

# KIC 012459731

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
012459731-01	OBS	3662.01	14.180061	143.134855	170897.8	4.639	790.4	549.5	1.14	6289	66.21	137.43
012459731-02	OBS	No	14.180368	135.775680	43440.3	5.537	229.4	210.0	1.14	6289	35.95	137.43

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
012459731-01	OBS	FP	0.00	0	1	0	0	MOD_SEC_DV—MOD_SEC_ALT—DEEP_V_SHAPED—HAS_SEC_TCE—CENT_KIC_POS
012459731-02	OBS	FP	0.00	1	1	0	0	IS_SEC_TCE—CENT_KIC_POS

**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.

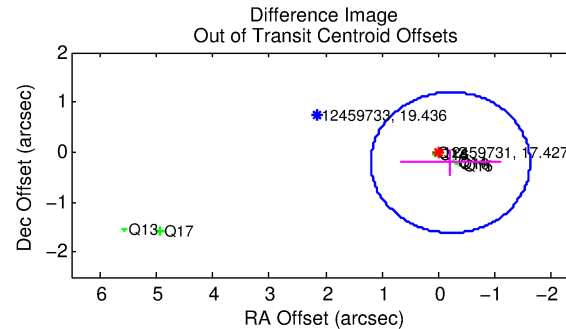
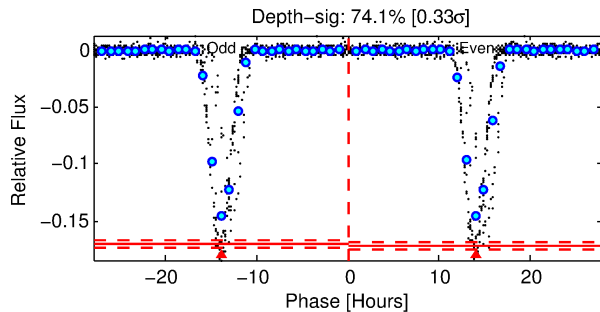
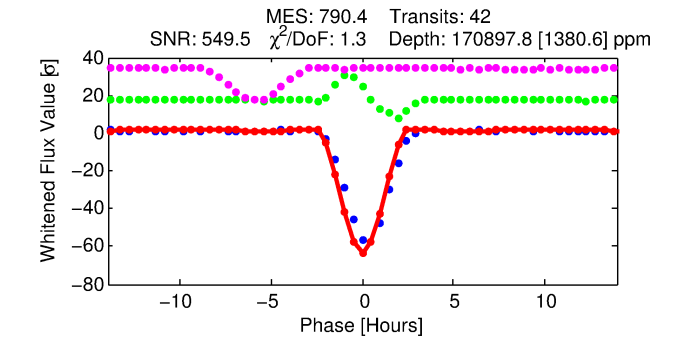
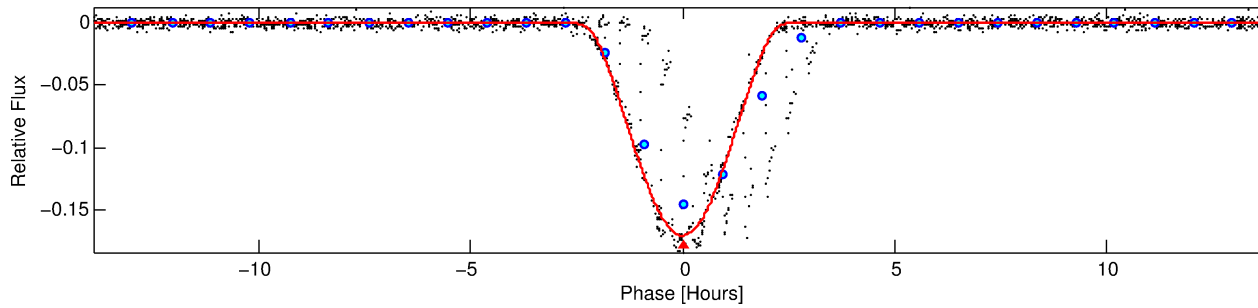
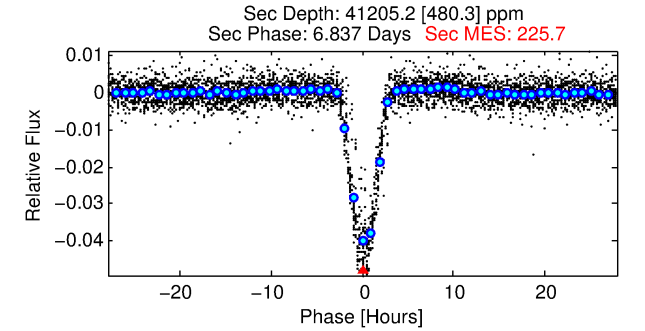
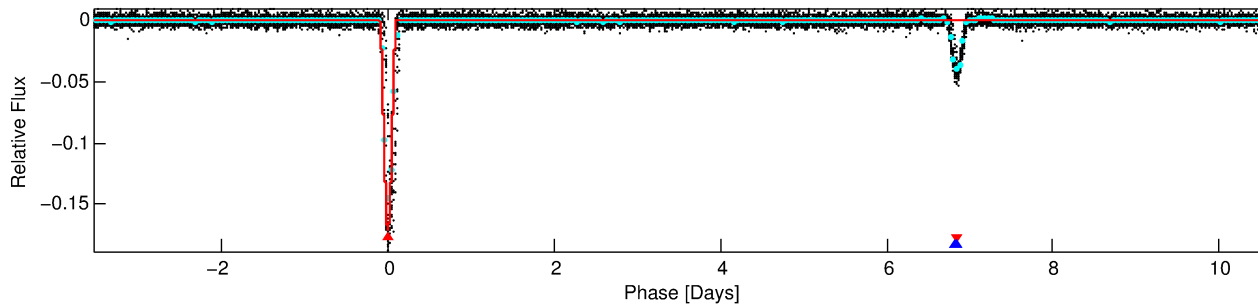
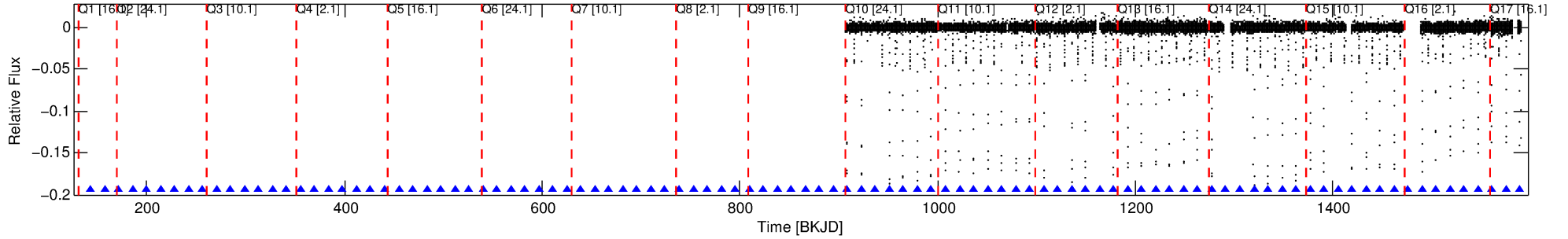
## Ephemeris Match Information For 012459731-01

No Significant Match Found

# DV One-Page Summary

KIC: 12459731 Candidate: 1 of 2 Period: 14.180 d  
KOI: K03662.01 Corr: 0.901

Kp: 17.43 R\*: 1.14 Rs Teff: 6289.0 K Logg: 4.33 Fe/H: -0.260



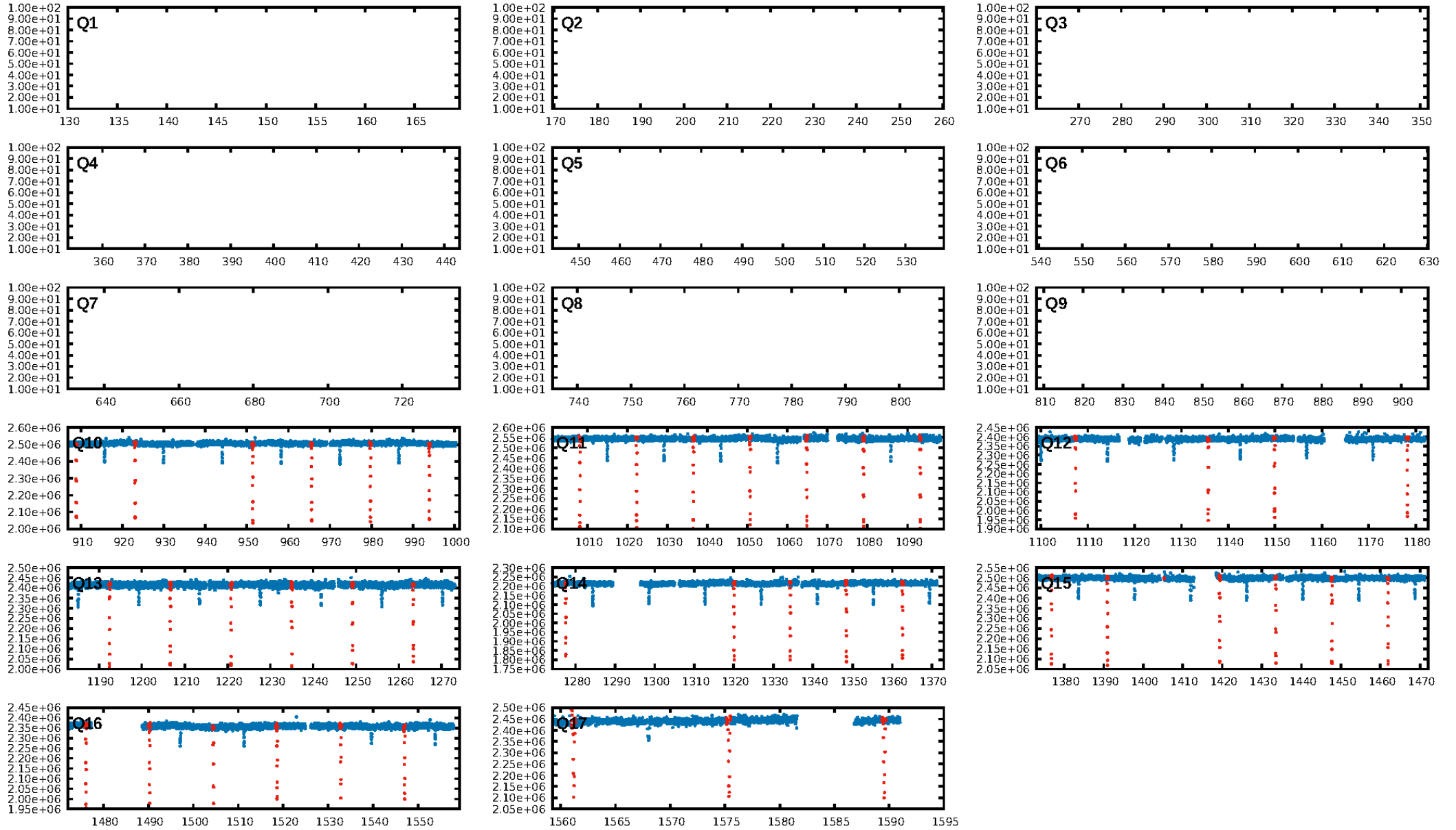
## DV Fit Results:

Period = 14.18006 [0.00001] d  
Epoch = 143.1349 [0.0005] BKJD  
Rp/R\* = 0.5313 [0.5457]  
a/R\* = 29.79 [2.99]  
b = 0.85 [0.81]  
Seff = 137.43 [52.78]  
Teq = 873 [84] K  
Rp = 66.21 [71.02] Re  
a = 0.1153 [0.0289] AU  
Ag = 68.78 [143.36] [0.47σ]  
Teffp = 3887 [2002] K [1.50σ]

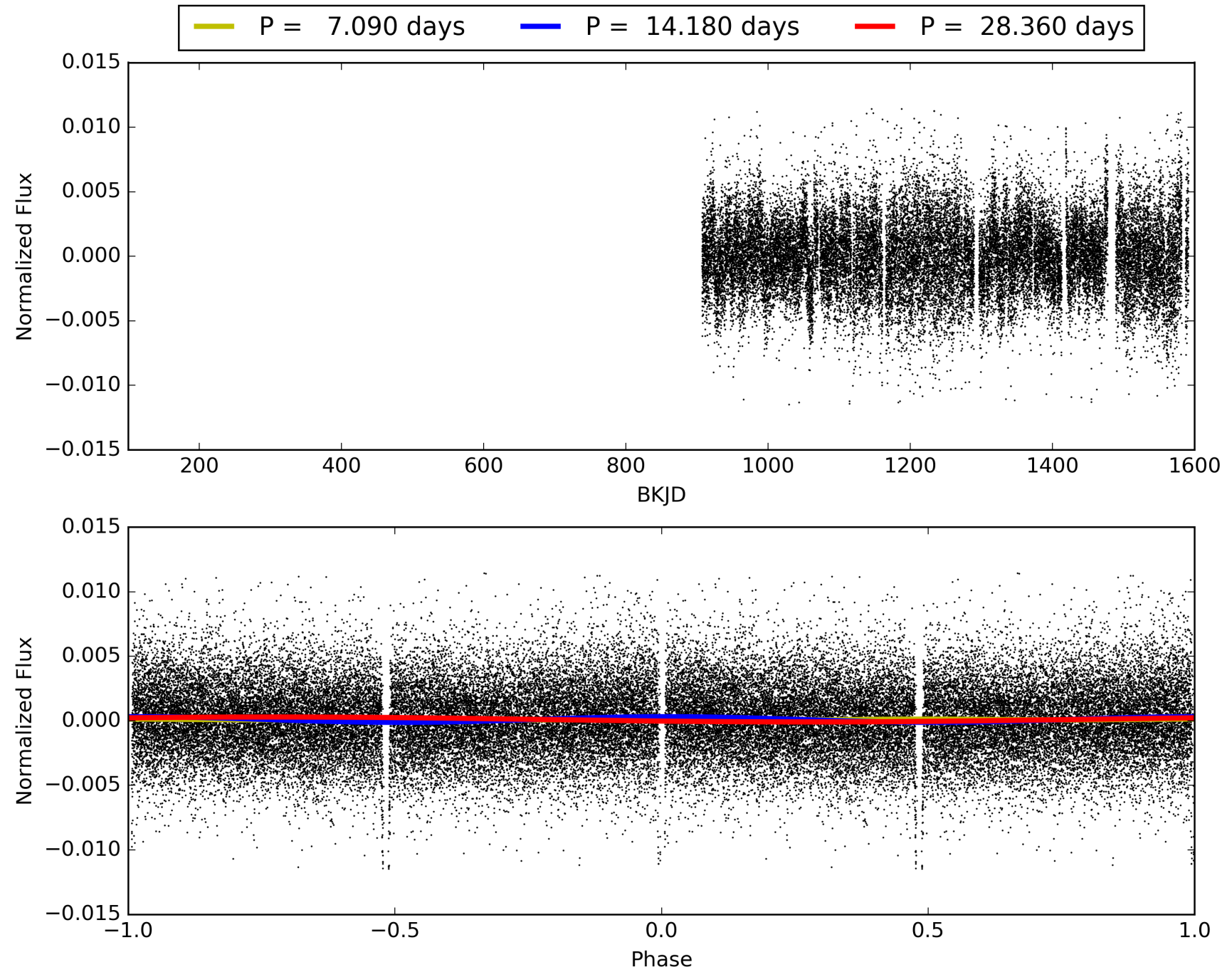
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 0.1% [0.00σ]  
ModelChiSquare2-sig: 0.0%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 0.00e+00  
RollingBand-fgt: 1.00 [39/39]  
GhostDiagnostic-chr: 4.897  
Centroid-sig: 0.0%  
Centroid-so: 0.701 arcsec [46.48σ]  
OotOffset-rm: 0.294 arcsec [0.63σ]  
KicOffset-rm: 0.196 arcsec [2.08σ]  
OotOffset-st: 2/2/2/2 [8]  
KicOffset-st: 2/2/2/2 [8]  
DiffImageQuality-fgm: 1.00 [8/8]  
DiffImageOverlap-fno: 1.00 [8/8]

# TCE 012459731-01, PDC Light Curves

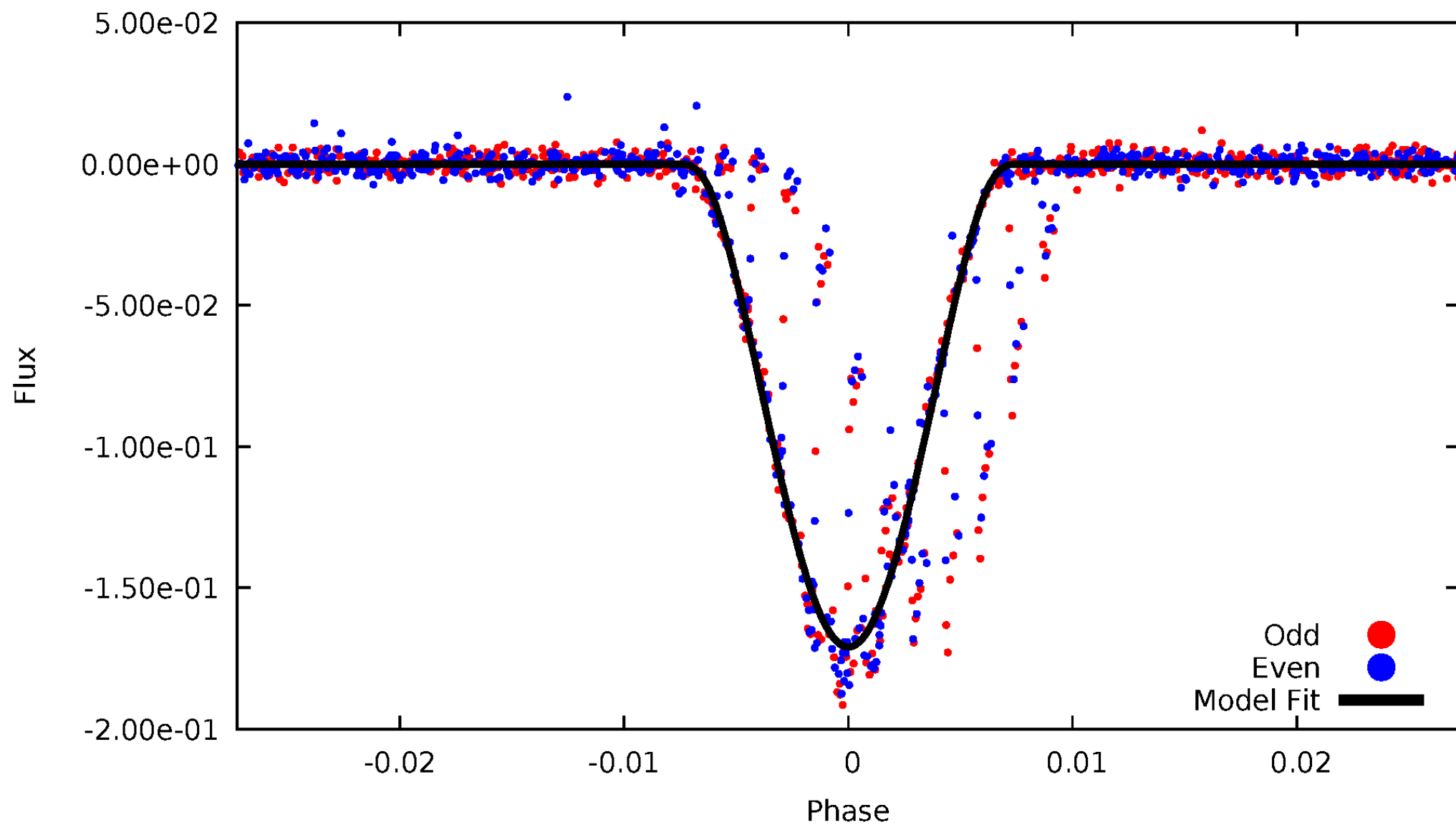


# TCE 012459731-01



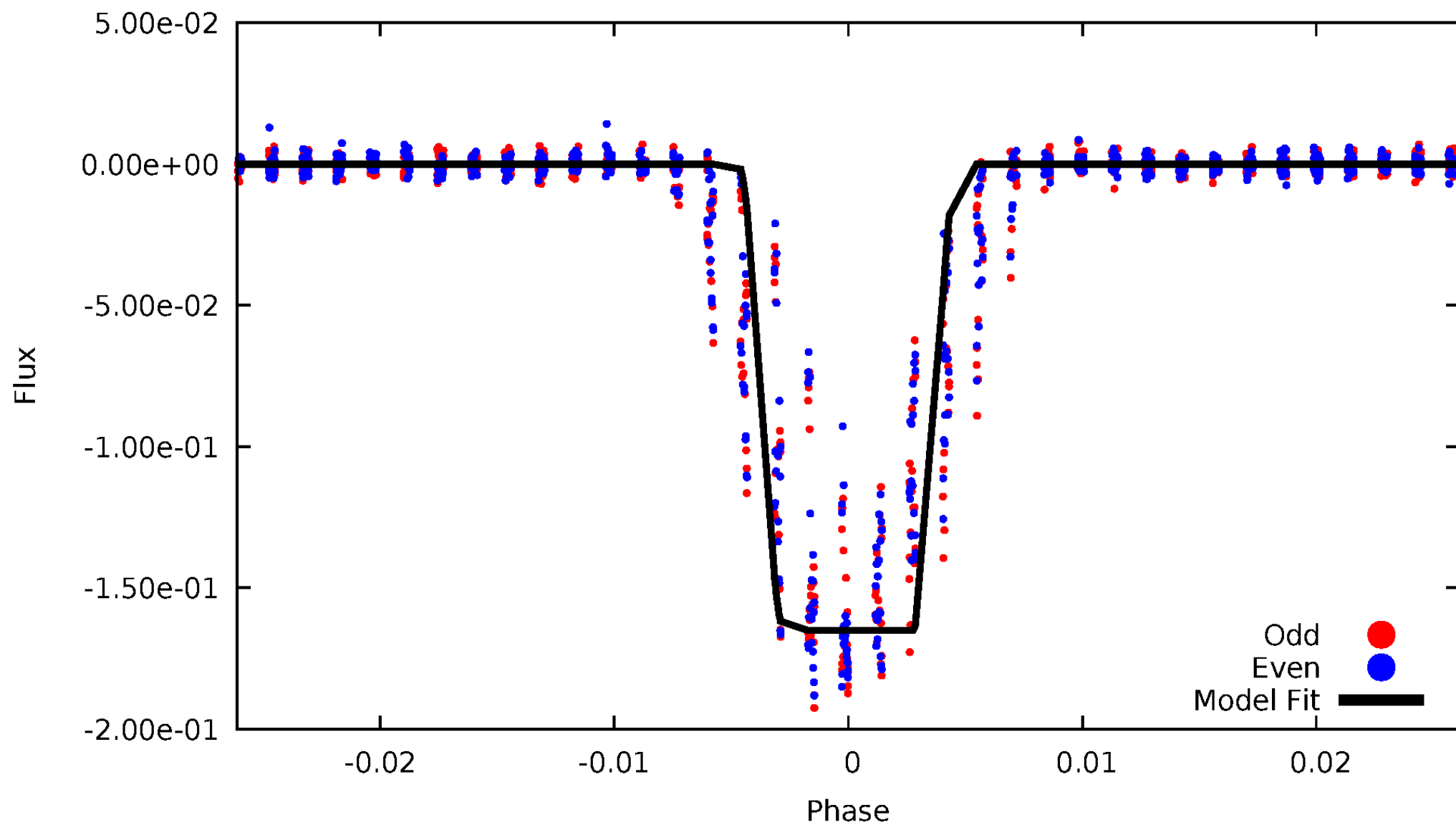
# DV Odd/Even

TCE 012459731-01



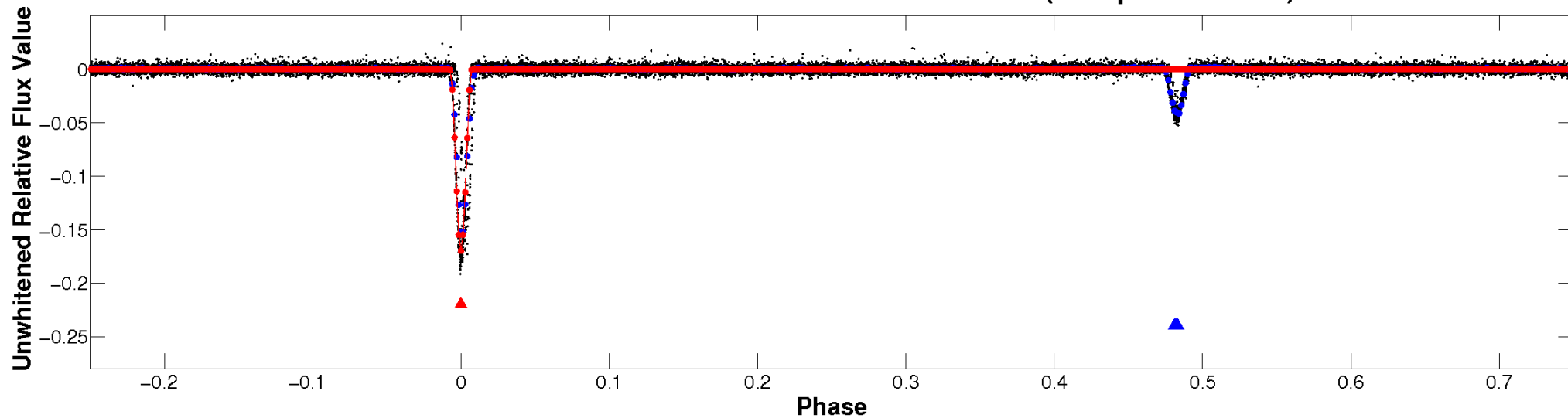
# ALT Odd/Even

TCE 012459731-01

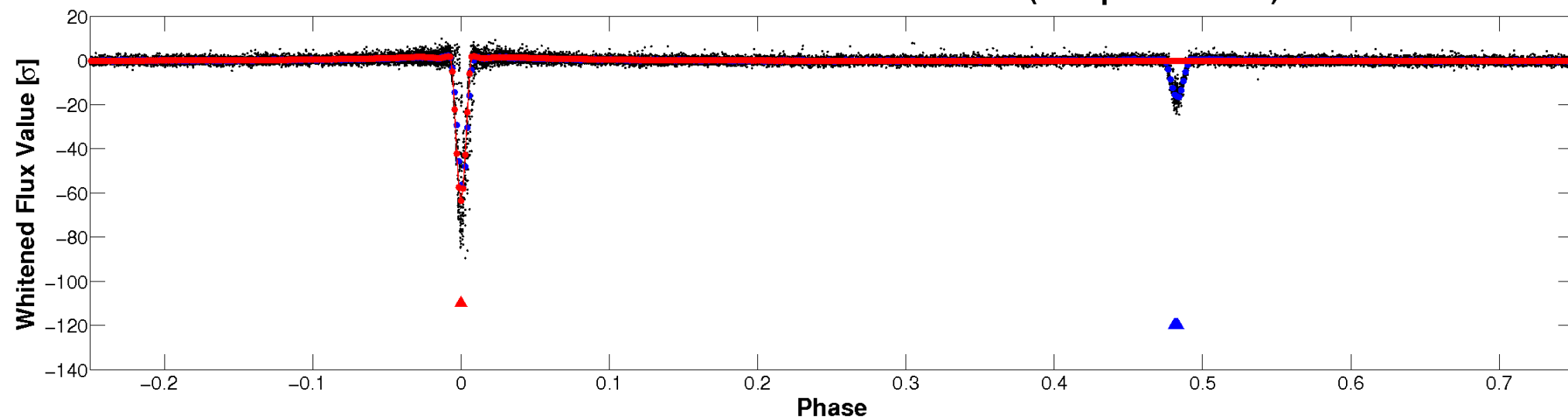


# Non-Whitened Vs. Whitened Light Curve

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

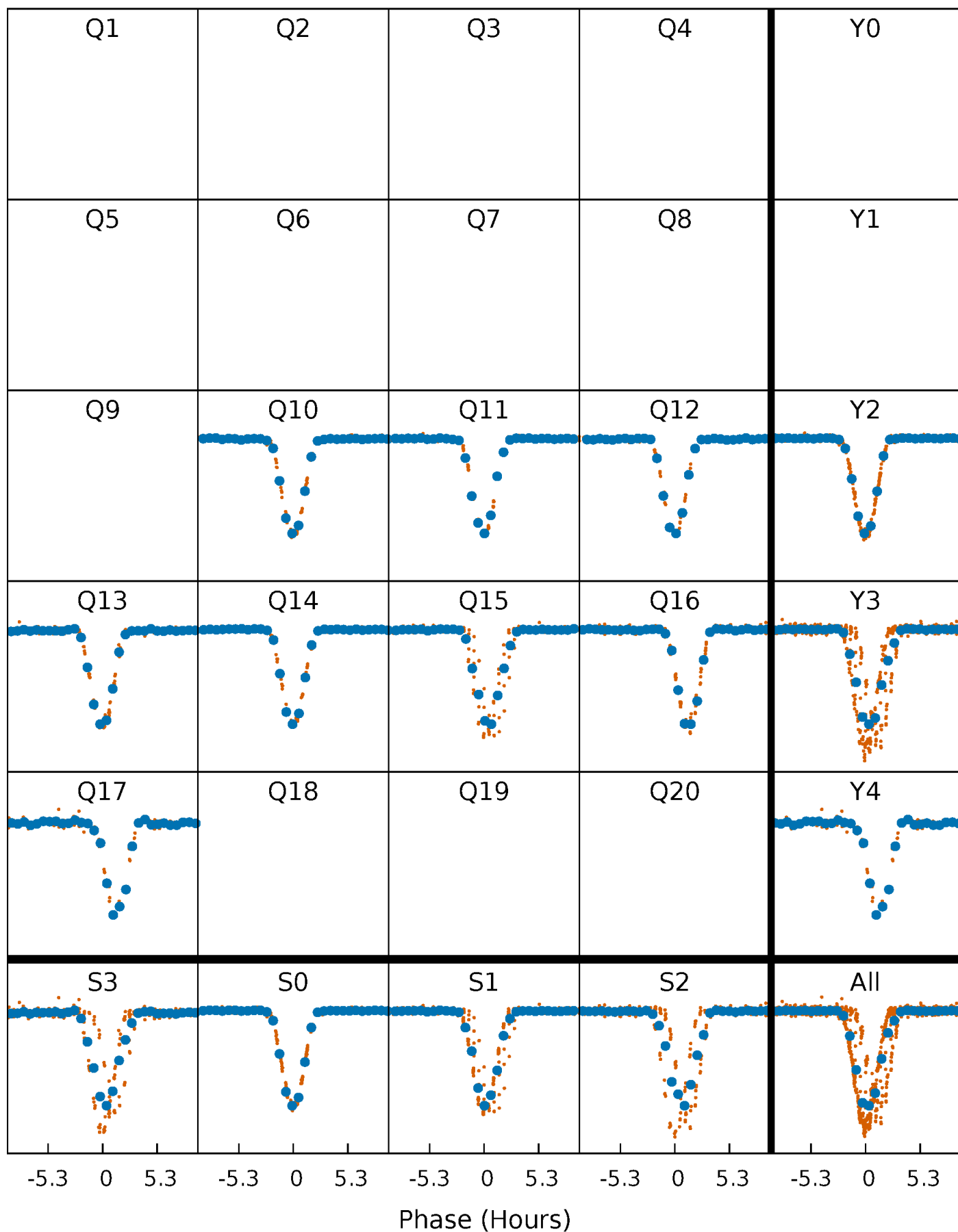


## Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

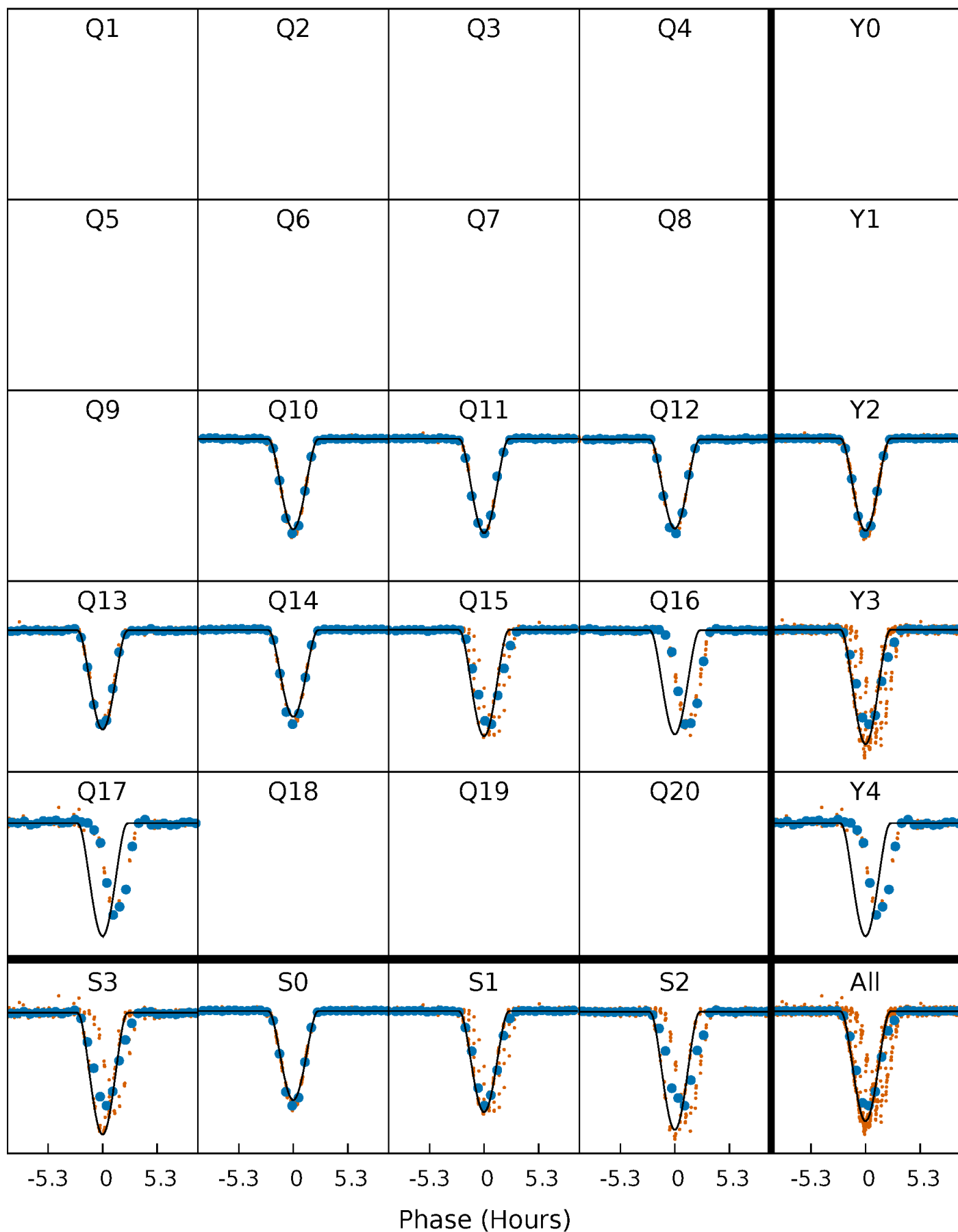
TCE 012459731-01 P= 14.180061 Days  $T_0=143.134855$  (BKJD)





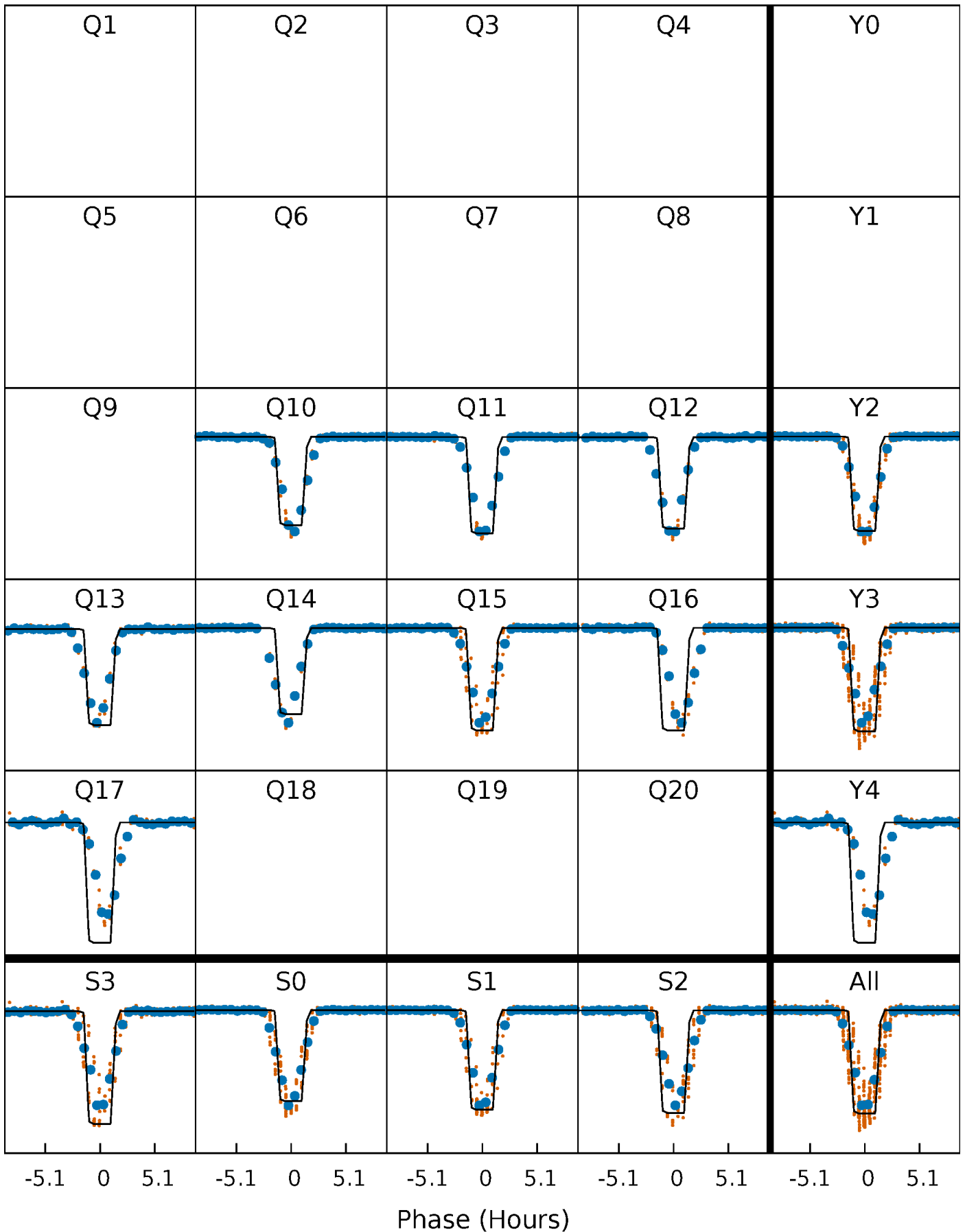
# DV Quarter-Phased Transit Curves

TCE 012459731-01 P= 14.180061 Days  $T_0=143.134855$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

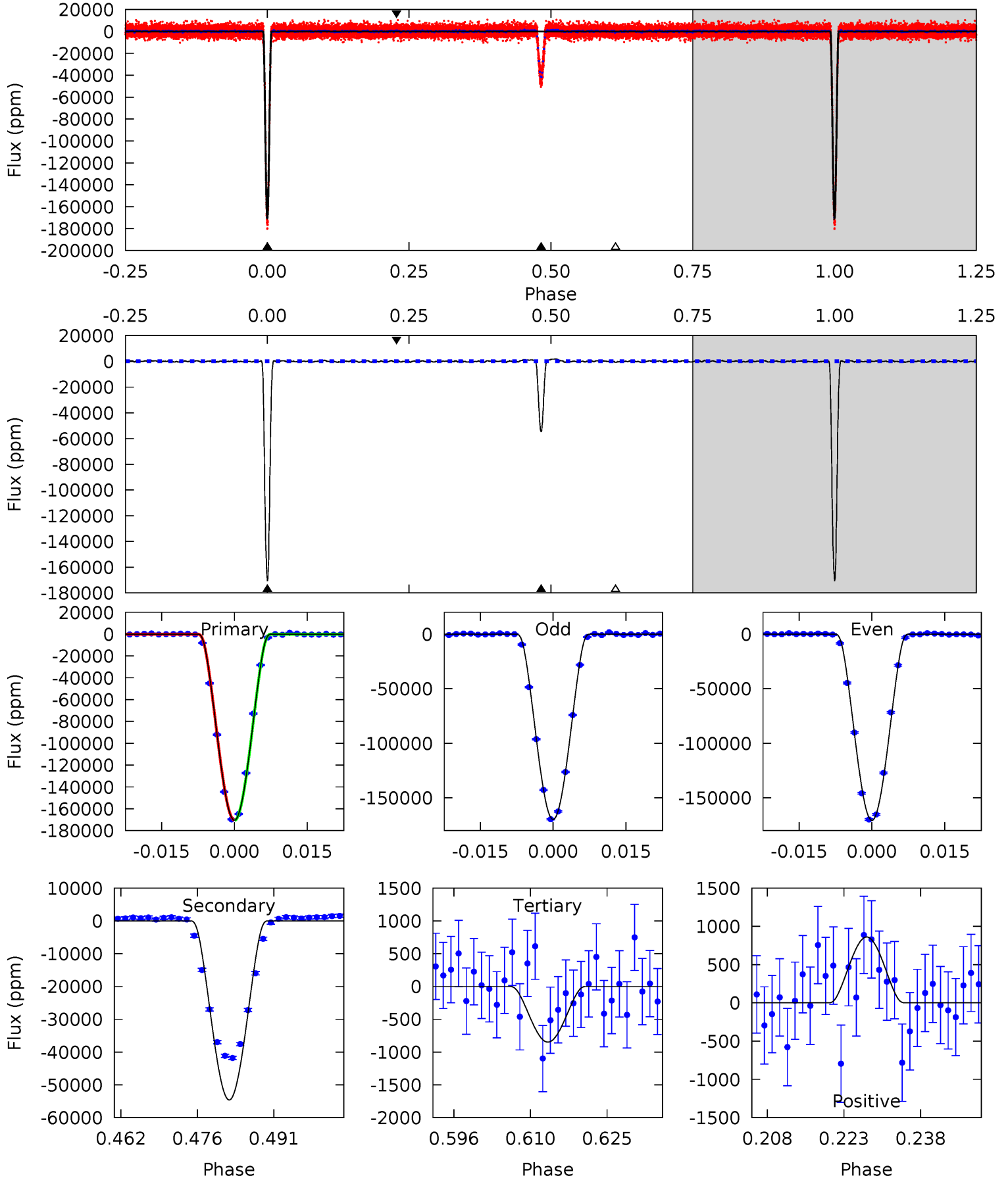
TCE 012459731-01 P= 14.180917 Days  $T_0=143.079301$  (BKJD)



# DV Model-Shift Uniqueness Test

012459731-01, P = 14.180061 Days, E = 143.134855 Days

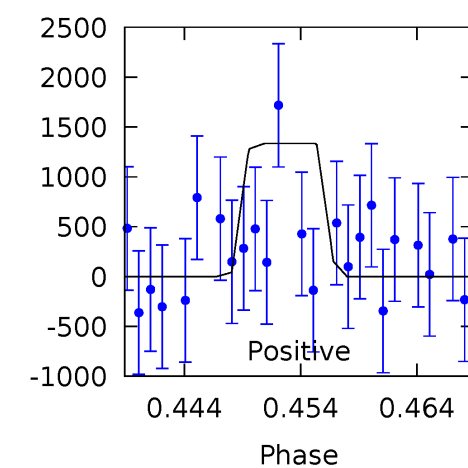
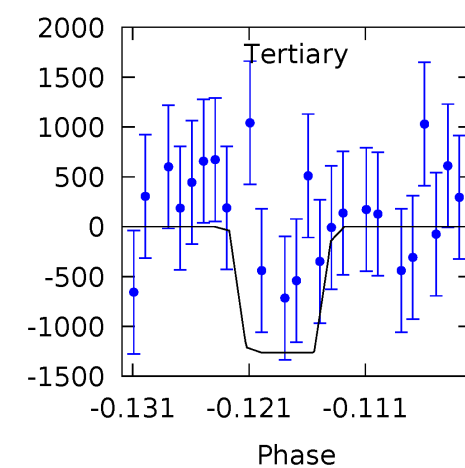
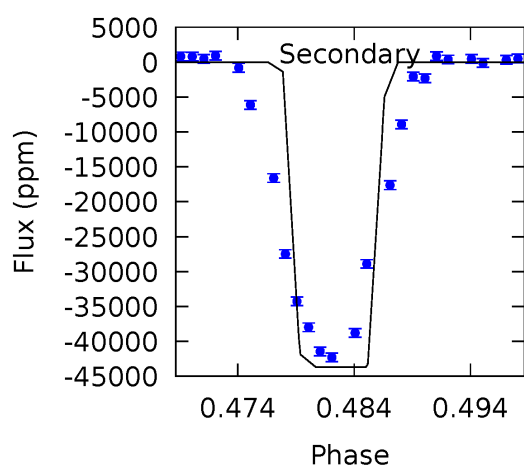
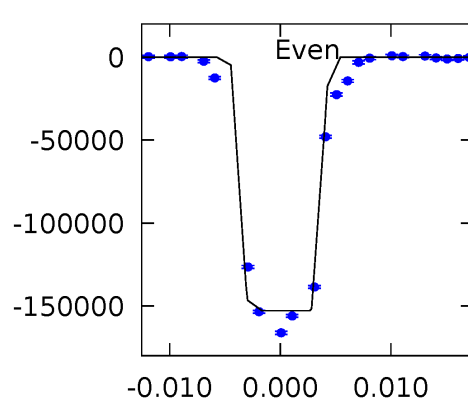
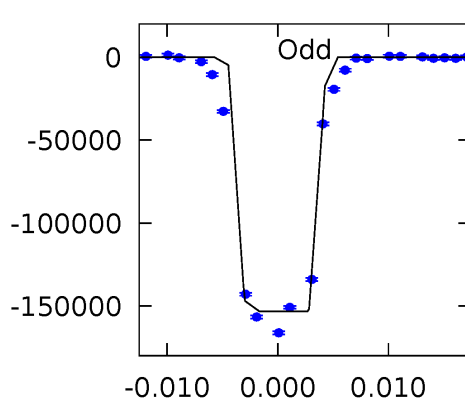
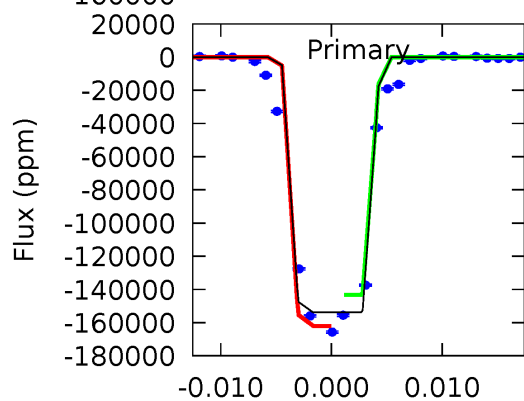
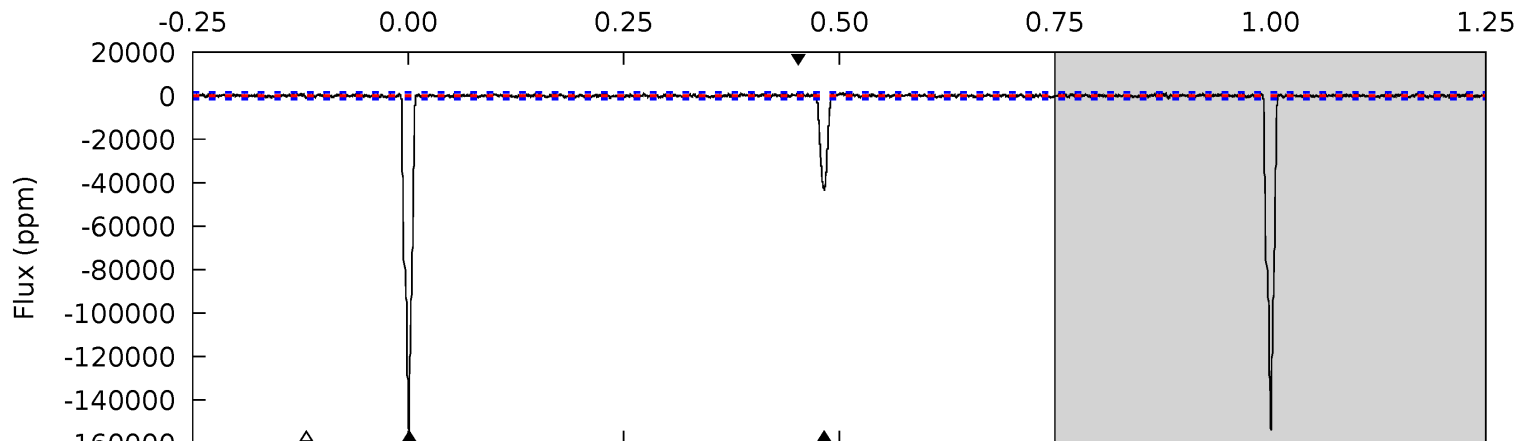
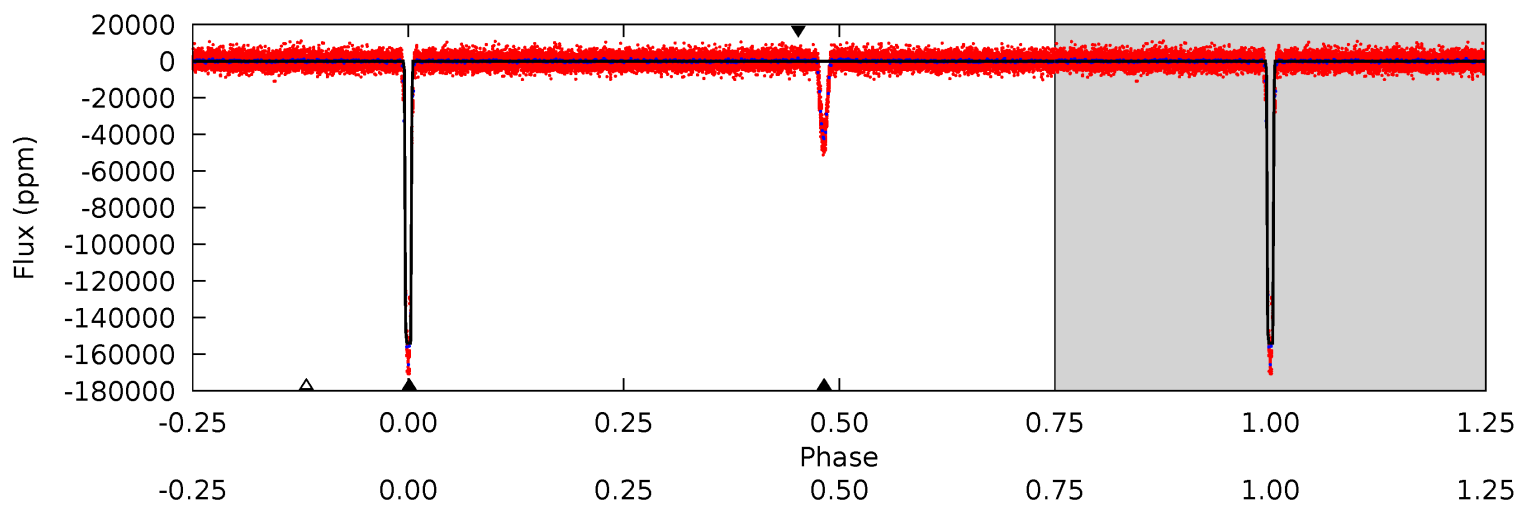
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
1099	351.8	5.46	5.54	4.95	2.44	2.47	1093	1093	346.3	346.2	2.85	0.92	0.01	0



# Alt Model-Shift Uniqueness Test

012459731-01, P = 14.180917 Days, E = 143.079301 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
514.2	146.0	4.23	4.46	5.02	2.57	1.17	510.0	509.8	141.7	141.5	0.76	0.97	0.01	19.4



### Stellar Parameters For KIC 012459731

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6289^{+197}_{-241}$	$4.330^{+0.124}_{-0.186}$	$-0.260^{+0.250}_{-0.300}$	$1.142^{+0.353}_{-0.190}$	$1.015^{+0.173}_{-0.115}$	$0.959^{+0.584}_{-0.492}$
	+3%/-4%	+3%/-4%	+96%/-115%	+31%/-17%	+17%/-11%	+61%/-51%
Source	KIC0	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 012459731-01 / KOI 3662.01

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-54584 \pm 155$	$82.91^{+68.83}_{-51.96}$	$1224^{+90}_{-80}$	$4081^{+2138}_{-720}$	$61^{+377}_{-43}$
Alt.	$-43673 \pm 299$	$71.28^{+55.93}_{-46.31}$	$1229^{+90}_{-76}$	$4198^{+2284}_{-802}$	$66^{+487}_{-45}$

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

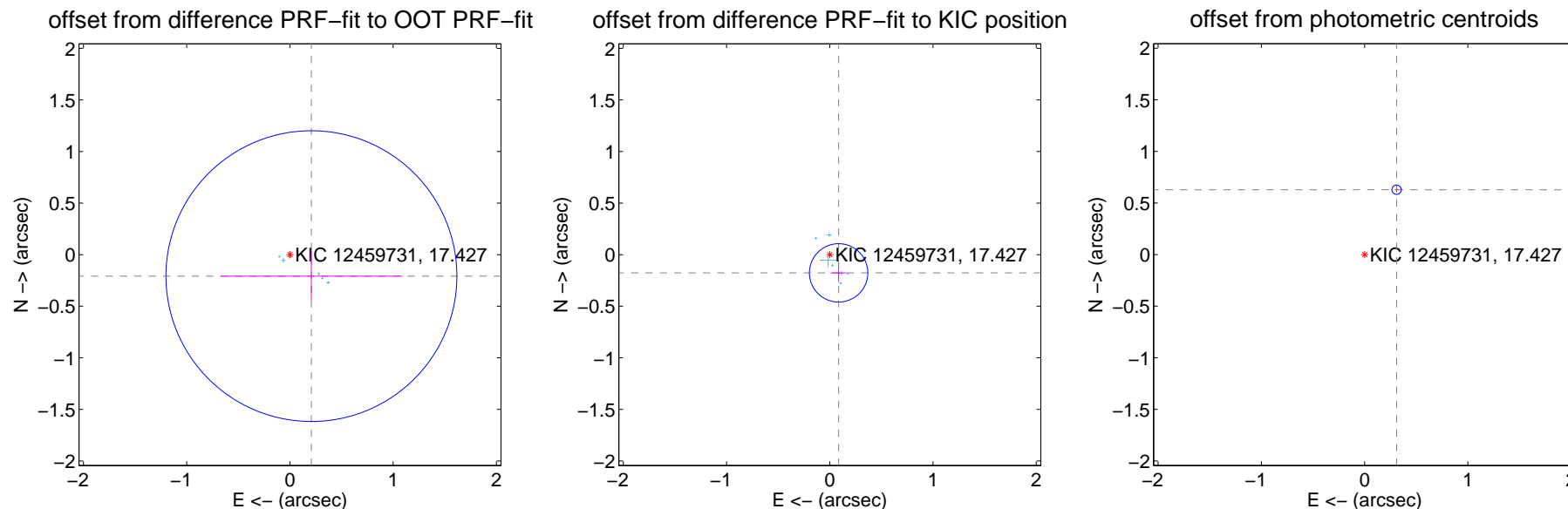
## DV Centroid Data

Supplemental centroid analysis for 012459731-01. Kepler magnitude: 17.43. Transit SNR 549.54

There are 8 quarters with good PRF difference image offsets

The OOT PRF centroid is offset from the target star catalog position by about 5.14 arcsec so the offset from difference PRF-fit to OOT-fit may be invalid.

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.294 \pm 0.470$	0.63	$-0.208 \pm 0.881$	$-0.208 \pm 0.237$
PRF-fit source offset from KIC position	$0.196 \pm 0.094$	2.08	$-0.085 \pm 0.076$	$-0.177 \pm 0.089$
photometric centroid source offset	$0.70 \pm 0.02$	46.48	$-0.31 \pm 0.02$	$0.63 \pm 0.02$

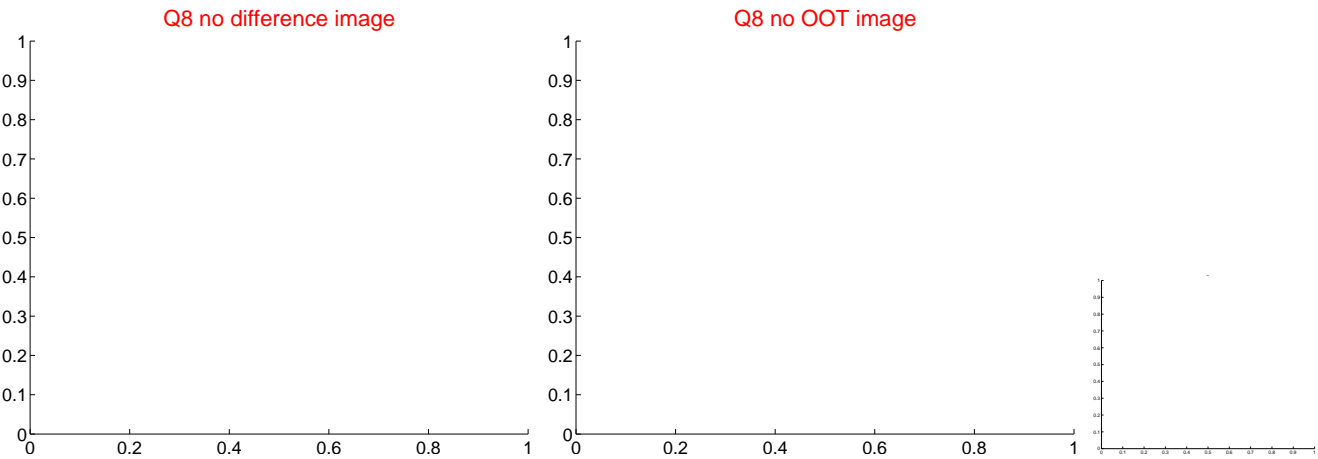
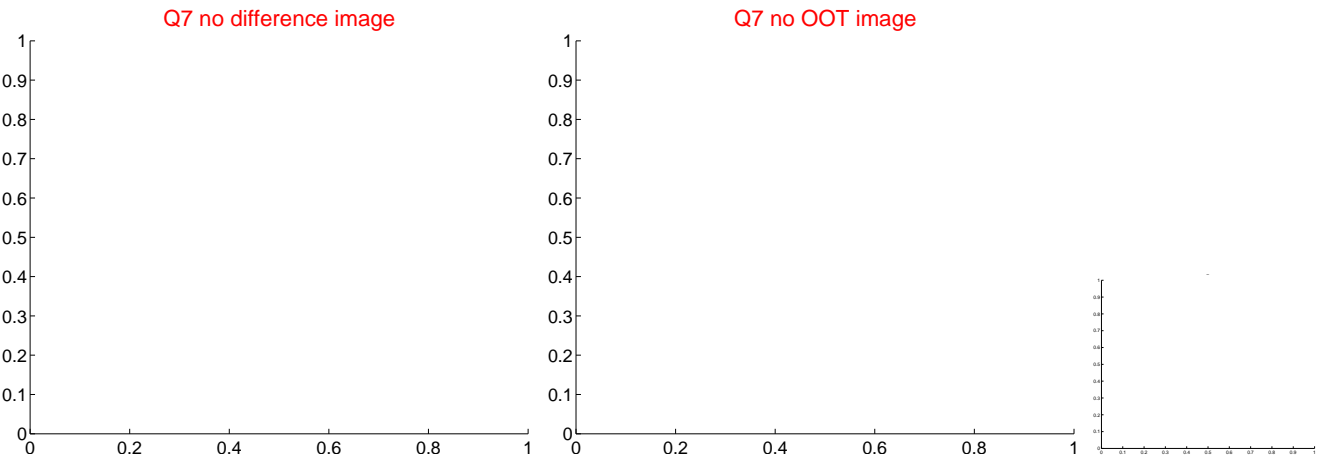
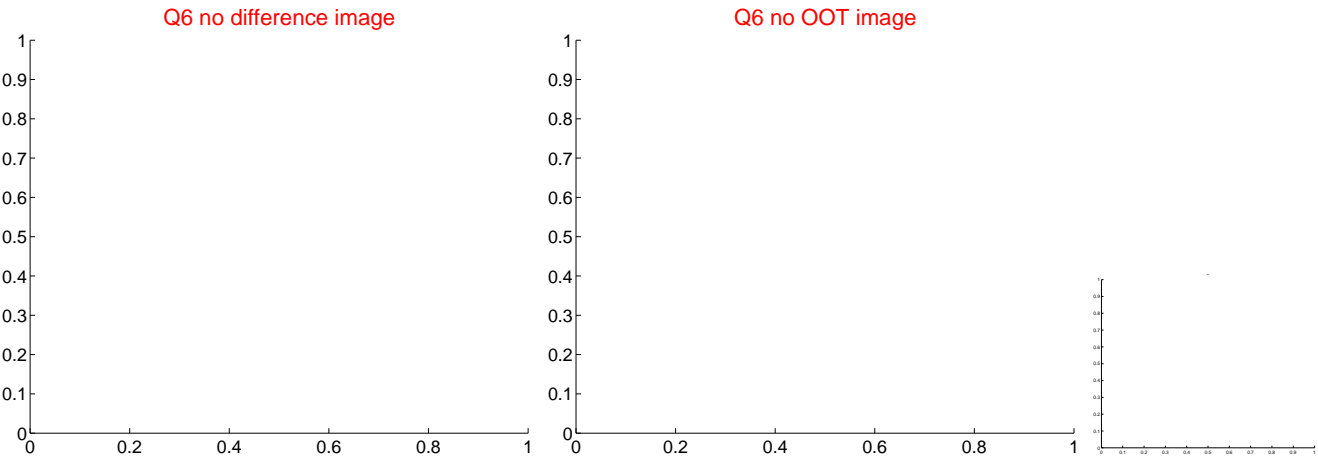
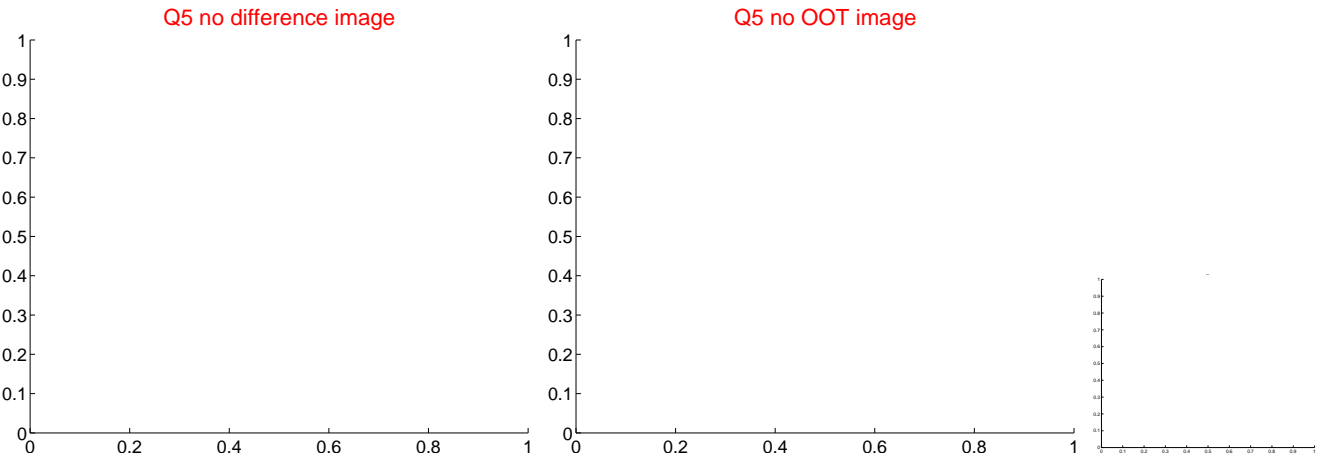


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

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

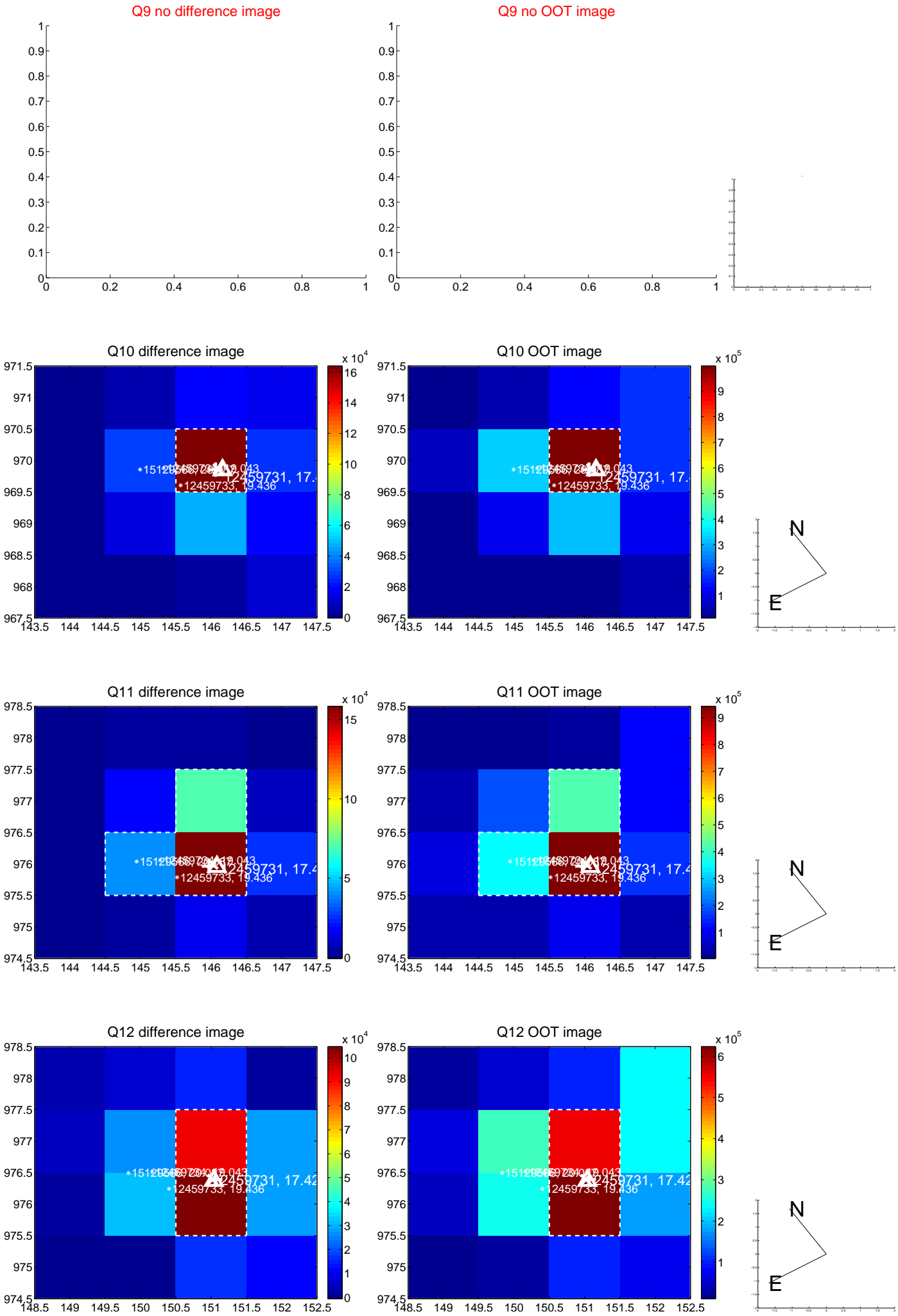


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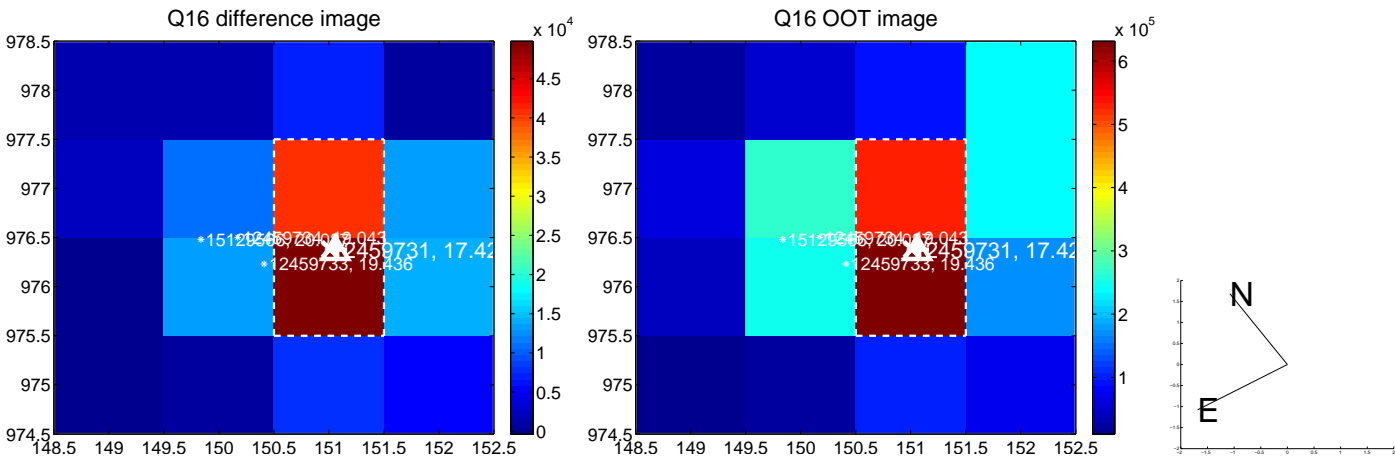
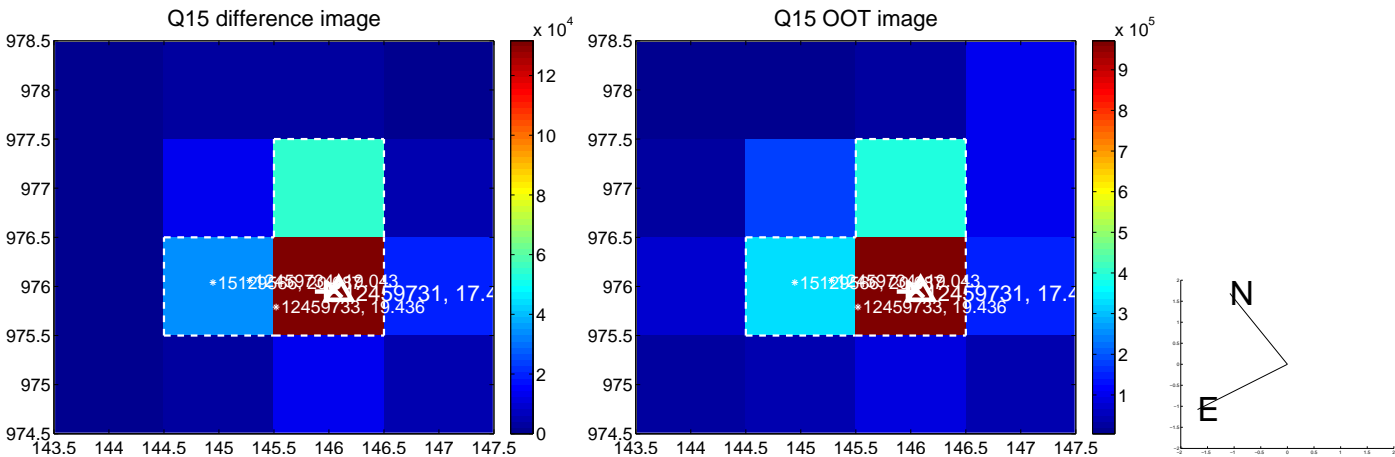
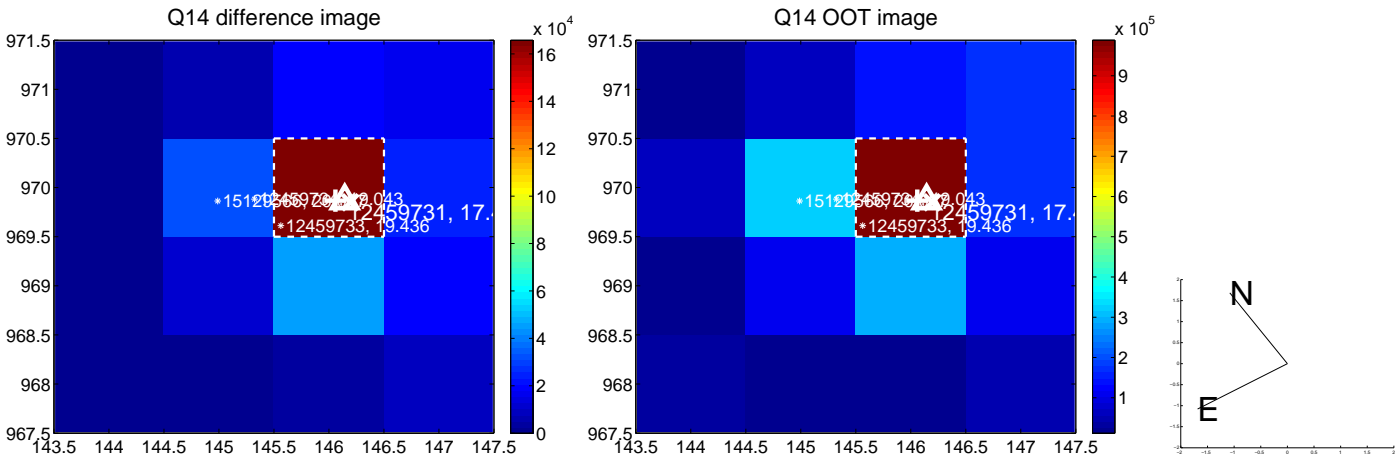
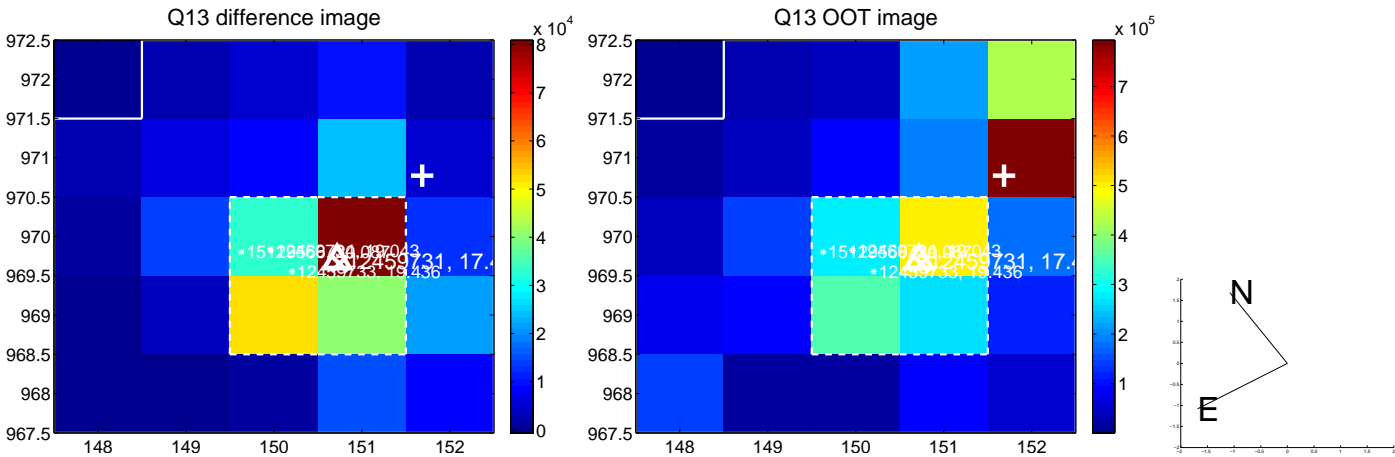




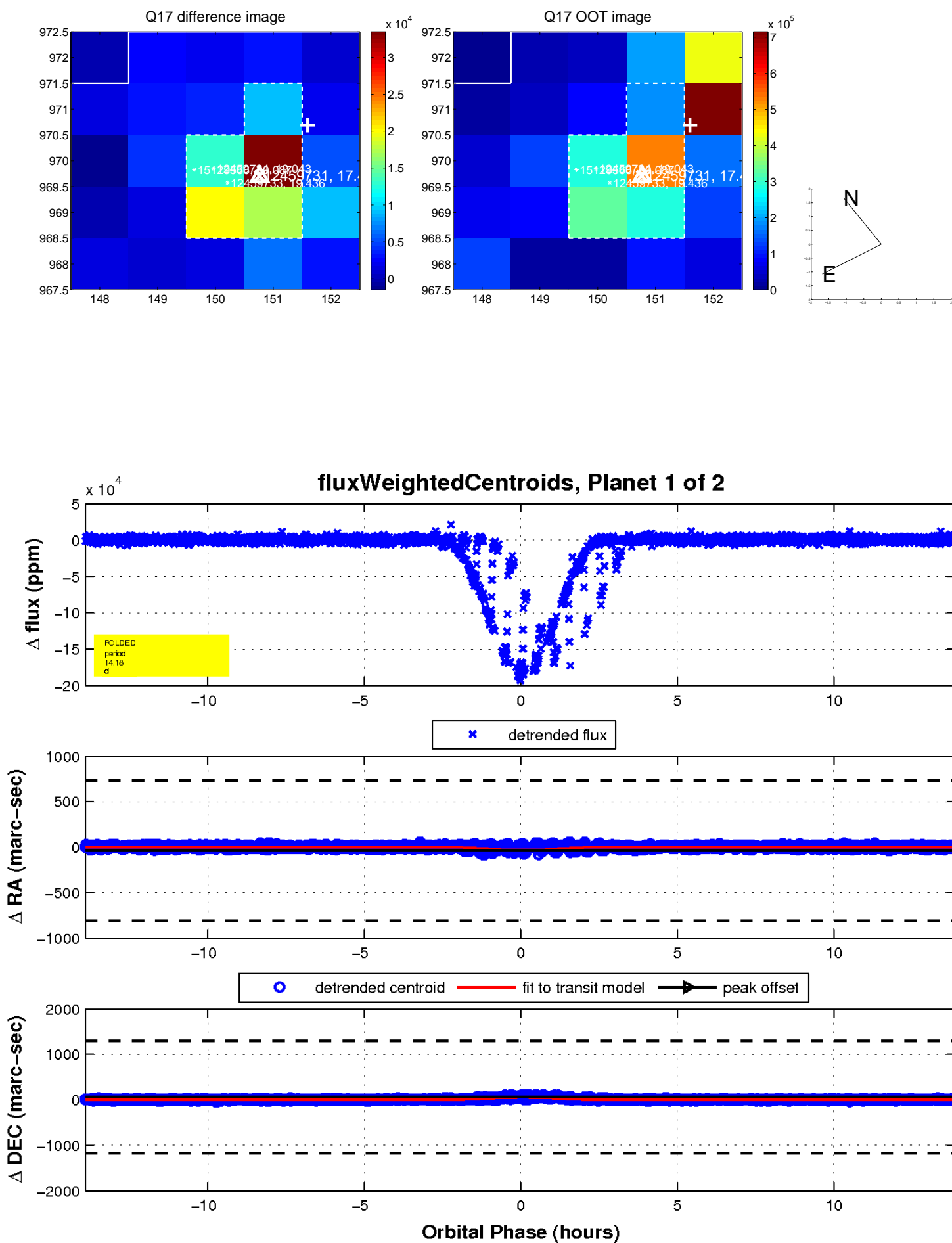
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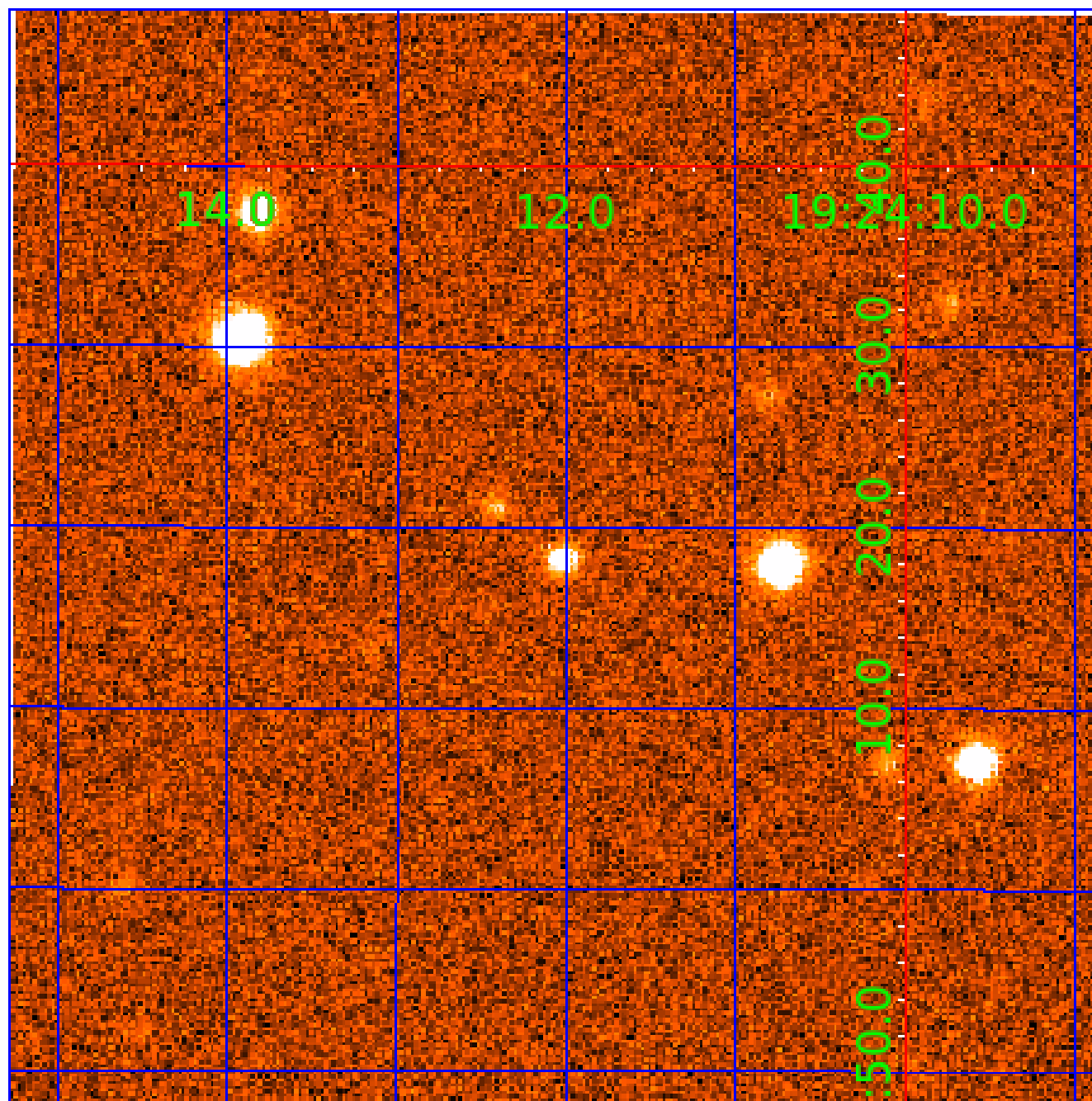


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UKIRT Image

Declination



# KIC 012459731

## 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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012459731-02	OBS	FP	0.00	1	1	0	0	IS_SEC_TCE—CENT_KIC_POS

**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.

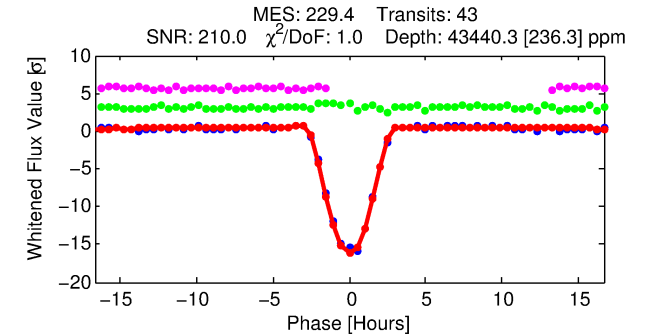
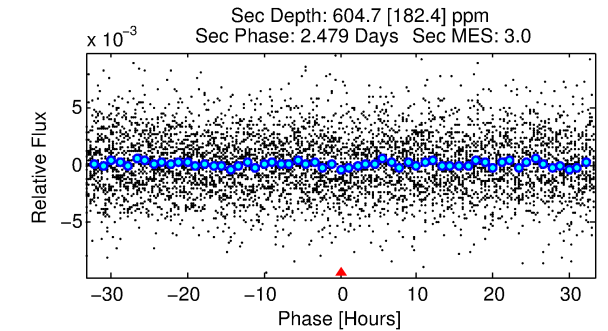
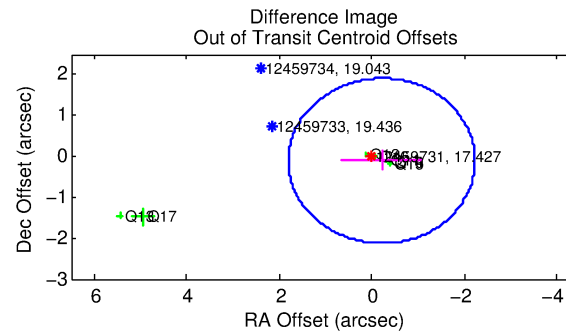
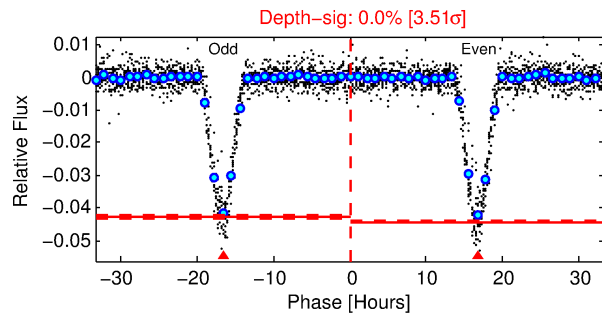
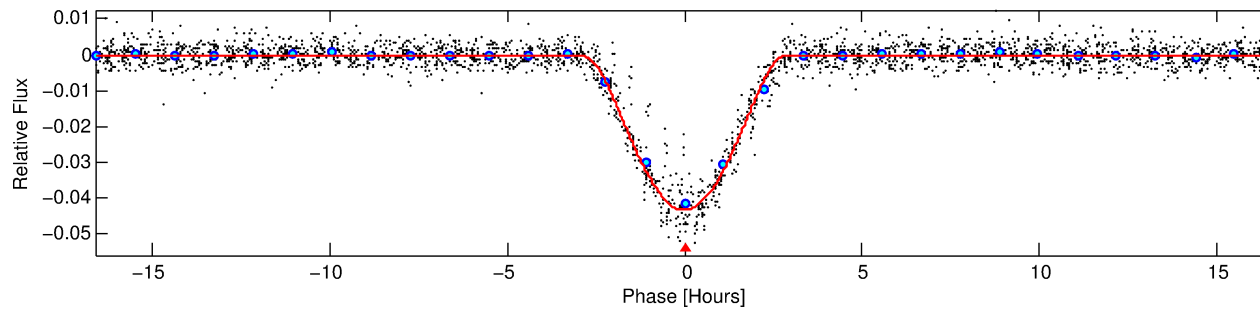
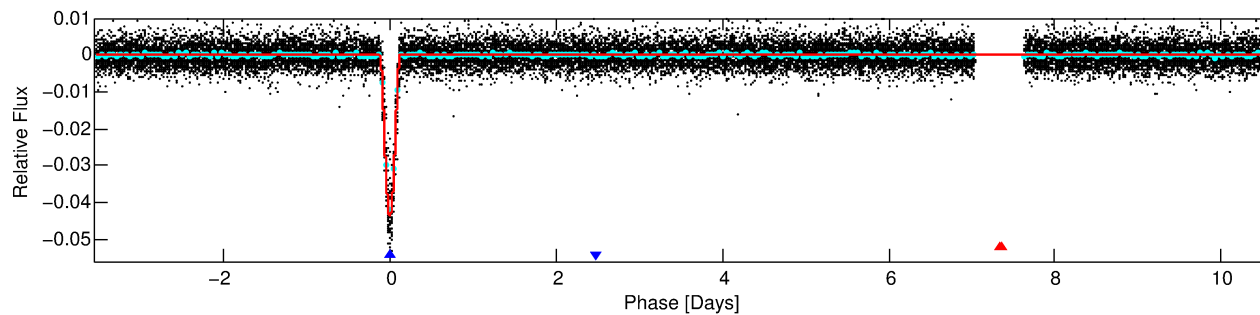
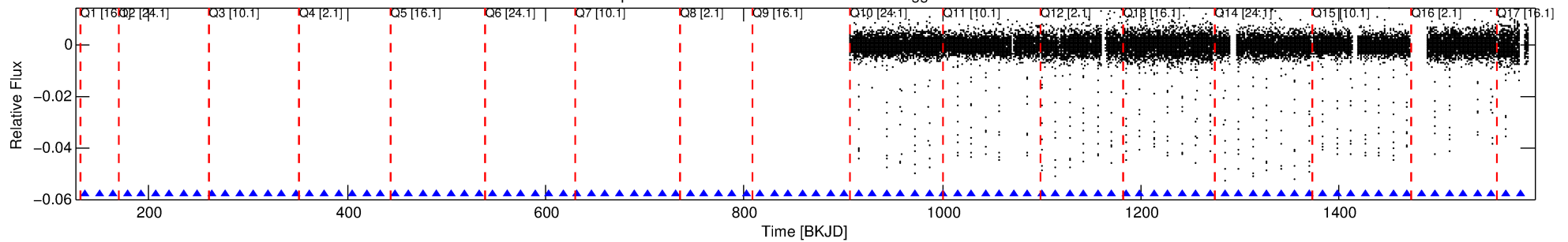
## Ephemeris Match Information For 012459731-02

No Significant Match Found

# DV One-Page Summary

KIC: 12459731 Candidate: 2 of 2 Period: 14.180 d  
KOI: K03662 Corr: No Ephemeris Match

Kp: 17.43 R\*: 1.14 Rs Teff: 6289.0 K Logg: 4.33 Fe/H: -0.260



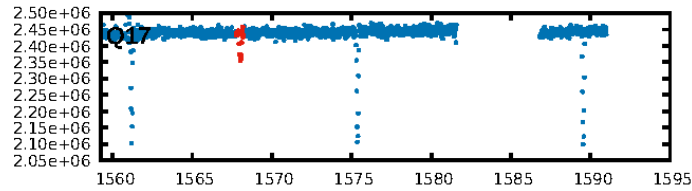
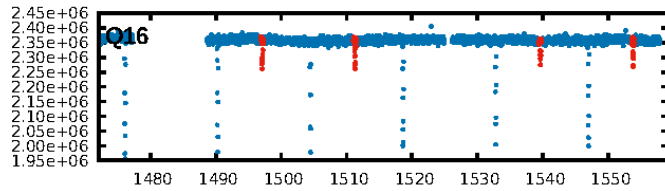
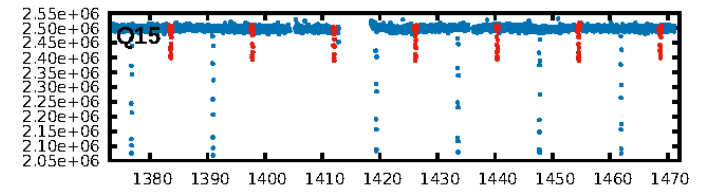
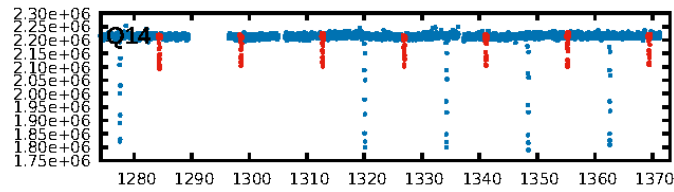
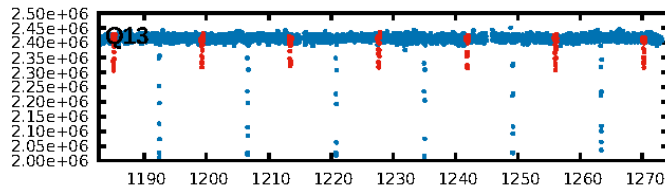
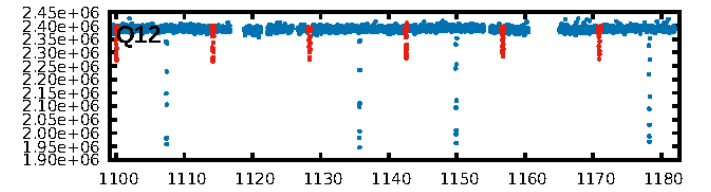
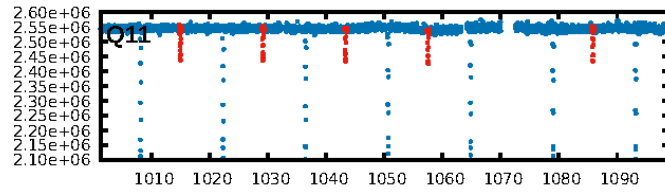
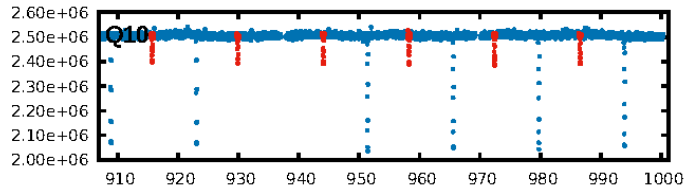
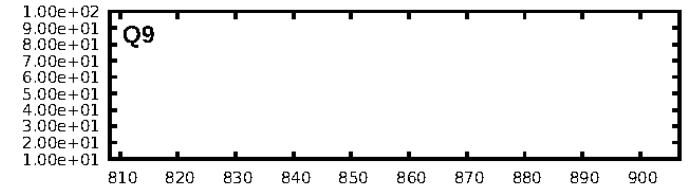
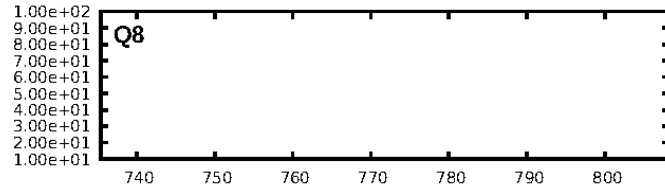
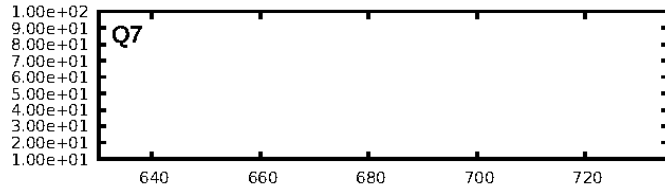
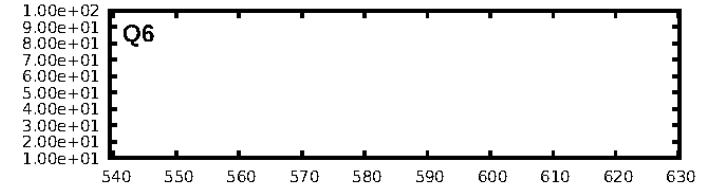
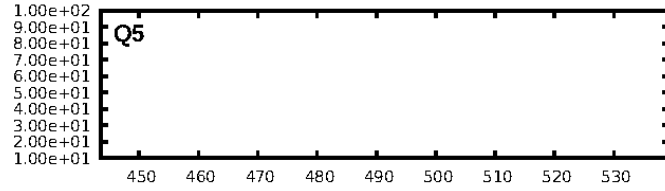
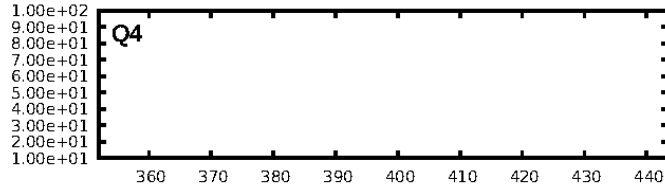
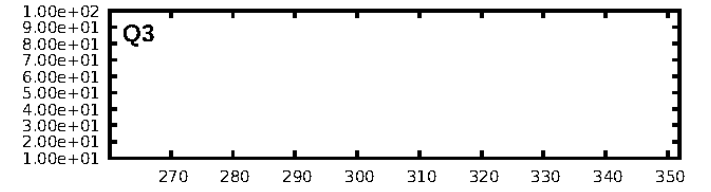
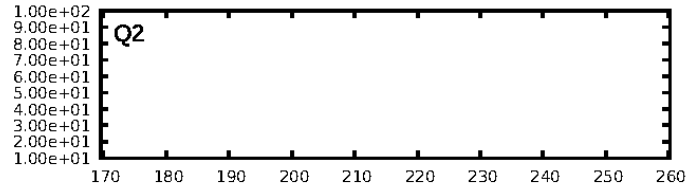
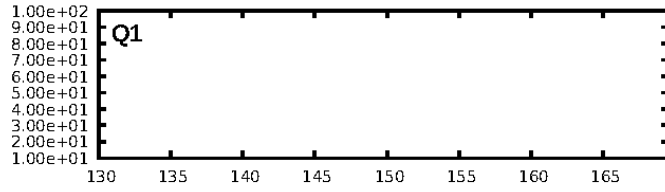
## DV Fit Results:

Period = 14.18037 [0.00002] d  
Epoch = 135.7757 [0.0018] BKJD  
Rp/R\* = 0.2884 [0.0689]  
a/R\* = 17.18 [0.34]  
b = 0.94 [0.10]  
Seff = 137.43 [52.78]  
Teq = 873 [84] K  
Rp = 35.95 [14.04] Re  
a = 0.1153 [0.0289] AU  
Ag = 3.42 [2.28] [1.06σ]  
Teffp = 1836 [269] K [3.42σ]

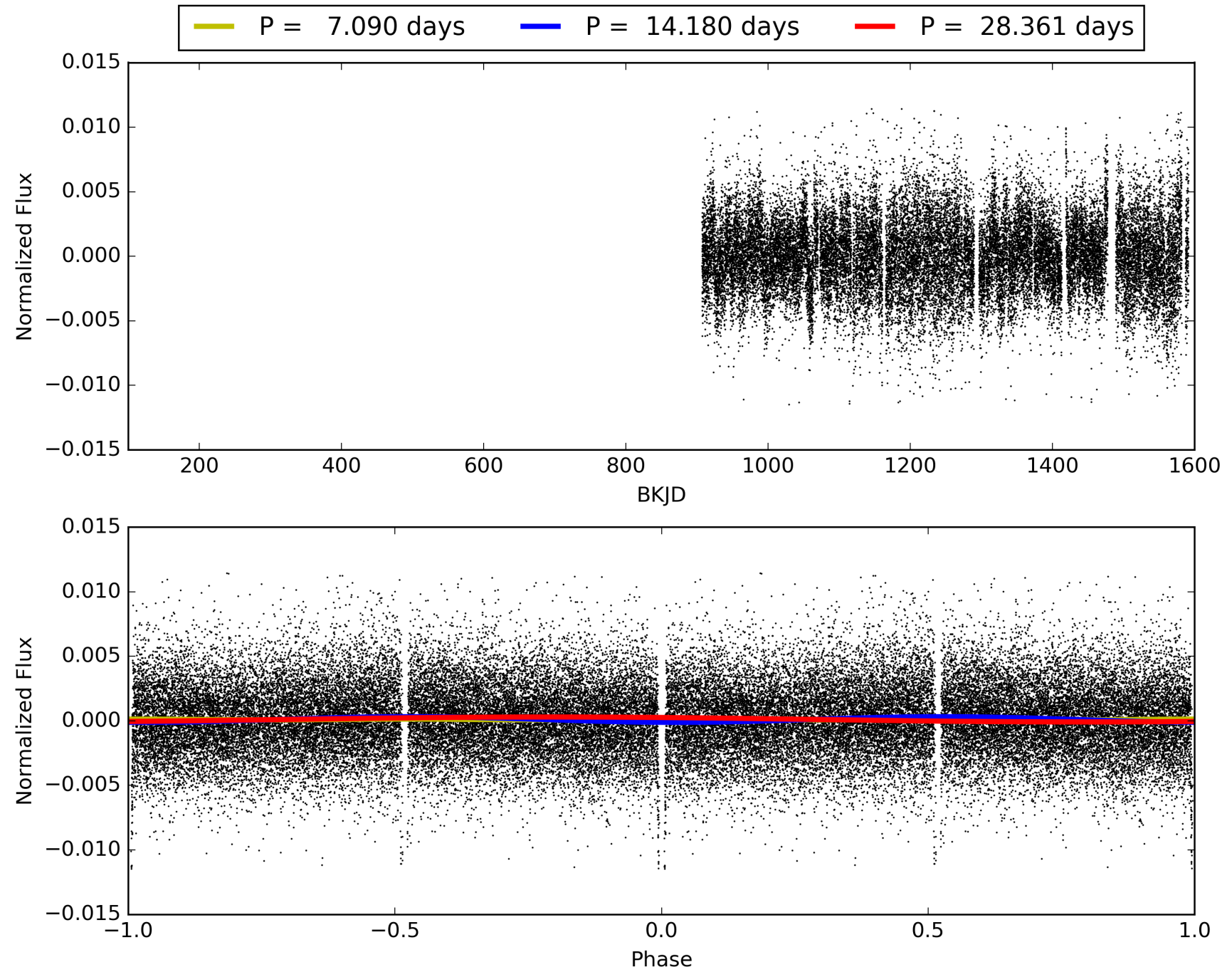
## DV Diagnostic Results:

ShortPeriod-sig: 0.1% [0.00σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 0.0%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 0.00e+00  
RollingBand-fgt: 1.00 [42/42]  
GhostDiagnostic-chr: 2.612  
Centroid-sig: 0.0%  
Centroid-so: 0.803 arcsec [15.50σ]  
OotOffset-rm: 0.240 arcsec [0.36σ]  
KicOffset-rm: 0.119 arcsec [1.37σ]  
OotOffset-st: 2/2/2/2 [8]  
KicOffset-st: 2/2/2/2 [8]  
DiffImageQuality-fgm: 1.00 [8/8]  
DiffImageOverlap-fno: 1.00 [8/8]

# TCE 012459731-02, PDC Light Curves



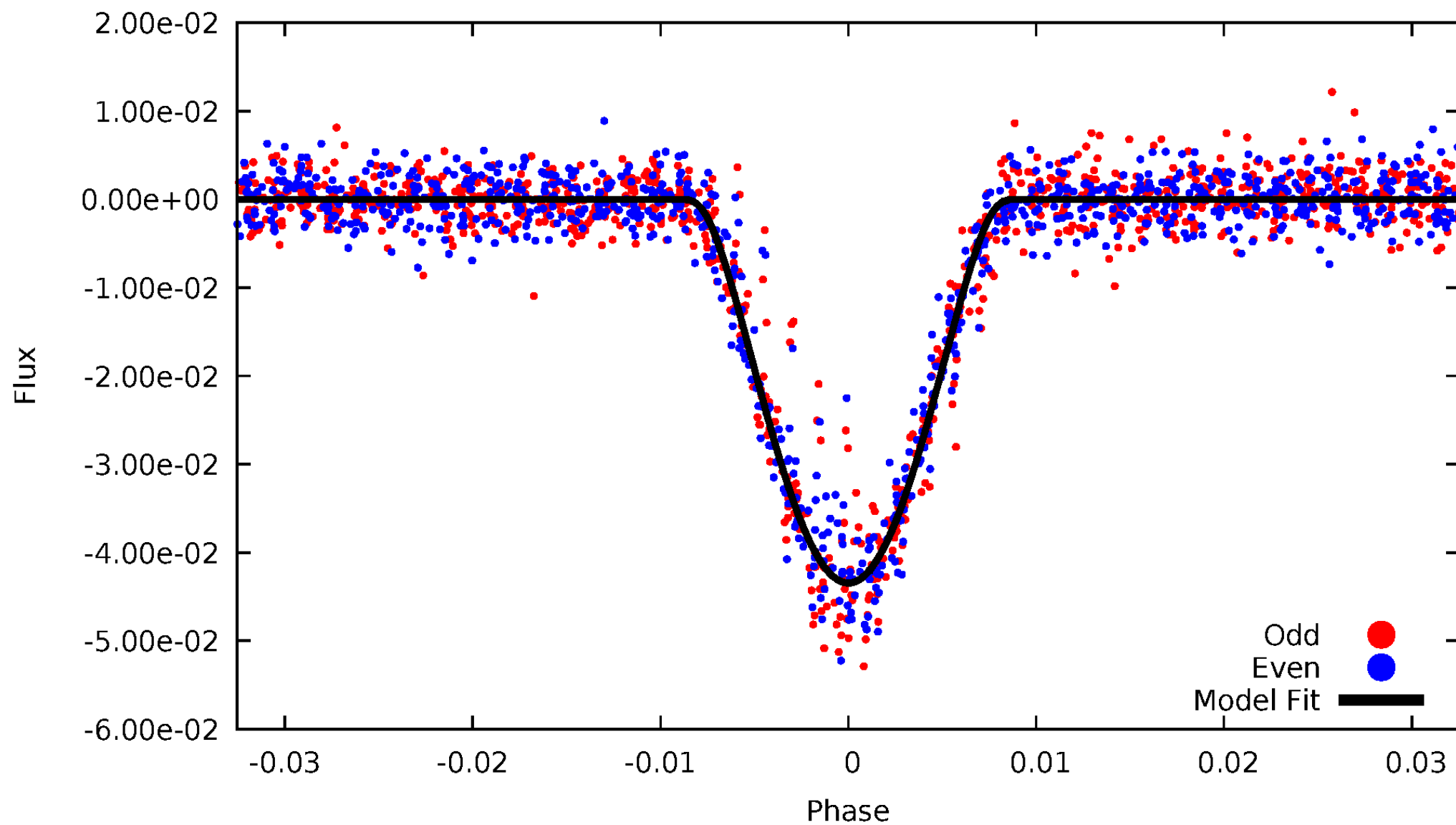
# TCE 012459731-02





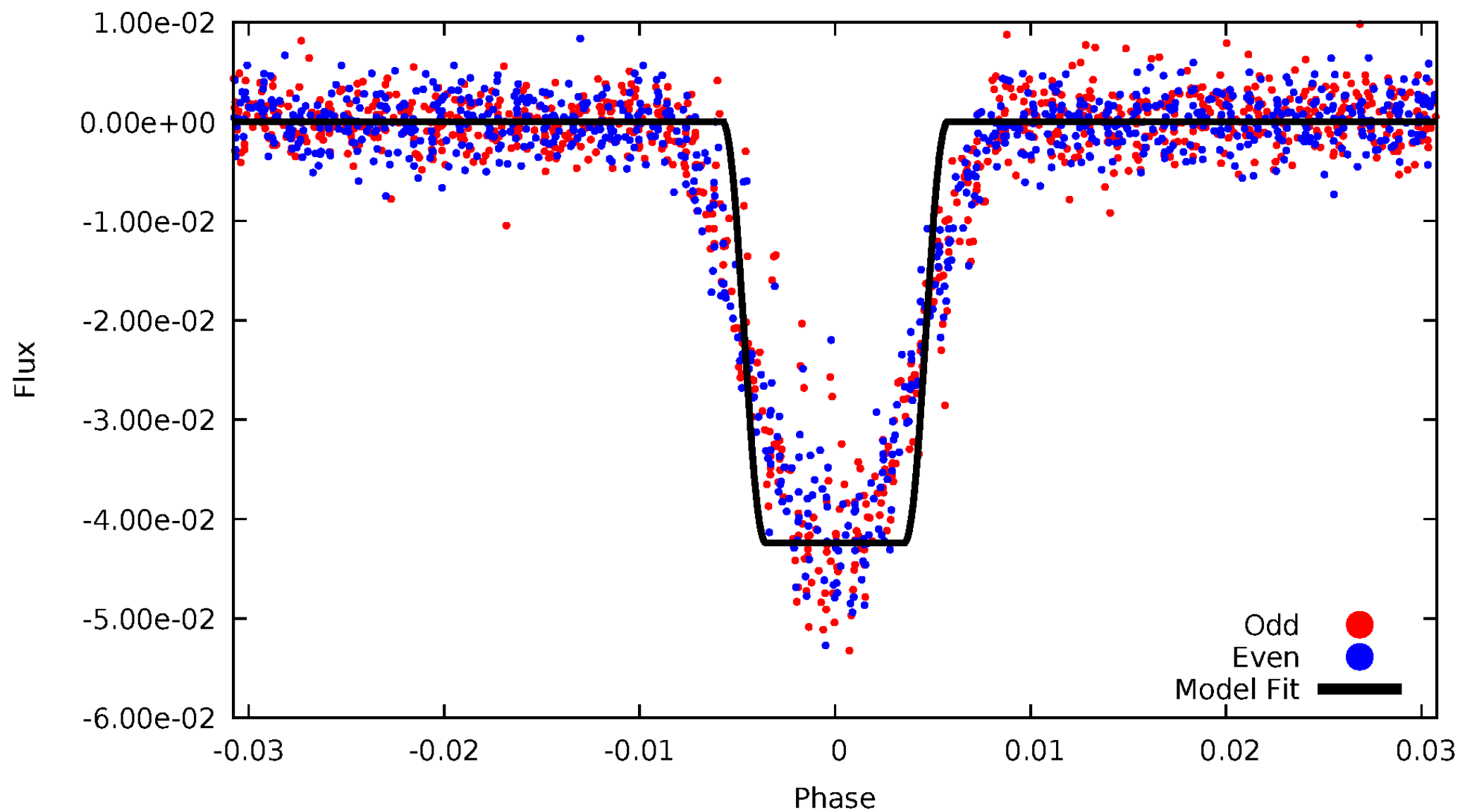
# DV Odd/Even

TCE 012459731-02



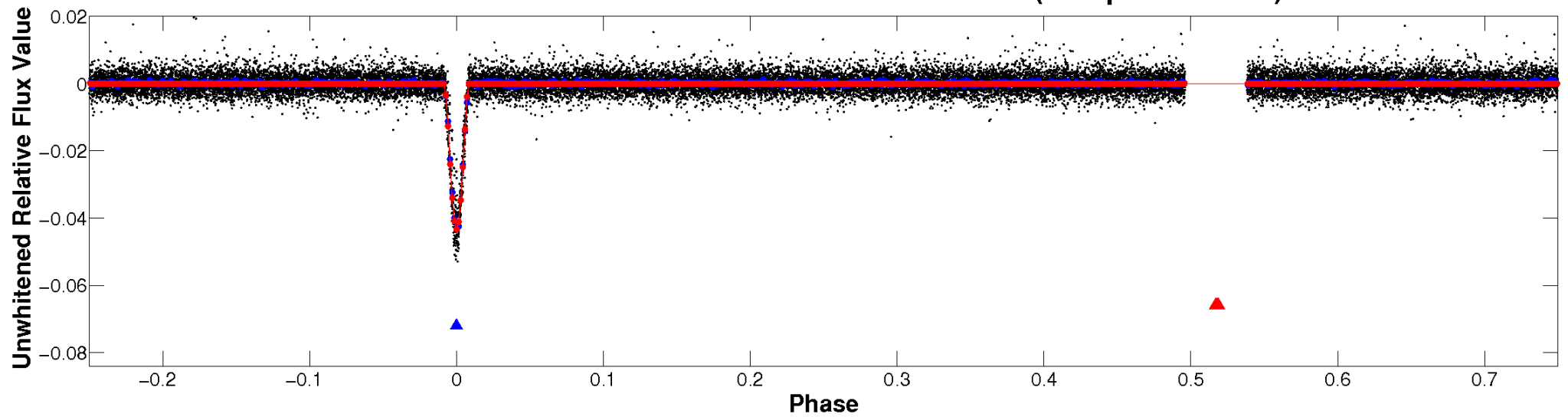
# ALT Odd/Even

TCE 012459731-02

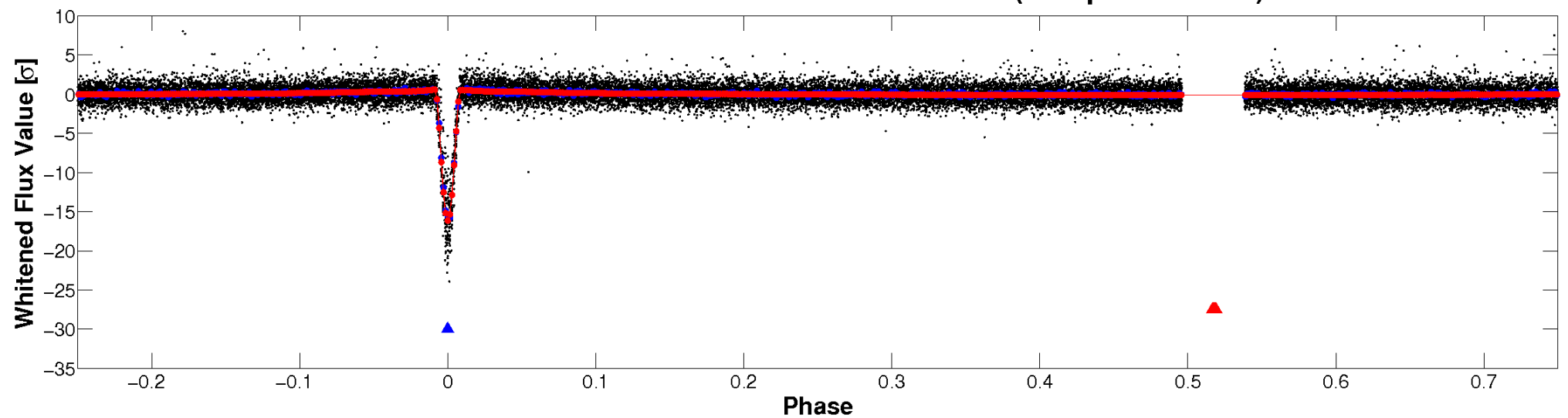


# Non-Whitened Vs. Whitened Light Curve

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

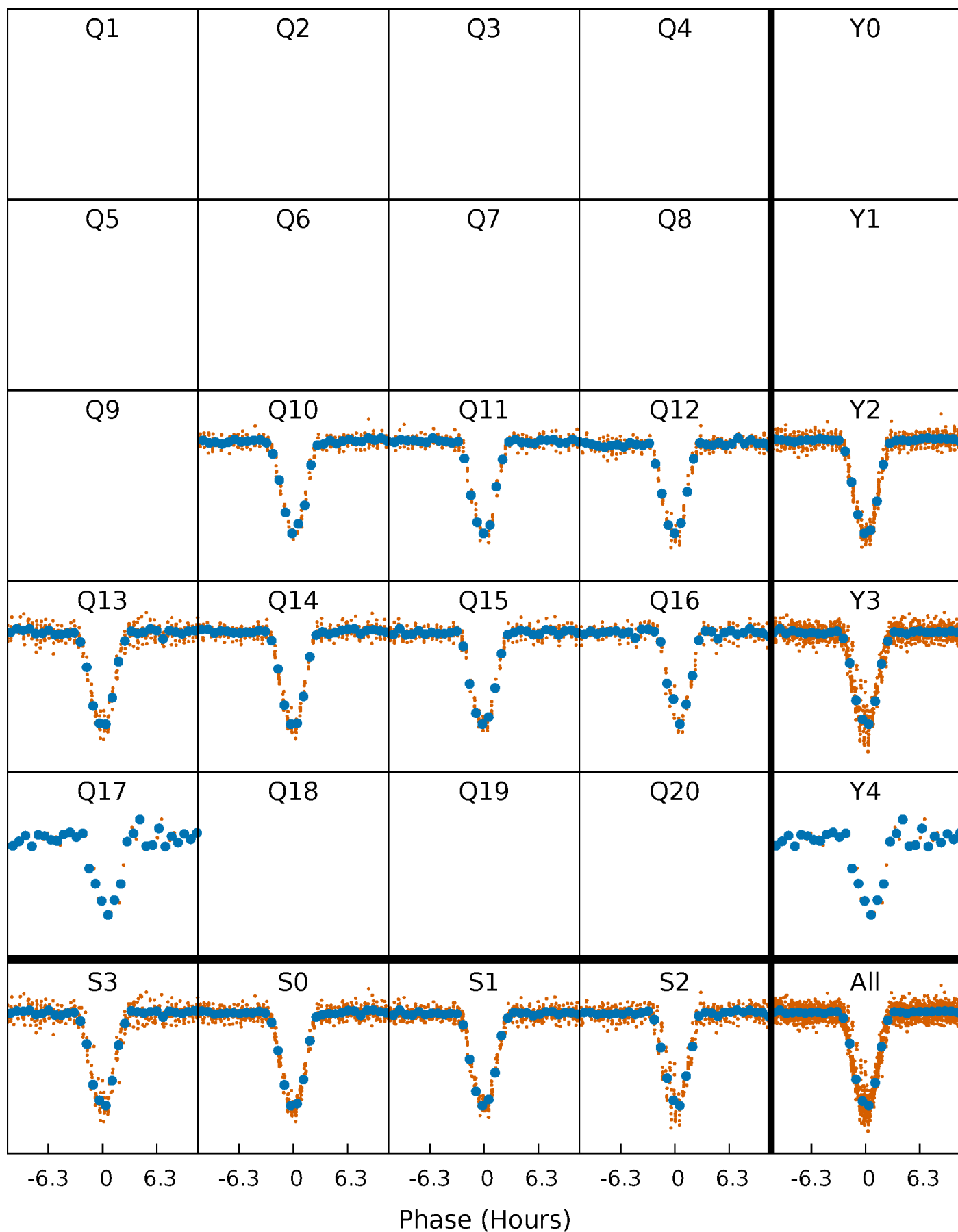


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



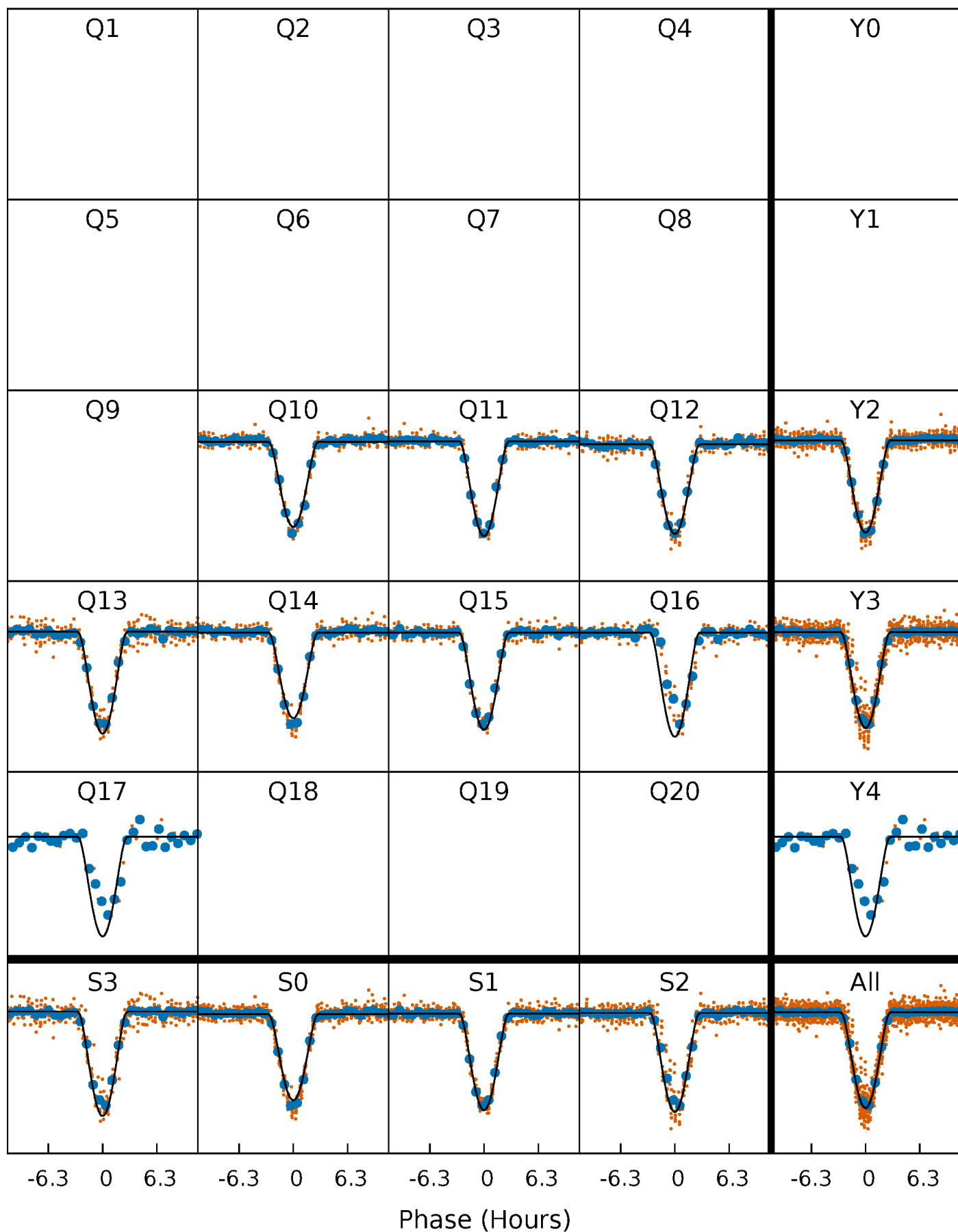
# PDC Quarter-Phased Transit Curves

TCE 012459731-02   P= 14.180368 Days    $T_0=135.775680$  (BKJD)



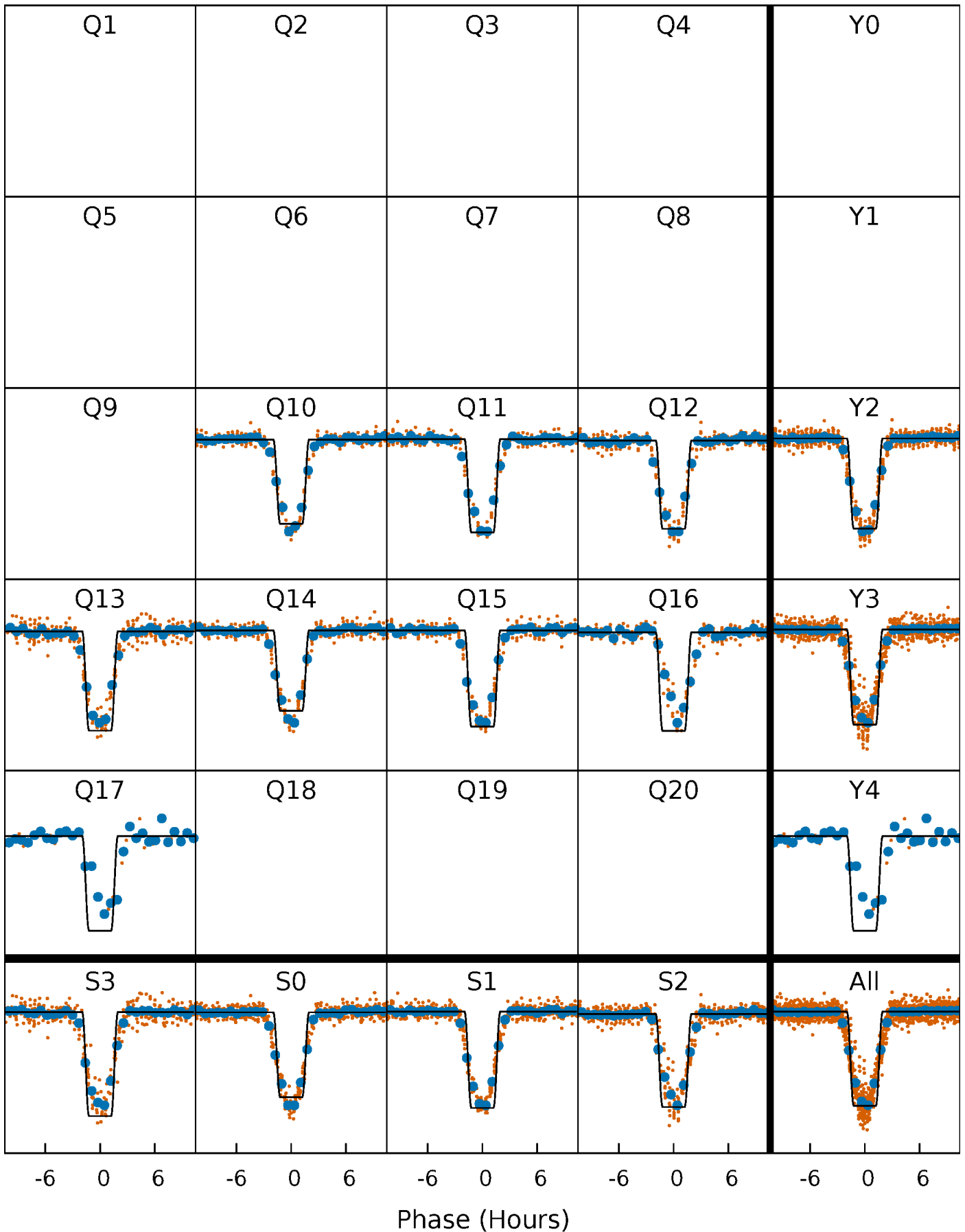
# DV Quarter-Phased Transit Curves

TCE 012459731-02   P= 14.180368 Days    $T_0=135.775680$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

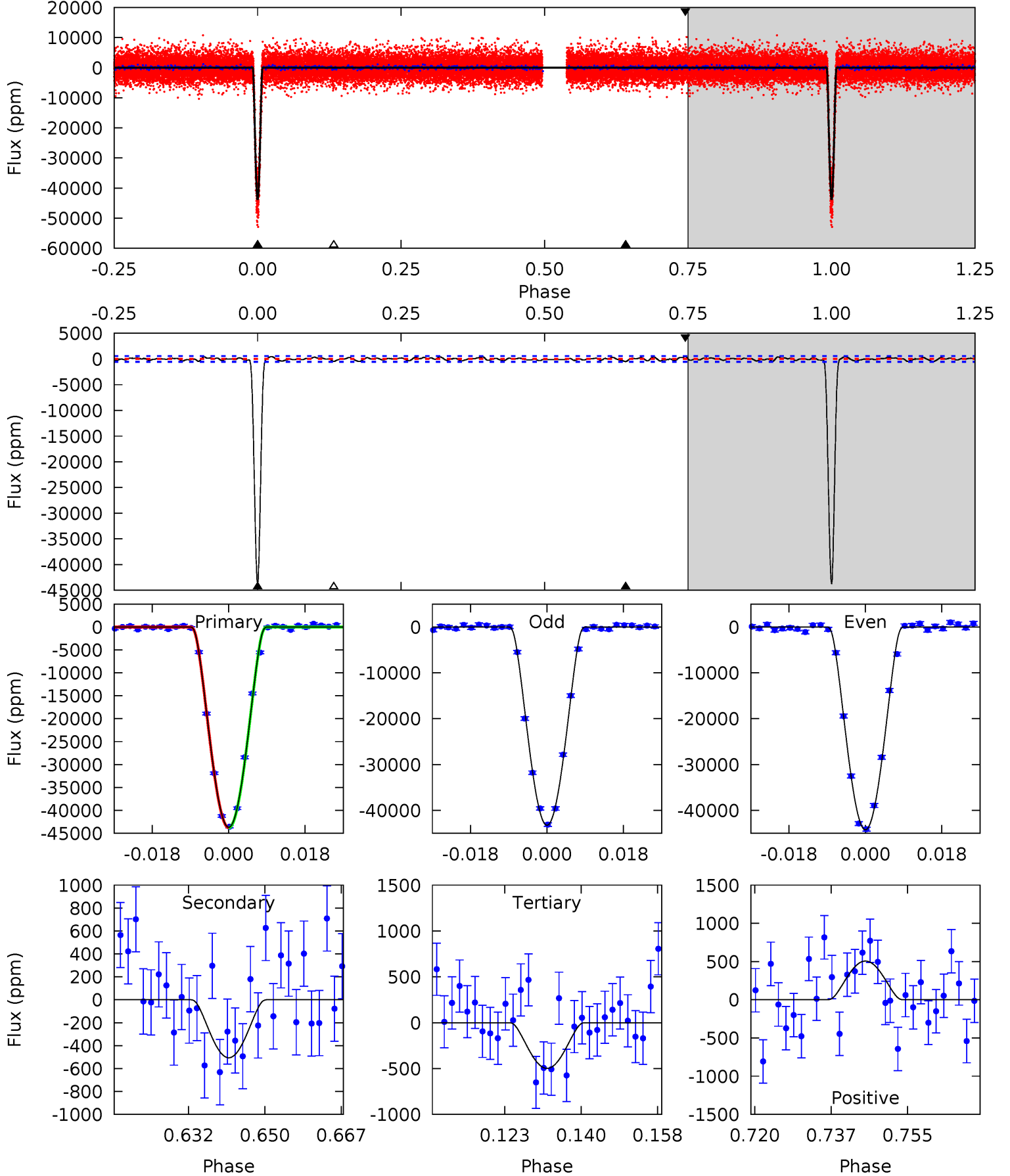
TCE 012459731-02     $P = 14.180394$  Days     $T_0 = 135.774776$  (BKJD)



# DV Model-Shift Uniqueness Test

012459731-02, P = 14.180368 Days, E = 135.775680 Days

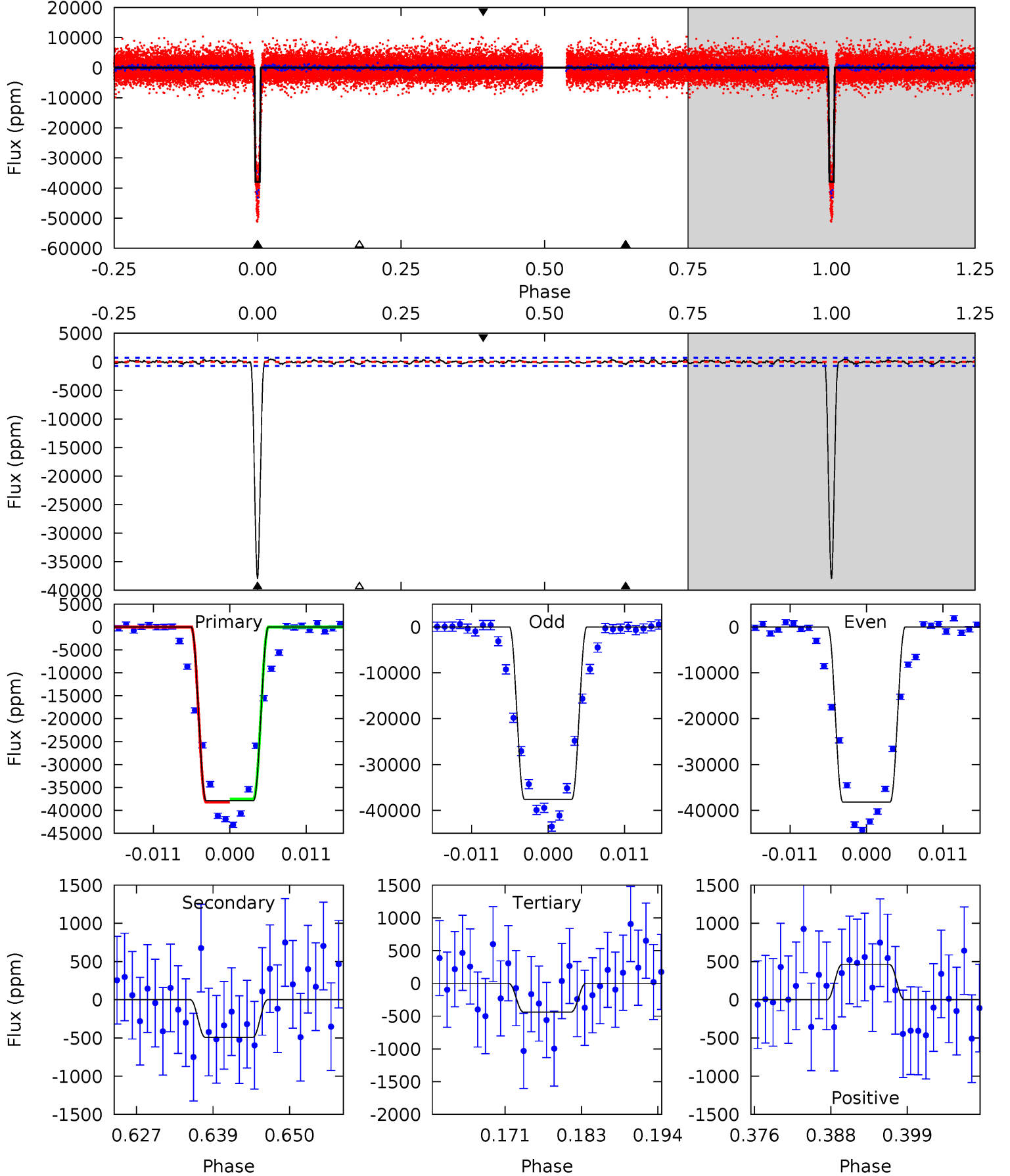
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
376.1	4.35	4.29	4.36	4.92	2.37	1.66	371.8	371.7	0.07	-0.00	4.25	1.00	0.01	0



# Alt Model-Shift Uniqueness Test

012459731-02,  $P = 14.180394$  Days,  $E = 135.774776$  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
257.7	3.35	2.99	3.14	5.00	2.53	1.17	254.8	254.6	0.35	0.21	2.05	0.99	0.01	2.42





### Stellar Parameters For KIC 012459731

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M$ ( $M_{\odot}$ )	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6289^{+197}_{-241}$	$4.330^{+0.124}_{-0.186}$	$-0.260^{+0.250}_{-0.300}$	$1.142^{+0.353}_{-0.190}$	$1.015^{+0.173}_{-0.115}$	$0.959^{+0.584}_{-0.492}$
	+3%/-4%	+3%/-4%	+96%/-115%	+31%/-17%	+17%/-11%	+61%/-51%
Source	KIC0	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 012459731-02 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-506 \pm 116$	$36.36^{+10.20}_{-9.47}$	$1227^{+84}_{-74}$	$2543^{+231}_{-184}$	$2.819^{+2.448}_{-1.229}$
Alt.	$-492 \pm 147$	$26.26^{+10.28}_{-9.12}$	$1226^{+95}_{-79}$	$2788^{+368}_{-272}$	$5.256^{+7.039}_{-2.731}$

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

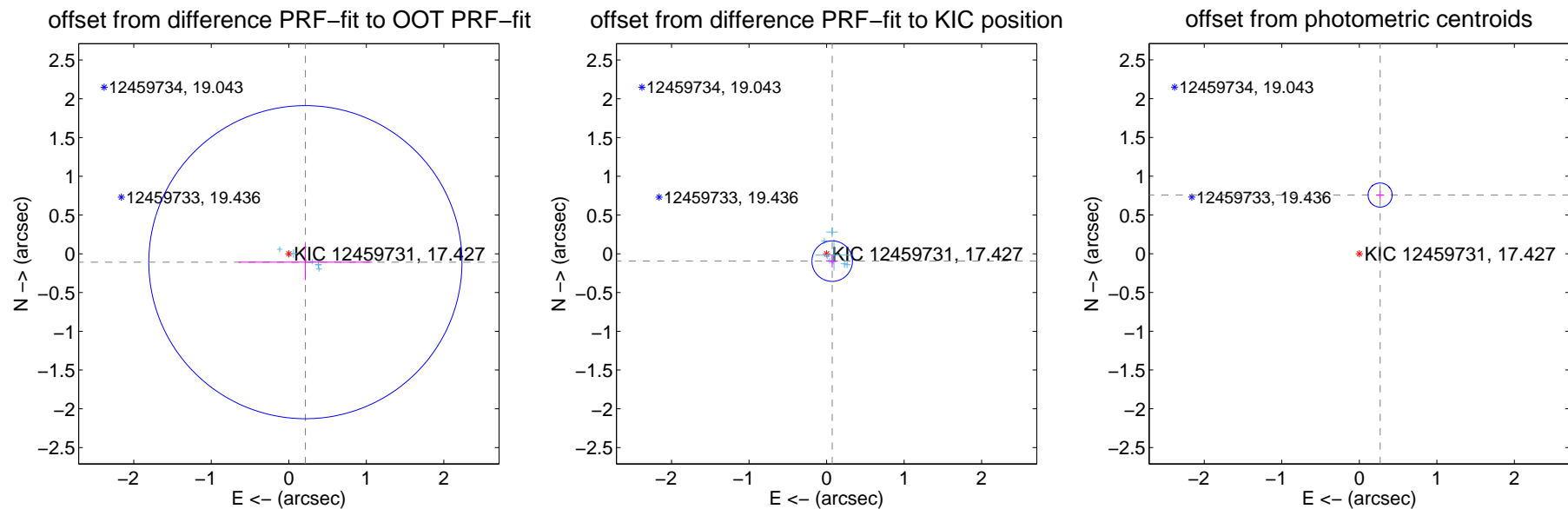
## DV Centroid Data

Supplemental centroid analysis for 012459731-02. Kepler magnitude: 17.43. Transit SNR 210.03

There are 8 quarters with good PRF difference image offsets

The OOT PRF centroid is offset from the target star catalog position by about 5.25 arcsec so the offset from difference PRF-fit to OOT-fit may be invalid.

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.240 \pm 0.673$	0.36	$-0.214 \pm 0.862$	$-0.108 \pm 0.231$
PRF-fit source offset from KIC position	$0.119 \pm 0.087$	1.37	$-0.072 \pm 0.075$	$-0.095 \pm 0.085$
photometric centroid source offset	$0.80 \pm 0.05$	15.50	$-0.27 \pm 0.05$	$0.76 \pm 0.05$

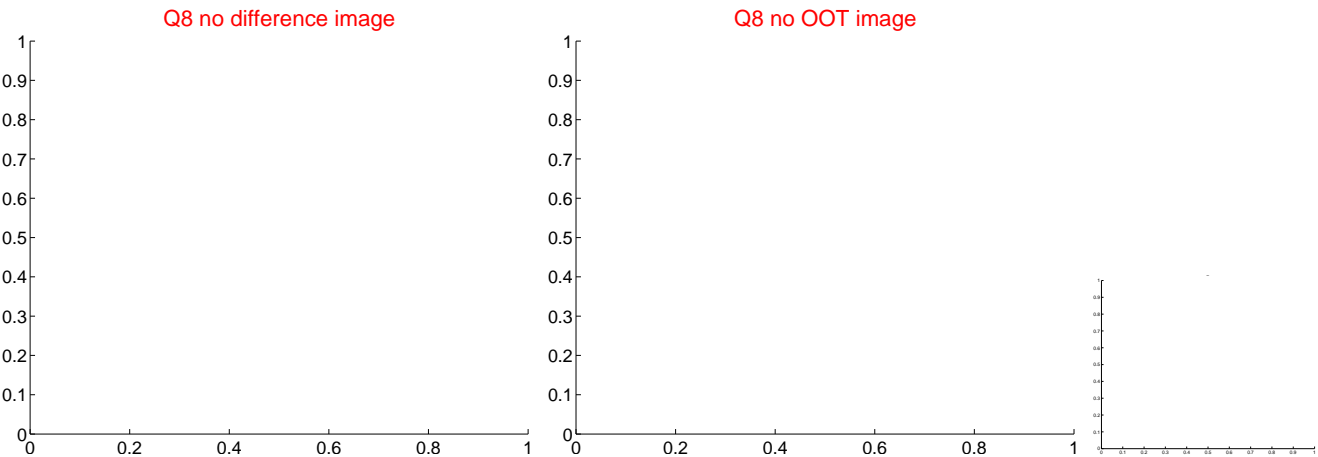
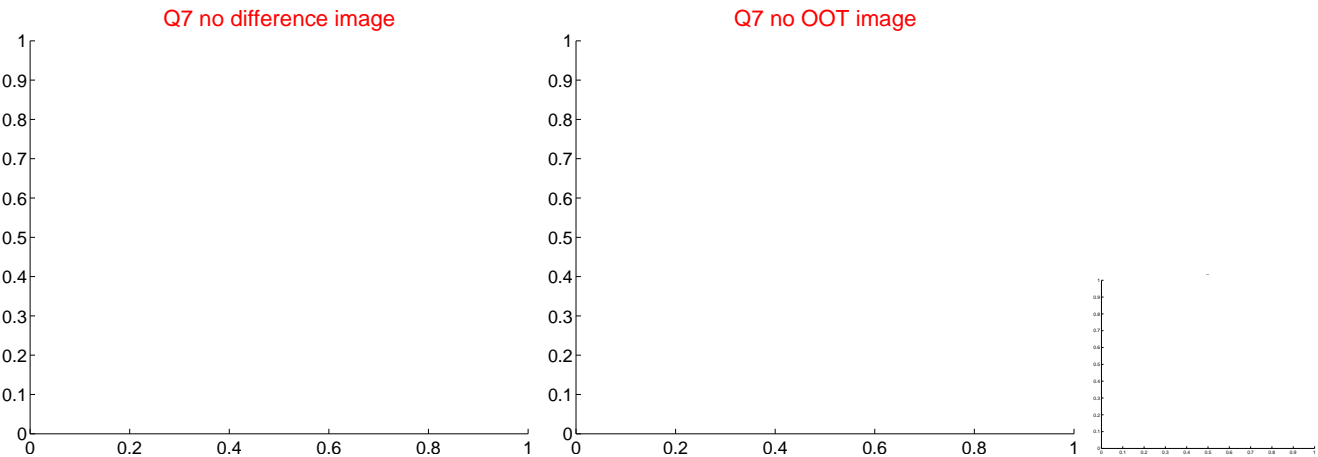
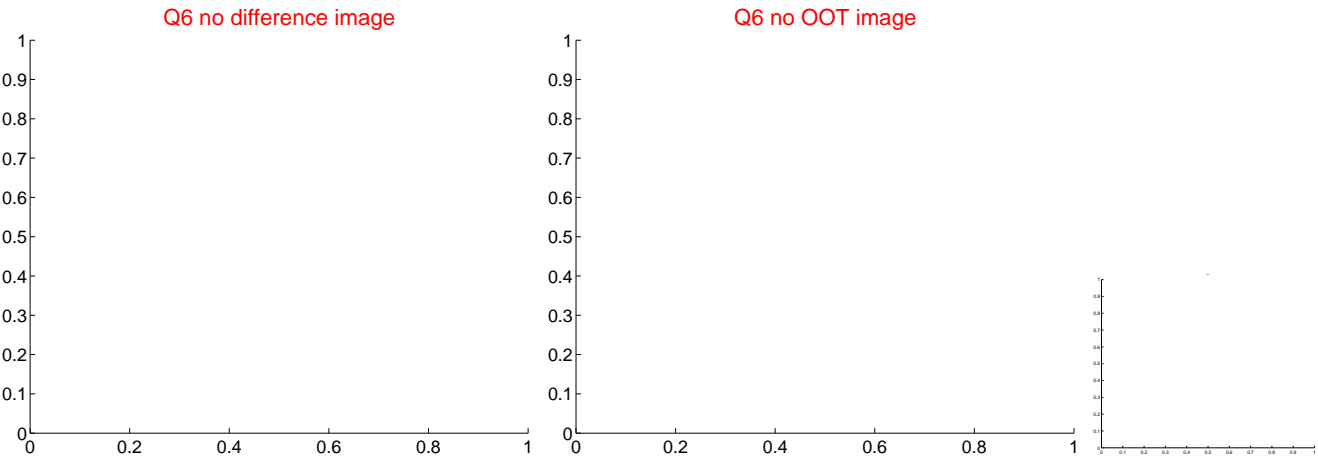
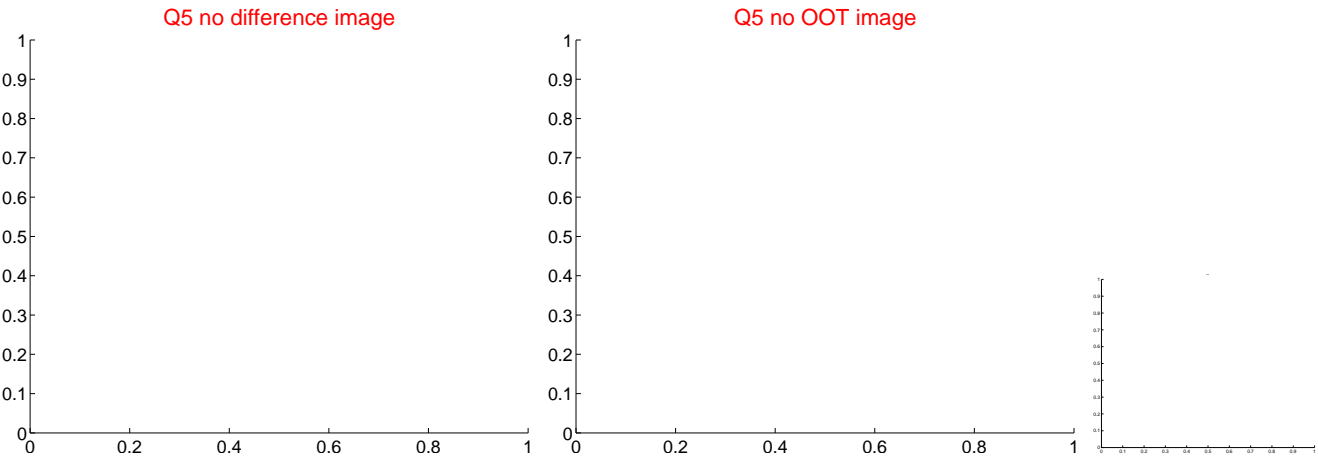


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

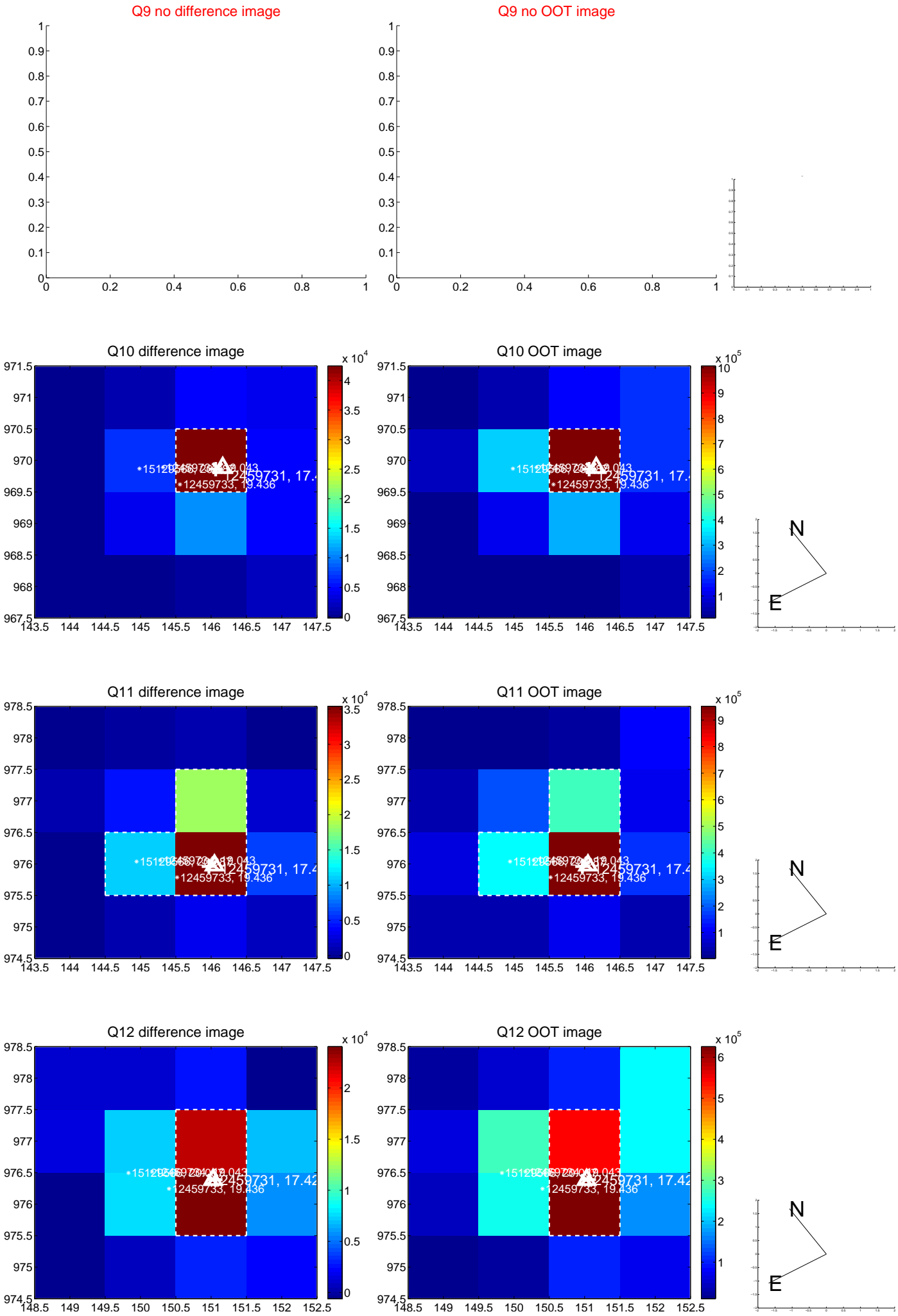
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



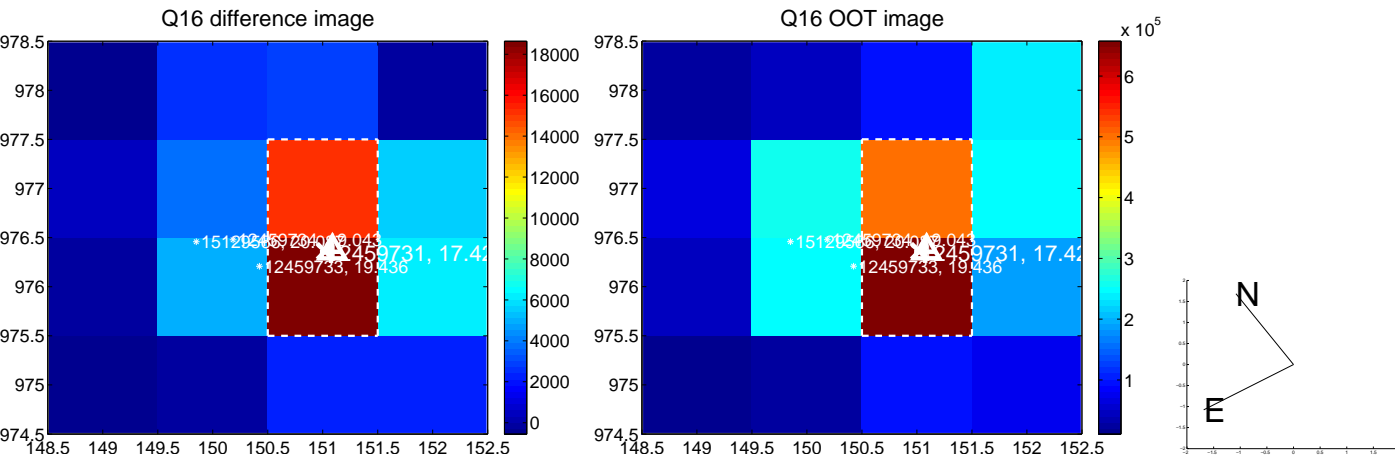
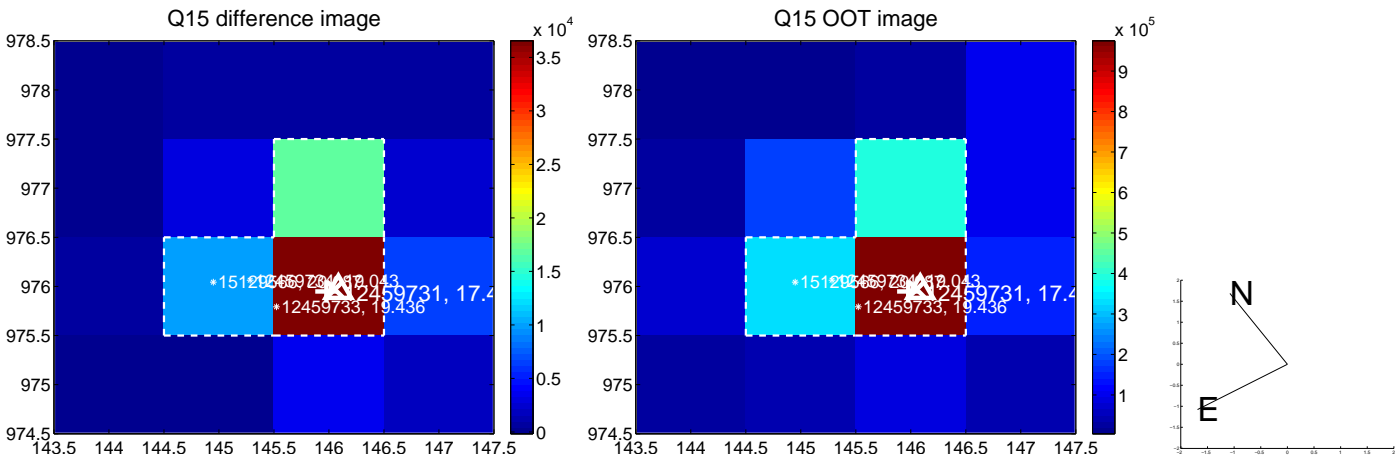
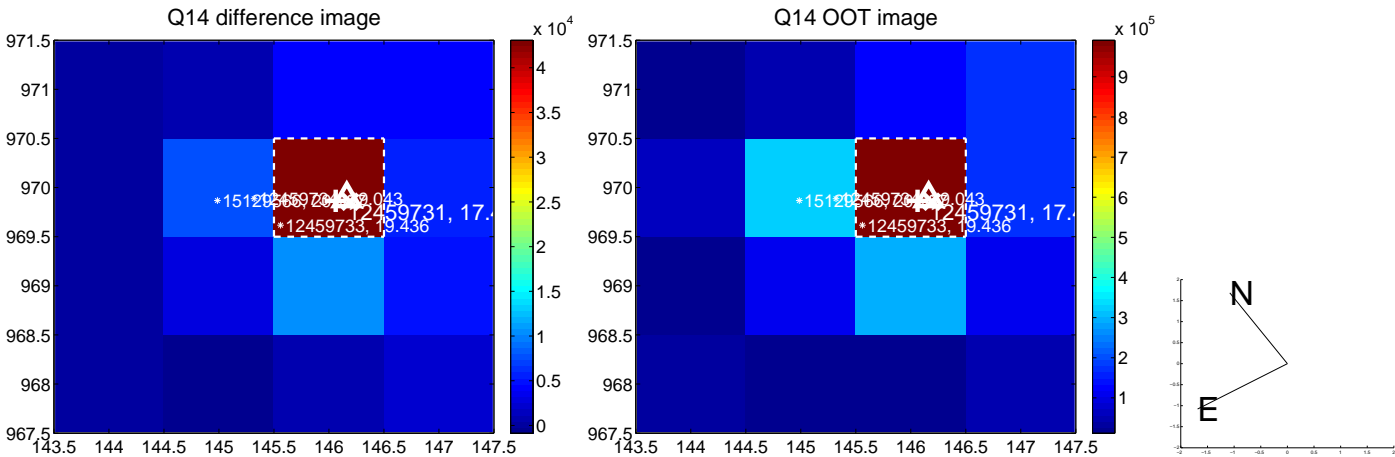
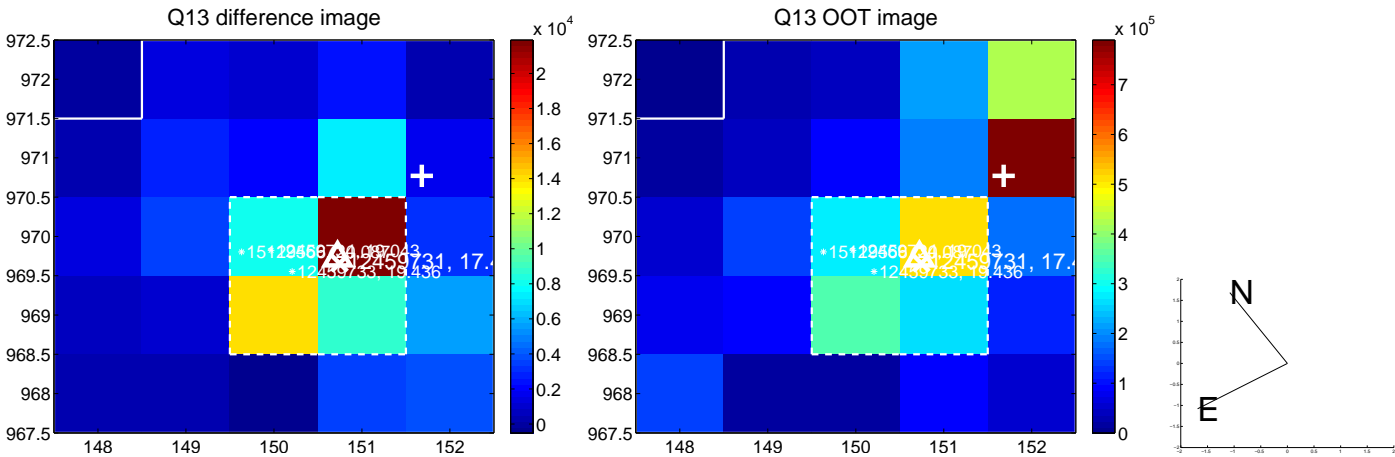
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



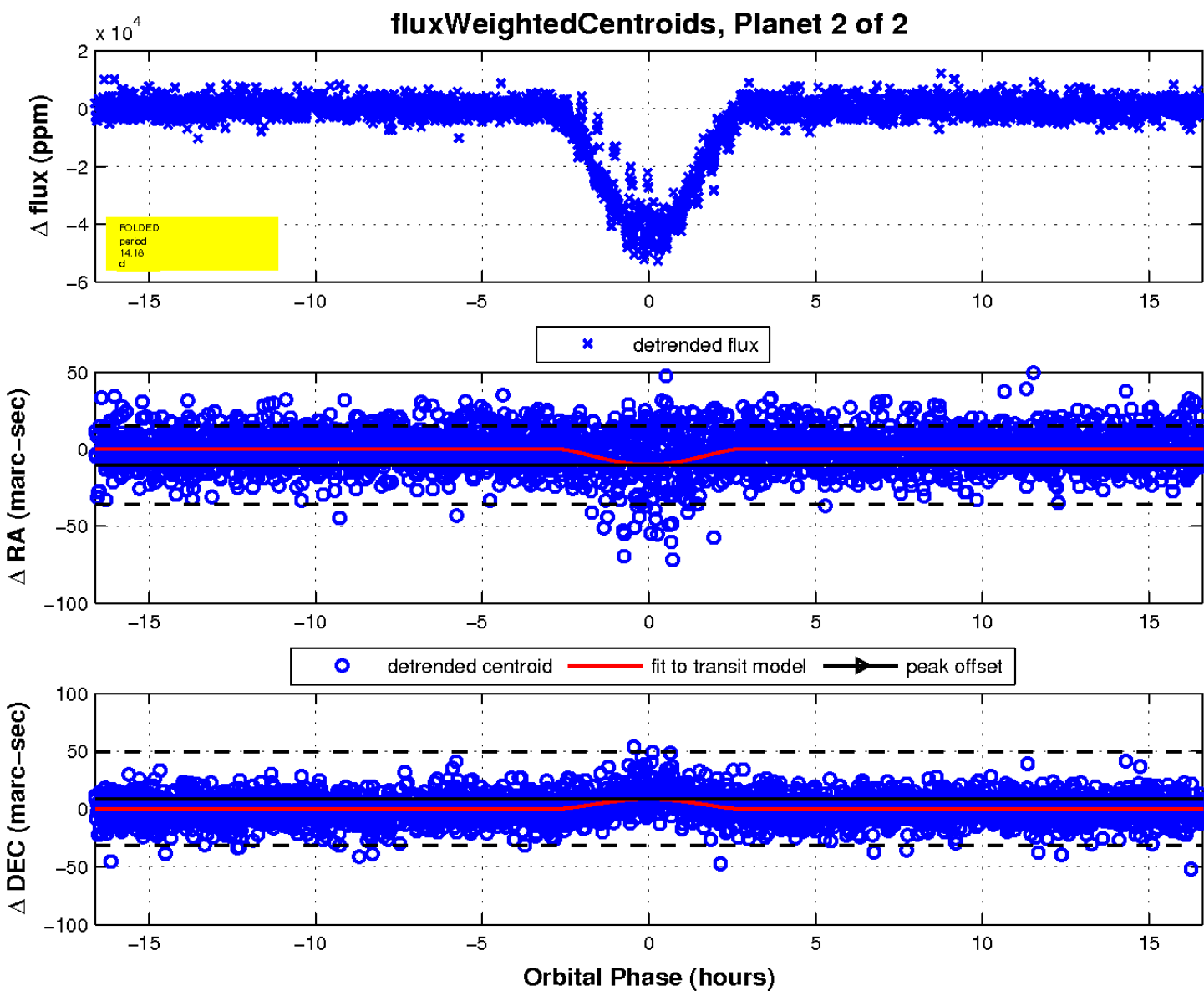
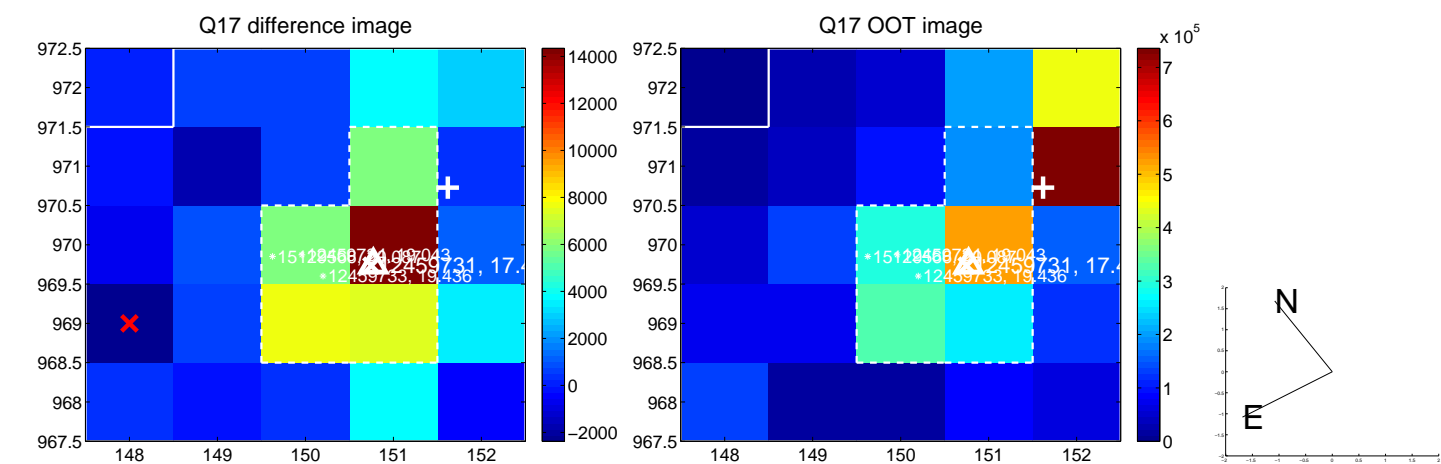
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

