

# KIC 008588031

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
008588031-01	OBS	No	1.129496	132.237416	74.7	5.037	10.0	10.9	1.54	6573	1.37	8005.50
008588031-02	OBS	No	123.981995	138.449081	1156.2	7.625	9.8	9.5	1.54	6573	6.81	15.23
008588031-03	OBS	No	86.855554	146.372129	767.0	12.857	8.0	7.7	1.54	6573	5.83	24.48
008588031-04	OBS	No	115.910270	147.875278	582.5	12.779	8.9	6.4	1.54	6573	4.41	16.66
008588031-05	OBS	No	429.269521	157.621676	932.0	10.002	7.9	7.9	1.54	6573	5.68	2.91
008588031-06	OBS	No	37.028934	155.605567	205.2	9.000	7.6	-1.0	1.54	6573	2.23	76.30

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
008588031-01	OBS	FP	0.00	1	0	0	0	LPP_DV—MOD_NONUNIQ_DV
008588031-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_ALT—INCONSISTENT_TRANS—CENT_FEW_MEAS
008588031-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT
008588031-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV
008588031-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT
008588031-06	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_ALT—CENT_NOFITS—HALO_GHOST

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

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

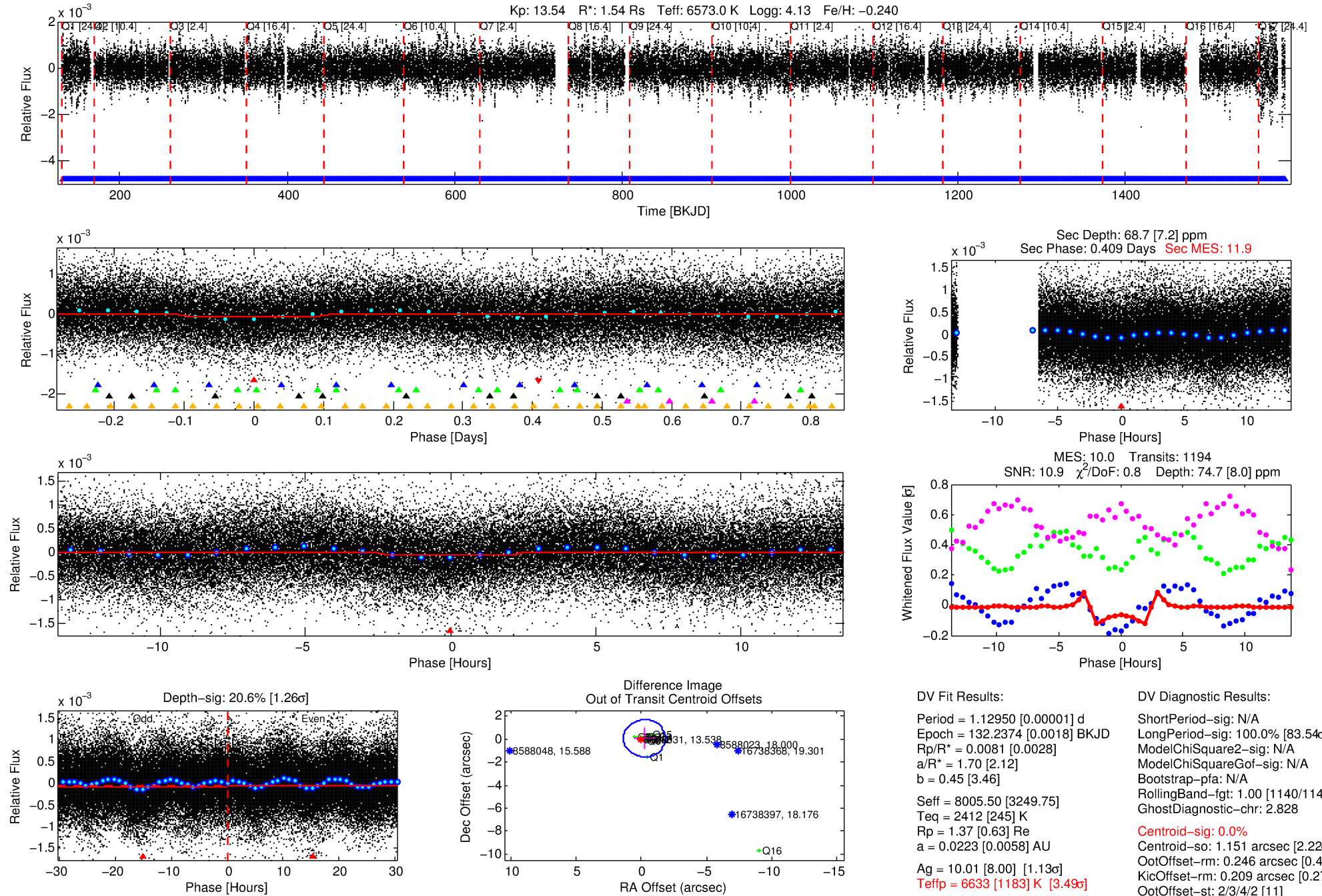
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 008588031-01

No Significant Match Found

# DV One-Page Summary

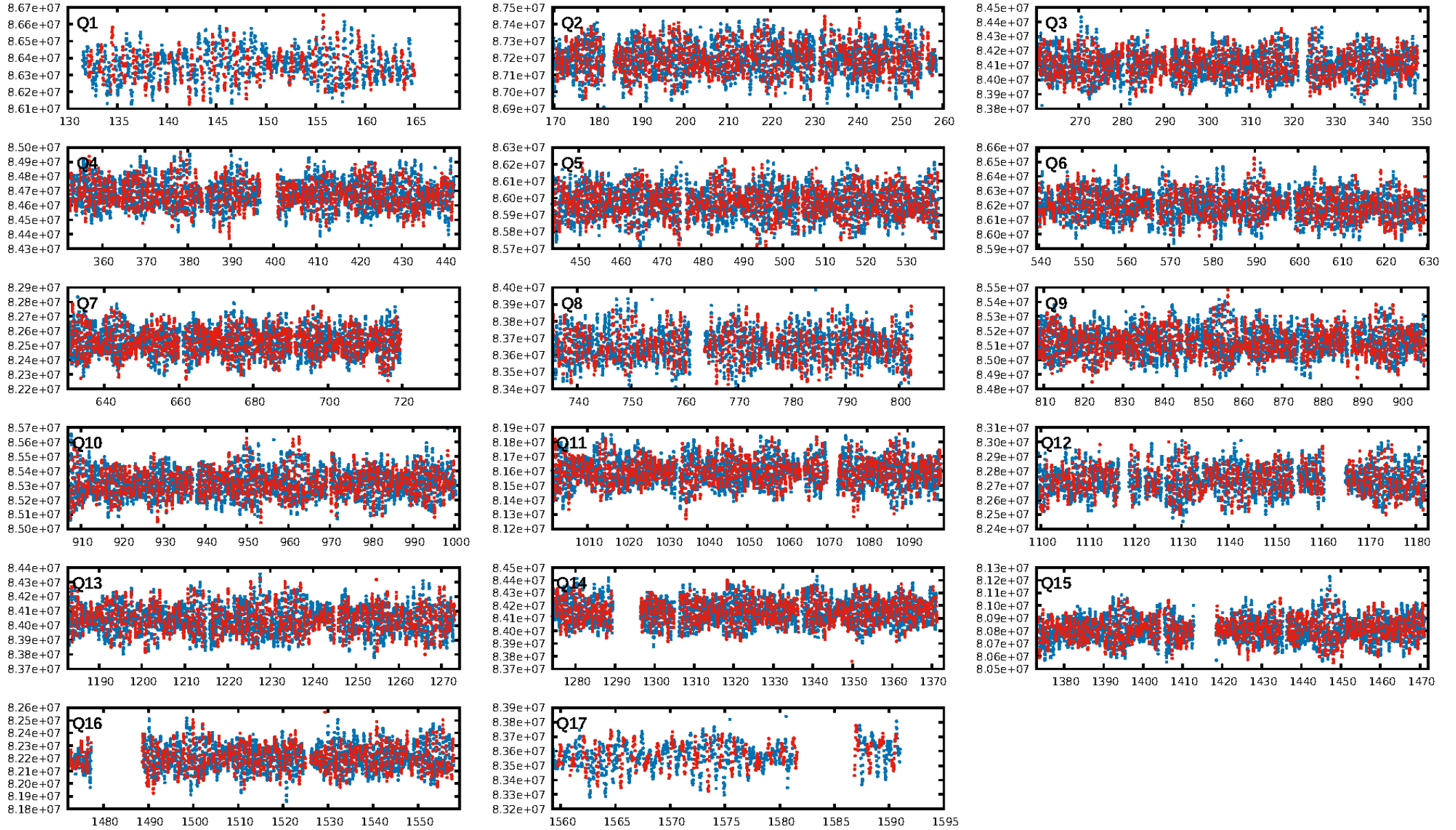
KIC: 8588031 Candidate: 1 of 6 Period: 1.129 d



Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 06:02:40 Z

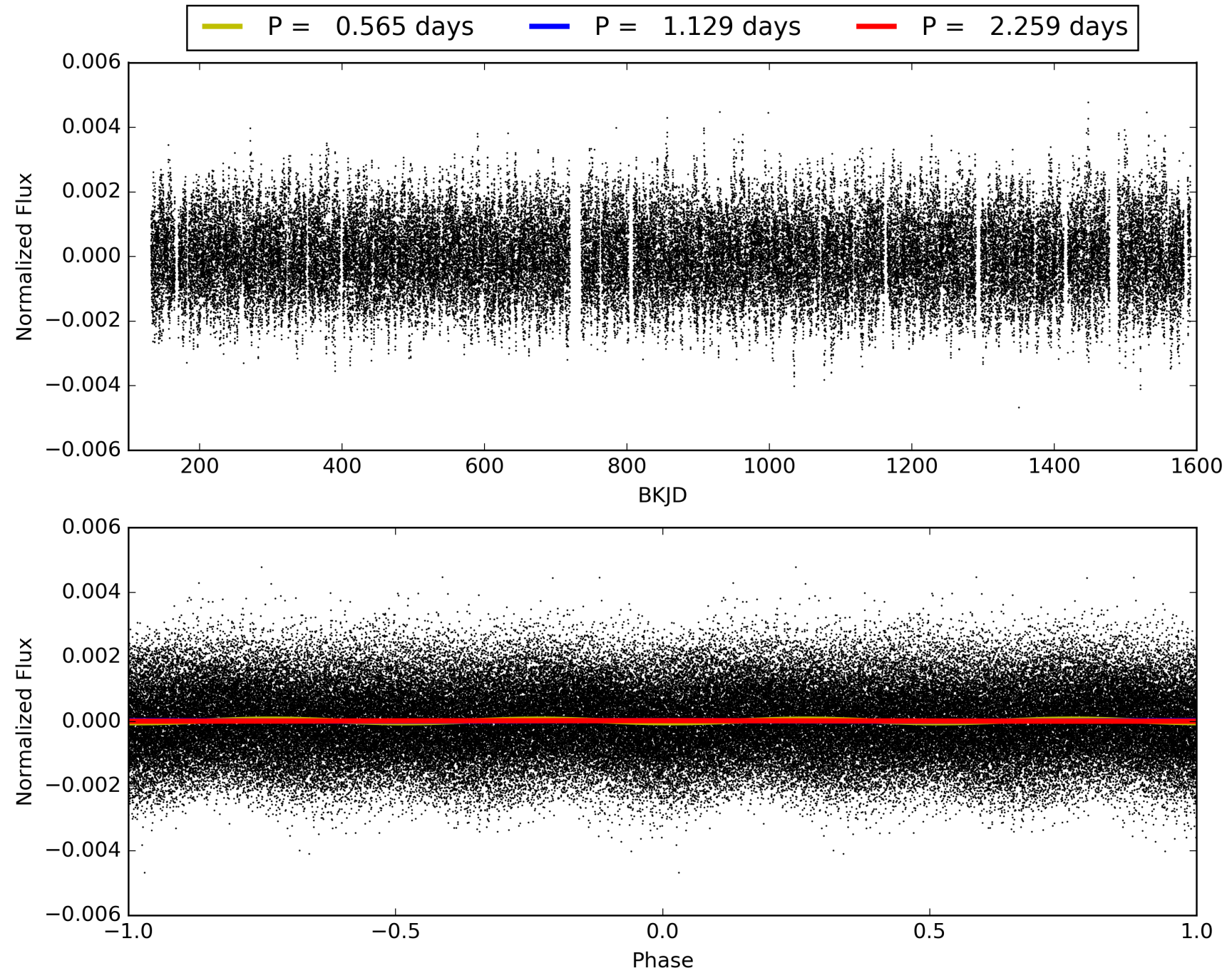
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 008588031-01, PDC Light Curves





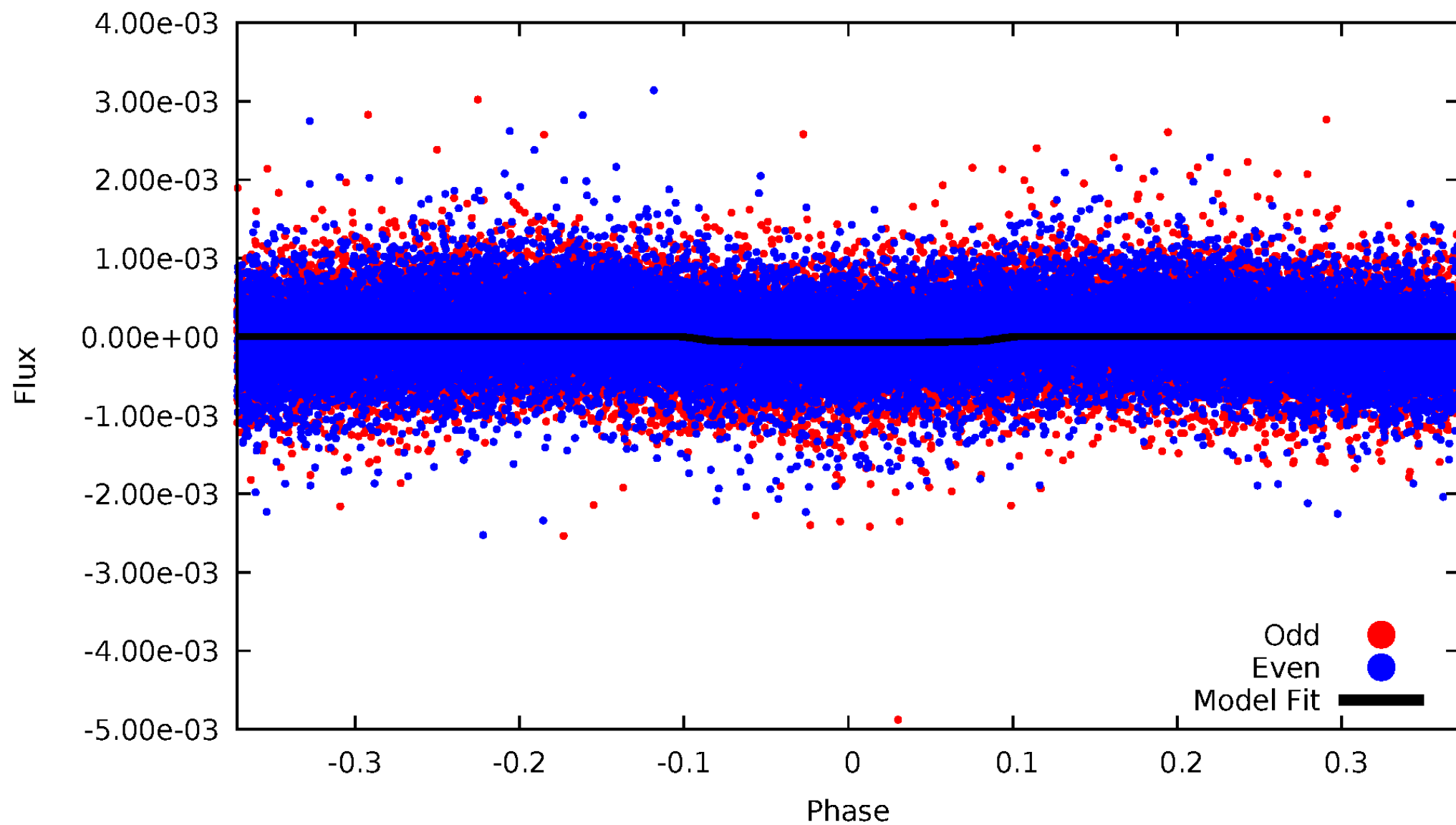
TCE 008588031-01





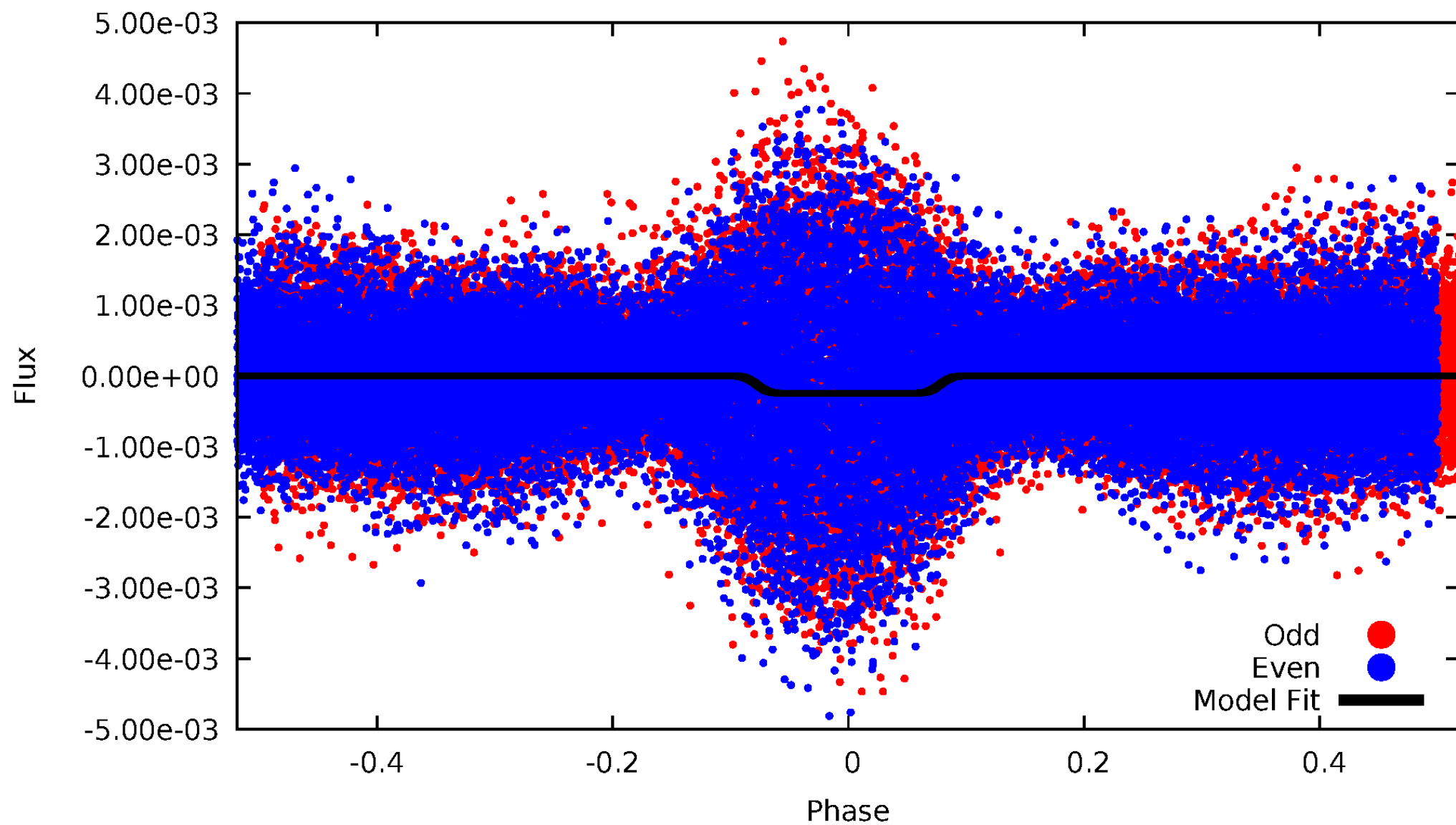
# DV Odd/Even

TCE 008588031-01

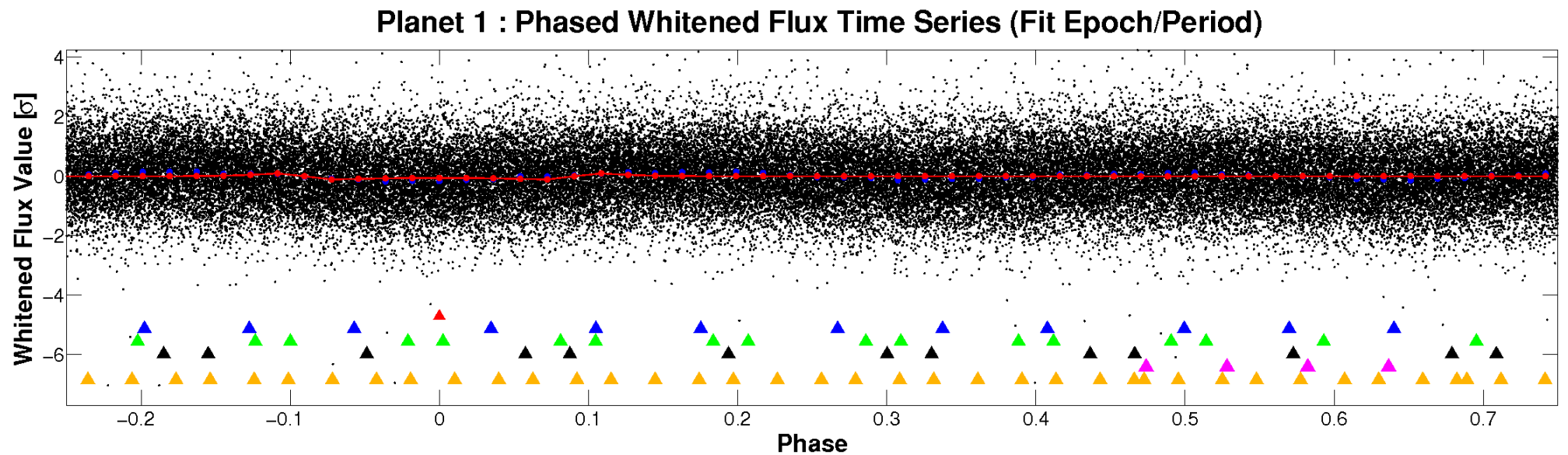
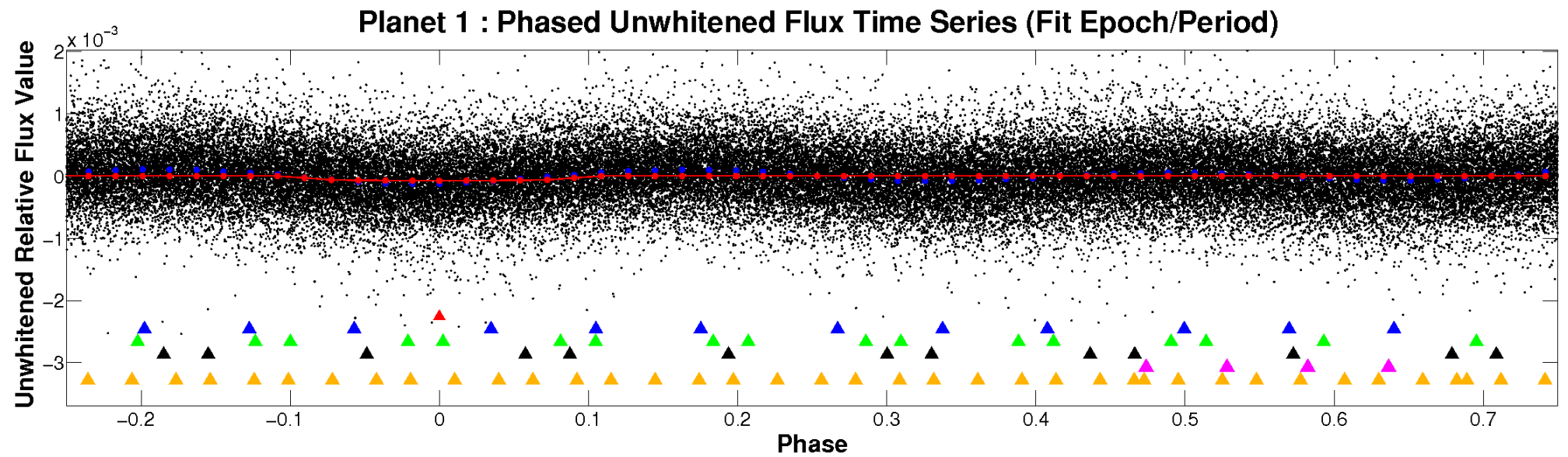


# ALT Odd/Even

TCE 008588031-01



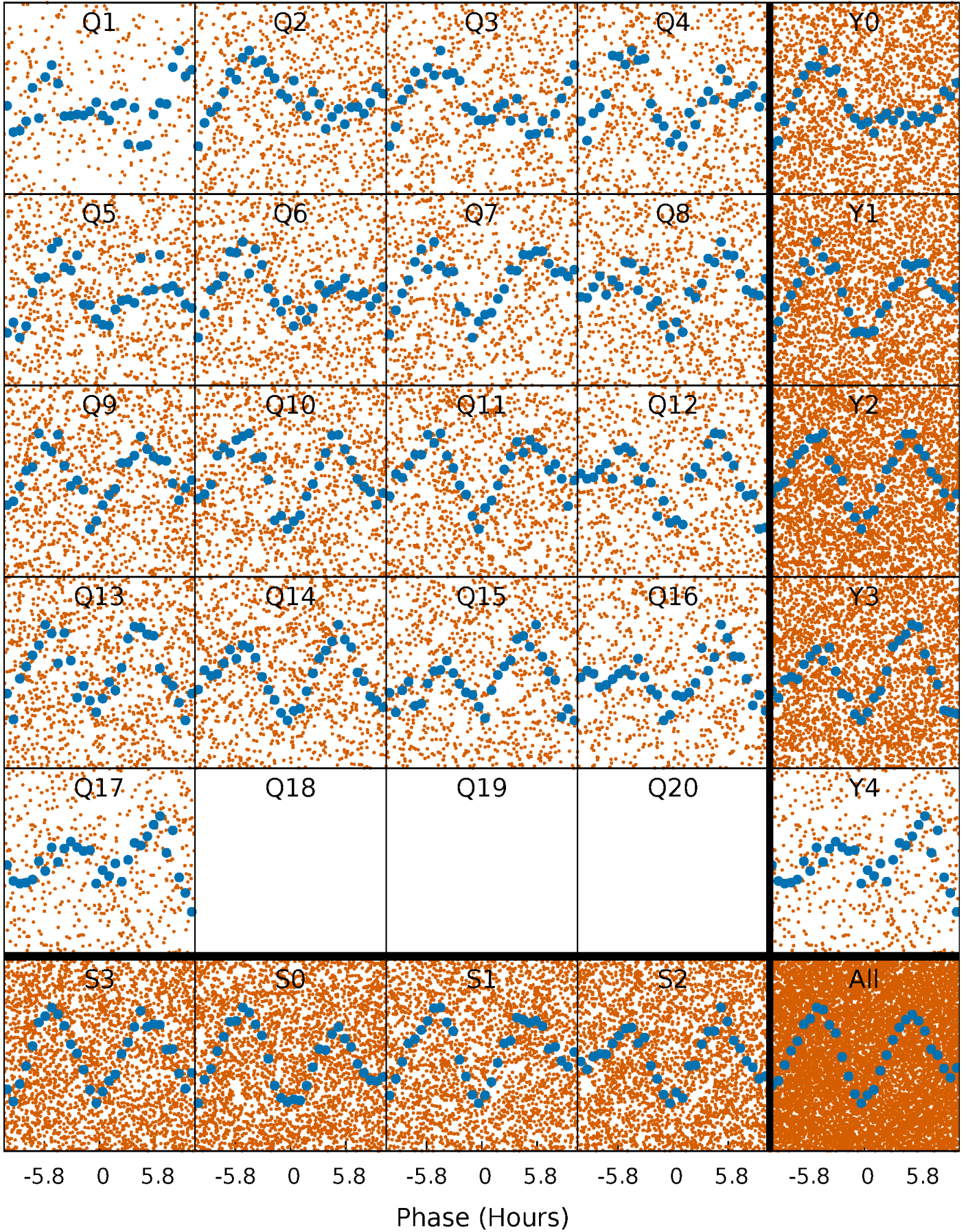
# Non-Whitened Vs. Whitened Light Curve





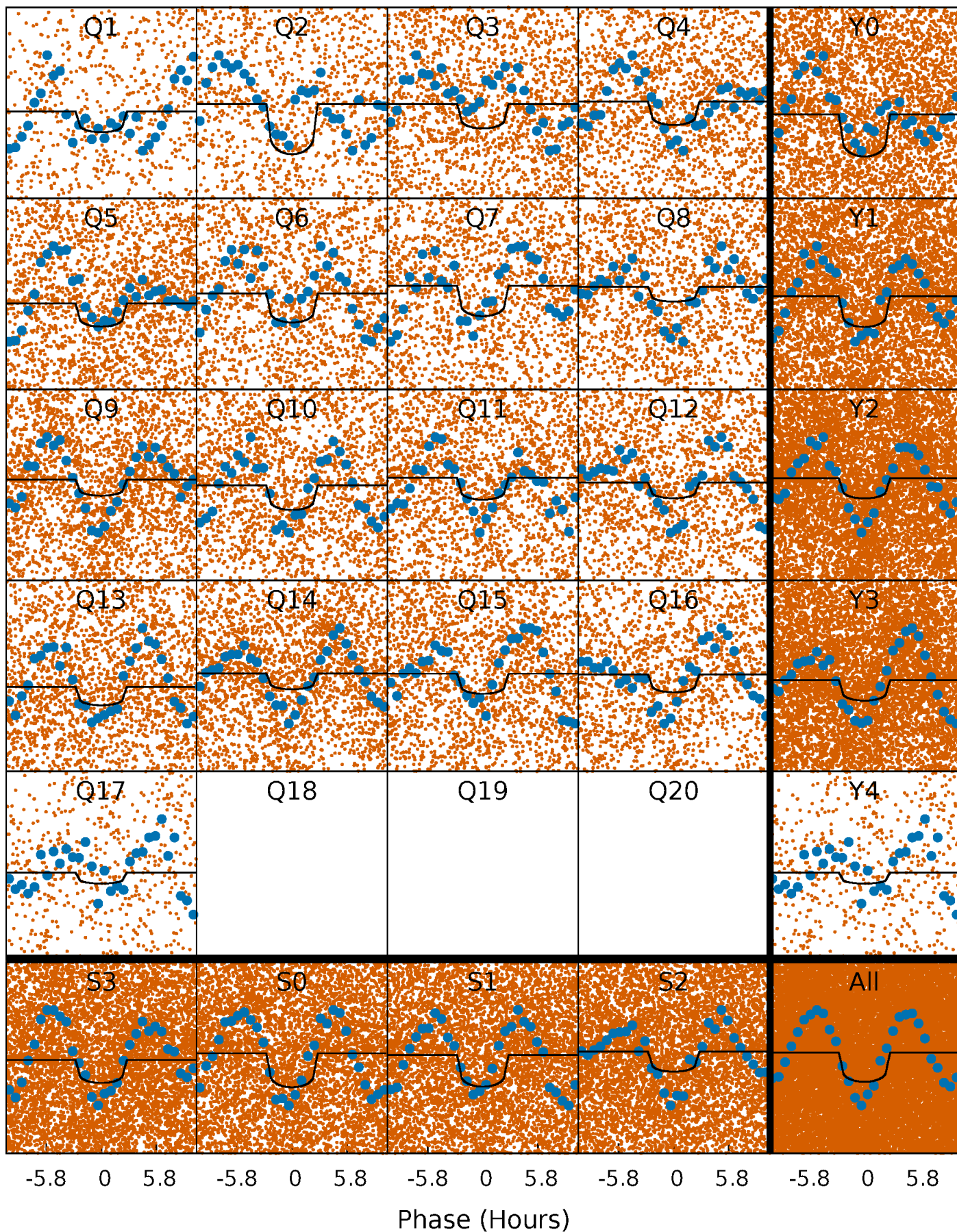
# PDC Quarter-Phased Transit Curves

TCE 008588031-01 P= 1.129496 Days  $T_0=132.237416$  (BKJD)



# DV Quarter-Phased Transit Curves

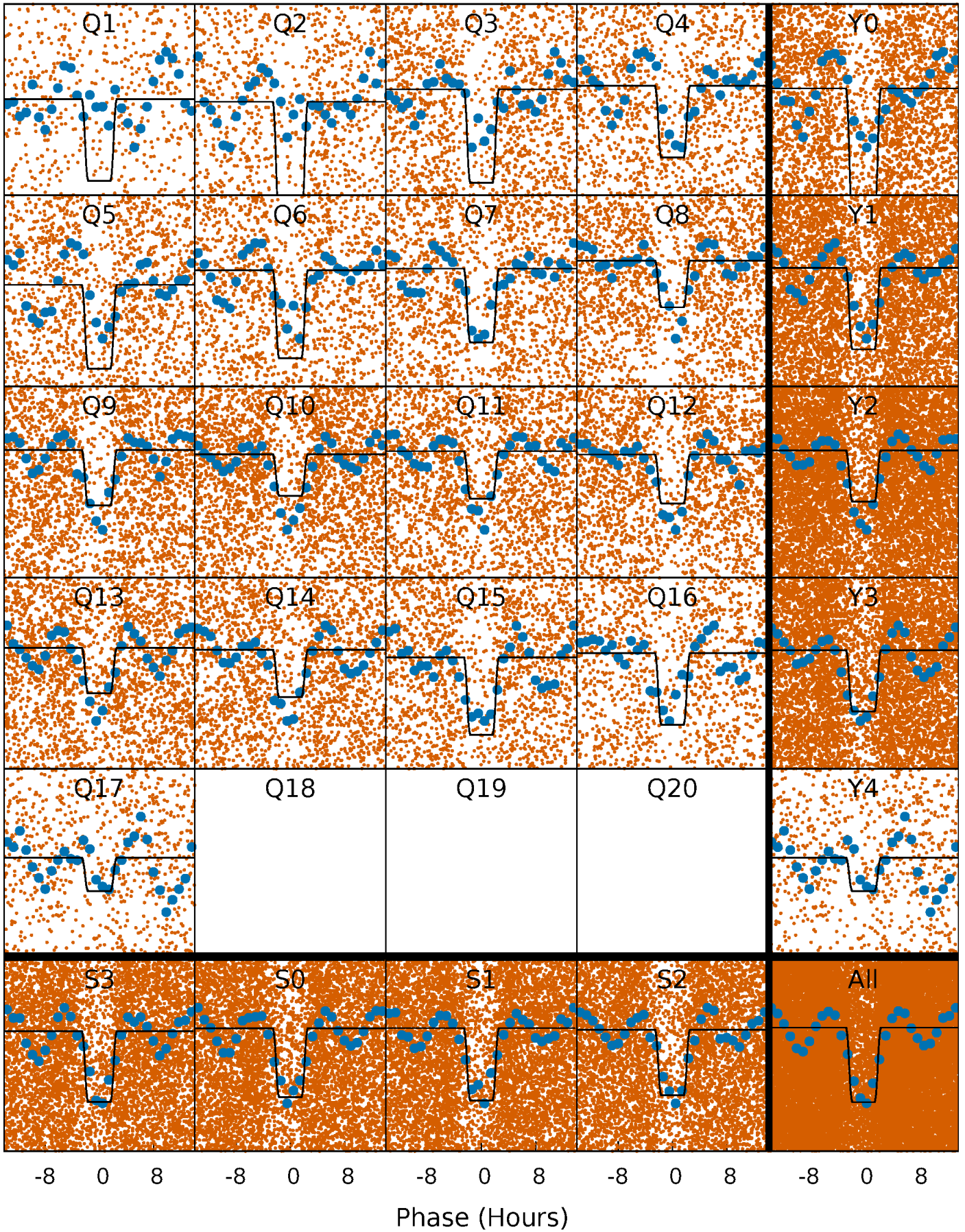
TCE 008588031-01 P= 1.129496 Days  $T_0=132.237416$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

TCE 008588031-01 P= 1.129529 Days  $T_0=132.204380$  (BKJD)

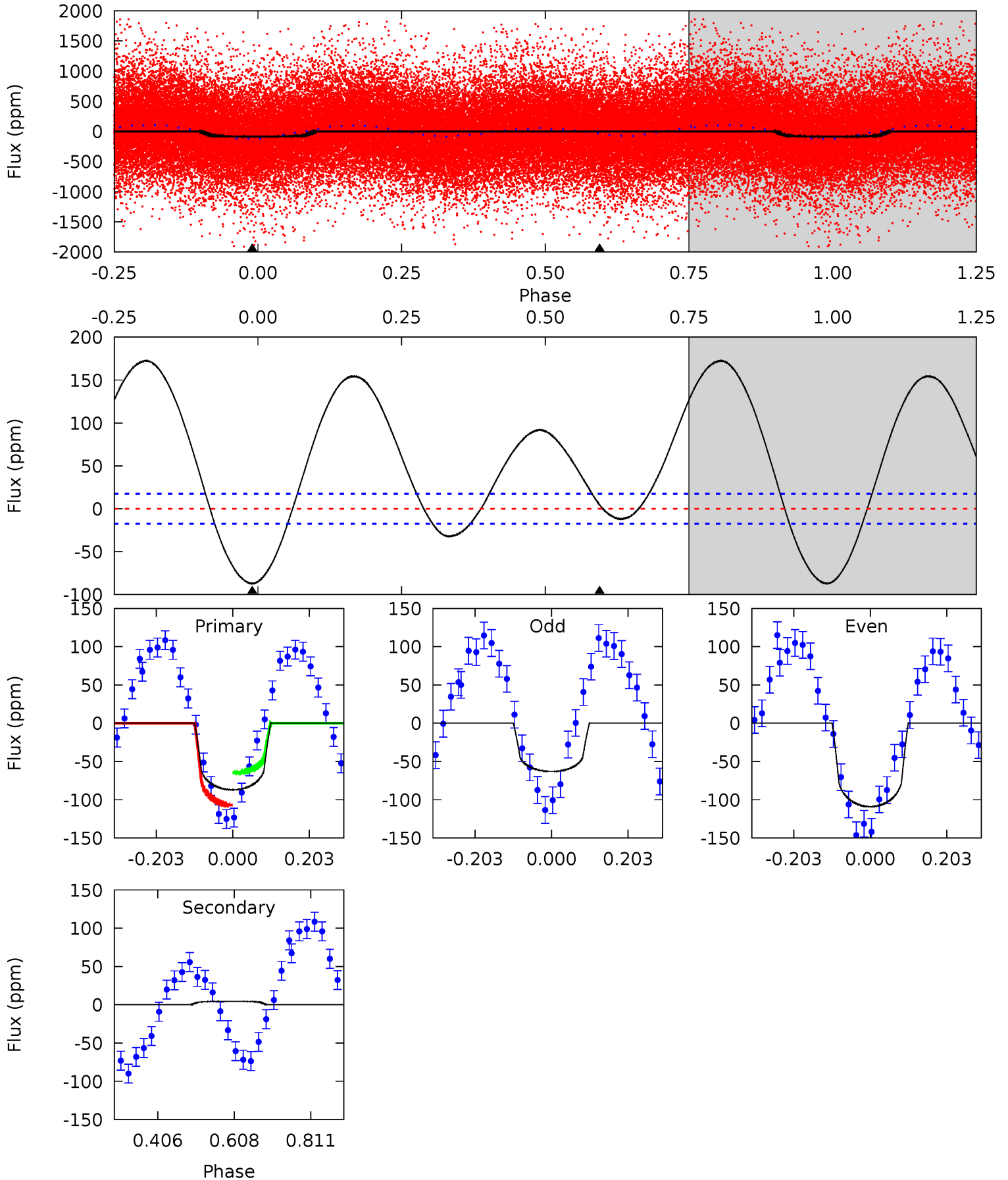




# DV Model-Shift Uniqueness Test

008588031-01, P = 1.129496 Days, E = 131.107920 Days

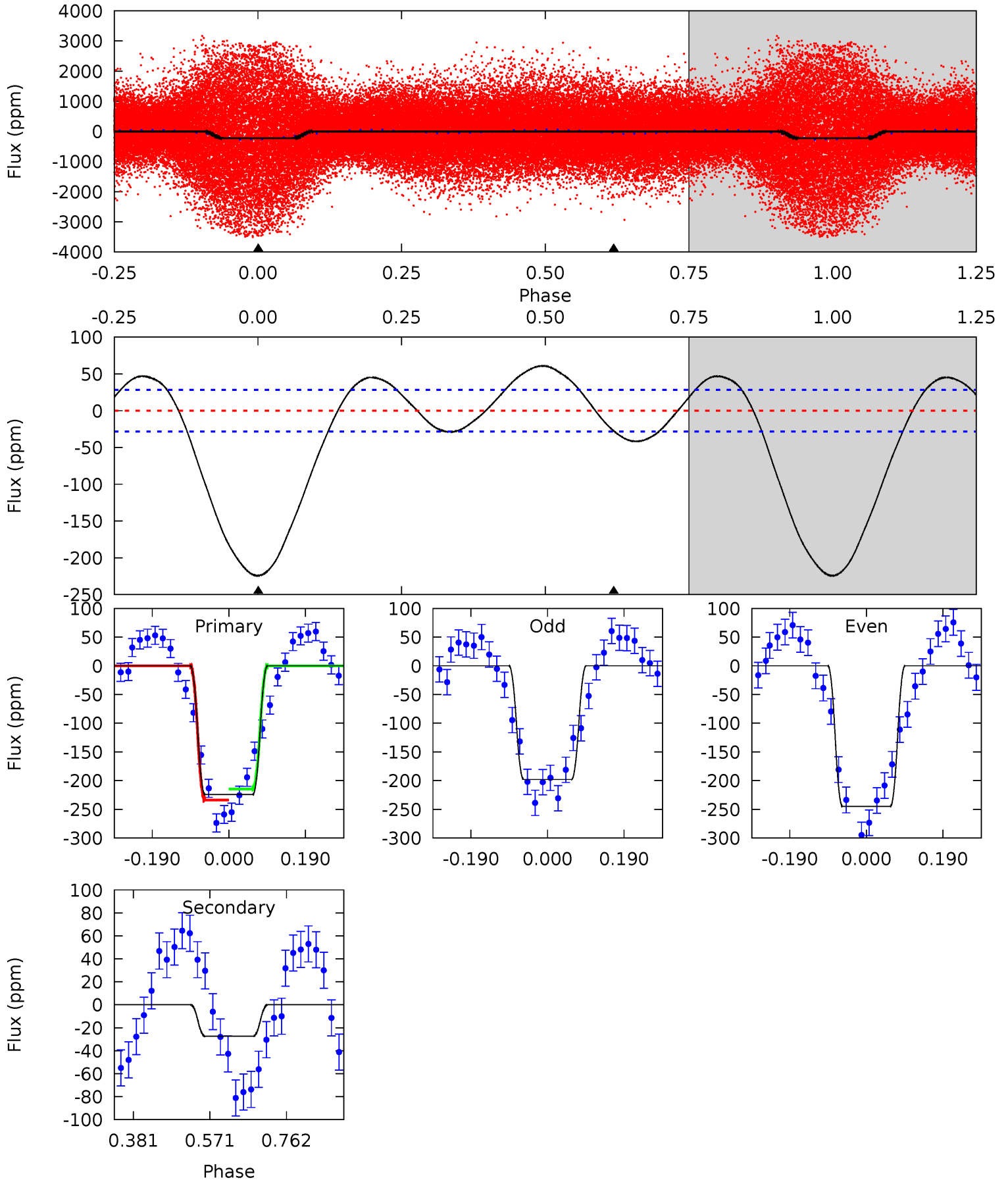
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
21.9	-1.15	0	0	4.41	1.27	14.3	21.9	21.9	-1.15	-1.15	5.82	1.09	0.66	5.30



# Alt Model-Shift Uniqueness Test

008588031-01, P = 1.129529 Days, E = 131.074851 Days

Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
35.0	4.28	0	0	4.43	1.31	3.89	35.0	35.0	4.28	4.28	3.66	0.90	0.21	1.61



### Stellar Parameters For KIC 008588031

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M$ ( $M_{\odot}$ )	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6573^{+175}_{-214}$	$4.126^{+0.214}_{-0.175}$	$-0.240^{+0.250}_{-0.300}$	$1.545^{+0.463}_{-0.421}$	$1.162^{+0.209}_{-0.157}$	$0.444^{+0.544}_{-0.214}$
	+3%/-3%	+5%/-4%	+104%/-125%	+30%/-27%	+18%/-14%	+123%/-48%
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 008588031-01 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{max}$ (K)	$T_{obs}$ (K)	$A_{obs}$
DV	$5 \pm 4$	$1.38^{+0.56}_{-0.52}$	$3365^{+239}_{-251}$	$-3977^{+539}_{-676}$	$-0.610^{+0.520}_{-1.302}$
Alt.	$-27 \pm 6$	$2.61^{+0.67}_{-0.60}$	$3362^{+266}_{-280}$	$3850^{+464}_{-429}$	$1.094^{+0.846}_{-0.444}$

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



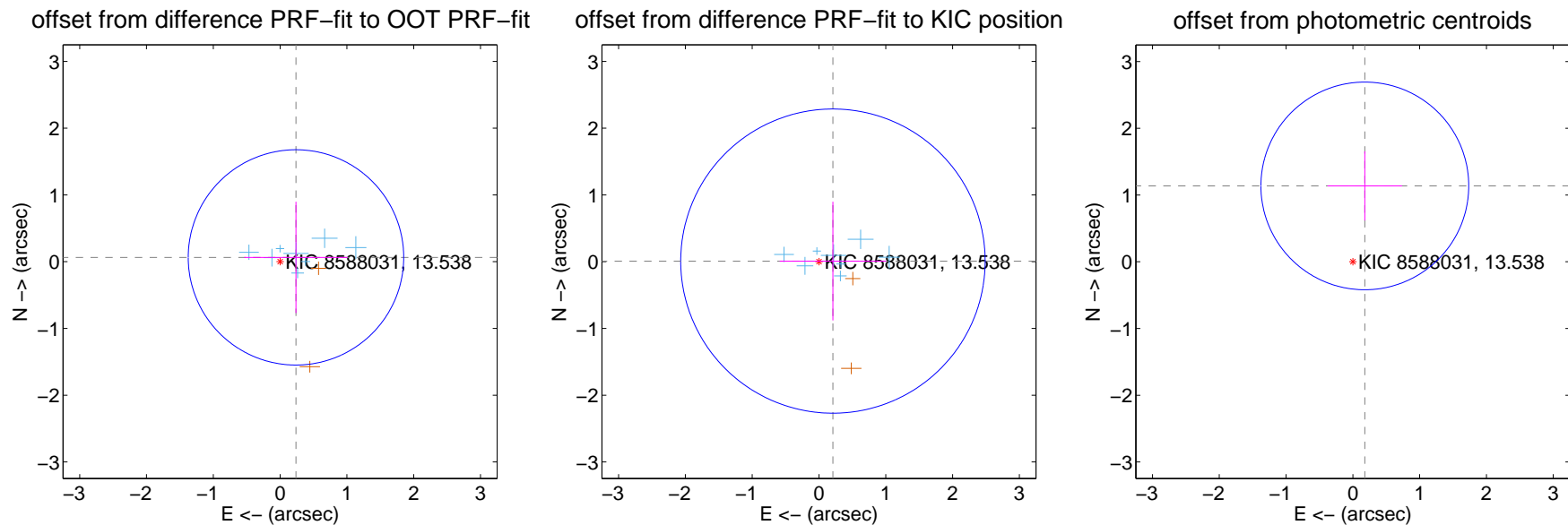
## DV Centroid Data

Supplemental centroid analysis for 008588031-01. Kepler magnitude: 13.54. Transit SNR 10.95

There are 9 quarters with good PRF difference image offsets

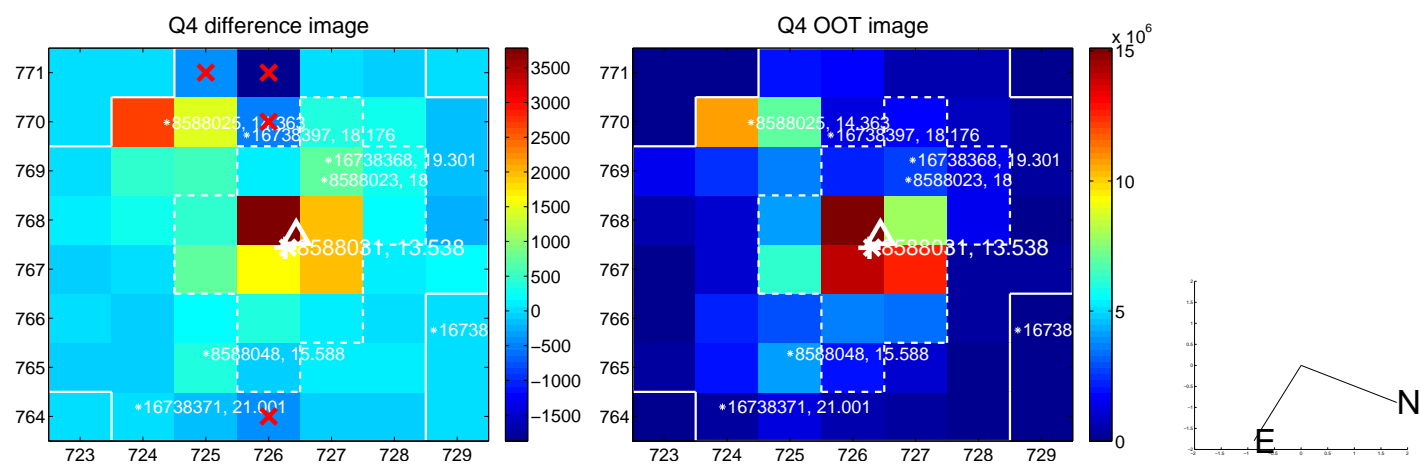
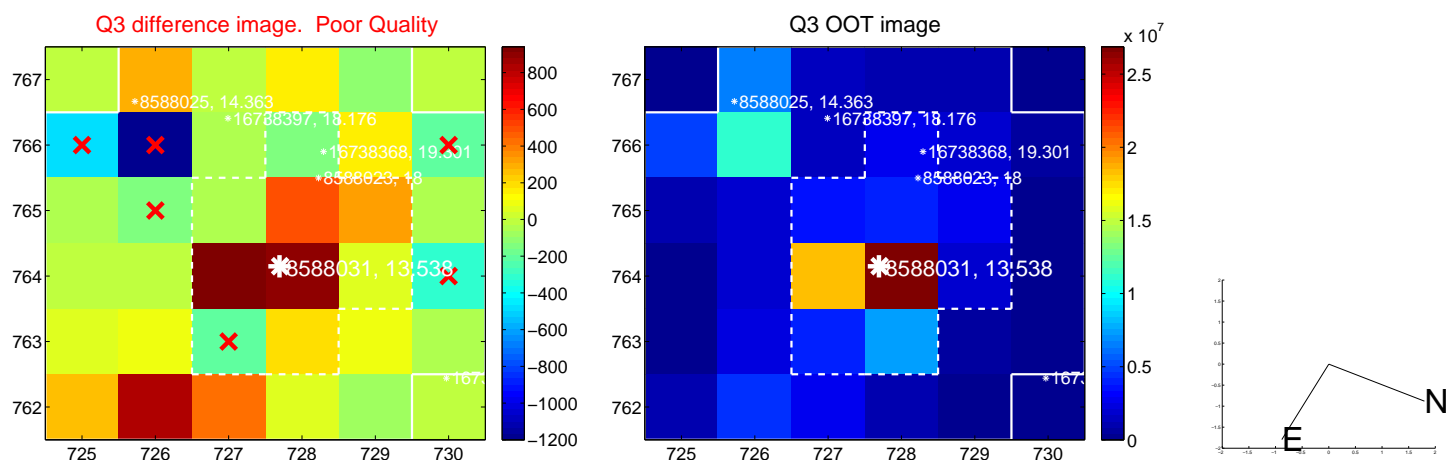
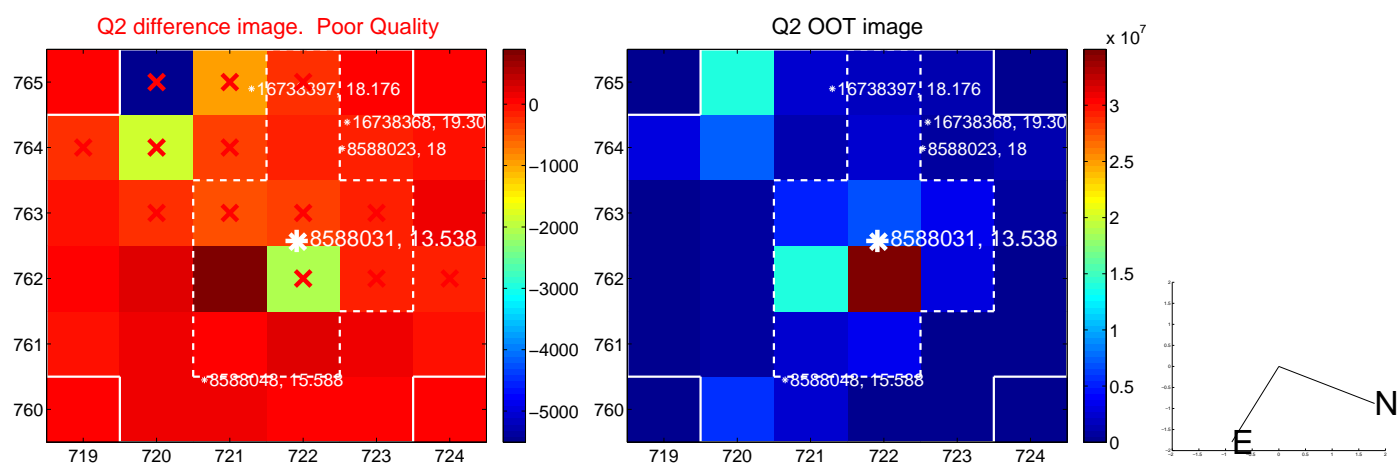
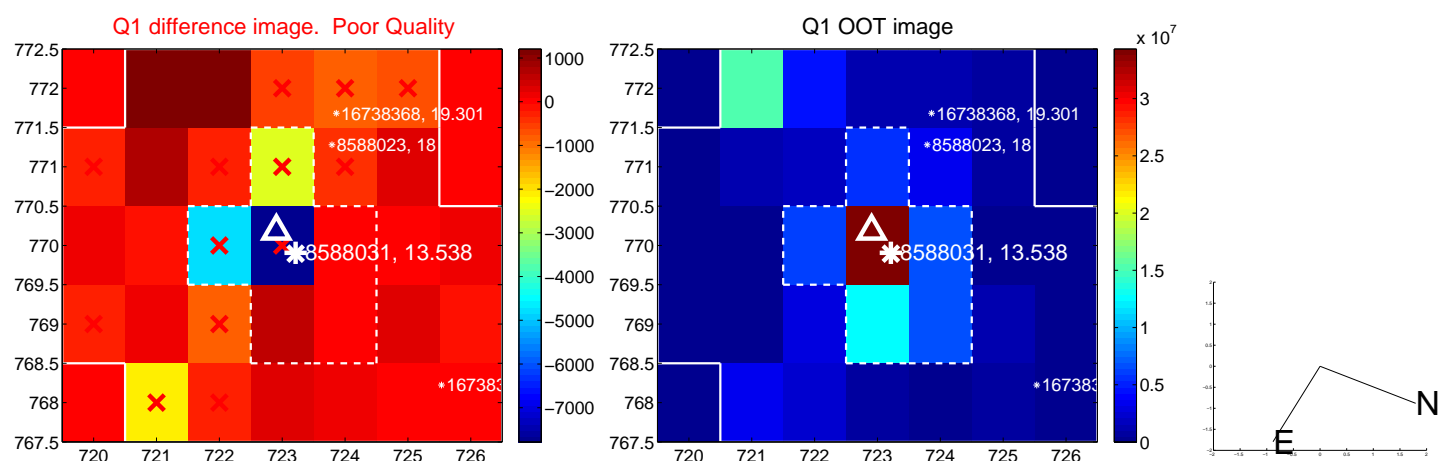
The direct PRF centroid is offset from the target star catalog position by about 0.20 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.246 \pm 0.538$	0.46	$-0.237 \pm 0.773$	$0.064 \pm 0.834$
PRF-fit source offset from KIC position	$0.209 \pm 0.759$	0.27	$-0.209 \pm 0.797$	$0.009 \pm 0.889$
photometric centroid source offset	$1.15 \pm 0.52$	2.22	$-0.18 \pm 0.56$	$1.14 \pm 0.52$

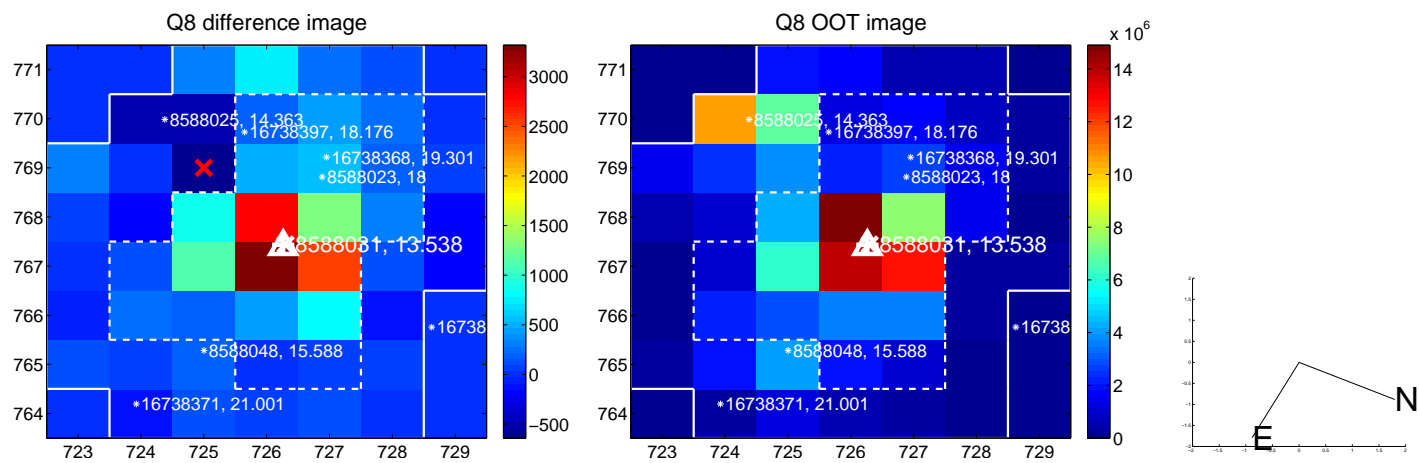
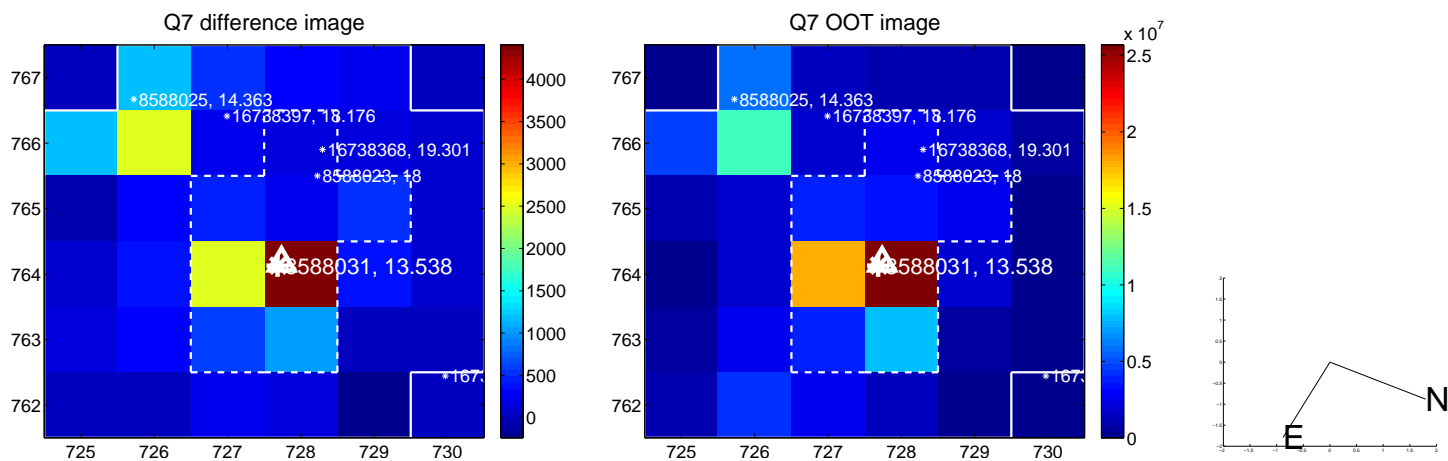
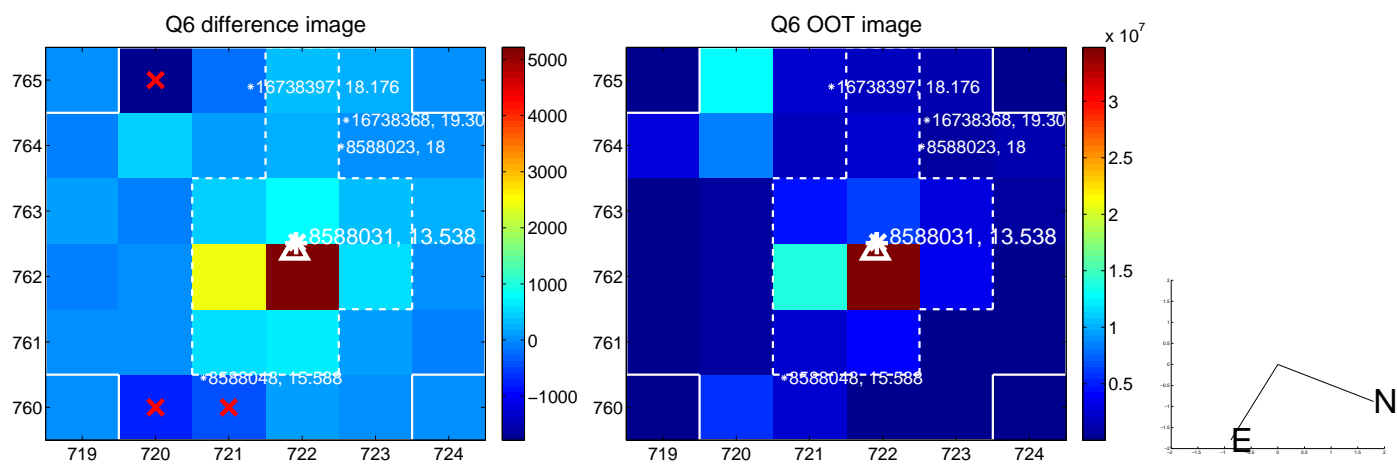
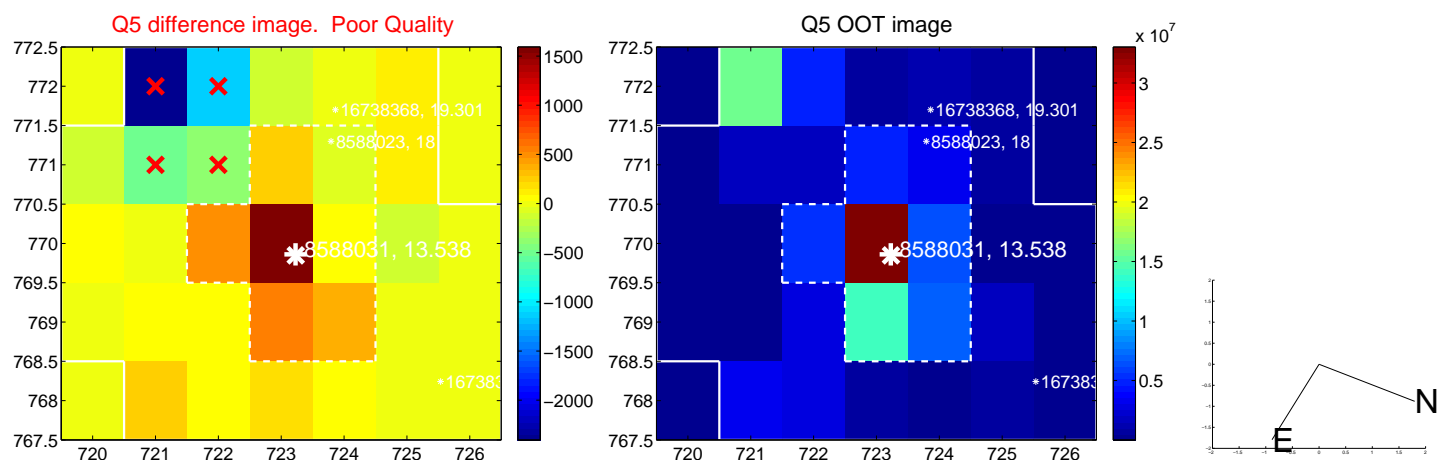


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

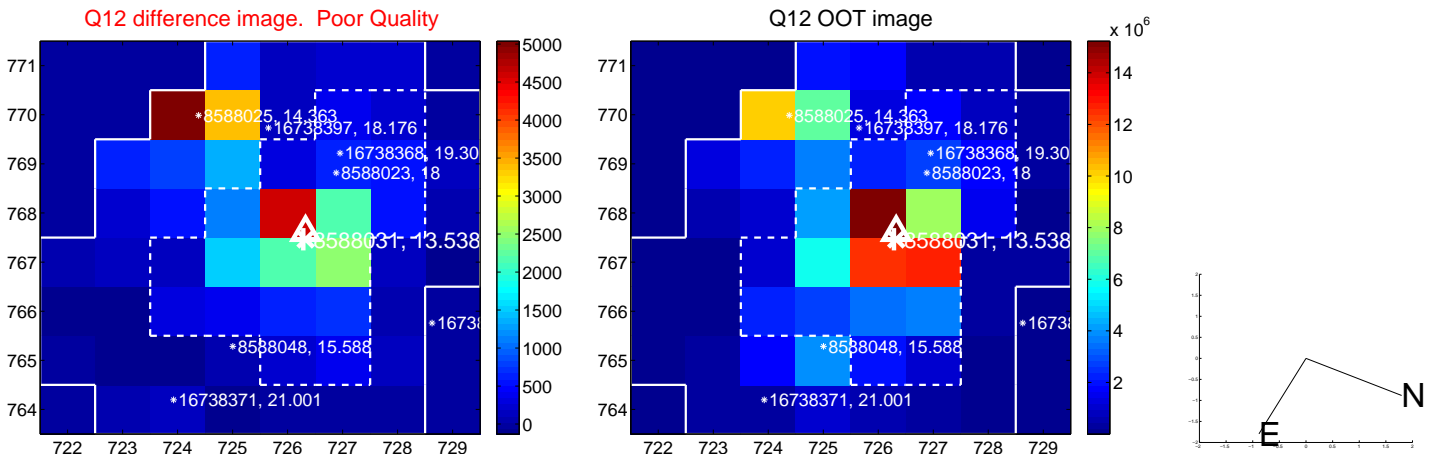
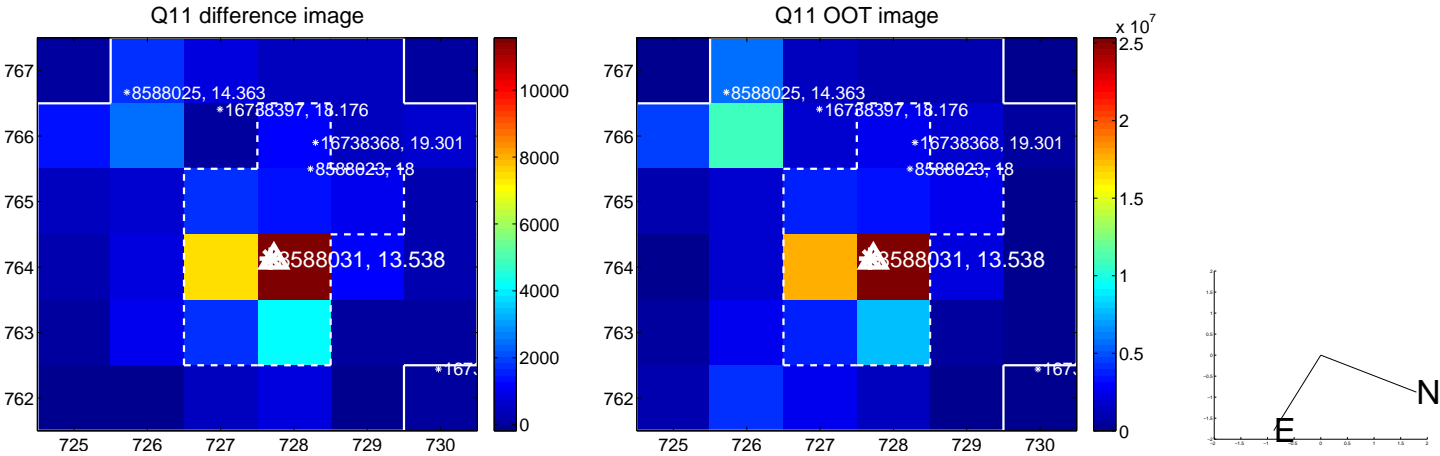
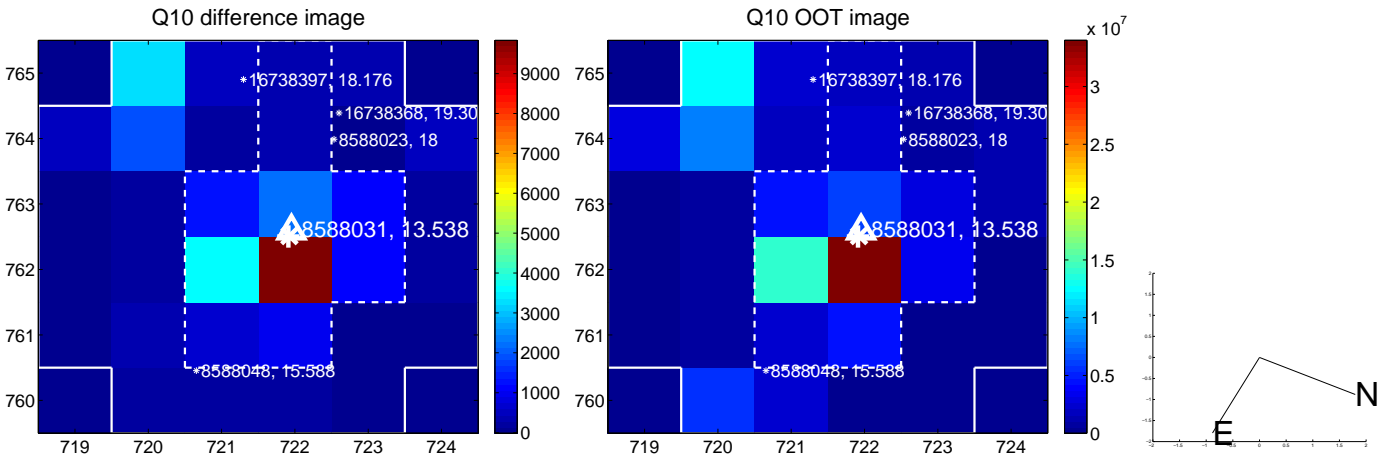
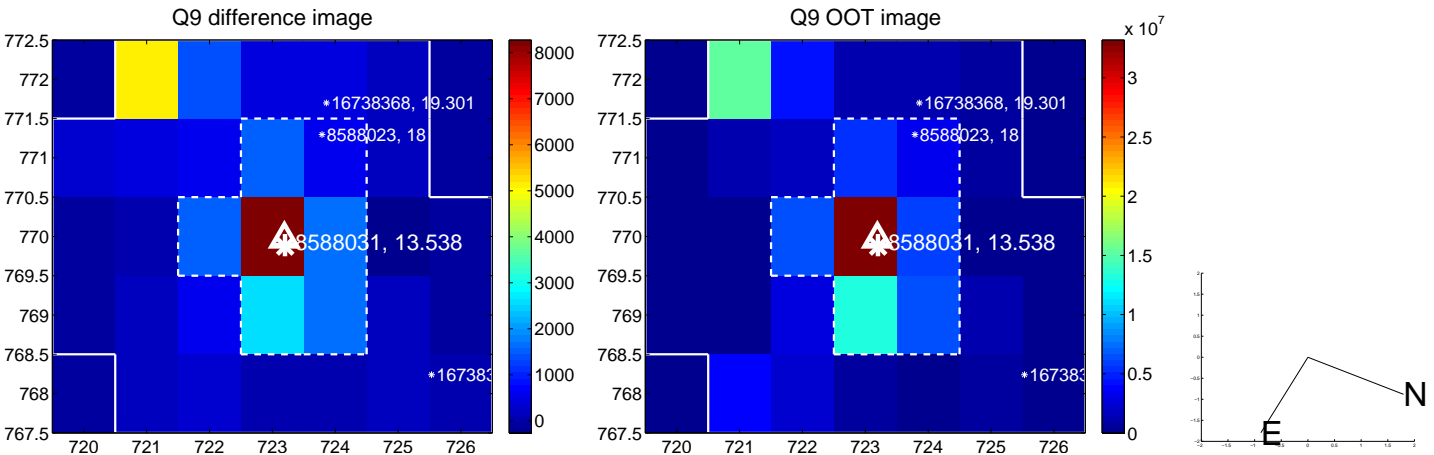


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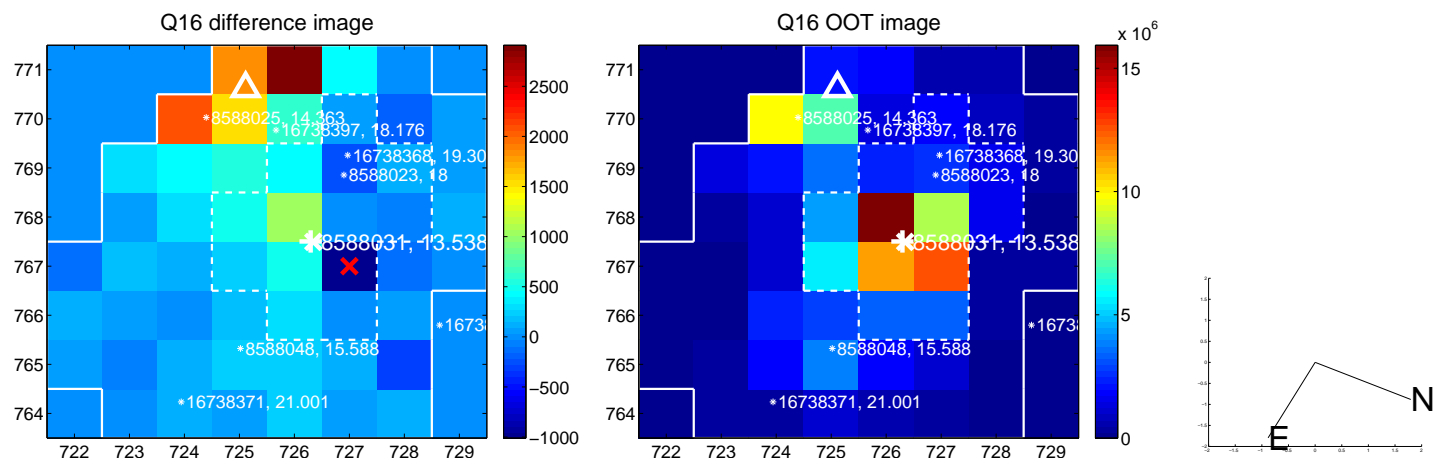
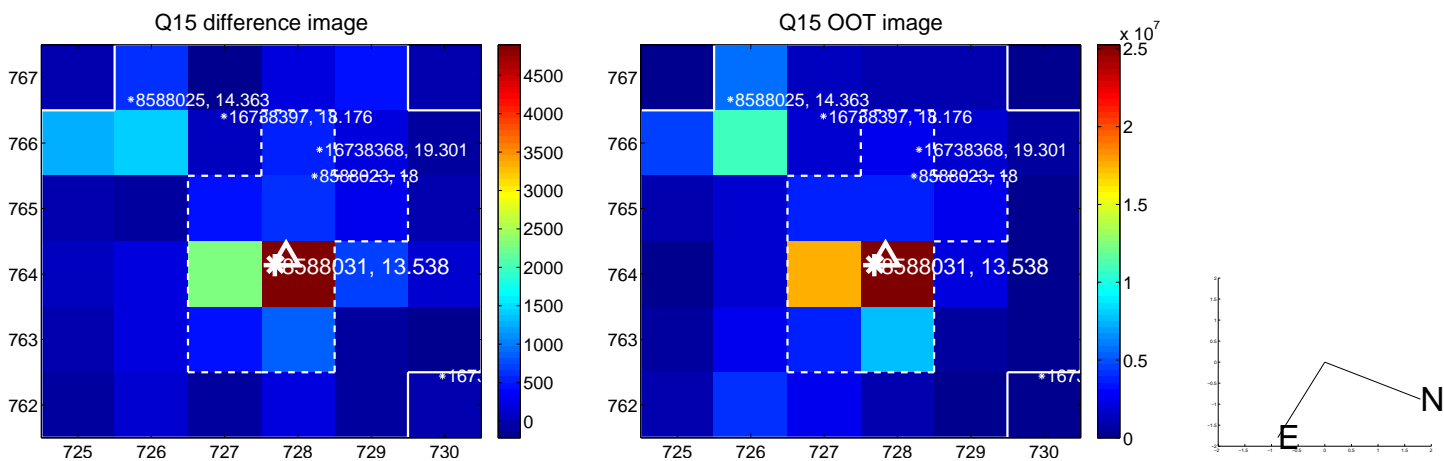
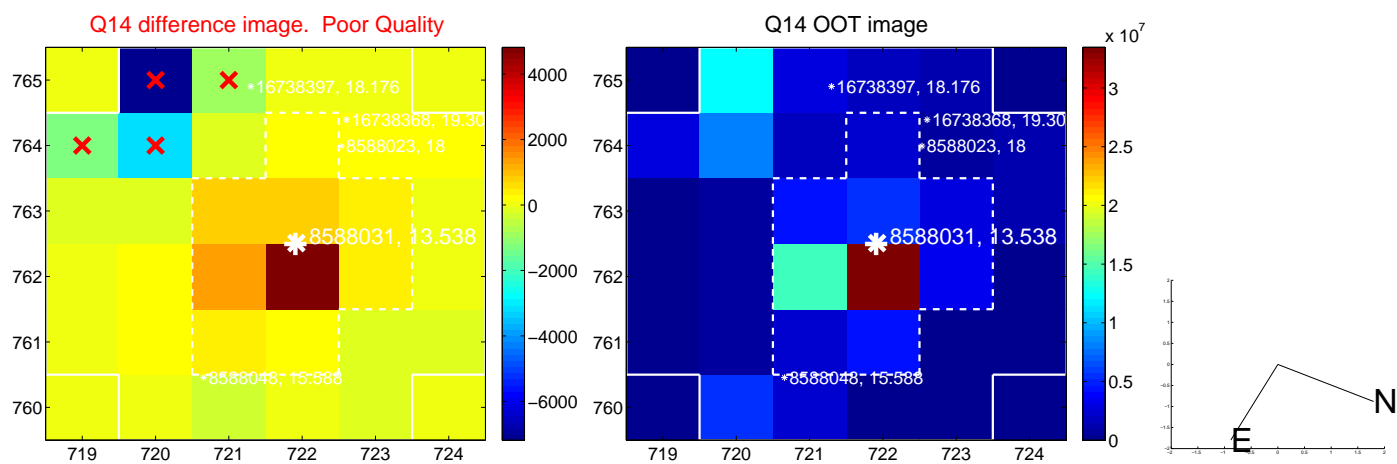
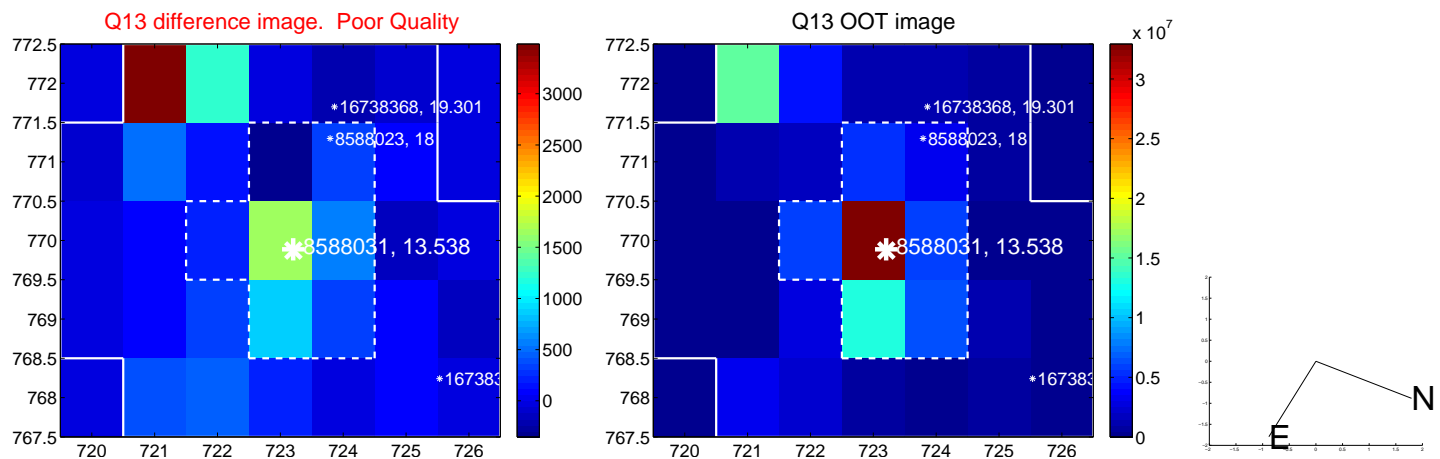




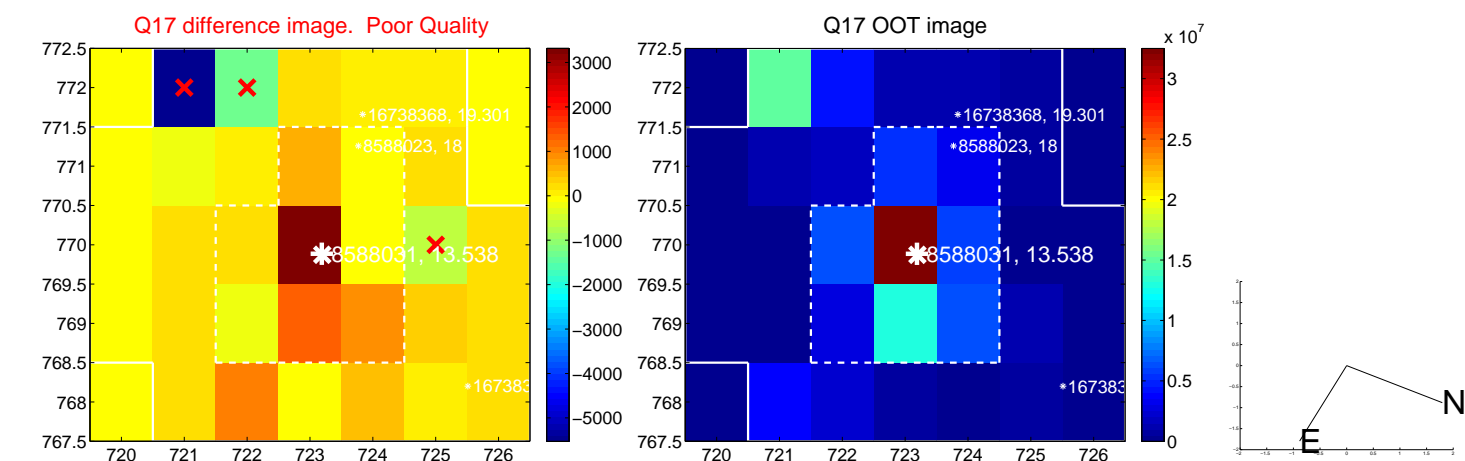
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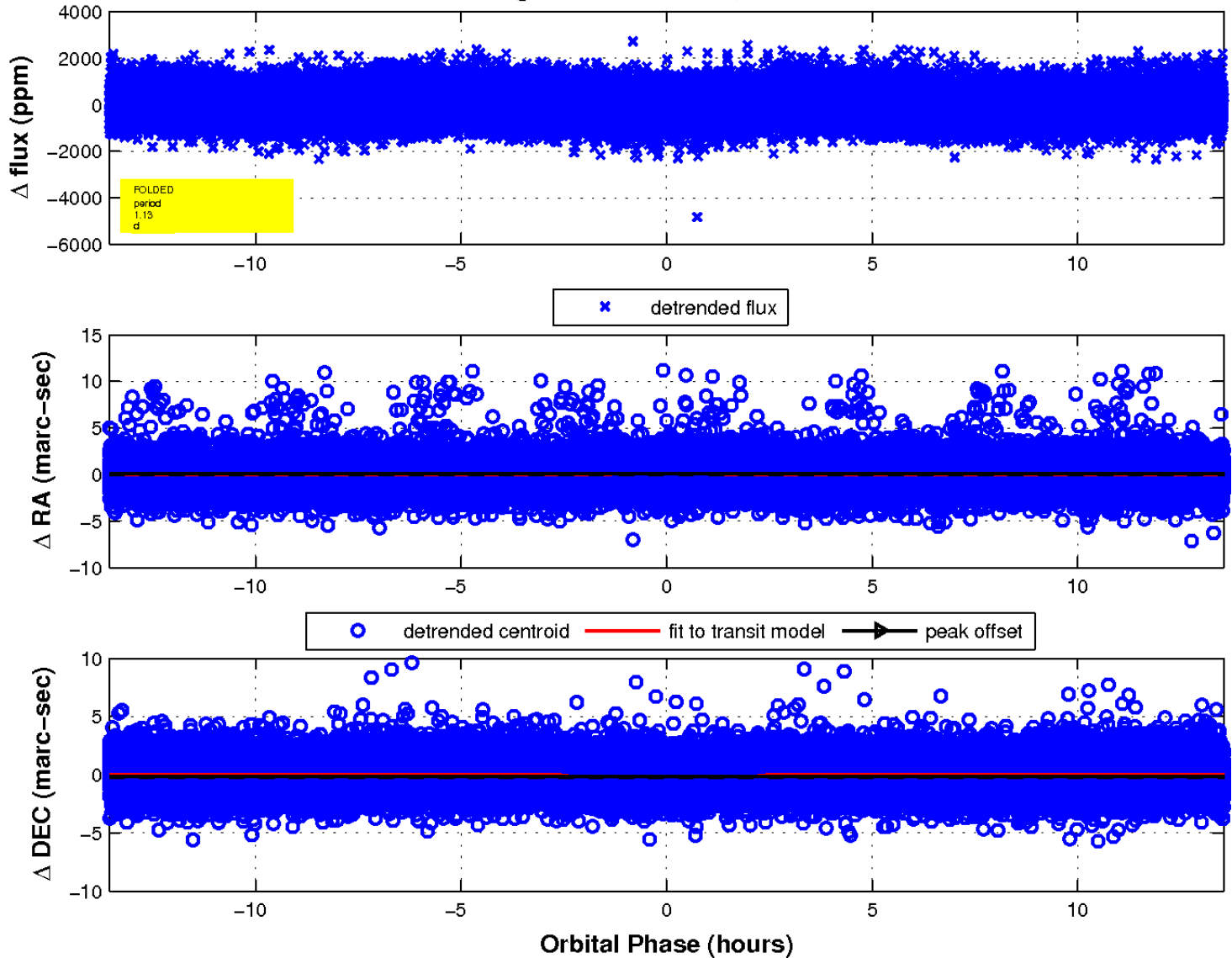
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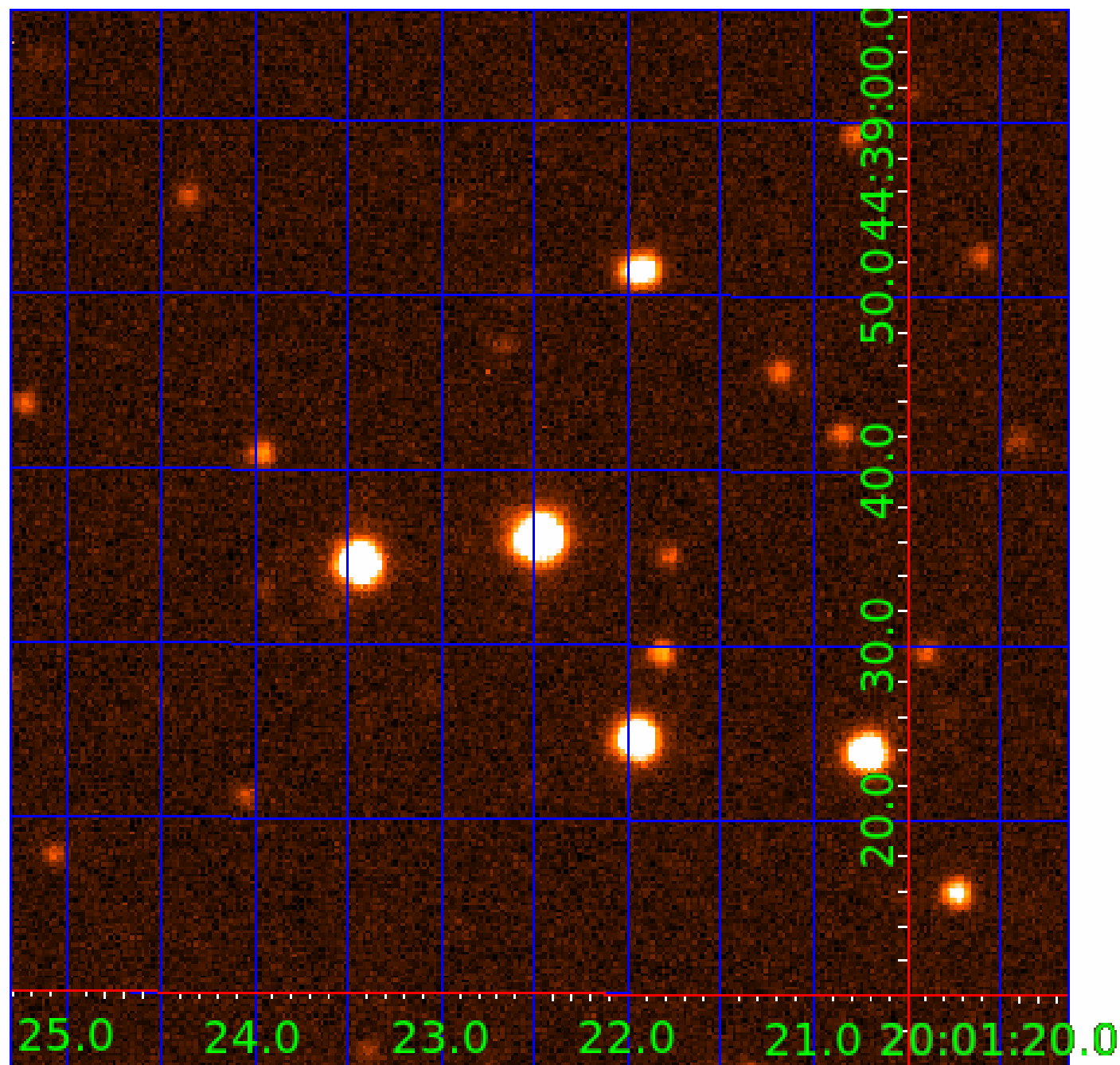


fluxWeightedCentroids, Planet 1 of 6



UKIRT Image

Declination



# KIC 008588031

## Q1-17 DR25 TCE Parameters

TCE	Run Type	KOI?	Period (Days)	Epoch (BKJD)	Depth (ppm)	Duration (Hours)	MES	SNR	$R_{\star}$ ( $R_{\odot}$ )	$T_{\star}$ (K)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
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## Robovetter Results

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008588031-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_ALT—INCONSISTENT_TRANS—CENT_FEW_MEAS
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008588031-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV
008588031-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT
008588031-06	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_ALT—CENT_NOFITS—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.

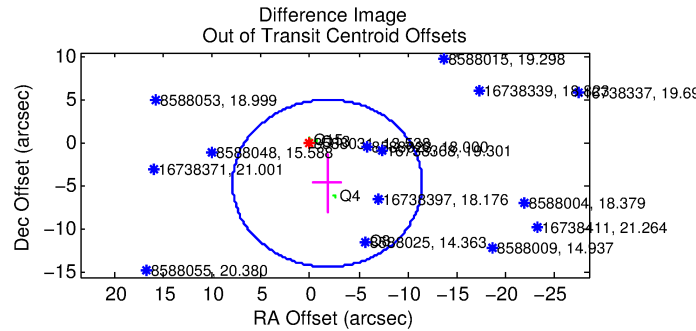
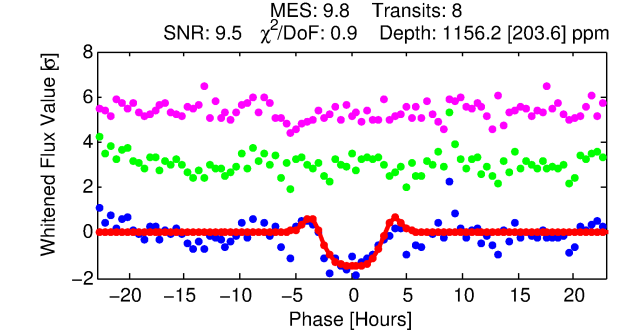
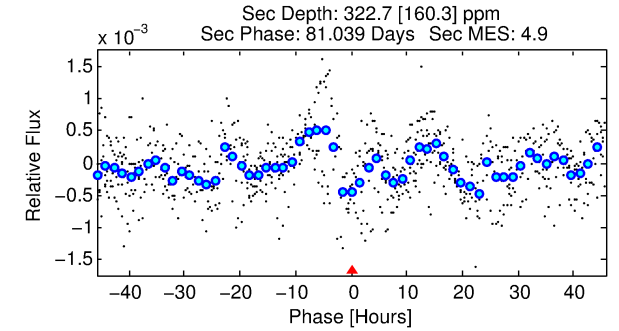
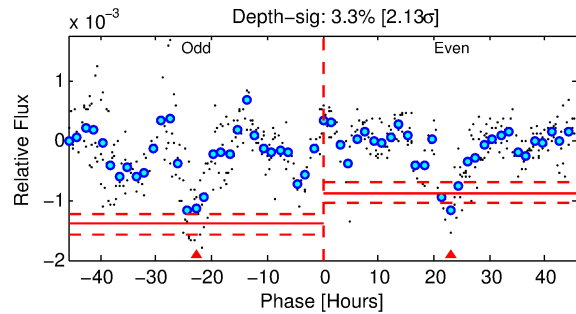
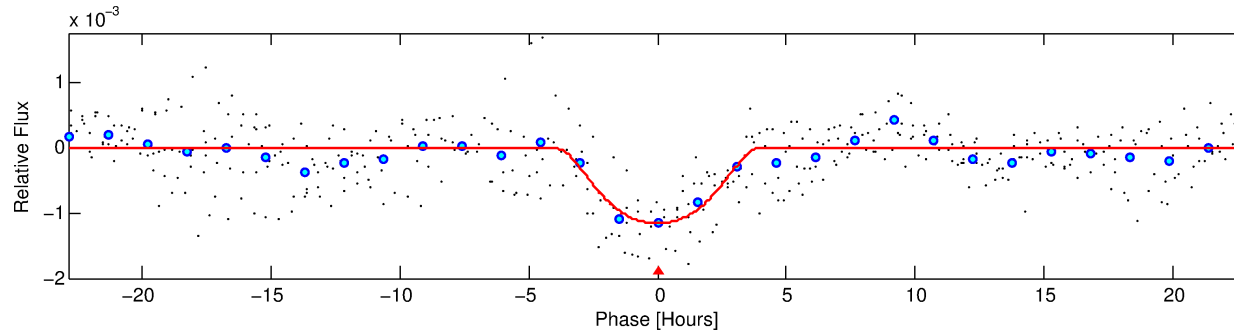
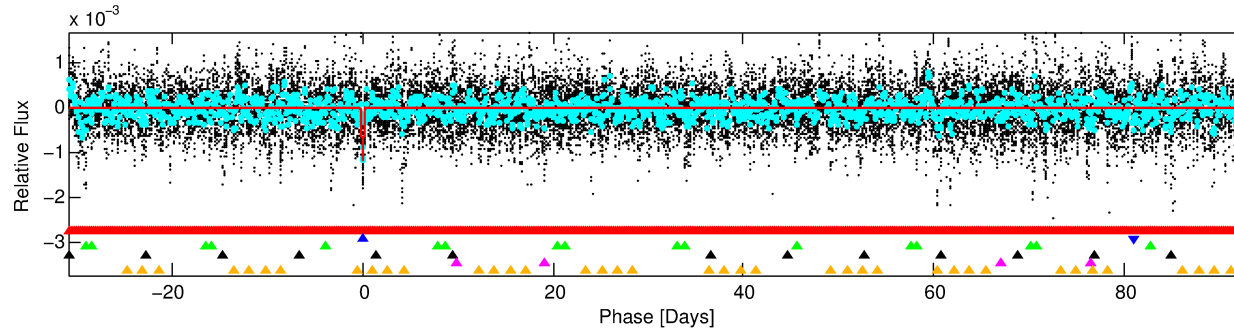
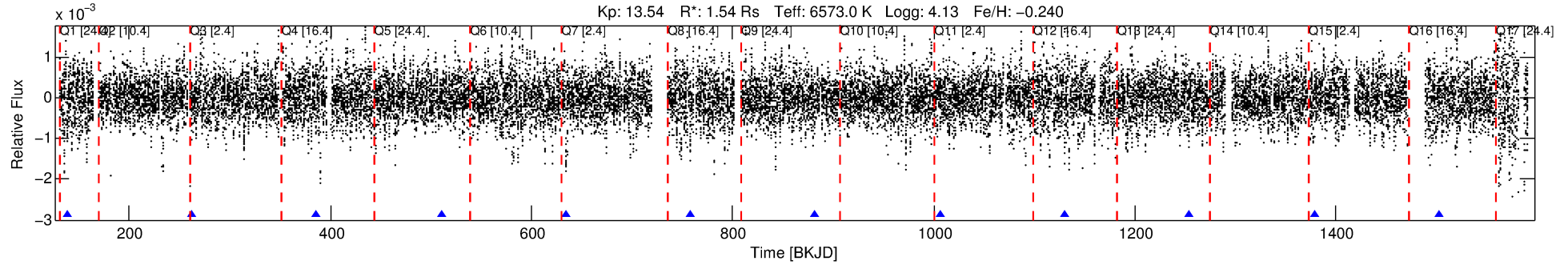
## Ephemeris Match Information For 008588031-02

No Significant Match Found



# DV One-Page Summary

KIC: 8588031 Candidate: 2 of 6 Period: 123.982 d



## DV Fit Results:

Period = 123.98200 [0.00195] d  
Epoch = 138.4491 [0.0107] BKJD  
Rp/R\* = 0.0404 [0.0071]  
a/R\* = 48.35 [6.02]  
b = 0.96 [0.02]  
Seff = 15.23 [6.18]  
Teq = 504 [51] K  
Rp = 6.81 [2.36] Re  
a = 0.5119 [0.1324] AU  
Ag = 1003.59 [721.55] [1.39 $\sigma$ ]  
Teffp = 4384 [681] K [5.68 $\sigma$ ]

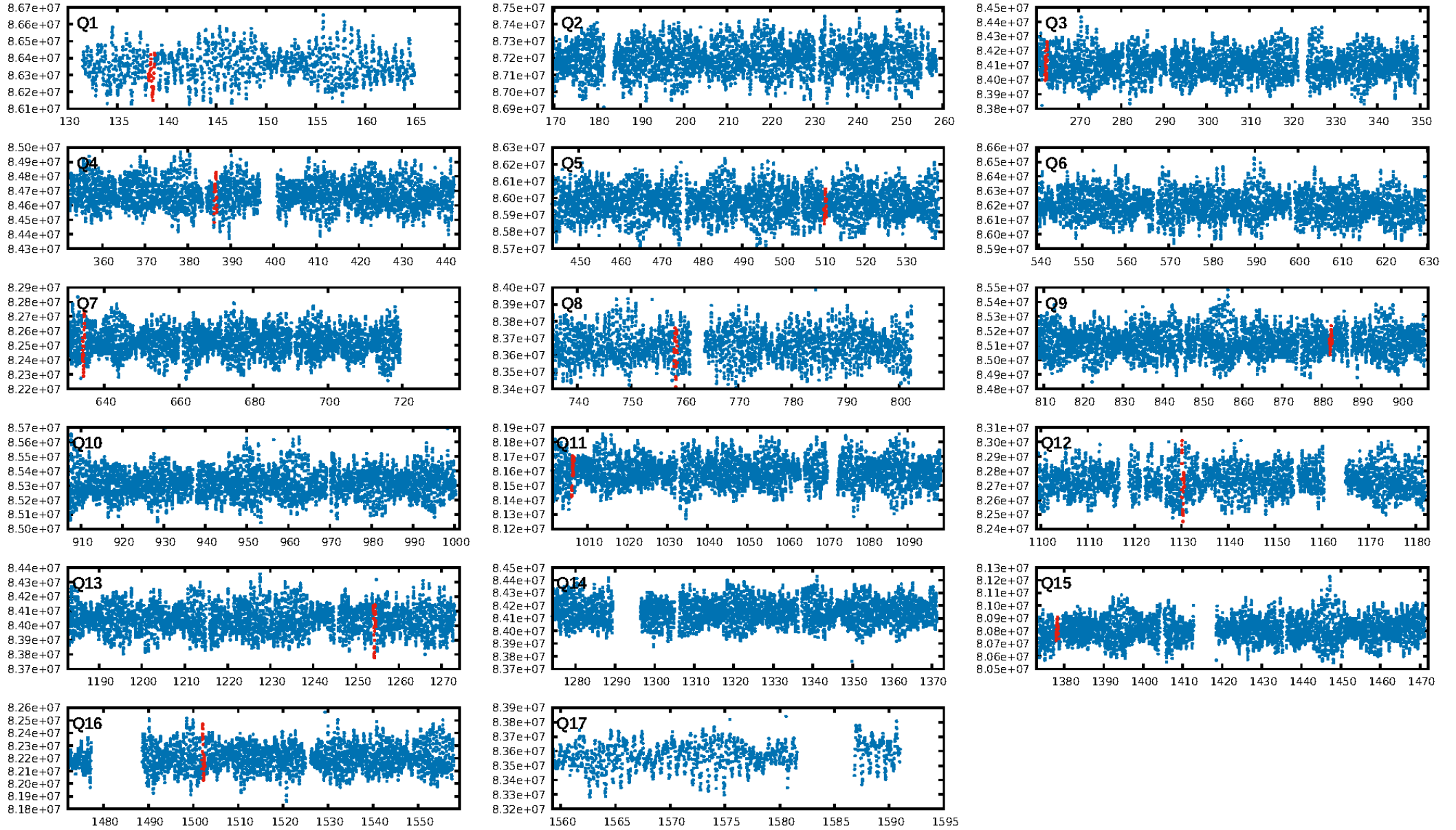
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [13.02 $\sigma$ ]  
LongPeriod-sig: 100.0% [582.55 $\sigma$ ]  
ModelChiSquare2-sig: 4.3%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [7/7]  
GhostDiagnostic-chr: 0.6606  
Centroid-sig: 57.6%  
Centroid-so: 1.295 arcsec [3.11 $\sigma$ ]  
OotOffset-rm: 4.989 arcsec [1.55 $\sigma$ ]  
KicOffset-rm: 5.059 arcsec [1.55 $\sigma$ ]  
OotOffset-st: 0/1/2/1 [4]  
KicOffset-st: 0/1/2/1 [4]  
DiffImageQuality-fgm: 0.50 [2/4]  
DiffImageOverlap-fno: 0.00 [0/10]

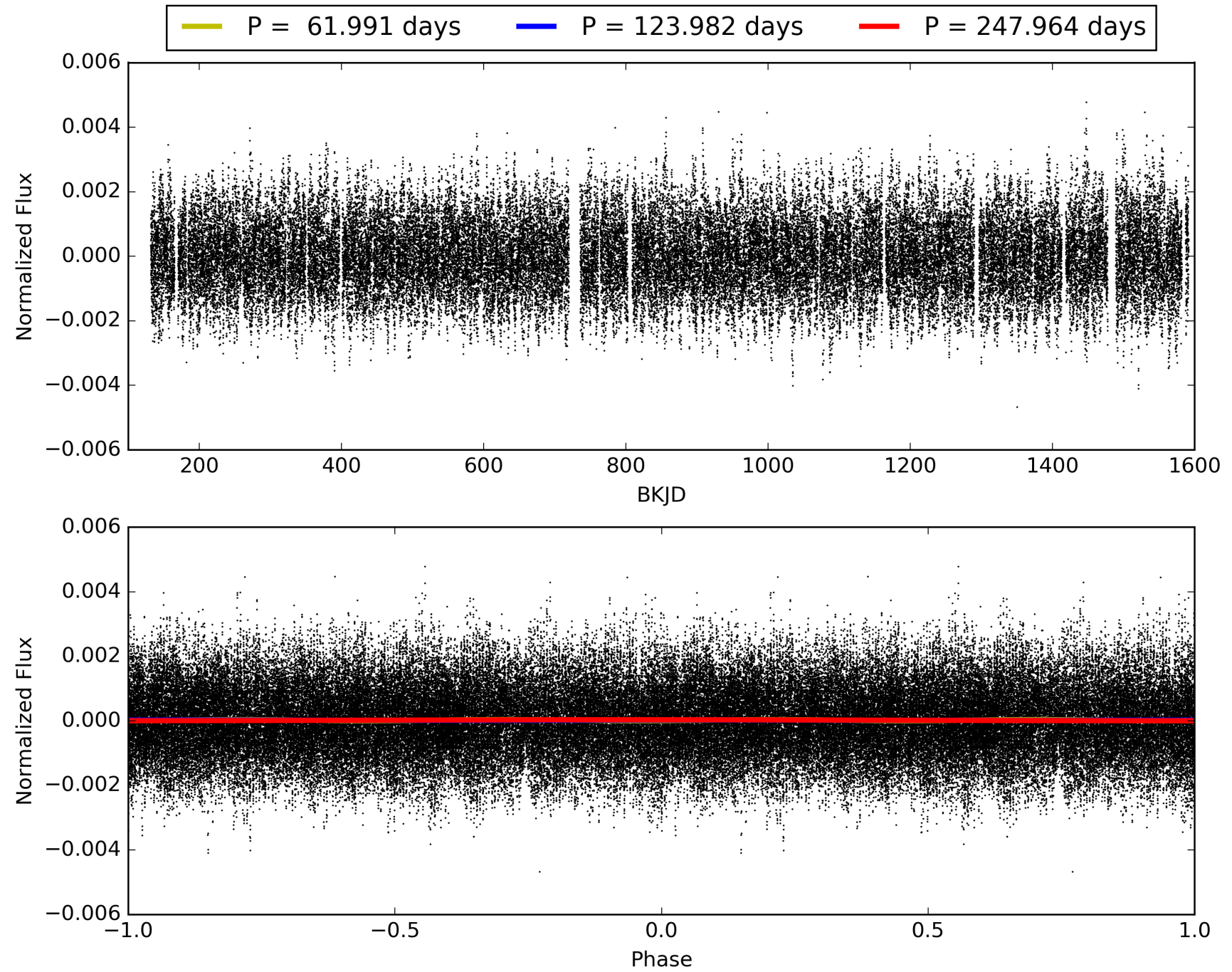
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 06:02:51 Z

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

# TCE 008588031-02, PDC Light Curves

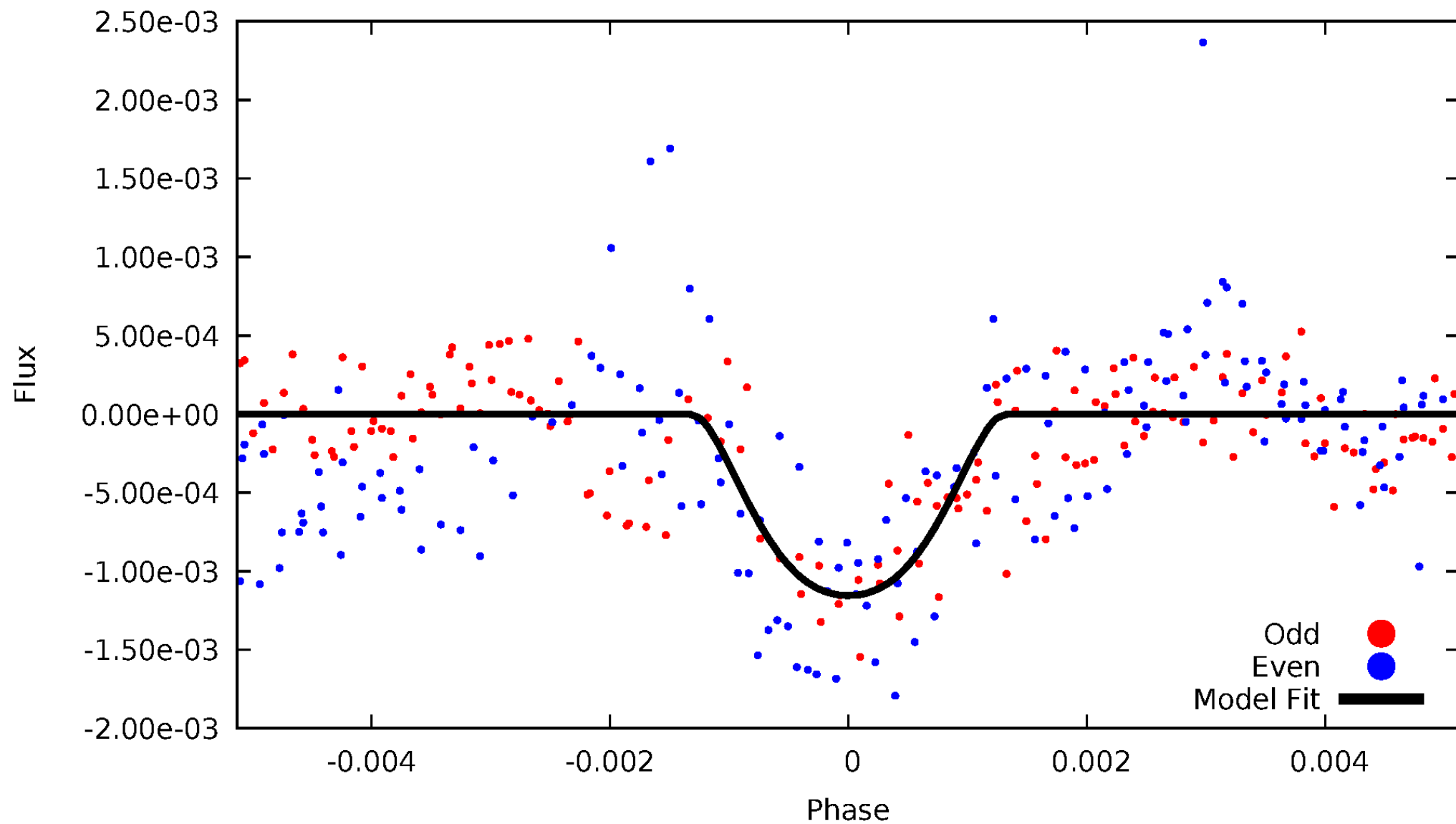


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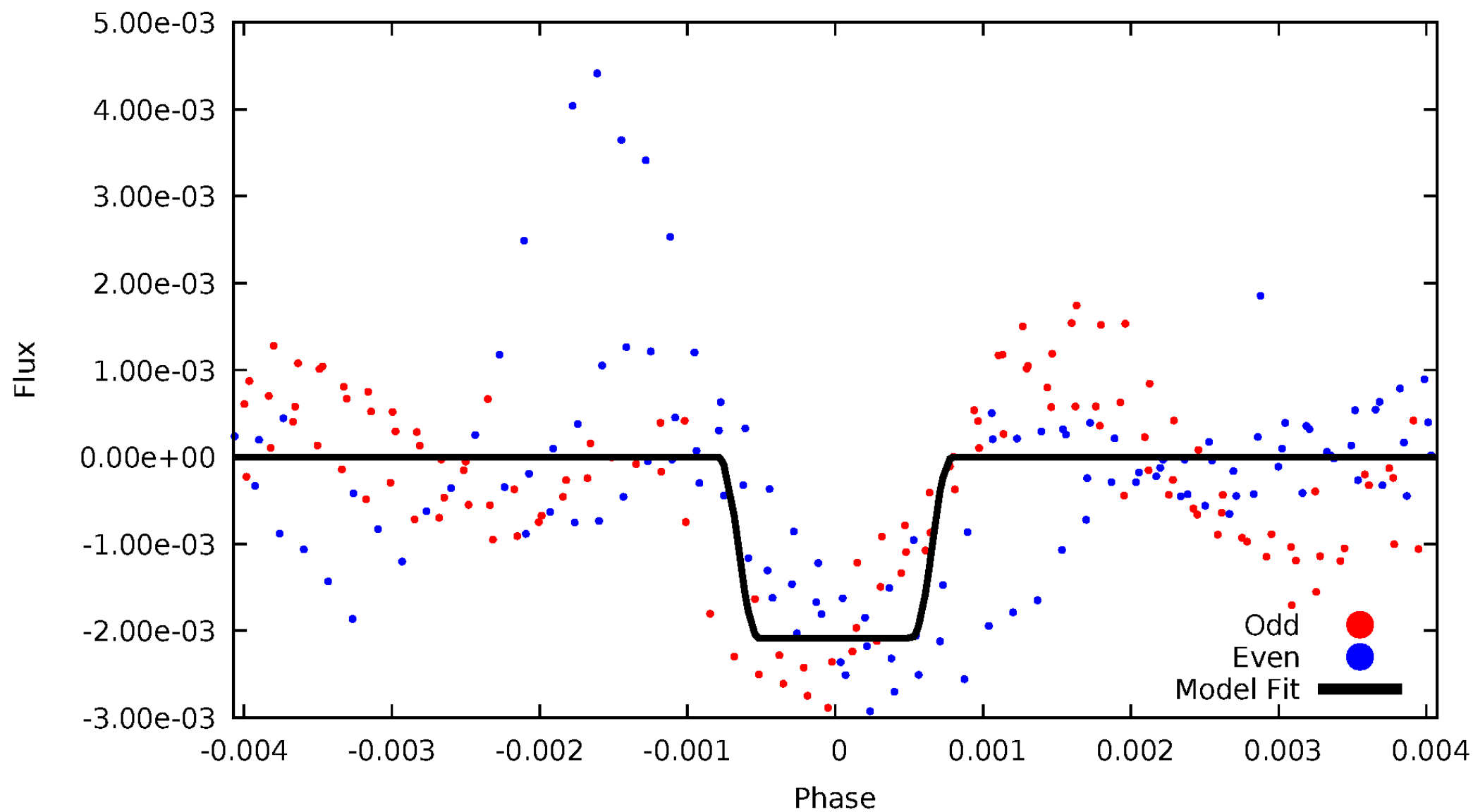
# DV Odd/Even

TCE 008588031-02



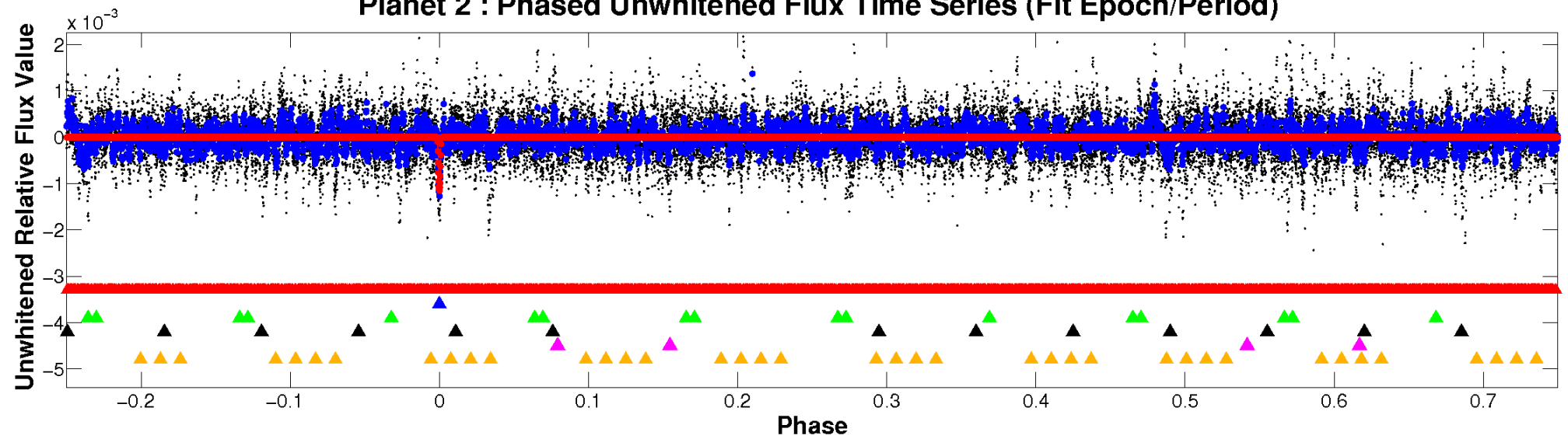
# ALT Odd/Even

TCE 008588031-02

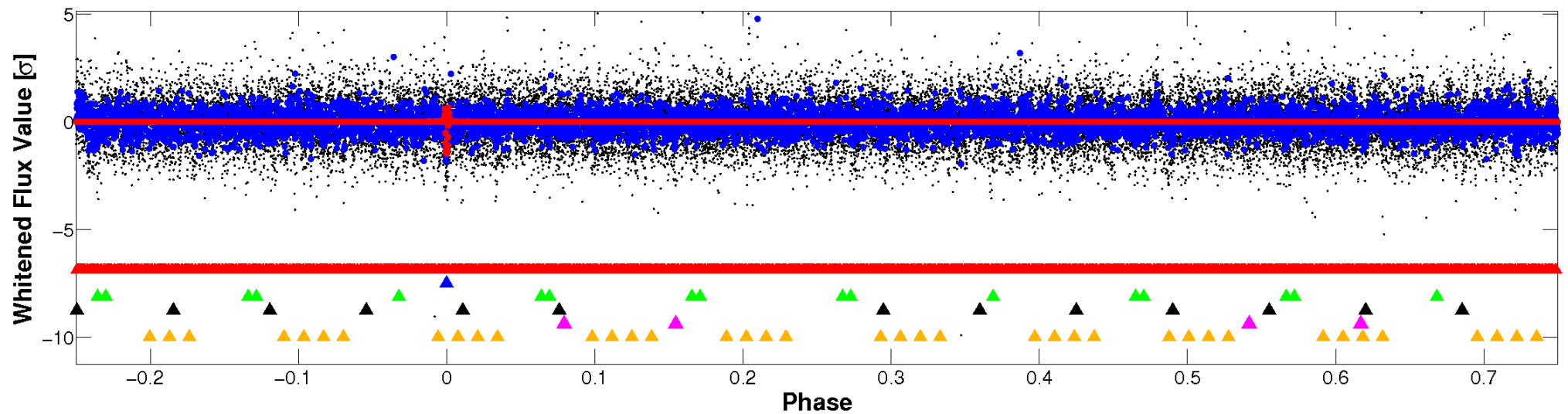


# Non-Whitened Vs. Whitened Light Curve

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



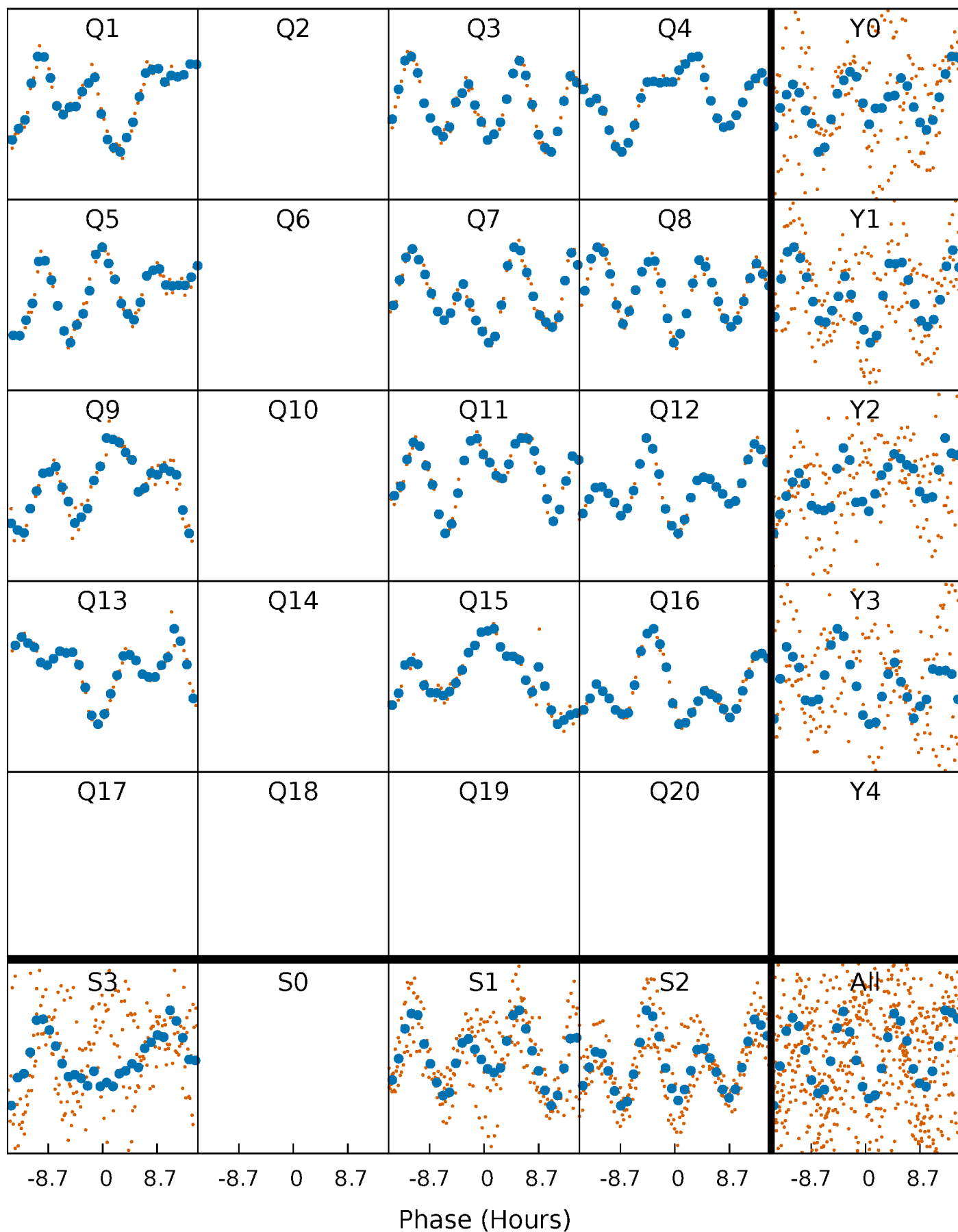
## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)





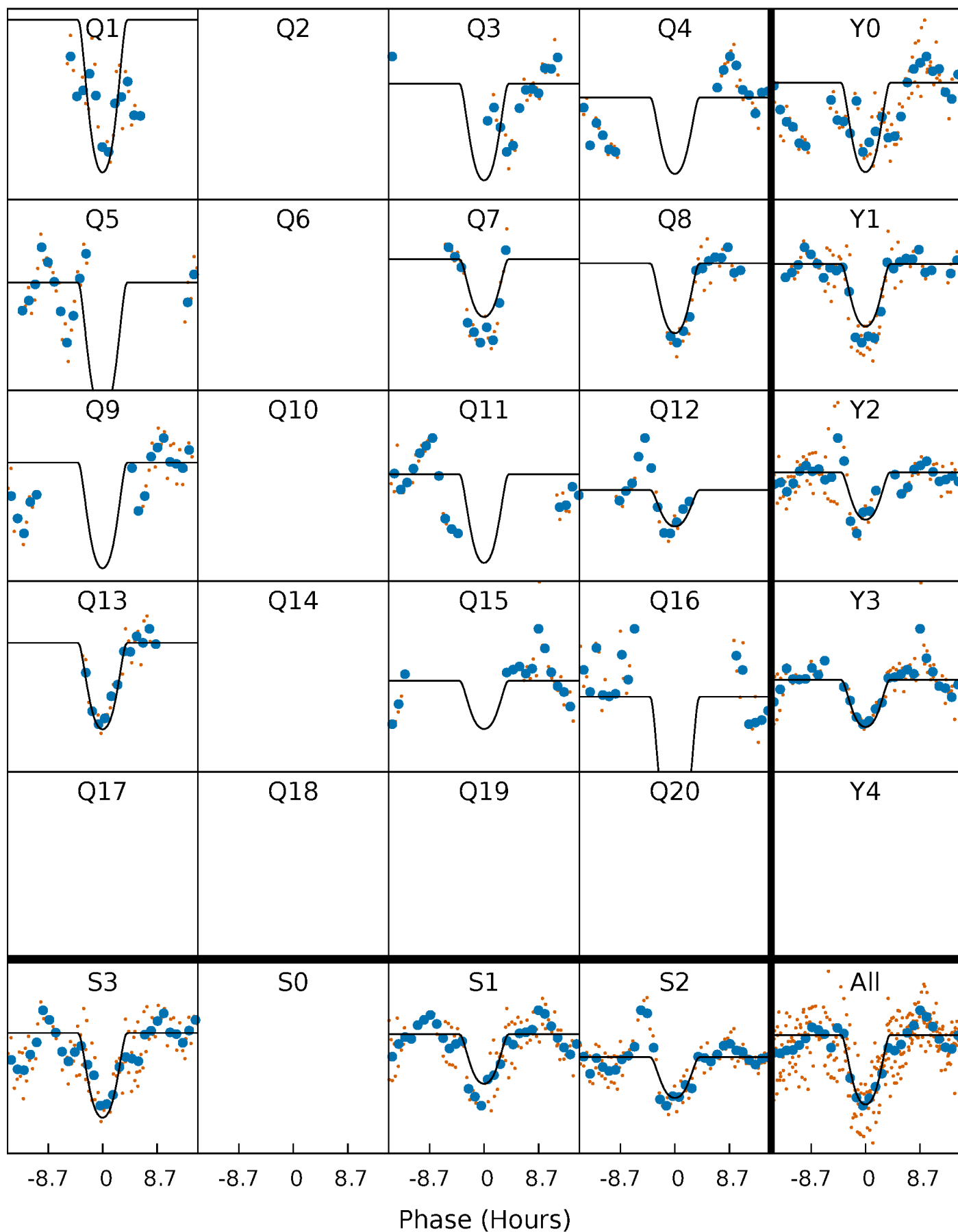
# PDC Quarter-Phased Transit Curves

TCE 008588031-02   P=123.981995 Days    $T_0=138.449081$  (BKJD)



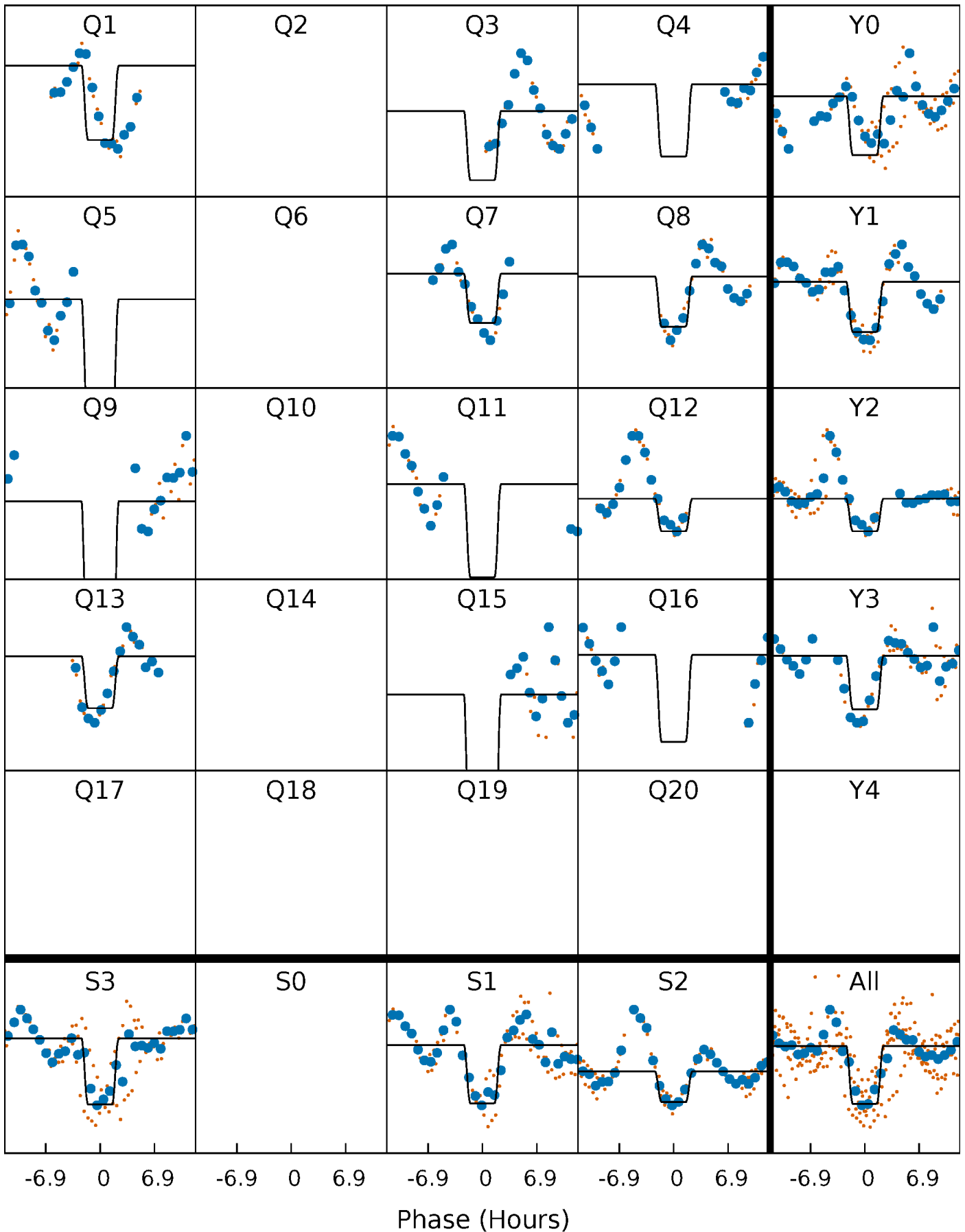
# DV Quarter-Phased Transit Curves

TCE 008588031-02 P=123.981995 Days  $T_0=138.449081$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

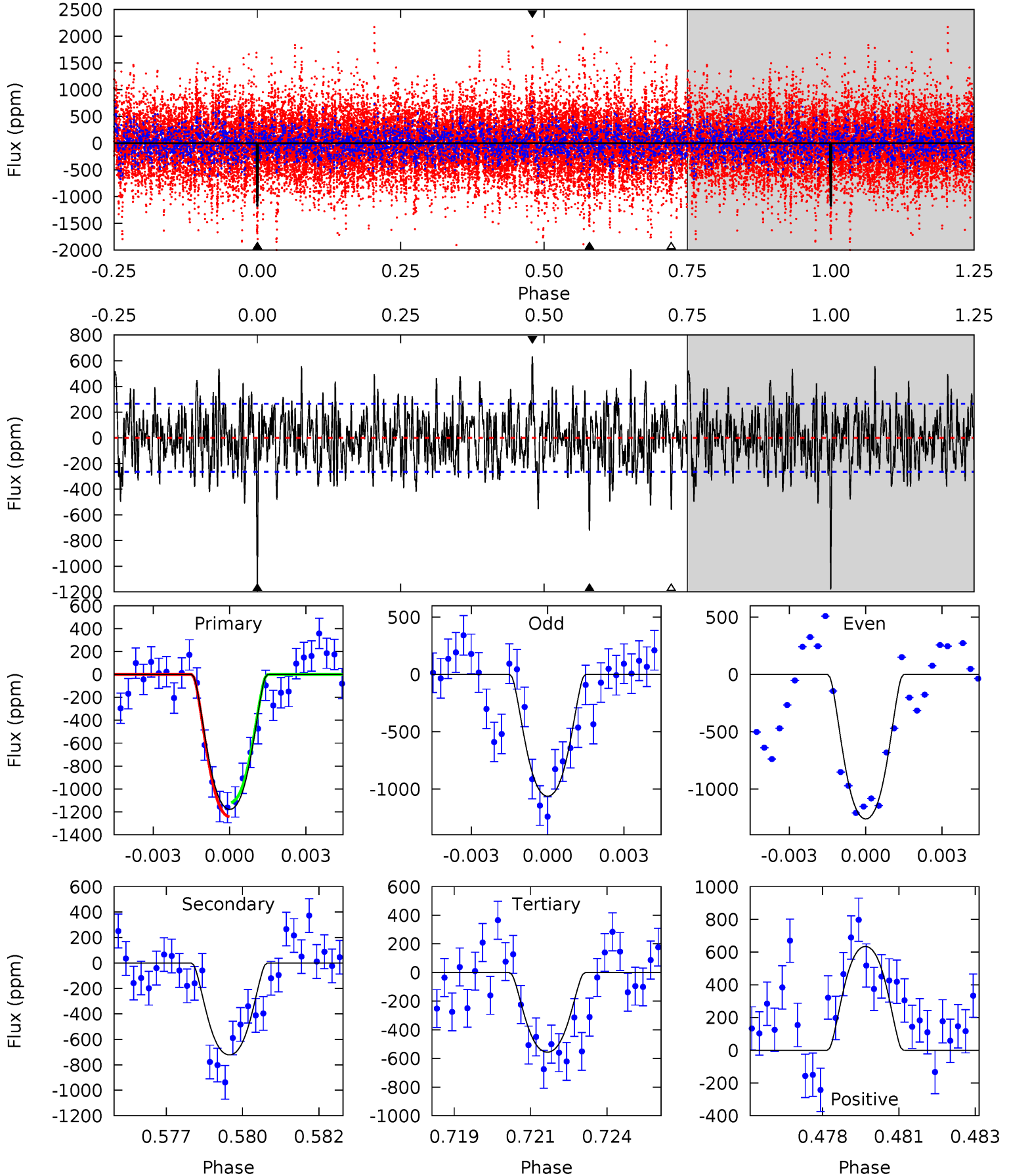
TCE 008588031-02 P=123.980732 Days  $T_0=138.473647$  (BKJD)



# DV Model-Shift Uniqueness Test

008588031-02, P = 123.981995 Days, E = 14.467086 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
23.5	14.4	11.1	12.6	5.27	3.00	3.70	12.4	10.9	3.31	1.76	1.96	0.54	0.35	1.22

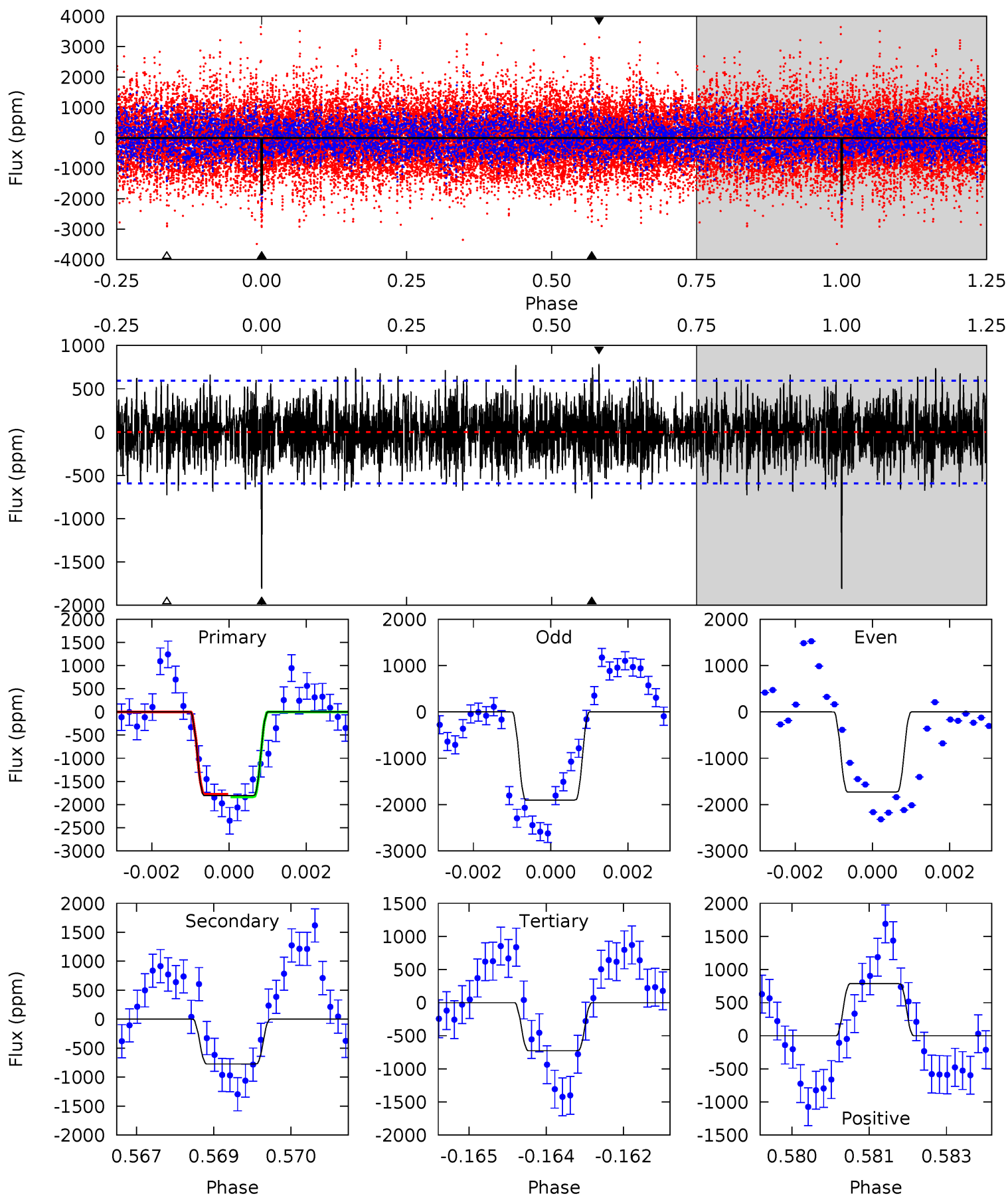




# Alt Model-Shift Uniqueness Test

008588031-02,  $P = 123.980732$  Days,  $E = 14.492915$  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
16.4	7.00	6.57	7.12	5.37	3.16	2.31	9.80	9.24	0.43	-0.13	0.78	0.97	0.30	0.26



### Stellar Parameters For KIC 008588031

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6573^{+175}_{-214}$	$4.126^{+0.214}_{-0.175}$	$-0.240^{+0.250}_{-0.300}$	$1.545^{+0.463}_{-0.421}$	$1.162^{+0.209}_{-0.157}$	$0.444^{+0.544}_{-0.214}$
	+3%/-3%	+5%/-4%	+104%/-125%	+30%/-27%	+18%/-14%	+123%/-48%
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 008588031-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-722 \pm 50$	$6.72^{+1.58}_{-1.47}$	$700^{+58}_{-50}$	$5401^{+513}_{-401}$	$2325^{+1450}_{-800}$
Alt.	$-773 \pm 110$	$7.79^{+1.77}_{-1.64}$	$703^{+56}_{-53}$	$5154^{+464}_{-366}$	$1840^{+1165}_{-621}$

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

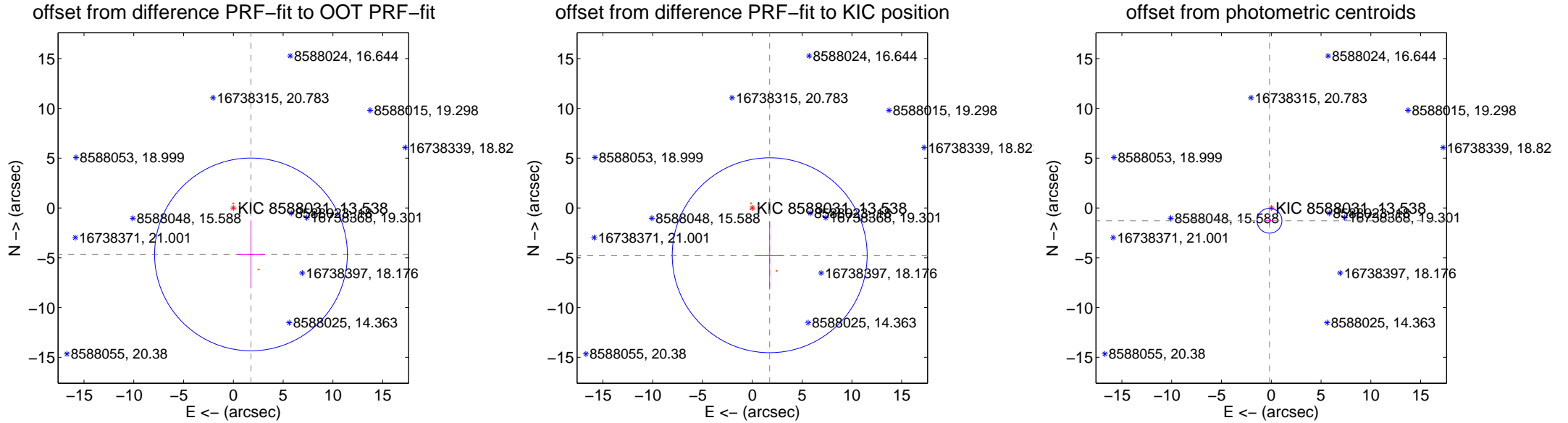
## DV Centroid Data

Supplemental centroid analysis for 008588031-02. Kepler magnitude: 13.54. Transit SNR 9.47

There are 2 quarters with good PRF difference image offsets

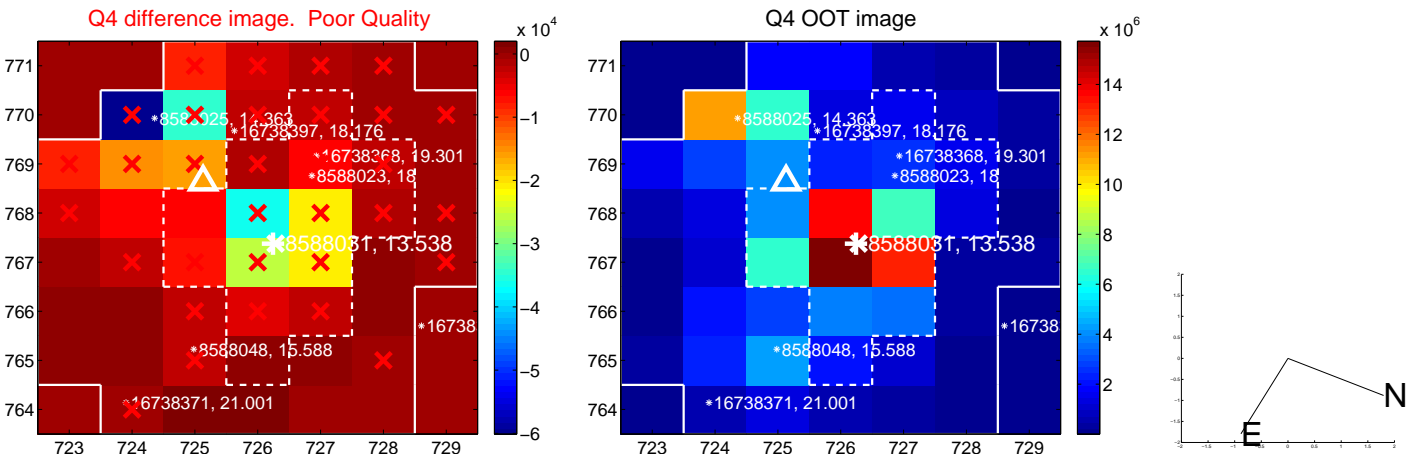
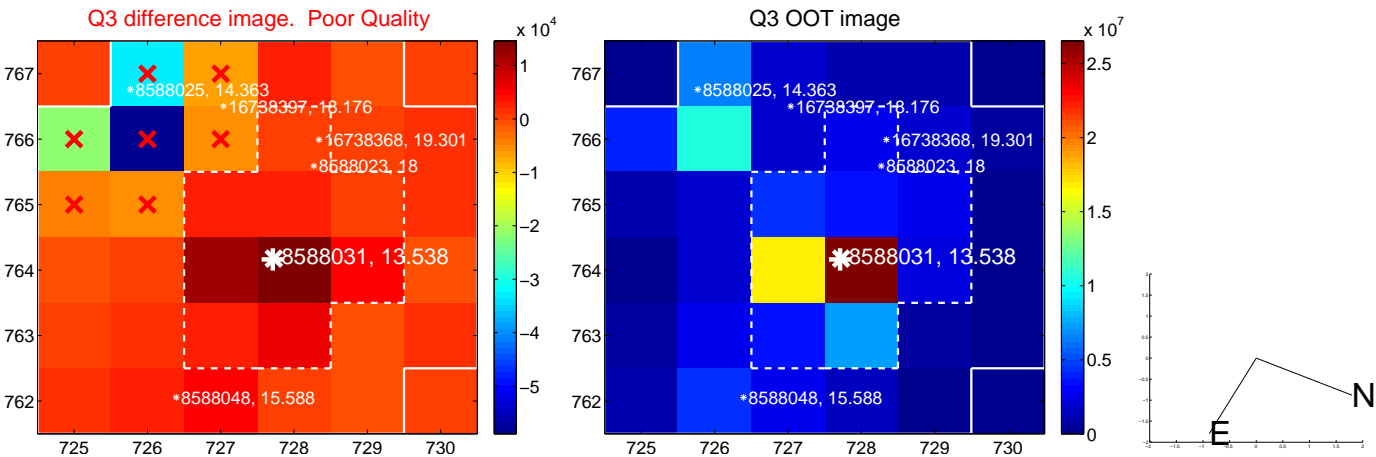
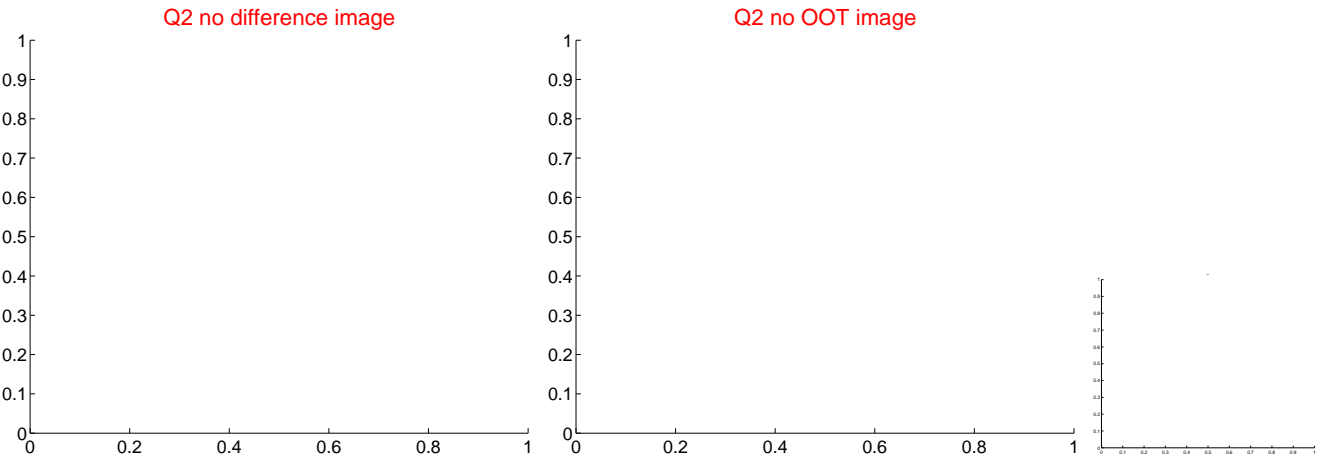
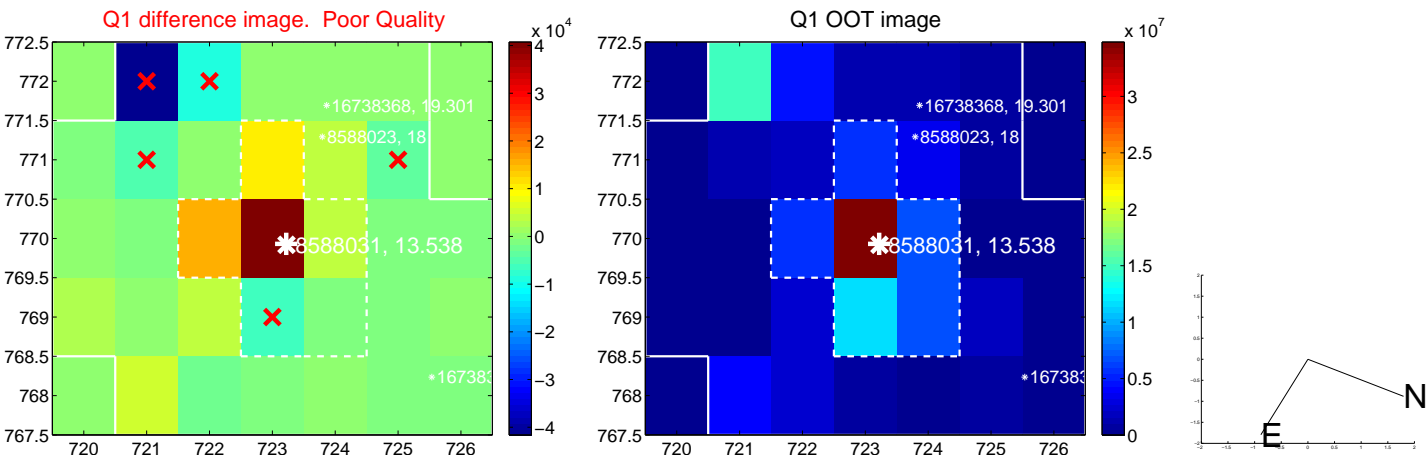
The direct PRF centroid is offset from the target star catalog position by about 0.11 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$4.989 \pm 3.226$	1.55	$-1.769 \pm 1.385$	$-4.665 \pm 3.410$
PRF-fit source offset from KIC position	$5.059 \pm 3.262$	1.55	$-1.747 \pm 1.356$	$-4.748 \pm 3.440$
photometric centroid source offset	$1.30 \pm 0.42$	3.11	$0.18 \pm 0.39$	$-1.28 \pm 0.42$



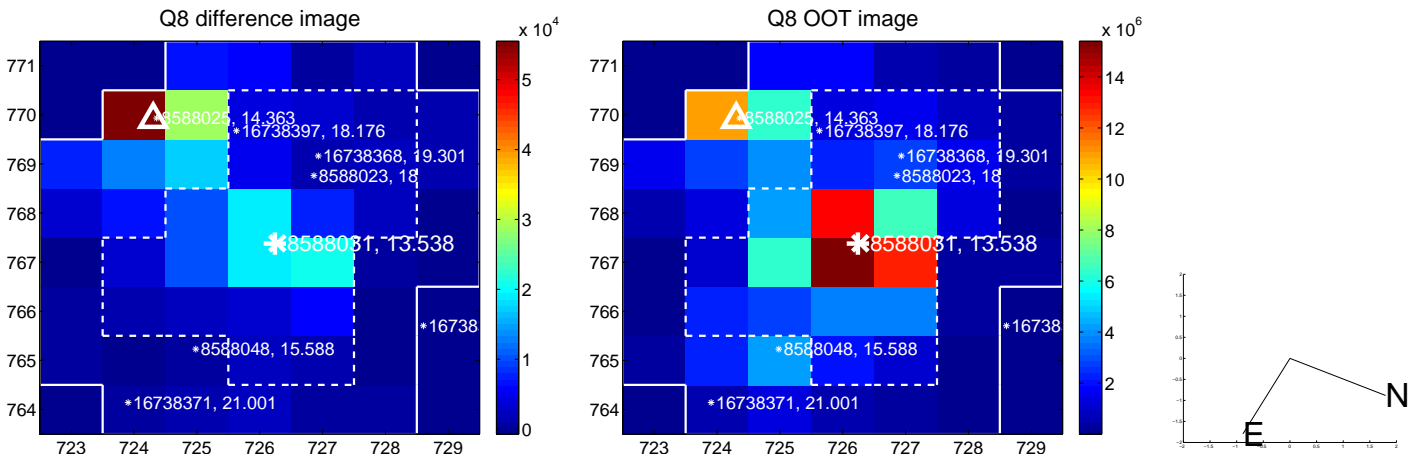
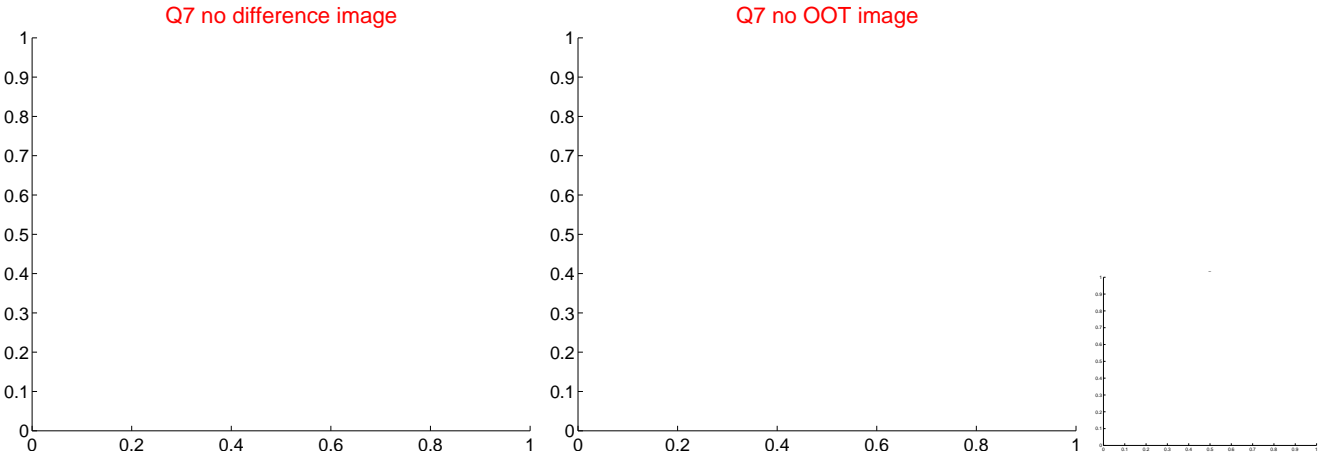
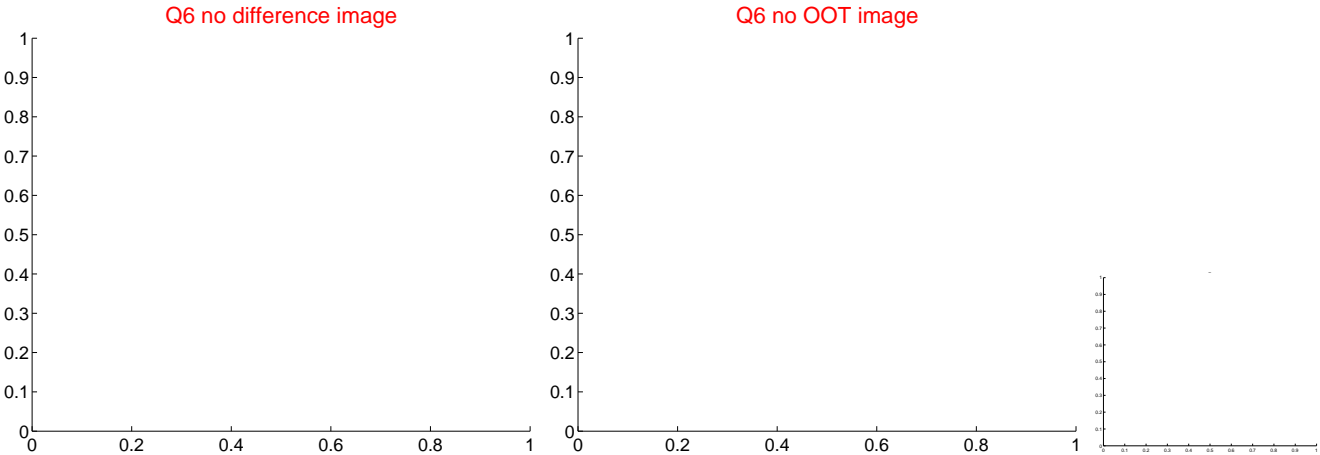
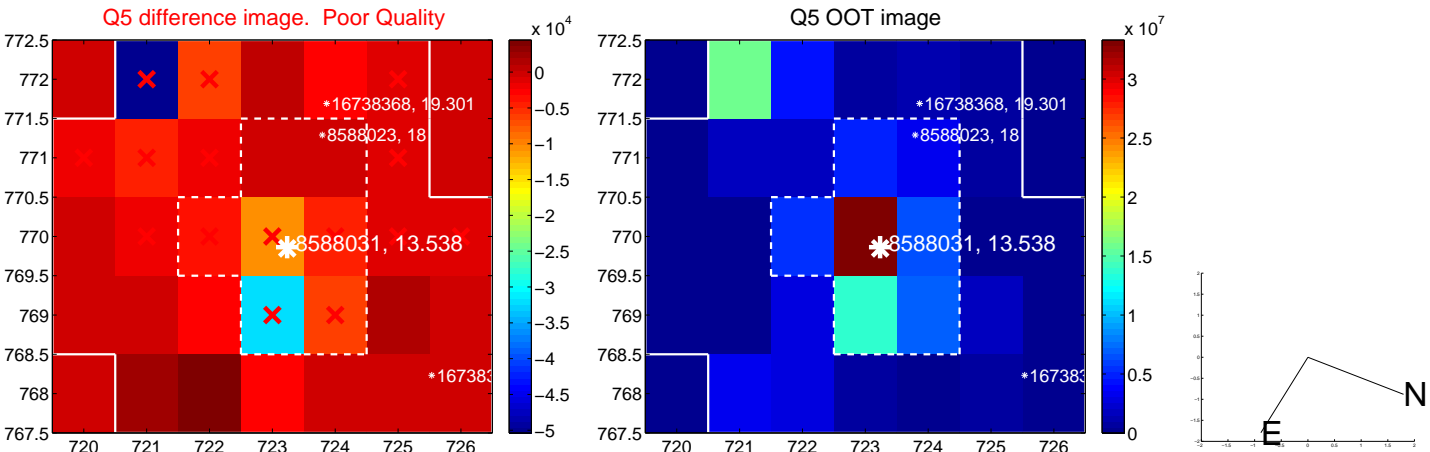
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

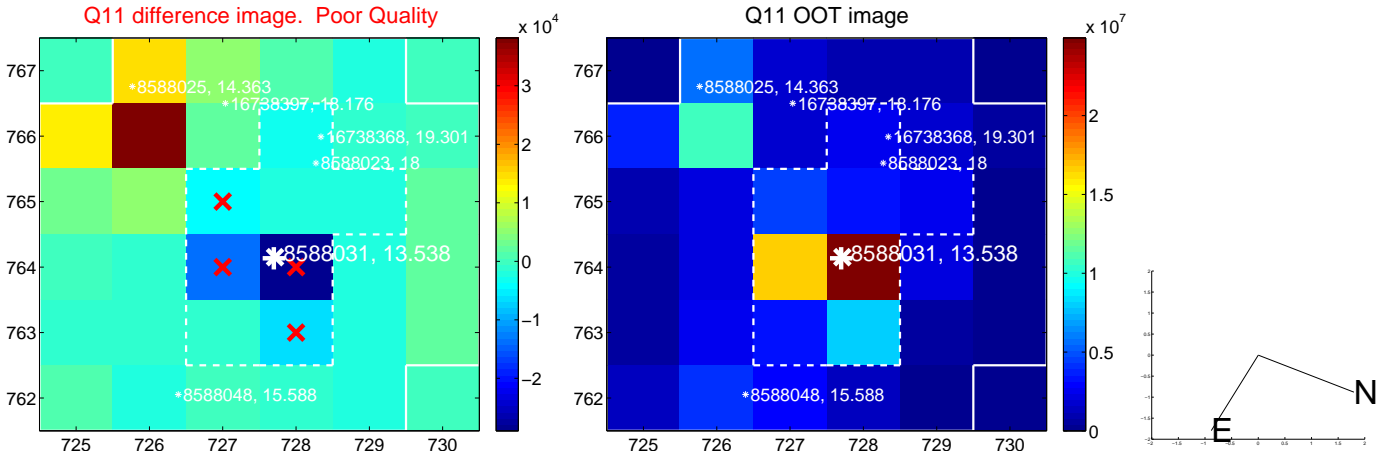
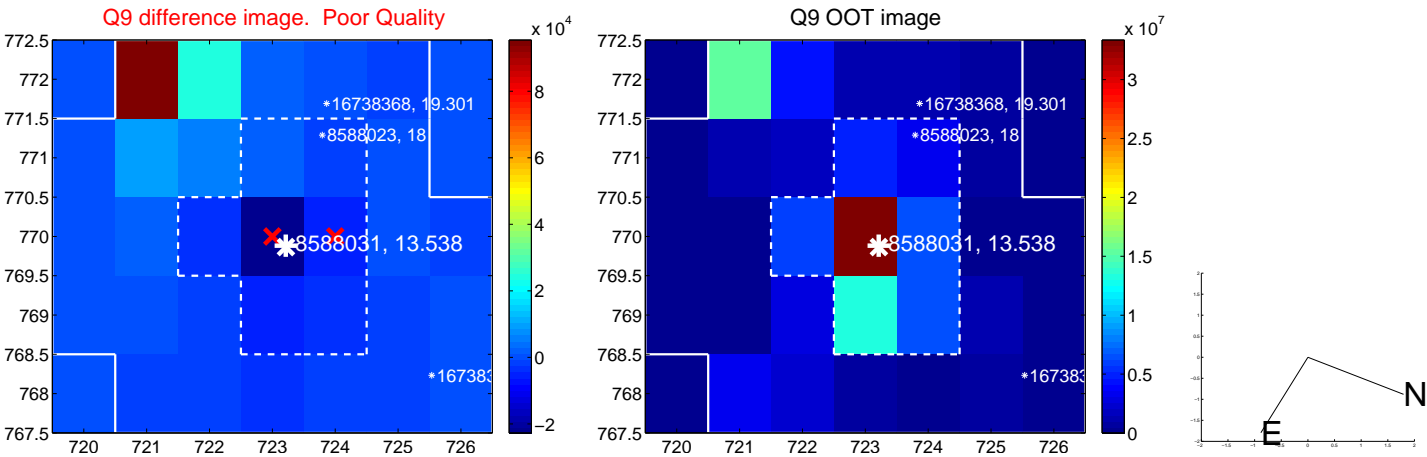




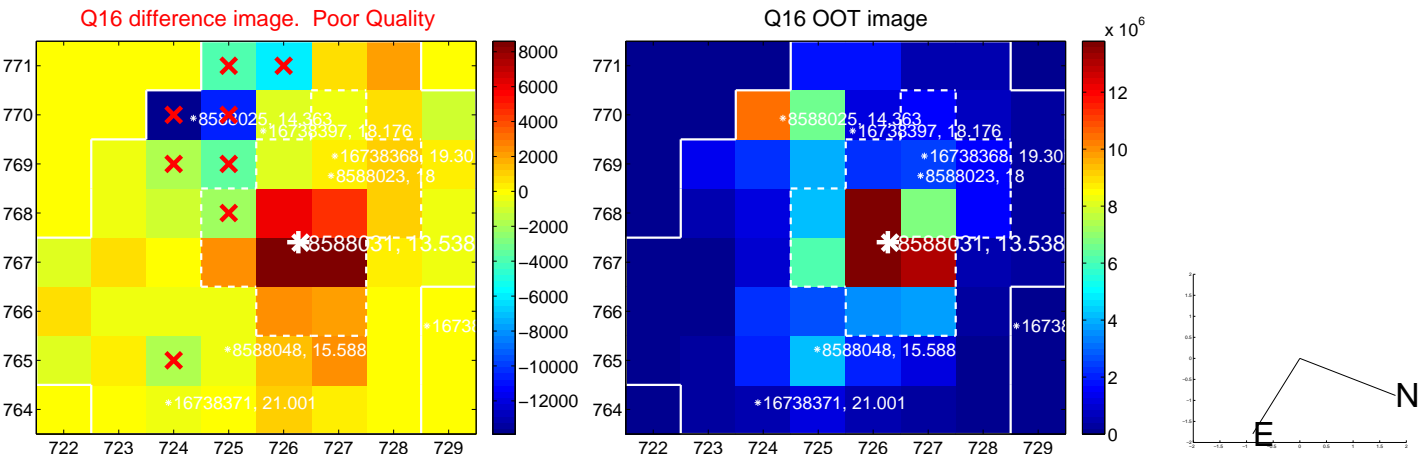
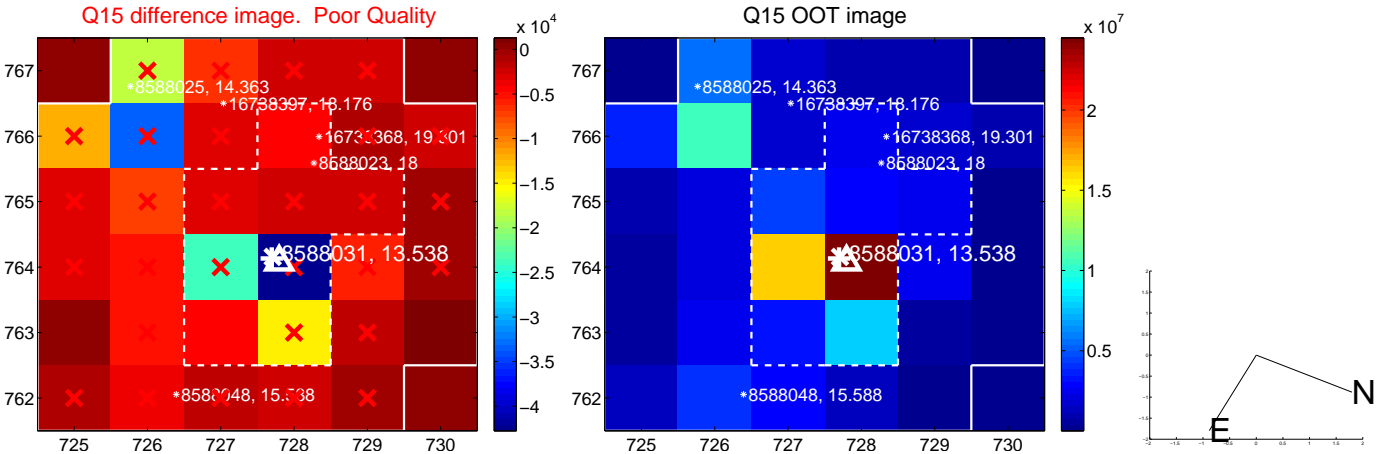
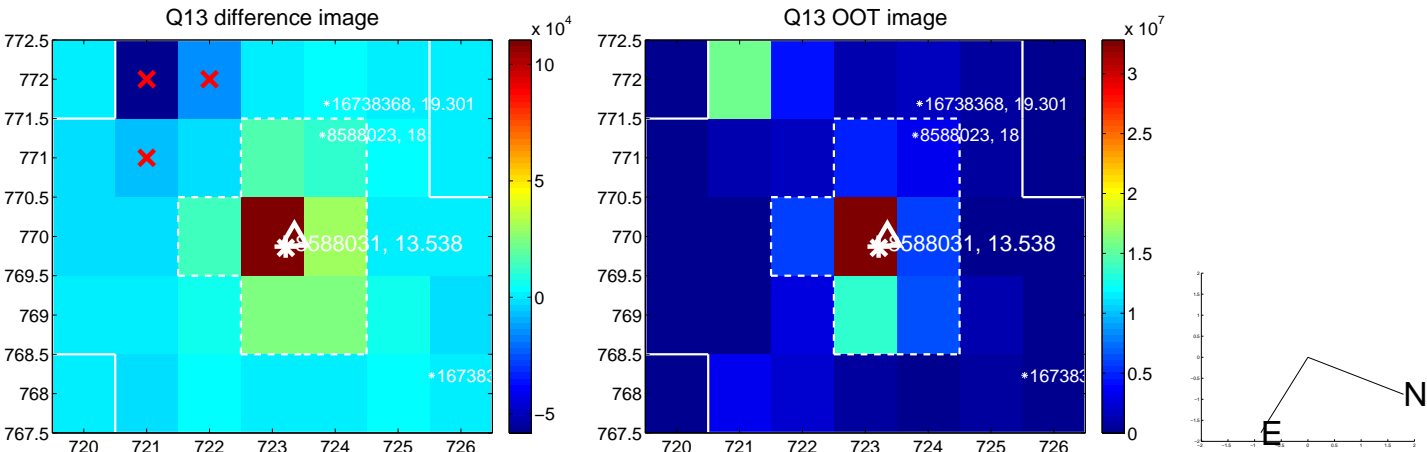
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



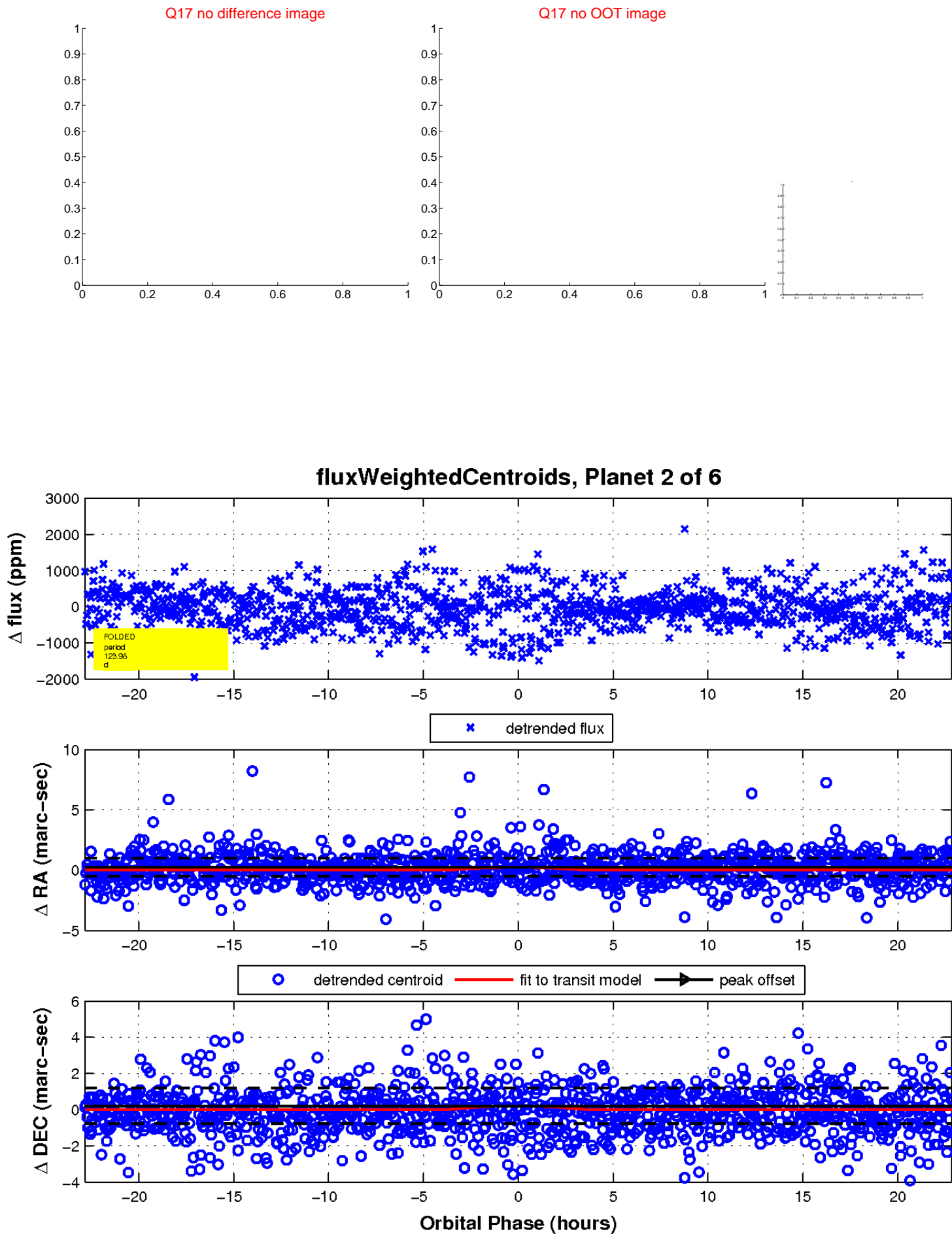
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

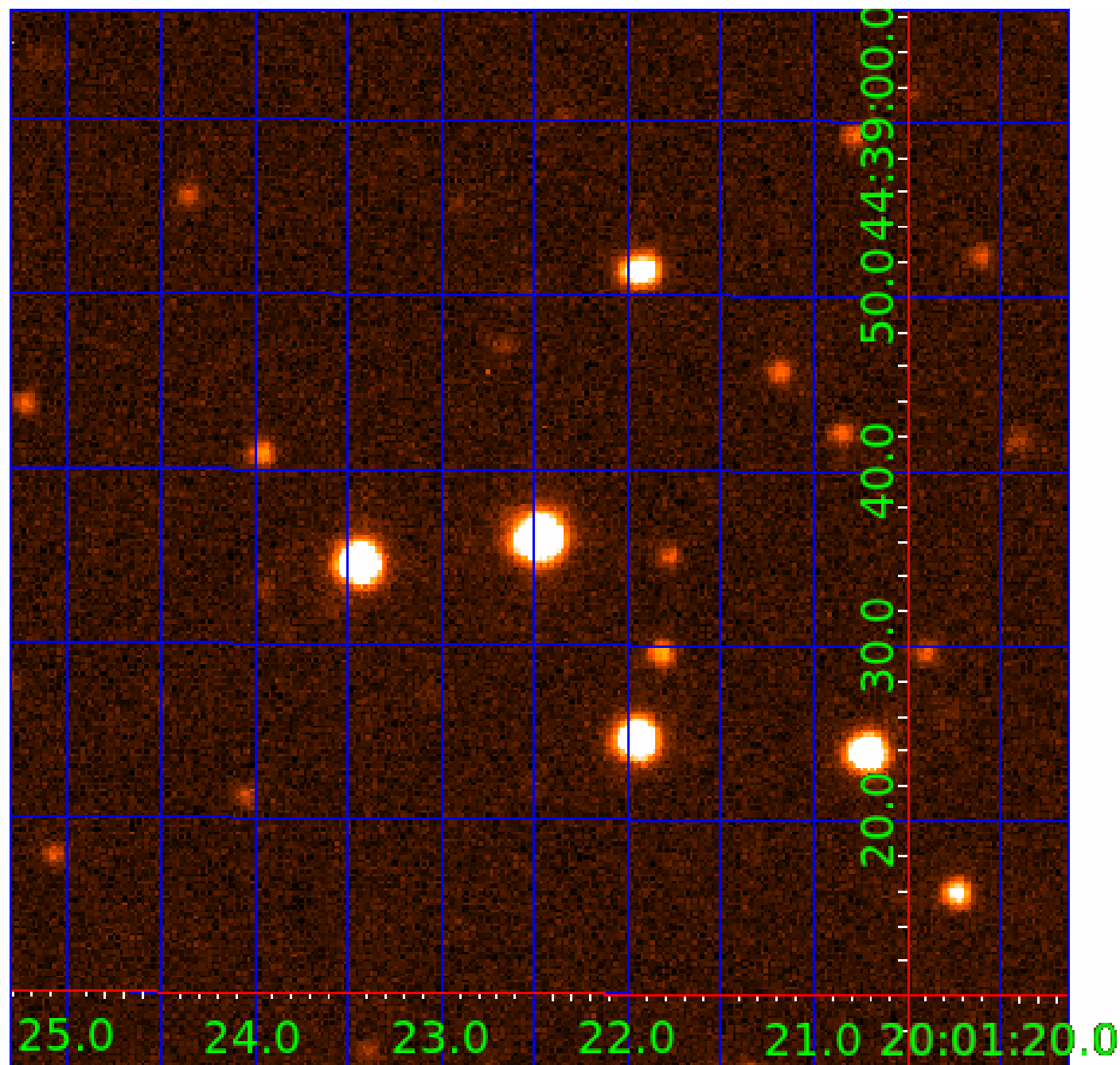


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination





# KIC 008588031

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
008588031-01	OBS	No	1.129496	132.237416	74.7	5.037	10.0	10.9	1.54	6573	1.37	8005.50
008588031-02	OBS	No	123.981995	138.449081	1156.2	7.625	9.8	9.5	1.54	6573	6.81	15.23
008588031-03	OBS	No	86.855554	146.372129	767.0	12.857	8.0	7.7	1.54	6573	5.83	24.48
008588031-04	OBS	No	115.910270	147.875278	582.5	12.779	8.9	6.4	1.54	6573	4.41	16.66
008588031-05	OBS	No	429.269521	157.621676	932.0	10.002	7.9	7.9	1.54	6573	5.68	2.91
008588031-06	OBS	No	37.028934	155.605567	205.2	9.000	7.6	-1.0	1.54	6573	2.23	76.30

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
008588031-01	OBS	FP	0.00	1	0	0	0	LPP_DV—MOD_NONUNIQ_DV
008588031-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_ALT—INCONSISTENT_TRANS—CENT_FEW_MEAS
008588031-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT
008588031-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV
008588031-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT
008588031-06	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_ALT—CENT_NOFITS—HALO_GHOST

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

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

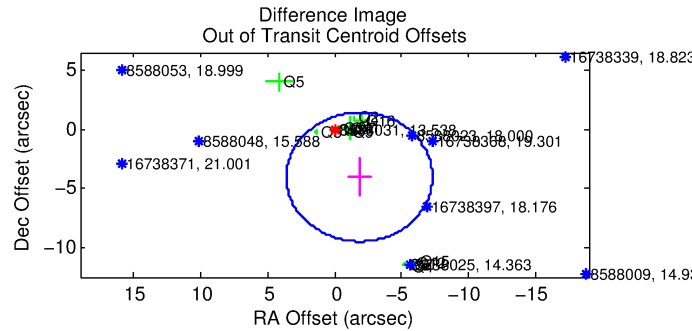
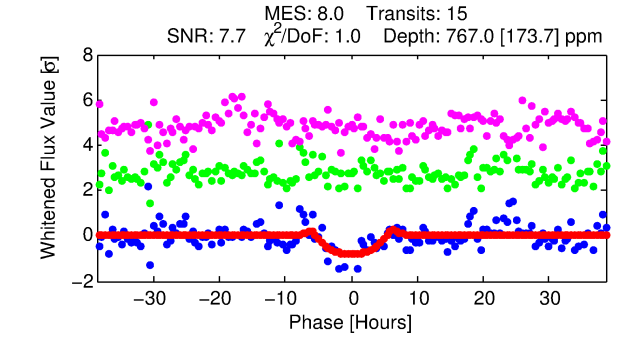
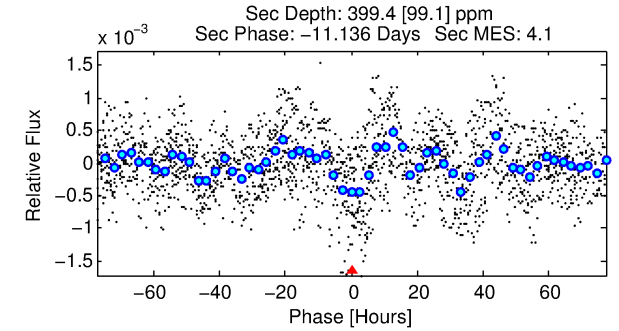
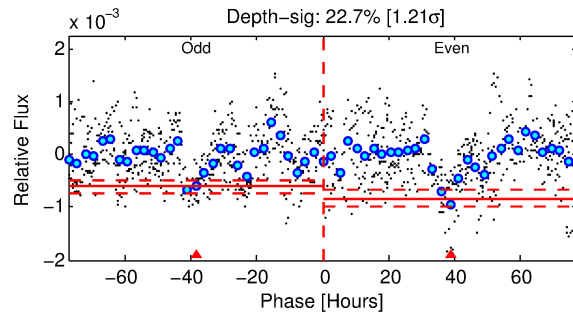
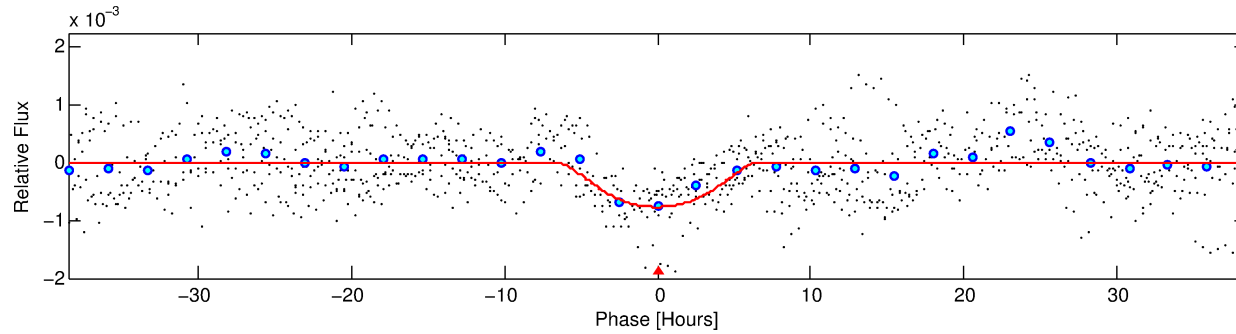
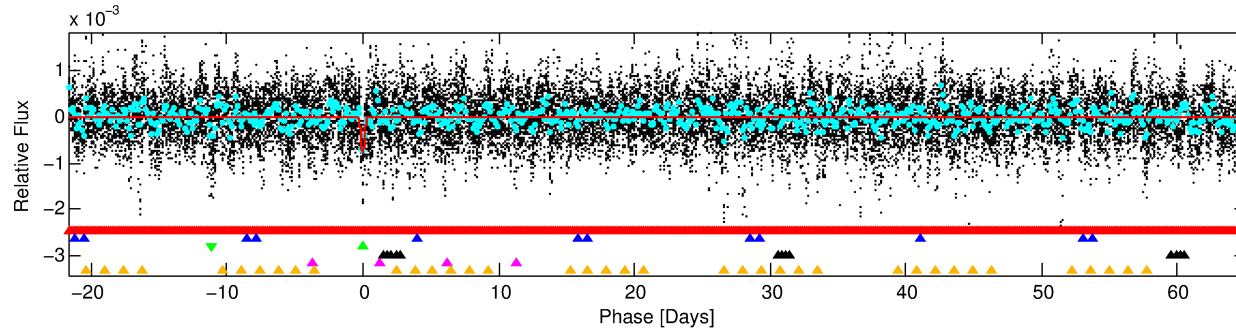
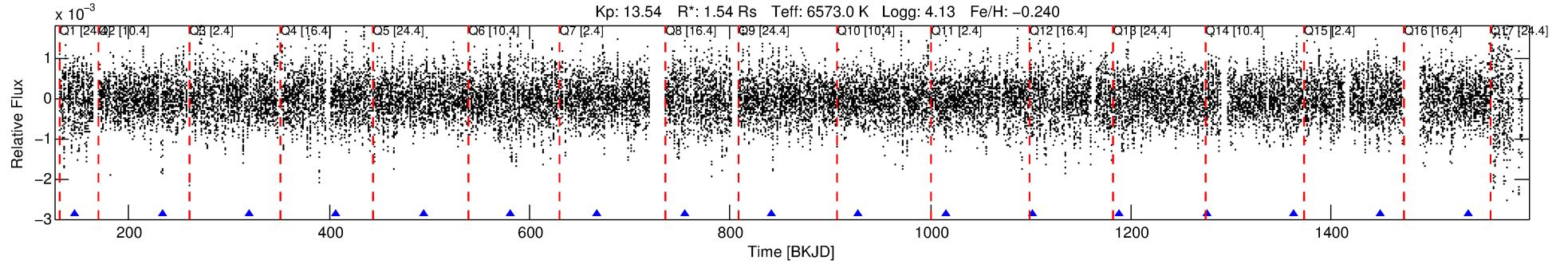
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 008588031-03

No Significant Match Found

# DV One-Page Summary

KIC: 8588031 Candidate: 3 of 6 Period: 86.856 d



## DV Fit Results:

Period = 86.8555 [0.00325] d  
Epoch = 146.3721 [0.0287] BKJD  
Rp/R\* = 0.0346 [0.0128]  
a/R\* = 17.88 [3.56]  
b = 0.98 [0.03]  
Seff = 24.48 [9.94]  
Teq = 567 [58] K  
Rp = 5.84 [2.78] Re  
a = 0.4038 [0.1044] AU  
Ag = 1052.13 [917.44] [1.15 $\sigma$ ]  
Teffp = 4995 [991] K [4.46 $\sigma$ ]

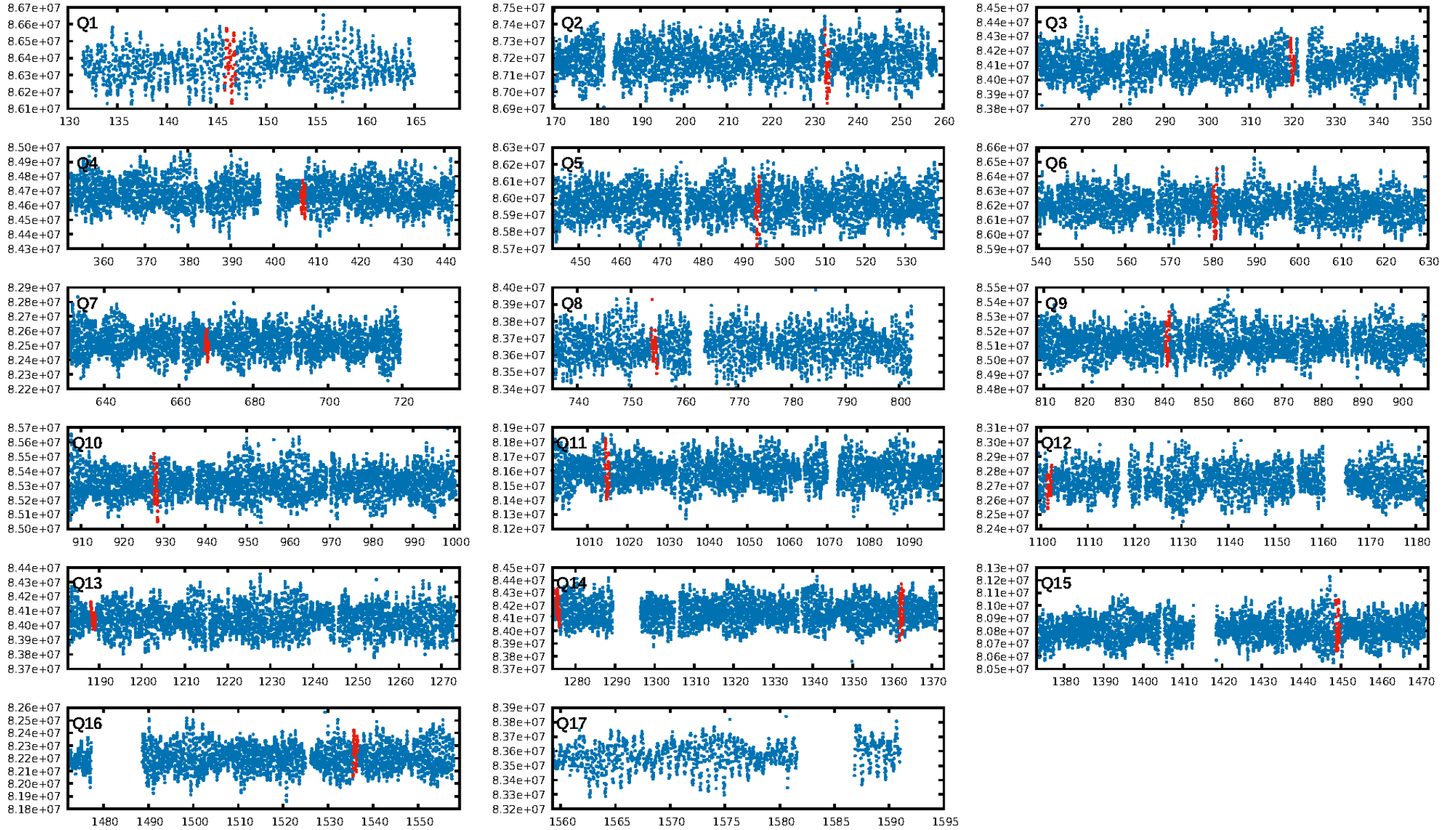
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [76.20 $\sigma$ ]  
LongPeriod-sig: 100.0% [38.47 $\sigma$ ]  
ModelChiSquare2-sig: 50.4%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [14/14]  
**GhostDiagnostic-chr: -0.378**  
Centroid-sig: 5.4%  
Centroid-so: 1.206 arcsec [2.58 $\sigma$ ]  
OotOffset-rm: 4.453 arcsec [2.45 $\sigma$ ]  
OotOffset-st: 3/4/4/2 [13]  
KicOffset-rm: 4.441 arcsec [2.57 $\sigma$ ]  
KicOffset-st: 3/4/4/2 [13]  
DiffImageQuality-fgm: 0.69 [9/13]  
DiffImageOverlap-fno: 0.00 [0/15]

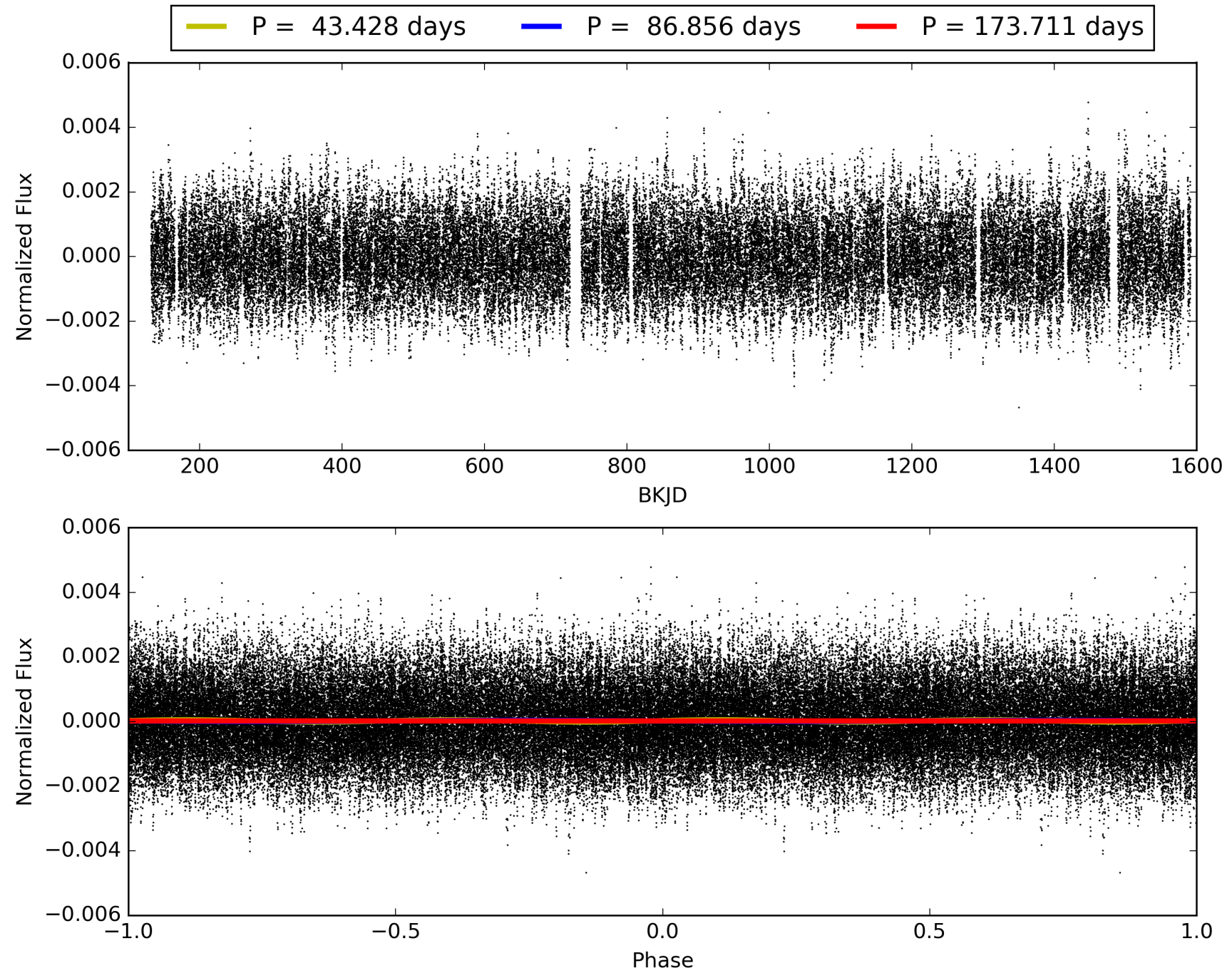
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 06:02:56 Z

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

# TCE 008588031-03, PDC Light Curves

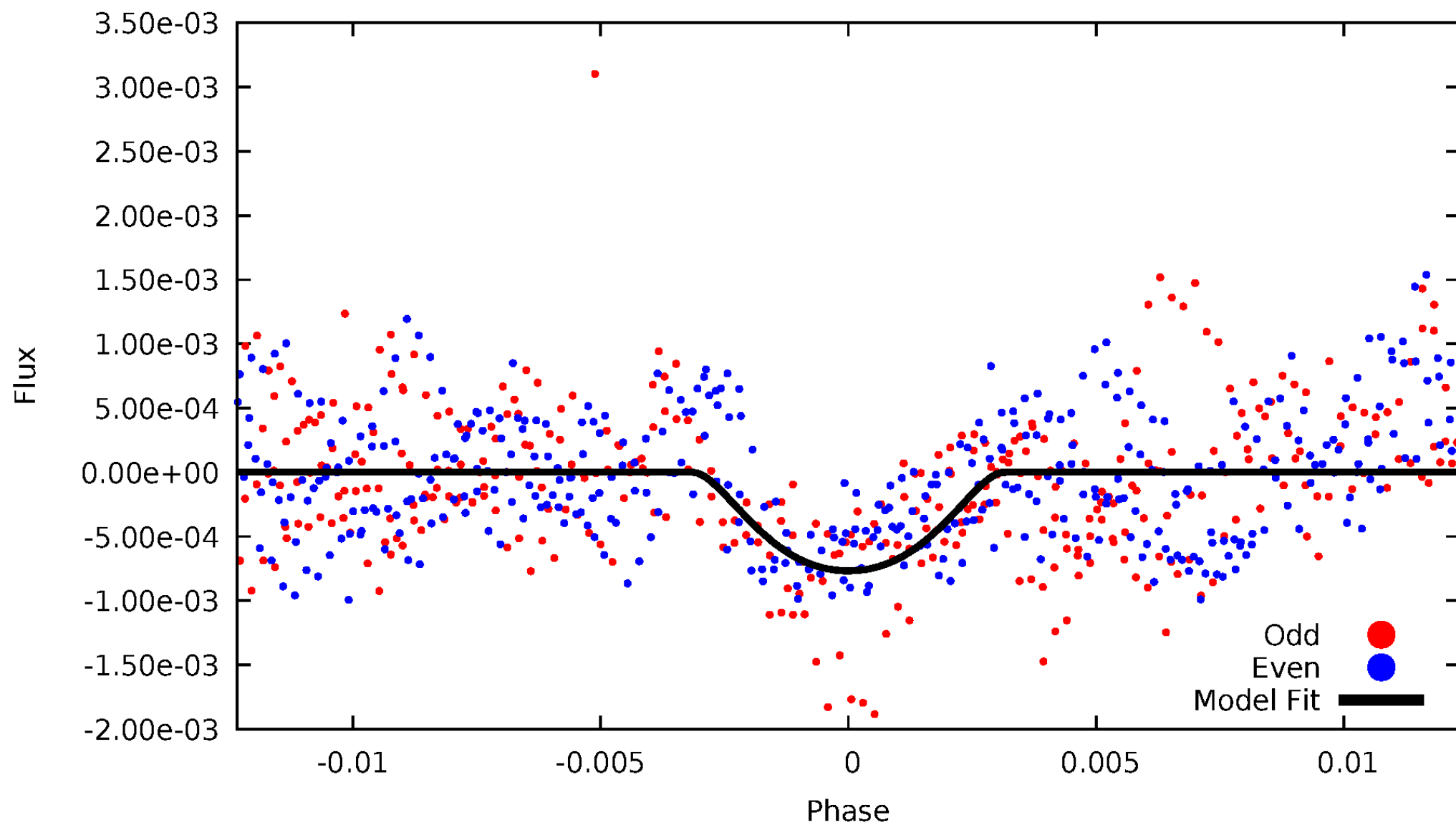


TCE 008588031-03



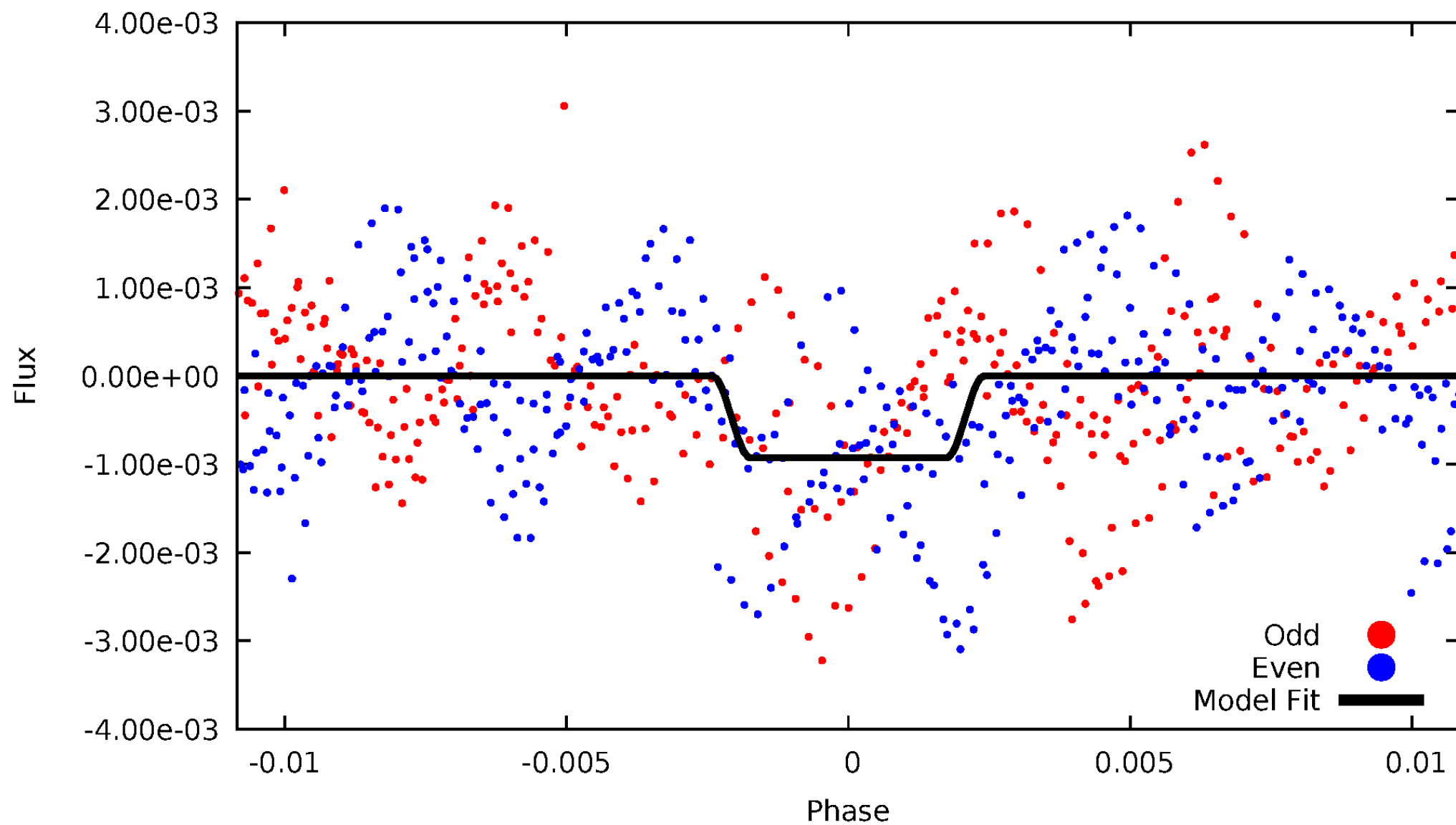
# DV Odd/Even

TCE 008588031-03



# ALT Odd/Even

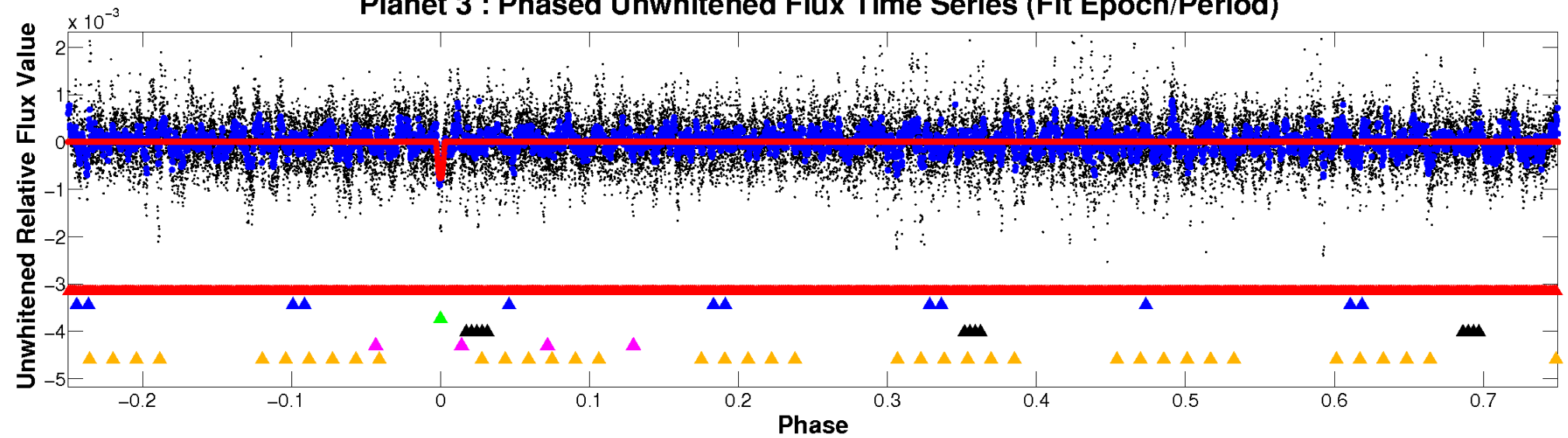
TCE 008588031-03



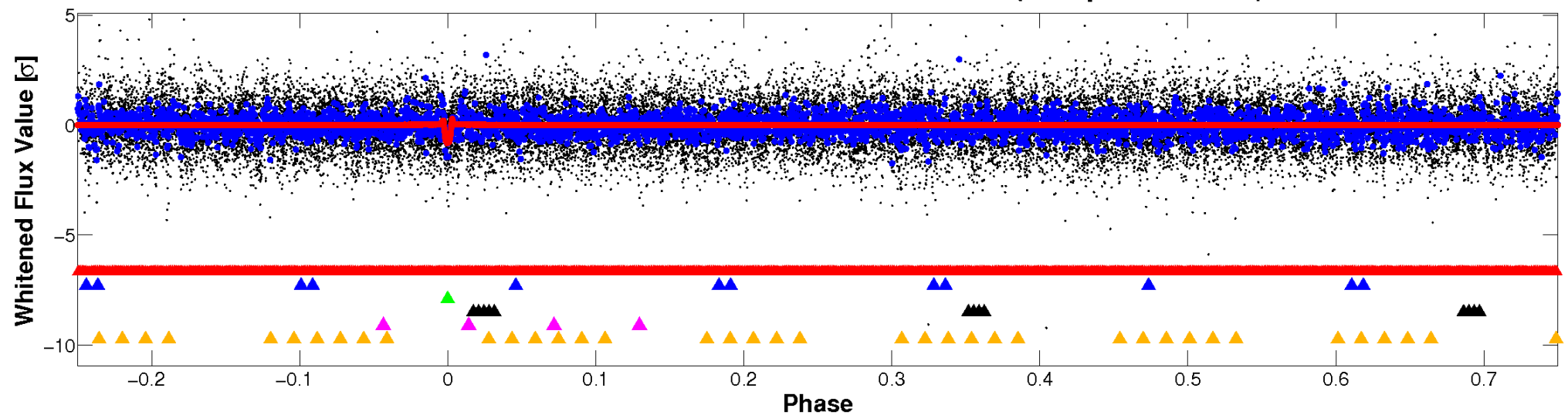


# Non-Whitened Vs. Whitened Light Curve

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

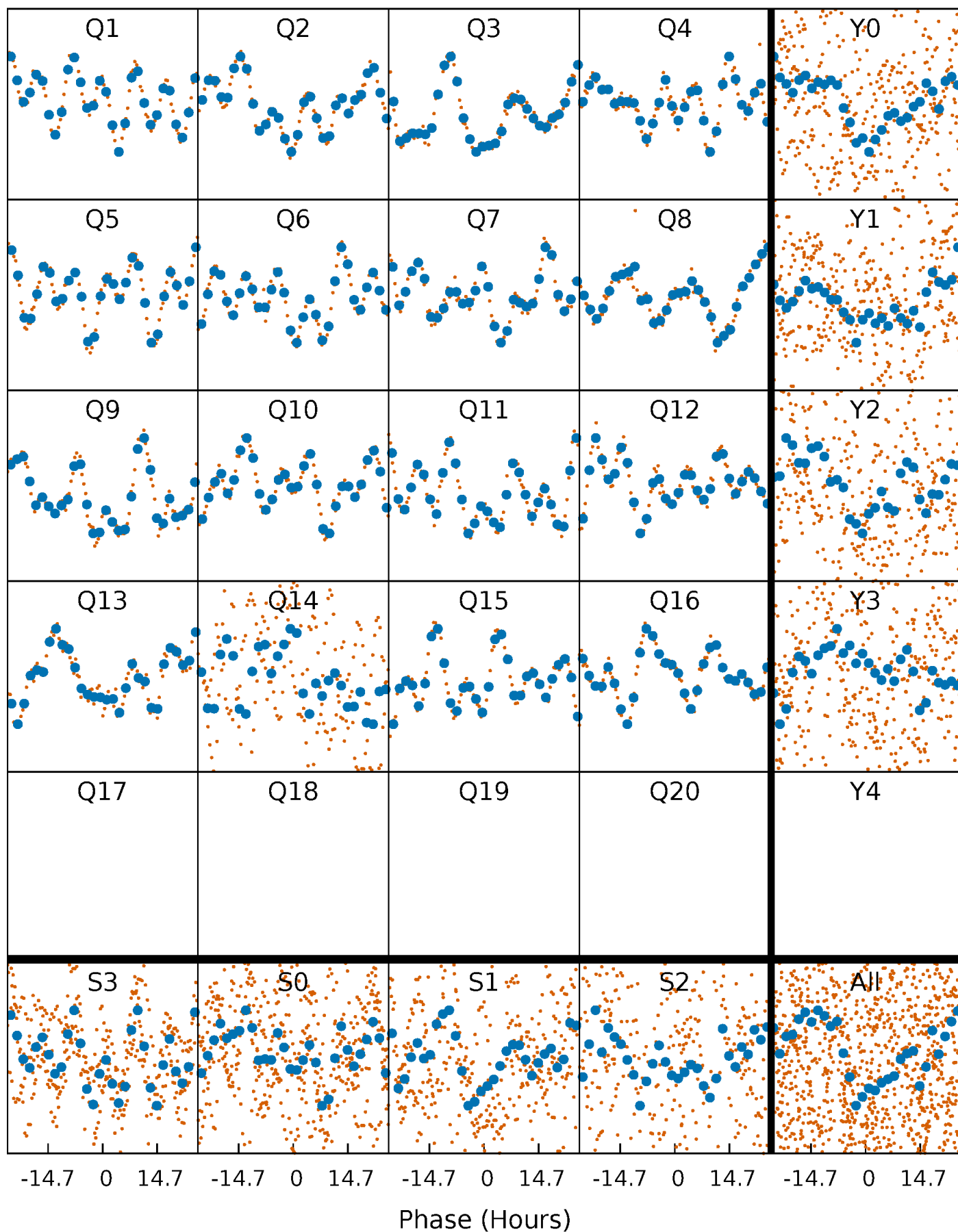


## Planet 3 : Phased Whitened Flux Time Series (Fit Epoch/Period)



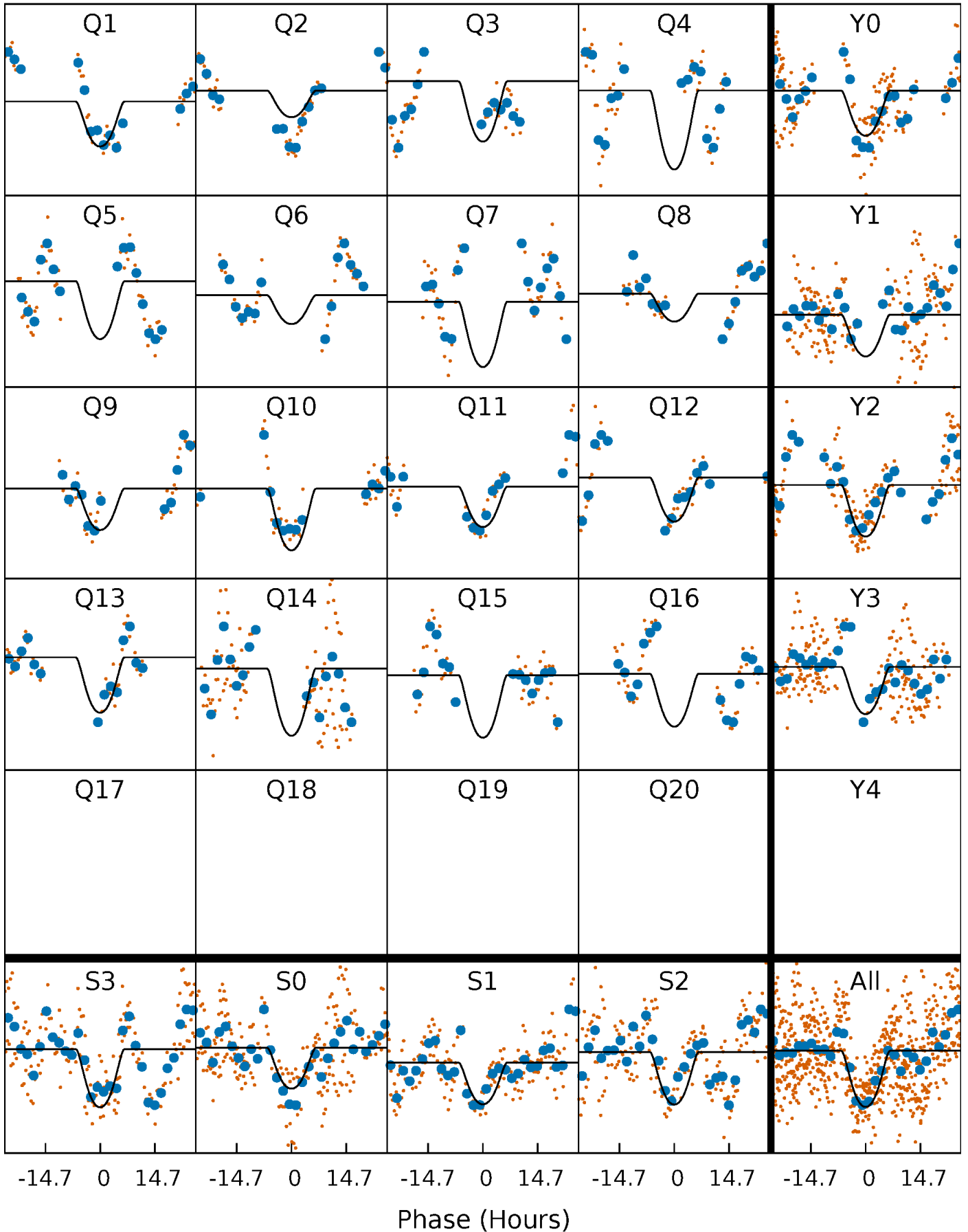
# PDC Quarter-Phased Transit Curves

TCE 008588031-03     $P = 86.855554$  Days     $T_0 = 146.372129$  (BKJD)



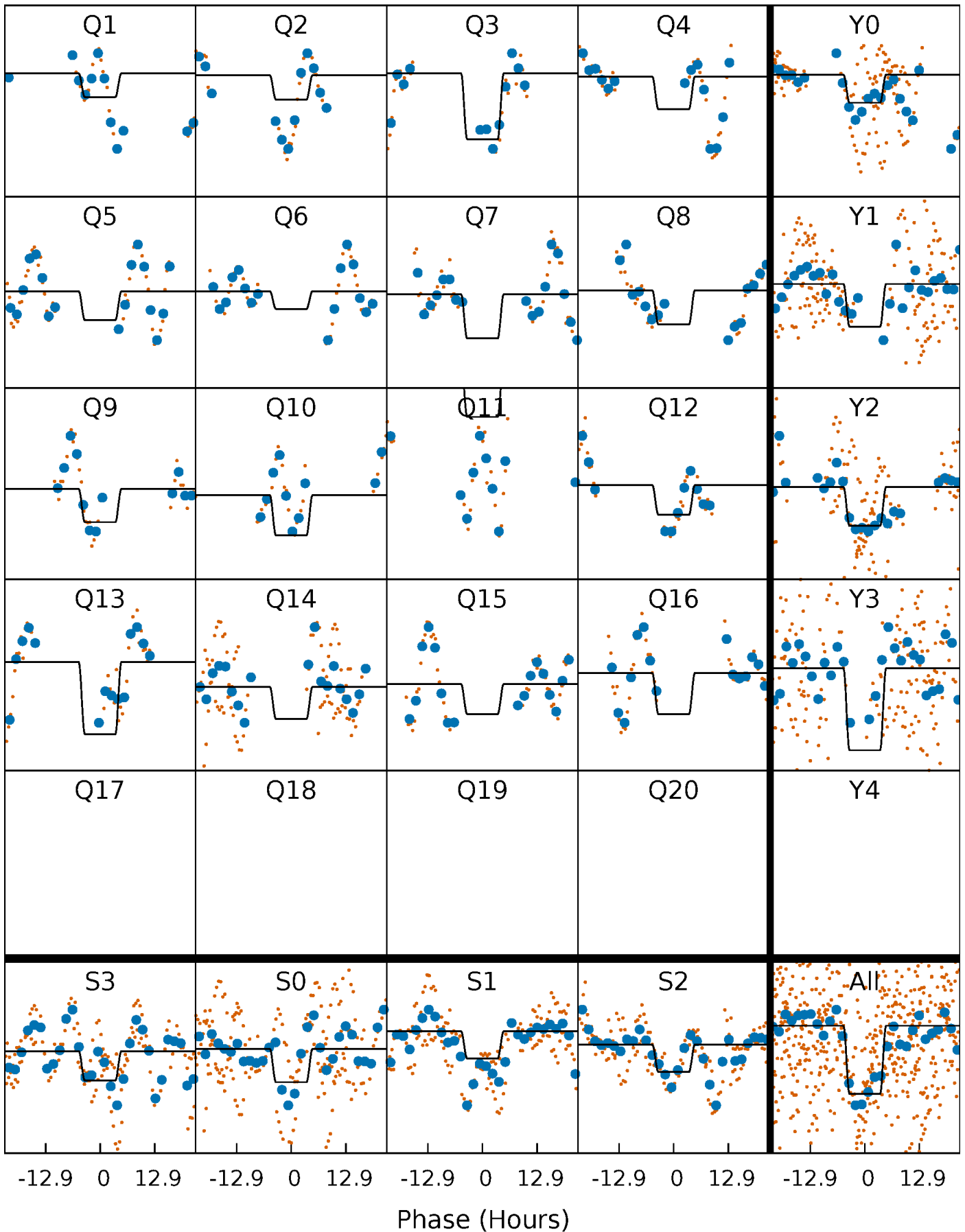
# DV Quarter-Phased Transit Curves

TCE 008588031-03     $P = 86.855554$  Days     $T_0 = 146.372129$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

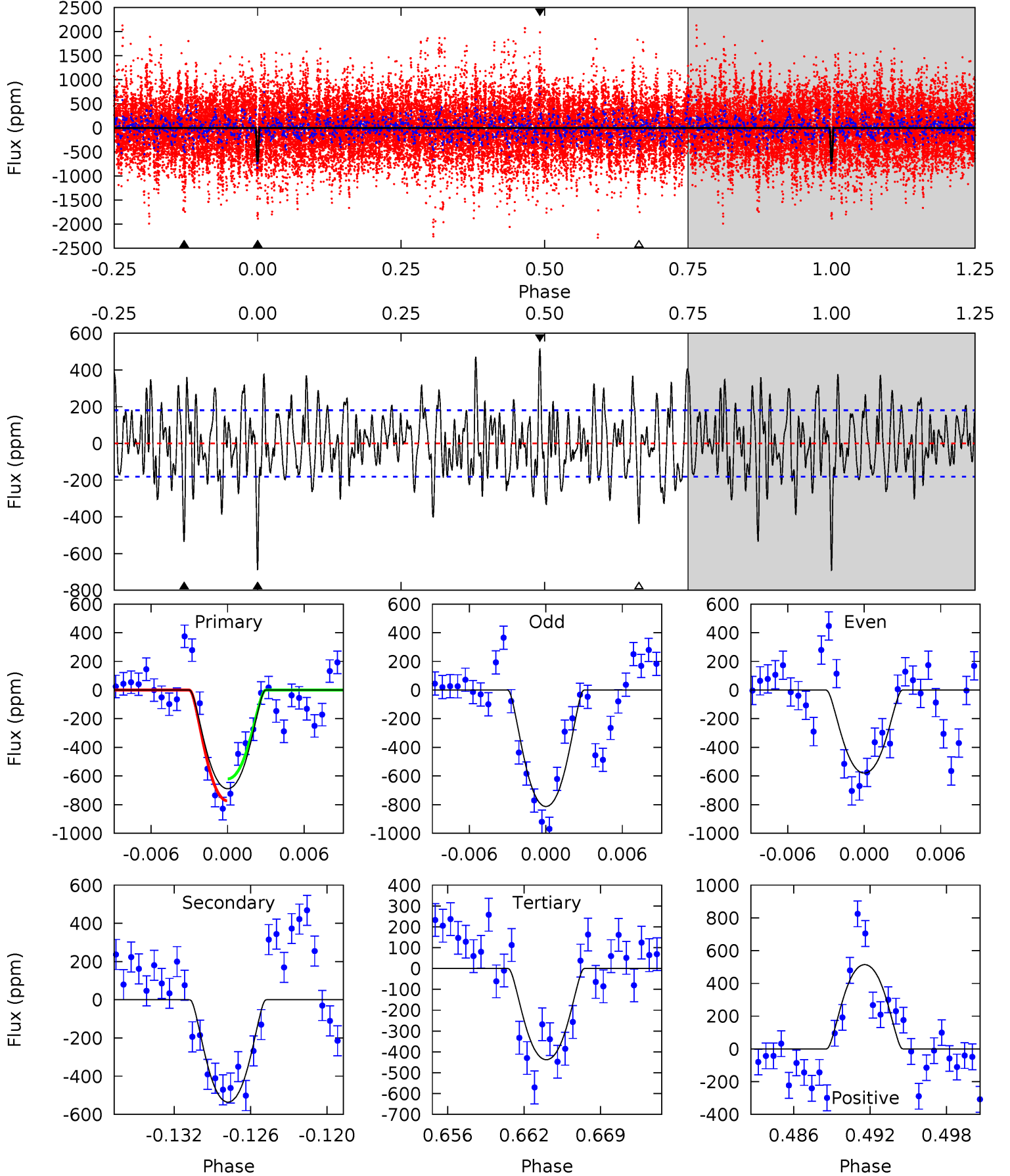
TCE 008588031-03     $P = 86.853752$  Days     $T_0 = 146.378768$  (BKJD)



# DV Model-Shift Uniqueness Test

008588031-03, P = 86.855554 Days, E = 59.516575 Days

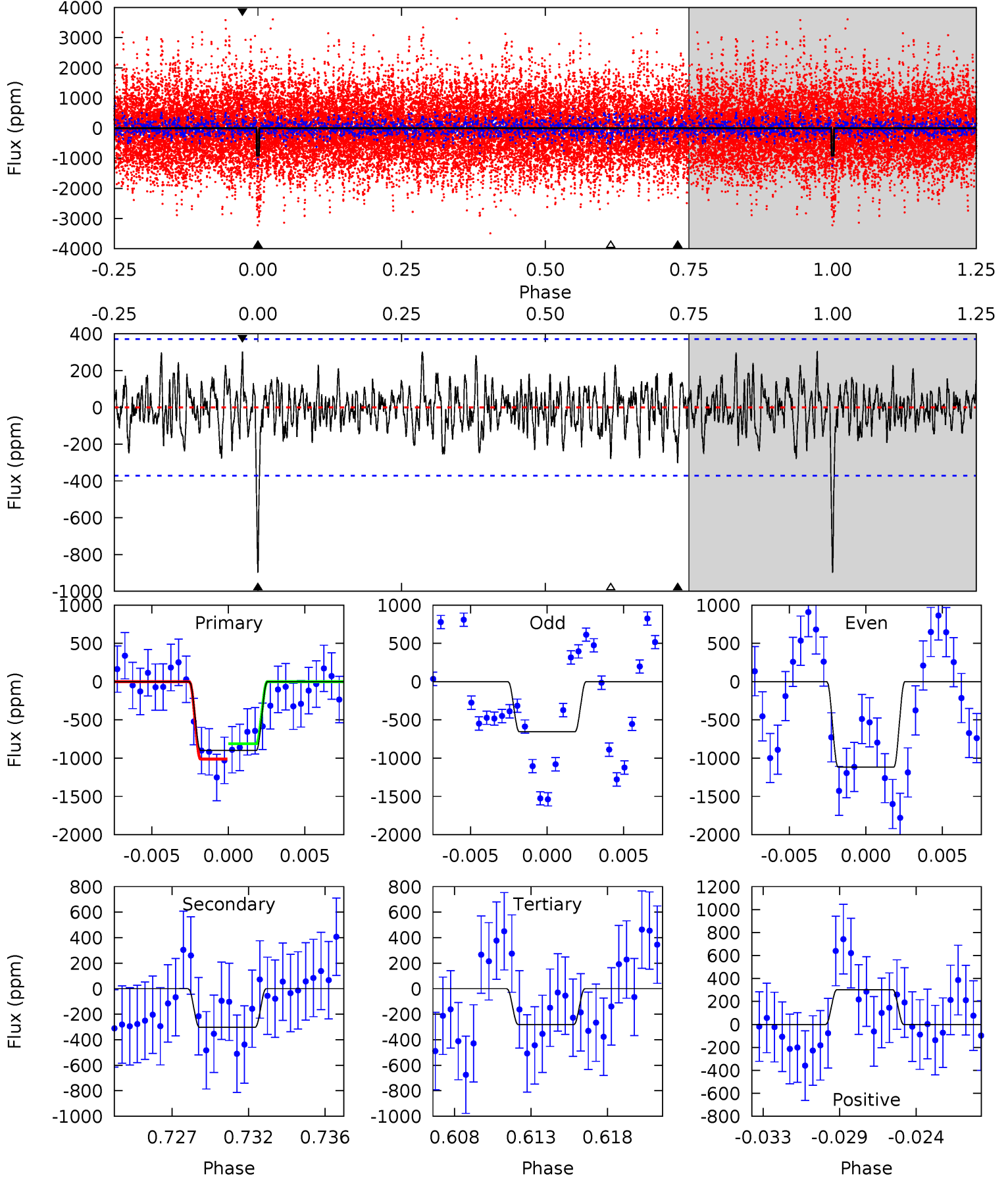
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
19.5	15.2	12.4	14.6	5.11	2.73	4.33	7.11	4.94	2.77	0.60	3.29	0.24	0.43	2.15



# Alt Model-Shift Uniqueness Test

008588031-03, P = 86.853752 Days, E = 59.525016 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	4.21	3.91	4.22	5.17	2.82	1.36	8.60	8.29	0.30	-0.01	3.19	0.89	0.25	1.38





### Stellar Parameters For KIC 008588031

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M$ ( $M_{\odot}$ )	$\rho_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$6573^{+175}_{-214}$	$4.126^{+0.214}_{-0.175}$	$-0.240^{+0.250}_{-0.300}$	$1.545^{+0.463}_{-0.421}$	$1.162^{+0.209}_{-0.157}$	$0.444^{+0.544}_{-0.214}$
	+3%/-3%	+5%/-4%	+104%/-125%	+30%/-27%	+18%/-14%	+123%/-48%
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 008588031-03 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	$-536 \pm 35$	$5.87^{+2.46}_{-2.18}$	$787^{+65}_{-59}$	$5328^{+1318}_{-650}$	$1390^{+2172}_{-704}$
Alt.	$-302 \pm 72$	$5.11^{+2.59}_{-2.08}$	$786^{+61}_{-55}$	$4957^{+1348}_{-670}$	$1000^{+1986}_{-554}$

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

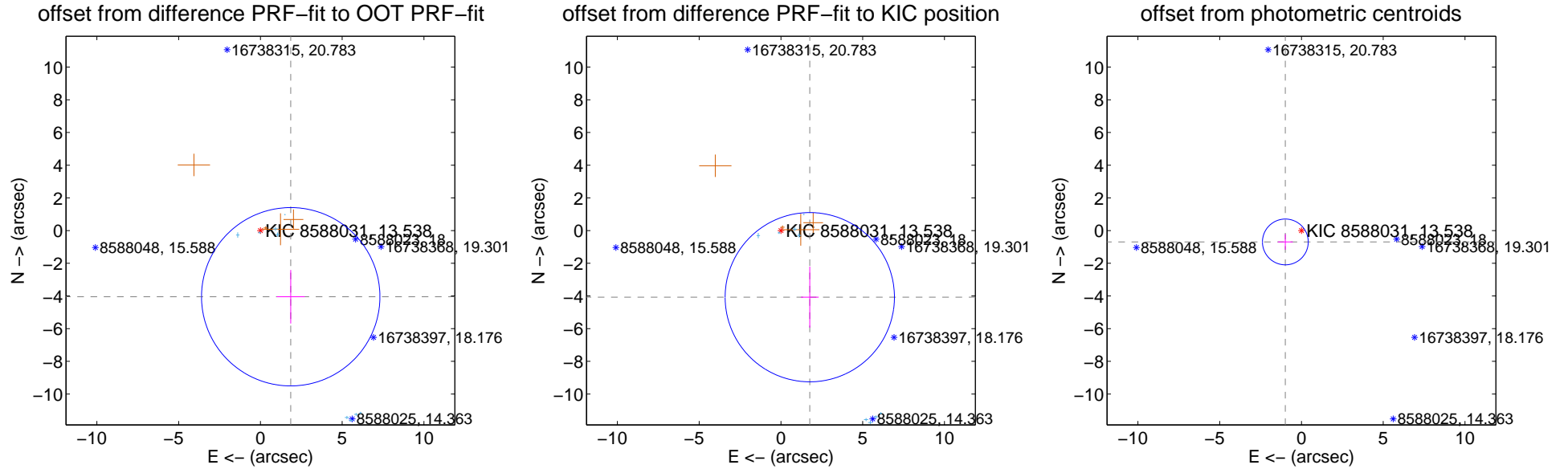
## DV Centroid Data

Supplemental centroid analysis for 008588031-03. Kepler magnitude: 13.54. Transit SNR 7.66

There are 9 quarters with good PRF difference image offsets

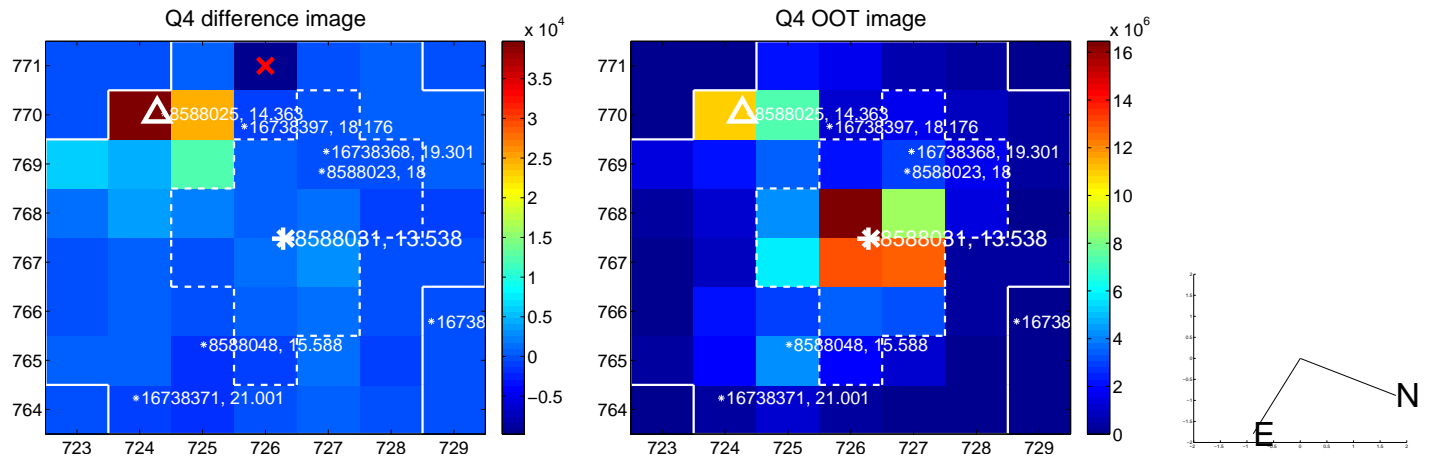
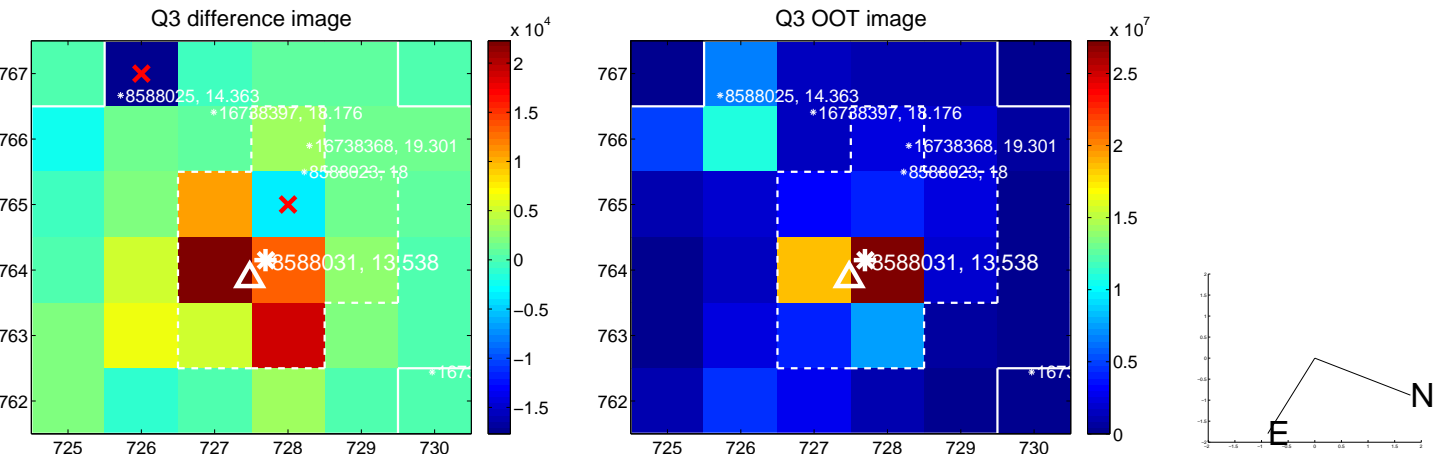
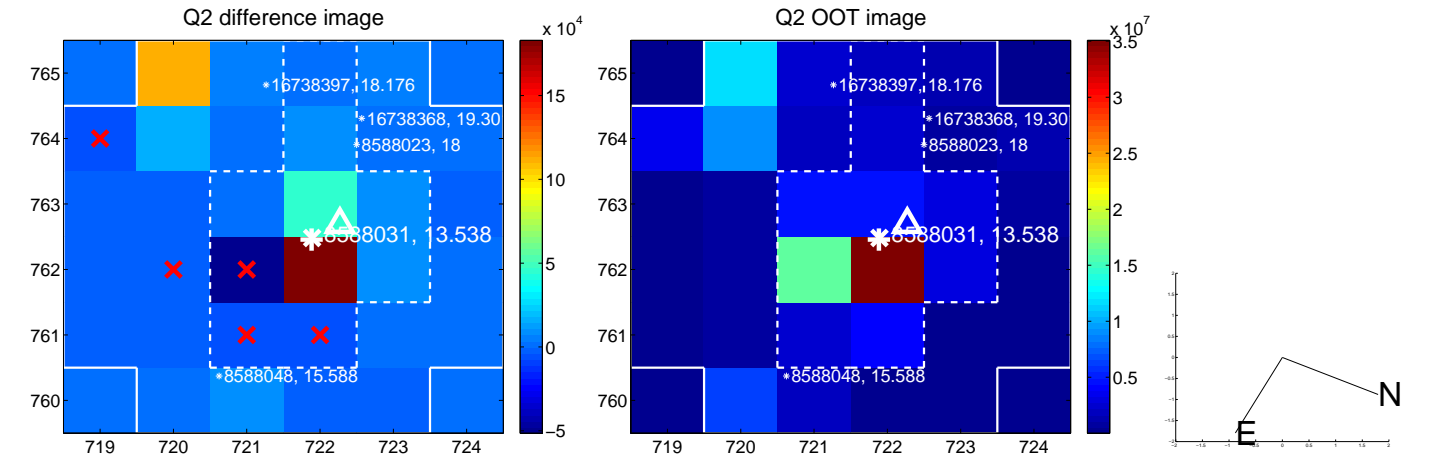
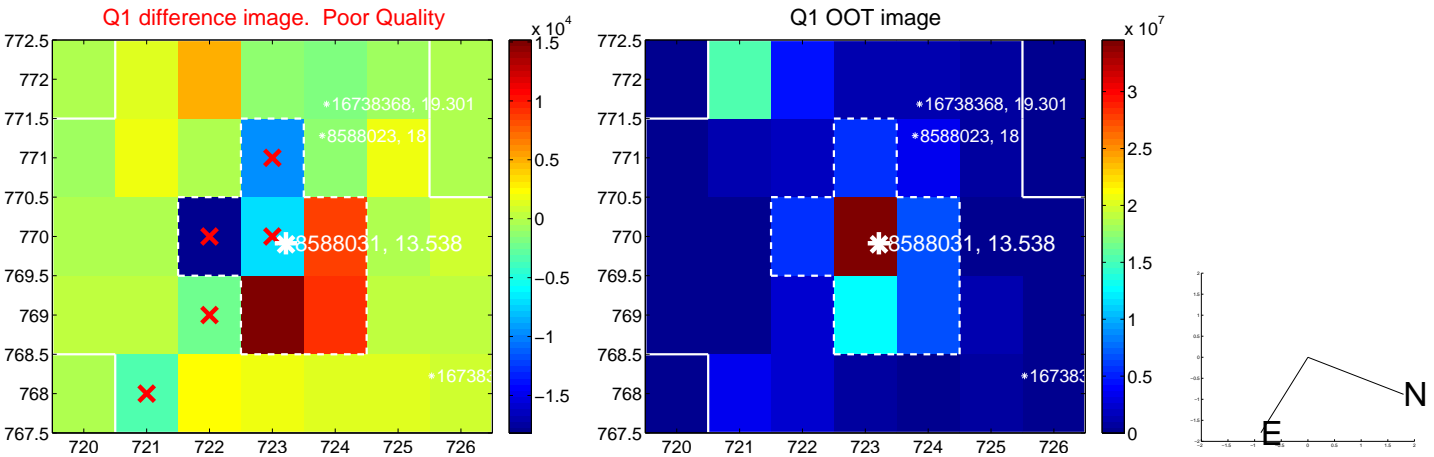
The direct PRF centroid is offset from the target star catalog position by about 0.20 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$4.453 \pm 1.818$	2.45	$-1.854 \pm 0.857$	$-4.048 \pm 1.639$
PRF-fit source offset from KIC position	$4.441 \pm 1.725$	2.57	$-1.765 \pm 0.543$	$-4.076 \pm 1.865$
photometric centroid source offset	$1.21 \pm 0.47$	2.58	$0.98 \pm 0.46$	$-0.70 \pm 0.48$

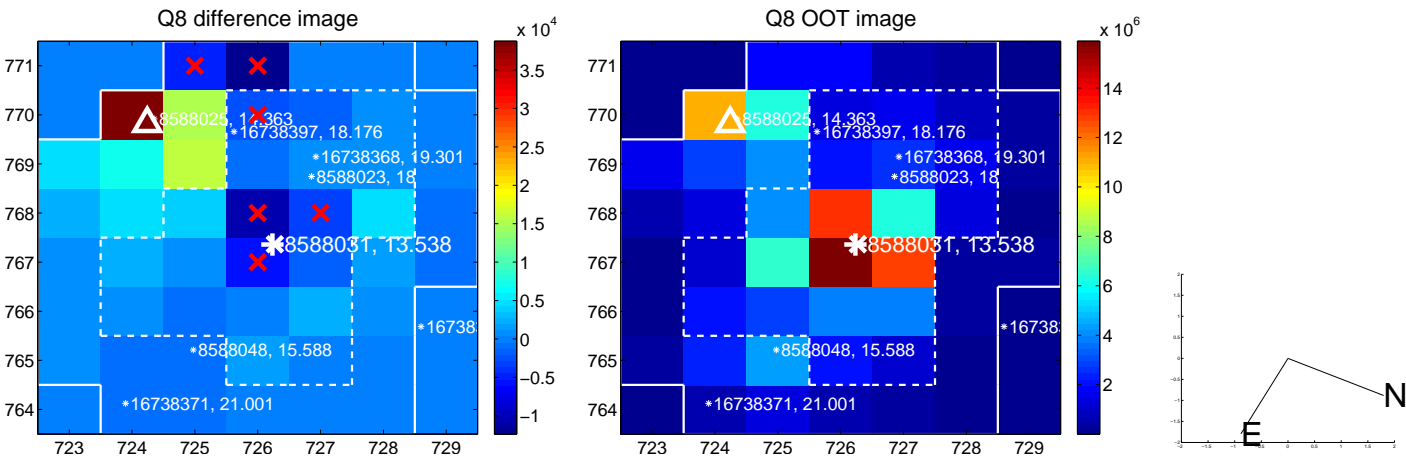
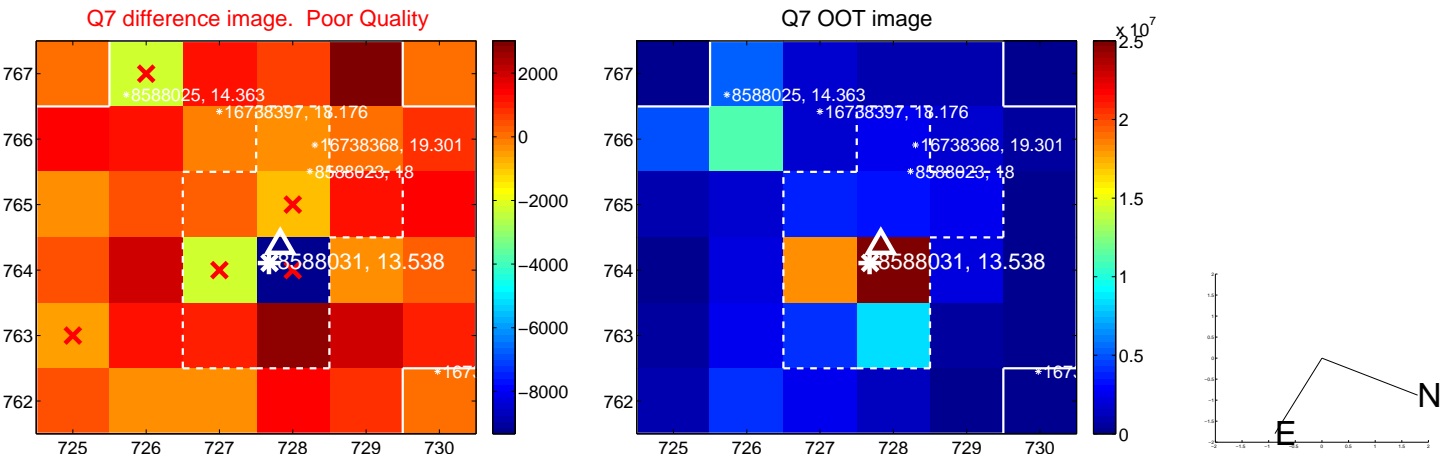
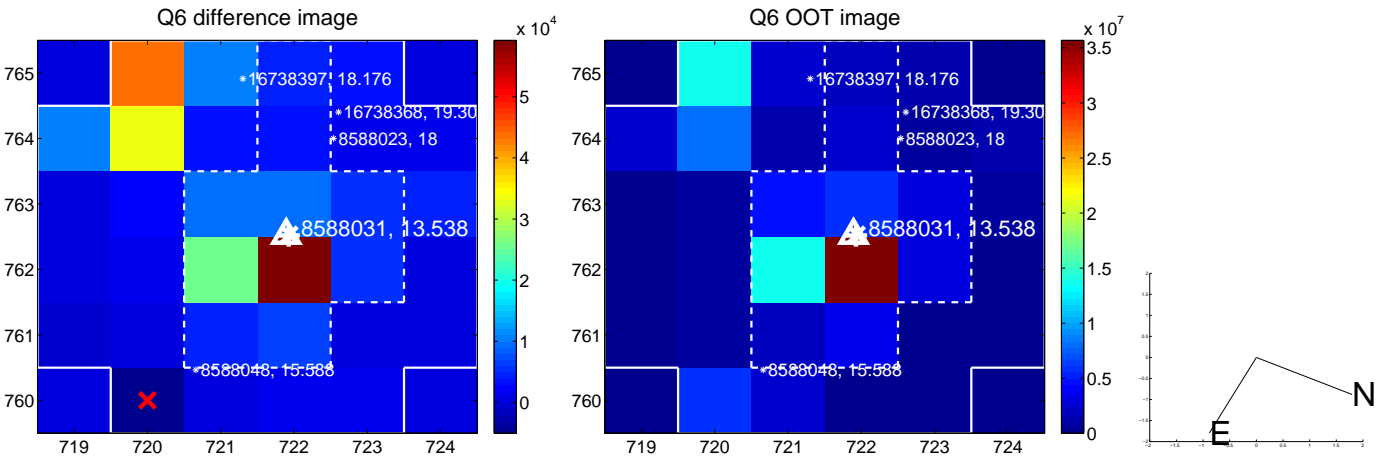
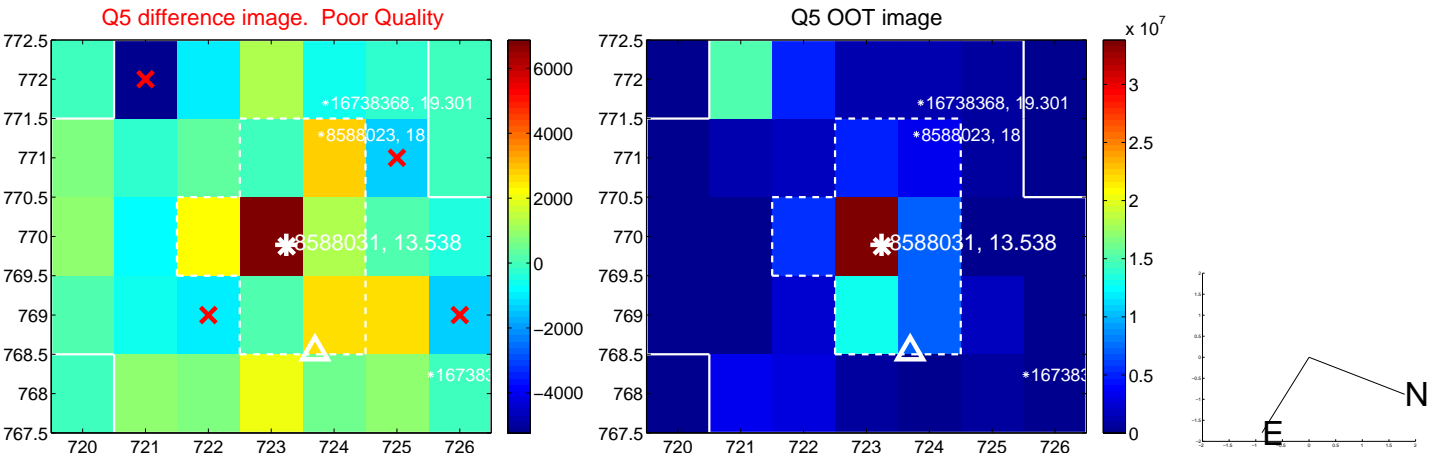


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses:** good quarterly centroid offsets; **Vermillion crosses:** bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

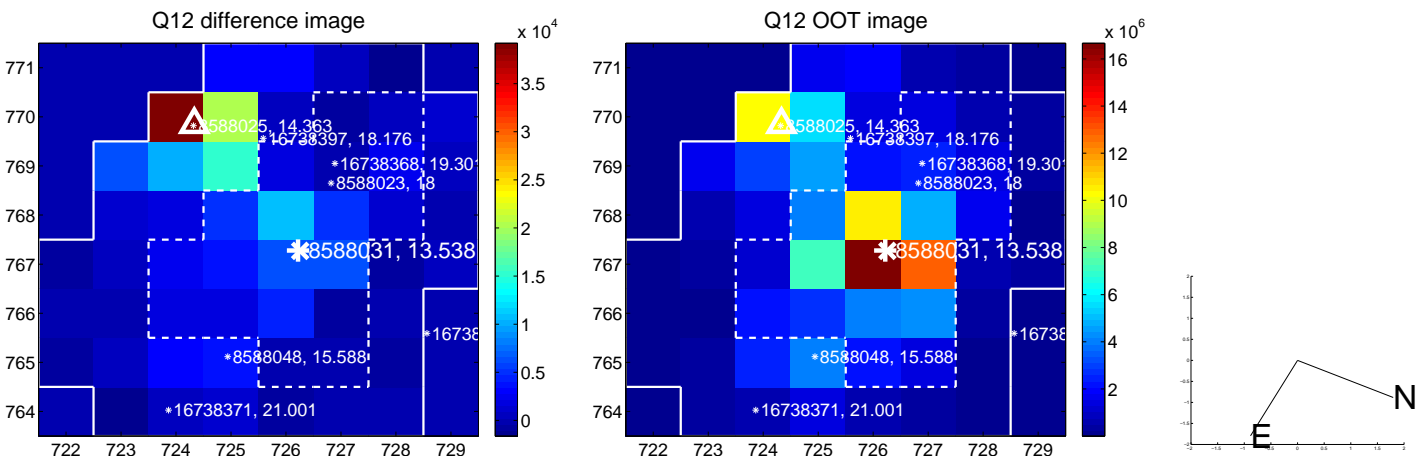
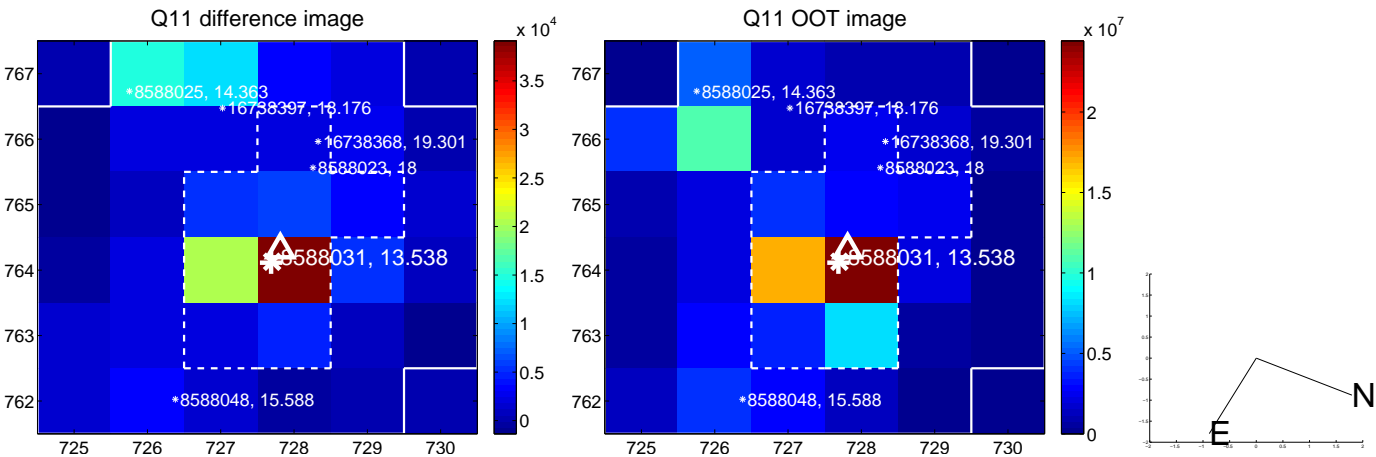
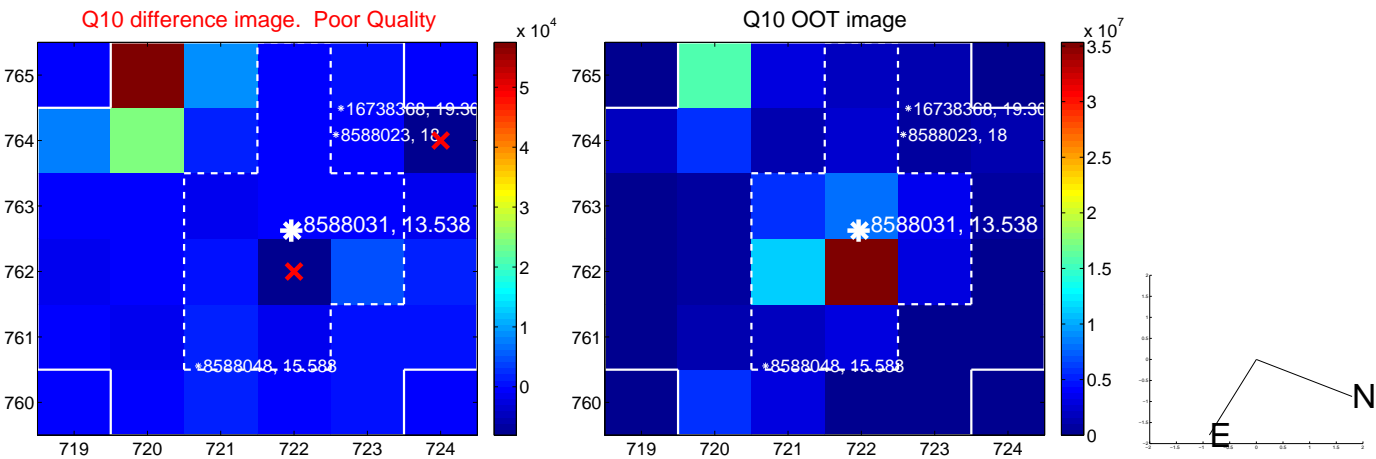
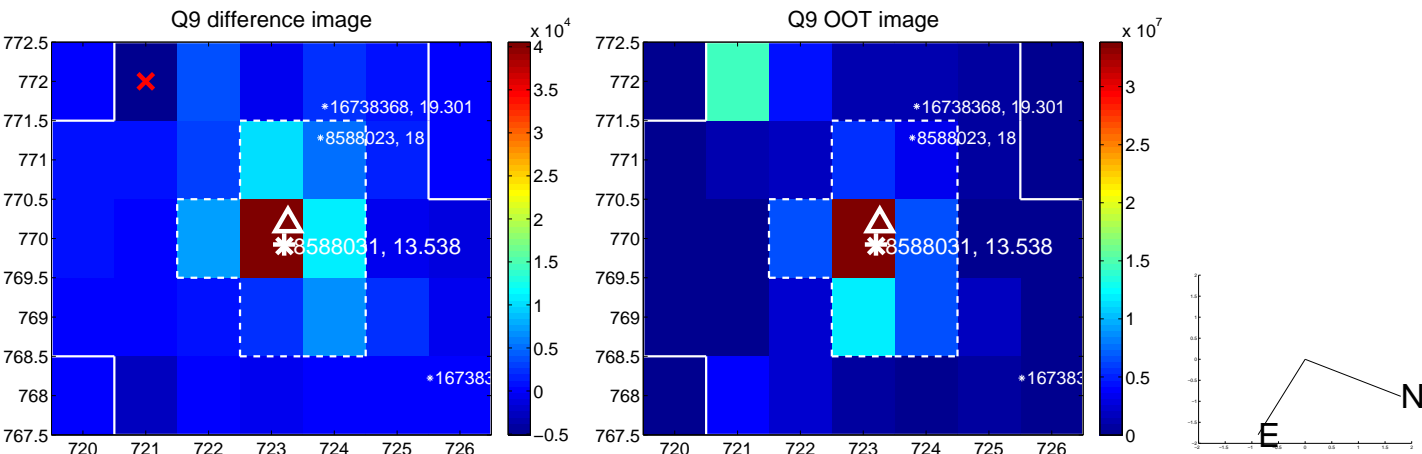
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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.

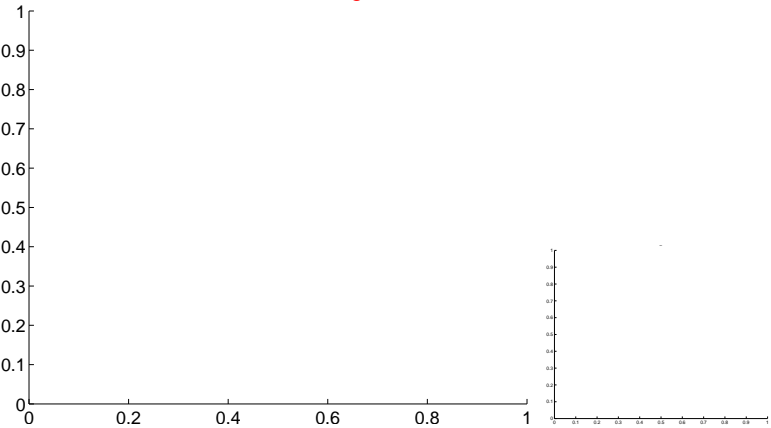


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

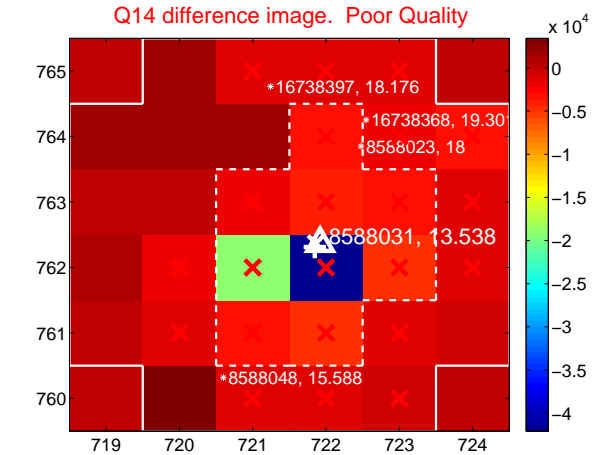
Q13 no difference image



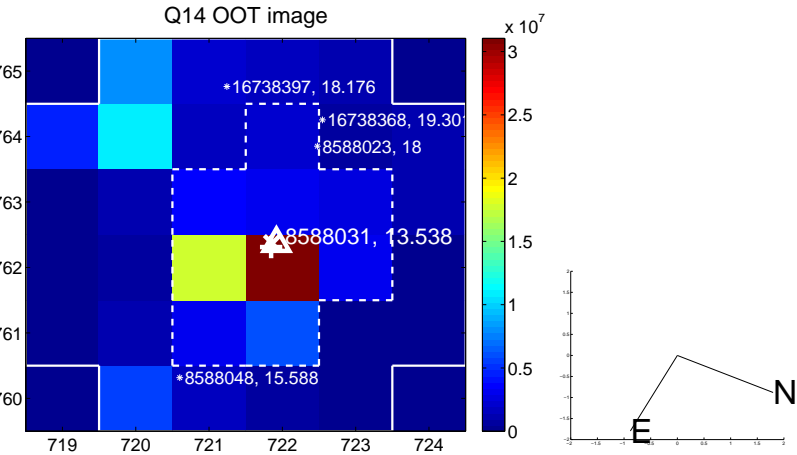
Q13 no OOT image



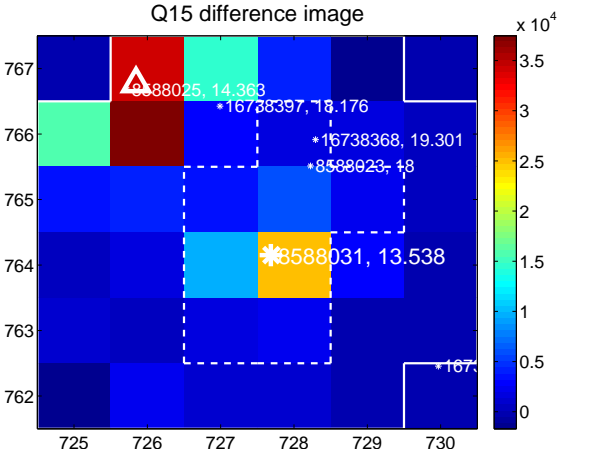
Q14 difference image. Poor Quality



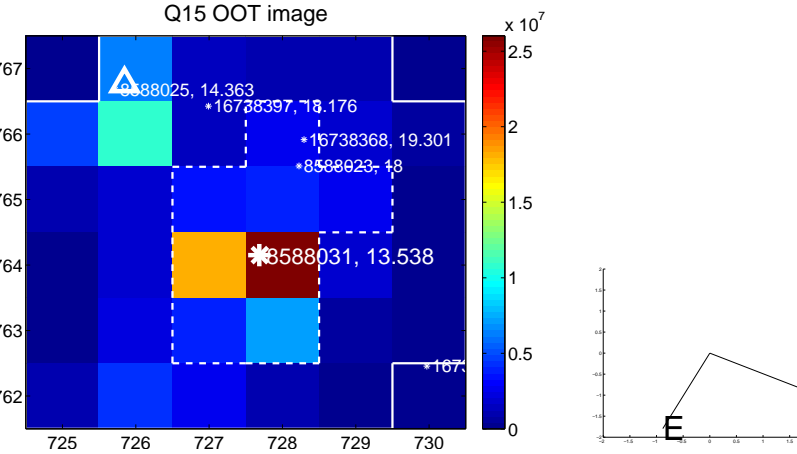
Q14 OOT image



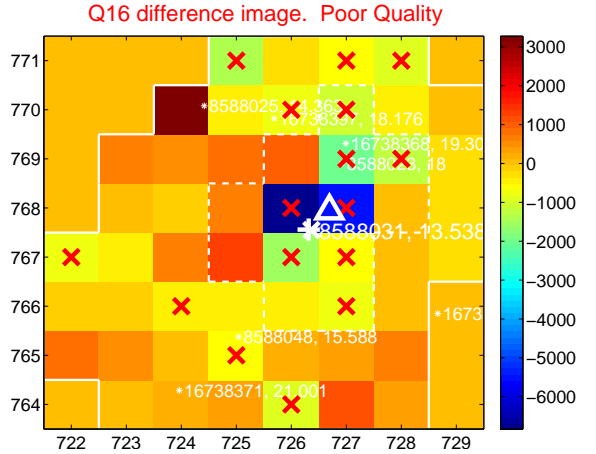
Q15 difference image



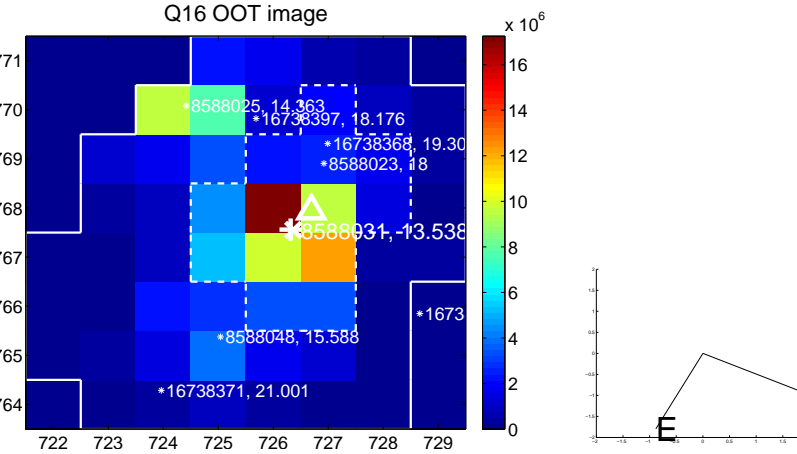
Q15 OOT image



Q16 difference image. Poor Quality

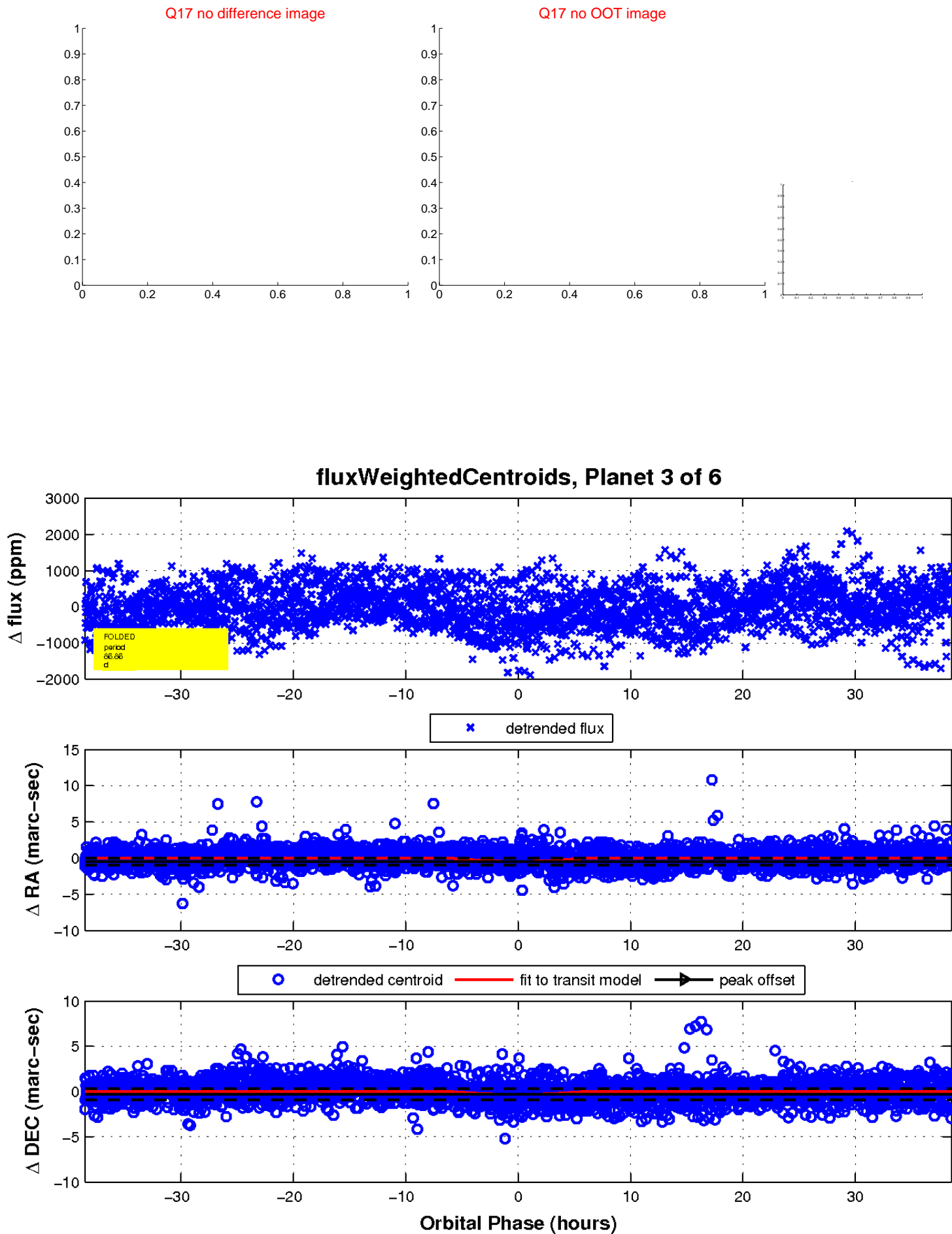


Q16 OOT image



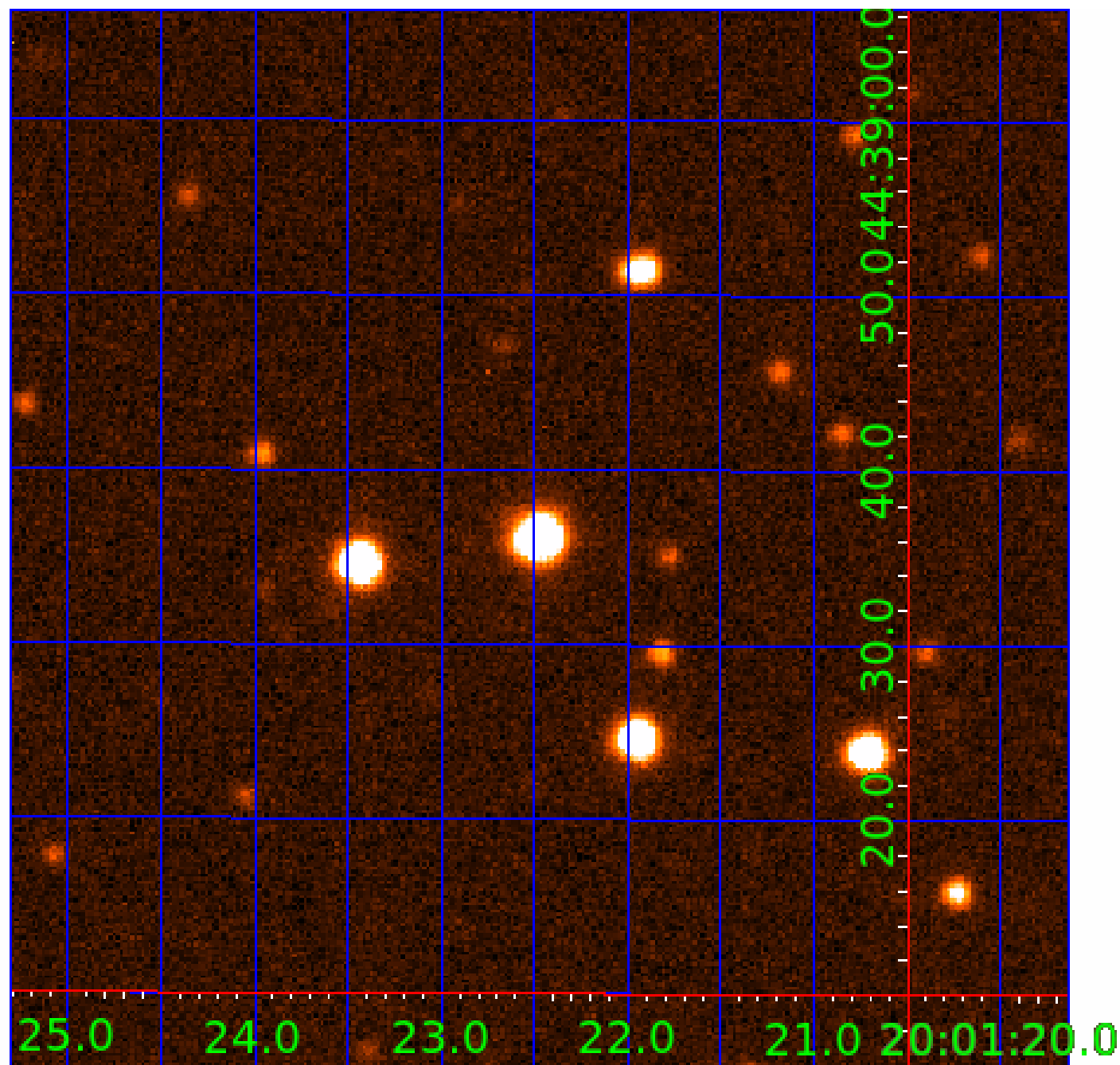


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 008588031

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
008588031-01	OBS	No	1.129496	132.237416	74.7	5.037	10.0	10.9	1.54	6573	1.37	8005.50
008588031-02	OBS	No	123.981995	138.449081	1156.2	7.625	9.8	9.5	1.54	6573	6.81	15.23
008588031-03	OBS	No	86.855554	146.372129	767.0	12.857	8.0	7.7	1.54	6573	5.83	24.48
008588031-04	OBS	No	115.910270	147.875278	582.5	12.779	8.9	6.4	1.54	6573	4.41	16.66
008588031-05	OBS	No	429.269521	157.621676	932.0	10.002	7.9	7.9	1.54	6573	5.68	2.91
008588031-06	OBS	No	37.028934	155.605567	205.2	9.000	7.6	-1.0	1.54	6573	2.23	76.30

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
008588031-01	OBS	FP	0.00	1	0	0	0	LPP_DV—MOD_NONUNIQ_DV
008588031-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_ALT—INCONSISTENT_TRANS—CENT_FEW_MEAS
008588031-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT
008588031-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV
008588031-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT
008588031-06	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_ALT—CENT_NOFITS—HALO_GHOST

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

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

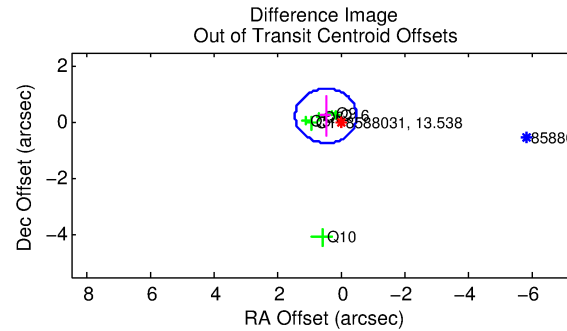
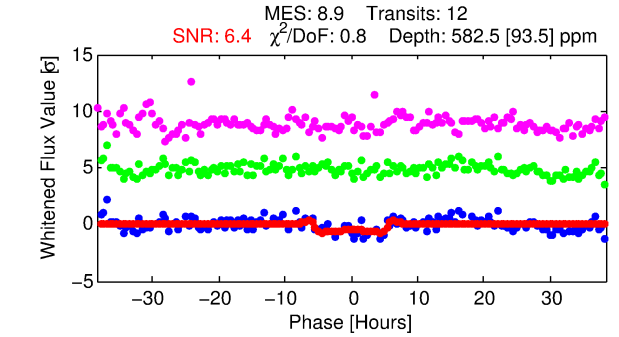
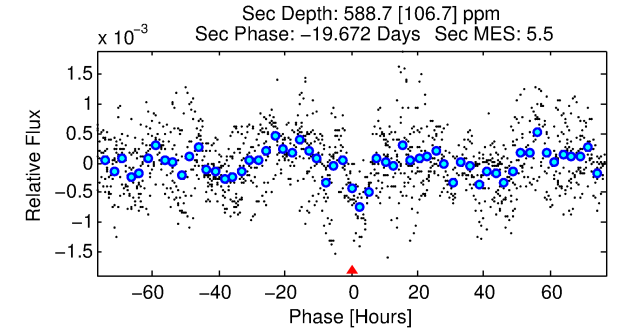
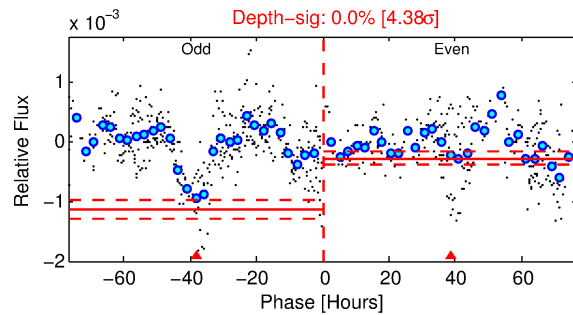
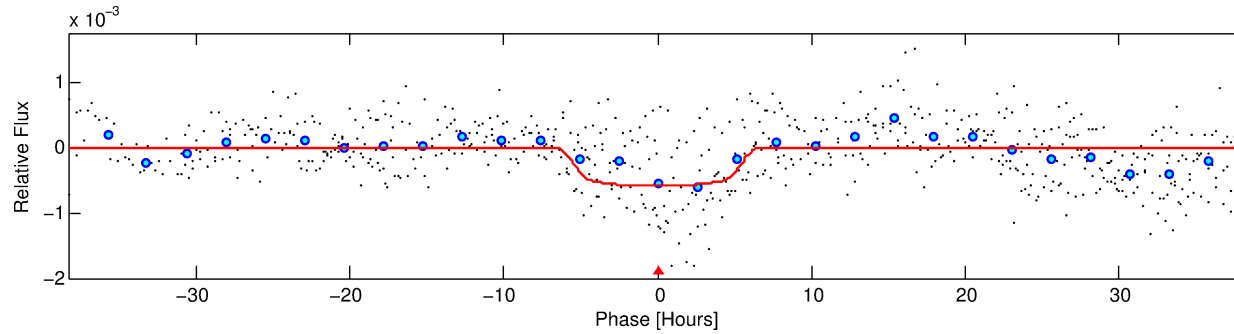
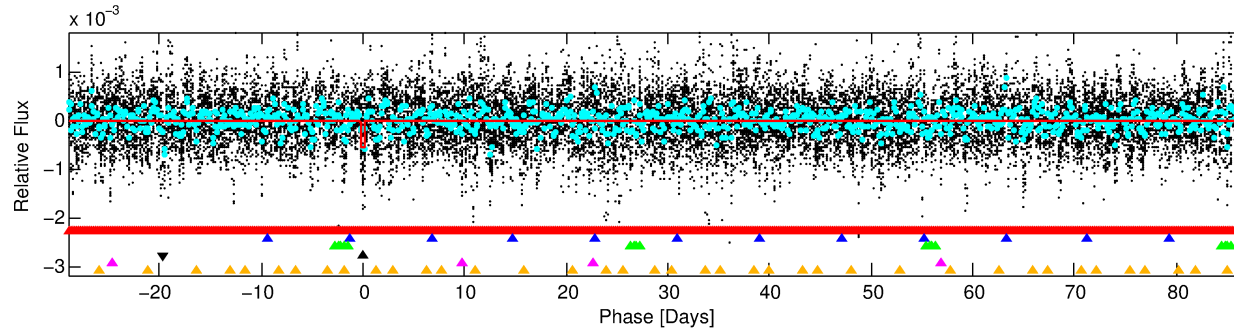
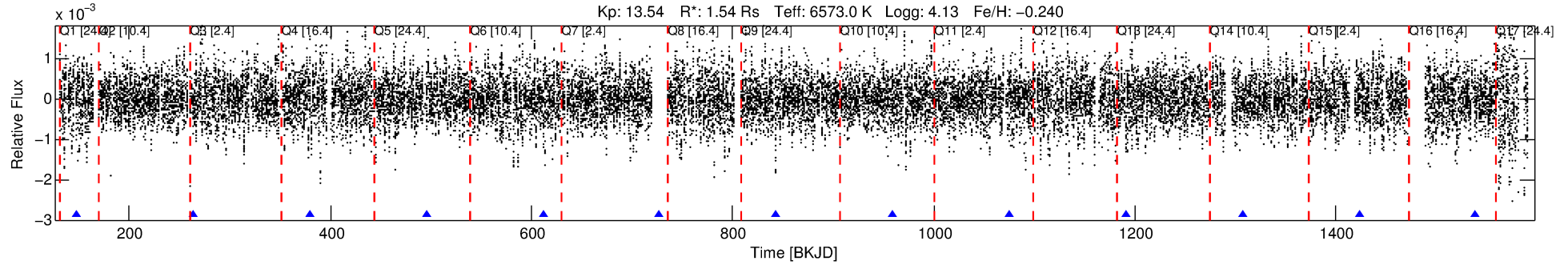
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 008588031-04

No Significant Match Found

# DV One-Page Summary

KIC: 8588031 Candidate: 4 of 6 Period: 115.910 d



## DV Fit Results:

Period = 115.91027 [0.00241] d  
Epoch = 147.8753 [0.0170] BKJD  
Rp/R\* = 0.0262 [0.0024]  
a/R\* = 32.01 [6.18]  
b = 0.92 [0.03]  
Seff = 16.66 [6.76]  
Teff = 515 [52] K  
Rp = 4.41 [1.38] Re  
a = 0.4895 [0.1266] AU  
Ag = 3981.75 [1843.61] [2.16 $\sigma$ ]  
Teffp = 6327 [457] K [12.63 $\sigma$ ]

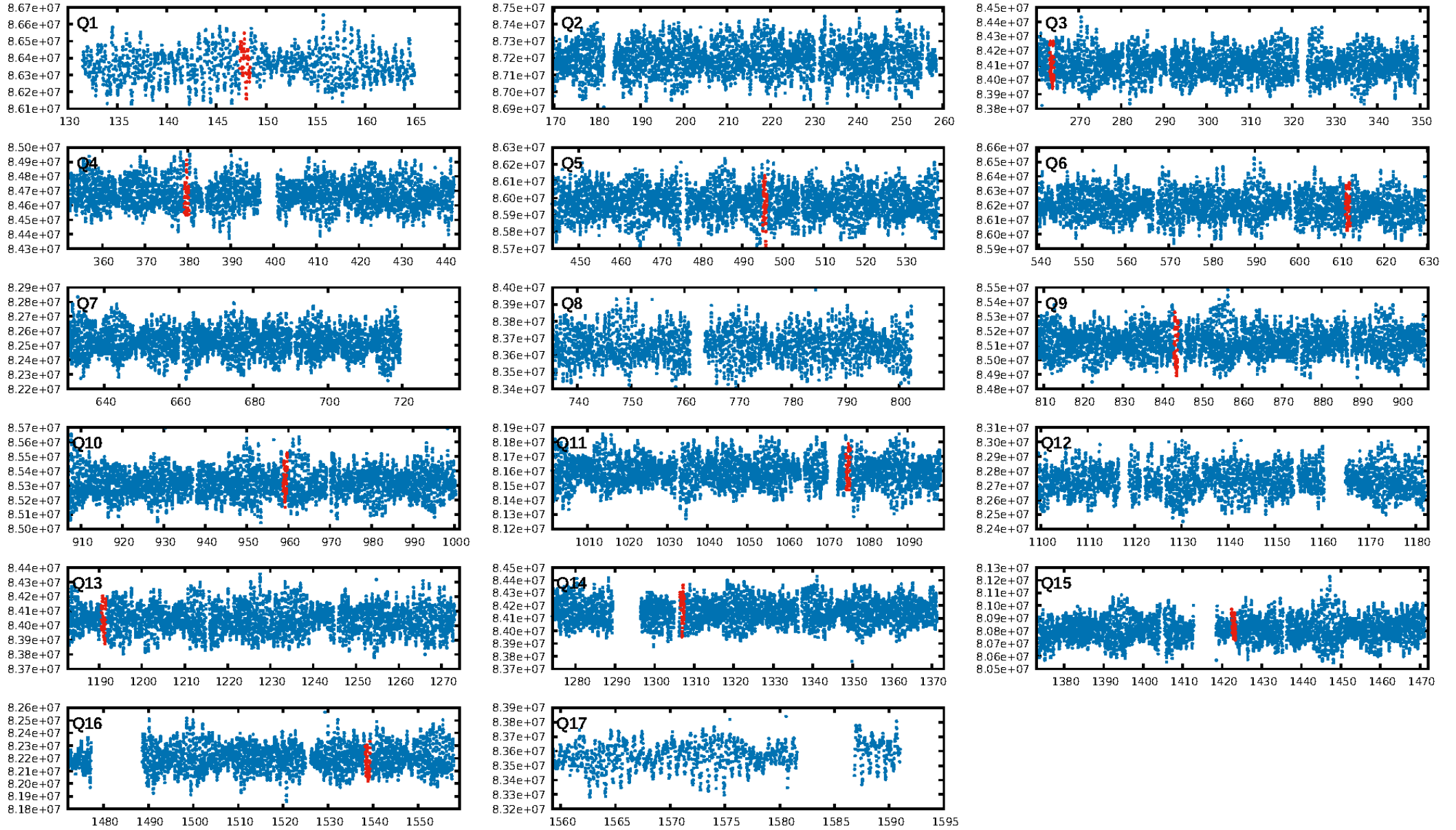
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [38.47 $\sigma$ ]  
LongPeriod-sig: 100.0% [13.02 $\sigma$ ]  
ModelChiSquare2-sig: 5.2%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [11/11]  
GhostDiagnostic-chr: 0.4159  
Centroid-sig: 8.0%  
Centroid-so: 1.704 arcsec [2.96 $\sigma$ ]  
OotOffset-rm: 0.546 arcsec [1.69 $\sigma$ ]  
KicOffset-rm: 0.541 arcsec [2.57 $\sigma$ ]  
OotOffset-st: 2/0/1/3 [6]  
KicOffset-st: 2/0/1/3 [6]  
DiffImageQuality-fgm: 0.67 [4/6]  
DiffImageOverlap-fno: 0.00 [0/11]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 06:03:01 Z

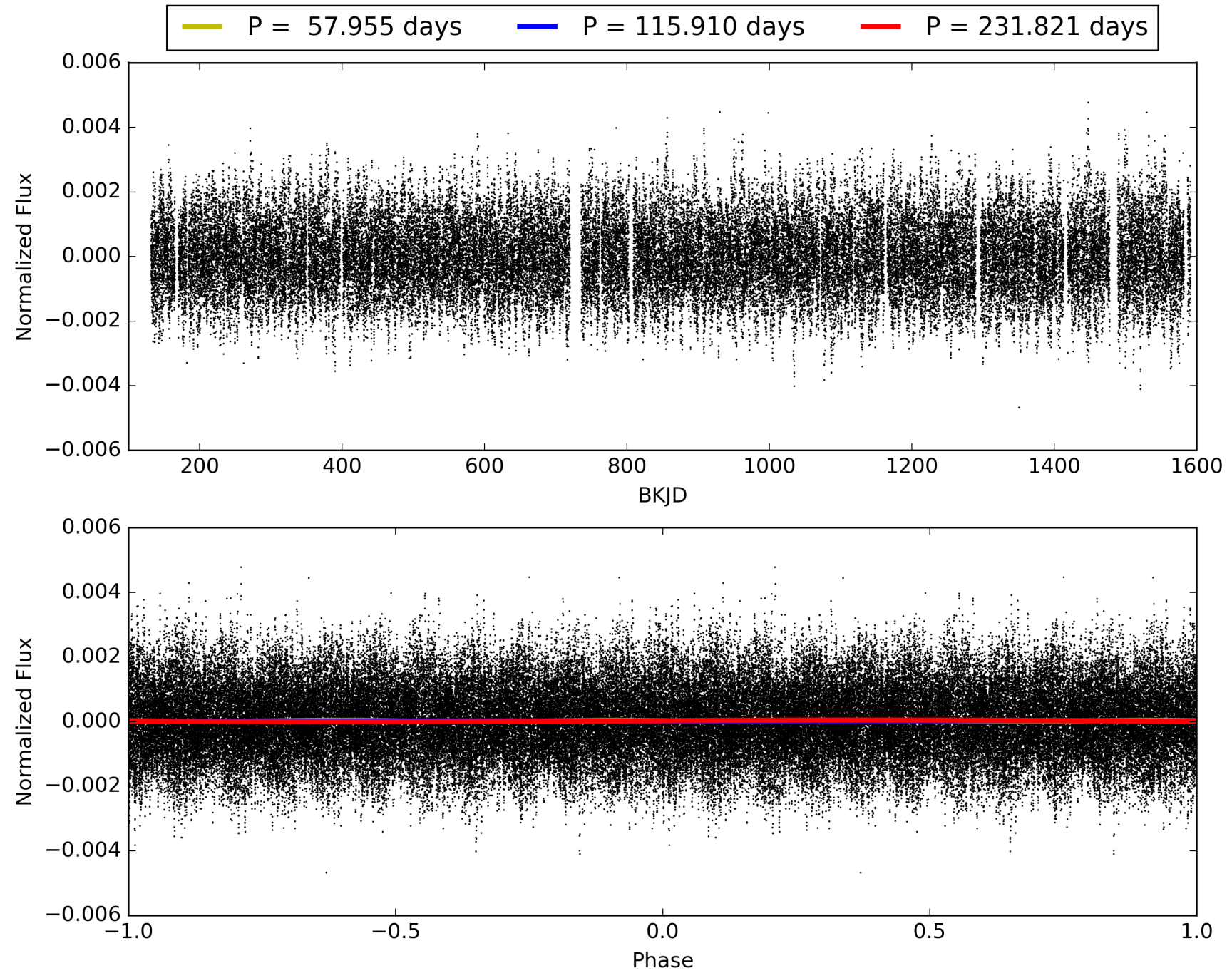
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 008588031-04, PDC Light Curves





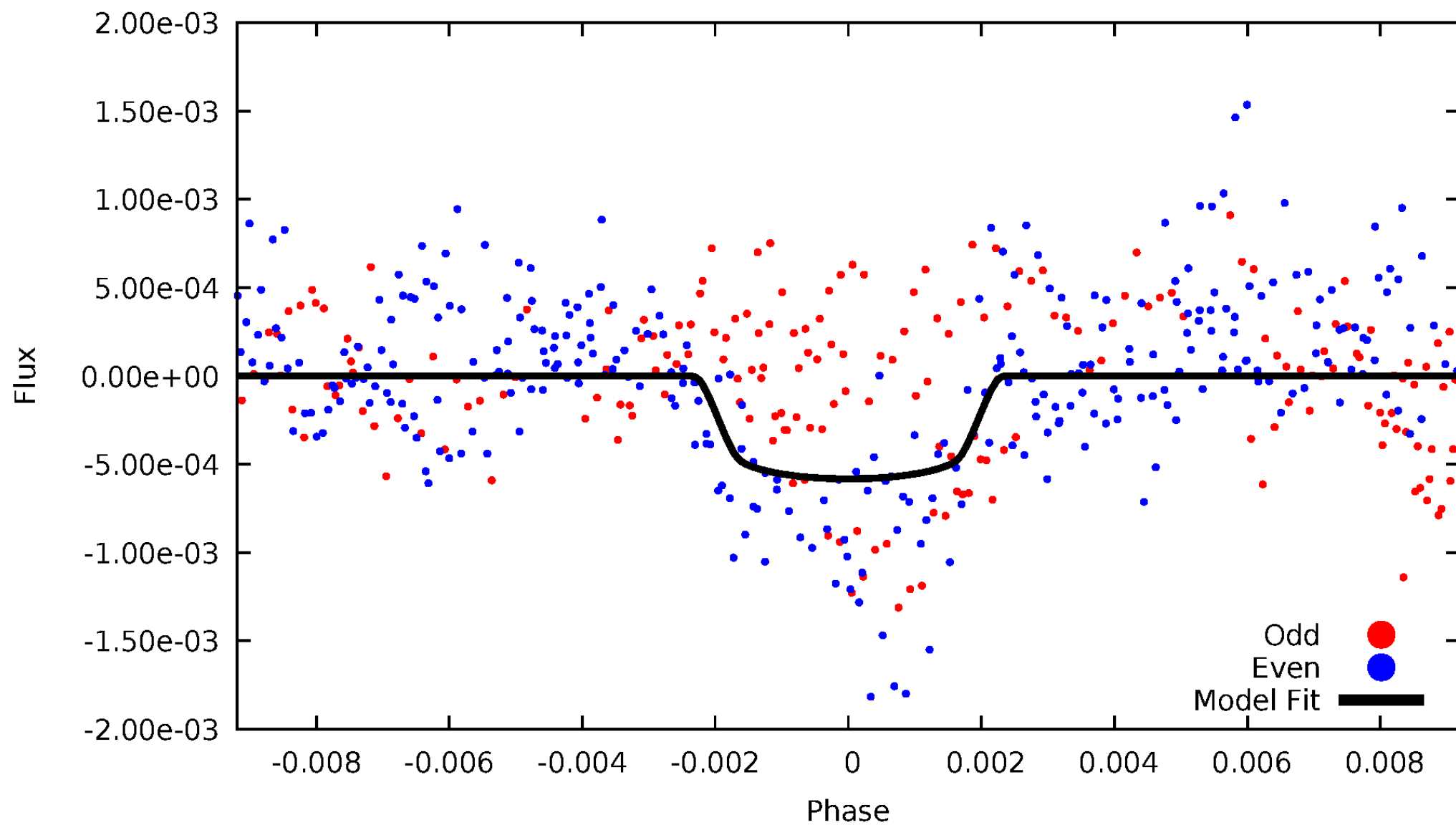
TCE 008588031-04





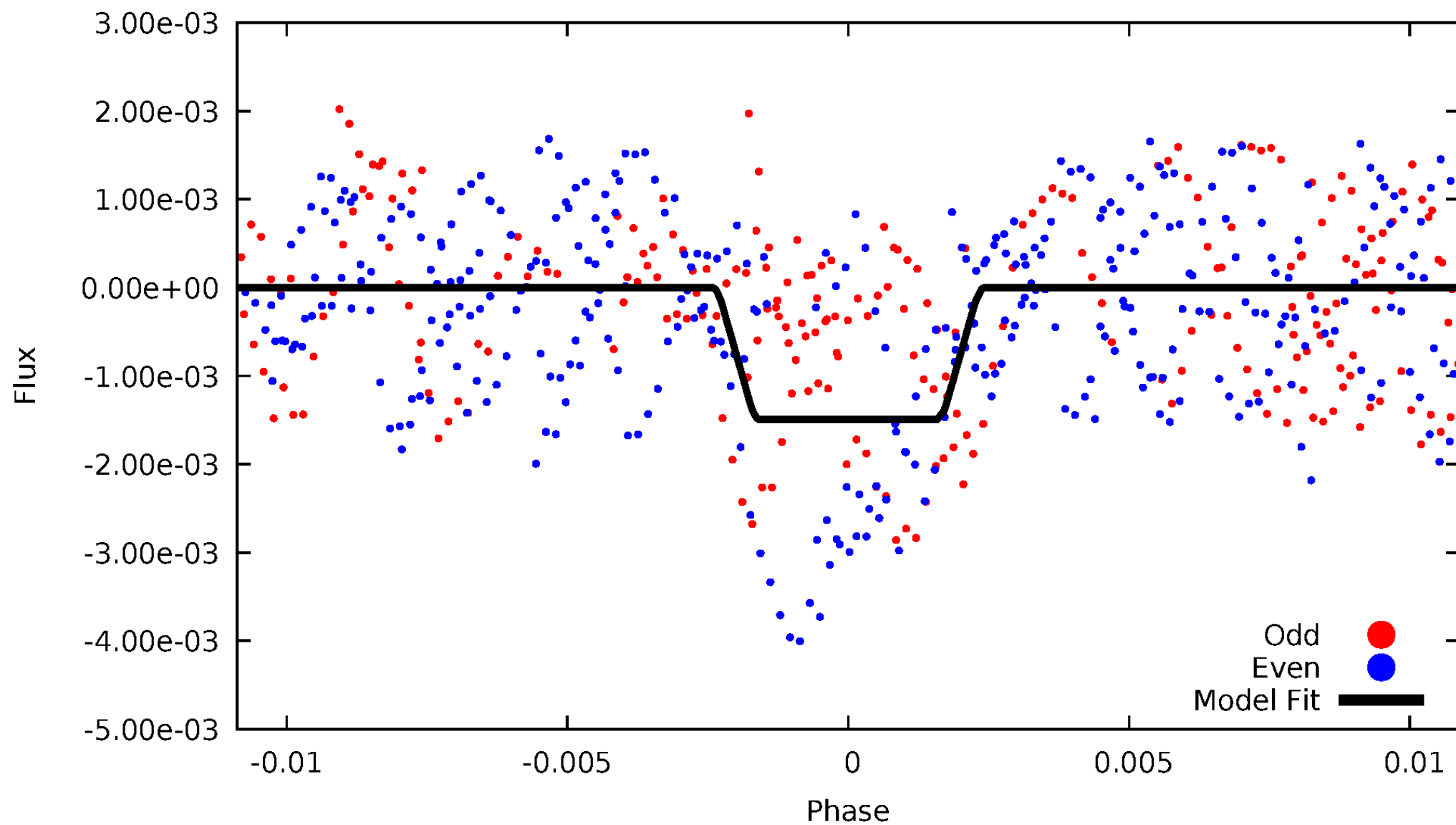
# DV Odd/Even

TCE 008588031-04



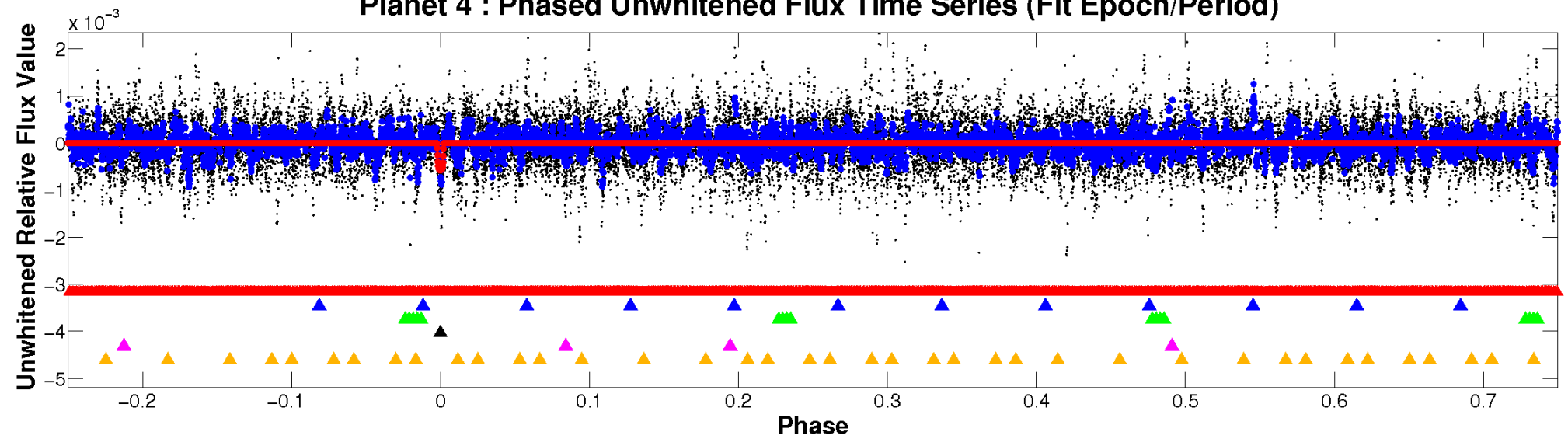
# ALT Odd/Even

TCE 008588031-04

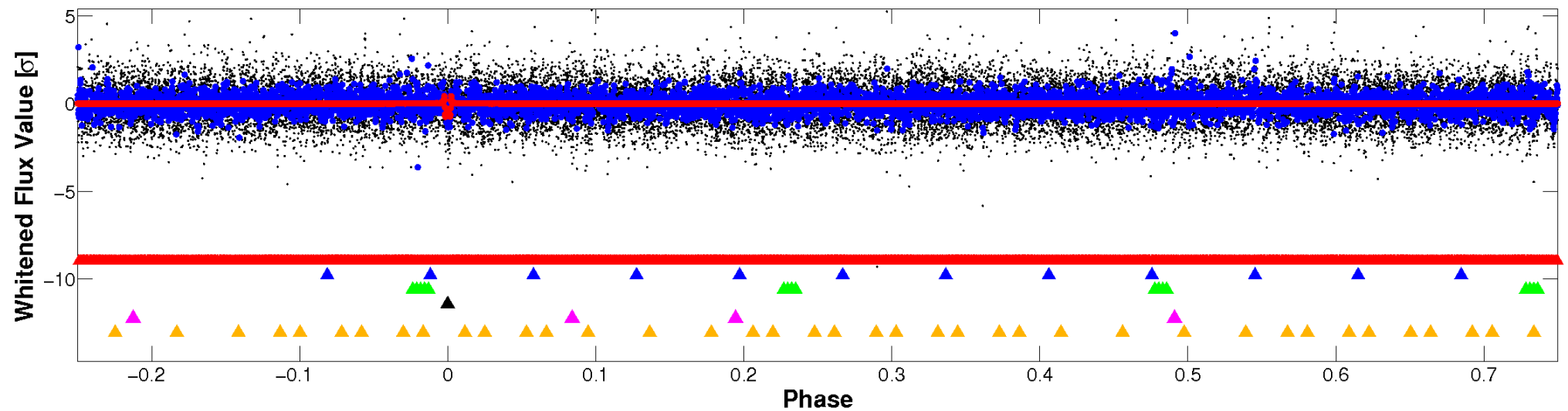


# Non-Whitened Vs. Whitened Light Curve

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

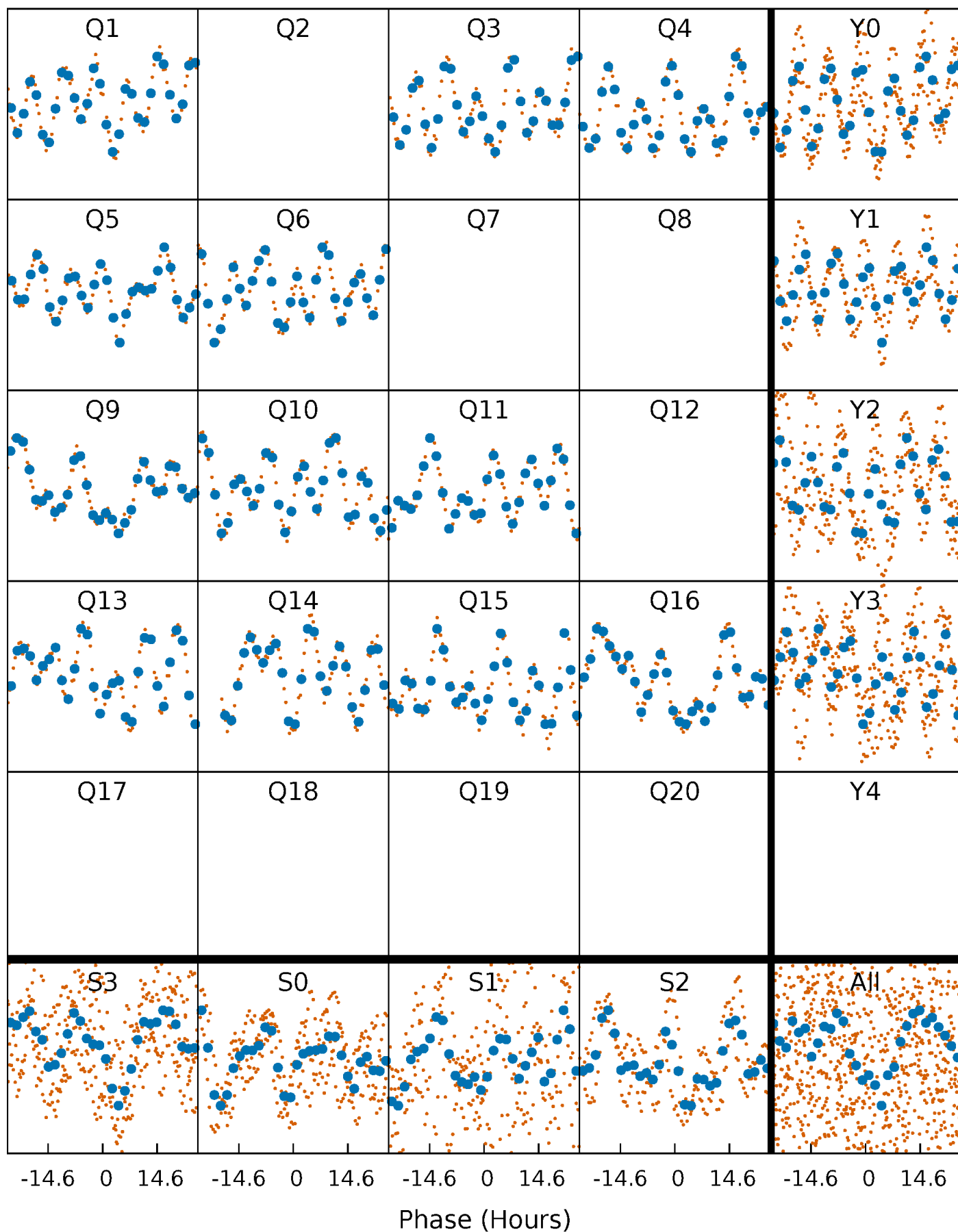


## Planet 4 : Phased Whitened Flux Time Series (Fit Epoch/Period)



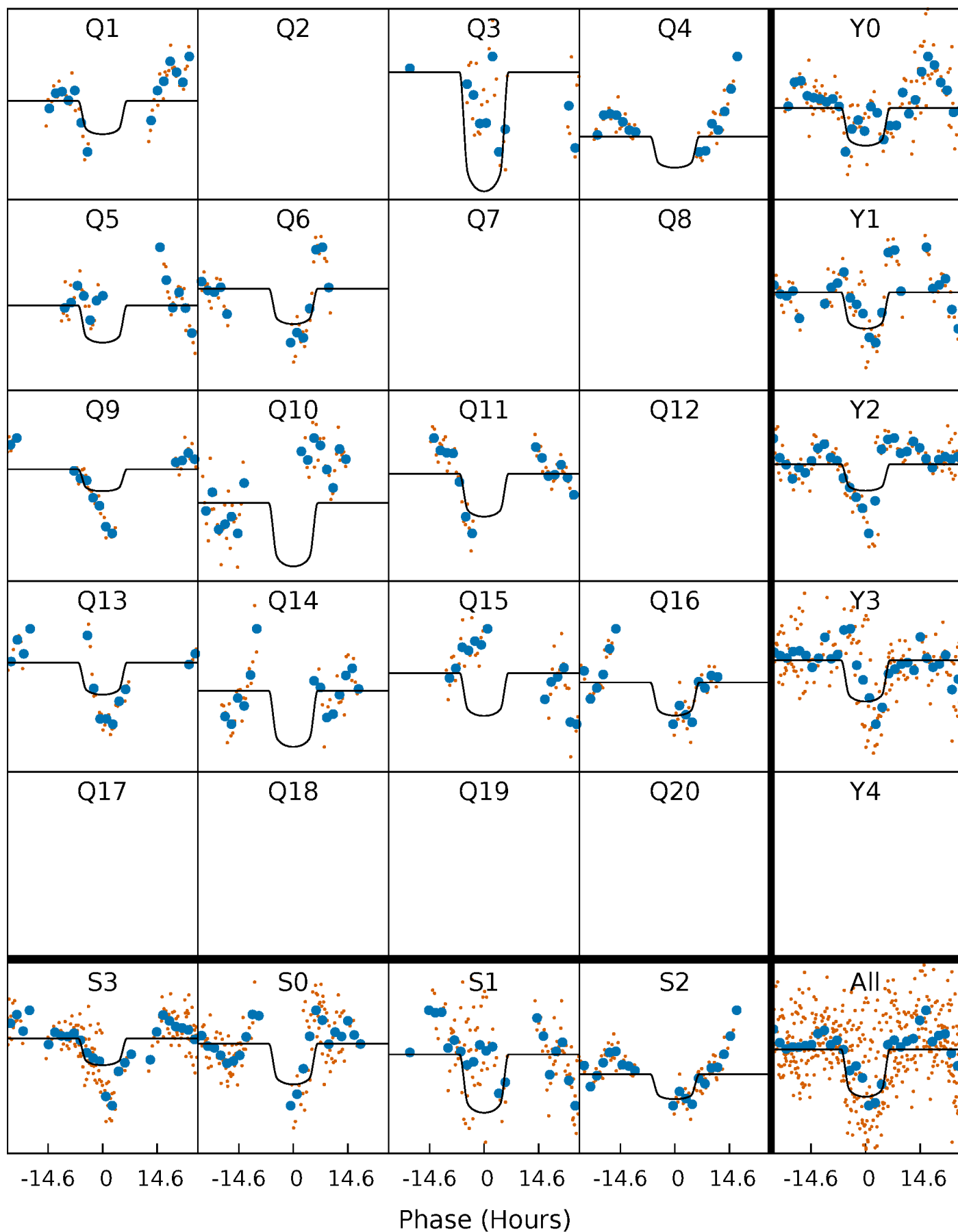
# PDC Quarter-Phased Transit Curves

TCE 008588031-04 P=115.910270 Days  $T_0=147.875278$  (BKJD)



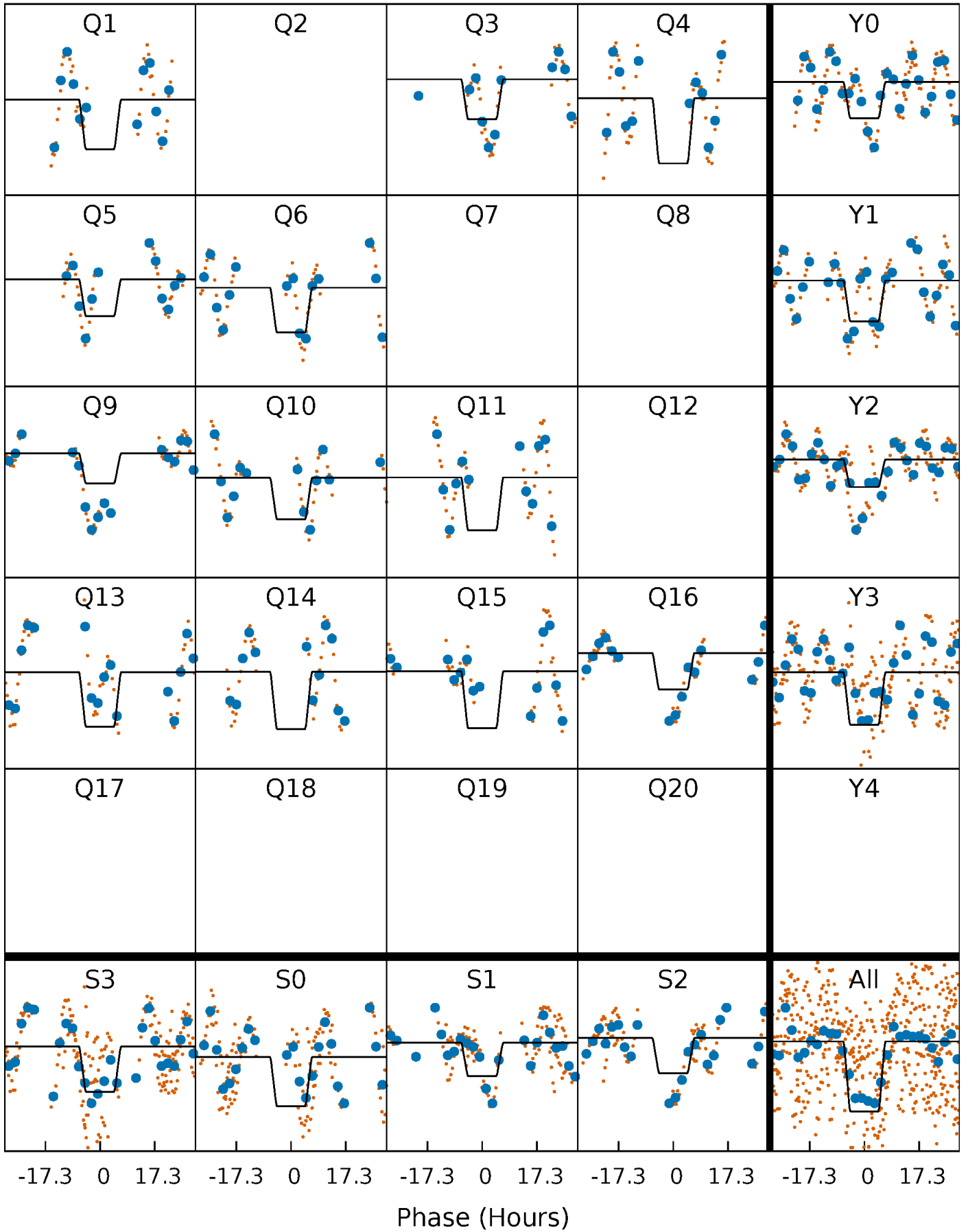
# DV Quarter-Phased Transit Curves

TCE 008588031-04     $P=115.910270$  Days     $T_0=147.875278$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

TCE 008588031-04   P=115.913808 Days    $T_0=147.890760$  (BKJD)

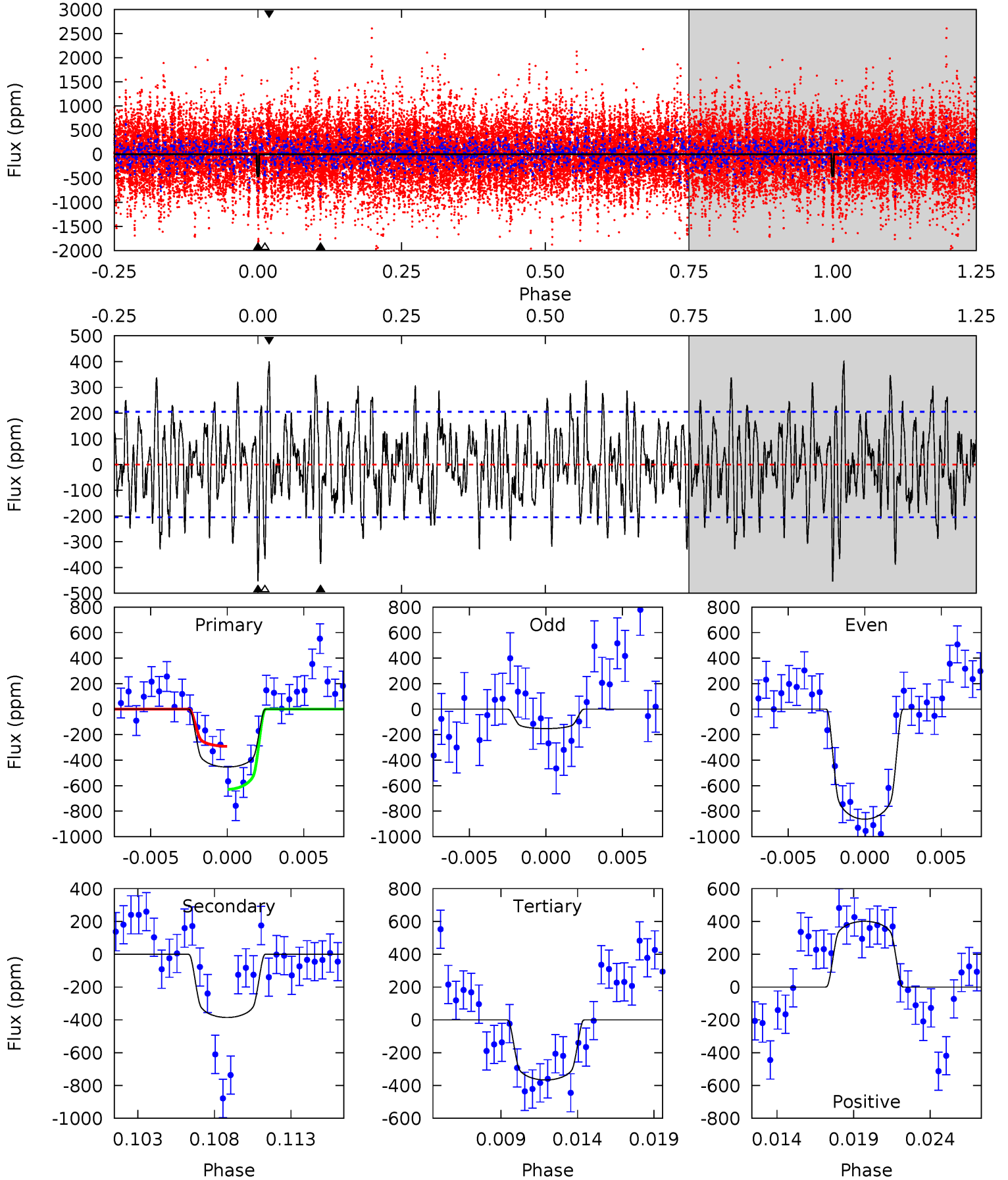




# DV Model-Shift Uniqueness Test

008588031-04, P = 115.910270 Days, E = 31.965008 Days

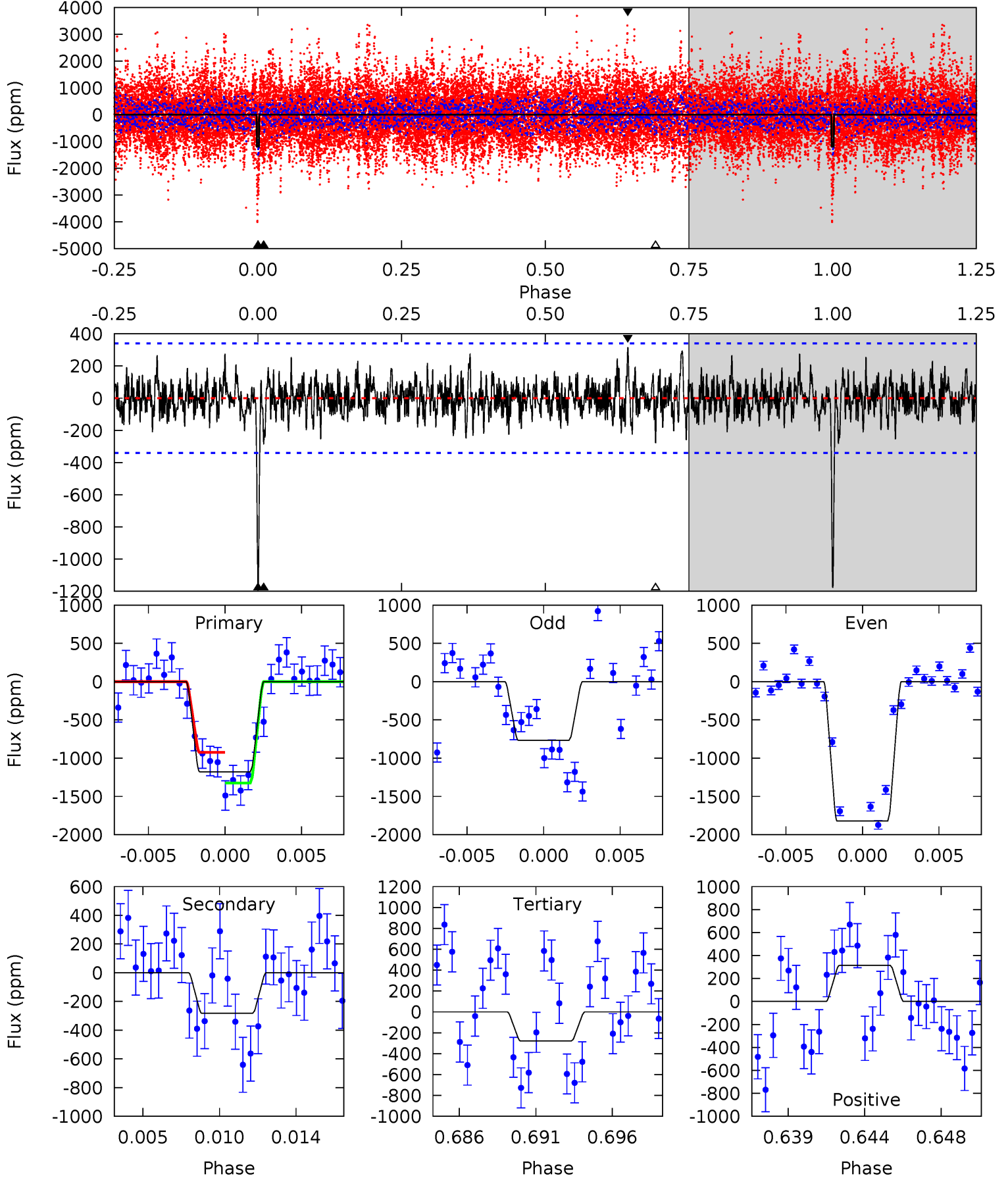
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
11.5	9.72	9.24	10.1	5.17	2.83	3.20	2.21	1.35	0.48	-0.38	8.89	0.82	0.47	4.27



# Alt Model-Shift Uniqueness Test

008588031-04, P = 115.913808 Days, E = 31.976952 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
17.9	4.29	4.23	4.76	5.17	2.82	1.33	13.7	13.1	0.06	-0.47	7.92	1.31	0.21	3.00



### Stellar Parameters For KIC 008588031

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$\rho_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6573^{+175}_{-214}$	$4.126^{+0.214}_{-0.175}$	$-0.240^{+0.250}_{-0.300}$	$1.545^{+0.463}_{-0.421}$	$1.162^{+0.209}_{-0.157}$	$0.444^{+0.544}_{-0.214}$
	+3%/-3%	+5%/-4%	+104%/-125%	+30%/-27%	+18%/-14%	+123%/-48%
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 008588031-04 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-386 \pm 40$	$4.38^{+0.81}_{-0.69}$	$712^{+60}_{-51}$	$5682^{+335}_{-294}$	$2655^{+1063}_{-766}$
Alt.	$-283 \pm 66$	$6.55^{+1.18}_{-1.06}$	$717^{+63}_{-58}$	$4504^{+243}_{-271}$	$871^{+459}_{-306}$

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

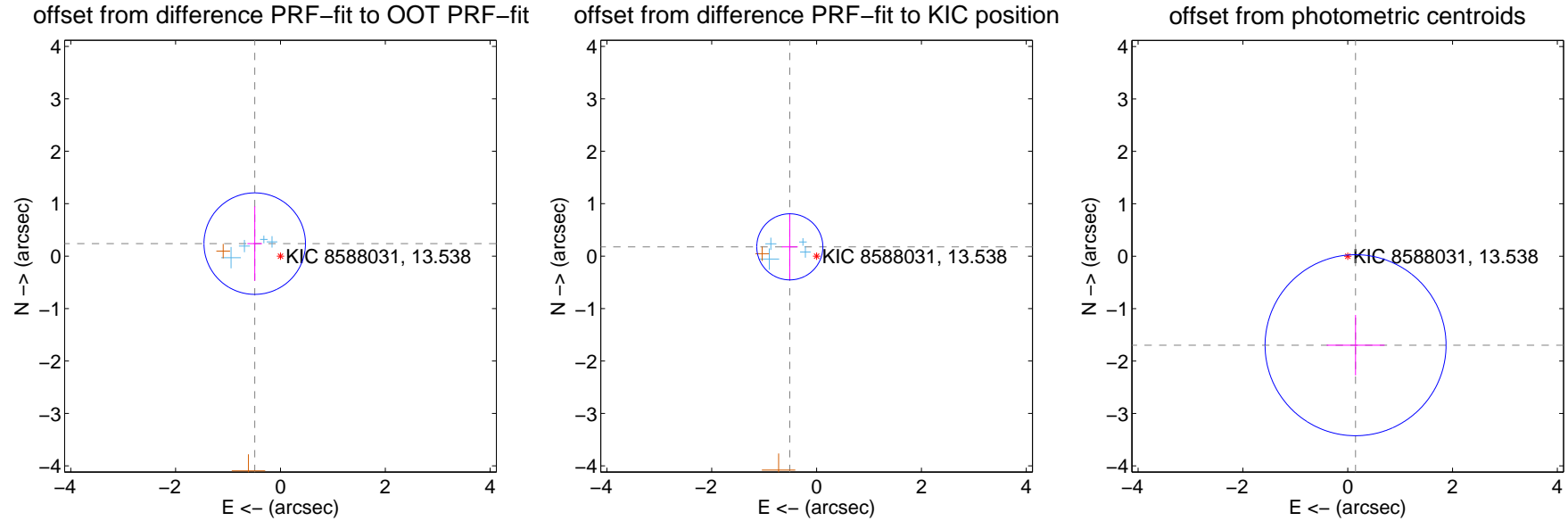
## DV Centroid Data

Supplemental centroid analysis for 008588031-04. Kepler magnitude: 13.54. Transit SNR 6.38

There are 4 quarters with good PRF difference image offsets

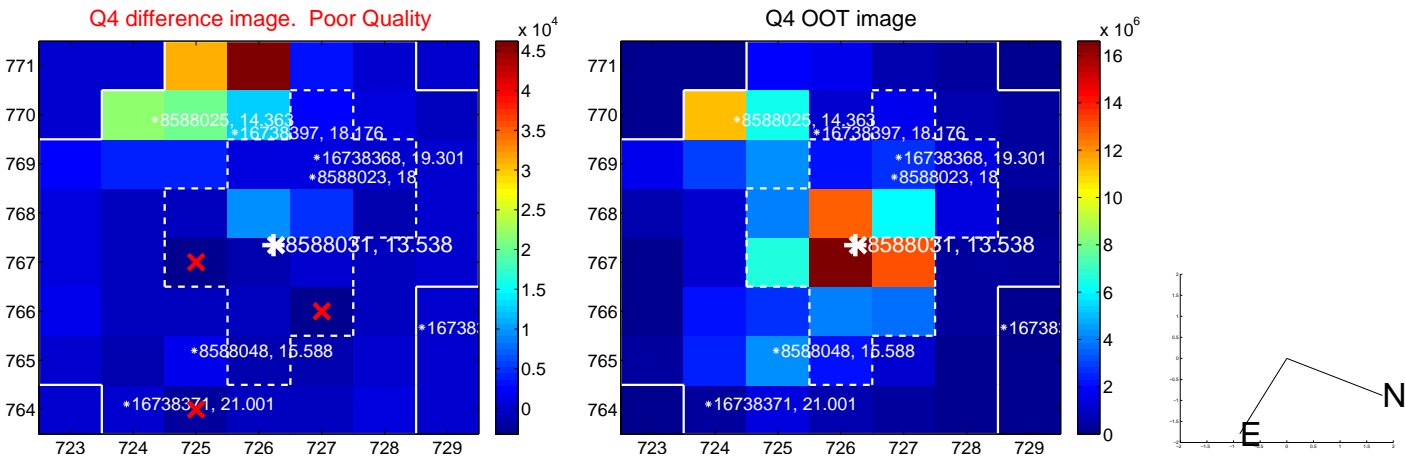
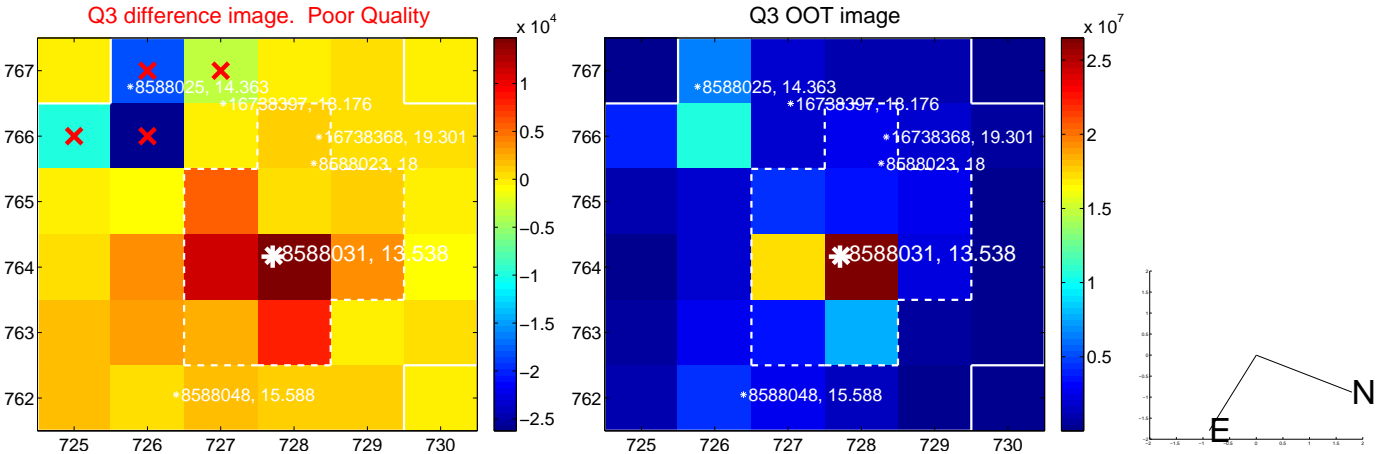
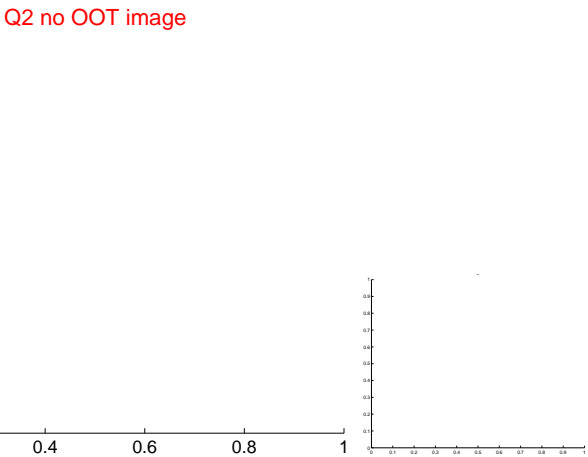
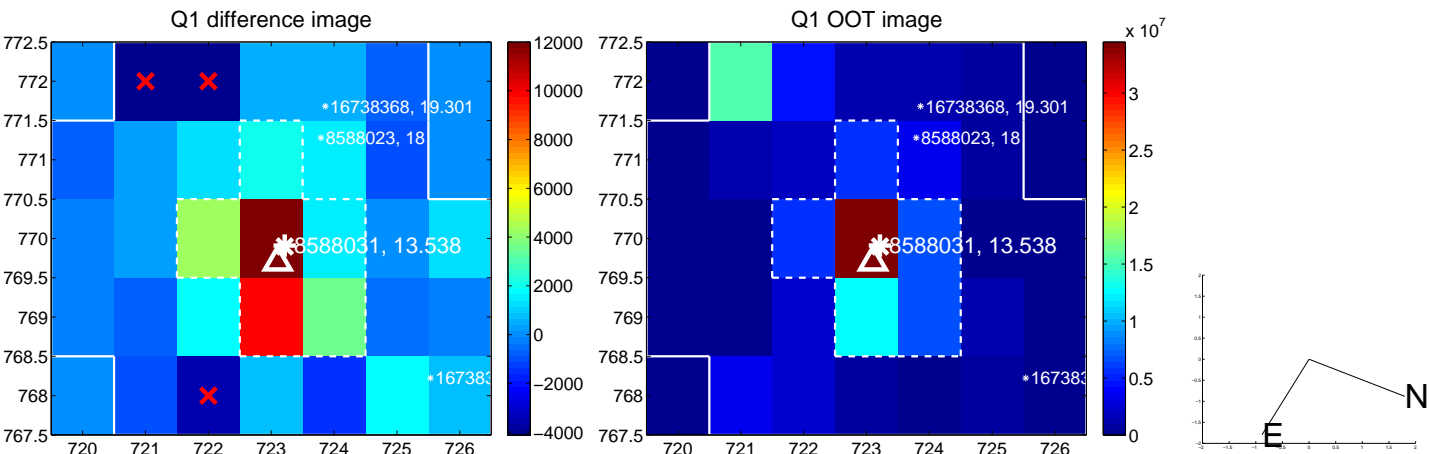
The direct PRF centroid is offset from the target star catalog position by about 0.20 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.546 \pm 0.323$	1.69	$0.491 \pm 0.140$	$0.239 \pm 0.709$
PRF-fit source offset from KIC position	$0.541 \pm 0.210$	2.57	$0.511 \pm 0.151$	$0.177 \pm 0.637$
photometric centroid source offset	$1.70 \pm 0.58$	2.96	$-0.15 \pm 0.55$	$-1.70 \pm 0.58$

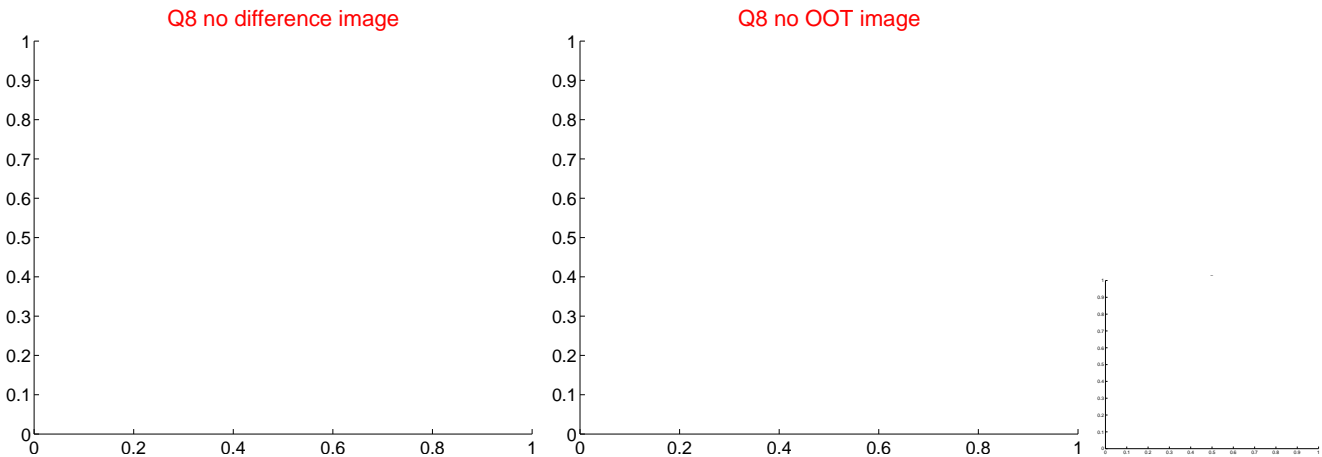
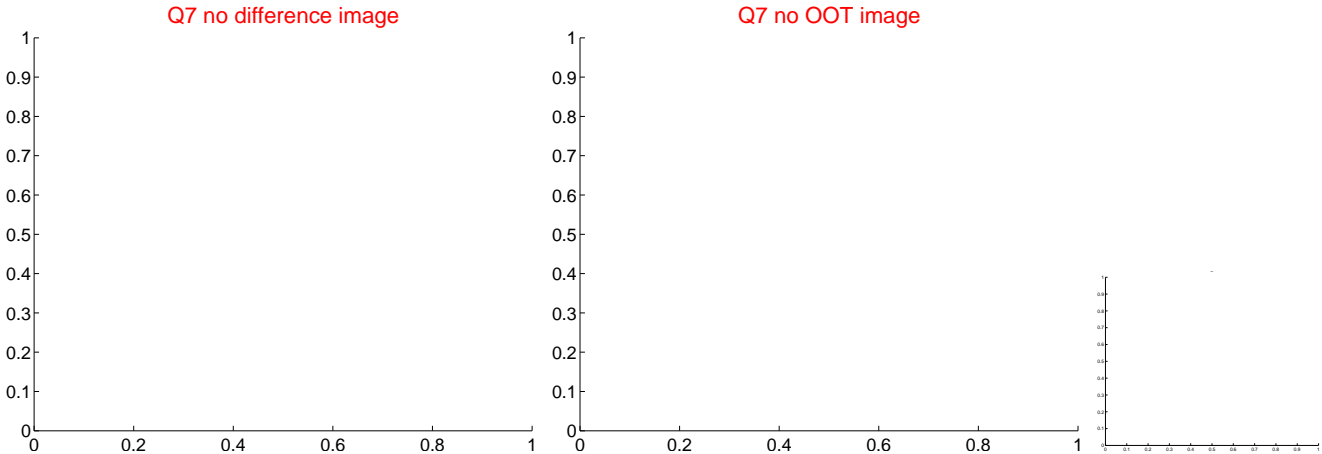
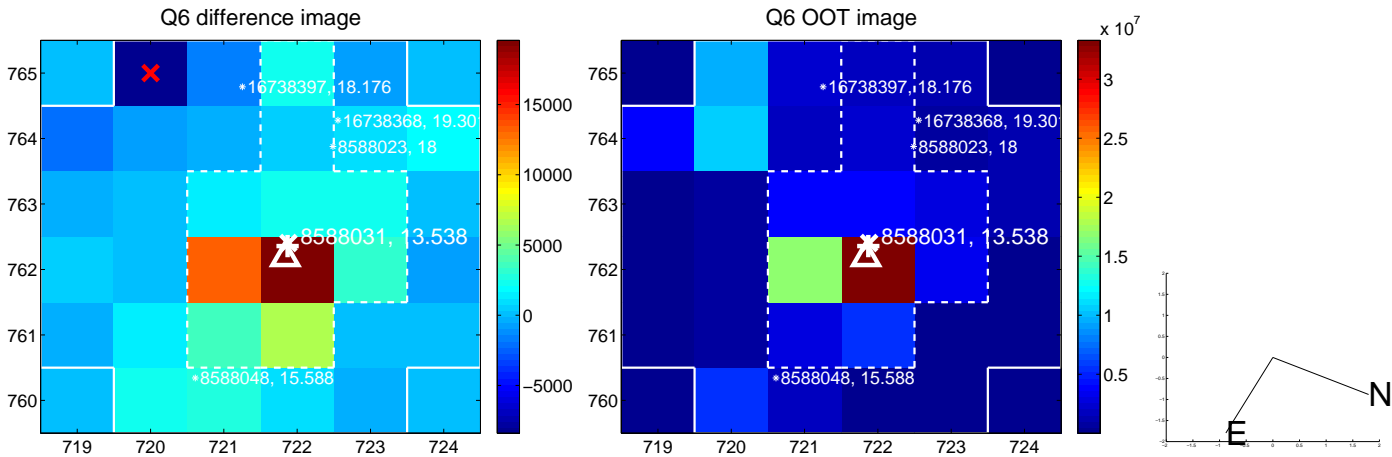
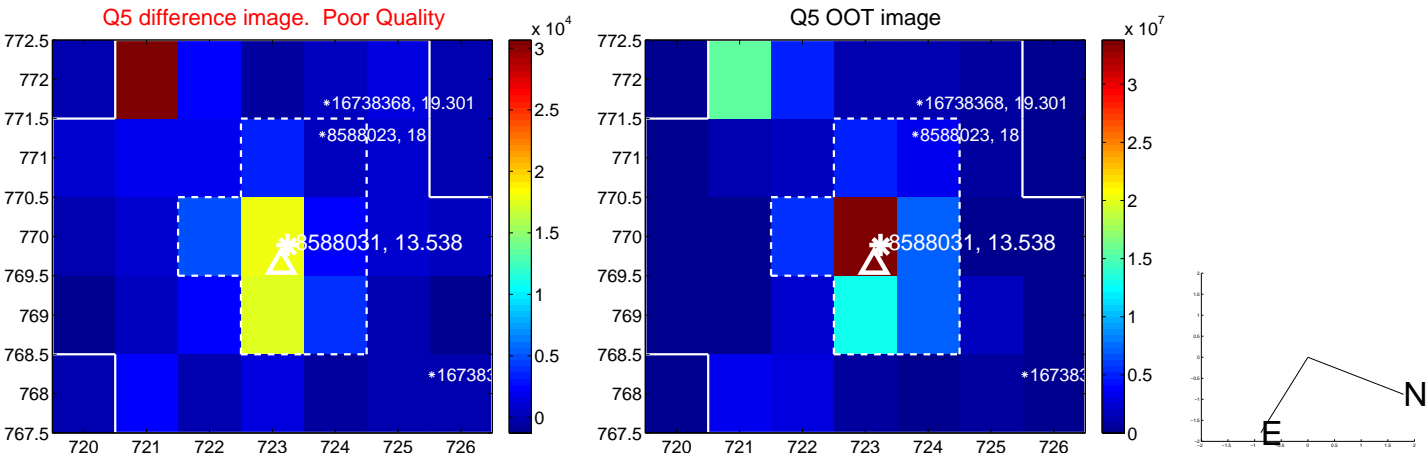


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets**; **Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

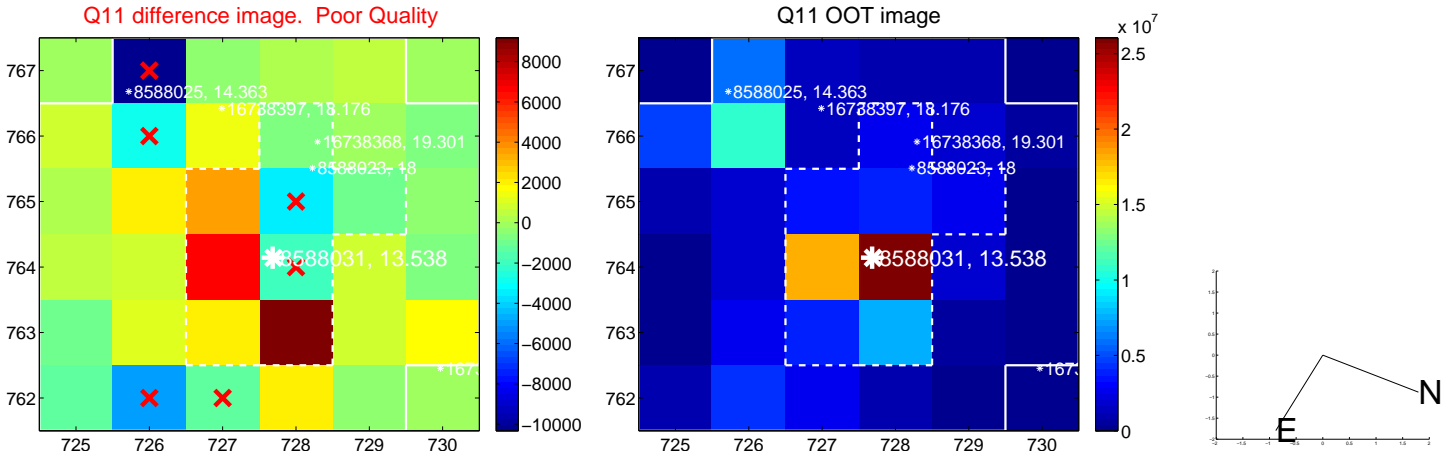
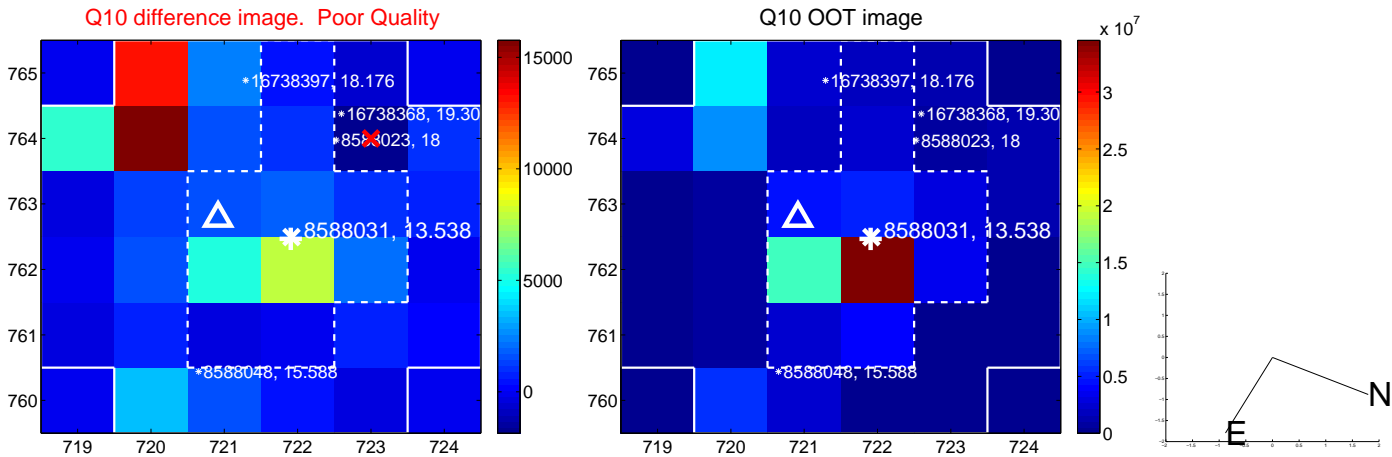
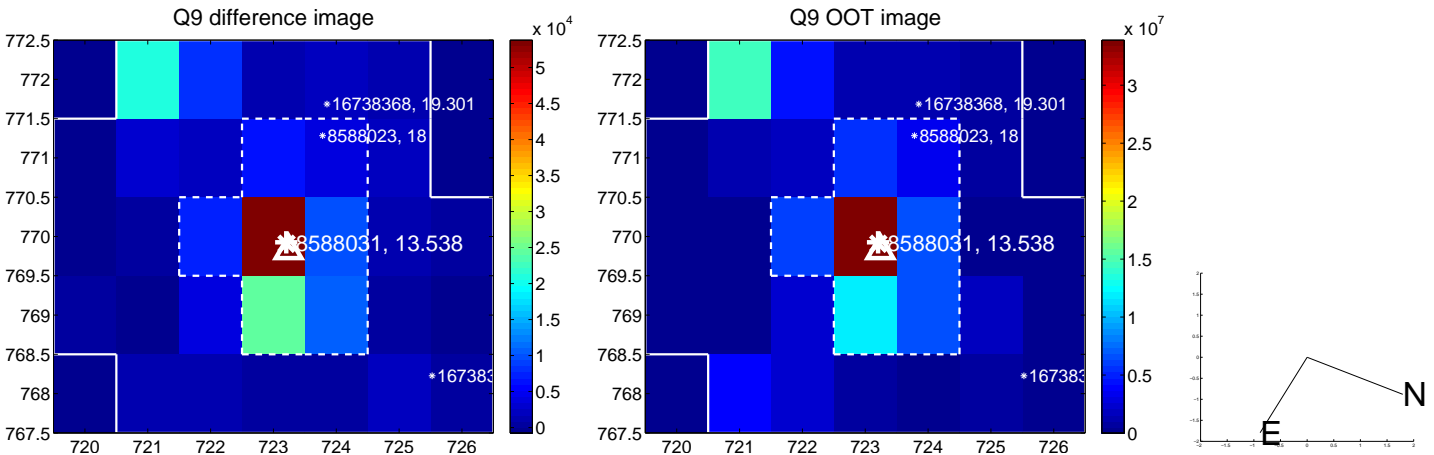


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

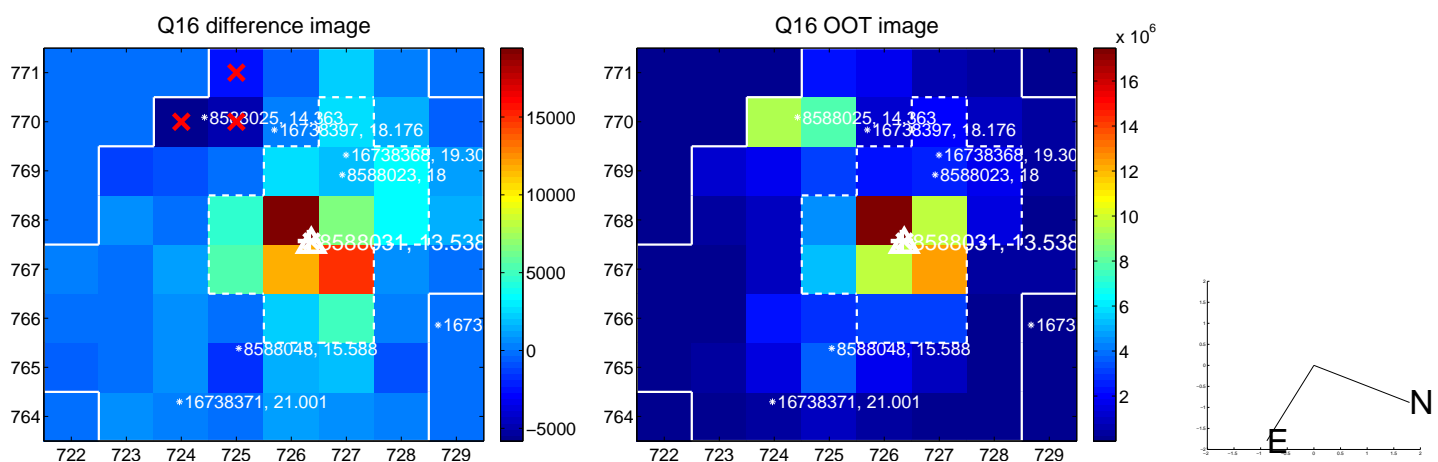
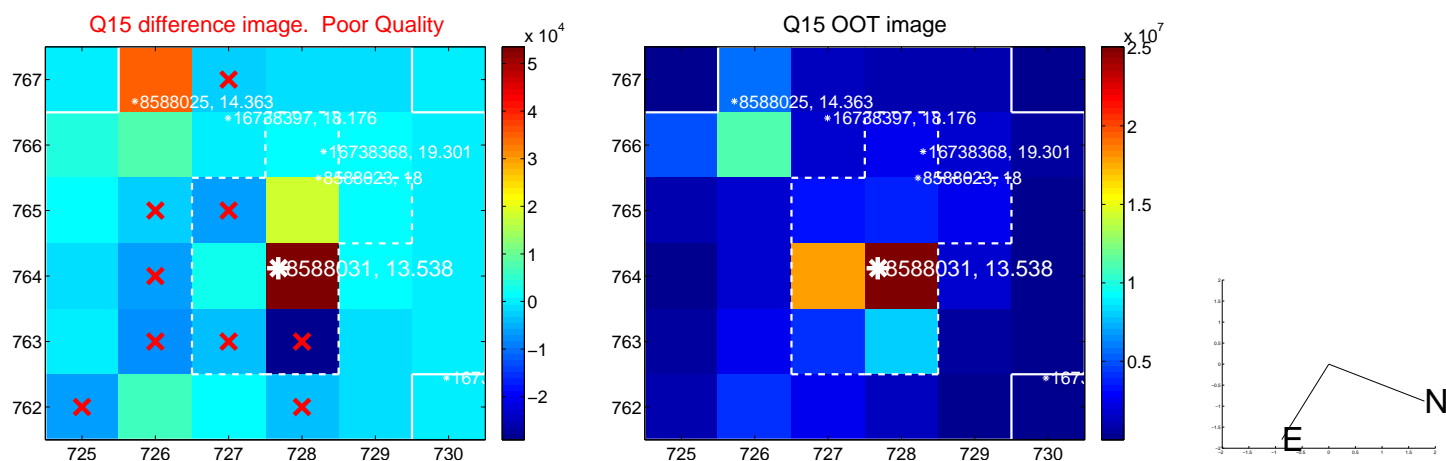
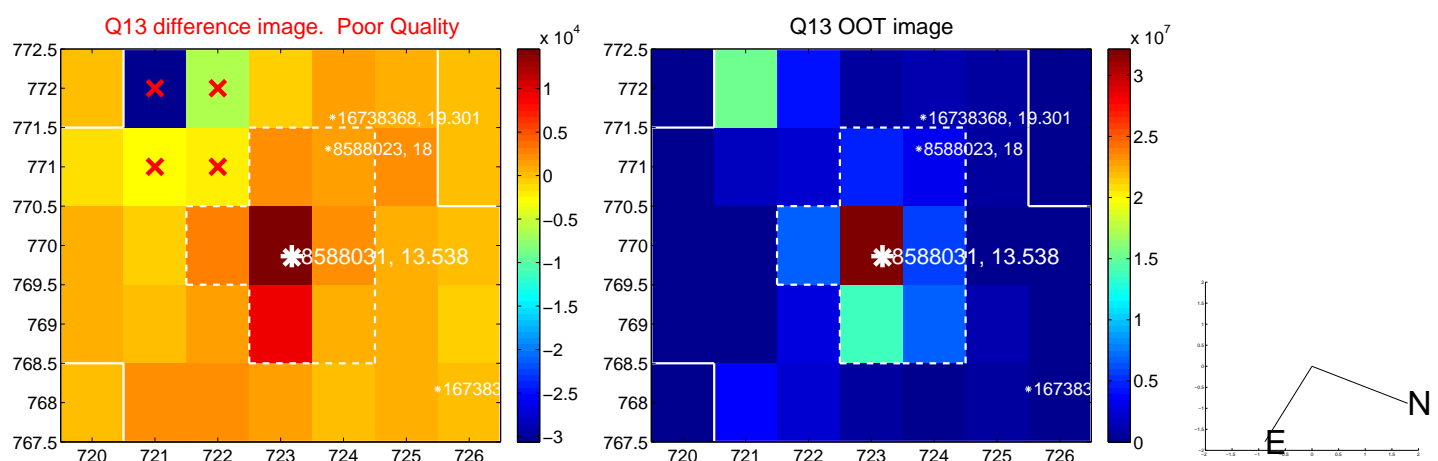




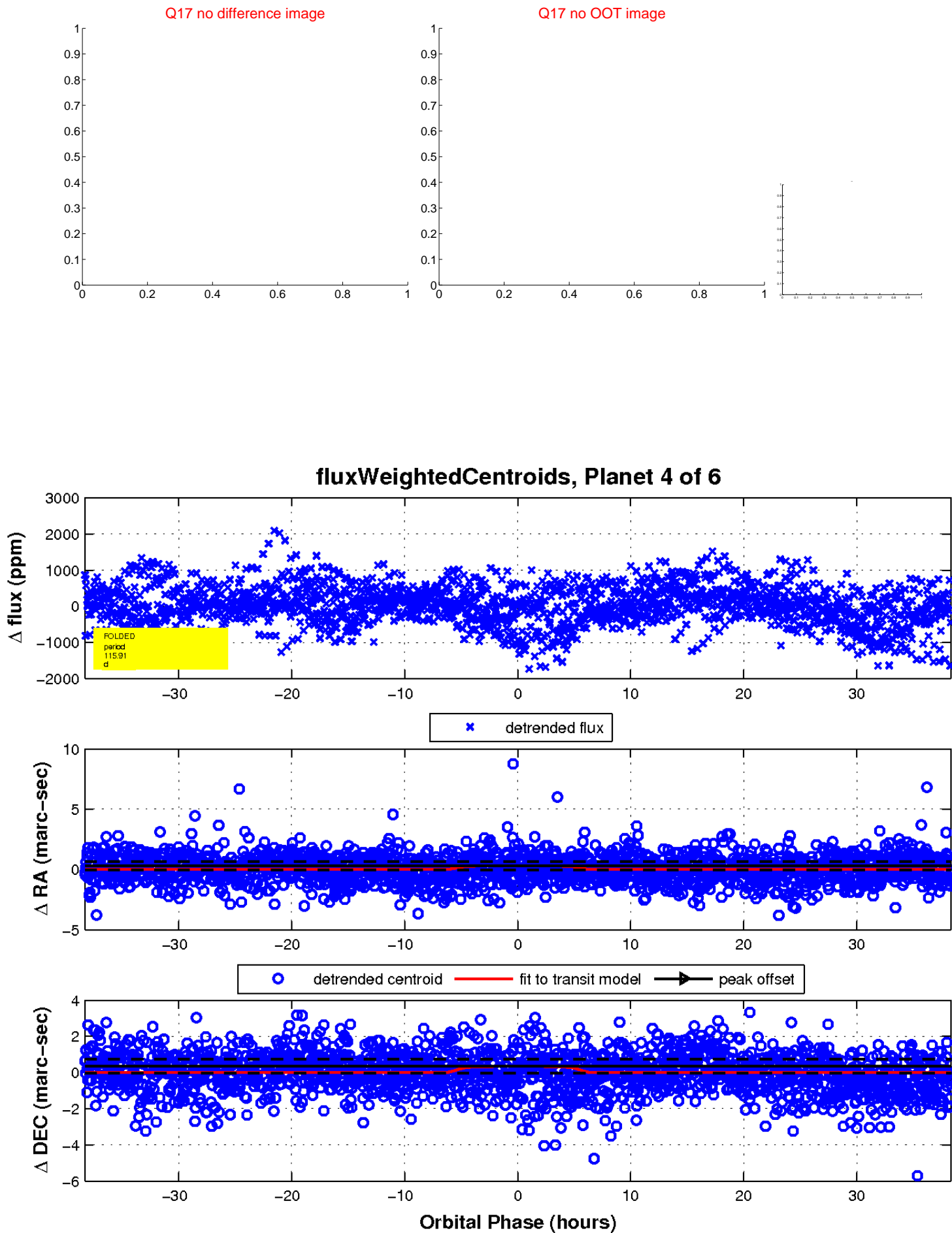
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

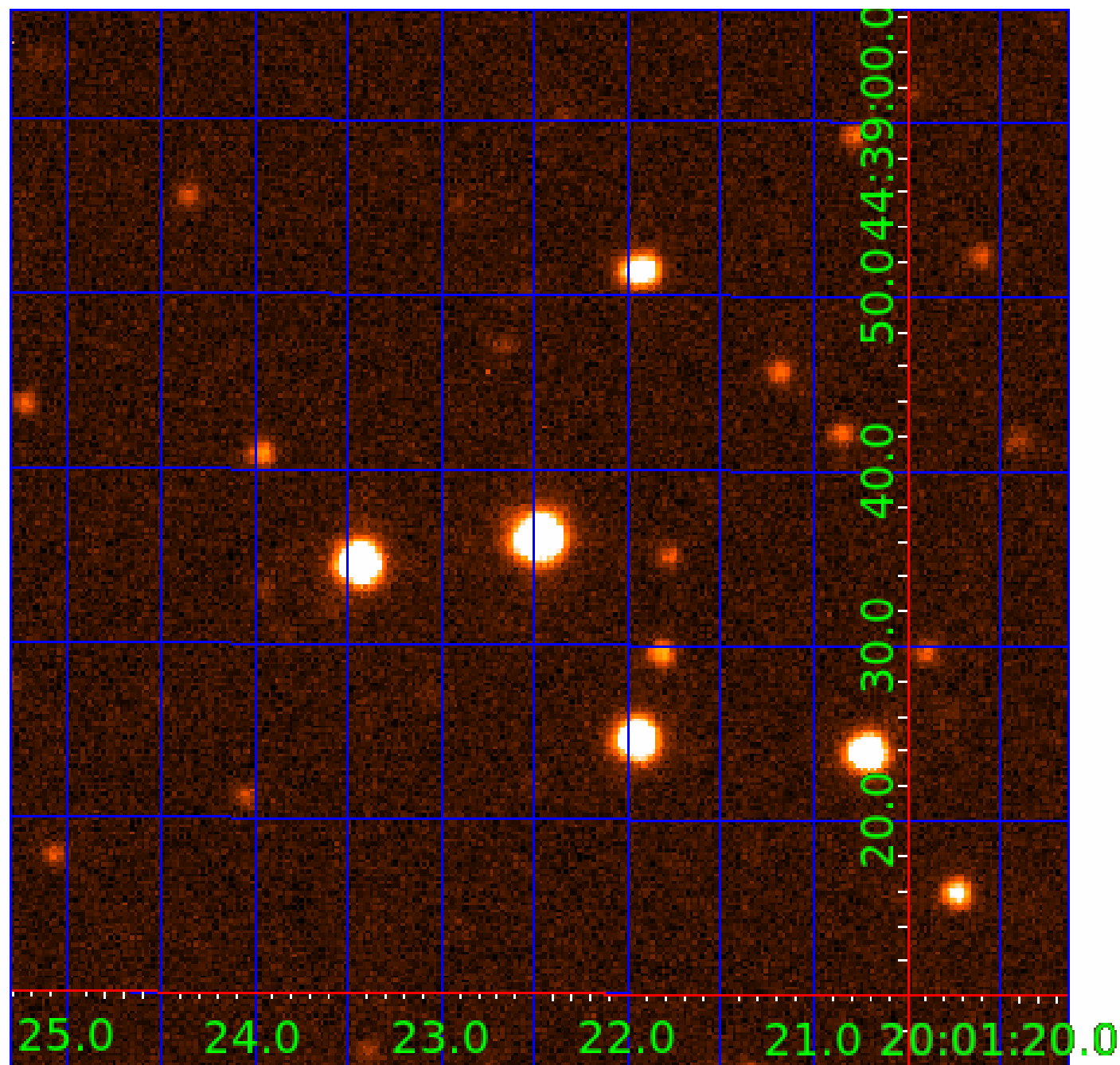


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 008588031

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
008588031-01	OBS	No	1.129496	132.237416	74.7	5.037	10.0	10.9	1.54	6573	1.37	8005.50
008588031-02	OBS	No	123.981995	138.449081	1156.2	7.625	9.8	9.5	1.54	6573	6.81	15.23
008588031-03	OBS	No	86.855554	146.372129	767.0	12.857	8.0	7.7	1.54	6573	5.83	24.48
008588031-04	OBS	No	115.910270	147.875278	582.5	12.779	8.9	6.4	1.54	6573	4.41	16.66
008588031-05	OBS	No	429.269521	157.621676	932.0	10.002	7.9	7.9	1.54	6573	5.68	2.91
008588031-06	OBS	No	37.028934	155.605567	205.2	9.000	7.6	-1.0	1.54	6573	2.23	76.30

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
008588031-01	OBS	FP	0.00	1	0	0	0	LPP_DV—MOD_NONUNIQ_DV
008588031-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_ALT—INCONSISTENT_TRANS—CENT_FEW_MEAS
008588031-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT
008588031-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV
008588031-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT
008588031-06	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_ALT—CENT_NOFITS—HALO_GHOST

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

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

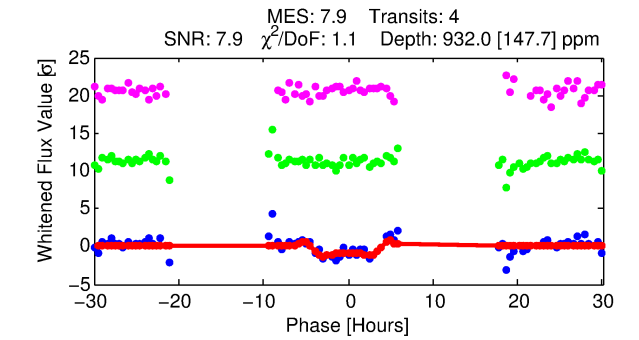
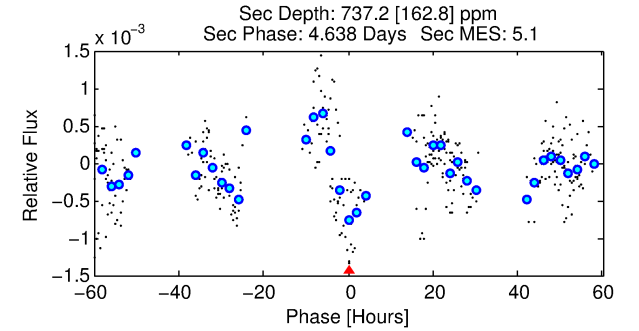
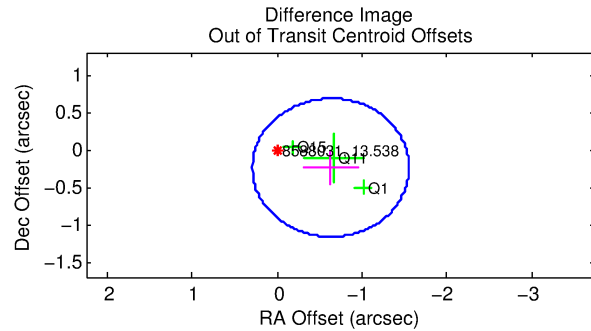
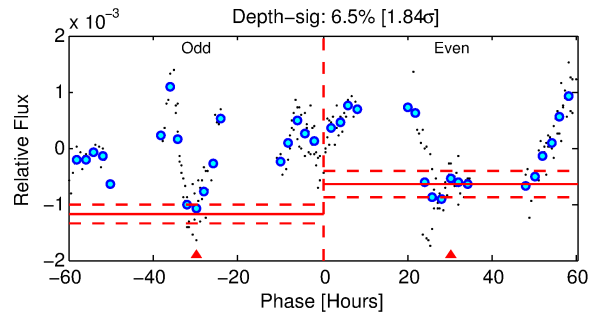
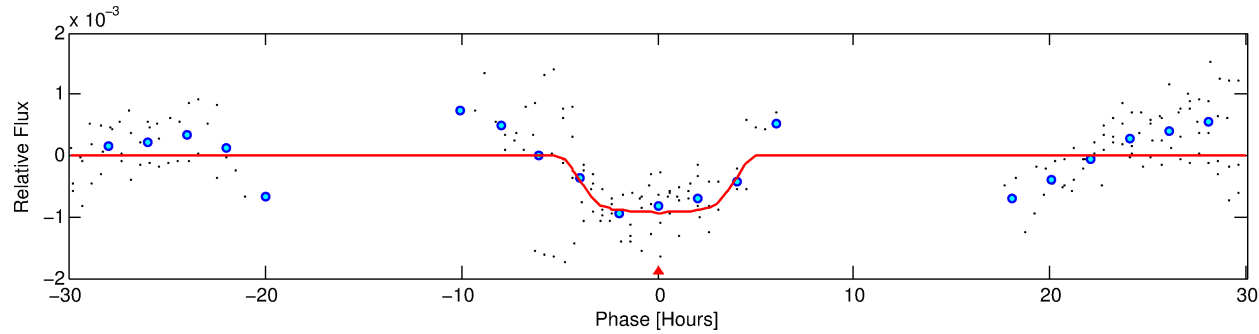
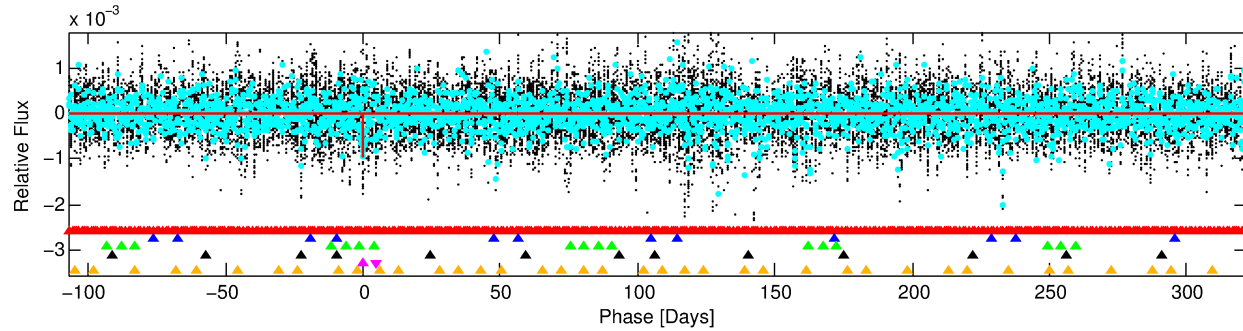
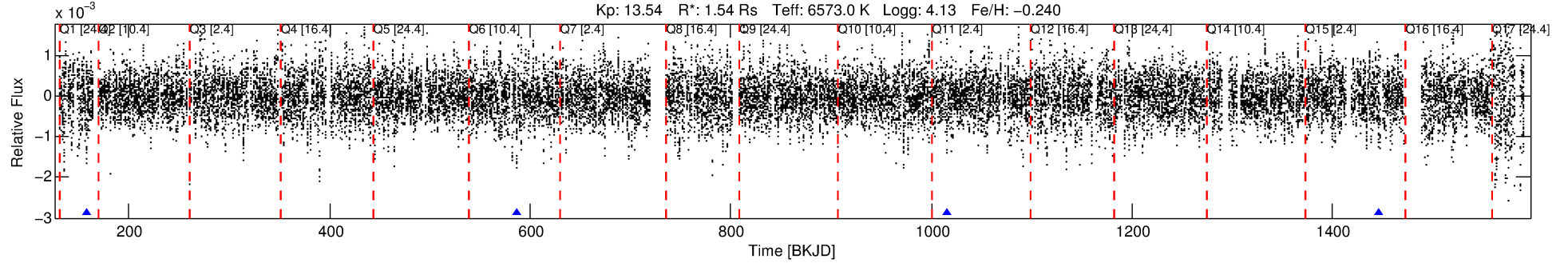
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 008588031-05

No Significant Match Found

# DV One-Page Summary

KIC: 8588031 Candidate: 5 of 6 Period: 429.270 d



## DV Fit Results:

Period = 429.26952 [0.00924] d  
Epoch = 157.6217 [0.0140] BKJD  
Rp/R\* = 0.0337 [0.0030]  
a/R\* = 146.88 [24.98]  
b = 0.93 [0.02]  
Seff = 2.91 [1.18]  
Teq = 333 [34] K  
Rp = 5.68 [1.78] Re  
a = 1.1717 [0.3030] AU  
Ag = 17255.78 [8245.73] [2.09 $\sigma$ ]  
Teffp = 5901 [461] K [12.06 $\sigma$ ]

## DV Diagnostic Results:

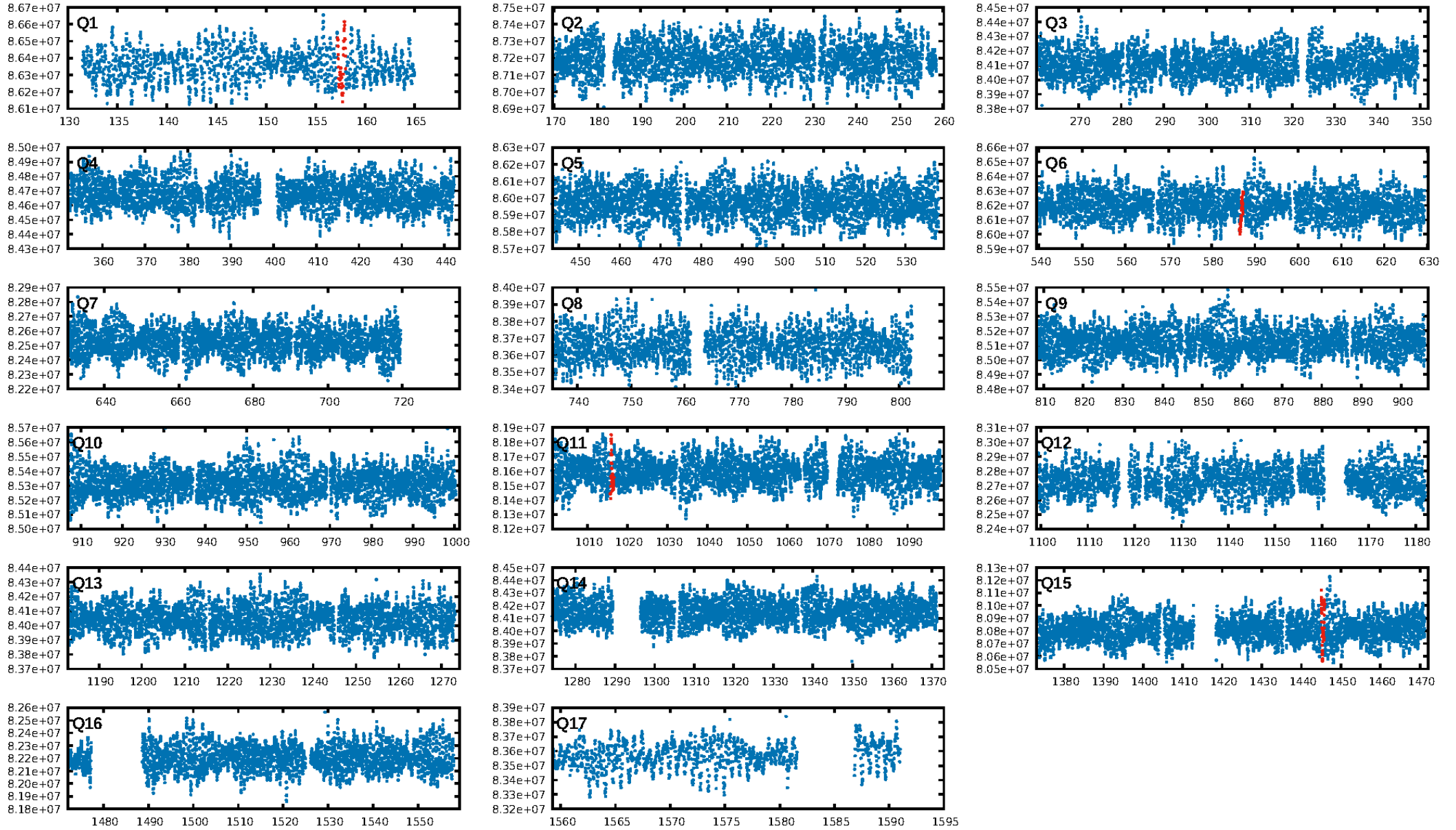
ShortPeriod-sig: 100.0% [582.55 $\sigma$ ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 27.4%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [3/3]  
GhostDiagnostic-chr: 4.454  
Centroid-sig: 62.5%  
Centroid-so: 1.361 arcsec [1.93 $\sigma$ ]  
OotOffset-rm: 0.678 arcsec [2.20 $\sigma$ ]  
KicOffset-rm: 0.697 arcsec [2.15 $\sigma$ ]  
OotOffset-st: 0/2/0/1 [3]  
KicOffset-st: 0/2/0/1 [3]  
DiffImageQuality-fgm: 1.00 [3/3]  
DiffImageOverlap-fno: 0.00 [0/4]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 06:03:07 Z

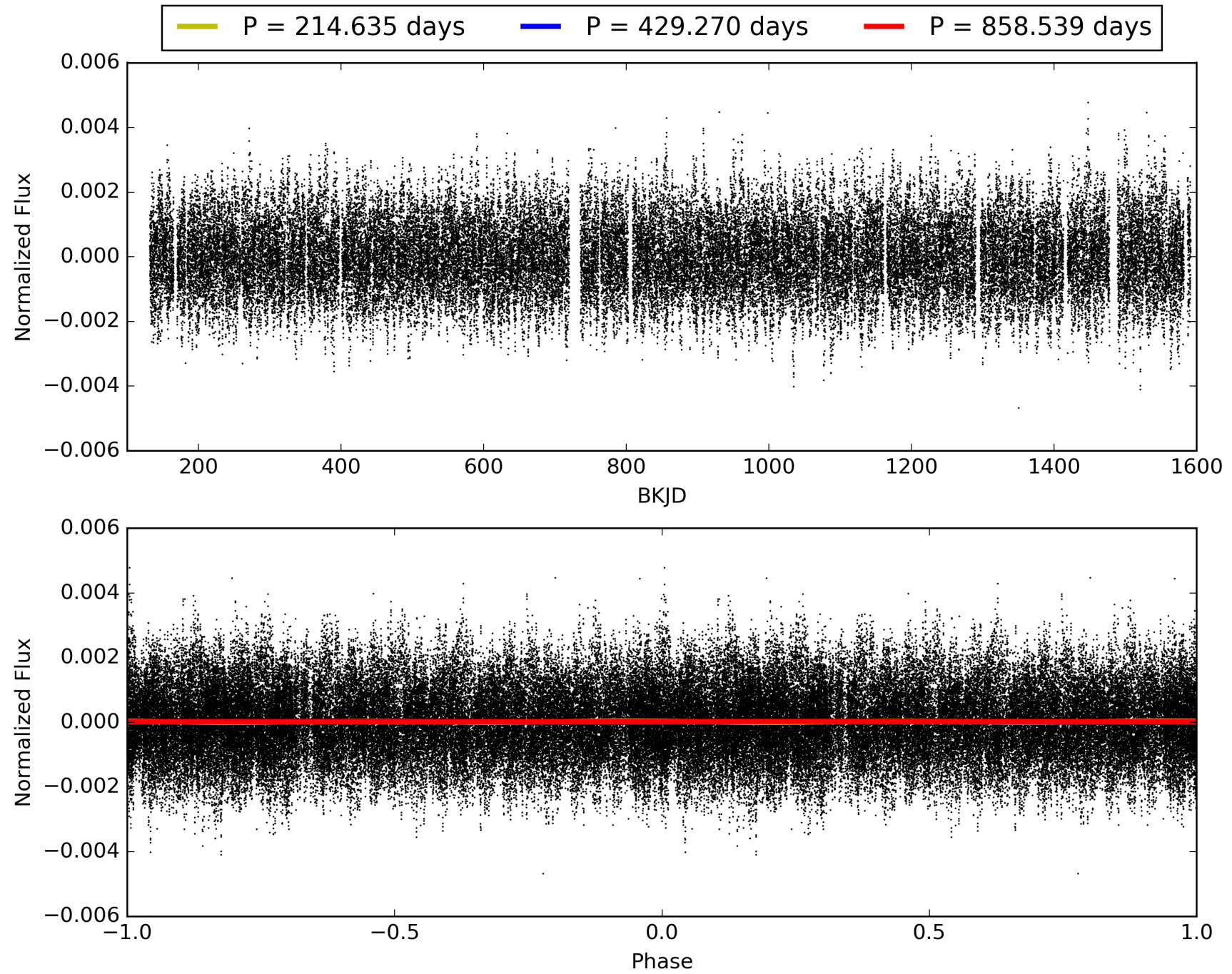
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center



# TCE 008588031-05, PDC Light Curves

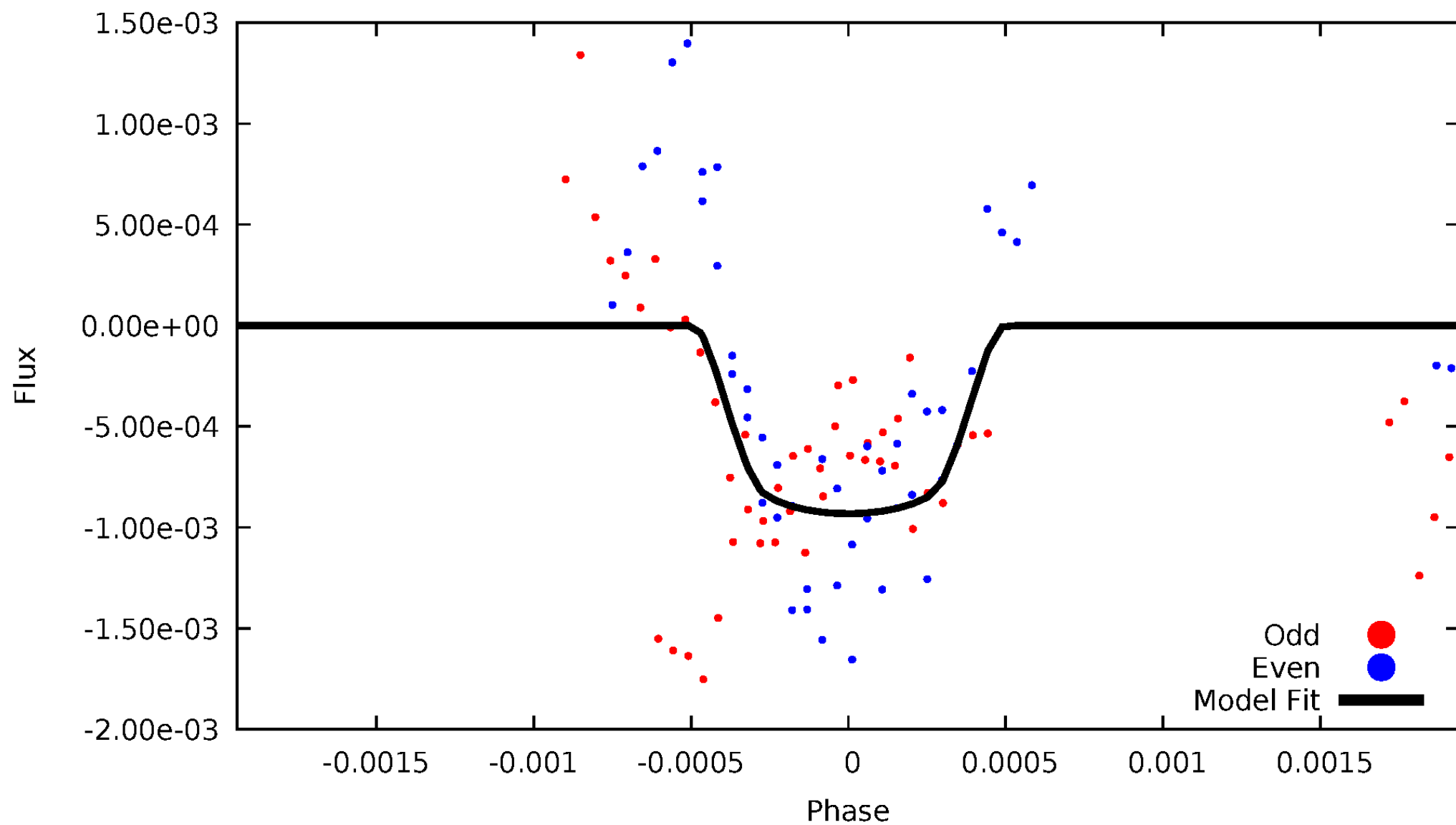


TCE 008588031-05



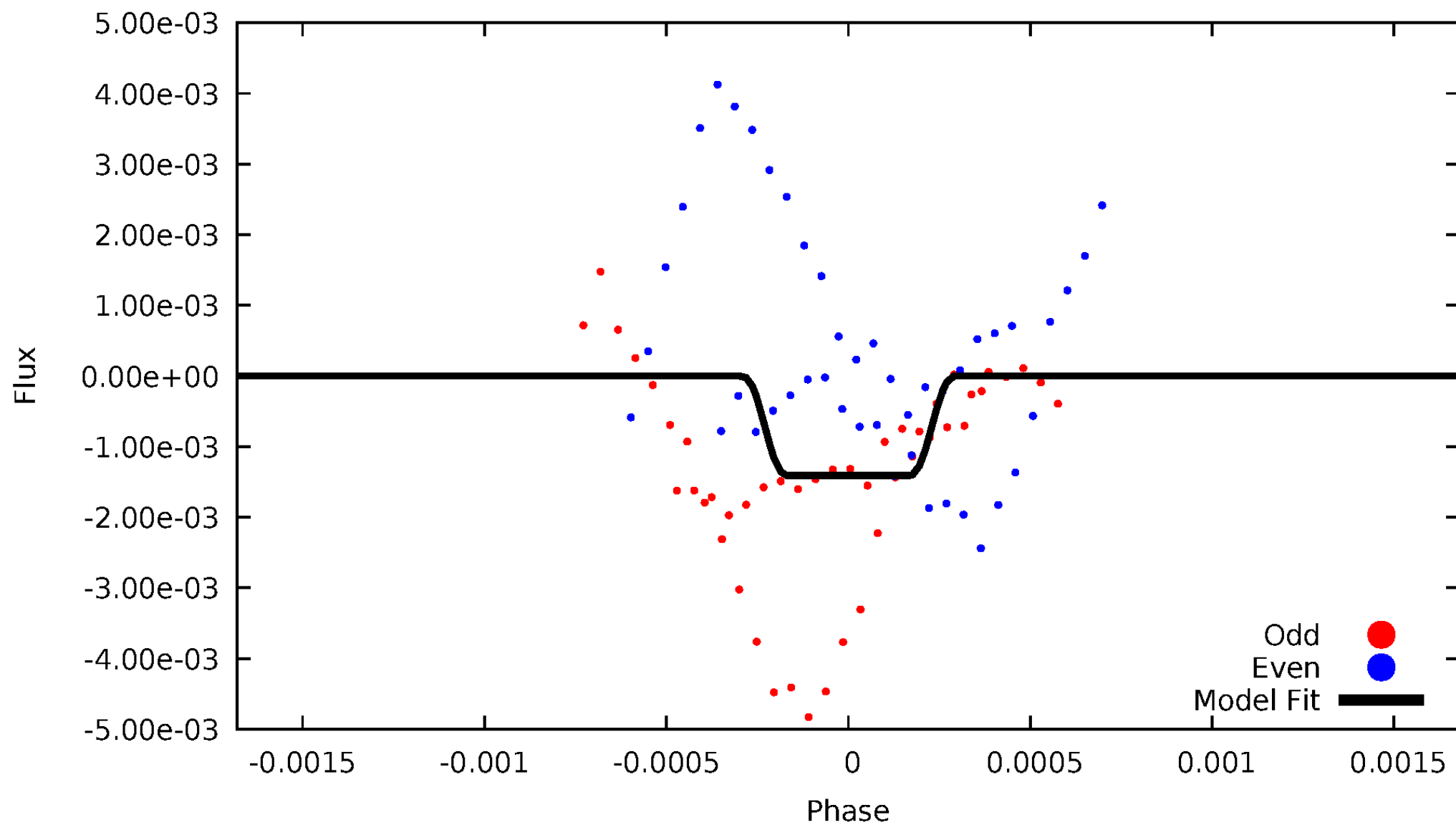
# DV Odd/Even

TCE 008588031-05



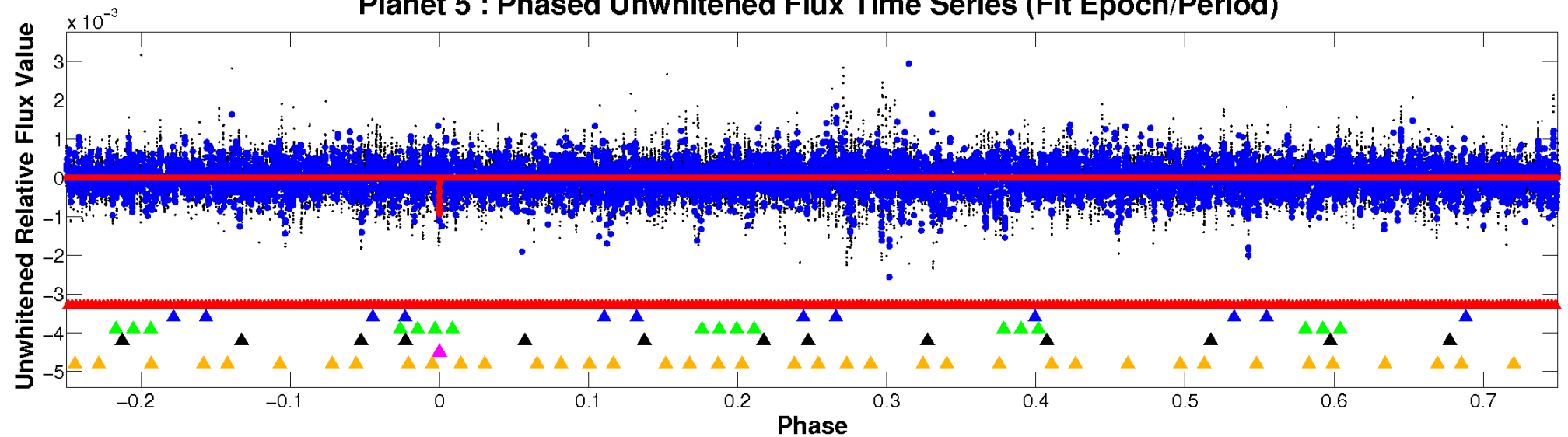
# ALT Odd/Even

TCE 008588031-05

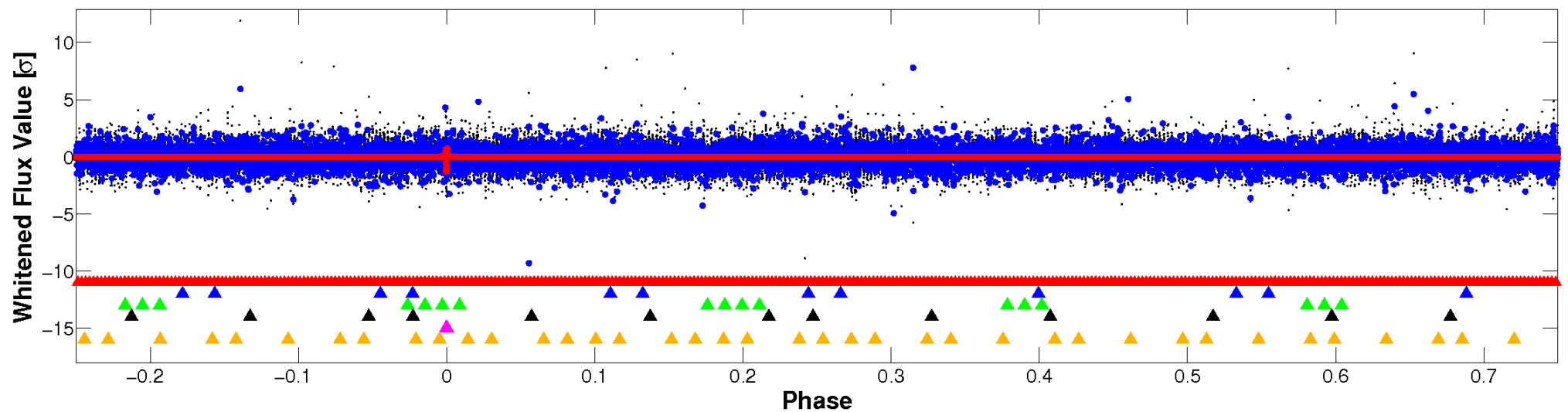


# Non-Whitened Vs. Whitened Light Curve

## Planet 5 : Phased Unwhitened Flux Time Series (Fit Epoch/Period)

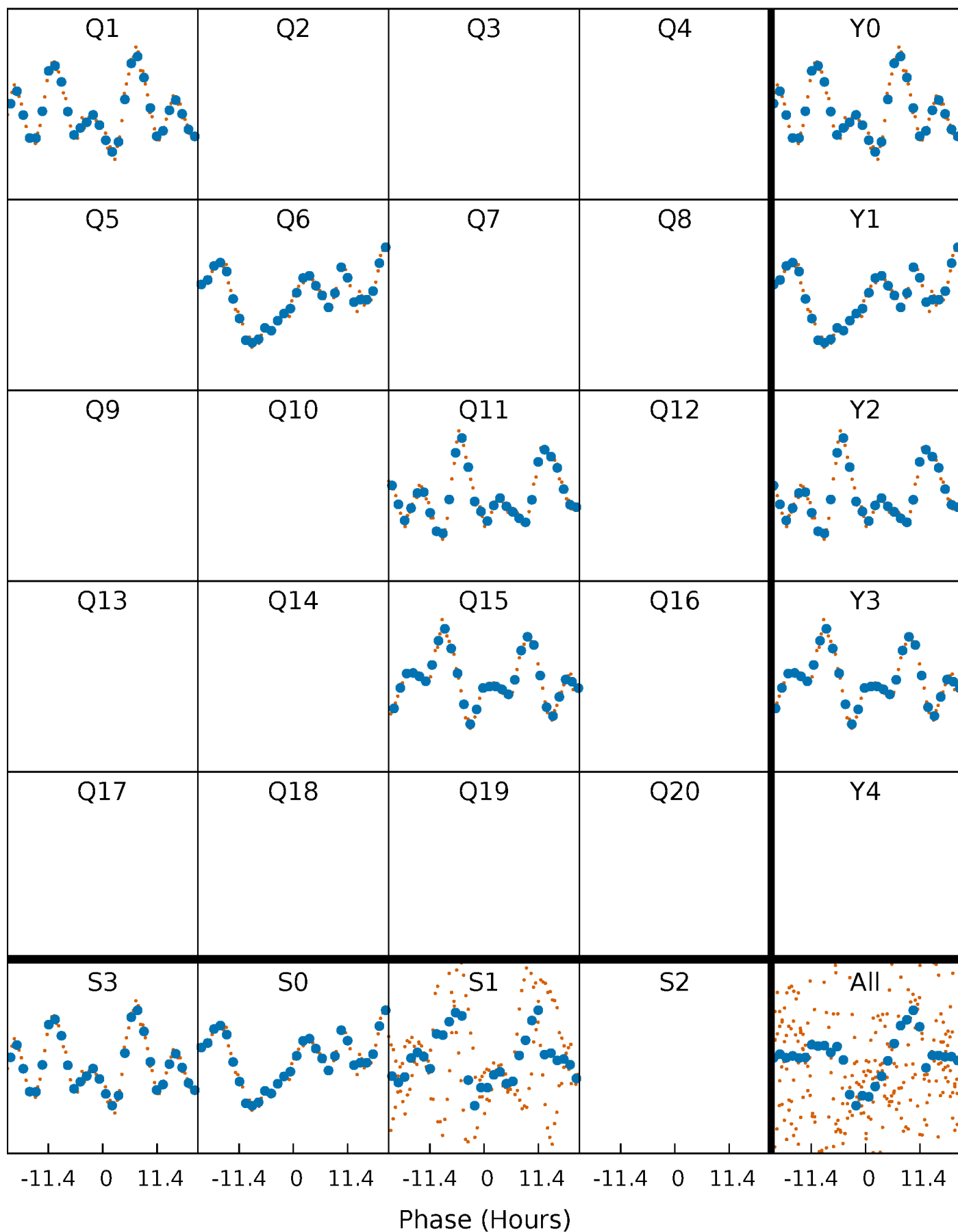


## Planet 5 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

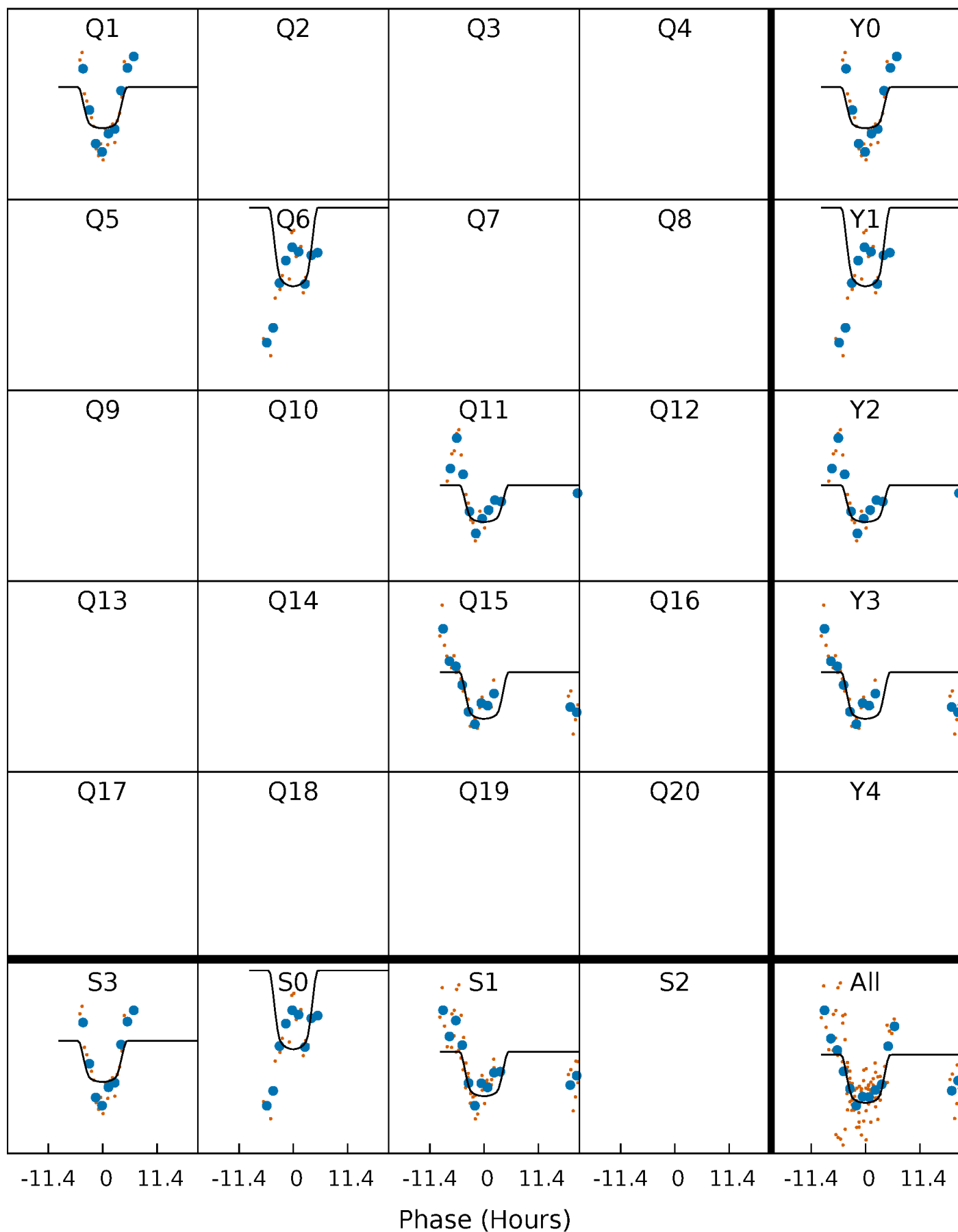
TCE 008588031-05     $P=429.269521$  Days     $T_0=157.621676$  (BKJD)





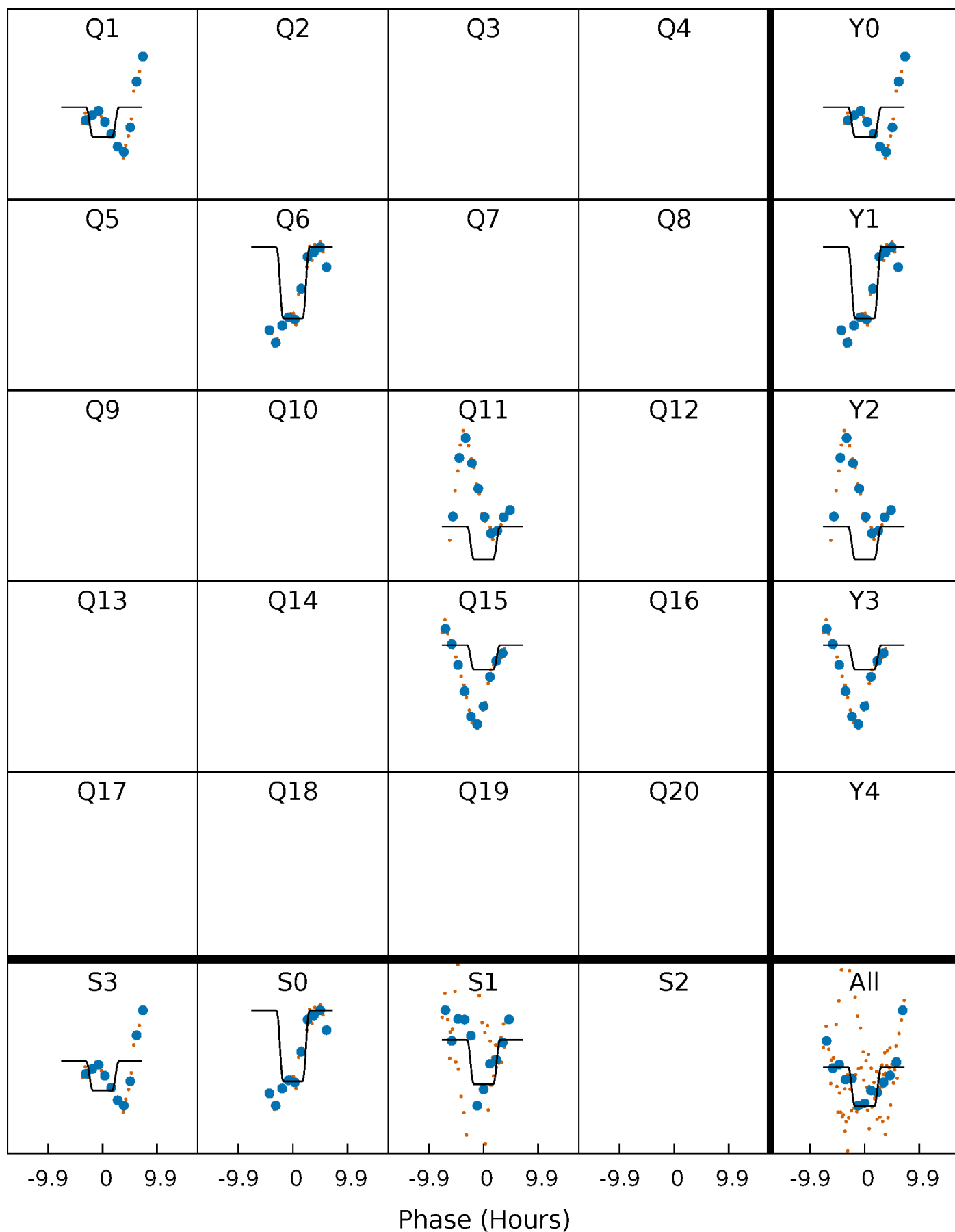
# DV Quarter-Phased Transit Curves

TCE 008588031-05     $P=429.269521$  Days     $T_0=157.621676$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

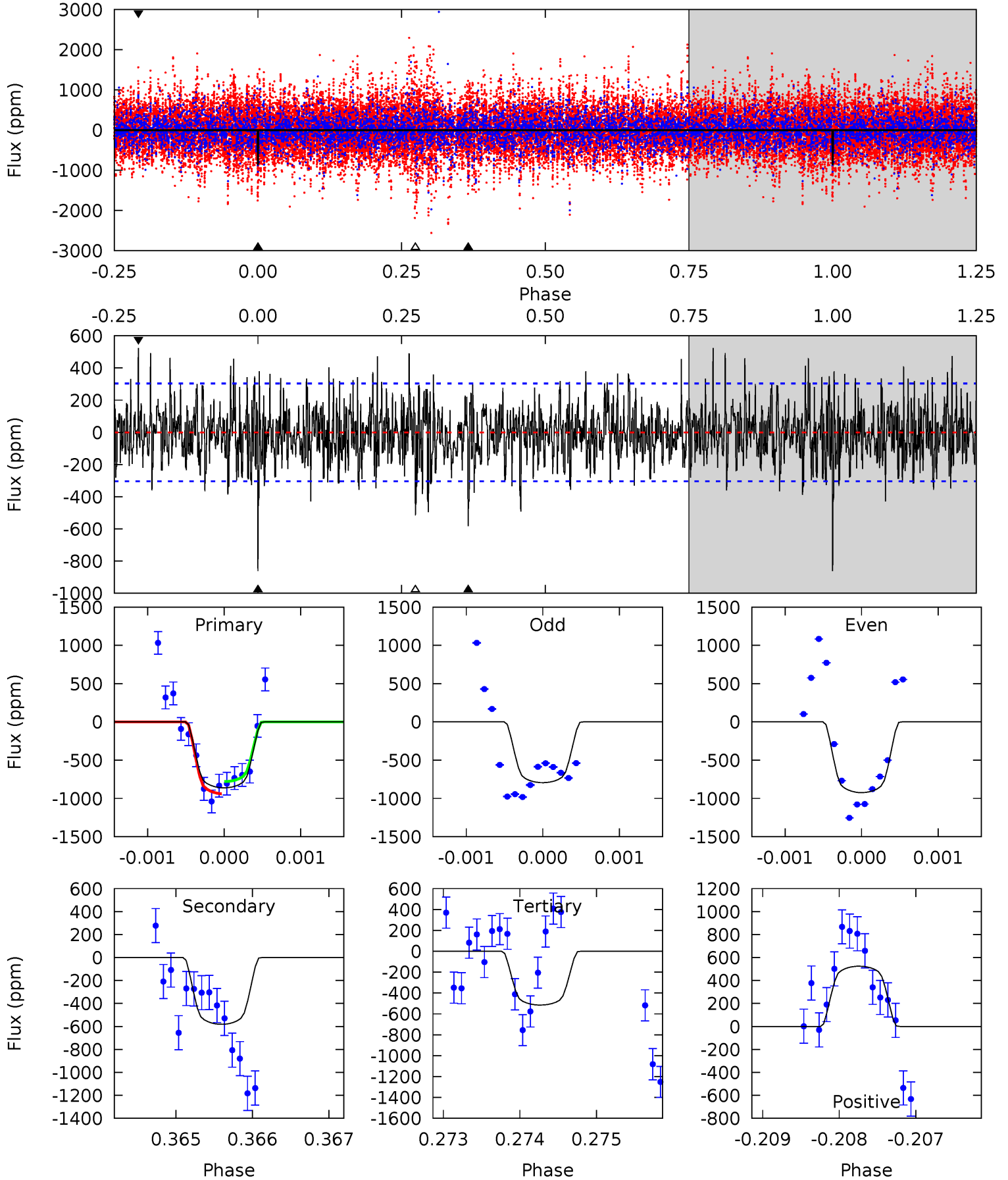
TCE 008588031-05 P=429.261417 Days  $T_0=157.572724$  (BKJD)



# DV Model-Shift Uniqueness Test

008588031-05, P = 429.269521 Days, E = 157.621676 Days

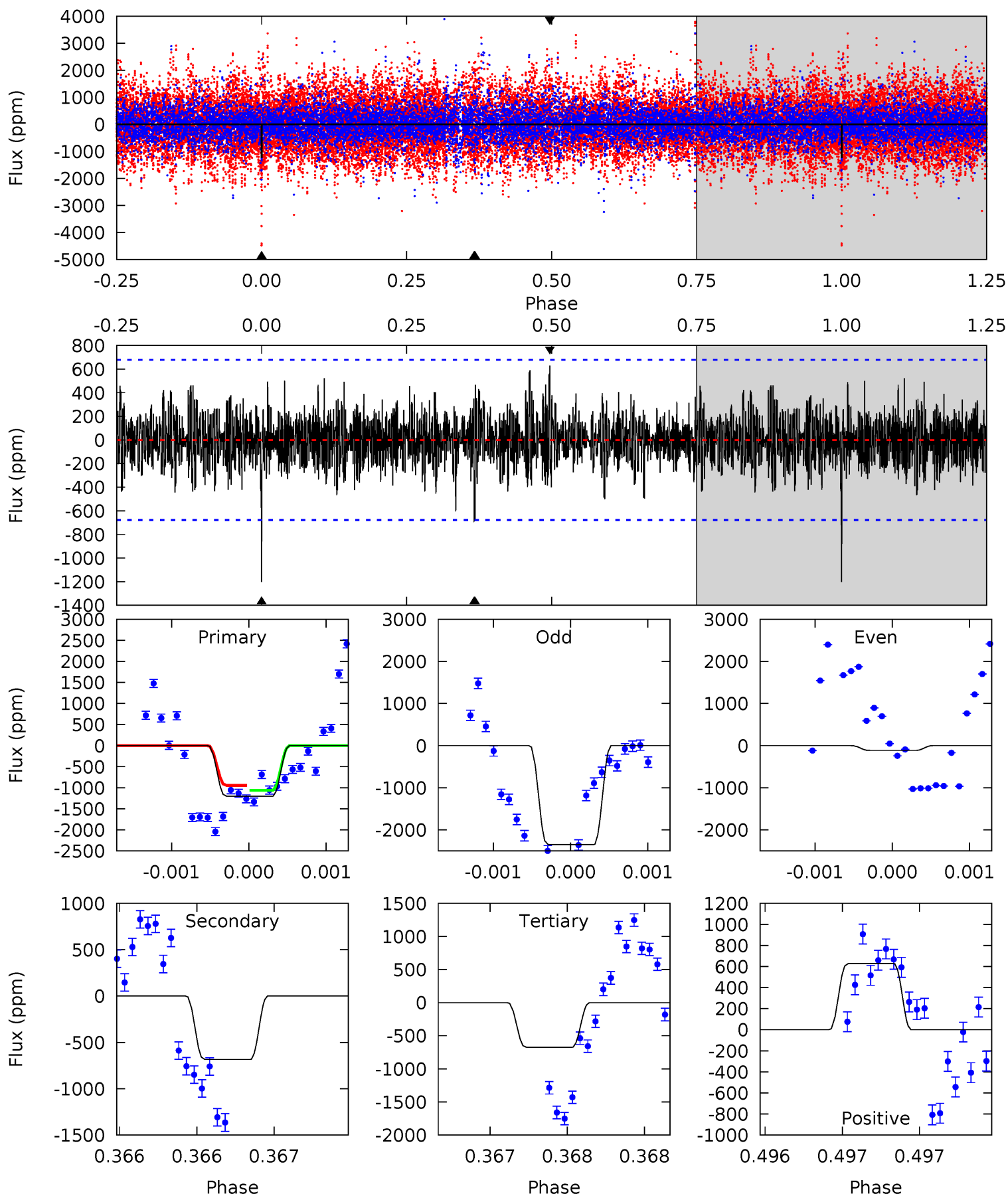
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
15.4	10.4	9.24	9.40	5.45	3.29	2.61	6.21	6.04	1.19	1.03	1.17	1.08	0.38	1.42



# Alt Model-Shift Uniqueness Test

008588031-05, P = 429.261417 Days, E = 157.572724 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
9.84	5.60	5.52	5.14	5.56	3.45	1.31	4.31	4.69	0.08	0.46	9.44	1.09	0.34	0.46



### Stellar Parameters For KIC 008588031

	$T_{\text{eff}}(K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M(M_{\odot})$	$\rho_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6573^{+175}_{-214}$	$4.126^{+0.214}_{-0.175}$	$-0.240^{+0.250}_{-0.300}$	$1.545^{+0.463}_{-0.421}$	$1.162^{+0.209}_{-0.157}$	$0.444^{+0.544}_{-0.214}$
	+3%/-3%	+5%/-4%	+104%/-125%	+30%/-27%	+18%/-14%	+123%/-48%
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 008588031-05 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-582 \pm 56$	$5.67^{+1.05}_{-0.91}$	$463^{+36}_{-32}$	$5561^{+287}_{-281}$	$13729^{+5420}_{-3970}$
Alt.	$-685 \pm 122$	$6.34^{+1.24}_{-1.07}$	$464^{+34}_{-34}$	$5481^{+344}_{-339}$	$12985^{+5457}_{-4266}$

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

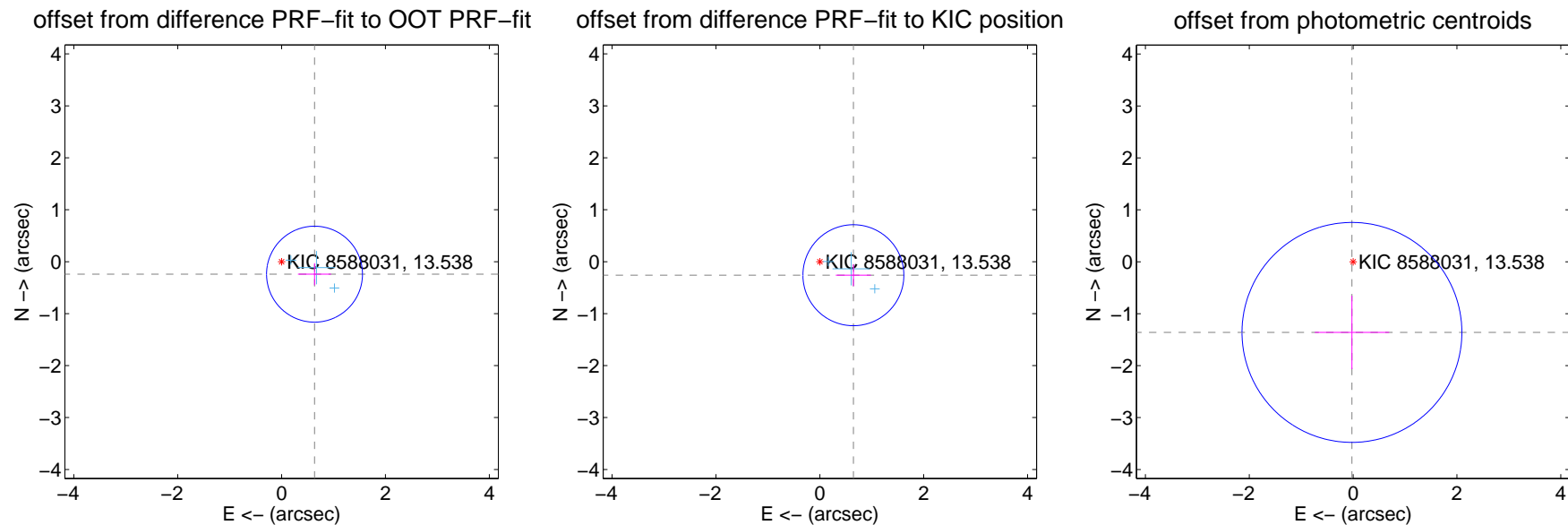
## DV Centroid Data

Supplemental centroid analysis for 008588031-05. Kepler magnitude: 13.54. Transit SNR 7.88

There are 3 quarters with good PRF difference image offsets

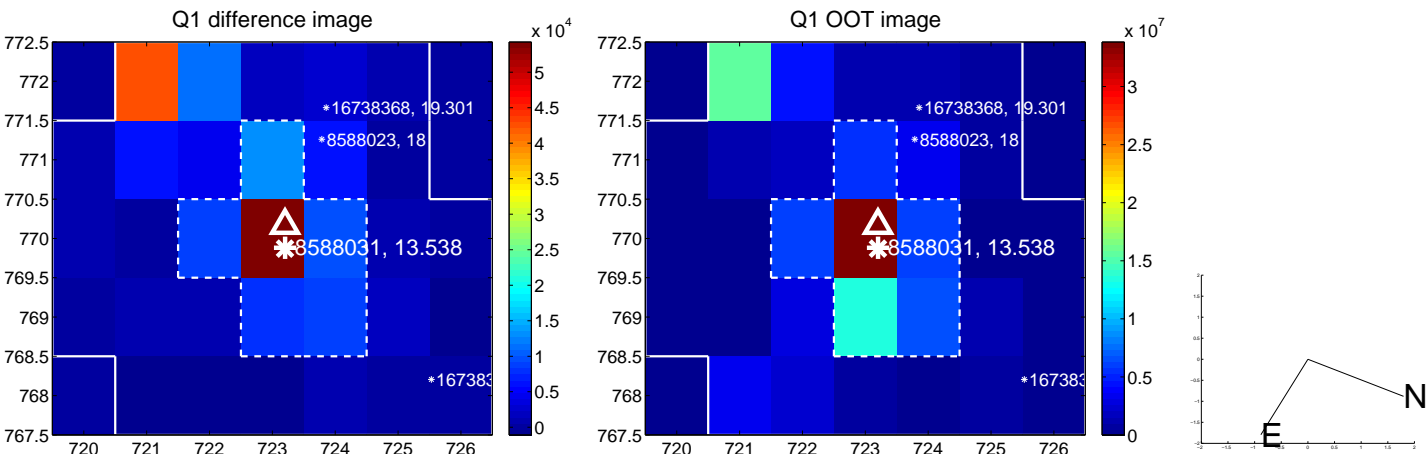
The direct PRF centroid is offset from the target star catalog position by about 0.03 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.678 \pm 0.308$	2.20	$-0.634 \pm 0.319$	$-0.240 \pm 0.213$
PRF-fit source offset from KIC position	$0.697 \pm 0.324$	2.15	$-0.646 \pm 0.339$	$-0.260 \pm 0.209$
photometric centroid source offset	$1.36 \pm 0.71$	1.93	$0.02 \pm 0.72$	$-1.36 \pm 0.71$



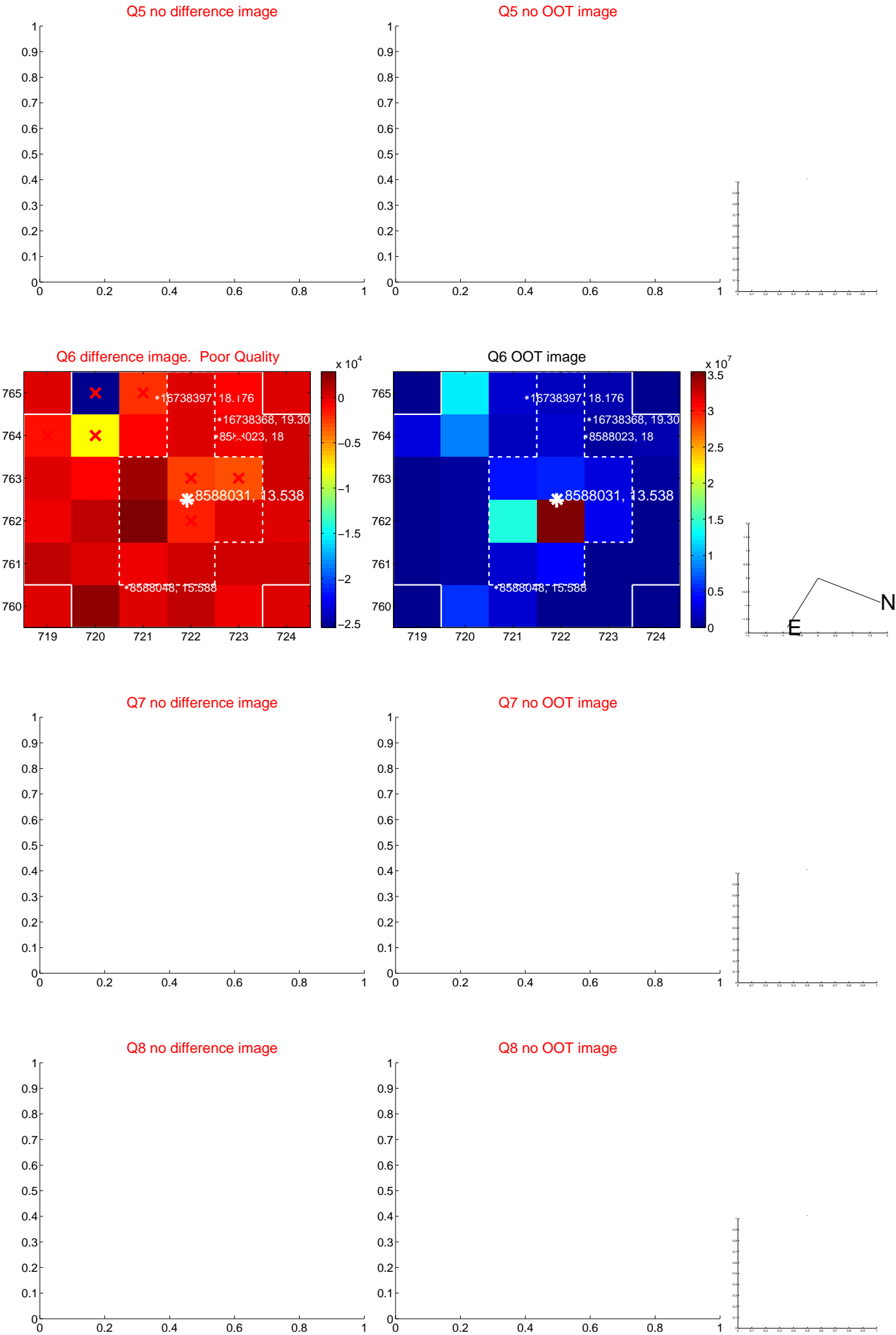
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

Q9 no difference image



Q9 no OOT image



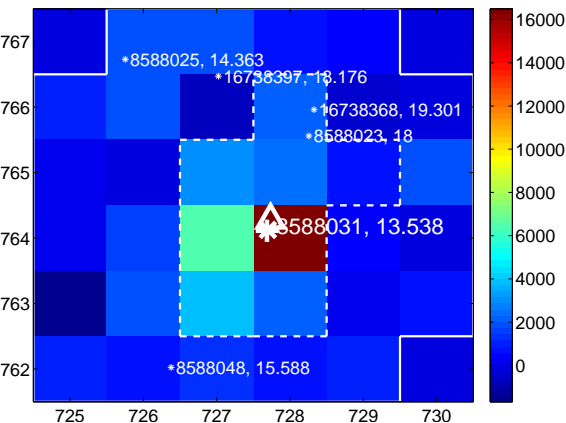
Q10 no difference image



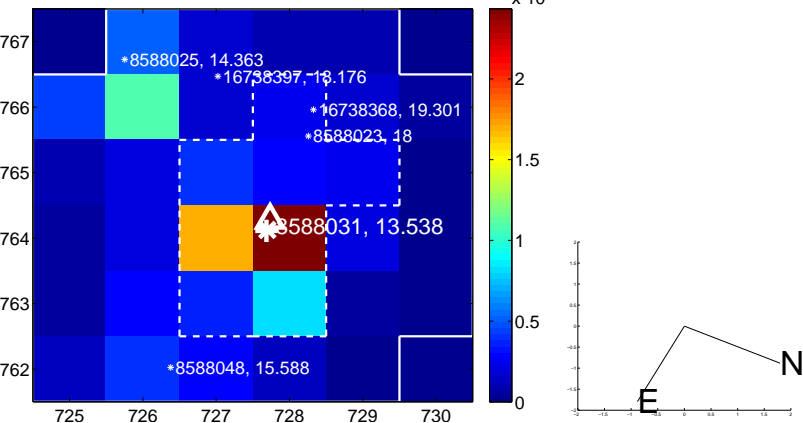
Q10 no OOT image



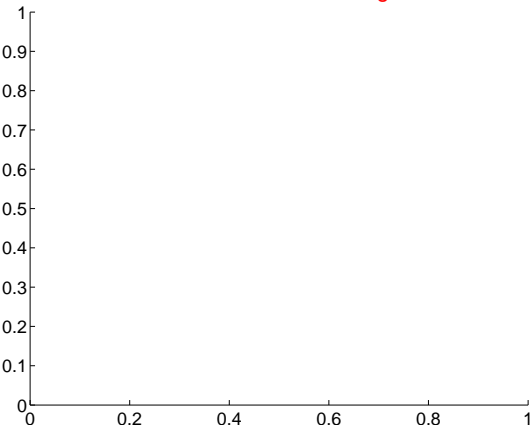
Q11 difference image



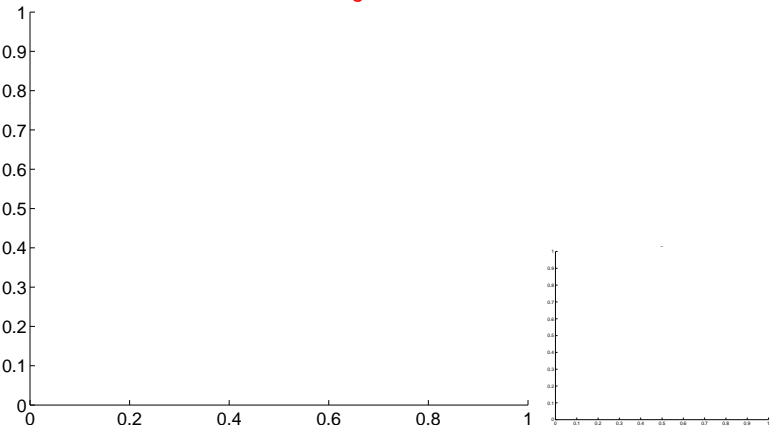
Q11 OOT image



Q12 no difference image



Q12 no OOT image



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

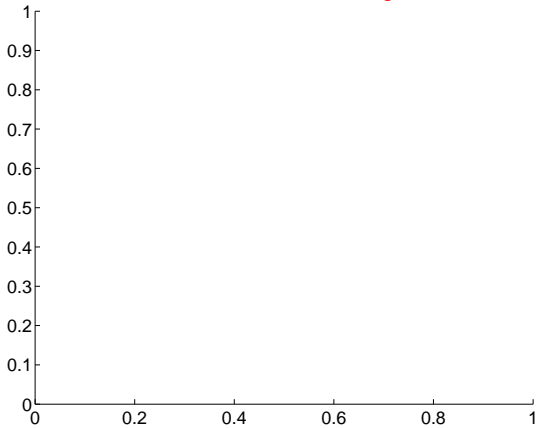
Q13 no difference image



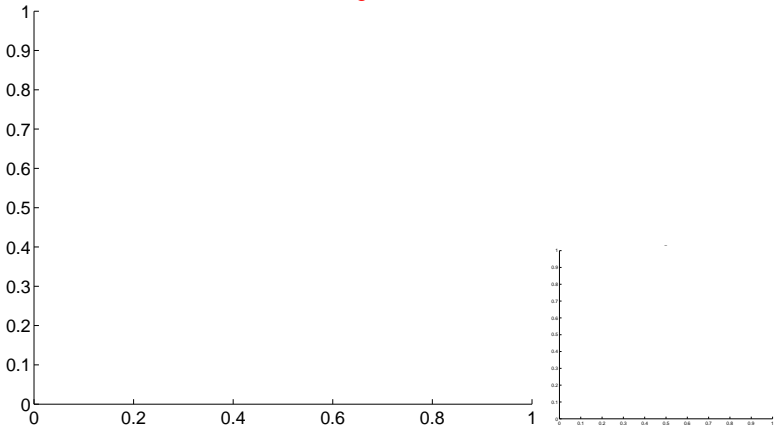
Q13 no OOT image



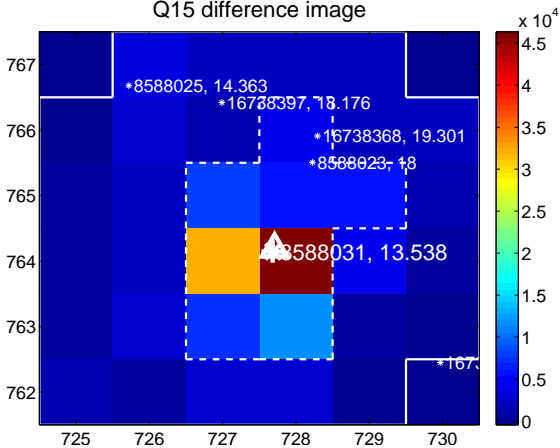
Q14 no difference image



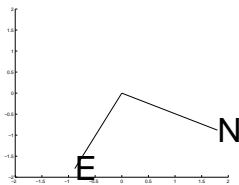
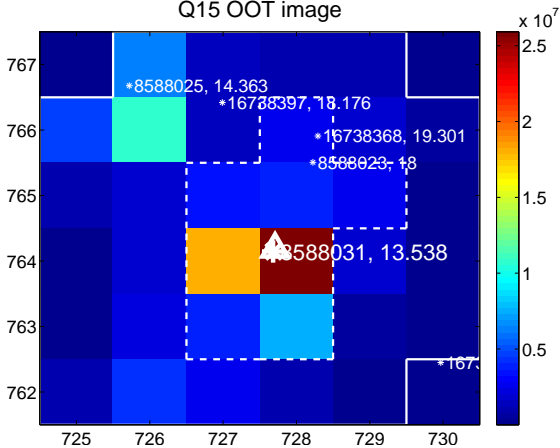
Q14 no OOT image



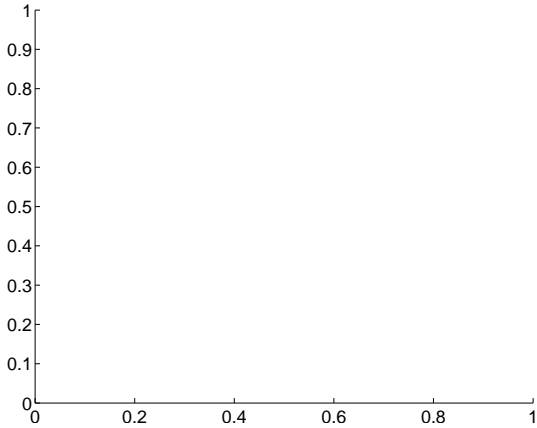
Q15 difference image



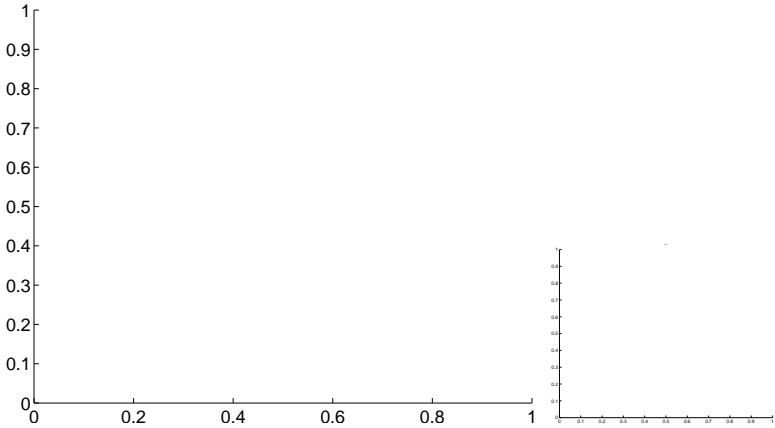
Q15 OOT image



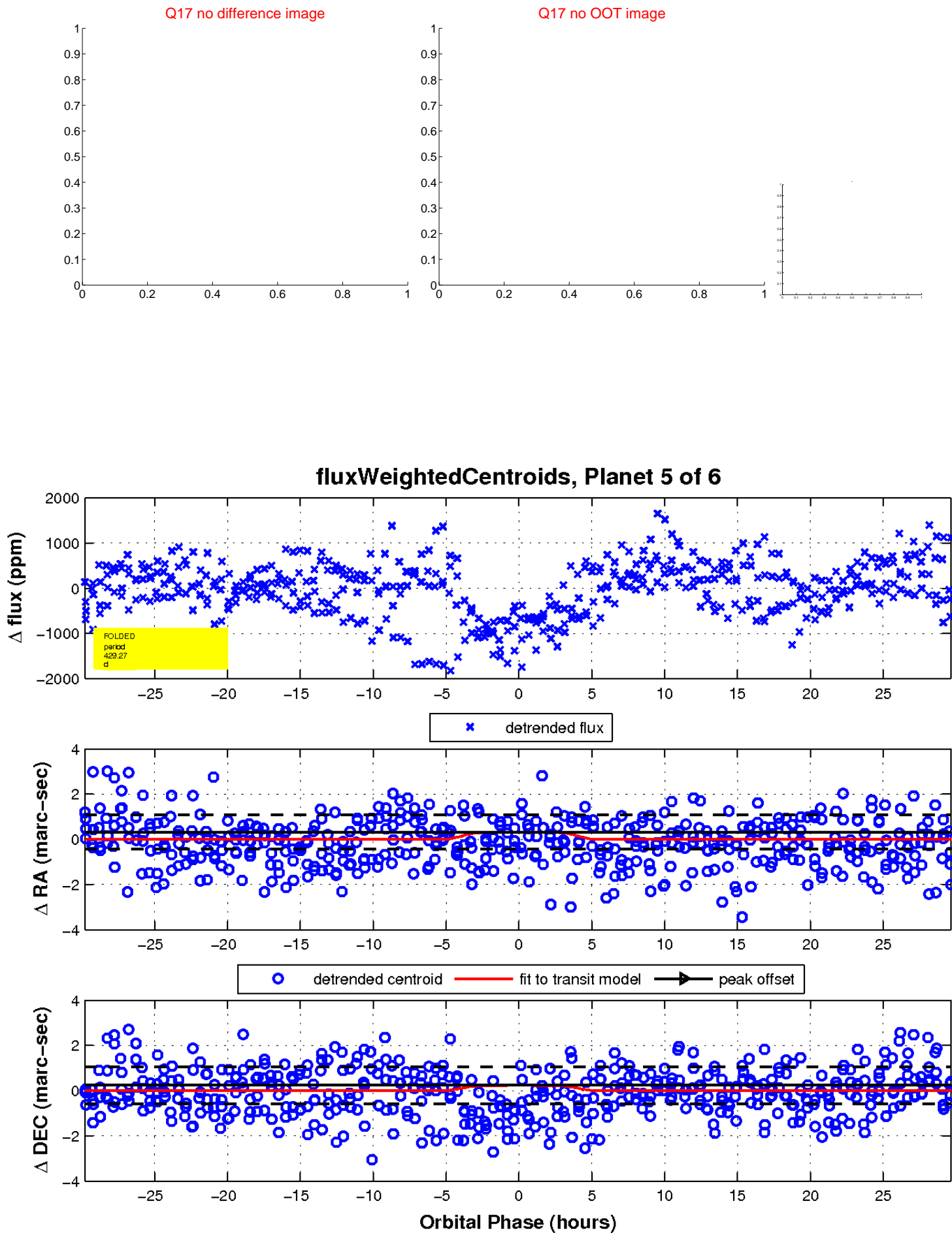
Q16 no difference image



Q16 no OOT image

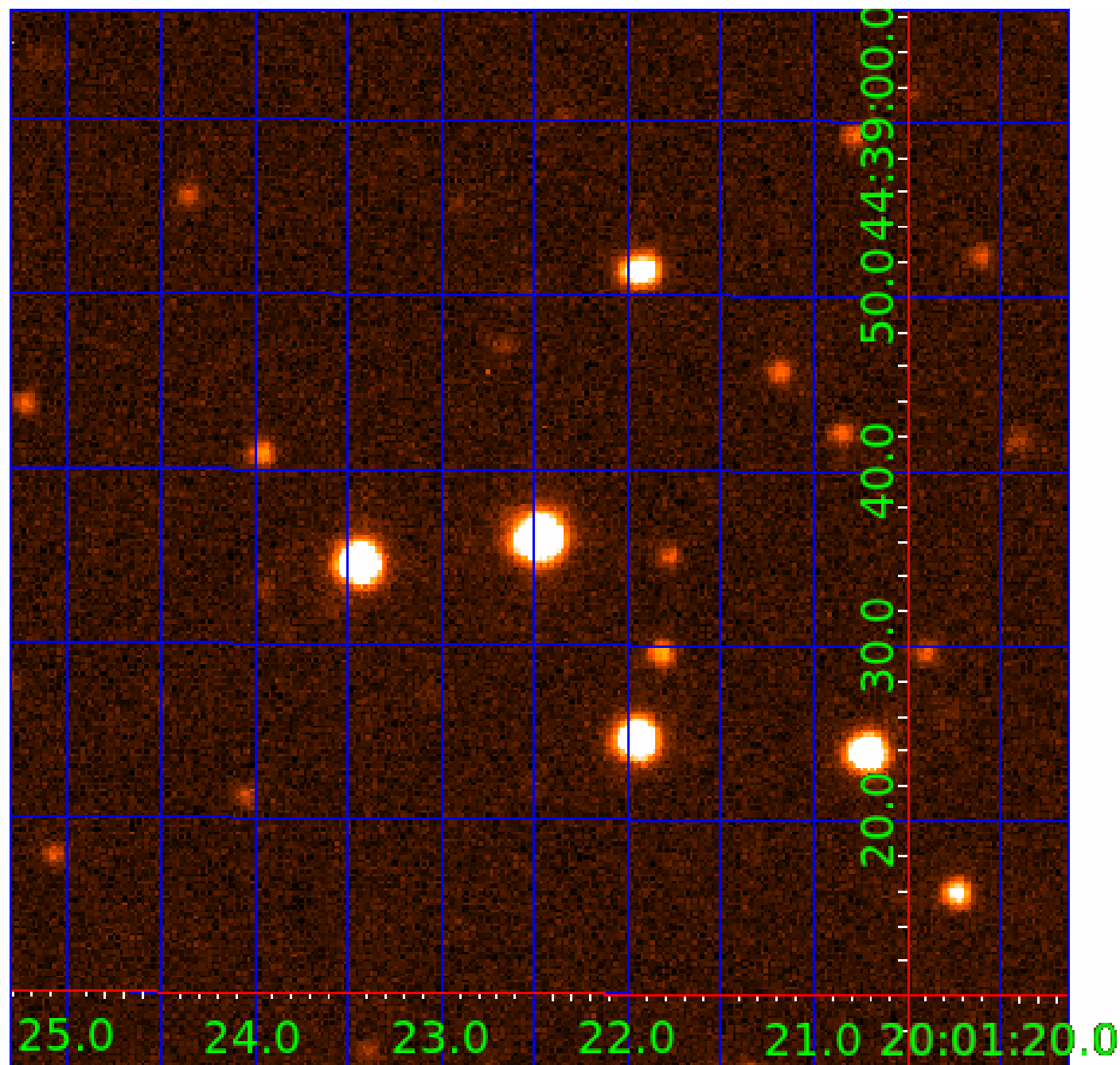


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 008588031

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
008588031-01	OBS	No	1.129496	132.237416	74.7	5.037	10.0	10.9	1.54	6573	1.37	8005.50
008588031-02	OBS	No	123.981995	138.449081	1156.2	7.625	9.8	9.5	1.54	6573	6.81	15.23
008588031-03	OBS	No	86.855554	146.372129	767.0	12.857	8.0	7.7	1.54	6573	5.83	24.48
008588031-04	OBS	No	115.910270	147.875278	582.5	12.779	8.9	6.4	1.54	6573	4.41	16.66
008588031-05	OBS	No	429.269521	157.621676	932.0	10.002	7.9	7.9	1.54	6573	5.68	2.91
008588031-06	OBS	No	37.028934	155.605567	205.2	9.000	7.6	-1.0	1.54	6573	2.23	76.30

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
008588031-01	OBS	FP	0.00	1	0	0	0	LPP_DV—MOD_NONUNIQ_DV
008588031-02	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_ALT—INCONSISTENT_TRANS—CENT_FEW_MEAS
008588031-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT
008588031-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV
008588031-05	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—LPP_DV—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_ALT
008588031-06	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—MOD_NONUNIQ_ALT—CENT_NOFITS—HALO_GHOST

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

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

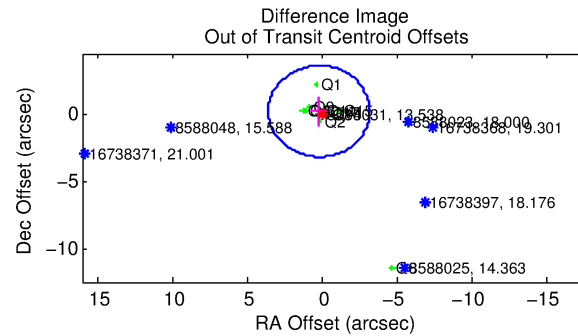
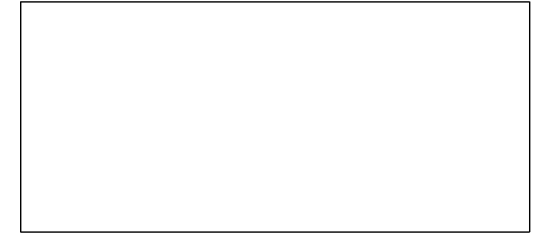
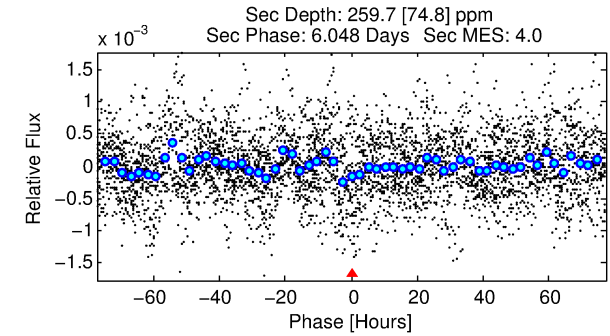
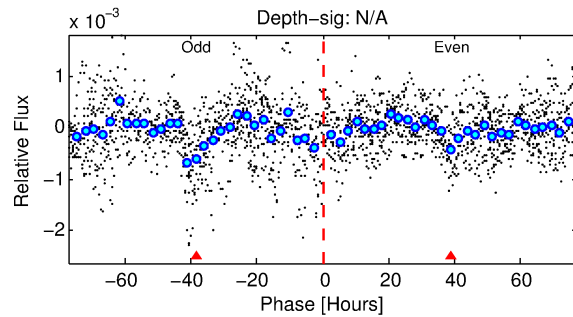
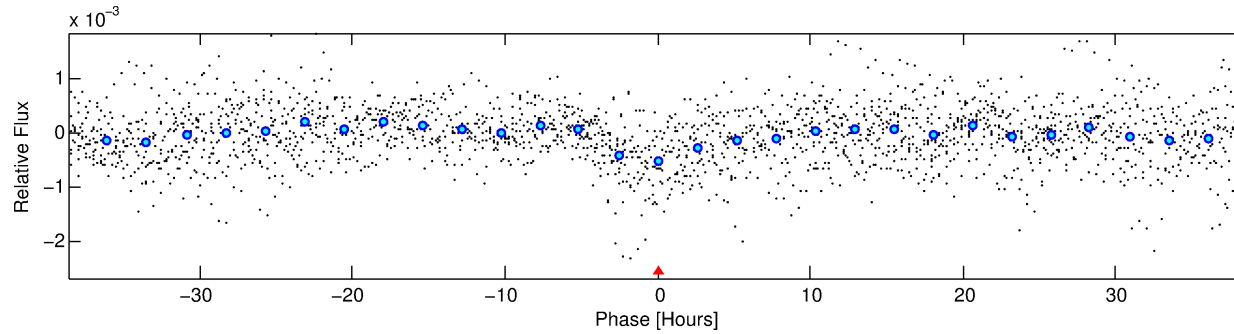
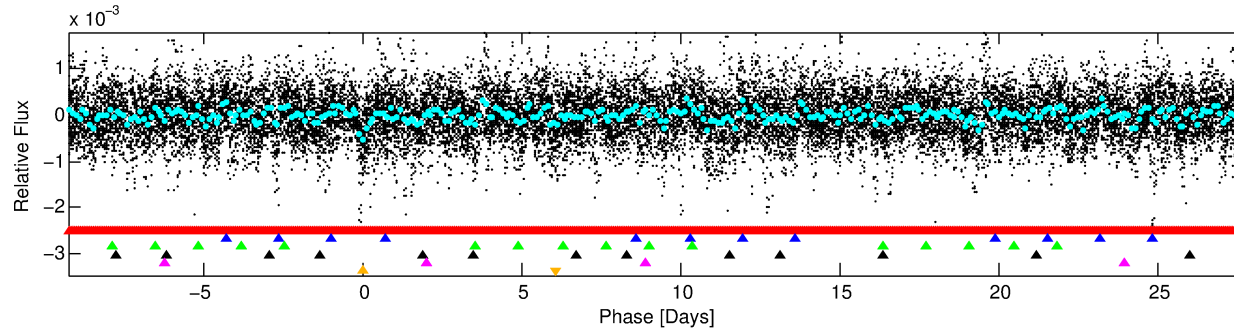
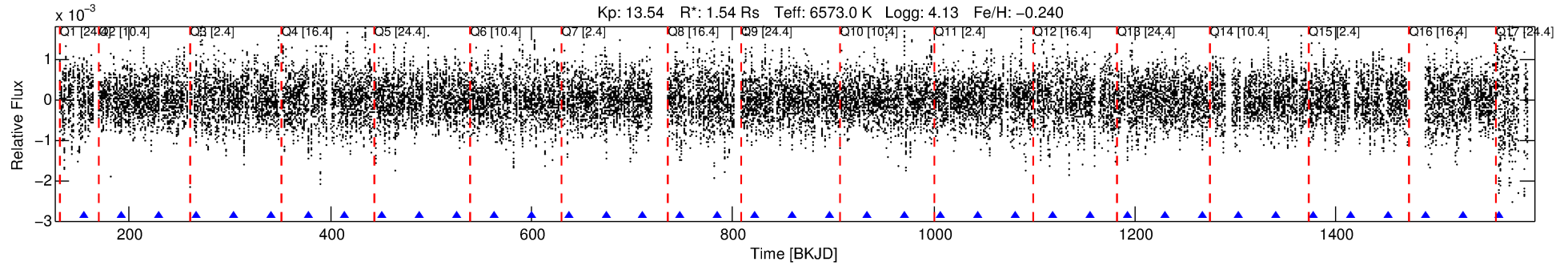
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 008588031-06

No Significant Match Found

# DV One-Page Summary

KIC: 8588031 Candidate: 6 of 6 Period: 37.029 d



## TPS TCE Results:

Period = 37.02893 d  
Epoch = 155.6056 BKJD

DV fit results are unavailable

## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [83.54 $\sigma$ ]  
LongPeriod-sig: 100.0% [76.20 $\sigma$ ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [29/29]  
GhostDiagnostic-chr: -0.1204

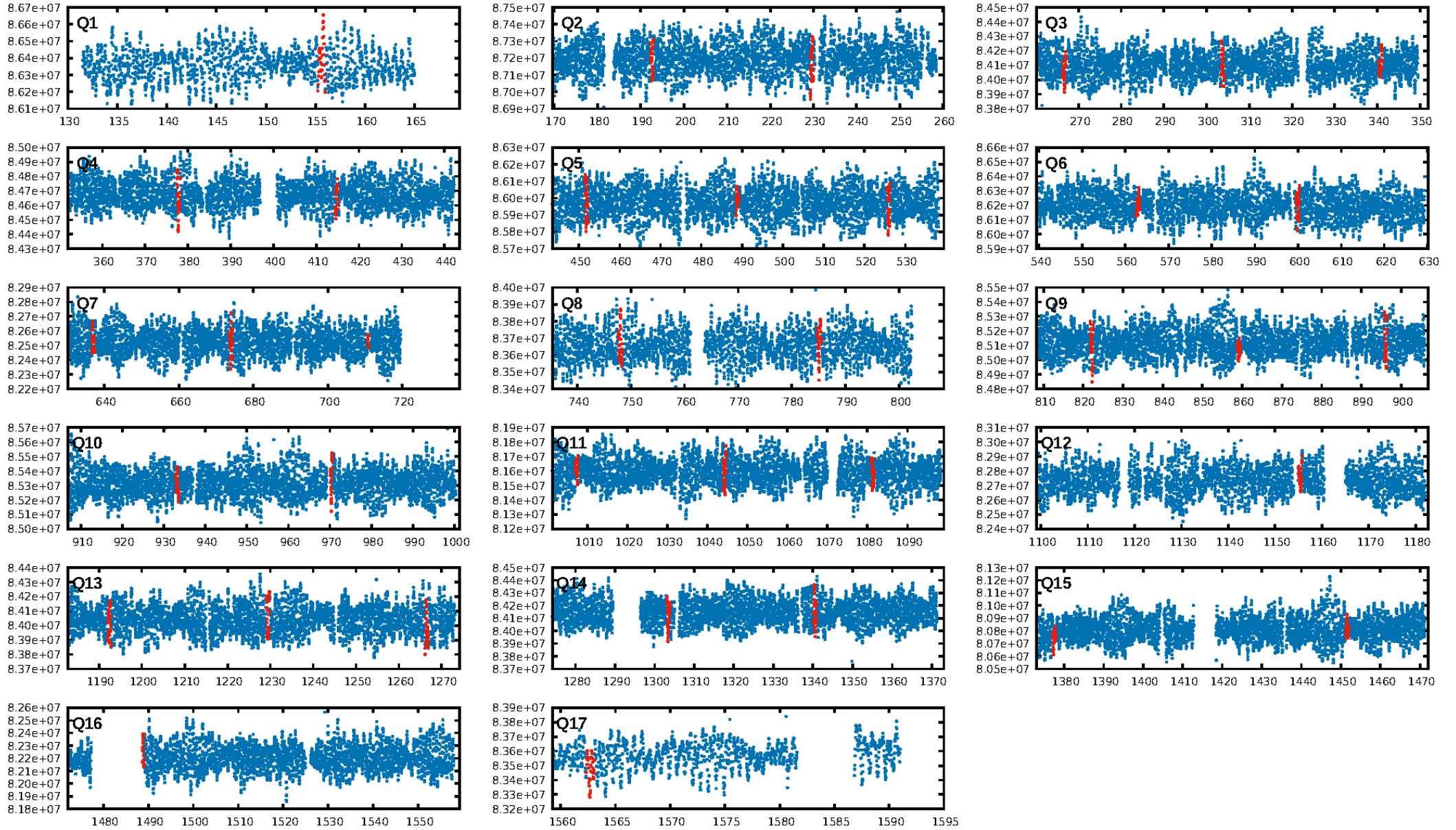
Centroid-sig: 28.1%  
Centroid-so: 1.388 arcsec [5.59 $\sigma$ ]  
OotOffset-rm: 0.269 arcsec [0.24 $\sigma$ ]  
KicOffset-rm: 0.244 arcsec [0.21 $\sigma$ ]  
OotOffset-st: 3/2/1/4 [10]  
KicOffset-st: 3/2/1/4 [10]  
DiffImageQuality-fgm: 0.60 [6/10]  
DiffImageOverlap-fno: 0.00 [0/14]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 06:03:11 Z

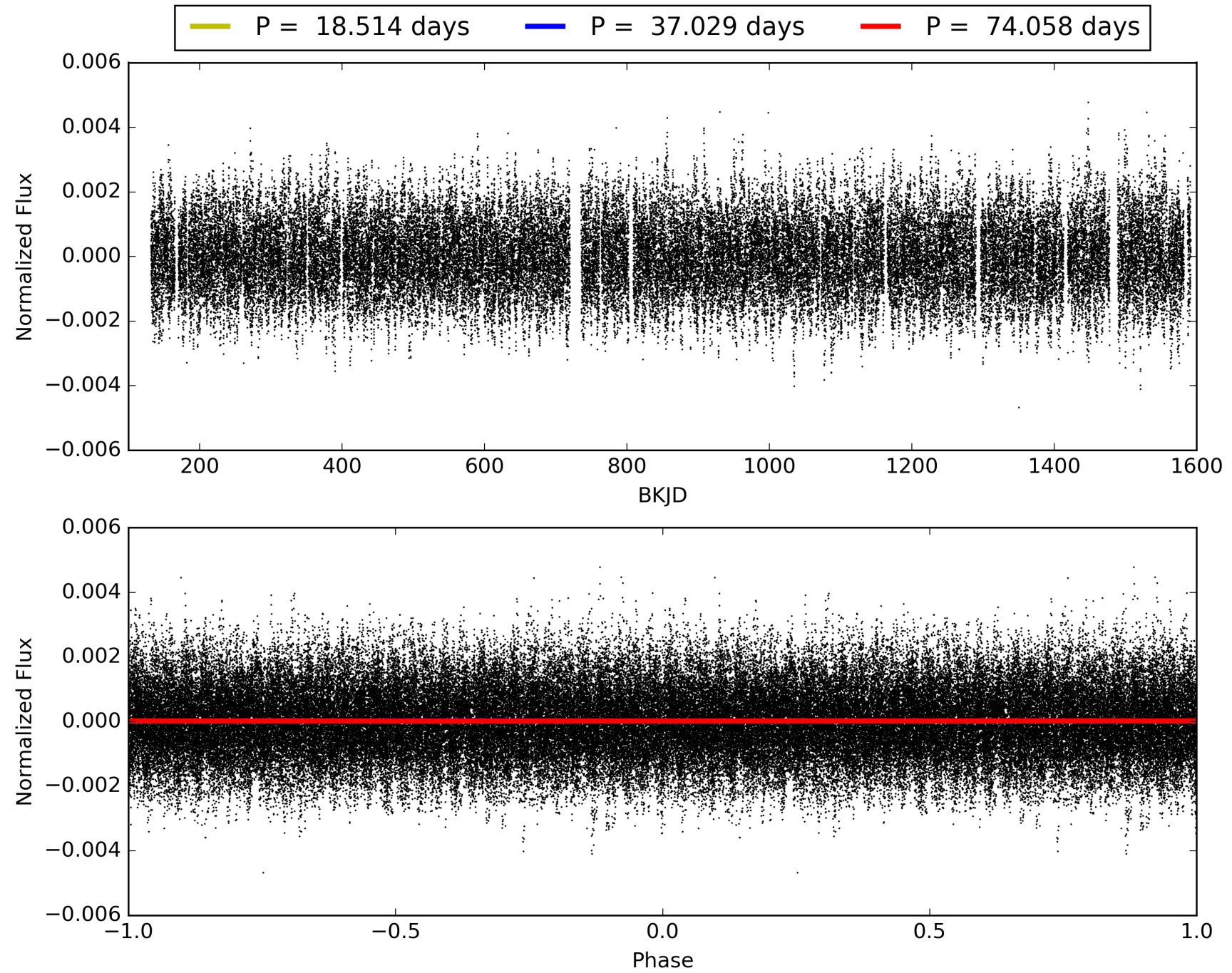
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center



# TCE 008588031-06, PDC Light Curves

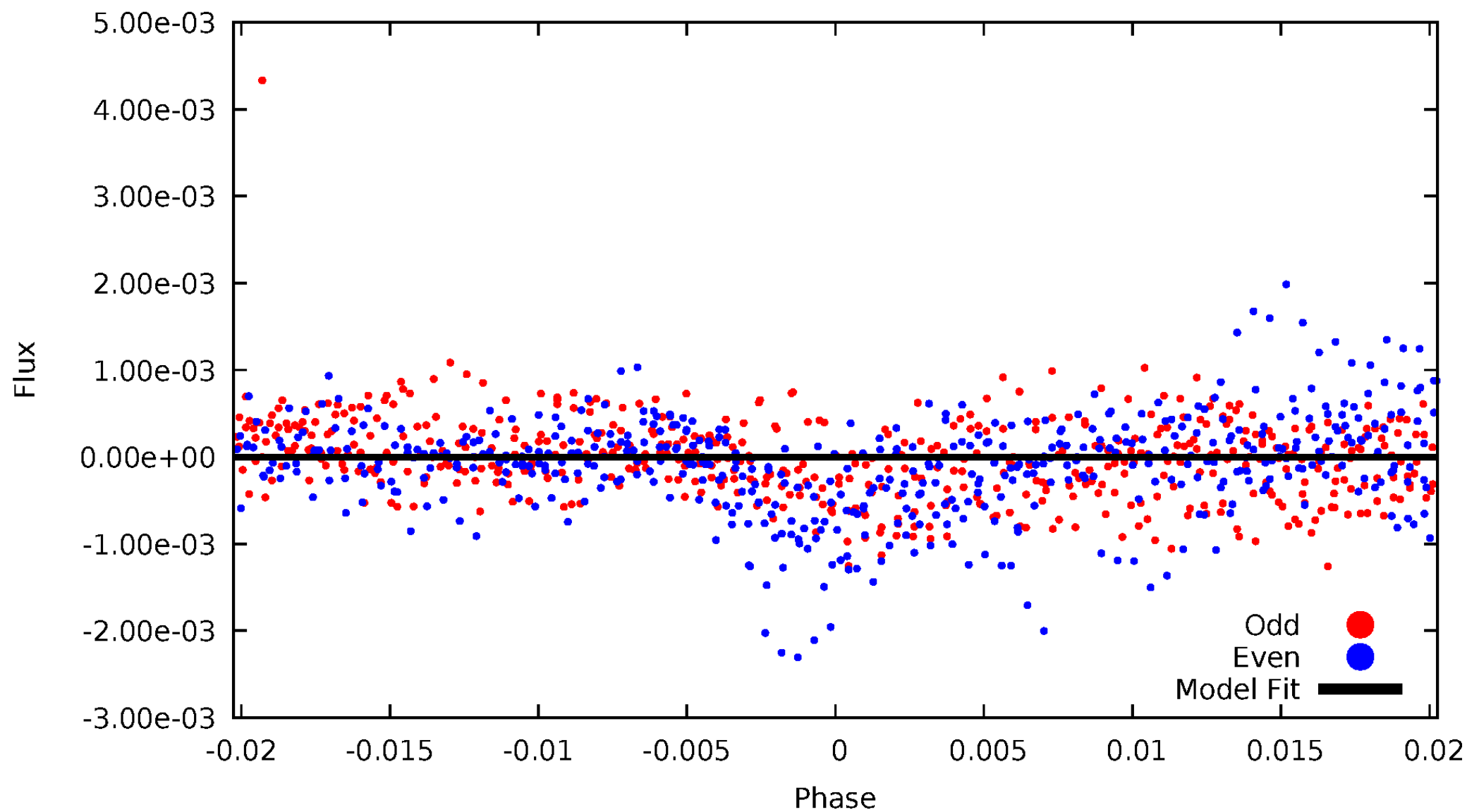


TCE 008588031-06



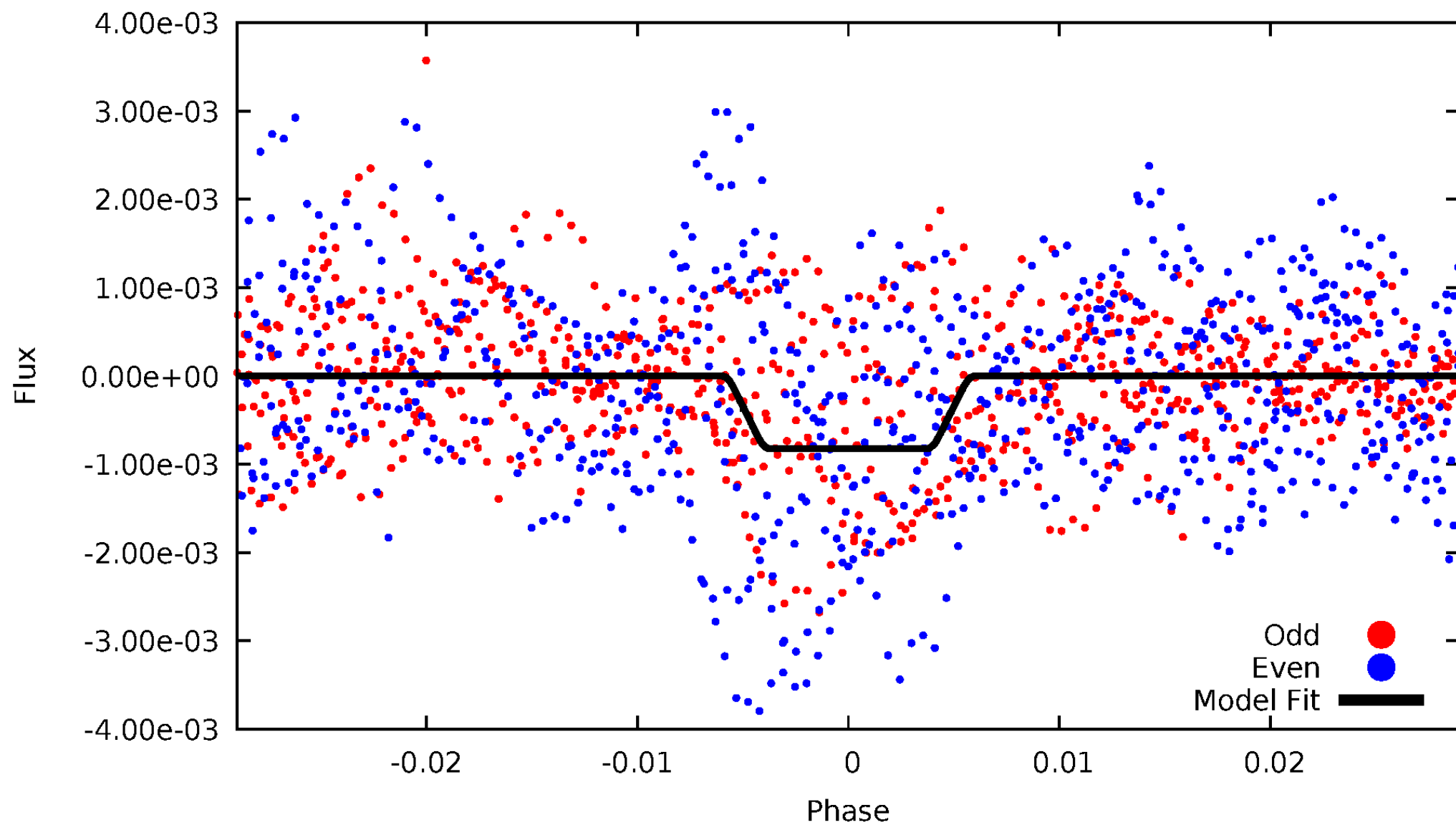
# DV Odd/Even

TCE 008588031-06



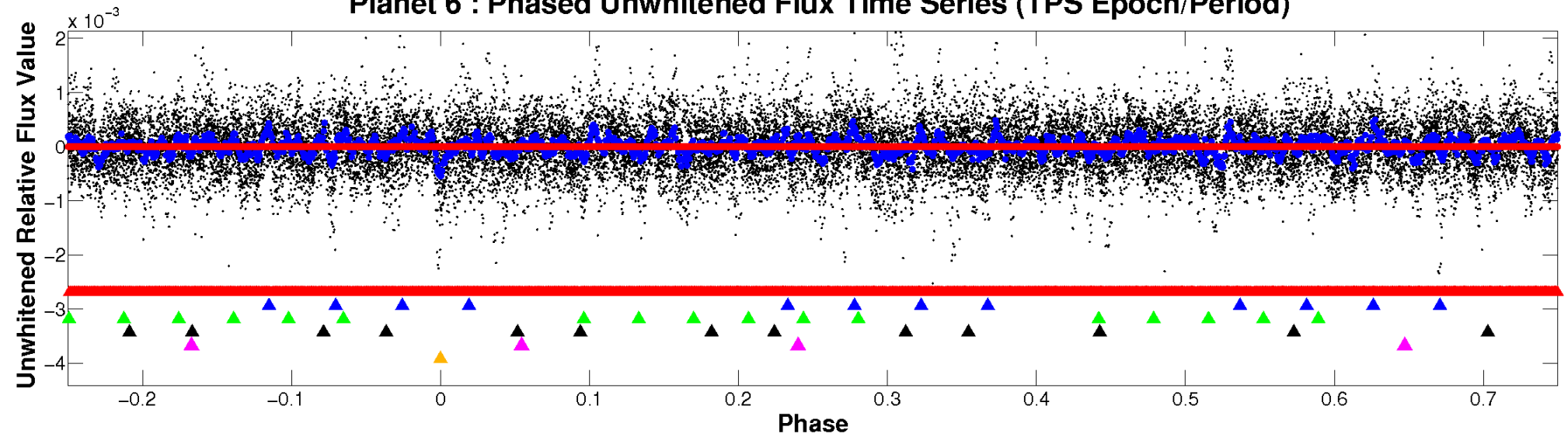
# ALT Odd/Even

TCE 008588031-06

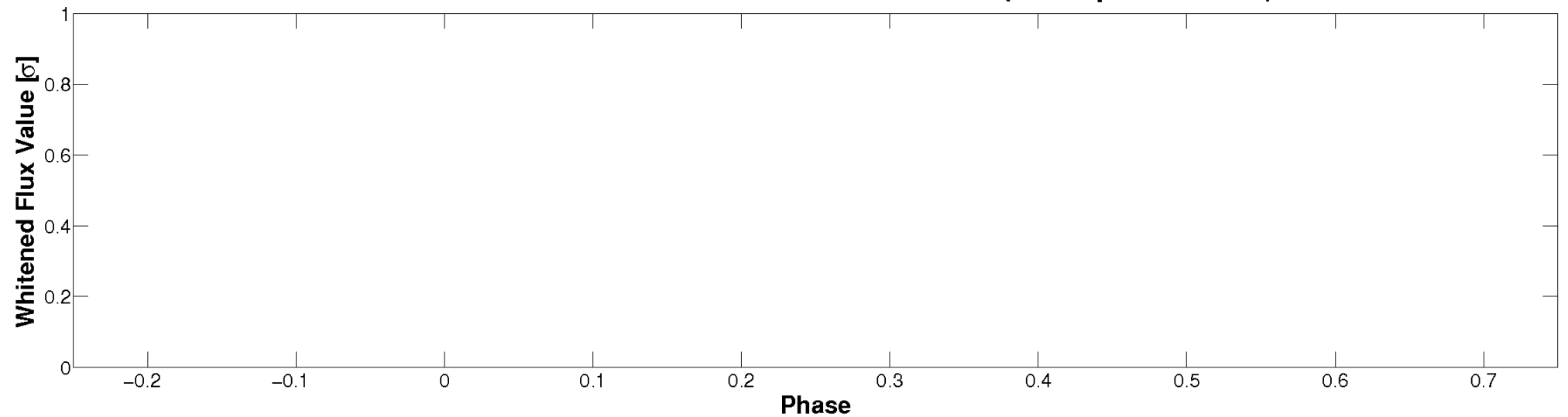


# Non-Whitened Vs. Whitened Light Curve

**Planet 6 : Phased Unwhitened Flux Time Series (TPS Epoch/Period)**

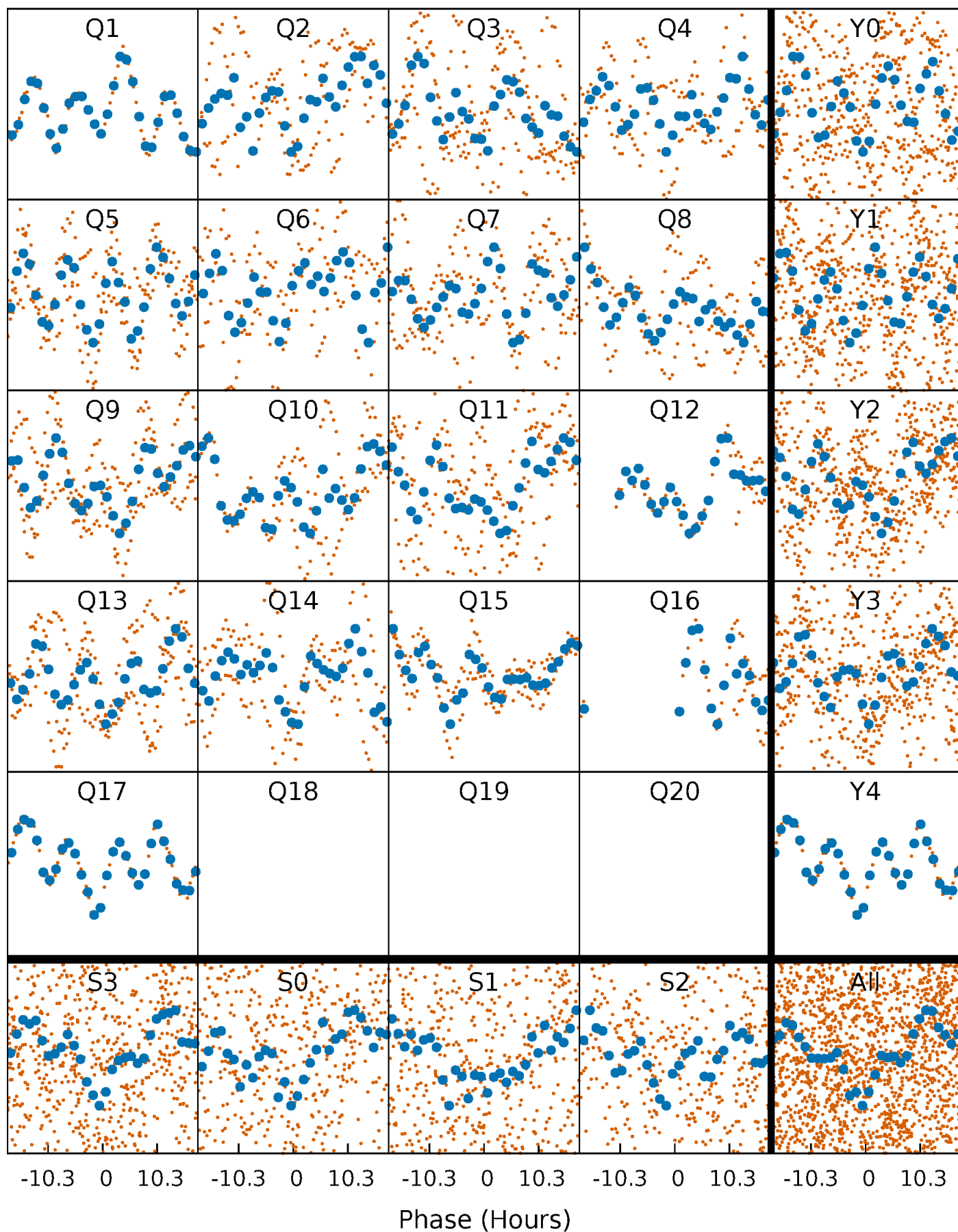


**Planet 6 : Phased Whitened Flux Time Series (TPS Epoch/Period)**



# PDC Quarter-Phased Transit Curves

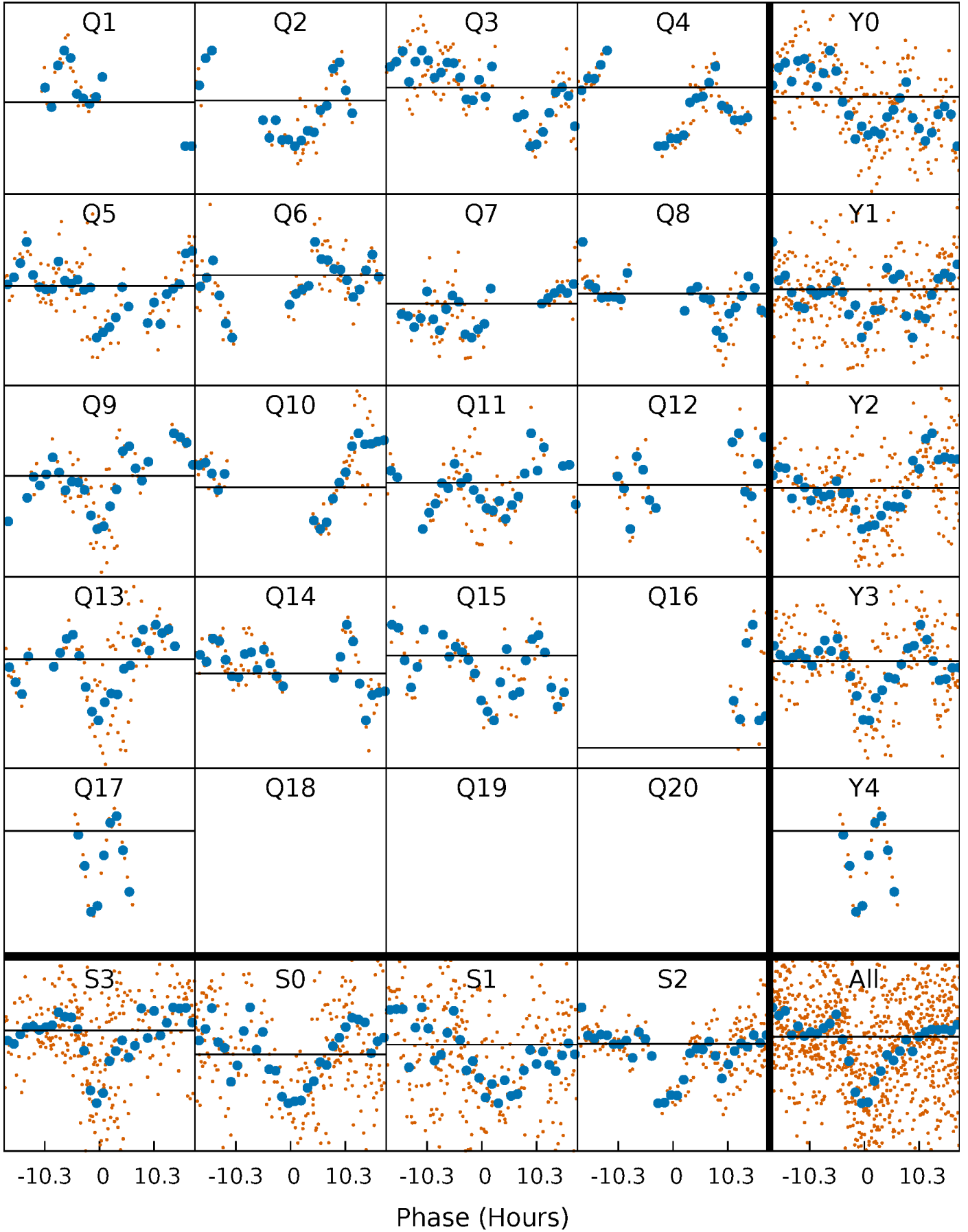
TCE 008588031-06   P= 37.028934 Days    $T_0=155.605567$  (BKJD)





# DV Quarter-Phased Transit Curves

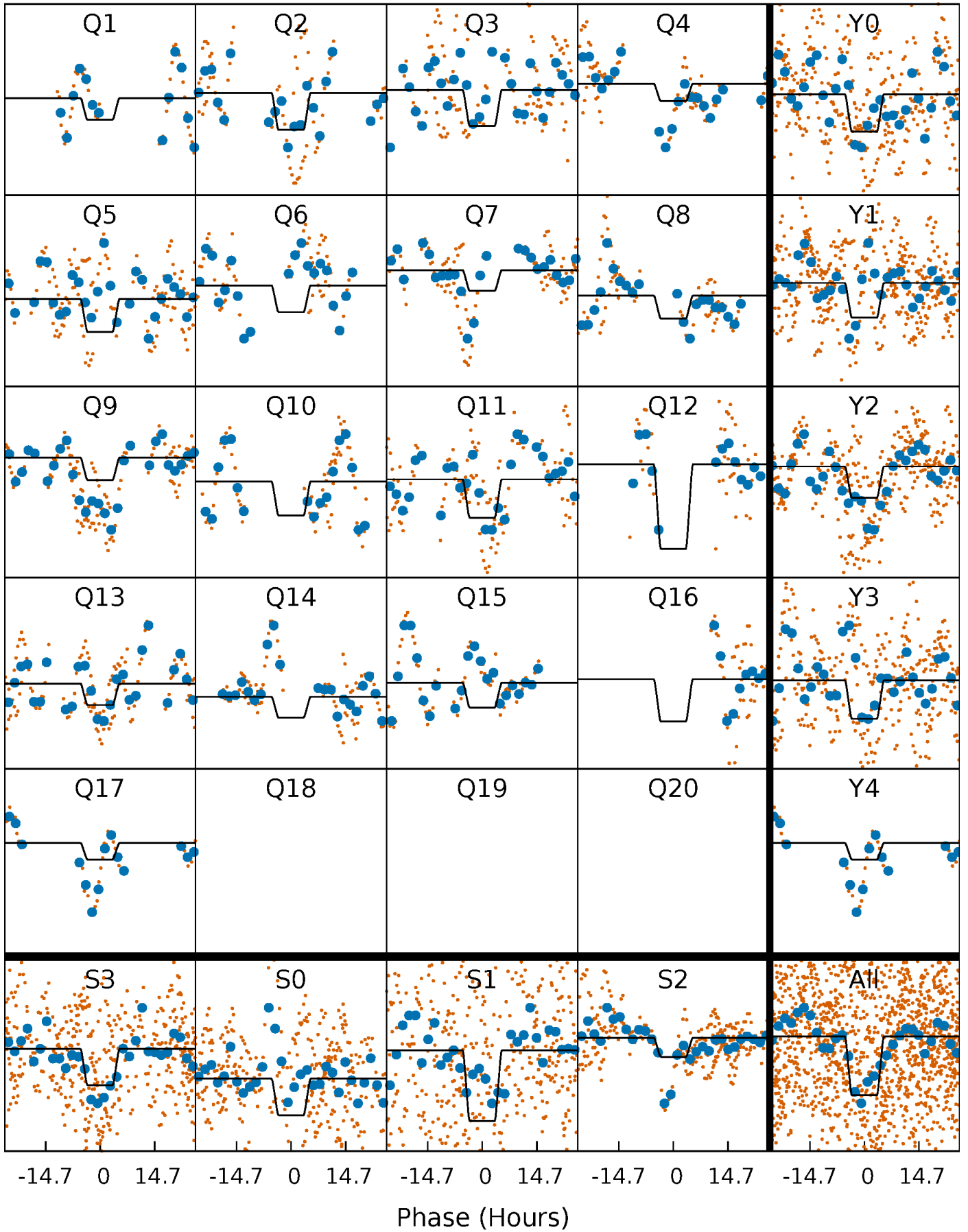
TCE 008588031-06     $P = 37.028934$  Days     $T_0 = 155.605567$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

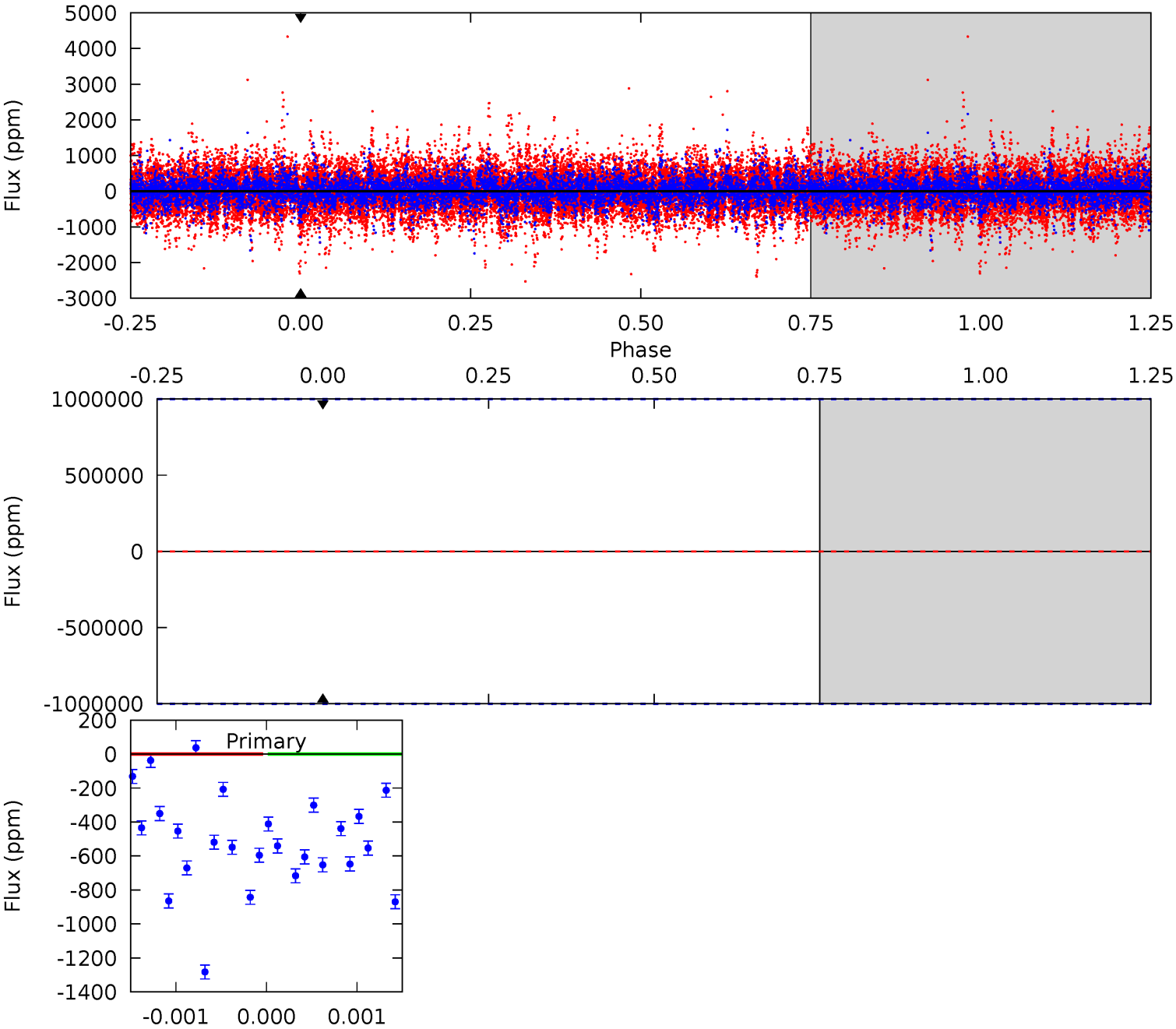
TCE 008588031-06 P= 37.028934 Days  $T_0=155.632355$  (BKJD)



# DV Model-Shift Uniqueness Test

008588031-06, P = 37.028934 Days, E = 118.576633 Days

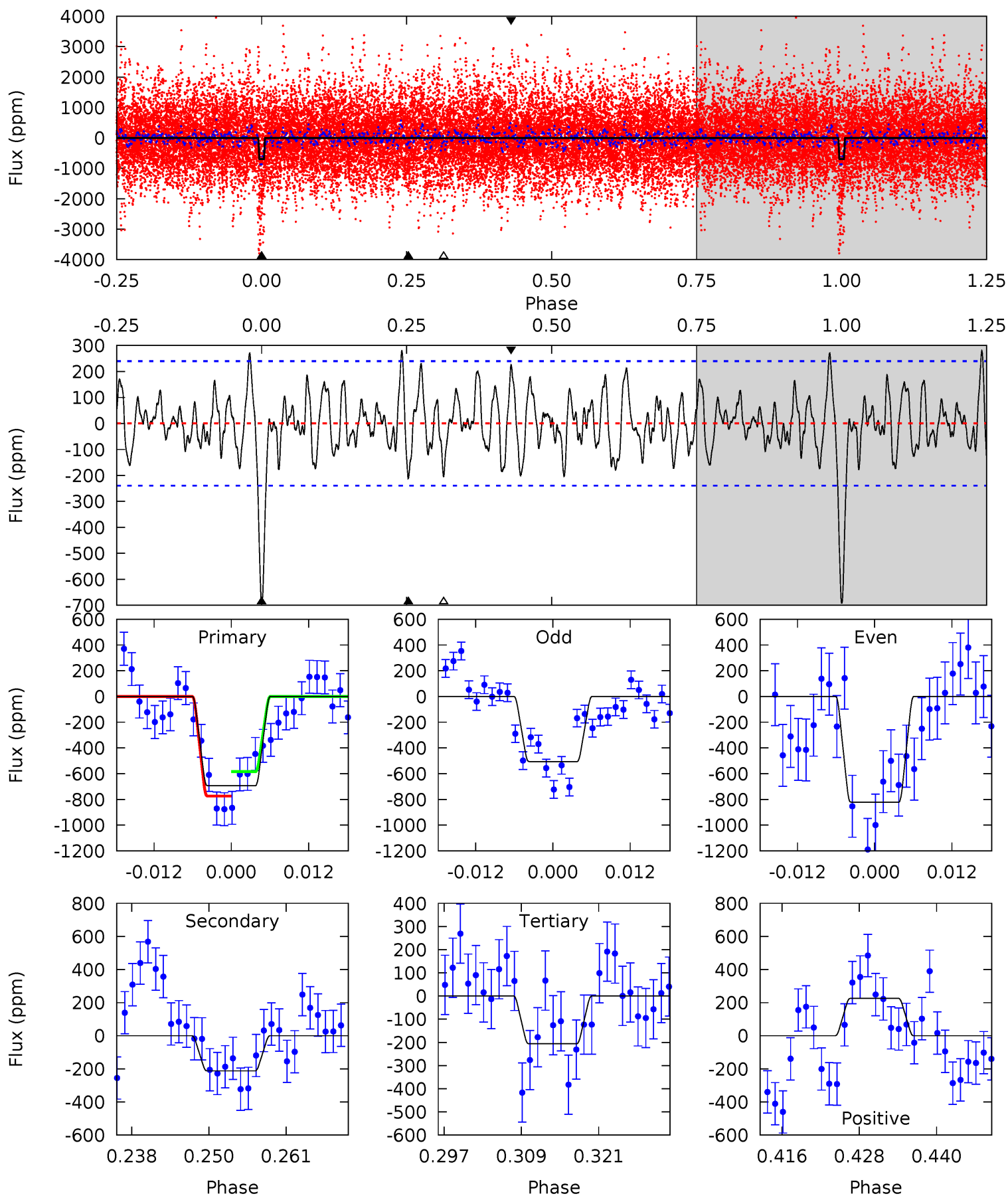
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
0	0	0	0	1.00	1.00	1.00	0	0	0	0	0	0	0	0



# Alt Model-Shift Uniqueness Test

008588031-06, P = 37.028934 Days, E = 118.603421 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
14.4	4.43	4.29	4.70	4.99	2.52	1.88	10.2	9.74	0.14	-0.27	3.27	0.94	0.29	1.98



### Stellar Parameters For KIC 008588031

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$6573^{+175}_{-214}$	$4.126^{+0.214}_{-0.175}$	$-0.240^{+0.250}_{-0.300}$	$1.545^{+0.463}_{-0.421}$	$1.162^{+0.209}_{-0.157}$	$0.444^{+0.544}_{-0.214}$
	+3%/-3%	+5%/-4%	+104%/-125%	+30%/-27%	+18%/-14%	+123%/-48%
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 008588031-06 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$0 \pm 1000000$	$12.02^{+13.67}_{-8.50}$	$1052^{+80}_{-81}$	$5367^{+24668}_{-34981}$	$468^{+36414}_{-35347}$
Alt.	$-212 \pm 48$	$12.66^{+13.12}_{-8.61}$	$1042^{+82}_{-75}$	$3370^{+1782}_{-617}$	$39^{+344}_{-30}$

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

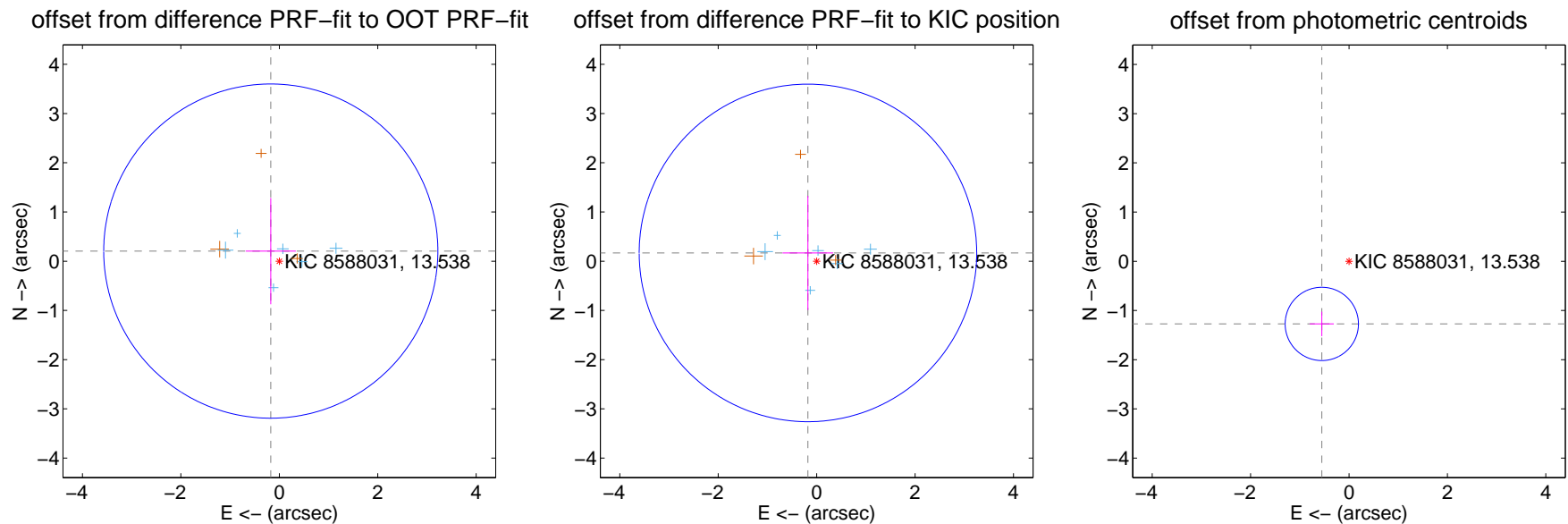
## DV Centroid Data

Supplemental centroid analysis for 008588031-06. Kepler magnitude: 13.54. Transit SNR -1.00

There are 6 quarters with good PRF difference image offsets

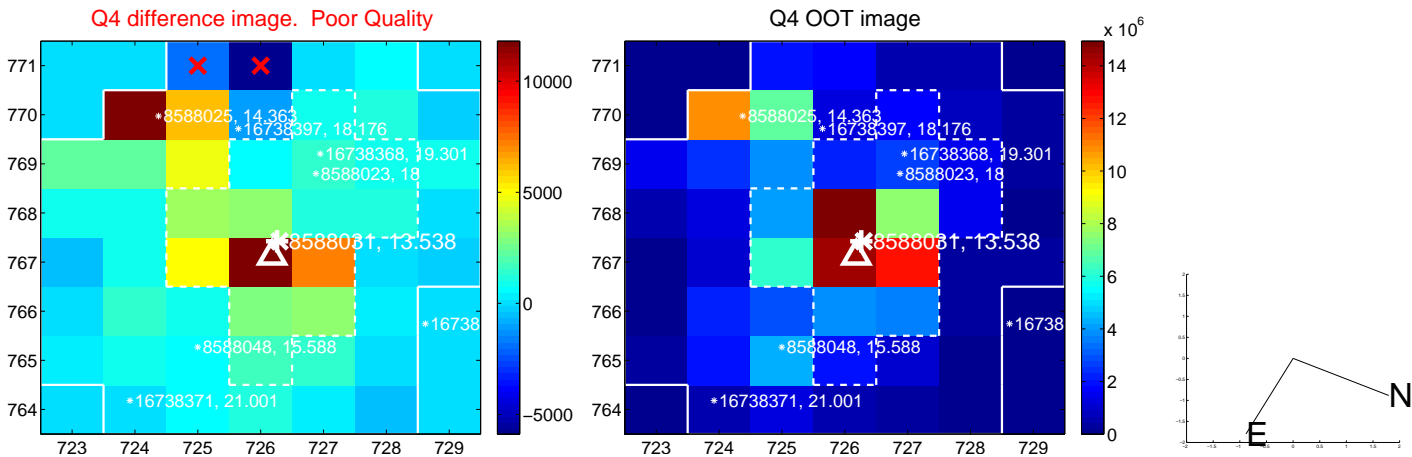
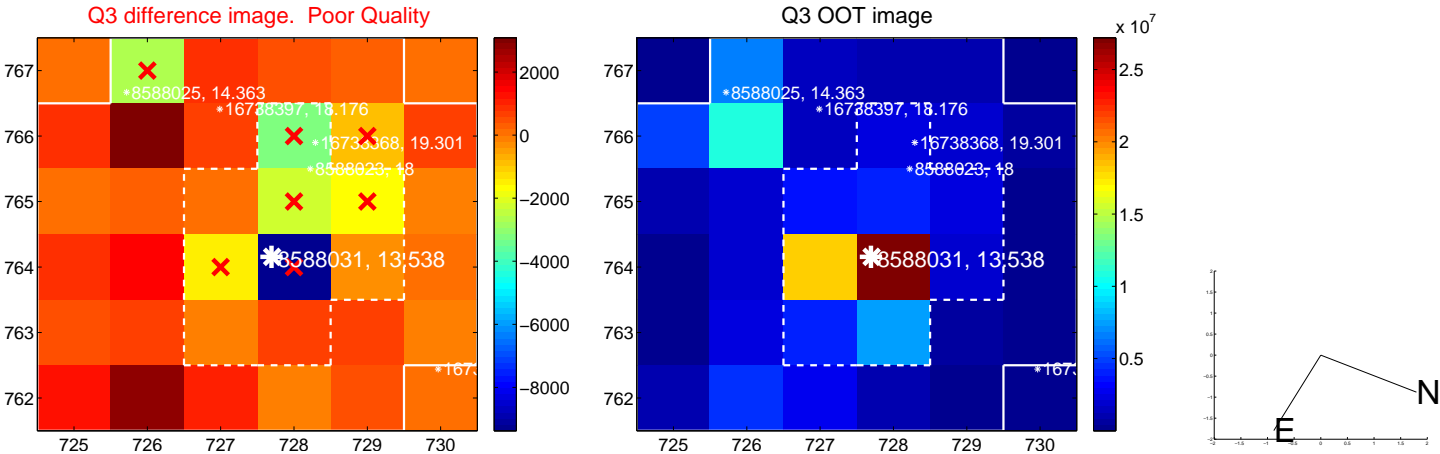
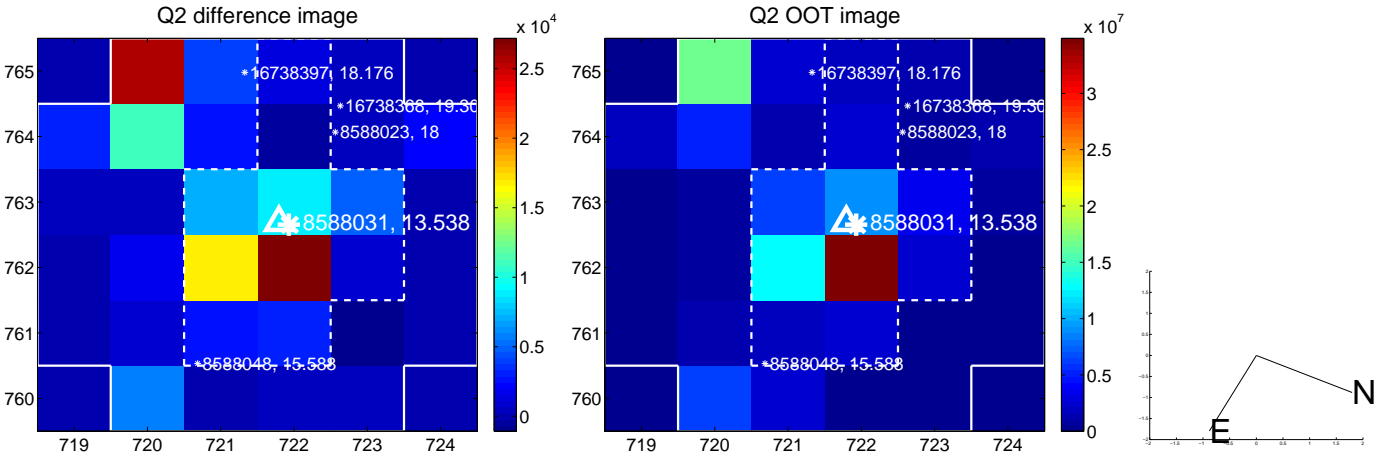
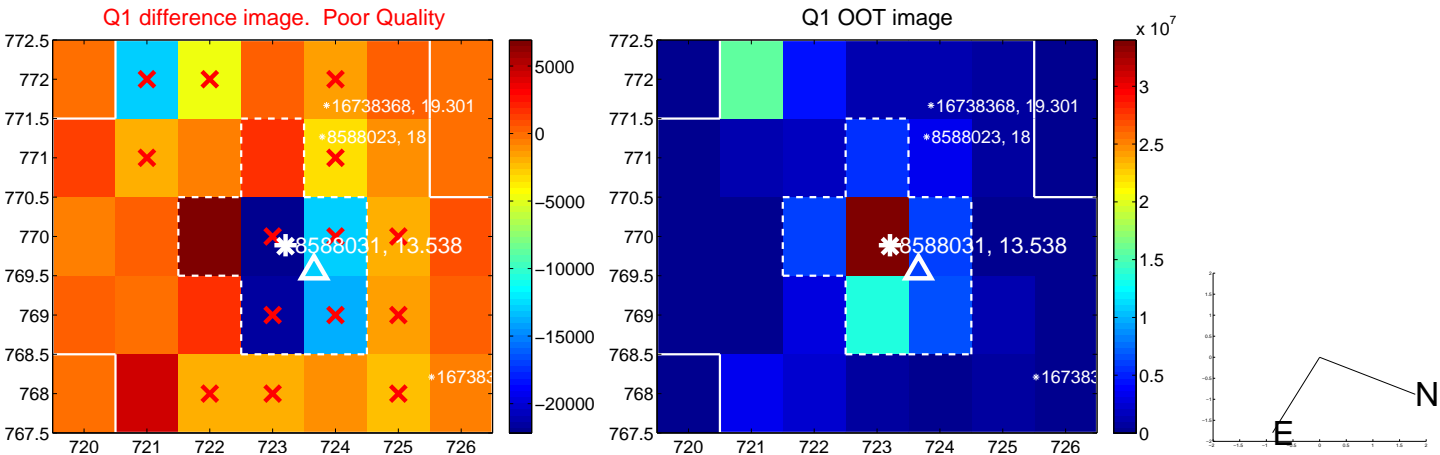
The direct PRF centroid is offset from the target star catalog position by about 0.04 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.269 \pm 1.132$	0.24	$0.173 \pm 0.510$	$0.205 \pm 1.080$
PRF-fit source offset from KIC position	$0.244 \pm 1.143$	0.21	$0.177 \pm 0.516$	$0.168 \pm 1.158$
photometric centroid source offset	$1.39 \pm 0.25$	5.59	$0.55 \pm 0.24$	$-1.27 \pm 0.25$

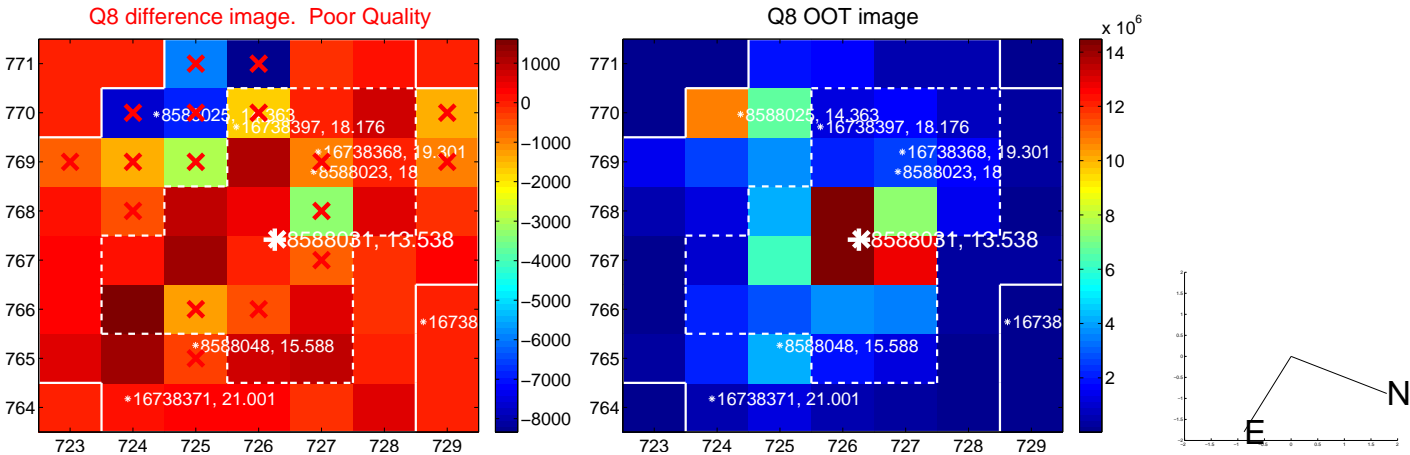
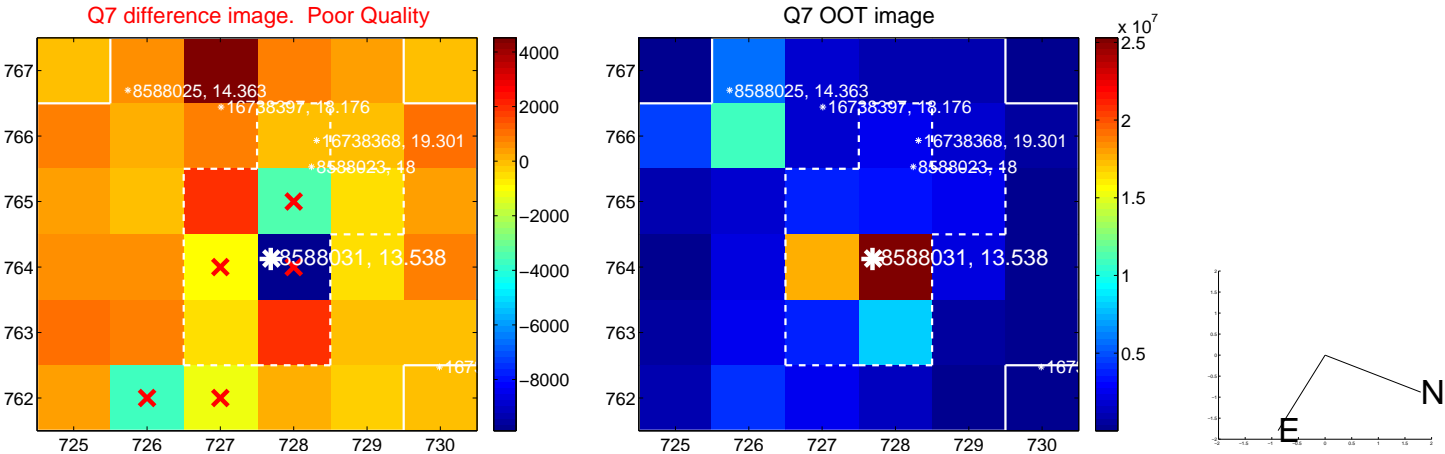
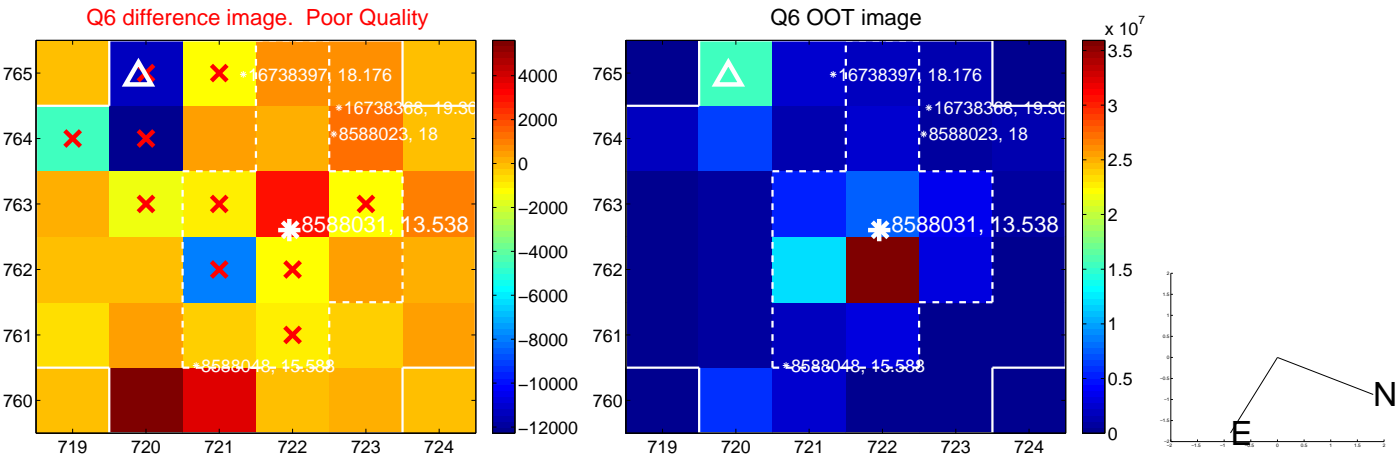
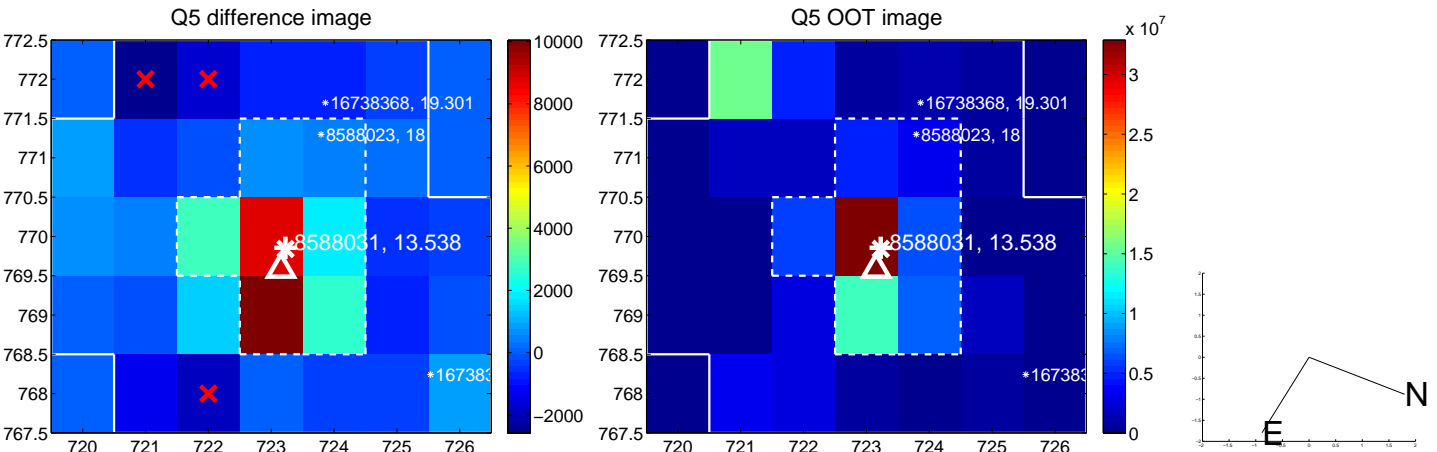


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

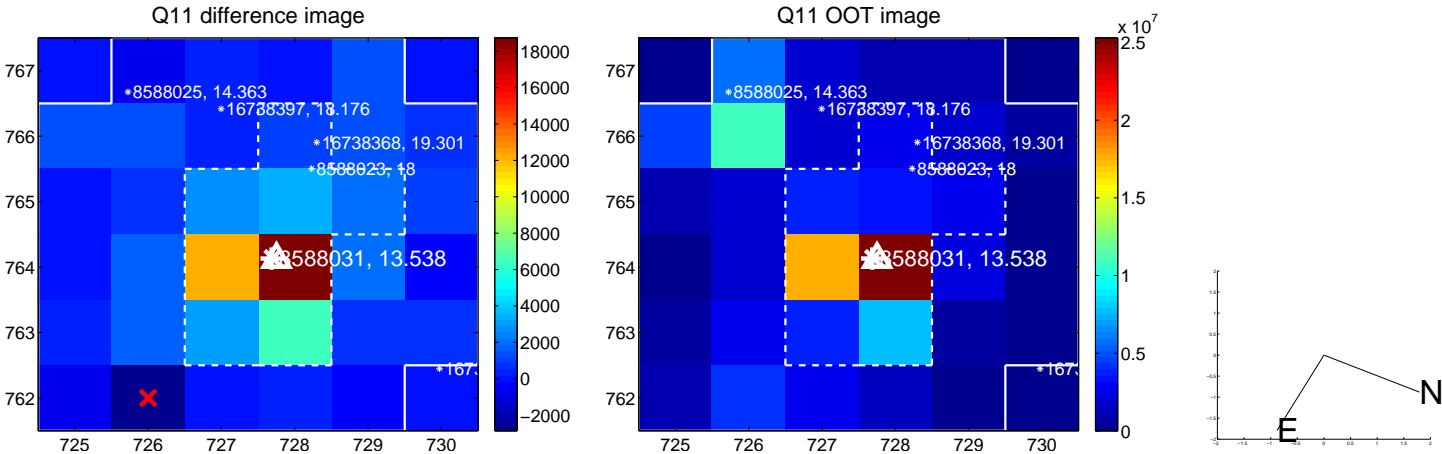
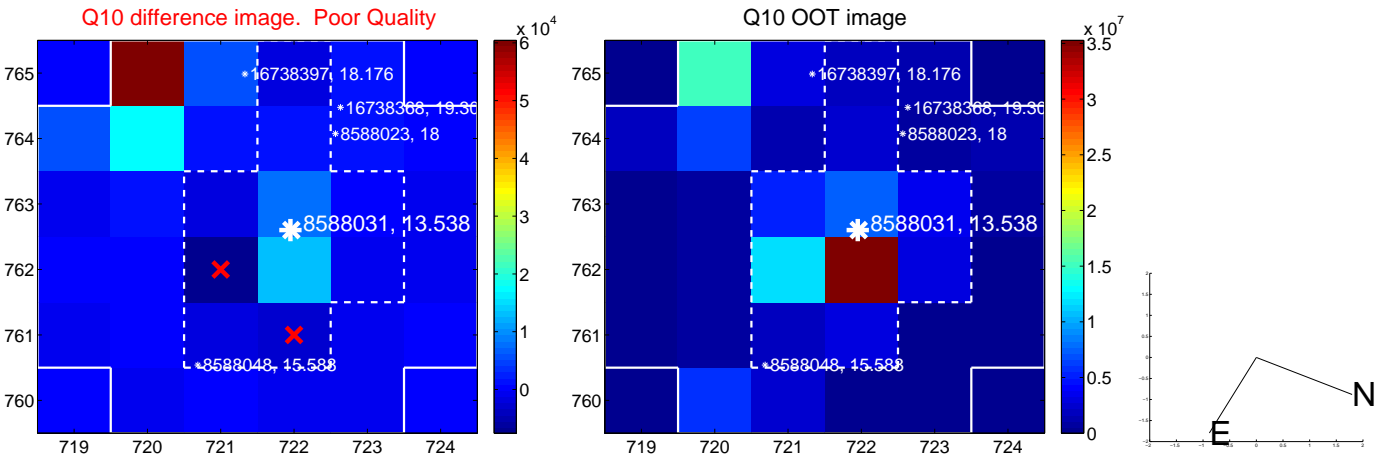
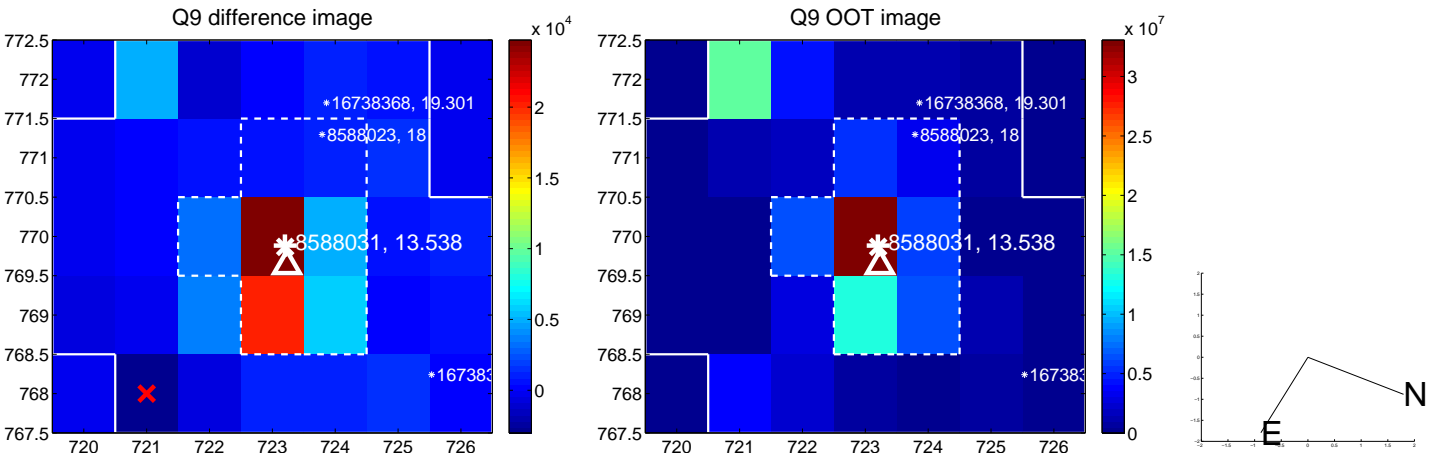


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.





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.

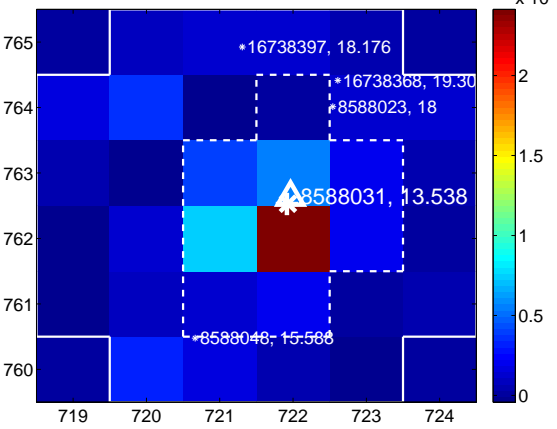
Q13 no difference image



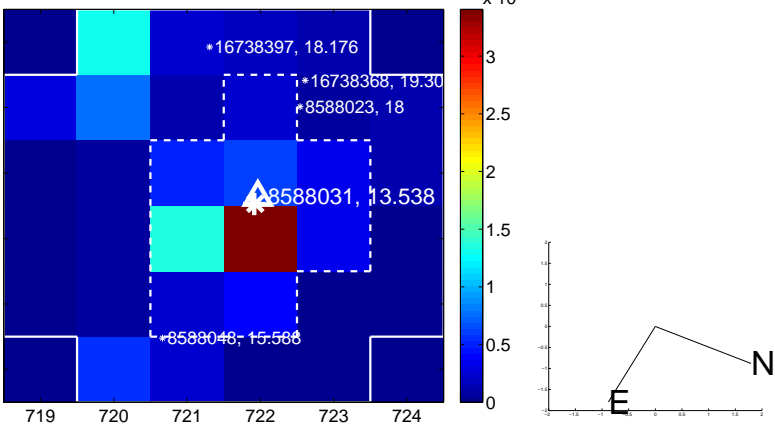
Q13 no OOT image



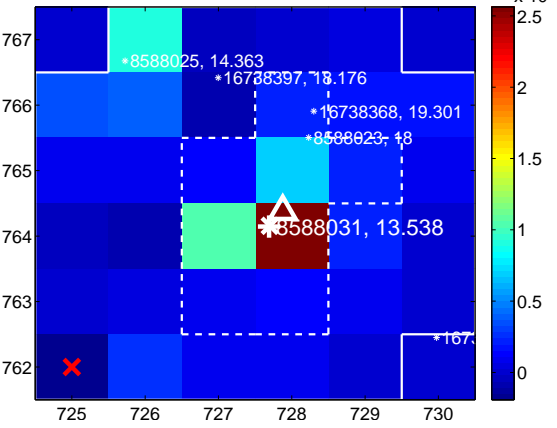
Q14 difference image



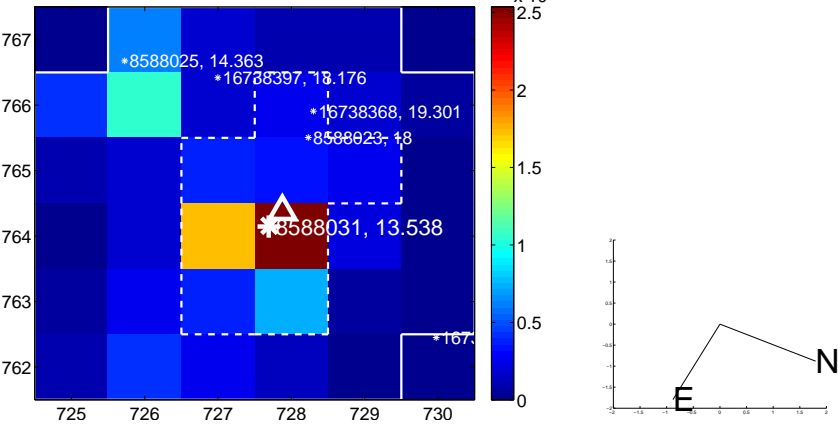
Q14 OOT image



Q15 difference image



Q15 OOT image



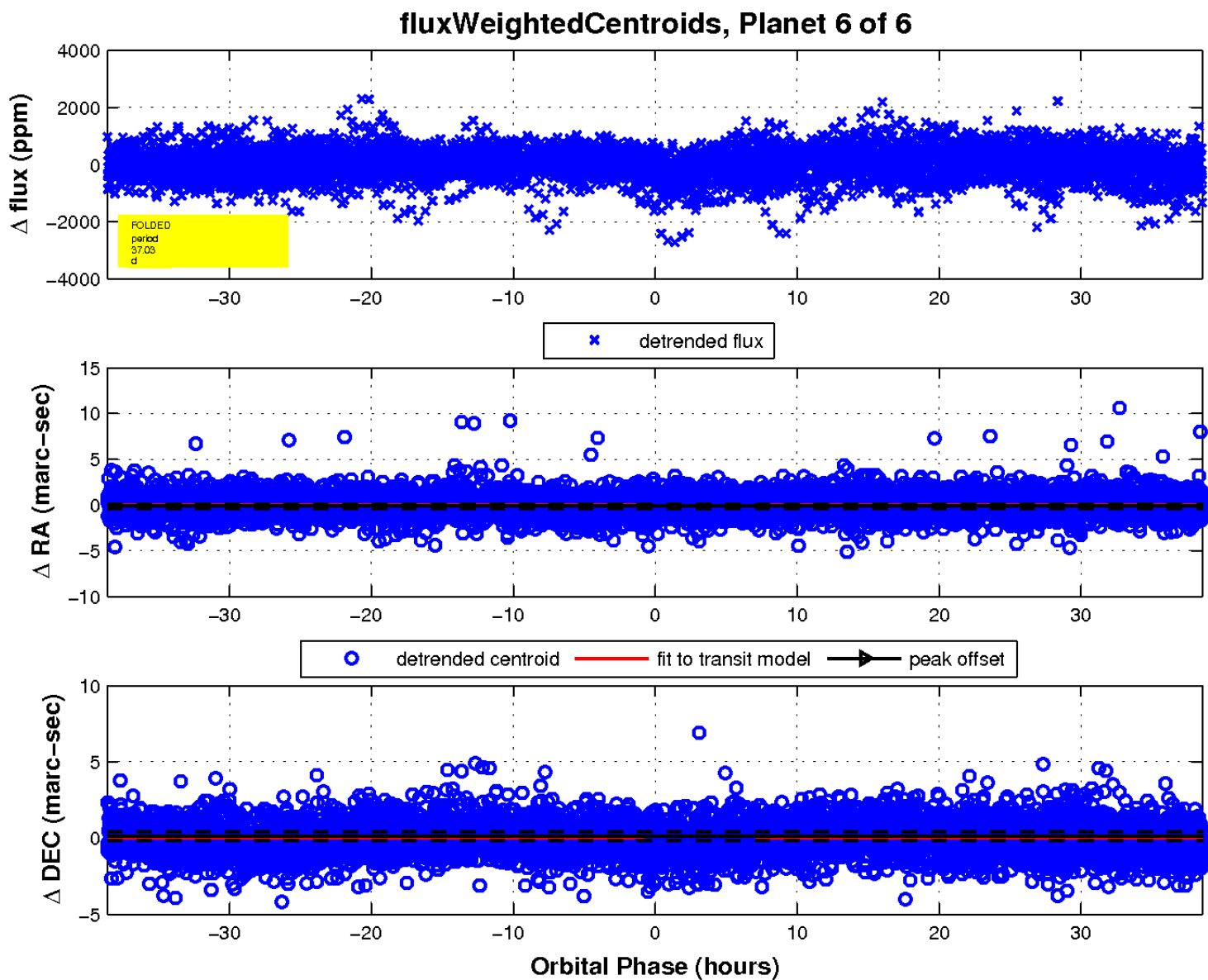
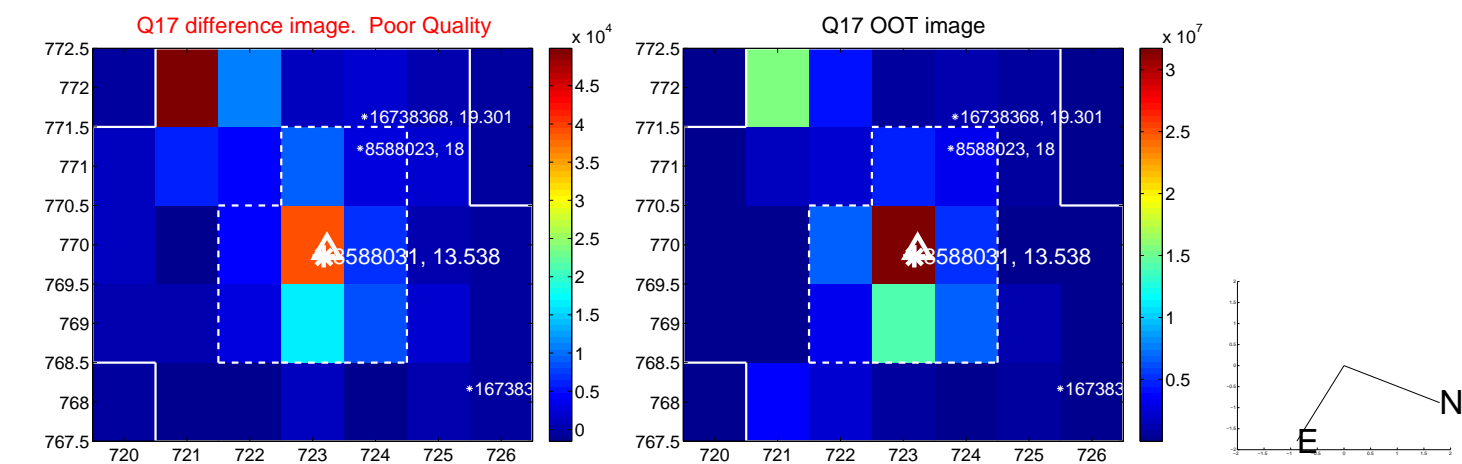
Q16 no difference image



Q16 no OOT image



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



UKIRT Image

Declination

