

# KIC 004731916

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
004731916-01	OBS	No	2.671070	133.457662	45.7	9.903	11.5	9.5	2.46	6907	1.93	6297.57
004731916-02	OBS	No	4.677951	132.558591	109.1	19.754	8.9	9.6	2.46	6907	4.78	2983.18
004731916-03	OBS	No	245.112584	274.403275	426.8	7.651	7.3	8.4	2.46	6907	6.04	15.21

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
004731916-01	OBS	FP	0.00	1	0	0	0	LPP_DV
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**Notes:** OBS = Observed. INJ = Injected. INV = Inverted. SCR = Scrambled.

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

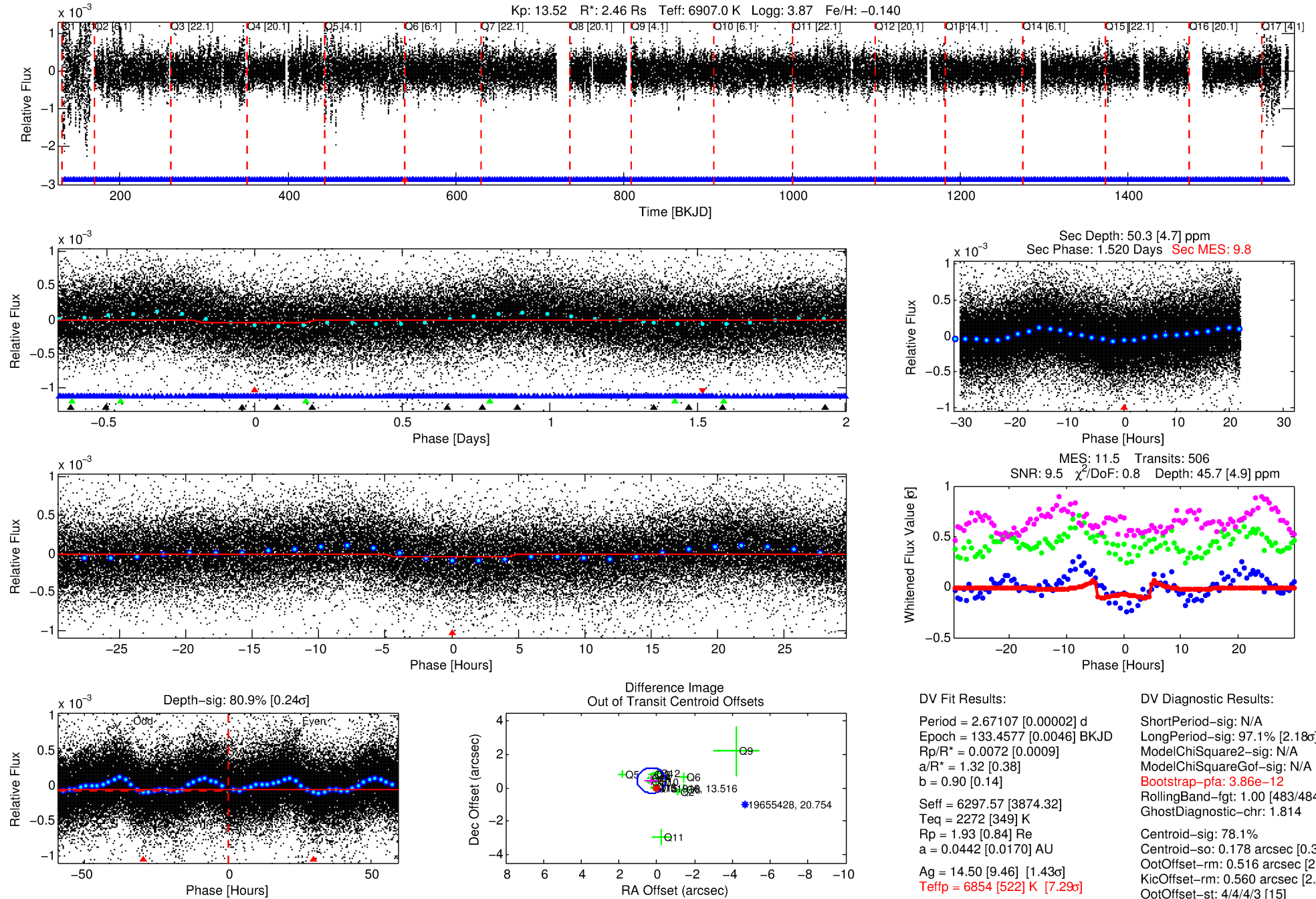
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 004731916-01

No Significant Match Found

# DV One-Page Summary

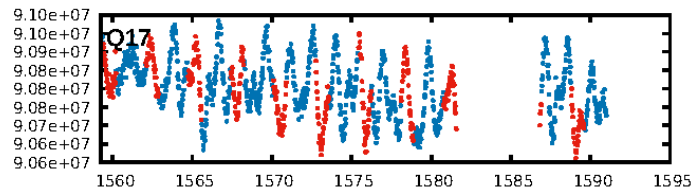
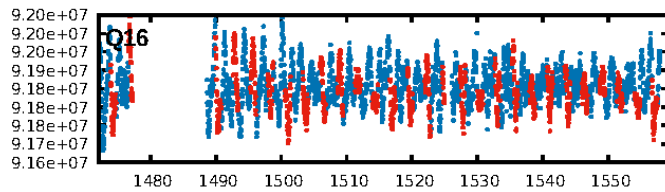
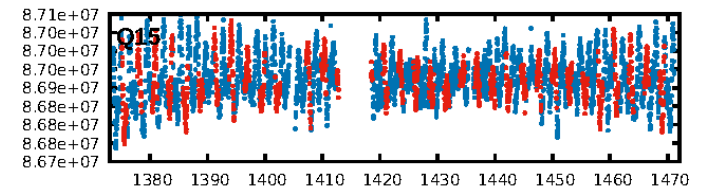
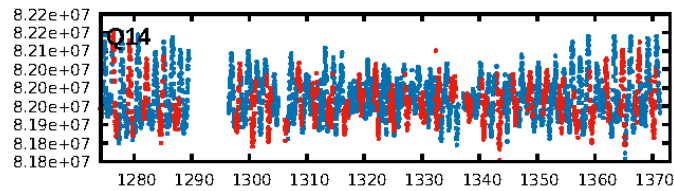
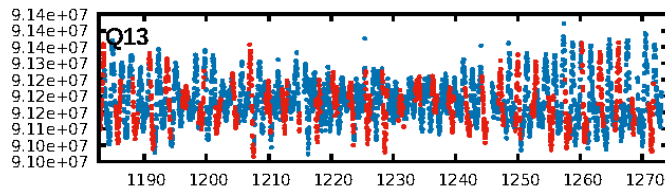
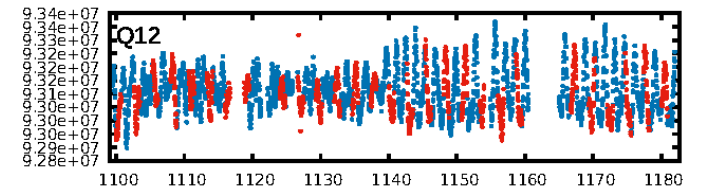
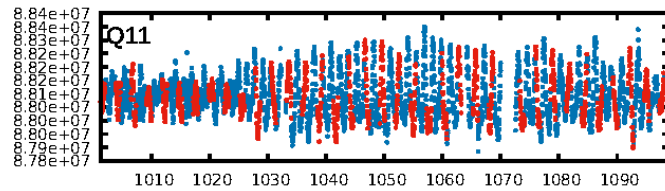
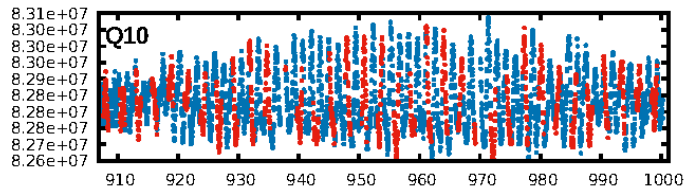
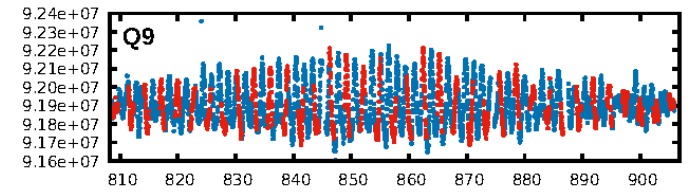
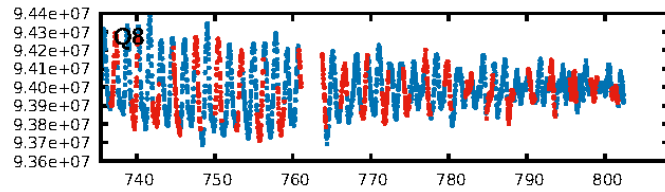
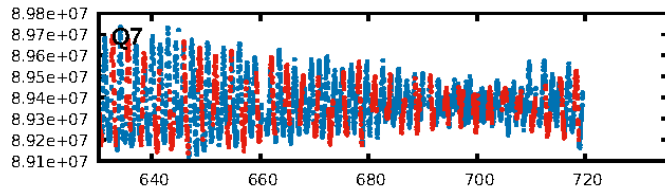
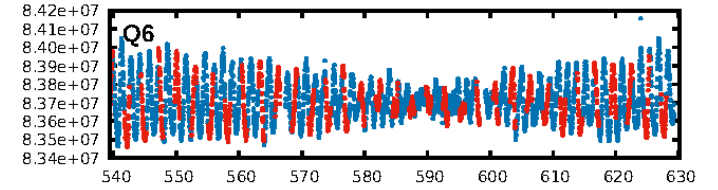
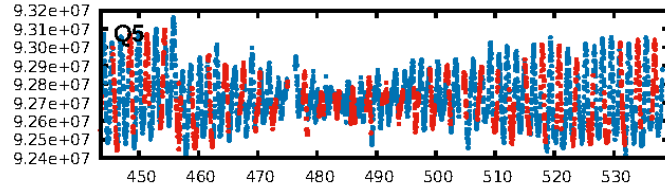
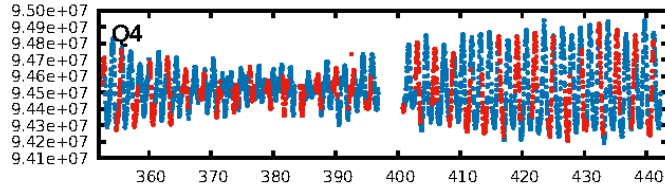
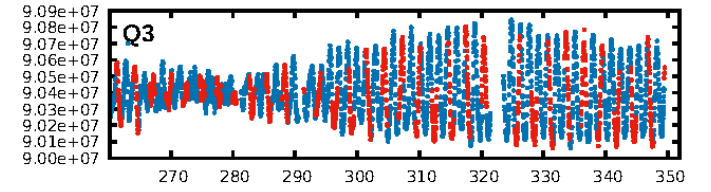
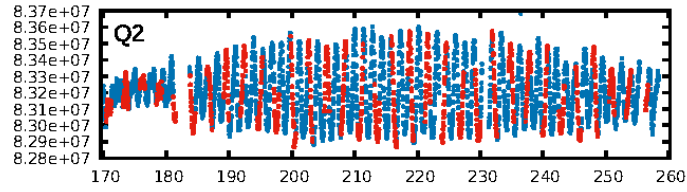
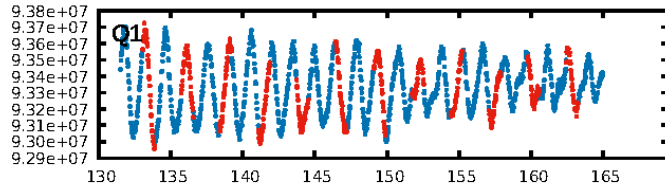
KIC: 4731916 Candidate: 1 of 4 Period: 2.671 d



Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 14:58:06 Z

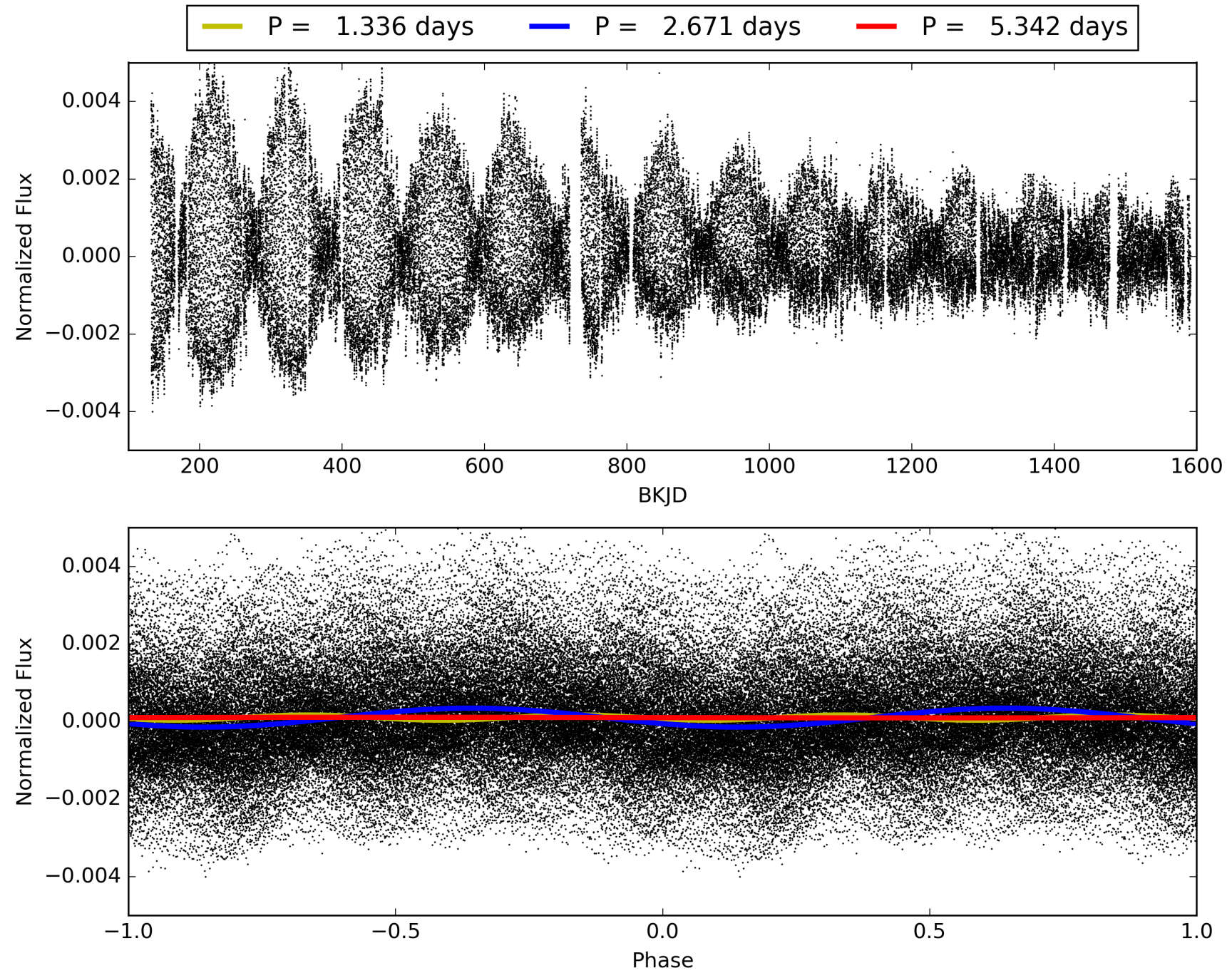
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 004731916-01, PDC Light Curves





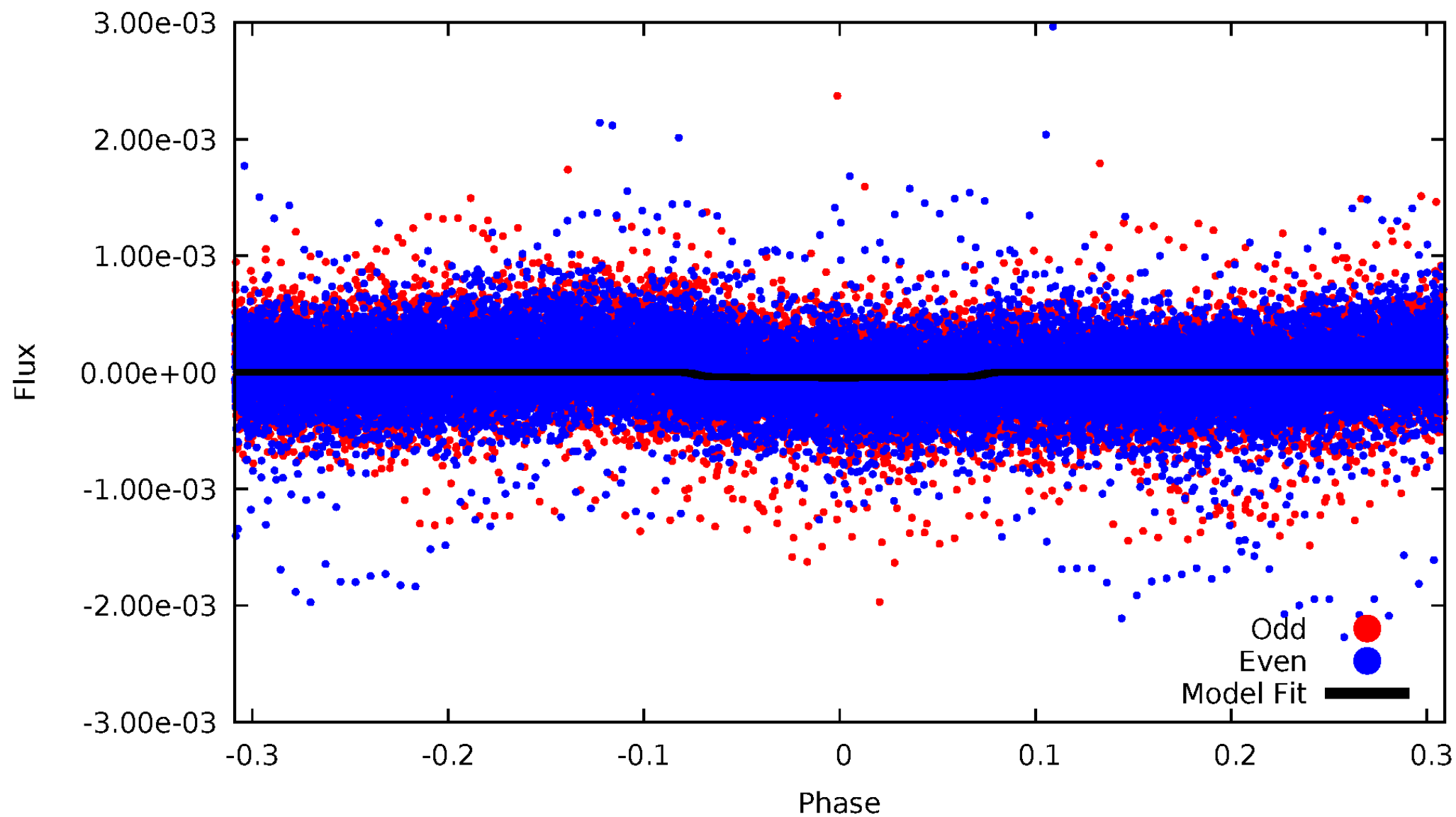
TCE 004731916-01





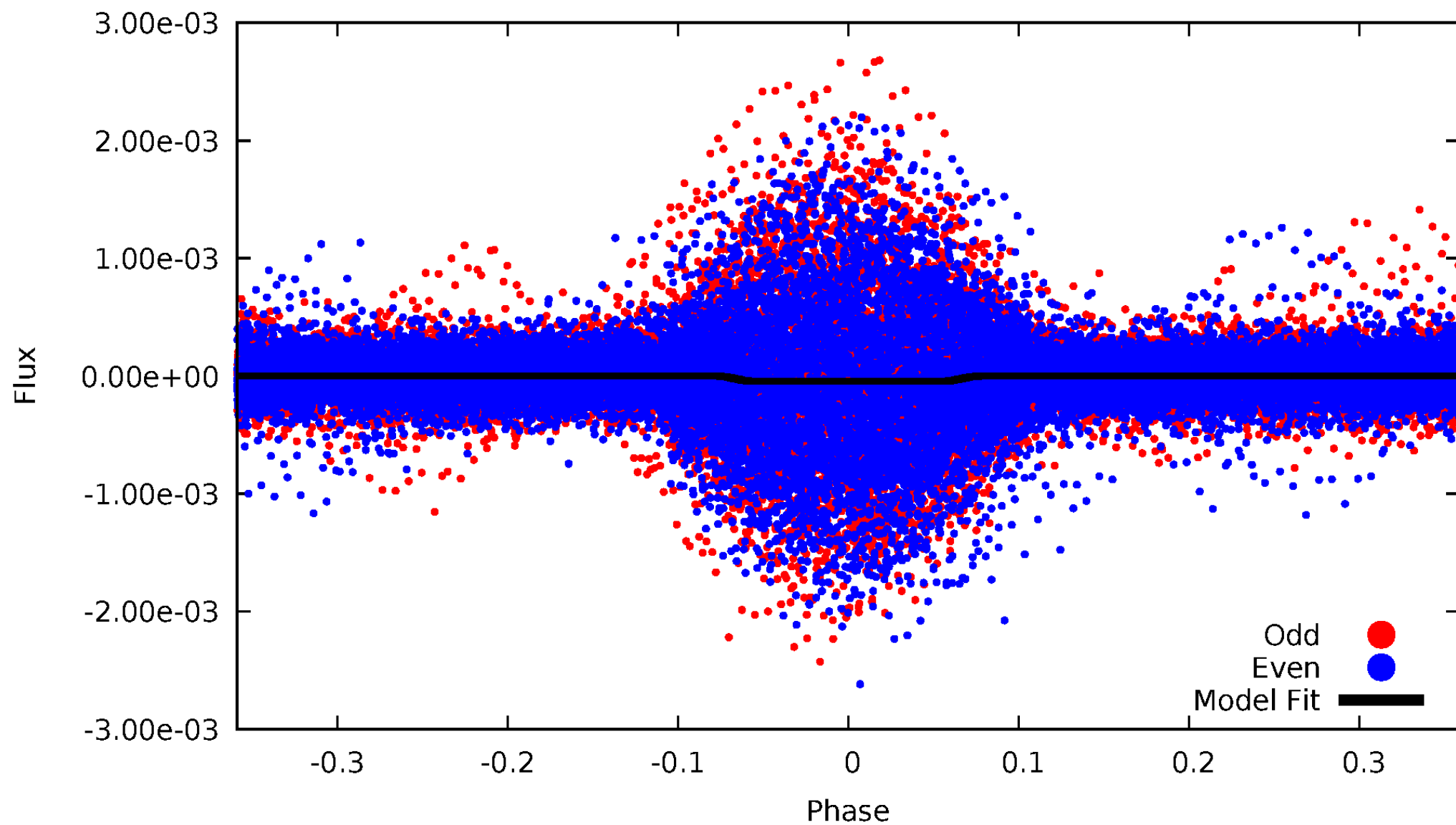
# DV Odd/Even

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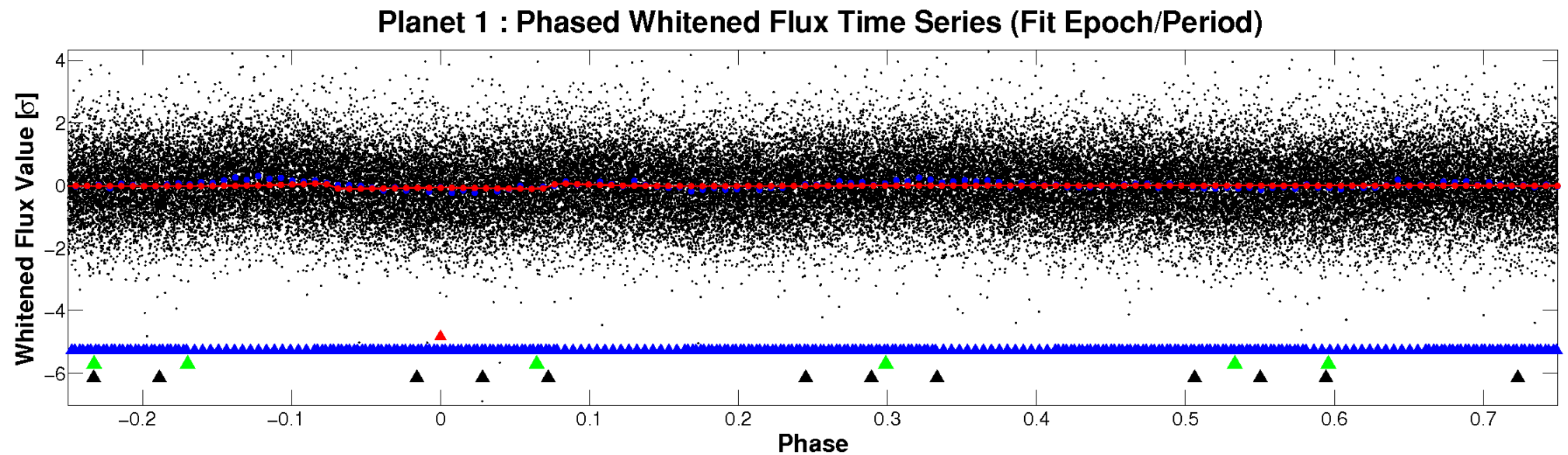
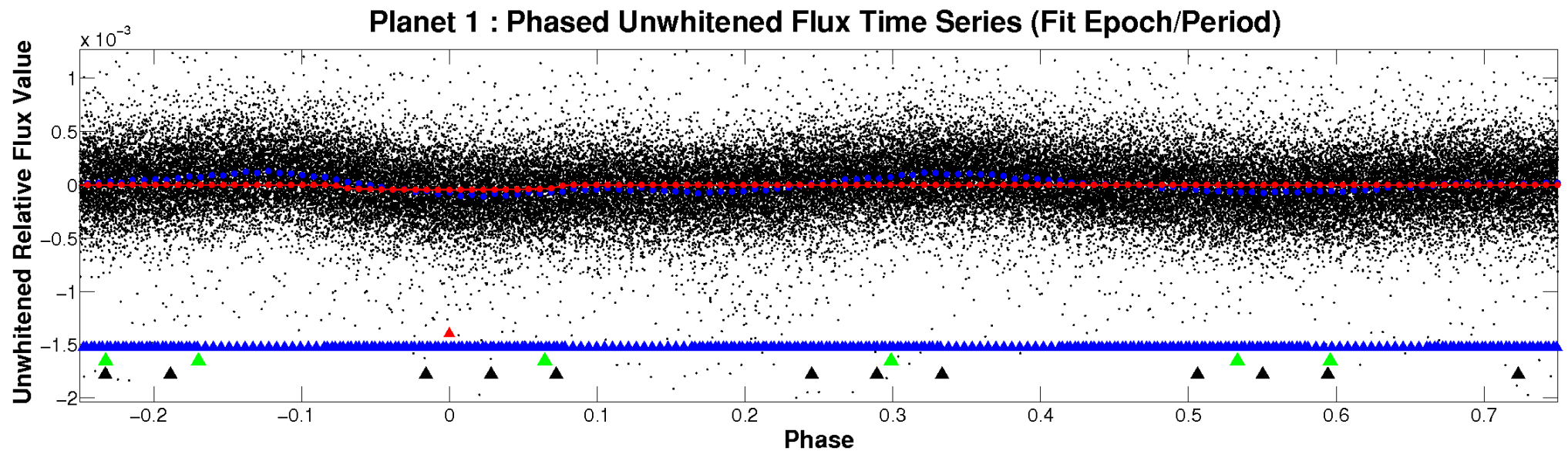


# ALT Odd/Even

TCE 004731916-01



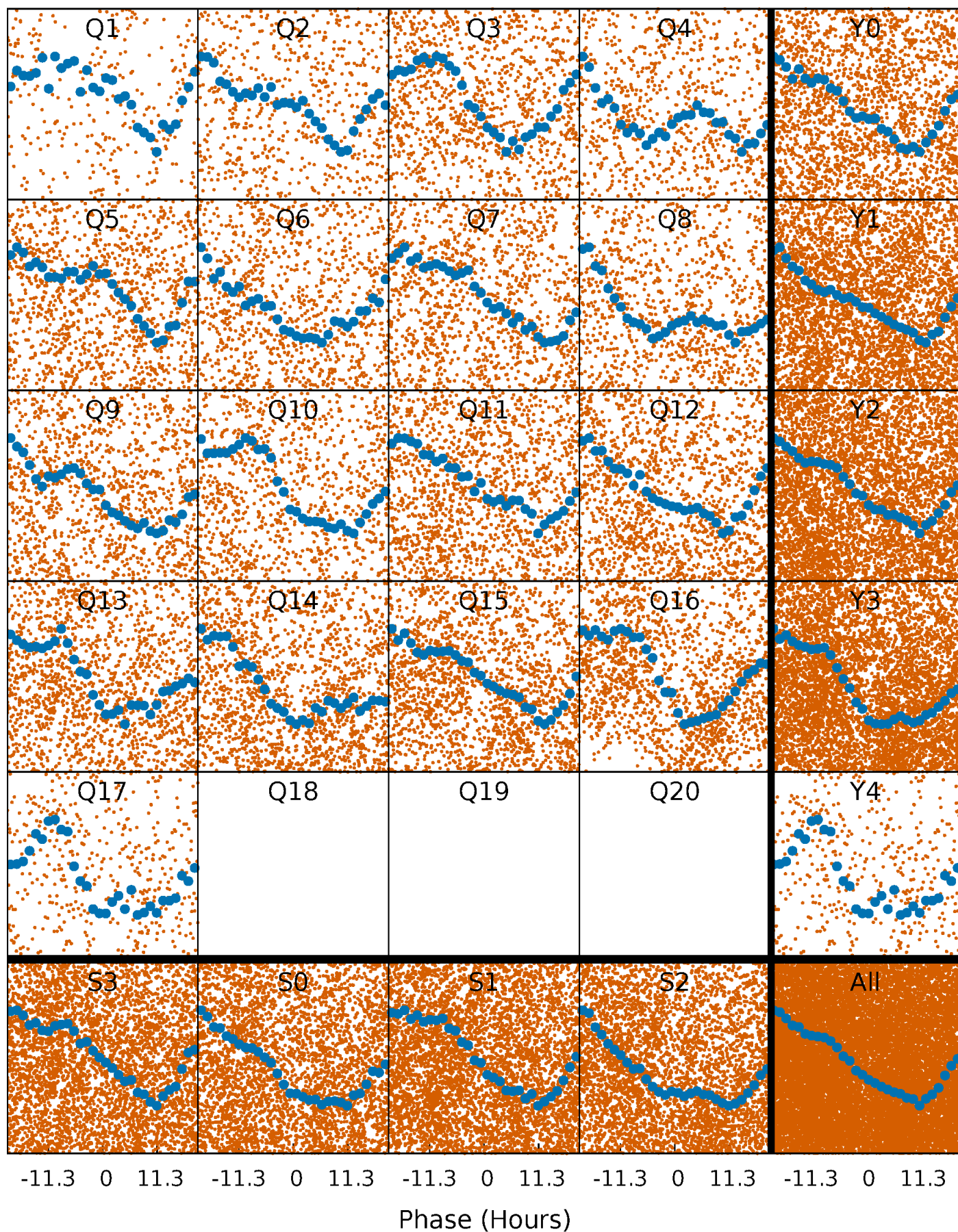
# Non-Whitened Vs. Whitened Light Curve





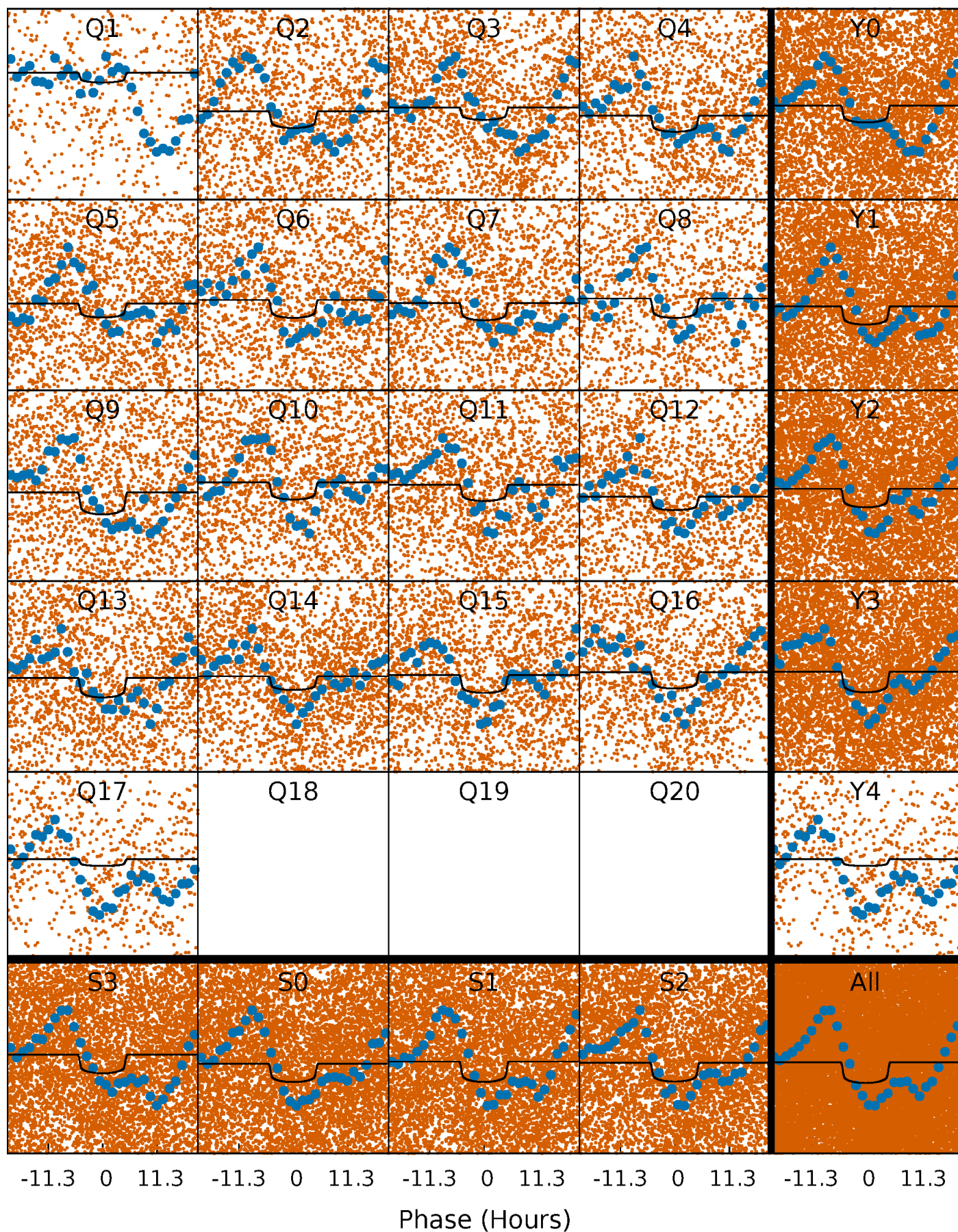
# PDC Quarter-Phased Transit Curves

TCE 004731916-01 P= 2.671070 Days  $T_0=133.457662$  (BKJD)



# DV Quarter-Phased Transit Curves

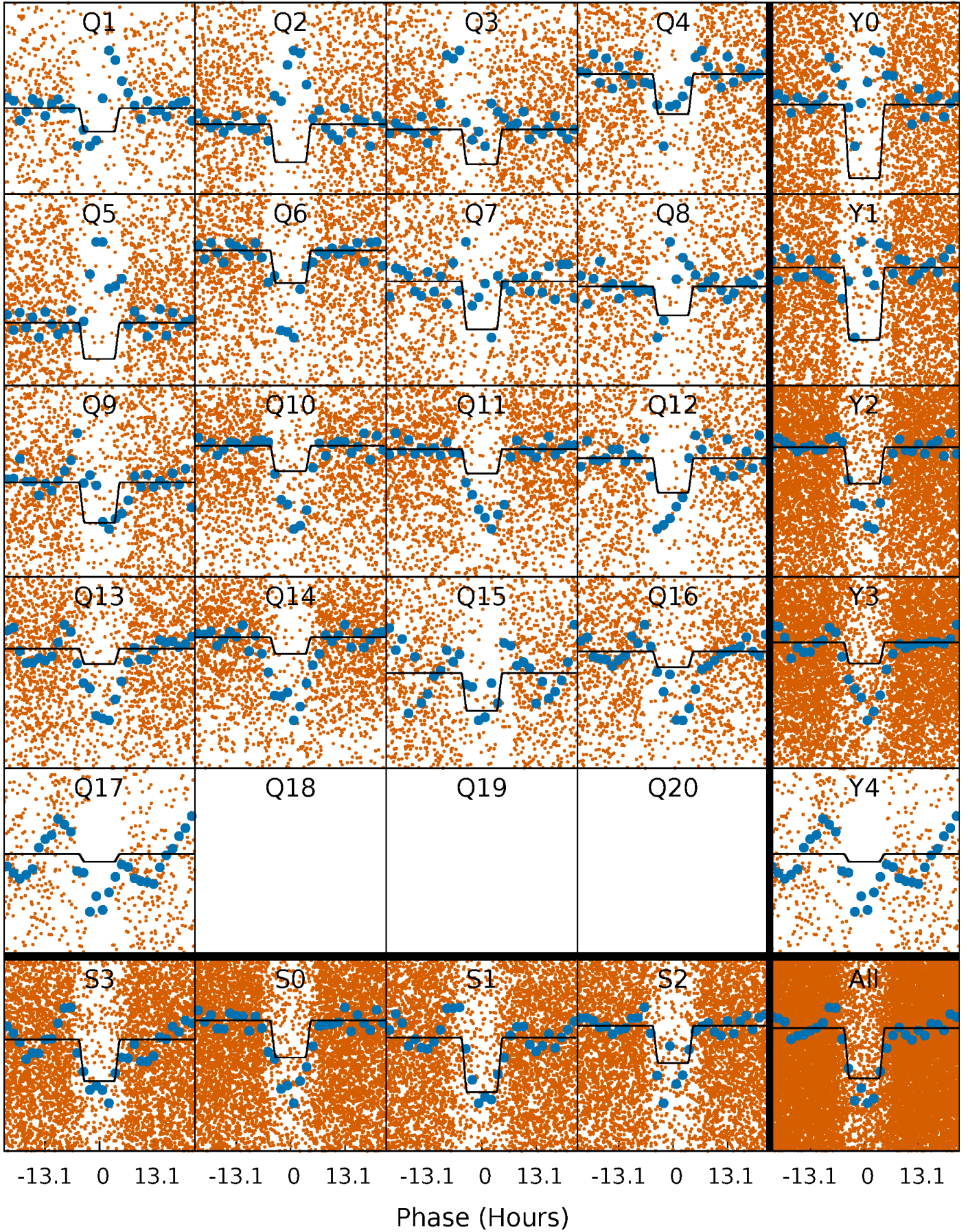
TCE 004731916-01 P= 2.671070 Days  $T_0=133.457662$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

TCE 004731916-01 P= 2.671042 Days  $T_0=133.454001$  (BKJD)

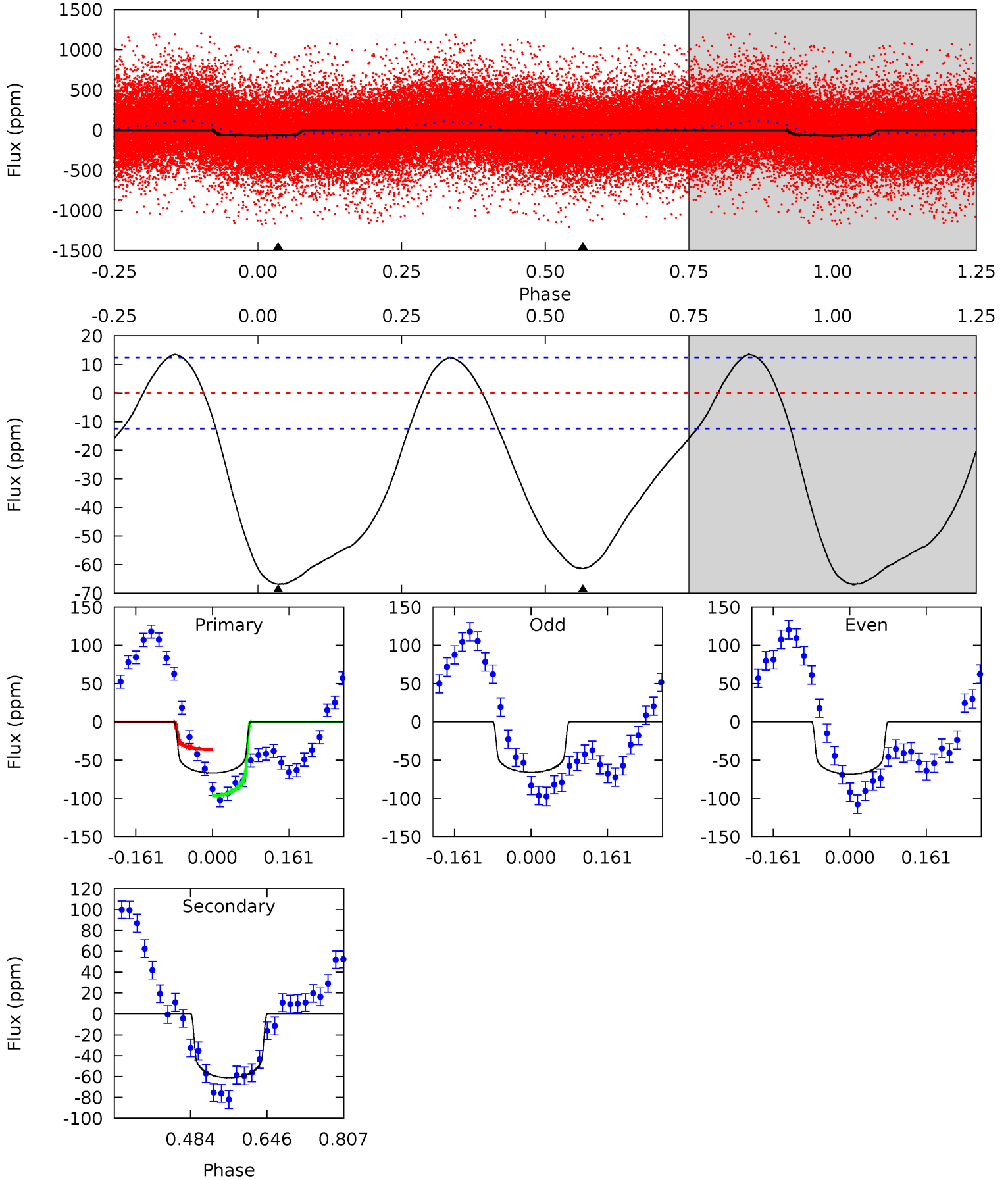




# DV Model-Shift Uniqueness Test

004731916-01, P = 2.671070 Days, E = 130.786592 Days

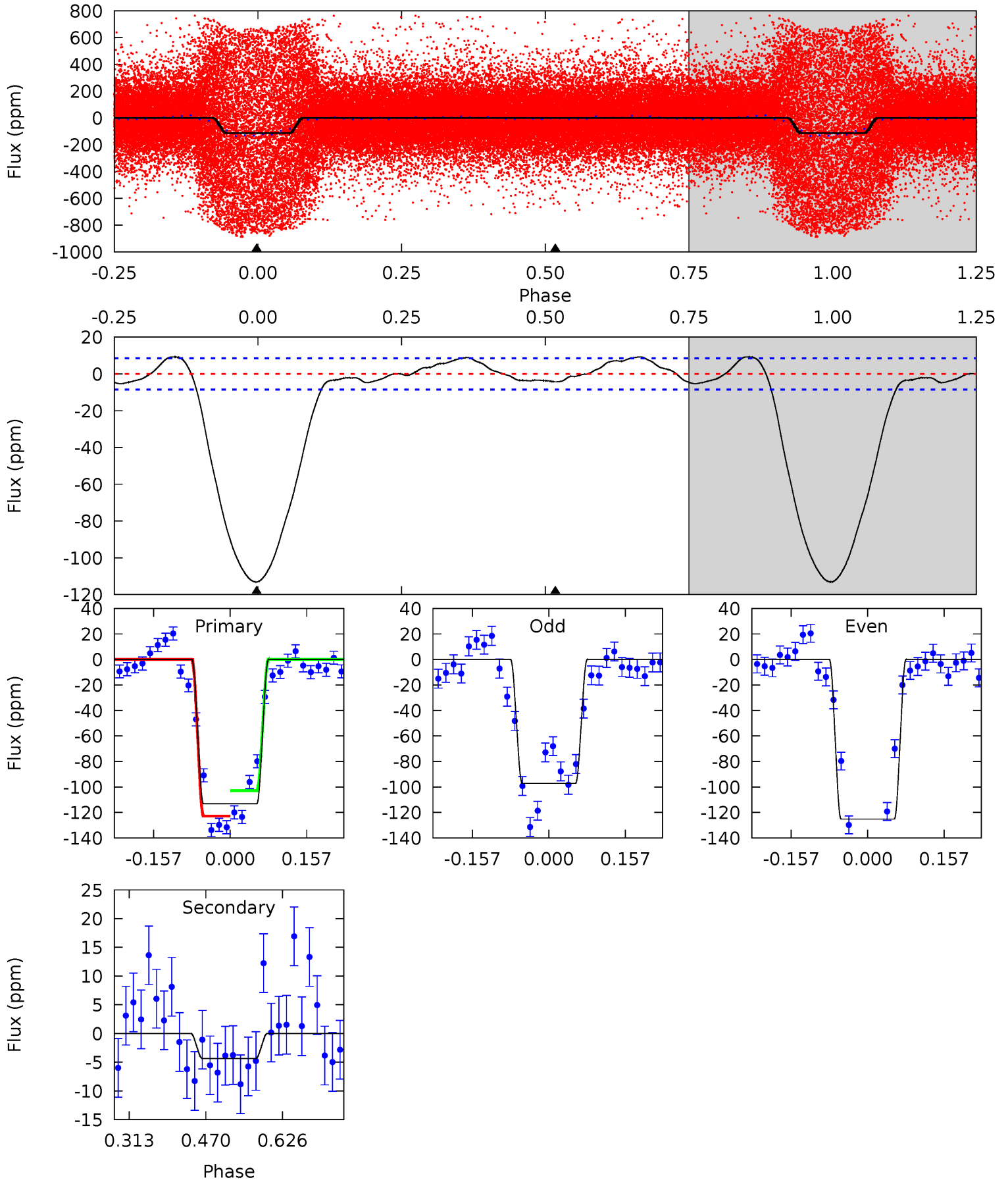
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
24.0	22.0	0	0	4.46	1.40	5.80	24.0	24.0	22.0	22.0	0.44	0.95	0.17	11.0



# Alt Model-Shift Uniqueness Test

004731916-01, P = 2.671042 Days, E = 130.782959 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
59.6	2.29	0	0	4.47	1.42	2.19	59.6	59.6	2.29	2.29	7.32	0.62	0.08	5.20



### Stellar Parameters For KIC 004731916

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6907^{+190}_{-262}$	$3.865^{+0.343}_{-0.147}$	$-0.140^{+0.250}_{-0.300}$	$2.455^{+0.555}_{-1.030}$	$1.609^{+0.210}_{-0.390}$	$0.153^{+0.422}_{-0.067}$
	+3%/-4%	+9%/-4%	+179%/-214%	+23%/-42%	+13%/-24%	+275%/-44%
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 004731916-01 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-61 \pm 3$	$1.85^{+0.45}_{-0.42}$	$3122^{+249}_{-308}$	$7165^{+680}_{-504}$	$19^{+11}_{-6}$
Alt.	$-4 \pm 2$	$1.72^{+0.39}_{-0.41}$	$3128^{+245}_{-337}$	$3920^{+437}_{-530}$	$1.512^{+1.291}_{-0.763}$

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



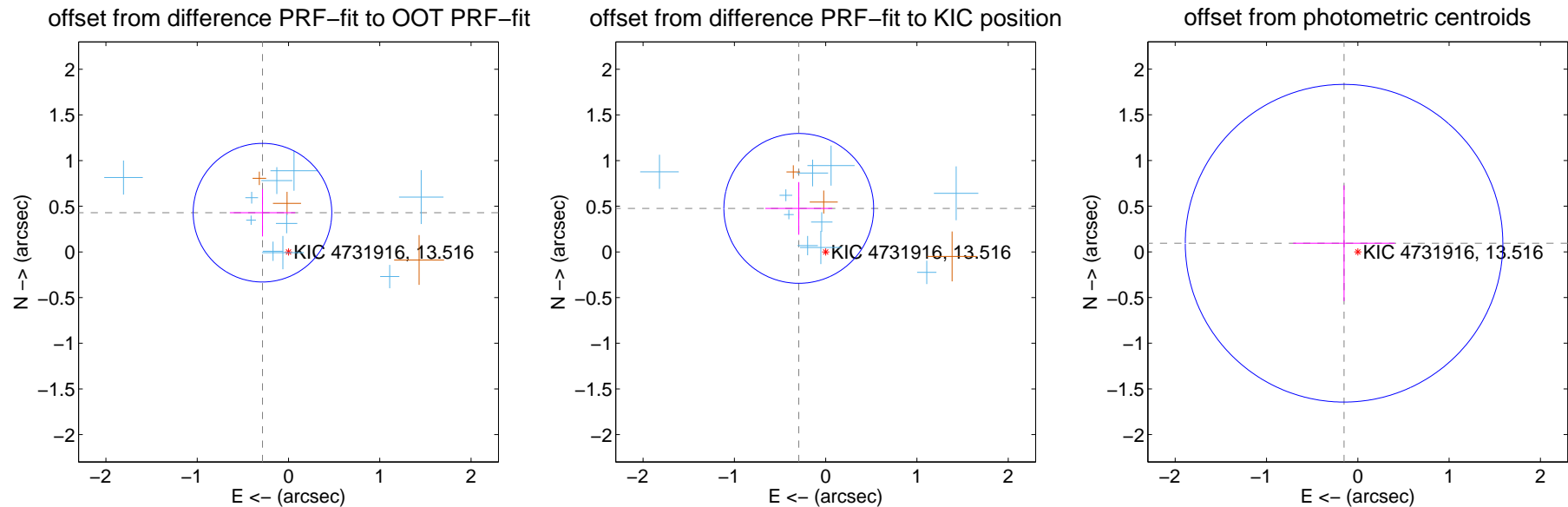
## DV Centroid Data

Supplemental centroid analysis for 004731916-01. Kepler magnitude: 13.52. Transit SNR 9.52

There are 11 quarters with good PRF difference image offsets

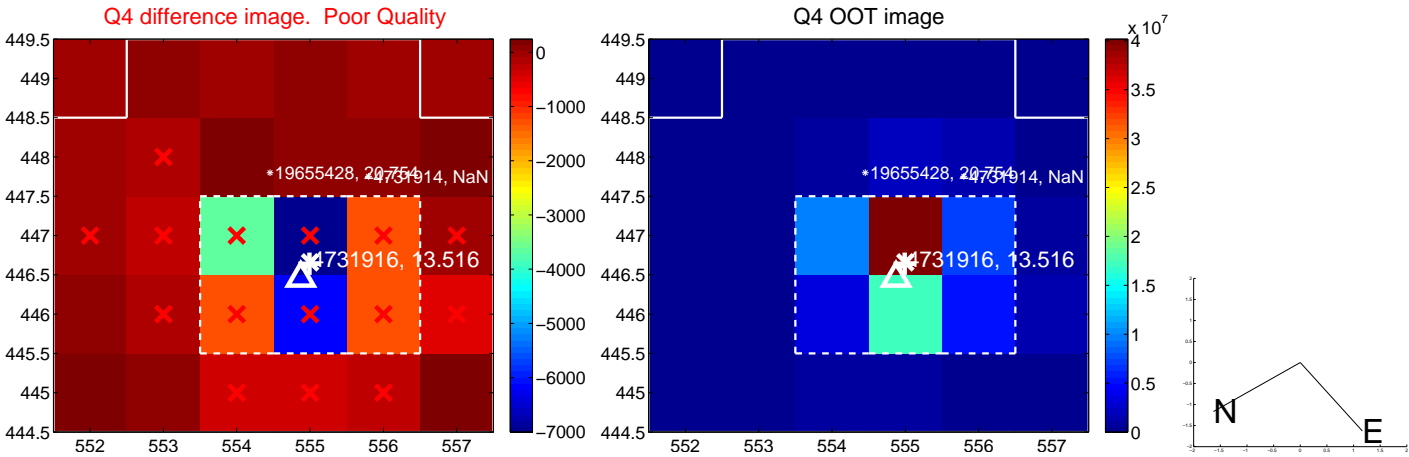
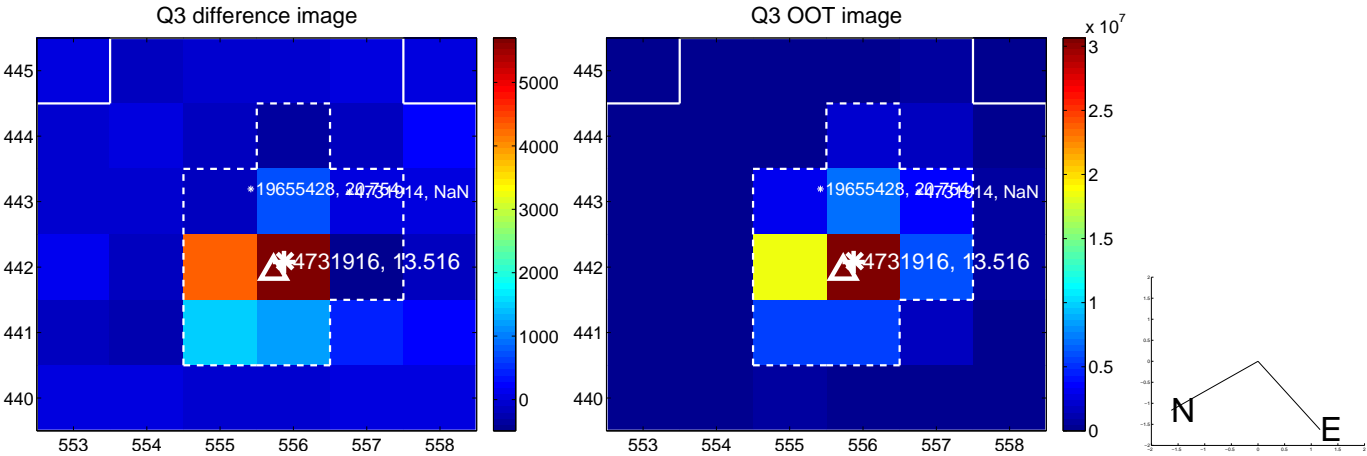
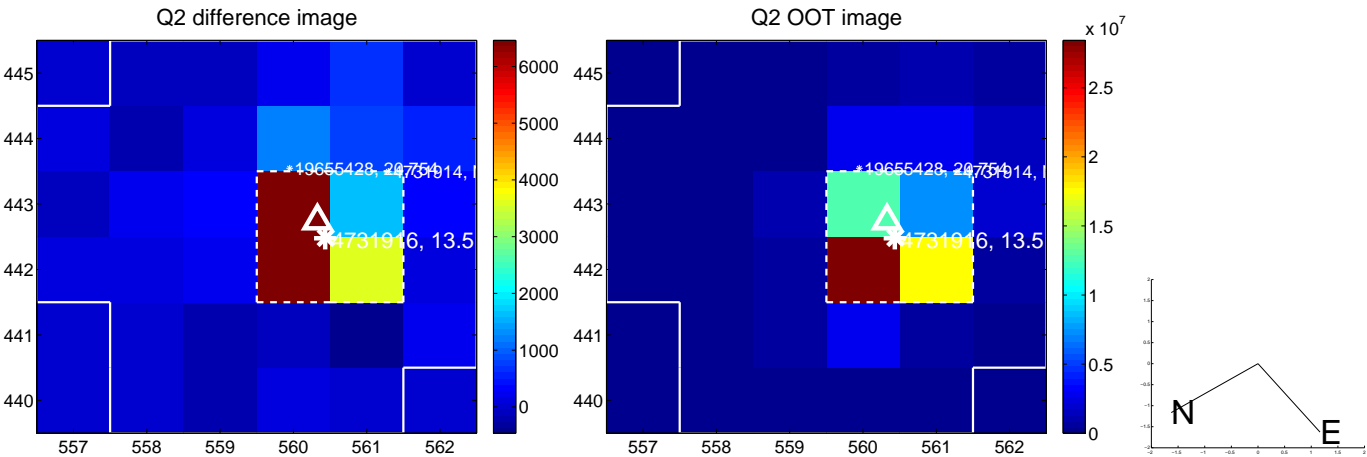
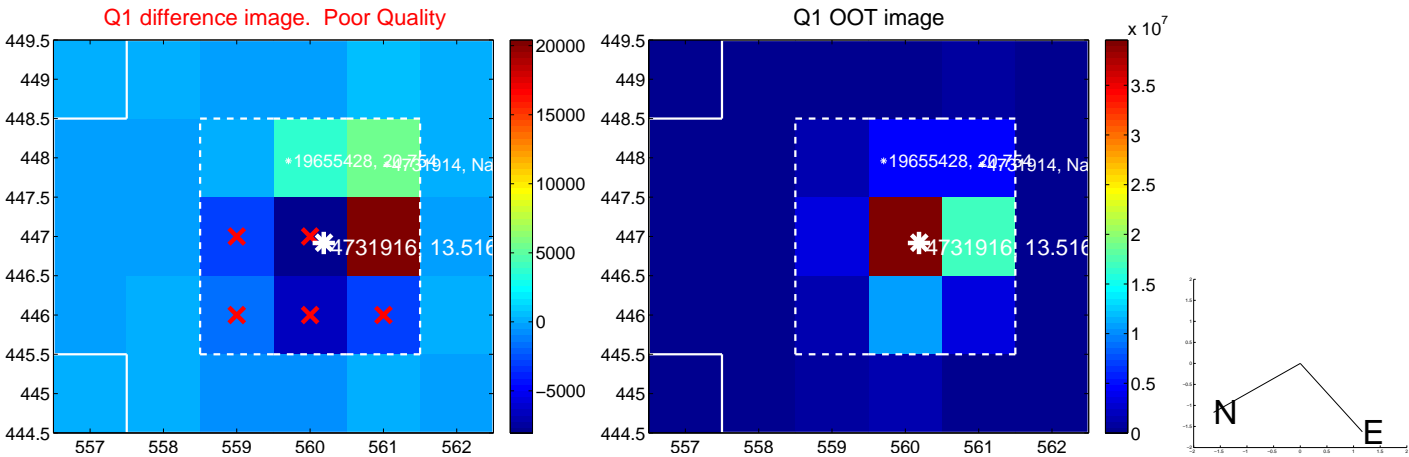
The direct PRF centroid is offset from the target star catalog position by about 0.06 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.516 \pm 0.253$	2.04	$0.285 \pm 0.358$	$0.430 \pm 0.260$
PRF-fit source offset from KIC position	$0.560 \pm 0.273$	2.05	$0.295 \pm 0.366$	$0.477 \pm 0.289$
photometric centroid source offset	$0.18 \pm 0.58$	0.31	$0.15 \pm 0.56$	$0.09 \pm 0.63$

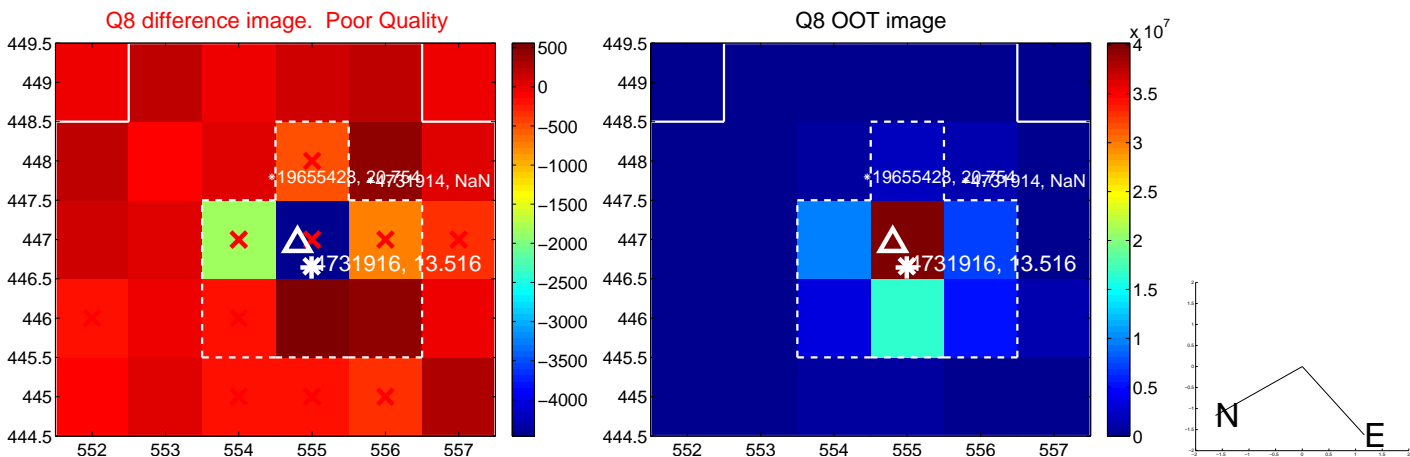
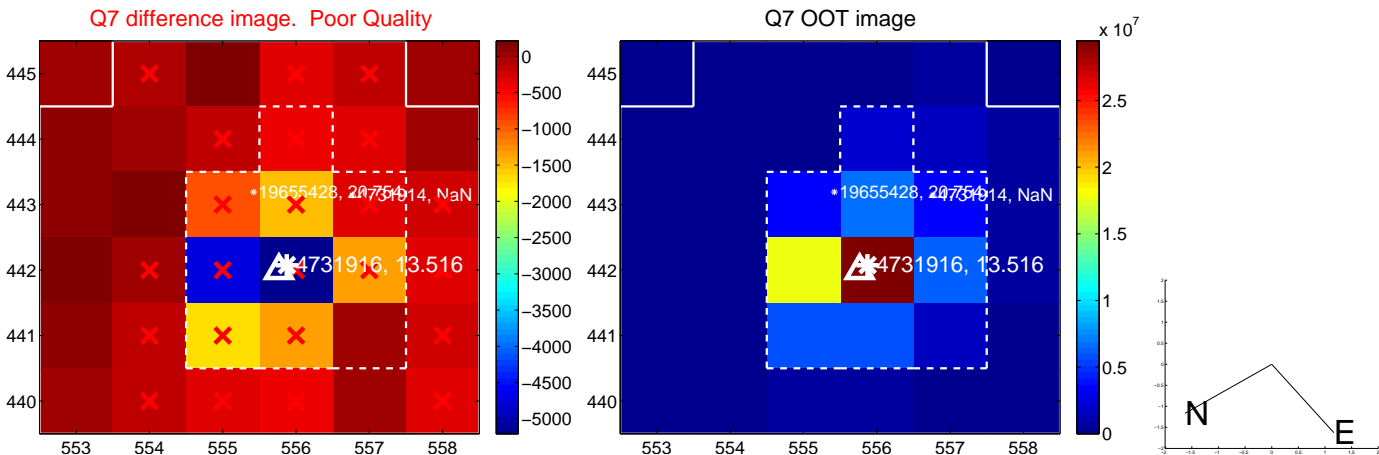
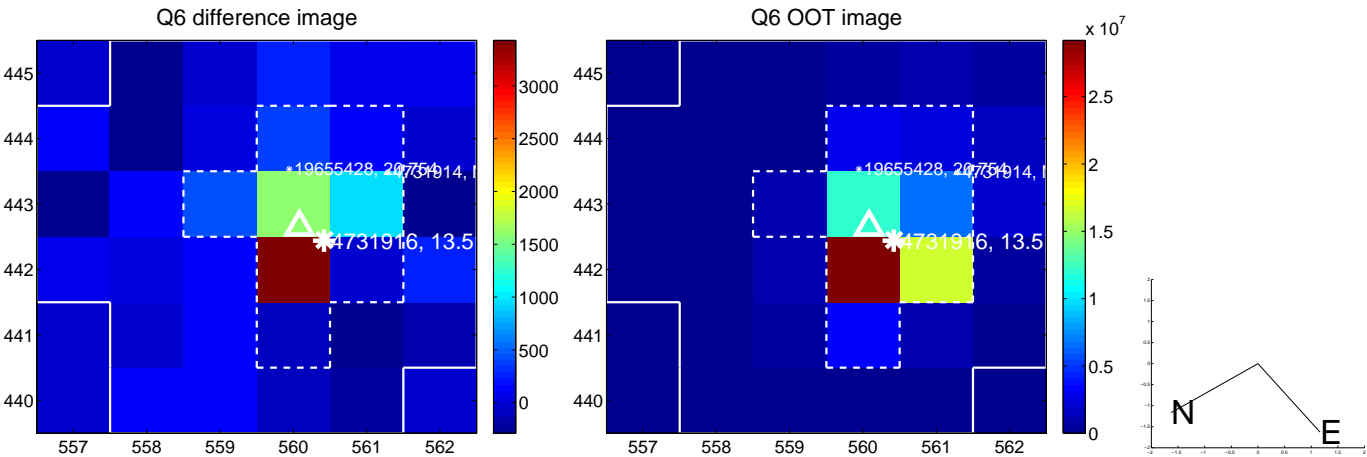
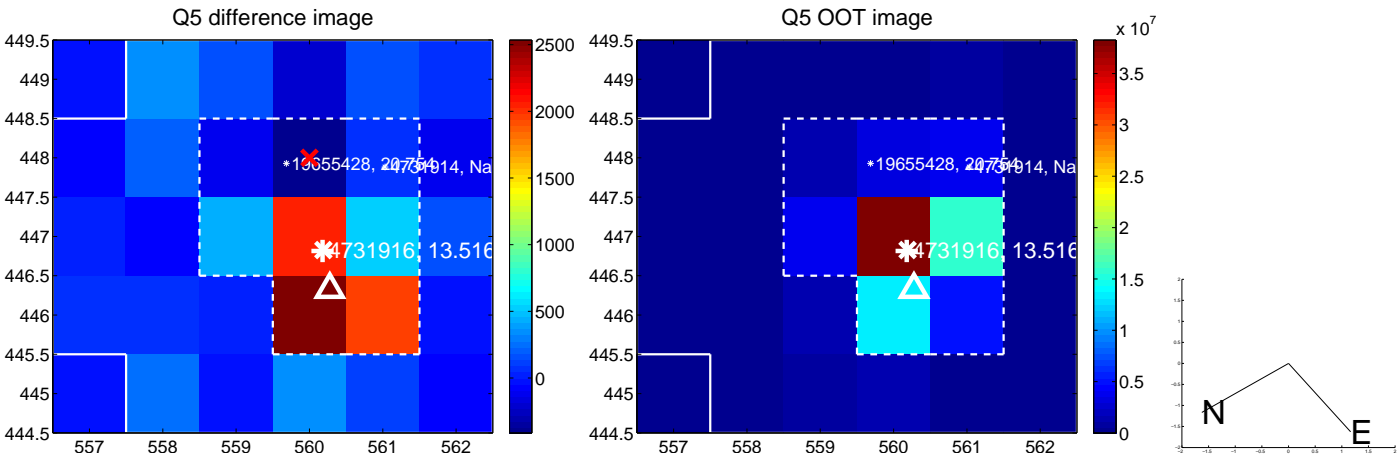


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

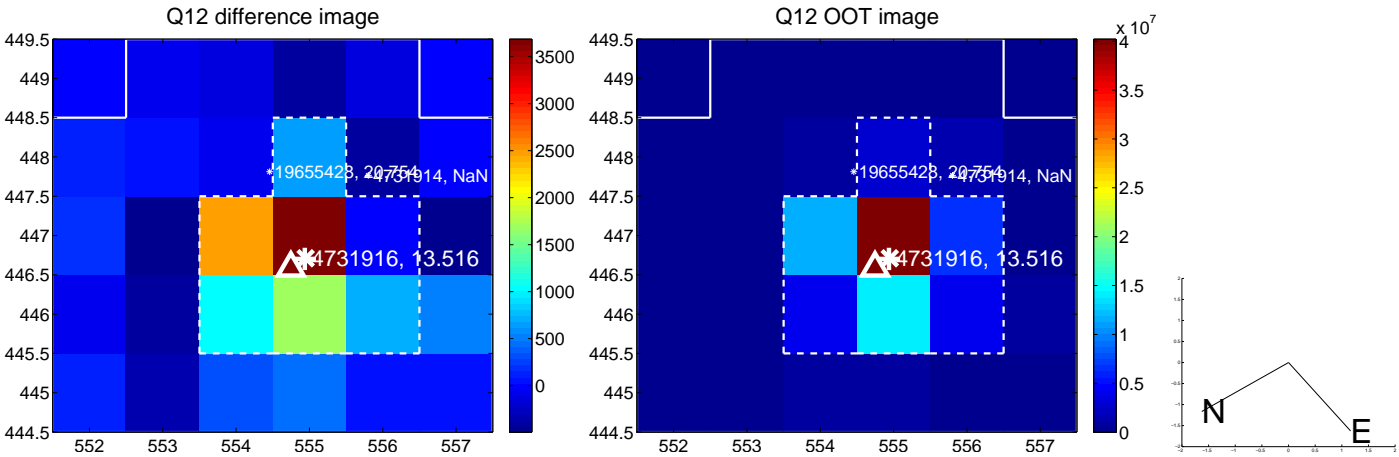
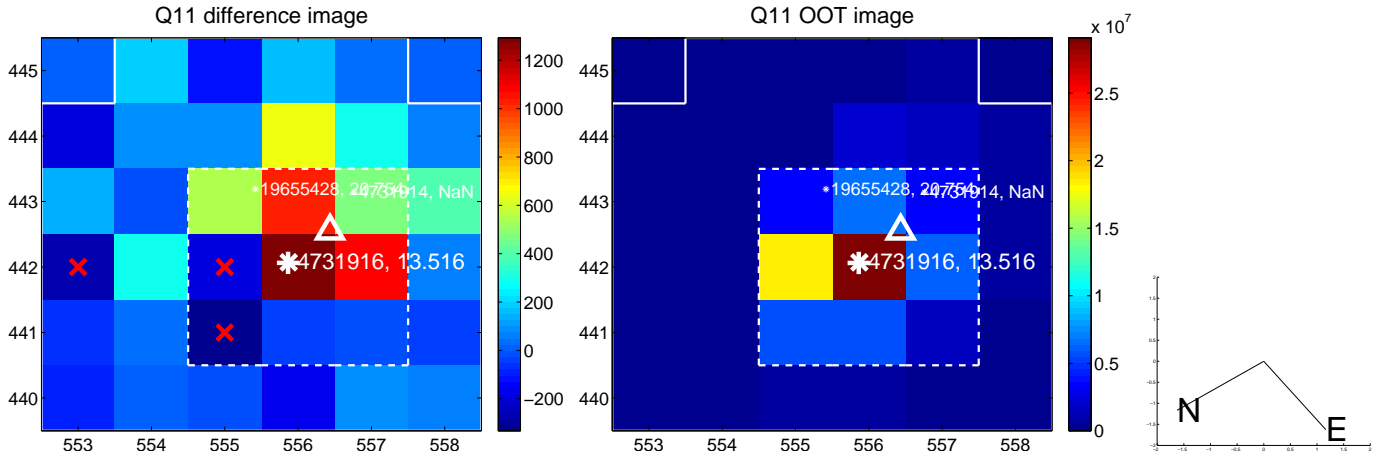
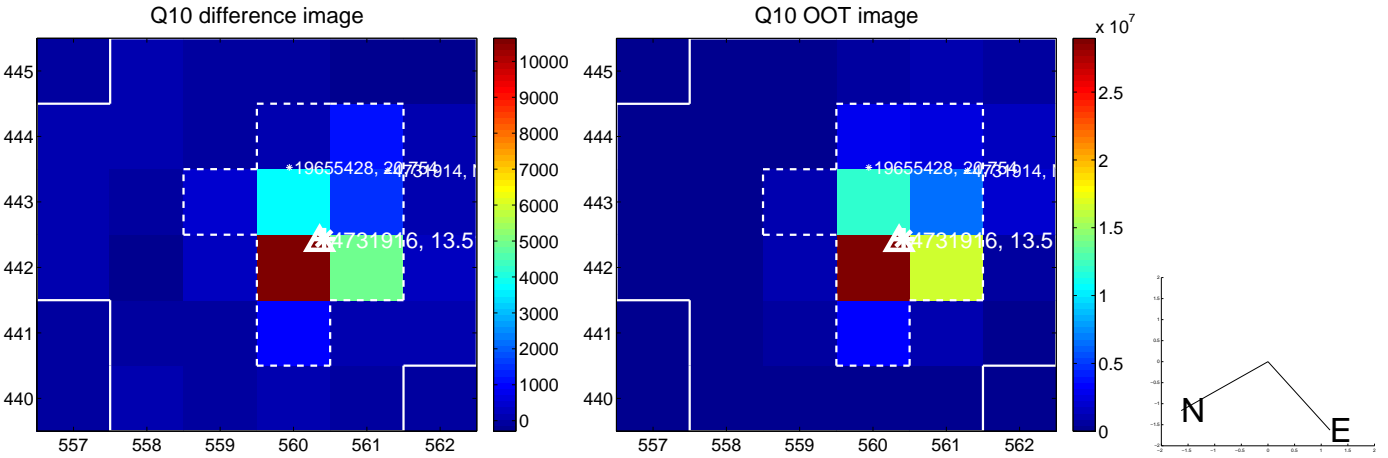
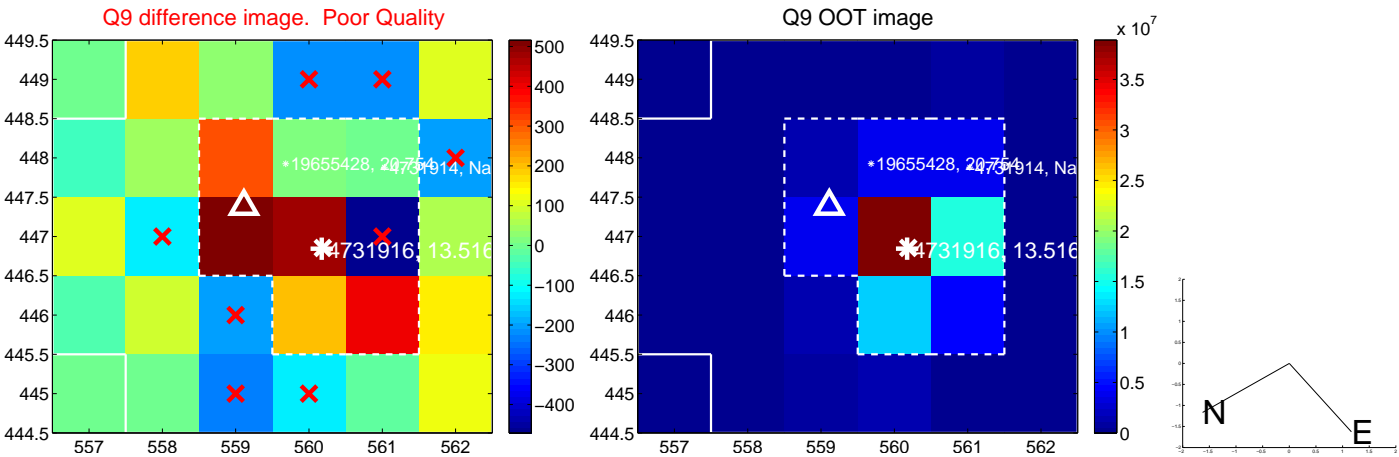


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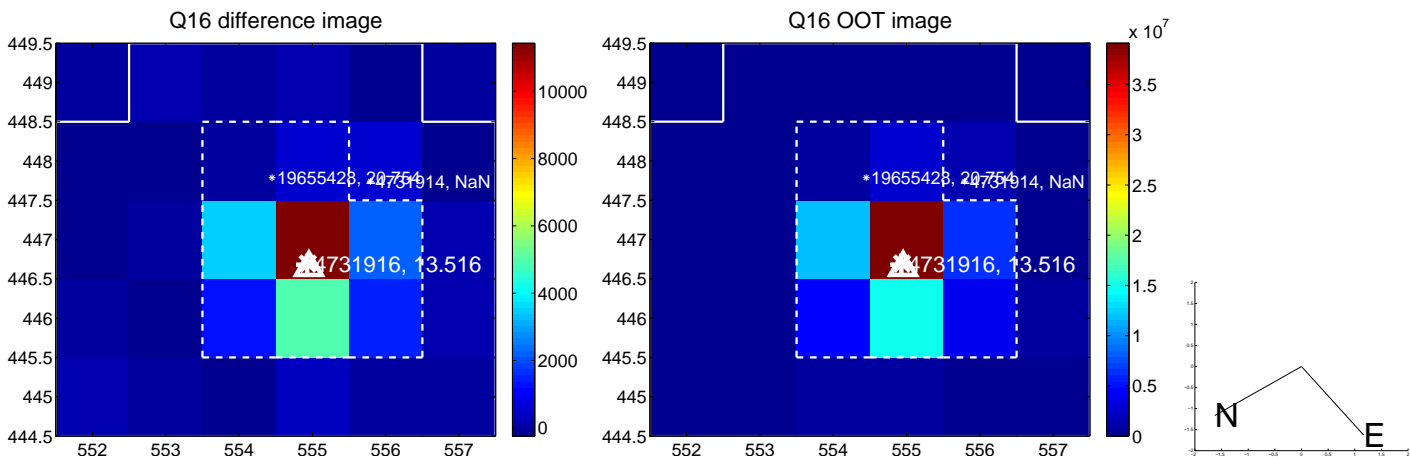
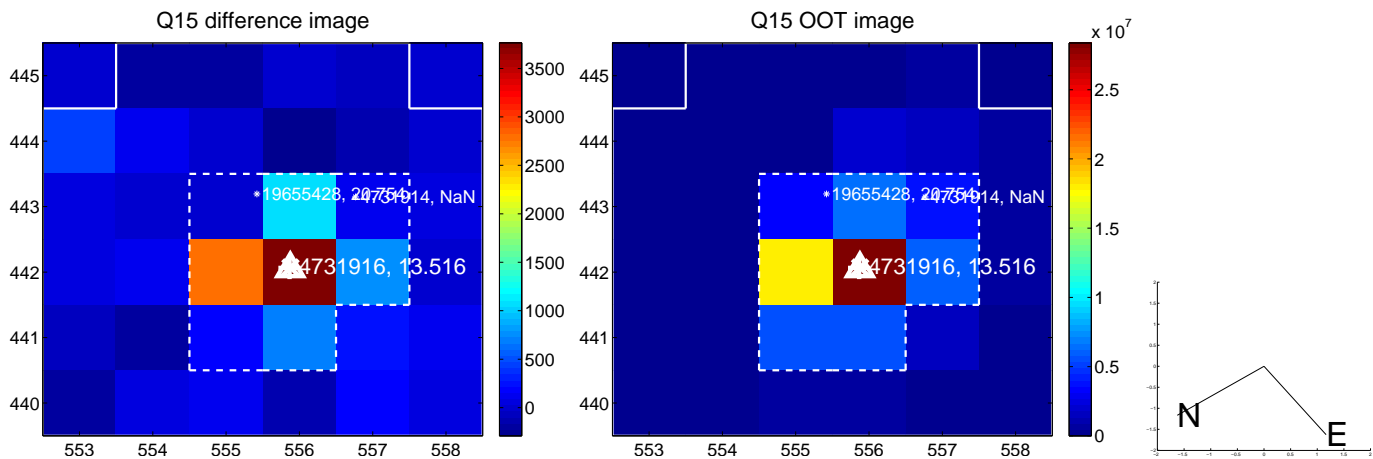
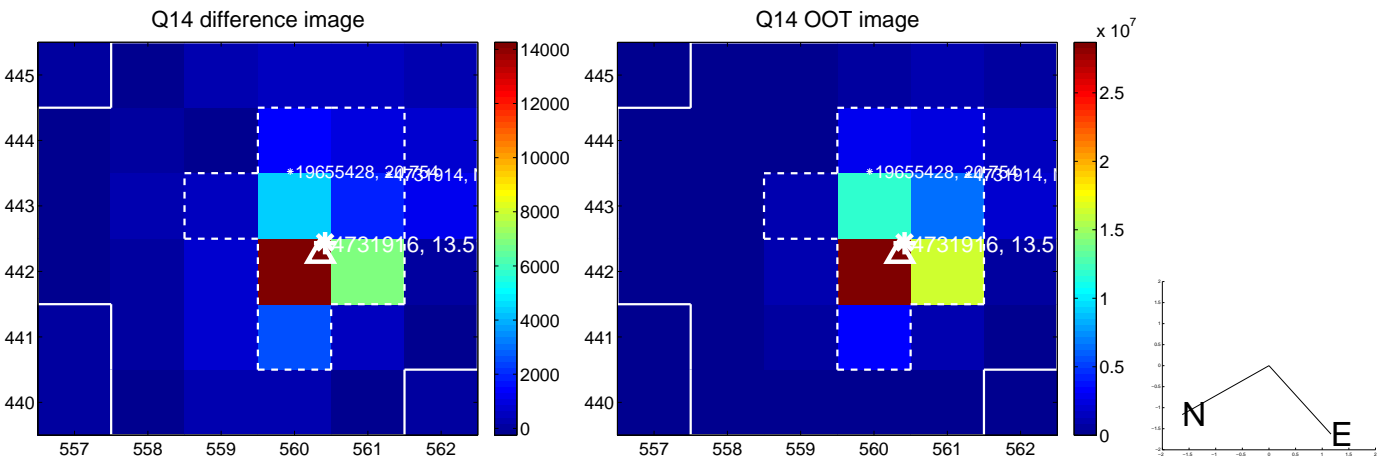
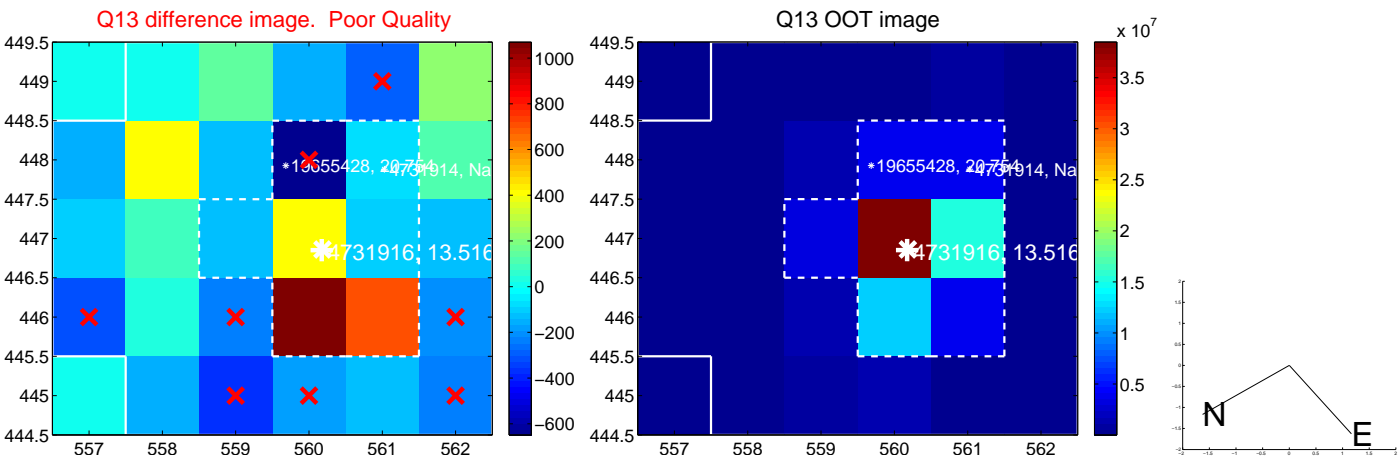




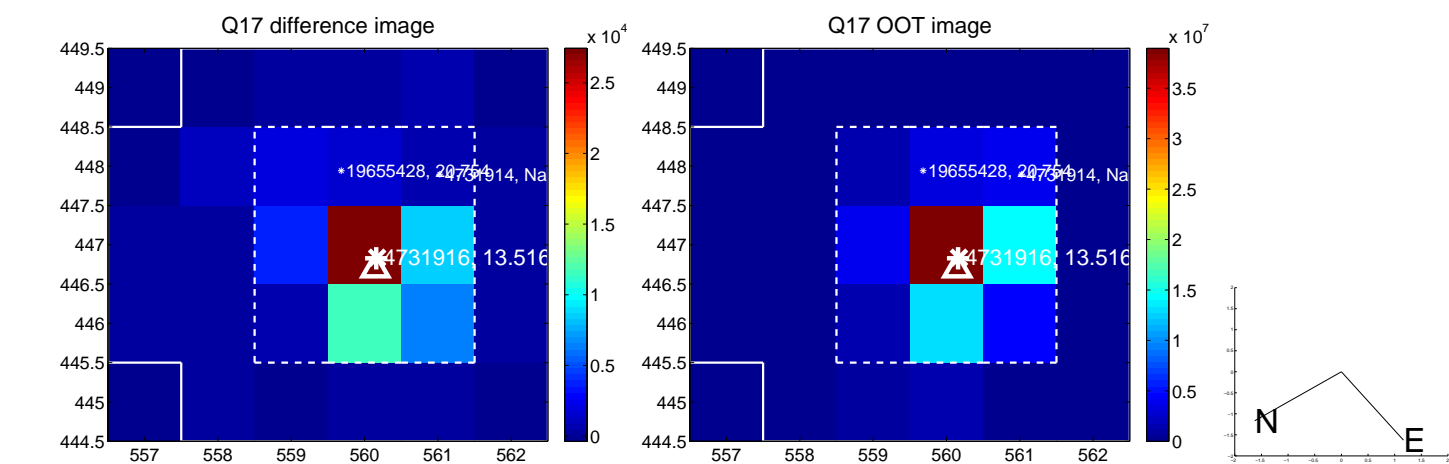
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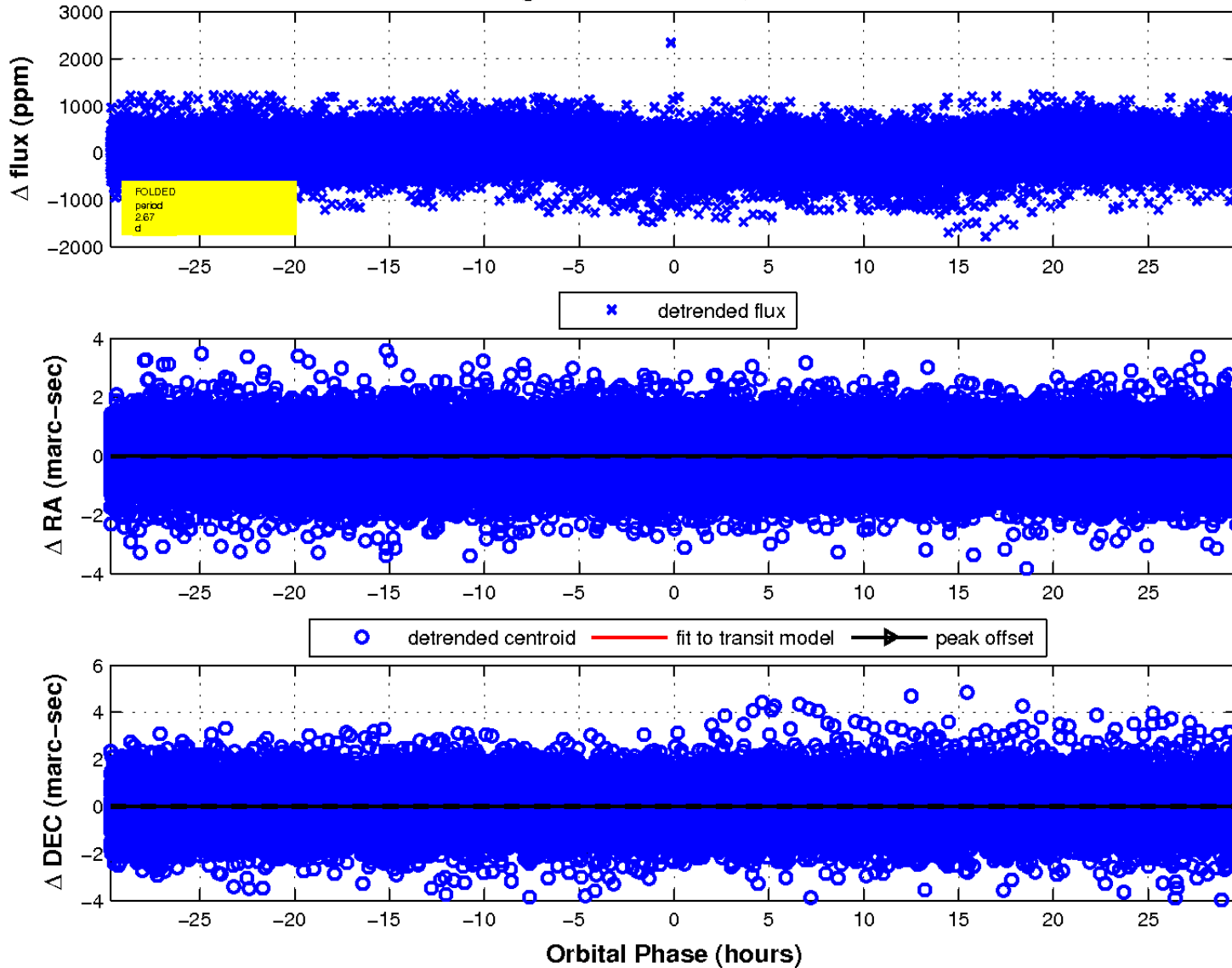
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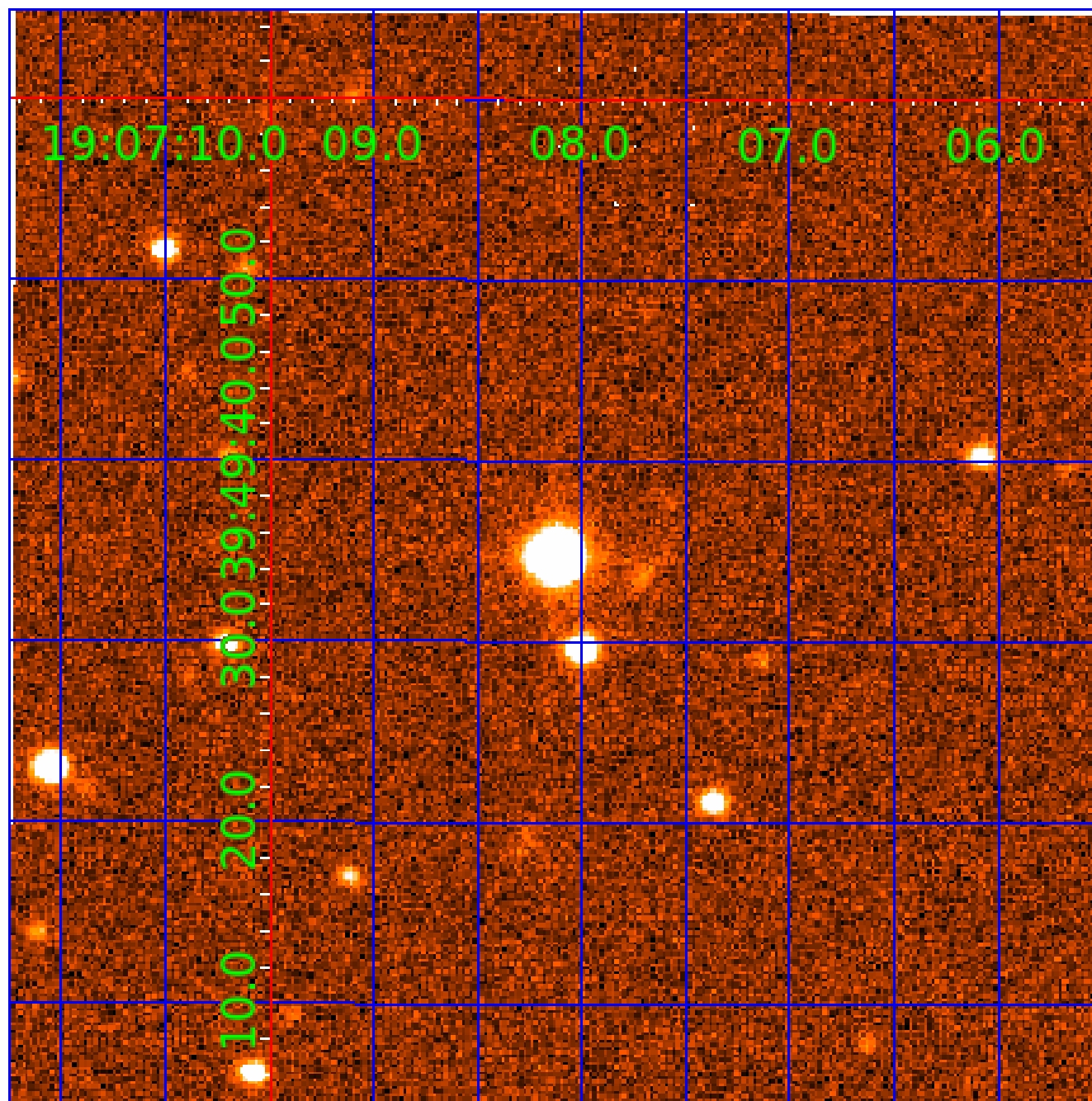


fluxWeightedCentroids, Planet 1 of 4



UKIRT Image

Declination





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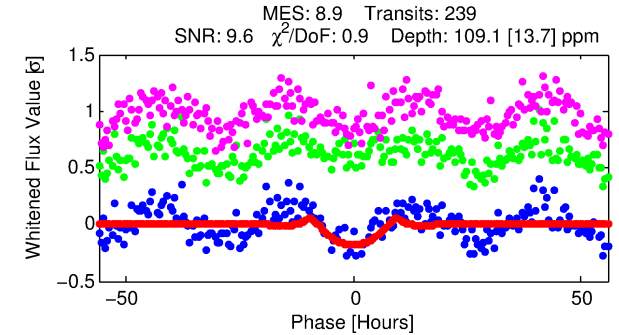
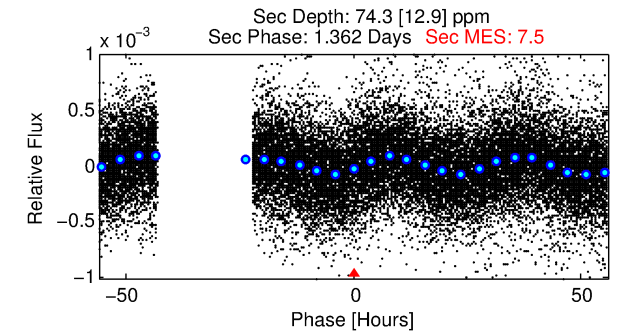
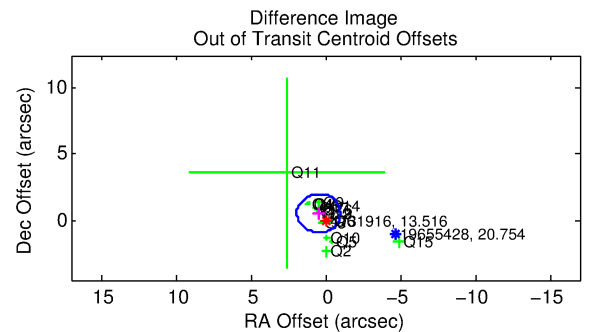
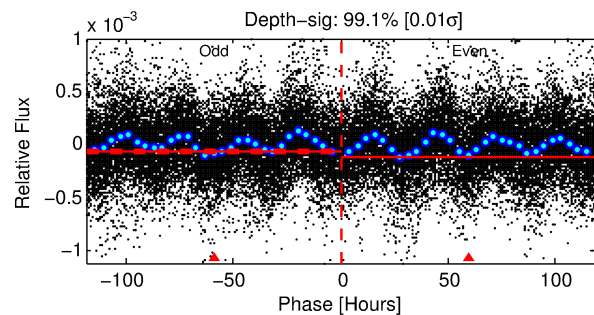
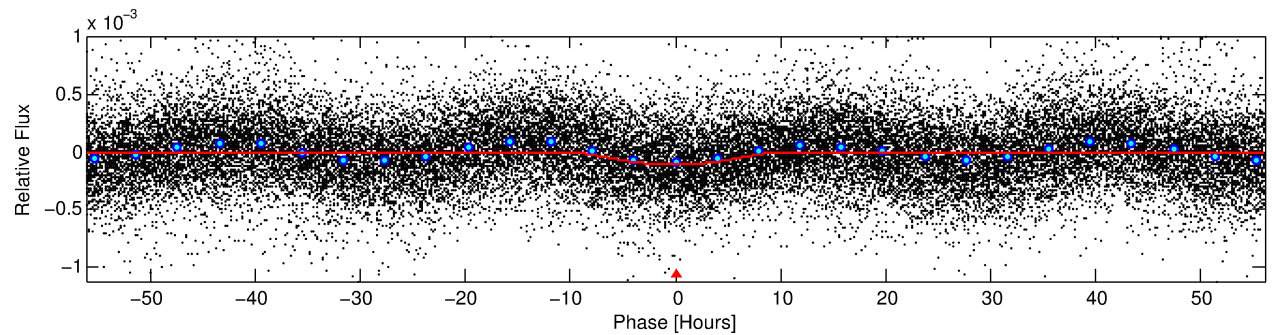
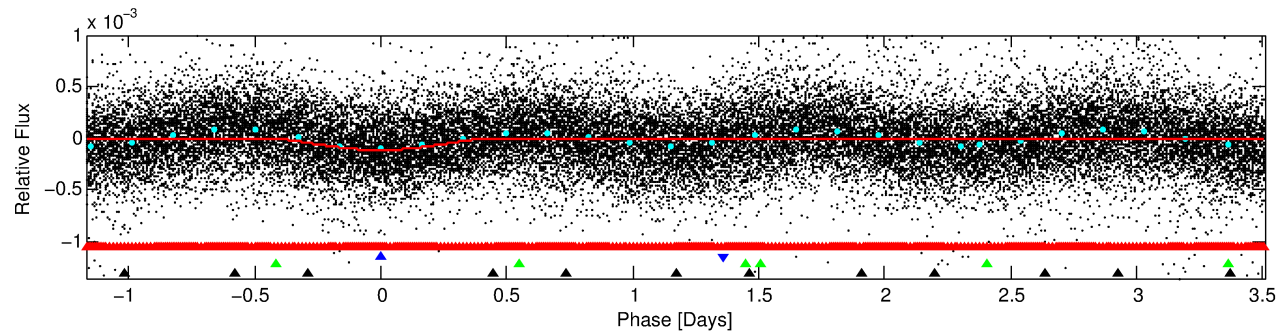
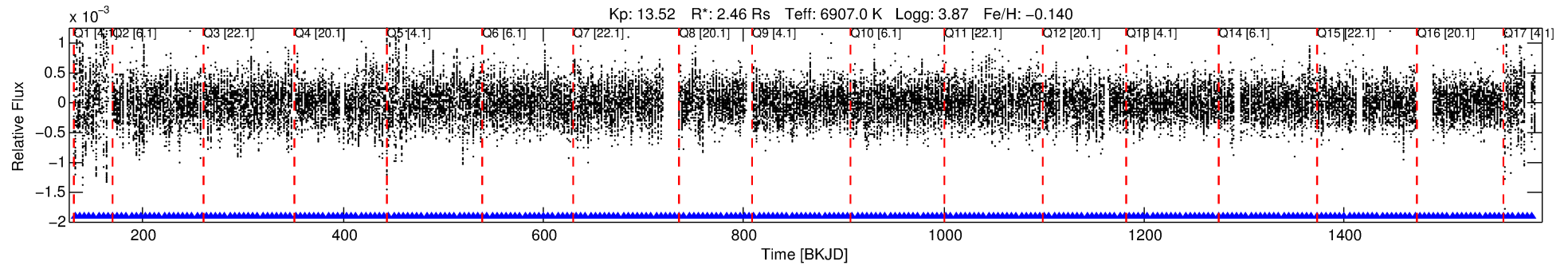
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## Ephemeris Match Information For 004731916-02

No Significant Match Found

# DV One-Page Summary

KIC: 4731916 Candidate: 2 of 4 Period: 4.678 d



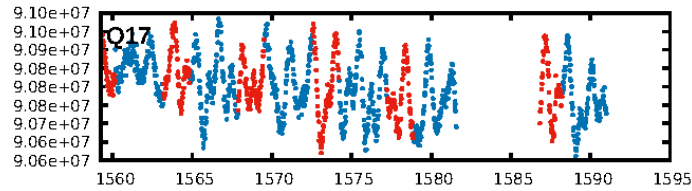
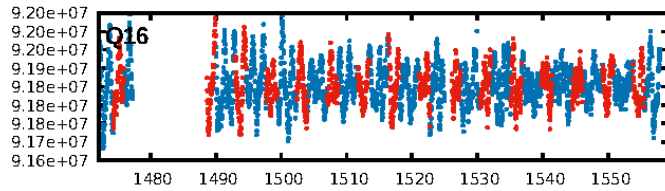
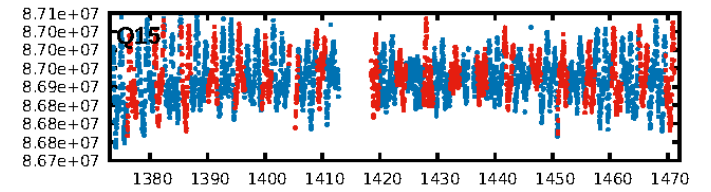
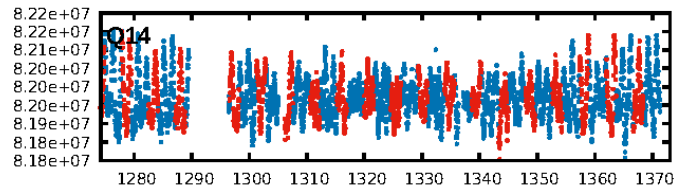
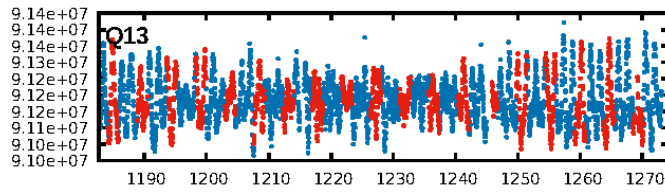
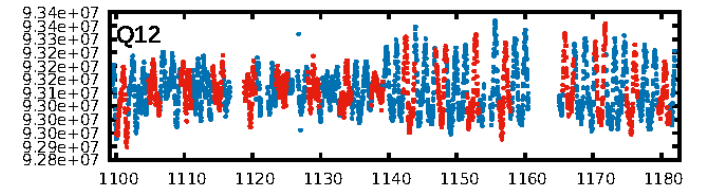
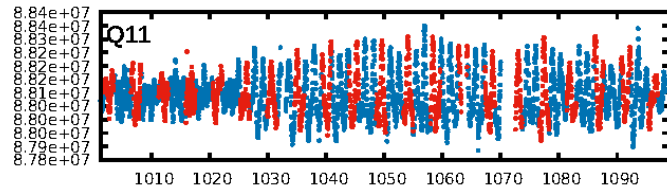
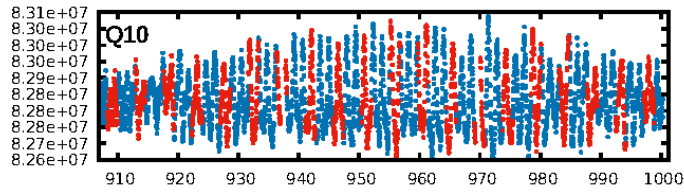
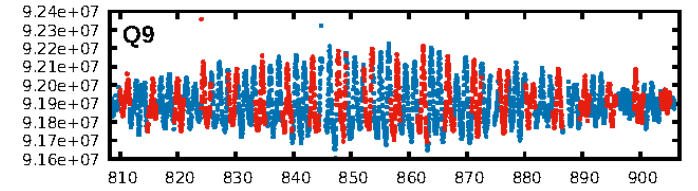
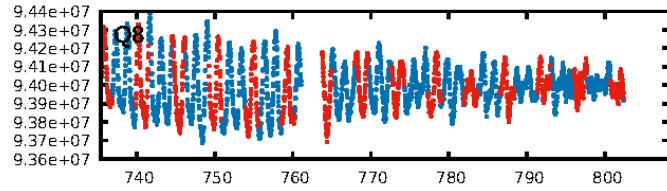
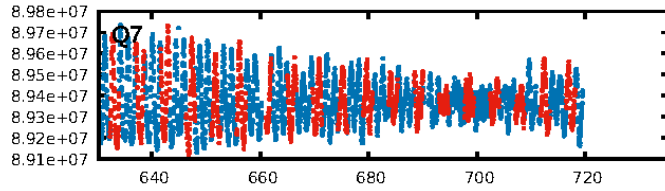
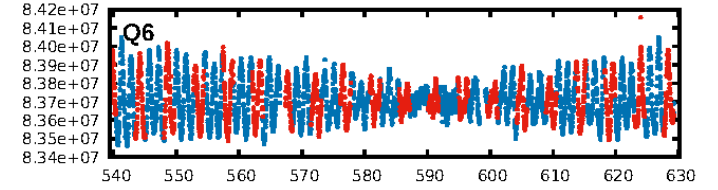
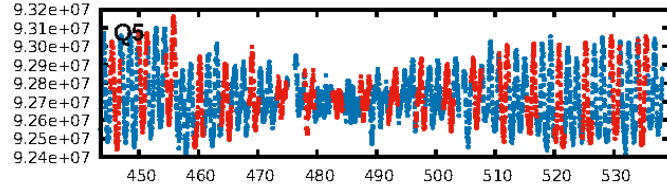
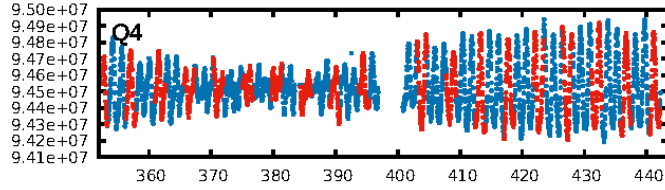
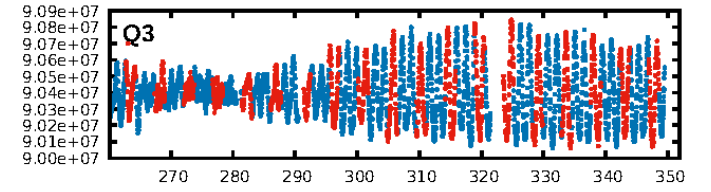
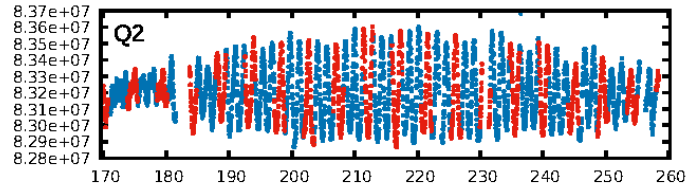
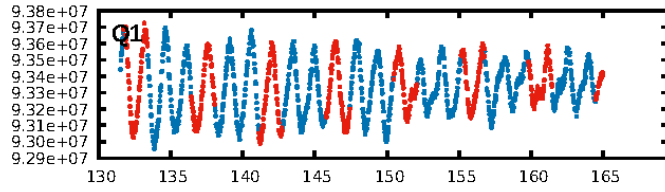
## DV Fit Results:

Period = 4.67795 [0.00022] d  
Epoch = 132.5586 [0.0412] BKJD  
Rp/R\* = 0.0179 [0.0189]  
a/R\* = 1.07 [0.02]  
b = 1.00 [0.03]  
Seff = 2983.18 [1835.28]  
Teq = 1884 [290] K  
Rp = 4.78 [5.44] Re  
a = 0.0642 [0.0247] AU  
Ag = 7.36 [16.21] [0.39 $\sigma$ ]  
Teffp = 4799 [2550] K [1.14 $\sigma$ ]

## DV Diagnostic Results:

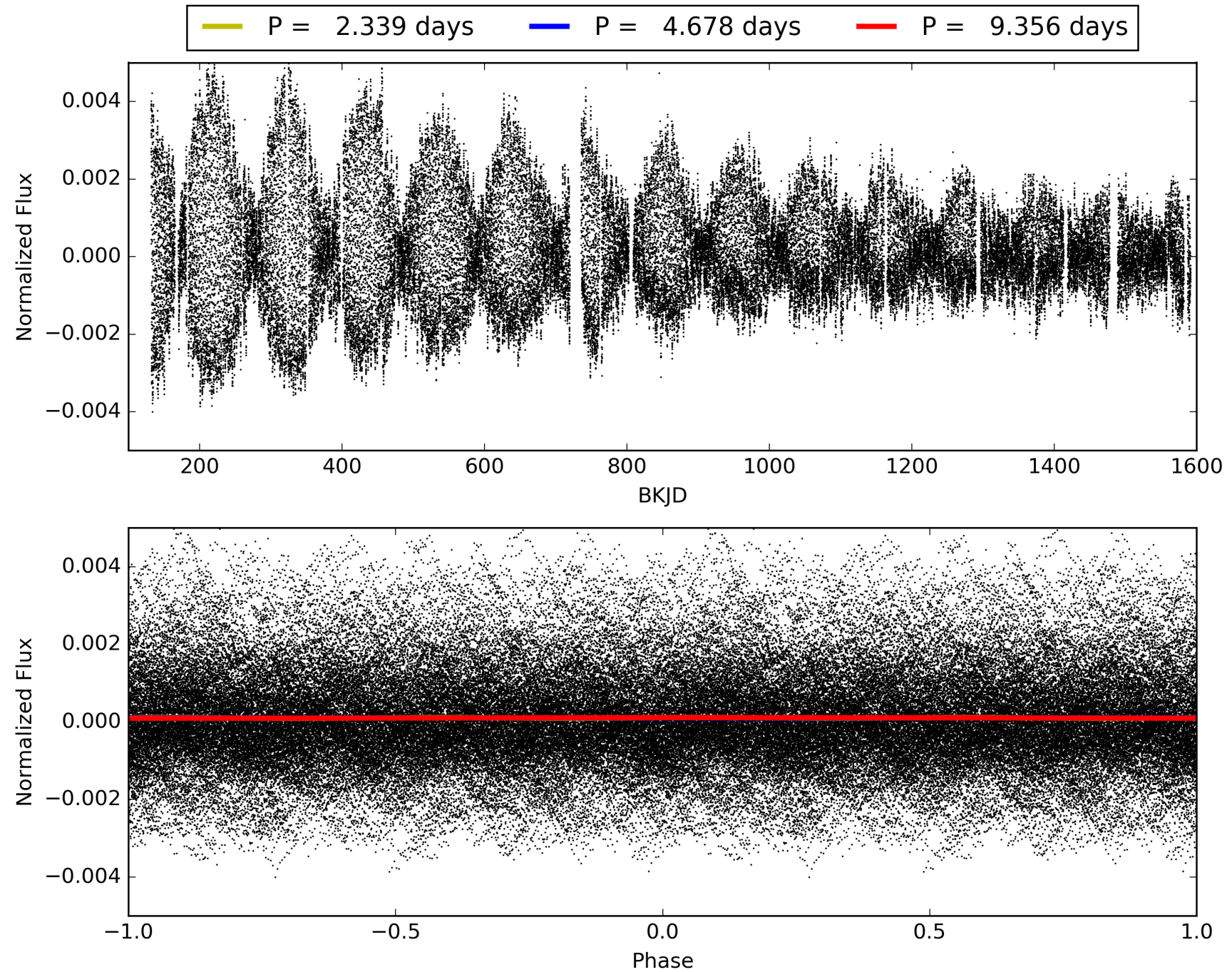
ShortPeriod-sig: 97.1% [2.18 $\sigma$ ]  
LongPeriod-sig: 100.0% [43.65 $\sigma$ ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
**Bootstrap-pfa: 3.26e-08**  
RollingBand-fgt: 1.00 [229/229]  
GhostDiagnostic-chr: 2.02  
Centroid-sig: 94.6%  
Centroid-so: 0.154 arcsec [0.48 $\sigma$ ]  
OotOffset-rm: 0.711 arcsec [1.46 $\sigma$ ]  
KicOffset-rm: 0.764 arcsec [1.44 $\sigma$ ]  
OotOffset-st: 4/2/4/5 [15]  
KicOffset-st: 4/2/4/5 [15]  
DiffImageQuality-fgm: 0.67 [10/15]  
DiffImageOverlap-fno: 0.00 [0/17]

# TCE 004731916-02, PDC Light Curves





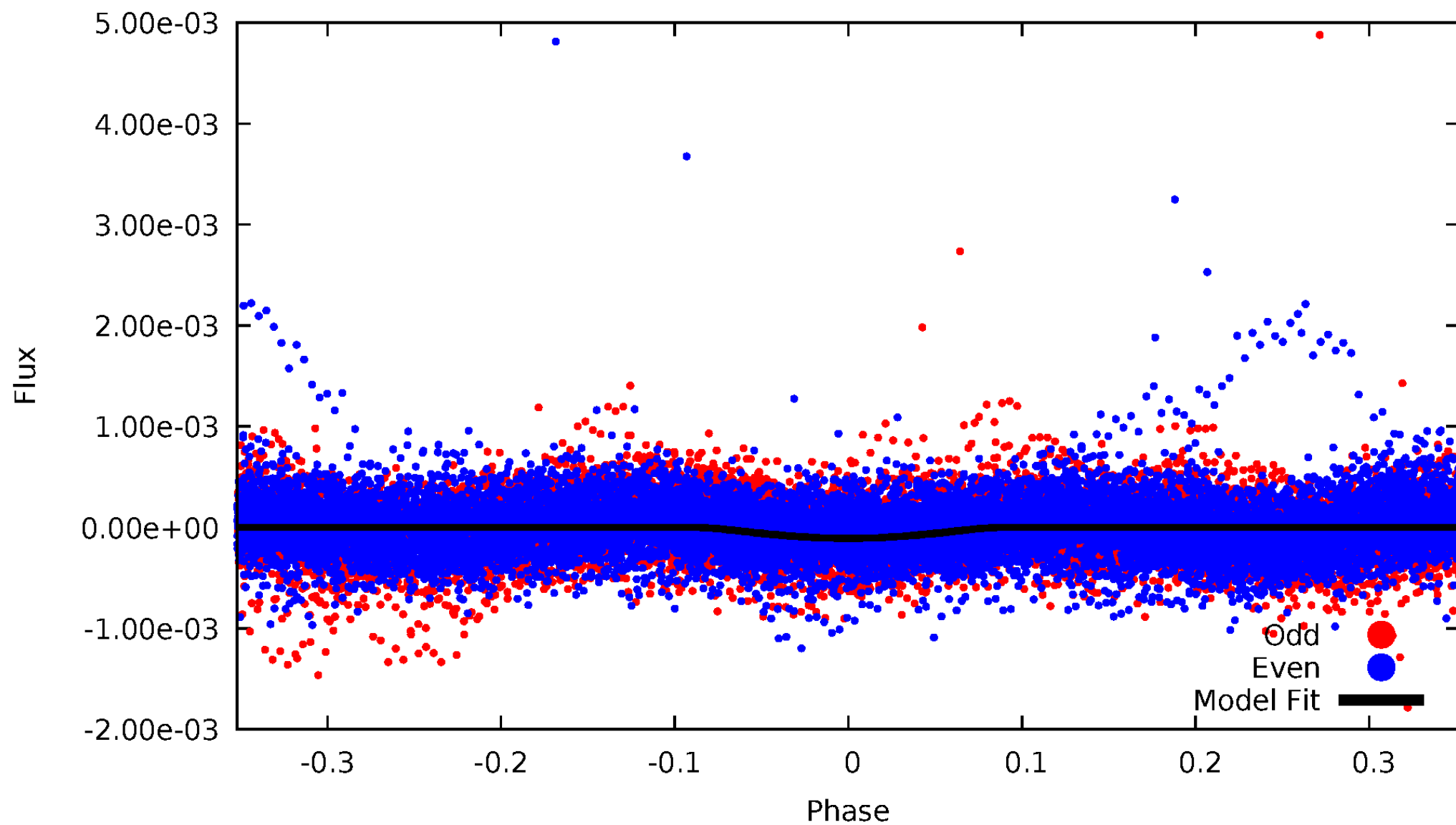
# TCE 004731916-02





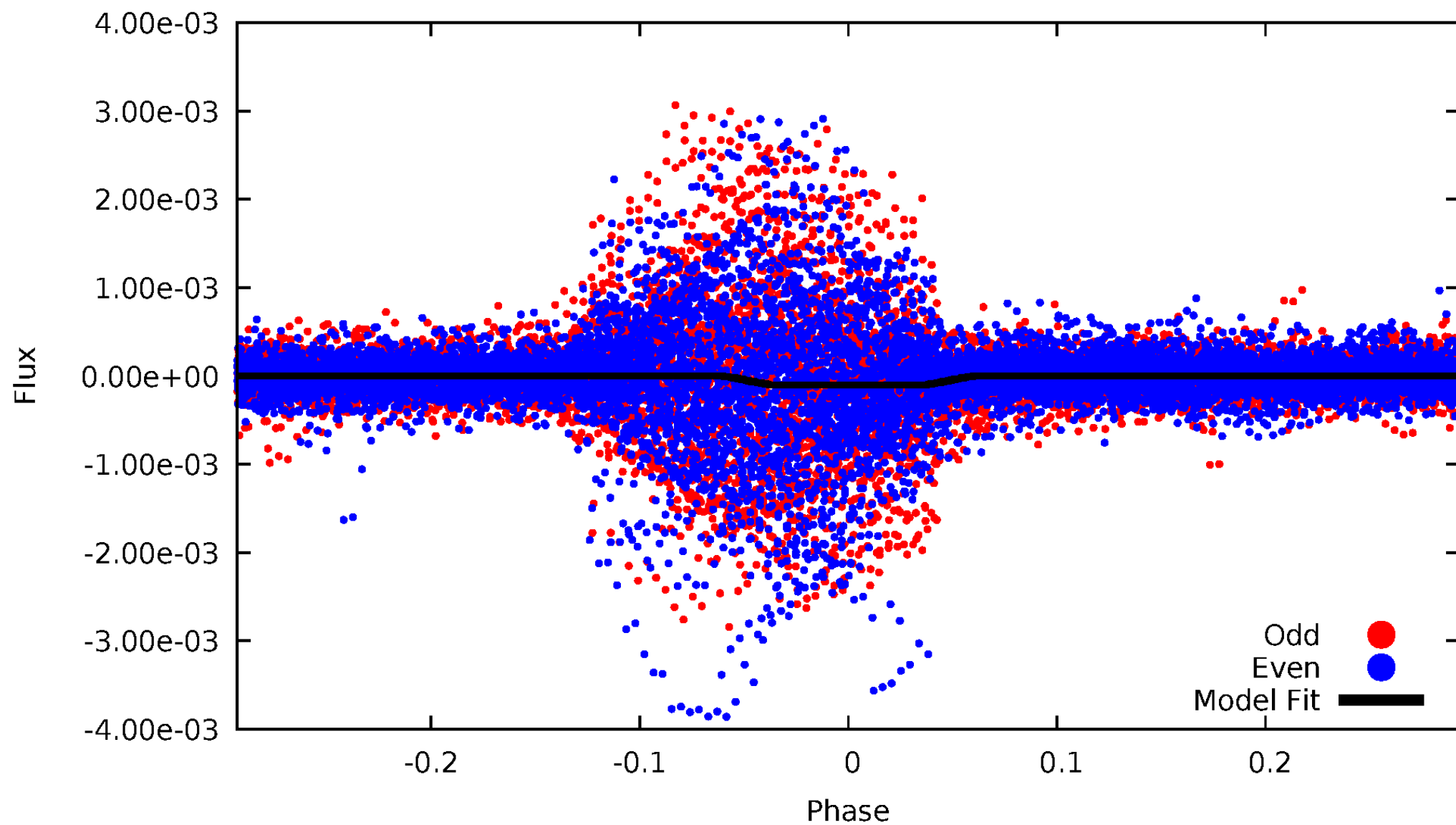
# DV Odd/Even

TCE 004731916-02



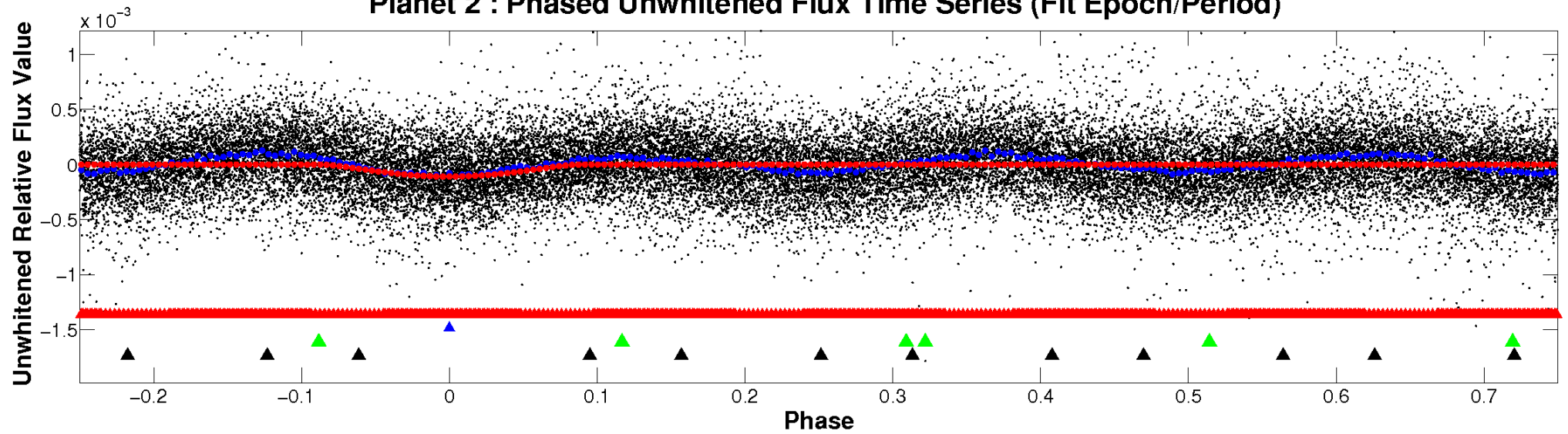
# ALT Odd/Even

TCE 004731916-02

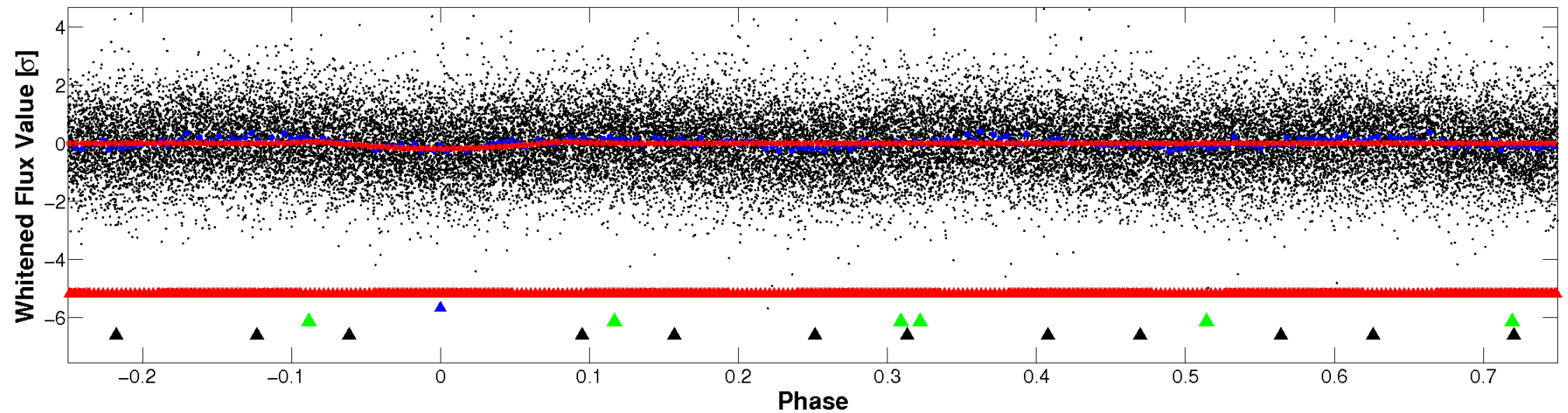


# Non-Whitened Vs. Whitened Light Curve

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

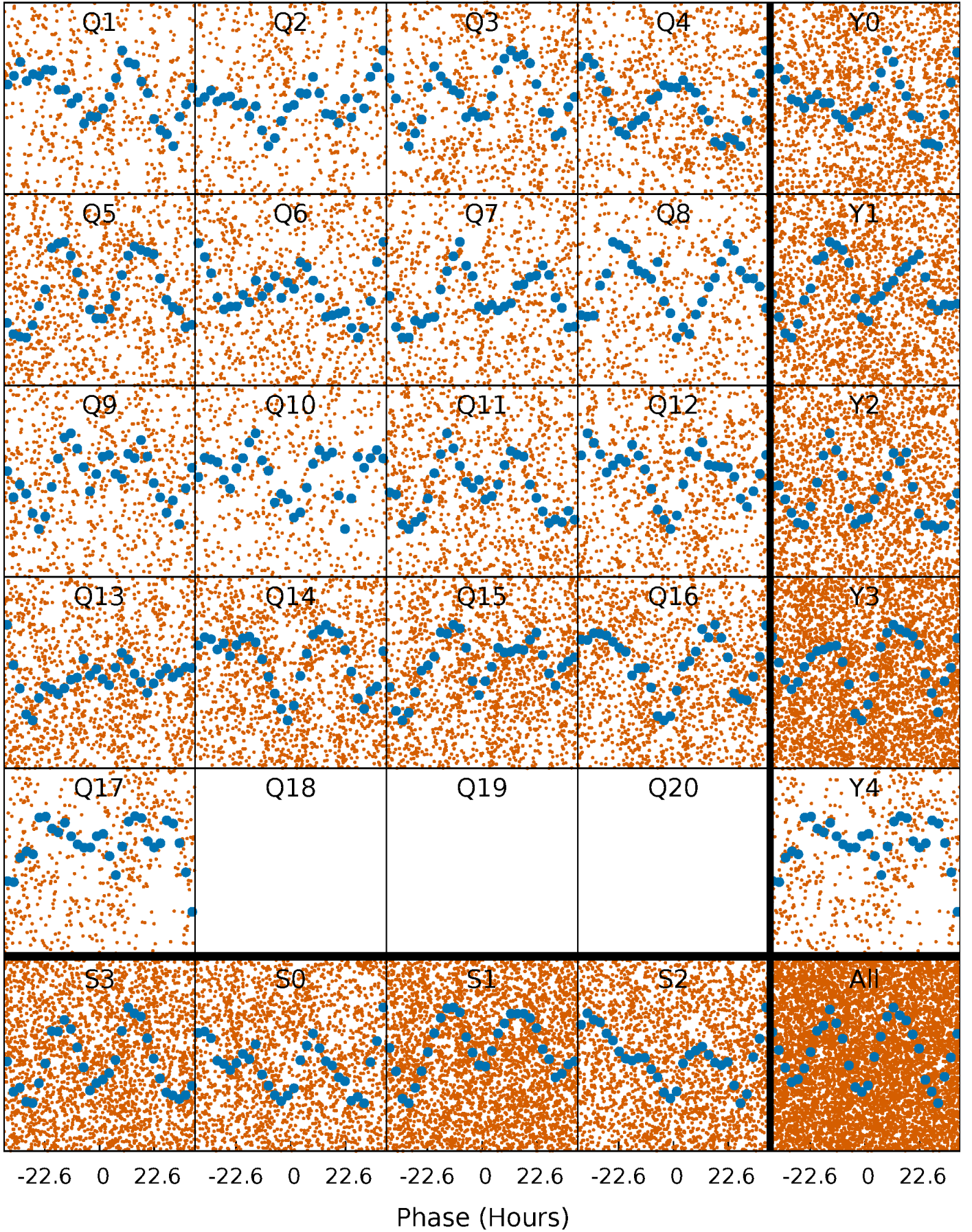


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

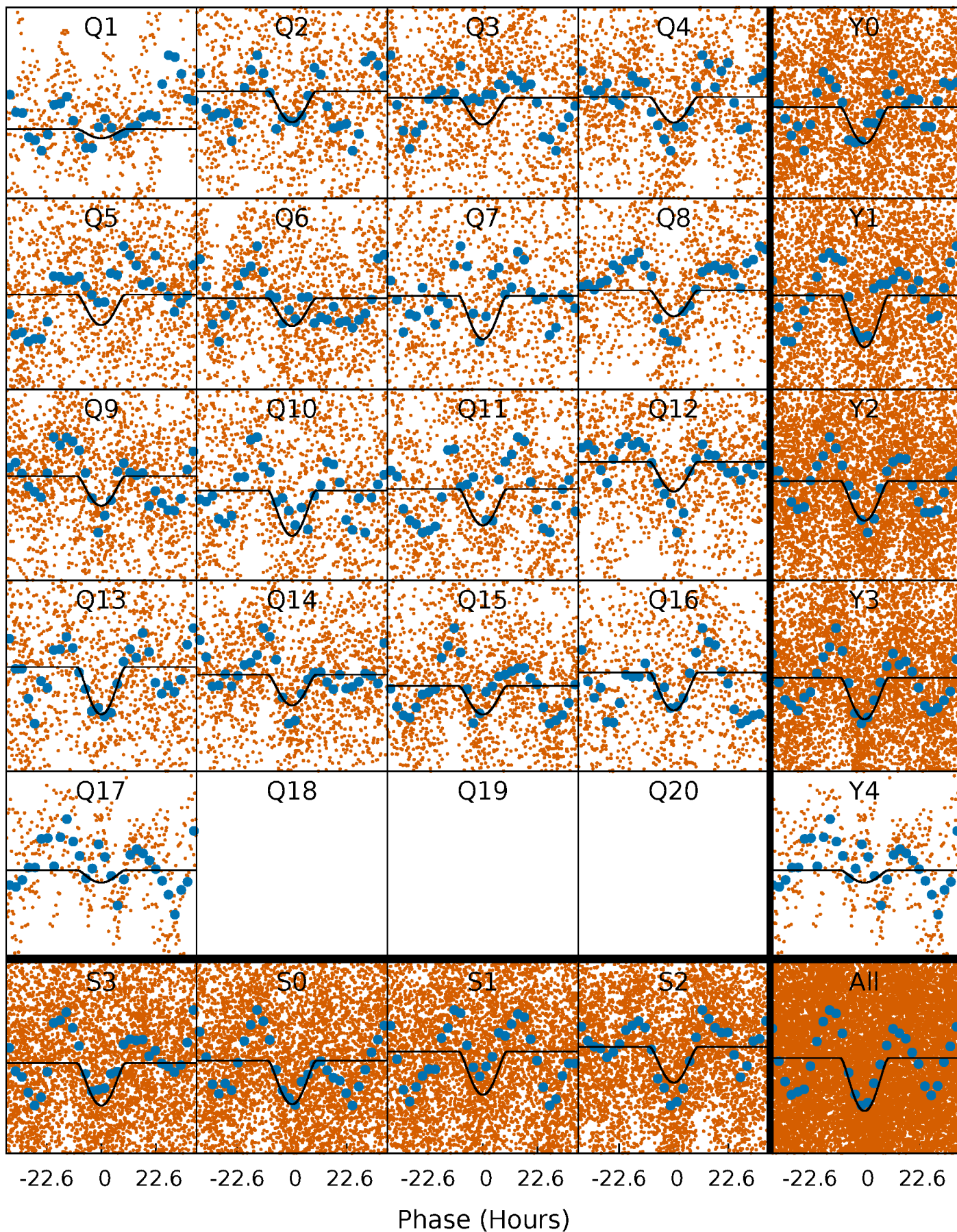
TCE 004731916-02   P= 4.677951 Days    $T_0=132.558591$  (BKJD)





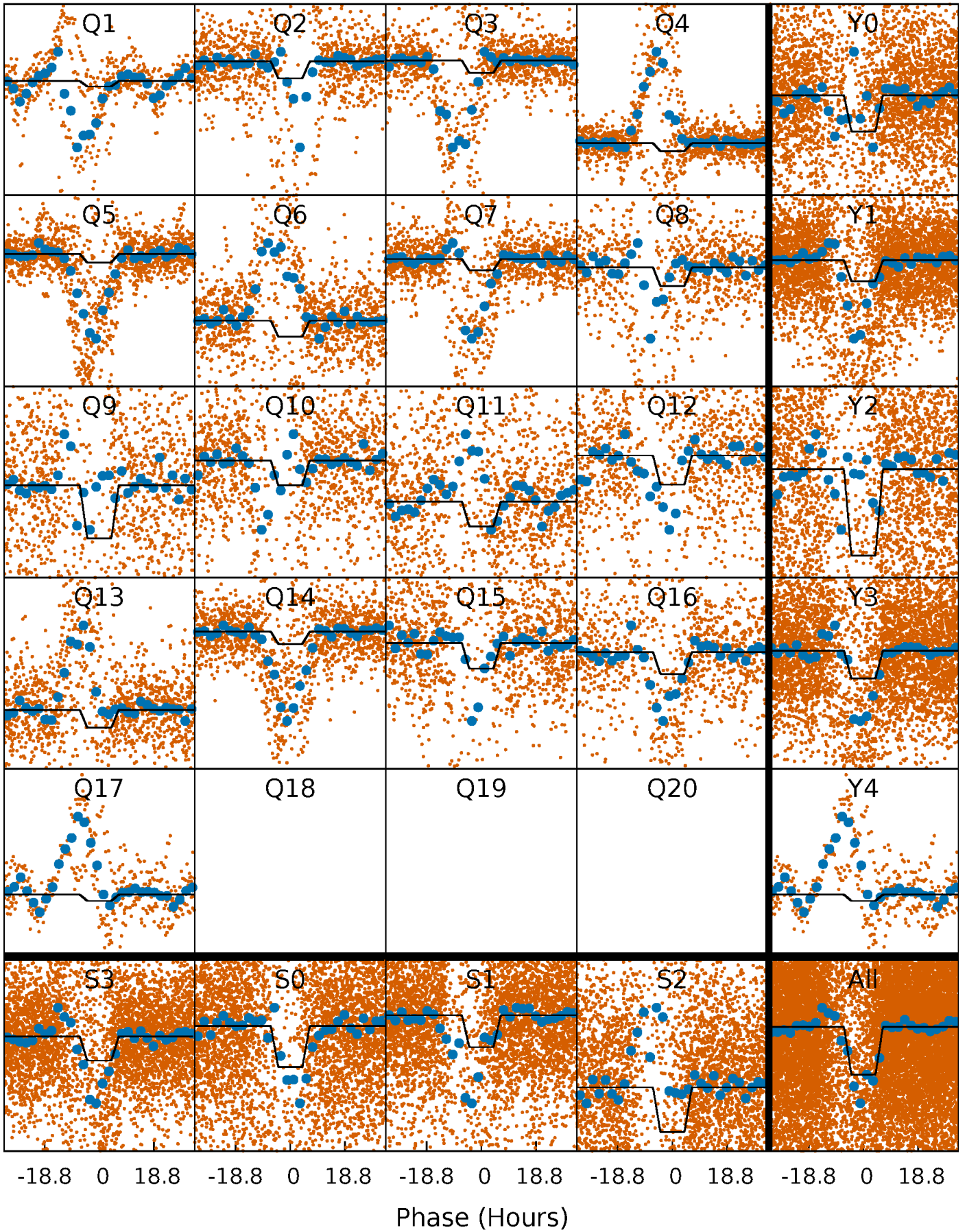
# DV Quarter-Phased Transit Curves

TCE 004731916-02   P= 4.677951 Days    $T_0=132.558591$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

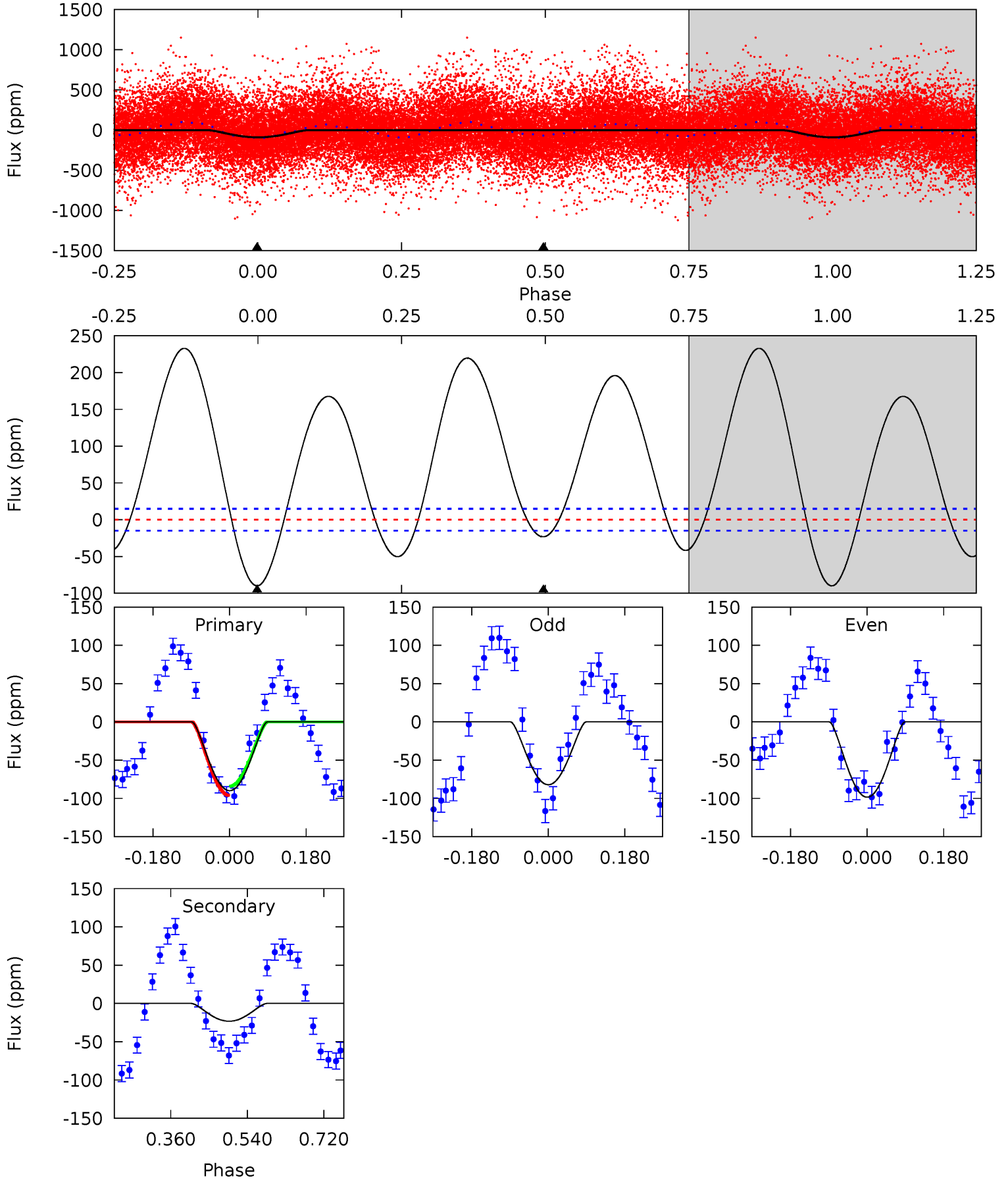
TCE 004731916-02     $P = 4.678094$  Days     $T_0 = 132.644371$  (BKJD)



# DV Model-Shift Uniqueness Test

004731916-02, P = 4.677951 Days, E = 127.880640 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
26.9	6.94	0	0	4.44	1.34	14.7	26.9	26.9	6.94	6.94	2.48	1.05	0.72	1.88

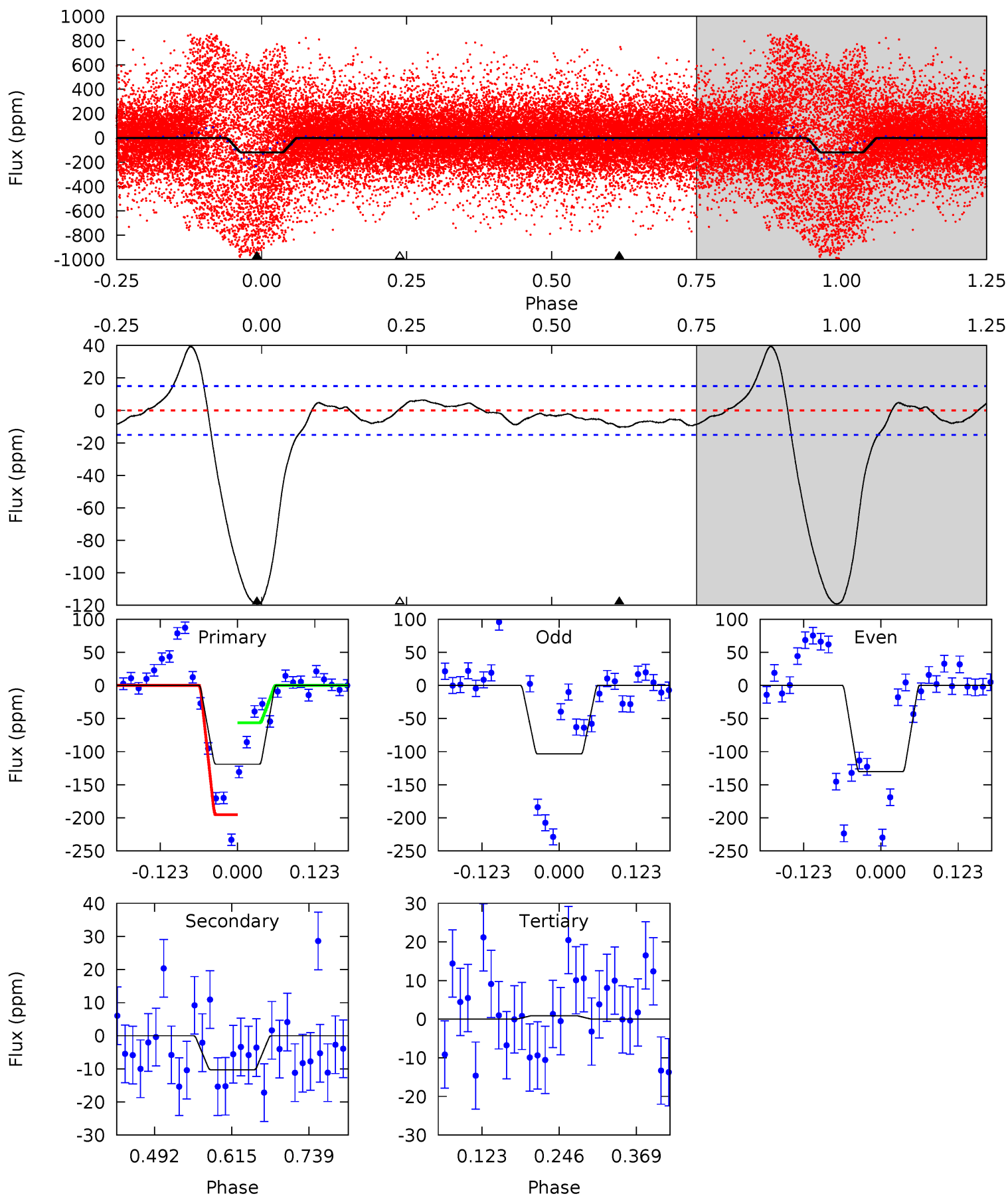




# Alt Model-Shift Uniqueness Test

004731916-02, P = 4.678094 Days, E = 127.966277 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
35.8	3.08	-0.27	0	4.52	1.54	2.10	36.1	35.8	3.35	3.08	4.01	0.26	0.25	0





### Stellar Parameters For KIC 004731916

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$\rho_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6907^{+190}_{-262}$	$3.865^{+0.343}_{-0.147}$	$-0.140^{+0.250}_{-0.300}$	$2.455^{+0.555}_{-1.030}$	$1.609^{+0.210}_{-0.390}$	$0.153^{+0.422}_{-0.067}$
	+3%/-4%	+9%/-4%	+179%/-214%	+23%/-42%	+13%/-24%	+275%/-44%
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 004731916-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-23 \pm 3$	$5.33^{+4.74}_{-3.32}$	$2581^{+210}_{-260}$	$3545^{+1761}_{-884}$	$1.819^{+11.330}_{-1.317}$
Alt.	$-10 \pm 3$	$4.17^{+4.05}_{-2.78}$	$2588^{+203}_{-269}$	$3269^{+1962}_{-1488}$	$1.225^{+10.947}_{-0.920}$

$T_{\text{max}}$  = 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

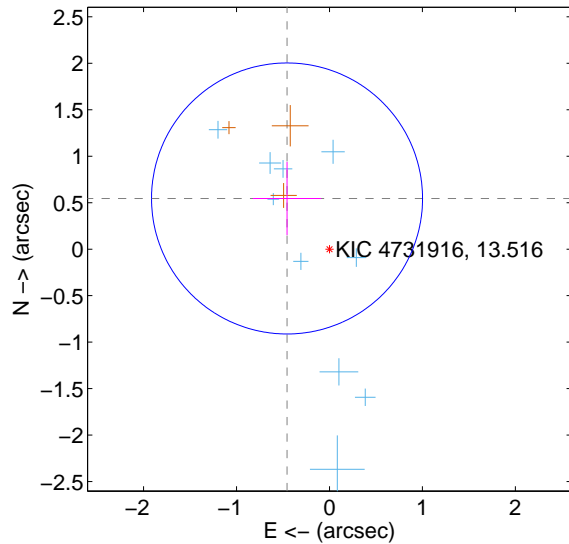
Supplemental centroid analysis for 004731916-02. Kepler magnitude: 13.52. Transit SNR 9.60

There are 10 quarters with good PRF difference image offsets

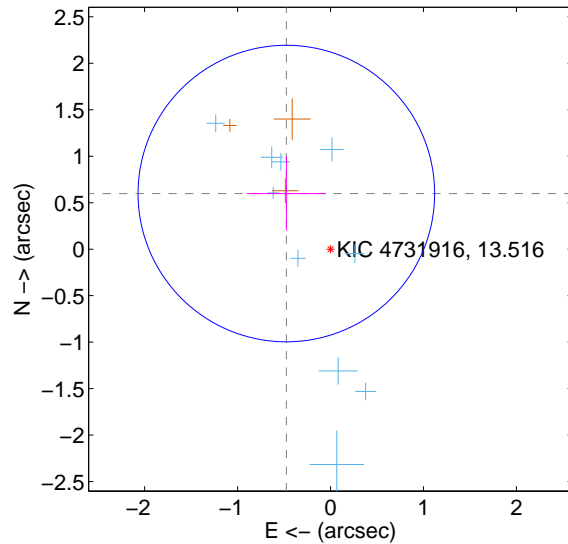
The direct PRF centroid is offset from the target star catalog position by about 0.06 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.711 \pm 0.486$	1.46	$0.457 \pm 0.368$	$0.546 \pm 0.394$
PRF-fit source offset from KIC position	$0.764 \pm 0.532$	1.44	$0.475 \pm 0.428$	$0.598 \pm 0.400$
photometric centroid source offset	$0.15 \pm 0.32$	0.48	$-0.14 \pm 0.31$	$-0.07 \pm 0.37$

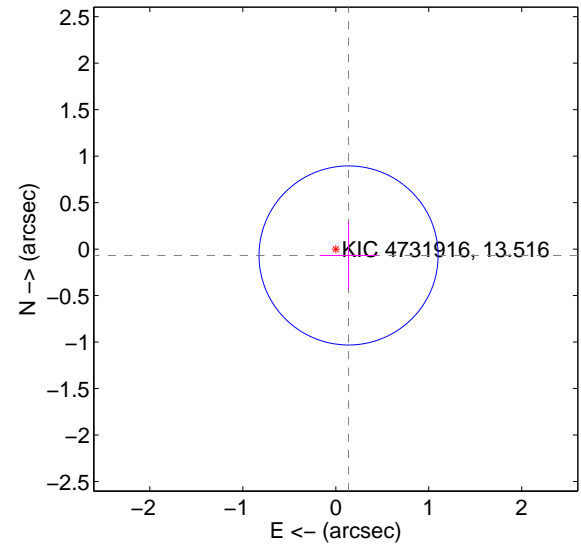
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

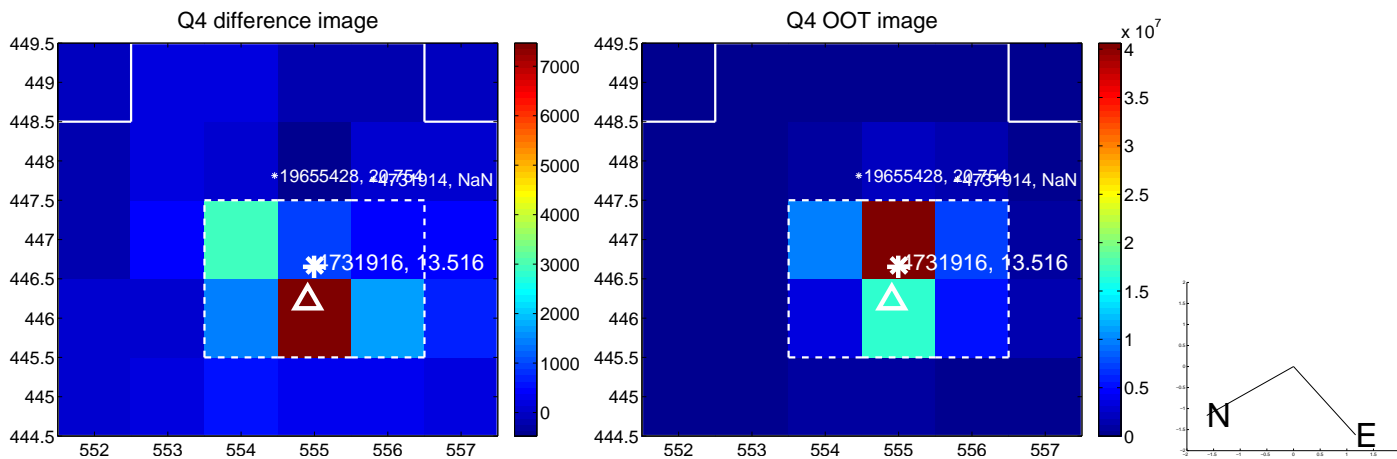
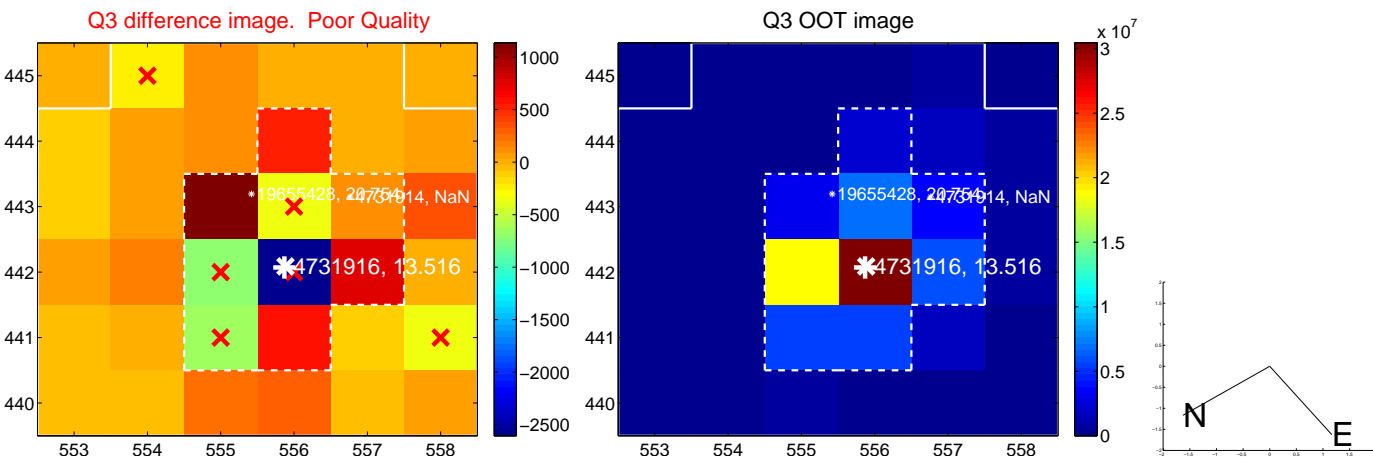
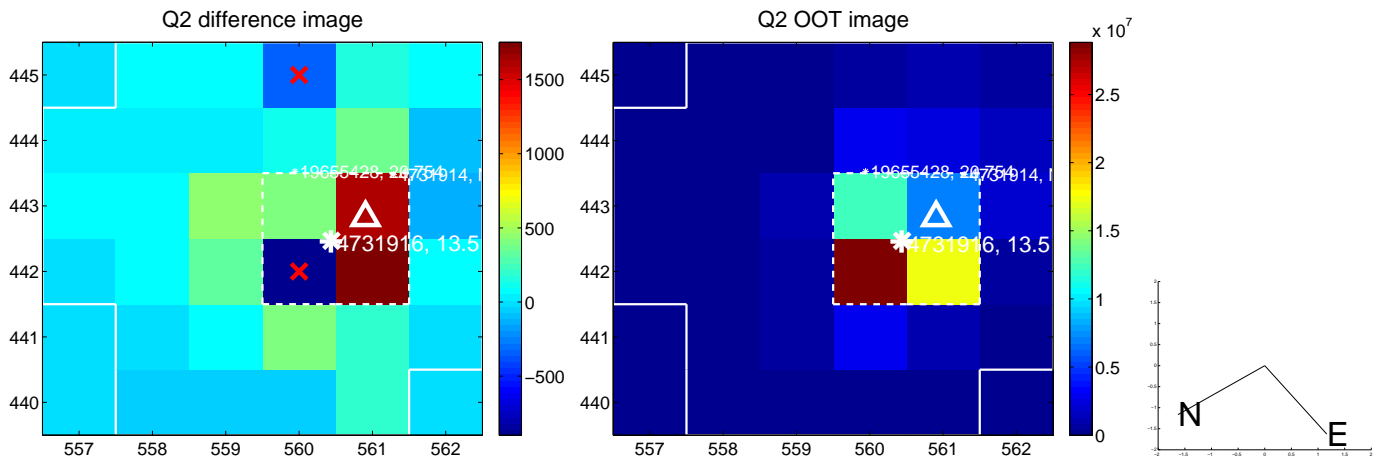
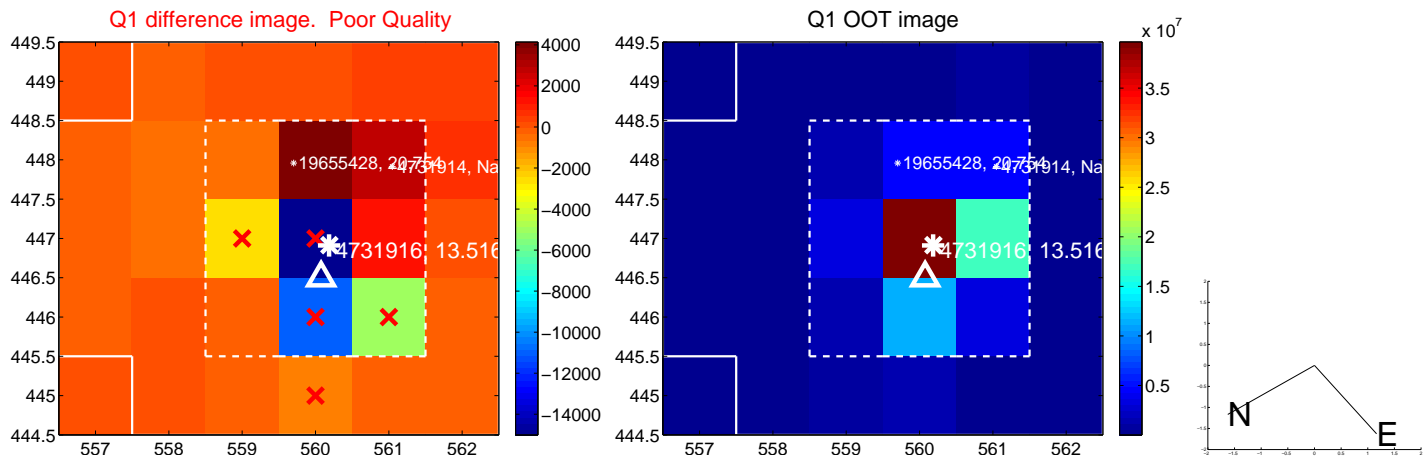


offset from photometric centroids

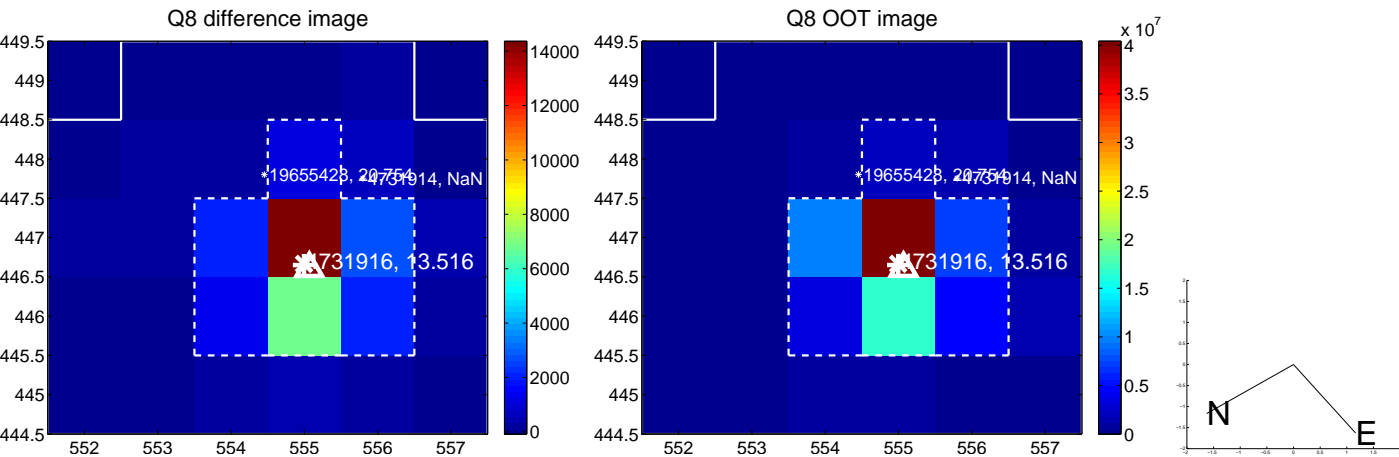
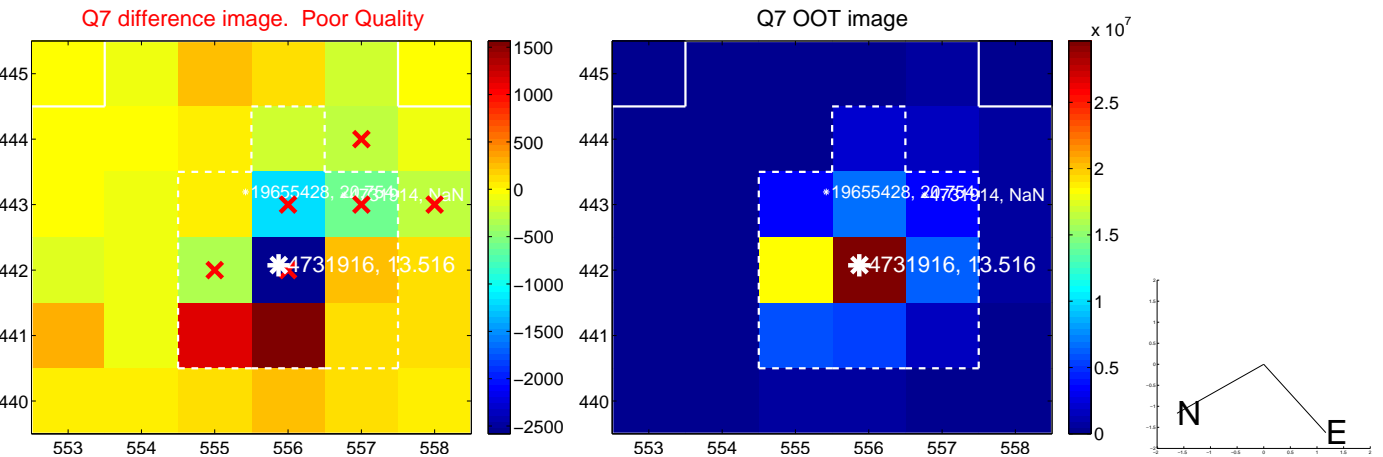
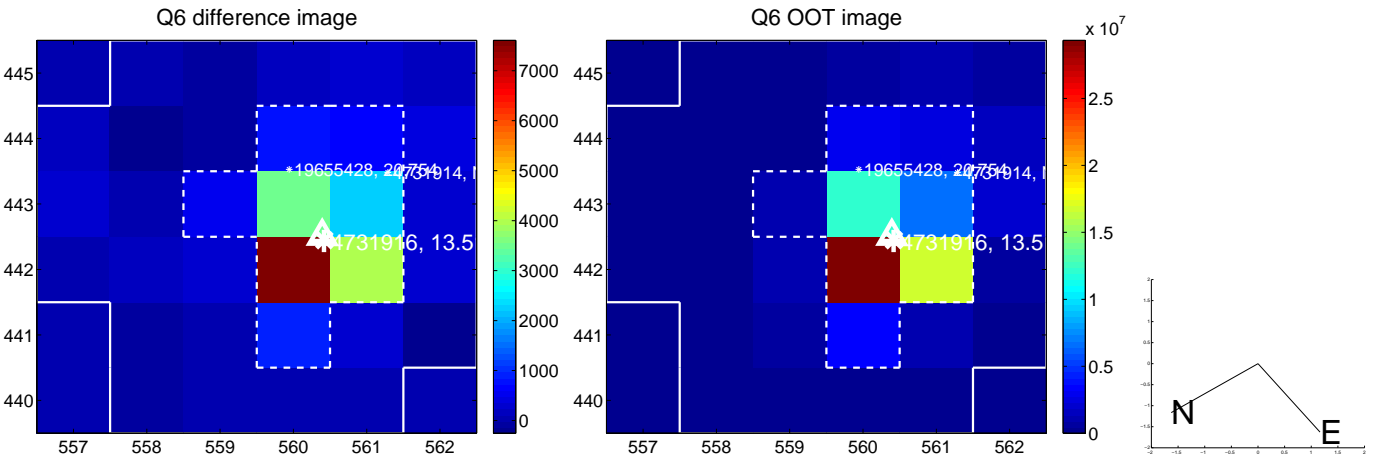
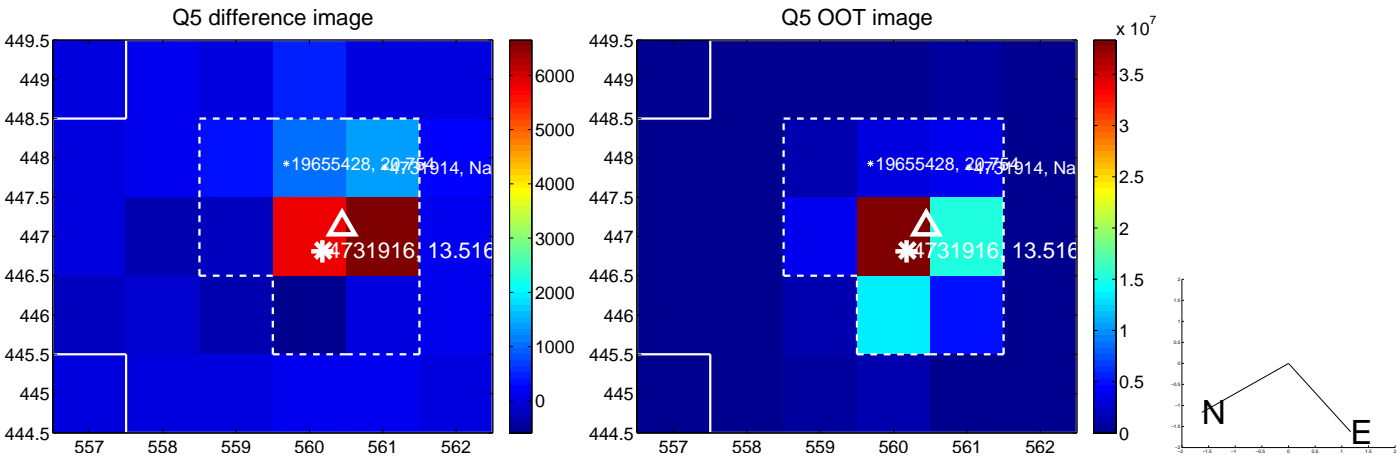


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets**; **Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

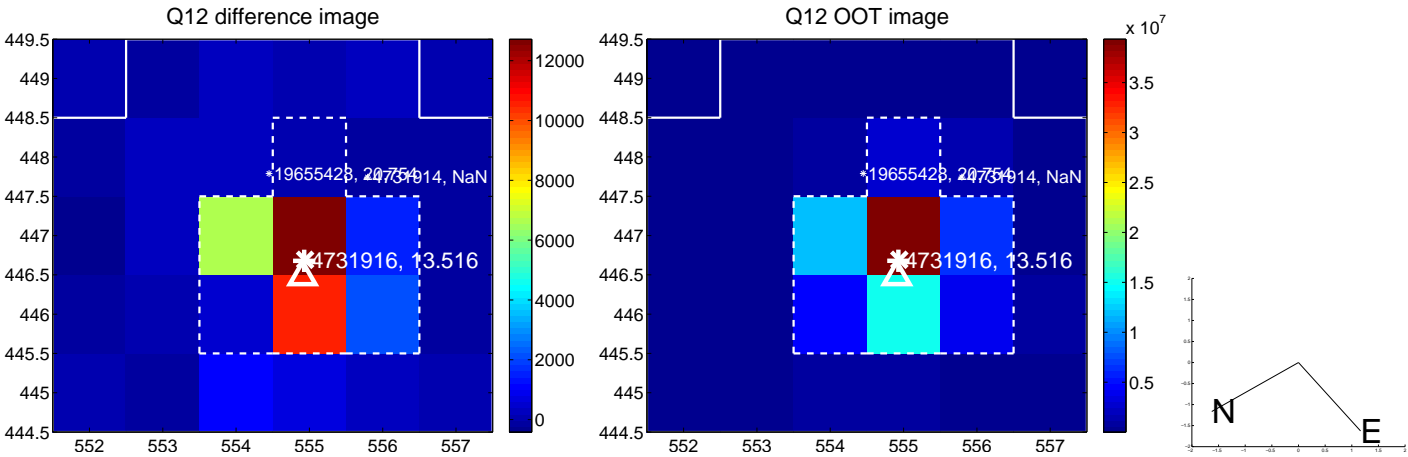
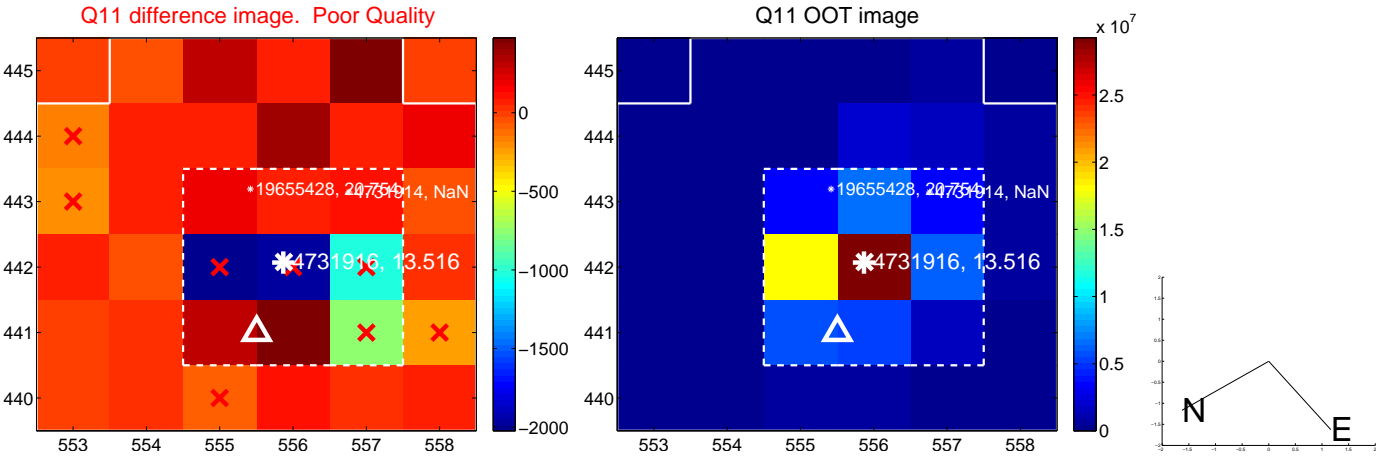
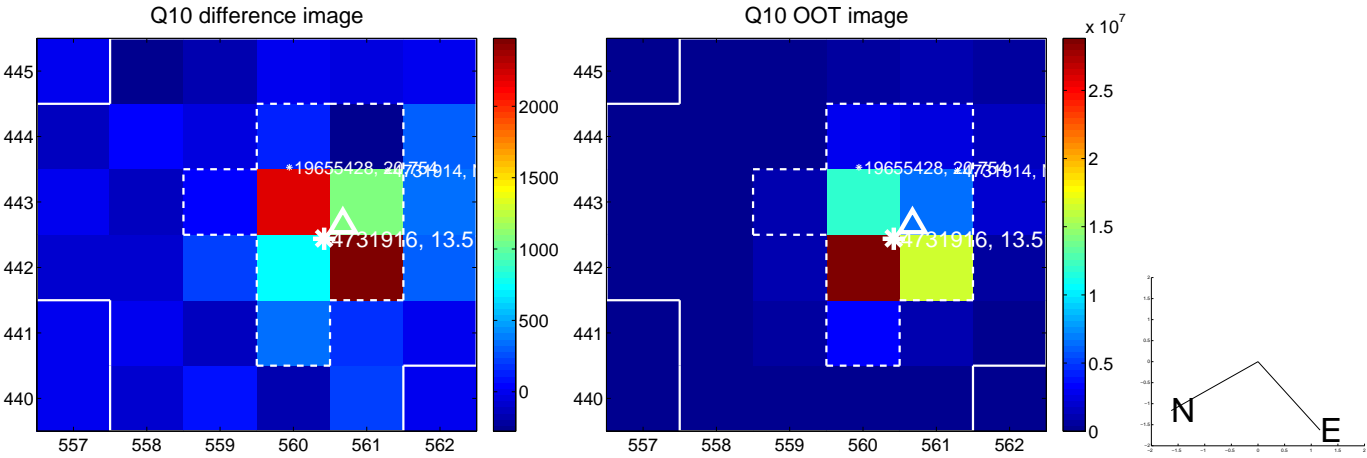
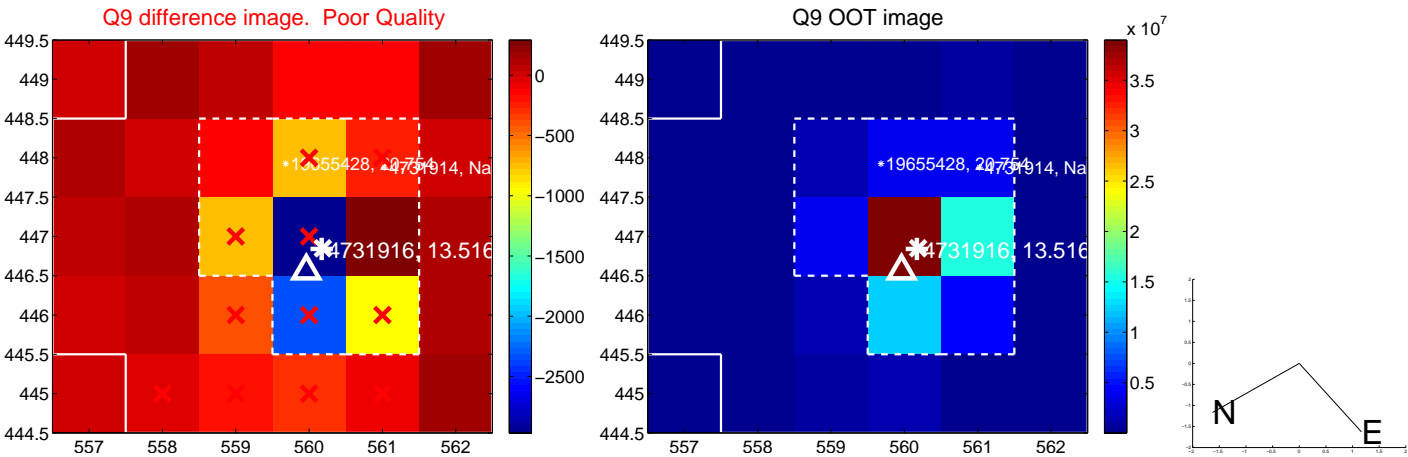
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

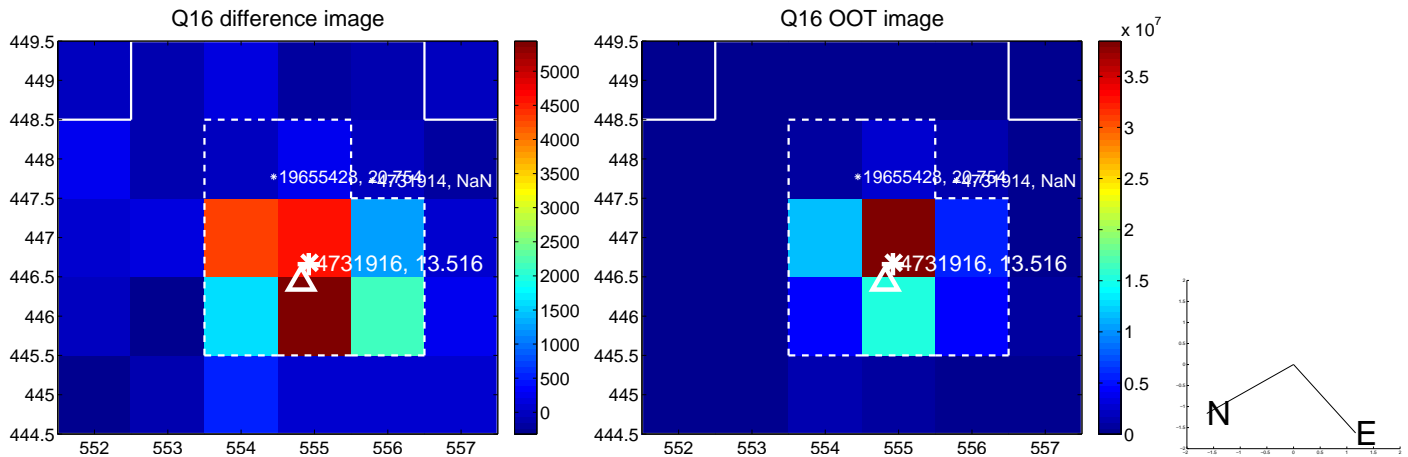
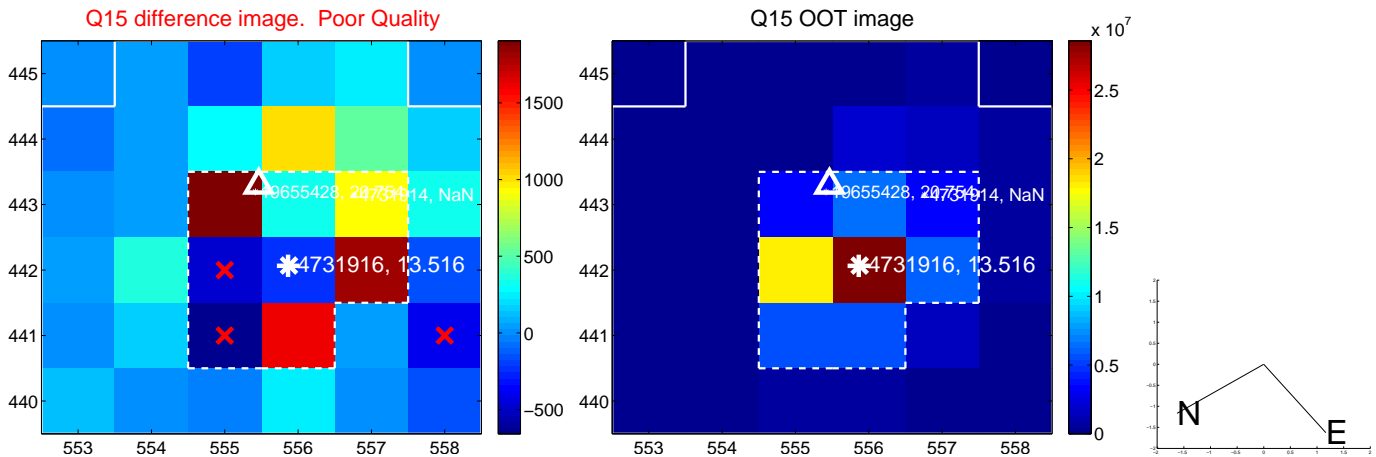
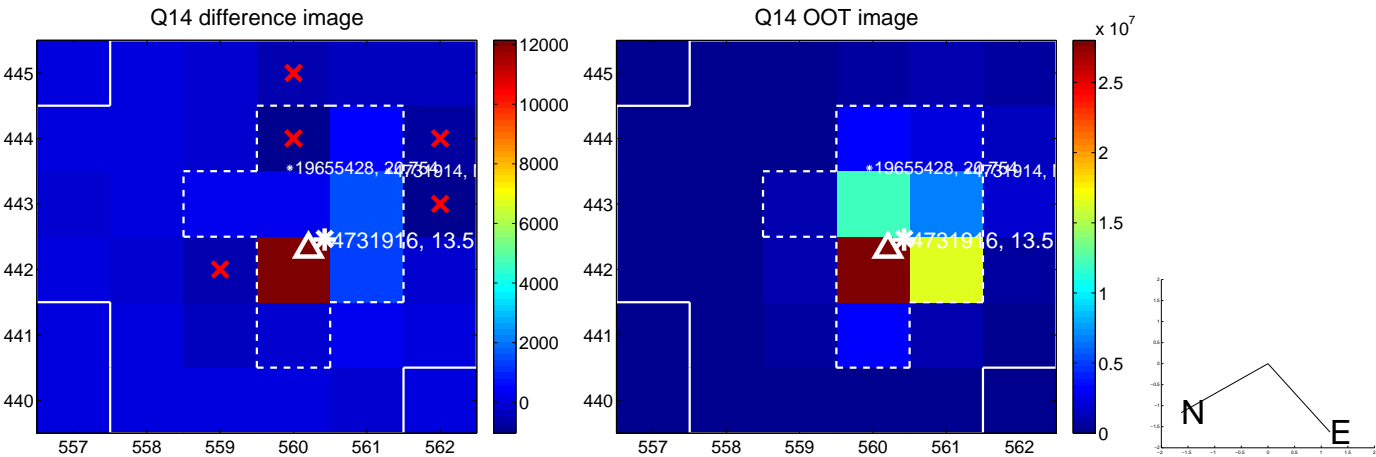
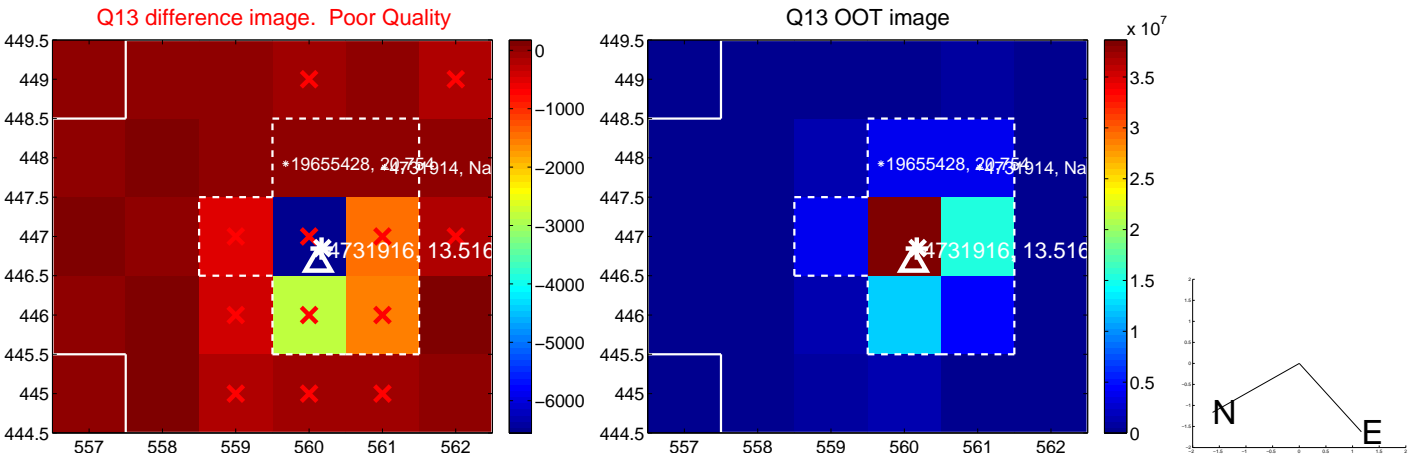


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

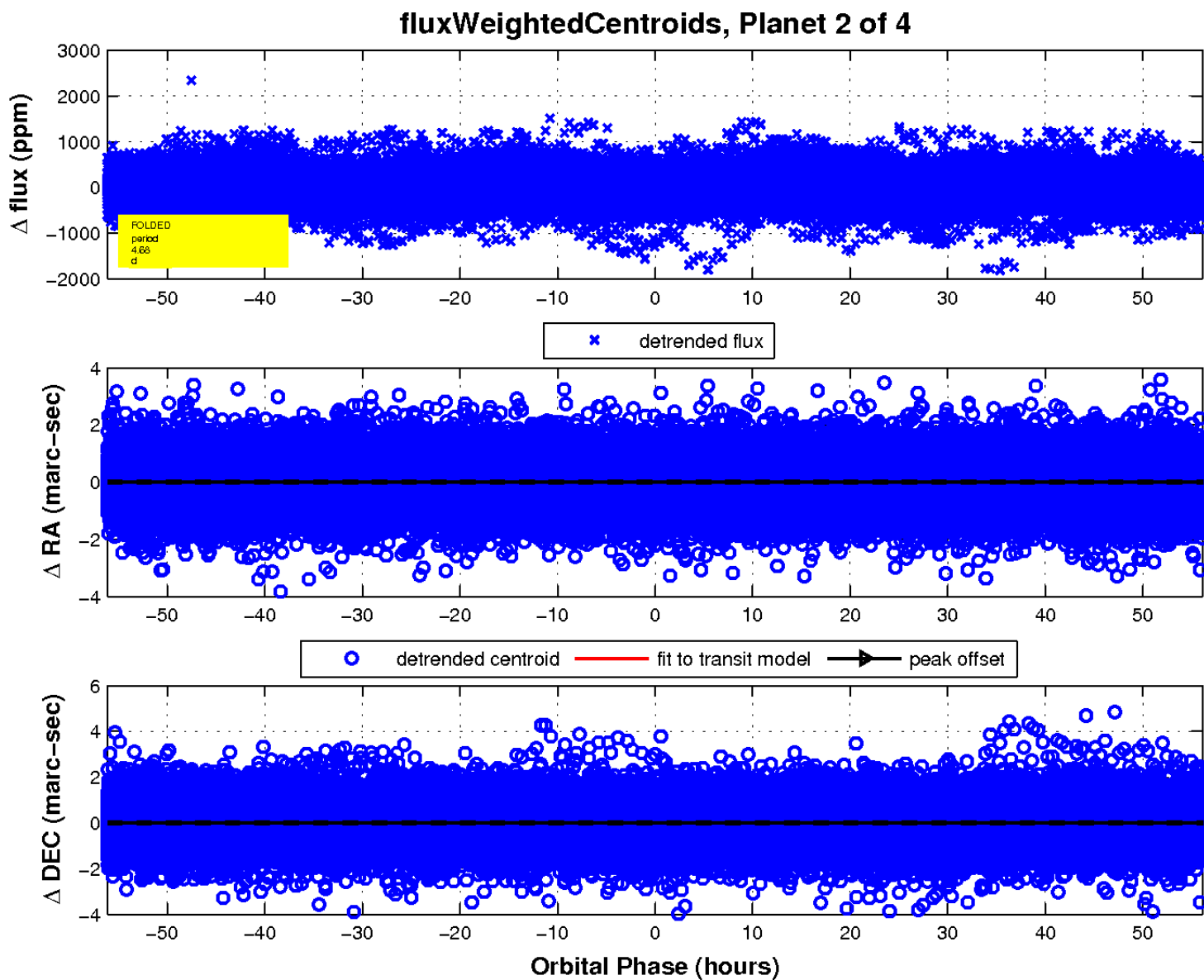
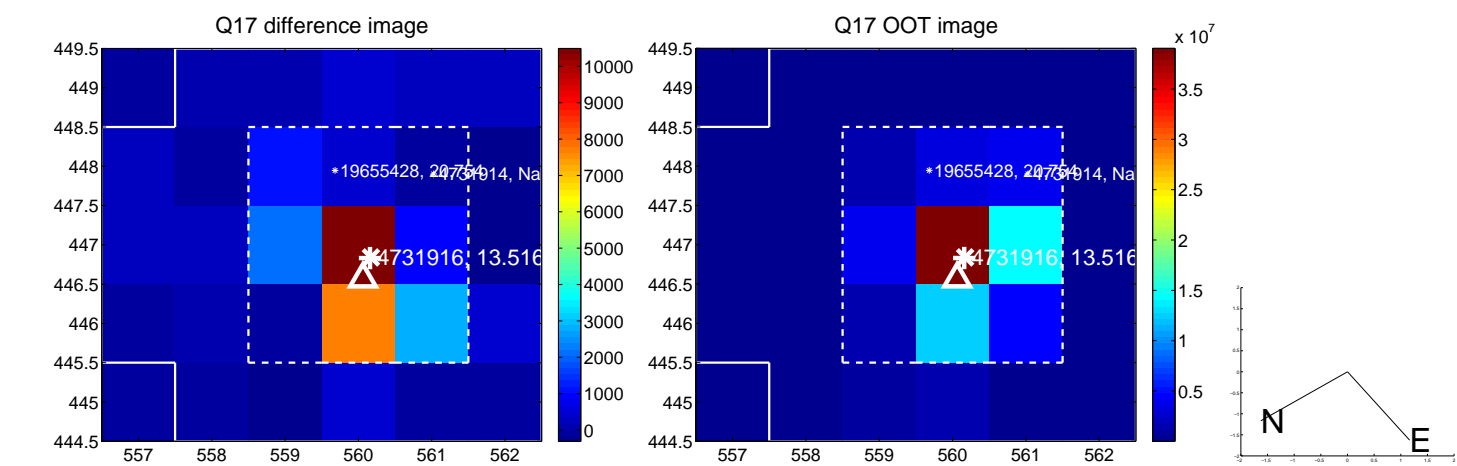




white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

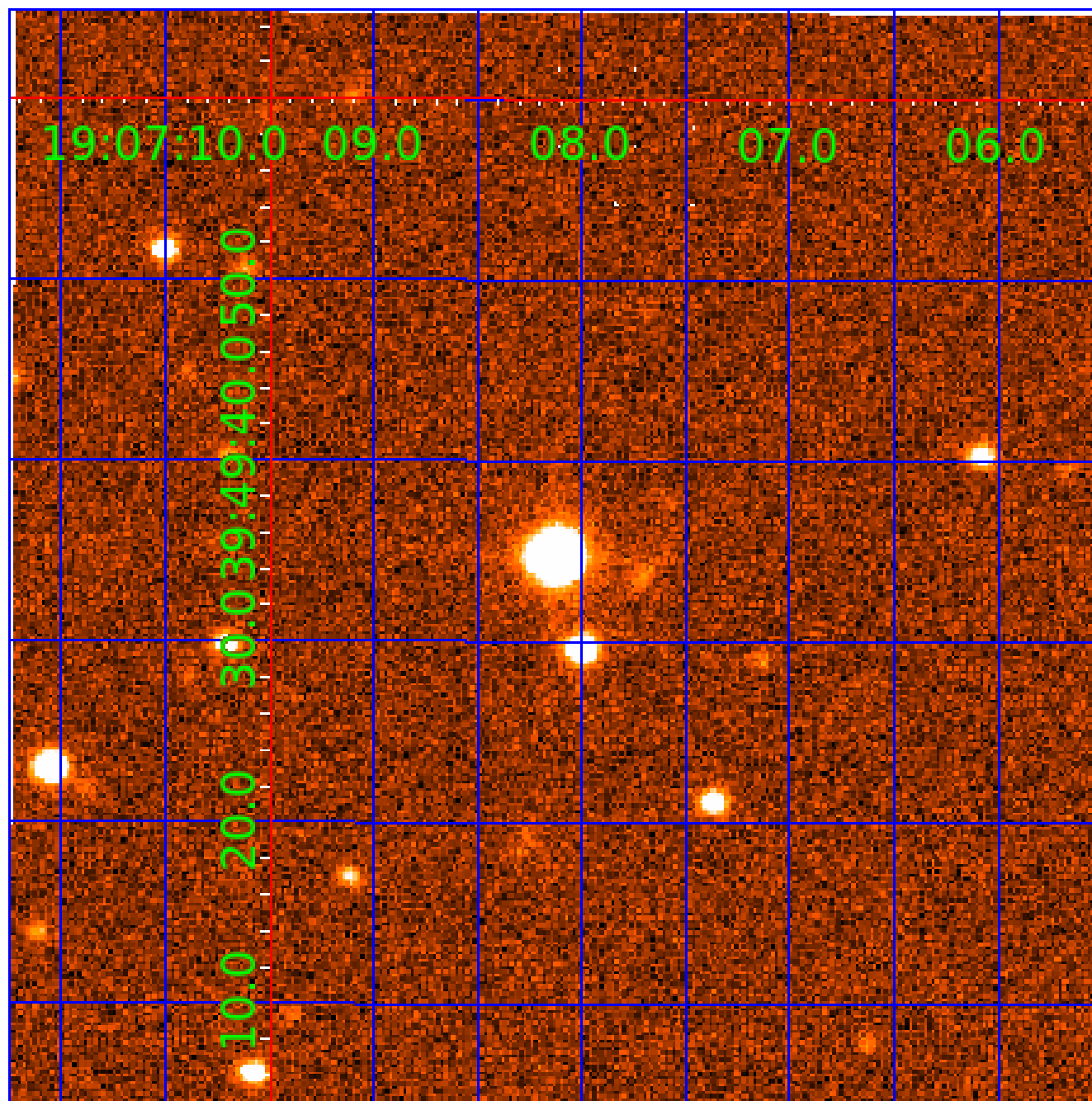


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 004731916

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
004731916-01	OBS	No	2.671070	133.457662	45.7	9.903	11.5	9.5	2.46	6907	1.93	6297.57
004731916-02	OBS	No	4.677951	132.558591	109.1	19.754	8.9	9.6	2.46	6907	4.78	2983.18
004731916-03	OBS	No	245.112584	274.403275	426.8	7.651	7.3	8.4	2.46	6907	6.04	15.21

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
004731916-01	OBS	FP	0.00	1	0	0	0	LPP_DV
004731916-02	OBS	FP	0.00	1	0	0	0	LPP_DV—MOD_NONUNIQ_DV
004731916-03	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE_CHASES—TRANS_GAPPED—LPP_DV—LPP_ALT—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS—HALO_GHOST

**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.

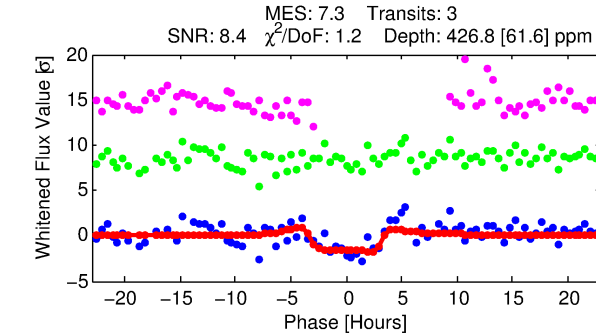
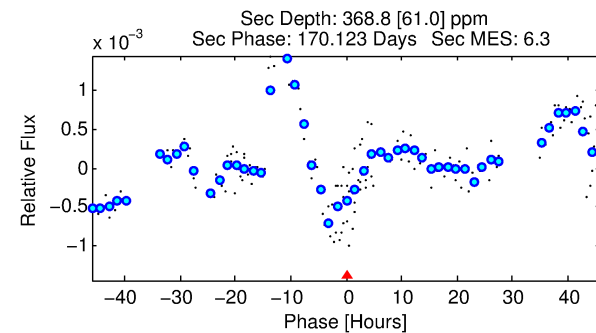
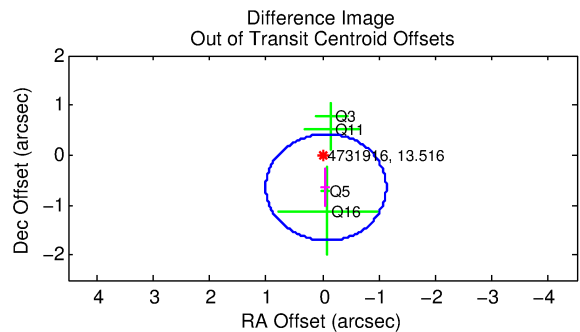
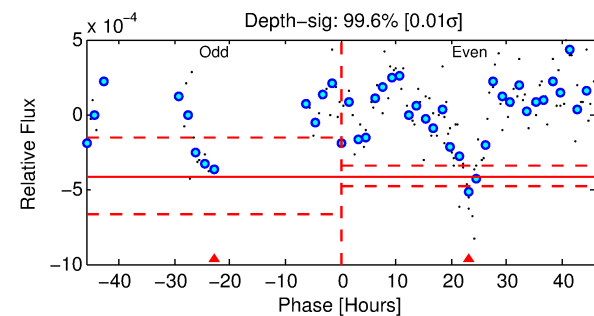
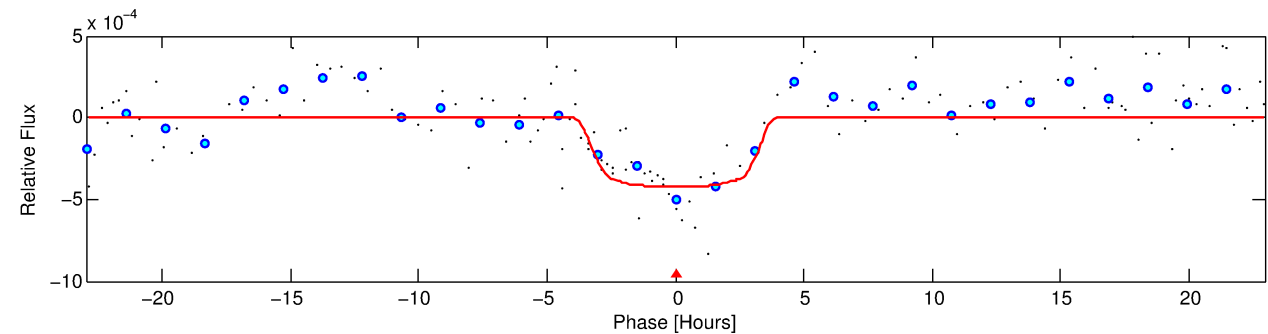
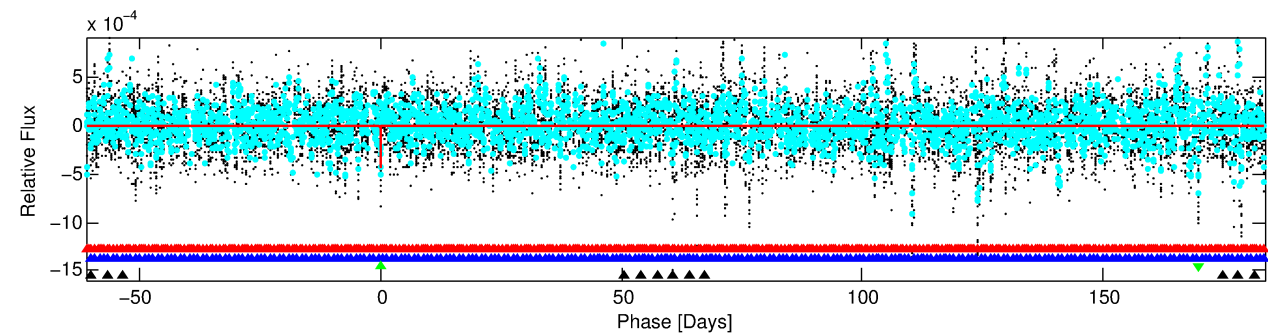
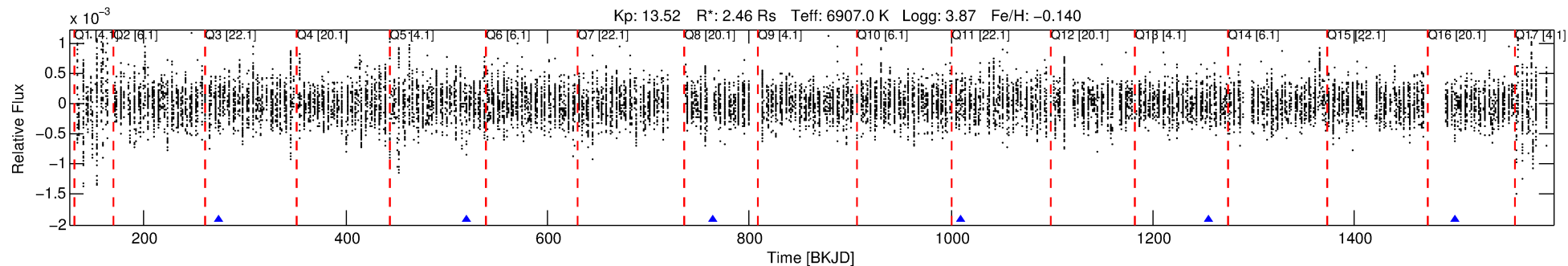
## Ephemeris Match Information For 004731916-03

No Significant Match Found



# DV One-Page Summary

KIC: 4731916 Candidate: 3 of 4 Period: 245.113 d



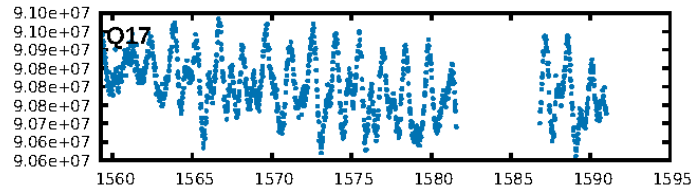
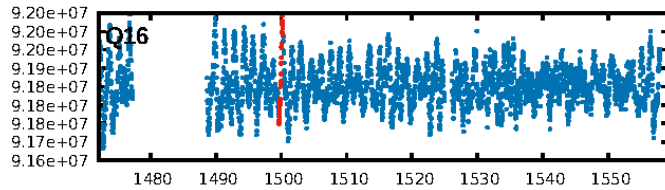
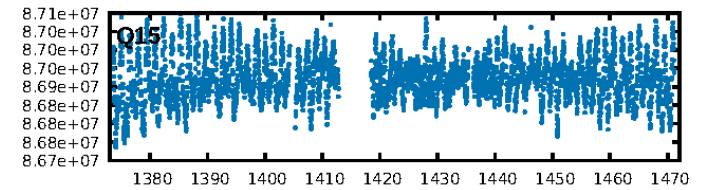
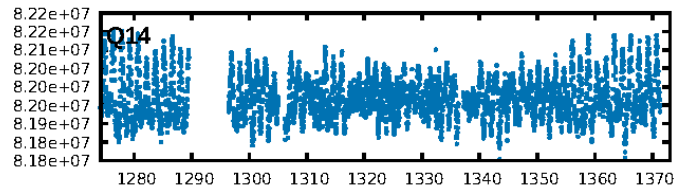
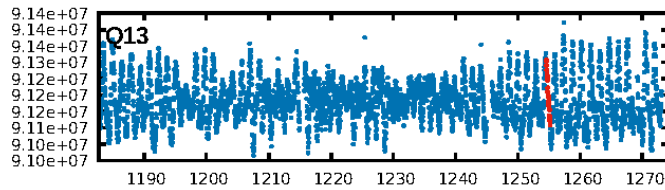
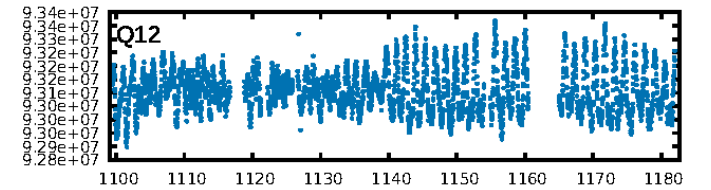
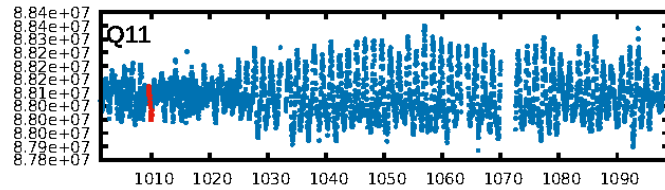
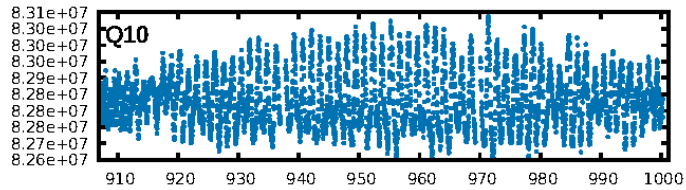
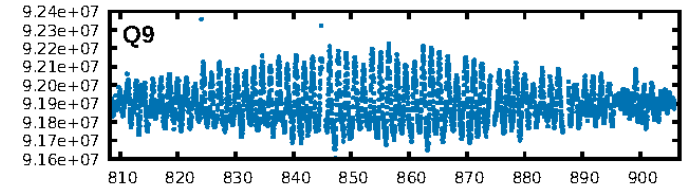
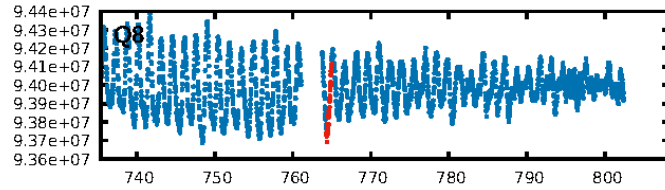
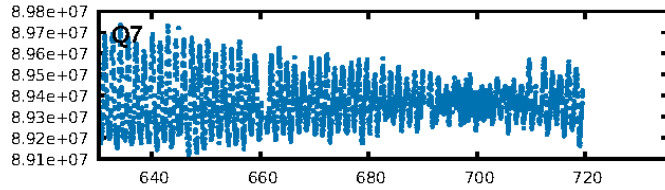
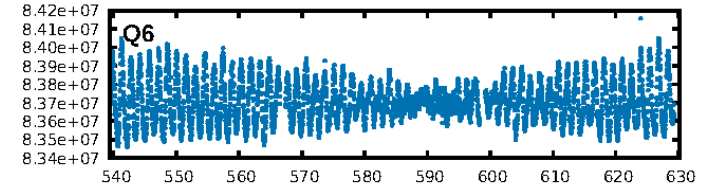
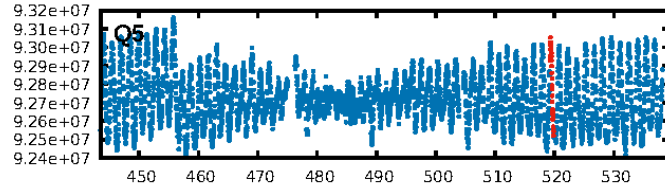
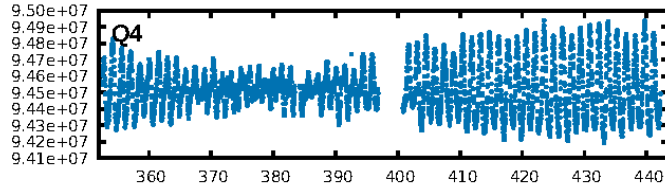
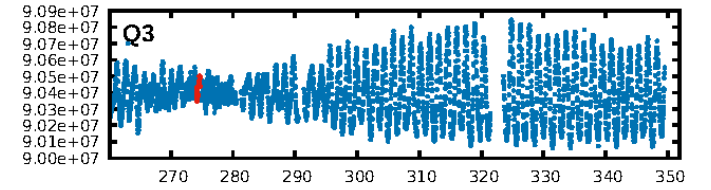
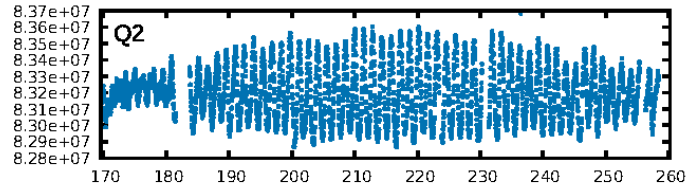
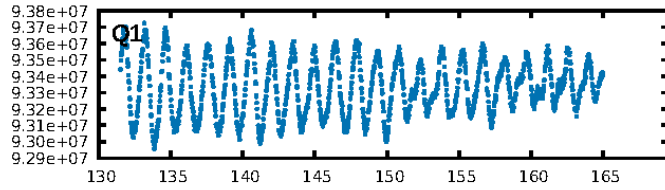
## DV Fit Results:

Period = 245.11258 [0.00406] d  
Epoch = 274.4033 [0.0168] BKJD  
Rp/R\* = 0.0226 [0.0024]  
a/R\* = 105.40 [42.29]  
b = 0.93 [0.06]  
Seff = 15.21 [9.36]  
Teq = 504 [77] K  
Rp = 6.05 [2.61] Re  
a = 0.8988 [0.3452] AU  
Ag = 4484.40 [2929.77] [1.53 $\sigma$ ]  
Teffp = 6372 [489] K [11.84 $\sigma$ ]

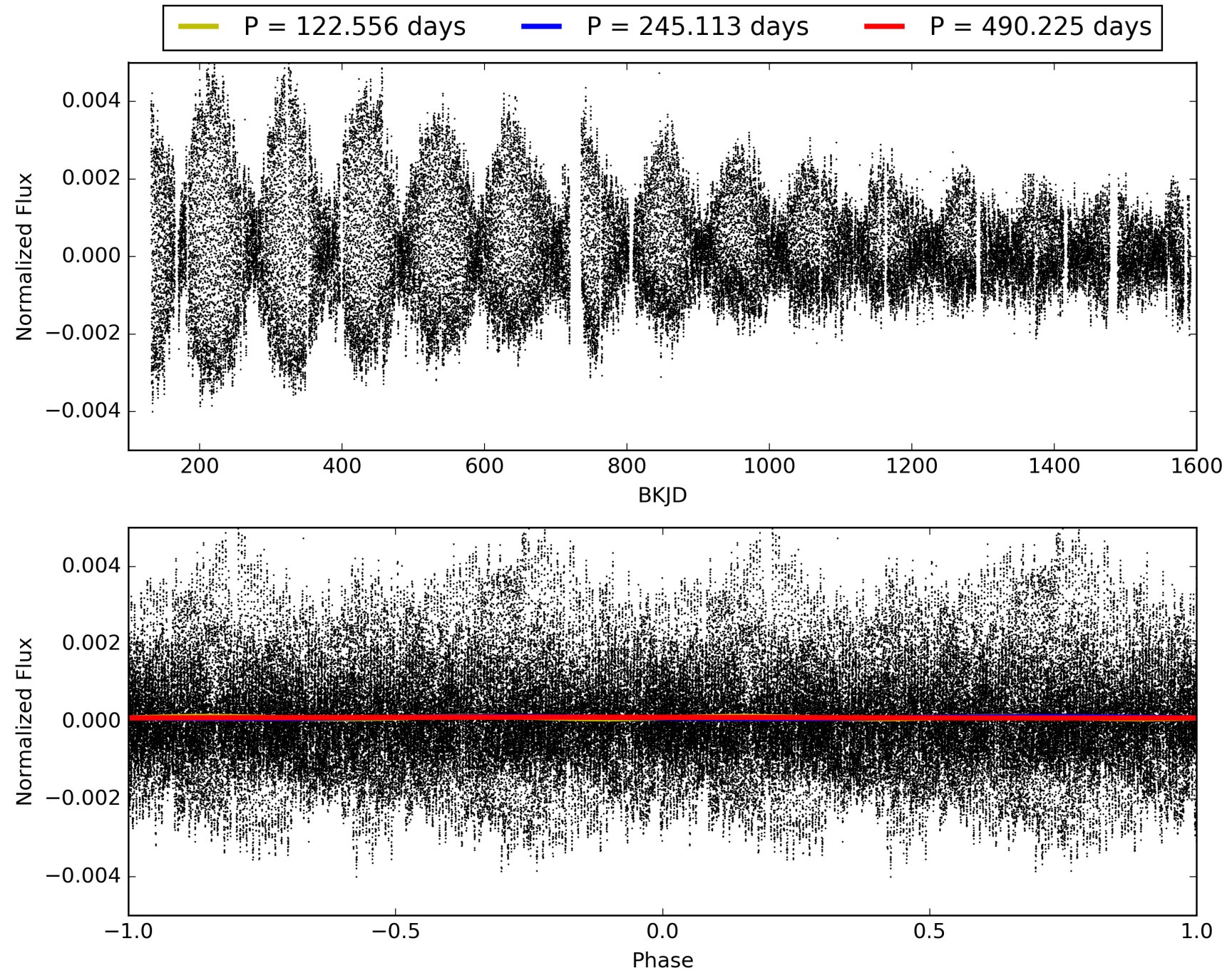
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [48.67 $\sigma$ ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 71.7%  
ModelChiSquareGof-sig: 99.8%  
**Bootstrap-pfa: 5.50e-06**  
RollingBand-fgt: 1.00 [3/3]  
**GhostDiagnostic-chr: -0.2045**  
Centroid-sig: 2.5%  
Centroid-so: 1.093 arcsec [1.62 $\sigma$ ]  
OotOffset-rm: 0.648 arcsec [1.82 $\sigma$ ]  
KicOffset-rm: 0.597 arcsec [1.27 $\sigma$ ]  
OotOffset-st: 0/2/1/1 [4]  
KicOffset-st: 0/2/1/1 [4]  
DiffImageQuality-fgm: 0.50 [2/4]  
DiffImageOverlap-fno: 0.40 [2/5]

# TCE 004731916-03, PDC Light Curves

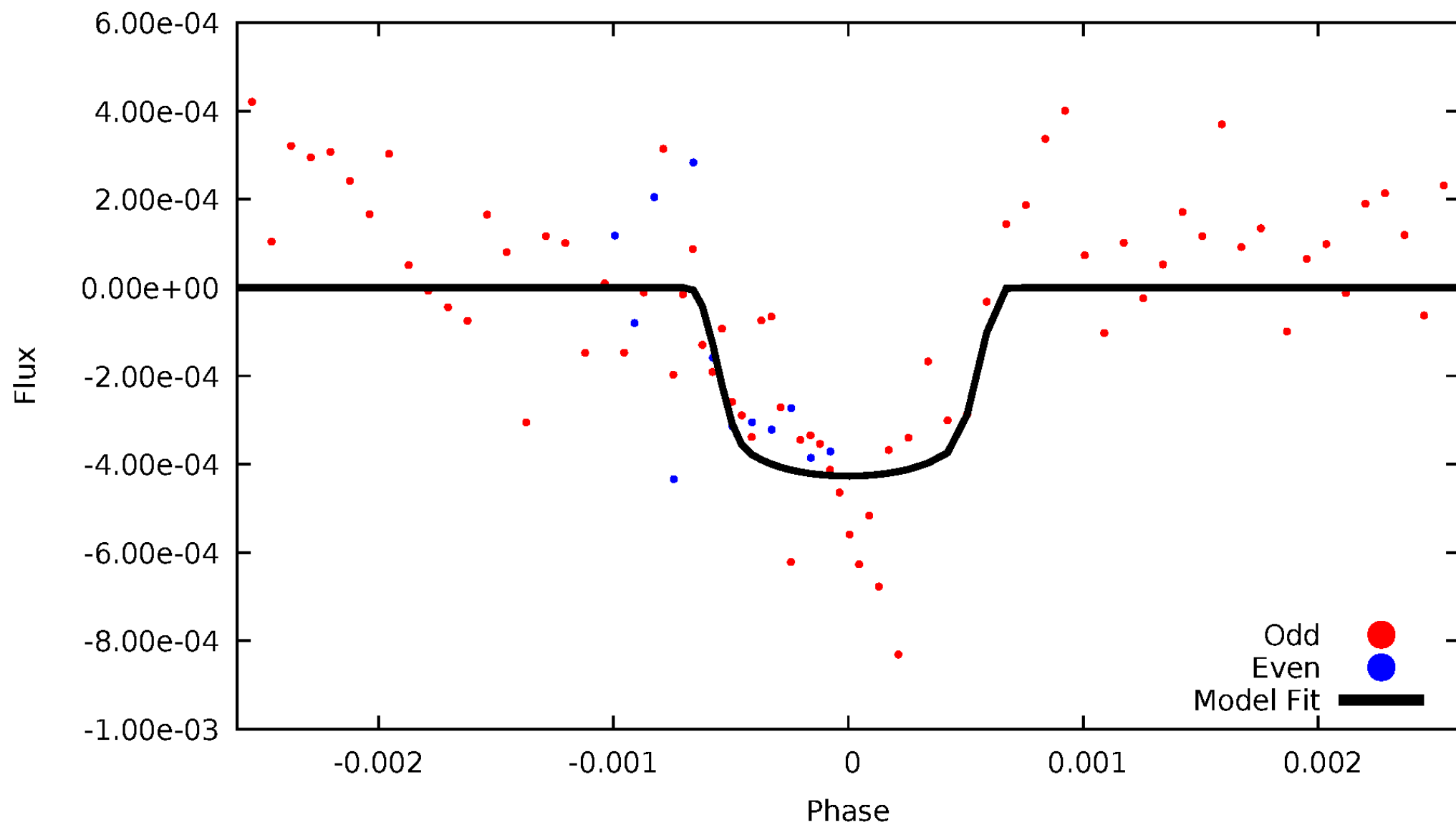


TCE 004731916-03



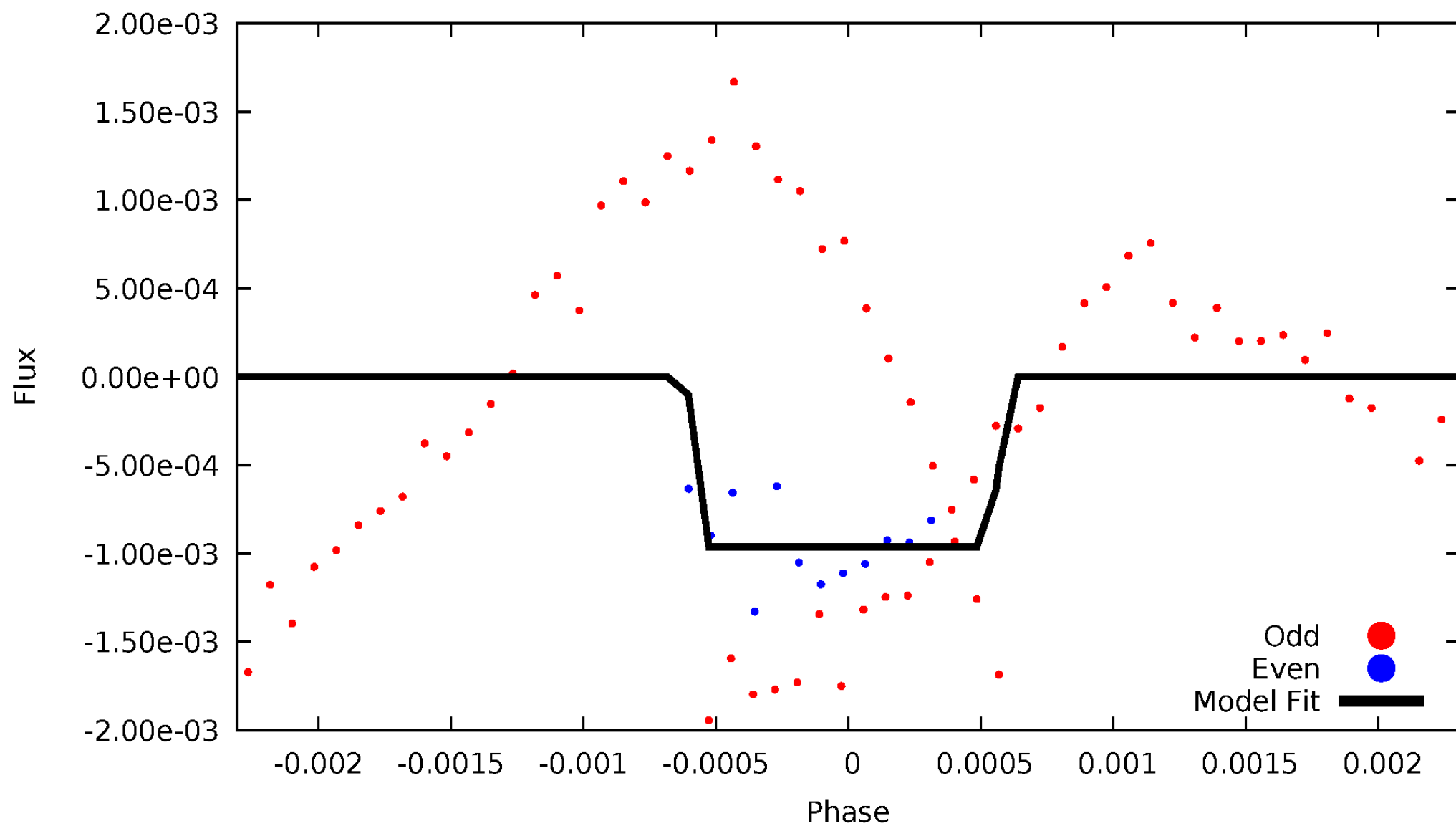
# DV Odd/Even

TCE 004731916-03



# ALT Odd/Even

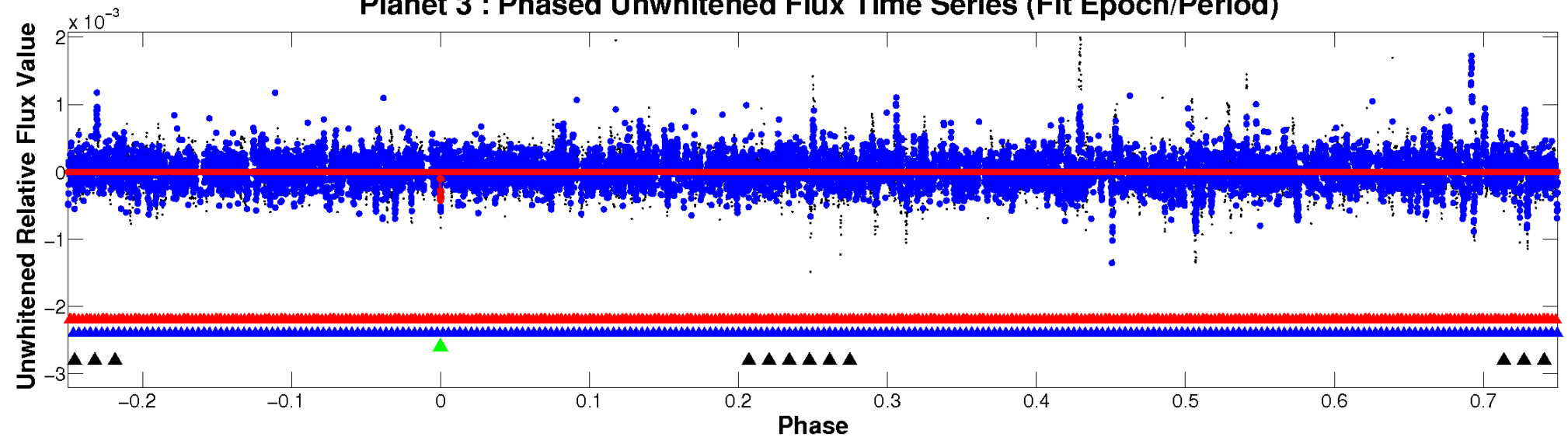
TCE 004731916-03



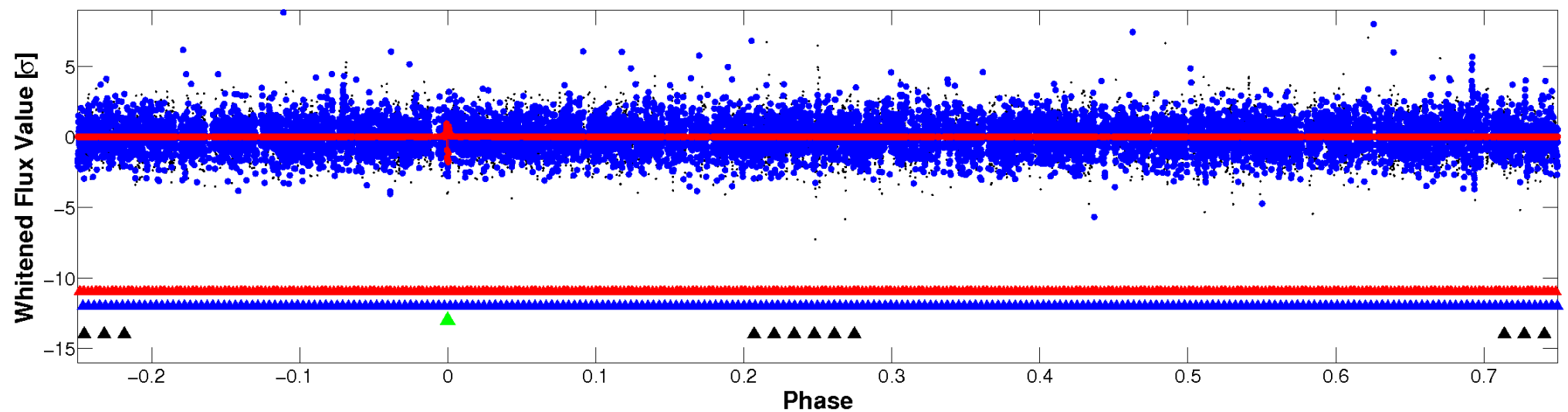


# Non-Whitened Vs. Whitened Light Curve

Planet 3 : Phased Unwhitened Flux Time Series (Fit Epoch/Period)

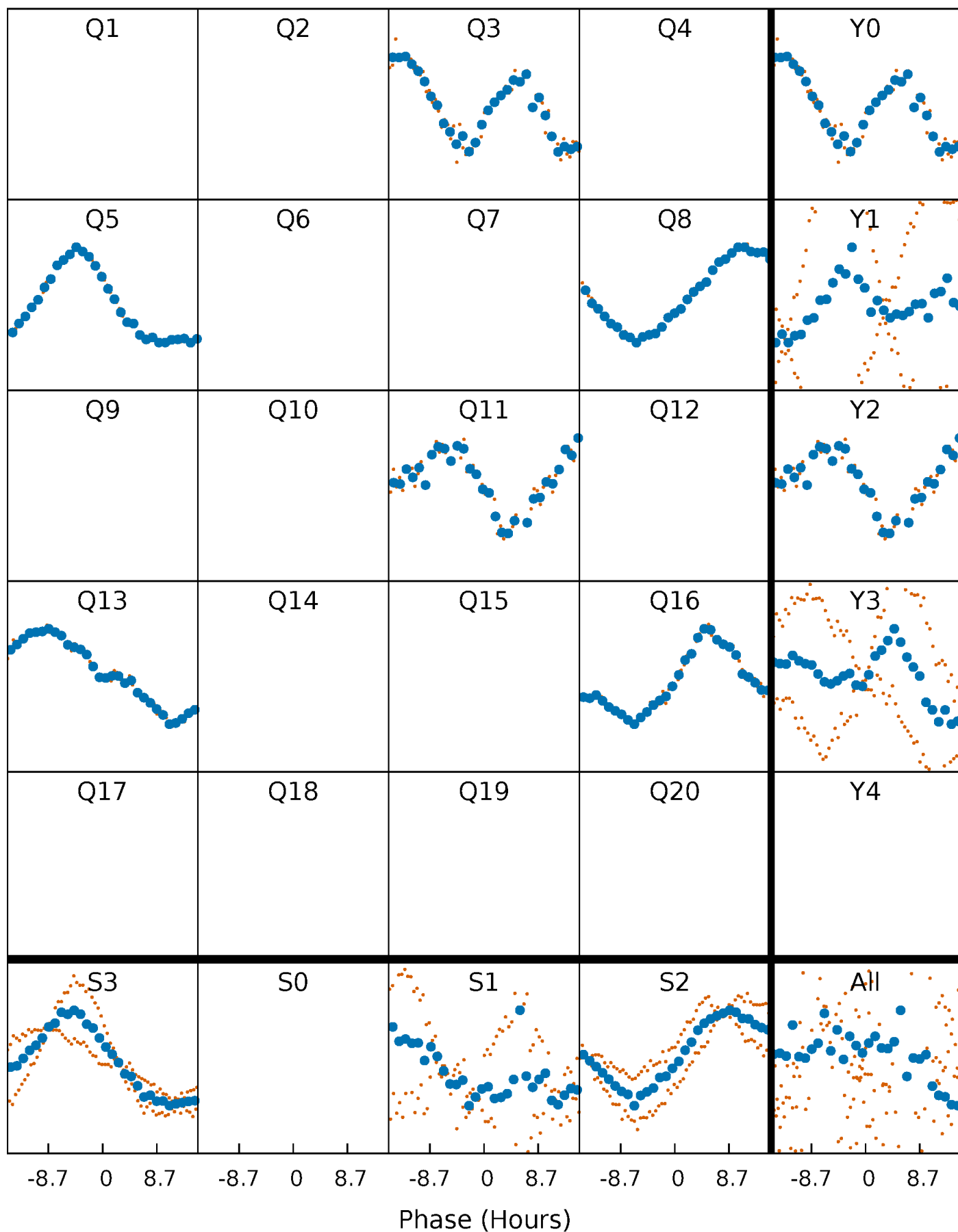


Planet 3 : Phased Whitened Flux Time Series (Fit Epoch/Period)



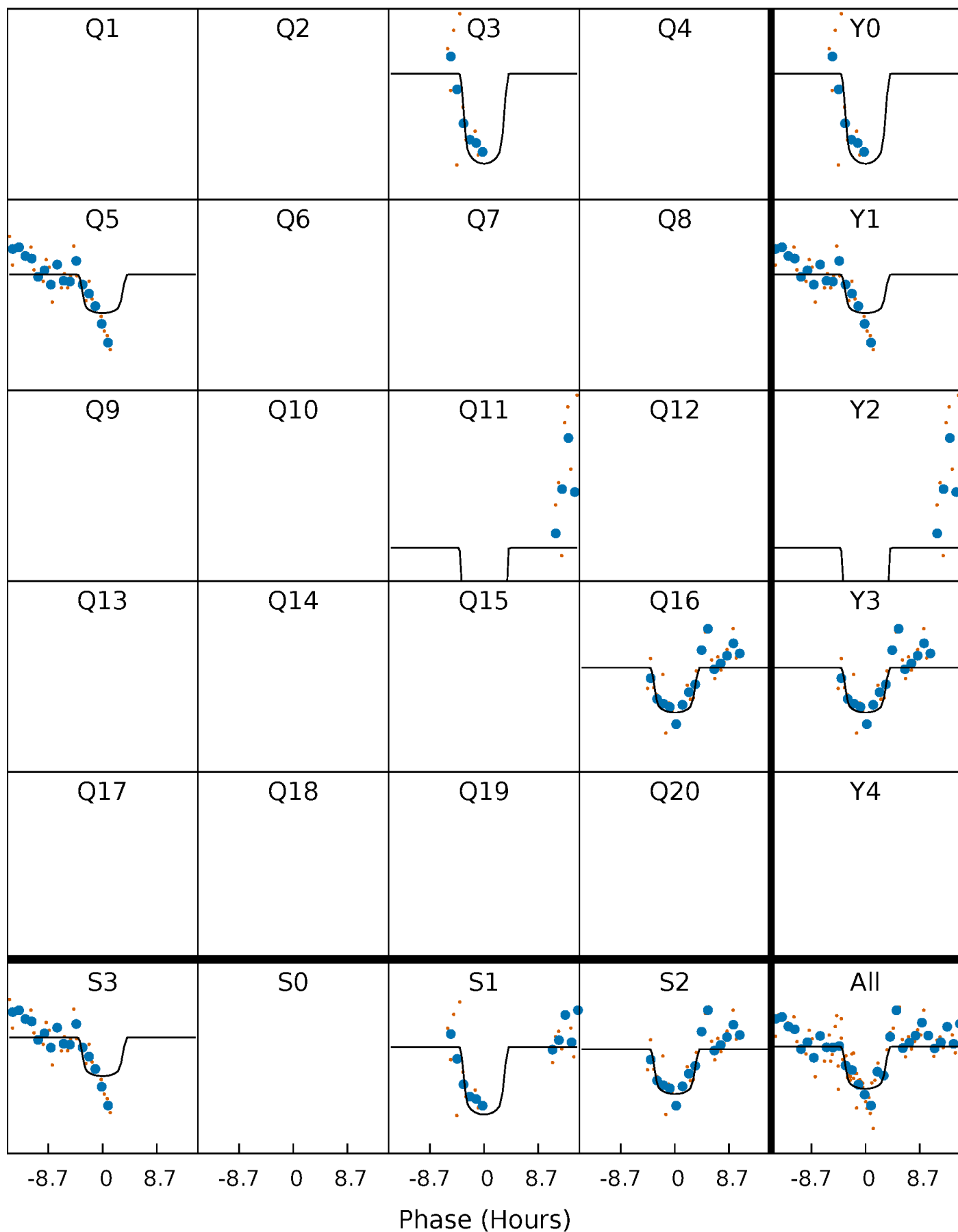
# PDC Quarter-Phased Transit Curves

TCE 004731916-03   P=245.112583 Days    $T_0=274.403275$  (BKJD)



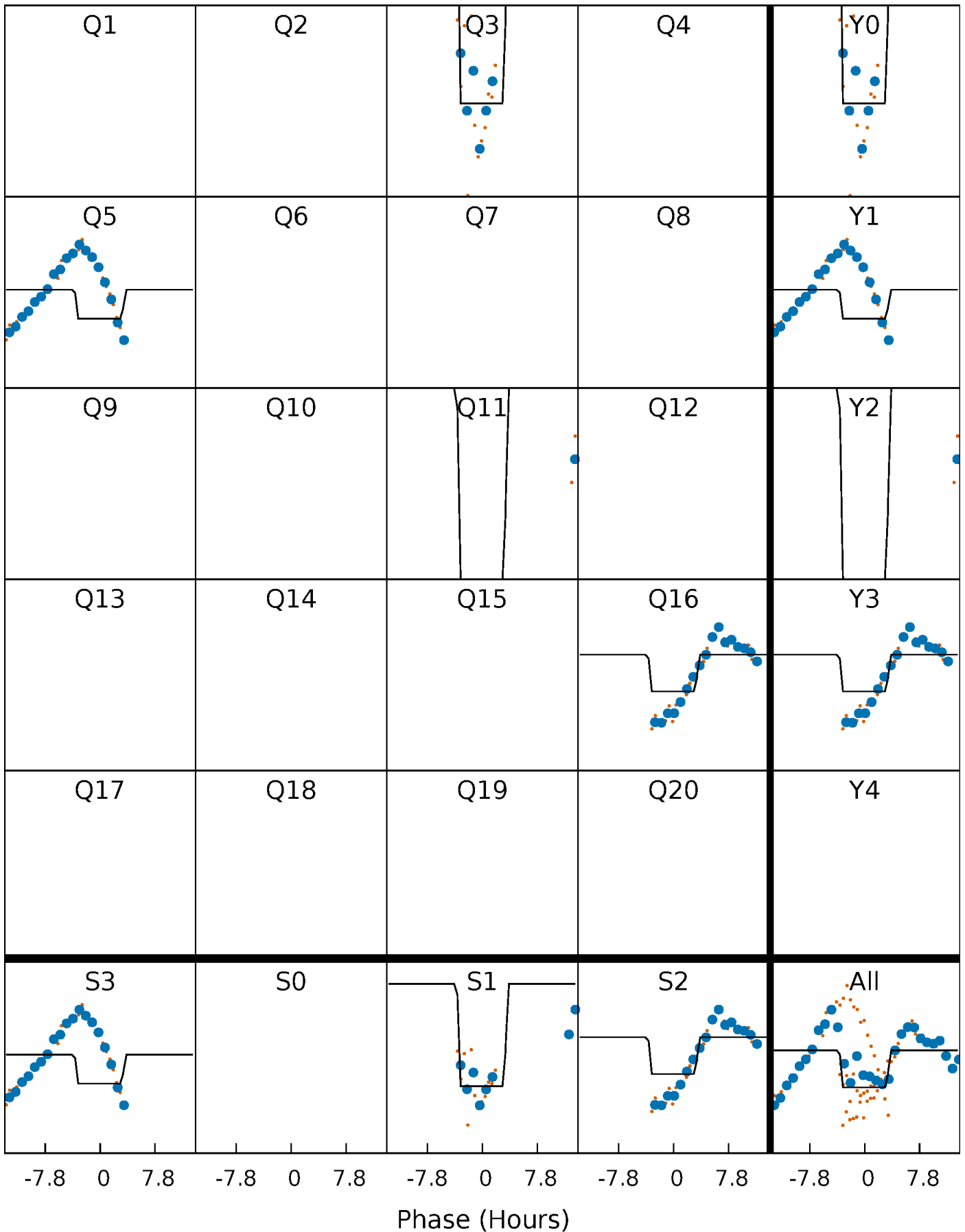
# DV Quarter-Phased Transit Curves

TCE 004731916-03     $P=245.112583$  Days     $T_0=274.403275$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

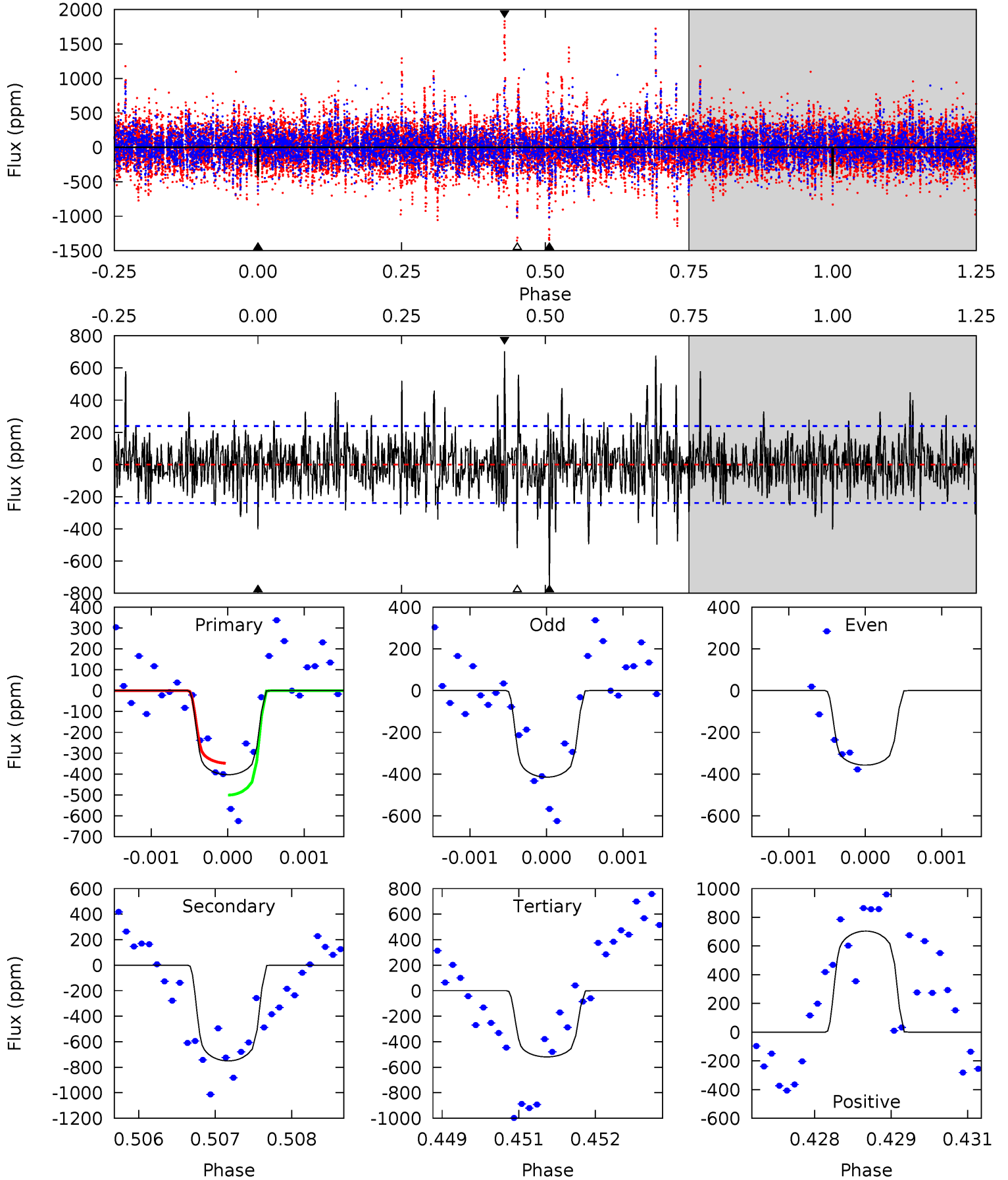
TCE 004731916-03 P=245.120986 Days  $T_0=274.307729$  (BKJD)



# DV Model-Shift Uniqueness Test

004731916-03, P = 245.112583 Days, E = 29.290692 Days

Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
9.12	17.0	11.7	15.9	5.40	3.21	3.10	-2.62	-6.80	5.23	1.04	0.58	1.03	0.48	1.63

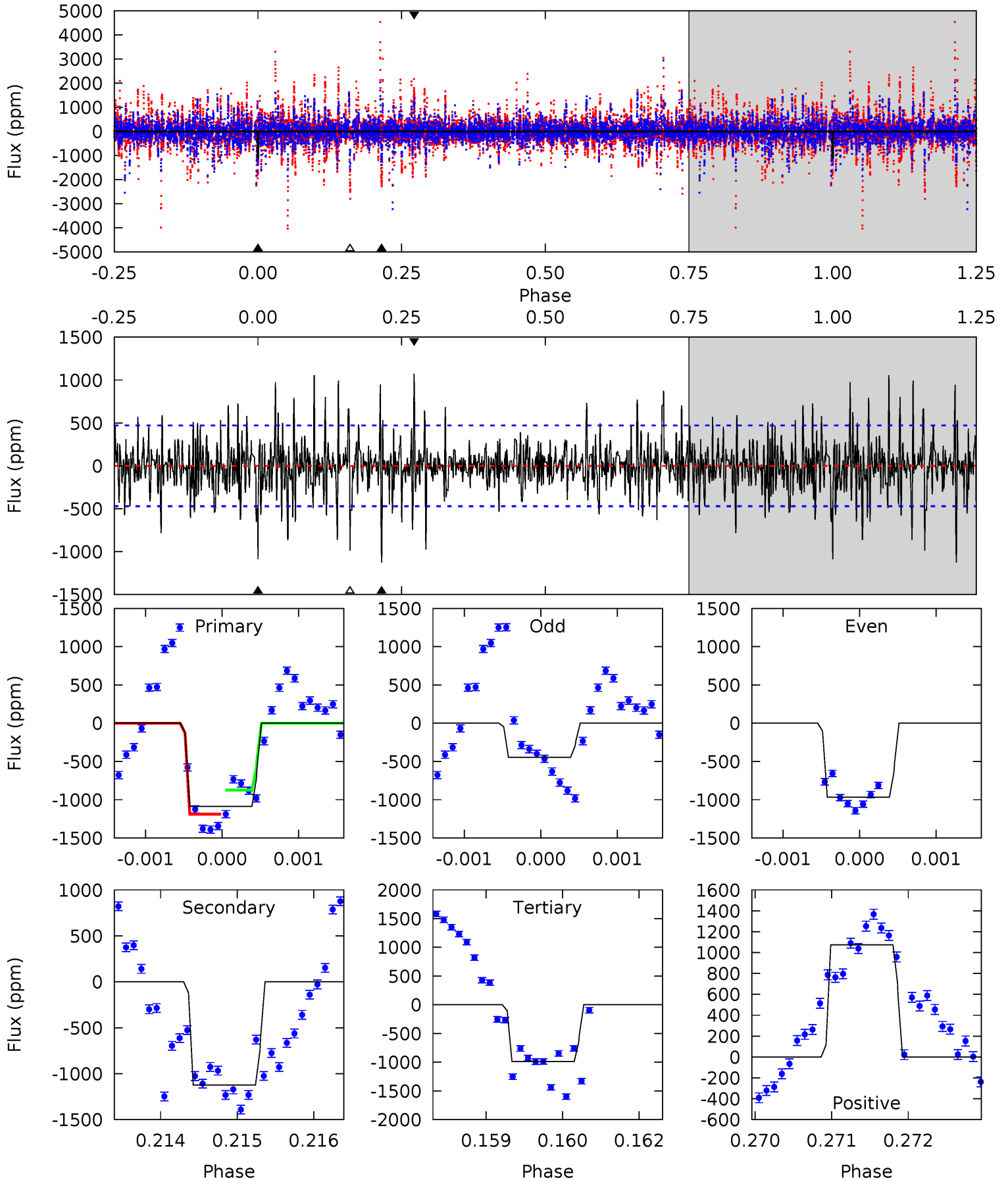




# Alt Model-Shift Uniqueness Test

004731916-03, P = 245.120986 Days, E = 29.186743 Days

Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
12.5	12.9	11.3	12.3	5.41	3.23	2.70	1.16	0.16	1.57	0.57	2.66	0.68	0.49	1.87



### Stellar Parameters For KIC 004731916

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$\rho_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6907^{+190}_{-262}$	$3.865^{+0.343}_{-0.147}$	$-0.140^{+0.250}_{-0.300}$	$2.455^{+0.555}_{-1.030}$	$1.609^{+0.210}_{-0.390}$	$0.153^{+0.422}_{-0.067}$
	+3%/-4%	+9%/-4%	+179%/-214%	+23%/-42%	+13%/-24%	+275%/-44%
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 004731916-03 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-750 \pm 44$	$5.77^{+1.25}_{-1.28}$	$691^{+52}_{-75}$	$7666^{+619}_{-515}$	$9945^{+5496}_{-3033}$
Alt.	$-1124 \pm 87$	$8.14^{+1.32}_{-1.80}$	$691^{+50}_{-74}$	$7159^{+455}_{-403}$	$7666^{+4286}_{-2075}$

$T_{max}$  = 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

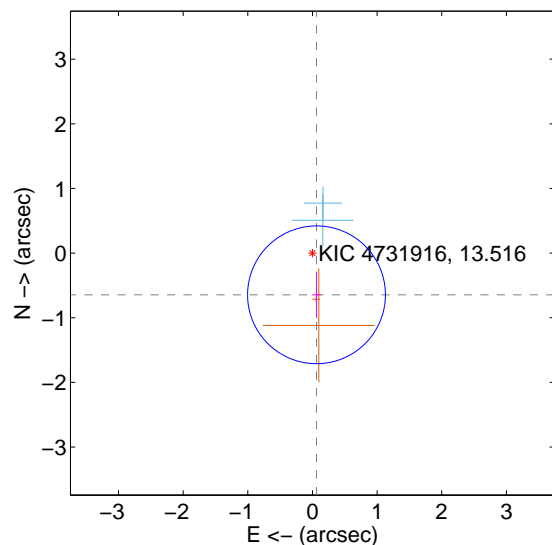
Supplemental centroid analysis for 004731916-03. Kepler magnitude: 13.52. Transit SNR 8.45

There are 2 quarters with good PRF difference image offsets

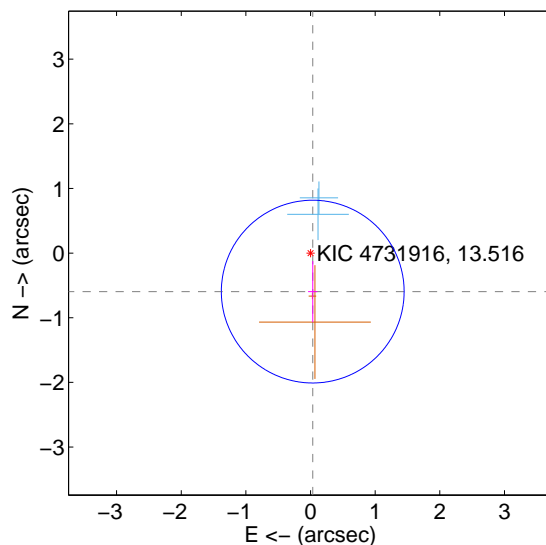
The direct PRF centroid is offset from the target star catalog position by about 0.06 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.648 \pm 0.355$	1.82	$-0.063 \pm 0.069$	$-0.645 \pm 0.358$
PRF-fit source offset from KIC position	$0.597 \pm 0.471$	1.27	$-0.034 \pm 0.072$	$-0.596 \pm 0.473$
photometric centroid source offset	$1.09 \pm 0.68$	1.62	$-0.15 \pm 0.61$	$-1.08 \pm 0.68$

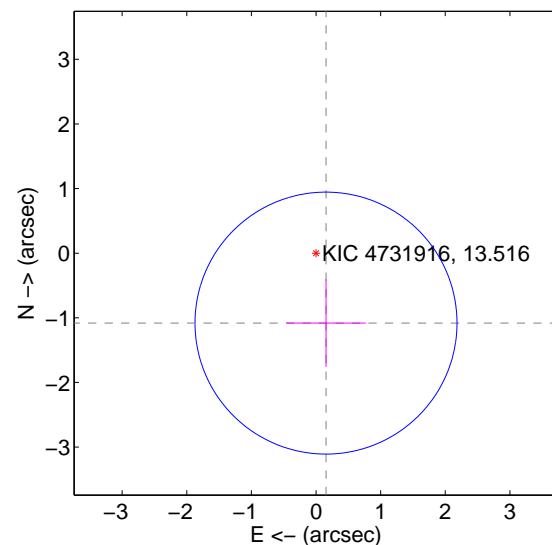
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

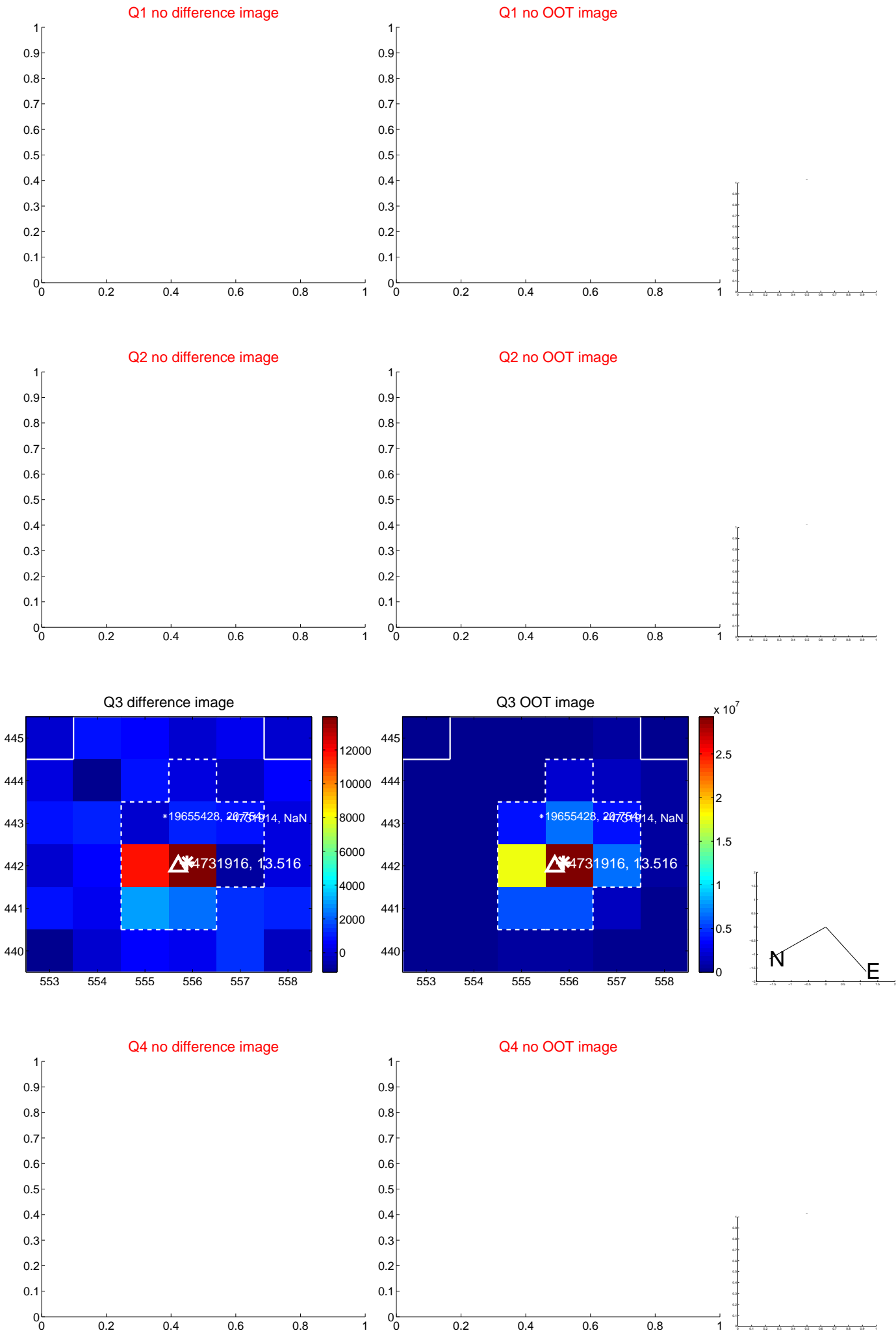


offset from photometric centroids

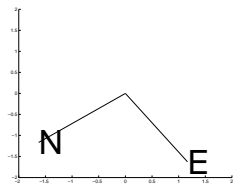
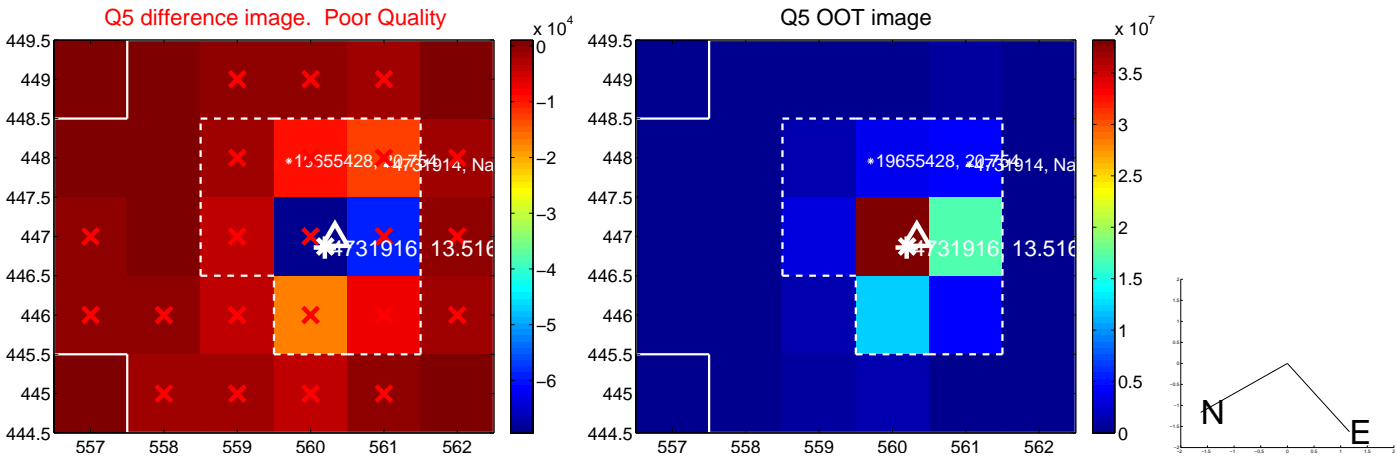


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

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

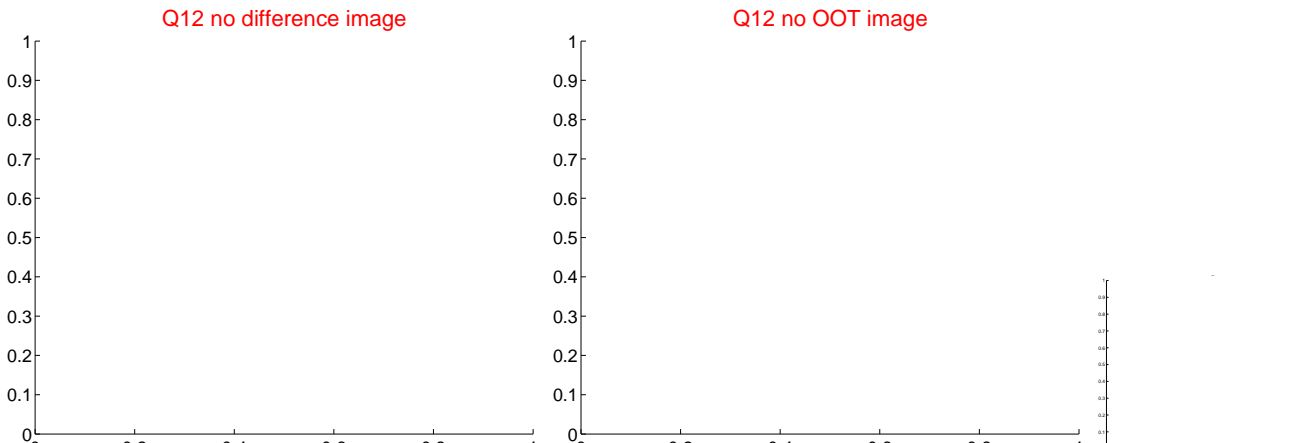
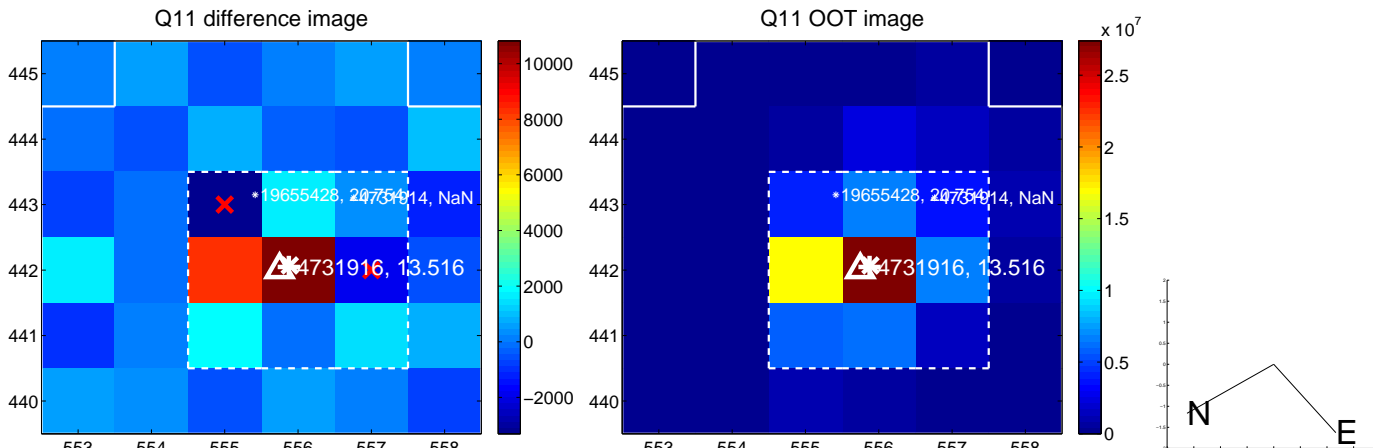
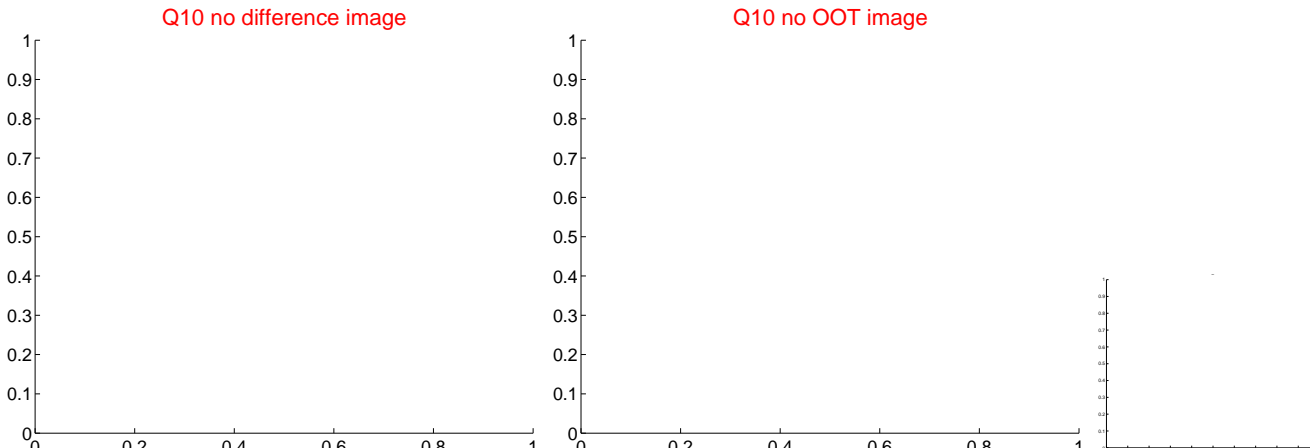
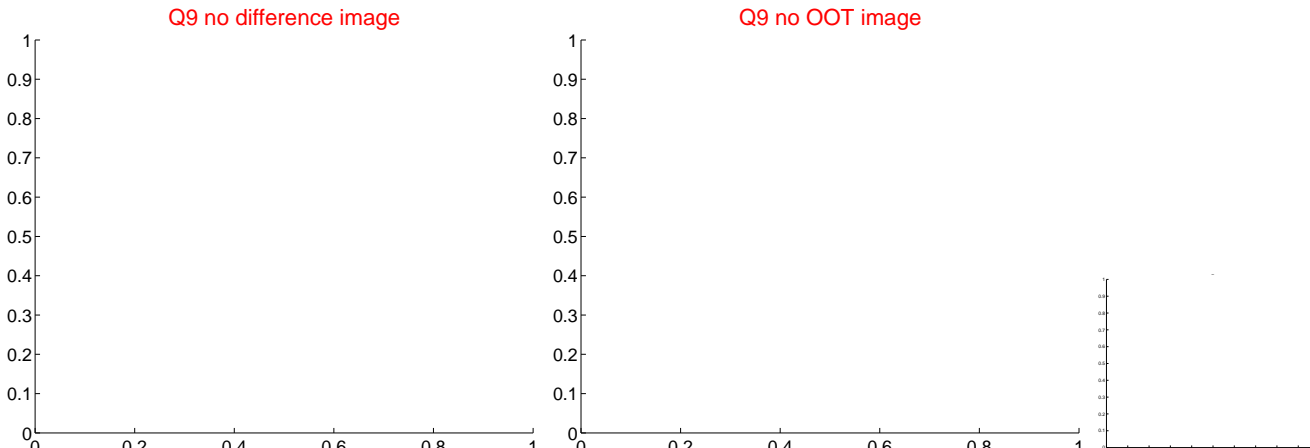


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

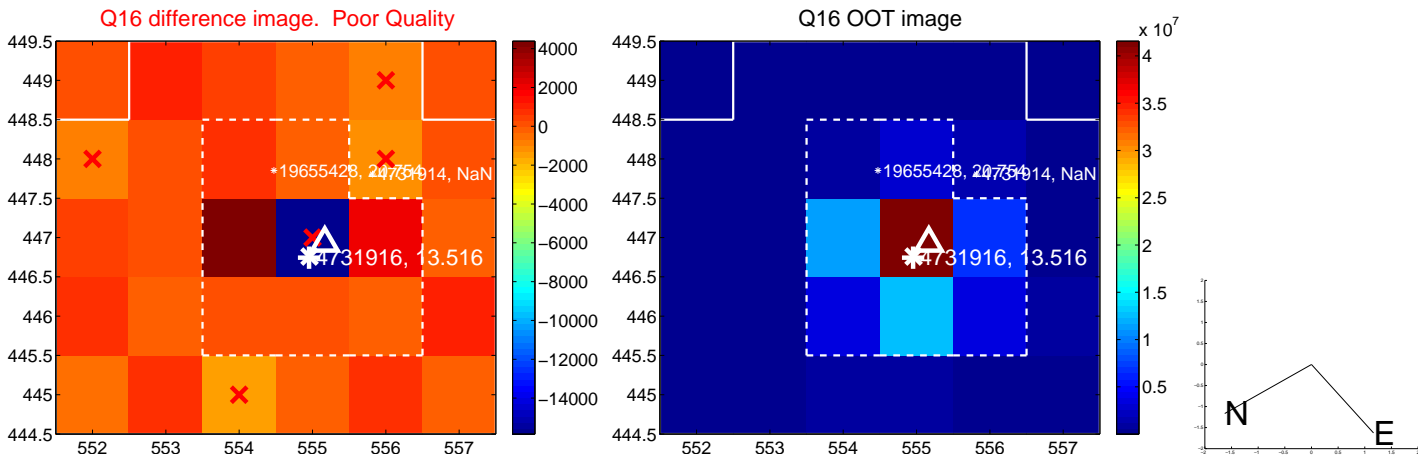
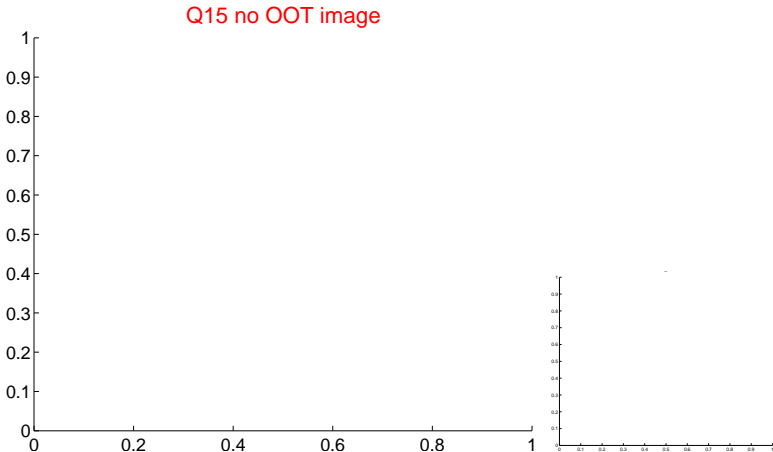
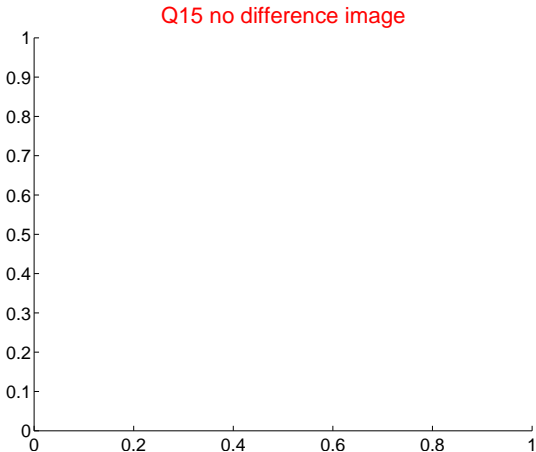
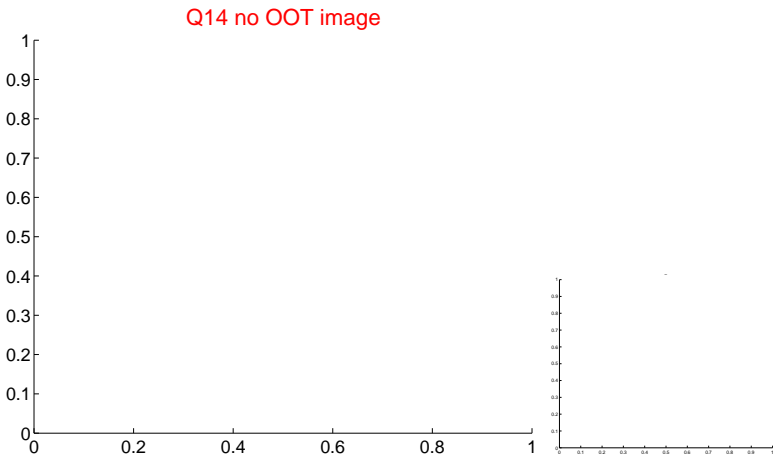
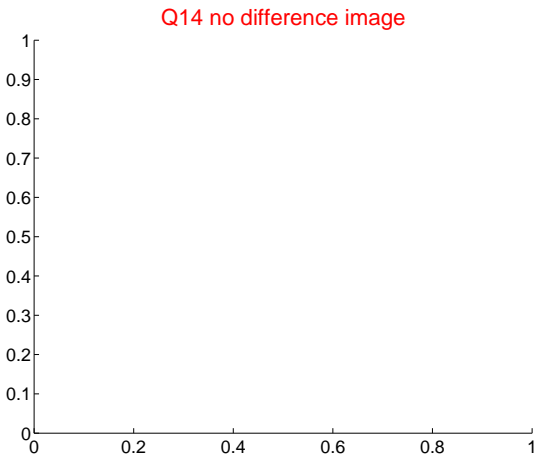
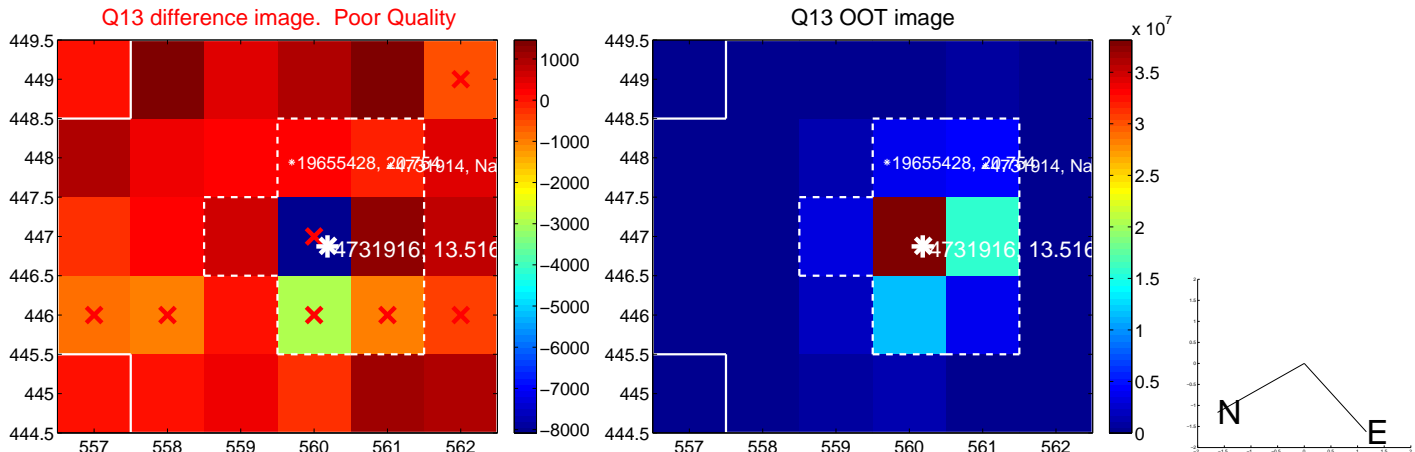




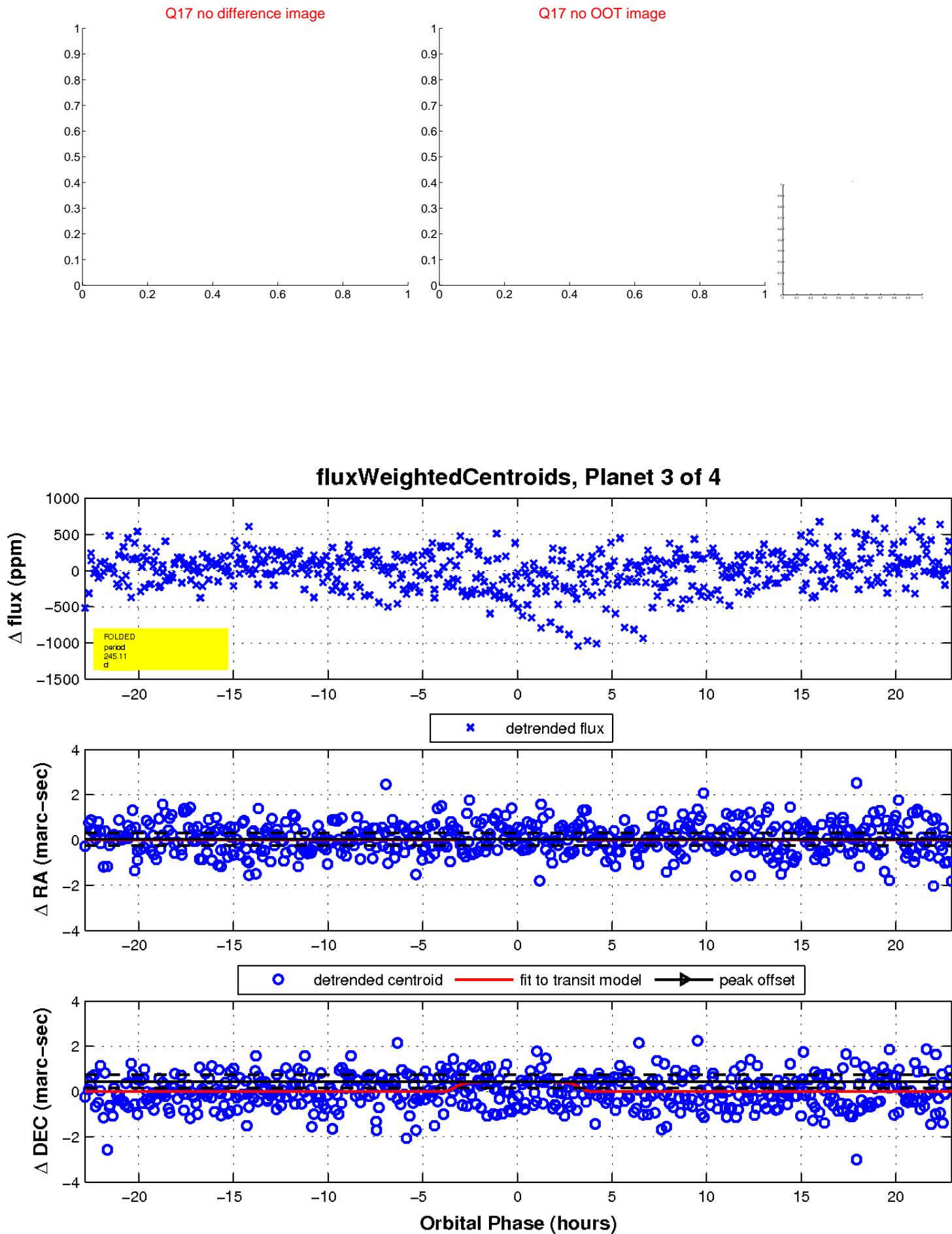
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value



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



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



UKIRT Image

Declination

