

# KIC 004920178

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
004920178-01	OBS	No	363.608228	279.534452	737.4	4.687	10.6	5.5	5.41	4617	14.26	12.16
004920178-02	OBS	No	292.007497	377.614656	1102.3	3.291	9.9	8.2	5.41	4617	22.86	16.29
004920178-03	OBS	No	566.717589	264.581231	1293.4	5.835	12.4	6.9	5.41	4617	21.63	6.73
004920178-04	OBS	No	682.284249	150.734964	721.0	2.880	9.1	4.9	5.41	4617	13.98	5.25

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
004920178-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_SKYE—ALL_TRANS_CHASES—INCONSISTENT_TRANS
004920178-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_POS_DV—INCONSISTENT_TRANS
004920178-03	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
004920178-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_SKYE_TRACKER—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—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.

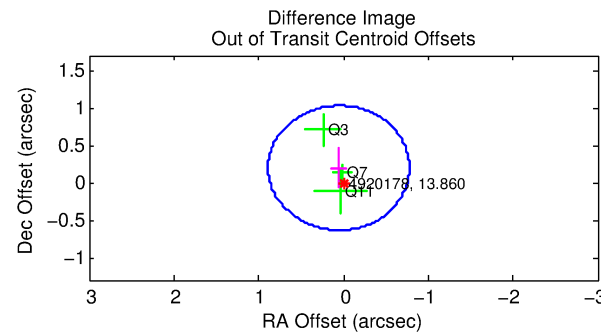
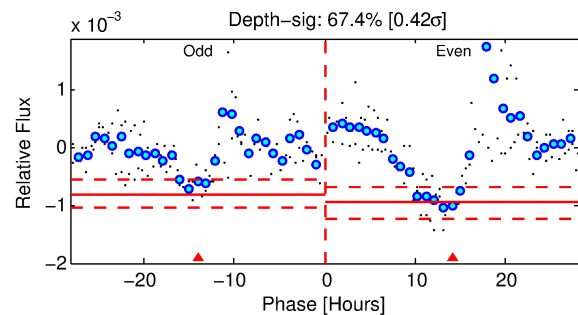
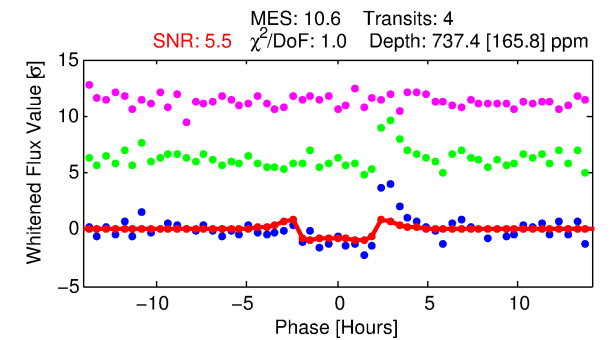
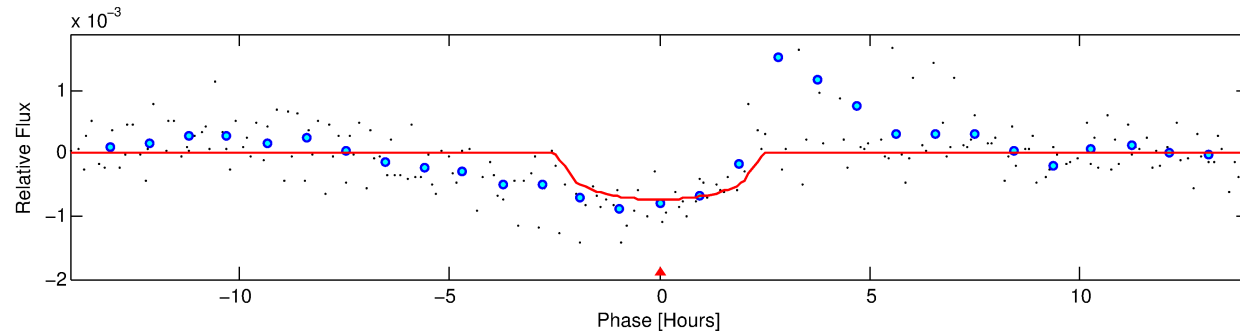
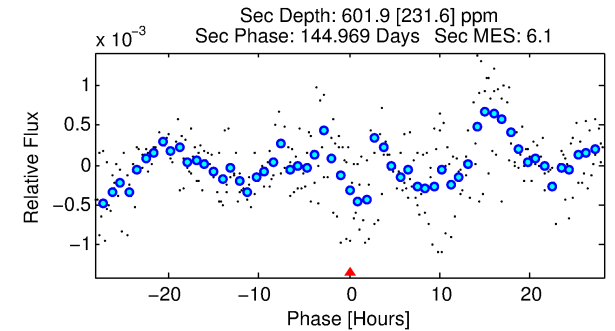
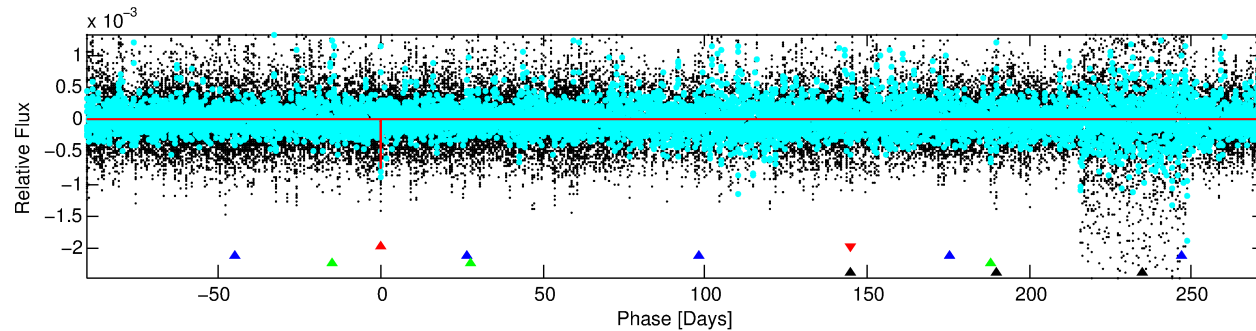
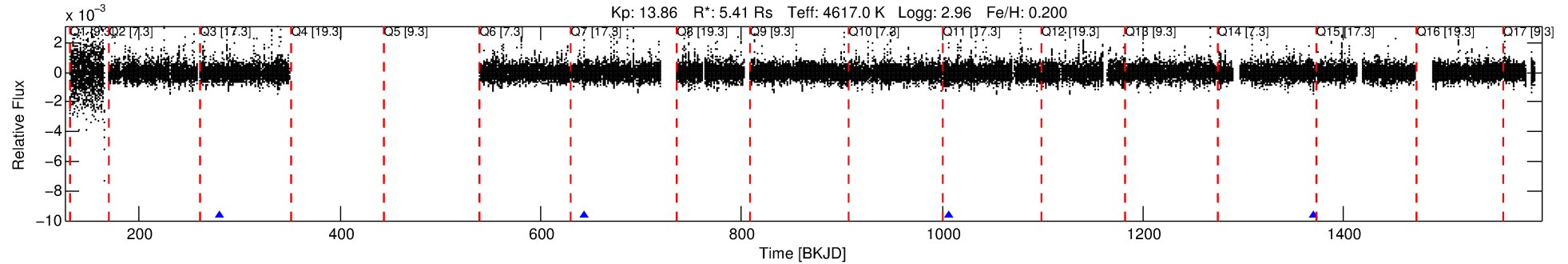
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 004920178-01

No Significant Match Found

# DV One-Page Summary

KIC: 4920178 Candidate: 1 of 4 Period: 363.608 d



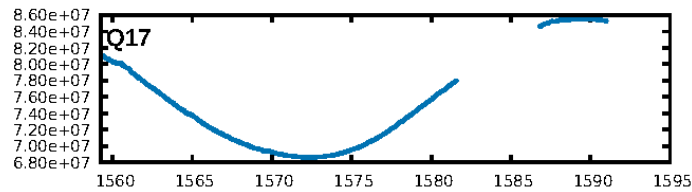
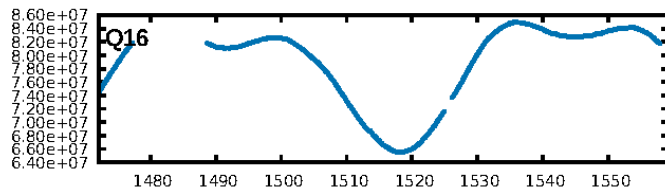
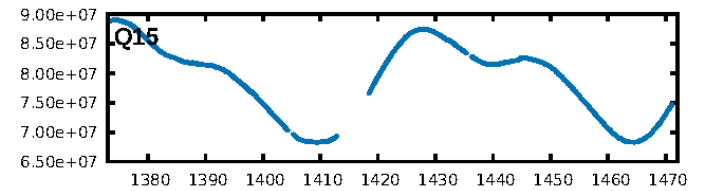
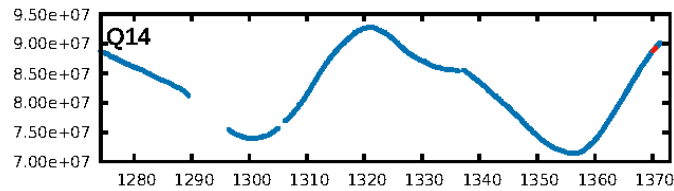
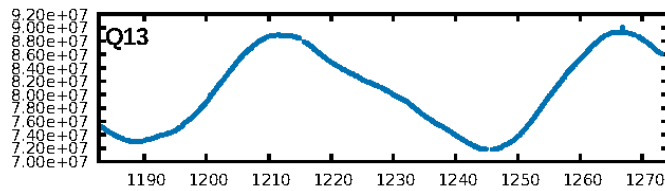
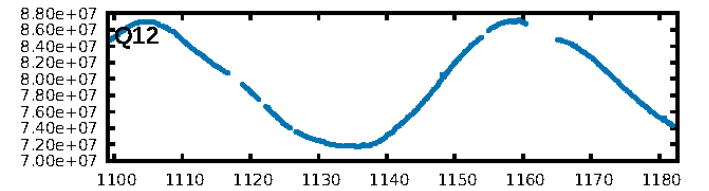
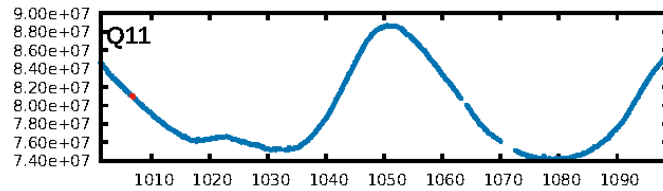
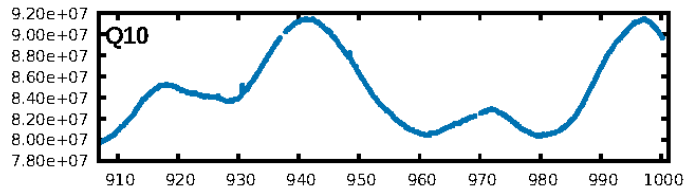
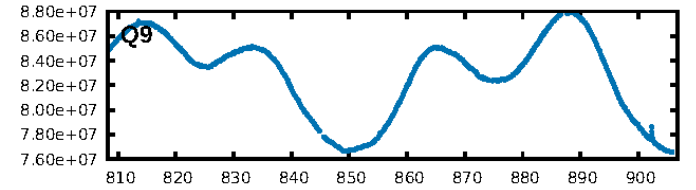
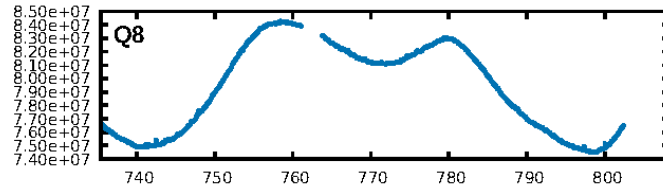
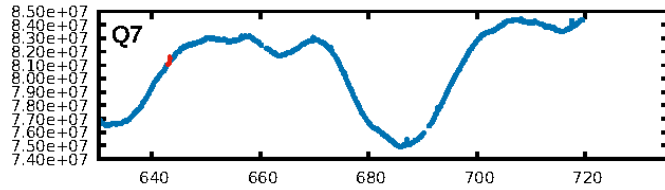
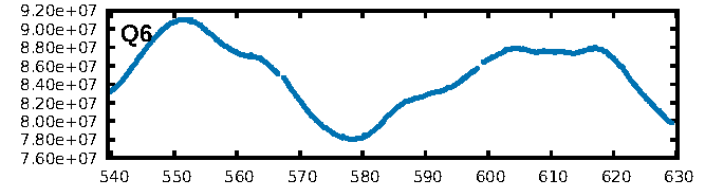
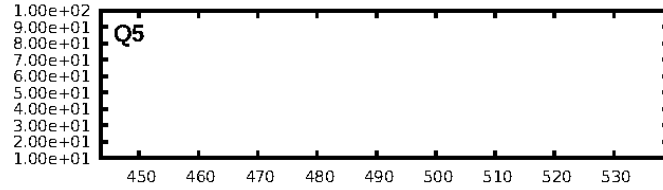
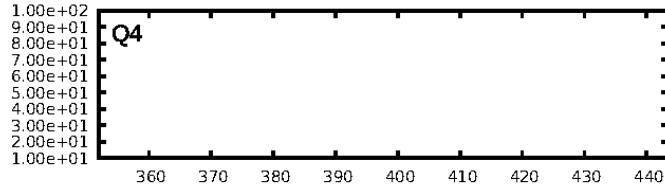
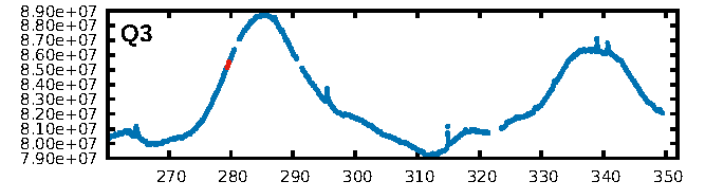
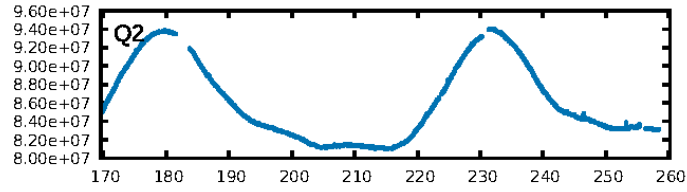
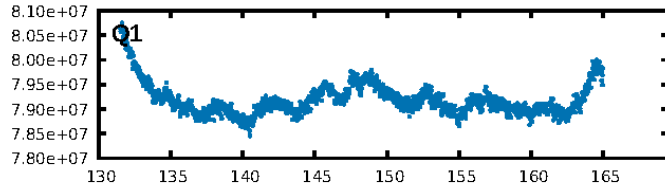
## DV Fit Results:

Period = 363.60823 [0.00434] d  
Epoch = 279.5345 [0.0083] BKJD  
Rp/R\* = 0.0242 [0.0286]  
a/R\* = 578.40 [2063.94]  
b = 0.31 [10.59]  
Seff = 12.16 [9.25]  
Teff = 476 [91] K  
Rp = 14.26 [19.91] Re  
a = 0.9900 [0.5620] AU  
Ag = 1595.90 [4016.49] [0.40 $\sigma$ ]  
Teffp = 4653 [2798] K [1.49 $\sigma$ ]

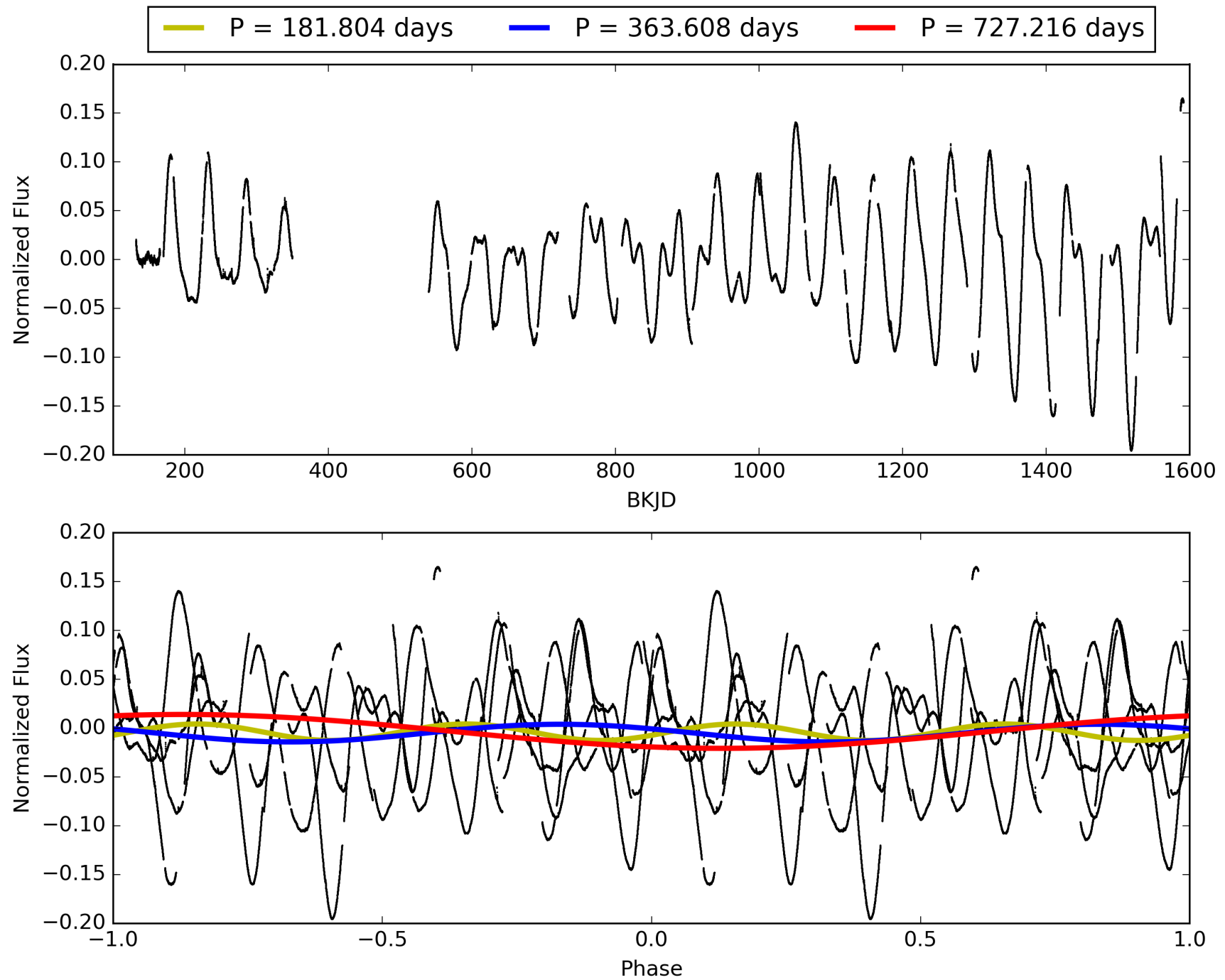
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [300.07 $\sigma$ ]  
LongPeriod-sig: 100.0% [651.36 $\sigma$ ]  
ModelChiSquare2-sig: 47.9%  
ModelChiSquareGof-sig: 97.0%  
**Bootstrap-pfa: 4.87e-10**  
RollingBand-fgt: 1.00 [4/4]  
GhostDiagnostic-chr: 1.117  
Centroid-sig: 17.0%  
Centroid-so: 0.647 arcsec [1.16 $\sigma$ ]  
OotOffset-rm: 0.203 arcsec [0.73 $\sigma$ ]  
KicOffset-rm: 0.230 arcsec [1.01 $\sigma$ ]  
OotOffset-st: 0/3/0/0 [3]  
KicOffset-st: 0/3/0/0 [3]  
DiffImageQuality-fgm: 1.00 [3/3]  
DiffImageOverlap-fno: 1.00 [3/3]

# TCE 004920178-01, PDC Light Curves

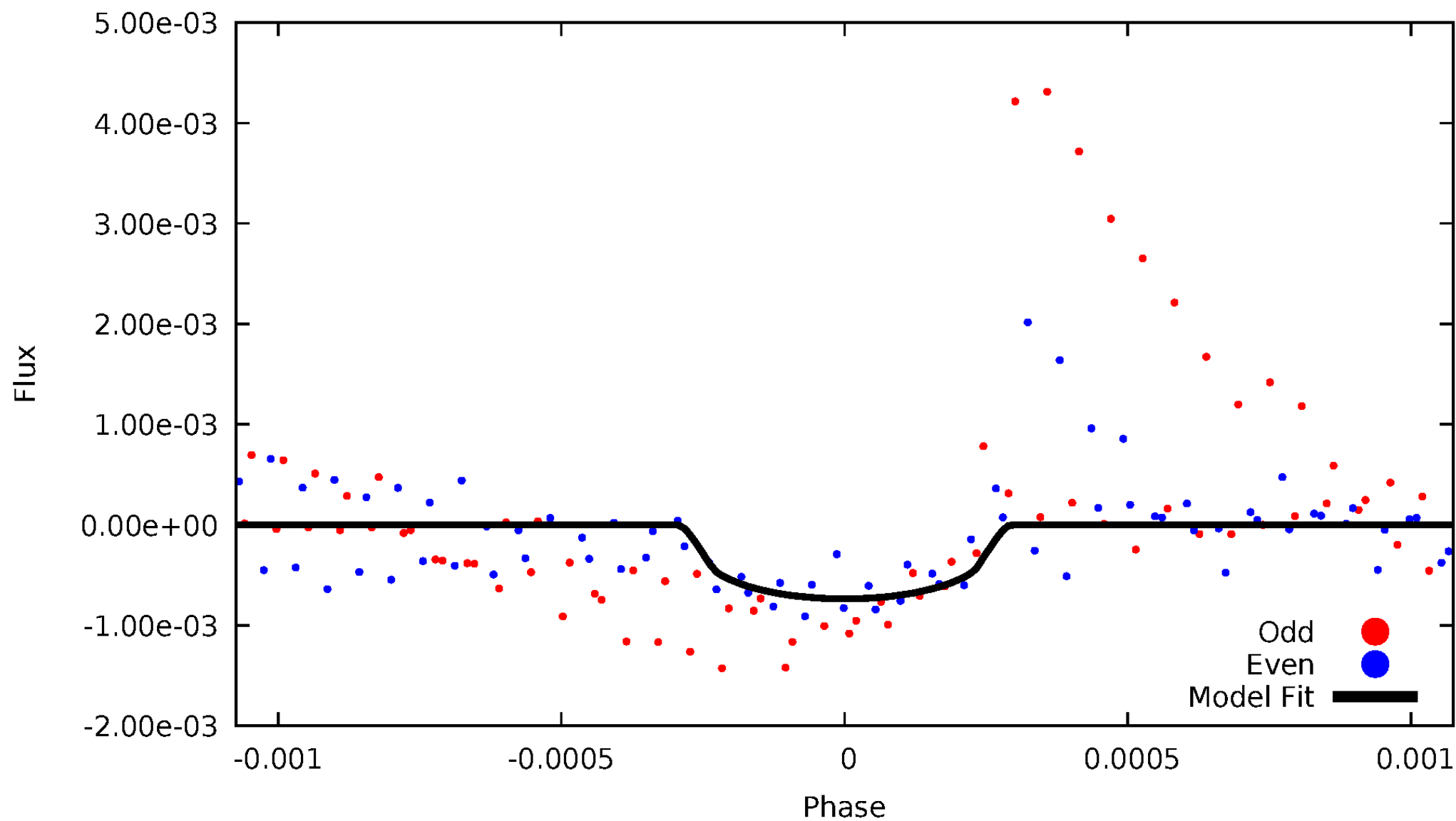


TCE 004920178-01



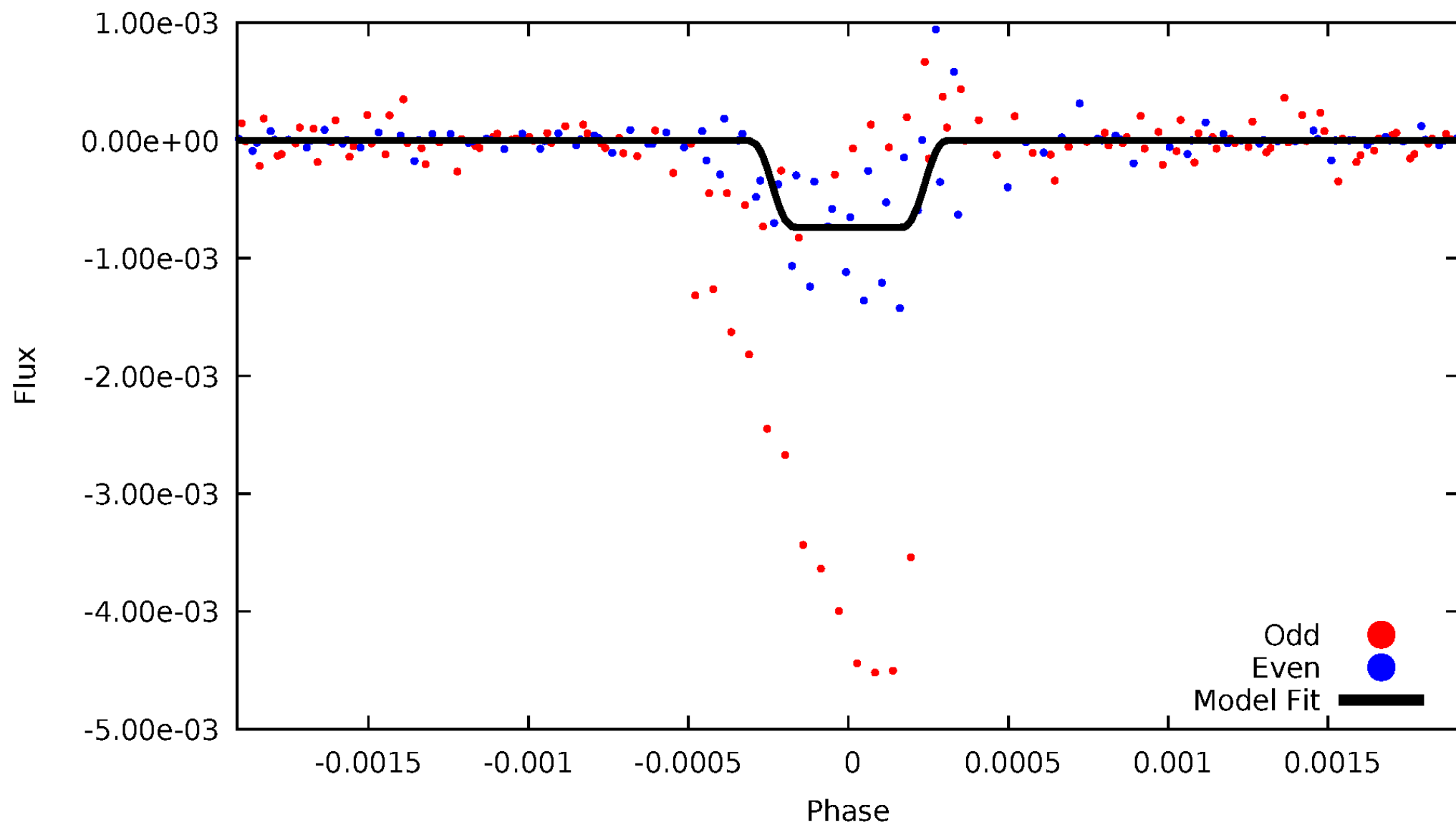
# DV Odd/Even

TCE 004920178-01



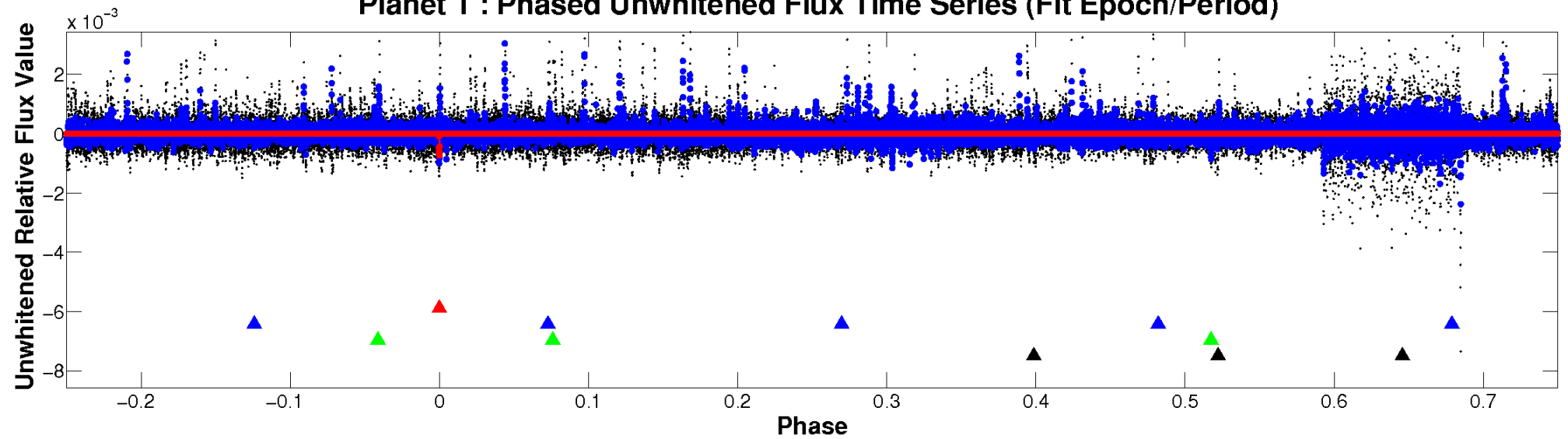
# ALT Odd/Even

TCE 004920178-01

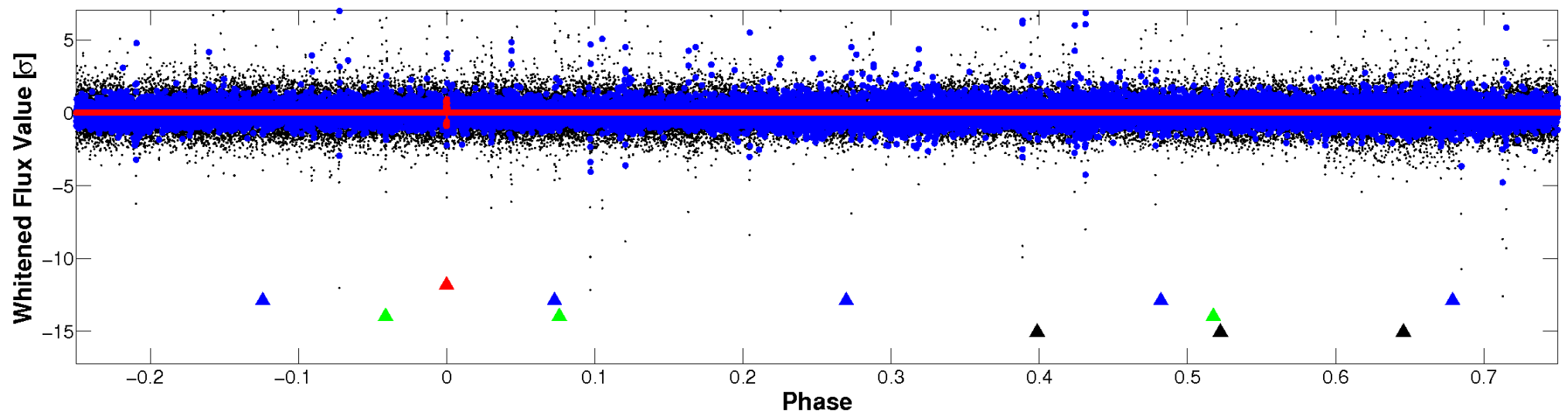


# Non-Whitened Vs. Whitened Light Curve

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

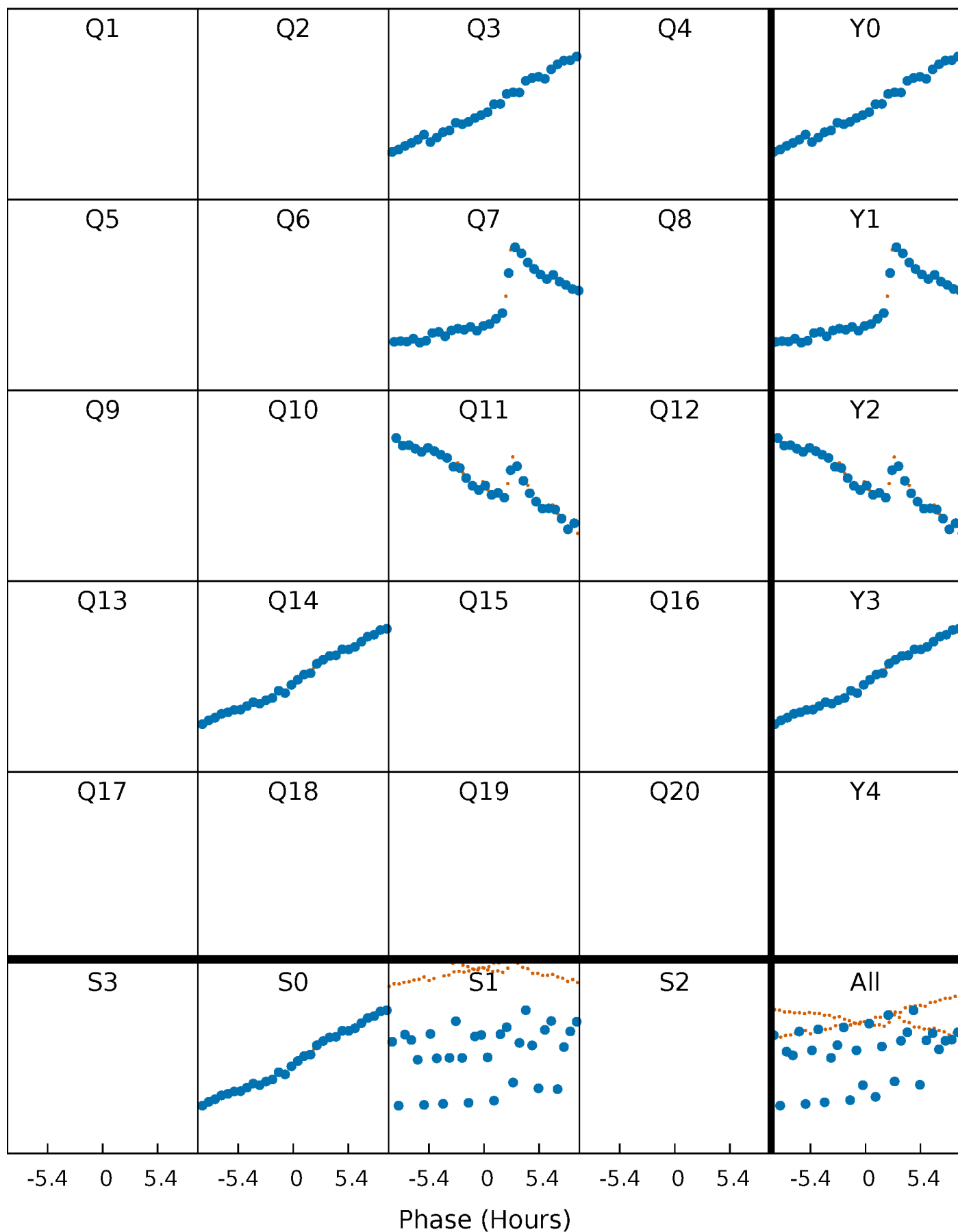


Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

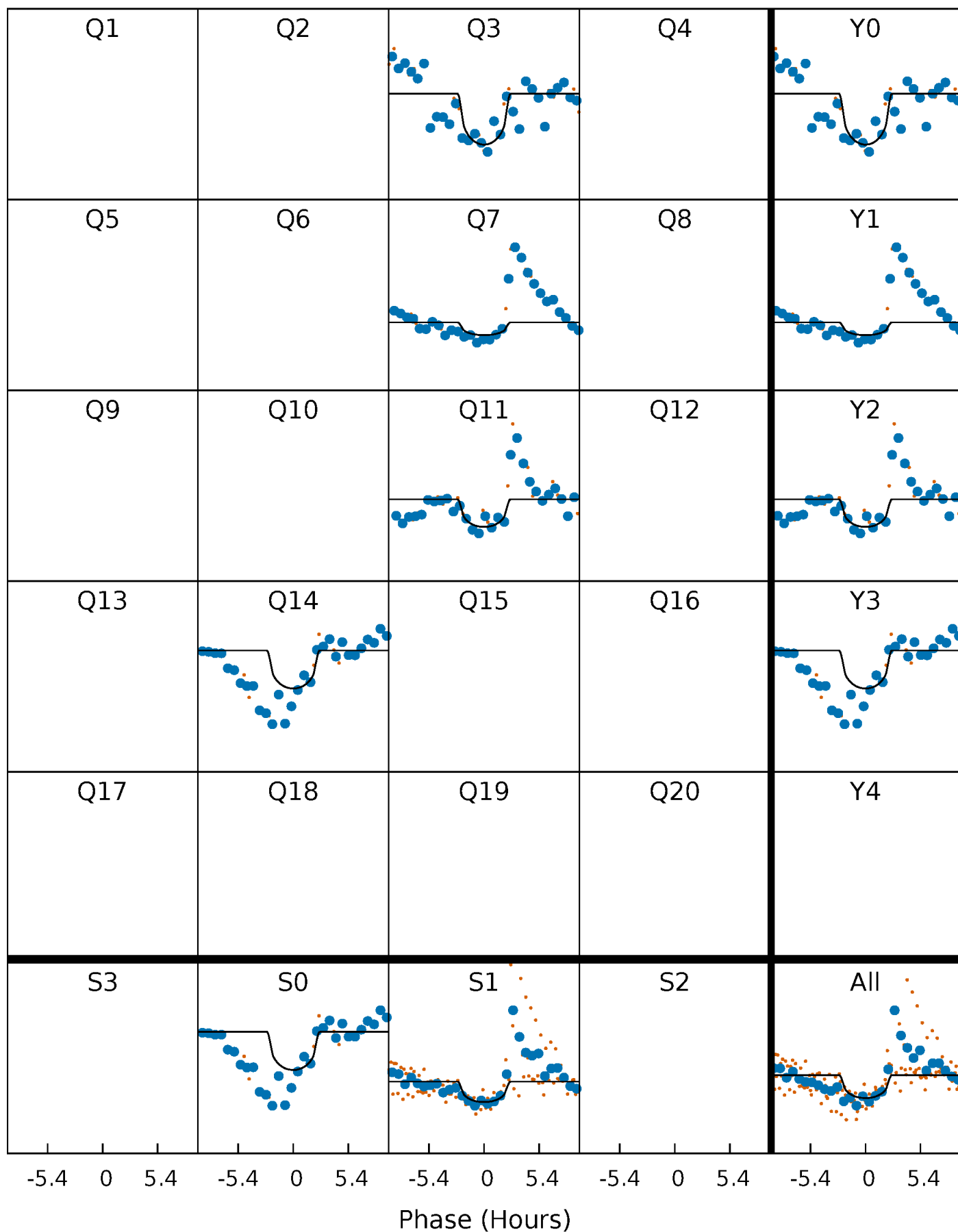
TCE 004920178-01 P=363.608228 Days  $T_0=279.534452$  (BKJD)





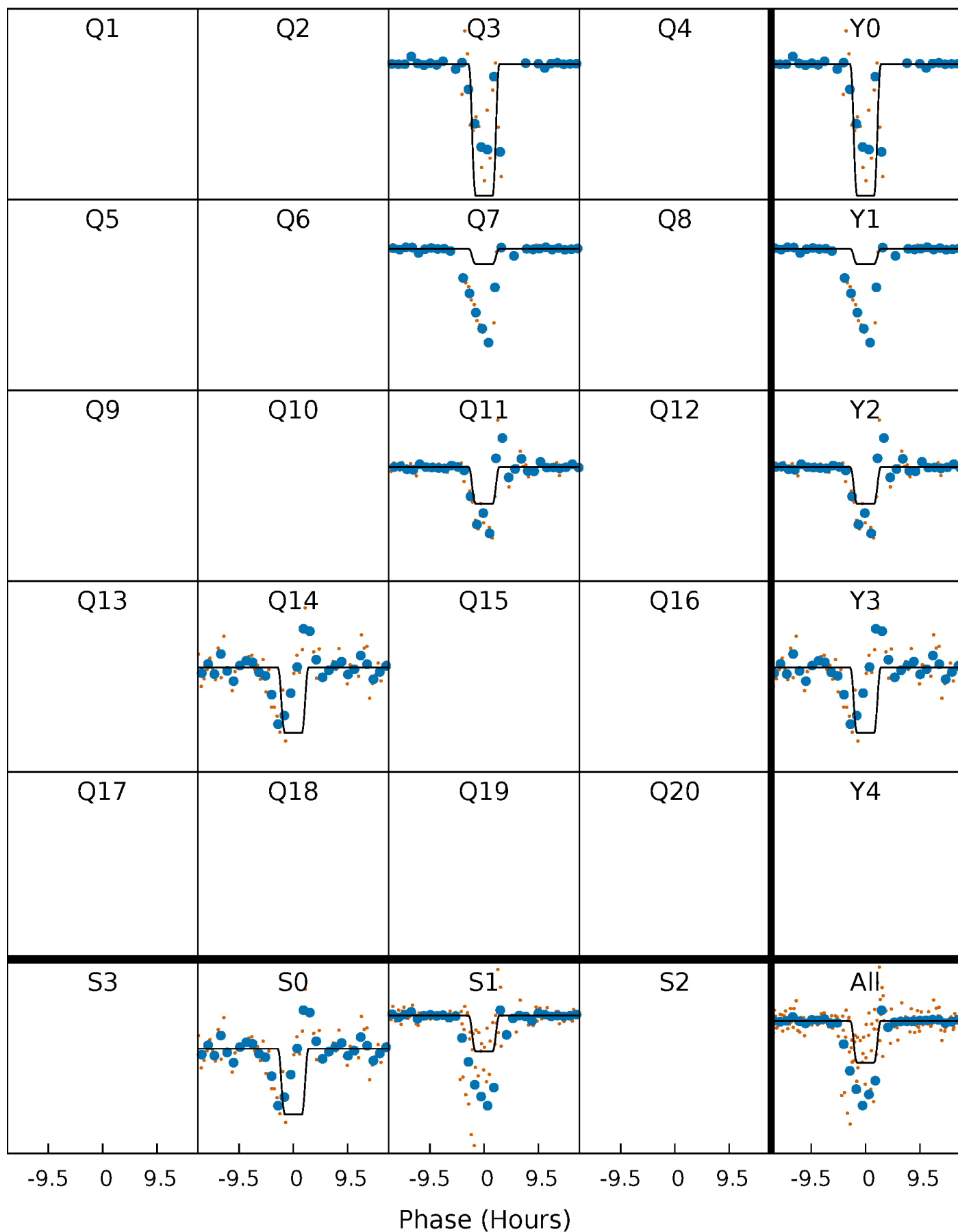
# DV Quarter-Phased Transit Curves

TCE 004920178-01 P=363.608228 Days  $T_0=279.534452$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

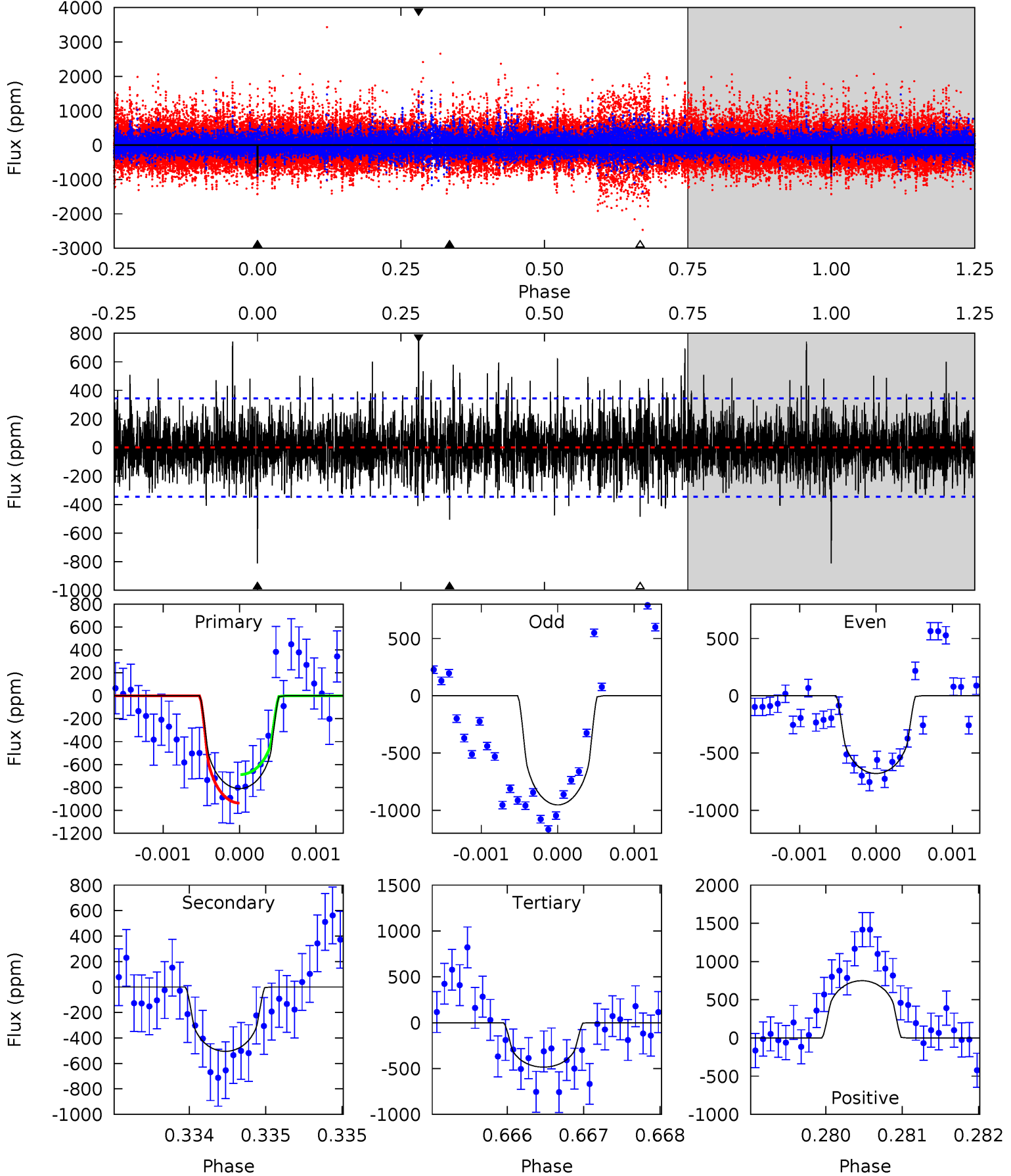
TCE 004920178-01 P=363.608389 Days  $T_0=279.552252$  (BKJD)



# DV Model-Shift Uniqueness Test

004920178-01, P = 363.608228 Days, E = 279.534452 Days

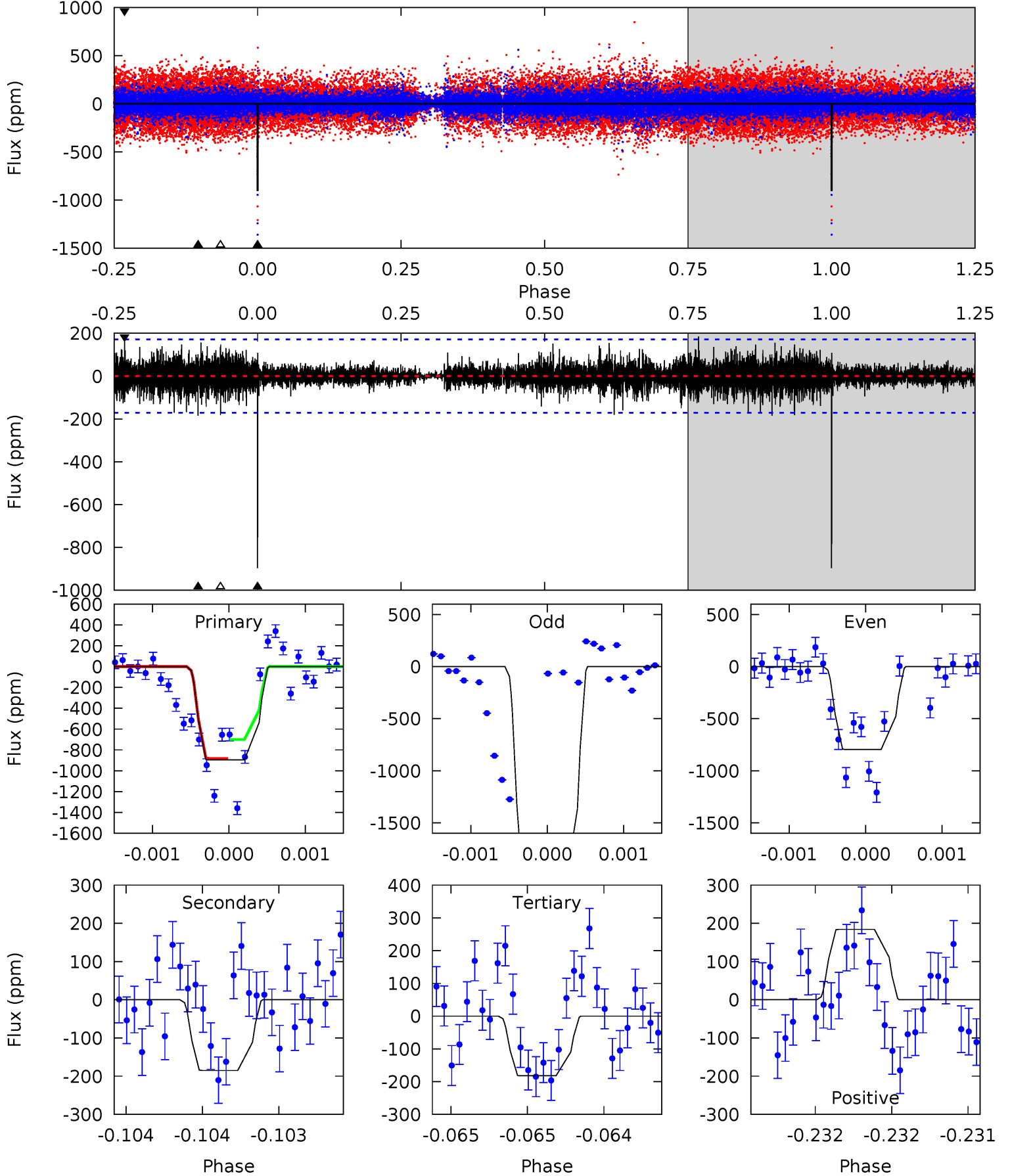
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
13.1	8.15	7.82	12.1	5.55	3.45	2.33	5.25	0.98	0.33	-3.94	1.96	1.05	0.48	2.01



# Alt Model-Shift Uniqueness Test

004920178-01, P = 363.608389 Days, E = 279.552252 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
29.0	5.99	5.90	5.97	5.55	3.44	1.06	23.1	23.1	0.09	0.03	28.1	1.84	0.17	3.13



### Stellar Parameters For KIC 004920178

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$4617^{+138}_{-103}$	$2.962^{+0.370}_{-0.370}$	$0.200^{+0.200}_{-0.200}$	$5.411^{+3.990}_{-1.710}$	$0.977^{+0.359}_{-0.040}$	$0.009^{+0.023}_{-0.006}$
	+3%/-2%	+12%/-12%	+100%/-100%	+74%/-32%	+37%/-4%	+263%/-69%
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 004920178-01 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-505 \pm 62$	$18.50^{+17.36}_{-12.27}$	$658^{+105}_{-70}$	$4064^{+2453}_{-714}$	$848^{+6952}_{-626}$
Alt.	$-185 \pm 31$	$20.29^{+19.60}_{-13.04}$	$659^{+110}_{-69}$	$3331^{+1483}_{-505}$	$257^{+1737}_{-191}$

$T_{max}$  = 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

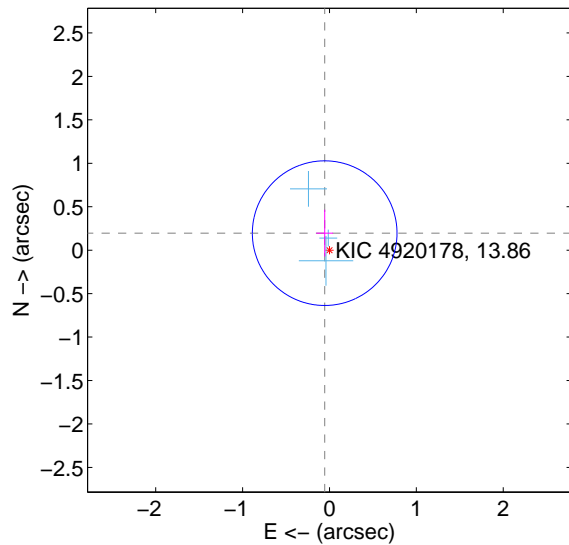
Supplemental centroid analysis for 004920178-01. Kepler magnitude: 13.86. Transit SNR 5.50

There are 3 quarters with good PRF difference image offsets

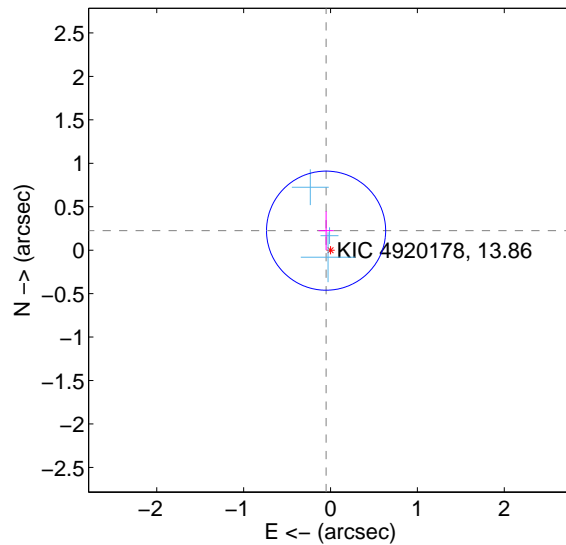
The direct PRF centroid is offset from the target star catalog position by about 0.04 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.203 \pm 0.277$	0.73	$0.055 \pm 0.096$	$0.196 \pm 0.269$
PRF-fit source offset from KIC position	$0.230 \pm 0.228$	1.01	$0.051 \pm 0.086$	$0.225 \pm 0.223$
photometric centroid source offset	$0.65 \pm 0.56$	1.16	$0.35 \pm 0.45$	$0.54 \pm 0.60$

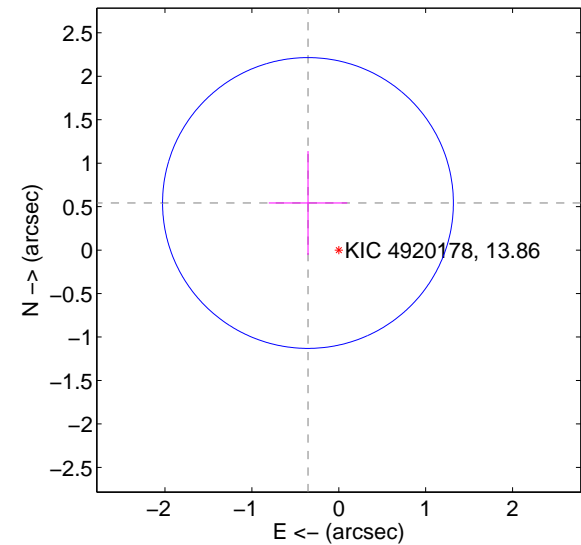
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

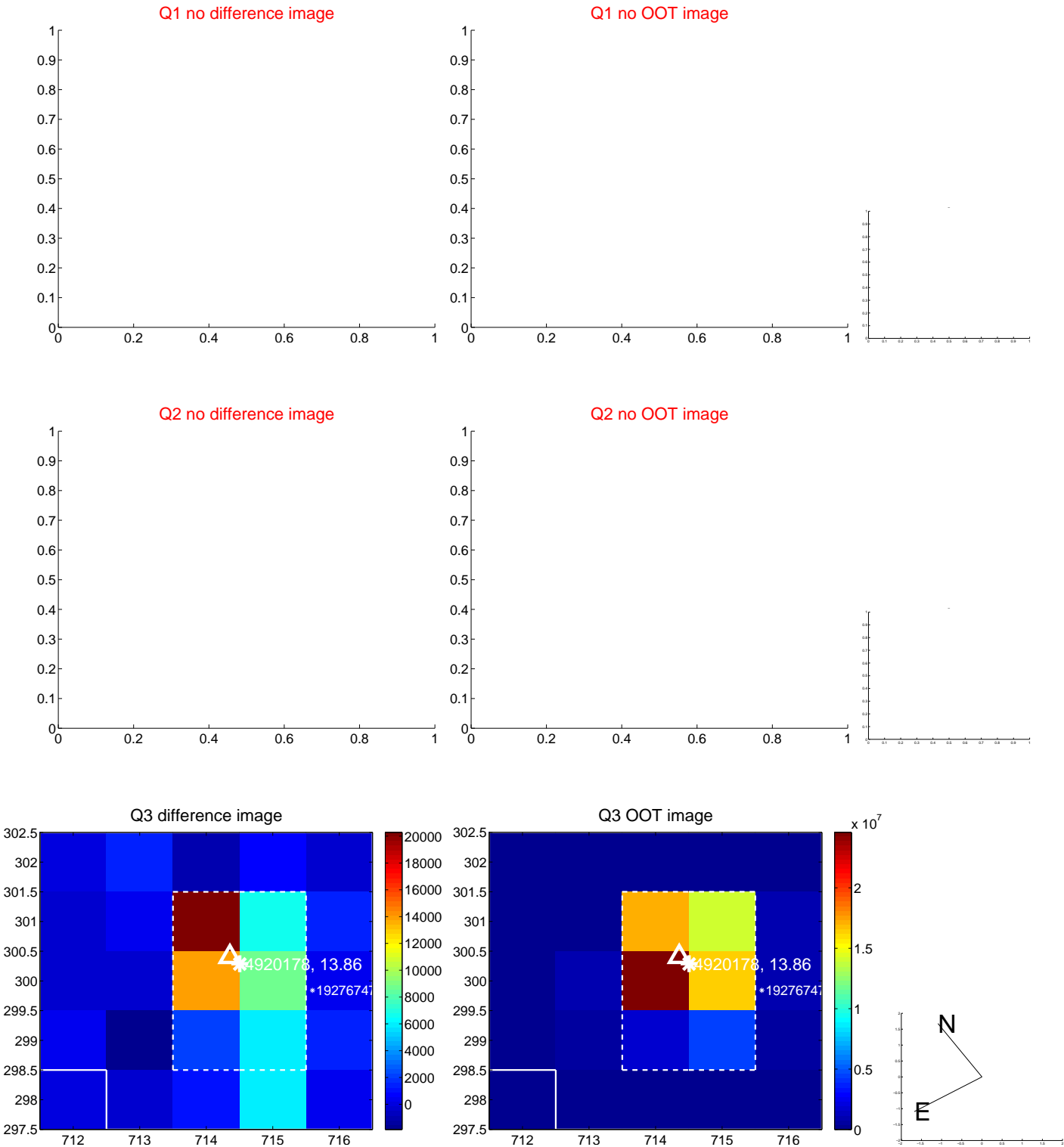


offset from photometric centroids

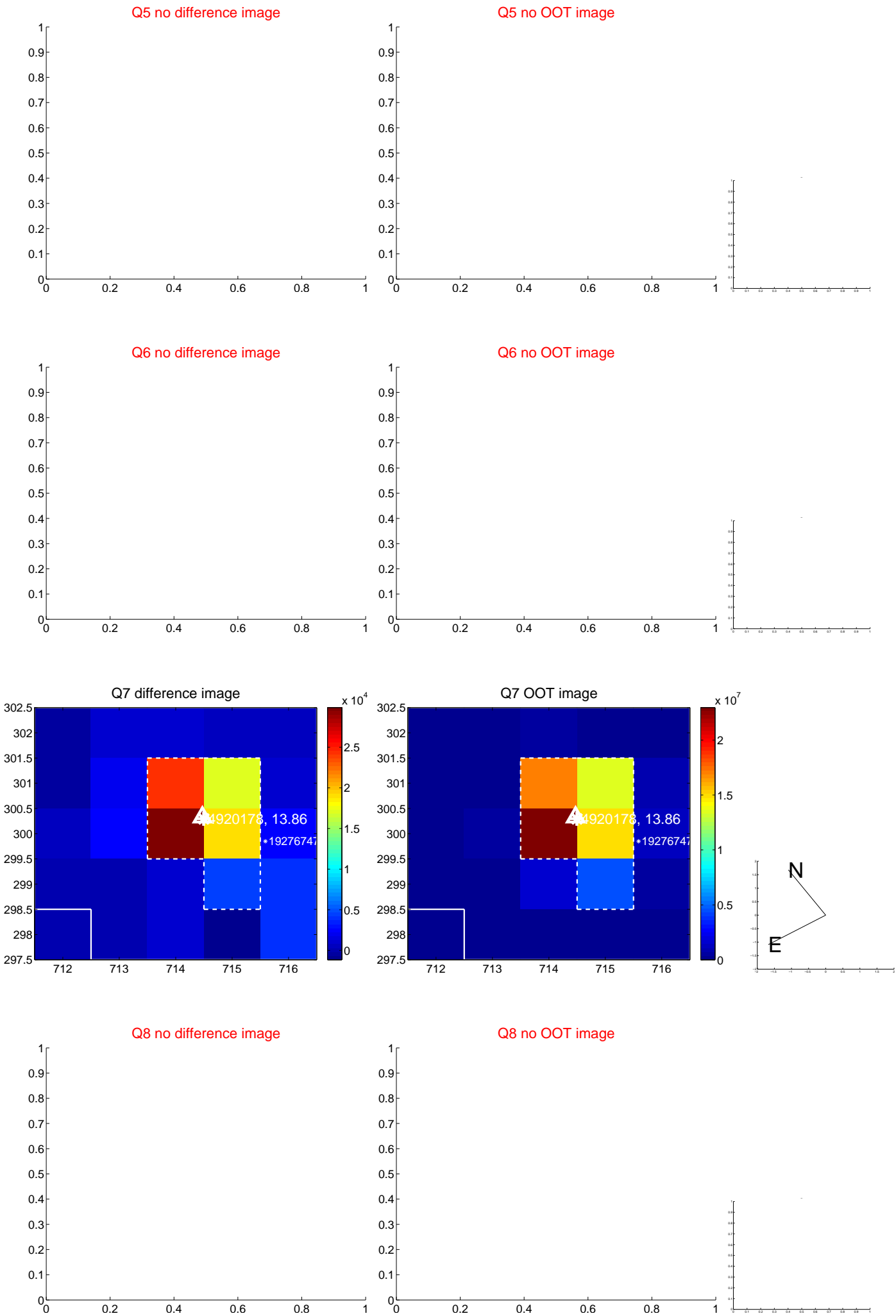


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

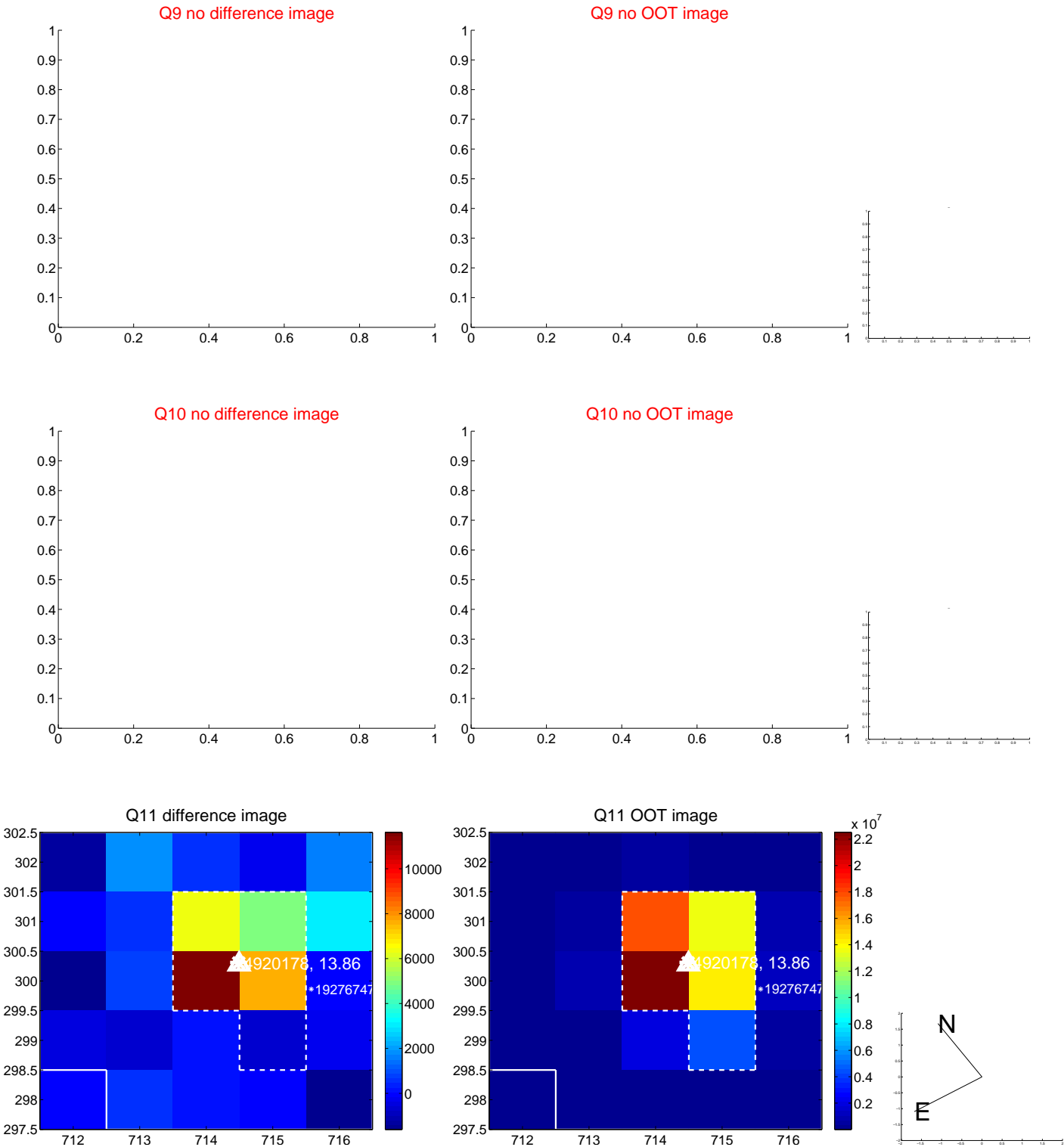


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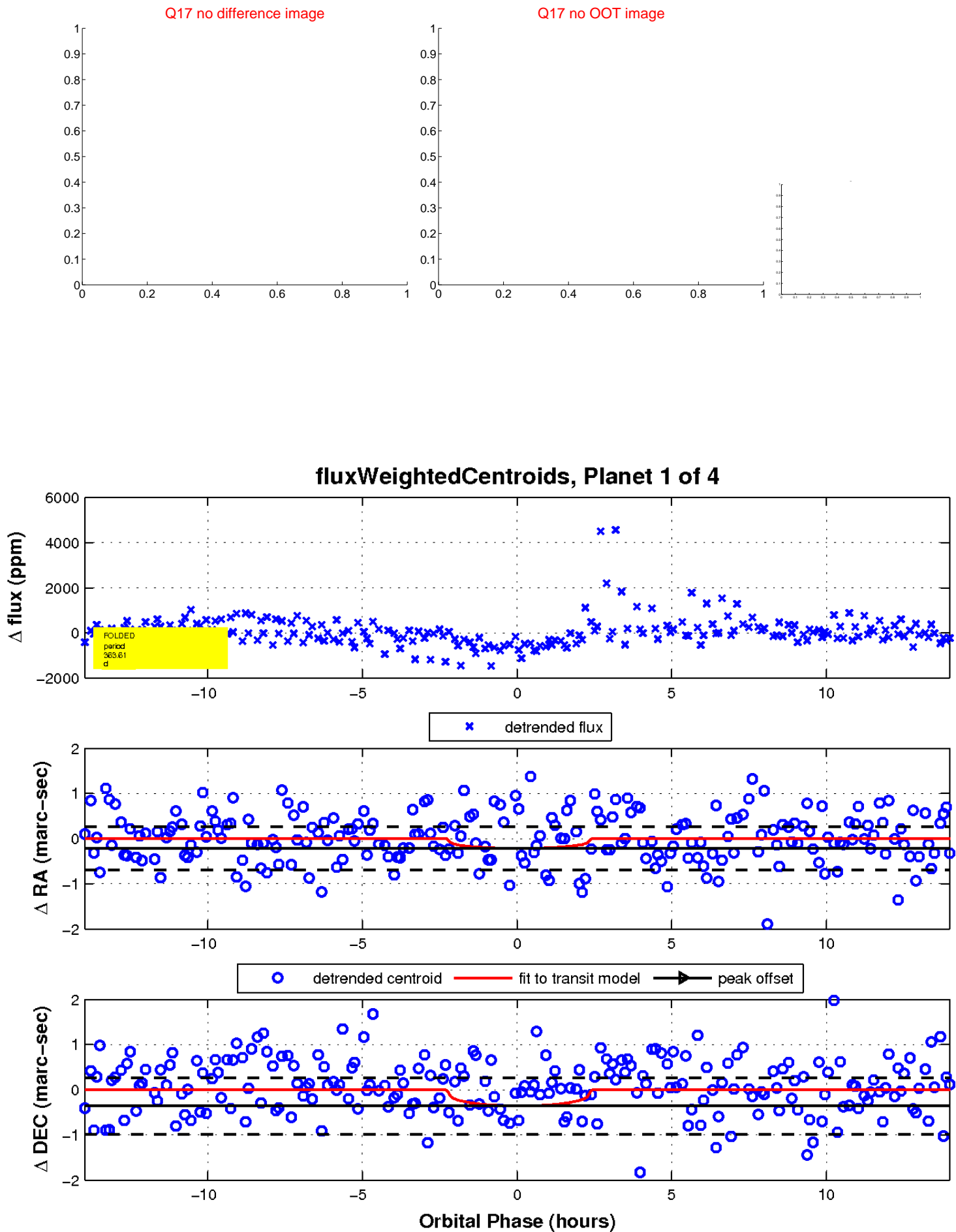
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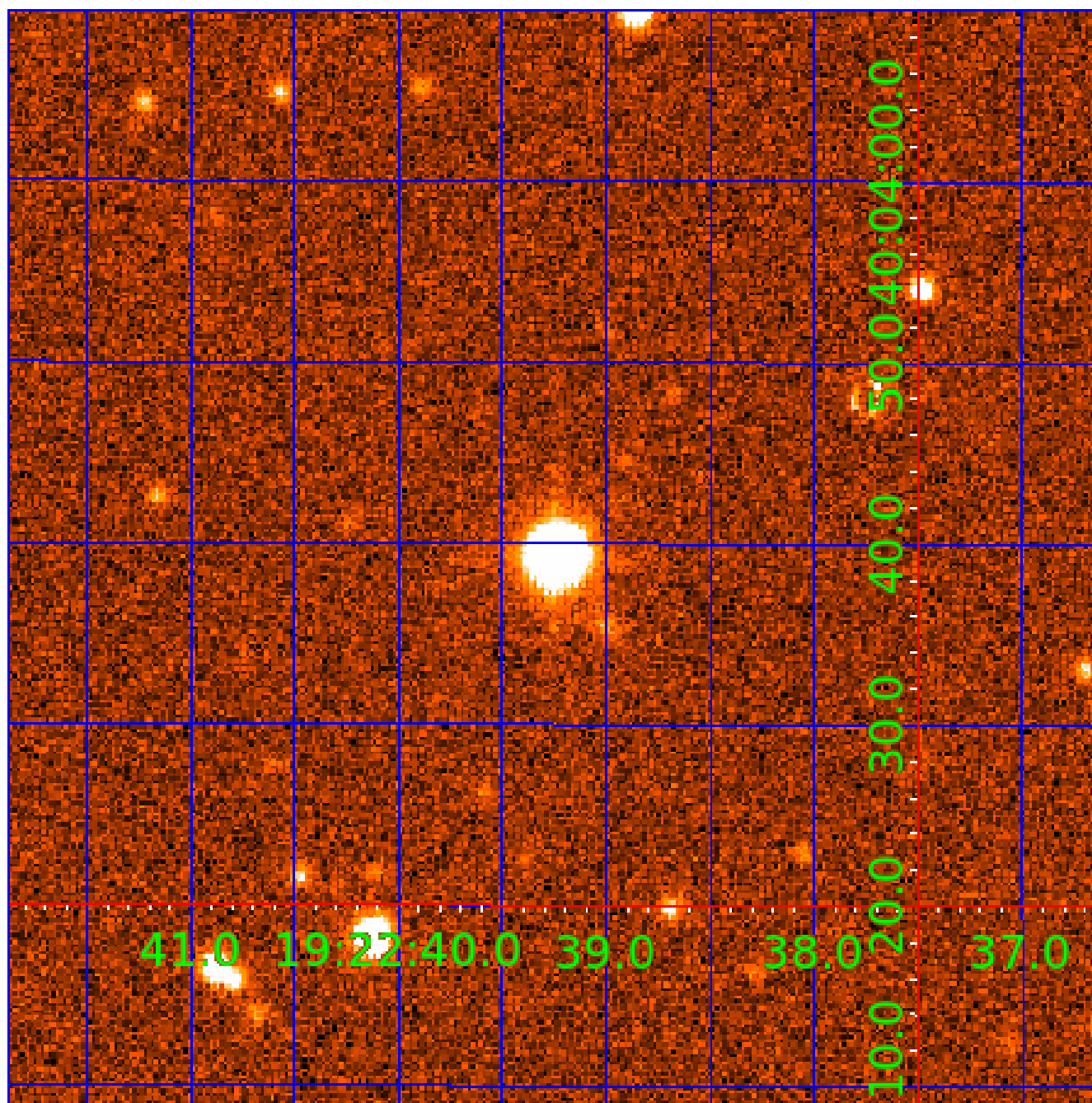


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UKIRT Image

Declination



# KIC 004920178

## 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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004920178-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_POS_DV—INCONSISTENT_TRANS
004920178-03	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
004920178-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_SKYE_TRACKER—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—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.

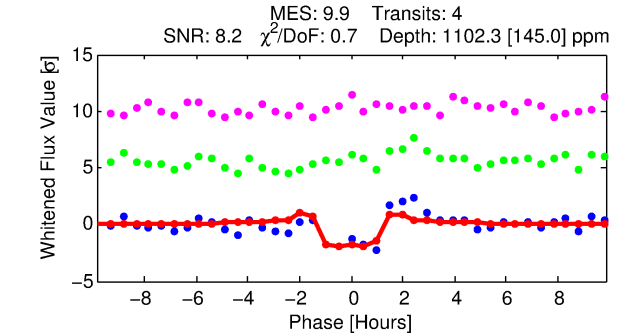
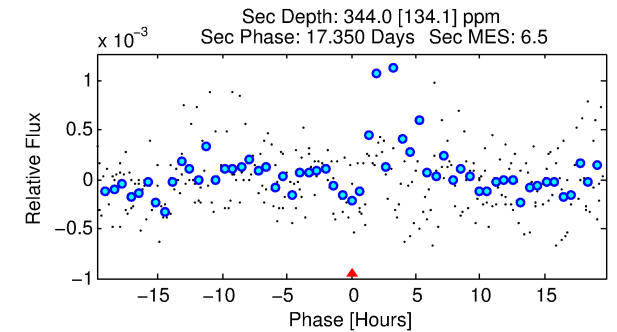
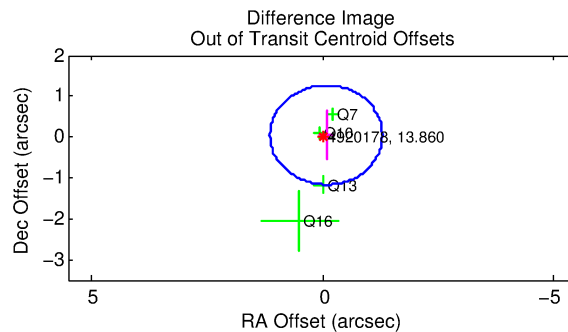
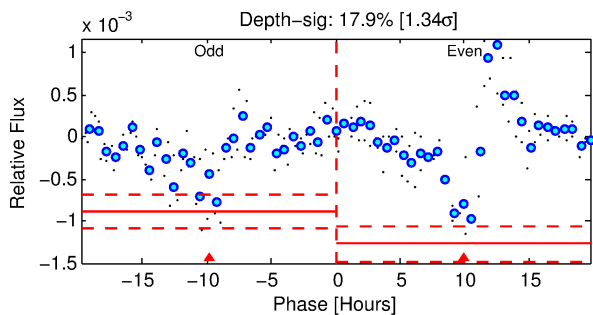
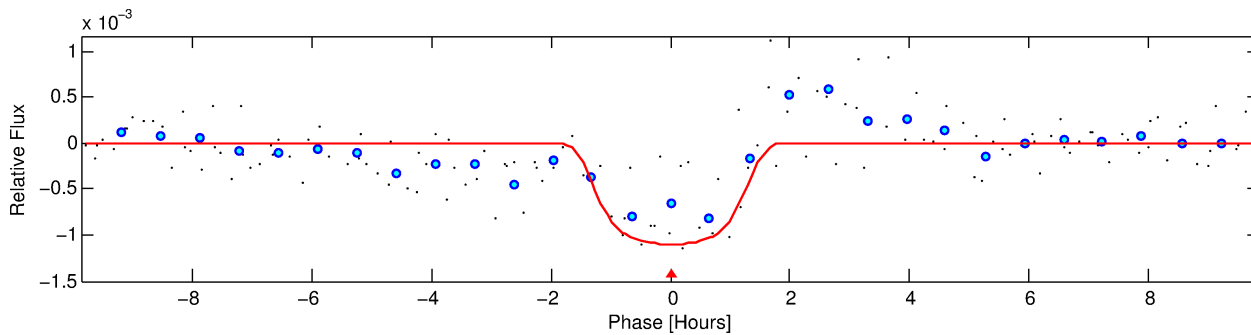
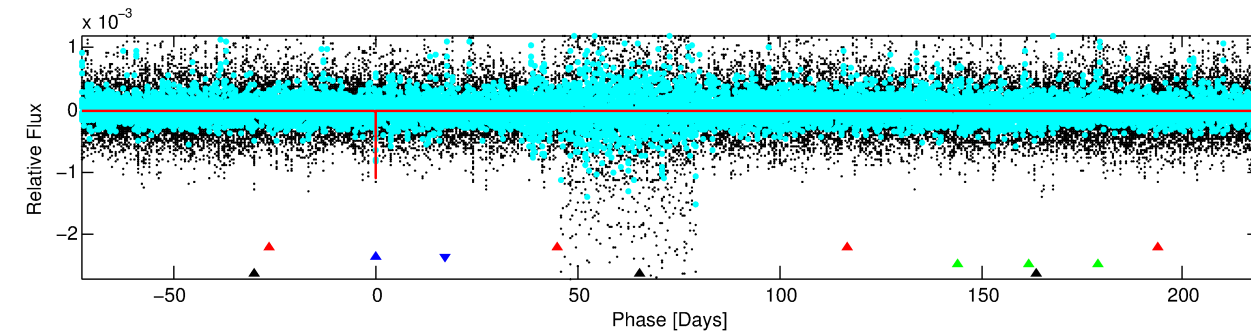
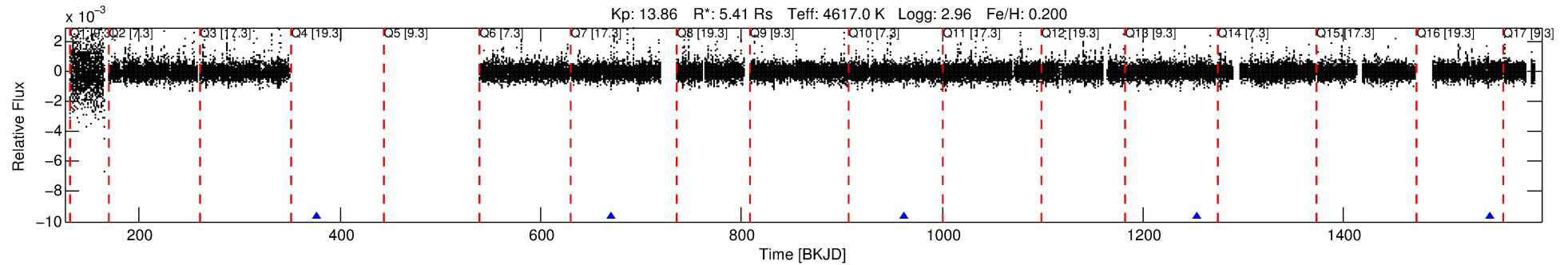
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 004920178-02

No Significant Match Found

# DV One-Page Summary

KIC: 4920178 Candidate: 2 of 4 Period: 292.007 d



## DV Fit Results:

Period = 292.00750 [0.00205] d  
Epoch = 377.6147 [0.0058] BKJD  
Rp/R\* = 0.0387 [0.0043]  
a/R\* = 327.07 [86.52]  
b = 0.92 [0.04]  
Seff = 16.29 [12.39]  
Teff = 512 [97] K  
Rp = 22.86 [17.05] Re  
a = 0.8554 [0.4856] AU  
Ag = 264.83 [231.62] [1.14 $\sigma$ ]  
Teffp = 3195 [370] K [7.01 $\sigma$ ]

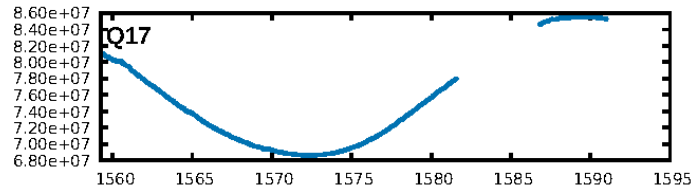
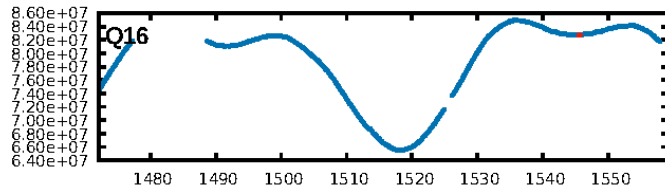
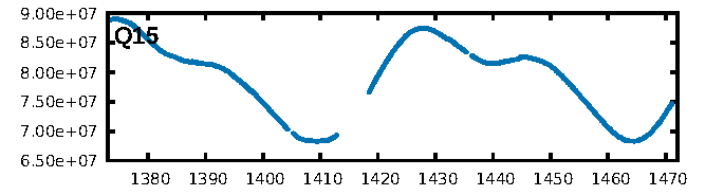
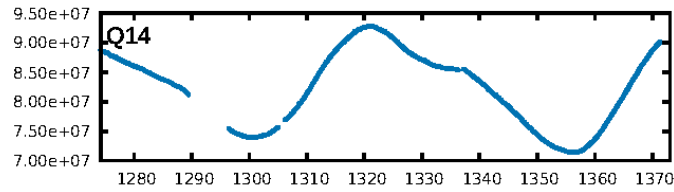
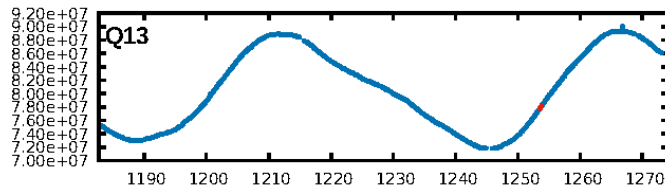
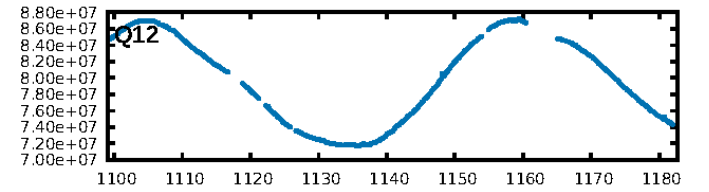
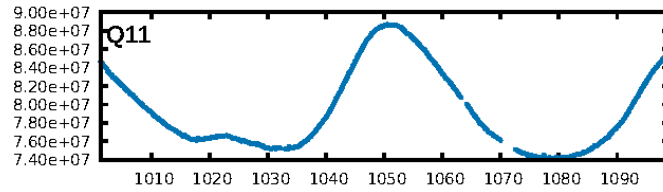
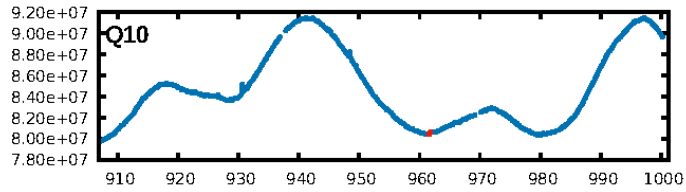
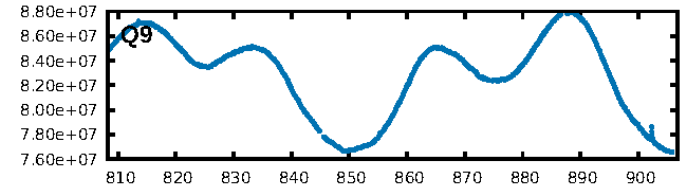
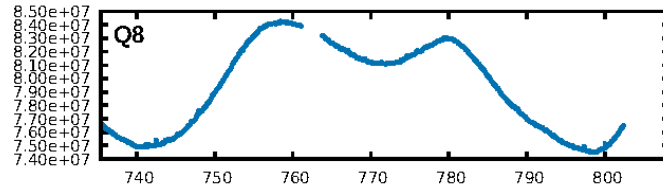
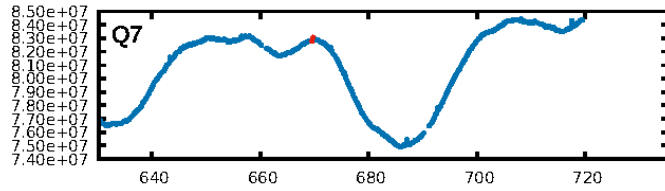
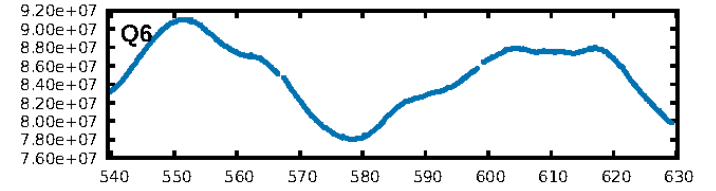
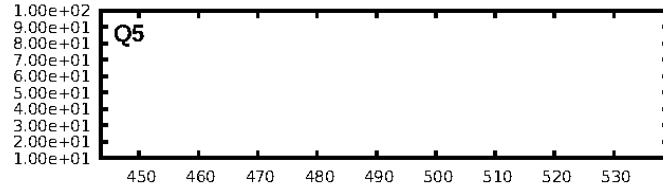
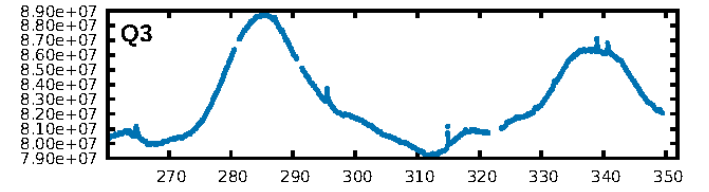
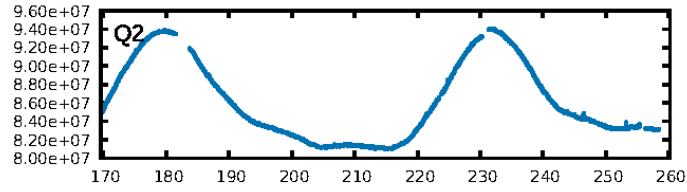
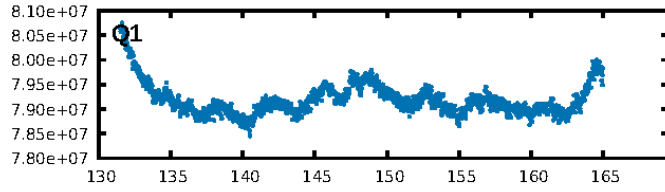
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [300.07 $\sigma$ ]  
ModelChiSquare2-sig: 22.9%  
ModelChiSquareGof-sig: 99.9%  
**Bootstrap-pfa: 3.47e-10**  
RollingBand-fgt: 1.00 [4/4]  
GhostDiagnostic-chr: 1.224  
Centroid-sig: 1.9%  
Centroid-so: 0.783 arcsec [1.92 $\sigma$ ]  
OotOffset-rm: 0.095 arcsec [0.23 $\sigma$ ]  
KicOffset-rm: 0.110 arcsec [0.24 $\sigma$ ]  
OotOffset-st: 1/1/1/1 [4]  
KicOffset-st: 1/1/1/1 [4]  
DiffImageQuality-fgm: 1.00 [4/4]  
DiffImageOverlap-fno: 1.00 [4/4]

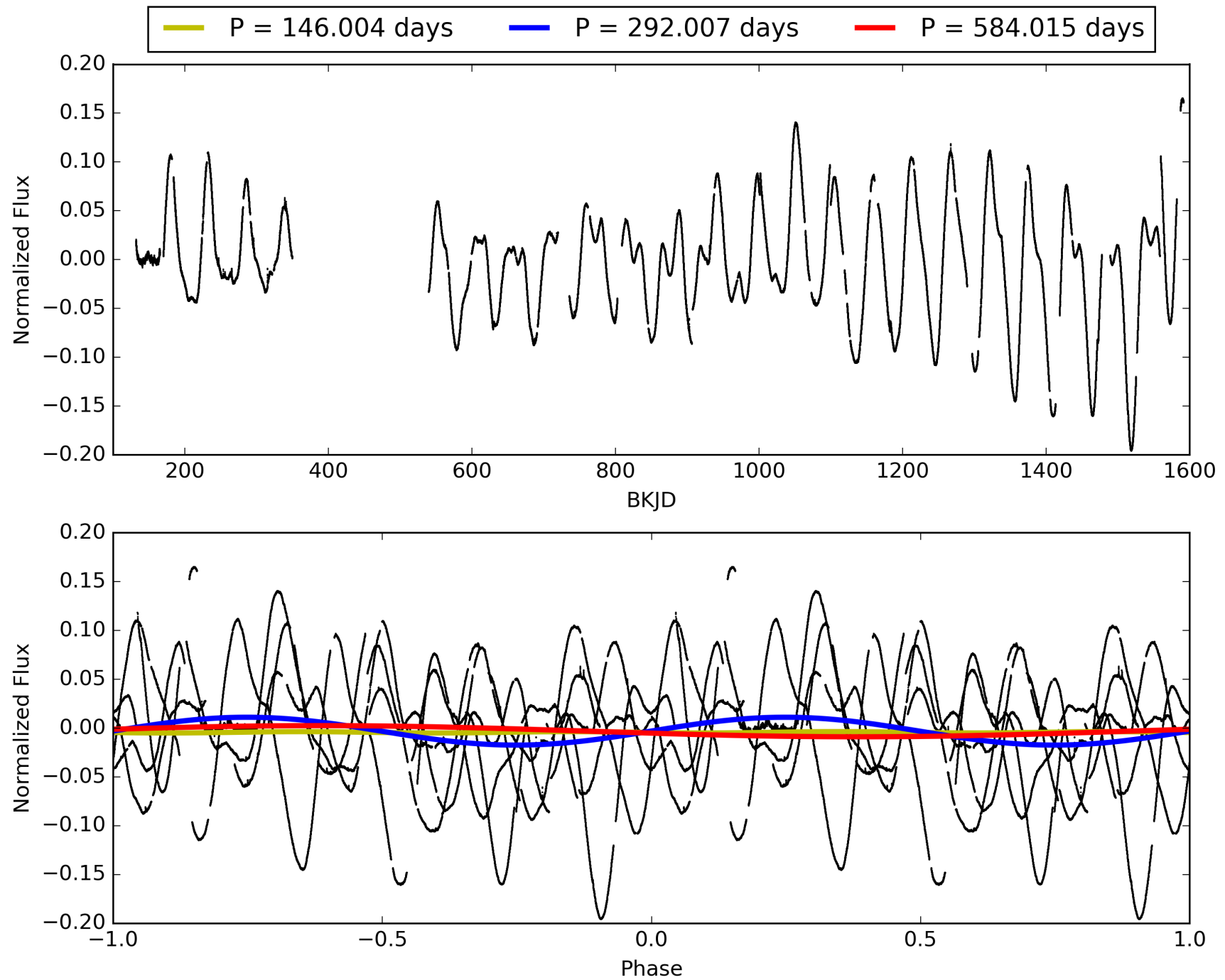
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 08:44:07 Z

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

# TCE 004920178-02, PDC Light Curves



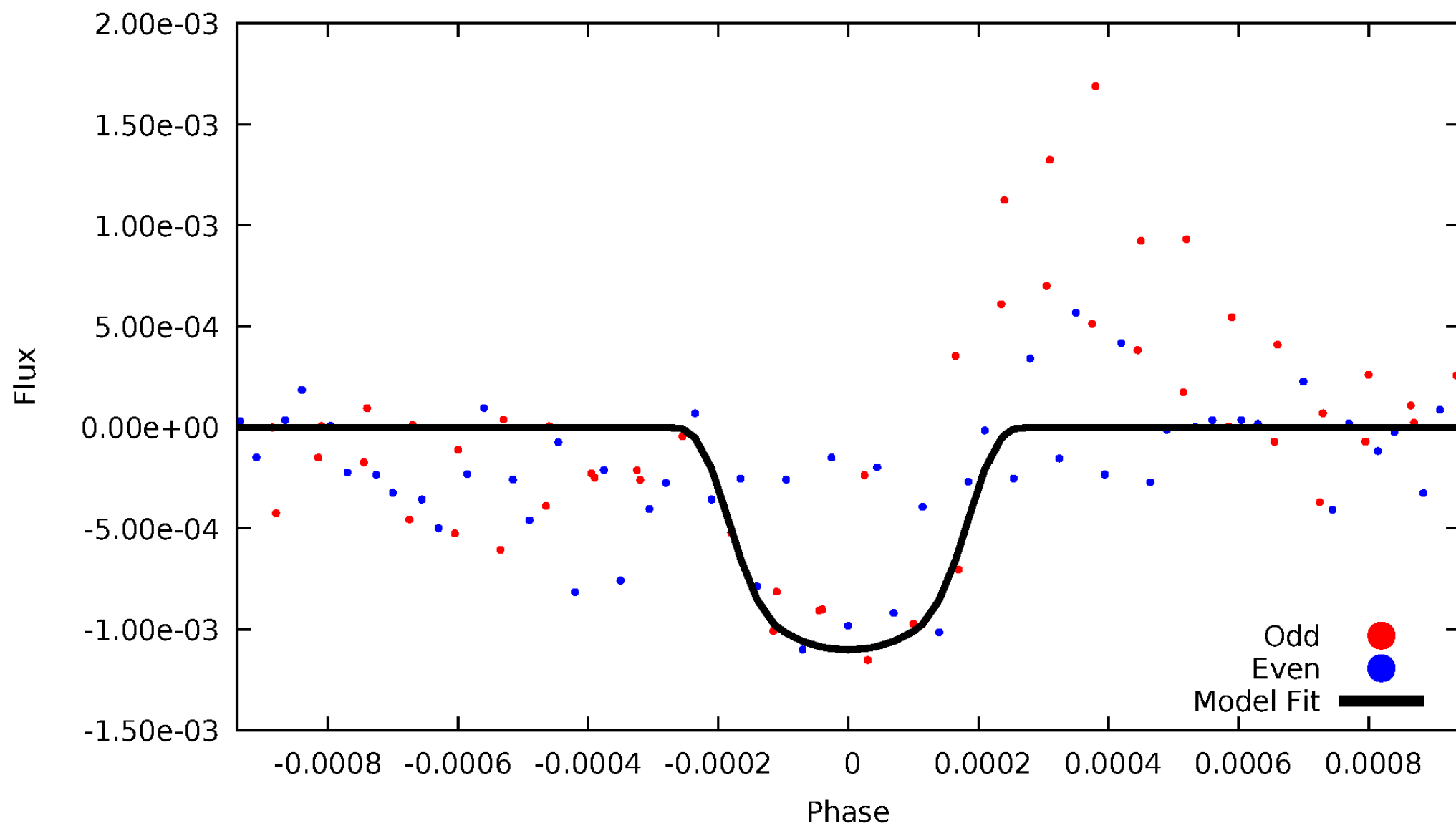
TCE 004920178-02





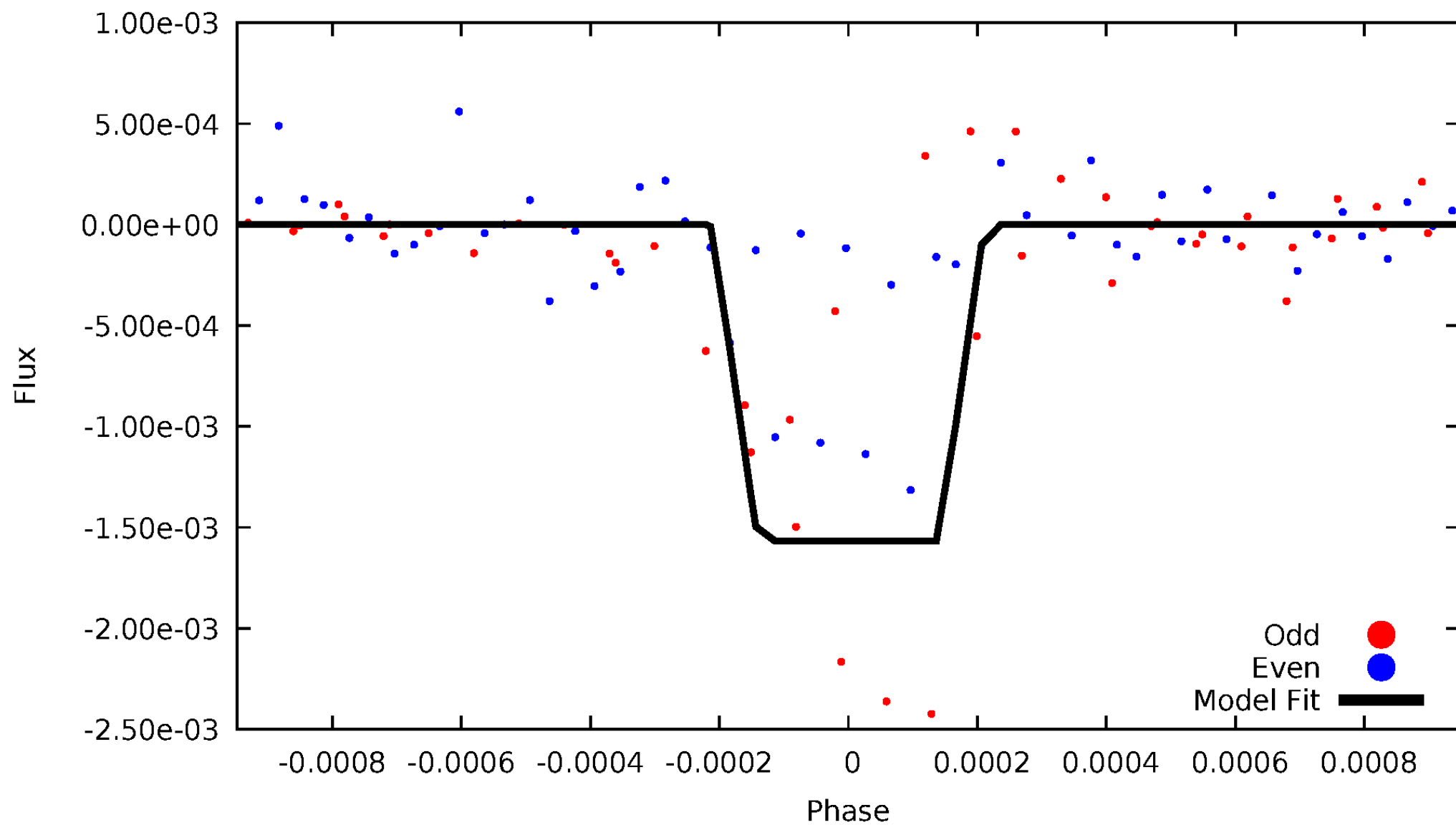
# DV Odd/Even

TCE 004920178-02



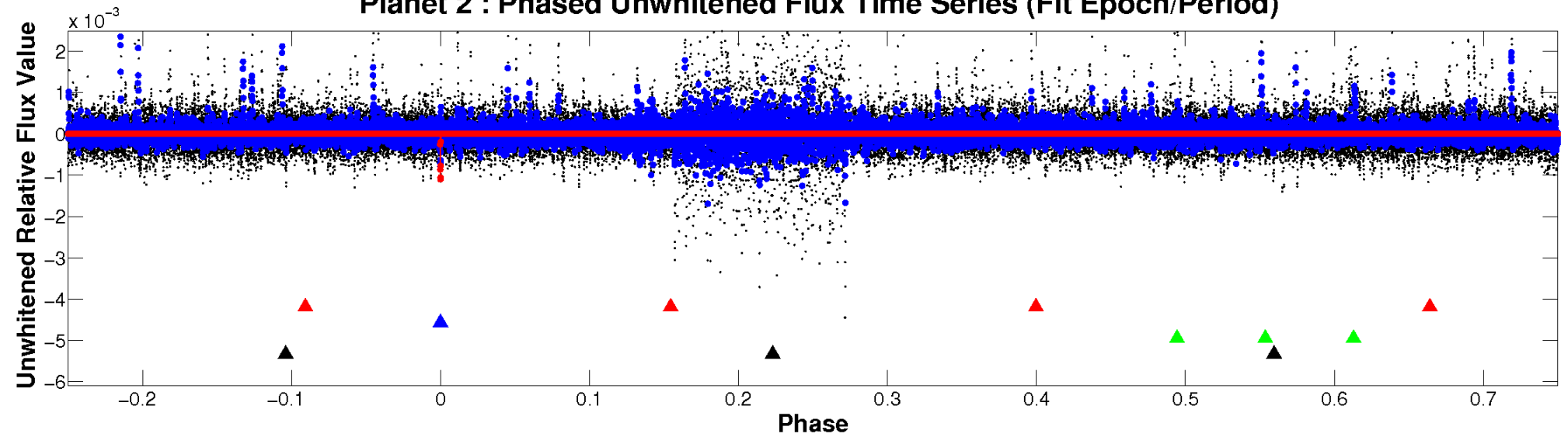
# ALT Odd/Even

TCE 004920178-02

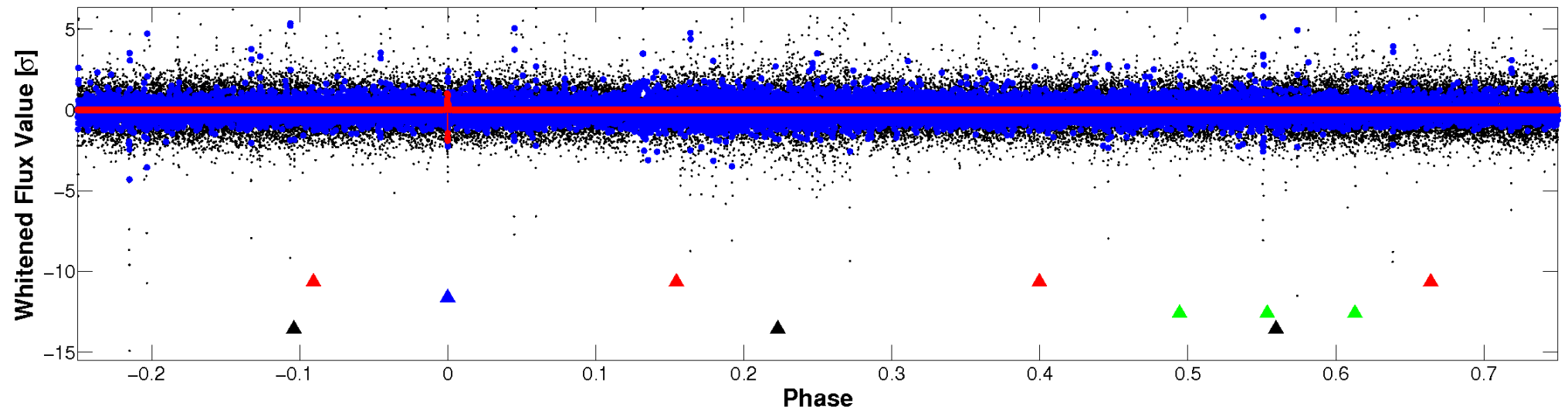


# Non-Whitened Vs. Whitened Light Curve

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

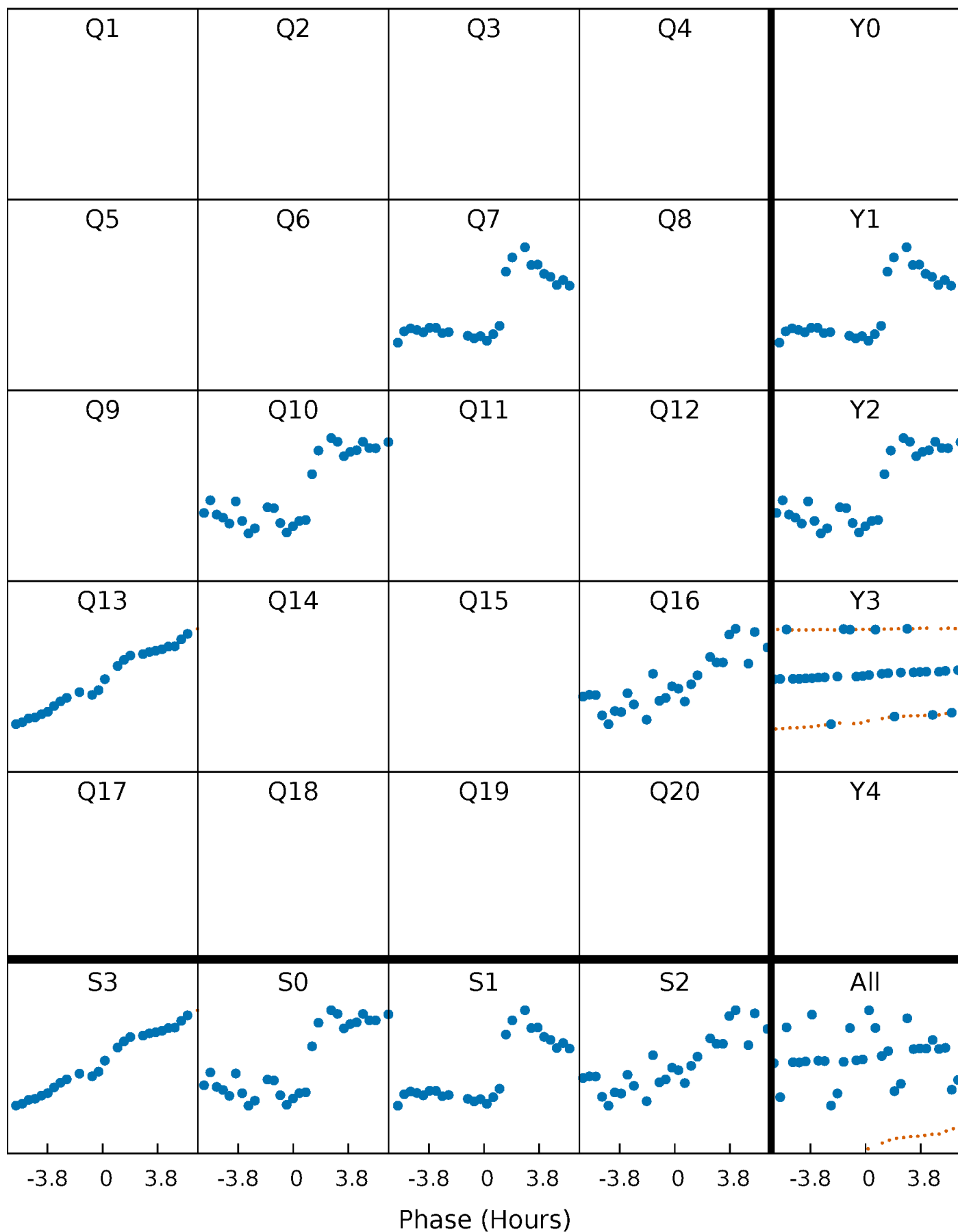


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



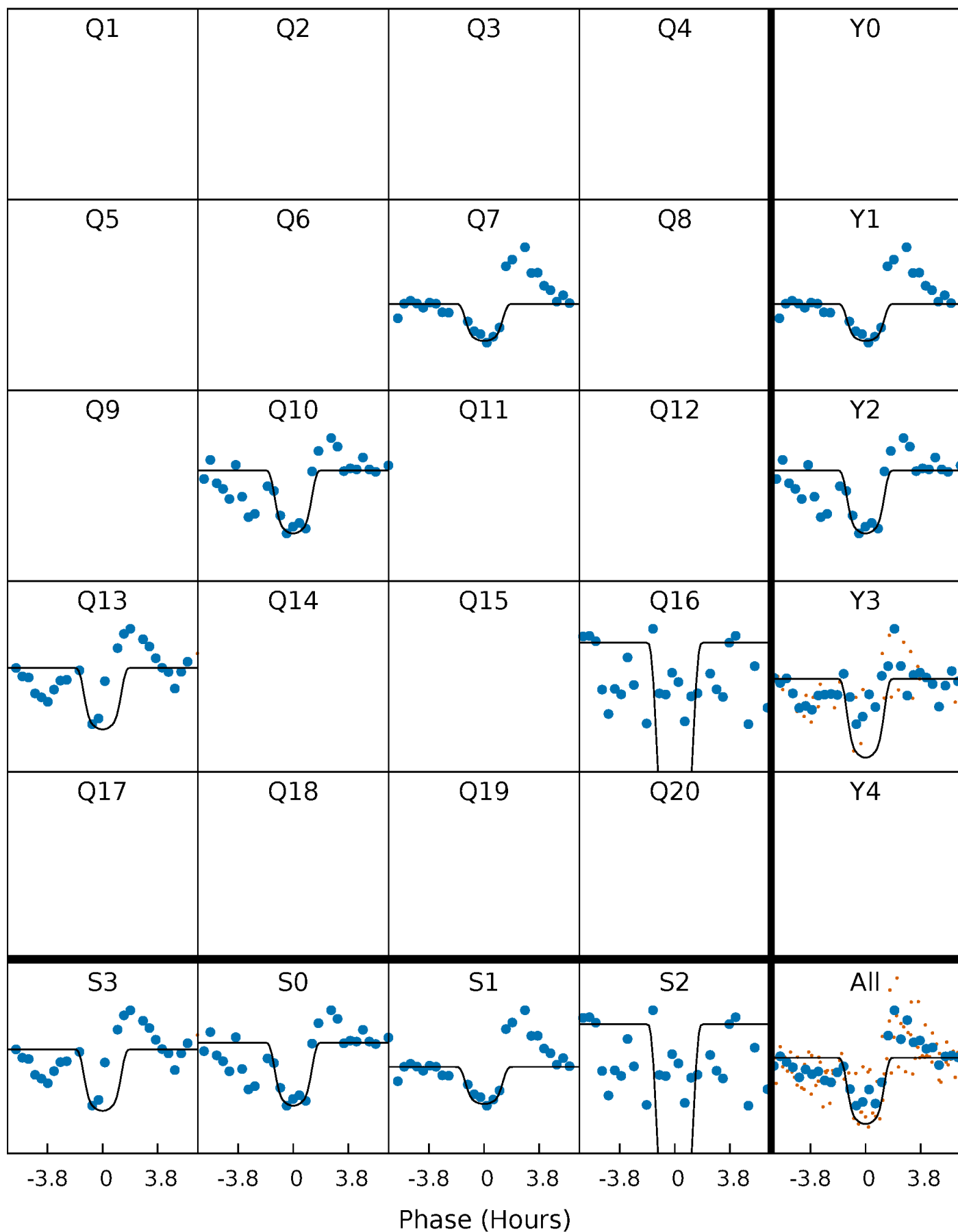
# PDC Quarter-Phased Transit Curves

TCE 004920178-02     $P=292.007497$  Days     $T_0=377.614656$  (BKJD)



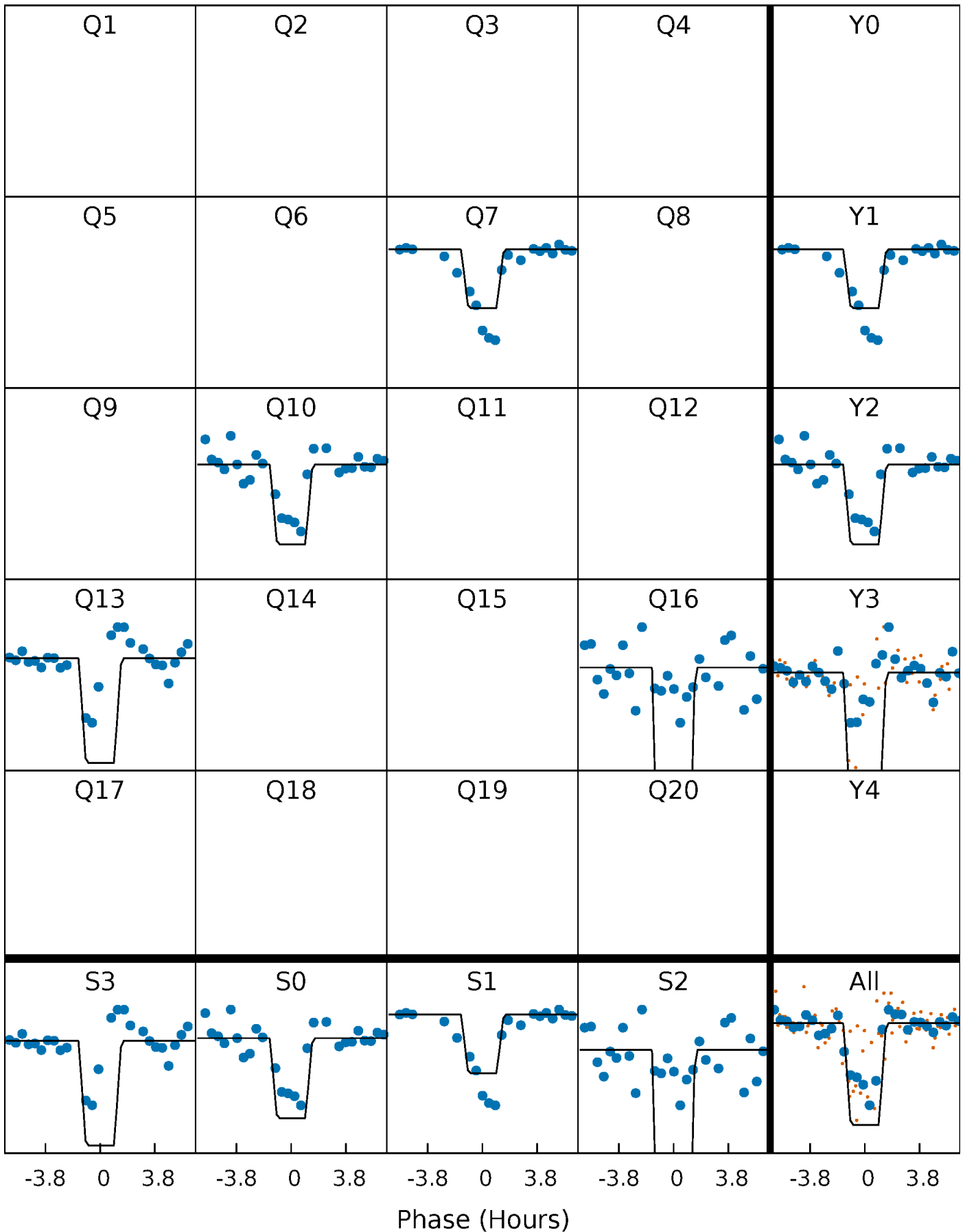
# DV Quarter-Phased Transit Curves

TCE 004920178-02 P=292.007497 Days  $T_0=377.614656$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

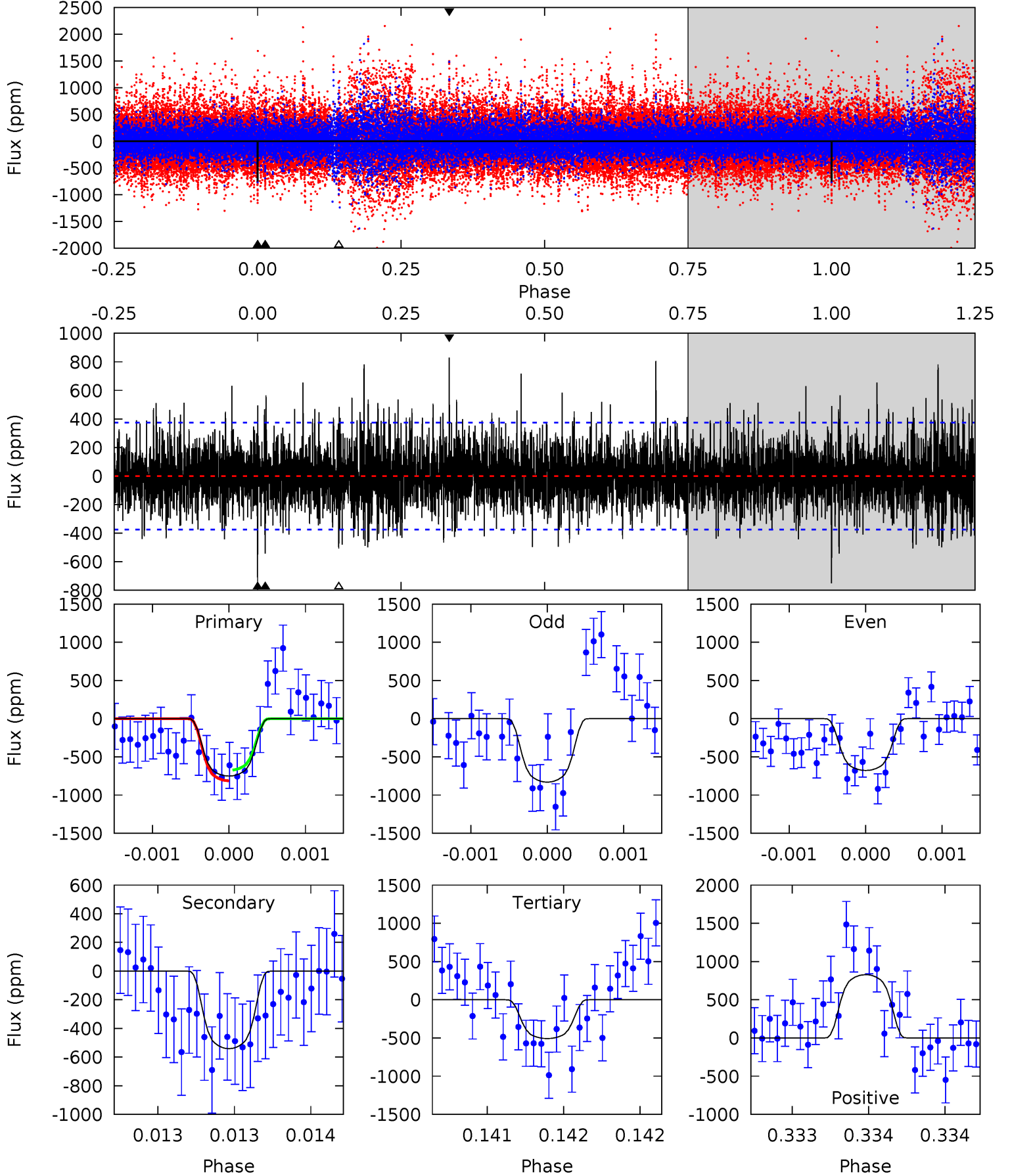
TCE 004920178-02 P=292.008169 Days  $T_0=377.625921$  (BKJD)



# DV Model-Shift Uniqueness Test

004920178-02,  $P = 292.007497$  Days,  $E = 85.607159$  Days

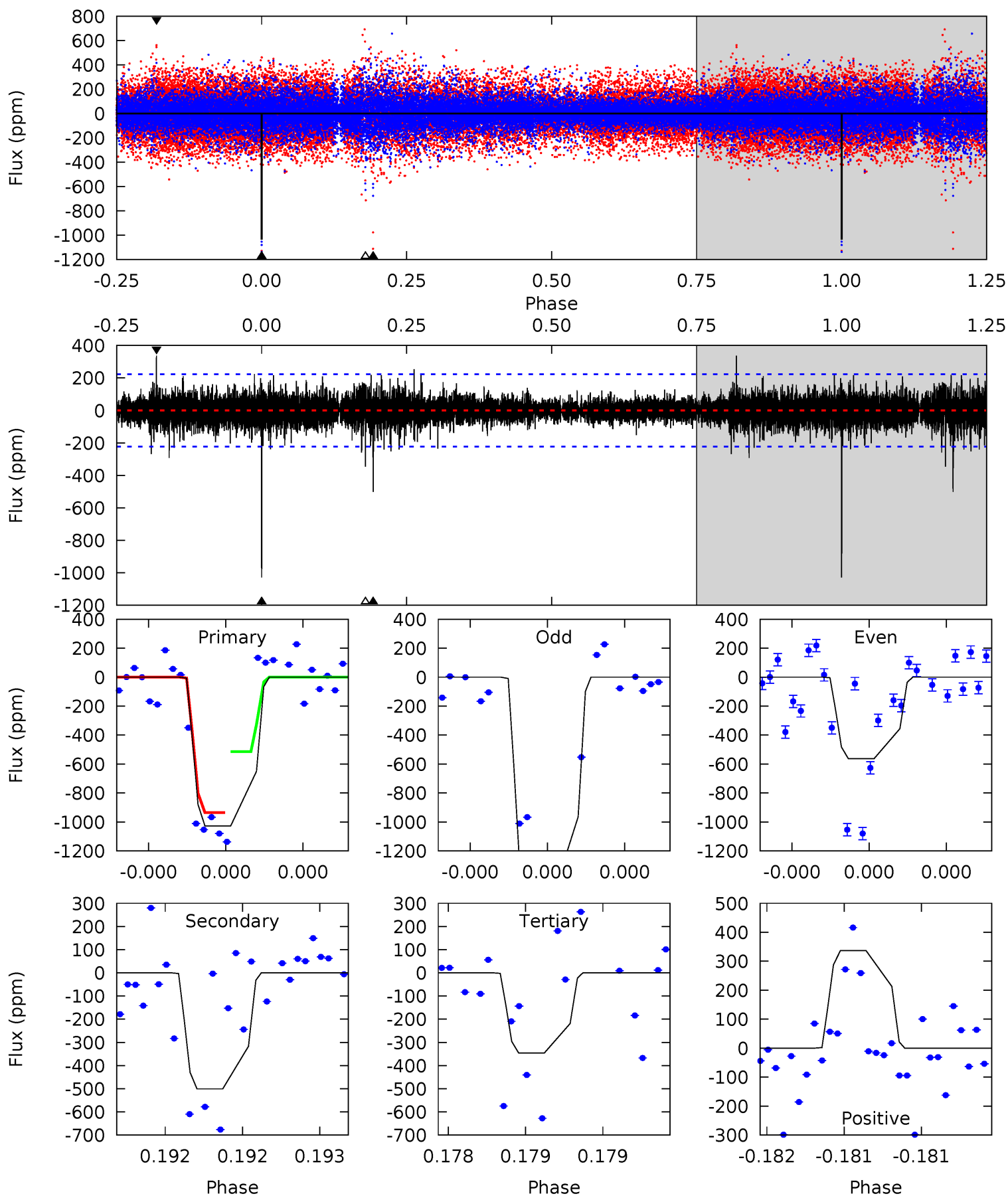
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
11.2	8.05	7.55	12.3	5.57	3.48	2.28	3.62	-1.15	0.50	-4.27	1.10	0.92	0.52	1.03



# Alt Model-Shift Uniqueness Test

004920178-02, P = 292.008169 Days, E = 85.617752 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
25.8	12.6	8.69	8.46	5.60	3.53	1.22	17.1	17.4	3.90	4.14	15.1	1.21	0.25	5.67





### Stellar Parameters For KIC 004920178

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$4617^{+138}_{-103}$	$2.962^{+0.370}_{-0.370}$	$0.200^{+0.200}_{-0.200}$	$5.411^{+3.990}_{-1.710}$	$0.977^{+0.359}_{-0.040}$	$0.009^{+0.023}_{-0.006}$
	+3%/-2%	+12%/-12%	+100%/-100%	+74%/-32%	+37%/-4%	+263%/-69%
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 004920178-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-541 \pm 67$	$23.22^{+9.84}_{-5.17}$	$711^{+139}_{-81}$	$3826^{+207}_{-179}$	$420^{+311}_{-208}$
Alt.	$-501 \pm 40$	$23.52^{+8.85}_{-5.62}$	$709^{+120}_{-78}$	$3752^{+197}_{-158}$	$391^{+279}_{-187}$

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

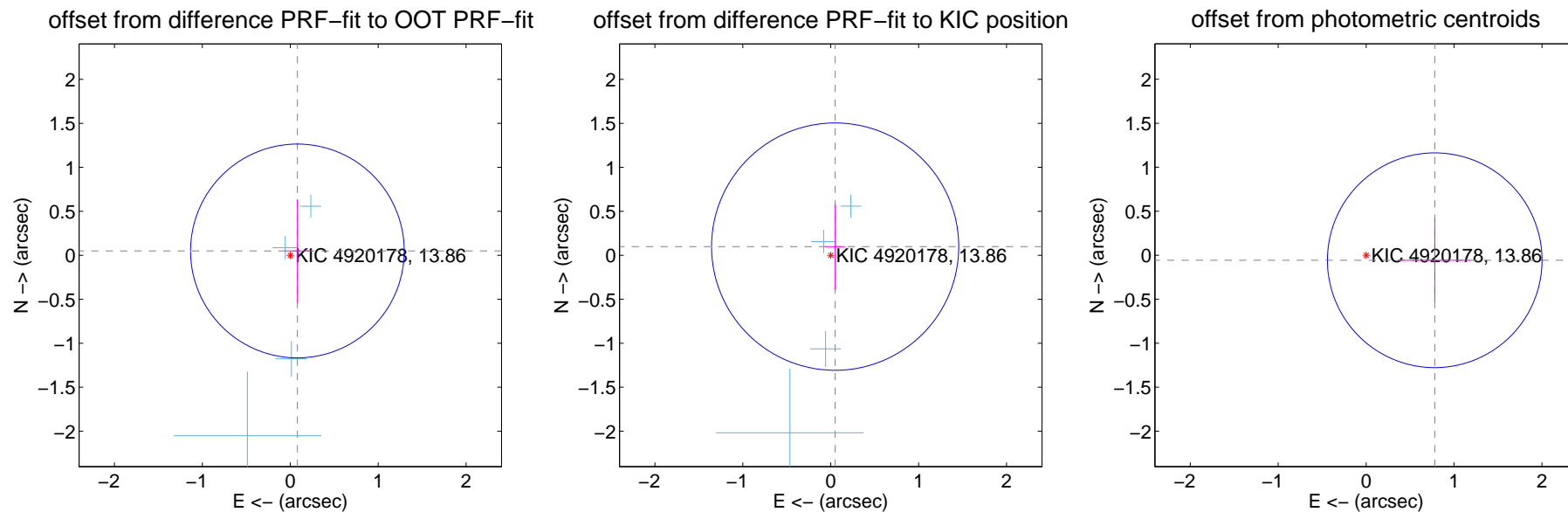
## DV Centroid Data

Supplemental centroid analysis for 004920178-02. Kepler magnitude: 13.86. 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 0.04 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.095 \pm 0.405$	0.23	$-0.081 \pm 0.144$	$0.049 \pm 0.586$
PRF-fit source offset from KIC position	$0.110 \pm 0.469$	0.24	$-0.050 \pm 0.116$	$0.098 \pm 0.485$
photometric centroid source offset	$0.78 \pm 0.41$	1.92	$-0.78 \pm 0.41$	$-0.06 \pm 0.47$

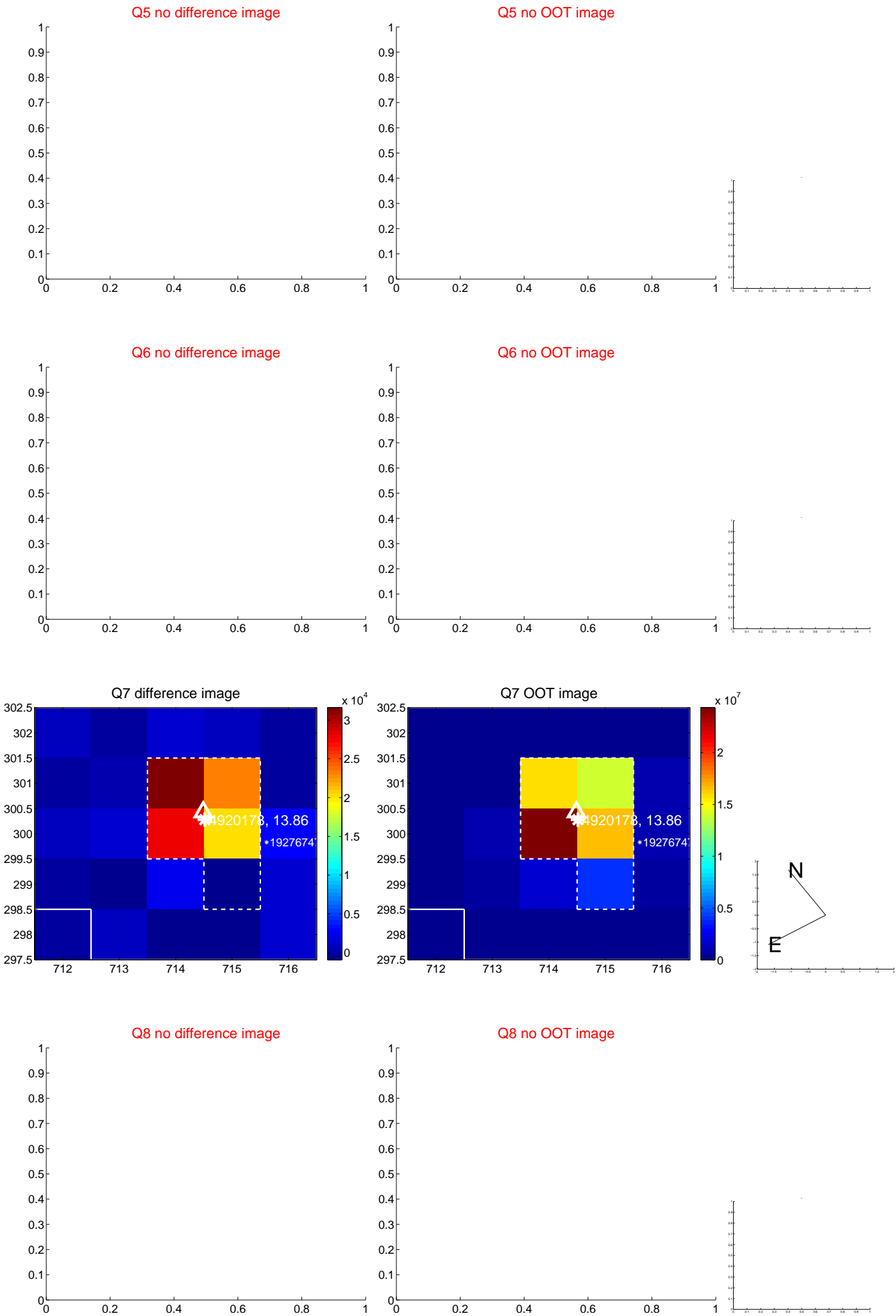


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

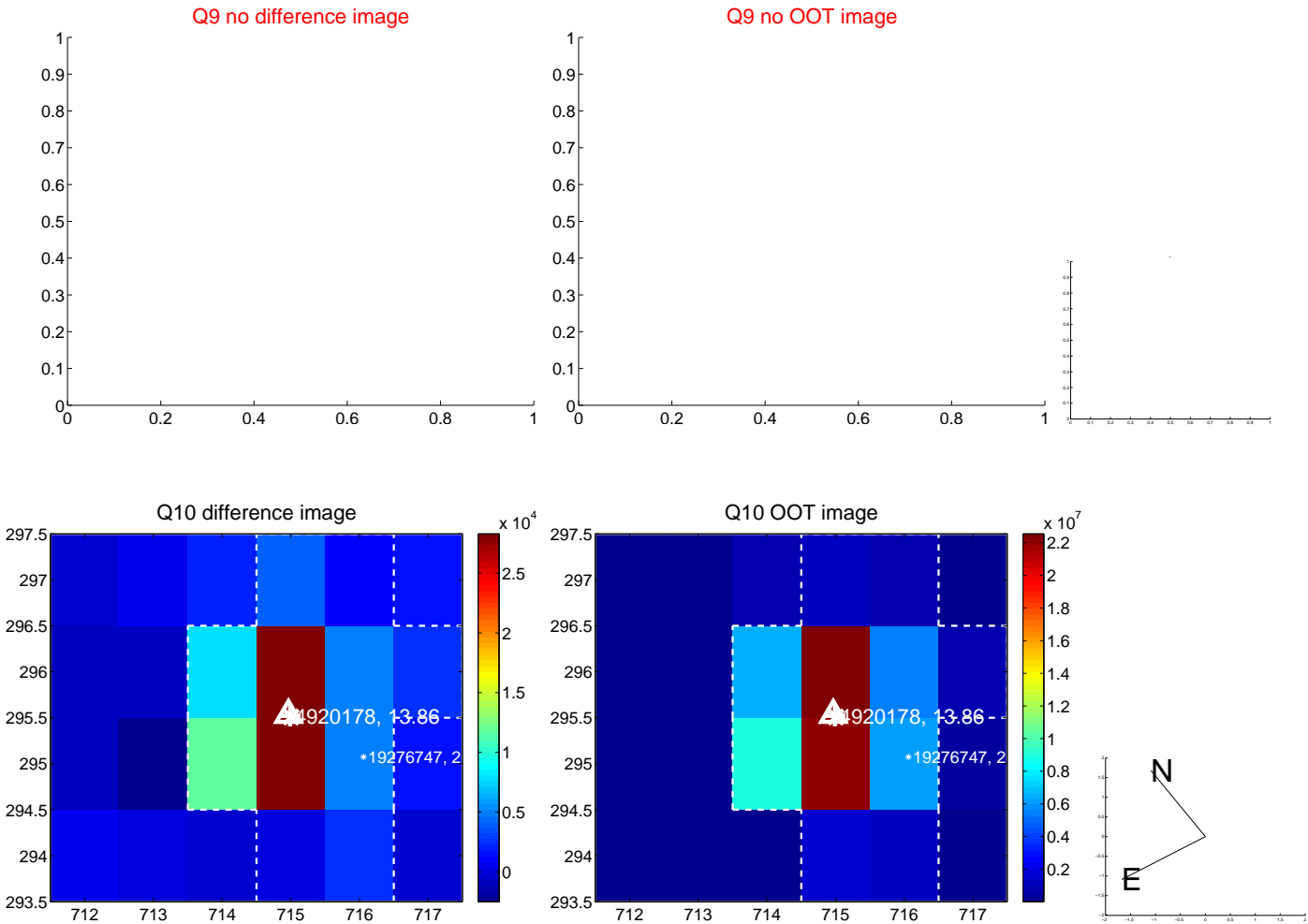
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



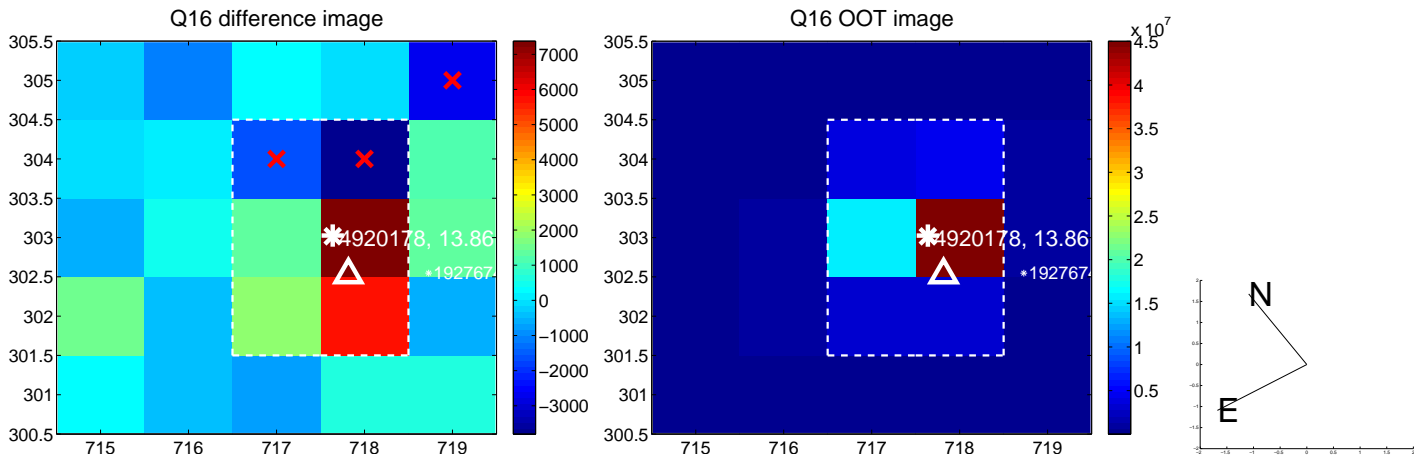
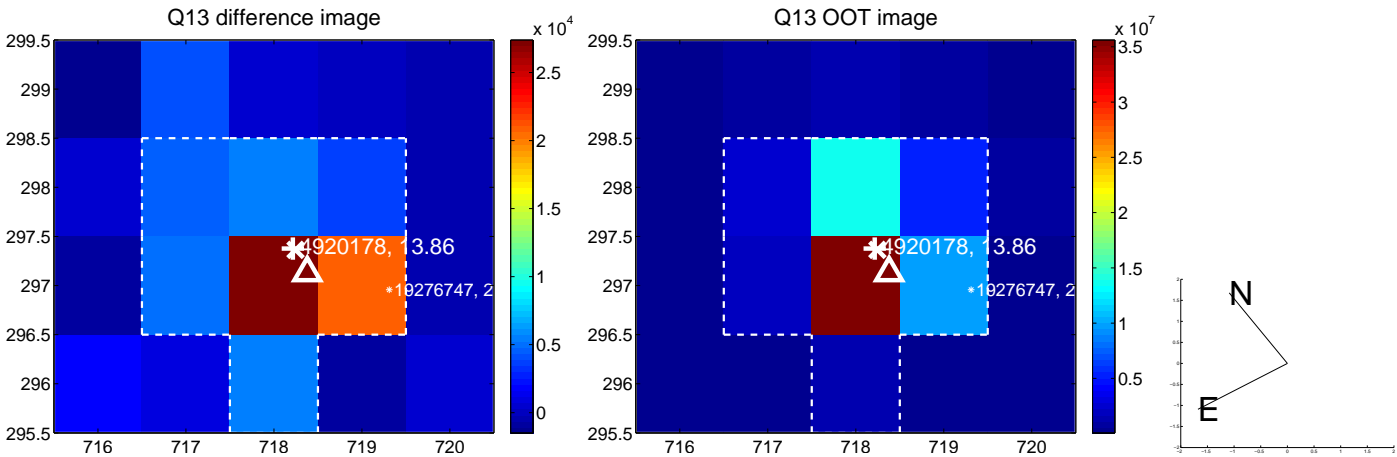
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



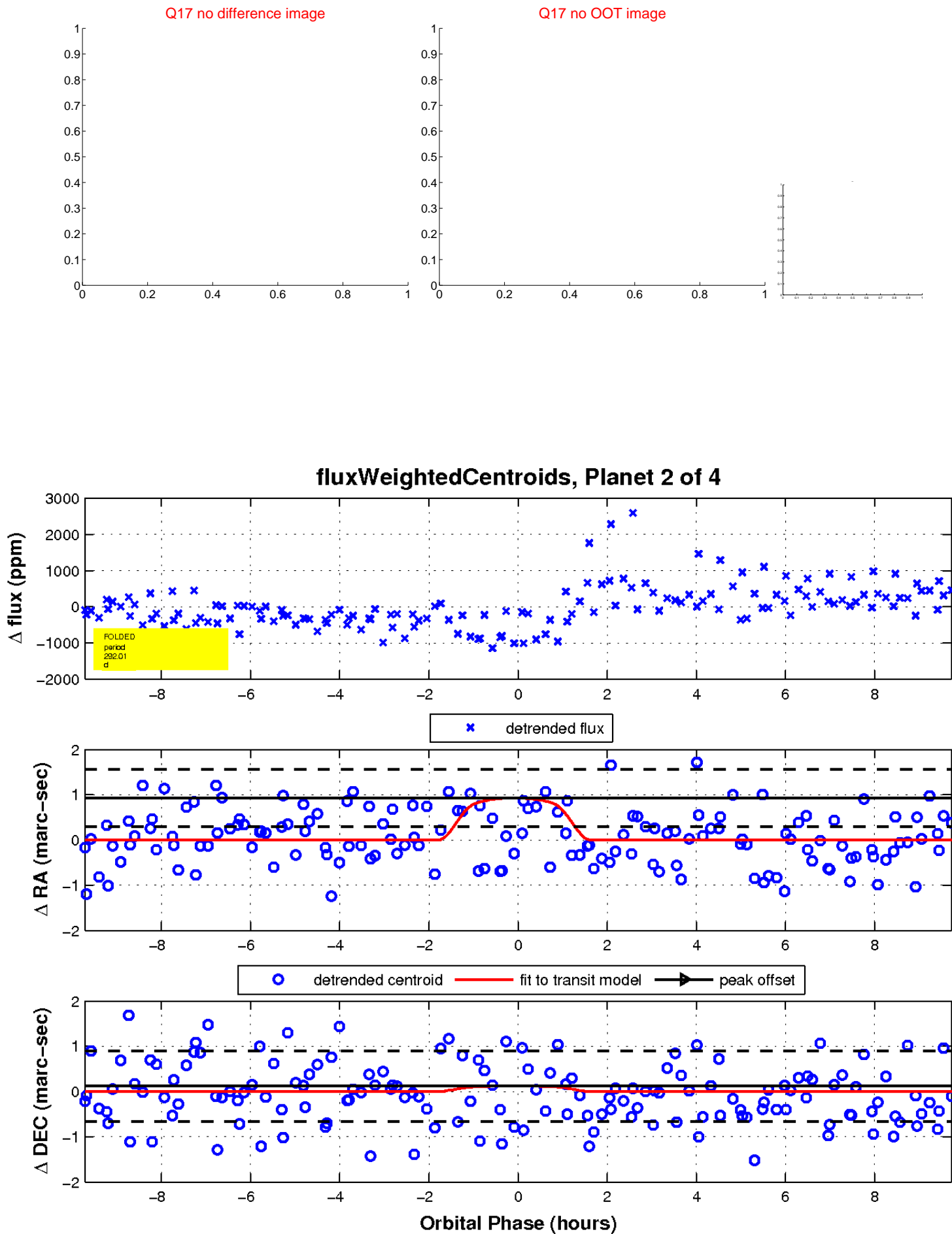
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

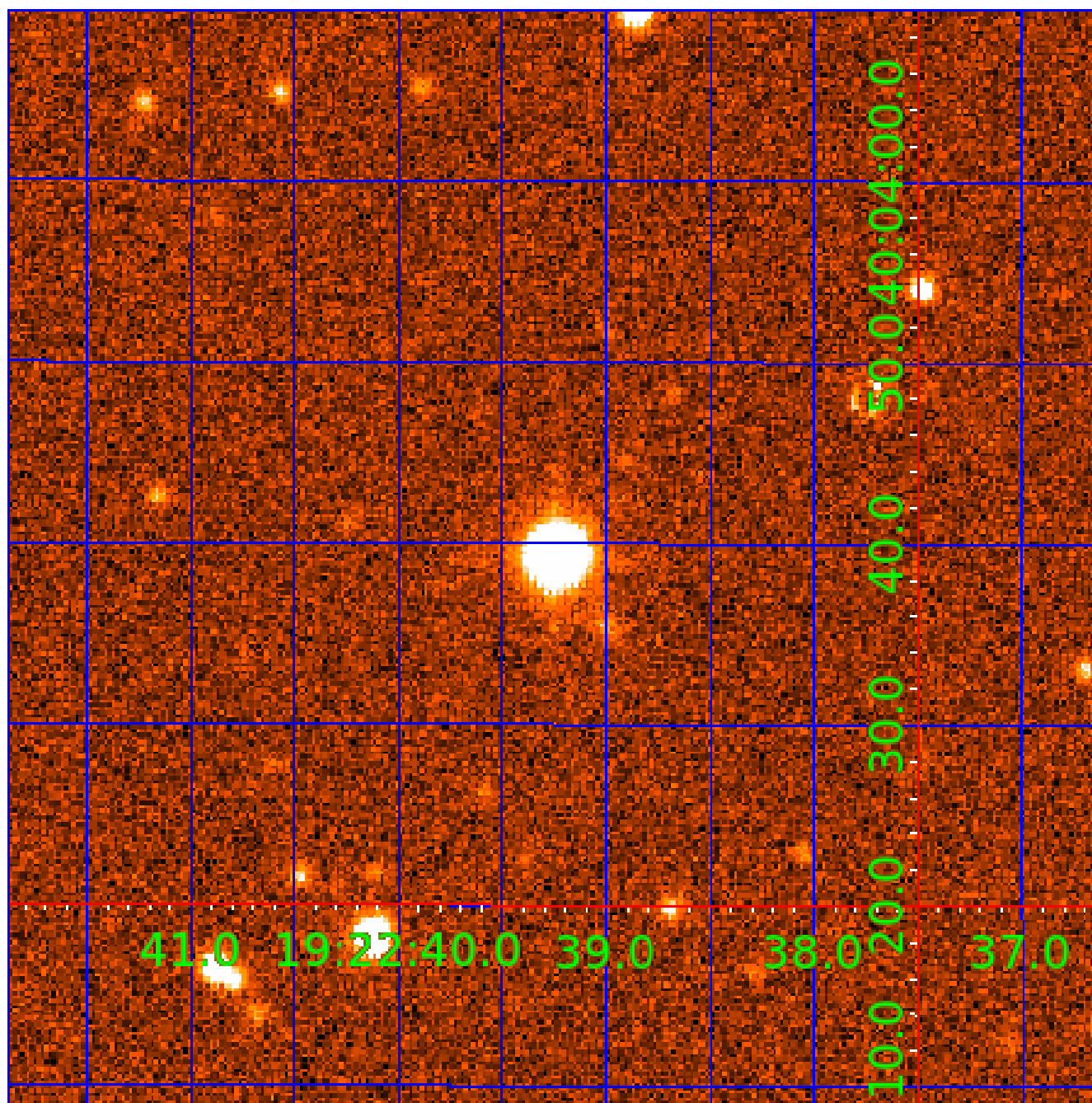


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination





# KIC 004920178

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
004920178-01	OBS	No	363.608228	279.534452	737.4	4.687	10.6	5.5	5.41	4617	14.26	12.16
004920178-02	OBS	No	292.007497	377.614656	1102.3	3.291	9.9	8.2	5.41	4617	22.86	16.29
004920178-03	OBS	No	566.717589	264.581231	1293.4	5.835	12.4	6.9	5.41	4617	21.63	6.73
004920178-04	OBS	No	682.284249	150.734964	721.0	2.880	9.1	4.9	5.41	4617	13.98	5.25

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
004920178-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_SKYE—ALL_TRANS_CHASES—INCONSISTENT_TRANS
004920178-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_POS_DV—INCONSISTENT_TRANS
004920178-03	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
004920178-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_SKYE_TRACKER—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—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.

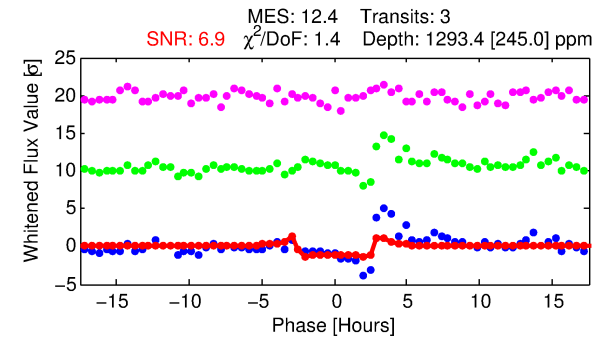
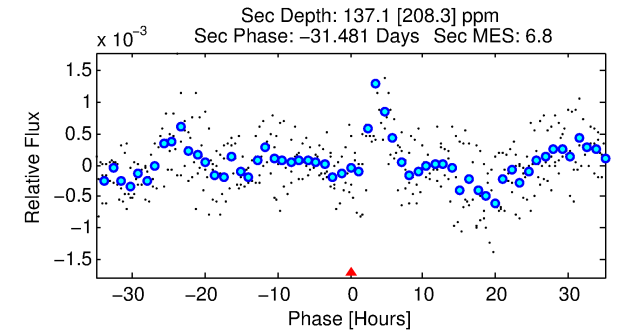
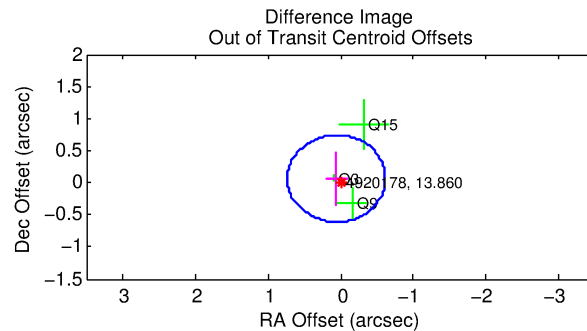
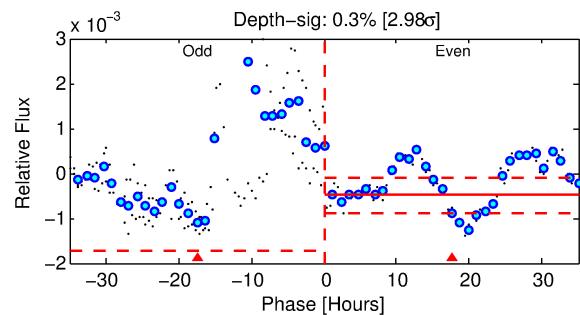
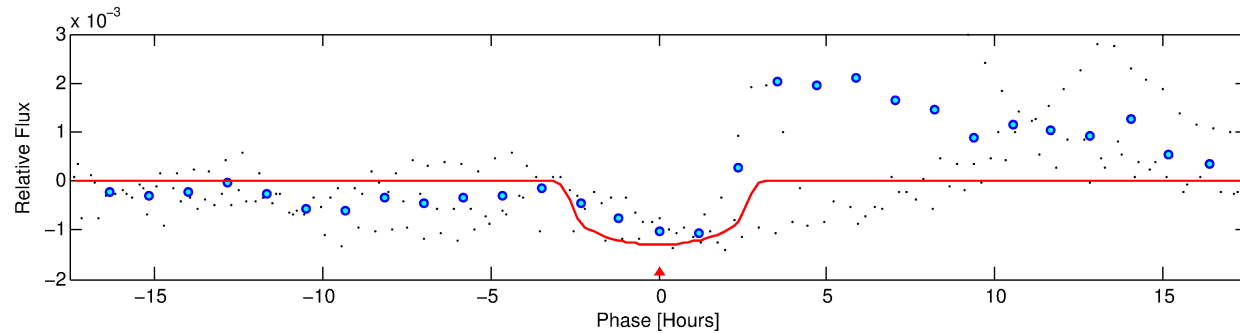
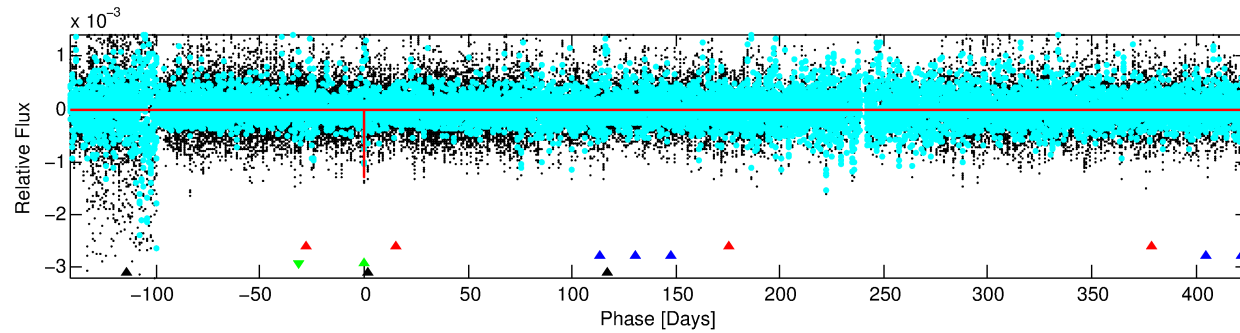
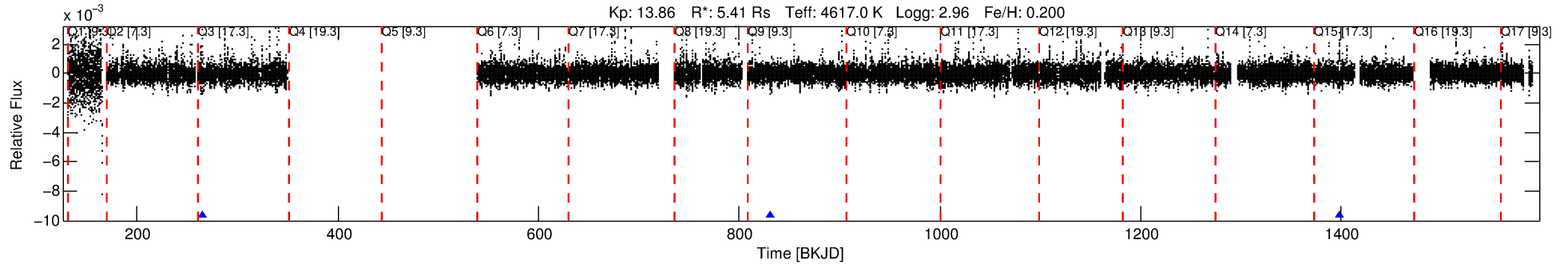
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 004920178-03

No Significant Match Found

# DV One-Page Summary

KIC: 4920178 Candidate: 3 of 4 Period: 566.718 d



## DV Fit Results:

Period = 566.71759 [0.00486] d  
Epoch = 264.5812 [0.0072] BKJD  
Rp/R\* = 0.0366 [0.0098]  
a/R\* = 507.11 [387.00]  
b = 0.78 [0.39]  
Seff = 6.73 [5.12]  
Teq = 411 [78] K  
Rp = 21.63 [16.97] Re  
a = 1.3308 [0.7556] AU  
Ag = 285.45 [507.36] [0.56 $\sigma$ ]  
Teffp = 2610 [1054] K [2.08 $\sigma$ ]

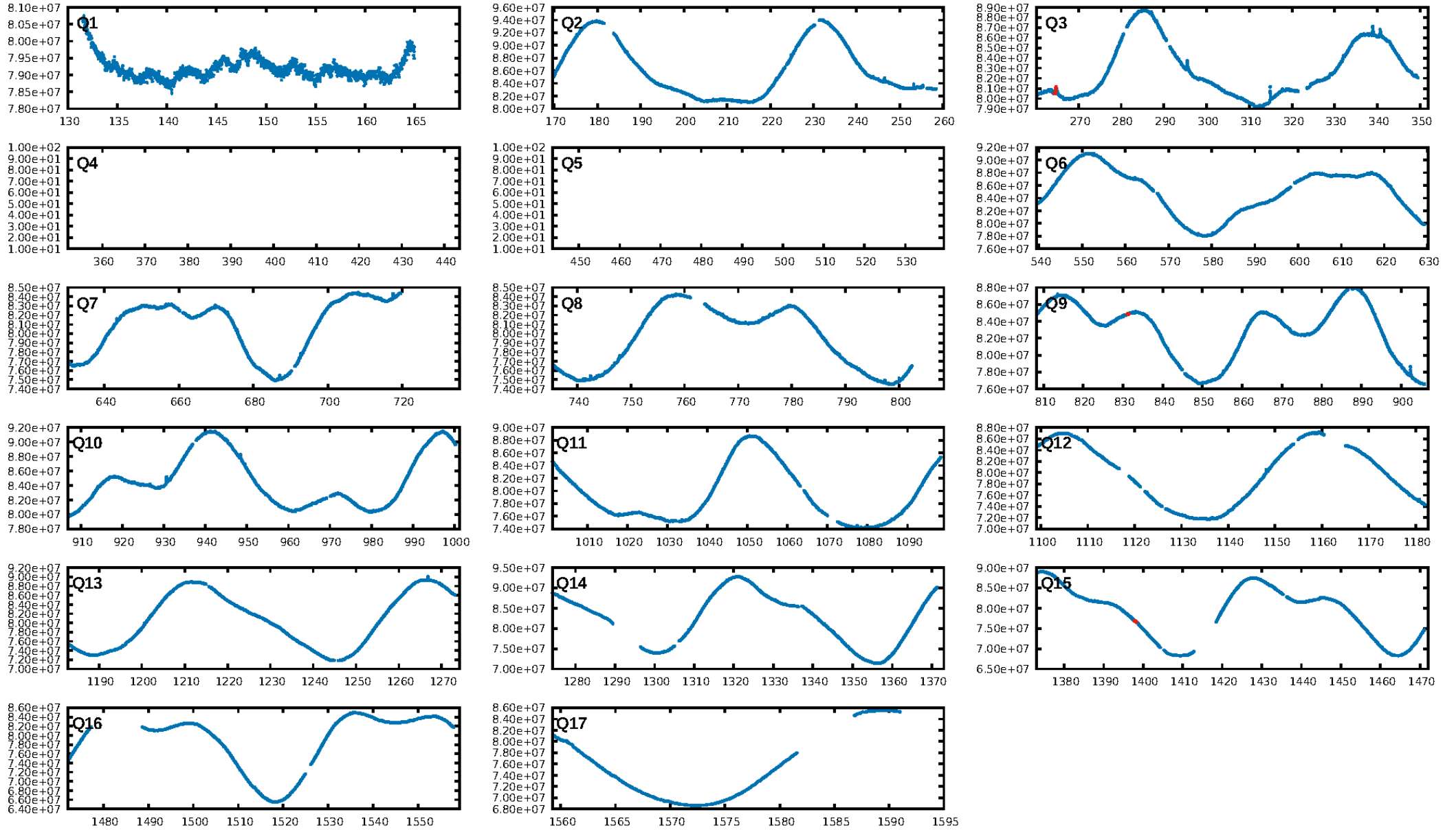
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [651.36 $\sigma$ ]  
LongPeriod-sig: 100.0% [426.28 $\sigma$ ]  
ModelChiSquare2-sig: 0.1%  
ModelChiSquareGof-sig: 67.7%  
Bootstrap-pfa: 6.99e-11  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: 0.7214  
Centroid-sig: 19.7%  
Centroid-so: 0.330 arcsec [0.99 $\sigma$ ]  
OotOffset-rm: 0.087 arcsec [0.39 $\sigma$ ]  
KicOffset-rm: 0.101 arcsec [0.48 $\sigma$ ]  
OotOffset-st: 0/2/0/1 [3]  
KicOffset-st: 0/2/0/1 [3]  
DiffImageQuality-fgm: 1.00 [3/3]  
DiffImageOverlap-fno: 1.00 [3/3]

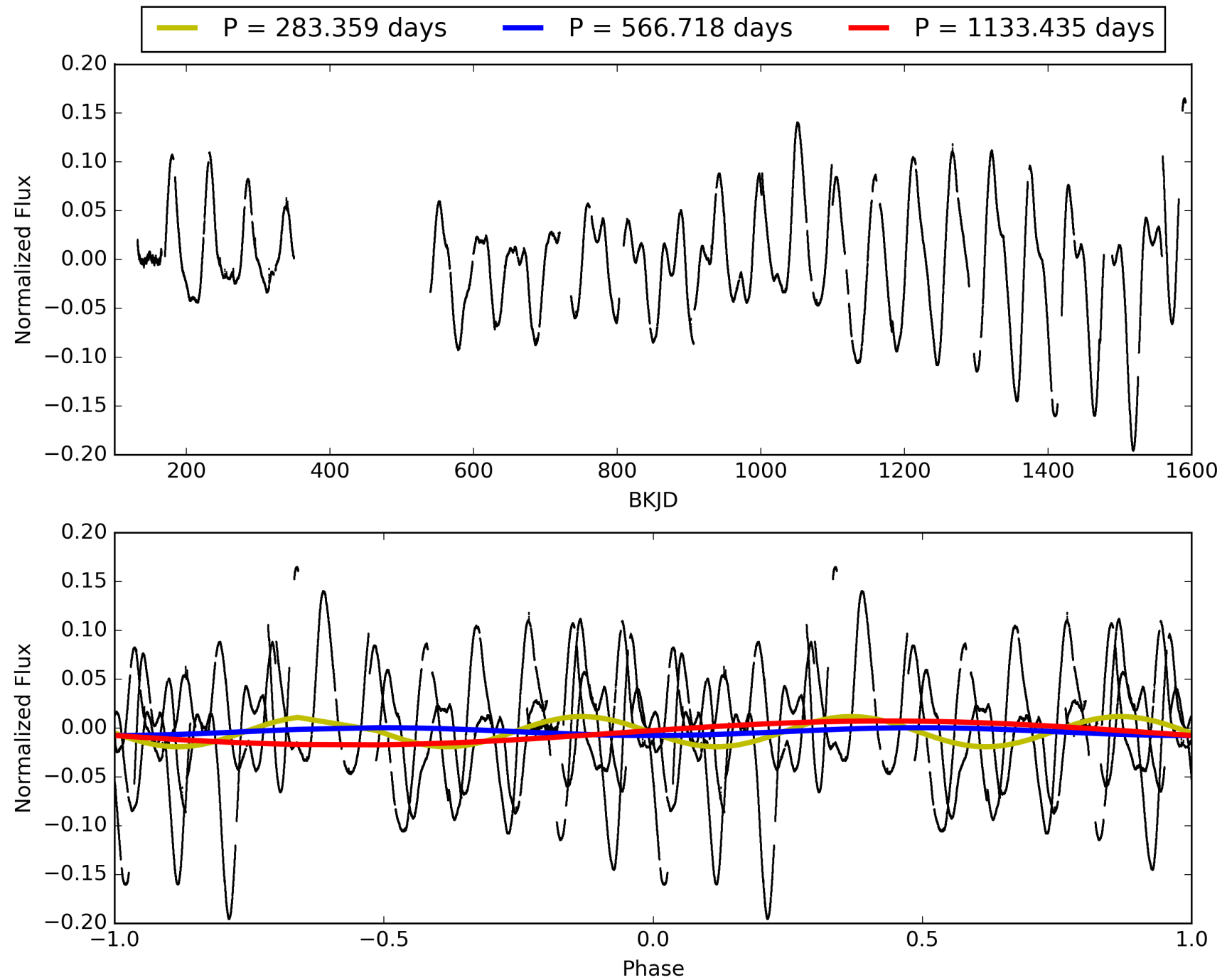
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 08:44:21 Z

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

# TCE 004920178-03, PDC Light Curves

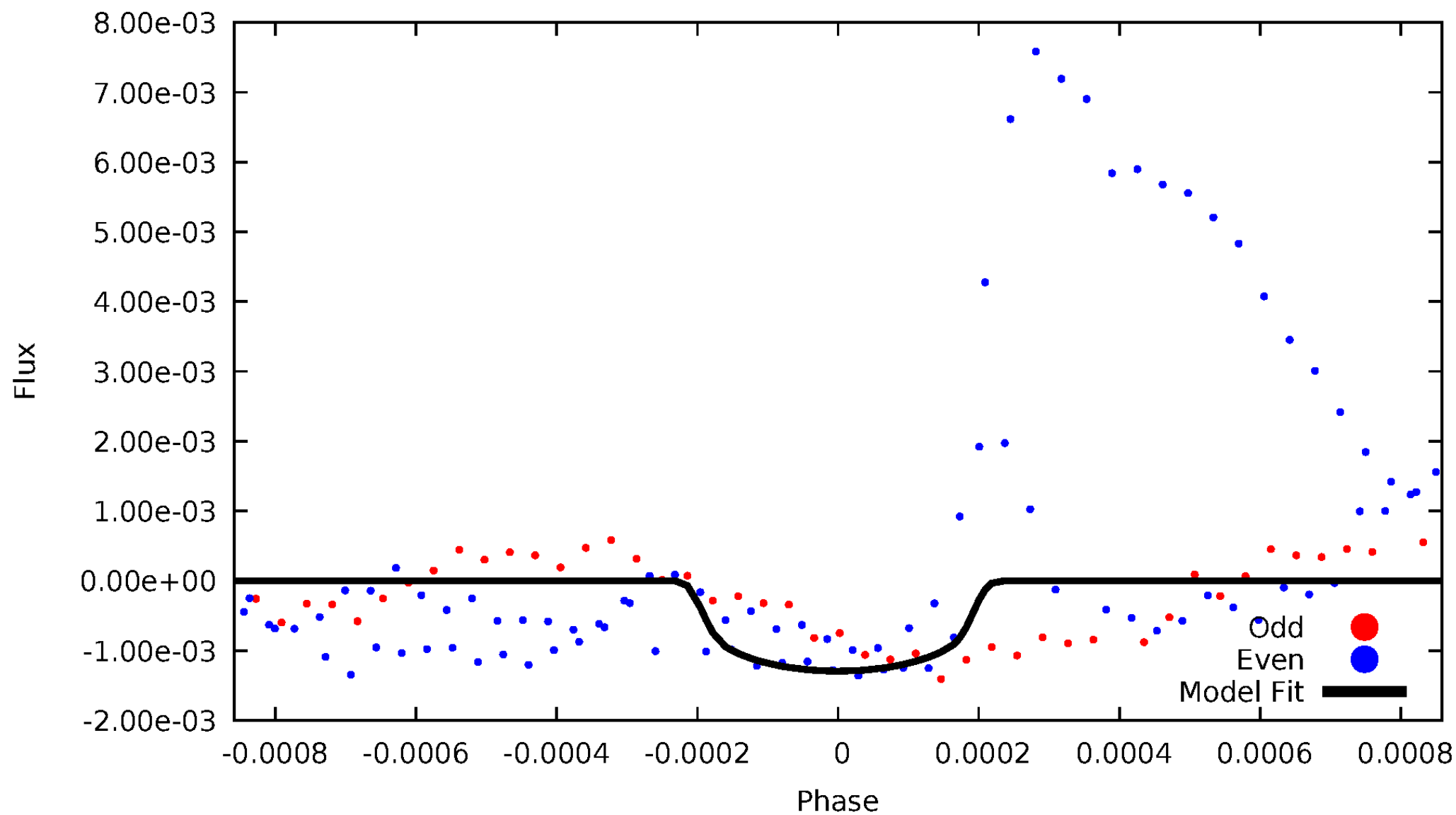


# TCE 004920178-03



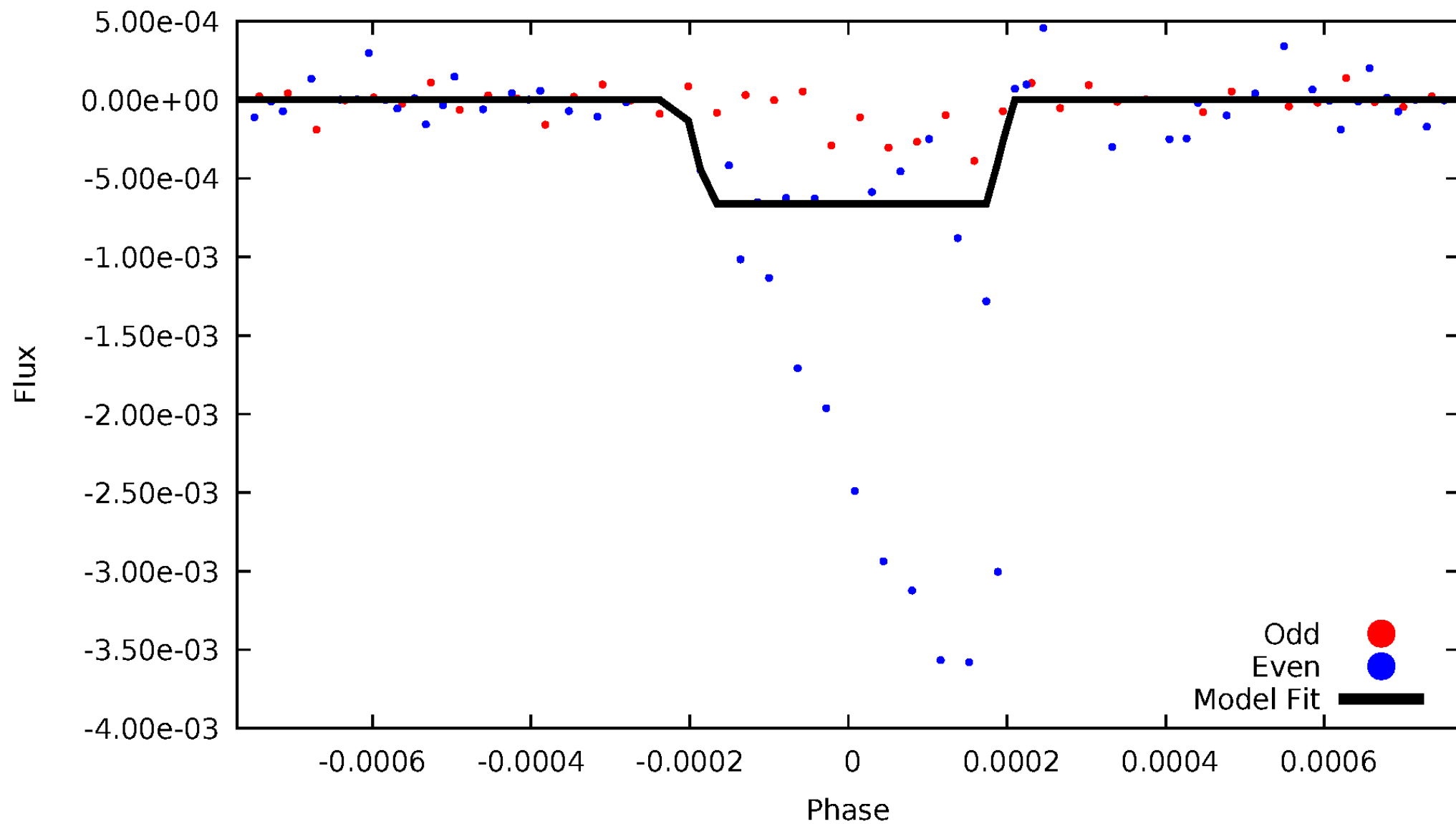
# DV Odd/Even

TCE 004920178-03

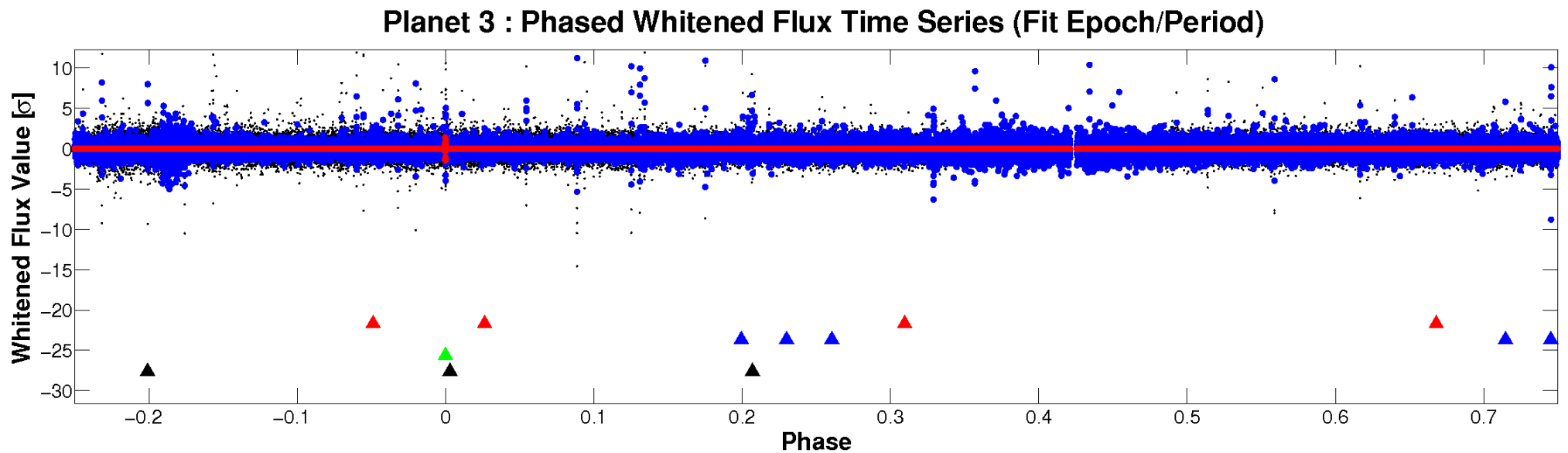
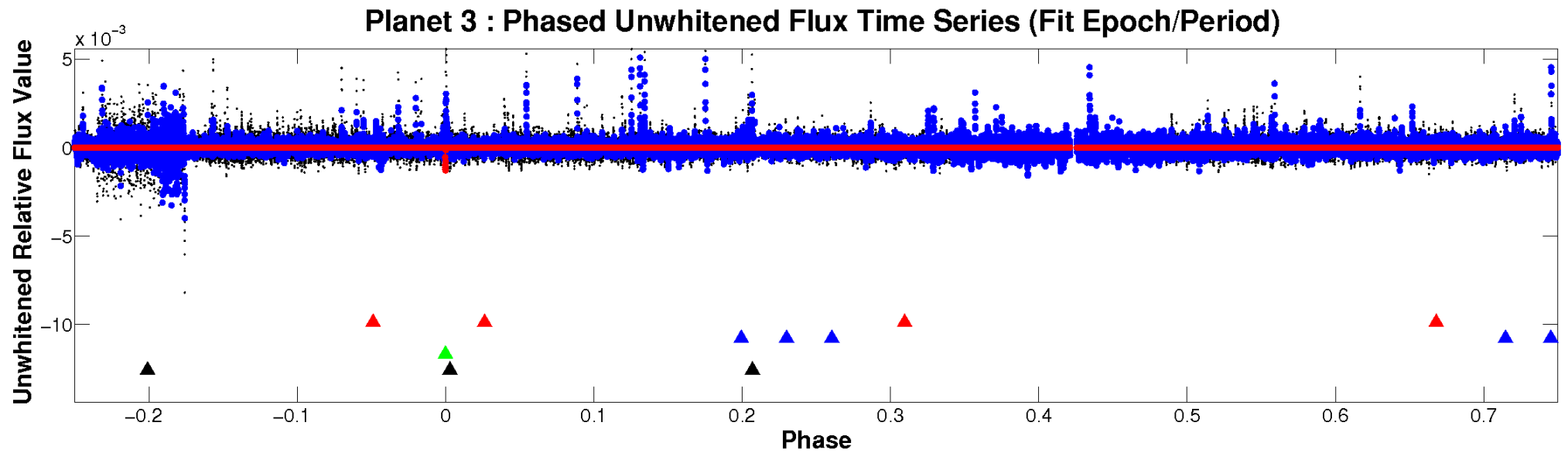


# ALT Odd/Even

TCE 004920178-03

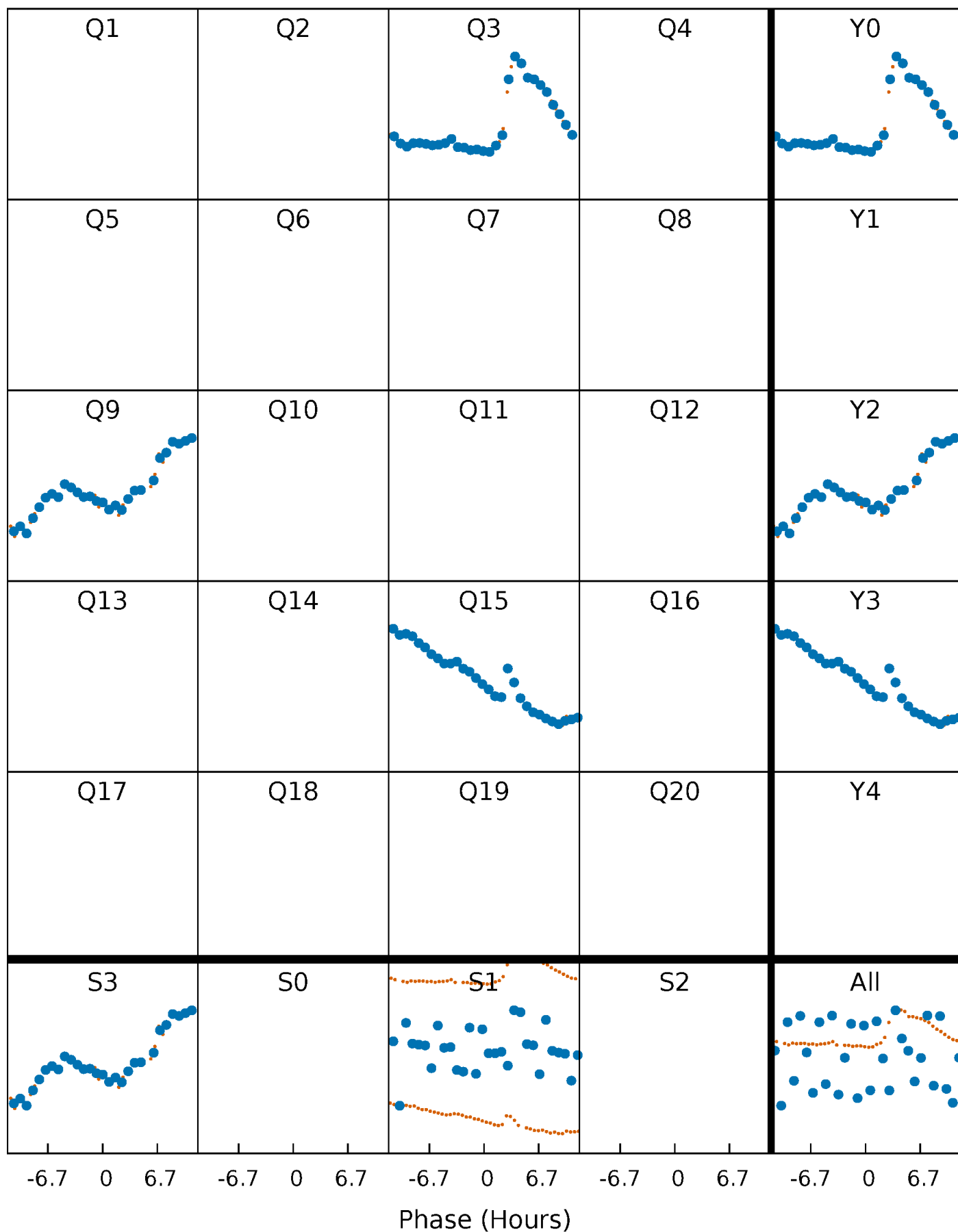


# Non-Whitened Vs. Whitened Light Curve



# PDC Quarter-Phased Transit Curves

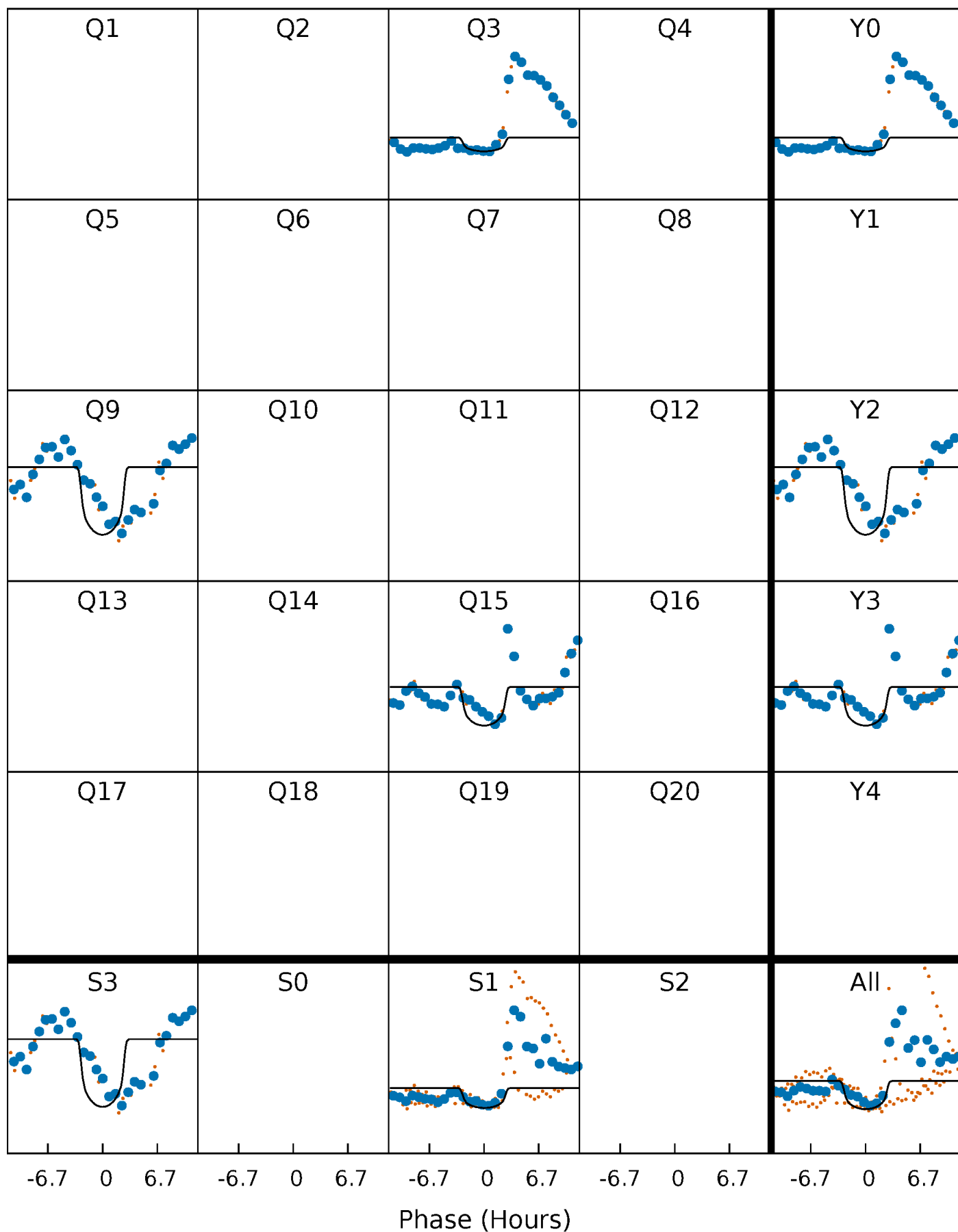
TCE 004920178-03 P=566.717589 Days  $T_0=264.581231$  (BKJD)





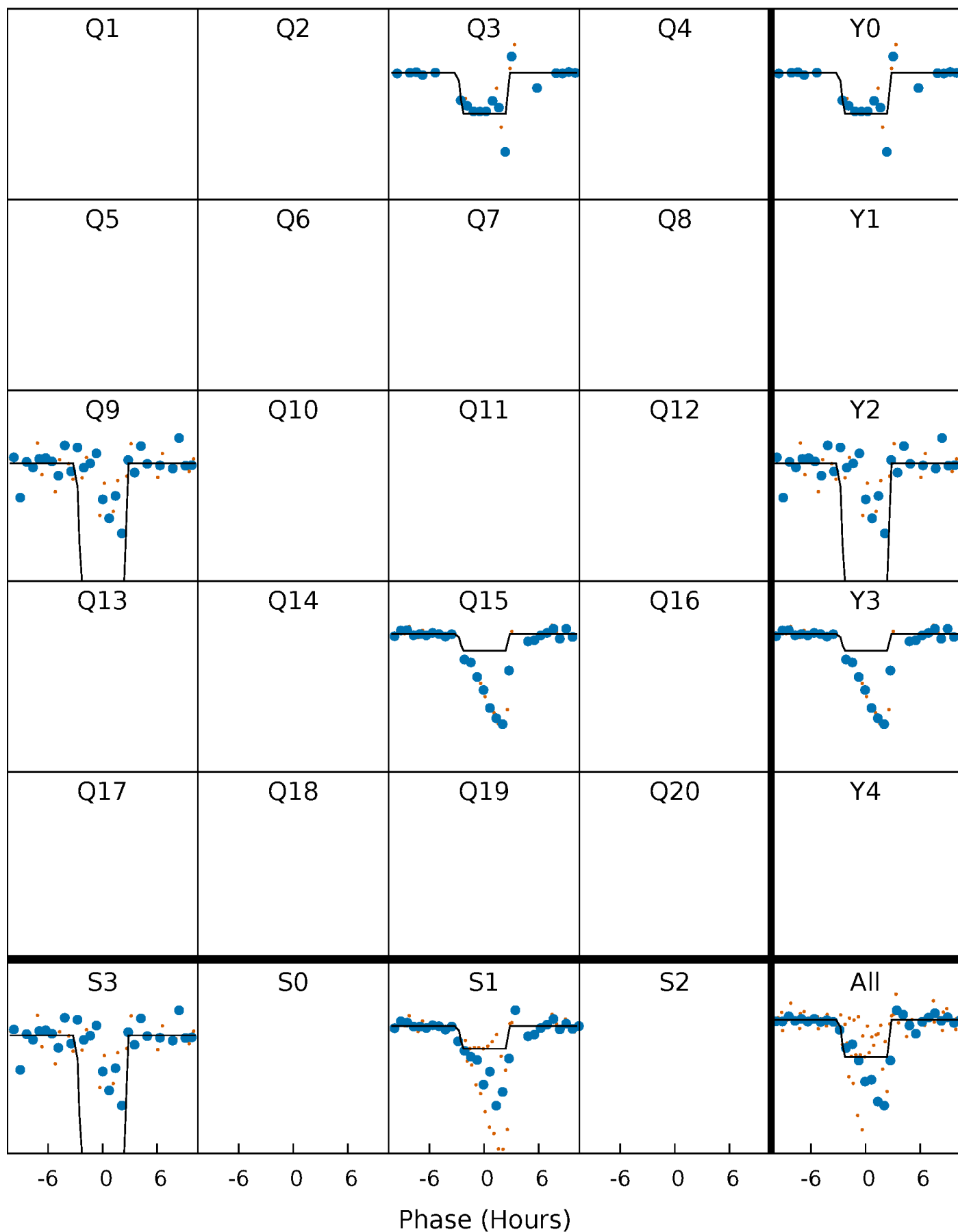
# DV Quarter-Phased Transit Curves

TCE 004920178-03 P=566.717589 Days  $T_0=264.581231$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

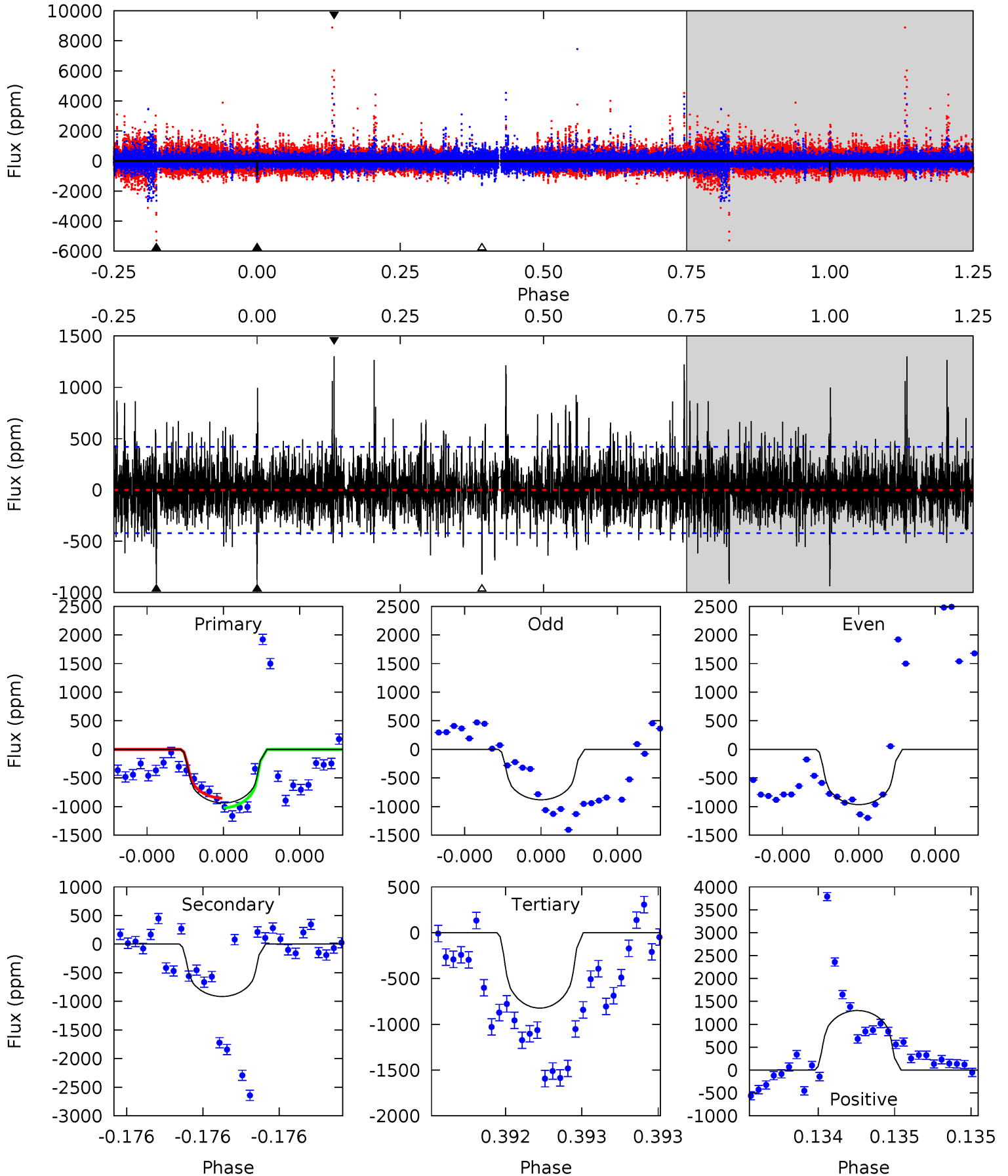
TCE 004920178-03 P=566.711164 Days  $T_0=264.580651$  (BKJD)



# DV Model-Shift Uniqueness Test

004920178-03, P = 566.717589 Days, E = 264.581231 Days

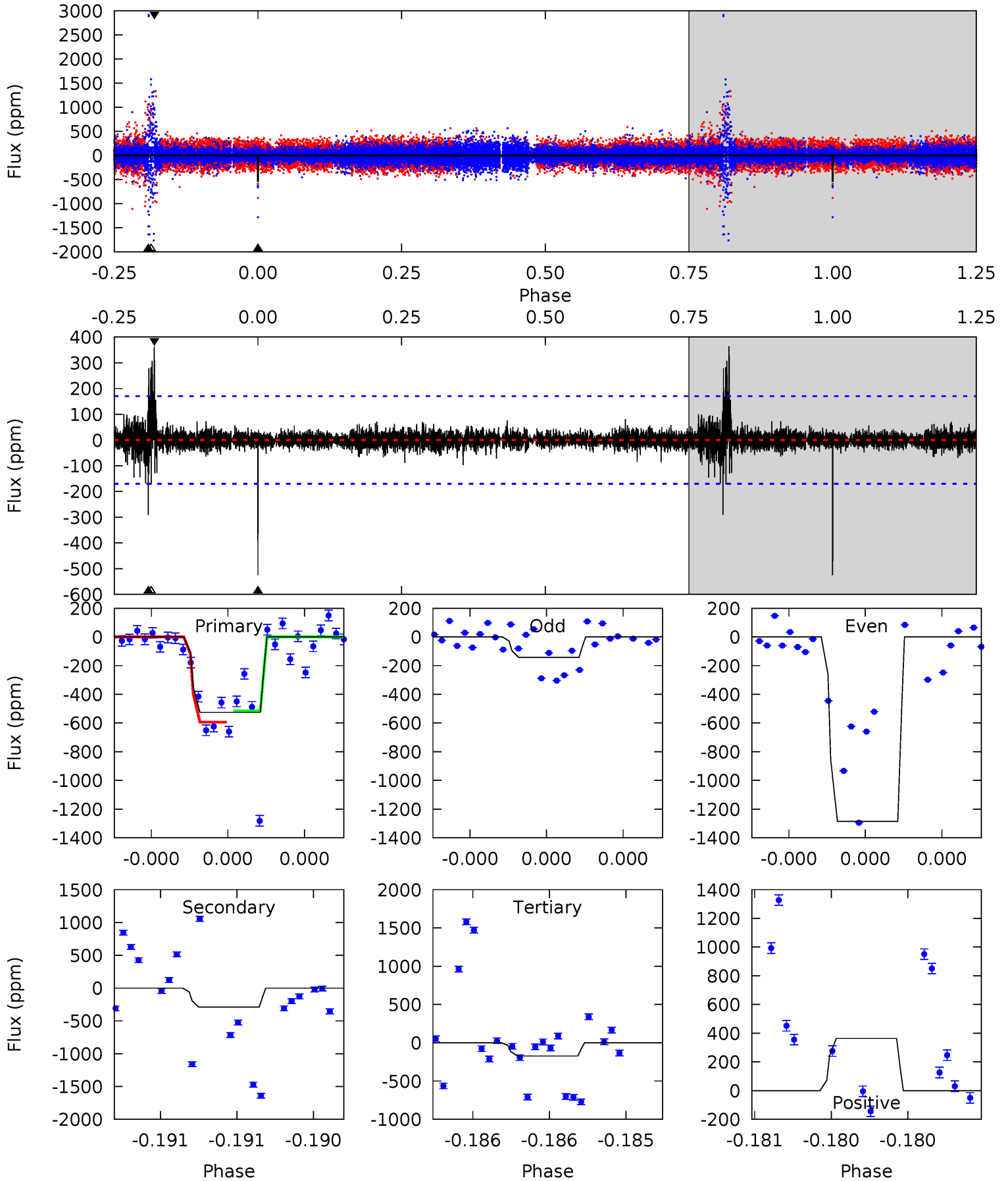
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
12.5	12.2	11.0	17.3	5.61	3.53	2.66	1.51	-4.84	1.22	-5.13	0.48	1.04	0.58	1.12



# Alt Model-Shift Uniqueness Test

004920178-03, P = 566.711164 Days, E = 264.580651 Days

Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
17.3	9.57	5.69	12.0	5.61	3.53	0.66	11.6	5.34	3.88	-2.39	22.9	1.70	0.41	1.24



### Stellar Parameters For KIC 004920178

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$4617^{+138}_{-103}$	$2.962^{+0.370}_{-0.370}$	$0.200^{+0.200}_{-0.200}$	$5.411^{+3.990}_{-1.710}$	$0.977^{+0.359}_{-0.040}$	$0.009^{+0.023}_{-0.006}$
	+3%/-2%	+12%/-12%	+100%/-100%	+74%/-32%	+37%/-4%	+263%/-69%
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 004920178-03 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-915 \pm 75$	$21.74^{+11.14}_{-7.25}$	$573^{+86}_{-59}$	$4302^{+615}_{-367}$	$1973^{+2336}_{-1077}$
Alt.	$-291 \pm 30$	$15.47^{+8.54}_{-6.39}$	$571^{+95}_{-57}$	$3946^{+815}_{-390}$	$1232^{+2474}_{-717}$

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

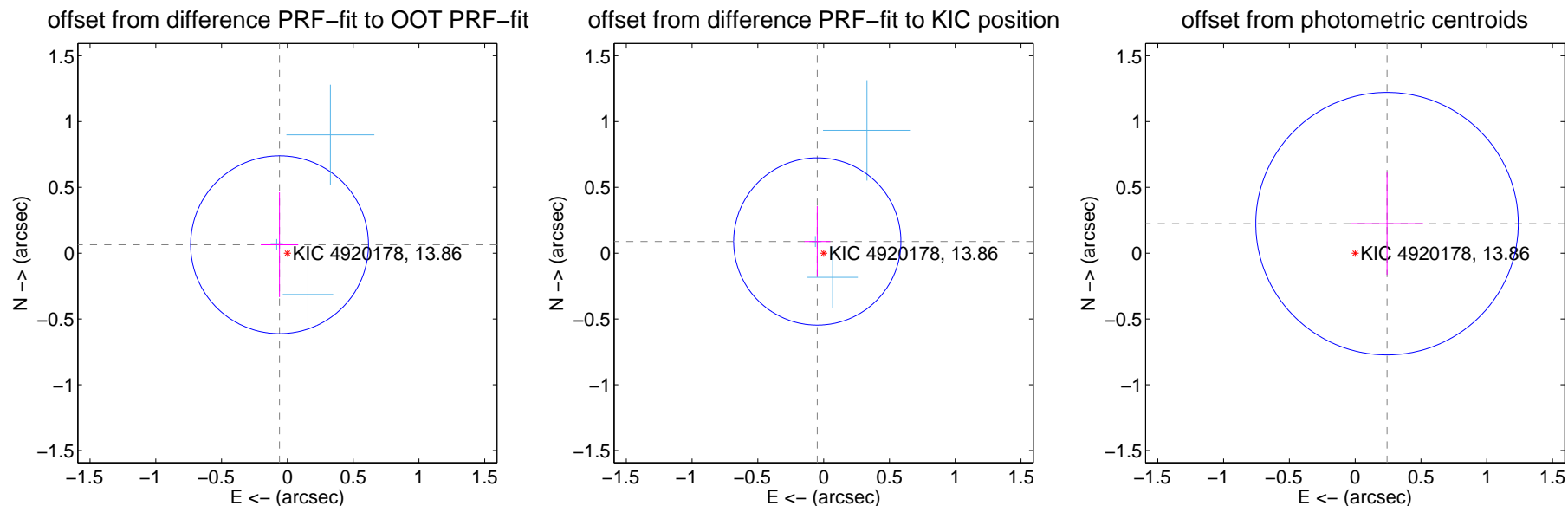
## DV Centroid Data

Supplemental centroid analysis for 004920178-03. Kepler magnitude: 13.86. Transit SNR 6.86

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	$0.087 \pm 0.225$	0.39	$0.060 \pm 0.142$	$0.064 \pm 0.398$
PRF-fit source offset from KIC position	$0.101 \pm 0.212$	0.48	$0.048 \pm 0.098$	$0.089 \pm 0.268$
photometric centroid source offset	$0.33 \pm 0.33$	0.99	$-0.24 \pm 0.28$	$0.22 \pm 0.39$



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.

Q1 no difference image



Q1 no OOT image



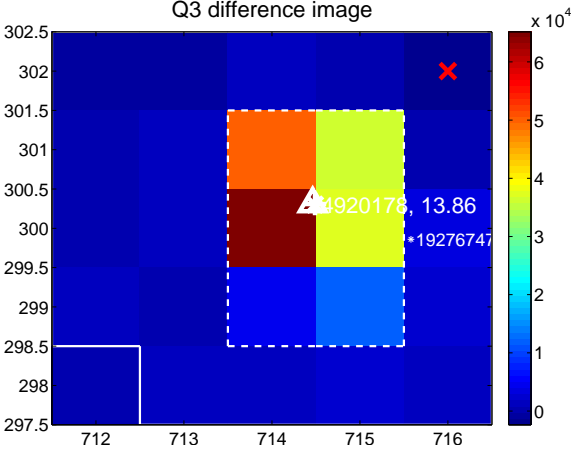
Q2 no difference image



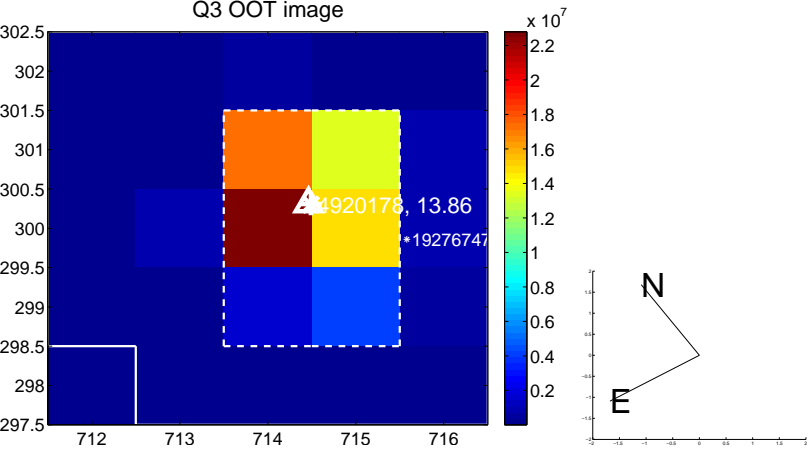
Q2 no OOT image



Q3 difference image



Q3 OOT image



Q4 no difference image



Q4 no OOT image

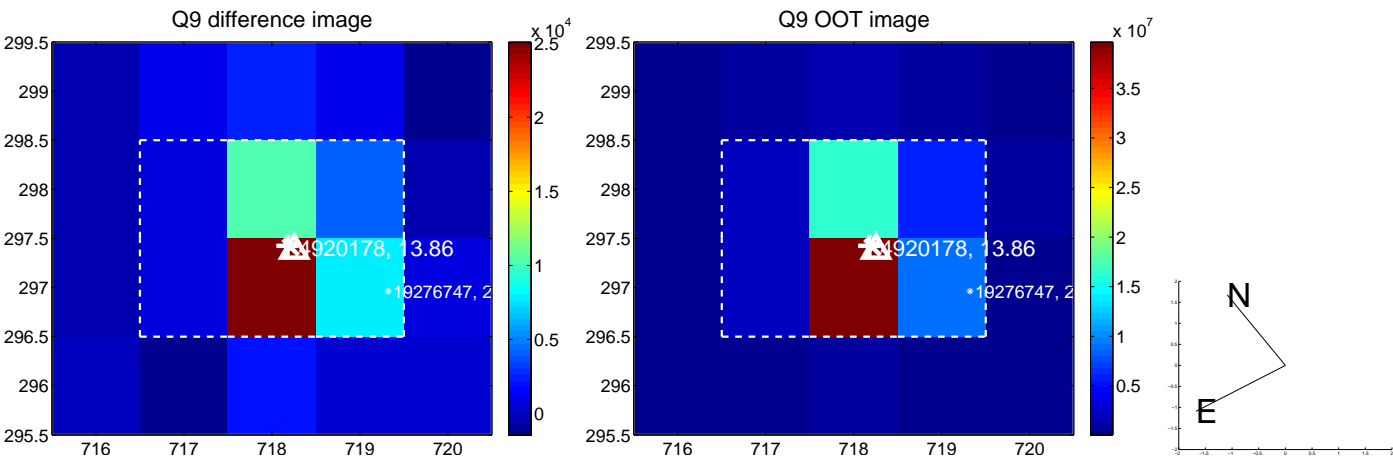


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

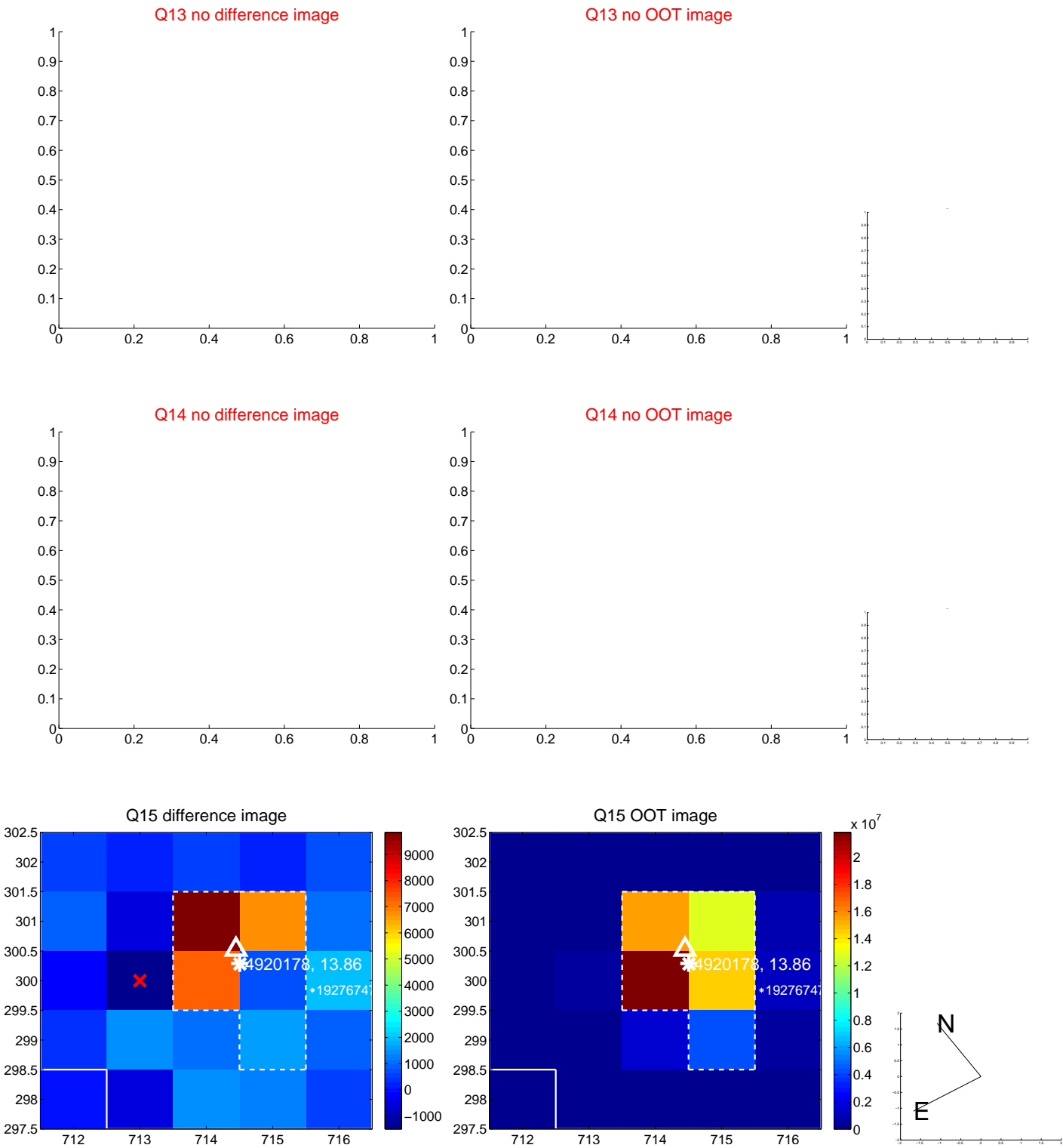




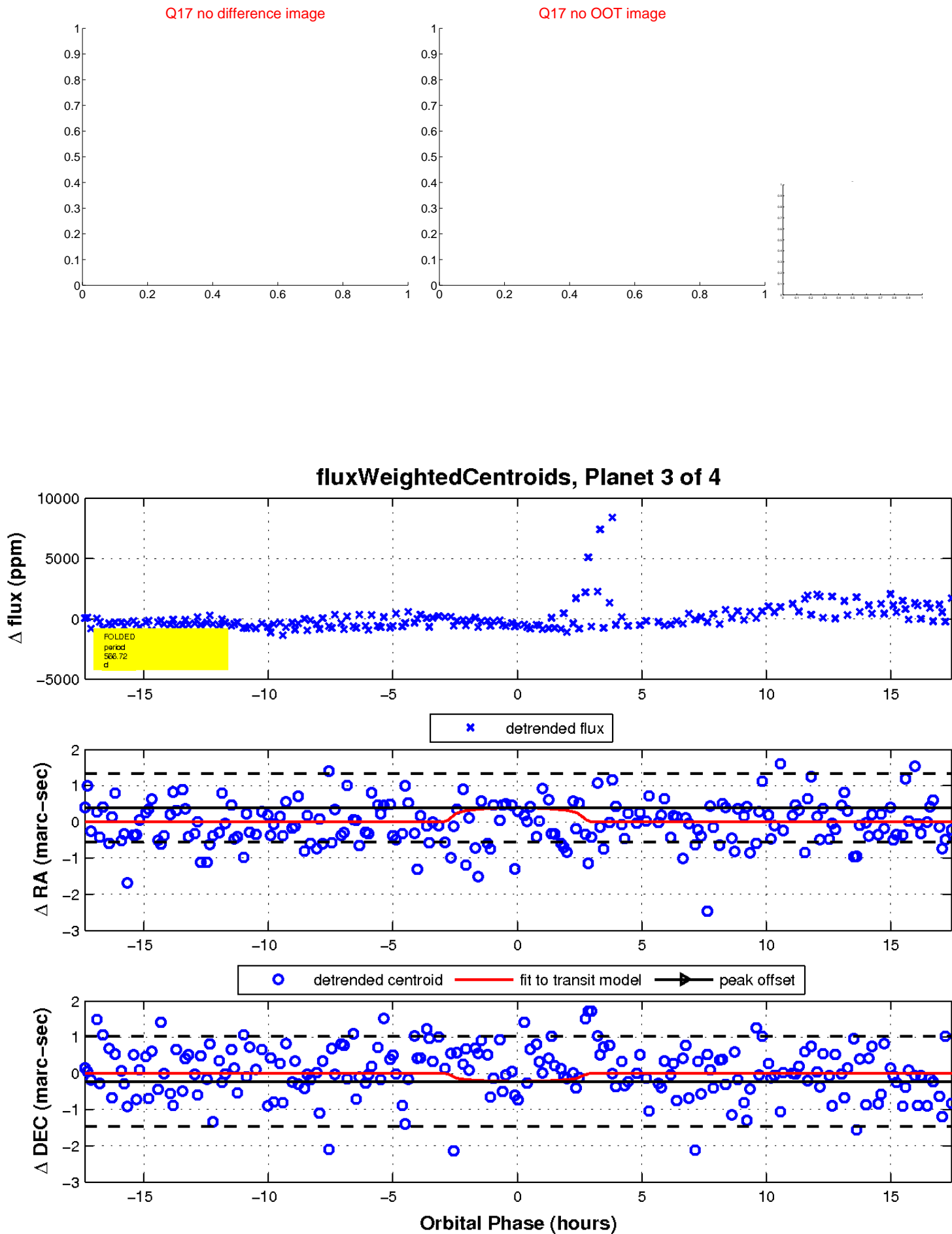
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

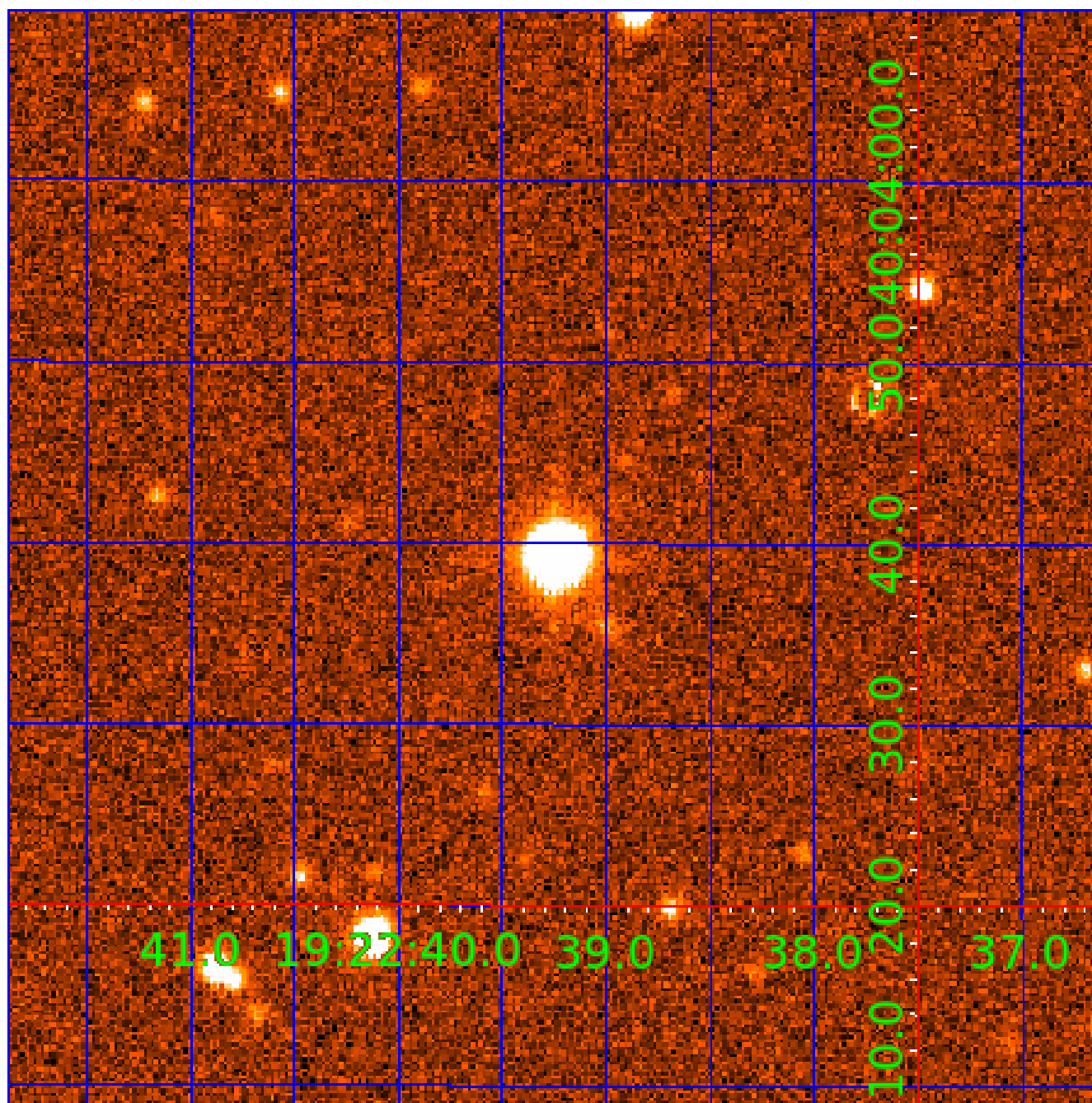


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 004920178

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
004920178-01	OBS	No	363.608228	279.534452	737.4	4.687	10.6	5.5	5.41	4617	14.26	12.16
004920178-02	OBS	No	292.007497	377.614656	1102.3	3.291	9.9	8.2	5.41	4617	22.86	16.29
004920178-03	OBS	No	566.717589	264.581231	1293.4	5.835	12.4	6.9	5.41	4617	21.63	6.73
004920178-04	OBS	No	682.284249	150.734964	721.0	2.880	9.1	4.9	5.41	4617	13.98	5.25

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
004920178-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_SKYE—ALL_TRANS_CHASES—INCONSISTENT_TRANS
004920178-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_POS_DV—INCONSISTENT_TRANS
004920178-03	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
004920178-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL_SKYE_TRACKER—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—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.

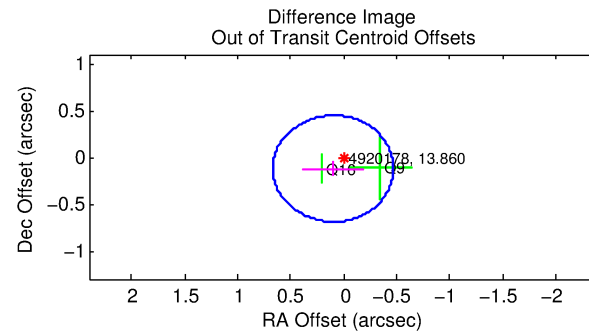
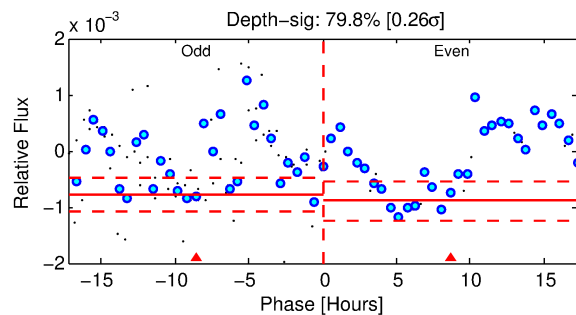
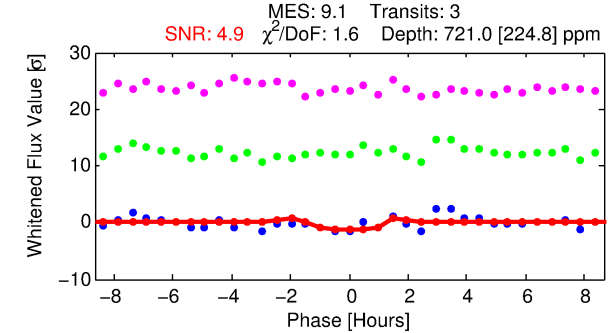
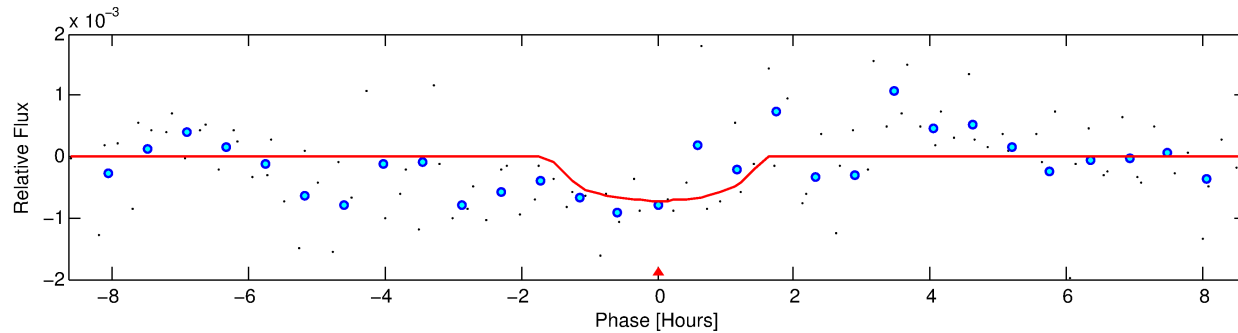
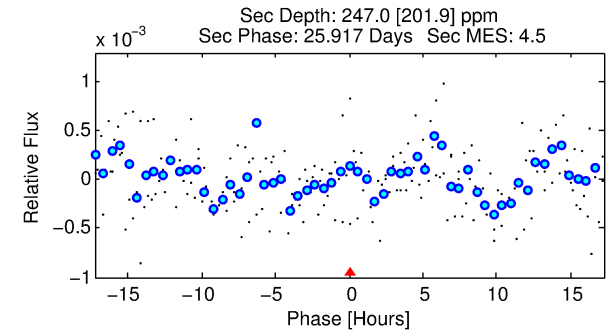
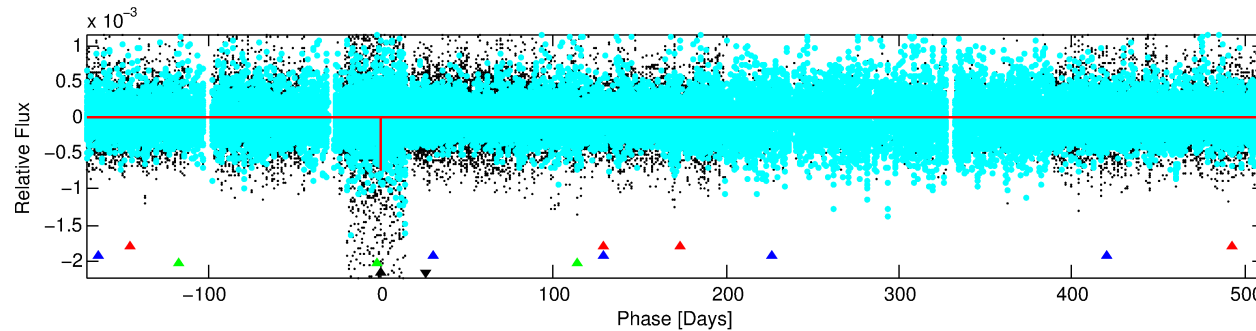
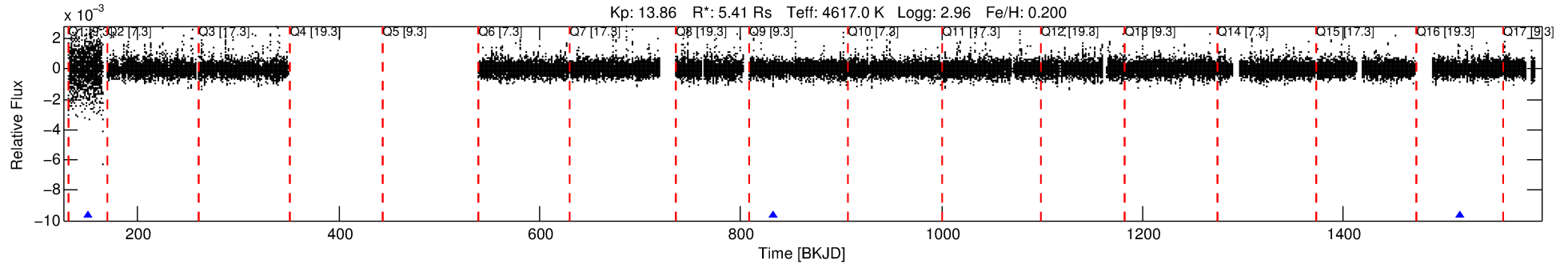
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 004920178-04

No Significant Match Found

# DV One-Page Summary

KIC: 4920178 Candidate: 4 of 4 Period: 682.284 d



## DV Fit Results:

Period = 682.28425 [0.00659] d  
Epoch = 150.7350 [0.0138] BKJD  
Rp/R\* = 0.0237 [0.1025]  
a/R\* = 1816.95 [22912.54]  
b = 0.20 [61.93]  
Seff = 5.25 [4.00]  
Teq = 386 [73] K  
Rp = 13.98 [61.41] Re  
a = 1.5061 [0.8551] AU  
Ag = 1577.72 [13777.97] [0.11σ]  
Teffp = 3762 [8184] K [0.41σ]

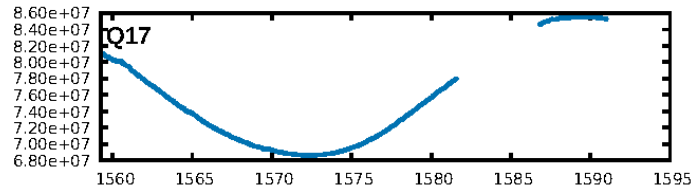
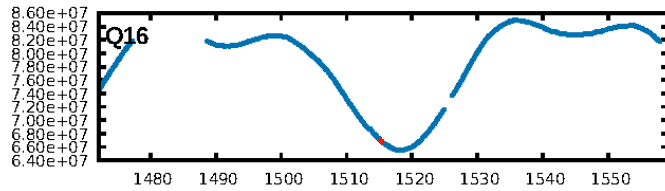
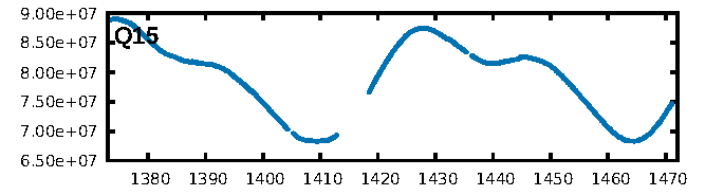
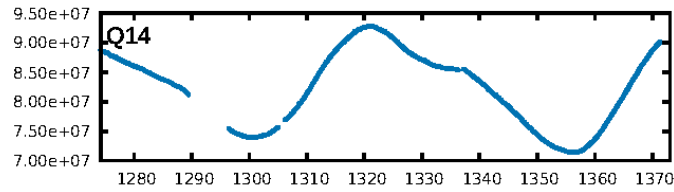
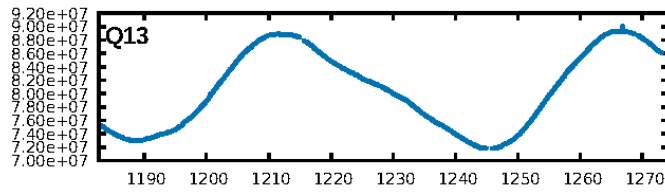
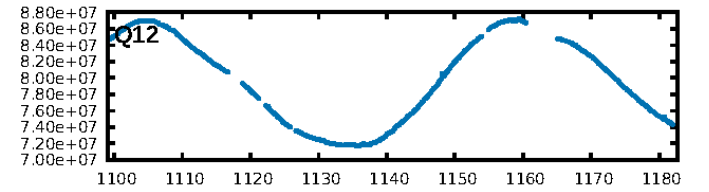
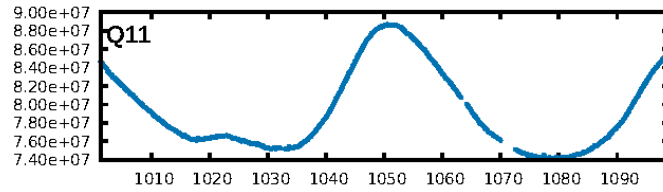
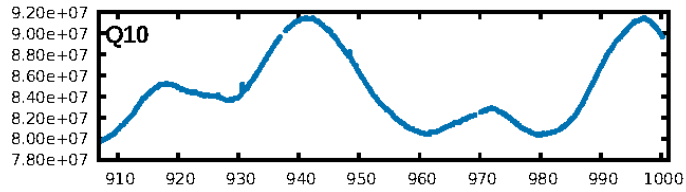
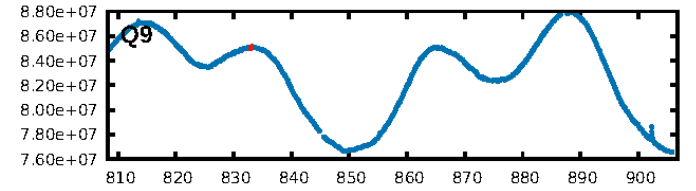
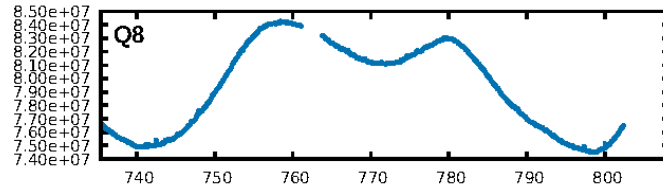
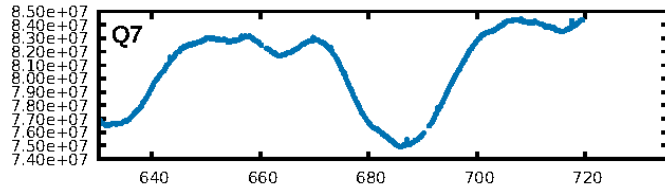
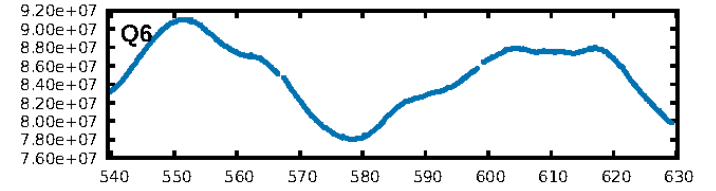
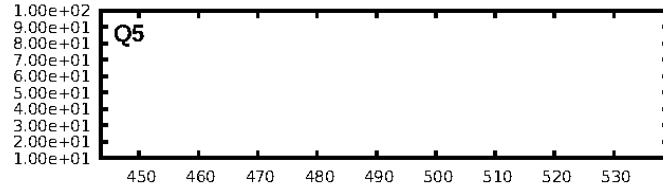
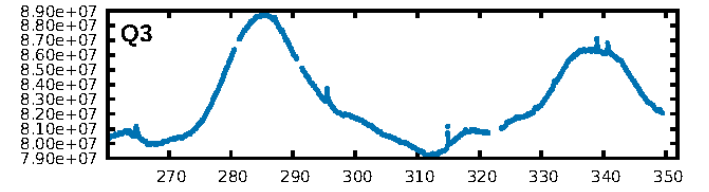
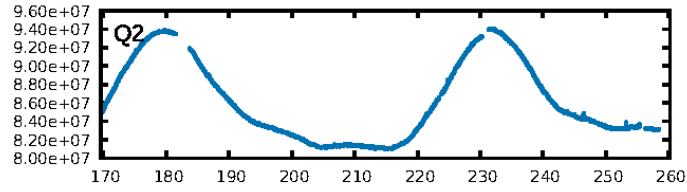
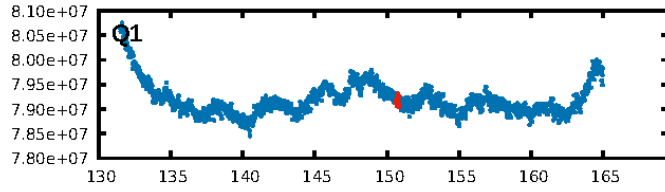
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [426.28σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 91.9%  
ModelChiSquareGof-sig: 79.0%  
**Bootstrap-pfa: 6.53e-08**  
RollingBand-fgt: 1.00 [2/2]  
GhostDiagnostic-chr: -0.6665  
Centroid-sig: 73.1%  
Centroid-so: 0.366 arcsec [0.46σ]  
OotOffset-rm: 0.156 arcsec [0.82σ]  
OotOffset-st: 0/0/1/1 [2]  
KicOffset-rm: 0.096 arcsec [0.52σ]  
KicOffset-st: 0/0/1/1 [2]  
DiffImageQuality-fgm: 1.00 [2/2]  
DiffImageOverlap-fno: 1.00 [3/3]

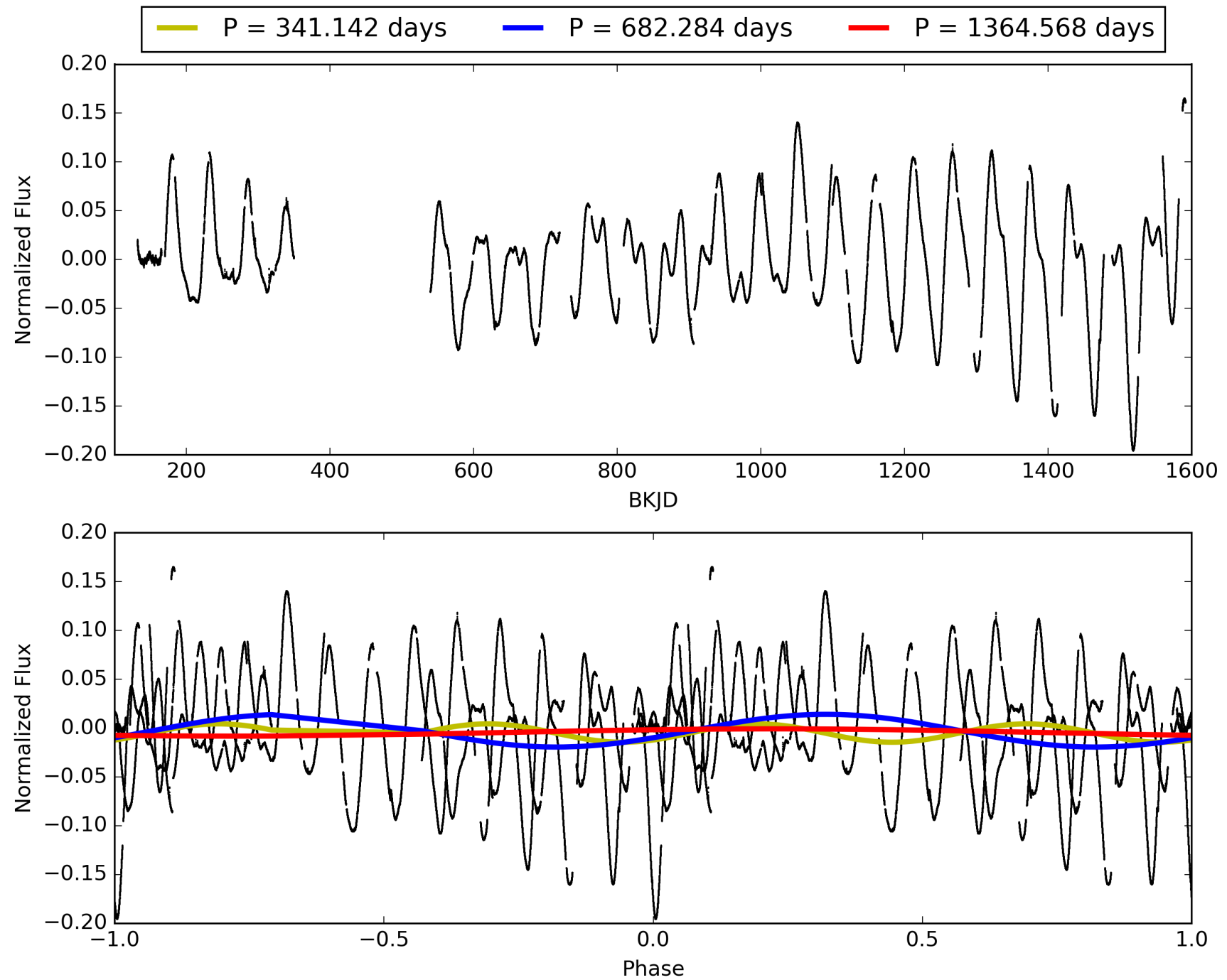
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 08:44:47 Z

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

# TCE 004920178-04, PDC Light Curves



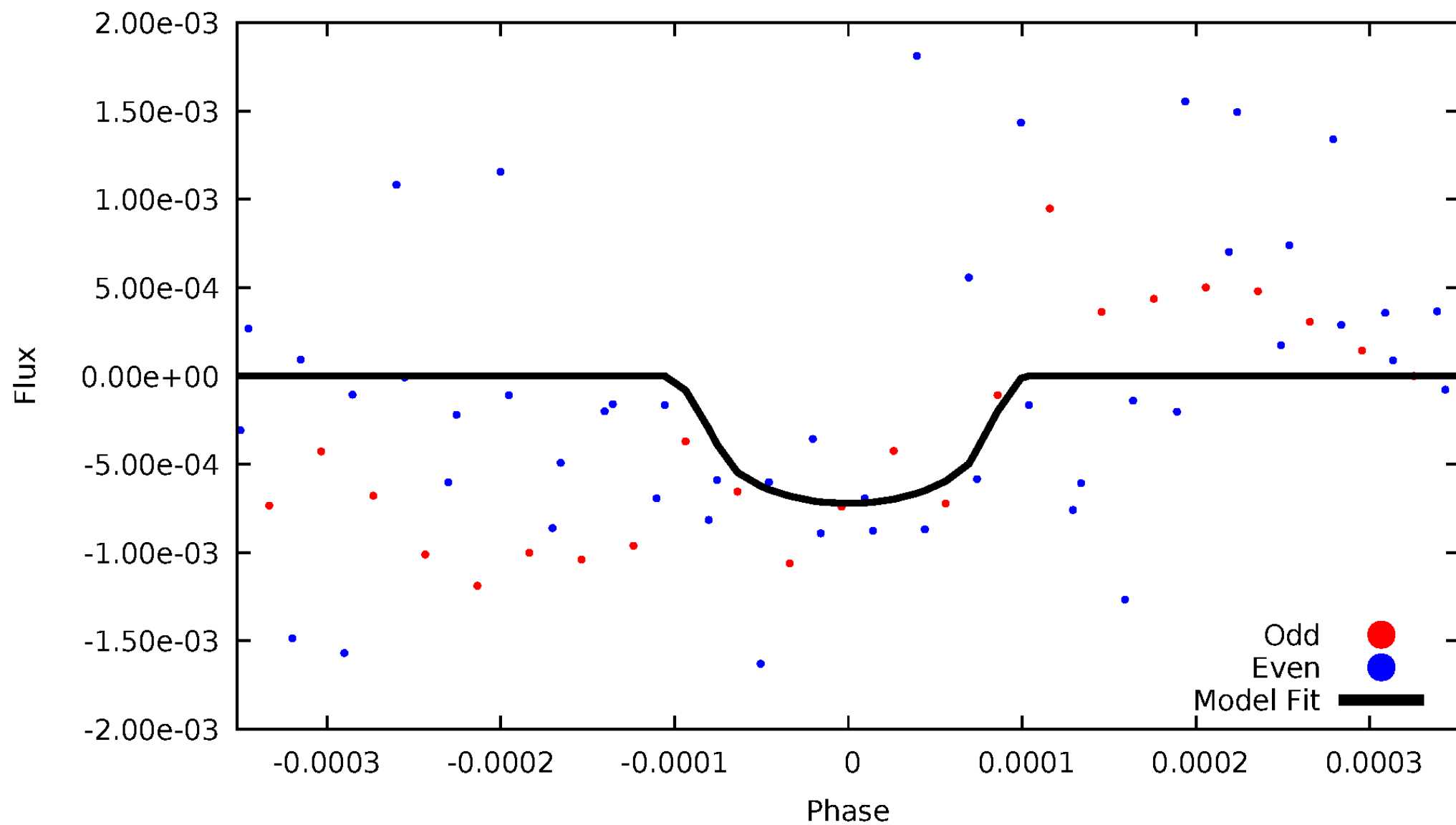
# TCE 004920178-04





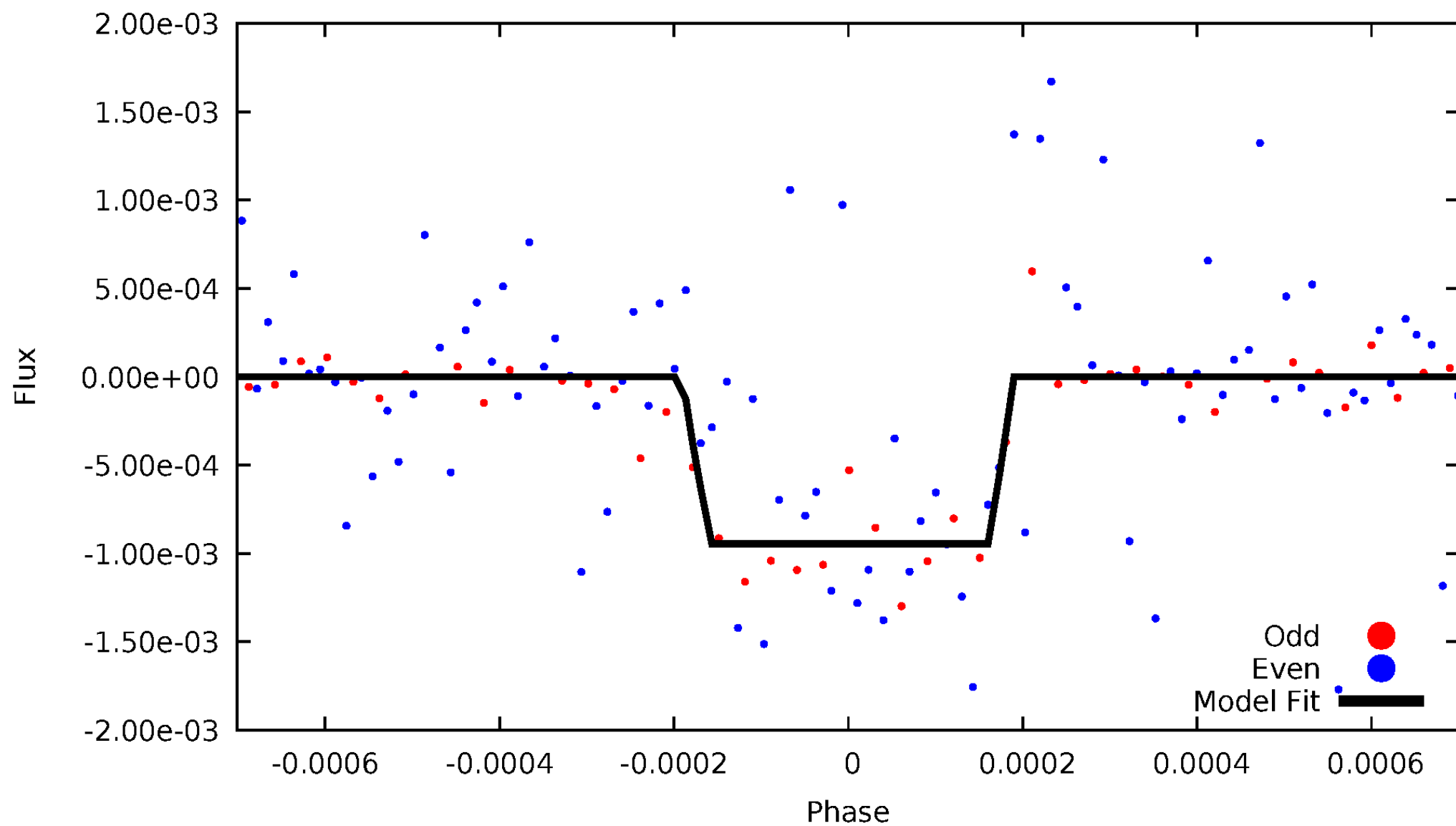
# DV Odd/Even

TCE 004920178-04



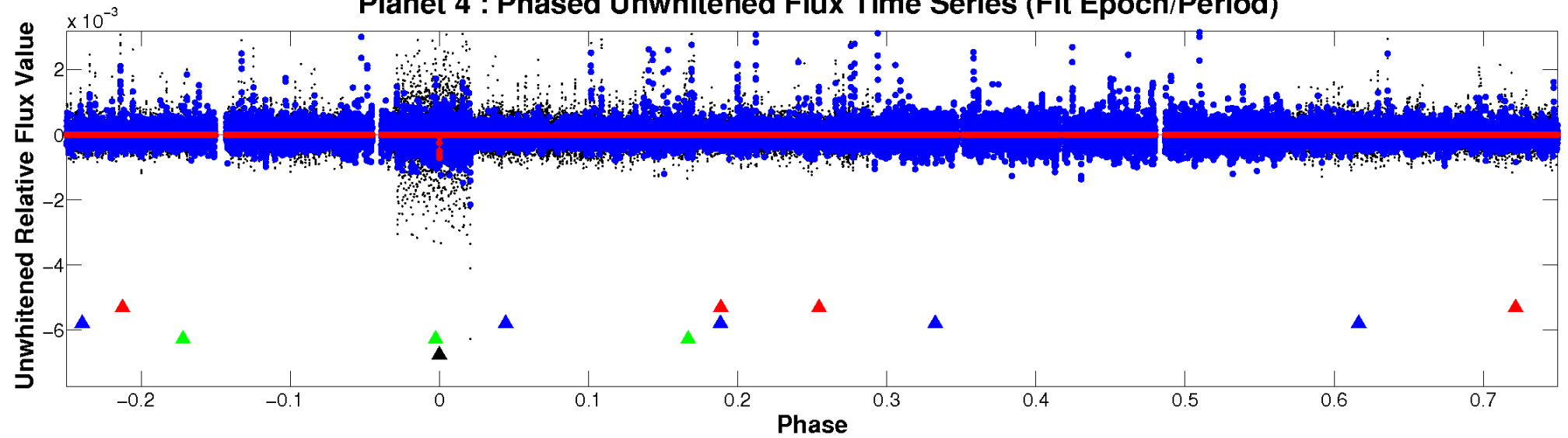
# ALT Odd/Even

TCE 004920178-04

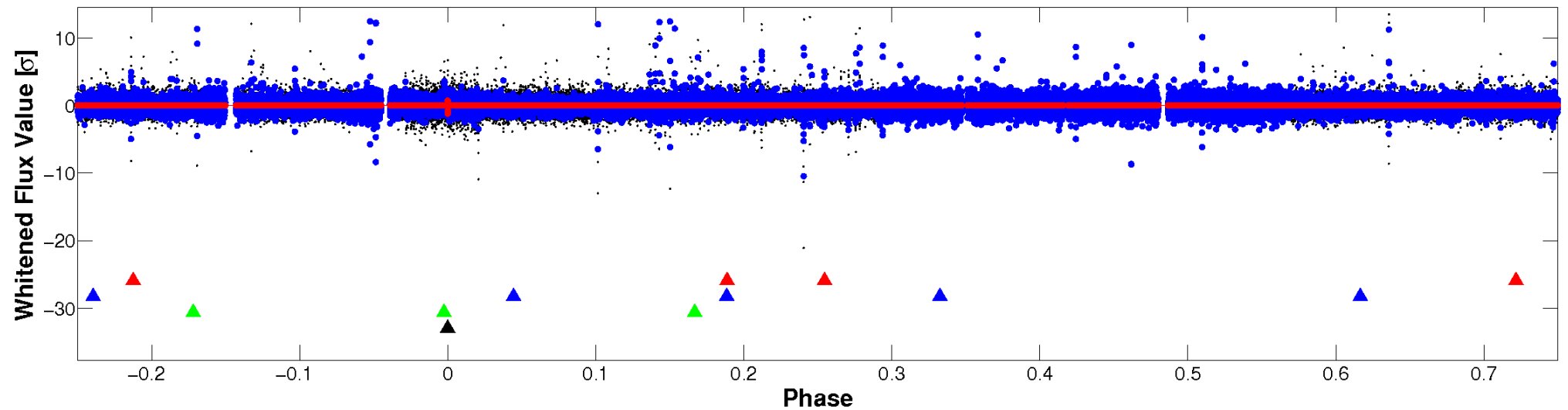


# Non-Whitened Vs. Whitened Light Curve

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

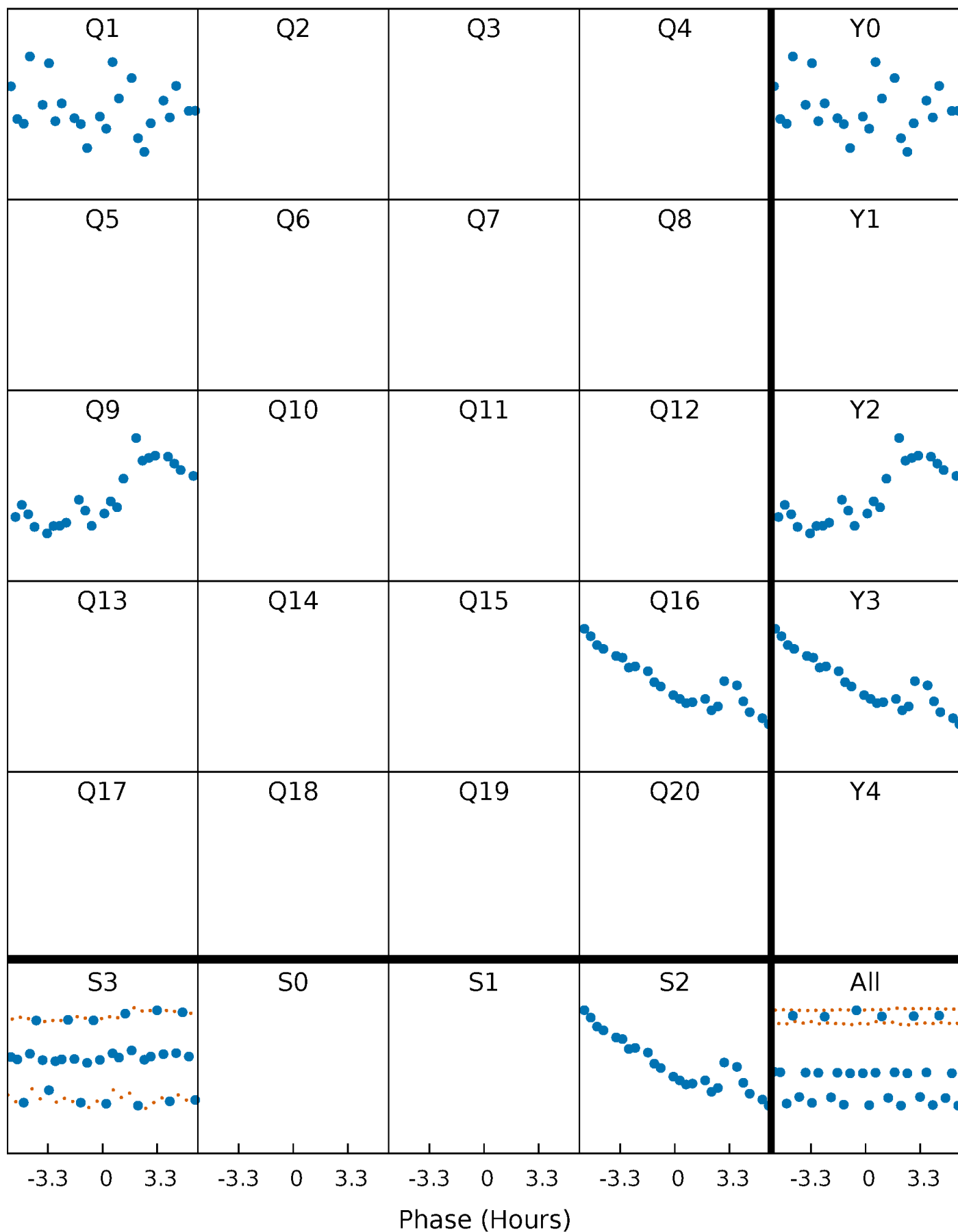


Planet 4 : Phased Whitened Flux Time Series (Fit Epoch/Period)



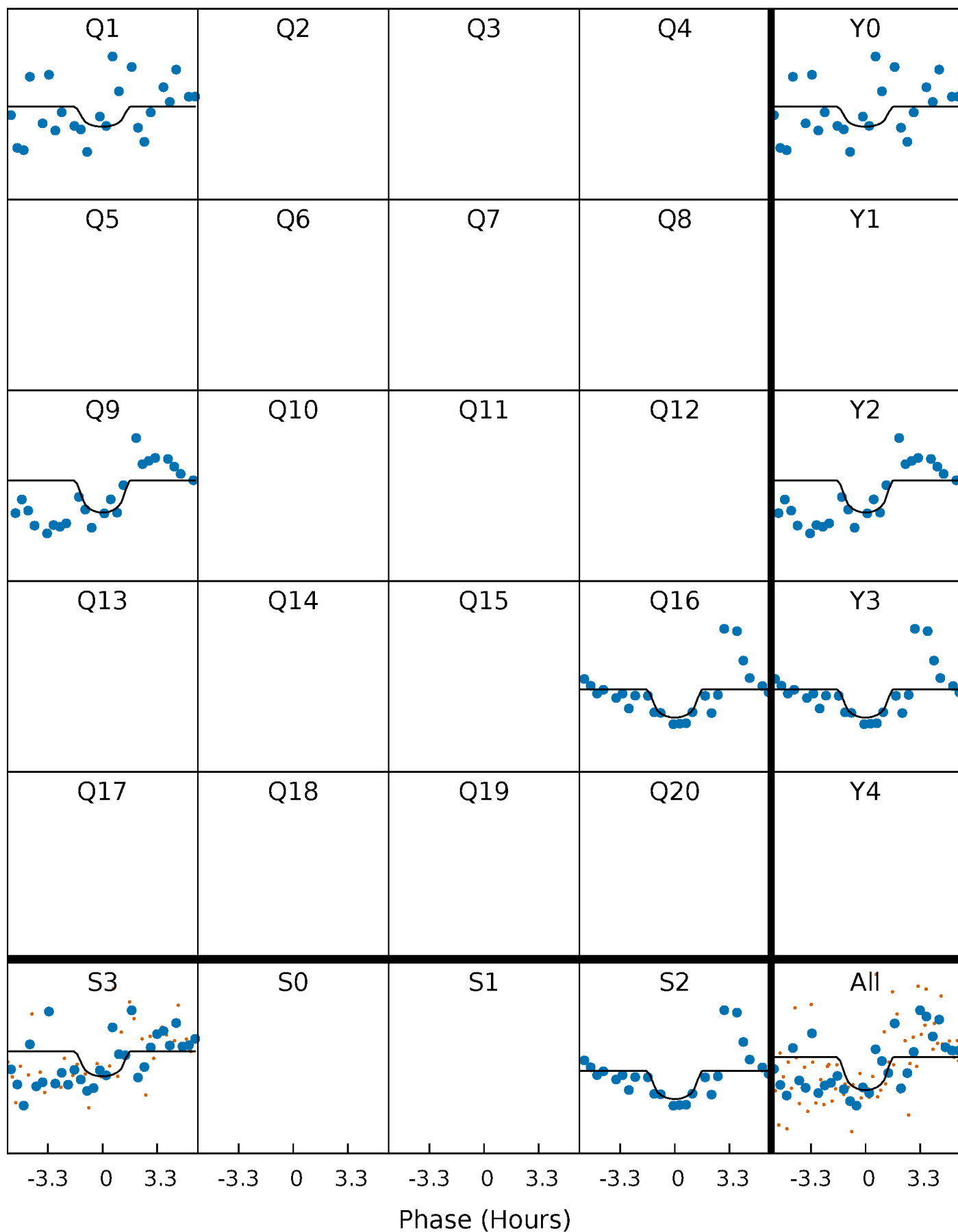
# PDC Quarter-Phased Transit Curves

TCE 004920178-04 P=682.284249 Days  $T_0=150.734964$  (BKJD)



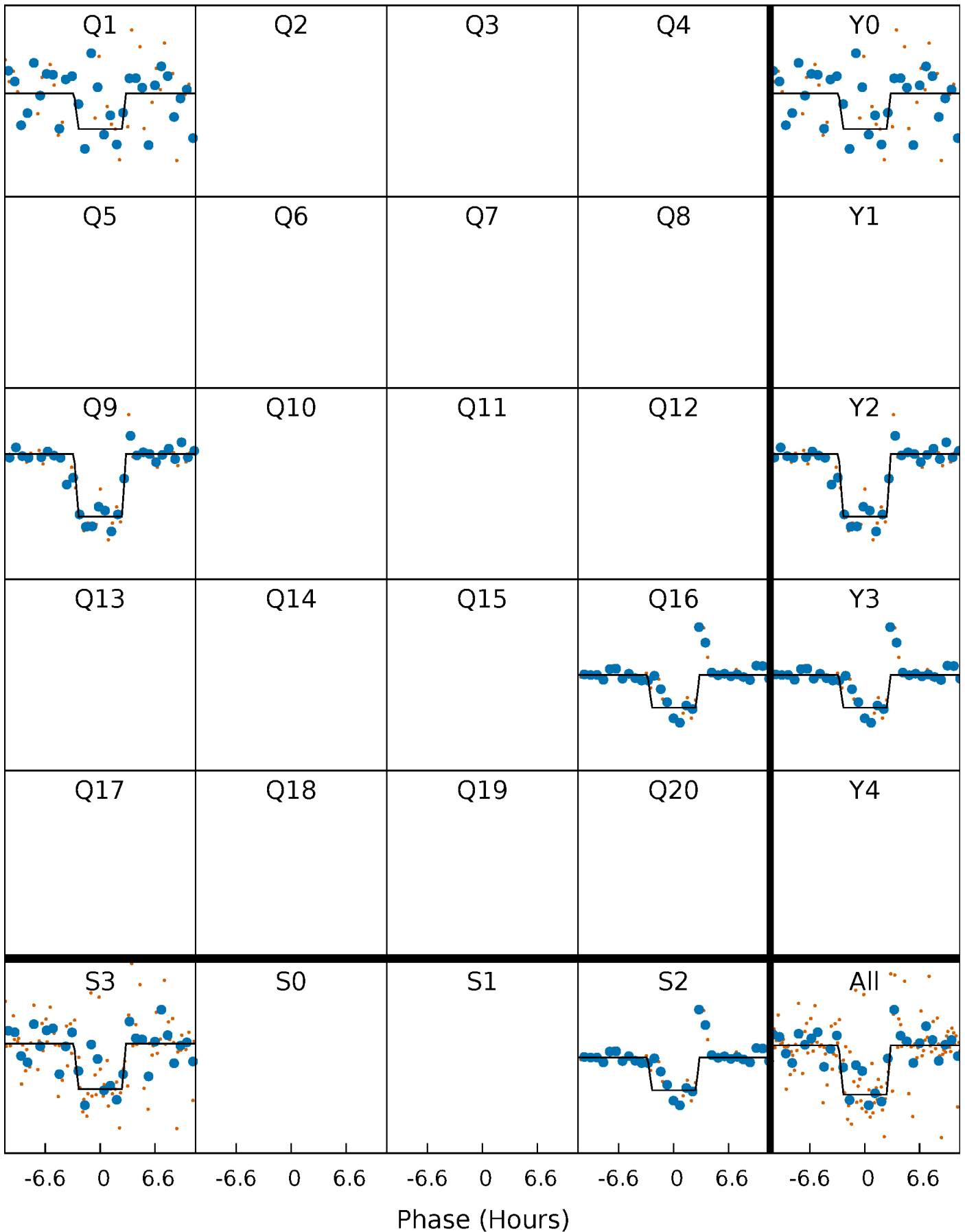
# DV Quarter-Phased Transit Curves

TCE 004920178-04     $P=682.284249$  Days     $T_0=150.734964$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

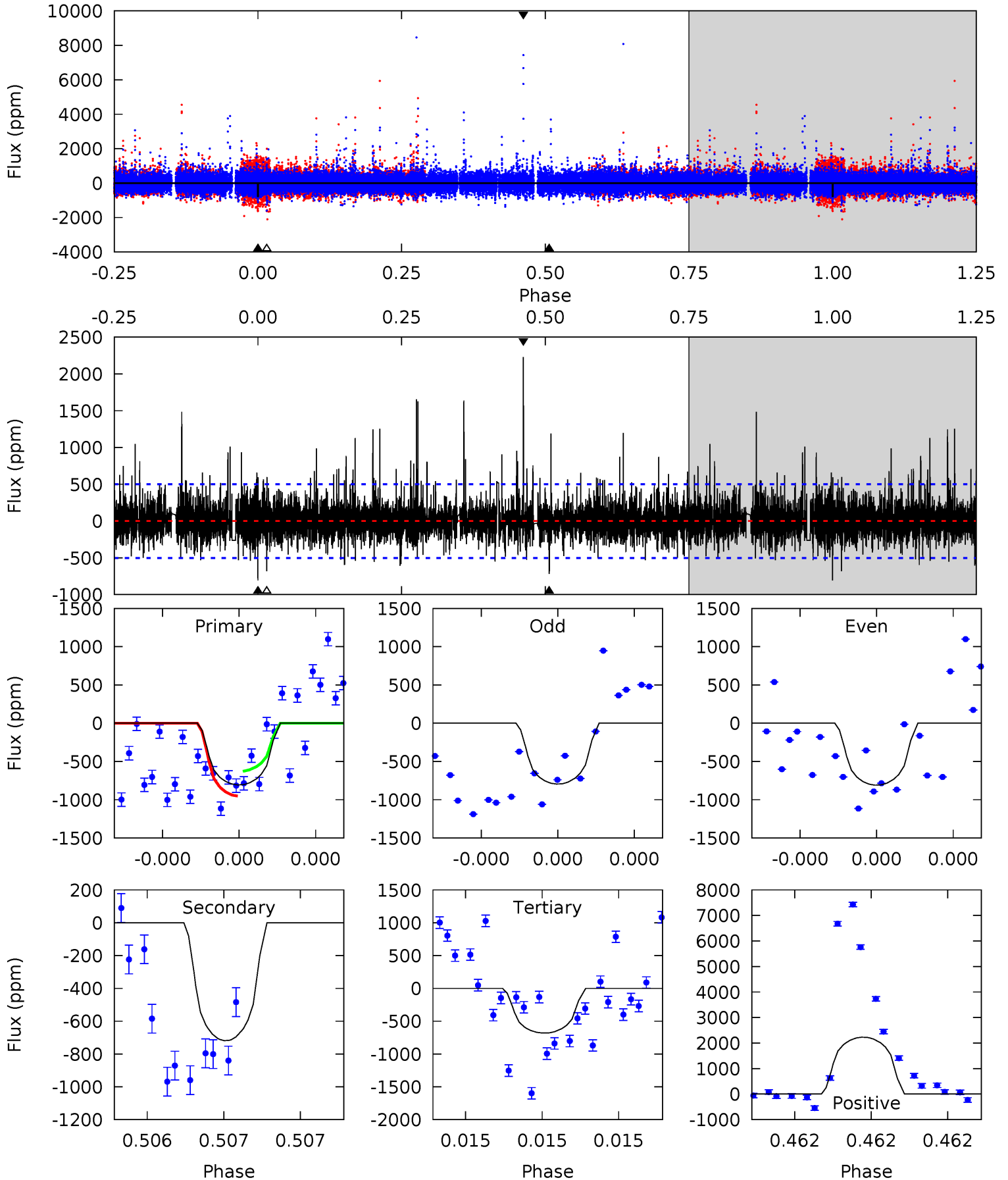
TCE 004920178-04 P=682.351491 Days  $T_0=150.603047$  (BKJD)



# DV Model-Shift Uniqueness Test

004920178-04, P = 682.284249 Days, E = 150.734964 Days

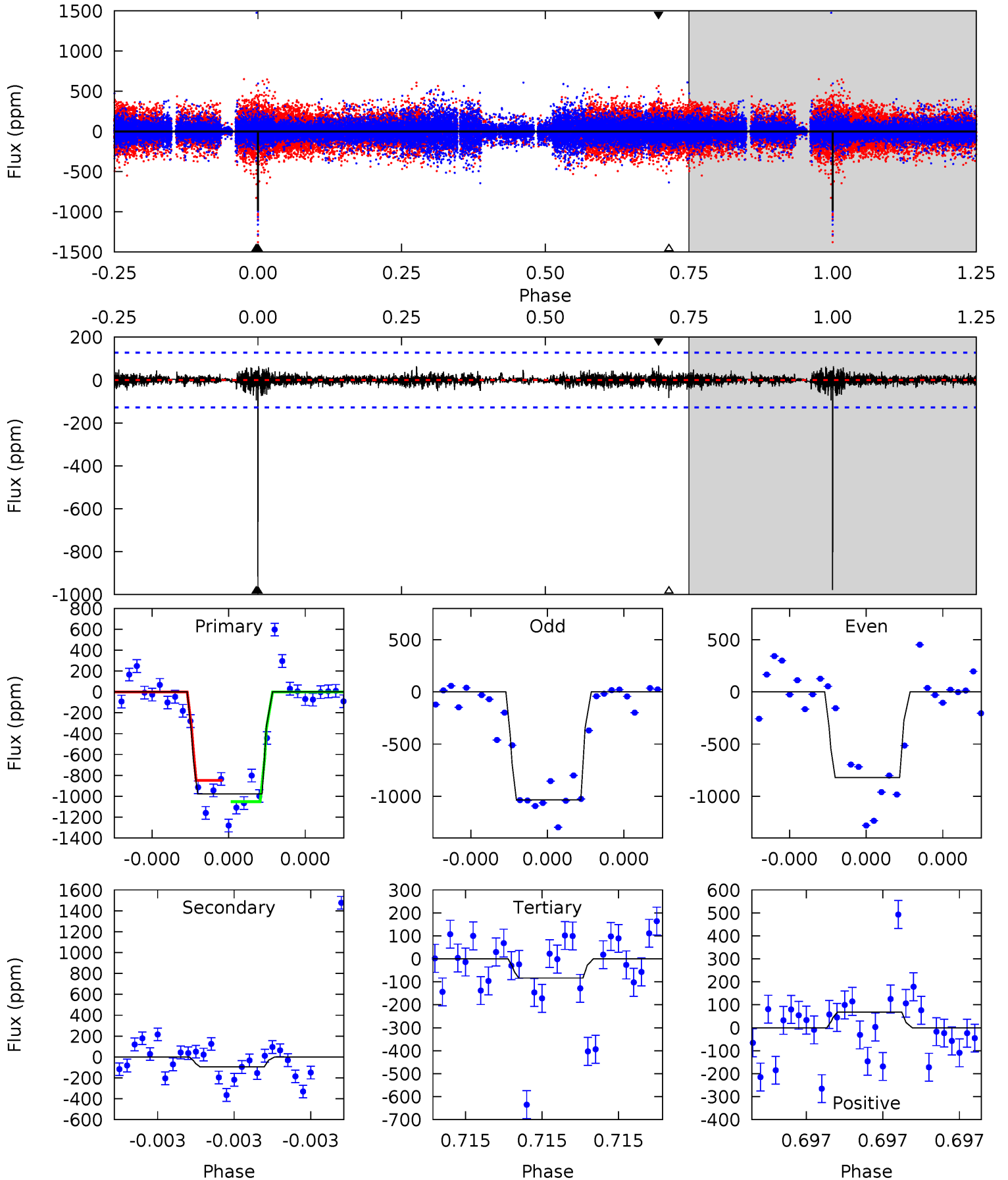
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
9.21	8.22	7.79	25.5	5.74	3.73	2.09	1.42	-16.3	0.43	-17.3	0.07	0.78	0.73	1.85



# Alt Model-Shift Uniqueness Test

004920178-04, P = 682.351491 Days, E = 150.603047 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
43.0	4.14	3.67	2.98	5.63	3.56	0.54	39.3	40.0	0.46	1.15	4.60	0.98	0.06	0





### Stellar Parameters For KIC 004920178

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$4617^{+138}_{-103}$	$2.962^{+0.370}_{-0.370}$	$0.200^{+0.200}_{-0.200}$	$5.411^{+3.990}_{-1.710}$	$0.977^{+0.359}_{-0.040}$	$0.009^{+0.023}_{-0.006}$
	+3%/-2%	+12%/-12%	+100%/-100%	+74%/-32%	+37%/-4%	+263%/-69%
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 004920178-04 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-719 \pm 87$	$48.40^{+54.83}_{-34.11}$	$535^{+91}_{-63}$	$3180^{+1647}_{-549}$	$400^{+4423}_{-307}$
Alt.	$-94 \pm 23$	$51.47^{+55.49}_{-34.26}$	$537^{+91}_{-60}$	$2389^{+789}_{-334}$	$45^{+363}_{-34}$

$T_{max}$  = 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

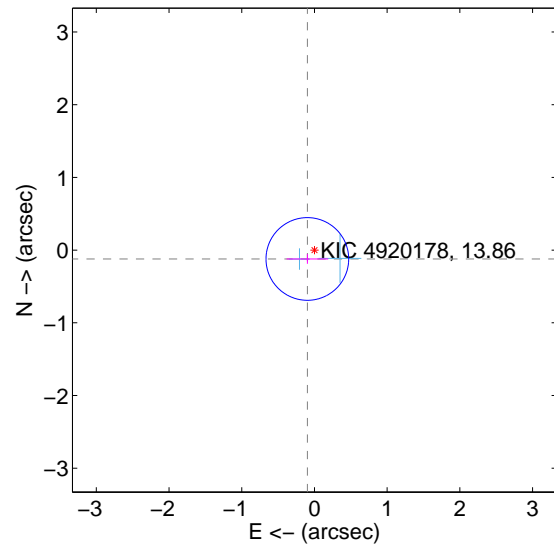
Supplemental centroid analysis for 004920178-04. Kepler magnitude: 13.86. Transit SNR 4.90

There are 2 quarters with good PRF difference image offsets

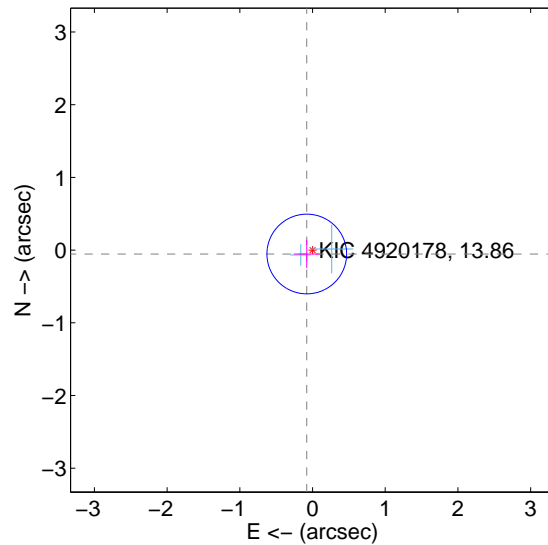
The direct PRF centroid is offset from the target star catalog position by about 0.07 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.156 \pm 0.190$	0.82	$0.097 \pm 0.287$	$-0.122 \pm 0.067$
PRF-fit source offset from KIC position	$0.096 \pm 0.183$	0.52	$0.079 \pm 0.177$	$-0.054 \pm 0.194$
photometric centroid source offset	$0.37 \pm 0.80$	0.46	$-0.23 \pm 0.74$	$0.29 \pm 0.84$

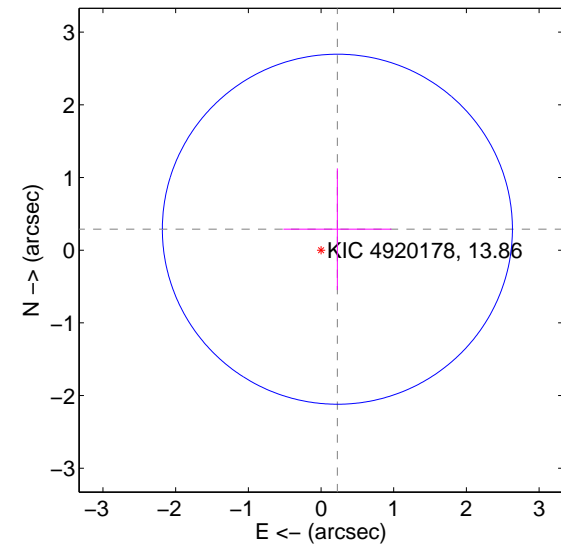
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

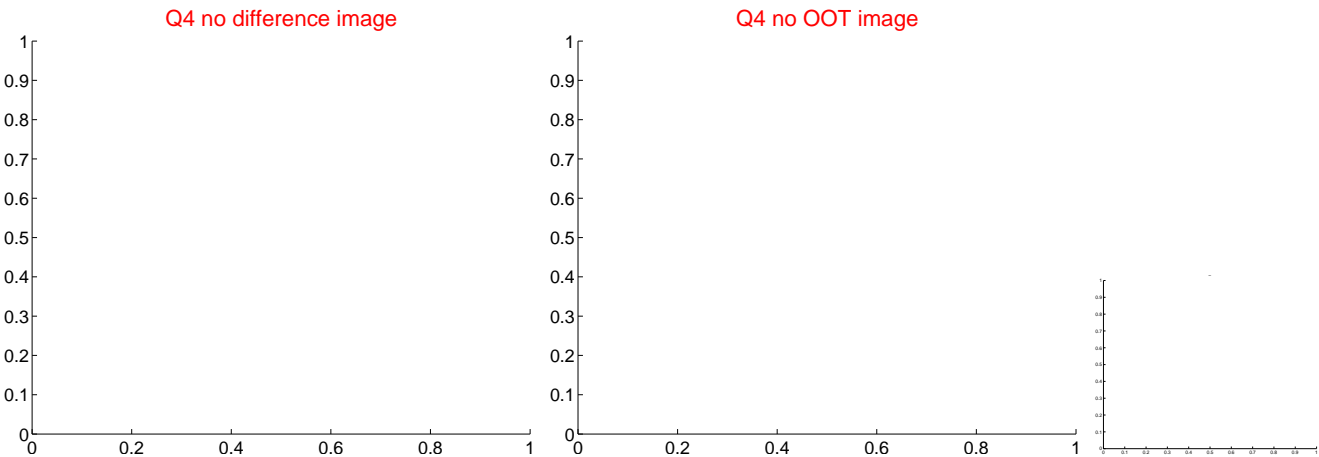
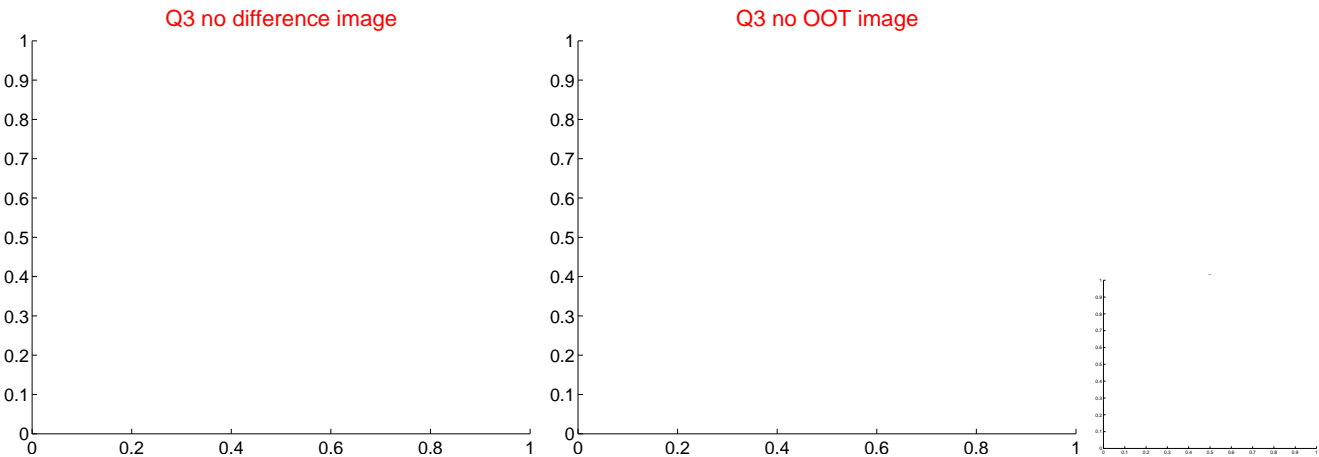
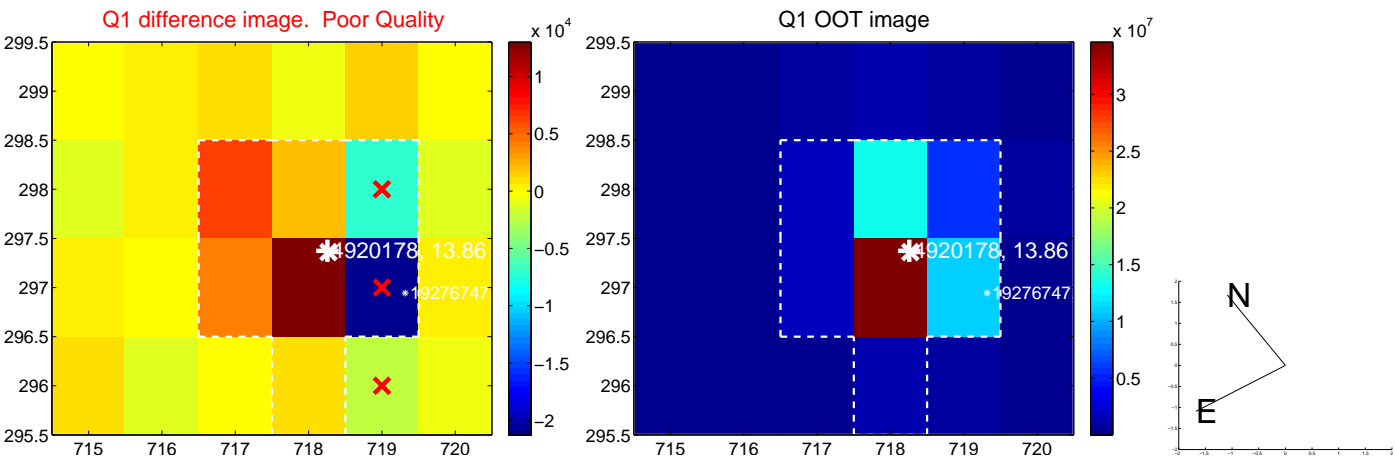


offset from photometric centroids



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.

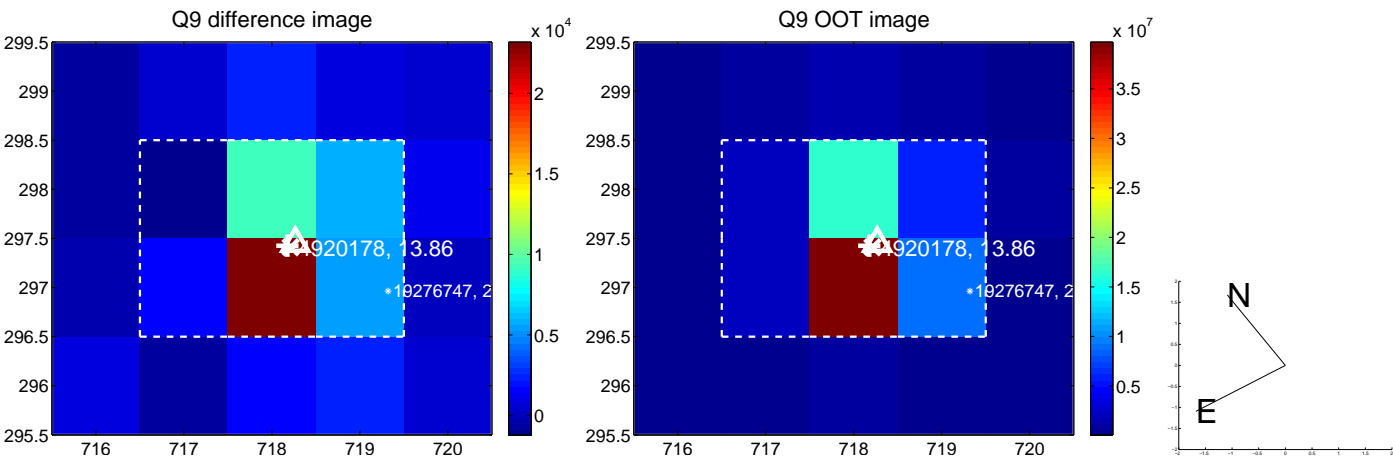
white ×: KIC target position; +: OOT centroid; △: difference centroid. red ✕: large negative pixel value.



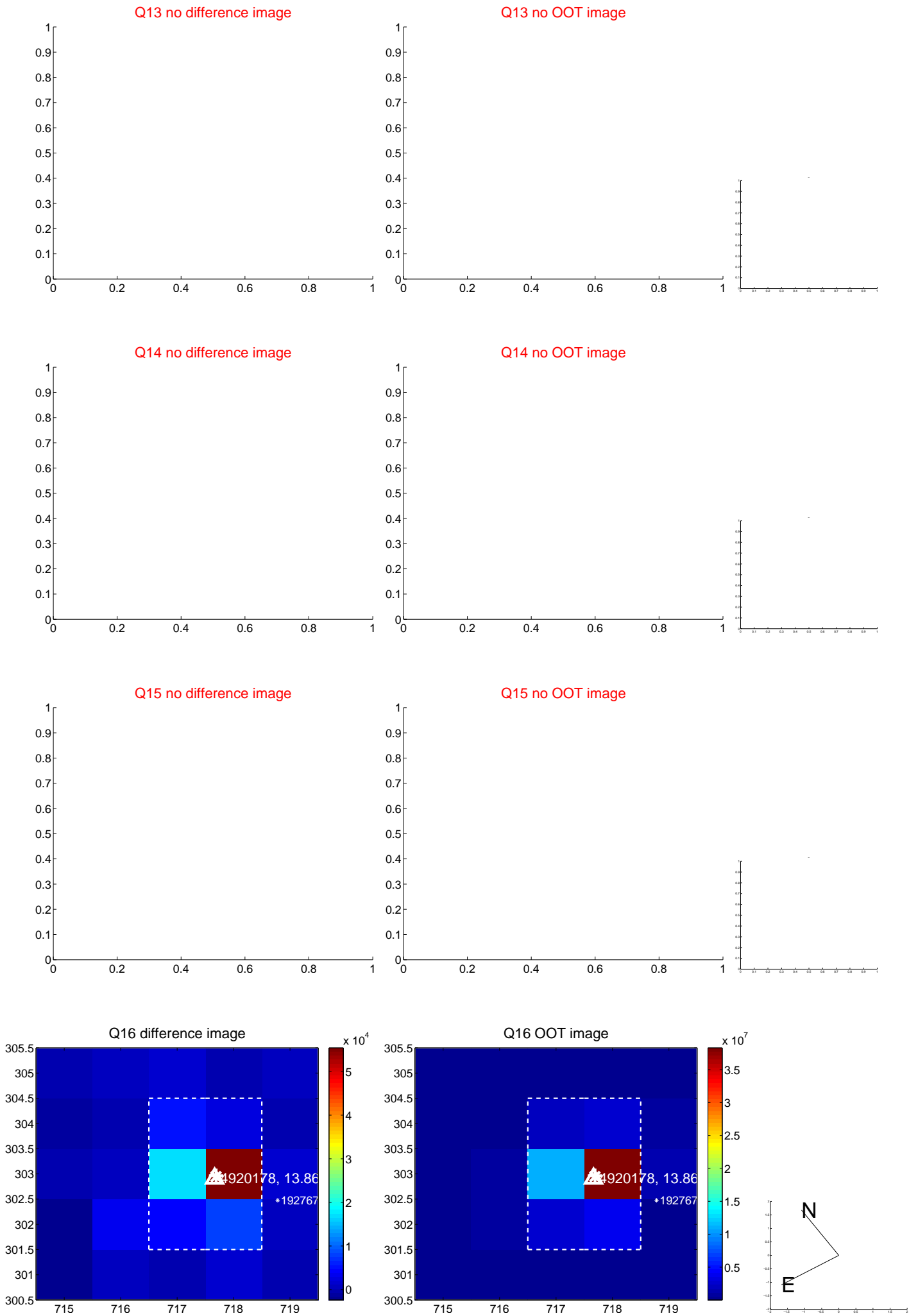
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



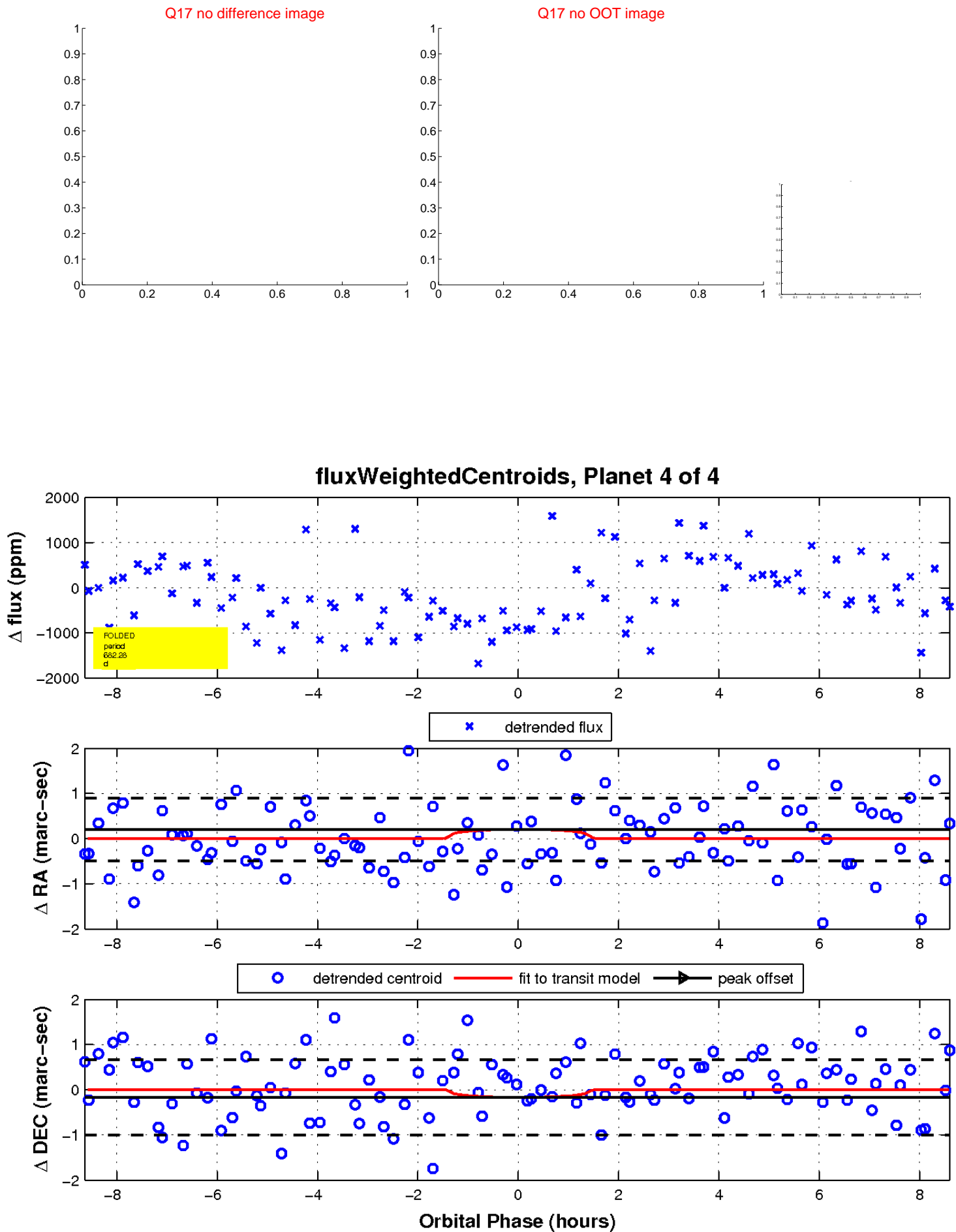
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

Declination

