

# KIC 006222381

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
006222381-01	OBS	No	541.544603	239.917367	120.7	19.867	15.0	14.9	3.09	8283	4.41	14.95
006222381-02	OBS	No	0.813598	131.969034	2.1	8.581	8.9	4.5	3.09	8283	0.45	86910.24

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
006222381-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT—INCONSISTENT_TRANS—CENT_SATURATED
006222381-02	OBS	FP	0.00	1	0	0	0	SWEET_NTL—LPP_DV—LPP_ALT—CENT_SATURATED

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

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

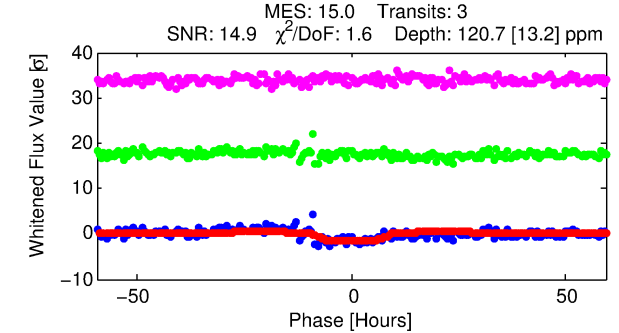
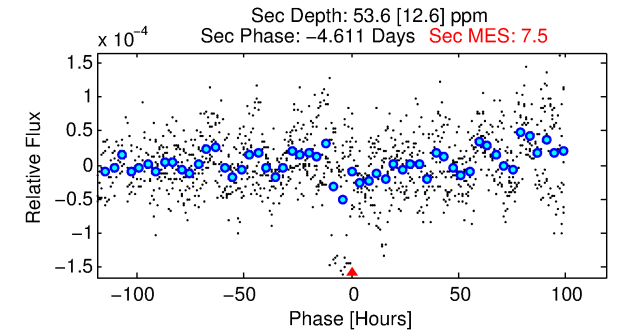
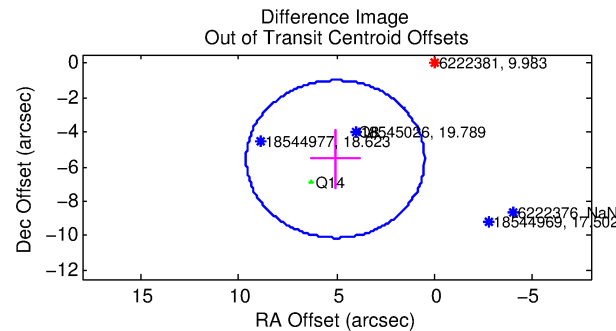
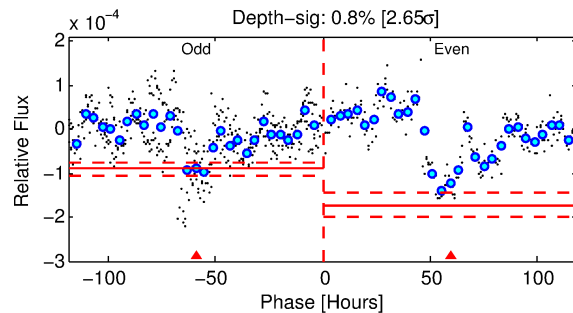
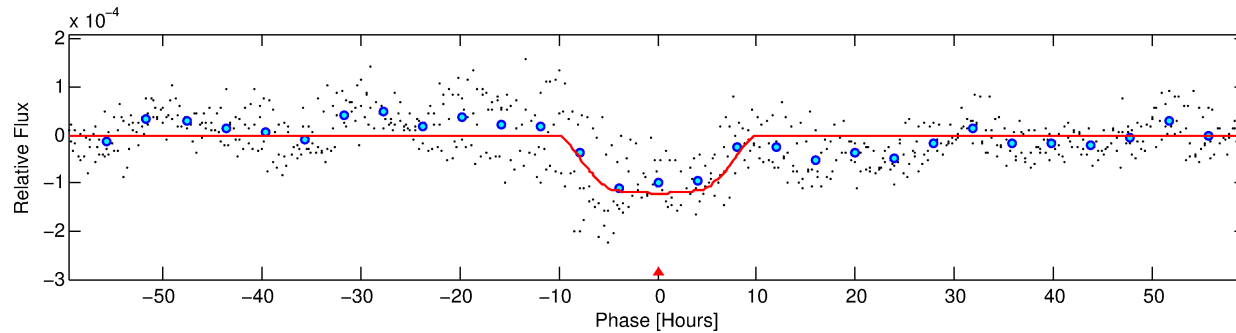
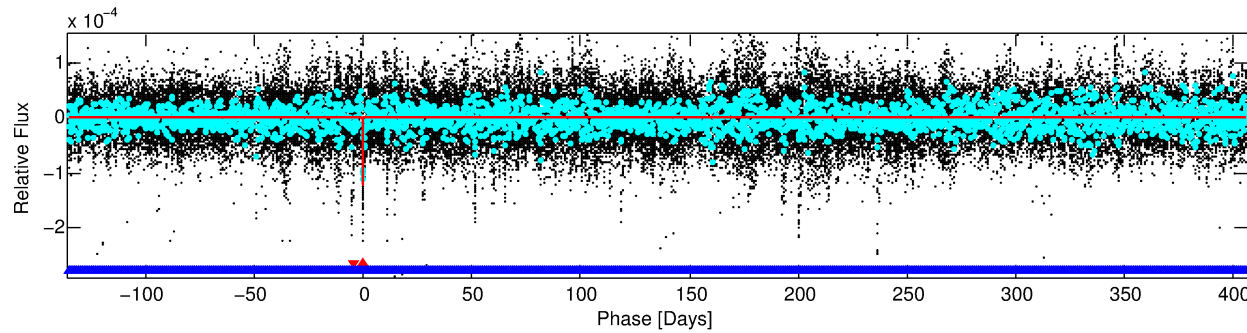
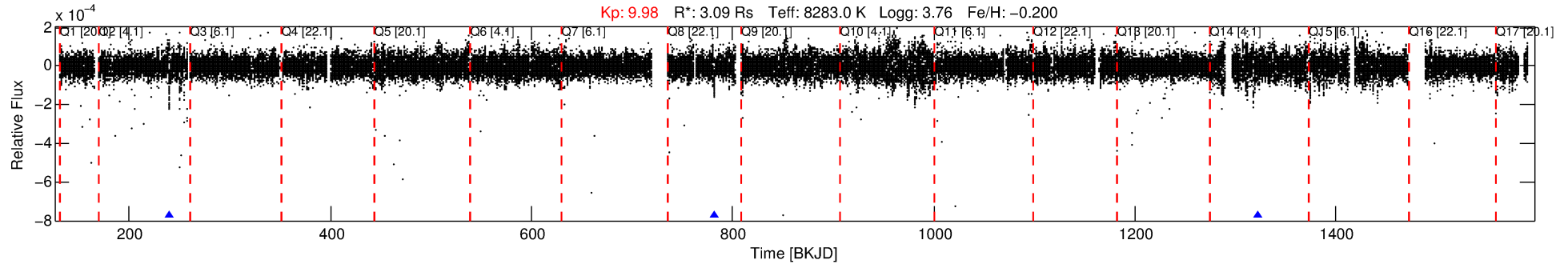
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 006222381-01

No Significant Match Found

# DV One-Page Summary

KIC: 6222381 Candidate: 1 of 2 Period: 541.545 d



## DV Fit Results:

Period = 541.54460 [0.02244] d  
Epoch = 239.9174 [0.0301] BKJD  
Rp/R\* = 0.0131 [0.0008]  
a/R\* = 53.66 [6.86]  
b = 0.98 [0.01]  
Seff = 14.95 [6.68]  
Teq = 501 [56] K  
Rp = 4.41 [1.40] Re  
a = 1.6409 [0.4692] AU  
Ag = 4080.52 [2116.89] [1.93σ]  
Teffp = 6196 [420] K [13.44σ]

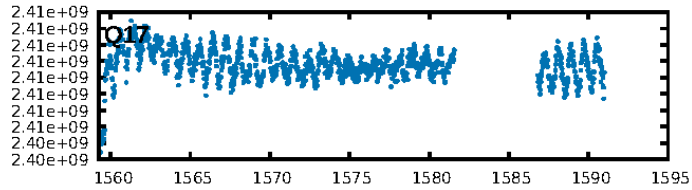
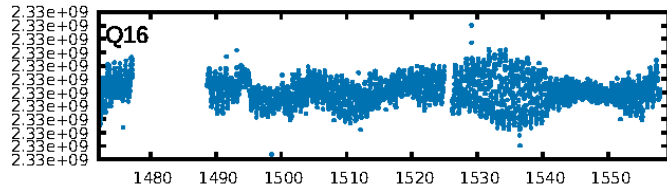
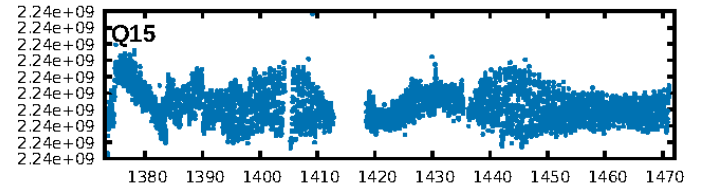
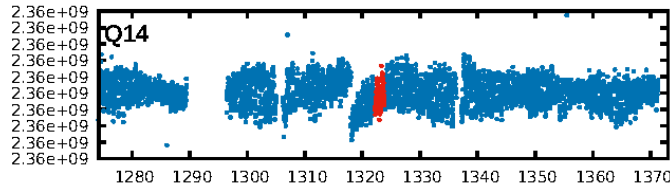
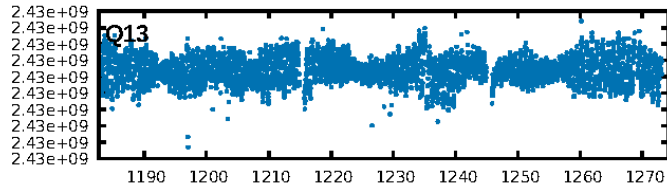
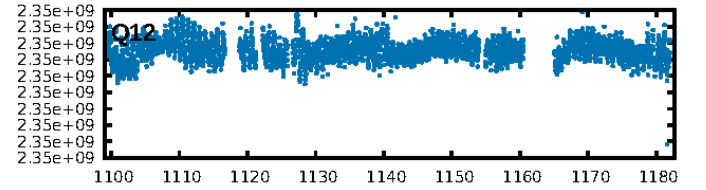
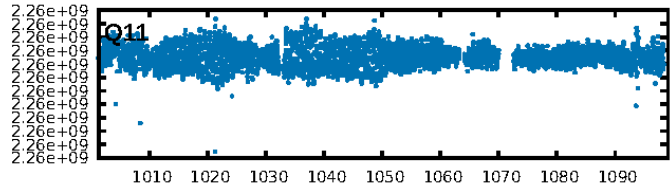
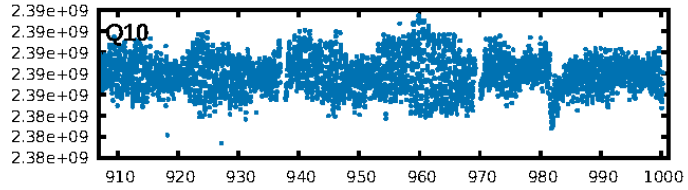
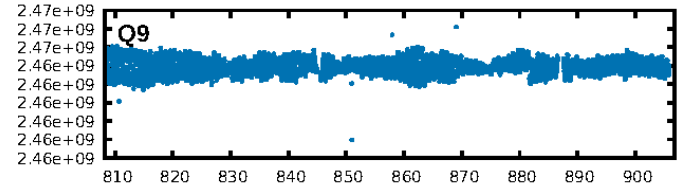
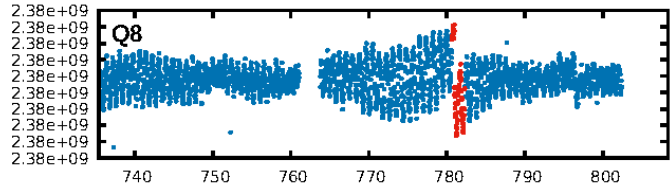
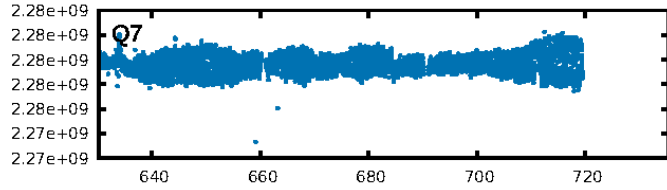
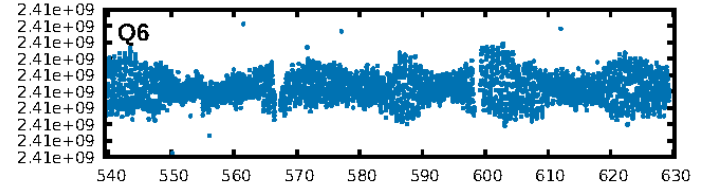
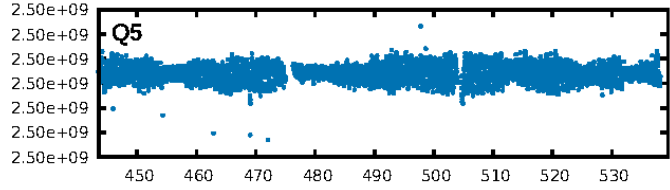
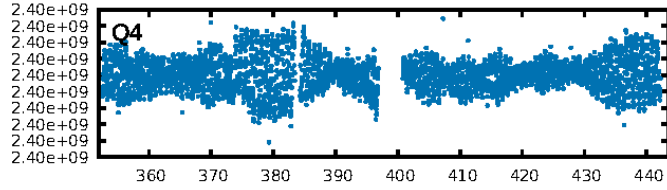
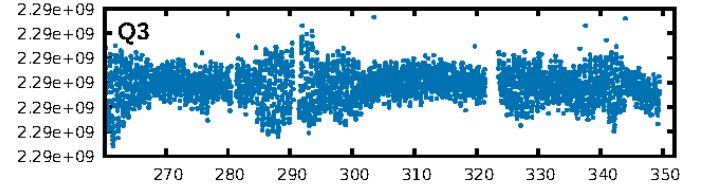
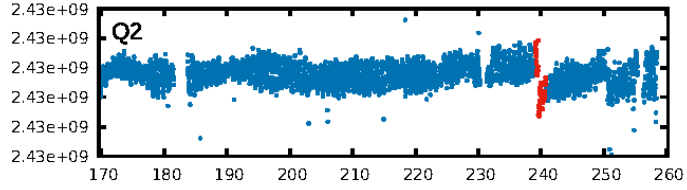
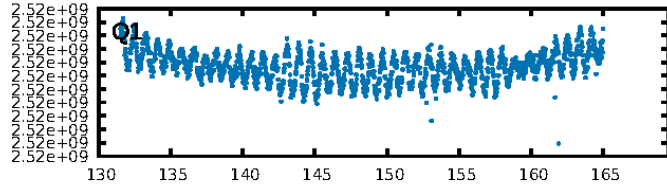
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [599.67σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 0.0%  
ModelChiSquareGof-sig: 16.2%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: N/A  
Centroid-sig: 34.3%  
Centroid-so: 2.720 arcsec [0.83σ]  
OotOffset-rm: 7.515 arcsec [4.95σ]  
KicOffset-rm: 7.527 arcsec [7.50σ]  
OotOffset-st: 1/0/1/0 [2]  
KicOffset-st: 1/0/1/0 [2]  
DiffImageQuality-fgm: 1.00 [2/2]  
DiffImageOverlap-fno: 0.00 [0/3]

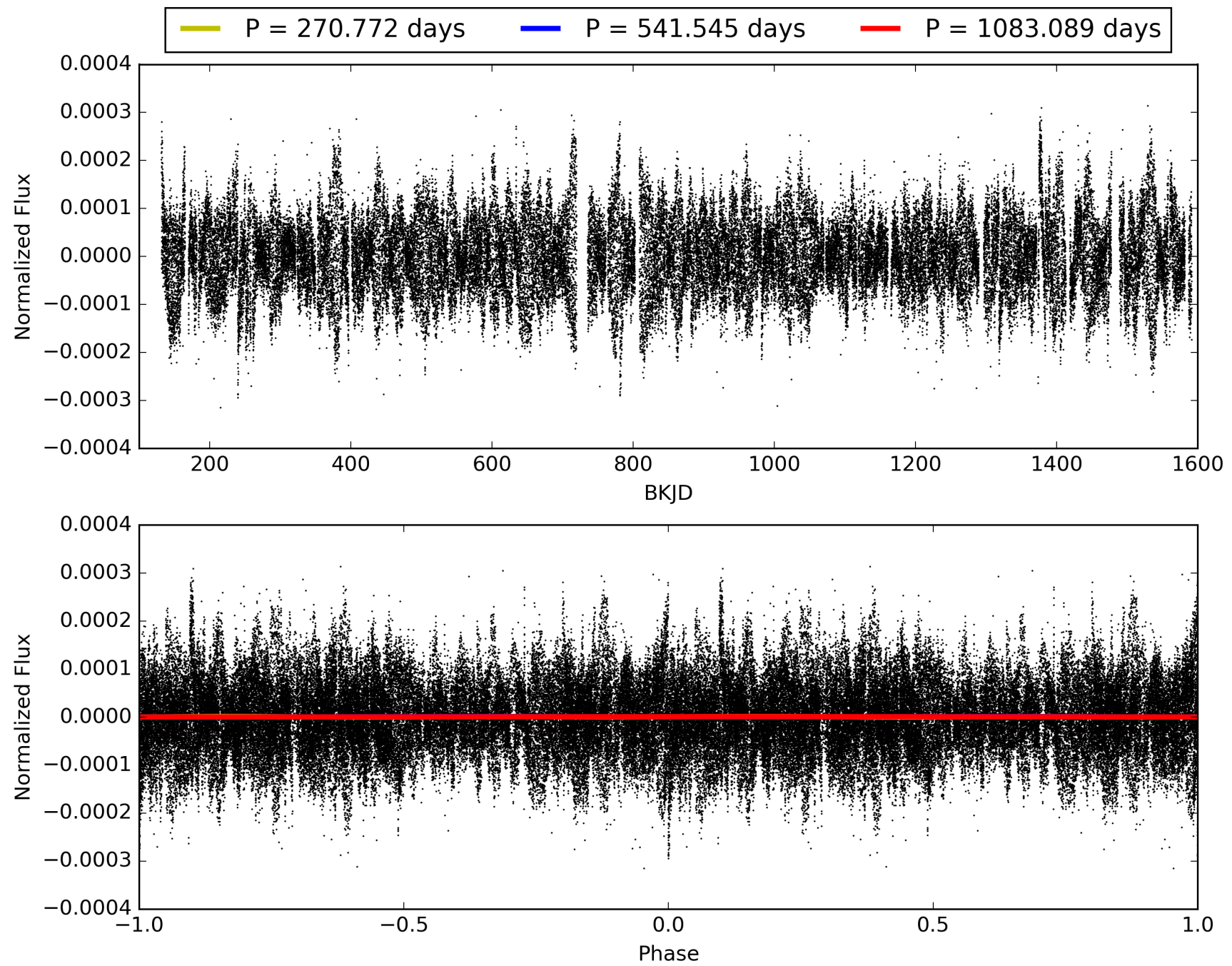
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 01:51:38 Z

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

## TCE 006222381-01, PDC Light Curves

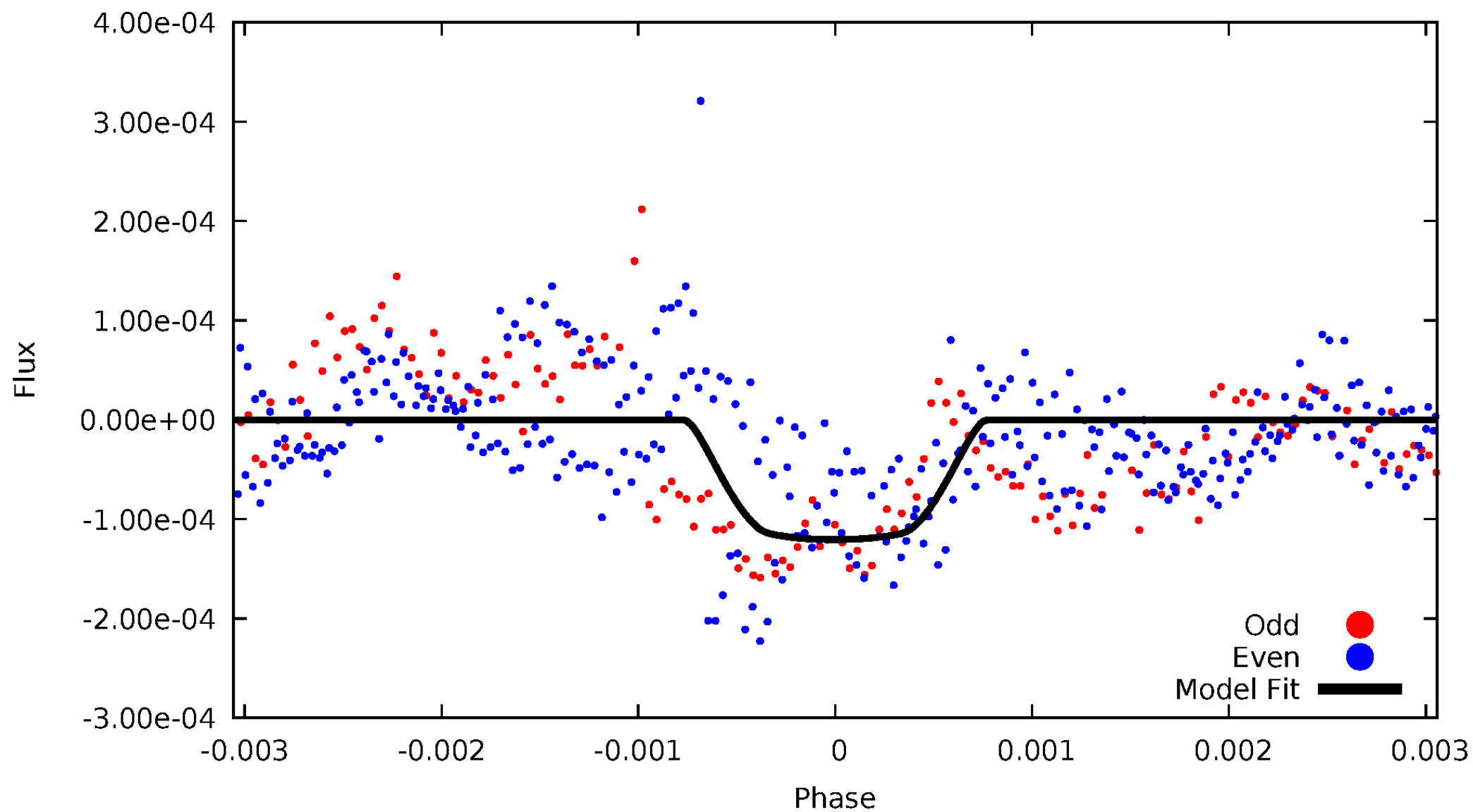


TCE 006222381-01



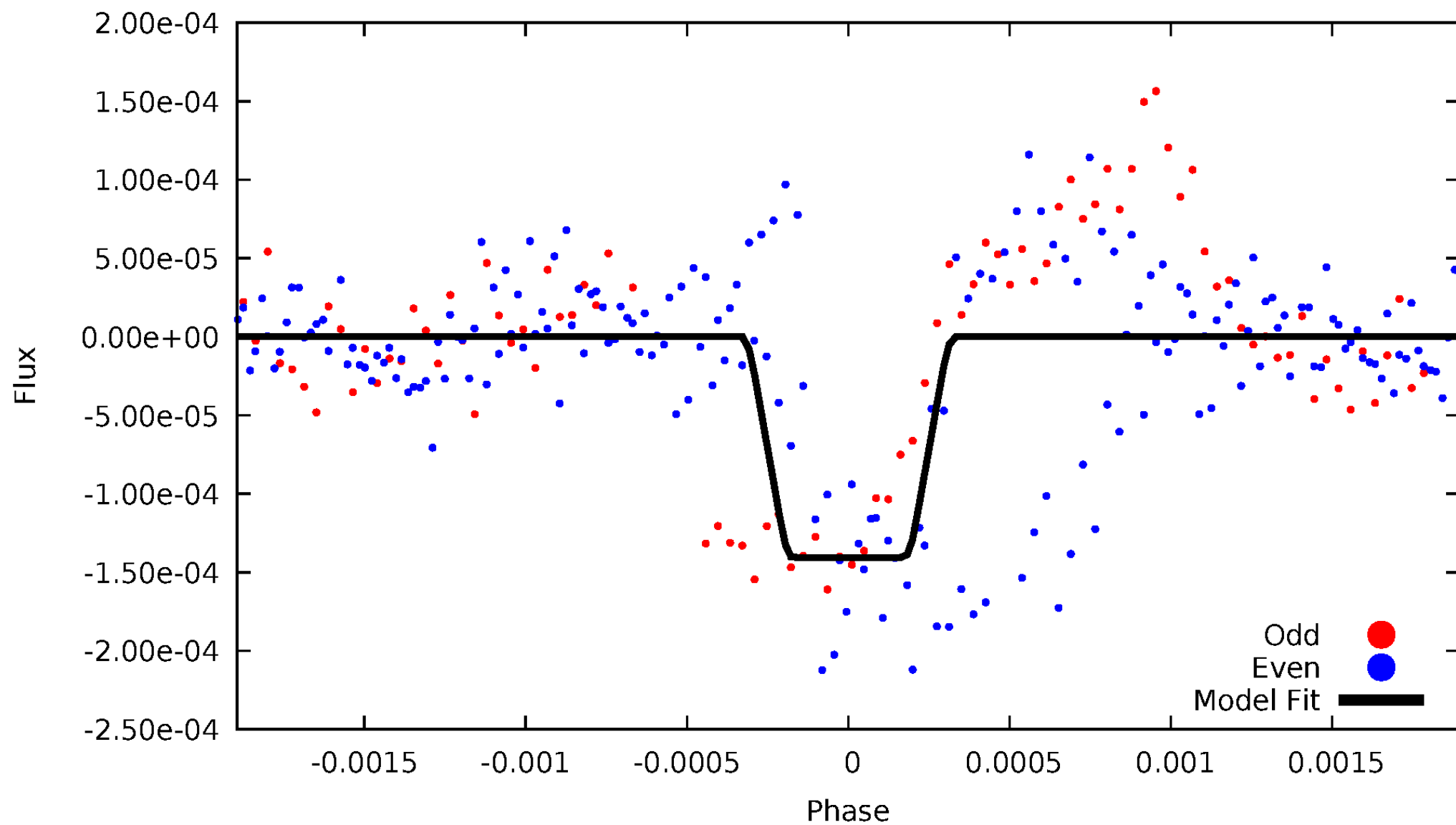
# DV Odd/Even

TCE 006222381-01



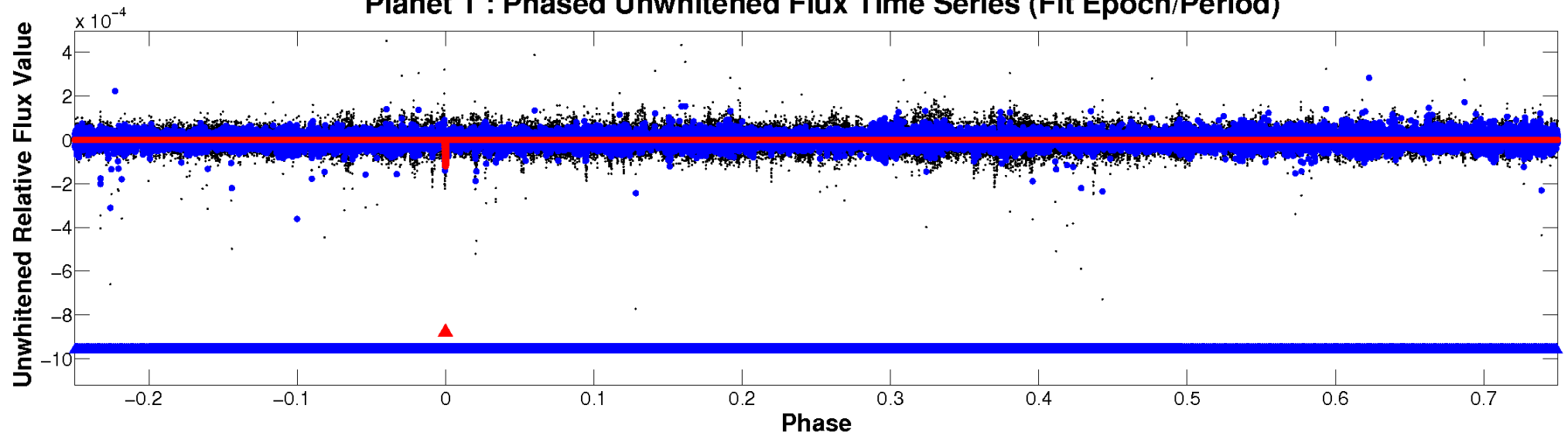
# ALT Odd/Even

TCE 006222381-01

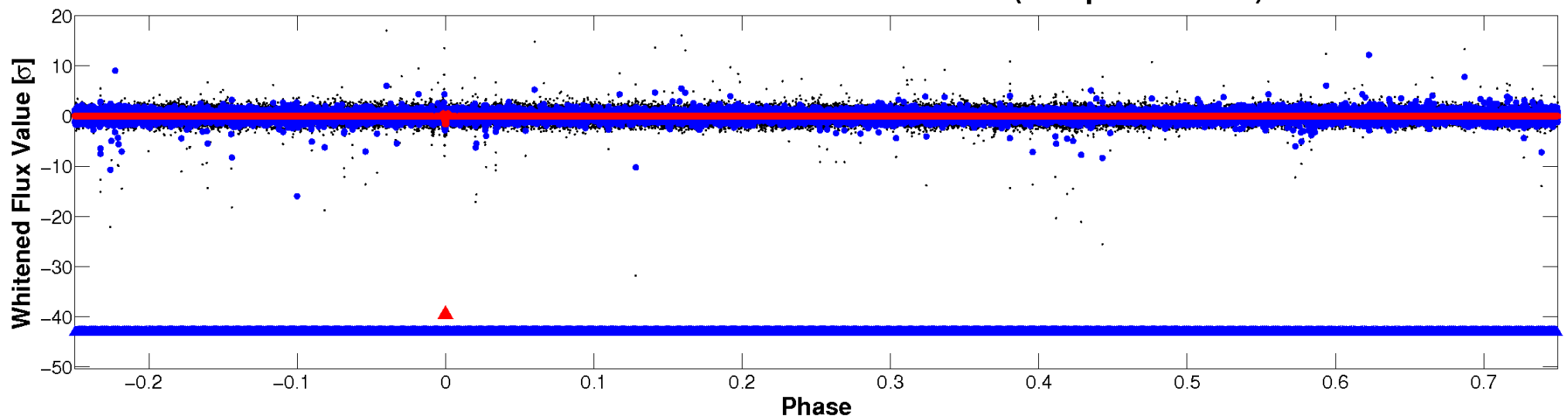


# Non-Whitened Vs. Whitened Light Curve

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

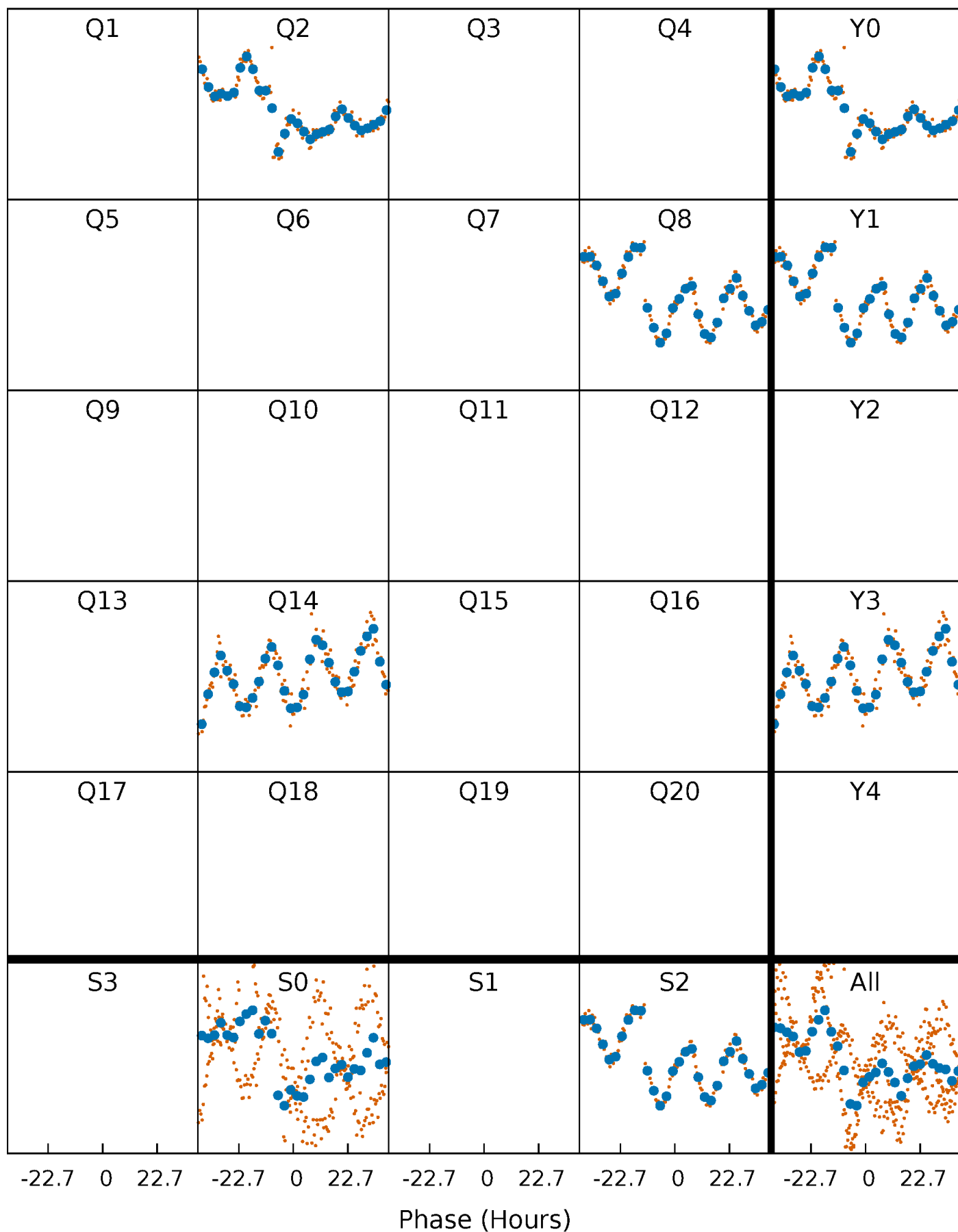


Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

TCE 006222381-01 P=541.544603 Days  $T_0=239.917367$  (BKJD)





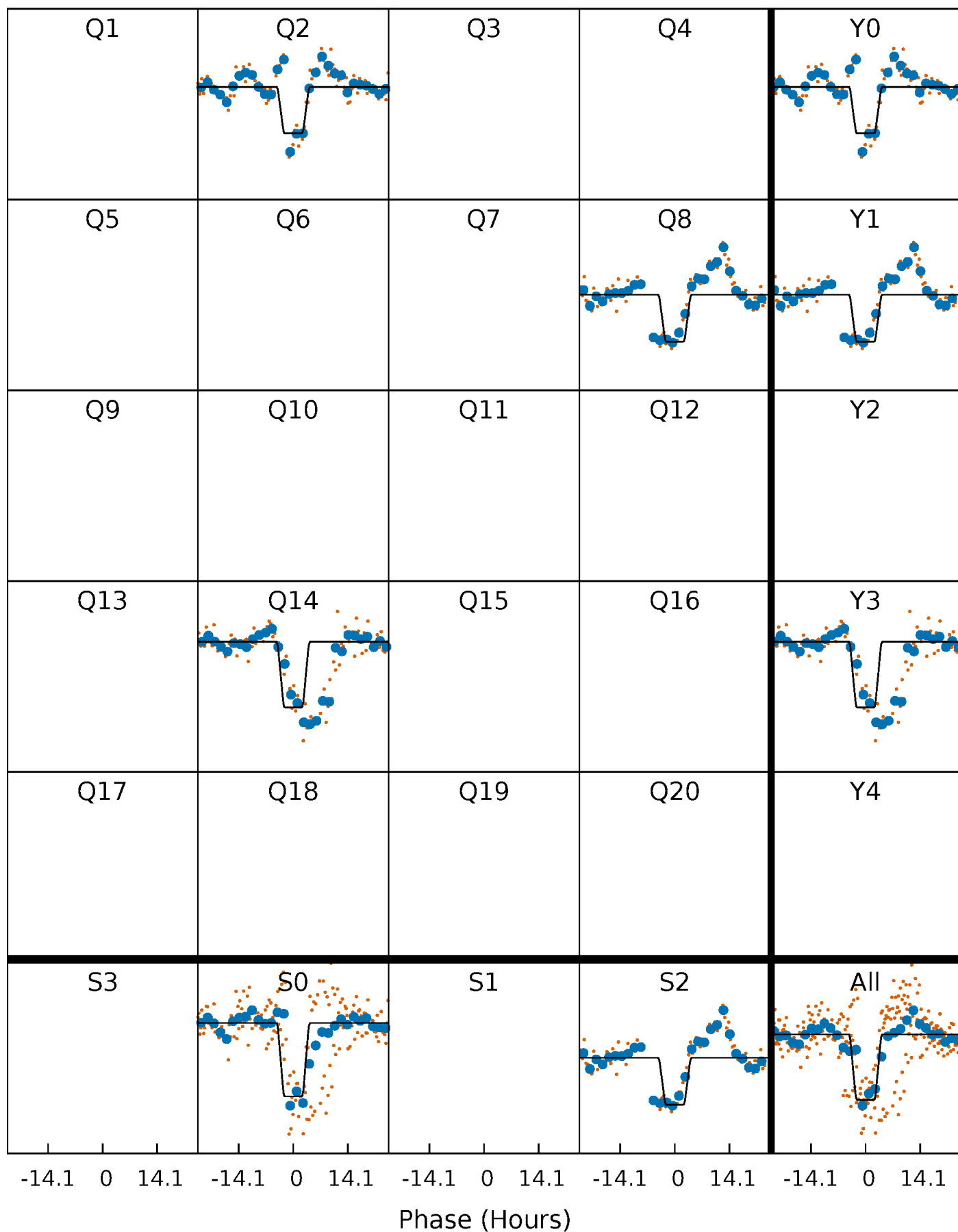
# DV Quarter-Phased Transit Curves

TCE 006222381-01     $P=541.544603$  Days     $T_0=239.917367$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

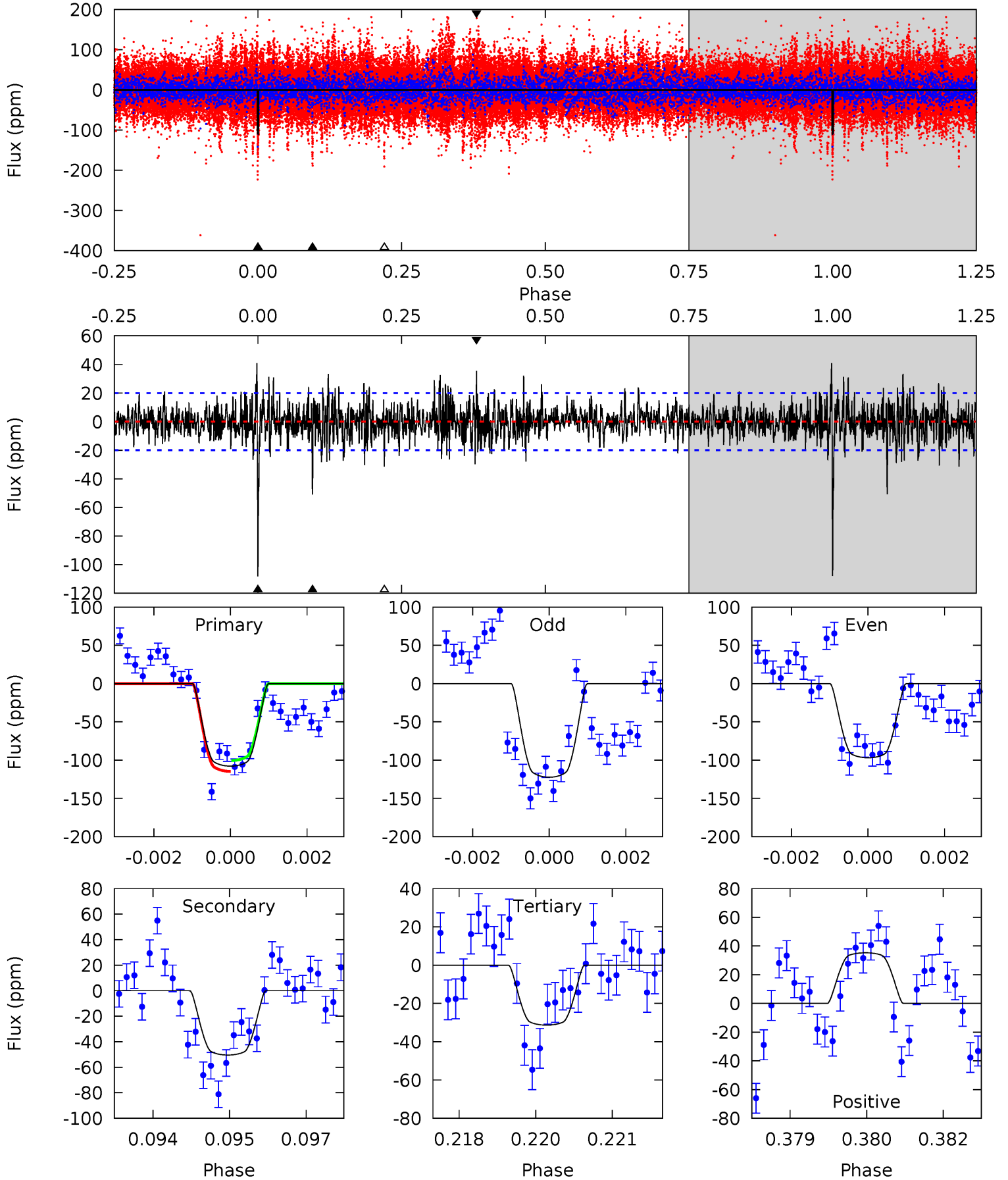
TCE 006222381-01 P=541.618753 Days  $T_0=239.611453$  (BKJD)



# DV Model-Shift Uniqueness Test

006222381-01, P = 541.544603 Days, E = 239.917367 Days

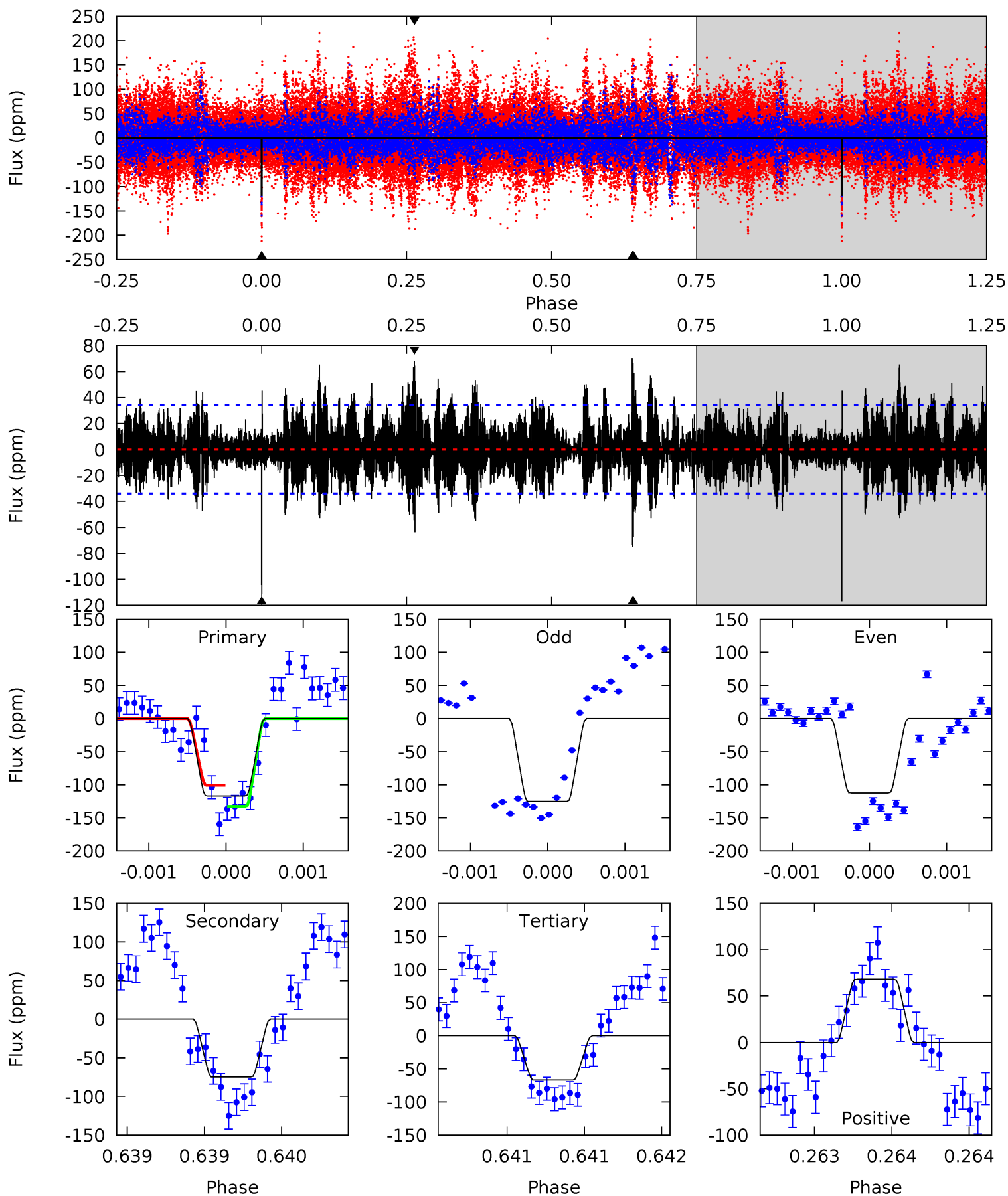
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
29.0	13.6	8.43	9.50	5.37	3.16	2.35	20.6	19.5	5.14	4.07	3.21	0.84	0.27	1.92



# Alt Model-Shift Uniqueness Test

006222381-01, P = 541.618753 Days, E = 239.611453 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
19.0	12.2	10.9	11.1	5.52	3.40	2.75	8.09	7.92	1.29	1.12	1.00	0.98	0.38	2.60



### Stellar Parameters For KIC 006222381

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$\rho_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$8283^{+66}_{-91}$	$3.761^{+0.256}_{-0.048}$	$-0.200^{+0.250}_{-0.200}$	$3.090^{+0.344}_{-0.963}$	$2.009^{+0.308}_{-0.205}$	$0.096^{+0.153}_{-0.016}$
	+1%/-1%	+7%/-1%	+125%/-100%	+11%/-31%	+15%/-10%	+159%/-16%
Source	SPE68	SPE68	SPE68	DSEP		

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

### Secondary Eclipse Parameters for KIC 006222381-01 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-50 \pm 4$	$4.29^{+0.51}_{-0.63}$	$688^{+23}_{-46}$	$5887^{+228}_{-190}$	$4187^{+1402}_{-771}$
Alt.	$-75 \pm 6$	$3.87^{+0.49}_{-0.62}$	$688^{+25}_{-53}$	$6888^{+314}_{-305}$	$7764^{+2736}_{-1708}$

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

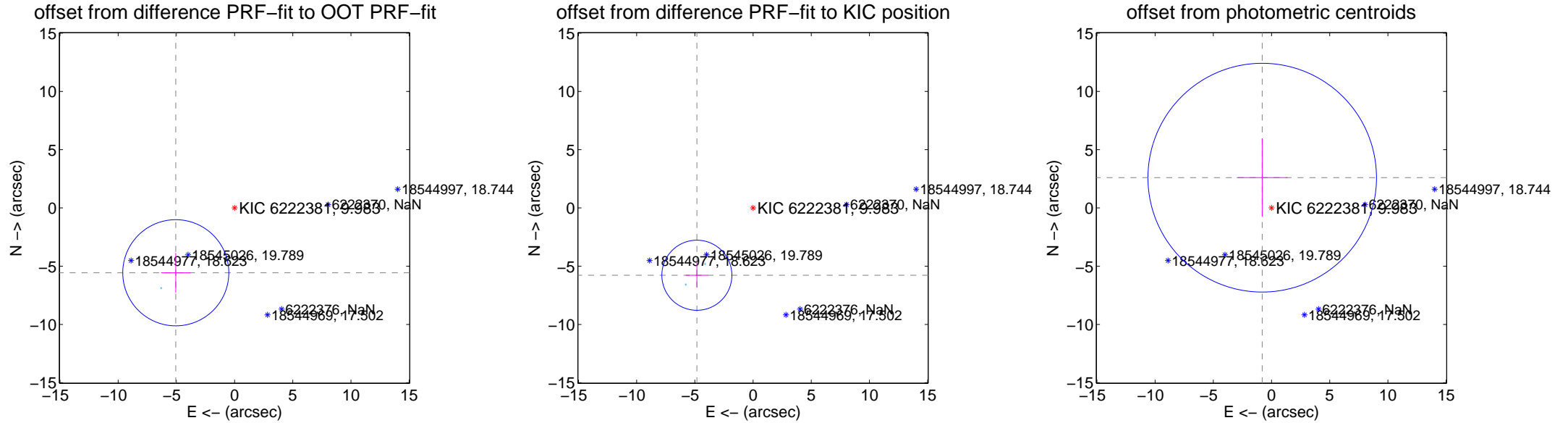
## DV Centroid Data

Supplemental centroid analysis for 006222381-01. **Kepler magnitude: 9.98.** Transit SNR 14.86

**There are 2 quarters with good PRF difference image offsets**

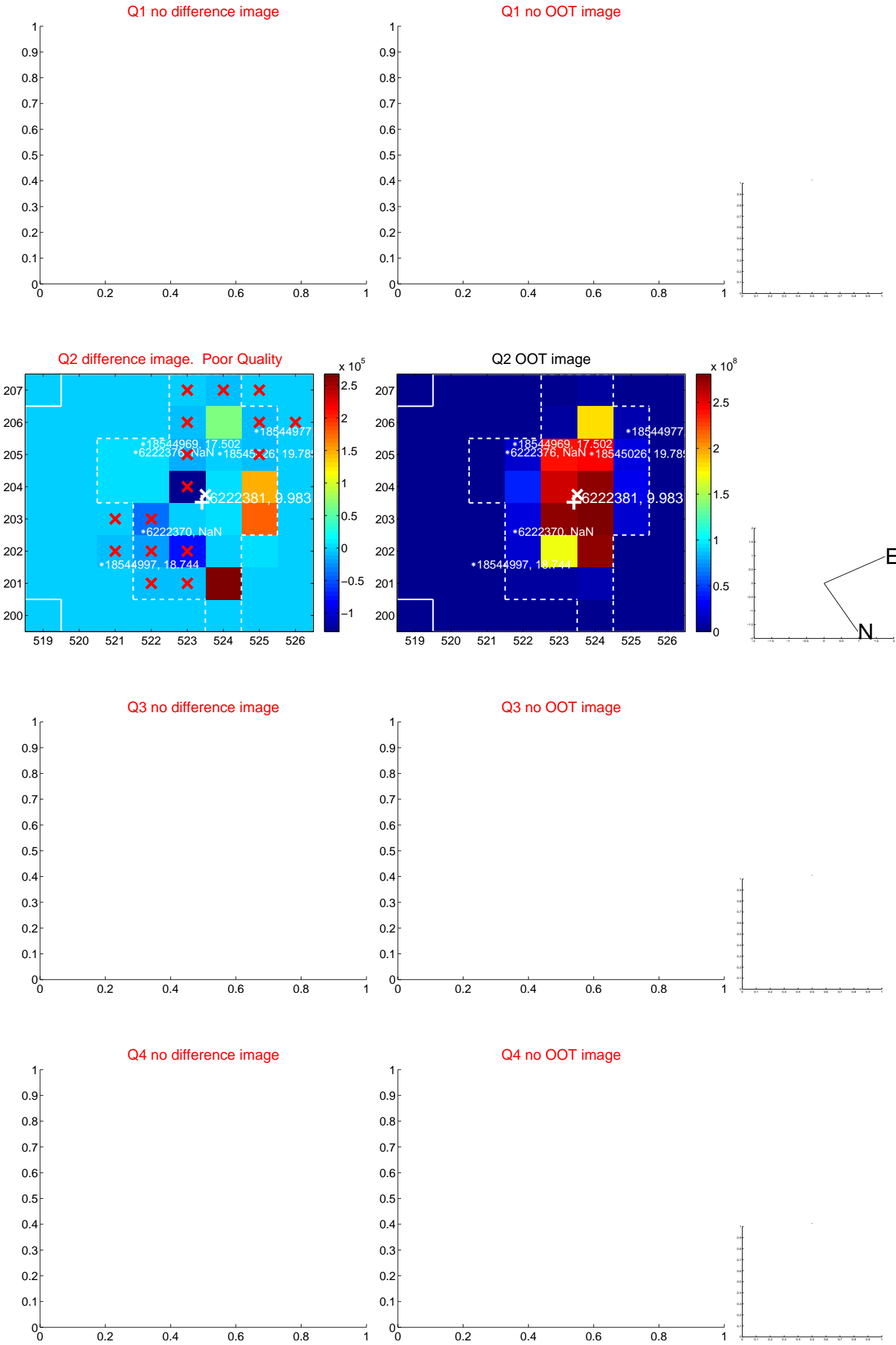
The direct PRF centroid is offset from the target star catalog position by about 0.61 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	<b>7.515 <math>\pm</math> 1.519</b>	<b>4.95</b>	5.051 $\pm$ 1.262	-5.564 $\pm$ 1.701
PRF-fit source offset from KIC position	<b>7.527 <math>\pm</math> 1.003</b>	<b>7.50</b>	4.827 $\pm$ 0.957	-5.776 $\pm$ 1.034
photometric centroid source offset	2.72 $\pm$ 3.27	0.83	0.80 $\pm$ 2.18	2.60 $\pm$ 3.36



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

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



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

Q5 no difference image



Q5 no OOT image



Q6 no difference image



Q6 no OOT image



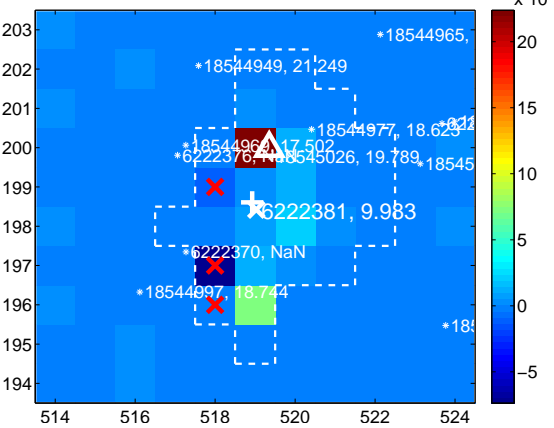
Q7 no difference image



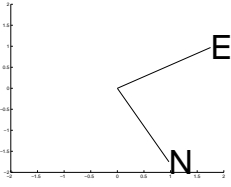
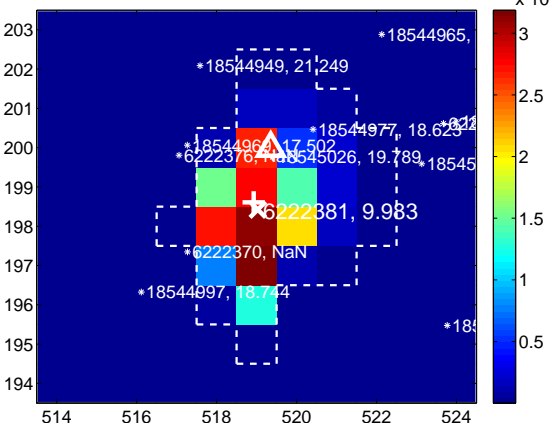
Q7 no OOT image



Q8 difference image



Q8 OOT image





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



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

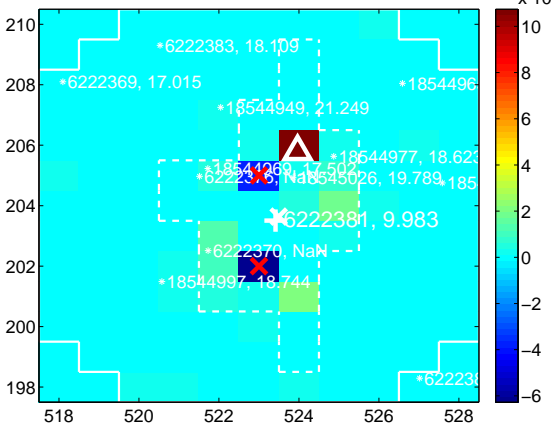
Q13 no difference image



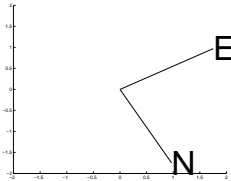
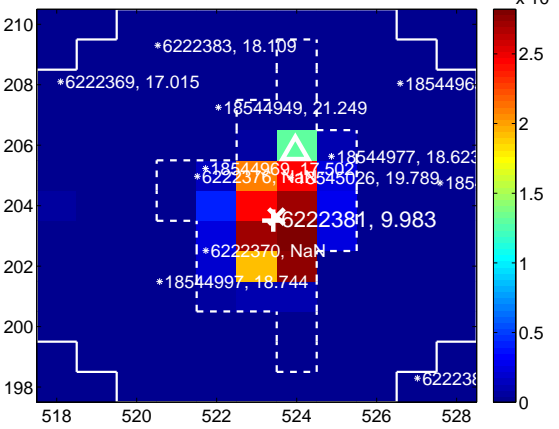
Q13 no OOT image



Q14 difference image



Q14 OOT image



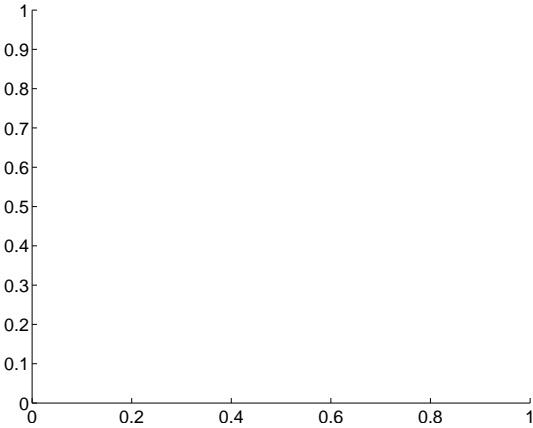
Q15 no difference image



Q15 no OOT image



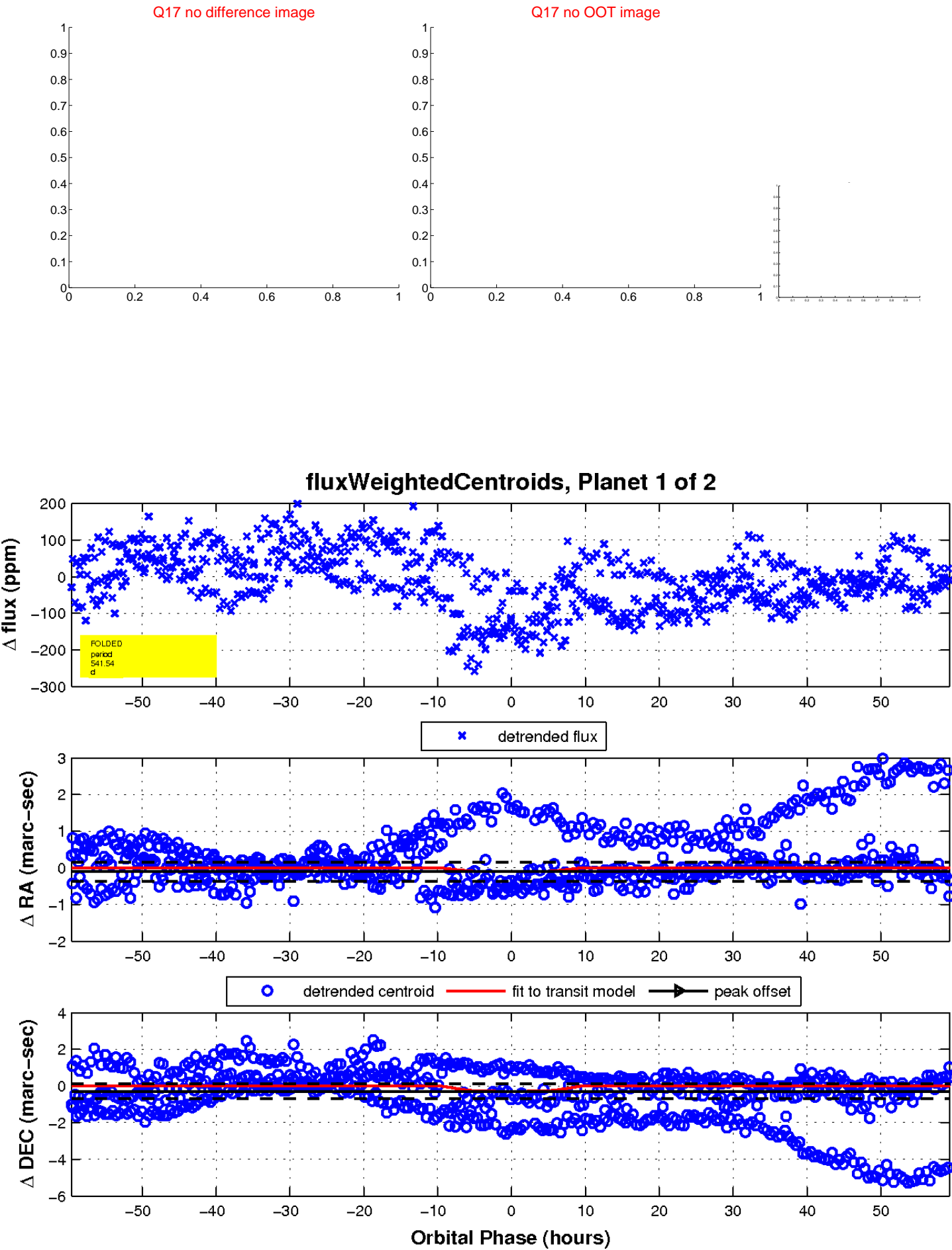
Q16 no difference image



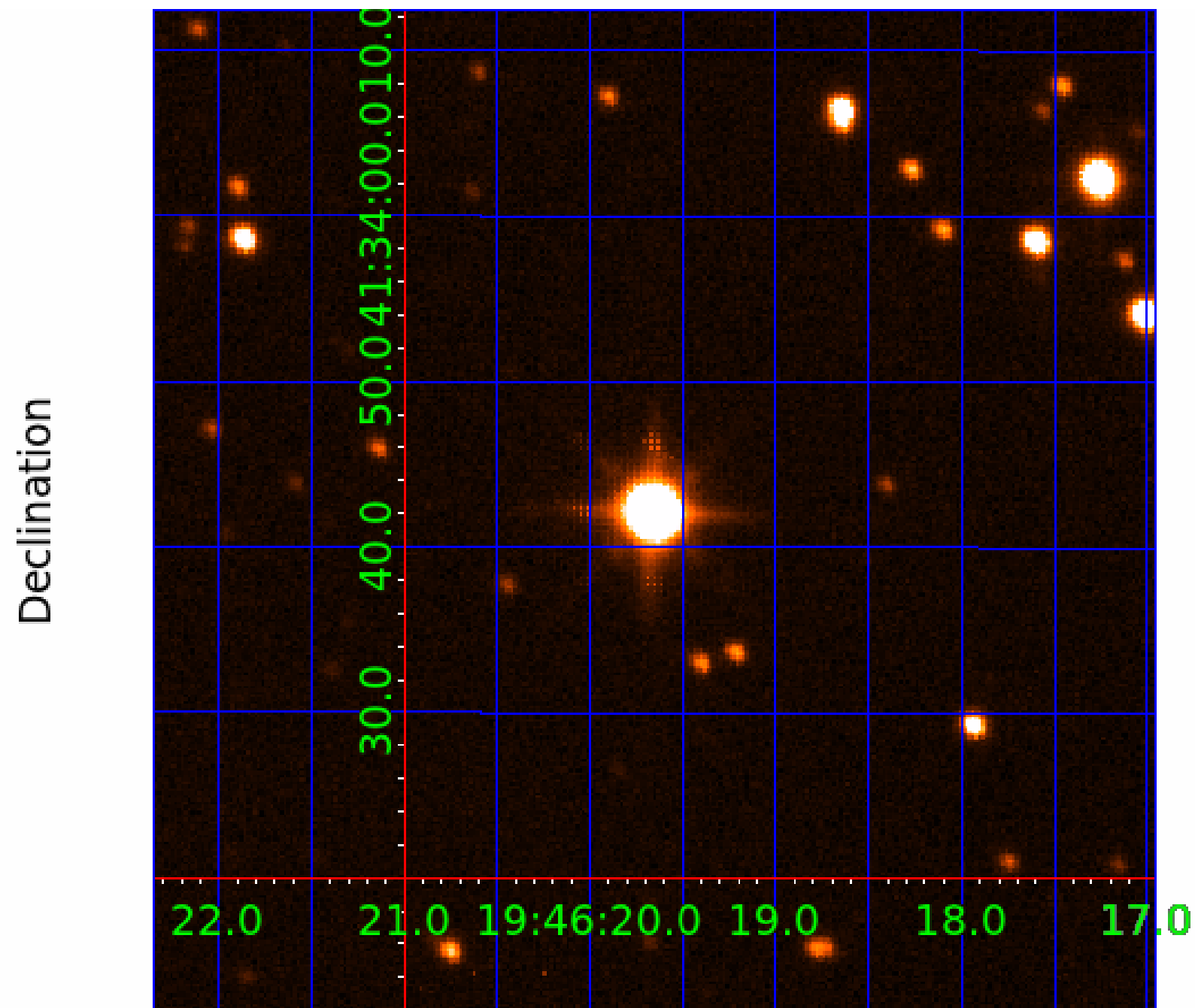
Q16 no OOT image



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



UKIRT Image



# KIC 006222381

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
006222381-01	OBS	No	541.544603	239.917367	120.7	19.867	15.0	14.9	3.09	8283	4.41	14.95
006222381-02	OBS	No	0.813598	131.969034	2.1	8.581	8.9	4.5	3.09	8283	0.45	86910.24

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
006222381-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_CHASES_MARSHALL—LPP_DV—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT—INCONSISTENT_TRANS—CENT_SATURATED
006222381-02	OBS	FP	0.00	1	0	0	0	SWEET_NTL—LPP_DV—LPP_ALT—CENT_SATURATED

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

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

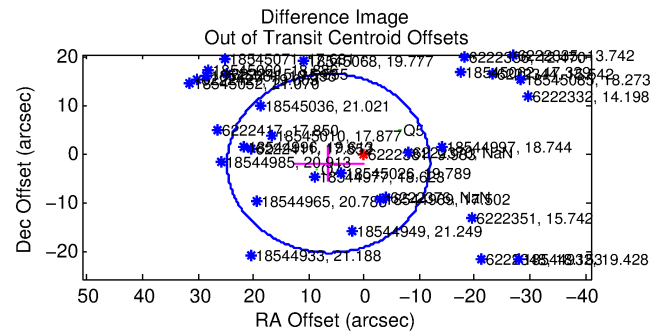
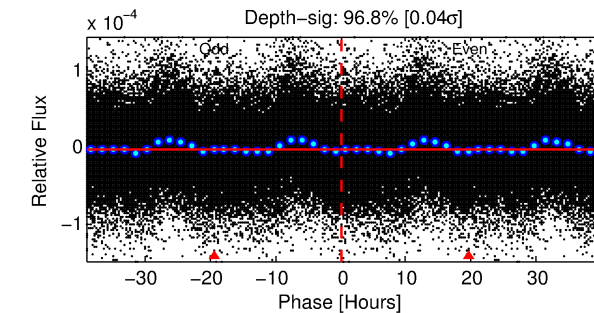
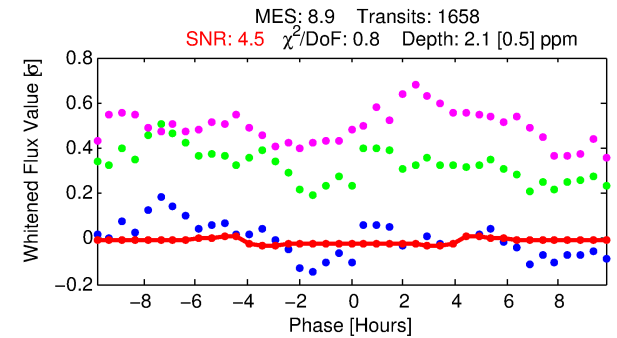
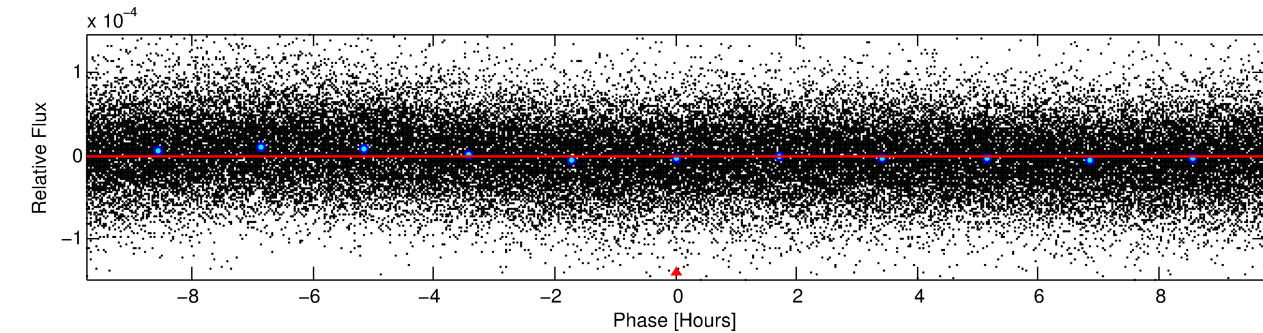
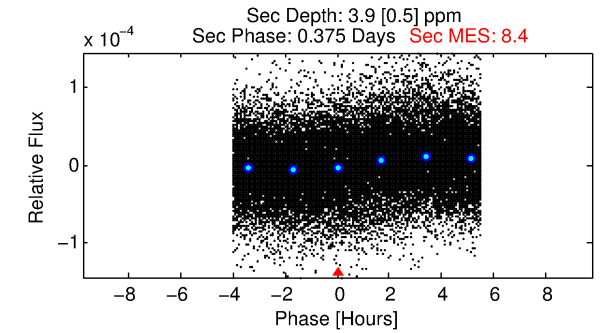
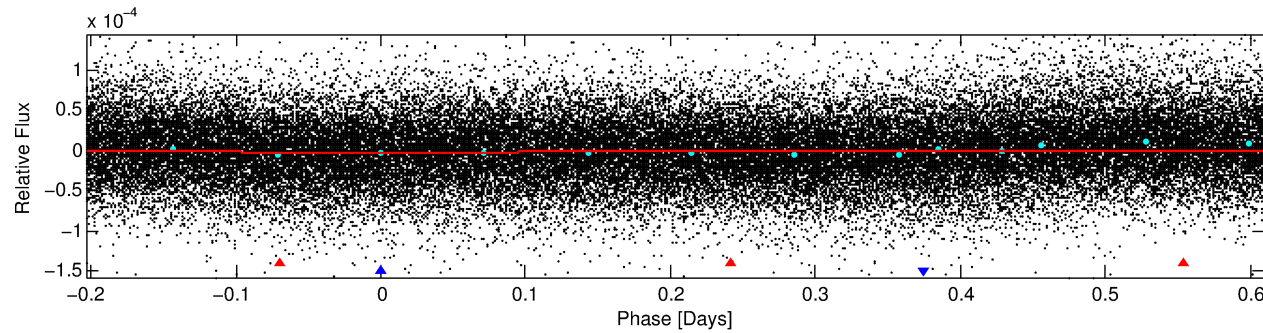
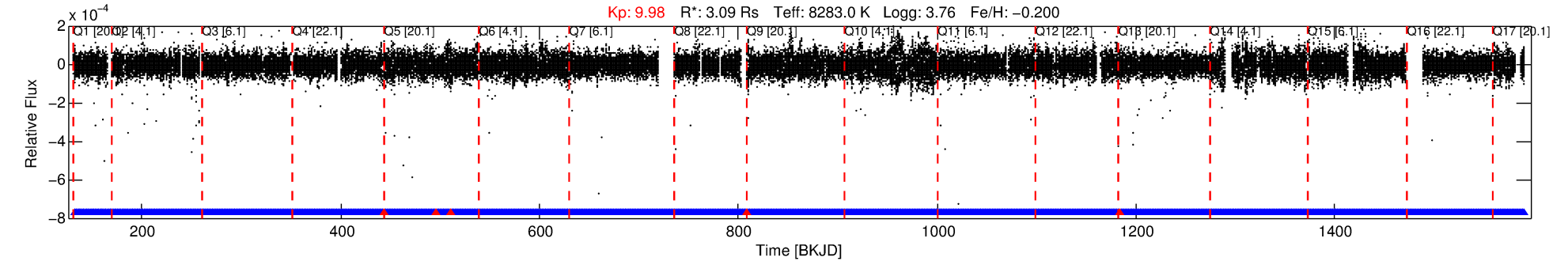
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 006222381-02

No Significant Match Found

# DV One-Page Summary

KIC: 6222381 Candidate: 2 of 2 Period: 0.814 d



## DV Fit Results:

Period = 0.81360 [0.00003] d  
Epoch = 131.9690 [0.0078] BKJD  
Rp/R\* = 0.0013 [0.0010]  
a/R\* = 1.02 [0.15]  
b = 0.32 [12.13]  
Seff = 86910.24 [38821.48]  
Teq = 4378 [489] K  
Rp = 0.45 [0.36] Re  
a = 0.0215 [0.0062] AU  
Ag = 4.79 [7.33] [0.52σ]  
Teff = 10013 [3670] K [1.52σ]

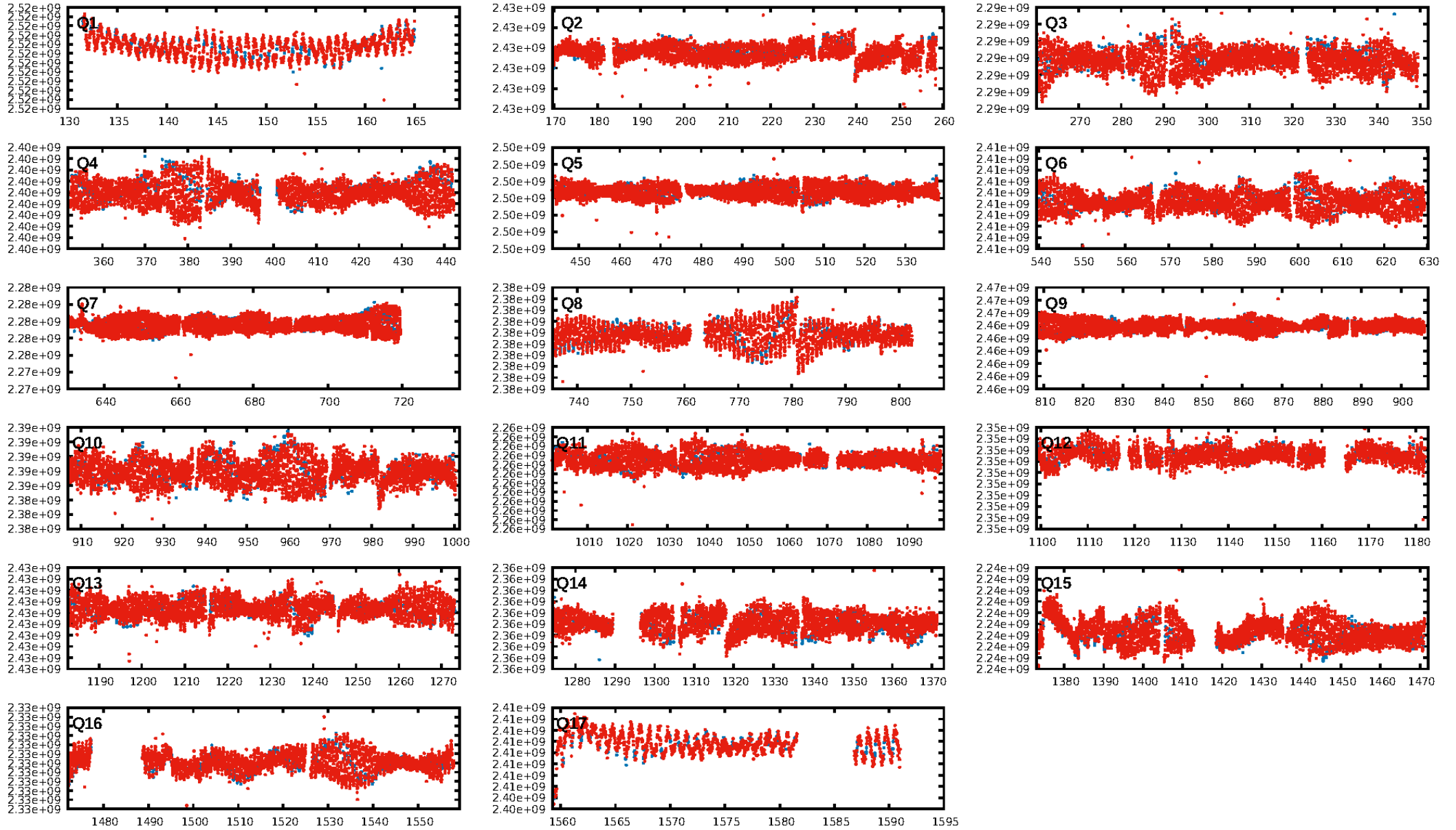
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [599.67σ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [1579/1584]  
GhostDiagnostic-chr: N/A  
Centroid-sig: N/A  
Centroid-so: N/A  
OotOffset-rm: 6.665 arcsec [1.09σ]  
KicOffset-rm: 5.936 arcsec [0.96σ]  
OotOffset-st: 0/1/0/1 [2]  
KicOffset-st: 0/1/0/1 [2]  
DiffImageQuality-fgm: 0.00 [0/2]  
DiffImageOverlap-fno: 1.00 [17/17]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 01:51:51 Z

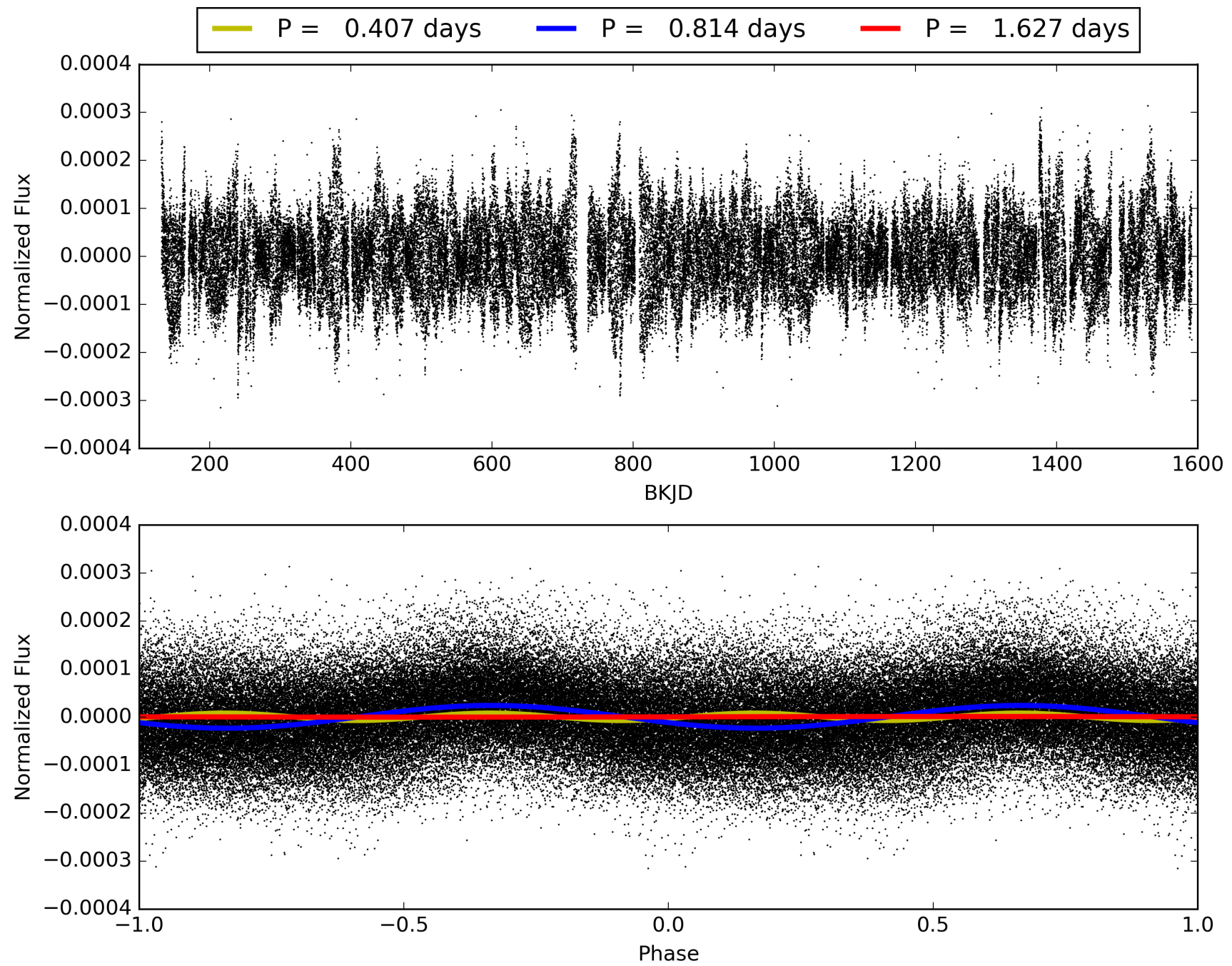
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 006222381-02, PDC Light Curves





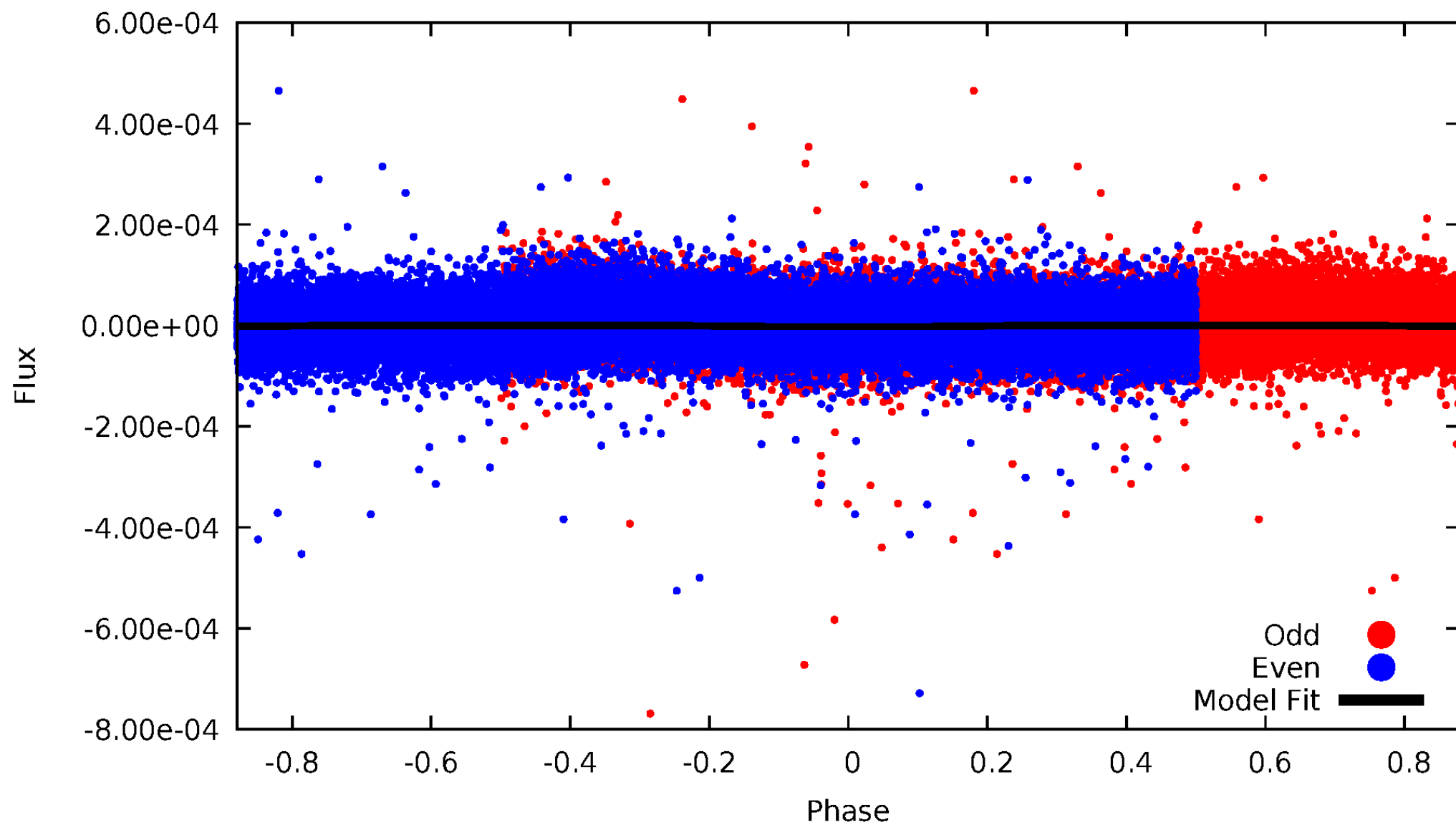
TCE 006222381-02





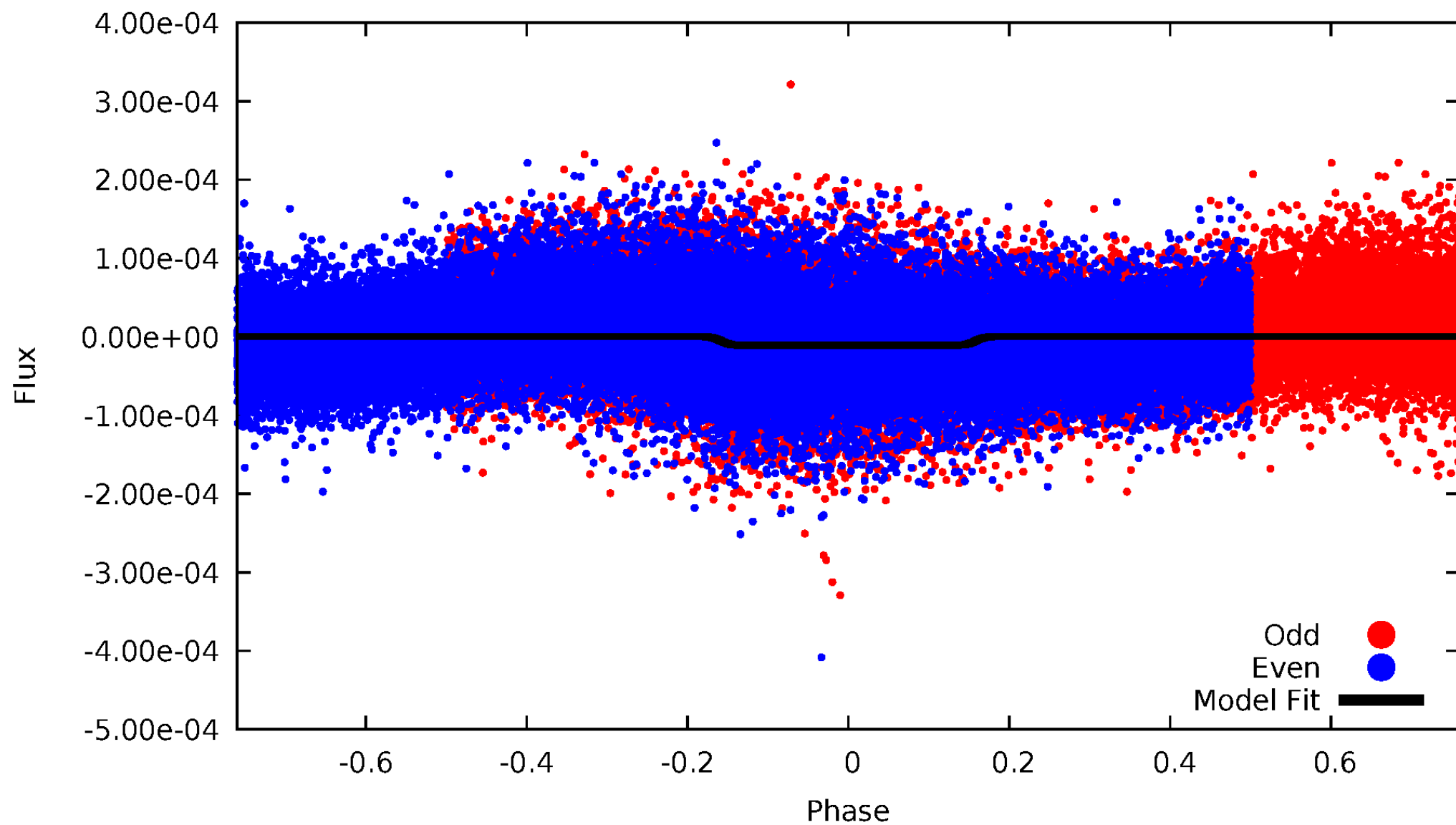
# DV Odd/Even

TCE 006222381-02



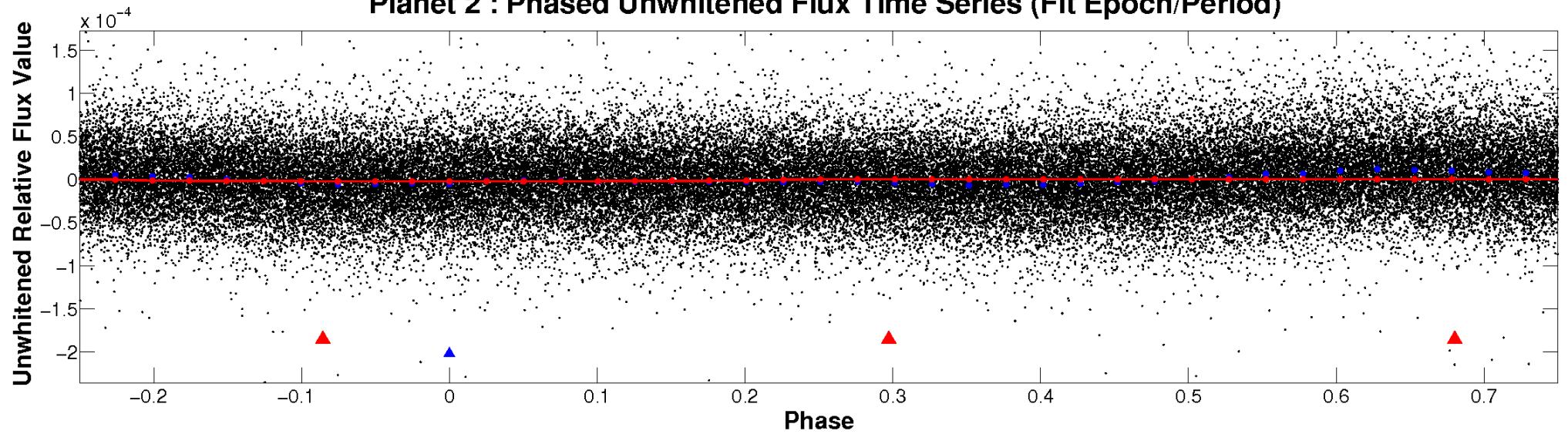
# ALT Odd/Even

TCE 006222381-02

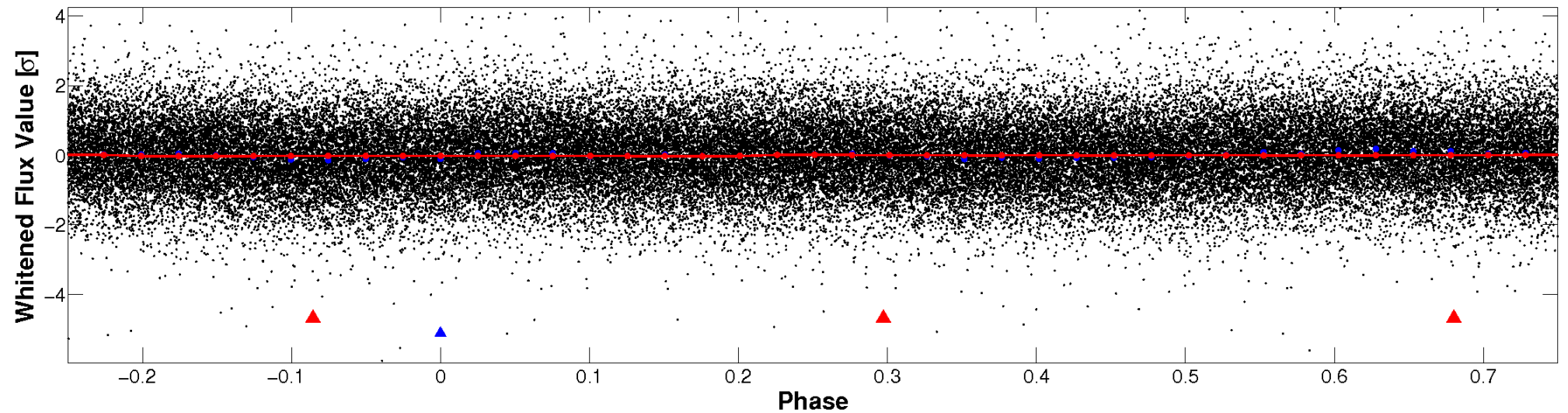


# Non-Whitened Vs. Whitened Light Curve

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

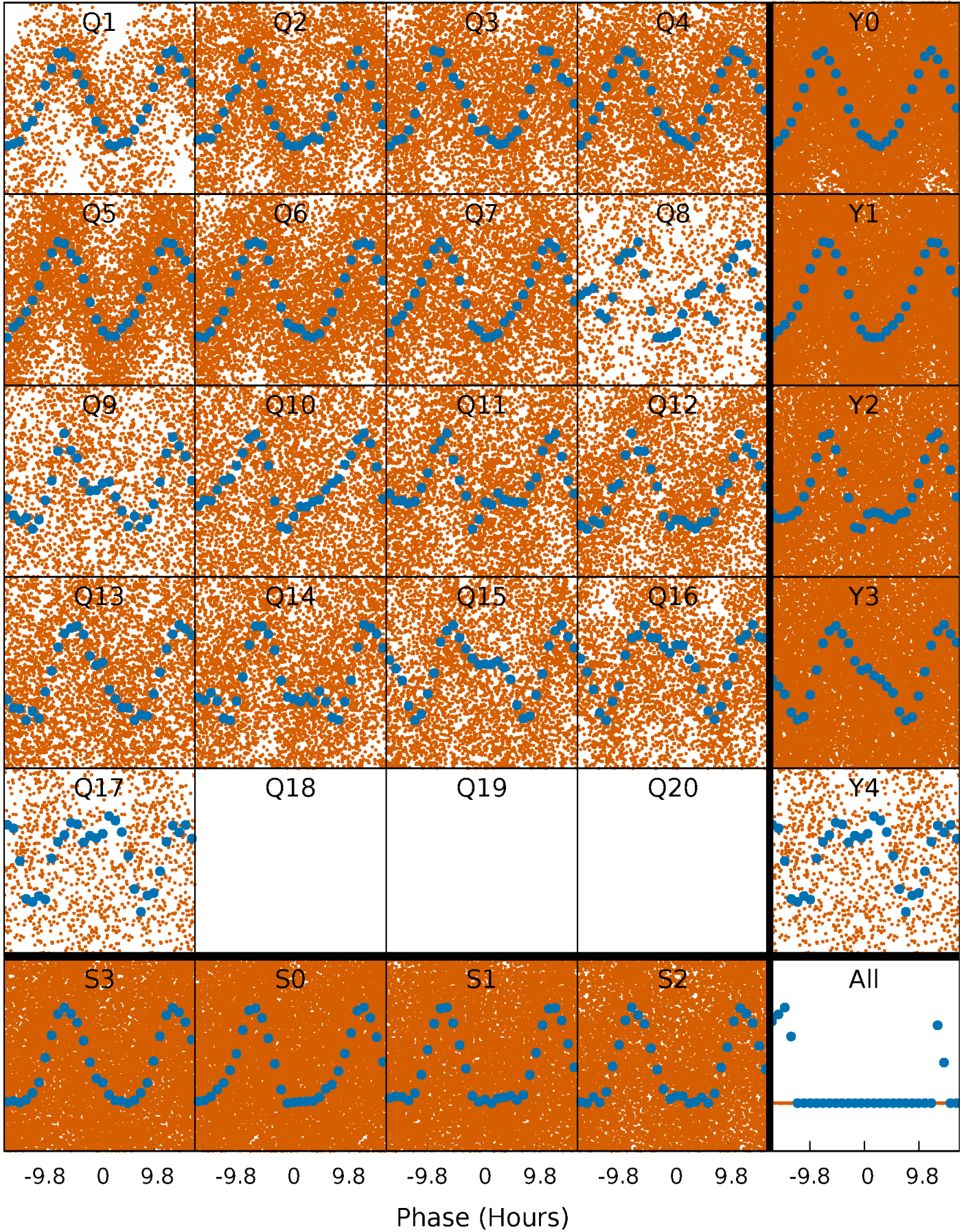


**Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



# PDC Quarter-Phased Transit Curves

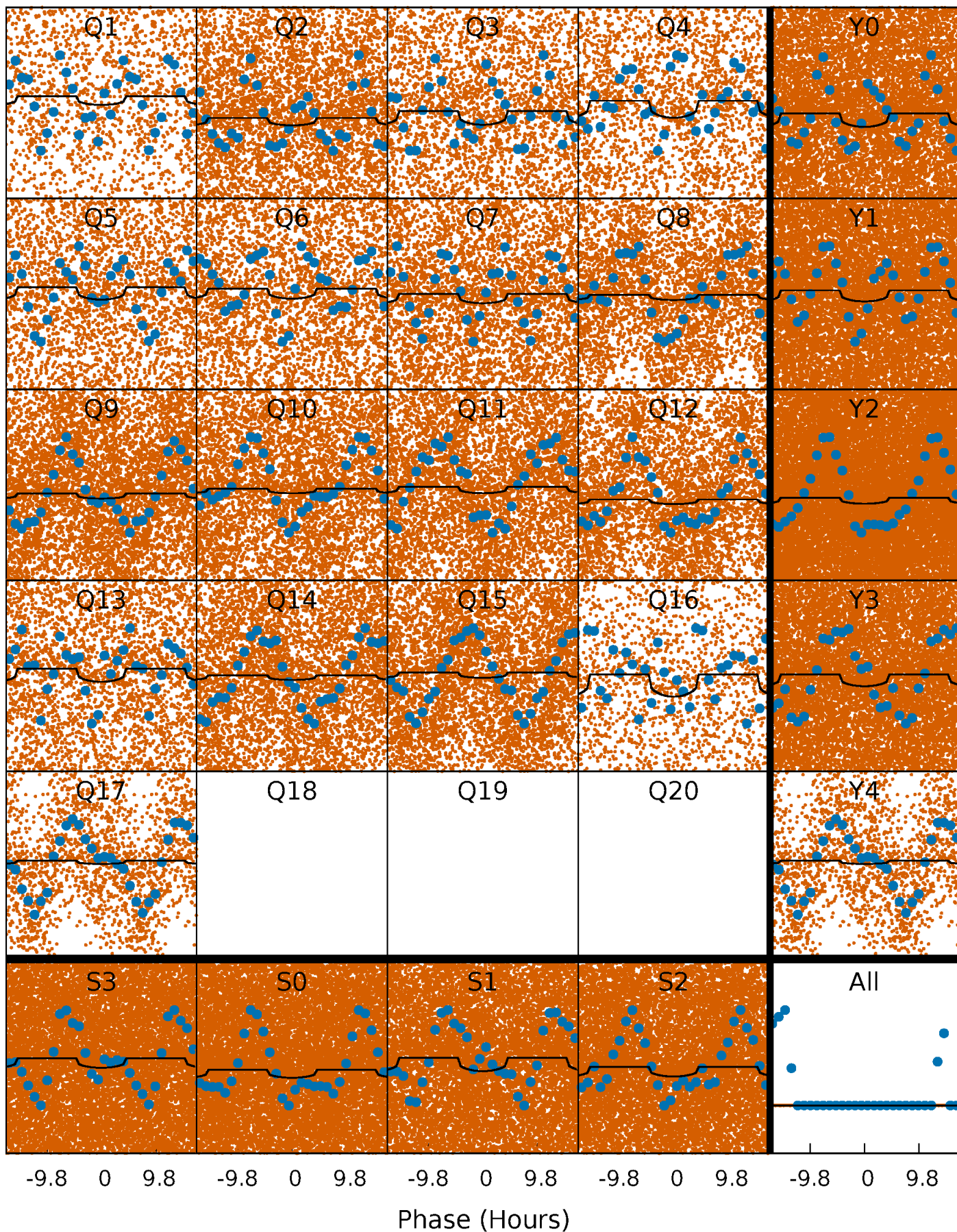
TCE 006222381-02   P= 0.813598 Days    $T_0=131.969034$  (BKJD)





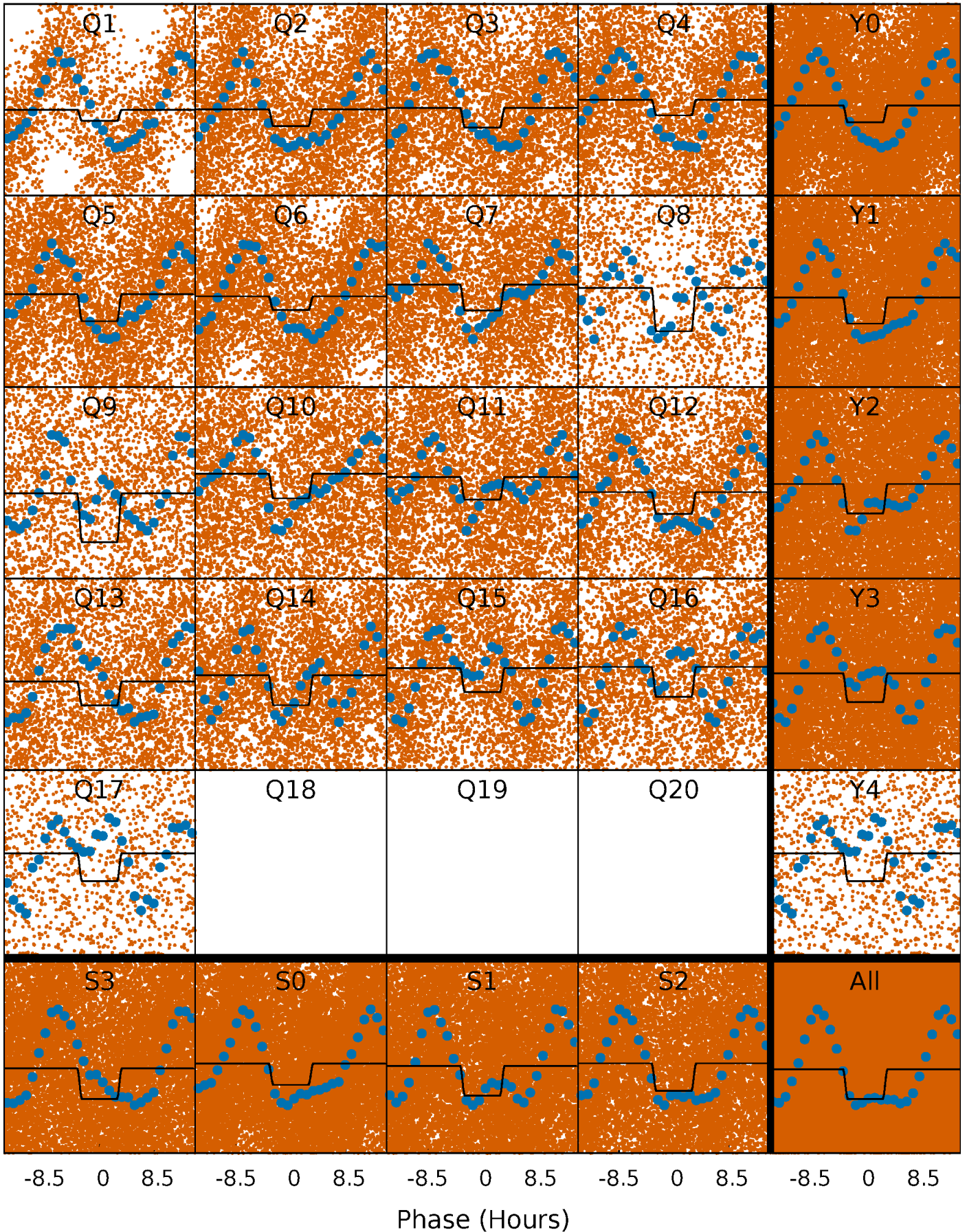
# DV Quarter-Phased Transit Curves

TCE 006222381-02   P= 0.813598 Days    $T_0=131.969034$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

TCE 006222381-02   P= 0.813632 Days    $T_0=131.958936$  (BKJD)

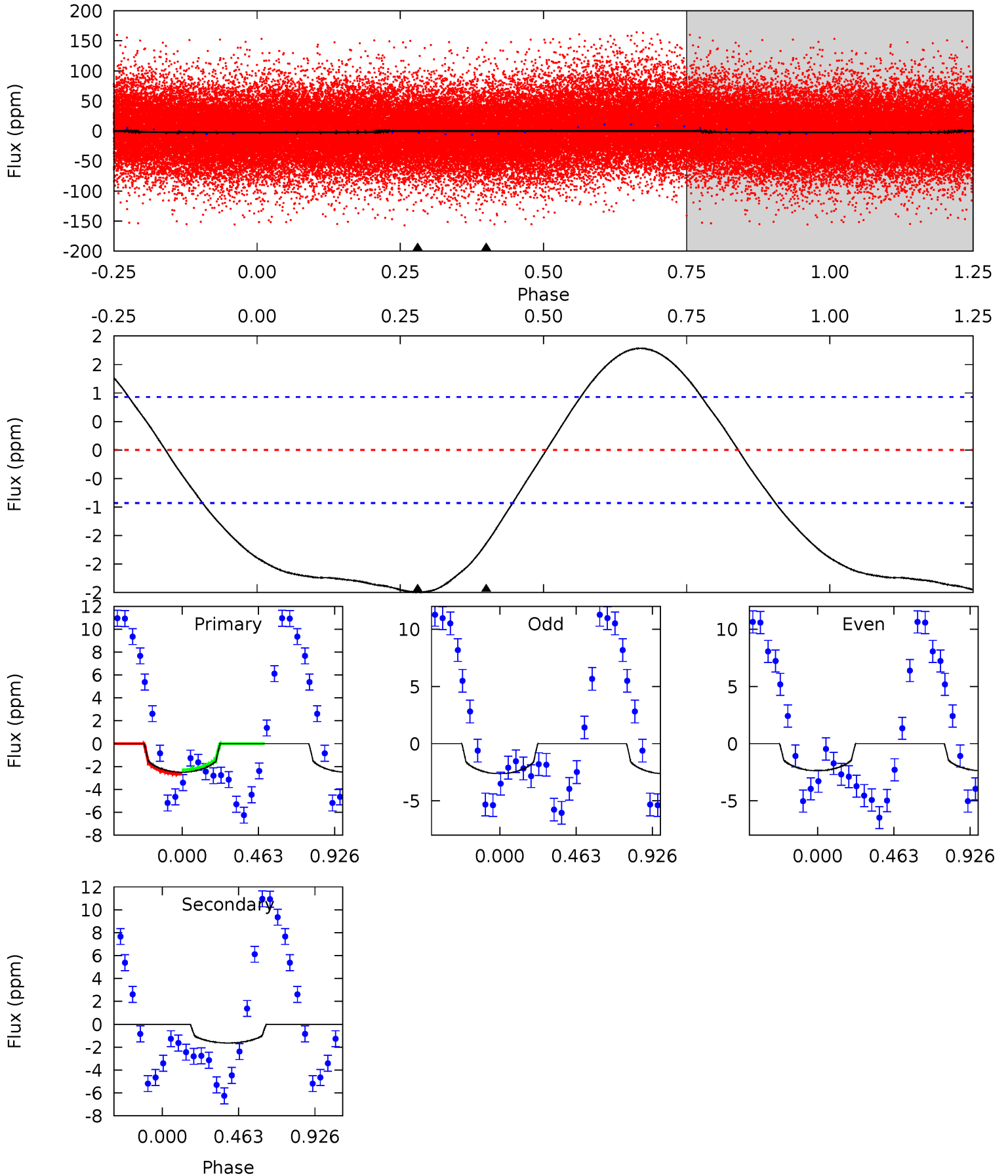




# DV Model-Shift Uniqueness Test

006222381-02, P = 0.813598 Days, E = 131.155436 Days

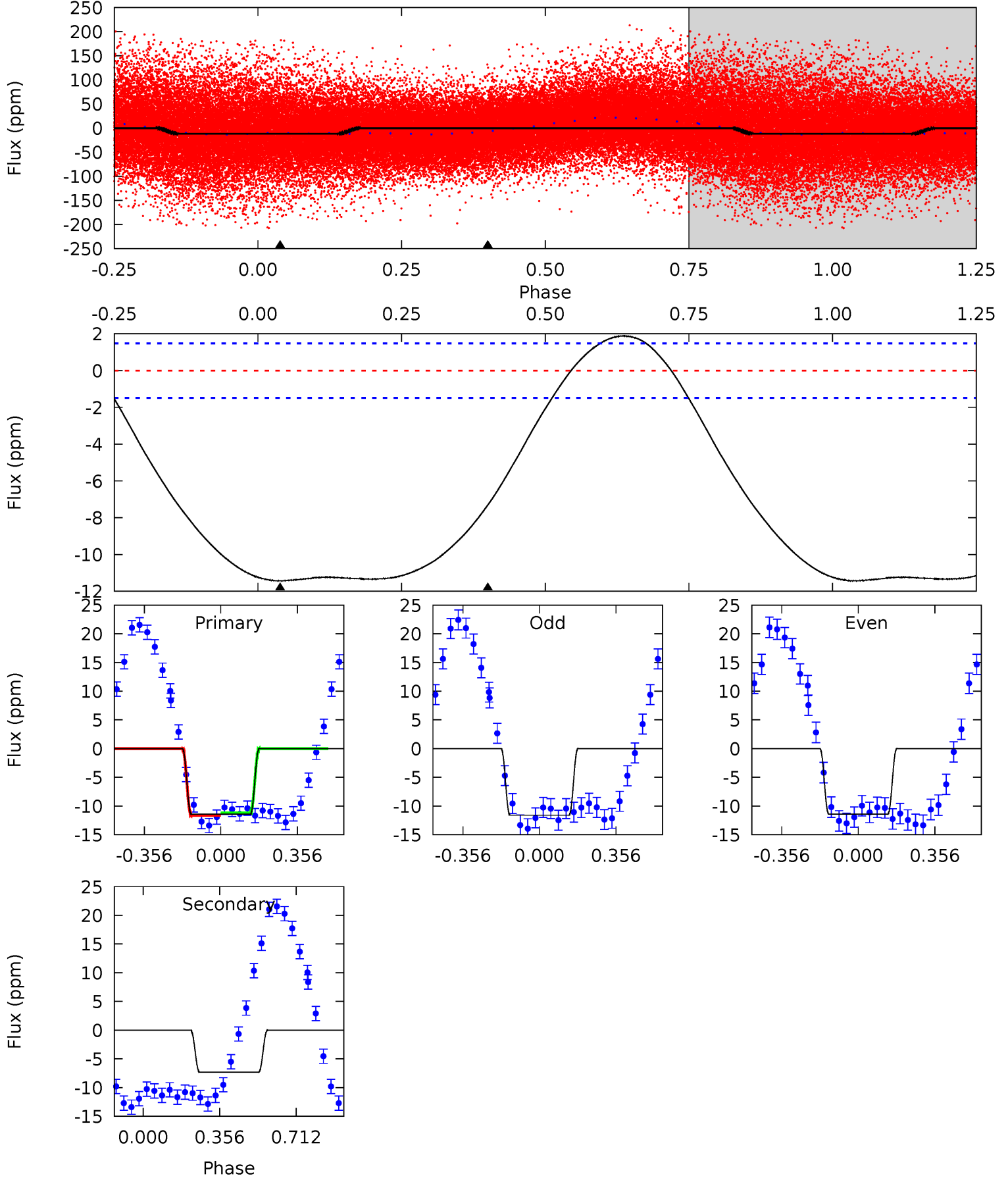
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
11.4	7.46	0	0	4.23	0.73	2.00	11.4	11.4	7.46	7.46	0.59	1.00	0.42	0.87



# Alt Model-Shift Uniqueness Test

006222381-02, P = 0.813632 Days, E = 131.145304 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
33.0	21.1	0	0	4.29	0.92	3.62	33.0	33.0	21.1	21.1	0.28	0.97	0.14	0.64





### Stellar Parameters For KIC 006222381

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$\rho_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$8283^{+66}_{-91}$	$3.761^{+0.256}_{-0.048}$	$-0.200^{+0.250}_{-0.200}$	$3.090^{+0.344}_{-0.963}$	$2.009^{+0.308}_{-0.205}$	$0.096^{+0.153}_{-0.016}$
	+1%/-1%	+7%/-1%	+125%/-100%	+11%/-31%	+15%/-10%	+159%/-16%
Source	SPE68	SPE68	SPE68	DSEP		

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

### Secondary Eclipse Parameters for KIC 006222381-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-2 \pm 0$	$0.45^{+0.32}_{-0.27}$	$6017^{+213}_{-478}$	$7490^{+7220}_{-2270}$	$2.114^{+9.465}_{-1.396}$
Alt.	$-7 \pm 0$	$1.04^{+0.34}_{-0.34}$	$6021^{+195}_{-410}$	$7005^{+2179}_{-1033}$	$1.793^{+2.023}_{-0.767}$

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

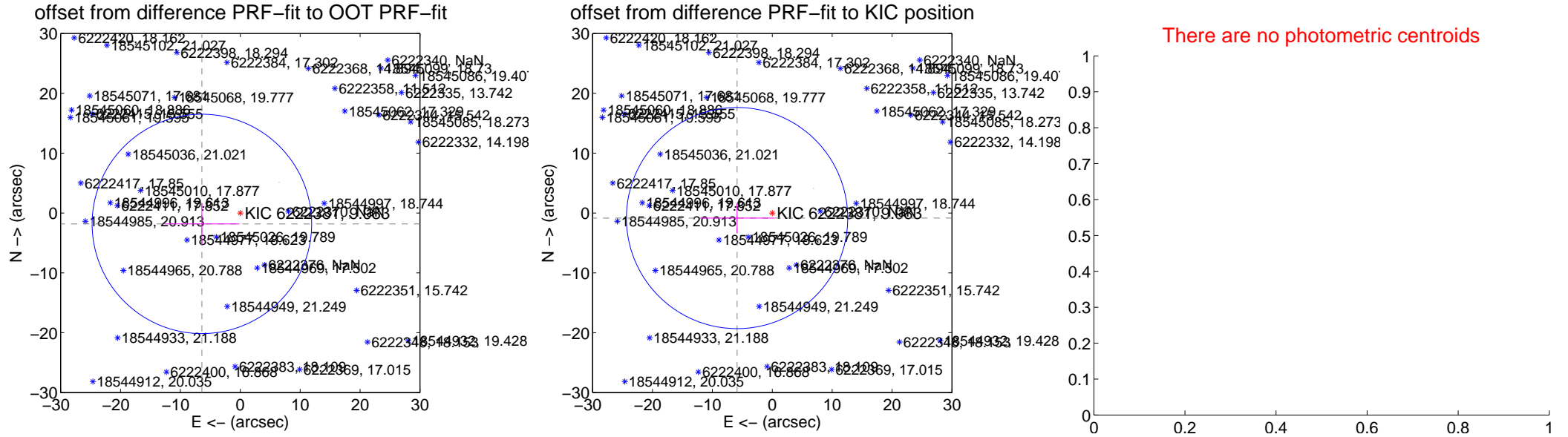
## DV Centroid Data

Supplemental centroid analysis for 006222381-02. **Kepler magnitude: 9.98.** Transit SNR 4.45

**There are 0 quarters with good PRF difference image offsets**

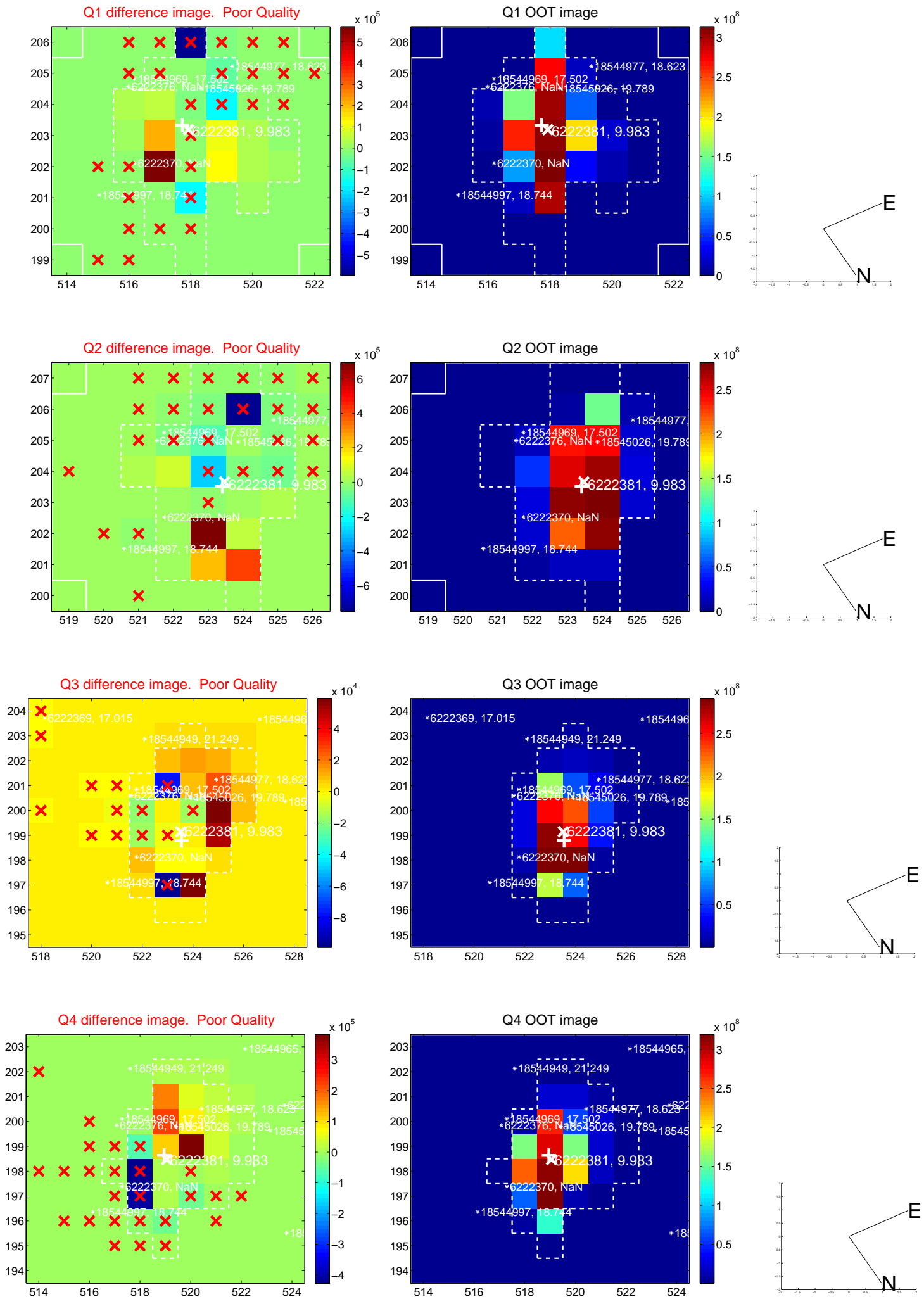
The direct PRF centroid is offset from the target star catalog position by about 1.45 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$6.665 \pm 6.109$	1.09	$6.411 \pm 6.274$	$-1.821 \pm 3.452$
PRF-fit source offset from KIC position	$5.936 \pm 6.158$	0.96	$5.876 \pm 6.211$	$-0.847 \pm 2.466$
photometric centroid source offset	—	—	—	—



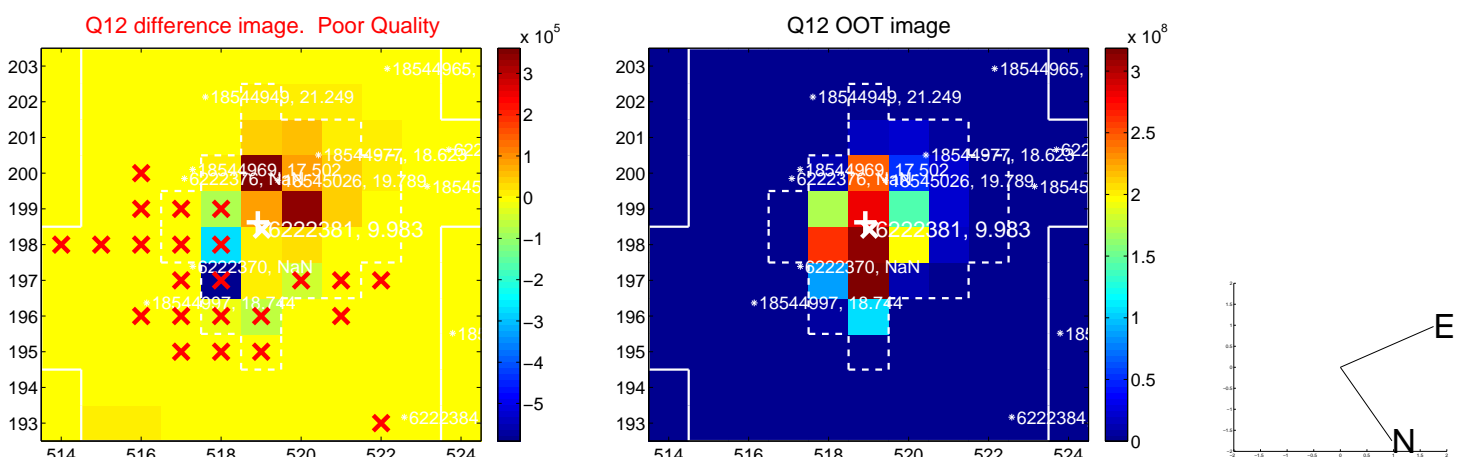
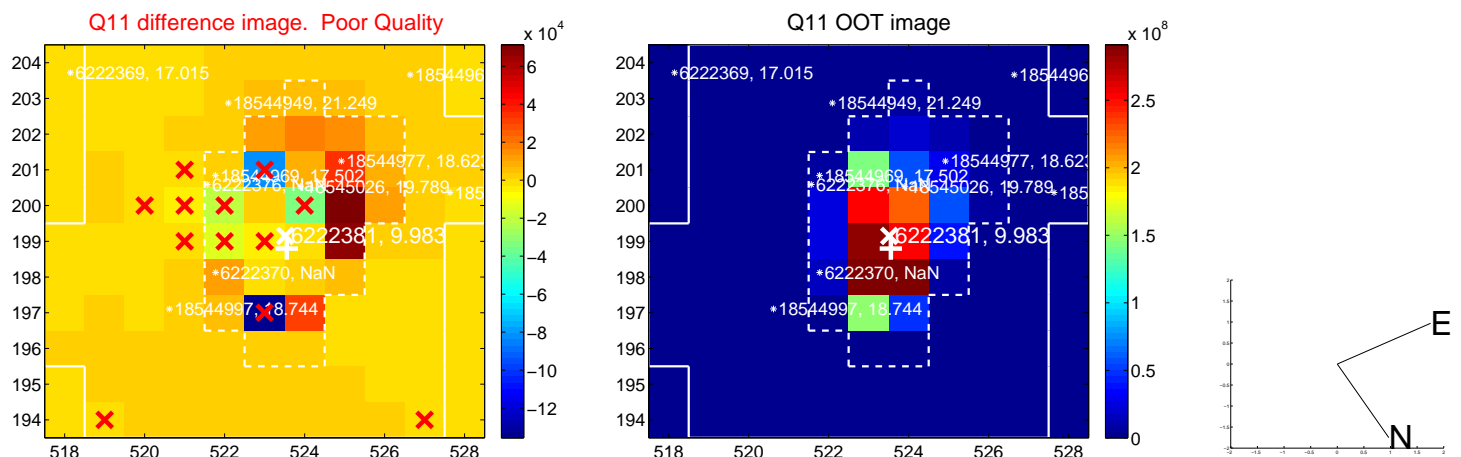
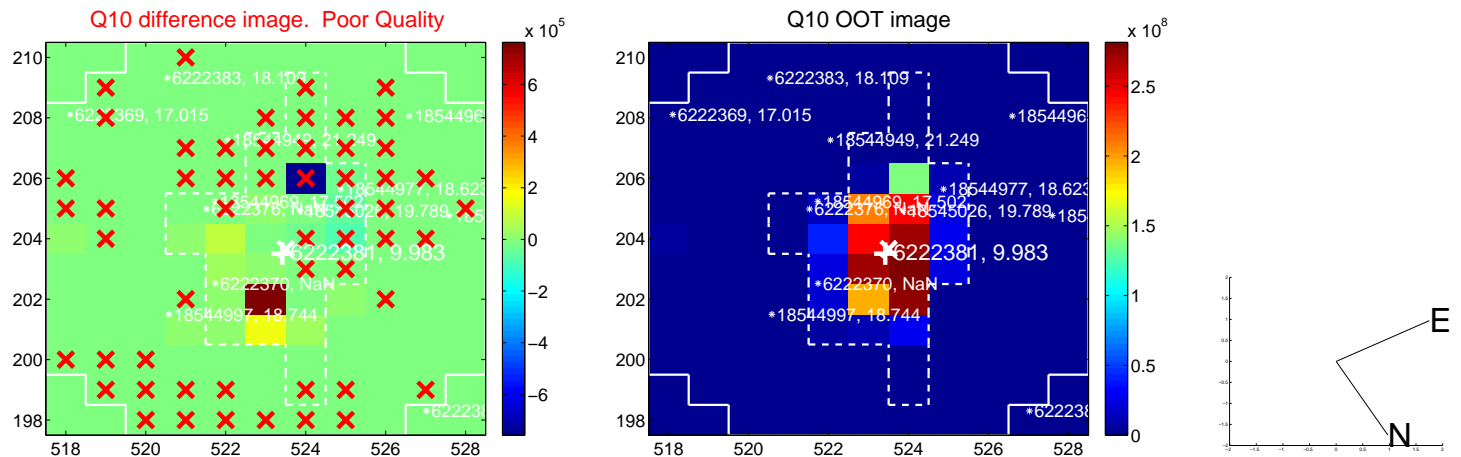
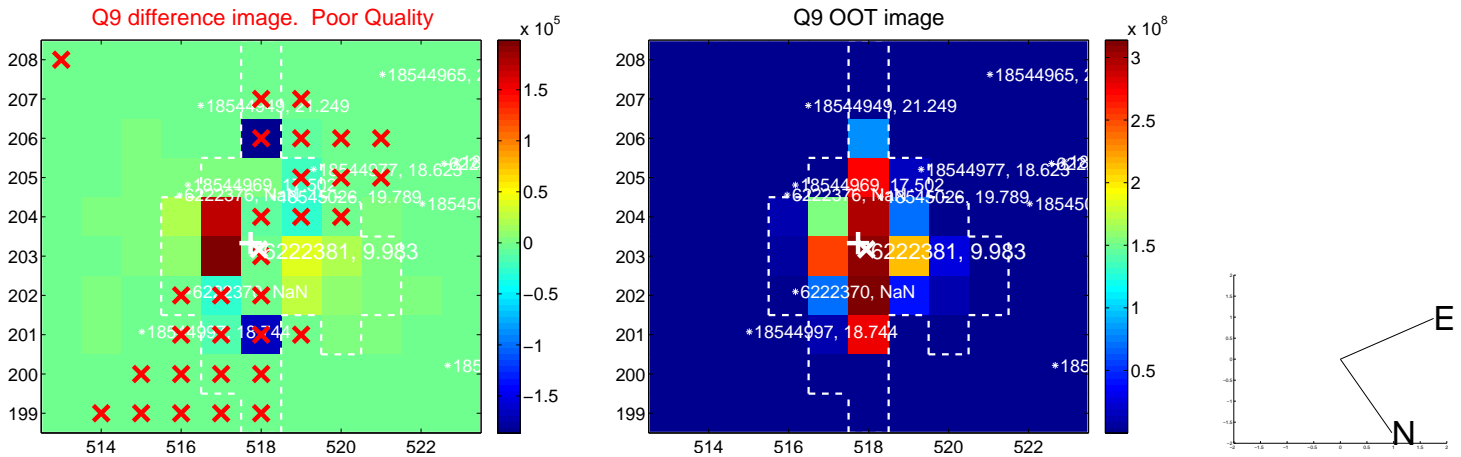
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

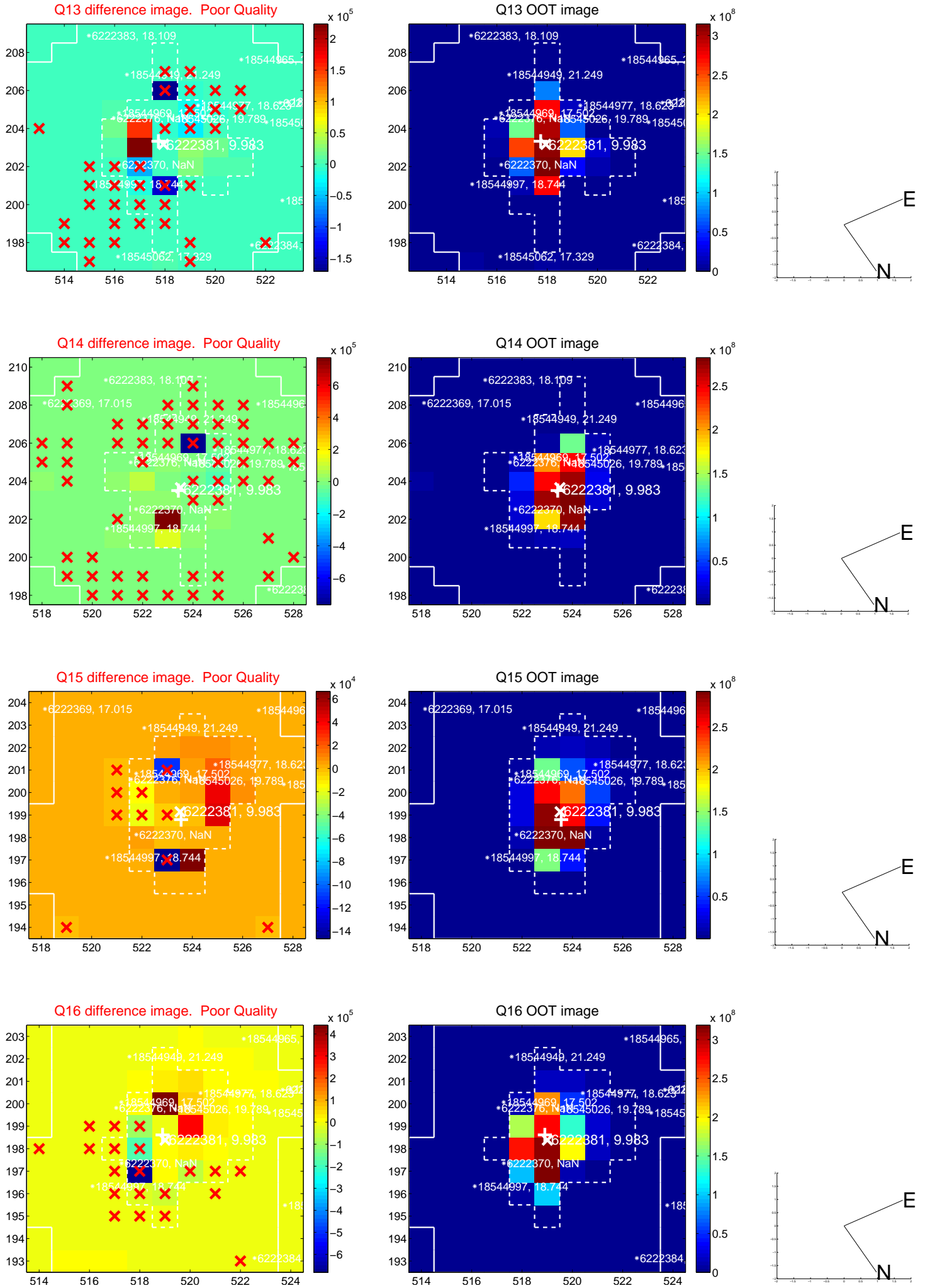




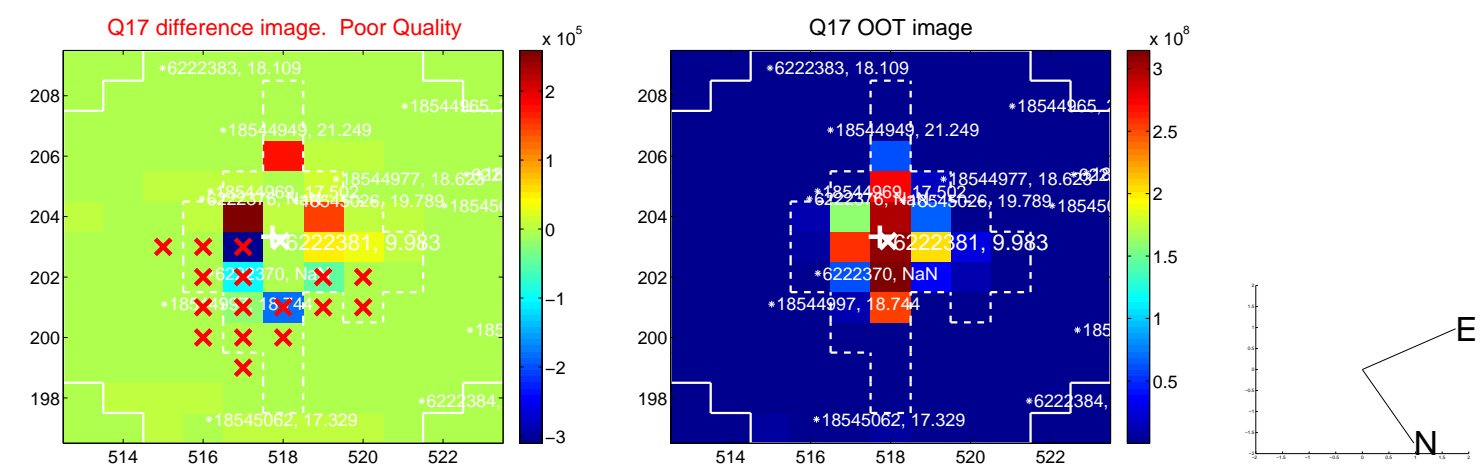
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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.



folded centroid time series figure for this object.

UKIRT Image

