

# KIC 012020365

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
012020365-01	OBS	No	1.876785	131.528022	145.2	6.000	12.9	-1.0	1.52	6637	1.85	4013.77
012020365-02	OBS	No	3.753550	132.092441	39.5	6.030	8.7	9.5	1.52	6637	0.96	1592.88
012020365-03	OBS	No	3.754067	134.586861	29.0	12.133	8.8	8.1	1.52	6637	0.94	1592.58
012020365-04	OBS	No	272.217587	376.525112	330.4	3.602	8.4	7.7	1.52	6637	3.10	5.27

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
012020365-01	OBS	FP	0.00	1	0	0	0	SWEET_NTL—LPP_DV—MOD_NONUNIQ_ALT—CENT_NOFITS
012020365-02	OBS	FP	0.00	1	0	0	0	SWEET_NTL—LPP_DV—MOD_NONUNIQ_DV—SAME_NTL_PERIOD
012020365-03	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—SAME_NTL_PERIOD
012020365-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS

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

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

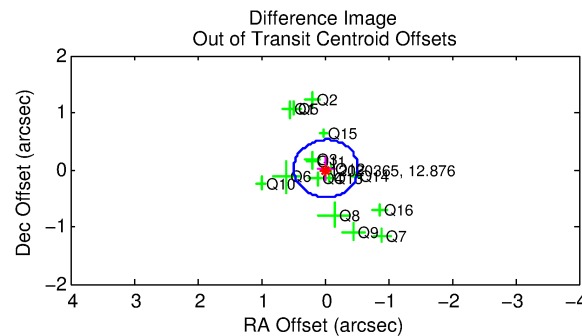
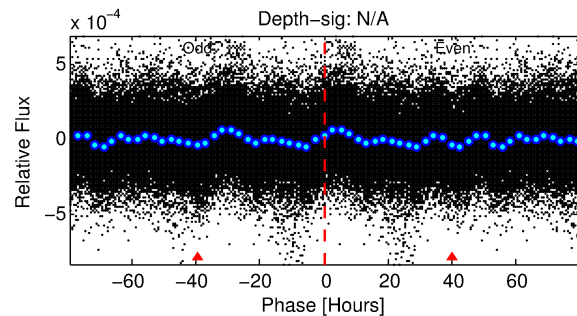
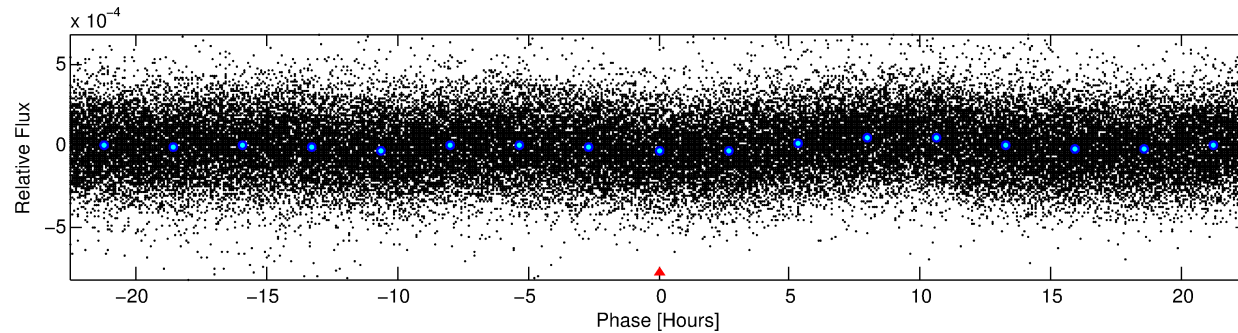
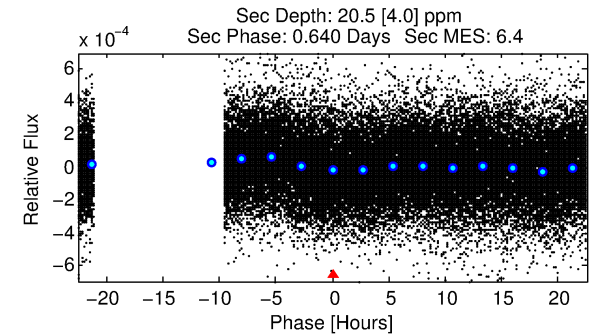
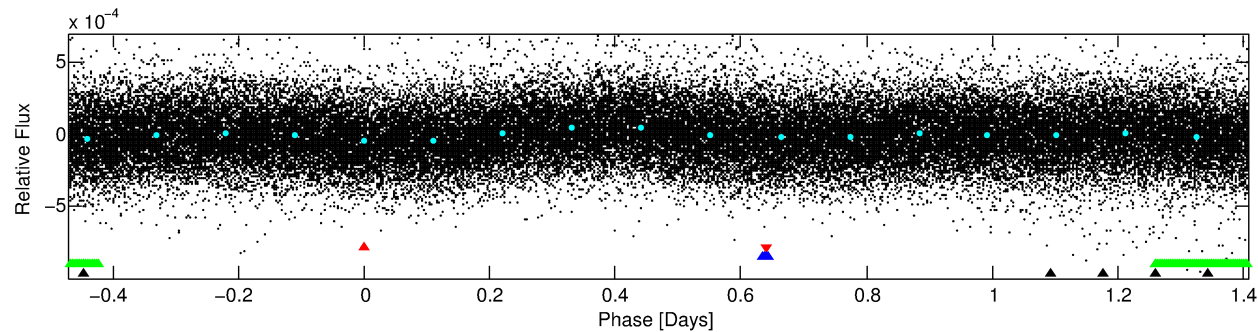
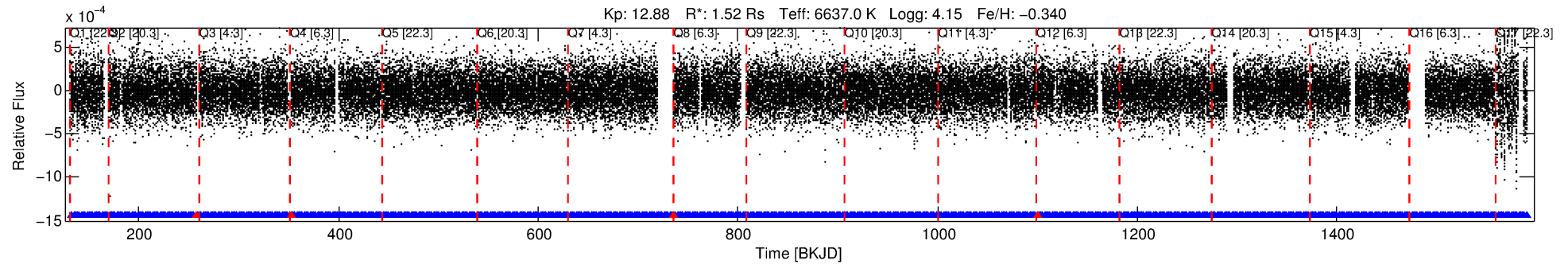
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 012020365-01

No Significant Match Found

# DV One-Page Summary

KIC: 12020365 Candidate: 1 of 4 Period: 1.877 d



## TPS TCE Results:

Period = 1.87678 d  
Epoch = 131.5280 BKJD

DV fit results are unavailable

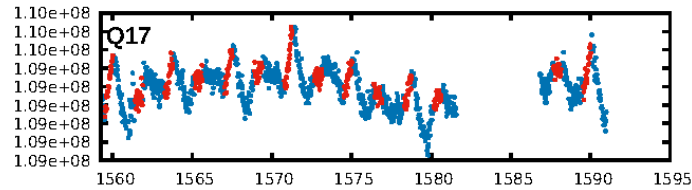
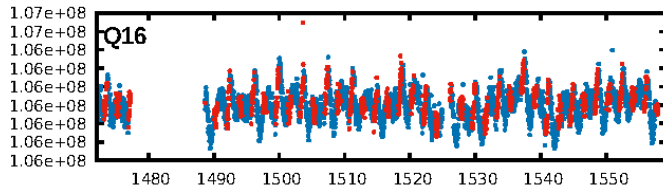
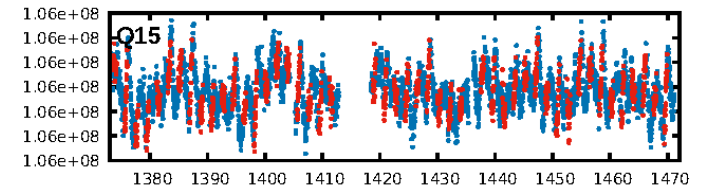
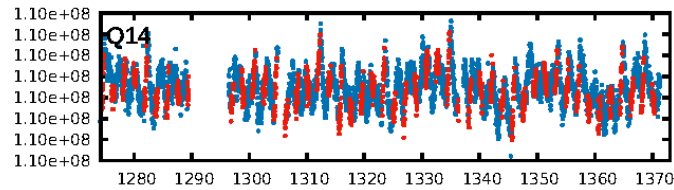
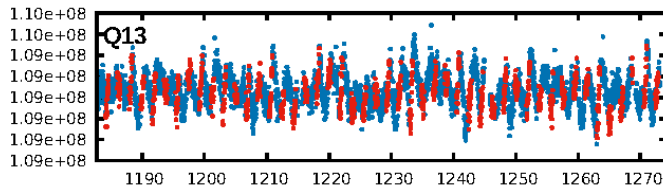
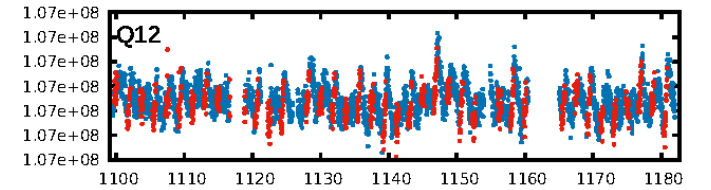
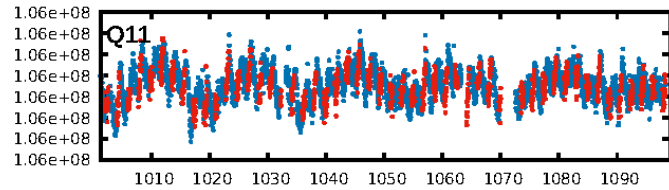
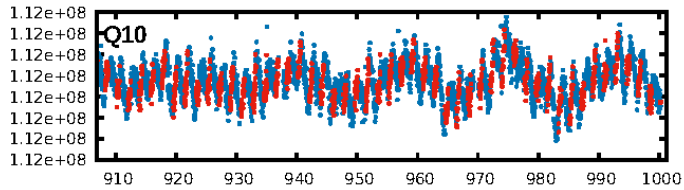
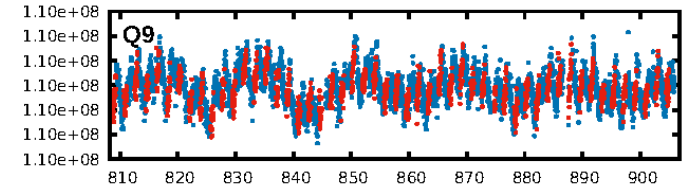
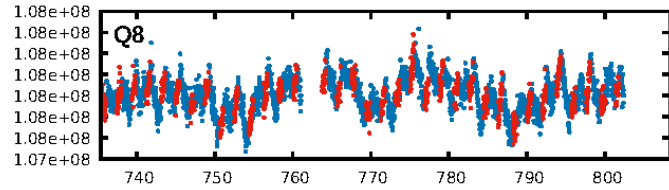
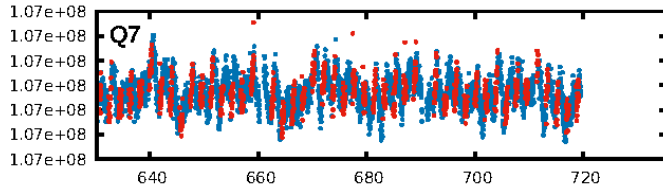
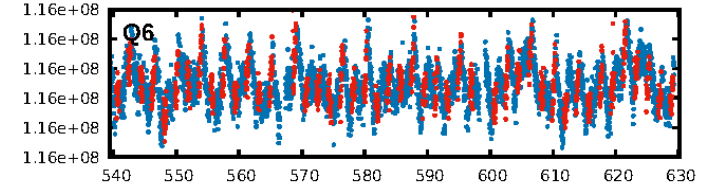
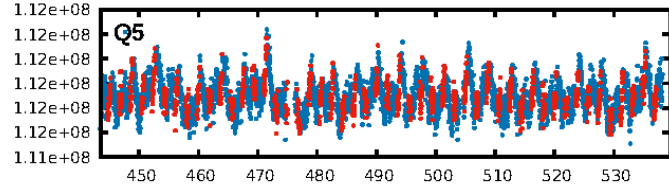
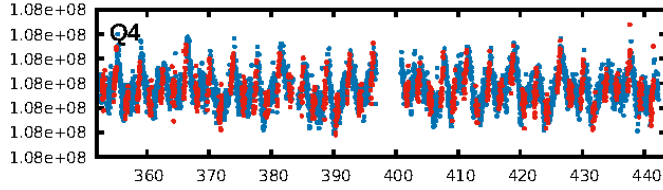
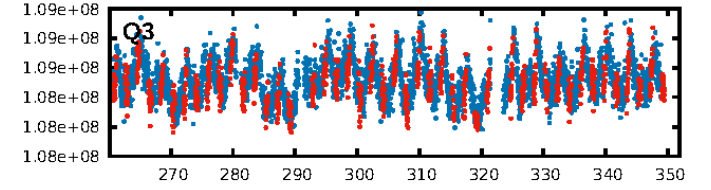
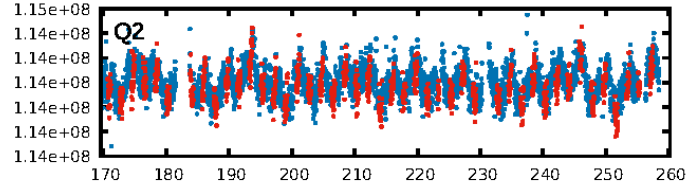
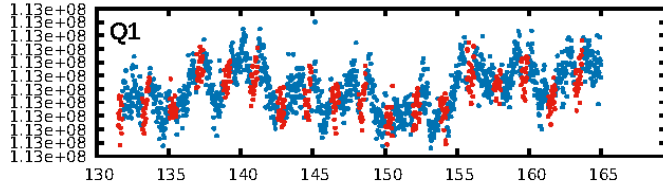
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [5.295]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: 9.76e-24  
RollingBand-fgt: 0.99 [686/690]  
GhostDiagnostic-chr: 1.22  
Centroid-sig: 16.6%  
Centroid-so: 0.249 arcsec [1.57σ]  
OotOffset-rm: 0.029 arcsec [0.17σ]  
KicOffset-rm: 0.192 arcsec [1.35σ]  
OotOffset-st: 4/4/4/4 [16]  
KicOffset-st: 4/4/4/4 [16]  
DiffImageQuality-fgm: 1.00 [16/16]  
DiffImageOverlap-fno: 1.00 [17/17]

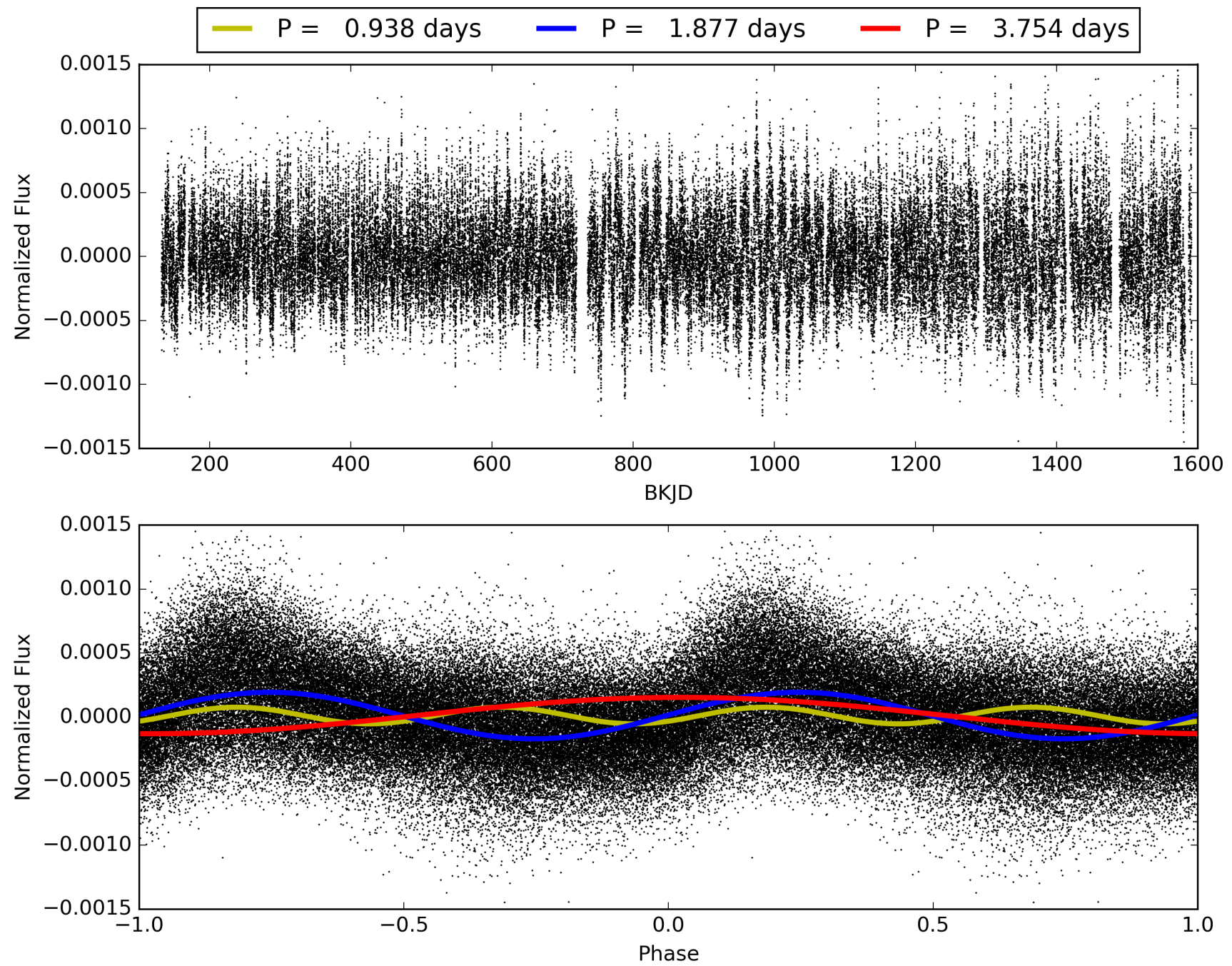
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 29-Jan-2016 15:27:11 Z

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

# TCE 012020365-01, PDC Light Curves



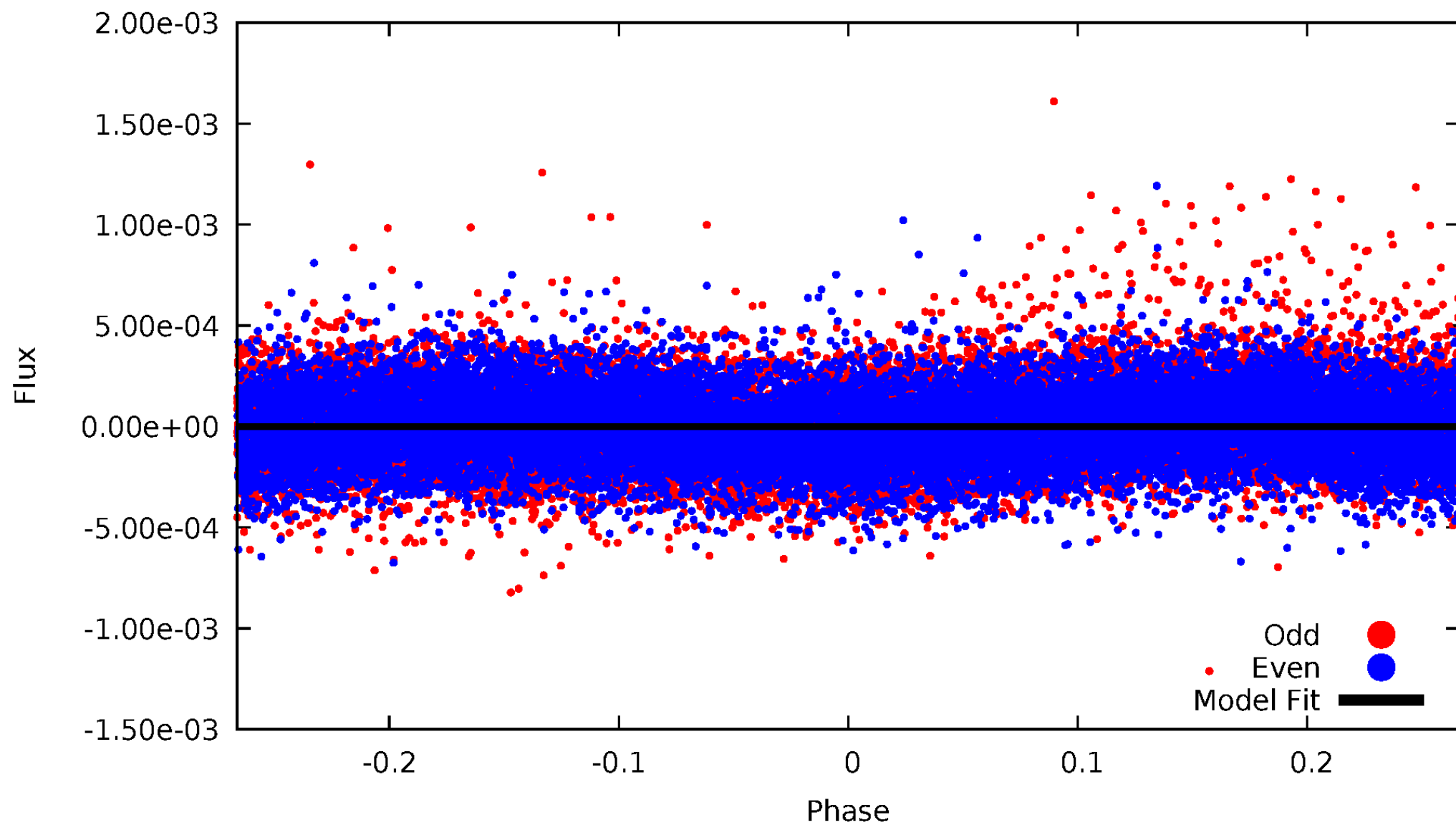
TCE 012020365-01





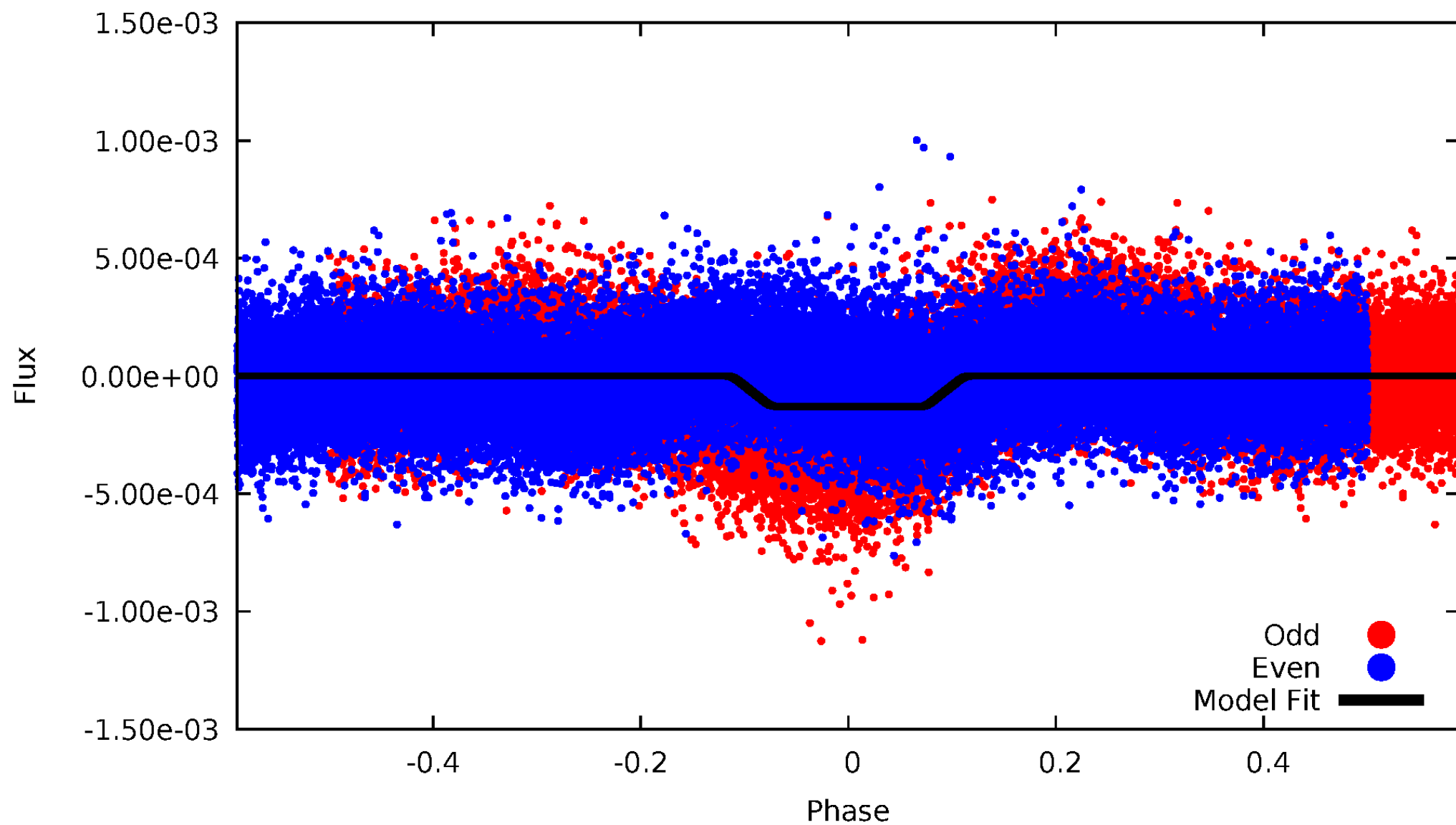
# DV Odd/Even

TCE 012020365-01

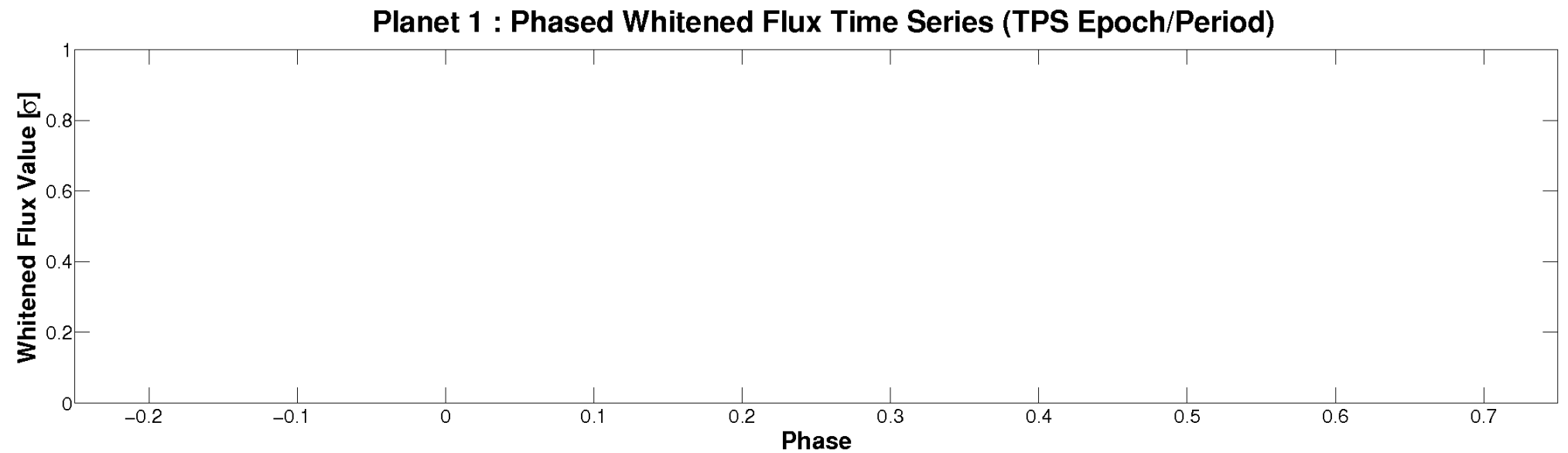
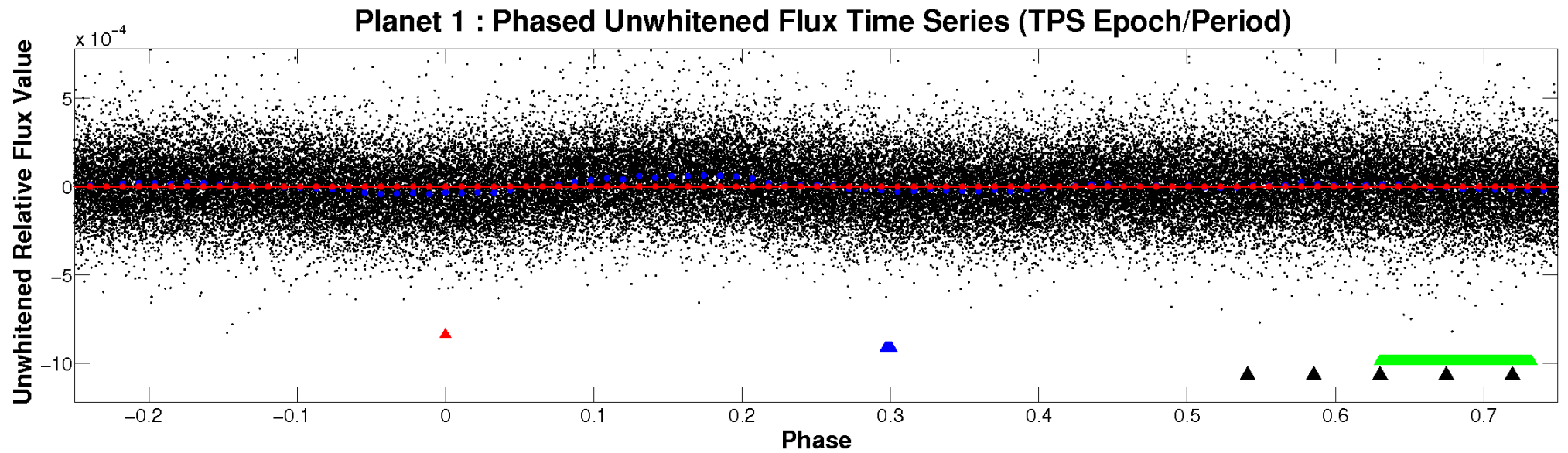


# ALT Odd/Even

TCE 012020365-01

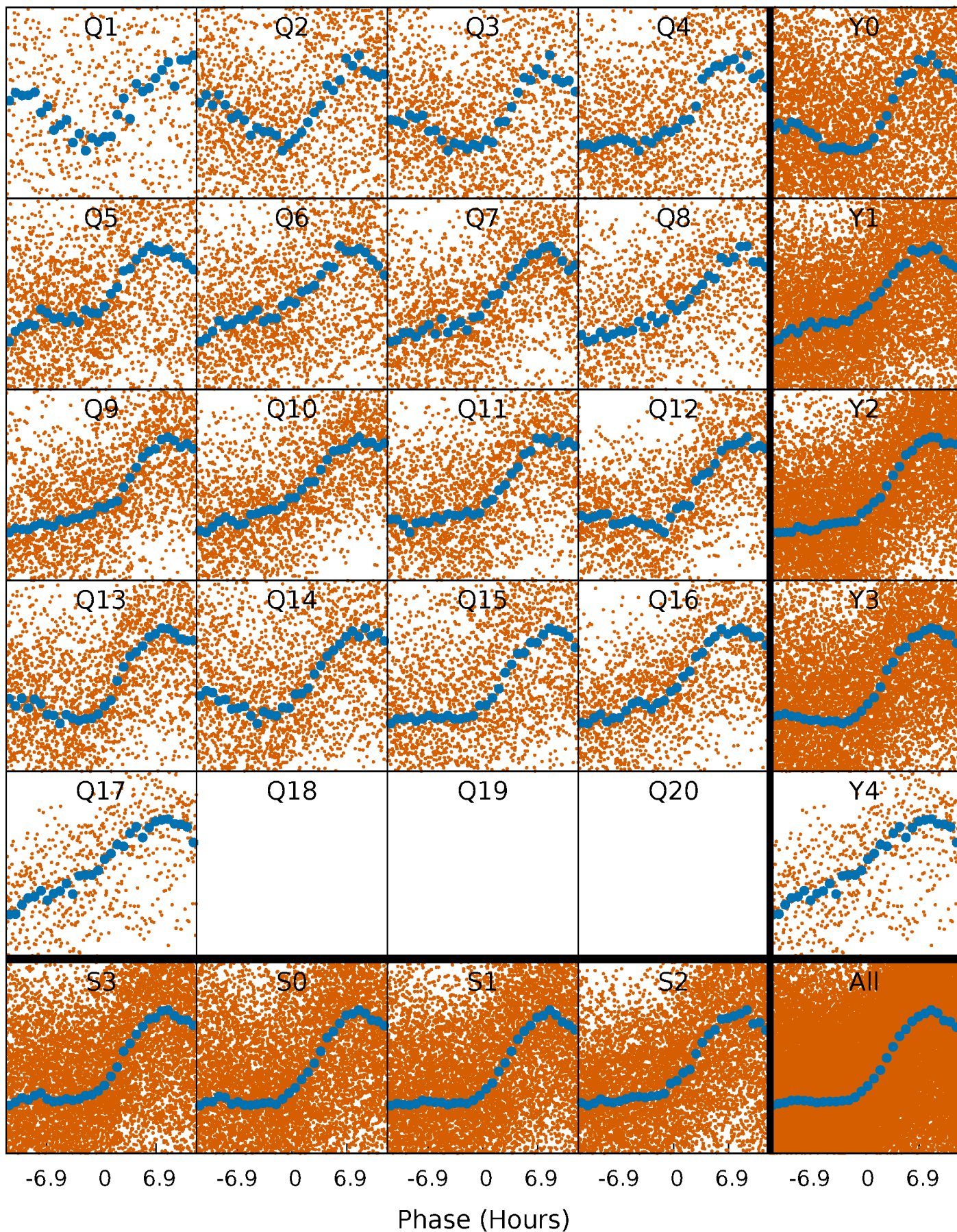


# Non-Whitened Vs. Whitened Light Curve



# PDC Quarter-Phased Transit Curves

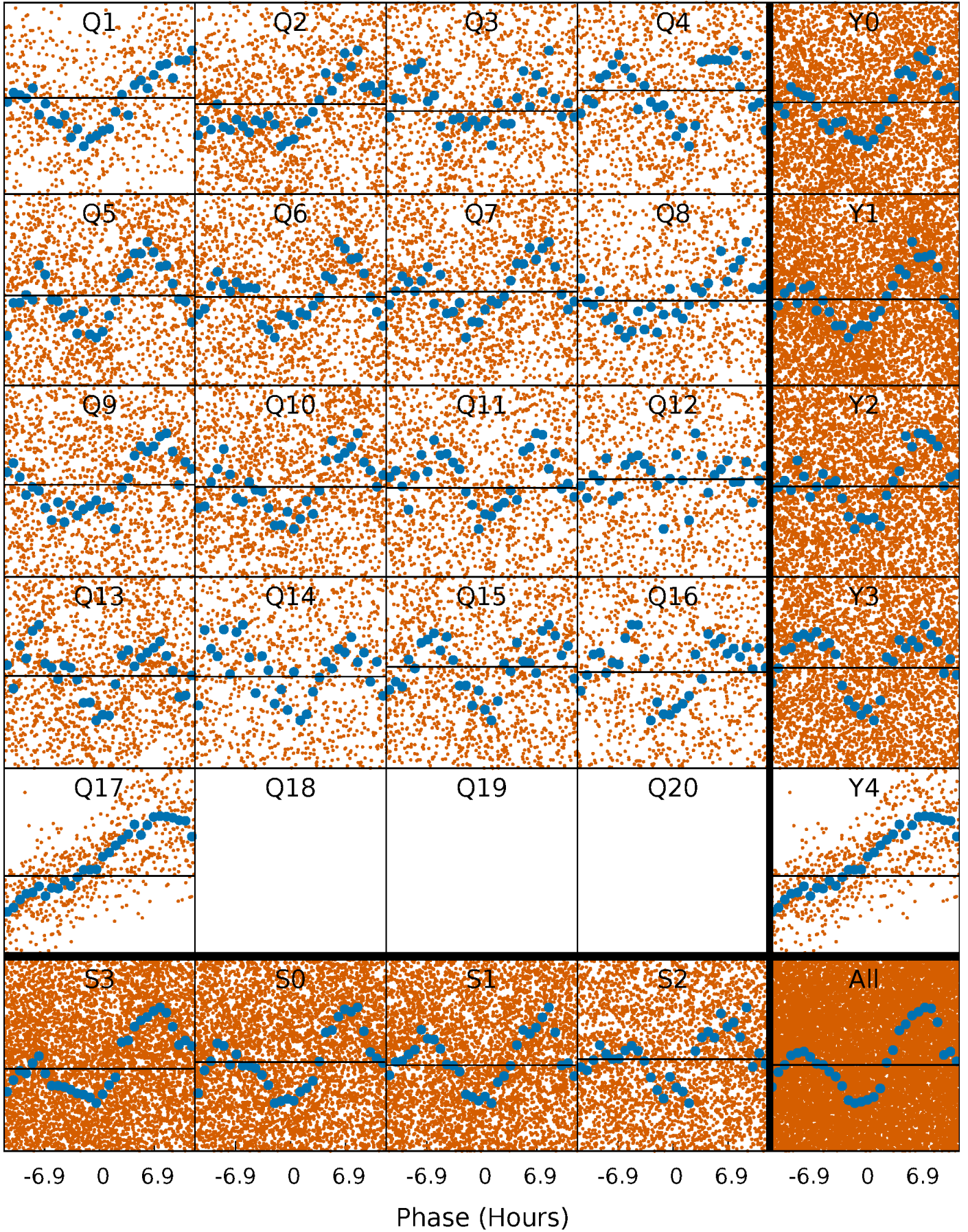
TCE 012020365-01   P= 1.876785 Days    $T_0=131.528022$  (BKJD)





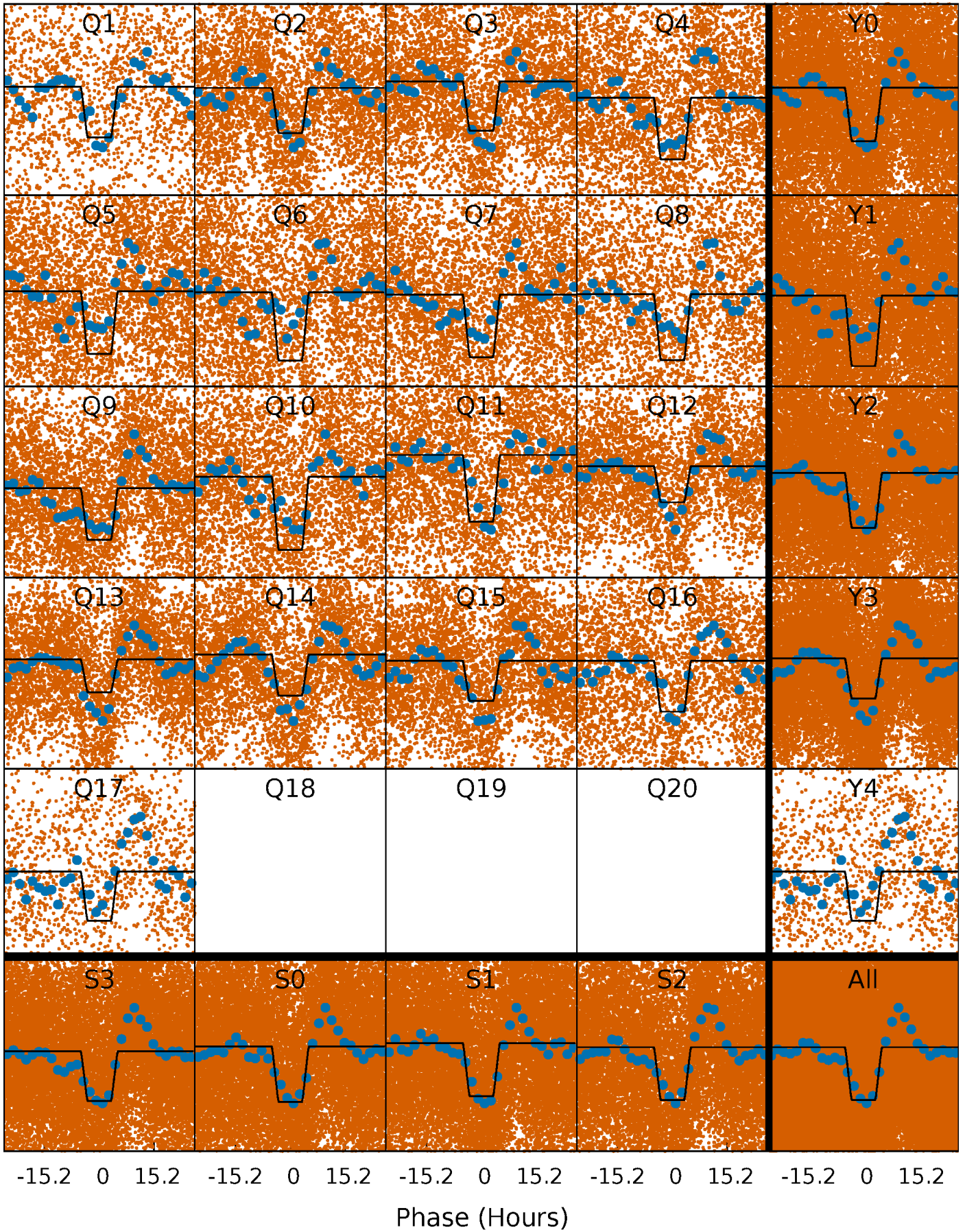
# DV Quarter-Phased Transit Curves

TCE 012020365-01 P= 1.876785 Days  $T_0=131.528022$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

TCE 012020365-01   P= 1.876785 Days    $T_0=133.326383$  (BKJD)

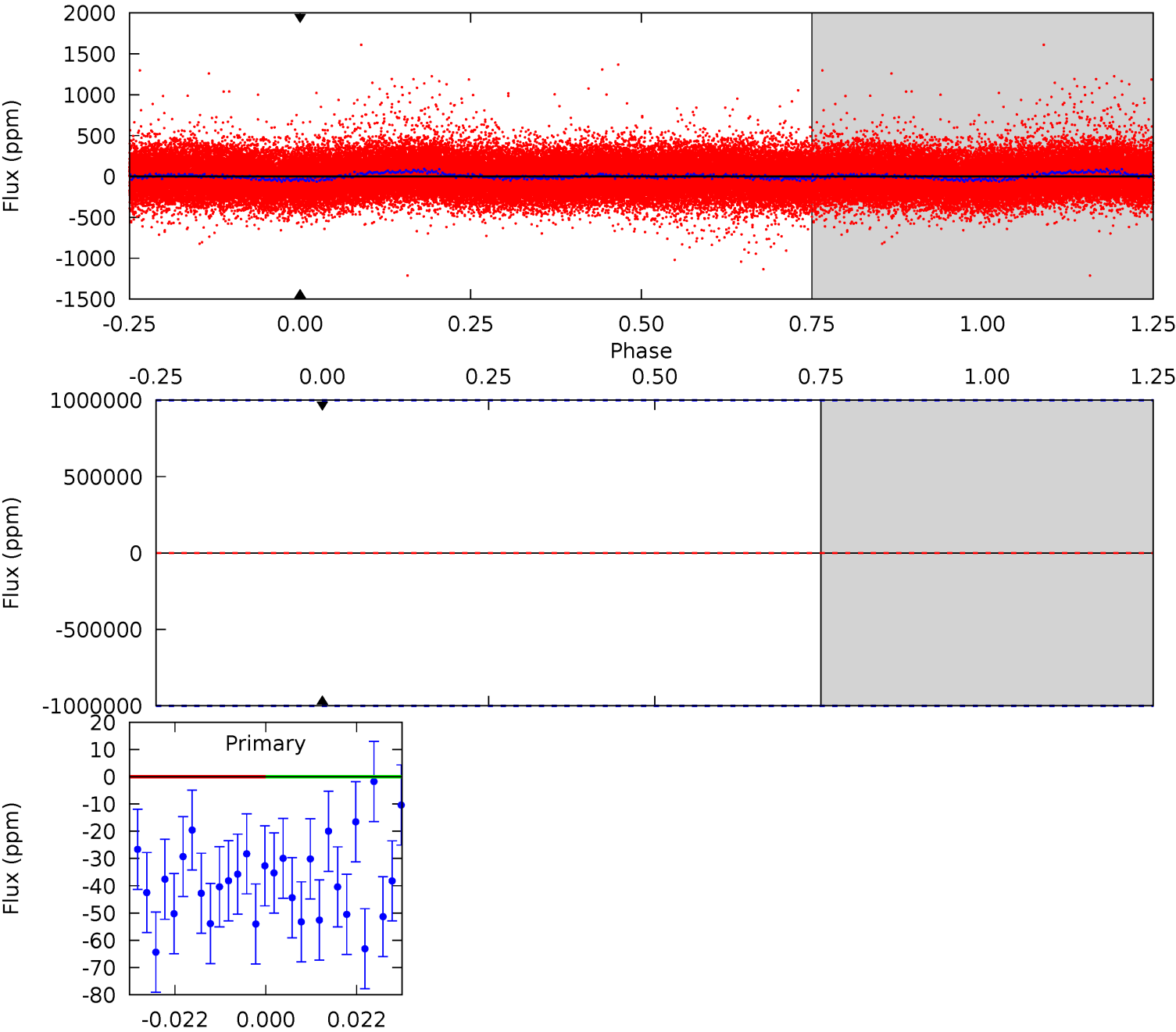




DV Model-Shift Uniqueness Test

012020365-01, P = 1.876785 Days, E = 129.651237 Days

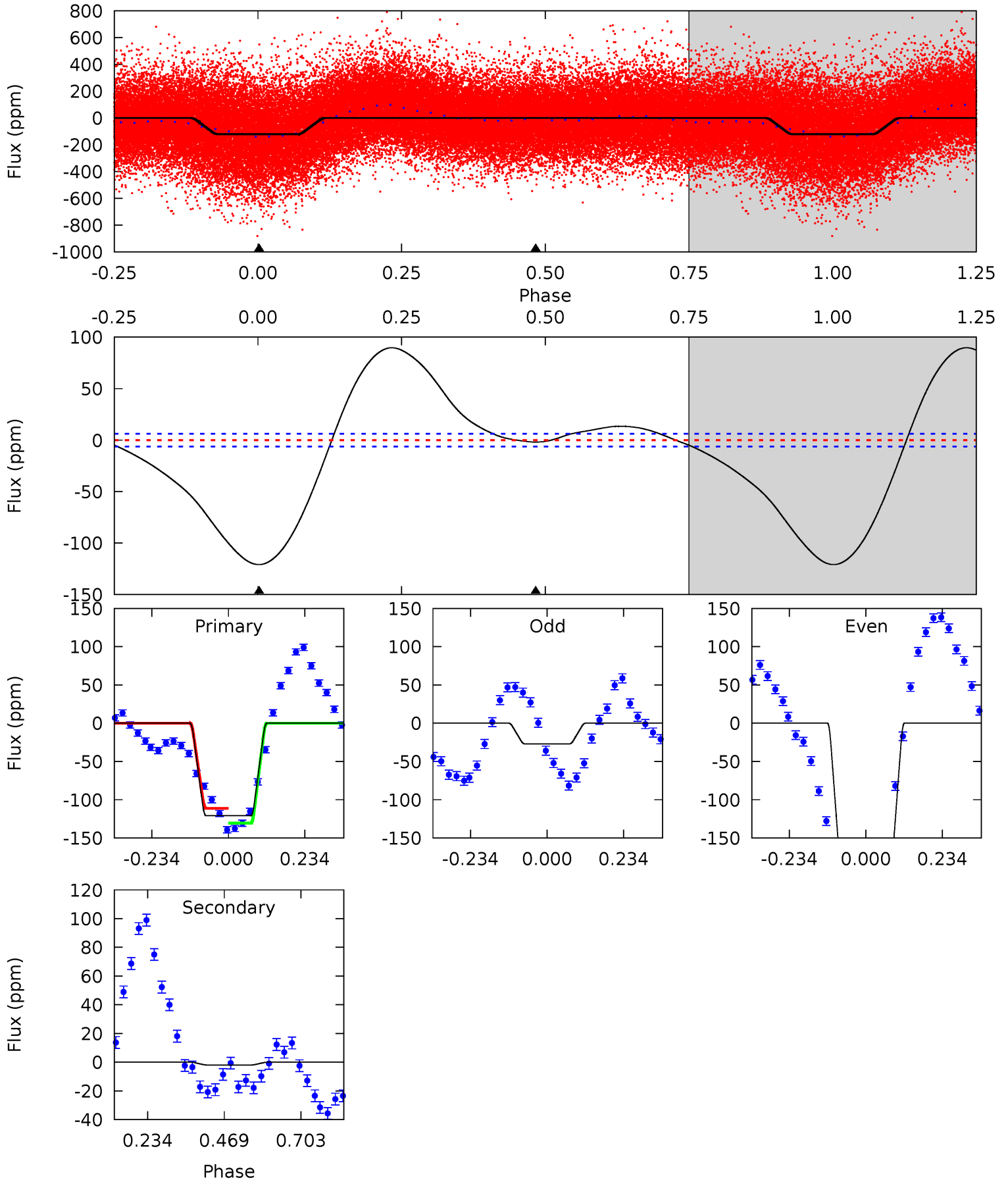
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
0	0	0	0	1.00	1.00	1.00	0	0	0	0	0	0	0	0



# Alt Model-Shift Uniqueness Test

012020365-01, P = 1.876785 Days, E = 131.449598 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
84.7	1.34	0	0	4.38	1.19	30.0	84.7	84.7	1.34	1.34	63.5	1.02	0.43	6.74





### Stellar Parameters For KIC 012020365

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6637^{+188}_{-235}$	$4.154^{+0.209}_{-0.171}$	$-0.340^{+0.250}_{-0.300}$	$1.524^{+0.437}_{-0.398}$	$1.212^{+0.171}_{-0.190}$	$0.482^{+0.582}_{-0.231}$
	+3%/-4%	+5%/-4%	+74%/-88%	+29%/-26%	+14%/-16%	+121%/-48%
Source	PHO54	PHO54	PHO54	DSEP		

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

### Secondary Eclipse Parameters for KIC 012020365-01 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$0 \pm 1000000$	$11.92^{+11.47}_{-7.96}$	$2827^{+225}_{-211}$	$4539^{+28239}_{-31640}$	$3.514^{+772.762}_{-551.945}$
Alt.	$-2 \pm 1$	$11.67^{+12.96}_{-8.21}$	$2826^{+202}_{-205}$	$-2948^{+204}_{-135}$	$0.006^{+0.069}_{-0.005}$

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

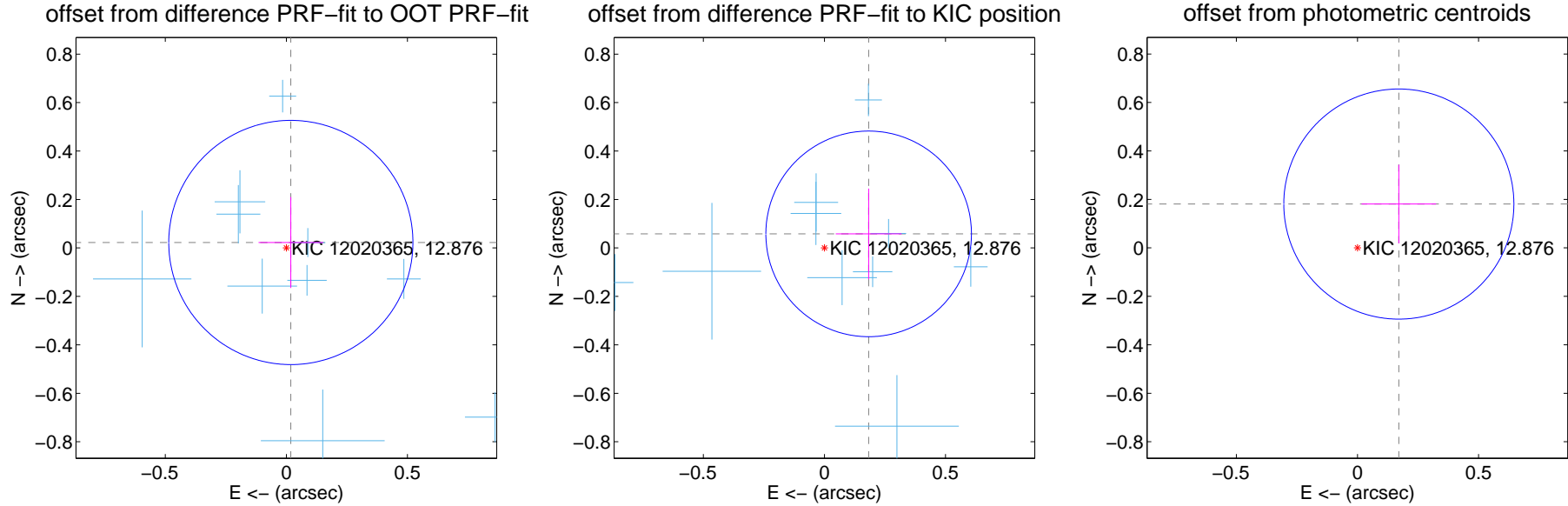
## DV Centroid Data

Supplemental centroid analysis for 012020365-01. Kepler magnitude: 12.88. Transit SNR -1.00

There are 16 quarters with good PRF difference image offsets

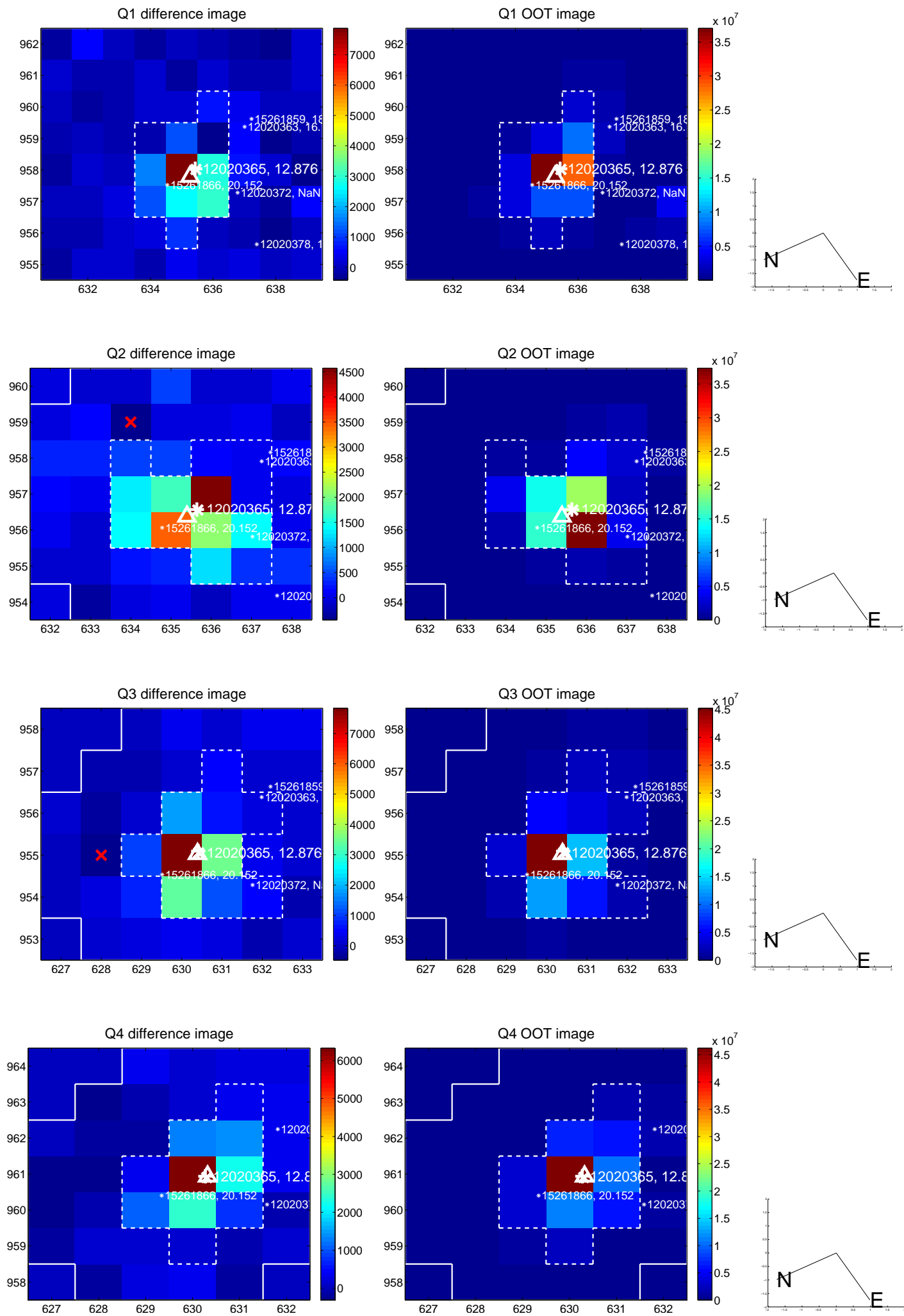
The direct PRF centroid is offset from the target star catalog position by about 0.18 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.029 \pm 0.168$	0.17	$-0.018 \pm 0.133$	$0.023 \pm 0.188$
PRF-fit source offset from KIC position	$0.192 \pm 0.141$	1.35	$-0.183 \pm 0.136$	$0.058 \pm 0.187$
photometric centroid source offset	$0.25 \pm 0.16$	1.57	$-0.17 \pm 0.15$	$0.18 \pm 0.16$

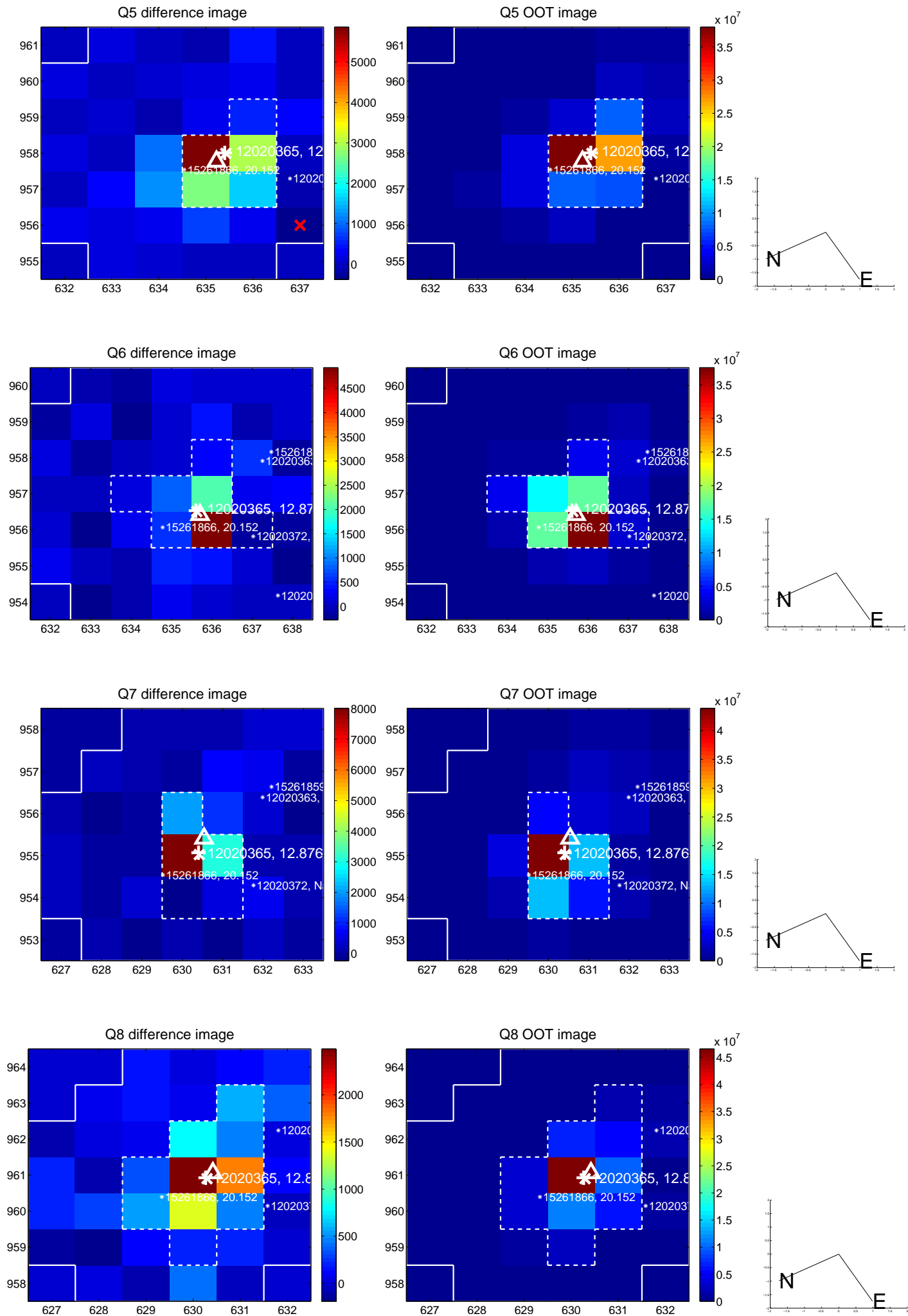


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

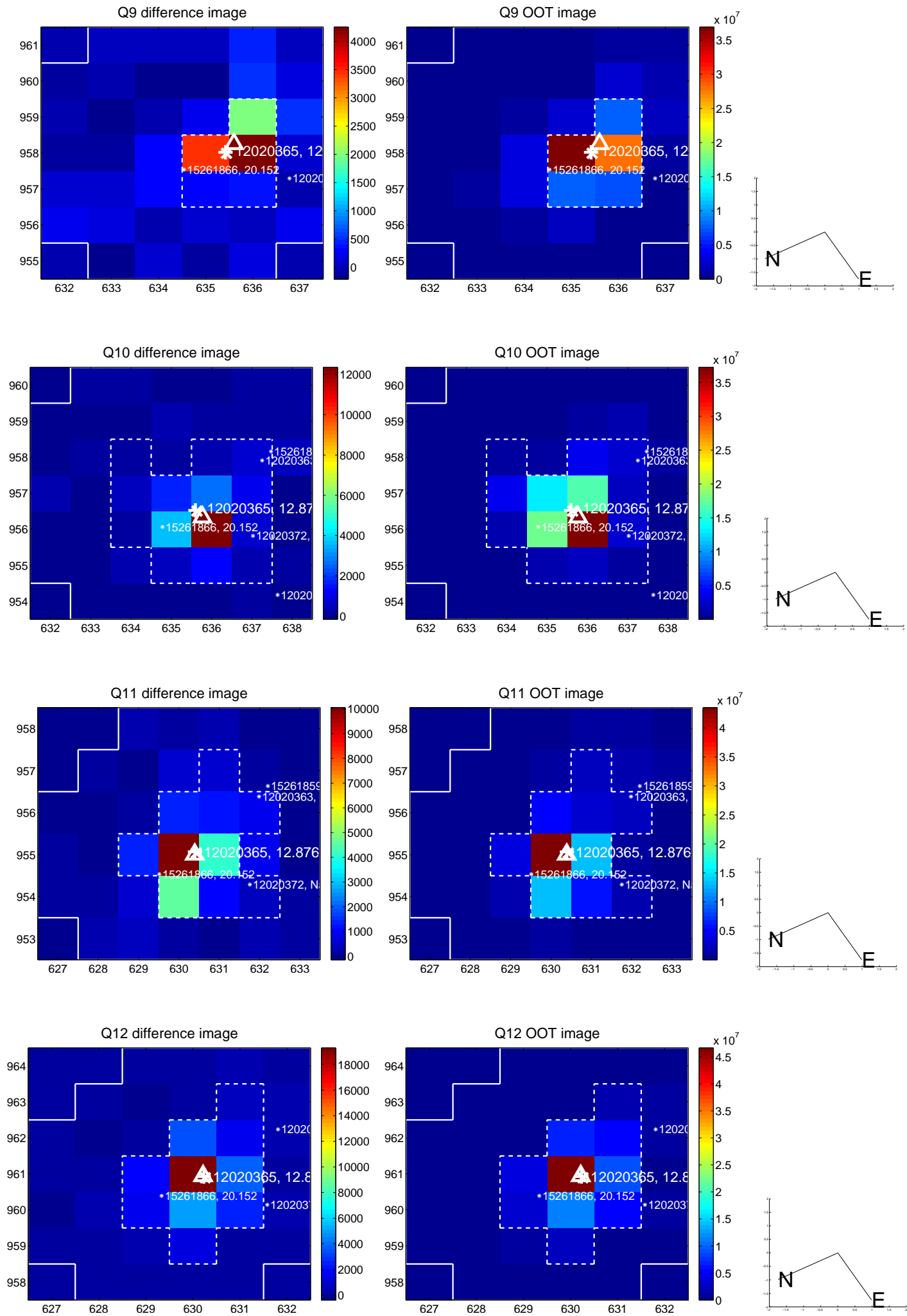


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

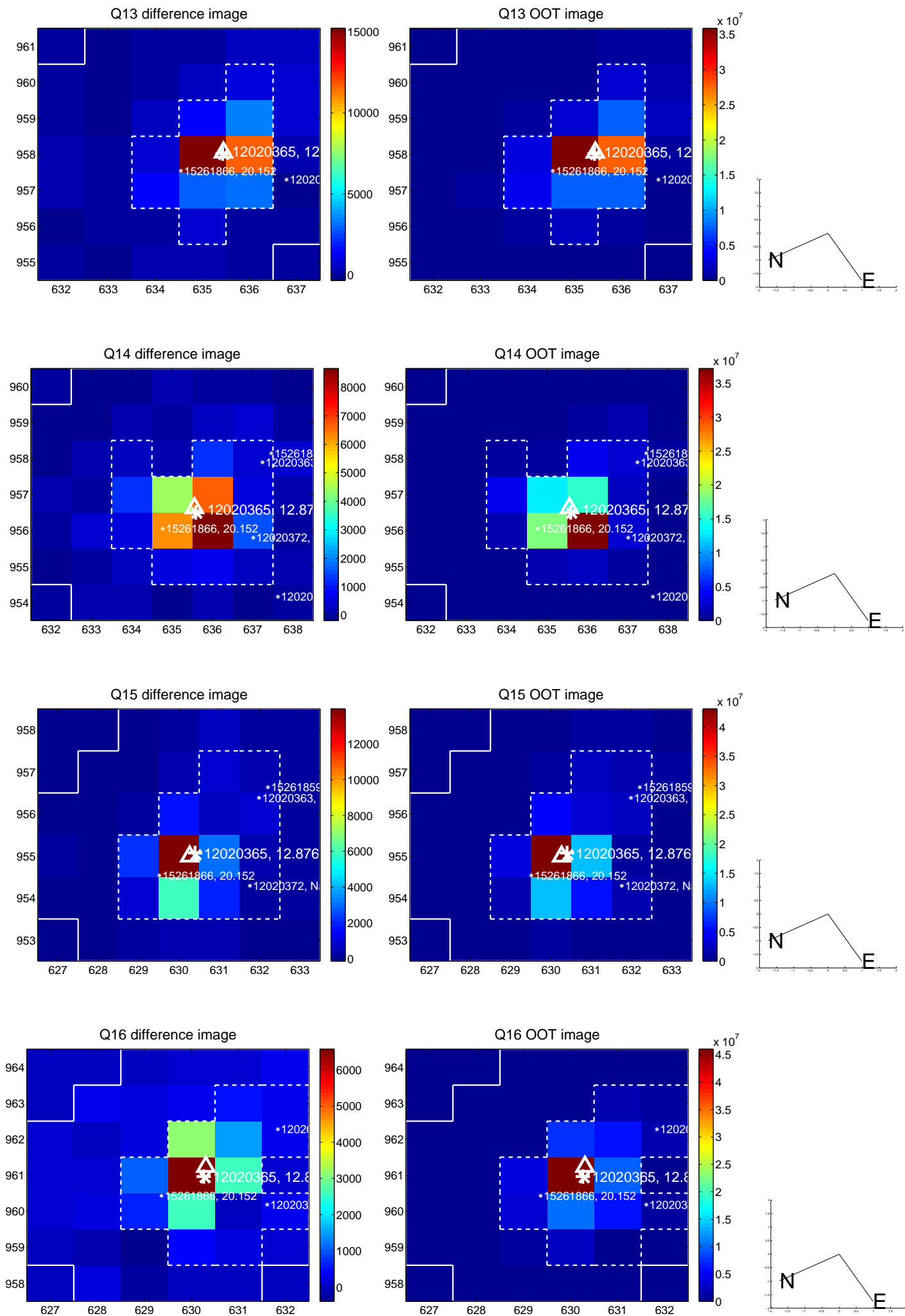




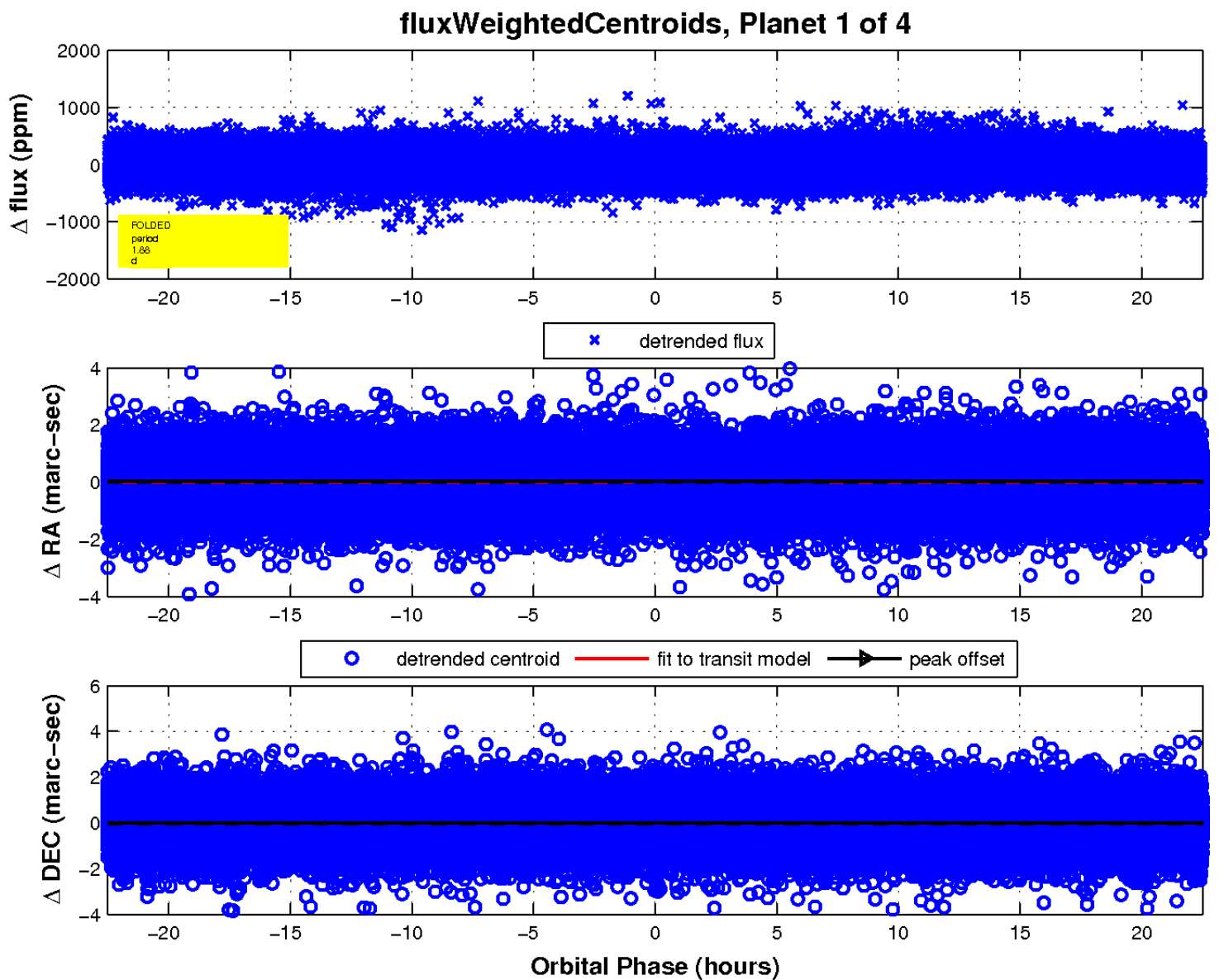
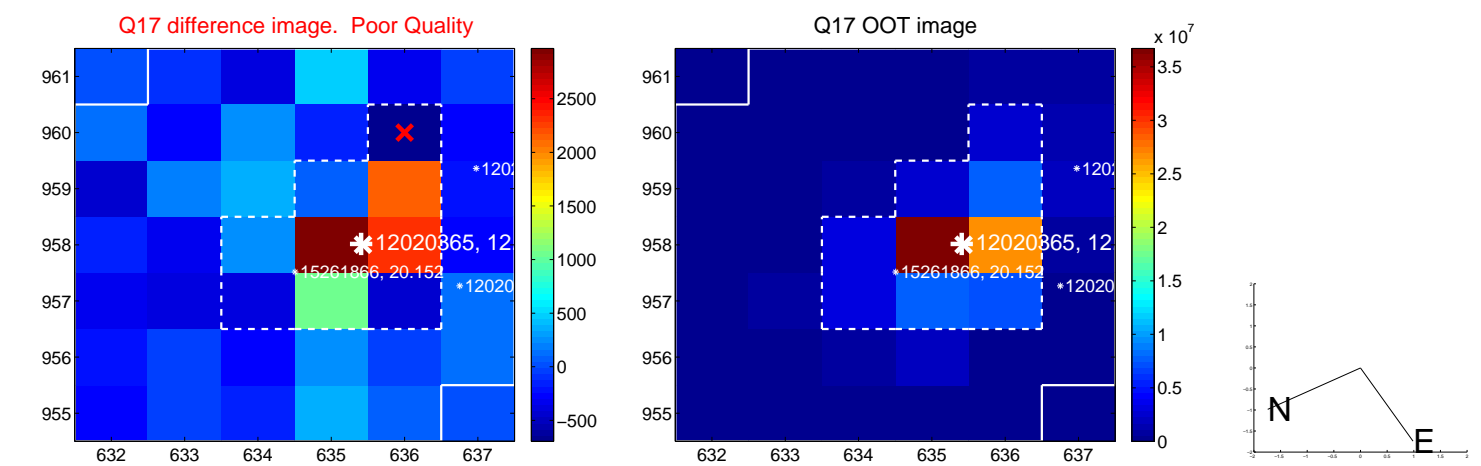
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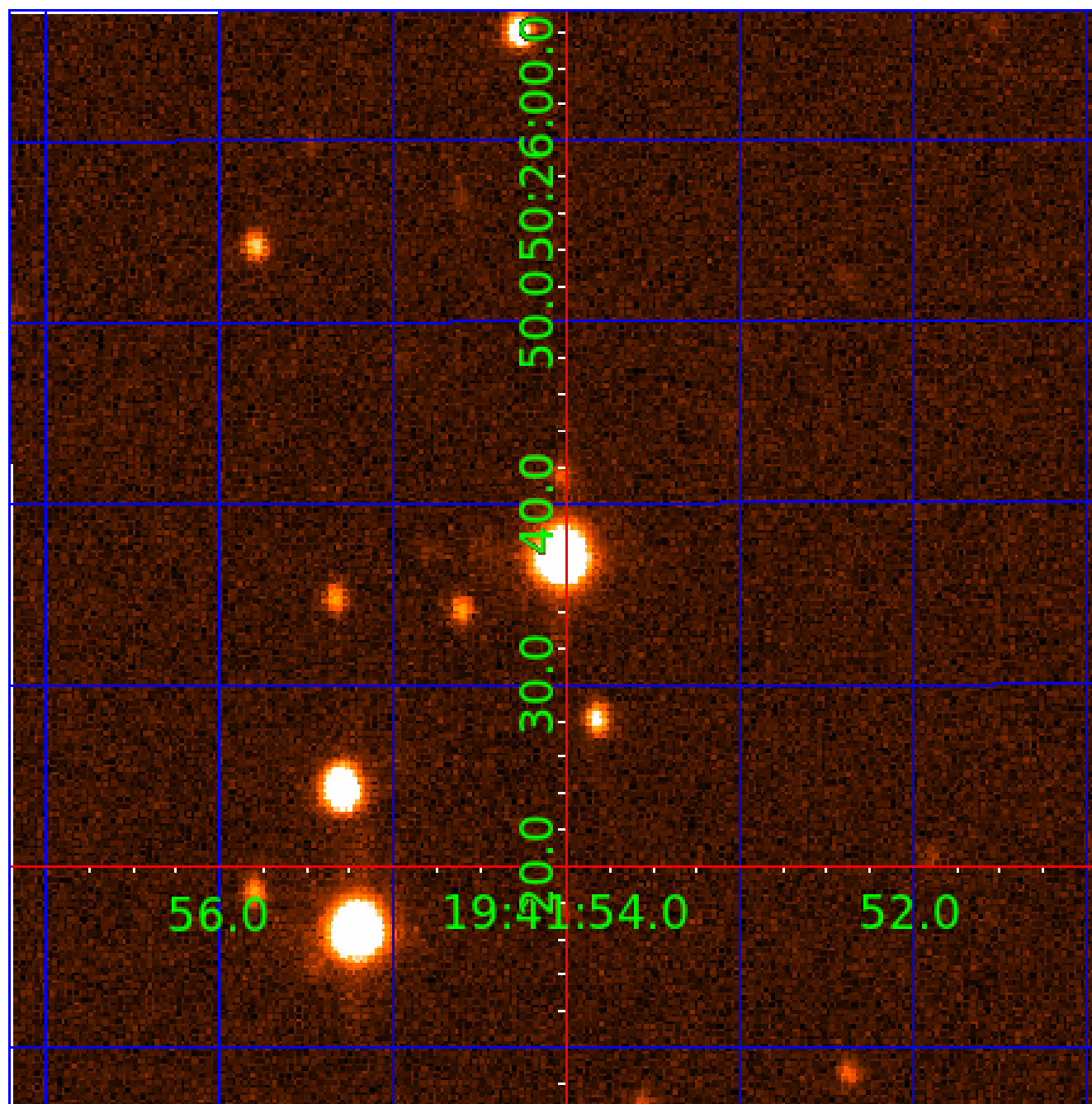


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination





# KIC 012020365

## 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

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012020365-03	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—SAME_NTL_PERIOD
012020365-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS

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

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

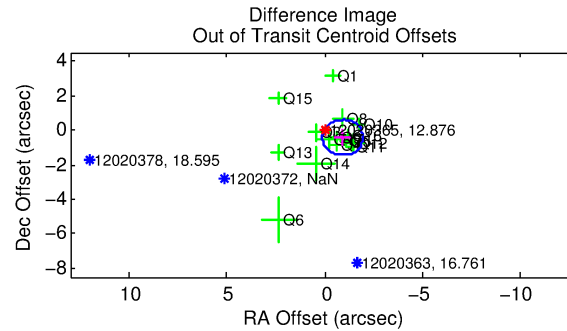
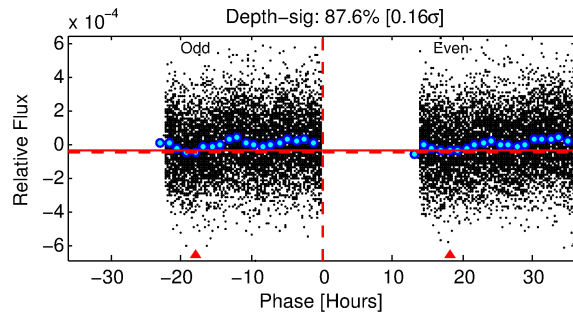
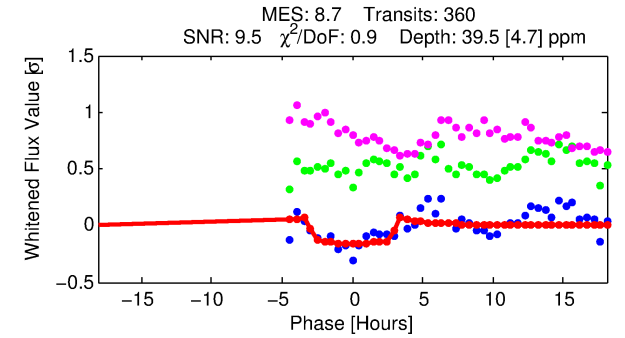
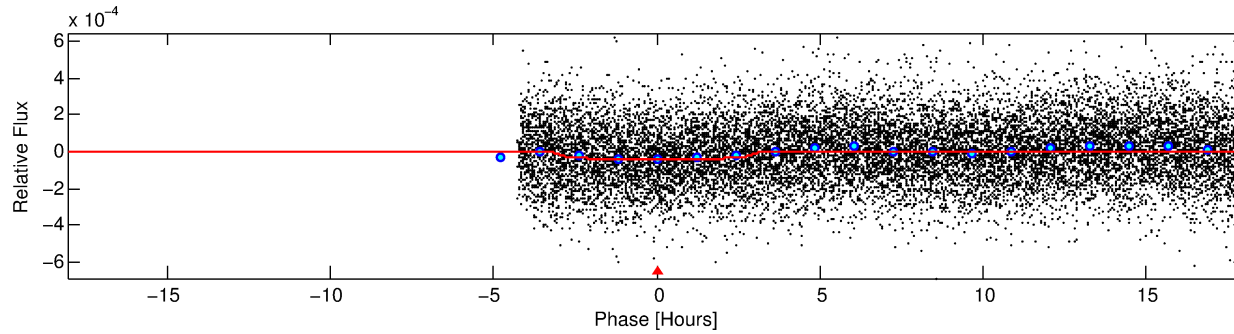
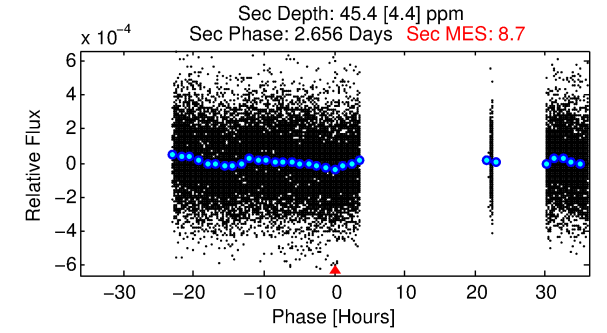
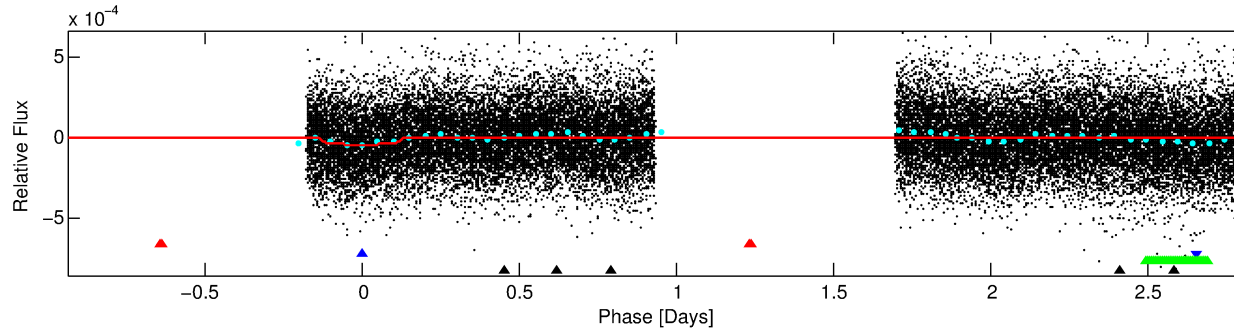
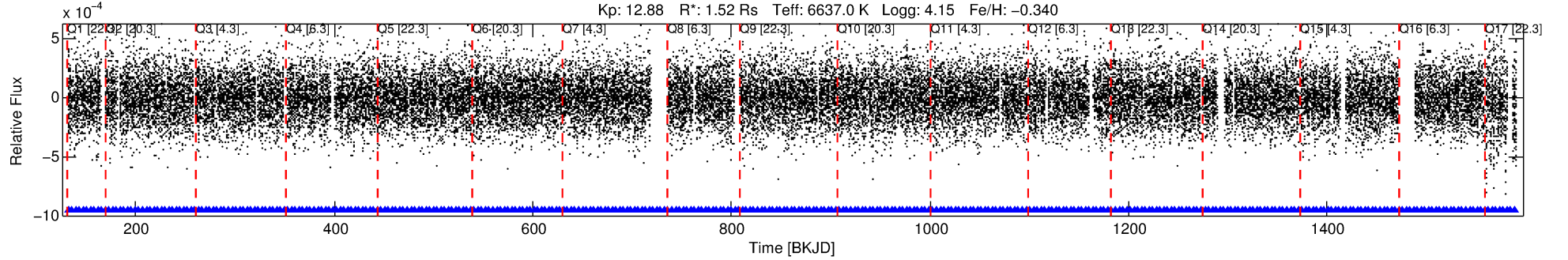
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 012020365-02

No Significant Match Found

# DV One-Page Summary

KIC: 12020365 Candidate: 2 of 4 Period: 3.754 d



## DV Fit Results:

Period = 3.75355 [0.00003] d  
Epoch = 132.0924 [0.0056] BKJD  
Rp/R\* = 0.0058 [0.0039]  
a/R\* = 4.82 [16.76]  
b = 0.00 [2333.18]  
Seff = 1592.88 [636.22]  
Teq = 1611 [161] K  
Rp = 0.96 [0.70] Re  
a = 0.0503 [0.0126] AU  
Ag = 68.06 [94.93] [0.71σ]  
Teffp = 7154 [2417] K [2.29σ]

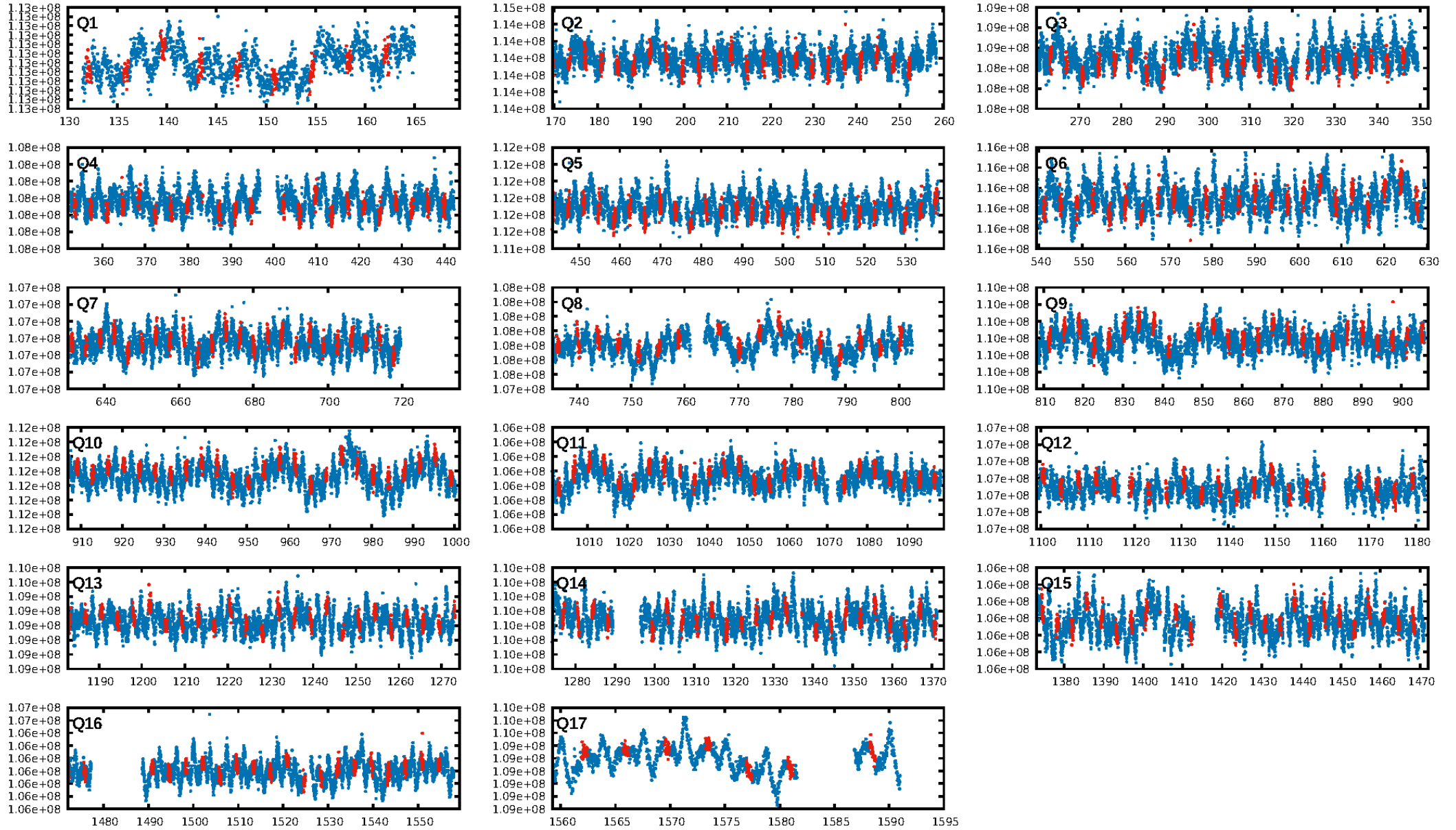
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [5.29σ]  
LongPeriod-sig: 0.1% [0.00σ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: 6.87e-13  
RollingBand-fgt: 1.00 [344/344]  
GhostDiagnostic-chr: 1.564  
Centroid-sig: 37.6%  
Centroid-so: 0.659 arcsec [0.70σ]  
OotOffset-rm: 1.009 arcsec [2.94σ]  
OotOffset-st: 3/3/4/5 [15]  
KicOffset-rm: 1.115 arcsec [3.25σ]  
KicOffset-st: 3/3/4/5 [15]  
DiffImageQuality-fgm: 0.20 [3/15]  
DiffImageOverlap-fno: 0.00 [0/17]

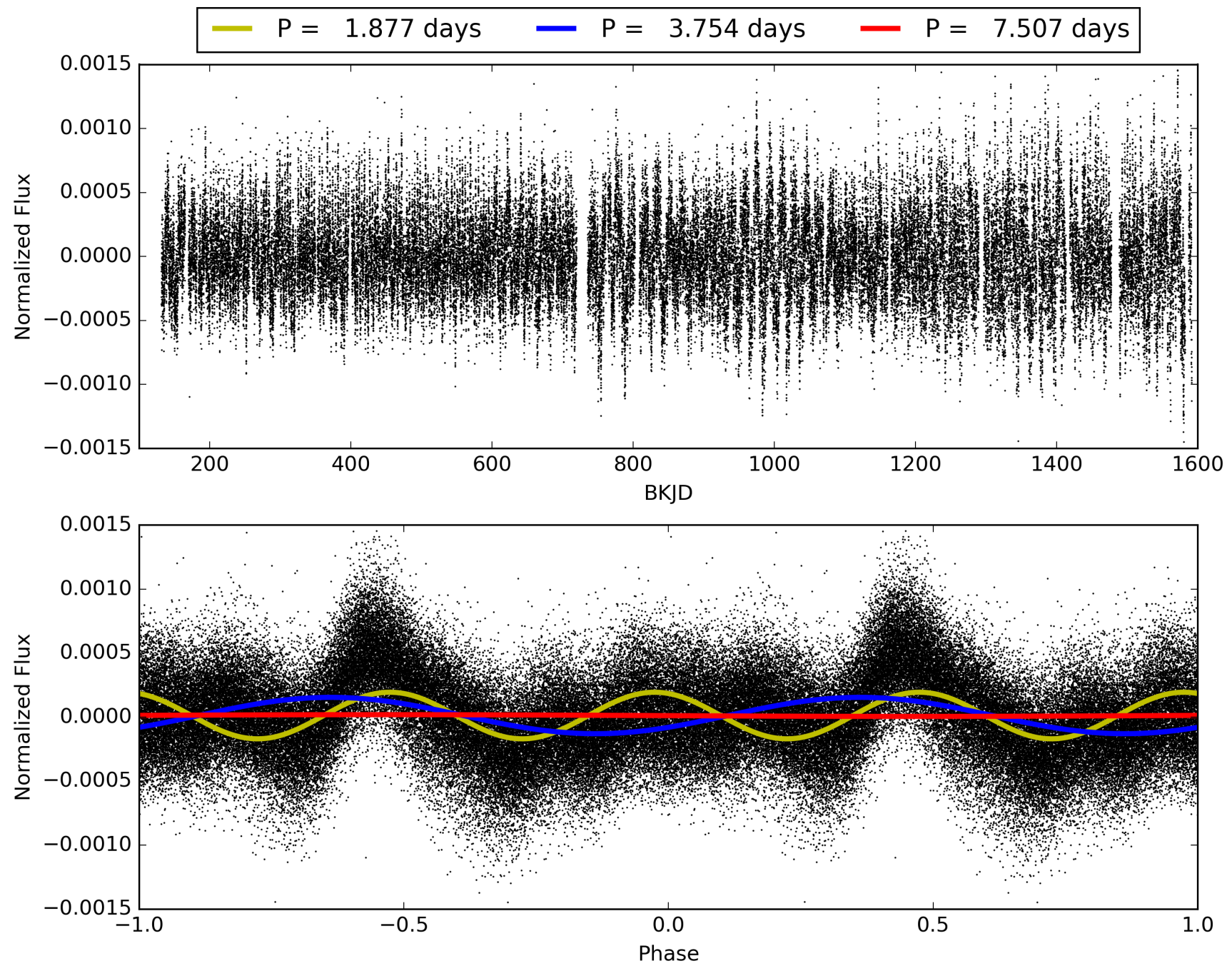
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 29-Jan-2016 15:27:23 Z

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

# TCE 012020365-02, PDC Light Curves



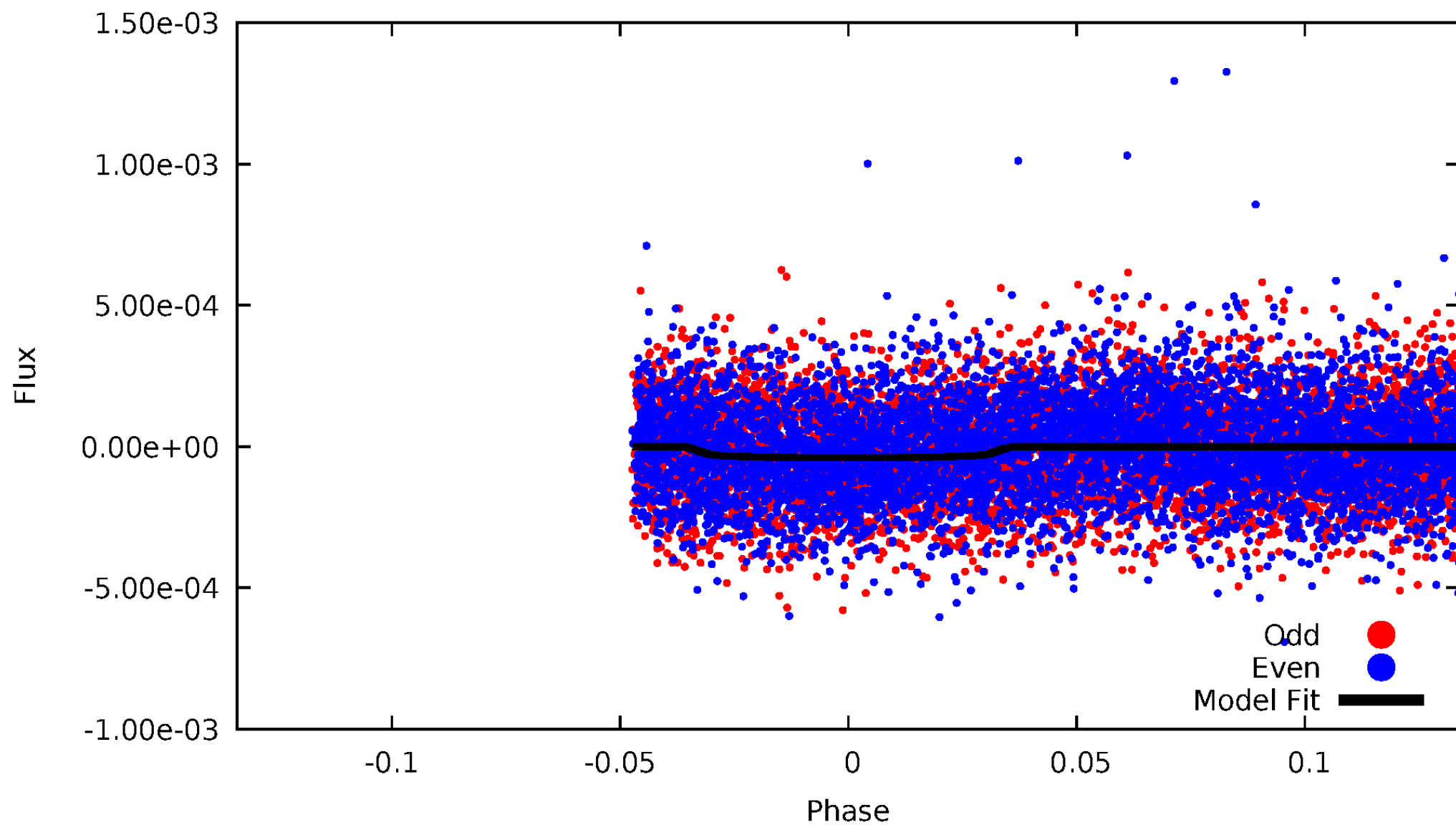
TCE 012020365-02





# DV Odd/Even

TCE 012020365-02





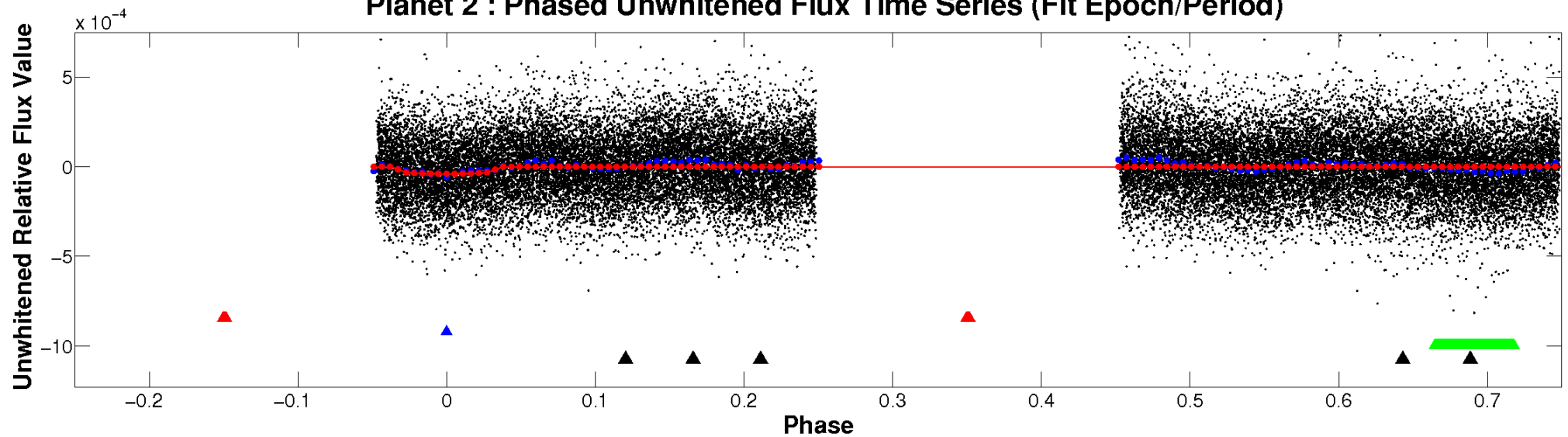


ALT Odd/Even

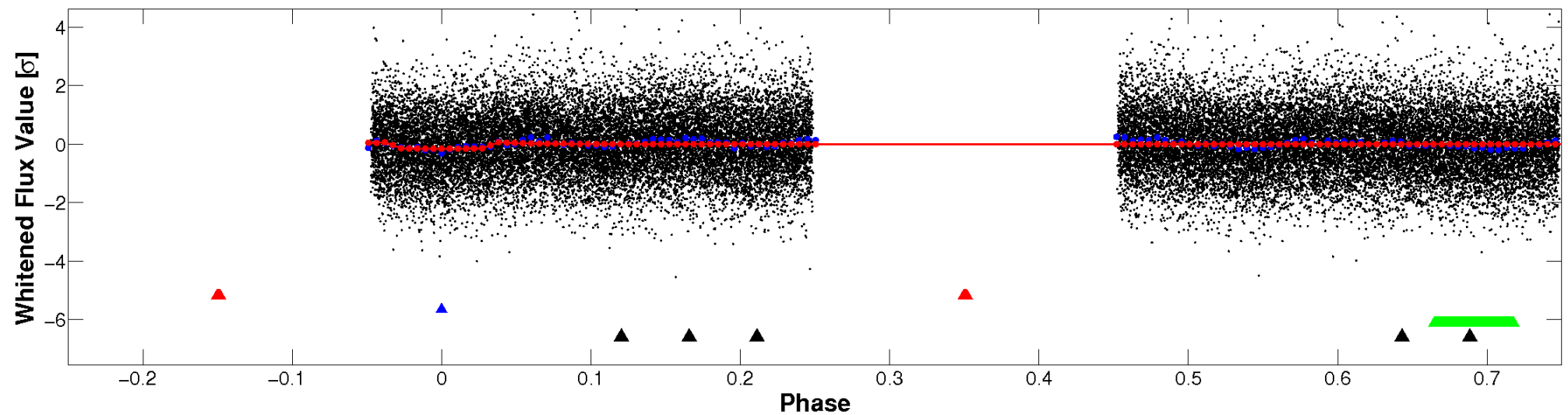
This plot does not exist for this TCE.

# Non-Whitened Vs. Whitened Light Curve

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

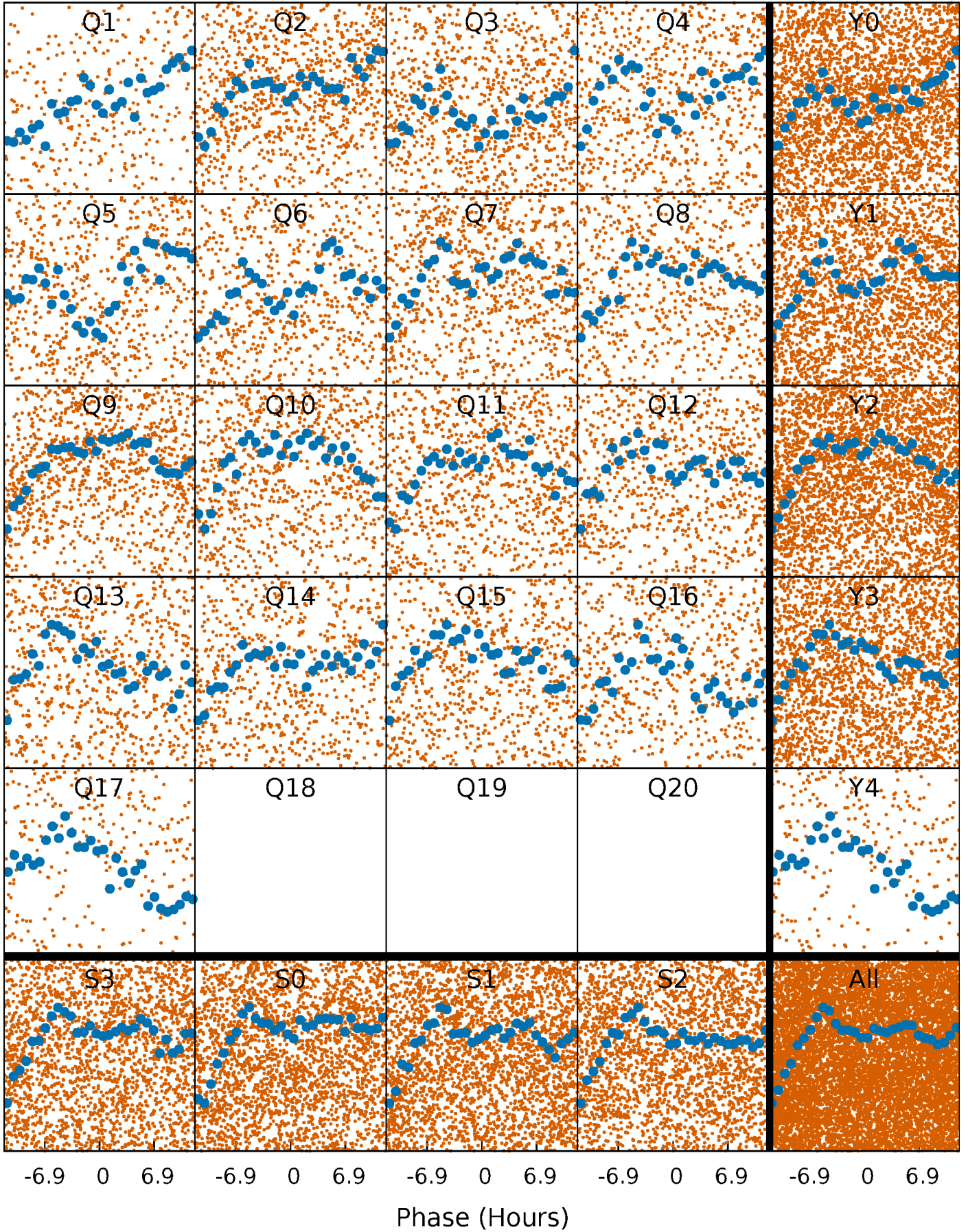


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



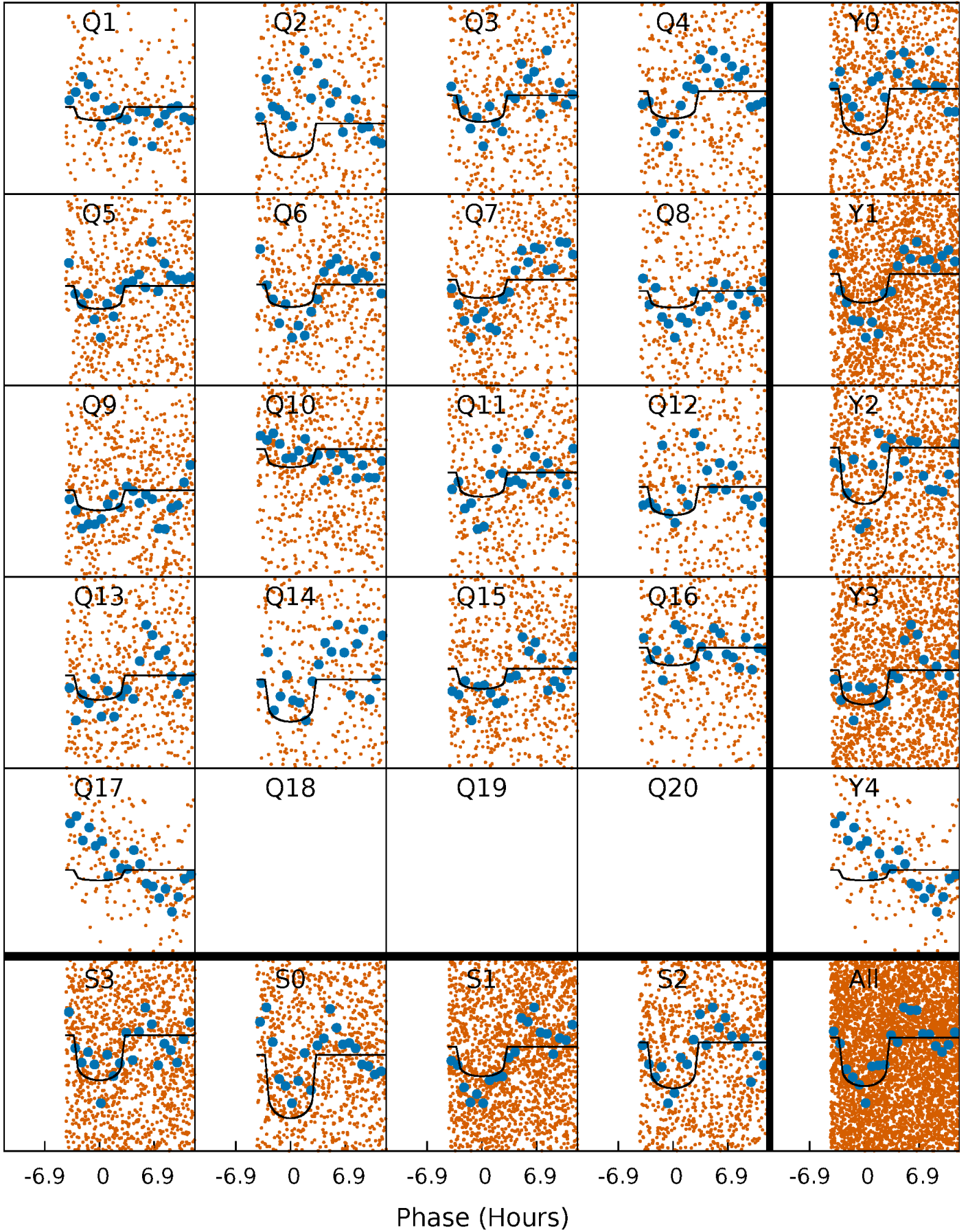
# PDC Quarter-Phased Transit Curves

TCE 012020365-02   P= 3.753550 Days    $T_0=132.092441$  (BKJD)



# DV Quarter-Phased Transit Curves

TCE 012020365-02     $P = 3.753550$  Days     $T_0 = 132.092441$  (BKJD)



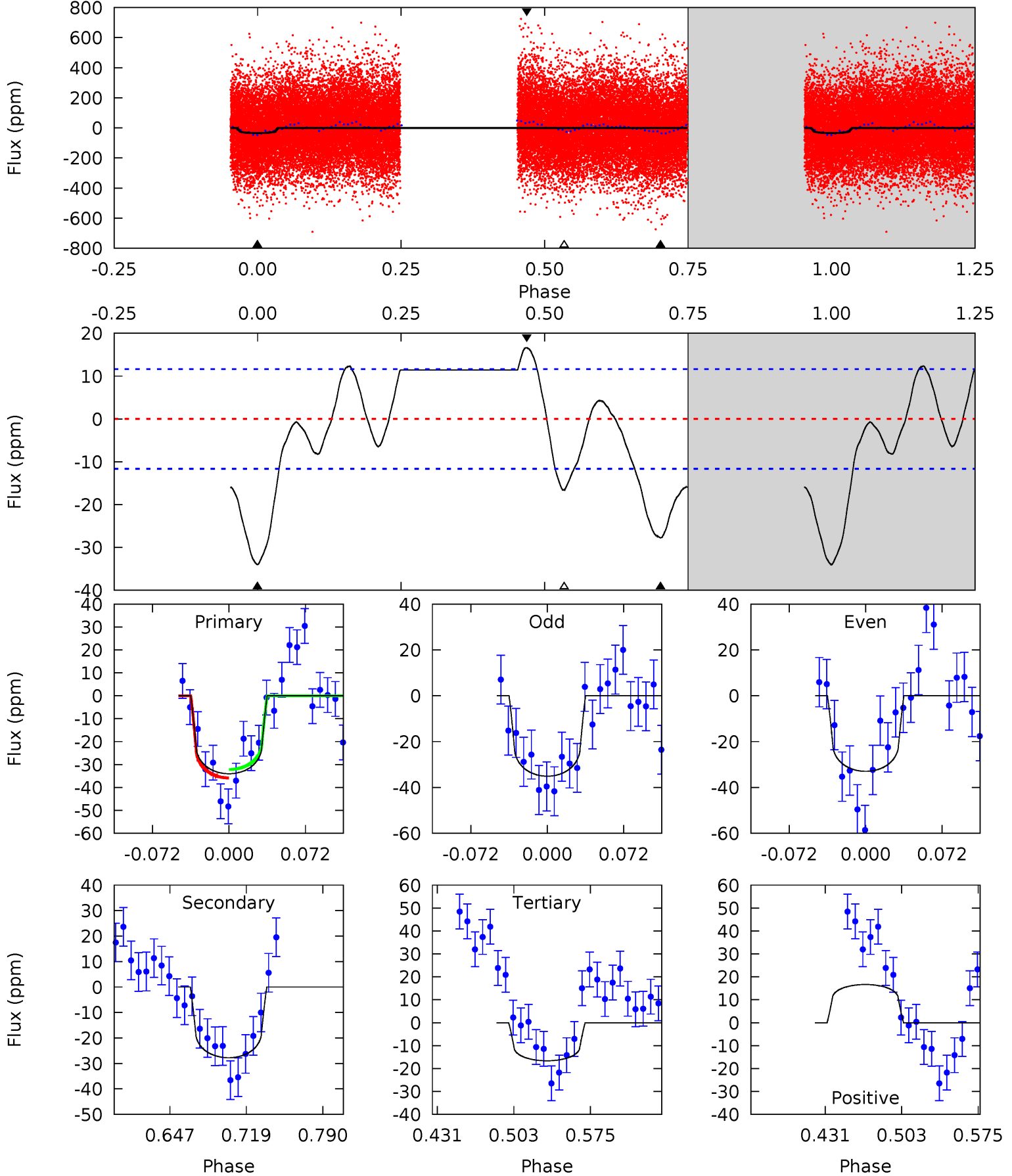


This plot does not exist for this TCE.

# DV Model-Shift Uniqueness Test

012020365-02, P = 3.753550 Days, E = 128.338891 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
13.6	11.0	6.62	6.63	4.63	1.80	3.38	6.94	6.92	4.43	4.42	0.43	1.01	0.33	0.74



## Alt Model-Shift Uniqueness Test

This plot does not exist for this TCE.

### Stellar Parameters For KIC 012020365

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6637^{+188}_{-235}$	$4.154^{+0.209}_{-0.171}$	$-0.340^{+0.250}_{-0.300}$	$1.524^{+0.437}_{-0.398}$	$1.212^{+0.171}_{-0.190}$	$0.482^{+0.582}_{-0.231}$
	+3%/-4%	+5%/-4%	+74%/-88%	+29%/-26%	+14%/-16%	+121%/-48%
Source	PHO54	PHO54	PHO54	DSEP		

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

### Secondary Eclipse Parameters for KIC 012020365-02 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	$-28 \pm 3$	$0.98^{+0.66}_{-0.55}$	$2240^{+155}_{-177}$	$6088^{+3935}_{-1186}$	$40^{+165}_{-26}$
Alt.	N/A	N/A	N/A	N/A	N/A

$T_{\text{max}}$  = 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

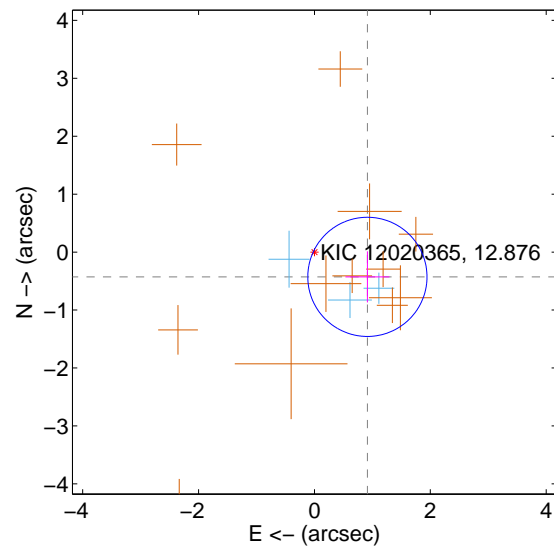
Supplemental centroid analysis for 012020365-02. Kepler magnitude: 12.88. Transit SNR 9.46

There are 3 quarters with good PRF difference image offsets

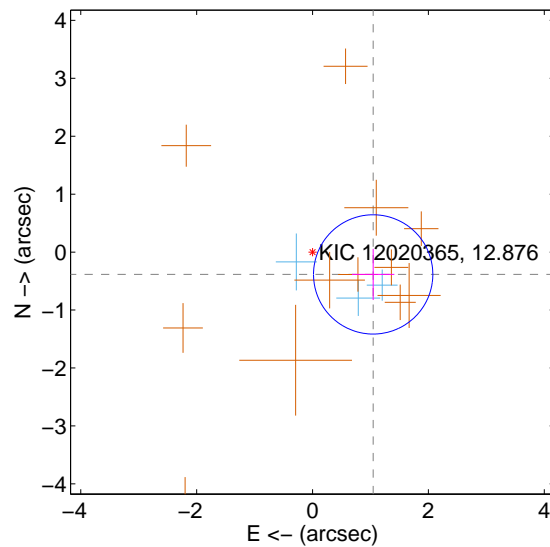
The direct PRF centroid is offset from the target star catalog position by about 0.11 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.009 \pm 0.343$	2.94	$-0.914 \pm 0.379$	$-0.427 \pm 0.441$
PRF-fit source offset from KIC position	$1.115 \pm 0.343$	3.25	$-1.047 \pm 0.366$	$-0.385 \pm 0.442$
photometric centroid source offset	$0.66 \pm 0.94$	0.70	$0.13 \pm 0.90$	$-0.65 \pm 0.94$

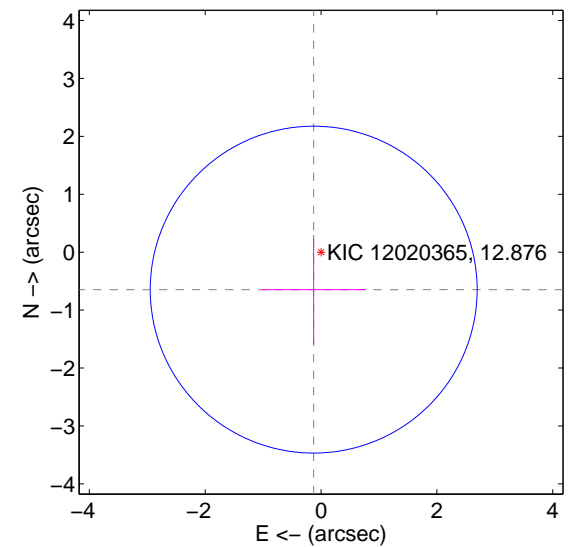
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position



offset from photometric centroids



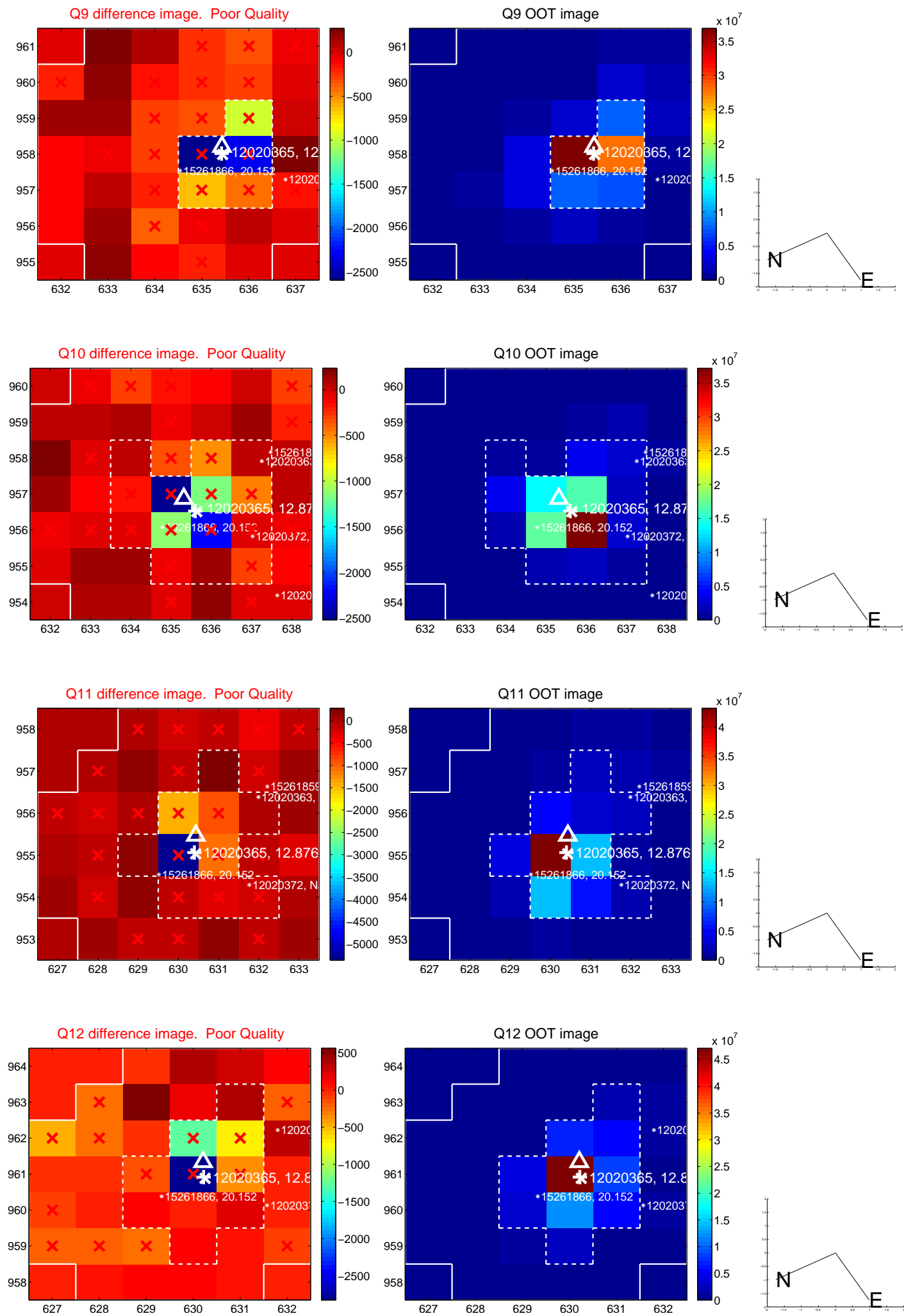
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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



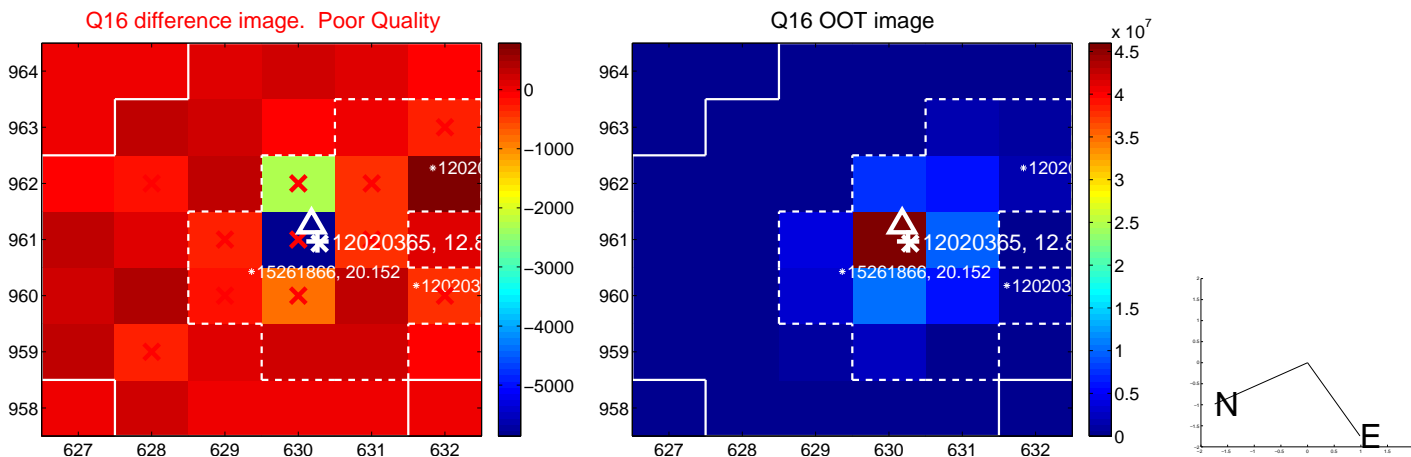
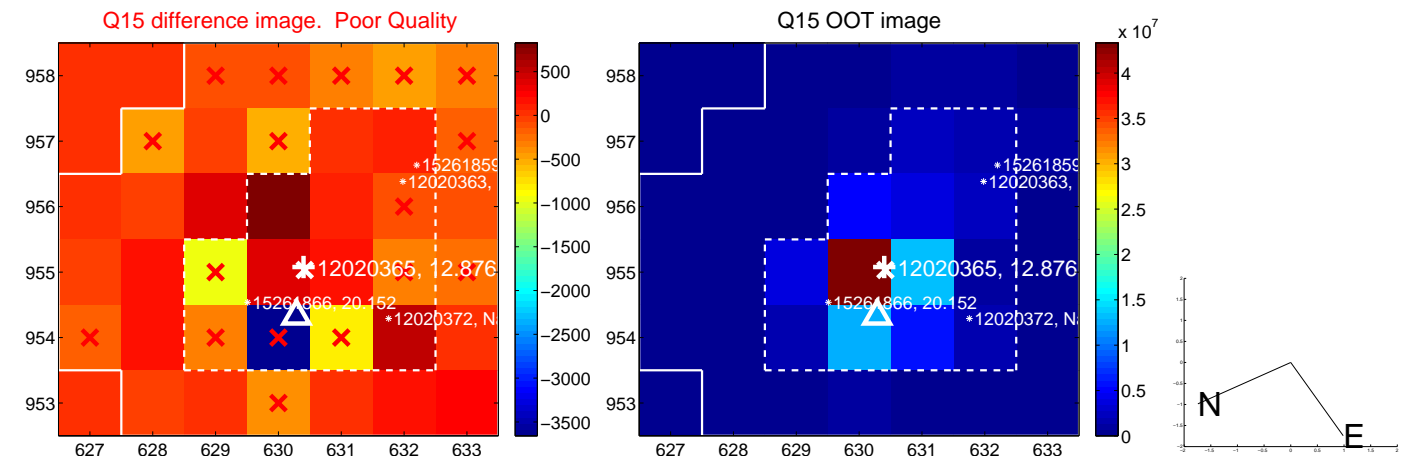
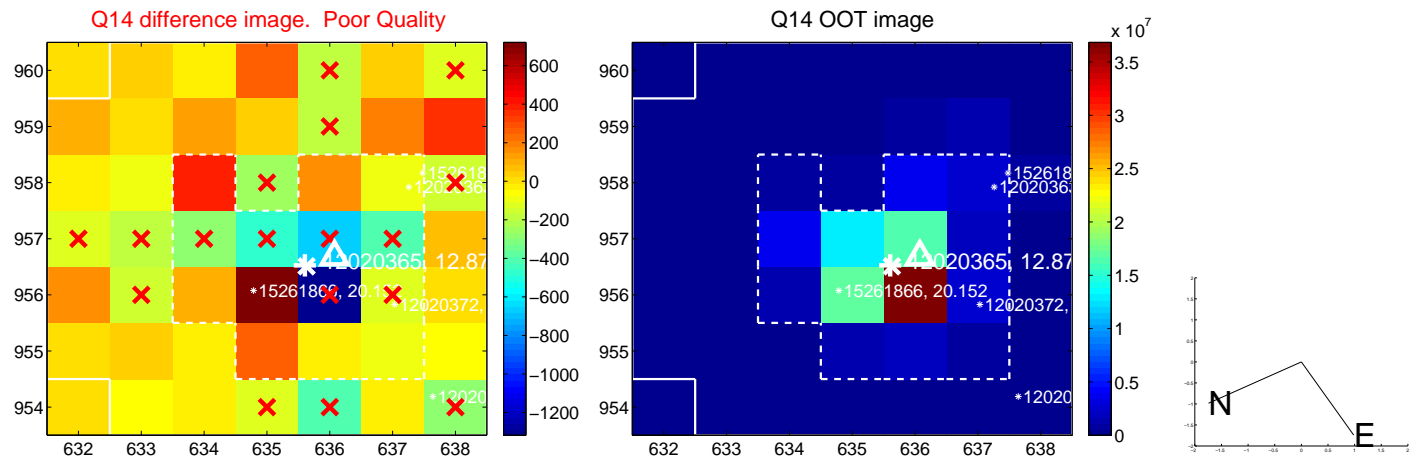
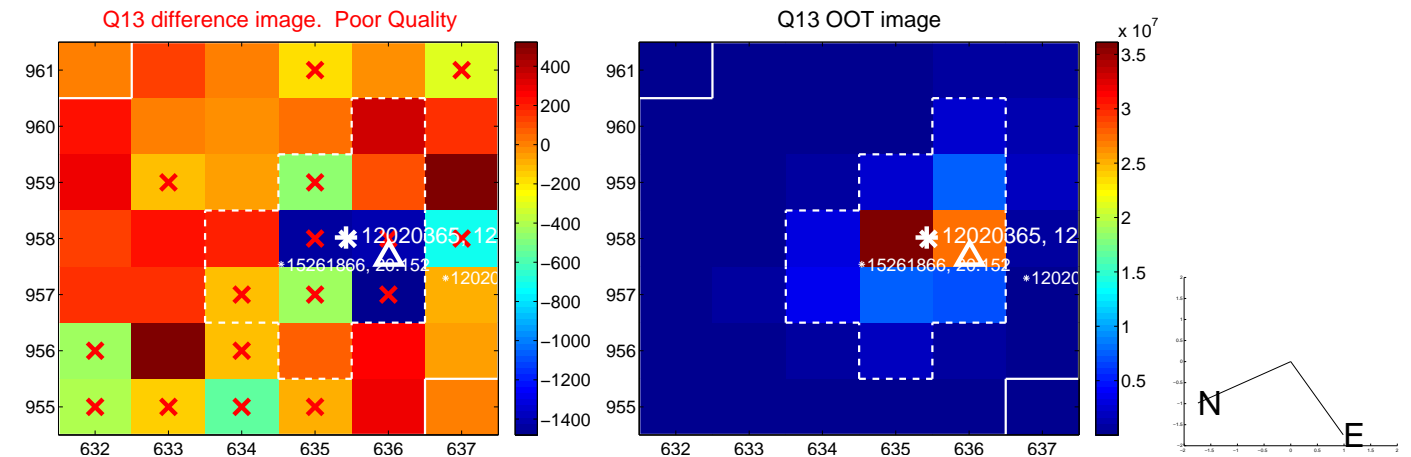




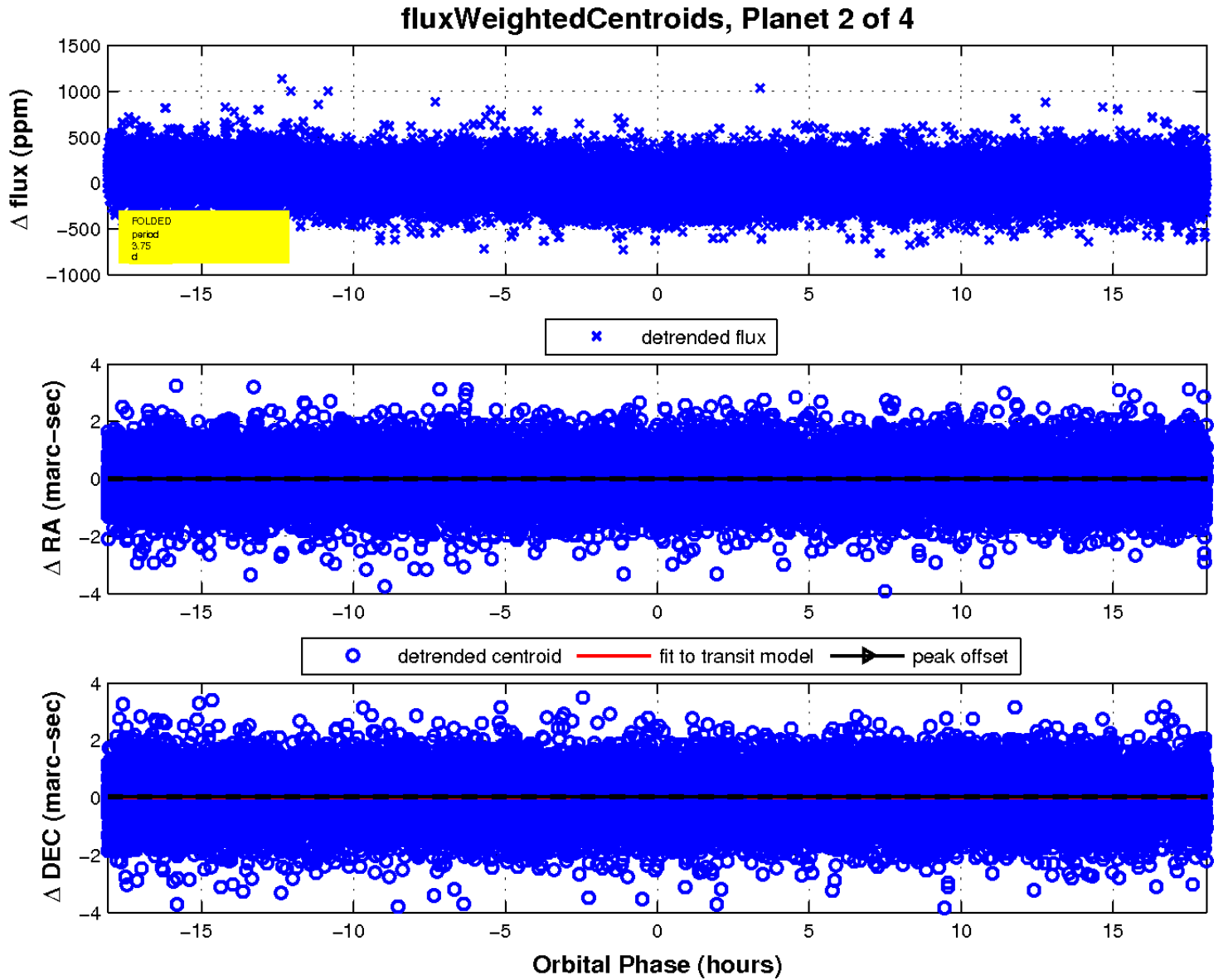
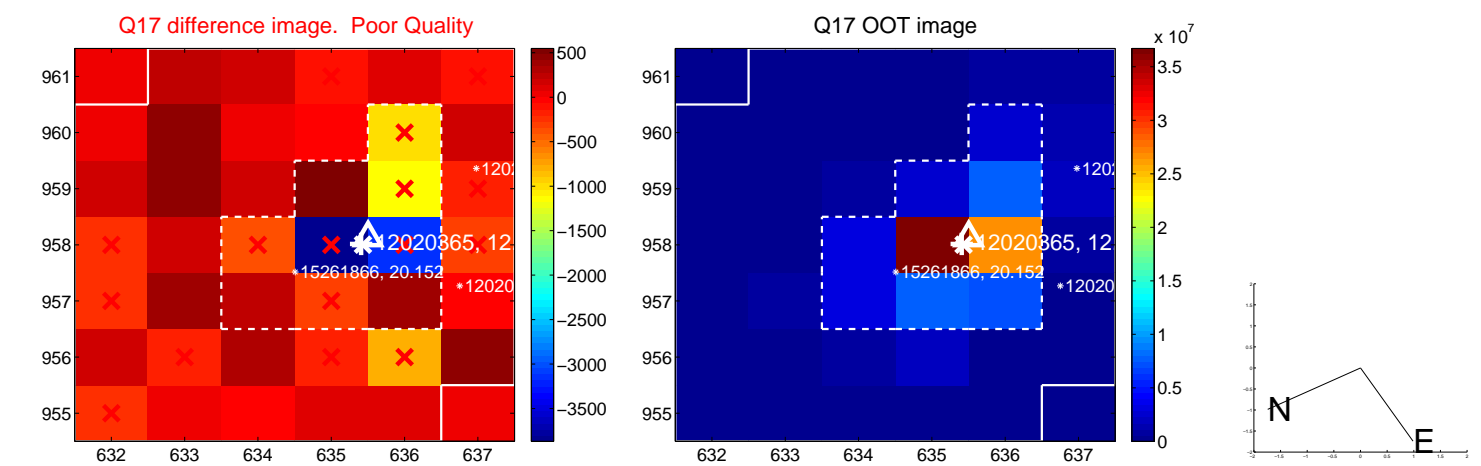
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



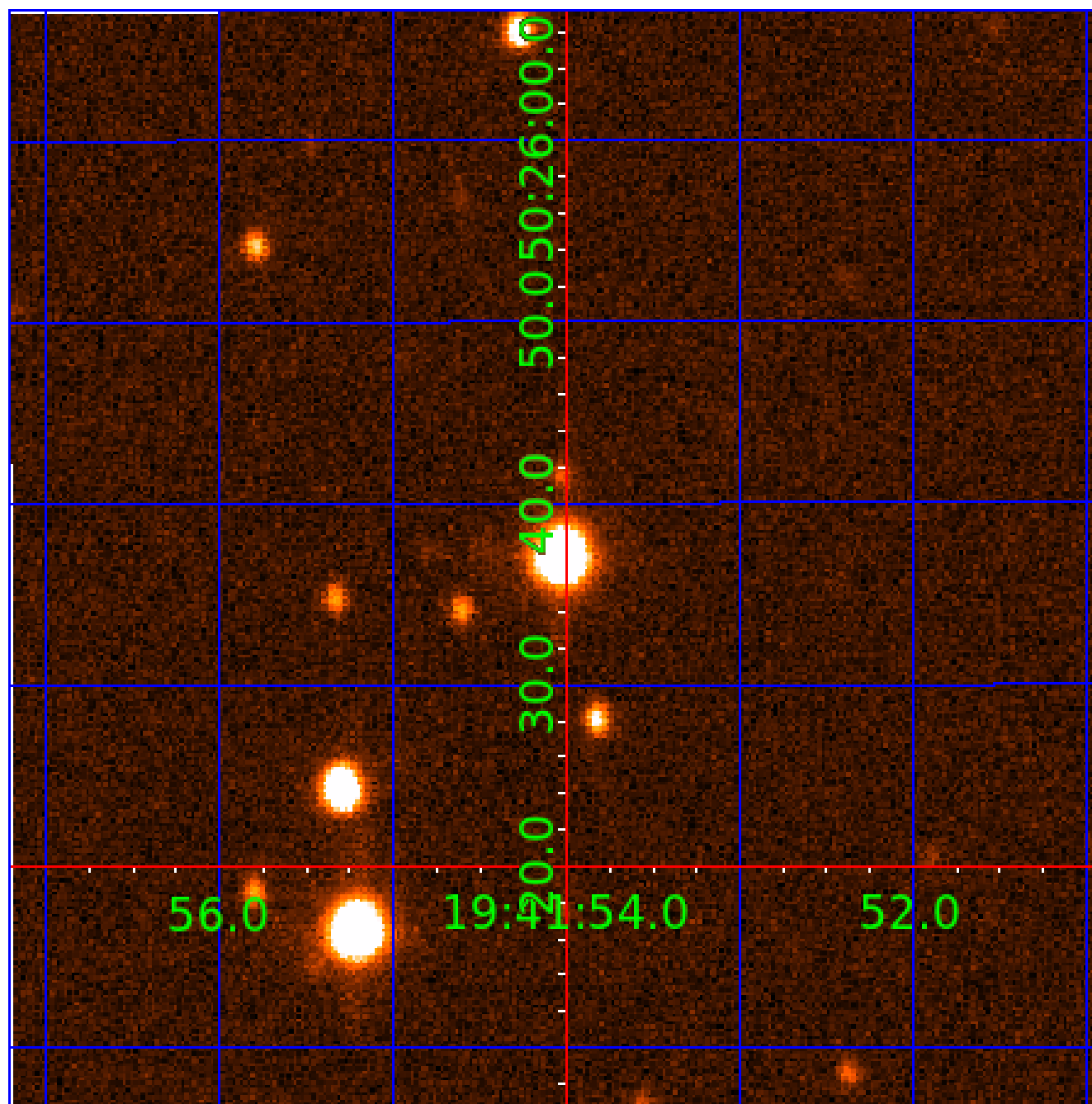
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





UKIRT Image

Declination



# KIC 012020365

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
012020365-01	OBS	No	1.876785	131.528022	145.2	6.000	12.9	-1.0	1.52	6637	1.85	4013.77
012020365-02	OBS	No	3.753550	132.092441	39.5	6.030	8.7	9.5	1.52	6637	0.96	1592.88
012020365-03	OBS	No	3.754067	134.586861	29.0	12.133	8.8	8.1	1.52	6637	0.94	1592.58
012020365-04	OBS	No	272.217587	376.525112	330.4	3.602	8.4	7.7	1.52	6637	3.10	5.27

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
012020365-01	OBS	FP	0.00	1	0	0	0	SWEET_NTL—LPP_DV—MOD_NONUNIQ_ALT—CENT_NOFITS
012020365-02	OBS	FP	0.00	1	0	0	0	SWEET_NTL—LPP_DV—MOD_NONUNIQ_DV—SAME_NTL_PERIOD
012020365-03	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—SAME_NTL_PERIOD
012020365-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS

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

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

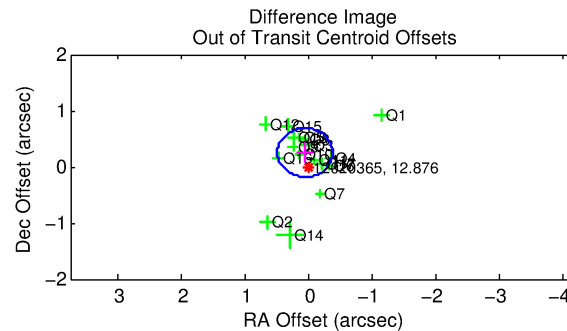
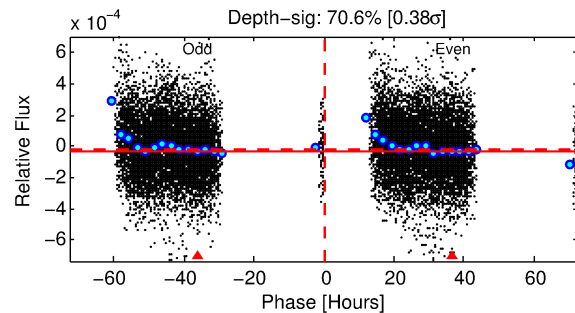
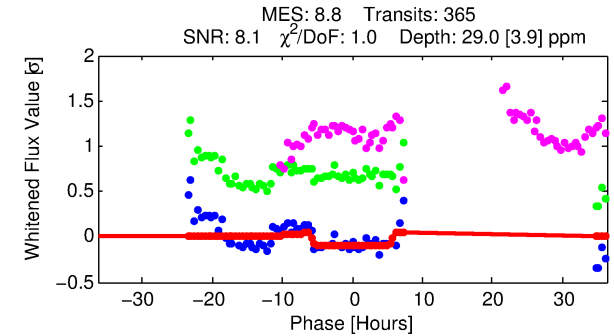
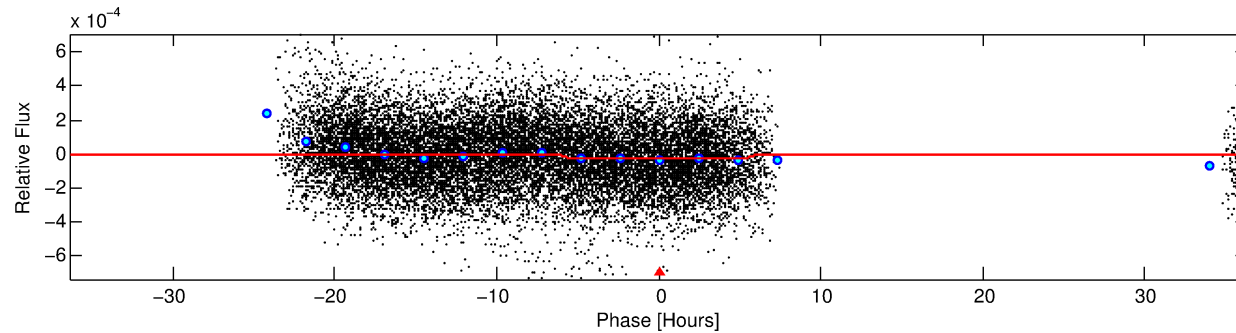
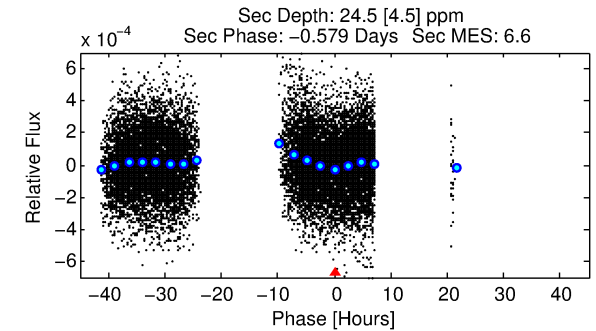
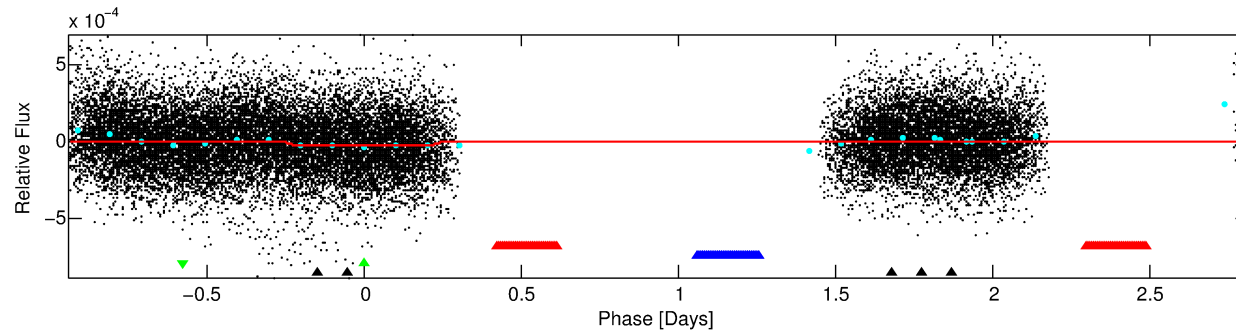
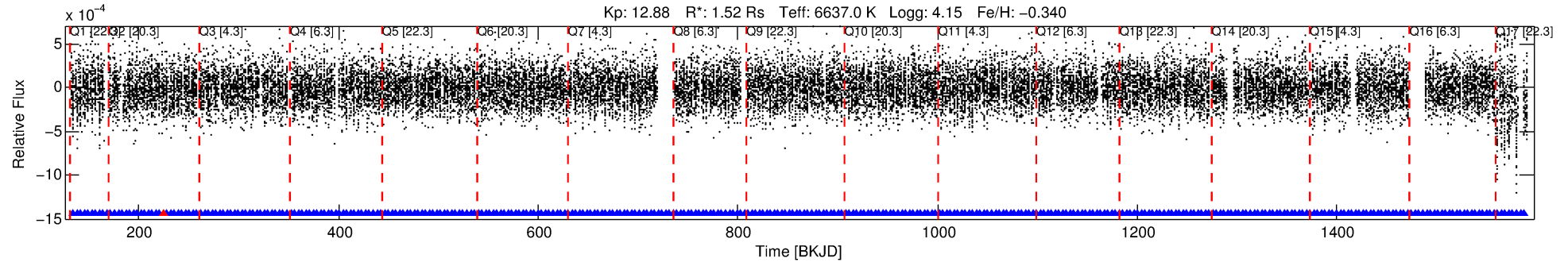
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 012020365-03

No Significant Match Found

# DV One-Page Summary

KIC: 12020365 Candidate: 3 of 4 Period: 3.754 d



## DV Fit Results:

Period = 3.75407 [0.00007] d  
Epoch = 134.5869 [0.0119] BKJD  
Rp/R\* = 0.0057 [0.0013]  
a/R\* = 1.46 [1.00]  
b = 0.88 [0.32]  
Seff = 1592.58 [636.10]  
Teq = 1611 [161] K  
Rp = 0.95 [0.35] Re  
a = 0.0504 [0.0126] AU  
Ag = 38.24 [23.59] [1.58σ]  
Teffp = 6193 [791] K [5.68σ]

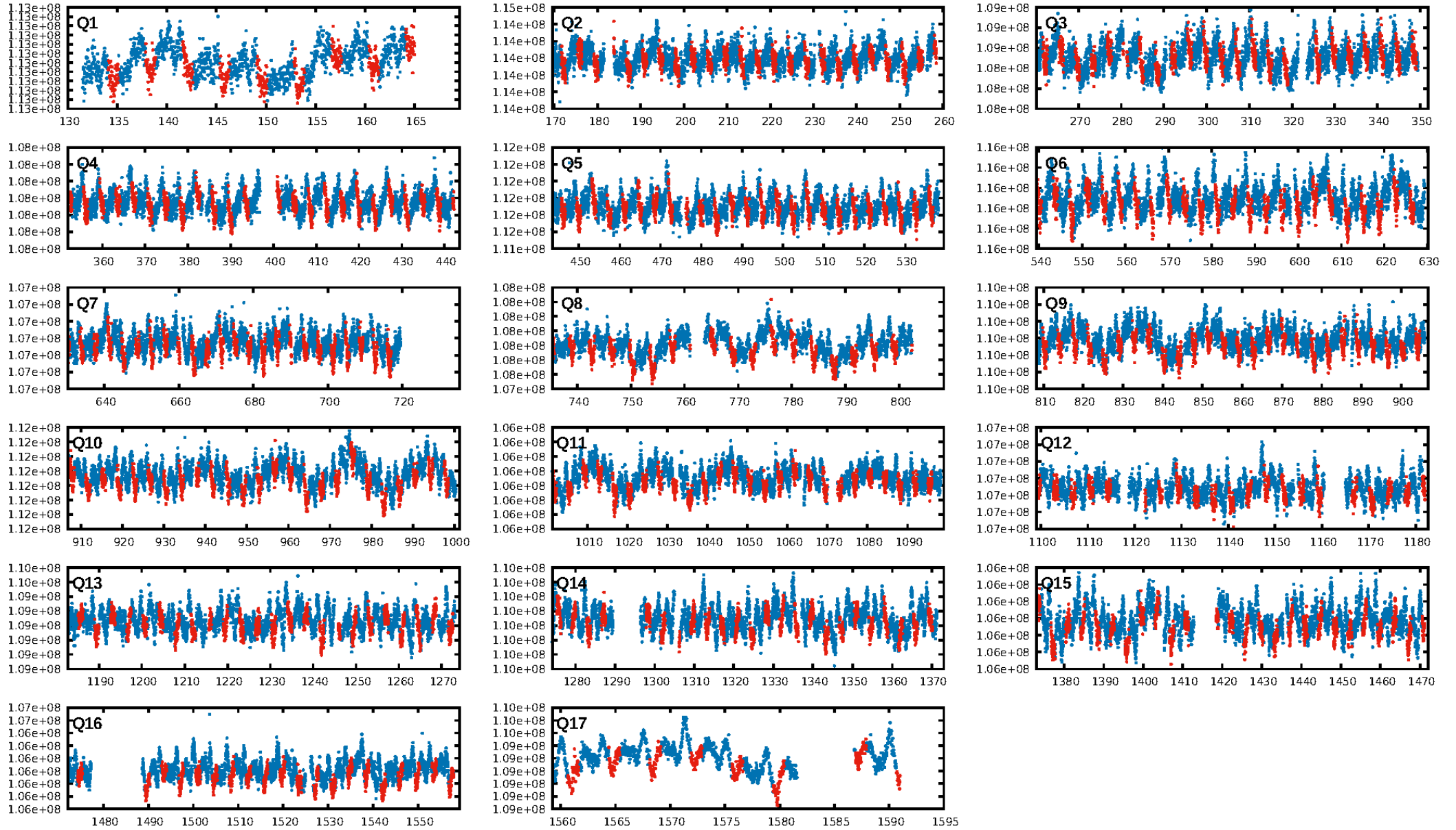
## DV Diagnostic Results:

ShortPeriod-sig: 0.1% [0.00σ]  
LongPeriod-sig: 100.0% [509.09σ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: 3.63e-13  
RollingBand-fgt: 1.00 [347/348]  
GhostDiagnostic-chr: 1.103  
Centroid-sig: 2.1%  
Centroid-so: 1.620 arcsec [1.67σ]  
OotOffset-rm: 0.259 arcsec [1.79σ]  
KicOffset-rm: 0.314 arcsec [2.07σ]  
OotOffset-st: 4/4/4/5 [17]  
KicOffset-st: 4/4/4/5 [17]  
DiffImageQuality-fgm: 1.00 [17/17]  
DiffImageOverlap-fno: 0.00 [0/17]

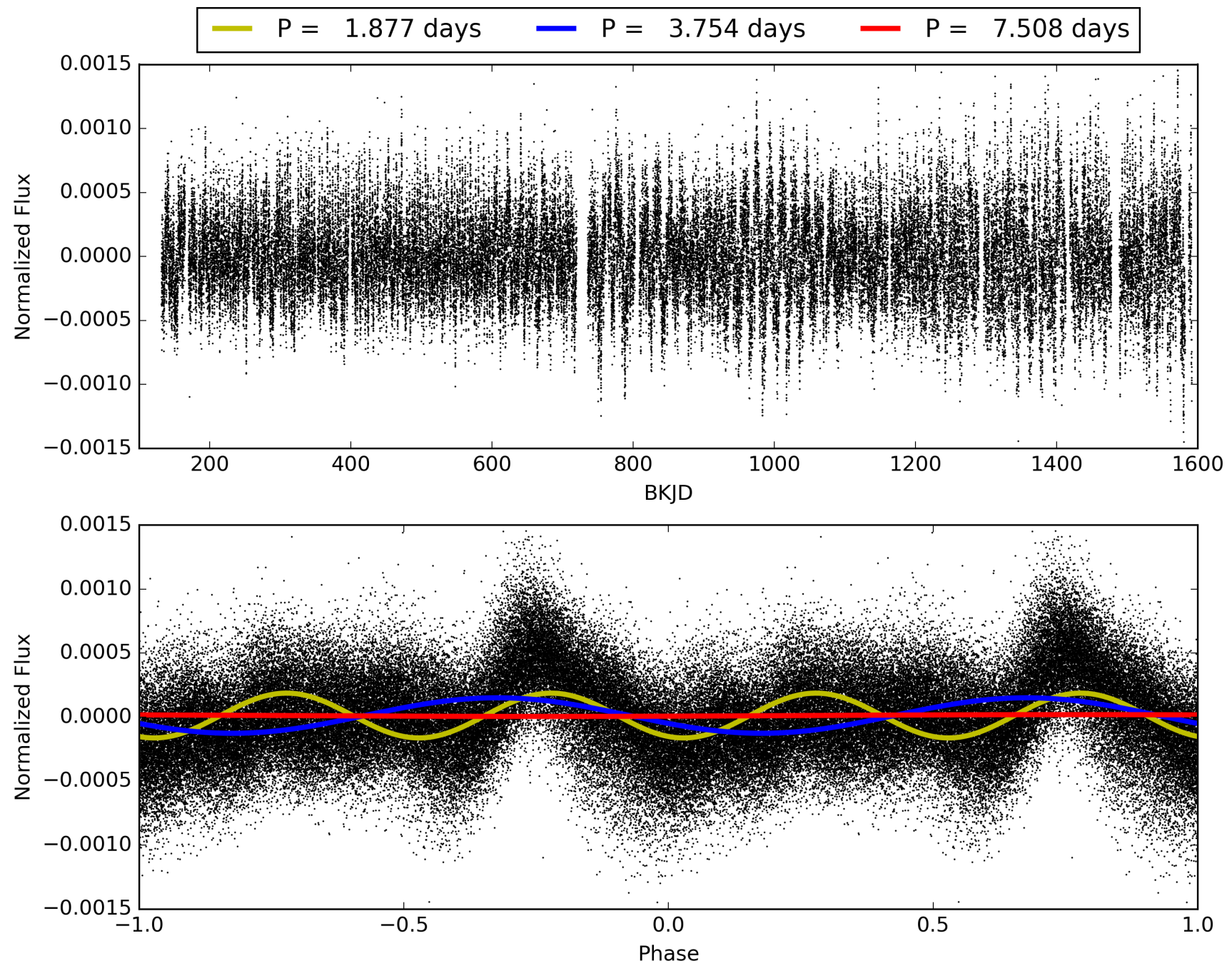
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 29-Jan-2016 15:27:31 Z

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

# TCE 012020365-03, PDC Light Curves



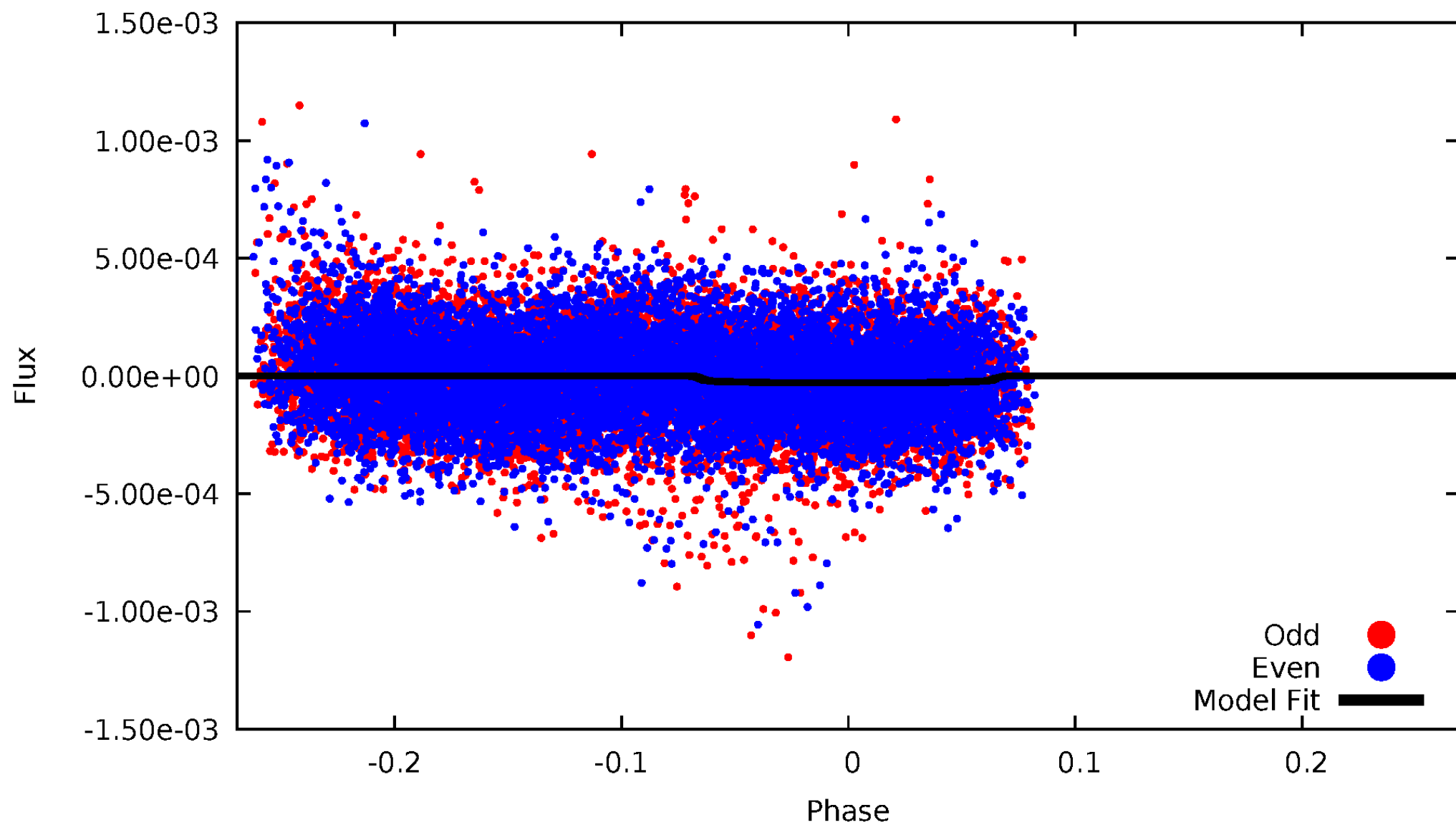
TCE 012020365-03





DV Odd/Even

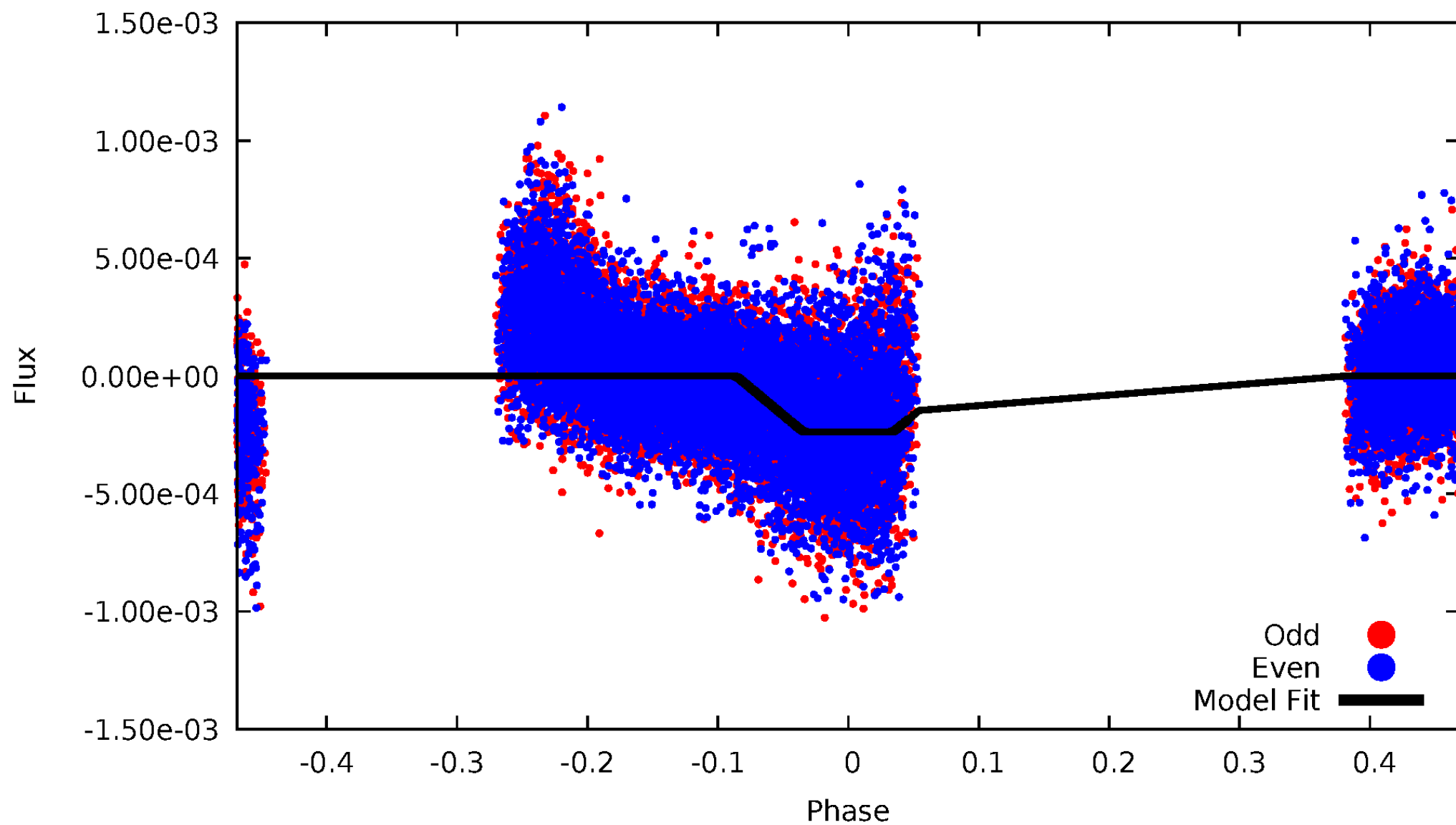
TCE 012020365-03



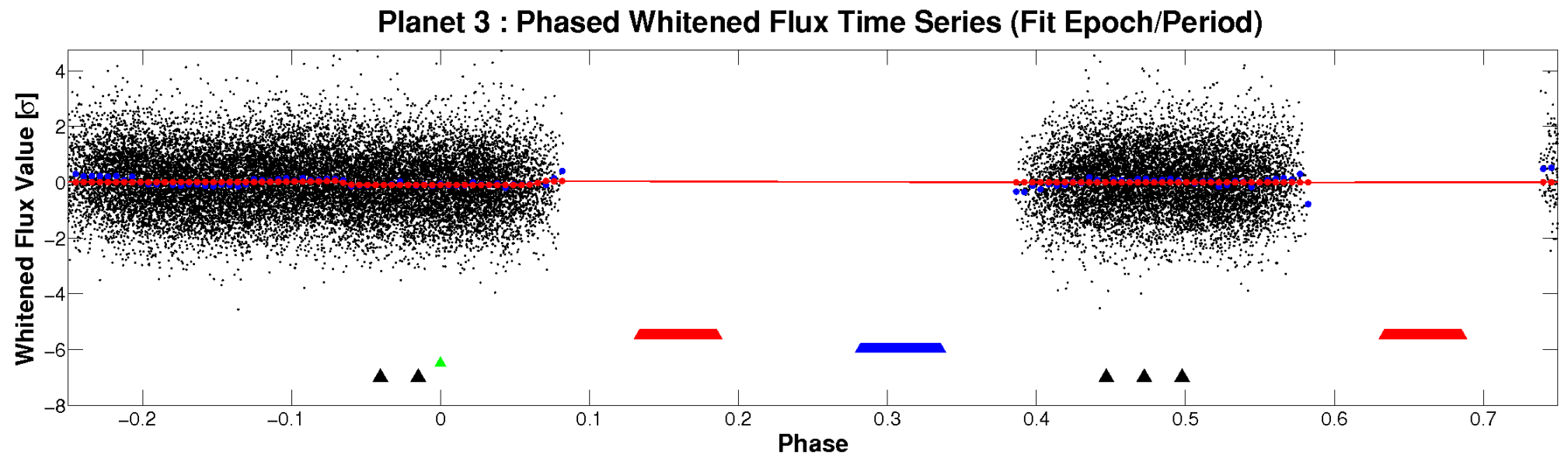
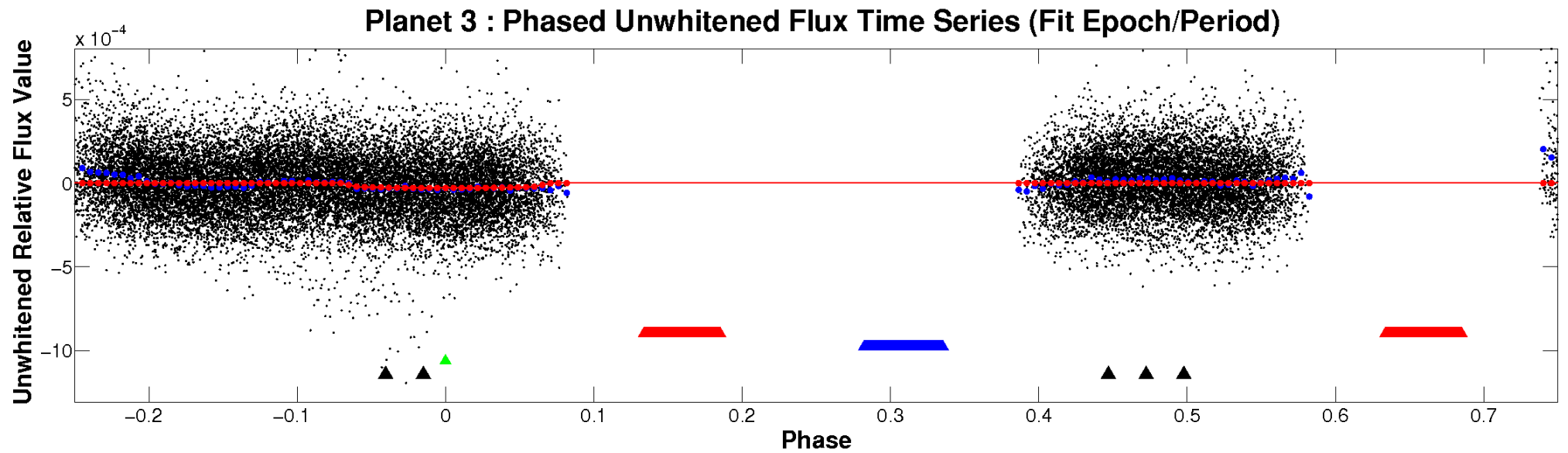


# ALT Odd/Even

TCE 012020365-03

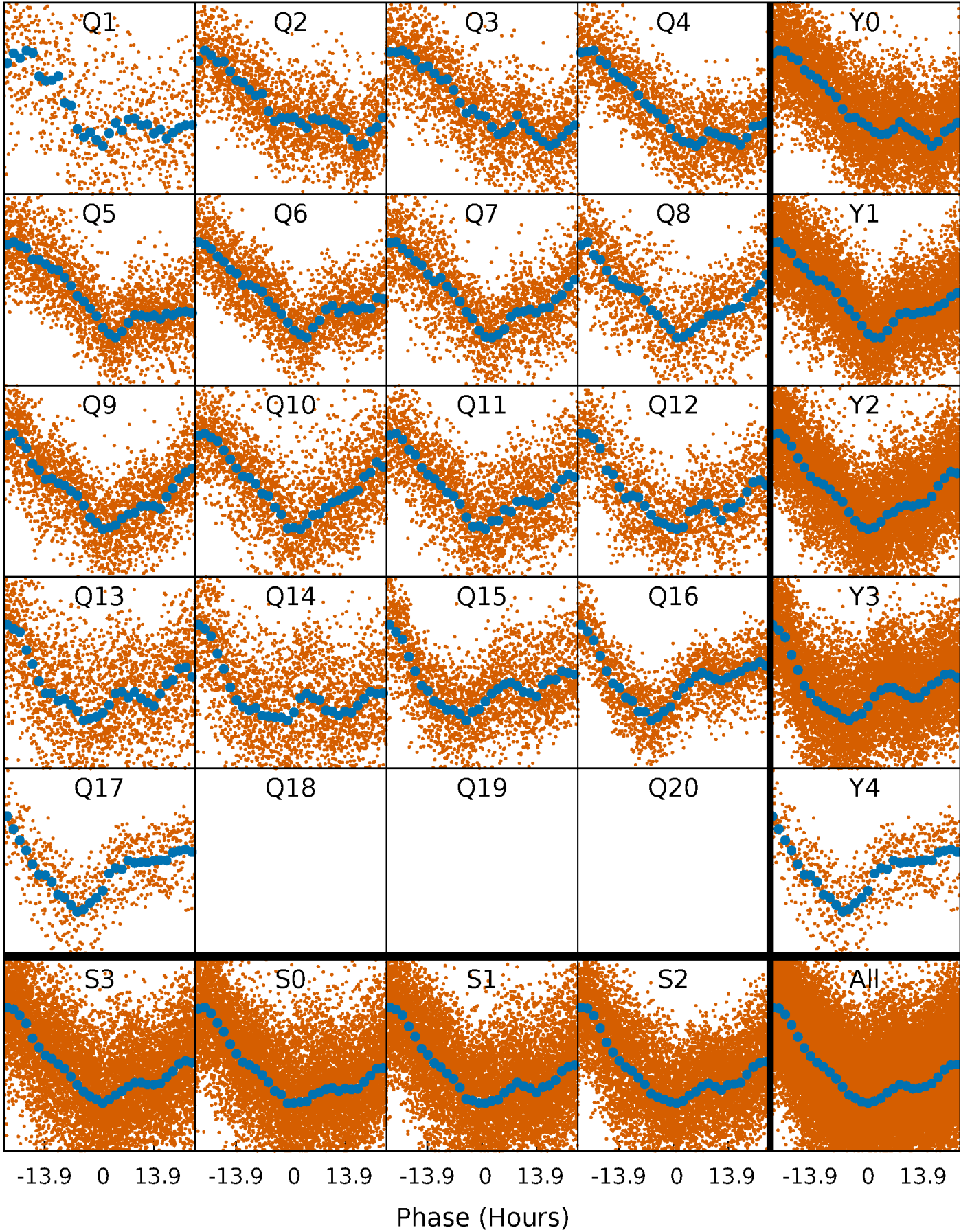


# Non-Whitened Vs. Whitened Light Curve



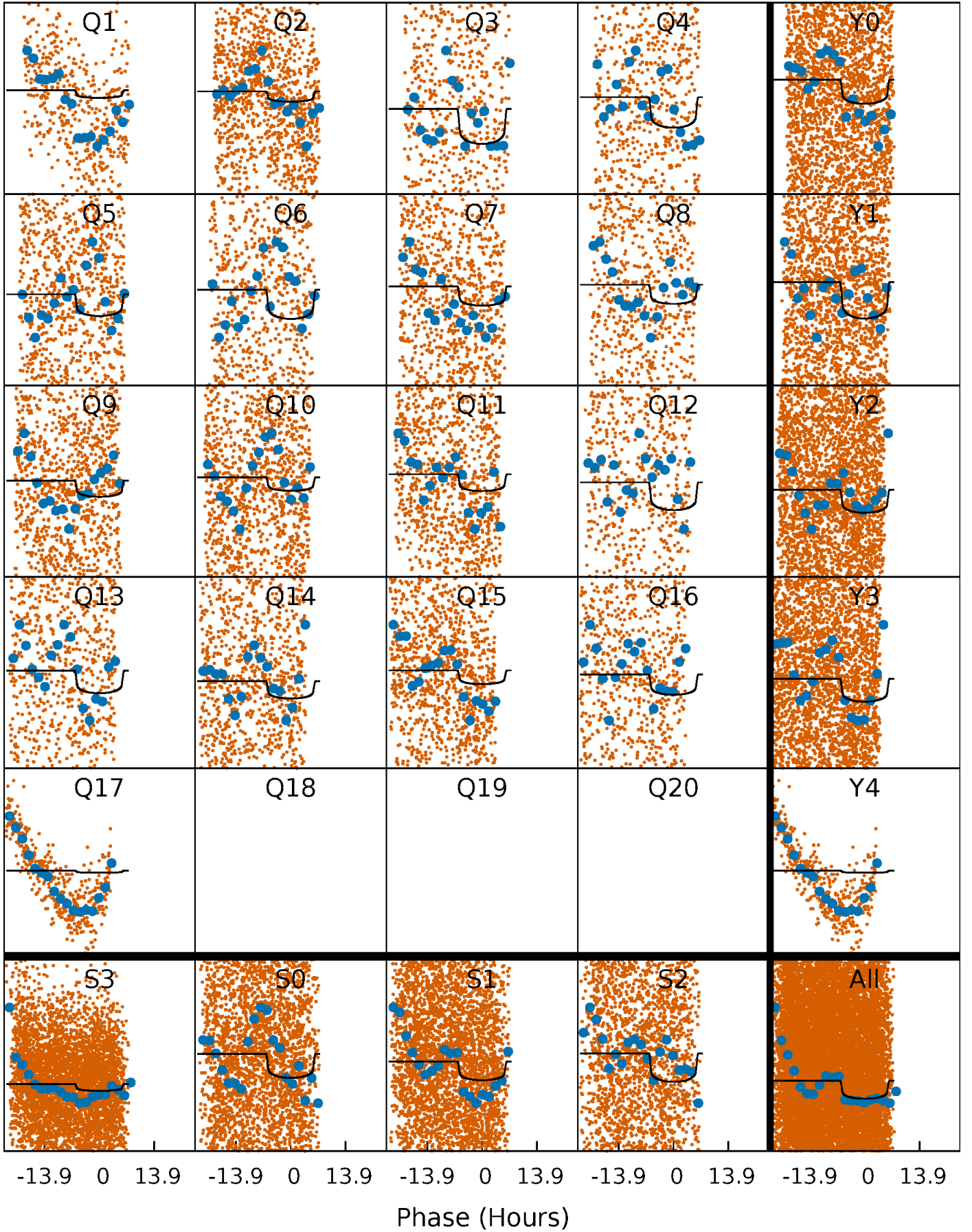
# PDC Quarter-Phased Transit Curves

TCE 012020365-03   P= 3.754067 Days    $T_0=134.586861$  (BKJD)



# DV Quarter-Phased Transit Curves

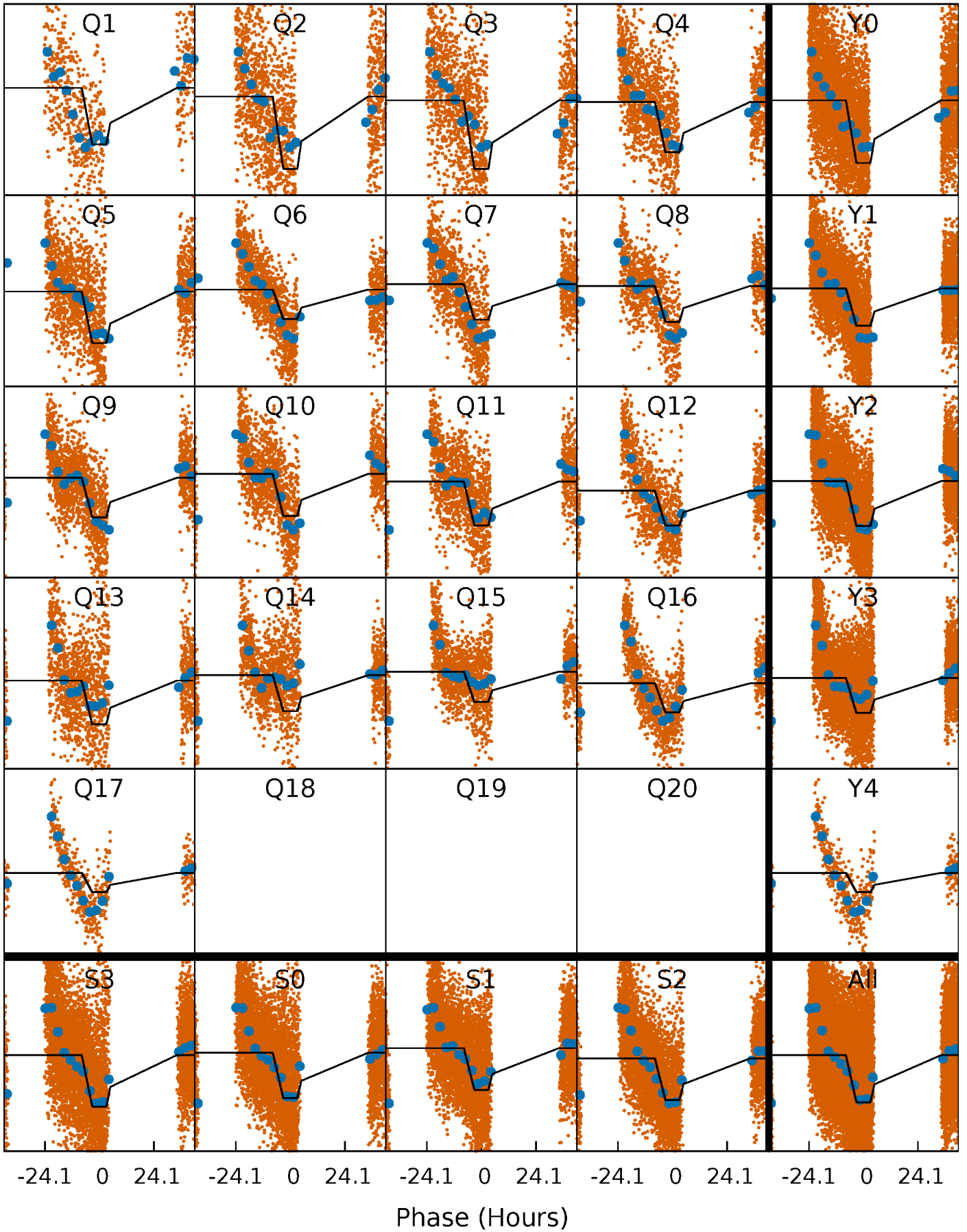
TCE 012020365-03   P= 3.754067 Days    $T_0=134.586861$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

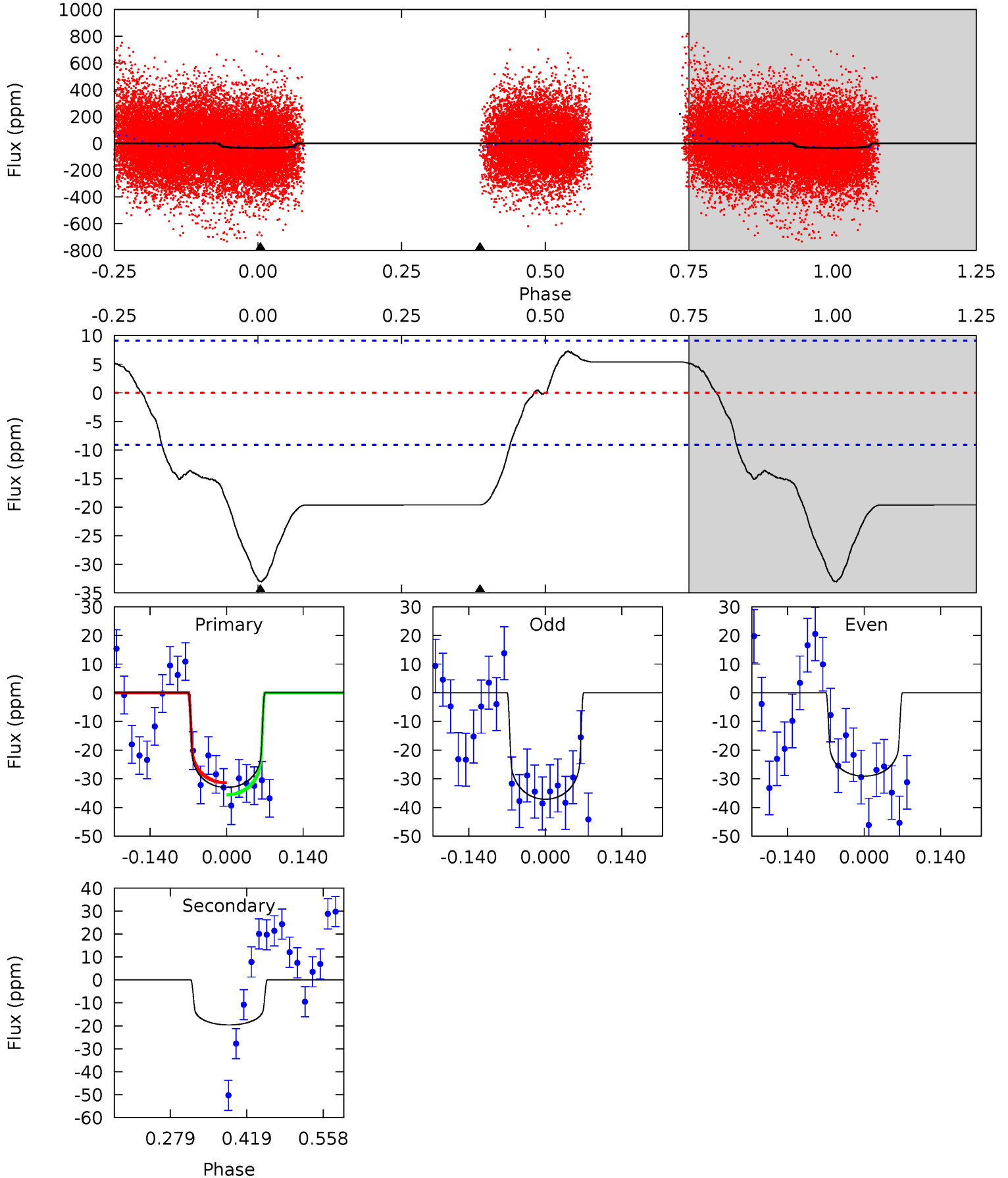
TCE 012020365-03   P= 3.753275 Days    $T_0=134.806654$  (BKJD)



# DV Model-Shift Uniqueness Test

012020365-03, P = 3.754067 Days, E = 130.832794 Days

Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
16.3	9.69	0	0	4.49	1.48	3.67	16.3	16.3	9.69	9.69	2.00	1.57	0.18	1.06

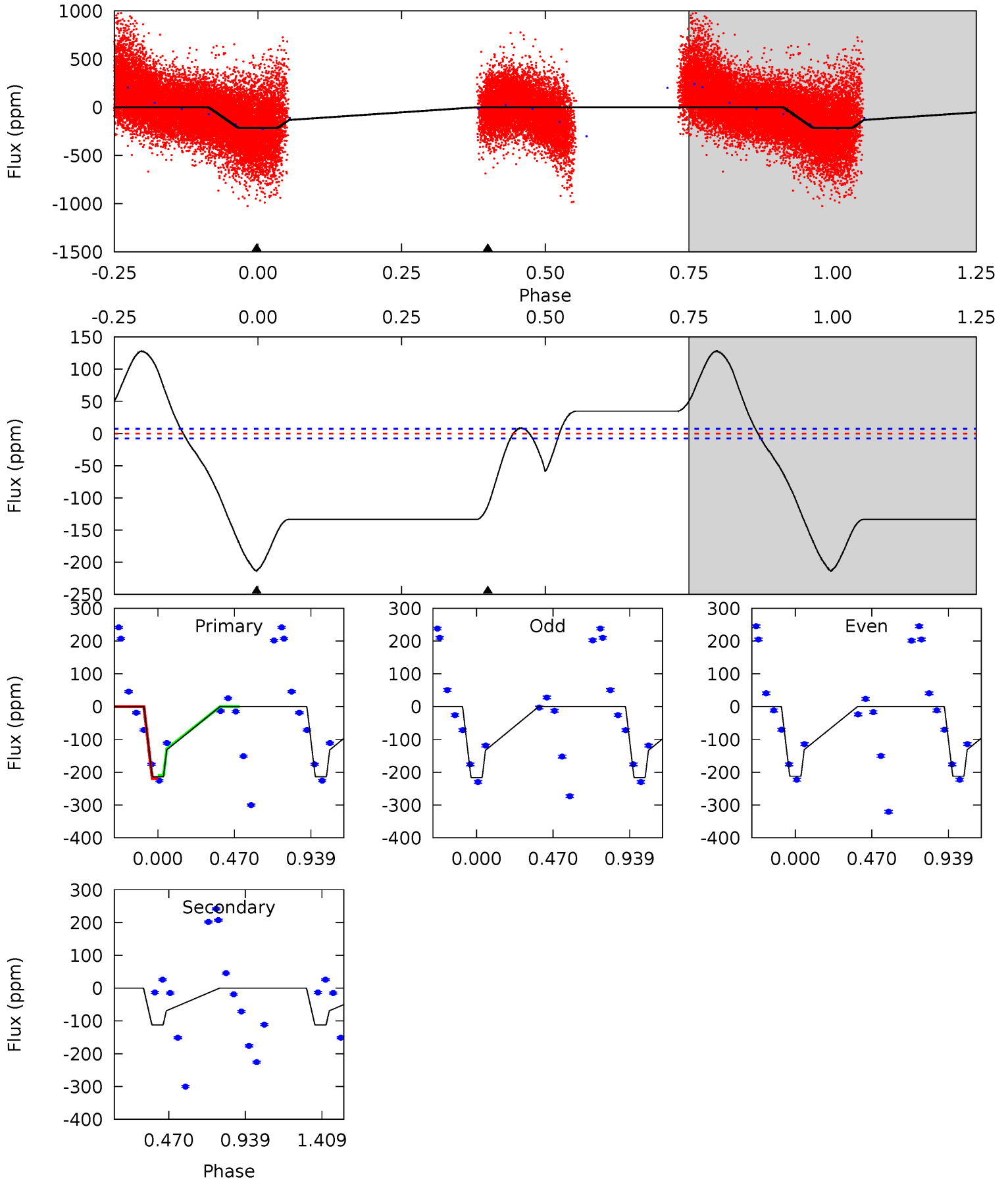




# Alt Model-Shift Uniqueness Test

012020365-03, P = 3.753275 Days, E = 131.053379 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
119.6	62.7	0	0	4.23	0.72	13.0	119.6	119.6	62.7	62.7	1.12	1.07	0.38	1.69



### Stellar Parameters For KIC 012020365

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M$ ( $M_{\odot}$ )	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6637^{+188}_{-235}$	$4.154^{+0.209}_{-0.171}$	$-0.340^{+0.250}_{-0.300}$	$1.524^{+0.437}_{-0.398}$	$1.212^{+0.171}_{-0.190}$	$0.482^{+0.582}_{-0.231}$
	+3%/-4%	+5%/-4%	+74%/-88%	+29%/-26%	+14%/-16%	+121%/-48%
Source	PHO54	PHO54	PHO54	DSEP		

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

### Secondary Eclipse Parameters for KIC 012020365-03 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-20 \pm 2$	$0.93^{+0.28}_{-0.26}$	$2247^{+169}_{-167}$	$5820^{+895}_{-551}$	$31^{+29}_{-13}$
Alt.	$-112 \pm 2$	$2.57^{+0.48}_{-0.46}$	$2247^{+167}_{-173}$	$5493^{+264}_{-252}$	$24^{+10}_{-7}$

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

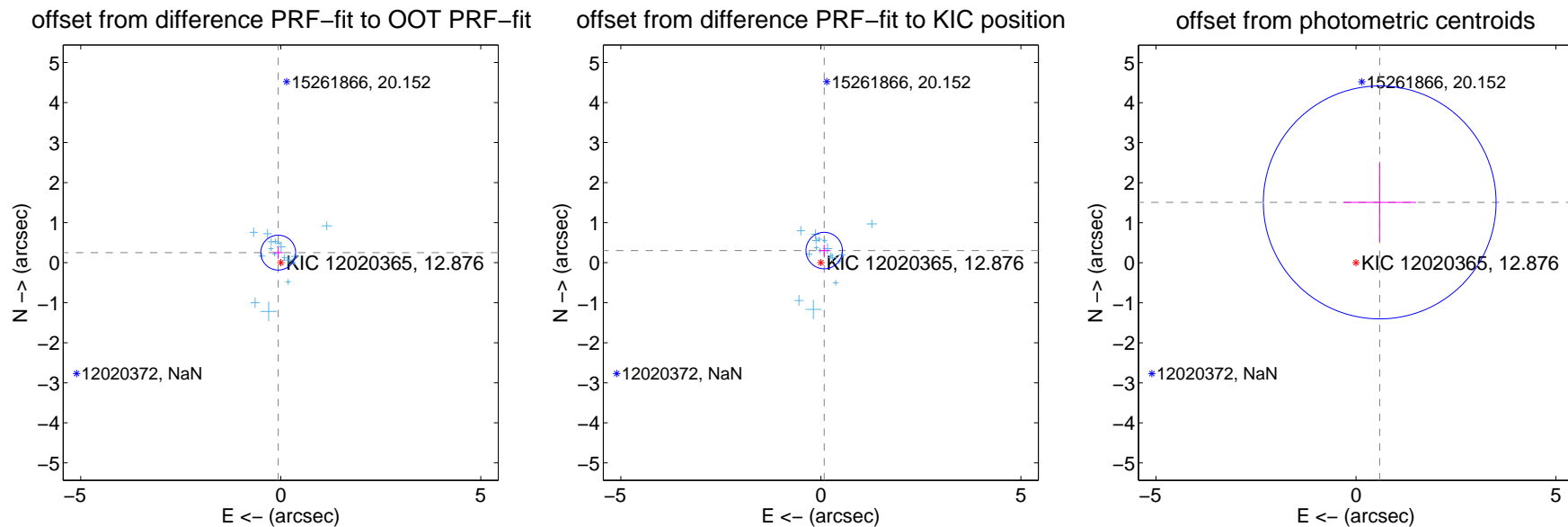
## DV Centroid Data

Supplemental centroid analysis for 012020365-03. Kepler magnitude: 12.88. Transit SNR 8.09

There are 17 quarters with good PRF difference image offsets

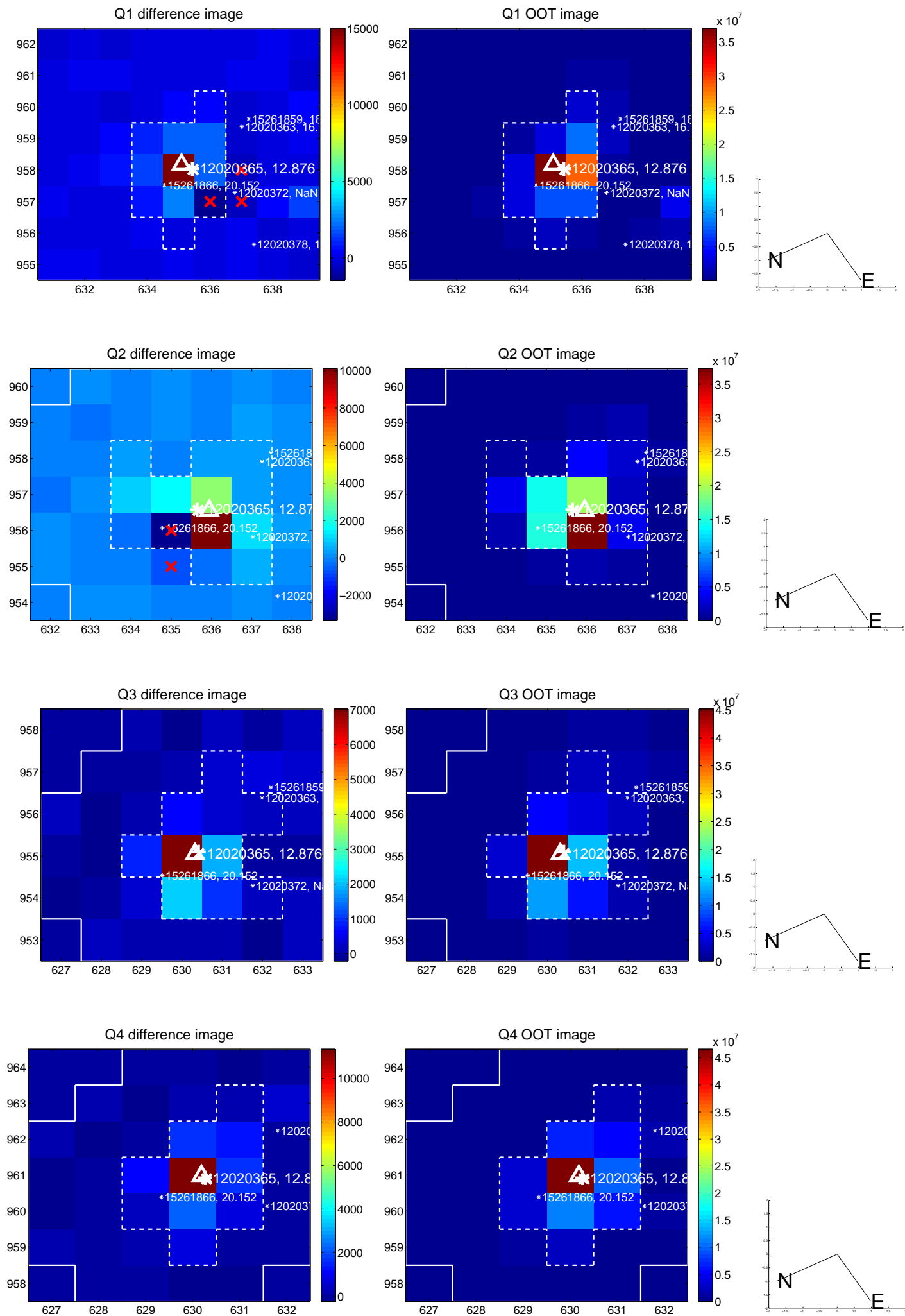
The direct PRF centroid is offset from the target star catalog position by about 0.11 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.259 \pm 0.145$	1.79	$0.063 \pm 0.119$	$0.252 \pm 0.152$
PRF-fit source offset from KIC position	$0.314 \pm 0.152$	2.07	$-0.083 \pm 0.129$	$0.303 \pm 0.145$
photometric centroid source offset	$1.62 \pm 0.97$	1.67	$-0.59 \pm 0.91$	$1.51 \pm 0.98$

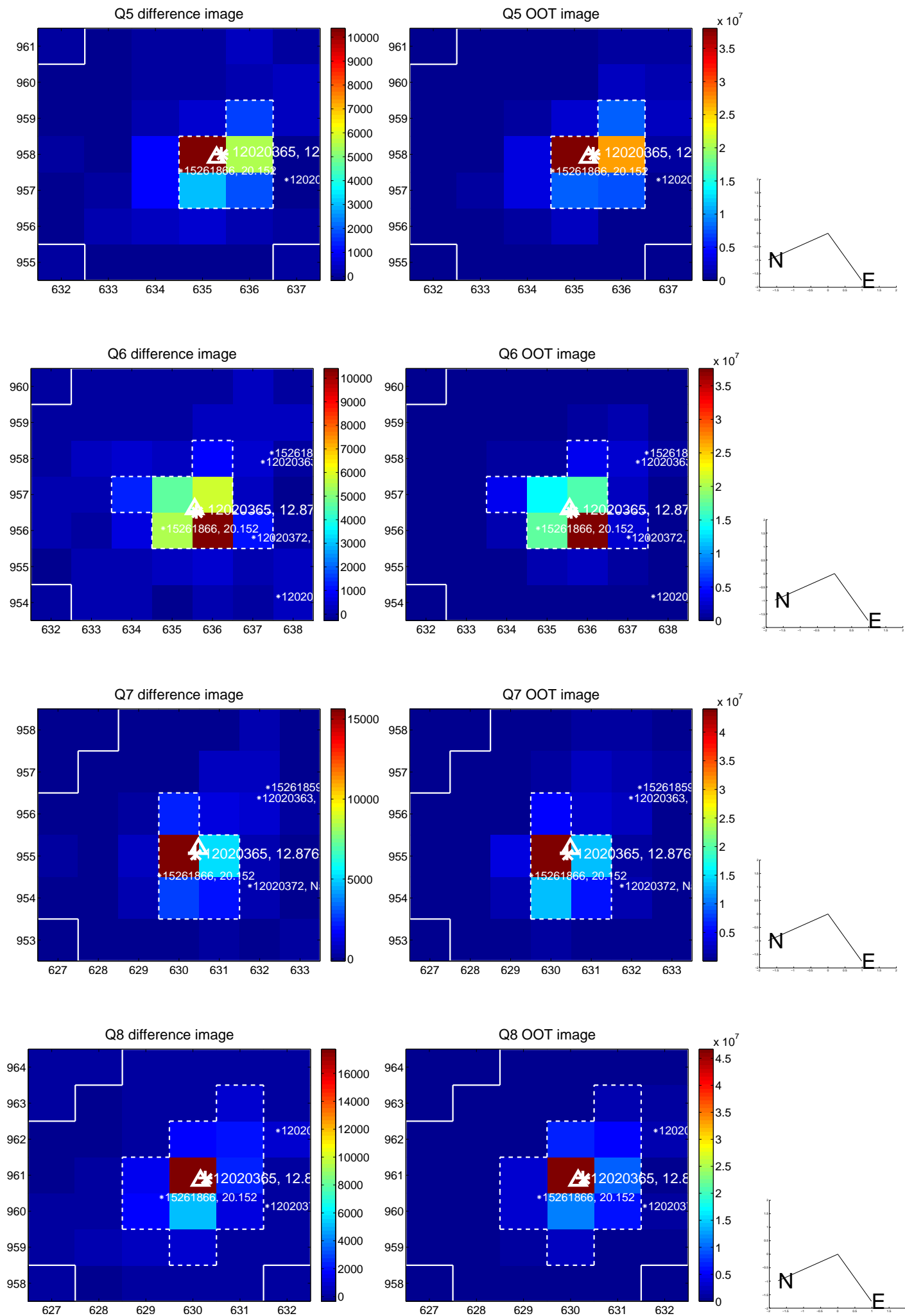


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

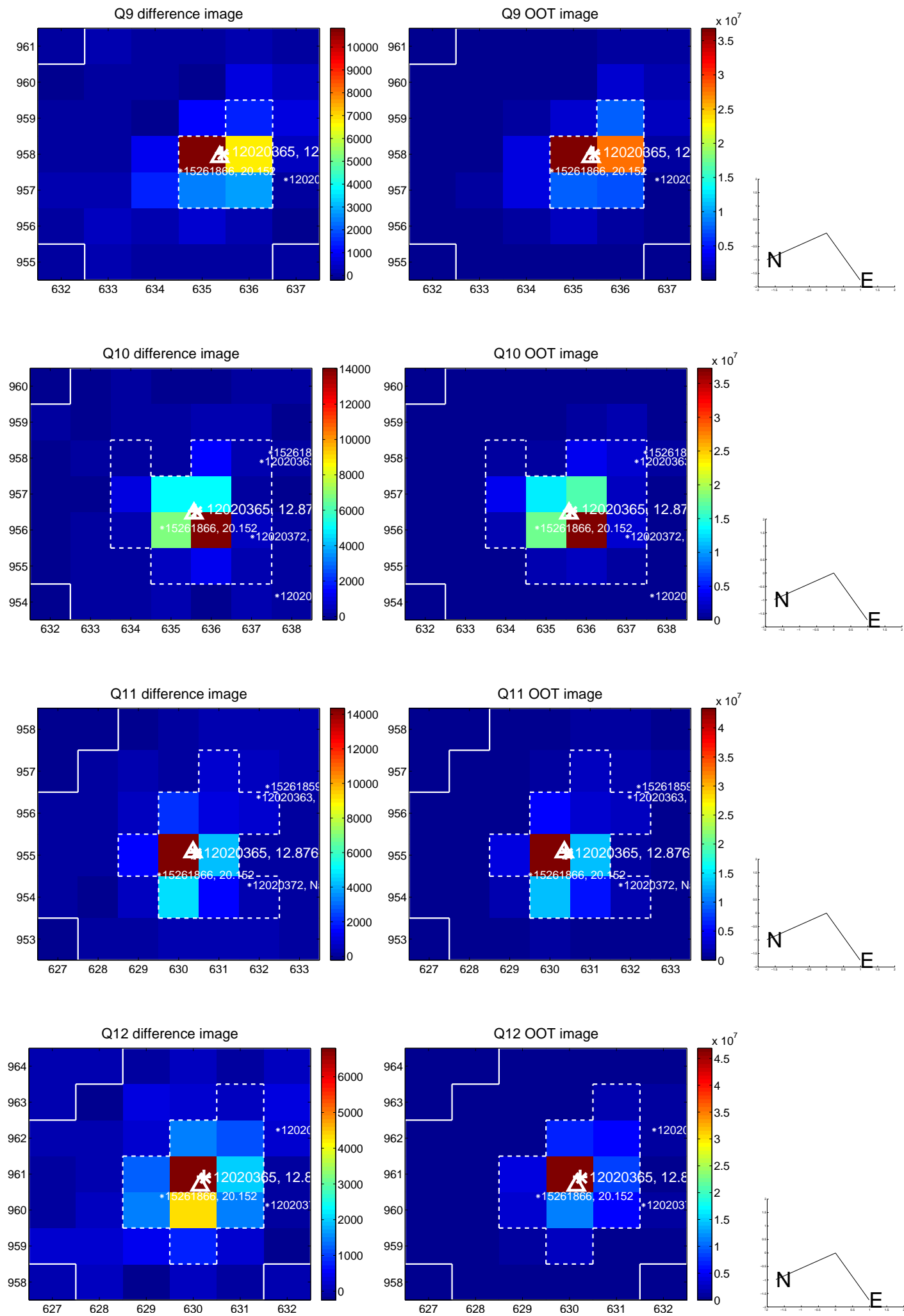
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

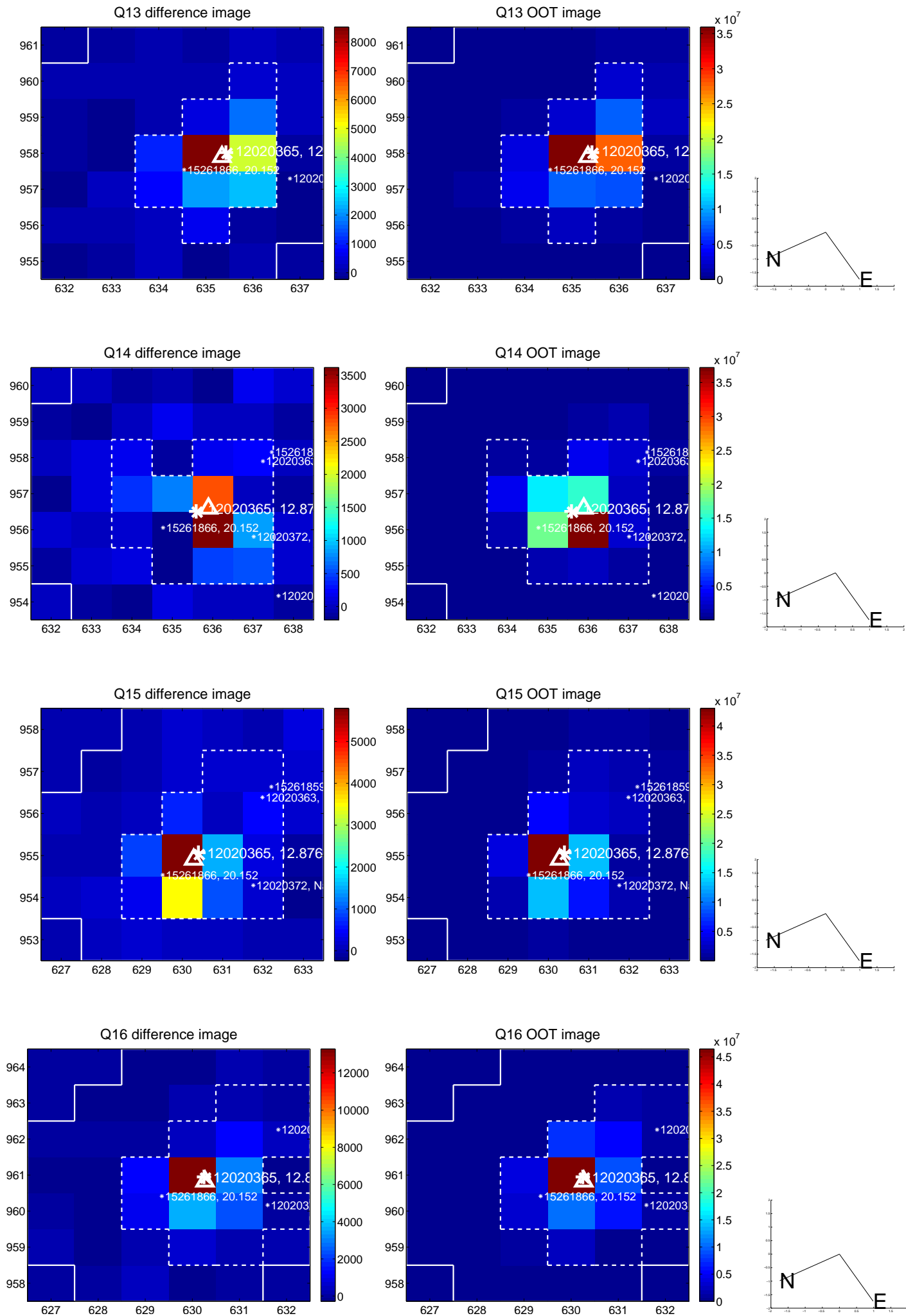


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

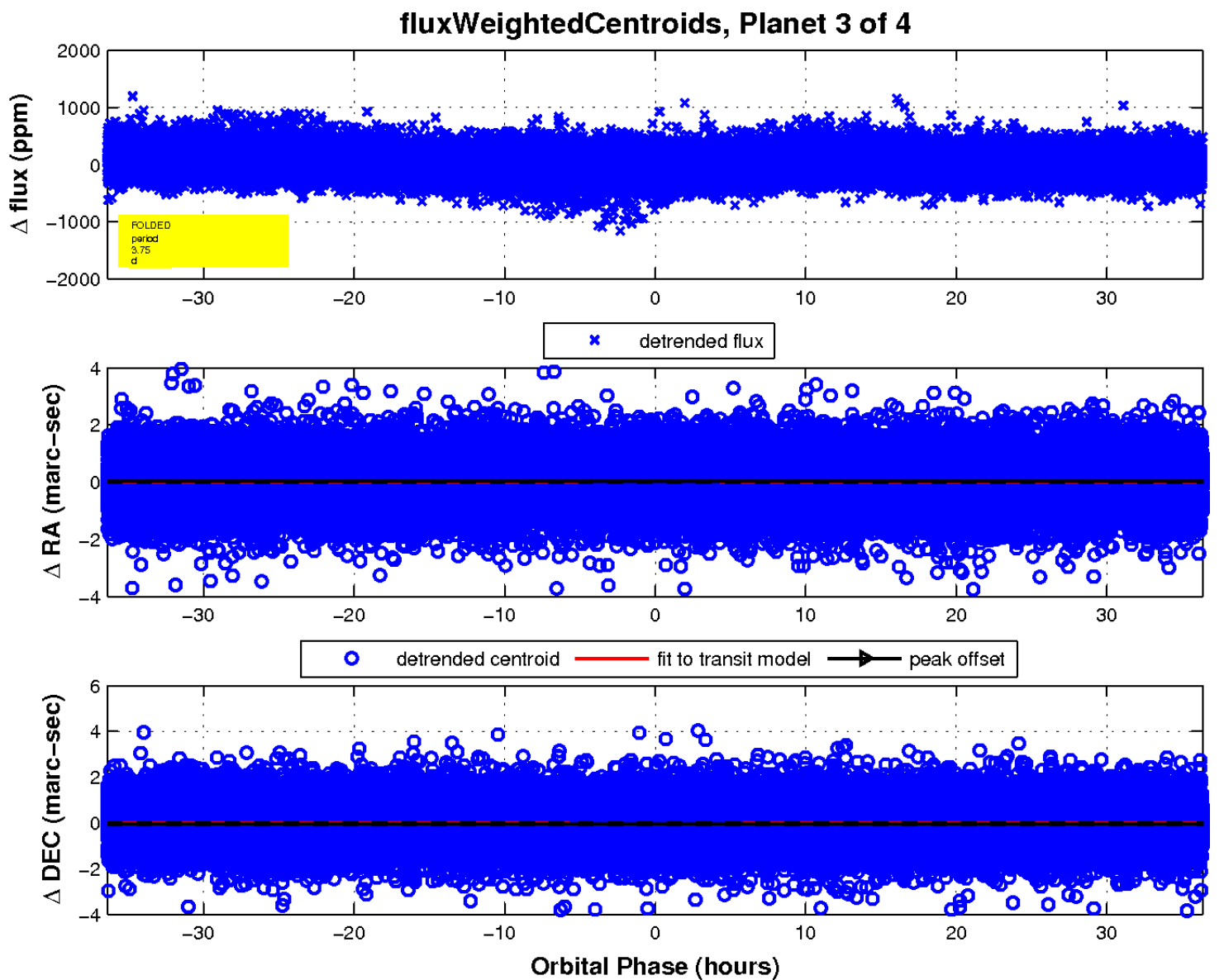
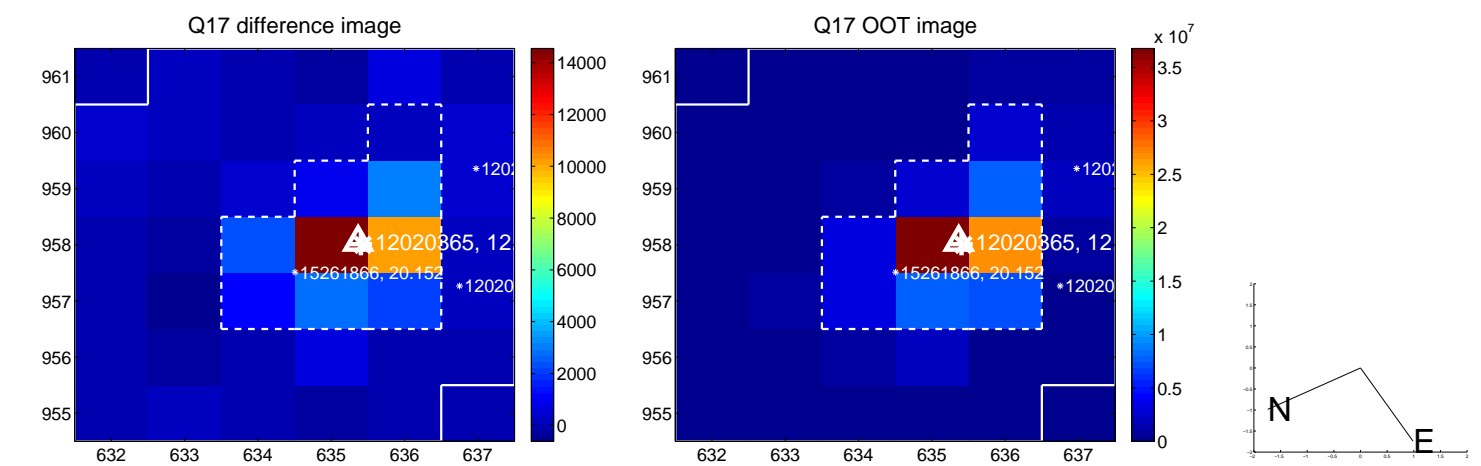




white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

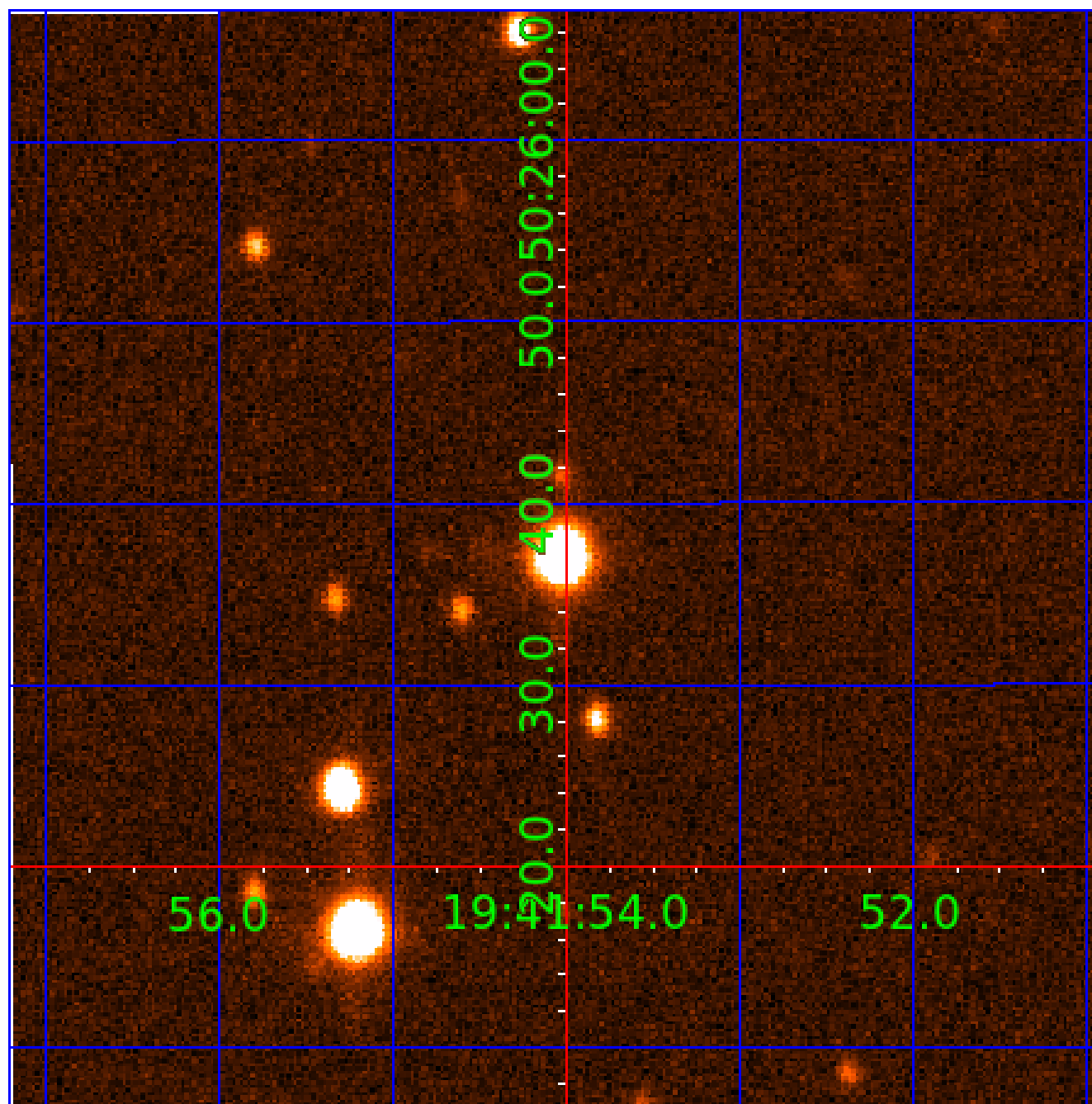


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 012020365

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
012020365-01	OBS	No	1.876785	131.528022	145.2	6.000	12.9	-1.0	1.52	6637	1.85	4013.77
012020365-02	OBS	No	3.753550	132.092441	39.5	6.030	8.7	9.5	1.52	6637	0.96	1592.88
012020365-03	OBS	No	3.754067	134.586861	29.0	12.133	8.8	8.1	1.52	6637	0.94	1592.58
012020365-04	OBS	No	272.217587	376.525112	330.4	3.602	8.4	7.7	1.52	6637	3.10	5.27

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
012020365-01	OBS	FP	0.00	1	0	0	0	SWEET_NTL—LPP_DV—MOD_NONUNIQ_ALT—CENT_NOFITS
012020365-02	OBS	FP	0.00	1	0	0	0	SWEET_NTL—LPP_DV—MOD_NONUNIQ_DV—SAME_NTL_PERIOD
012020365-03	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—SAME_NTL_PERIOD
012020365-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_MARSHALL—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—INCONSISTENT_TRANS—CENT_FEW_DIFFS

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

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

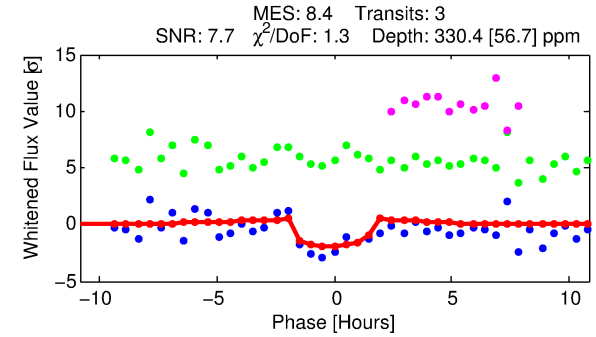
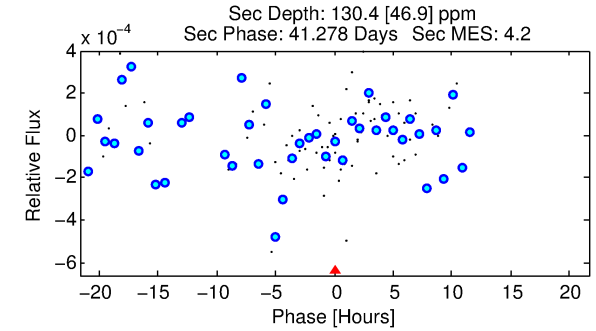
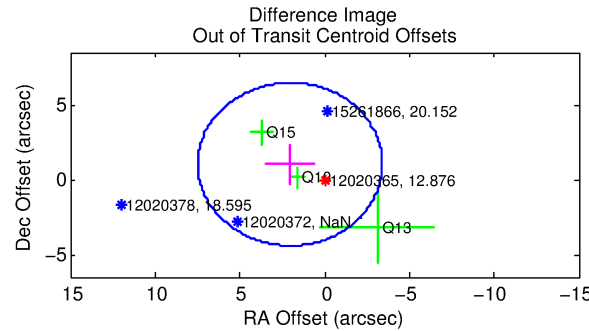
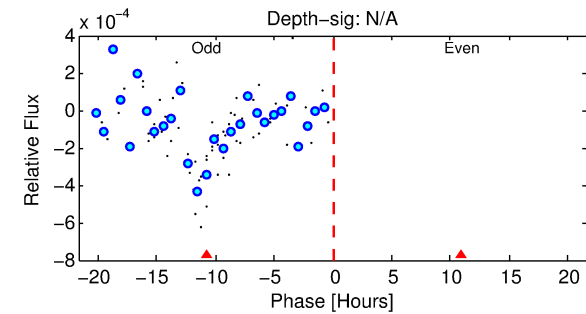
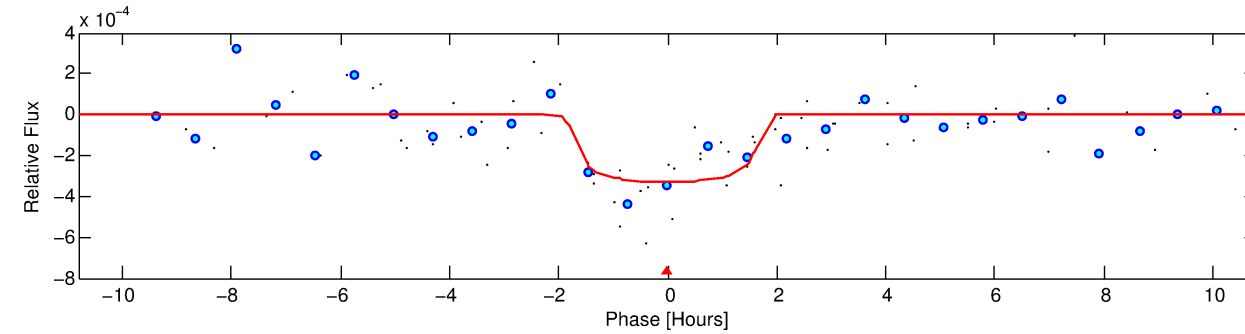
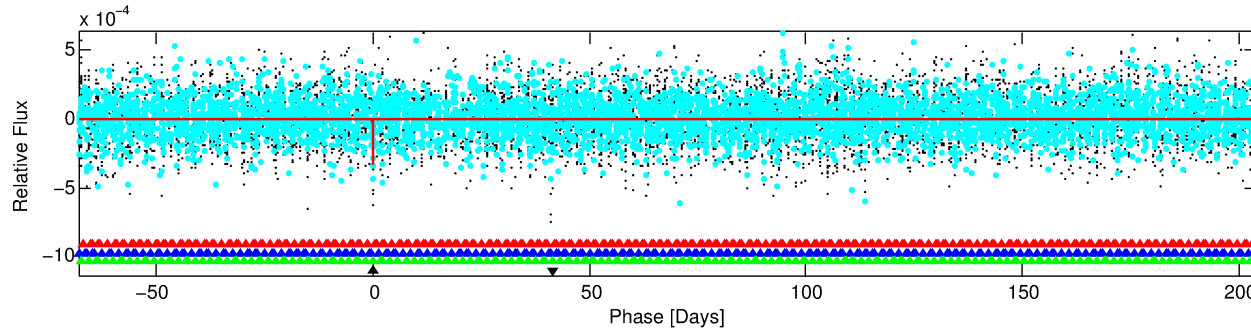
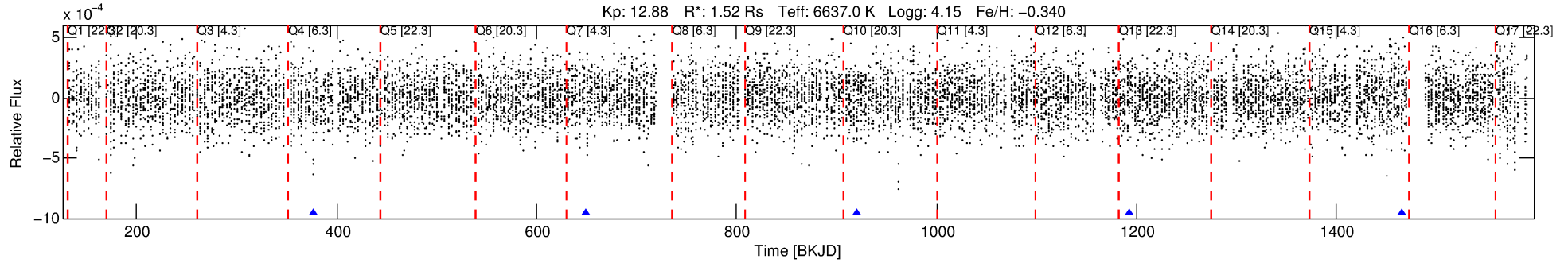
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 012020365-04

No Significant Match Found

# DV One-Page Summary

KIC: 12020365 Candidate: 4 of 4 Period: 272.218 d



## DV Fit Results:

Period = 272.21759 [0.00444] d  
Epoch = 376.5251 [0.0145] BKJD  
Rp/R\* = 0.0187 [0.0120]  
a/R\* = 336.64 [1272.84]  
b = 0.84 [1.35]  
Seff = 5.27 [2.10]  
Teq = 386 [39] K  
Rp = 3.11 [2.19] Re  
a = 0.8756 [0.2185] AU  
Ag = 5703.02 [7924.46] [0.72] $\sigma$   
Teffp = 5190 [1746] K [2.75] $\sigma$

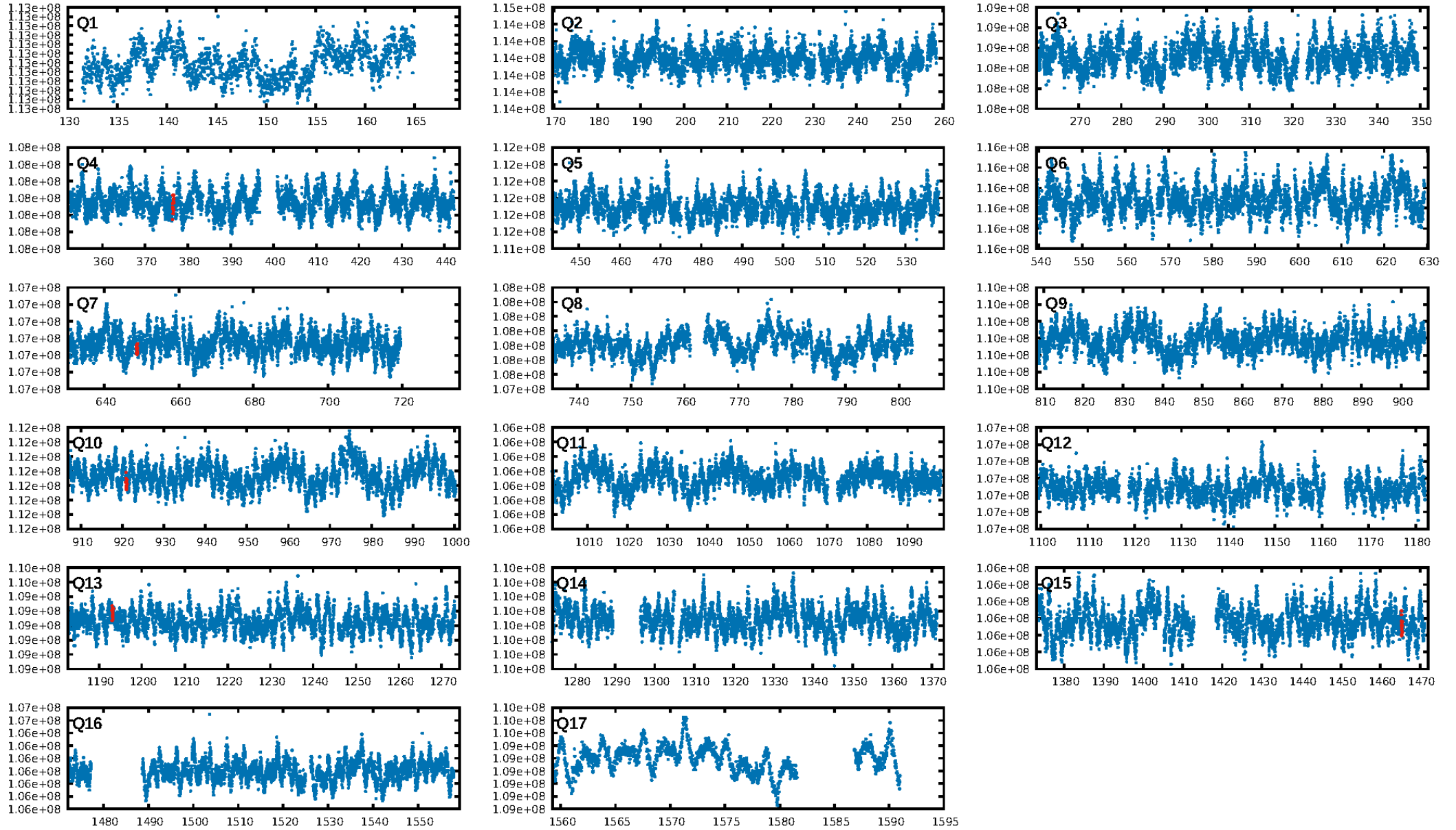
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [509.09] $\sigma$   
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 2.3%  
ModelChiSquareGof-sig: 94.1%  
**Bootstrap-pfa: 1.08e-08**  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: 1.326  
Centroid-sig: 14.0%  
Centroid-so: 1.295 arcsec [1.05] $\sigma$   
OotOffset-rm: 2.286 arcsec [1.26] $\sigma$   
OotOffset-st: 1/1/0/1 [3]  
KicOffset-rm: 2.221 arcsec [0.90] $\sigma$   
KicOffset-st: 1/1/0/1 [3]  
DiffImageQuality-fgm: 0.33 [1/3]  
DiffImageOverlap-fno: 0.00 [0/5]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 29-Jan-2016 15:27:38 Z

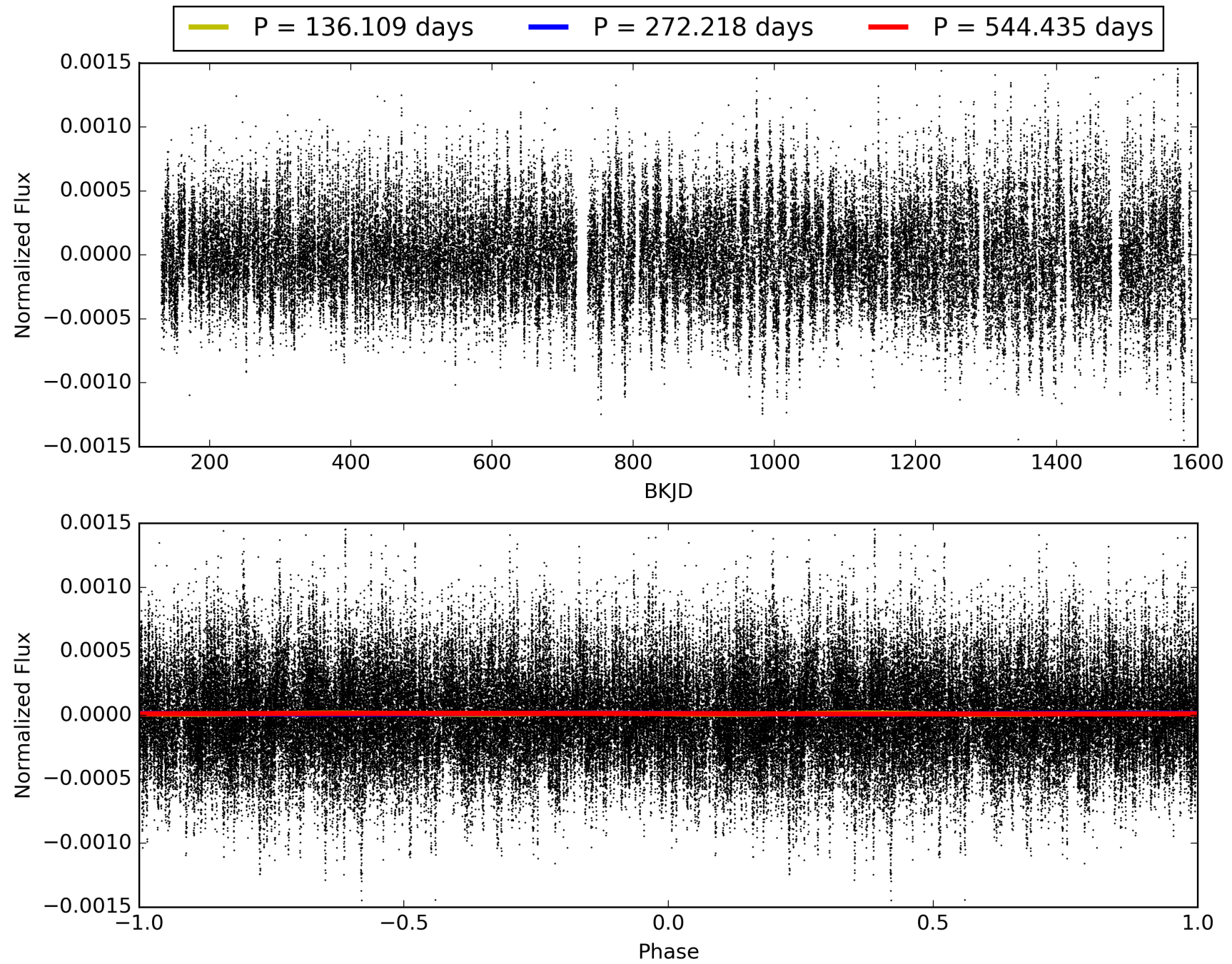
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 012020365-04, PDC Light Curves



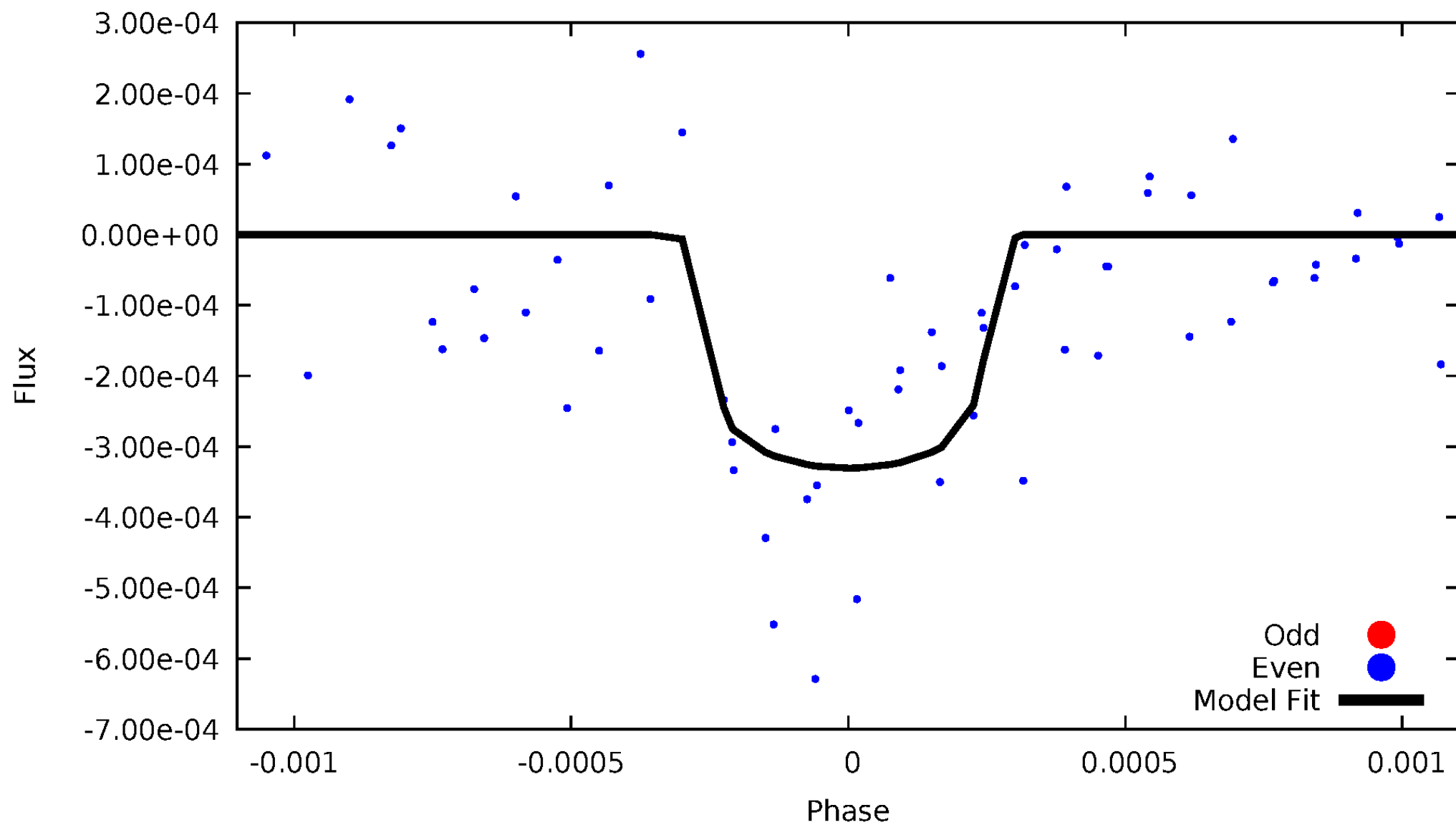


TCE 012020365-04



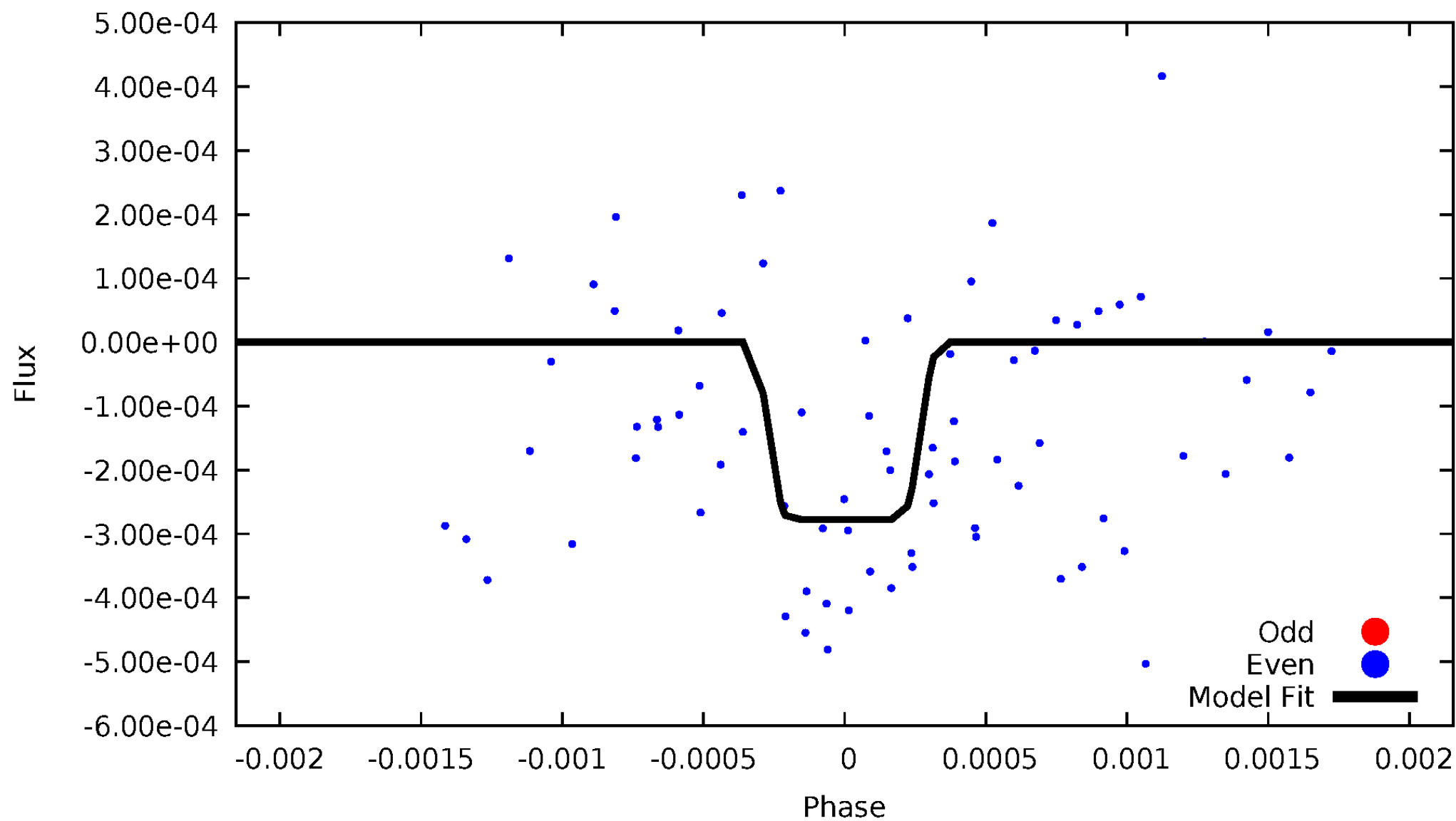
# DV Odd/Even

TCE 012020365-04



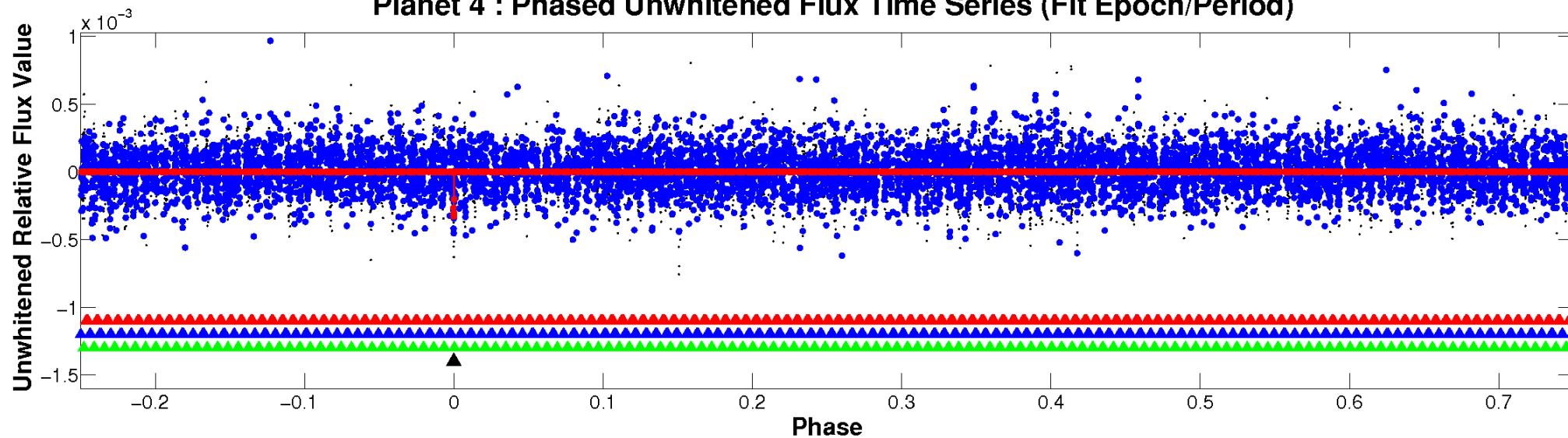
# ALT Odd/Even

TCE 012020365-04

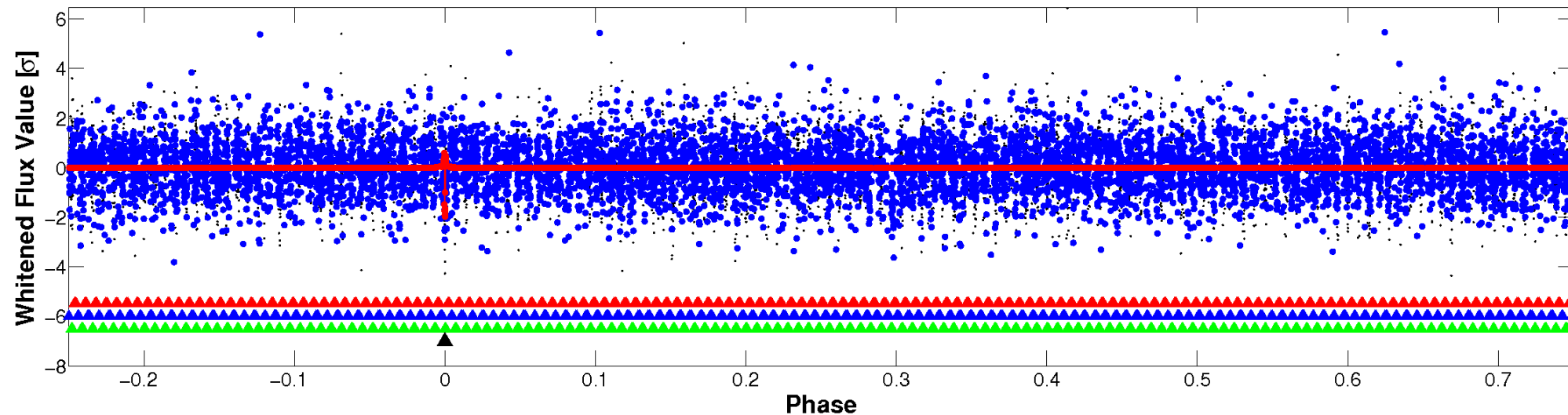


# Non-Whitened Vs. Whitened Light Curve

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

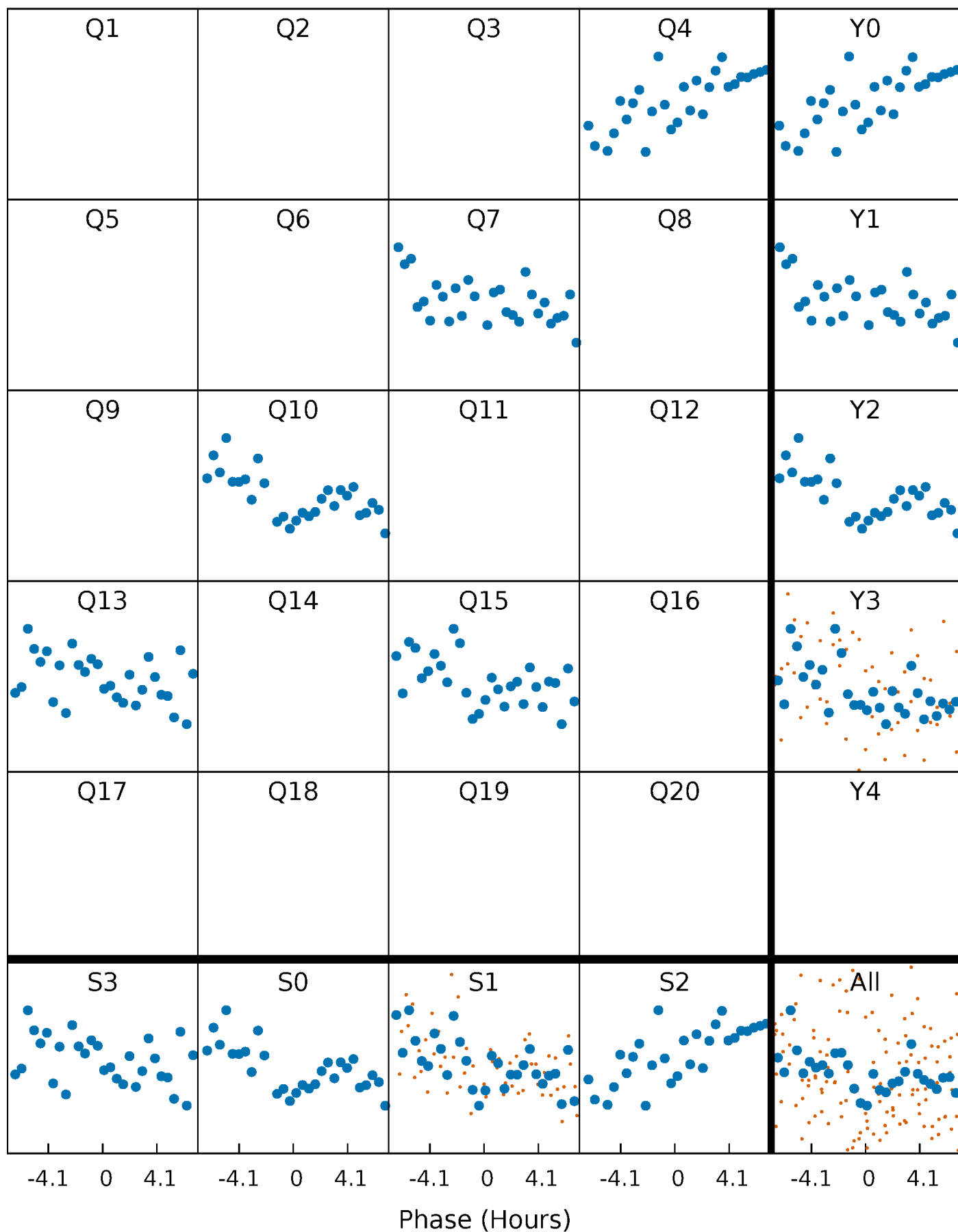


## Planet 4 : Phased Whitened Flux Time Series (Fit Epoch/Period)



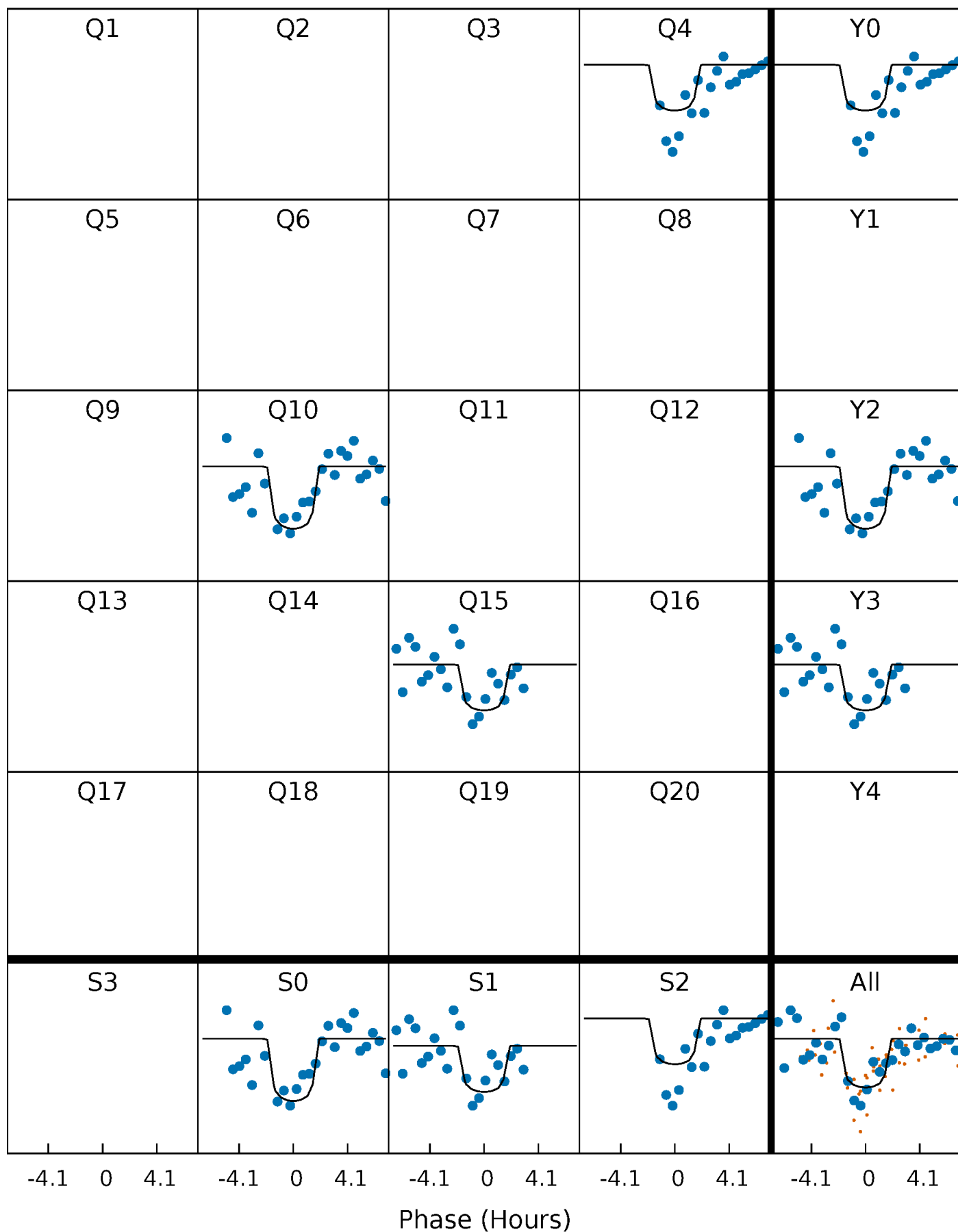
# PDC Quarter-Phased Transit Curves

TCE 012020365-04 P=272.217587 Days  $T_0=376.525112$  (BKJD)



# DV Quarter-Phased Transit Curves

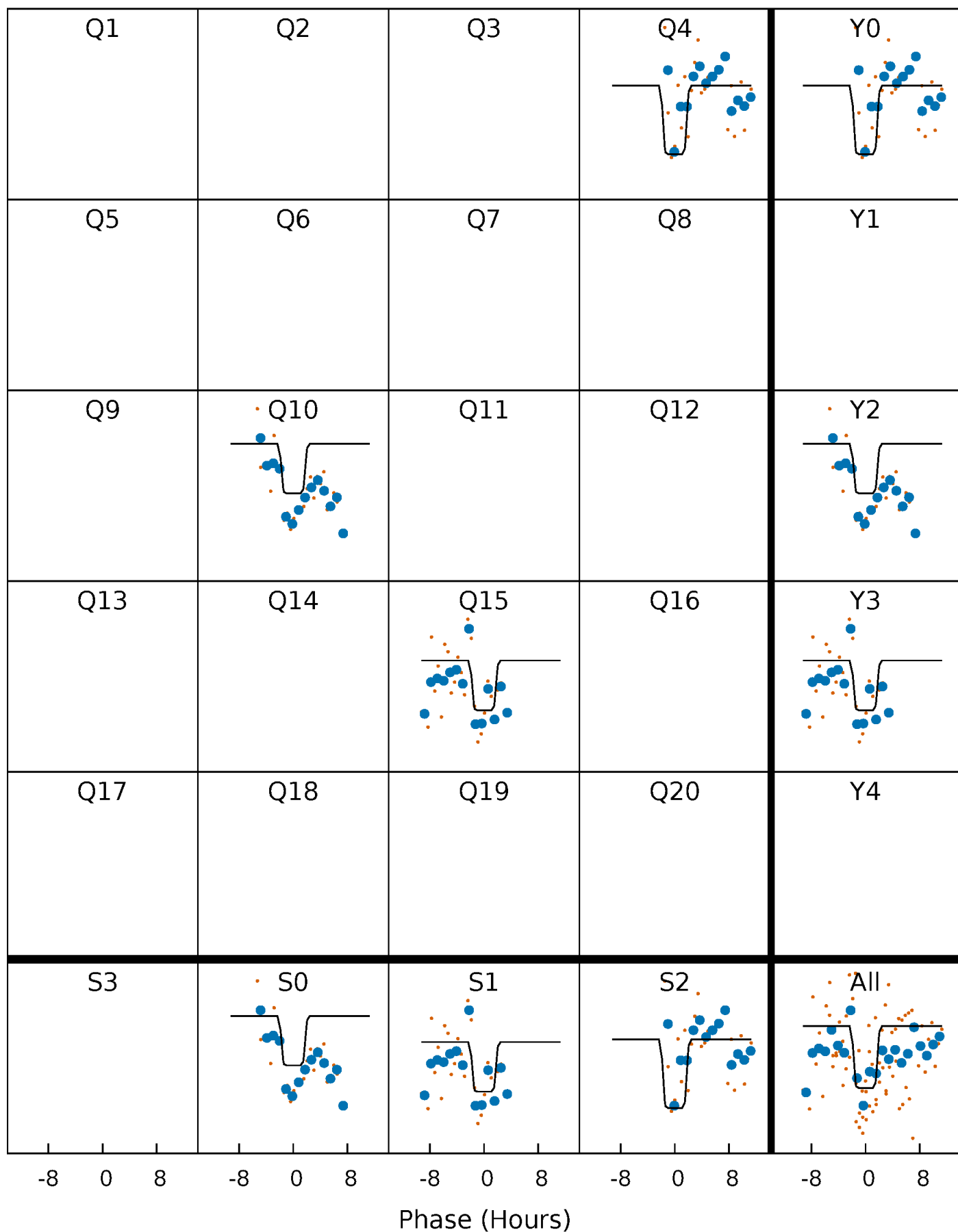
TCE 012020365-04 P=272.217587 Days  $T_0=376.525112$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

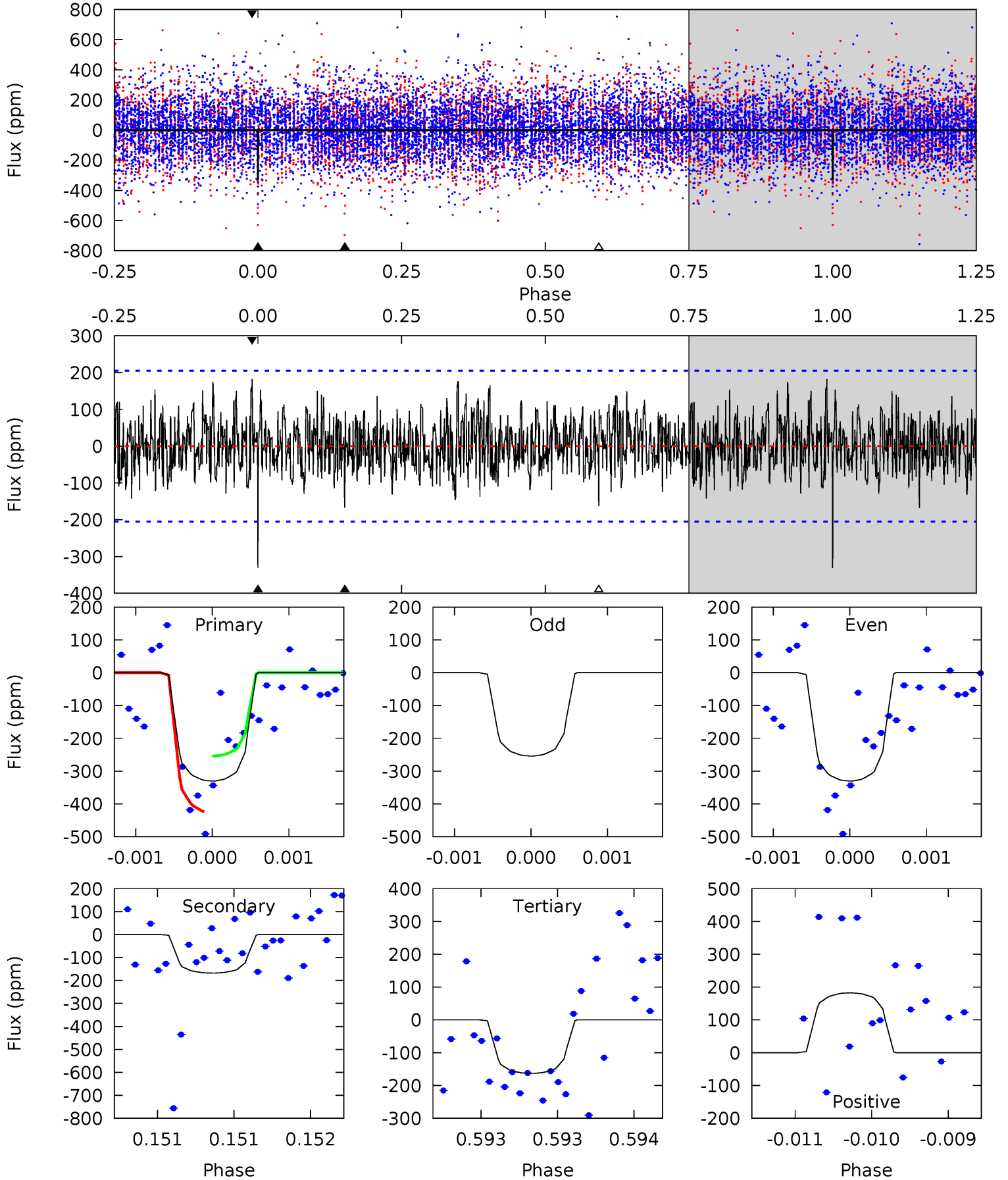
TCE 012020365-04 P=272.215665 Days  $T_0=376.529802$  (BKJD)



# DV Model-Shift Uniqueness Test

012020365-04, P = 272.217587 Days, E = 104.307525 Days

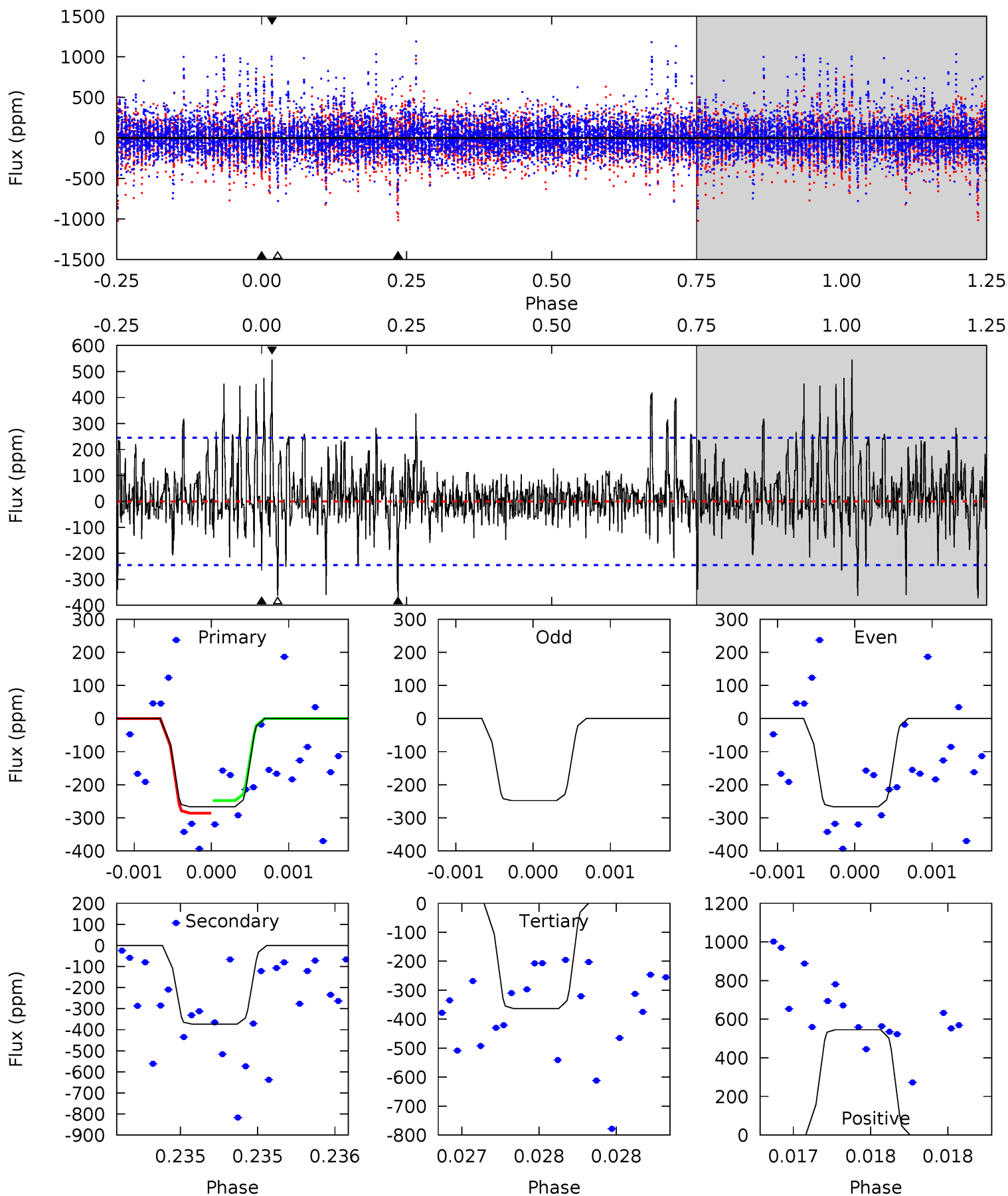
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
8.97	4.56	4.43	4.95	5.56	3.47	1.42	4.54	4.02	0.13	-0.39	1.26	1.18	0.36	2.25



# Alt Model-Shift Uniqueness Test

012020365-04, P = 272.215665 Days, E = 104.314137 Days

Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
6.04	8.46	8.24	12.4	5.56	3.46	2.00	-2.20	-6.32	0.23	-3.90	0.24	0.91	0.59	0.42



### Stellar Parameters For KIC 012020365

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6637^{+188}_{-235}$	$4.154^{+0.209}_{-0.171}$	$-0.340^{+0.250}_{-0.300}$	$1.524^{+0.437}_{-0.398}$	$1.212^{+0.171}_{-0.190}$	$0.482^{+0.582}_{-0.231}$
	+3%/-4%	+5%/-4%	+74%/-88%	+29%/-26%	+14%/-16%	+121%/-48%
Source	PHO54	PHO54	PHO54	DSEP		

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

### Secondary Eclipse Parameters for KIC 012020365-04 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-168 \pm 37$	$3.19^{+2.03}_{-1.78}$	$540^{+40}_{-42}$	$5443^{+2917}_{-1011}$	$6924^{+28941}_{-4343}$
Alt.	$-373 \pm 44$	$2.78^{+2.14}_{-1.57}$	$538^{+41}_{-43}$	$7131^{+5665}_{-1720}$	$20268^{+88513}_{-13805}$

$T_{max}$  = 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

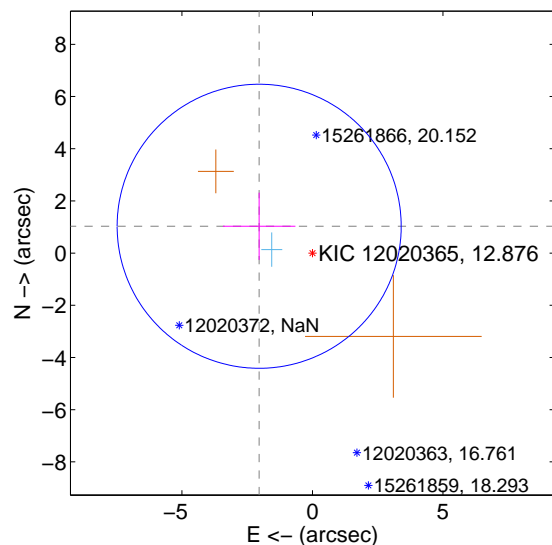
Supplemental centroid analysis for 012020365-04. Kepler magnitude: 12.88. Transit SNR 7.75

There are 1 quarters with good PRF difference image offsets

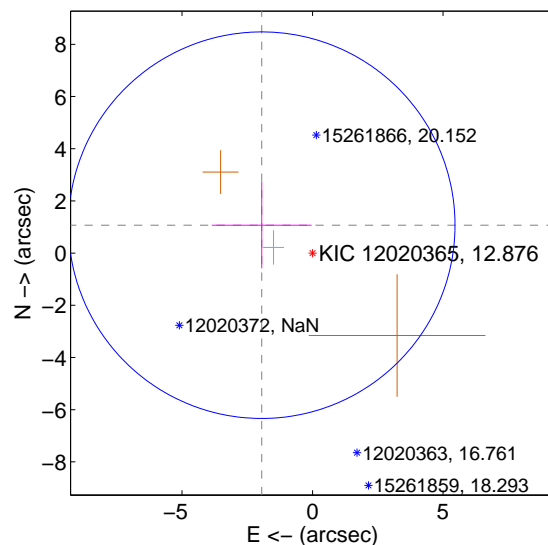
The direct PRF centroid is offset from the target star catalog position by about 0.18 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$2.286 \pm 1.814$	1.26	$2.041 \pm 1.390$	$1.028 \pm 1.289$
PRF-fit source offset from KIC position	$2.221 \pm 2.469$	0.90	$1.947 \pm 1.911$	$1.070 \pm 1.657$
photometric centroid source offset	$1.29 \pm 1.24$	1.05	$0.68 \pm 1.24$	$-1.10 \pm 1.24$

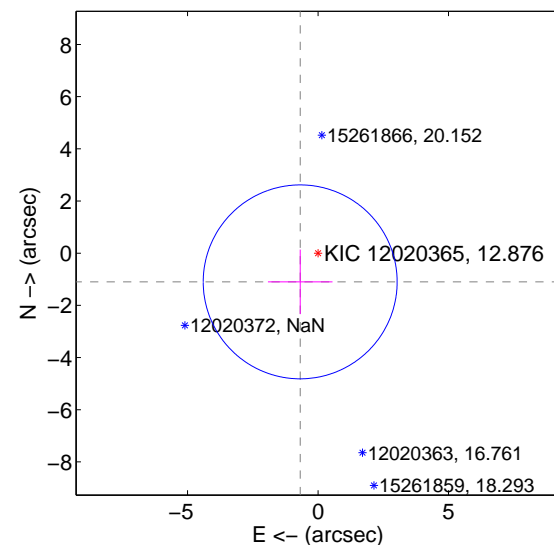
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

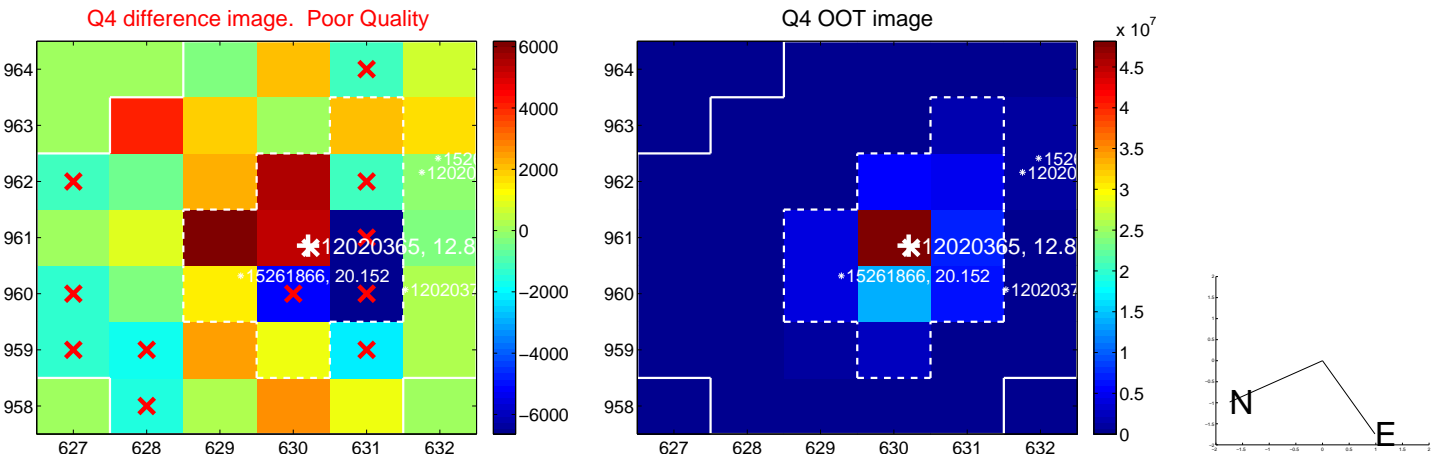
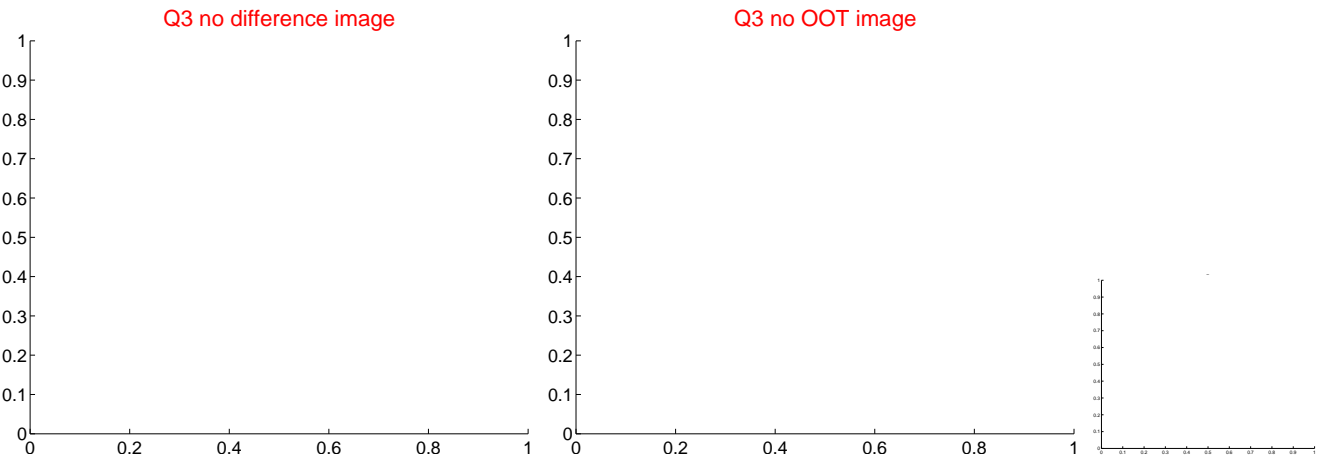
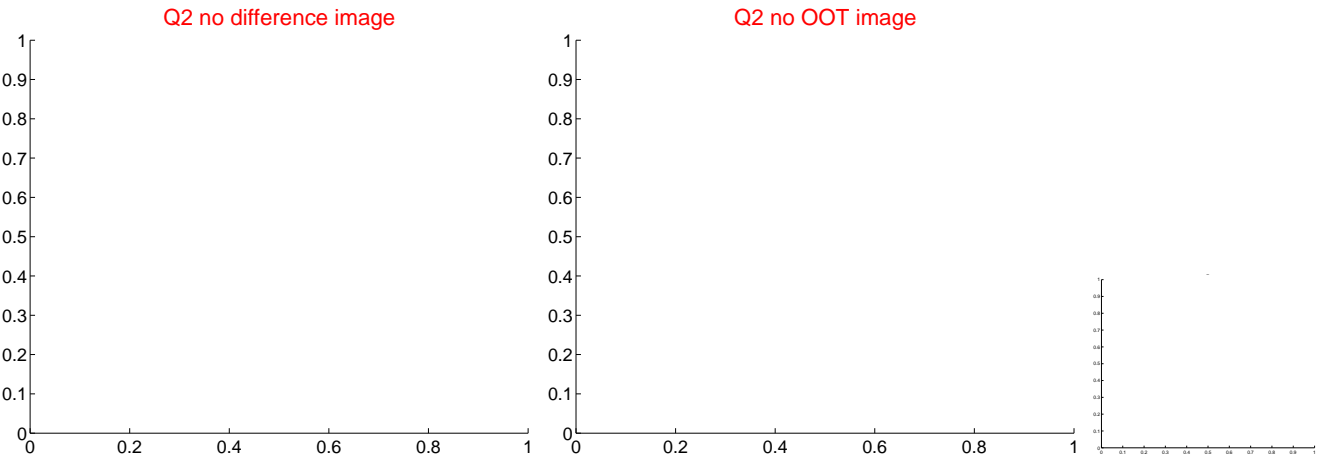
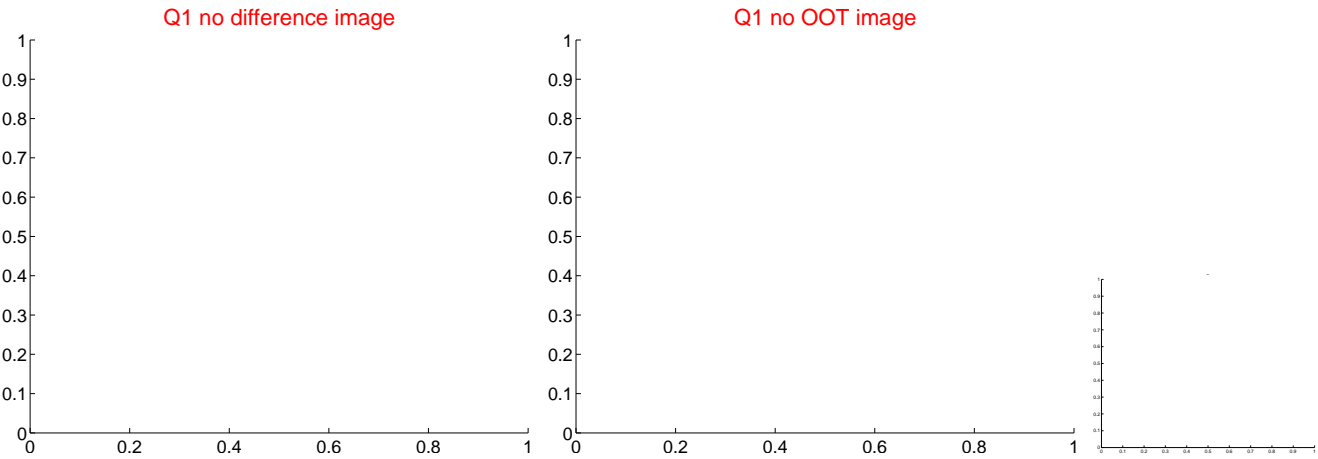


offset from photometric centroids



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



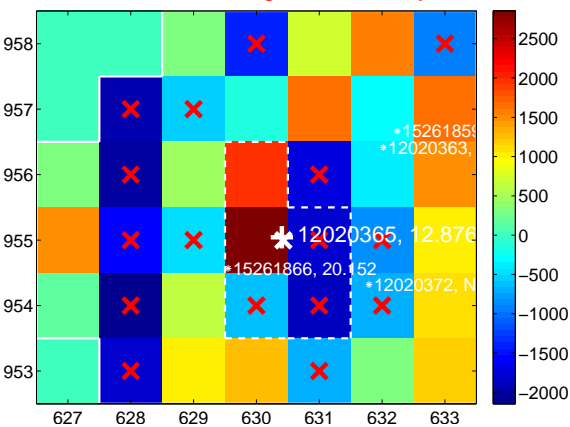
Q6 no difference image



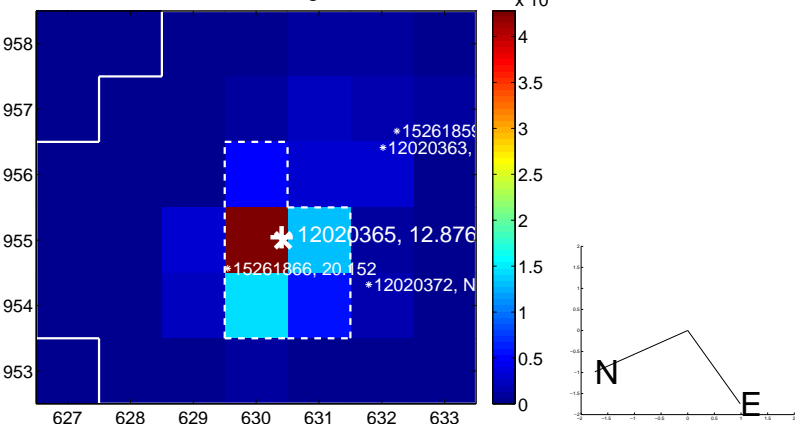
Q6 no OOT image



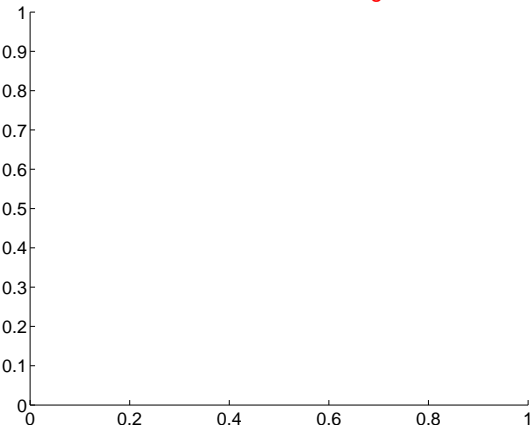
Q7 difference image. Poor Quality



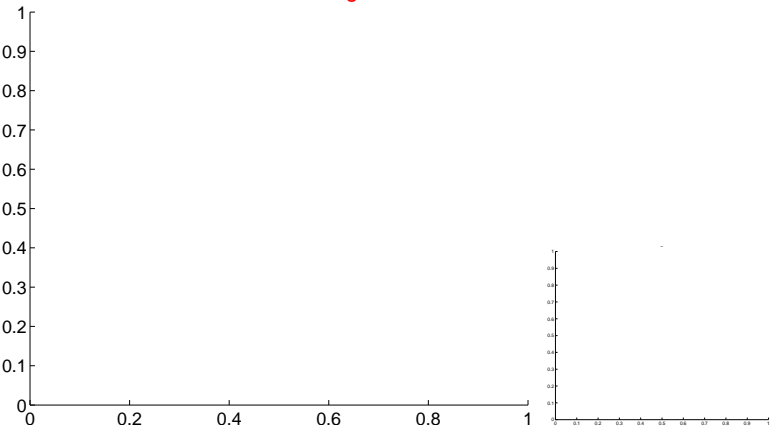
Q7 OOT image



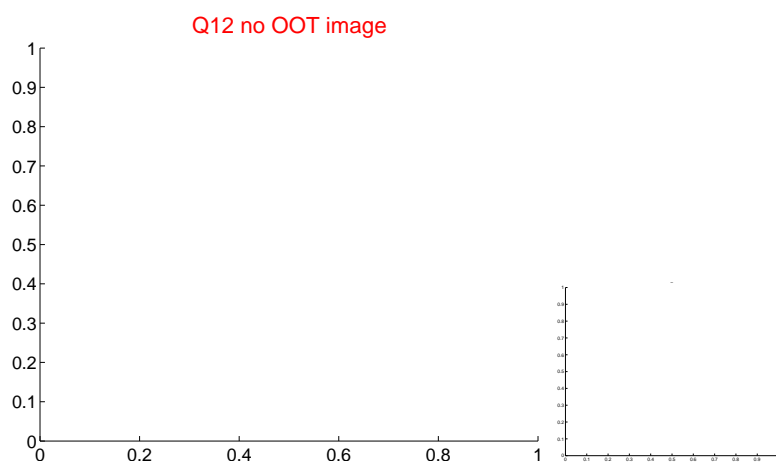
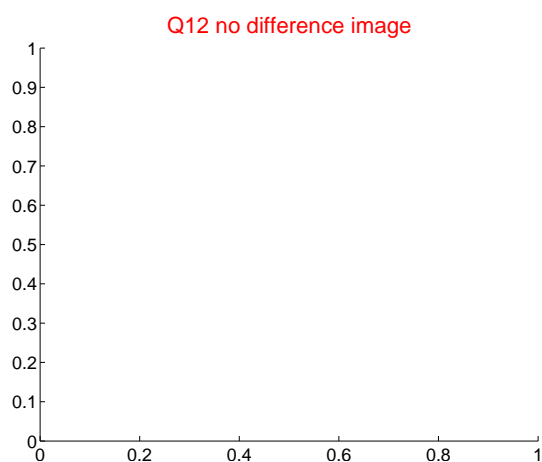
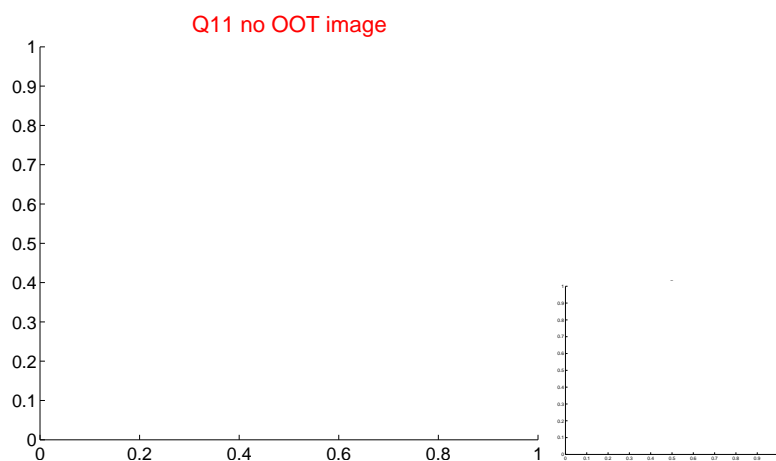
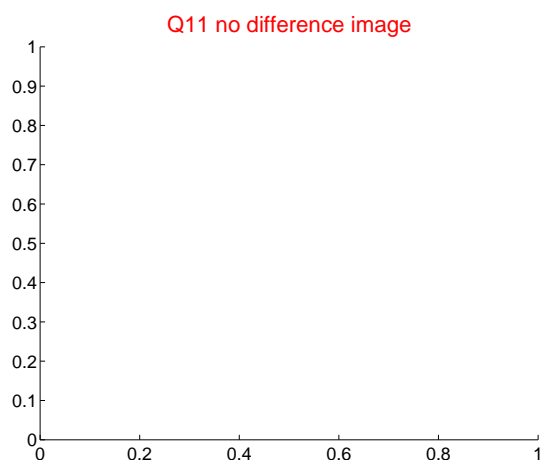
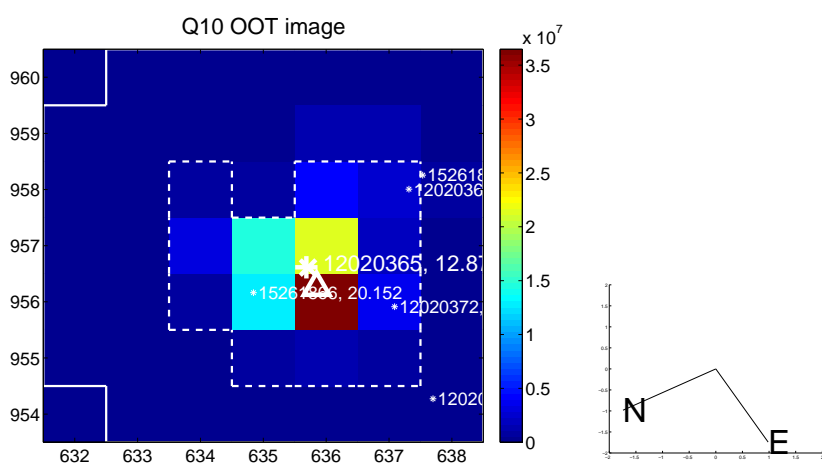
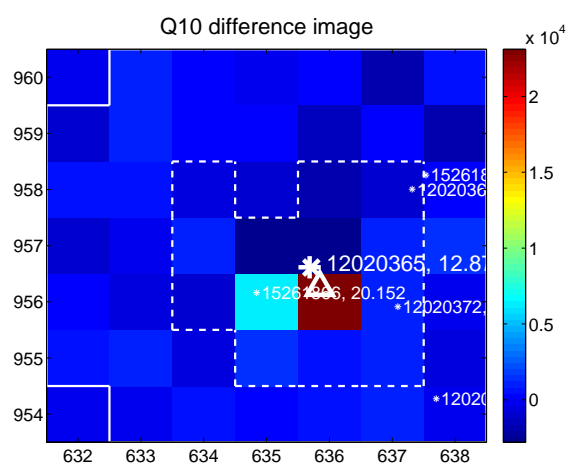
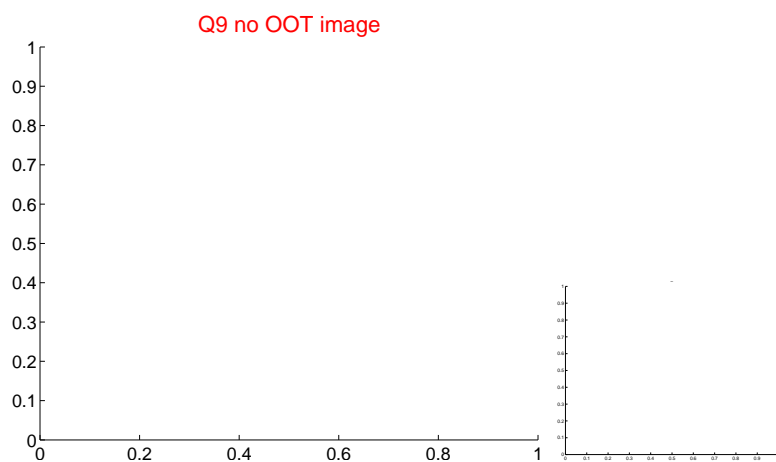
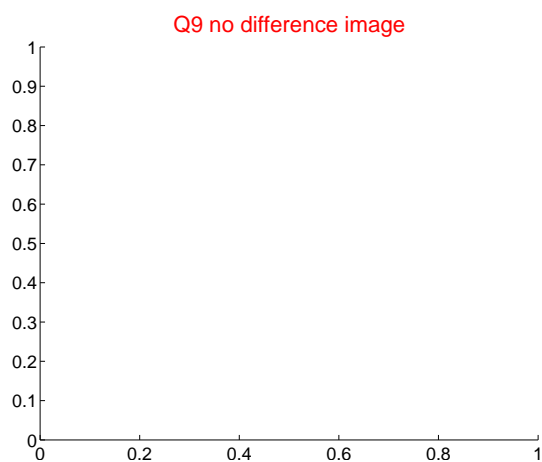
Q8 no difference image



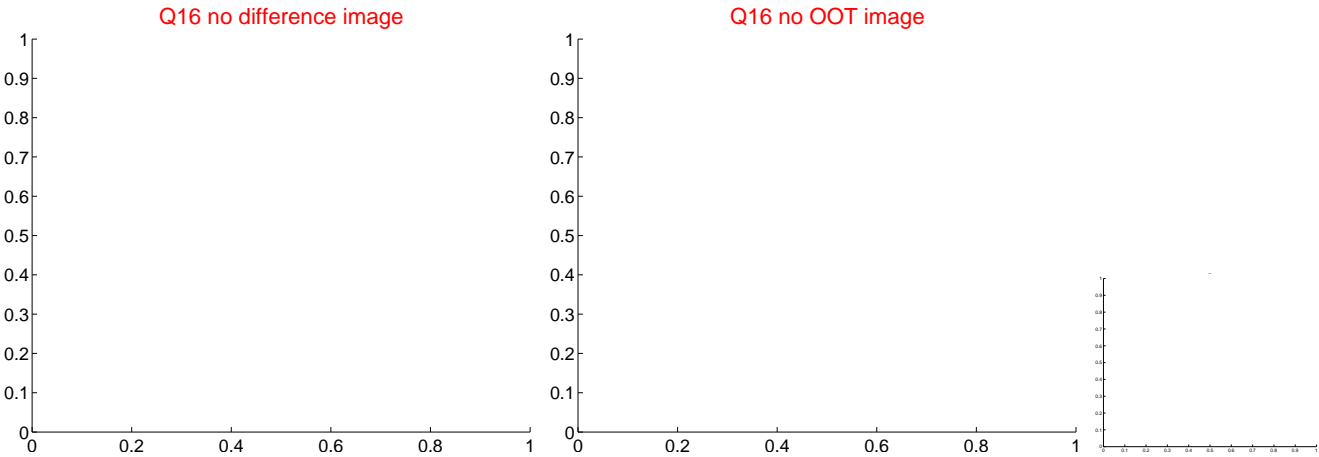
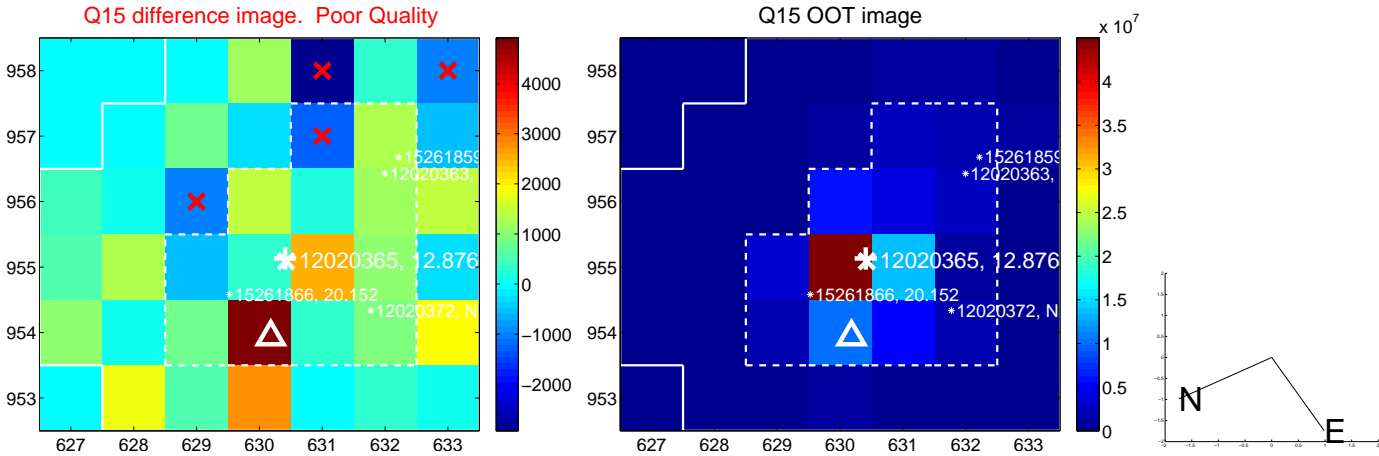
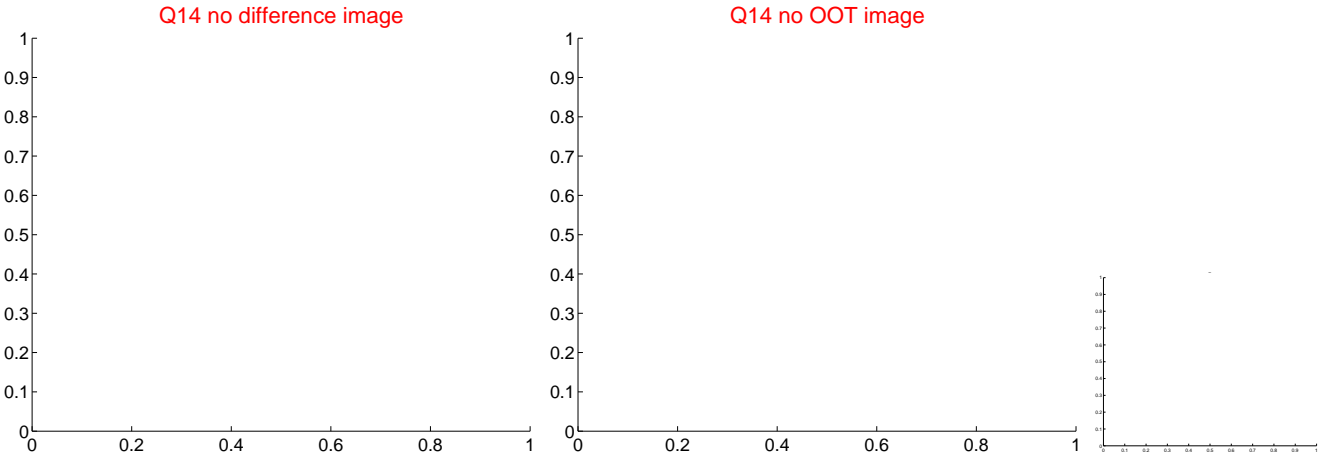
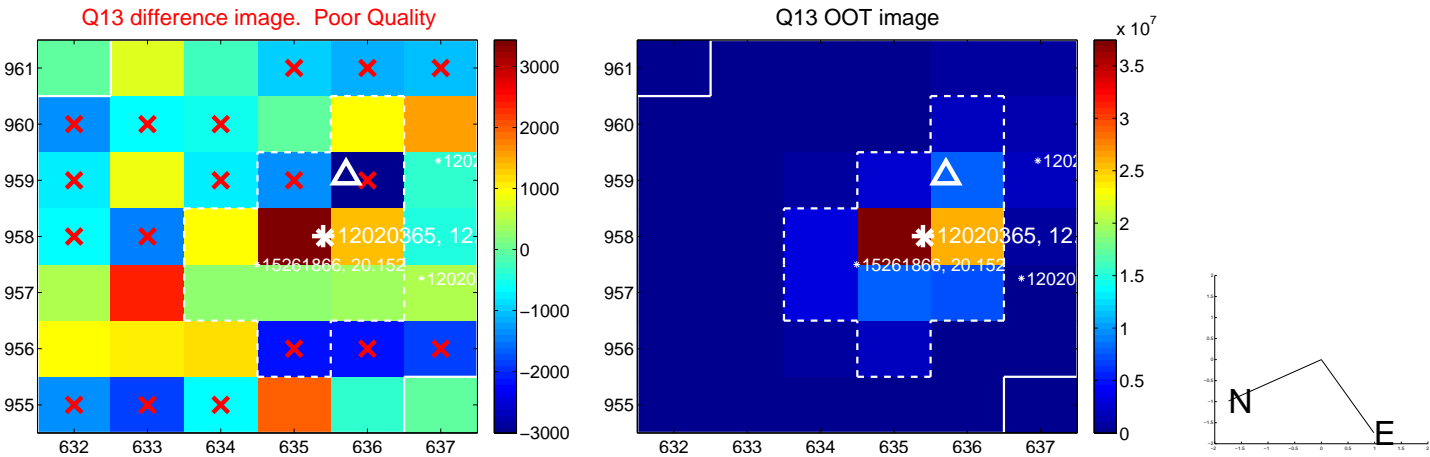
Q8 no OOT image



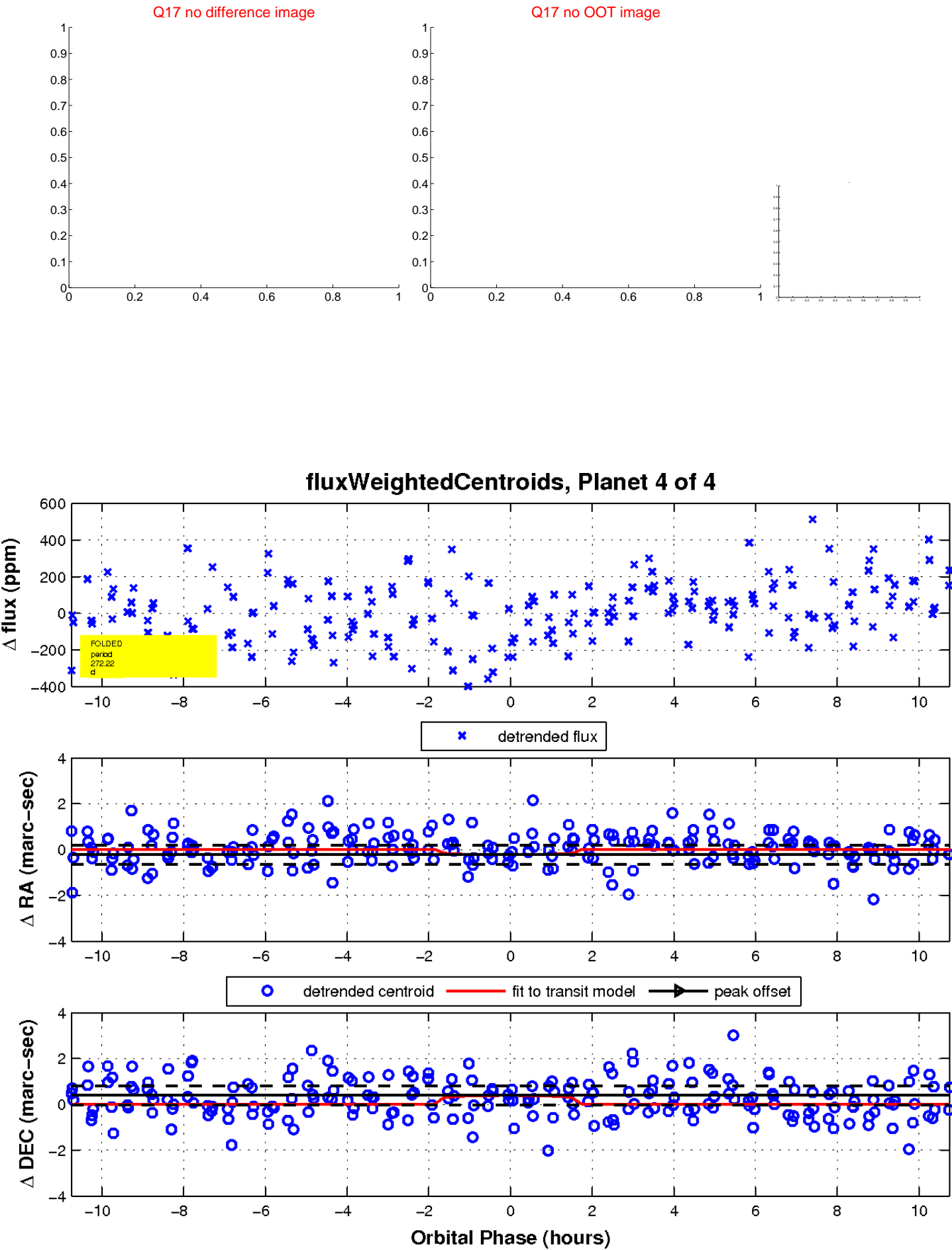
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value



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



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



UKIRT Image

Declination

