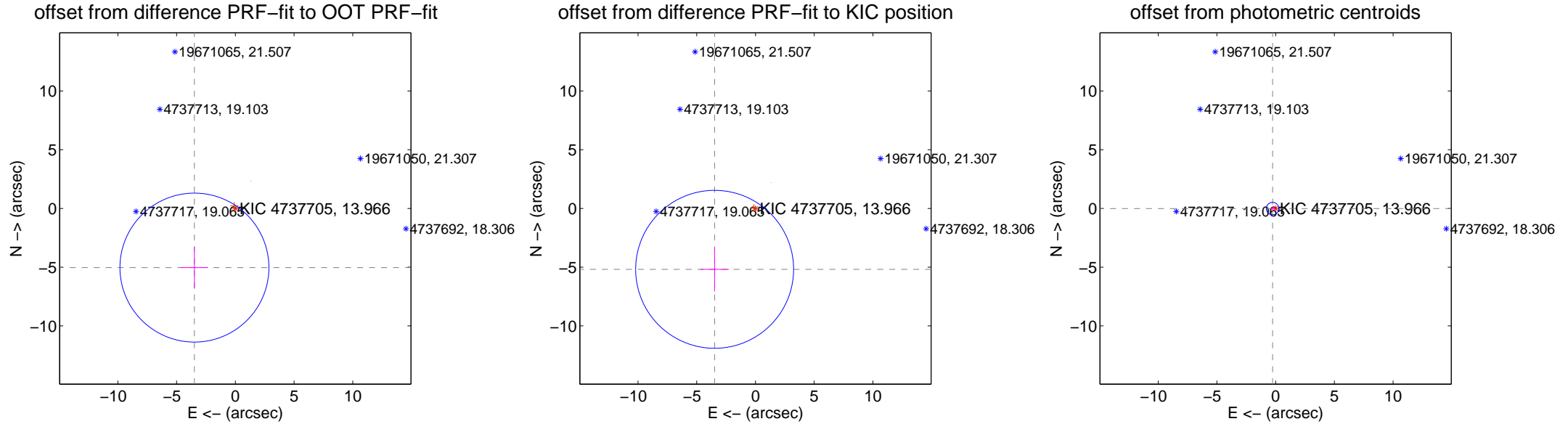
## DV Centroid Data

Supplemental centroid analysis for 004737705-02. Kepler magnitude: 13.97. Transit SNR 11.85

There are 0 quarters with good PRF difference image offsets

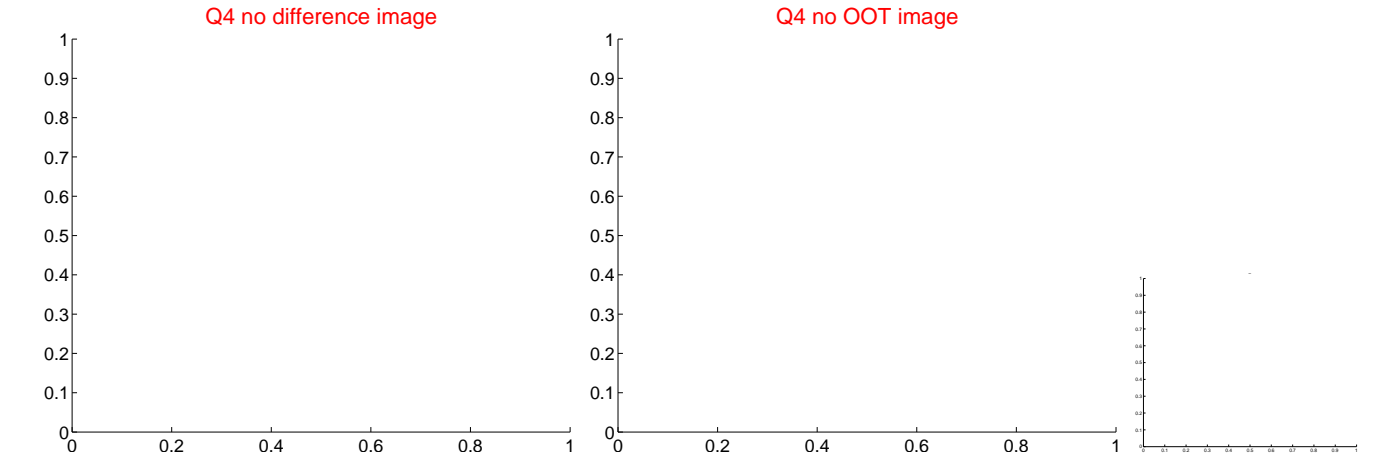
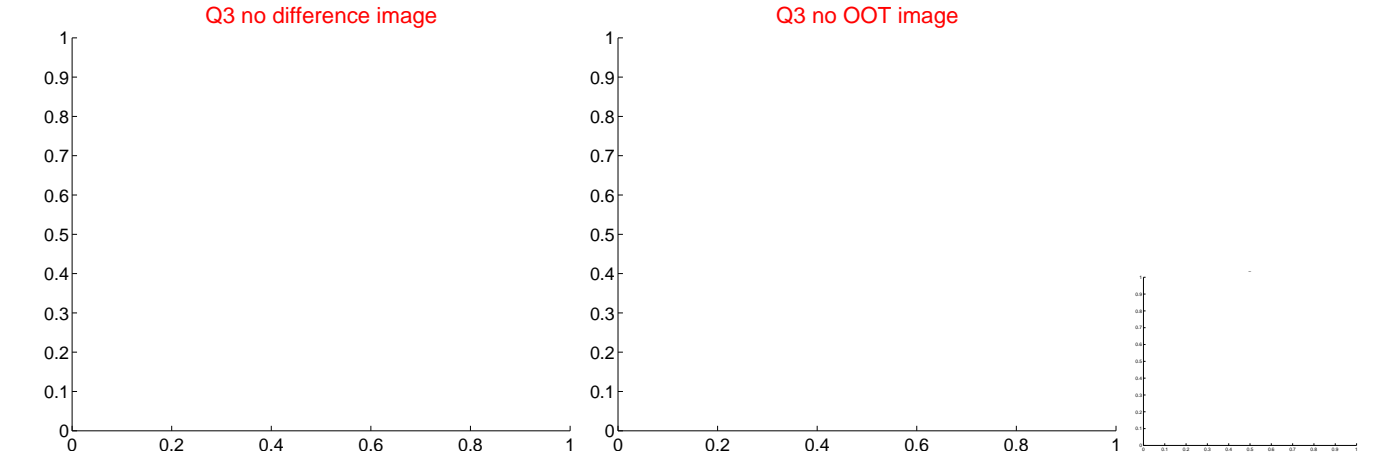
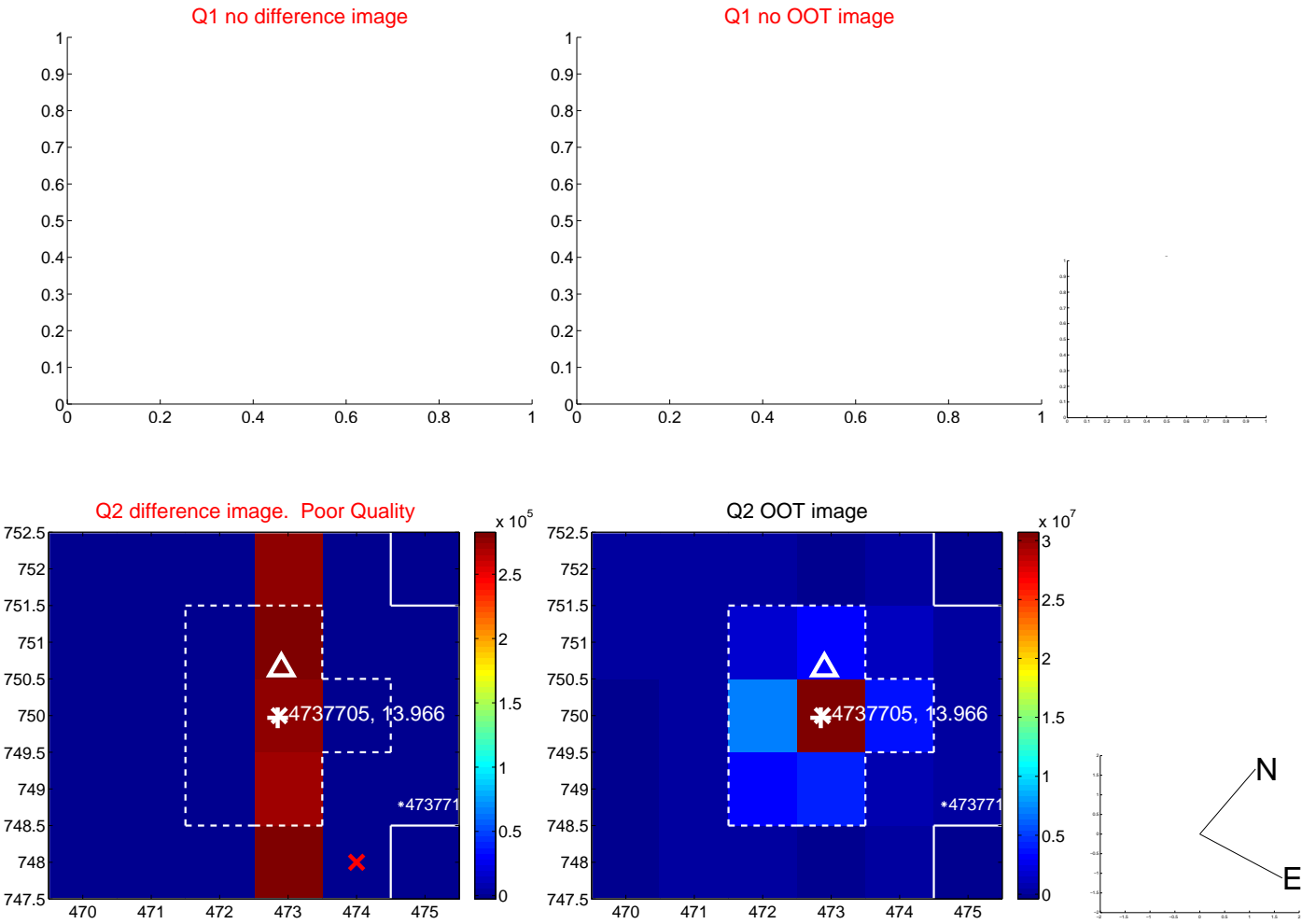
The direct PRF centroid is offset from the target star catalog position by about 0.17 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$6.125 \pm 2.114$	2.90	$3.485 \pm 1.151$	$-5.037 \pm 1.775$
PRF-fit source offset from KIC position	$6.243 \pm 2.241$	2.79	$3.480 \pm 1.213$	$-5.183 \pm 1.886$
photometric centroid source offset	$0.26 \pm 0.18$	1.47	$0.26 \pm 0.18$	$-0.01 \pm 0.15$

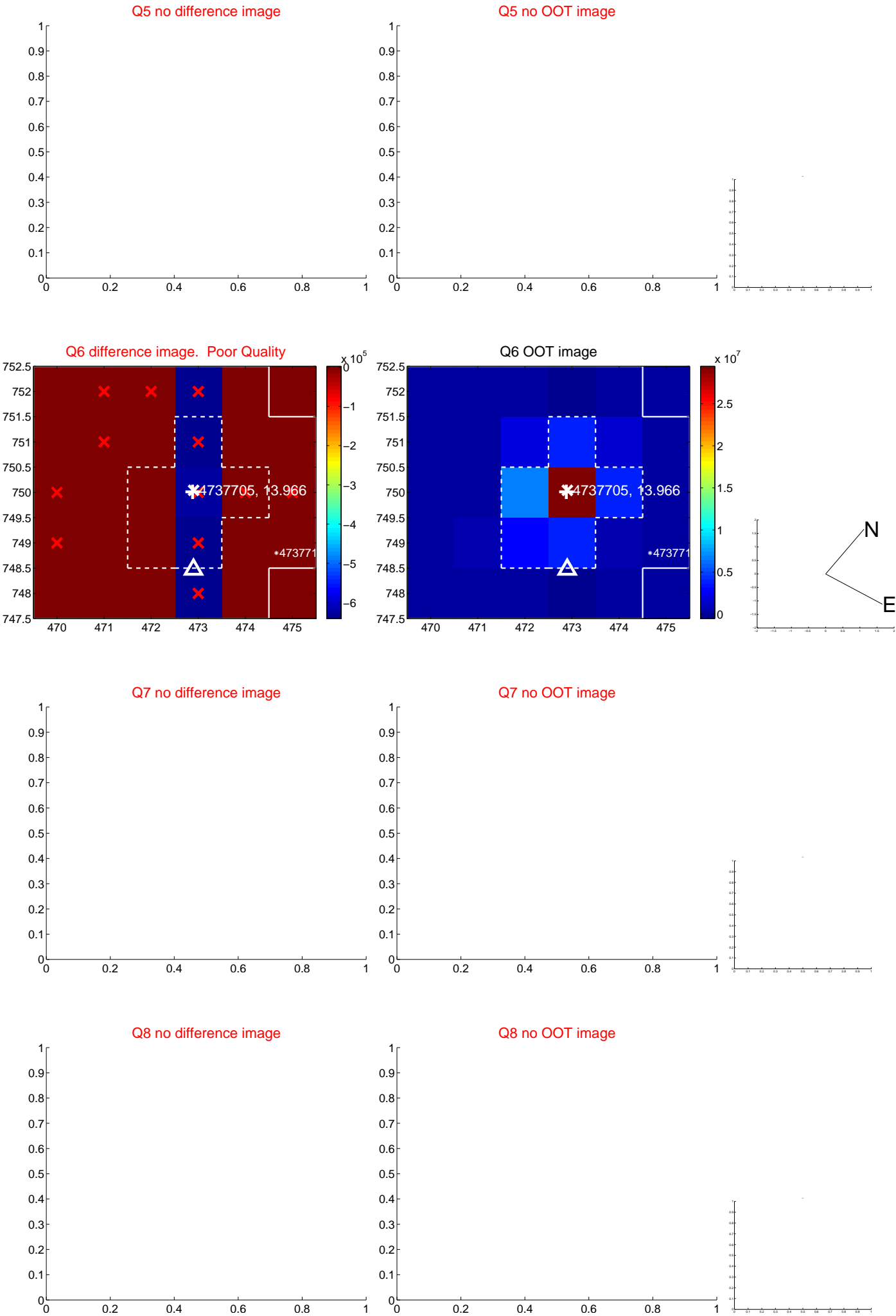


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

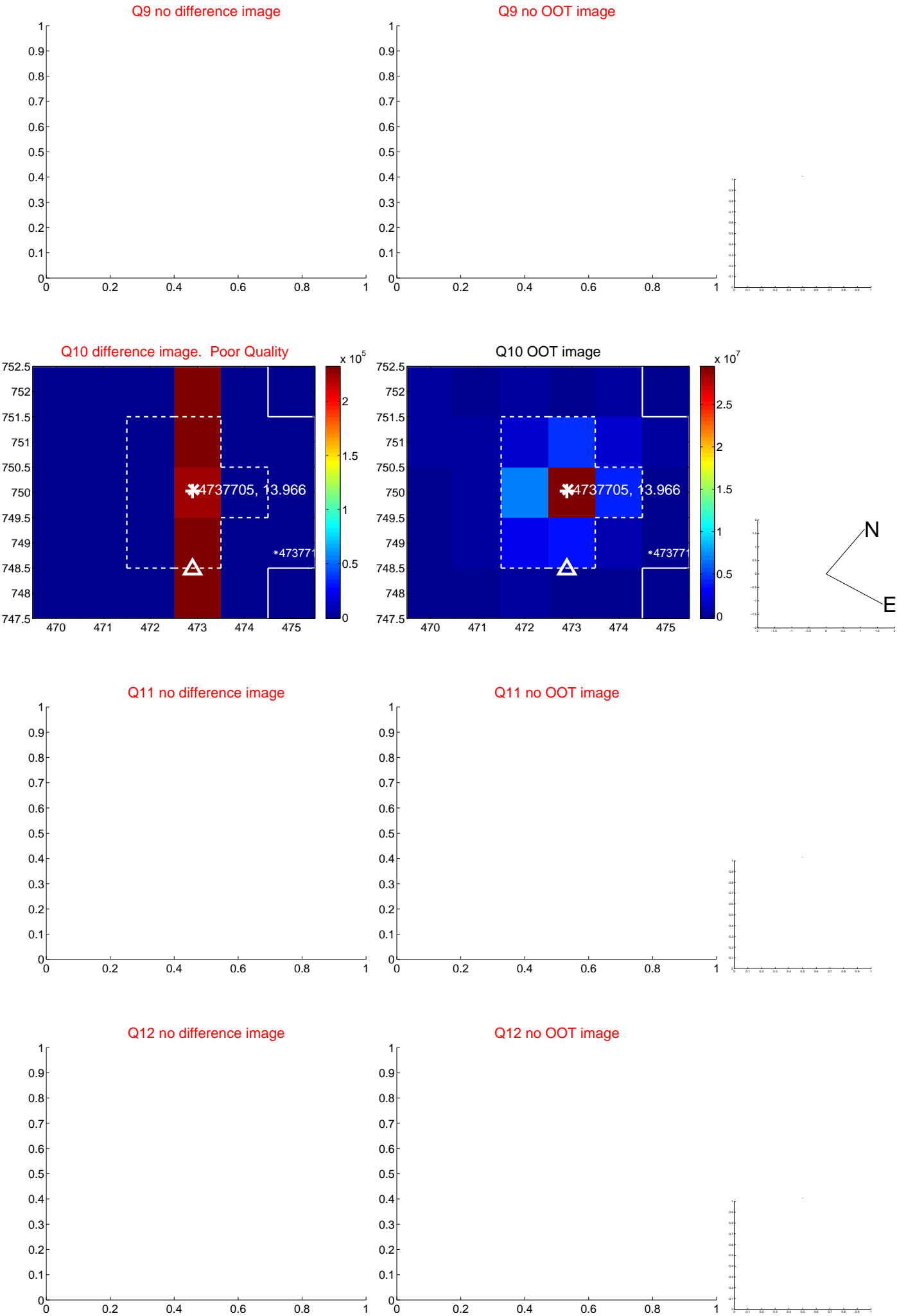
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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.

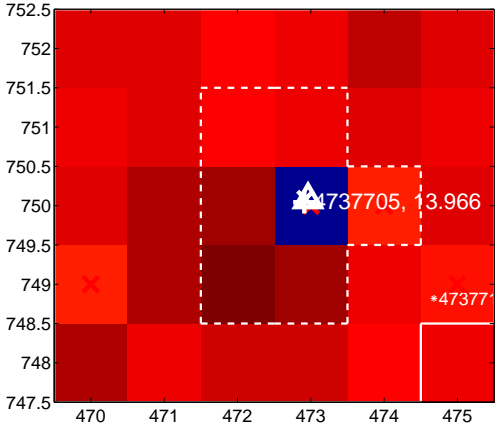
Q13 no difference image



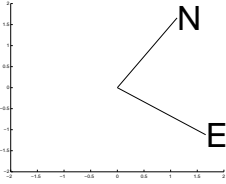
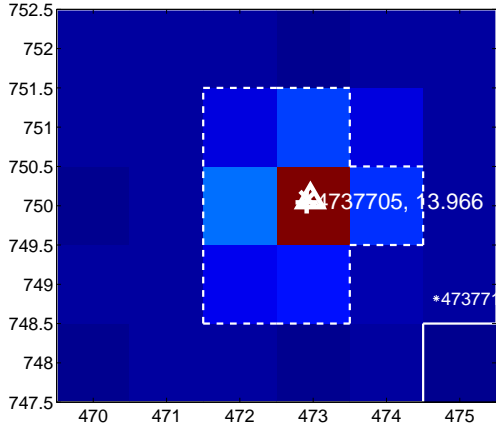
Q13 no OOT image



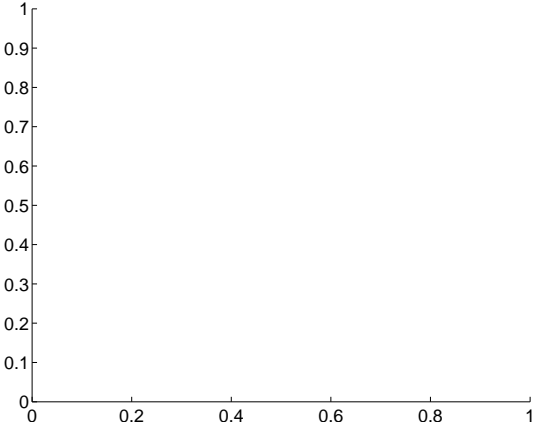
Q14 difference image. Poor Quality



Q14 OOT image



Q15 no difference image



Q15 no OOT image



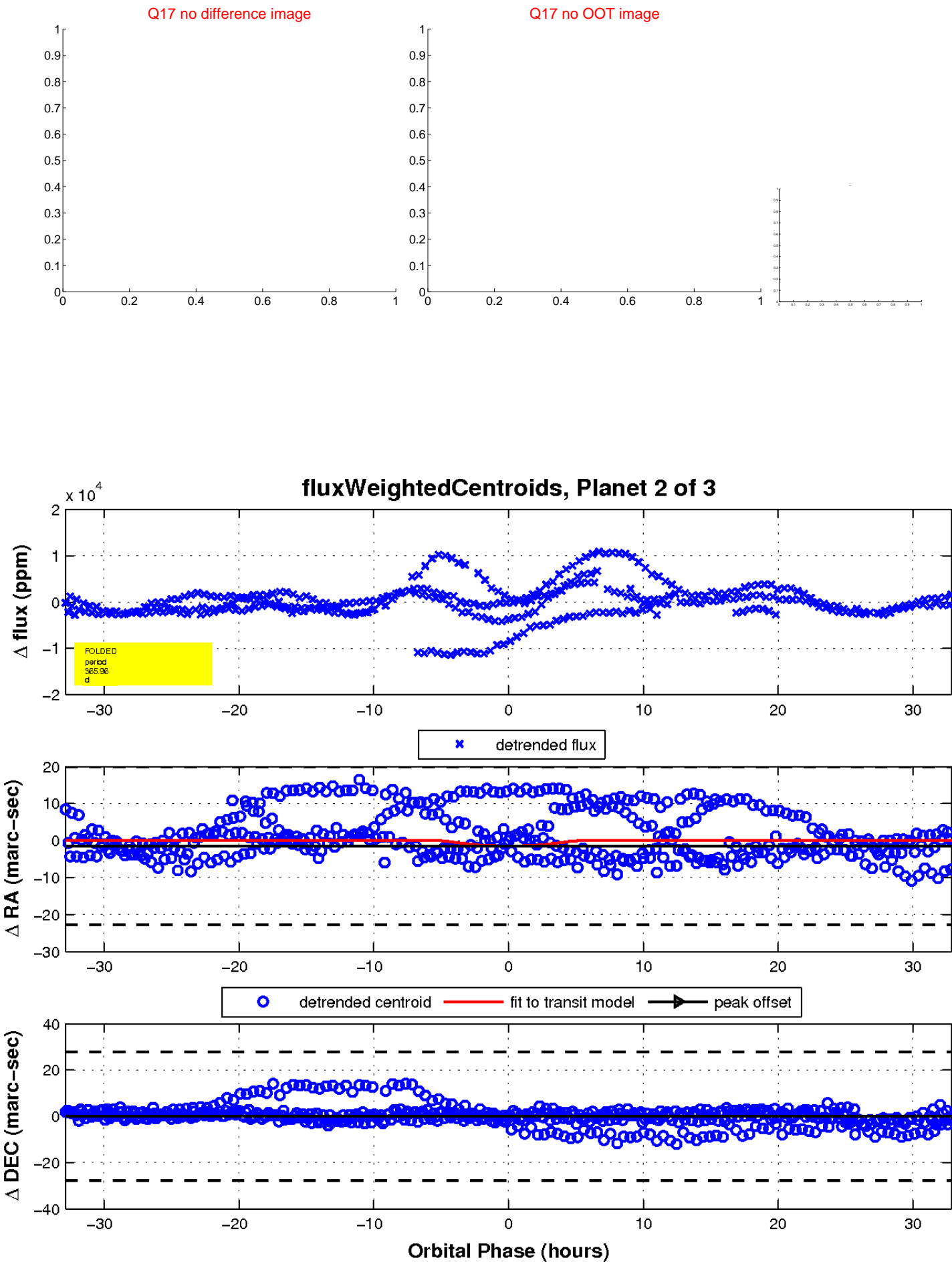
Q16 no difference image



Q16 no OOT image



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



UKIRT Image

Declination

