

# KIC 009713986

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009713986-01	OBS	No	349.119105	334.077044	2175.9	2.665	12.0	6.7	0.74	4543	3.32	0.27
009713986-02	OBS	No	535.645922	135.887646	3383.7	5.552	10.8	9.9	0.74	4543	4.12	0.15
009713986-03	OBS	No	455.126748	453.743478	1604.5	4.248	10.9	5.8	0.74	4543	3.28	0.19
009713986-04	OBS	No	373.878246	488.033065	2071.5	3.653	10.2	6.2	0.74	4543	3.55	0.25

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009713986-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009713986-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009713986-03	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS—HALO_GHOST
009713986-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_SKYE—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS

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

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

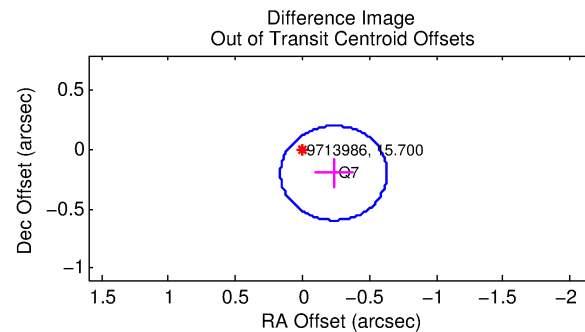
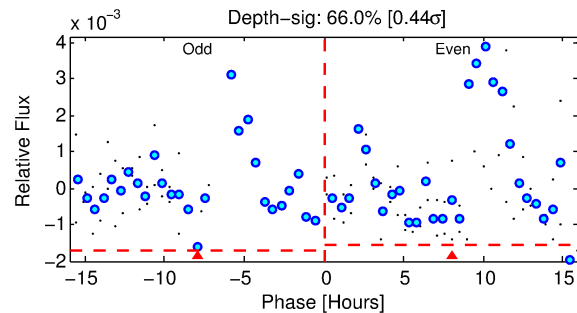
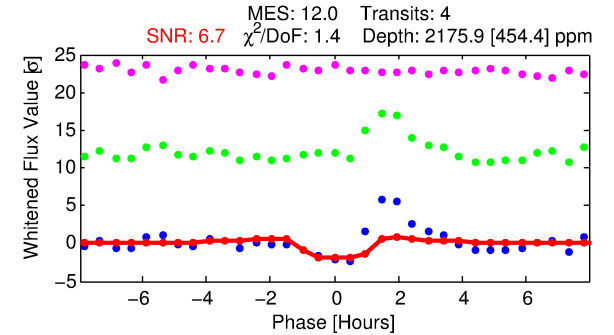
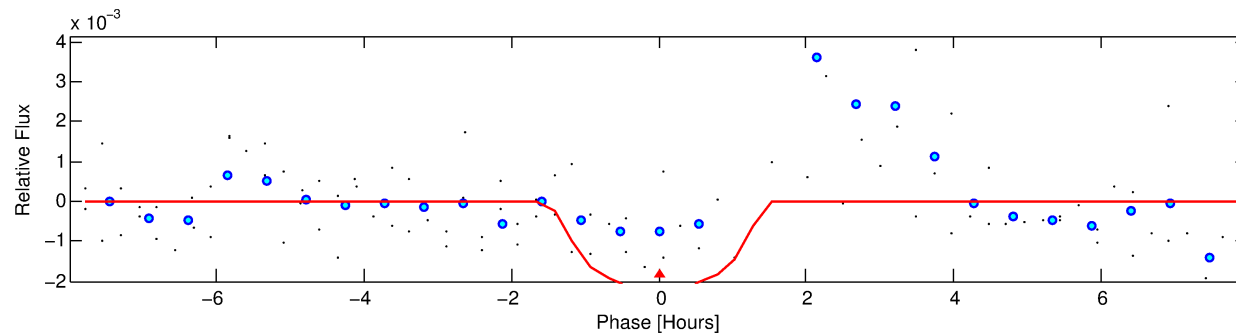
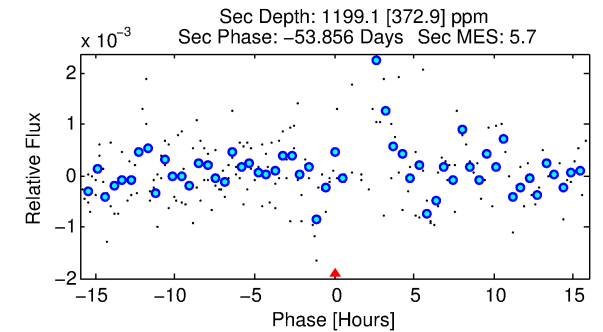
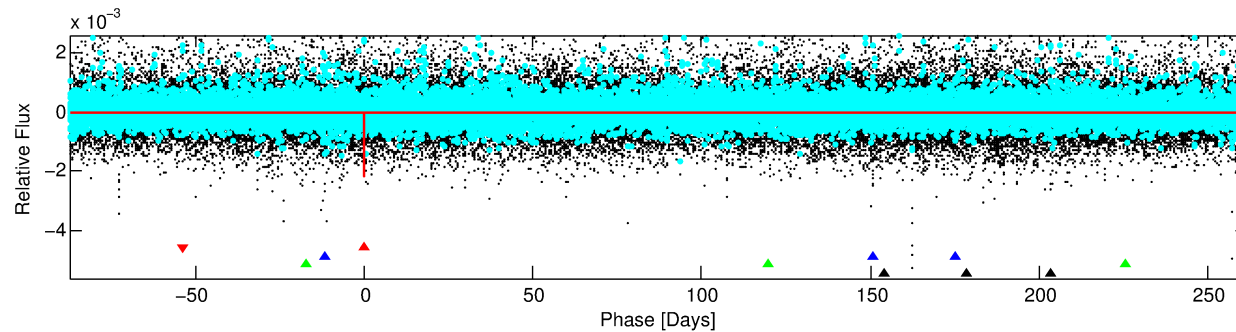
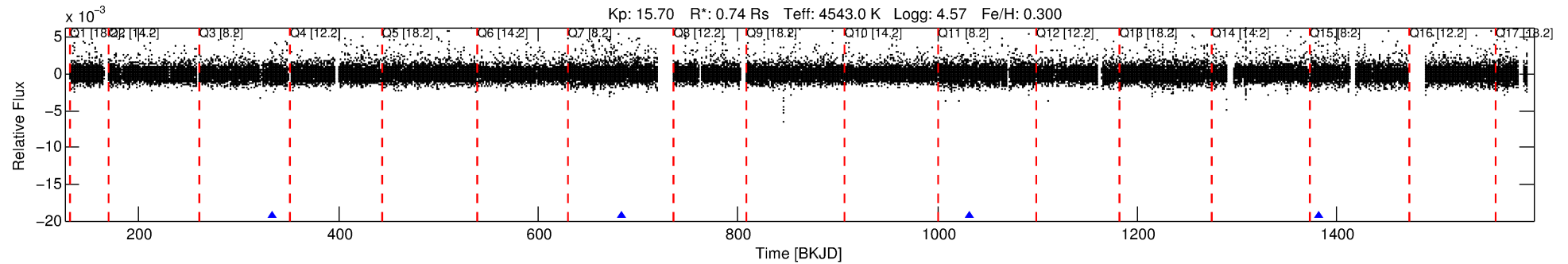
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 009713986-01

No Significant Match Found

# DV One-Page Summary

KIC: 9713986 Candidate: 1 of 4 Period: 349.119 d



## DV Fit Results:

Period = 349.11910 [0.00379] d  
Epoch = 334.0770 [0.0074] BKJD  
Rp/R\* = 0.0409 [0.1293]  
a/R\* = 1032.91 [9111.94]  
b = 0.14 [66.09]  
Seff = 0.27 [0.05]  
Teq = 184 [8] K  
Rp = 3.32 [10.50] Re  
a = 0.8791 [0.0618] AU  
Ag = 46280.77 [293068.75] [0.16 $\sigma$ ]  
Teffp = 4181 [6620] K [0.60 $\sigma$ ]

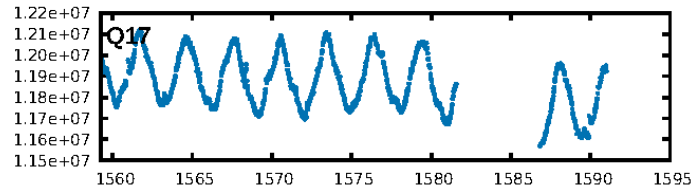
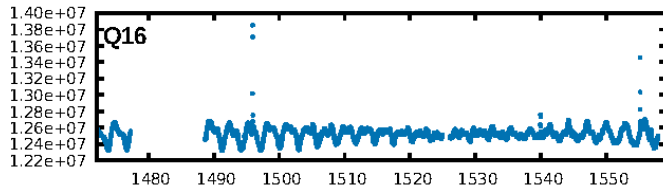
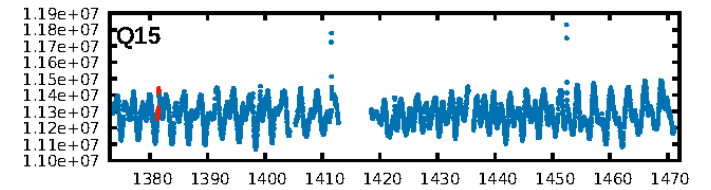
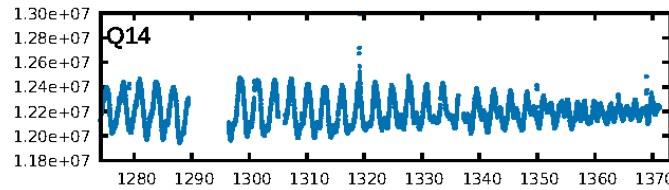
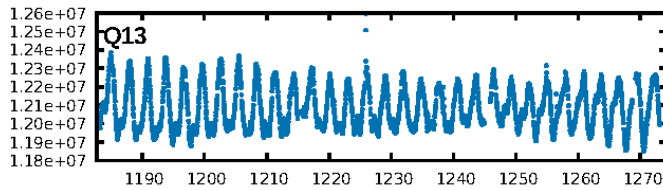
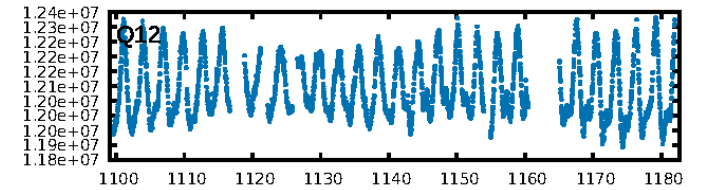
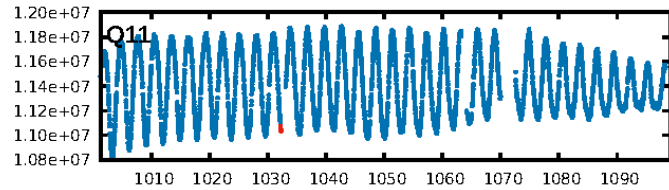
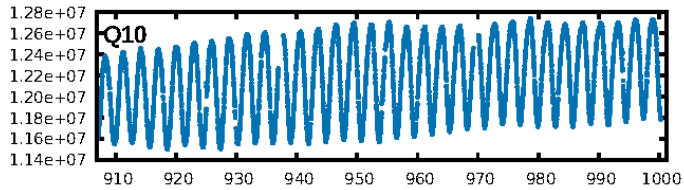
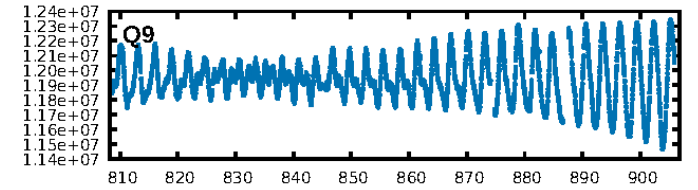
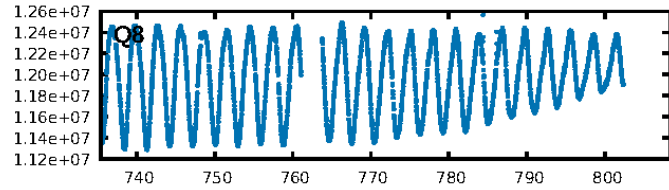
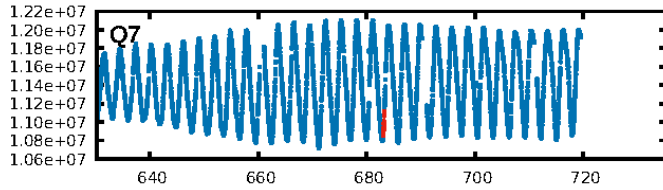
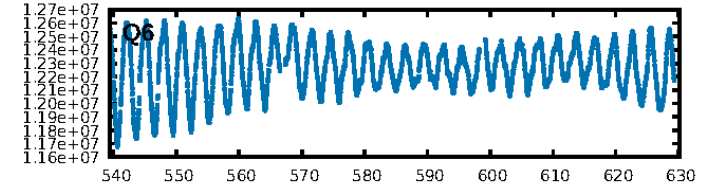
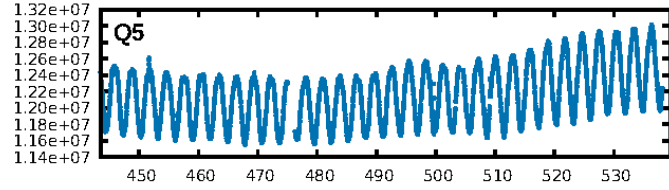
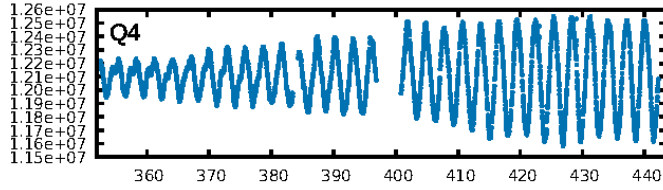
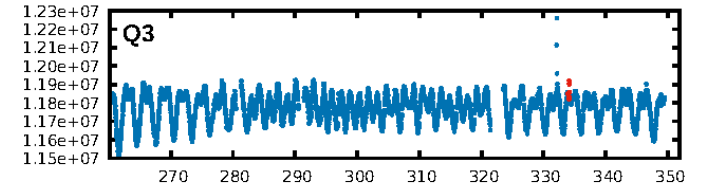
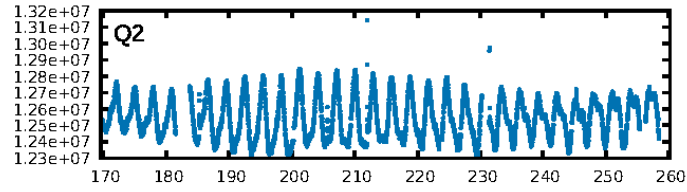
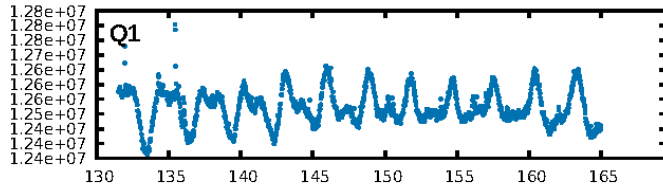
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [131.41 $\sigma$ ]  
ModelChiSquare2-sig: 0.8%  
ModelChiSquareGof-sig: 76.7%  
**Bootstrap-pfa: 3.37e-12**  
RollingBand-fgt: 1.00 [4/4]  
GhostDiagnostic-chr: 2.485  
Centroid-sig: 15.0%  
Centroid-so: 1.354 arcsec [1.01 $\sigma$ ]  
OotOffset-rm: 0.305 arcsec [2.29 $\sigma$ ]  
KicOffset-rm: 0.353 arcsec [2.89 $\sigma$ ]  
OotOffset-st: 0/1/0/0 [1]  
KicOffset-st: 0/1/0/0 [1]  
DiffImageQuality-fgm: 1.00 [1/1]  
DiffImageOverlap-fno: 1.00 [3/3]

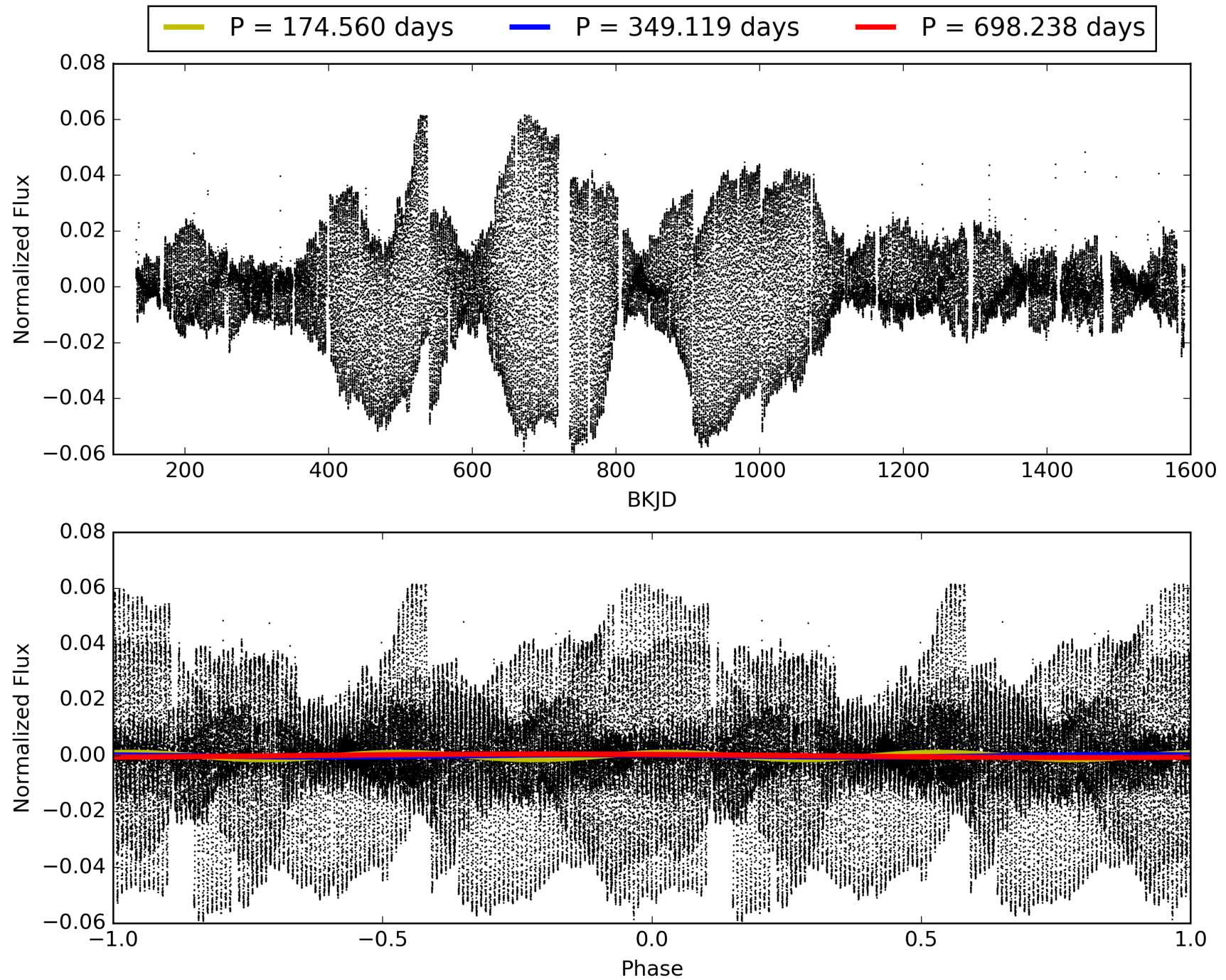
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This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 009713986-01, PDC Light Curves



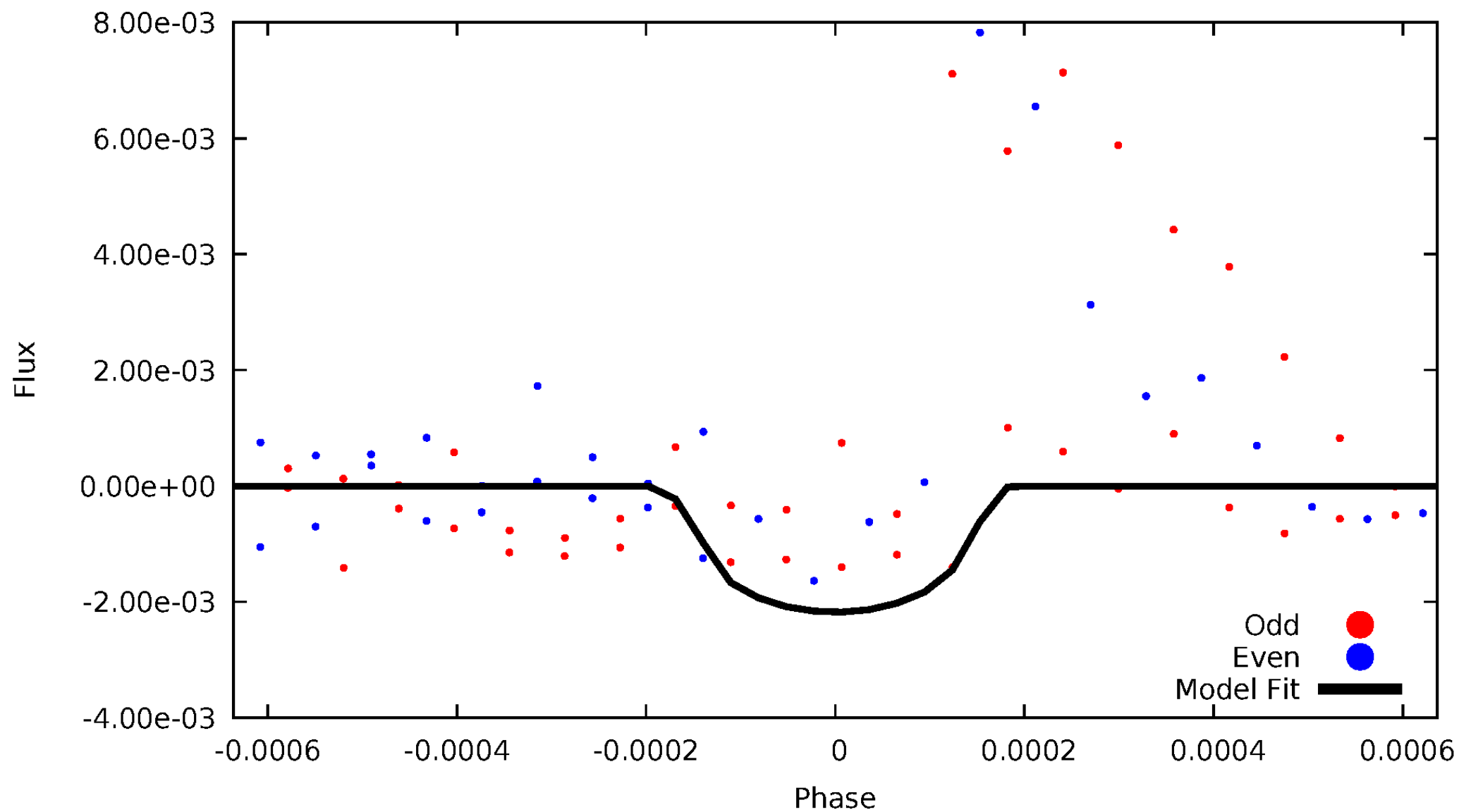
TCE 009713986-01





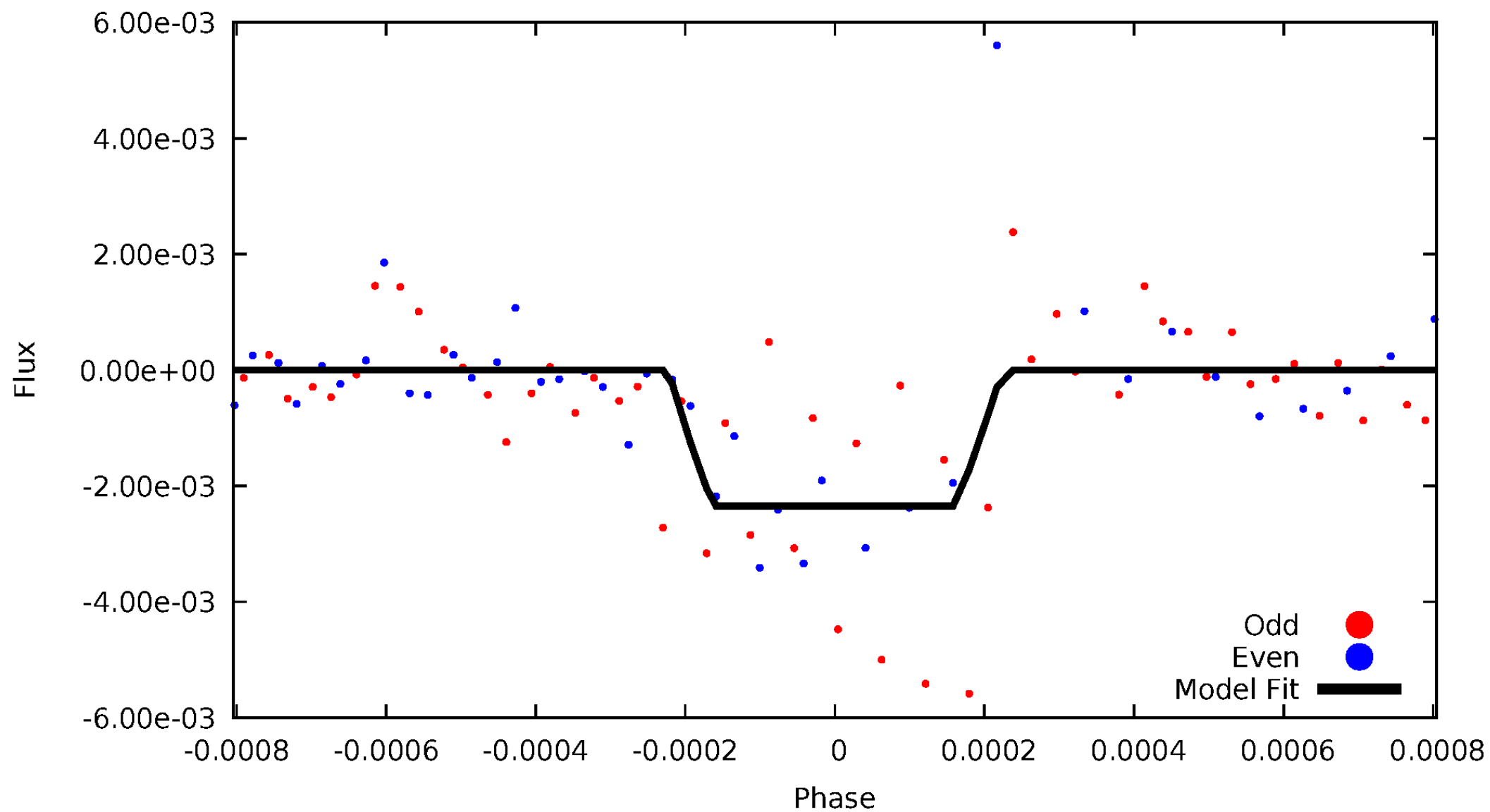
# DV Odd/Even

TCE 009713986-01



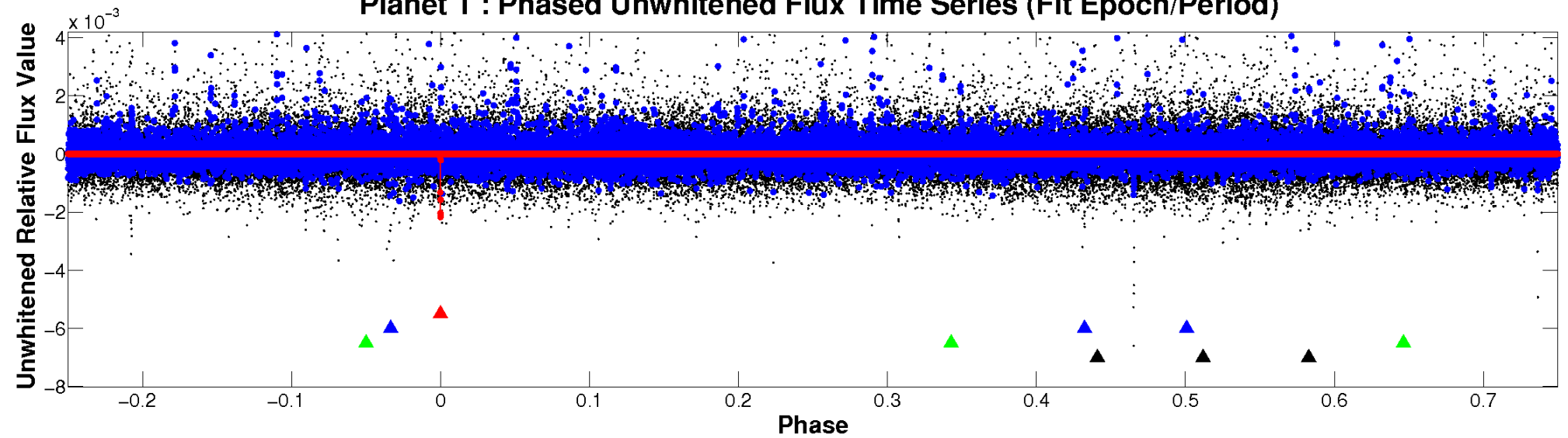
# ALT Odd/Even

TCE 009713986-01

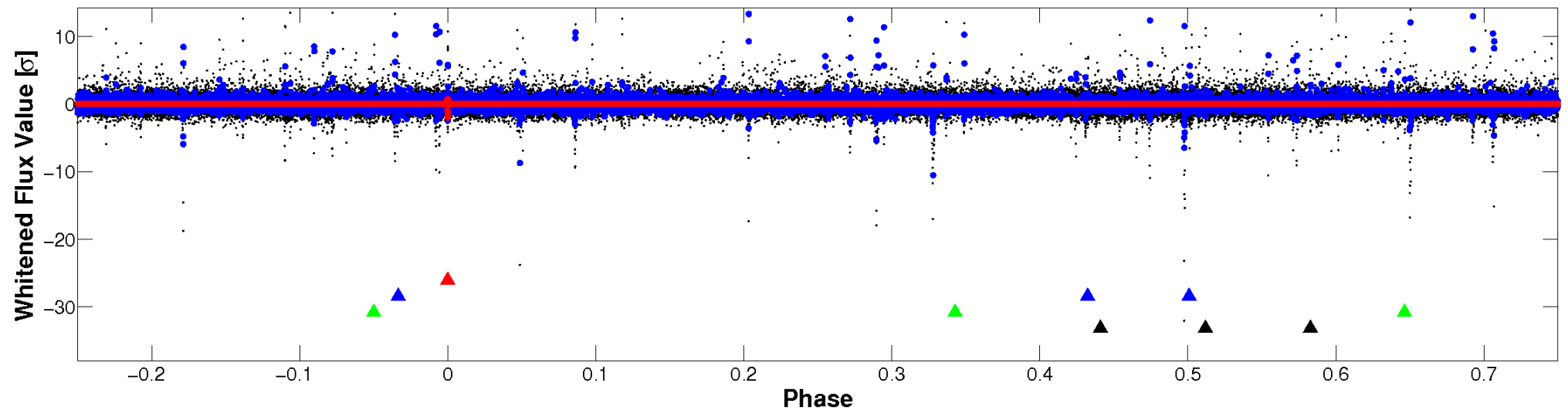


# Non-Whitened Vs. Whitened Light Curve

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

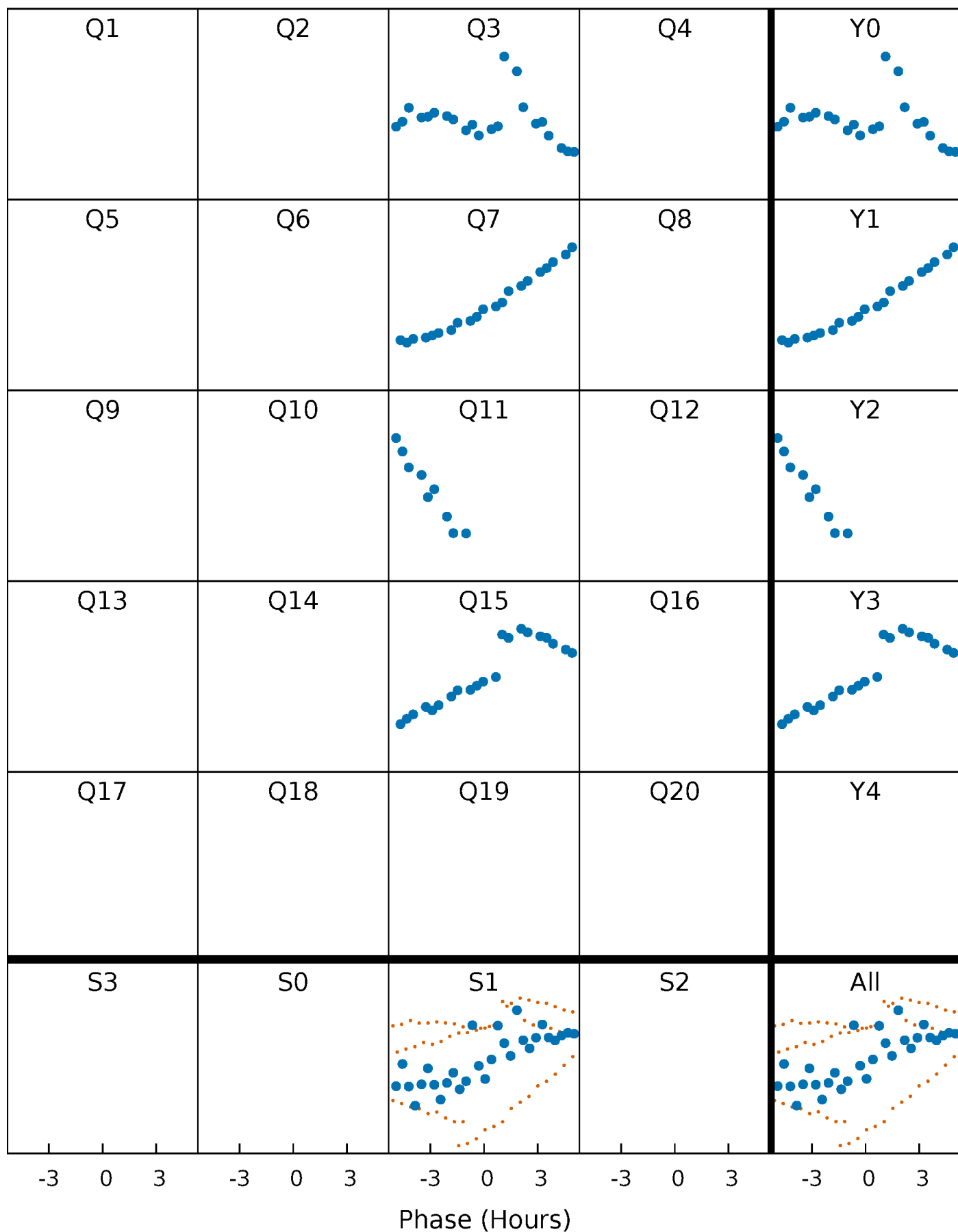


Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

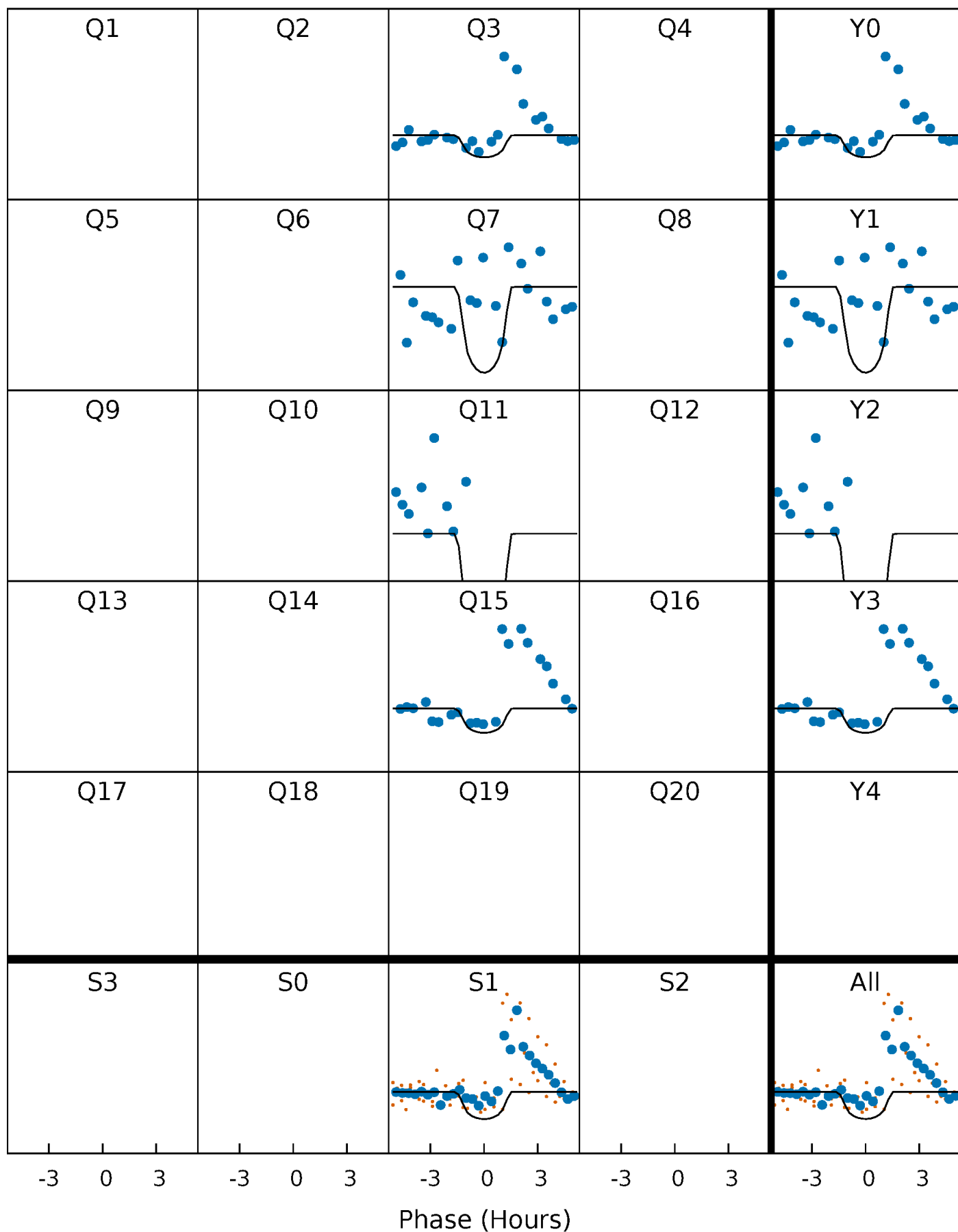
TCE 009713986-01 P=349.119105 Days  $T_0=334.077044$  (BKJD)





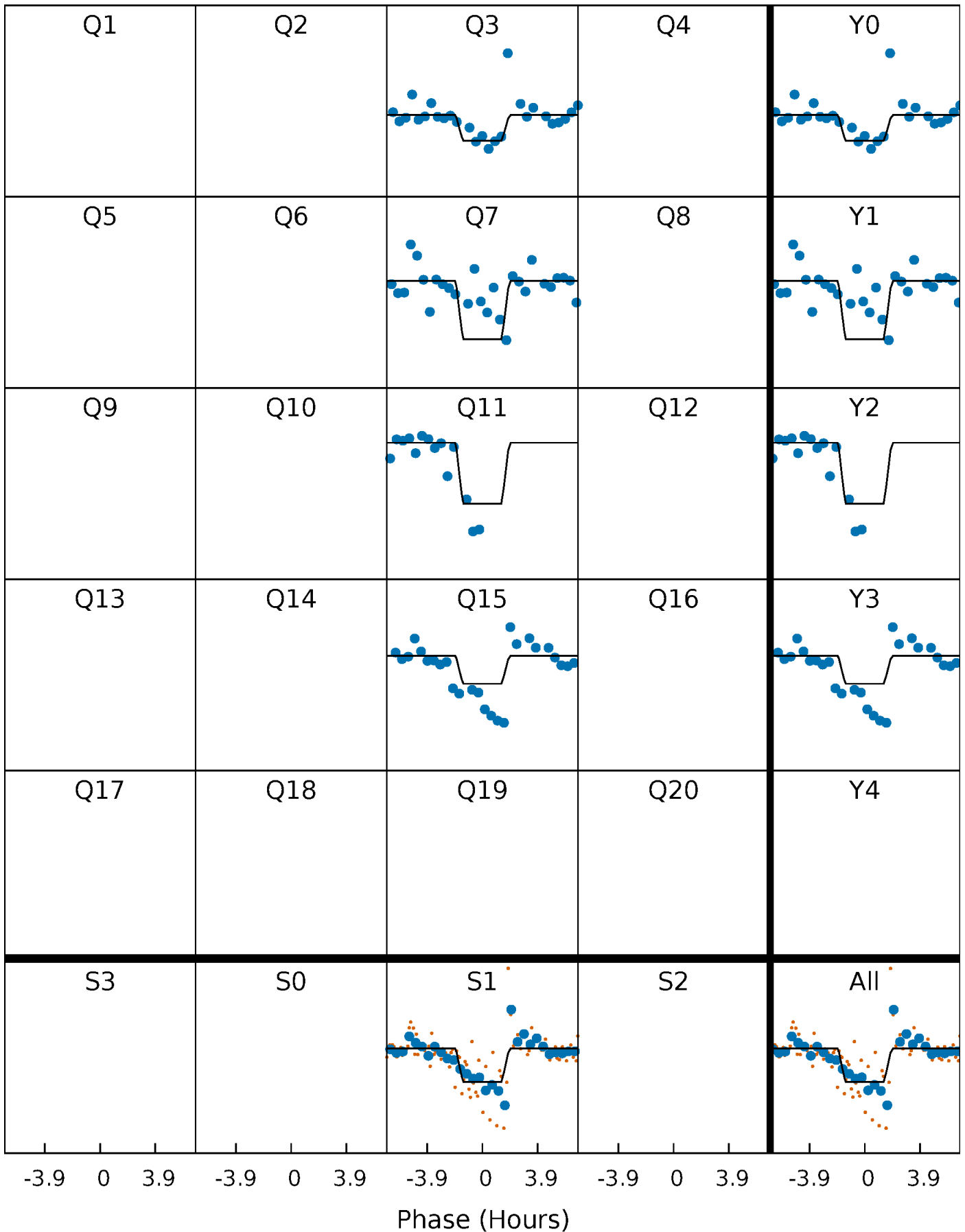
# DV Quarter-Phased Transit Curves

TCE 009713986-01 P=349.119105 Days  $T_0=334.077044$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

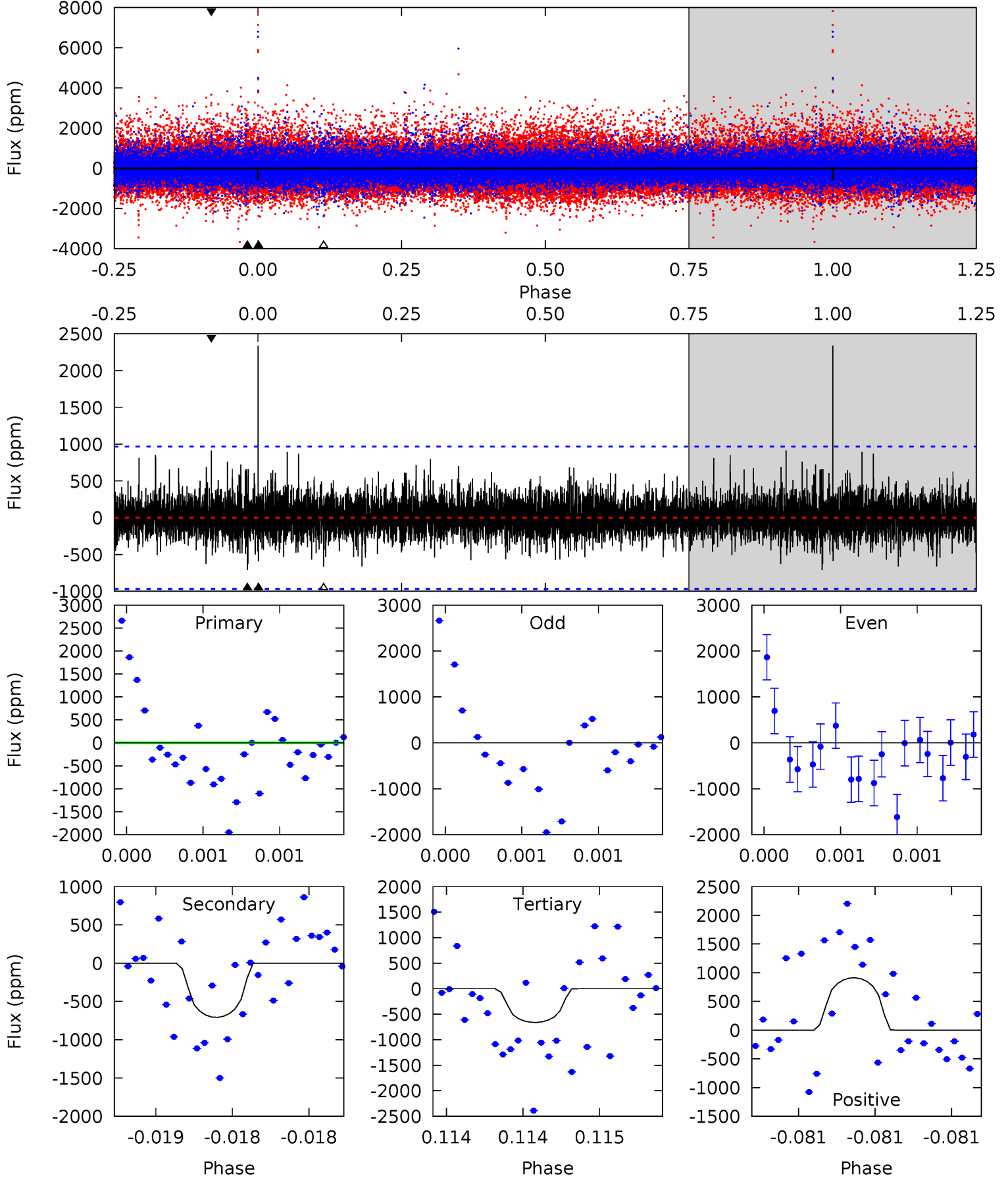
TCE 009713986-01 P=349.113183 Days  $T_0=334.054806$  (BKJD)



# DV Model-Shift Uniqueness Test

009713986-01, P = 349.119105 Days, E = 334.077044 Days

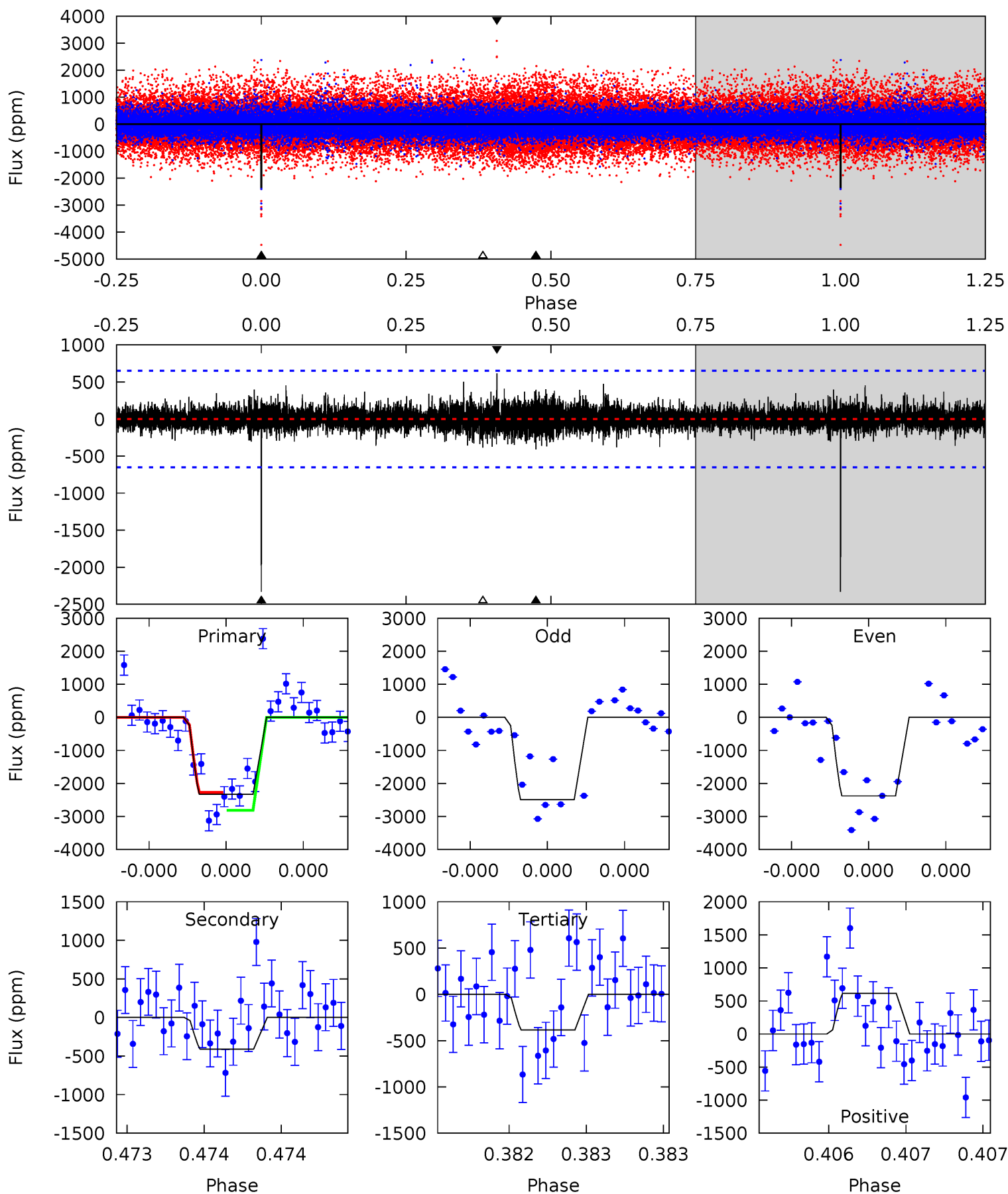
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
3.43	4.11	3.85	5.30	5.62	3.55	1.02	-0.42	-1.87	0.27	-1.19	1.87	0.70	0.77	2.11



# Alt Model-Shift Uniqueness Test

009713986-01, P = 349.113183 Days, E = 334.054806 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
20.0	3.51	3.31	5.27	5.59	3.51	0.79	16.7	14.7	0.20	-1.76	0.51	1.03	0.21	2.25





### Stellar Parameters For KIC 009713986

	$T_{\text{eff}}(K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$4543^{+150}_{-150}$	$4.566^{+0.056}_{-0.020}$	$0.300^{+0.150}_{-0.300}$	$0.744^{+0.031}_{-0.062}$	$0.743^{+0.043}_{-0.052}$	$2.540^{+0.591}_{-0.218}$
	+3%/-3%	+1%/-0%	+50%/-100%	+4%/-8%	+6%/-7%	+23%/-9%
Source	PHO1	KIC0	KIC0	DSEP		

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

### Secondary Eclipse Parameters for KIC 009713986-01 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-708 \pm 172$	$8.13^{+8.67}_{-5.59}$	$256^{+9}_{-9}$	$2953^{+1305}_{-522}$	$4761^{+42098}_{-3663}$
Alt.	$-409 \pm 117$	$8.76^{+8.69}_{-5.81}$	$256^{+9}_{-10}$	$2659^{+983}_{-410}$	$2160^{+16617}_{-1605}$

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

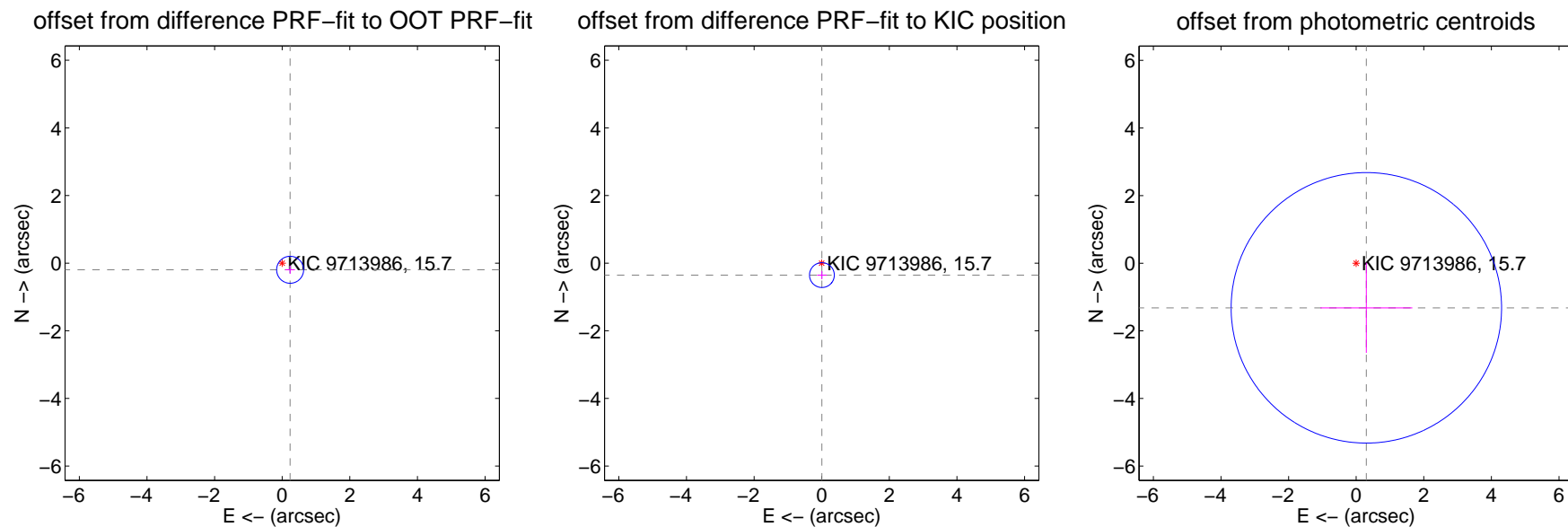
## DV Centroid Data

Supplemental centroid analysis for 009713986-01. Kepler magnitude: 15.70. Transit SNR 6.73

There are 1 quarters with good PRF difference image offsets

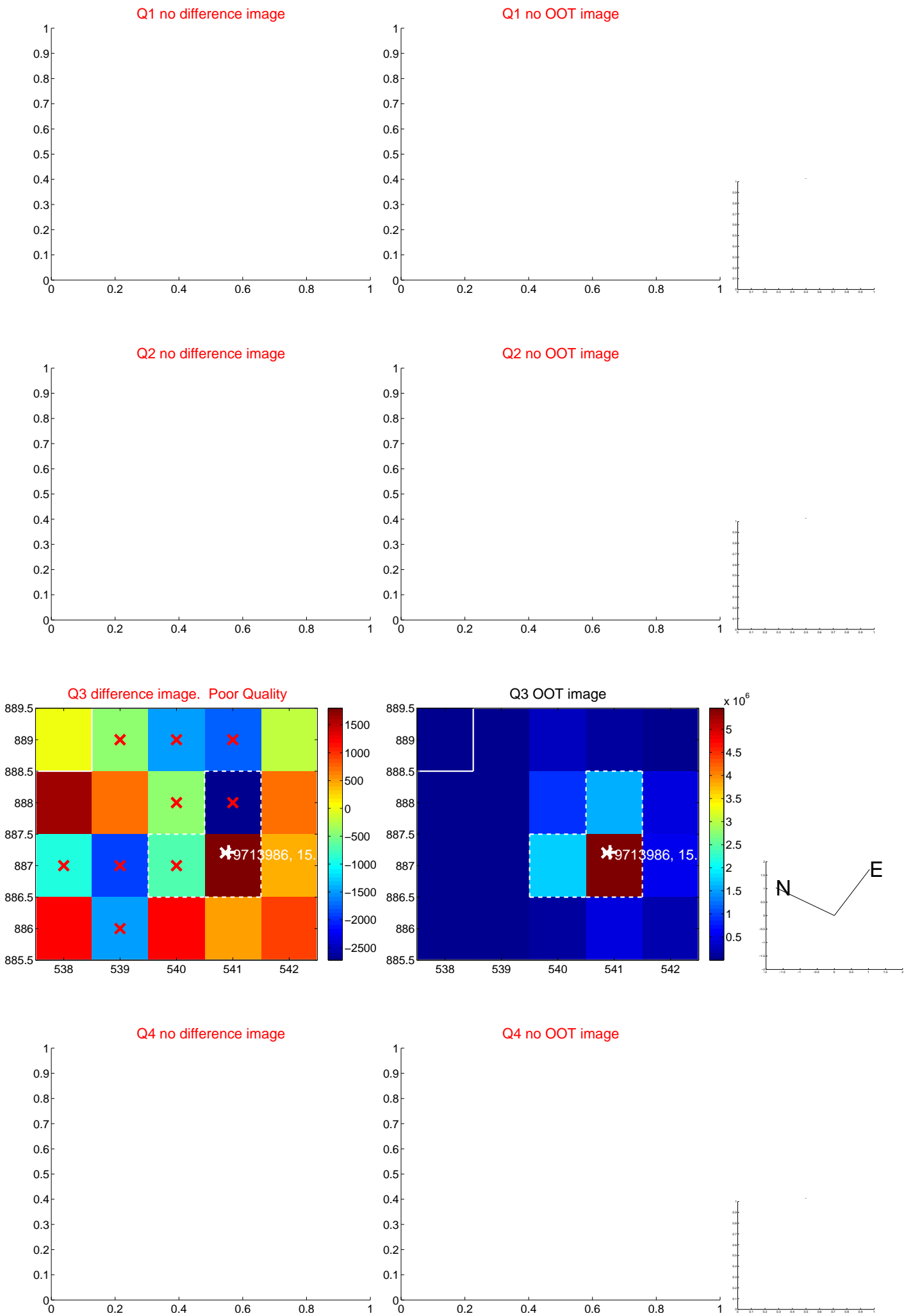
The direct PRF centroid is offset from the target star catalog position by about 0.28 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.305 \pm 0.133$	2.29	$-0.234 \pm 0.140$	$-0.196 \pm 0.122$
PRF-fit source offset from KIC position	$0.353 \pm 0.122$	2.89	$-0.005 \pm 0.140$	$-0.353 \pm 0.122$
photometric centroid source offset	$1.35 \pm 1.33$	1.01	$-0.30 \pm 1.36$	$-1.32 \pm 1.33$

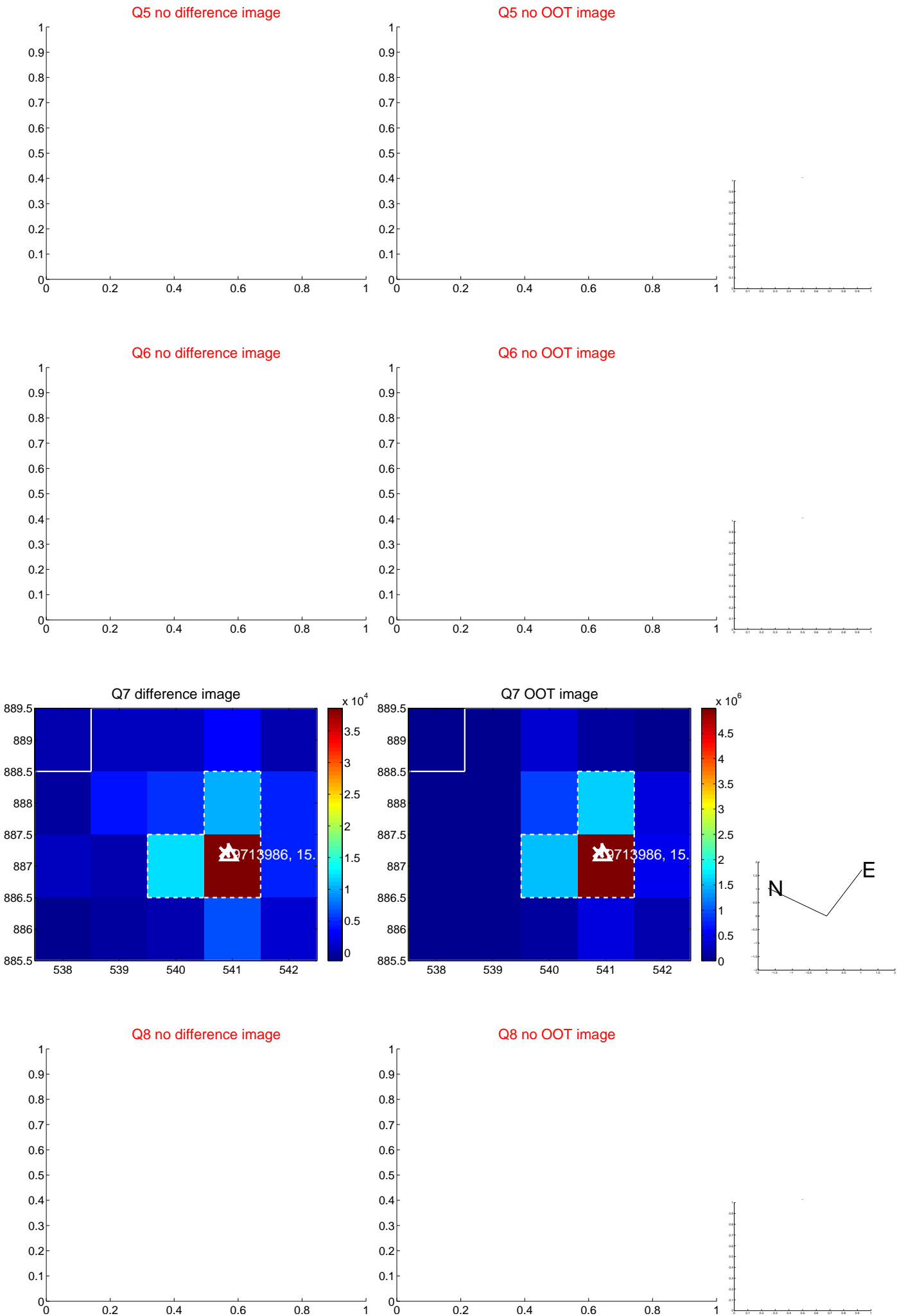


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

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



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

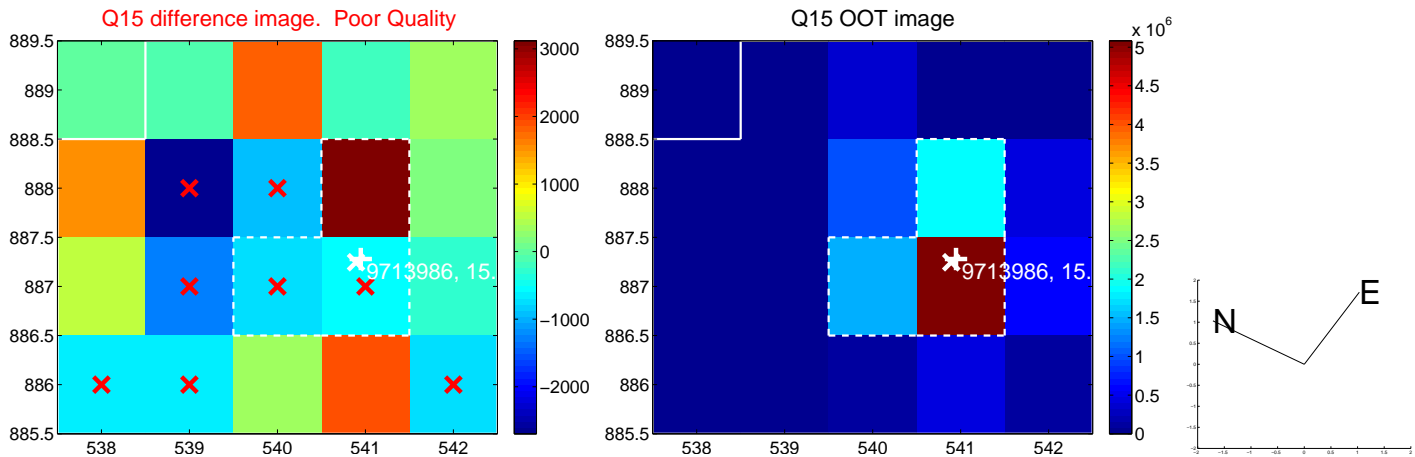




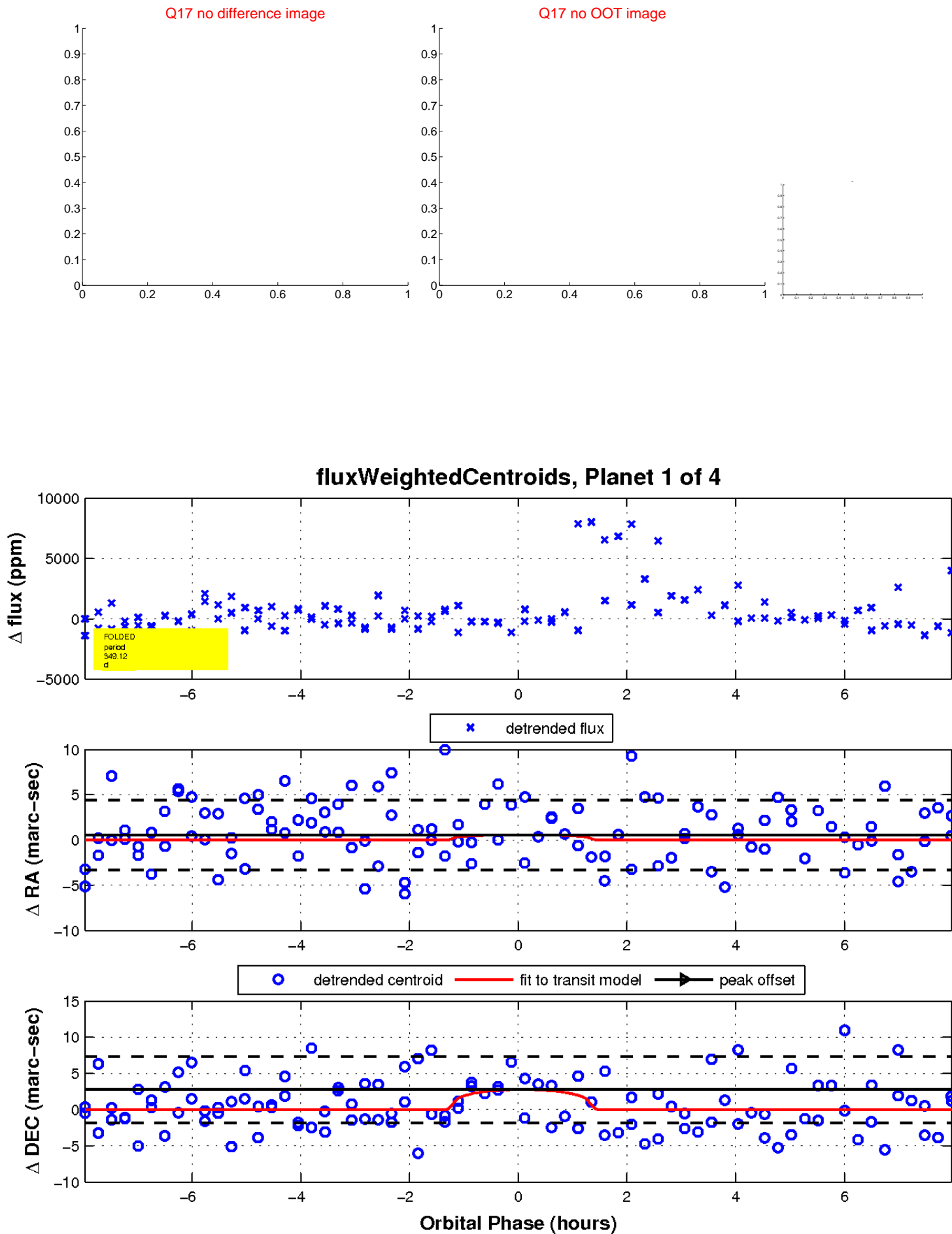
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



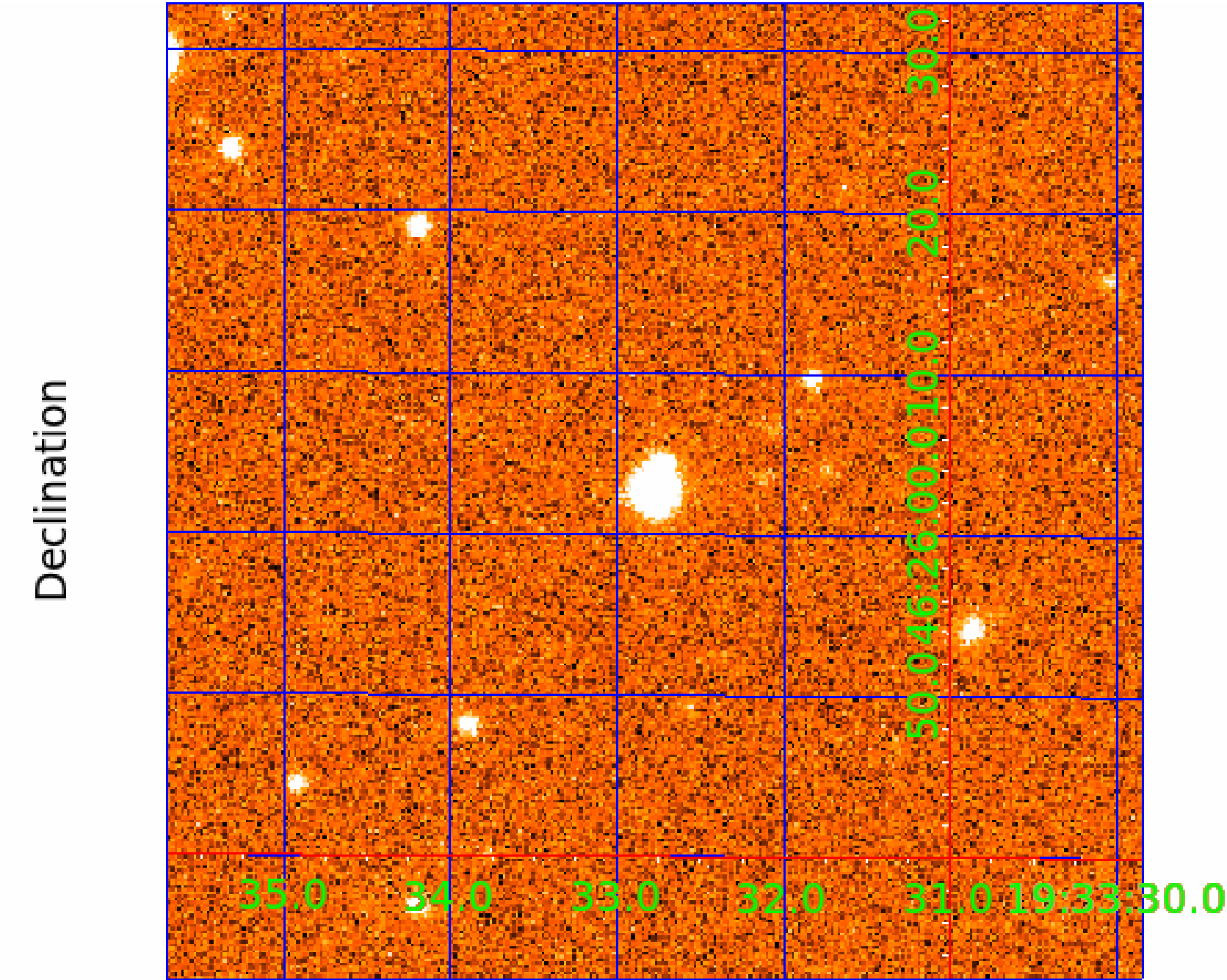
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value



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



UKIRT Image





# KIC 009713986

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009713986-01	OBS	No	349.119105	334.077044	2175.9	2.665	12.0	6.7	0.74	4543	3.32	0.27
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## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009713986-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009713986-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009713986-03	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS—HALO_GHOST
009713986-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_SKYE—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS

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

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

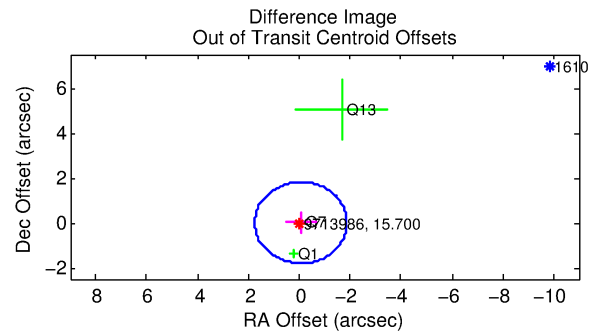
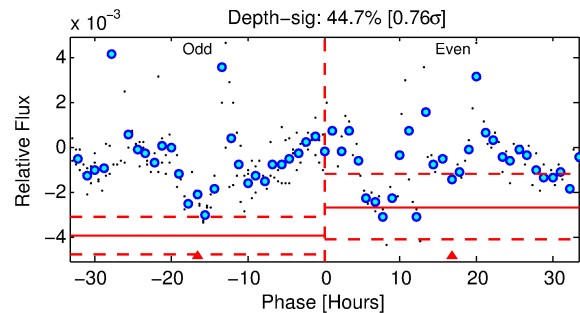
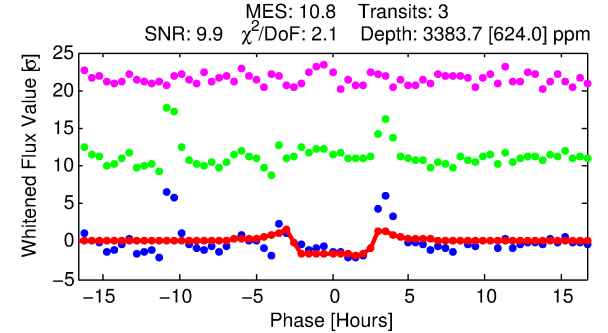
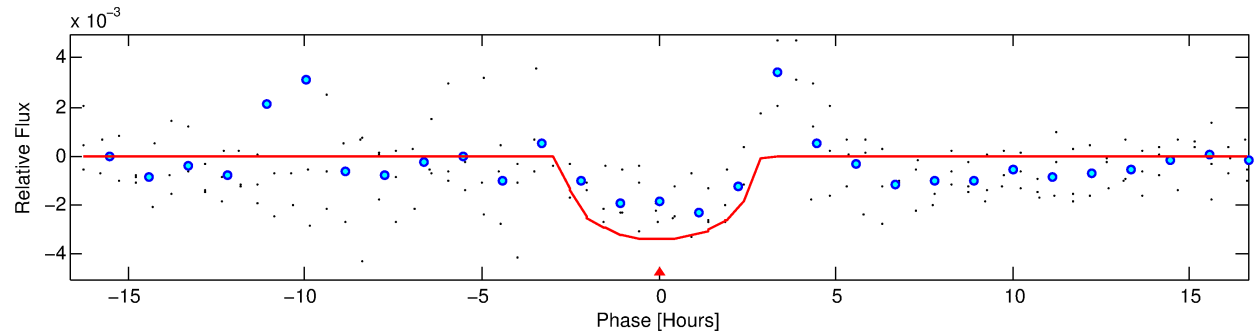
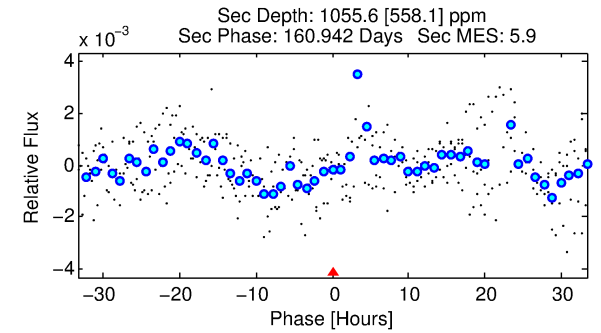
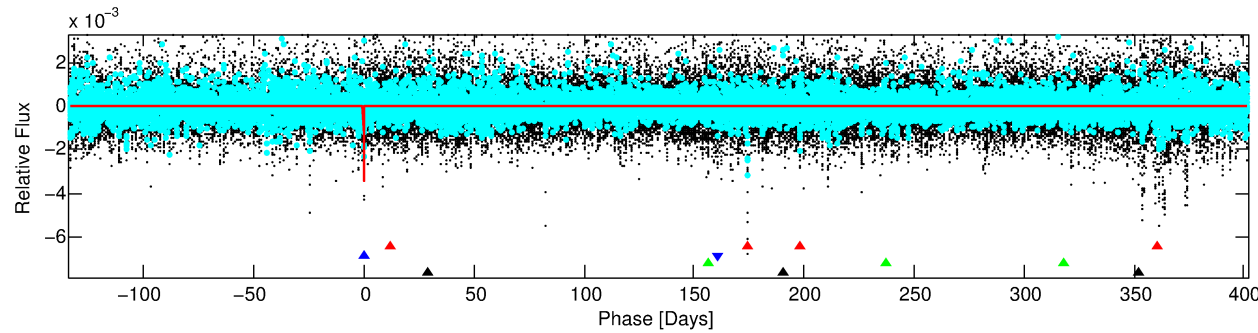
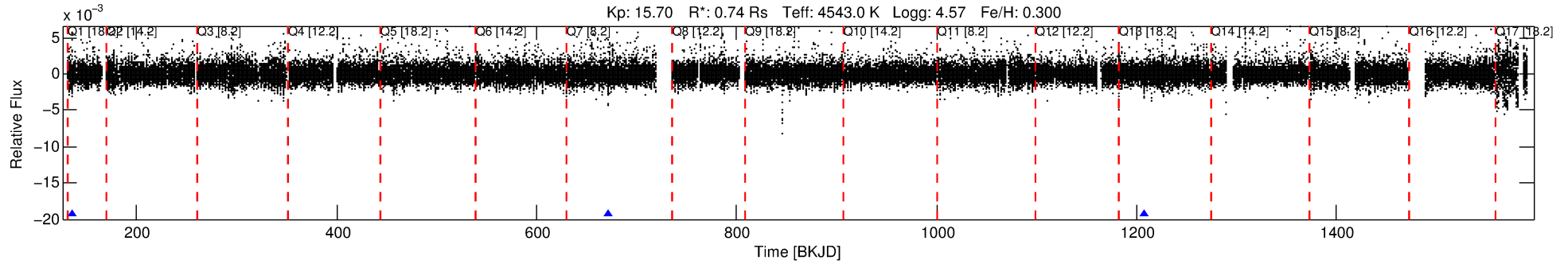
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 009713986-02

No Significant Match Found

# DV One-Page Summary

KIC: 9713986 Candidate: 2 of 4 Period: 535.646 d



## DV Fit Results:

Period = 535.64592 [0.00647] d  
Epoch = 135.8876 [0.0100] BKJD  
Rp/R\* = 0.0507 [0.0669]  
a/R\* = 774.47 [2854.27]  
b = 0.00 [5064.17]  
Seff = 0.15 [0.03]  
Teq = 160 [7] K  
Rp = 4.12 [5.44] Re  
a = 1.1695 [0.0821] AU  
Ag = 46838.90 [126061.38] [0.37σ]  
Teffp = 3636 [2448] K [1.42σ]

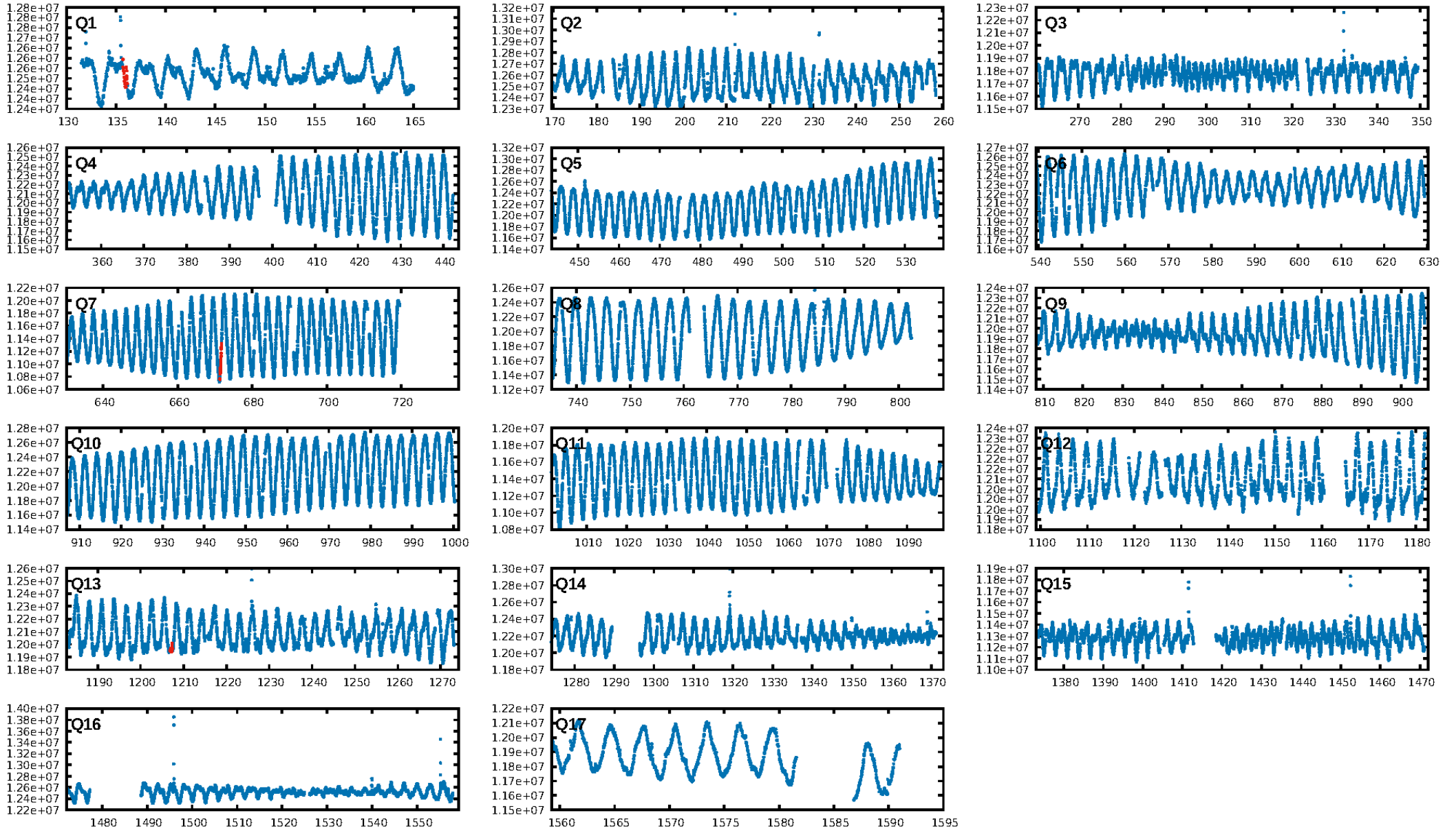
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [276.45σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 3.5%  
ModelChiSquareGof-sig: 75.7%  
**Bootstrap-pfa: 7.35e-09**  
RollingBand-fgt: 1.00 [2/2]  
GhostDiagnostic-chr: -50.75  
Centroid-sig: 14.6%  
Centroid-so: 0.688 arcsec [1.15σ]  
OotOffset-rm: 0.060 arcsec [0.10σ]  
OotOffset-st: 0/1/0/2 [3]  
KicOffset-rm: 0.204 arcsec [0.12σ]  
KicOffset-st: 0/1/0/2 [3]  
DiffImageQuality-fgm: 0.67 [2/3]  
DiffImageOverlap-fno: 1.00 [3/3]

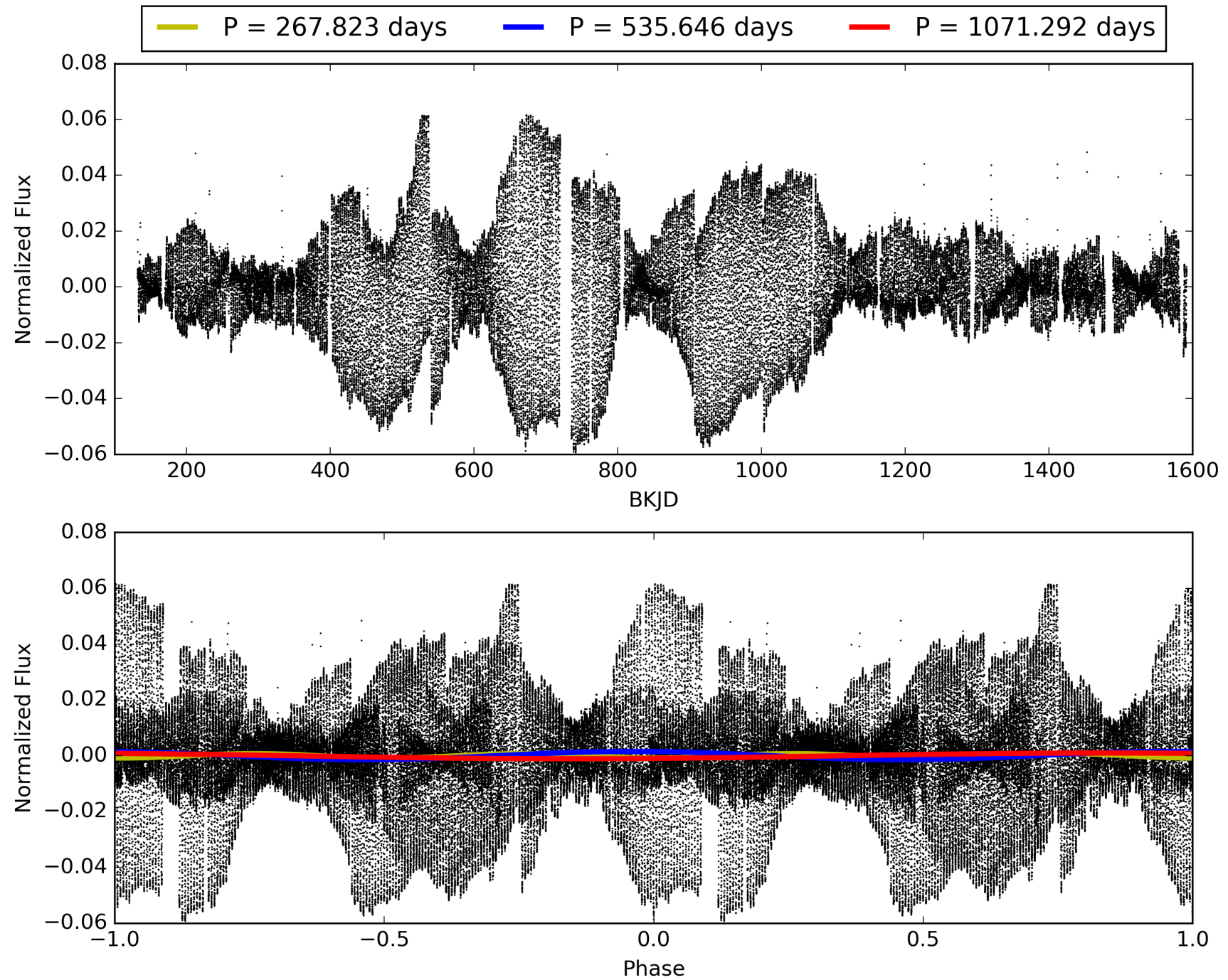
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 10:57:29 Z

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

# TCE 009713986-02, PDC Light Curves

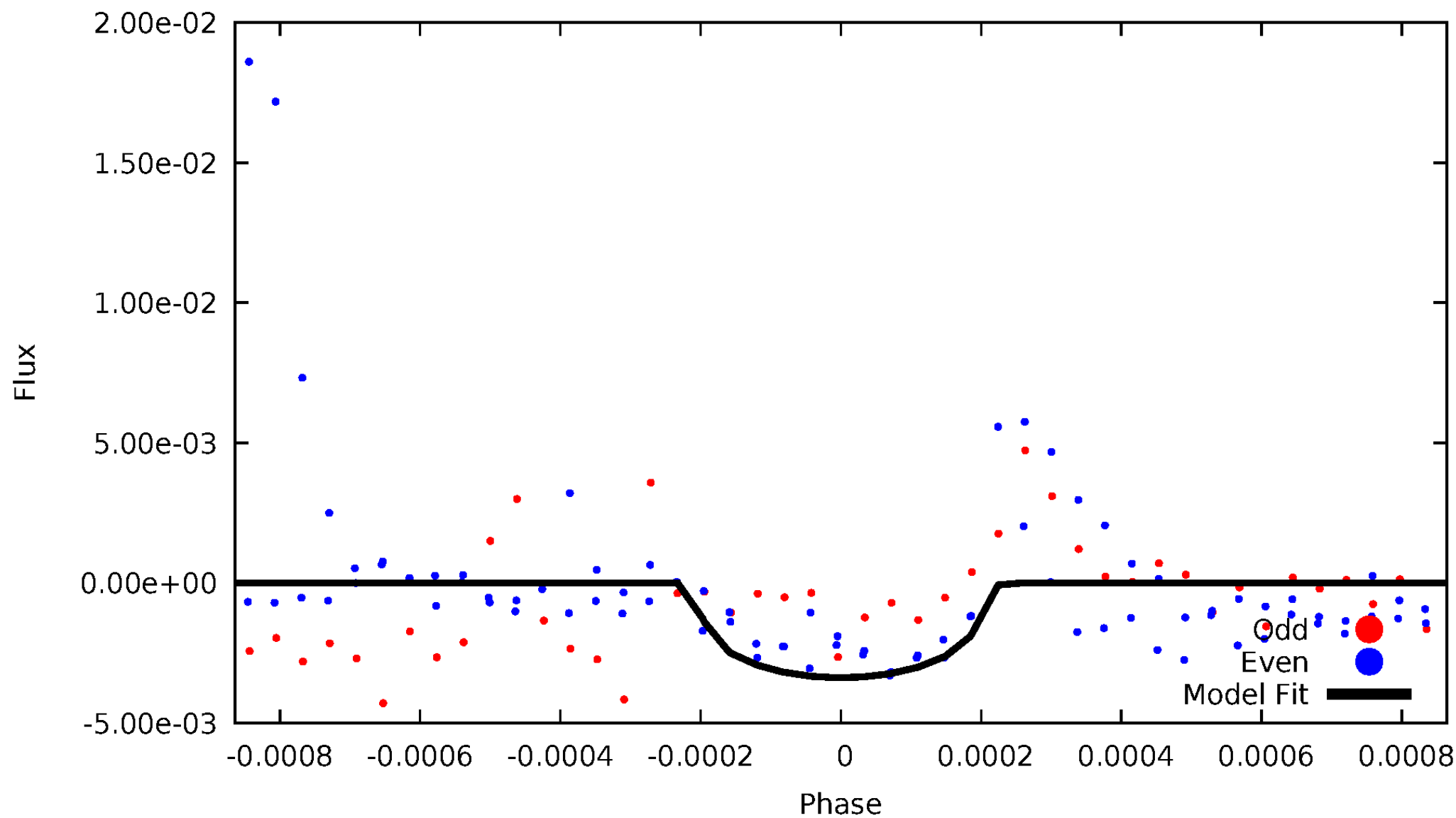


TCE 009713986-02



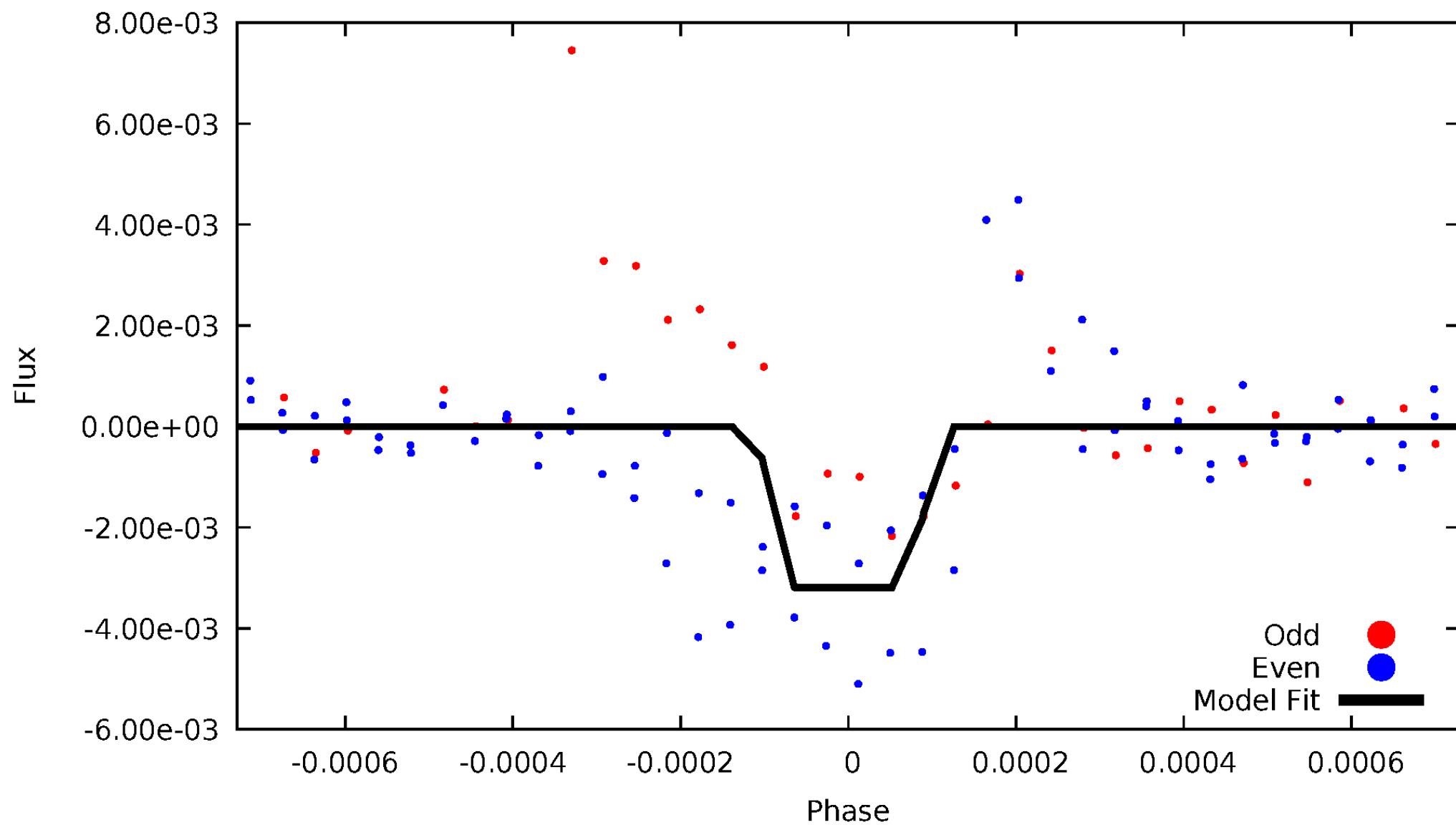
# DV Odd/Even

TCE 009713986-02



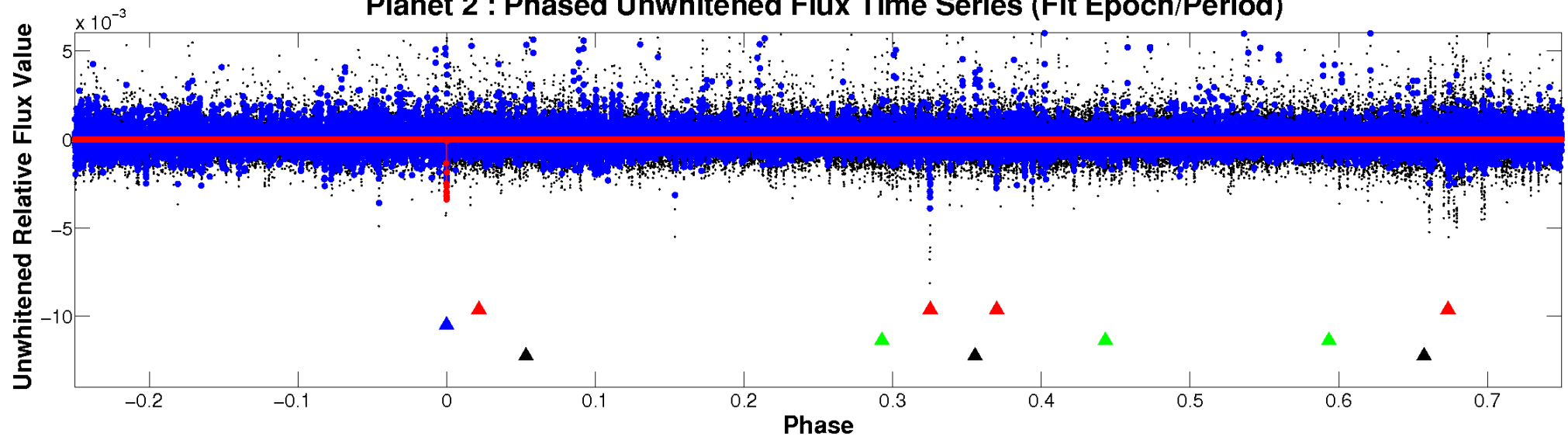
# ALT Odd/Even

TCE 009713986-02

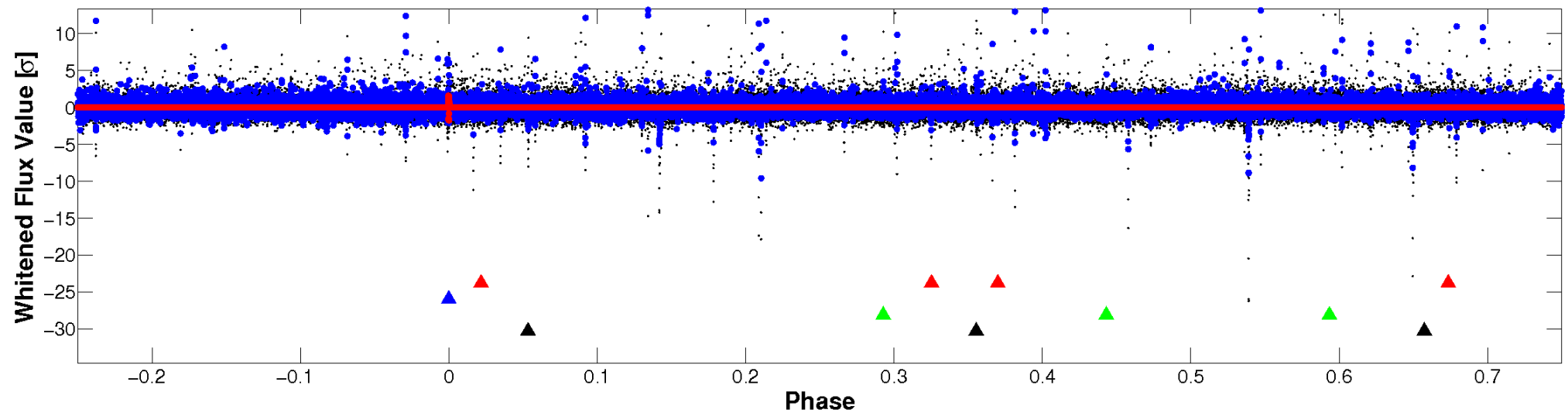


# Non-Whitened Vs. Whitened Light Curve

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



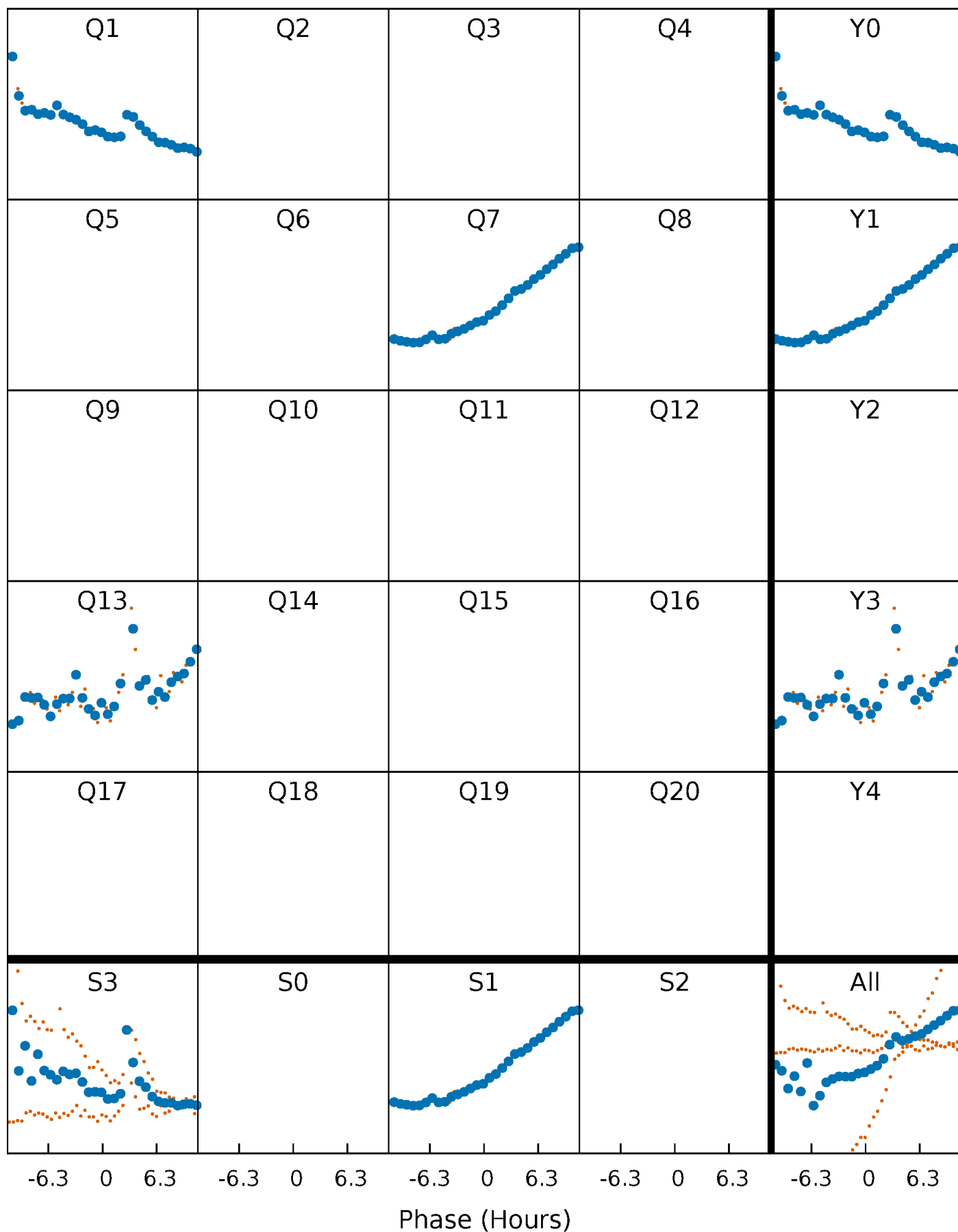
## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)





# PDC Quarter-Phased Transit Curves

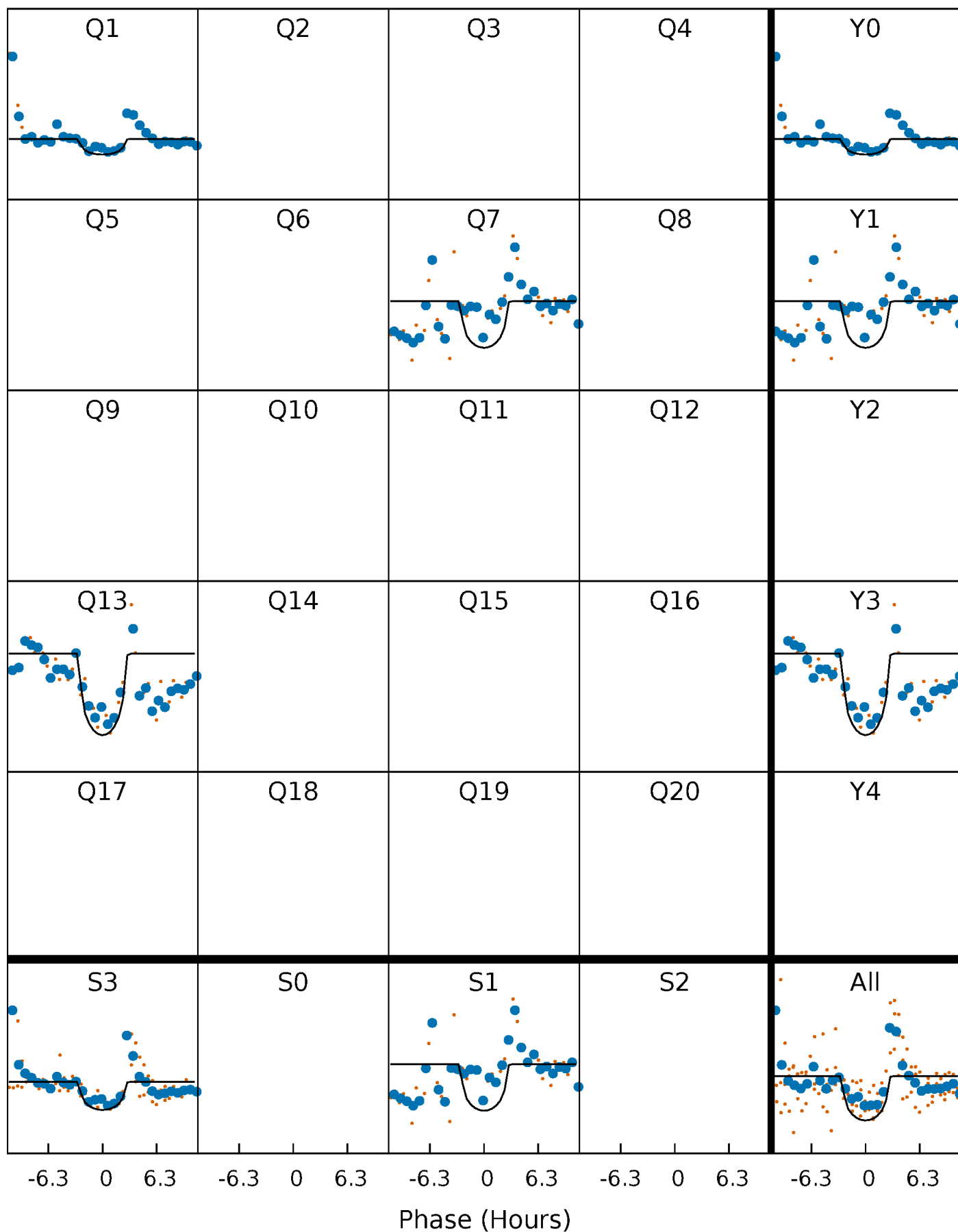
TCE 009713986-02     $P=535.645922$  Days     $T_0=135.887646$  (BKJD)





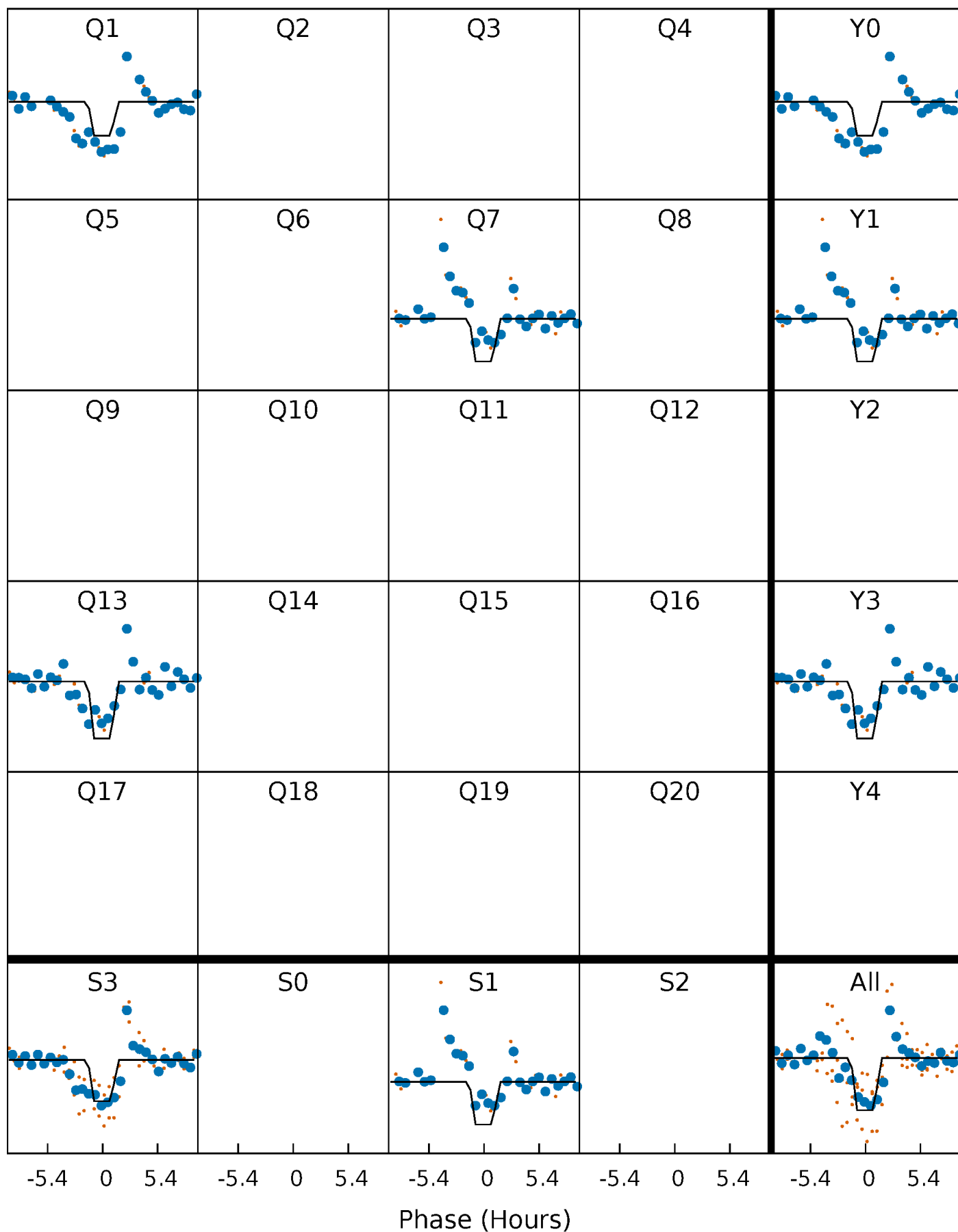
# DV Quarter-Phased Transit Curves

TCE 009713986-02     $P=535.645922$  Days     $T_0=135.887646$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

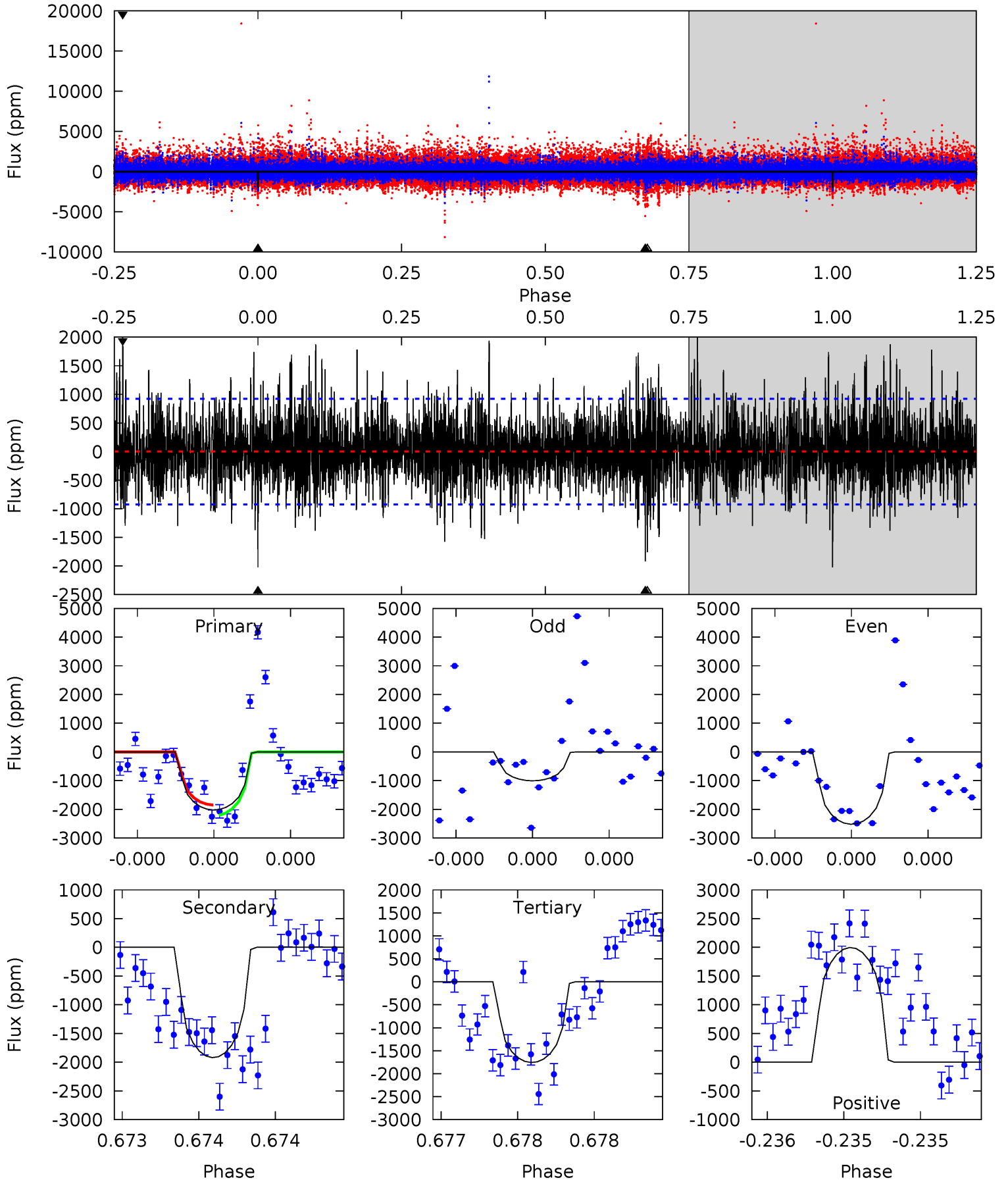
TCE 009713986-02     $P=535.645342$  Days     $T_0=135.919604$  (BKJD)



# DV Model-Shift Uniqueness Test

009713986-02,  $P = 535.645922$  Days,  $E = 135.887646$  Days

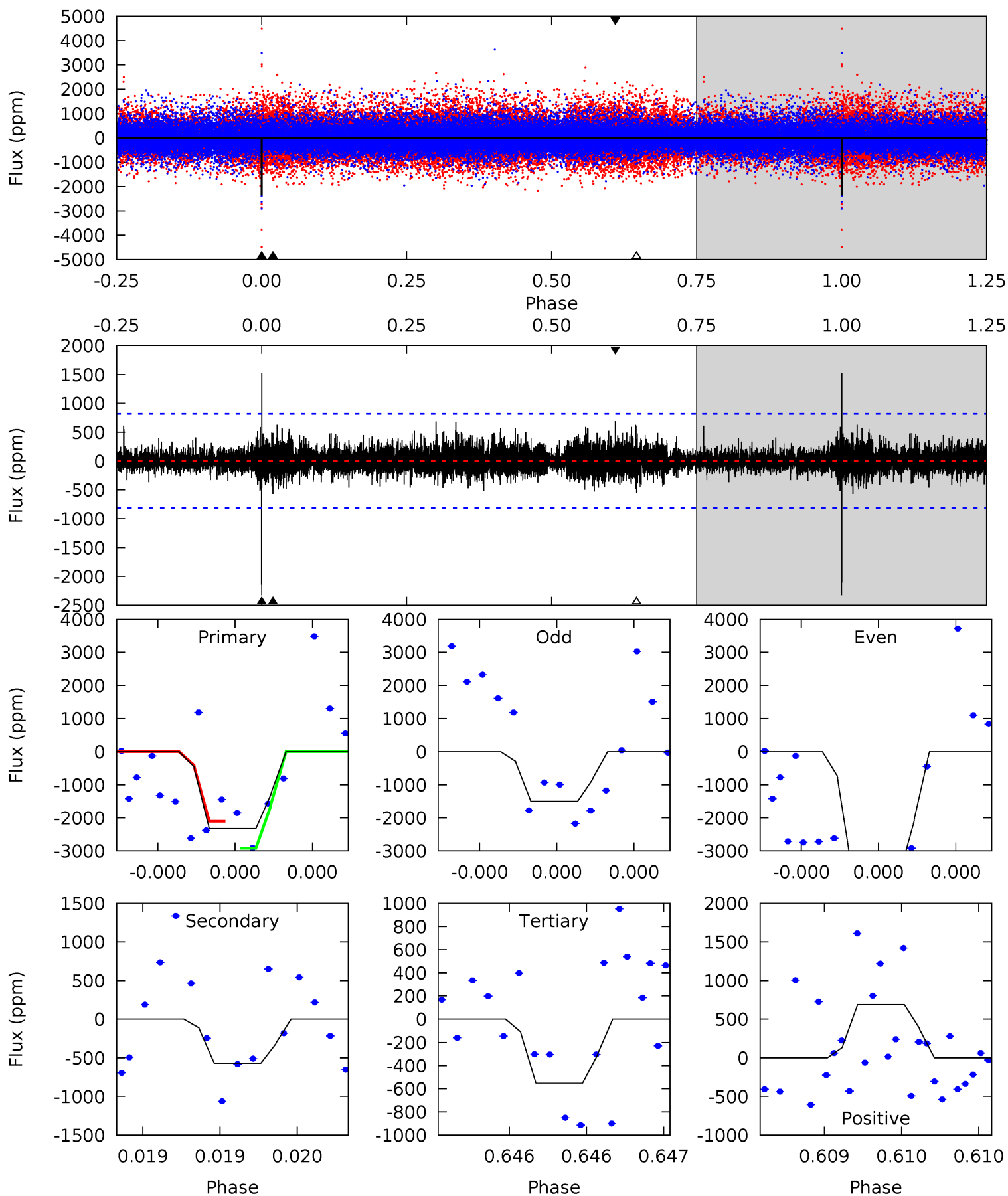
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
12.2	11.6	10.6	12.1	5.59	3.50	2.68	1.60	0.15	0.99	-0.46	3.79	0.84	0.50	1.09



# Alt Model-Shift Uniqueness Test

009713986-02, P = 535.645342 Days, E = 135.919604 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
16.3	4.00	3.88	4.85	5.74	3.73	0.88	12.5	11.5	0.12	-0.85	7.83	1.28	0.40	2.99



### Stellar Parameters For KIC 009713986

	$T_{\text{eff}}(K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$4543^{+150}_{-150}$	$4.566^{+0.056}_{-0.020}$	$0.300^{+0.150}_{-0.300}$	$0.744^{+0.031}_{-0.062}$	$0.743^{+0.043}_{-0.052}$	$2.540^{+0.591}_{-0.218}$
	+3%/-3%	+1%/-0%	+50%/-100%	+4%/-8%	+6%/-7%	+23%/-9%
Source	PHO1	KIC0	KIC0	DSEP		

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

### Secondary Eclipse Parameters for KIC 009713986-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-1921 \pm 165$	$5.64^{+4.58}_{-3.67}$	$221^{+8}_{-8}$	$3823^{+2056}_{-664}$	$44967^{+350181}_{-31362}$
Alt.	$-569 \pm 142$	$6.05^{+4.94}_{-4.04}$	$221^{+8}_{-8}$	$3083^{+1366}_{-506}$	$11389^{+99442}_{-8263}$

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

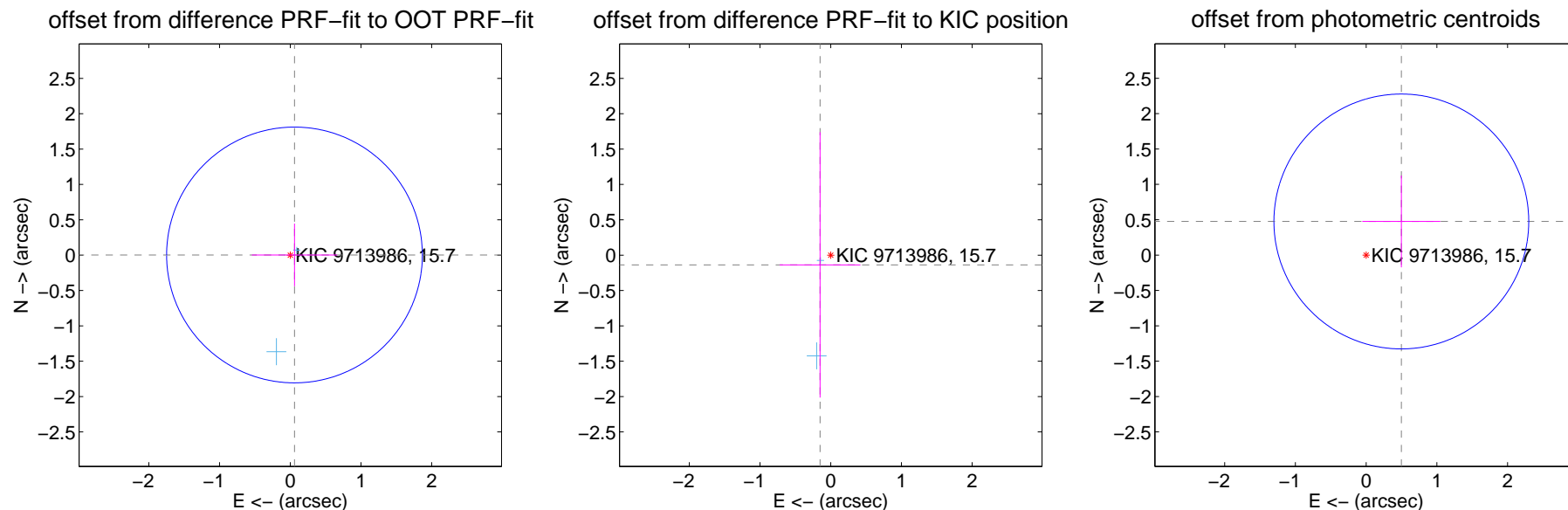
## DV Centroid Data

Supplemental centroid analysis for 009713986-02. Kepler magnitude: 15.70. Transit SNR 9.91

There are 2 quarters with good PRF difference image offsets

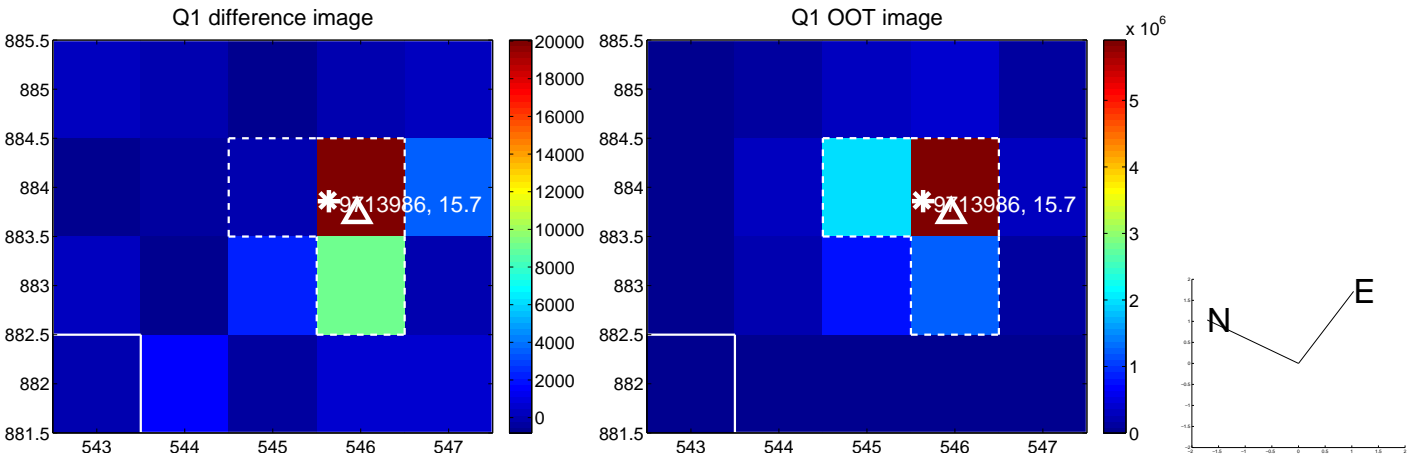
The direct PRF centroid is offset from the target star catalog position by about 0.04 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.060 \pm 0.603$	0.10	$-0.060 \pm 0.603$	$0.003 \pm 0.443$
PRF-fit source offset from KIC position	$0.204 \pm 1.685$	0.12	$0.150 \pm 0.571$	$-0.138 \pm 1.877$
photometric centroid source offset	$0.69 \pm 0.60$	1.15	$-0.50 \pm 0.55$	$0.48 \pm 0.65$

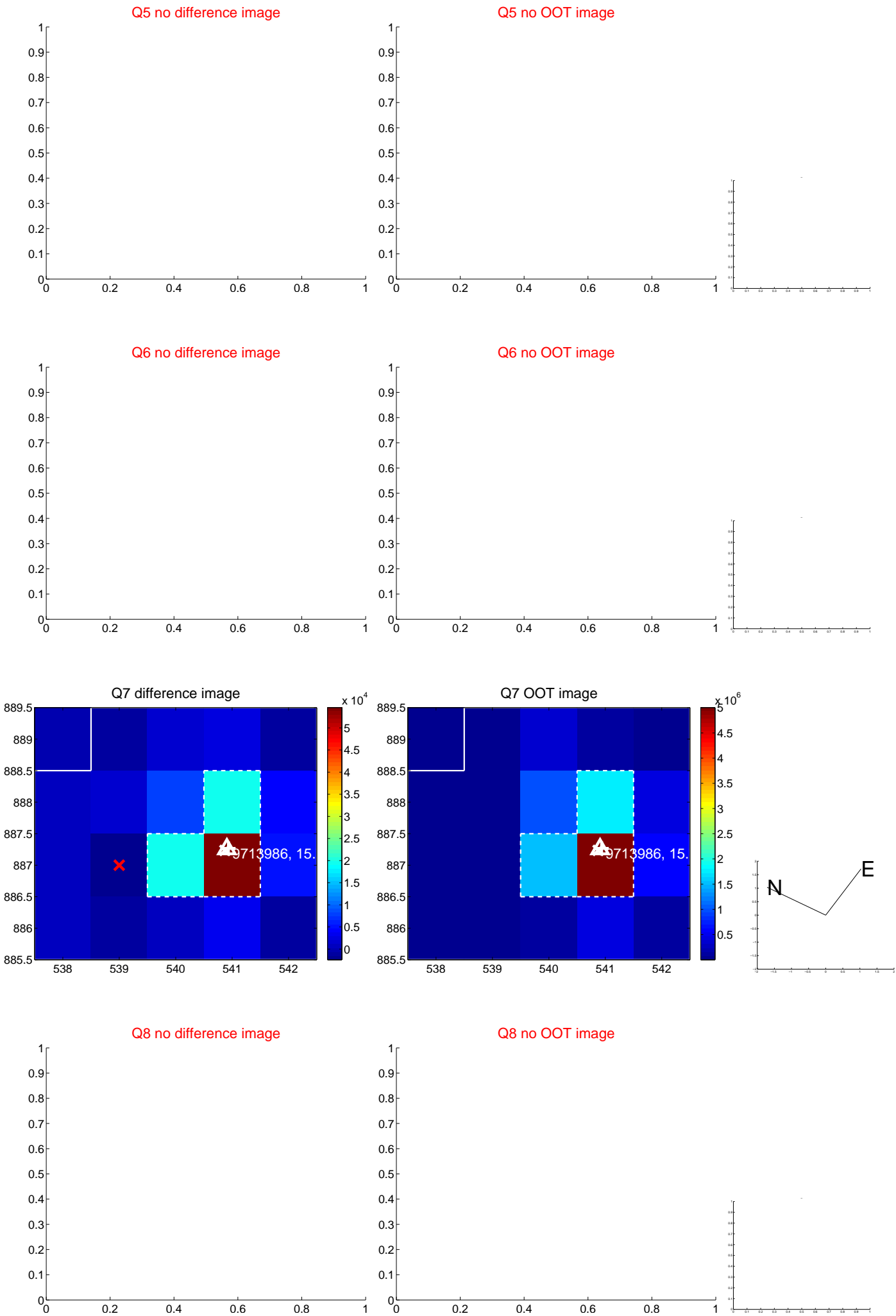


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

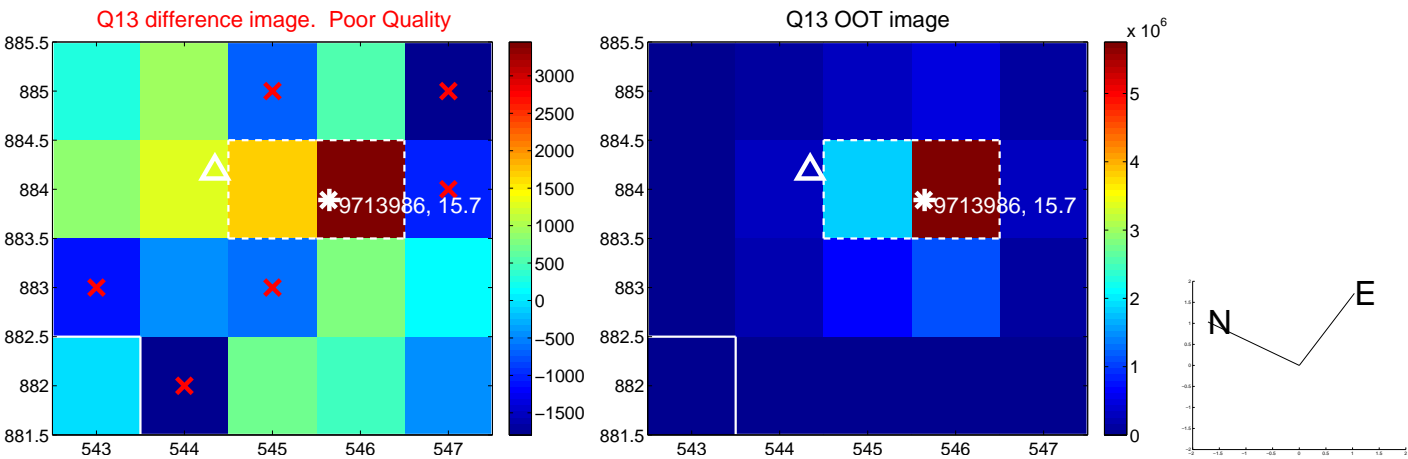




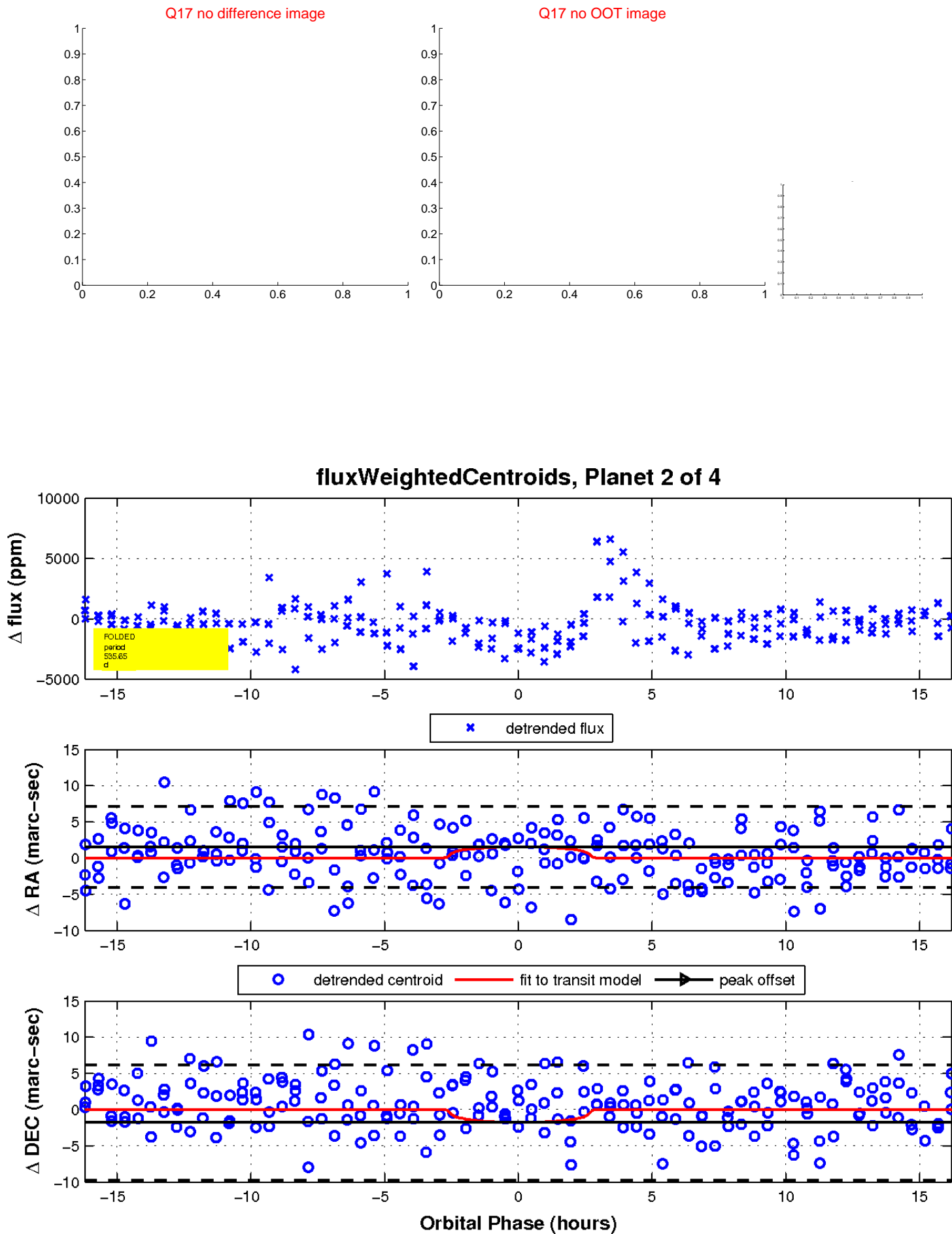
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



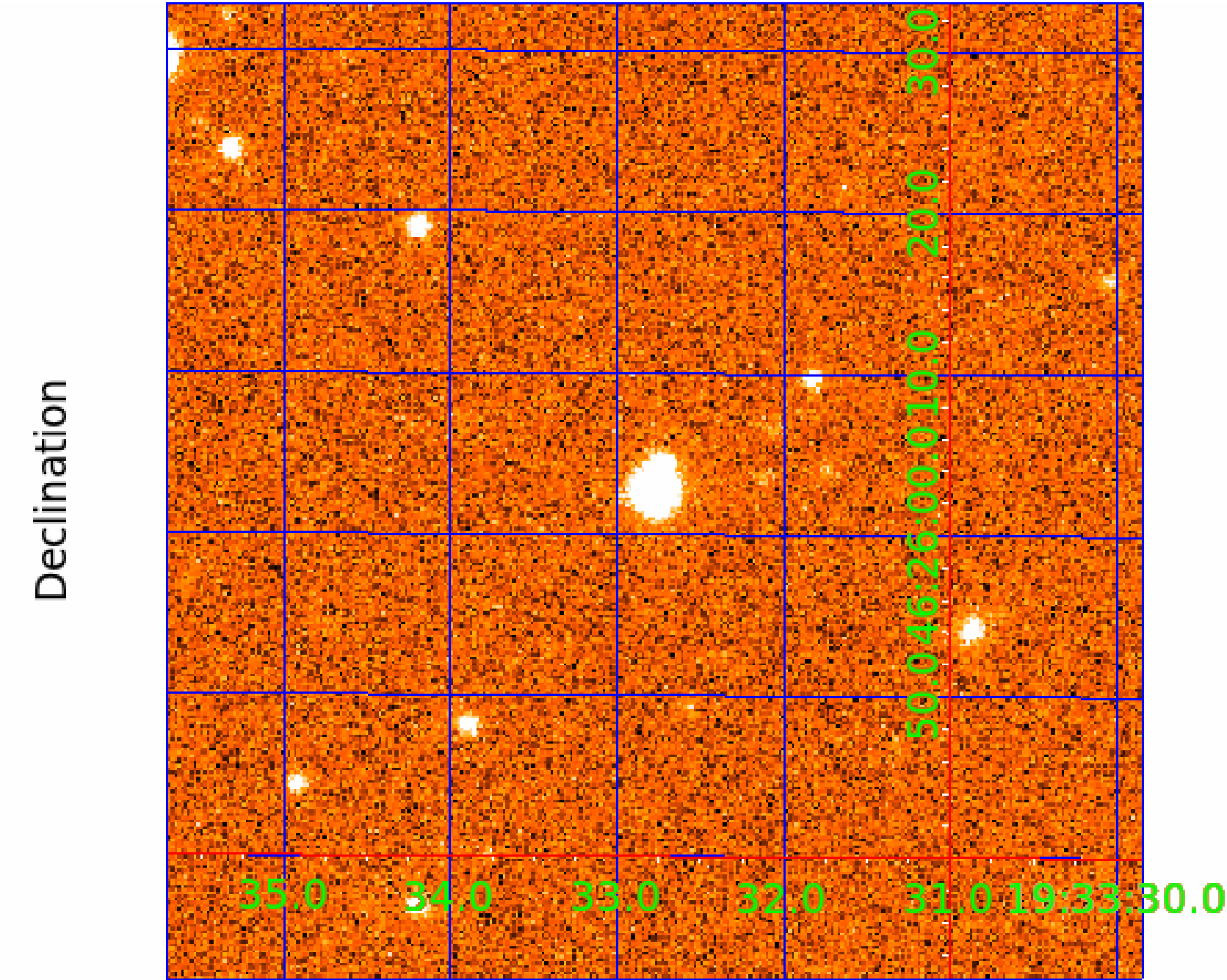
white ×: KIC target position; +: OOT centroid; △: difference centroid. red ✕: large negative pixel value.



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



UKIRT Image



# KIC 009713986

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009713986-01	OBS	No	349.119105	334.077044	2175.9	2.665	12.0	6.7	0.74	4543	3.32	0.27
009713986-02	OBS	No	535.645922	135.887646	3383.7	5.552	10.8	9.9	0.74	4543	4.12	0.15
009713986-03	OBS	No	455.126748	453.743478	1604.5	4.248	10.9	5.8	0.74	4543	3.28	0.19
009713986-04	OBS	No	373.878246	488.033065	2071.5	3.653	10.2	6.2	0.74	4543	3.55	0.25

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009713986-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009713986-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009713986-03	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS—HALO_GHOST
009713986-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_SKYE—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS

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

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

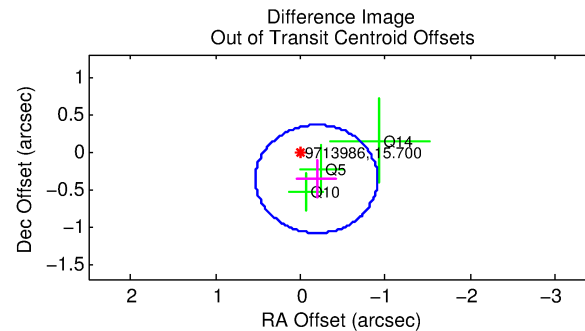
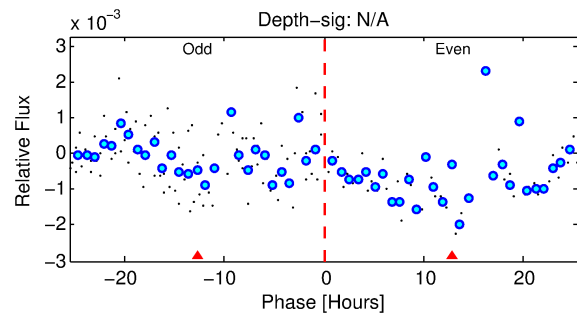
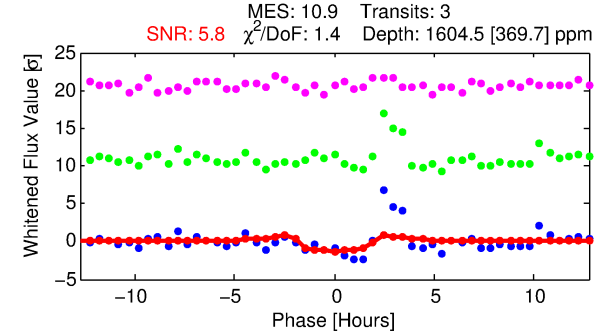
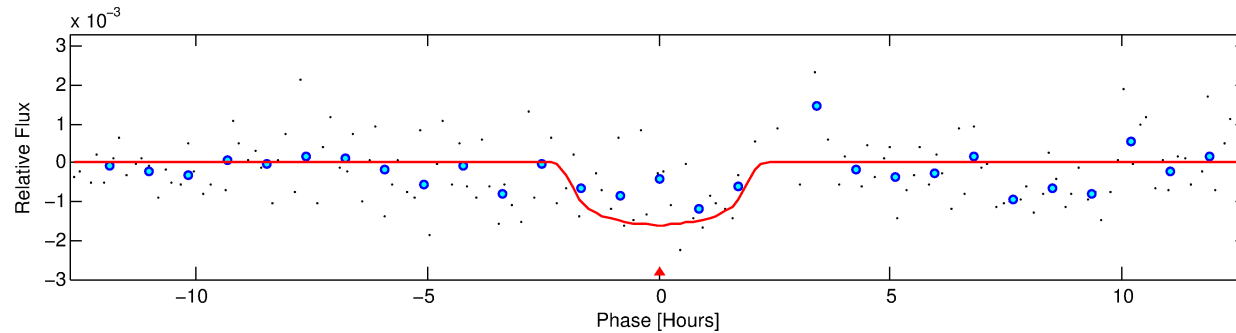
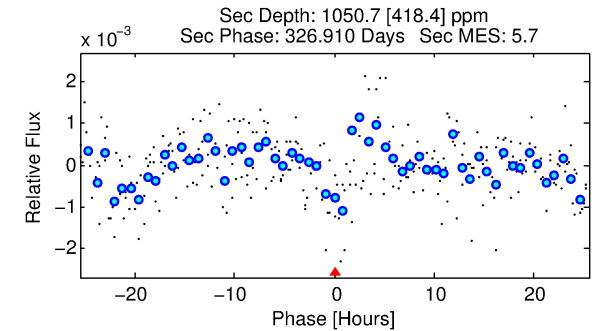
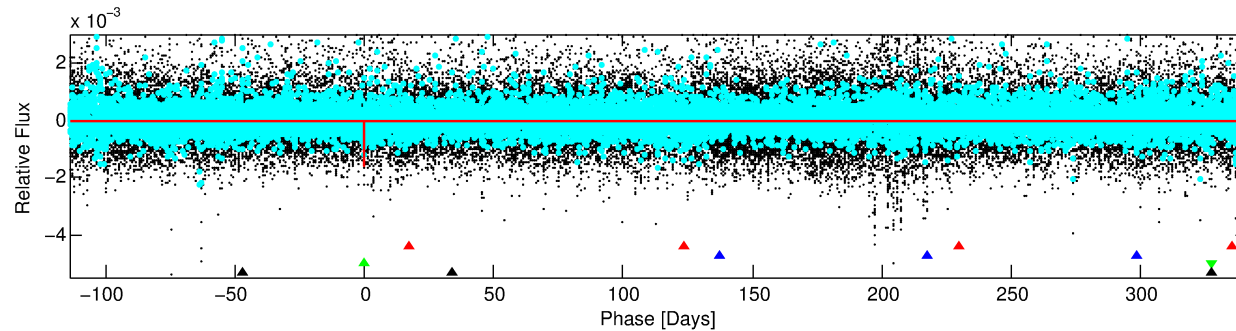
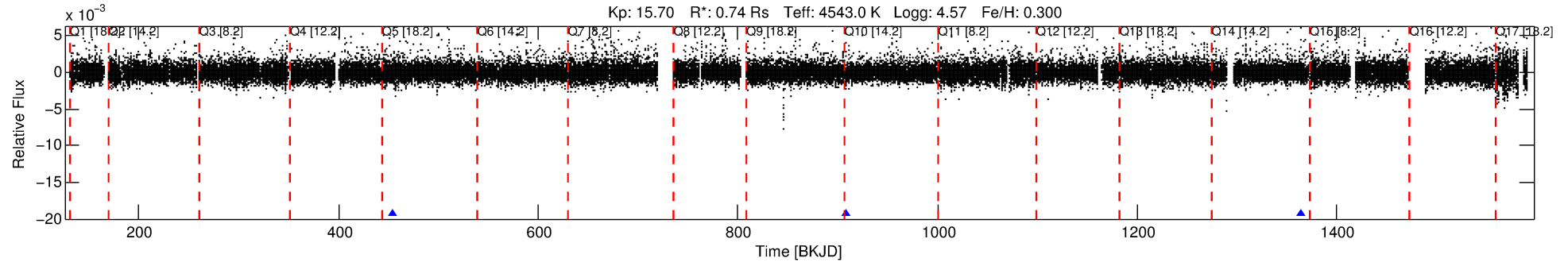
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 009713986-03

No Significant Match Found

# DV One-Page Summary

KIC: 9713986 Candidate: 3 of 4 Period: 455.127 d



## DV Fit Results:

Period = 455.12675 [0.00983] d  
Epoch = 453.7435 [0.0145] BKJD  
Rp/R\* = 0.0404 [0.0411]  
a/R\* = 580.78 [1789.06]  
b = 0.76 [1.76]  
Seff = 0.19 [0.03]  
Teq = 169 [7] K  
Rp = 3.28 [3.35] Re  
a = 1.0491 [0.0737] AU  
Ag = 59052.59 [122524.62] [0.48]  
Teffp = 4068 [2112] K [1.85]

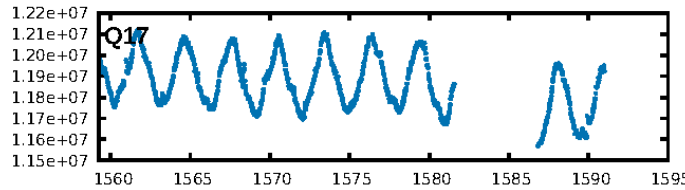
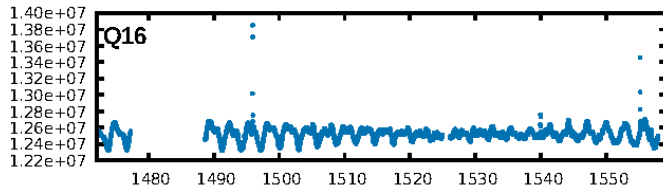
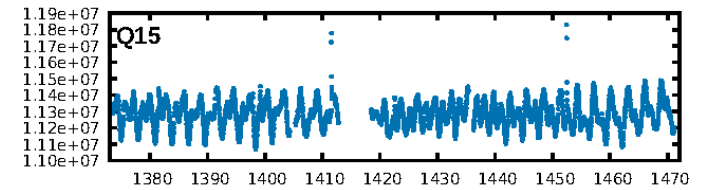
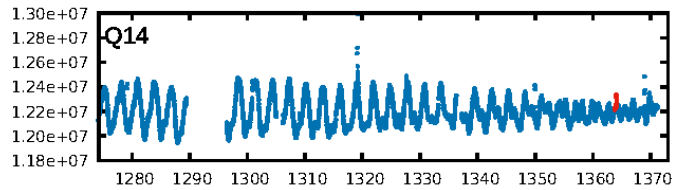
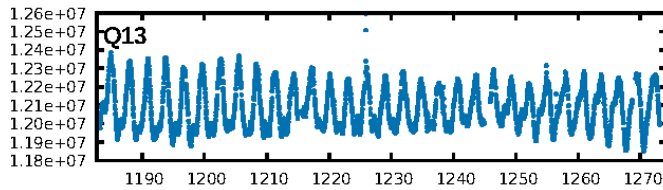
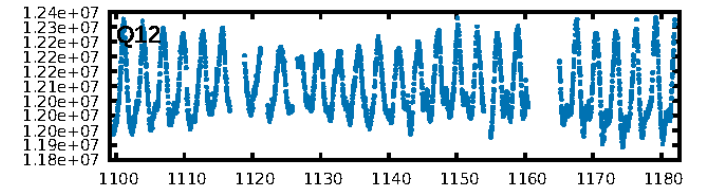
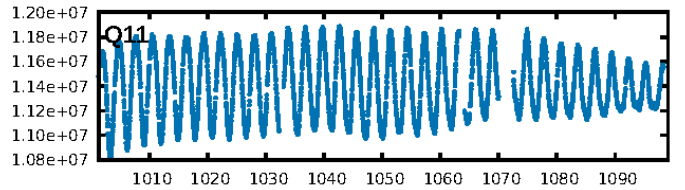
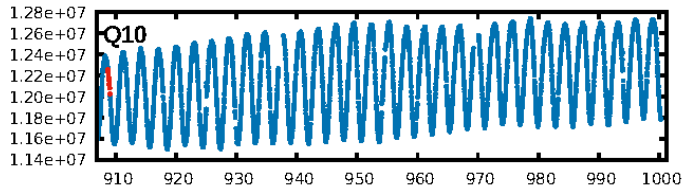
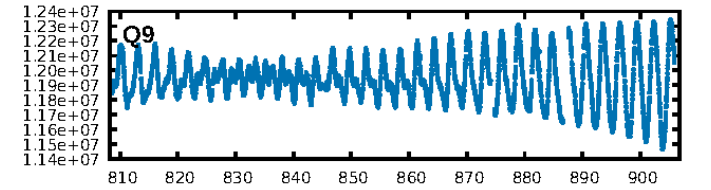
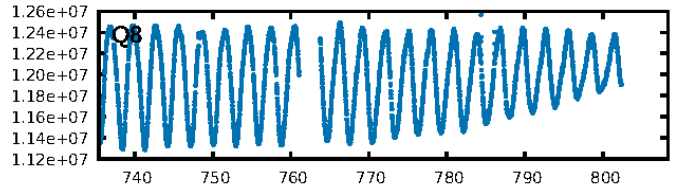
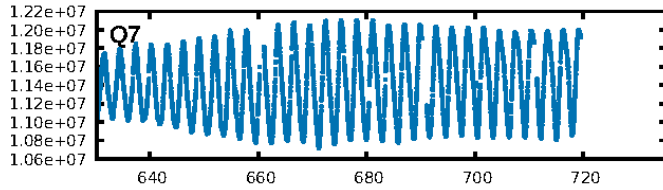
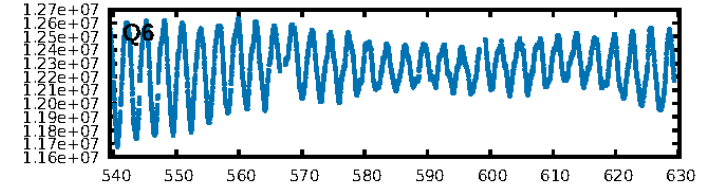
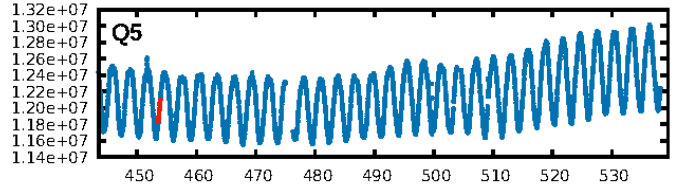
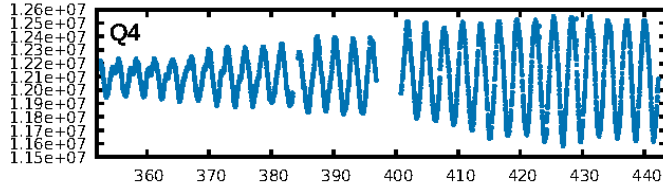
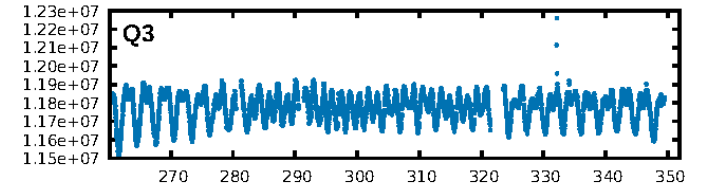
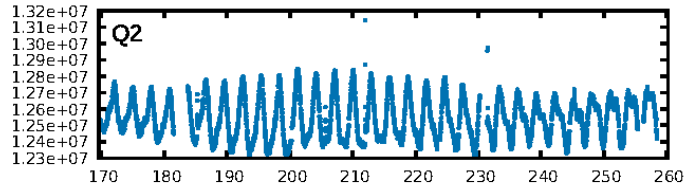
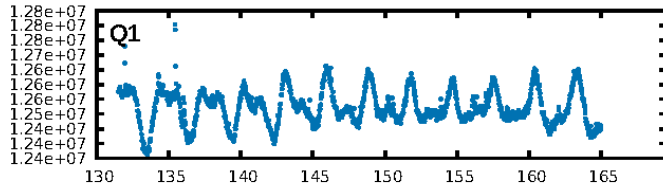
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [348.05]  
LongPeriod-sig: 100.0% [276.45]  
ModelChiSquare2-sig: 1.7%  
ModelChiSquareGof-sig: 66.2%  
**Bootstrap-pfa: 2.91e-10**  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: 0.04143  
Centroid-sig: 10.0%  
Centroid-so: 1.974 arcsec [1.41]  
OotOffset-rm: 0.412 arcsec [1.72]  
OotOffset-st: 2/0/0/1 [3]  
KicOffset-rm: 0.414 arcsec [1.73]  
KicOffset-st: 2/0/0/1 [3]  
DiffImageQuality-fgm: 0.33 [1/3]  
DiffImageOverlap-fno: 1.00 [3/3]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 10:57:45 Z

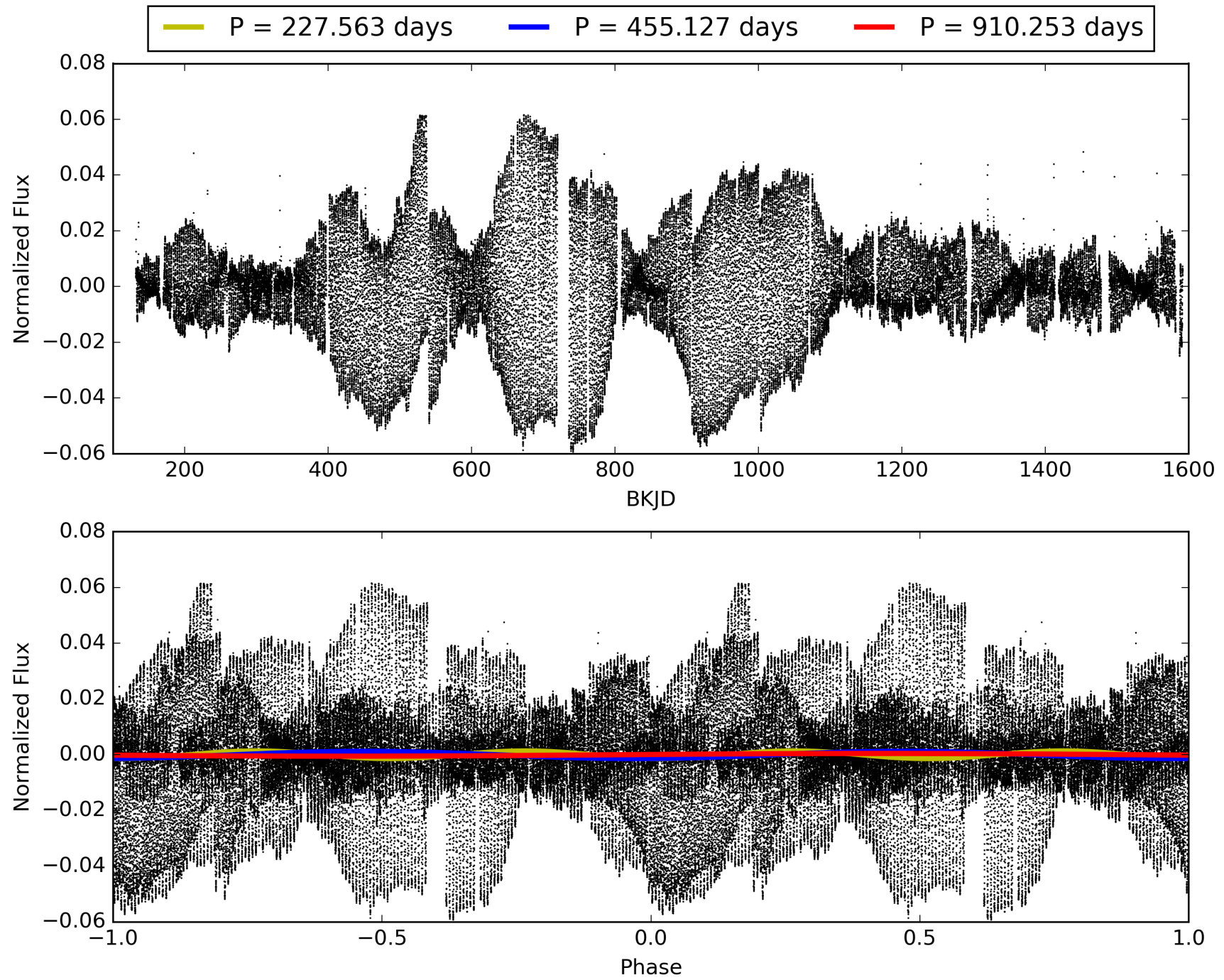
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 009713986-03, PDC Light Curves





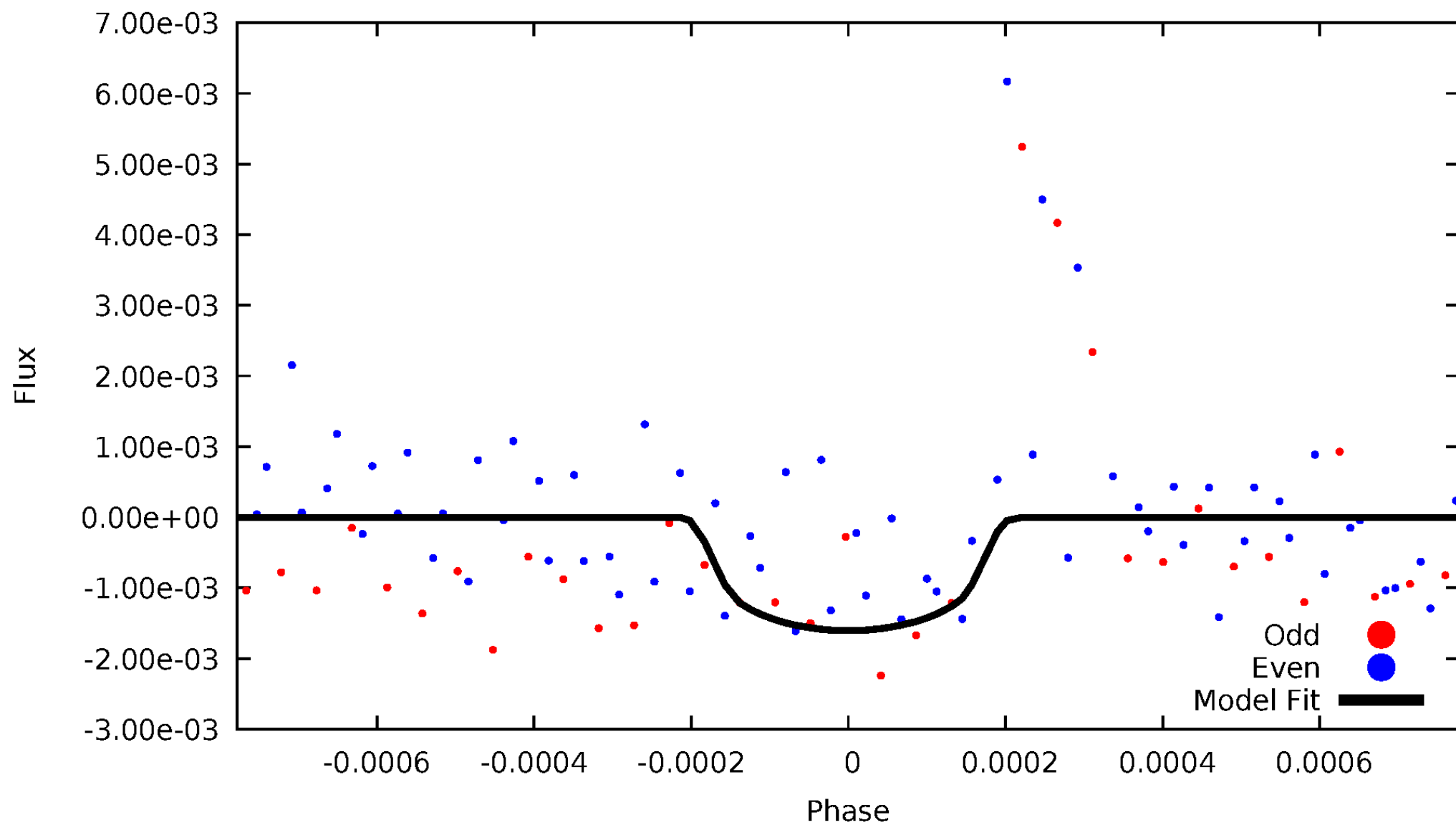
TCE 009713986-03





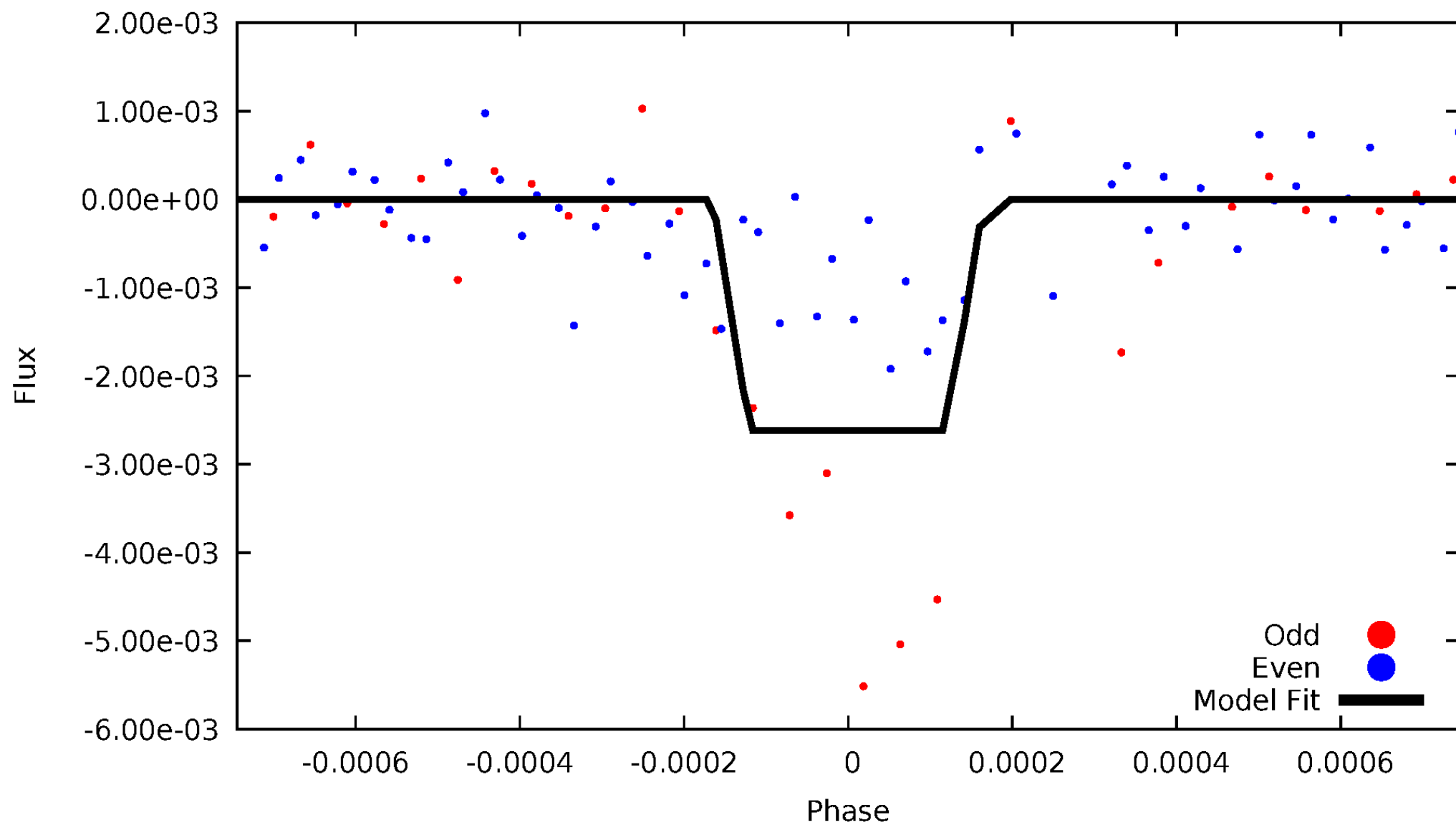
# DV Odd/Even

TCE 009713986-03



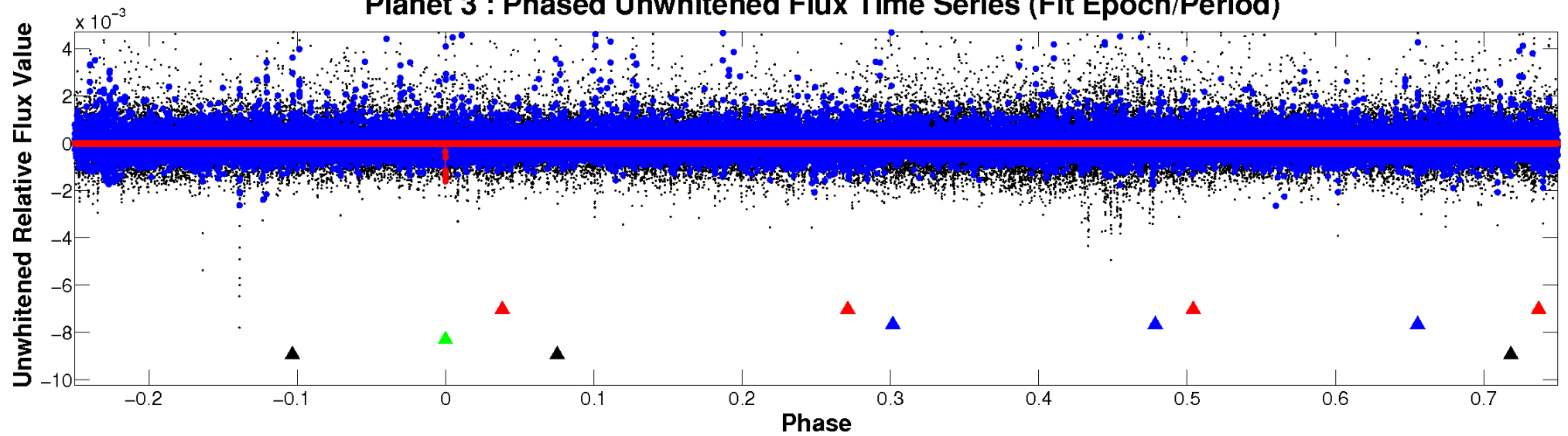
# ALT Odd/Even

TCE 009713986-03

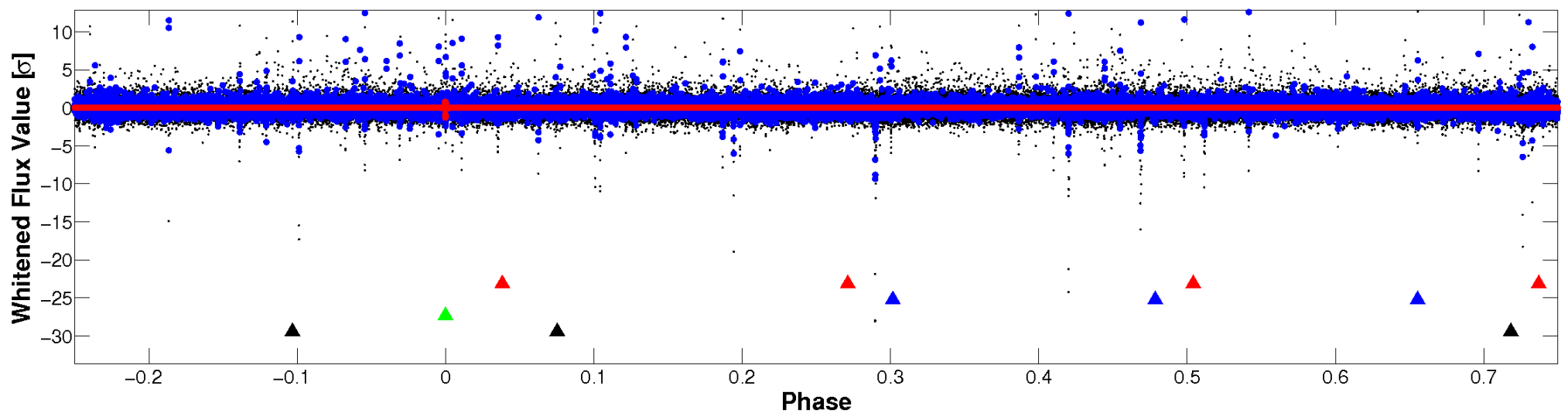


# Non-Whitened Vs. Whitened Light Curve

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

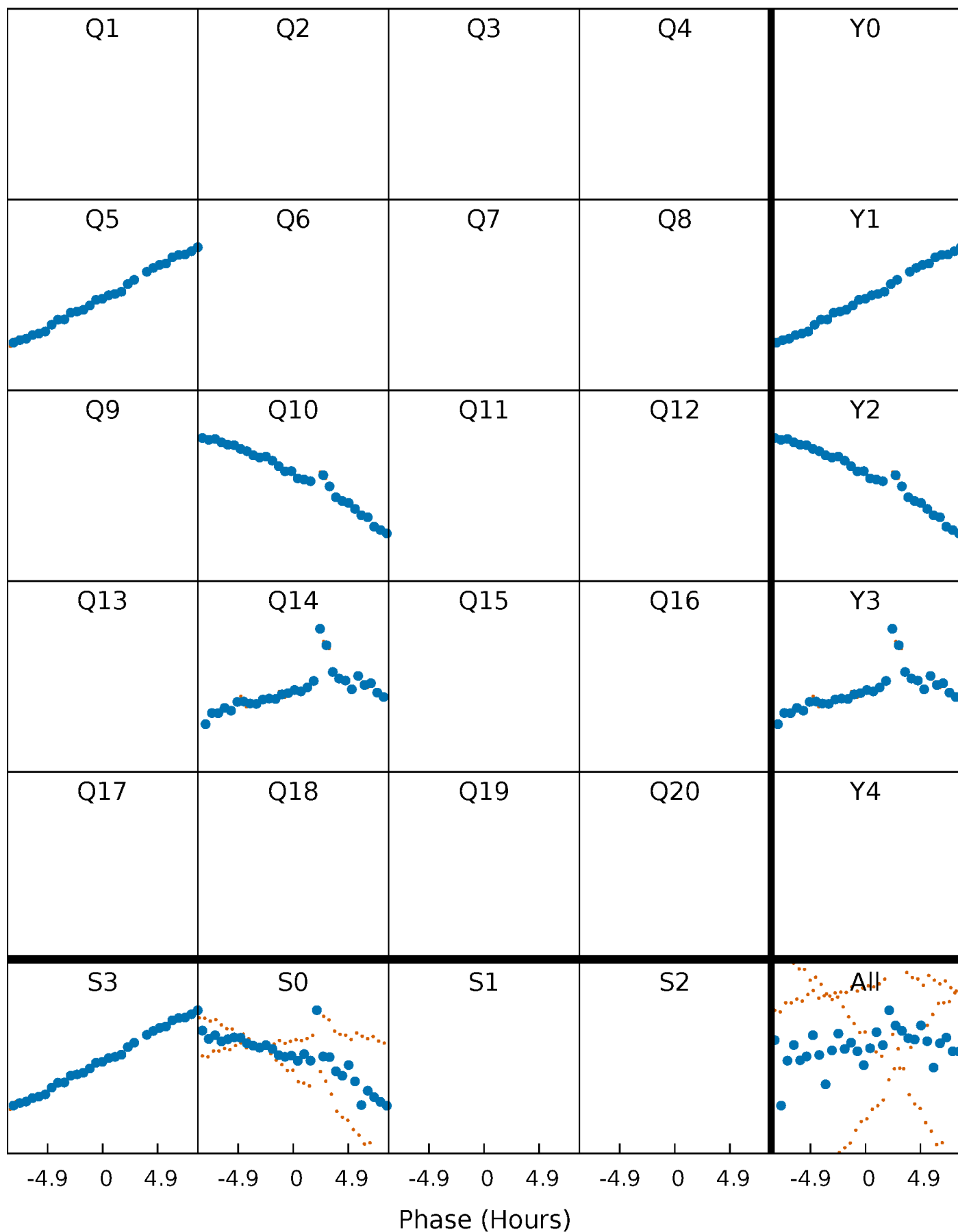


**Planet 3 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



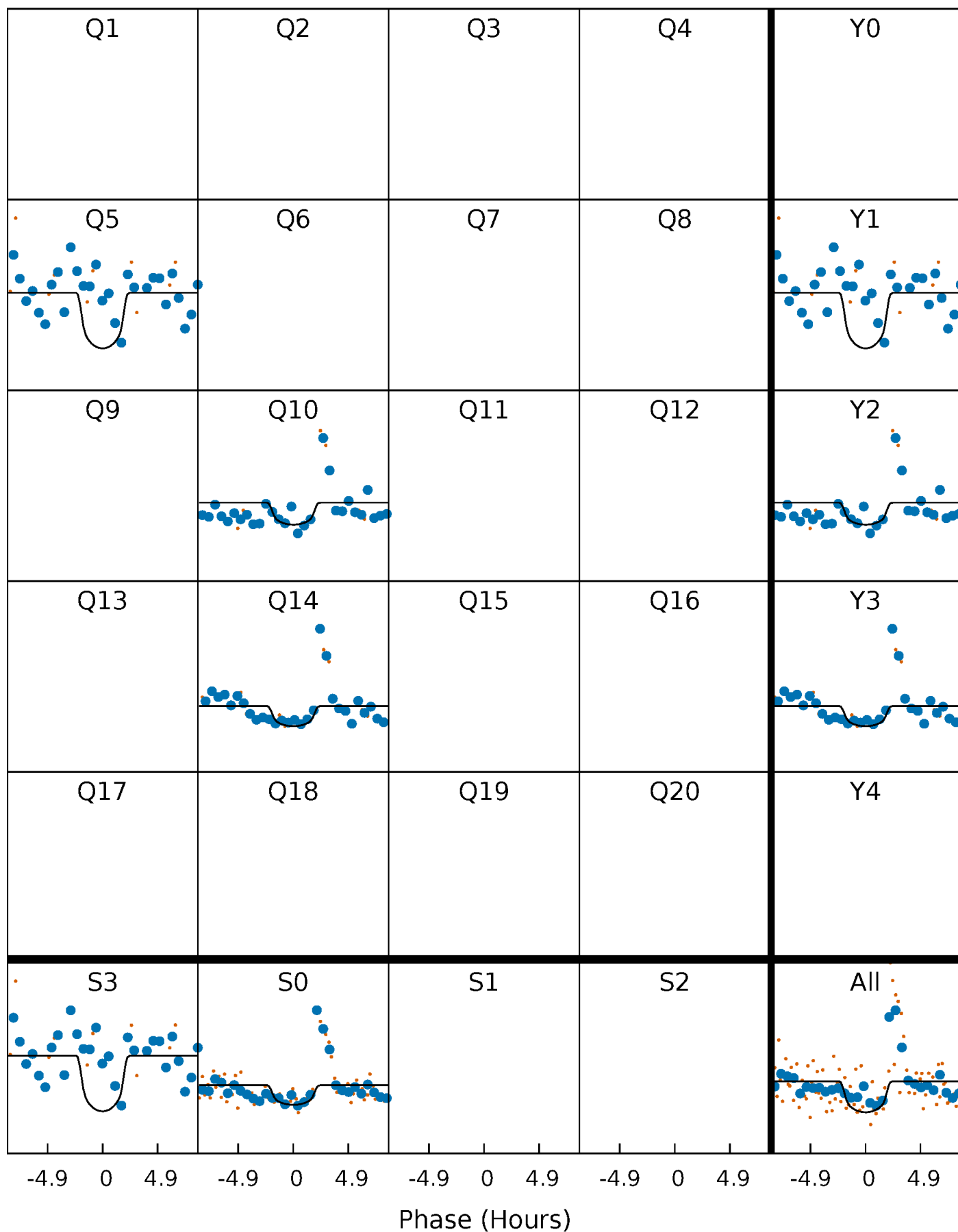
# PDC Quarter-Phased Transit Curves

TCE 009713986-03     $P=455.126748$  Days     $T_0=453.743478$  (BKJD)



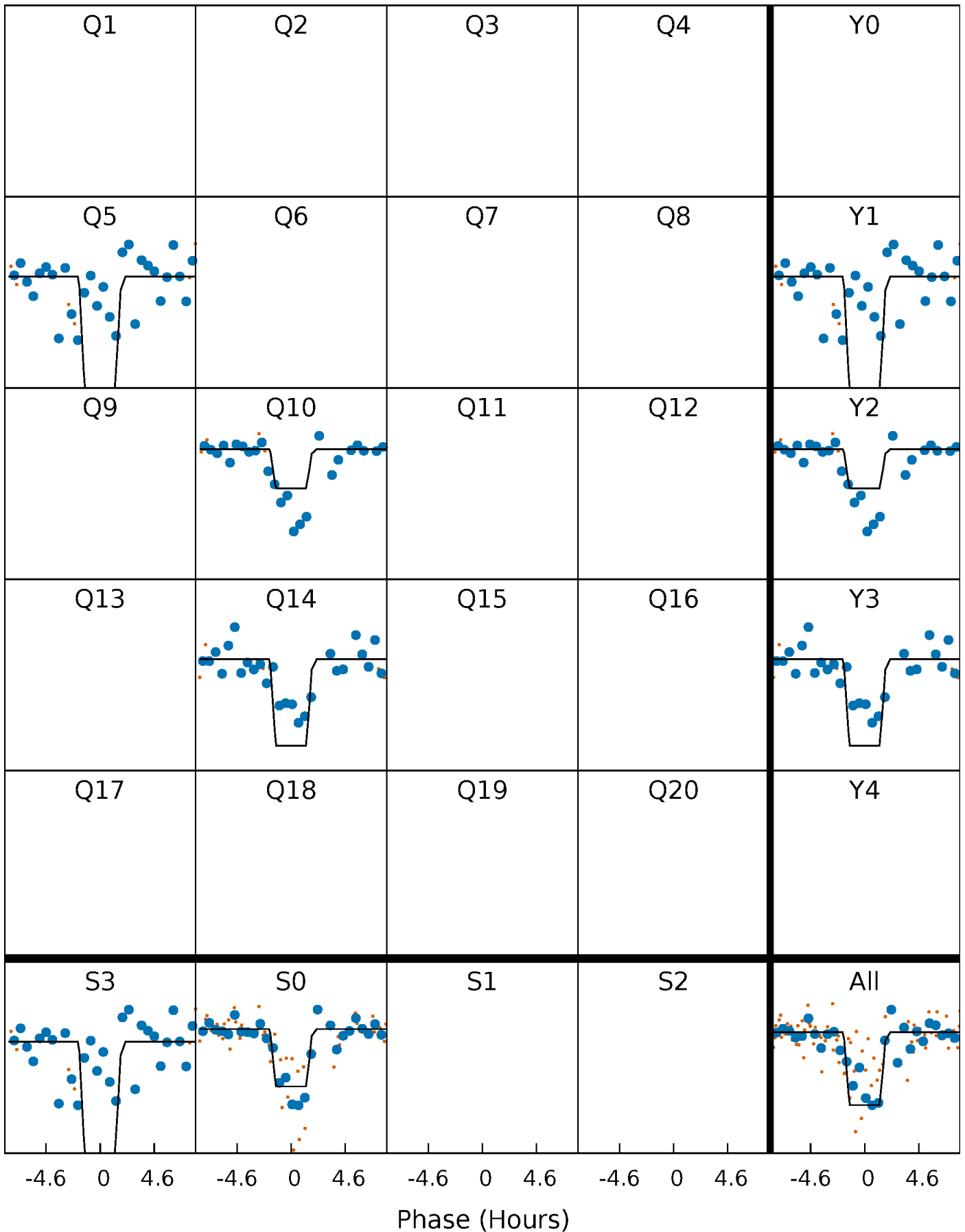
# DV Quarter-Phased Transit Curves

TCE 009713986-03     $P=455.126748$  Days     $T_0=453.743478$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

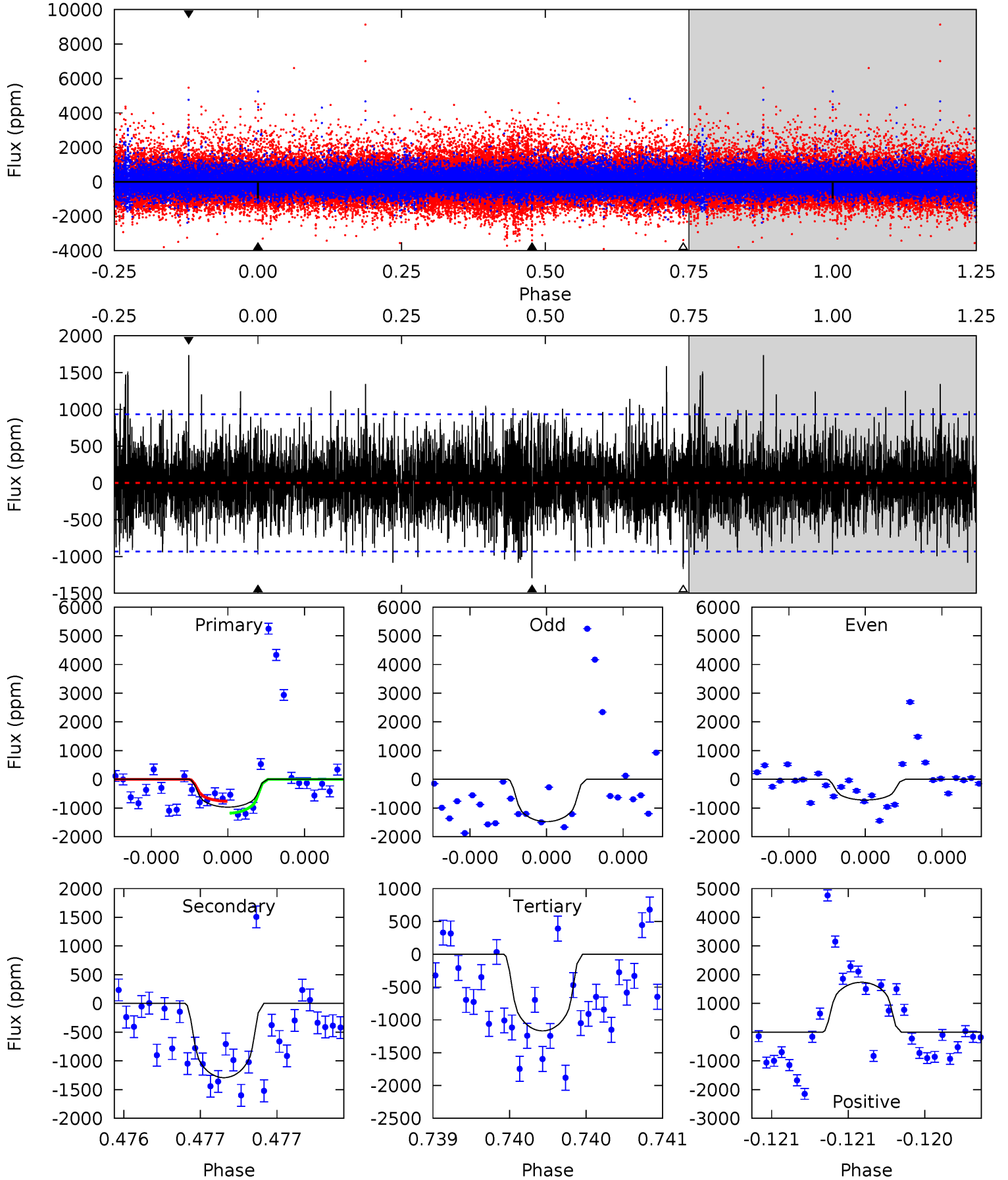
TCE 009713986-03     $P=455.123493$  Days     $T_0=453.757250$  (BKJD)



# DV Model-Shift Uniqueness Test

009713986-03, P = 455.126748 Days, E = 453.743478 Days

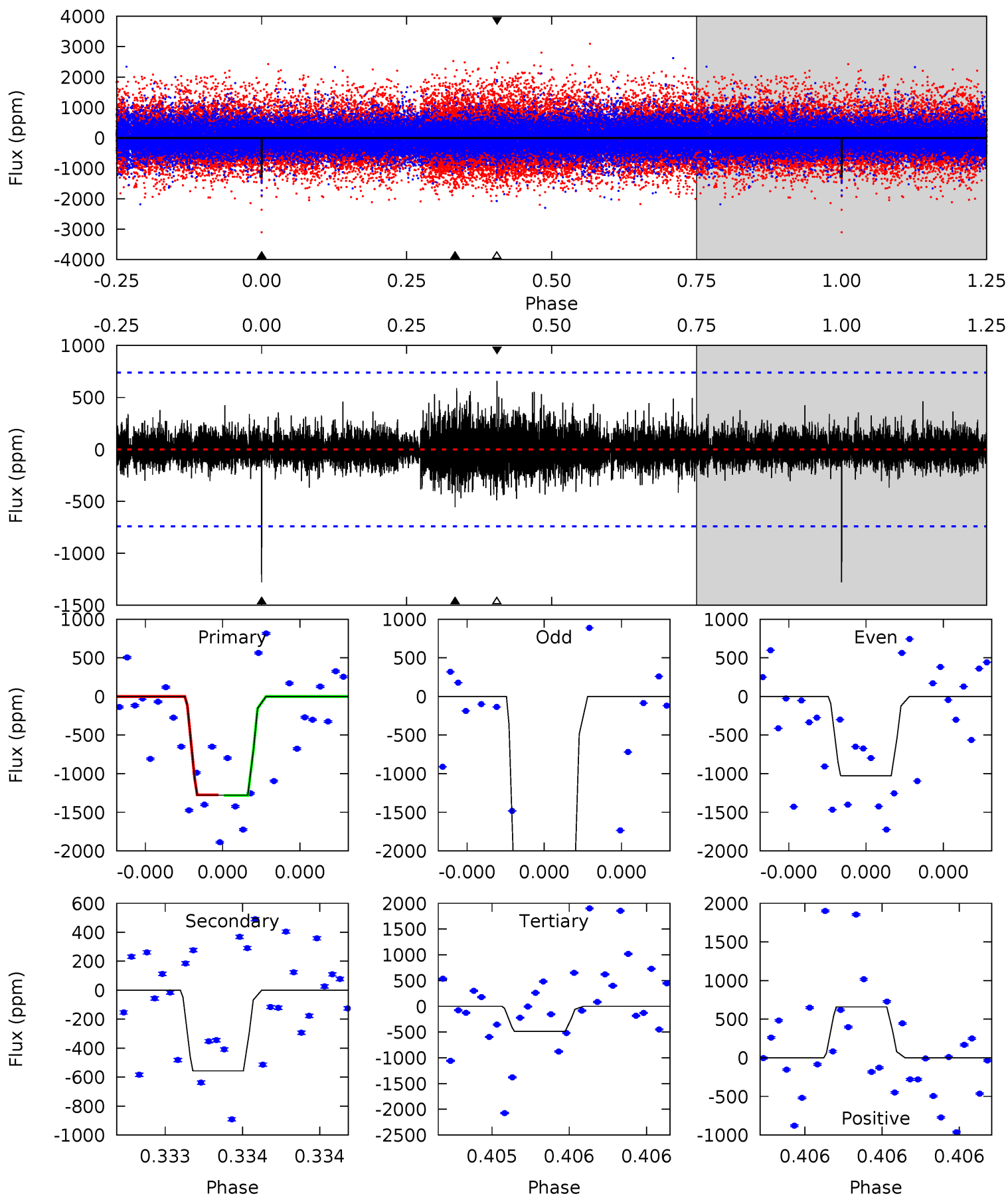
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
5.83	7.77	7.02	10.4	5.60	3.53	1.99	-1.19	-4.61	0.75	-2.68	1.83	0.74	0.57	1.25



# Alt Model-Shift Uniqueness Test

009713986-03, P = 455.123493 Days, E = 453.757250 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
9.73	4.24	3.72	5.01	5.63	3.57	0.84	6.01	4.72	0.52	-0.77	12.0	1.42	0.34	0.03





### Stellar Parameters For KIC 009713986

	$T_{\text{eff}}(K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$4543^{+150}_{-150}$	$4.566^{+0.056}_{-0.020}$	$0.300^{+0.150}_{-0.300}$	$0.744^{+0.031}_{-0.062}$	$0.743^{+0.043}_{-0.052}$	$2.540^{+0.591}_{-0.218}$
	+3%/-3%	+1%/-0%	+50%/-100%	+4%/-8%	+6%/-7%	+23%/-9%
Source	PHO1	KIC0	KIC0	DSEP		

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

### Secondary Eclipse Parameters for KIC 009713986-03 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-1293 \pm 166$	$3.97^{+2.84}_{-2.43}$	$234^{+9}_{-8}$	$4018^{+1983}_{-648}$	$50668^{+267712}_{-33716}$
Alt.	$-557 \pm 131$	$4.65^{+3.12}_{-2.79}$	$234^{+9}_{-9}$	$3320^{+1194}_{-467}$	$15366^{+76866}_{-10155}$

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

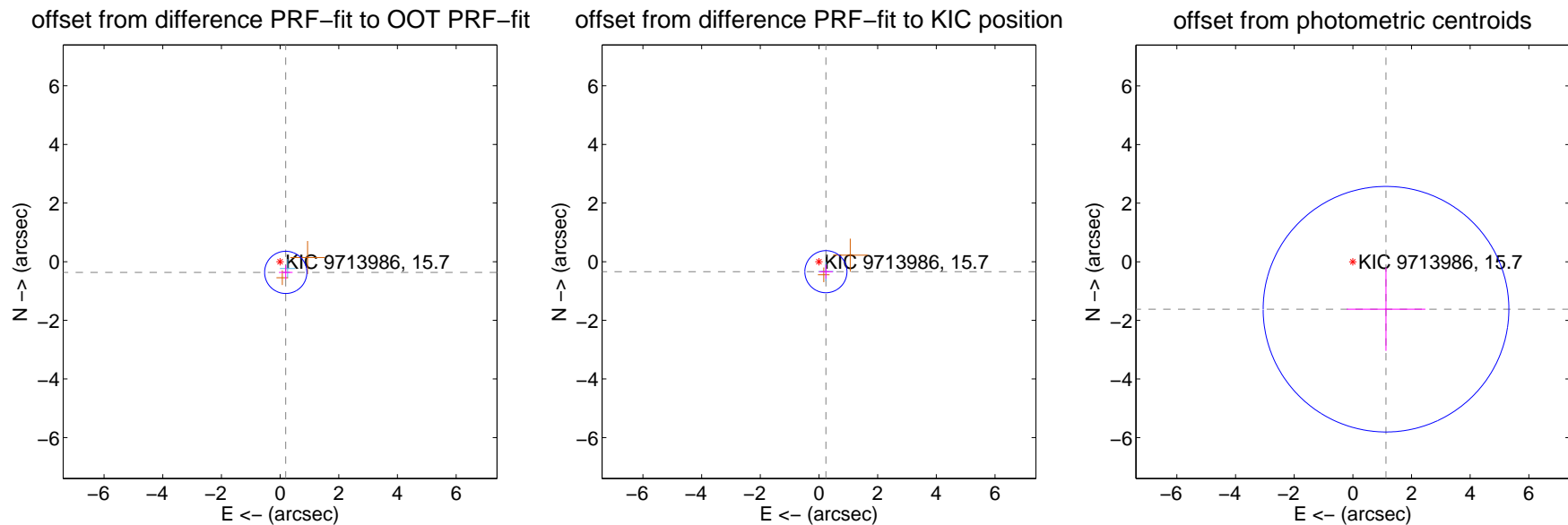
## DV Centroid Data

Supplemental centroid analysis for 009713986-03. Kepler magnitude: 15.70. Transit SNR 5.76

There are 1 quarters with good PRF difference image offsets

The direct PRF centroid is offset from the target star catalog position by about 0.15 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.412 \pm 0.240$	1.72	$-0.192 \pm 0.234$	$-0.364 \pm 0.242$
PRF-fit source offset from KIC position	$0.414 \pm 0.239$	1.73	$-0.236 \pm 0.234$	$-0.341 \pm 0.242$
photometric centroid source offset	$1.97 \pm 1.40$	1.41	$-1.13 \pm 1.34$	$-1.62 \pm 1.42$

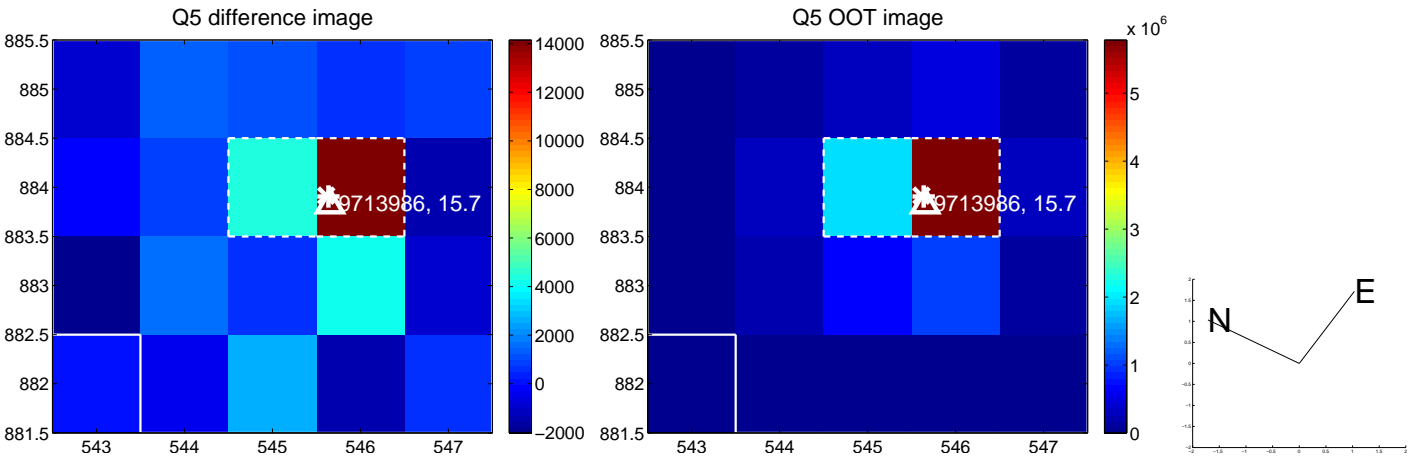


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

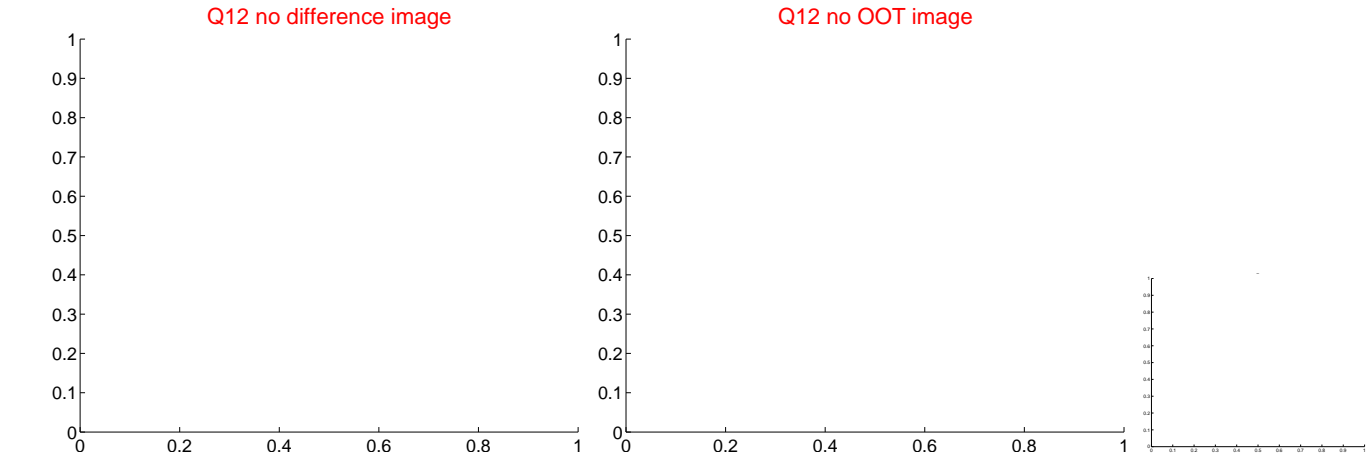
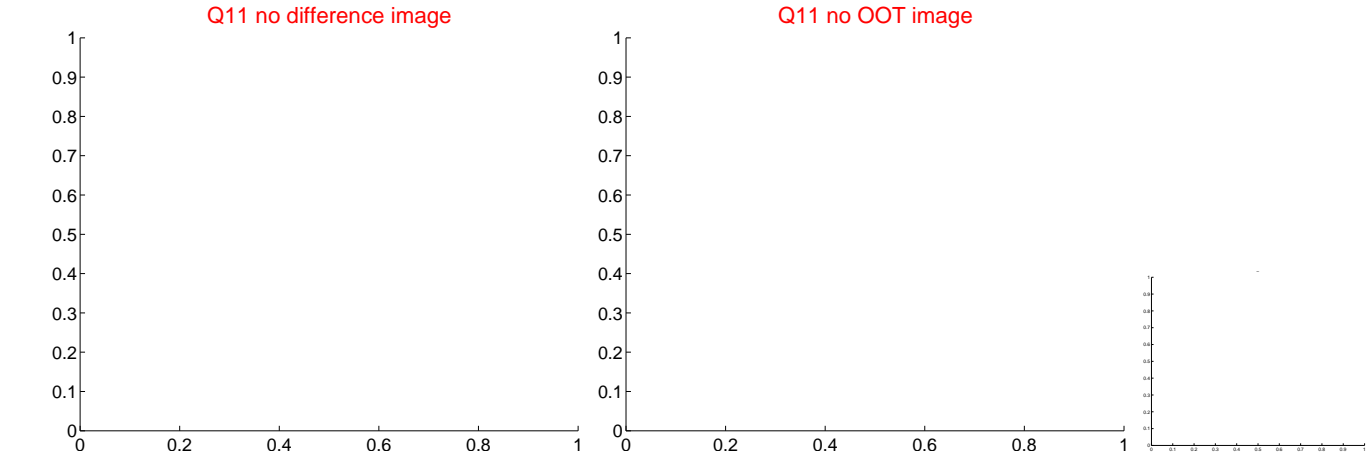
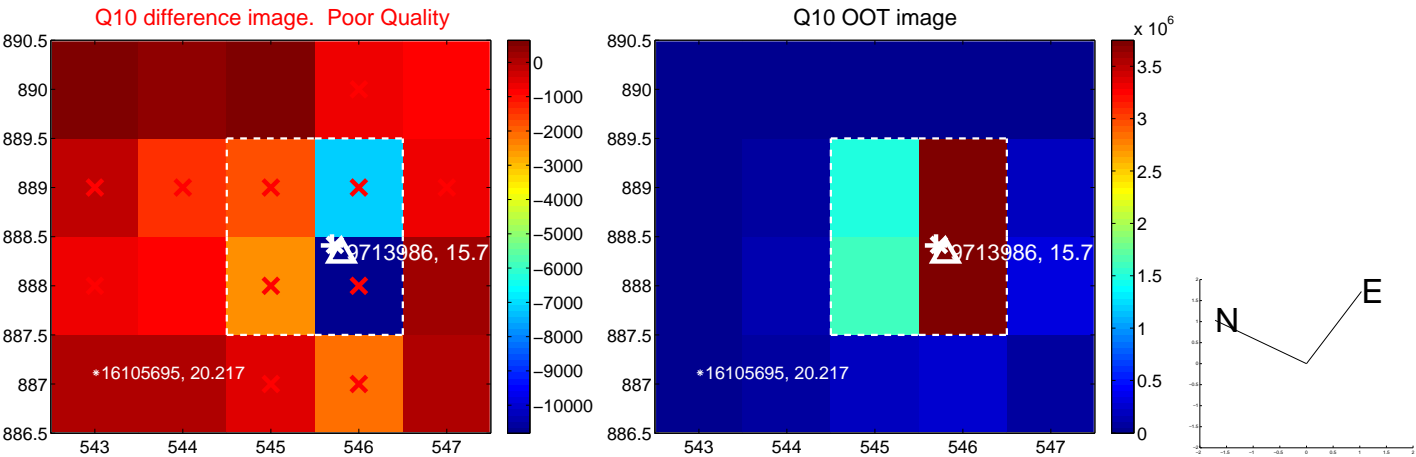
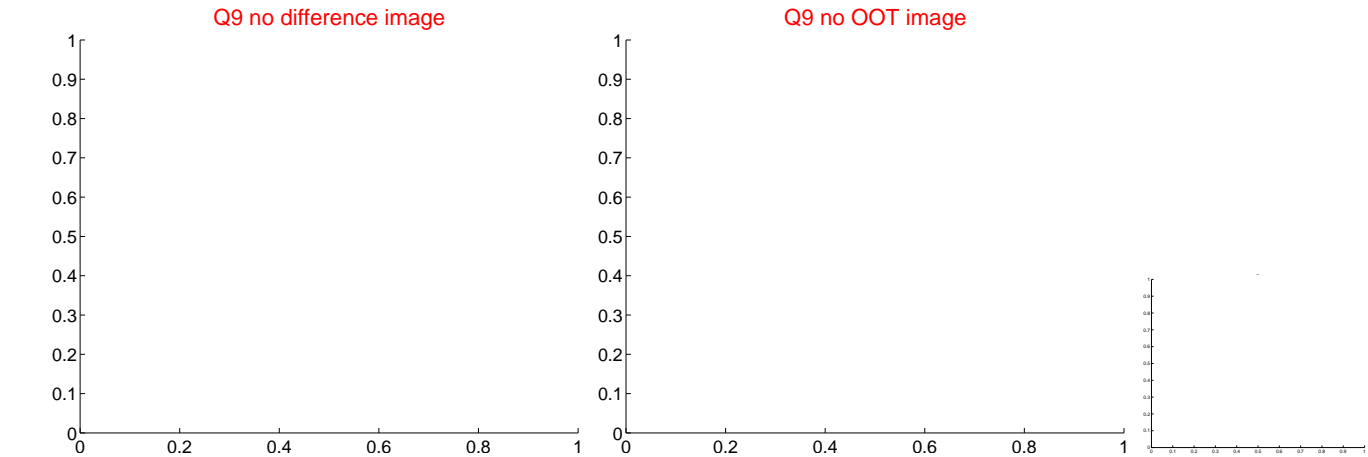
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



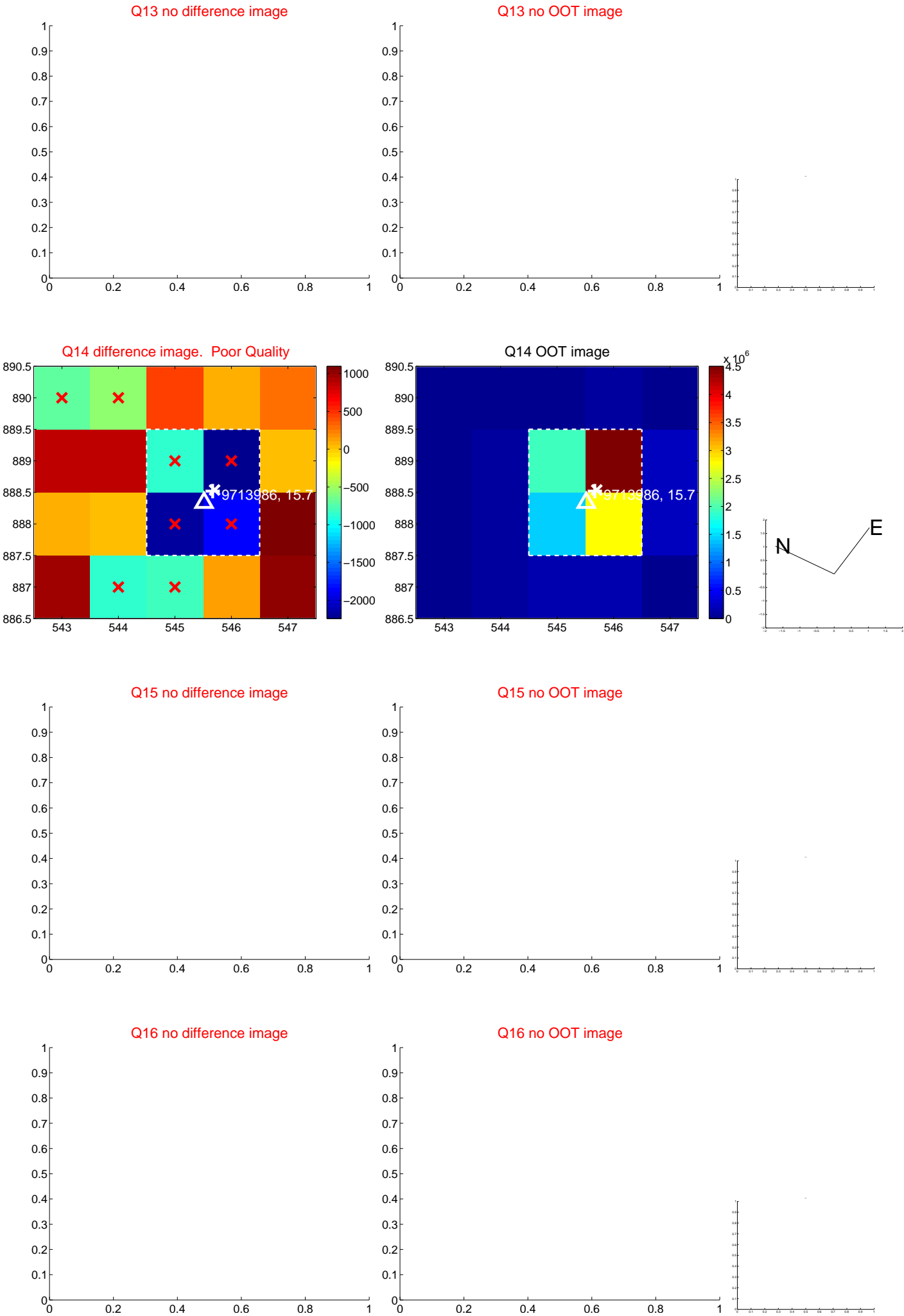
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



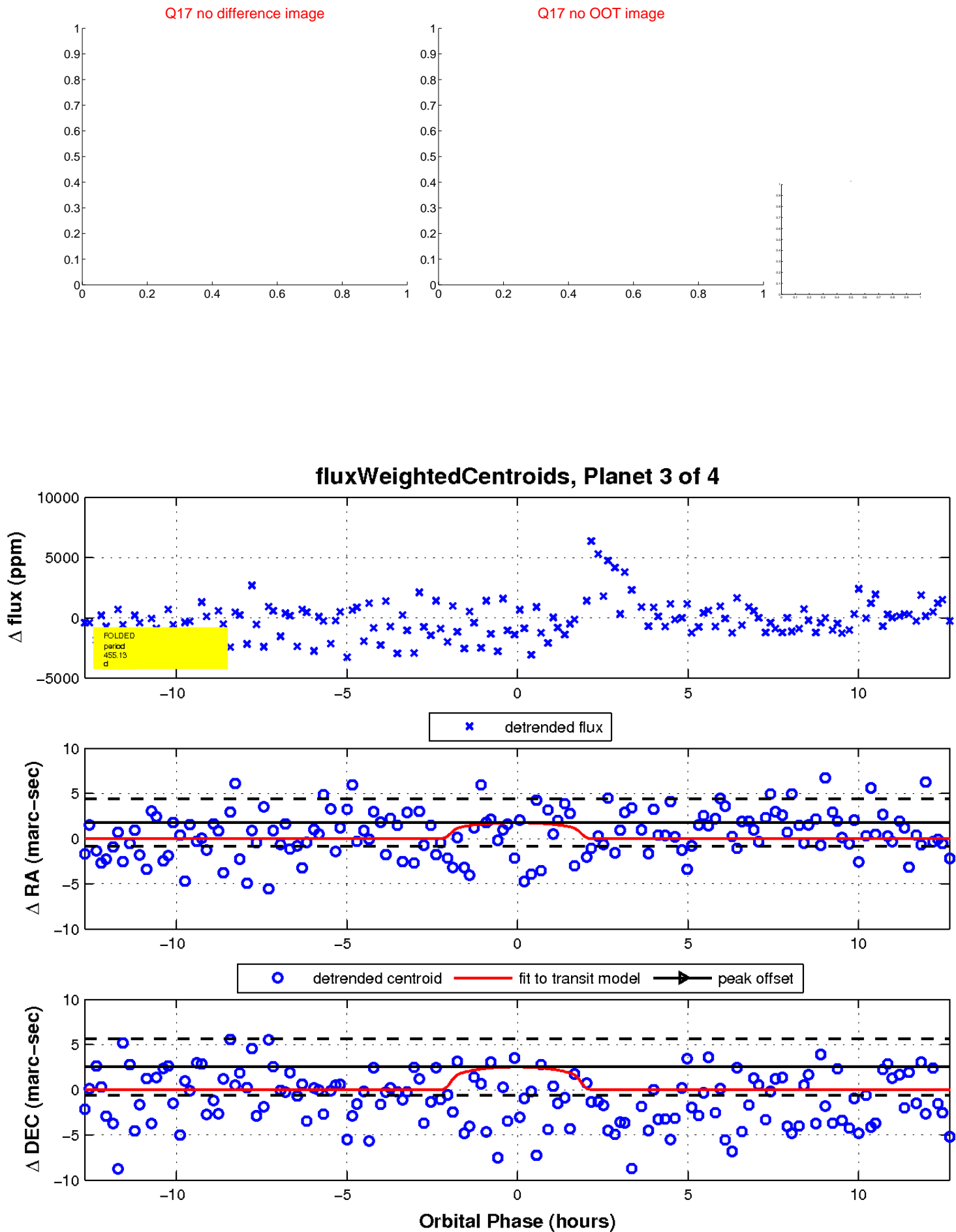
white ×: KIC target position; +: OOT centroid; △: difference centroid. red ✕: large negative pixel value.



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

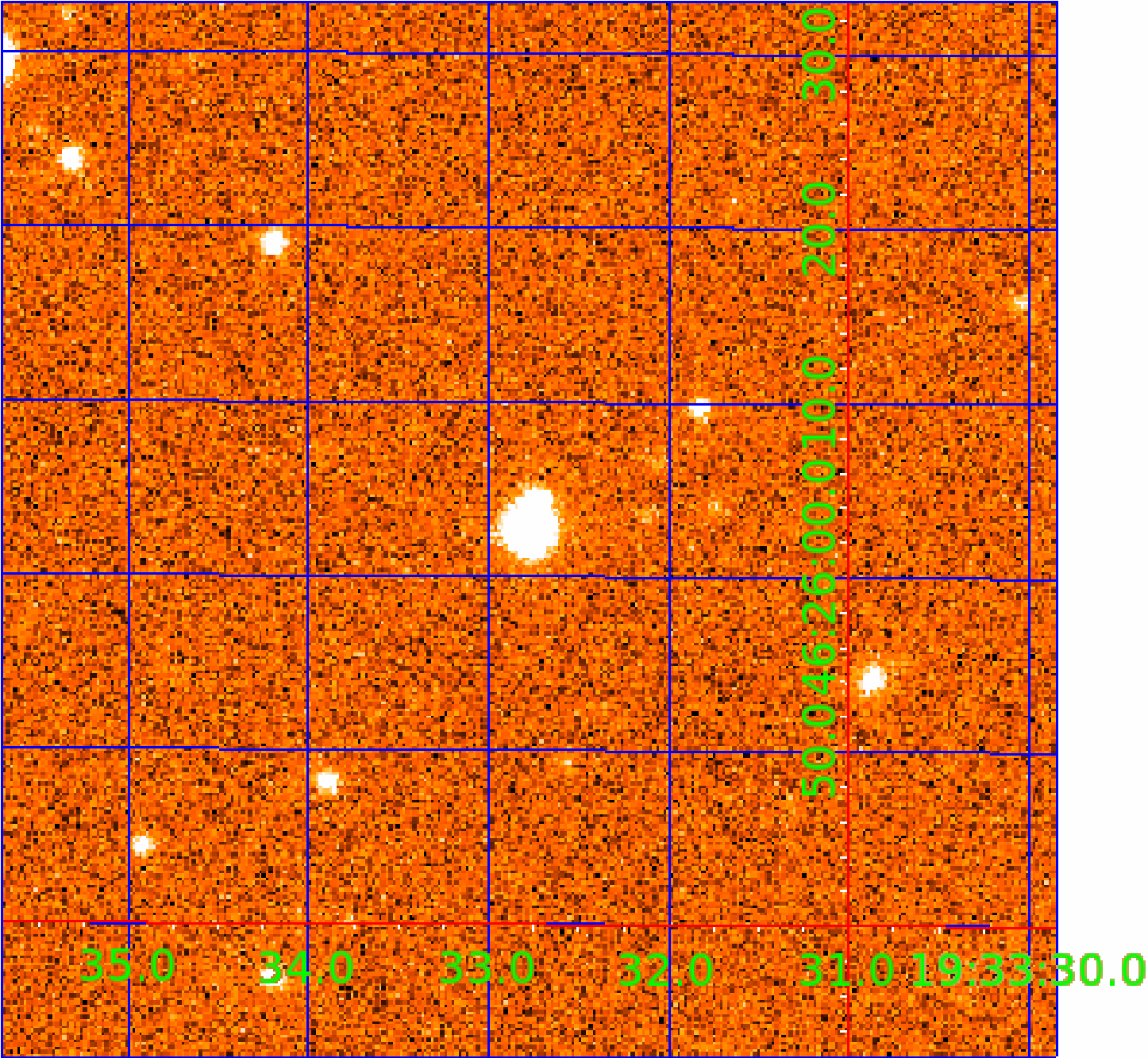


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination





# KIC 009713986

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
009713986-01	OBS	No	349.119105	334.077044	2175.9	2.665	12.0	6.7	0.74	4543	3.32	0.27
009713986-02	OBS	No	535.645922	135.887646	3383.7	5.552	10.8	9.9	0.74	4543	4.12	0.15
009713986-03	OBS	No	455.126748	453.743478	1604.5	4.248	10.9	5.8	0.74	4543	3.28	0.19
009713986-04	OBS	No	373.878246	488.033065	2071.5	3.653	10.2	6.2	0.74	4543	3.55	0.25

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
009713986-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009713986-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS
009713986-03	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS—HALO_GHOST
009713986-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_SKYE—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS

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

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

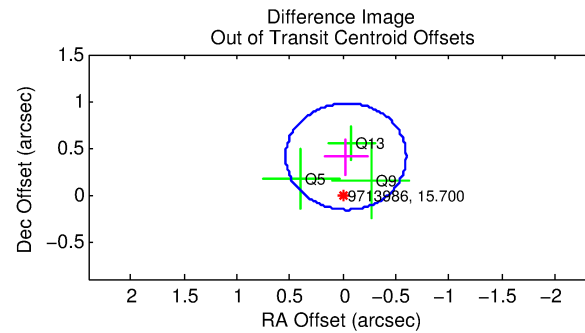
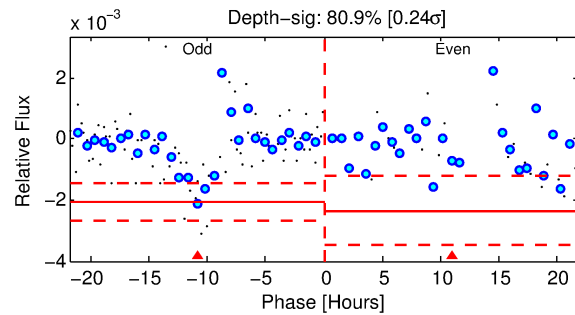
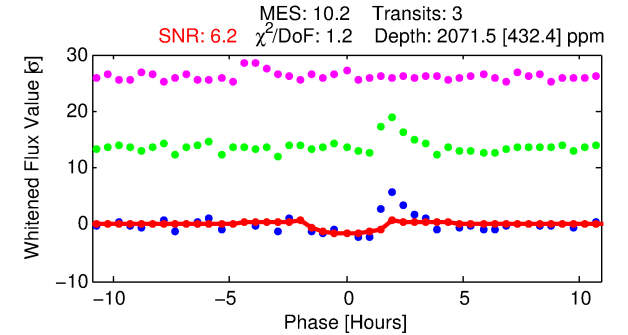
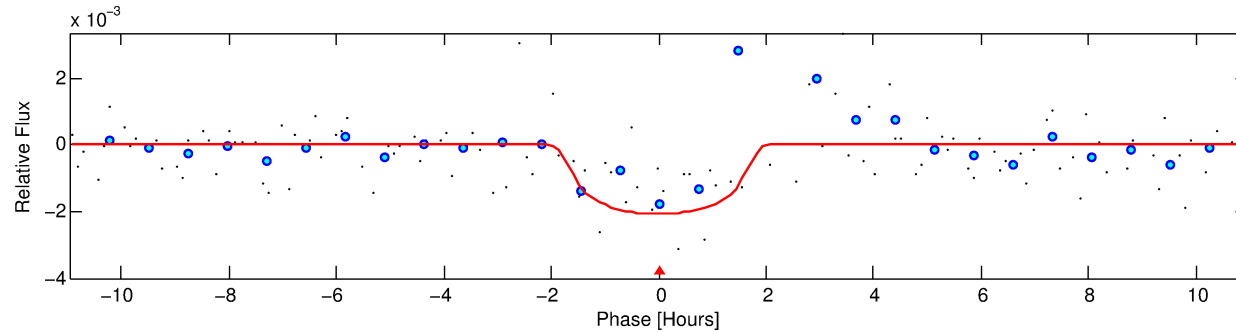
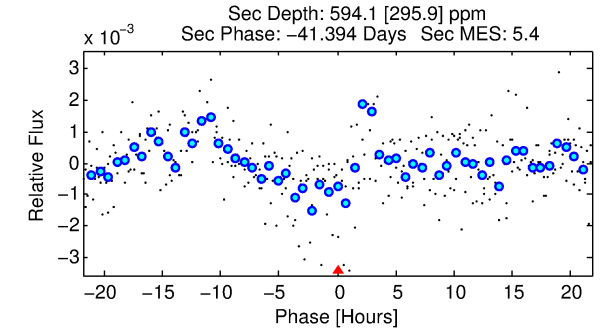
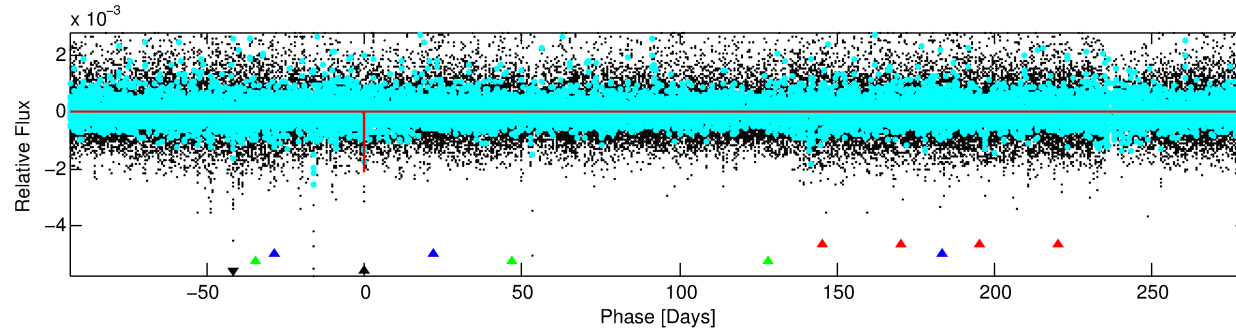
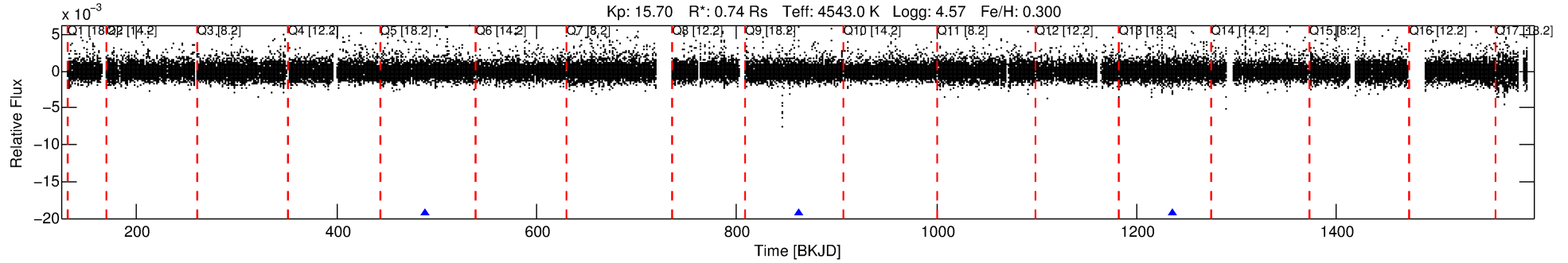
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 009713986-04

No Significant Match Found

# DV One-Page Summary

KIC: 9713986 Candidate: 4 of 4 Period: 373.878 d



## DV Fit Results:

Period = 373.87825 [0.00816] d  
Epoch = 488.0331 [0.0105] BKJD  
Rp/R\* = 0.0438 [0.0695]  
a/R\* = 633.34 [2939.77]  
b = 0.66 [4.13]  
Seff = 0.25 [0.04]  
Teq = 180 [8] K  
Rp = 3.55 [5.65] Re  
a = 0.9202 [0.0646] AU  
Ag = 21908.95 [70480.27] [0.31 $\sigma$ ]  
Teffp = 3390 [2727] K [1.18 $\sigma$ ]

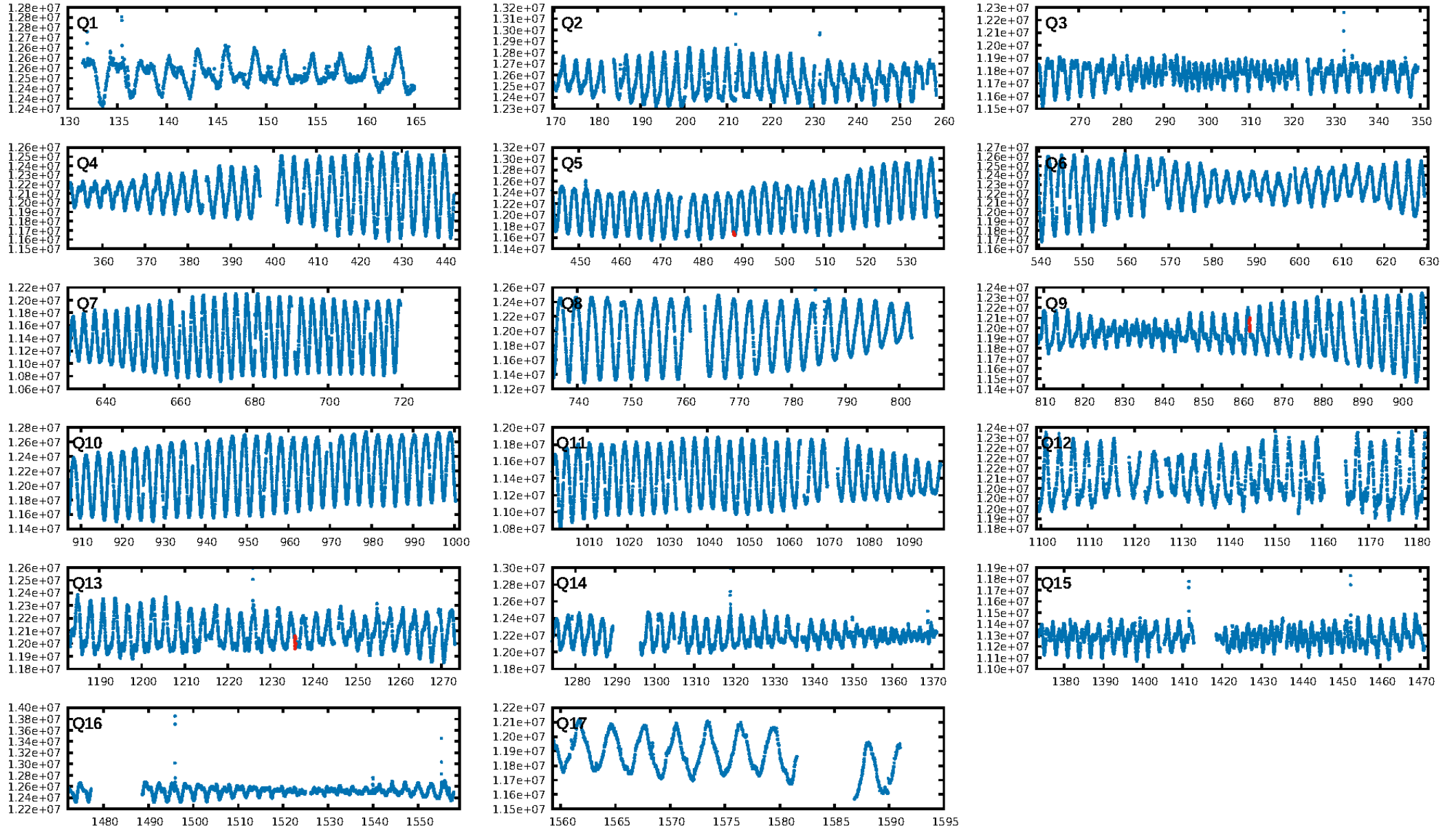
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [131.41 $\sigma$ ]  
LongPeriod-sig: 100.0% [348.05 $\sigma$ ]  
ModelChiSquare2-sig: 2.1%  
ModelChiSquareGof-sig: 87.1%  
**Bootstrap-pfa: 2.47e-09**  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: 2.303  
Centroid-sig: 5.0%  
Centroid-so: 1.487 arcsec [1.23 $\sigma$ ]  
OotOffset-rm: 0.409 arcsec [2.16 $\sigma$ ]  
KicOffset-rm: 0.365 arcsec [1.90 $\sigma$ ]  
OotOffset-st: 0/0/0/3 [3]  
KicOffset-st: 0/0/0/3 [3]  
DiffImageQuality-fgm: 1.00 [3/3]  
DiffImageOverlap-fno: 1.00 [3/3]

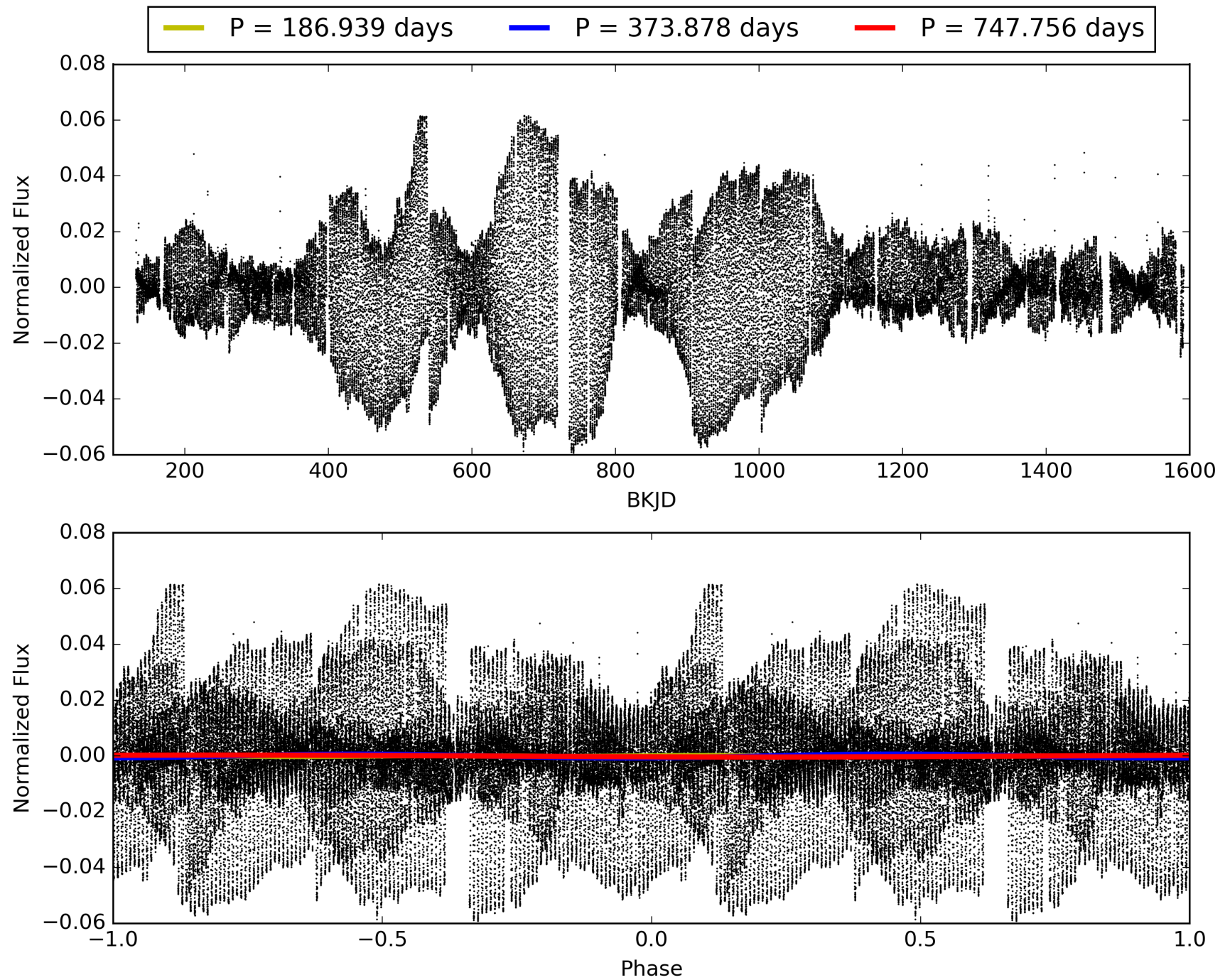
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 10:58:18 Z

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

# TCE 009713986-04, PDC Light Curves

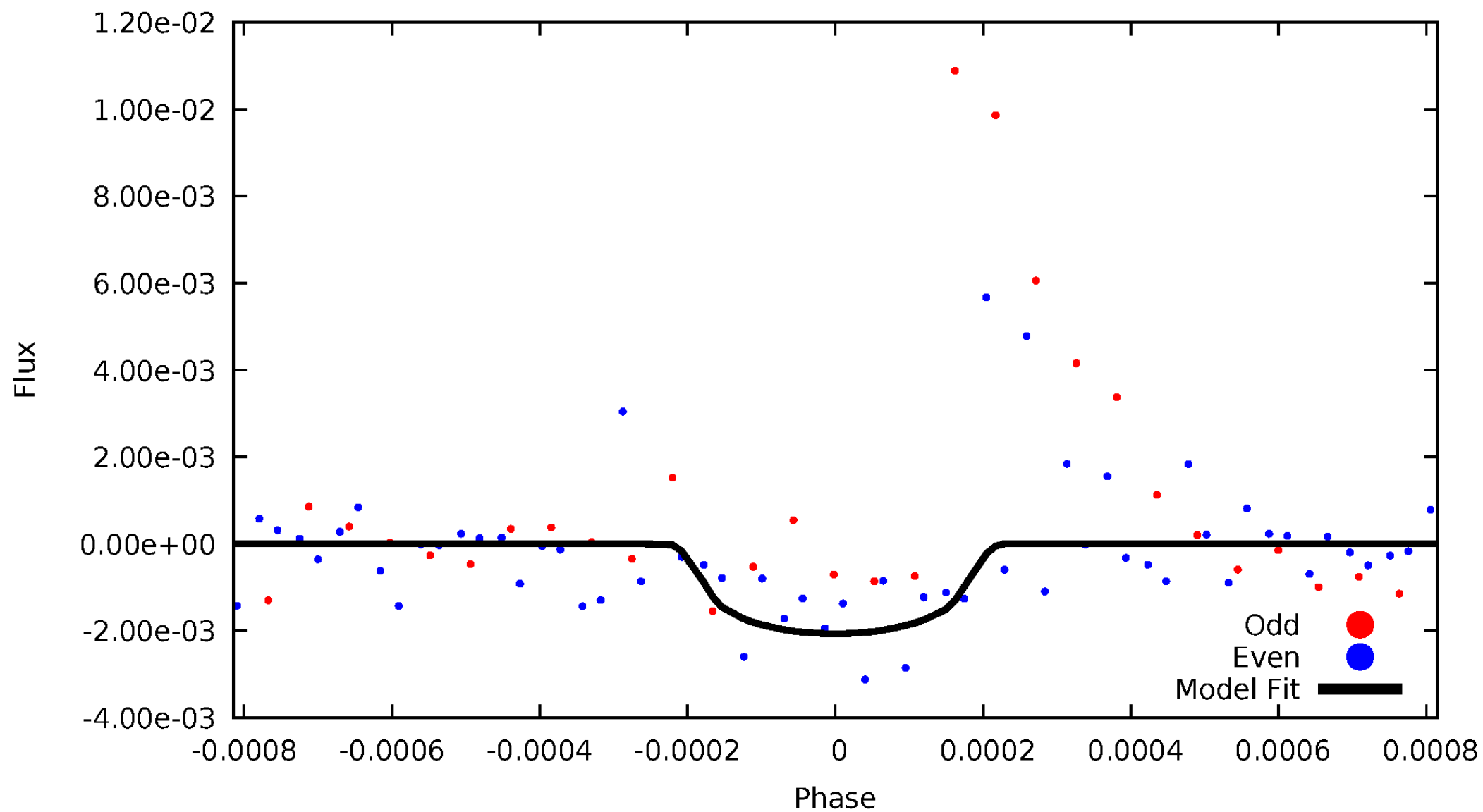


TCE 009713986-04



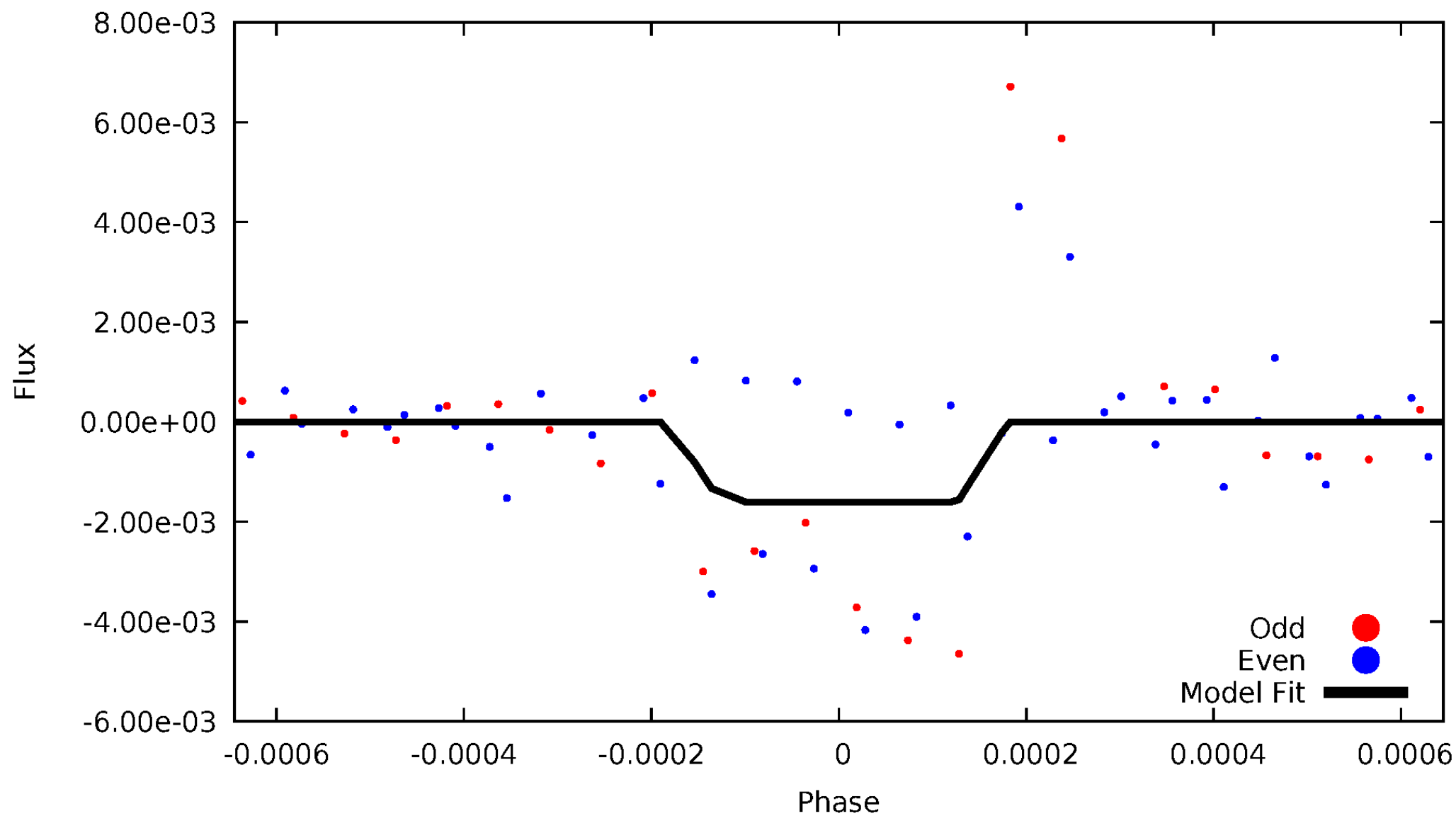
# DV Odd/Even

TCE 009713986-04



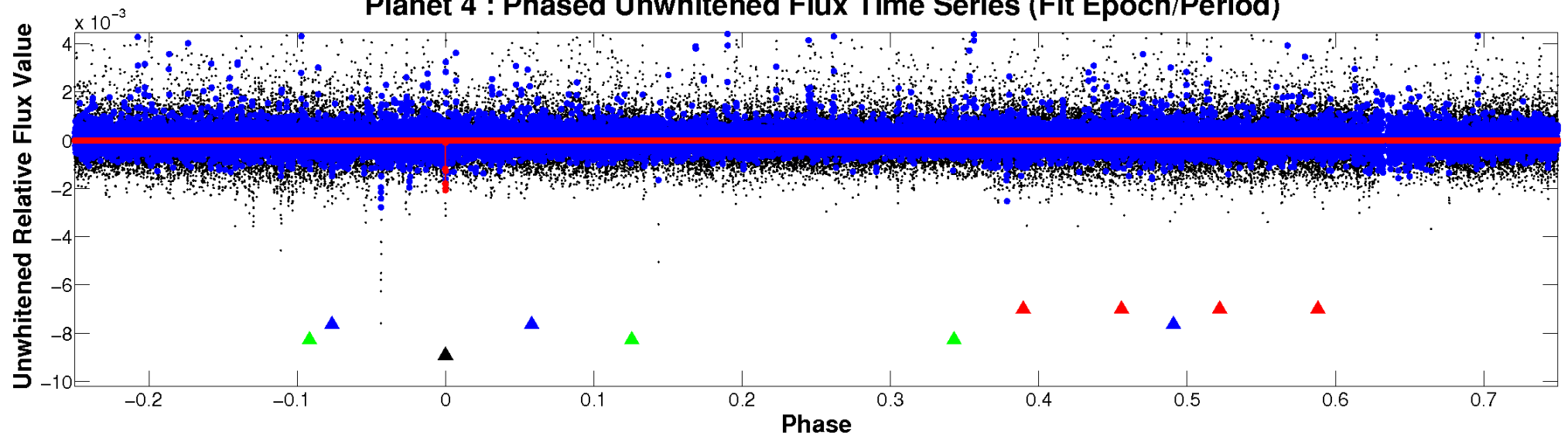
# ALT Odd/Even

TCE 009713986-04

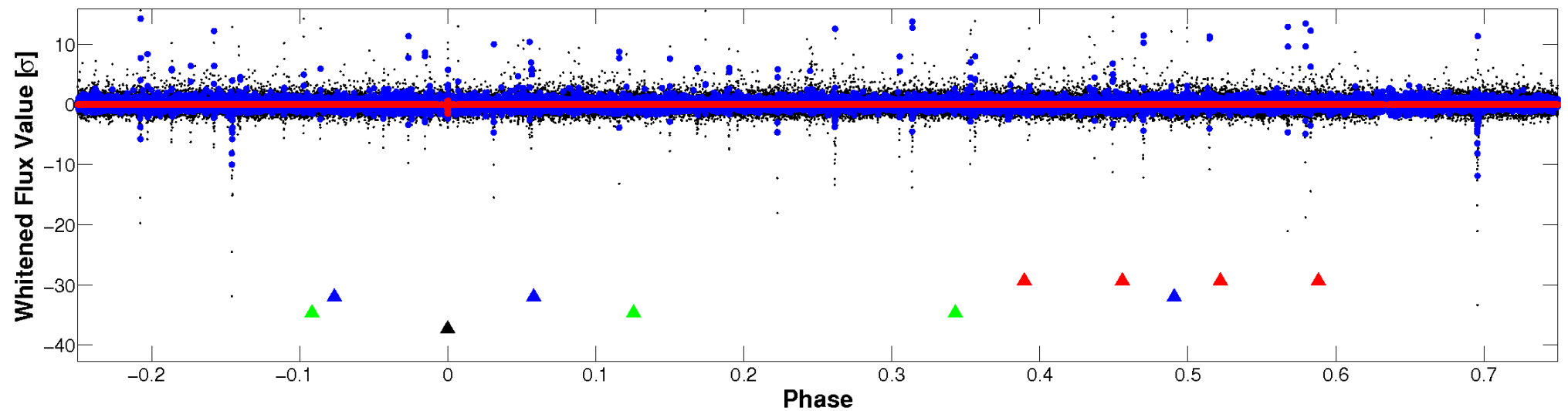


# Non-Whitened Vs. Whitened Light Curve

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



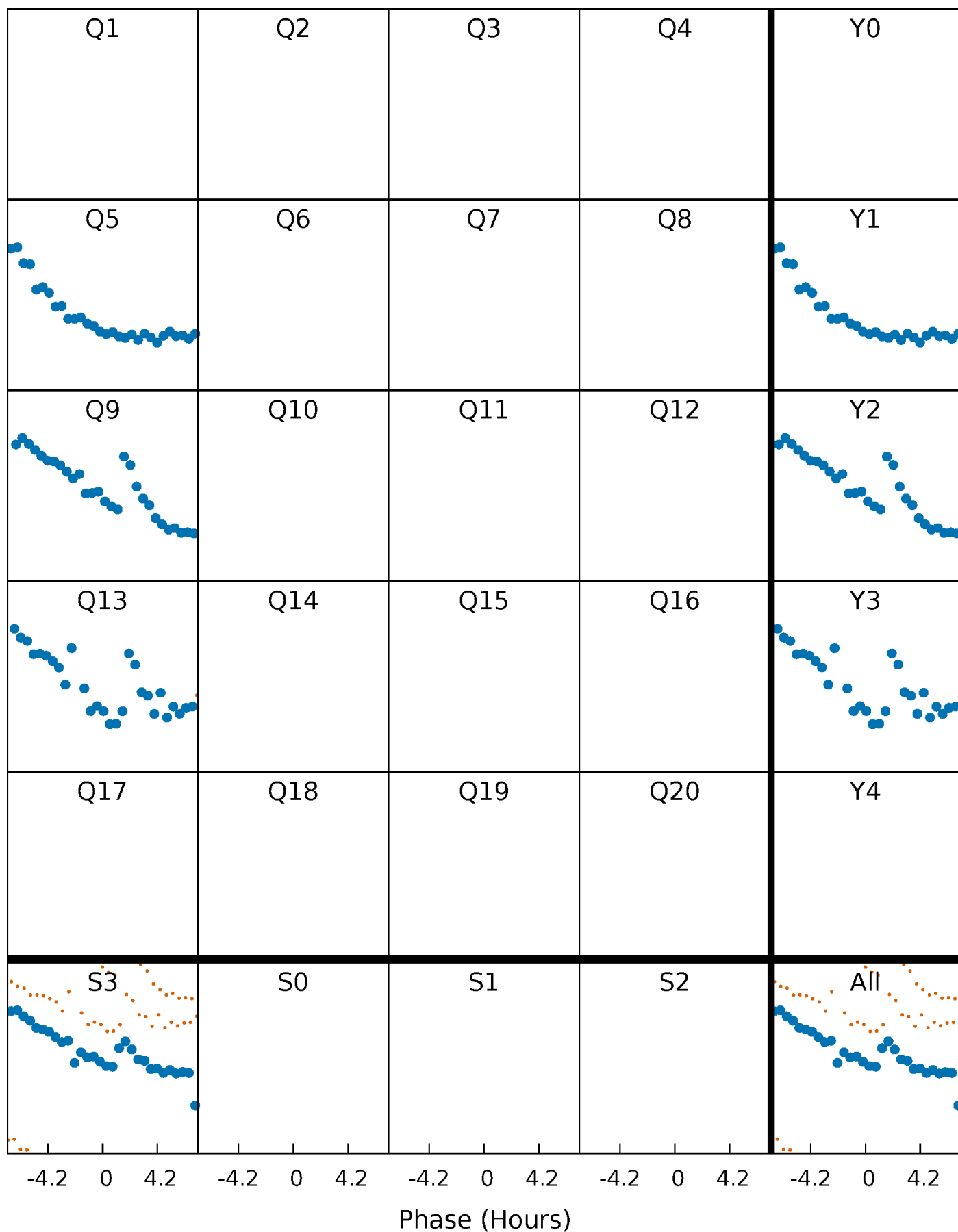
## Planet 4 : Phased Whitened Flux Time Series (Fit Epoch/Period)





# PDC Quarter-Phased Transit Curves

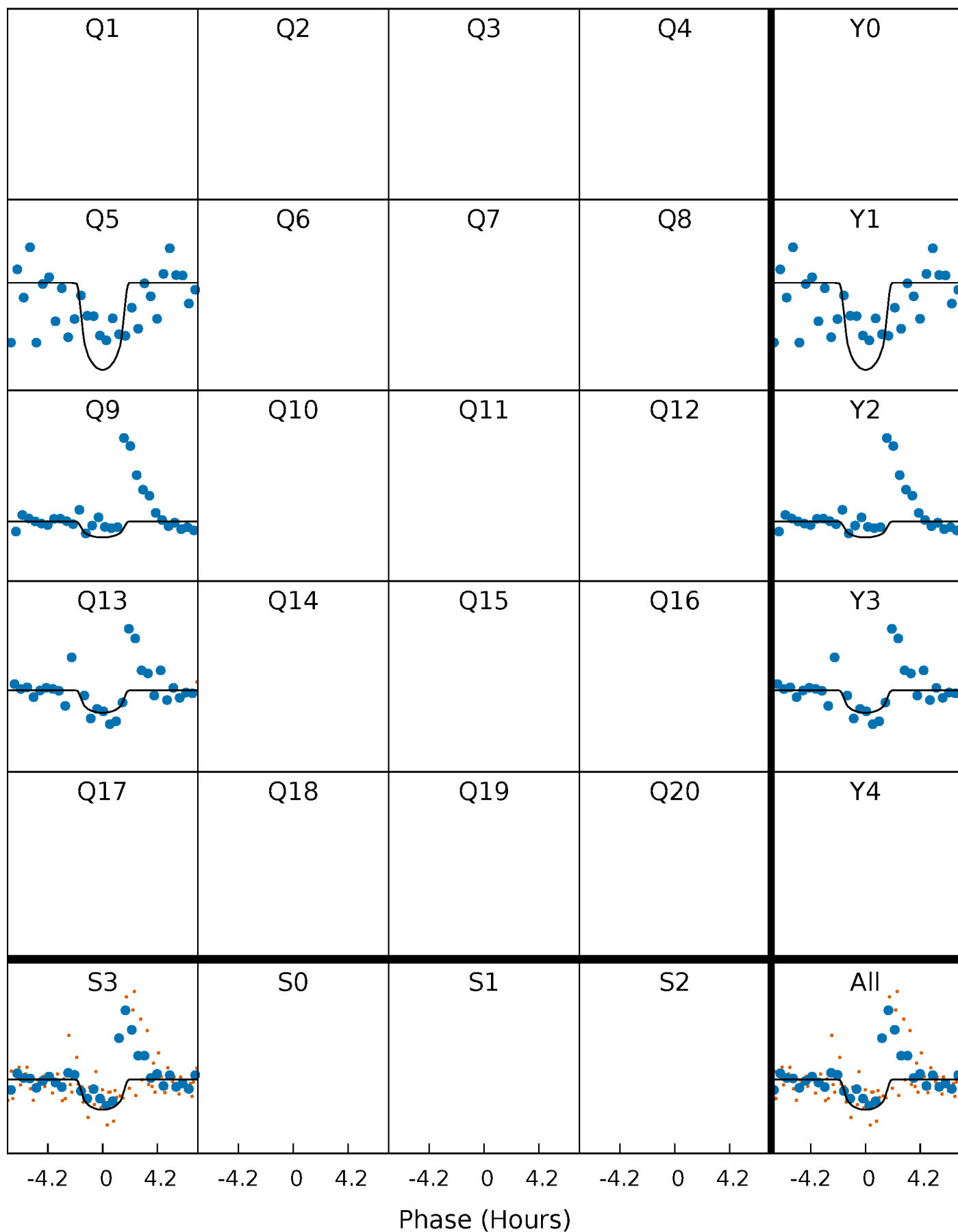
TCE 009713986-04     $P=373.878246$  Days     $T_0=488.033065$  (BKJD)





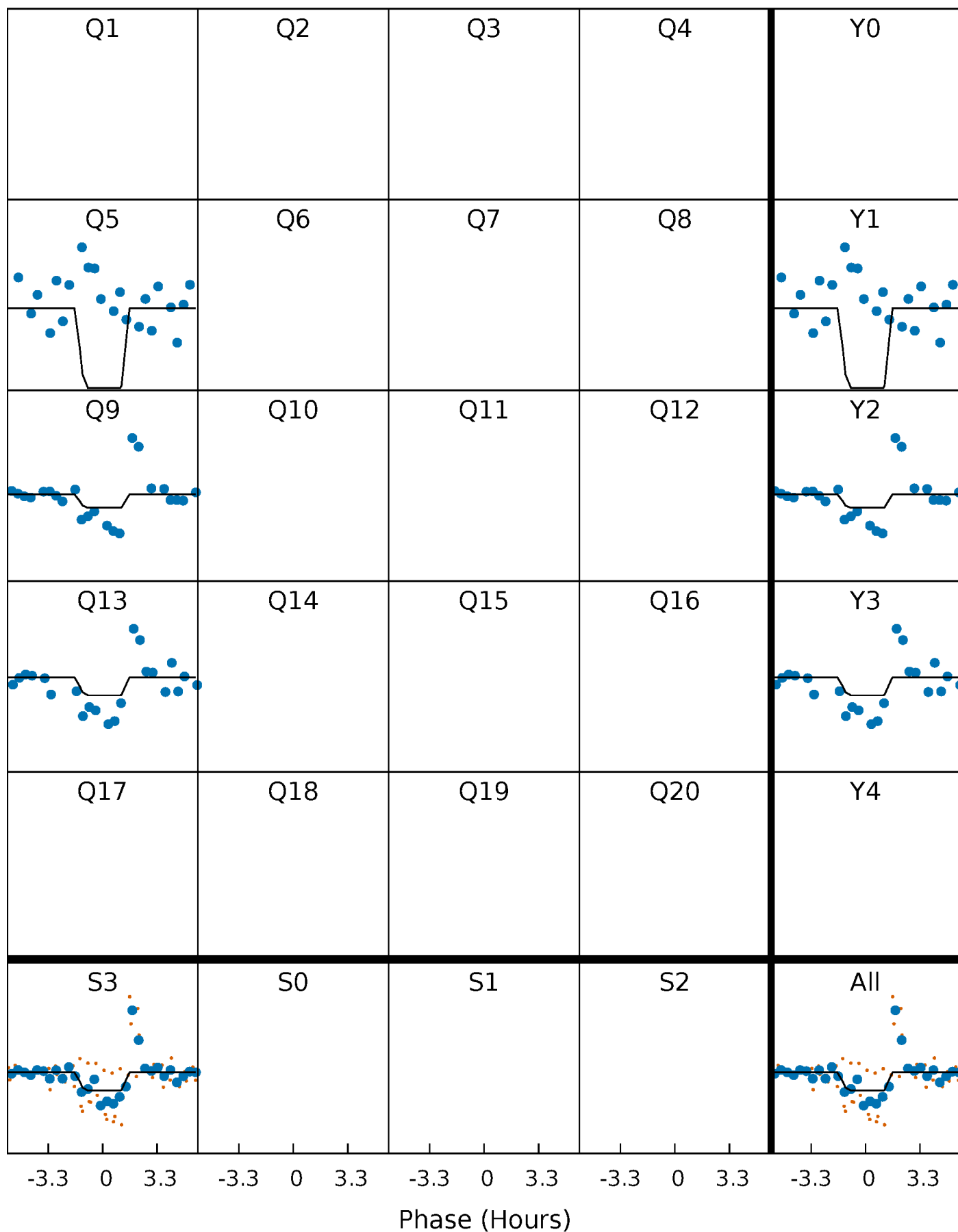
# DV Quarter-Phased Transit Curves

TCE 009713986-04     $P=373.878246$  Days     $T_0=488.033065$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

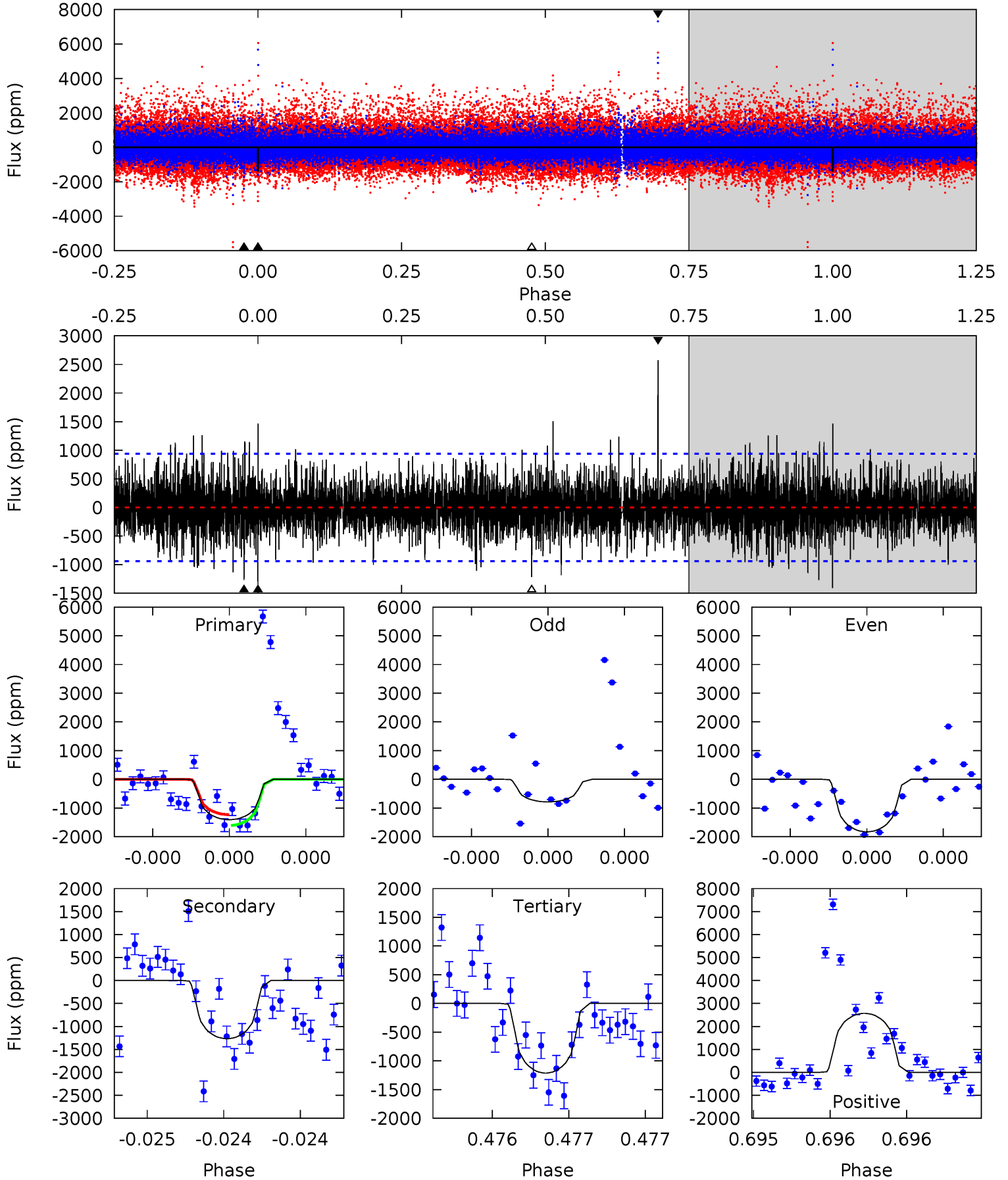
TCE 009713986-04 P=373.890689 Days  $T_0=488.012770$  (BKJD)



# DV Model-Shift Uniqueness Test

009713986-04, P = 373.878246 Days, E = 114.154819 Days

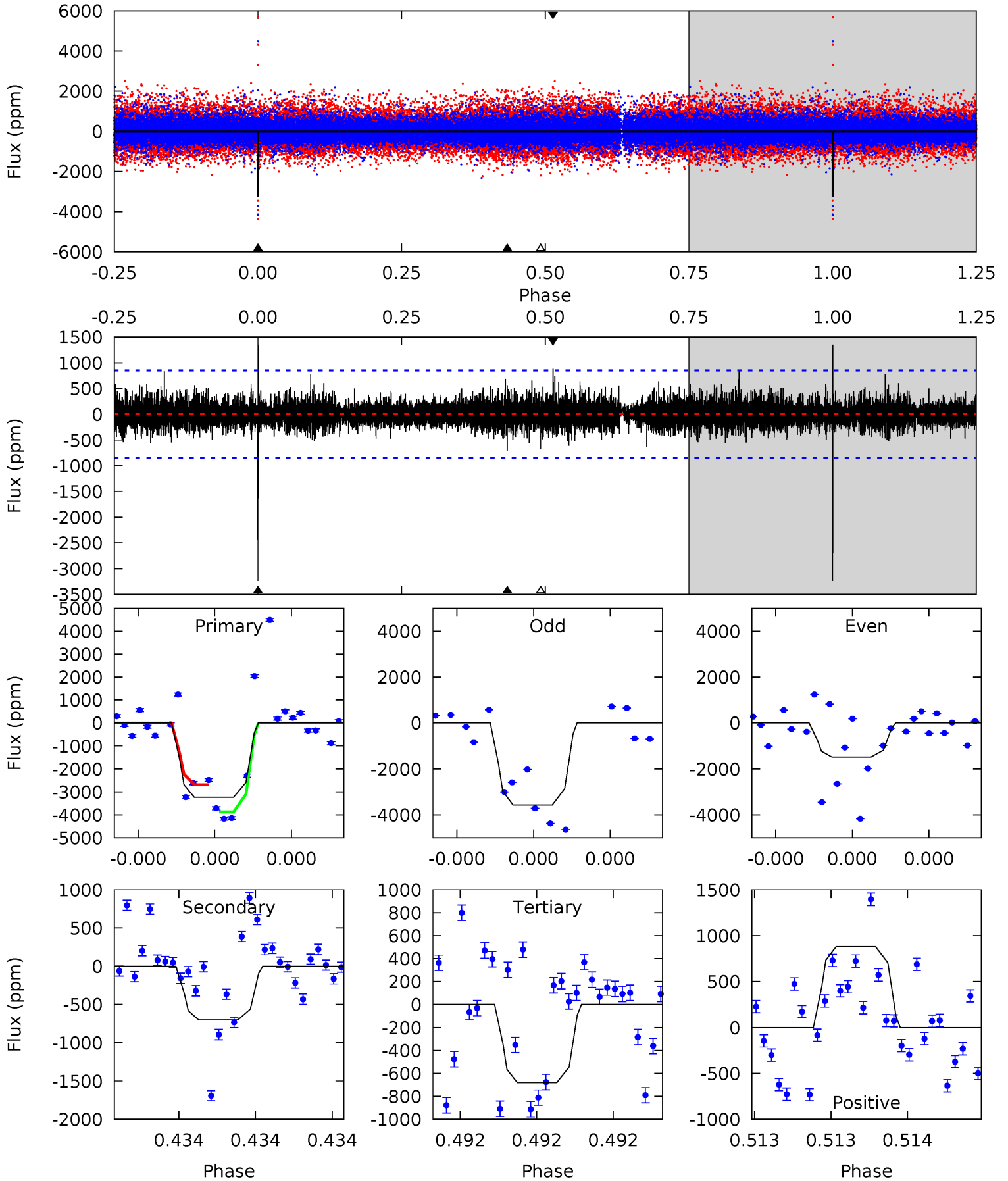
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
8.39	7.55	7.22	15.3	5.59	3.51	1.82	1.16	-6.93	0.32	-7.76	2.92	0.74	0.65	1.13



# Alt Model-Shift Uniqueness Test

009713986-04, P = 373.890689 Days, E = 114.122081 Days

Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
21.4	4.64	4.51	5.83	5.64	3.59	0.97	16.9	15.6	0.13	-1.19	7.79	0.63	0.29	3.95



### Stellar Parameters For KIC 009713986

	$T_{\text{eff}}(K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$4543^{+150}_{-150}$	$4.566^{+0.056}_{-0.020}$	$0.300^{+0.150}_{-0.300}$	$0.744^{+0.031}_{-0.062}$	$0.743^{+0.043}_{-0.052}$	$2.540^{+0.591}_{-0.218}$
	+3%/-3%	+1%/-0%	+50%/-100%	+4%/-8%	+6%/-7%	+23%/-9%
Source	PHO1	KIC0	KIC0	DSEP		

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

### Secondary Eclipse Parameters for KIC 009713986-04 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-1268 \pm 168$	$5.57^{+4.57}_{-3.64}$	$250^{+9}_{-9}$	$3587^{+1739}_{-600}$	$19210^{+133508}_{-13665}$
Alt.	$-701 \pm 151$	$5.07^{+4.75}_{-3.28}$	$250^{+9}_{-9}$	$3348^{+1461}_{-594}$	$12305^{+88963}_{-9060}$

$T_{\text{max}}$  = 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

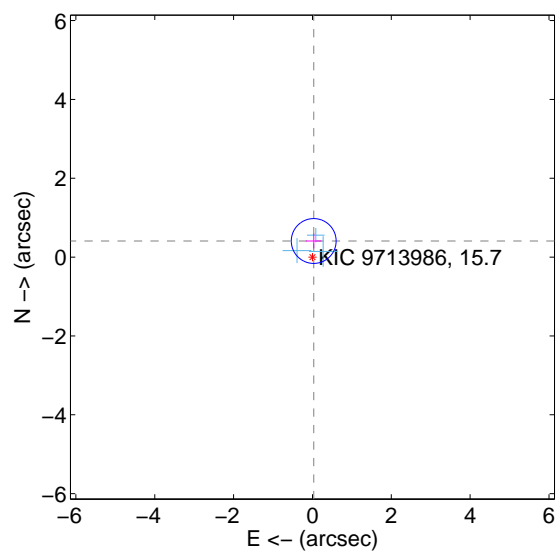
Supplemental centroid analysis for 009713986-04. Kepler magnitude: 15.70. Transit SNR 6.18

There are 3 quarters with good PRF difference image offsets

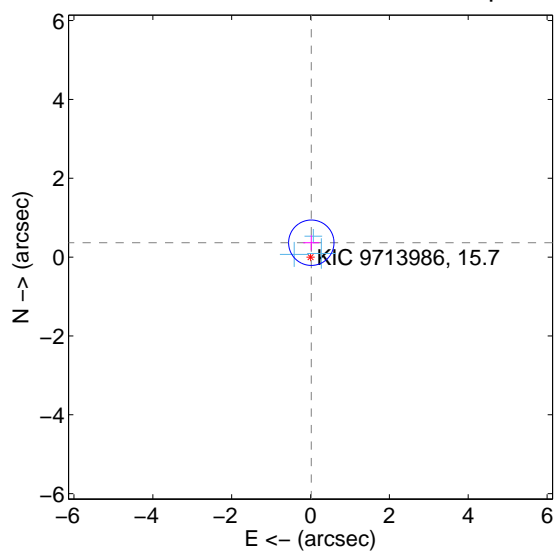
The direct PRF centroid is offset from the target star catalog position by about 0.03 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.409 \pm 0.190$	2.16	$-0.032 \pm 0.198$	$0.408 \pm 0.189$
PRF-fit source offset from KIC position	$0.365 \pm 0.192$	1.90	$-0.020 \pm 0.203$	$0.365 \pm 0.192$
photometric centroid source offset	$1.49 \pm 1.21$	1.23	$0.16 \pm 0.99$	$1.48 \pm 1.21$

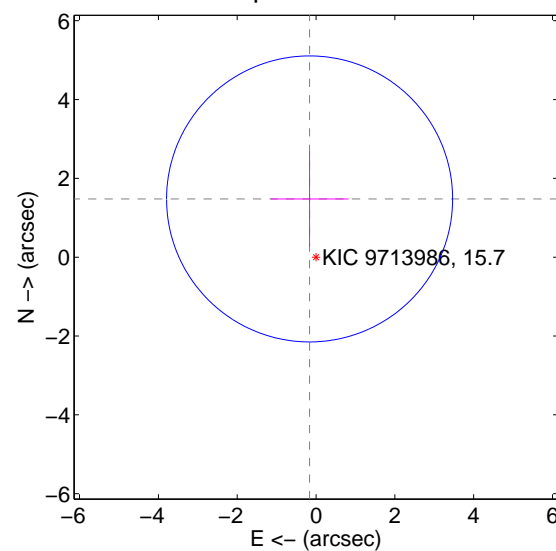
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position



offset from photometric centroids

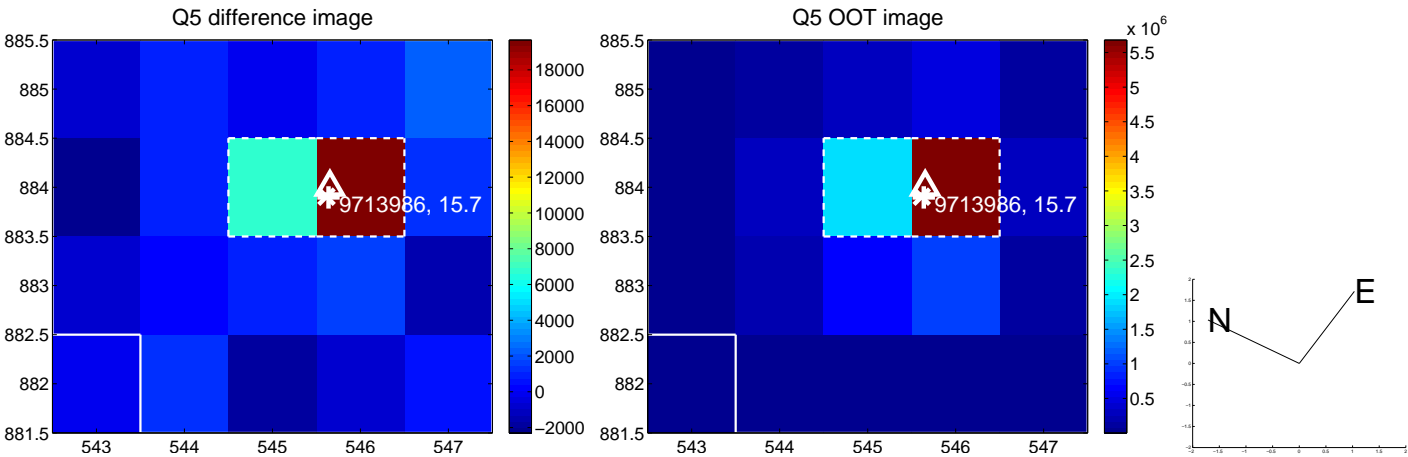


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

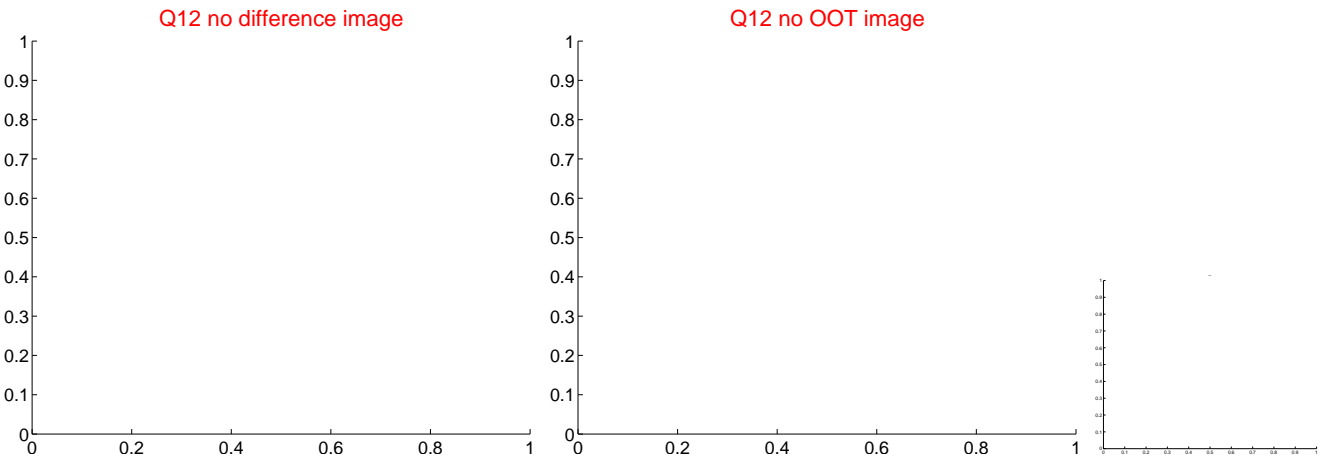
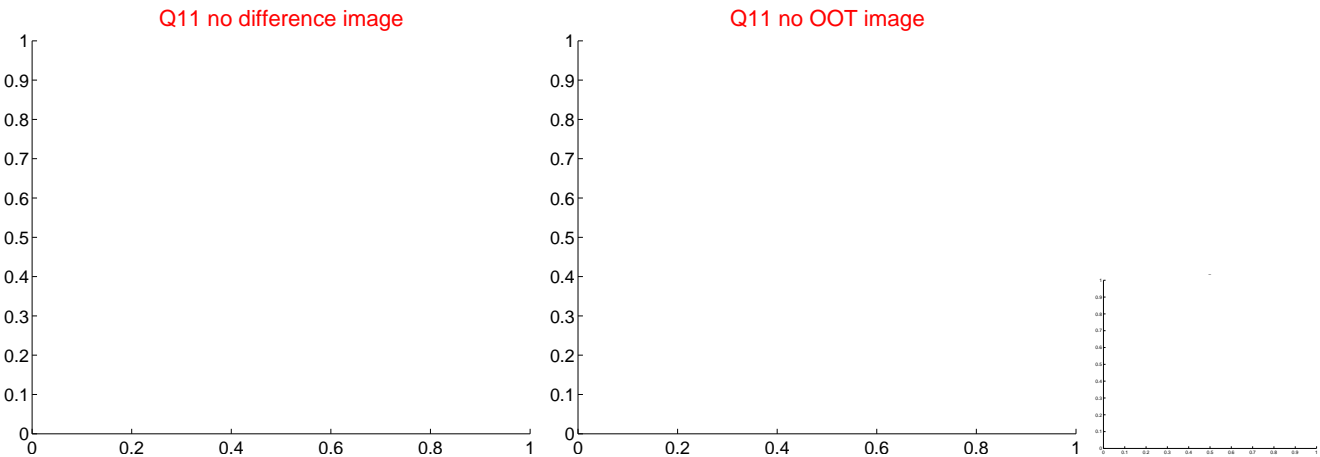
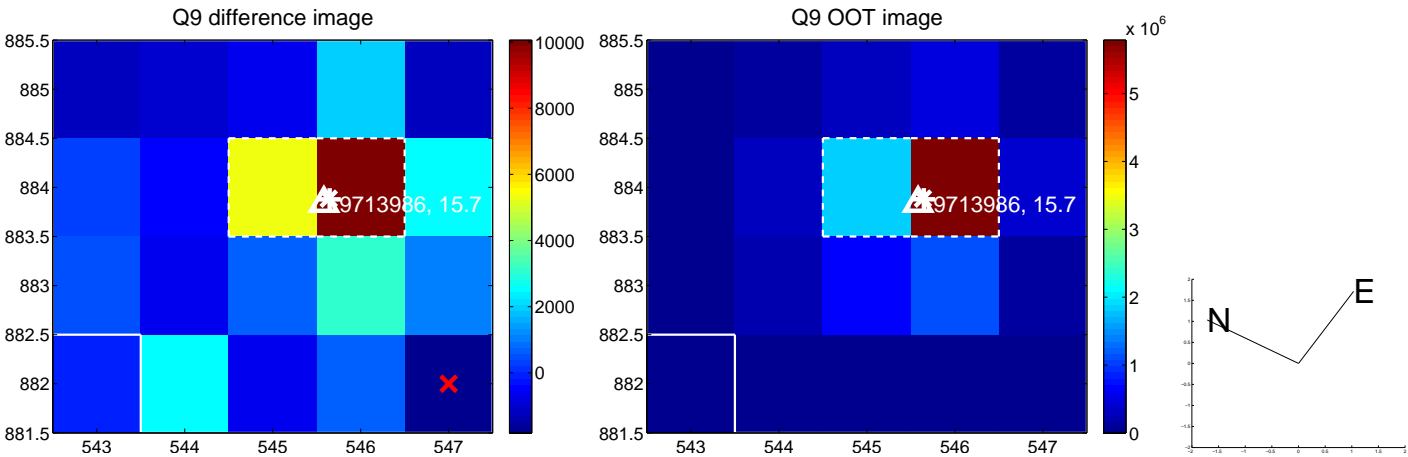


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

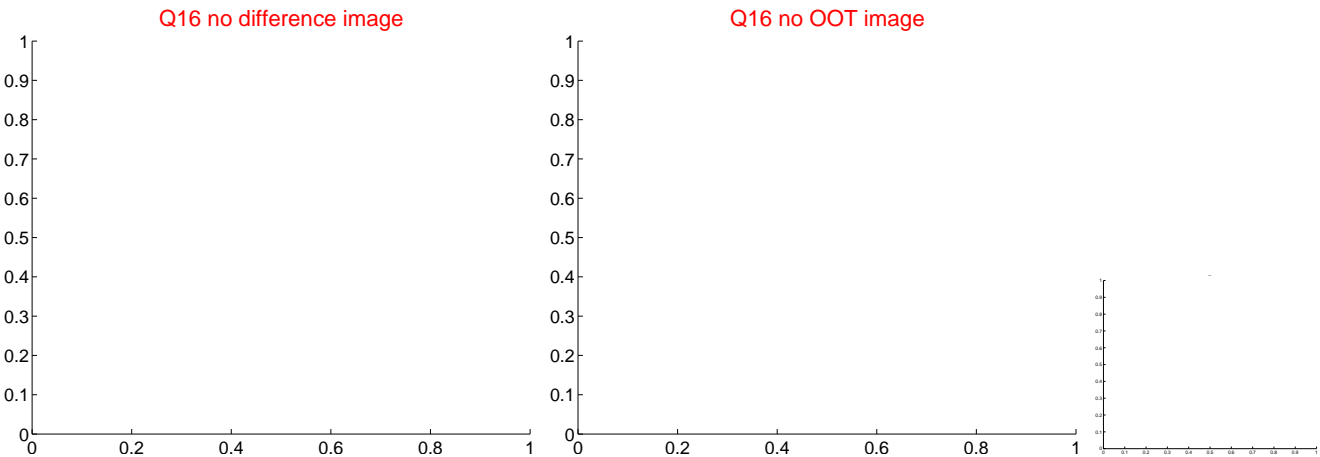
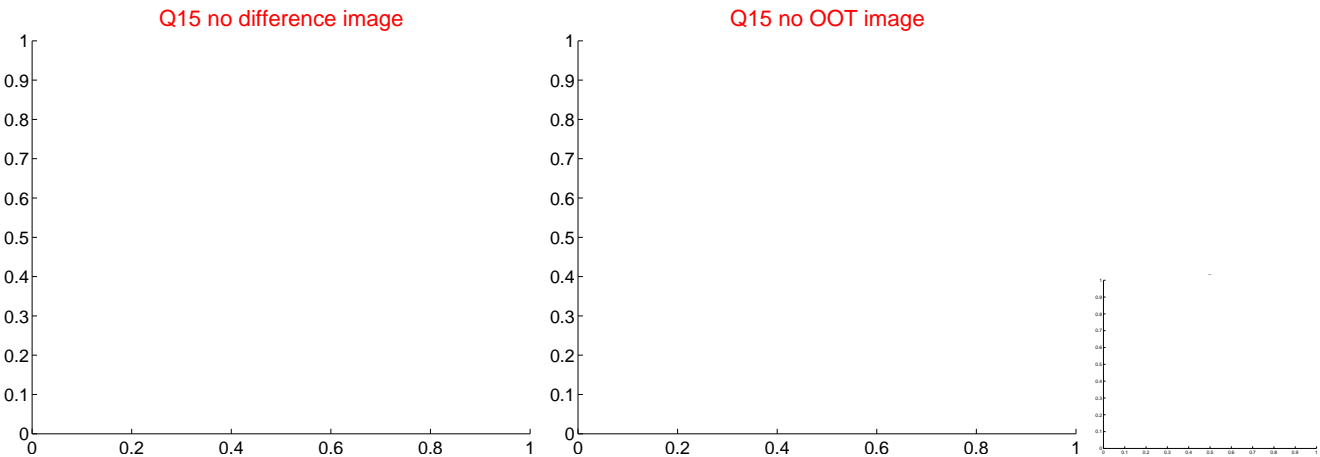
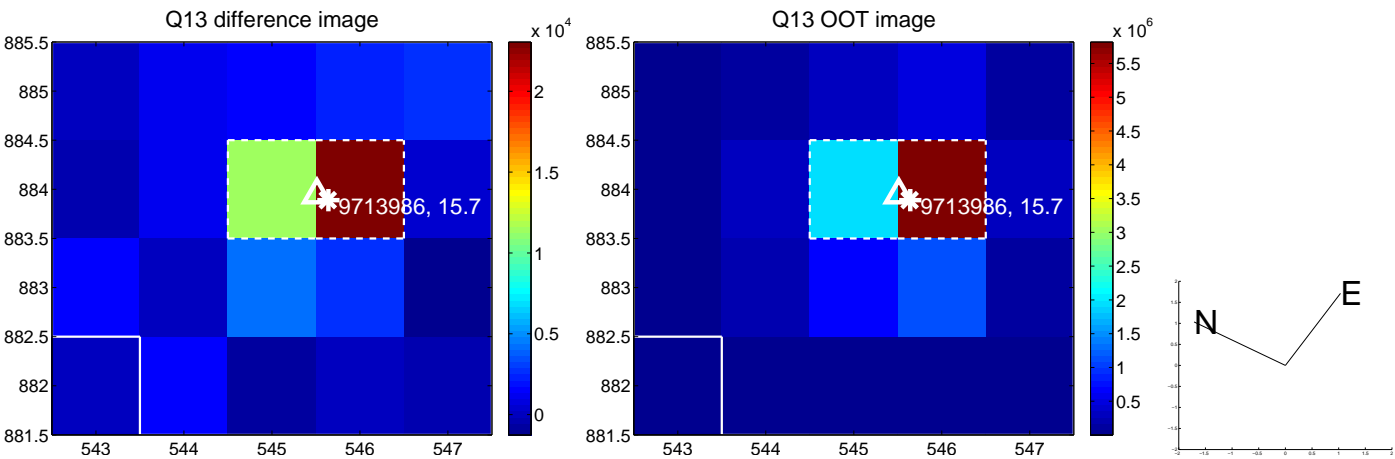




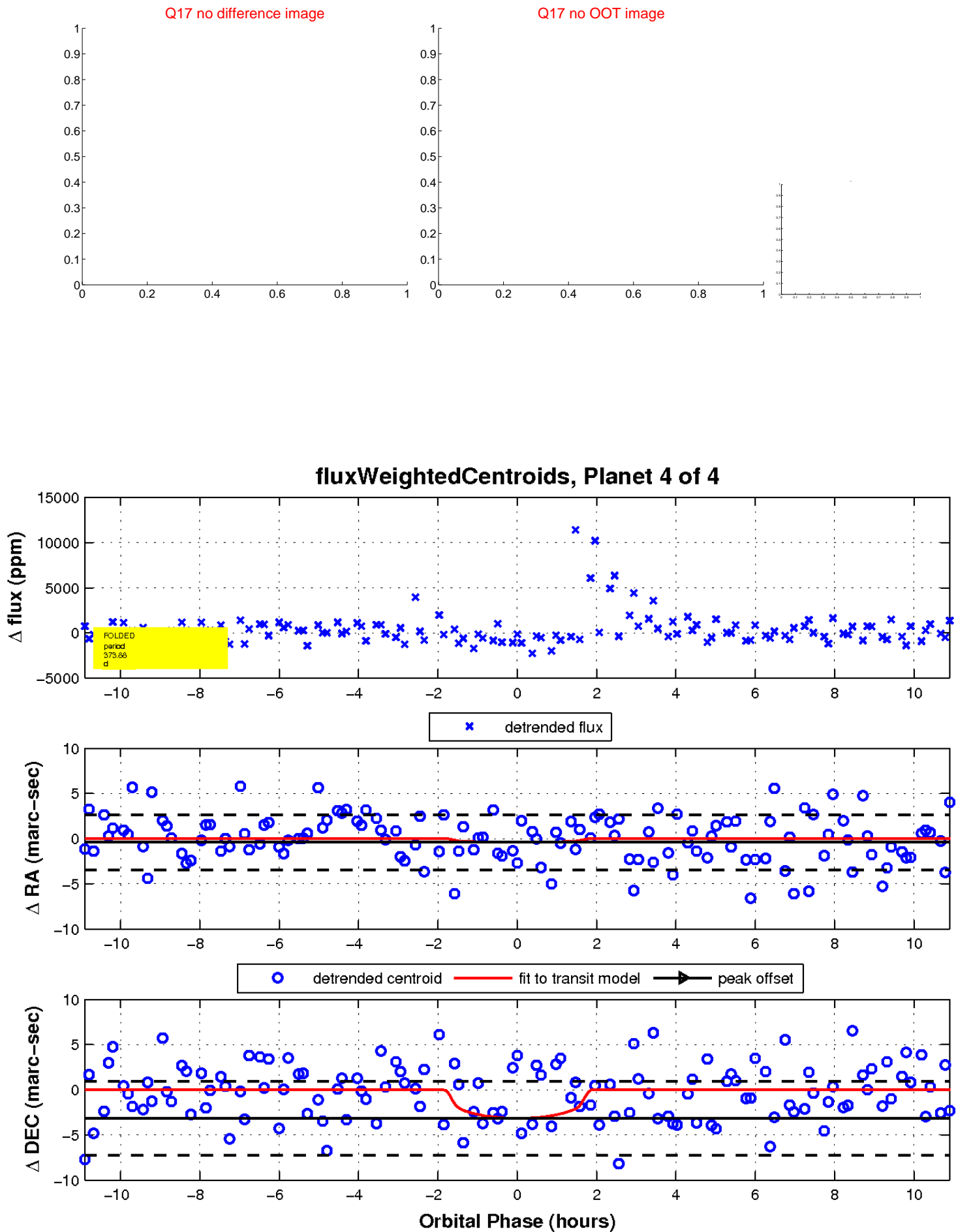
white ×: KIC target position; +: OOT centroid; △: difference centroid. red ×: large negative pixel value.



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



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



UKIRT Image

