

# KIC 008440076

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
008440076-01	OBS	No	369.152658	233.773061	1610.3	18.736	7.3	8.4	0.88	5767	4.37	0.77
008440076-02	OBS	No	368.858364	178.947810	2911.7	16.730	9.0	9.4	0.88	5767	5.64	0.77
008440076-03	OBS	No	393.464873	158.795088	2814.8	20.101	8.9	9.6	0.88	5767	5.96	0.71
008440076-04	OBS	No	191.332540	160.159401	1531.6	13.762	7.7	7.3	0.88	5767	4.13	1.85

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
008440076-01	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_CHASES_MARSHALL_SKYE—INCONSISTENT_TRANS—CENT_FEW_DIFFS—HALO_GHOST
008440076-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL_SKYE—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT—CENT_FEW_DIFFS
008440076-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL_SKYE—INCONSISTENT_TRANS—CENT_FEW_DIFFS
008440076-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL_SKYE—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.

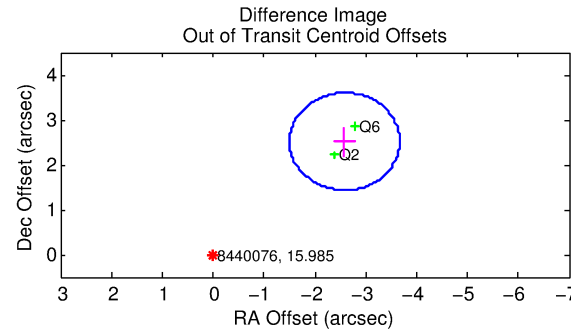
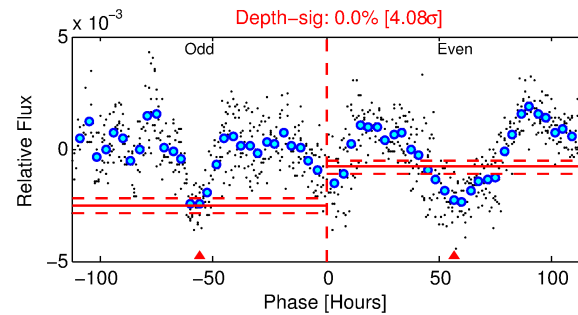
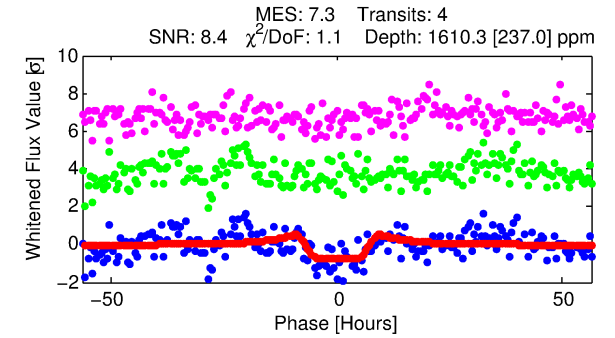
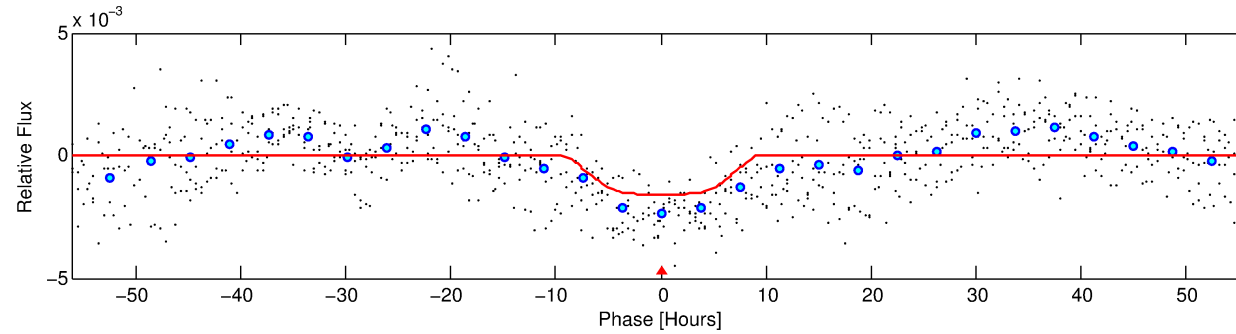
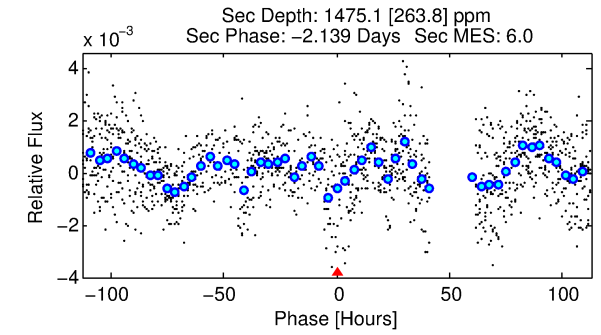
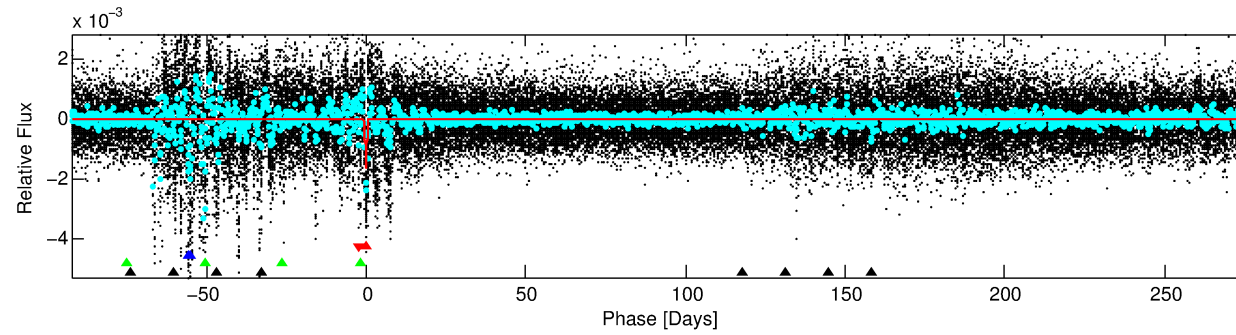
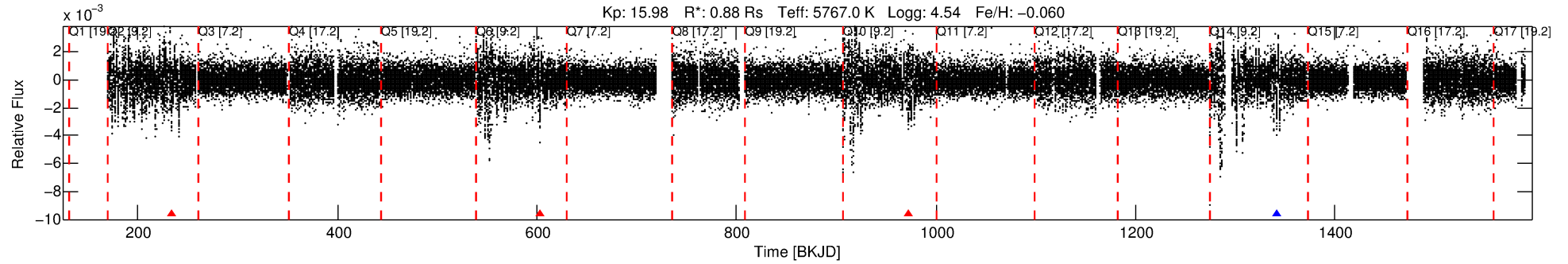
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 008440076-01

No Significant Match Found

# DV One-Page Summary

KIC: 8440076 Candidate: 1 of 4 Period: 369.153 d



## DV Fit Results:

Period = 369.15266 [0.01753] d  
Epoch = 233.7731 [0.0324] BKJD  
Rp/R\* = 0.0455 [0.0042]  
a/R\* = 71.42 [12.59]  
b = 0.93 [0.03]  
Seff = 0.77 [0.29]  
Teq = 239 [22] K  
Rp = 4.37 [1.35] Re  
a = 0.9996 [0.2457] AU  
Ag = 42418.46 [18583.29] [2.28σ]  
Teffp = 5300 [377] K [13.42σ]

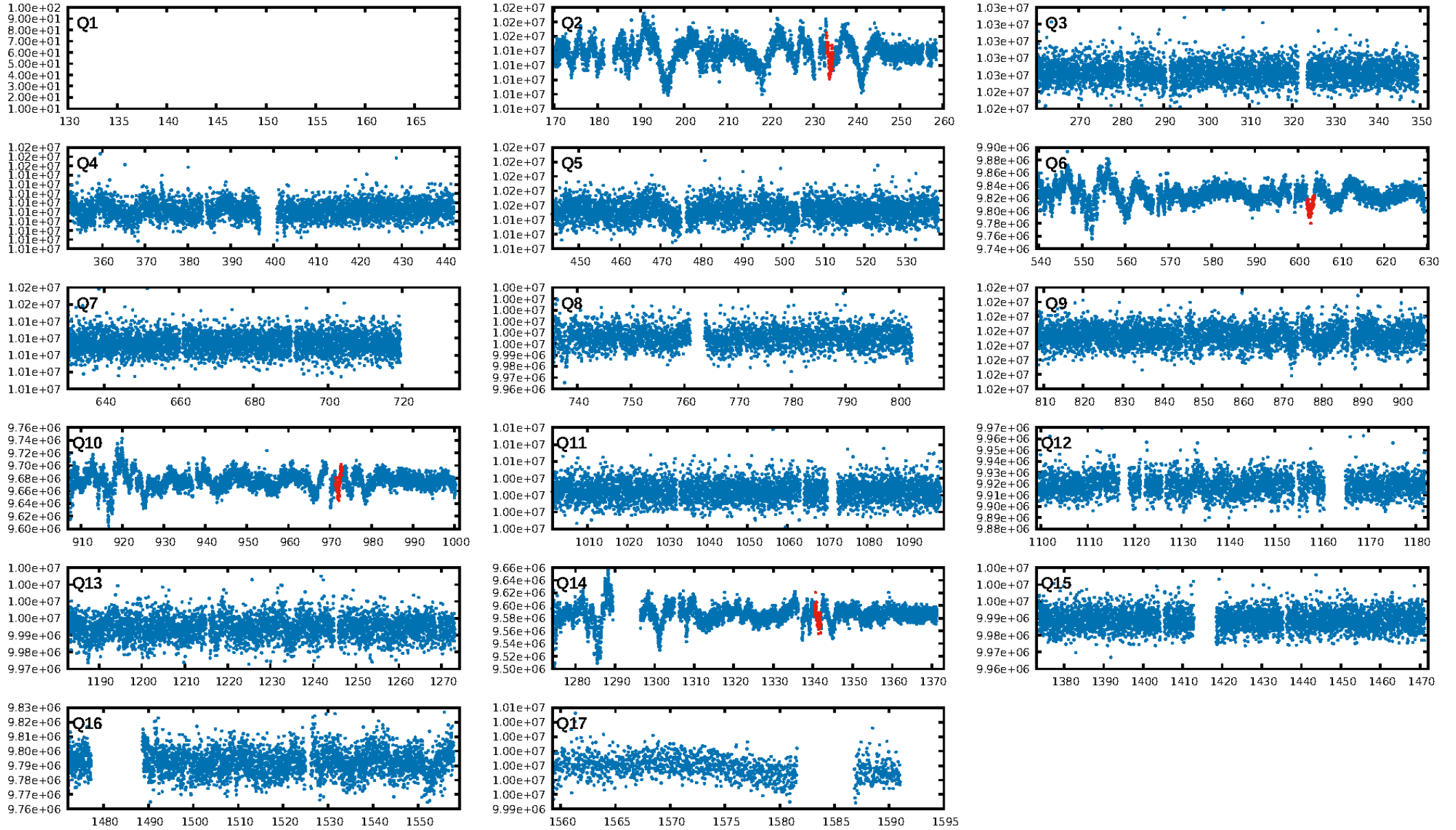
## DV Diagnostic Results:

ShortPeriod-sig: 22.1% [0.28σ]  
LongPeriod-sig: 100.0% [21.23σ]  
ModelChiSquare2-sig: 3.8%  
ModelChiSquareGof-sig: 99.9%  
Bootstrap-pfa: 1.75e-09  
RollingBand-fgt: 0.25 [1/4]  
GhostDiagnostic-chr: 0.0613  
Centroid-sig: 17.7%  
Centroid-so: 3.008 arcsec [1.10σ]  
OotOffset-rm: 3.605 arcsec [9.97σ]  
KicOffset-rm: 3.561 arcsec [11.20σ]  
OotOffset-st: 2/0/0/0 [2]  
KicOffset-st: 2/0/0/0 [2]  
DiffImageQuality-fgm: 0.50 [1/2]  
DiffImageOverlap-fno: 1.00 [3/3]

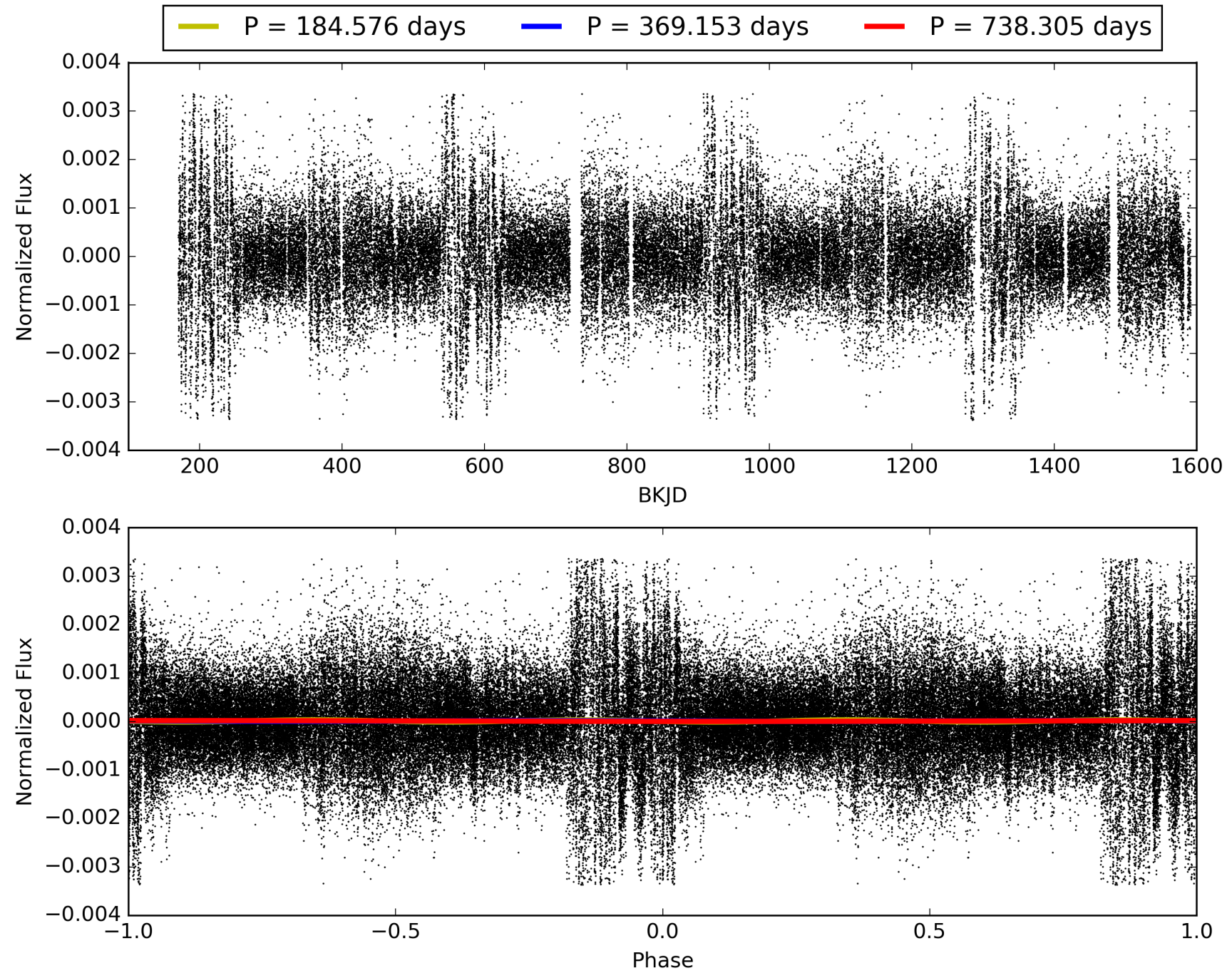
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 29-Jan-2016 12:53:28 Z

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

# TCE 008440076-01, PDC Light Curves

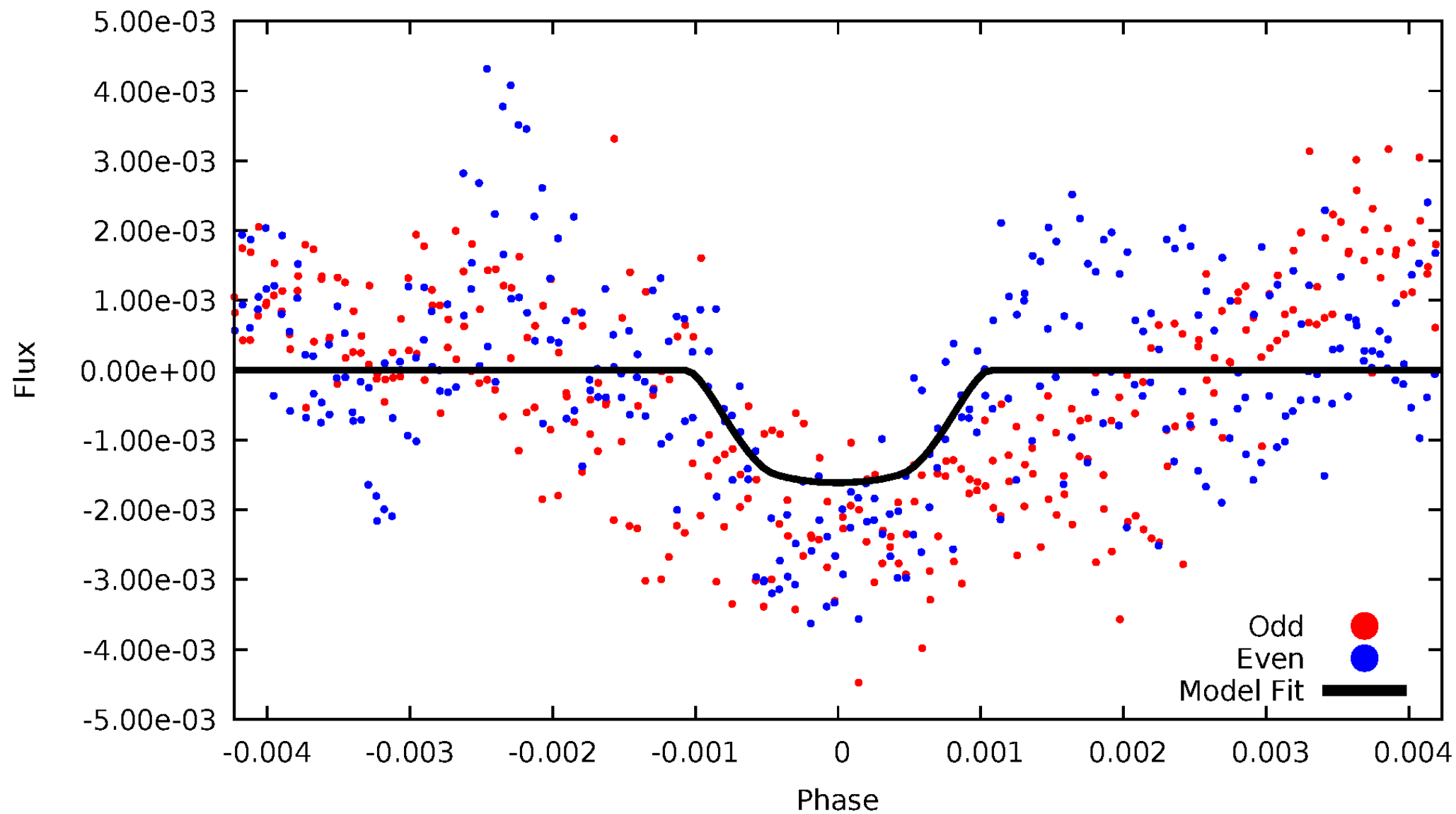


TCE 008440076-01



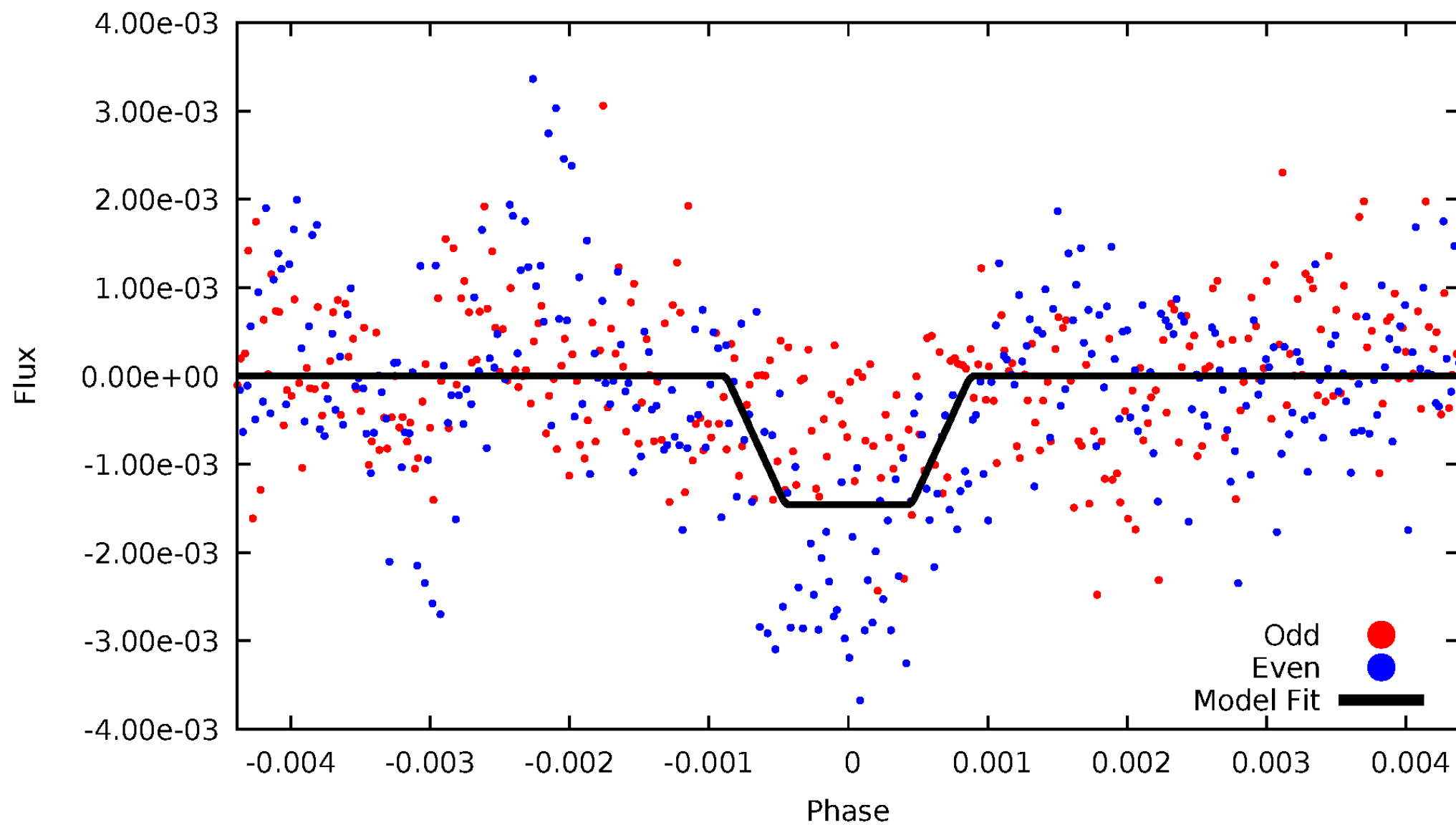
# DV Odd/Even

TCE 008440076-01



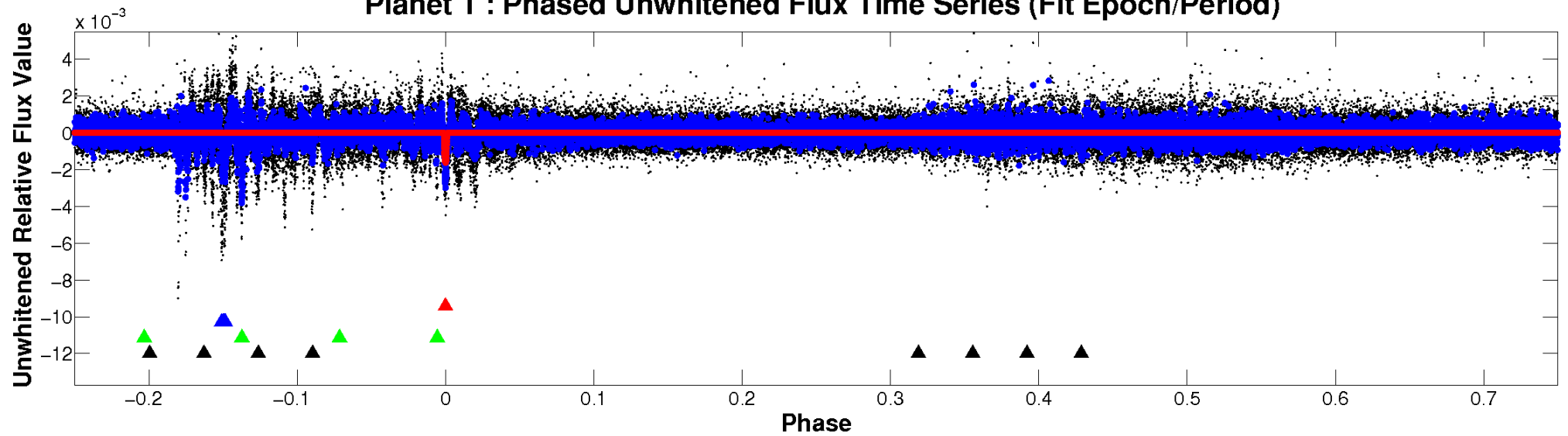
# ALT Odd/Even

TCE 008440076-01

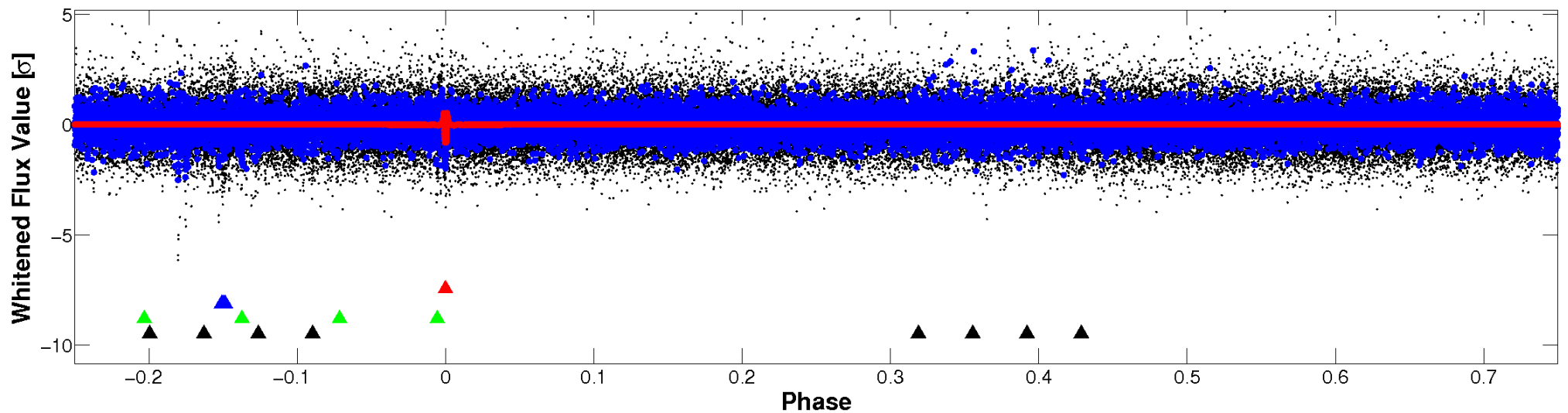


# Non-Whitened Vs. Whitened Light Curve

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

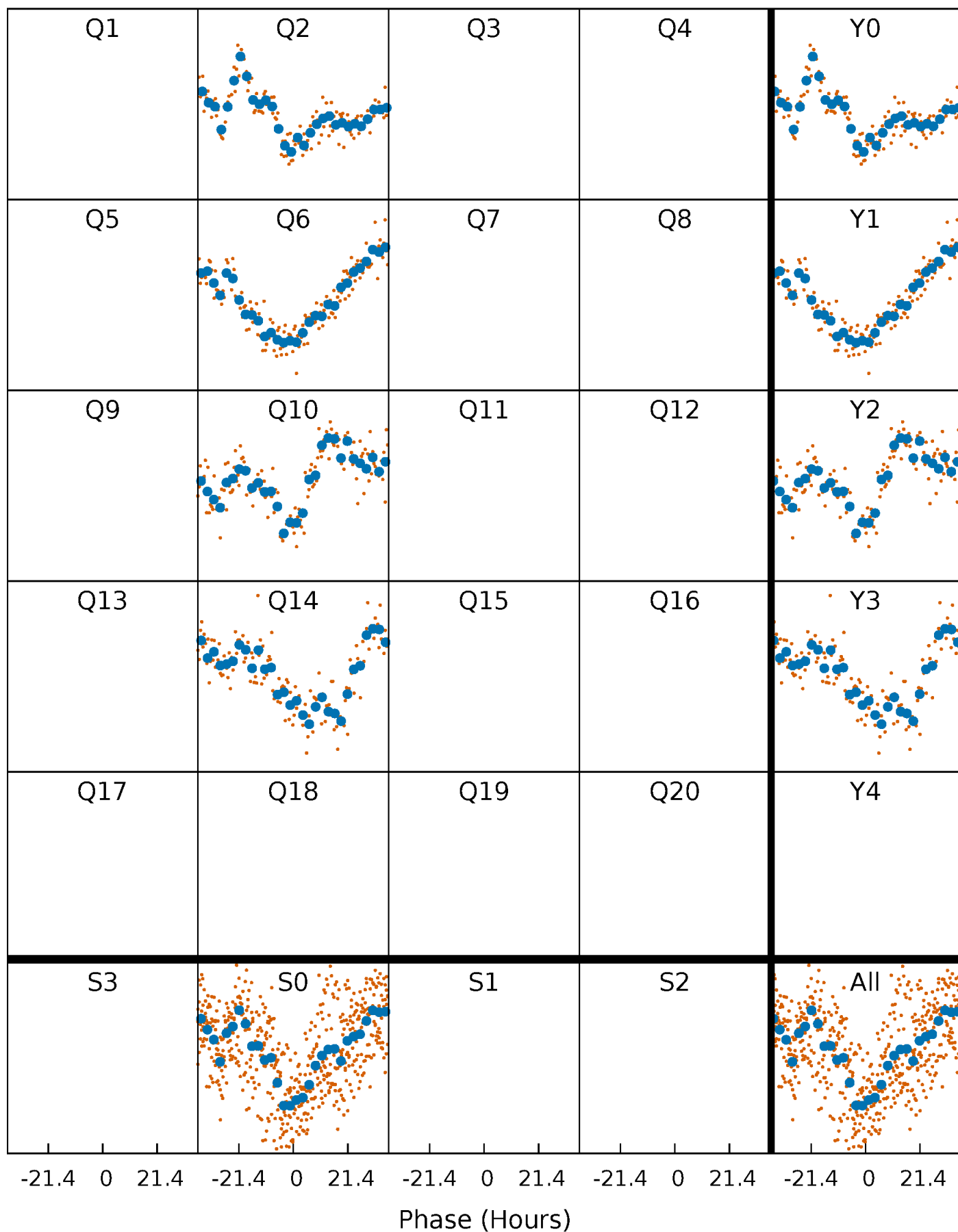


Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)



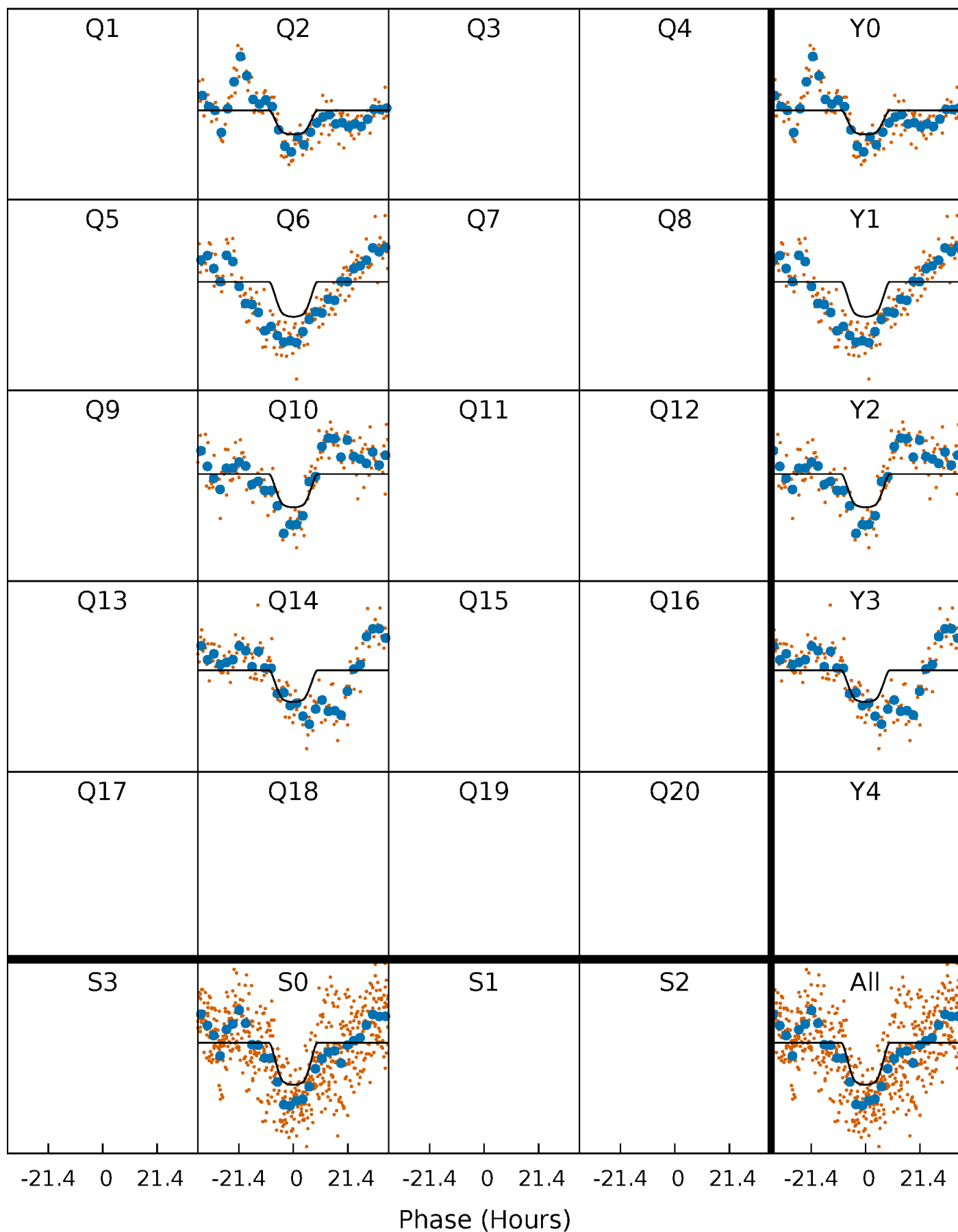
# PDC Quarter-Phased Transit Curves

TCE 008440076-01 P=369.152658 Days  $T_0=233.773061$  (BKJD)



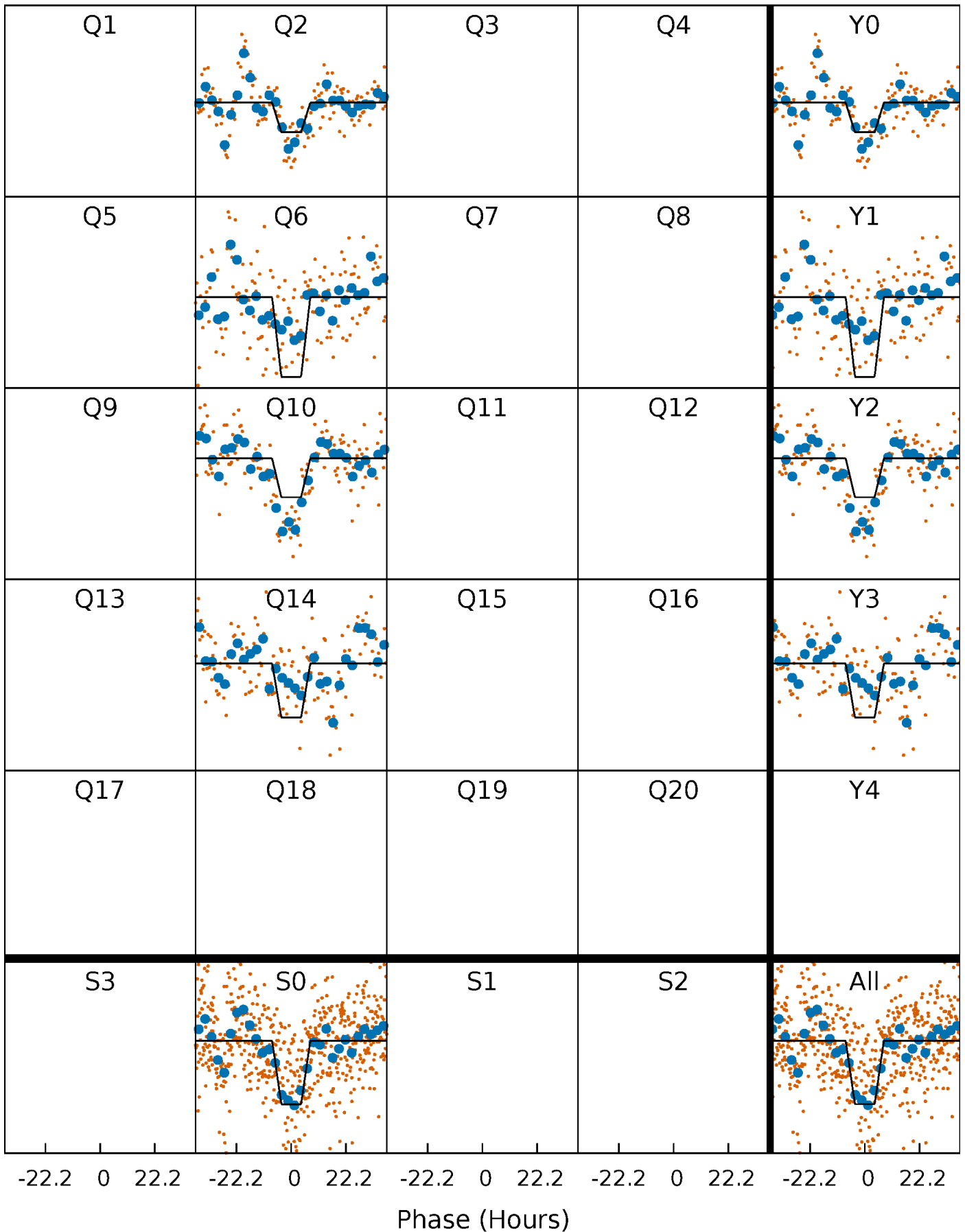
# DV Quarter-Phased Transit Curves

TCE 008440076-01 P=369.152658 Days  $T_0=233.773061$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

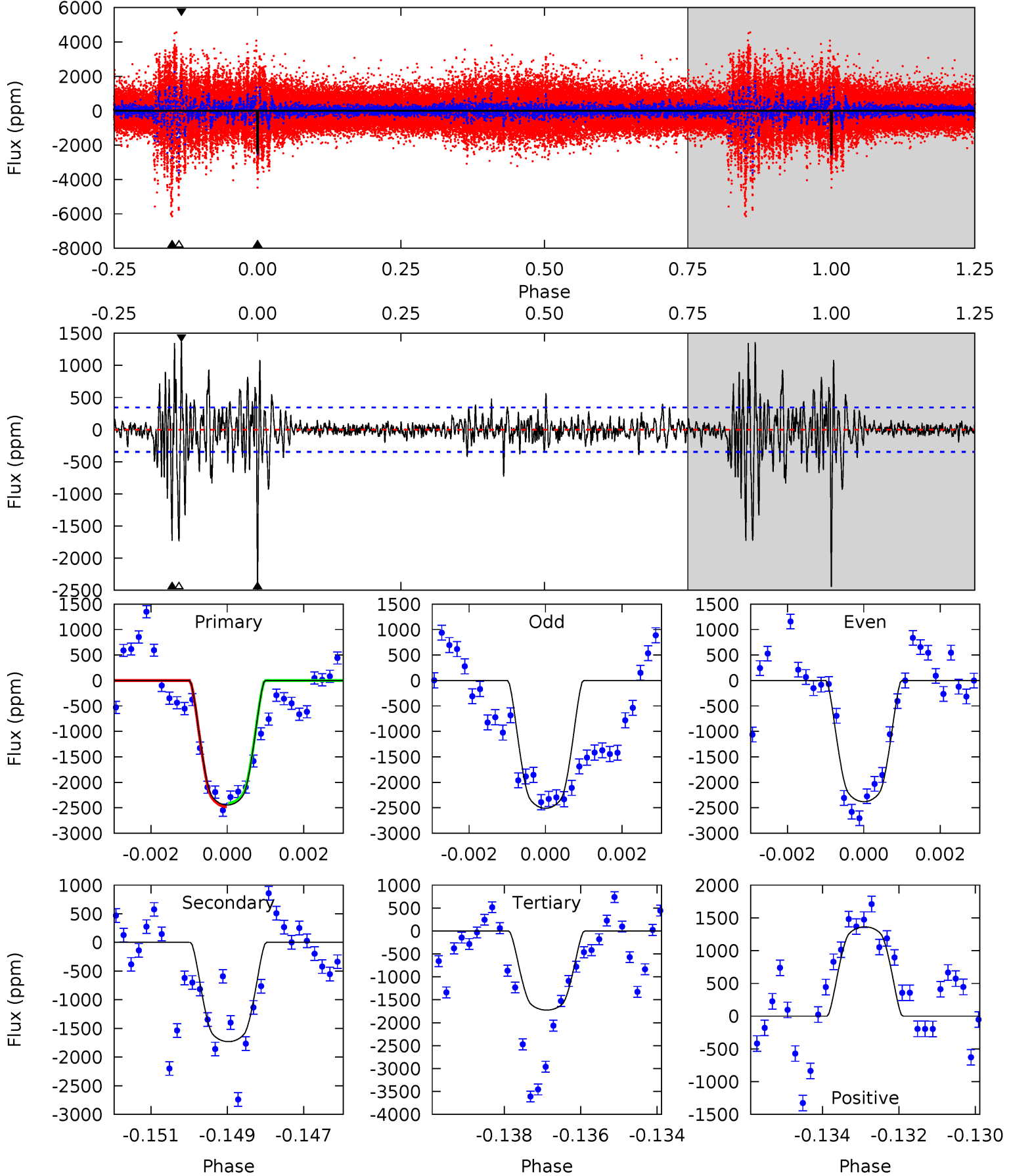
TCE 008440076-01 P=369.200373 Days  $T_0=233.700126$  (BKJD)



# DV Model-Shift Uniqueness Test

008440076-01, P = 369.152658 Days, E = 233.773061 Days

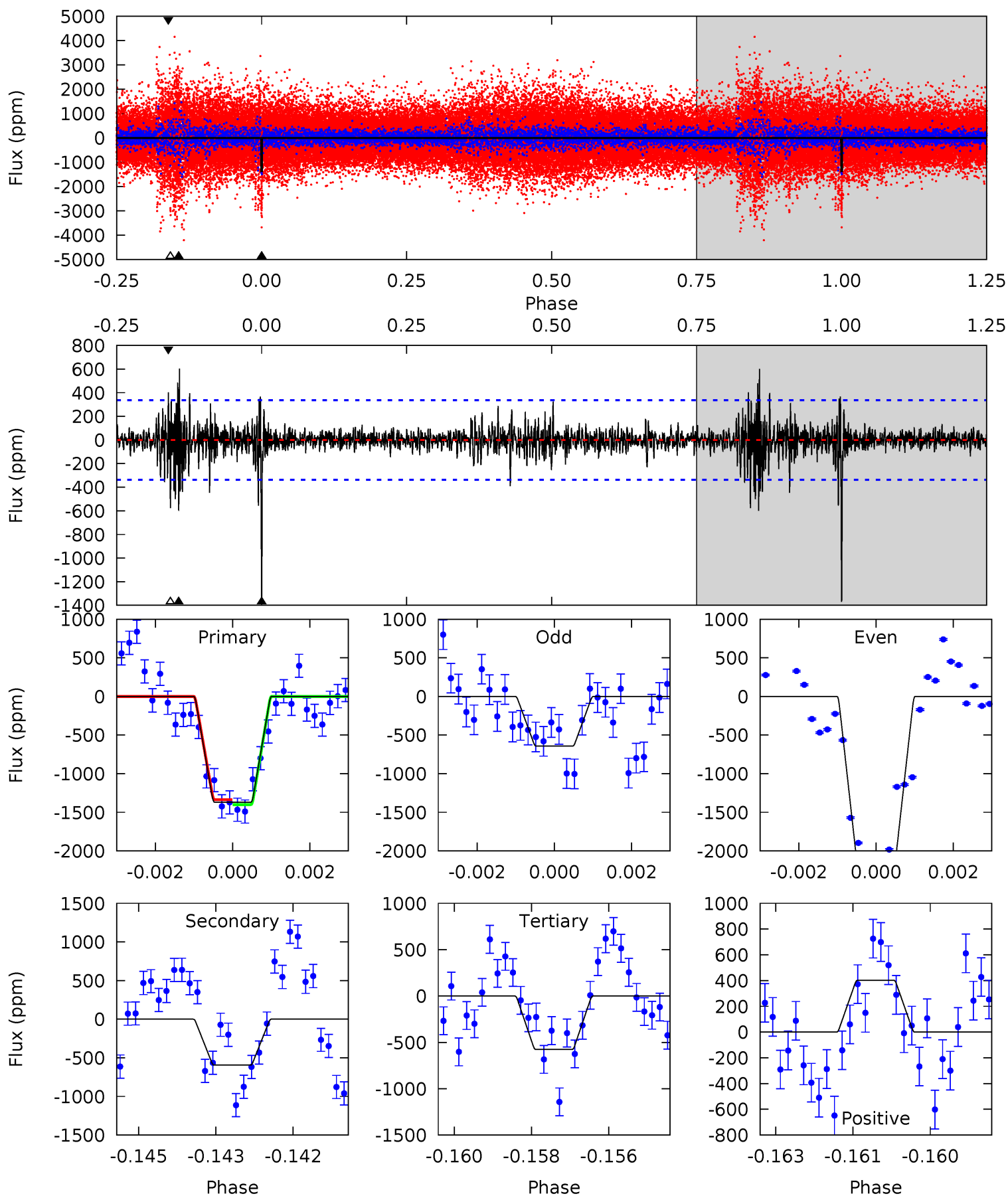
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
37.6	26.6	26.6	21.0	5.31	3.07	3.48	11.1	16.7	0.08	5.66	0.98	1.03	0.36	0.53



# Alt Model-Shift Uniqueness Test

008440076-01, P = 369.200373 Days, E = 233.700126 Days

Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
21.7	9.44	9.15	6.38	5.35	3.12	1.31	12.6	15.4	0.29	3.06	11.6	1.17	0.30	0.51



### Stellar Parameters For KIC 008440076

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5767^{+156}_{-173}$	$4.538^{+0.036}_{-0.192}$	$-0.060^{+0.300}_{-0.300}$	$0.881^{+0.260}_{-0.081}$	$0.979^{+0.102}_{-0.125}$	$2.017^{+0.404}_{-1.052}$
	+3%/-3%	+1%/-4%	+500%/-500%	+30%/-9%	+10%/-13%	+20%/-52%
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 008440076-01 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-1731 \pm 65$	$4.54^{+0.78}_{-0.52}$	$342^{+23}_{-15}$	$5551^{+298}_{-274}$	$44567^{+12159}_{-11151}$
Alt.	$-594 \pm 63$	$3.82^{+0.71}_{-0.52}$	$342^{+24}_{-17}$	$4724^{+281}_{-255}$	$21321^{+7875}_{-5898}$

$T_{max}$  = 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

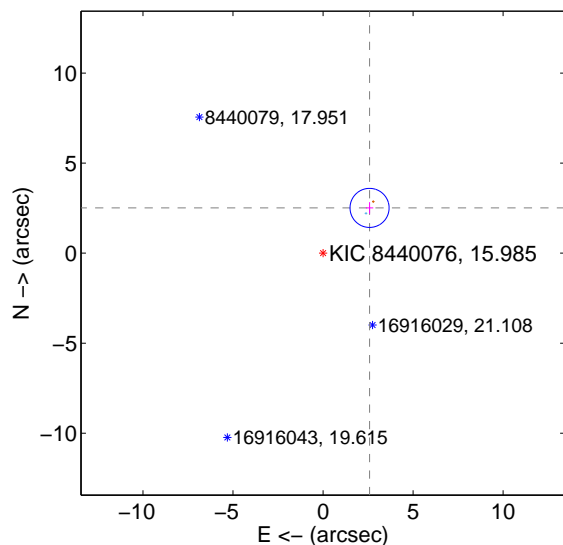
Supplemental centroid analysis for 008440076-01. Kepler magnitude: 15.98. Transit SNR 8.38

There are 1 quarters with good PRF difference image offsets

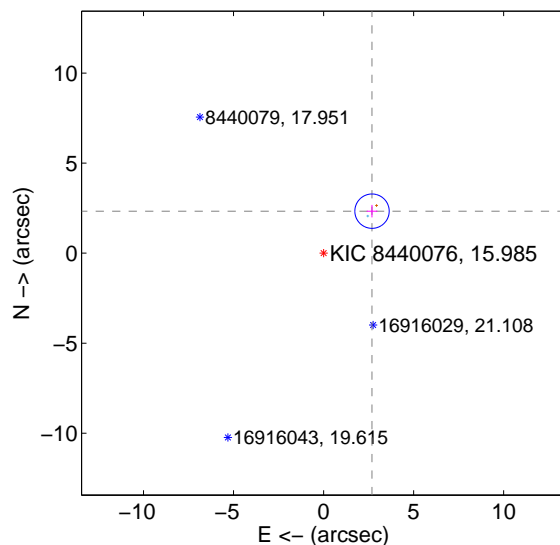
The direct PRF centroid is offset from the target star catalog position by about 0.26 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$3.605 \pm 0.362$	9.97	$-2.584 \pm 0.205$	$2.514 \pm 0.318$
PRF-fit source offset from KIC position	$3.561 \pm 0.318$	11.20	$-2.690 \pm 0.293$	$2.333 \pm 0.348$
photometric centroid source offset	$3.01 \pm 2.73$	1.10	$-0.16 \pm 2.44$	$3.00 \pm 2.73$

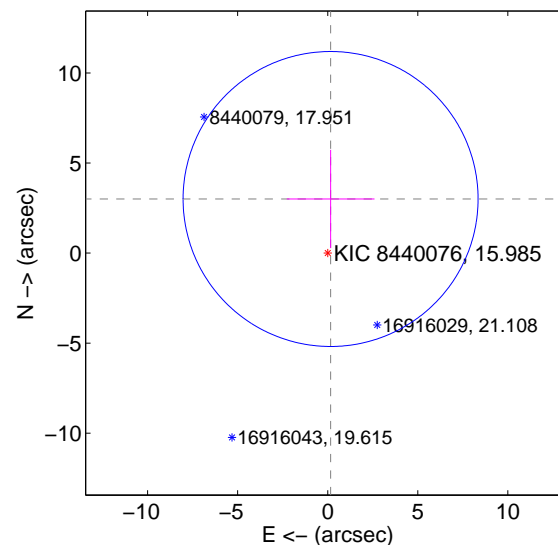
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

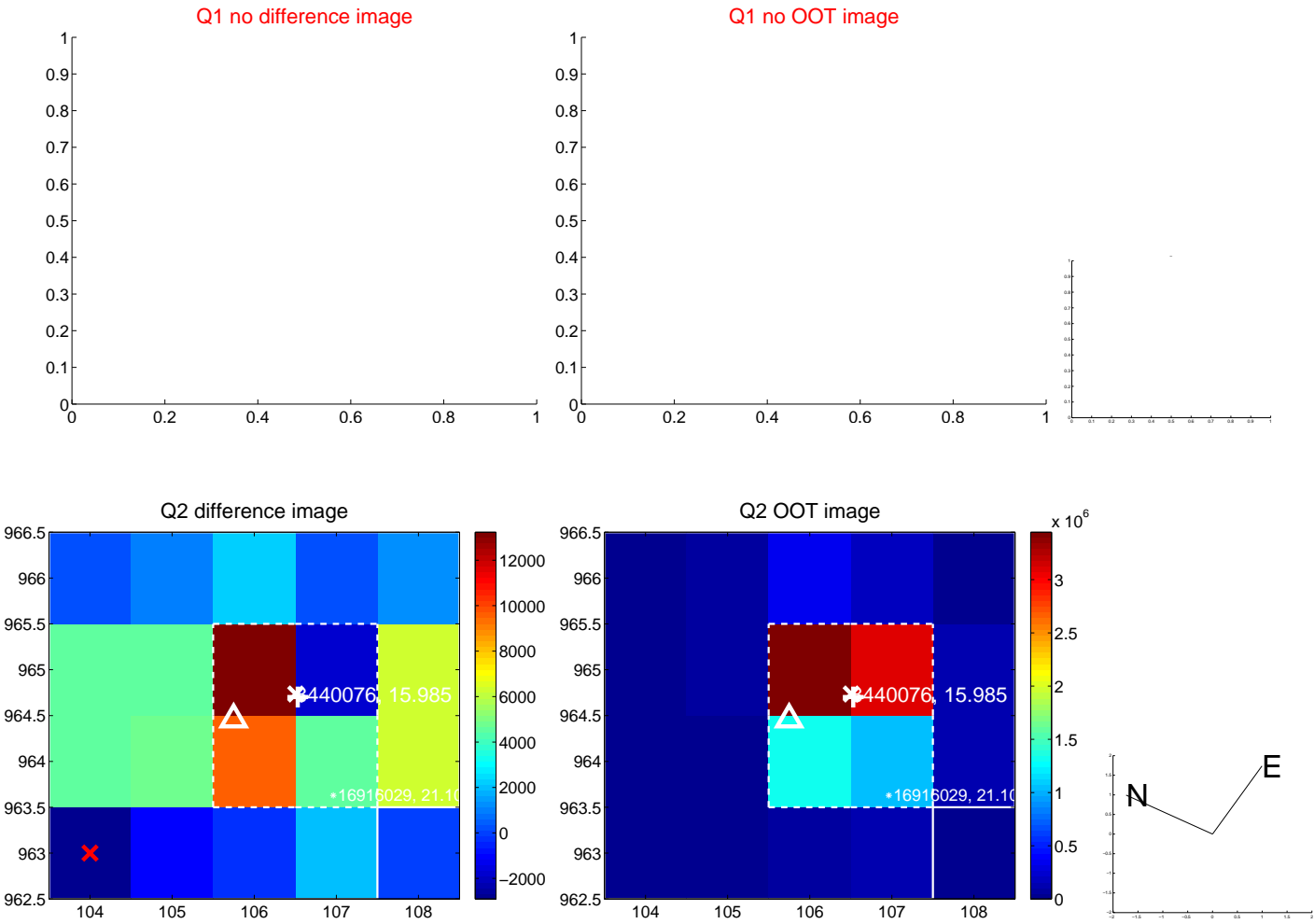


offset from photometric centroids

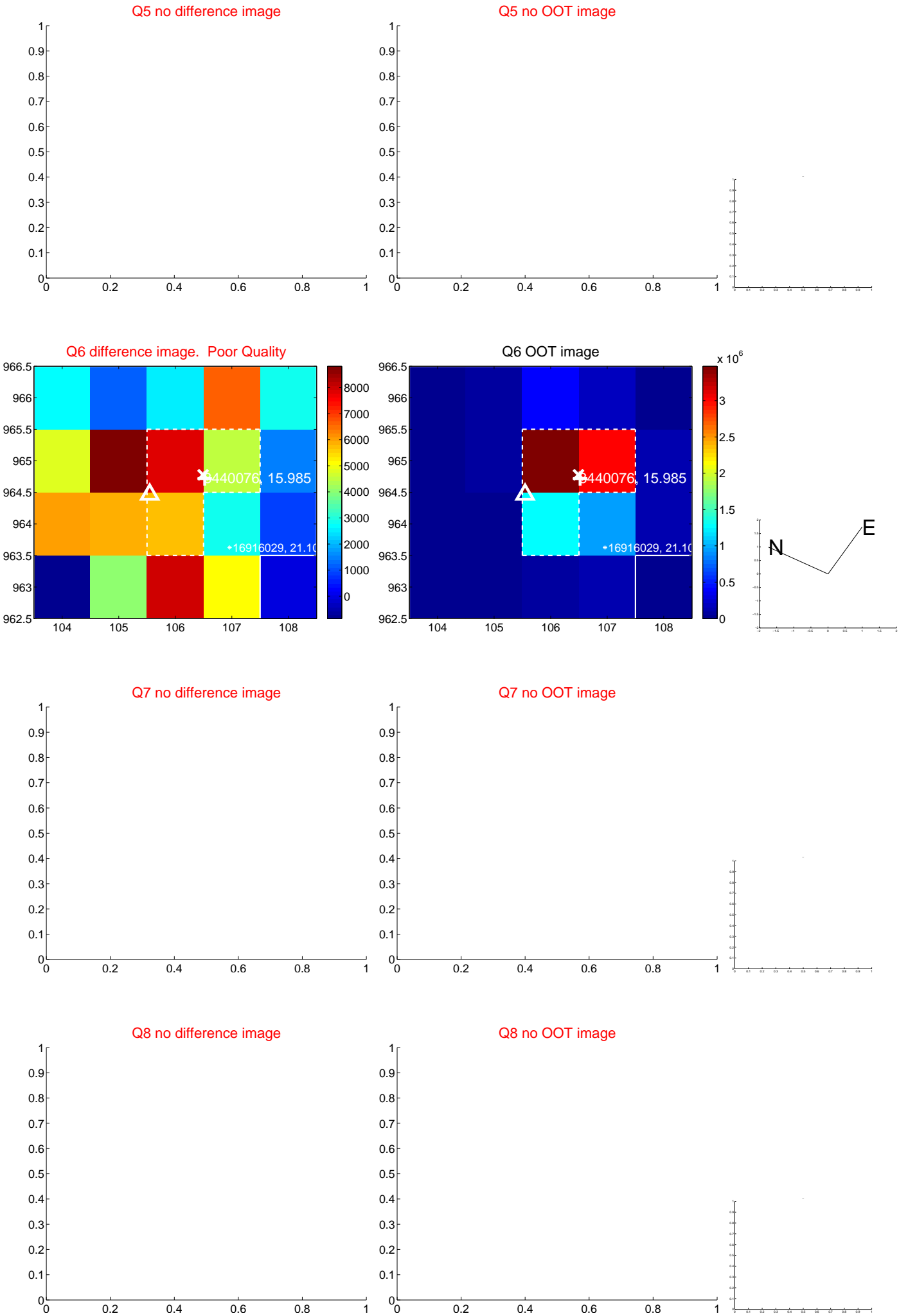


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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



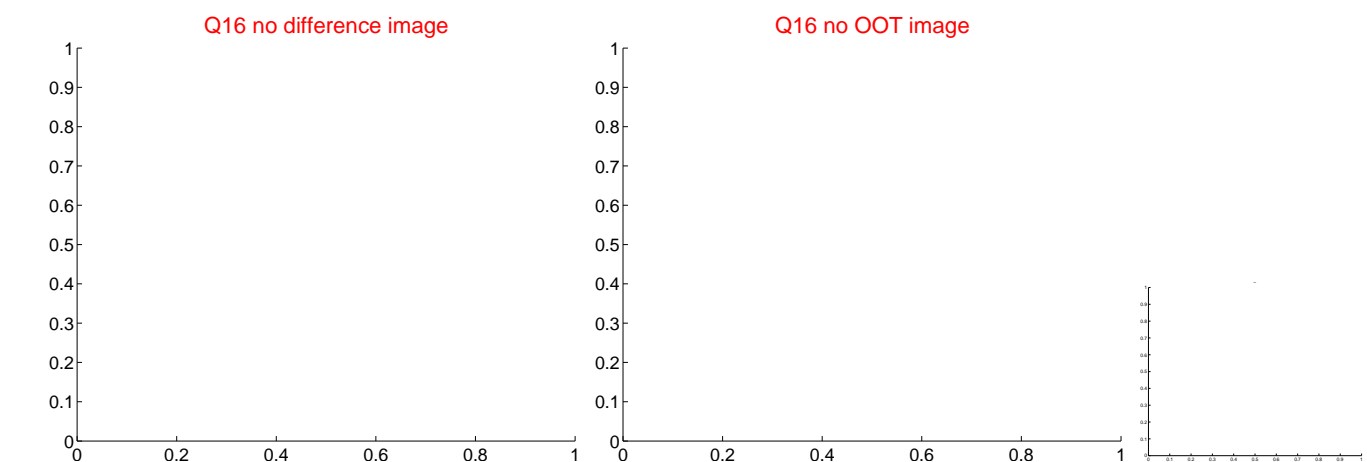
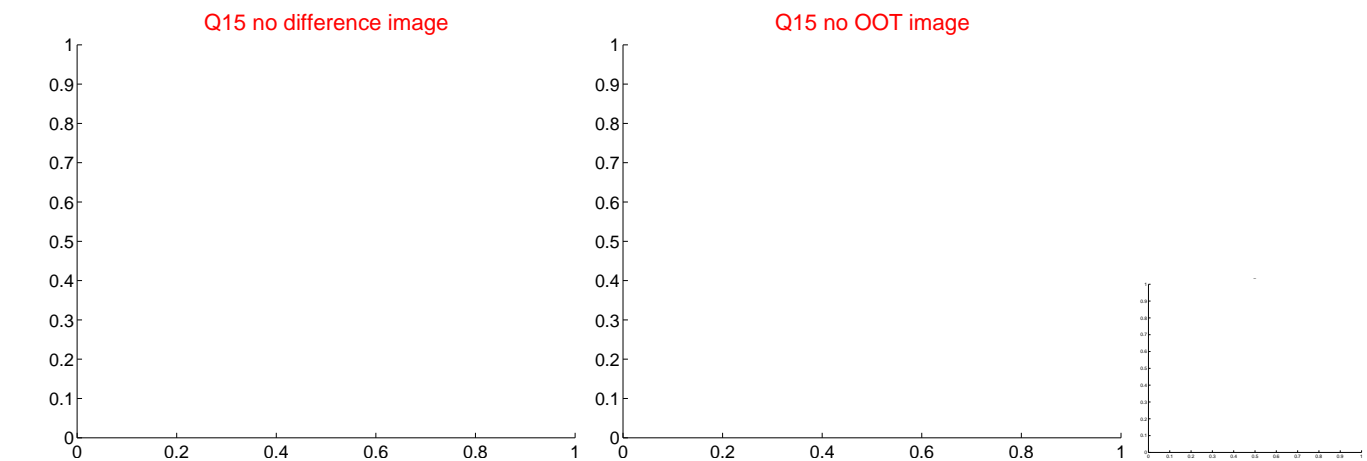
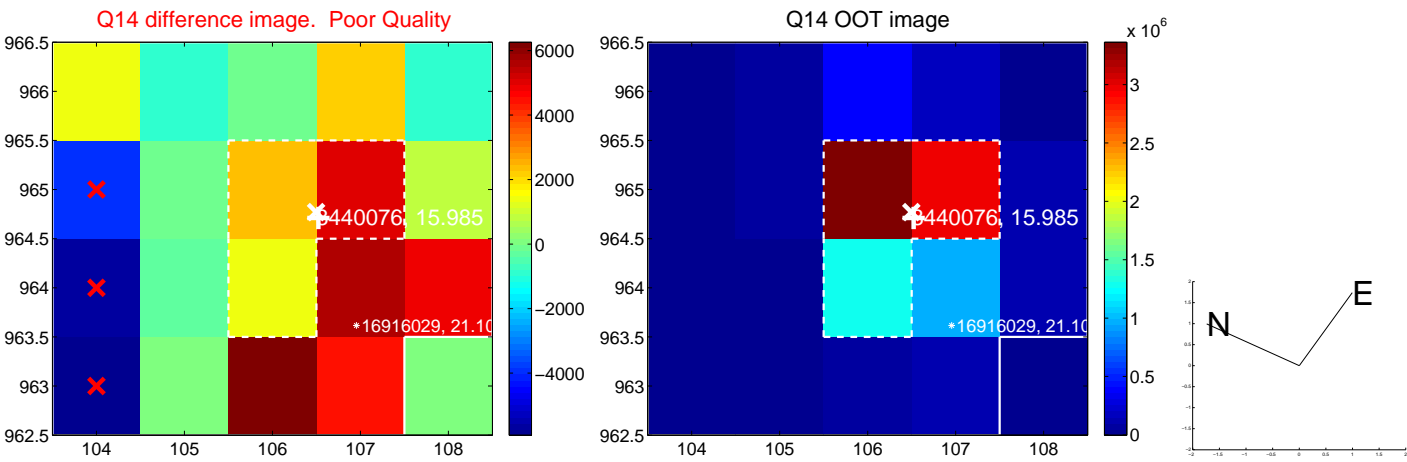
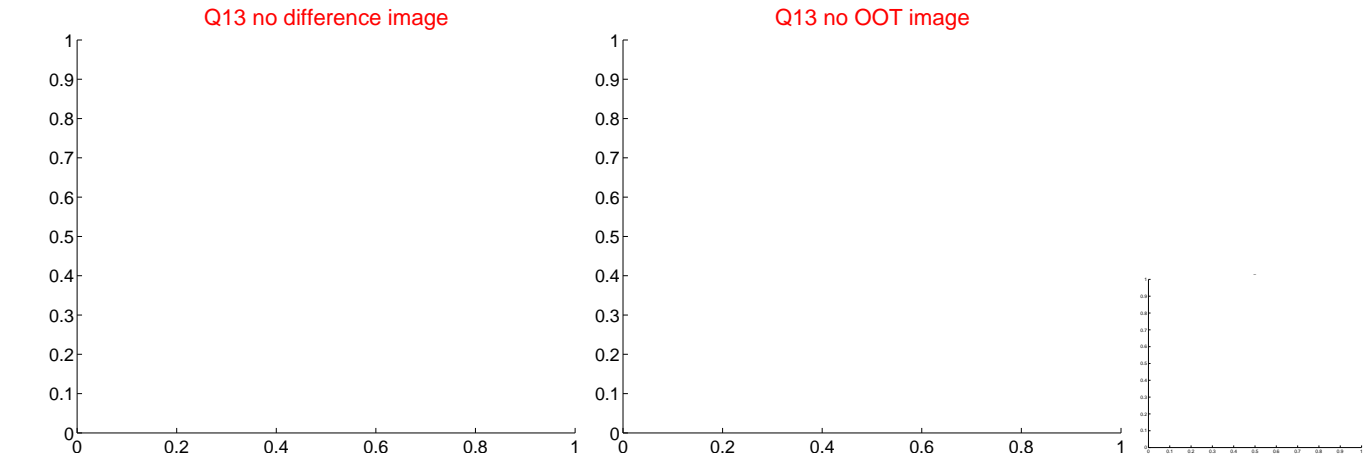
white ×: KIC target position; +: OOT centroid; △: difference centroid. red ✕: large negative pixel value.



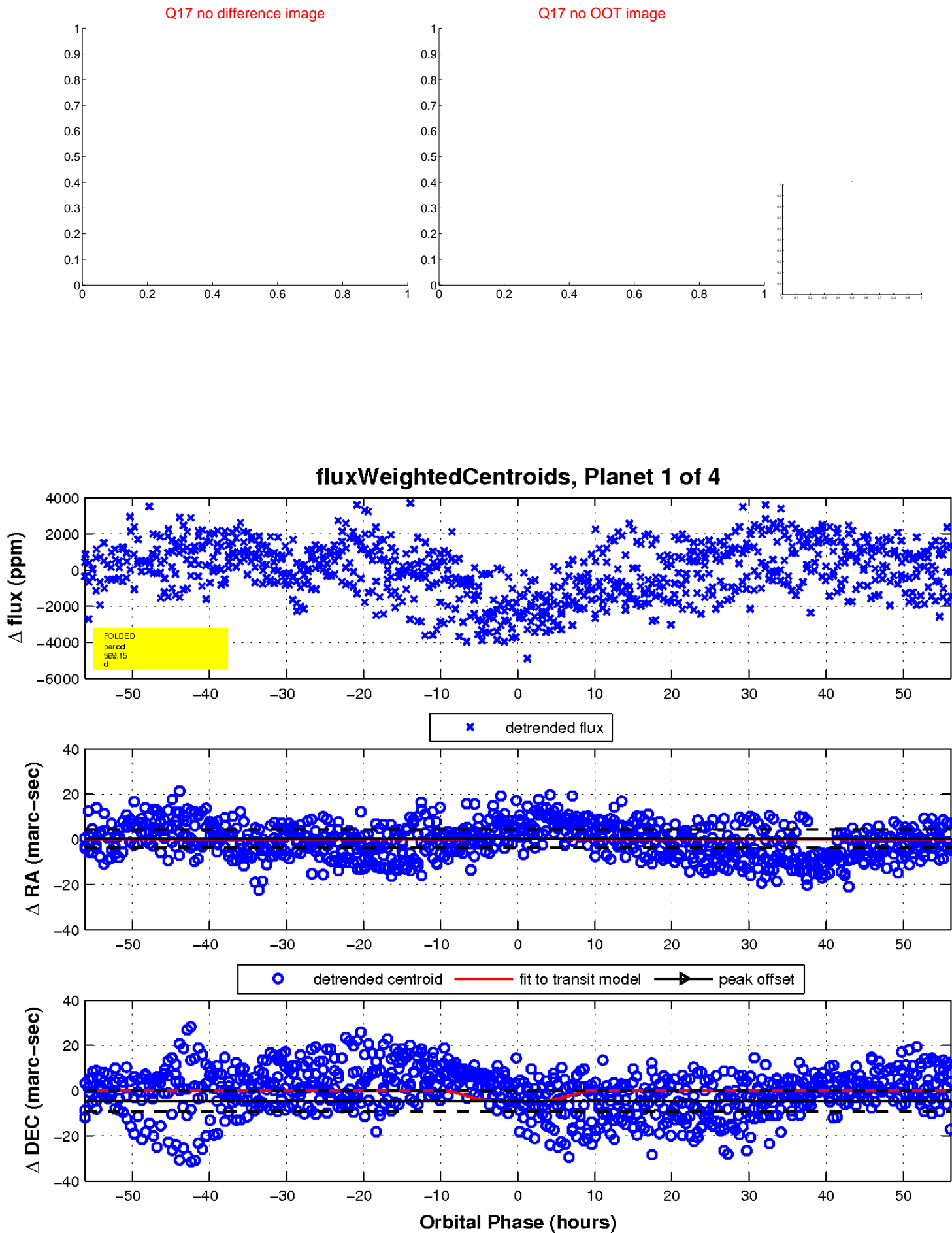
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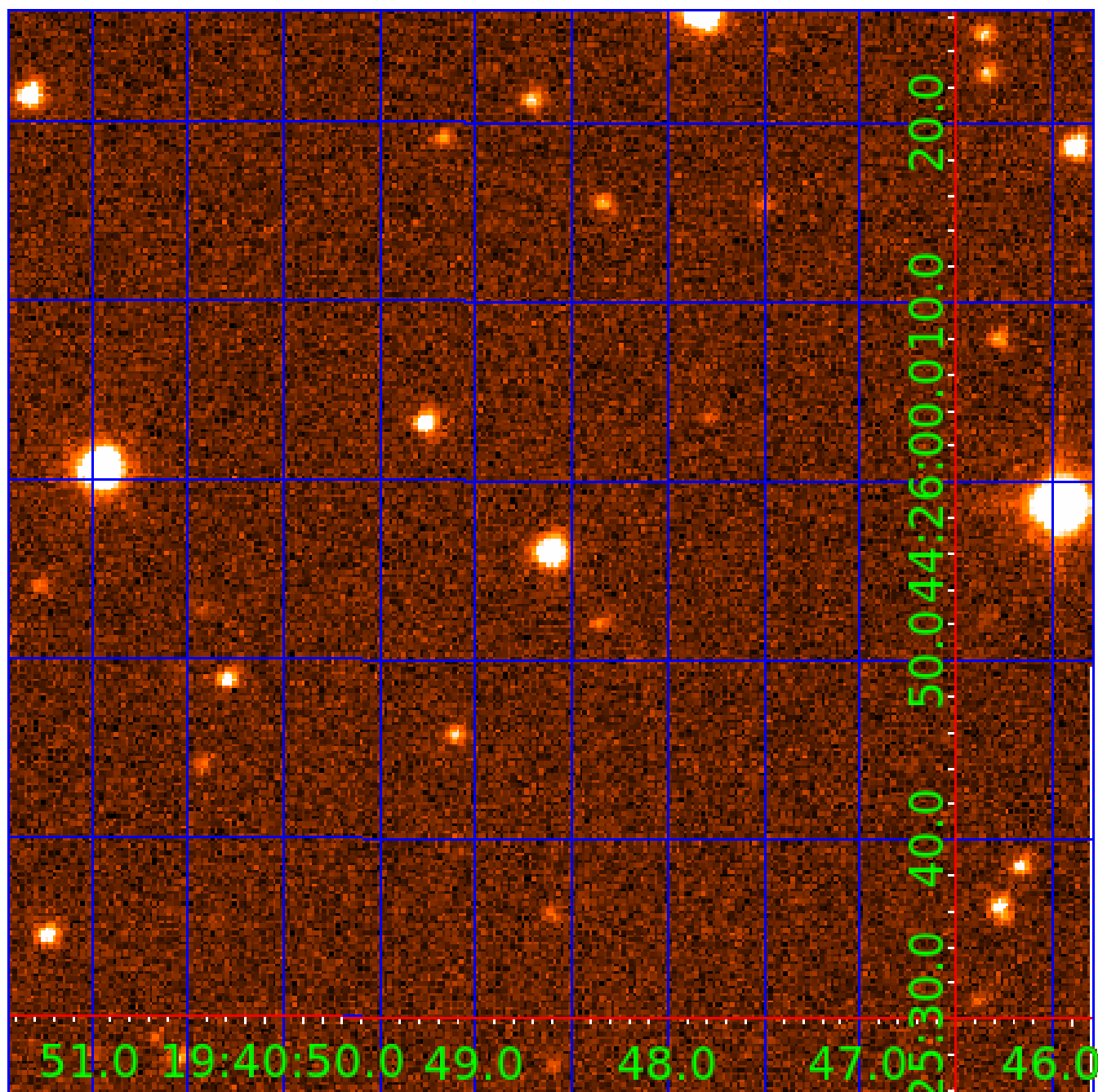


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 008440076

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
008440076-01	OBS	No	369.152658	233.773061	1610.3	18.736	7.3	8.4	0.88	5767	4.37	0.77
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008440076-04	OBS	No	191.332540	160.159401	1531.6	13.762	7.7	7.3	0.88	5767	4.13	1.85

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
008440076-01	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_CHASES_MARSHALL_SKYE—INCONSISTENT_TRANS—CENT_FEW_DIFFS—HALO_GHOST
008440076-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL_SKYE—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT—CENT_FEW_DIFFS
008440076-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL_SKYE—INCONSISTENT_TRANS—CENT_FEW_DIFFS
008440076-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL_SKYE—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.

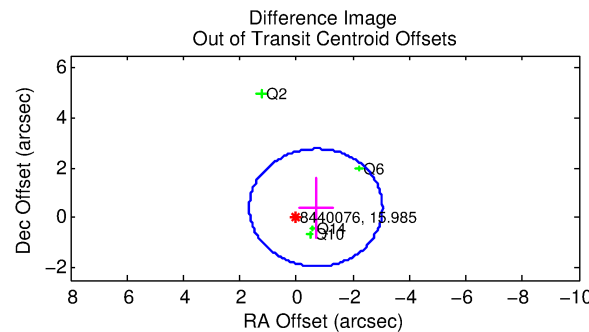
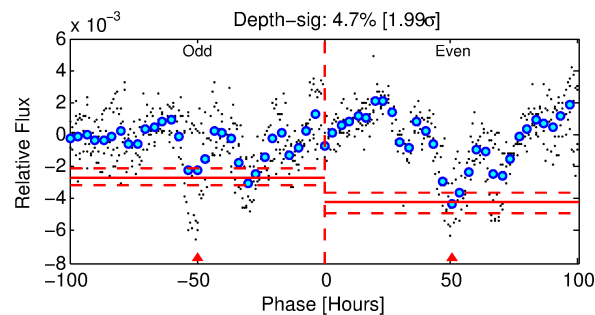
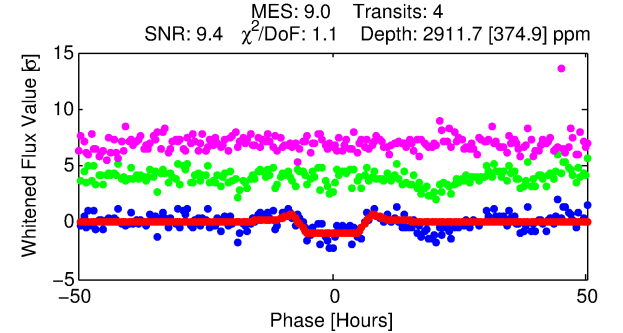
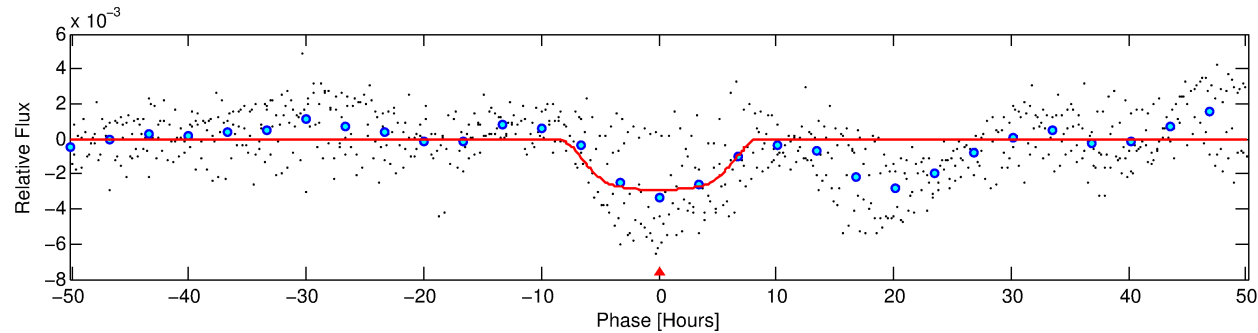
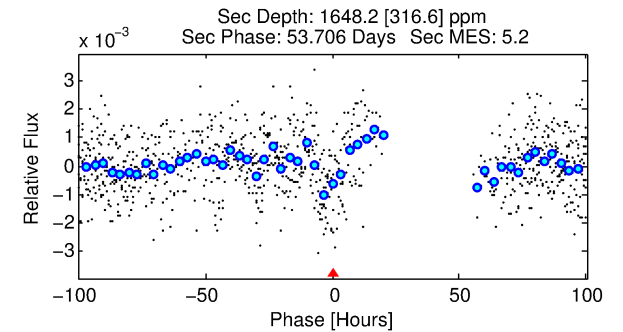
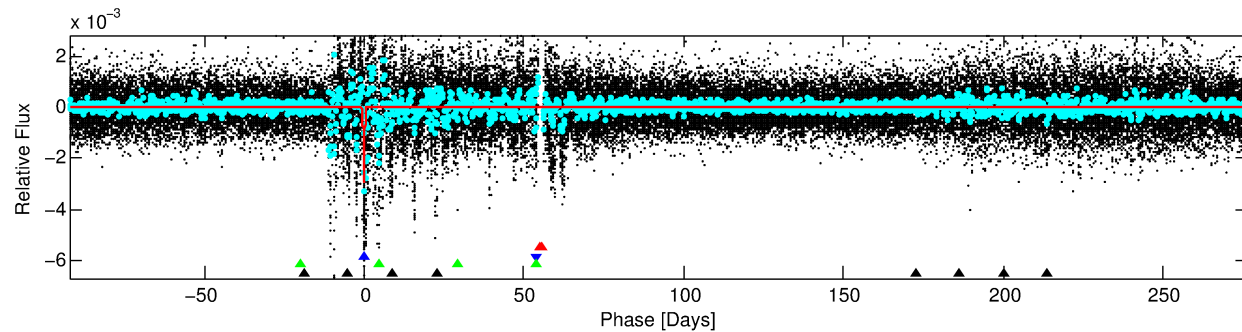
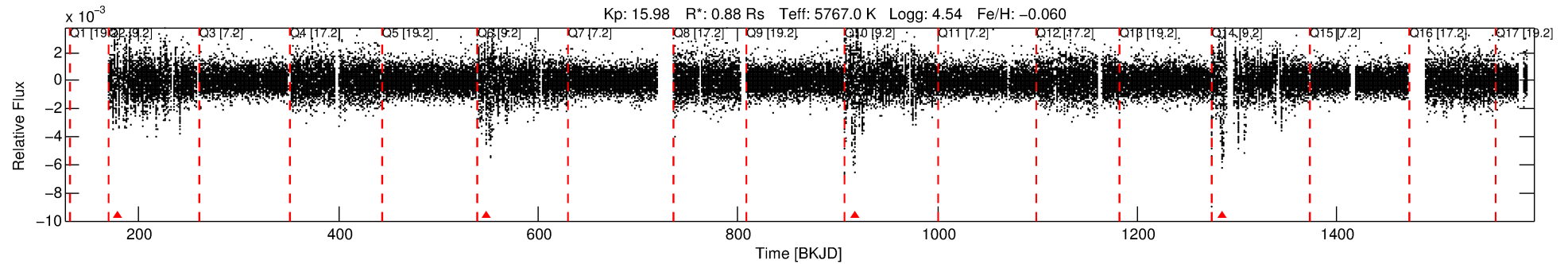
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 008440076-02

No Significant Match Found

# DV One-Page Summary

KIC: 8440076 Candidate: 2 of 4 Period: 368.858 d



## DV Fit Results:

Period = 368.85836 [0.01057] d  
Epoch = 178.9478 [0.0190] BKJD  
Rp/R\* = 0.0587 [0.0044]  
a/R\* = 95.06 [11.52]  
b = 0.90 [0.03]  
Seff = 0.77 [0.29]  
Teq = 239 [22] K  
Rp = 5.64 [1.72] Re  
a = 0.9991 [0.2456] AU  
Ag = 28437.34 [12234.99] [2.32σ]  
Teffp = 4797 [326] K [13.95σ]

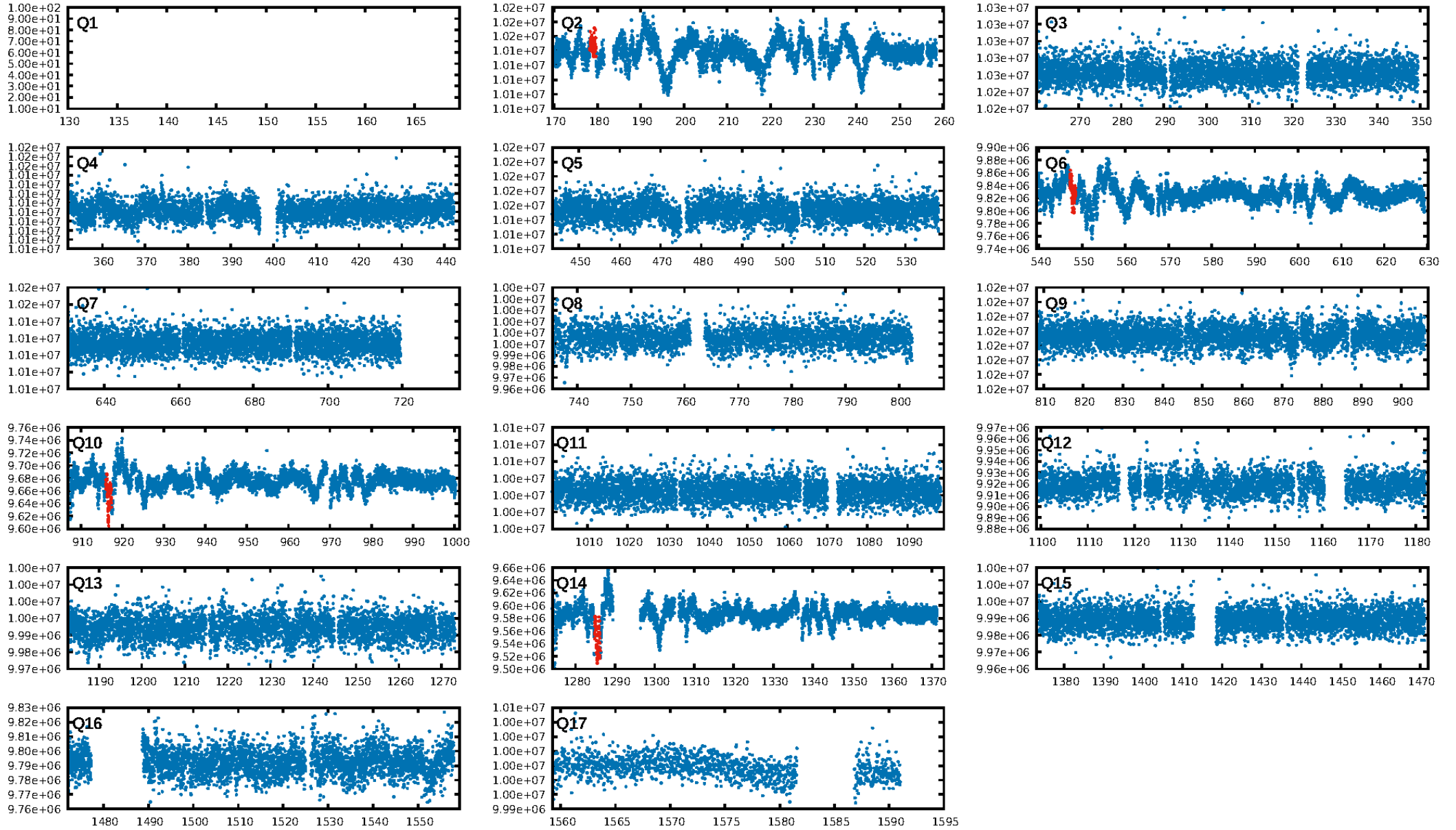
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [196.68σ]  
LongPeriod-sig: 22.1% [0.28σ]  
ModelChiSquare2-sig: 0.0%  
ModelChiSquareGof-sig: 89.7%  
Bootstrap-pfa: 1.50e-10  
RollingBand-fgt: 0.00 [0/4]  
GhostDiagnostic-chr: 17.78  
Centroid-sig: 0.0%  
Centroid-so: 8.167 arcsec [4.69σ]  
OotOffset-rm: 0.801 arcsec [1.02σ]  
KicOffset-rm: 0.776 arcsec [1.03σ]  
OotOffset-st: 4/0/0/0 [4]  
KicOffset-st: 4/0/0/0 [4]  
DiffImageQuality-fgm: 0.25 [1/4]  
DiffImageOverlap-fno: 1.00 [4/4]

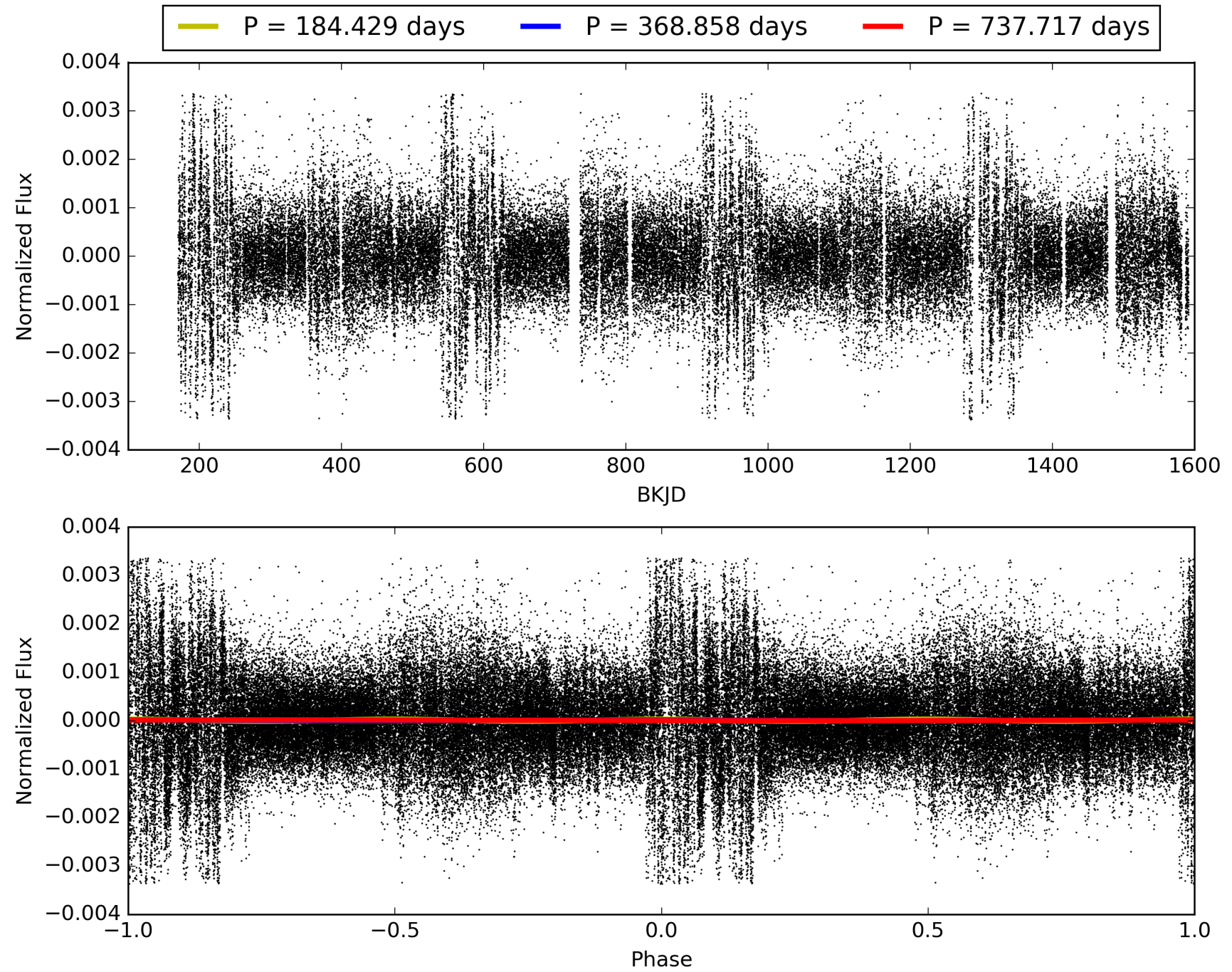
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 29-Jan-2016 12:53:36 Z

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

# TCE 008440076-02, PDC Light Curves

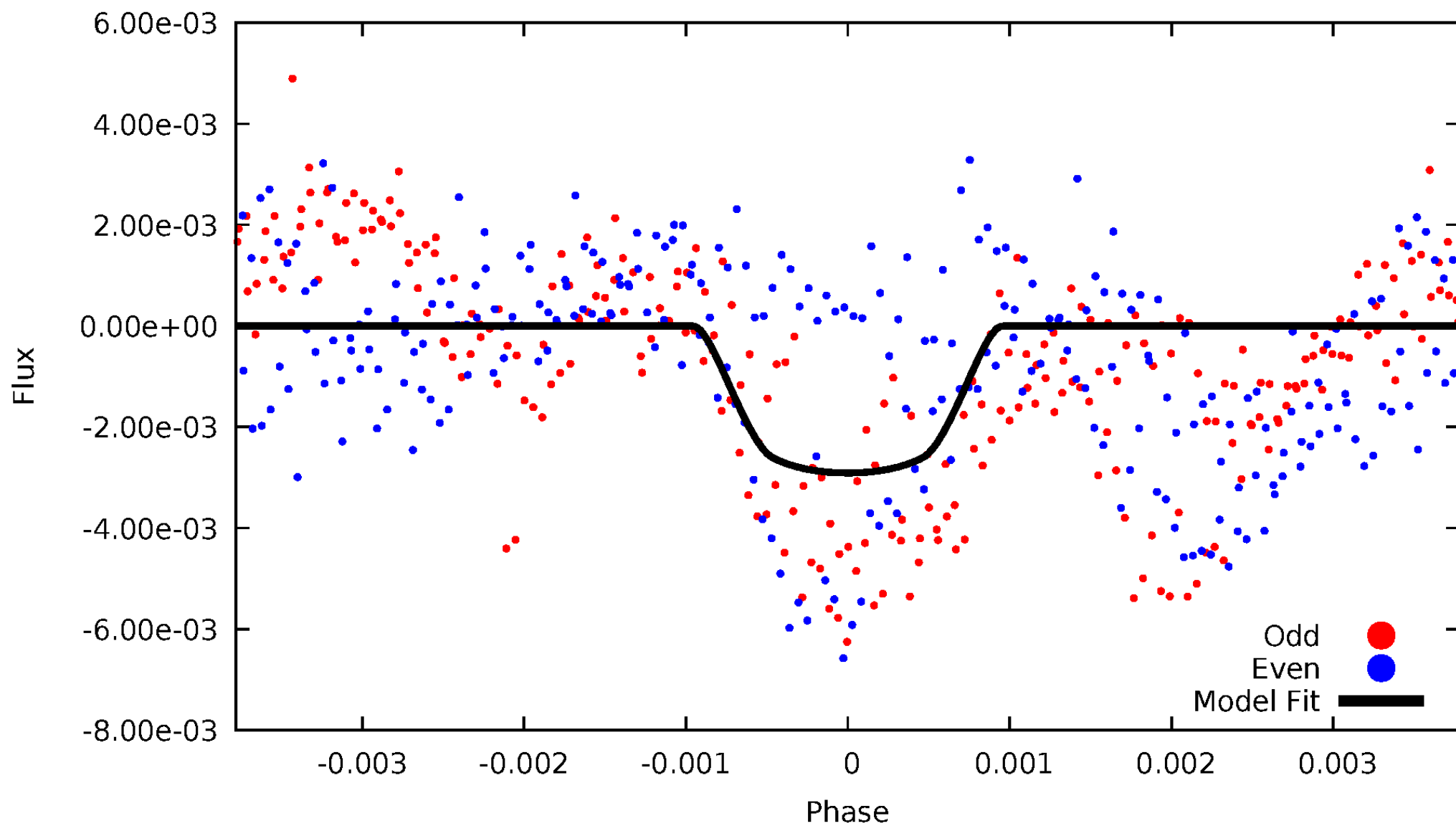


# TCE 008440076-02



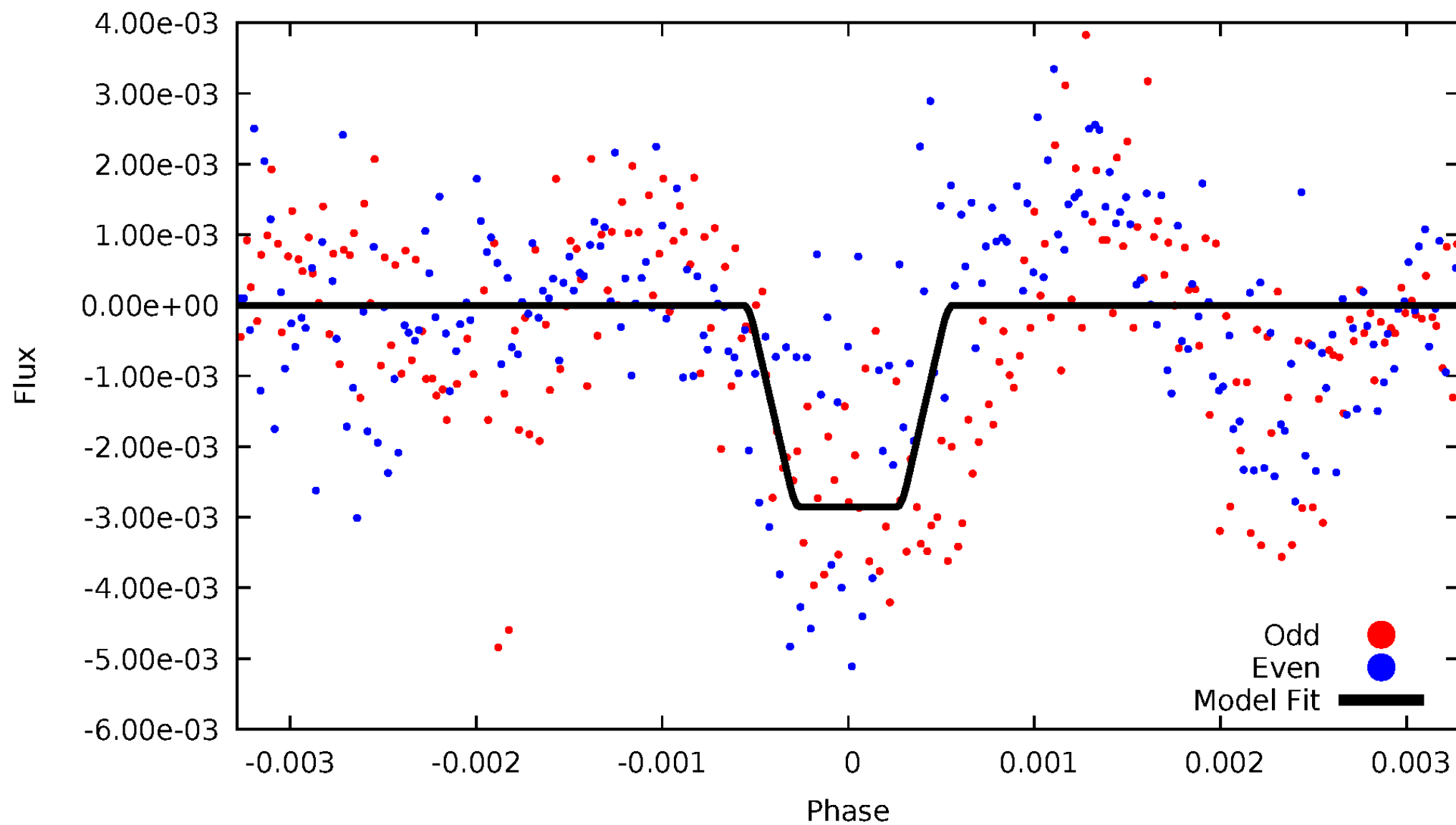
# DV Odd/Even

TCE 008440076-02



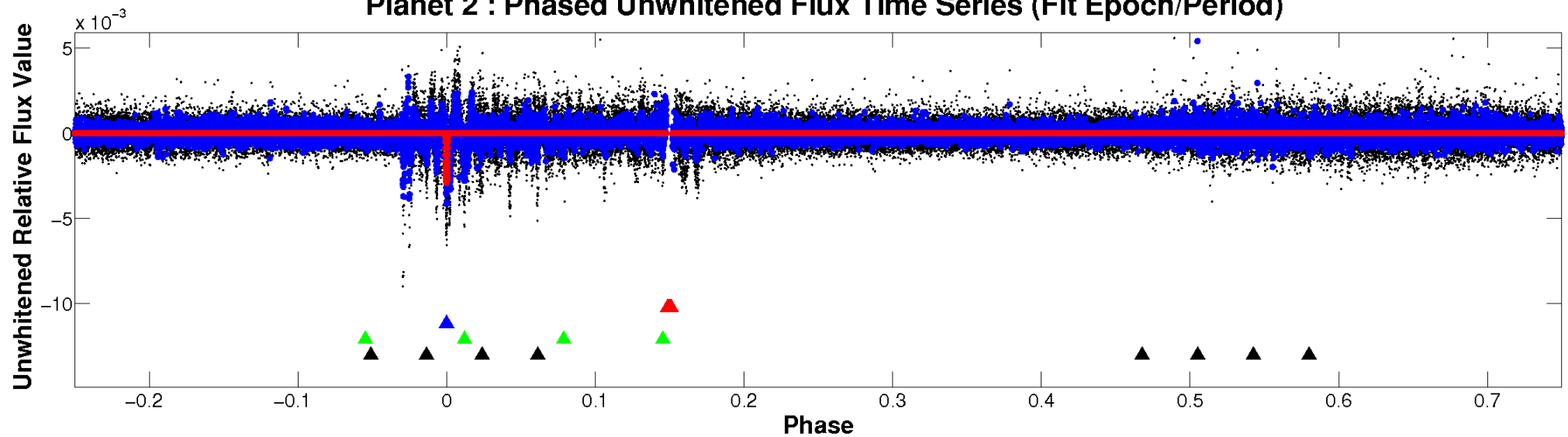
# ALT Odd/Even

TCE 008440076-02

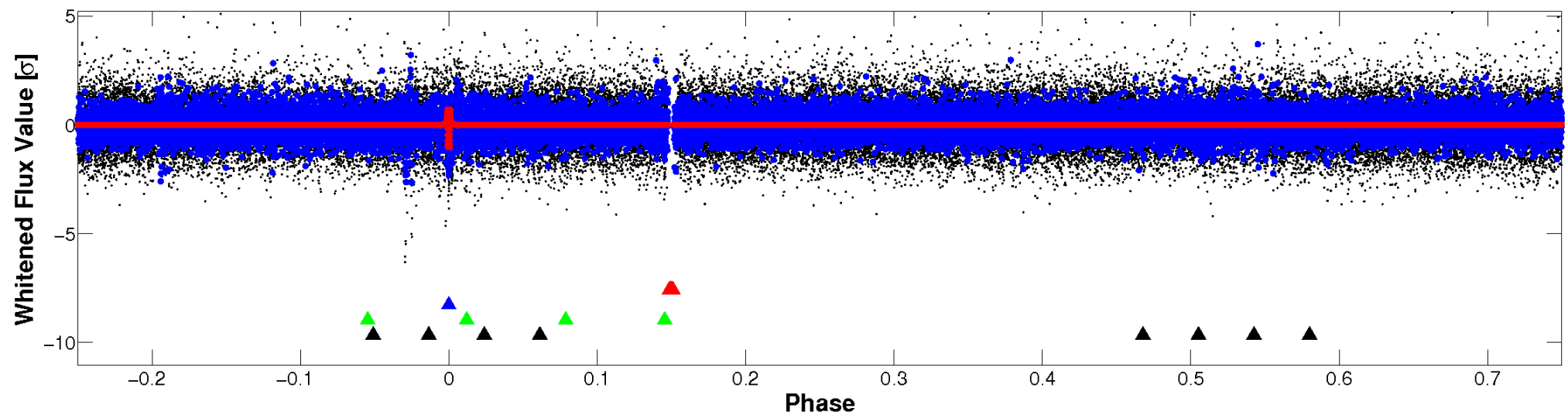


# Non-Whitened Vs. Whitened Light Curve

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

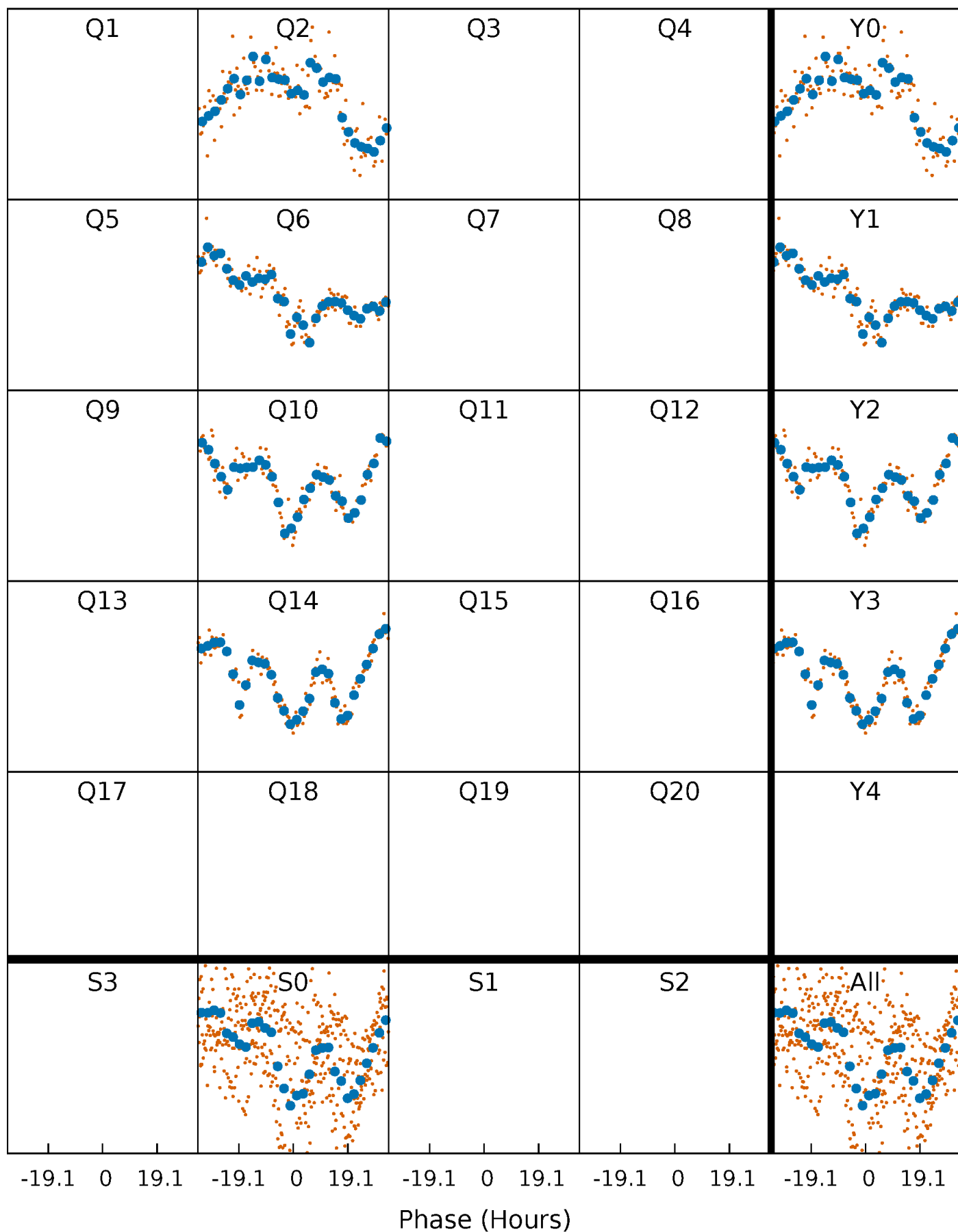


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



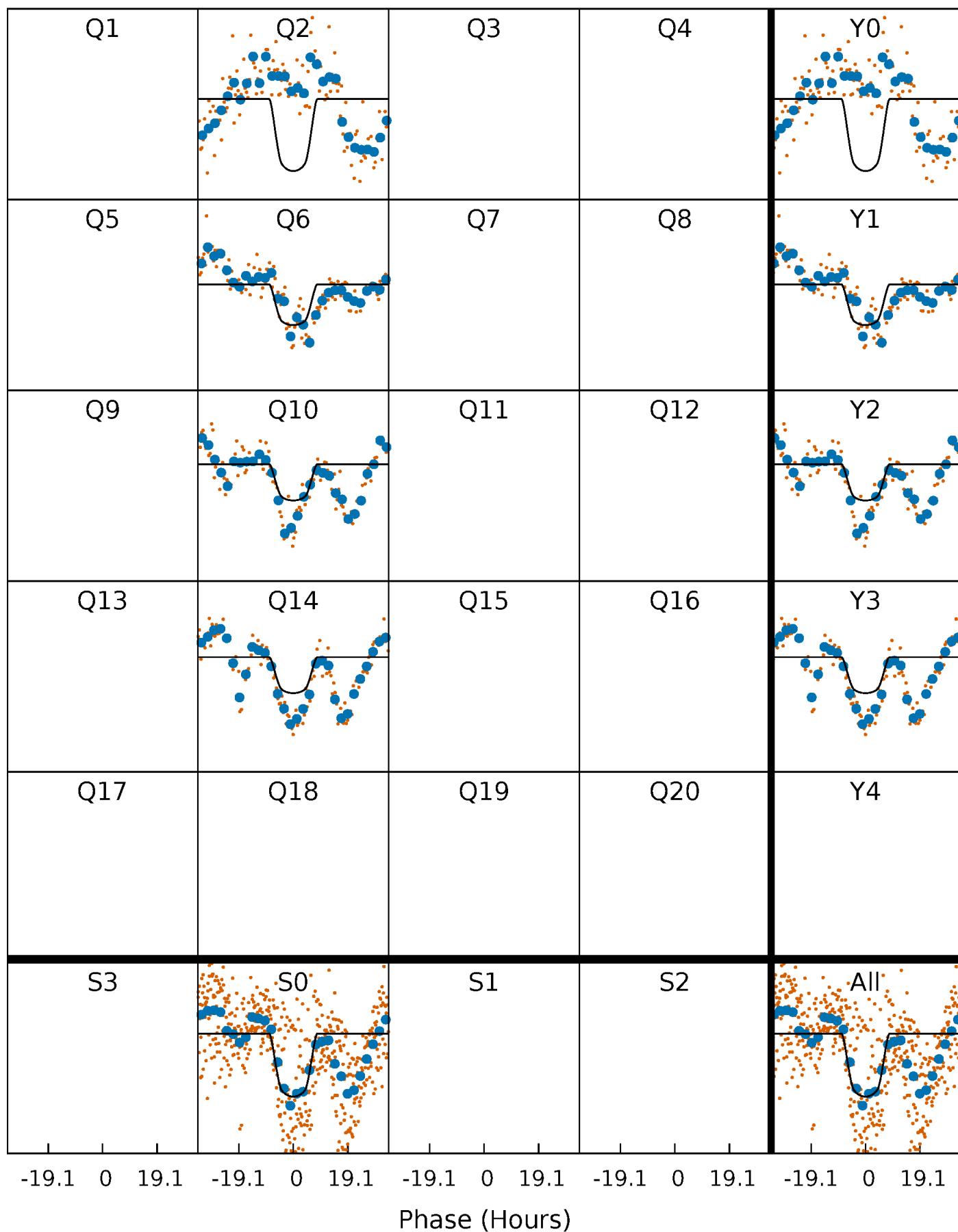
# PDC Quarter-Phased Transit Curves

TCE 008440076-02     $P=368.858364$  Days     $T_0=178.947811$  (BKJD)



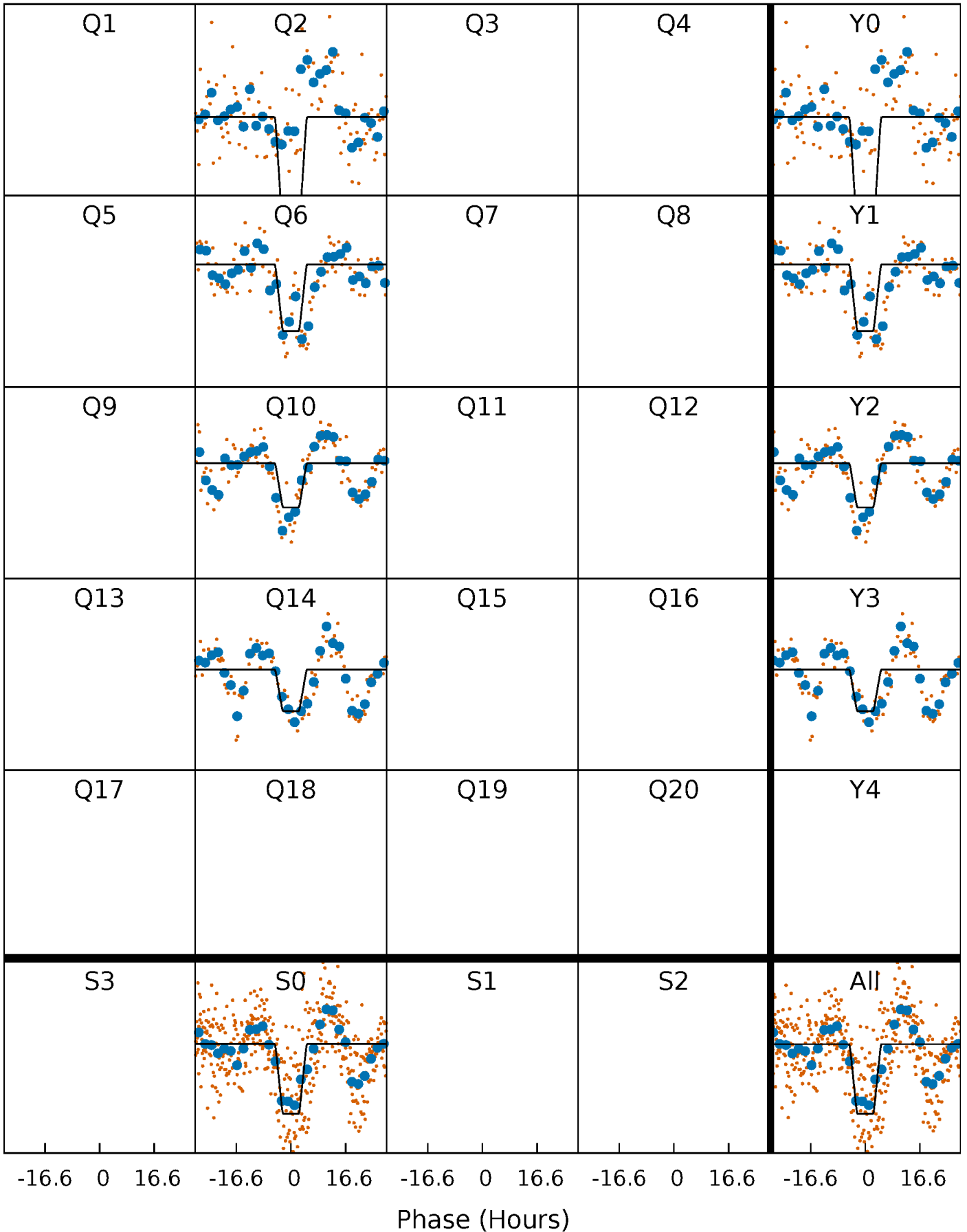
# DV Quarter-Phased Transit Curves

TCE 008440076-02     $P=368.858364$  Days     $T_0=178.947811$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

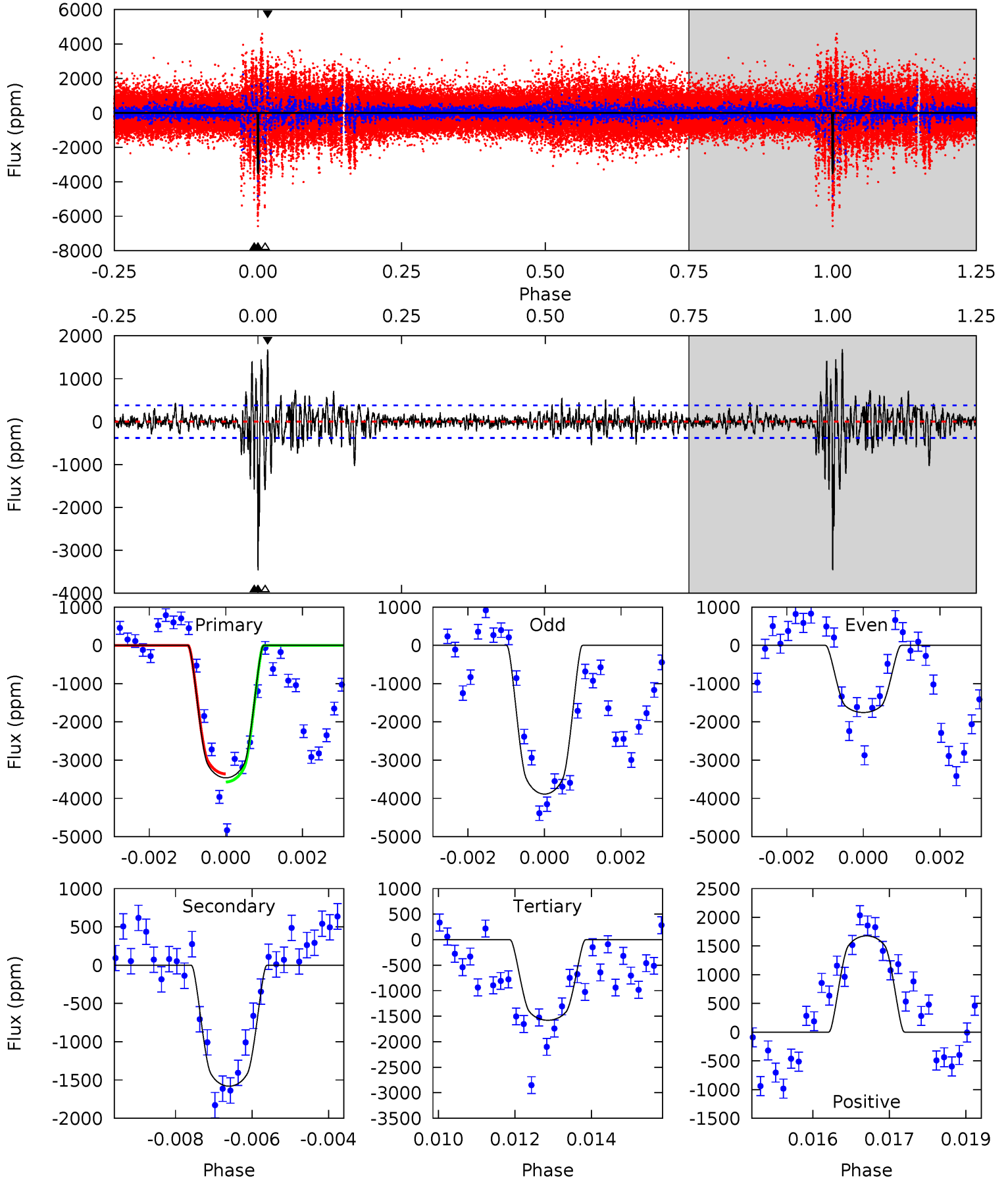
TCE 008440076-02 P=368.791702 Days  $T_0=179.063652$  (BKJD)



# DV Model-Shift Uniqueness Test

008440076-02, P = 368.858364 Days, E = 178.947811 Days

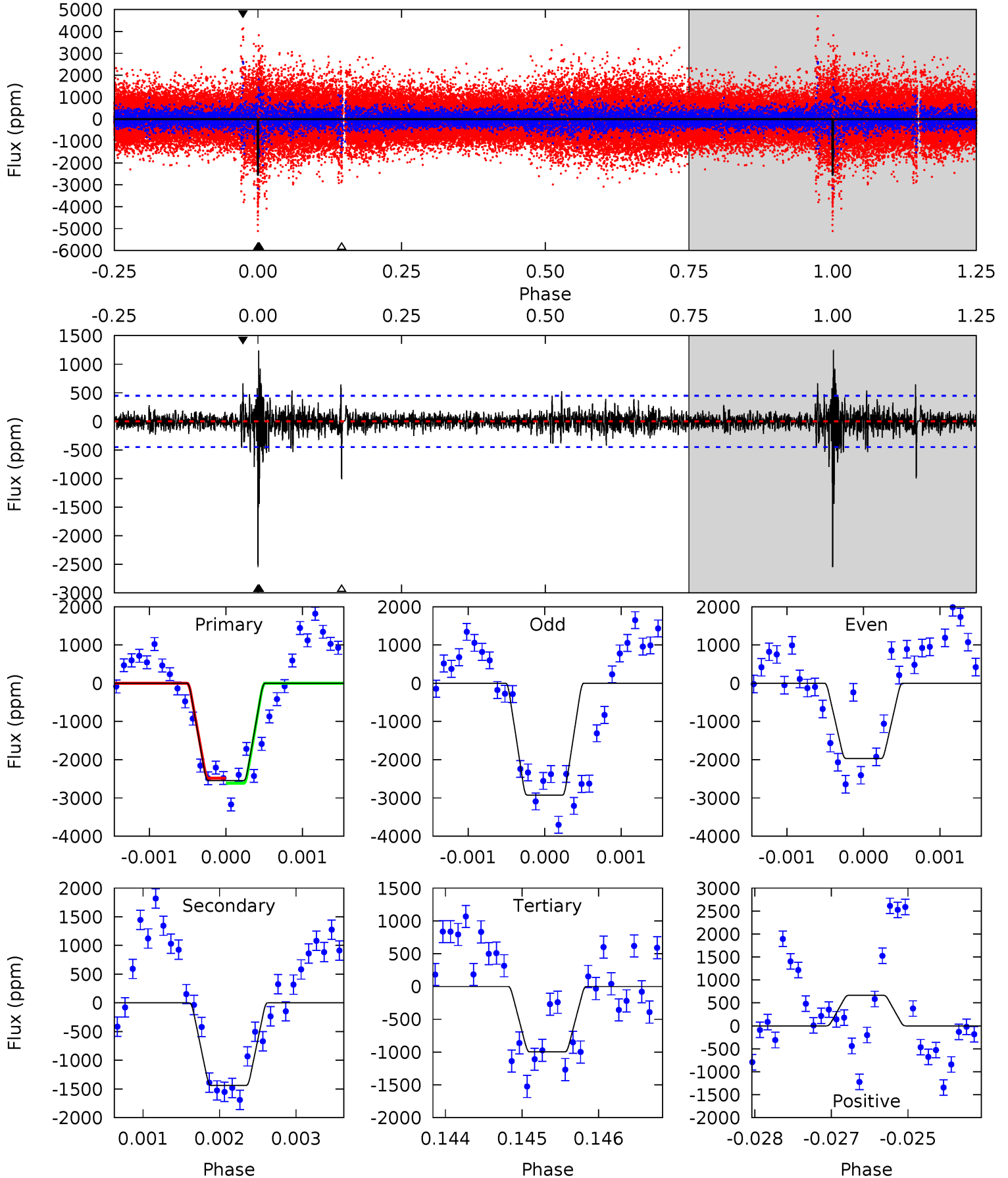
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
48.6	22.2	22.1	23.5	5.33	3.10	3.34	26.4	25.0	0.02	-1.36	15.7	0.78	0.33	1.49



# Alt Model-Shift Uniqueness Test

008440076-02, P = 368.791702 Days, E = 179.063652 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
30.9	17.5	12.1	8.04	5.43	3.26	1.44	18.8	22.8	5.34	9.41	5.83	0.84	0.33	0.79



### Stellar Parameters For KIC 008440076

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5767^{+156}_{-173}$	$4.538^{+0.036}_{-0.192}$	$-0.060^{+0.300}_{-0.300}$	$0.881^{+0.260}_{-0.081}$	$0.979^{+0.102}_{-0.125}$	$2.017^{+0.404}_{-1.052}$
	+3%/-3%	+1%/-4%	+500%/-500%	+30%/-9%	+10%/-13%	+20%/-52%
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 008440076-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-1581 \pm 71$	$5.86^{+0.92}_{-0.65}$	$341^{+25}_{-16}$	$4866^{+191}_{-196}$	$24806^{+6025}_{-5852}$
Alt.	$-1439 \pm 82$	$5.40^{+0.82}_{-0.63}$	$342^{+24}_{-15}$	$4947^{+228}_{-208}$	$26559^{+7311}_{-6235}$

$T_{max}$  = 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

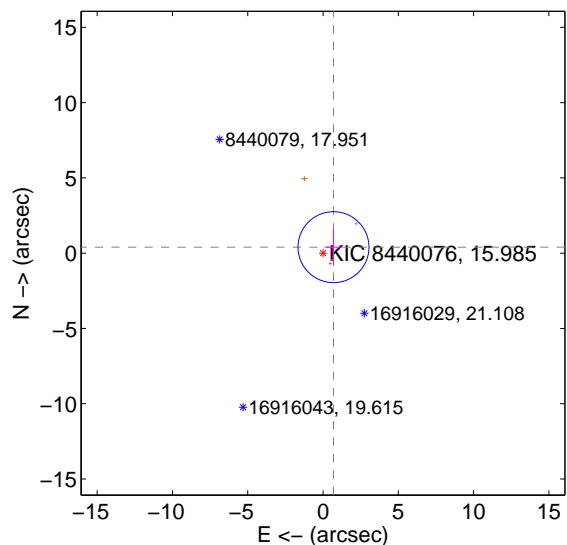
Supplemental centroid analysis for 008440076-02. Kepler magnitude: 15.98. Transit SNR 9.43

There are 1 quarters with good PRF difference image offsets

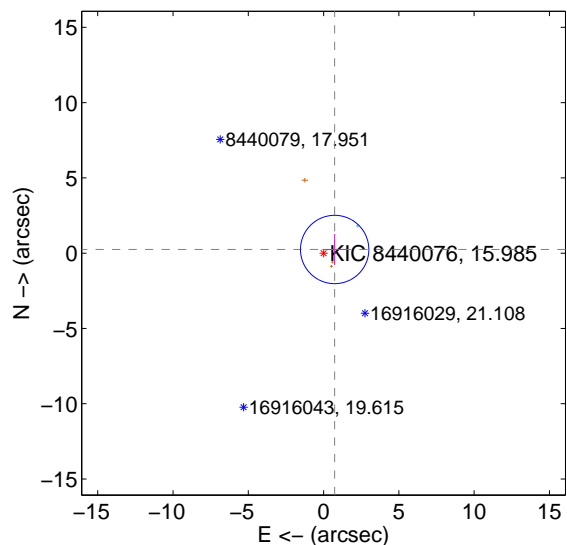
The direct PRF centroid is offset from the target star catalog position by about 0.15 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.801 \pm 0.785$	1.02	$-0.695 \pm 0.574$	$0.398 \pm 1.222$
PRF-fit source offset from KIC position	$0.776 \pm 0.757$	1.03	$-0.736 \pm 0.812$	$0.245 \pm 1.031$
photometric centroid source offset	$8.17 \pm 1.74$	4.69	$5.21 \pm 1.53$	$-6.29 \pm 1.88$

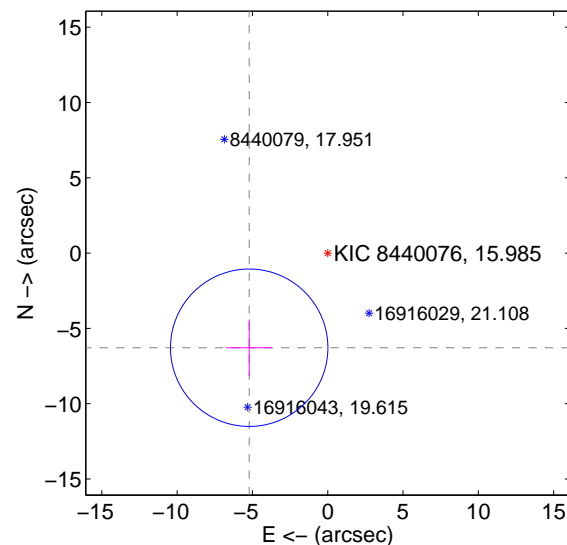
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

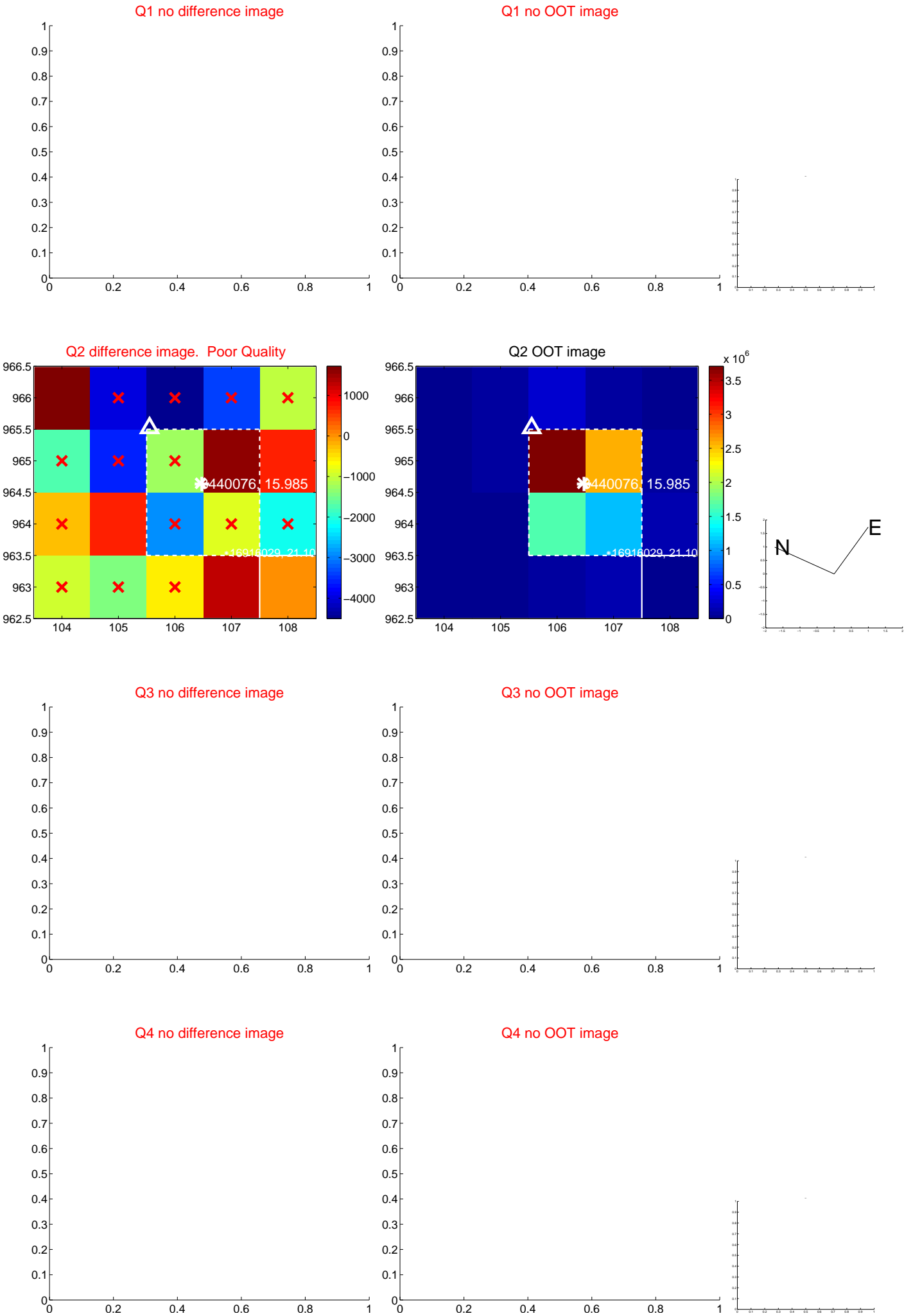


offset from photometric centroids

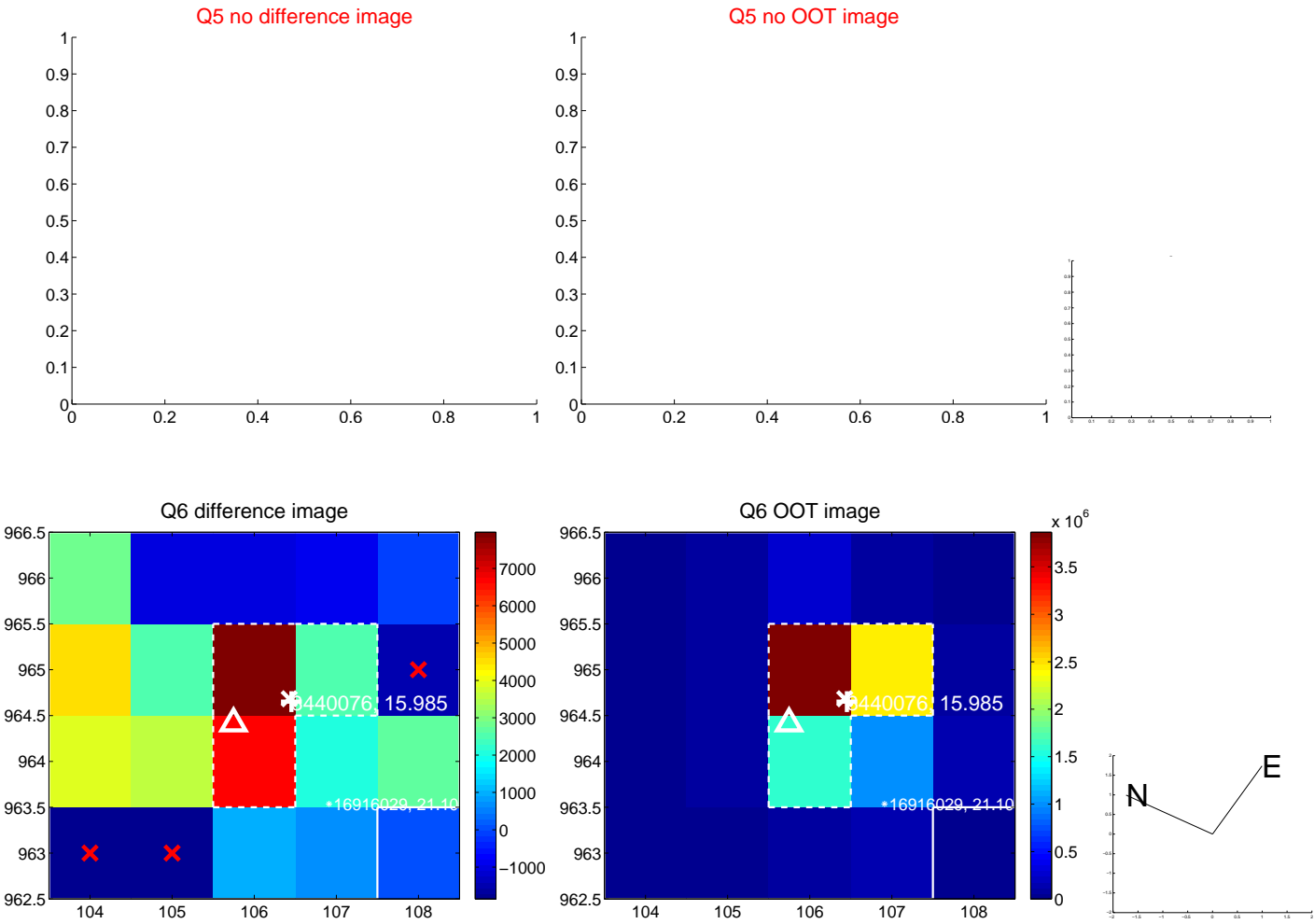


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

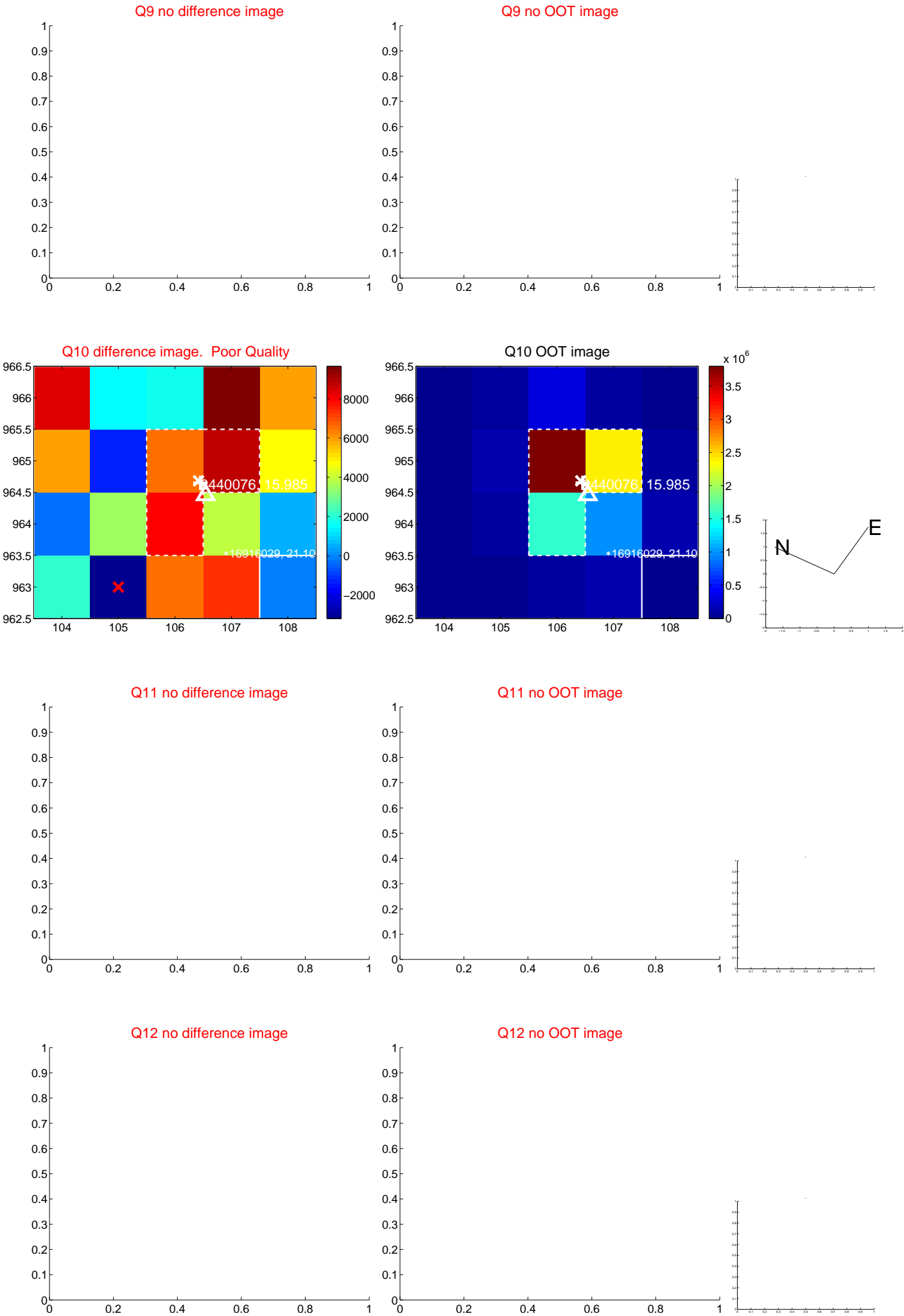
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



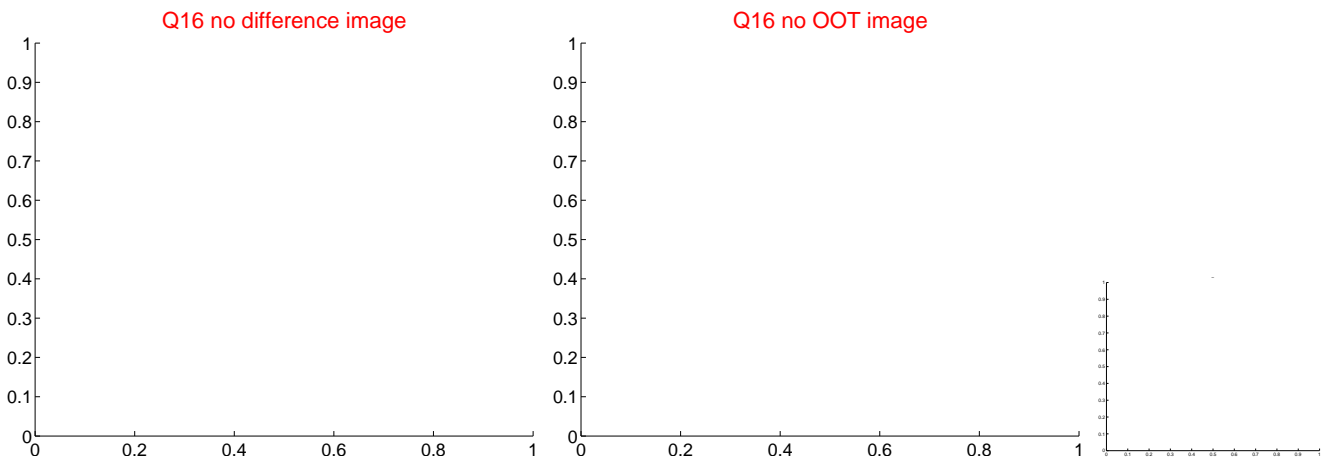
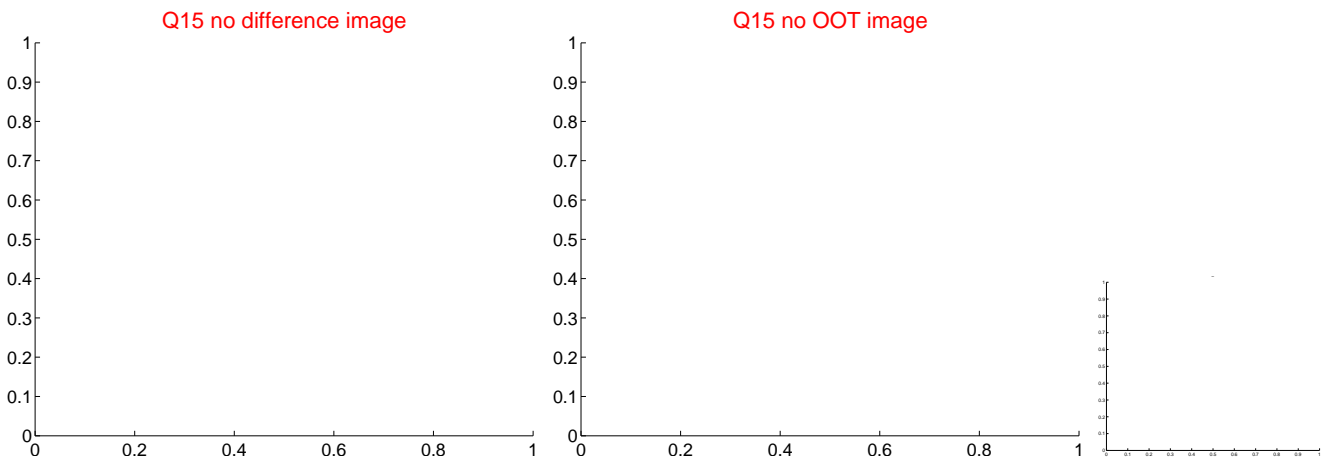
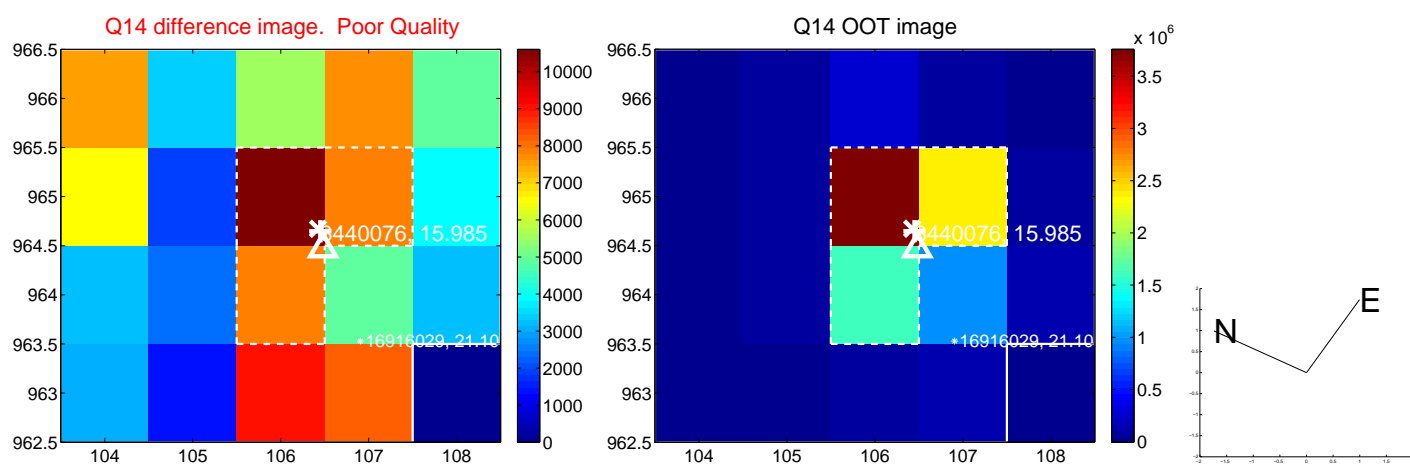
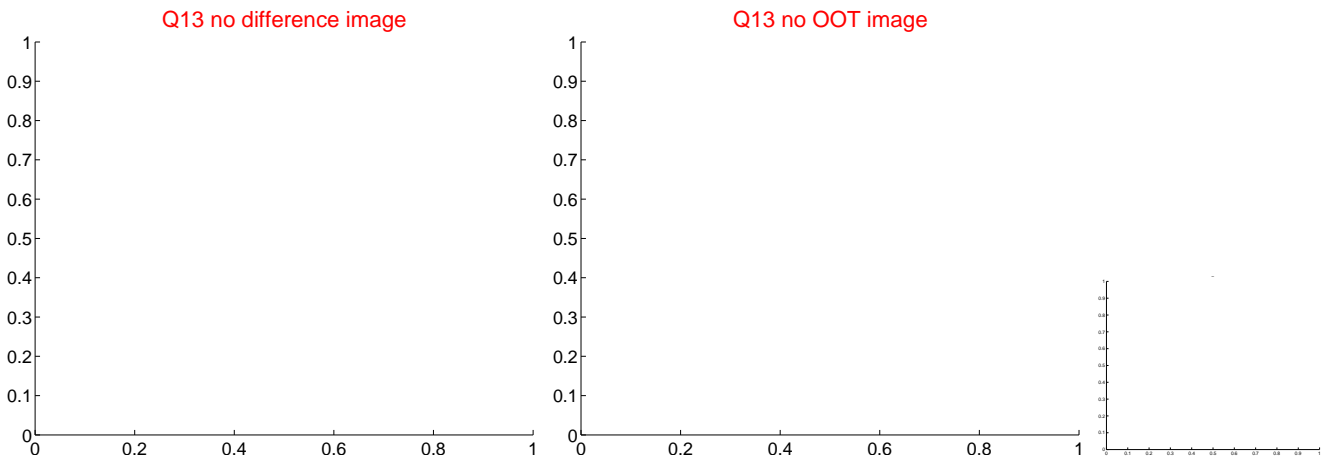
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



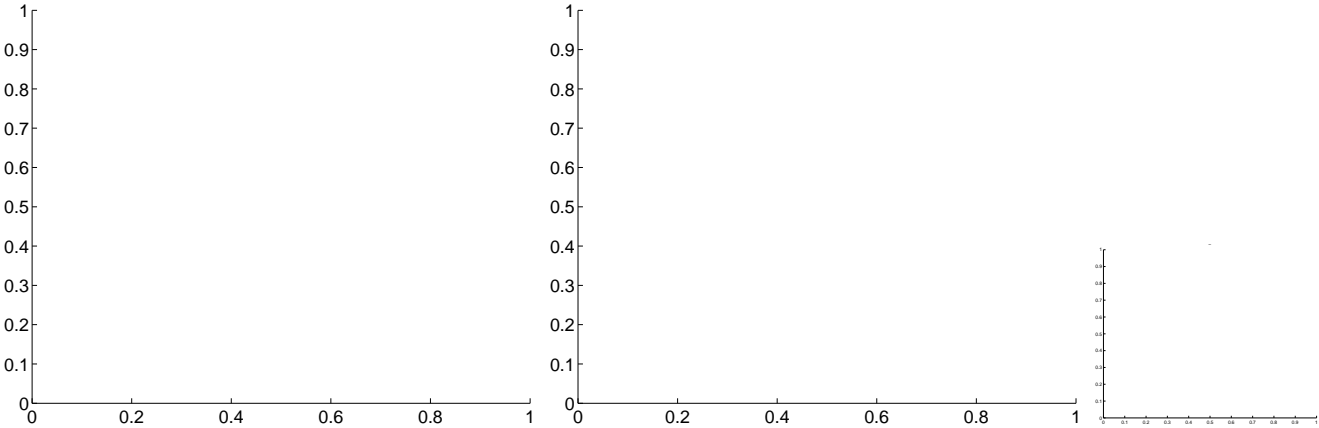
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



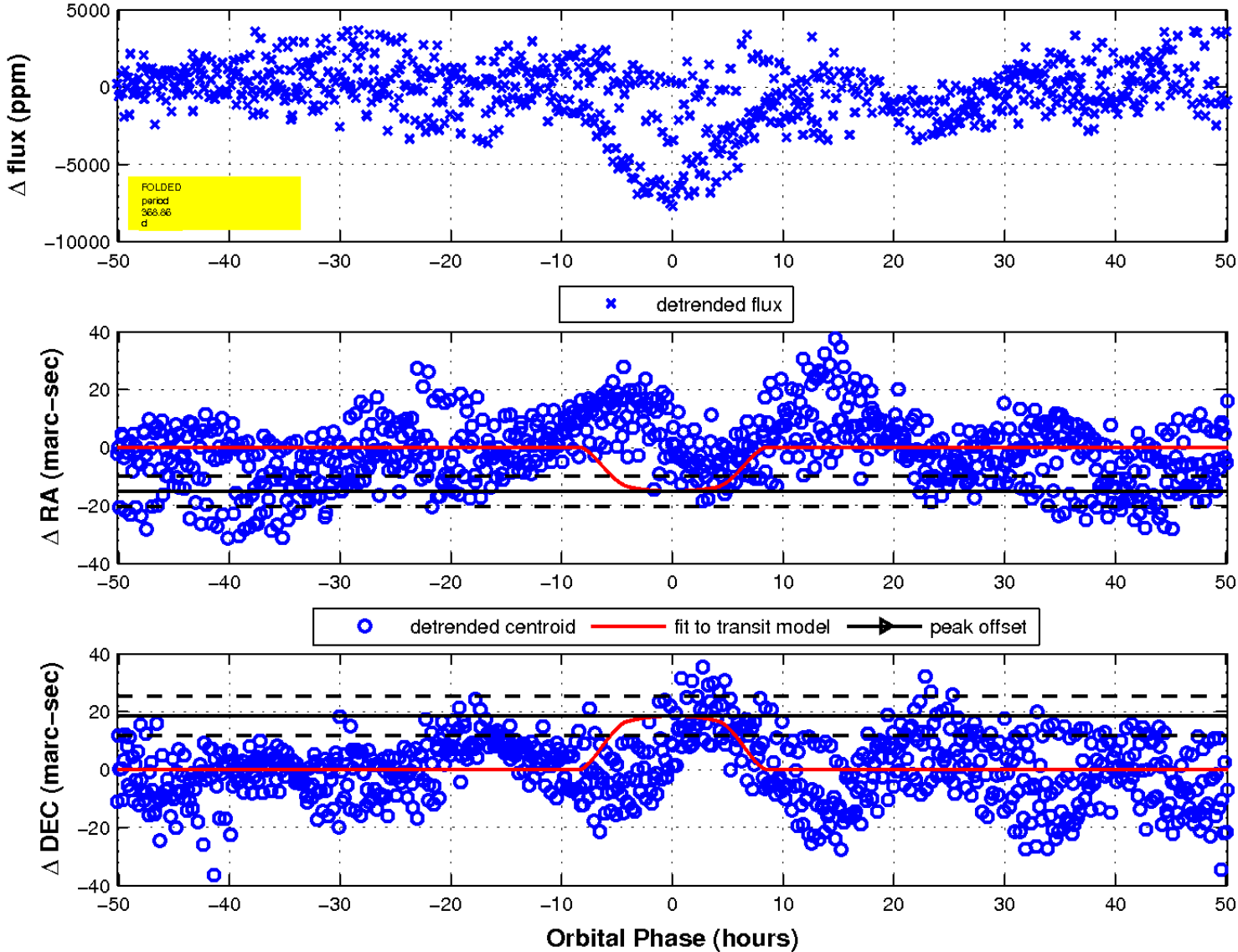
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

Q17 no difference image

Q17 no OOT image

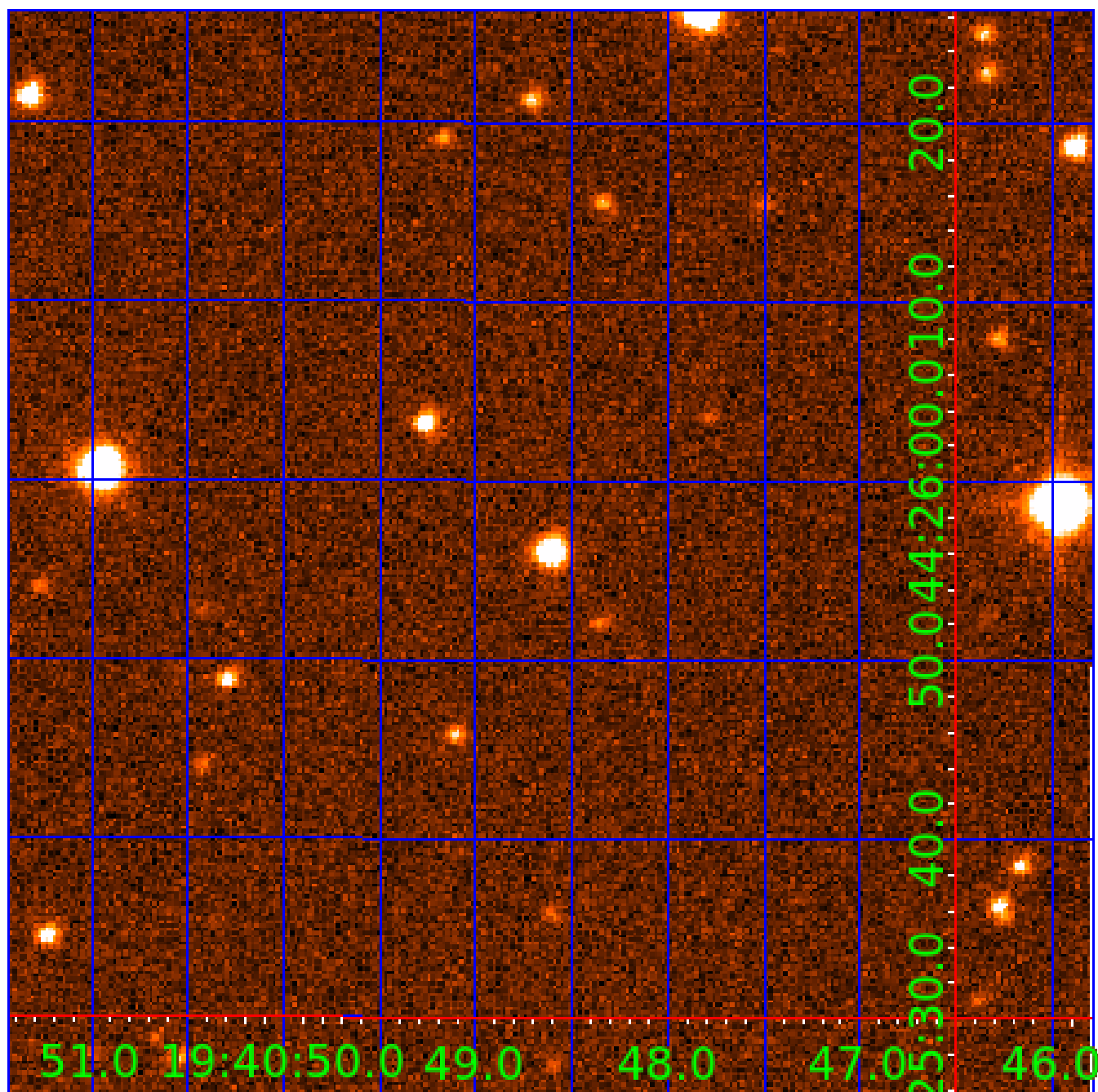


fluxWeightedCentroids, Planet 2 of 4



UKIRT Image

Declination



# KIC 008440076

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
008440076-01	OBS	No	369.152658	233.773061	1610.3	18.736	7.3	8.4	0.88	5767	4.37	0.77
008440076-02	OBS	No	368.858364	178.947810	2911.7	16.730	9.0	9.4	0.88	5767	5.64	0.77
008440076-03	OBS	No	393.464873	158.795088	2814.8	20.101	8.9	9.6	0.88	5767	5.96	0.71
008440076-04	OBS	No	191.332540	160.159401	1531.6	13.762	7.7	7.3	0.88	5767	4.13	1.85

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
008440076-01	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_CHASES_MARSHALL_SKYE—INCONSISTENT_TRANS—CENT_FEW_DIFFS—HALO_GHOST
008440076-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL_SKYE—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT—CENT_FEW_DIFFS
008440076-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL_SKYE—INCONSISTENT_TRANS—CENT_FEW_DIFFS
008440076-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL_SKYE—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.

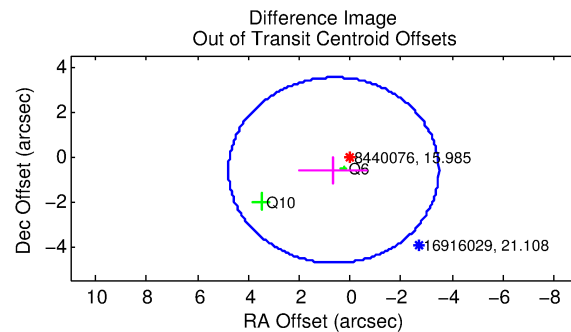
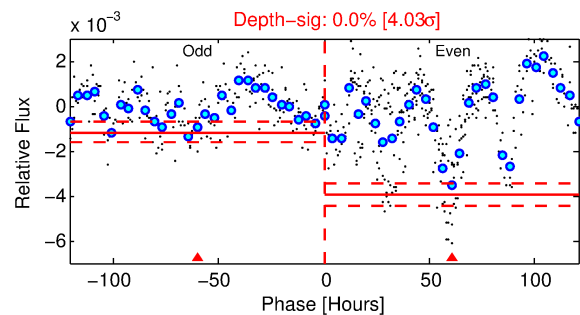
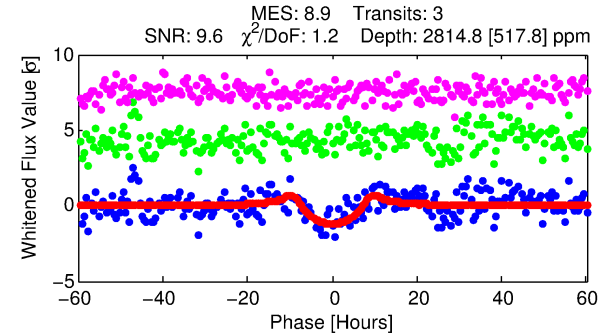
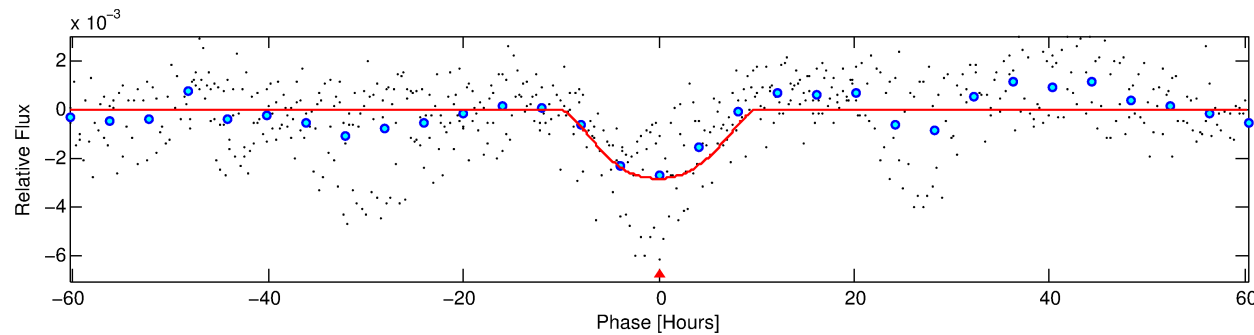
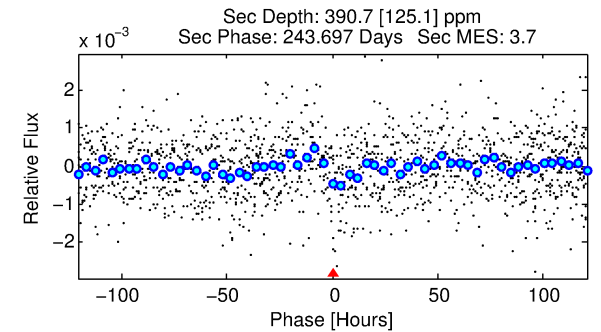
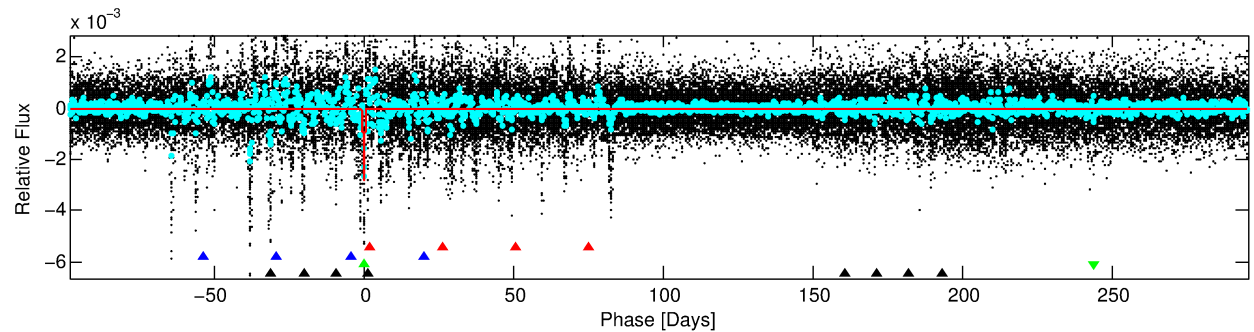
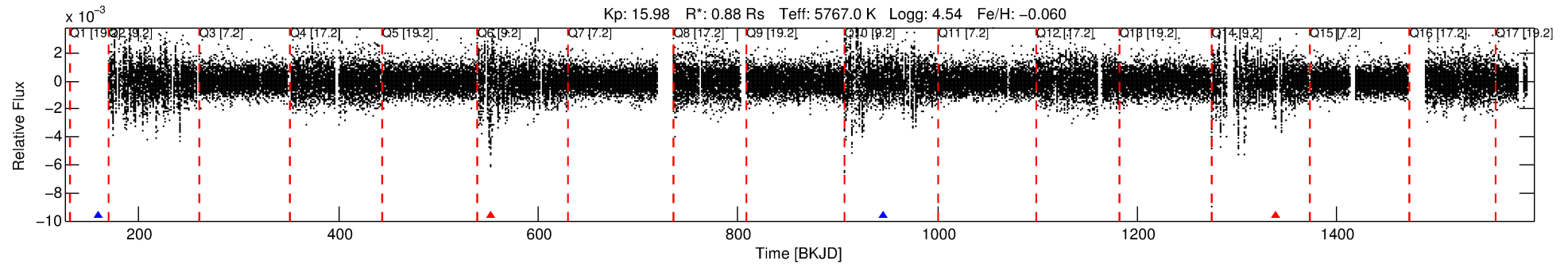
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 008440076-03

No Significant Match Found

# DV One-Page Summary

KIC: 8440076 Candidate: 3 of 4 Period: 393.465 d



## DV Fit Results:

Period = 393.46487 [0.02552] d  
Epoch = 158.7951 [0.0619] BKJD  
Rp/R\* = 0.0620 [0.0114]  
a/R\* = 73.09 [10.76]  
b = 0.94 [0.03]  
Seff = 0.71 [0.26]  
Teq = 234 [22] K  
Rp = 5.96 [2.07] Re  
a = 1.0430 [0.2564] AU  
Ag = 6574.90 [3964.95] [1.66σ]  
Teffp = 3255 [409] K [7.38σ]

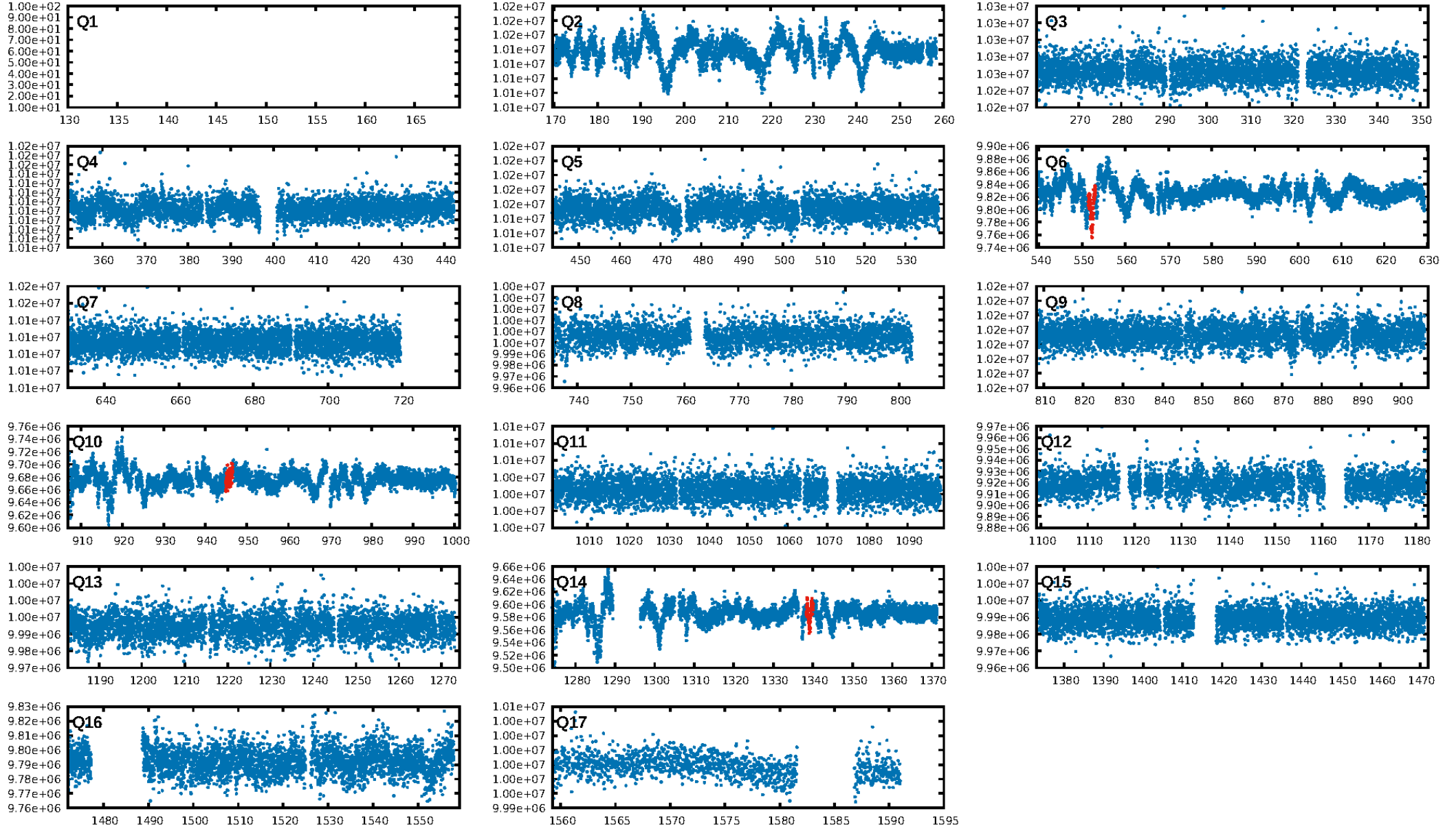
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [21.23σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 0.0%  
ModelChiSquareGof-sig: 89.5%  
Bootstrap-pfa: 2.43e-10  
RollingBand-fgt: 0.33 [1/3]  
GhostDiagnostic-chr: 2.511  
Centroid-sig: 0.2%  
Centroid-so: 4.602 arcsec [2.19σ]  
OotOffset-rm: 0.890 arcsec [0.65σ]  
KicOffset-rm: 0.969 arcsec [0.75σ]  
OotOffset-st: 2/0/0 [2]  
KicOffset-st: 2/0/0 [2]  
DiffImageQuality-fgm: 0.00 [0/2]  
DiffImageOverlap-fno: 1.00 [2/2]

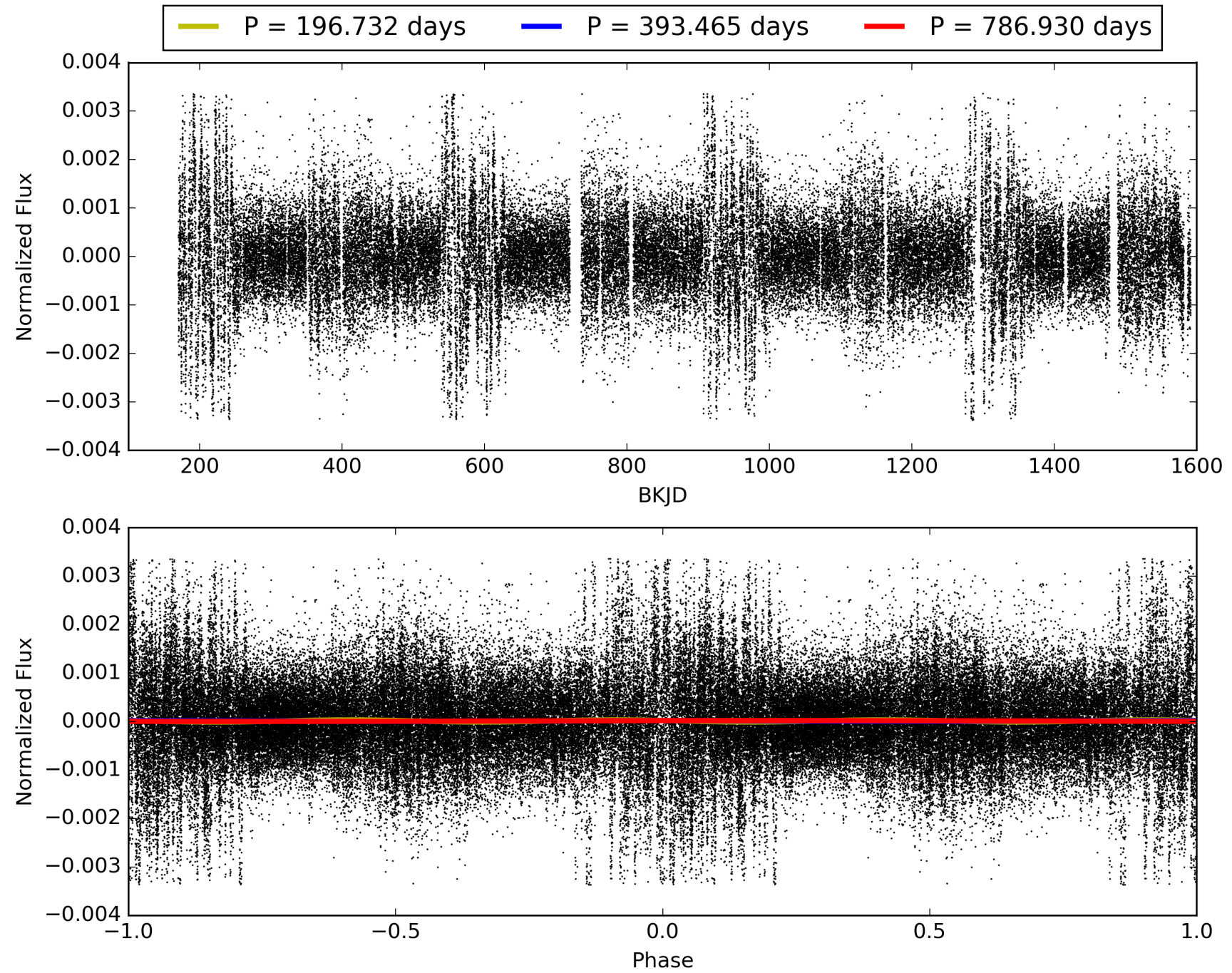
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 29-Jan-2016 12:53:43 Z

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

# TCE 008440076-03, PDC Light Curves

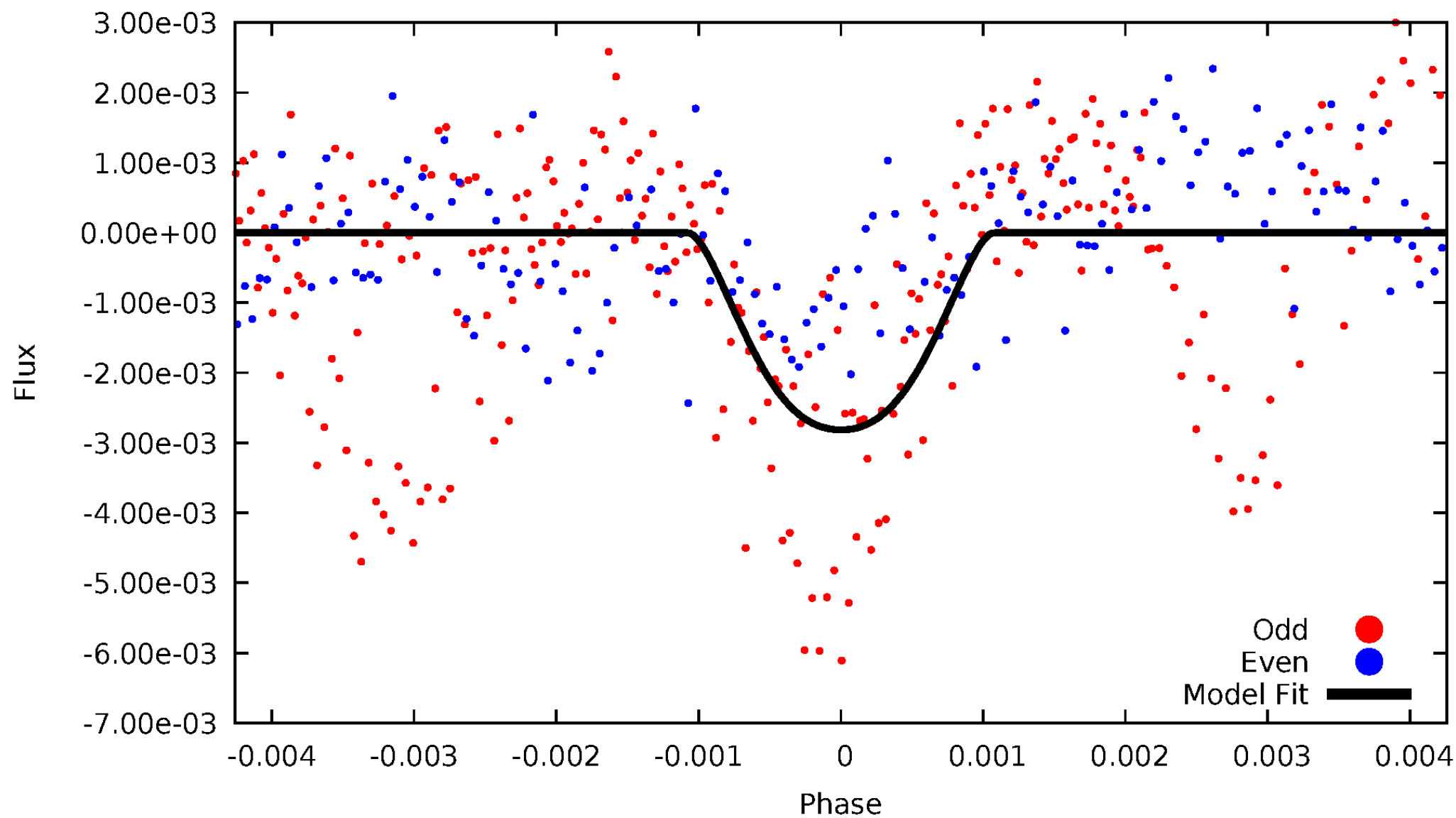


TCE 008440076-03



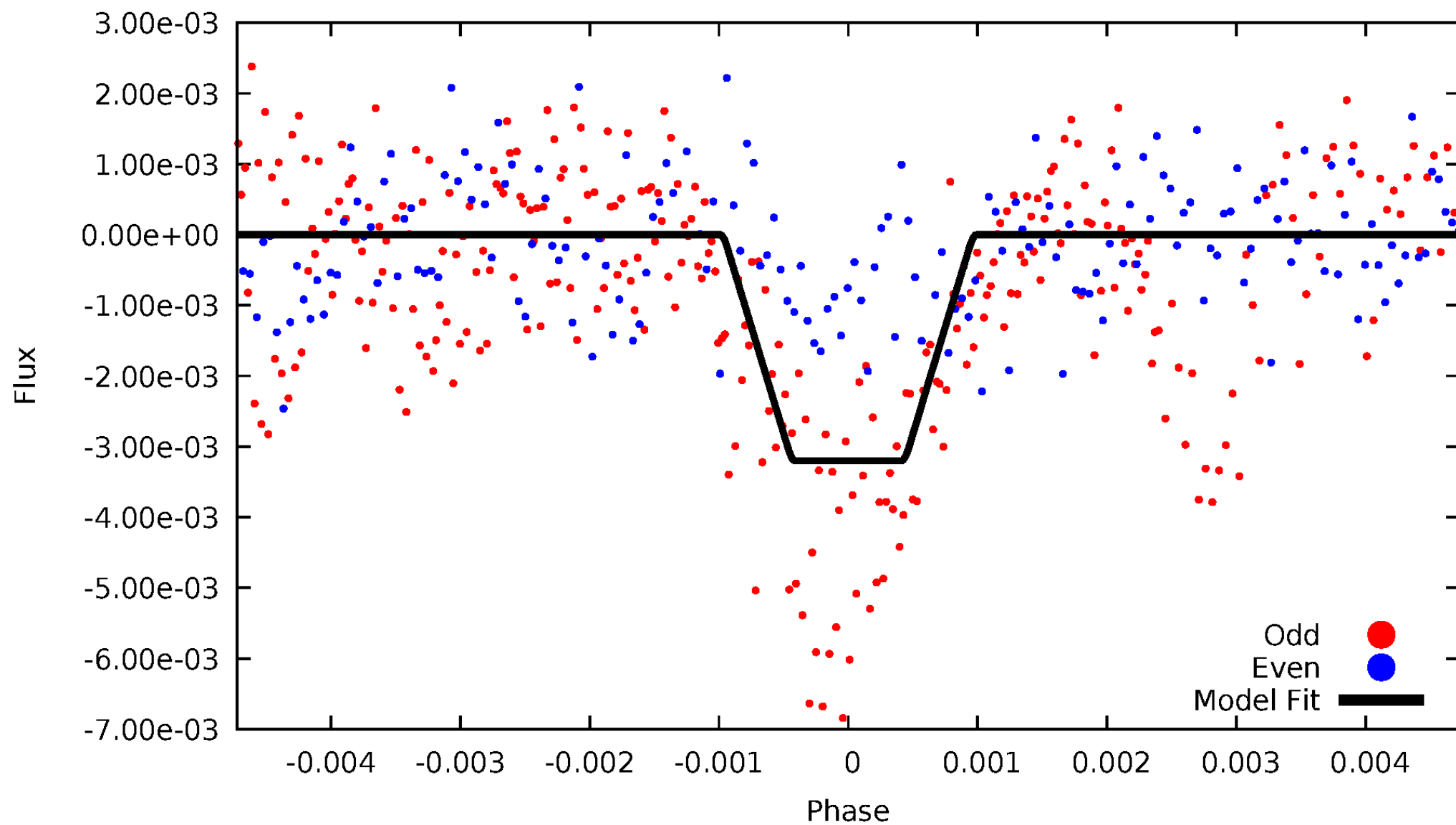
# DV Odd/Even

TCE 008440076-03

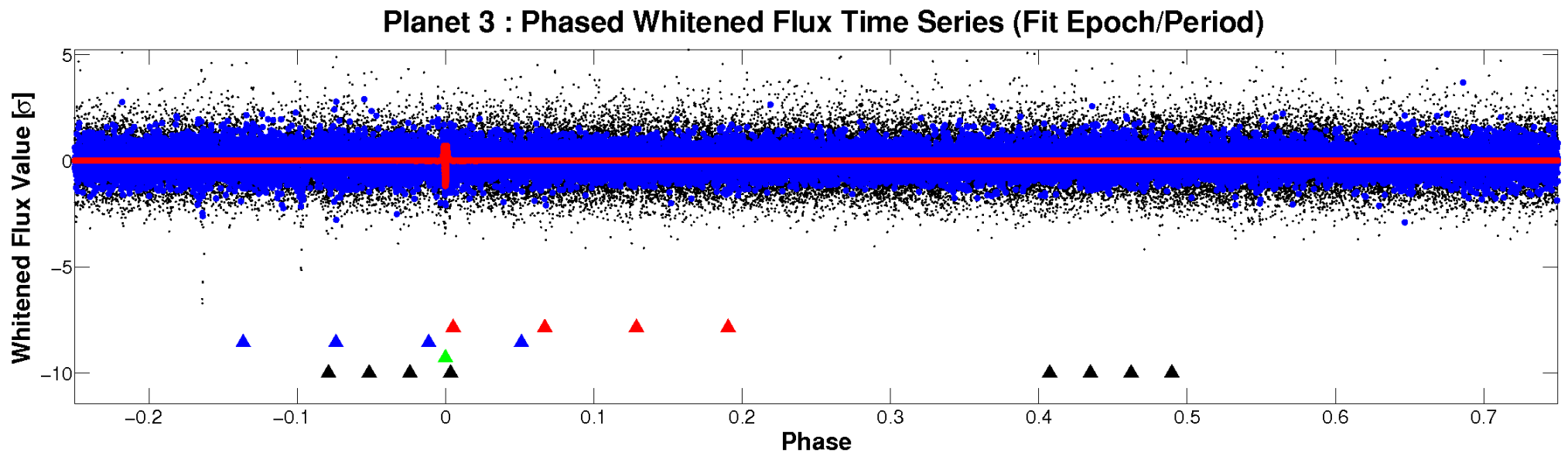
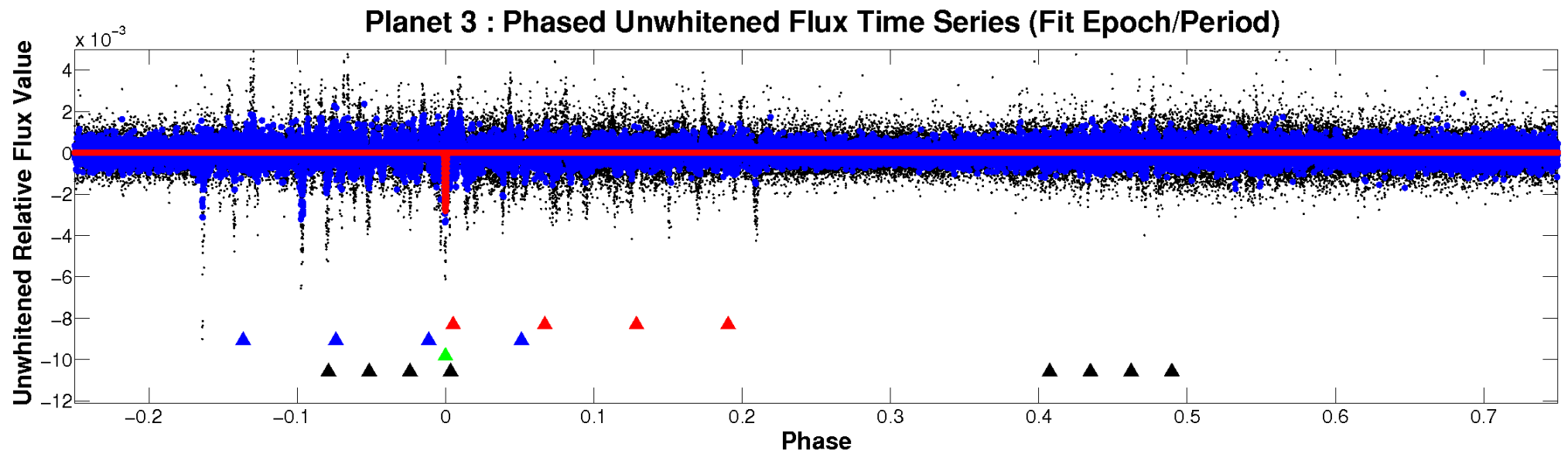


# ALT Odd/Even

TCE 008440076-03

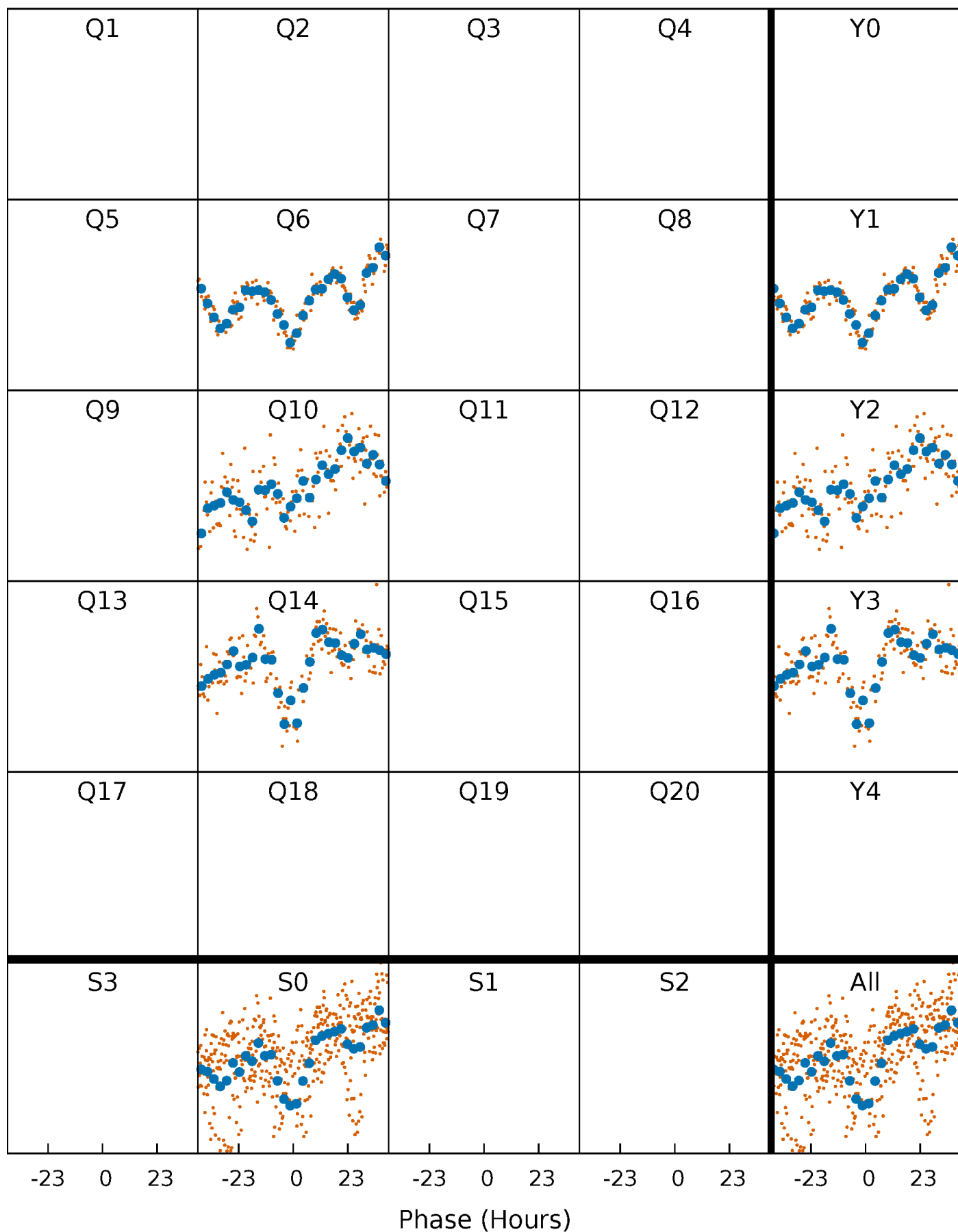


# Non-Whitened Vs. Whitened Light Curve



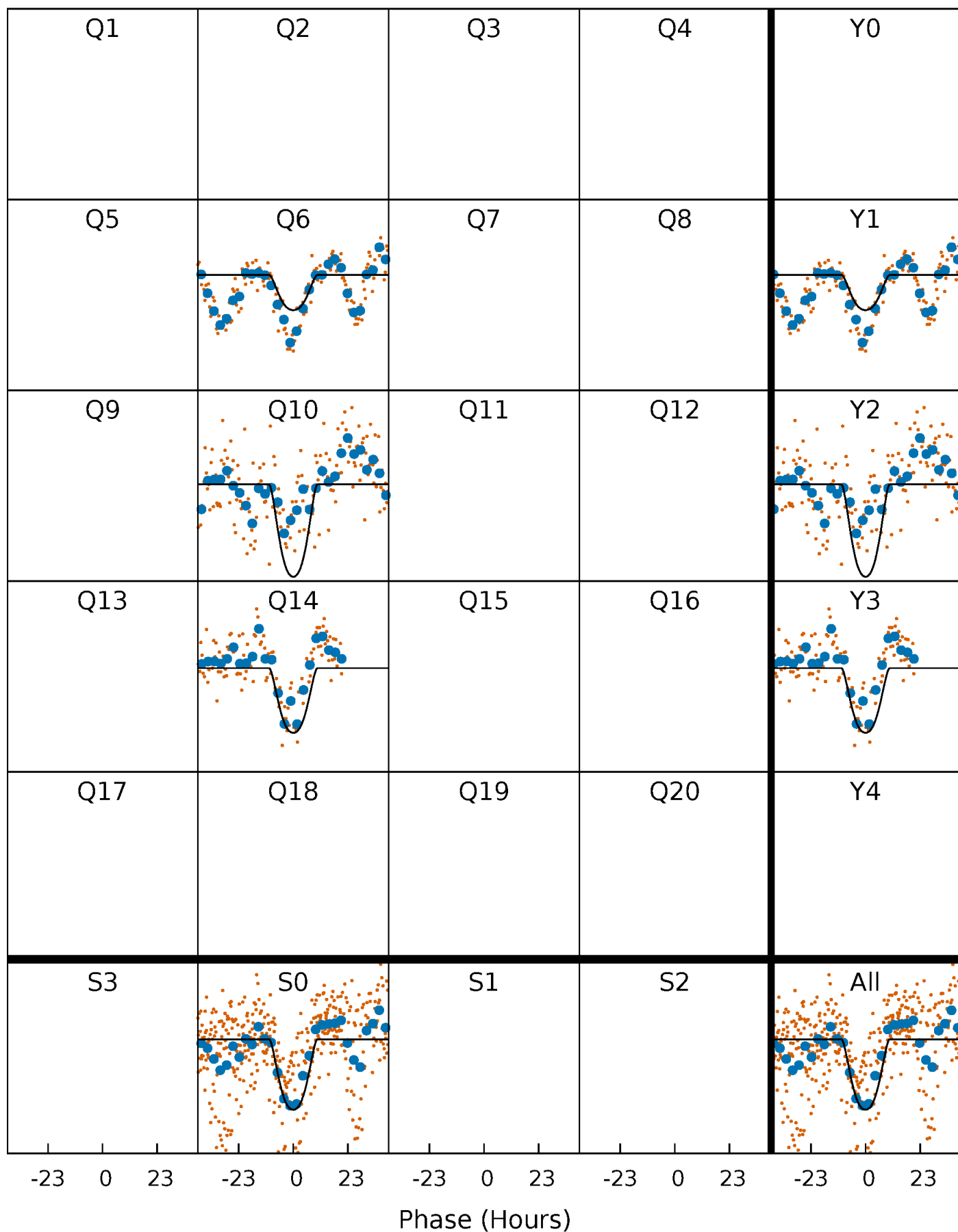
# PDC Quarter-Phased Transit Curves

TCE 008440076-03     $P=393.464873$  Days     $T_0=158.795088$  (BKJD)



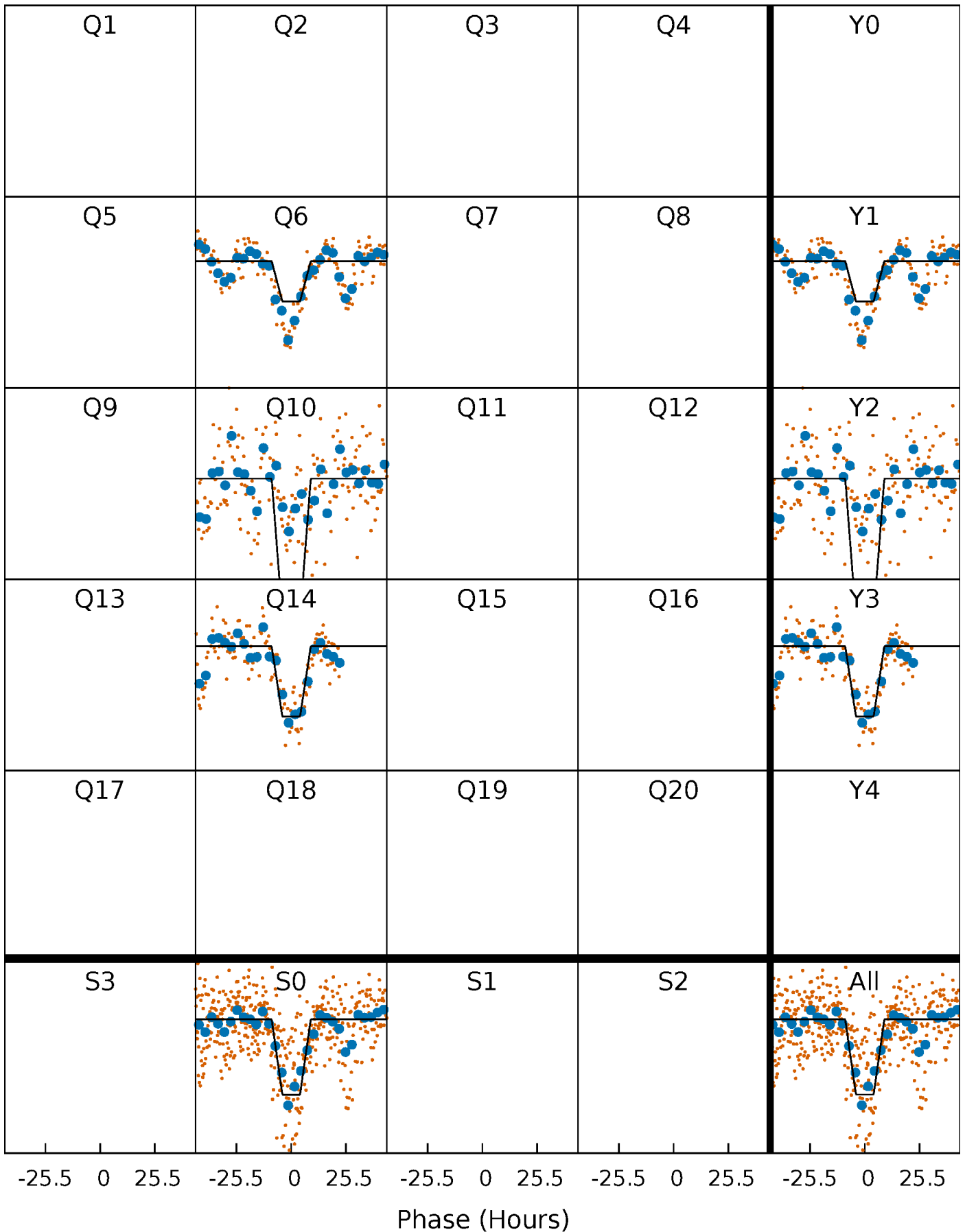
# DV Quarter-Phased Transit Curves

TCE 008440076-03     $P=393.464873$  Days     $T_0=158.795088$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

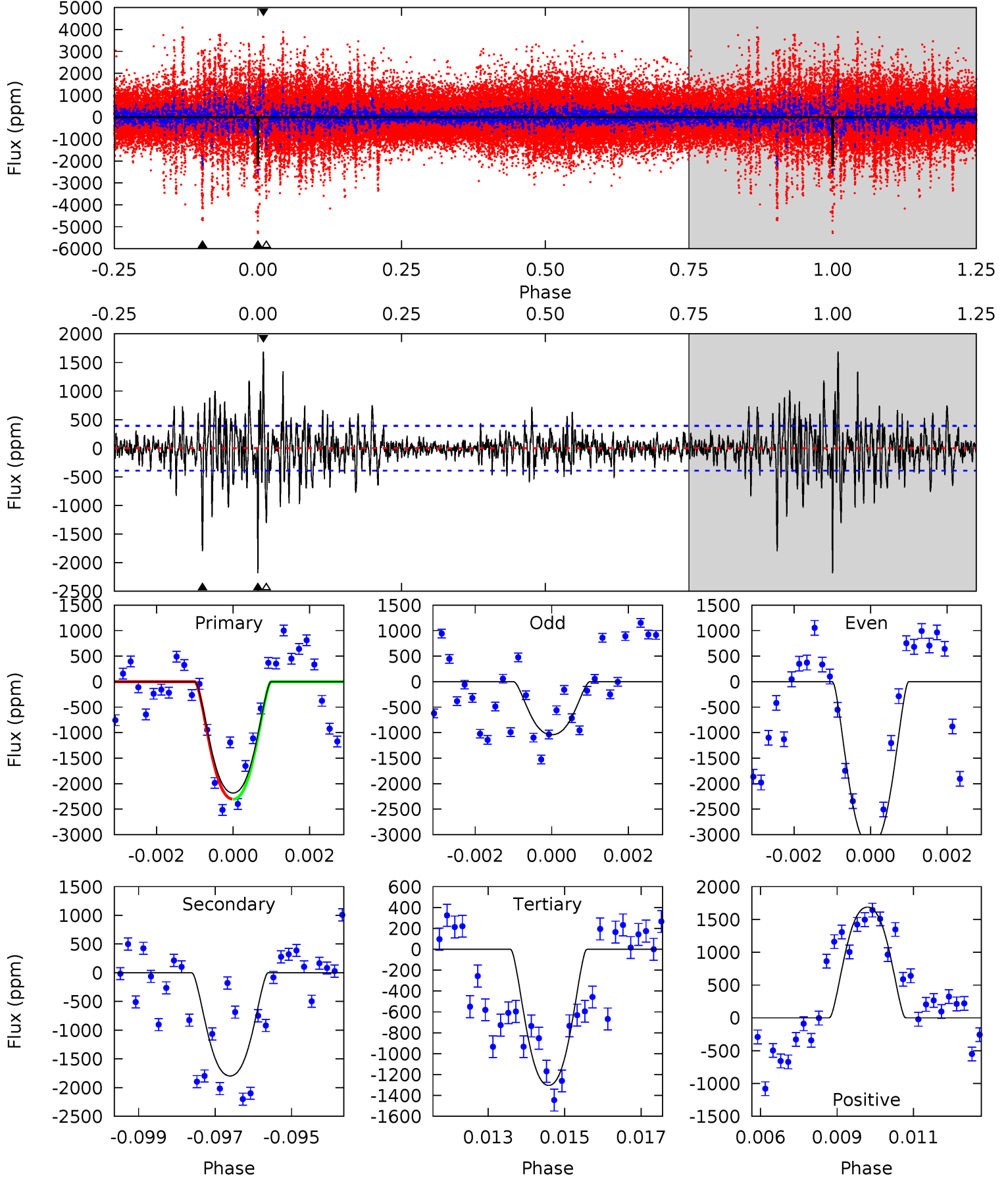
TCE 008440076-03 P=393.414142 Days  $T_0=158.864451$  (BKJD)



# DV Model-Shift Uniqueness Test

008440076-03, P = 393.464873 Days, E = 158.795088 Days

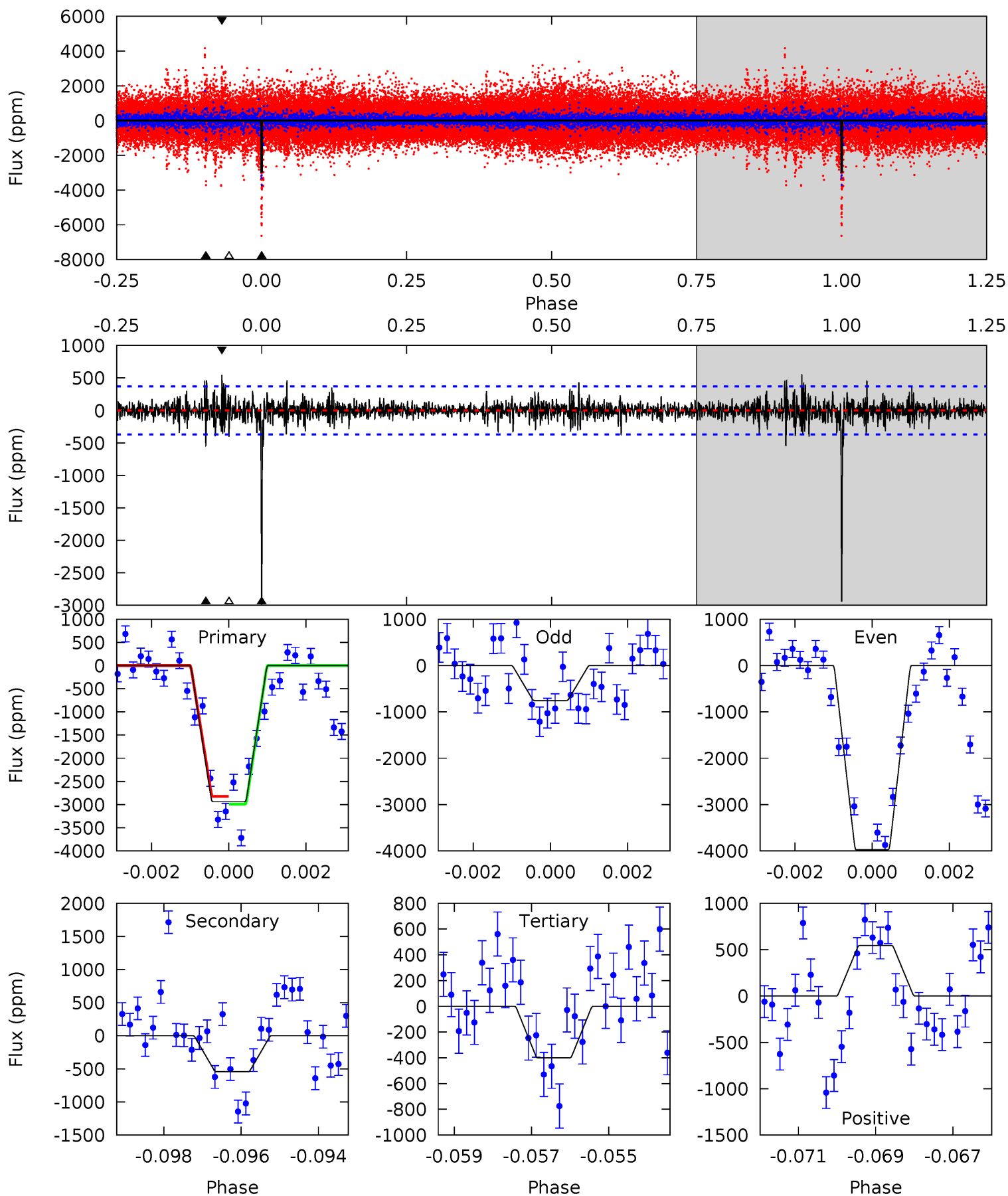
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
29.6	24.3	17.7	22.9	5.31	3.07	3.45	11.9	6.71	6.68	1.49	13.9	1.30	0.44	0.02



# Alt Model-Shift Uniqueness Test

008440076-03, P = 393.414142 Days, E = 158.864451 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
42.4	7.82	5.77	7.86	5.33	3.10	1.36	36.6	34.5	2.05	-0.03	22.4	0.94	0.16	1.20



### Stellar Parameters For KIC 008440076

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5767^{+156}_{-173}$	$4.538^{+0.036}_{-0.192}$	$-0.060^{+0.300}_{-0.300}$	$0.881^{+0.260}_{-0.081}$	$0.979^{+0.102}_{-0.125}$	$2.017^{+0.404}_{-1.052}$
	+3%/-3%	+1%/-4%	+500%/-500%	+30%/-9%	+10%/-13%	+20%/-52%
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 008440076-03 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-1798 \pm 74$	$6.28^{+1.41}_{-1.35}$	$335^{+22}_{-15}$	$4897^{+472}_{-386}$	$27011^{+15731}_{-9021}$
Alt.	$-543 \pm 69$	$5.70^{+1.37}_{-1.21}$	$333^{+22}_{-14}$	$4011^{+356}_{-289}$	$9696^{+6244}_{-3429}$

$T_{\text{max}}$  = 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

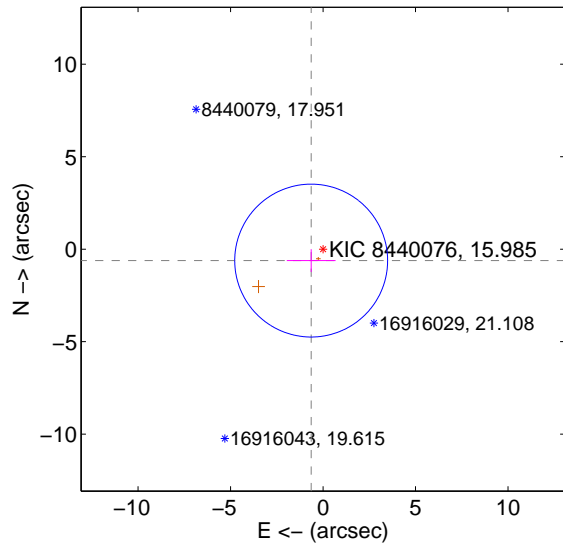
Supplemental centroid analysis for 008440076-03. Kepler magnitude: 15.98. Transit SNR 9.57

There are 0 quarters with good PRF difference image offsets

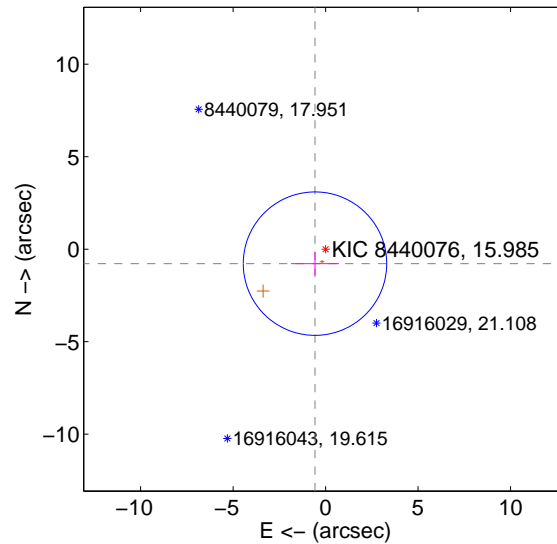
The direct PRF centroid is offset from the target star catalog position by about 0.27 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.890 \pm 1.377$	0.65	$0.641 \pm 1.321$	$-0.617 \pm 0.617$
PRF-fit source offset from KIC position	$0.969 \pm 1.292$	0.75	$0.573 \pm 1.301$	$-0.782 \pm 0.651$
photometric centroid source offset	$4.60 \pm 2.10$	2.19	$2.43 \pm 1.82$	$-3.91 \pm 2.20$

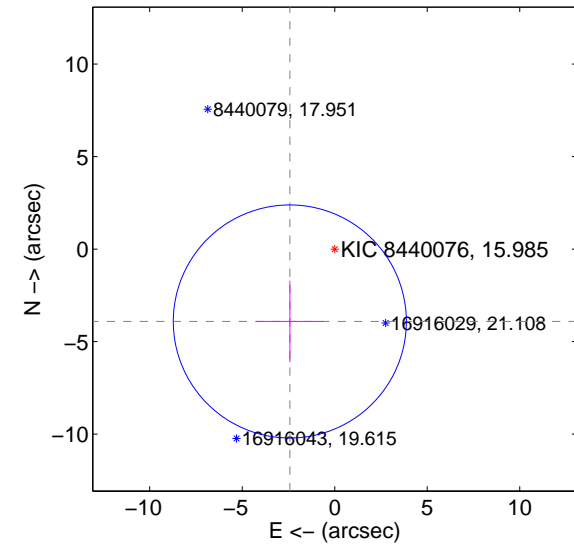
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

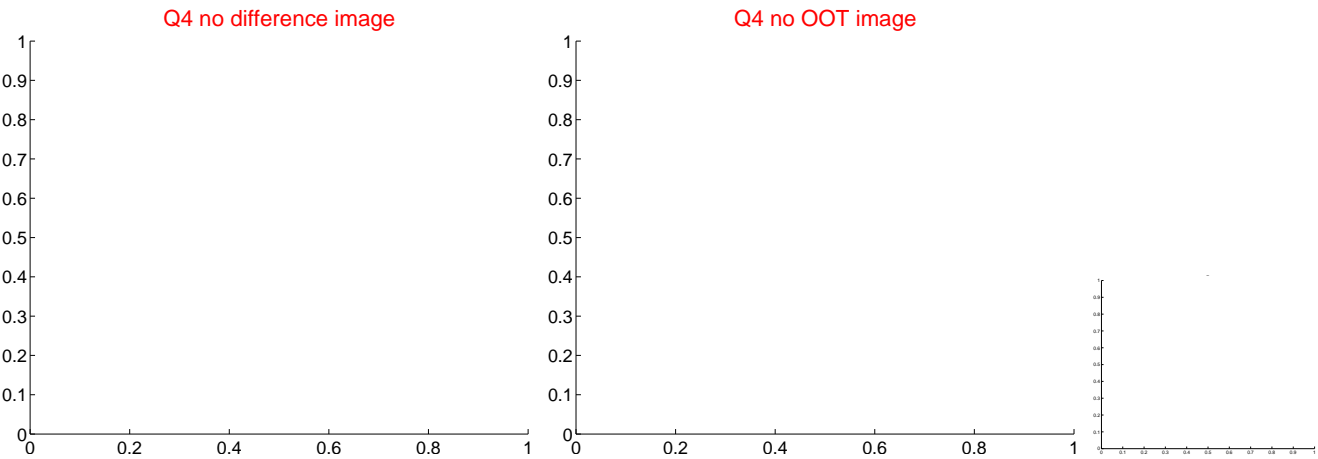
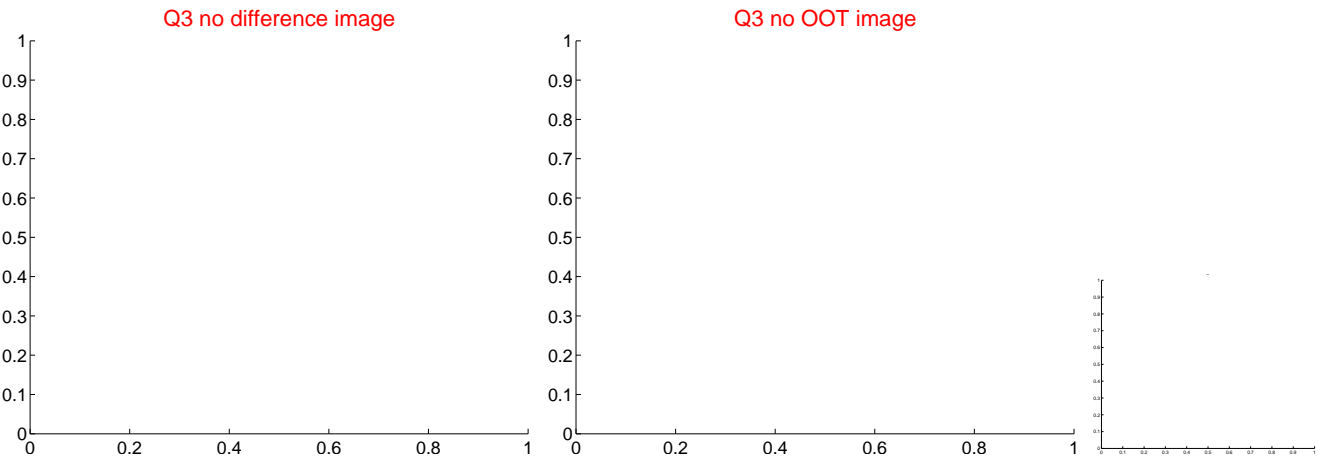
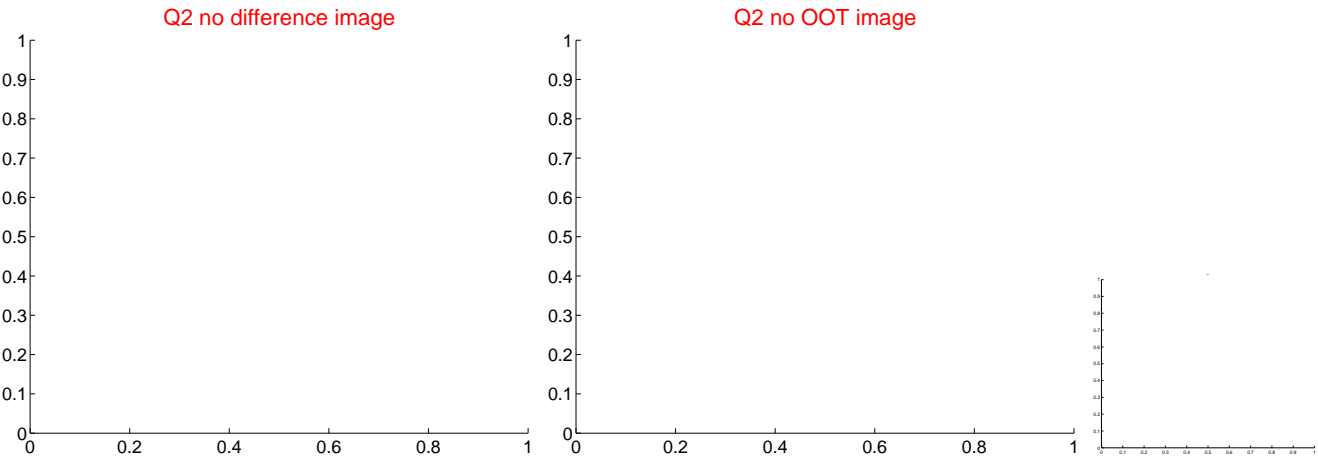
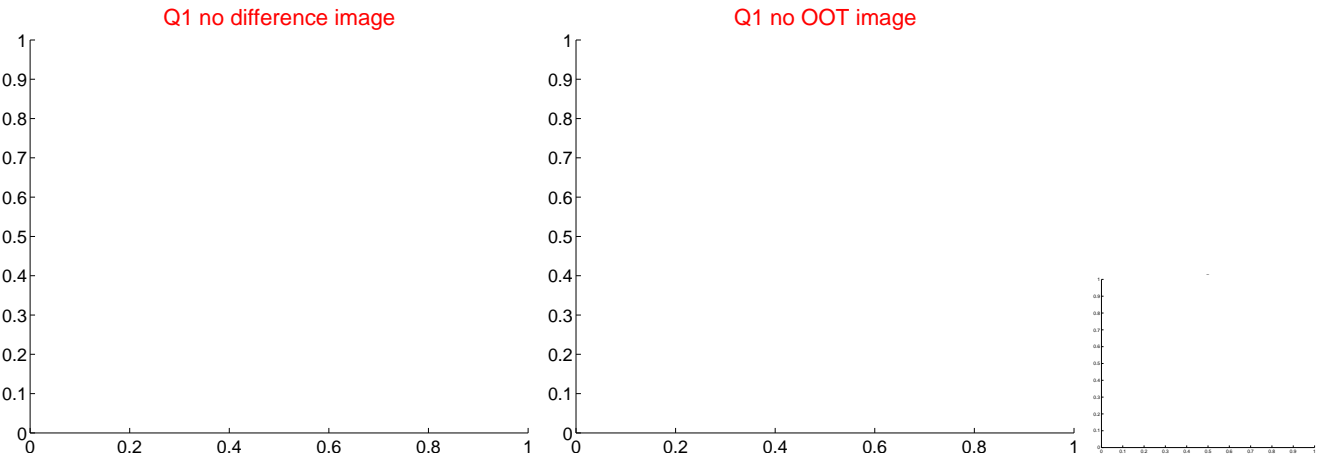


offset from photometric centroids

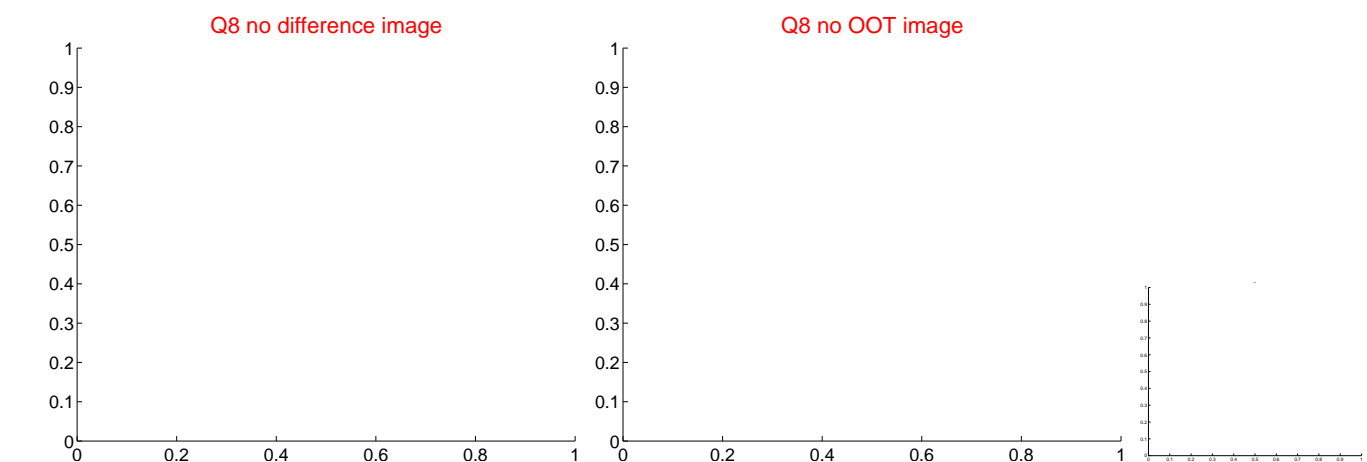
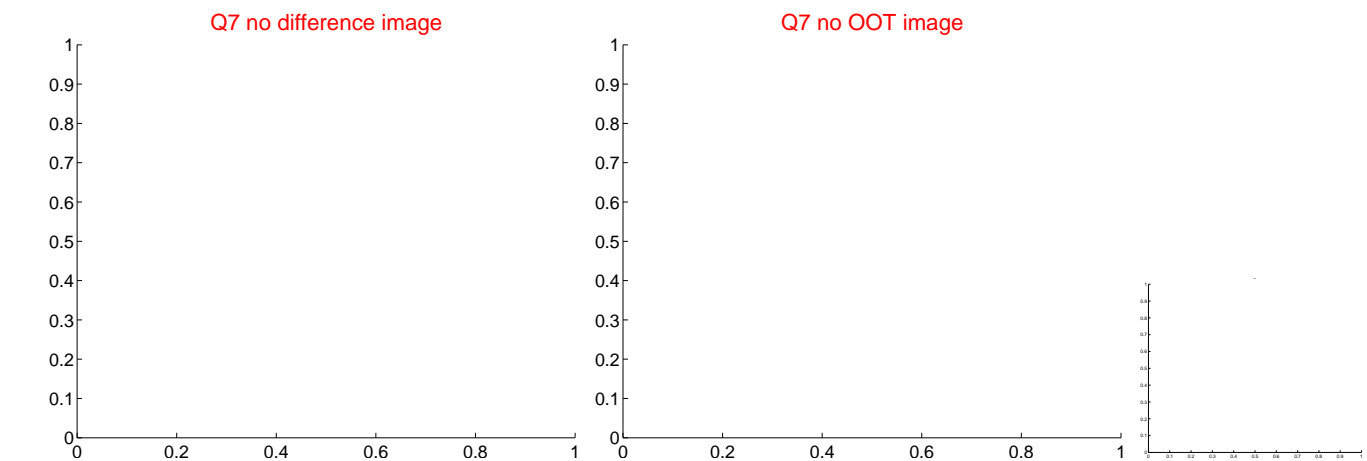
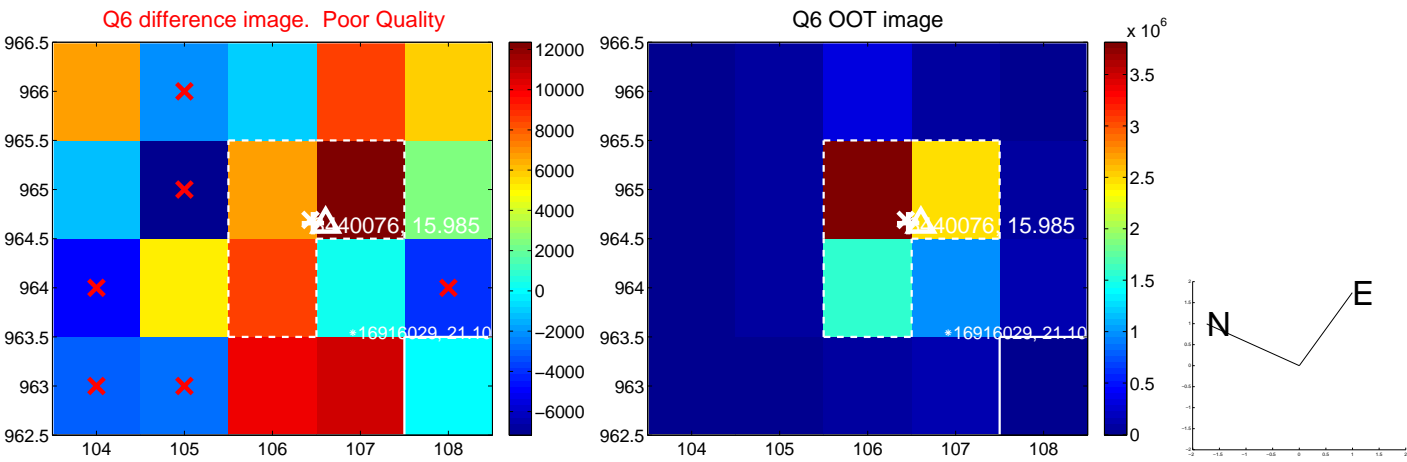
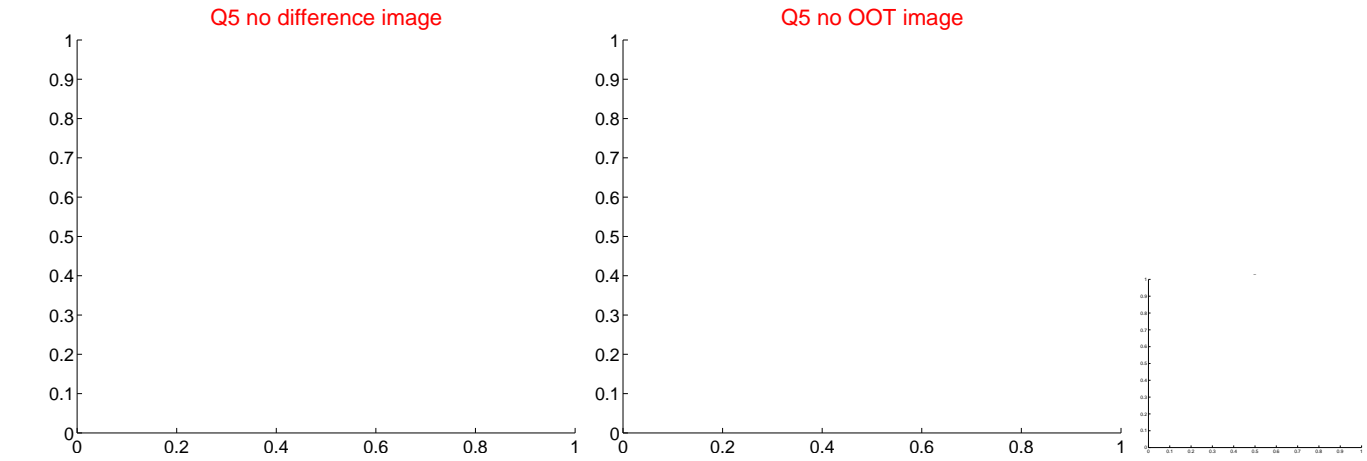


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

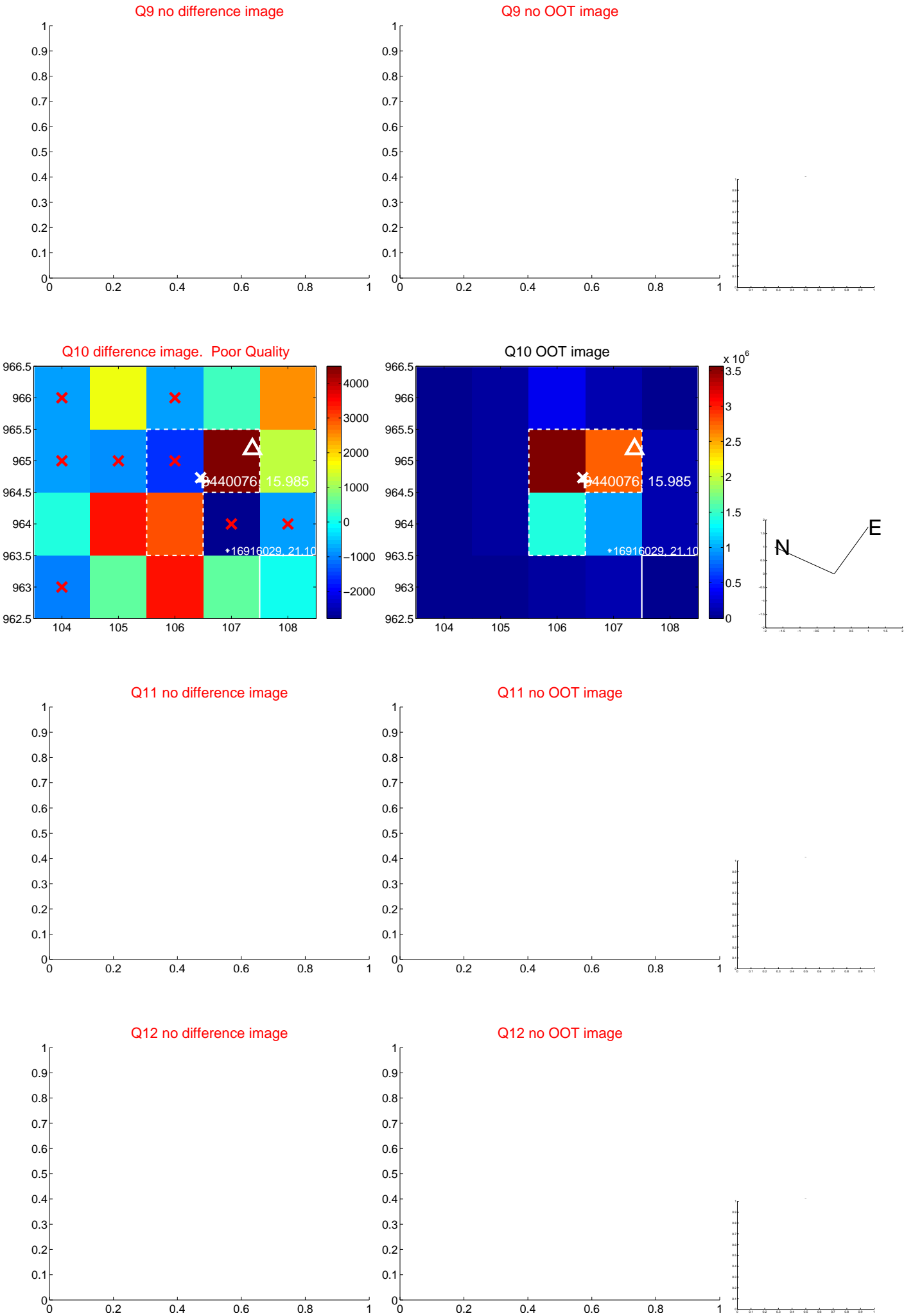
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



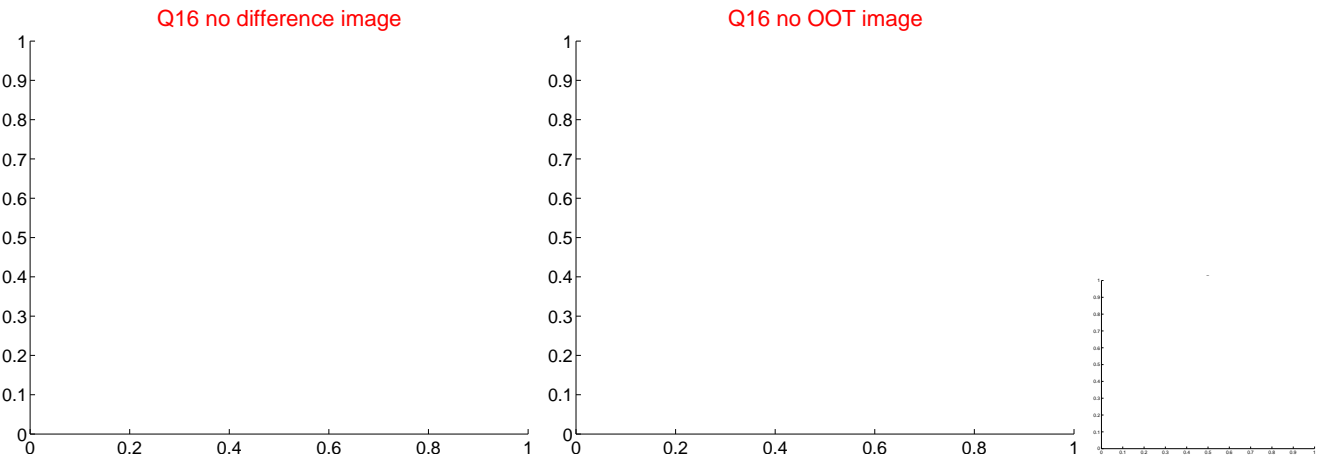
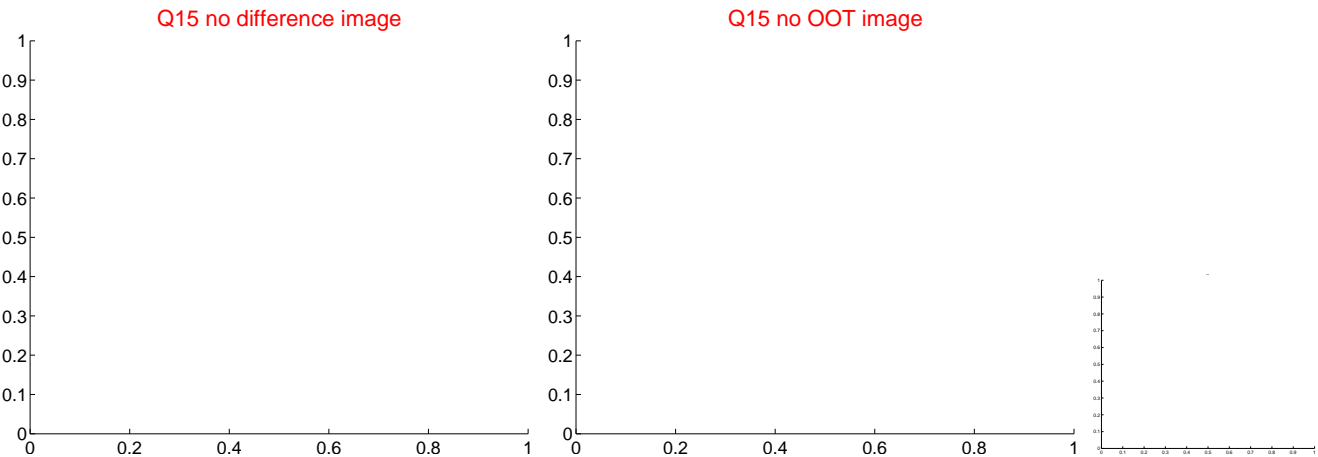
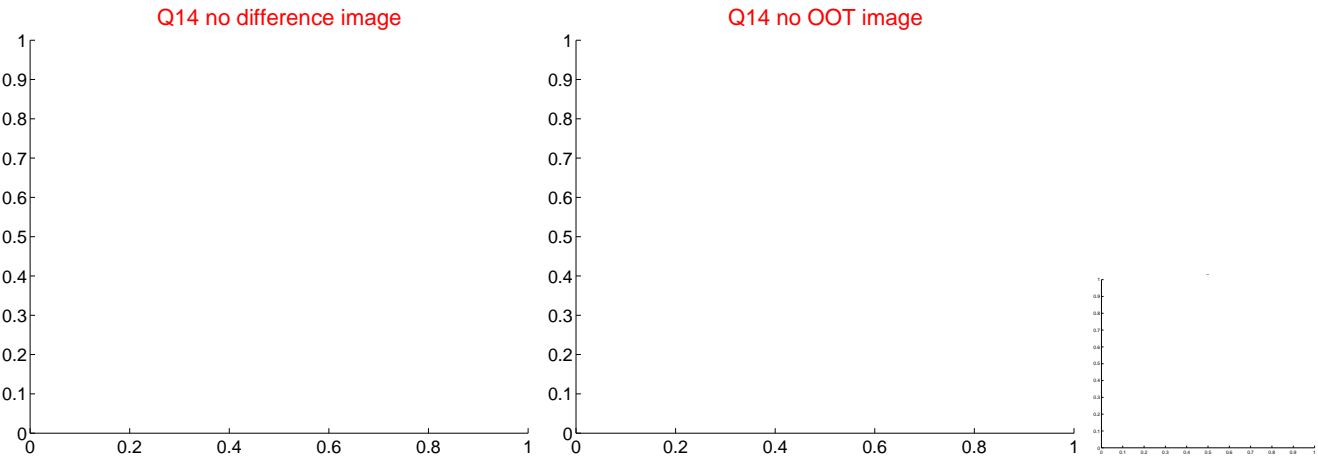
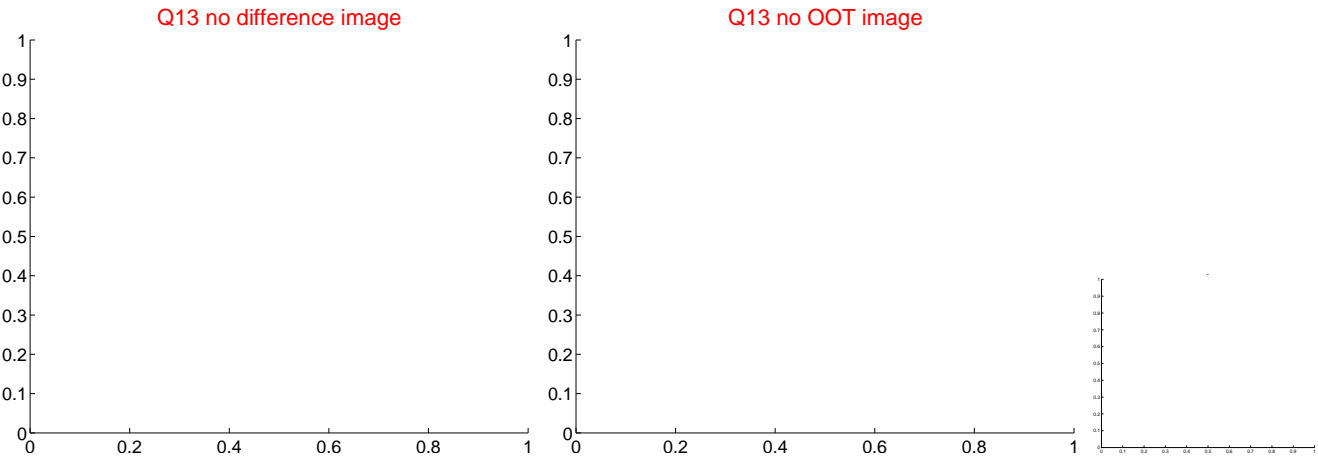
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



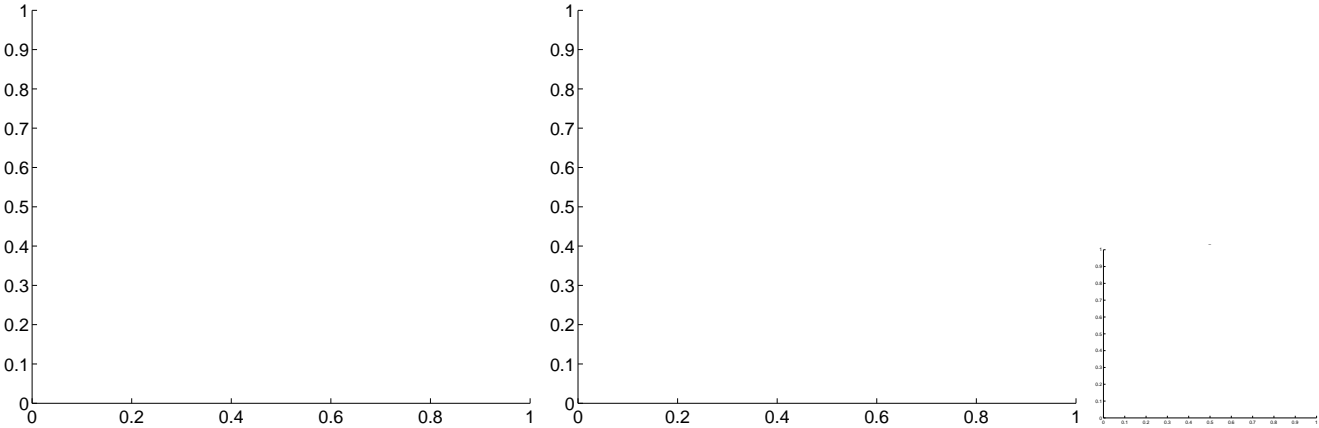
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



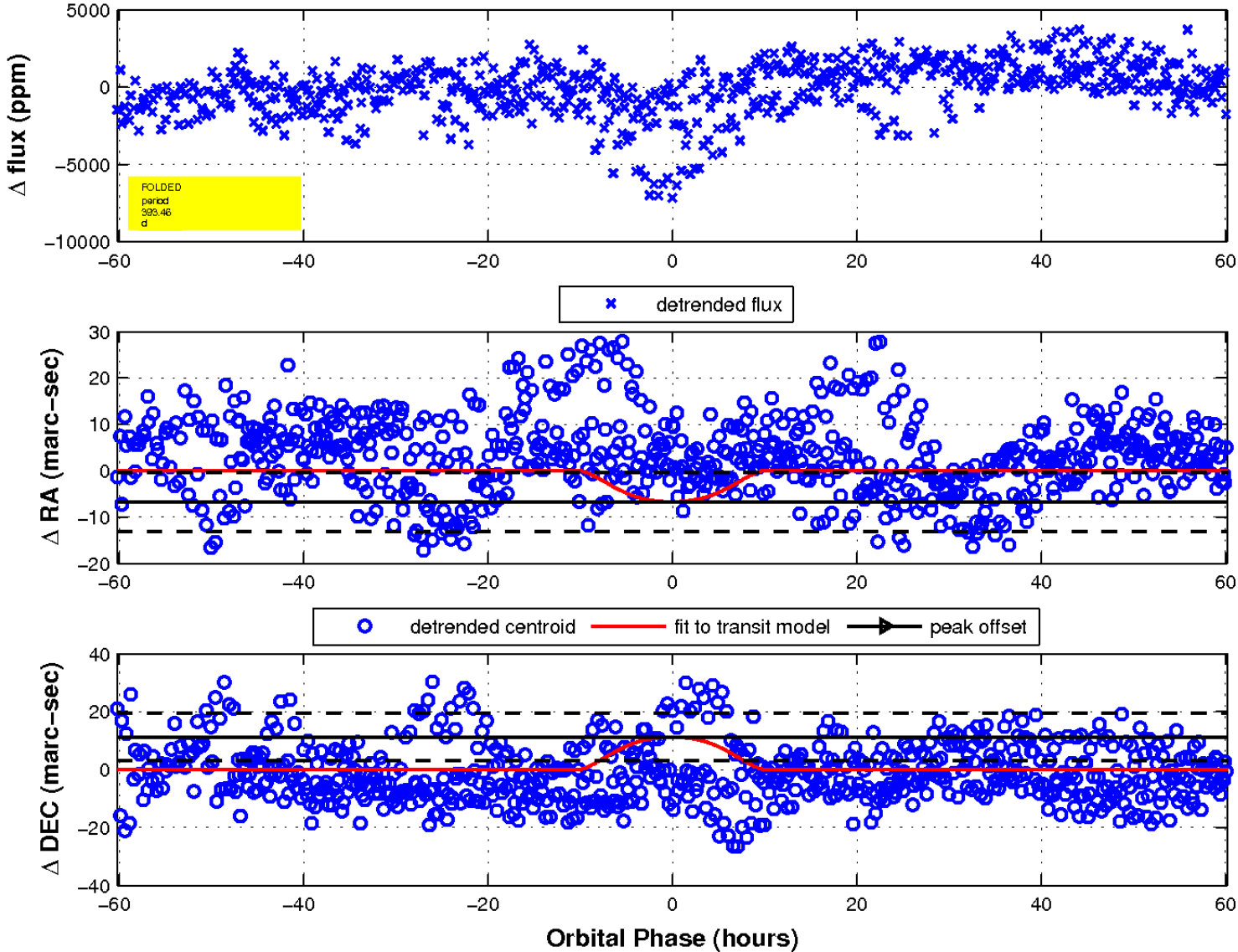
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

Q17 no difference image

Q17 no OOT image

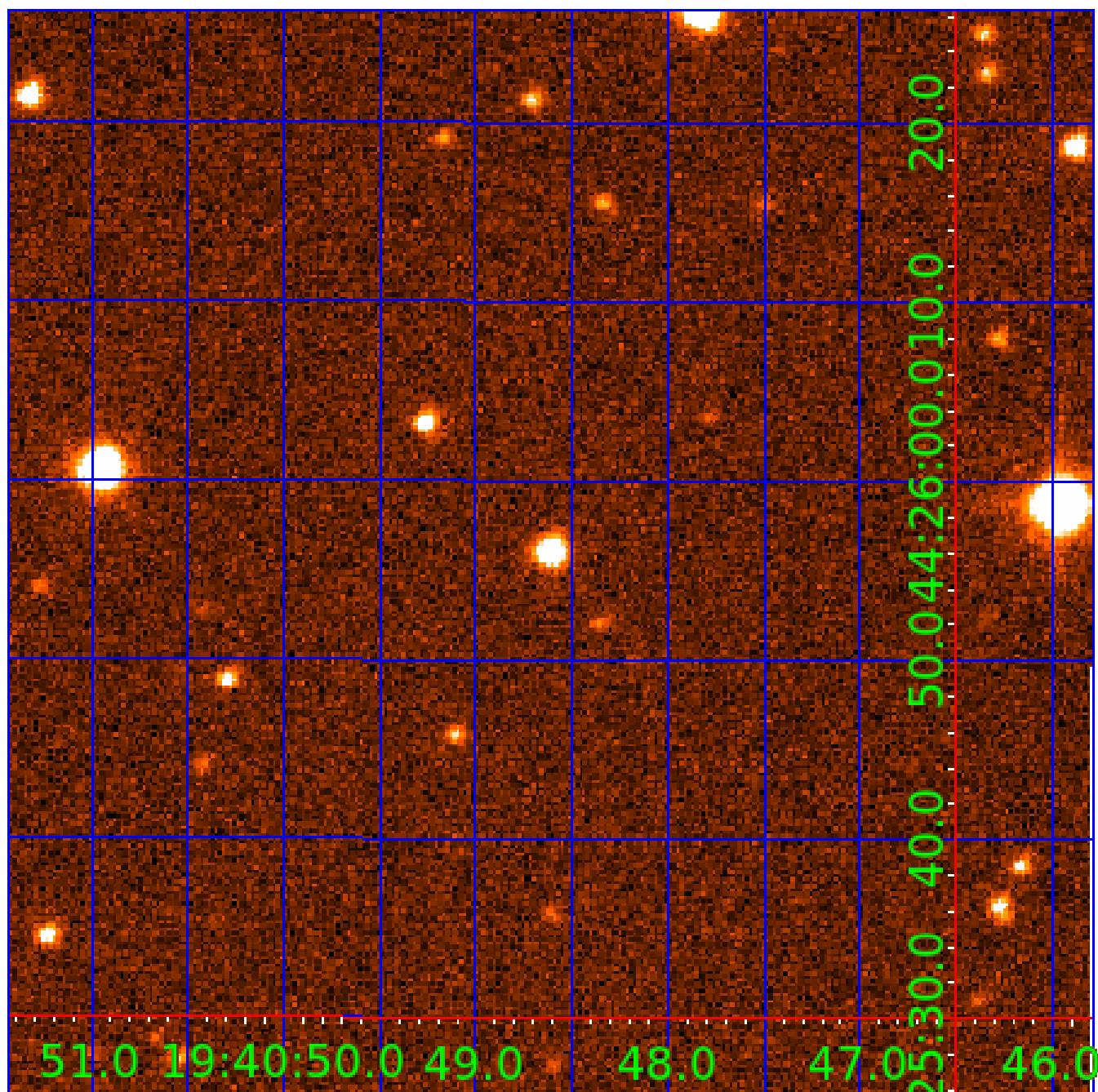


fluxWeightedCentroids, Planet 3 of 4



UKIRT Image

Declination



# KIC 008440076

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
008440076-01	OBS	No	369.152658	233.773061	1610.3	18.736	7.3	8.4	0.88	5767	4.37	0.77
008440076-02	OBS	No	368.858364	178.947810	2911.7	16.730	9.0	9.4	0.88	5767	5.64	0.77
008440076-03	OBS	No	393.464873	158.795088	2814.8	20.101	8.9	9.6	0.88	5767	5.96	0.71
008440076-04	OBS	No	191.332540	160.159401	1531.6	13.762	7.7	7.3	0.88	5767	4.13	1.85

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
008440076-01	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_CHASES_MARSHALL_SKYE—INCONSISTENT_TRANS—CENT_FEW_DIFFS—HALO_GHOST
008440076-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL_SKYE—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT—CENT_FEW_DIFFS
008440076-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL_SKYE—INCONSISTENT_TRANS—CENT_FEW_DIFFS
008440076-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_MARSHALL_SKYE—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.

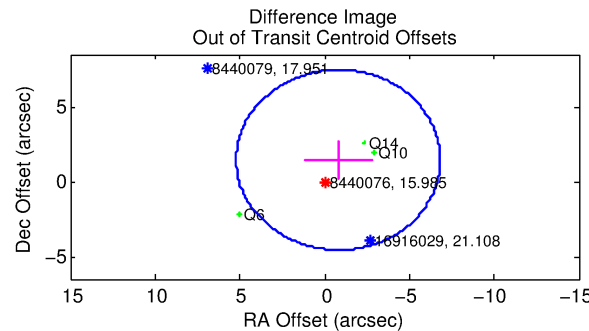
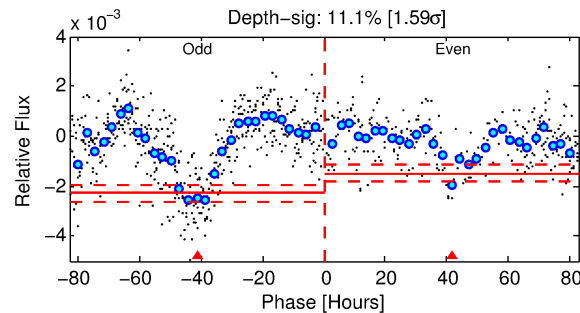
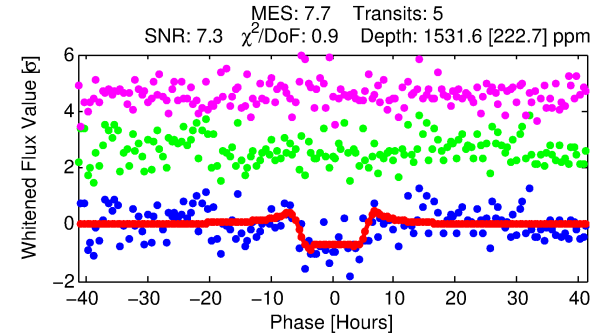
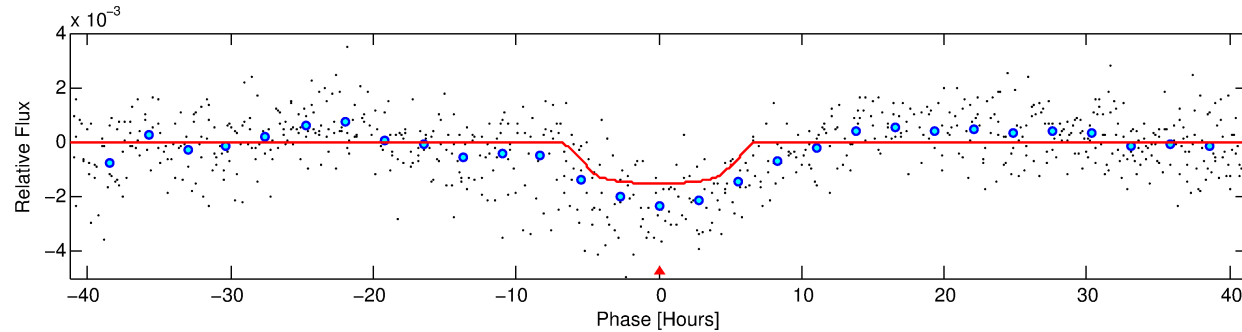
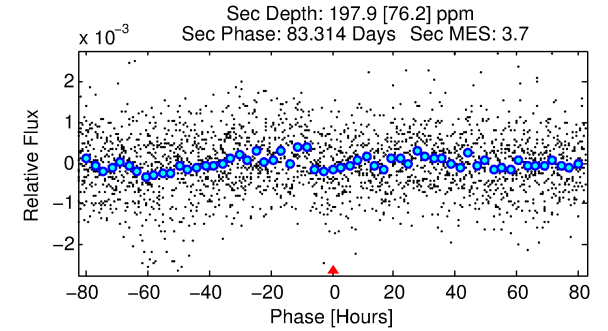
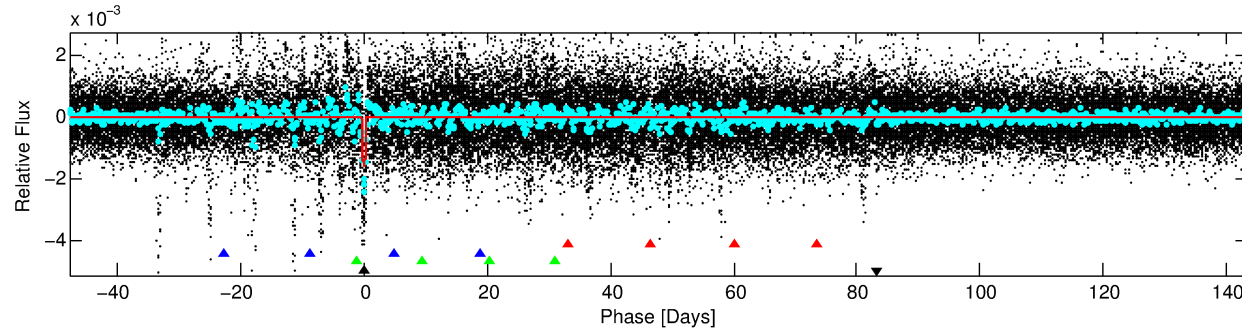
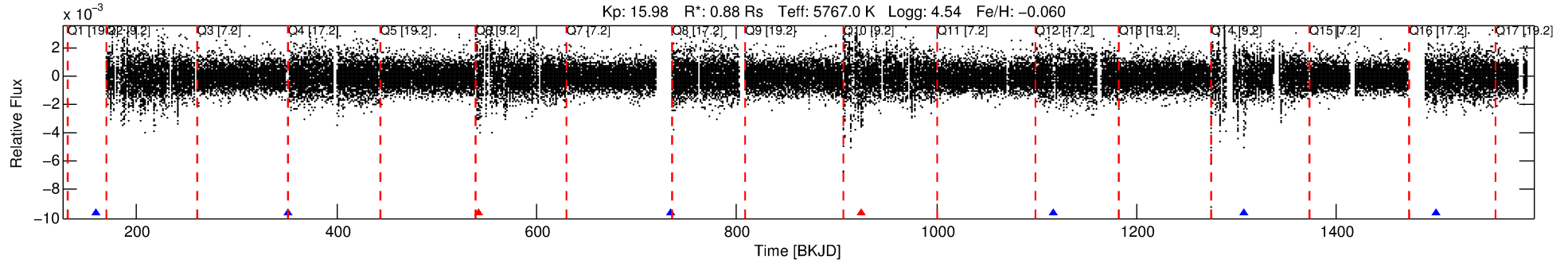
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 008440076-04

No Significant Match Found

# DV One-Page Summary

KIC: 8440076 Candidate: 4 of 4 Period: 191.333 d



## DV Fit Results:

Period = 191.33254 [0.00724] d  
Epoch = 160.1594 [0.0385] BKJD  
Rp/R\* = 0.0429 [0.0041]  
a/R\* = 54.89 [12.00]  
b = 0.91 [0.05]  
Seff = 1.85 [0.69]  
Teq = 297 [28] K  
Rp = 4.13 [1.28] Re  
a = 0.6450 [0.1585] AU  
Ag = 2658.56 [1481.31] [1.79σ]  
Teffp = 3301 [368] K [8.13σ]

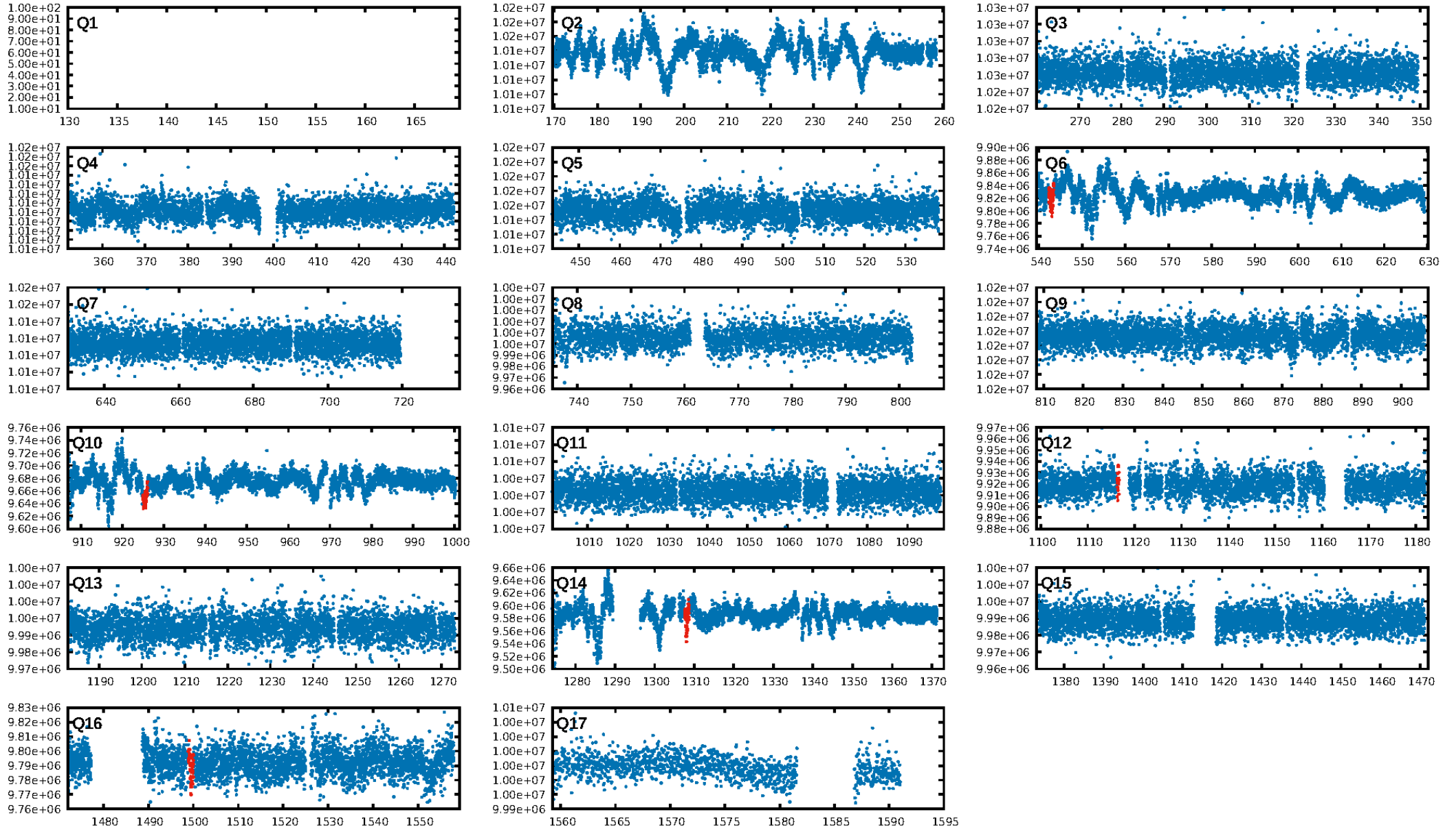
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [196.68σ]  
ModelChiSquare2-sig: 10.4%  
ModelChiSquareGof-sig: 100.0%  
**Bootstrap-pfa: 2.96e-11**  
**RollingBand-fgt: 0.60 [3/5]**  
GhostDiagnostic-chr: -7.112  
Centroid-sig: 0.7%  
Centroid-so: 4.670 arcsec [2.26σ]  
OotOffset-rm: 1.657 arcsec [0.83σ]  
OotOffset-st: 3/0/0/0 [3]  
KicOffset-rm: 1.544 arcsec [0.66σ]  
KicOffset-st: 3/0/0/0 [3]  
DiffImageQuality-fgm: 0.00 [0/3]  
DiffImageOverlap-fno: 1.00 [3/3]

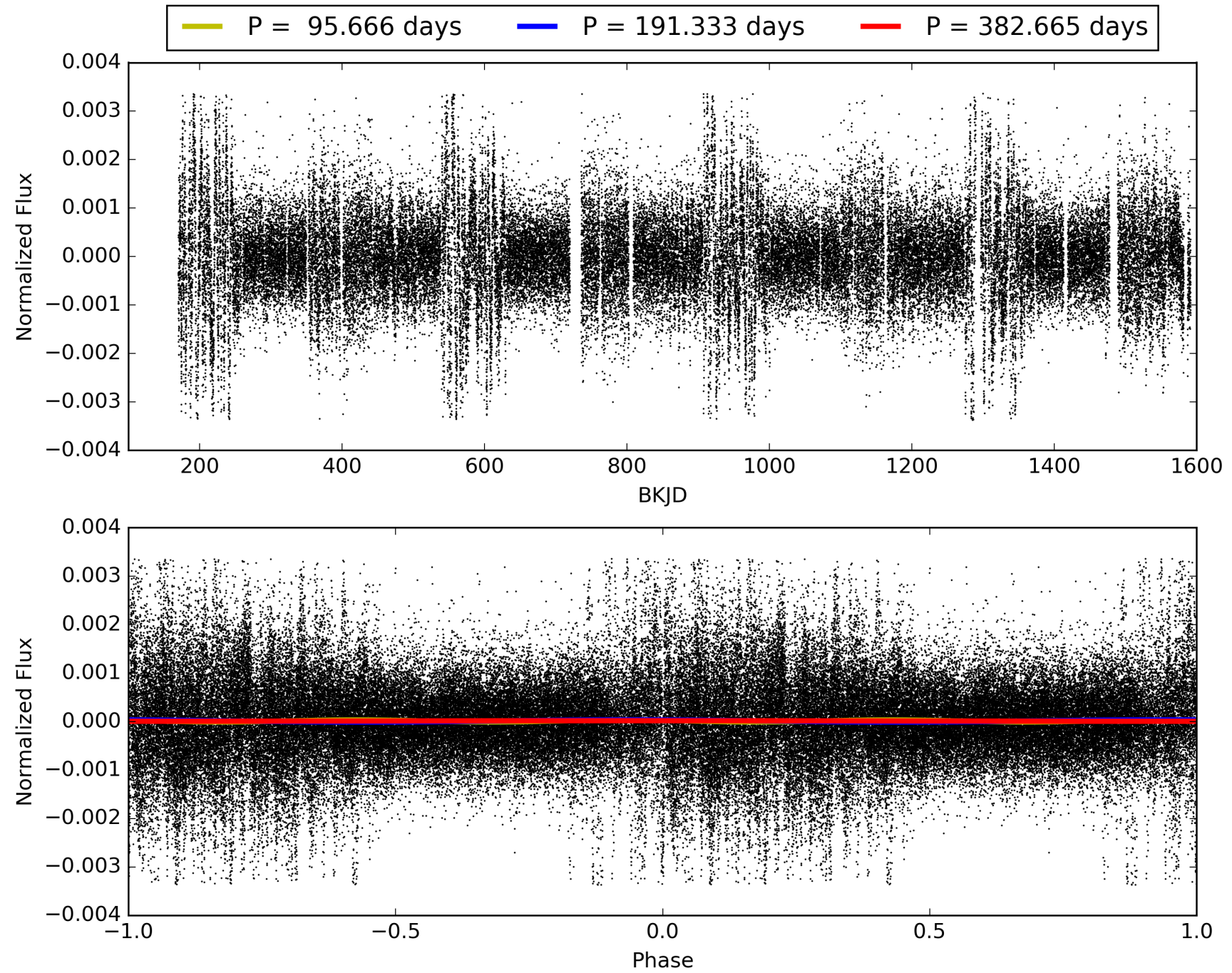
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 29-Jan-2016 12:53:51 Z

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

# TCE 008440076-04, PDC Light Curves

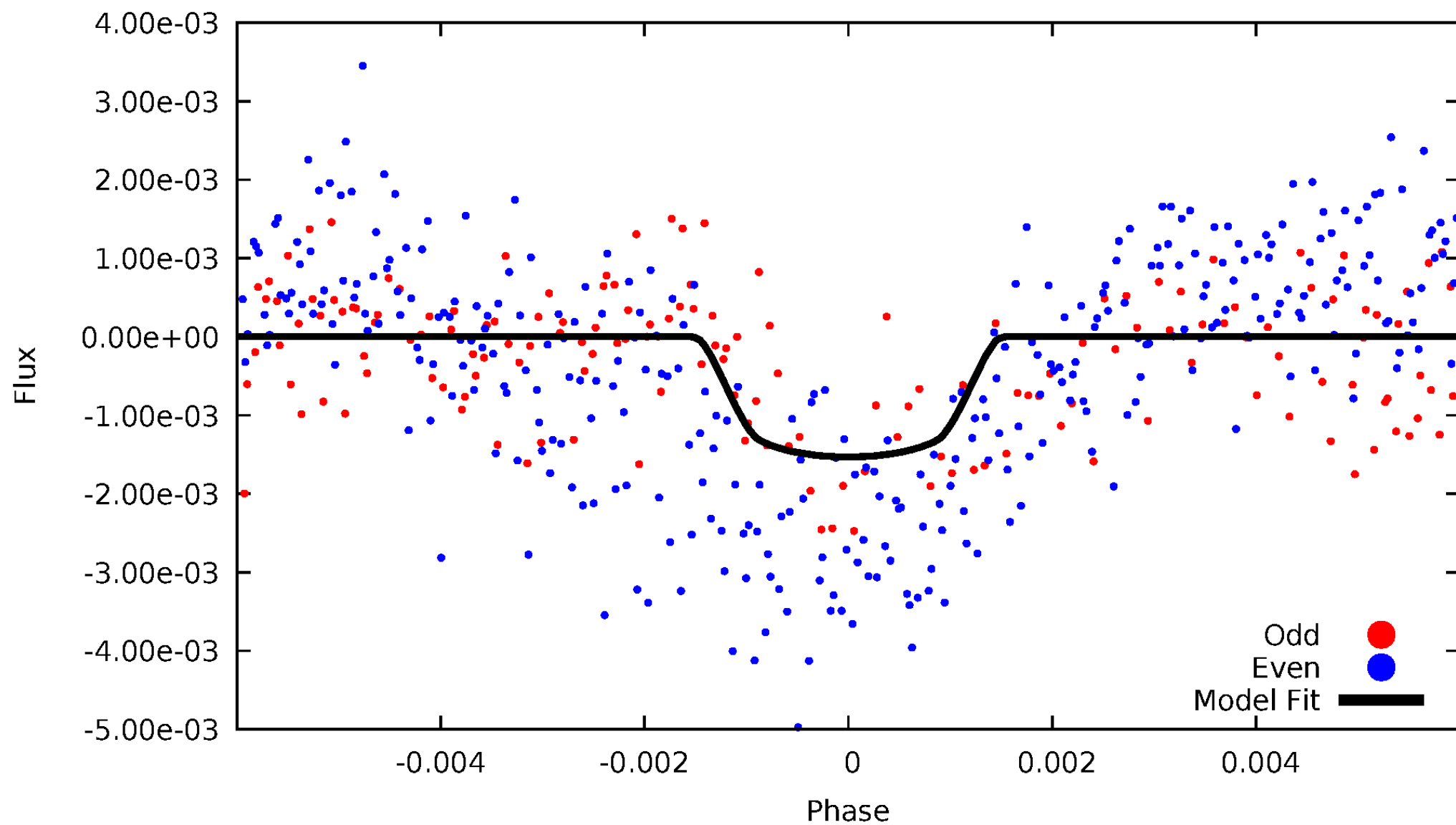


TCE 008440076-04



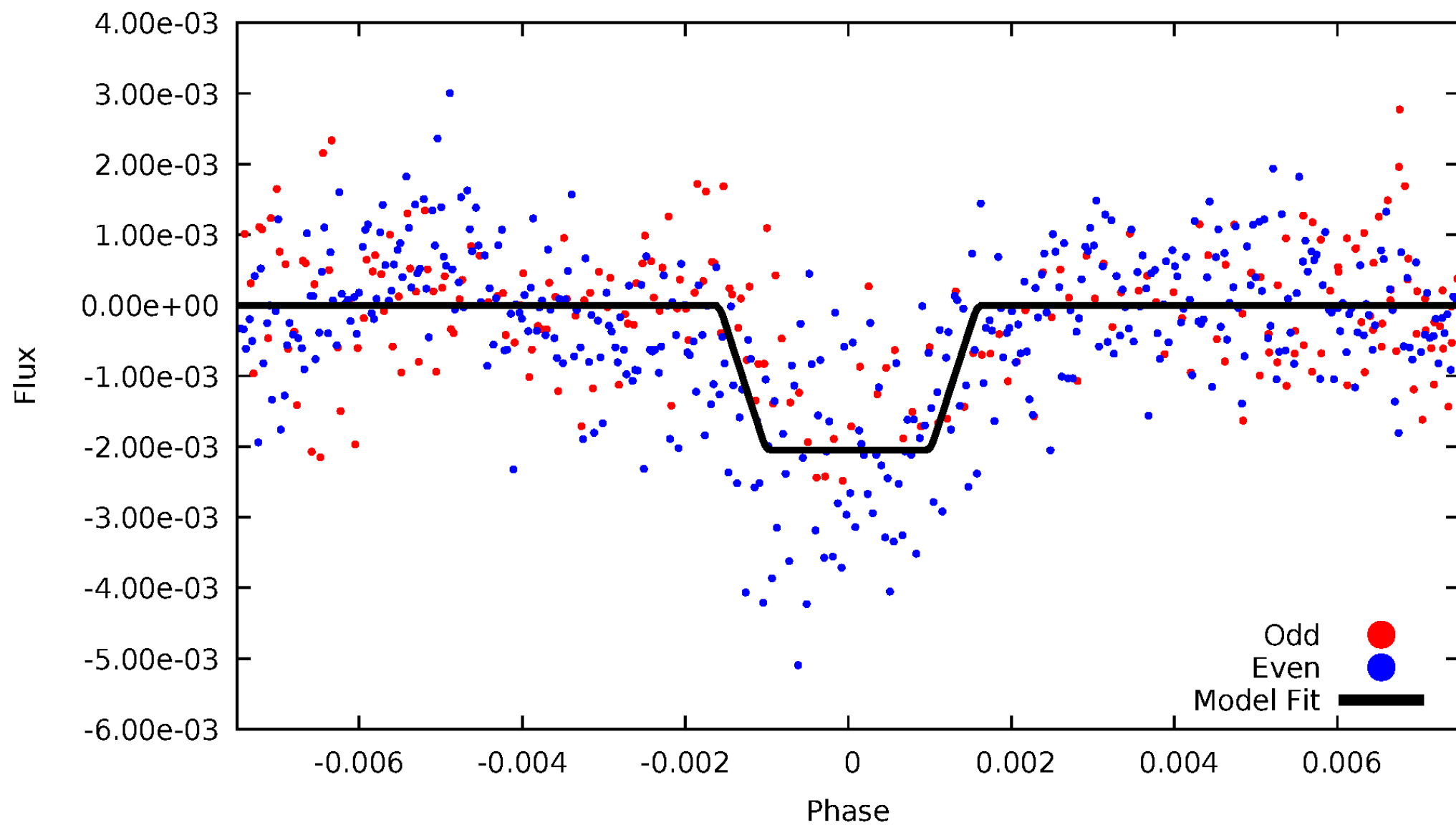
# DV Odd/Even

TCE 008440076-04



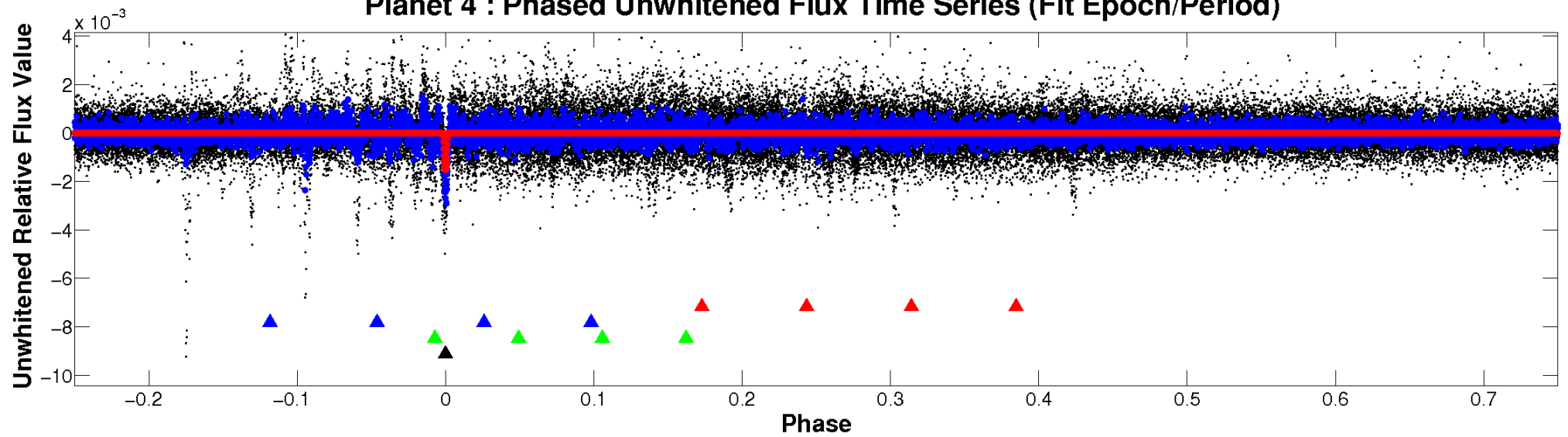
# ALT Odd/Even

TCE 008440076-04

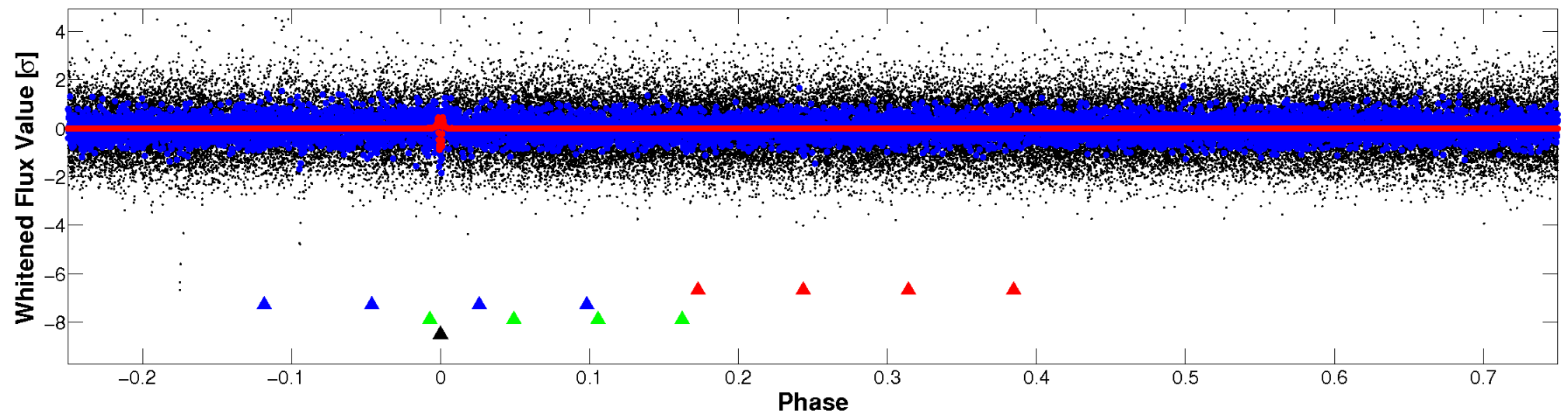


# Non-Whitened Vs. Whitened Light Curve

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

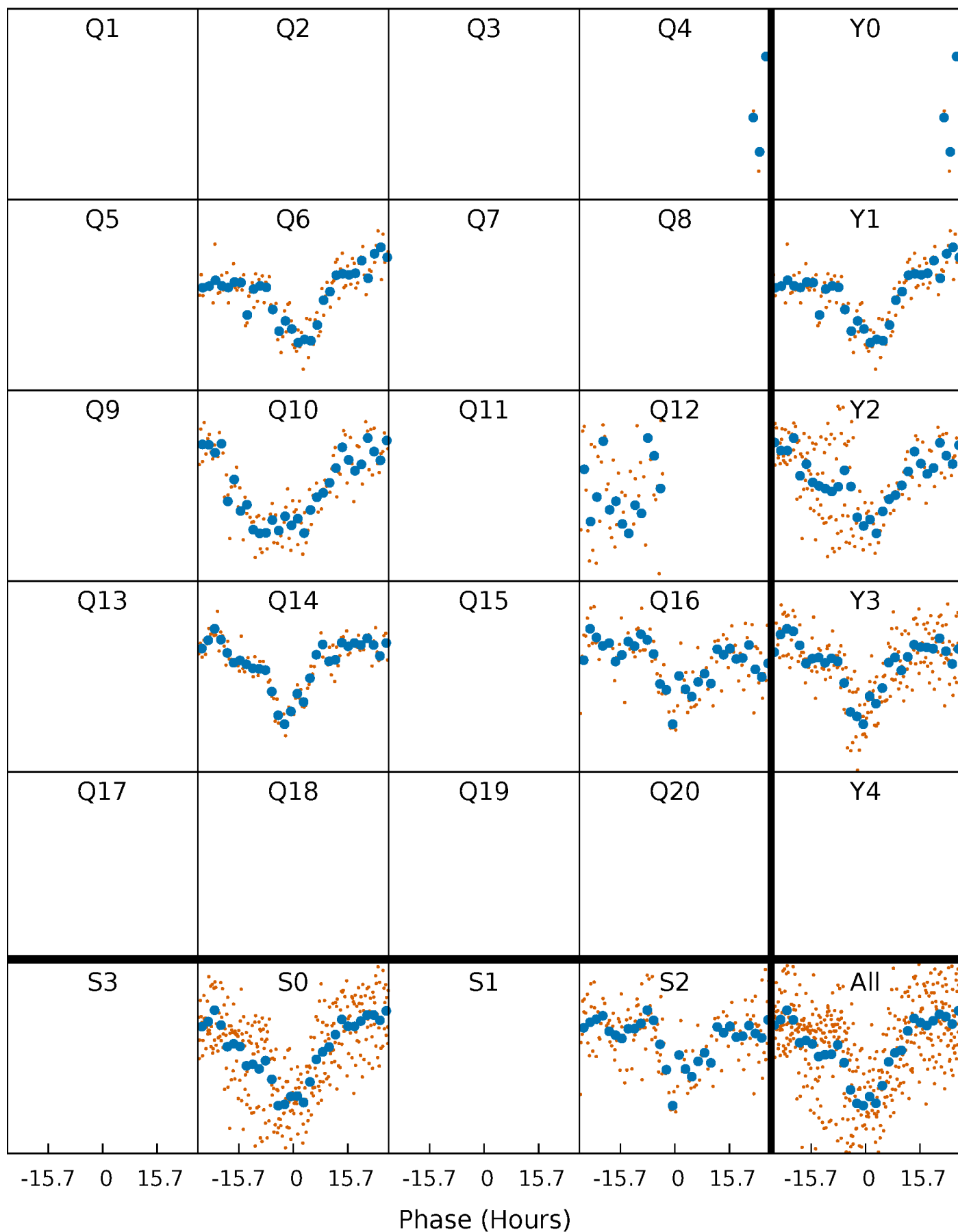


Planet 4 : Phased Whitened Flux Time Series (Fit Epoch/Period)



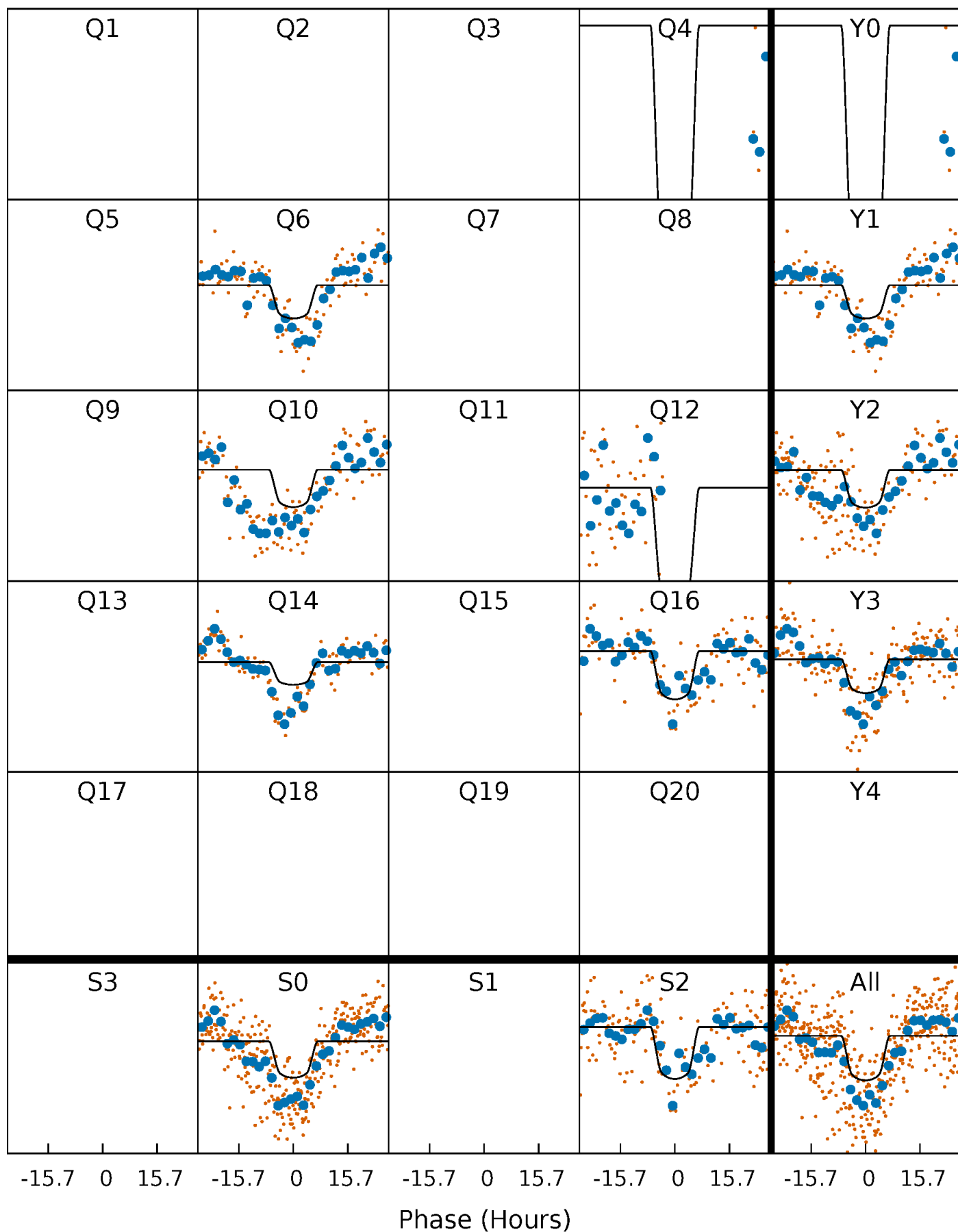
# PDC Quarter-Phased Transit Curves

TCE 008440076-04 P=191.332540 Days  $T_0=160.159401$  (BKJD)



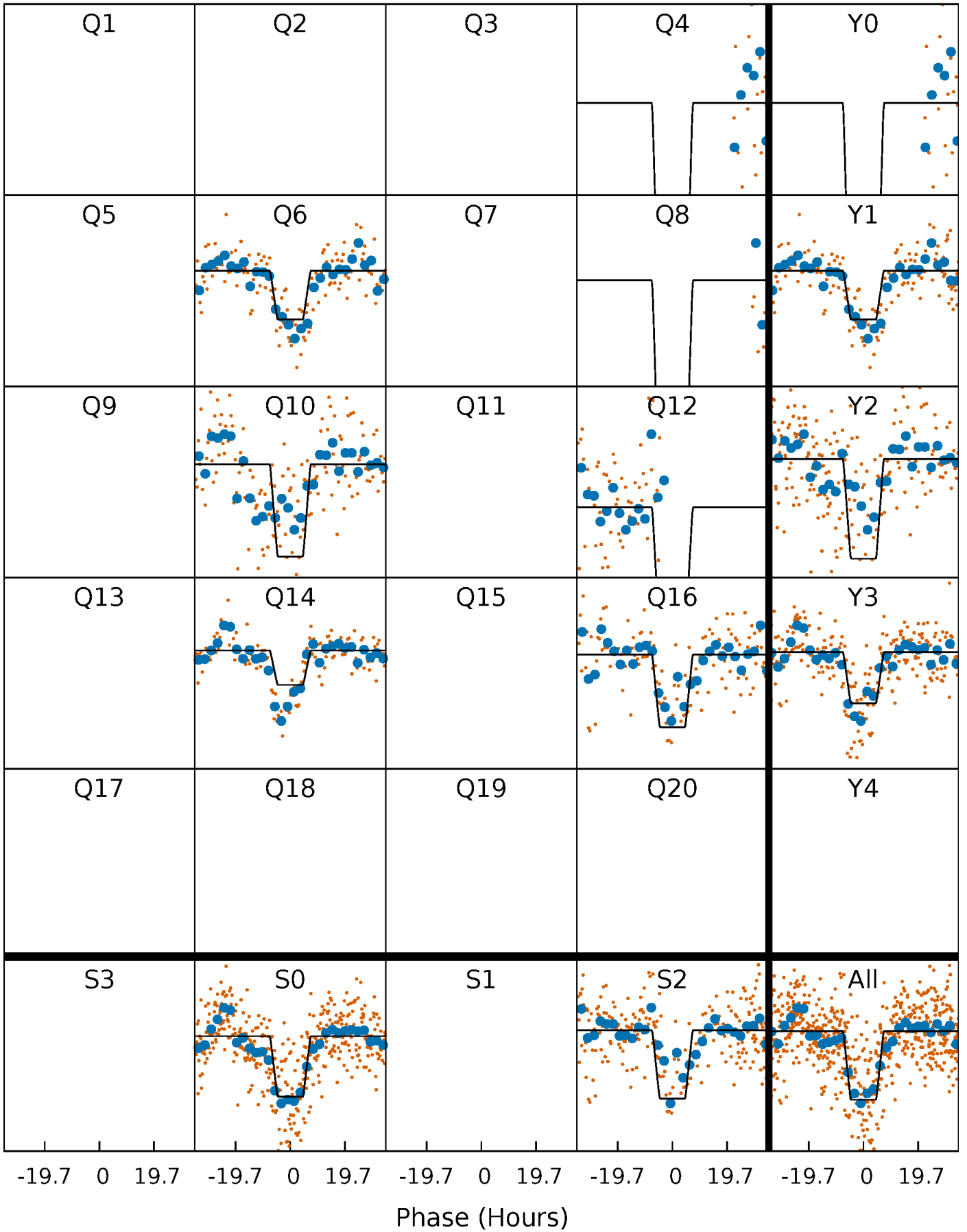
# DV Quarter-Phased Transit Curves

TCE 008440076-04 P=191.332540 Days  $T_0=160.159401$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

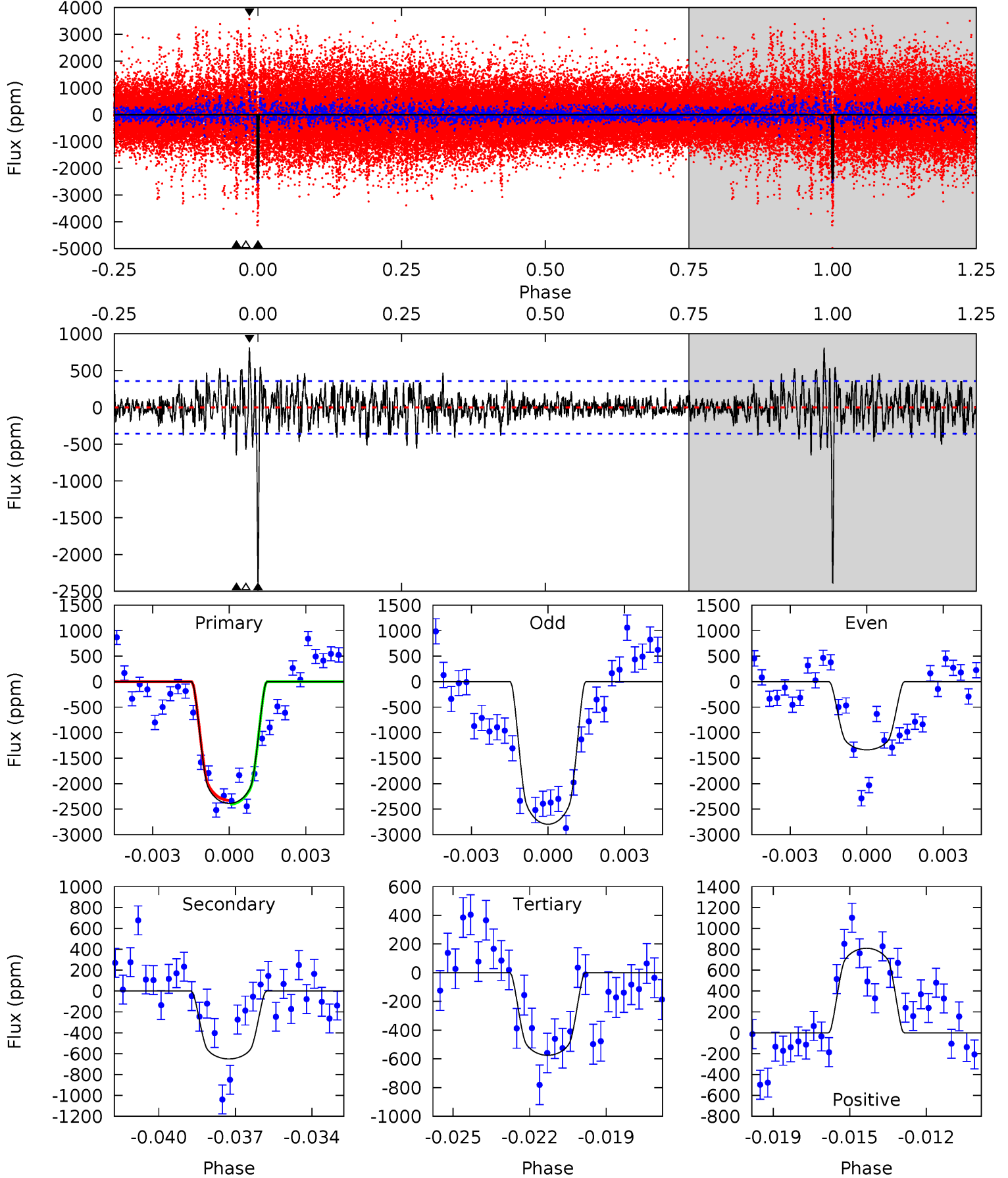
TCE 008440076-04 P=191.333045 Days  $T_0=160.180060$  (BKJD)



# DV Model-Shift Uniqueness Test

008440076-04, P = 191.332540 Days, E = 160.159401 Days

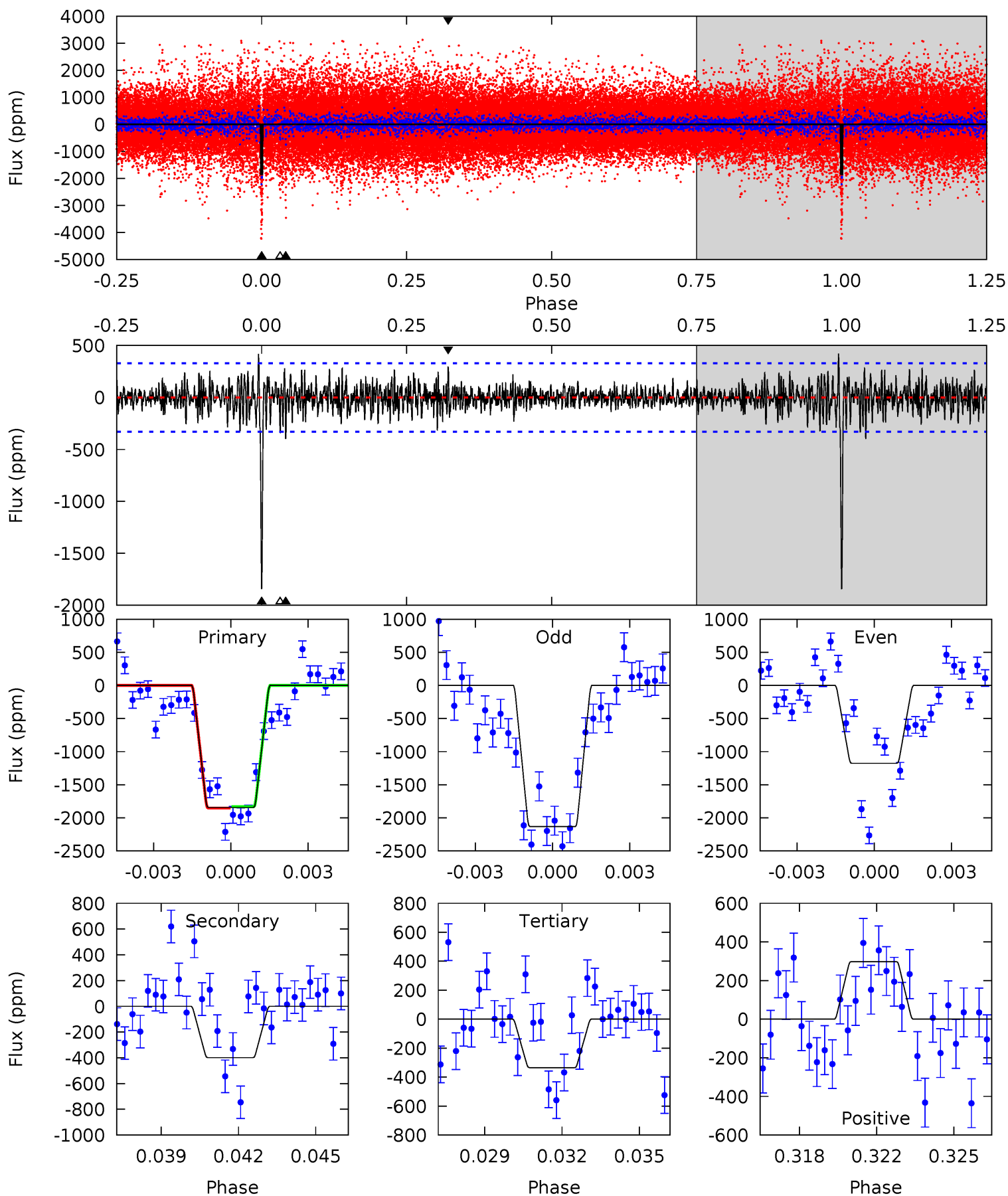
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
35.0	9.53	8.42	11.9	5.25	2.96	2.24	26.5	23.1	1.11	-2.33	10.1	0.82	0.25	0.57



# Alt Model-Shift Uniqueness Test

008440076-04, P = 191.333045 Days, E = 160.180060 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
29.3	6.33	5.32	4.73	5.24	2.95	1.37	24.0	24.6	1.01	1.60	7.08	1.08	0.19	0.16



### Stellar Parameters For KIC 008440076

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5767^{+156}_{-173}$	$4.538^{+0.036}_{-0.192}$	$-0.060^{+0.300}_{-0.300}$	$0.881^{+0.260}_{-0.081}$	$0.979^{+0.102}_{-0.125}$	$2.017^{+0.404}_{-1.052}$
	+3%/-3%	+1%/-4%	+500%/-500%	+30%/-9%	+10%/-13%	+20%/-52%
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 008440076-04 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-650 \pm 68$	$4.33^{+0.69}_{-0.54}$	$426^{+26}_{-19}$	$4594^{+233}_{-216}$	$7722^{+2546}_{-2027}$
Alt.	$-399 \pm 63$	$4.55^{+0.71}_{-0.54}$	$426^{+28}_{-17}$	$4115^{+200}_{-187}$	$4319^{+1423}_{-1226}$

$T_{max}$  = 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

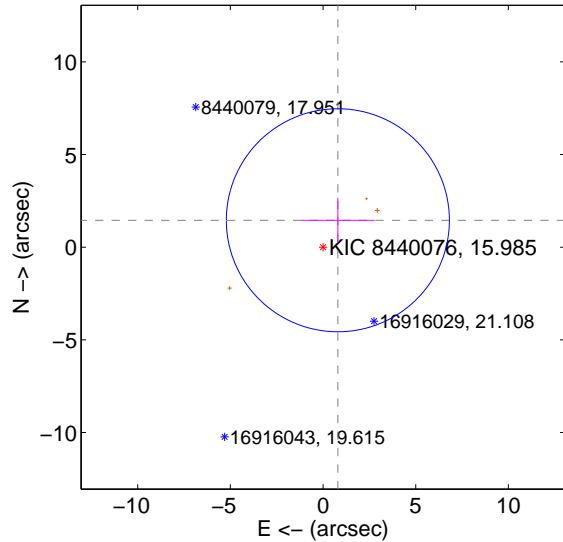
Supplemental centroid analysis for 008440076-04. Kepler magnitude: 15.98. Transit SNR 7.32

There are 0 quarters with good PRF difference image offsets

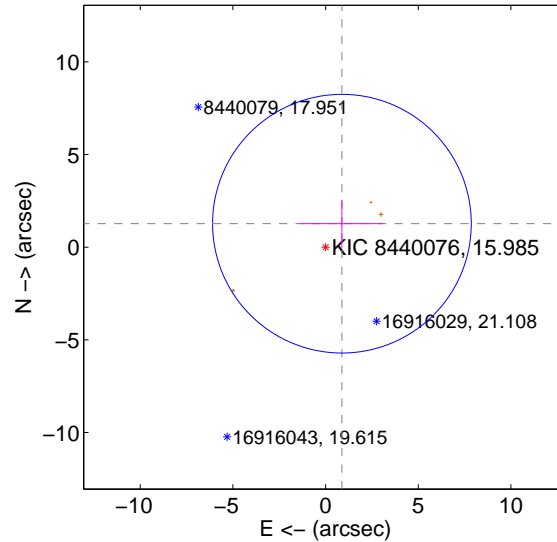
The direct PRF centroid is offset from the target star catalog position by about 0.22 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.657 \pm 2.005$	0.83	$-0.799 \pm 1.986$	$1.452 \pm 1.210$
PRF-fit source offset from KIC position	$1.544 \pm 2.326$	0.66	$-0.882 \pm 2.231$	$1.267 \pm 1.295$
photometric centroid source offset	$4.67 \pm 2.07$	2.26	$-4.04 \pm 1.89$	$-2.34 \pm 2.54$

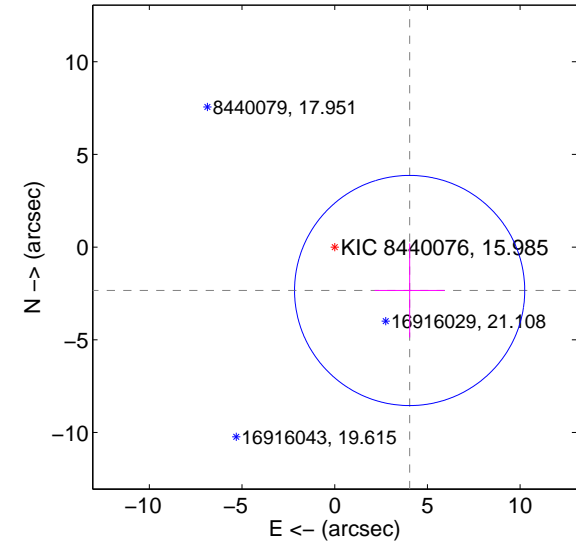
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

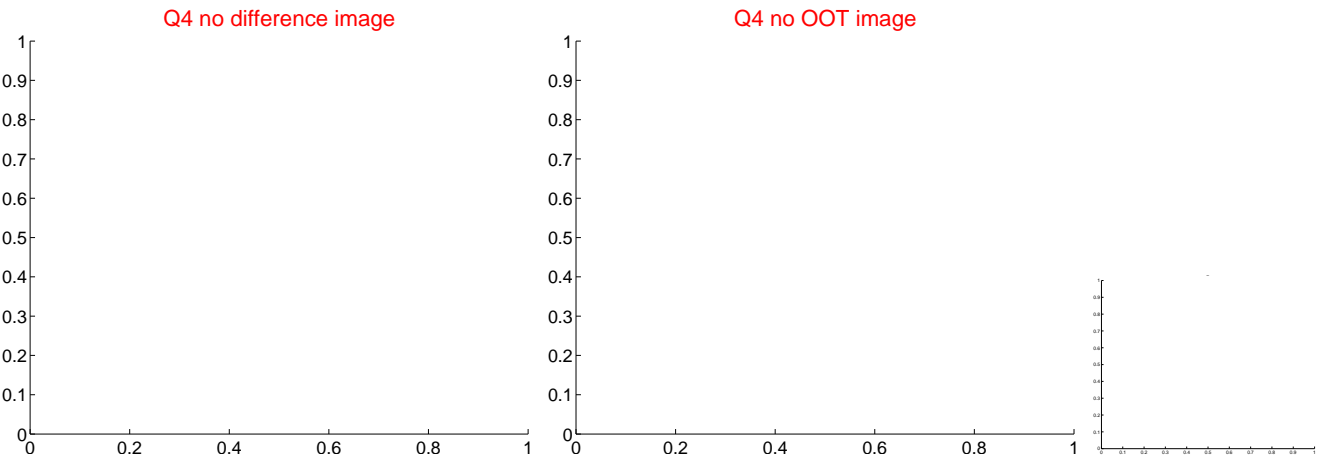
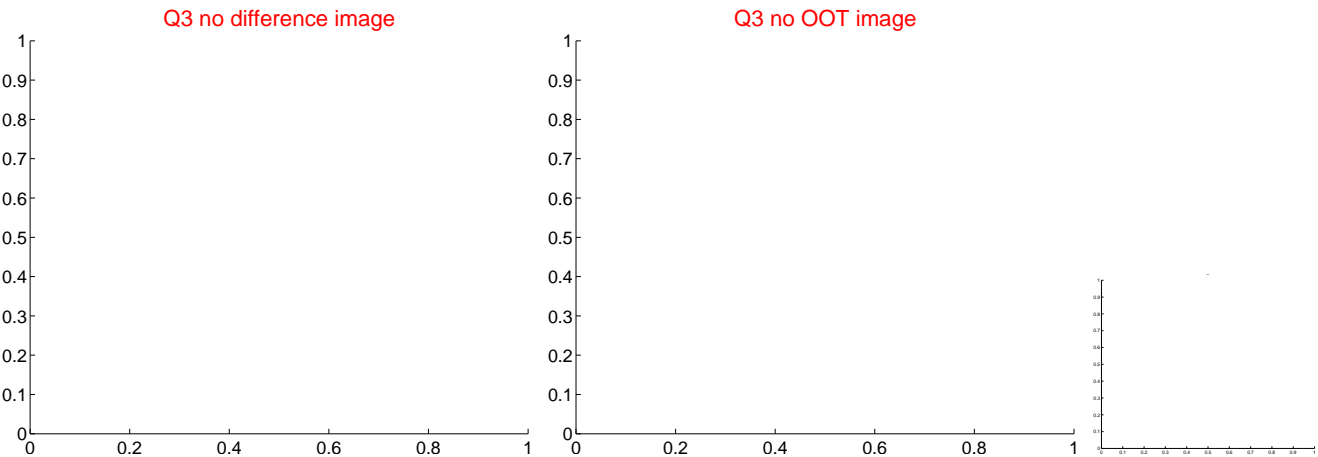
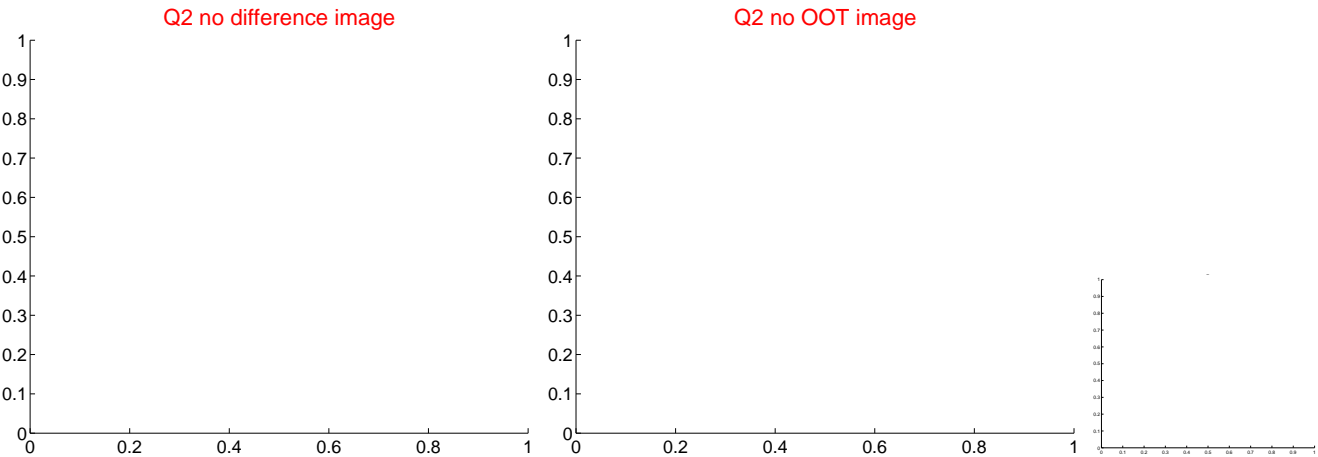
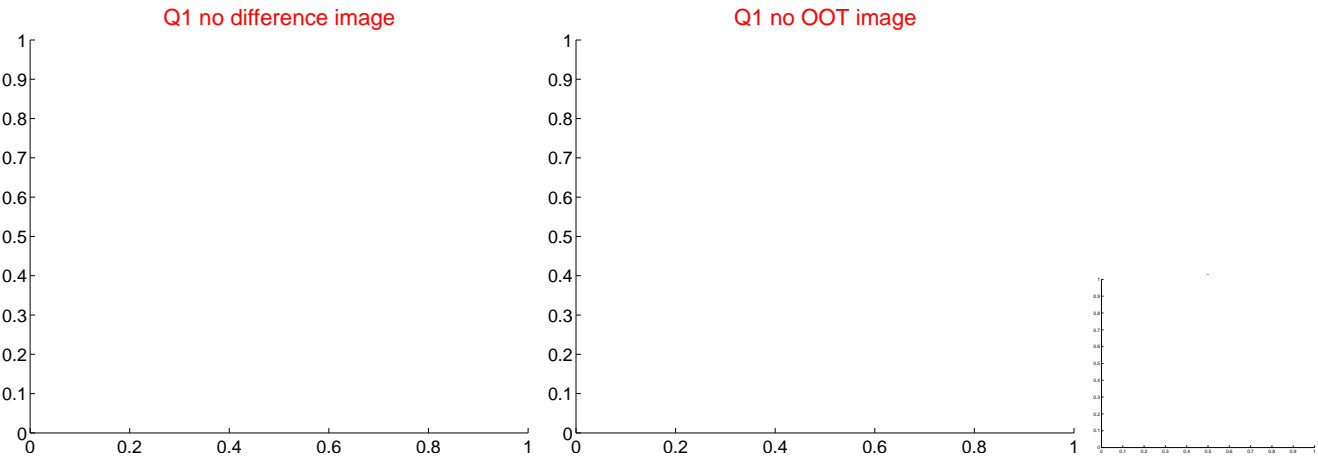


offset from photometric centroids

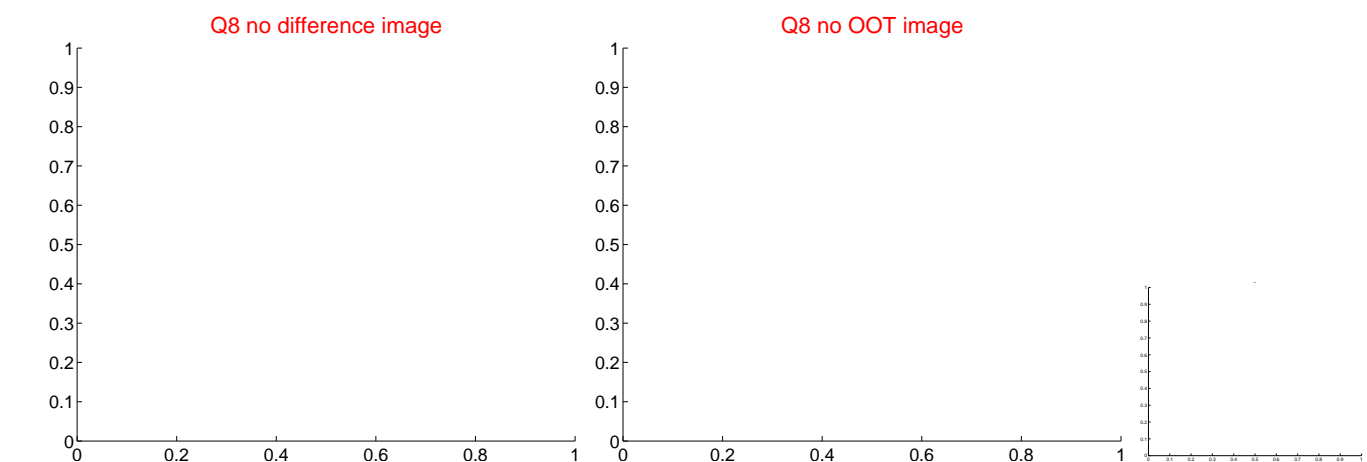
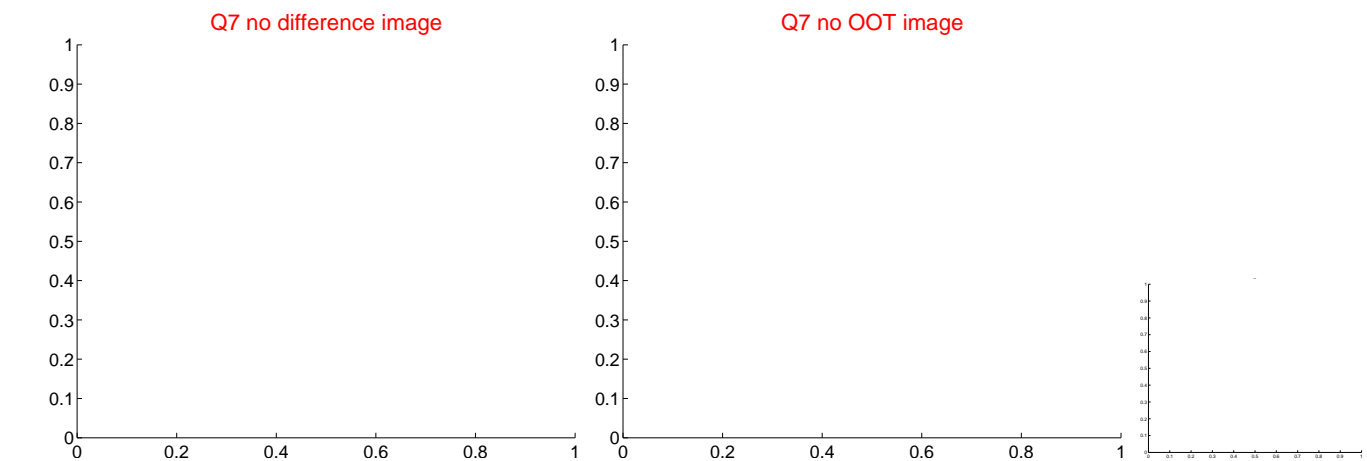
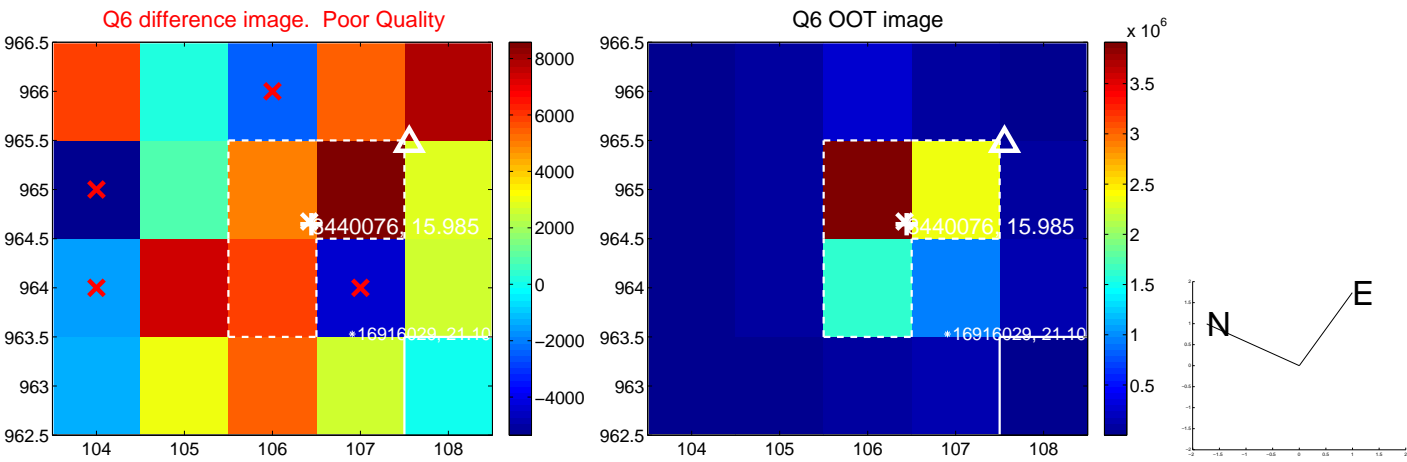
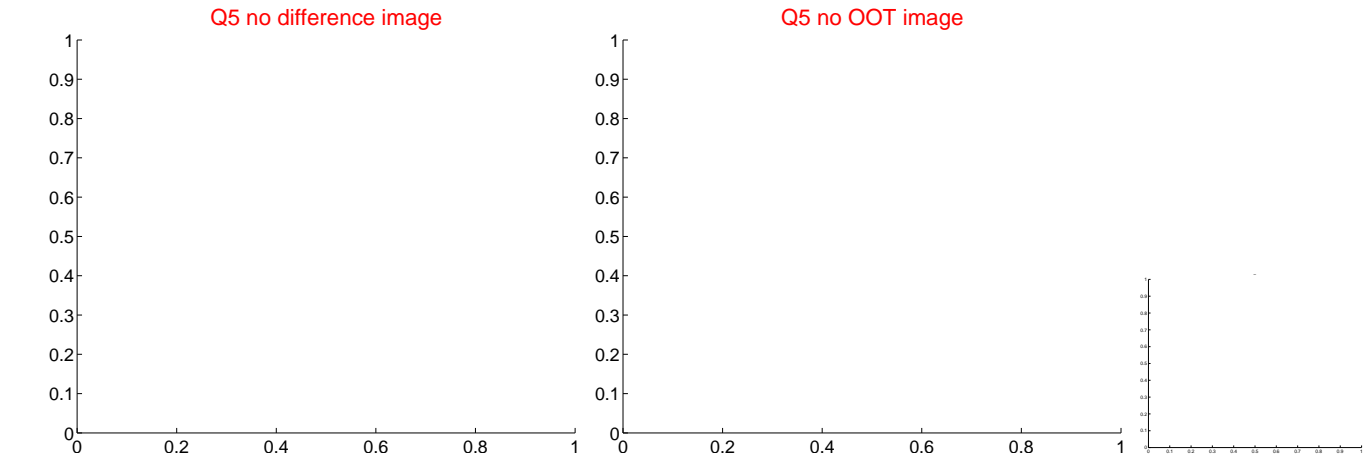


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

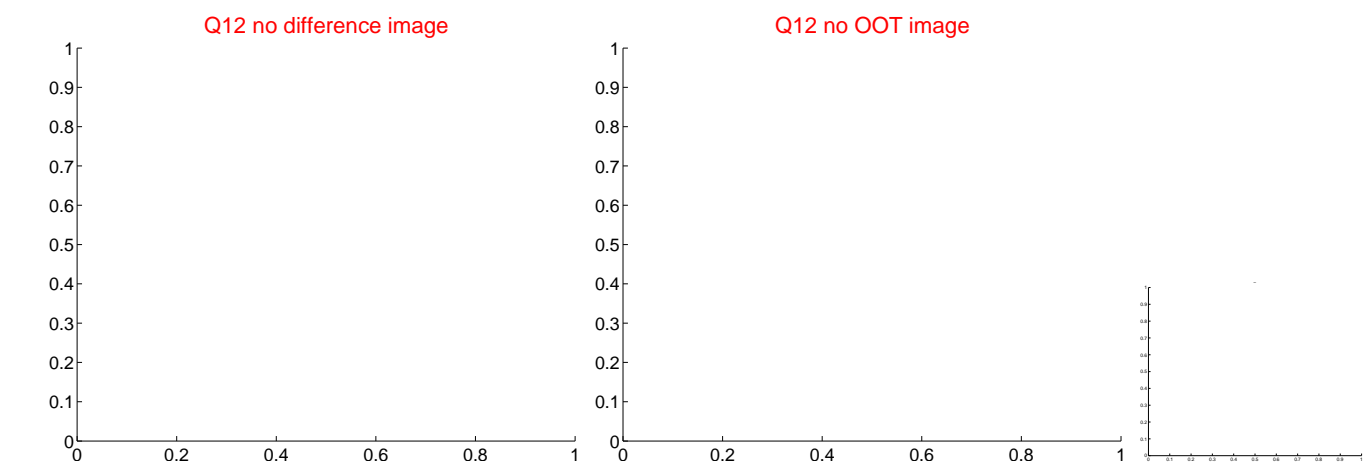
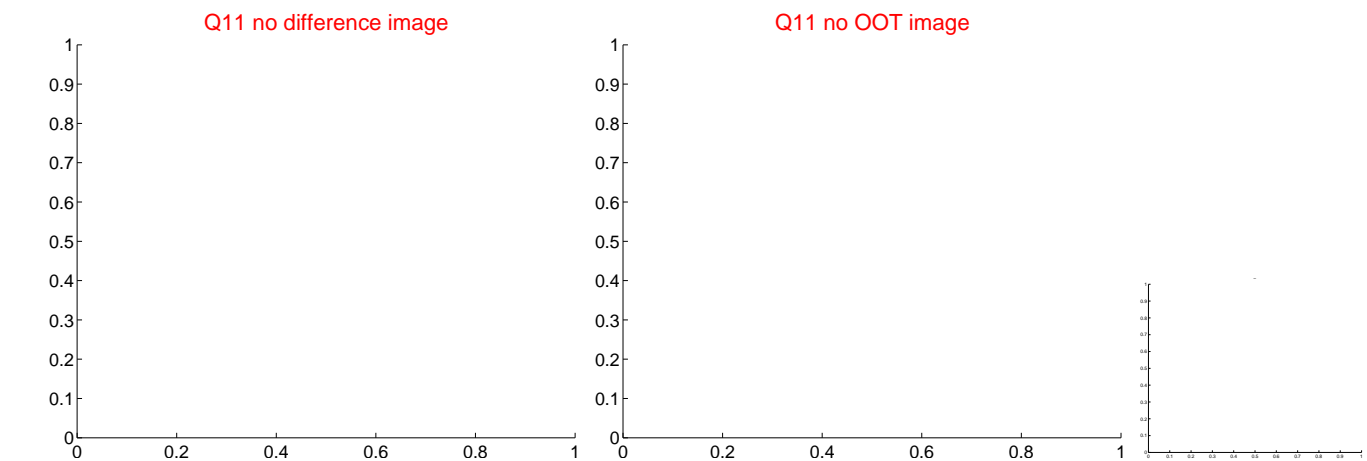
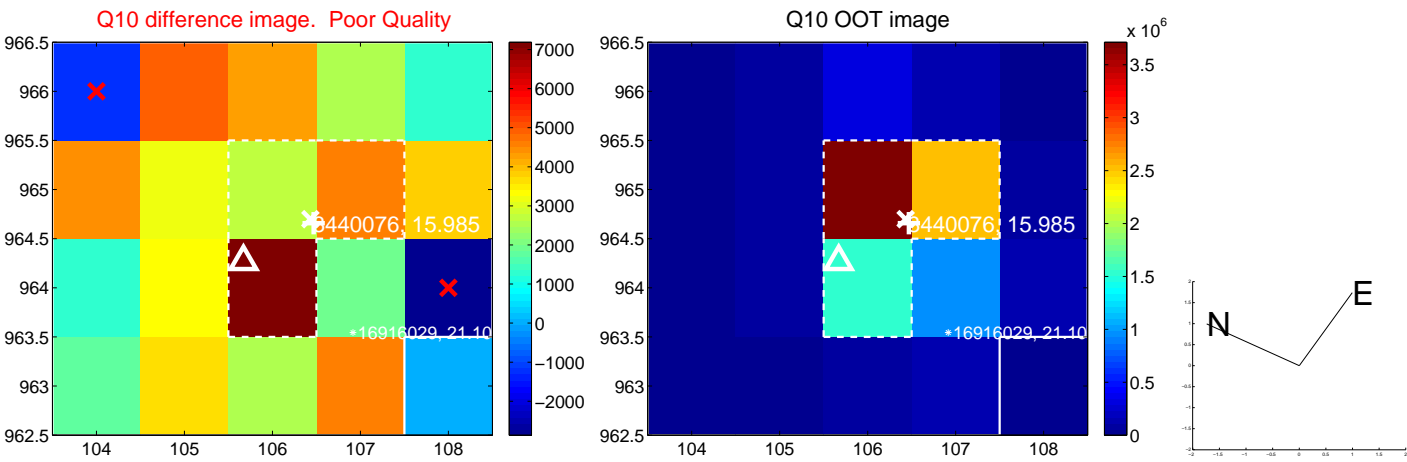
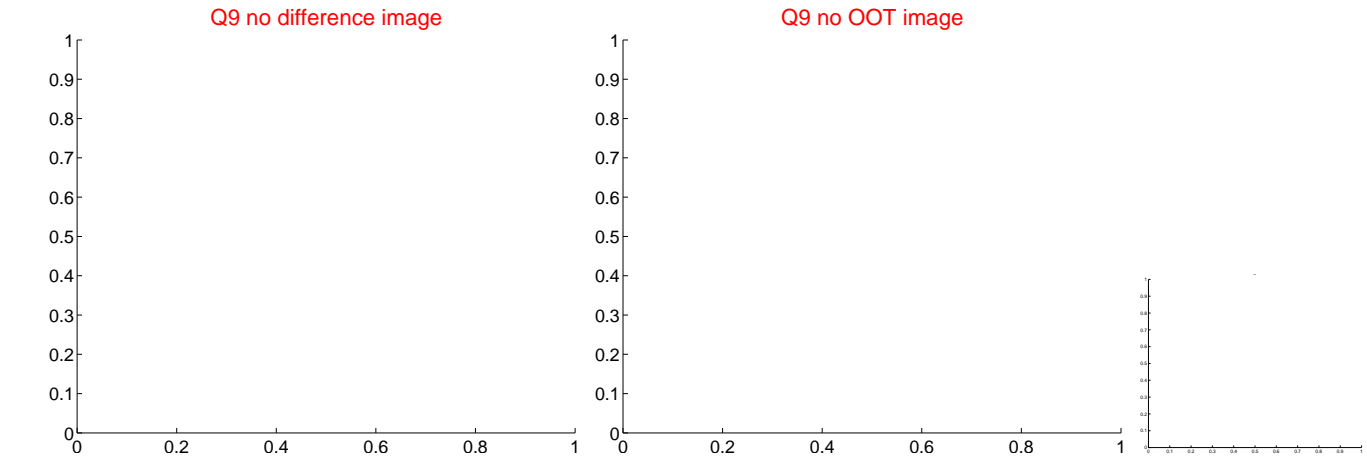
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



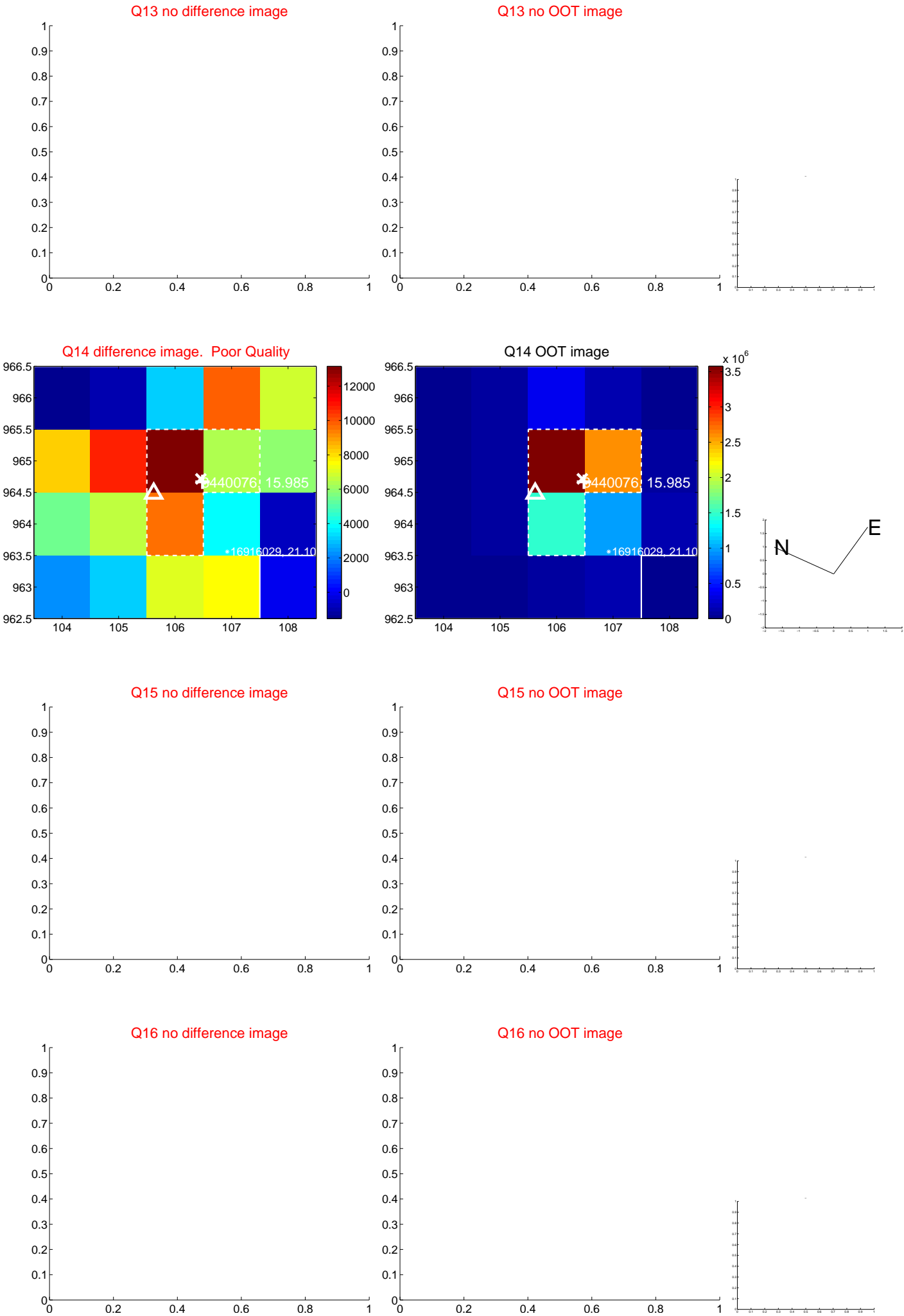
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



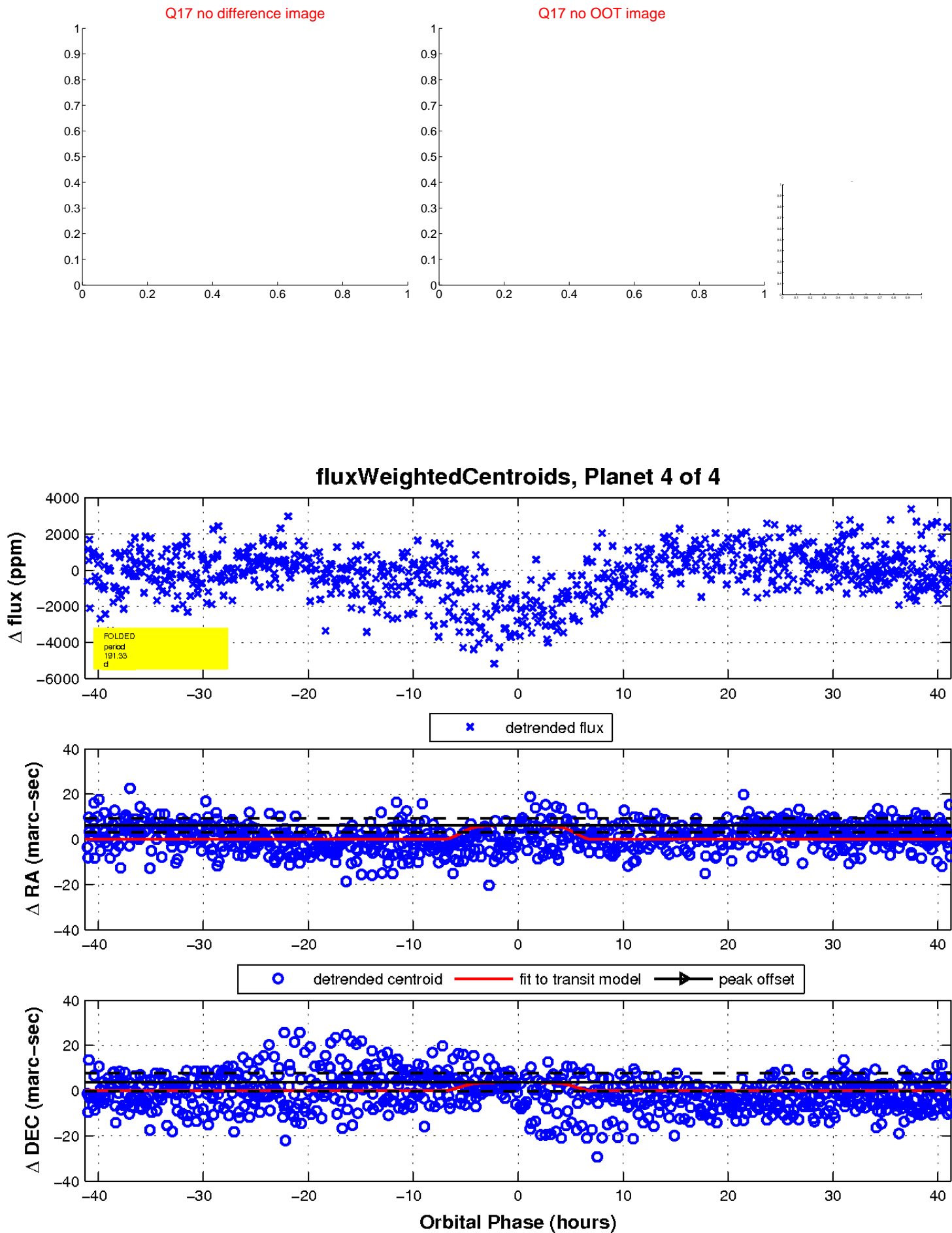
white ×: KIC target position; +: OOT centroid; △: difference centroid. red ✕: large negative pixel value.



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



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



UKIRT Image

Declination

