

# KIC 007840502

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
007840502-01	OBS	No	1.587481	131.719564	5.0	10.521	7.9	4.9	1.96	5927	0.45	5200.56
007840502-02	OBS	No	77.895503	165.798364	112.7	10.860	10.8	8.2	1.96	5927	2.35	28.95
007840502-03	OBS	No	80.123112	154.337574	92.0	19.477	10.4	8.6	1.96	5927	2.13	27.88
007840502-04	OBS	No	53.276778	144.153876	70.9	6.760	8.8	7.2	1.96	5927	1.96	48.04

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
007840502-01	OBS	FP	0.00	1	0	1	0	LPP_DV—MOD_NONUNIQ_ALT—CENT_RESOLVED_OFFSET
007840502-02	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE_SKYE—TRANS_GAPPED—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS—HALO_GHOST
007840502-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
007840502-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—CENT_FEW_MEAS

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

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

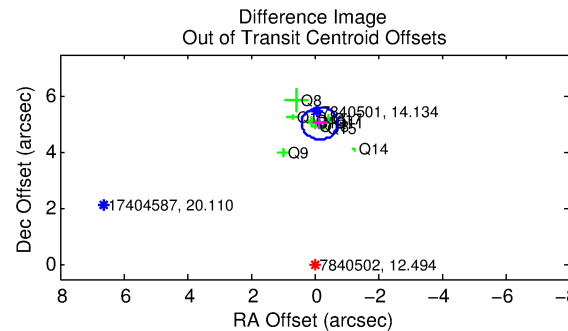
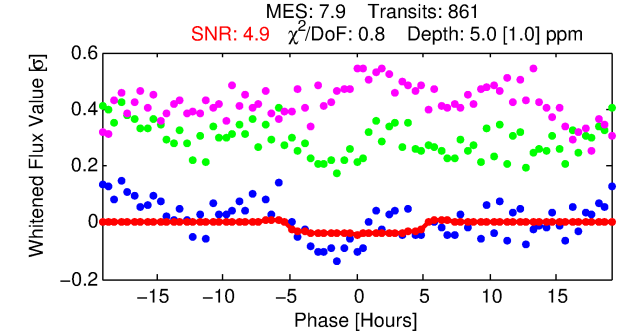
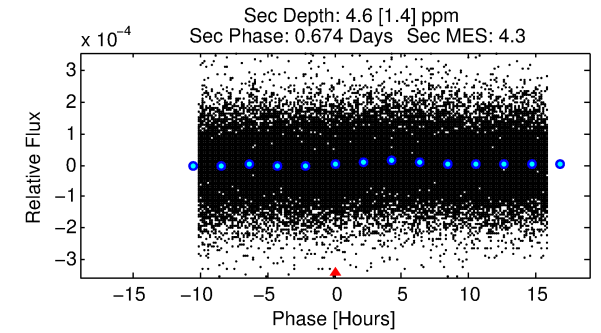
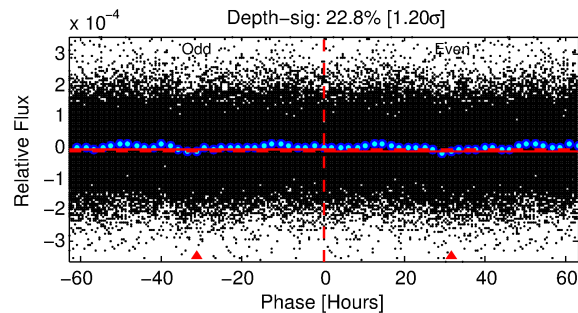
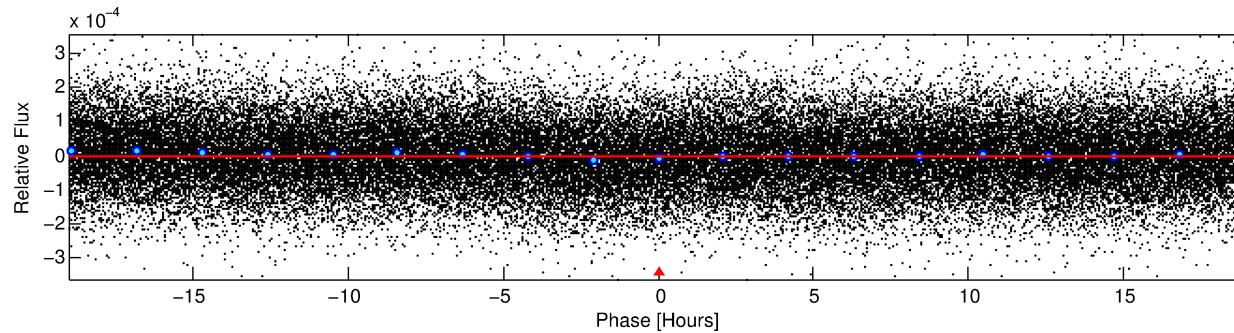
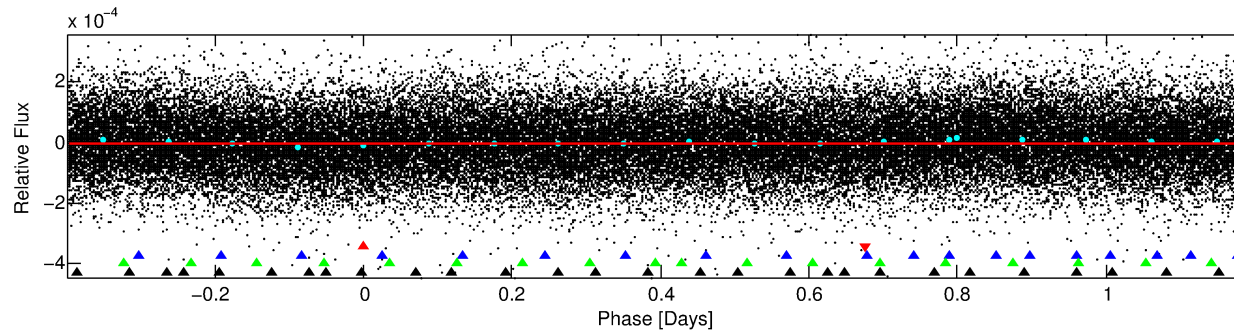
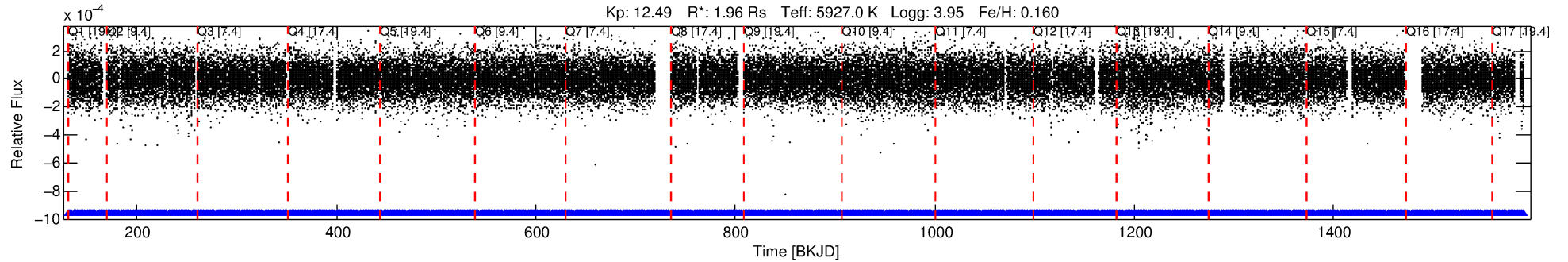
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 007840502-01

No Significant Match Found

# DV One-Page Summary

KIC: 7840502 Candidate: 1 of 4 Period: 1.587 d



## DV Fit Results:

Period = 1.58748 [0.00006] d  
Epoch = 131.7196 [0.0177] BKJD  
Rp/R\* = 0.0021 [0.0019]  
a/R\* = 1.24 [1.75]  
b = 0.50 [6.04]  
Seff = 5200.56 [3544.47]  
Teq = 2165 [369] K  
Rp = 0.45 [0.45] Re  
a = 0.0286 [0.0122] AU  
Ag = 10.09 [19.26] [0.47 $\sigma$ ]  
Teffp = 5967 [2671] K [1.41 $\sigma$ ]

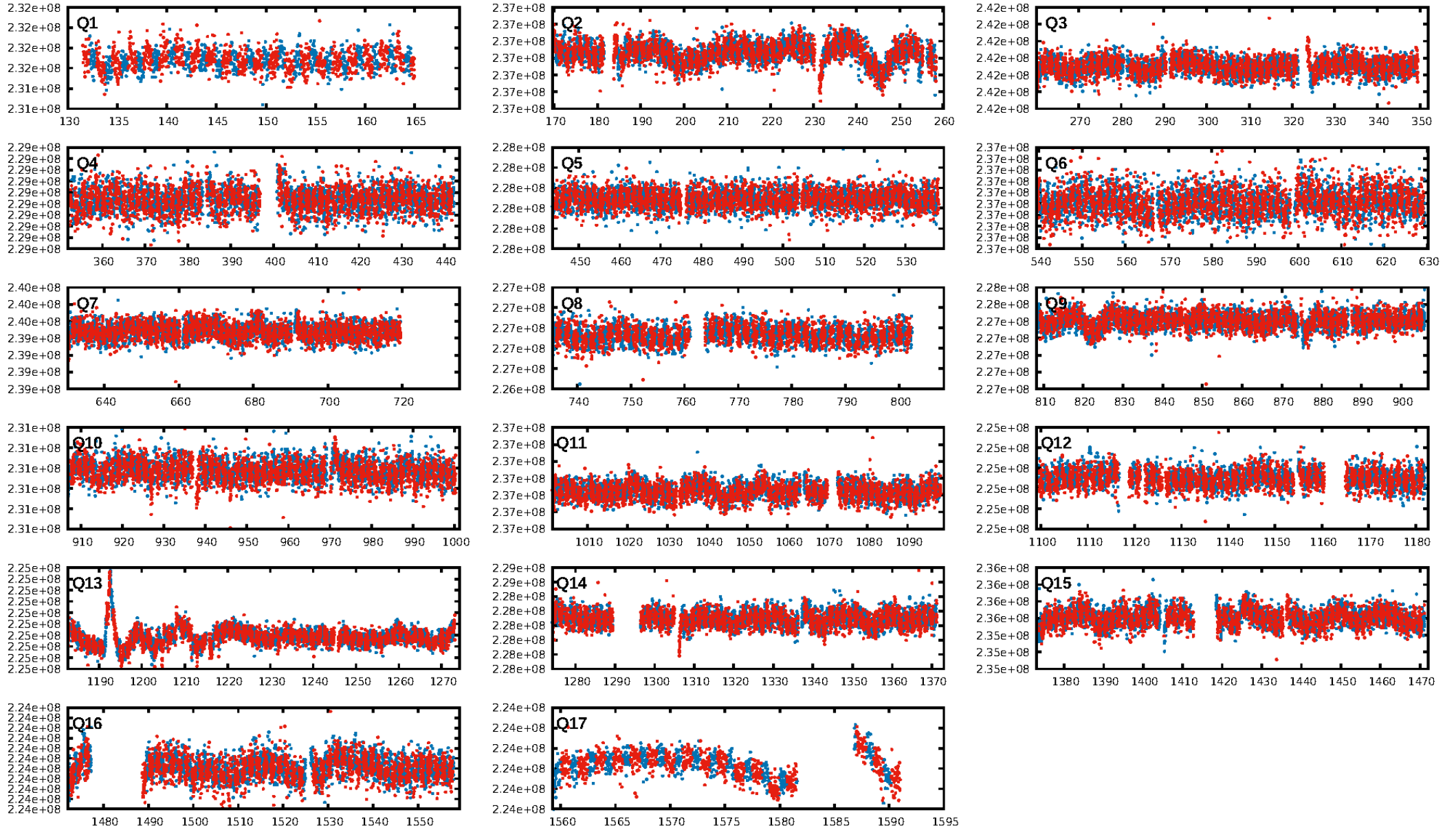
## DV Diagnostic Results:

ShortPeriod-sig: N/A  
LongPeriod-sig: 100.0% [99.20 $\sigma$ ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: 1.23e-13  
RollingBand-fgt: 1.00 [822/822]  
GhostDiagnostic-chr: -0.3135  
Centroid-sig: N/A  
Centroid-so: 11.384 arcsec [5.64 $\sigma$ ]  
OotOffset-rm: 5.039 arcsec [26.64 $\sigma$ ]  
KicOffset-rm: 5.560 arcsec [34.96 $\sigma$ ]  
OotOffset-st: 2/2/3/3 [10]  
KicOffset-st: 2/2/3/3 [10]  
DiffImageQuality-fgm: 0.90 [9/10]  
DiffImageOverlap-fno: 1.00 [17/17]

Software Revision: svn-ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 06:56:53 Z

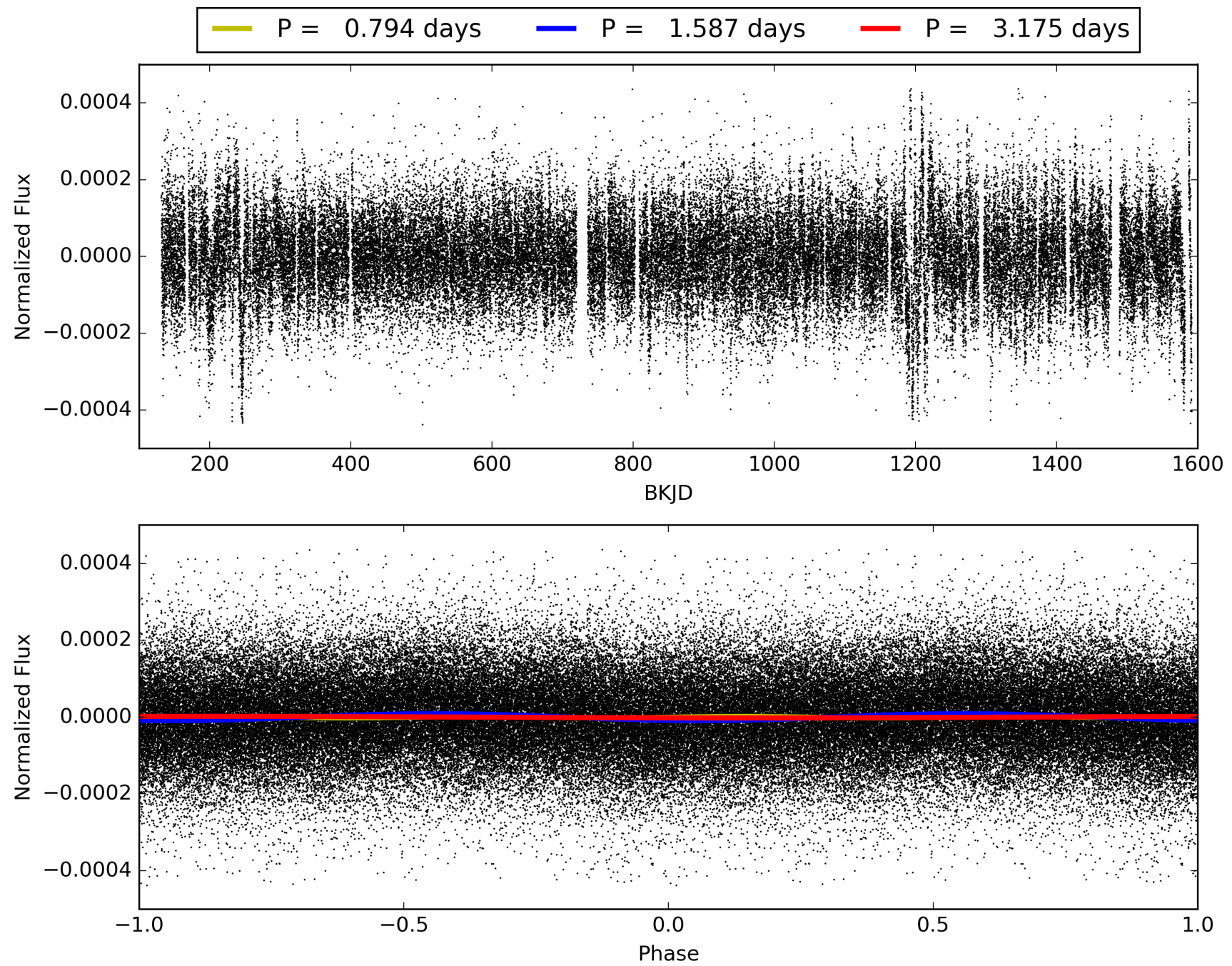
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 007840502-01, PDC Light Curves





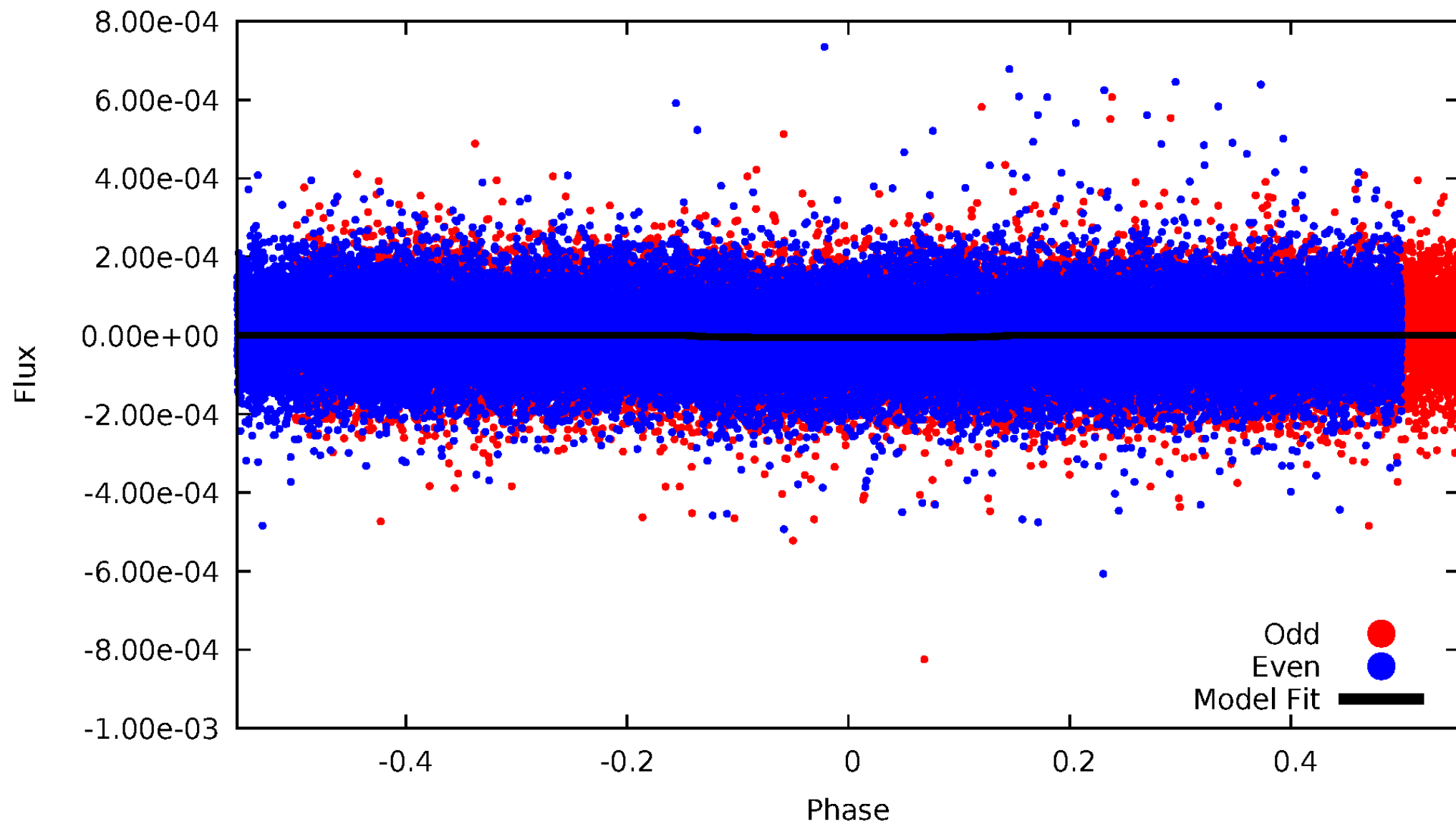
TCE 007840502-01





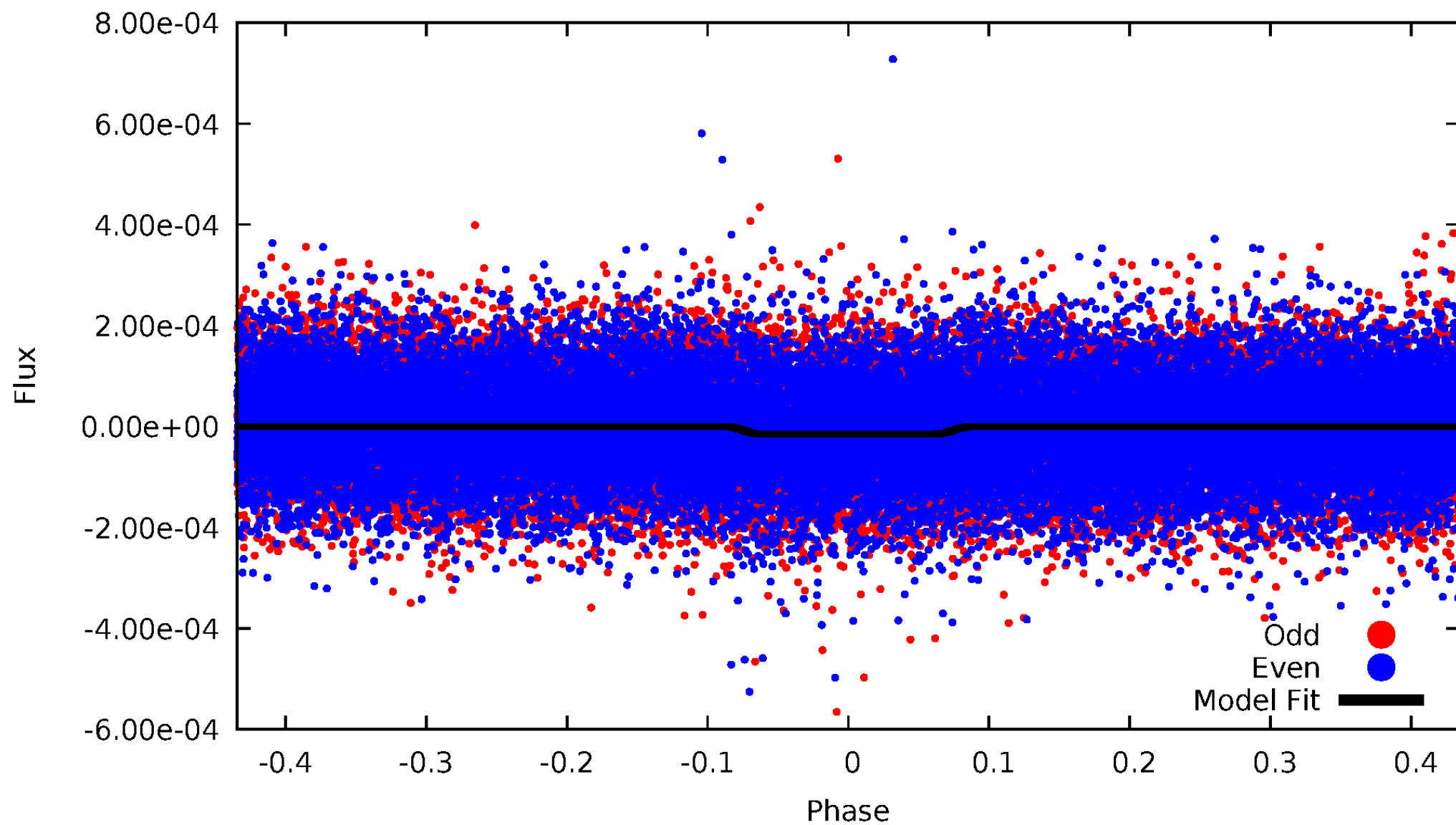
# DV Odd/Even

TCE 007840502-01

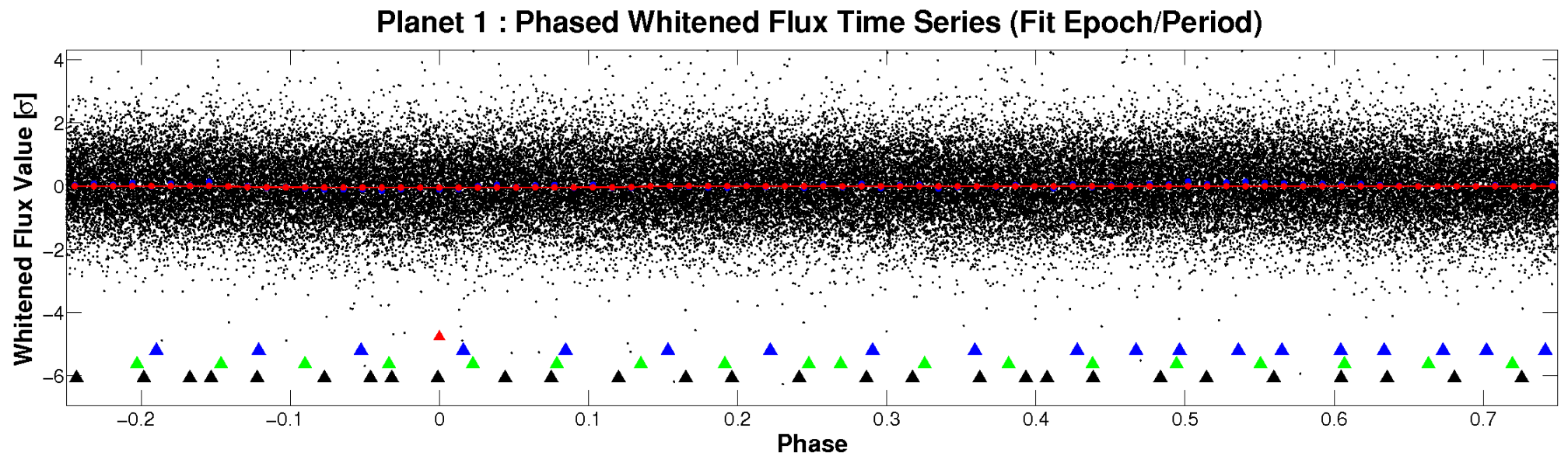
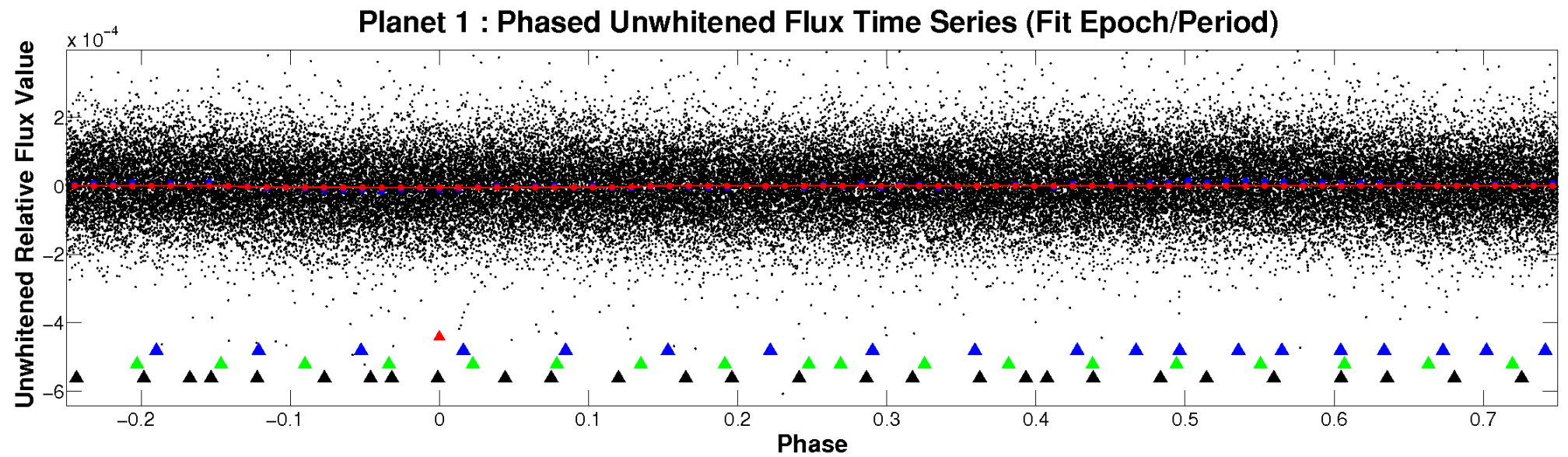


# ALT Odd/Even

TCE 007840502-01



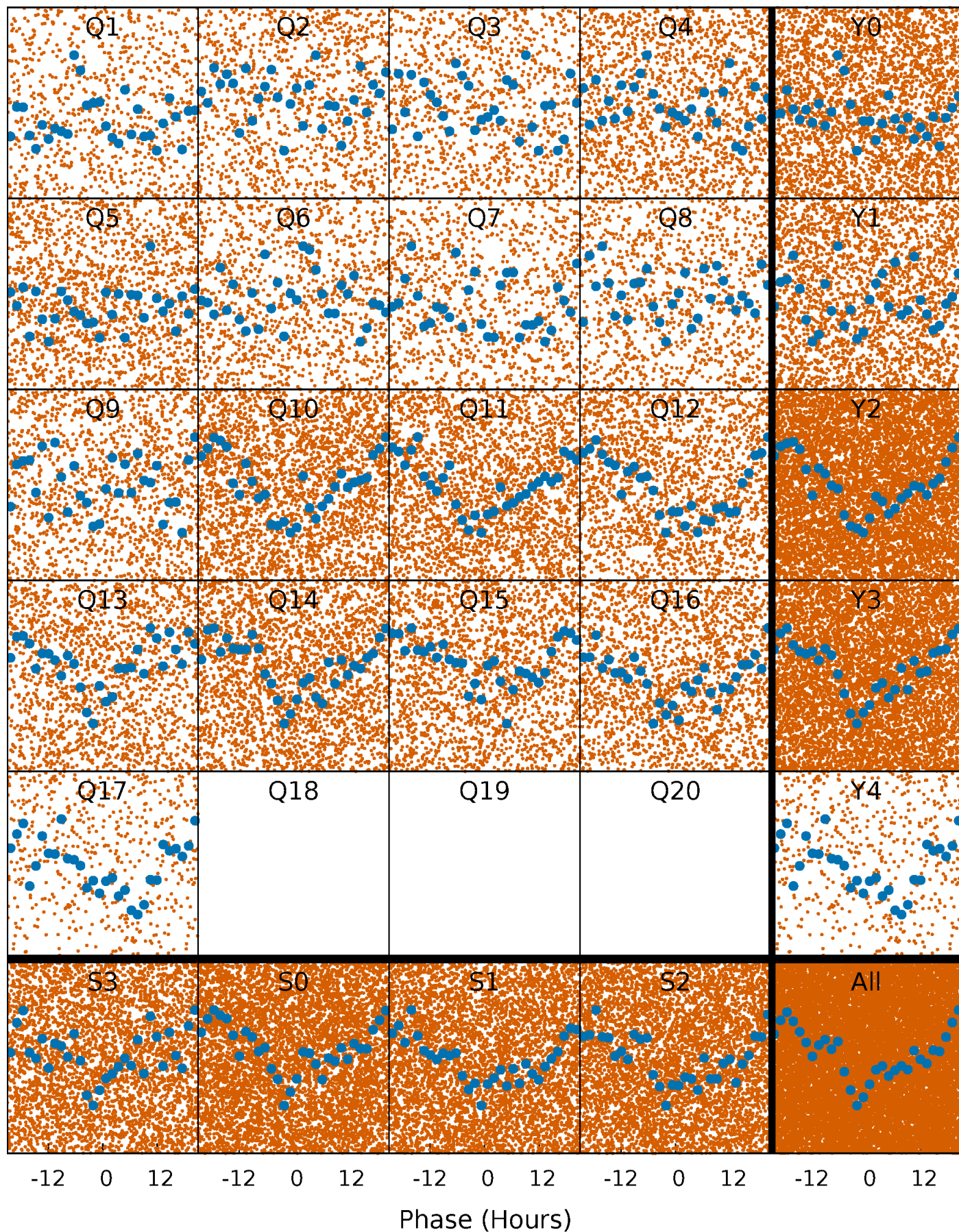
# Non-Whitened Vs. Whitened Light Curve





# PDC Quarter-Phased Transit Curves

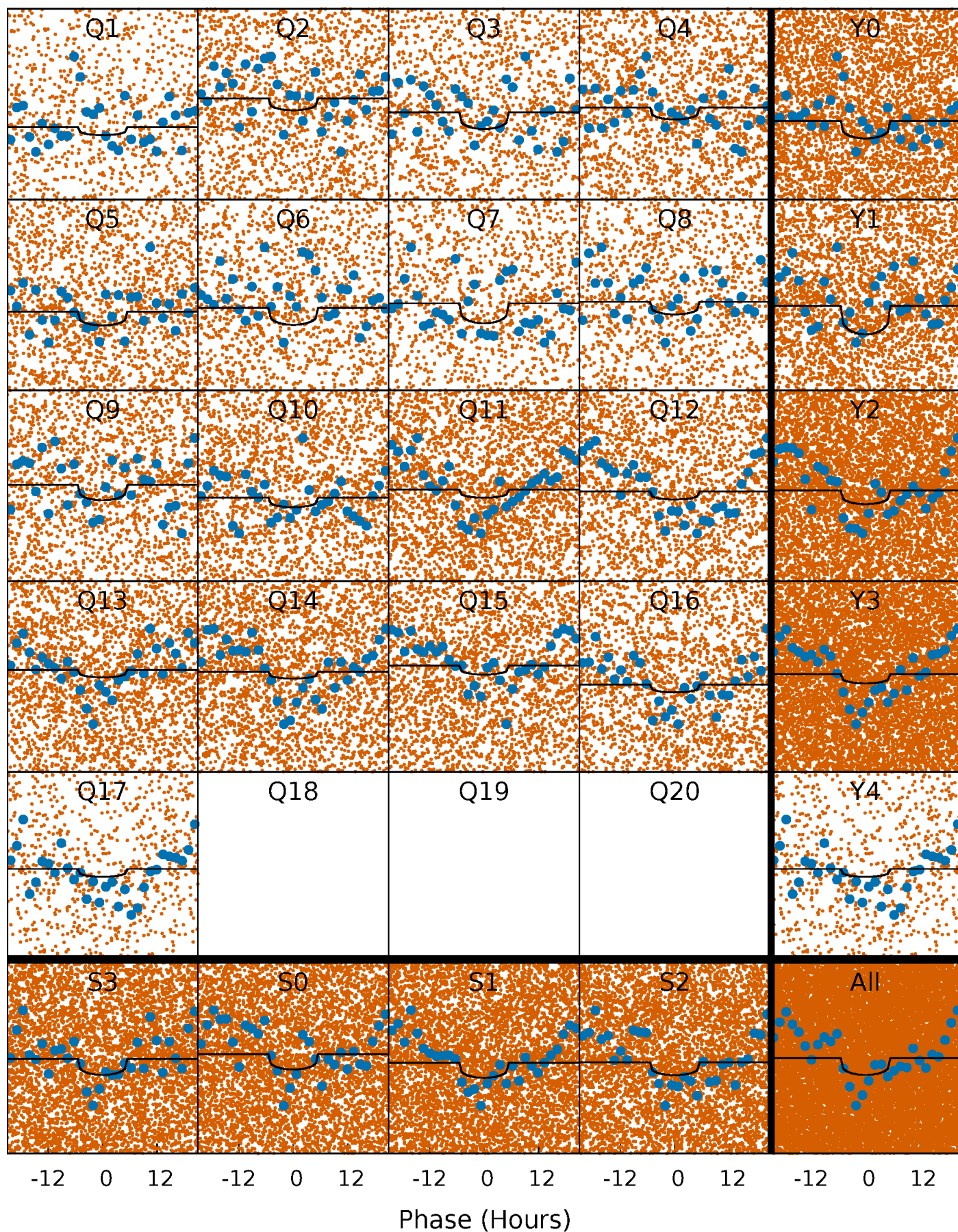
TCE 007840502-01 P= 1.587481 Days  $T_0=131.719564$  (BKJD)





# DV Quarter-Phased Transit Curves

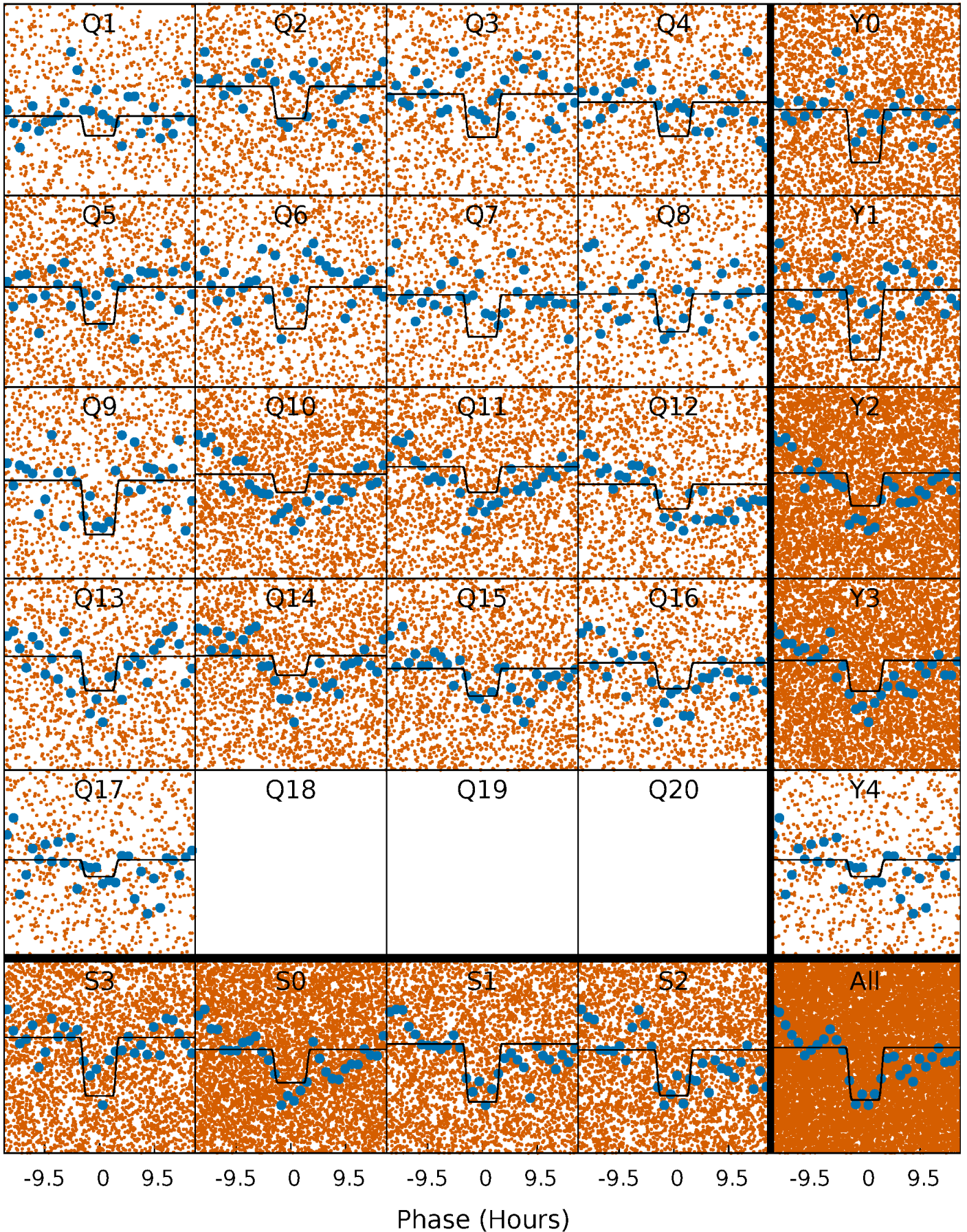
TCE 007840502-01 P= 1.587481 Days  $T_0=131.719564$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

TCE 007840502-01 P= 1.587413 Days  $T_0=131.688476$  (BKJD)

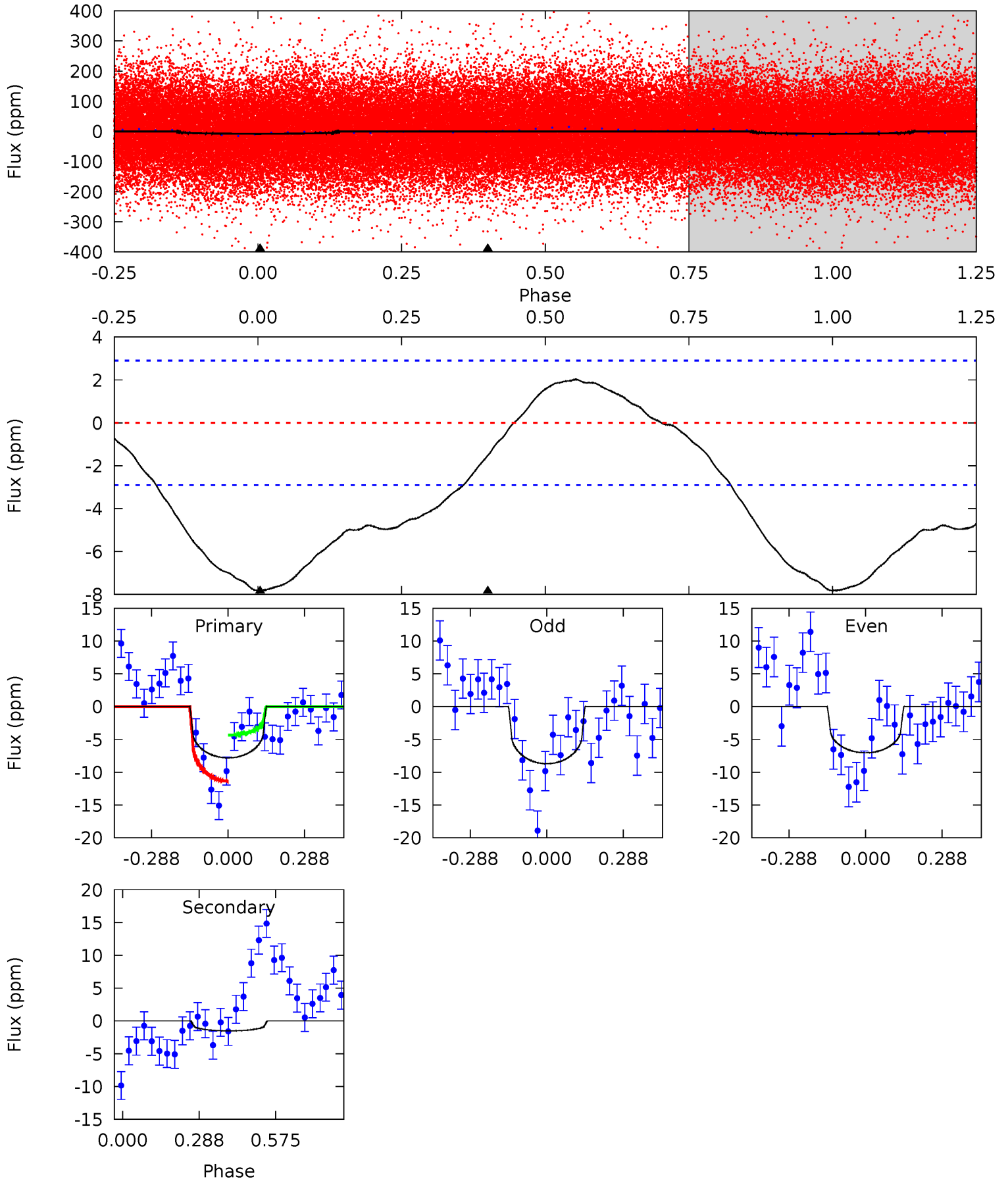




# DV Model-Shift Uniqueness Test

007840502-01, P = 1.587481 Days, E = 130.132083 Days

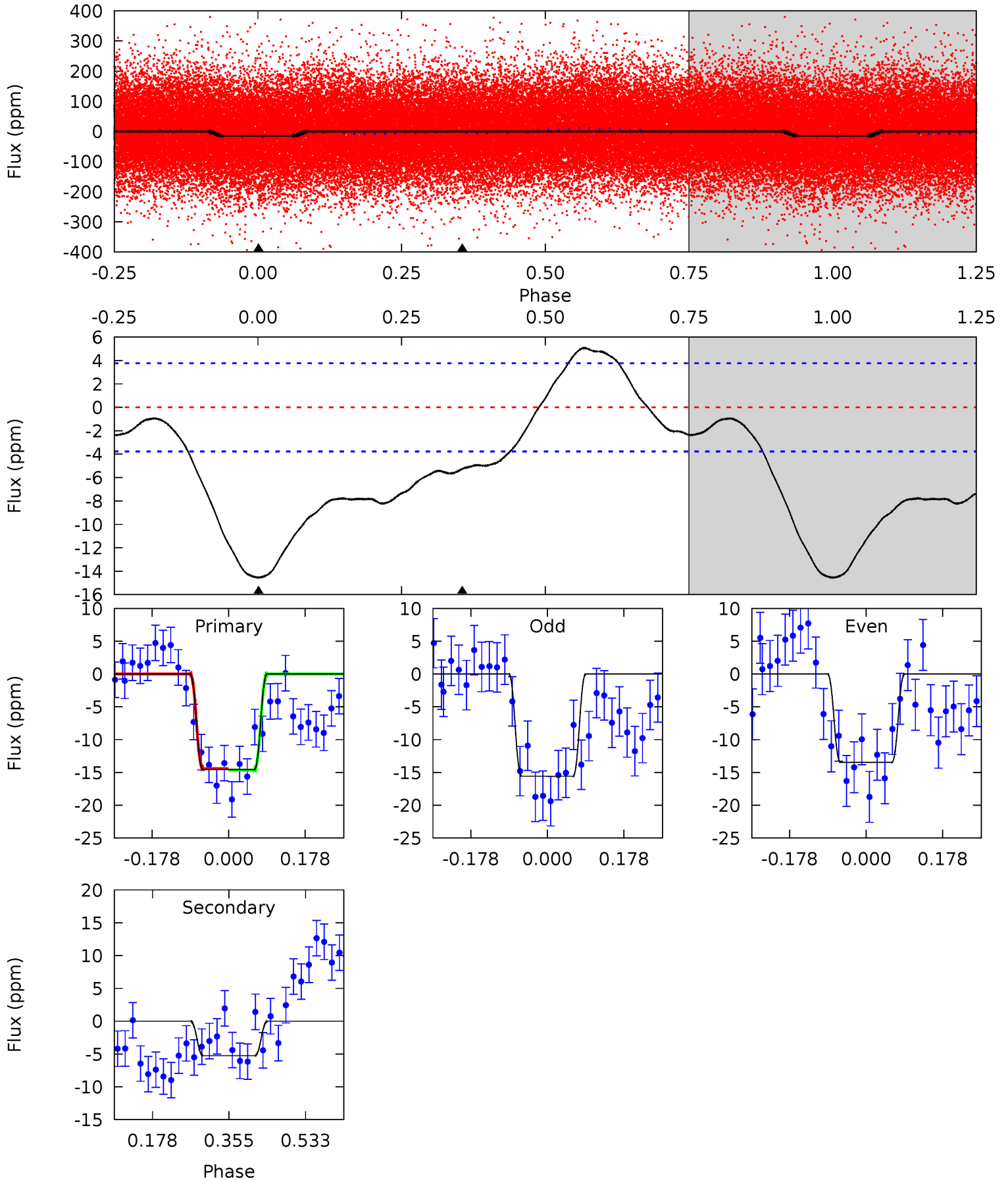
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
11.7	2.27	0	0	4.34	1.06	0.66	11.7	11.7	2.27	2.27	1.25	1.07	0.21	5.24



# Alt Model-Shift Uniqueness Test

007840502-01, P = 1.587413 Days, E = 130.101063 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
17.2	6.21	0	0	4.44	1.35	3.35	17.2	17.2	6.21	6.21	1.26	1.04	0.26	0.14



### Stellar Parameters For KIC 007840502

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$5927^{+160}_{-178}$	$3.946^{+0.390}_{-0.130}$	$0.160^{+0.200}_{-0.300}$	$1.964^{+0.382}_{-0.892}$	$1.242^{+0.168}_{-0.252}$	$0.231^{+0.755}_{-0.087}$
	+3%/-3%	+10%/-3%	+125%/-188%	+19%/-45%	+14%/-20%	+327%/-38%
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 007840502-01 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	$-2 \pm 1$	$0.47^{+0.37}_{-0.29}$	$2992^{+204}_{-331}$	$4347^{+2327}_{-1019}$	$2.991^{+16.554}_{-2.172}$
Alt.	$-5 \pm 1$	$0.79^{+0.43}_{-0.36}$	$2993^{+206}_{-350}$	$4530^{+1566}_{-672}$	$3.709^{+8.839}_{-2.136}$

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



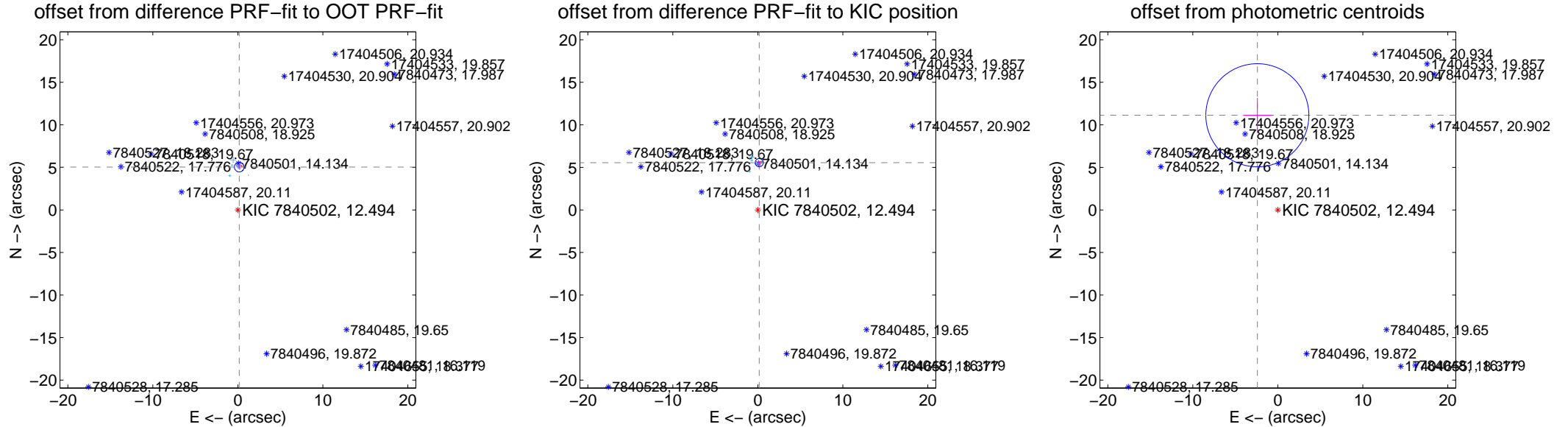
## DV Centroid Data

Supplemental centroid analysis for 007840502-01. Kepler magnitude: 12.49. Transit SNR 4.89

There are 9 quarters with good PRF difference image offsets

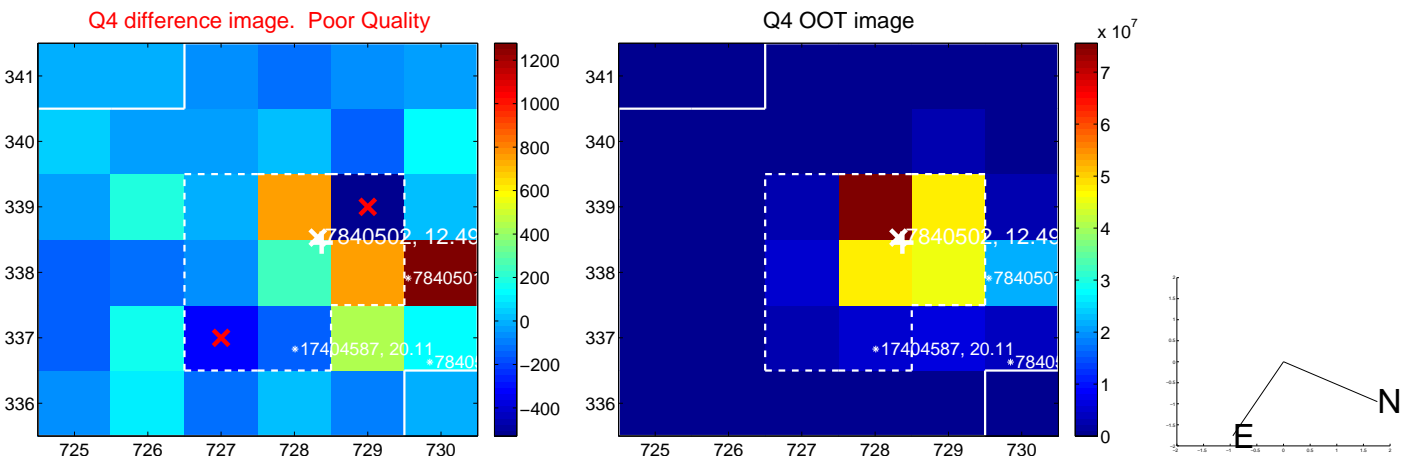
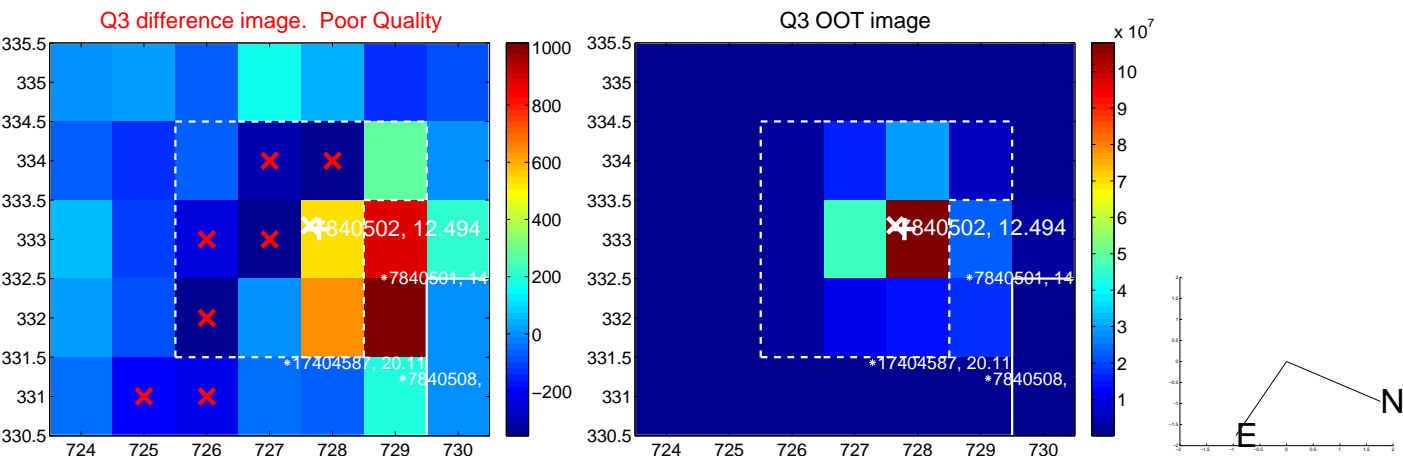
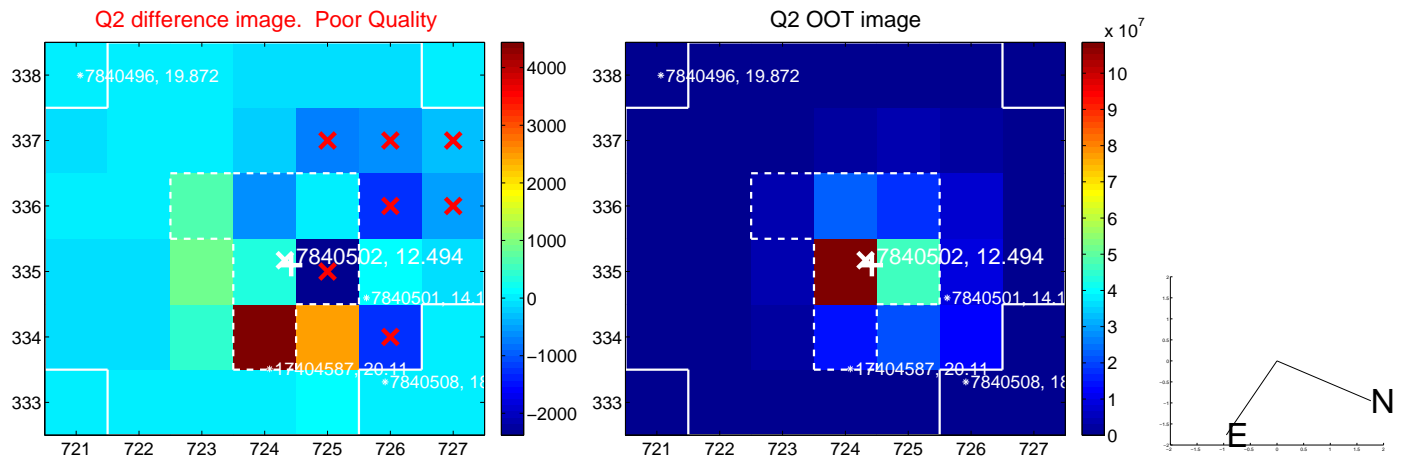
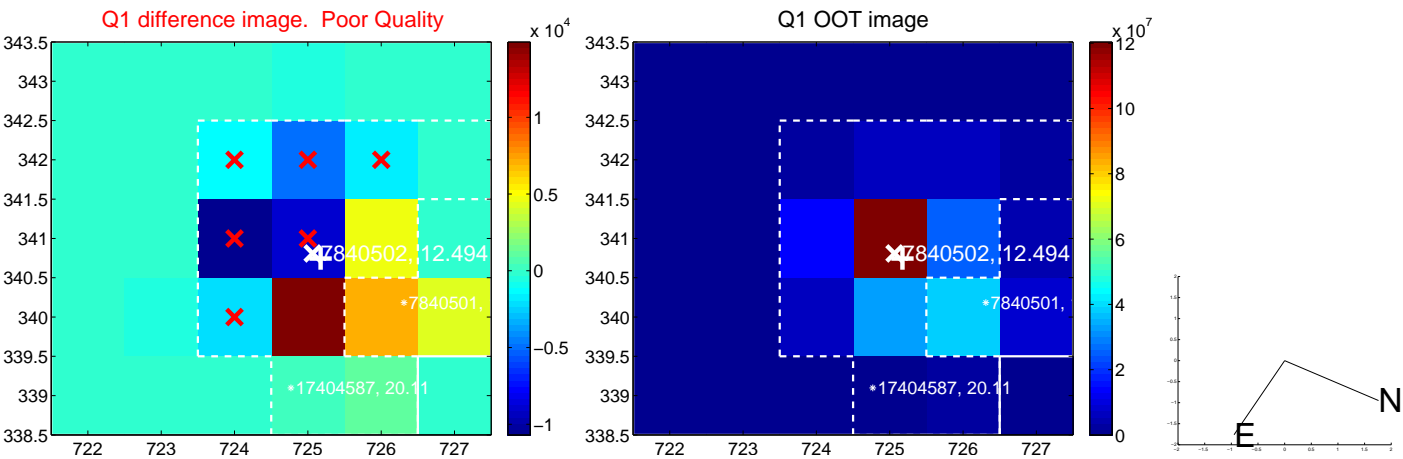
The direct PRF centroid is offset from the target star catalog position by about 0.46 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$5.039 \pm 0.189$	26.64	$-0.164 \pm 0.211$	$5.037 \pm 0.190$
PRF-fit source offset from KIC position	$5.560 \pm 0.159$	34.96	$-0.165 \pm 0.206$	$5.557 \pm 0.160$
photometric centroid source offset	$11.38 \pm 2.02$	5.64	$2.41 \pm 1.67$	$11.13 \pm 2.04$

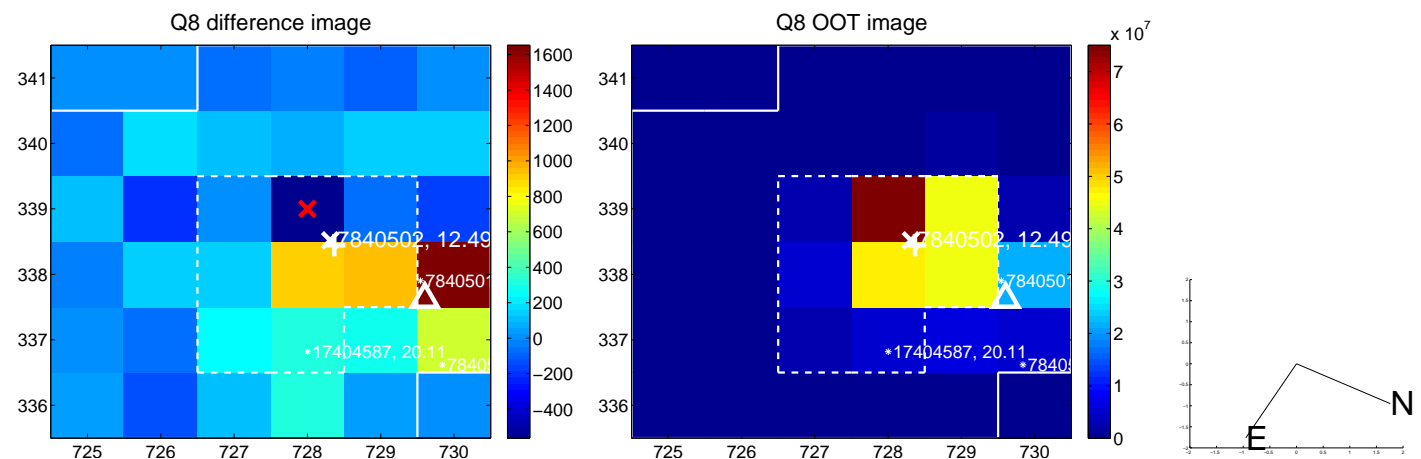
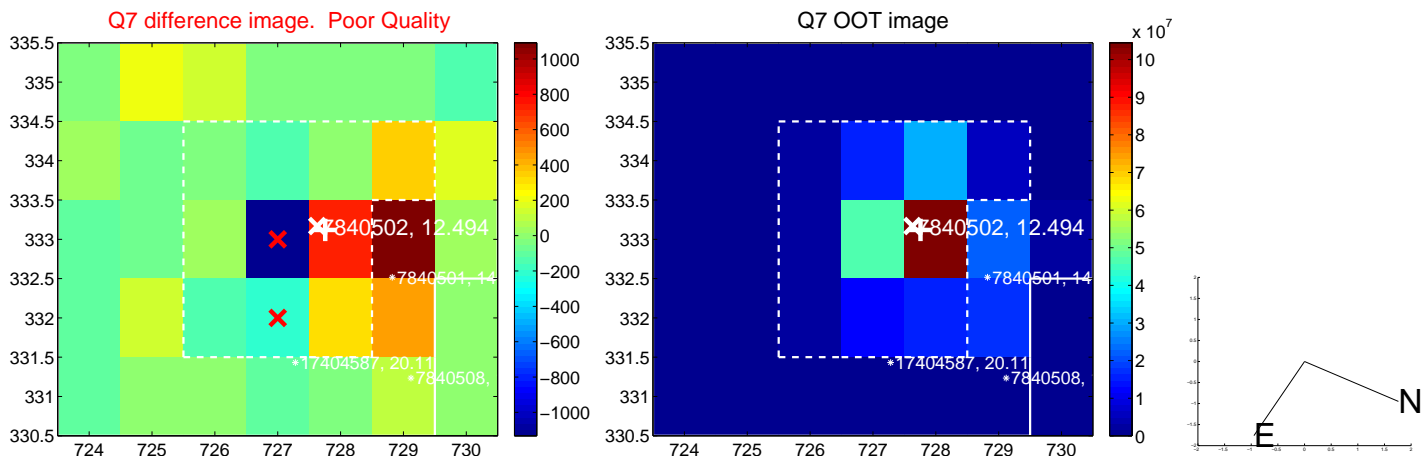
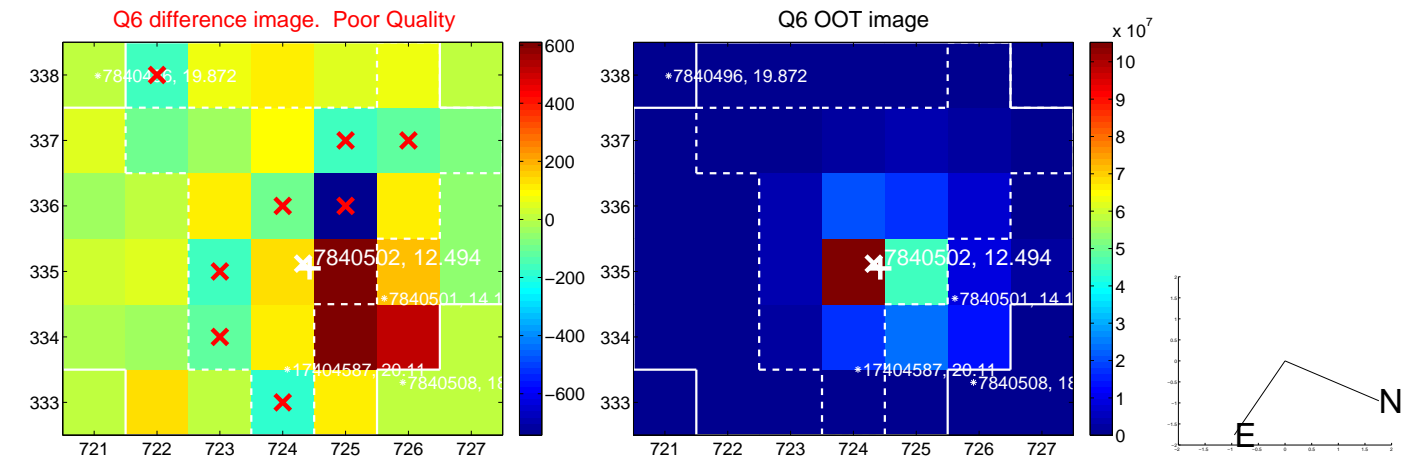
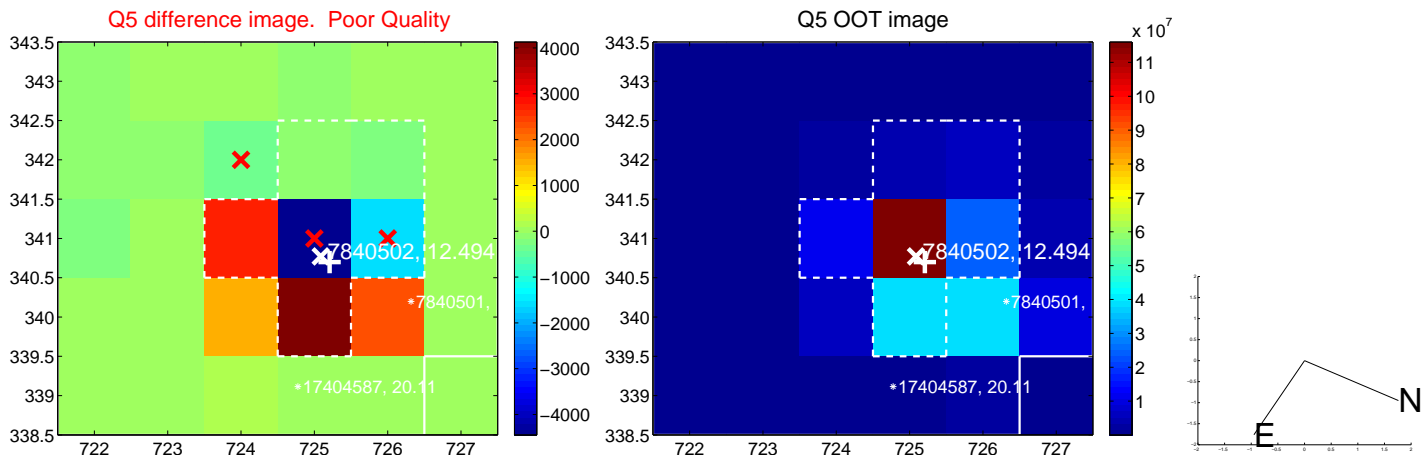


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

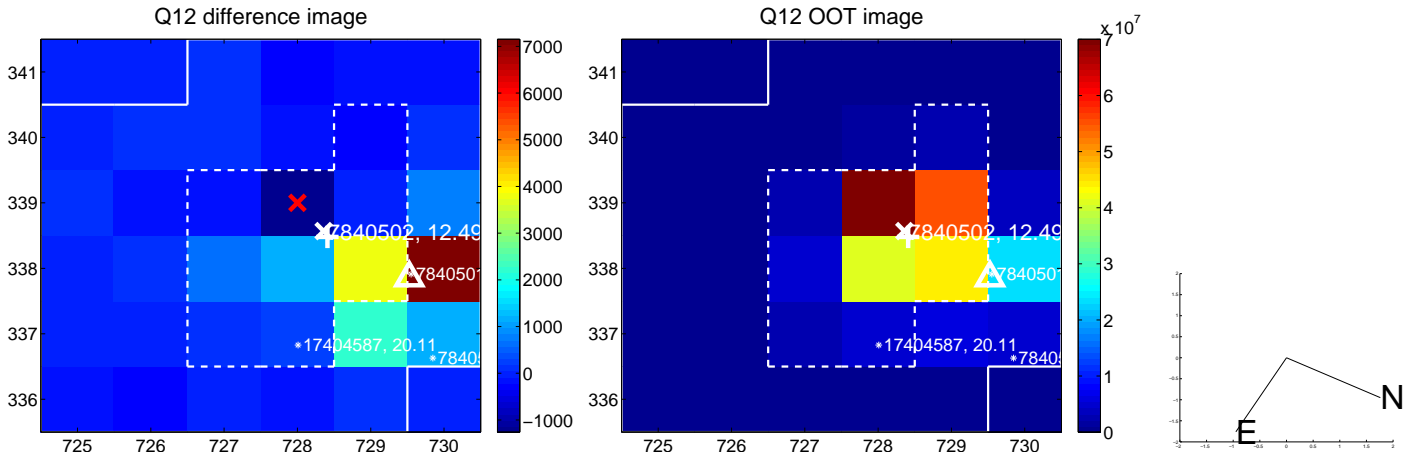
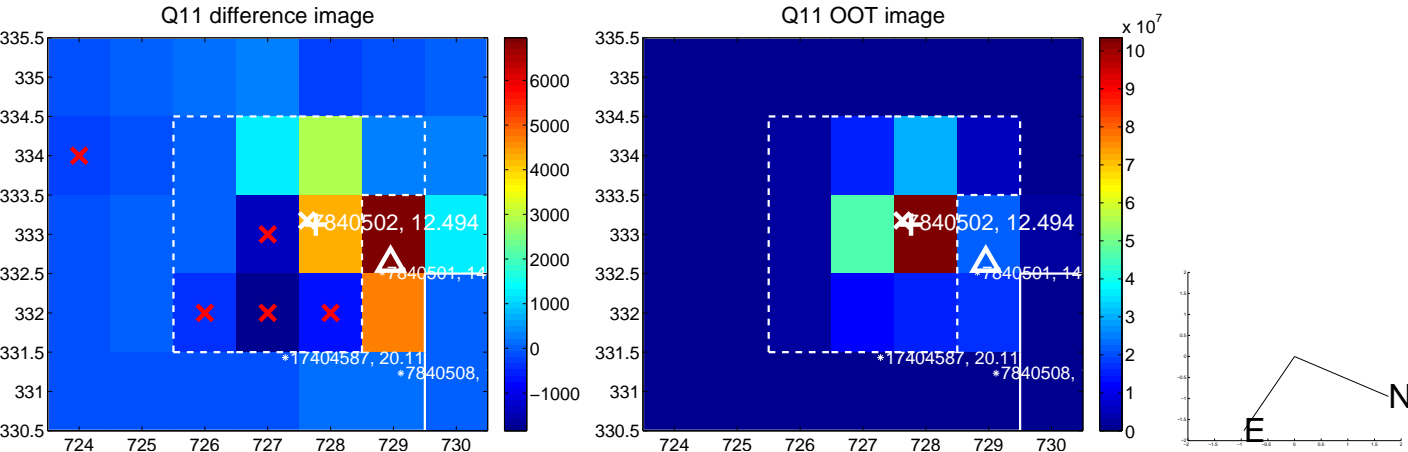
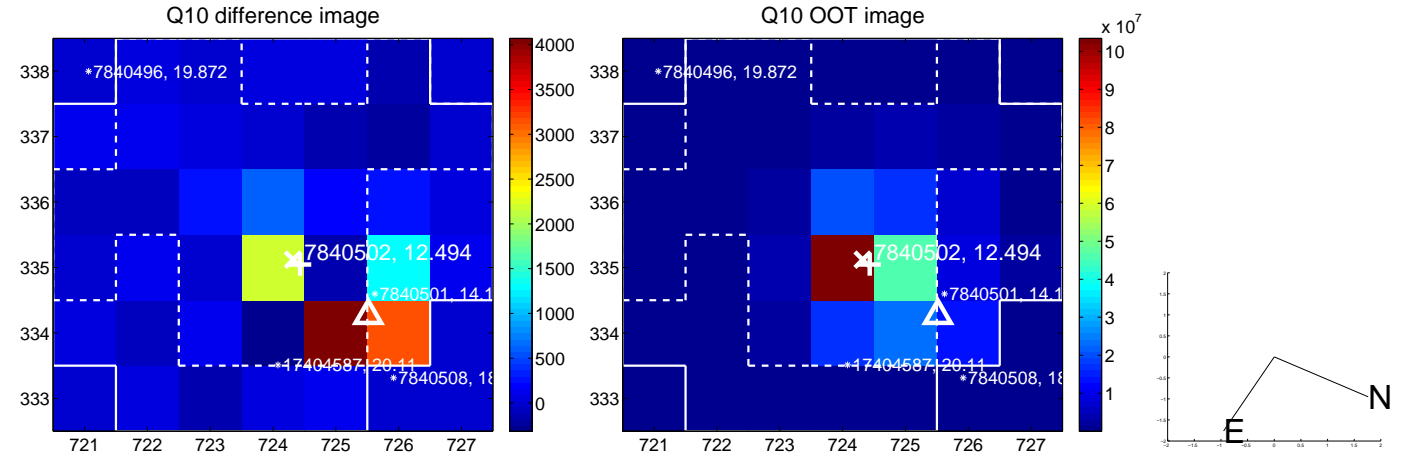
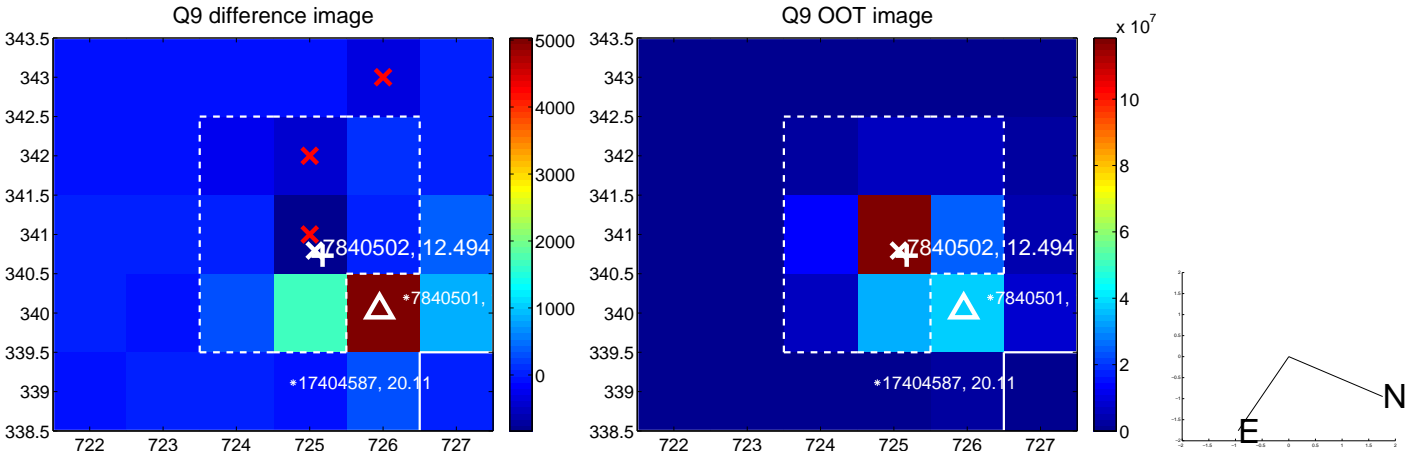
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



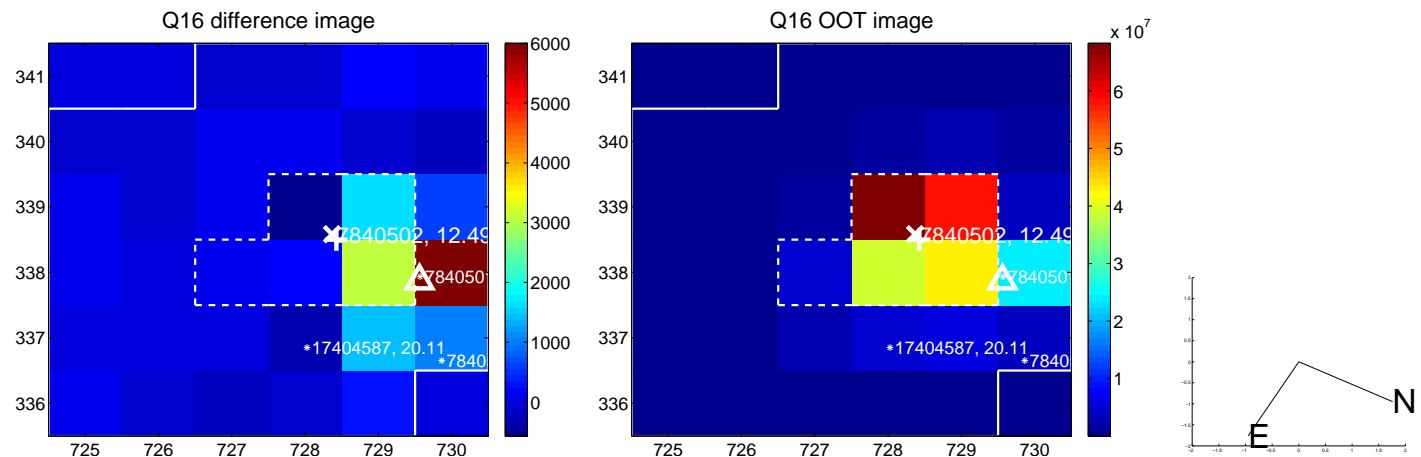
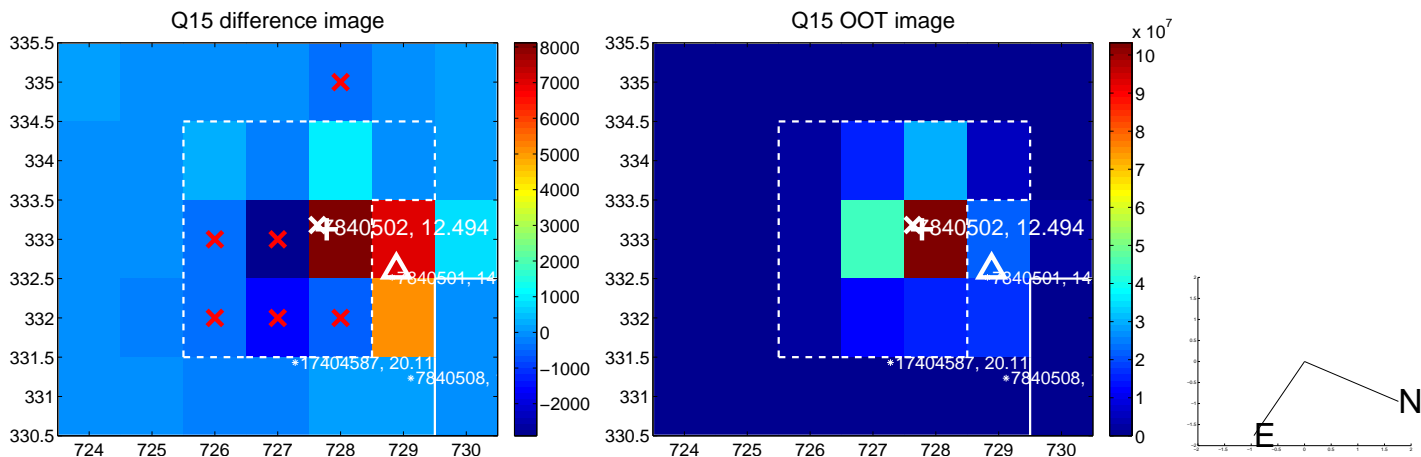
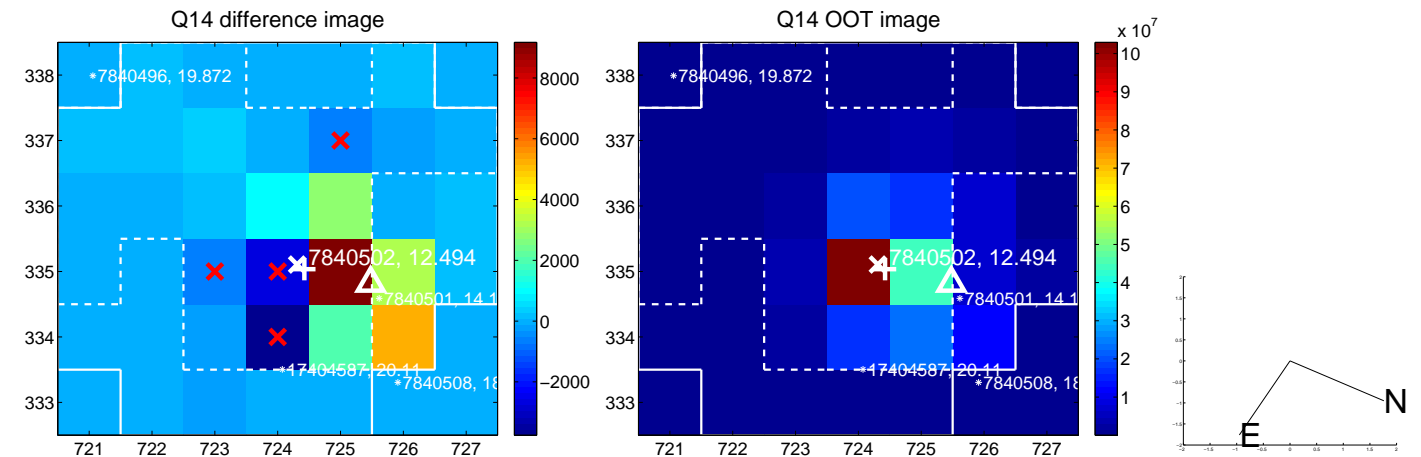
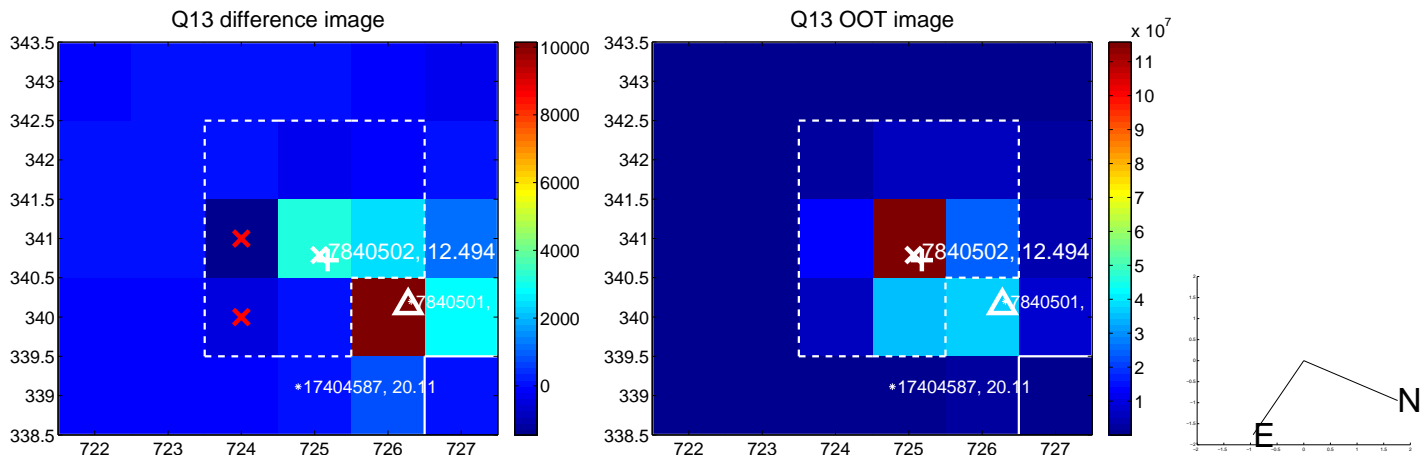
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white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

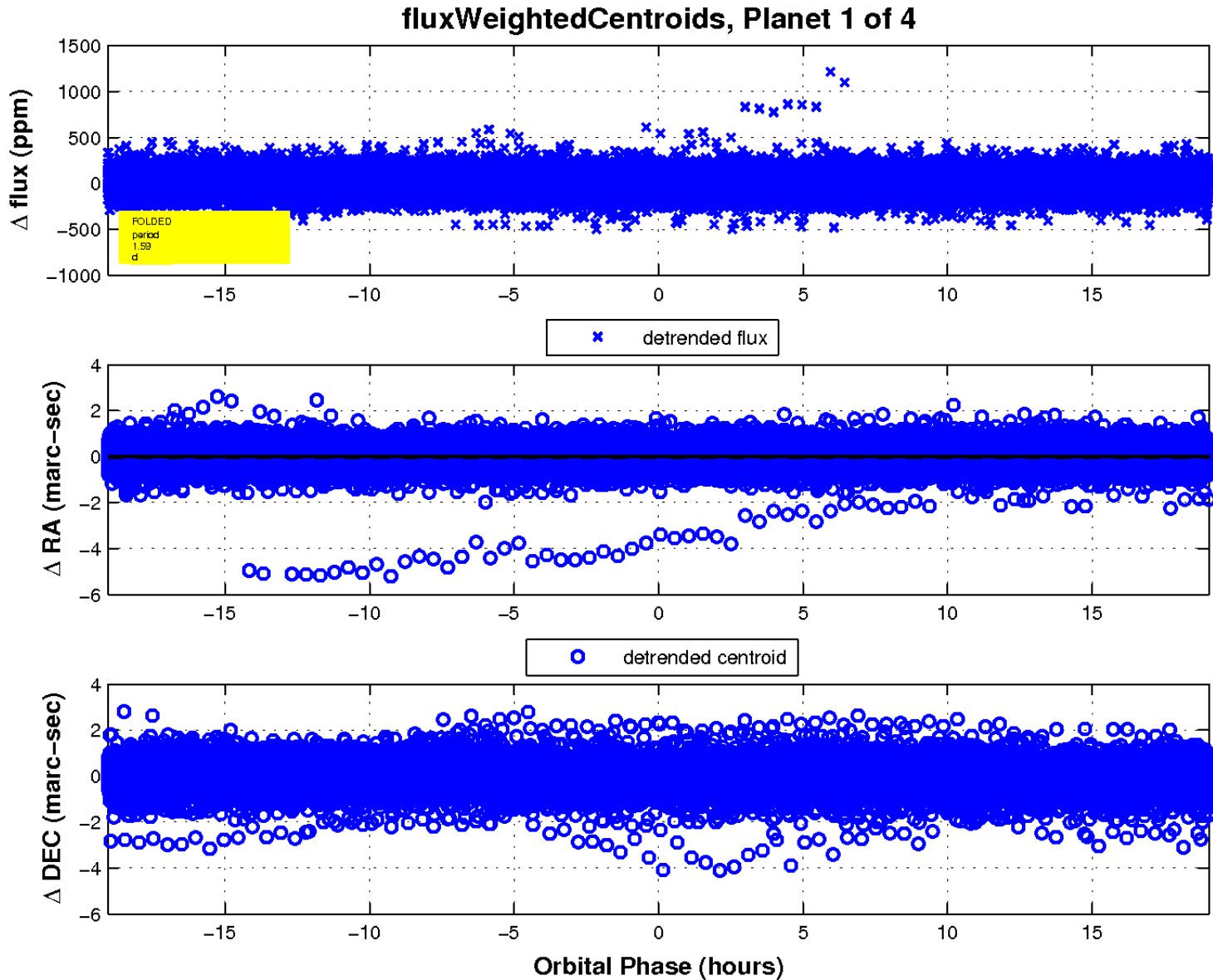
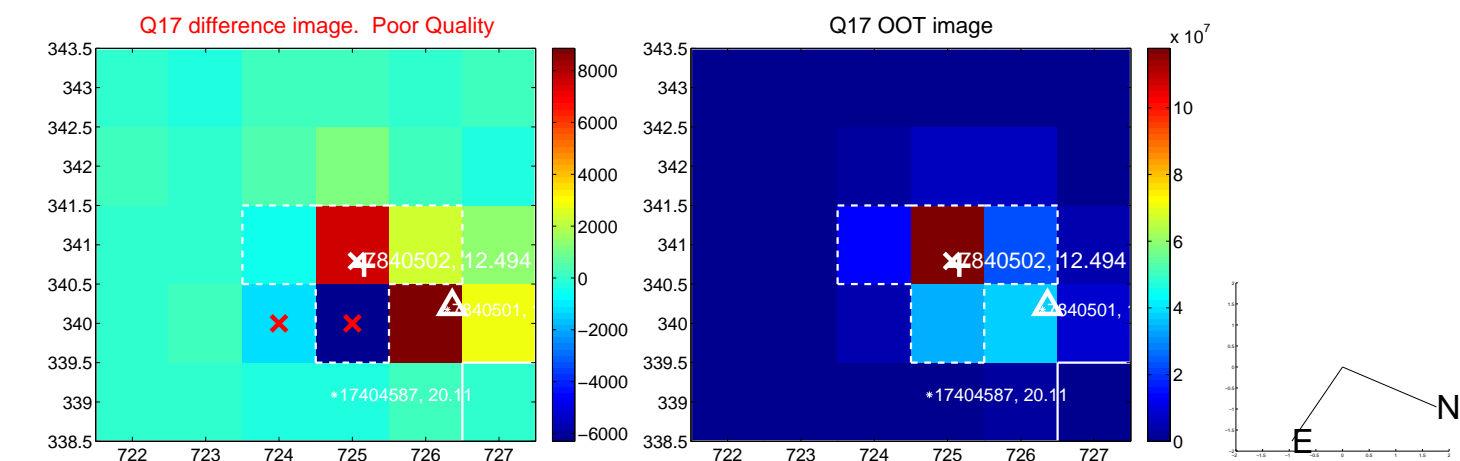


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



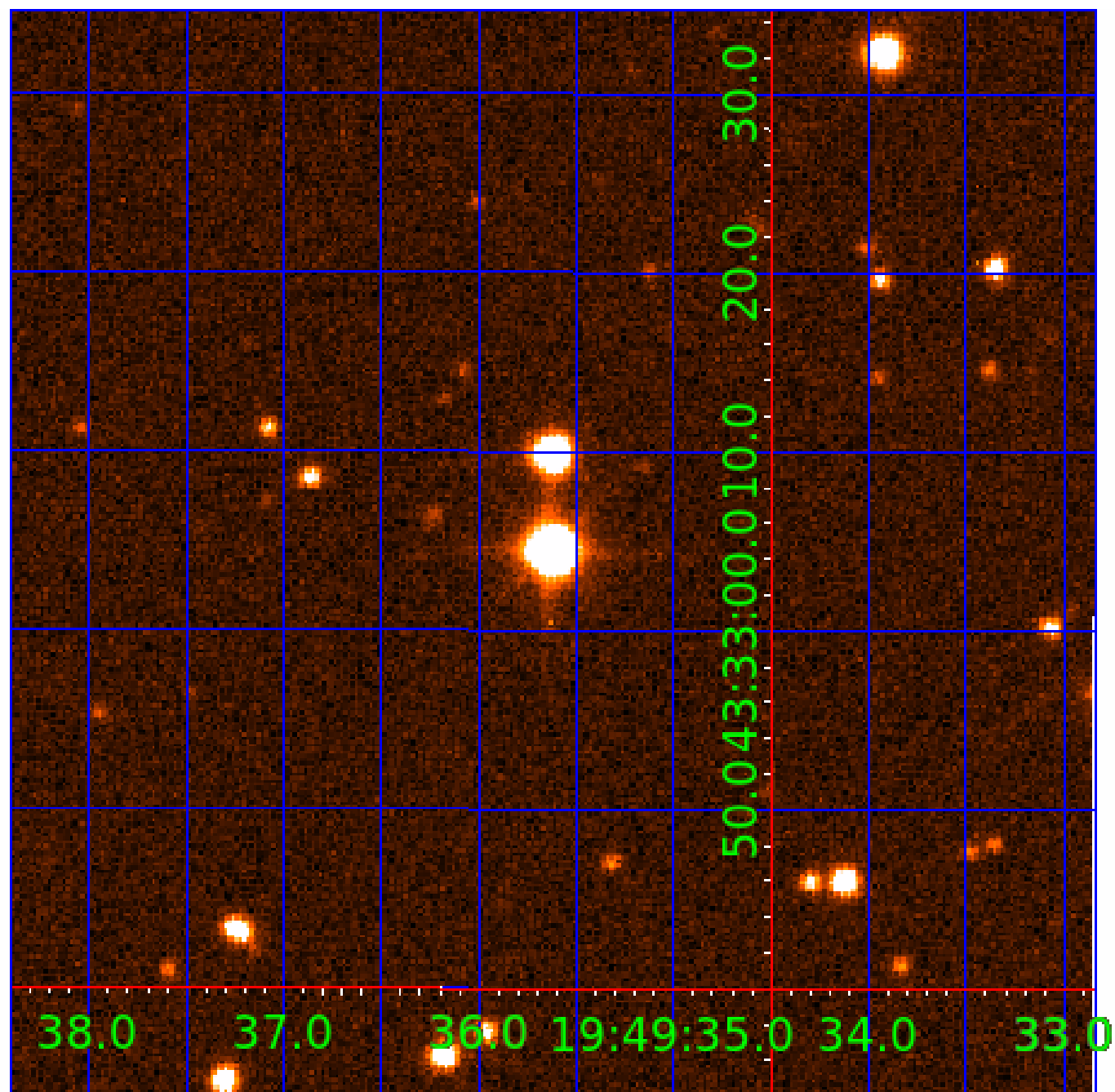


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 007840502

## 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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007840502-03	OBS	No	80.123112	154.337574	92.0	19.477	10.4	8.6	1.96	5927	2.13	27.88
007840502-04	OBS	No	53.276778	144.153876	70.9	6.760	8.8	7.2	1.96	5927	1.96	48.04

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
007840502-01	OBS	FP	0.00	1	0	1	0	LPP_DV—MOD_NONUNIQ_ALT—CENT_RESOLVED_OFFSET
007840502-02	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE_SKYE—TRANS_GAPPED—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS—HALO_GHOST
007840502-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
007840502-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—CENT_FEW_MEAS

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

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

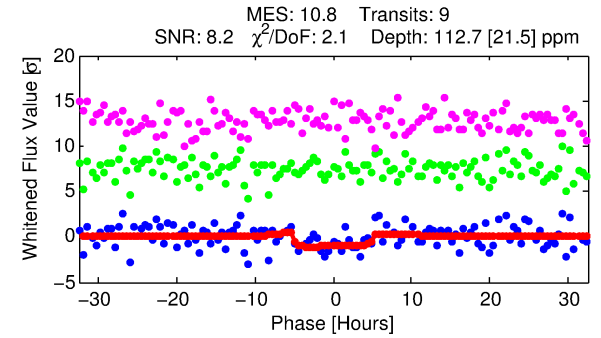
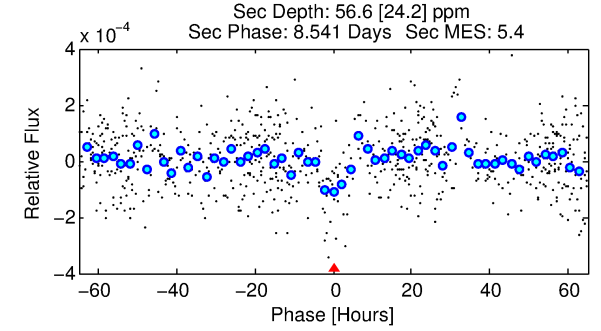
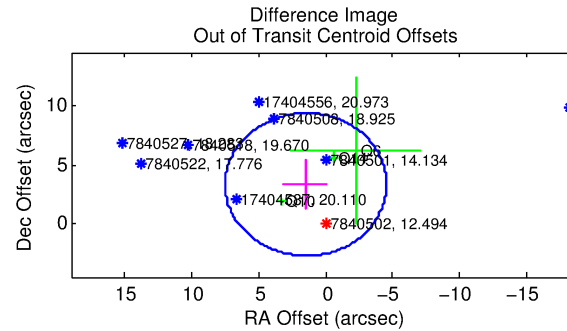
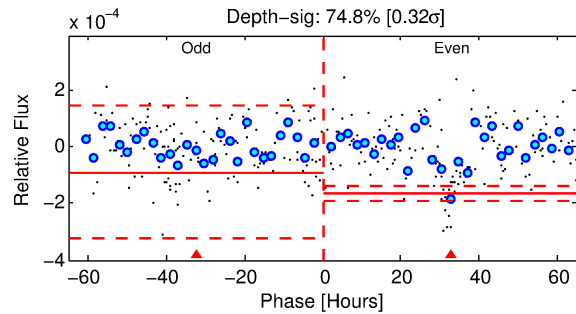
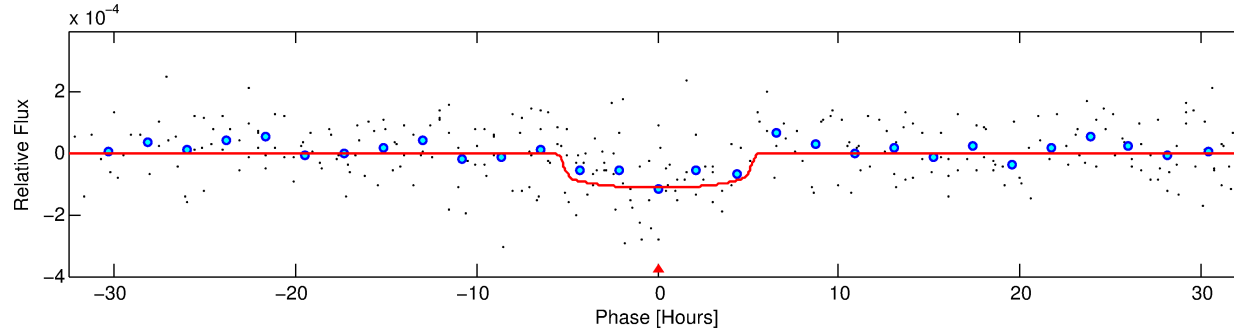
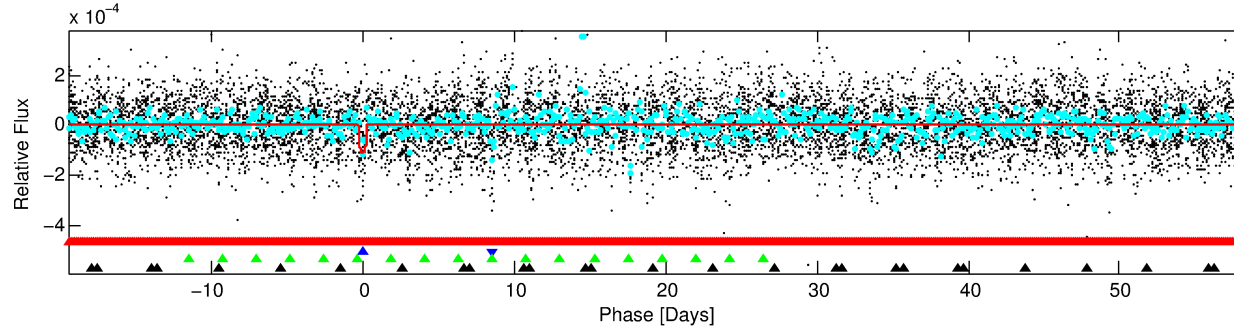
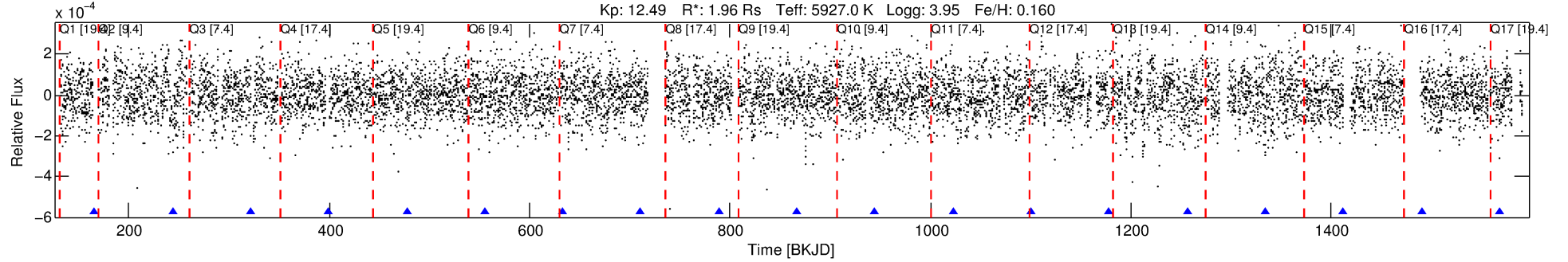
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 007840502-02

No Significant Match Found

# DV One-Page Summary

KIC: 7840502 Candidate: 2 of 4 Period: 77.896 d



## DV Fit Results:

Period = 77.89550 [0.00238] d  
Epoch = 165.7984 [0.0348] BKJD  
Rp/R\* = 0.0110 [0.0048]  
a/R\* = 31.53 [64.31]  
b = 0.83 [0.76]  
Seff = 28.95 [19.73]  
Teq = 591 [101] K  
Rp = 2.35 [1.48] Re  
a = 0.3838 [0.1634] AU  
Ag = 830.97 [983.07] [0.84 $\sigma$ ]  
Teffp = 4910 [1205] K [3.57 $\sigma$ ]

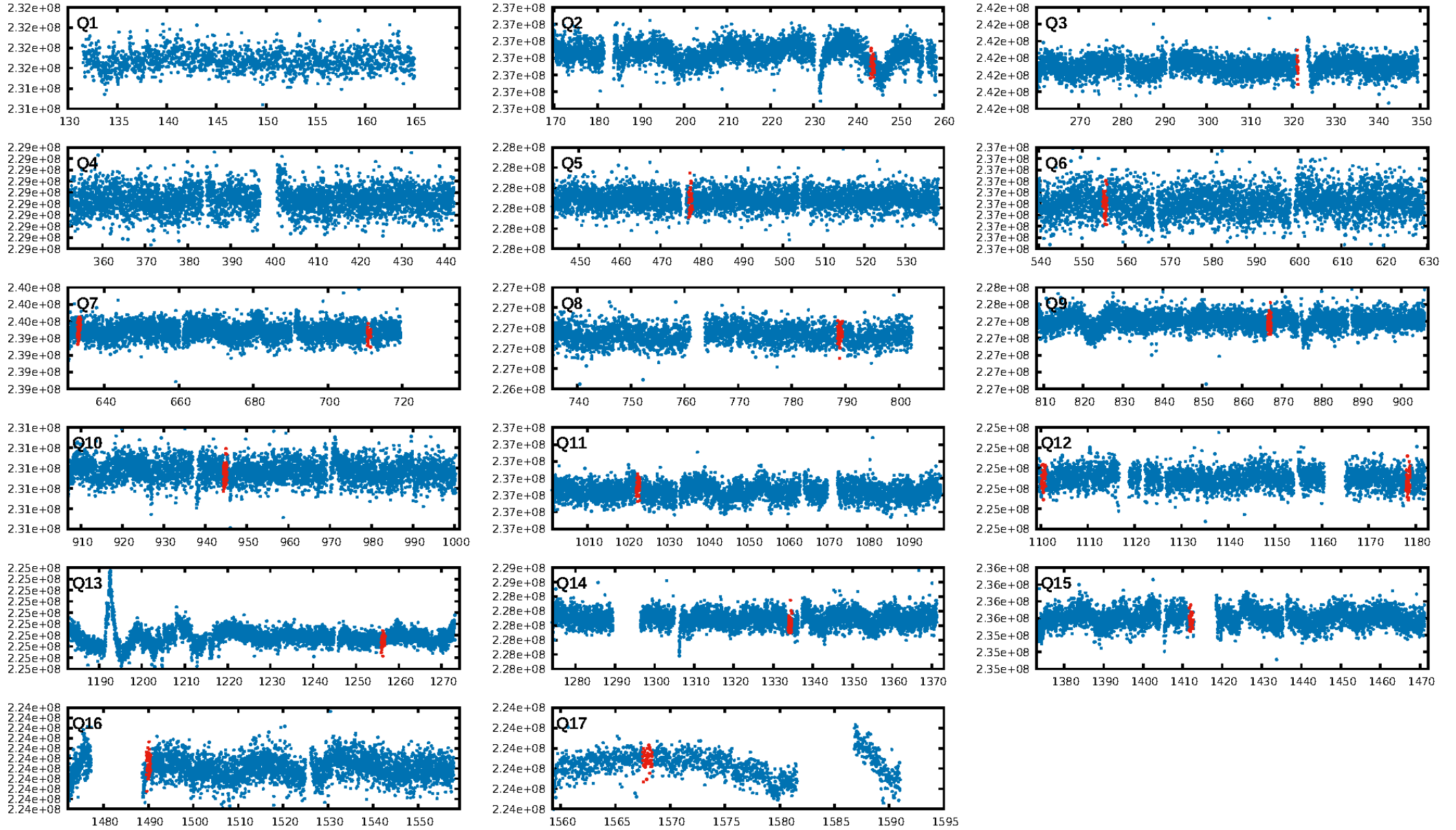
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [46.19 $\sigma$ ]  
LongPeriod-sig: 98.3% [2.40 $\sigma$ ]  
ModelChiSquare2-sig: 0.1%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 2.78e-27  
RollingBand-fgt: 1.00 [8/8]  
GhostDiagnostic-chr: 0.01876  
Centroid-sig: N/A  
Centroid-so: 0.805 arcsec [1.16 $\sigma$ ]  
OotOffset-rm: 3.634 arcsec [1.81 $\sigma$ ]  
KicOffset-rm: 4.102 arcsec [2.03 $\sigma$ ]  
OotOffset-st: 3/0/0/0 [3]  
KicOffset-st: 3/0/0/0 [3]  
DiffImageQuality-fgm: 0.00 [0/3]  
DiffImageOverlap-fno: 0.00 [0/9]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 06:57:05 Z

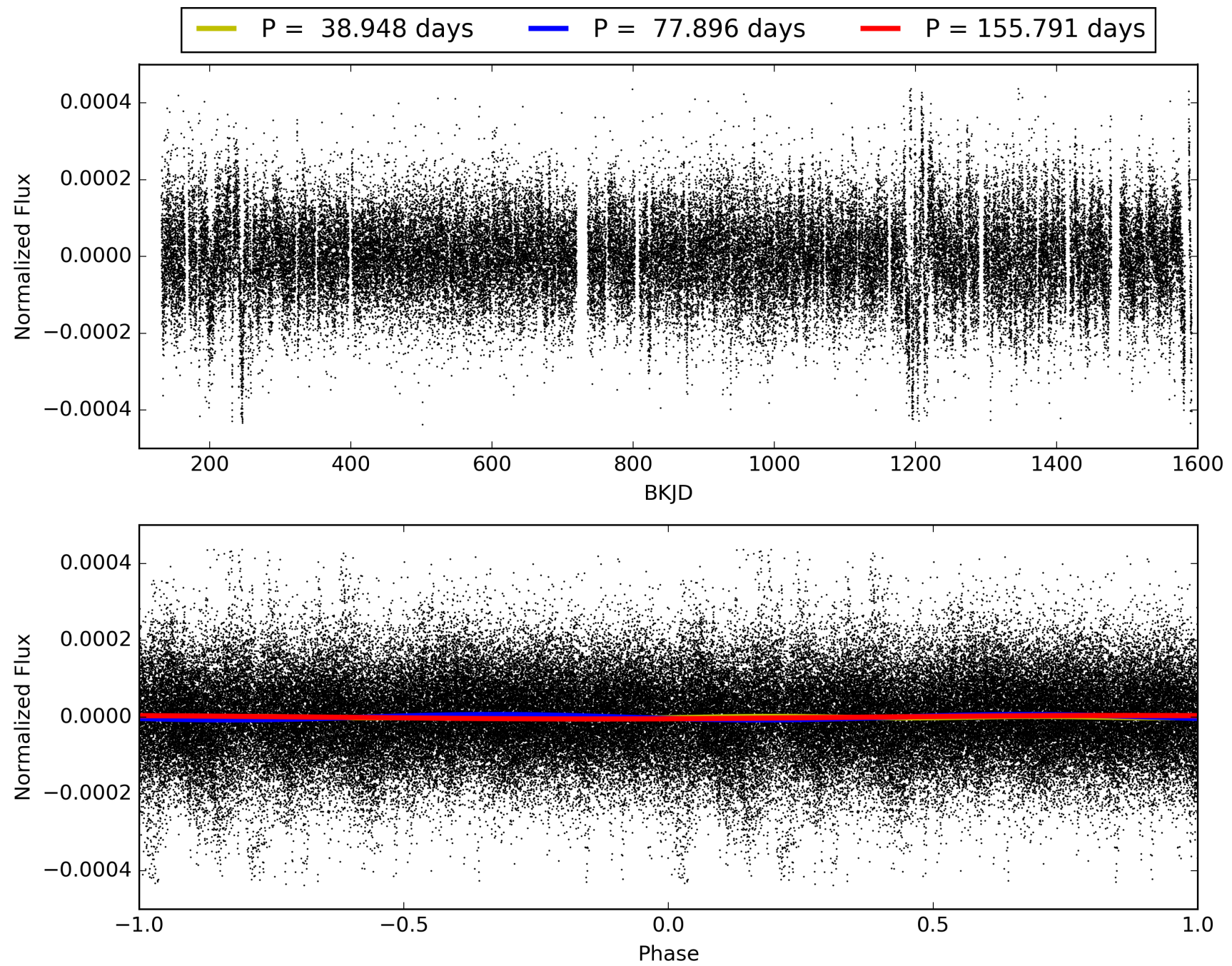
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 007840502-02, PDC Light Curves



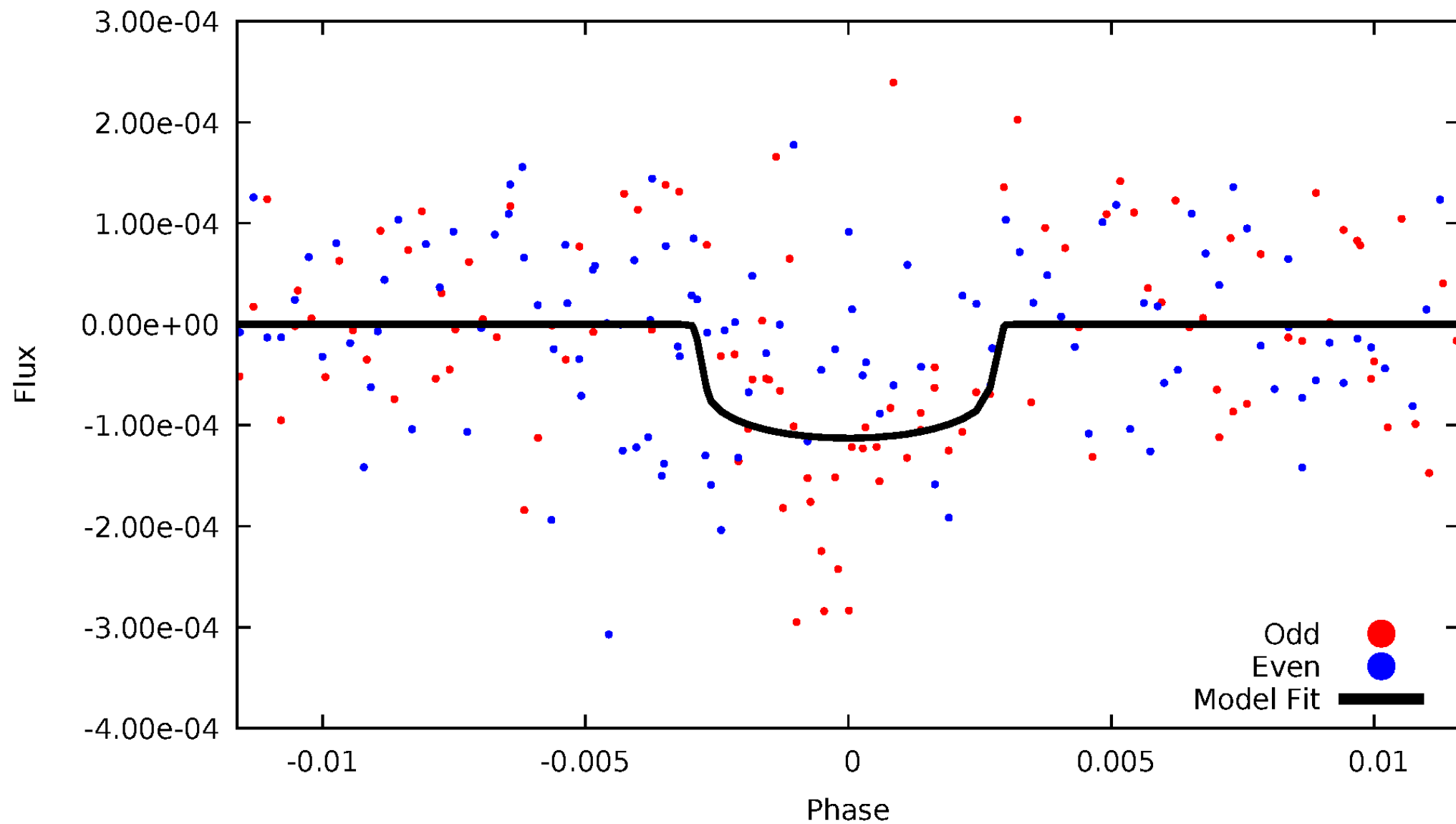


TCE 007840502-02



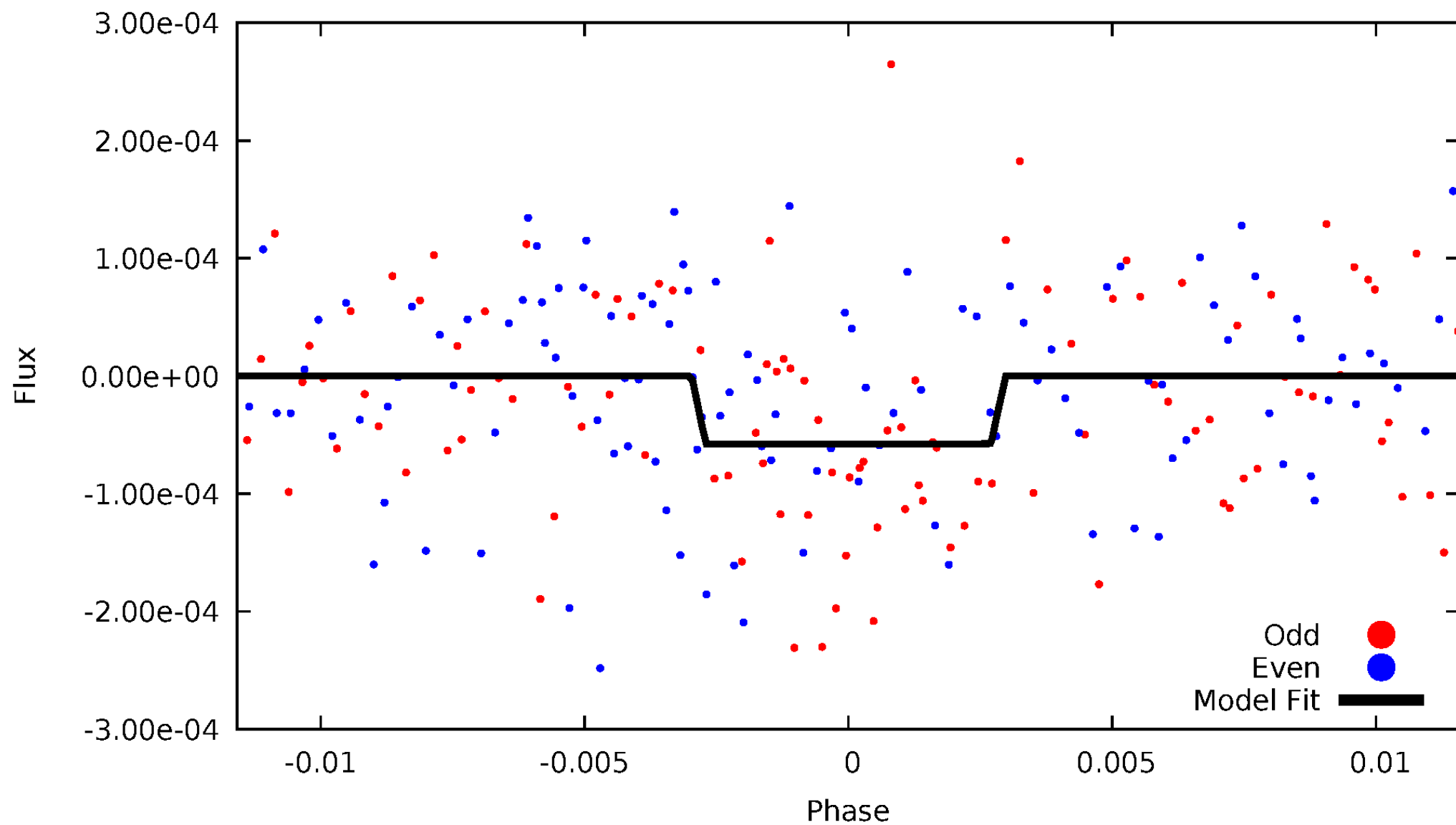
# DV Odd/Even

TCE 007840502-02



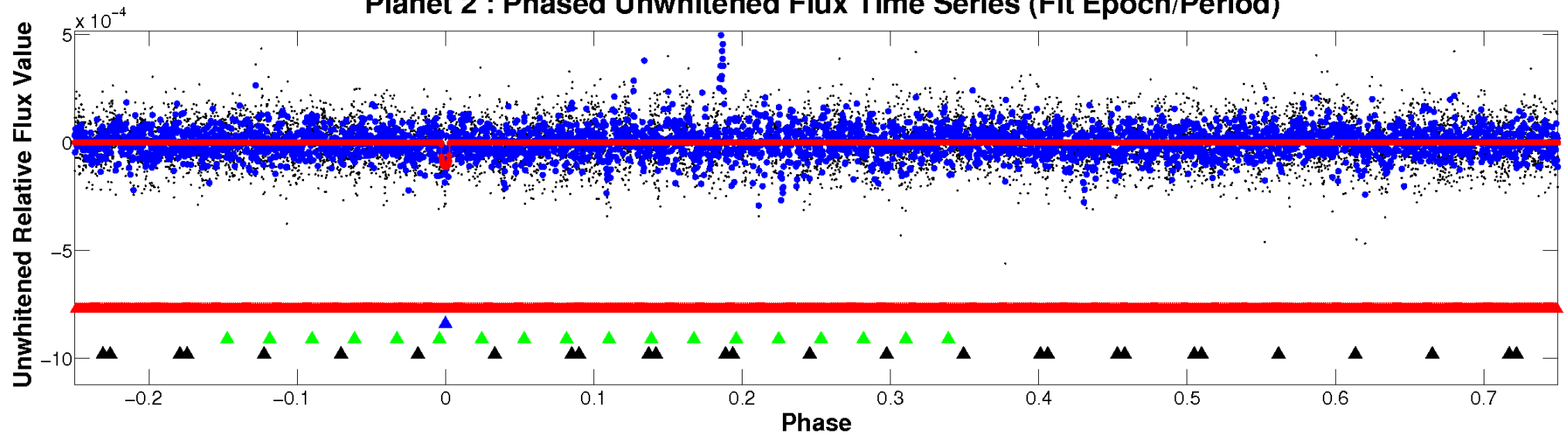
# ALT Odd/Even

TCE 007840502-02

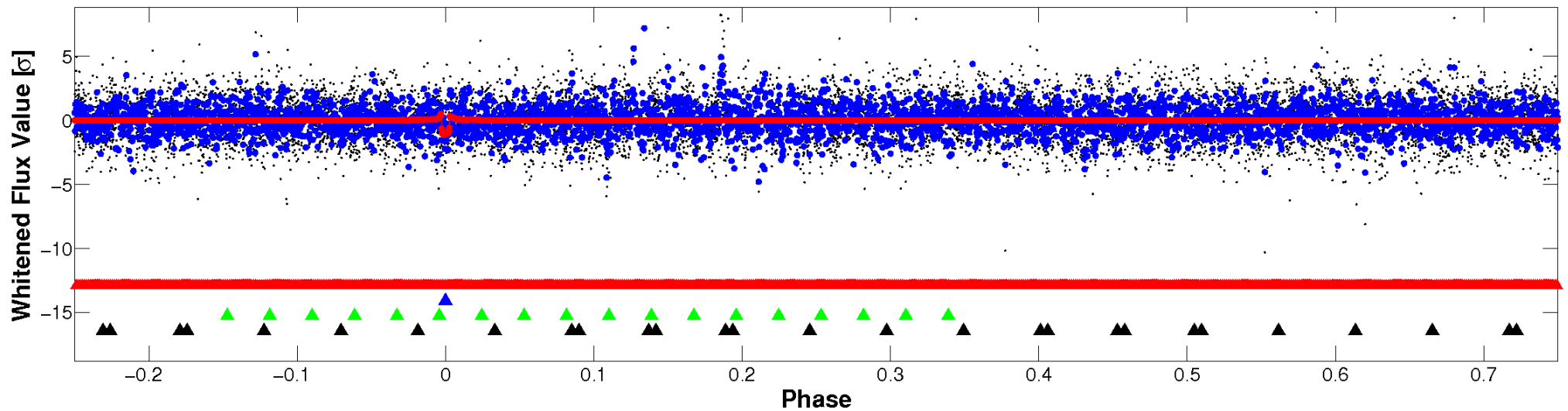


# Non-Whitened Vs. Whitened Light Curve

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



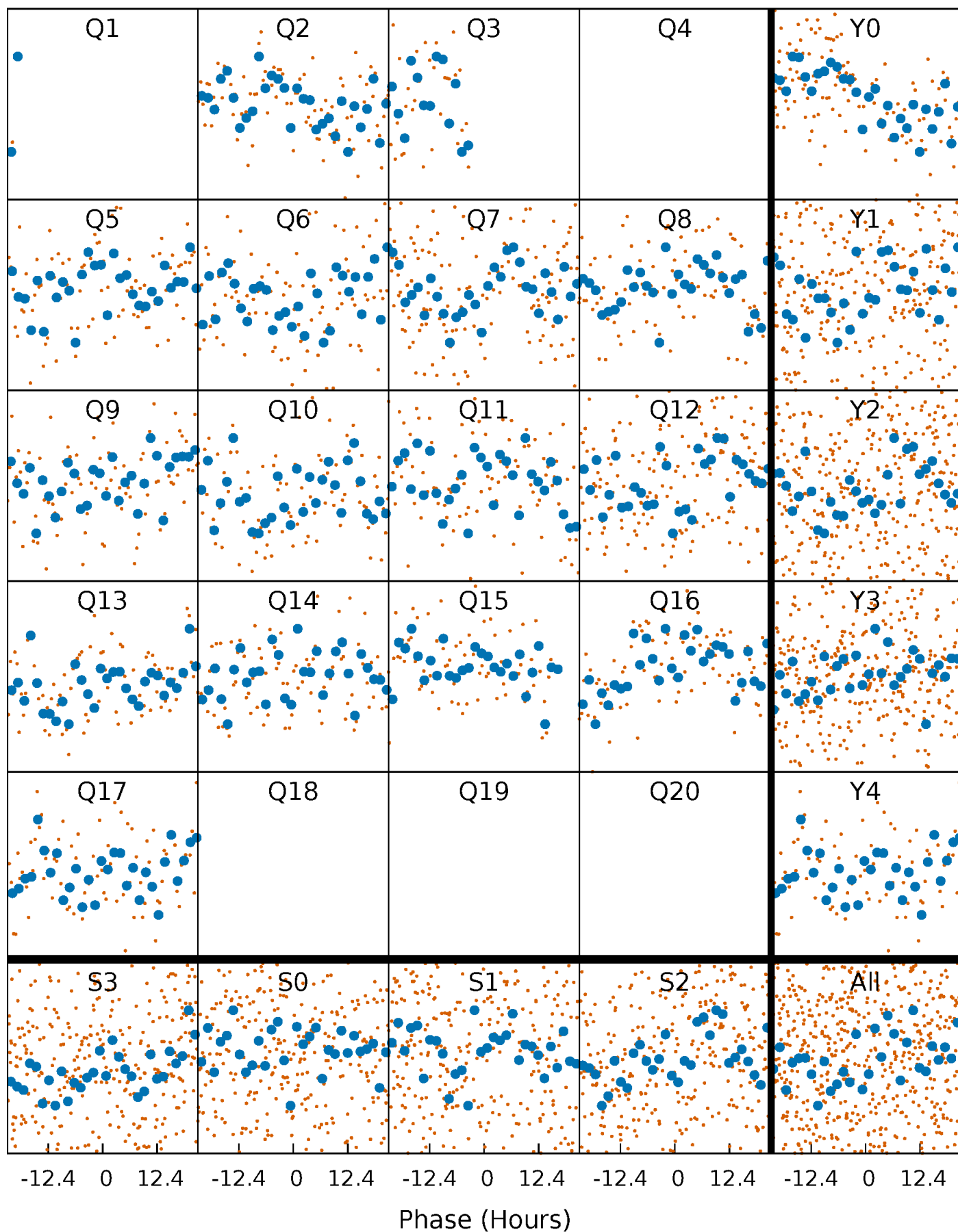
Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)





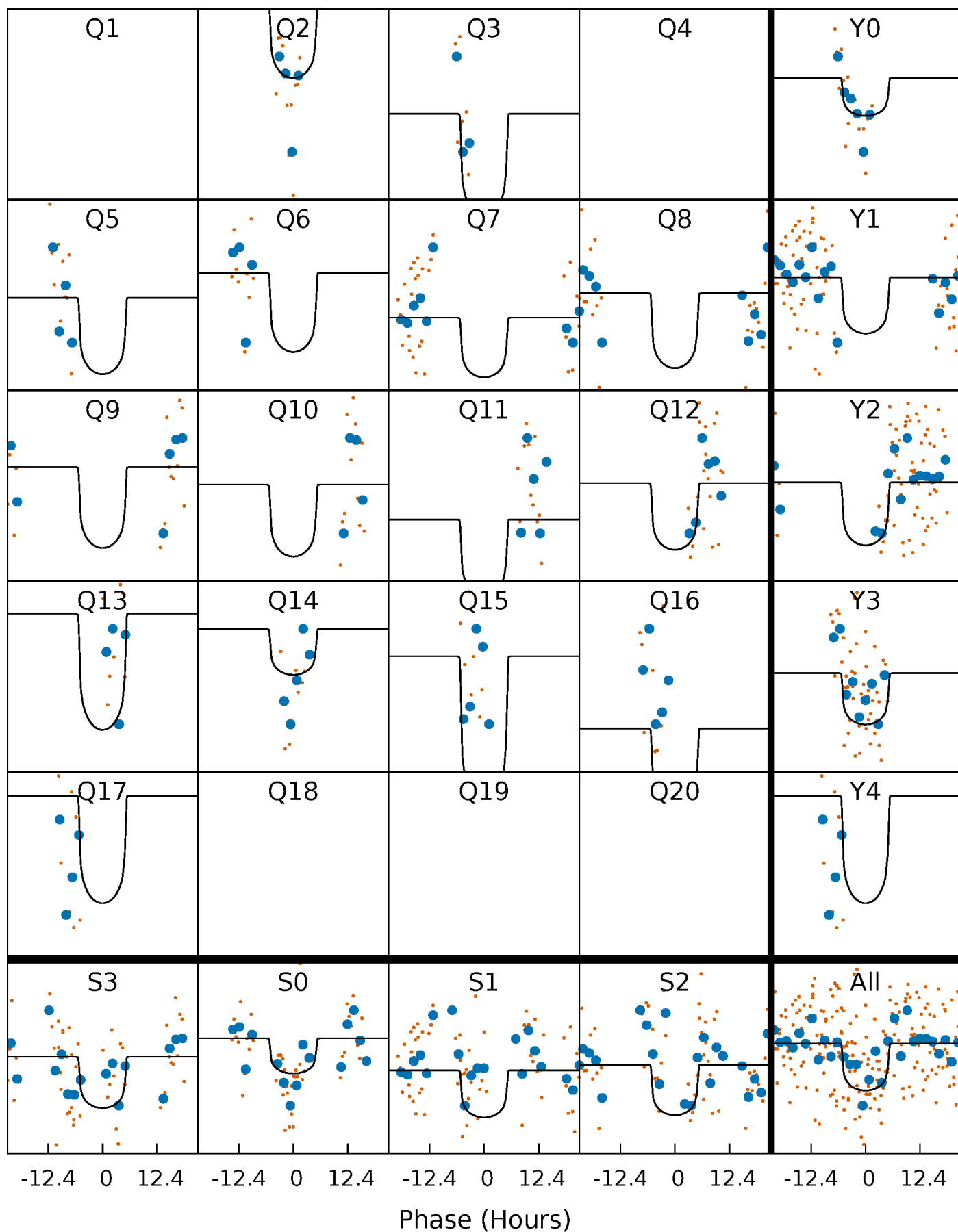
# PDC Quarter-Phased Transit Curves

TCE 007840502-02 P= 77.895503 Days  $T_0=165.798364$  (BKJD)



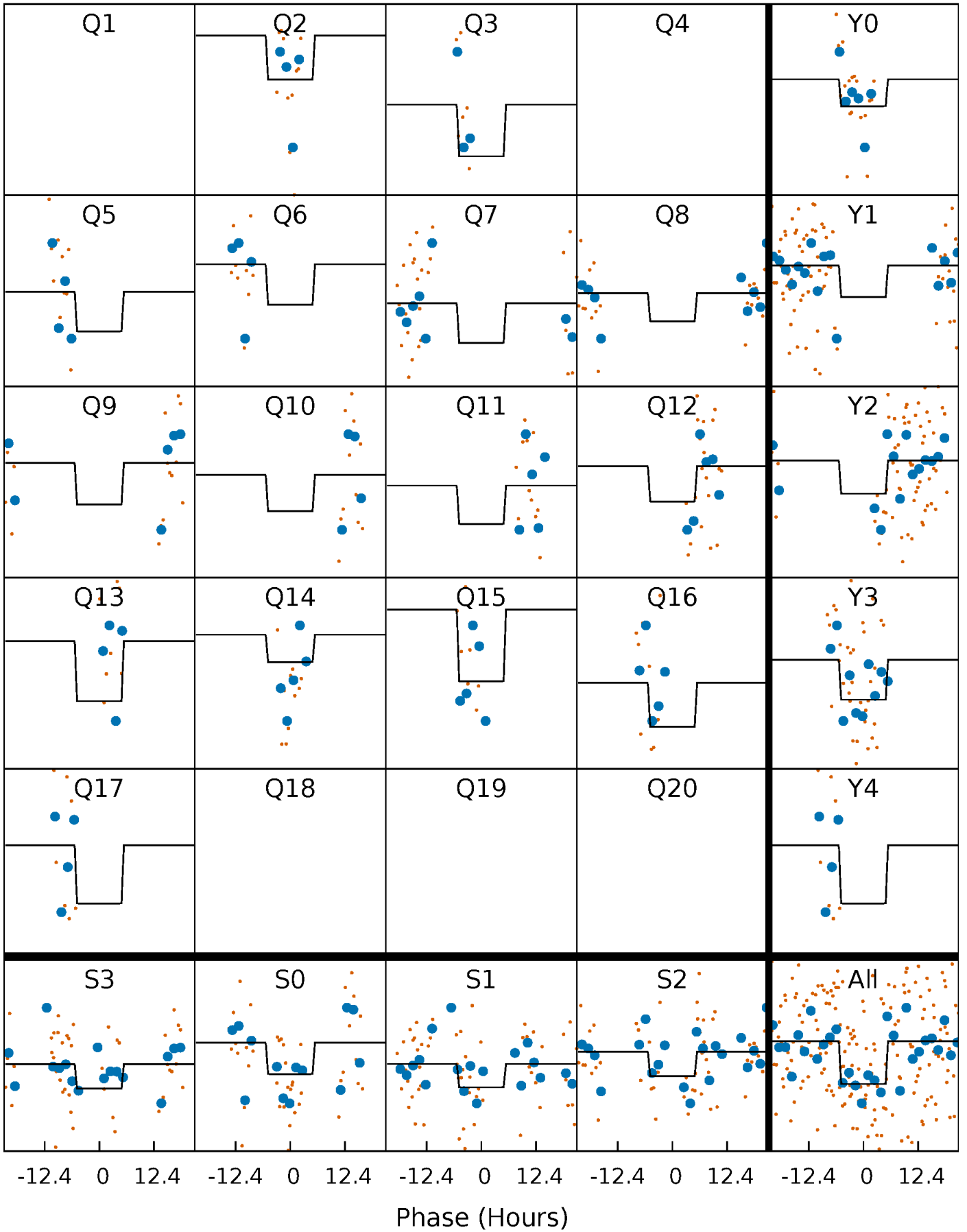
# DV Quarter-Phased Transit Curves

TCE 007840502-02   P= 77.895503 Days    $T_0=165.798364$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

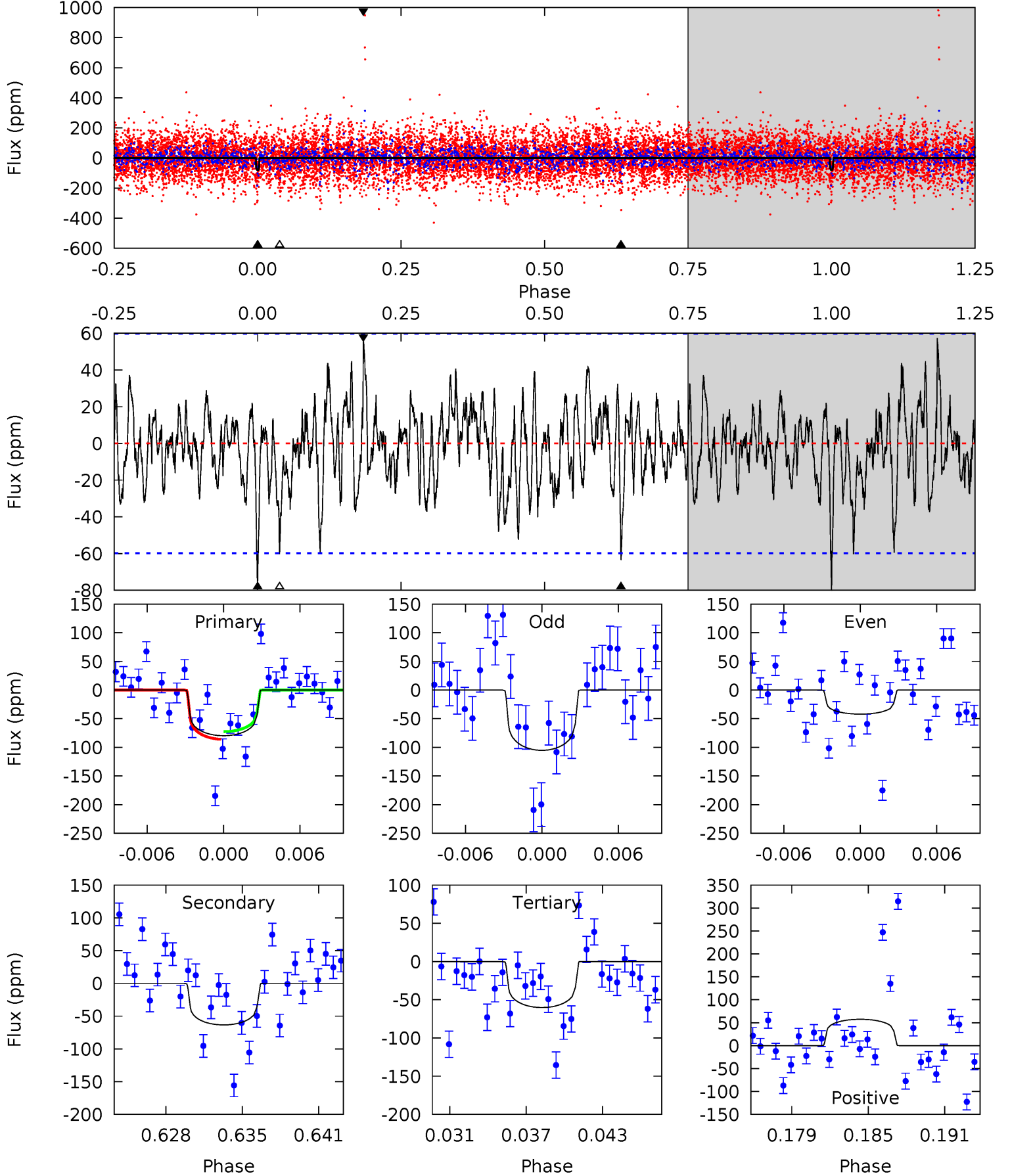
TCE 007840502-02   P= 77.898331 Days    $T_0=165.759142$  (BKJD)



# DV Model-Shift Uniqueness Test

007840502-02, P = 77.895503 Days, E = 87.902861 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
6.82	5.43	5.15	4.91	5.12	2.74	1.53	1.67	1.91	0.28	0.52	2.62	0.99	0.42	0.57

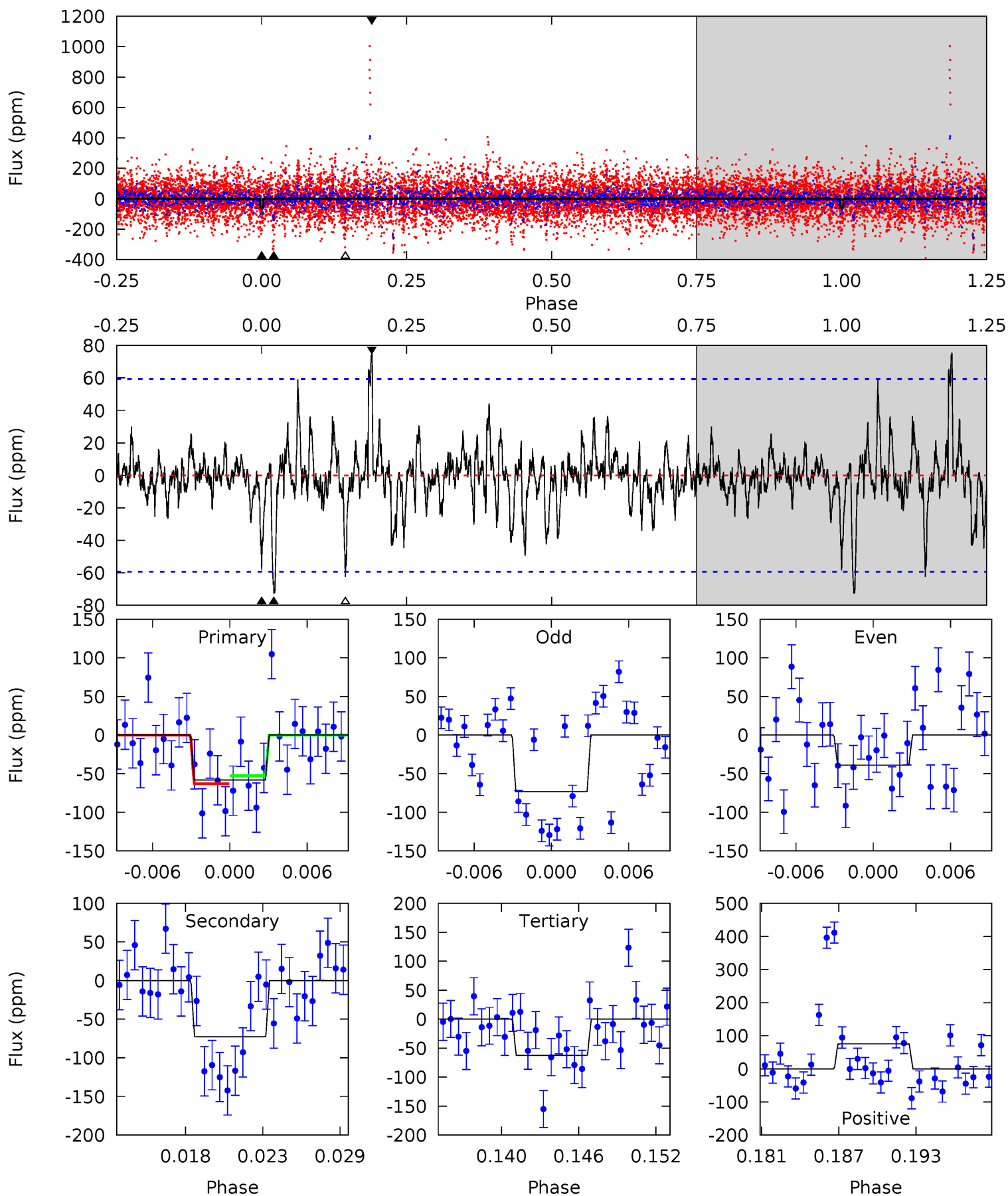




# Alt Model-Shift Uniqueness Test

007840502-02, P = 77.898331 Days, E = 87.860811 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
5.03	6.28	5.39	6.51	5.13	2.76	1.32	-0.36	-1.48	0.89	-0.23	1.46	1.09	0.51	0.44



### Stellar Parameters For KIC 007840502

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$5927^{+160}_{-178}$	$3.946^{+0.390}_{-0.130}$	$0.160^{+0.200}_{-0.300}$	$1.964^{+0.382}_{-0.892}$	$1.242^{+0.168}_{-0.252}$	$0.231^{+0.755}_{-0.087}$
	+3%/-3%	+10%/-3%	+125%/-188%	+19%/-45%	+14%/-20%	+327%/-38%
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 007840502-02 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	$-63 \pm 12$	$2.16^{+1.14}_{-1.00}$	$813^{+61}_{-85}$	$5149^{+1682}_{-793}$	$1089^{+2587}_{-620}$
Alt.	$-73 \pm 12$	$1.59^{+1.08}_{-0.87}$	$814^{+56}_{-89}$	$6154^{+3242}_{-1225}$	$2330^{+9151}_{-1515}$

$T_{\text{max}}$  = 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

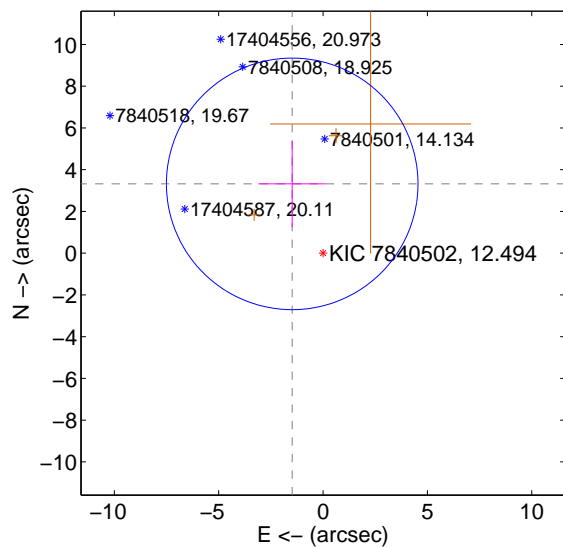
Supplemental centroid analysis for 007840502-02. Kepler magnitude: 12.49. Transit SNR 8.19

There are 0 quarters with good PRF difference image offsets

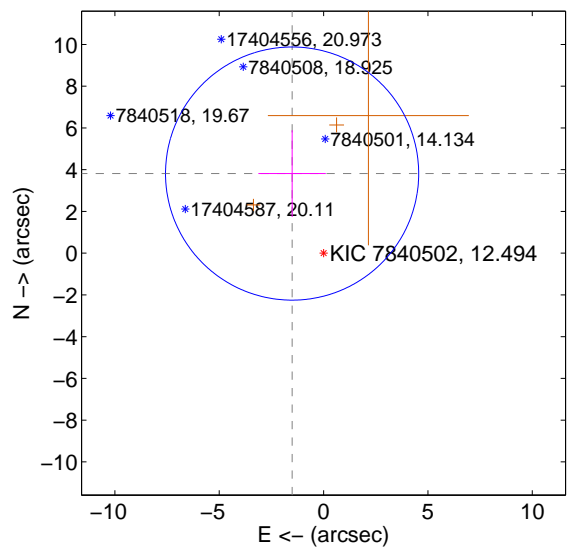
The direct PRF centroid is offset from the target star catalog position by about 0.52 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$3.634 \pm 2.009$	1.81	$1.478 \pm 1.614$	$3.320 \pm 2.078$
PRF-fit source offset from KIC position	$4.102 \pm 2.022$	2.03	$1.508 \pm 1.614$	$3.814 \pm 2.078$
photometric centroid source offset	$0.80 \pm 0.69$	1.16	$-0.26 \pm 0.57$	$0.76 \pm 0.71$

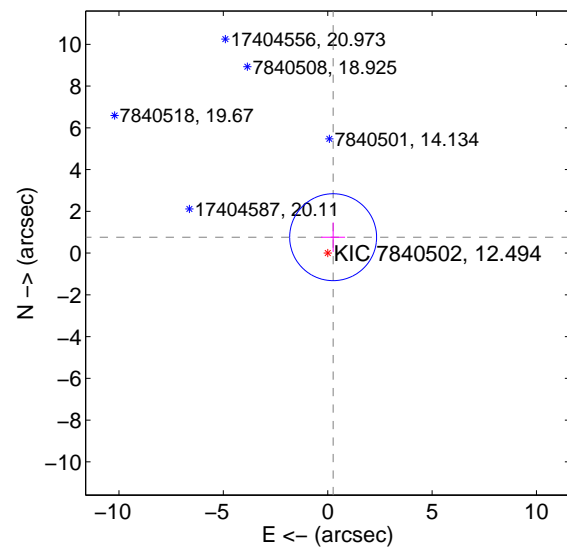
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

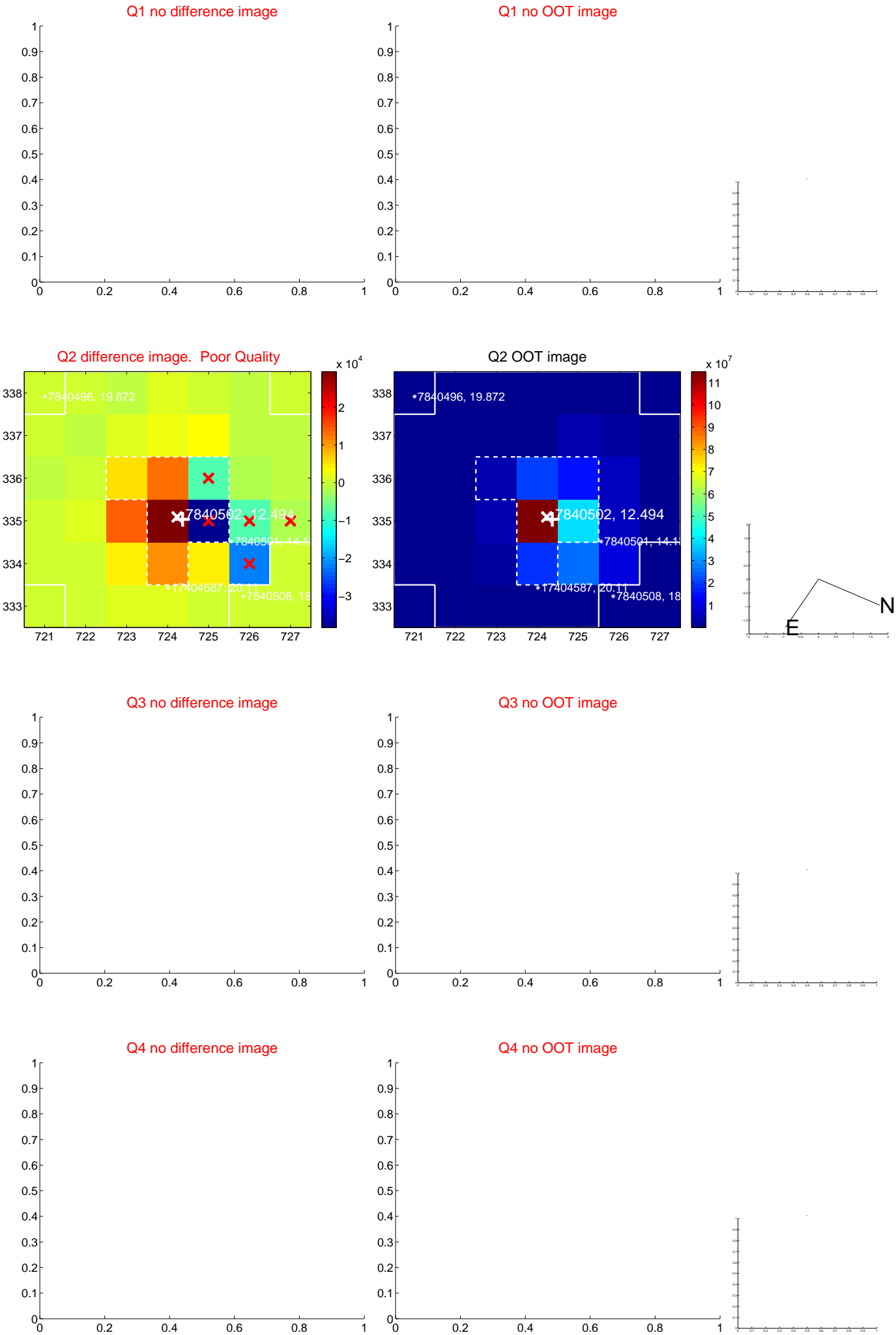


offset from photometric centroids



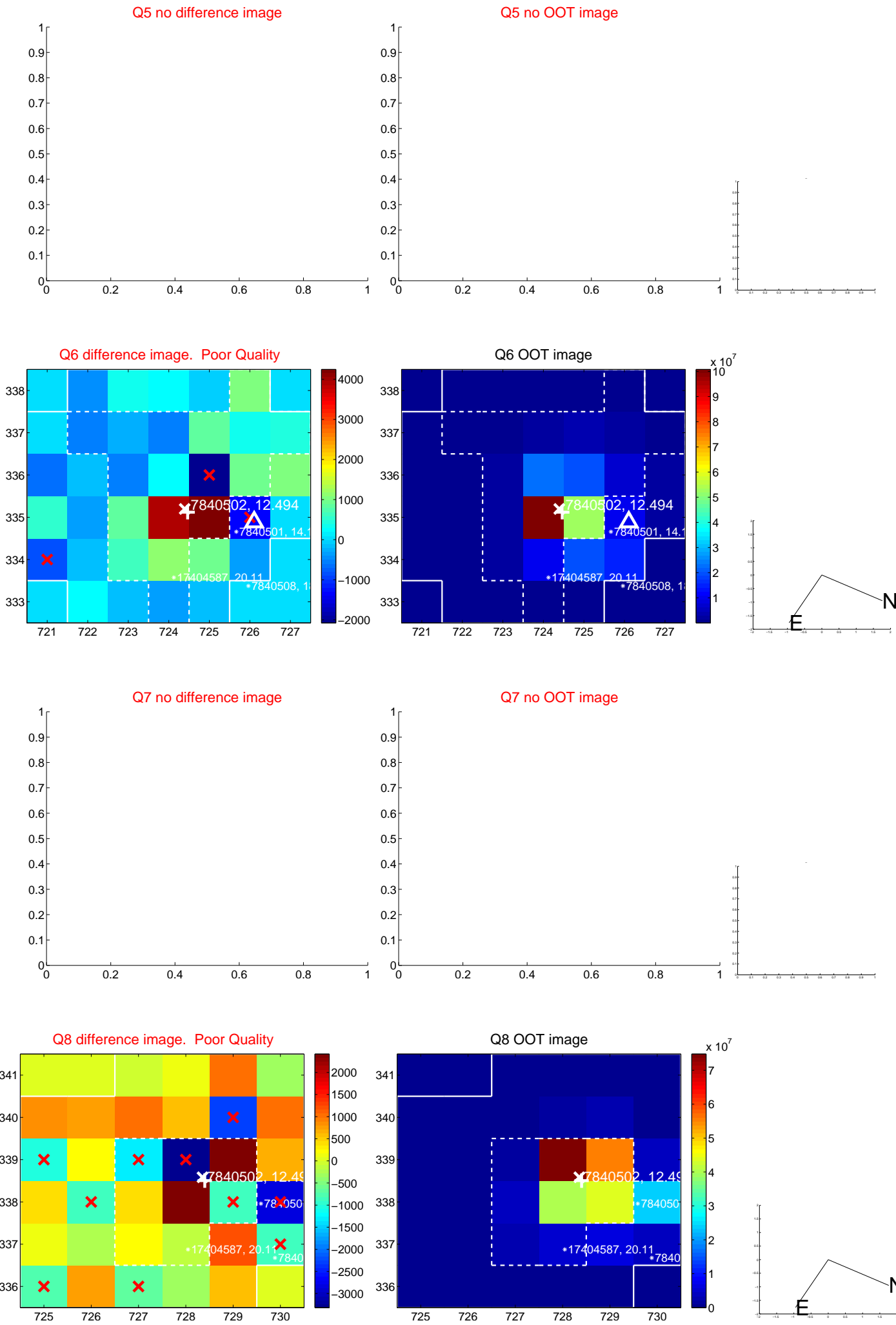
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

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

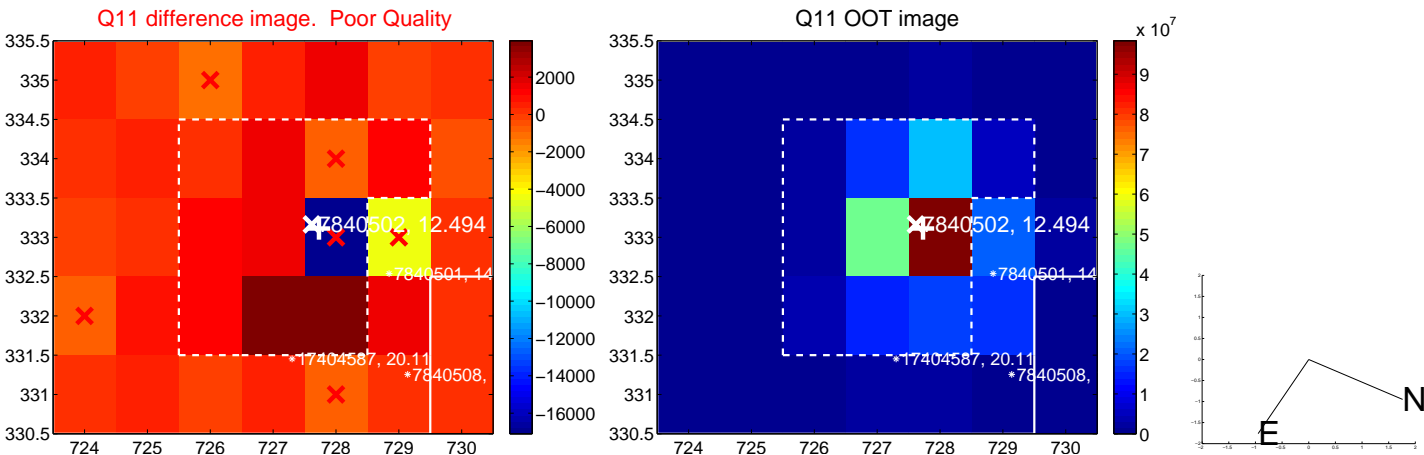
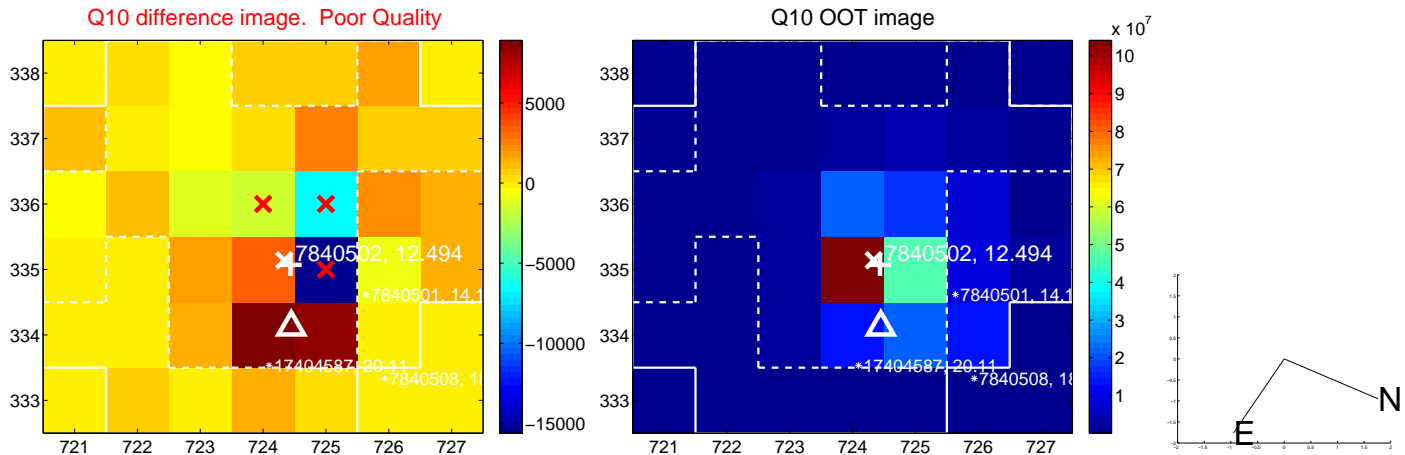
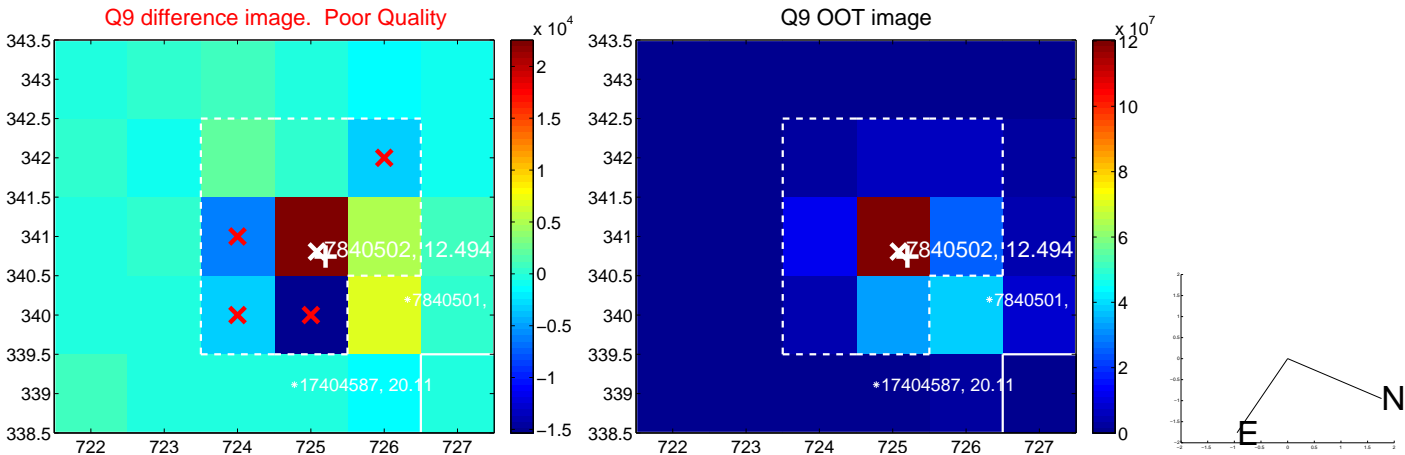




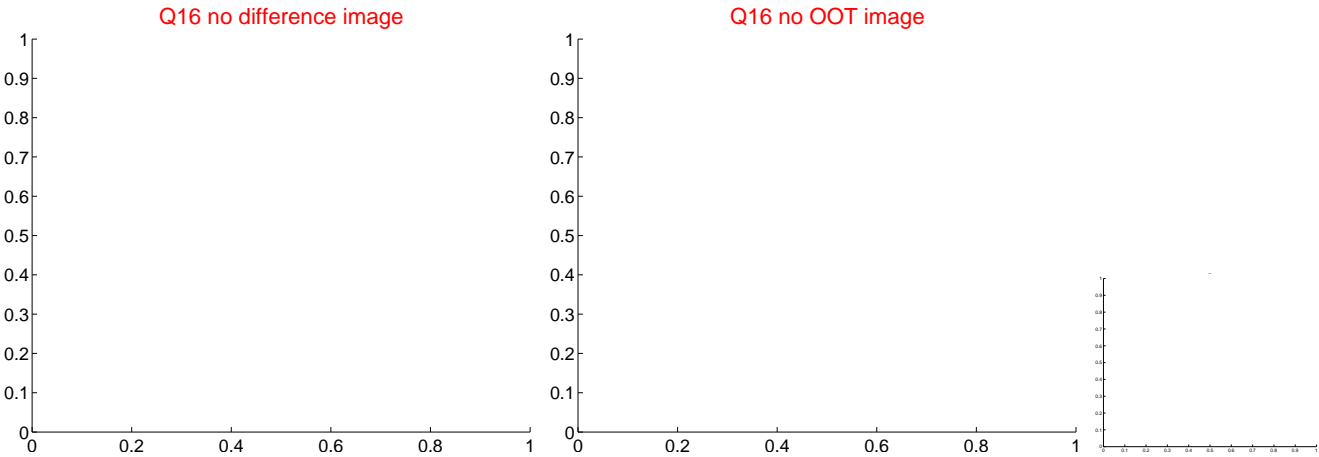
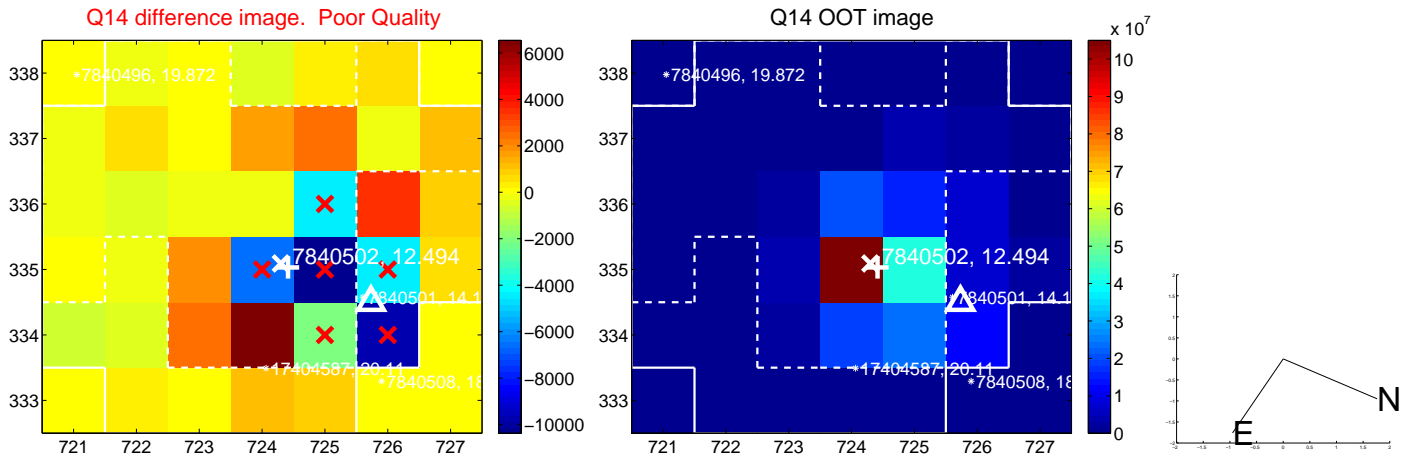
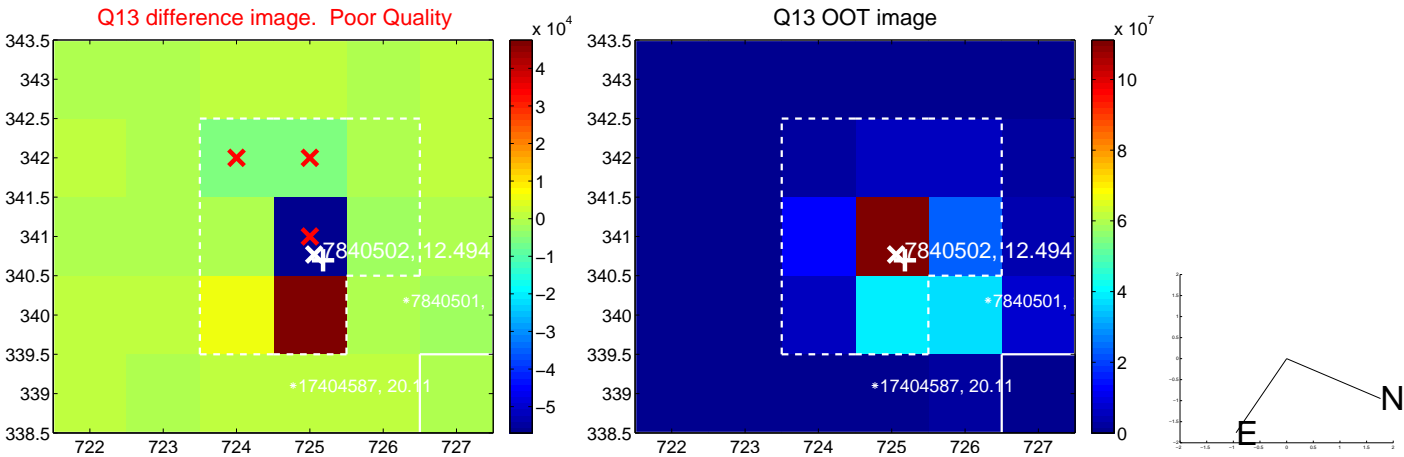
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



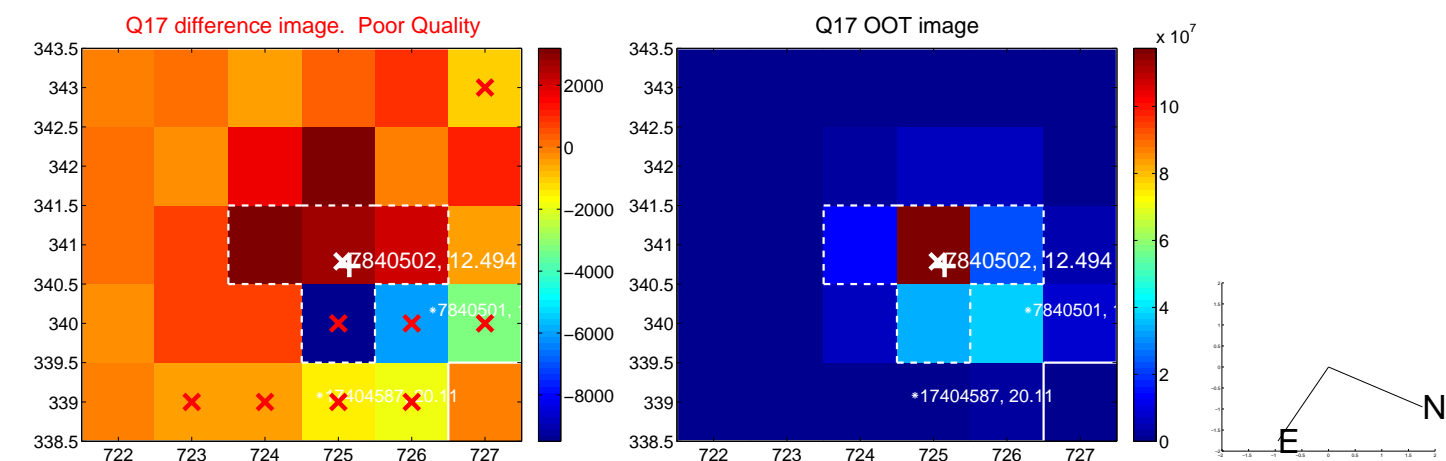
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



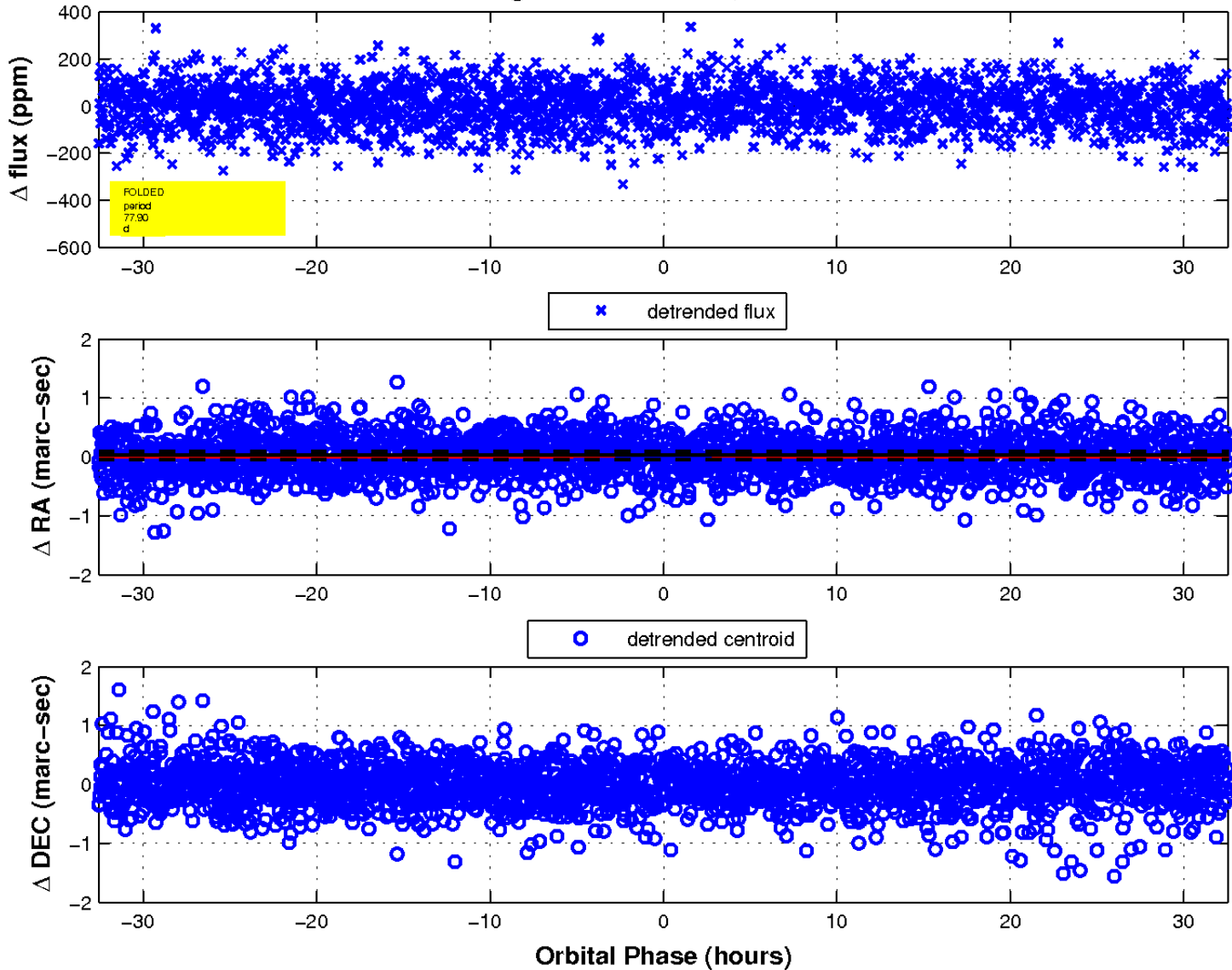
white ×: KIC target position; +: OOT centroid; △: difference centroid. red ×: large negative pixel value.



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

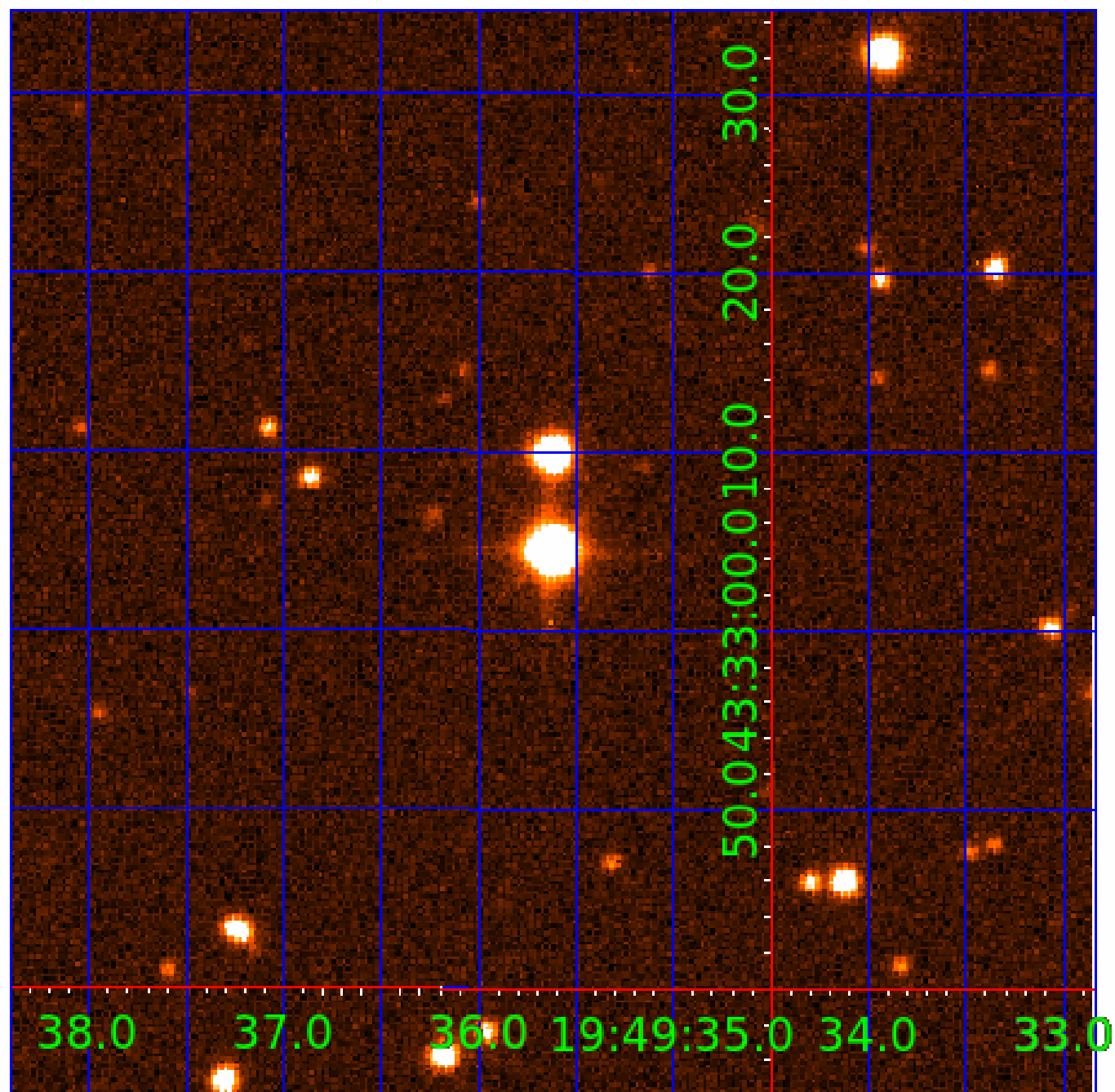


fluxWeightedCentroids, Planet 2 of 4



UKIRT Image

Declination





# KIC 007840502

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
007840502-01	OBS	No	1.587481	131.719564	5.0	10.521	7.9	4.9	1.96	5927	0.45	5200.56
007840502-02	OBS	No	77.895503	165.798364	112.7	10.860	10.8	8.2	1.96	5927	2.35	28.95
007840502-03	OBS	No	80.123112	154.337574	92.0	19.477	10.4	8.6	1.96	5927	2.13	27.88
007840502-04	OBS	No	53.276778	144.153876	70.9	6.760	8.8	7.2	1.96	5927	1.96	48.04

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
007840502-01	OBS	FP	0.00	1	0	1	0	LPP_DV—MOD_NONUNIQ_ALT—CENT_RESOLVED_OFFSET
007840502-02	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE_SKYE—TRANS_GAPPED—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS—HALO_GHOST
007840502-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
007840502-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—CENT_FEW_MEAS

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

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

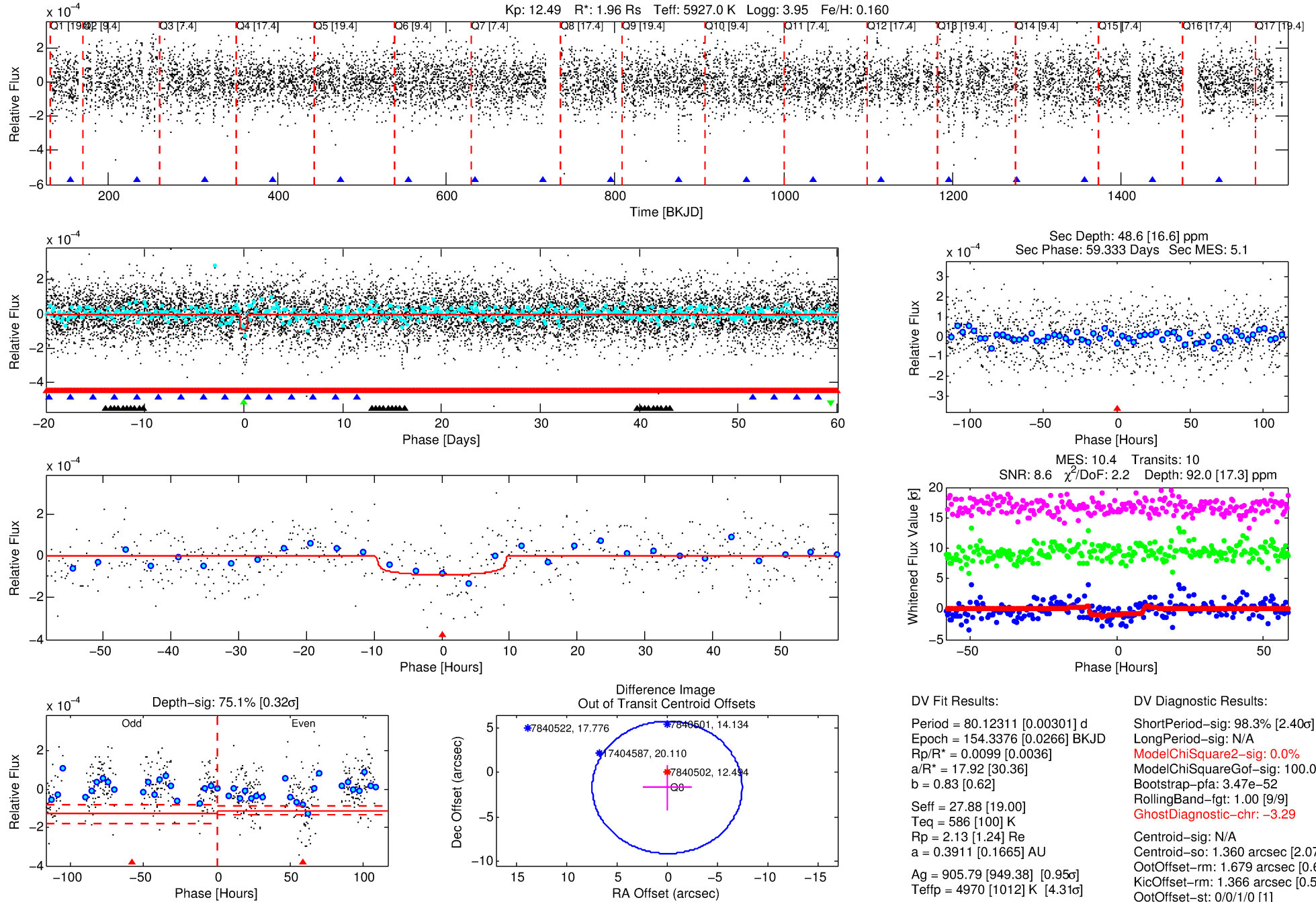
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 007840502-03

No Significant Match Found

# DV One-Page Summary

KIC: 7840502 Candidate: 3 of 4 Period: 80.123 d



## DV Fit Results:

Period = 80.12311 [0.00301] d  
Epoch = 154.3376 [0.0266] BKJD  
Rp/R\* = 0.0099 [0.0036]  
a/R\* = 17.92 [30.36]  
b = 0.83 [0.62]  
Seff = 27.88 [19.00]  
Teq = 586 [100] K  
Rp = 2.13 [1.24] Re  
a = 0.3911 [0.1665] AU  
Ag = 905.79 [949.38] [0.95 $\sigma$ ]  
Teffp = 4970 [1012] K [4.31 $\sigma$ ]

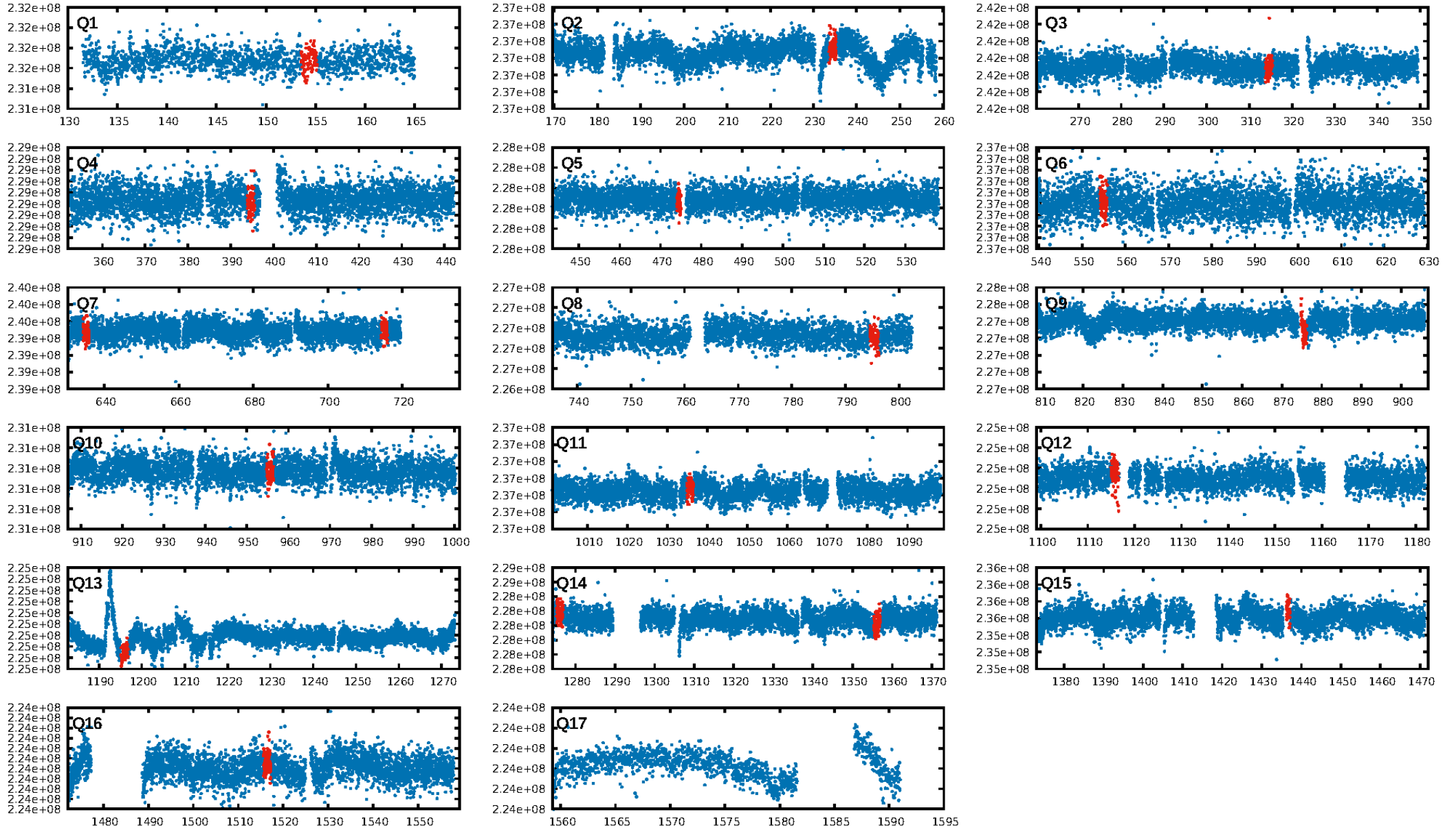
## DV Diagnostic Results:

ShortPeriod-sig: 98.3% [2.40 $\sigma$ ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: 0.0%  
ModelChiSquareGof-sig: 100.0%  
Bootstrap-pfa: 3.47e-52  
RollingBand-fgt: 1.00 [9/9]  
GhostDiagnostic-chr: -3.29  
Centroid-sig: N/A  
Centroid-so: 1.360 arcsec [2.07 $\sigma$ ]  
OotOffset-rm: 1.679 arcsec [0.68 $\sigma$ ]  
KicOffset-rm: 1.366 arcsec [0.55 $\sigma$ ]  
OotOffset-st: 0/0/1/0 [1]  
KicOffset-st: 0/0/1/0 [1]  
DiffImageQuality-fgm: 0.00 [0/1]  
DiffImageOverlap-fno: 0.00 [0/9]

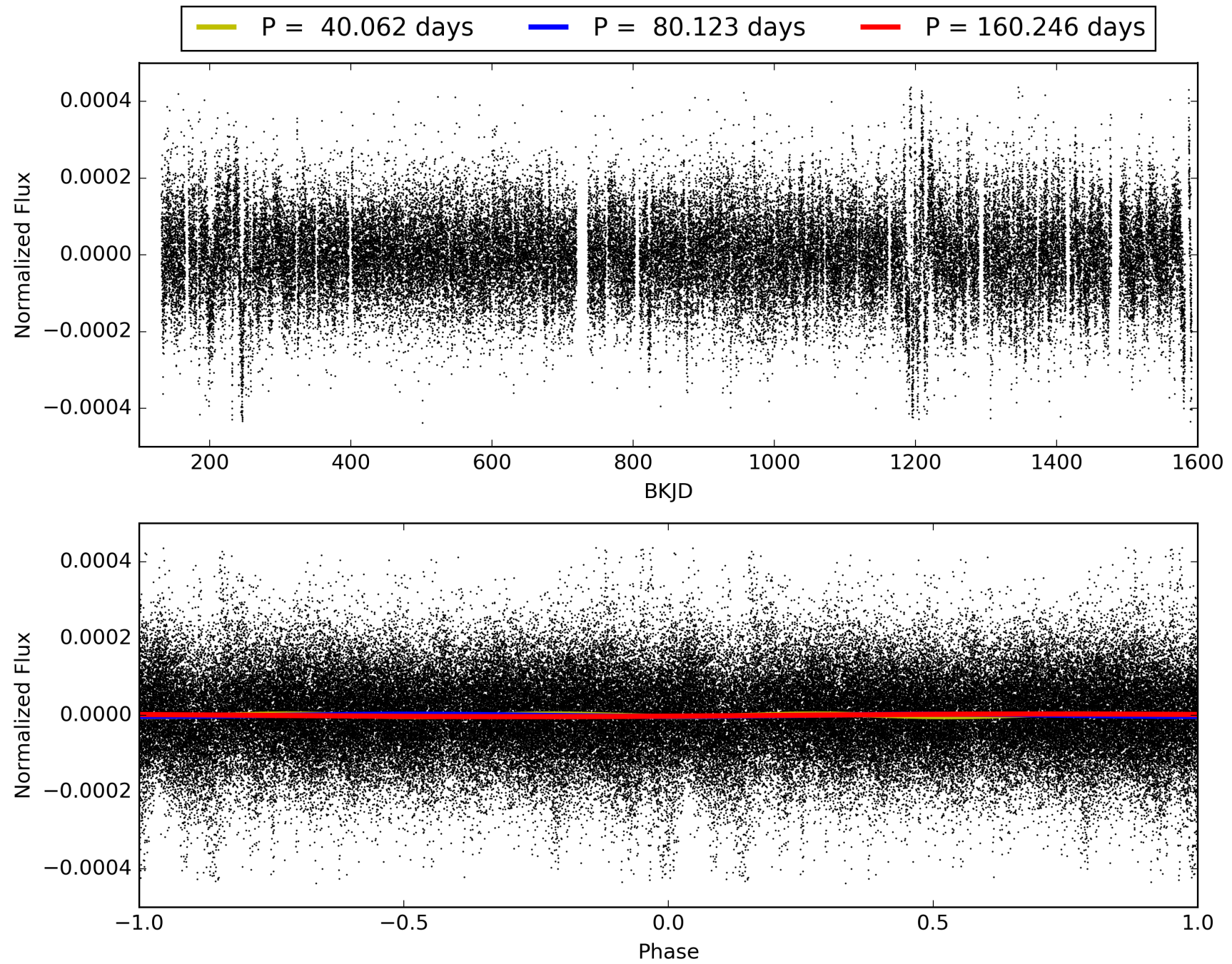
Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 06:57:08 Z

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

# TCE 007840502-03, PDC Light Curves

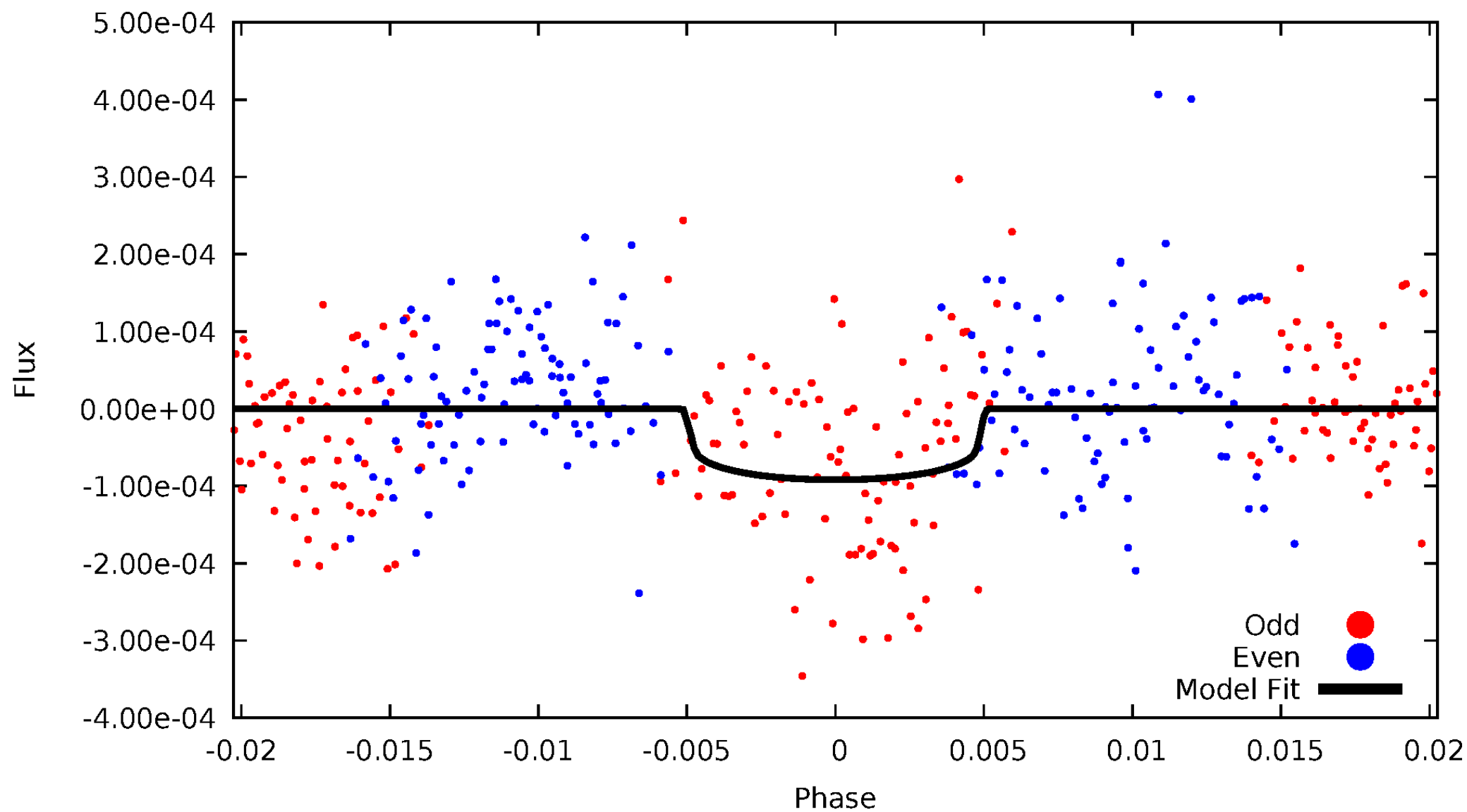


TCE 007840502-03



# DV Odd/Even

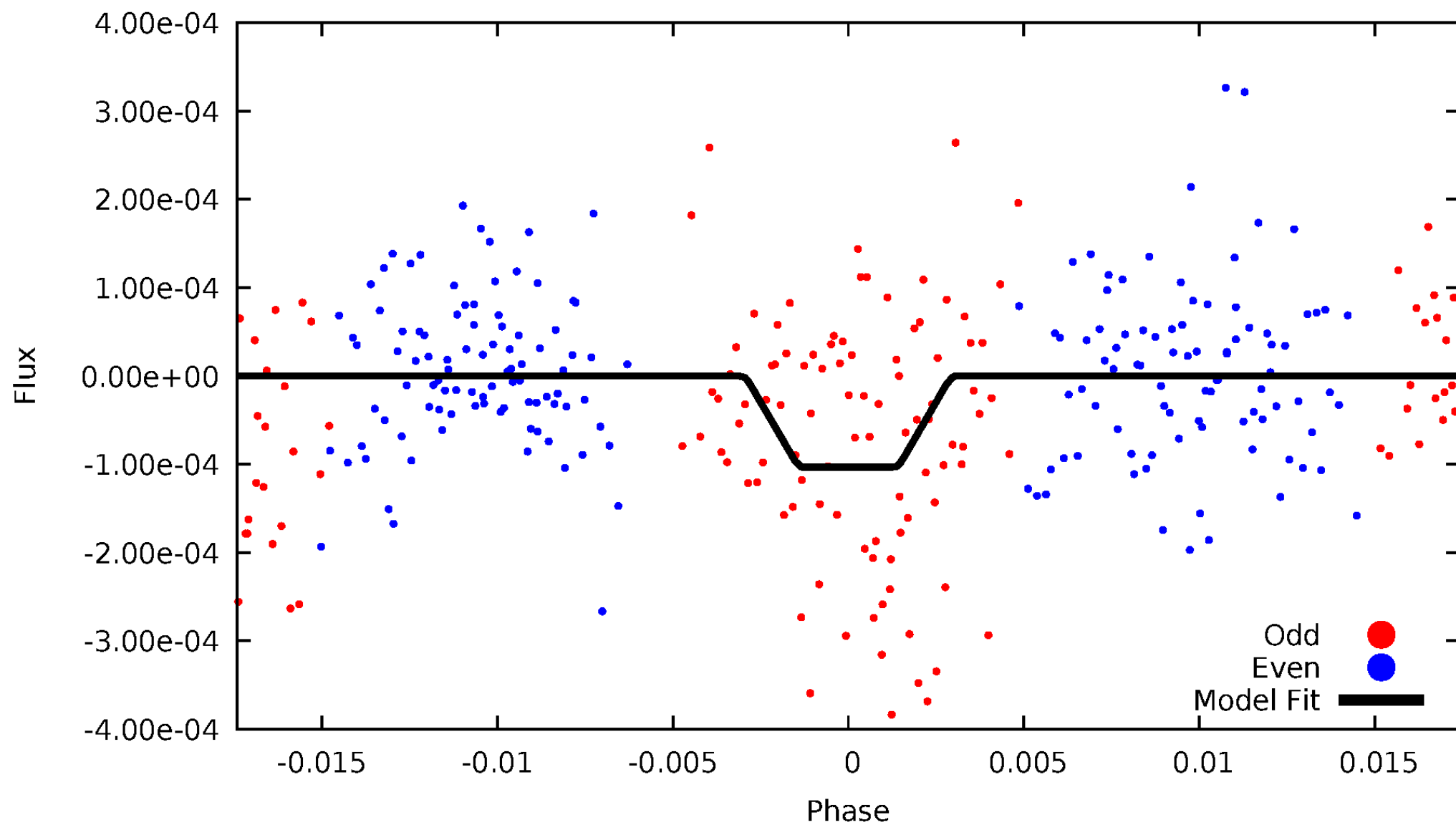
TCE 007840502-03





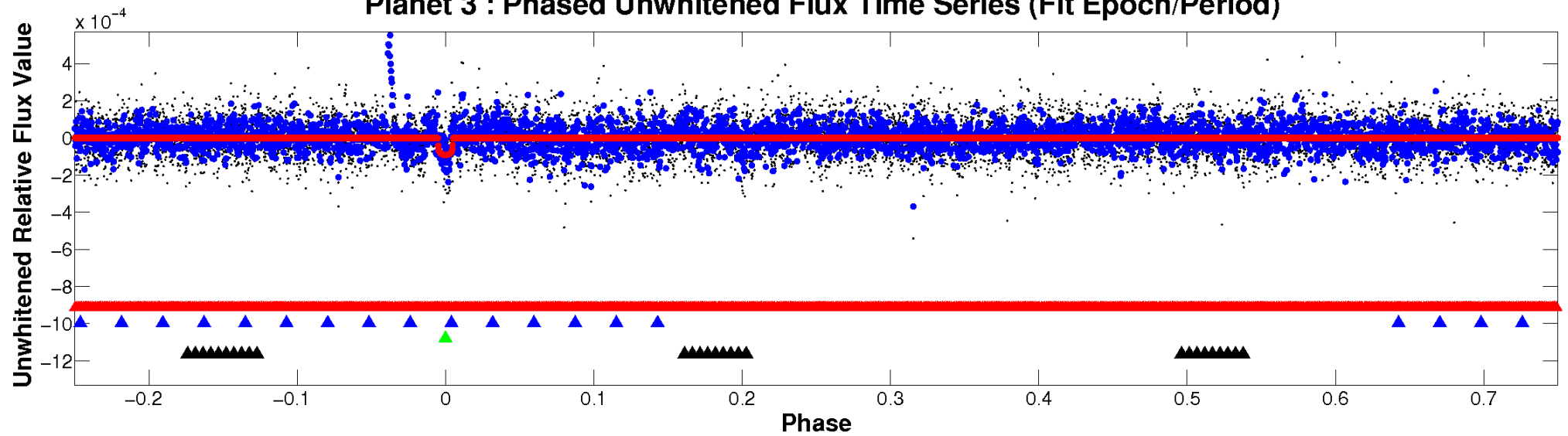
# ALT Odd/Even

TCE 007840502-03

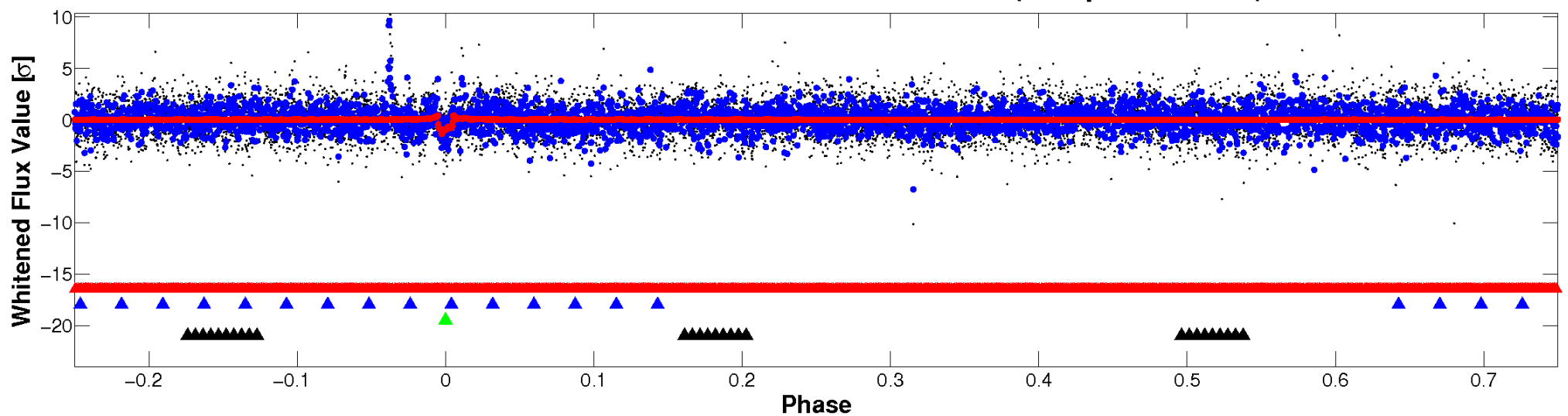


# Non-Whitened Vs. Whitened Light Curve

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

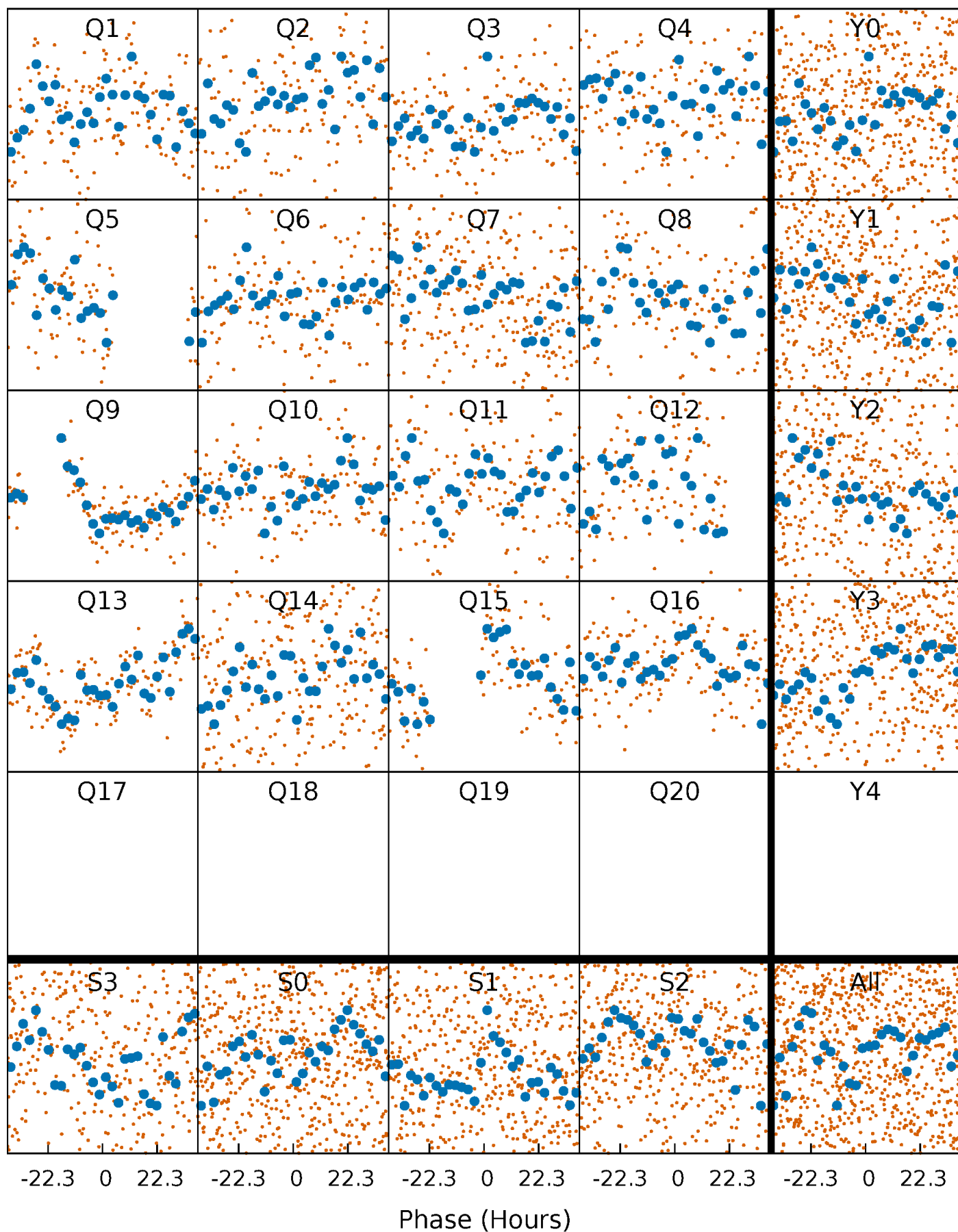


## Planet 3 : Phased Whitened Flux Time Series (Fit Epoch/Period)



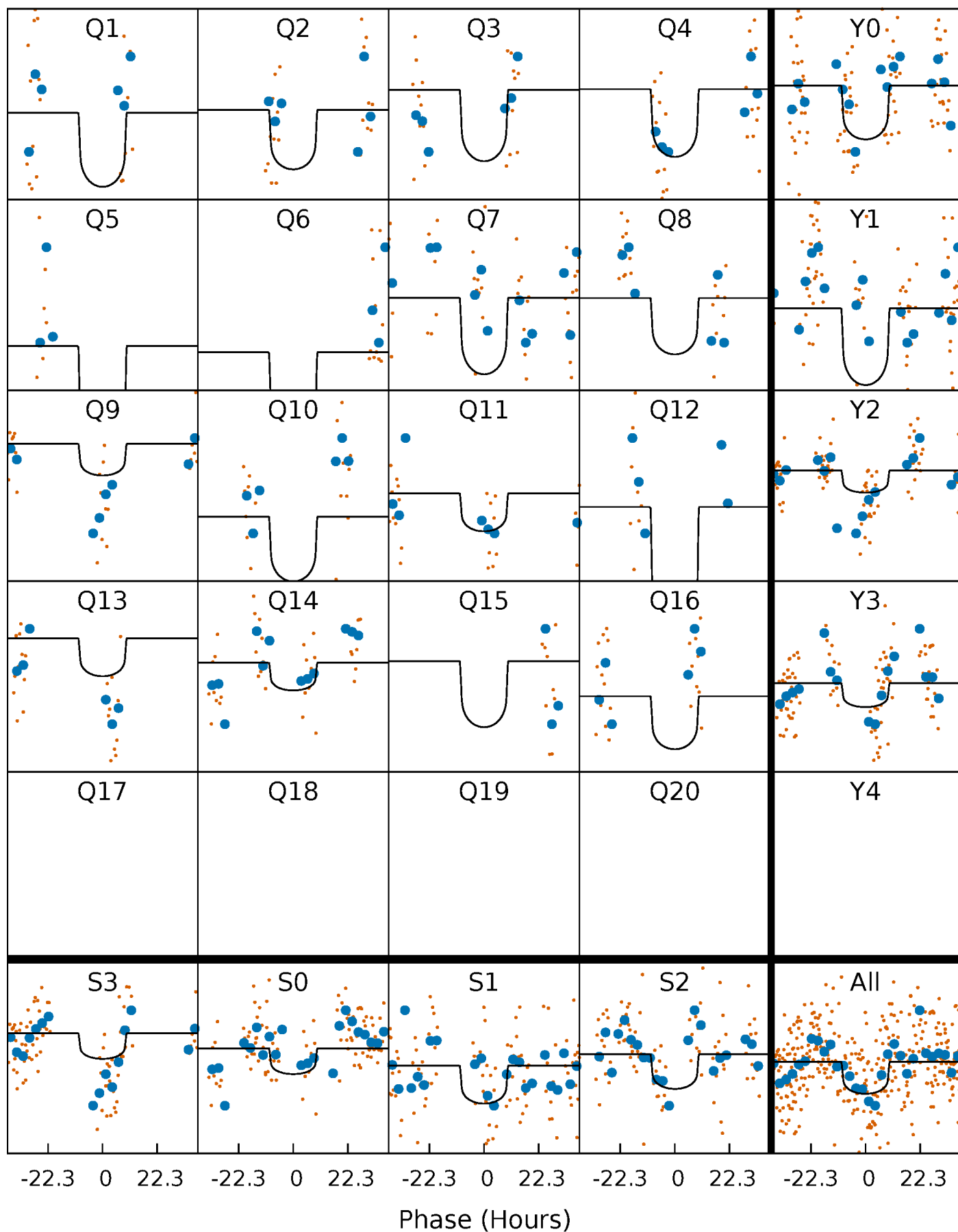
# PDC Quarter-Phased Transit Curves

TCE 007840502-03     $P = 80.123112$  Days     $T_0 = 154.337574$  (BKJD)



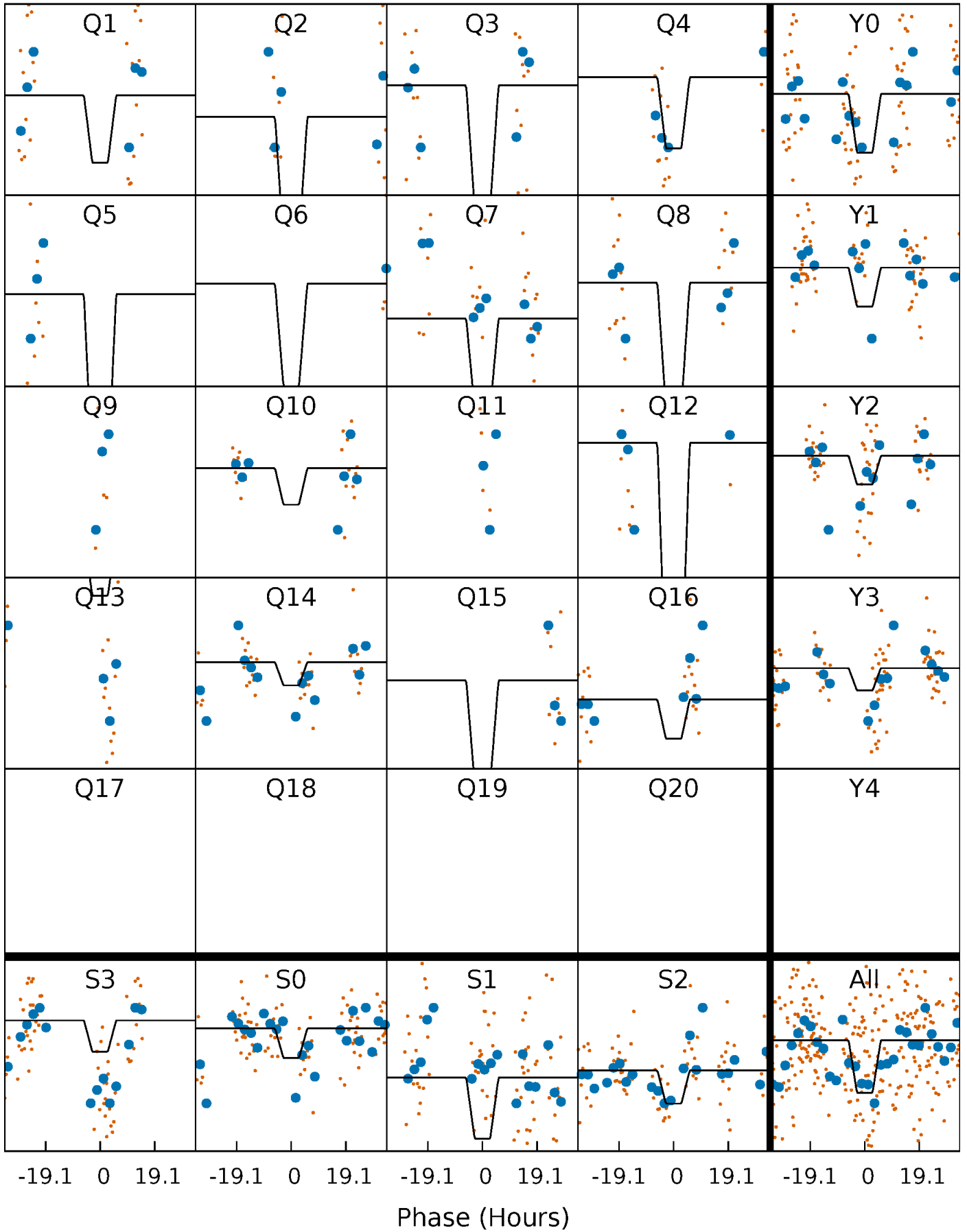
# DV Quarter-Phased Transit Curves

TCE 007840502-03     $P = 80.123112$  Days     $T_0 = 154.337574$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

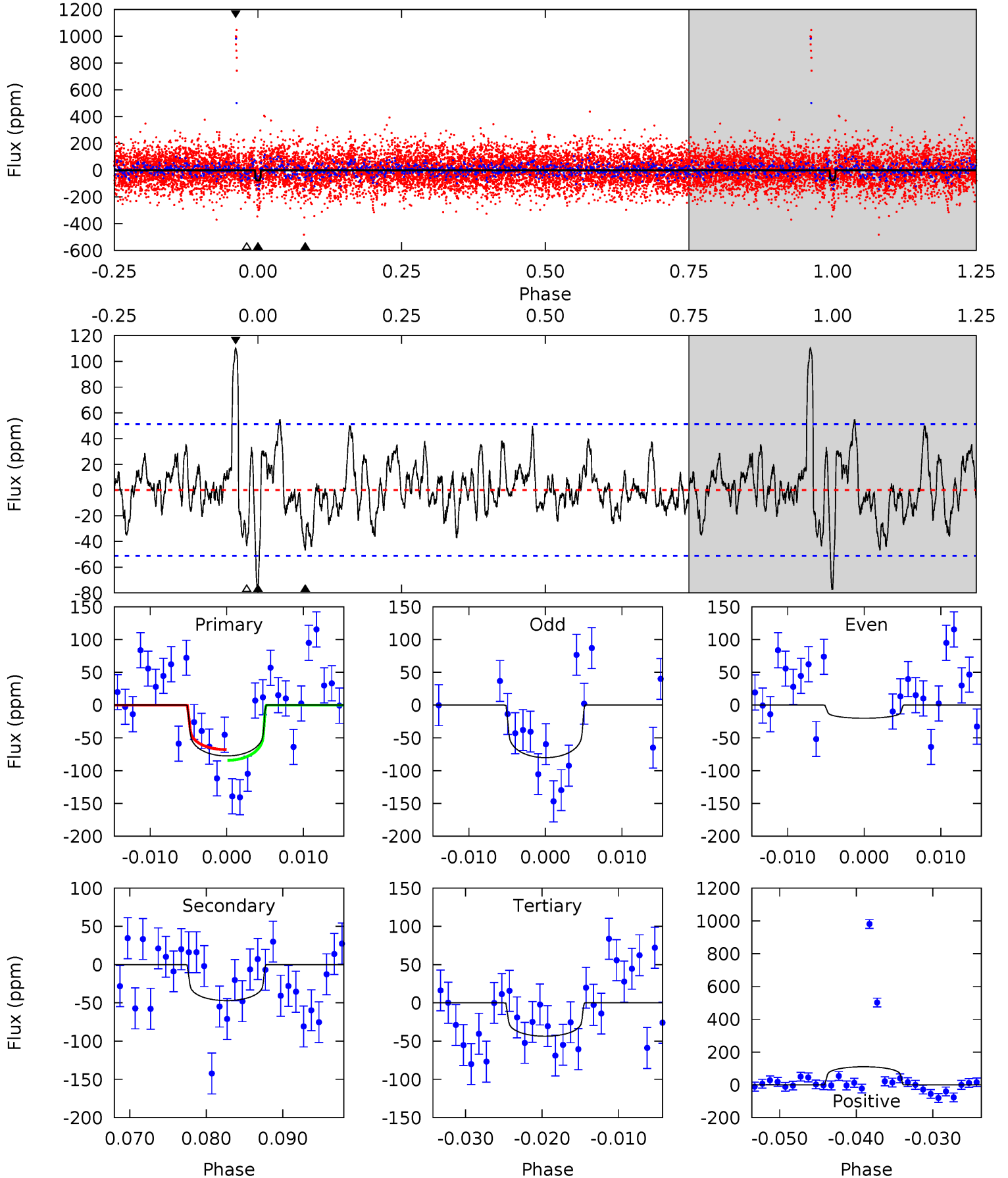
TCE 007840502-03     $P = 80.134452$  Days     $T_0 = 154.233264$  (BKJD)



# DV Model-Shift Uniqueness Test

007840502-03, P = 80.123112 Days, E = 74.214462 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
7.60	4.61	4.27	10.8	5.03	2.58	1.82	3.33	-3.21	0.34	-6.21	1.70	0.99	0.59	0.78

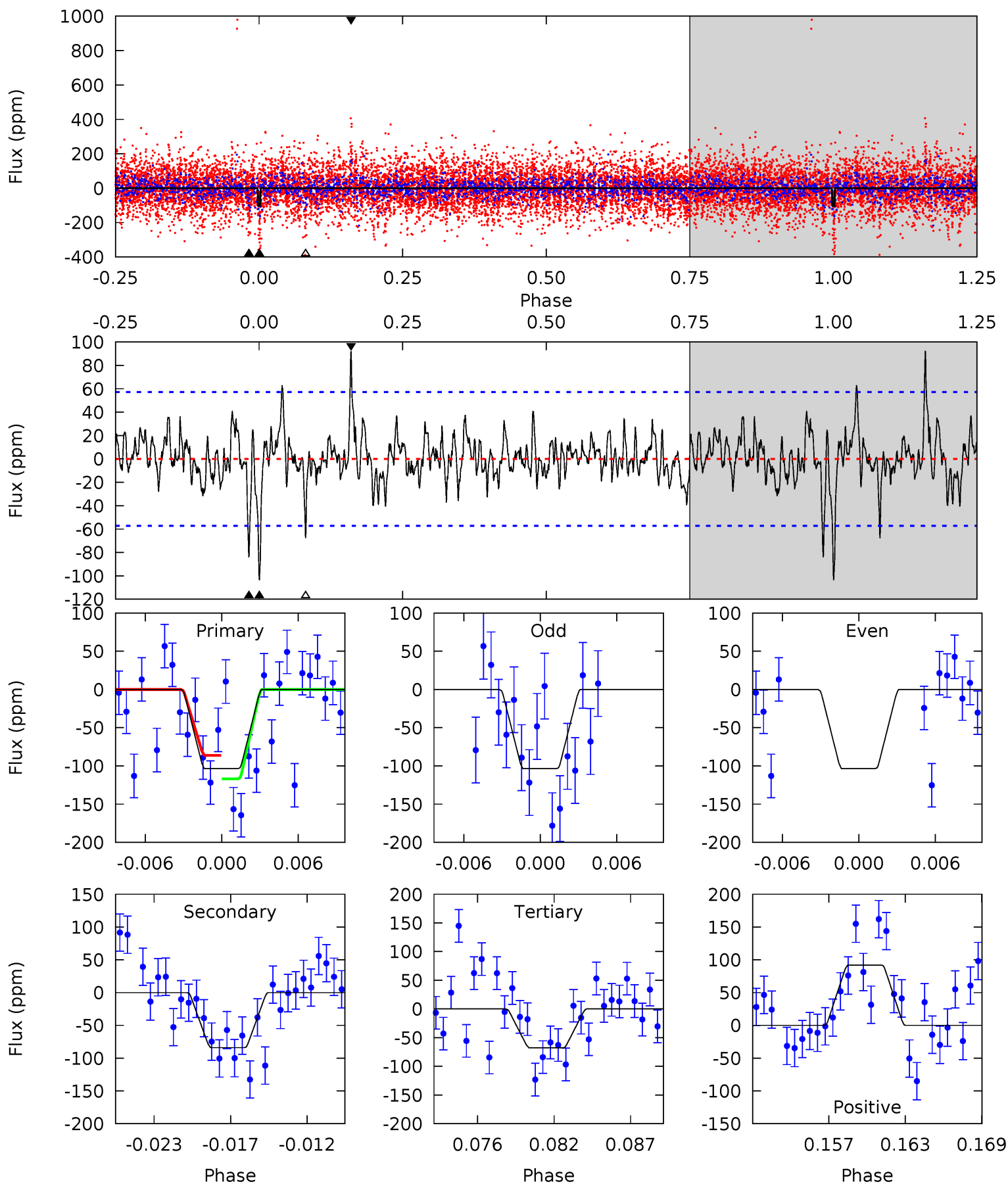




# Alt Model-Shift Uniqueness Test

007840502-03, P = 80.134452 Days, E = 74.098812 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
9.29	7.54	6.07	8.25	5.13	2.76	1.49	3.22	1.05	1.46	-0.71	0	1.56	0.47	1.35



### Stellar Parameters For KIC 007840502

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R$ ( $R_{\odot}$ )	$M(M_{\odot})$	$p_{\star}$ ( $\text{g}\cdot\text{cm}^{-3}$ )
	$5927^{+160}_{-178}$	$3.946^{+0.390}_{-0.130}$	$0.160^{+0.200}_{-0.300}$	$1.964^{+0.382}_{-0.892}$	$1.242^{+0.168}_{-0.252}$	$0.231^{+0.755}_{-0.087}$
	+3%/-3%	+10%/-3%	+125%/-188%	+19%/-45%	+14%/-20%	+327%/-38%
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 007840502-03 / KOI

Detrend	Depth (ppm)	$R_p$ ( $R_{\oplus}$ )	$T_{\text{max}}$ (K)	$T_{\text{obs}}$ (K)	$A_{\text{obs}}$
DV	$-47 \pm 10$	$1.99^{+0.88}_{-0.89}$	$809^{+55}_{-85}$	$5037^{+1356}_{-638}$	$1002^{+2459}_{-526}$
Alt.	$-84 \pm 11$	$2.02^{+0.88}_{-0.80}$	$802^{+58}_{-95}$	$5595^{+1372}_{-730}$	$1712^{+2952}_{-857}$

$T_{\text{max}}$  = 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

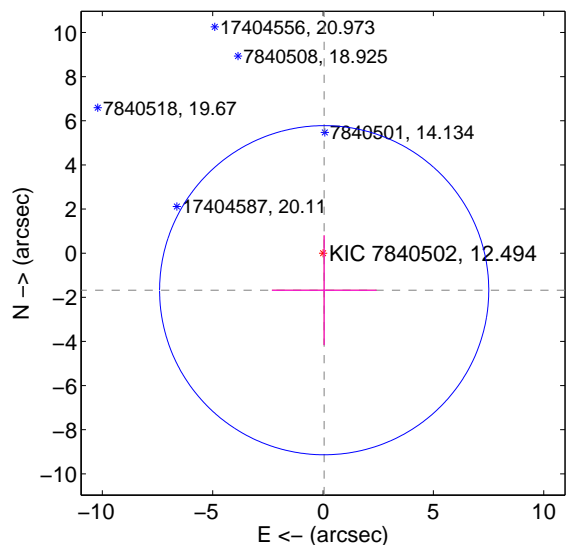
Supplemental centroid analysis for 007840502-03. Kepler magnitude: 12.49. Transit SNR 8.55

There are 0 quarters with good PRF difference image offsets

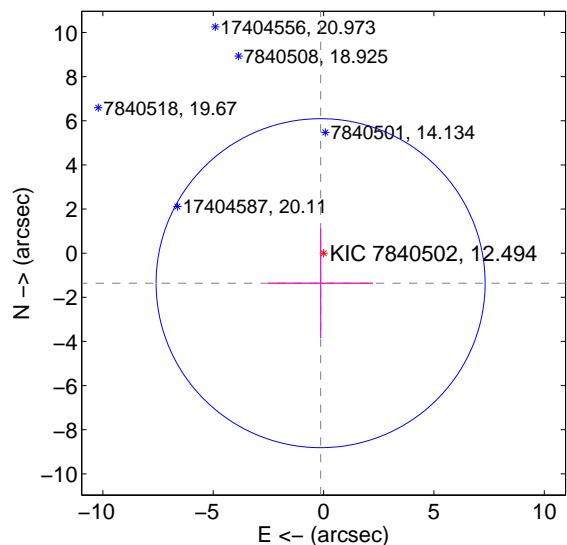
The direct PRF centroid is offset from the target star catalog position by about 0.37 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$1.679 \pm 2.486$	0.68	$-0.052 \pm 2.368$	$-1.678 \pm 2.486$
PRF-fit source offset from KIC position	$1.366 \pm 2.485$	0.55	$0.135 \pm 2.368$	$-1.360 \pm 2.486$
photometric centroid source offset	$1.36 \pm 0.66$	2.07	$-0.37 \pm 0.57$	$1.31 \pm 0.66$

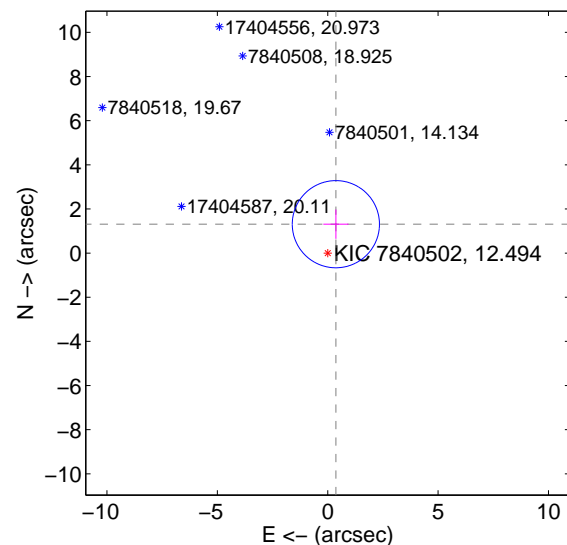
offset from difference PRF-fit to OOT PRF-fit



offset from difference PRF-fit to KIC position

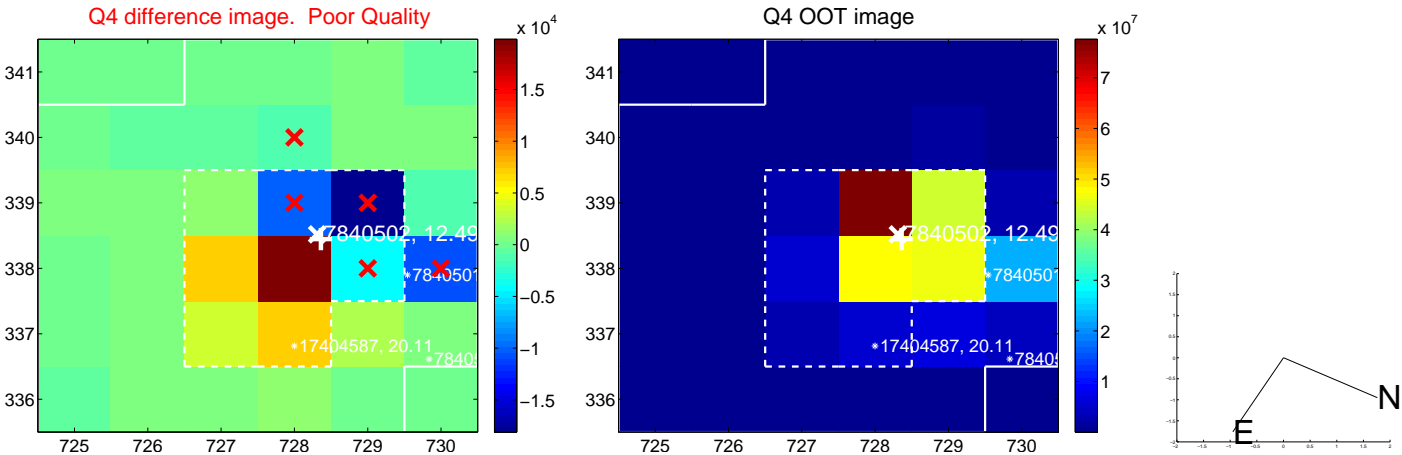
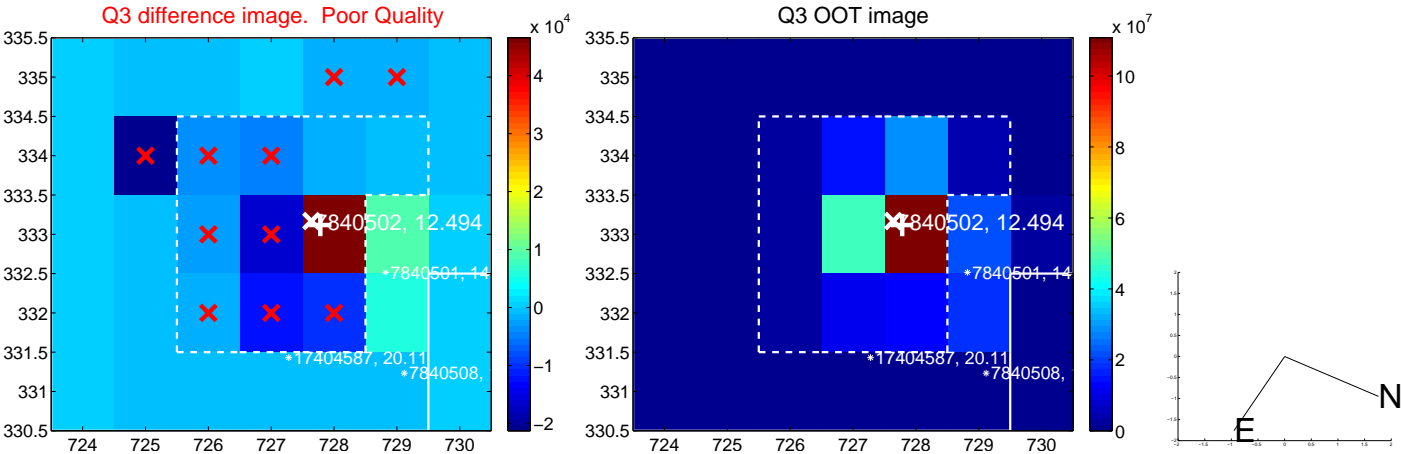
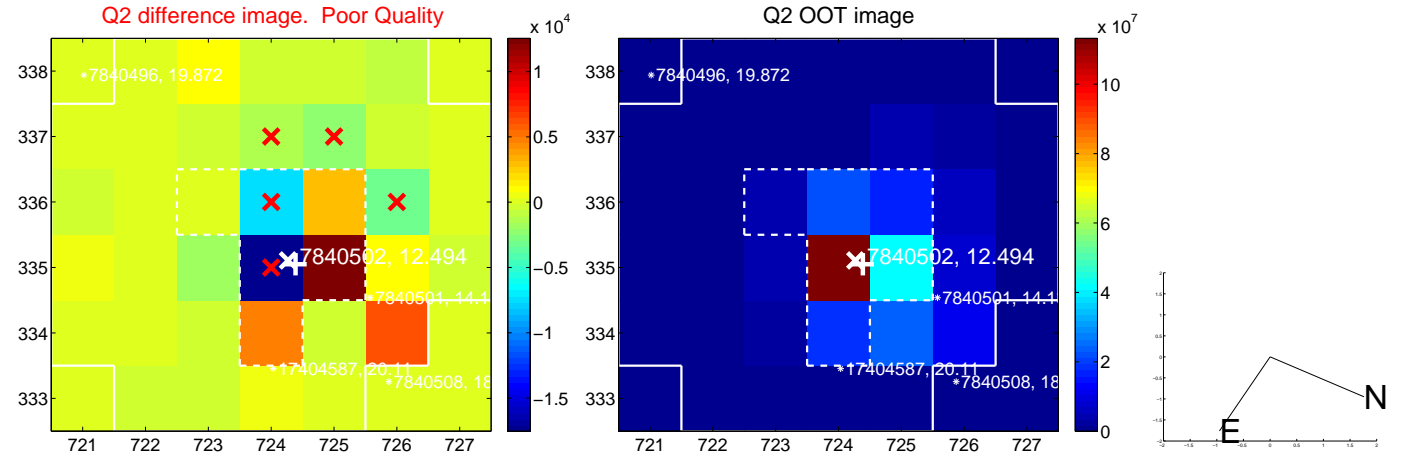
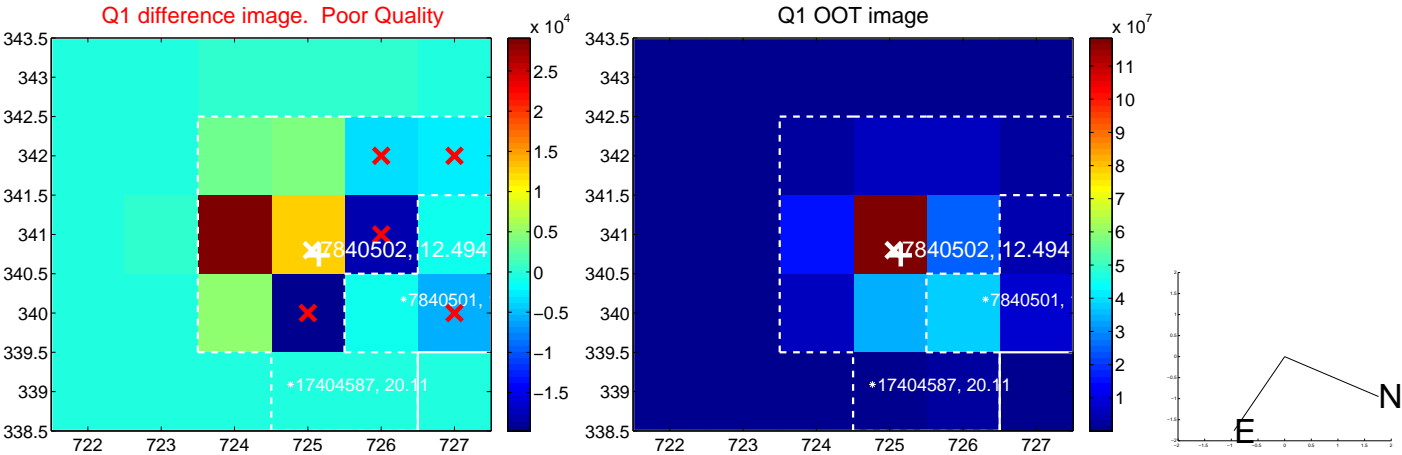


offset from photometric centroids

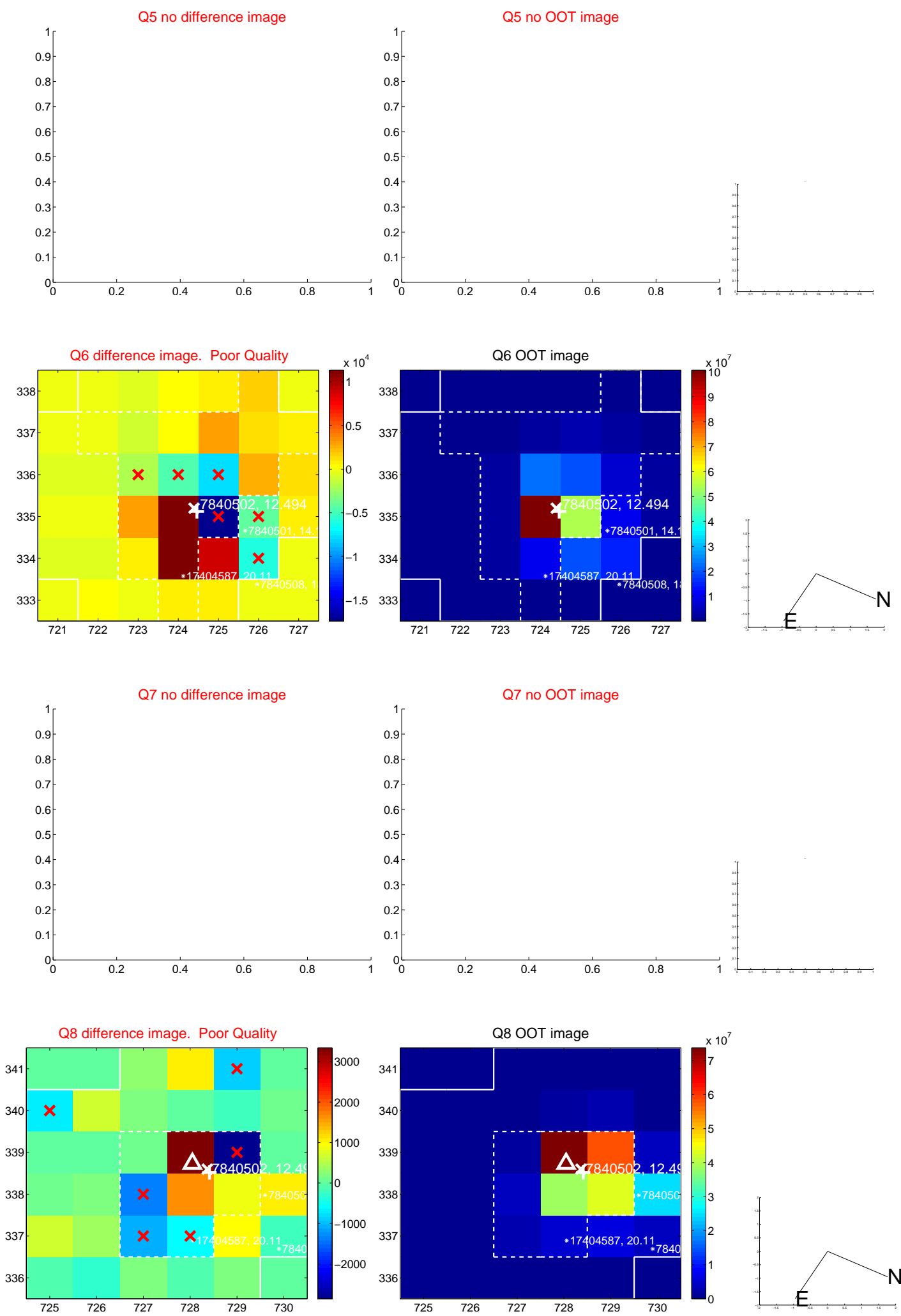


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: three-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

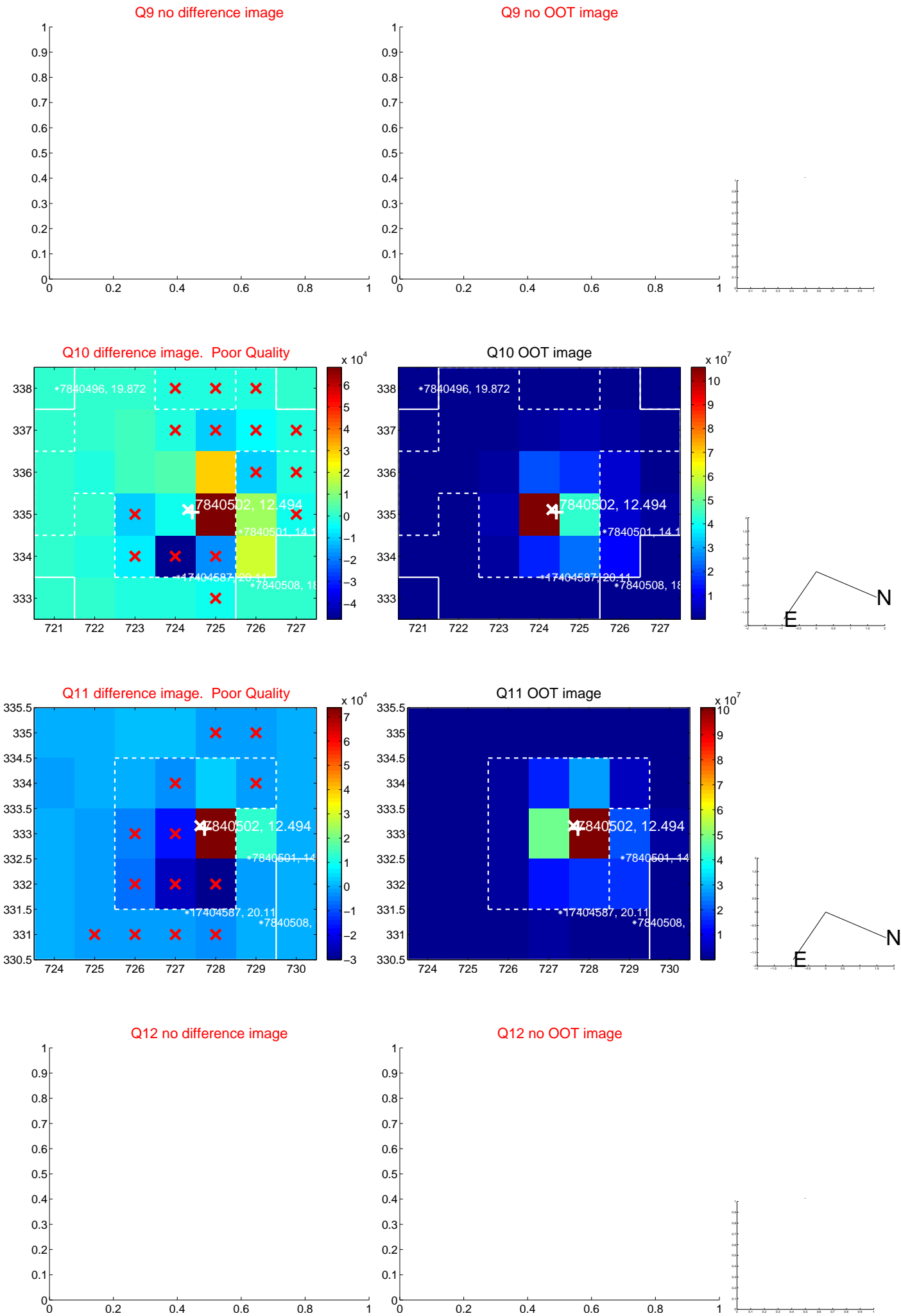
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

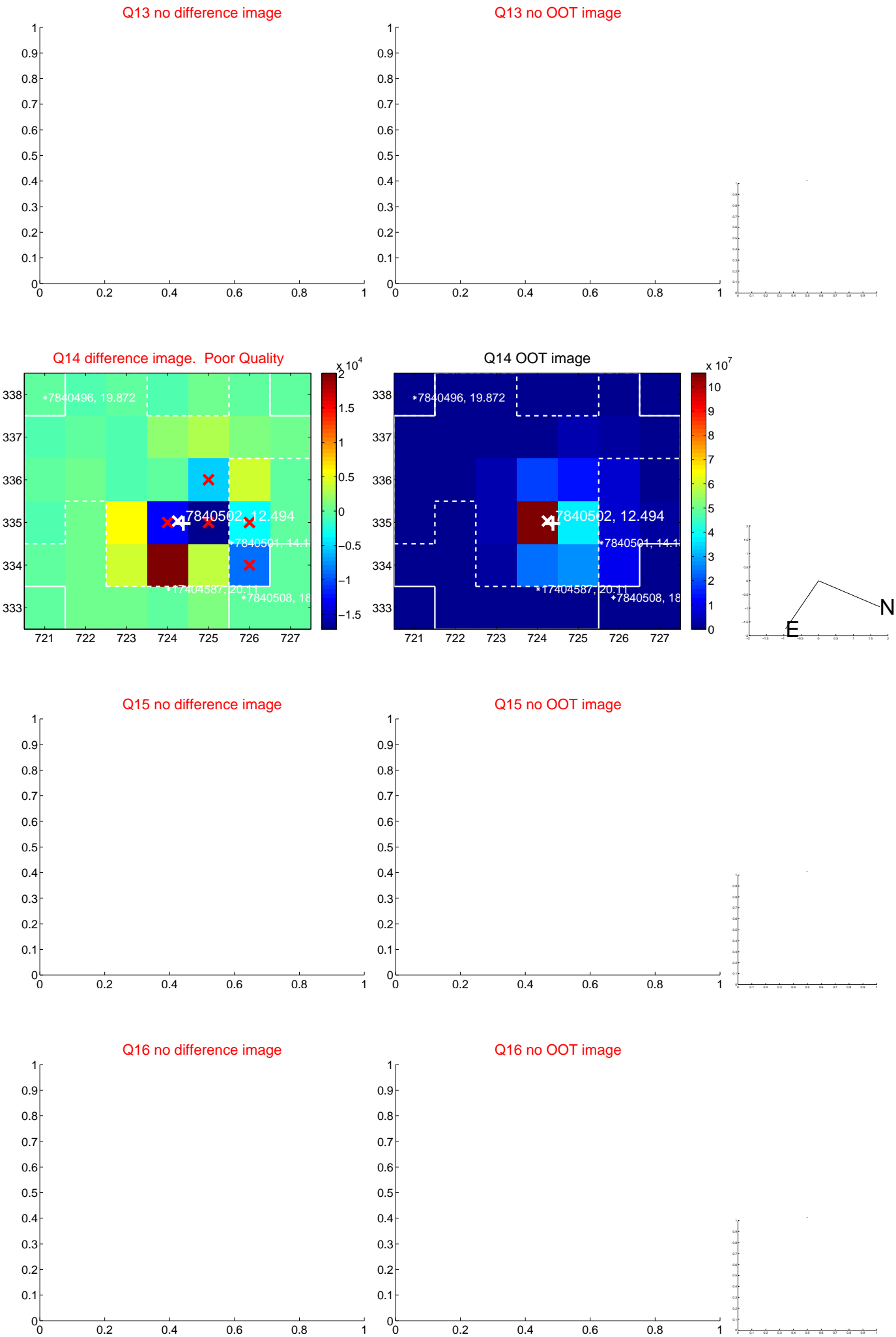


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

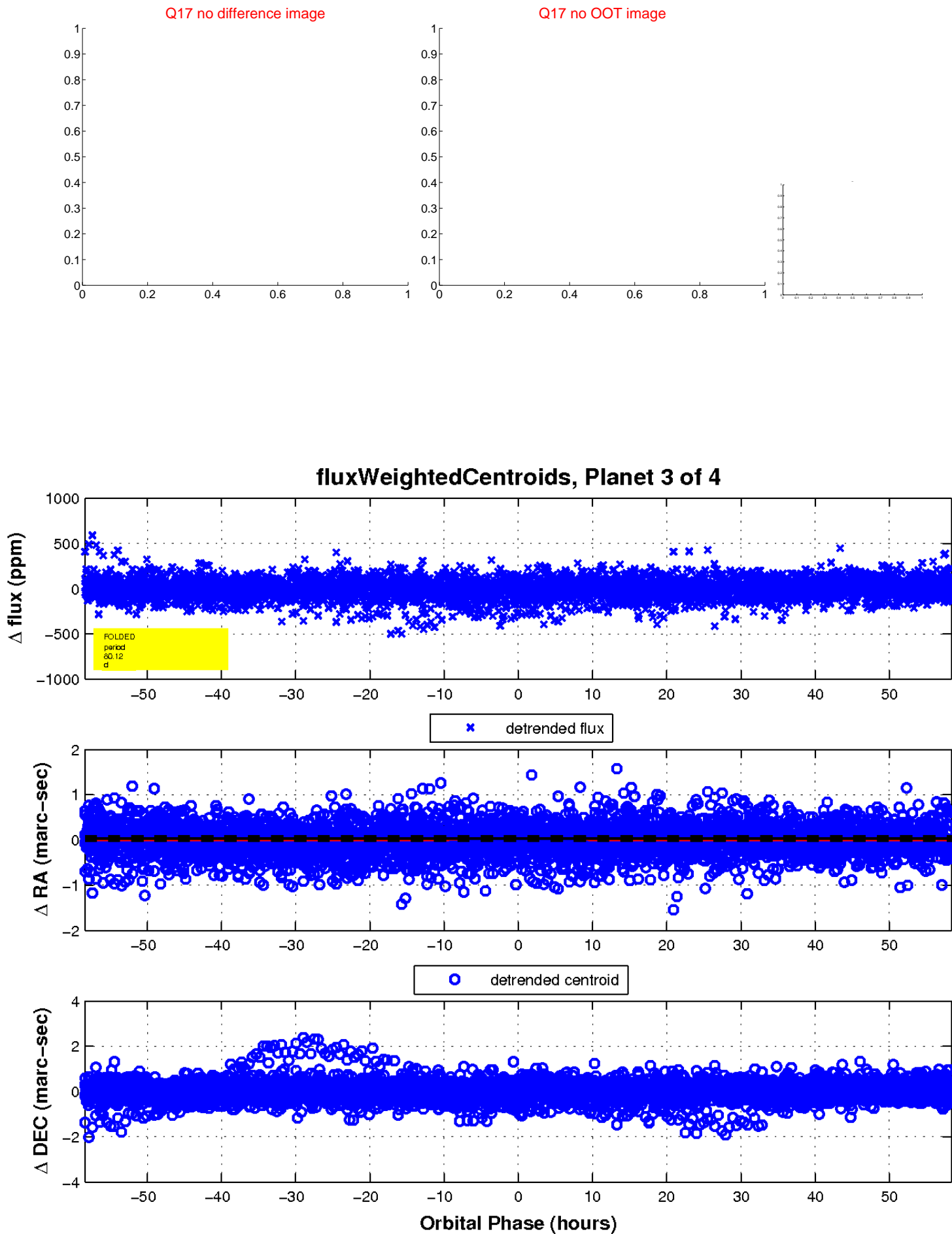




white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

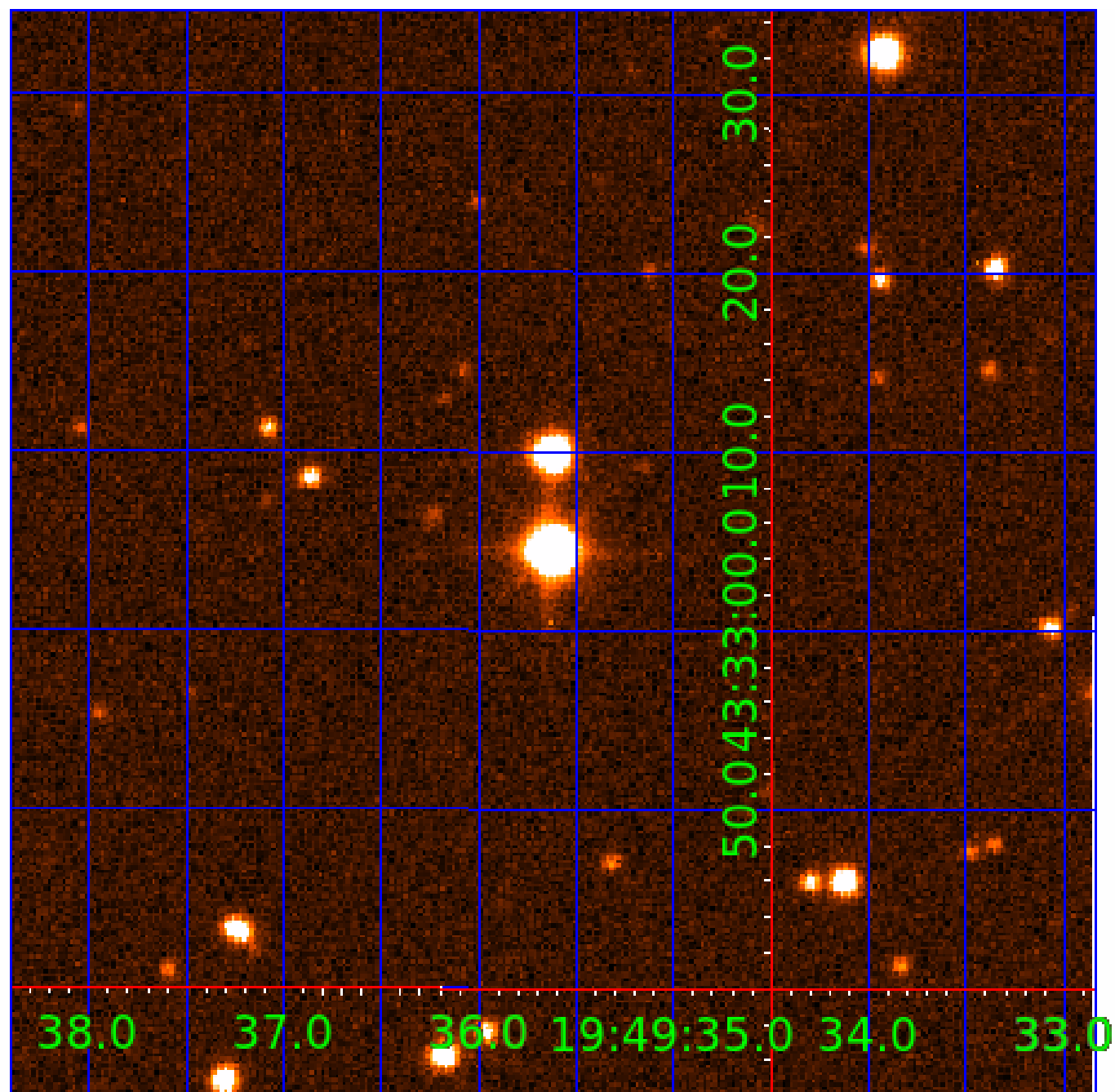


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination



# KIC 007840502

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
007840502-01	OBS	No	1.587481	131.719564	5.0	10.521	7.9	4.9	1.96	5927	0.45	5200.56
007840502-02	OBS	No	77.895503	165.798364	112.7	10.860	10.8	8.2	1.96	5927	2.35	28.95
007840502-03	OBS	No	80.123112	154.337574	92.0	19.477	10.4	8.6	1.96	5927	2.13	27.88
007840502-04	OBS	No	53.276778	144.153876	70.9	6.760	8.8	7.2	1.96	5927	1.96	48.04

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
007840502-01	OBS	FP	0.00	1	0	1	0	LPP_DV—MOD_NONUNIQ_ALT—CENT_RESOLVED_OFFSET
007840502-02	OBS	FP	0.00	1	0	1	0	INDIV_TRANS_RUBBLE_SKYE—TRANS_GAPPED—LPP_ALT—ALL_TRANS_CHASES—MOD_NONUNIQ_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_FEW_DIFFS—HALO_GHOST
007840502-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—MOD_POS_DV—MOD_NONUNIQ_ALT—MOD_POS_ALT—CENT_FEW_DIFFS
007840502-04	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE—TRANS_GAPPED—LPP_DV—MOD_NONUNIQ_DV—MOD_TER_DV—MOD_NONUNIQ_ALT—MOD_TER_ALT—CENT_FEW_MEAS

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

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

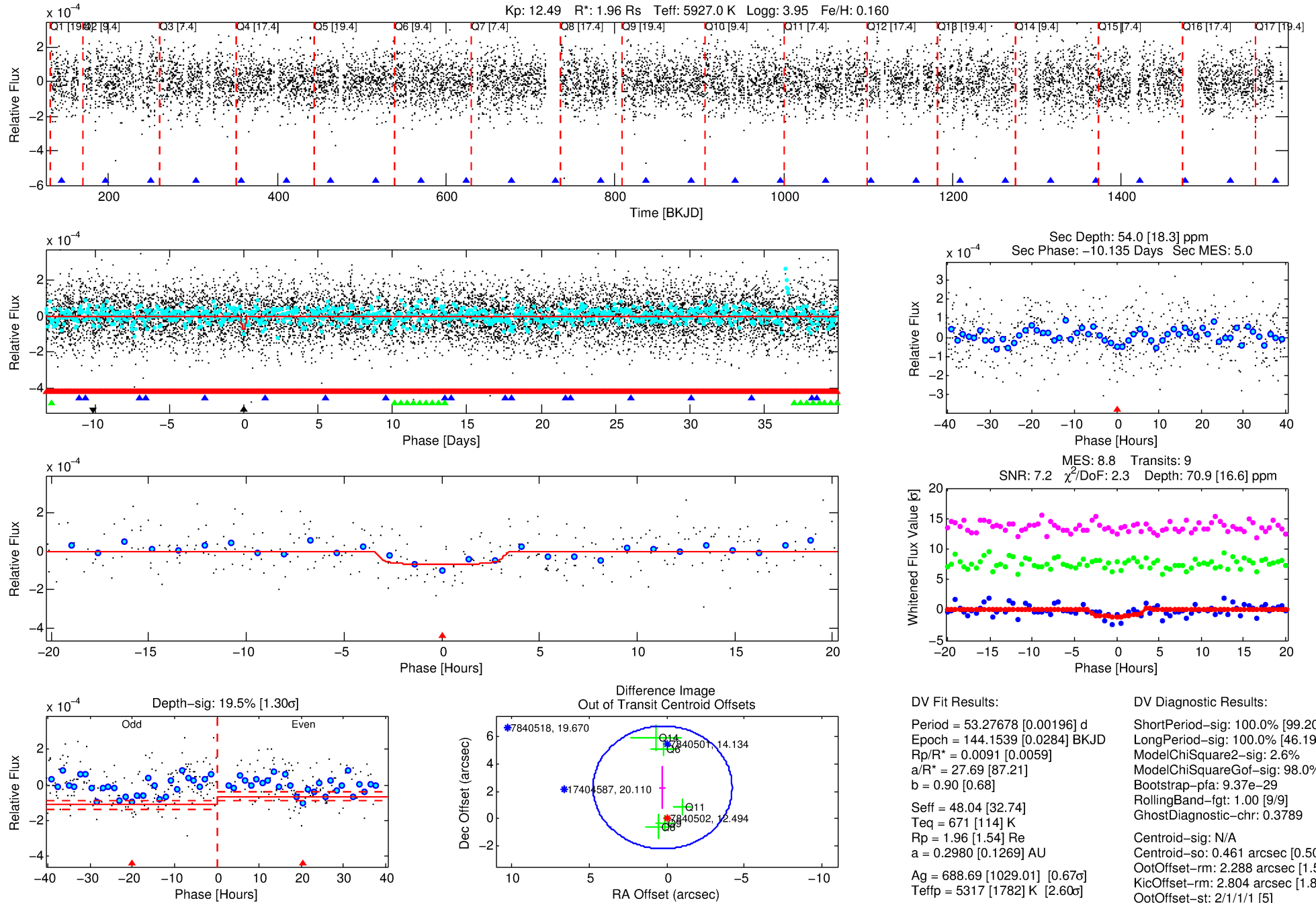
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

## Ephemeris Match Information For 007840502-04

No Significant Match Found

# DV One-Page Summary

KIC: 7840502 Candidate: 4 of 4 Period: 53.277 d



## DV Fit Results:

Period = 53.27678 [0.00196] d  
Epoch = 144.1539 [0.0284] BKJD  
Rp/R\* = 0.0091 [0.0059]  
a/R\* = 27.69 [87.21]  
b = 0.90 [0.68]  
Seff = 48.04 [32.74]  
Teq = 671 [114] K  
Rp = 1.96 [1.54] Re  
a = 0.2980 [0.1269] AU  
Ag = 688.69 [1029.01] [0.67 $\sigma$ ]  
Teffp = 5317 [1782] K [2.60 $\sigma$ ]

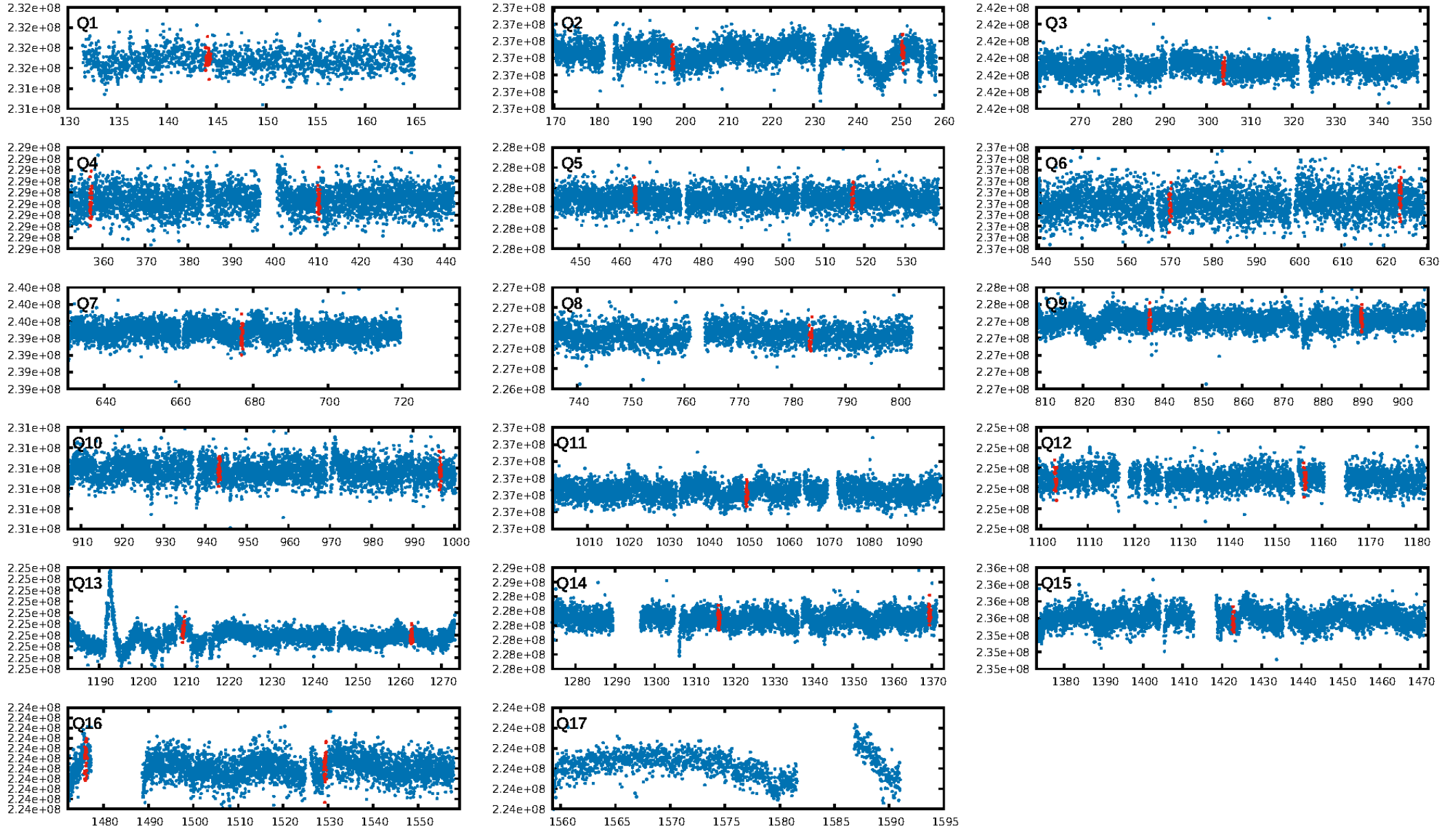
## DV Diagnostic Results:

ShortPeriod-sig: 100.0% [99.20 $\sigma$ ]  
LongPeriod-sig: 100.0% [46.19 $\sigma$ ]  
ModelChiSquare2-sig: 2.6%  
ModelChiSquareGof-sig: 98.0%  
Bootstrap-pfa: 9.37e-29  
RollingBand-fgt: 1.00 [9/9]  
GhostDiagnostic-chr: 0.3789  
Centroid-sig: N/A  
Centroid-so: 0.461 arcsec [0.50 $\sigma$ ]  
OotOffset-rm: 2.288 arcsec [1.53 $\sigma$ ]  
KicOffset-rm: 2.804 arcsec [1.86 $\sigma$ ]  
OotOffset-st: 2/1/1/1 [5]  
KicOffset-st: 2/1/1/1 [5]  
DiffImageQuality-fgm: 0.40 [2/5]  
DiffImageOverlap-fno: 0.06 [1/16]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 31-Jan-2016 06:57:12 Z

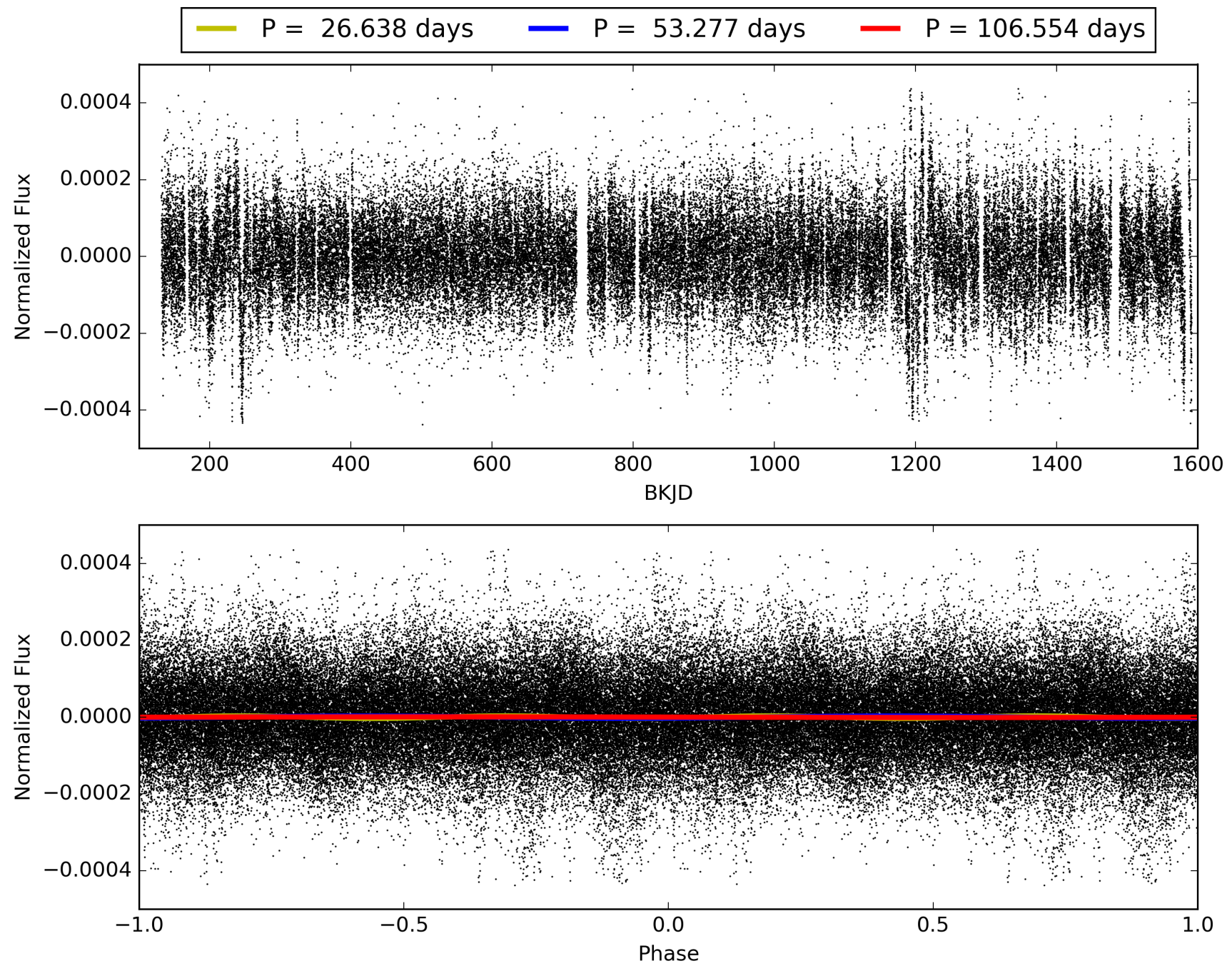
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 007840502-04, PDC Light Curves



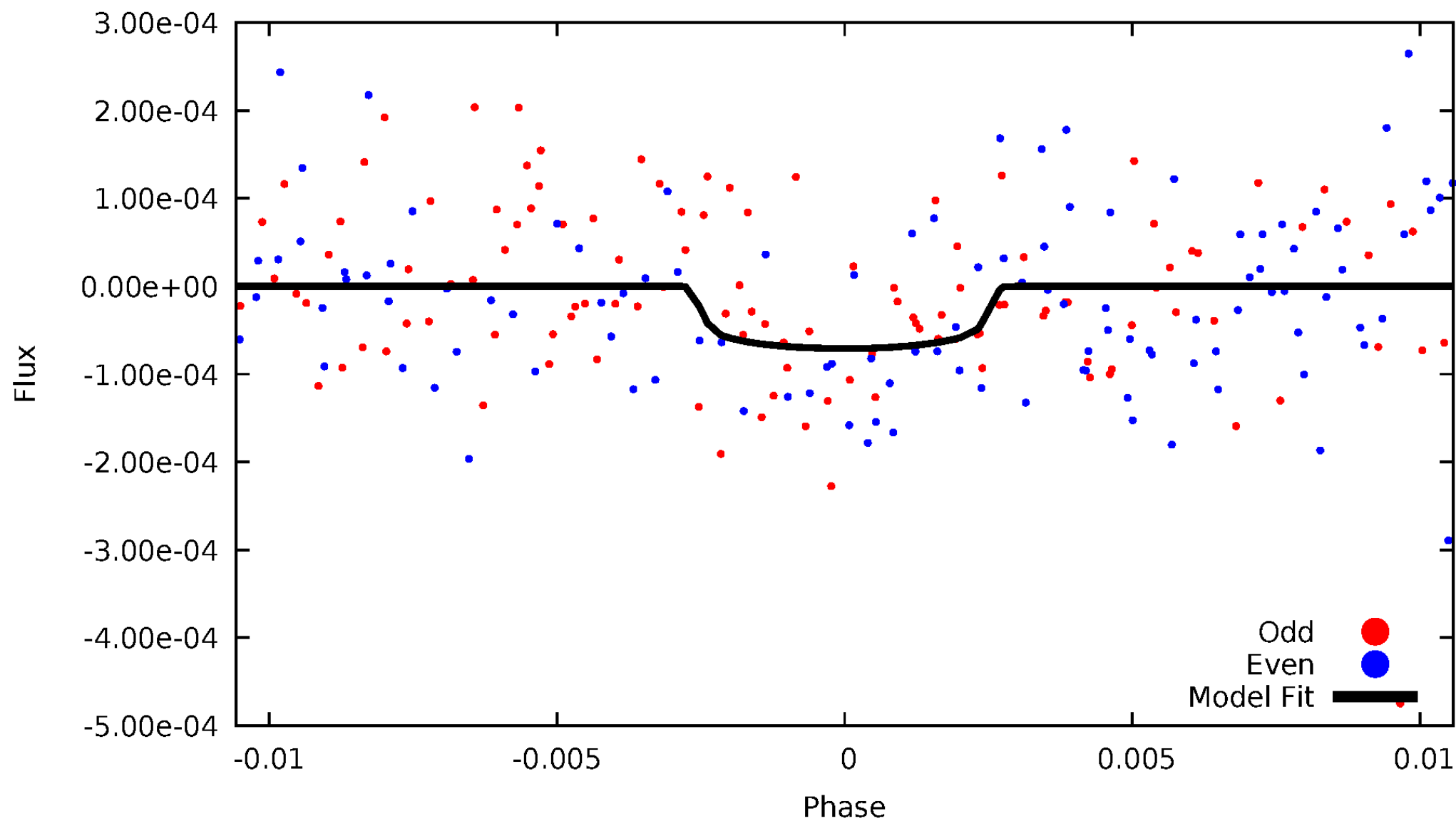


TCE 007840502-04



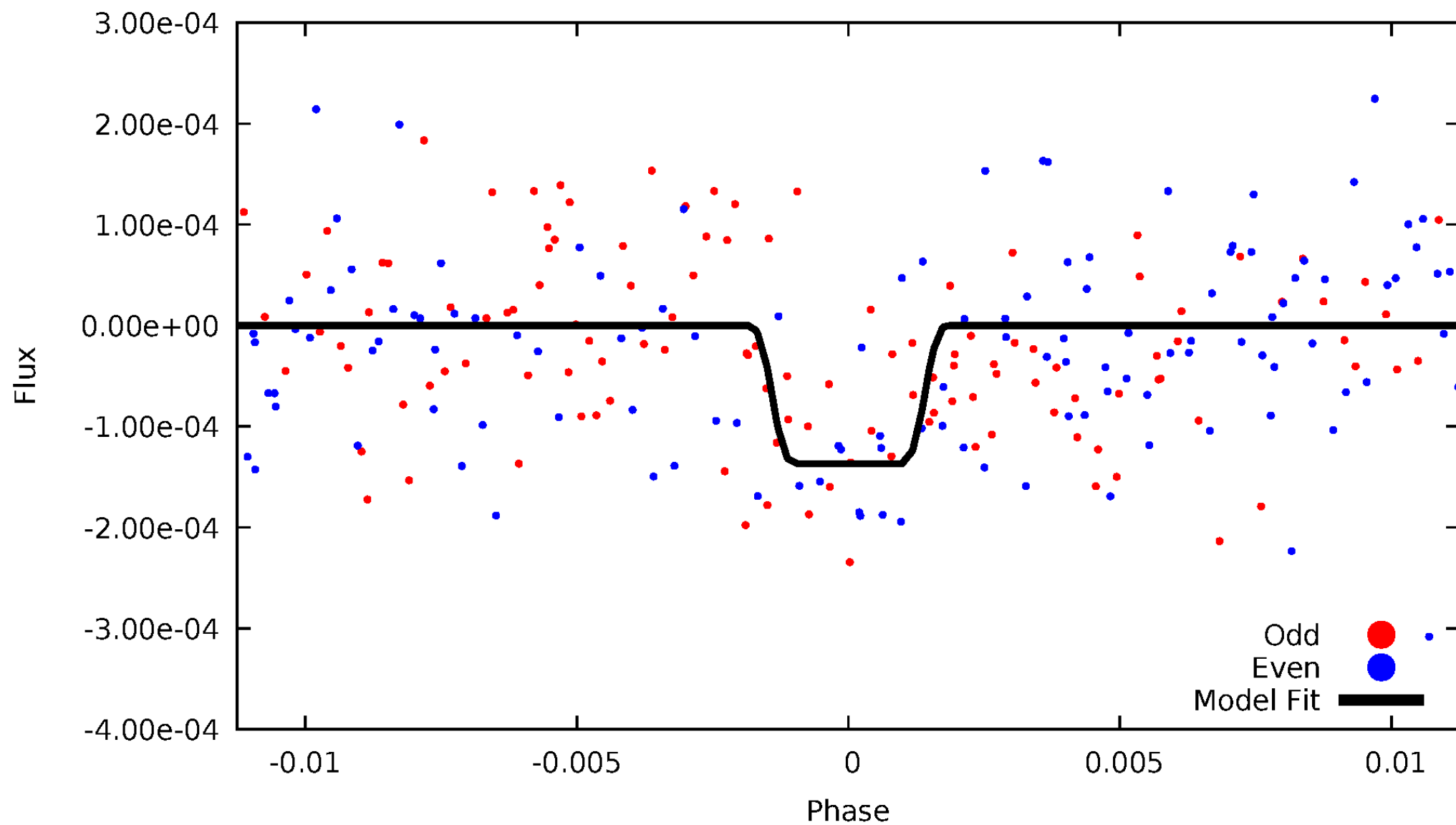
# DV Odd/Even

TCE 007840502-04



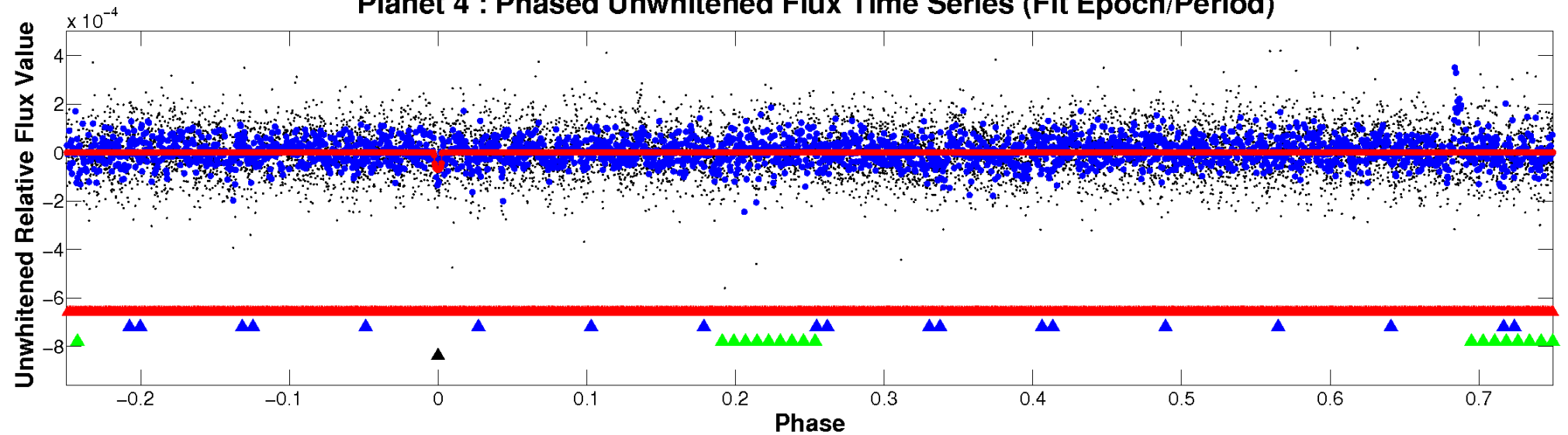
# ALT Odd/Even

TCE 007840502-04

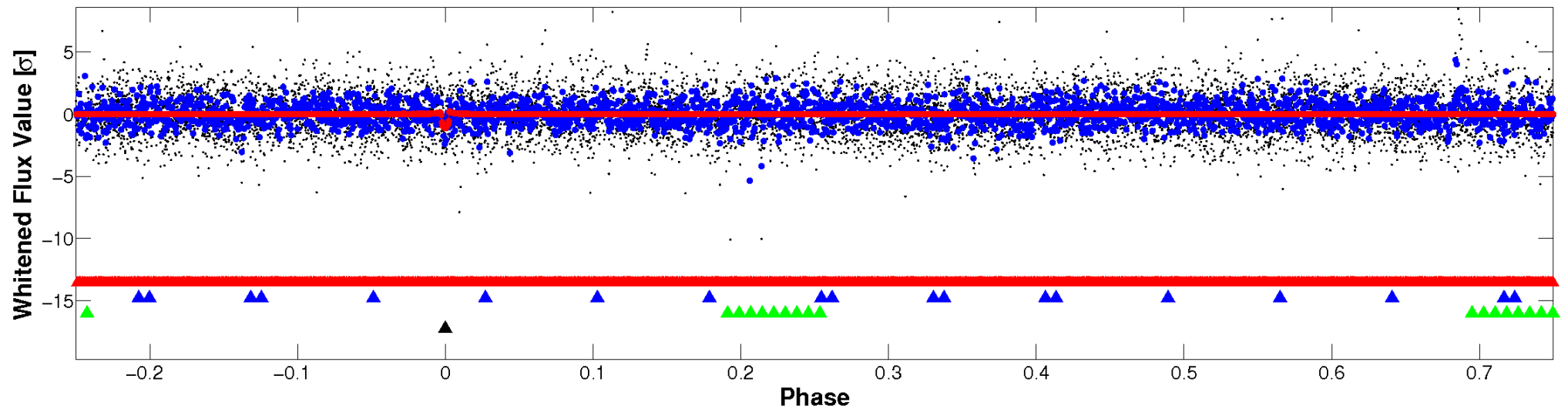


# Non-Whitened Vs. Whitened Light Curve

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

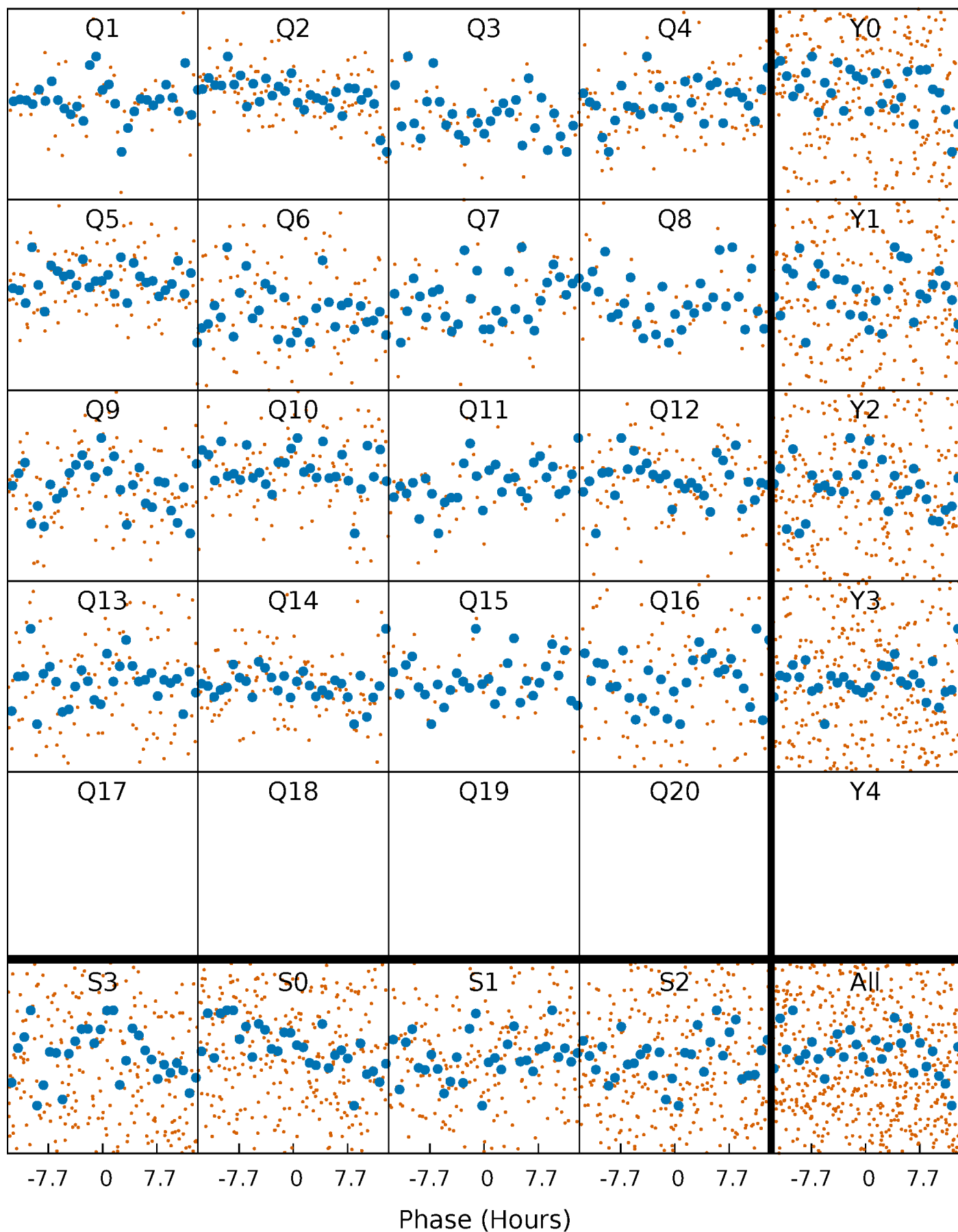


## Planet 4 : Phased Whitened Flux Time Series (Fit Epoch/Period)



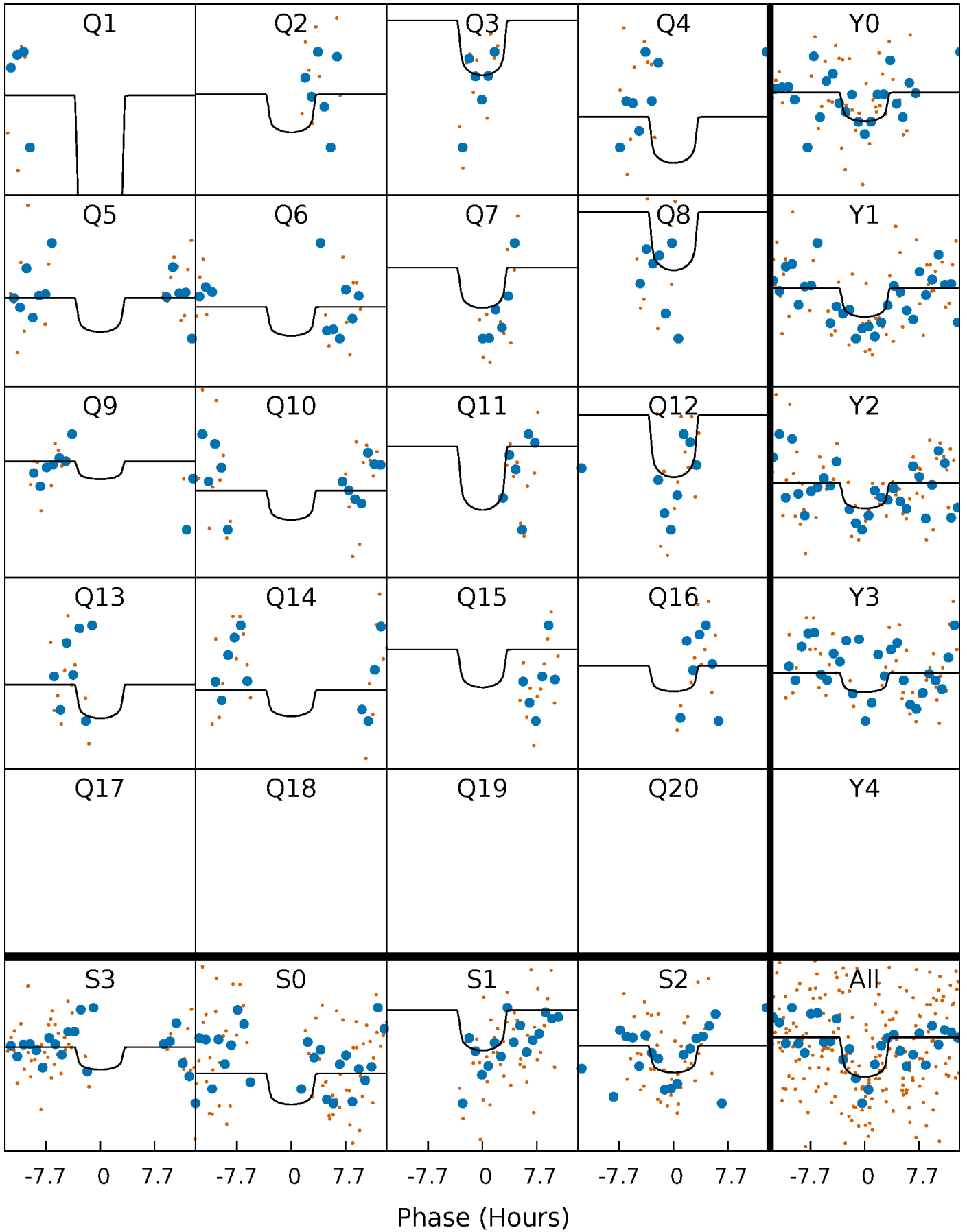
# PDC Quarter-Phased Transit Curves

TCE 007840502-04     $P = 53.276778$  Days     $T_0 = 144.153876$  (BKJD)



# DV Quarter-Phased Transit Curves

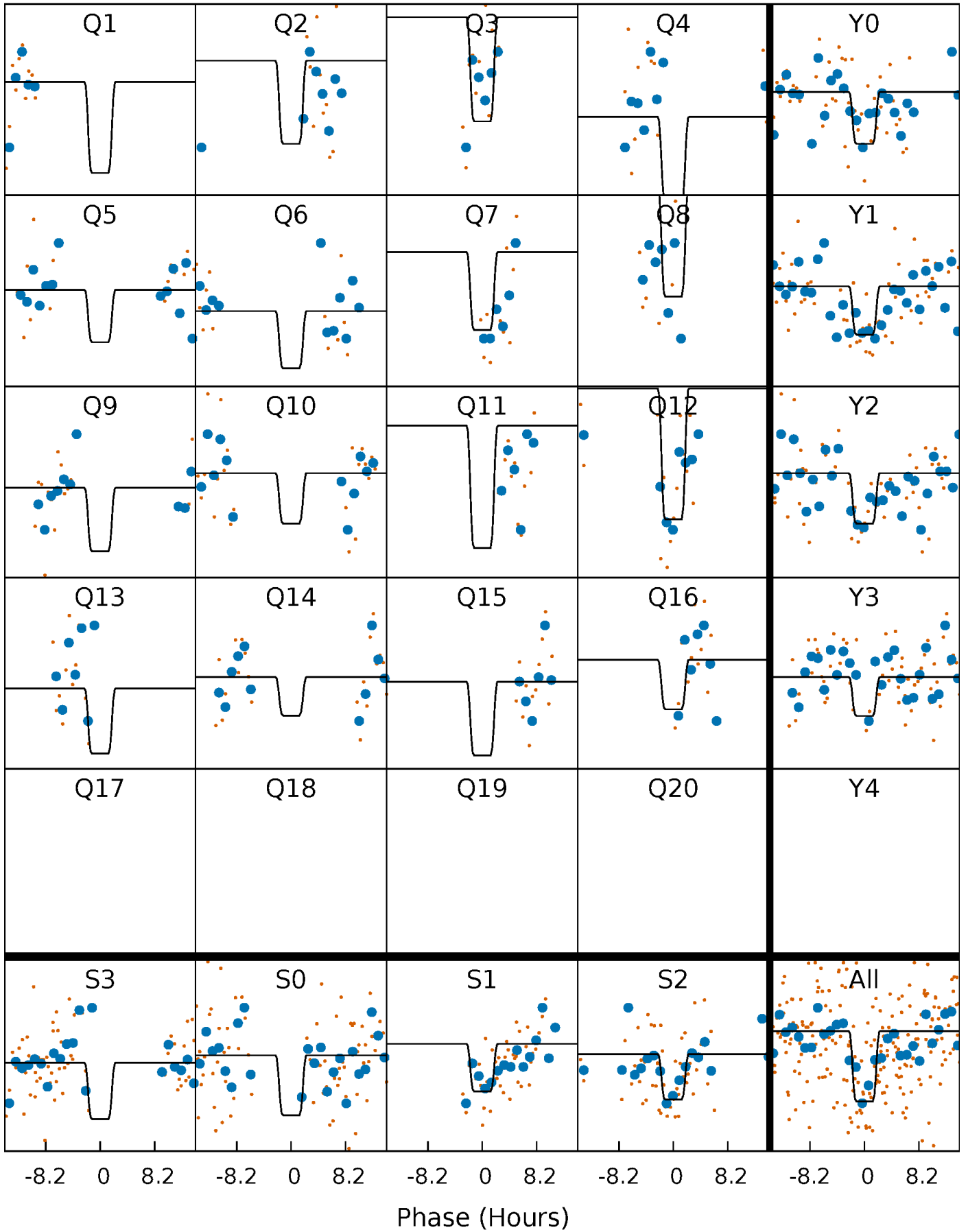
TCE 007840502-04   P= 53.276778 Days    $T_0=144.153876$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

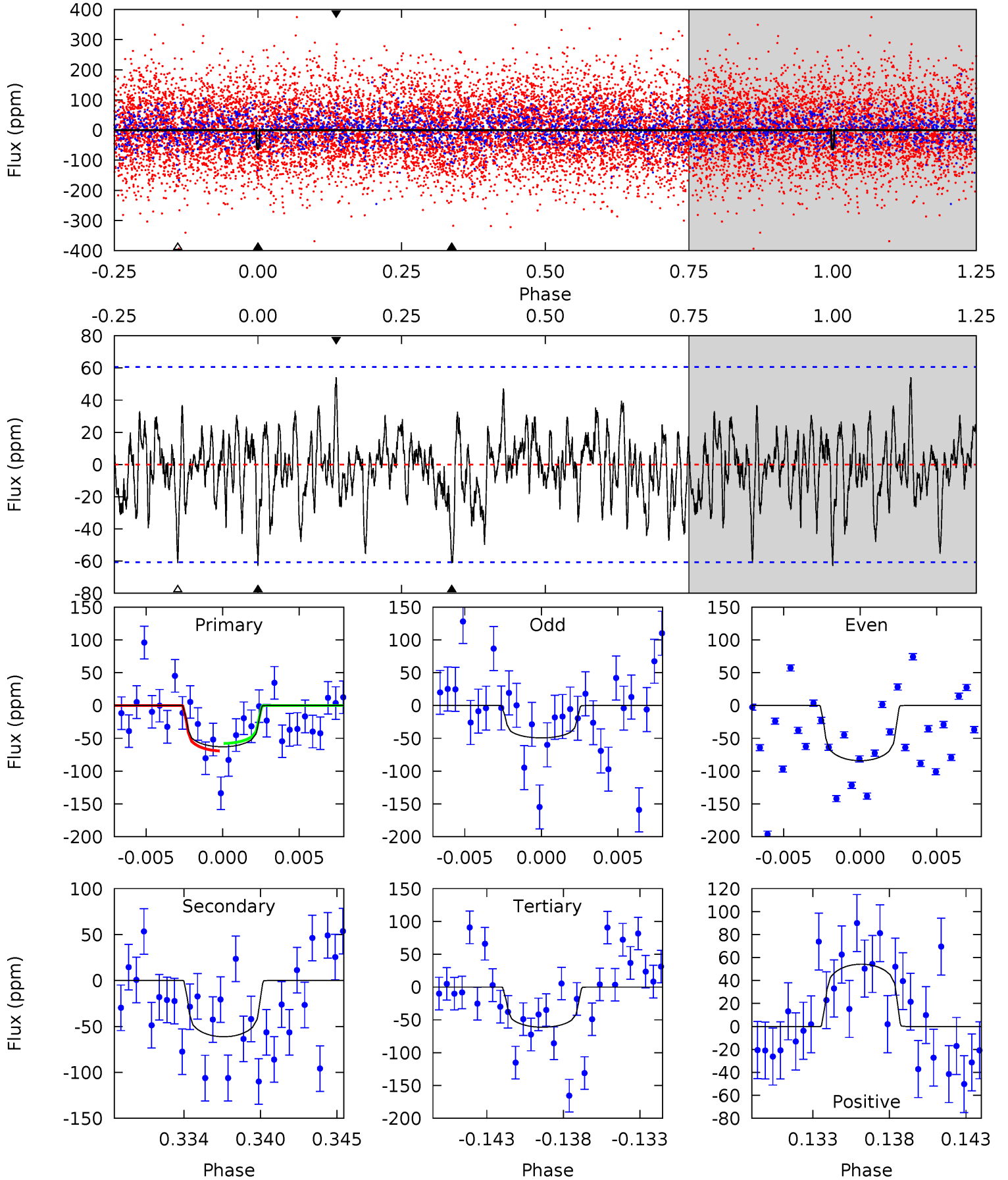
TCE 007840502-04   P= 53.277795 Days    $T_0=144.137155$  (BKJD)



# DV Model-Shift Uniqueness Test

007840502-04, P = 53.276778 Days, E = 90.877098 Days

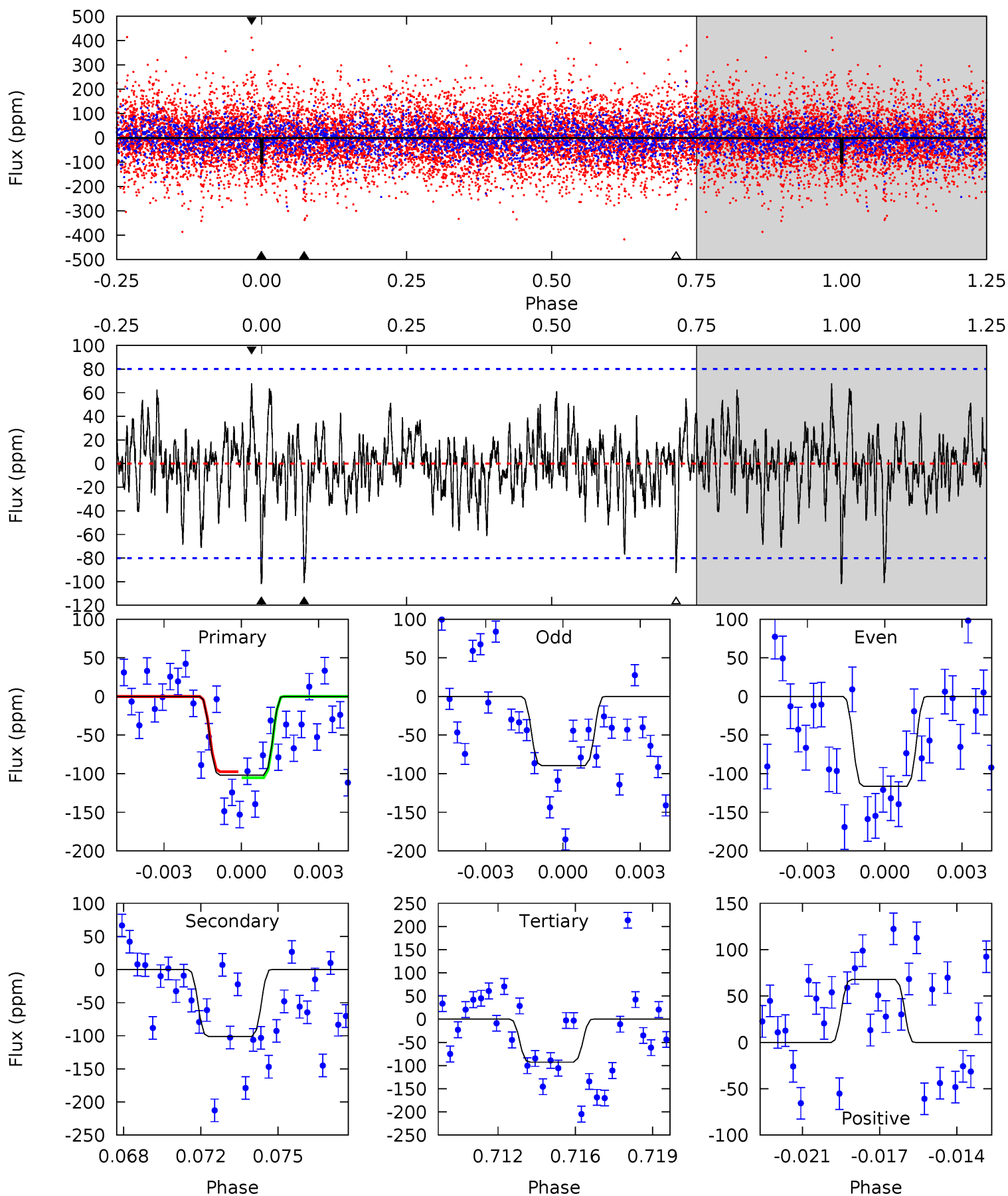
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
5.34	5.19	5.19	4.59	5.15	2.79	1.49	0.15	0.75	0.00	0.60	1.39	0.54	0.46	0.48



# Alt Model-Shift Uniqueness Test

007840502-04, P = 53.277795 Days, E = 90.859360 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
6.66	6.60	6.05	4.43	5.23	2.93	1.44	0.61	2.23	0.55	2.17	0.85	0.84	0.40	0.25



### Stellar Parameters For KIC 007840502

	$T_{\text{eff}}(K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$5927^{+160}_{-178}$	$3.946^{+0.390}_{-0.130}$	$0.160^{+0.200}_{-0.300}$	$1.964^{+0.382}_{-0.892}$	$1.242^{+0.168}_{-0.252}$	$0.231^{+0.755}_{-0.087}$
	+3%/-3%	+10%/-3%	+125%/-188%	+19%/-45%	+14%/-20%	+327%/-38%
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 007840502-04 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-61 \pm 12$	$1.87^{+1.23}_{-1.02}$	$925^{+63}_{-96}$	$5425^{+2607}_{-945}$	$844^{+3162}_{-538}$
Alt.	$-101 \pm 15$	$2.29^{+1.45}_{-1.10}$	$928^{+67}_{-107}$	$5434^{+2325}_{-831}$	$887^{+2677}_{-542}$

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

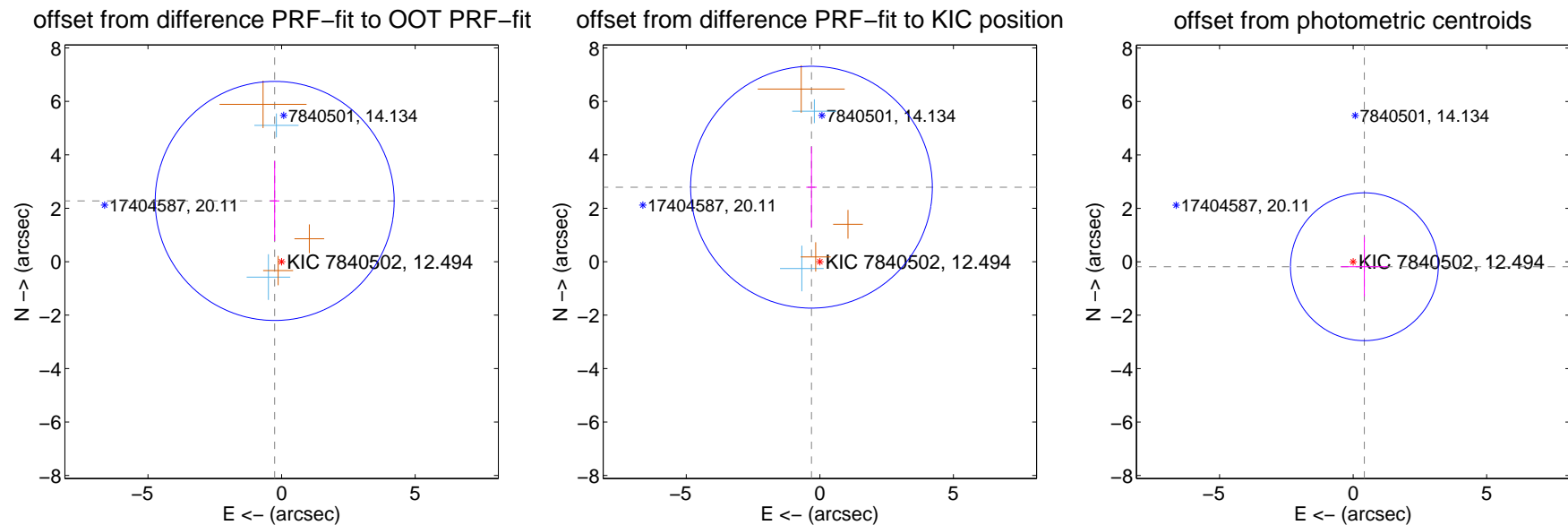
## DV Centroid Data

Supplemental centroid analysis for 007840502-04. Kepler magnitude: 12.49. Transit SNR 7.18

There are 2 quarters with good PRF difference image offsets

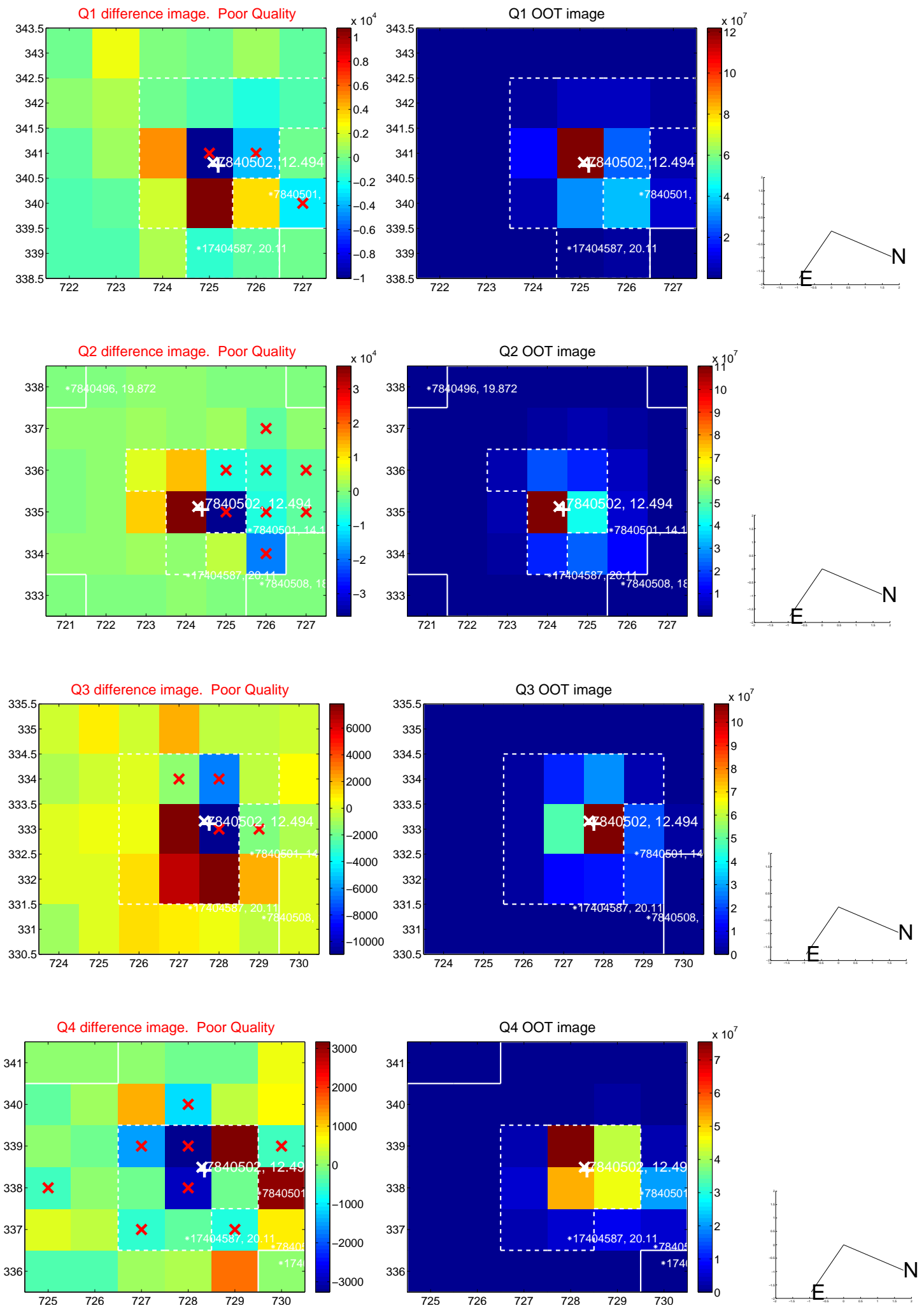
The direct PRF centroid is offset from the target star catalog position by about 0.57 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$2.288 \pm 1.491$	1.53	$0.258 \pm 0.174$	$2.273 \pm 1.500$
PRF-fit source offset from KIC position	$2.804 \pm 1.508$	1.86	$0.314 \pm 0.196$	$2.787 \pm 1.517$
photometric centroid source offset	$0.46 \pm 0.92$	0.50	$-0.42 \pm 0.88$	$-0.19 \pm 1.11$

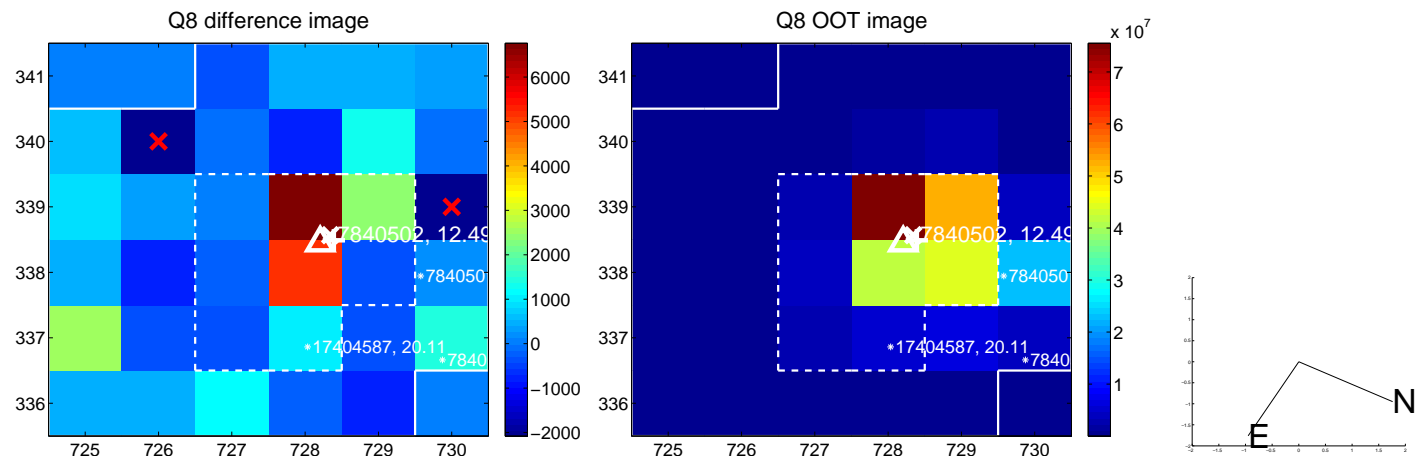
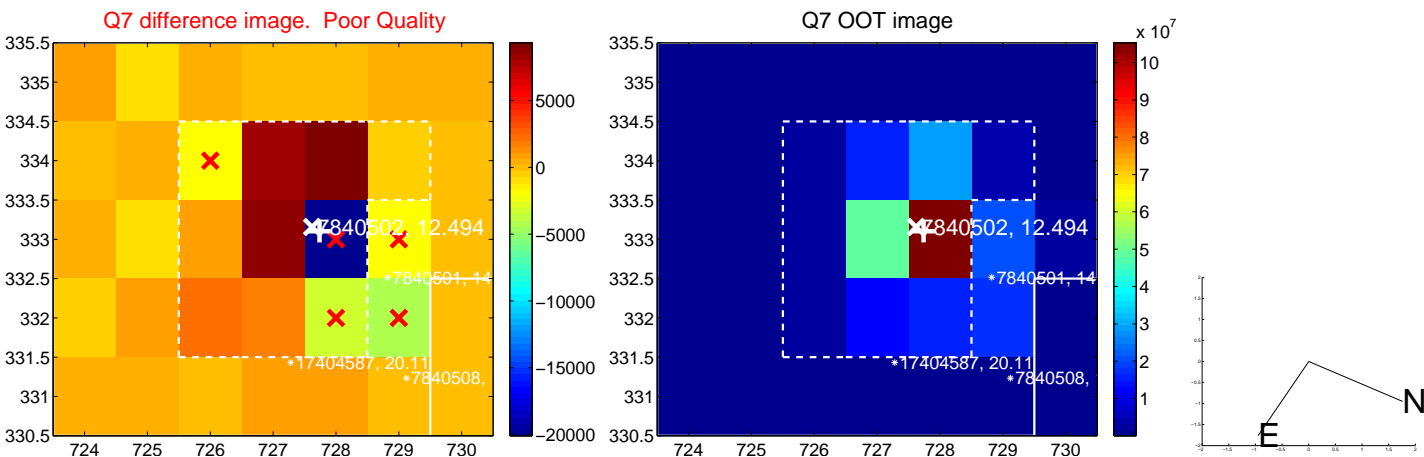
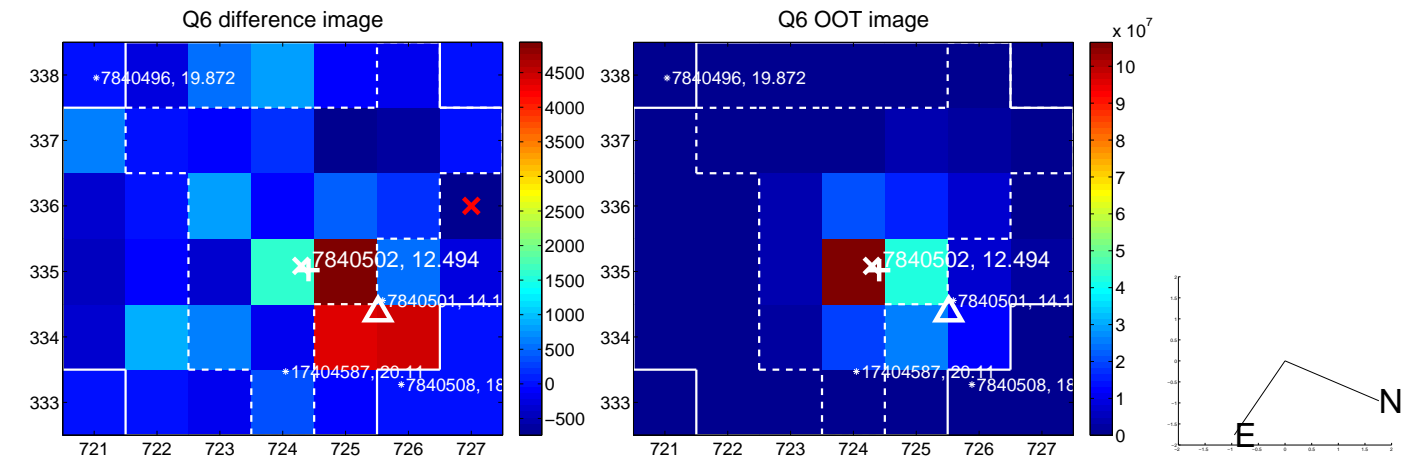
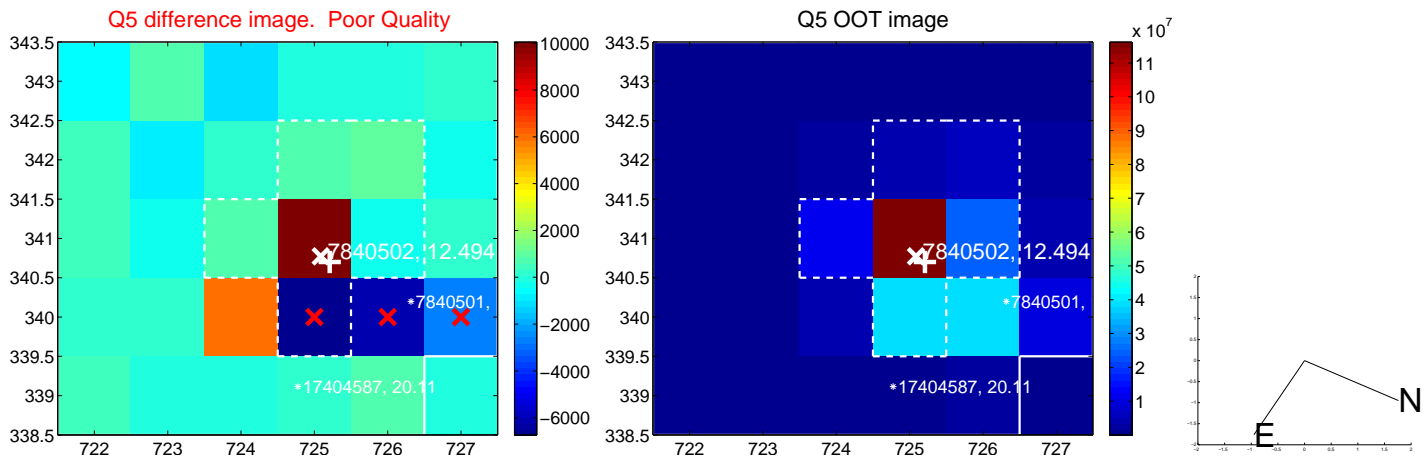


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets**; magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

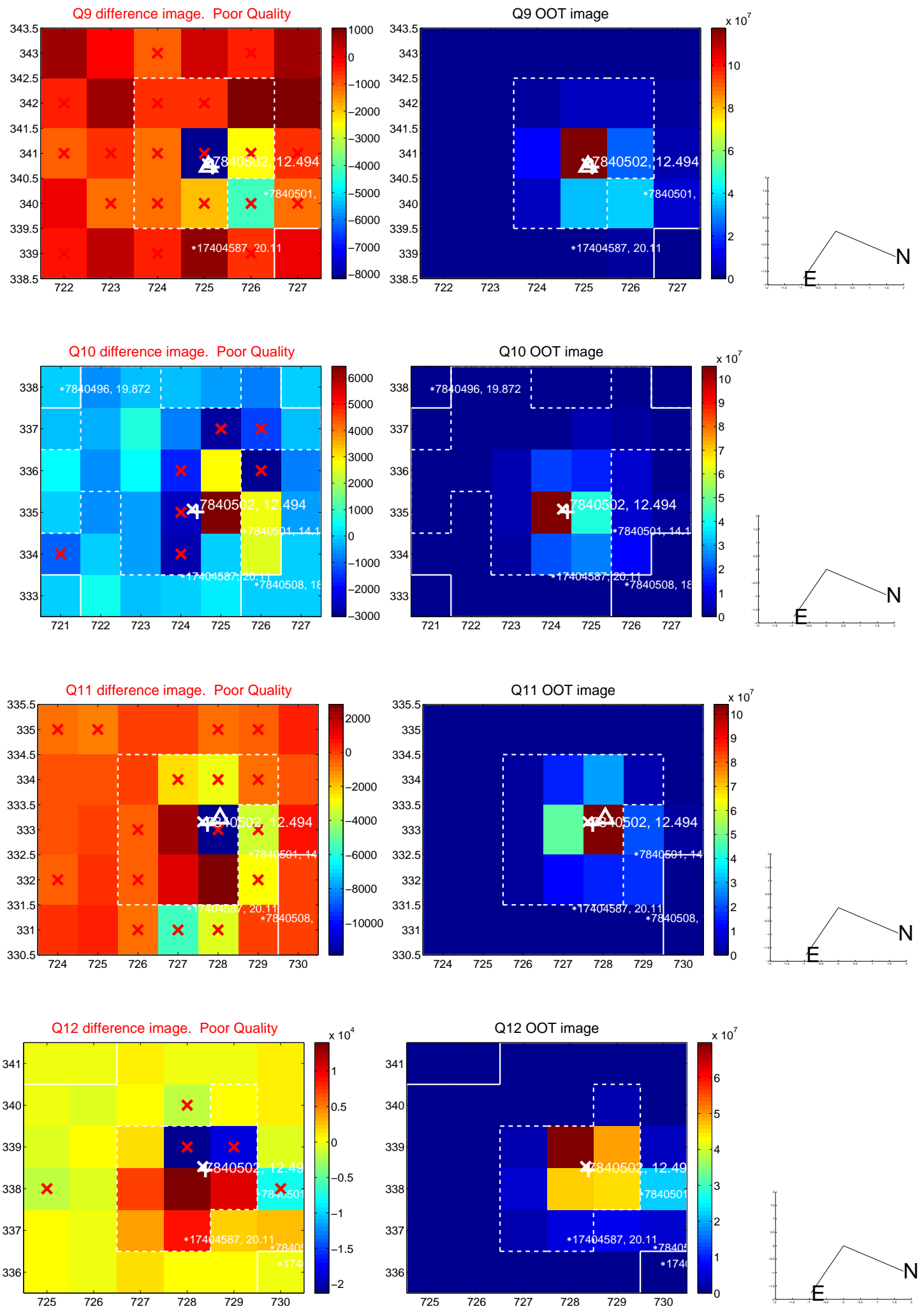


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

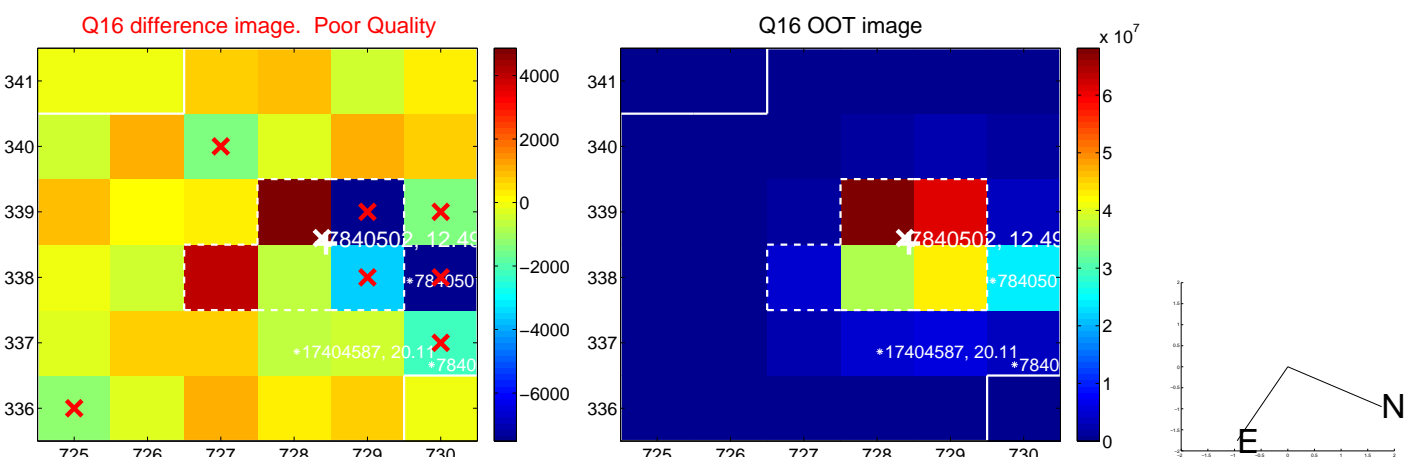
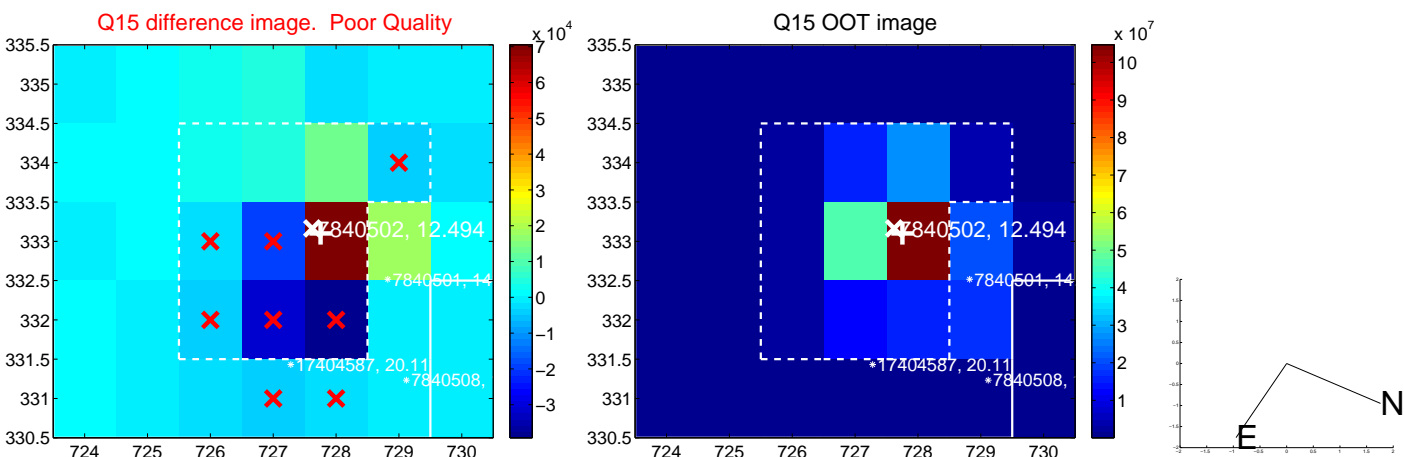
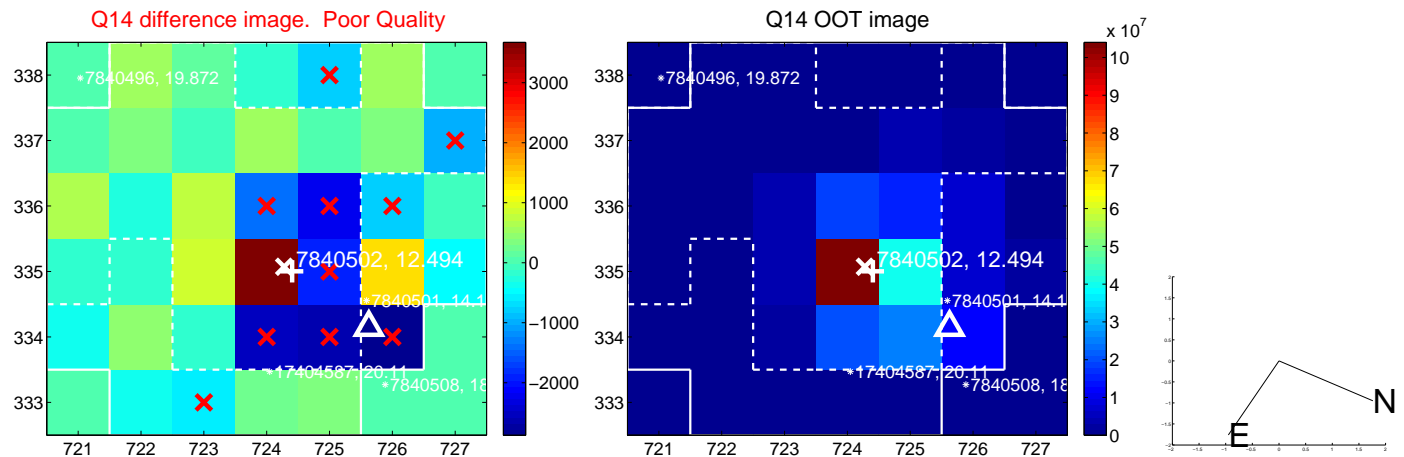
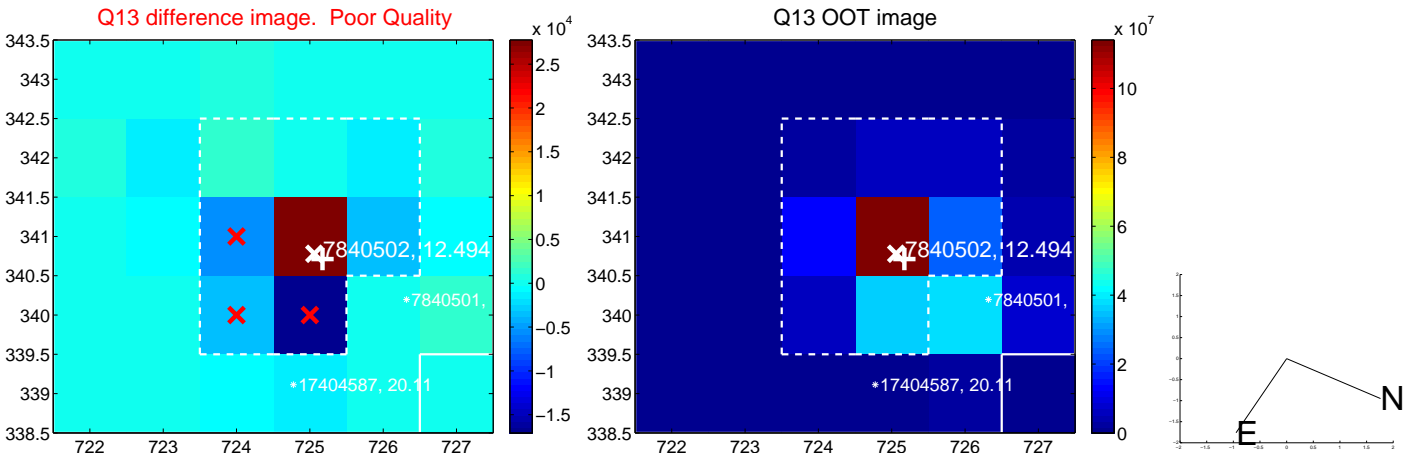




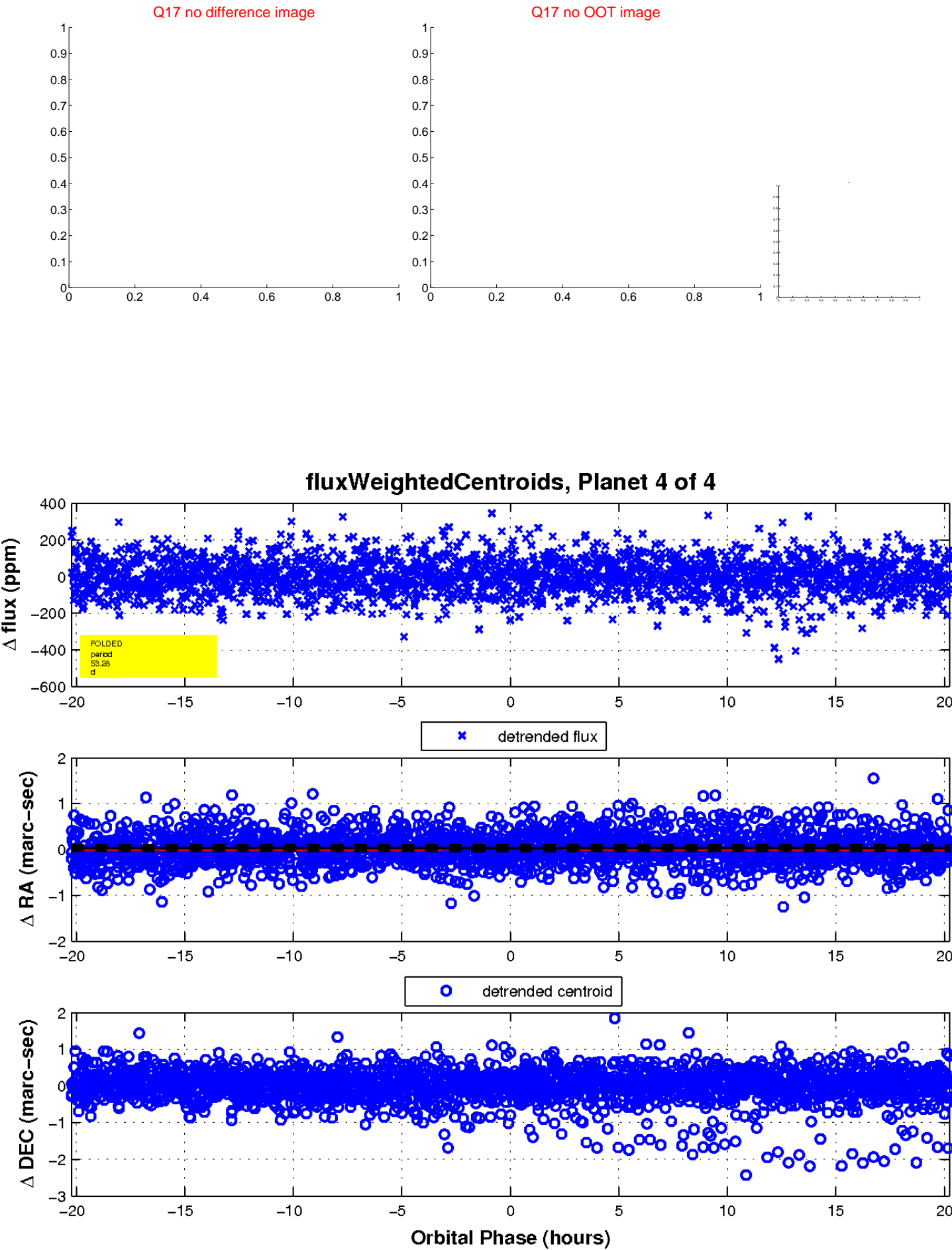
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white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



UKIRT Image

Declination

