

# KIC 007377422

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
007377422-01	OBS	No	107.621414	153.652941	19735.1	48.470	43.7	121.3	7.61	4683	102.78	138.22
007377422-02	OBS	No	107.623947	178.000842	4007.9	26.013	17.4	28.8	7.61	4683	59.09	138.21

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
007377422-01	OBS	FP	0.00	1	0	0	0	LPP_ALT
007377422-02	OBS	FP	0.00	1	0	0	0	LPP_DV—SAME_NTL_PERIOD

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

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

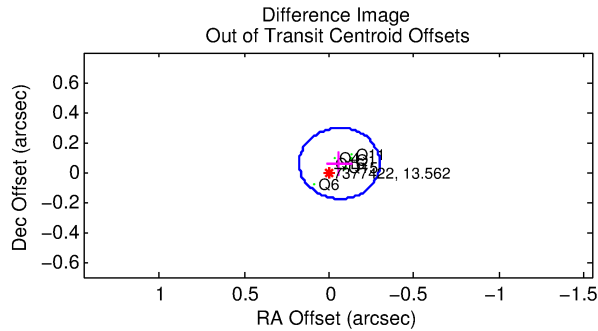
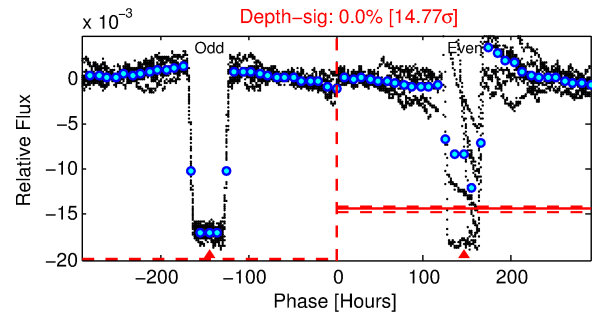
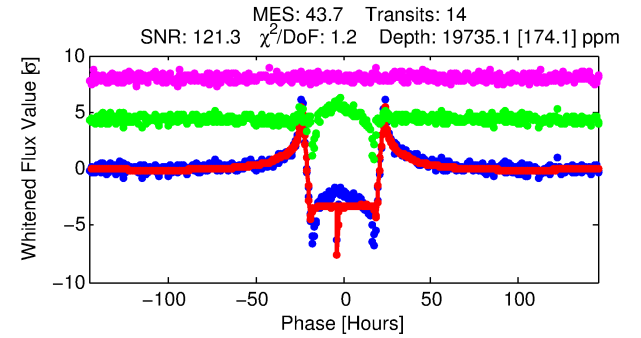
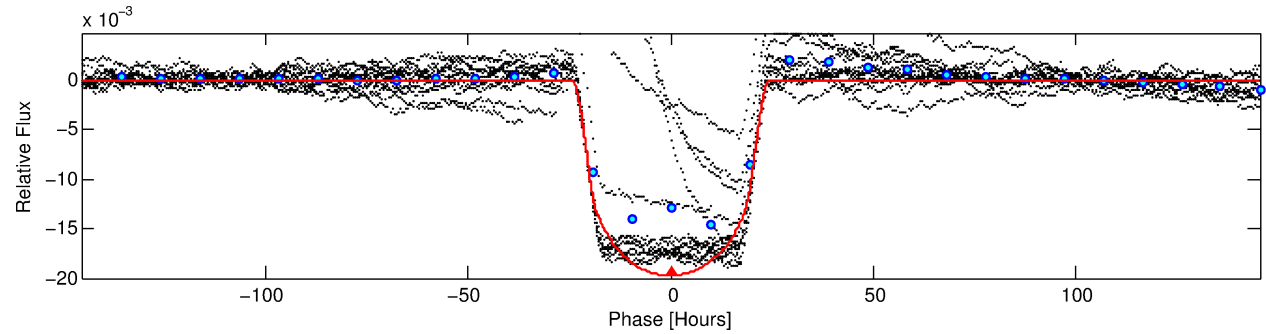
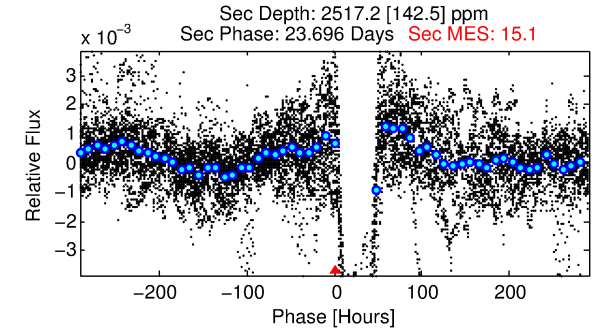
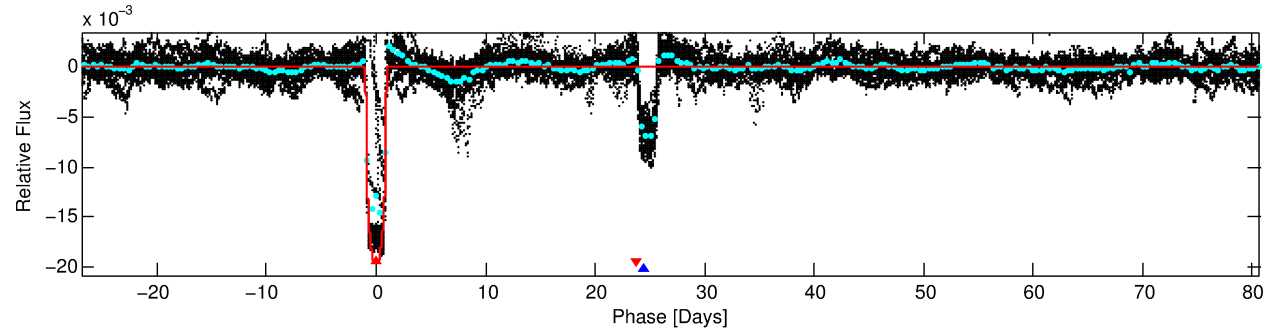
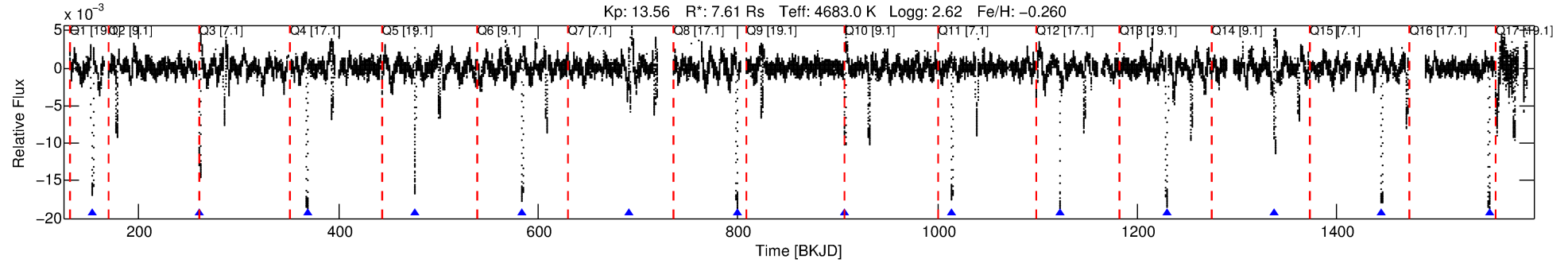
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 007377422-01

No Significant Match Found

# DV One-Page Summary

KIC: 7377422 Candidate: 1 of 2 Period: 107.621 d



## DV Fit Results:

Period = 107.62141 [0.00033] d  
Epoch = 153.6529 [0.0026] BKJD  
Rp/R\* = 0.1238 [0.0006]  
a/R\* = 19.06 [0.15]  
b = 0.04 [0.21]  
Seff = 138.22 [101.28]  
Teq = 874 [160] K  
**Rp = 102.78 [60.33] Re**  
a = 0.4247 [0.2104] AU  
Ag = 23.64 [17.15] [1.32]  
**Teffp = 2981 [99] K [11.19%]**

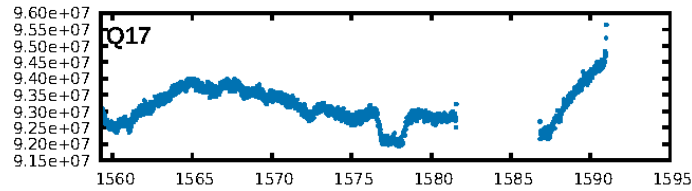
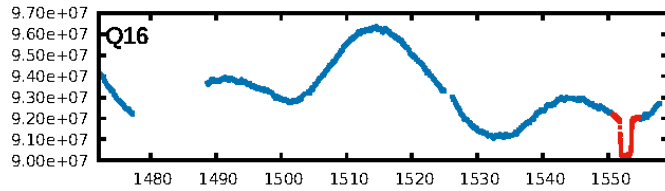
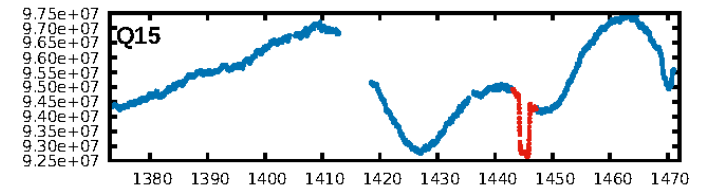
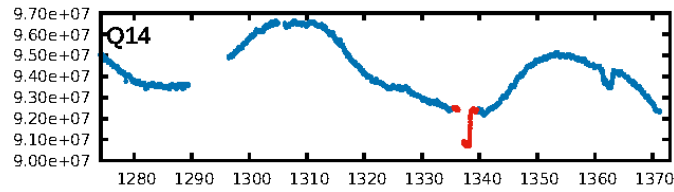
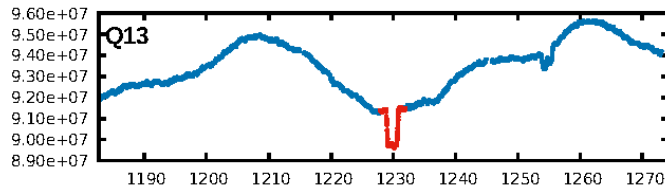
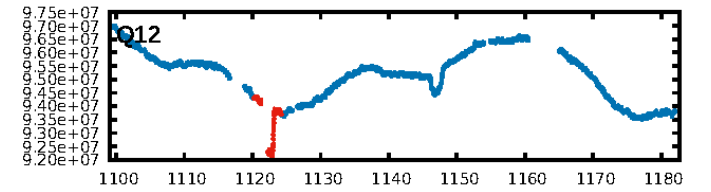
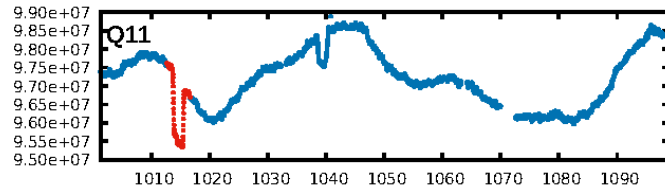
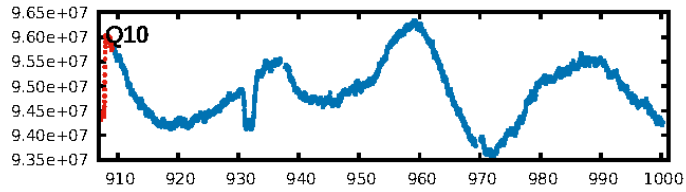
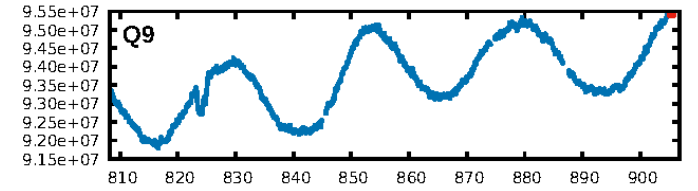
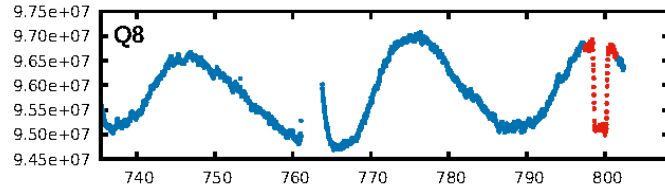
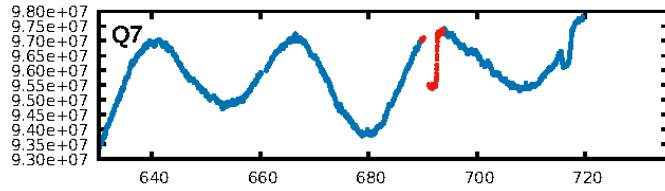
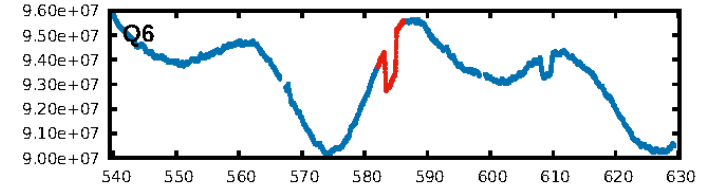
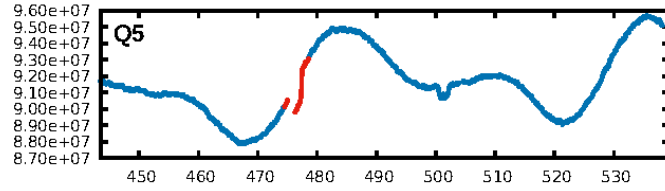
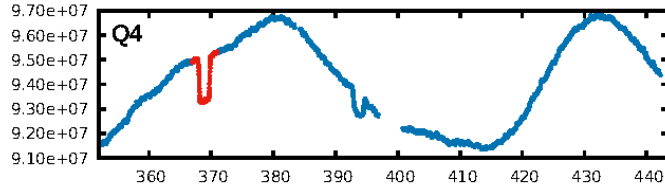
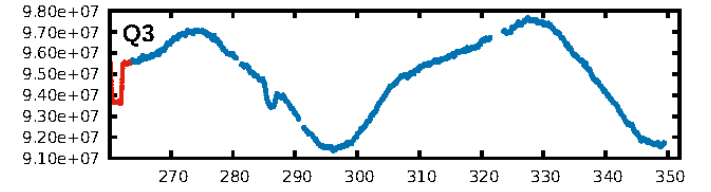
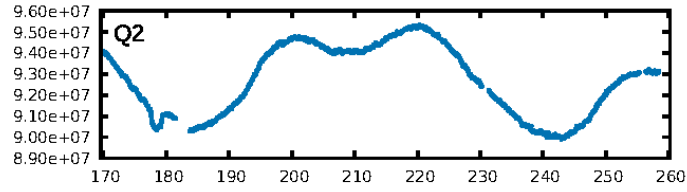
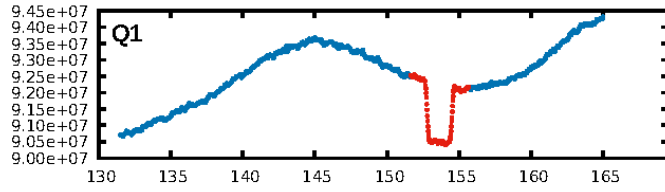
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
**LongPeriod-sig: 0.1% [0.00%]**  
**ModelChiSquare2-sig: 0.0%**  
ModelChiSquareGof-sig: 76.8%  
Bootstrap-pfa: 0.00e+00  
RollingBand-fgt: 1.00 [13/13]  
GhostDiagnostic-chr: 1.081  
**Centroid-sig: 0.0%**  
**Centroid-so: 0.259 arcsec [35.81%]**  
OotOffset-rm: 0.084 arcsec [1.07]  
OotOffset-st: 1/2/2/1 [6]  
KicOffset-rm: 0.203 arcsec [2.83]  
KicOffset-st: 1/2/2/1 [6]  
DiffImageQuality-fgm: 1.00 [6/6]  
DiffImageOverlap-fno: 1.00 [6/6]

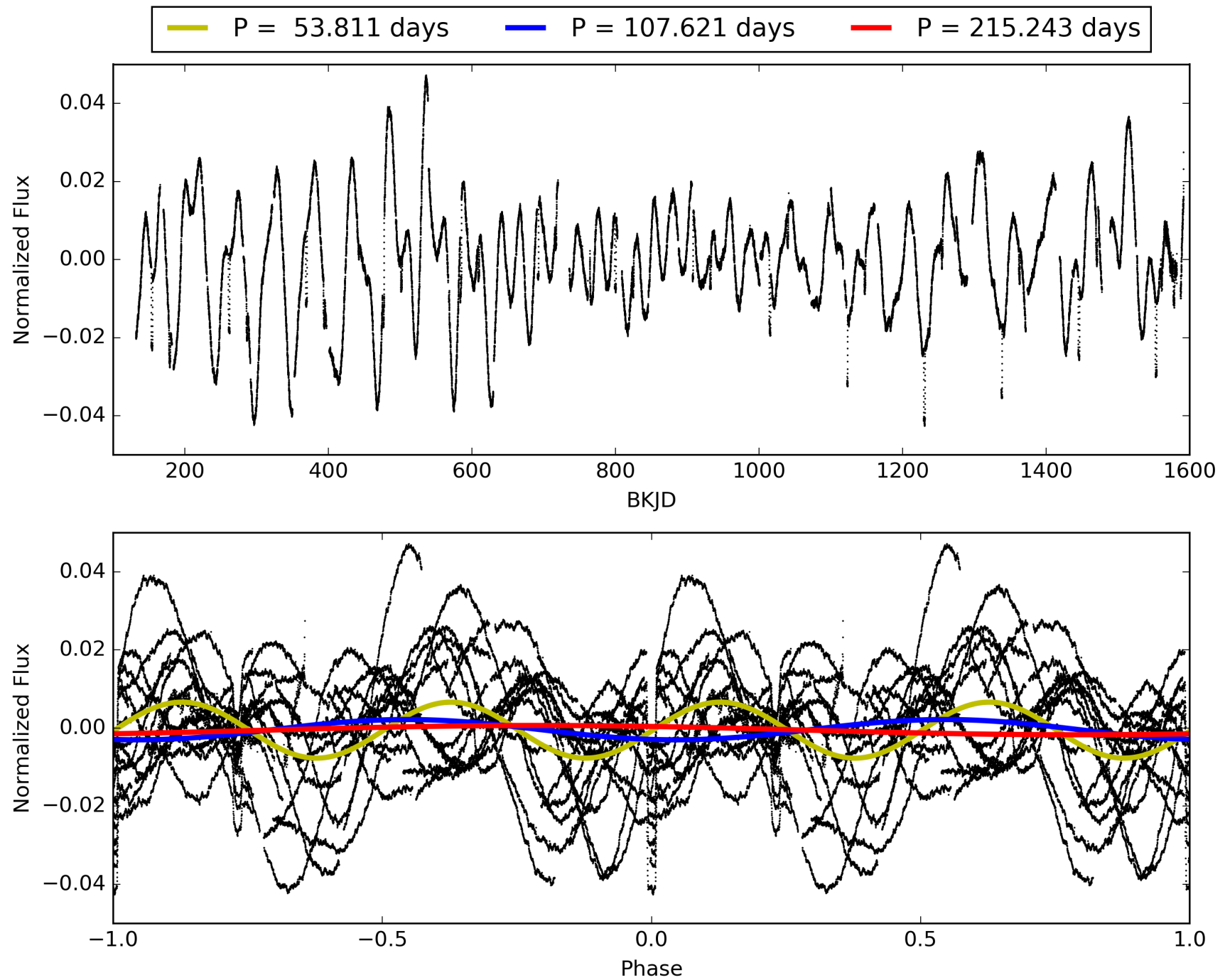
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 06:57:22 Z

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

# TCE 007377422-01, PDC Light Curves

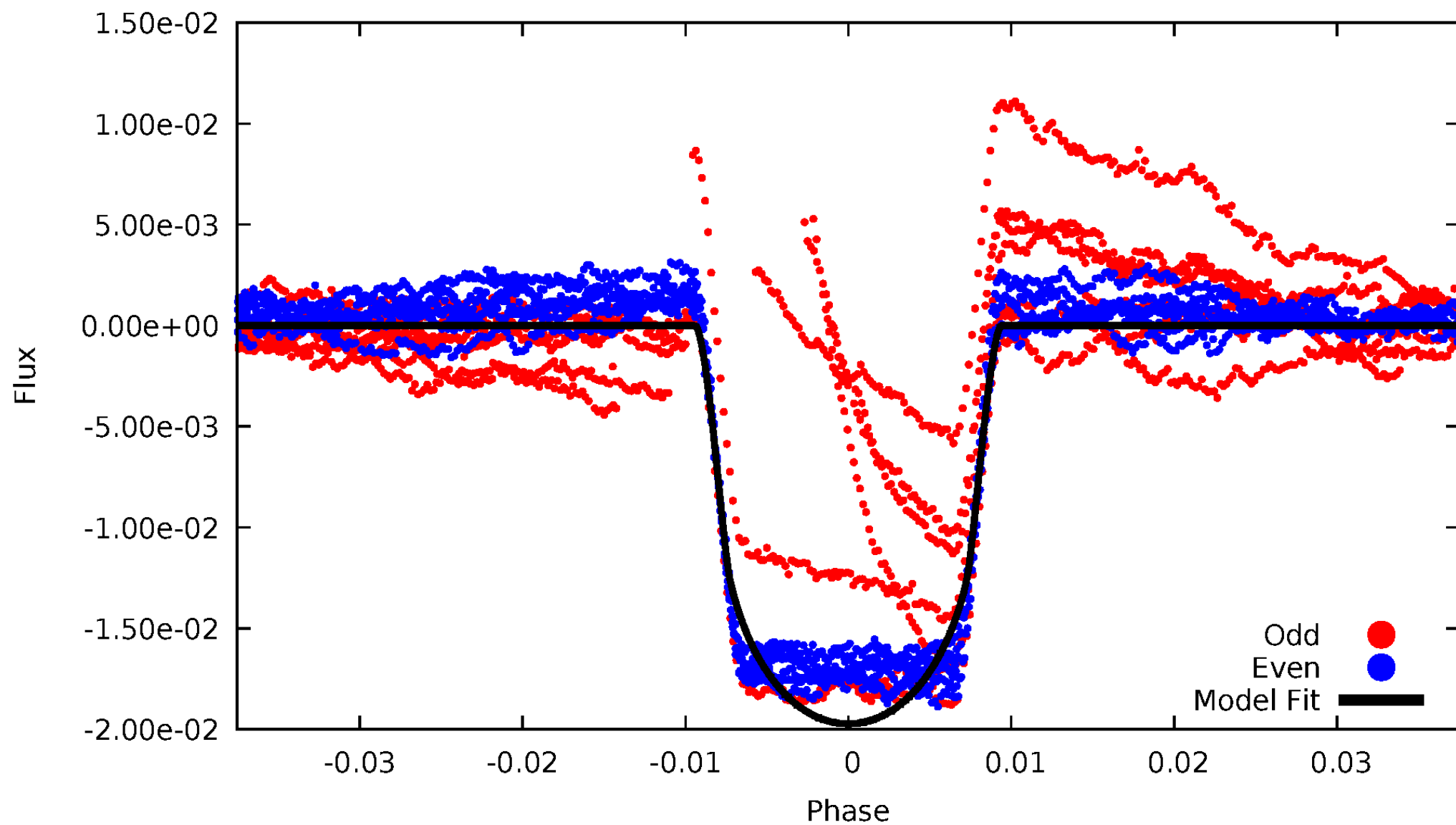


TCE 007377422-01



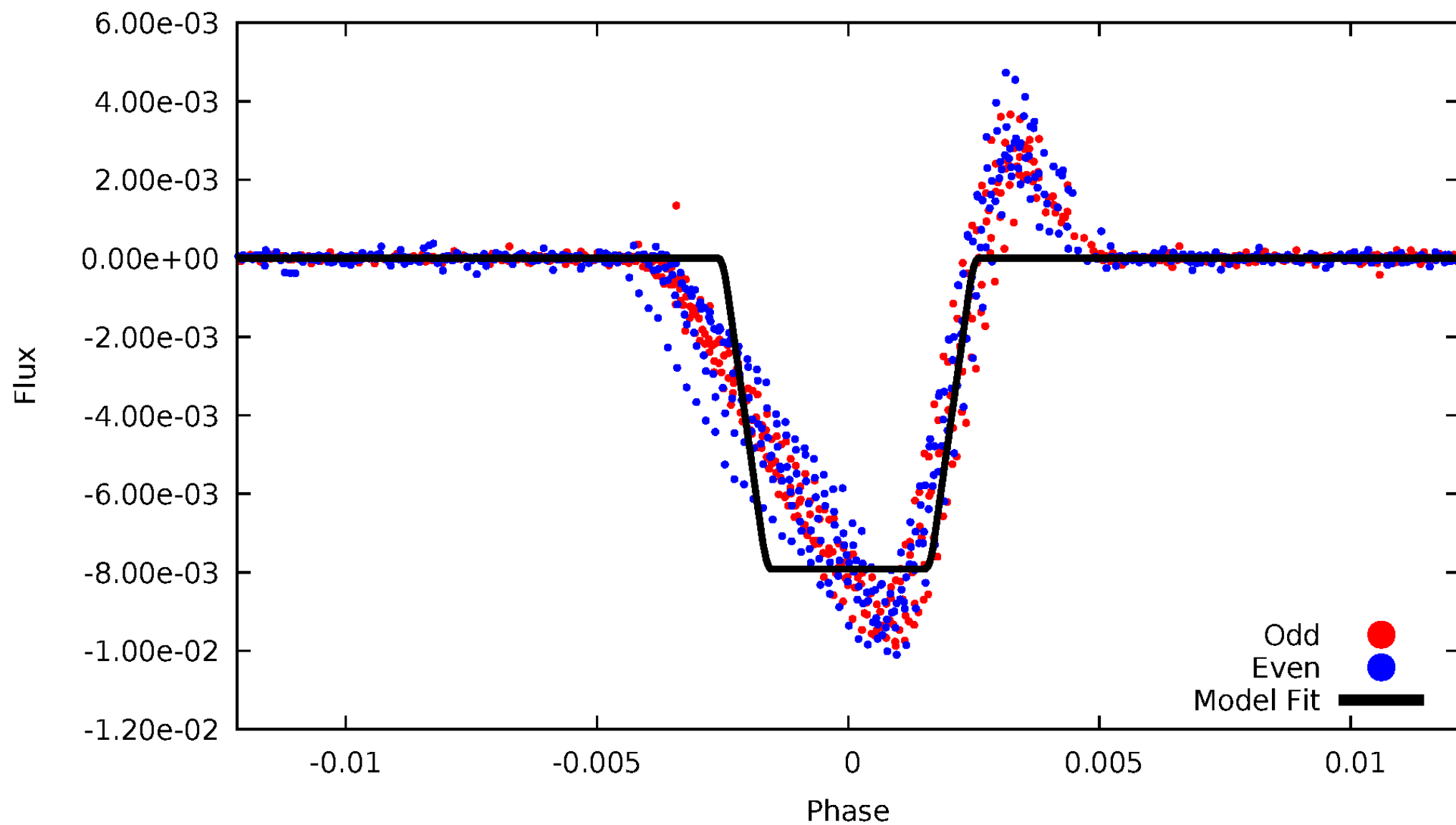
# DV Odd/Even

TCE 007377422-01



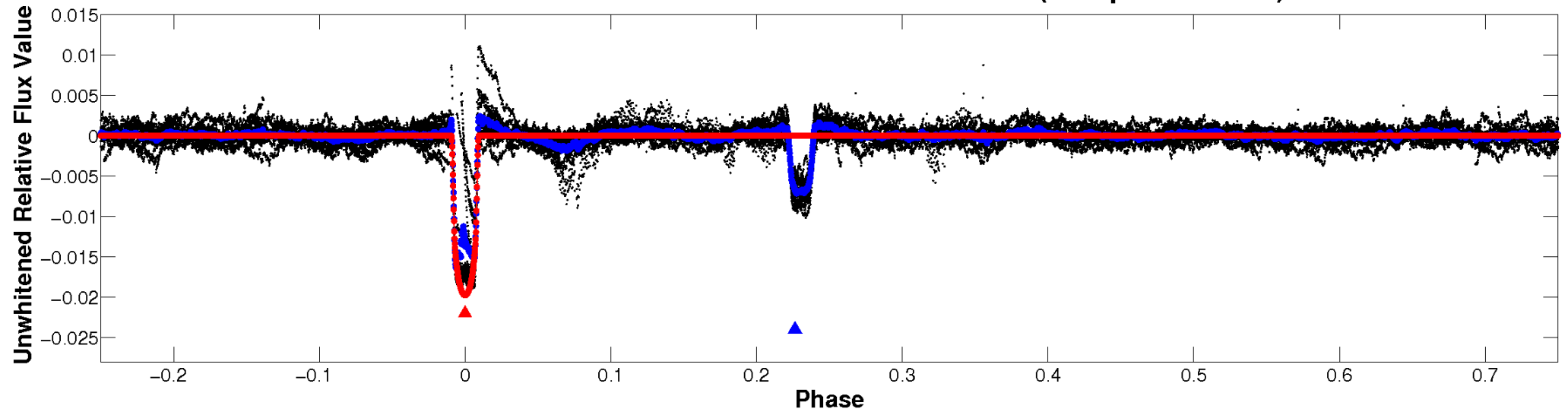
# ALT Odd/Even

TCE 007377422-01

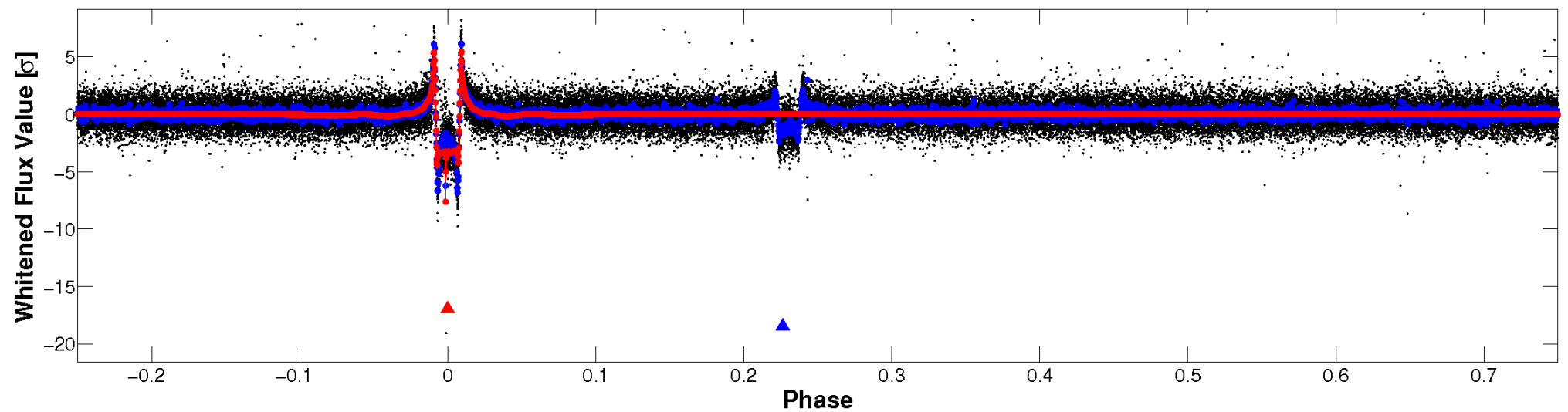


# Non-Whitened Vs. Whitened Light Curve

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

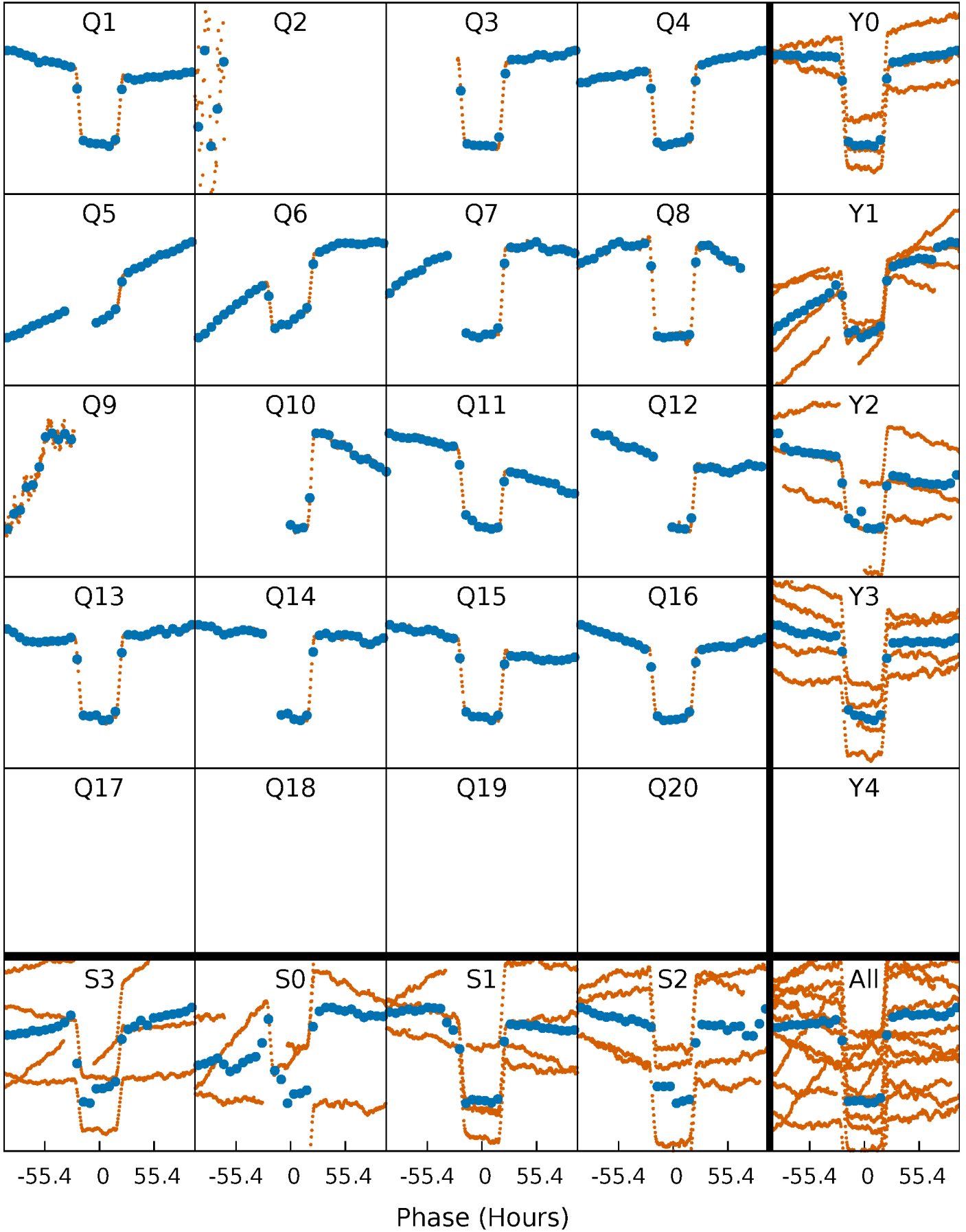


Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

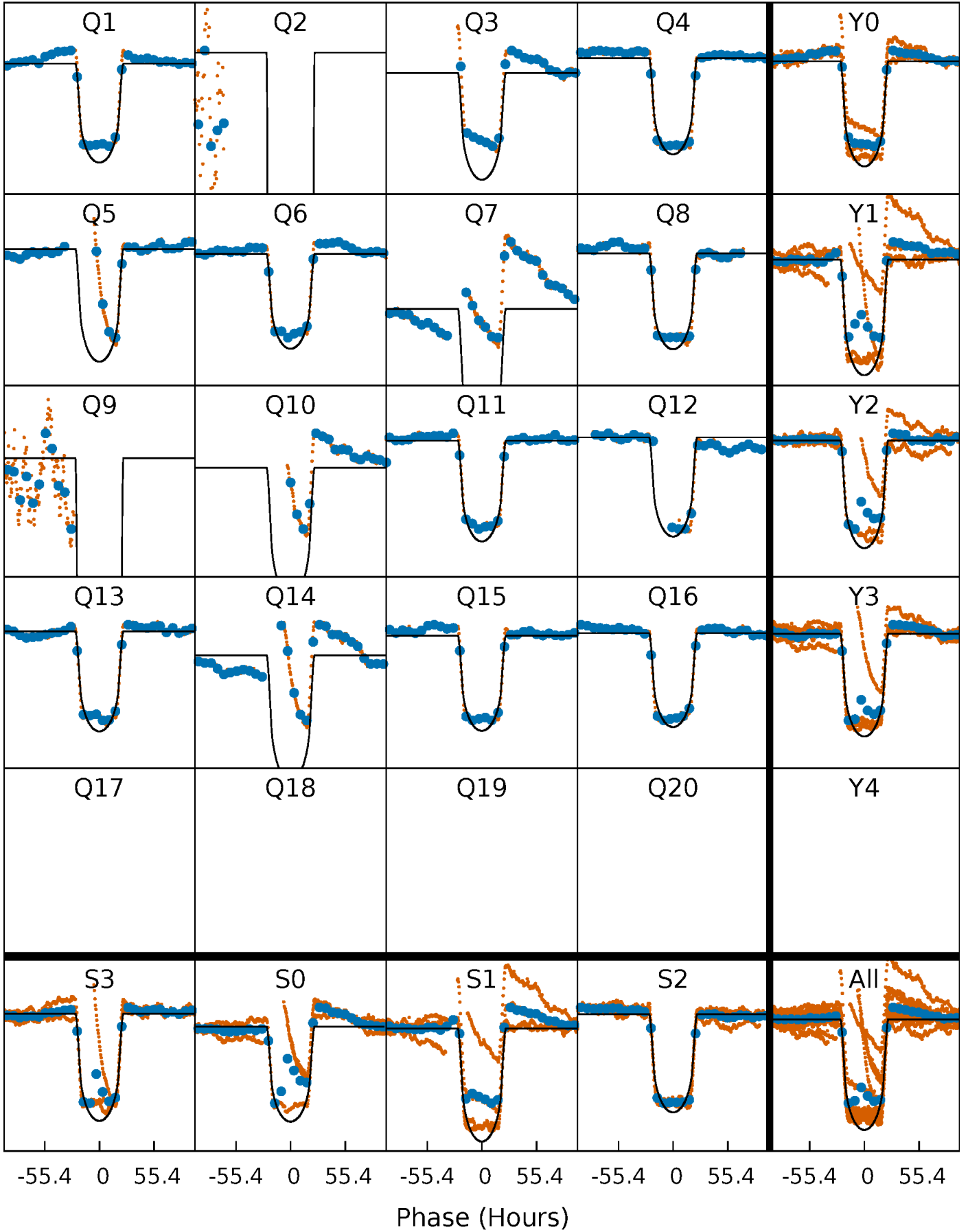
TCE 007377422-01 P=107.621414 Days  $T_0=153.652941$  (BKJD)





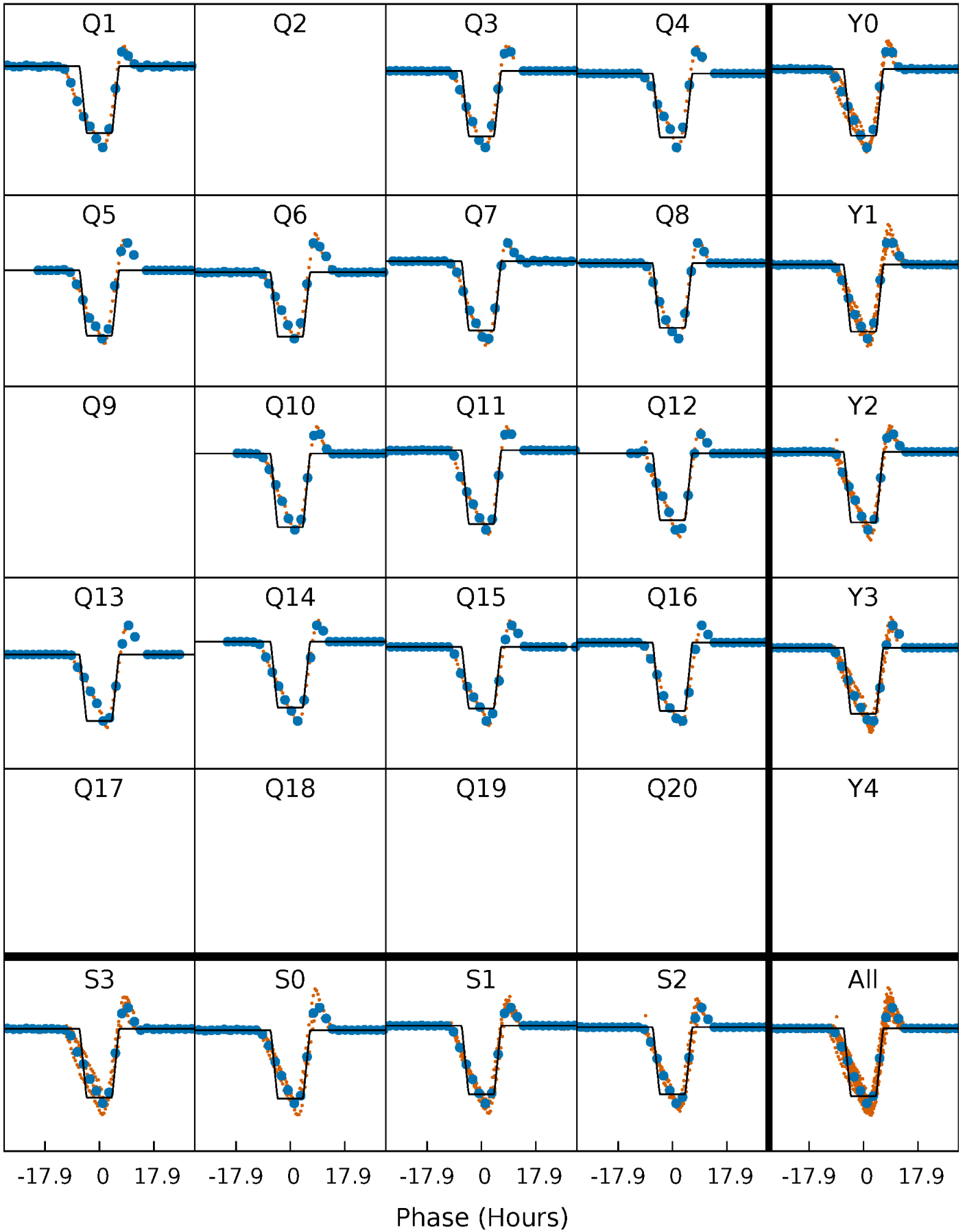
# DV Quarter-Phased Transit Curves

TCE 007377422-01 P=107.621414 Days  $T_0=153.652941$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

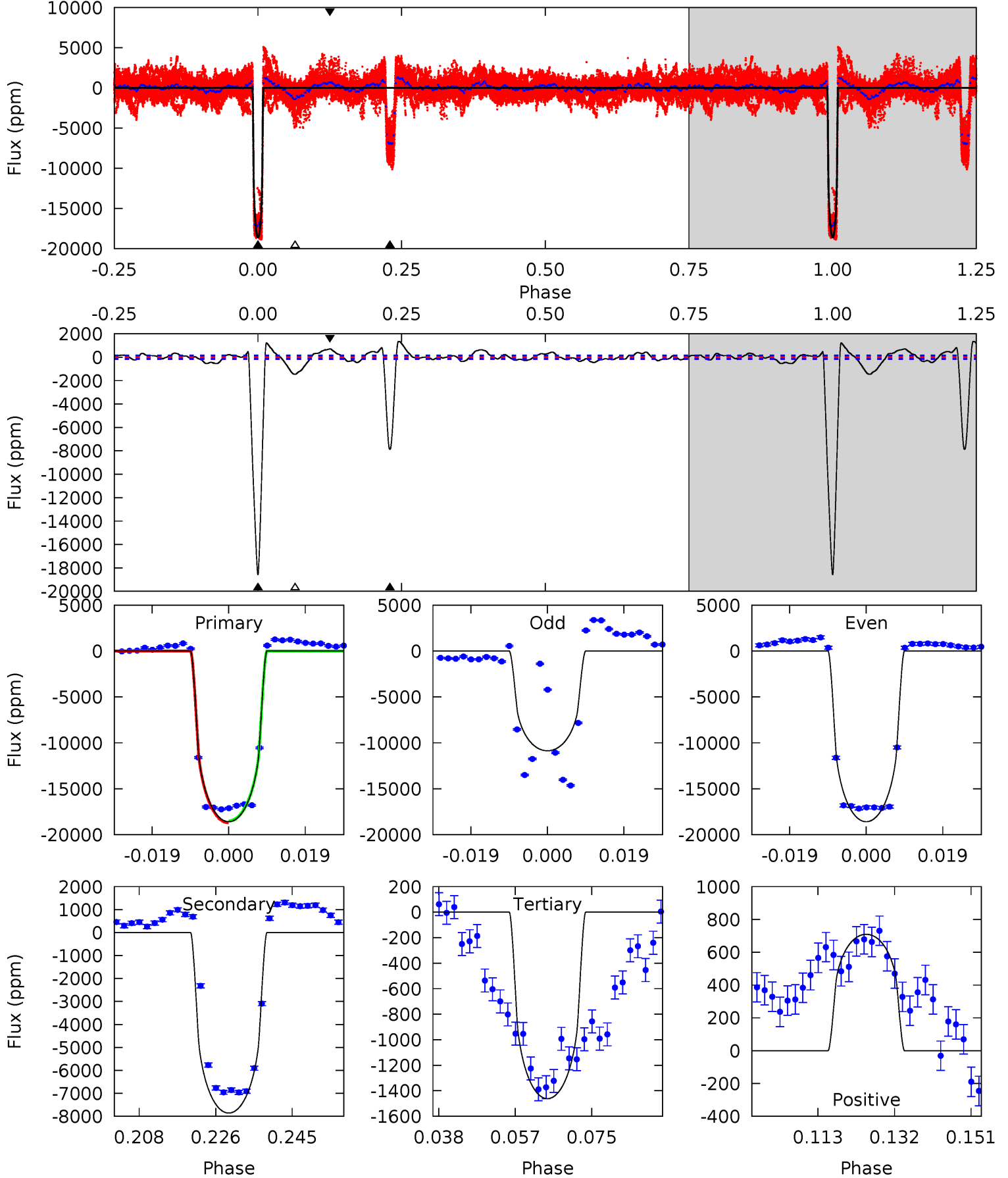
TCE 007377422-01 P=107.616749 Days  $T_0=154.315718$  (BKJD)



# DV Model-Shift Uniqueness Test

007377422-01, P = 107.621414 Days, E = 46.031527 Days

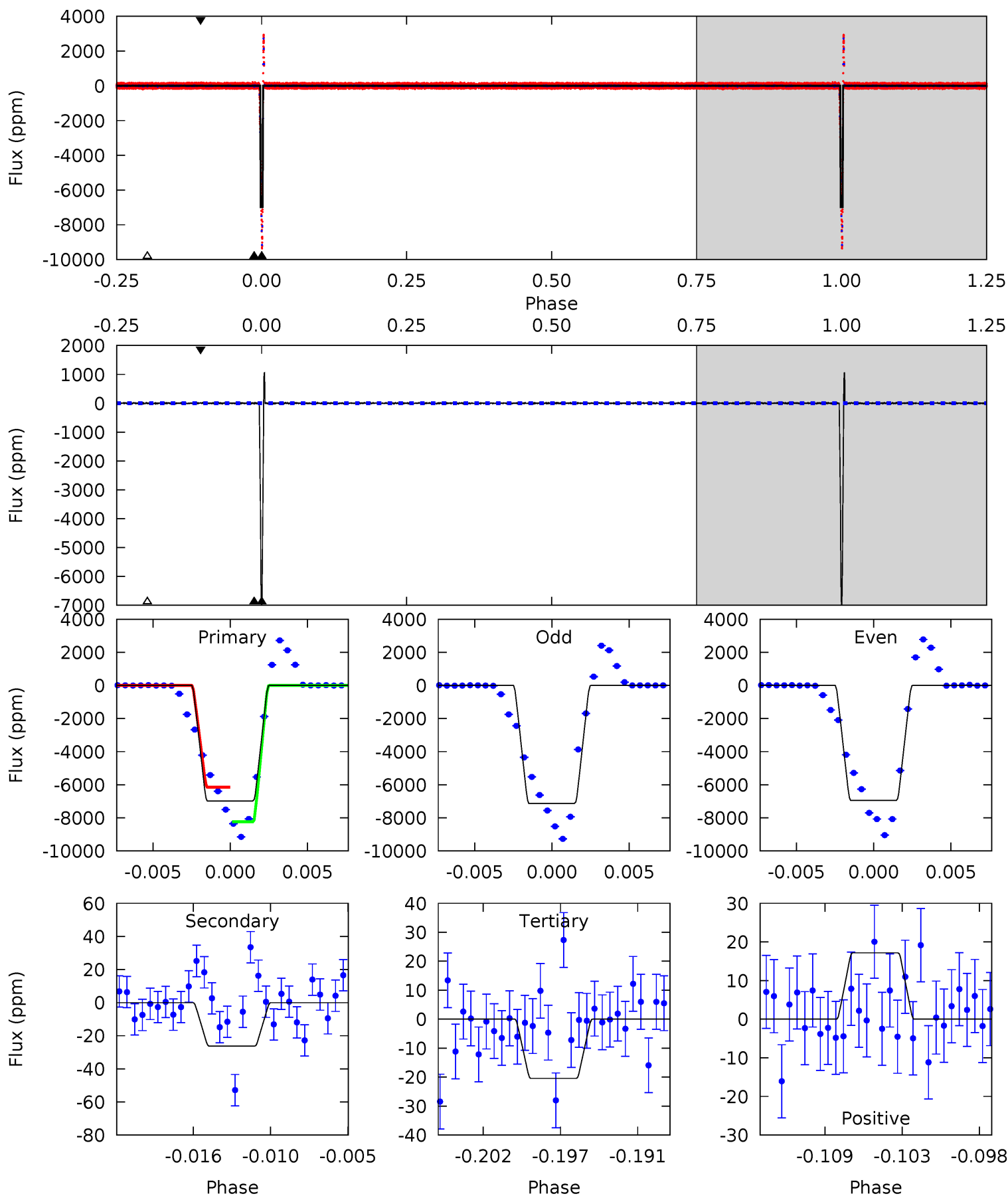
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
581.0	245.7	45.7	22.2	4.90	2.35	11.4	535.3	558.8	200.0	223.5	111.5	0.82	0.07	0



# Alt Model-Shift Uniqueness Test

007377422-01, P = 107.616749 Days, E = 46.698969 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
1103	4.15	3.23	2.71	5.15	2.80	1.06	1100	1100	0.92	1.44	15.1	0.97	0.13	162.9



### Stellar Parameters For KIC 007377422

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$4683^{+140}_{-93}$	$2.621^{+0.396}_{-0.264}$	$-0.260^{+0.300}_{-0.200}$	$7.606^{+4.464}_{-2.747}$	$0.883^{+0.464}_{-0.024}$	$0.003^{+0.007}_{-0.002}$
	+3%/-2%	+15%/-10%	+115%/-77%	+59%/-36%	+53%/-3%	+264%/-64%
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 007377422-01 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-7859 \pm 32$	$102.76^{+34.36}_{-20.94}$	$1203^{+172}_{-140}$	$4124^{+119}_{-75}$	$80^{+49}_{-32}$
Alt.	$-26 \pm 6$	$73.65^{+23.47}_{-15.38}$	$1210^{+141}_{-145}$	$1892^{+119}_{-3282}$	$0.506^{+0.334}_{-0.210}$

$T_{max}$  = 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

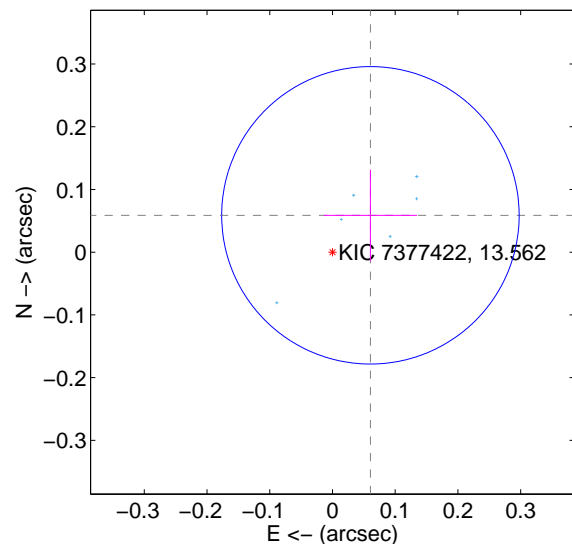
Supplemental centroid analysis for 007377422-01. Kepler magnitude: 13.56. Transit SNR 121.32

There are 6 quarters with good PRF difference image offsets

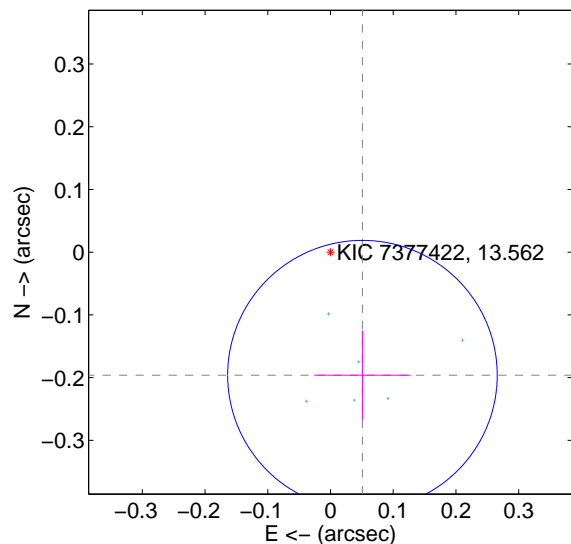
The direct PRF centroid is offset from the target star catalog position by about 0.29 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.084 \pm 0.079$	1.07	$-0.060 \pm 0.074$	$0.059 \pm 0.073$
PRF-fit source offset from KIC position	$0.203 \pm 0.072$	2.83	$-0.051 \pm 0.077$	$-0.196 \pm 0.071$
photometric centroid source offset	$0.26 \pm 0.01$	35.81	$-0.01 \pm 0.00$	$-0.26 \pm 0.01$

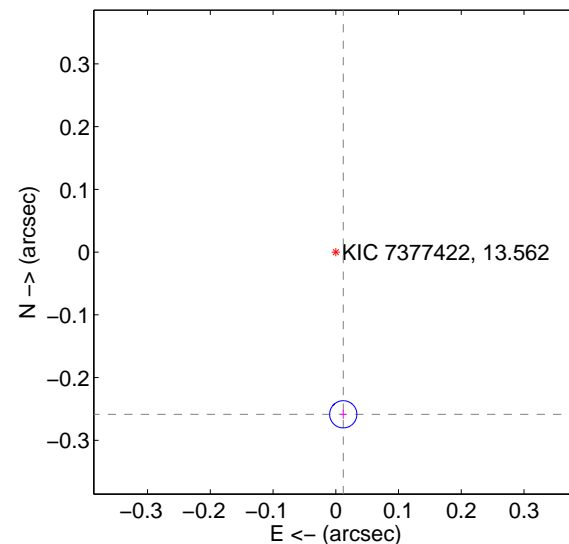
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

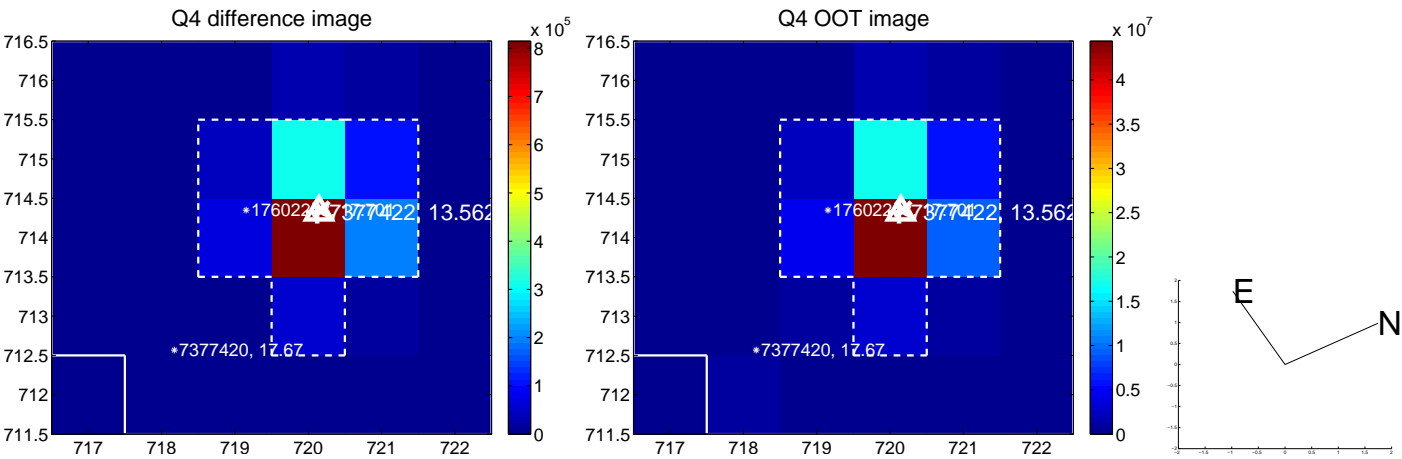
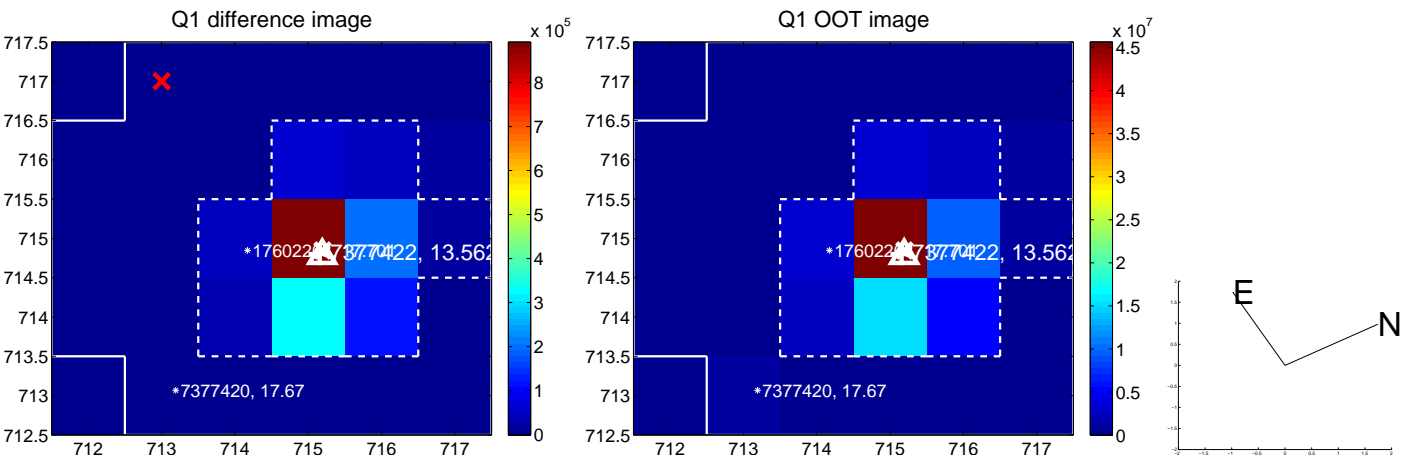


offset from photometric centroids



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.

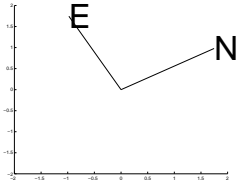
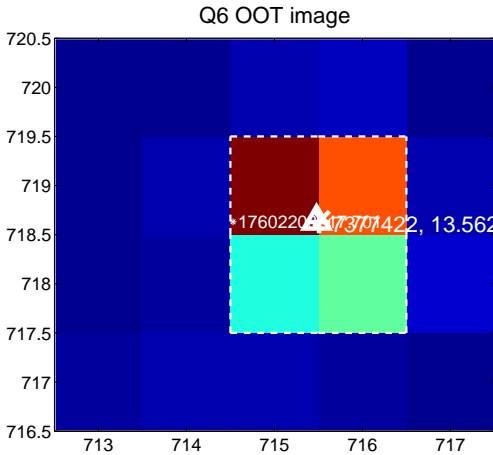
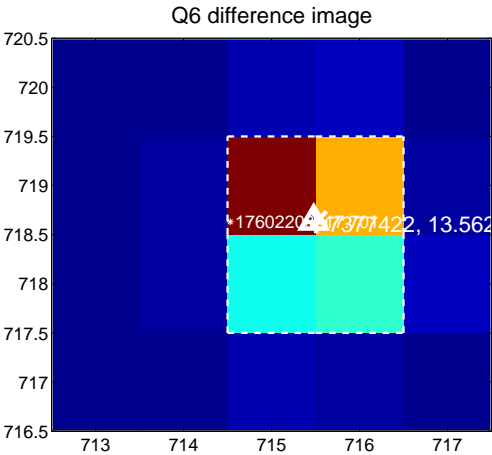


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

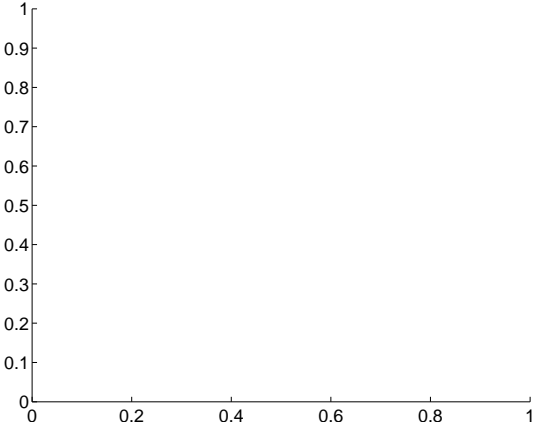
Q5 no difference image



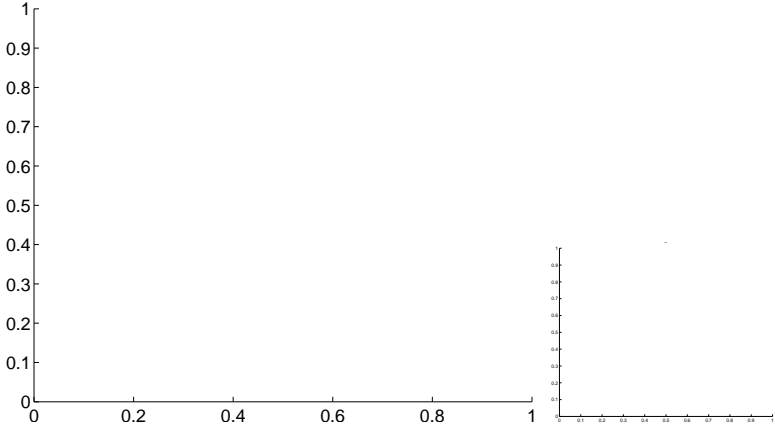
Q5 no OOT image



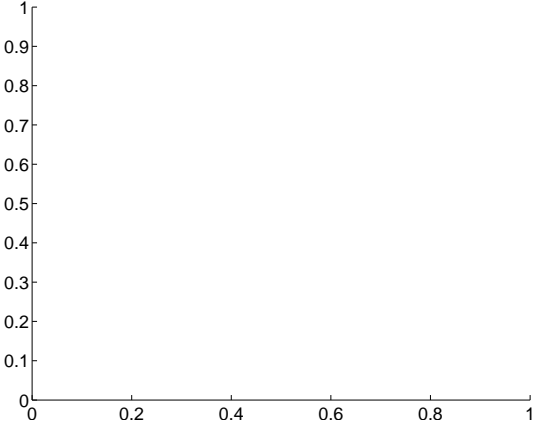
Q7 no difference image



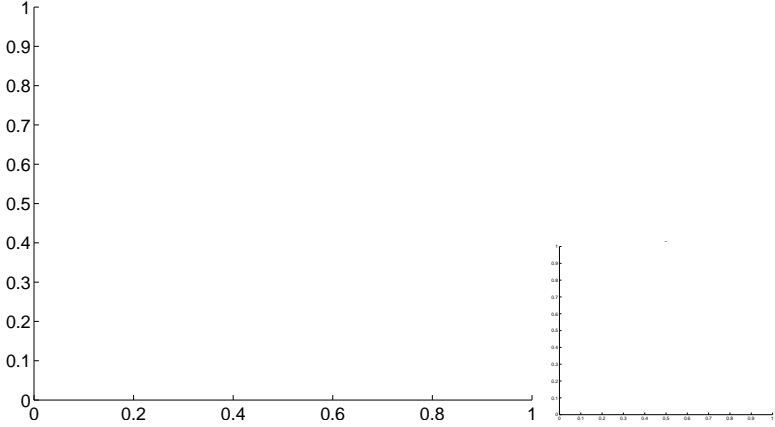
Q7 no OOT image



Q8 no difference image

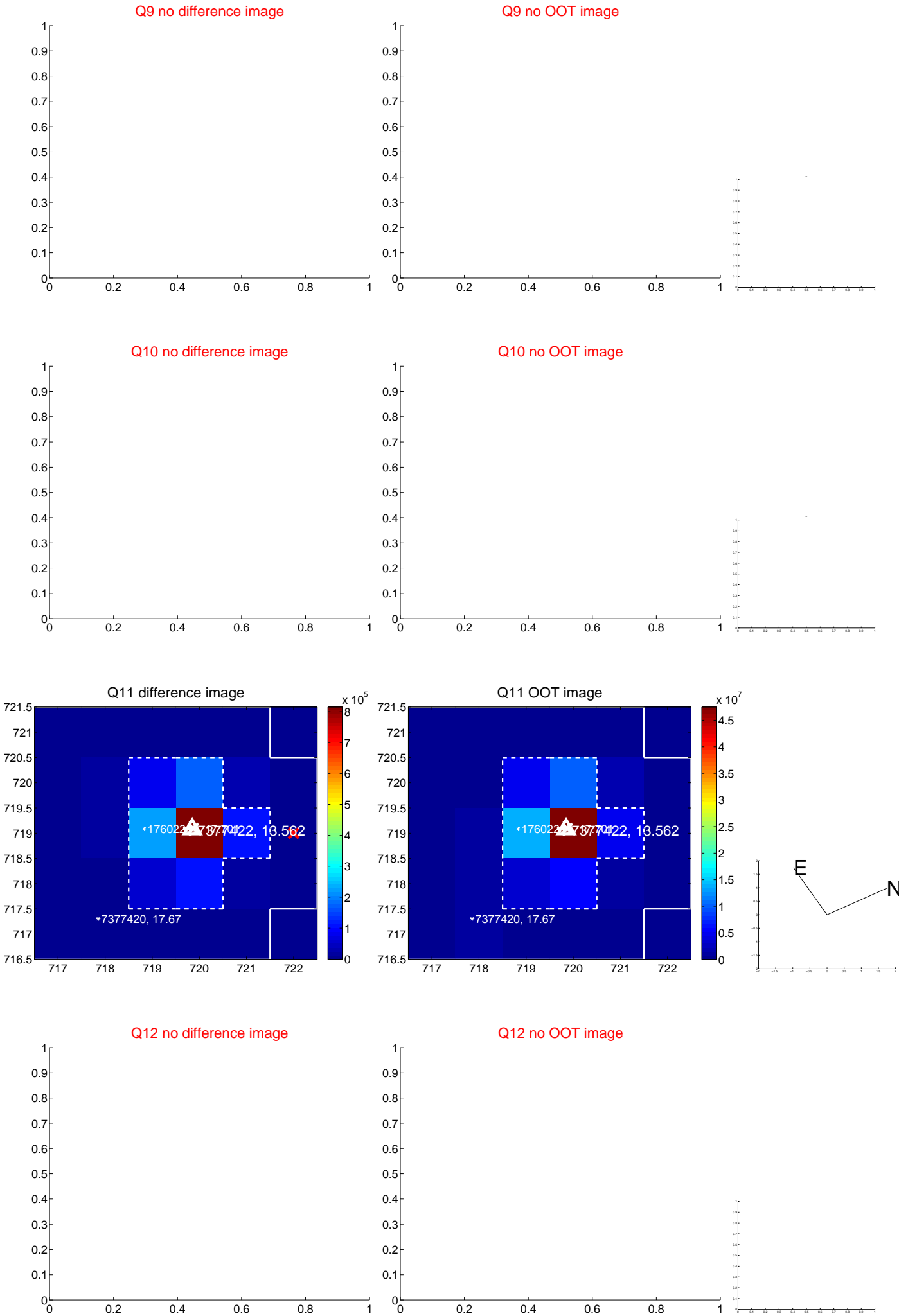


Q8 no OOT image

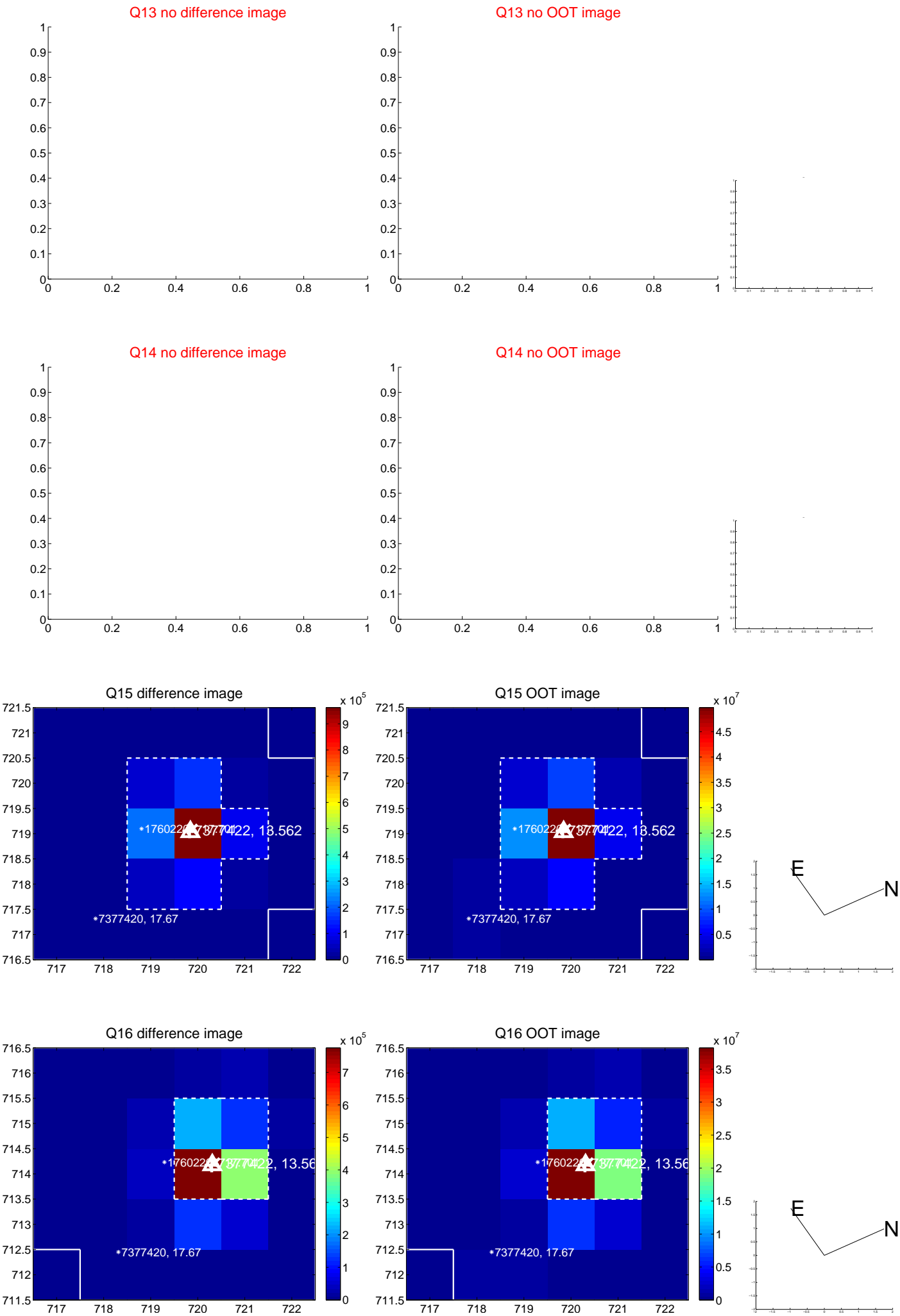




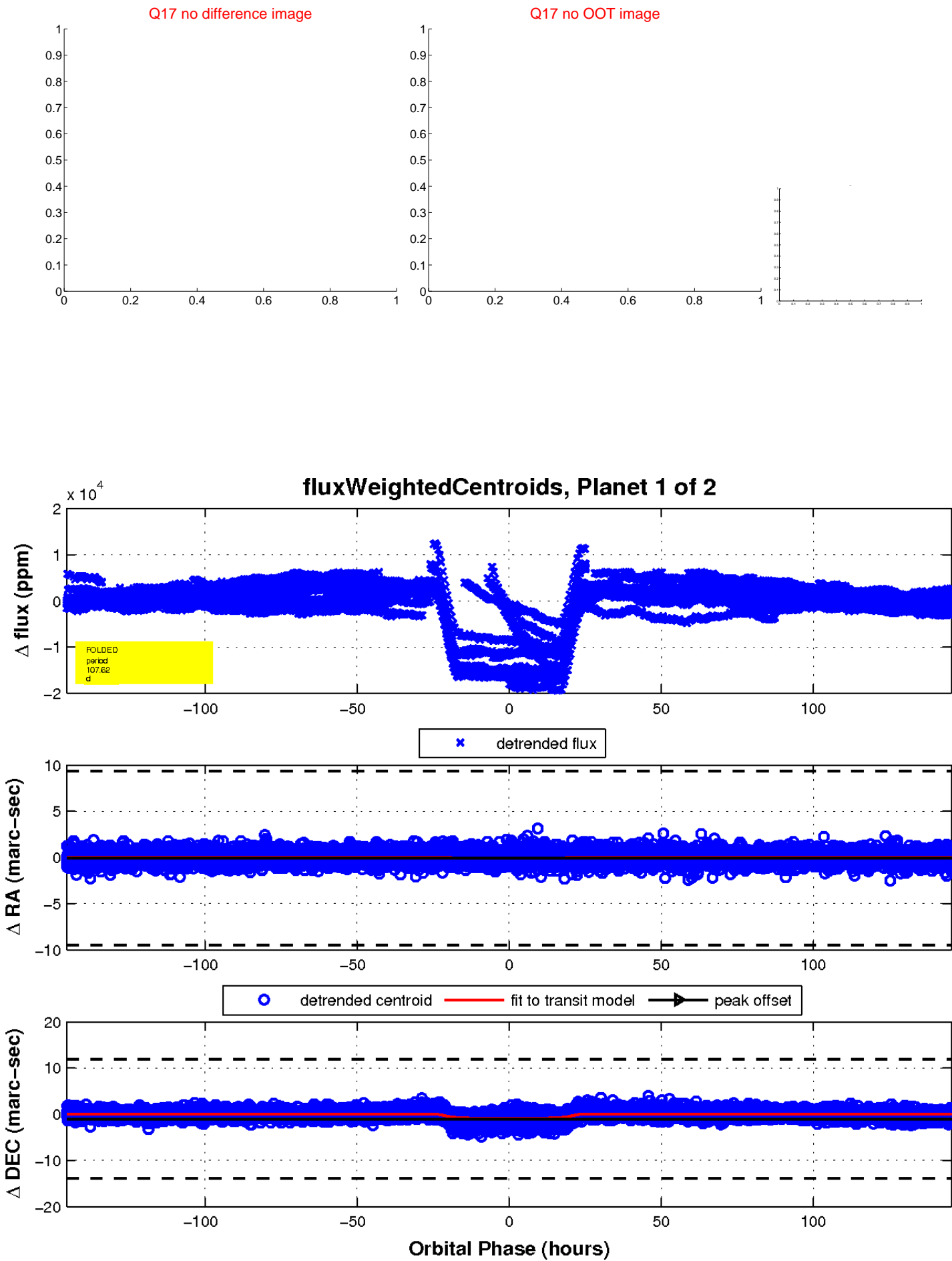
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



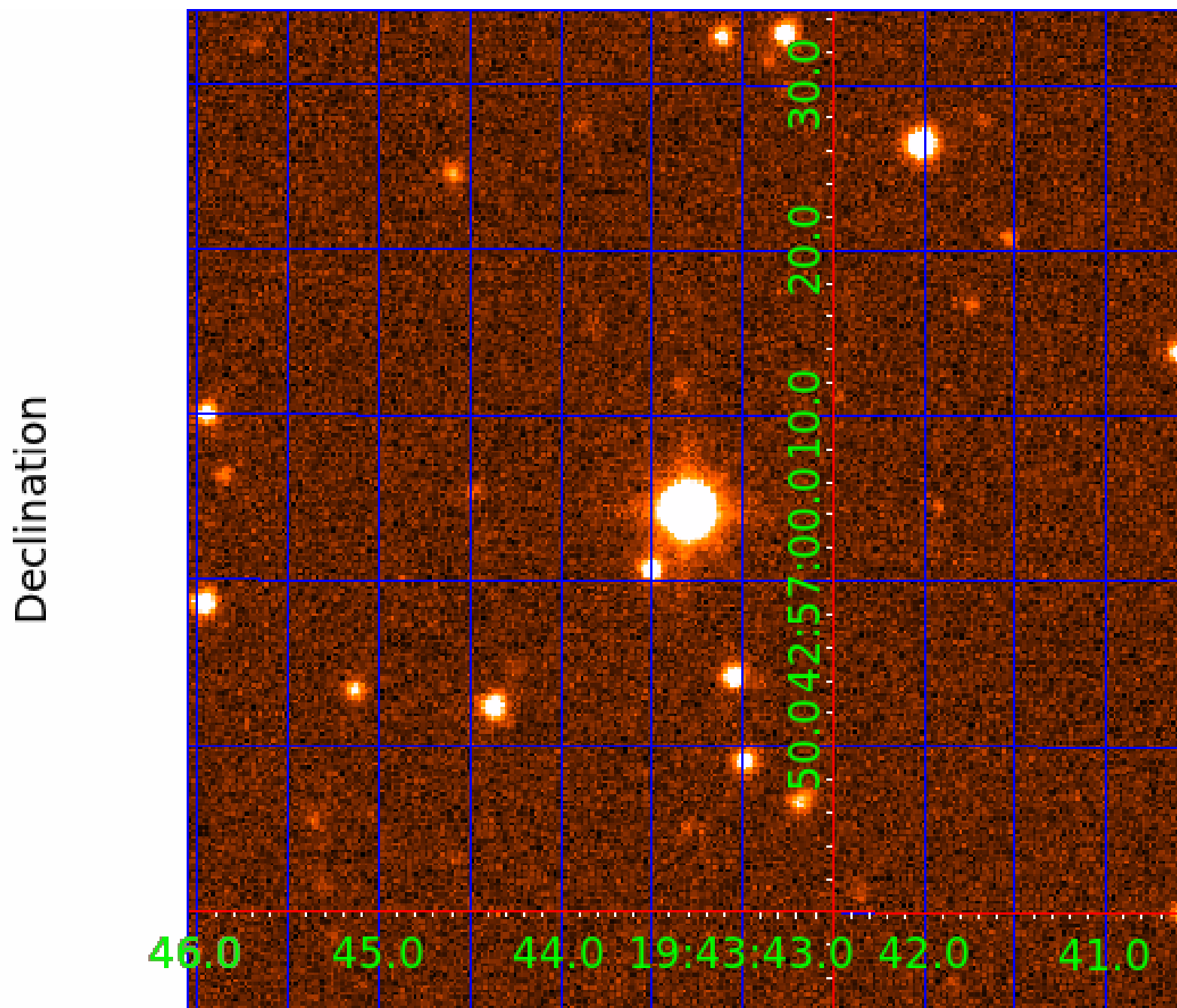
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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UKIRT Image



# KIC 007377422

## 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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## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
007377422-01	OBS	FP	0.00	1	0	0	0	LPP_ALT
007377422-02	OBS	FP	0.00	1	0	0	0	LPP_DV—SAME_NTL_PERIOD

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

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

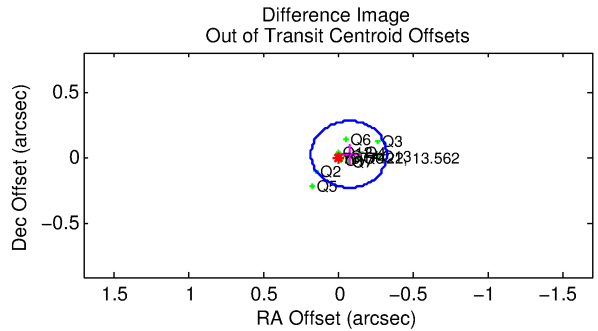
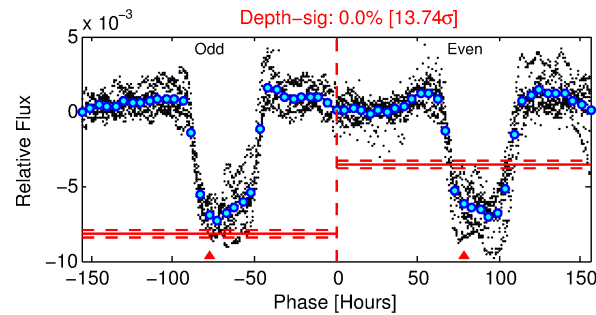
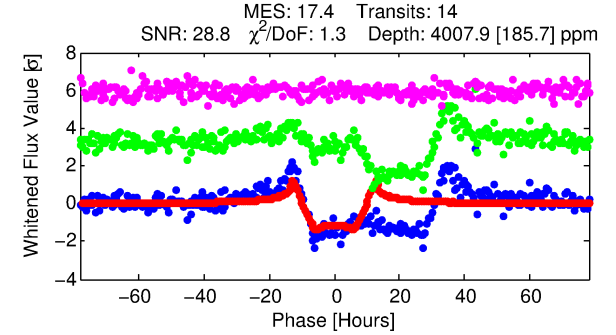
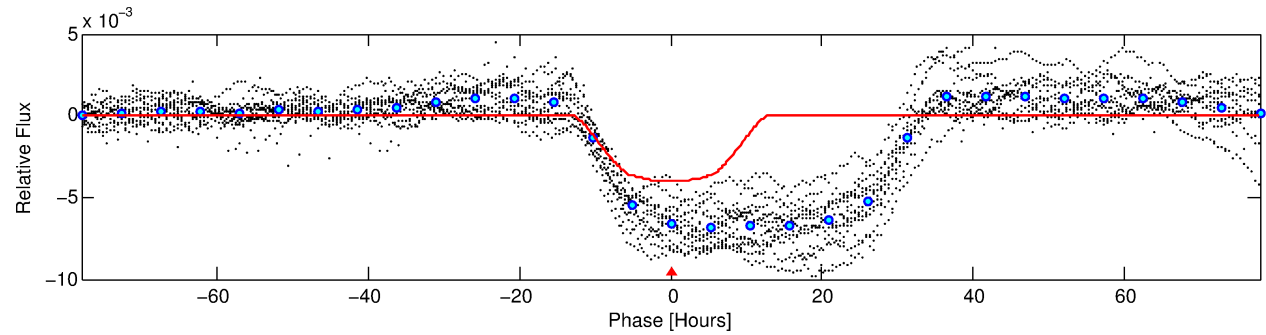
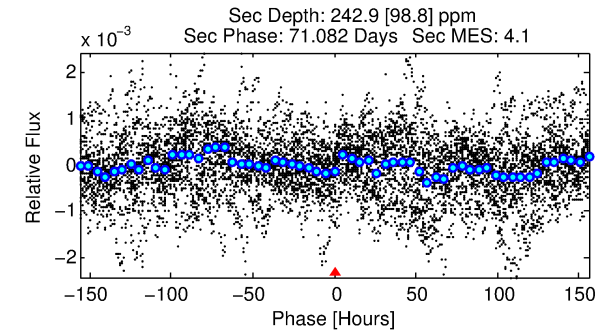
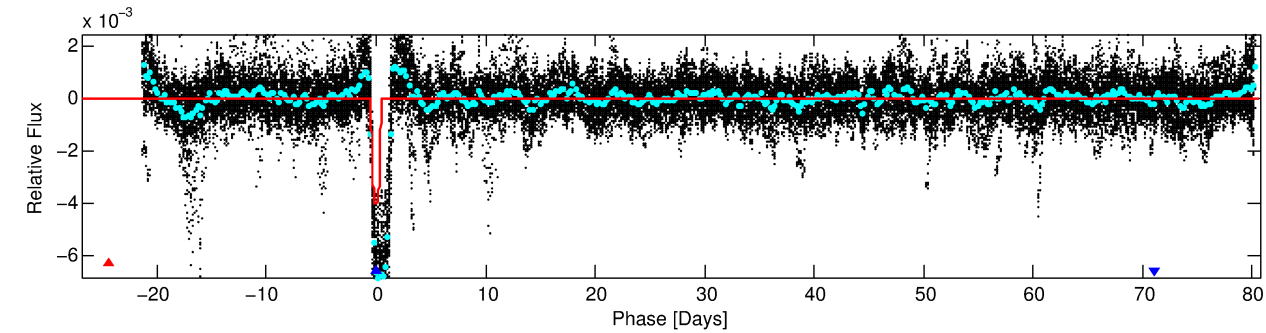
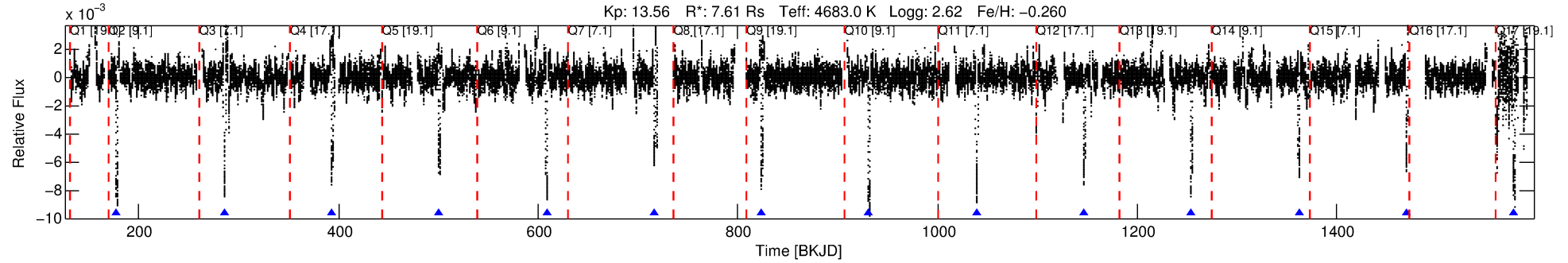
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 007377422-02

No Significant Match Found

# DV One-Page Summary

KIC: 7377422 Candidate: 2 of 2 Period: 107.624 d



## DV Fit Results:

Period = 107.62395 [0.00157] d  
Epoch = 178.0008 [0.0116] BKJD  
Rp/R\* = 0.0712 [0.0018]  
a/R\* = 18.53 [0.47]  
b = 0.90 [0.01]  
Seff = 138.21 [101.27]  
Teff = 874 [160] K  
Rp = 59.09 [34.71] Re  
a = 0.4247 [0.2104] AU  
Ag = 6.90 [5.74] [1.03σ]  
Teffp = 2191 [234] K [4.64σ]

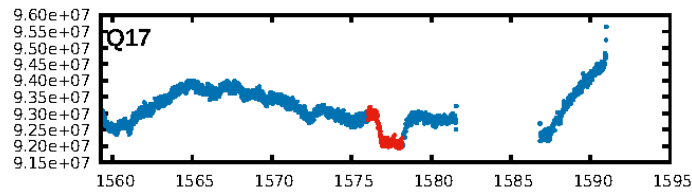
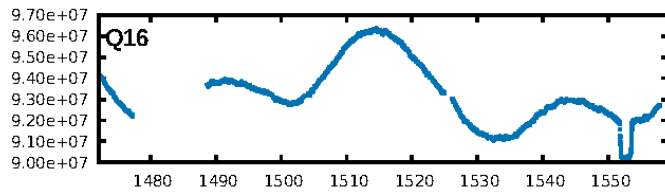
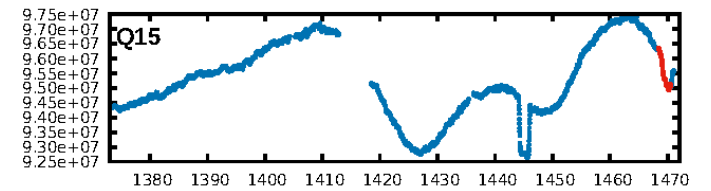
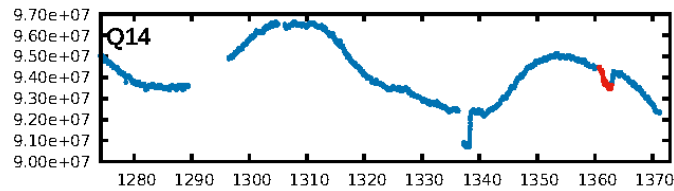
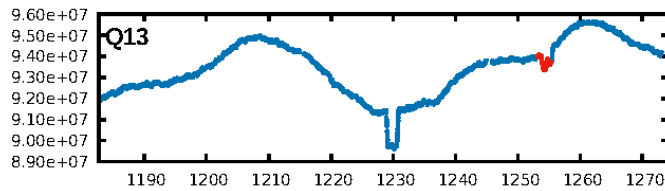
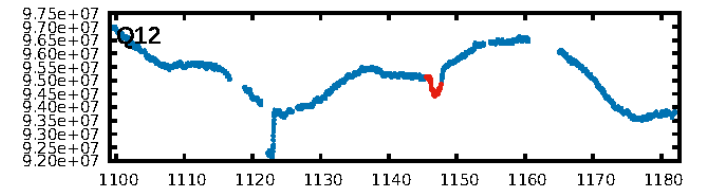
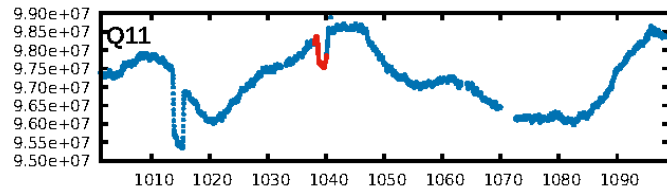
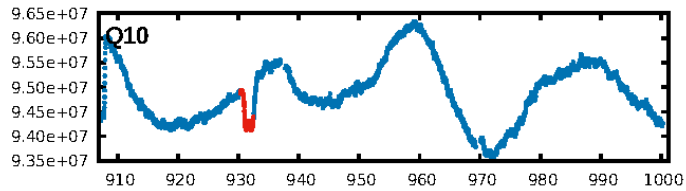
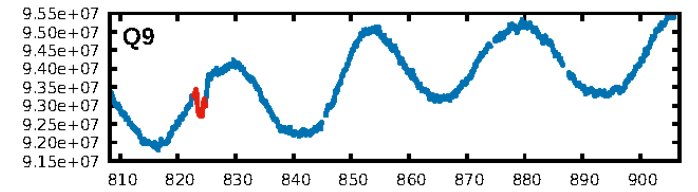
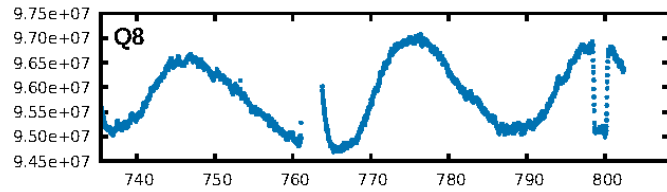
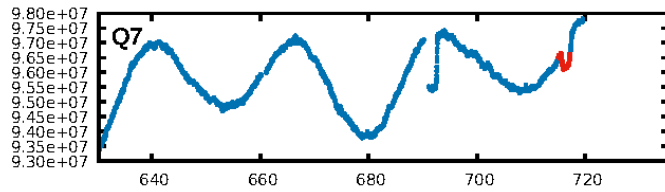
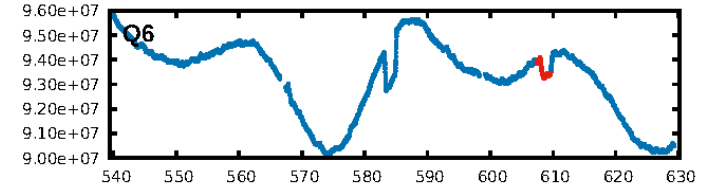
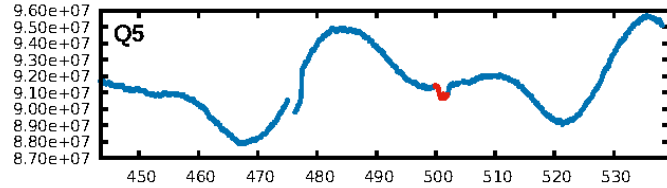
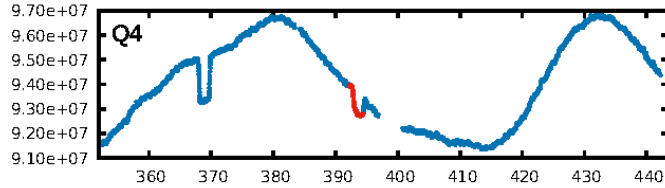
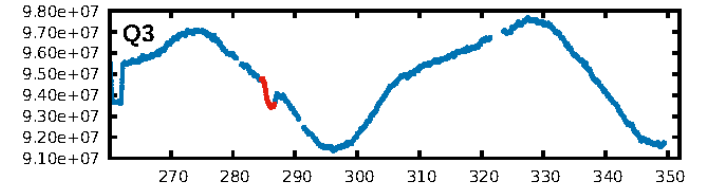
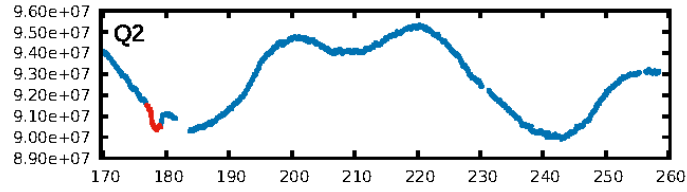
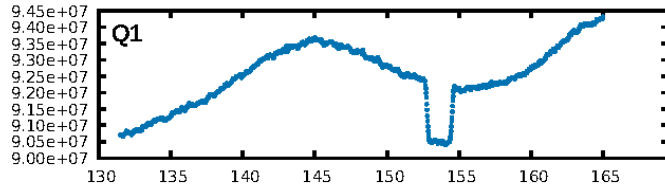
## DV Diagnostic Results:

ShortPeriod-sig: 0.1% [0.00σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 2.4%  
ModelChiSquareGof-sig: 99.4%  
Bootstrap-pfa: 5.09e-53  
RollingBand-fgt: 1.00 [13/13]  
GhostDiagnostic-chr: 2.278  
Centroid-sig: 5.6%  
Centroid-so: 0.267 arcsec [7.16σ]  
OotOffset-rm: 0.080 arcsec [0.95σ]  
KicOffset-rm: 0.242 arcsec [3.31σ]  
OotOffset-st: 3/2/2/4 [11]  
KicOffset-st: 3/2/2/4 [11]  
DiffImageQuality-fgm: 1.00 [11/11]  
DiffImageOverlap-fno: 1.00 [11/11]

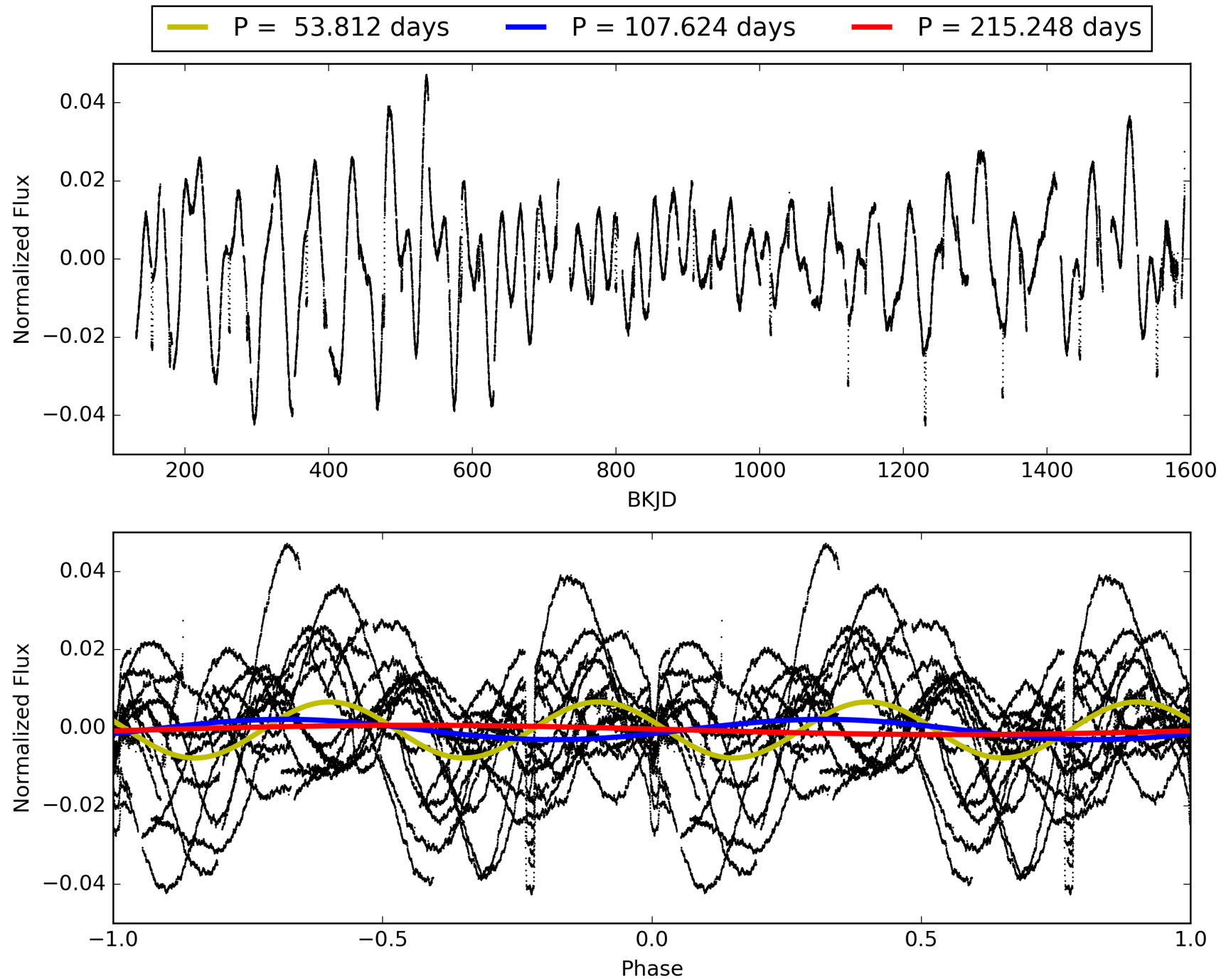
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 06:57:29 Z

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

# TCE 007377422-02, PDC Light Curves



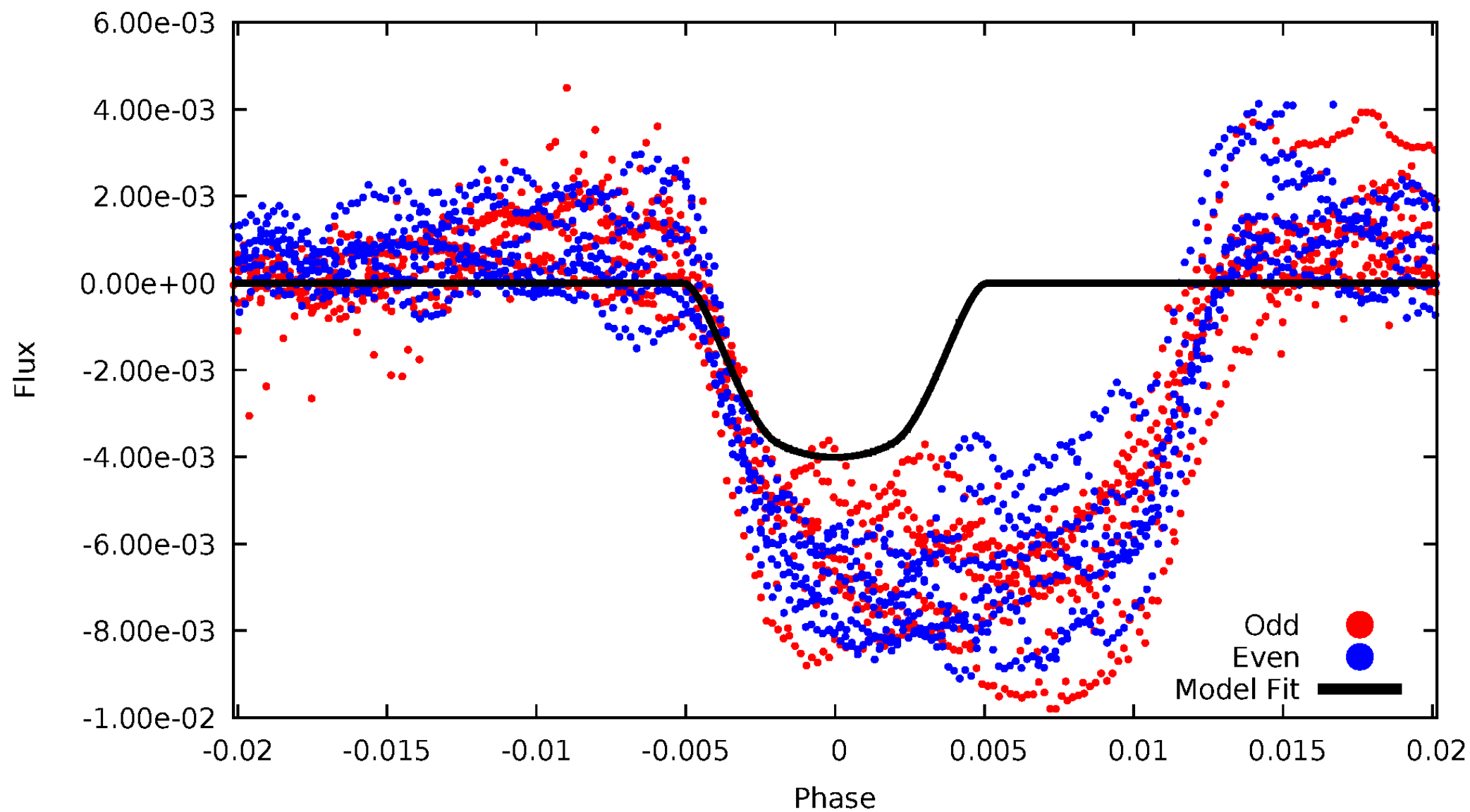
TCE 007377422-02





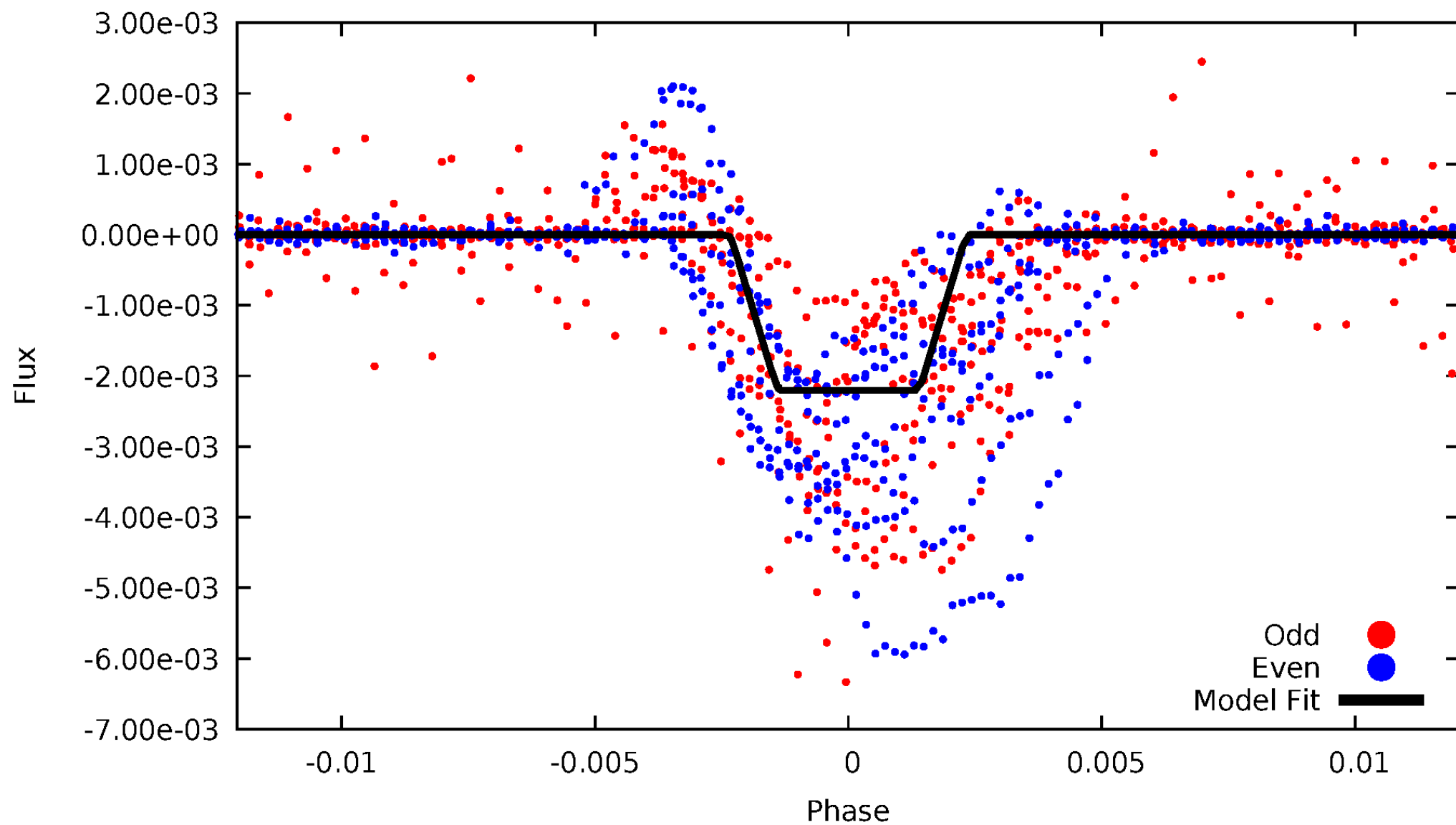
# DV Odd/Even

TCE 007377422-02



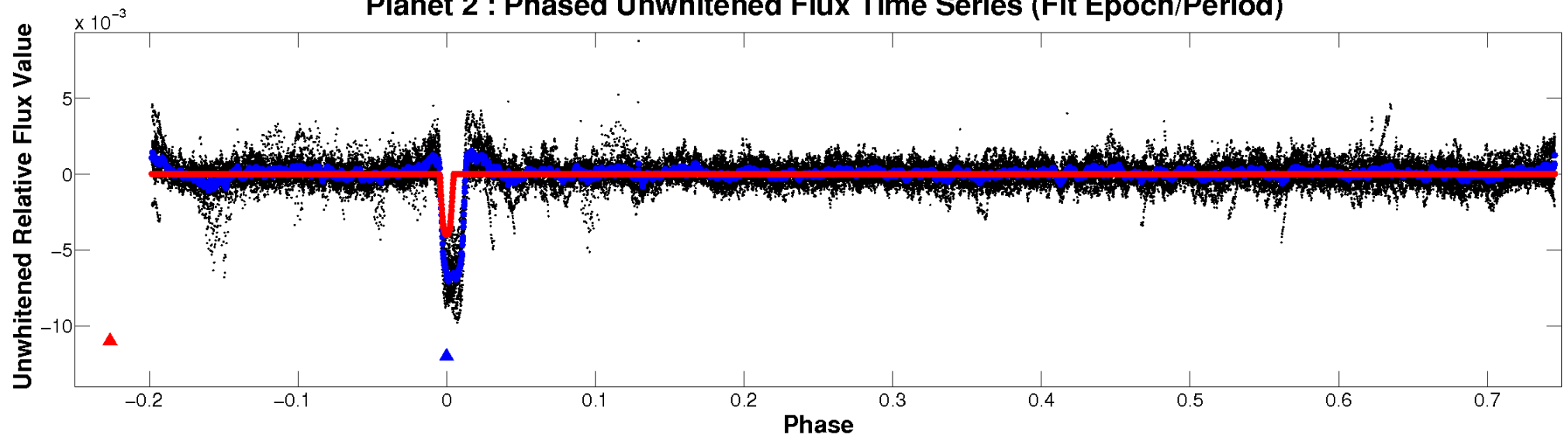
# ALT Odd/Even

TCE 007377422-02

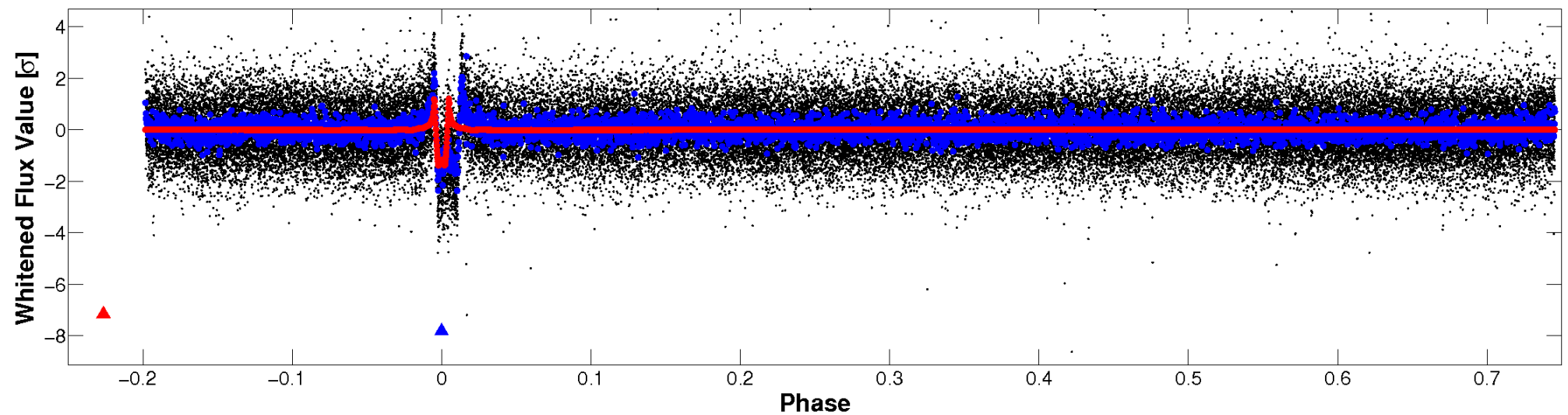


# Non-Whitened Vs. Whitened Light Curve

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

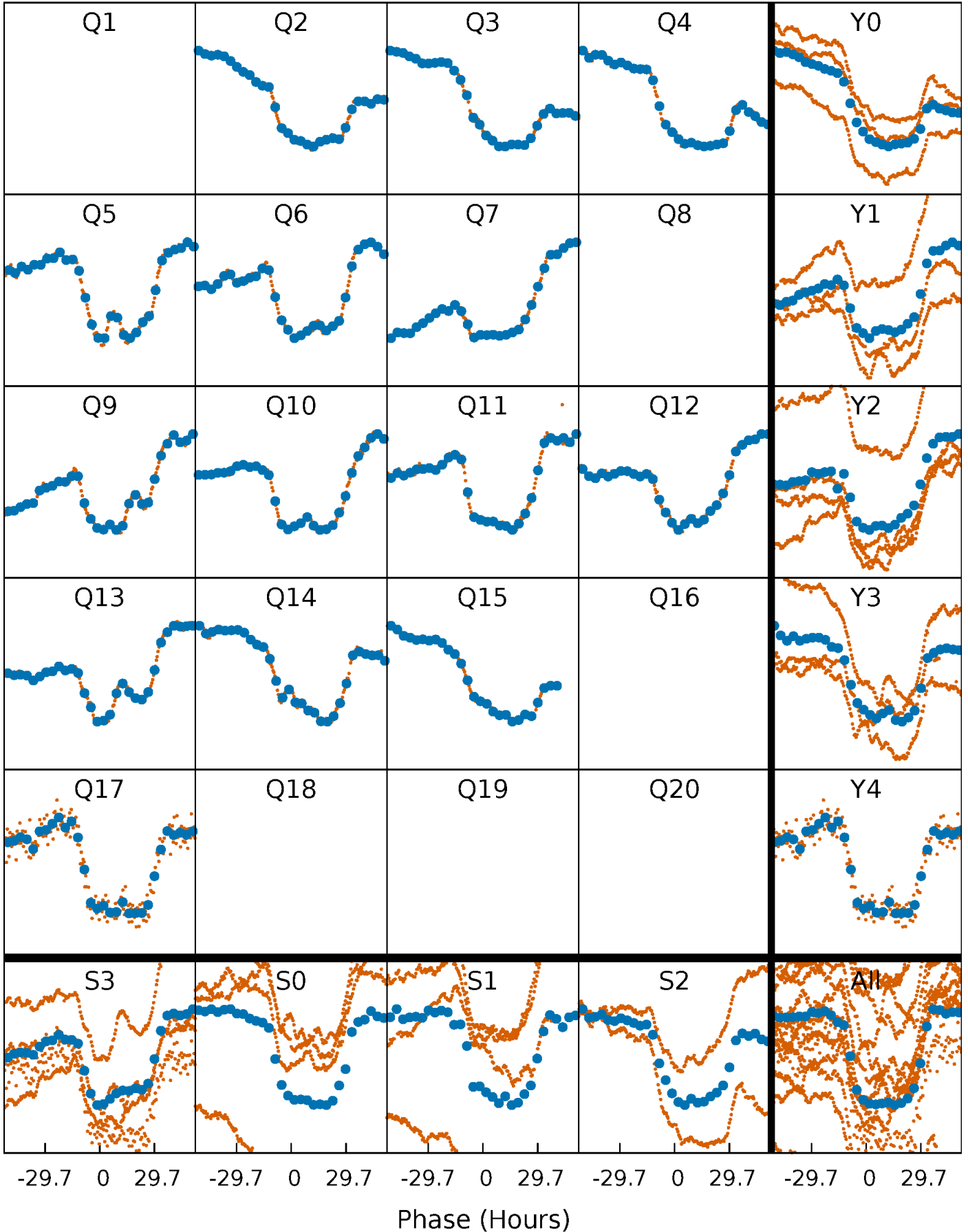


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



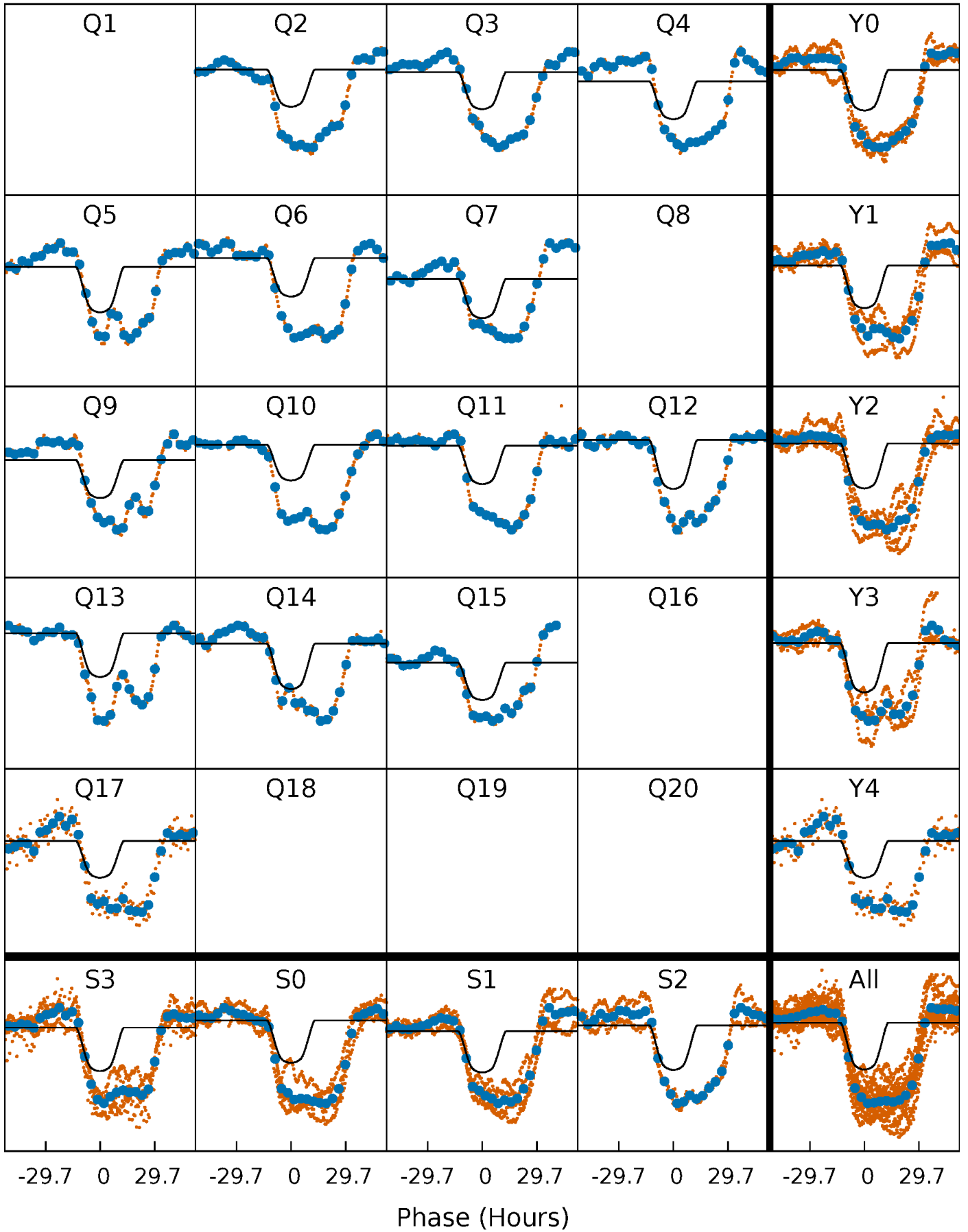
# PDC Quarter-Phased Transit Curves

TCE 007377422-02 P=107.623947 Days  $T_0=178.000842$  (BKJD)



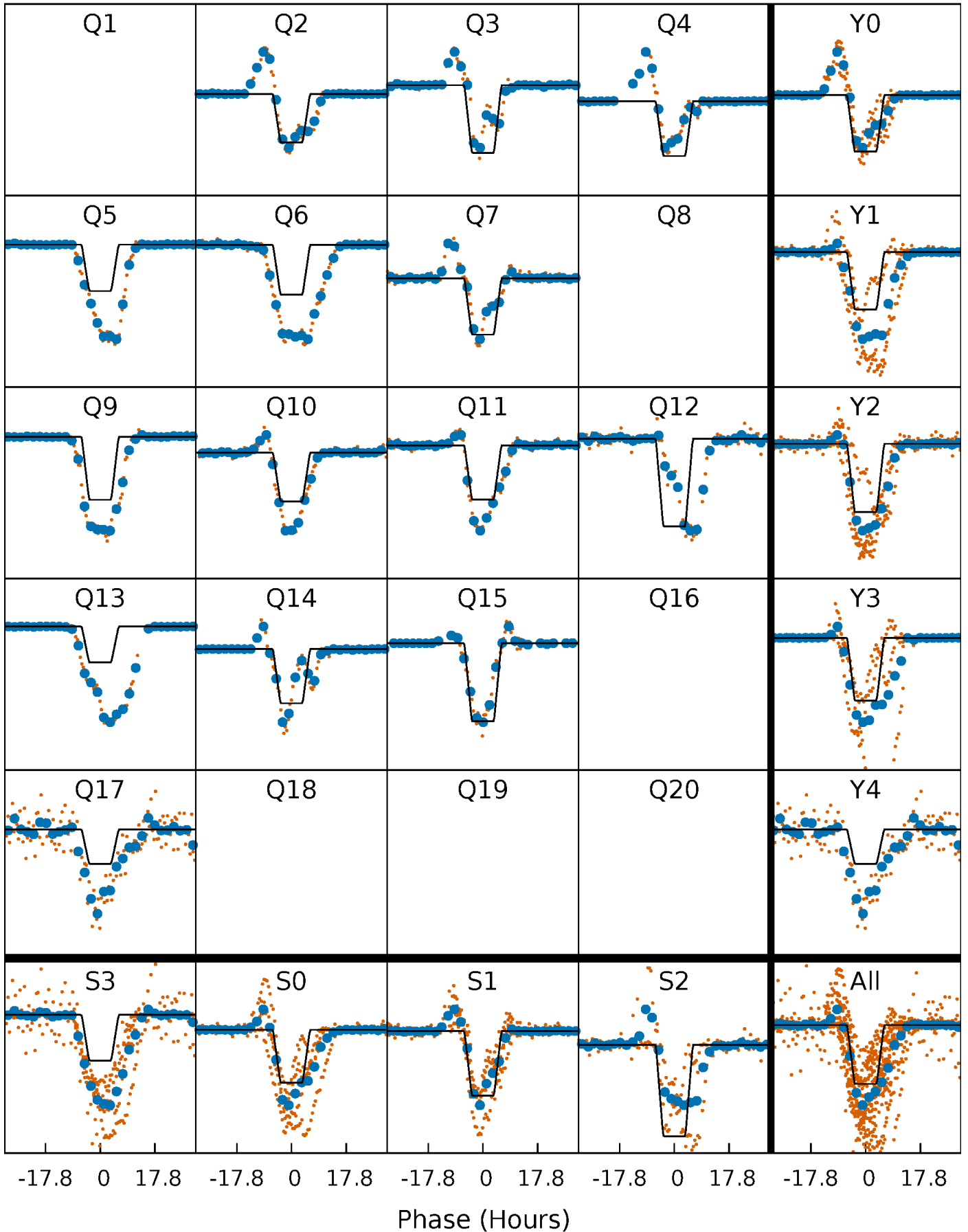
# DV Quarter-Phased Transit Curves

TCE 007377422-02 P=107.623947 Days  $T_0=178.000842$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

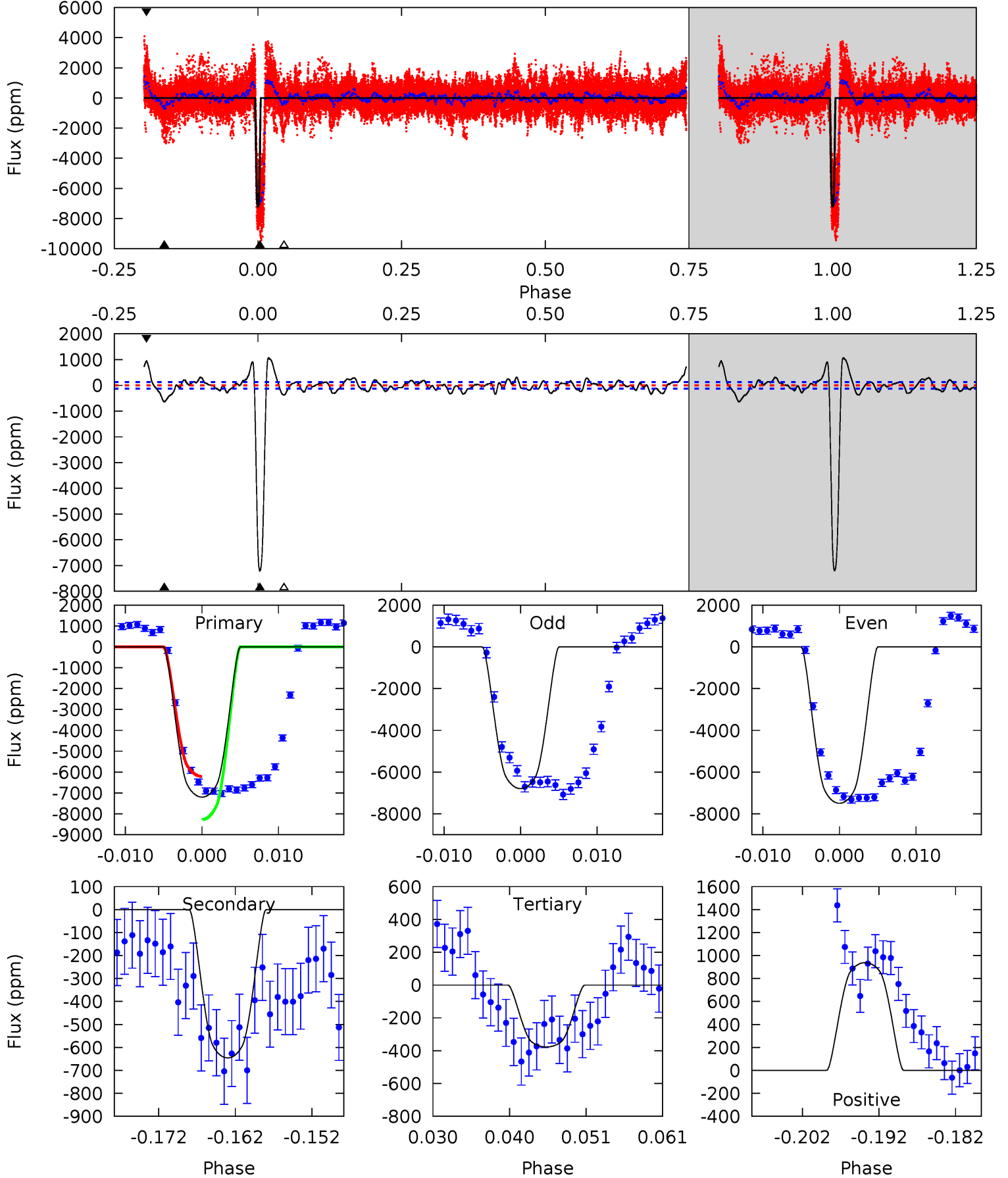
TCE 007377422-02 P=107.623560 Days  $T_0=177.840961$  (BKJD)



# DV Model-Shift Uniqueness Test

007377422-02, P = 107.623947 Days, E = 70.376895 Days

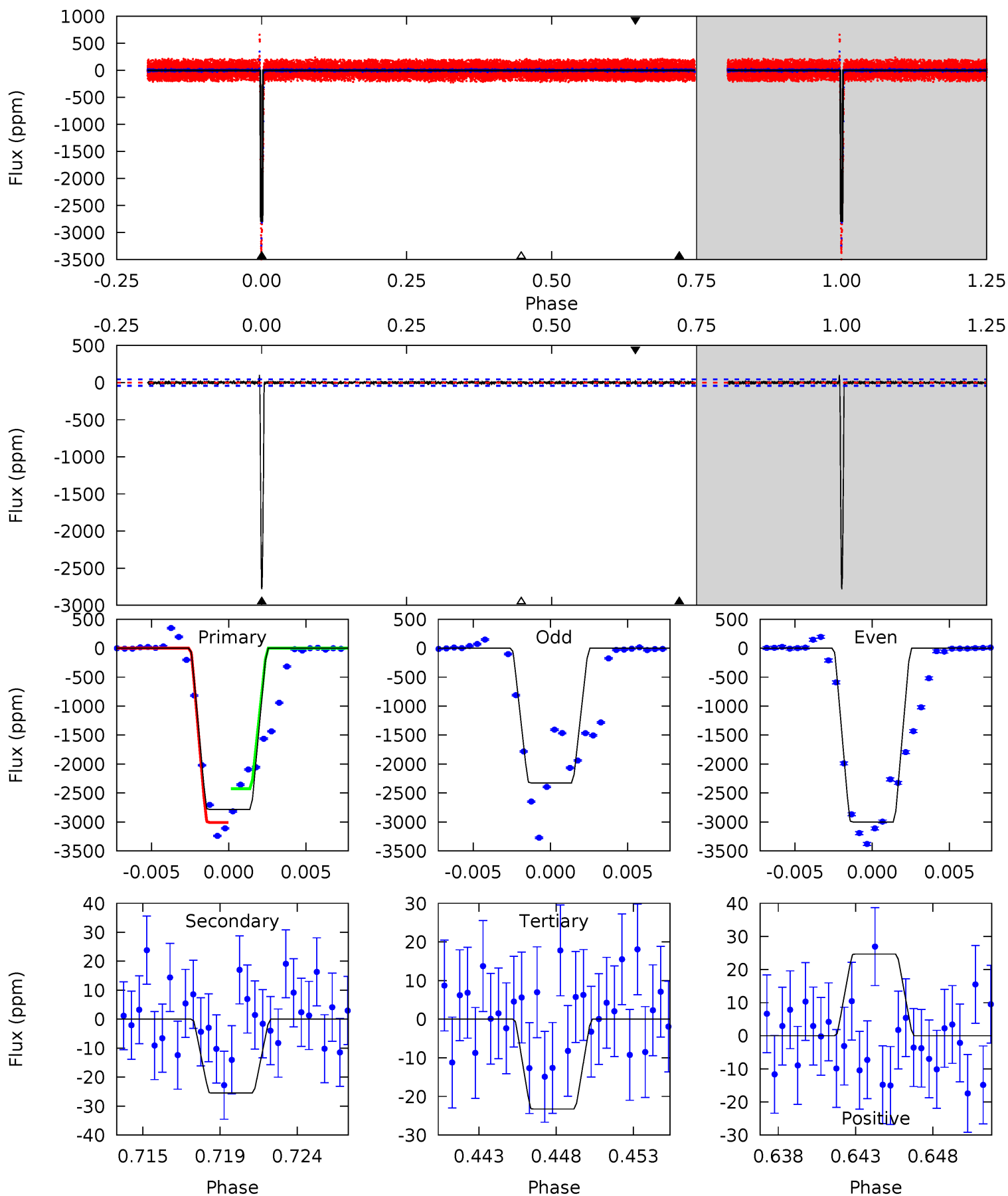
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
282.6	25.3	14.8	36.8	5.02	2.57	8.84	267.8	245.7	10.5	-11.5	13.7	1.00	0.13	39.6



# Alt Model-Shift Uniqueness Test

007377422-02, P = 107.623560 Days, E = 70.217401 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
329.9	3.02	2.76	2.93	5.17	2.82	0.80	327.2	327.0	0.26	0.10	45.3	1.11	0.04	0





### Stellar Parameters For KIC 007377422

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M$ ( $M_{\odot}$ )	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$4683^{+140}_{-93}$	$2.621^{+0.396}_{-0.264}$	$-0.260^{+0.300}_{-0.200}$	$7.606^{+4.464}_{-2.747}$	$0.883^{+0.464}_{-0.024}$	$0.003^{+0.007}_{-0.002}$
	+3%/-2%	+15%/-10%	+115%/-77%	+59%/-36%	+53%/-3%	+264%/-64%
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 007377422-02 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-646 \pm 25$	$59.15^{+18.56}_{-10.93}$	$1206^{+164}_{-124}$	$3278^{+78}_{-64}$	$20^{+11}_{-7}$
Alt.	$-25 \pm 8$	$39.31^{+11.52}_{-8.01}$	$1206^{+154}_{-131}$	$2328^{+108}_{-144}$	$1.708^{+1.230}_{-0.779}$

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

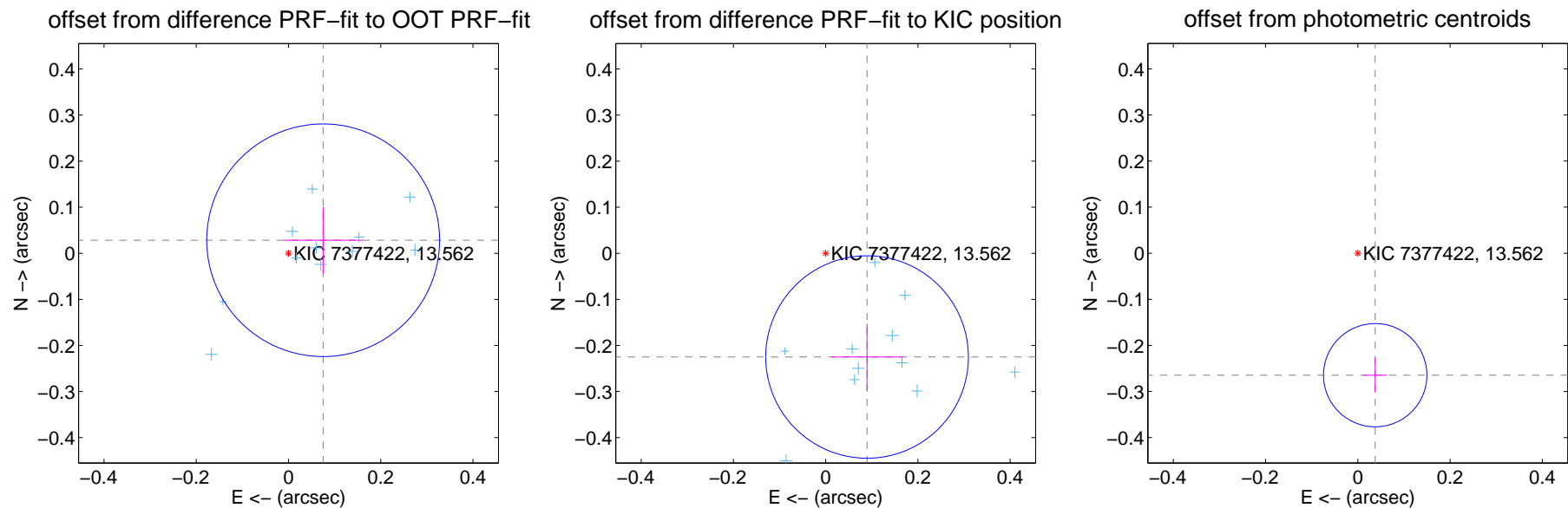
## DV Centroid Data

Supplemental centroid analysis for 007377422-02. Kepler magnitude: 13.56. Transit SNR 28.79

There are 11 quarters with good PRF difference image offsets

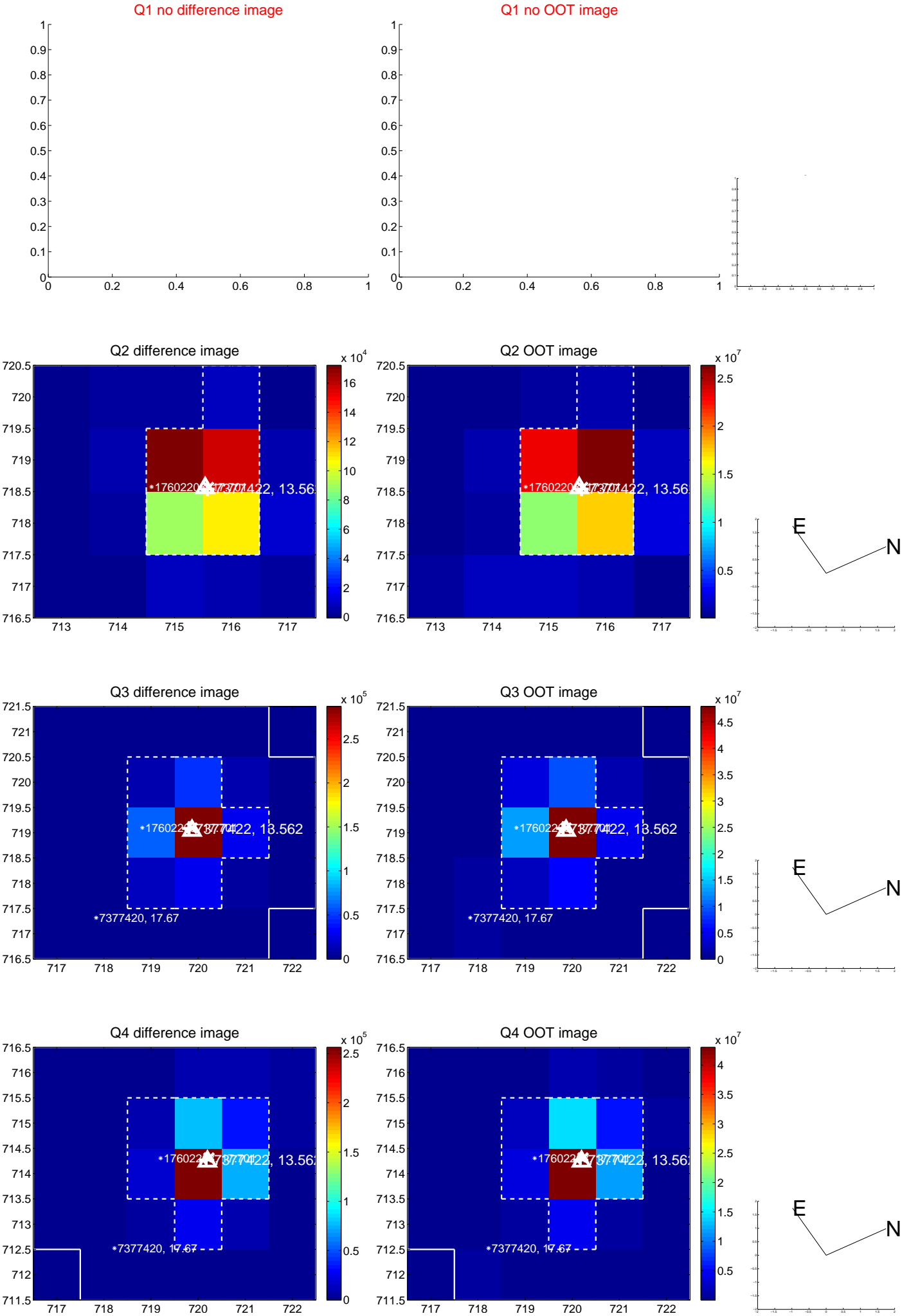
The direct PRF centroid is offset from the target star catalog position by about 0.27 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.080 \pm 0.084$	0.95	$-0.075 \pm 0.086$	$0.028 \pm 0.072$
PRF-fit source offset from KIC position	$0.242 \pm 0.073$	3.31	$-0.090 \pm 0.078$	$-0.225 \pm 0.072$
photometric centroid source offset	$0.27 \pm 0.04$	7.16	$-0.04 \pm 0.03$	$-0.26 \pm 0.04$

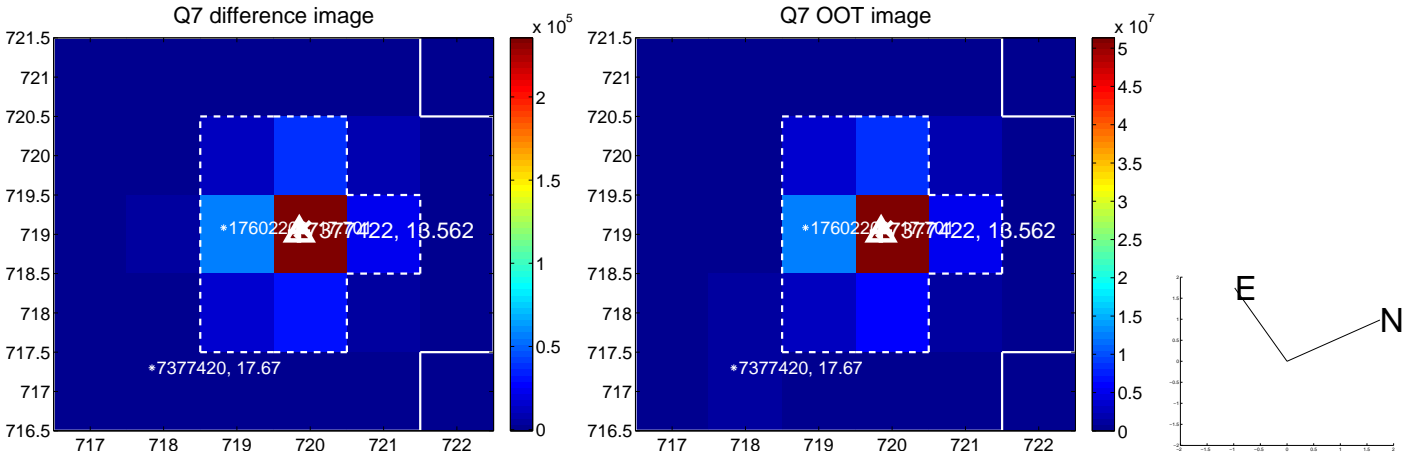
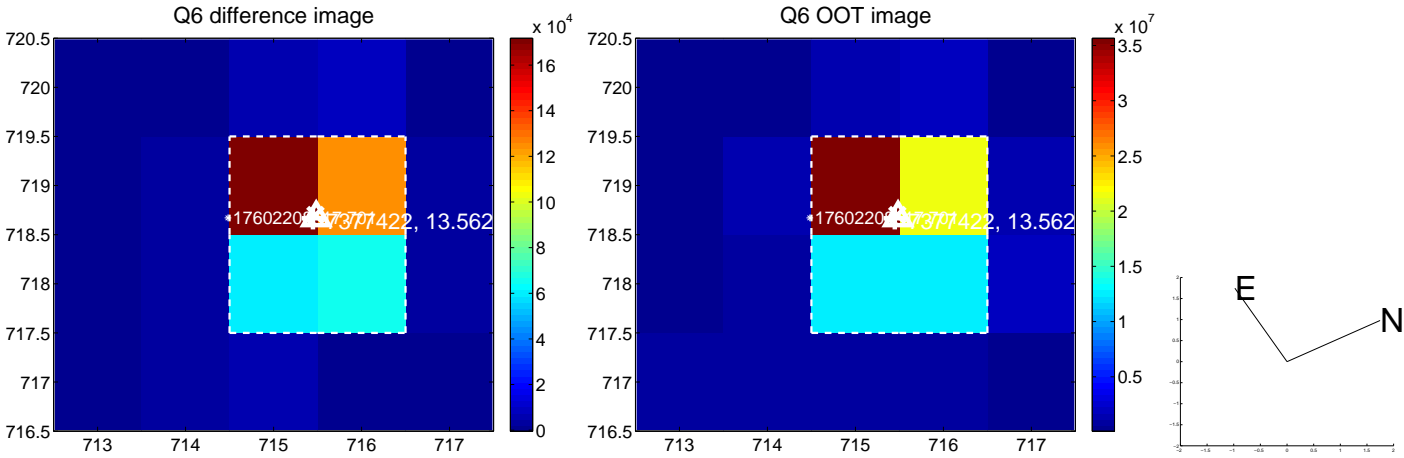
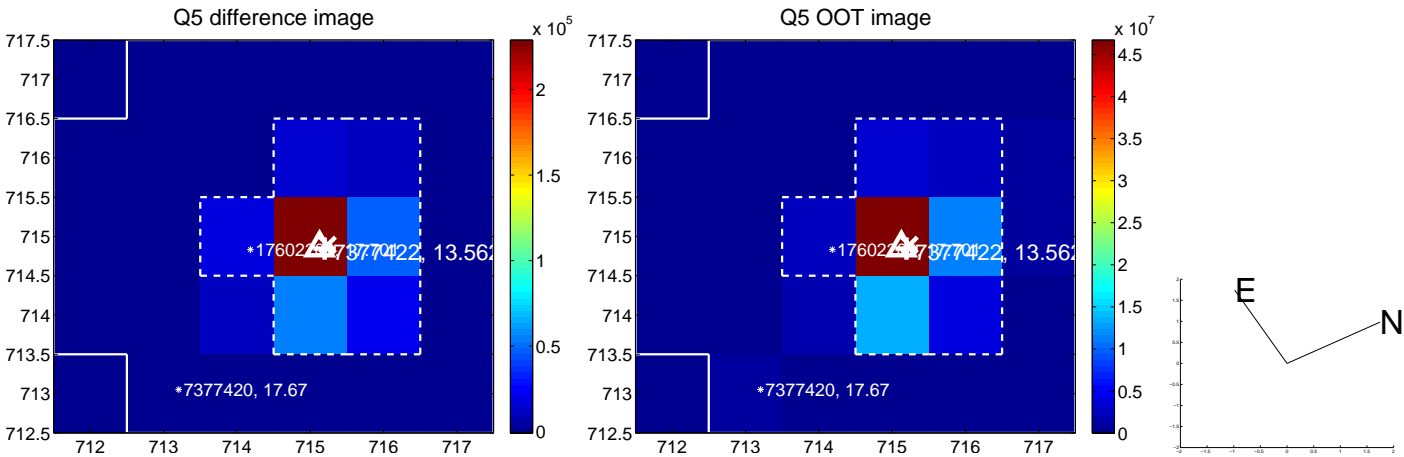


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

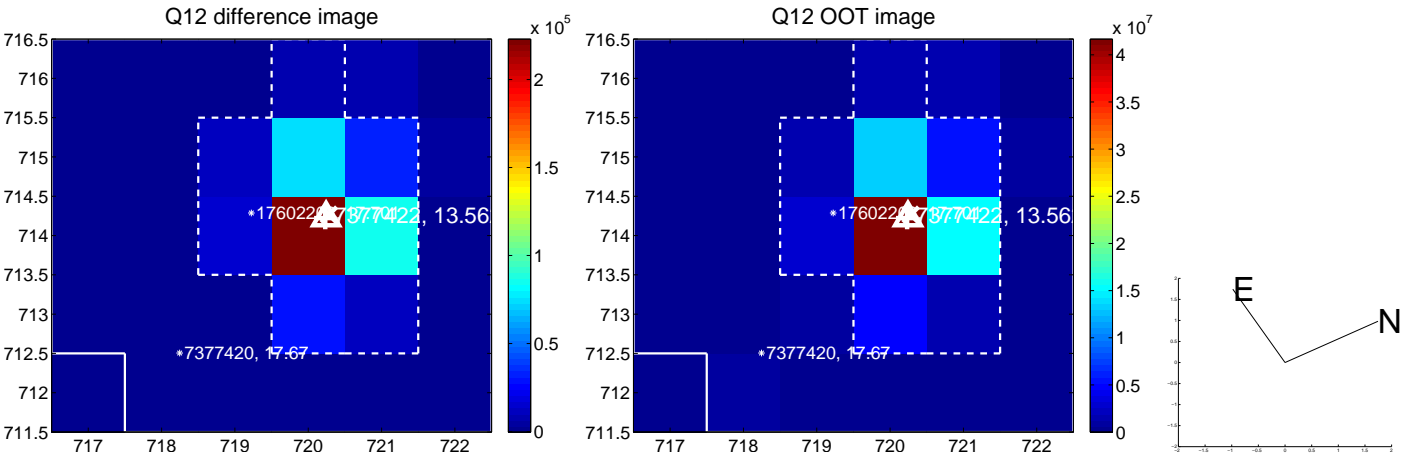
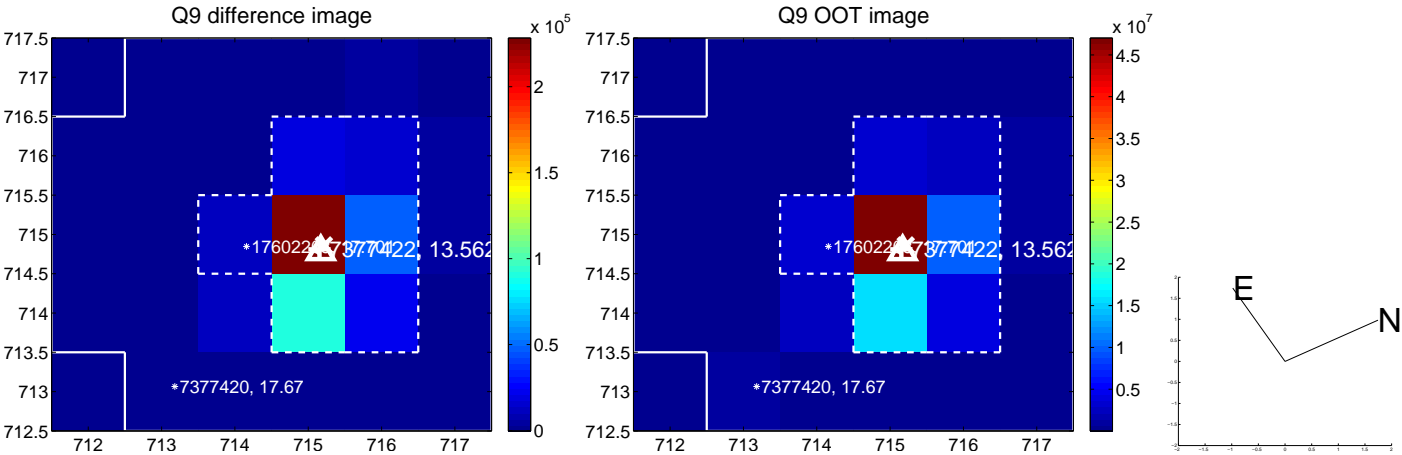
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



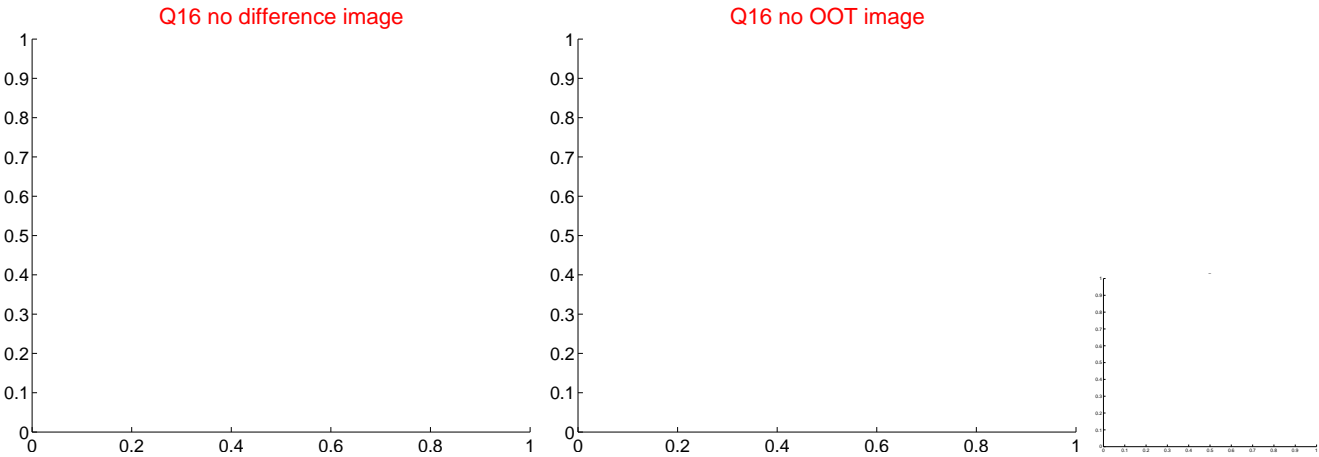
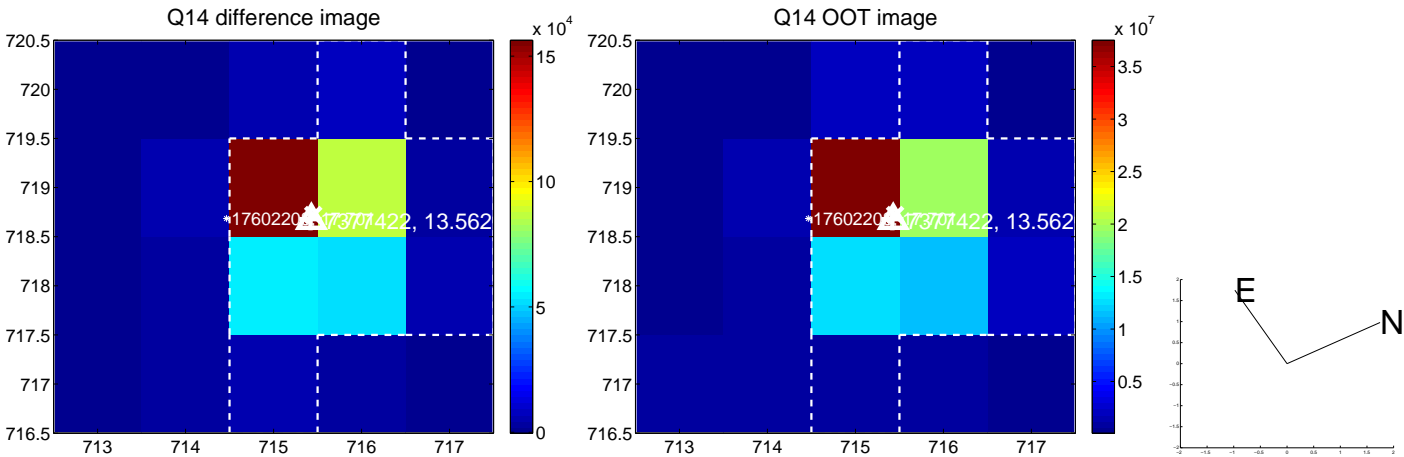
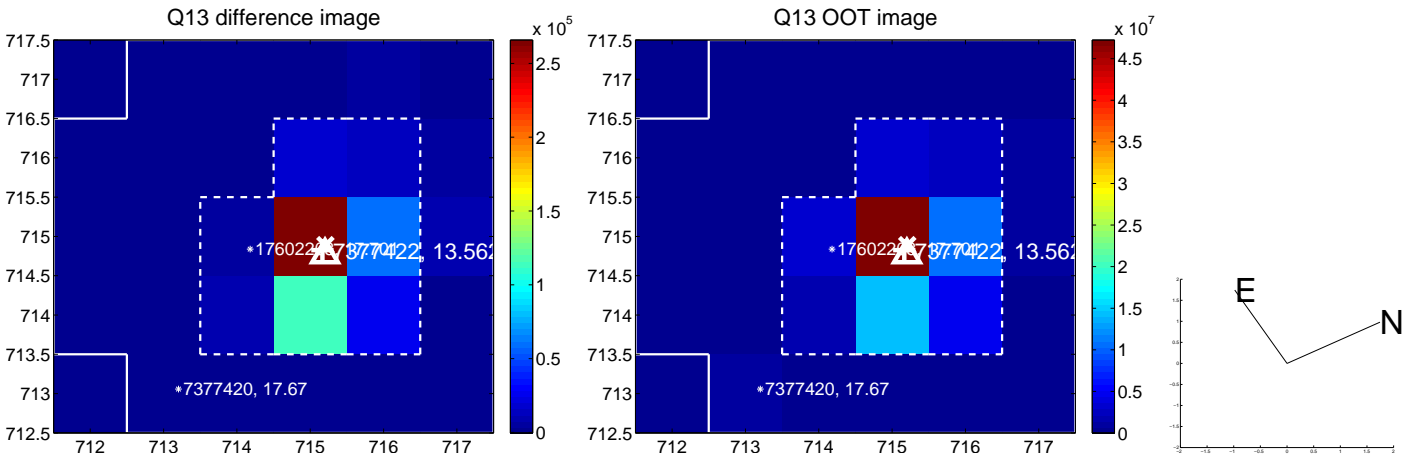
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



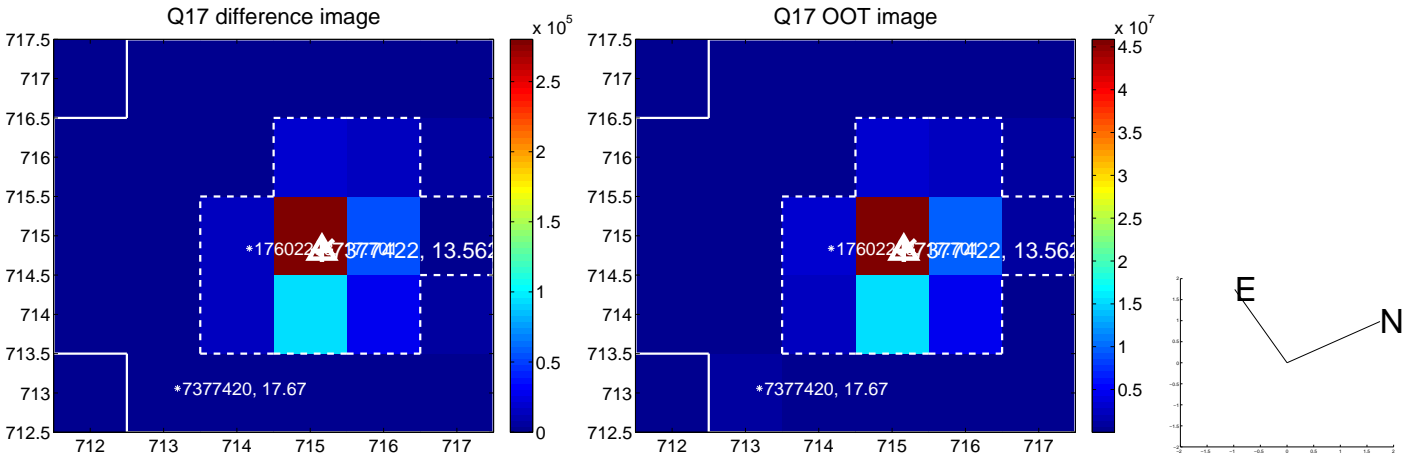
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



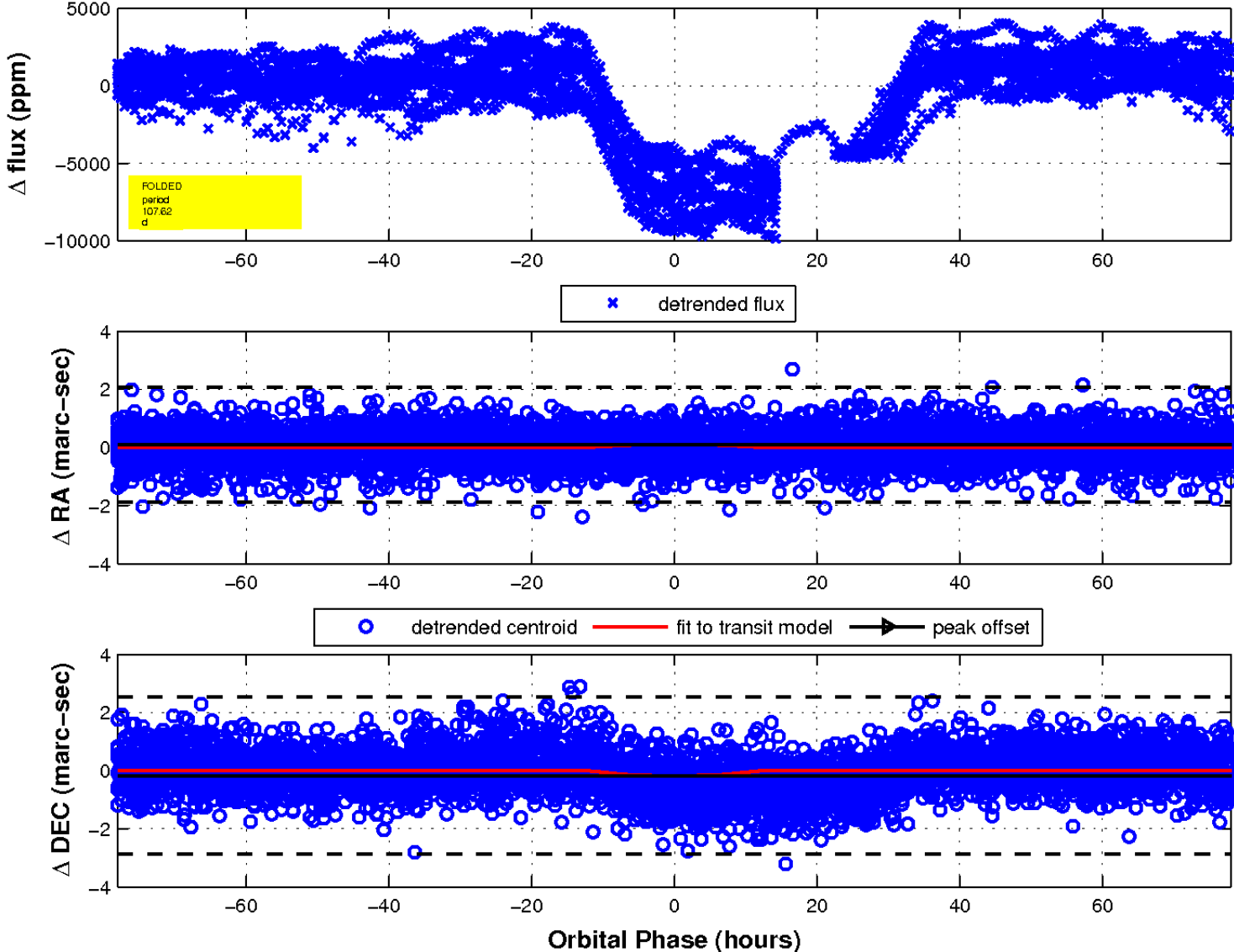
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



fluxWeightedCentroids, Planet 2 of 2



UKIRT Image

