

# KIC 012647070

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
012647070-01	OBS	No	0.885347	132.381896	0.0	1.605	11.1	0.0	2.56	7490	0.01	38899.97
012647070-02	OBS	No	0.885597	131.546355	33.6	3.081	12.4	13.5	2.56	7490	1.74	38885.31
012647070-03	OBS	No	0.885029	132.031963	29.9	2.886	8.3	8.2	2.56	7490	1.45	38918.58
012647070-04	OBS	No	0.884838	131.600777	50.5	3.000	8.6	-1.0	2.56	7490	1.83	38929.80

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
012647070-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE_ZUMA_TRACKER—LPP_DV—LPP_ALT—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
012647070-02	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_ALT—MOD_POS_ALT—SAME_NTL_PERIOD—CENT_SATURATED
012647070-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE_ZUMA_TRACKER—LPP_DV—LPP_ALT—SAME_NTL_PERIOD—CENT_SATURATED
012647070-04	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_DV—LPP_ALT—SAME_NTL_PERIOD—CENT_SATURATED

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

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

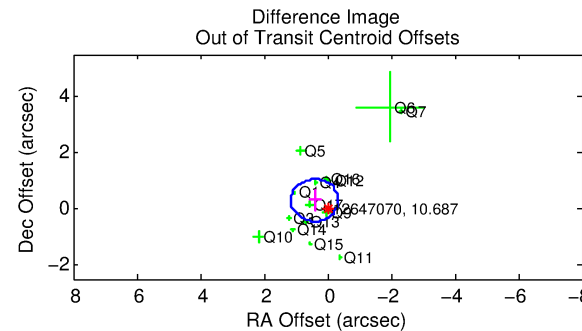
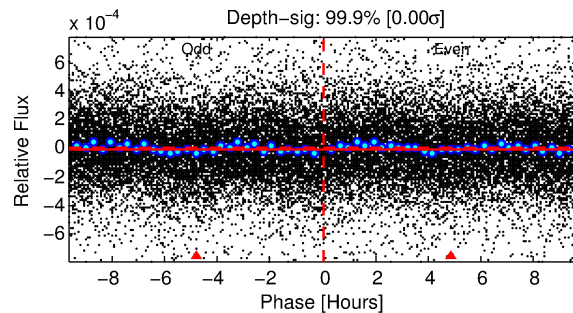
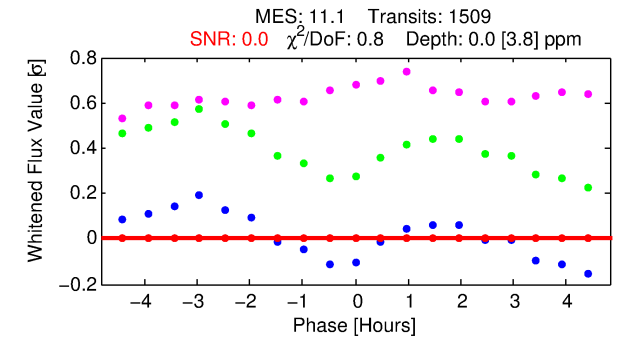
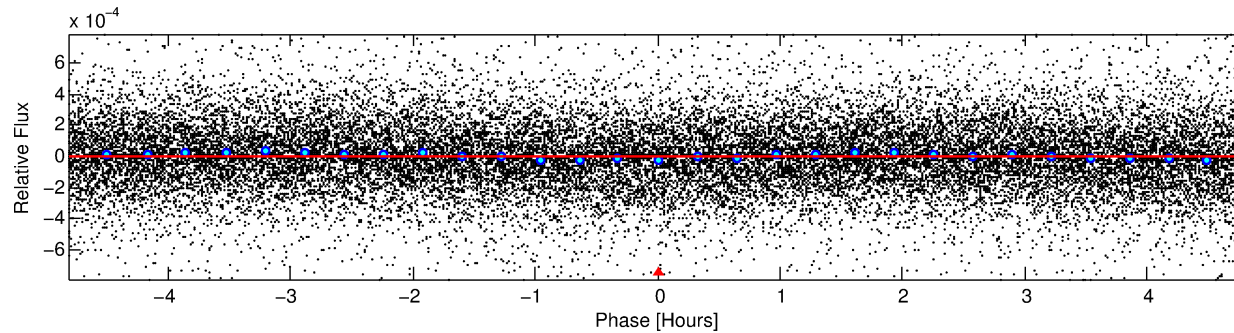
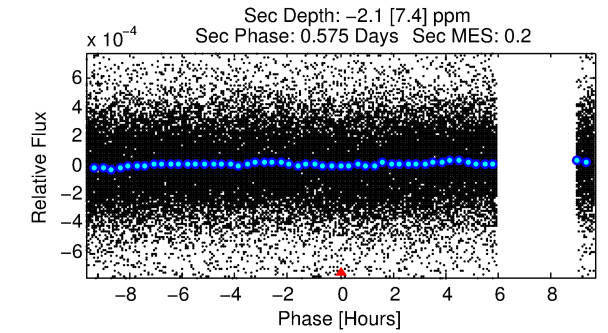
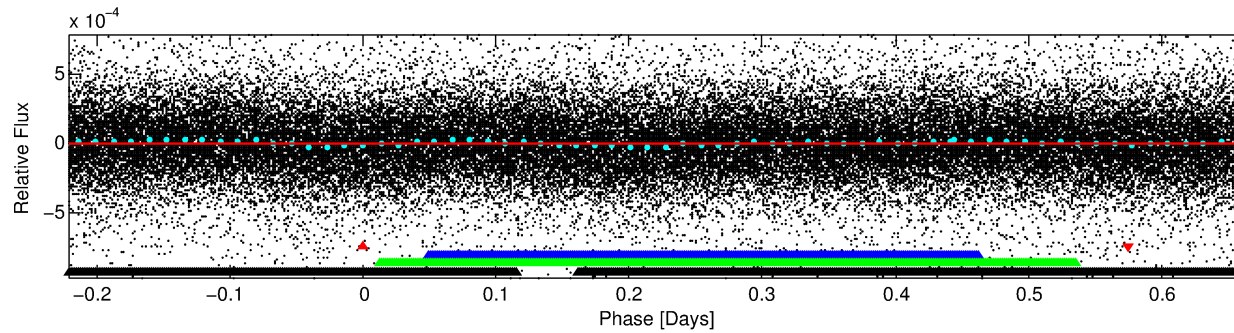
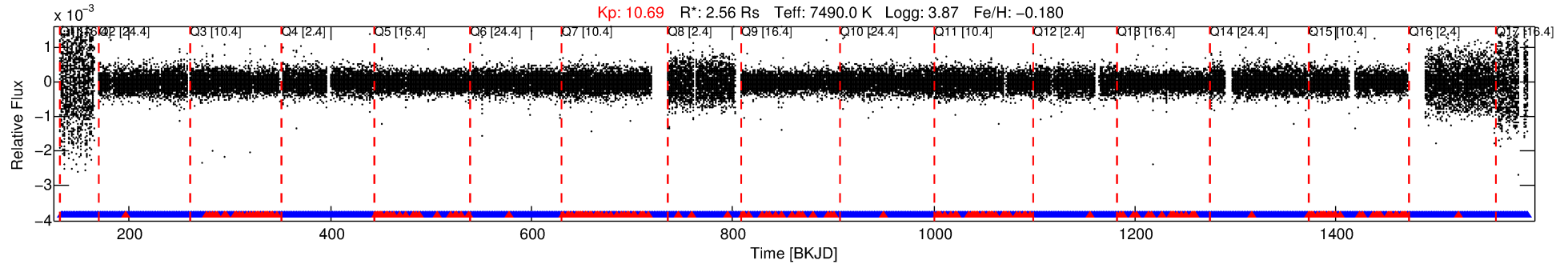
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 012647070-01

No Significant Match Found

# DV One-Page Summary

KIC: 12647070 Candidate: 1 of 4 Period: 0.885 d



## DV Fit Results:

Period = 0.88535 [0.17478] d  
Epoch = 132.3819 [46.0758] BKJD  
Rp/R\* = 0.0000 [0.0517]  
a/R\* = 1.93 [311.53]  
b = 0.92 [93.95]  
Seff = 38899.97 [25499.29]  
Teff = 3581 [587] K  
Rp = 0.01 [14.47] Re  
a = 0.0218 [0.0084] AU  
Ag = N/A  
Teffp = N/A

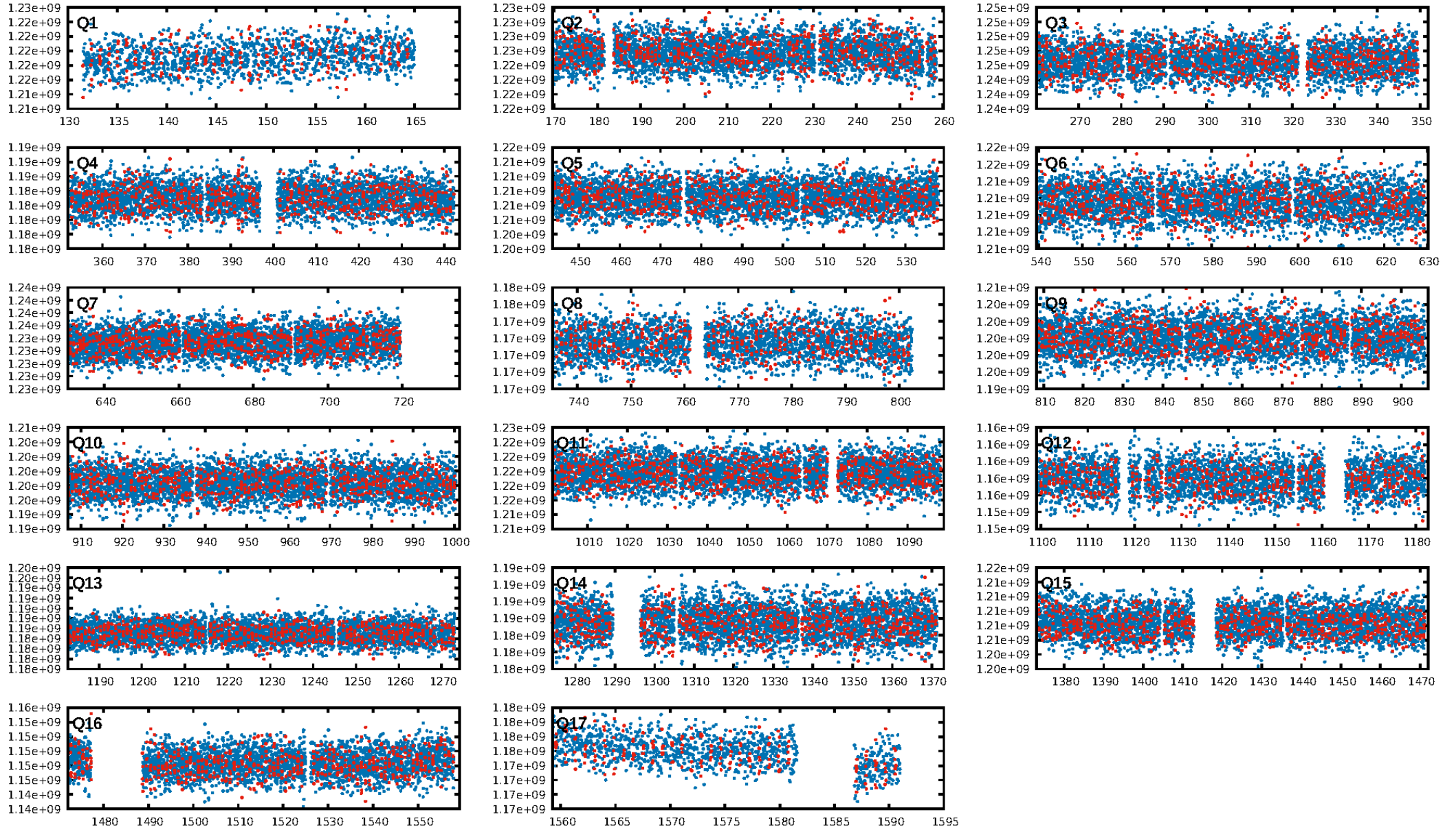
## DV Diagnostic Results:

ShortPeriod-sig: 0.2% [0.00σ]  
LongPeriod-sig: 0.1% [0.00σ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: N/A  
RollingBand-fgt: 0.87 [1249/1441]  
GhostDiagnostic-chr: N/A  
Centroid-sig: N/A  
Centroid-so: N/A  
OotOffset-rm: 0.509 arcsec [2.03σ]  
KicOffset-rm: 0.519 arcsec [1.63σ]  
OotOffset-st: 3/4/3/5 [15]  
KicOffset-st: 3/4/3/5 [15]  
DiffImageQuality-fgm: 0.33 [5/15]  
DiffImageOverlap-fno: 0.00 [0/17]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 30-Jan-2016 06:19:51 Z

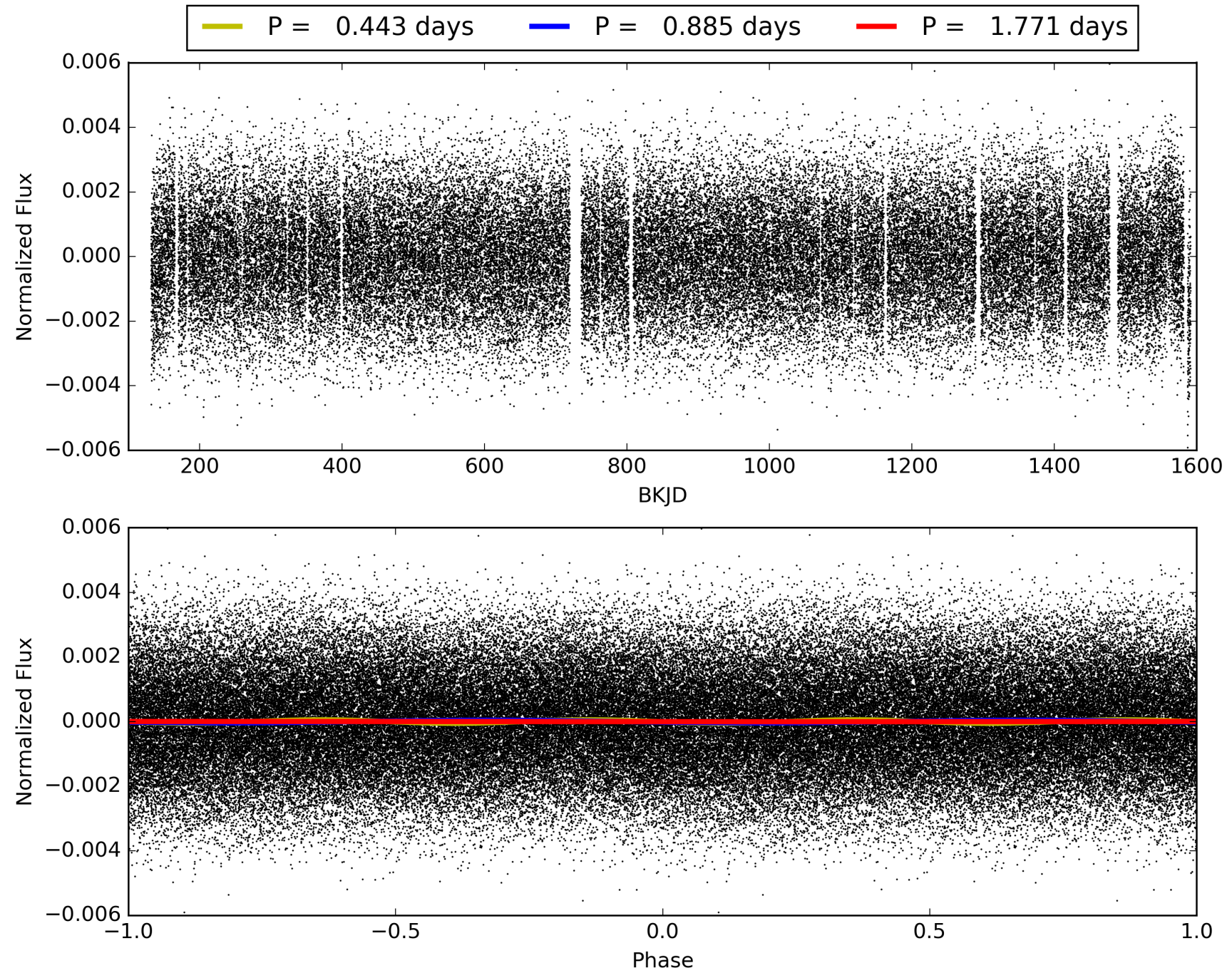
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 012647070-01, PDC Light Curves





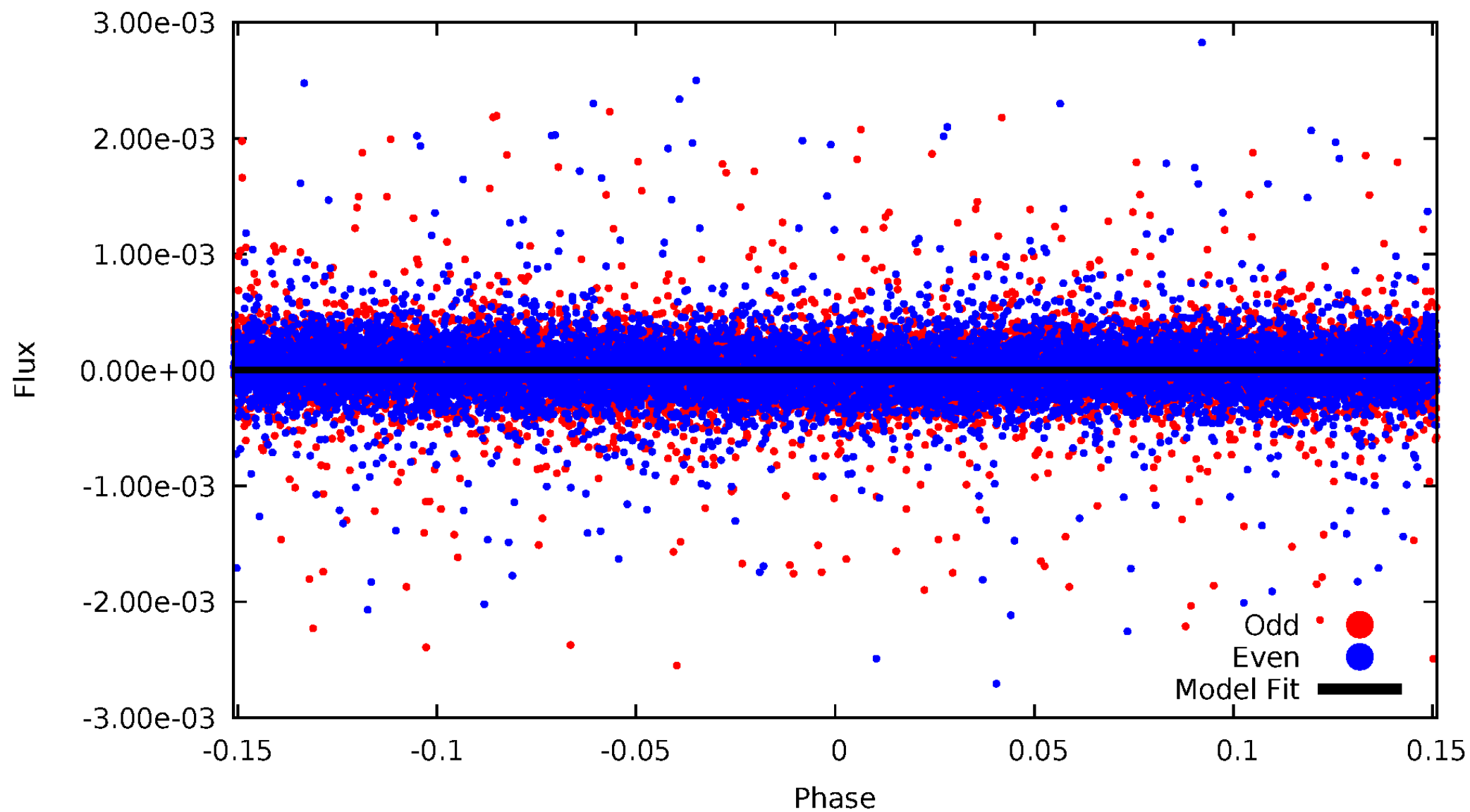
TCE 012647070-01





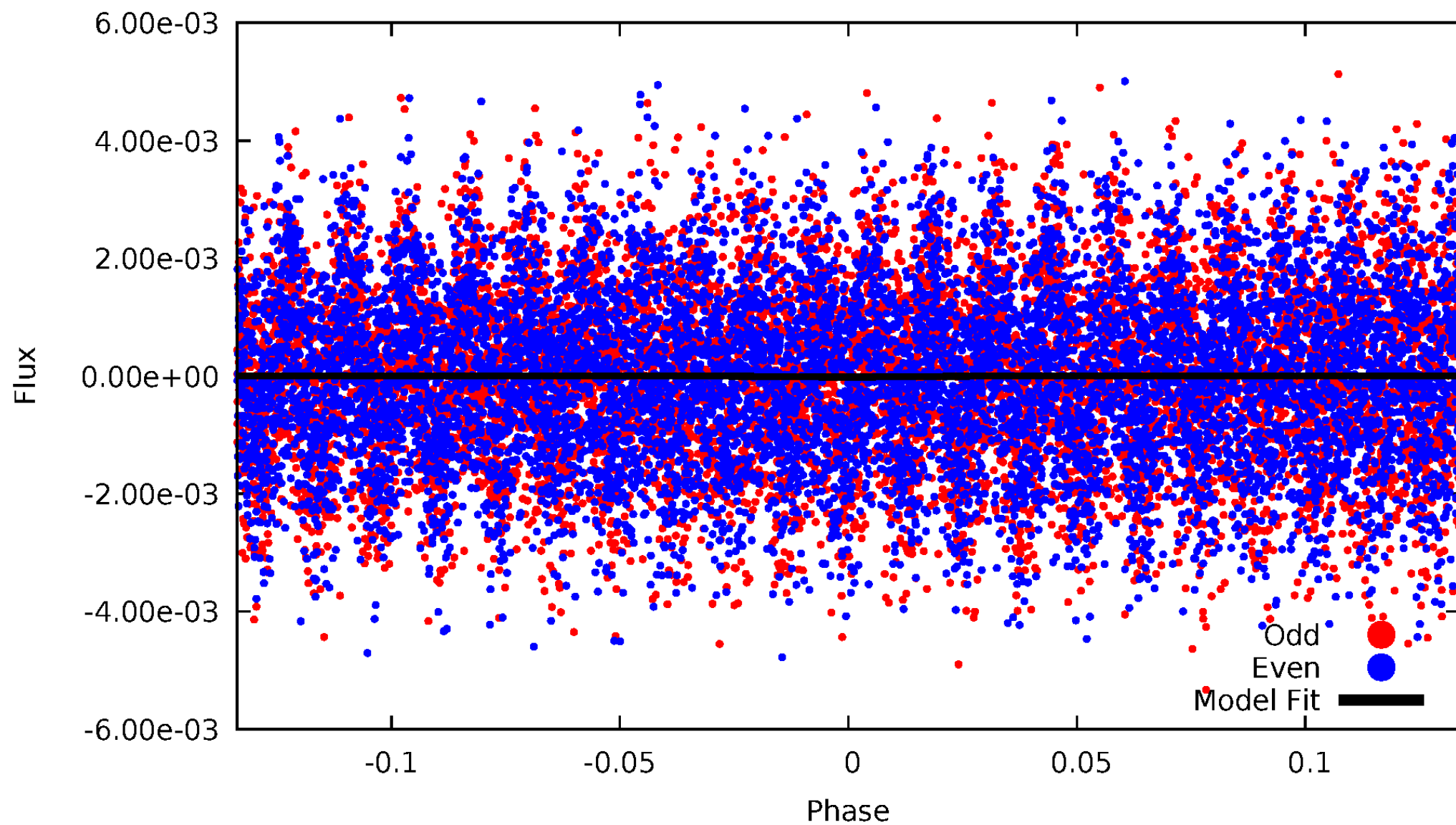
# DV Odd/Even

TCE 012647070-01



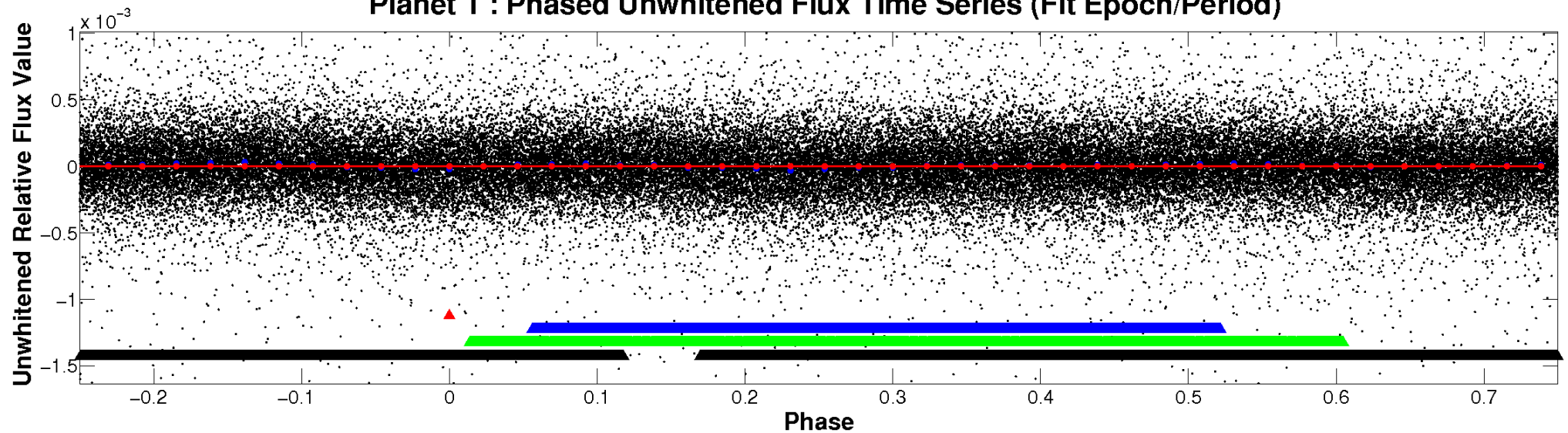
# ALT Odd/Even

TCE 012647070-01

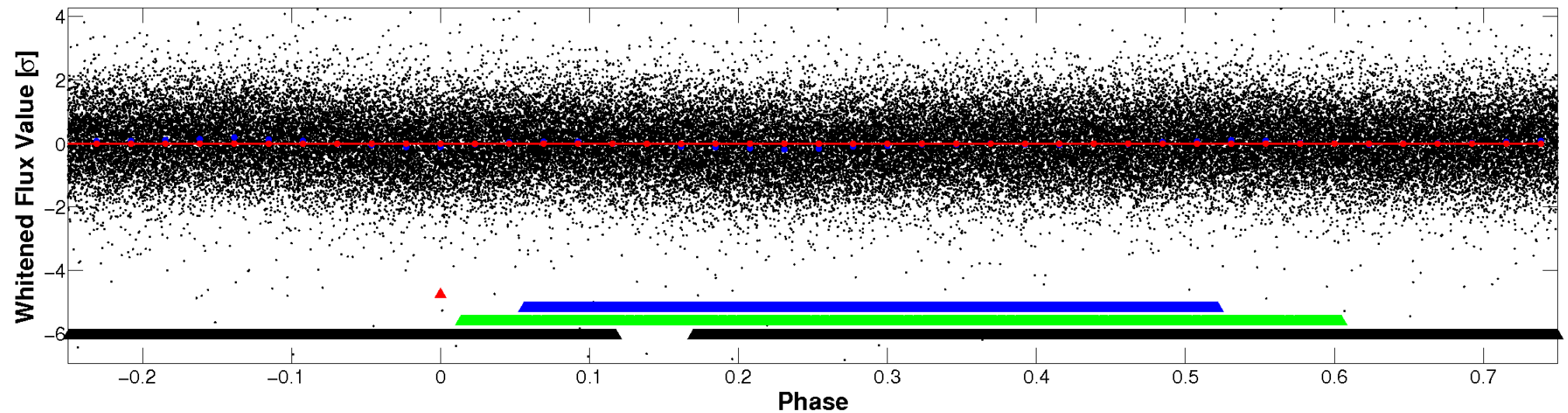


# Non-Whitened Vs. Whitened Light Curve

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



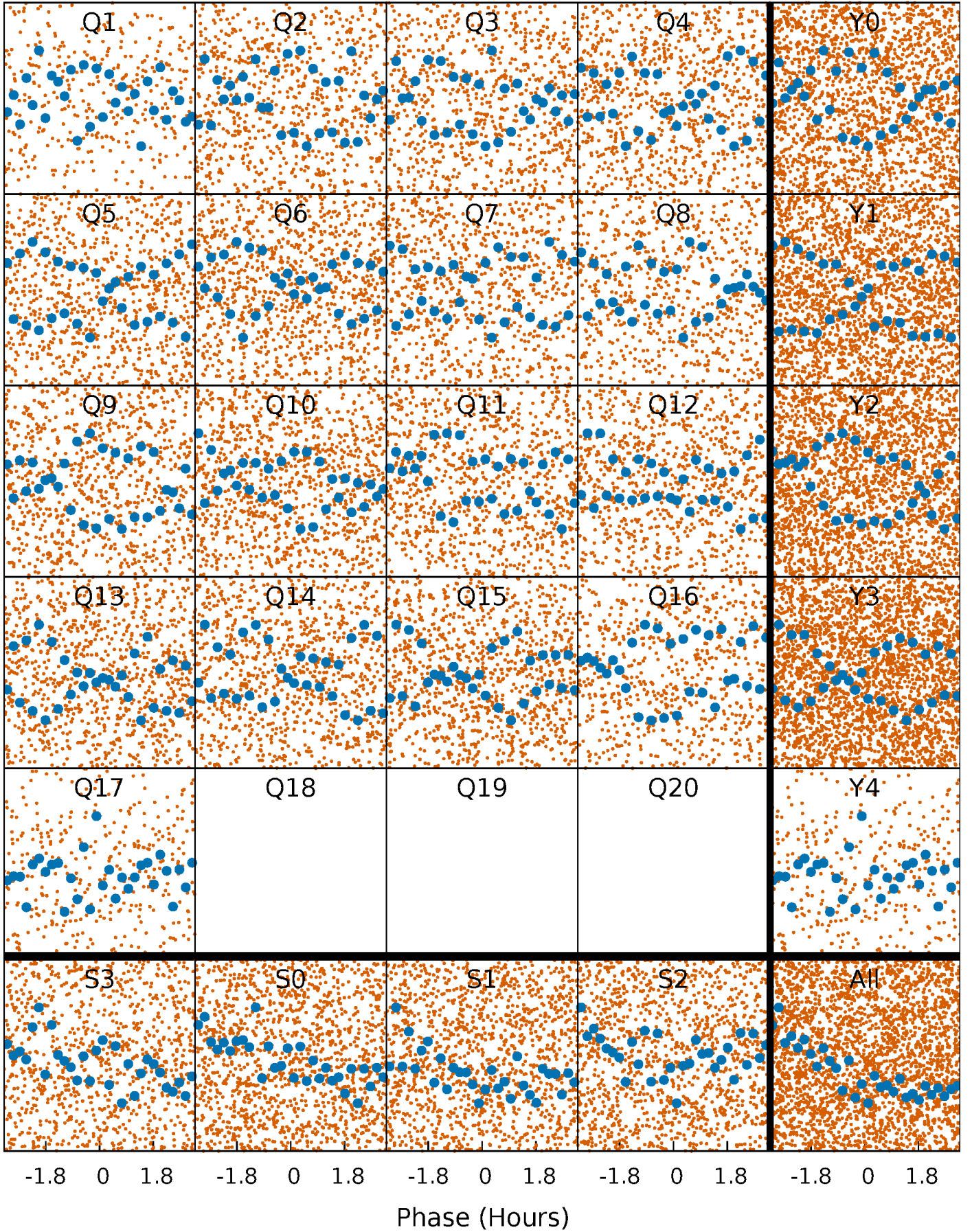
Planet 1 : Phased Whitened Flux Time Series (Fit Epoch/Period)





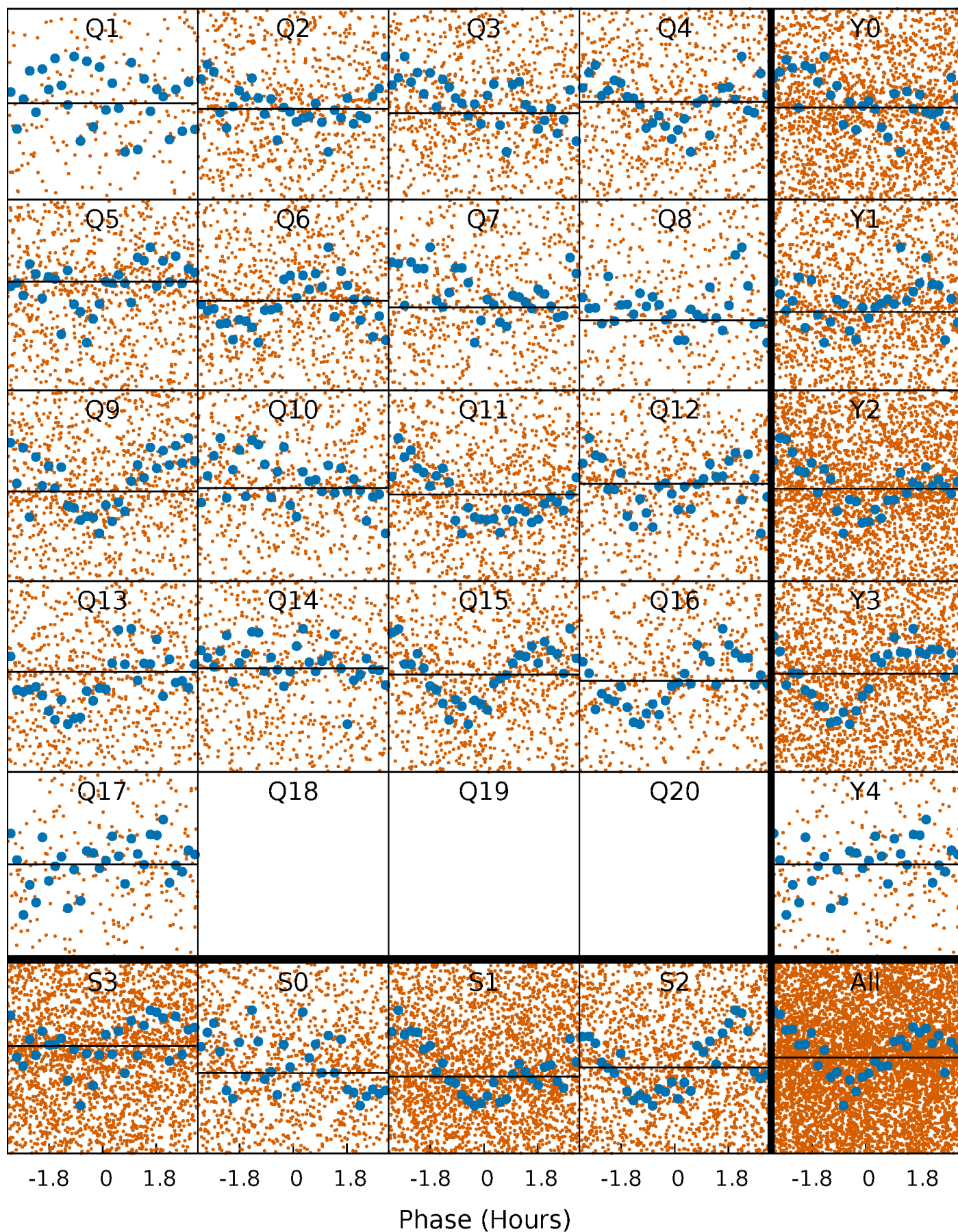
# PDC Quarter-Phased Transit Curves

TCE 012647070-01 P= 0.885347 Days  $T_0=132.381896$  (BKJD)



# DV Quarter-Phased Transit Curves

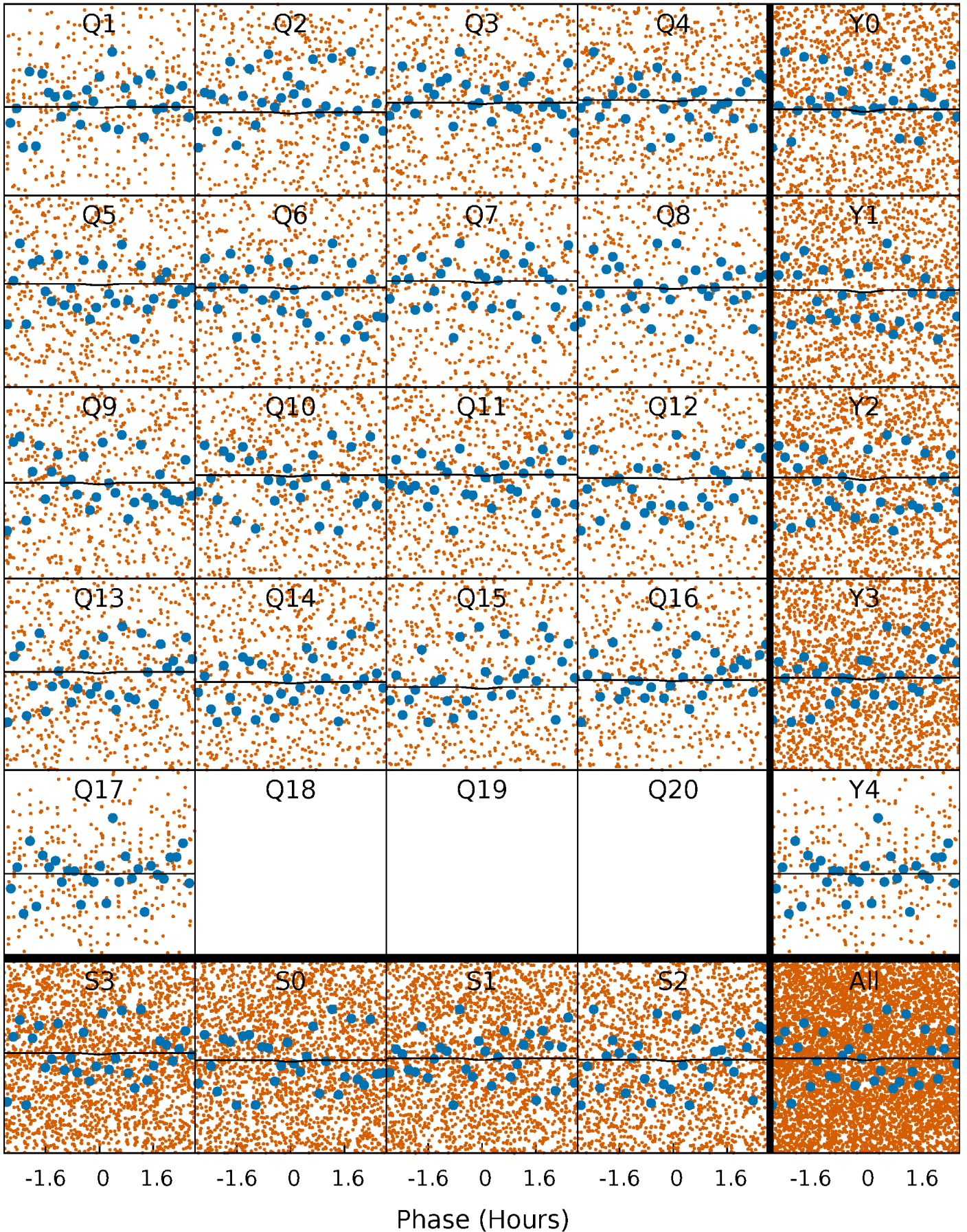
TCE 012647070-01 P= 0.885347 Days  $T_0=132.381896$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

TCE 012647070-01 P= 0.885535 Days  $T_0=132.291764$  (BKJD)

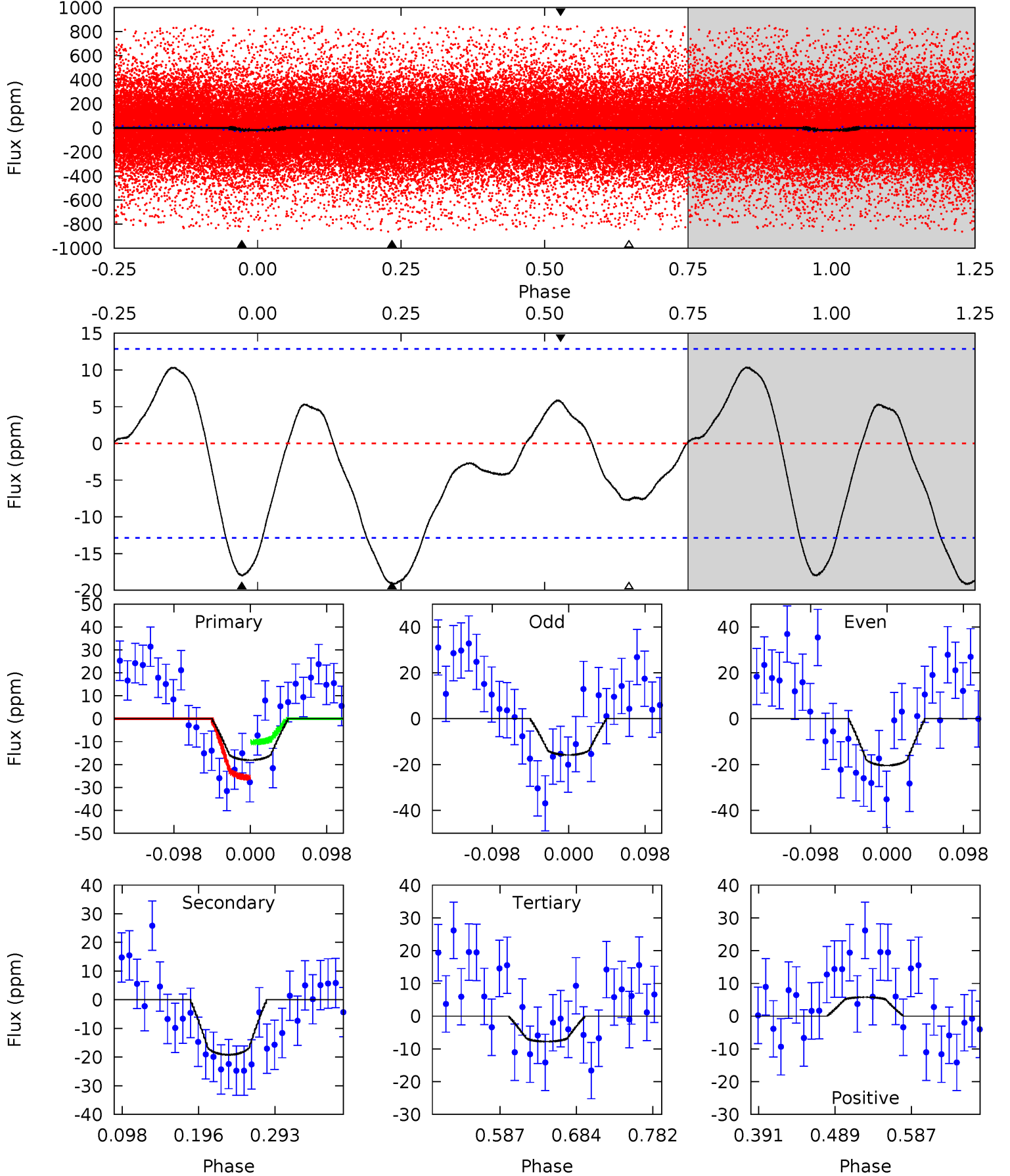




# DV Model-Shift Uniqueness Test

012647070-01, P = 0.885347 Days, E = 131.496549 Days

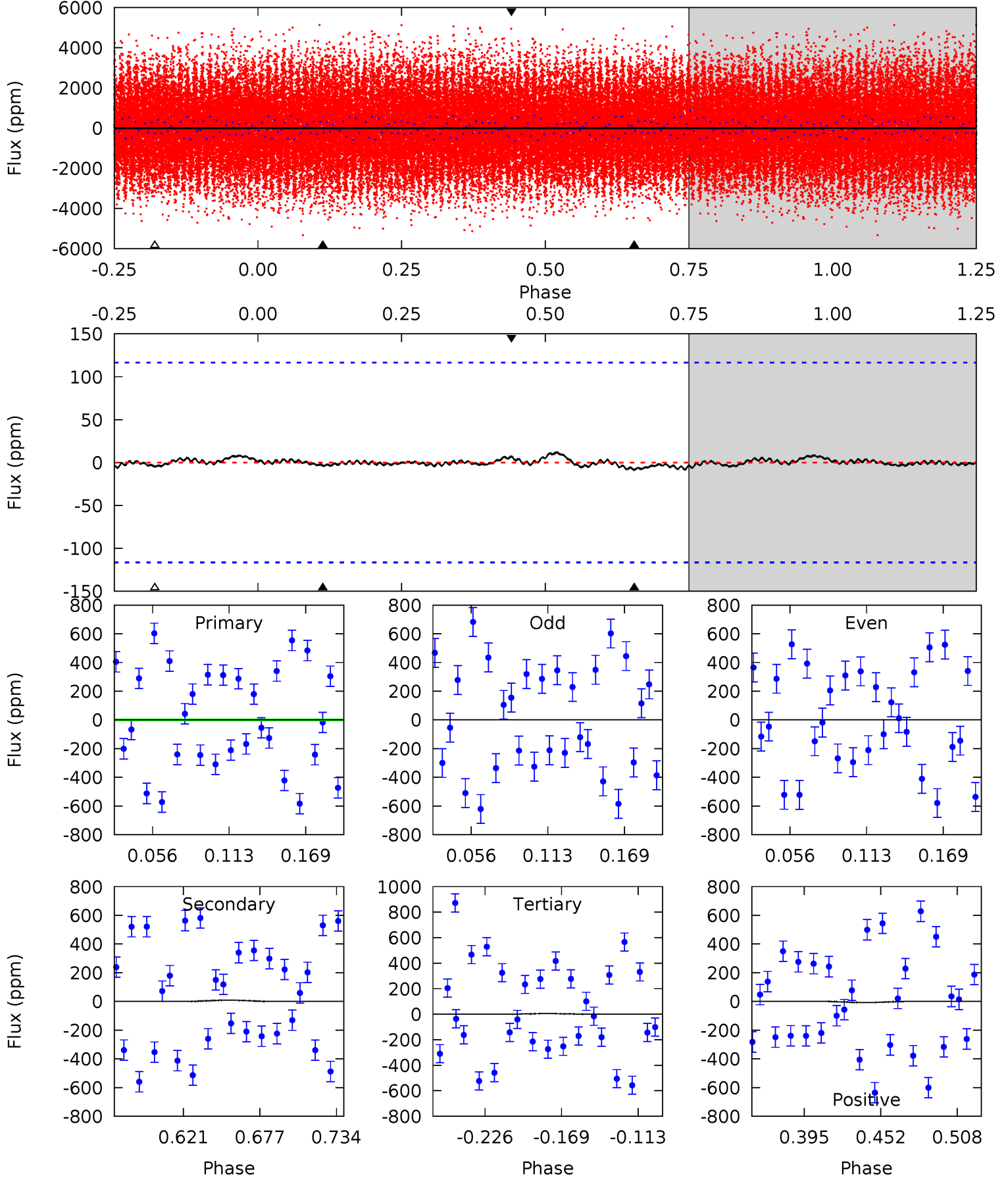
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
6.41	6.82	2.75	2.06	4.57	1.66	1.75	3.66	4.35	4.06	4.76	0.82	1.15	0.35	2.76



# Alt Model-Shift Uniqueness Test

012647070-01, P = 0.885535 Days, E = 131.406229 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
0.15	0.34	0.19	0.29	4.68	1.91	0.15	-0.04	-0.14	0.16	0.05	0.15	-0.37	0.58	0.19



### Stellar Parameters For KIC 012647070

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$7490^{+235}_{-314}$	$3.868^{+0.338}_{-0.113}$	$-0.180^{+0.250}_{-0.350}$	$2.564^{+0.446}_{-0.966}$	$1.770^{+0.173}_{-0.404}$	$0.148^{+0.359}_{-0.049}$
	+3%/-4%	+9%/-3%	+139%/-194%	+17%/-38%	+10%/-23%	+242%/-33%
Source	KIC0	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 012647070-01 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-19 \pm 3$	$9.42^{+10.60}_{-6.64}$	$4892^{+557}_{-517}$	$-3922^{+8062}_{-468}$	$0.053^{+0.535}_{-0.041}$
Alt.	$-9 \pm 25$	$8.72^{+11.78}_{-6.16}$	$4864^{+543}_{-577}$	$-4104^{+6643}_{-562}$	$0.012^{+0.304}_{-0.075}$

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



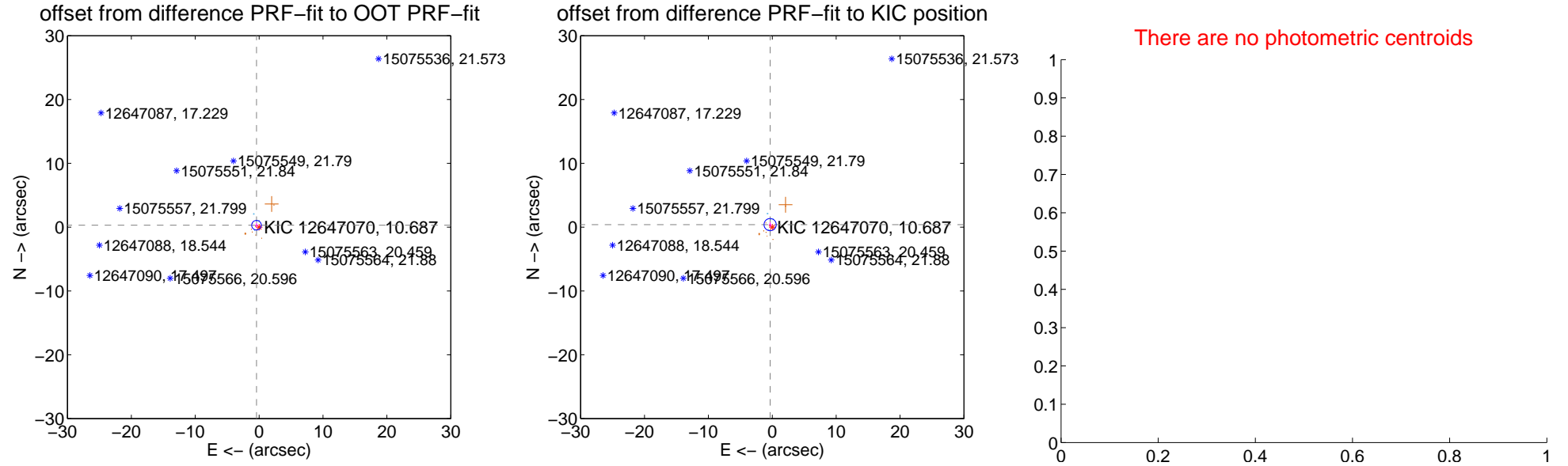
## DV Centroid Data

Supplemental centroid analysis for 012647070-01. **Kepler magnitude: 10.69.** Transit SNR 0.00

There are 5 quarters with good PRF difference image offsets

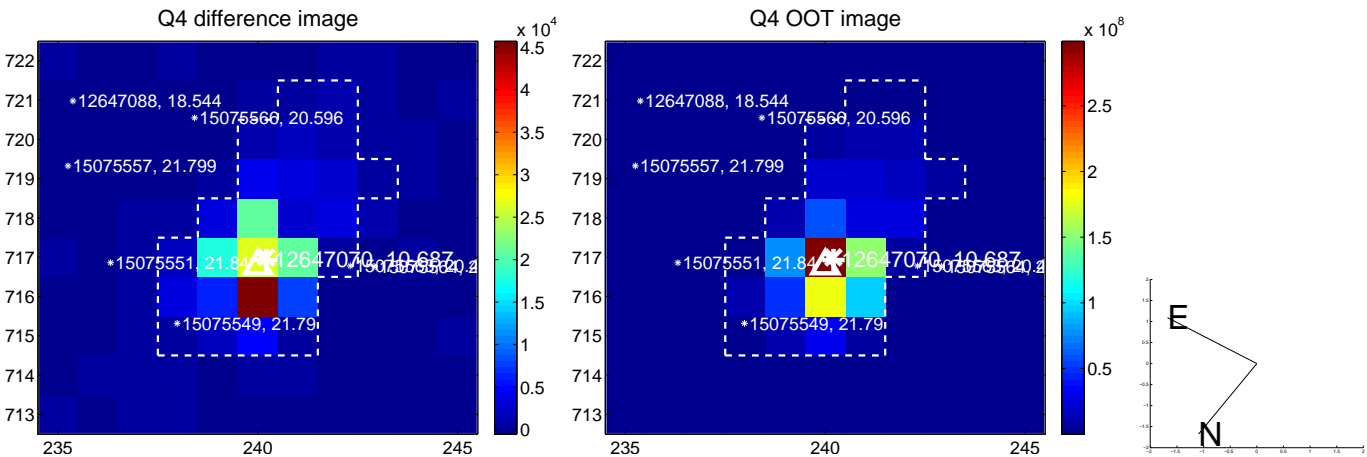
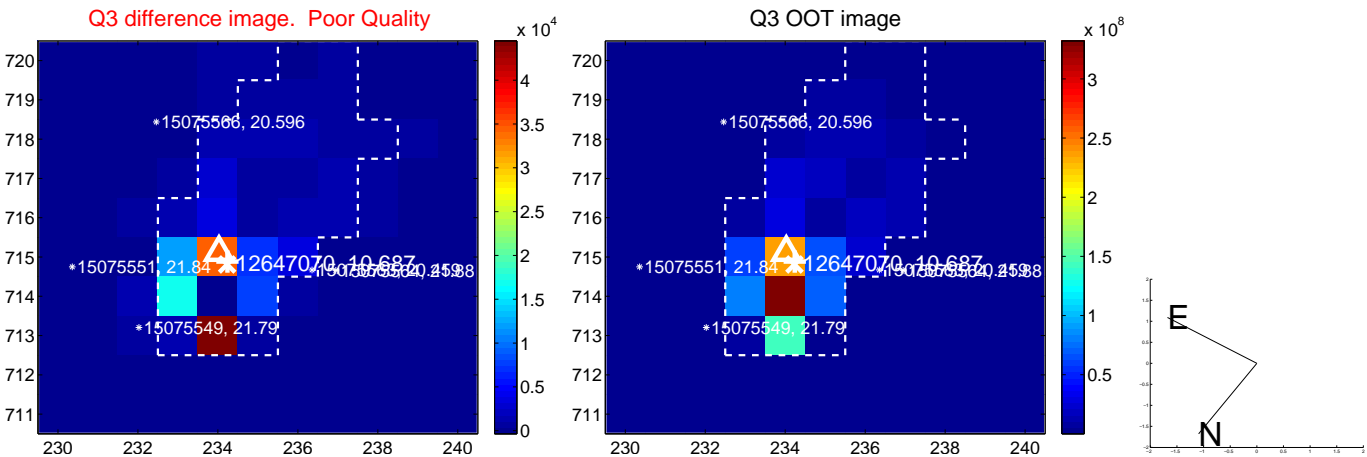
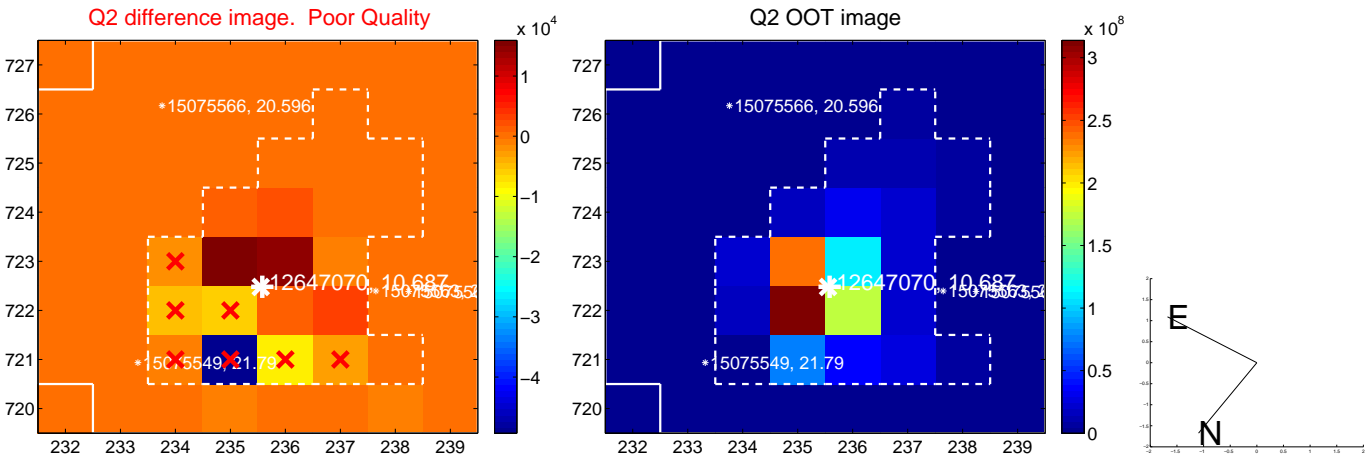
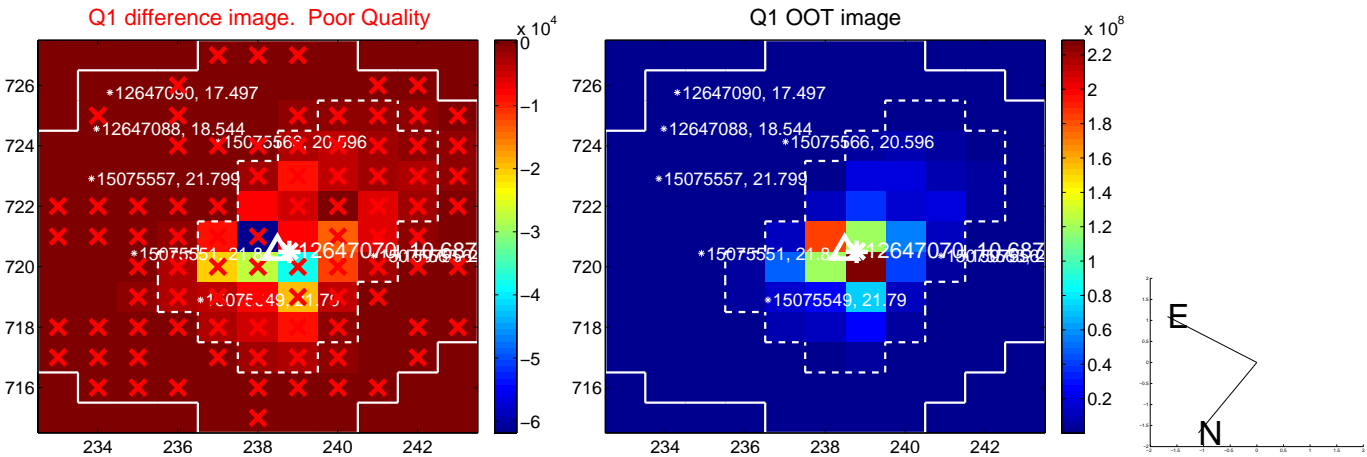
The direct PRF centroid is offset from the target star catalog position by about 0.15 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.509 \pm 0.250$	2.03	$0.410 \pm 0.177$	$0.301 \pm 0.347$
PRF-fit source offset from KIC position	$0.519 \pm 0.318$	1.63	$0.336 \pm 0.200$	$0.395 \pm 0.381$
photometric centroid source offset	—	—	—	—

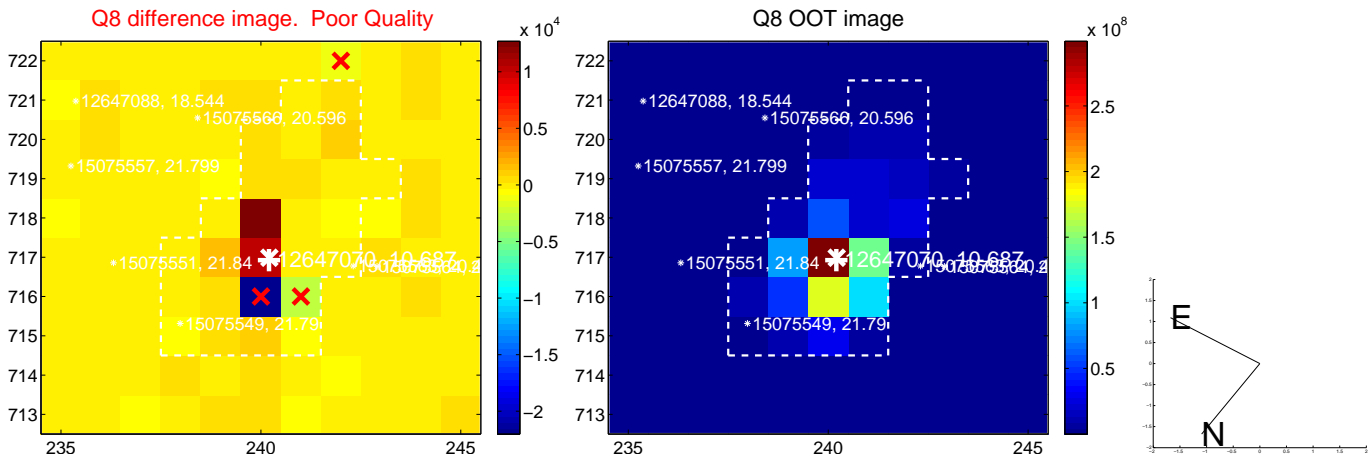
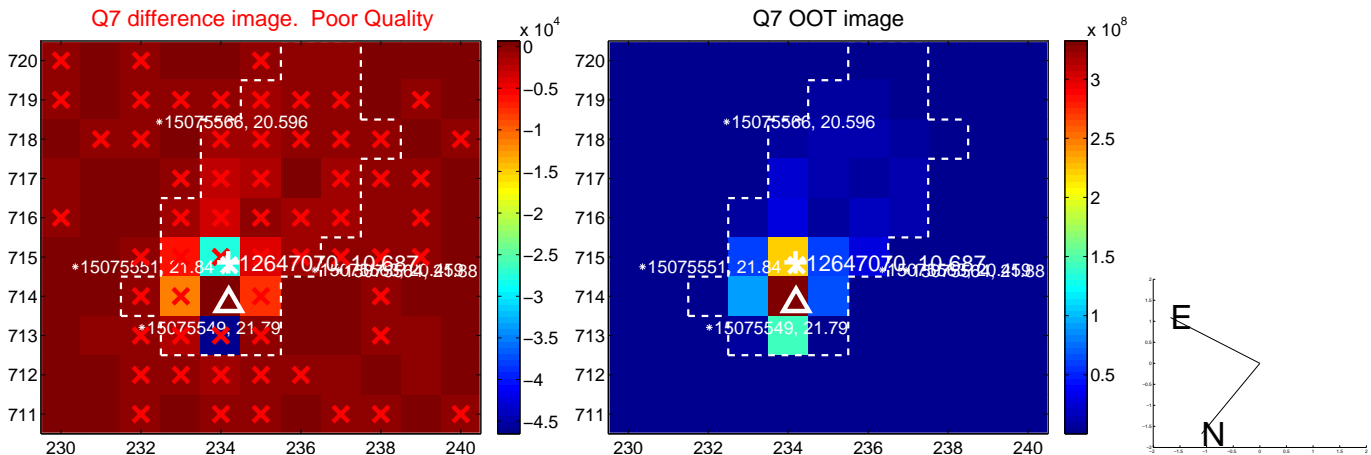
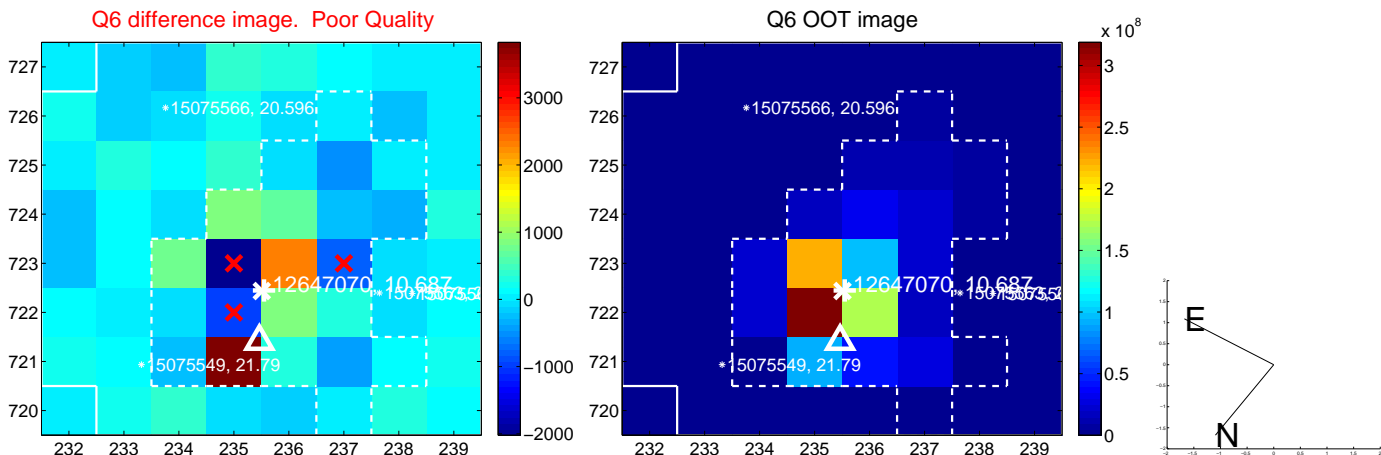
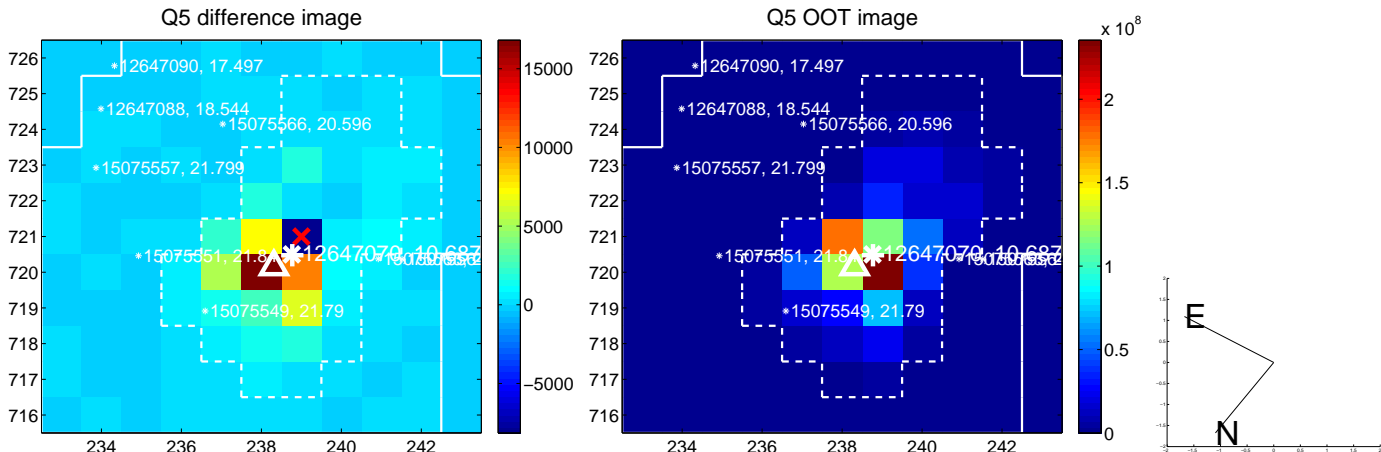


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

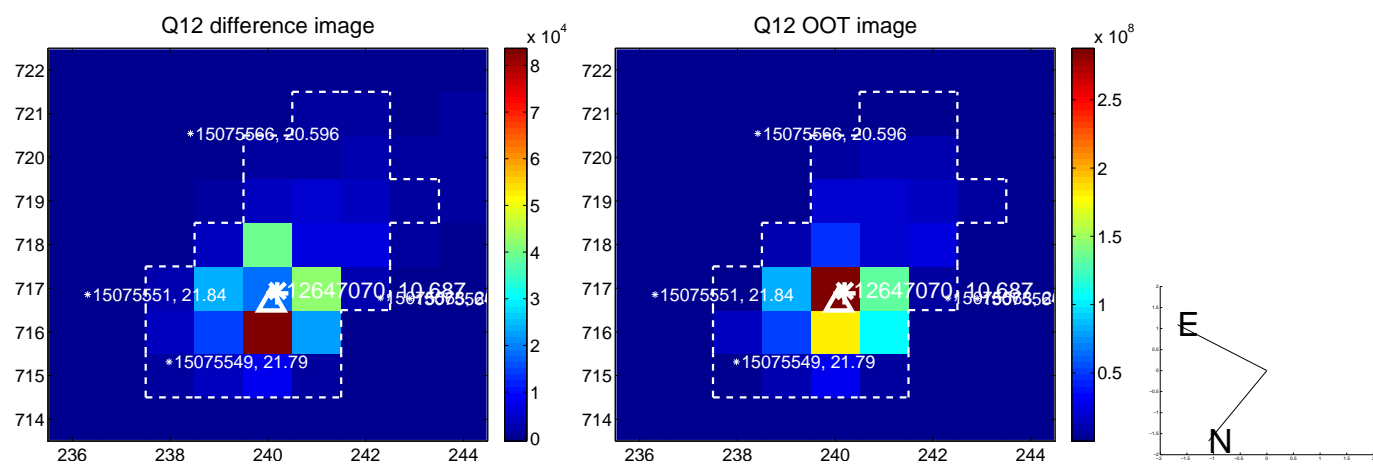
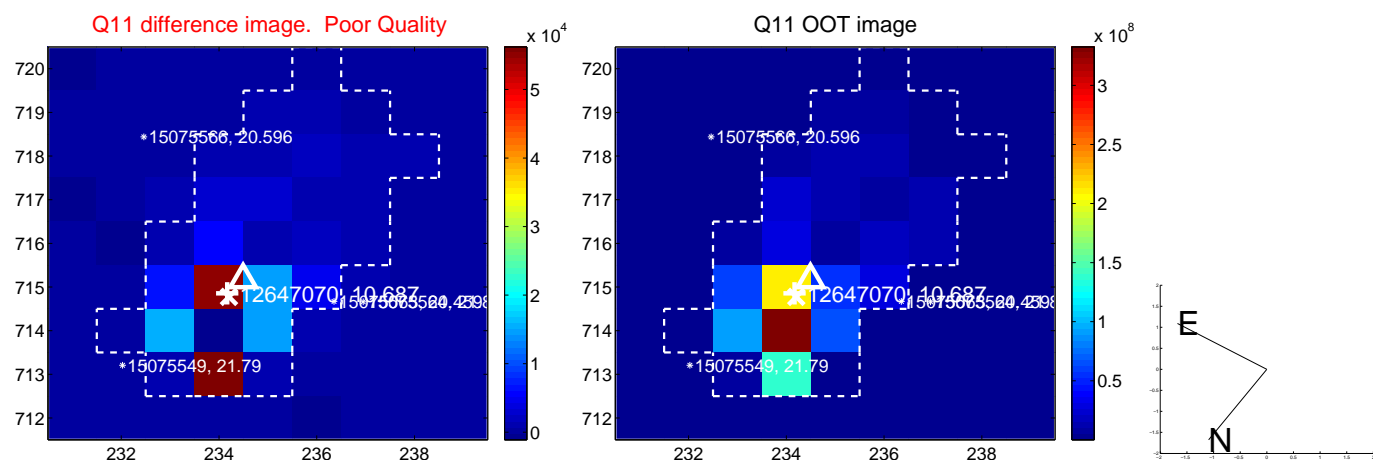
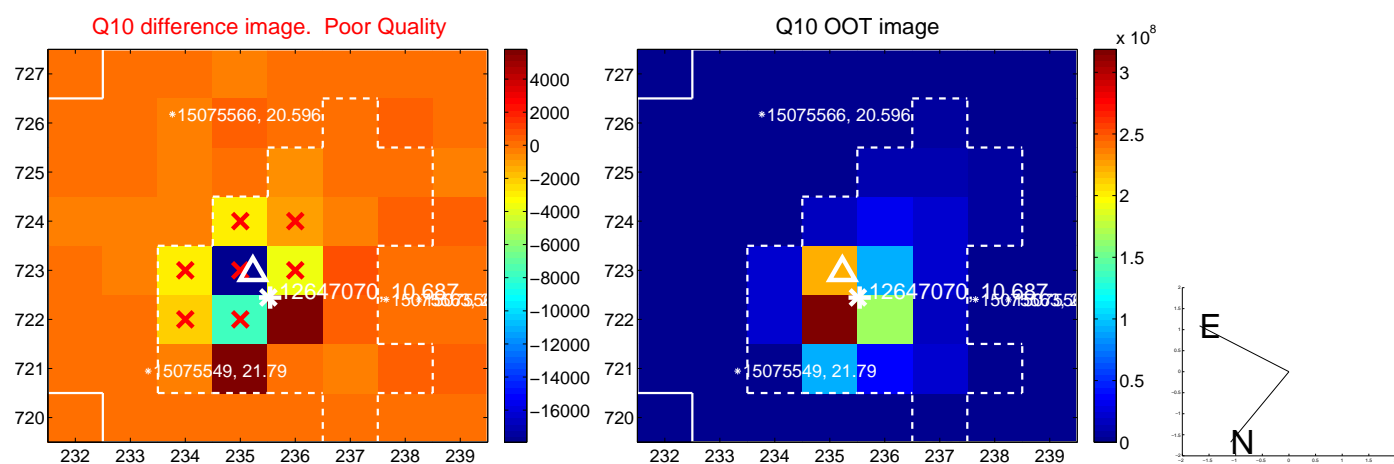
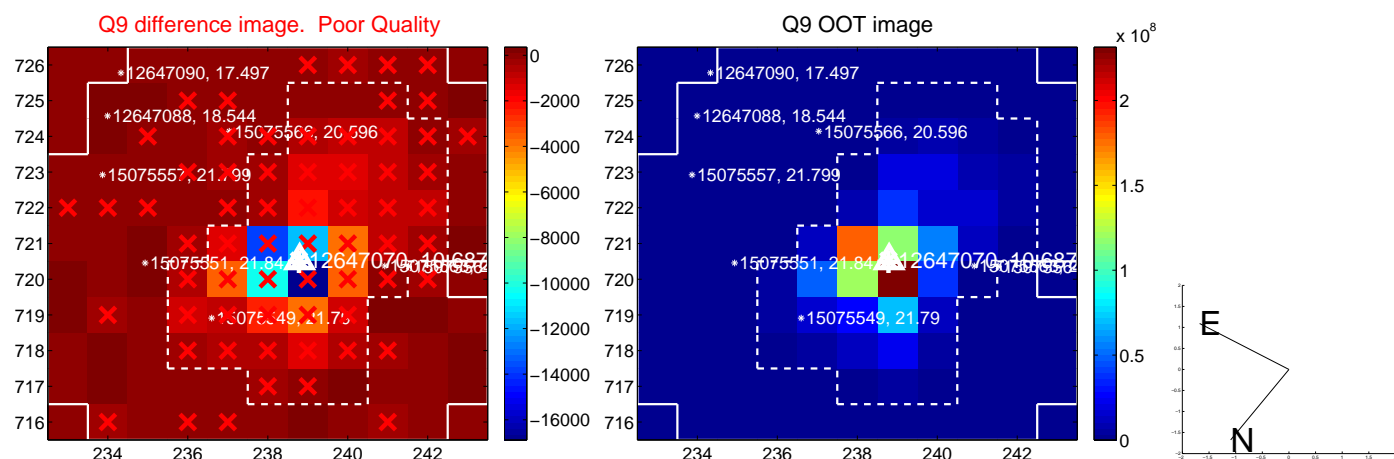
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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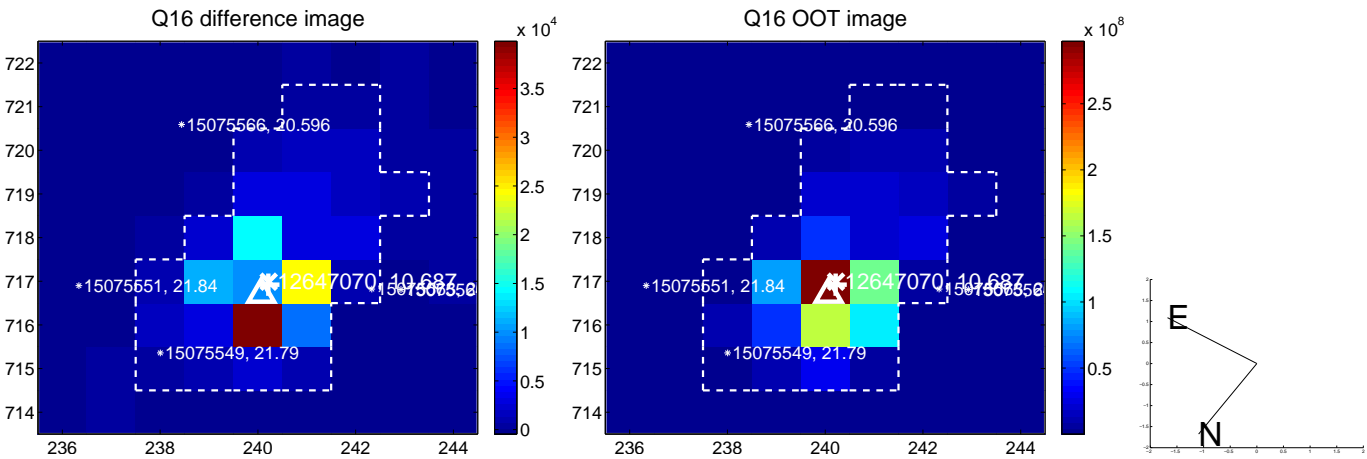
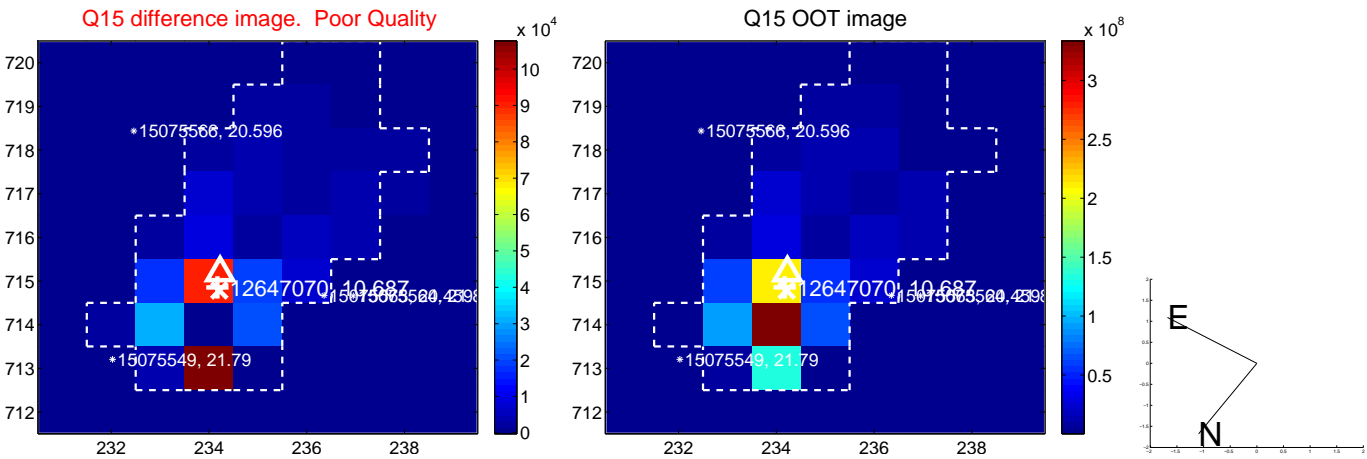
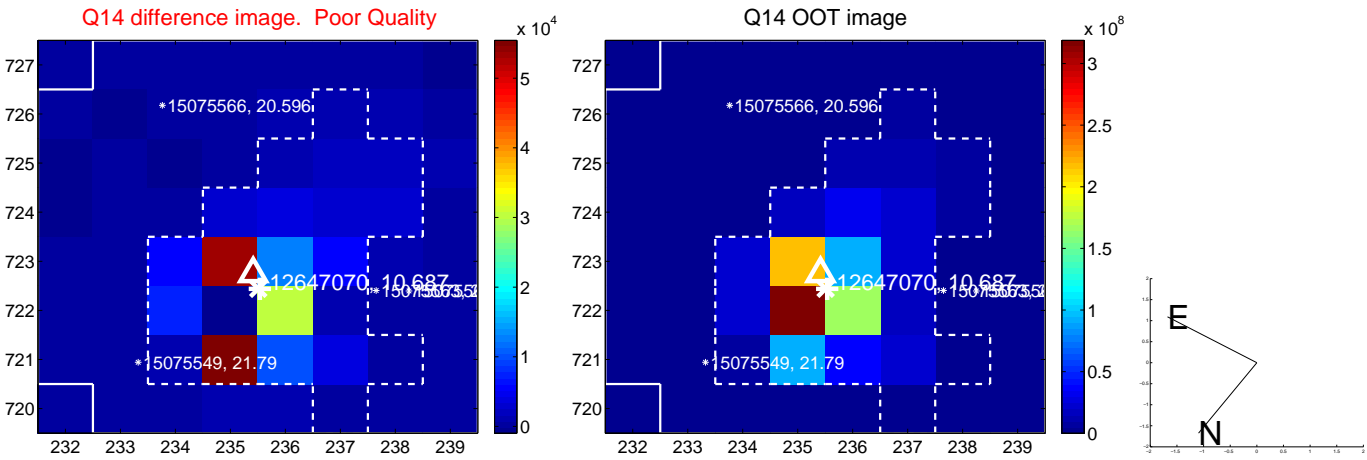
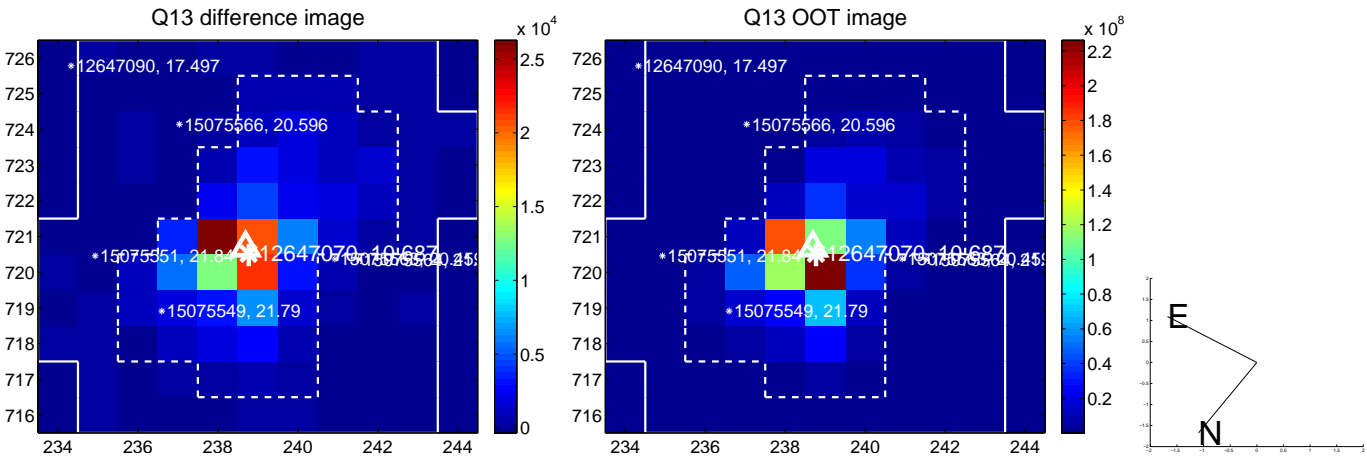


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

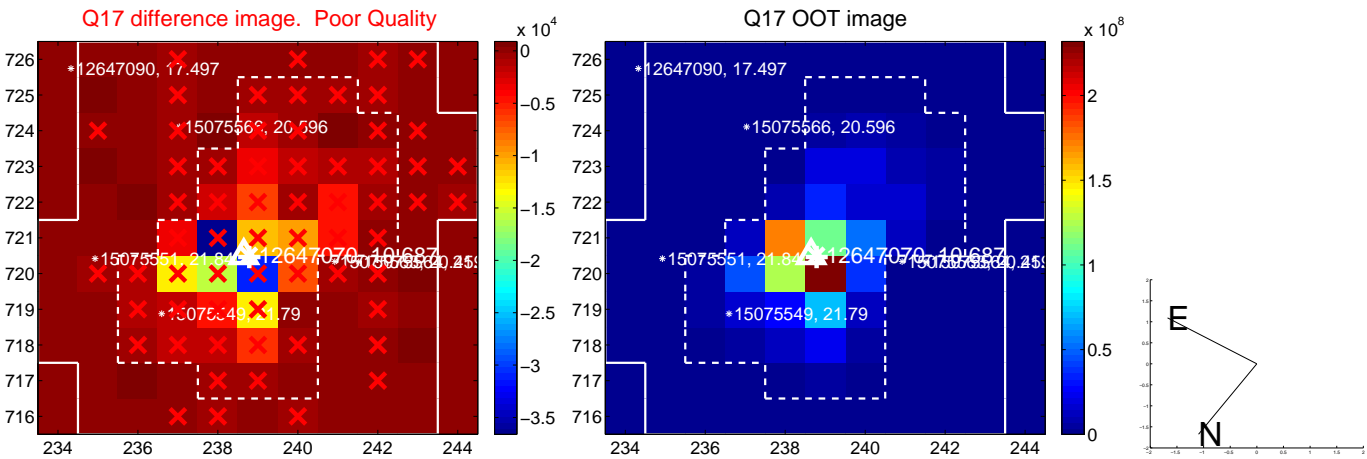




white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

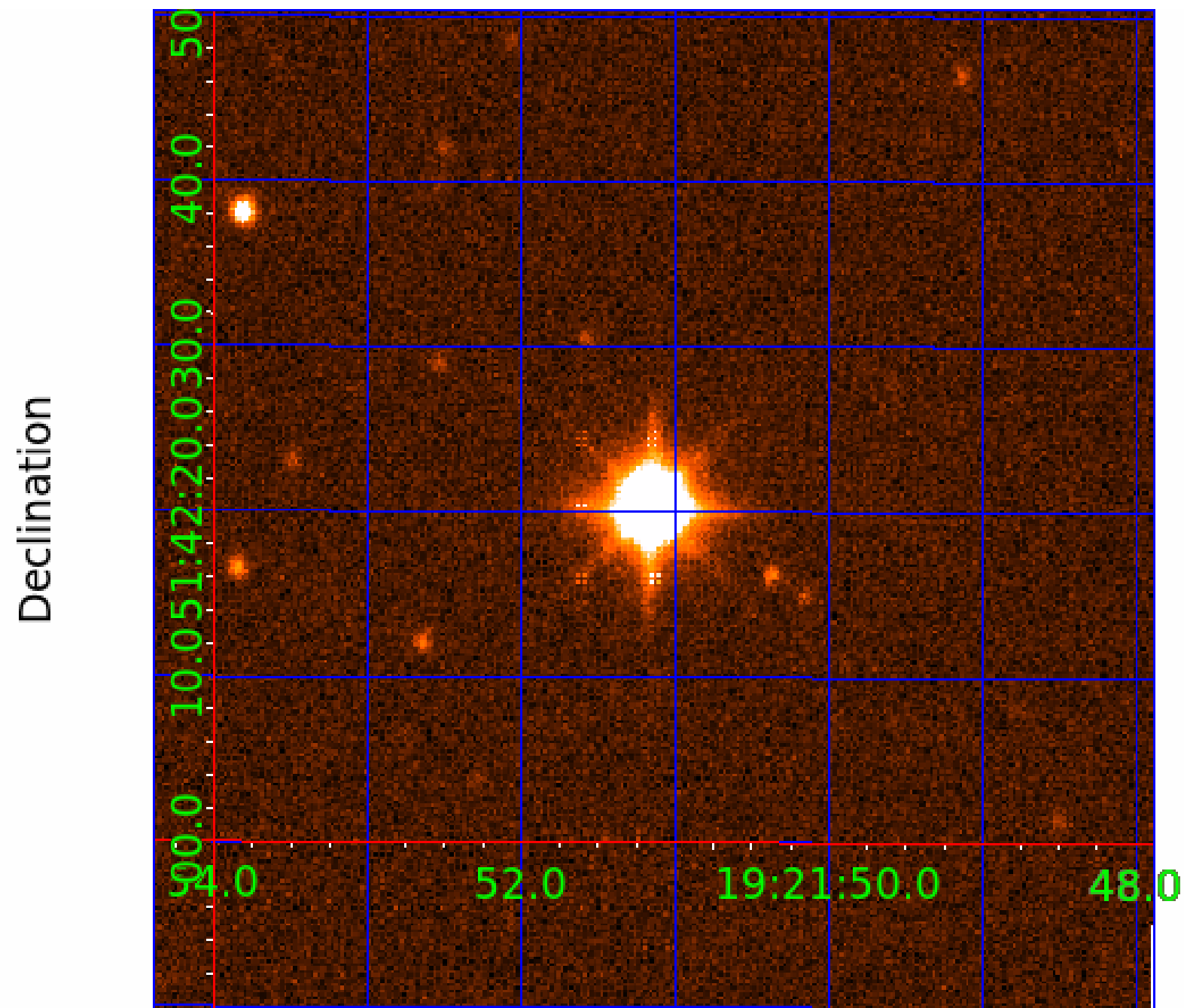


white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



folded centroid time series figure for this object.

UKIRT Image



# KIC 012647070

## 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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012647070-02	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_ALT—MOD_POS_ALT—SAME_NTL_PERIOD—CENT_SATURATED
012647070-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE_ZUMA_TRACKER—LPP_DV—LPP_ALT—SAME_NTL_PERIOD—CENT_SATURATED
012647070-04	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_DV—LPP_ALT—SAME_NTL_PERIOD—CENT_SATURATED

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

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

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

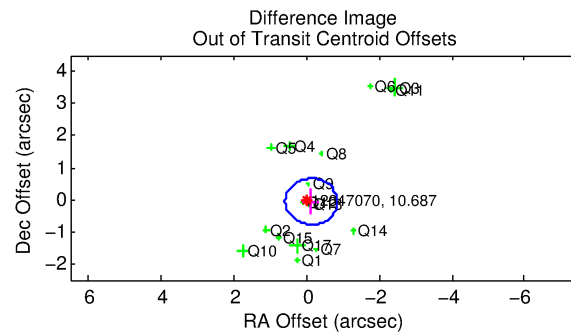
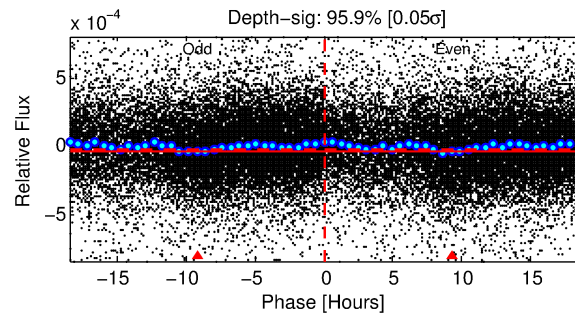
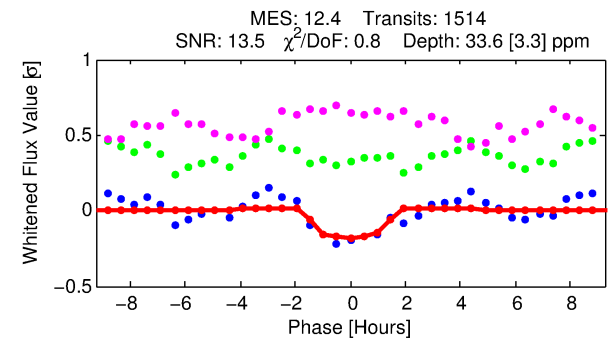
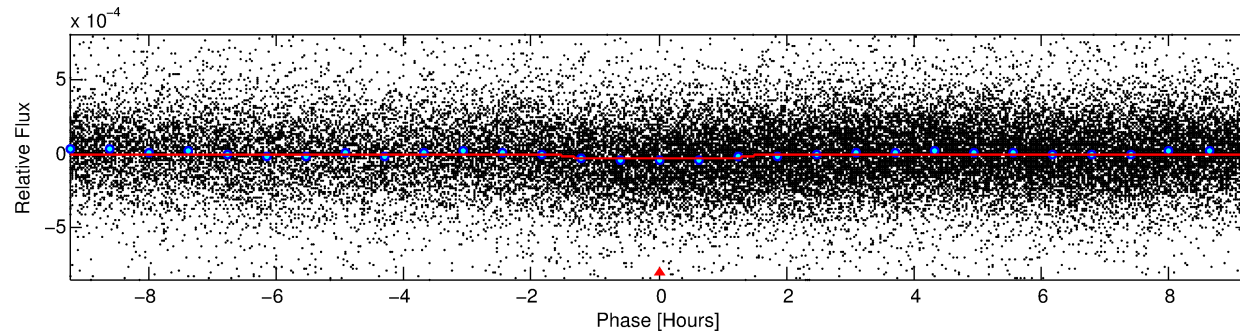
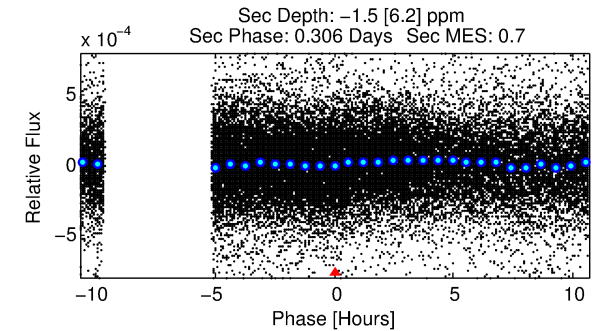
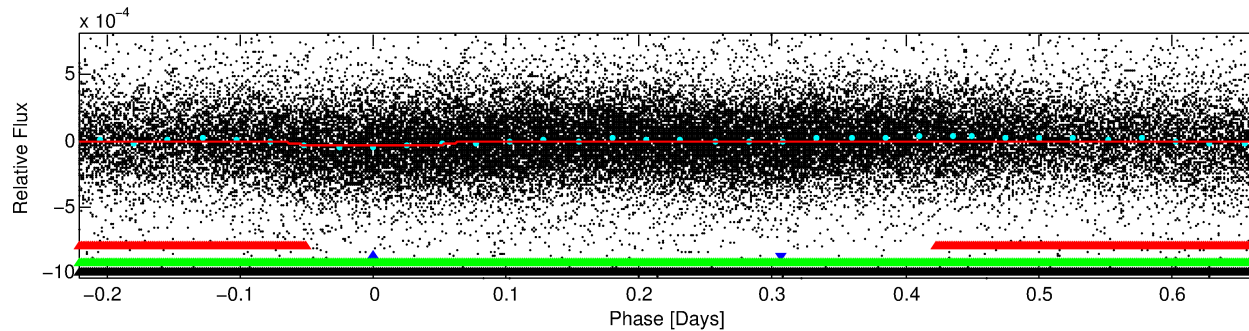
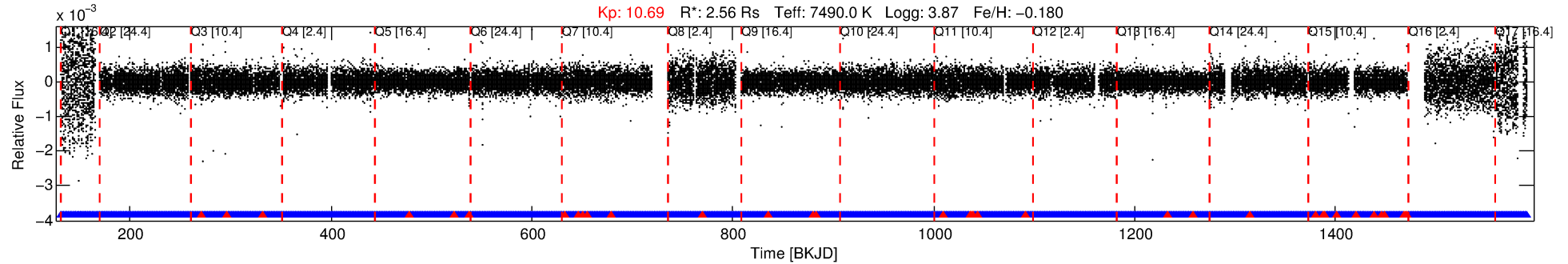
Ephemeris Match Information For 012647070-02

No Significant Match Found



# DV One-Page Summary

KIC: 12647070 Candidate: 2 of 4 Period: 0.886 d



## DV Fit Results:

Period = 0.88560 [0.00001] d  
Epoch = 131.5464 [0.0030] BKJD  
Rp/R\* = 0.0062 [0.0027]  
a/R\* = 1.37 [1.59]  
b = 0.90 [0.55]  
Seff = 38885.31 [23344.50]  
Teq = 3581 [537] K  
Rp = 1.74 [1.00] Re  
a = 0.0218 [0.0079] AU  
Ag = N/A  
Teffp = N/A

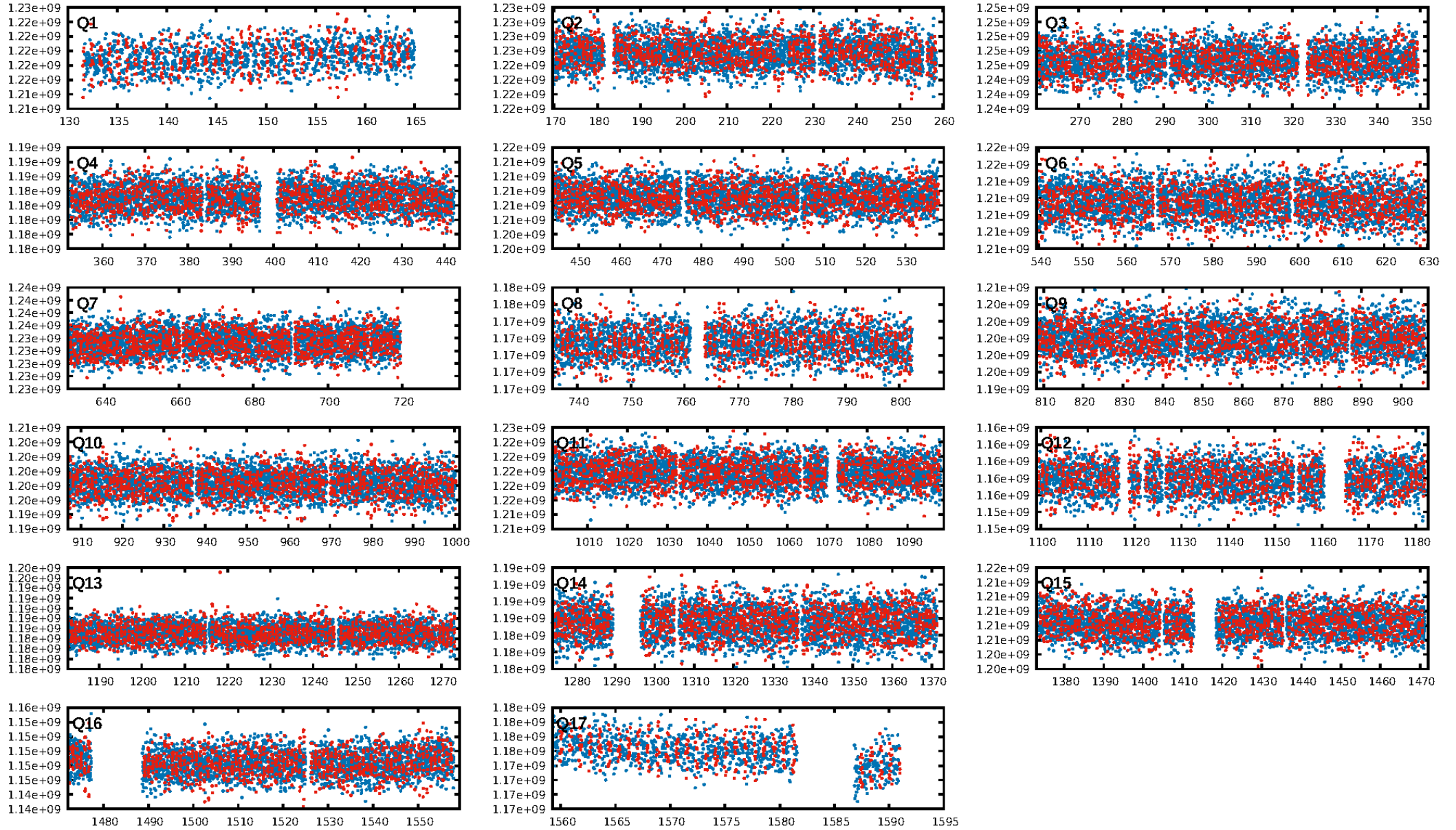
## DV Diagnostic Results:

ShortPeriod-sig: 0.1% [0.00σ]  
LongPeriod-sig: N/A  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: N/A  
RollingBand-fgt: 0.98 [1410/1446]  
GhostDiagnostic-chr: N/A  
Centroid-sig: 3.4%  
Centroid-so: 0.689 arcsec [1.69σ]  
OotOffset-rm: 0.142 arcsec [0.59σ]  
KicOffset-rm: 0.350 arcsec [0.73σ]  
OotOffset-st: 4/4/3/5 [16]  
KicOffset-st: 4/4/3/5 [16]  
DiffImageQuality-fgm: 0.38 [6/16]  
DiffImageOverlap-fno: 0.00 [0/17]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 30-Jan-2016 06:20:02 Z

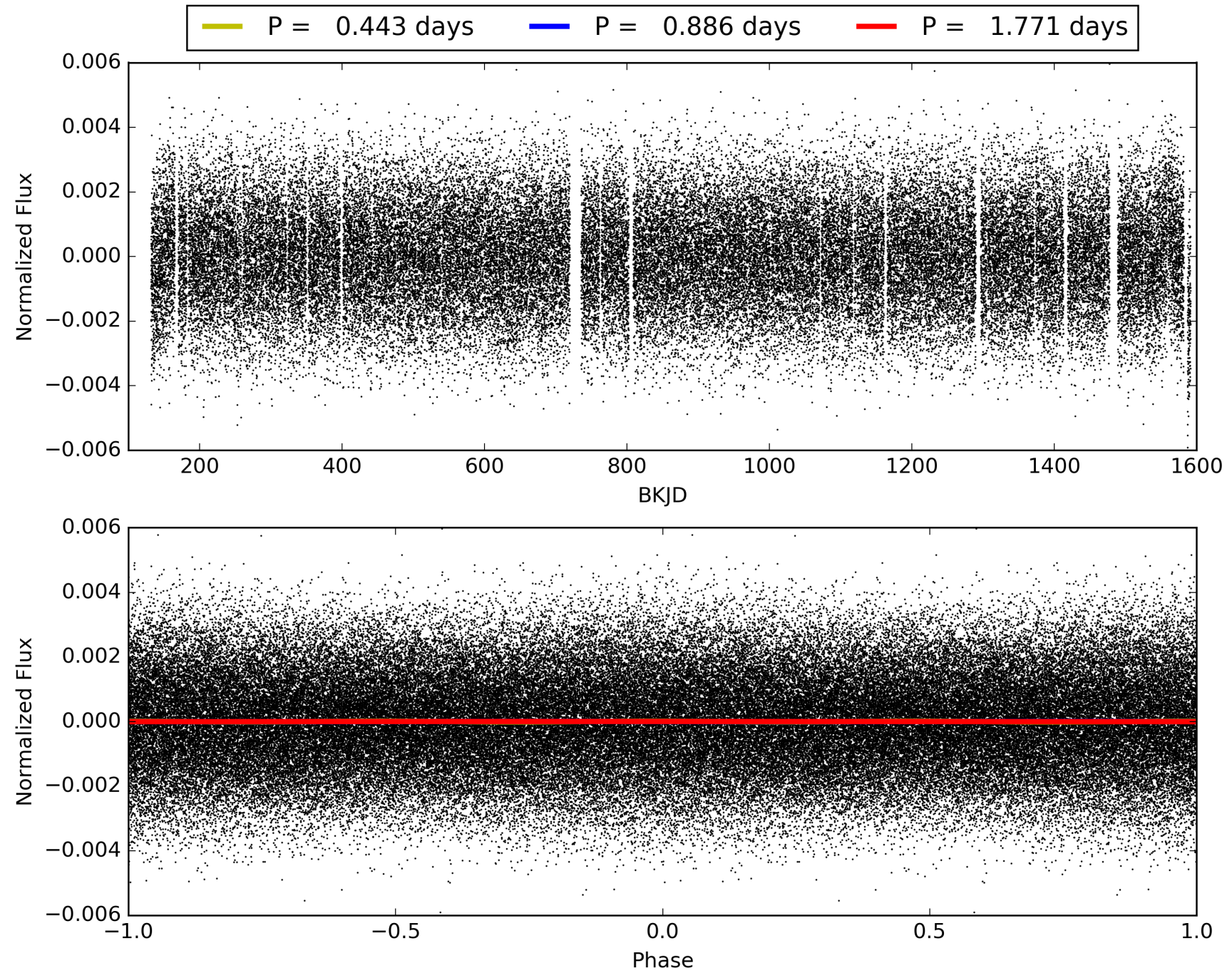
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 012647070-02, PDC Light Curves



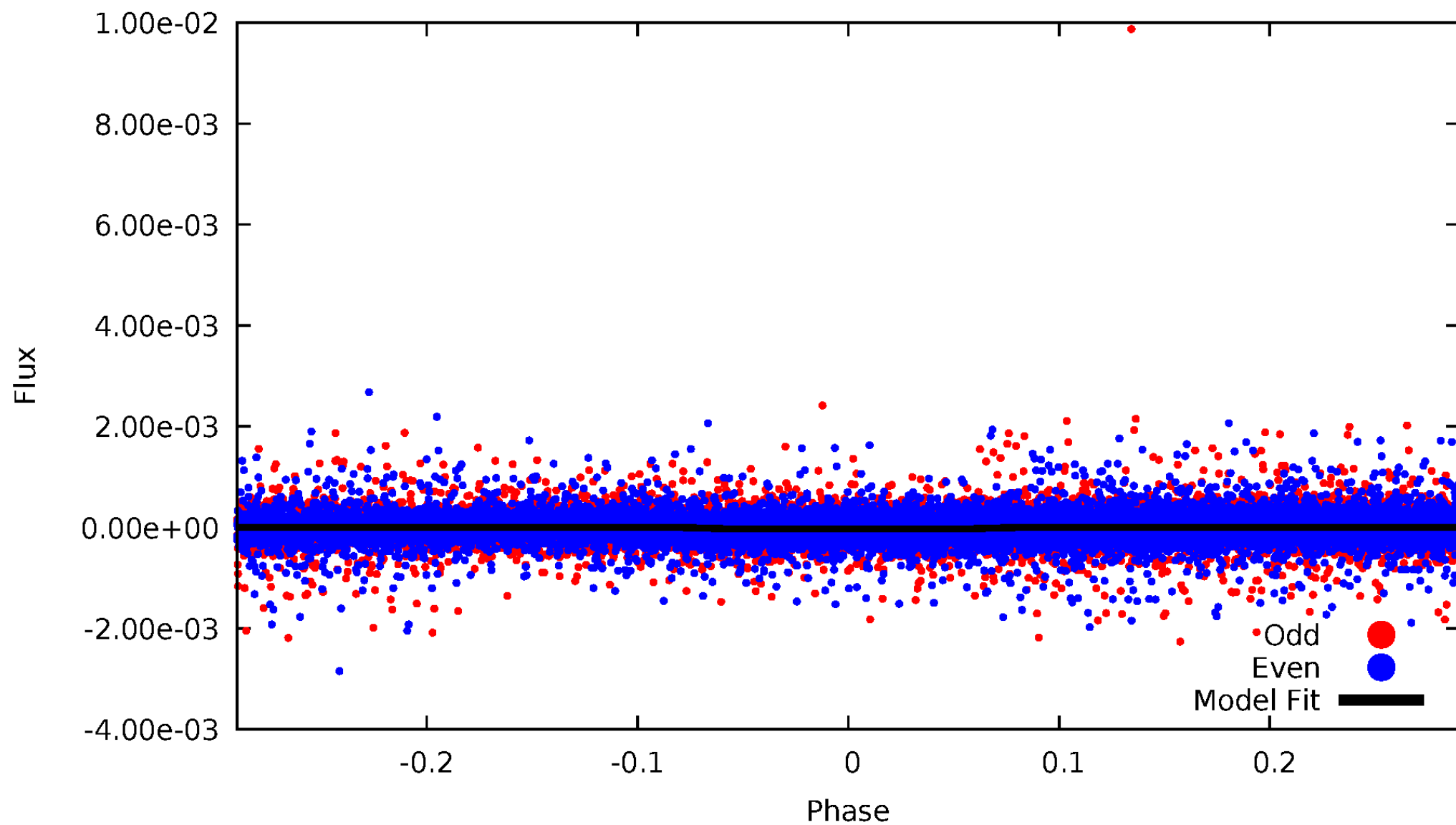


TCE 012647070-02



# DV Odd/Even

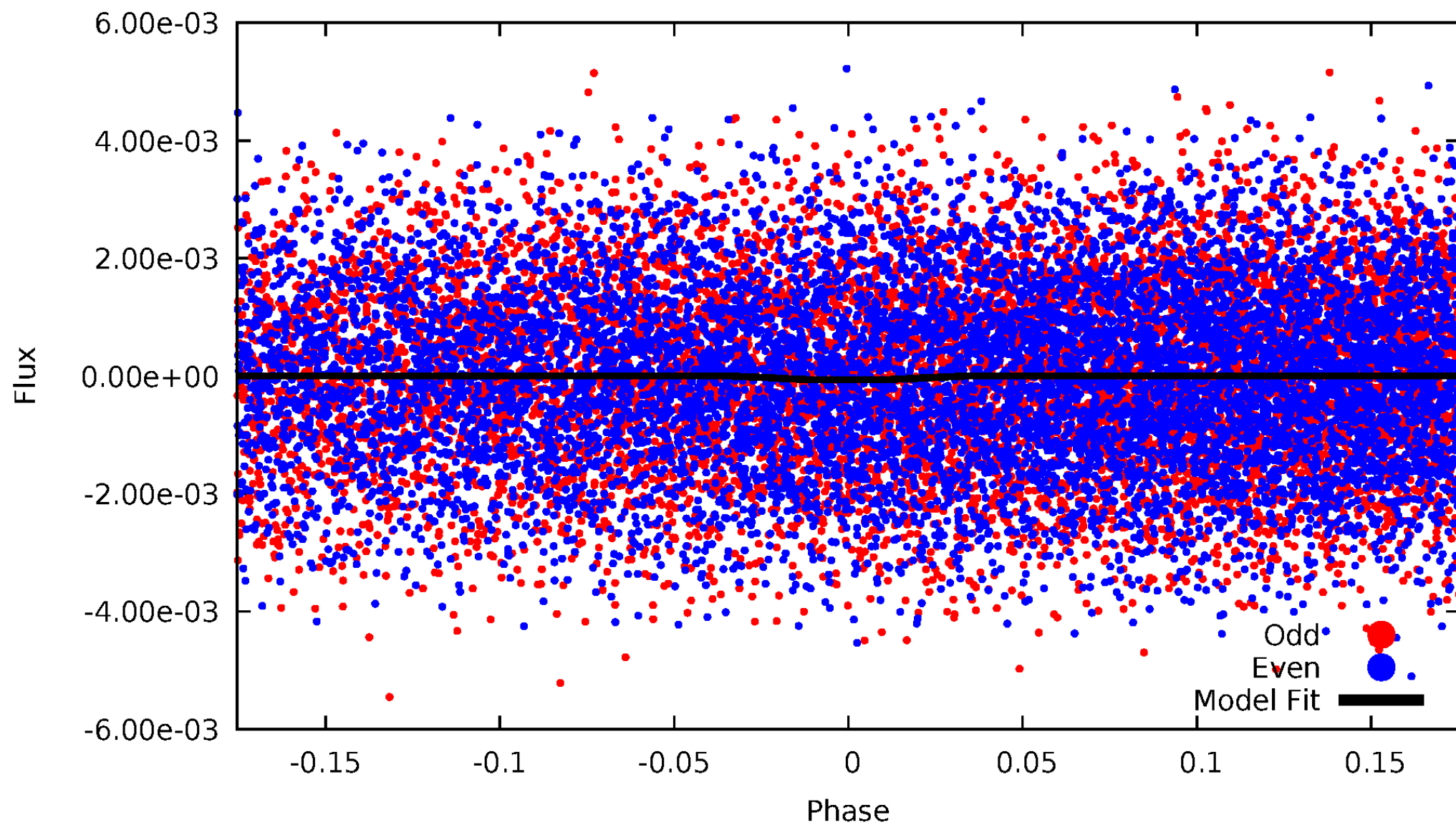
TCE 012647070-02





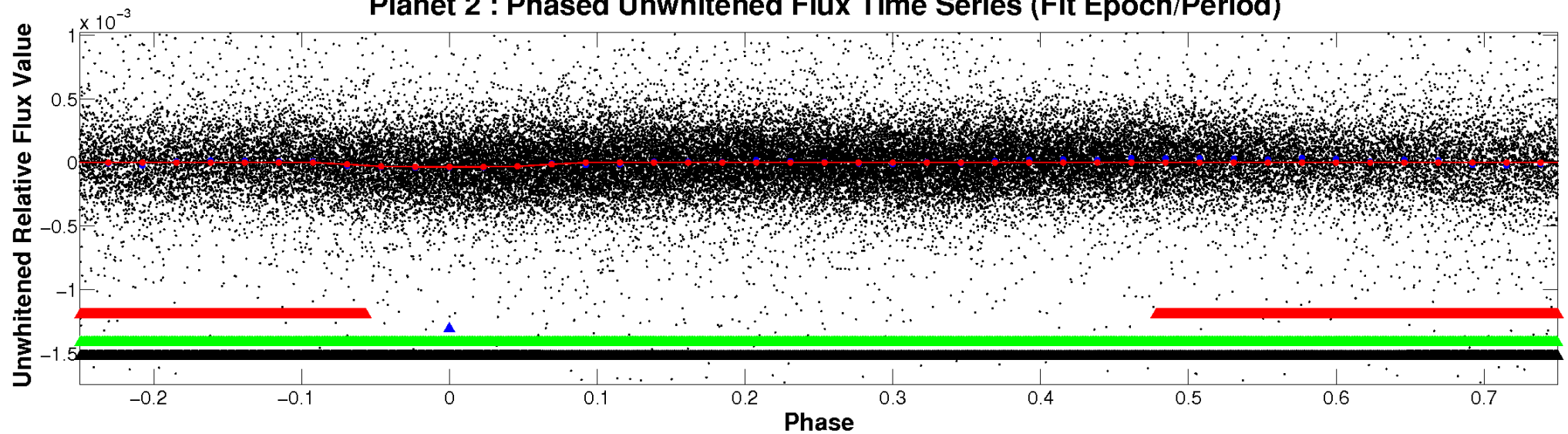
# ALT Odd/Even

TCE 012647070-02

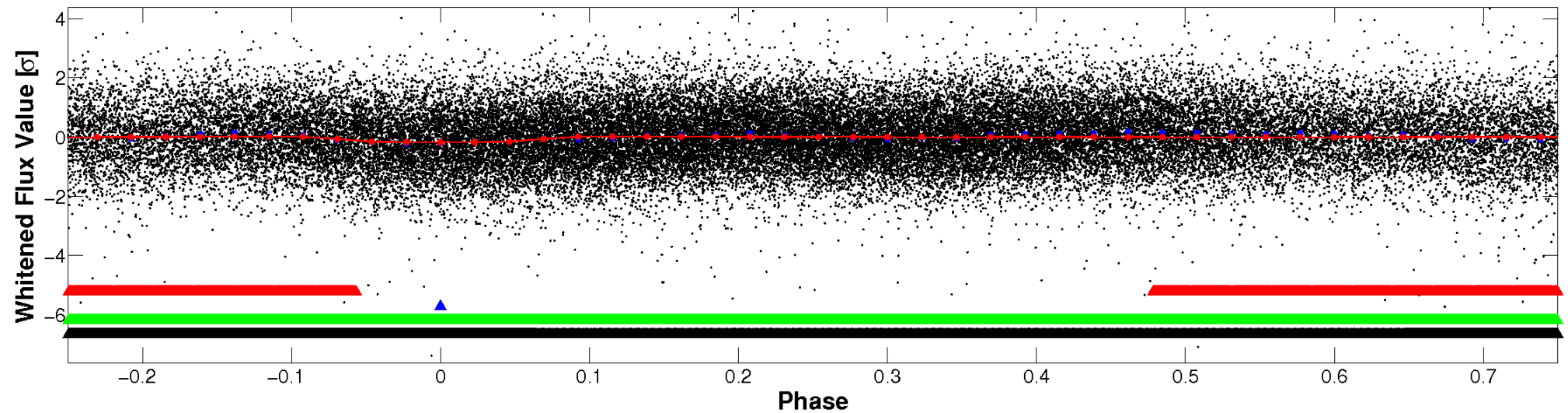


# Non-Whitened Vs. Whitened Light Curve

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

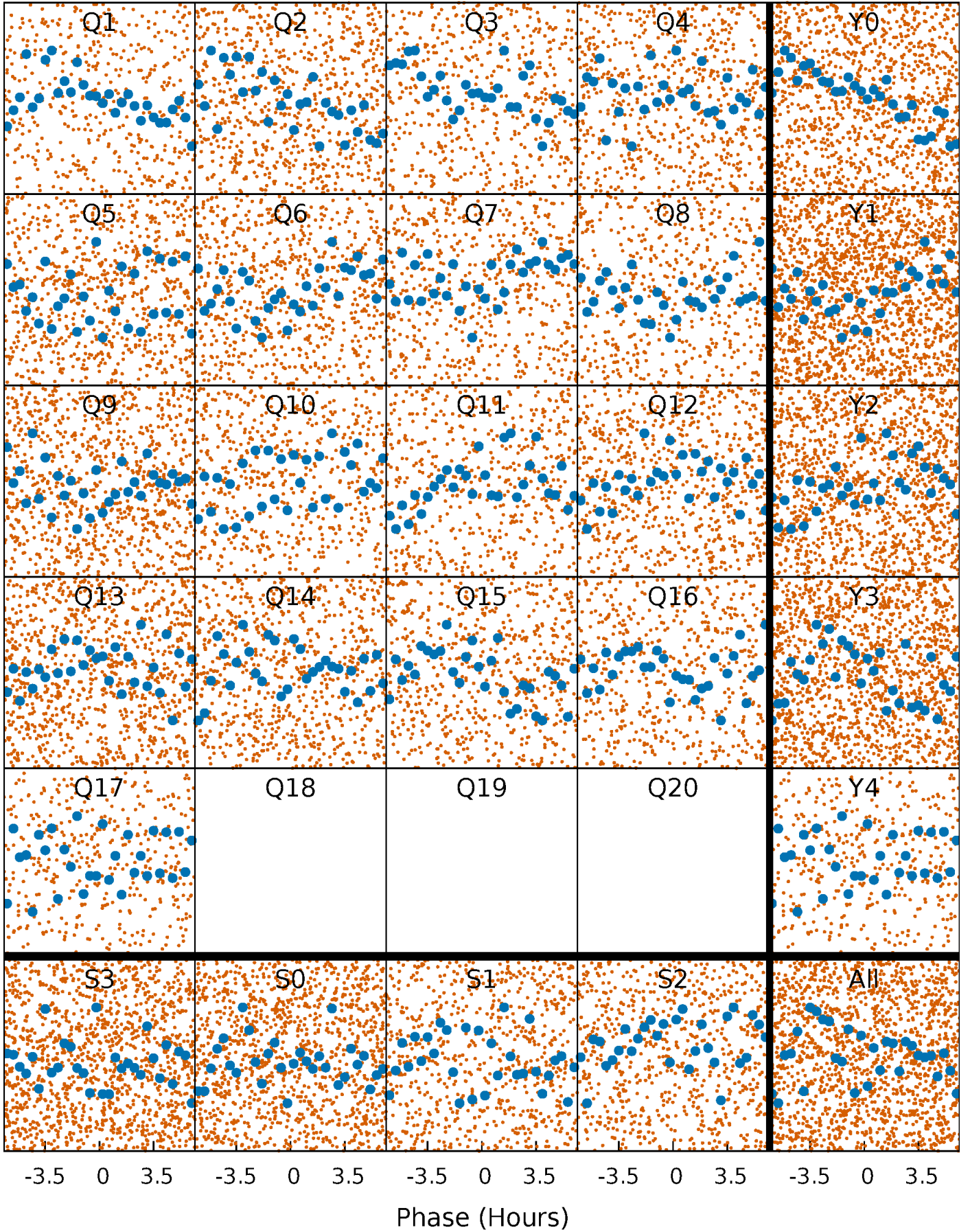


## Planet 2 : Phased Whitened Flux Time Series (Fit Epoch/Period)



# PDC Quarter-Phased Transit Curves

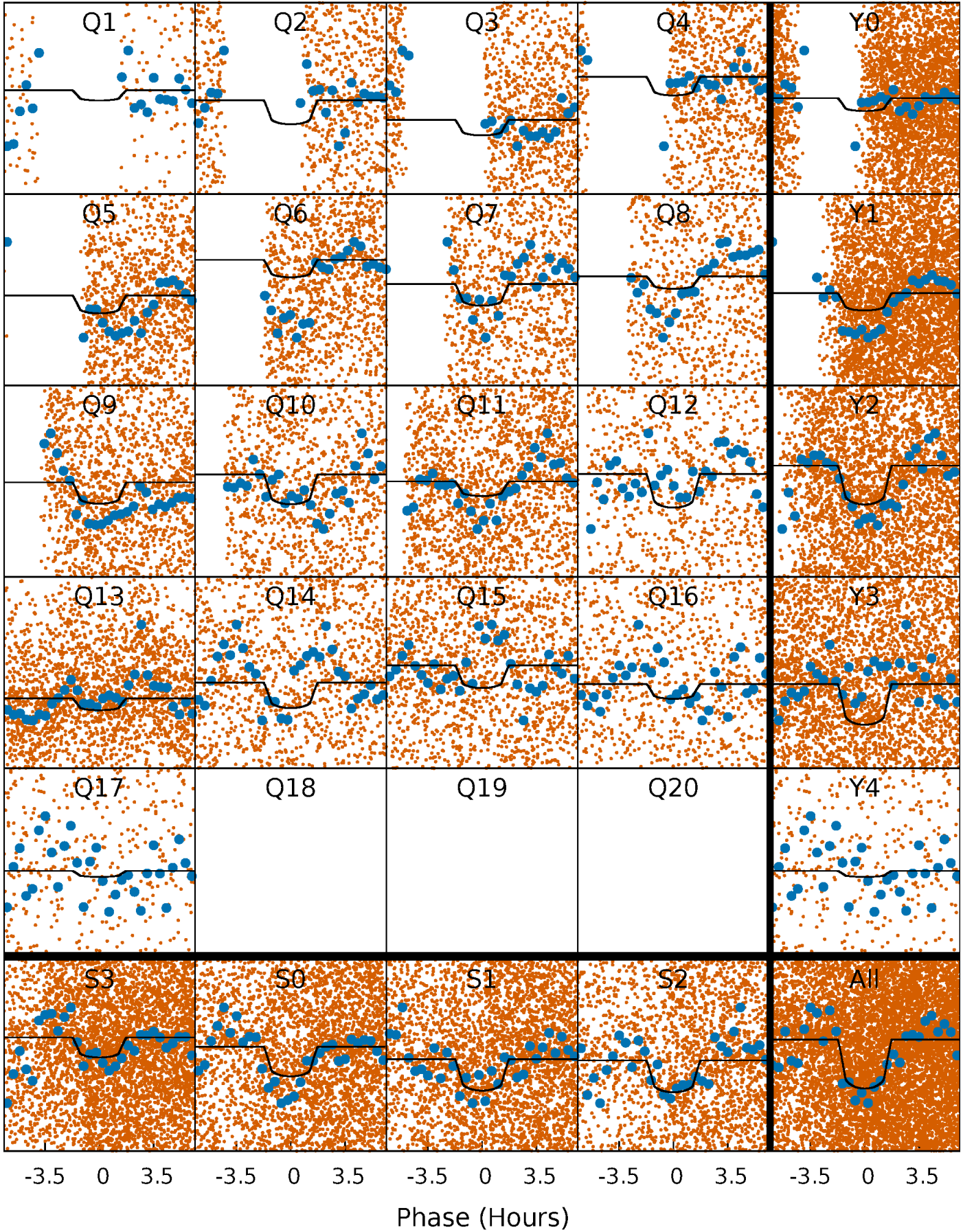
TCE 012647070-02     $P = 0.885597$  Days     $T_0 = 131.546355$  (BKJD)





# DV Quarter-Phased Transit Curves

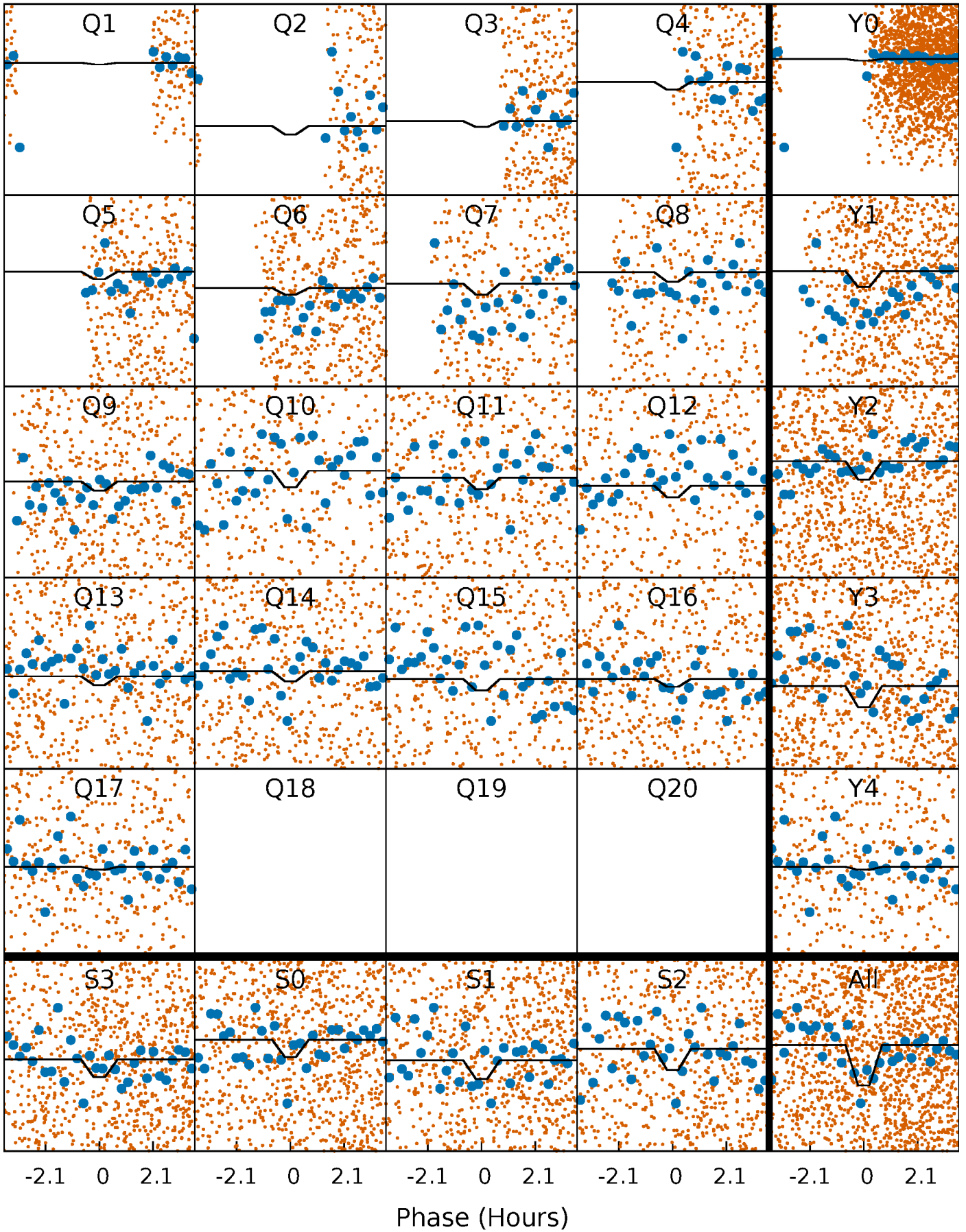
TCE 012647070-02   P= 0.885597 Days    $T_0=131.546355$  (BKJD)





# Alt. Detrend Quarter-Phased Transit Curves

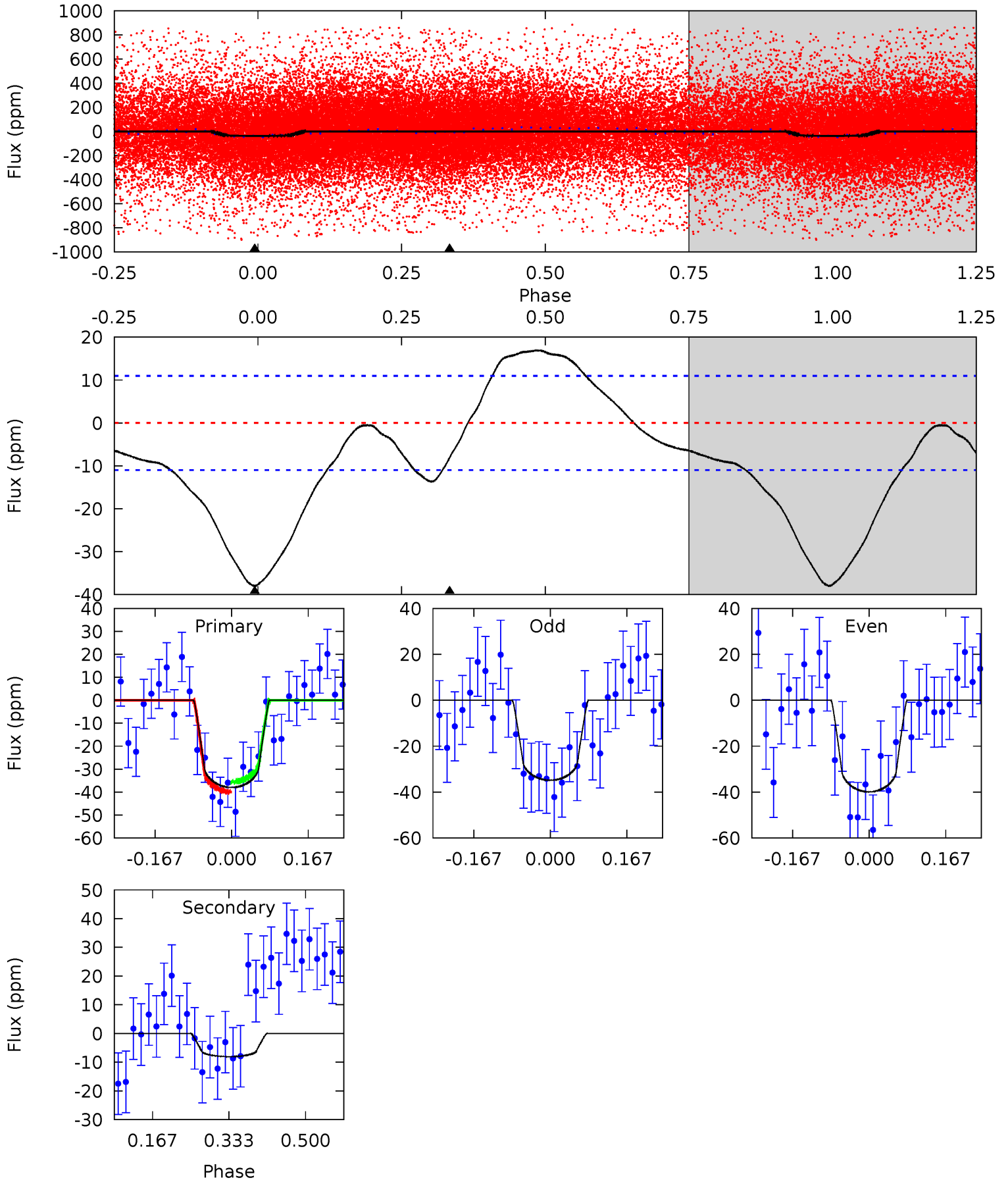
TCE 012647070-02 P= 0.885611 Days  $T_0=131.516929$  (BKJD)



# DV Model-Shift Uniqueness Test

012647070-02, P = 0.885597 Days, E = 131.546355 Days

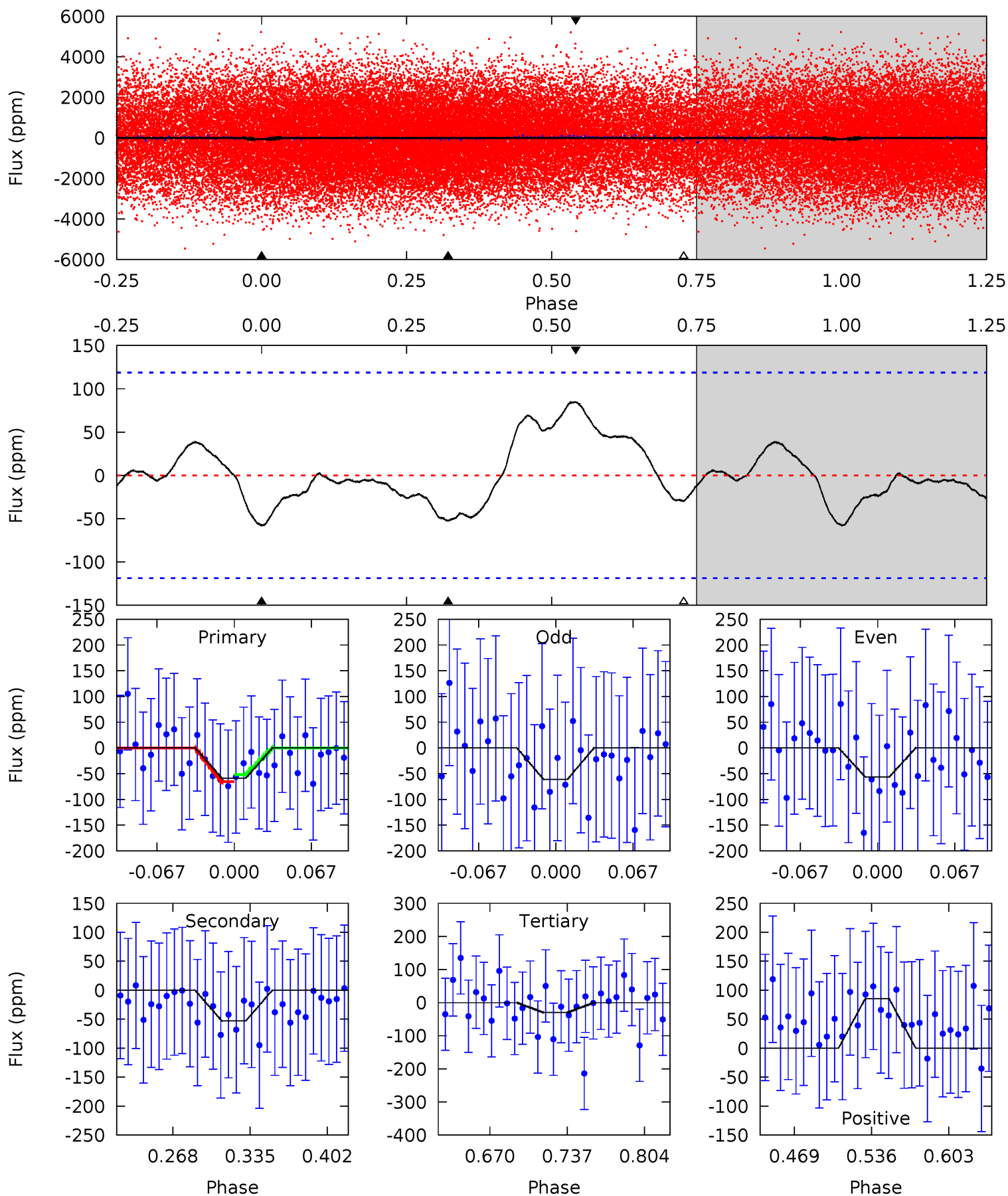
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
15.4	3.28	0	0	4.46	1.38	3.65	15.4	15.4	3.28	3.28	1.04	0.93	0.31	0.89



# Alt Model-Shift Uniqueness Test

012647070-02, P = 0.885611 Days, E = 131.516929 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
2.30	2.08	1.17	3.34	4.65	1.83	1.25	1.13	-1.04	0.90	-1.27	0.09	1.17	0.59	0.27



### Stellar Parameters For KIC 012647070

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$\rho_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$7490^{+235}_{-314}$	$3.868^{+0.338}_{-0.113}$	$-0.180^{+0.250}_{-0.350}$	$2.564^{+0.446}_{-0.966}$	$1.770^{+0.173}_{-0.404}$	$0.148^{+0.359}_{-0.049}$
	+3%/-4%	+9%/-3%	+139%/-194%	+17%/-38%	+10%/-23%	+242%/-33%
Source	KIC0	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 012647070-02 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$-8 \pm 2$	$1.64^{+0.79}_{-0.71}$	$4891^{+356}_{-437}$	$4541^{+1719}_{-1665}$	$0.789^{+1.556}_{-0.461}$
Alt.	$-53 \pm 26$	$2.08^{+0.84}_{-0.75}$	$4917^{+323}_{-470}$	$6750^{+2231}_{-1461}$	$2.882^{+5.041}_{-1.725}$

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

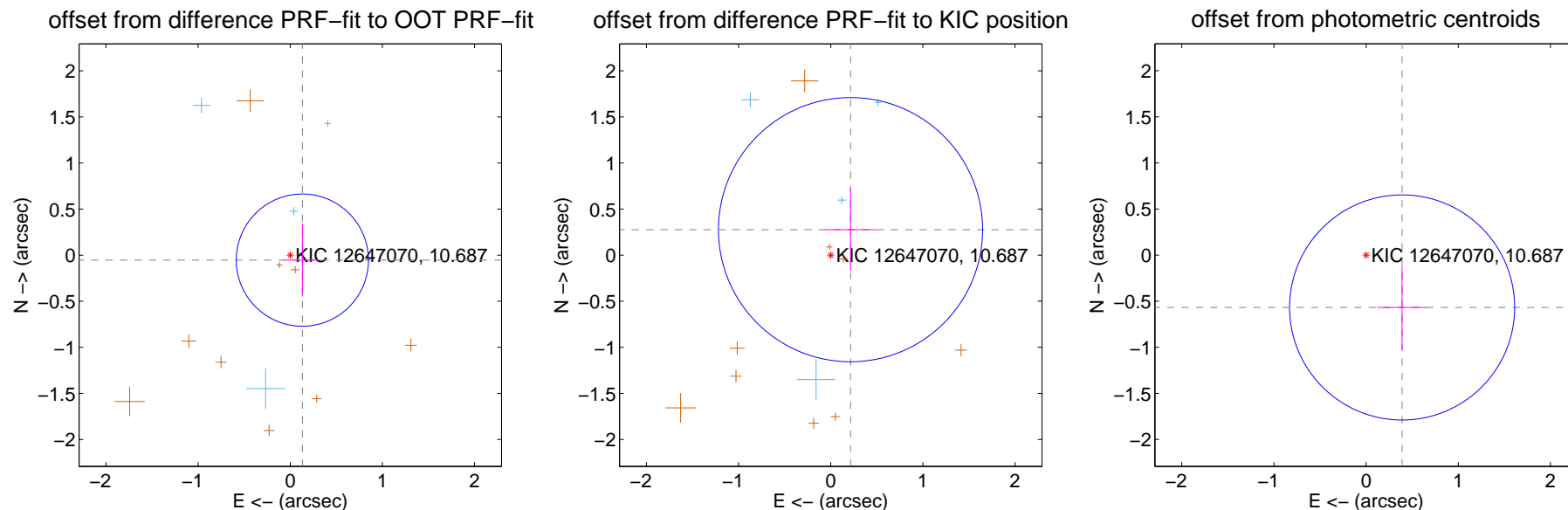
## DV Centroid Data

Supplemental centroid analysis for 012647070-02. **Kepler magnitude: 10.69.** Transit SNR 13.46

There are 6 quarters with good PRF difference image offsets

The direct PRF centroid is offset from the target star catalog position by about 0.15 arcsec

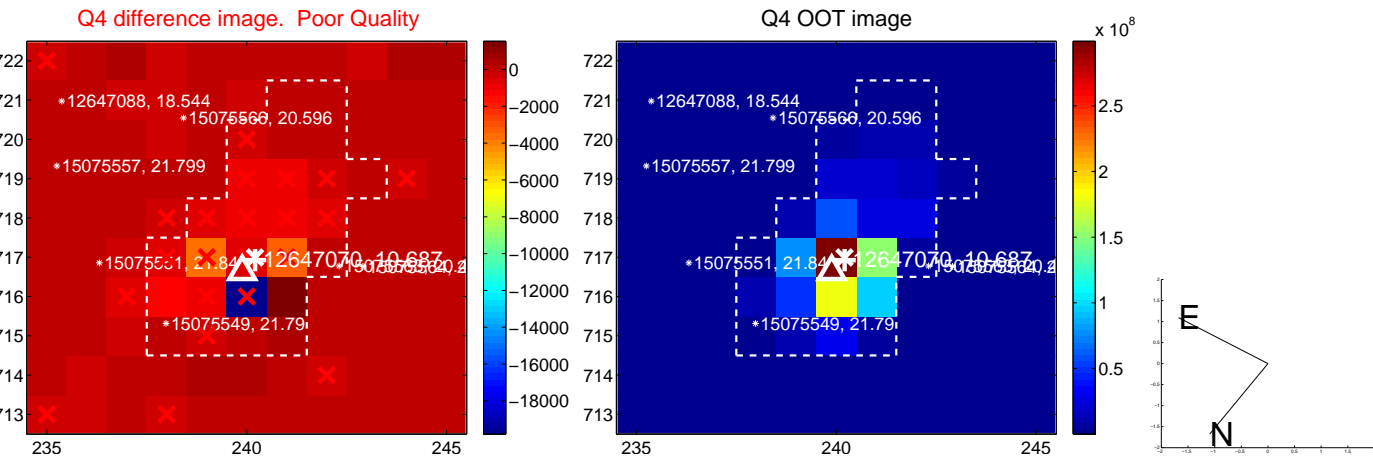
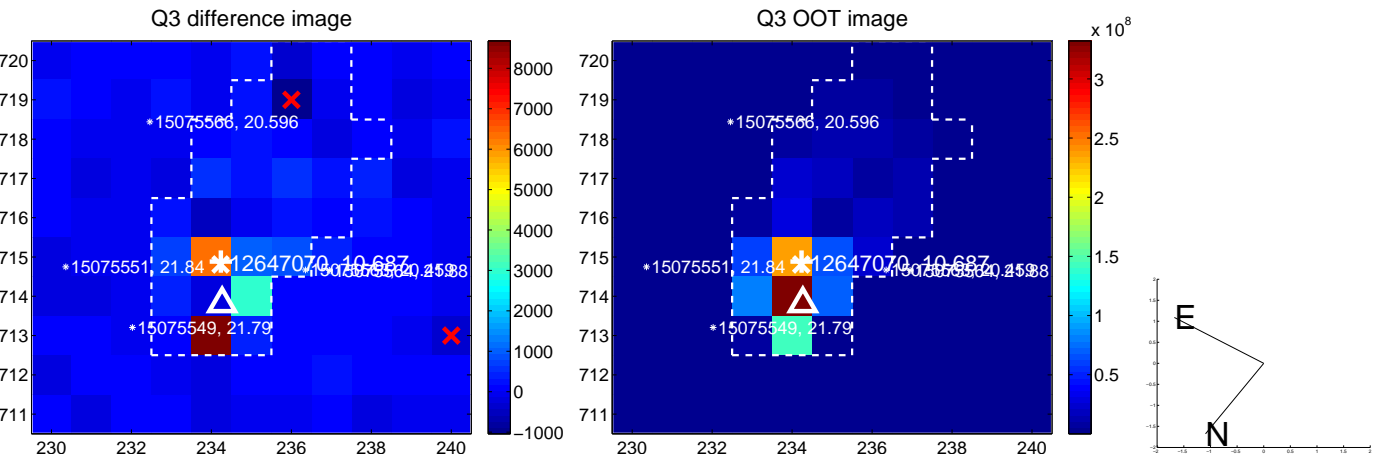
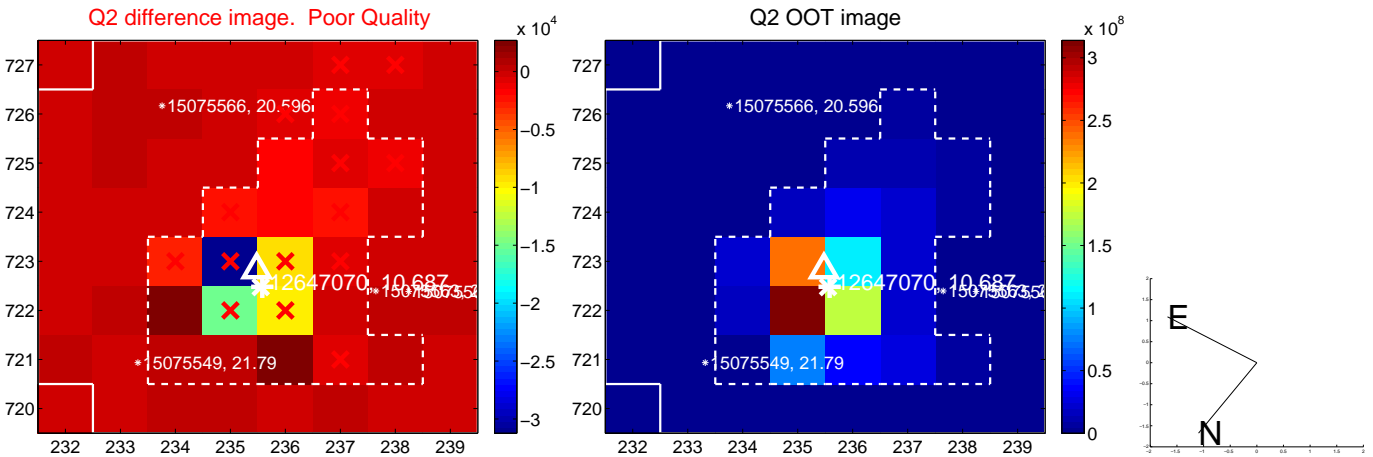
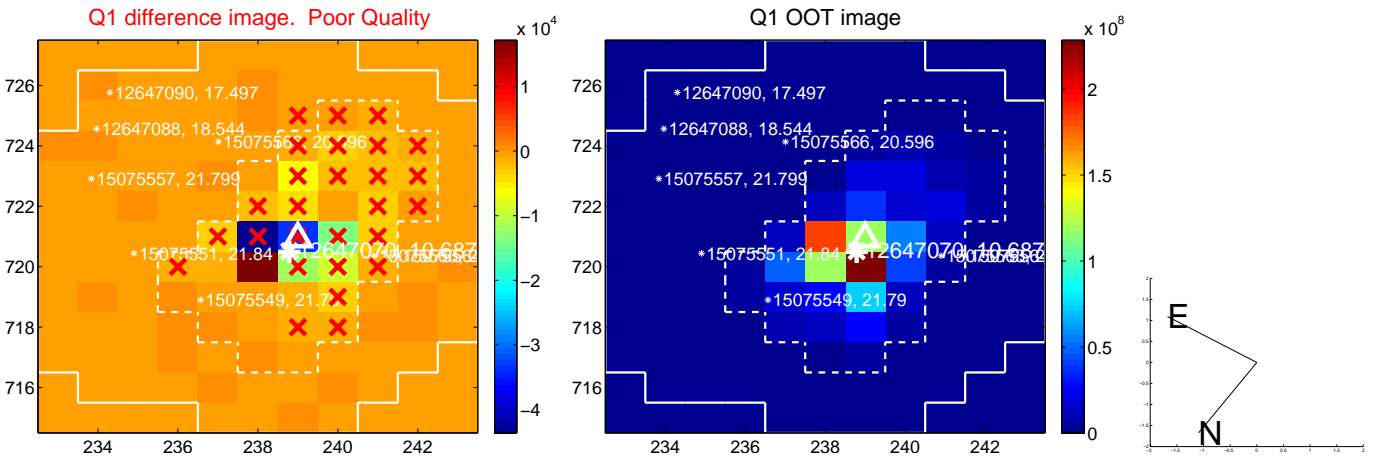
	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.142 \pm 0.239$	0.59	$-0.131 \pm 0.202$	$-0.054 \pm 0.394$
PRF-fit source offset from KIC position	$0.350 \pm 0.478$	0.73	$-0.215 \pm 0.278$	$0.277 \pm 0.447$
photometric centroid source offset	$0.69 \pm 0.41$	1.69	$-0.39 \pm 0.27$	$-0.57 \pm 0.46$



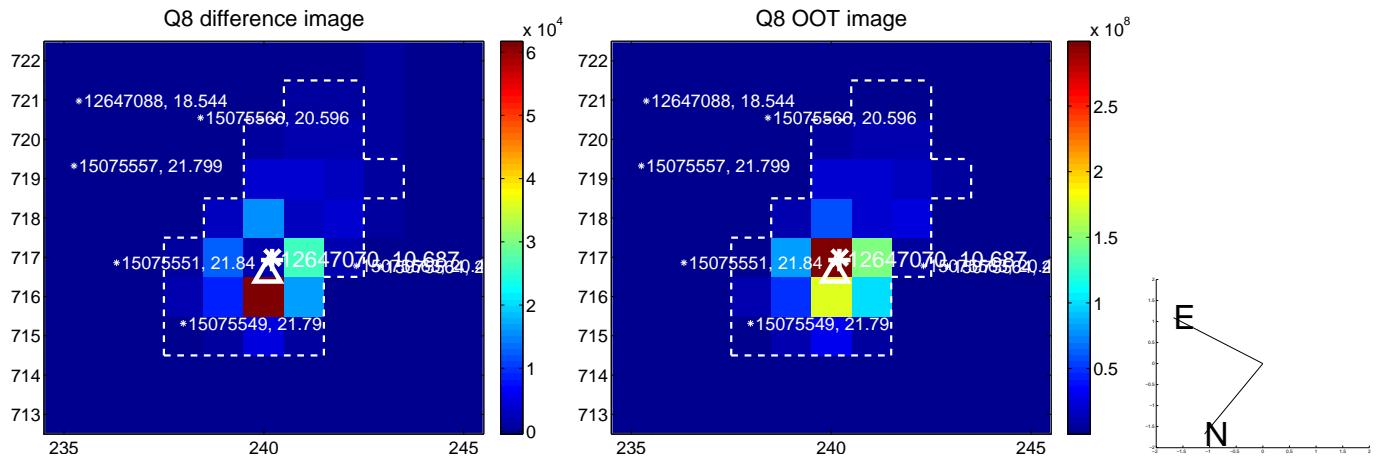
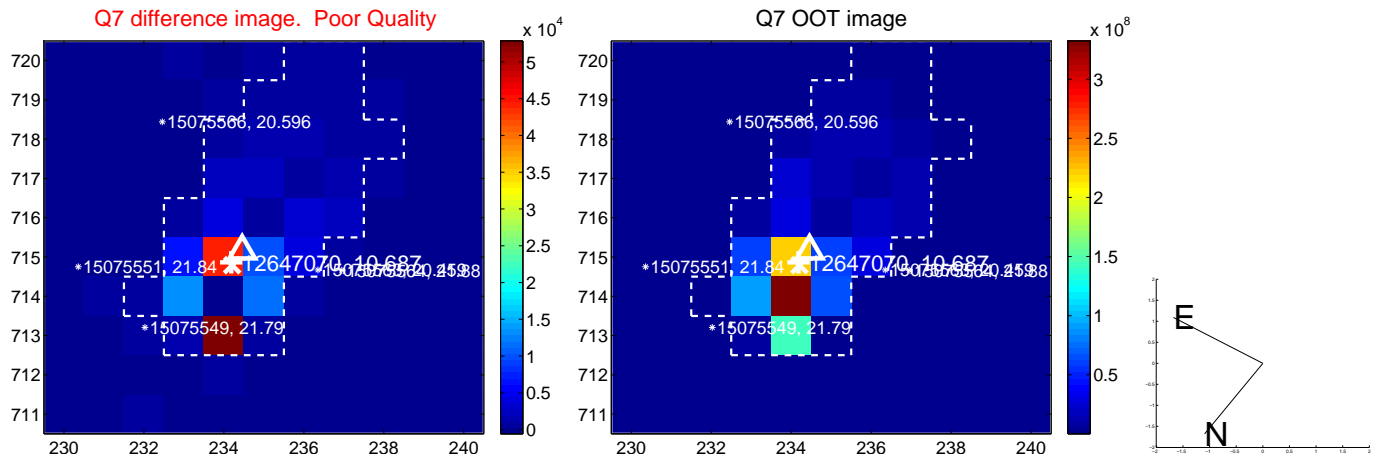
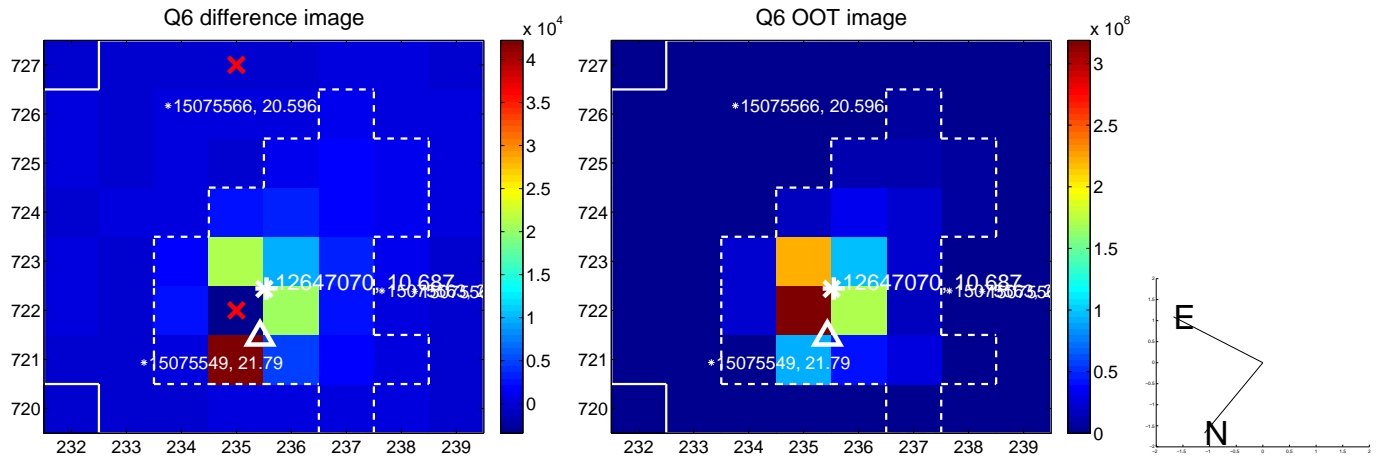
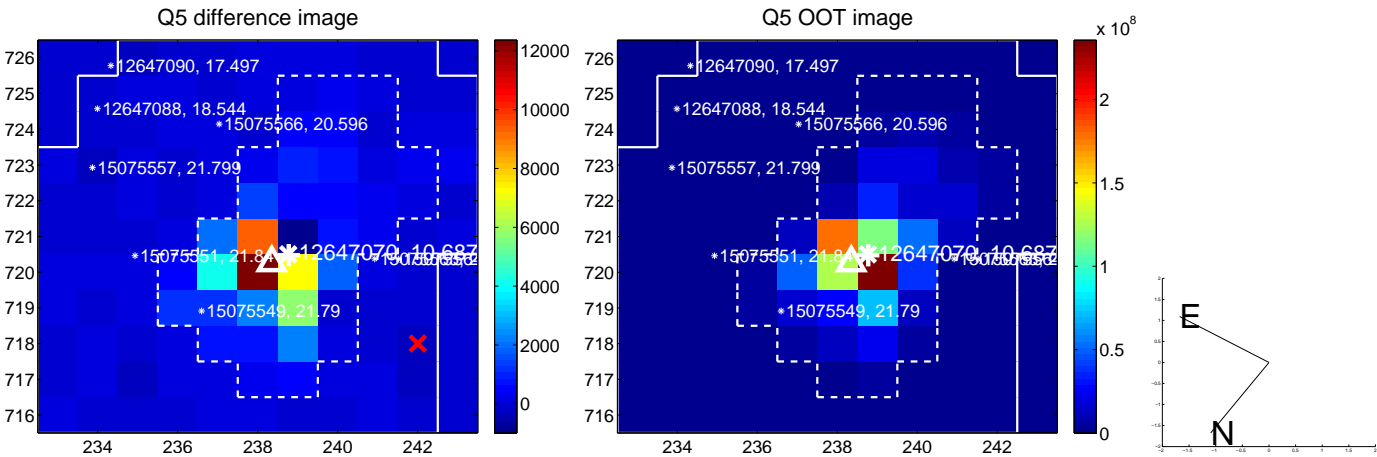
Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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



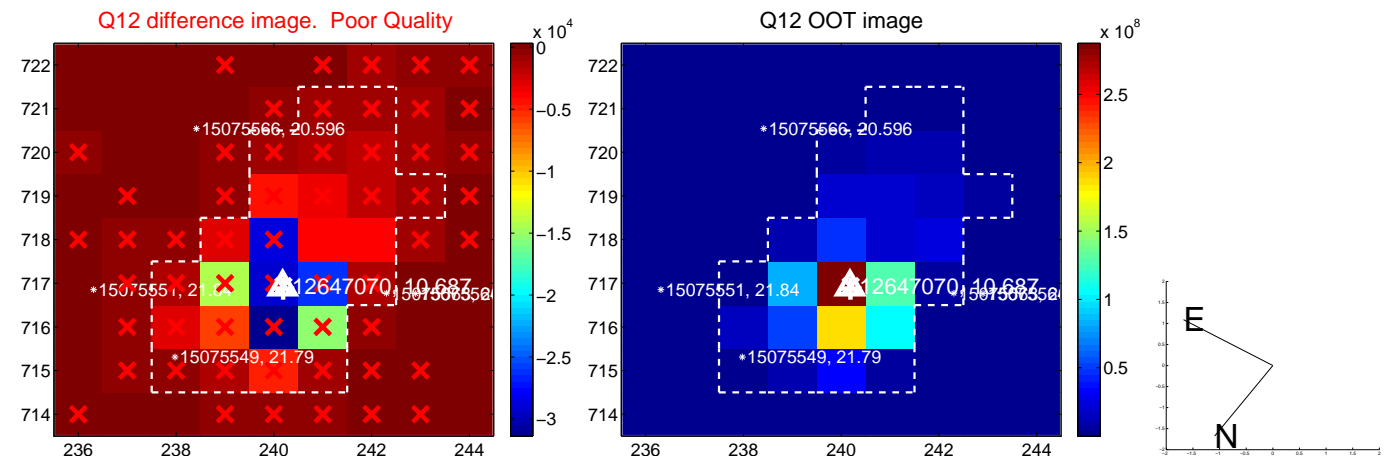
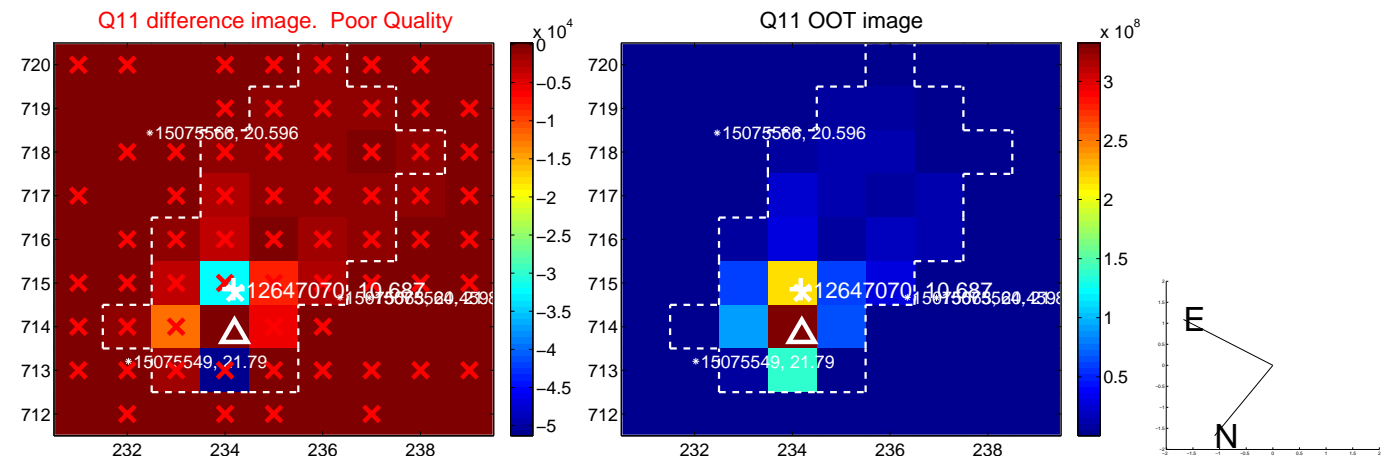
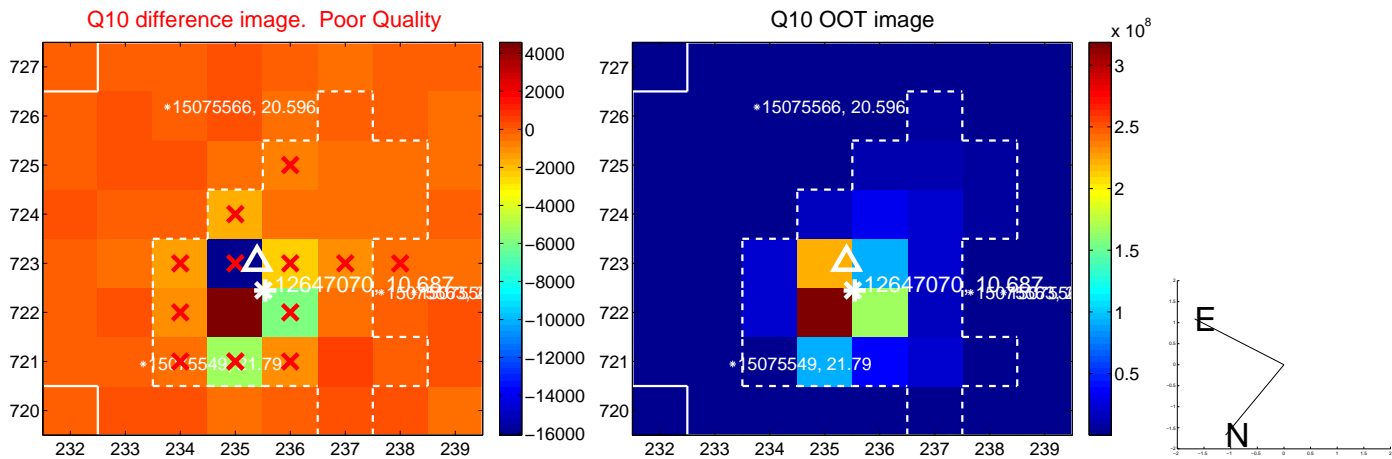
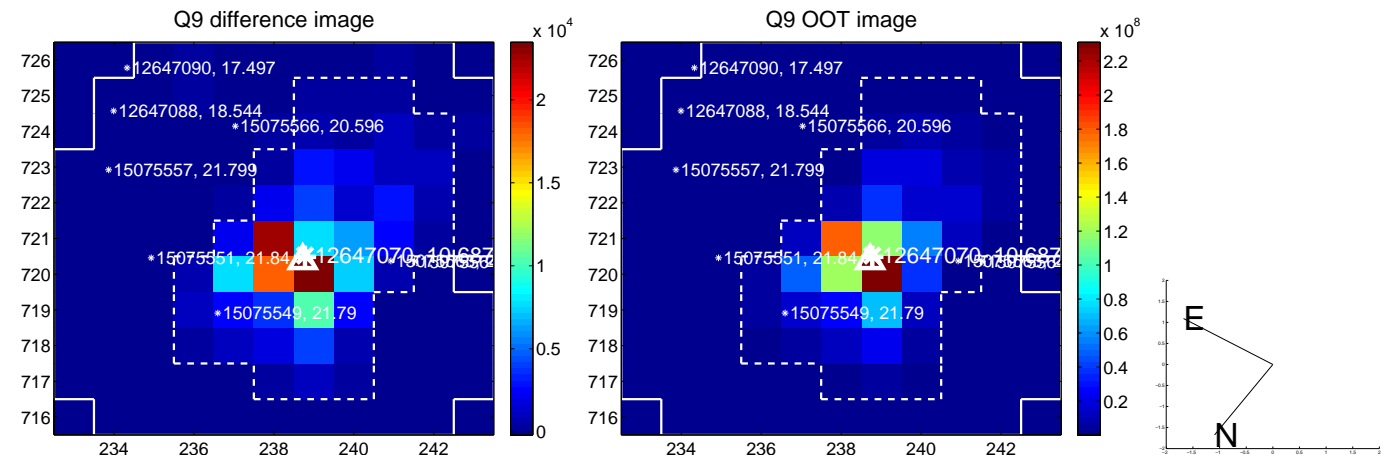
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



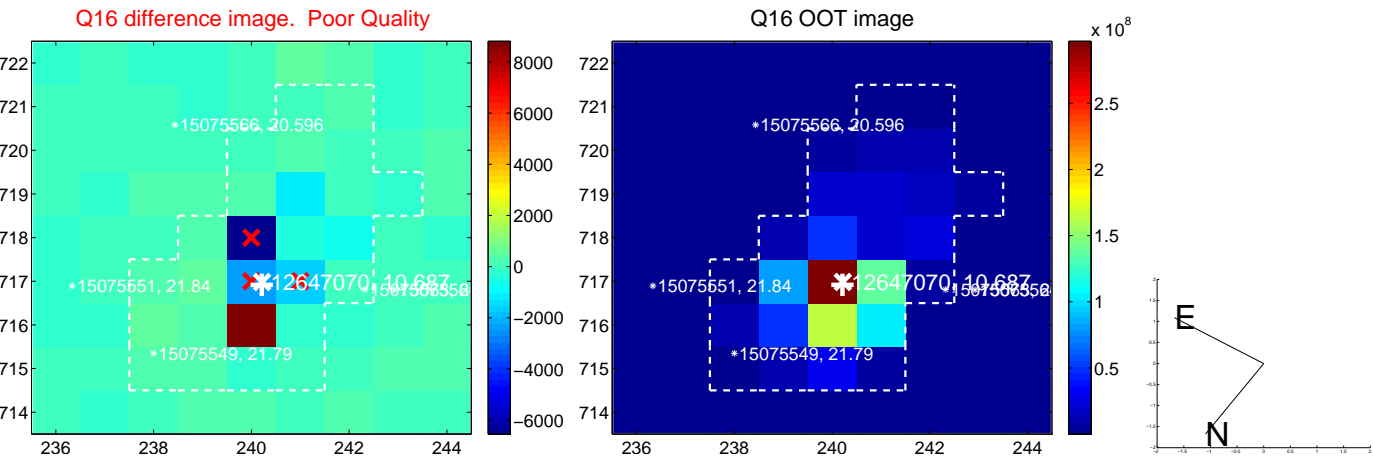
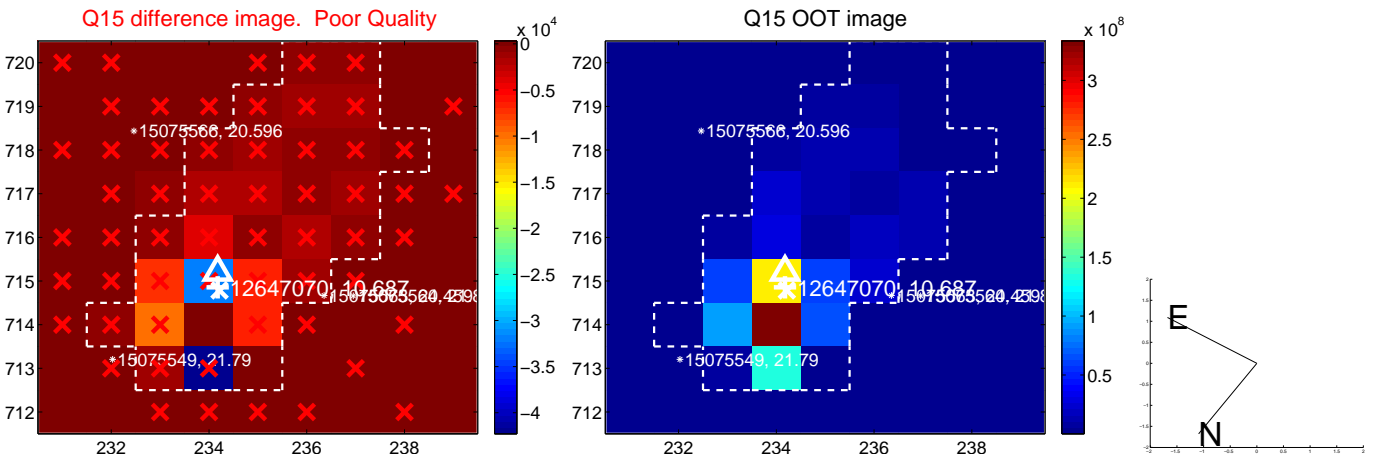
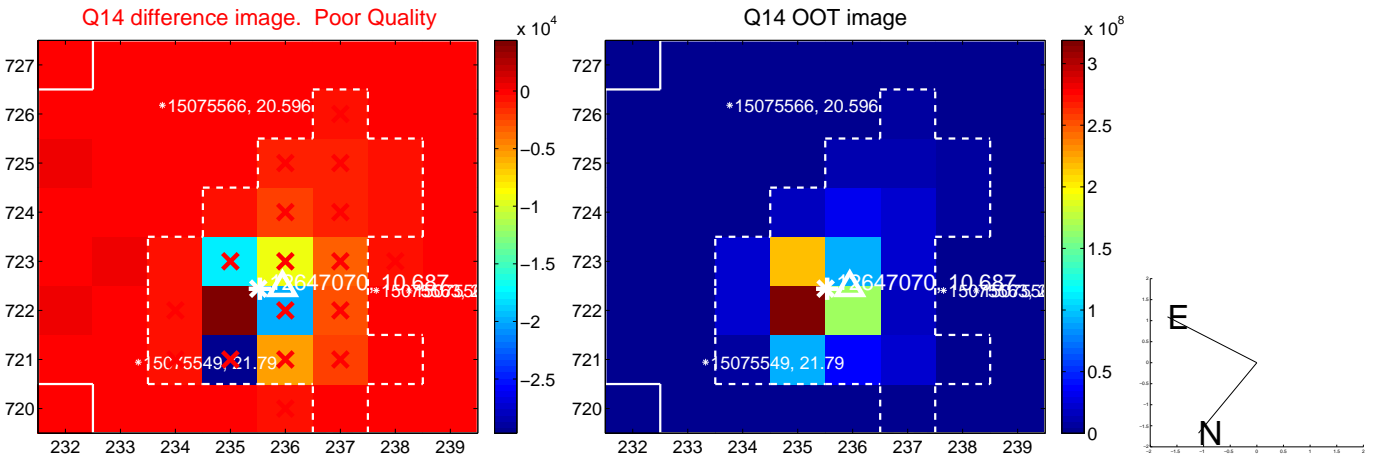
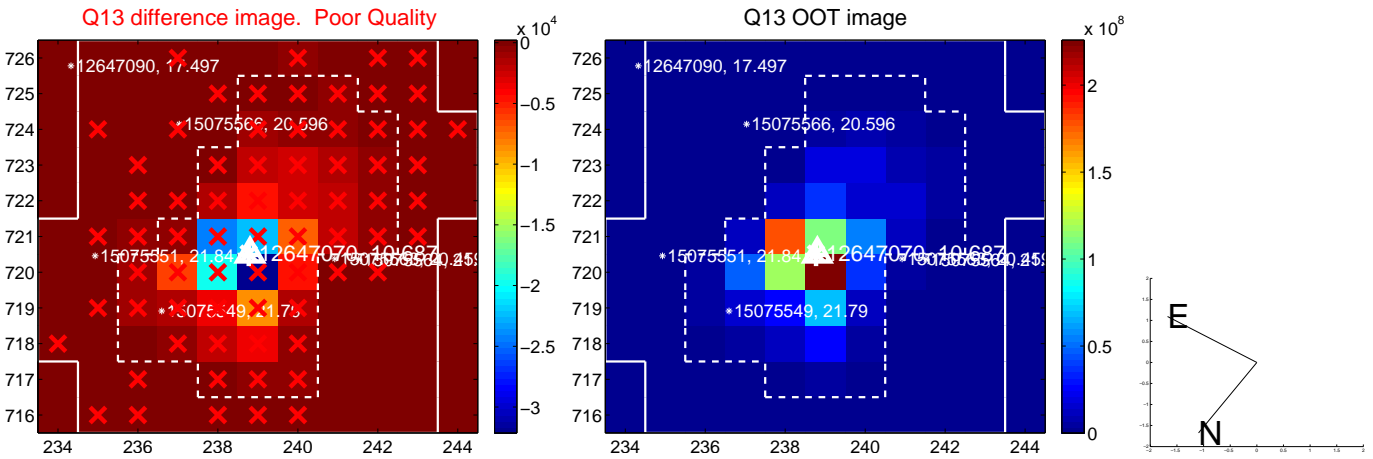
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



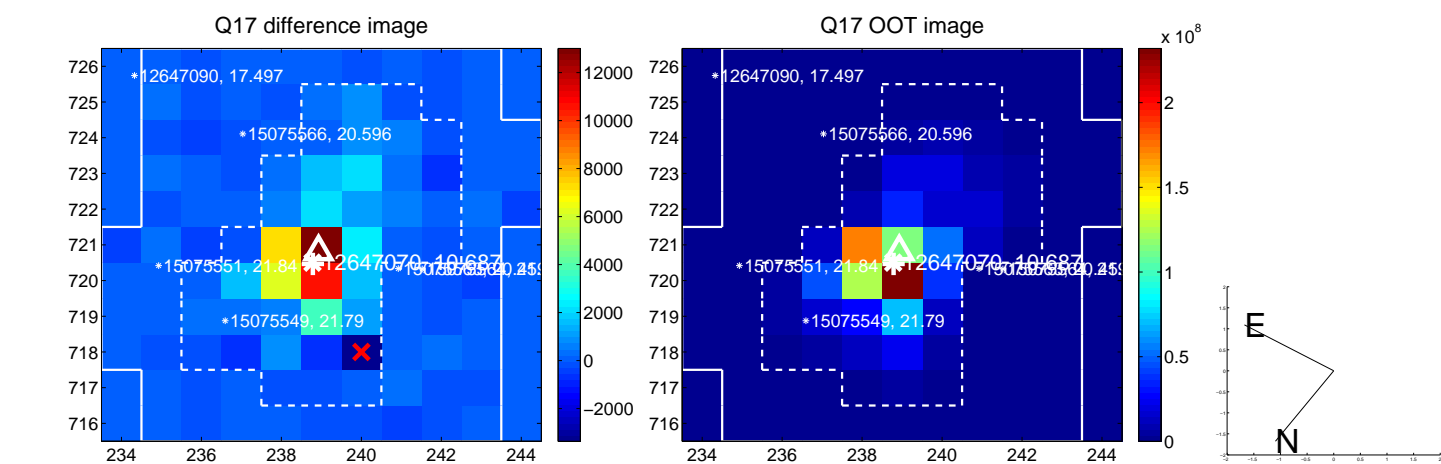
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



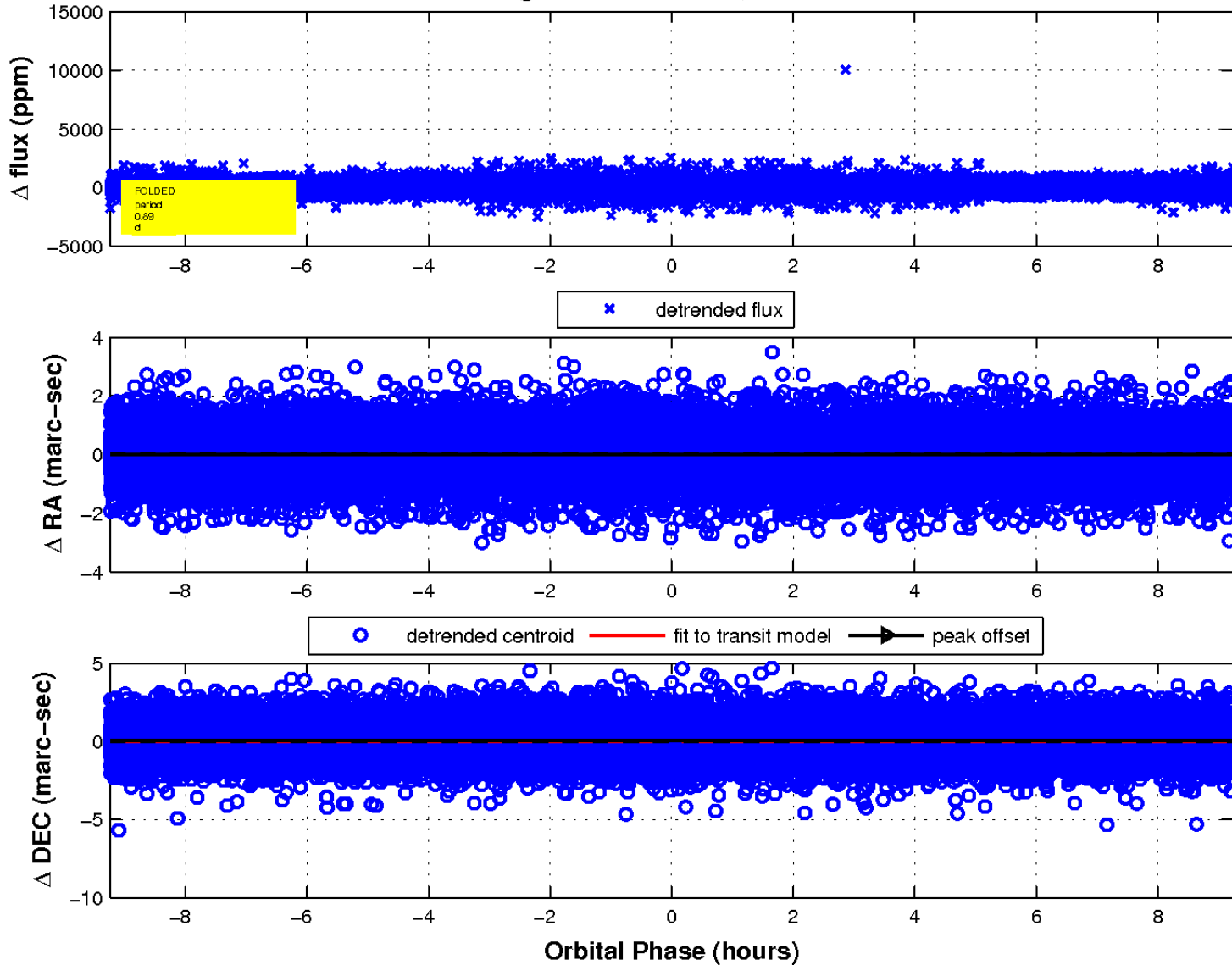
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

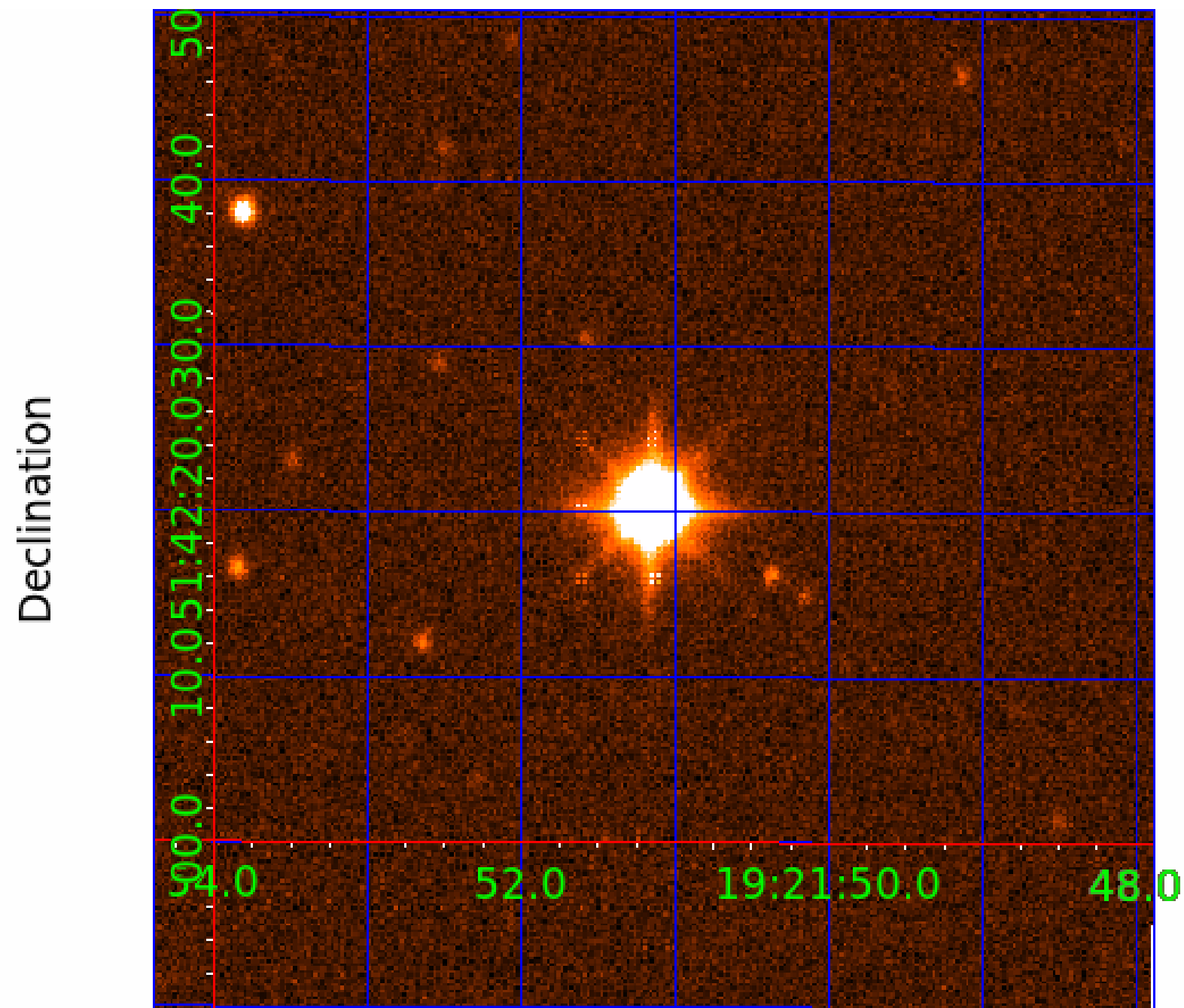


fluxWeightedCentroids, Planet 2 of 4





UKIRT Image



# KIC 012647070

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
012647070-01	OBS	No	0.885347	132.381896	0.0	1.605	11.1	0.0	2.56	7490	0.01	38899.97
012647070-02	OBS	No	0.885597	131.546355	33.6	3.081	12.4	13.5	2.56	7490	1.74	38885.31
012647070-03	OBS	No	0.885029	132.031963	29.9	2.886	8.3	8.2	2.56	7490	1.45	38918.58
012647070-04	OBS	No	0.884838	131.600777	50.5	3.000	8.6	-1.0	2.56	7490	1.83	38929.80

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
012647070-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE_ZUMA_TRACKER—LPP_DV—LPP_ALT—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
012647070-02	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_ALT—MOD_POS_ALT—SAME_NTL_PERIOD—CENT_SATURATED
012647070-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE_ZUMA_TRACKER—LPP_DV—LPP_ALT—SAME_NTL_PERIOD—CENT_SATURATED
012647070-04	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_DV—LPP_ALT—SAME_NTL_PERIOD—CENT_SATURATED

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

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

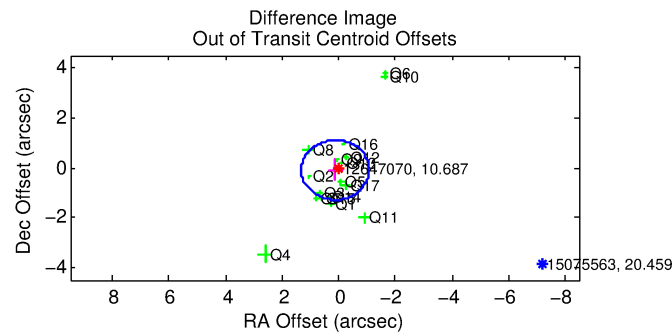
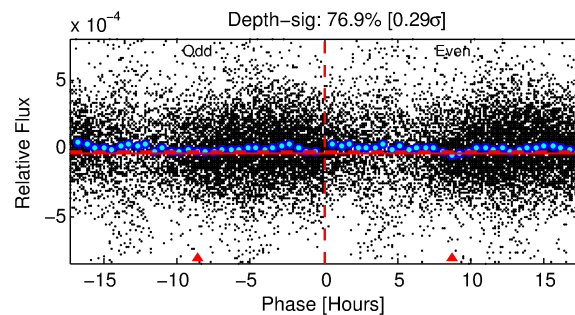
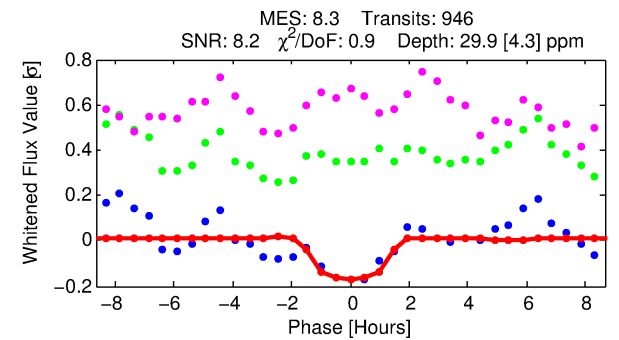
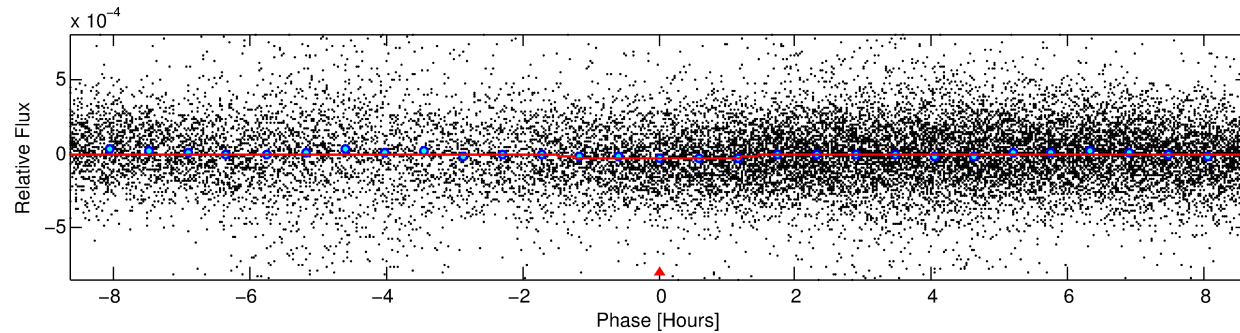
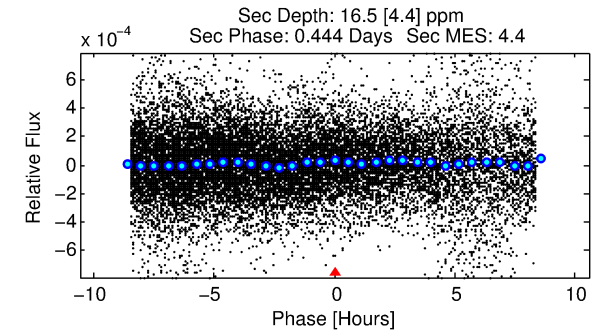
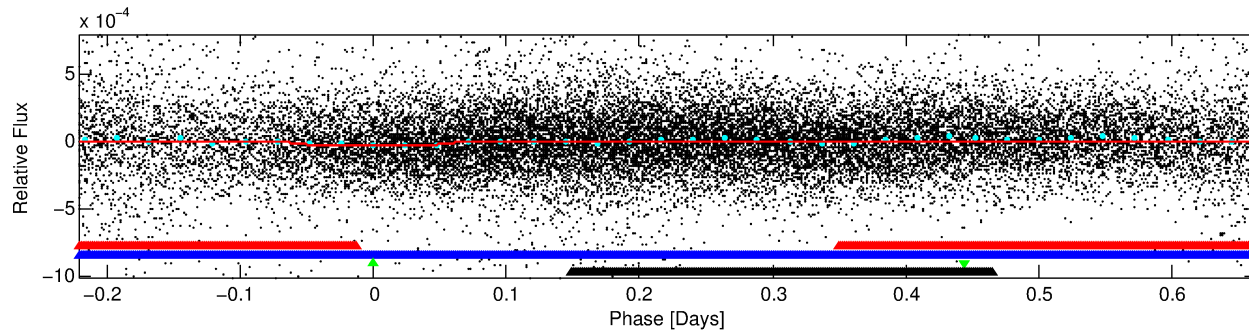
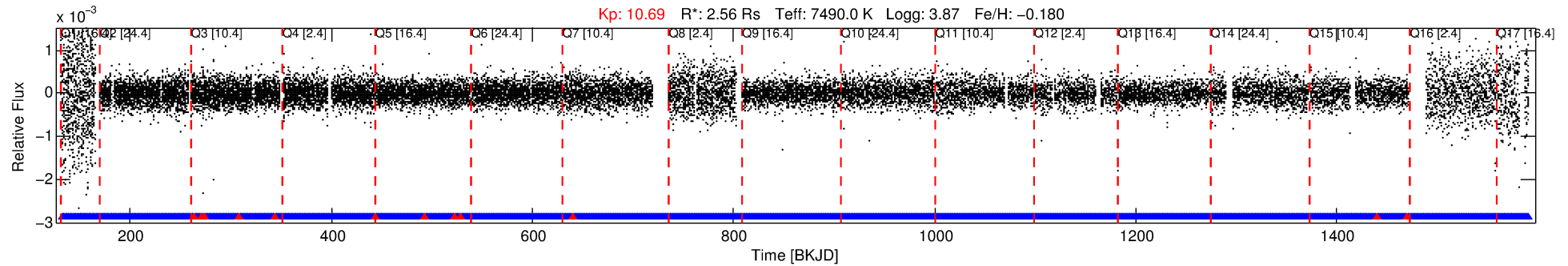
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 012647070-03

No Significant Match Found

# DV One-Page Summary

KIC: 12647070 Candidate: 3 of 4 Period: 0.885 d



## DV Fit Results:

Period = 0.88503 [0.00002] d  
Epoch = 132.0320 [0.0053] BKJD  
 $R_p/R^*$  = 0.0052 [0.0030]  
 $a/R^*$  = 2.17 [5.16]  
 $b$  = 0.50 [4.59]  
 $\text{Seff}$  = 38918.58 [23364.47]  
 $T_{\text{eq}}$  = 3582 [538] K  
 $R_p$  = 1.45 [1.00]  $R_e$   
 $a$  = 0.0218 [0.0079] AU  
 $A_g$  = 2.07 [2.75] [0.39σ]  
 $T_{\text{eff}}$  = 6642 [2006] K [1.47σ]

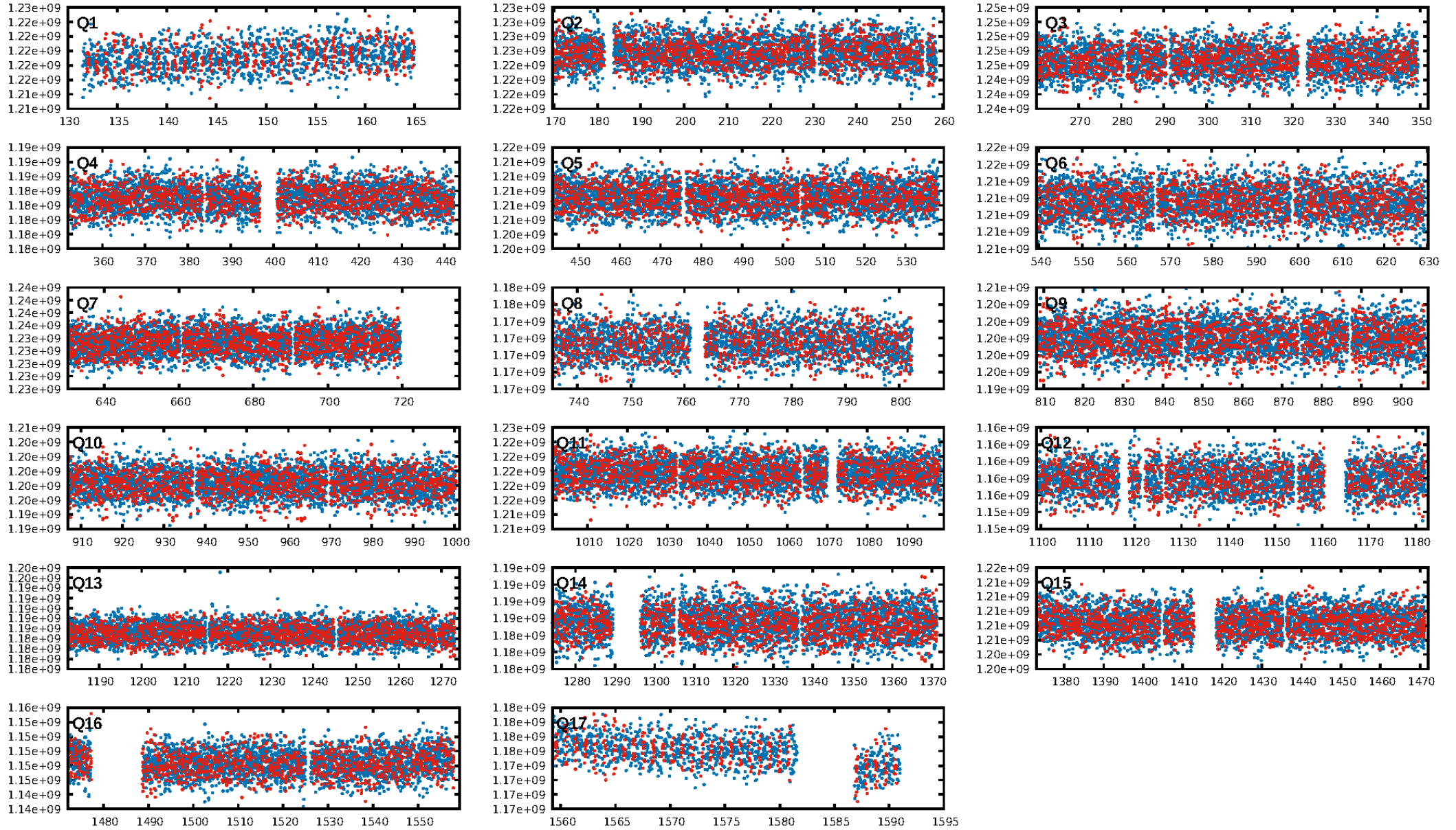
## DV Diagnostic Results:

ShortPeriod-sig: 0.1% [0.00σ]  
LongPeriod-sig: 0.2% [0.00σ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: N/A  
RollingBand-fgt: 0.99 [895/908]  
GhostDiagnostic-chr: N/A  
Centroid-sig: 0.4%  
Centroid-so: 0.741 arcsec [1.80σ]  
OotOffset-rm: 0.162 arcsec [0.40σ]  
KicOffset-rm: 0.098 arcsec [0.30σ]  
OotOffset-st: 4/4/4/5 [17]  
KicOffset-st: 4/4/4/5 [17]  
DiffImageQuality-fgm: 0.41 [7/17]  
DiffImageOverlap-fno: 0.18 [3/17]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 30-Jan-2016 06:20:13 Z

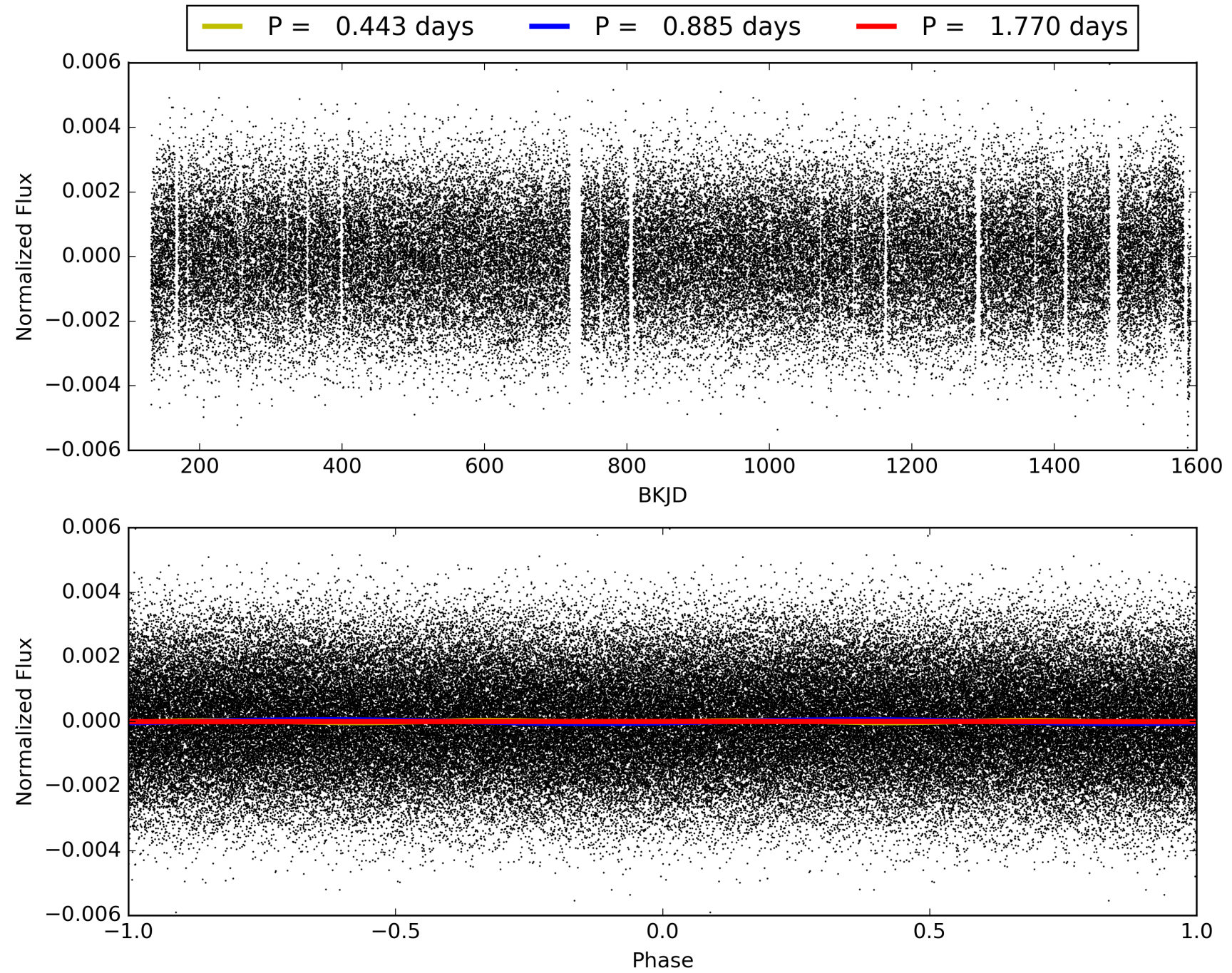
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center

# TCE 012647070-03, PDC Light Curves



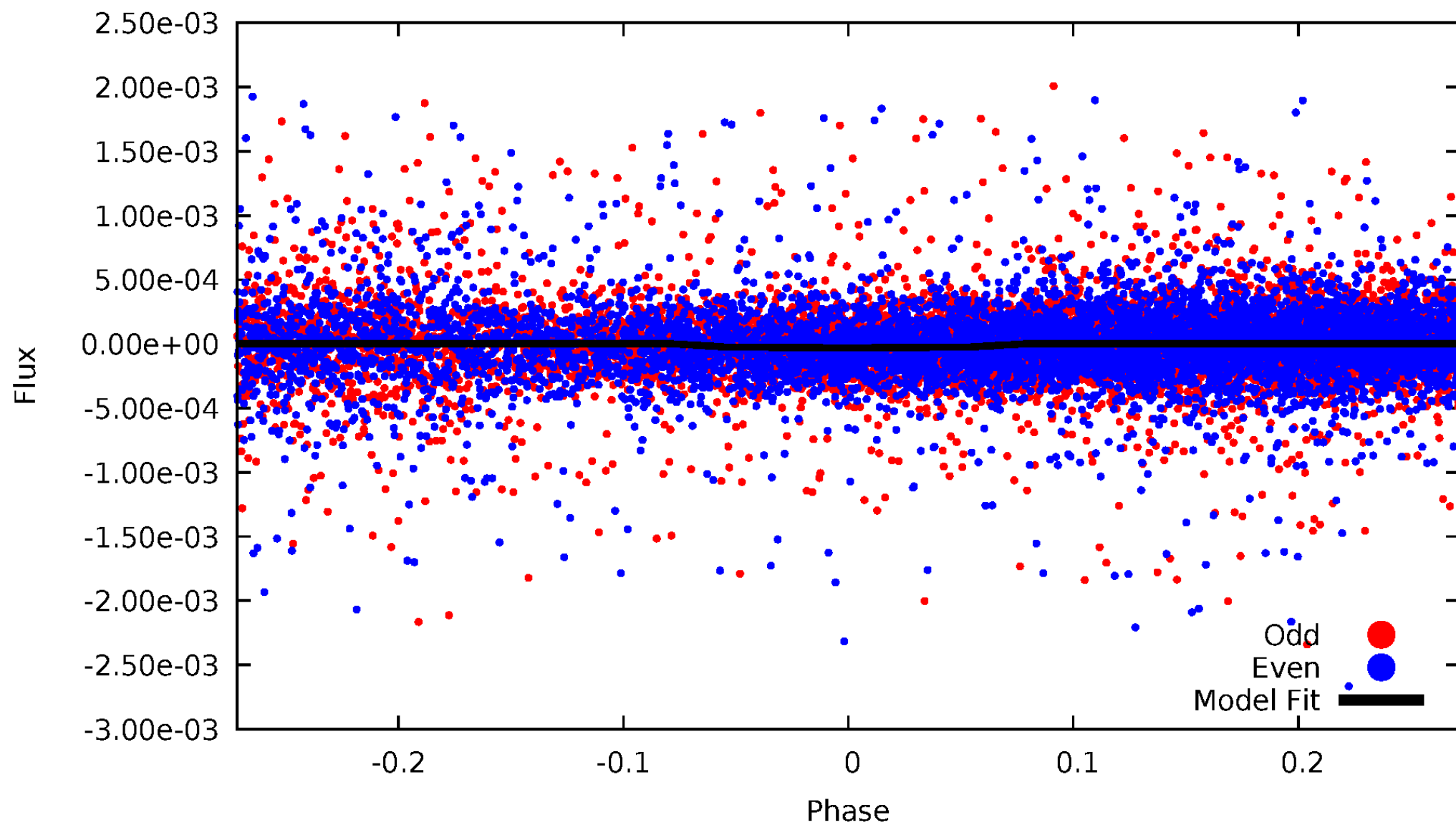


# TCE 012647070-03



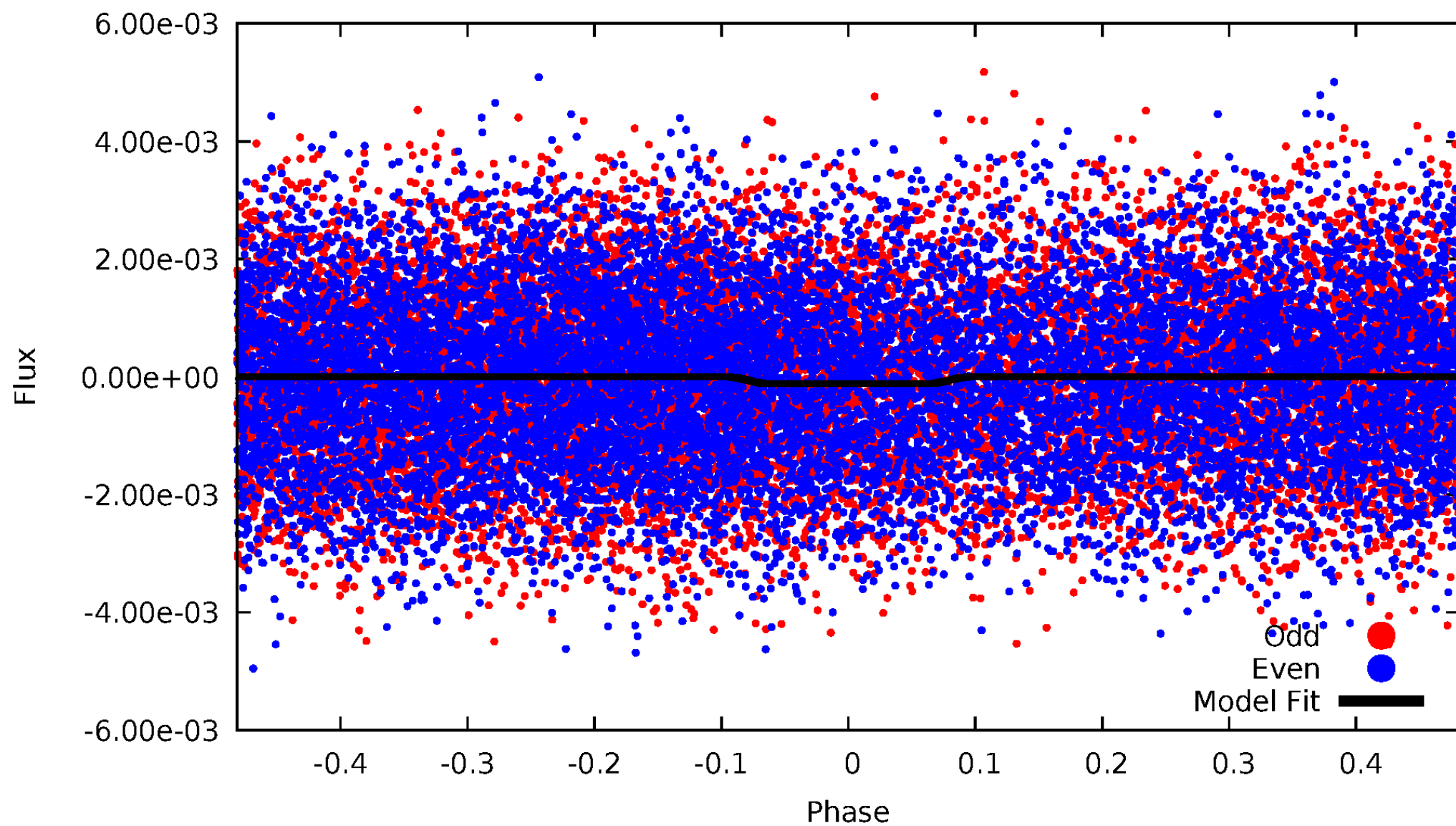
# DV Odd/Even

TCE 012647070-03



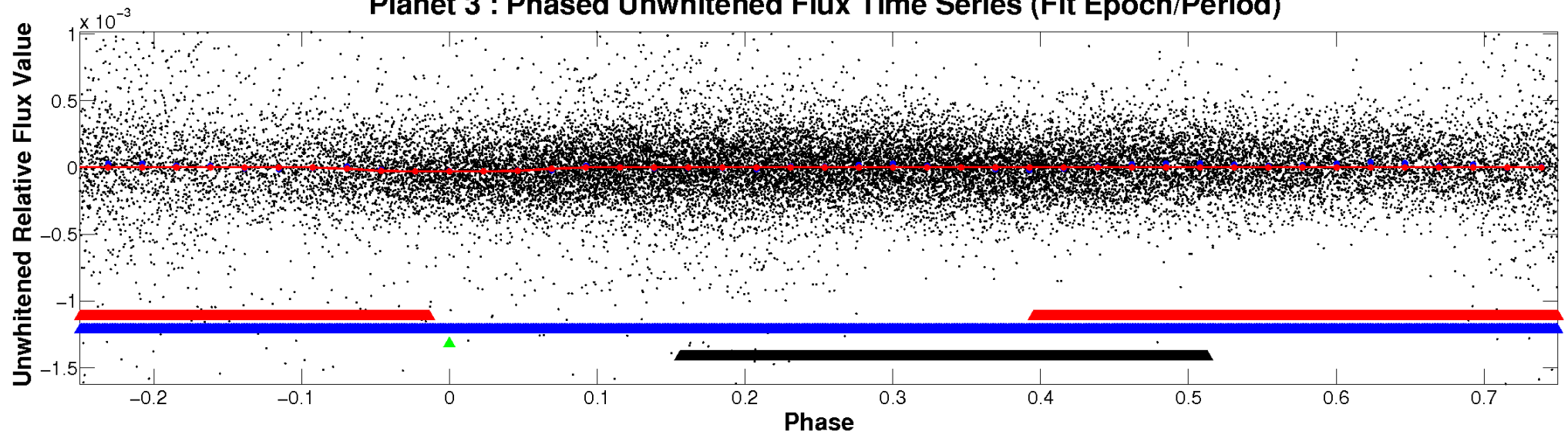
# ALT Odd/Even

TCE 012647070-03

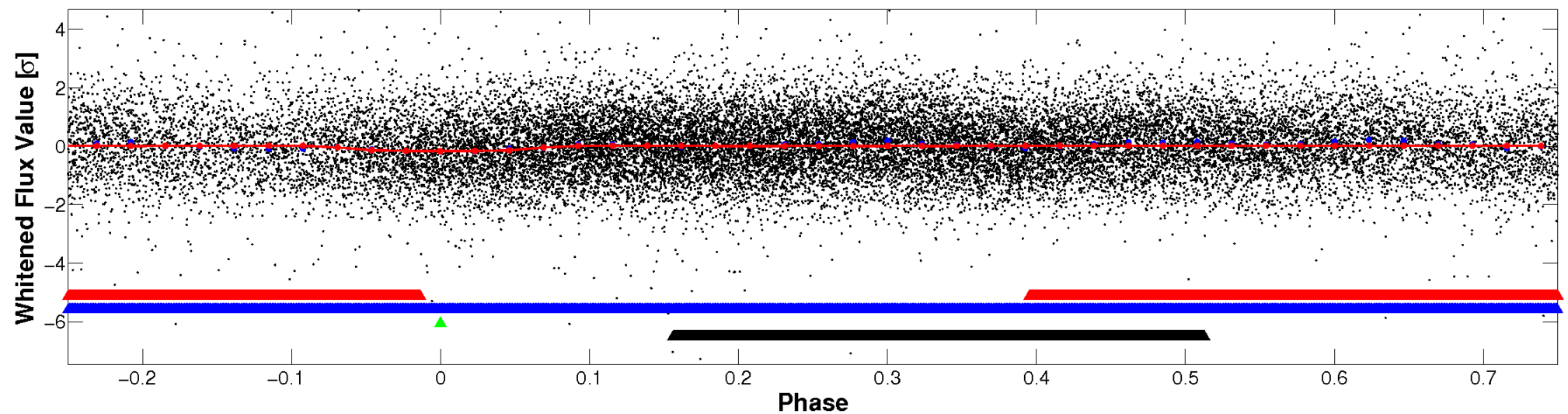


# Non-Whitened Vs. Whitened Light Curve

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



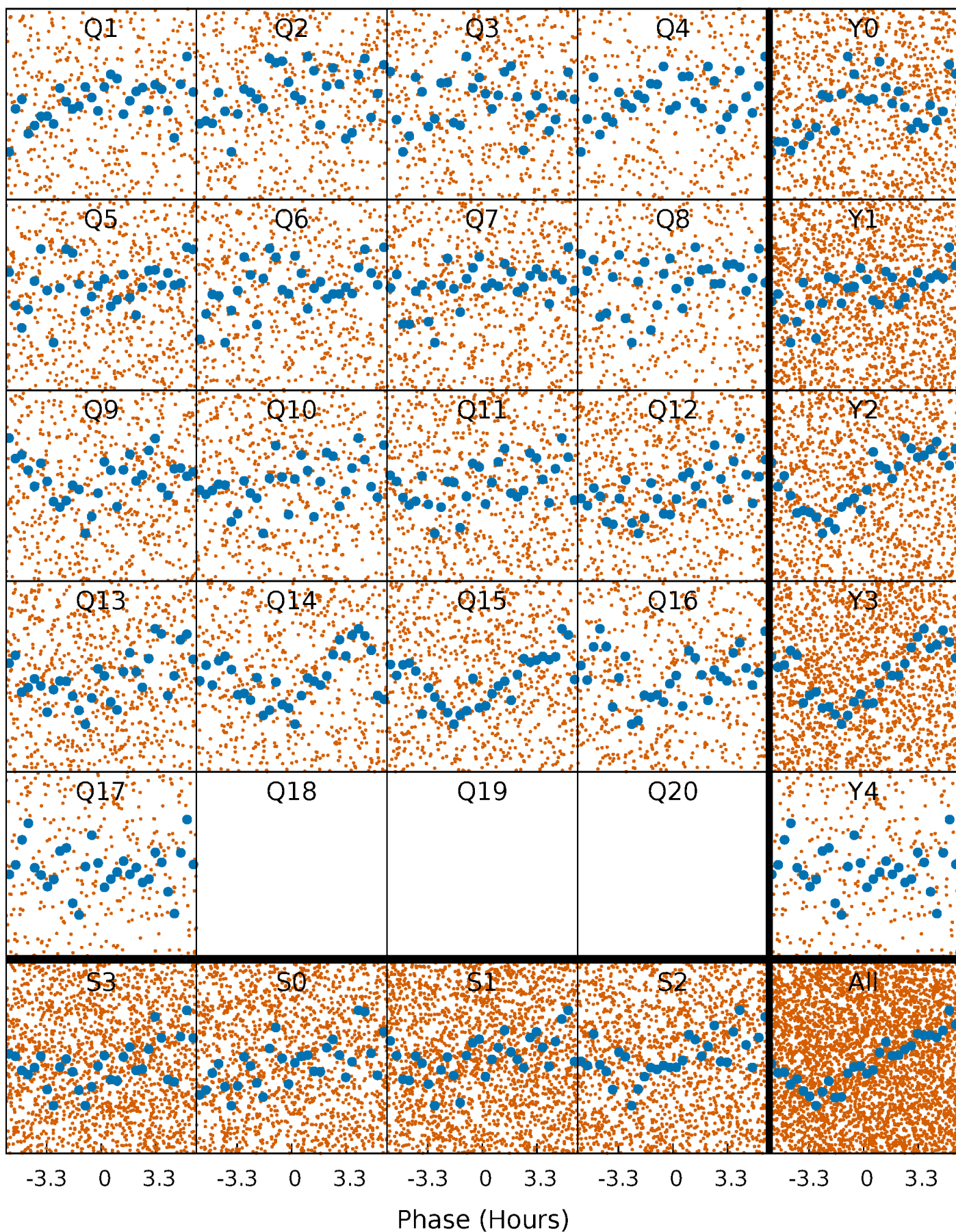
## Planet 3 : Phased Whitened Flux Time Series (Fit Epoch/Period)





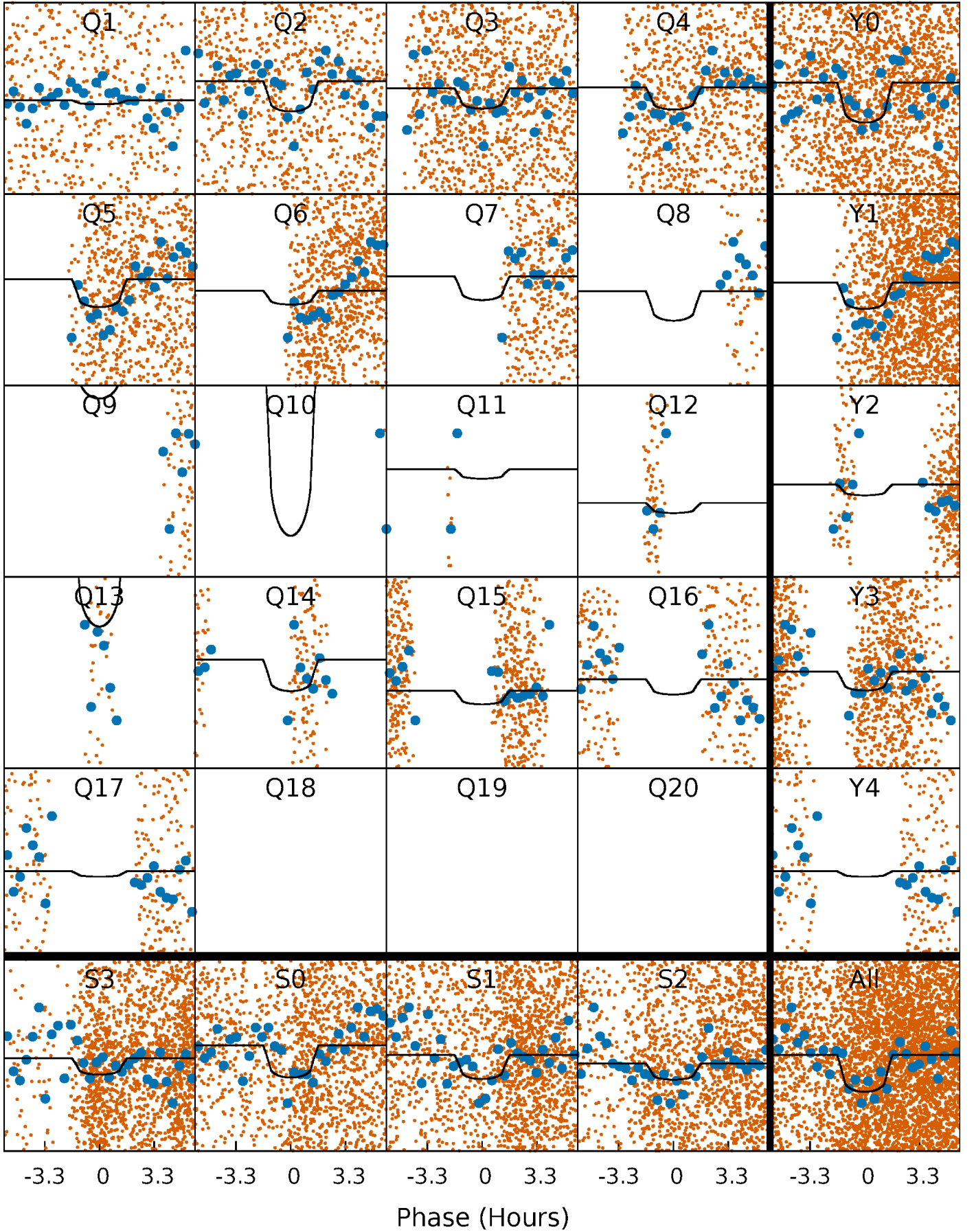
# PDC Quarter-Phased Transit Curves

TCE 012647070-03 P= 0.885029 Days  $T_0=132.031963$  (BKJD)



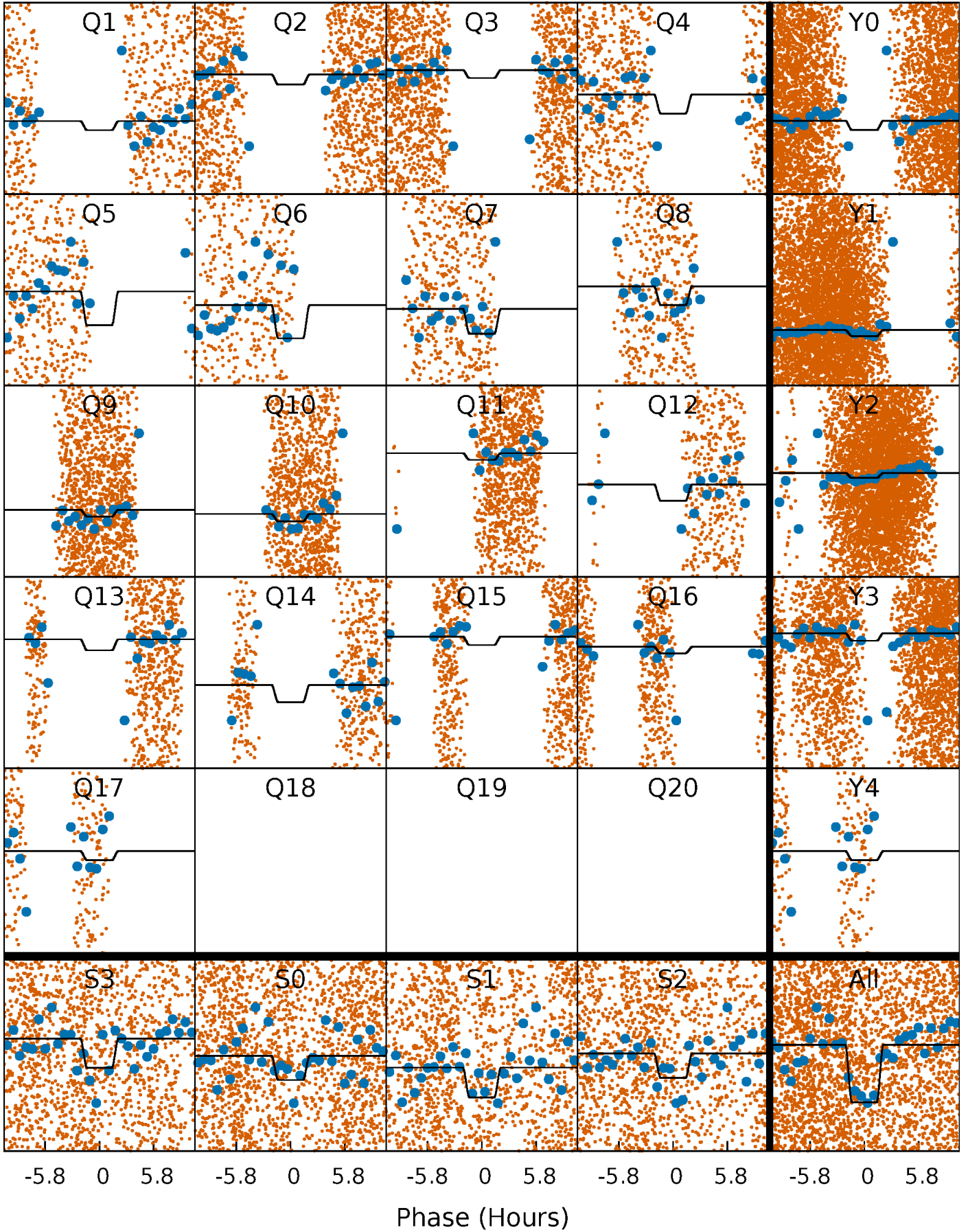
# DV Quarter-Phased Transit Curves

TCE 012647070-03   P= 0.885029 Days    $T_0=132.031963$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

TCE 012647070-03 P= 0.884853 Days  $T_0=131.640837$  (BKJD)

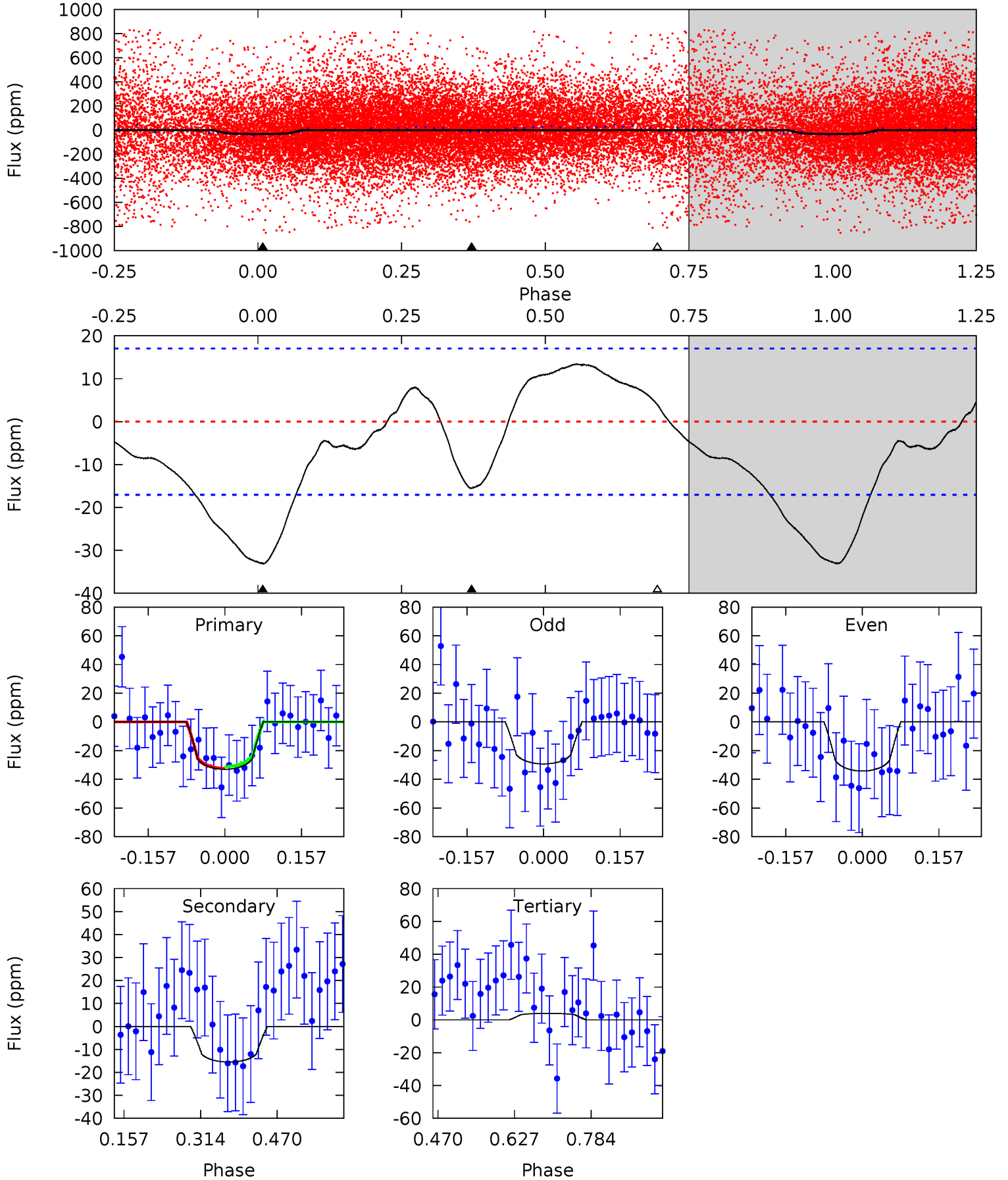




# DV Model-Shift Uniqueness Test

012647070-03, P = 0.885029 Days, E = 131.146934 Days

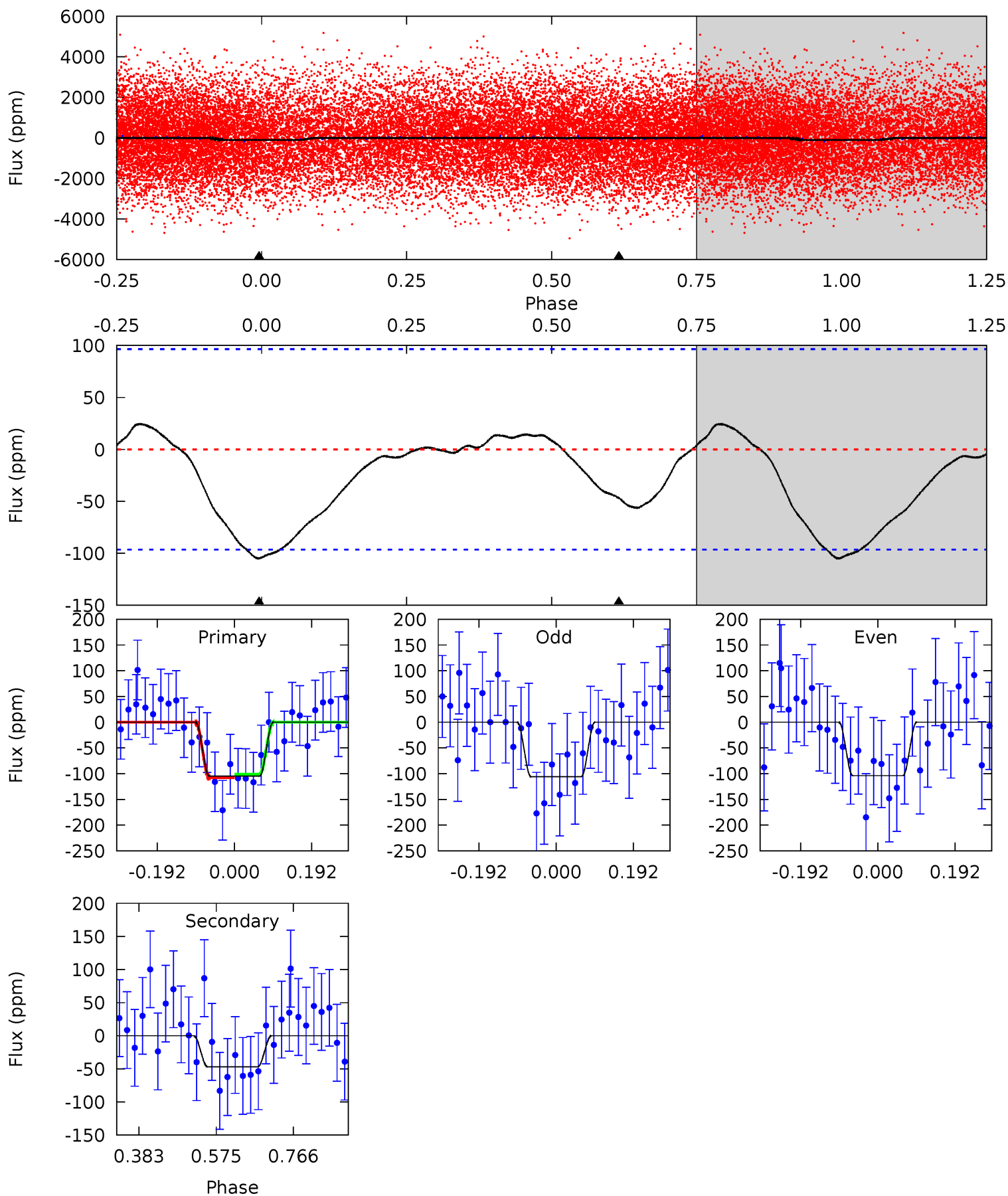
Pri	Sec	Ter	Pos	FA <sub>1</sub>	FA <sub>2</sub>	F <sub>Red</sub>	Pri-Ter	Pri-Pos	Sec-Ter	Sec-Pos	Odd-Evn	DMM	Shape	TAT
8.66	4.06	-1.04	0	4.47	1.42	2.15	9.70	8.66	5.10	4.06	0.66	0.93	0.29	0.16



# Alt Model-Shift Uniqueness Test

012647070-03, P = 0.884853 Days, E = 131.640837 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
4.81	2.15	0	0	4.43	1.31	0.30	4.81	4.81	2.15	2.15	0.05	0.90	0.19	0.15





### Stellar Parameters For KIC 012647070

	$T_{\text{eff}}(K)$	$\log(g)$	[Fe/H]	$R (R_{\odot})$	$M(M_{\odot})$	$p_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$7490^{+235}_{-314}$	$3.868^{+0.338}_{-0.113}$	$-0.180^{+0.250}_{-0.350}$	$2.564^{+0.446}_{-0.966}$	$1.770^{+0.173}_{-0.404}$	$0.148^{+0.359}_{-0.049}$
	+3%/-4%	+9%/-3%	+139%/-194%	+17%/-38%	+10%/-23%	+242%/-33%
Source	KIC0	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 012647070-03 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{max} (K)$	$T_{obs} (K)$	$A_{obs}$
DV	$-15 \pm 4$	$1.38^{+0.84}_{-0.74}$	$4907^{+347}_{-465}$	$6010^{+3754}_{-1458}$	$2.095^{+8.314}_{-1.337}$
Alt.	$-47 \pm 22$	$2.78^{+1.04}_{-0.90}$	$4891^{+354}_{-465}$	$5486^{+1476}_{-1226}$	$1.454^{+2.073}_{-0.845}$

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

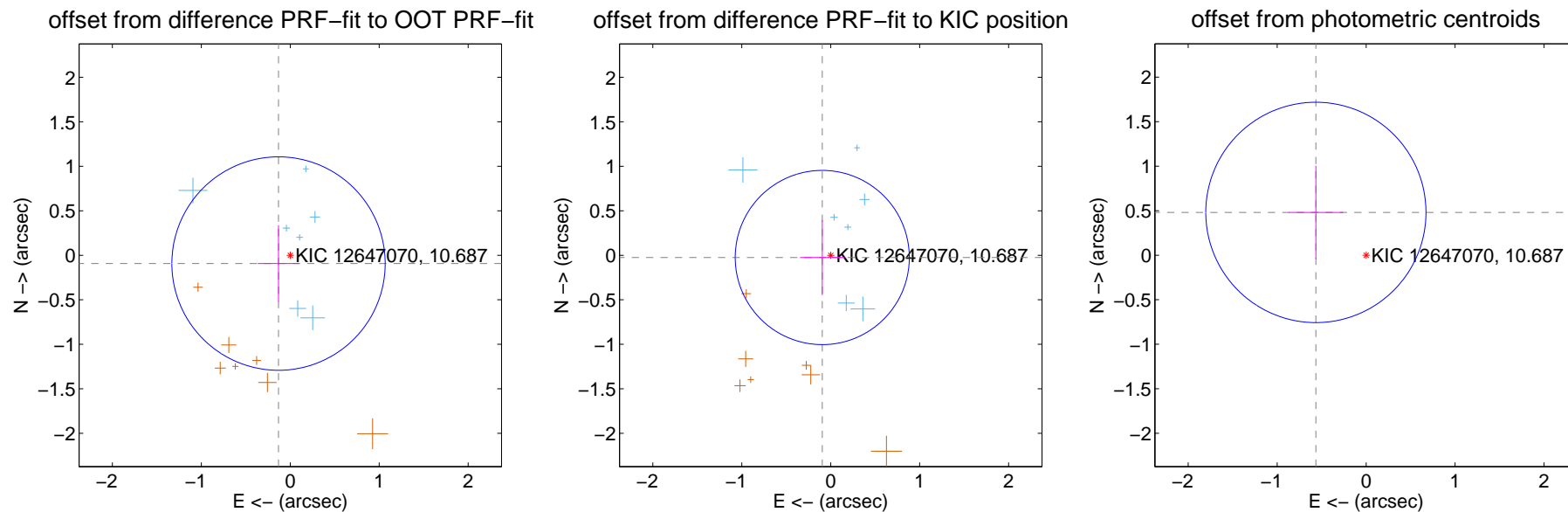
## DV Centroid Data

Supplemental centroid analysis for 012647070-03. **Kepler magnitude: 10.69.** Transit SNR 8.24

There are 7 quarters with good PRF difference image offsets

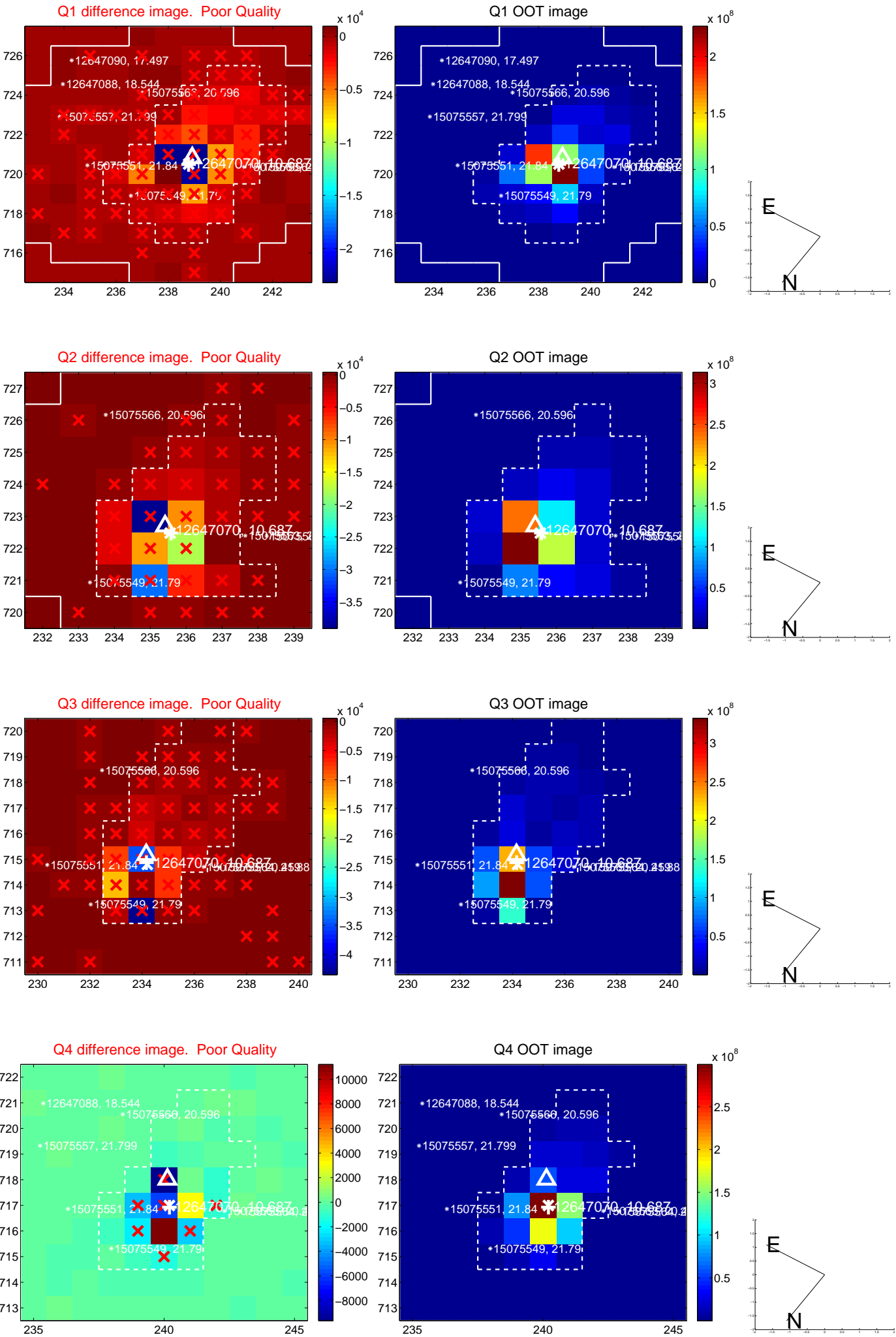
The direct PRF centroid is offset from the target star catalog position by about 0.15 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.162 \pm 0.400$	0.40	$0.132 \pm 0.234$	$-0.093 \pm 0.428$
PRF-fit source offset from KIC position	$0.098 \pm 0.326$	0.30	$0.095 \pm 0.250$	$-0.025 \pm 0.421$
photometric centroid source offset	$0.74 \pm 0.41$	1.80	$0.56 \pm 0.31$	$0.48 \pm 0.52$

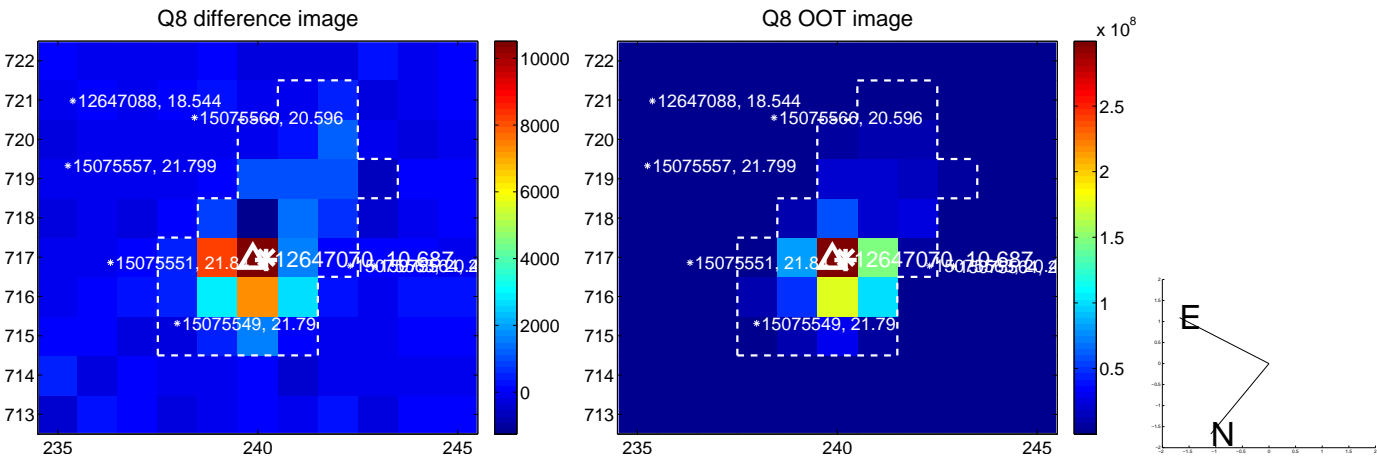
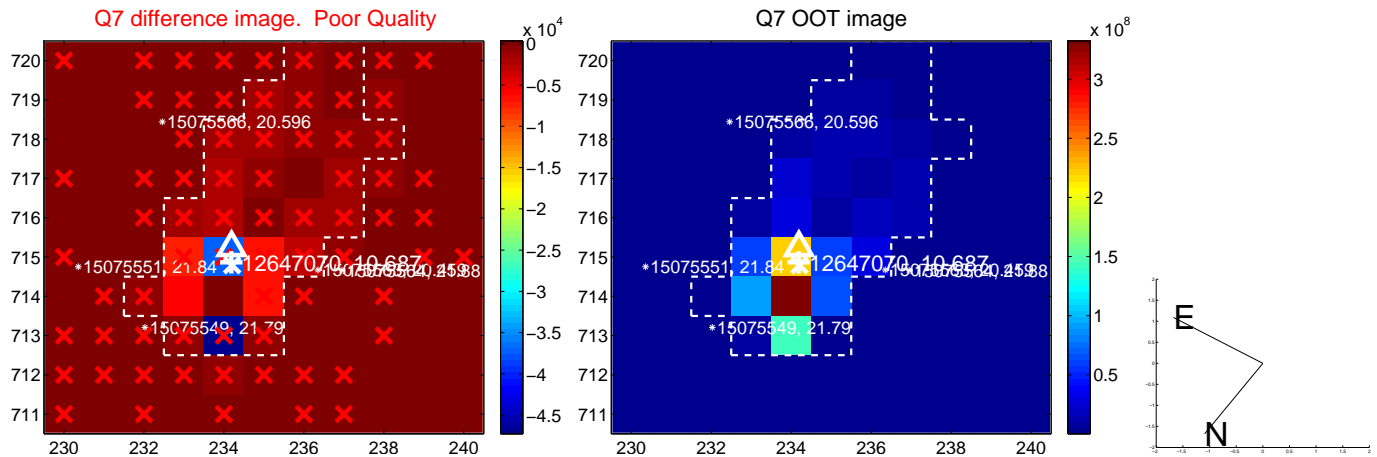
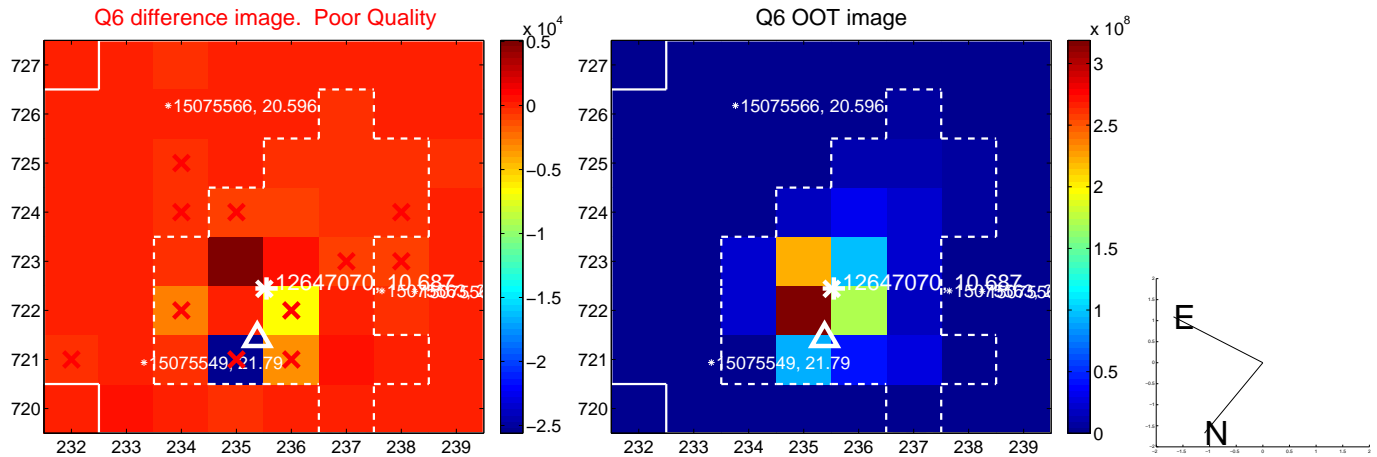
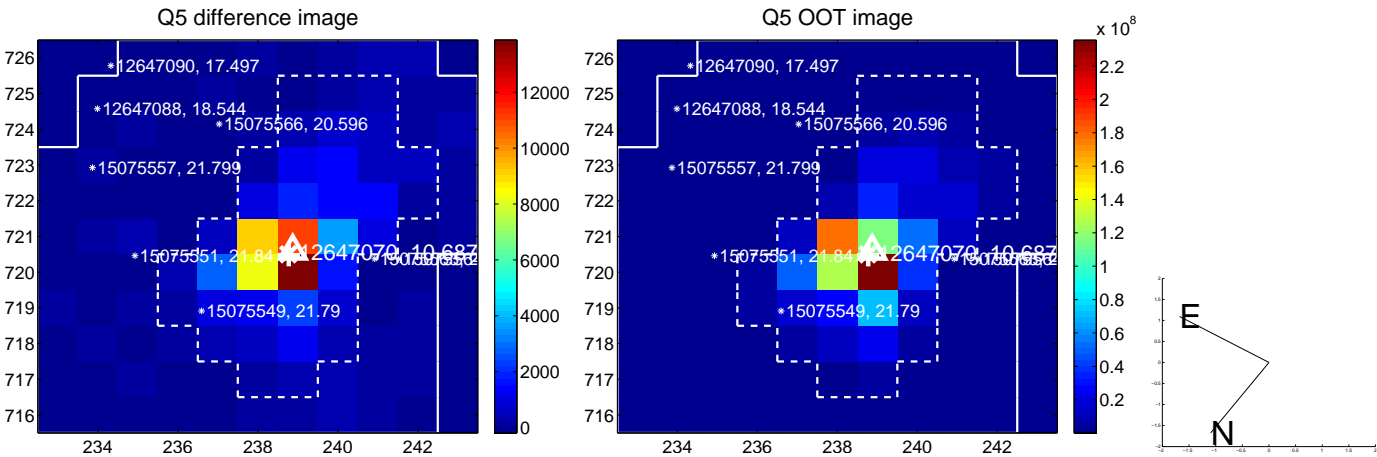


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

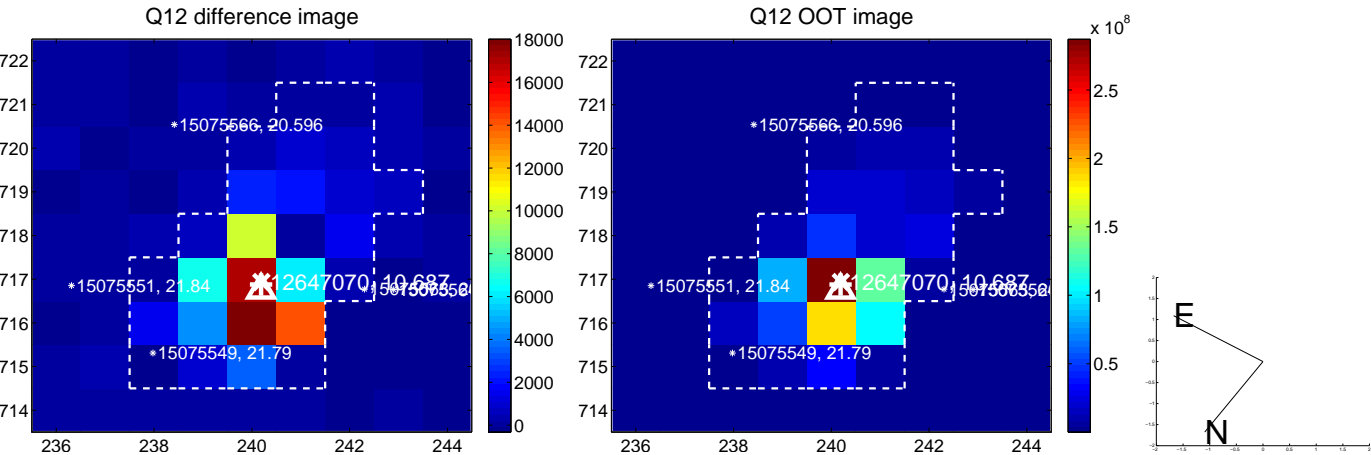
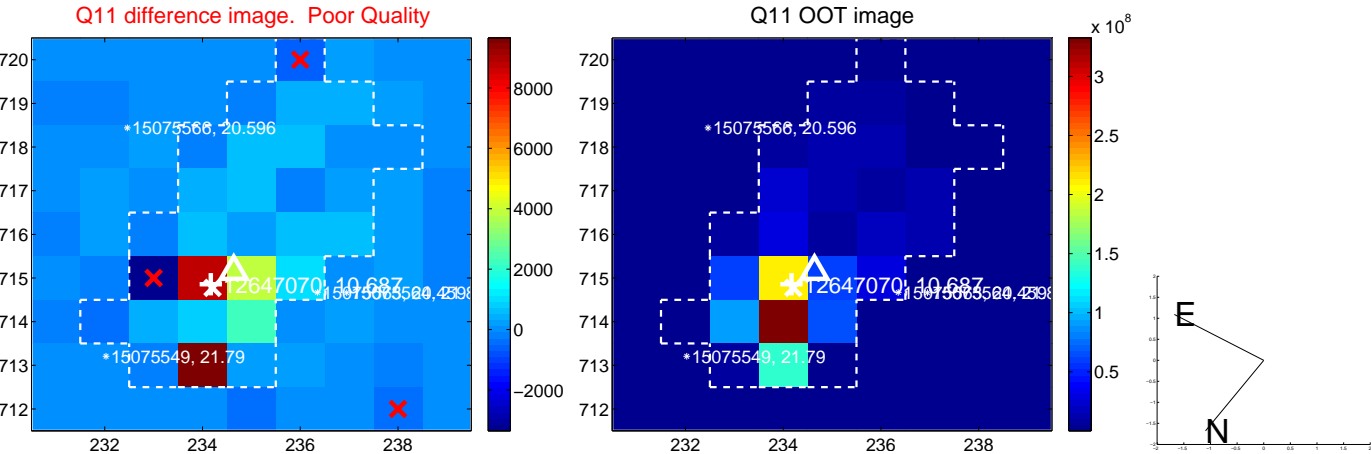
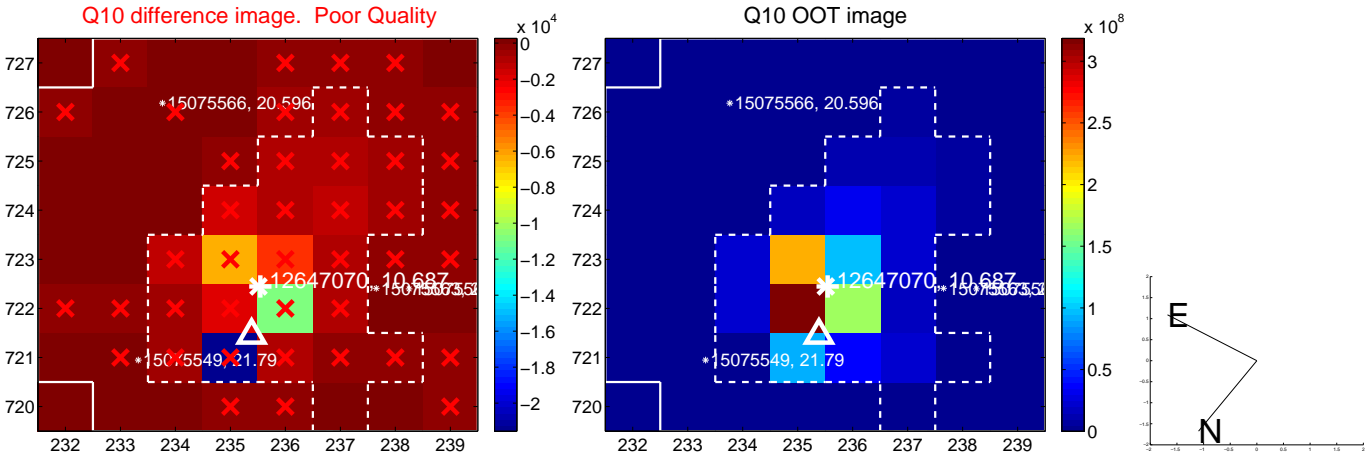
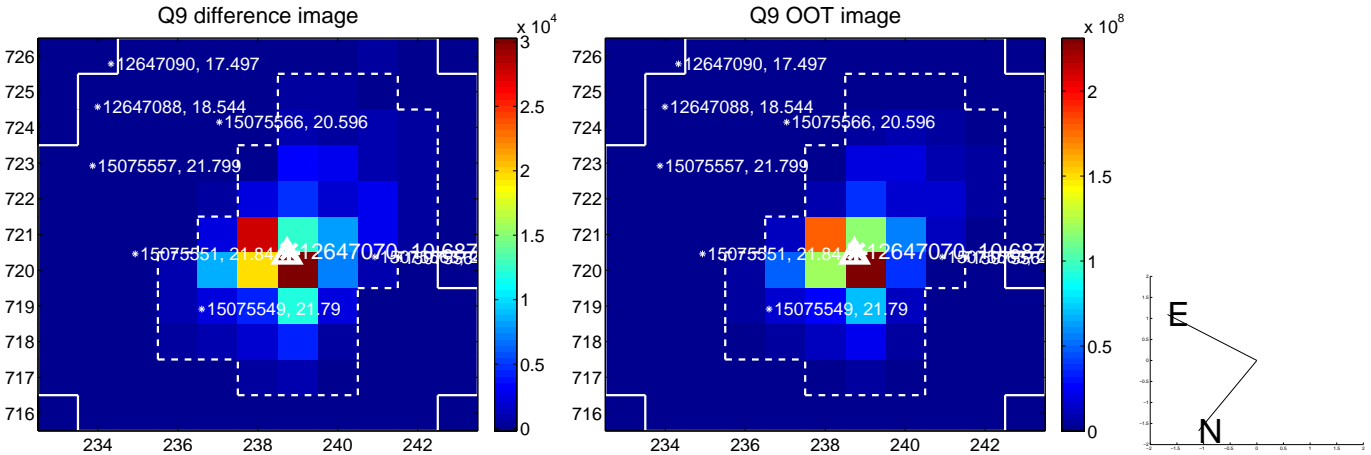
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

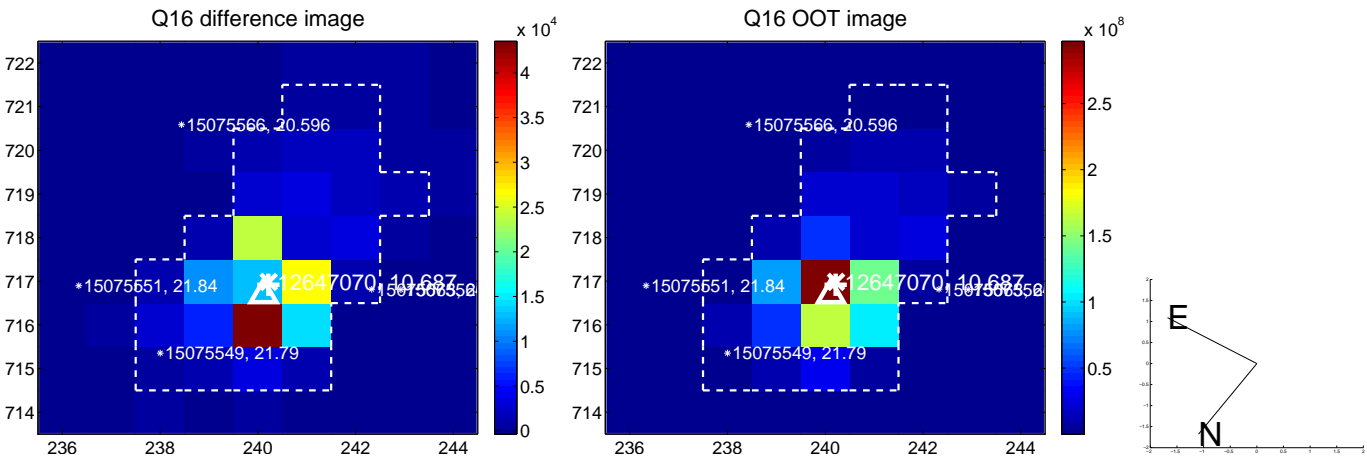
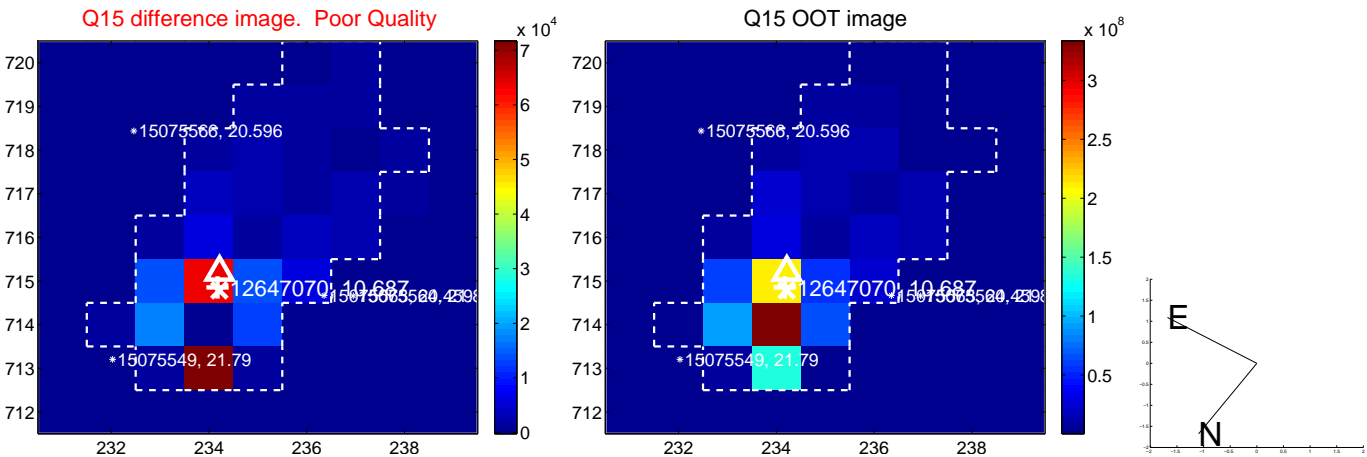
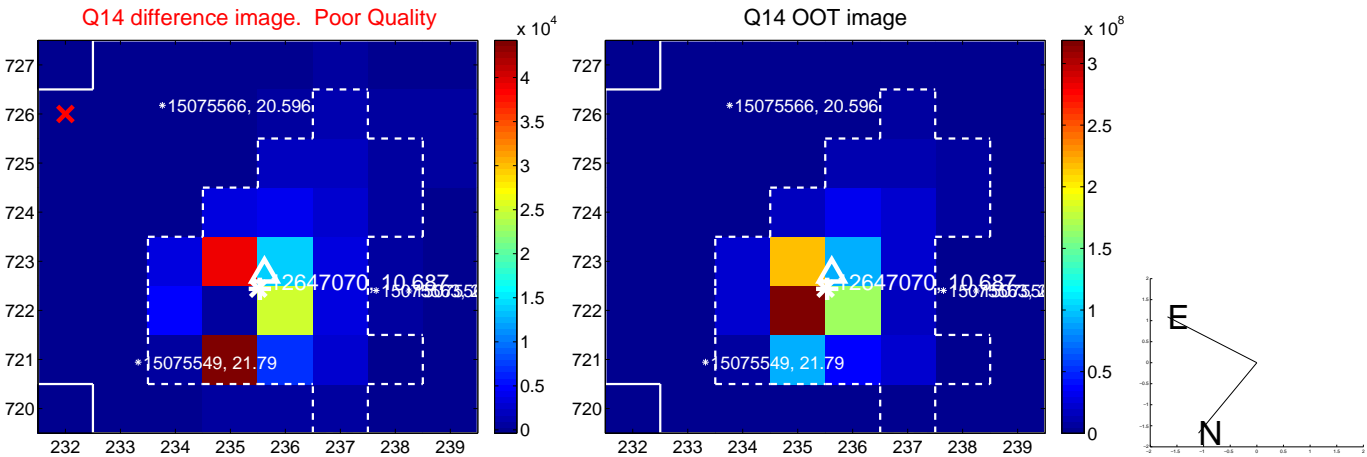
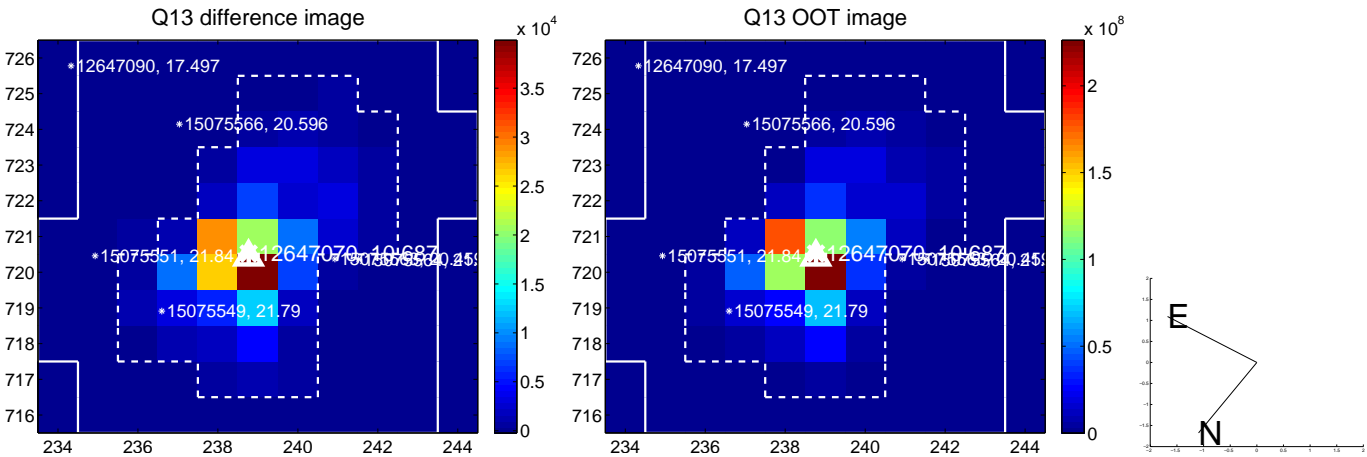


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

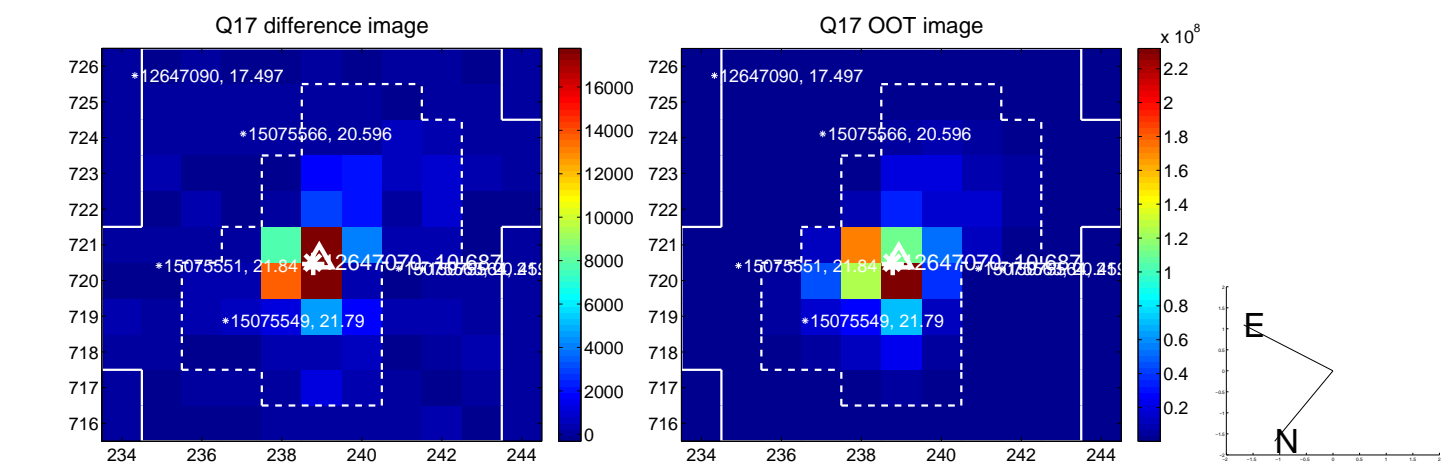




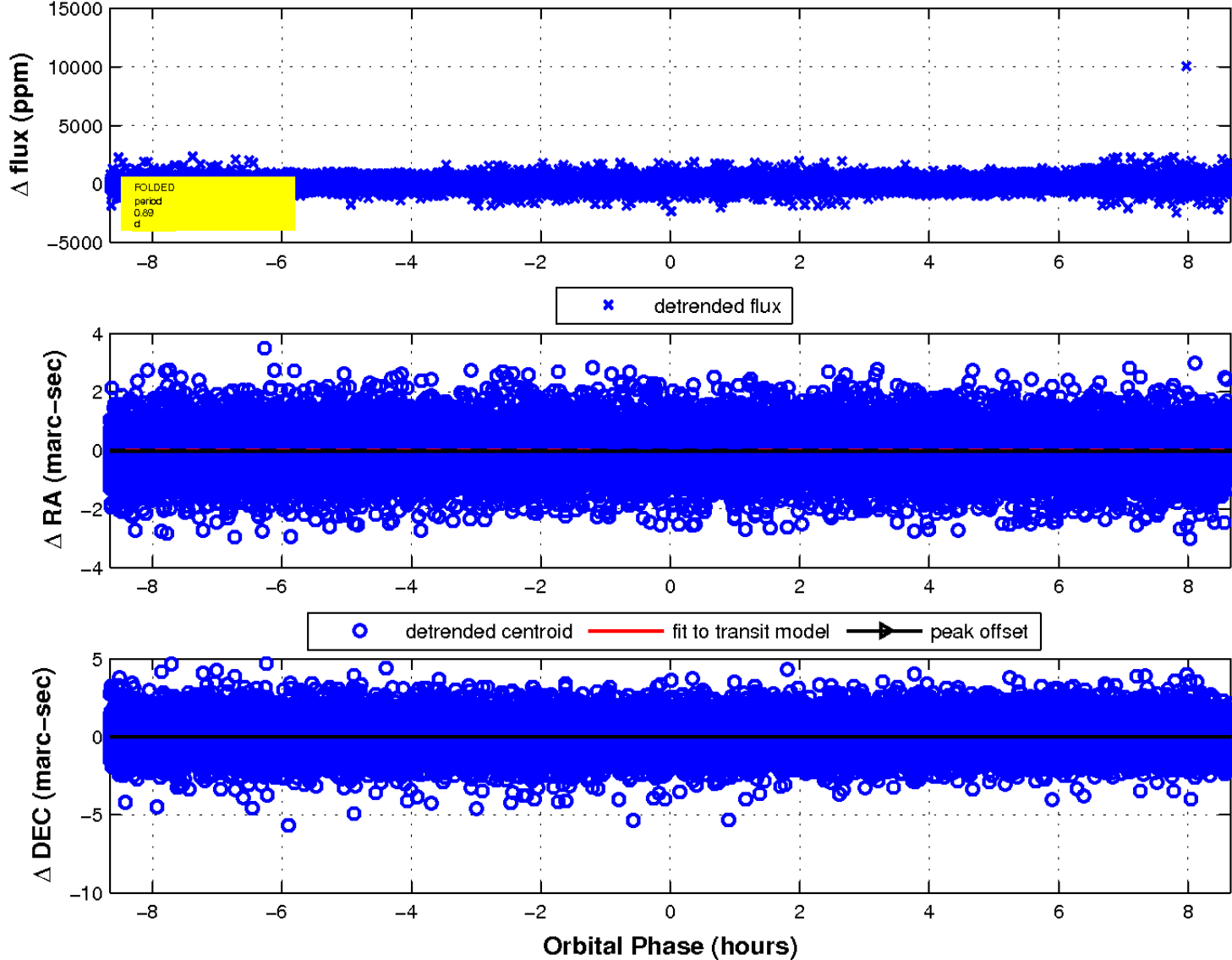
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



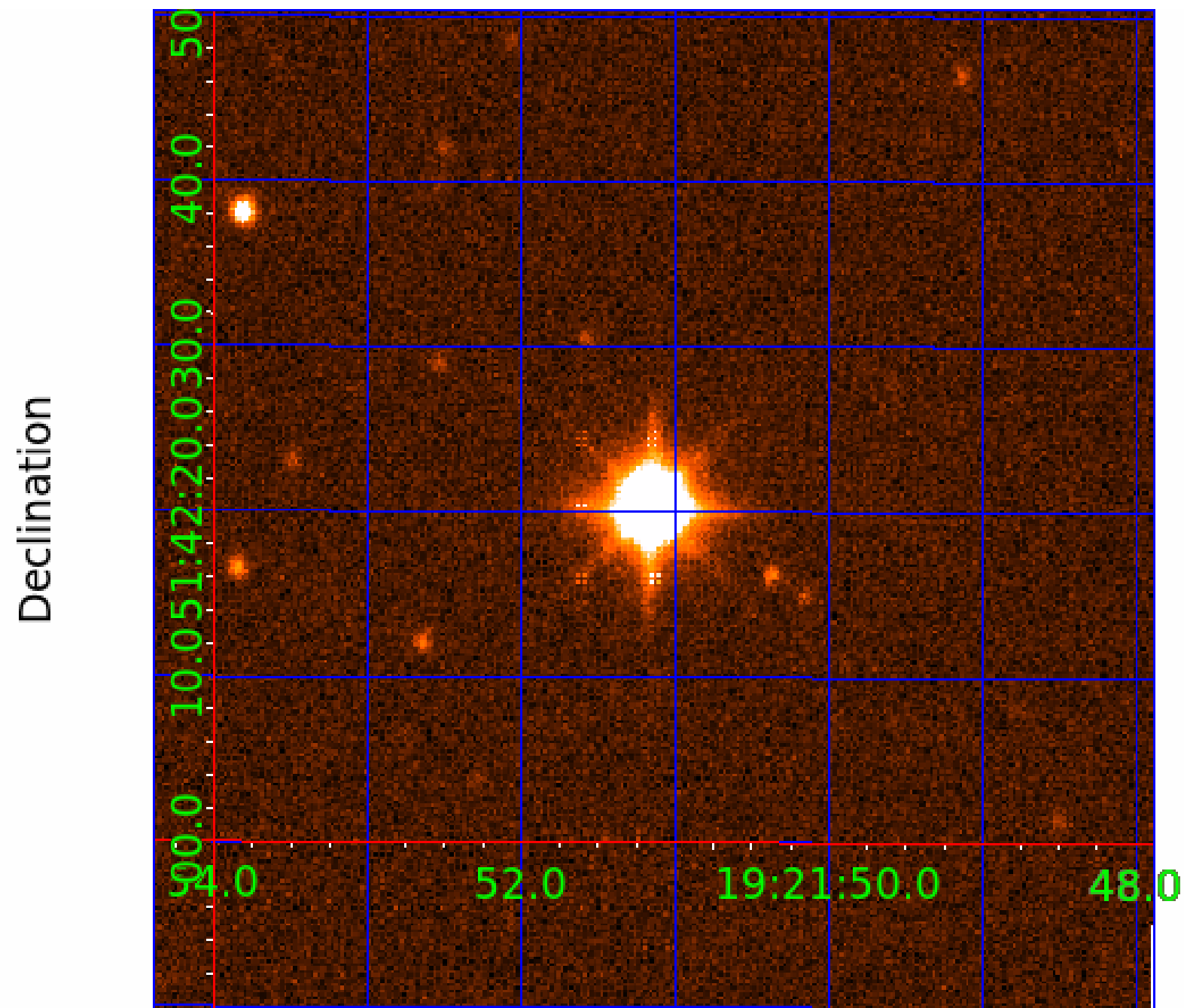
white  $\times$ : KIC target position;  $+$ : OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



fluxWeightedCentroids, Planet 3 of 4



UKIRT Image



# KIC 012647070

## 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)	$R_p$ ( $R_{\oplus}$ )	$S_p$ ( $S_{\oplus}$ )
012647070-01	OBS	No	0.885347	132.381896	0.0	1.605	11.1	0.0	2.56	7490	0.01	38899.97
012647070-02	OBS	No	0.885597	131.546355	33.6	3.081	12.4	13.5	2.56	7490	1.74	38885.31
012647070-03	OBS	No	0.885029	132.031963	29.9	2.886	8.3	8.2	2.56	7490	1.45	38918.58
012647070-04	OBS	No	0.884838	131.600777	50.5	3.000	8.6	-1.0	2.56	7490	1.83	38929.80

## Robovetter Results

TCE	Run Type	Disp	Score	N	S	C	E	Comments
012647070-01	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE_ZUMA_TRACKER—LPP_DV—LPP_ALT—MOD_NONUNIQ_ALT—MOD_TER_ALT—MOD_POS_ALT—CENT_SATURATED
012647070-02	OBS	FP	0.00	1	0	0	0	LPP_DV—LPP_ALT—MOD_NONUNIQ_ALT—MOD_POS_ALT—SAME_NTL_PERIOD—CENT_SATURATED
012647070-03	OBS	FP	0.00	1	0	0	0	INDIV_TRANS_RUBBLE_SKYE_ZUMA_TRACKER—LPP_DV—LPP_ALT—SAME_NTL_PERIOD—CENT_SATURATED
012647070-04	OBS	FP	0.00	1	0	0	0	TRANS_GAPPED—LPP_DV—LPP_ALT—SAME_NTL_PERIOD—CENT_SATURATED

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

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

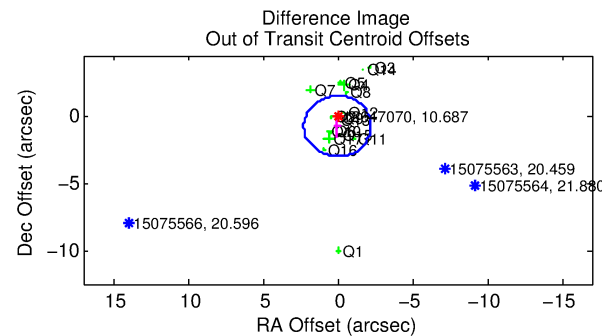
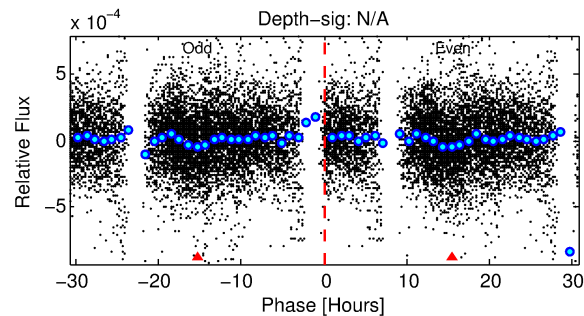
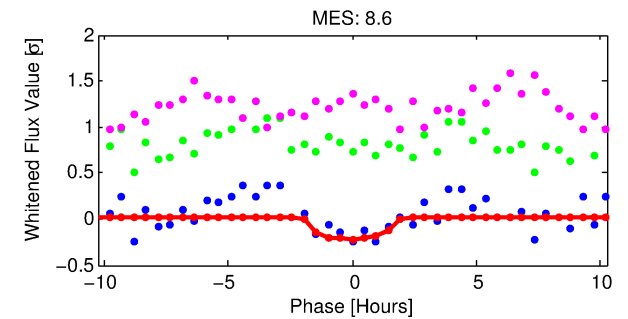
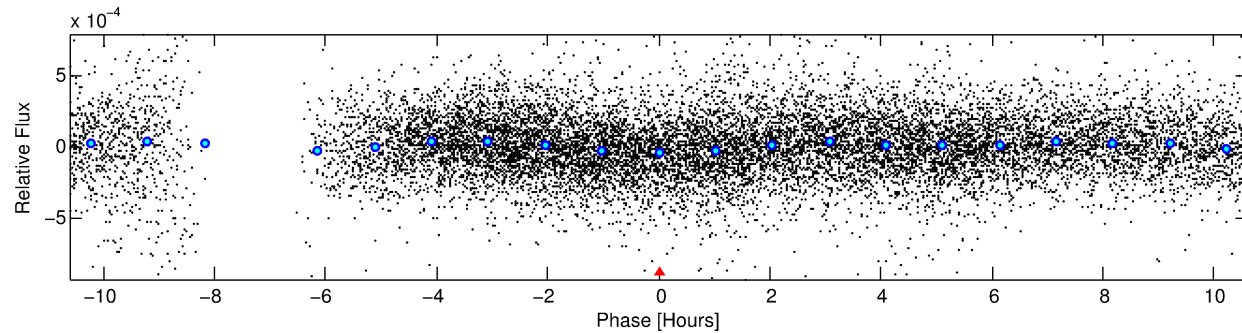
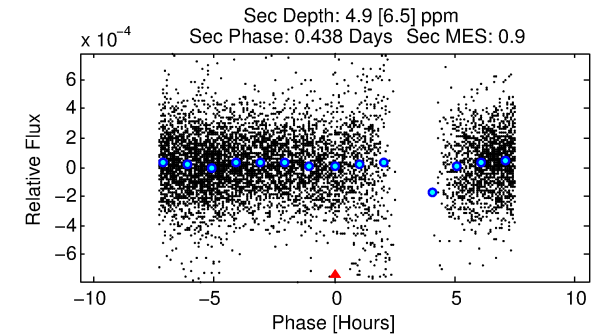
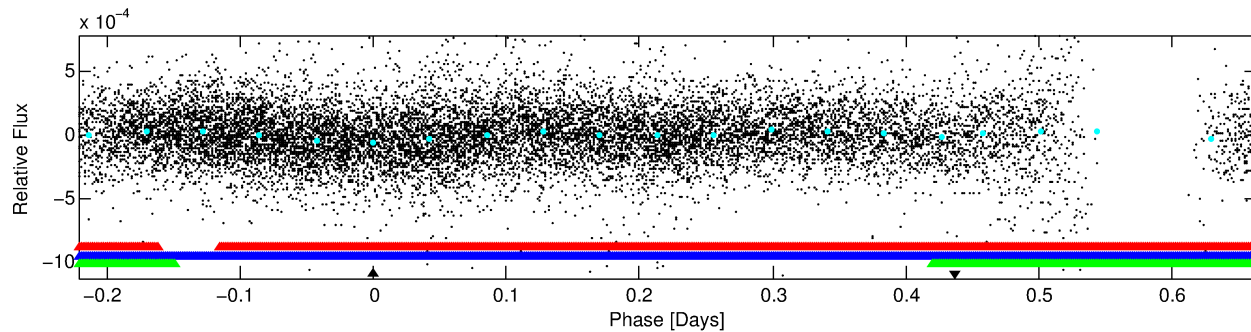
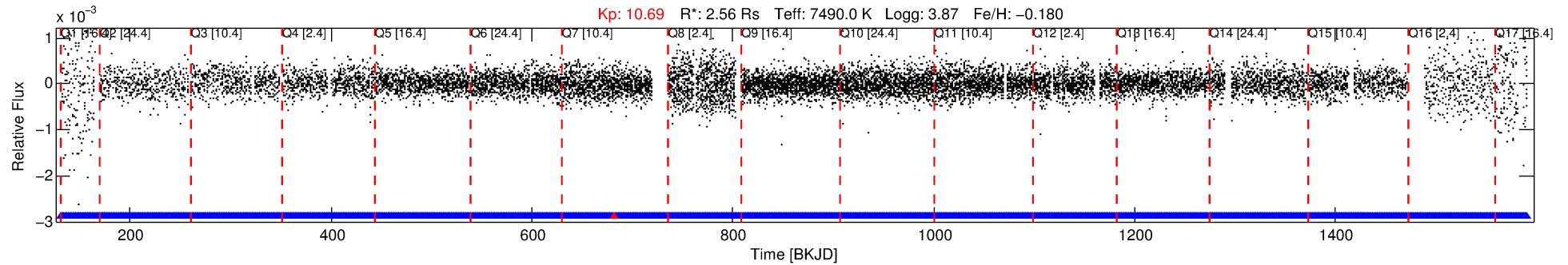
See [http://exoplanetarchive.ipac.caltech.edu/docs/API\\_kepcandidate\\_columns.html#proj\\_disp\\_col](http://exoplanetarchive.ipac.caltech.edu/docs/API_kepcandidate_columns.html#proj_disp_col) for comment definitions.

Ephemeris Match Information For 012647070-04

No Significant Match Found

# DV One-Page Summary

KIC: 12647070 Candidate: 4 of 4 Period: 0.885 d



## TPS TCE Results:

Period = 0.88484 d  
Epoch = 131.6008 BKJD

DV fit results are unavailable

## DV Diagnostic Results:

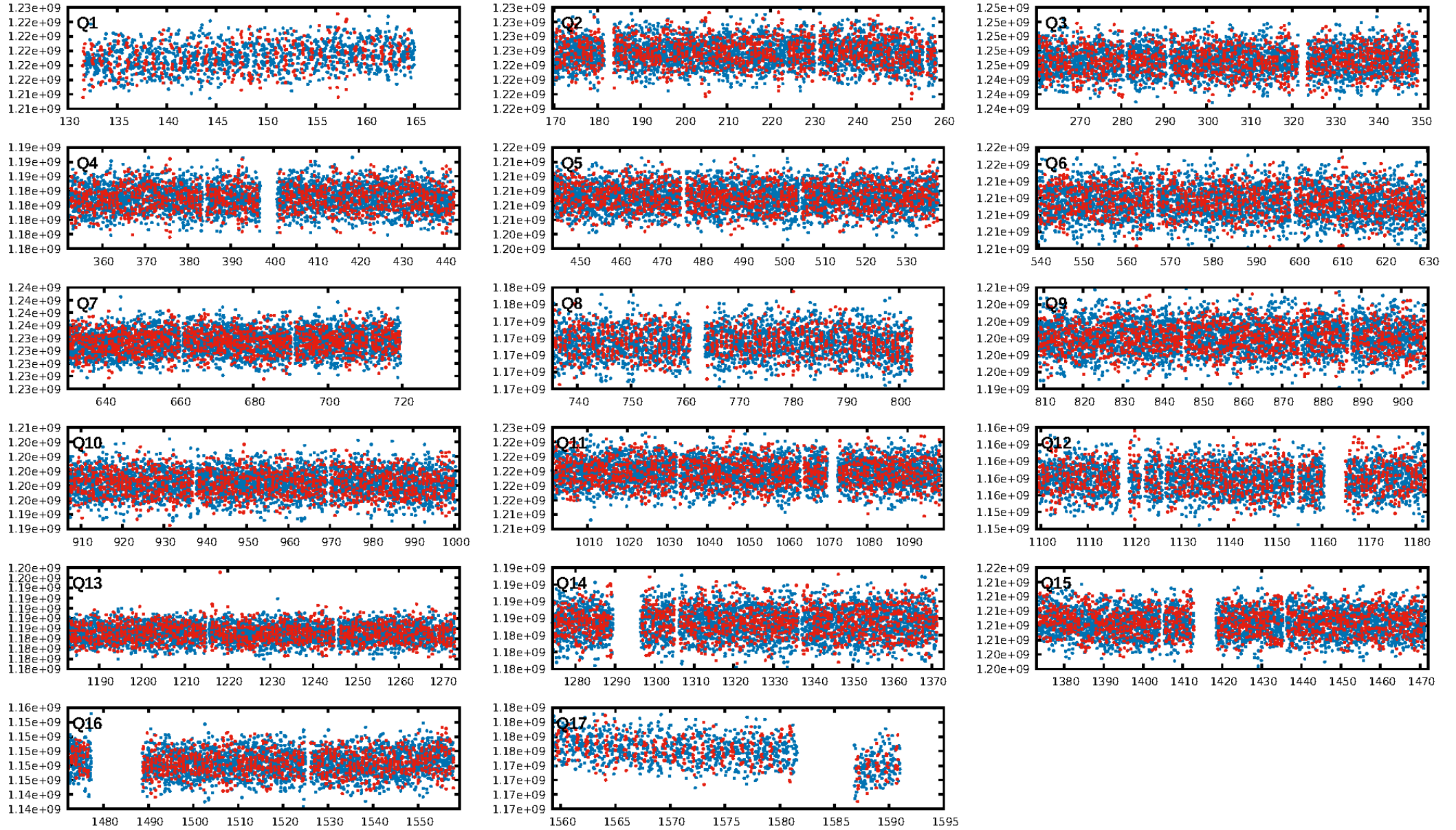
ShortPeriod-sig: N/A  
LongPeriod-sig: 0.1% [0.00σ]  
ModelChiSquare2-sig: N/A  
ModelChiSquareGof-sig: N/A  
Bootstrap-pfa: N/A  
RollingBand-fgt: 1.00 [865/866]  
GhostDiagnostic-chr: N/A  
Centroid-sig: 67.7%  
Centroid-so: 0.164 arcsec [3.04σ]  
OotOffset-rm: 0.751 arcsec [1.00σ]  
KicOffset-rm: 0.734 arcsec [1.01σ]  
OotOffset-st: 4/4/4/5 [17]  
KicOffset-st: 4/4/4/5 [17]  
DiffImageQuality-fgm: 0.29 [5/17]  
DiffImageOverlap-fno: 0.00 [0/17]

Software Revision: svn+ssh://murzim/repo/soc/tags/release/9.3.42@60958 -- Date Generated: 30-Jan-2016 06:20:22 Z

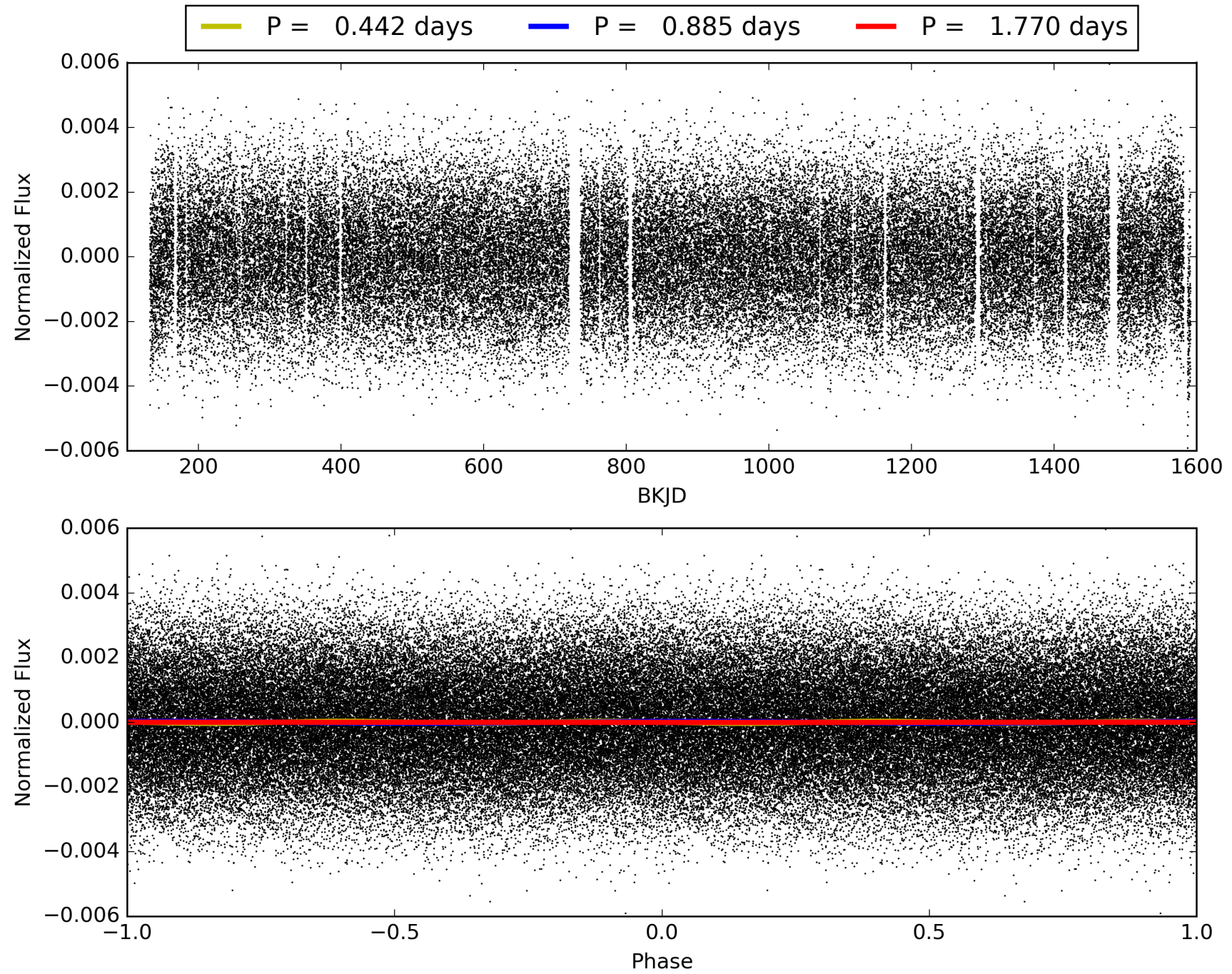
This Data Validation Report Summary was produced in the Kepler Science Operations Center Pipeline at NASA Ames Research Center



# TCE 012647070-04, PDC Light Curves

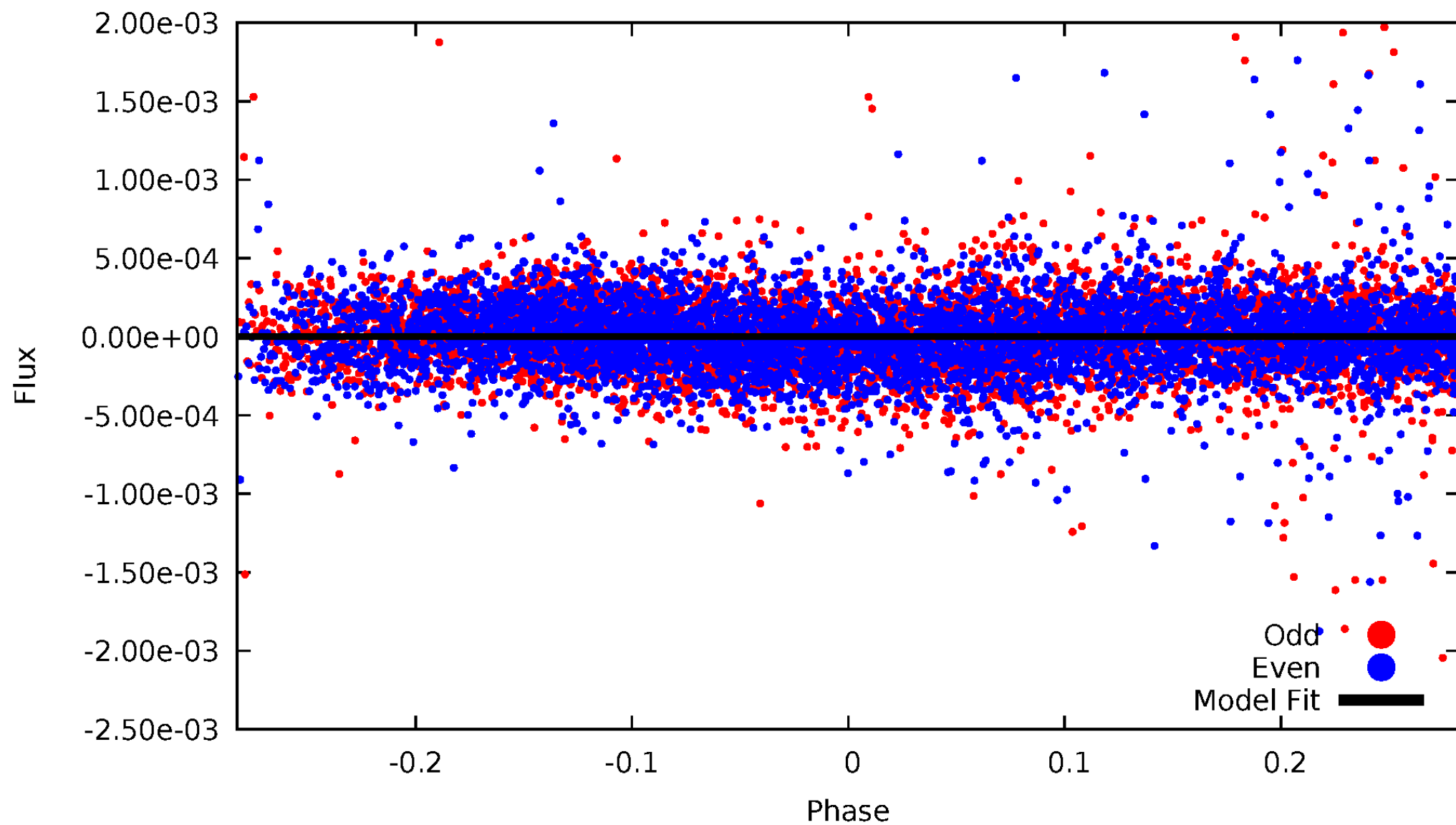


# TCE 012647070-04



DV Odd/Even

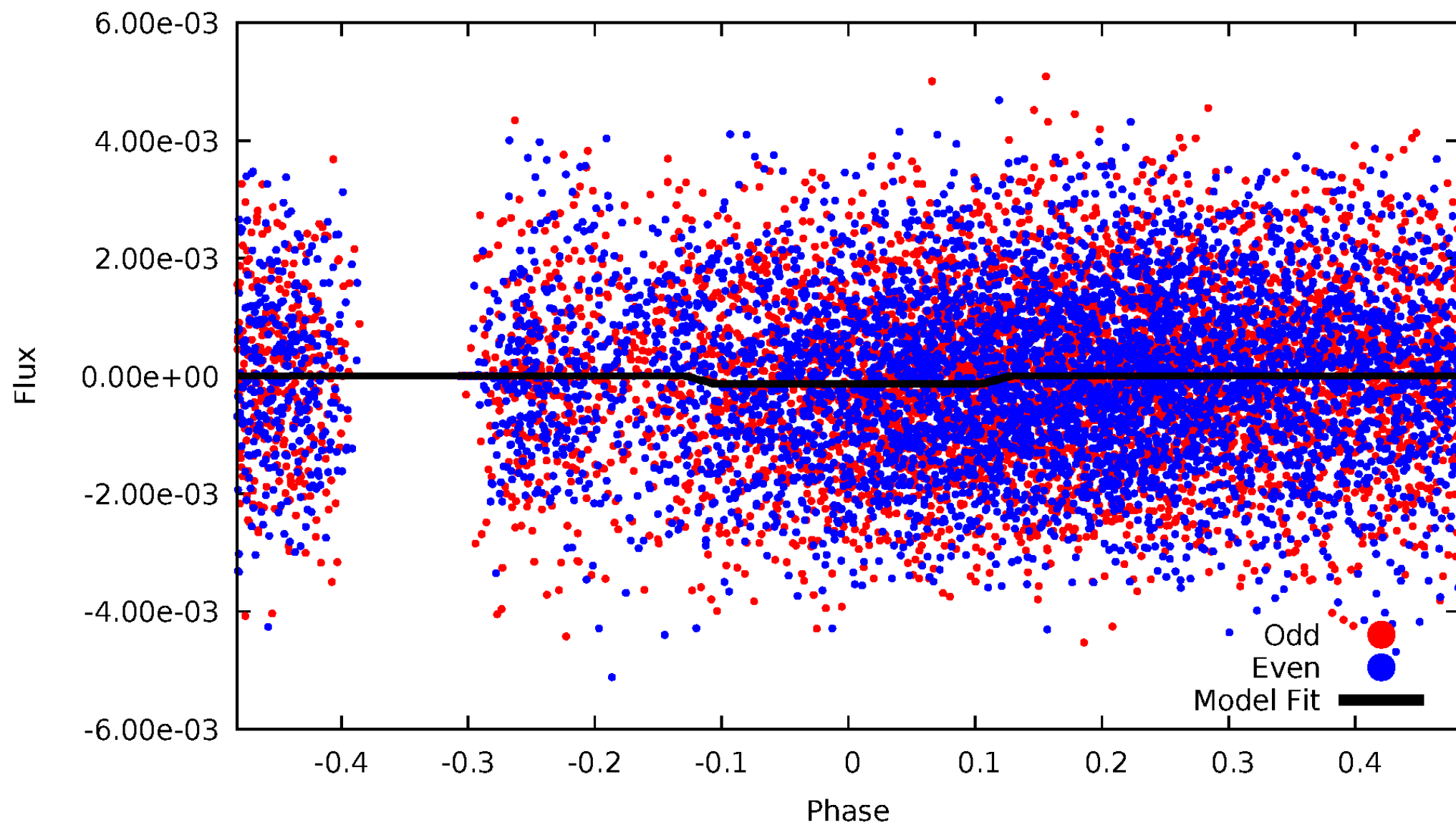
TCE 012647070-04





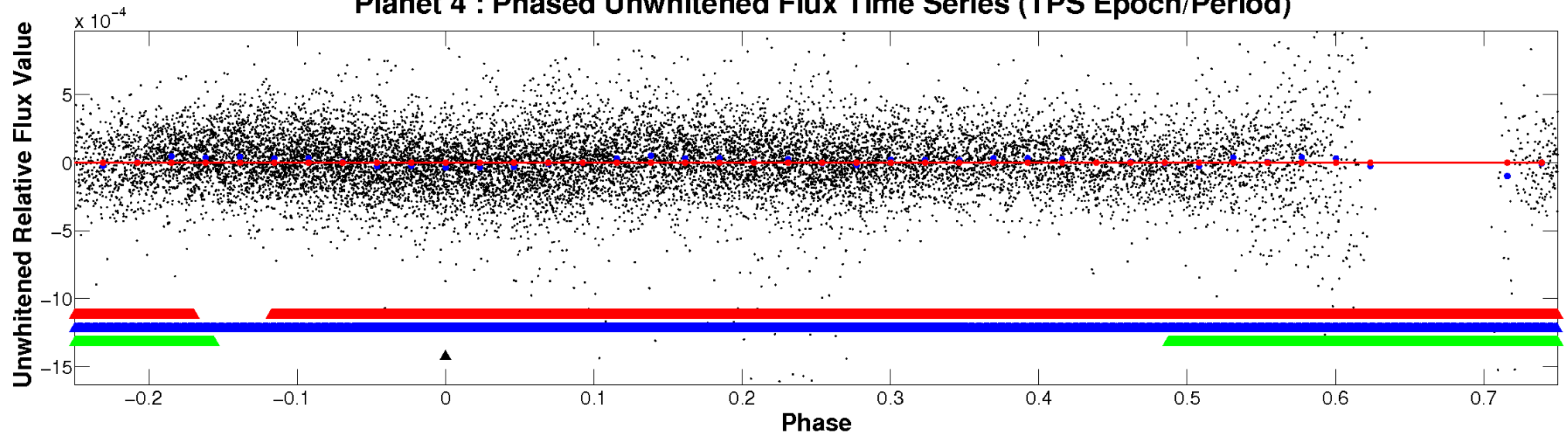
# ALT Odd/Even

TCE 012647070-04

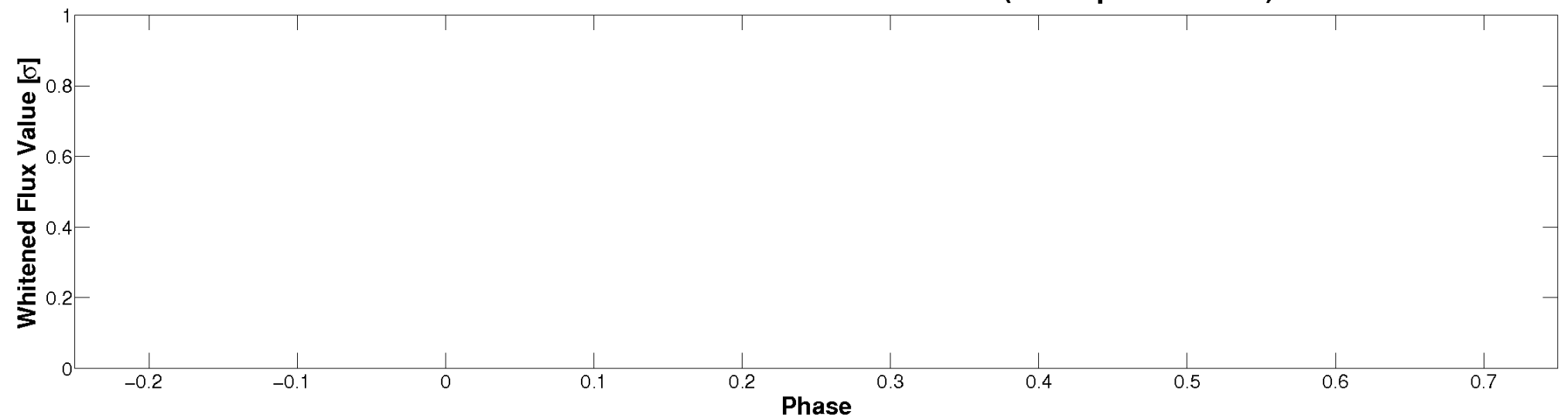


# Non-Whitened Vs. Whitened Light Curve

**Planet 4 : Phased Unwhitened Flux Time Series (TPS Epoch/Period)**



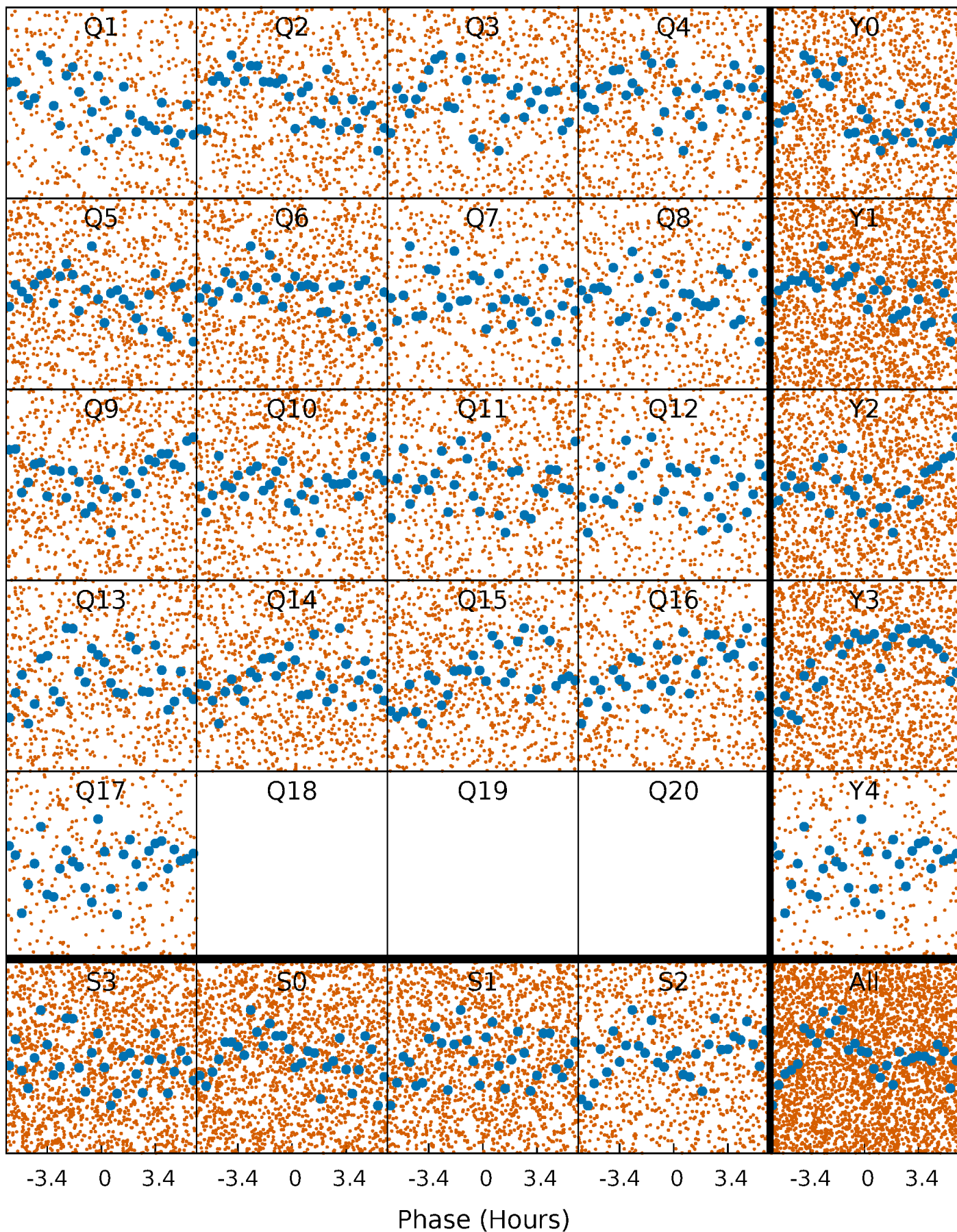
**Planet 4 : Phased Whitened Flux Time Series (TPS Epoch/Period)**





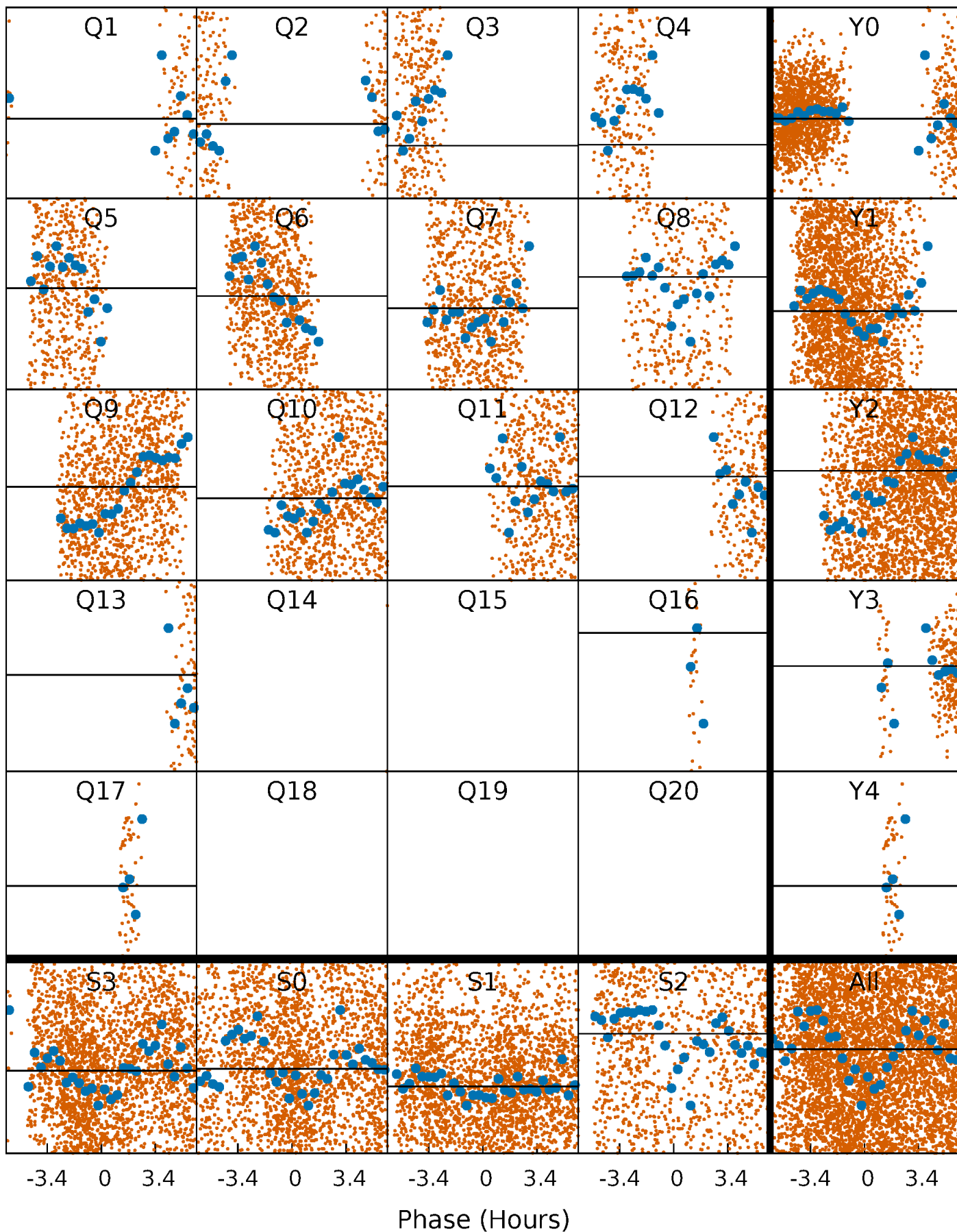
# PDC Quarter-Phased Transit Curves

TCE 012647070-04 P= 0.884838 Days  $T_0=131.600777$  (BKJD)



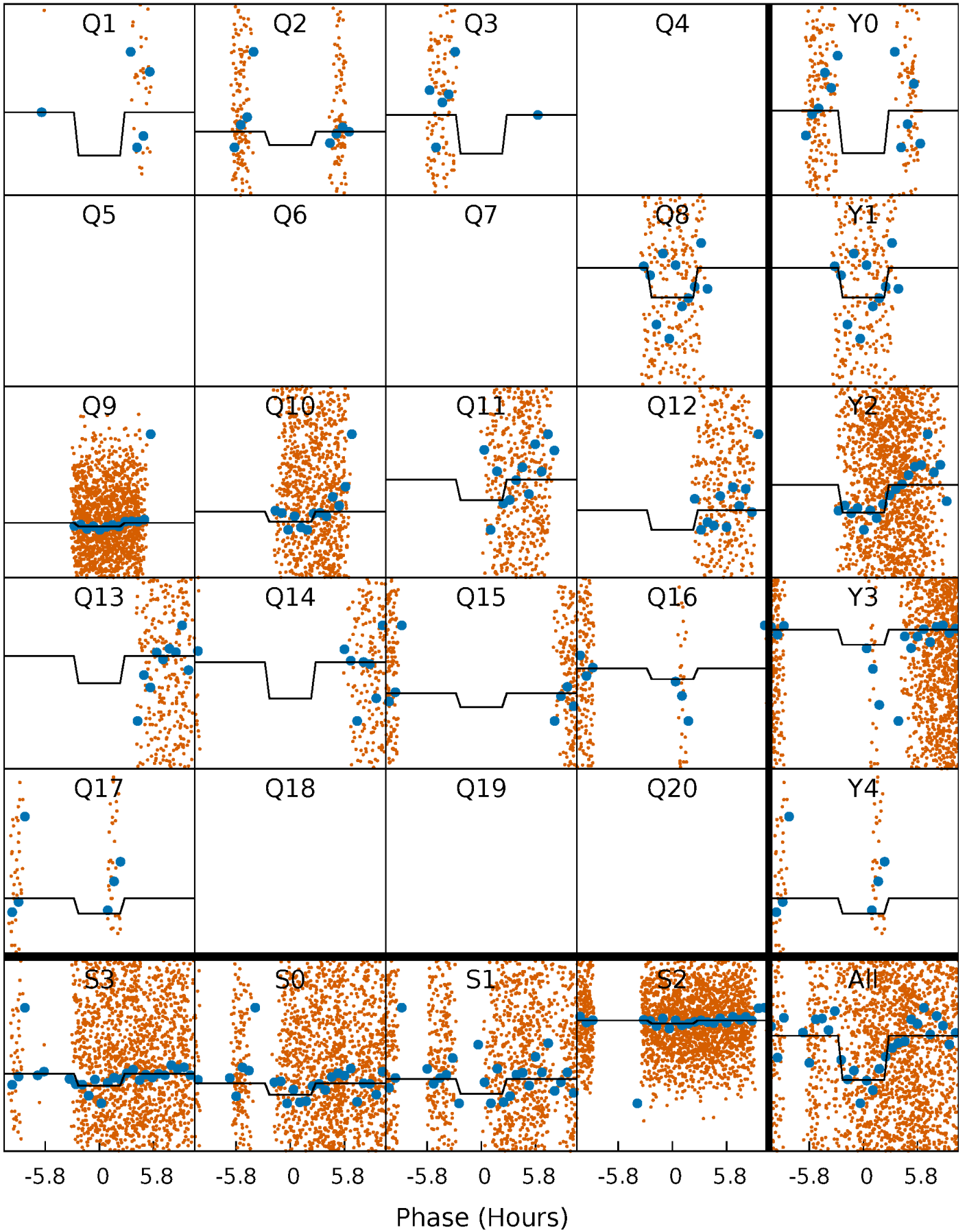
# DV Quarter-Phased Transit Curves

TCE 012647070-04 P= 0.884838 Days  $T_0=131.600777$  (BKJD)



# Alt. Detrend Quarter-Phased Transit Curves

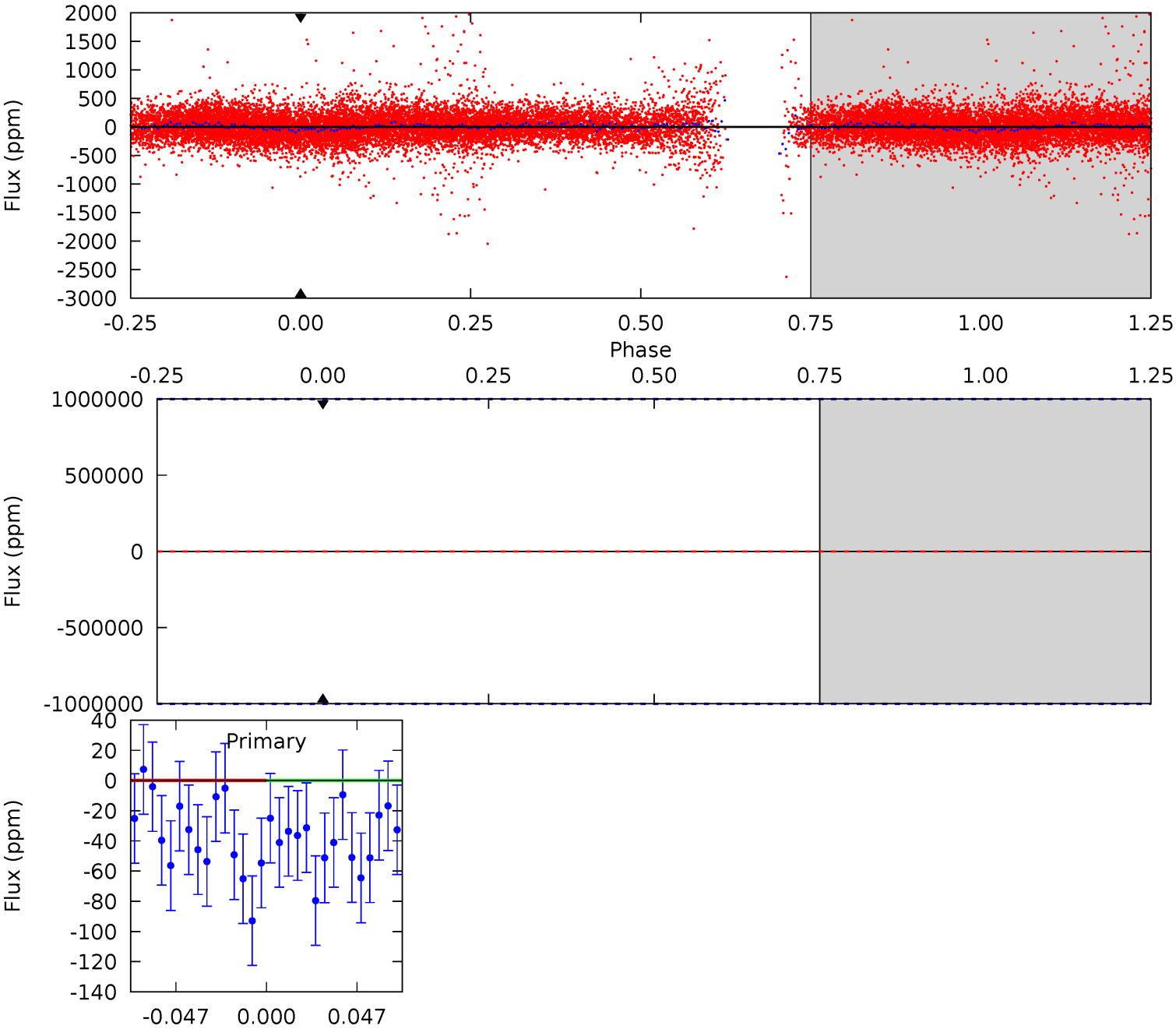
TCE 012647070-04     $P = 0.884838$  Days     $T_0 = 131.611898$  (BKJD)



DV Model-Shift Uniqueness Test

012647070-04, P = 0.884838 Days, E = 131.600777 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

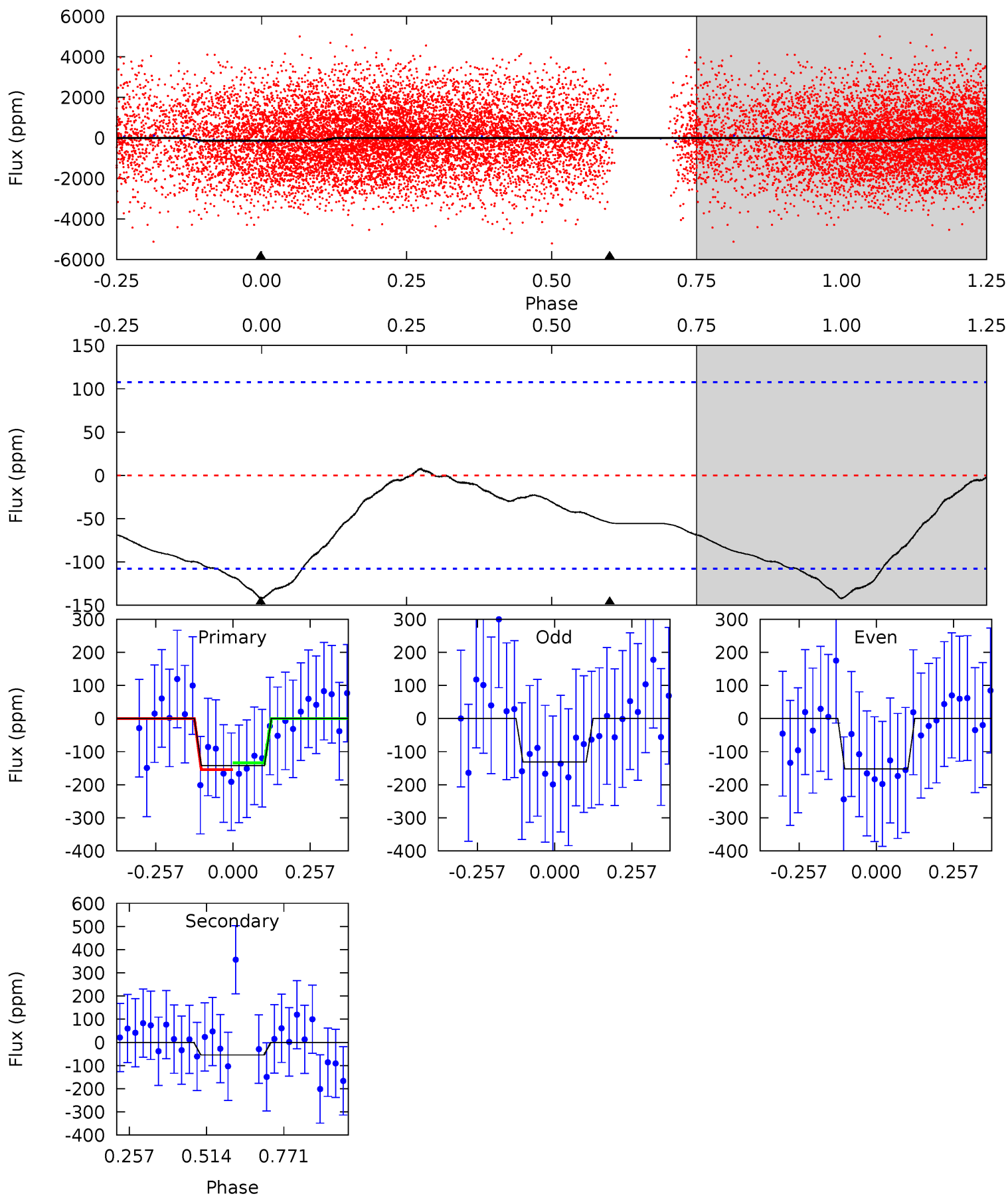




# Alt Model-Shift Uniqueness Test

012647070-04, P = 0.884838 Days, E = 131.611898 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
5.75	2.21	0	0	4.36	1.13	0.17	5.75	5.75	2.21	2.21	0.42	1.01	0.05	0.42





### Stellar Parameters For KIC 012647070

	$T_{\text{eff}} (K)$	$\log(g)$	$[\text{Fe}/\text{H}]$	$R (R_{\odot})$	$M (M_{\odot})$	$\rho_{\star} (\text{g}\cdot\text{cm}^{-3})$
	$7490^{+235}_{-314}$	$3.868^{+0.338}_{-0.113}$	$-0.180^{+0.250}_{-0.350}$	$2.564^{+0.446}_{-0.966}$	$1.770^{+0.173}_{-0.404}$	$0.148^{+0.359}_{-0.049}$
	+3%/-4%	+9%/-3%	+139%/-194%	+17%/-38%	+10%/-23%	+242%/-33%
Source	KIC0	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 012647070-04 / KOI

Detrend	Depth (ppm)	$R_p (R_{\oplus})$	$T_{\text{max}} (K)$	$T_{\text{obs}} (K)$	$A_{\text{obs}}$
DV	$0 \pm 1000000$	$17.51^{+21.39}_{-12.45}$	$4907^{+340}_{-481}$	$-4668^{+47219}_{-38835}$	$-0.066^{+136.901}_{-133.804}$
Alt.	$-55 \pm 25$	$18.75^{+21.95}_{-13.54}$	$4894^{+336}_{-452}$	$-3999^{+7792}_{-326}$	$0.037^{+0.446}_{-0.030}$

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

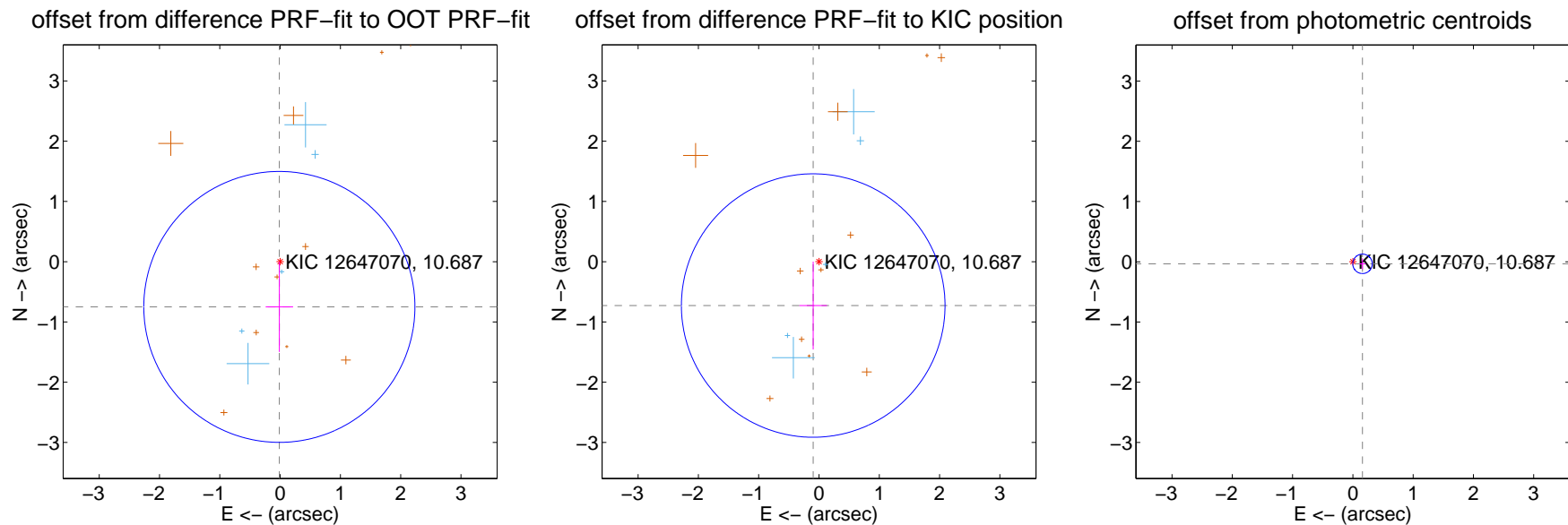
## DV Centroid Data

Supplemental centroid analysis for 012647070-04. **Kepler magnitude: 10.69.** Transit SNR -1.00

There are 5 quarters with good PRF difference image offsets

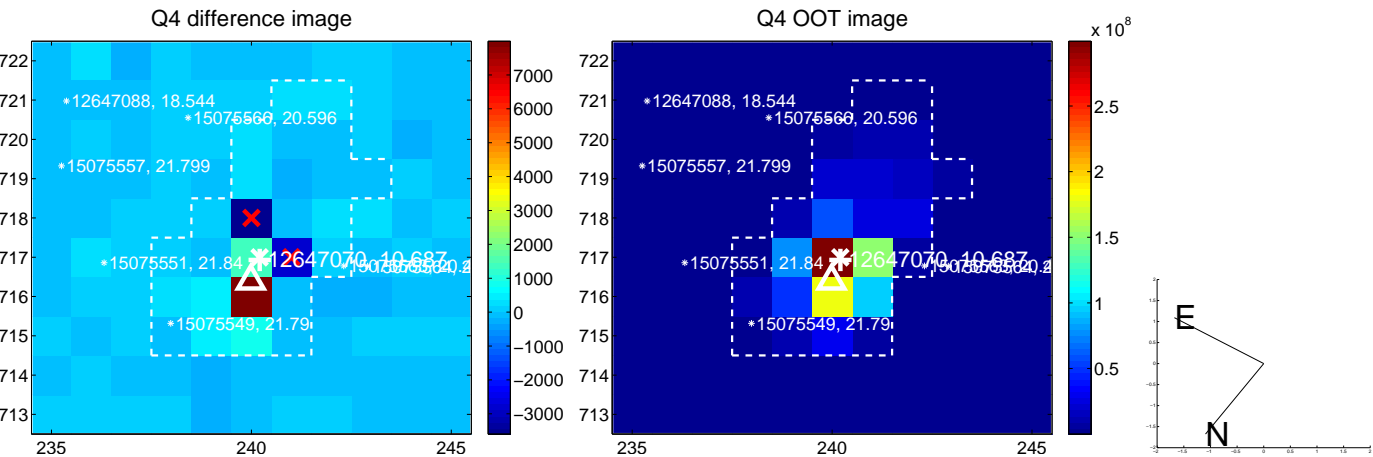
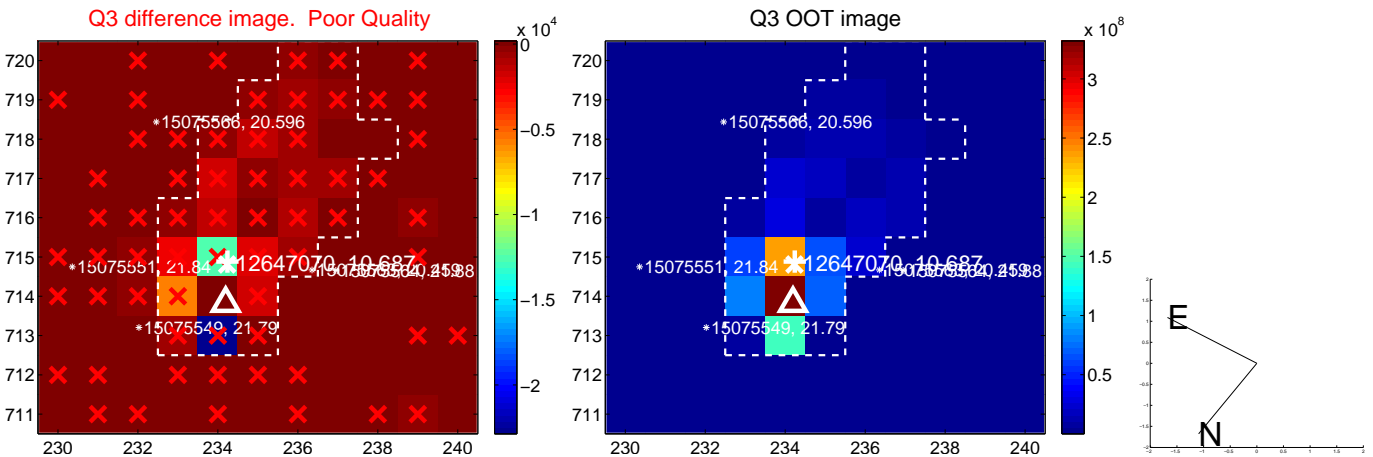
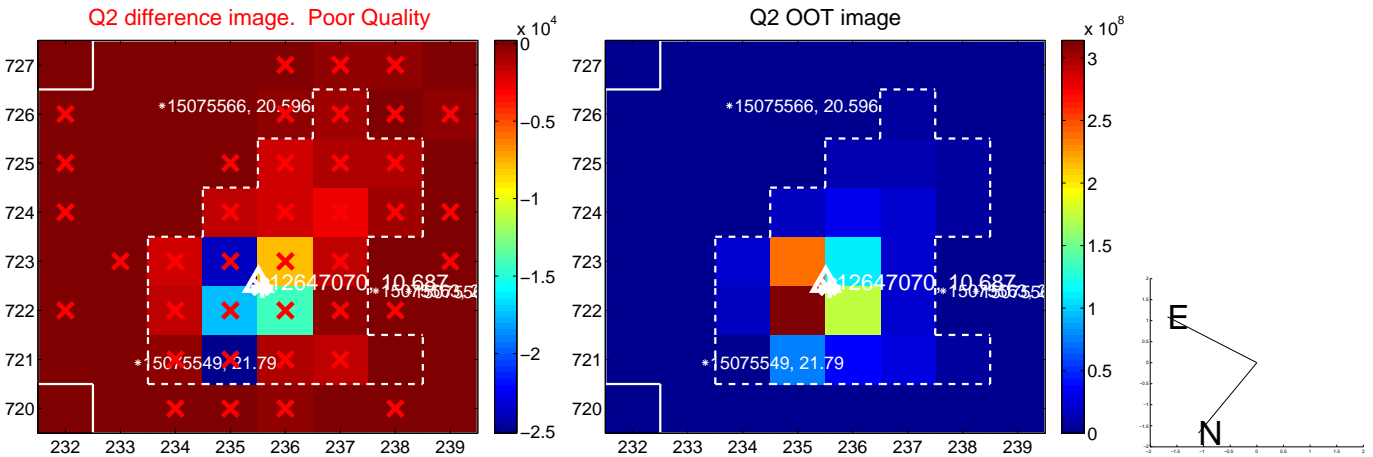
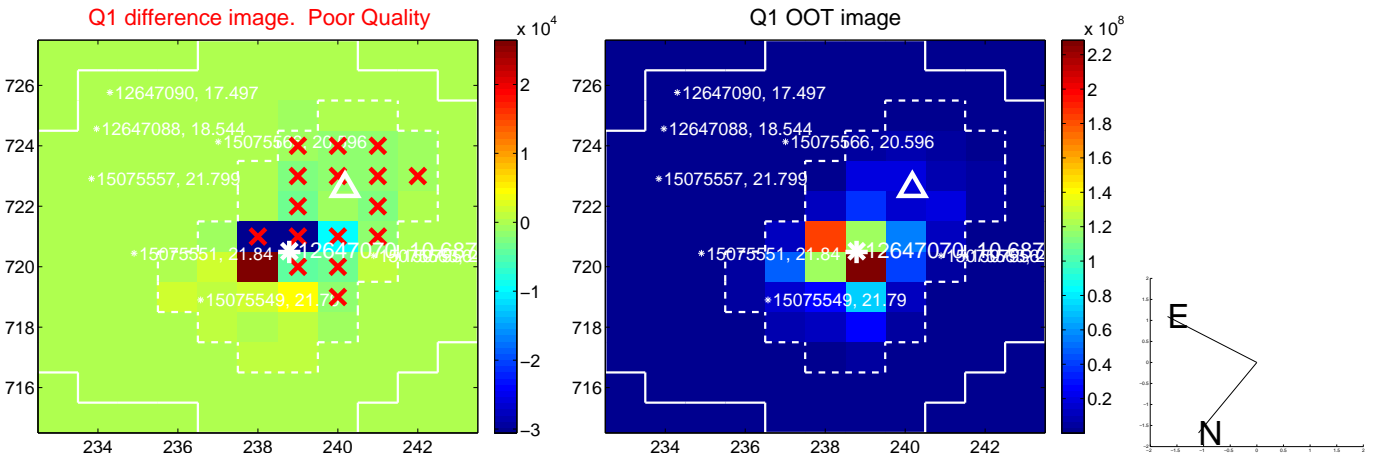
The direct PRF centroid is offset from the target star catalog position by about 0.15 arcsec

	Distance in arcsec	Distance / $\sigma$	$\Delta$ RA	$\Delta$ Dec
PRF-fit source offset from OOT	$0.751 \pm 0.750$	1.00	$0.013 \pm 0.227$	$-0.751 \pm 0.748$
PRF-fit source offset from KIC position	$0.734 \pm 0.729$	1.01	$0.096 \pm 0.228$	$-0.728 \pm 0.729$
photometric centroid source offset	<b><math>0.16 \pm 0.05</math></b>	<b>3.04</b>	$-0.16 \pm 0.05$	$-0.03 \pm 0.09$

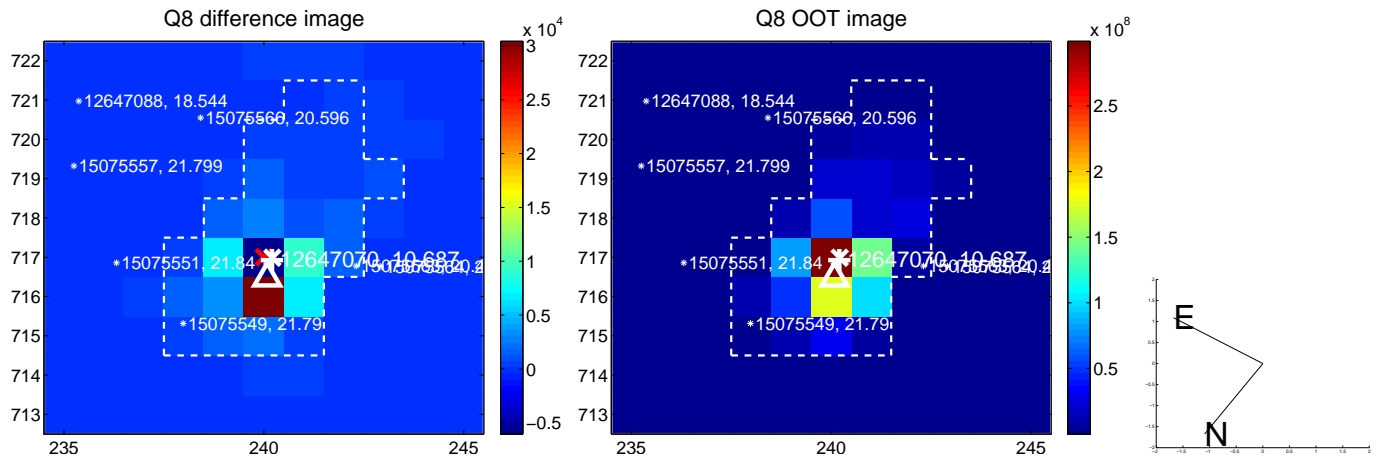
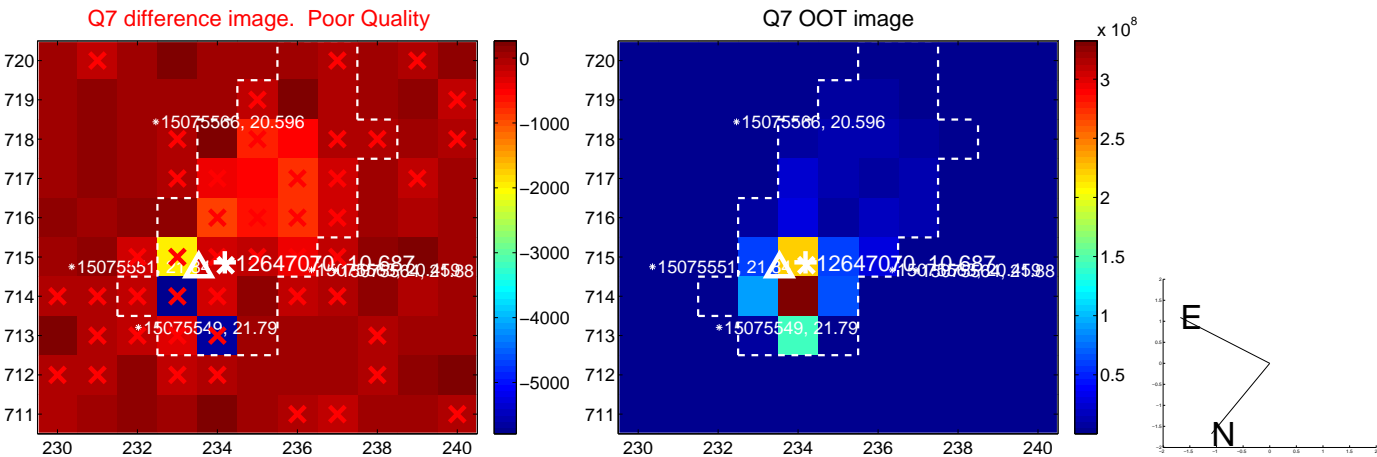
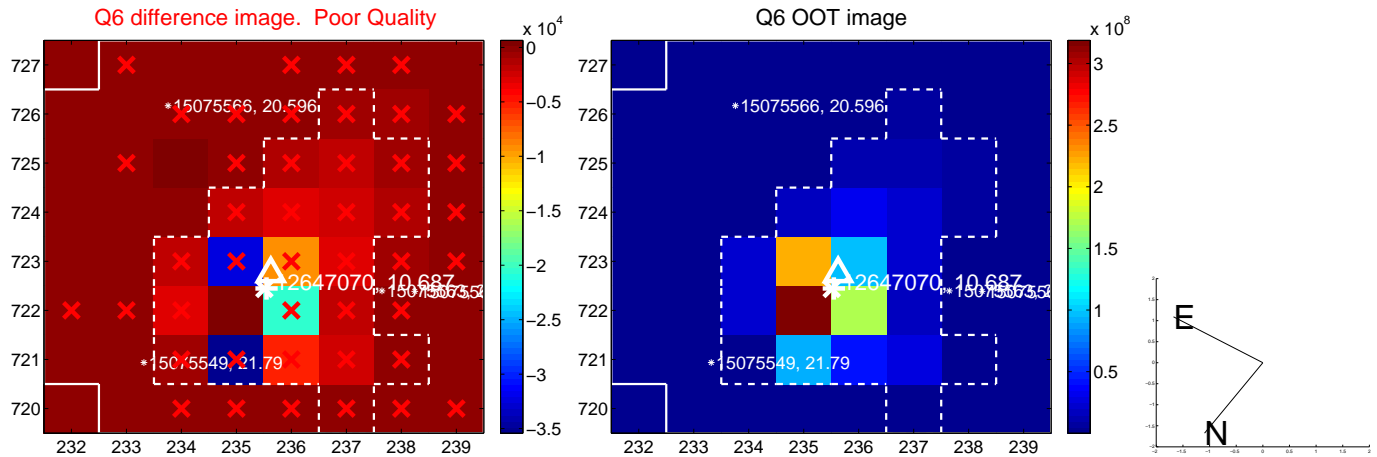
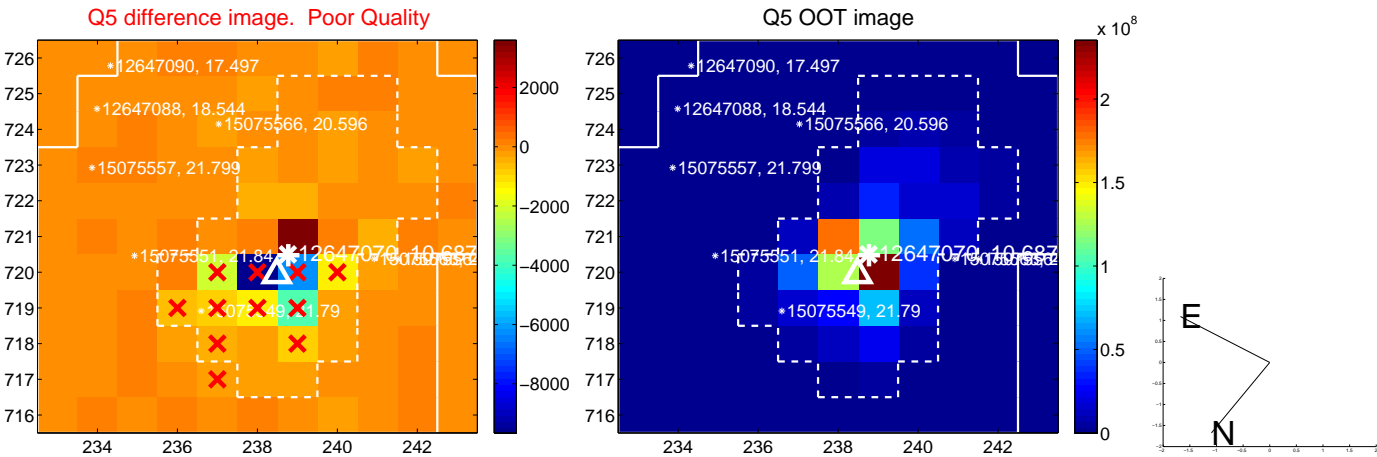


Centroid source offsets from the target star reconstructed from PRF and photometric centroids. **Sky blue crosses: good quarterly centroid offsets; Vermillion crosses: bad quarterly centroid offsets;** magenta cross: average over quarters. Length of the crosses: one- $\sigma$  uncertainty. Blue circle: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

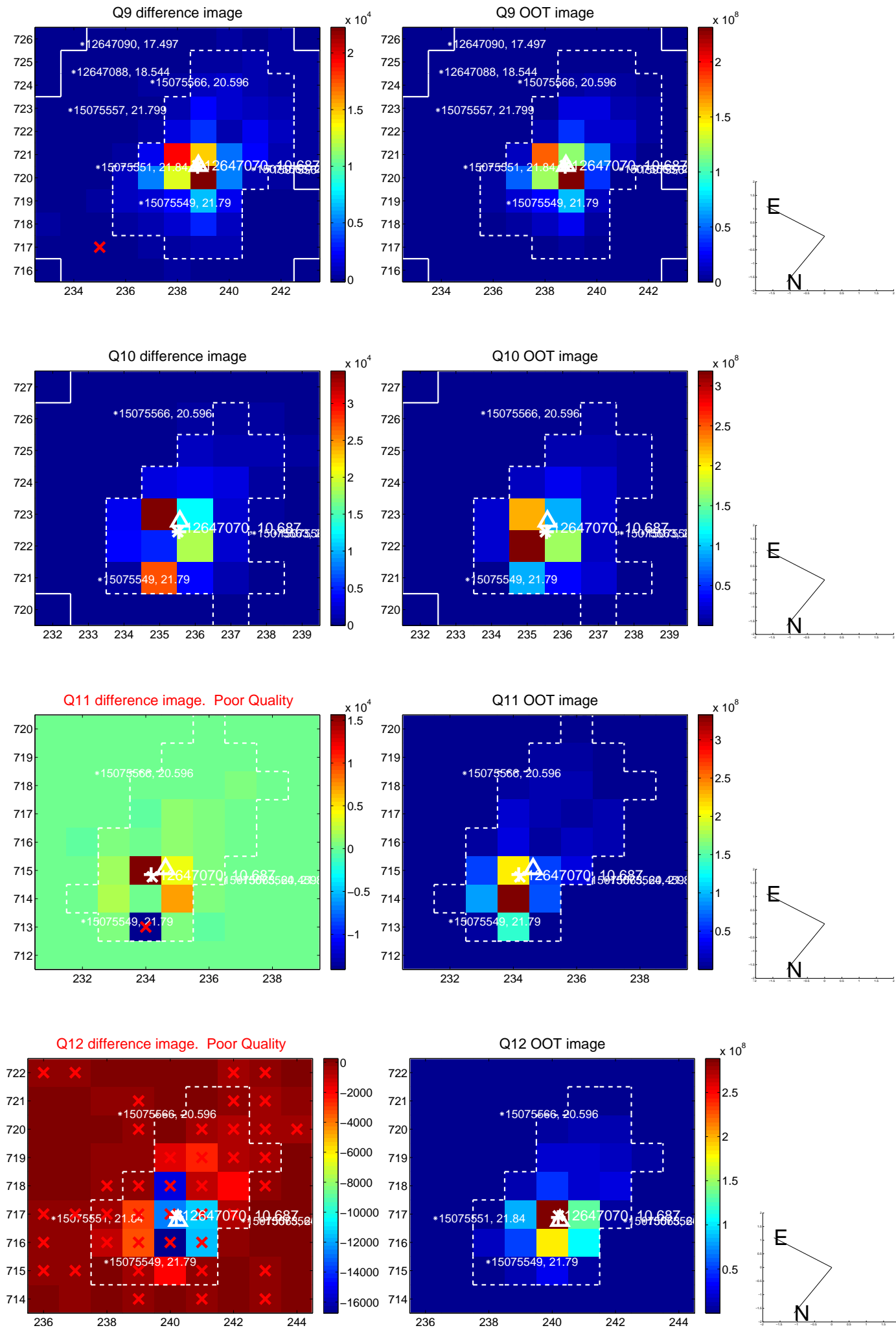
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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

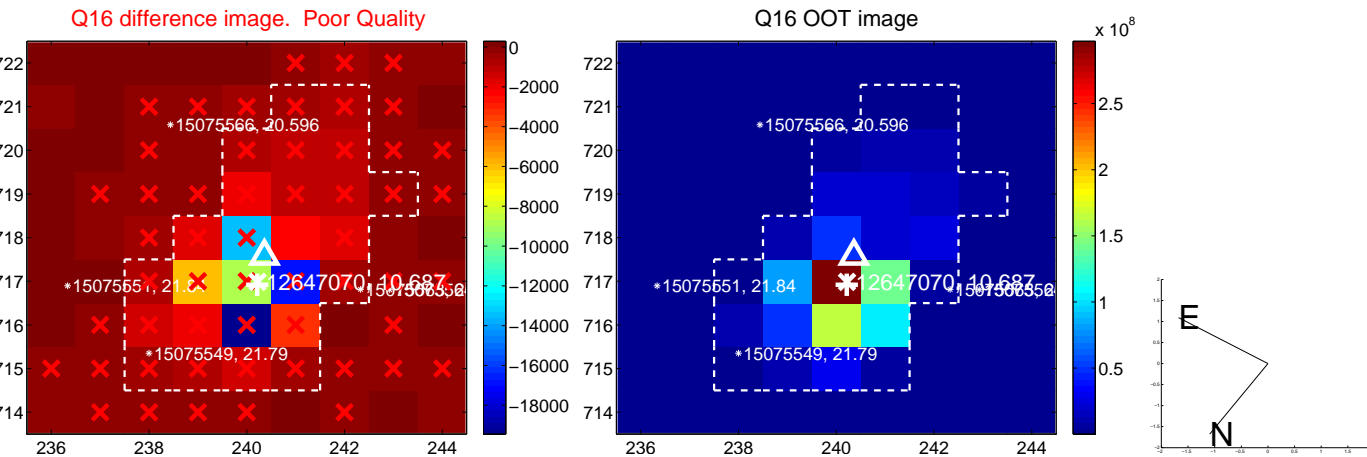
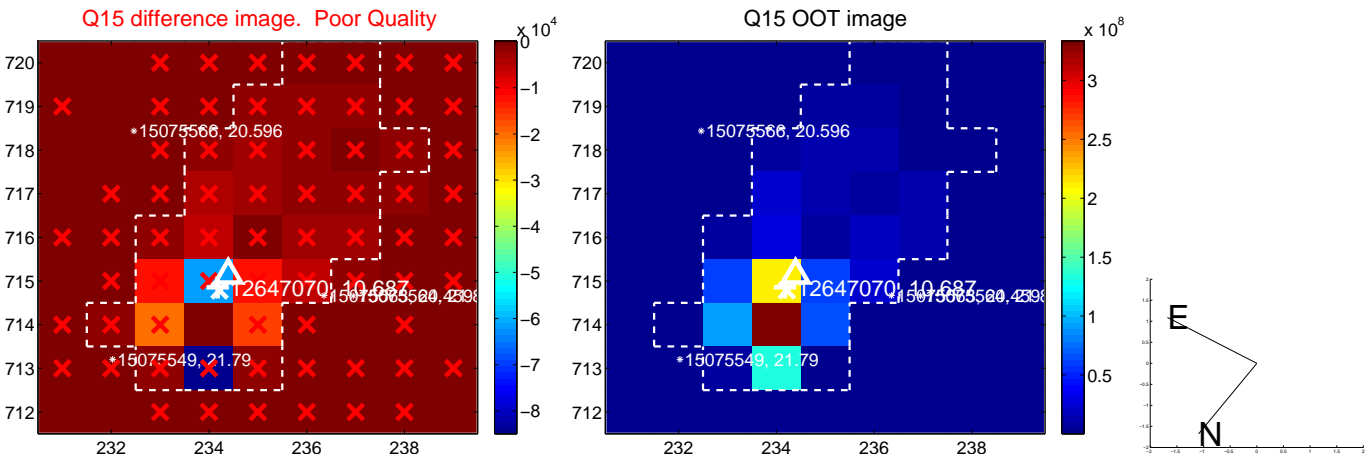
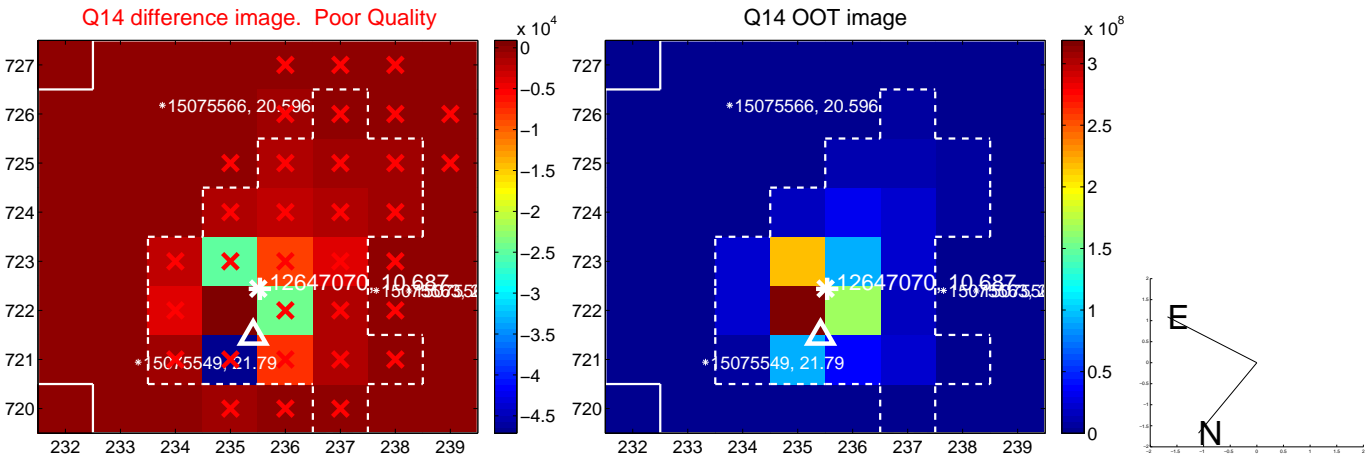
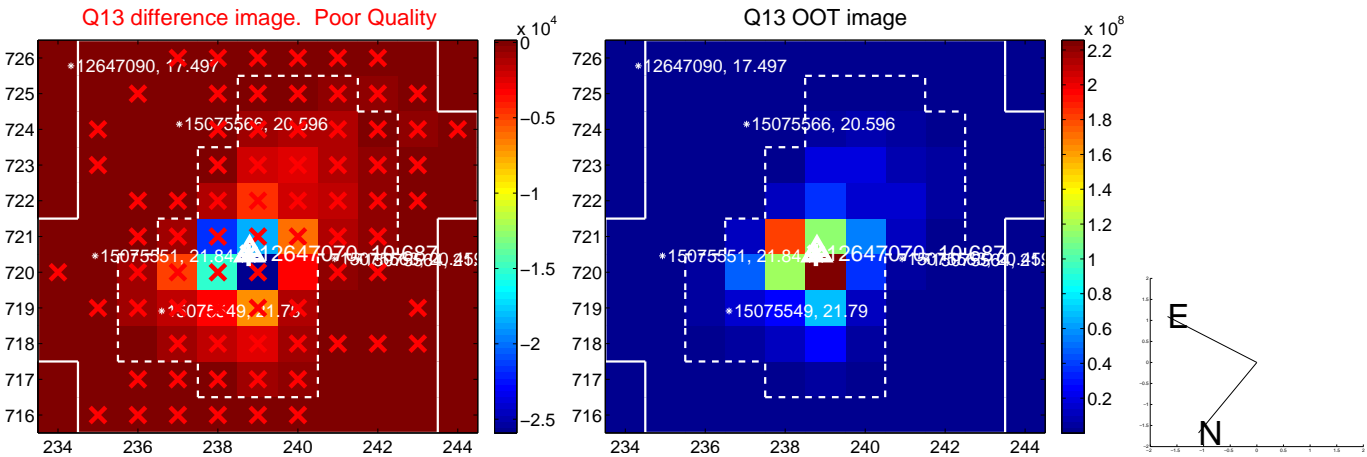


white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.

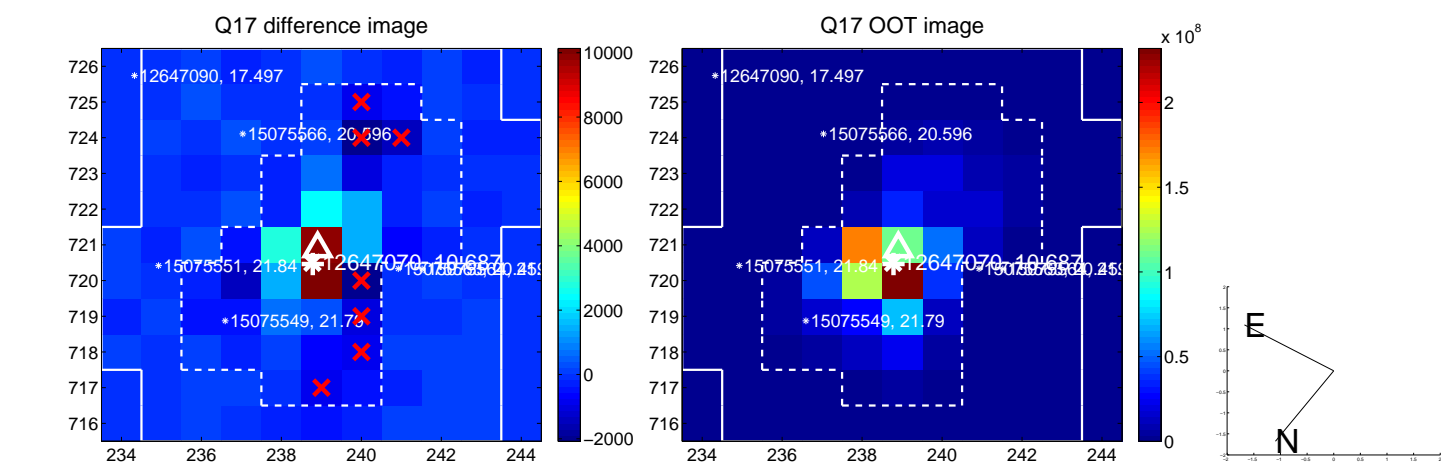




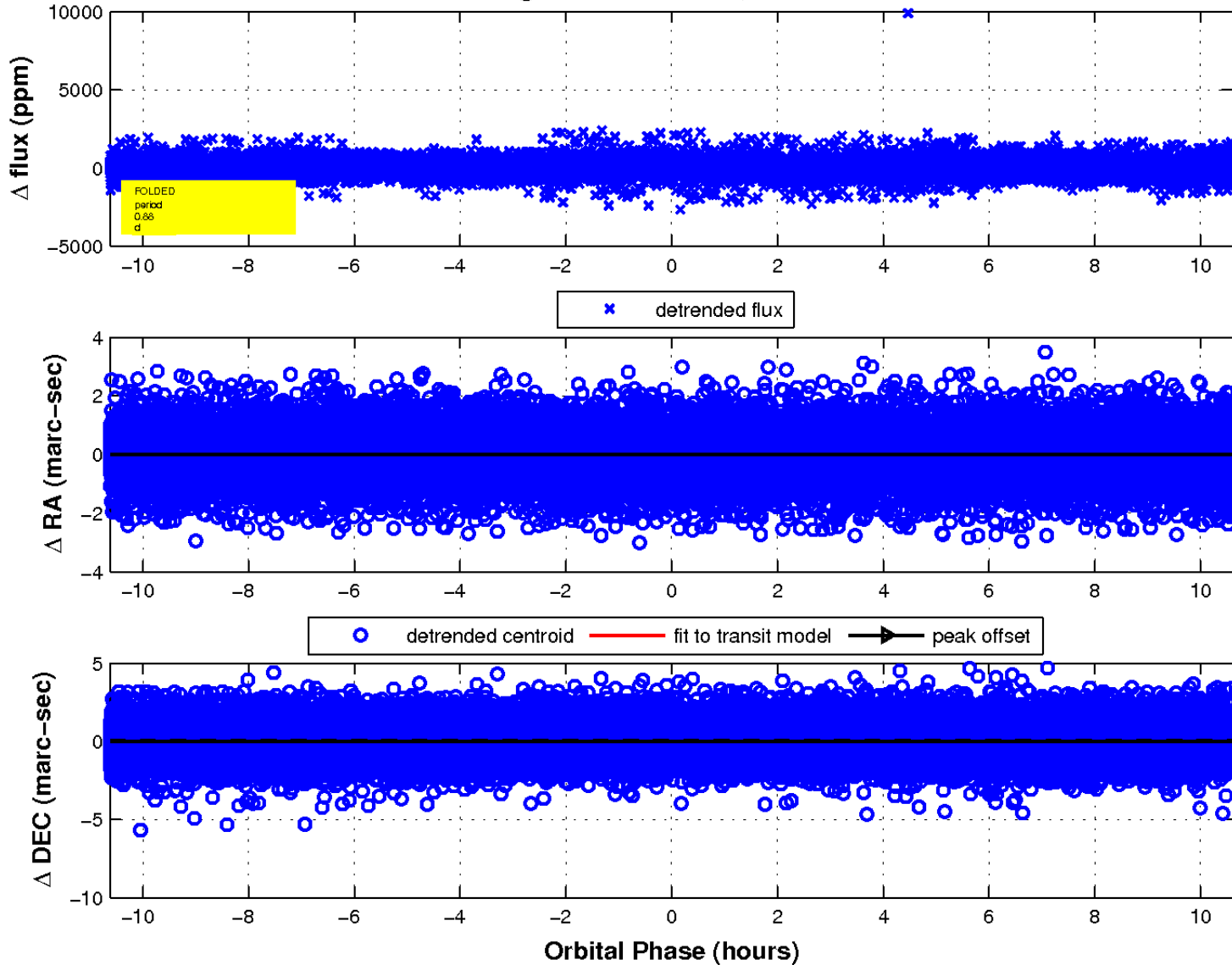
white  $\times$ : KIC target position; +: OOT centroid;  $\triangle$ : difference centroid. red  $\times$ : large negative pixel value.



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



fluxWeightedCentroids, Planet 4 of 4



UKIRT Image

