

# KIC 008822216

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
008822216-01	OBS	0581.01	6.996909	133.934278	1309.3	2.858	93.7	96.8	0.89	5713	3.51	147.36
008822216-02	OBS	0581.02	151.865105	143.309772	737.4	8.730	13.3	14.9	0.89	5713	2.49	2.43
008822216-03	OBS	No	467.239651	511.974648	604.2	4.686	7.3	7.2	0.89	5713	2.36	0.54

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
008822216-01	OBS	PC	1.00	0	0	0	0	NO_COMMENT
008822216-02	OBS	PC	0.96	0	0	0	0	NO_COMMENT
008822216-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_CHASES_MARSHALL—ALL_TRANS_CHASES—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS

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

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

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

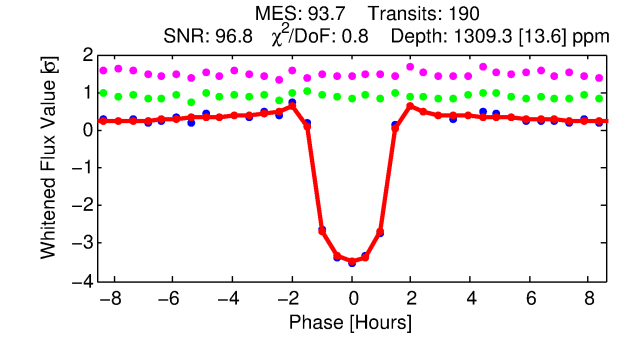
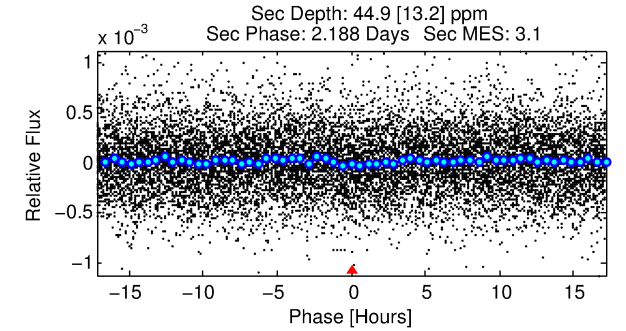
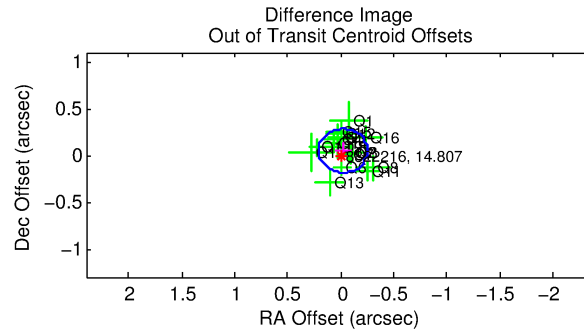
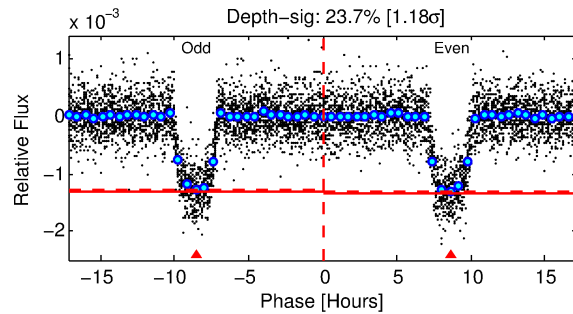
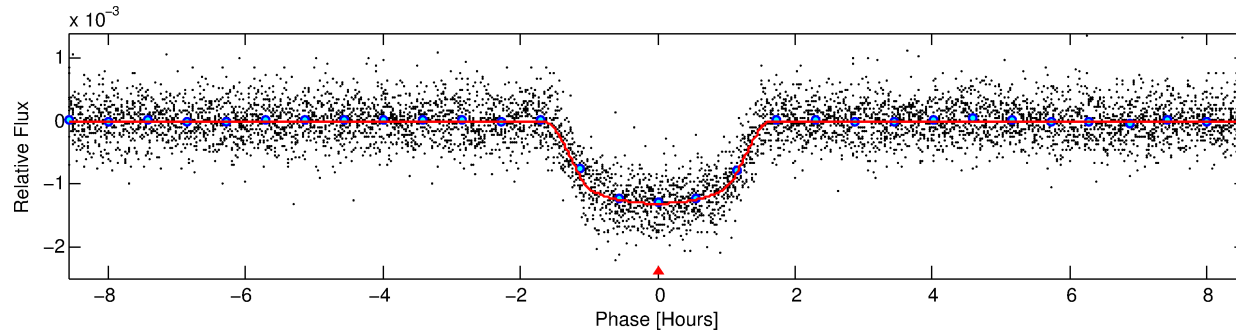
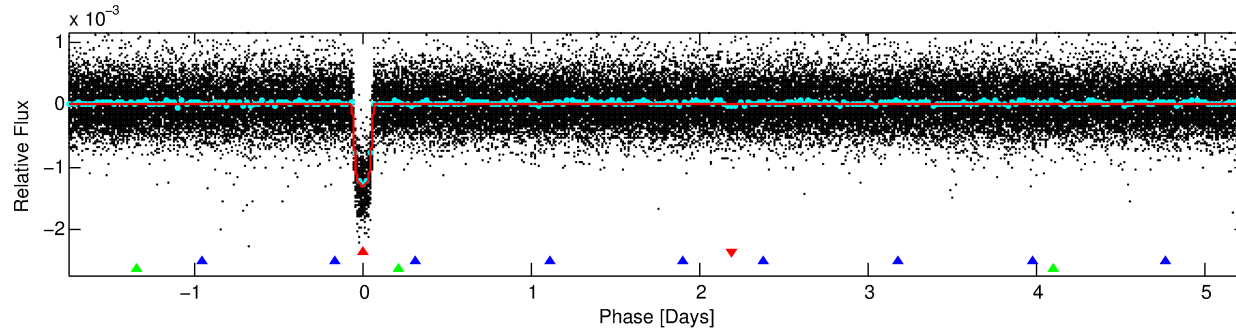
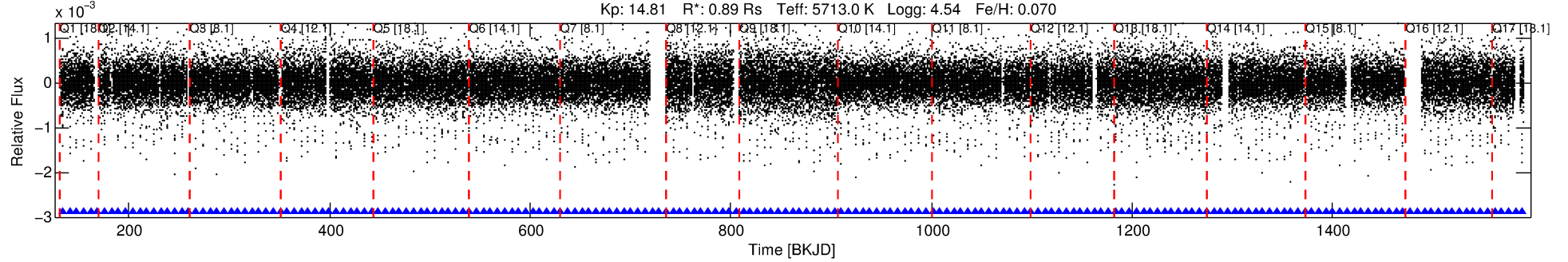
Ephemeris Match Information For 008822216-01

No Significant Match Found

# DV One-Page Summary

KIC: 8822216 Candidate: 1 of 3 Period: 6.997 d  
KOI: K00581.01 Corr: 0.979

Kp: 14.81 R\*: 0.89 Rs Teff: 5713.0 K Logg: 4.54 Fe/H: 0.070



## DV Fit Results:

Period = 6.99691 [0.00000] d  
Epoch = 133.9343 [0.0005] BKJD  
Rp/R\* = 0.0360 [0.0025]  
a/R\* = 13.46 [3.87]  
b = 0.75 [0.17]  
Seff = 147.36 [48.19]  
Teff = 888 [73] K  
Rp = 3.51 [0.88] Re  
a = 0.0719 [0.0148] AU  
Ag = 10.36 [4.60] [2.04σ]  
Teffp = 2464 [213] K [7.01σ]

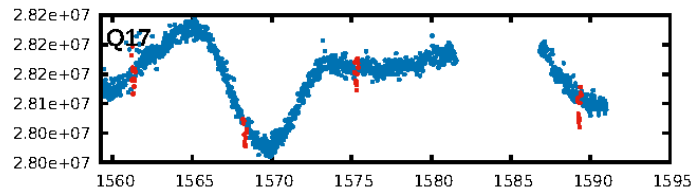
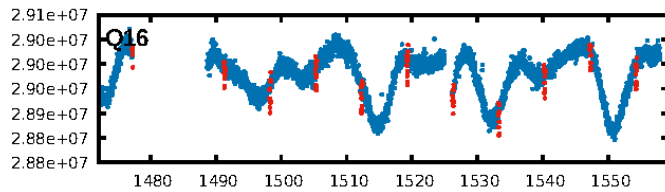
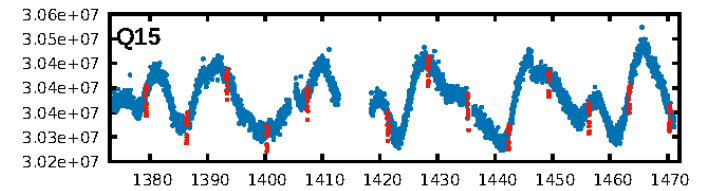
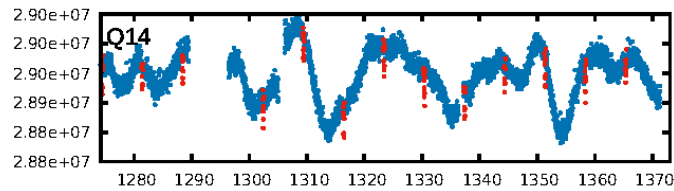
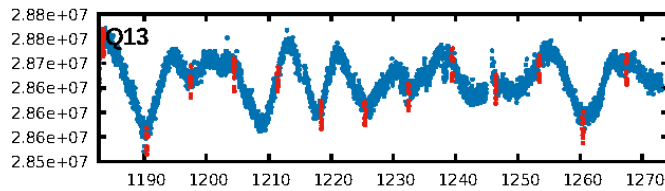
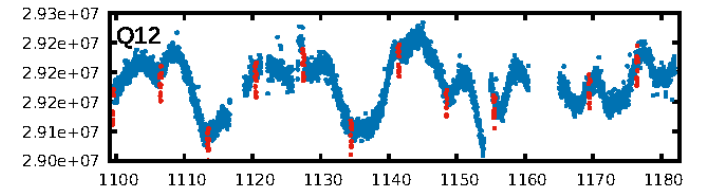
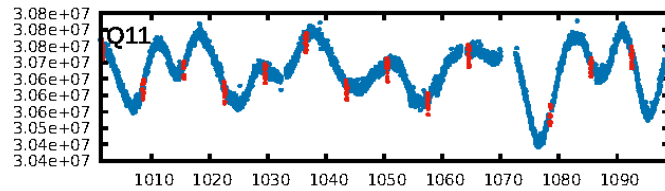
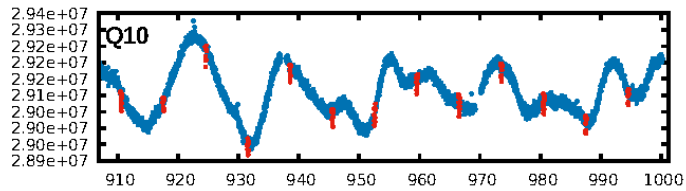
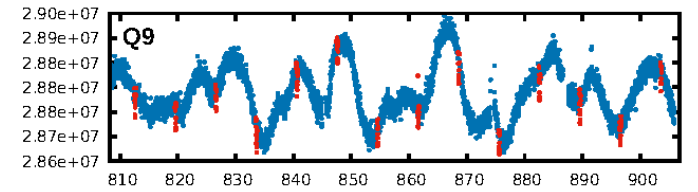
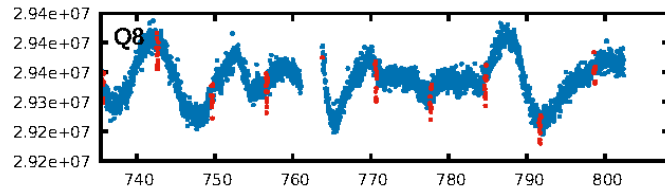
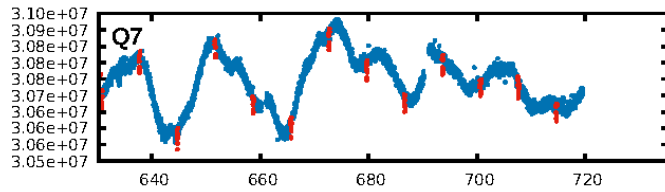
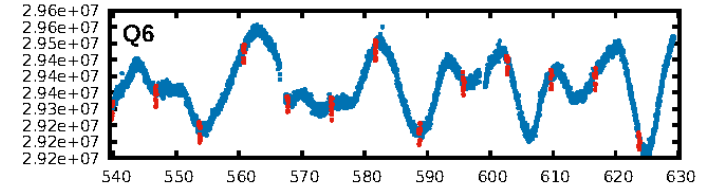
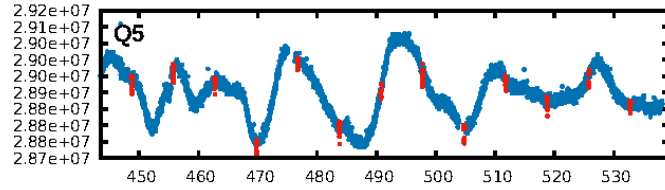
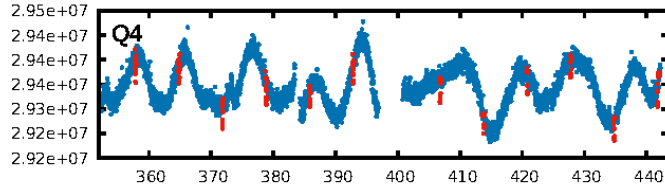
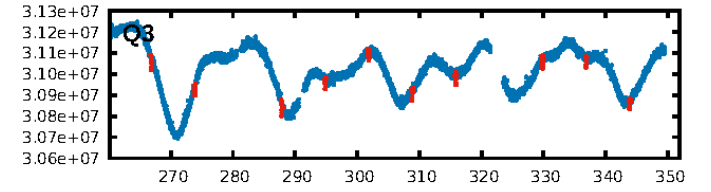
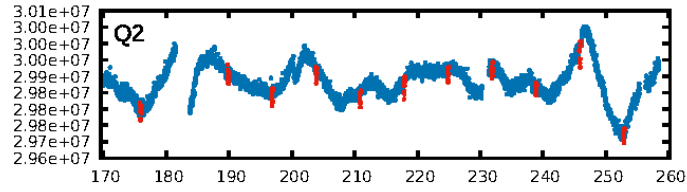
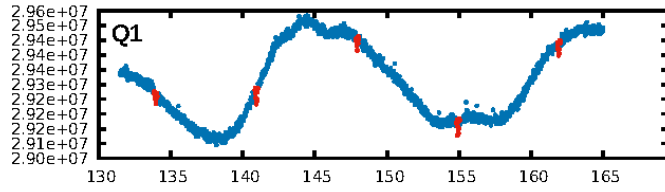
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [378.49σ]  
ModelChiSquare2-sig: 100.0%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 0.00e+00  
RollingBand-fgt: 1.00 [181/181]  
GhostDiagnostic-chr: 4.886  
Centroid-sig: 0.0%  
Centroid-so: 0.160 arcsec [1.30σ]  
OotOffset-rm: 0.053 arcsec [0.69σ]  
KicOffset-rm: 0.040 arcsec [0.51σ]  
OotOffset-st: 4/4/4/5 [17]  
KicOffset-st: 4/4/4/5 [17]  
DiffImageQuality-fgm: 1.00 [17/17]  
DiffImageOverlap-fno: 1.00 [17/17]

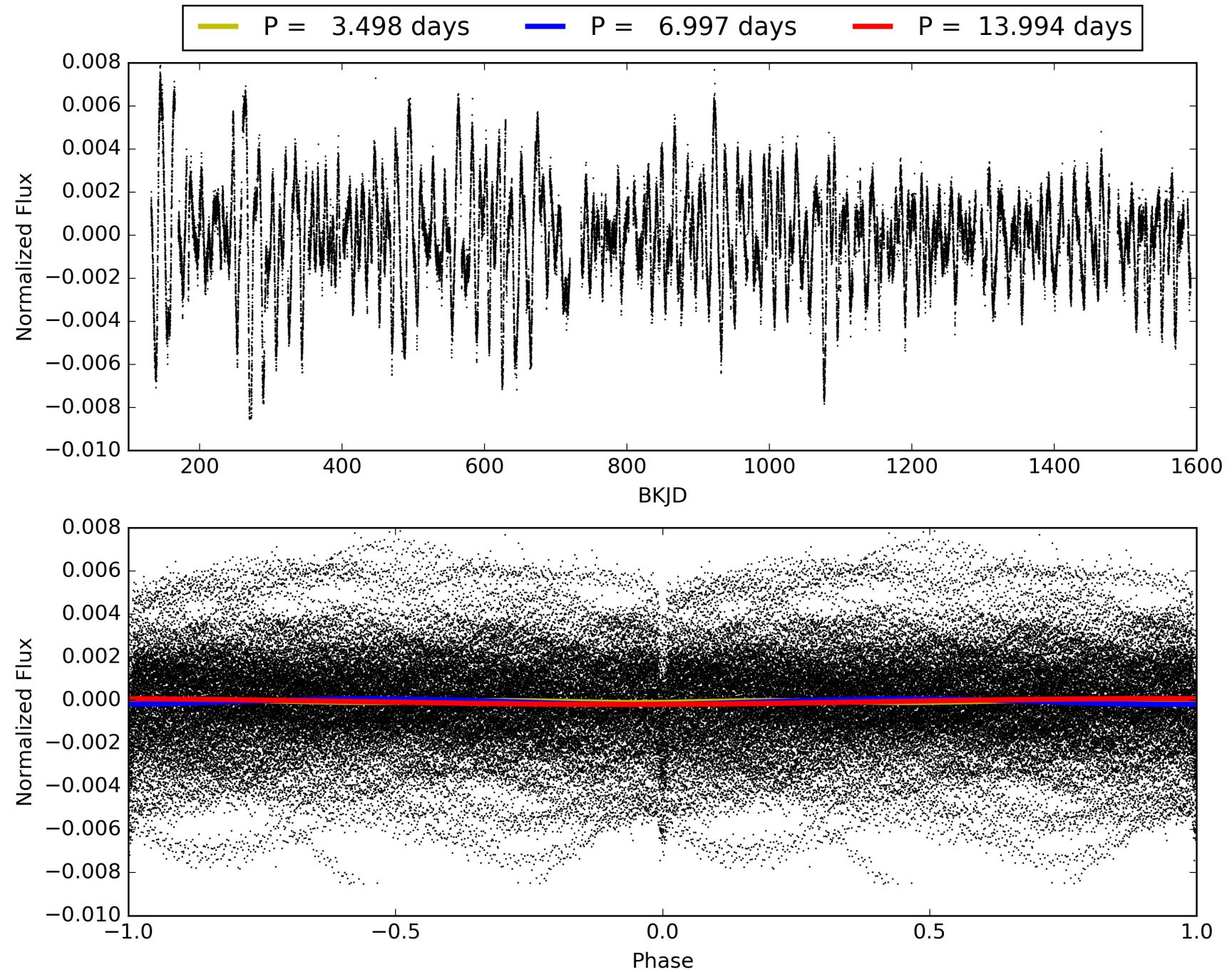
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 01-Feb-2016 02:08:39 Z

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

# TCE 008822216-01, PDC Light Curves

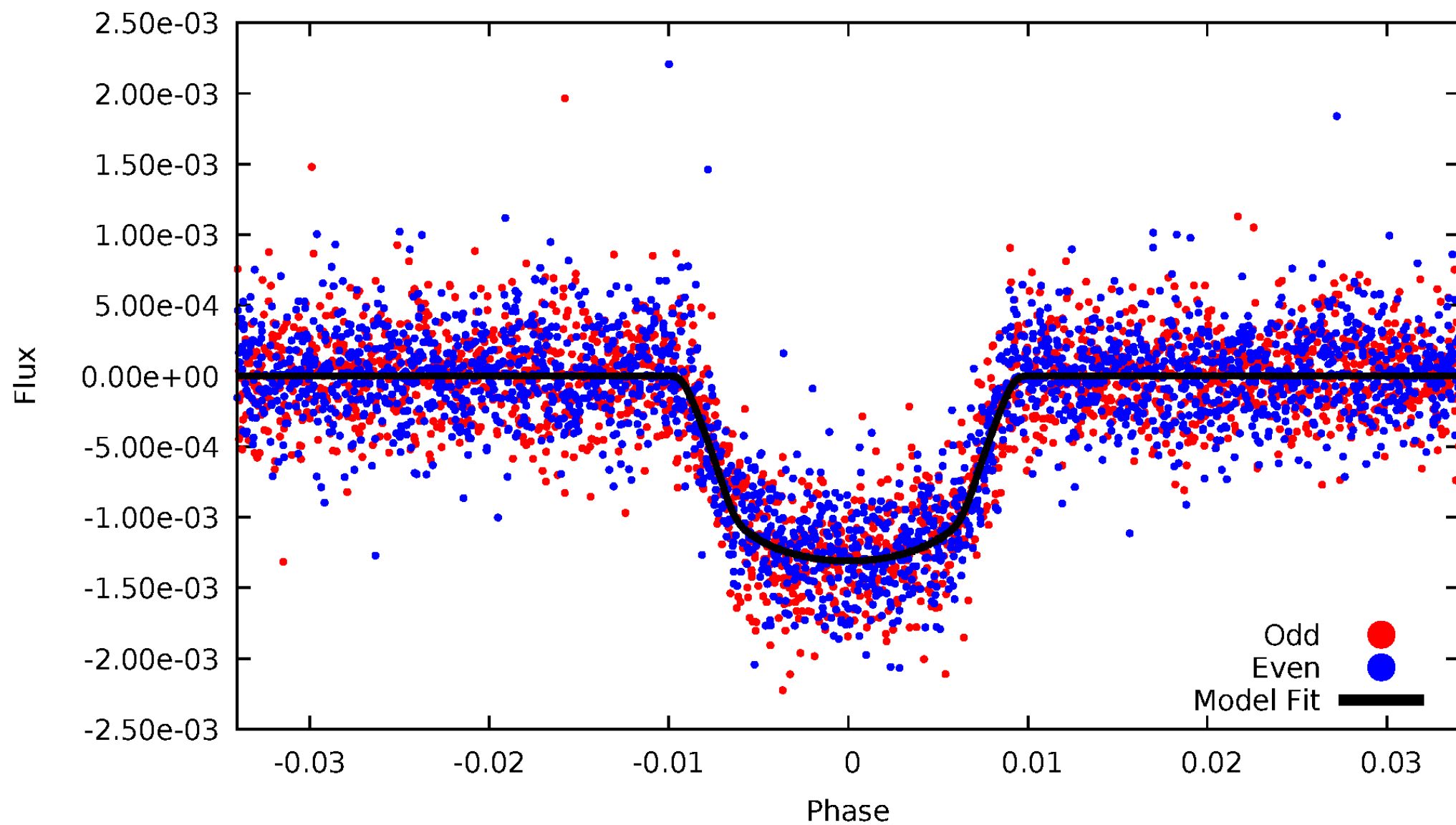


TCE 008822216-01



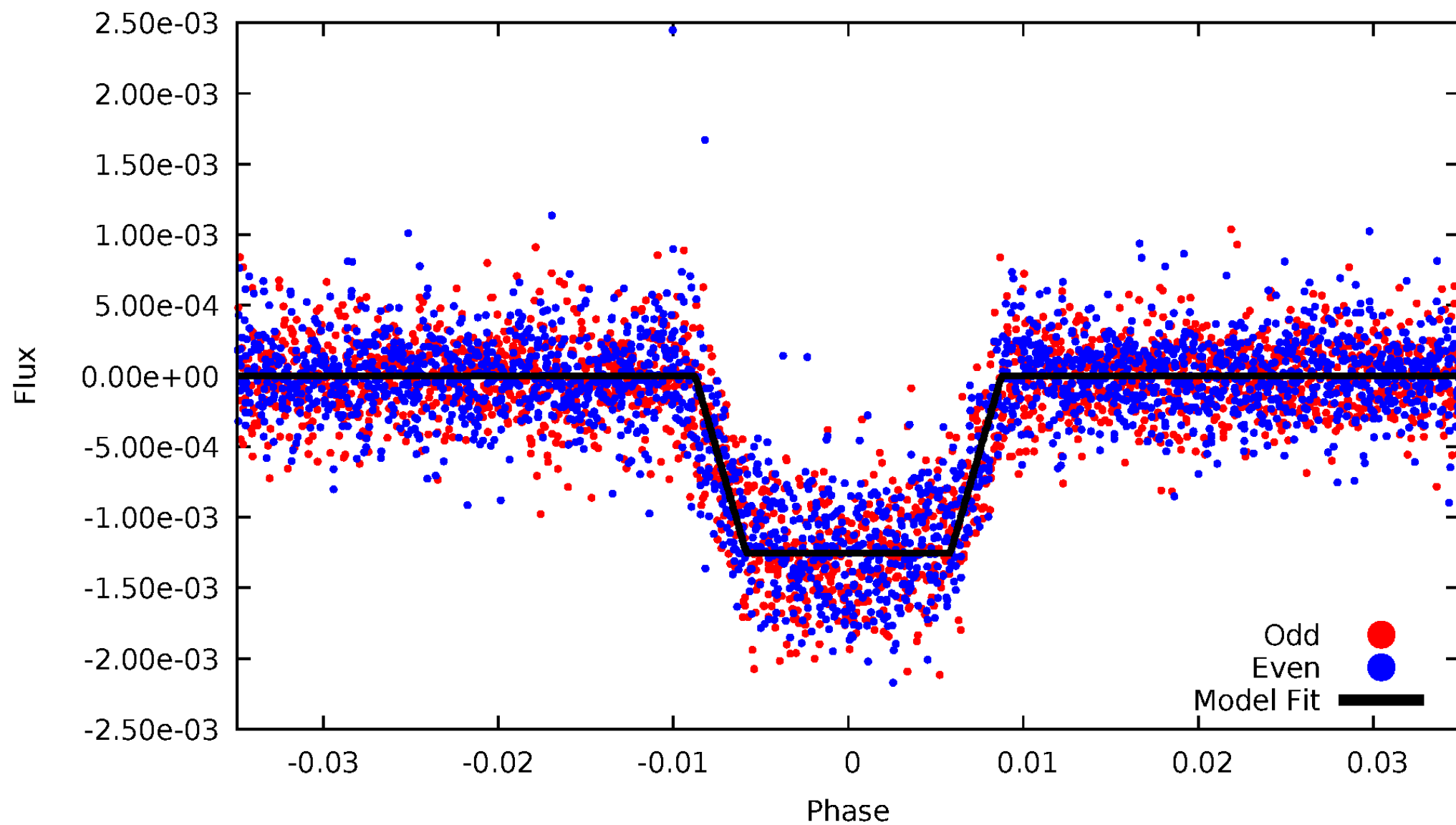
# DV Odd/Even

TCE 008822216-01



# ALT Odd/Even

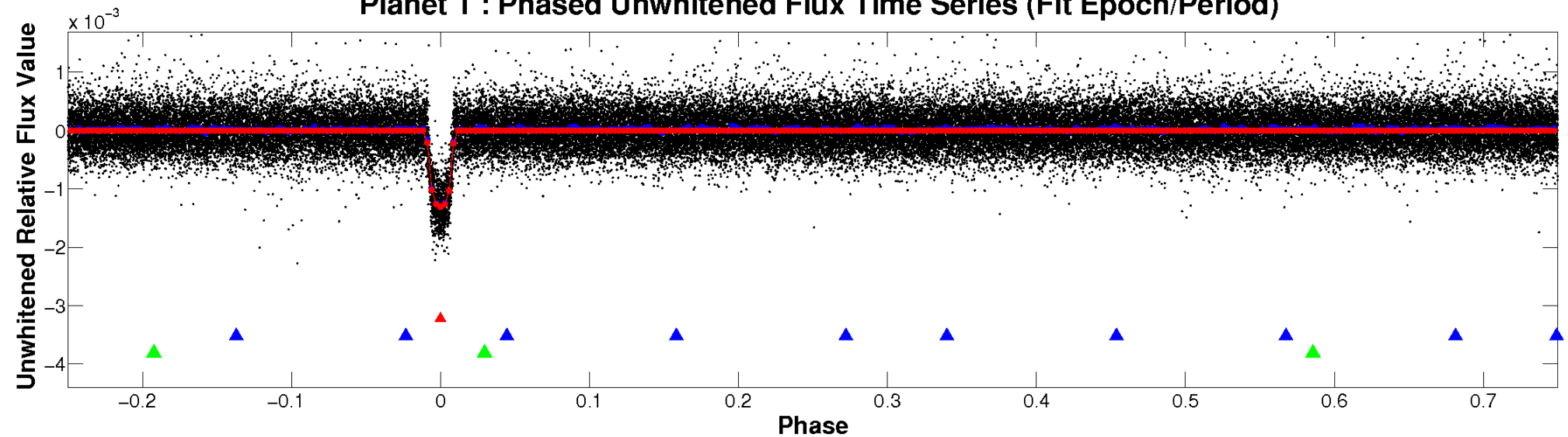
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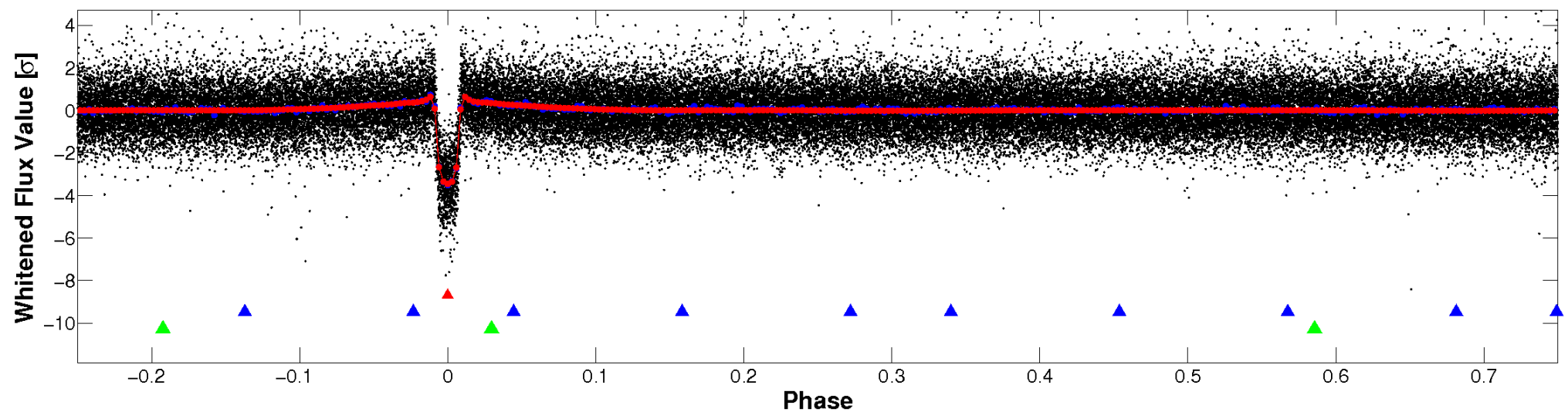


# Non-Whitened Vs. Whitened Light Curve

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

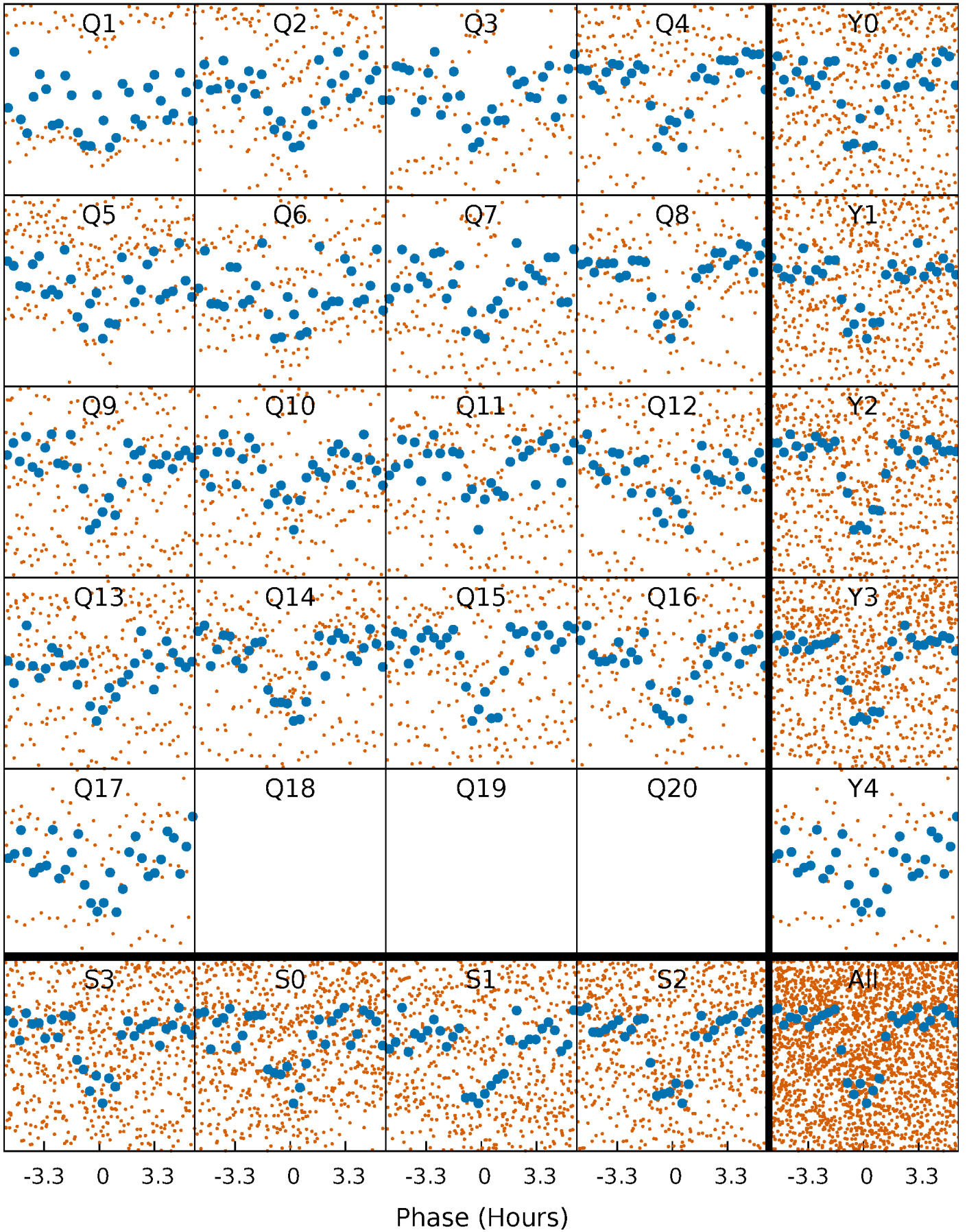


**Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)**



# PDC Quarter-Phased Transit Curves

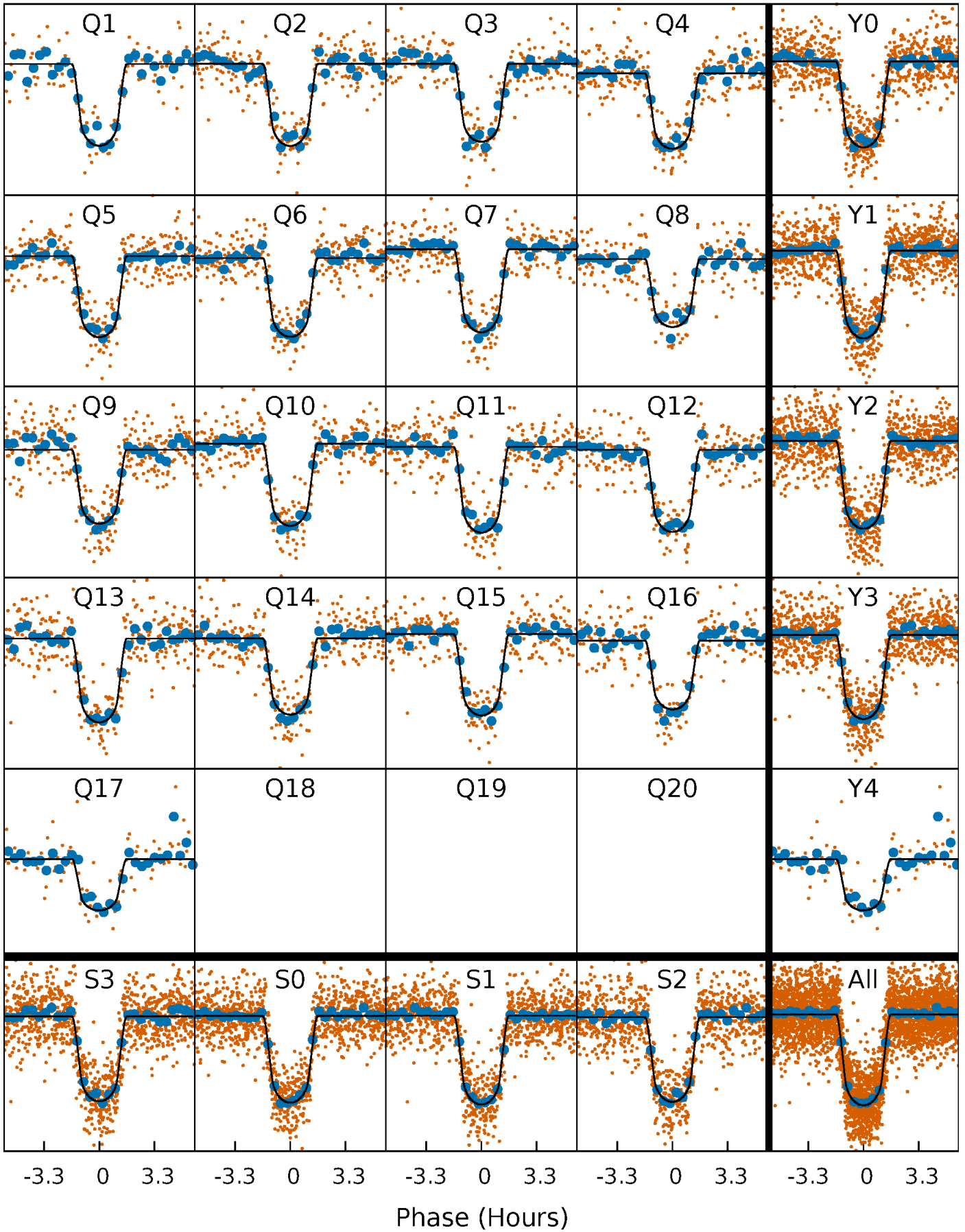
TCE 008822216-01 P= 6.996909 Days  $T_0=133.934278$  (BKJD)





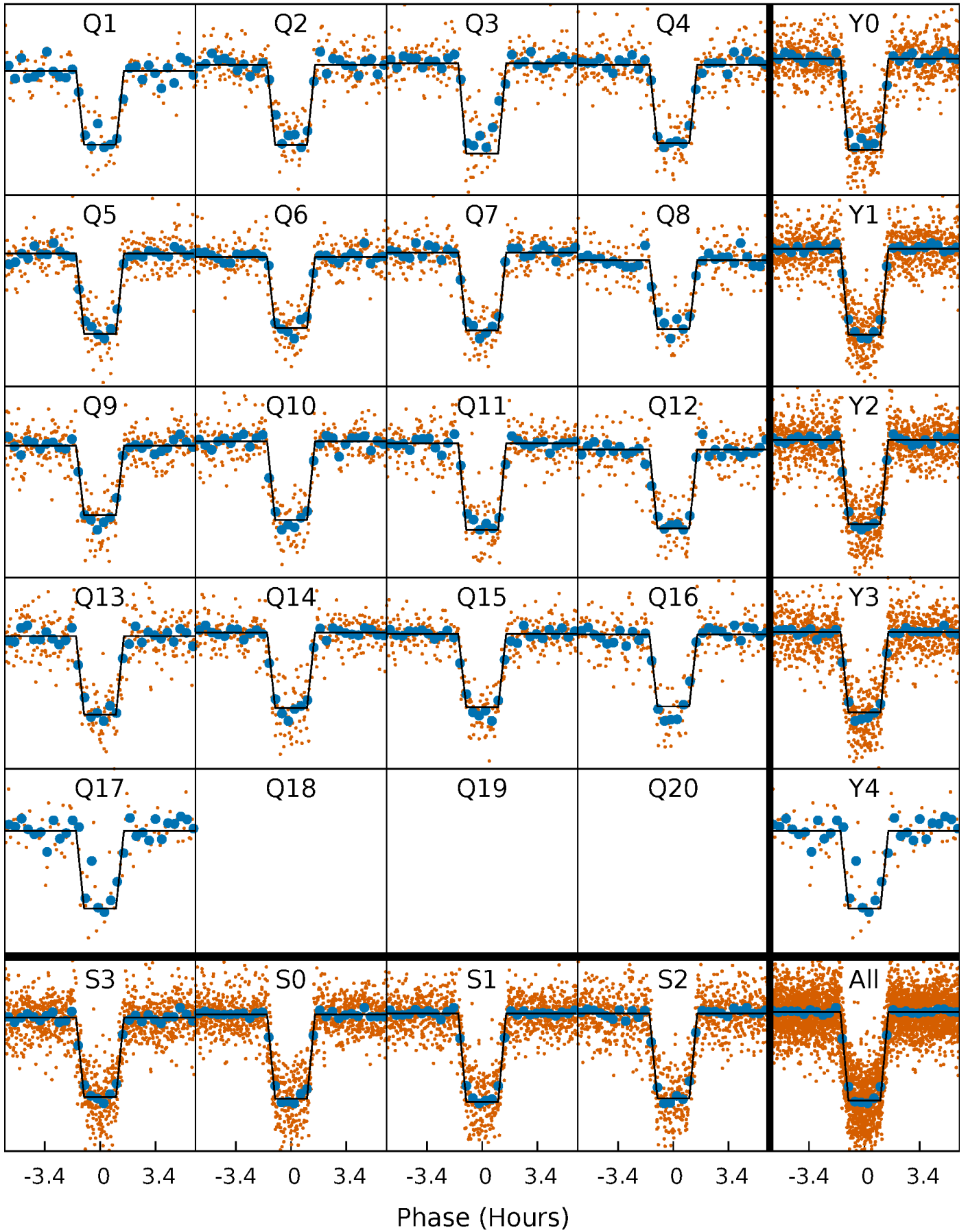
# DV Quarter-Phased Transit Curves

TCE 008822216-01   P= 6.996909 Days    $T_0=133.934278$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

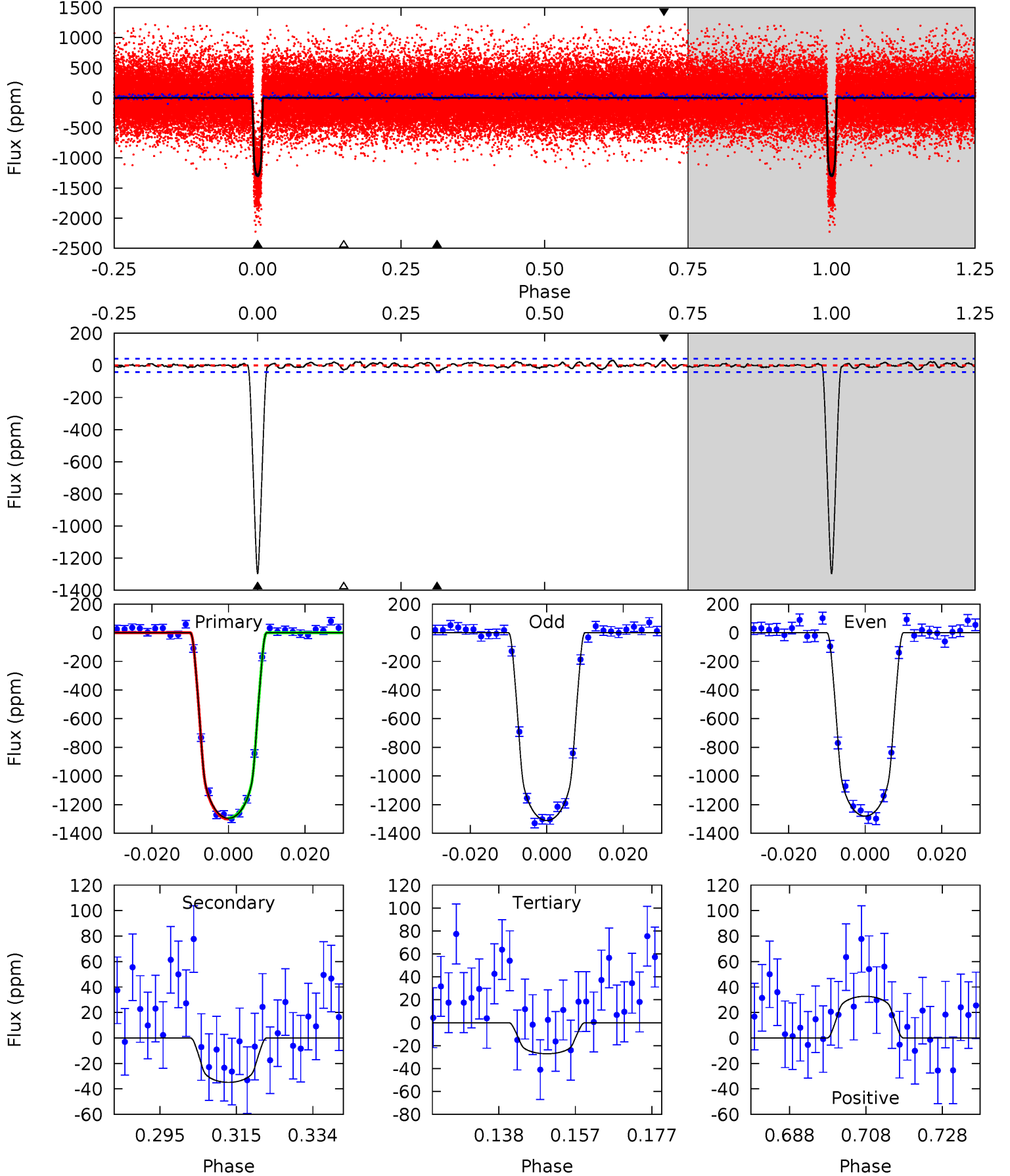
TCE 008822216-01 P= 6.996931 Days  $T_0=133.932185$  (BKJD)



# DV Model-Shift Uniqueness Test

008822216-01, P = 6.996909 Days, E = 126.937369 Days

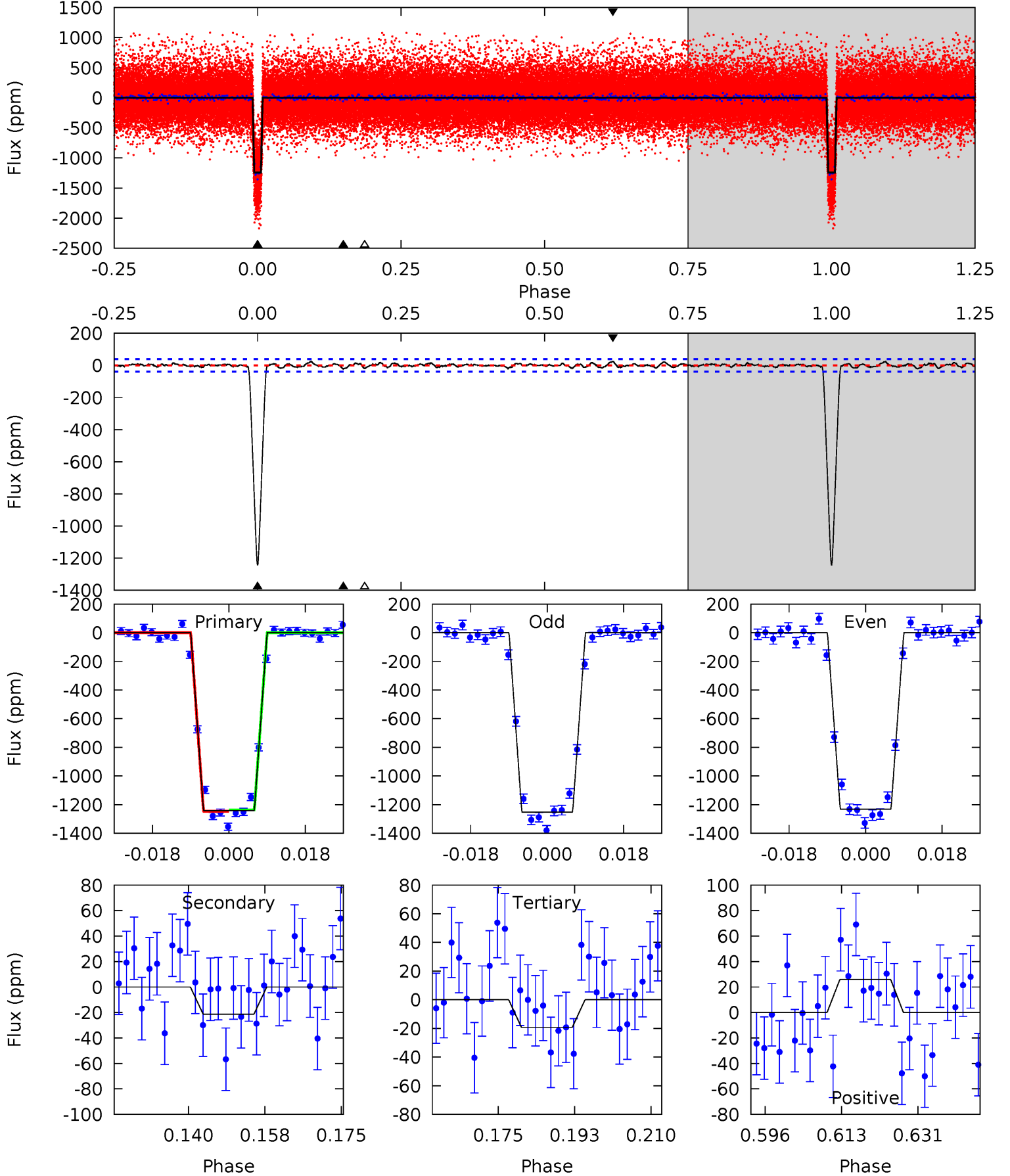
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
153.3	4.13	3.21	3.87	4.89	2.33	1.26	150.1	149.5	0.92	0.25	1.81	0.99	0.02	0.44



# Alt Model-Shift Uniqueness Test

008822216-01, P = 6.996931 Days, E = 126.935254 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
156.1	2.67	2.42	3.25	4.92	2.38	0.97	153.6	152.8	0.25	-0.58	1.29	0.98	0.02	0.59



### Stellar Parameters For KIC 008822216

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5713^{+138}_{-173}$	$4.541^{+0.042}_{-0.168}$	$0.070^{+0.200}_{-0.350}$	$0.893^{+0.215}_{-0.086}$	$1.010^{+0.083}_{-0.134}$	$2.000^{+0.346}_{-0.949}$
	+2%/-3%	+1%/-4%	+286%/-500%	+24%/-10%	+8%/-13%	+17%/-47%
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 008822216-01 / KOI 0581.01

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-35 \pm 8$	$3.63^{+0.48}_{-0.38}$	$1268^{+75}_{-55}$	$2958^{+135}_{-136}$	$7.096^{+2.856}_{-2.111}$
Alt.	$-21 \pm 8$	$3.54^{+0.51}_{-0.34}$	$1261^{+69}_{-50}$	$2774^{+151}_{-188}$	$4.607^{+2.111}_{-1.812}$

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



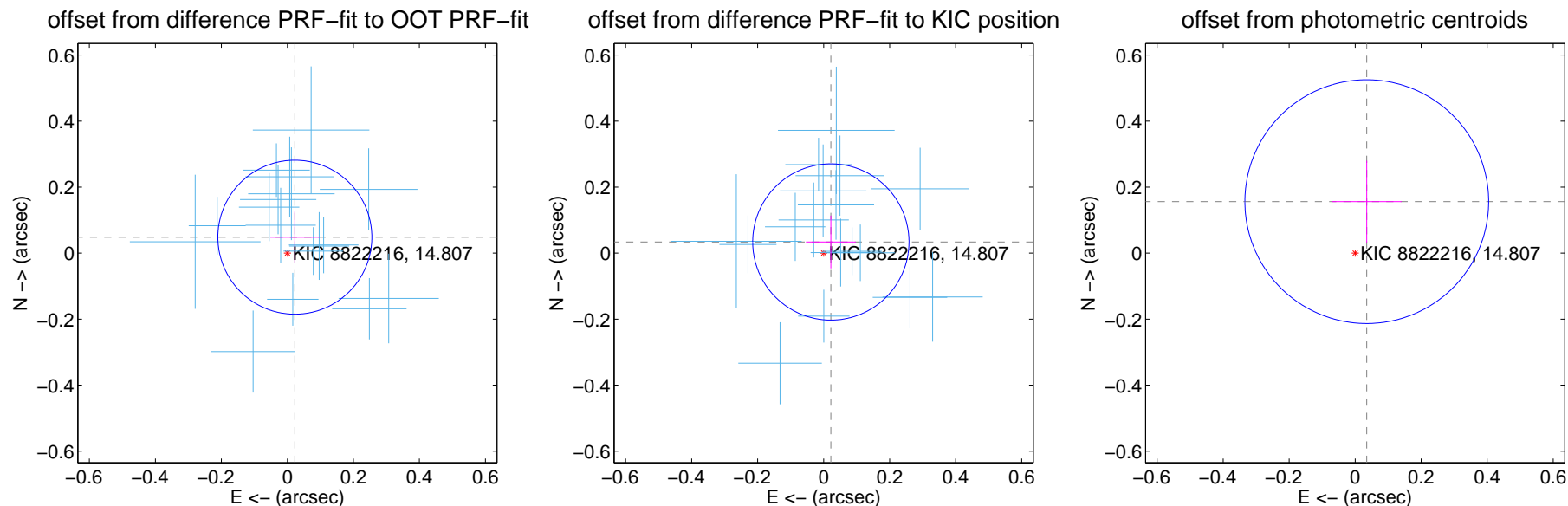
## DV Centroid Data

Supplemental centroid analysis for 008822216-01. Kepler magnitude: 14.81. Transit SNR 96.78

There are 17 quarters with good PRF difference image offsets

The direct PRF centroid is offset from the target star catalog position by about 0.01 arcsec

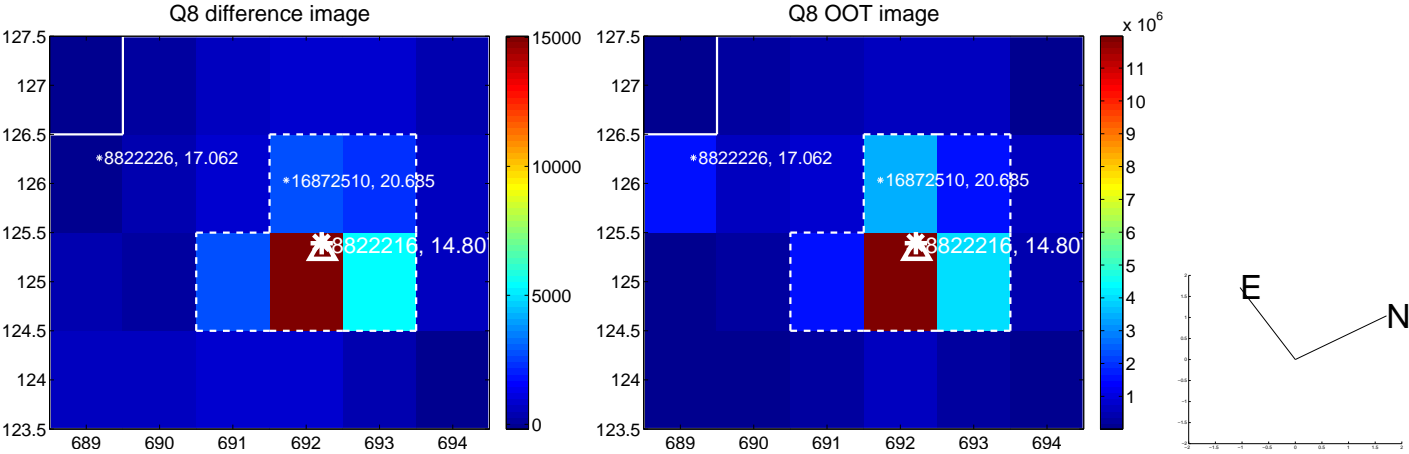
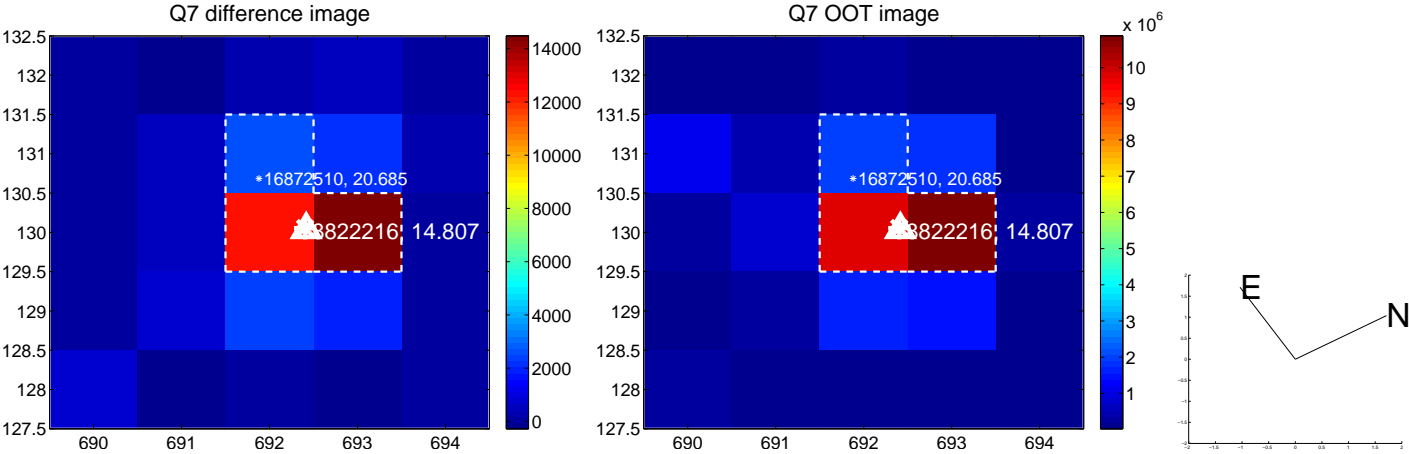
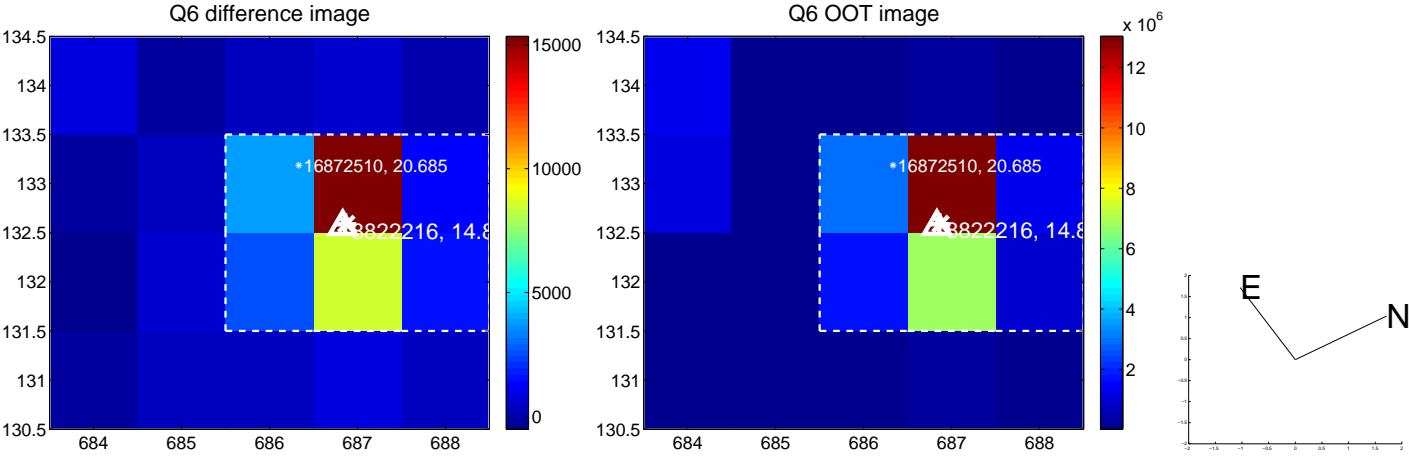
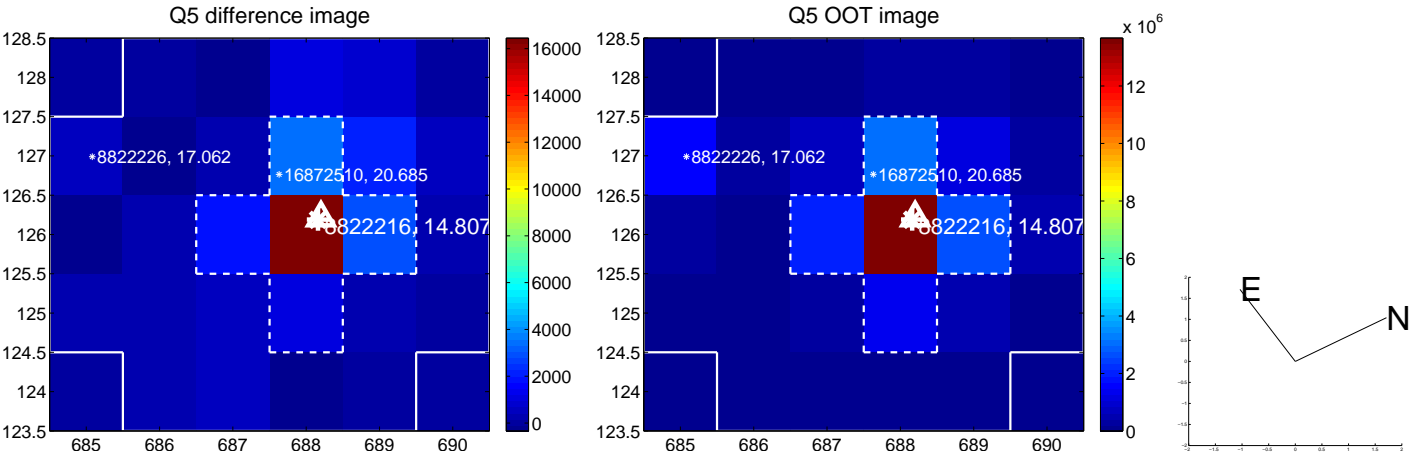
	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.053 \pm 0.078$	0.69	$-0.023 \pm 0.075$	$0.048 \pm 0.078$
PRF-fit source offset from KIC position	$0.040 \pm 0.079$	0.51	$-0.022 \pm 0.075$	$0.034 \pm 0.080$
photometric centroid source offset	$0.16 \pm 0.12$	1.30	$-0.04 \pm 0.11$	$0.16 \pm 0.12$



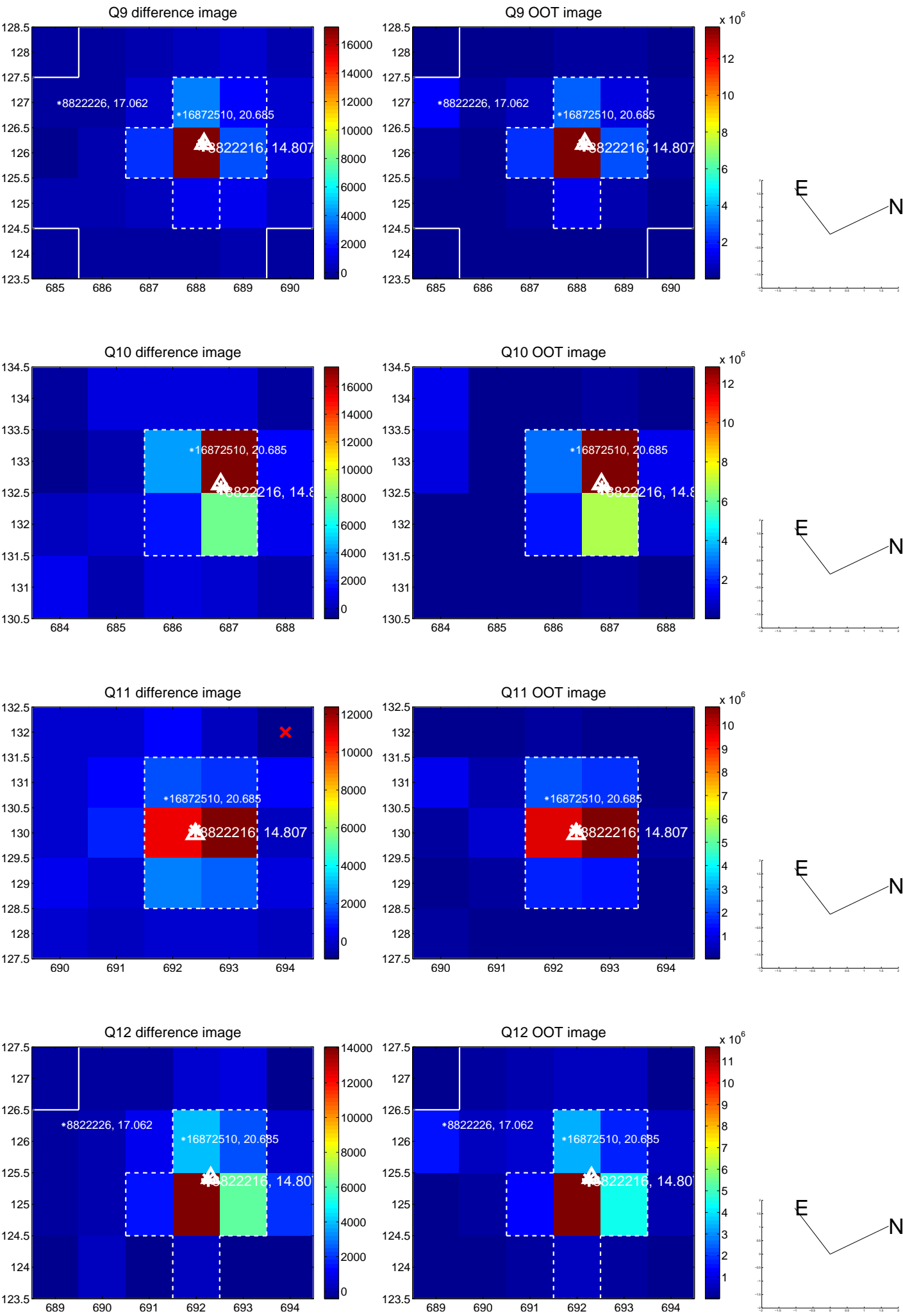
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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



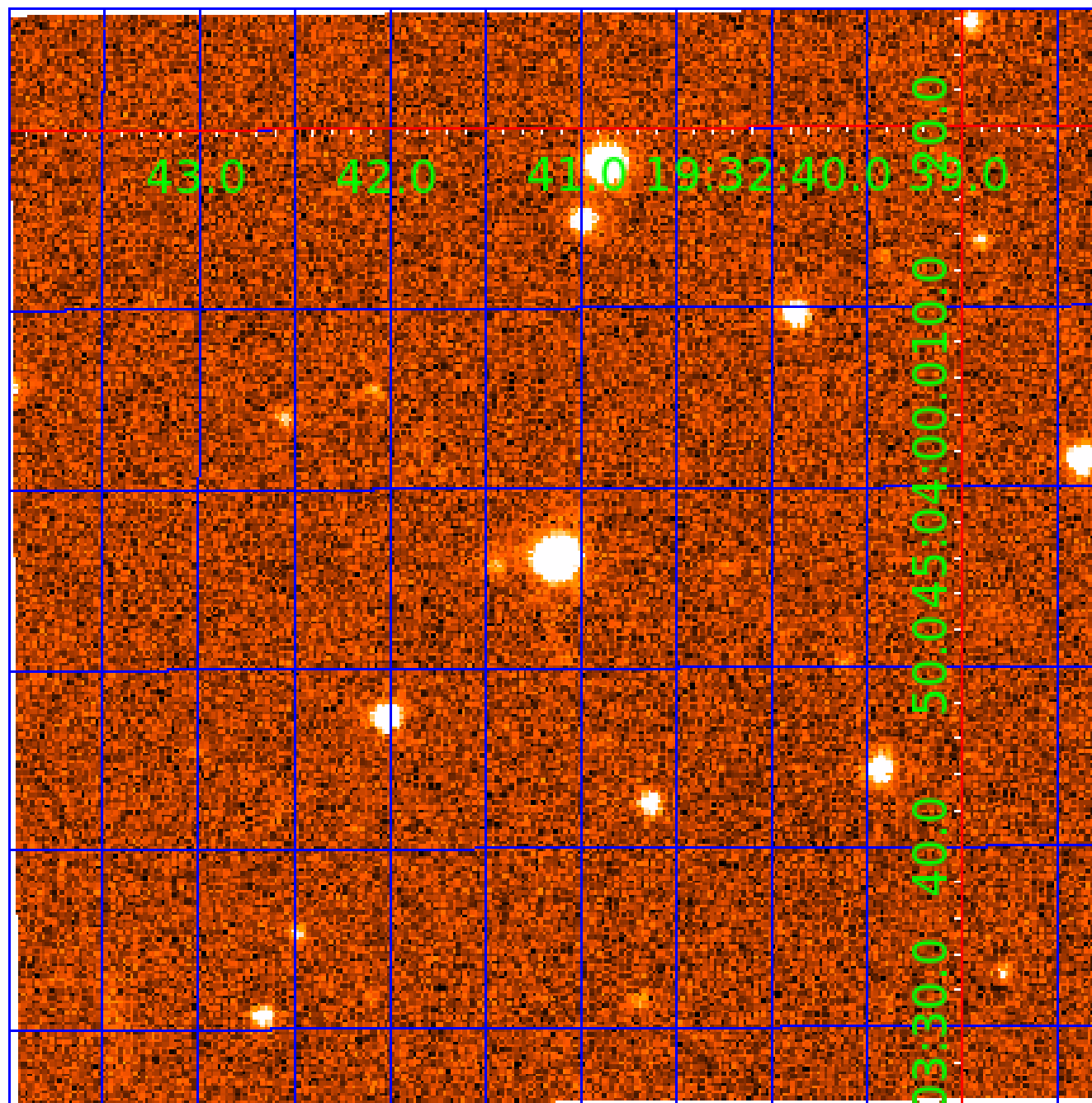






# UKIRT Image

Declination



# KIC 008822216

## Q1-17 DR25 TCE Parameters

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008822216-02	OBS	PC	0.96	0	0	0	0	NO_COMMENT
008822216-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_CHASES_MARSHALL—ALL_TRANS_CHASES—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS

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

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

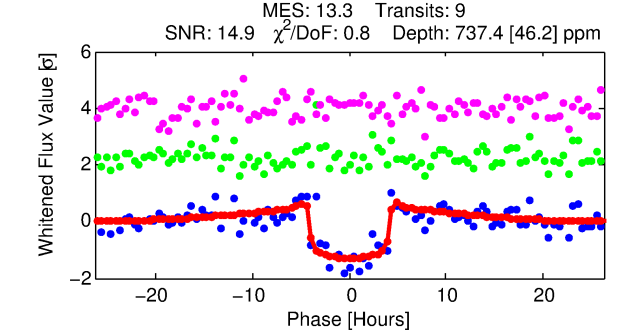
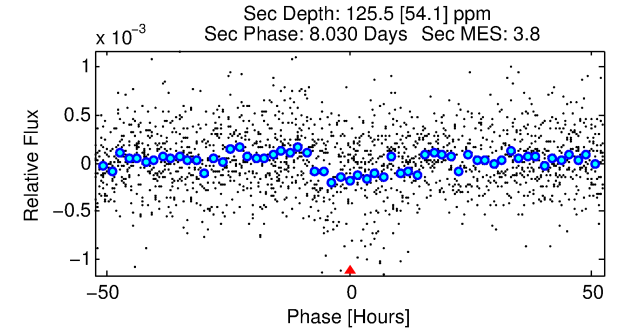
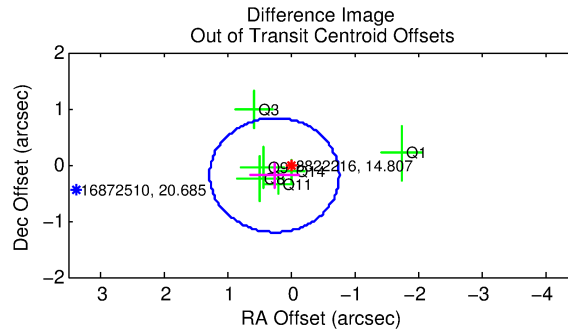
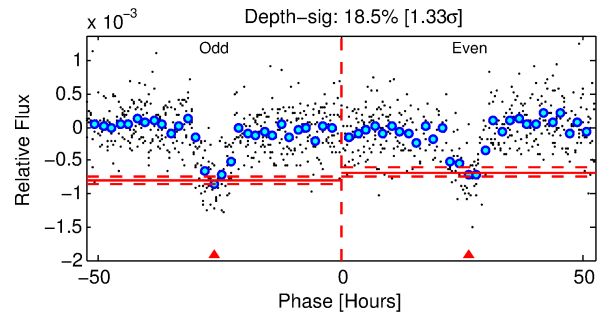
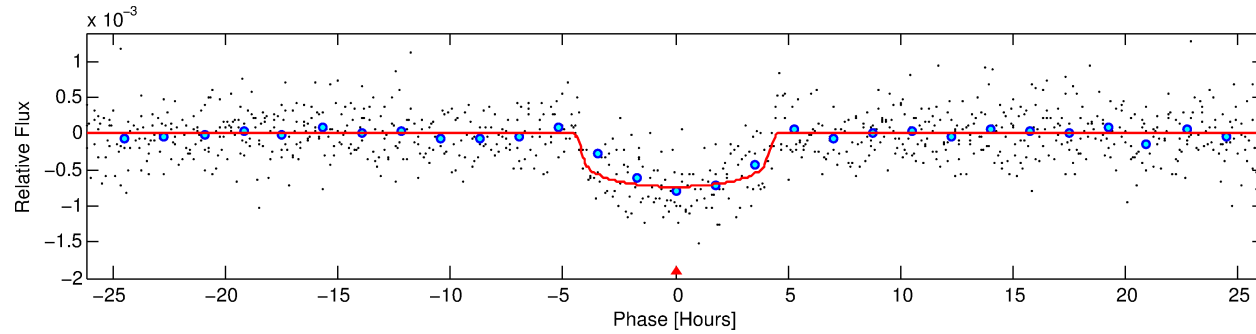
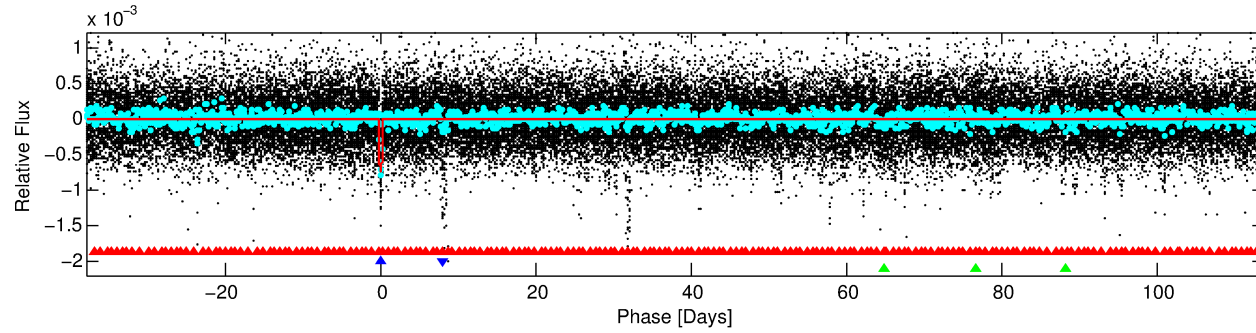
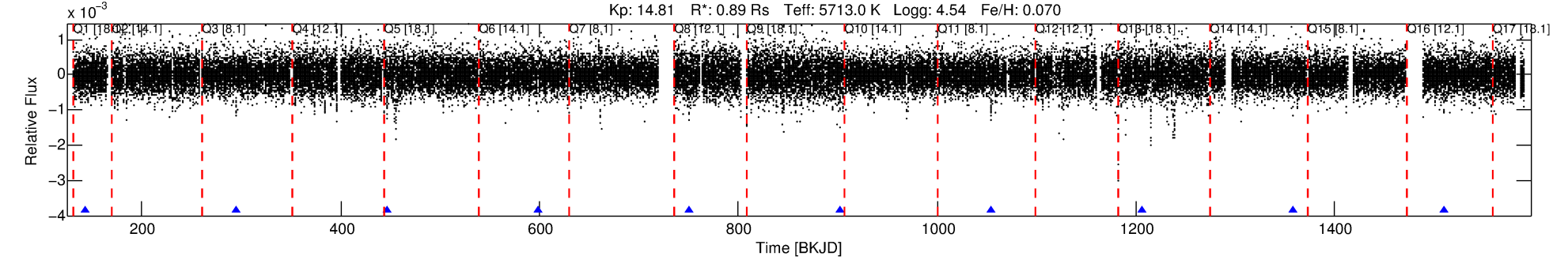
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 008822216-02

No Significant Match Found

# DV One-Page Summary

KIC: 8822216 Candidate: 2 of 3 Period: 151.865 d  
KOI: K00581.02 Corr: 0.990



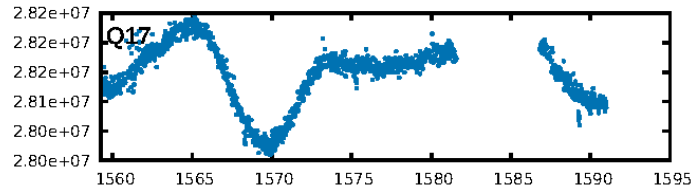
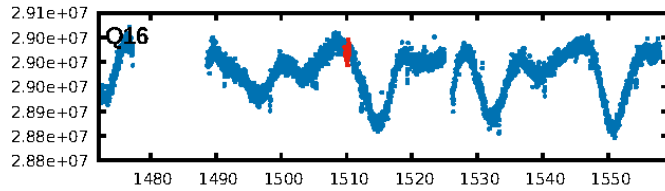
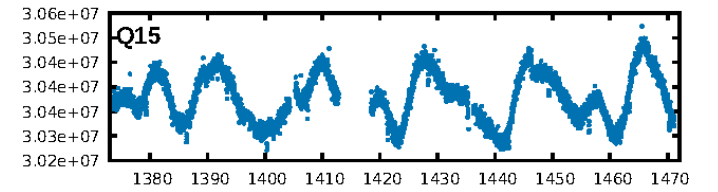
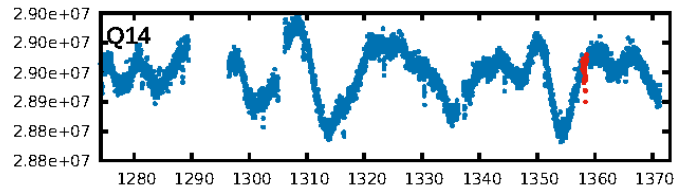
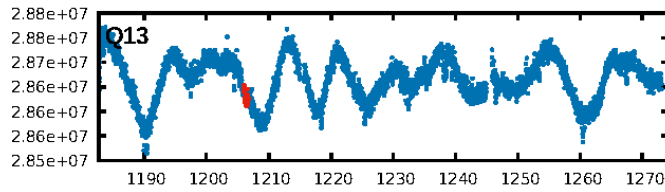
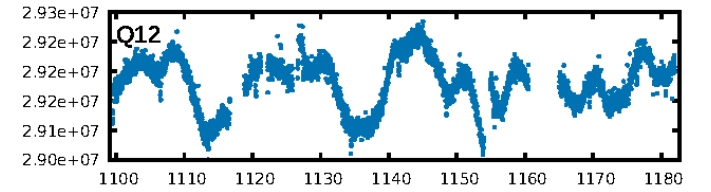
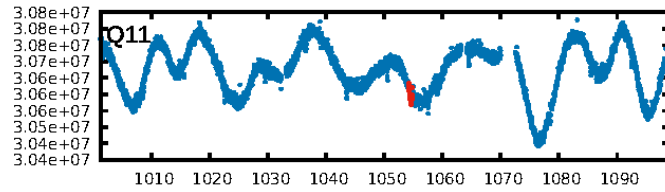
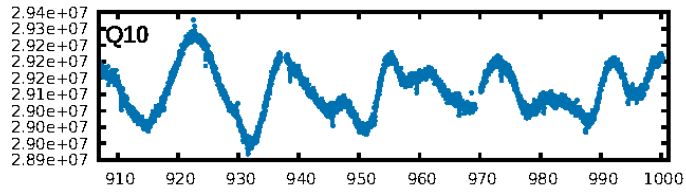
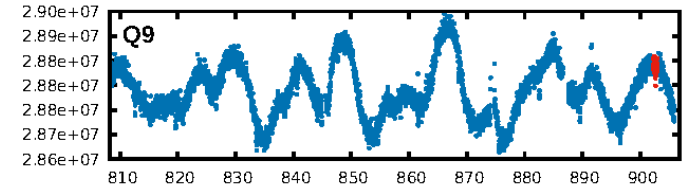
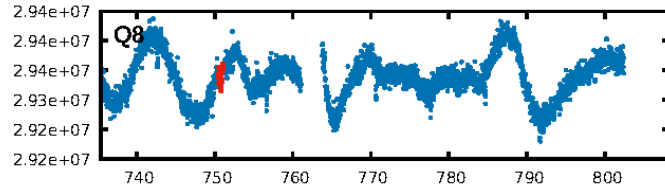
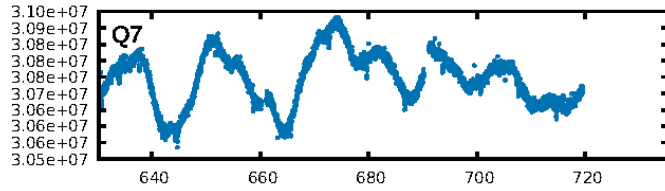
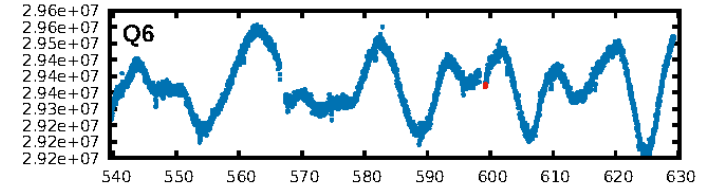
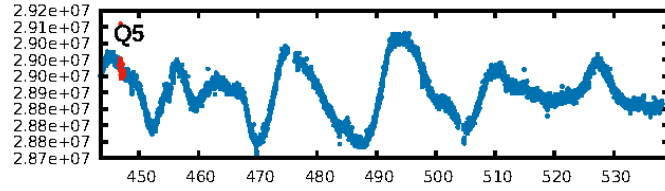
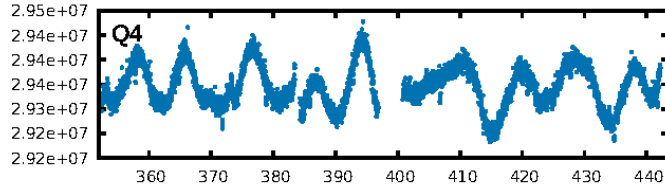
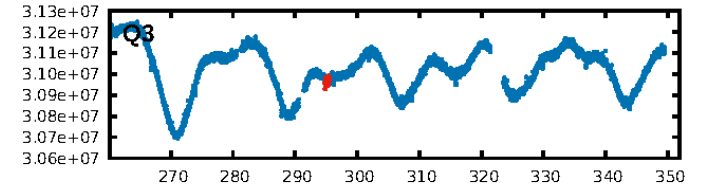
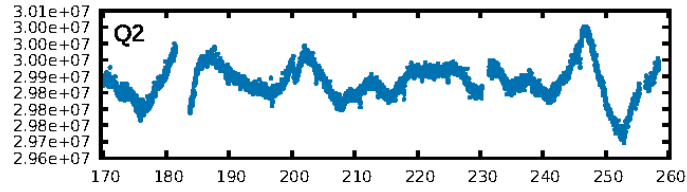
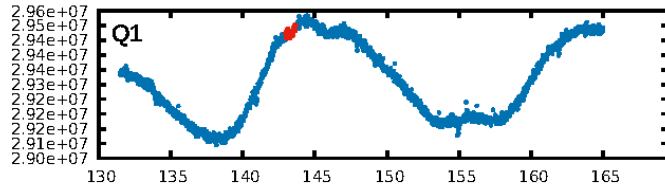
## DV Fit Results:

Period = 151.86511 [0.00113] d  
Epoch = 143.3098 [0.0063] BKJD  
Rp/R\* = 0.0256 [0.0106]  
a/R\* = 115.40 [200.33]  
b = 0.55 [2.25]  
Seff = 2.43 [0.80]  
Teq = 318 [26] K  
Rp = 2.49 [1.19] Re  
a = 0.5592 [0.1151] AU  
Ag = 3474.10 [3401.10] [1.02 $\sigma$ ]  
Teffp = 3781 [887] K [3.90 $\sigma$ ]

## DV Diagnostic Results:

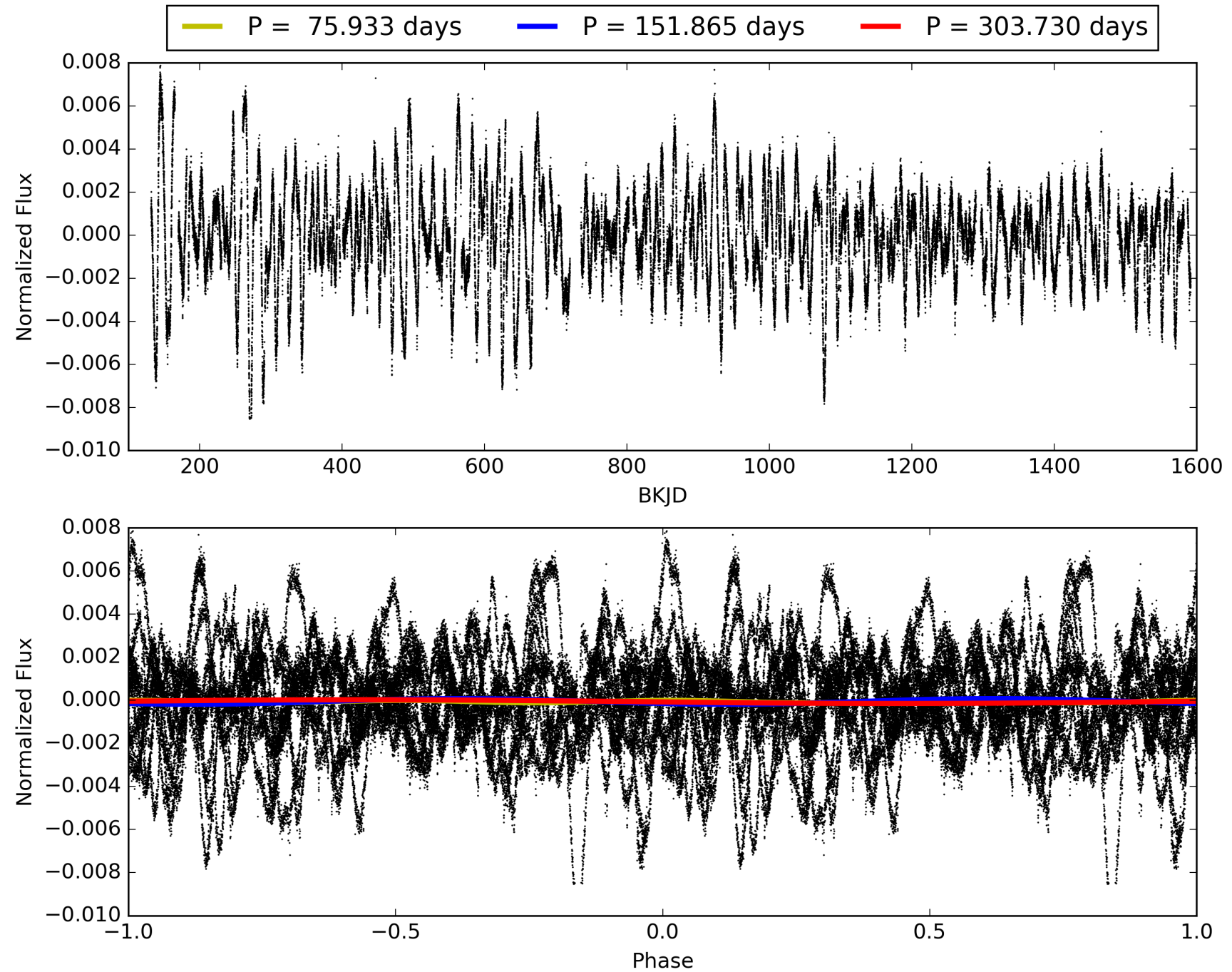
ShortPeriod-sig: 100.0% [378.49 $\sigma$ ]  
LongPeriod-sig: 100.0% [763.90 $\sigma$ ]  
ModelChiSquare2-sig: 16.1%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 2.51e-23  
RollingBand-fgt: 1.00 [8/8]  
GhostDiagnostic-chr: 1.644  
Centroid-sig: 92.0%  
Centroid-so: 0.195 arcsec [0.38 $\sigma$ ]  
OotOffset-rm: 0.314 arcsec [0.93 $\sigma$ ]  
KicOffset-rm: 0.334 arcsec [1.17 $\sigma$ ]  
OotOffset-st: 1/2/1/2 [6]  
KicOffset-st: 1/2/1/2 [6]  
DiffImageQuality-fgm: 1.00 [6/6]  
DiffImageOverlap-fno: 0.71 [5/7]

# TCE 008822216-02, PDC Light Curves



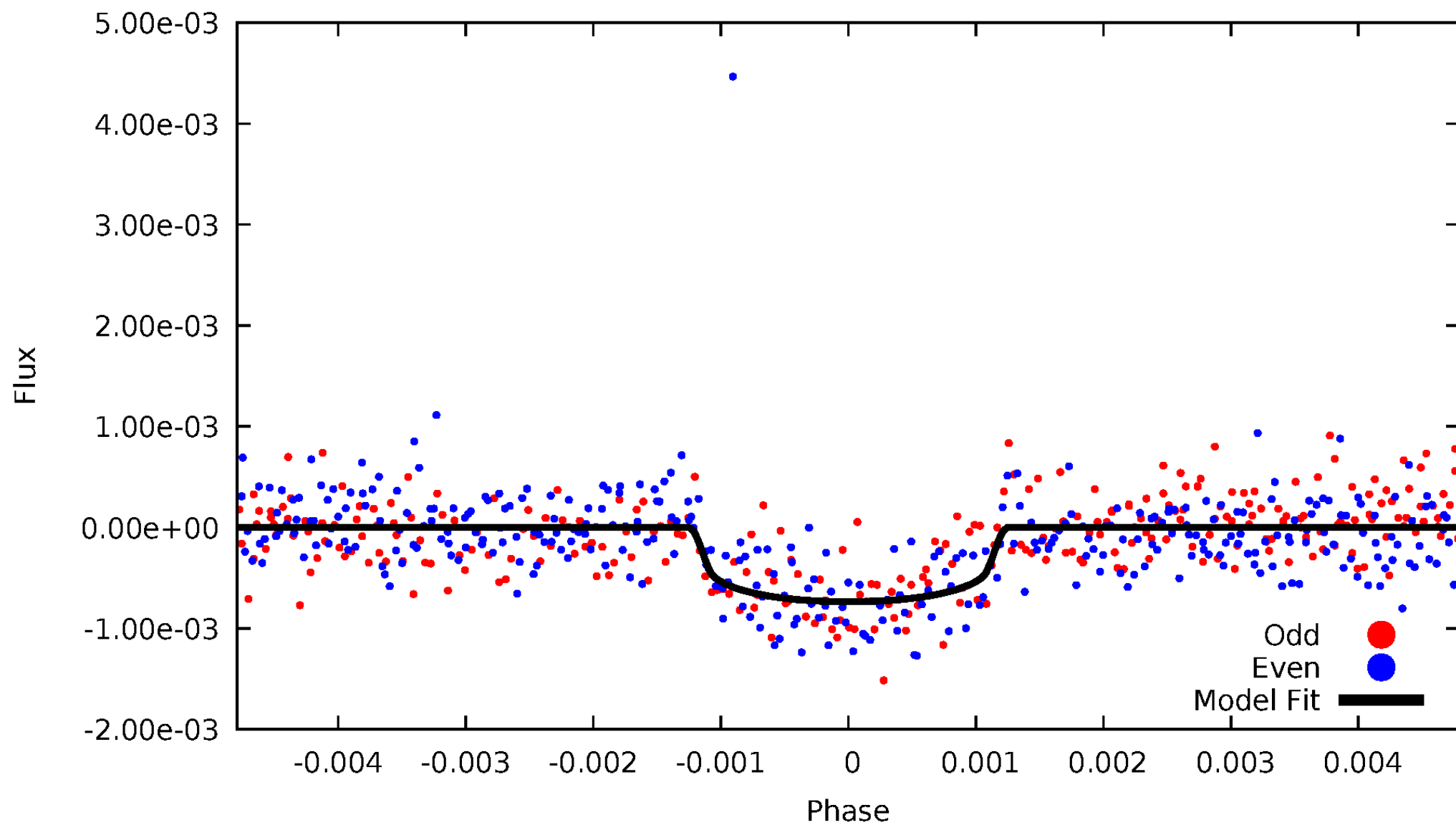


# TCE 008822216-02



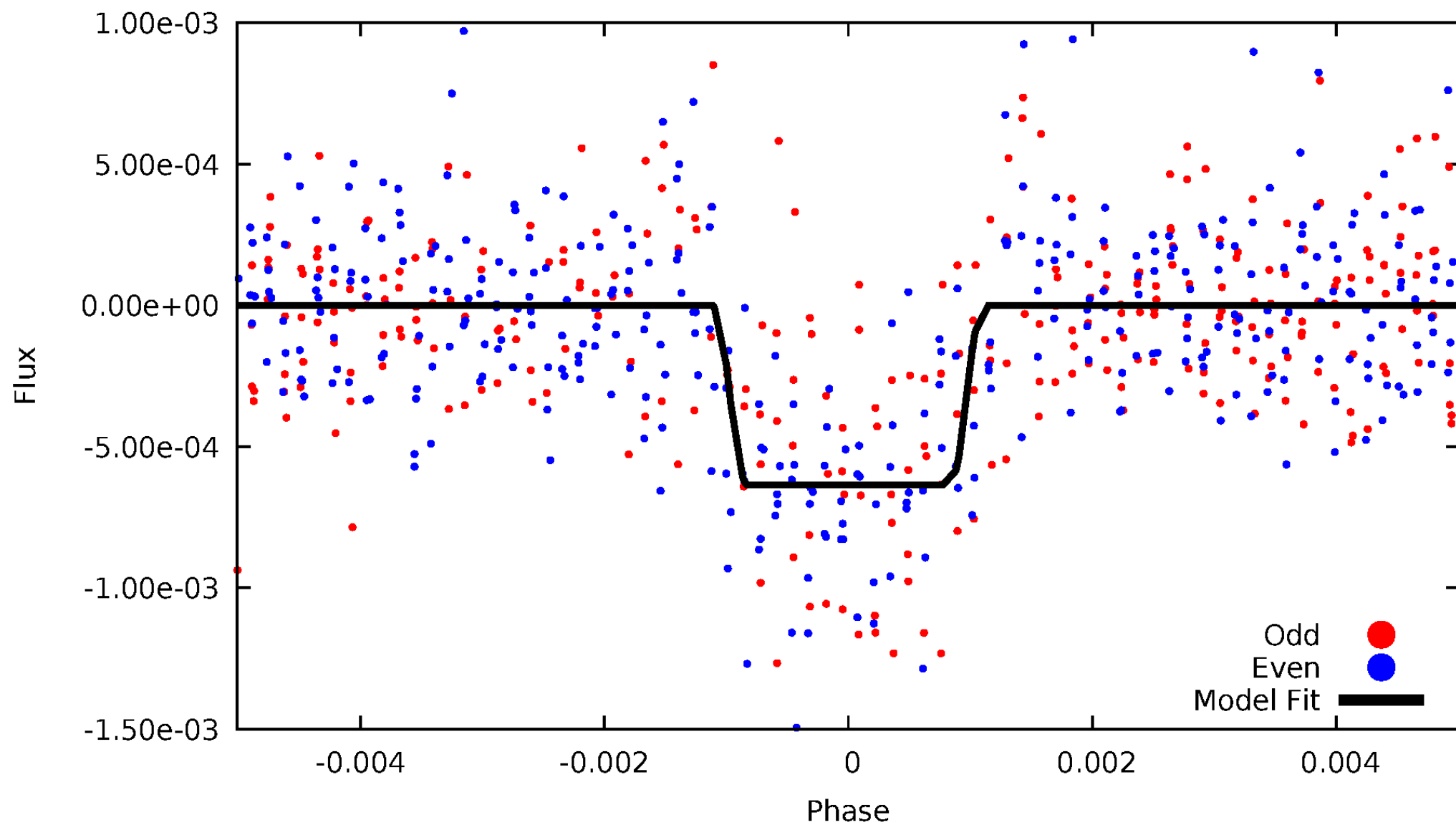
# DV Odd/Even

TCE 008822216-02



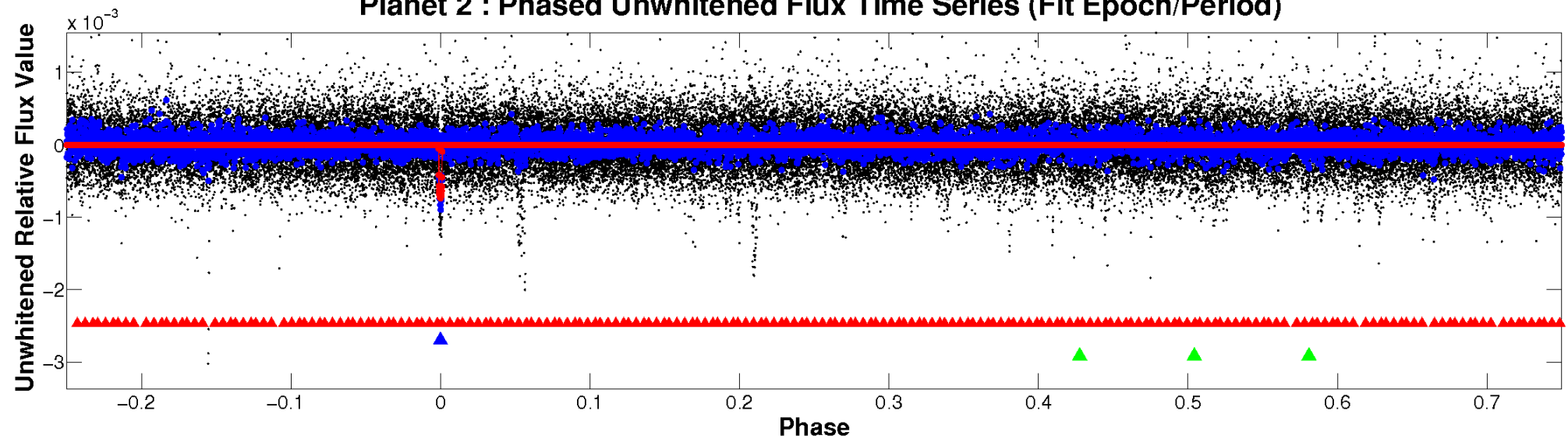
# ALT Odd/Even

TCE 008822216-02

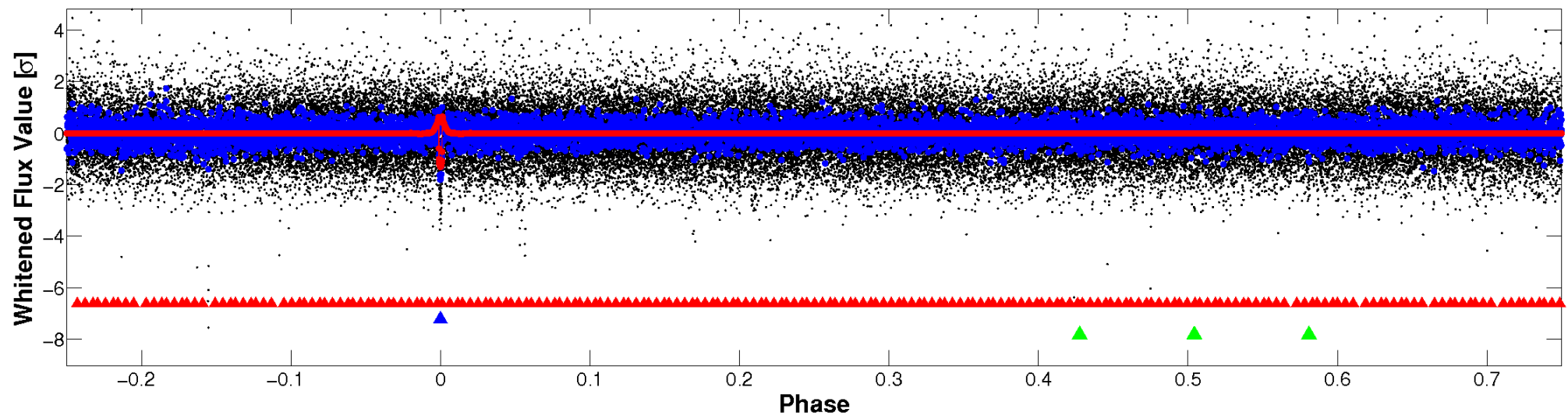


# Non-Whitened Vs. Whitened Light Curve

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

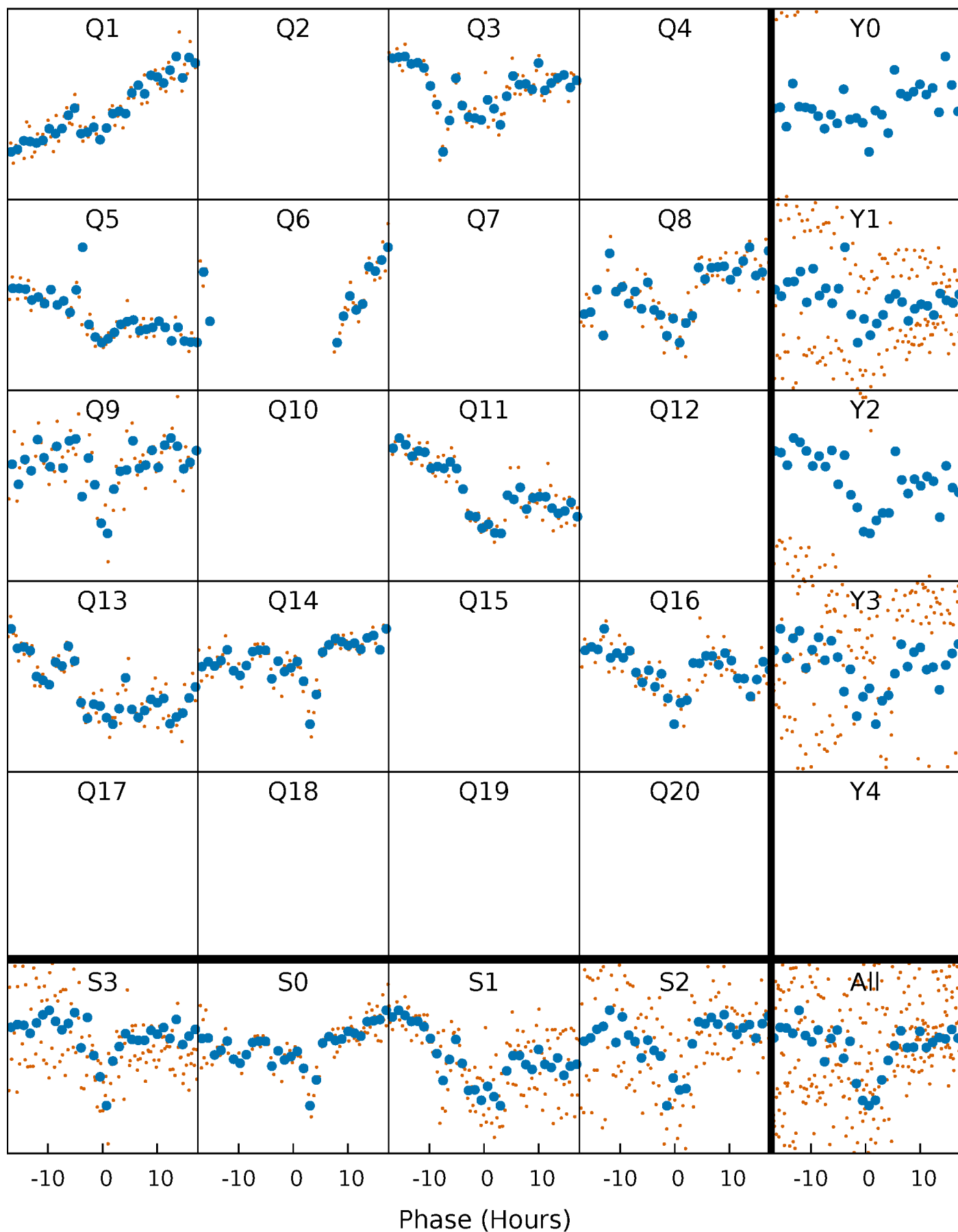


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

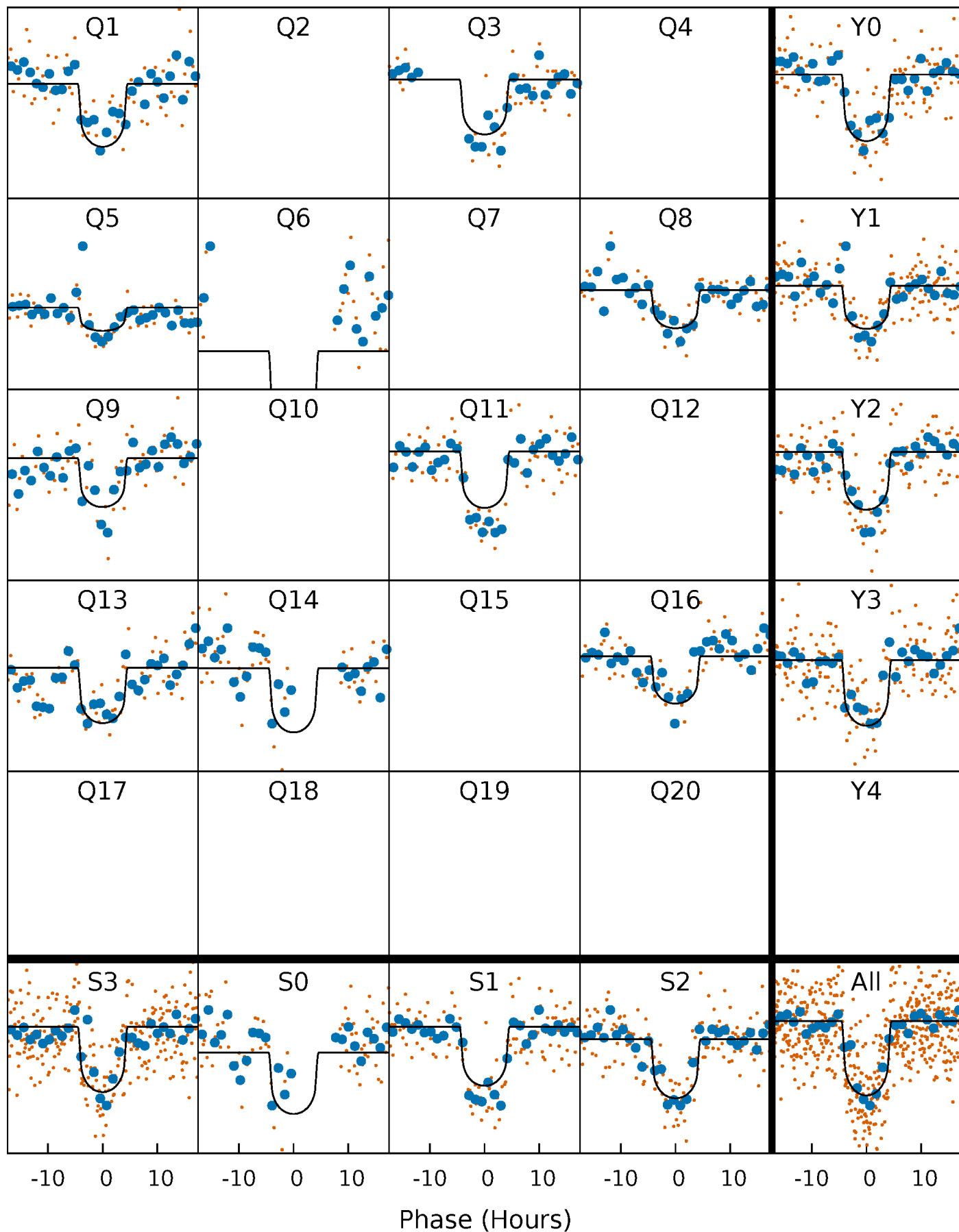
TCE 008822216-02   P=151.865105 Days    $T_0=143.309772$  (BKJD)





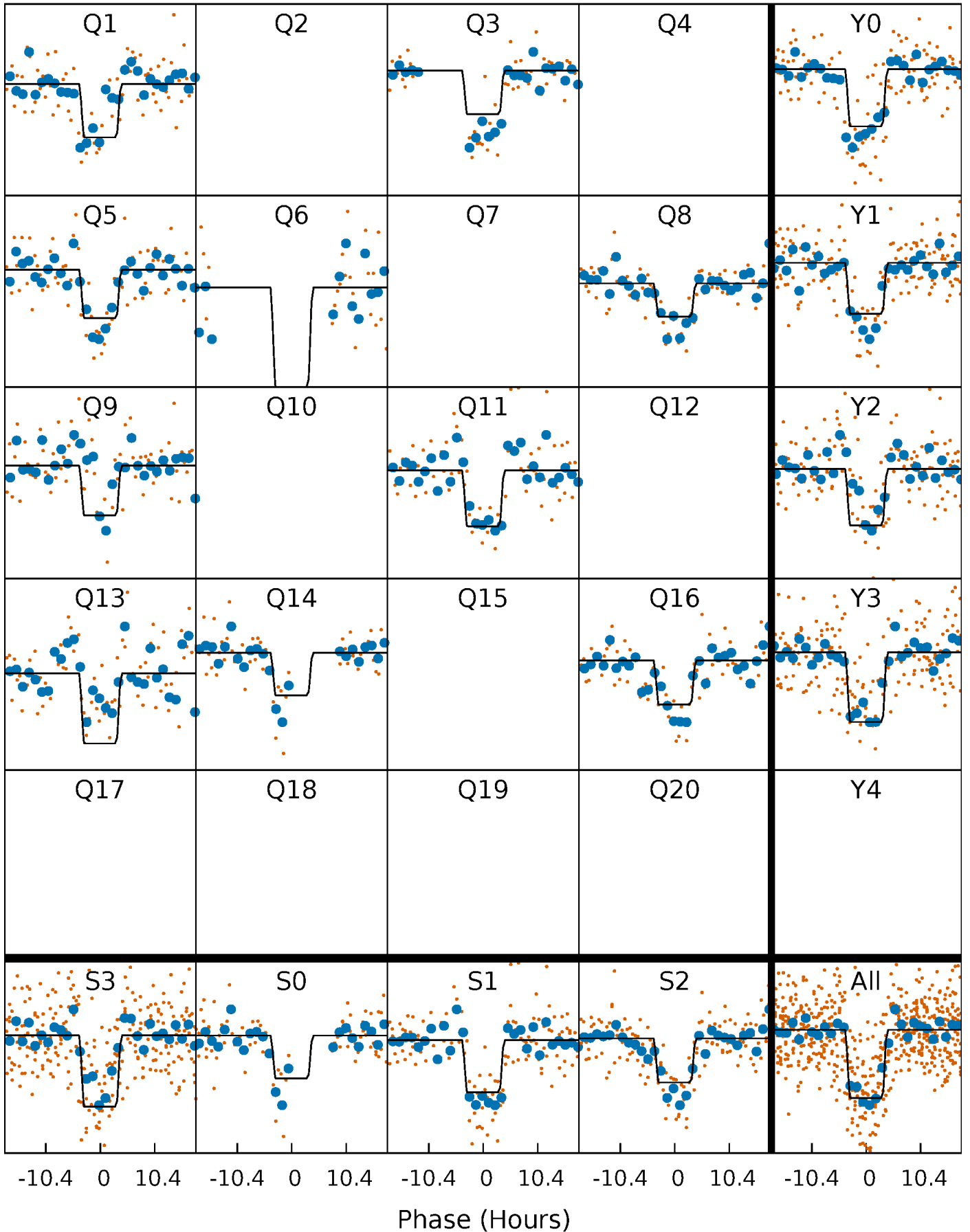
# DV Quarter-Phased Transit Curves

TCE 008822216-02   P=151.865105 Days    $T_0=143.309772$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

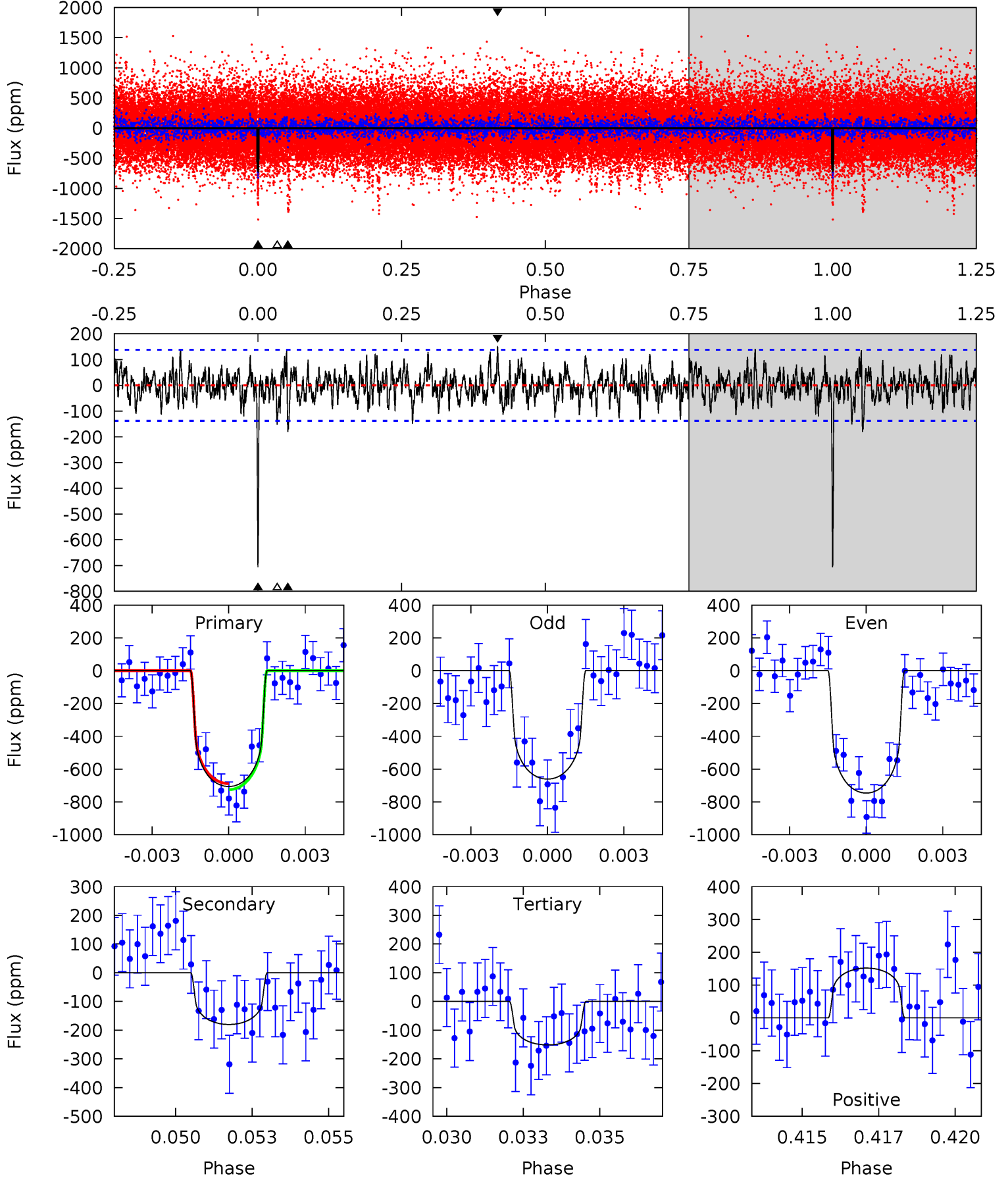
TCE 008822216-02 P=151.862218 Days  $T_0=143.309917$  (BKJD)



# DV Model-Shift Uniqueness Test

008822216-02, P = 151.865105 Days, E = 143.309772 Days

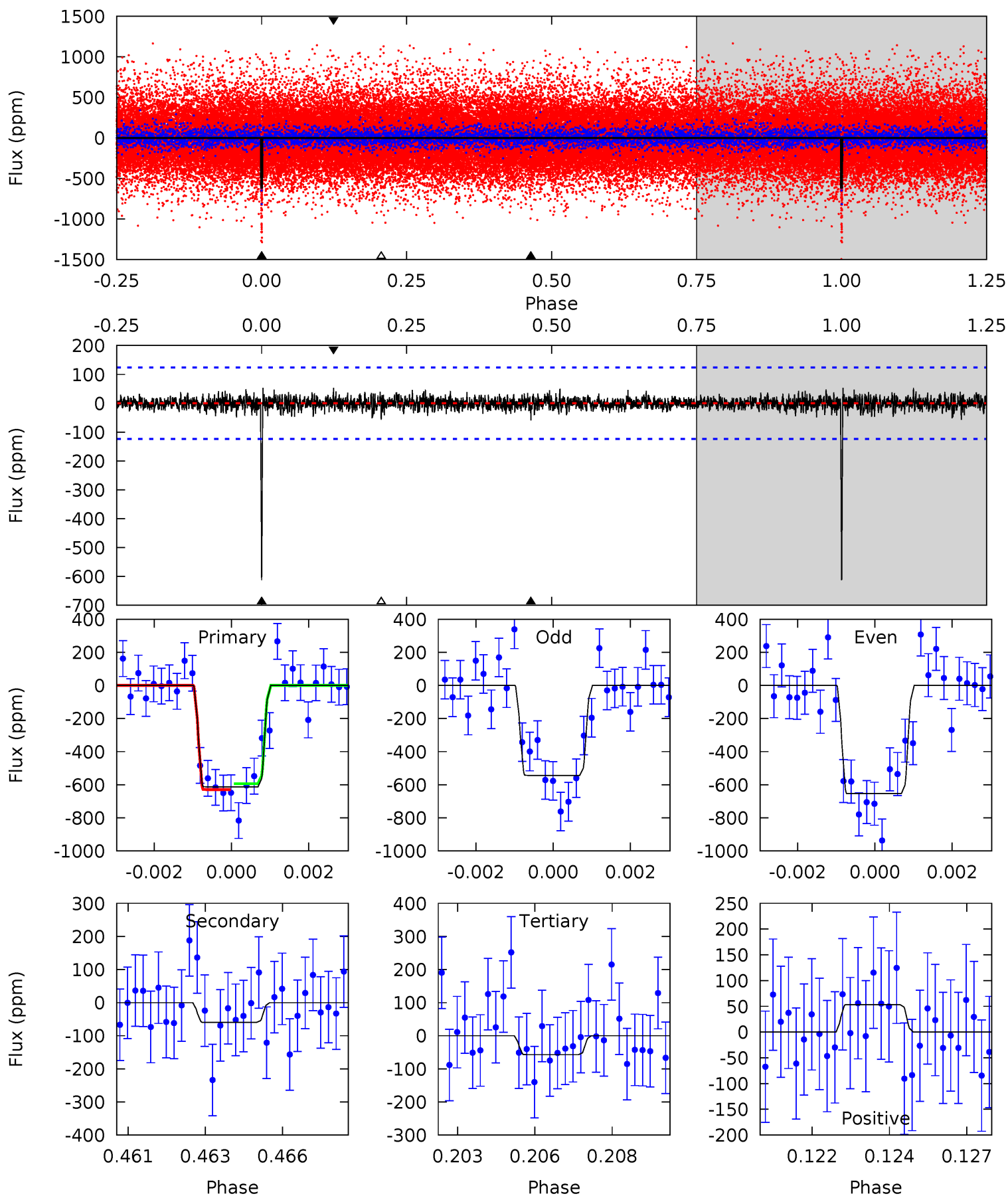
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
27.1	6.92	5.81	5.83	5.29	3.02	1.76	21.3	21.3	1.10	1.09	1.63	1.10	0.18	0.70



# Alt Model-Shift Uniqueness Test

008822216-02, P = 151.862218 Days, E = 143.309917 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
26.2	2.54	2.44	2.27	5.30	3.05	0.59	23.8	23.9	0.10	0.27	2.37	0.89	0.08	0.76



### Stellar Parameters For KIC 008822216

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M$ ( $M_{\odot}$ )	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$5713^{+138}_{-173}$	$4.541^{+0.042}_{-0.168}$	$0.070^{+0.200}_{-0.350}$	$0.893^{+0.215}_{-0.086}$	$1.010^{+0.083}_{-0.134}$	$2.000^{+0.346}_{-0.949}$
	+2%/-3%	+1%/-4%	+286%/-500%	+24%/-10%	+8%/-13%	+17%/-47%
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 008822216-02 / KOI 0581.02

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$-180 \pm 26$	$2.61^{+1.02}_{-1.14}$	$454^{+25}_{-19}$	$4360^{+1098}_{-558}$	$4495^{+8761}_{-2363}$
Alt.	$-59 \pm 23$	$2.56^{+1.03}_{-1.07}$	$452^{+27}_{-19}$	$3569^{+752}_{-420}$	$1510^{+2901}_{-873}$

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

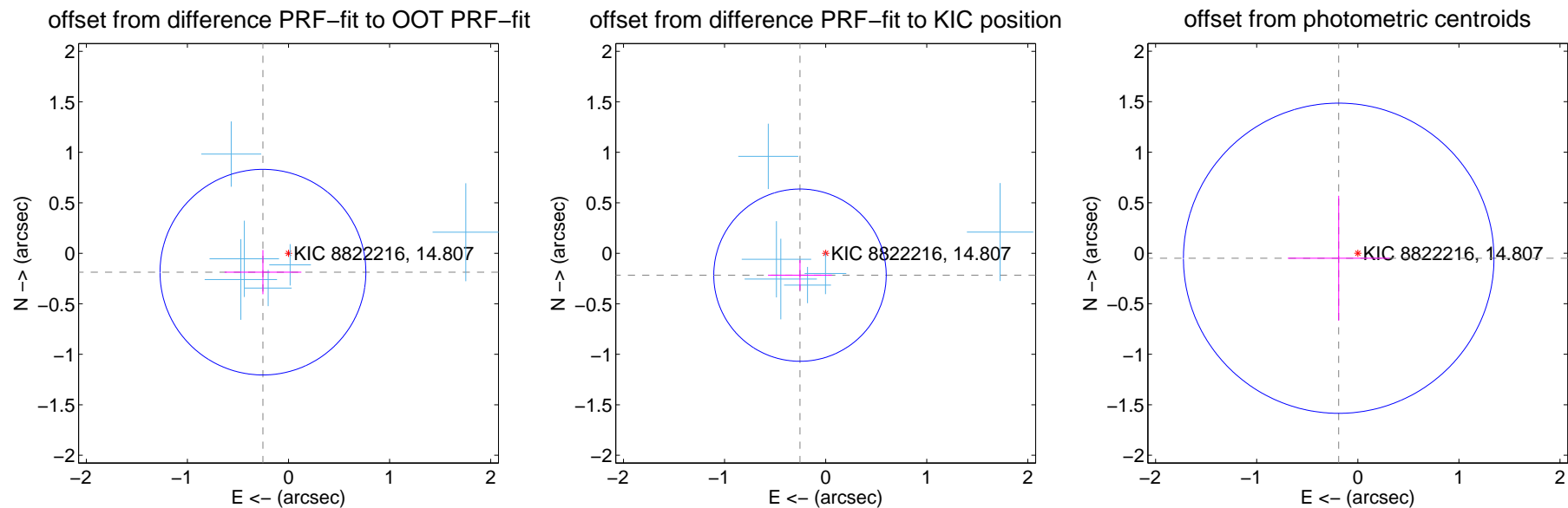
## DV Centroid Data

Supplemental centroid analysis for 008822216-02. Kepler magnitude: 14.81. Transit SNR 14.94

There are 6 quarters with good PRF difference image offsets

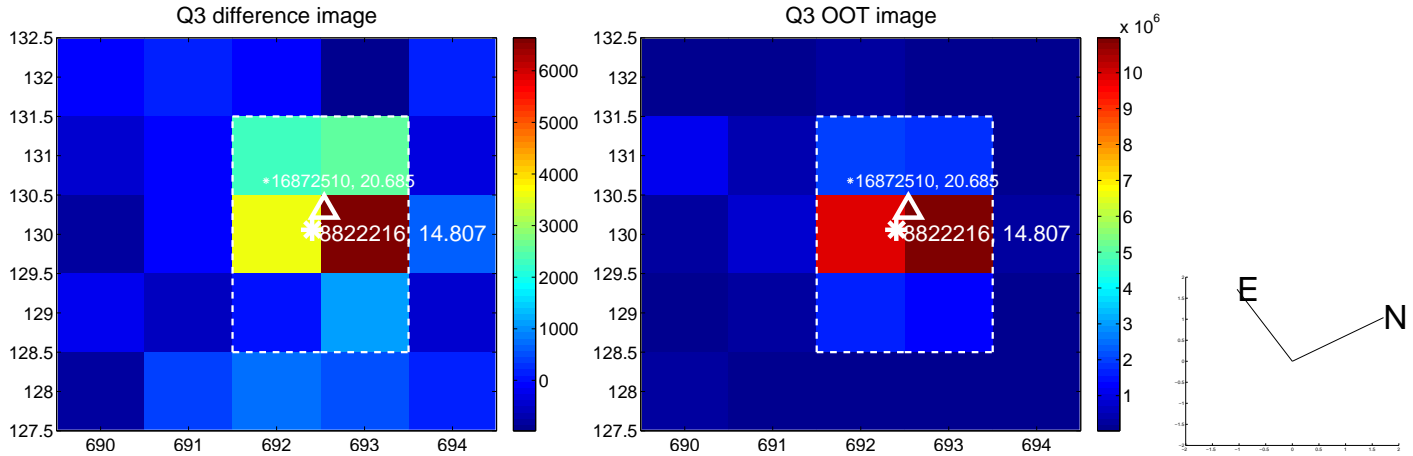
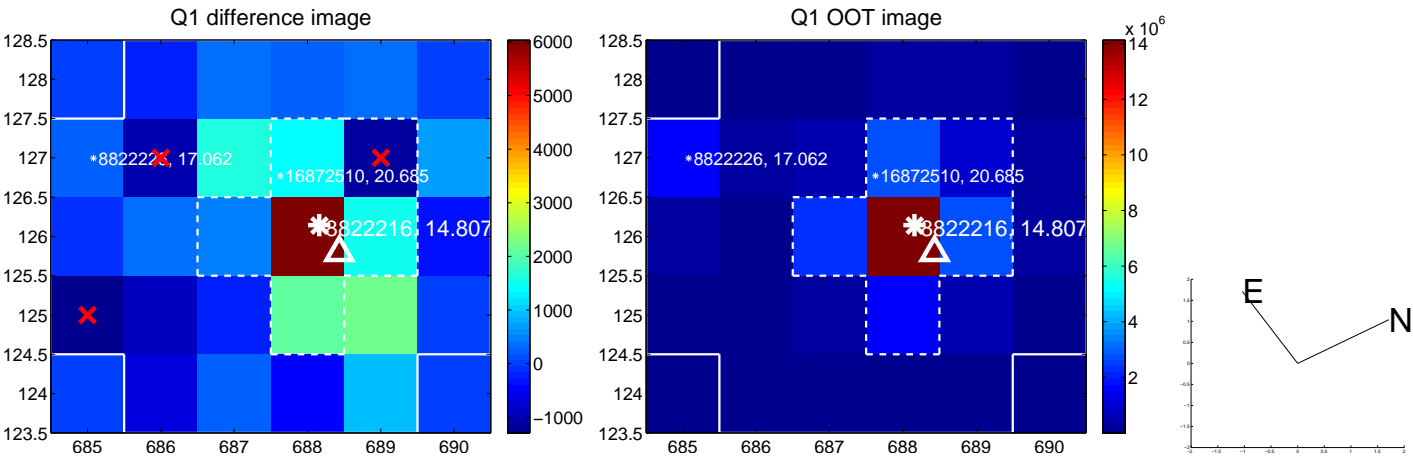
The direct PRF centroid is offset from the target star catalog position by about 0.09 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.314 \pm 0.339$	0.93	$0.253 \pm 0.380$	$-0.187 \pm 0.218$
PRF-fit source offset from KIC position	$0.334 \pm 0.284$	1.17	$0.254 \pm 0.317$	$-0.217 \pm 0.150$
photometric centroid source offset	$0.20 \pm 0.51$	0.38	$0.19 \pm 0.50$	$-0.05 \pm 0.62$



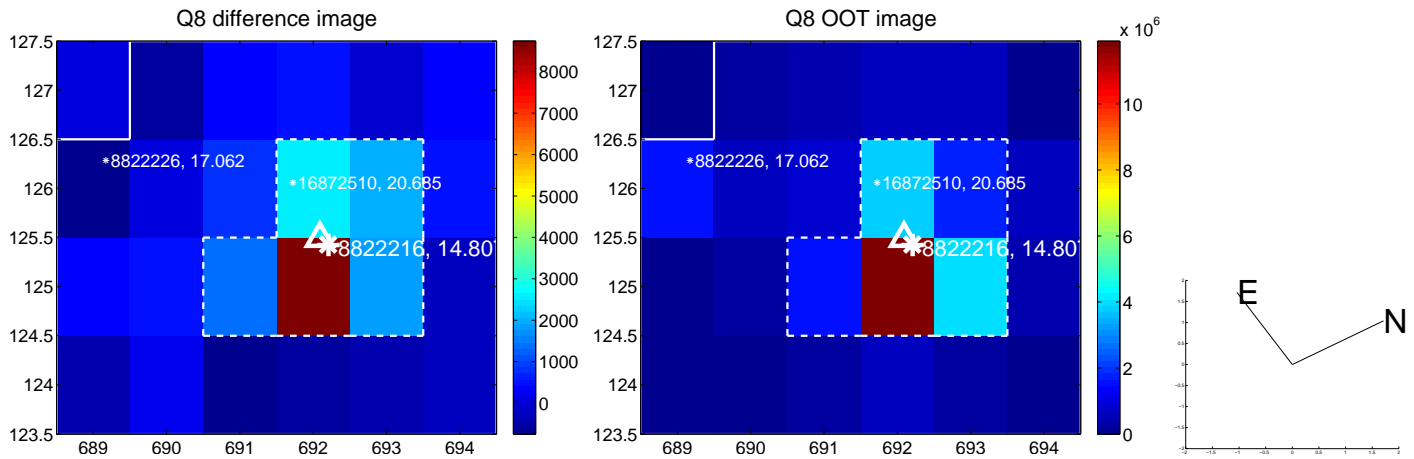
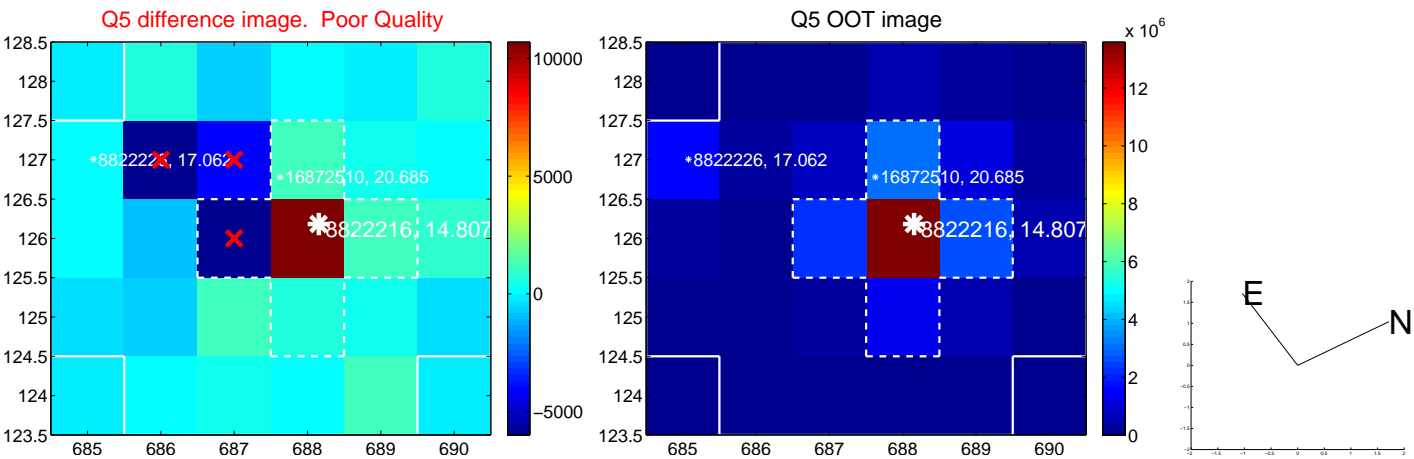
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

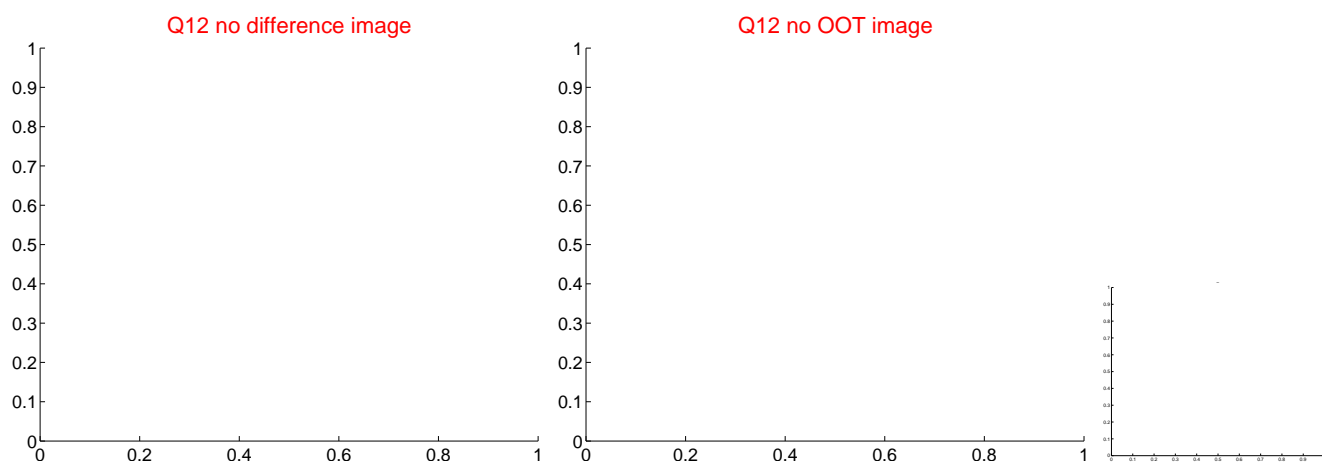
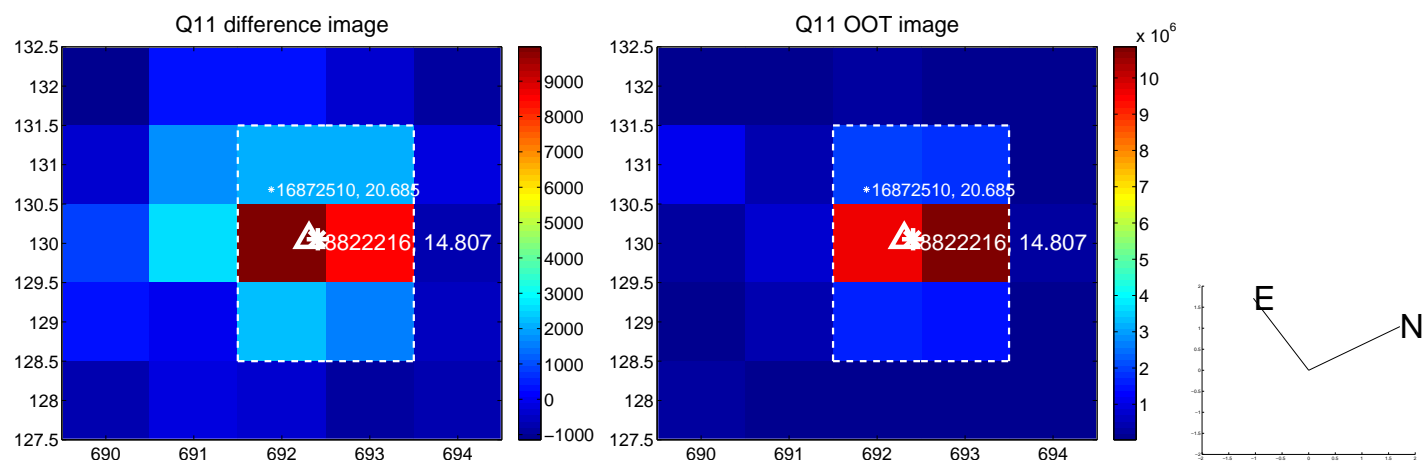
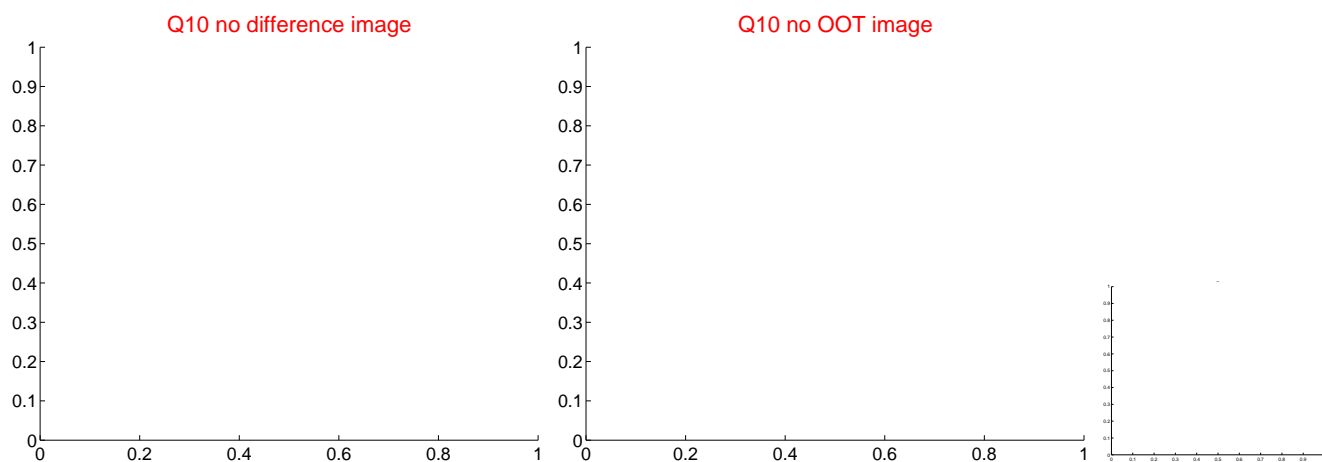
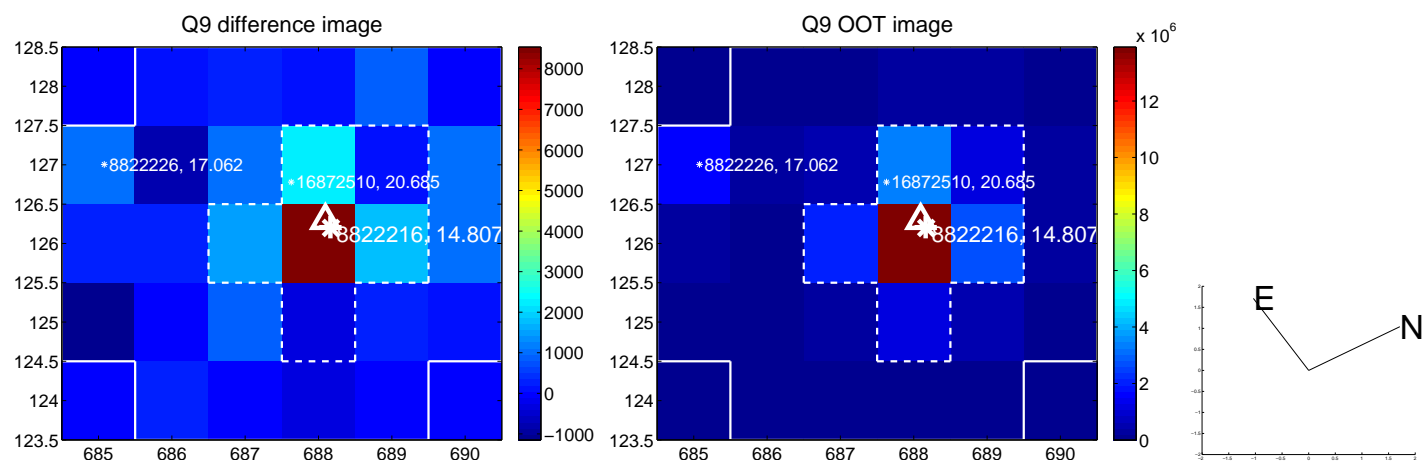




white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

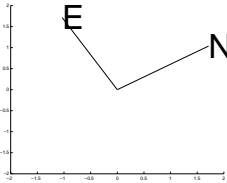
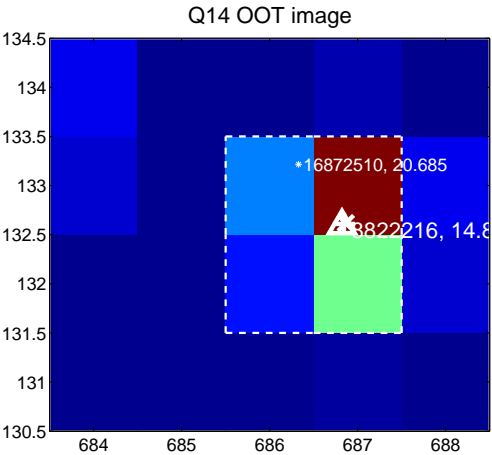
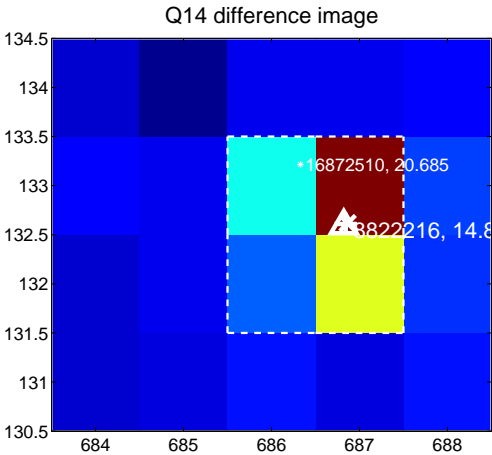


white ×: KIC target position; +: OOT centroid; △: difference centroid. red ✕: large negative pixel value.

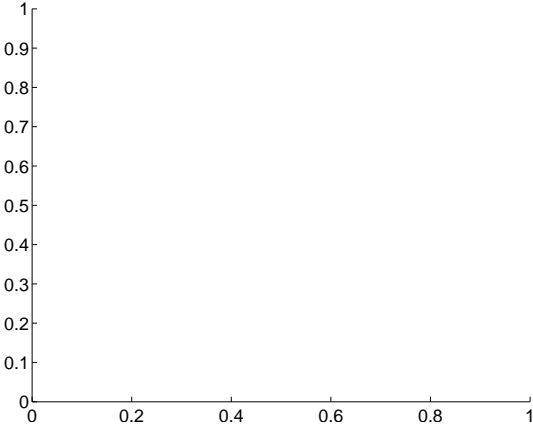
Q13 no difference image



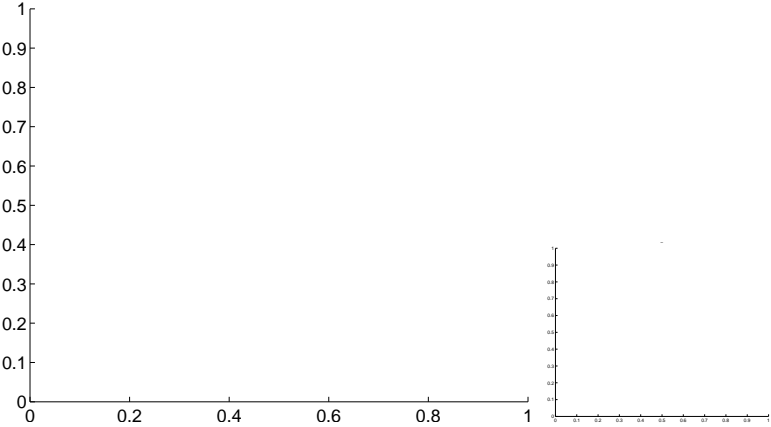
Q13 no OOT image



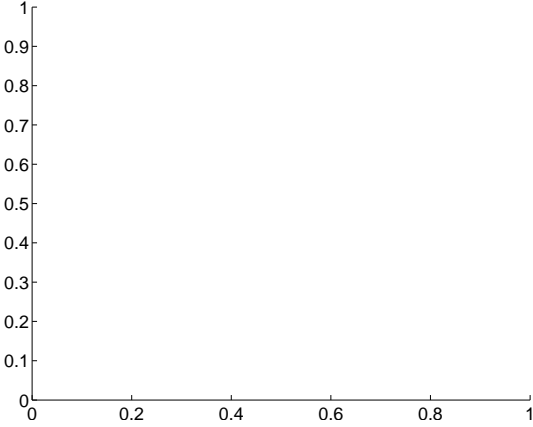
Q15 no difference image



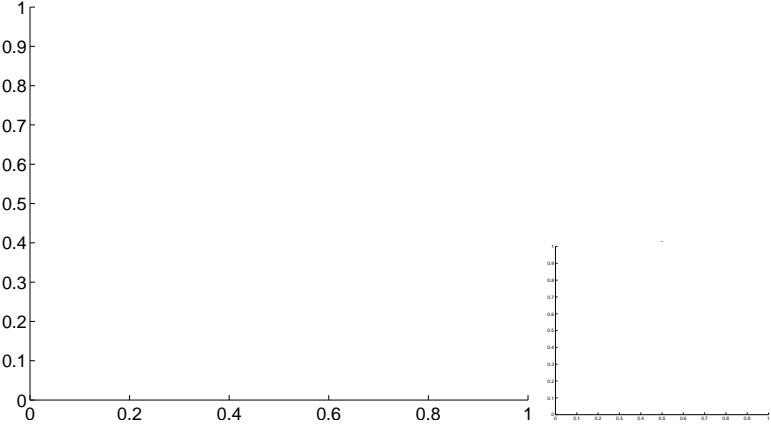
Q15 no OOT image



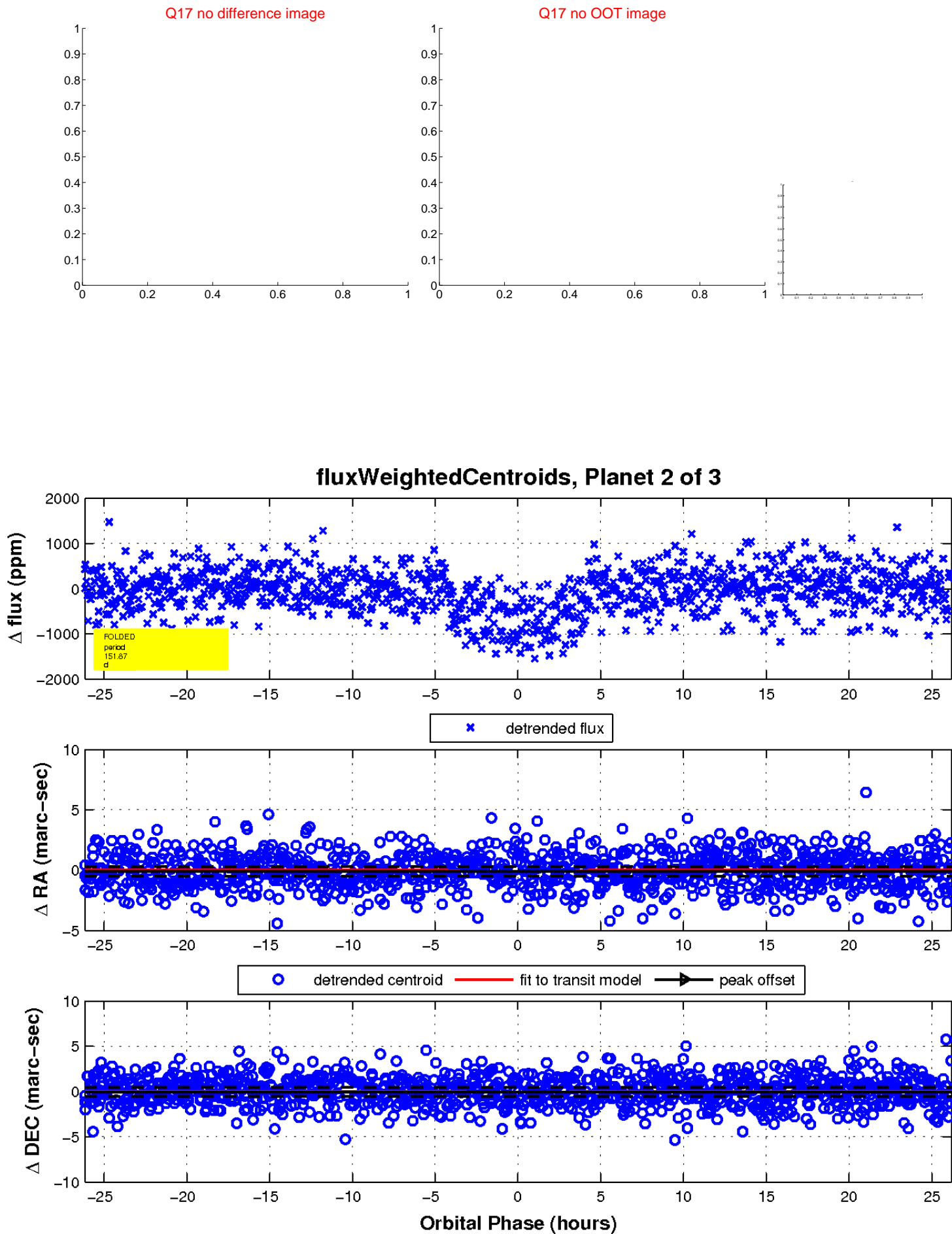
Q16 no difference image



Q16 no OOT image

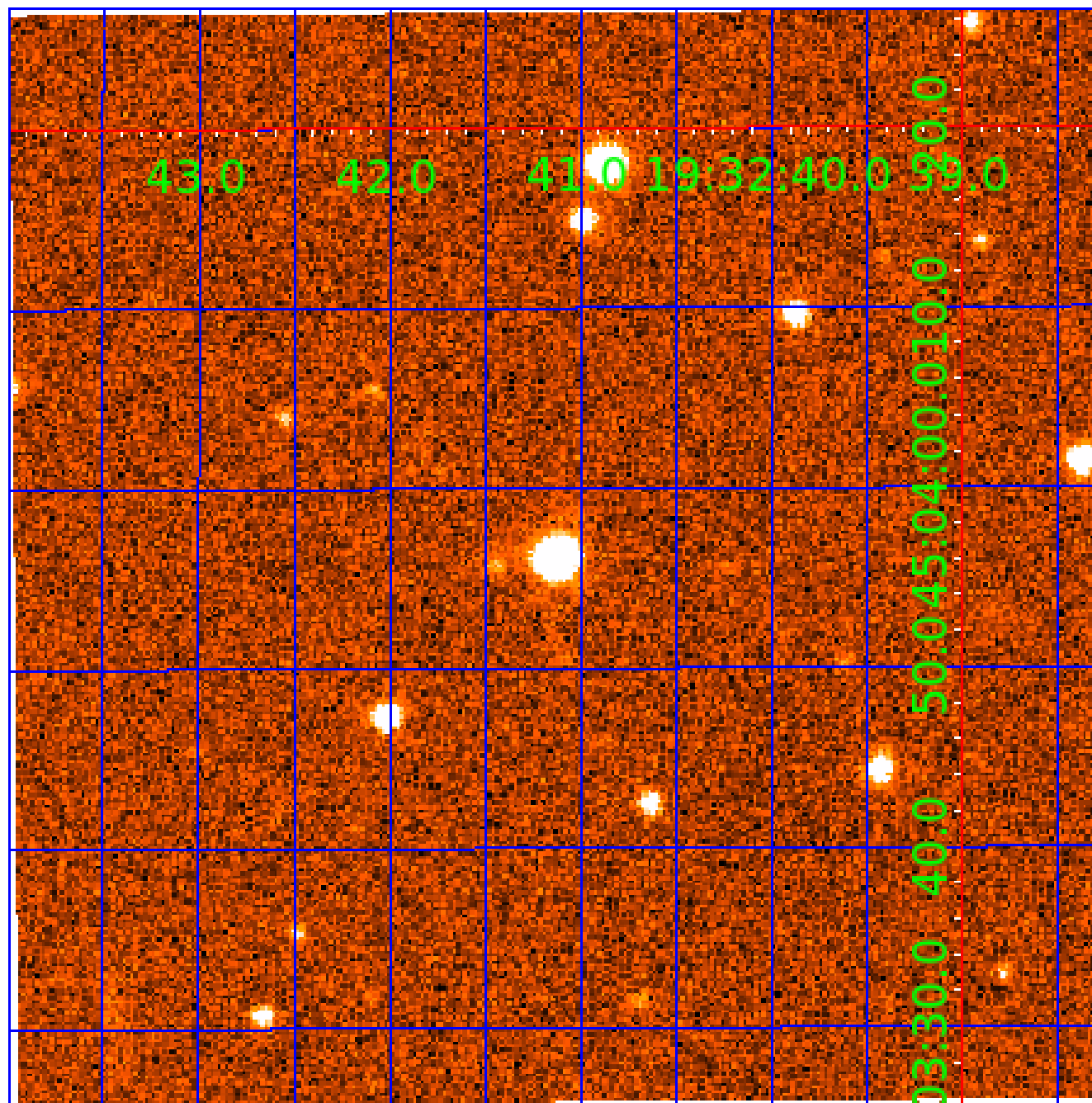


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



# UKIRT Image

Declination



# KIC 008822216

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
008822216-01	OBS	0581.01	6.996909	133.934278	1309.3	2.858	93.7	96.8	0.89	5713	3.51	147.36
008822216-02	OBS	0581.02	151.865105	143.309772	737.4	8.730	13.3	14.9	0.89	5713	2.49	2.43
008822216-03	OBS	No	467.239651	511.974648	604.2	4.686	7.3	7.2	0.89	5713	2.36	0.54

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
008822216-01	OBS	PC	1.00	0	0	0	0	NO_COMMENT
008822216-02	OBS	PC	0.96	0	0	0	0	NO_COMMENT
008822216-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_CHASES_MARSHALL—ALL_TRANS_CHASES—MOD_POS_DV—INCONSISTENT_TRANS—CENT_FEW_DIFFS

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

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

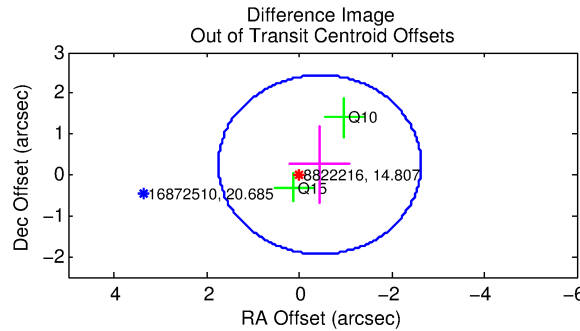
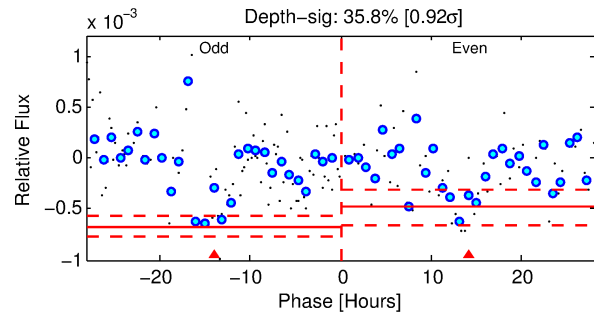
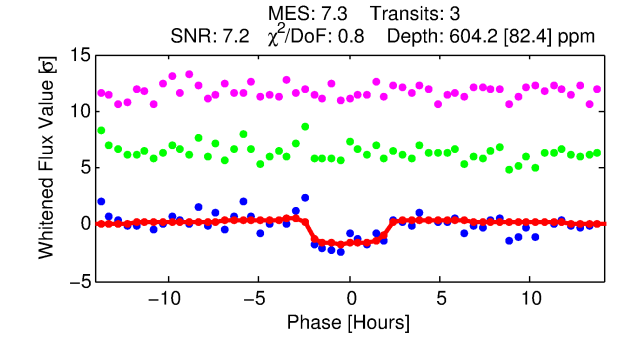
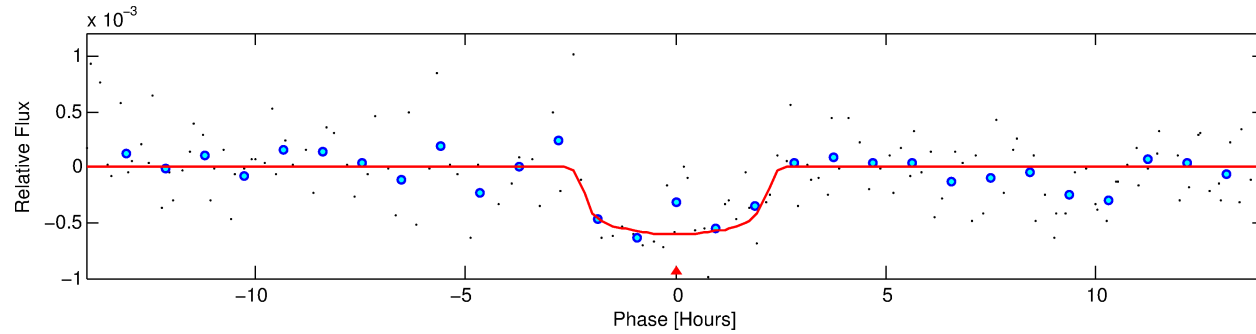
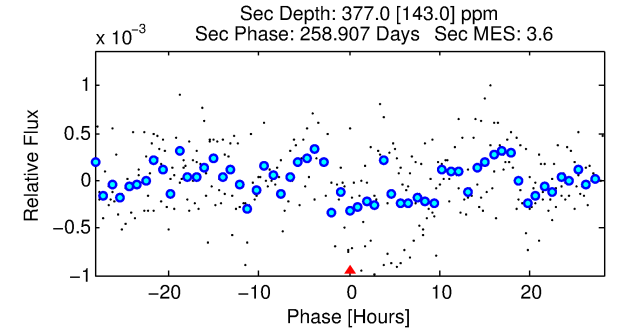
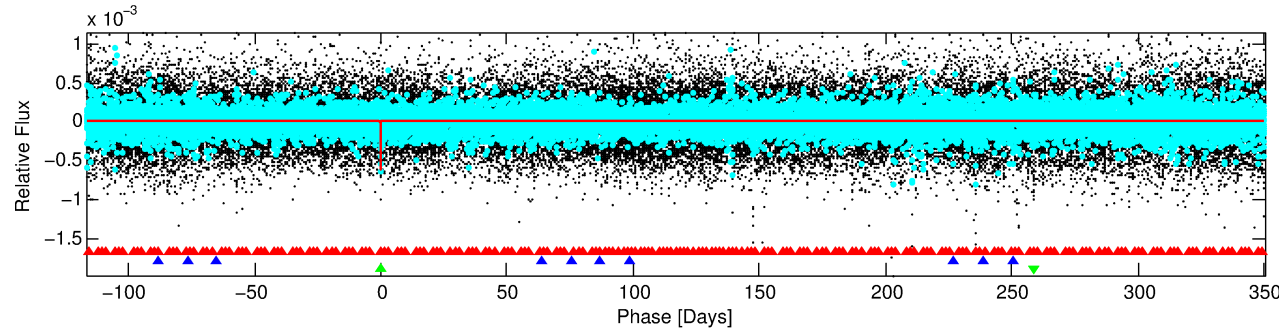
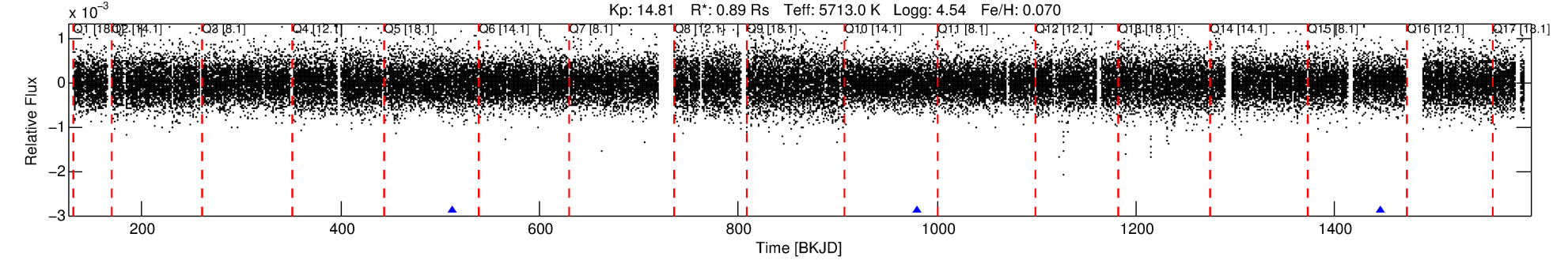
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 008822216-03

No Significant Match Found

# DV One-Page Summary

KIC: 8822216 Candidate: 3 of 3 Period: 467.240 d  
KOI: K00581 Corr: No Ephemeris Match



## DV Fit Results:

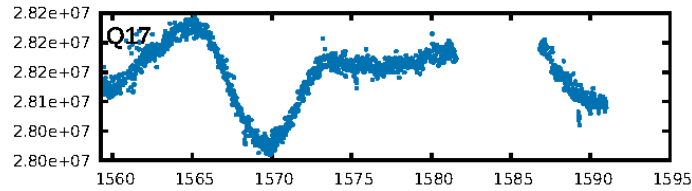
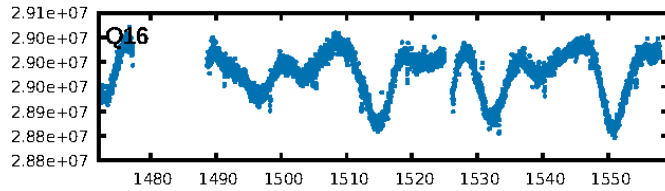
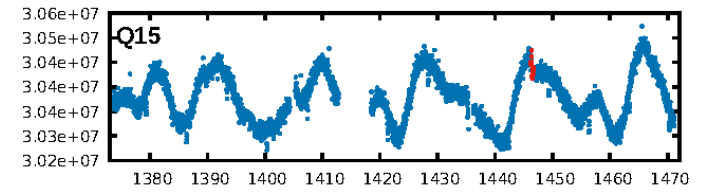
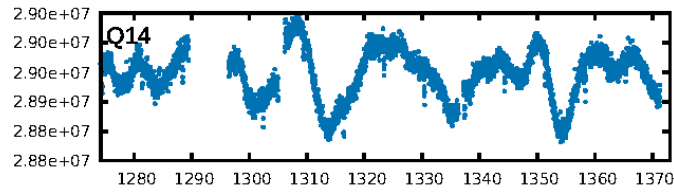
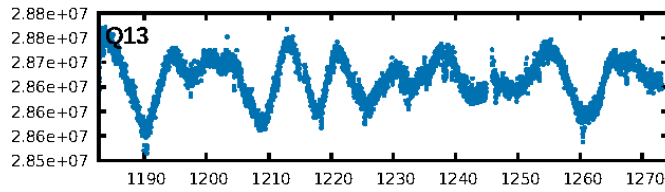
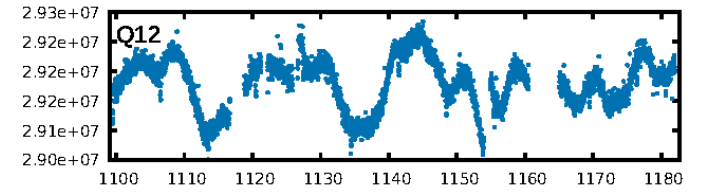
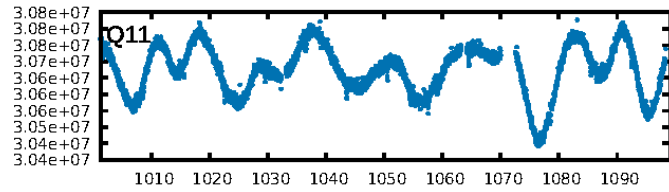
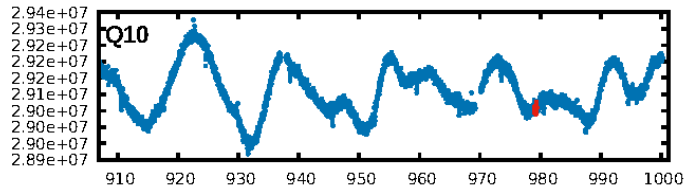
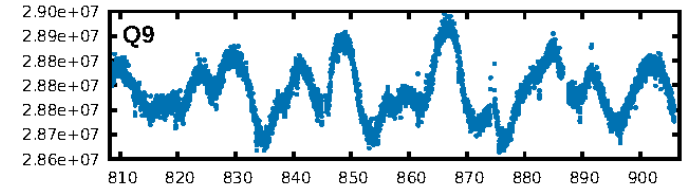
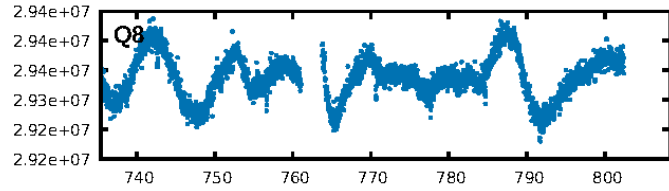
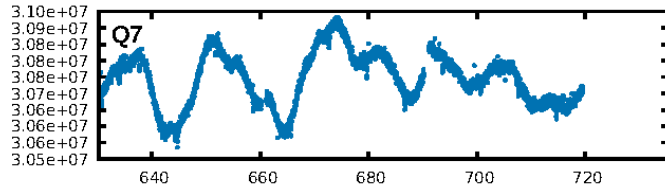
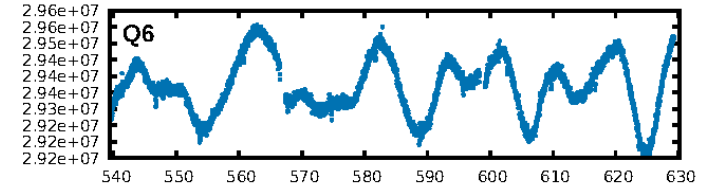
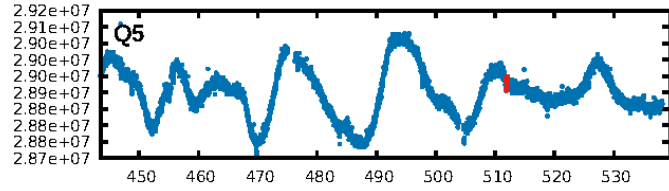
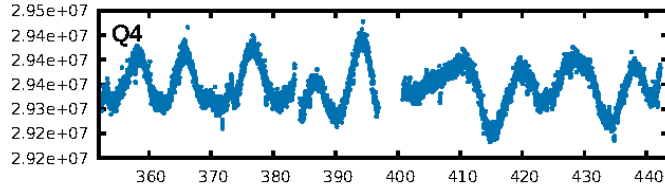
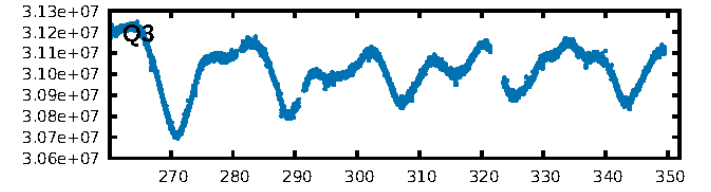
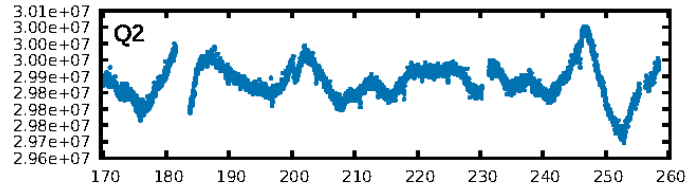
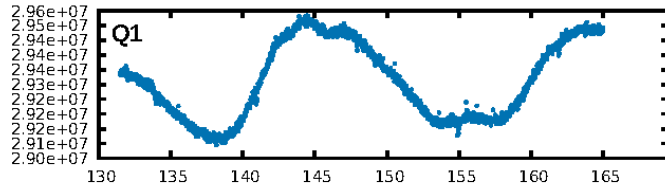
Period = 467.23965 [0.01097] d  
Epoch = 511.9746 [0.0157] BKJD  
Rp/R\* = 0.0243 [0.0250]  
a/R\* = 550.08 [2407.93]  
b = 0.73 [2.89]  
Seff = 0.54 [0.18]  
Teq = 219 [18] K  
Rp = 2.36 [2.50] Re  
a = 1.1829 [0.2435] AU  
Ag = 51924.53 [109987.98] [0.47 $\sigma$ ]  
Teff = 5111 [2683] K [1.82 $\sigma$ ]

## DV Diagnostic Results:

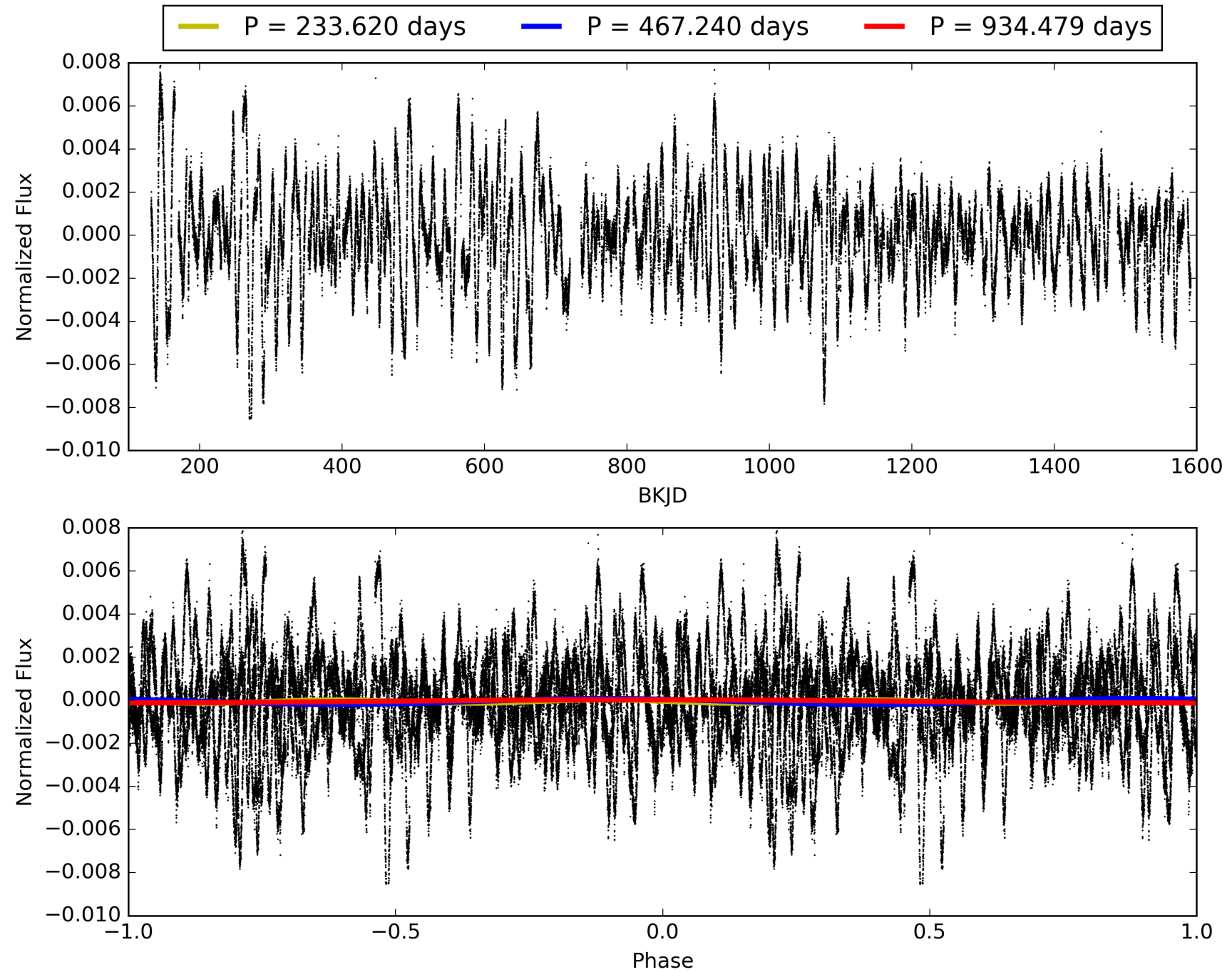
ShortPeriod-sig: 100.0% [763.90 $\sigma$ ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 34.7%  
ModelChiSquareGof-sig: 100.0%  
**Bootstrap-pfa: 1.07e-09**  
**RollingBand-fgt: 1.00 [3/3]**  
**GhostDiagnostic-chr: 1.048**  
Centroid-sig: 38.1%  
Centroid-so: 1.399 arcsec [0.98 $\sigma$ ]  
OotOffset-rm: 0.508 arcsec [0.70 $\sigma$ ]  
KicOffset-rm: 0.506 arcsec [0.62 $\sigma$ ]  
OotOffset-st: 1/1/0/0 [2]  
KicOffset-st: 1/1/0/0 [2]  
DiffImageQuality-fgm: 1.00 [2/2]  
DiffImageOverlap-fno: 0.67 [2/3]



# TCE 008822216-03, PDC Light Curves

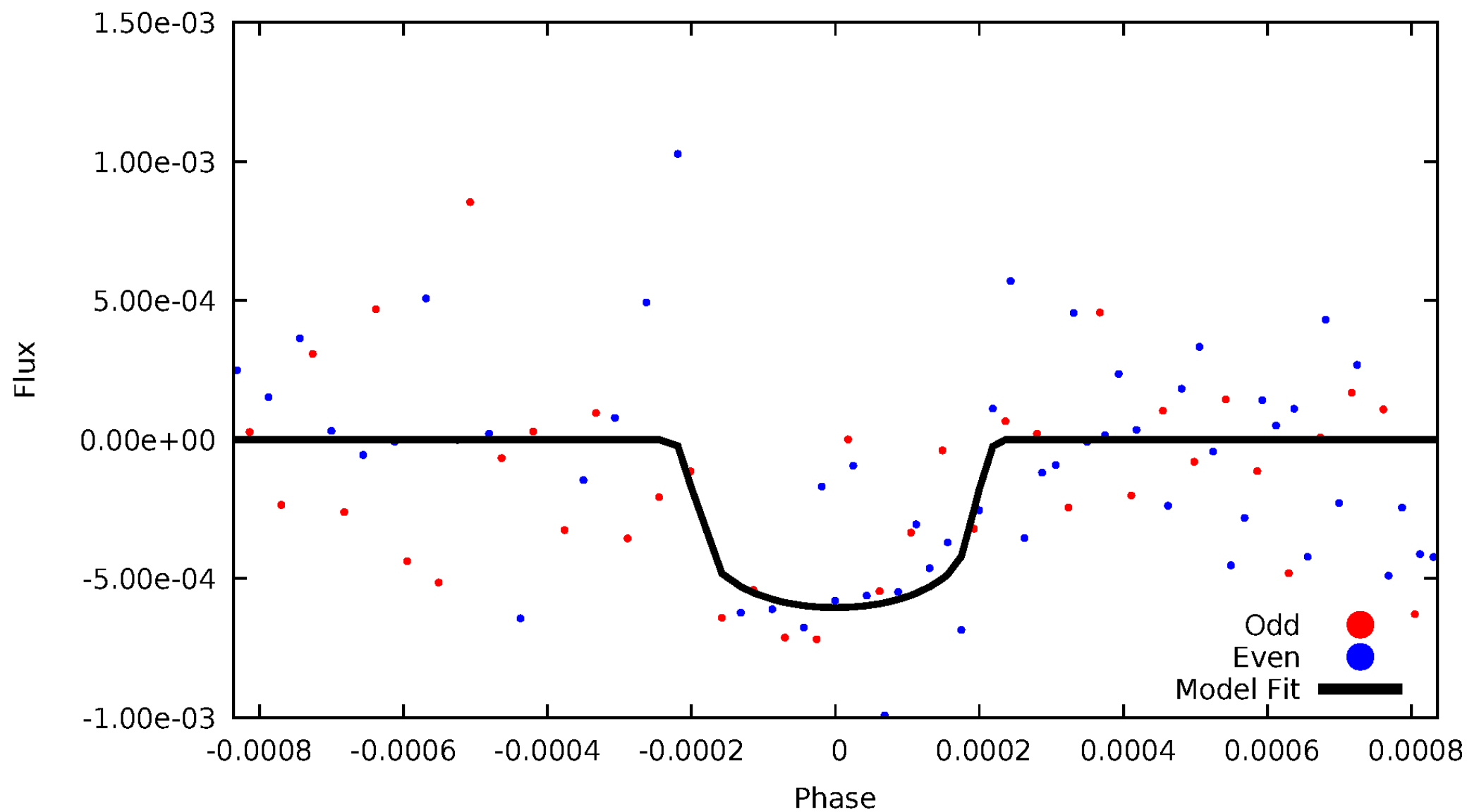


# TCE 008822216-03



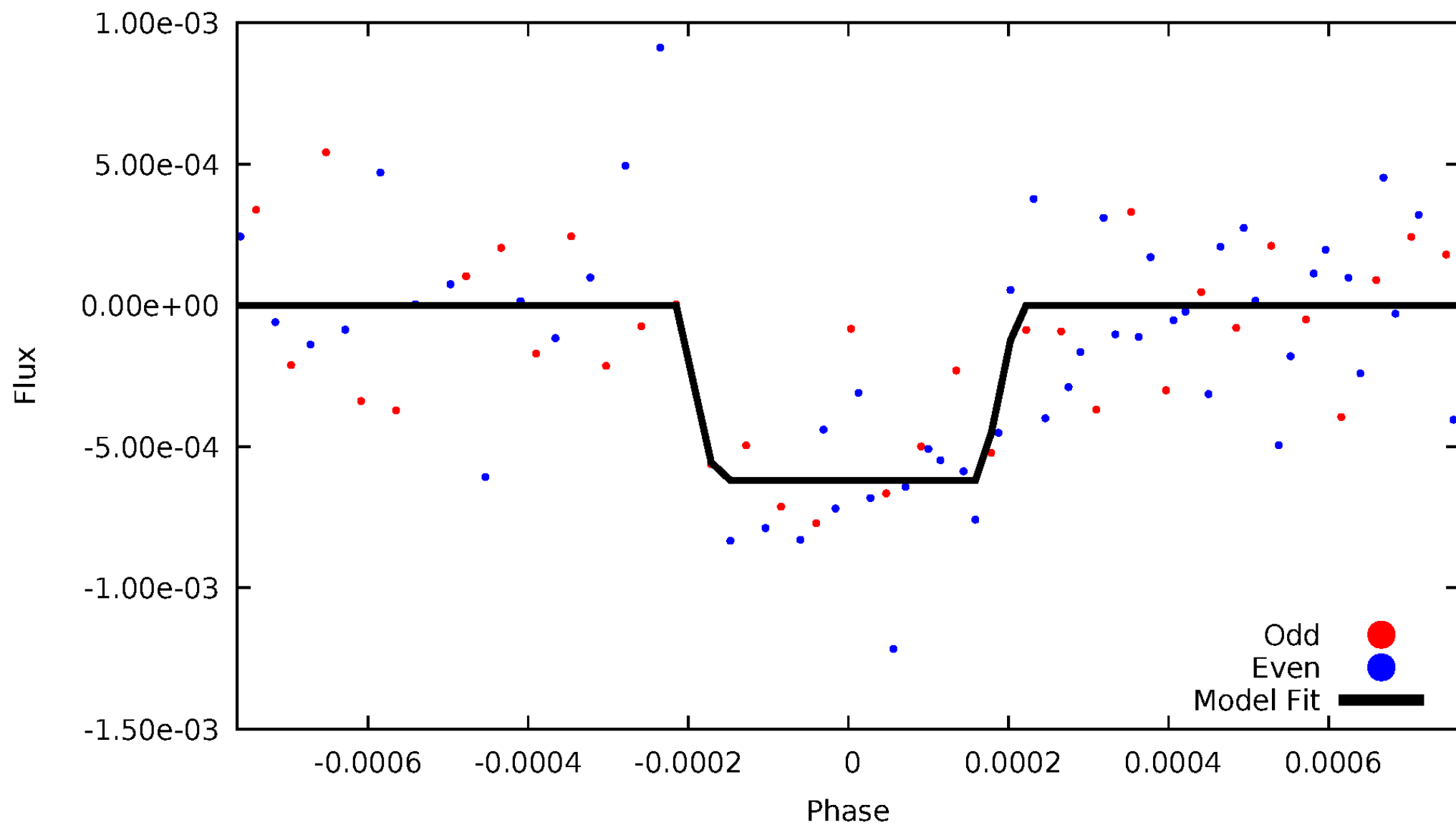
# DV Odd/Even

TCE 008822216-03



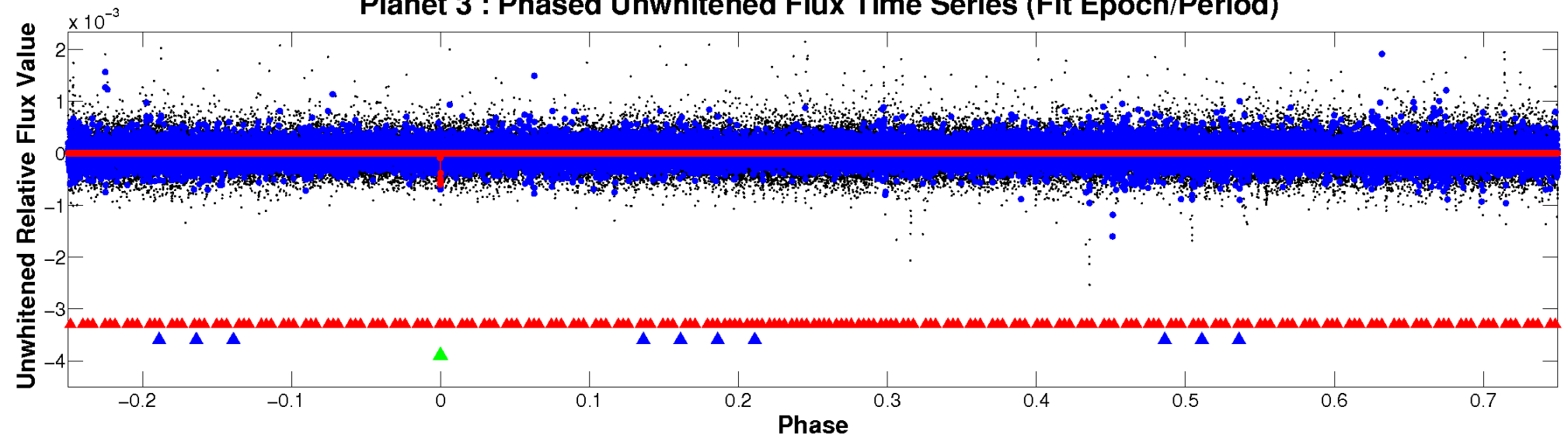
# ALT Odd/Even

TCE 008822216-03

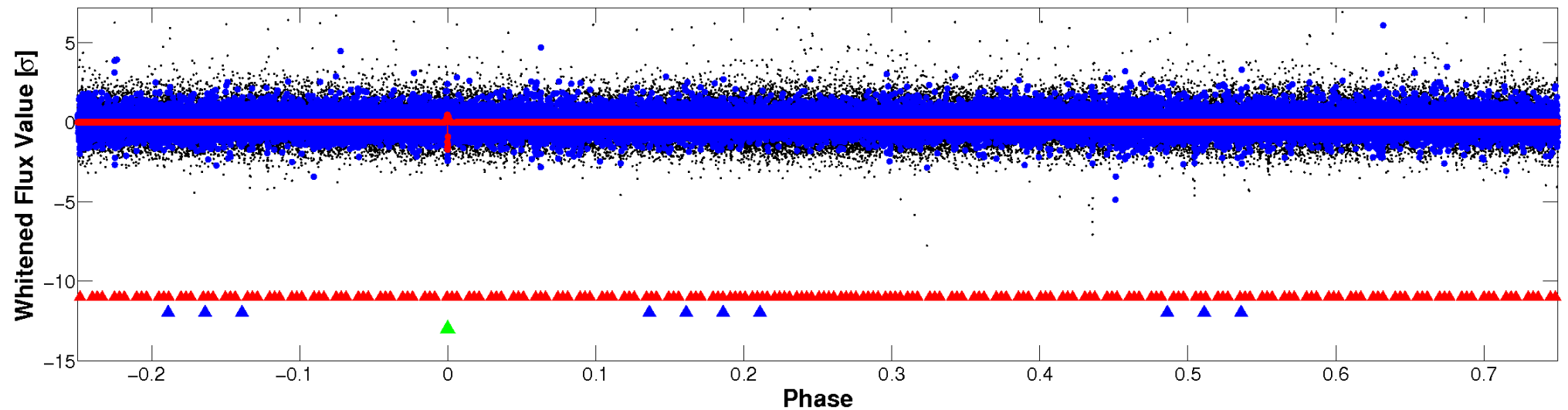


# Non-Whitened Vs. Whitened Light Curve

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

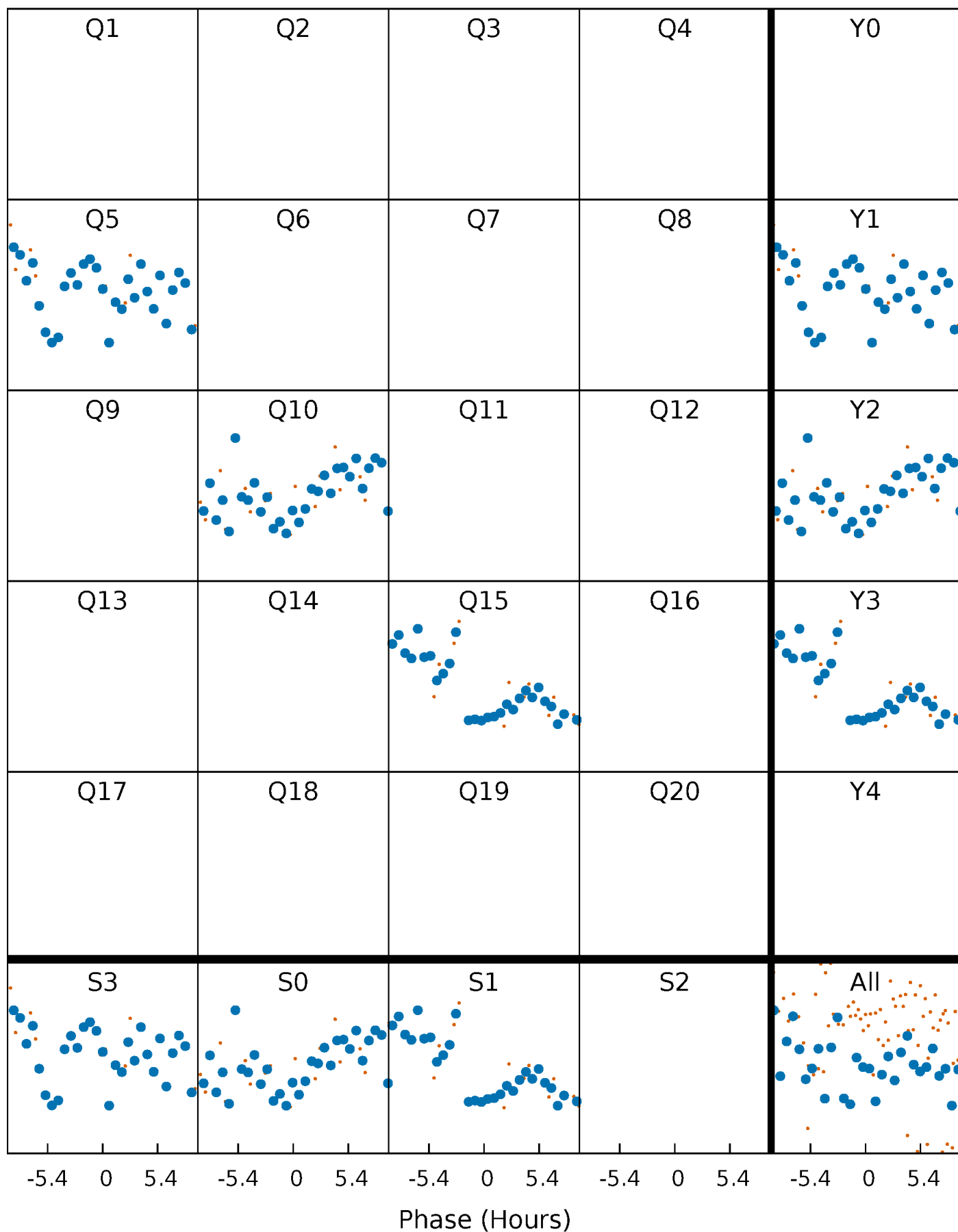


## Planet 3 : Phased Whitened Flux Time Series (Fit Epoch/Period)



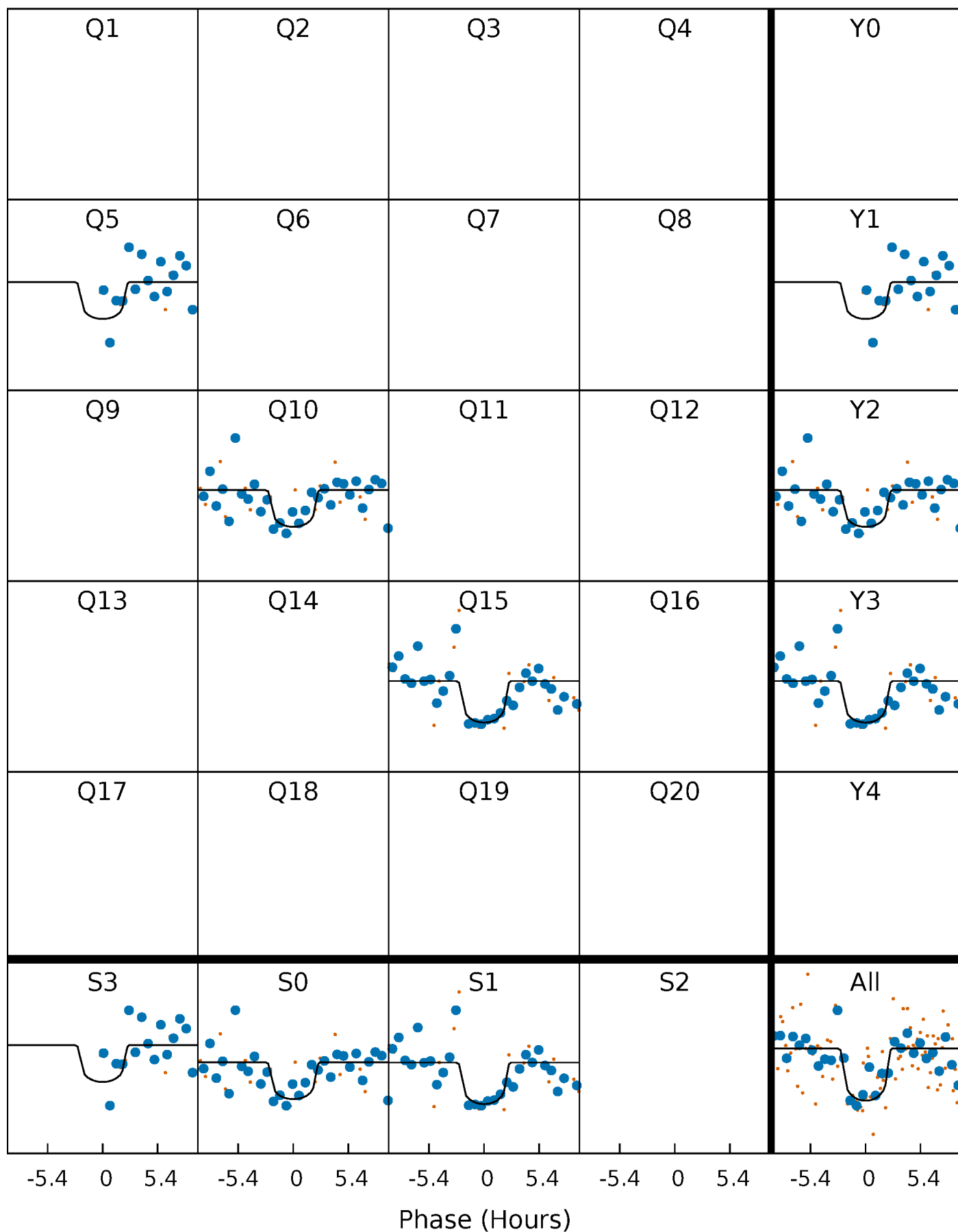
# PDC Quarter-Phased Transit Curves

TCE 008822216-03 P=467.239651 Days  $T_0=511.974648$  (BKJD)



# DV Quarter-Phased Transit Curves

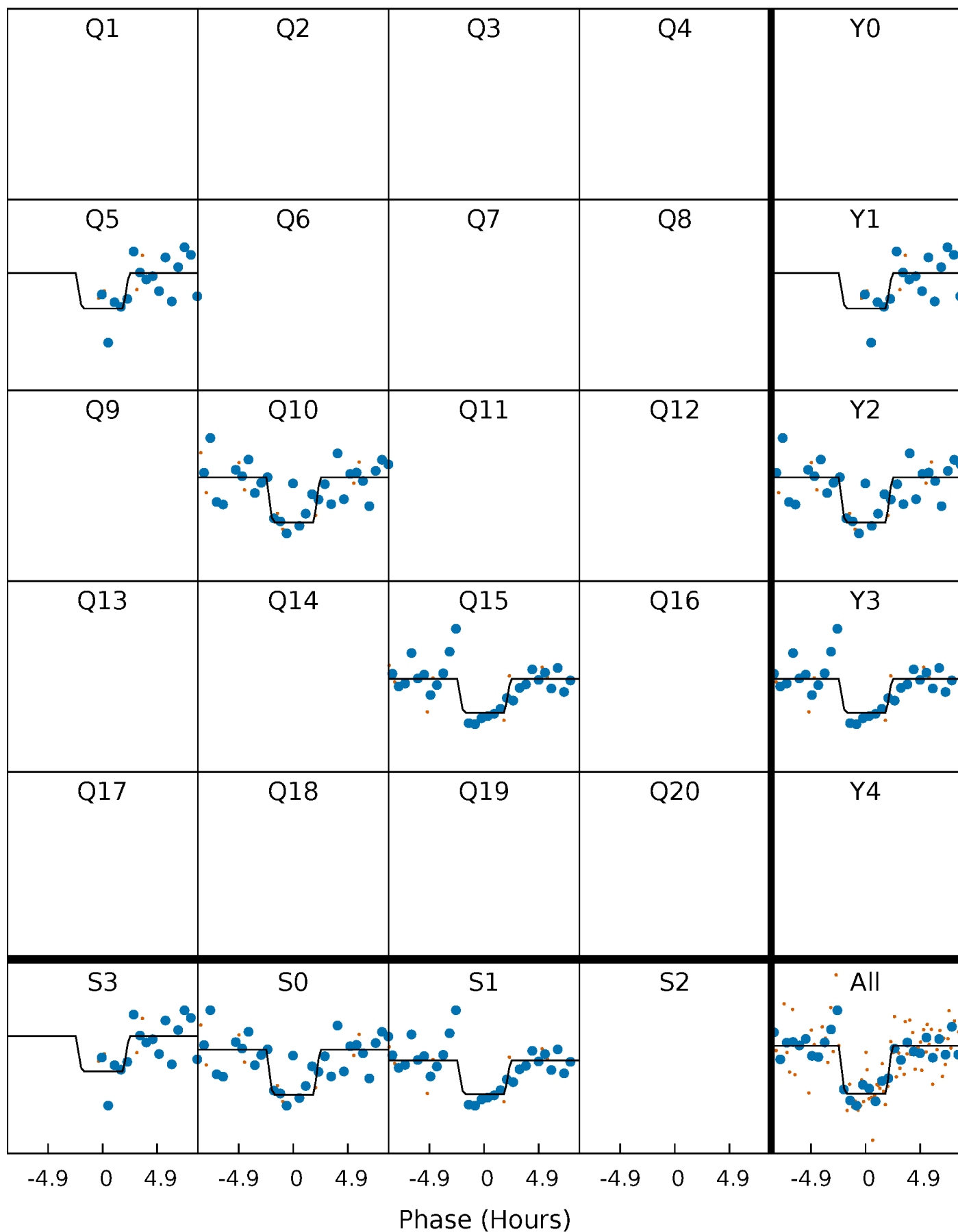
TCE 008822216-03 P=467.239651 Days  $T_0=511.974648$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

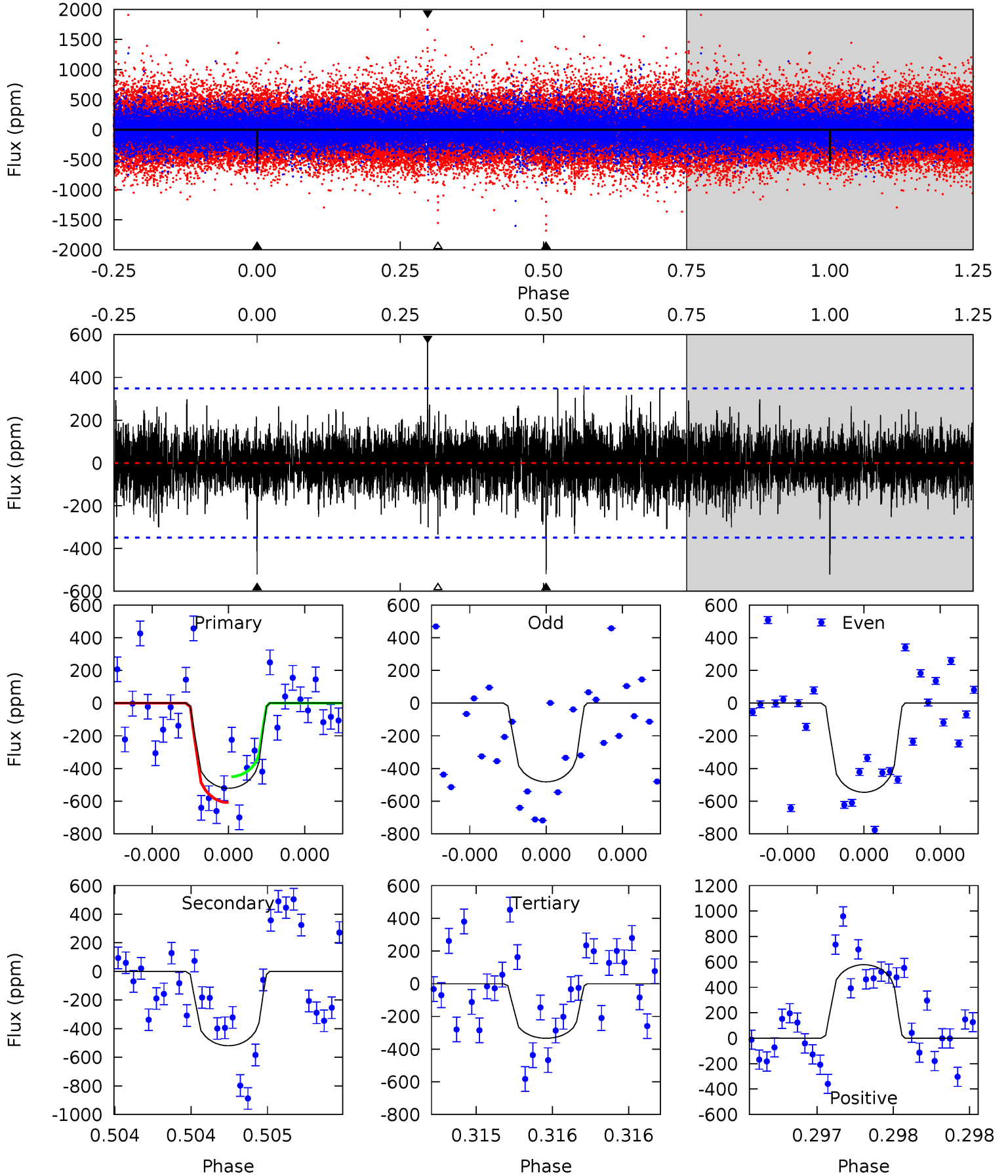
TCE 008822216-03 P=467.240594 Days  $T_0=511.980206$  (BKJD)



# DV Model-Shift Uniqueness Test

008822216-03, P = 467.239651 Days, E = 44.734997 Days

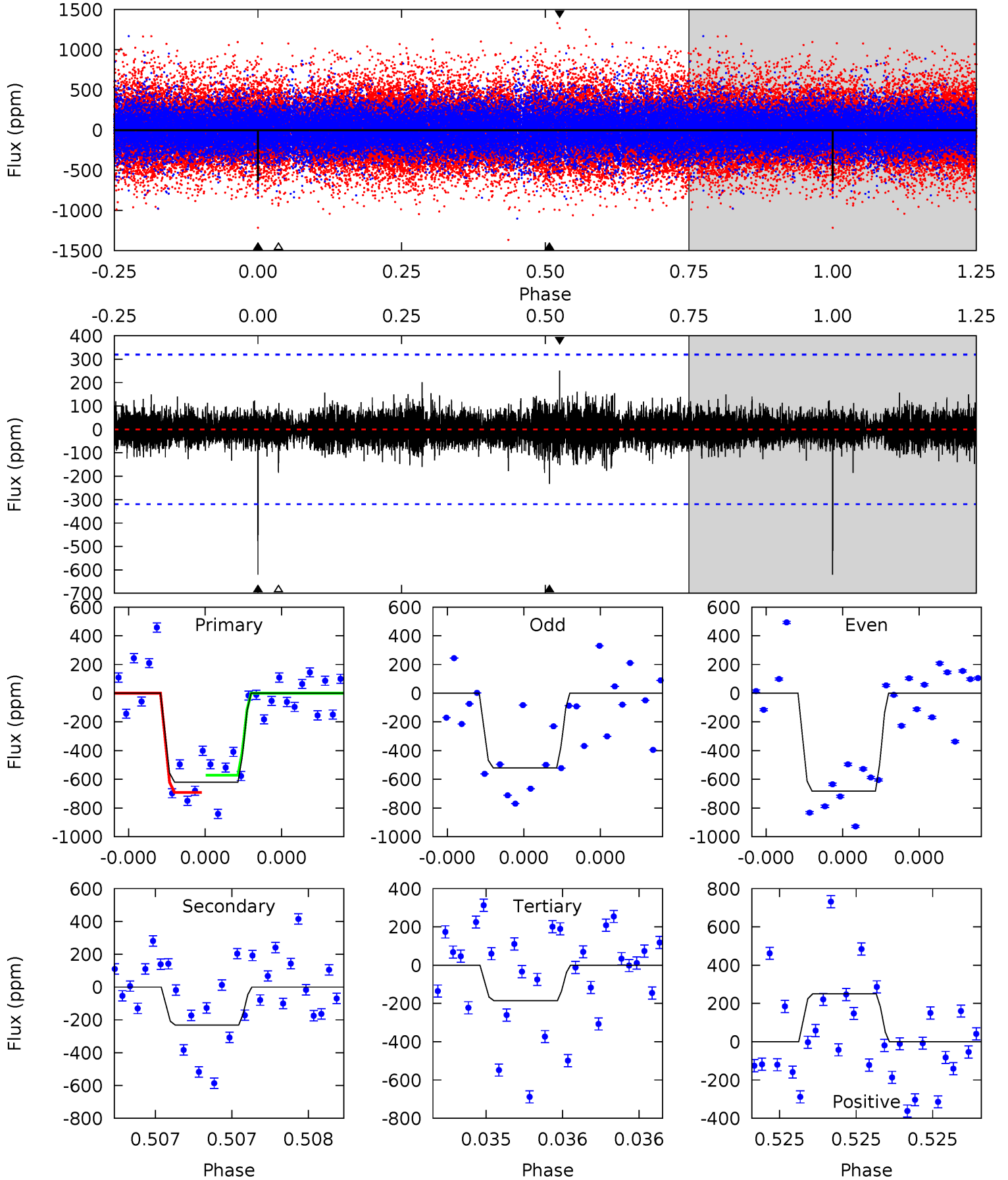
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
8.37	8.34	5.36	9.28	5.60	3.52	1.32	3.01	-0.92	2.98	-0.95	0.51	1.06	0.53	1.24



# Alt Model-Shift Uniqueness Test

008822216-03, P = 467.240594 Days, E = 44.739612 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
10.9	4.09	3.27	4.42	5.63	3.56	0.70	7.65	6.50	0.82	-0.33	1.39	1.00	0.29	0.99



### Stellar Parameters For KIC 008822216

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5713^{+138}_{-173}$	$4.541^{+0.042}_{-0.168}$	$0.070^{+0.200}_{-0.350}$	$0.893^{+0.215}_{-0.086}$	$1.010^{+0.083}_{-0.134}$	$2.000^{+0.346}_{-0.949}$
	+2%/-3%	+1%/-4%	+286%/-500%	+24%/-10%	+8%/-13%	+17%/-47%
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 008822216-03 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	-519±62	$3.07^{+2.41}_{-1.98}$	$310^{+17}_{-13}$	$4983^{+3673}_{-983}$	$40593^{+301268}_{-27539}$
Alt.	-232±57	$3.14^{+2.35}_{-1.91}$	$311^{+18}_{-13}$	$4210^{+2082}_{-726}$	$17409^{+93555}_{-11924}$

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

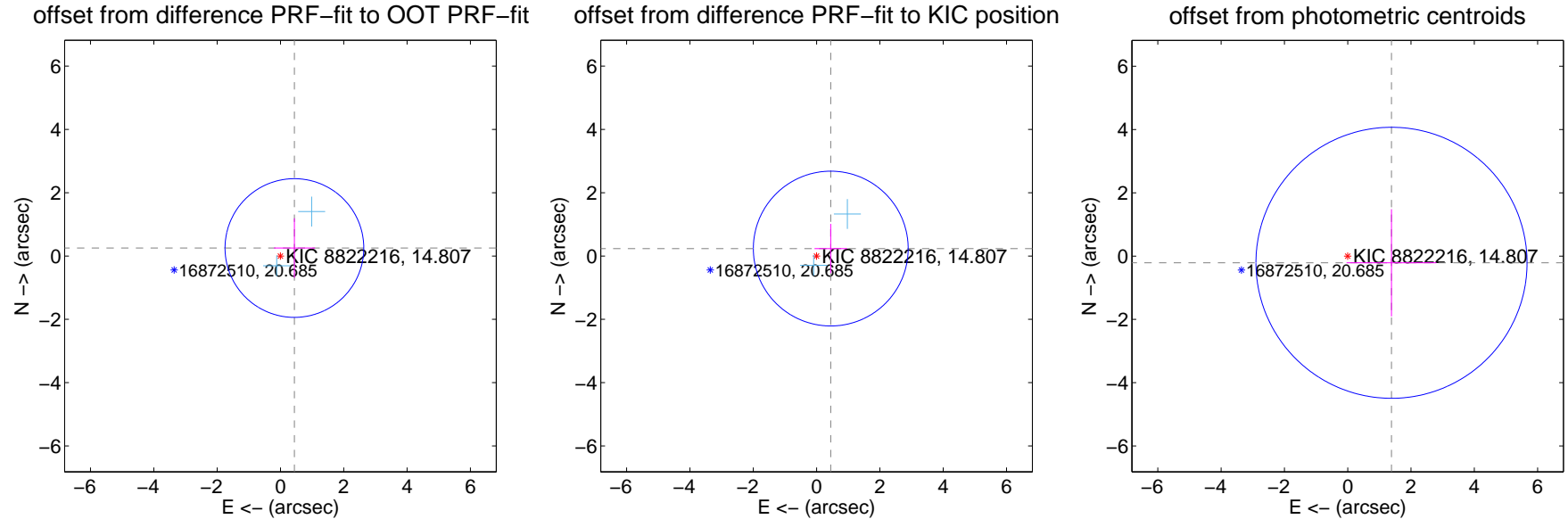
## DV Centroid Data

Supplemental centroid analysis for 008822216-03. Kepler magnitude: 14.81. Transit SNR 7.24

There are 2 quarters with good PRF difference image offsets

The direct PRF centroid is offset from the target star catalog position by about 0.03 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.508 \pm 0.730$	0.70	$-0.441 \pm 0.647$	$0.252 \pm 0.940$
PRF-fit source offset from KIC position	$0.506 \pm 0.815$	0.62	$-0.448 \pm 0.514$	$0.235 \pm 0.780$
photometric centroid source offset	$1.40 \pm 1.43$	0.98	$-1.38 \pm 1.42$	$-0.21 \pm 1.69$

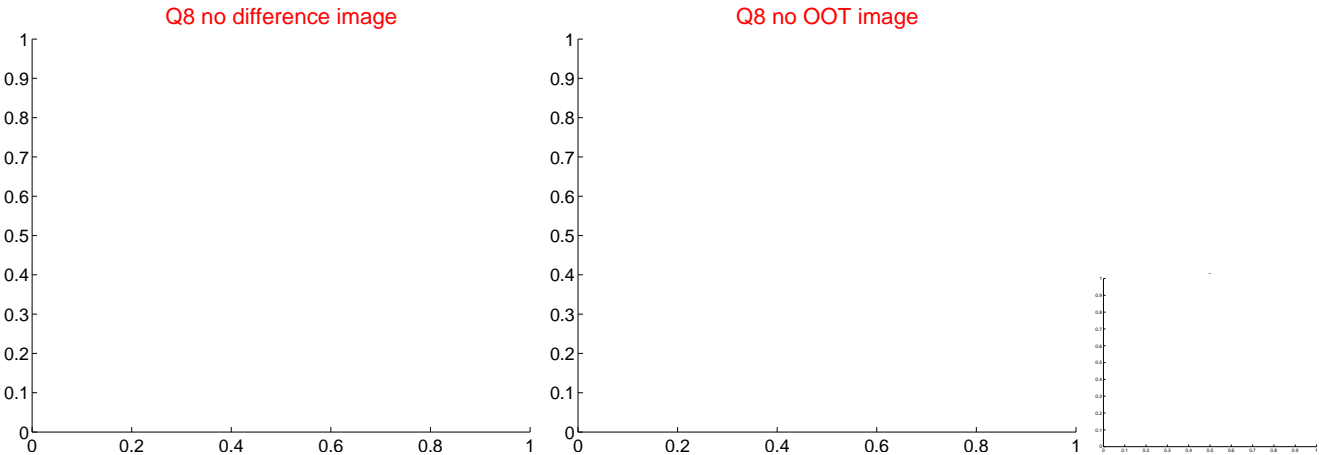
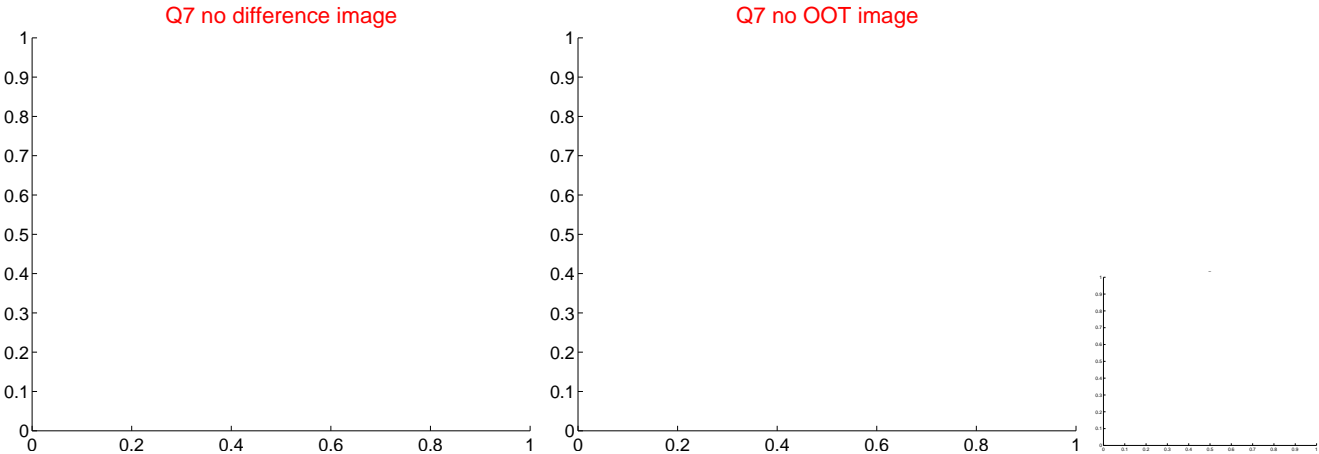
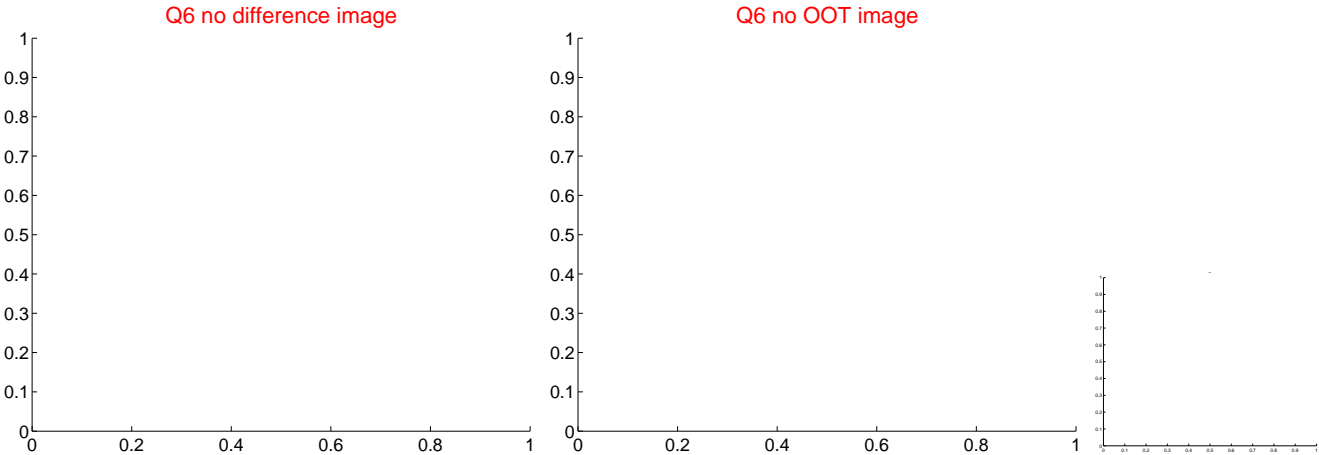
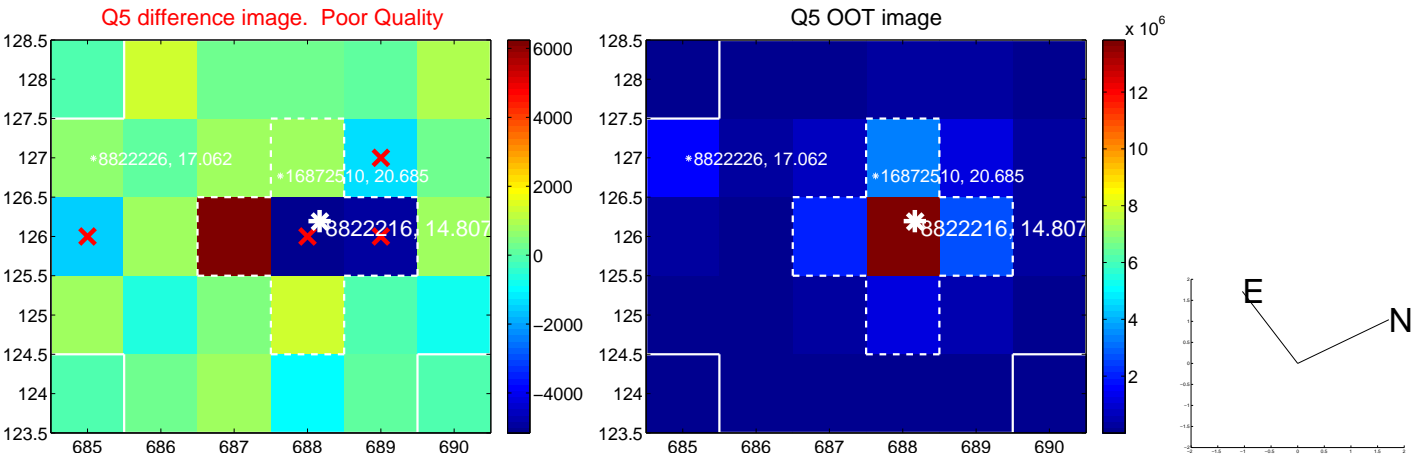


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

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



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



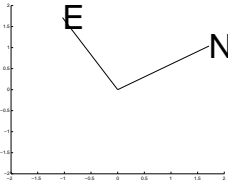
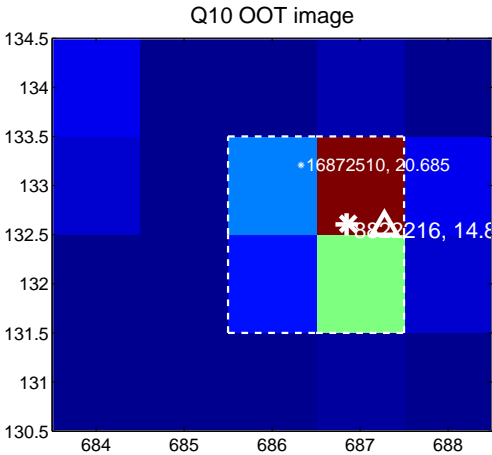
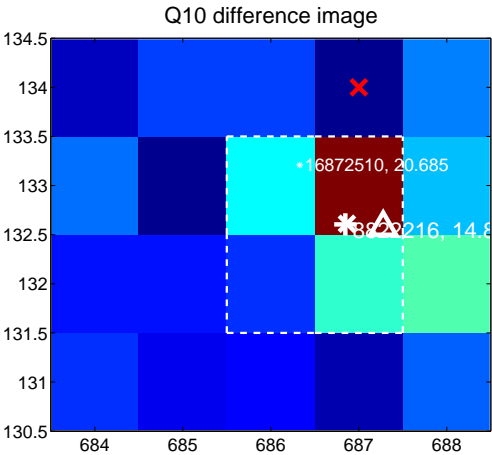


white ×: KIC target position; +: OOT centroid; △: difference centroid. red ✕: large negative pixel value.

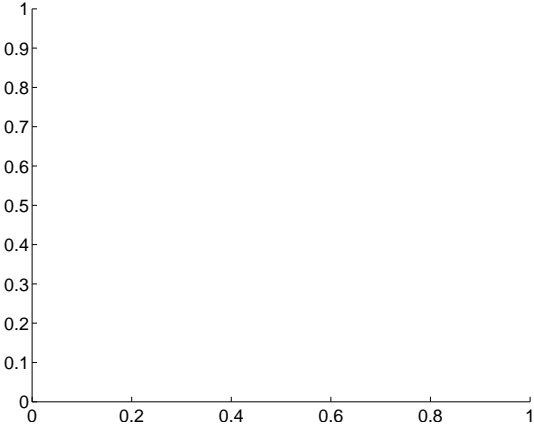
Q9 no difference image



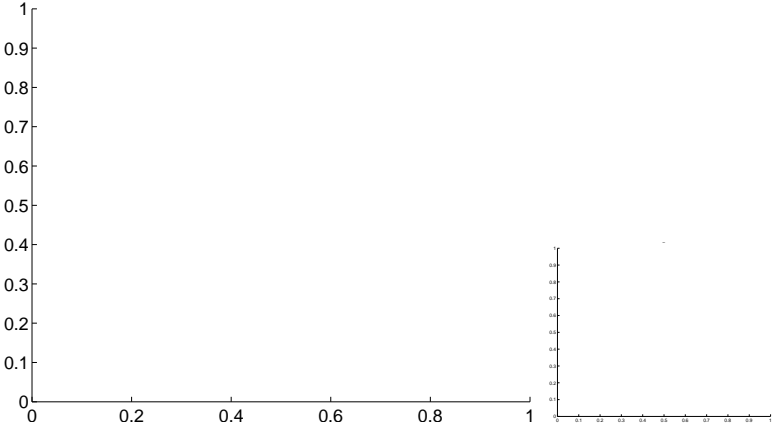
Q9 no OOT image



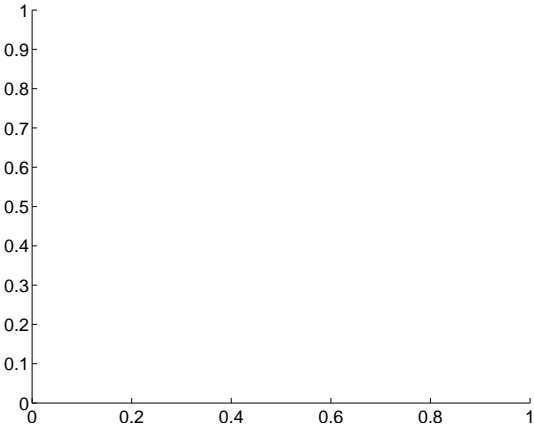
Q11 no difference image



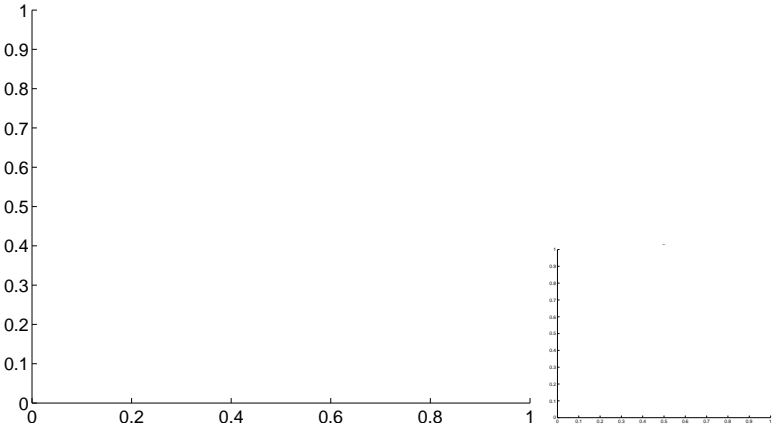
Q11 no OOT image



Q12 no difference image



Q12 no OOT image



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

Q13 no difference image



Q13 no OOT image



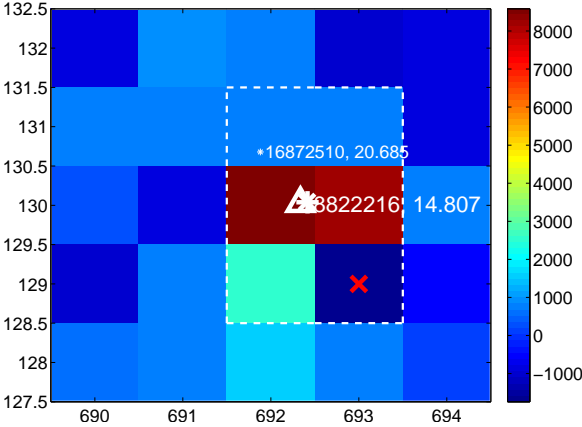
Q14 no difference image



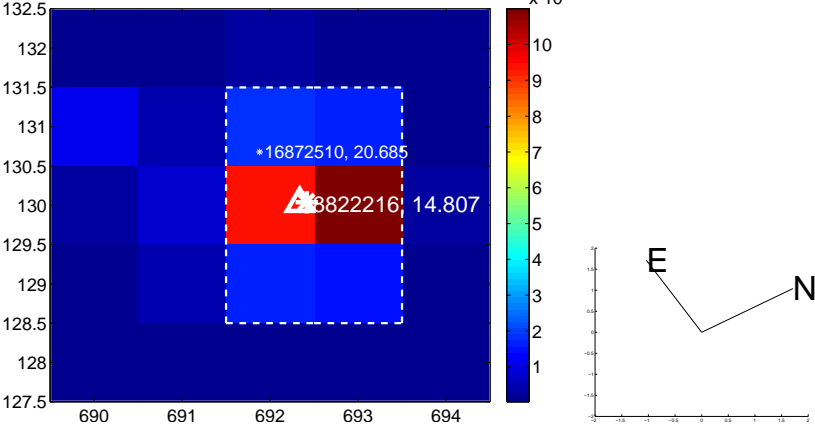
Q14 no OOT image



Q15 difference image



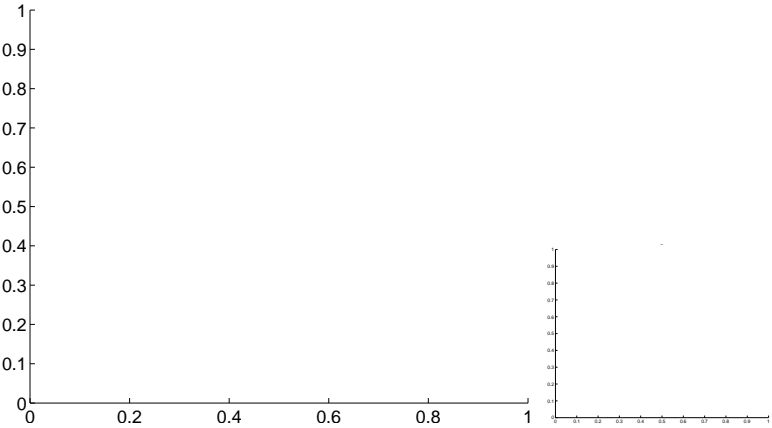
Q15 OOT image



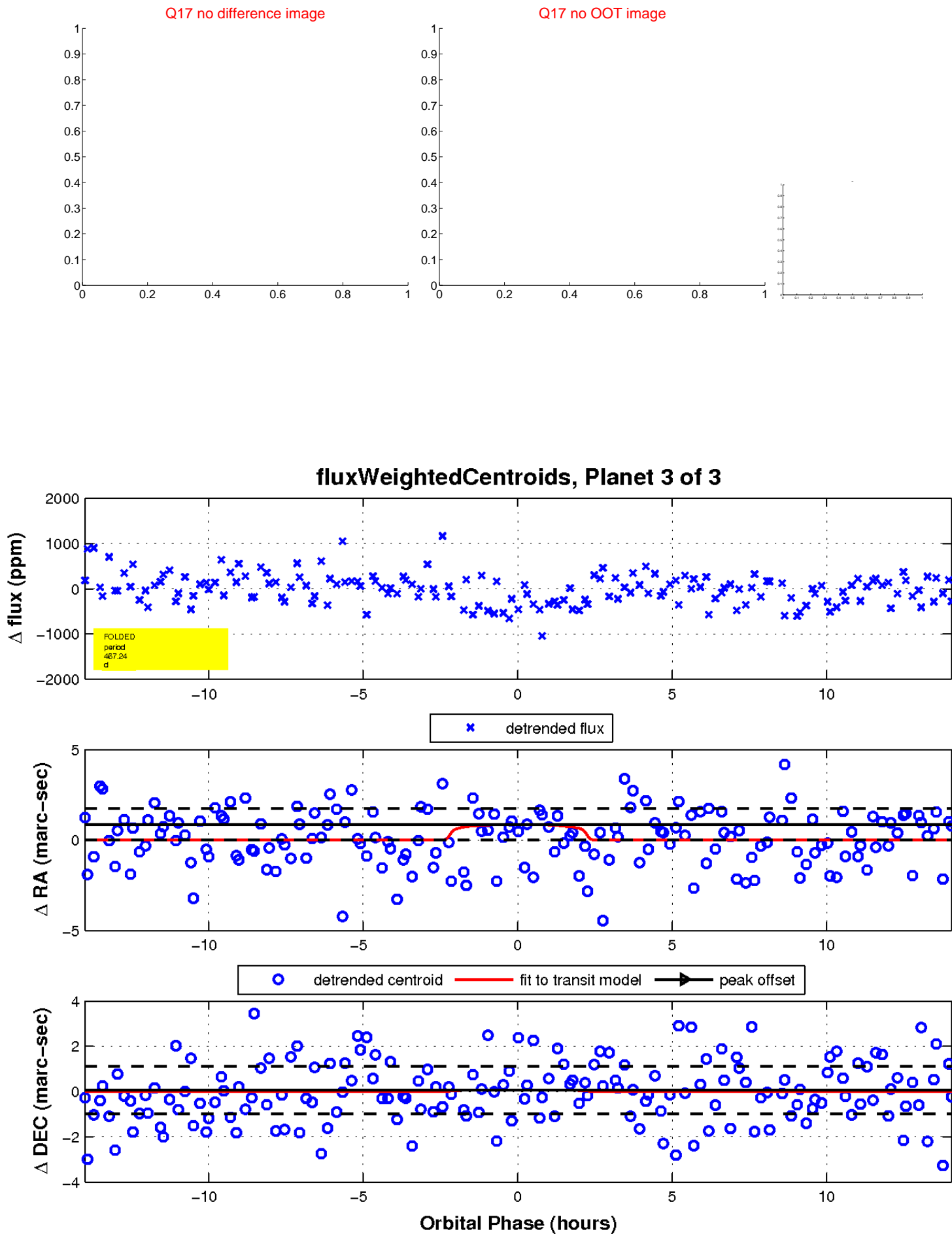
Q16 no difference image



Q16 no OOT image



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



UKIRT Image

Declination

